

FCC Test Report

Test report no.: EMC_906FCC15.247_2005_D640

FCC Part 15.247 for FHSS systems / CANADA RSS-210

Model: D640

FCC ID: AL8-D640 IC: 457A-D640



Accredited according to ISO/IEC 17025





FCC listed # 101450

IC recognized # 3925

CETECOM Inc.

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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 Inc. USA 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 Inc USA.

TEST REPORT PREPARED BY: EMC Engineer: Harpreet Sidhu

1.2 Testing laboratory

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E-mail: lothar.schmidt@cetecomusa.com

Internet: www.cetecom.com



1.3 Details of applicant

Name : Plantronics, Inc.
Street : 345 Encinal St.
City / Zip Code : Santa Cruz / 95060

Country : USA

Contact : Edward F. Godstein

Telephone : +831 458 4476 Fax : +831 429 5731

e-mail : <u>Sid.sin@plantronics.com</u>

1.4 Application details

Date of receipt test item : 2005-04-21

Date of test : 2005-04-21/22/25/26/27

1.5 Test item

Marketing Name : Tahiti Model No. : D640

Description : BT Headset HW / SW version : 30 / 3.06 FCC-ID : AL8-D640 IC ID : 457A-D640

Additional information

Frequency : 2402MHz - 2480MHz

Type of modulation : GFSK Number of channels : 79

Antenna : Printed Meandering Line (ML)

Power supply : Lithium Ion Polymer Battery (60mAH)

Output power : -0.1dBm (0.977mW) max. conducted peak power

Extreme vol. Limits : 3.4 – 4.2VDC (3.7 nominal)

Extreme temp. Tolerance : 0°C-50°C

1.6 Test standards: FCC Part 15 §15.247 (DA00-705) / RSS 210

Note: All radiated measurements were made in all three orthogonal planes. The values reported are the maximum values.



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2 Technical test

2.1 Summary of test results

No deviations from the technical specification(s) were Performed	e ascertained in the course of the tests
Final Verdict: (only "passed" if all single measurements are "passed")	Passed

Technical responsibility for area of testing:

Responsible for test report and project leader:

2005-05-16 EMC & Radio Harpreet Sidhu (EMC Engineer)

Date Section Name Signature



2.2 Test report

TEST REPORT

Test report no.: EMC_906FCC15.247_2005_D640



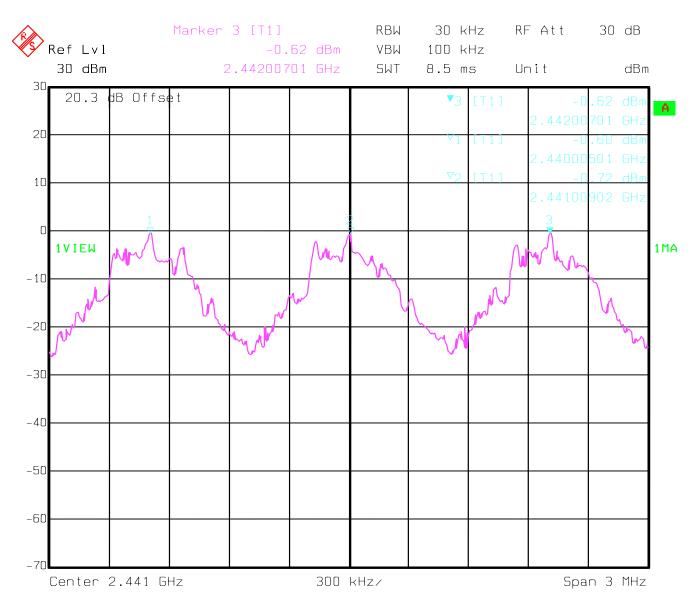
TEST REPORT REFERENCE

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CARRIER FREQUENCY SEPERATION

§15.247(a)



Date: 28.APR.2005 19:35:15

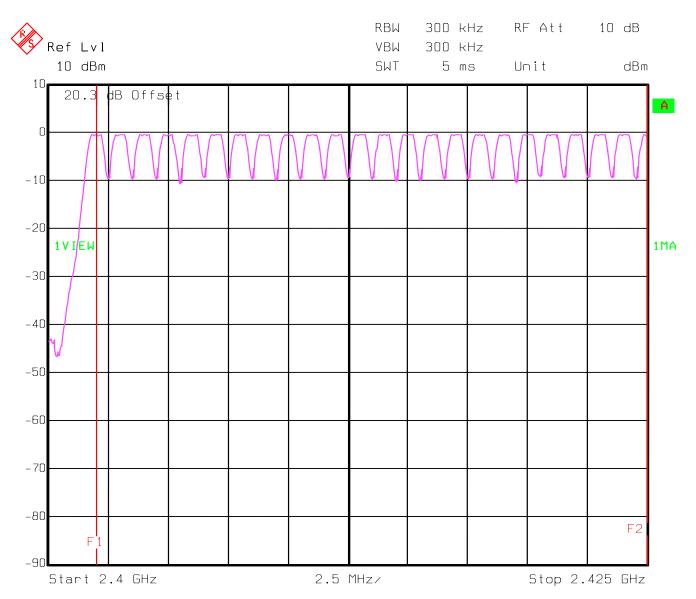


NUMBER OF HOPPING CHANNELS

§15.247(a)

The number of hopping channels is 79 (see next 4 plots)
The right red line corresponds to the left red line from the next plot.

