



FCC Test Report

Test report no.: EMC_797FCC15.247_2004_5745_5825_PP09L

FCC Part 15.247 / CANADA RSS-210

EUT: WLAN Model: BCM94309MP

HOST: Dell Laptop Model: PP09L

FCC ID: QDS-BRCM1015

IC ID: 4324B-94309MP

(This test report covers freq. 5745-5825MHz)



TTI-P-G 081/94-A0

Accredited according to ISO/IEC 17025

Bluetooth™
Bluetooth Qualification
Test Facility
(BQTF)

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC listed # 101450

IC recognized # 3925

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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 : **Broadcom corporation**
Street : **190 Mathilda Place**
City / Zip Code : **Sunnyvale, CA 94086**
Country : **USA**
Contact : **Dan Lawless**
Telephone : **408-922-5870**
Tele-fax : **408-543-3399**
e-mail : **dlawless@broadcom.com**

1.4 Application details

Date of receipt test item : 2004-11-15
Date of test : 2003-11-19, 2004-11-15, 2005-02-01

1.5 Test item

Manufacturer : Applicant
Model No. (EUT) : **BCM94309MP**
Model No. (Host) : **PP09L (Dell Laptop)**
Description : **WLAN MiniPCI Multiband card incorporating 2.4GHz and 5GHz radios**
FCC ID : **QDS-BRCM1015**
IC ID : **4324B-94309MP**

Additional information

Frequency : **5745-5825MHz**
Type of modulation : **DSSS / OFDM (orthogonal frequency division multiplexing)**
Number of channels : **13 for 5GHz band**
Antenna : **Hitachi Stamped metal sheet antenna 2.8dBi for 5GHz band**
Power supply : **3.3 VDC from Host**
Output power : **20.5dBm (112.2mW) conducted peak power**
Extreme temp. Tolerance : **0°C to +70°C**

1.6 Test standards:**FCC Part 15 §15.247 / CANADA RSS-210****Measurements done as per DA 02-2138 / FCC04-165**

PROJECT OVERVIEW:

BCM94309MP is WLAN MiniPCI Multiband card incorporating 2.4GHz and 5GHz radios.

This test report carries all measurements required as per FCC 15.247 on WLAN mini PCI card tested in worst-case laptop & antenna combination in freq. range 5745-5825MHz. **Please note measurement procedure as per DA 02-2138 is used as directed by FCC 04-165.**

WLAN was tested for spurious emissions in both DSSS & OFDM modes at different data rates (1, 2, 5.5, 6, 11, and 54) to ensure compliance of the whole device. Test report shows only worst-case test results of all data rates.

All radiated measurements were done on following worst-case antenna platform;
PP09L with Hitachi stamped metal sheet ant. max gain 2.8dBi (5745-5825MHz)

BCM94309MP antenna list						
No	Dell Model (Internal Name)	Supplier	Antenna Type	Model number	Max Peak gain 2.4GHz/dBi	Max Peak Gain 5GHz/dBi
1	Dell PP09L	Hitachi	PIFA stamped Metal	HFT08-DL-AS (Antenna side) HFT08-DL-MS (Module side)	2.9 (Aux)	2.8 (Main)
2	Dell PP14L	Hitachi	PIFA stamped Metal	HFT17-DL03	Main 1.5 (H)	Main 5.1 (V)

2 Technical test**2.1 Summary of test results**

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

Final Verdict: (Only "passed" if all single measurements are "passed")	Passed
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Technical responsibility for area of testing:

2005-02-17 EMC & Radio Lothar Schmidt (Manager)

Date	Section	Name	Signature
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Responsible for test report and project leader:

2005-02-17 EMC & Radio Harpreet Sidhu (EMC Engineer)

Date	Section	Name	Signature
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2.2 Test report

TEST REPORT

Test report no.: EMC_797FCC15.247_2004_5745_5825_PP09L

TEST REPORT REFERENCE

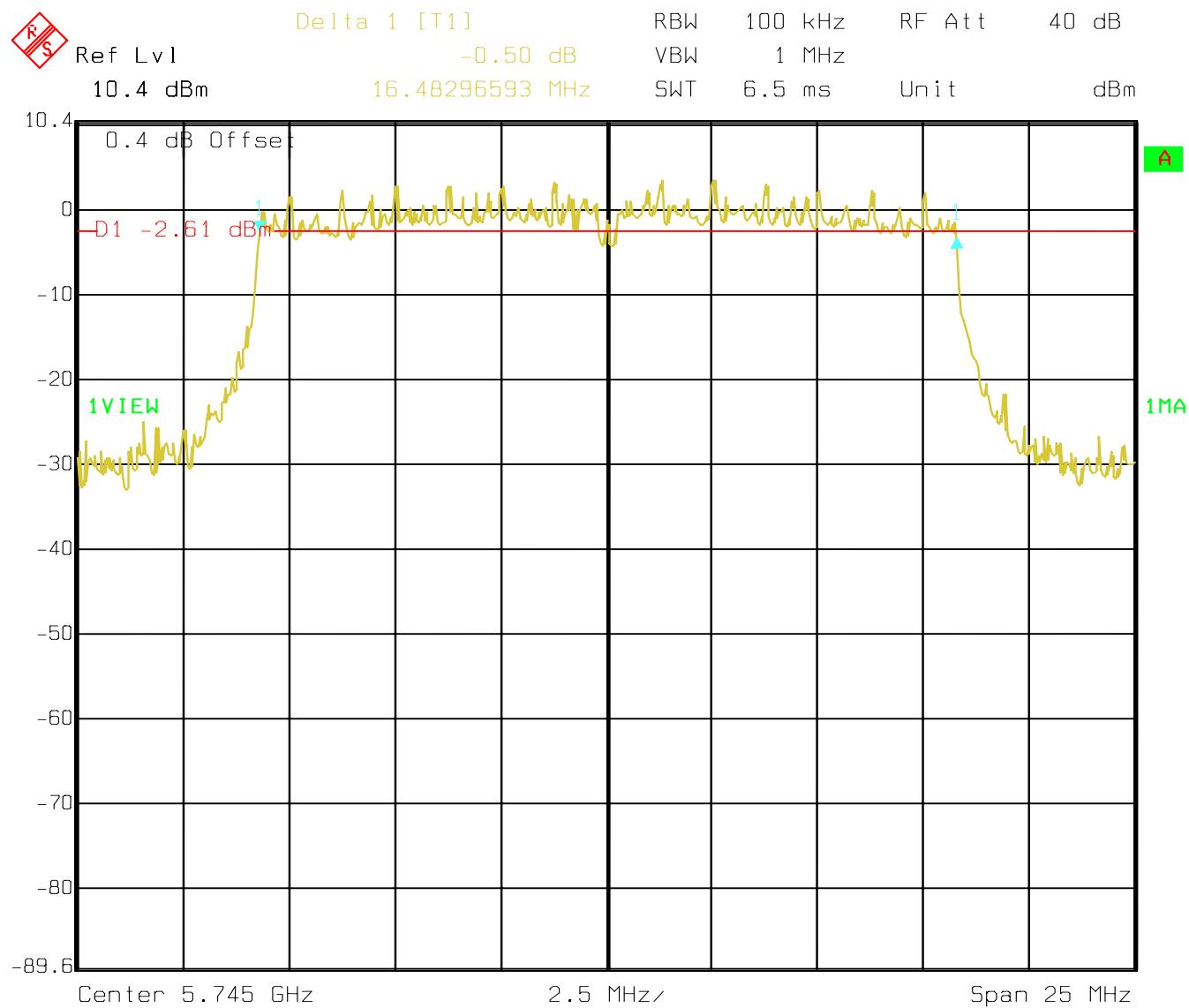
LIST OF MEASUREMENTS		PAGE
SPECTRUM BANDWIDTH OF DSSS SYSTEM	§15.247(a) (2)	8
OUTPUT POWER	§ 15.247 (b) (3)	12
POWER SPECTRAL DENSITY	§15.247 (e)	14
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SPECTRUM BANDWIDTH OF DSSS SYSTEM **§15.247(a) (2)****6 dB bandwidth****(Data rate – 54Mbps)**

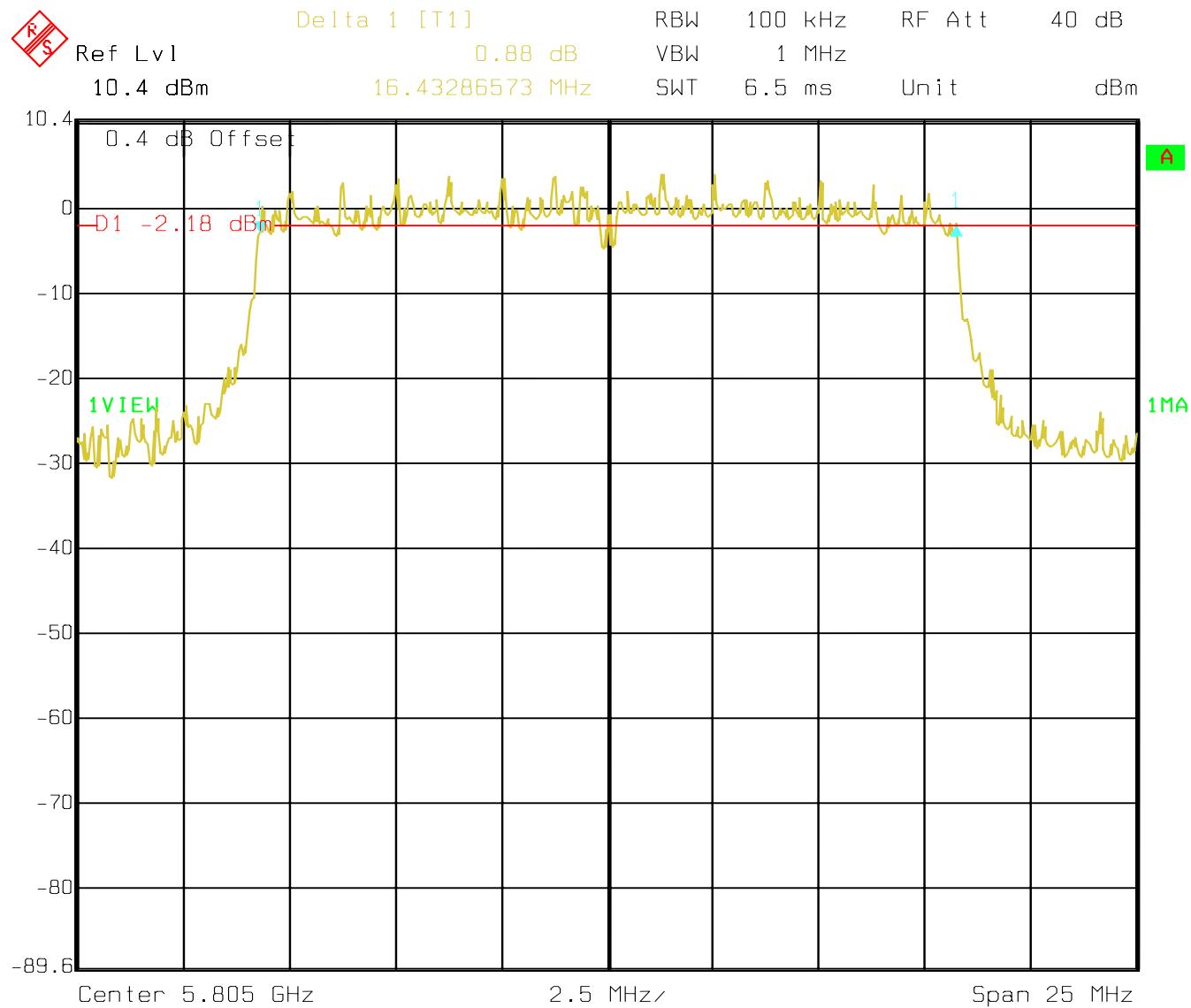
TEST CONDITIONS		6 dB BANDWIDTH (MHz)		
Frequency (MHz)		5745	5805	5825
T_{nom}(23)°C	V_{nom}(3.3) VDC	16.48	16.43	16.43

