

Recognized by the
Federal Communications Commission
Anechoic chamber registration no.: 90462 (FCC)
Anechoic chamber registration no.: 3463 (IC)
TCB ID: DE 0001



Accredited by the
German Accreditation Council
DAR-Registration Number
DAT-P-176/94-D1



Independent ETSI
compliance test house



Accredited Bluetooth® Test Facility (BQTF)

Test report no. : 4-2089-1-5_06
Applicant : Sennheiser Communications S/A
Type : Bluetooth Office Headset
BW900 HS
Test Standard : FCC Part 15.247
RSS-210 Issue 6
FCC ID : DMOCBWDYB
Certification No. IC : 2099D-900

The Bluetooth word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by Cetecom ICT is under license

Table of contents

1. ADMINISTRATIVE DATA	3
1.1. ADMINISTRATIVE DATA OF THE TEST FACILITY	3
1.1.1 Identification of the testing laboratory	3
1.1.2 Organizational items.....	3
1.1.3 Applicant's details	4
1.2 ADMINISTRATIVE DATA OF MANUFACTURER / MEMBER	4
1.3 DESCRIPTION OF THE EQUIPMENT UNDER TEST (EUT)	5
1.3.1 EUT: Type, S/N etc.	5
1.3.2 If RF component testing only, description of additional used HW/SW.....	5
1.3.3 Additional EUT information For IC Canada (appendix 2).....	6
1.3.4 EUT operating modes	7
1.3.5 Extreme conditions testing values.....	7
2. TESTSTANDARD & SUMMARY LIST OF ALL PERFORMED TEST CASES	8
3. RF MEASUREMENT TESTING	9
3.1 DESCRIPTION OF TEST SET-UP	9
3.1.1 Radiated measurements	9
3.1.2 Conducted measurements	9
3.2 REFERENCED DOCUMENTS.....	10
3.3 ADDITIONAL COMMENTS	10
3.4 ANTENNA GAIN	10
3.5 CARRIER FREQUENCY SEPARATION §15.247(A1).....	11
3.6 NUMBER OF HOPPING CHANNELS §15.247(A1)	12
3.7 TIME OF OCCUPANCY (DWELL TIME) §15.247(A1 III)	13
3.8 POWER SPECTRAL DENSITY (HYBRID SYSTEM IN INQUIRY MODE/PAGE SCAN) §15.247(D)	14
3.9 SPECTRUM BANDWIDTH OF A FHSS SYSTEM / 20dB BANDWITH §15.247(A1)	15
3.10 MAXIMUM OUTPUT POWER (CONDUCTED) § 15.247 (B) (1)	17
3.11 MAX. PEAK OUTPUT POWER (RADIATED) § 15.247 (B) (1).....	19
3.12 BAND-EDGE COMPLIANCE OF CONDUCTED EMISSIONS §15.247 (C)	20
3.13 BAND-EDGE COMPLIANCE OF RADIATED EMISSIONS §15.205	23
3.14 SPURIOUS EMISSIONS - CONDUCTED (TRANSMITTER) § 15.247 (C) (1)	27
3.15 SPURIOUS EMISSIONS > 30 MHz- RADIATED (TRANSMITTER) § 15.247 (C) (1)	29
3.16 SPURIOUS EMISSIONS - RADIATED (RECEIVER) § 15.109	33
3.17 SPURIOUS EMISSIONS < 30 MHz - TRANSMITTER RADIATED § 15.209	35
3.18 CONDUCTED EMISSIONS <30 MHz § 15.107/207	36
4 PHOTOGRAPHS OF TEST SET-UP	39
5 PHOTOGRAPHS OF EUT	41

ANNEX 1: TECHNICAL PRODUCT DESCRIPTION

1. Administrative data

1.1. Administrative data of the test facility

1.1.1 Identification of the testing laboratory

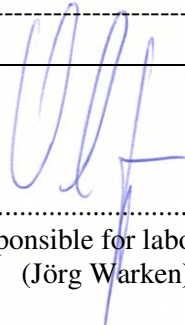
Company name:	Cetecom ICT Services GmbH
Address:	Untertürkheimerstr. 6-10 D-66117 Saarbruecken Germany
Laboratory accreditation:	DAR-Registration No. DAT-P-176/94-D1 Bluetooth Qualification Test Facility (BQTF)
Responsible for testing laboratory:	Jörg Warken Phone: +49 681 598 0 Fax: +49 681 598 9075 email: info@ict.cetecom.de



.....
Responsible for testing
(Jakob Reschke)

1.1.2 Organizational items

Reference No.:	4-2089-1-5_06
Order No.:	
Receipt of EUT:	2006-05-30
Date(s) of test:	2006-05-30 to 2006-06-01
Date of report:	2006-06-01
Number of report pages:	49
Version of template:	1.8



.....
Responsible for laboratory
(Jörg Warken)

Note:

The test results of this test report relate exclusively to the item tested as specified in this report. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations 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.

During the test no hardware and software changes are allowed to be performed at the EUT.