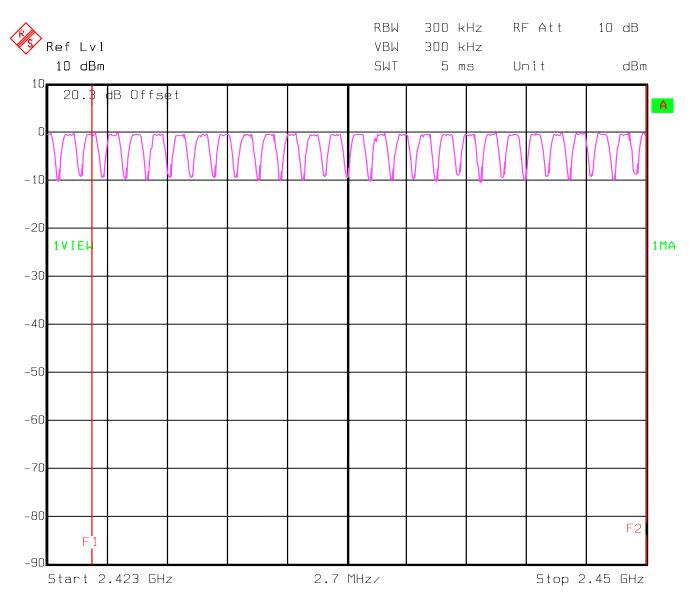
Plot 1: Total 24



Date: 28.APR.2005 19:47:41



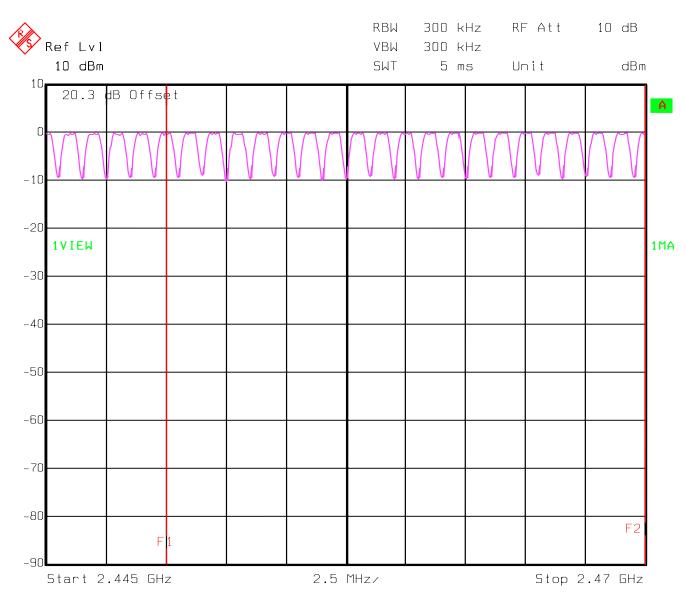
Plot 2: Total 25



Date: 28.APR.2005 19:54:30



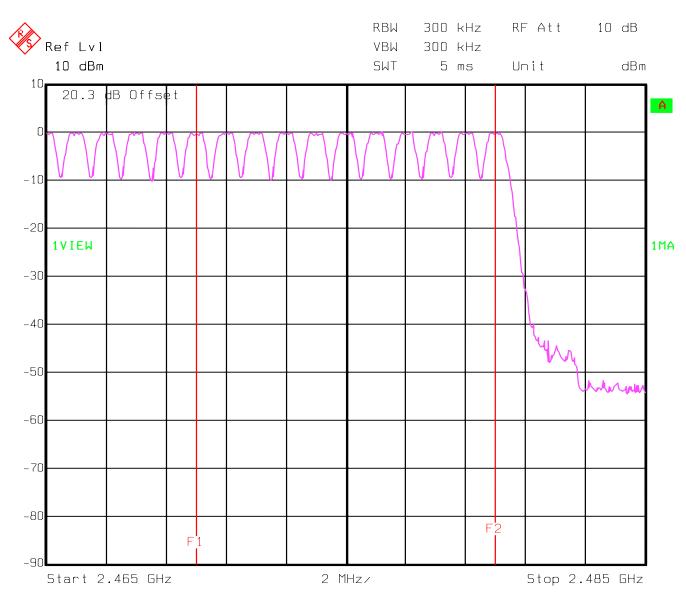
Plot 3: Total 20



Date: 28.APR.2005 20:06:52



Plot 4: Total 10



Date: 28.APR.2005 20:09:54



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TIME OF OCCUPANCY (DWELL TIME)

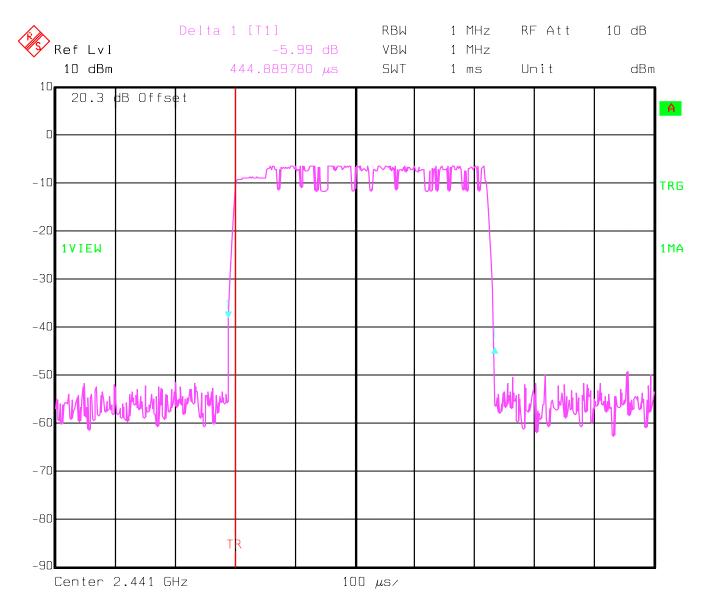
§15.247(a)

DH1 - Packet

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 so for 31.6 seconds you have 320.108 times of appearance.

Each Tx-time per appearance is 444.89µs.

So we have $320.108 * 444.89 \mu s = 142.41 ms$ per 31.6 seconds.



Date: 28.APR.2005 20:36:24



TIME OF OCCUPANCY (DWELL TIME)

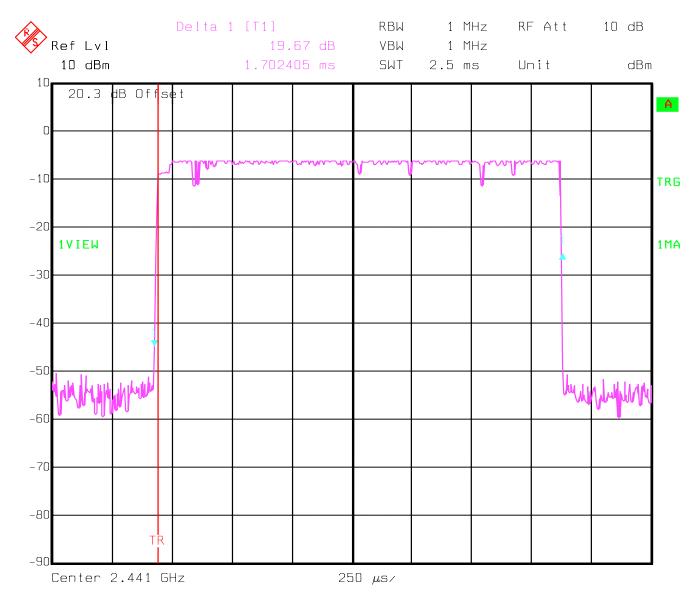
§15.247(a)

DH3 - Packet

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 so for 31.6 seconds you have 161.16 times of appearance.

Each Tx-time per appearance is 1.7ms.

So we have 161.16 * 1.7ms = 273.97ms per 31.6 seconds.



Date: 28.APR.2005 20:39:39



TIME OF OCCUPANCY (DWELL TIME)

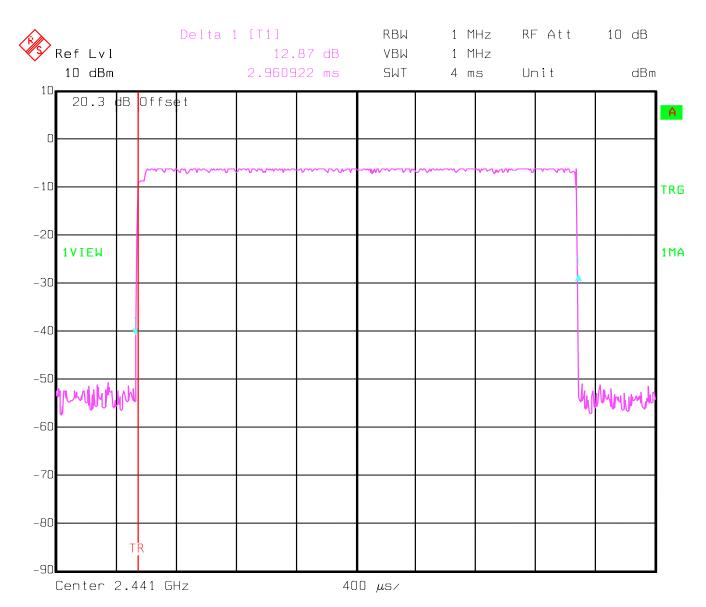
§15.247(a)

DH5 - Packet

At DH5 Packets you need 5 time slots for transmit and 1 for receiving, then the system makes worst case 266,7 hops per second with 79 channels. So you have each channel 3.36 times per second and so for 30 seconds you have 106.176 times of appearance.

Each Tx-time per appearance is 2.96ms.

So we have 106.176 * 2.96ms = 314.28ms per 31.6 seconds.



Date: 28.APR.2005 20:43:49



SPECTRUM BANDWIDTH OF FHSS SYSTEM

§15.247(a)

20 dB bandwidth

TEST CON	NDITIONS	20 dB BANDWIDTH (kHz)		
Frequenc	ey (MHz)	2402	2441	2480
T _{nom} (23)°C	$\mathbf{V}_{\mathrm{nom}}$	825.65	829.65	825.65

RBW / VBW as provided in the "Measurement Guidelines" (DA 00-705, March 30, 2000)

LIMIT

SUBCLAUSE §15.247(a) (1)

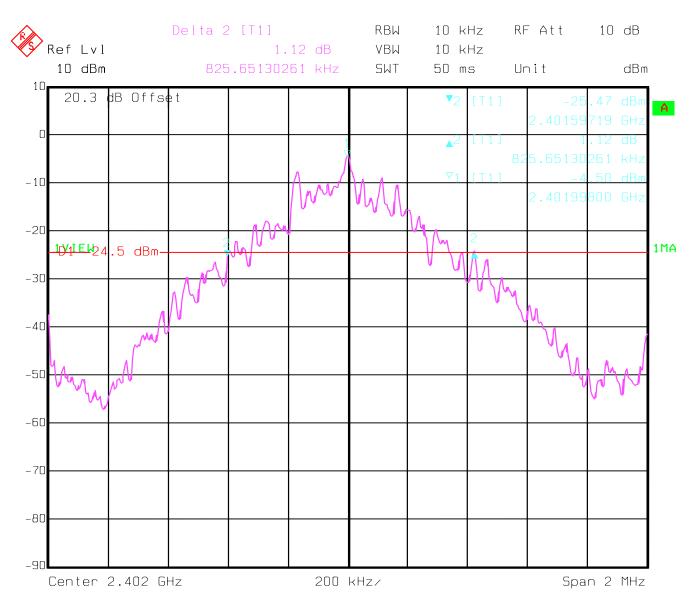
The maximum 20dB bandwidth shall be at maximum 1000 KHz