LIMIT**SUBCLAUSE §15.247(a) (2)**

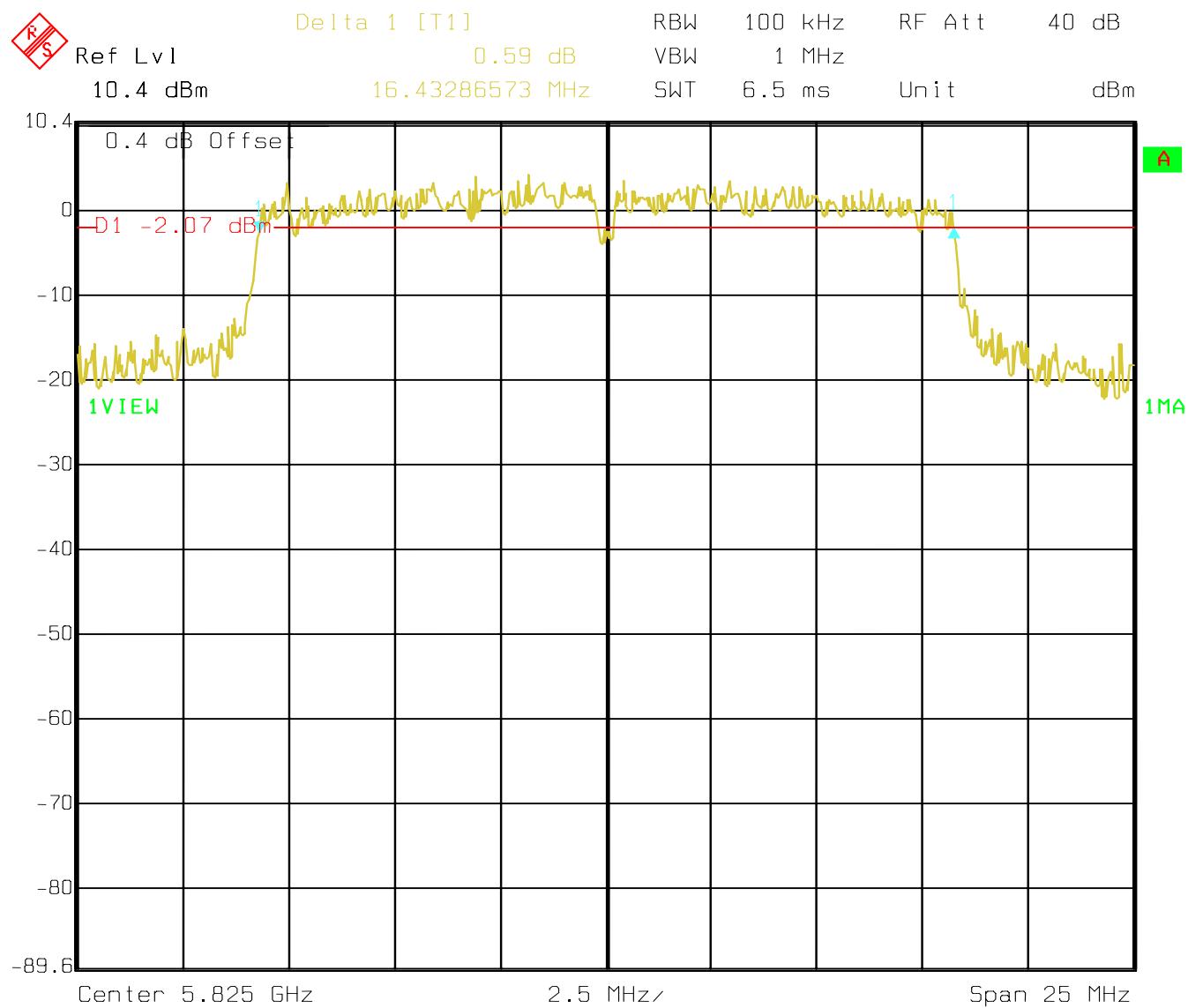
The minimum 6dB bandwidth shall be at least 500 KHz

SPECTRUM BANDWIDTH OF DSSS SYSTEM**§15.247(a) (2)****6 dB bandwidth****(Data rate – 54Mbps)****Lowest Channel: 5745MHz**

Date: 14.FEB.2005 13:50:44

SPECTRUM BANDWIDTH OF DSSSS SYSTEM §15.247(a) (2)**6 dB bandwidth****(Data rate – 54Mbps)****Mid Channel: 5805MHz**

Date: 14.FEB.2005 13:54:36

SPECTRUM BANDWIDTH OF DSSS SYSTEM**§15.247(a) (2)****6 dB bandwidth****(Data rate – 54Mbps)****Highest Channel: 5825MHz**

Date: 14.FEB.2005 13:52:39

OUTPUT POWER**§ 15.247 (b) (3)****(Conducted)****Measurement procedure as per DA 02-2138 is used as directed by FCC 04-165.**

TEST CONDITIONS		OUTPUT POWER (dBm)			
Frequency (MHz)		5745	5805	5825	
T _{nom} (23)°C	V _{nom} (3.3) VDC	Av	20.5	20.45	16.92
Measurement uncertainty		±0.5dBm			

LIMIT**SUBCLAUSE § 15.247 (b) (3)**

Frequency range	RF power output
5725-5850 MHz	1.0 Watt / 30dBm

**OUTPUT POWER
(RADIATED)****§ 15.247 (b) (3)****Measurement procedure as per DA 02-2138 is used as directed by FCC 04-165.****EIRP:**

TEST CONDITIONS		OUTPUT POWER EIRP(dBm)		
Frequency (MHz)		5745	5805	5825
T _{nom} (23)°C	V _{nom} (3.3) VDC	23.3	23.25	19.72
Measurement uncertainty		±0.5dBm		

Note: EIRP is calculated based on 2.8dBi antenna gain and conducted power measurements.*LIMIT****SUBCLAUSE § 15.247 (b) (3)**

Frequency range	RF power output
5725-5850 MHz	30dBm on Conducted

POWER SPECTRAL DENSITY §15.247 (e)
Measurement procedure as per DA 02-2138 is used as directed by FCC 04-165.

TEST CONDITIONS		POWER SPECTRAL DENSITY (dBm)		
Frequency (MHz)		5745	5805	5825
T _{nom} (23)°C	V _{nom} (3.3) VDC	5.08	4.64	2.2

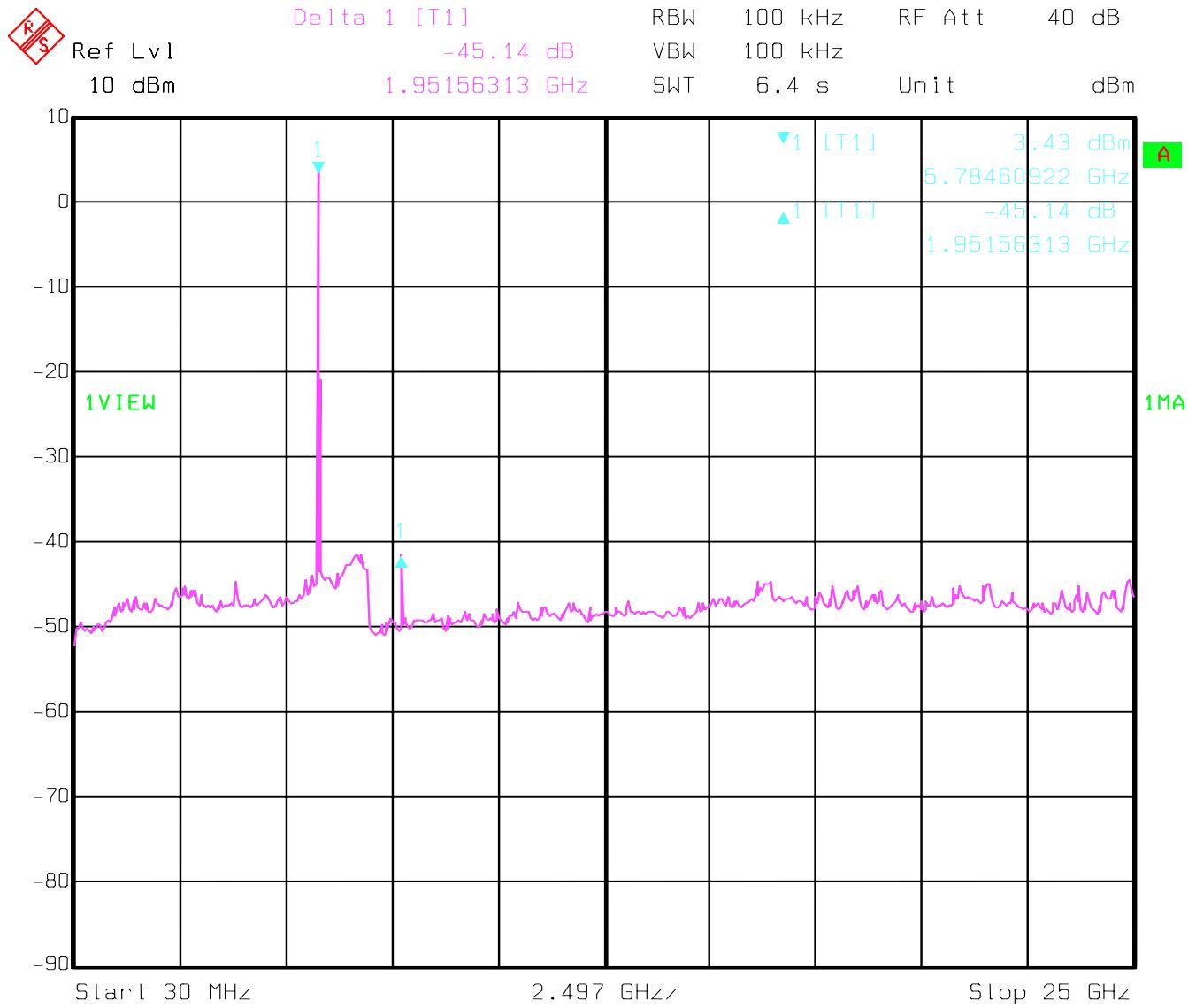
LIMIT SUBCLAUSE §15.247(e)