1.1.3 Applicant's details

Applicant's name:	Sennheiser Communications A/S
Address:	Langager 6 DK-2680 Solroed Strand
Contact person:	Niels Hostrup Phone: +45 5618 0018 Fax: +45 5618 0099 email: nh@senncom.com

1.2 Administrative data of manufacturer / member

Manufacturer's name:	Gamma (Dongguan Jia Hua Electric Co., LTD.)
Address:	No. 27 Da Yuan Road Chang Cun Dong Cheng Dong Guan Guang Dong China

1.3 Description of the Equipment under test (EUT)

1.3.1 EUT: Type, S/N etc.

Product name : *Bluetooth Office Headset BW900 HS*
Product ID : BW900 HS
Description : *Bluetooth* Headset
S/N serial number : Ser. No 231 (radiated measurements)
Ser. No 60 (conducted measurements)
HW hardware status : 5
SW software status : SW Headset Testmode
Frequency Band [MHz] : ISM 2.400 - 2.483,5
Type of Modulation : FHSS
Number of channels : 79
Antenna : Integrated antenna
Power Supply : 3.5 V AC by Li-Polymer battery
Temperature Range : na°C - na°C

Max. power radiated: + 14.15 dBm EIRP

Max. power conducted: + 16.04 dBm

FCC ID : DMOCBWDYB

Certification No. IC : 2099D-900

1.3.2 If RF component testing only, description of additional used HW/SW

	Product name	Product ID	Description	S/N serial number	HW hardware status	SW software status
1						
2						
3						
4						

1.3.3 Additional EUT information For IC Canada (appendix 2)

Company Number:	2099D-900
Model Name:	Bluetooth Office Headset BW900 HS
Applicant (complete Adress):	Sennheiser Communications A/S Langager 6 DK-2680 Solroed Strand
Tested to Radio Standards Specification (RSS) No.:	RSS-210 Issue 6
Open Area Test Site Industry Canada Number:	3463
Frequency Range (or fixed frequency) [MHz]:	2402 – 2480 MHz
RF: Power [W] (max):	Rad. EIRP: 26.00 mW Conducted : 40.00 mW
Antenna Type:	Integrated antenna
Occupied Bandwidth (99% BW) [kHz]:	980
Type of Modulation:	FSK
Emission Designator (TRC-43):	980K FXD
Transmitter Spurious (worst case) [μ V/m in 3m]:	252
Receiver Spurious (worst case) [μ V/m in 3m]:	89

ATTESTATION: I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned departmental standard(s), and that the radio equipment identified in this application has been subject to all the applicable test conditions specified in the departmental standards and all of the requirements of the standards have been met.

Signature:



Date: 2006-06-01

Testengineer: Jakob Reschke

1.3.4 EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
Op. 0	Normal mode	Normal temperature and power source conditions
Op. 1		low temperature, low power source conditions
Op. 2		low temperature, high power source conditions
Op. 3		high temperature, low power source conditions
Op. 4		high temperature, high power source conditions

*) EUT operating mode no. is used to simplify the testplan

1.3.5 Extreme conditions testing values

Description	Shortcut	Unit	Value
Nominal Temperature / humidity	T _{nom}	°C / %	+20 / 45
Low Temperature	T _{low}	°C	na
High Temperature	T _{high}	°C	na
Nominal Power Source	V _{nom}	V	3.5
Low Power Source	V _{low}	V	na
High Power Source	V _{high}	V	na

Type of powersource: V AC

Deviations from this values are reported in chapter 2

2. Teststandard & summary list of all performed test cases

TC identifier	Description	verdict	date	Remark
RF-Testing	FCC Part 15 §15.247 - CANADA RSS-210 Issue 6	PASS	2006-06-01	PASS

Test Specification Clause	Test Case	Modulation	Pass	Fail	N/A	Not performed
None	Antenna Gain	GFSK	Yes			
§15.247(a1)	Carrier frequency separation	GFSK	Yes			
§15.247(a1)	Number of hopping channels	GFSK	Yes			
§15.247(a)(1)(iii)	Time of occupancy (dwell time)	--	Yes			
§15.247(e)	Power Spectral density (Hybrid system in Inquiry mode/Page scan)	--			Yes	
§15.247(a)(1)	Spectrum Bandwidth of a FHSS System / 20dB Bandwith	GFSK Pi/4 DQPSK 8 DPSK	Yes		Yes Yes	
§ 15.247 (b)(1)	Maximum output power (conducted)	GFSK Pi/4 DQPSK 8 DPSK	Yes		Yes Yes	
§ 15.247 (b)(1)	Max. peak output power (radiated)	GFSK	Yes			
§ 15.247 (d)	Band-edge compliance of conducted emissions	Widest modulation	Yes			
§ 15.205	Band-edge compliance of radiated emissions	Widest modulation	Yes			
§ 15.247 (d)	Spurious Emission - conducted (Transmitter)	GFSK	Yes			
§ 15.247 (d)	Spurious Emission - radiated (Transmitter) >30 MHz	GFSK	Yes			
§ 15.109	Spurious Emissions - radiated (Receiver)	GFSK	Yes			
§ 15.209	Spurious Emissions - radiated (Transmitter) <30 MHz	GFSK	Yes			
§ 15.107/207	Conducted Emissions <30 MHz	GFSK	Yes			

3. RF measurement testing

3.1 Description of test set-up

3.1.1 Radiated measurements

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 C63.4-2003 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 C63-4-2003 clause 4.2.

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

9 kHz - 150 MHz: Quasi Peak measurement, 200 Hz Bandwidth, passive loop antenna.

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

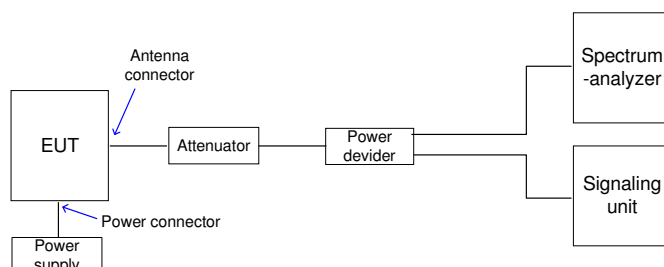
1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horn

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 EUT is powered by an external power supply with nominal voltage. The signaling is performed from outside the chamber with a signaling unit (CMU200 or other) by airlink using signaling antenna.

3.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal path is connected to the communication base Station (CMU200 or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signaling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signaling unit and the spectrum analyzer are impedance matched on 50 Ohm.