SPECTRUM BANDWIDTH OF FHSS SYSTEM 20 dB bandwidth

§15.247(a)

Lowest Channel: 2402MHz



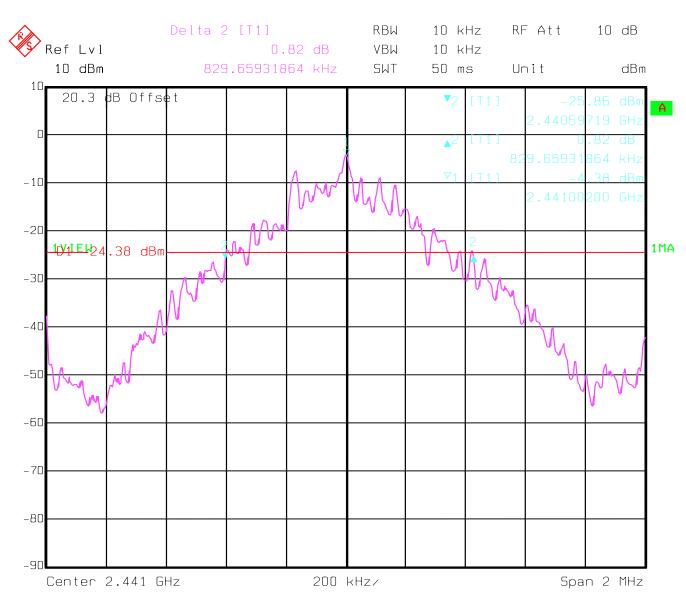
Date: 13.MAY 2005 19:07:12



SPECTRUM BANDWIDTH OF FHSS SYSTEM 20 dB bandwidth

§15.247(a)

Mid Channel: 2441MHz



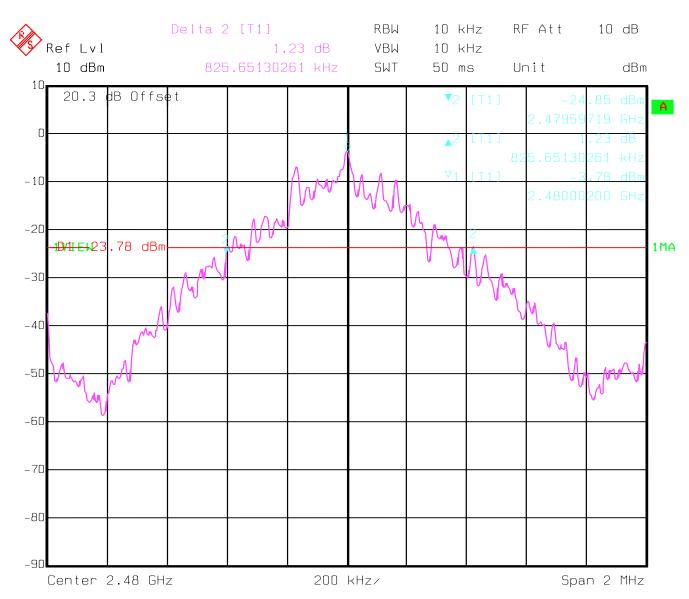
Date: 13.MAY 2005 19:10:05



SPECTRUM BANDWIDTH OF FHSS SYSTEM 20 dB bandwidth

§15.247(a)

Highest Channel: 2480MHz



Date: 13.MAY 2005 19:12:03



MAXIMUM PEAK OUTPUT POWER

§ 15.247 (b) (3)

(Conducted)

TEST CON	NDITIONS	MAXIMUM	PEAK OUTPUT PO	OWER (dBm)
Frequenc	cy (MHz)	2402	2441	2480
T _{nom} (23)°C	$\mathbf{V}_{ ext{nom}}$	-0.59	-0.45	-0.10
Measuremen	t uncertainty		±0.5dBm	I

RBW / VBW: 3 MHz

LIMIT

SUBCLAUSE § 15.247 (b) (3)

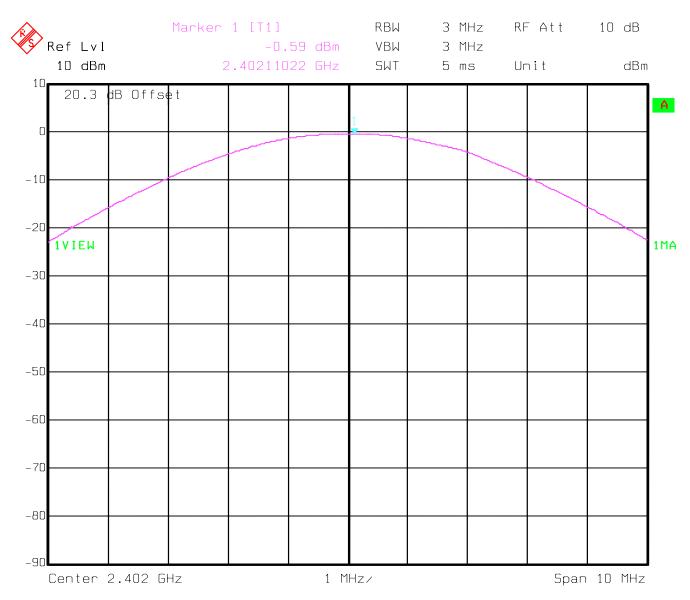
Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt



PEAK OUTPUT POWER (CONDUCTED)

§15.247 (b) (3)

Lowest Channel: 2402MHz



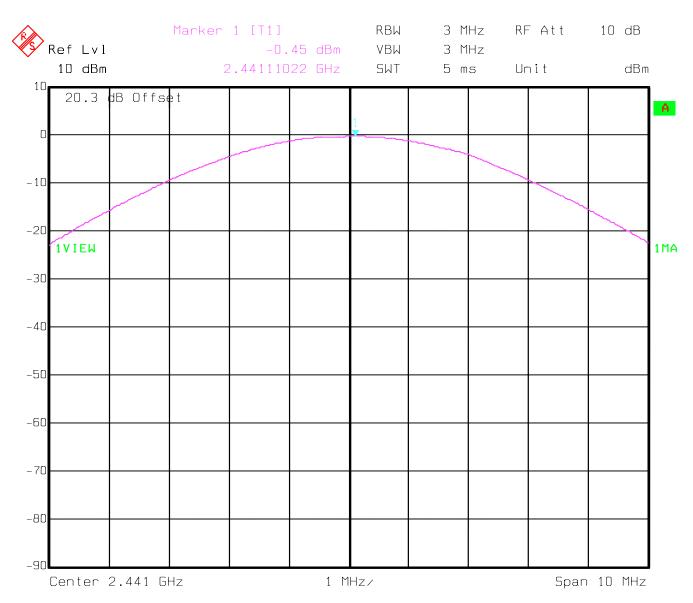
Date: 28.APR.2005 19:15:11



PEAK OUTPUT POWER (CONDUCTED)

§15.247 (b) (3)

Mid Channel: 2441MHz



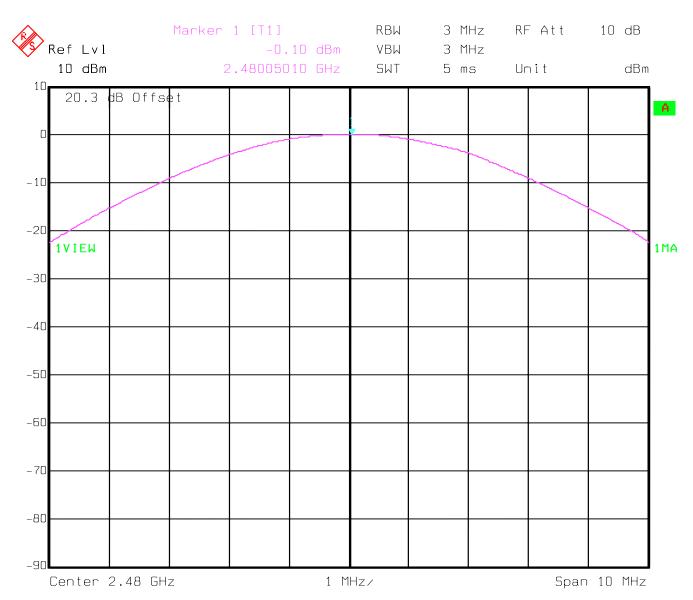
Date: 28.APR.2005 19:16:10



PEAK OUTPUT POWER (CONDUCTED)