The peak power spectral density shall not be greater than 8dBm in any 3 kHz band

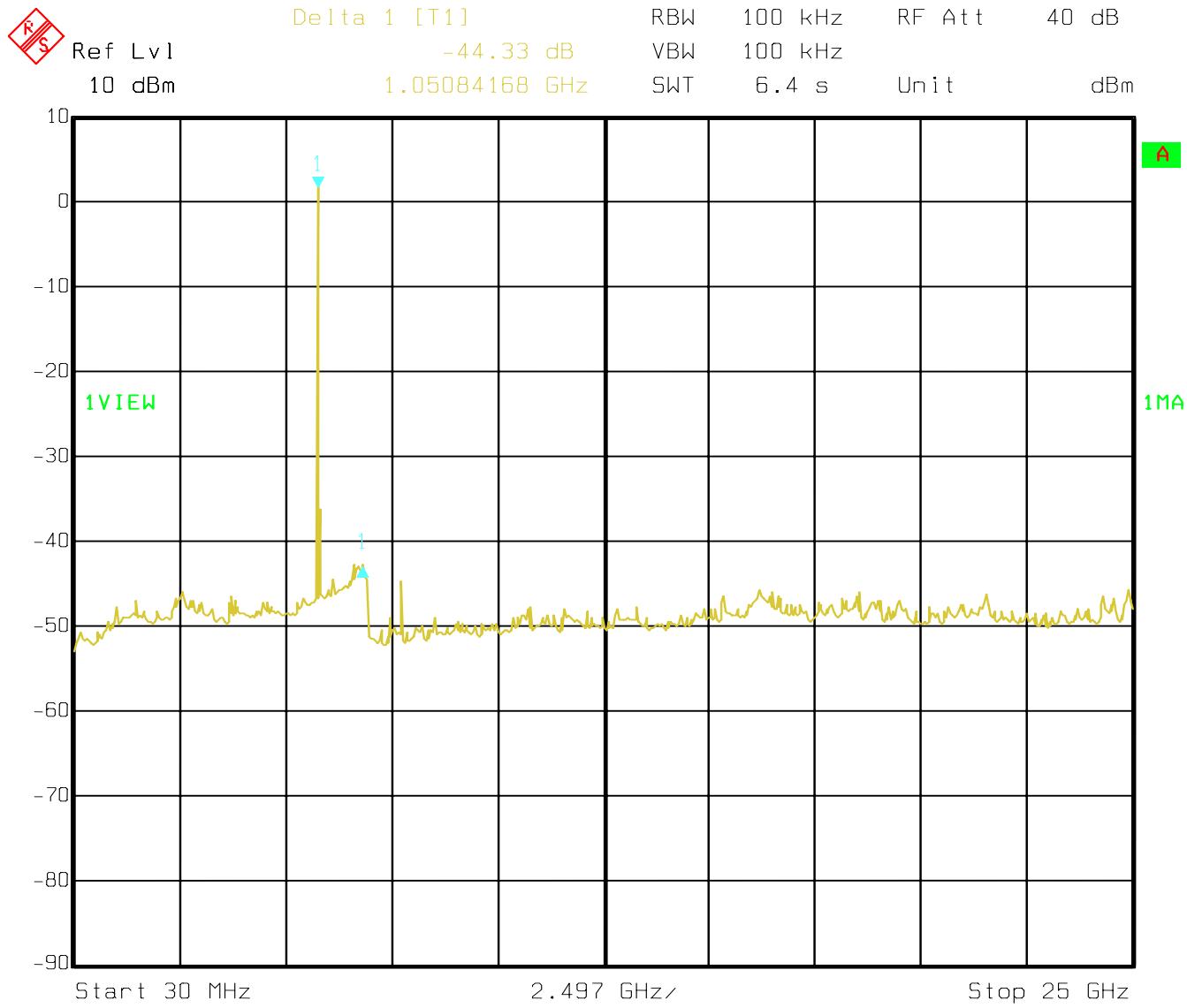
ANALYZER SETTINGS: RBW=1MHz, VBW=3MHz

EMISSION LIMITATIONS (Conducted)**§ 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, 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)).

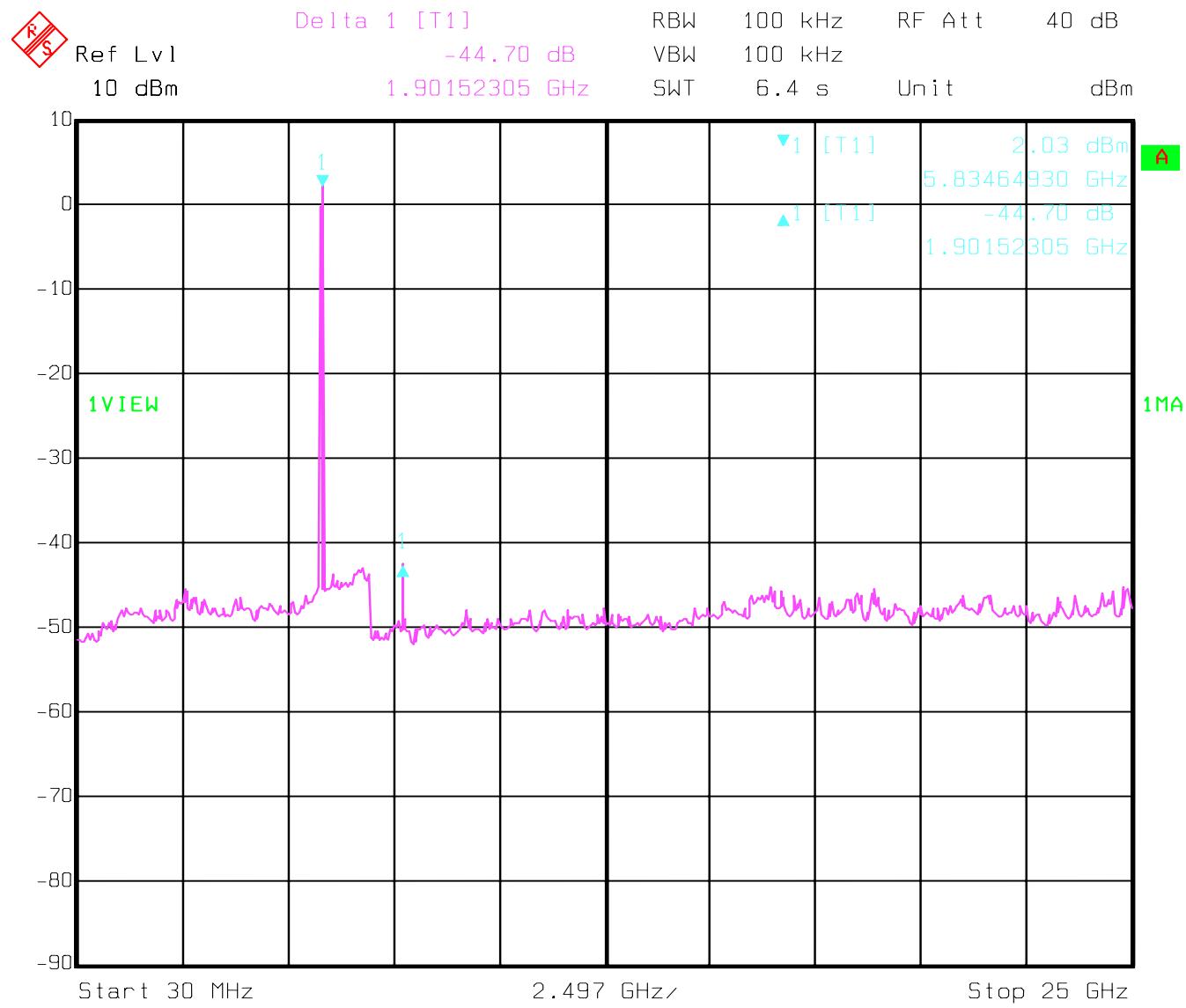
Lowest Channel (5745MHz): 30MHz – 25GHz

Date: 02.MAR.2005 14:00:50

Middle Channel (5805MHz): 30MHz – 25GHz

Date: 14.FEB.2005 14:28:59

Highest Channel (5825MHz): 30MHz – 25GHz



Date: 02.MAR.2005 14:02:14

**EMISSION LIMITATIONS (Radiated)
Transmitter****§ 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, 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)).

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 40 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.

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)
30MHz – 1GHz

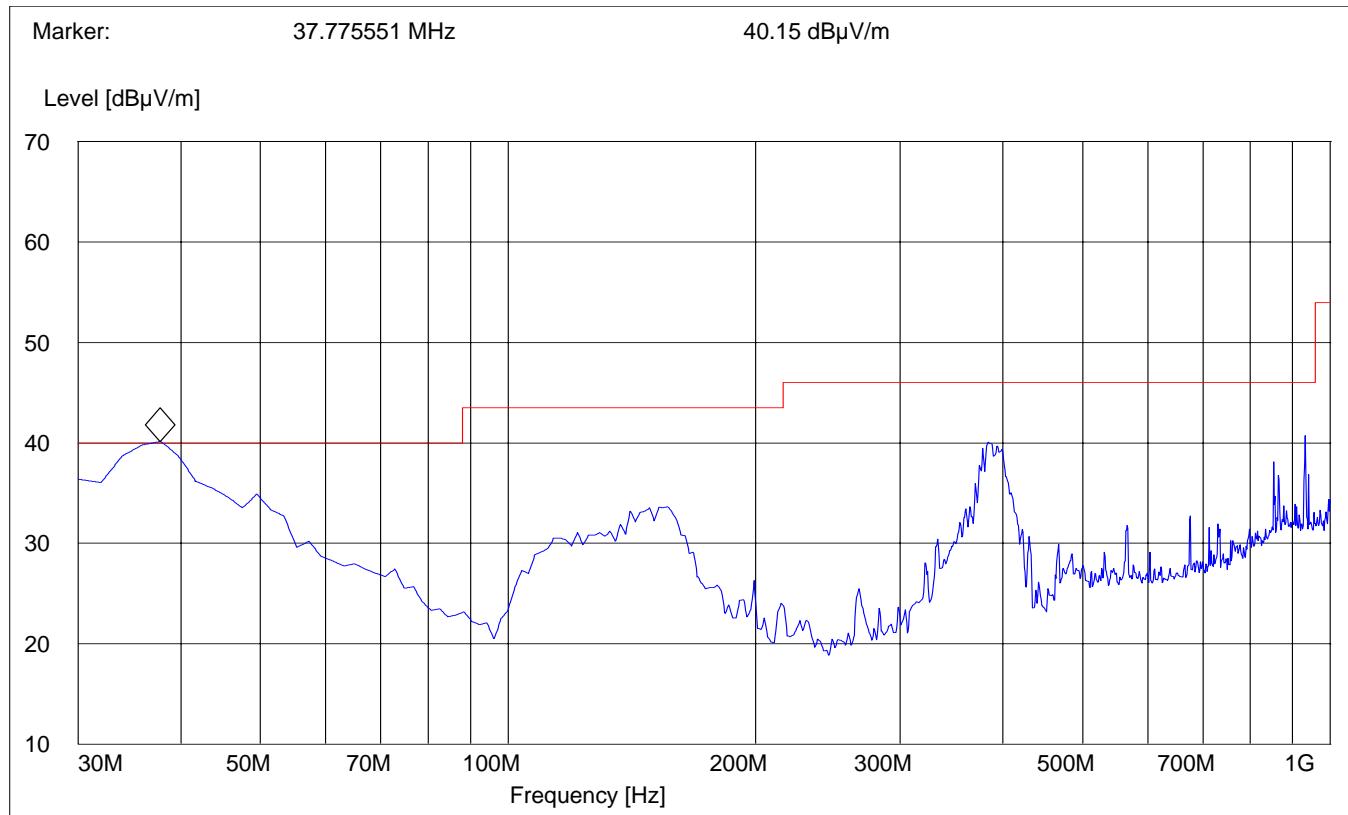
Antenna: Vertical
EUT plane: Horizontal with screen vertical @ 90°