3.2 Referenced documents

none

3.3 Additional comments

--

3.4 Antenna gain

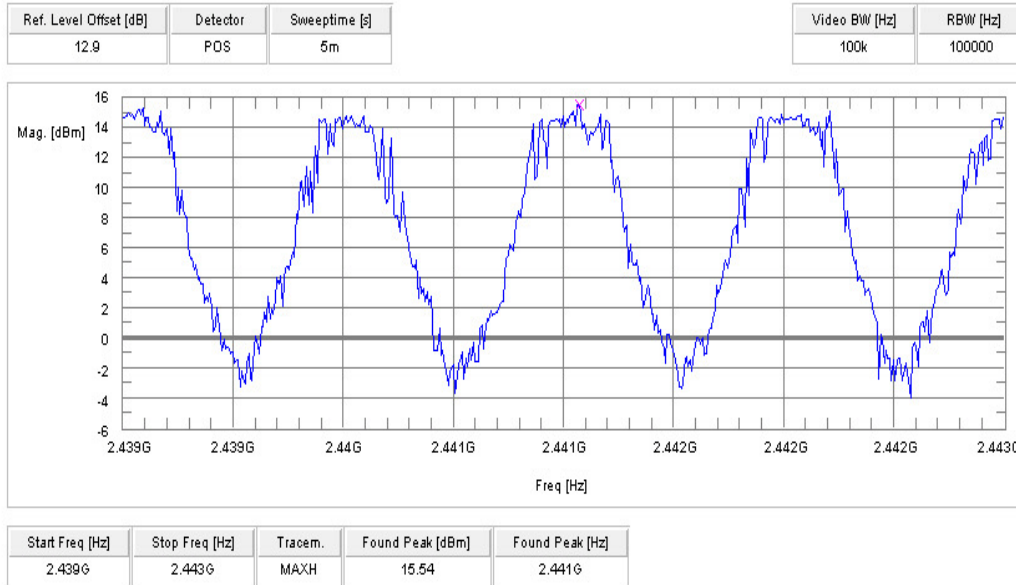
The antenna gain of the complete system is calculated by the difference of conducted power of the module and the radiated power in EIRP.

	low channel	mid channel	high channel
Conducted power [dBm] <i>GFSK</i>	15.99	15.99	16.04
Radiated power [dBm] <i>GFSK</i>	12.48	14.15	13.48
Gain [dB]	-3.51	-1.85	-2.56

3.5 Carrier frequency separation §15.247(a)(1)

Modulation: GFSK

Plot 1 of 1:



Result : Channel separation is: ~ 1 MHz

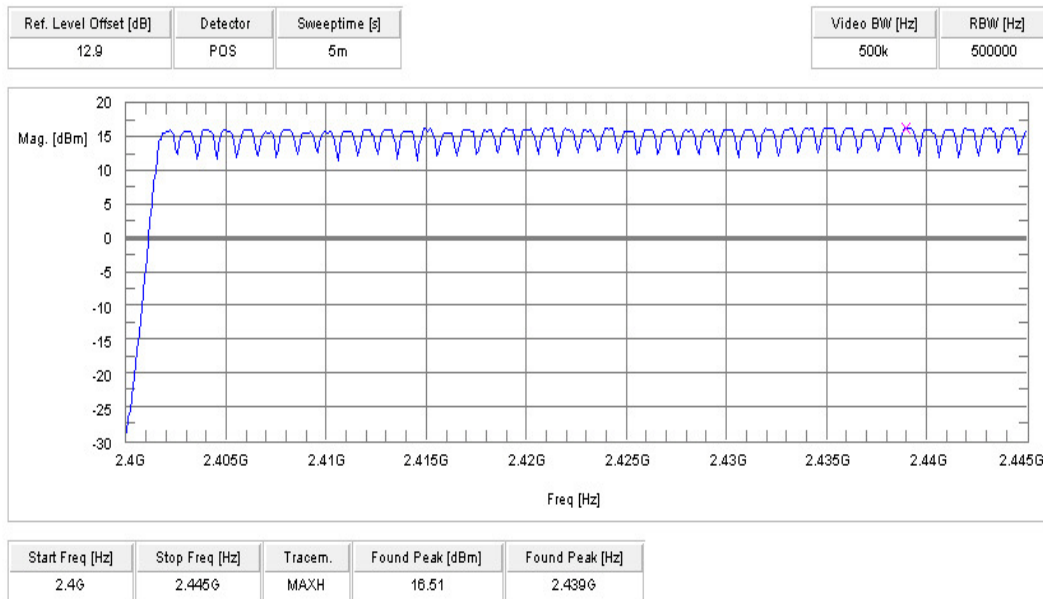
Limits :

Under normal test conditions only	Minimum 25 kHz or 20 dB Bandwidth of the hopping system
-----------------------------------	---