§15.247 (b) (3)

Highest Channel: 2480MHz



Date: 28.APR.2005 19:16:50



MAXIMUM PEAK OUTPUT POWER (RADIATED)

§15.247 (b) (3)

EIRP:

TEST CON	NDITIONS	MAXIMUM P	PEAK OUTPUT PO	OWER (dBm)
Frequenc	ey (MHz)	2402	2441	2480
T _{nom} (23)°C	$\mathbf{V}_{ ext{nom}}$	-1.59	-1.92	-1.36
Measuremen	t uncertainty		±0.5dBm	

RBW/VBW: 3 MHz

LIMIT

SUBCLAUSE §15.247 (b) (3)

Frequency range	RF power output
2400-2483.5 MHz	1.0 Watt



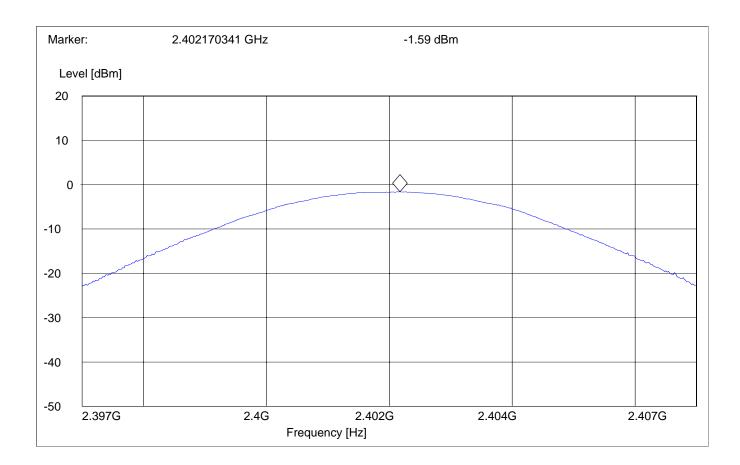
PEAK OUTPUT POWER (RADIATED)

§15.247 (b) (3)

Lowest Channel: 2402MHz

SWEEP TABLE: "EIRP BT low channel"

Short Description: EIRP Bluetooth channel-2402MHz Start Stop Detector Meas. IF Frequency Frequency Time BW2.397GHz 2.407GHz MaxPeak Coupled 3 MHz





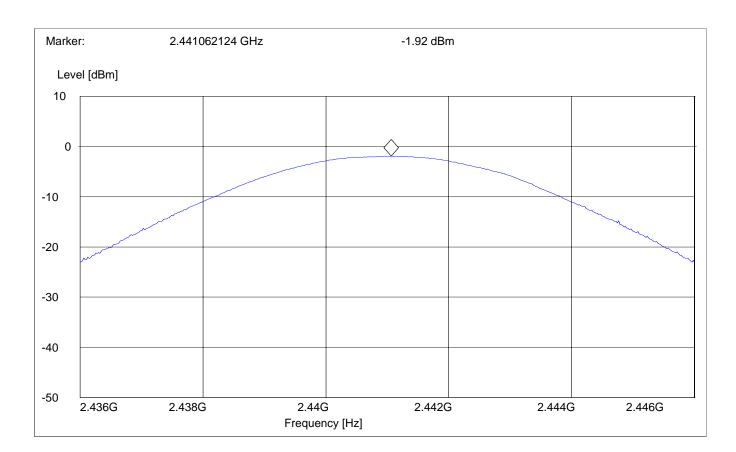
PEAK OUTPUT POWER (RADIATED)

§15.247 (b) (3)

Mid Channel: 2441MHz

SWEEP TABLE: "EIRP BT Mid channel"

EIRP Bluetooth channel-2441MHz Short Description: Start Stop Detector Meas. IF BWFrequency Frequency Time 2.436GHz 2.446GHz MaxPeak Coupled 3 MHz





PEAK OUTPUT POWER (RADIATED)

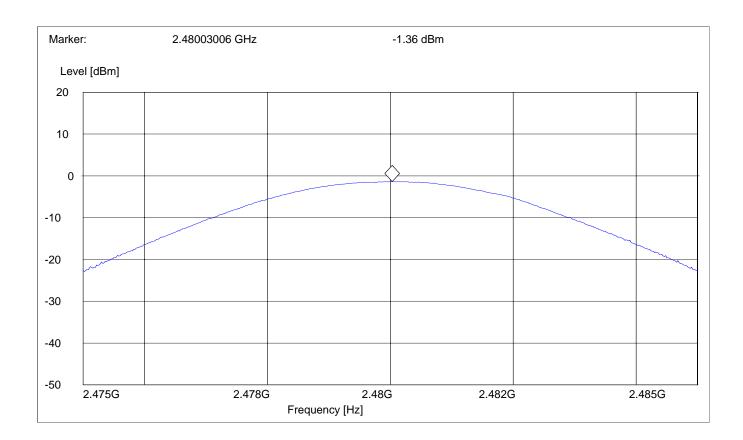
§15.247 (b) (3)

Highest Channel: 2480MHz

SWEEP TABLE: "EIRP BT High channel"

EIRP Bluetooth channel-2480MHz Short Description: Start Stop Detector Meas. IF Frequency Frequency Time BW2.475GHz 2.485GHz MaxPeak Coupled 3 MHz

EIRP Bluetooth channel-2480MHz





BAND EDGE COMPLIANCE

§15.247 (d)

Low frequency section (spurious in the restricted band $2310-2390\ MHz)$ Average Measurement

(This plot is valid for both Hopping ON & OFF)

Operating condition : Tx at 2402MHz

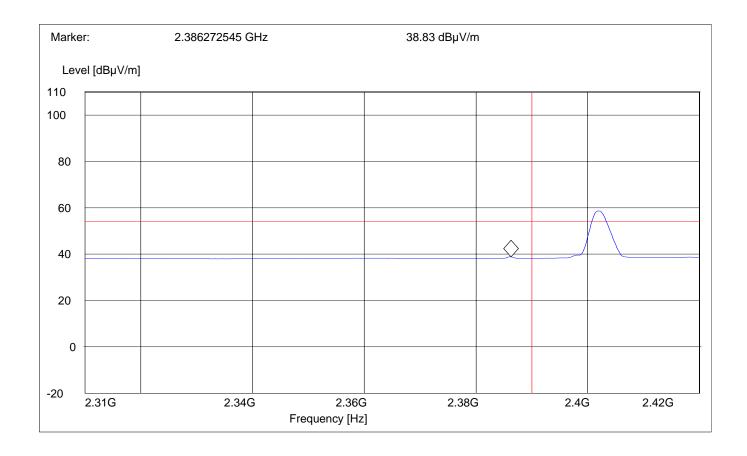
SWEEP TABLE : "FCC15.247 LBE_AVG"
Short Description : FCC15.247 BT Low-band-edge

 $Limit\ Line \qquad \qquad : \qquad \qquad 54dB\mu V$

Start Stop Detector Meas. RBW VBW Transducer

Frequency Frequency Time Bandw.