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

SWEEP TABLE: "FCC 15.407 30-1G_V"

Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186

Freq. (MHz)	Pk Level (dB μ V/m)	QPk Level (dB μ V/m)
37.77	40.15	35.15



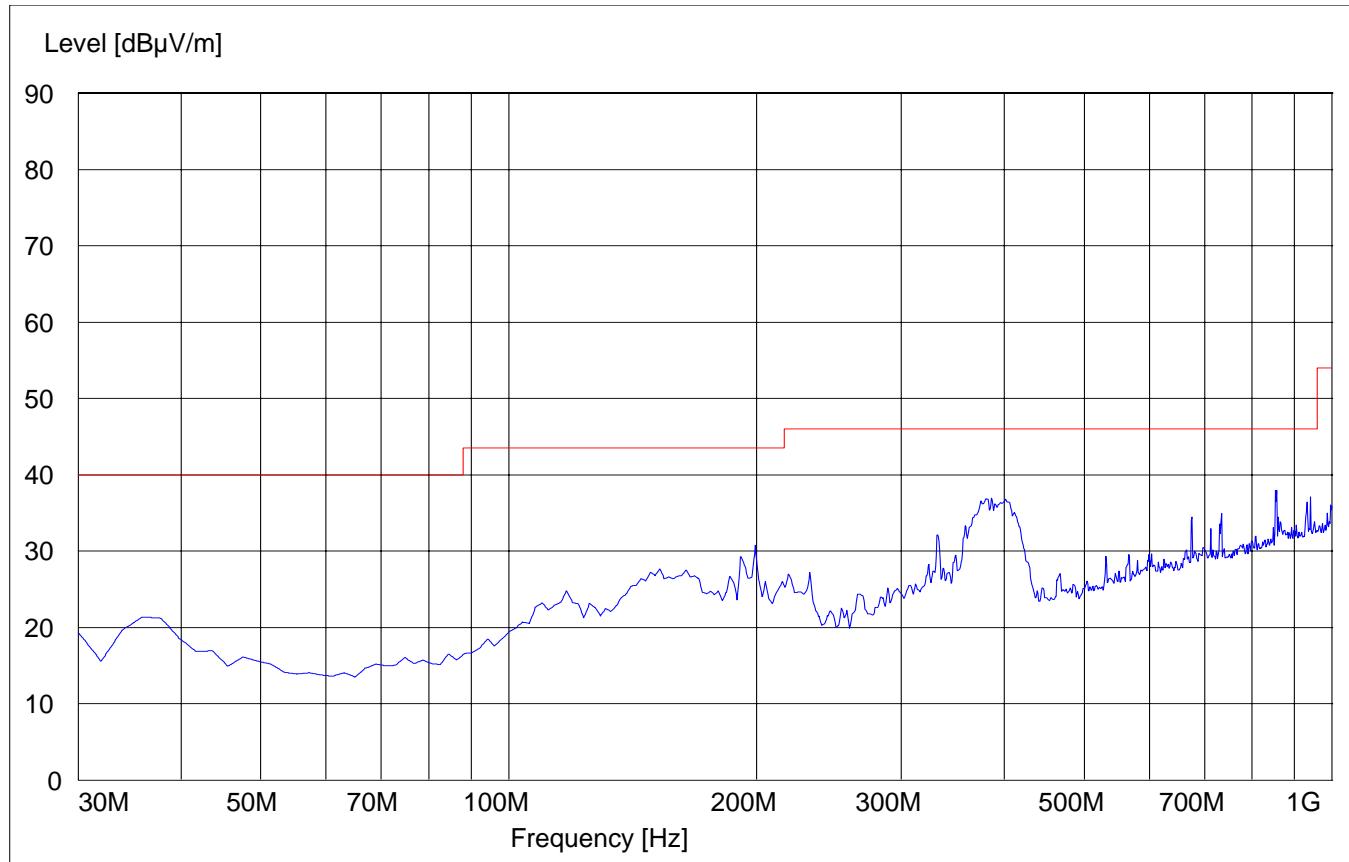
EMISSION LIMITATIONS - Radiated (Transmitter) **§ 15.247 (d)**
30MHz – 1GHz

Antenna: **Horizontal**
EUT plane: **Horizontal with screen vertical @ 90°**

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

SWEEP TABLE: "FCC 15.407 30-1G_H"

Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	3141-#1186



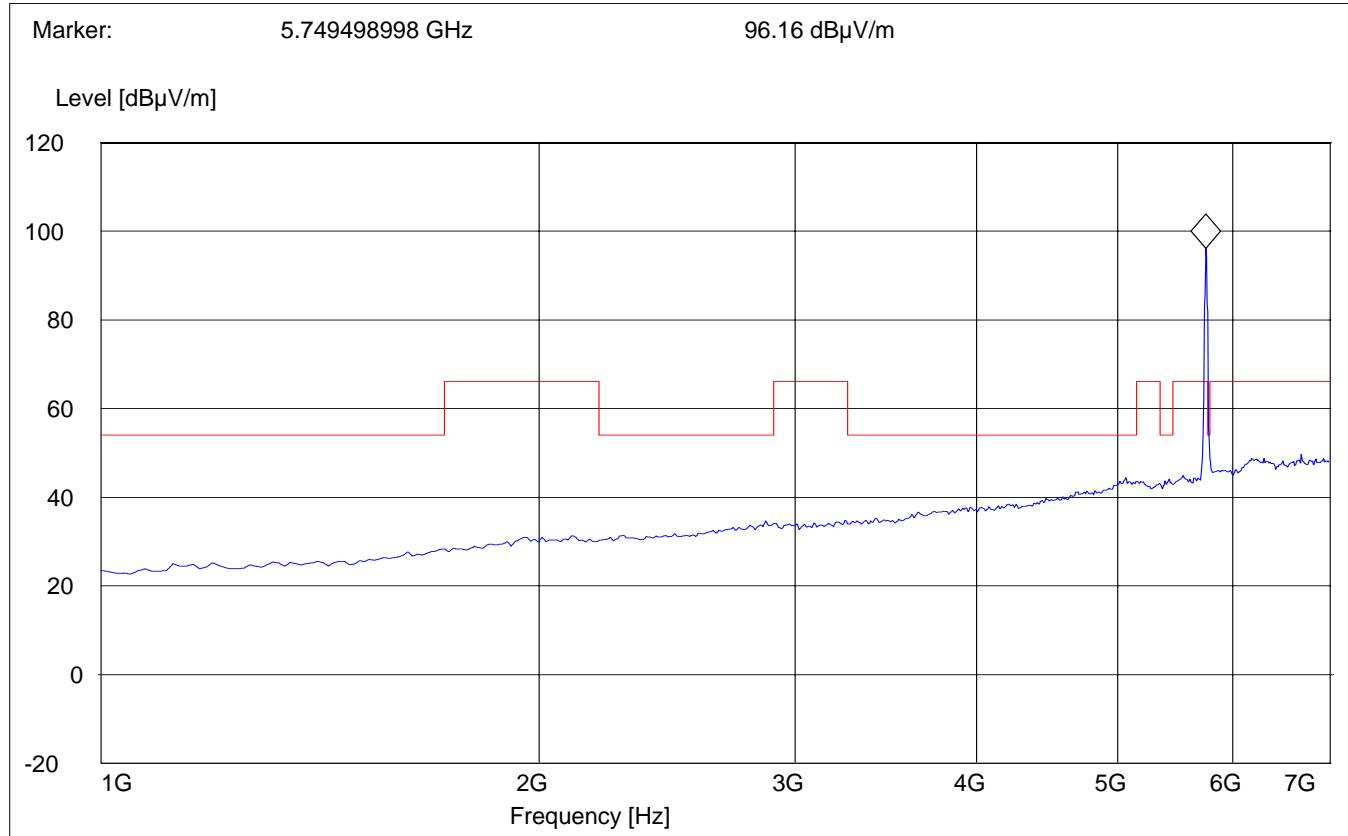
EMISSION LIMITATIONS - Radiated (Transmitter) § 15.247 (d)**Lowest Channel (5745MHz): 1GHz – 7GHz
(Average)**

Antenna: Horizontal
EUT plane: Horizontal with screen vertical @ 90°

Note: The peak above the limit line is the carrier freq.

SWEEP TABLE: "FCC 15.407 1-7G"