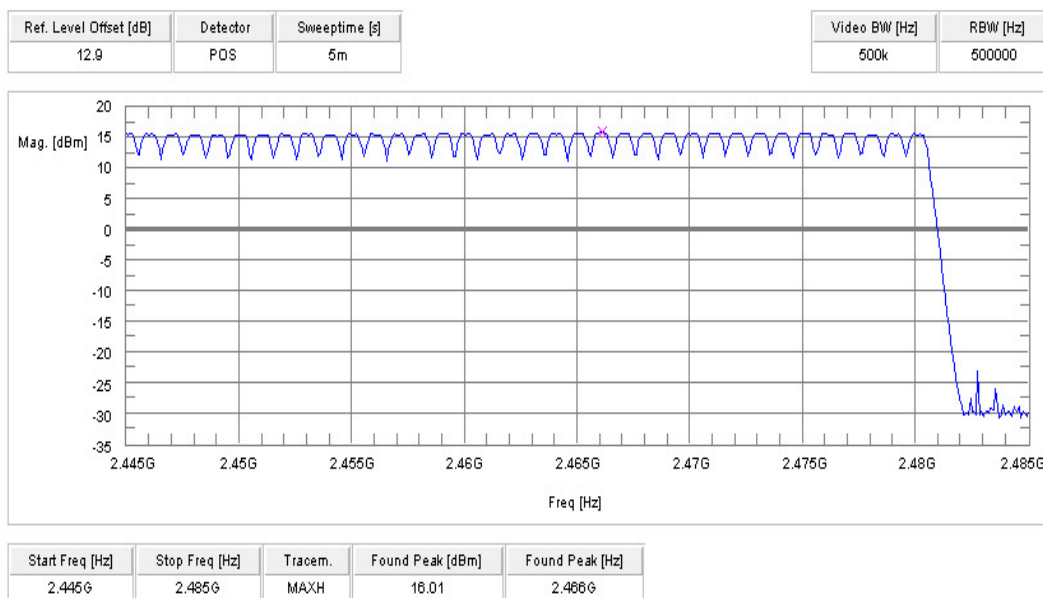
3.6 Number of hopping channels §15.247(a)(1)

Modulation: GFSK

Plot 1 of 2:



Plot 2 of 2:



Result : The number of hopping channels is: 79

Limits :

Under normal test conditions only	at least 15 non-overlapping channels
-----------------------------------	--------------------------------------

3.7 Time of occupancy (dwell time) §15.247(a)(1)(iii)

For Bluetooth devices:

The dwell time of 0.4 s within a 31.6 second period in data mode is independent from the packet type (packet length).
The calculation for a 31.6 second period is as follows:

Dwell time = time slot length * hop rate / number of hopping channels * 31.6 s

Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = $625 \mu\text{s} * 1600 \text{ 1/s} / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (in a 31.6 s 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 = $5 * 625 \mu\text{s} * 1600 * 1/5 * 1/s / 79 * 31.6 \text{ s} = 0.4 \text{ s}$ (in a 31.6 s period)

This is according to the Bluetooth Core Specification V 1.1 & V 1.2 & V2.0 (+ 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)

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

Plot 1 of 1:

[*No more applicable*](#)

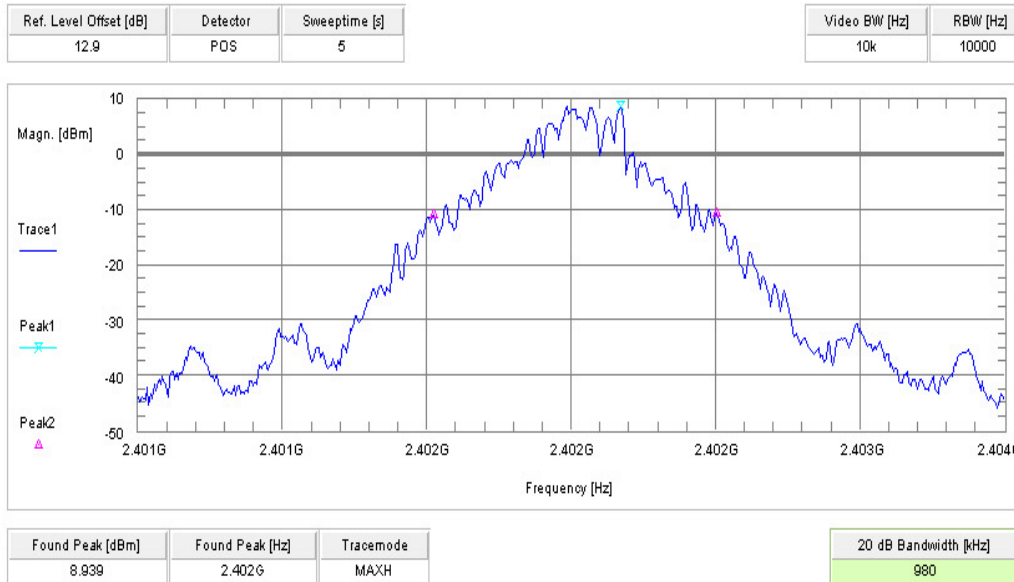
Result: Power density : - dBm/Hz = - dBm / 3 KHz
Correction factor from dBm/Hz to dBm/3KHz is +34,8 dB

Limits :

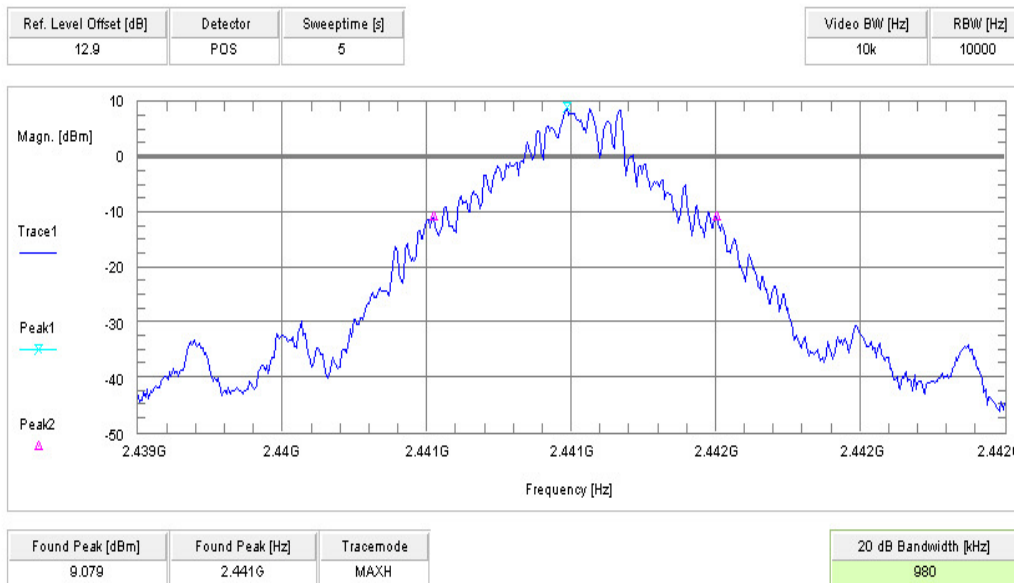
Under normal test conditions only	For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 KHz band during any time interval of continuous transmission
-----------------------------------	---