2.31 GHz 2.412 GHz MaxPeak Coupled 1 MHz 10Hz #326 horn (dBi)





BAND EDGE COMPLIANCE

§15.247 (d)

Low frequency section (spurious in the restricted band $2310-2390\ MHz)$ Peak Measurement

(This plot is valid for both Hopping ON & OFF)

Operating condition : Tx at 2402MHz SWEEP TABLE : "FCC15.247 LBE Pk"

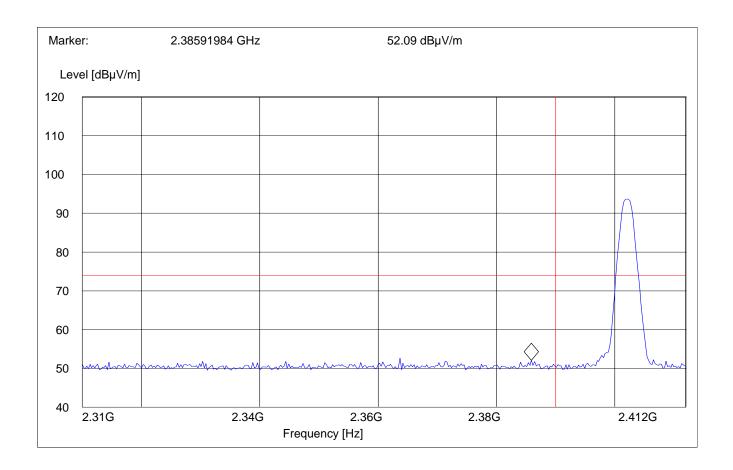
Short Description : FCC15.247 BT Low-band-edge

Limit Line : 74dBµV

Start Stop Detector Meas. RBW VBW Transducer

Frequency Frequency Time Bandw.

2.31 GHz 2.412 GHz MaxPeak Coupled 1 MHz 1MHz #326 horn (dBi)





BAND EDGE COMPLIANCE

§15.247 (d)

High frequency section (spurious in the restricted band $2483.5 - 2500 \; MHz$) Average Measurement

(This plot is valid for both Hopping ON & OFF)

Operating condition : Tx at 2480MHz

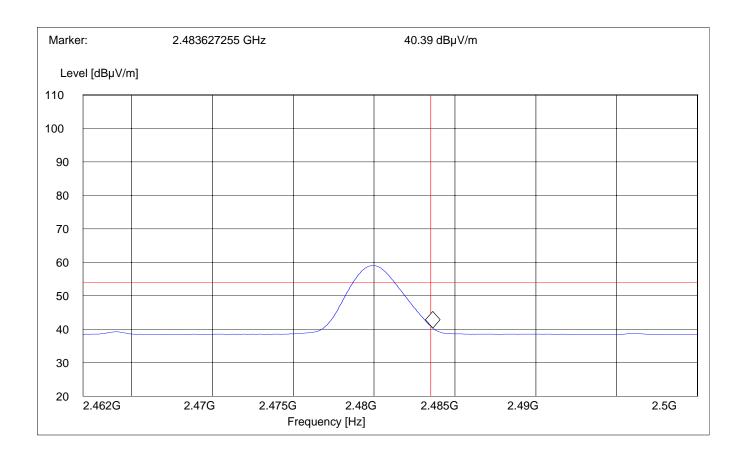
SWEEP TABLE : "FCC15.247 HBE_AVG"
Short Description : FCC15.247 BT High-band-edge

 $Limit\ Line \qquad \qquad : \qquad \qquad 54dB\mu V$

Start Stop Detector Meas. RBW VBW Transducer

Frequency Frequency Time Bandw.

2.462 GHz 2.5 GHz MaxPeak Coupled 1 MHz 10Hz #326 horn (dBi)





BAND EDGE COMPLIANCE

§15.247 (d)

High frequency section (spurious in the restricted band 2483.5 - 2500 MHz) Peak Measurement

(This plot is valid for both Hopping ON & OFF)

Operating condition : Tx at 2480MHz

SWEEP TABLE : "FCC15.247 HBE_PK"

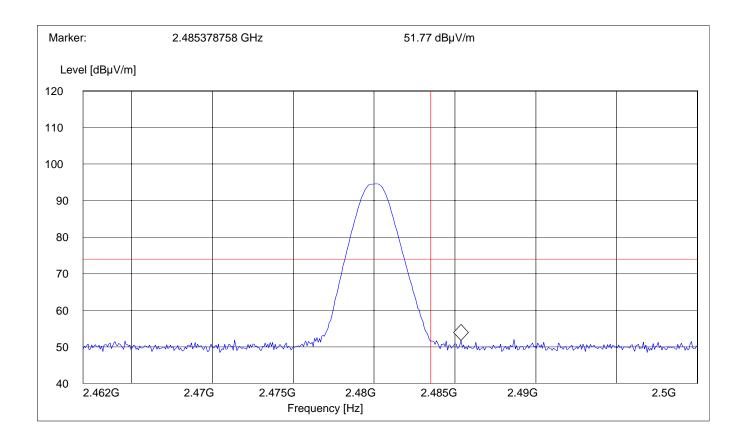
Short Description : FCC15.247 BT High-band-edge

 $Limit\ Line \qquad \qquad : \qquad \qquad 74dB\mu V$

Start Stop Detector Meas. RBW VBW Transducer

Frequency Frequency Time Bandw.

2.462 GHz 2.5 GHz MaxPeak Coupled 1 MHz 1MHz #326 horn (dBi)





EMISSION LIMITATIONS Transmitter (Conducted) LIMITS §15.247 (d)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions that 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)).

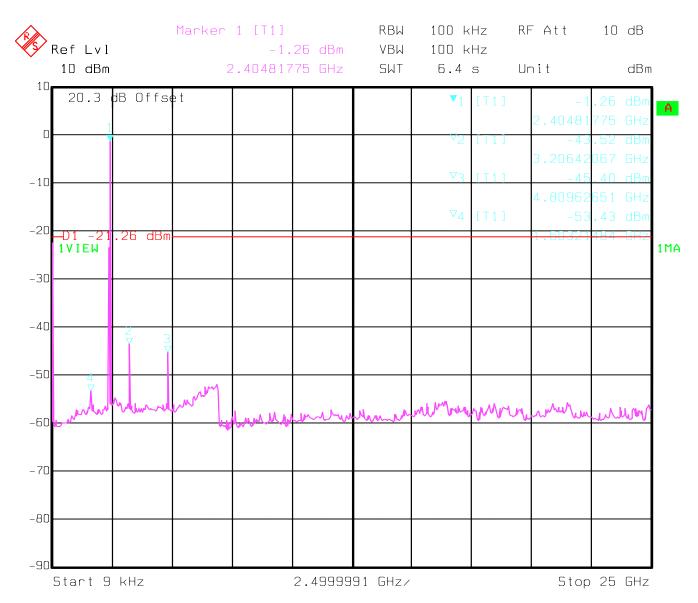
<u>NOTE</u>: Frequency resolution is not fine enough to show the exact frequency of the carrier, refer to plots under EIRP.



EMISSION LIMITATIONS - Conducted (Transmitter)

§15.247 (d)

Lowest Channel (2402MHz): 9KHz - 25GHz



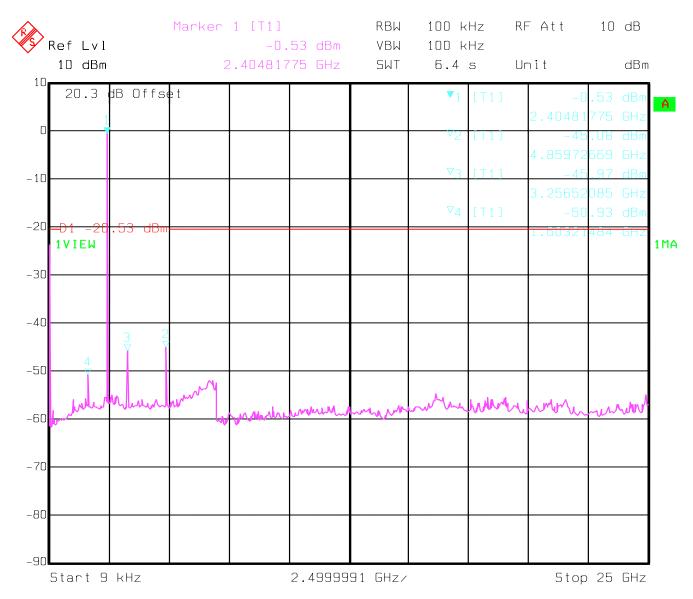
Date: 28.APR.2005 20:51:16



EMISSION LIMITATIONS - Conducted (Transmitter)

§15.247 (d)