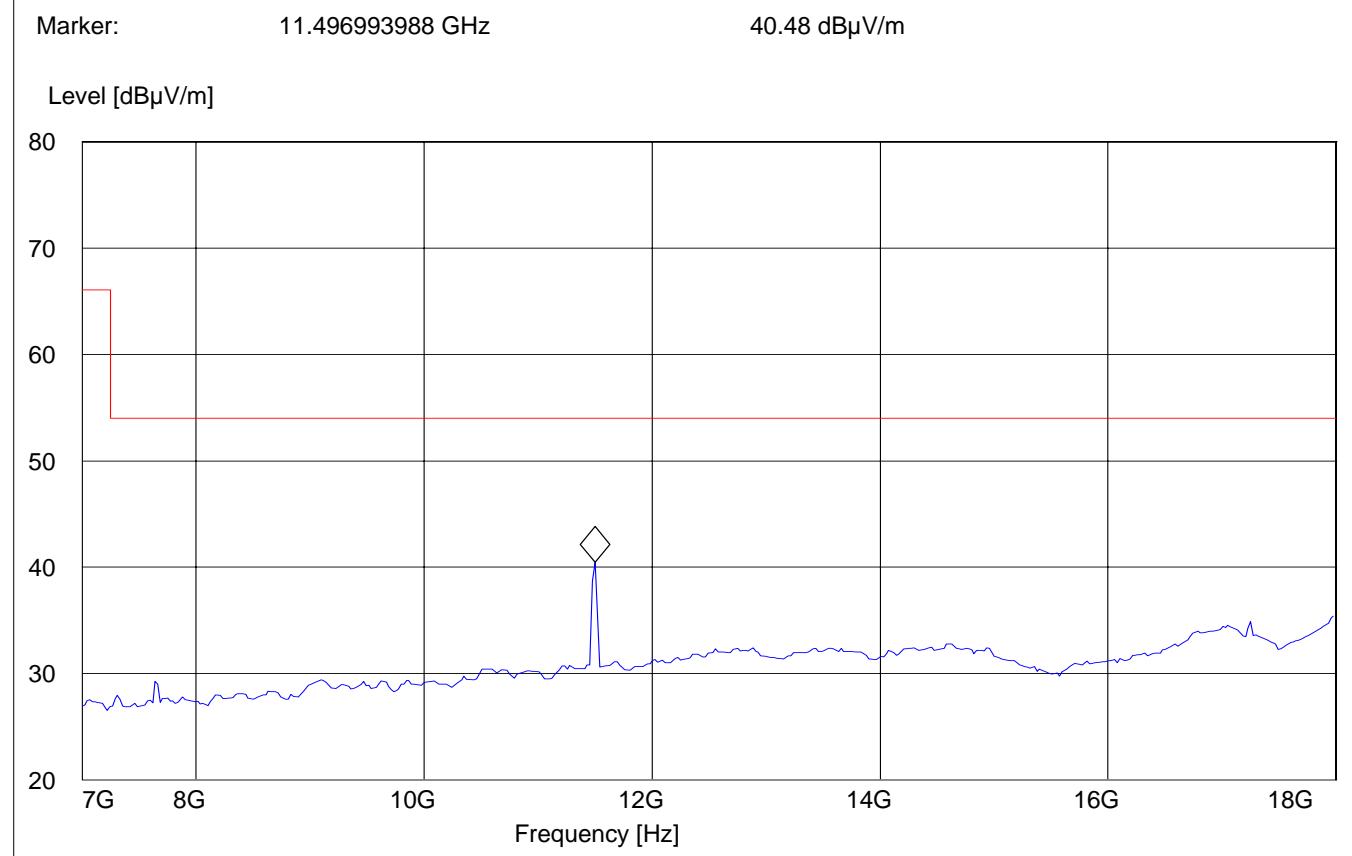
Start Frequency	Stop Frequency	Detector	Meas.	RBW	VBW	Transducer
1GHz	7.0 GHz	MaxPeak	Coupled	1MHz	10Hz	326 horn



EMISSION LIMITATIONS - Radiated (Transmitter) § 15.247 (d)**Lowest Channel (5745MHz): 7GHz – 18GHz****Average****Antenna:** **Horizontal****EUT plane:** **Horizontal with screen vertical @ 90°**

SWEEP TABLE: "FCC 15.407 7-18G"

Start Frequency	Stop Frequency	Detector	Meas.	RBW	VBW	Transducer
7GHz	18.0 GHz	MaxPeak	Time Coupled	1MHz	10Hz	326 horn



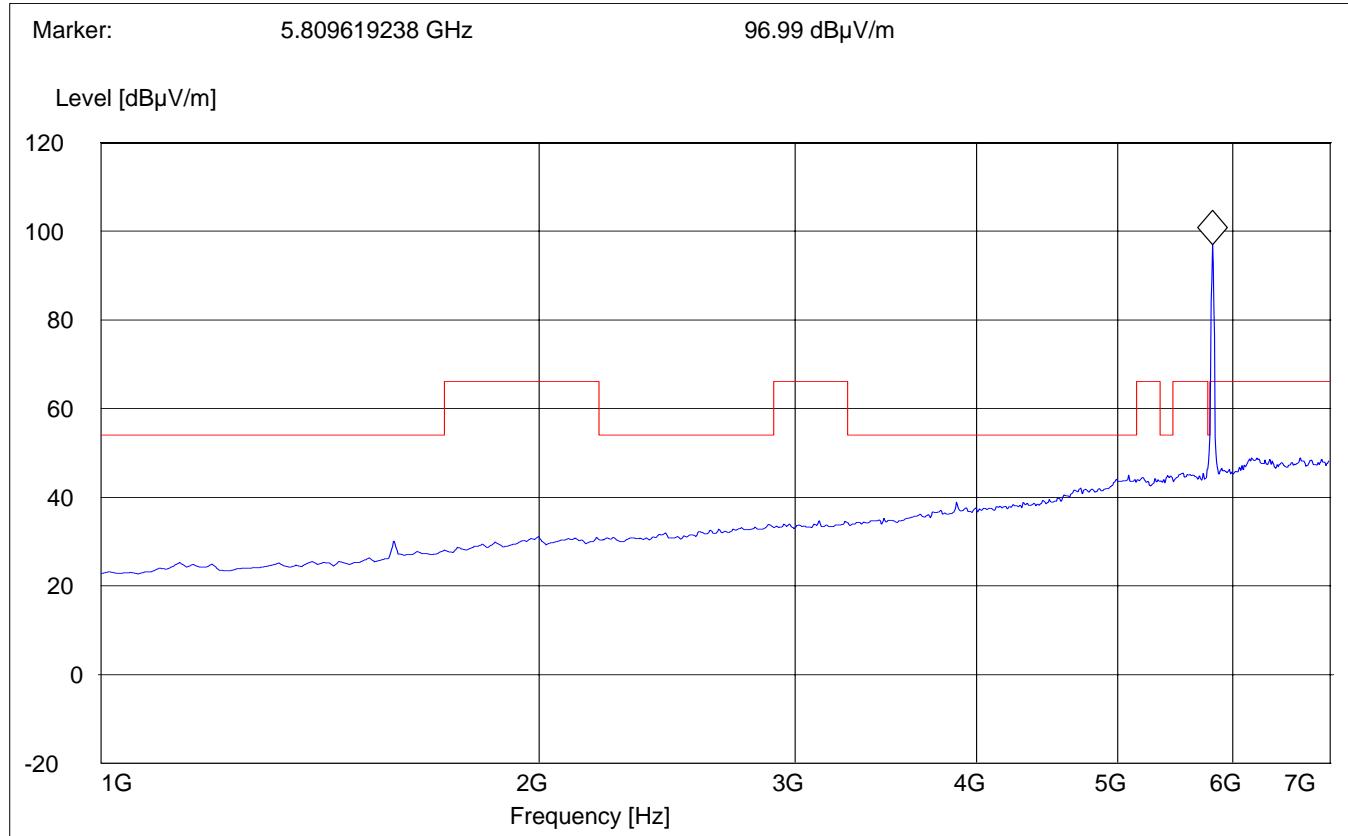
EMISSION LIMITATIONS - Radiated (Transmitter) § 15.247 (d)**Highest Channel (5805MHz): 1GHz – 7GHz
(Average)**

Antenna: Horizontal
EUT plane: Horizontal with screen vertical @ 90°

Note: The peak above the limit line is the carrier freq.

SWEEP TABLE: "FCC 15.407 1-7G"

Start Frequency	Stop Frequency	Detector	Meas.	RBW	VBW	Transducer
1GHz	7.0 GHz	MaxPeak	Coupled	1MHz	10Hz	326 horn

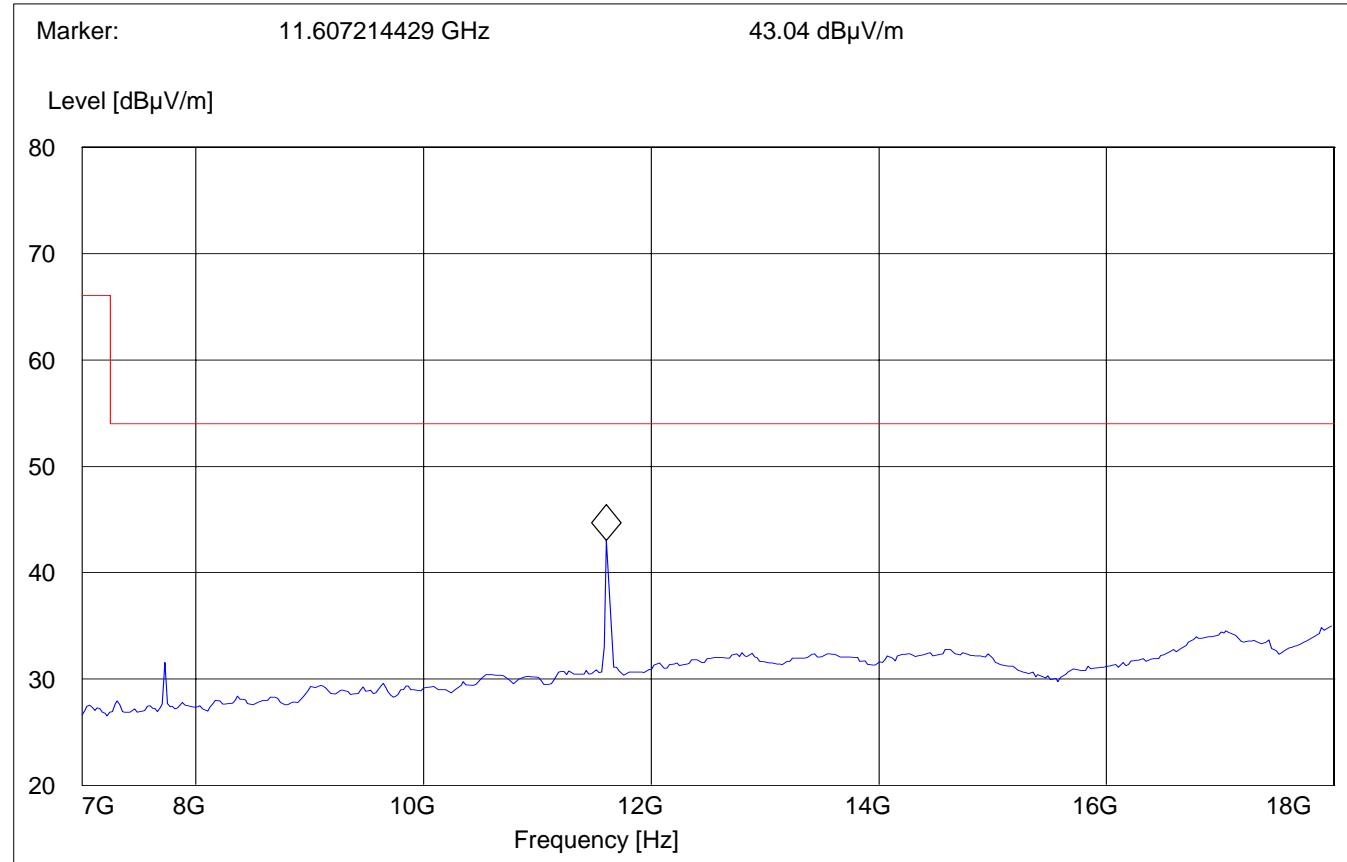


EMISSION LIMITATIONS - Radiated (Transmitter) § 15.247 (d)**Highest Channel (5805MHz): 7GHz – 18GHz****Average**

Antenna: **Horizontal**
EUT plane: **Horizontal with screen vertical @ 90°**

SWEEP TABLE: "FCC 15.407 7-18G"

Start Frequency	Stop Frequency	Detector	Meas.	RBW	VBW	Transducer
7GHz	18.0 GHz	MaxPeak	Time Coupled	1MHz	10Hz	326 horn