3.9 Spectrum Bandwidth of a FHSS System / 20dB Bandwidth §15.247(a)(1)

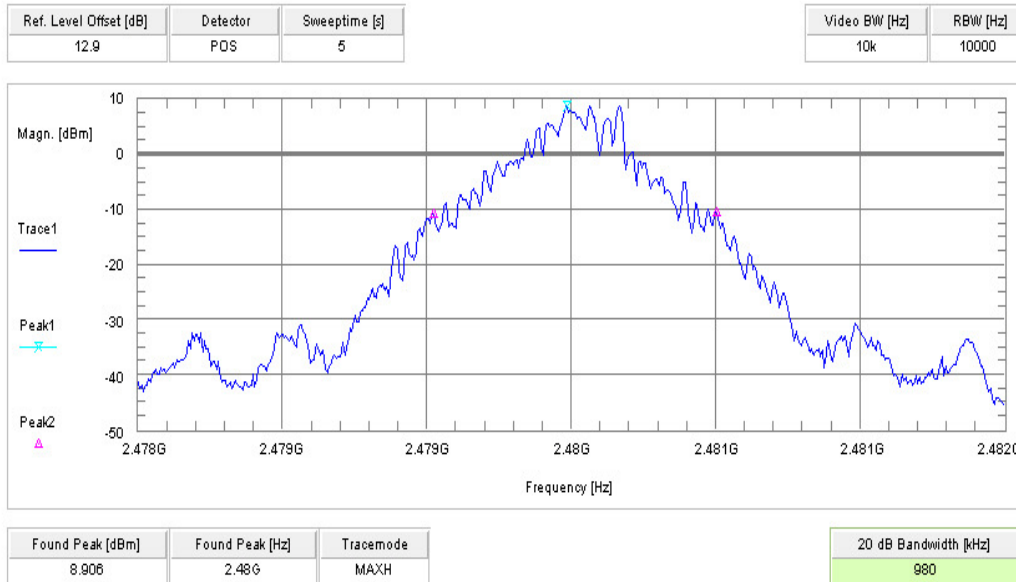
Plot 1 GFSK



Plot 2 GFSK



Plot 3 GFSK



Results:

Modulation	20 dB BANDWIDTH [KHz]		
Frequency [MHz]	2402	2441	2480
<i>GFSK</i>	980	980	980
<i>π/4 DQPSK</i>	na	na	na
<i>8DPSK</i>	na	na	na
Measurement uncertainty	±1kHz		

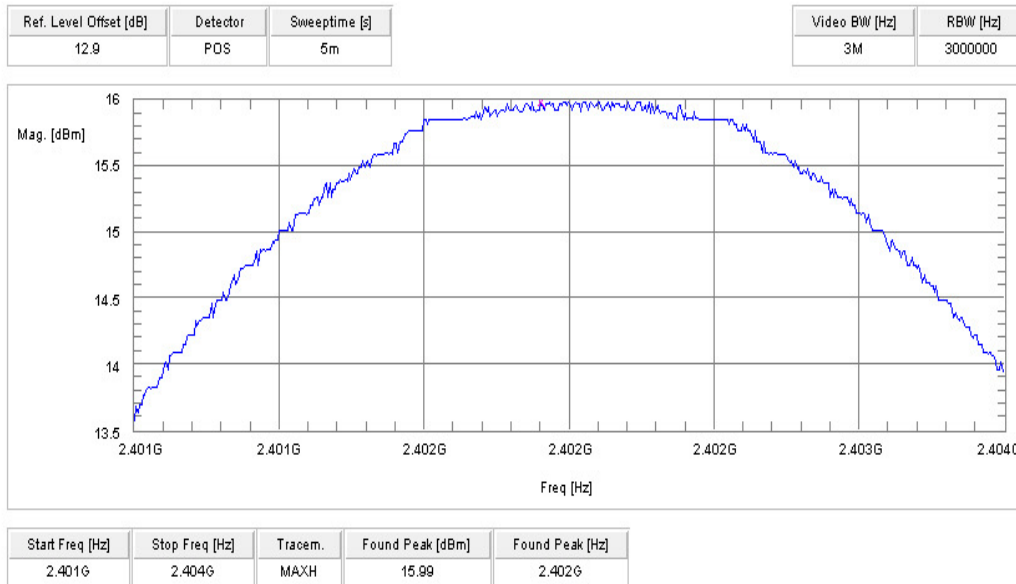
RBW / VBW as provided in the „Measurement Guidelines“ (DA 00-705, March 30, 2000)
RBW: 10 kHz / VBW 100 kHz

Limits :