Mid Channel (2441MHz): 9KHz - 25GHz



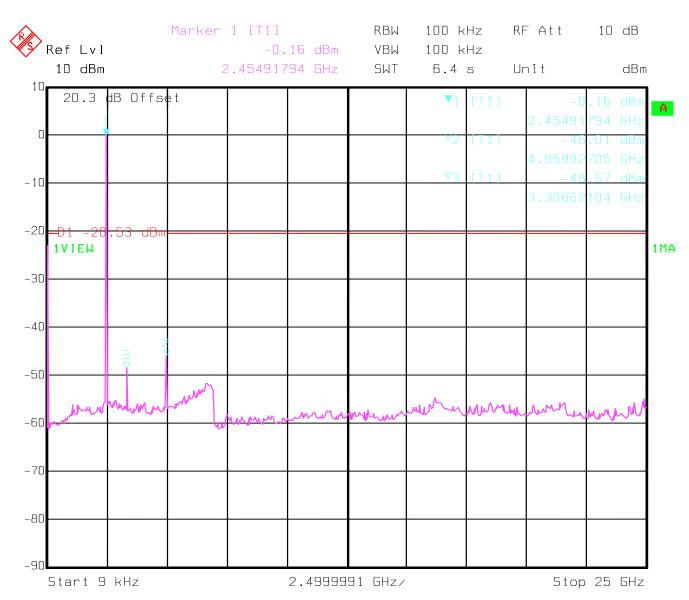
Date: 28.APR.2005 20:56:57



EMISSION LIMITATIONS - Conducted (Transmitter)

§15.247 (d)

Highest Channel (2480MHz): 9KHz - 25GHz



Date: 28.APR.2005 20:59:35



EMISSION LIMITATIONS Transmitter (Radiated) §15.247 (d)

LIMITS

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions that 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)).

NOTE:

- 1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 26.5 GHz very short cable connections to the antenna was used to minimize the noise level.
- 2. Frequency resolution is not fine enough to show the exact frequency of the carrier, refer to plots under EIRP.
- 3. All measurements are done in peak mode unless specified with plots.

Results for the radiated measurements below 30MHz according § 15.33

Frequency	Measured values	Remarks
9KHz – 30MHz	No emissions found, caused by the EUT	This is valid for all the tested channels



EMISSION LIMITATIONS - Radiated (Transmitter)

§15.247 (d)

Note: All radiated measurements were made in all three orthogonal planes. The values reported are the maximum values.

Transm	it at Lowest channel	Frequency 2402MH	I z	
Frequency (MHz)		Level (dBµV/m)		
	Peak	Quasi-Peak	Average	
4803.6	68.55		45.63	
Transm	it at Middle channel	Frequency 2441MH	<u> </u> Iz	
Frequency (MHz)		Level (dBµV/m)		
	Peak	Quasi-Peak	Average	
4863.7	69.4		45.25	
Transmi	it at Highest channel	Frequency 2480MF	łz	
Frequency (MHz)		Level (dBµV/m)		
	Peak	Quasi-Peak	Average	
	69.48		44.56	



EMISSION LIMITATIONS - Radiated (Transmitter)

§15.247 (d)

30MHz – 1GHz Antenna: vertical

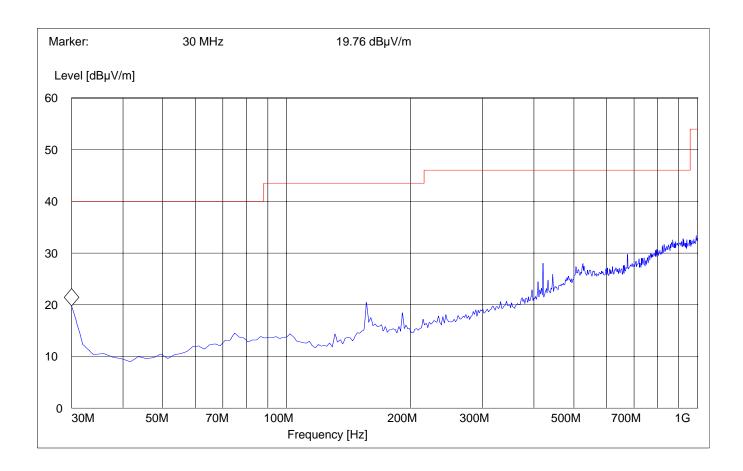
Note: This plot is valid for low, mid & high channels (worst-case plot)

SWEEP TABLE: "BT Spuri hi 30-1G"
Short Description: Bluetooth 30MHz-1GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time VBW

30.0 MHz 1.0 GHz MaxPeak Coupled 100 kHz 3141-#1186





EMISSION LIMITATIONS - Radiated (Transmitter)

§15.247 (d)

30MHz – 1GHz Antenna: horizontal

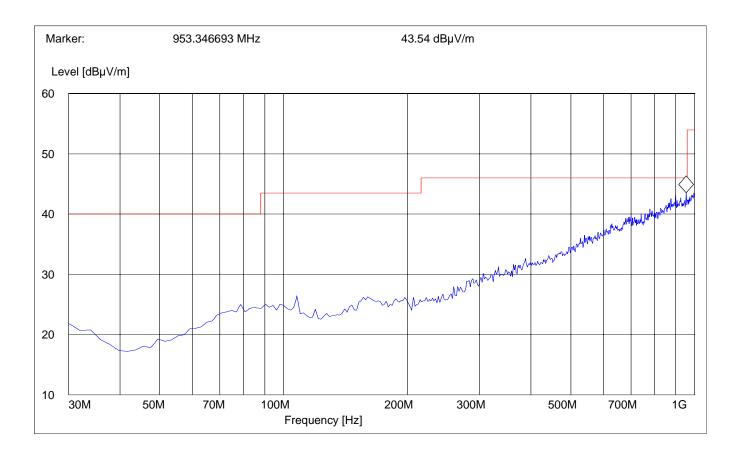
Note: This plot is valid for low, mid & high channels (worst-case plot)

SWEEP TABLE: "BT Spuri hi 30-1G"
Short Description: Bluetooth 30MHz-1GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time VBW

30.0 MHz 1.0 GHz MaxPeak Coupled 100 kHz 3141-#1186





${\bf EMISSION\ LIMITATIONS\ -\ Radiated\ (Transmitter)}$

§15.247 (d)

Lowest Channel (2402MHz): 1GHz - 3GHz

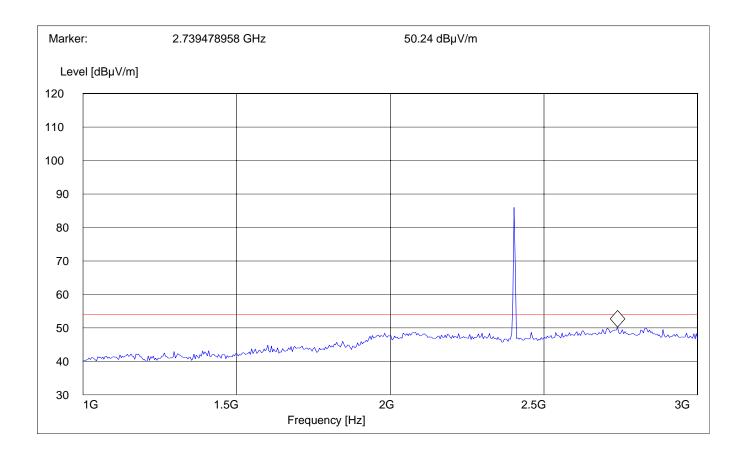
NOTE: The peak above the limit is the carrier frequency.

SWEEP TABLE: "BT Spuri hi 1-3G"

Short Description: Bluetooth Spurious 1-3GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW





EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d)

Lowest Channel (2402MHz): 3GHz - 18GHz

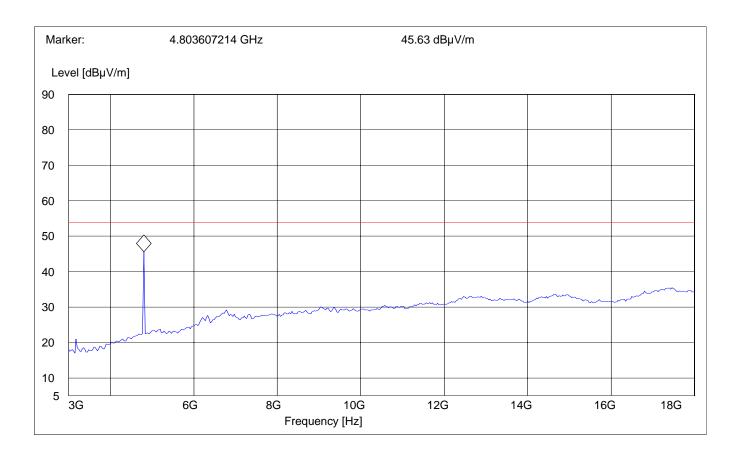
Average

SWEEP TABLE: "BT Spuri hi 3-18G"