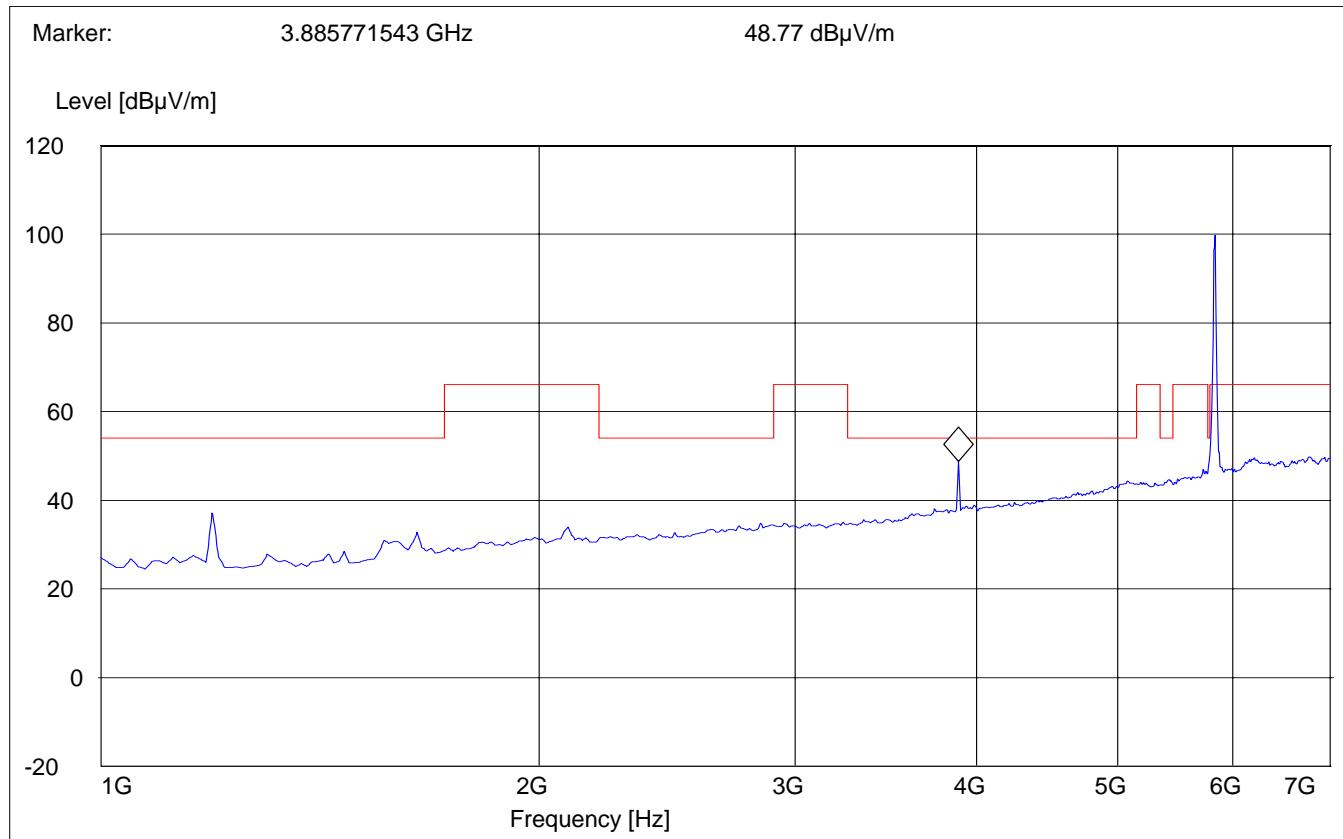
**EMISSION LIMITATIONS - Radiated (Transmitter)
(5825MHz): 1GHz – 7GHz
(Average)****§ 15.247 (d)**

Antenna: Horizontal
EUT plane: Horizontal with screen vertical @ 90°

Note: The peak above the limit line is the carrier freq.

SWEEP TABLE: "FCC 15.407 1-7G"

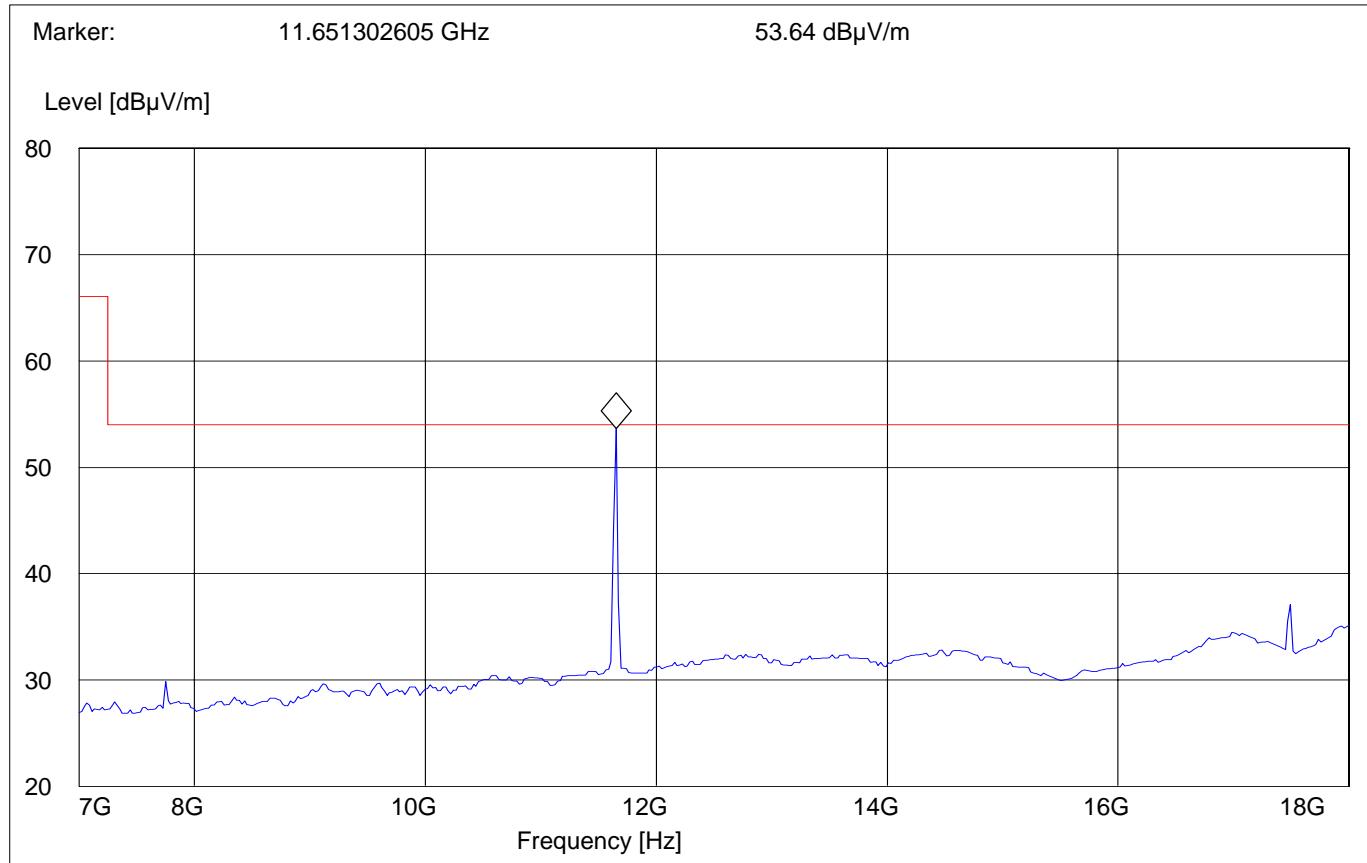
Start Frequency	Stop Frequency	Detector	Meas.	RBW	VBW	Transducer
1GHz	7.0 GHz	MaxPeak	Coupled	1MHz	10Hz	326 horn



**EMISSION LIMITATIONS - Radiated (Transmitter)
(5825MHz): 7GHz – 18GHz****§ 15.247 (d)****Average****Antenna: Horizontal**
EUT plane: Horizontal with screen vertical @ 90°

SWEEP TABLE: "FCC 15.407 7-18G"

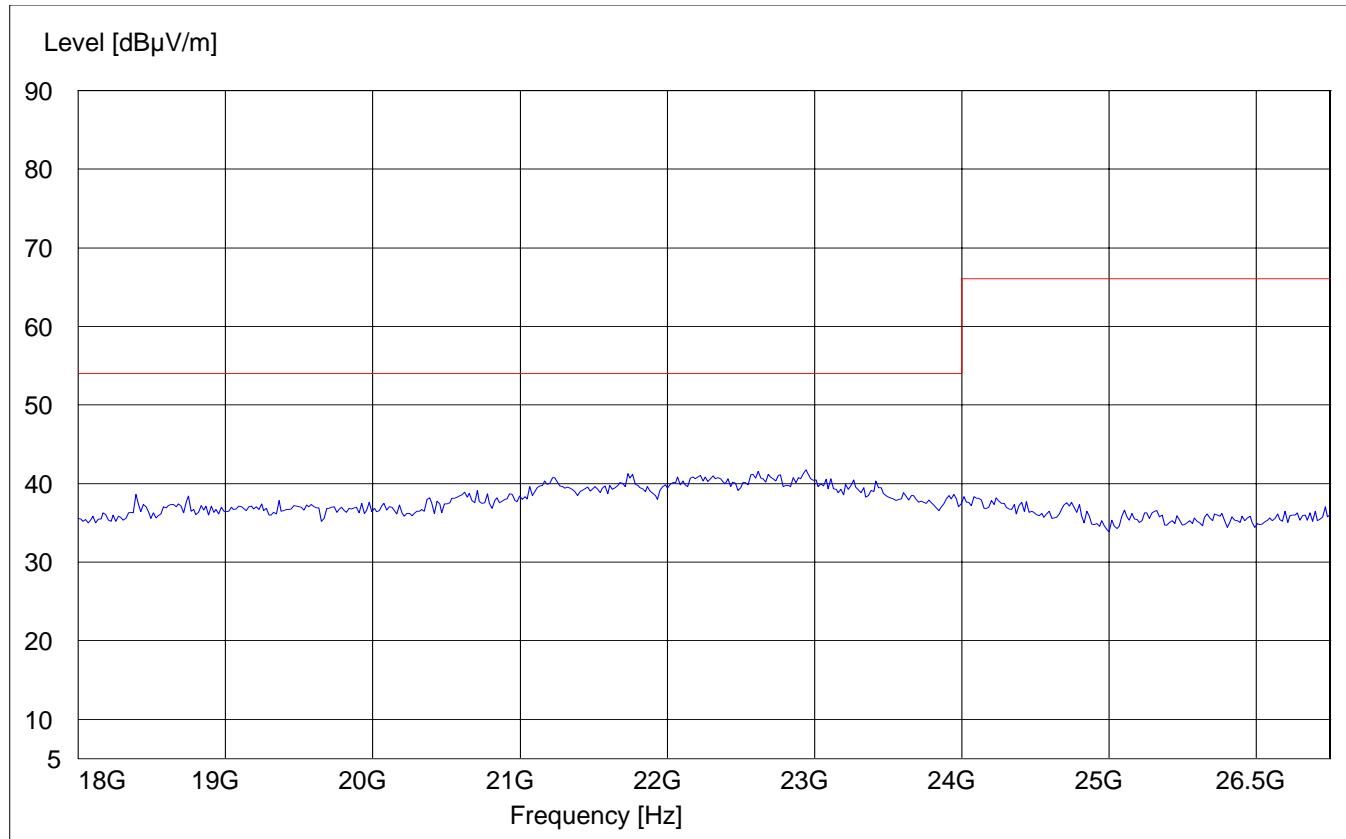
Start Frequency	Stop Frequency	Detector	Meas.	RBW	VBW	Transducer
7GHz	18.0 GHz	MaxPeak	Time Coupled	1MHz	10Hz	326 horn



EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (d)****18GHz – 26.5GHz**Antenna: **Horizontal**EUT plane: **Horizontal with screen vertical @ 90°****Note: This plot is valid for low & high channels (worst-case plot)**

SWEEP TABLE: "FCC 15.407 18-26.5G"

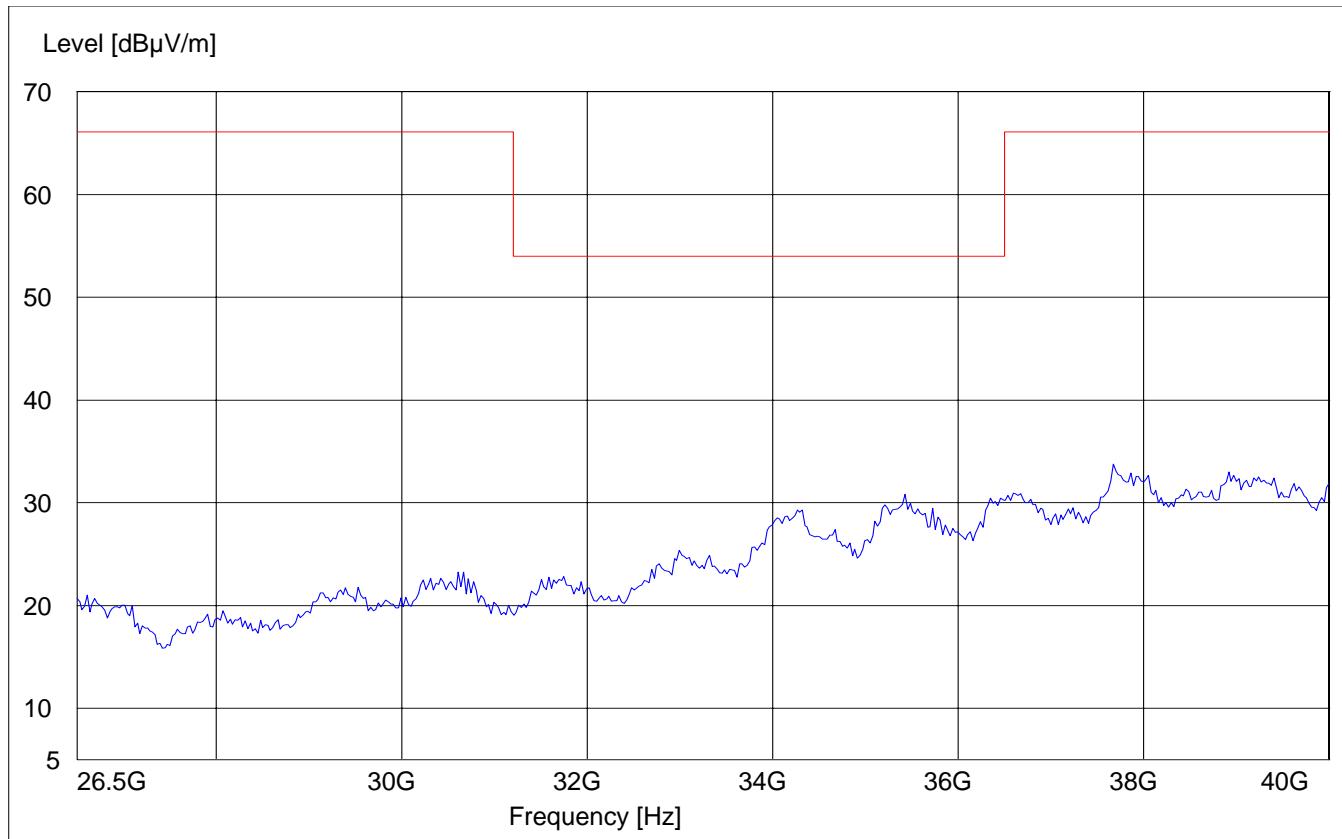
Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
18GHz	26.5 GHz	MaxPeak	Coupled	1MHz	3160-09 horn



EMISSION LIMITATIONS - Radiated (Transmitter)**§ 15.247 (d)****26.5GHz – 40GHz**Antenna: **Horizontal**EUT plane: **Horizontal with screen vertical @ 90°****Note: This plot is valid for low & high channels (worst-case plot)**

SWEEP TABLE: "FCC 15.407 26.5-40G"

Start Frequency	Stop Frequency	Detector	Meas.	RBW	Transducer
26.5GHz	40 GHz	MaxPeak	Time Coupled	1MHz	3160-10 horn



CONDUCTED EMISSIONS**§ 15.107/207****Measured with AC/DC power adapter*****SWEEP TABLE: "55022 cond"***

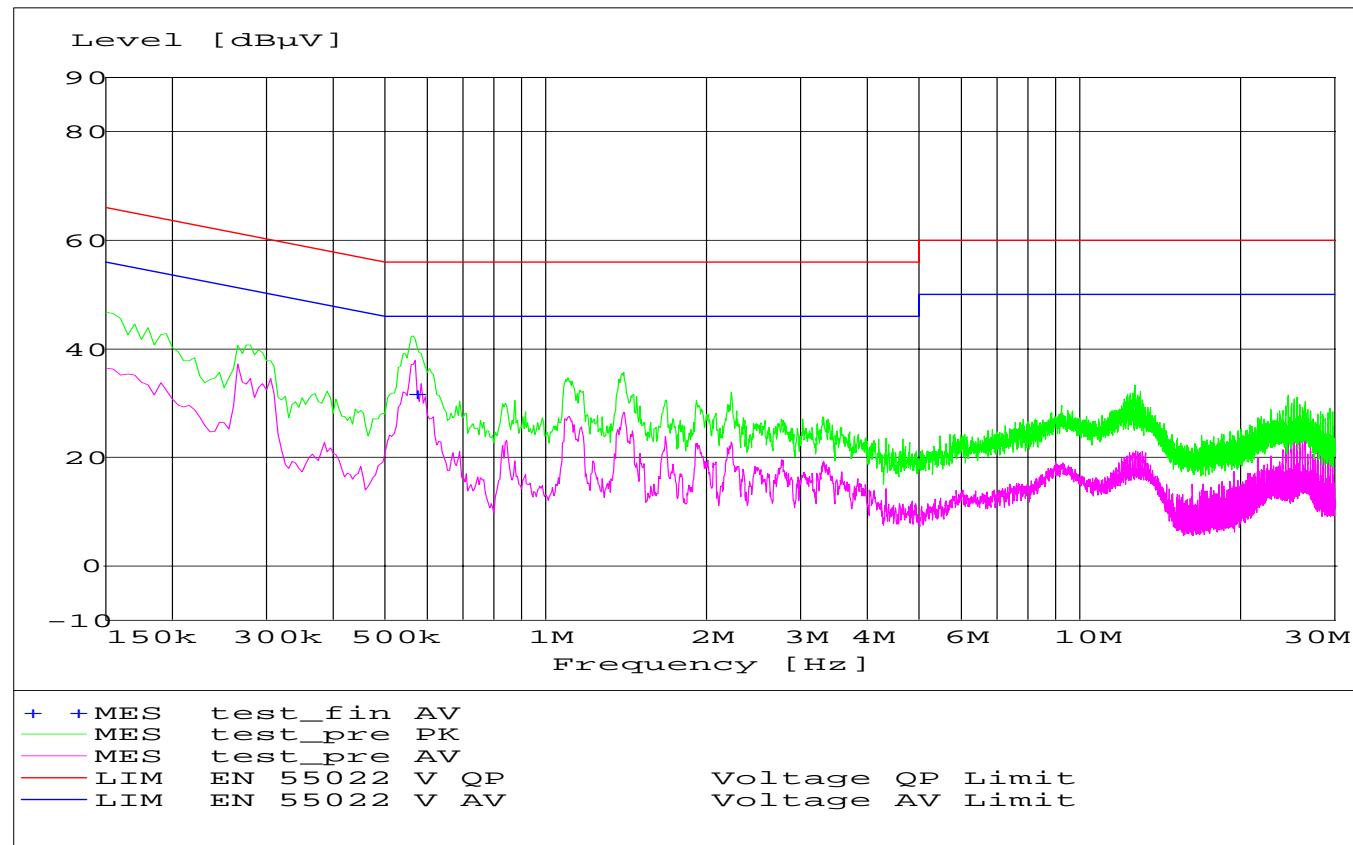
Short Description: EN 55022 for 150KHz-30MHz

Start Frequency	Stop Frequency	Detector	Meas	IF	Transducer
150.0 kHz	30.0 MHz	MaxPeak	Coupled	10 kHz	None

Technical specification: 15.107 / 15.207 (Revised as of August 20, 2002)**Limit**

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	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 (μ V/m)	Measurement distance (m)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
above 960	500	3