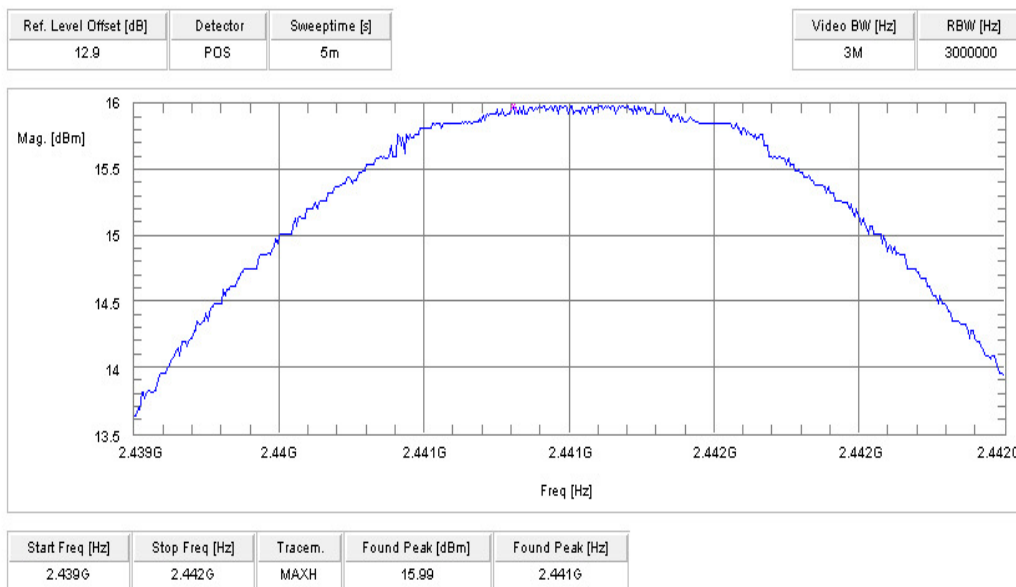
Under normal test conditions only	< 1000 KHz
-----------------------------------	------------

3.10 Maximum output power (conducted) § 15.247 (b)(1)

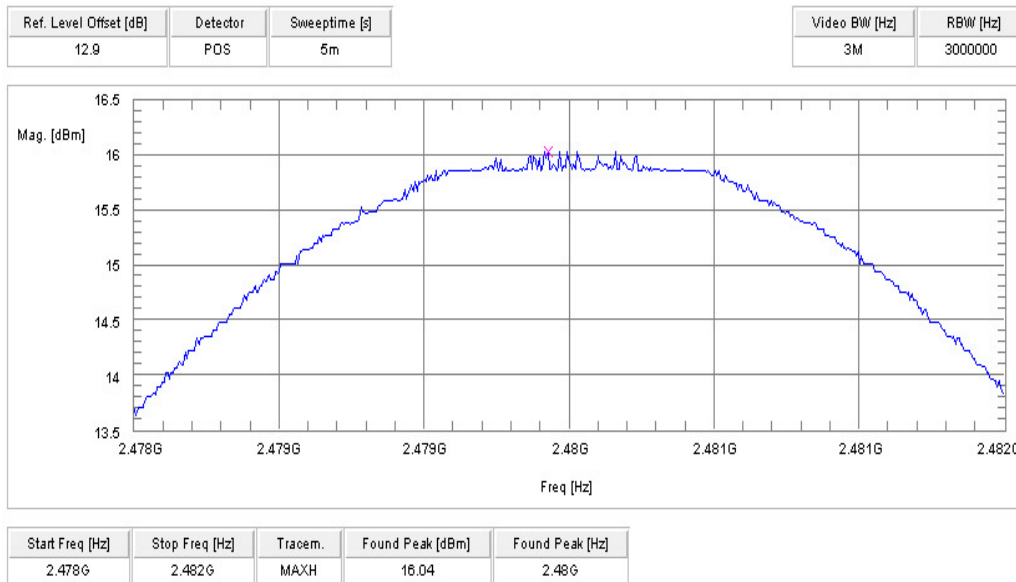
Plot 1 GFSK



Plot 2 GFSK



Plot 3 GFSK



Results:

Modulation	Max. peak output power [dBm]		
	2402	2441	2480
Frequency [MHz]	2402	2441	2480
<i>GFSK</i>	15.99	15.99	16.04
<i>Pi/4 DQPSK</i>	na	na	na
<i>8DPSK</i>	na	na	na
Measurement uncertainty	±2dB		

RBW / VBW : 3 MHz

Limits:

Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt
--	---------------

3.11 Max. peak output power (radiated) § 15.247 (b)(1)

Modulation: GFSK

Test conditions		Max. peak output power EIRP [dBm]		
Frequency [MHz]		2402	2442	2480
T _{nom}	V _{nom}	12.48	14.15	13.48
Measurement uncertainty		±3dB		

RBW / VBW : 3 MHz

Measured at a distance of 3m

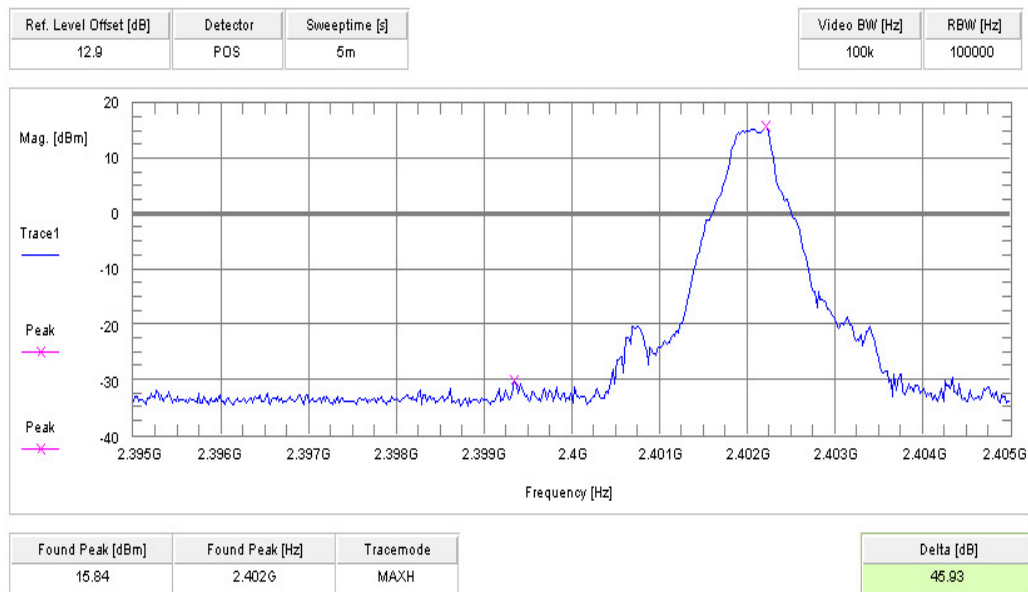
Limits:

Under normal test conditions only, for frequency range 2400-2483.5 MHz	Max. 1.0 Watt
--	---------------

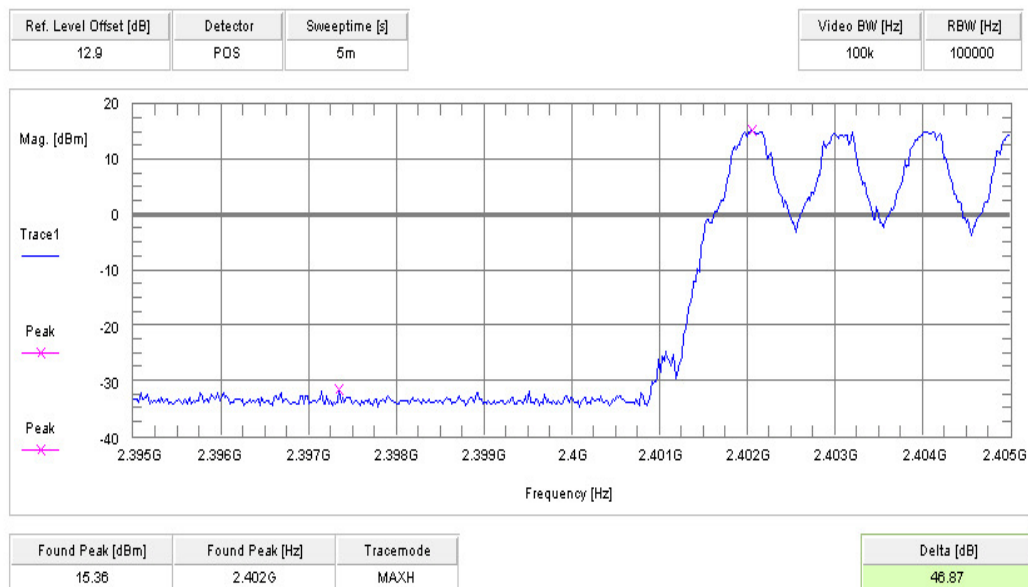
3.12 Band-edge compliance of conducted emissions §15.247 (d)

Modulation: widest

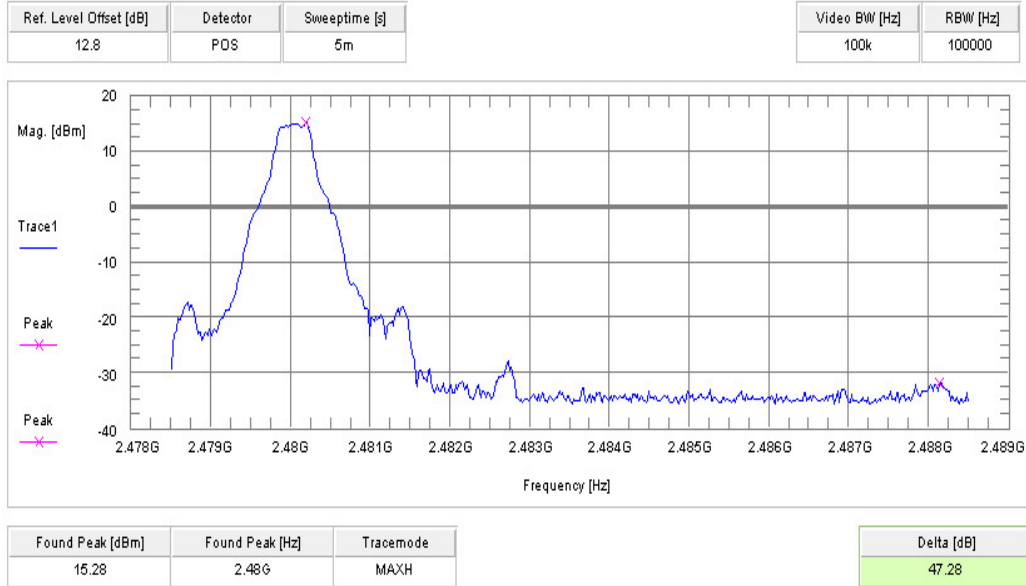
Plot 1 of 4 (hopping off, lowest frequency):