Short Description: Bluetooth Spurious 3-18 GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW





${\bf EMISSION\ LIMITATIONS\ -\ Radiated\ (Transmitter)}$

§15.247 (d)

Middle Channel (2441MHz): 1GHz – 3GHz

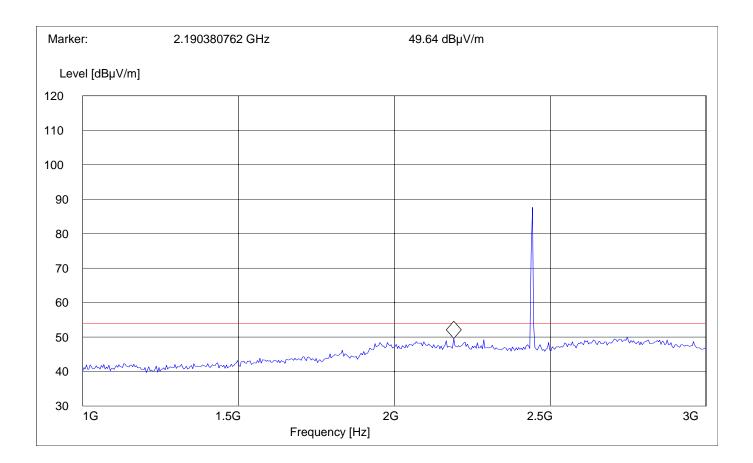
NOTE: The peak above the limit is the carrier frequency.

SWEEP TABLE: "BT Spuri hi 1-3G"

Short Description: Bluetooth Spurious 1-3GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW





${\bf EMISSION\ LIMITATIONS\ -\ Radiated\ (Transmitter)}$

§15.247 (d)

 $Middle\ Channel\ (2441MHz)\hbox{:}\ 3GHz-18GHz$

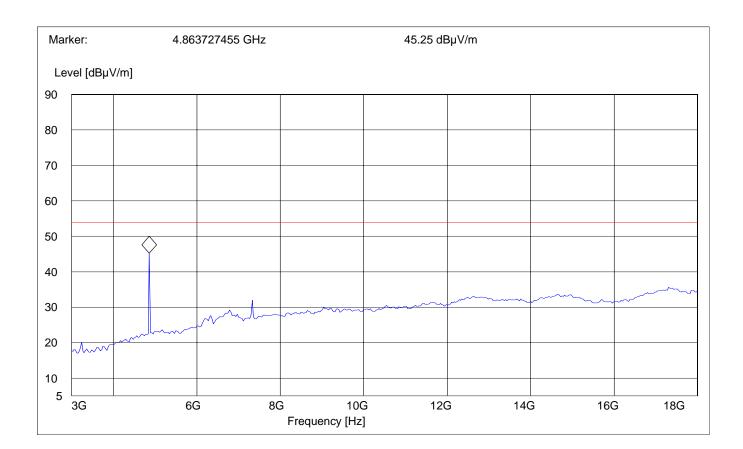
Average

SWEEP TABLE: "BT Spuri hi 3-18G"

Short Description: Bluetooth Spurious 3-18GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW





EMISSION LIMITATIONS - Radiated (Transmitter)

§15.247 (d)

Highest Channel (2480MHz): 1GHz – 3GHz

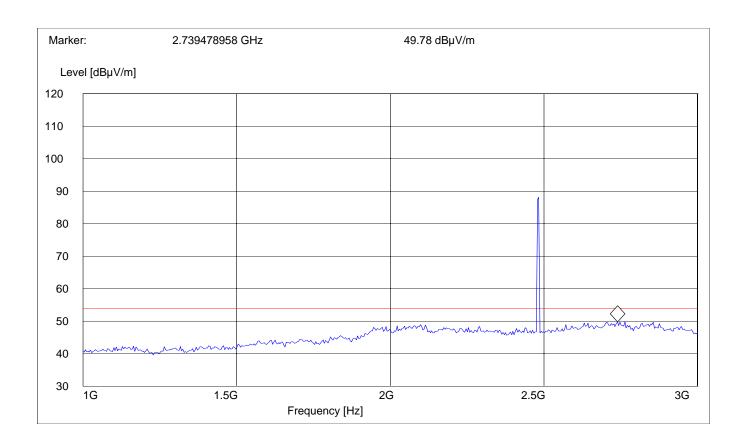
NOTE: The peak above the limit is the carrier frequency.

SWEEP TABLE: "BT Spuri hi 1-3G"

Short Description: Bluetooth Spurious 1-3GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW





EMISSION LIMITATIONS - Radiated (Transmitter) §15.247 (d)

Highest Channel (2480MHz): 3GHz - 18GHz

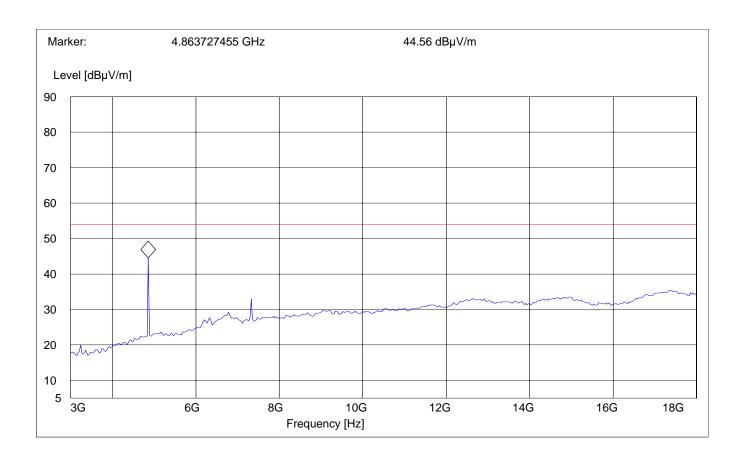
Average

SWEEP TABLE: "BT Spuri hi 3-18G"

Short Description: Bluetooth Spurious 3-18GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW





EMISSION LIMITATIONS - Radiated (Transmitter)

§15.247 (d)

18GHz – 26.5GHz

Note: This plot is valid for low, mid & high channels (worst-case plot)

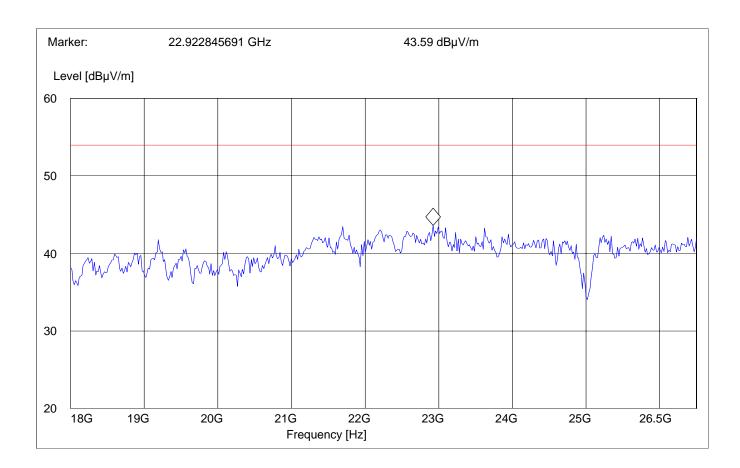
SWEEP TABLE: "BT Spuri hi 18-26.5G"

Short Description: Bluetooth Spurious 18-26.5GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW

18 GHz 26.5 GHz MaxPeak Coupled 1 MHz #141 horn (dBi)





CONDUCTED EMISSIONS

§ 15.107/207

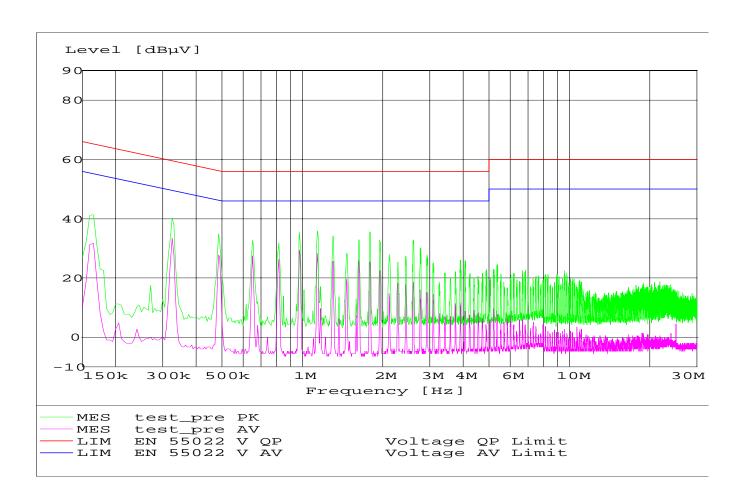
$Technical\ specification:\ 15.107\ /\ 15.207\ (Revised\ as\ of\ August\ 20,\ 2002)$

Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)			
	Quasi-Peak	Average		
0.15 - 0.5	66 to 56*	56 to 46*		
0.5 - 5	56	46		
5 – 30	60	50		
* Decreases with logarithm of the frequency				

ANALYZER SETTINGS: RBW = 10KHz

VBW = 10KHz





RECEIVER SPURIOUS RADIATION

§ 15.209

Limits

Frequency (MHz)	Field strength (µV/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	30	
30 - 88	100	3	
88 - 216	150	3	
216 - 960	200	3	
above 960	500	3	

NOTE:

- 1. The radiated emissions were done with different settings, using the relevant pre-amplifiers for the relevant frequency ranges. This is the reason that the graphs show different noise levels. In the range between 3 and 26.5 GHz very short cable connections to the antenna was used to minimize the noise level.
- 2. All measurements are done in peak mode unless specified with the plots.



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RECEIVER SPURIOUS RADIATION

30MHz – 1GHz

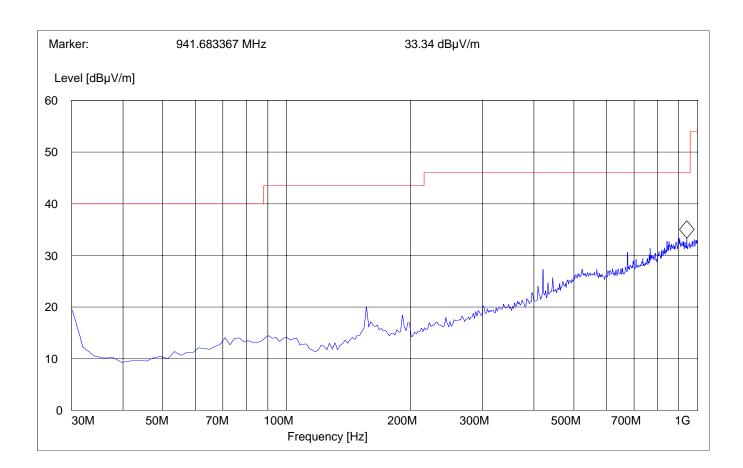
Antenna: vertical (worst-case plot)

SWEEP TABLE: "BT Spuri hi 30-1G"
Short Description: Bluetooth 30MHz-1GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time VBW

30.0 MHz 1.0 GHz MaxPeak Coupled 100 kHz 3141-#1186





RECEIVER SPURIOUS RADIATION 1GHz – 3GHz

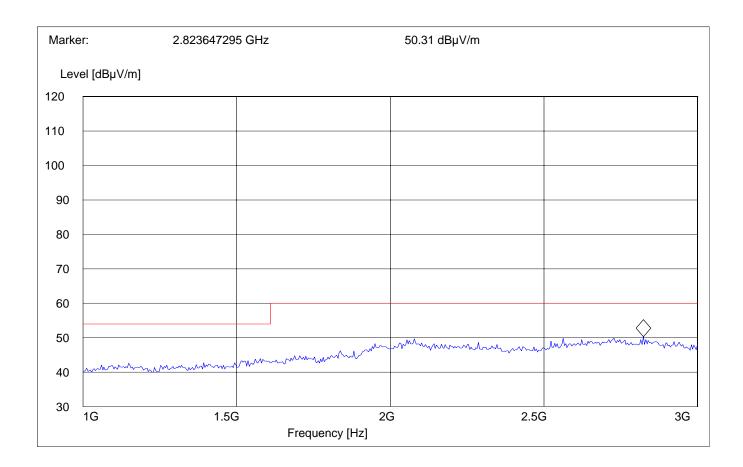
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SWEEP TABLE: "BT Spuri hi 1-3G"

Short Description: Bluetooth Spurious 1-3GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW





RECEIVER SPURIOUS RADIATION 3GHz – 18GHz

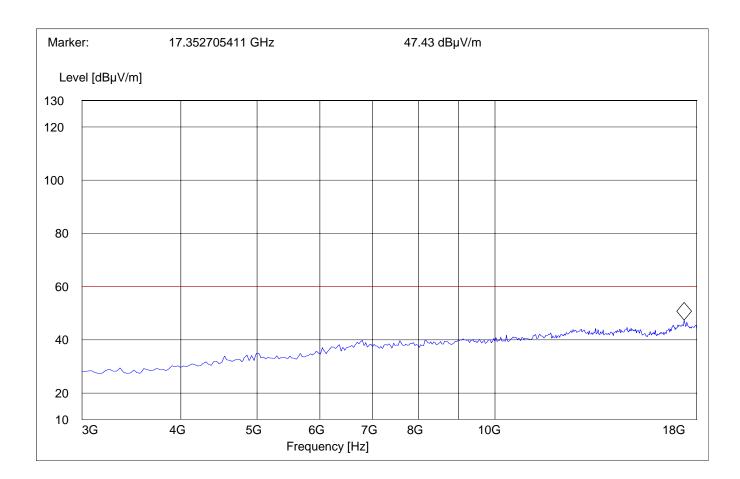
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SWEEP TABLE: "BT Spuri hi 3-18G"

Short Description: Bluetooth Spurious 3-18 GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW





RECEIVER SPURIOUS RADIATION 18GHz – 26.5GHz

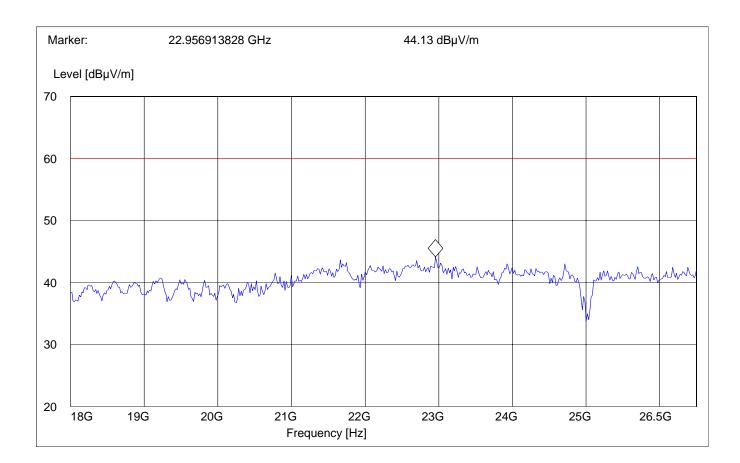
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SWEEP TABLE: "BT Spuri hi 18-26.5G"

Short Description: Bluetooth Spurious 18-26.5GHz

Start Stop Detector Meas. RBW Transducer

Frequency Frequency Time Bandw. VBW



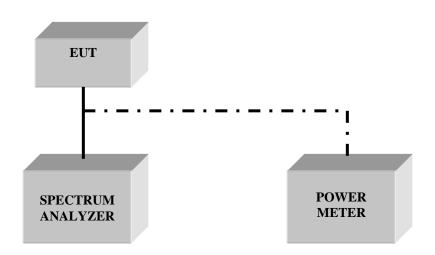


TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Туре	Manufacturer	Serial No.
01	Spectrum Analyzer	ESIB 40	Rohde & Schwarz	100107
02	Spectrum Analyzer	FSEM 30	Rohde & Schwarz	826880/010
03	Biconilog Antenna	3141	EMCO	0005-1186
04	Horn Antenna (700M-18GHz)	SAS-200/571	AH Systems	325
05	Horn Antenna (18-26.5GHz)	3160-09	EMCO	1240
06	2-3GHz Band reject filter	BRM50701	Microtronics	6
07	Pre-Amplifier	TS-ANA	Rohde & Schwarz	
08	Pre-Amplifier	JS4-00102600	Miteq	00616



BLOCK DIAGRAMSConducted Testing





Radiated Testing

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