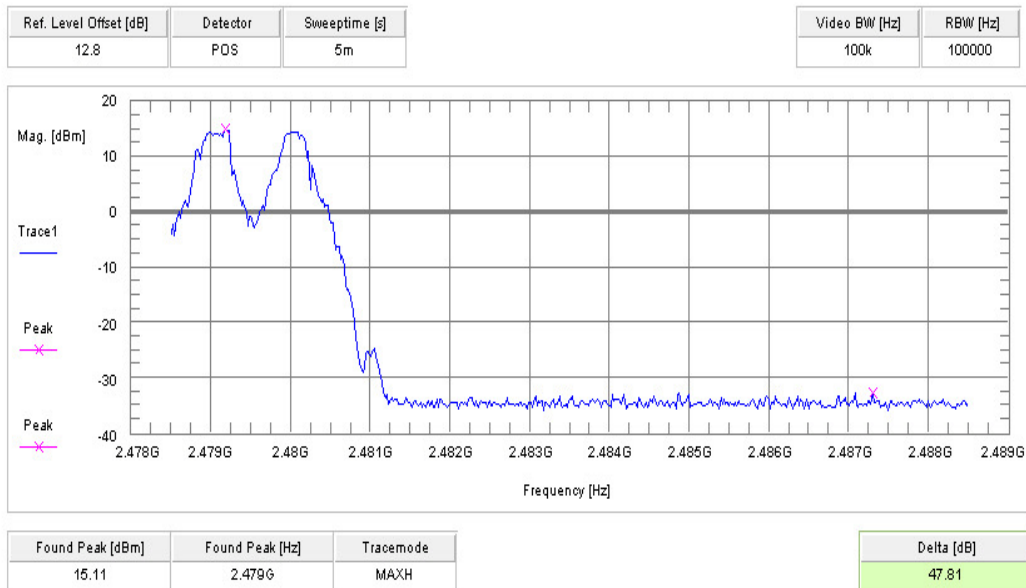
Plot 2 of 4 (hopping on, lowest frequency):



Plot 3 of 4 (hopping off, highest frequency):



Plot 4 of 4 (hopping on, highest frequency):



Results:

SZENARIO	DELTA VALUE [DB]
hopping off, lowest frequency	45.93
hopping on, lowest frequency	46.87
hopping off, highest frequency	47.28
hopping on, highest frequency	47.81
Measurement uncertainty	±1,5dB

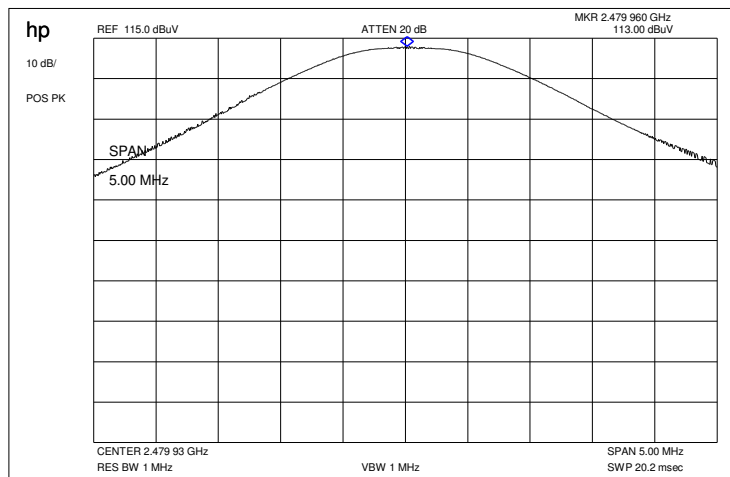
Limits:

Under normal test conditions only	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 5.205(c)).
-----------------------------------	--

3.13 Band-edge compliance of radiated emissions §15.205

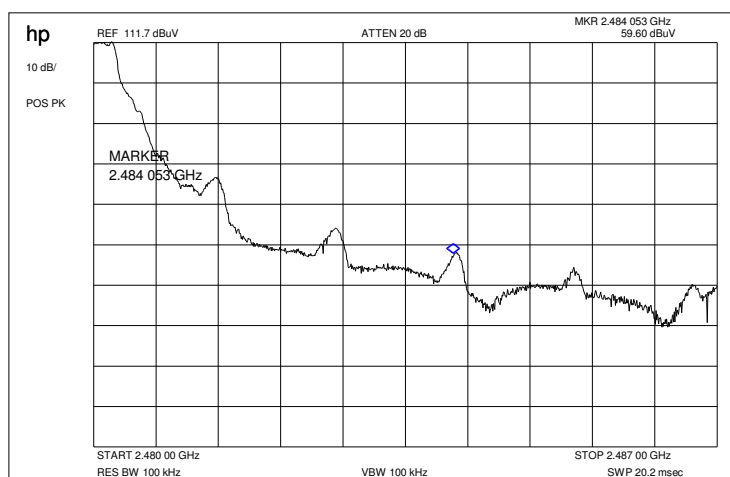
Modulation: widest; here GFSK

Plot 1 : Max field strength in 3m distance (single frequency)



Result: 113 dB μ V/m

Plot 2: Marker-Delta Method (single carrier)

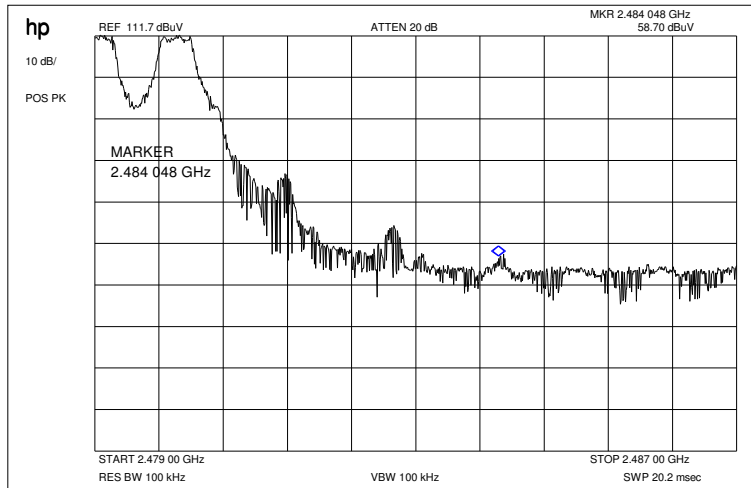


Result:

Marker-Delta-Value : 59,60 dB

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

Plot 3: Marker-Delta Method (hopping)



Result:

Marker-Delta-Value : 58.70 dB

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

Plot 4: Restricted Bands low