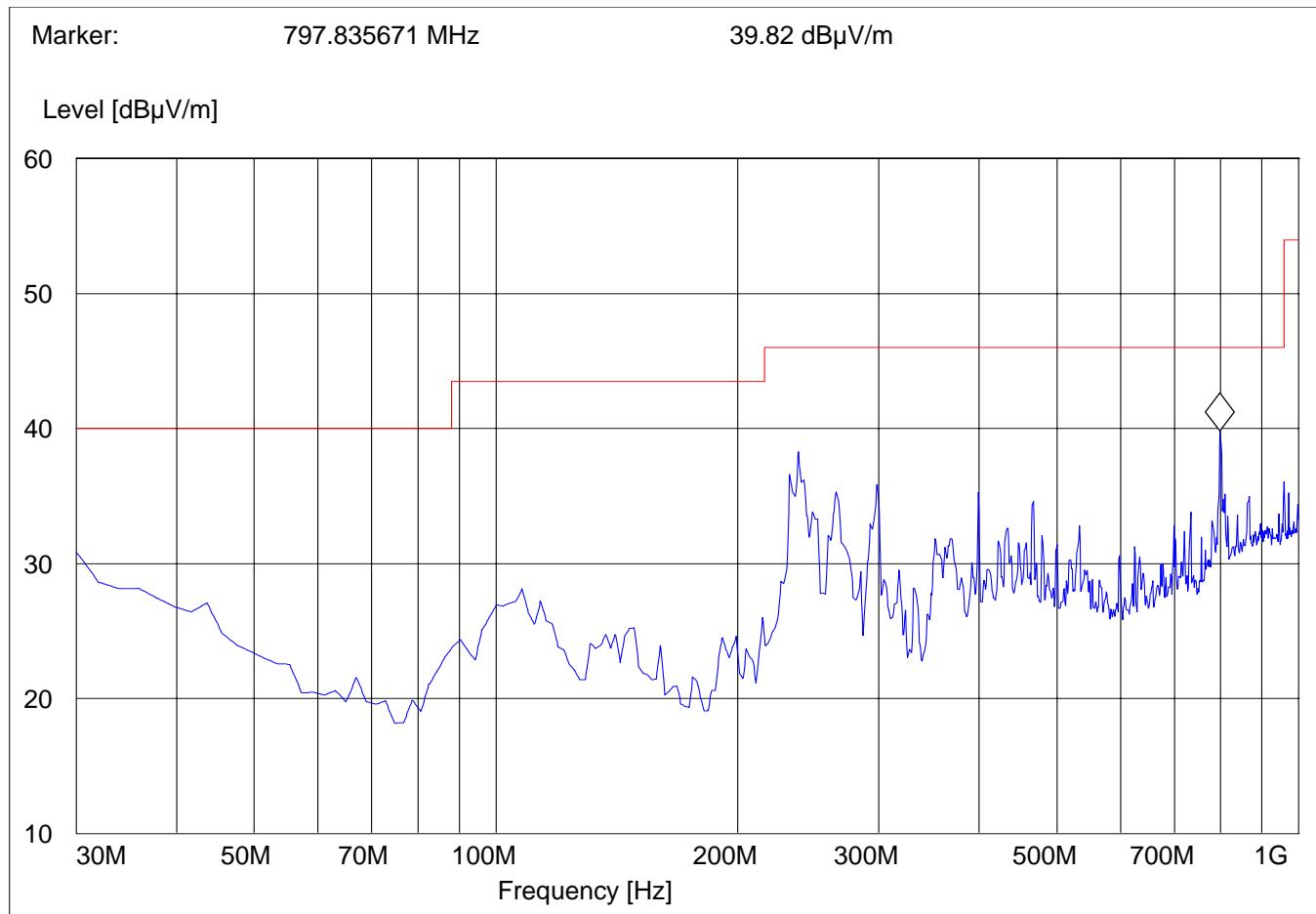
NOTE:

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 40 GHz very short cable connections to the antenna was used to minimize the noise level.

**RECEIVER SPURIOUS RADIATION
30MHz – 1GHz****§ 15.209**

Antenna: Vertical
EUT plane: Horizontal with screen vertical @ 90°

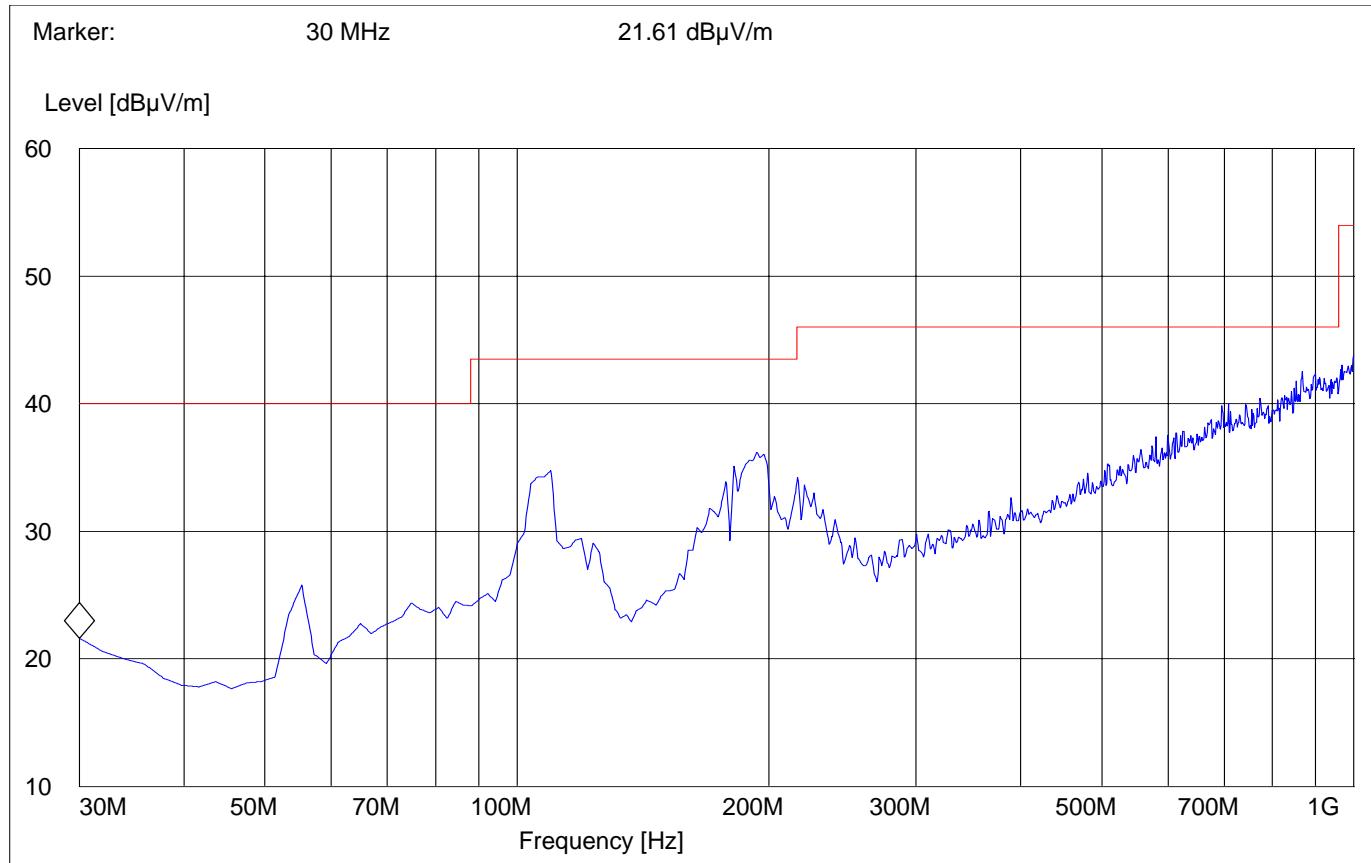
SWEEP TABLE: "WLAN Spuri hi 30-1G"
Start Stop Detector Meas. RBW Transducer
Frequency Frequency Time VBW
30.0 MHz 1.0 GHz MaxPeak Coupled 100 kHz 3141-#1186



**RECEIVER SPURIOUS RADIATION
30MHz – 1GHz****§ 15.209**

Antenna: Horizontal
EUT plane: Horizontal with screen vertical @ 90°

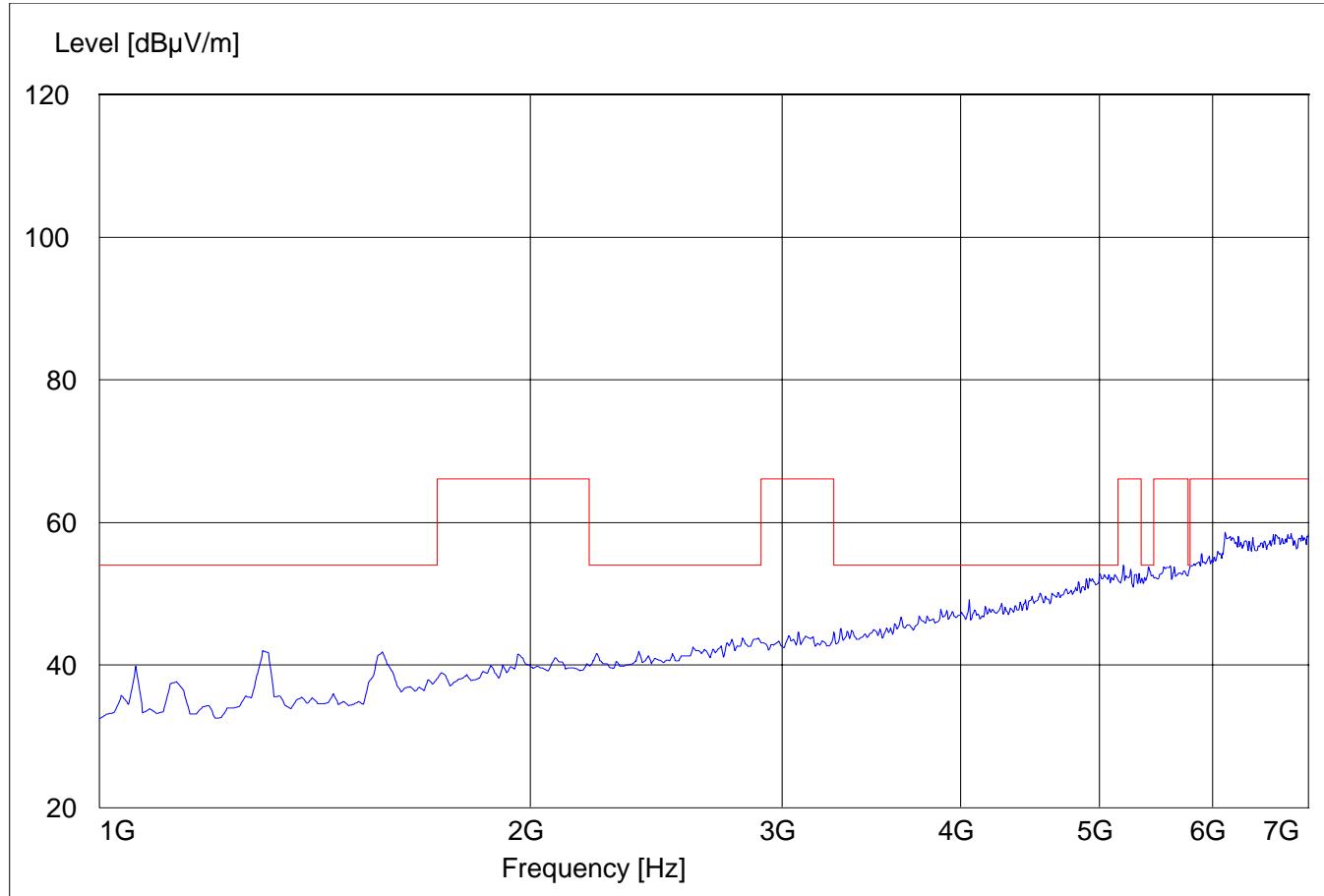
SWEEP TABLE: "WLAN Spuri hi 30-1G"
Start Stop Detector Meas. RBW Transducer
Frequency Frequency Time VBW
30.0 MHz 1.0 GHz MaxPeak Coupled 100 kHz 3141-#1186



RECEIVER SPURIOUS RADIATION**§ 15.209****1GHz – 7GHz****Average****Antenna:** **Horizontal****EUT plane:** **Horizontal with screen vertical @ 90°**

SWEEP TABLE: "WLAN Spuri hi 1-7G"

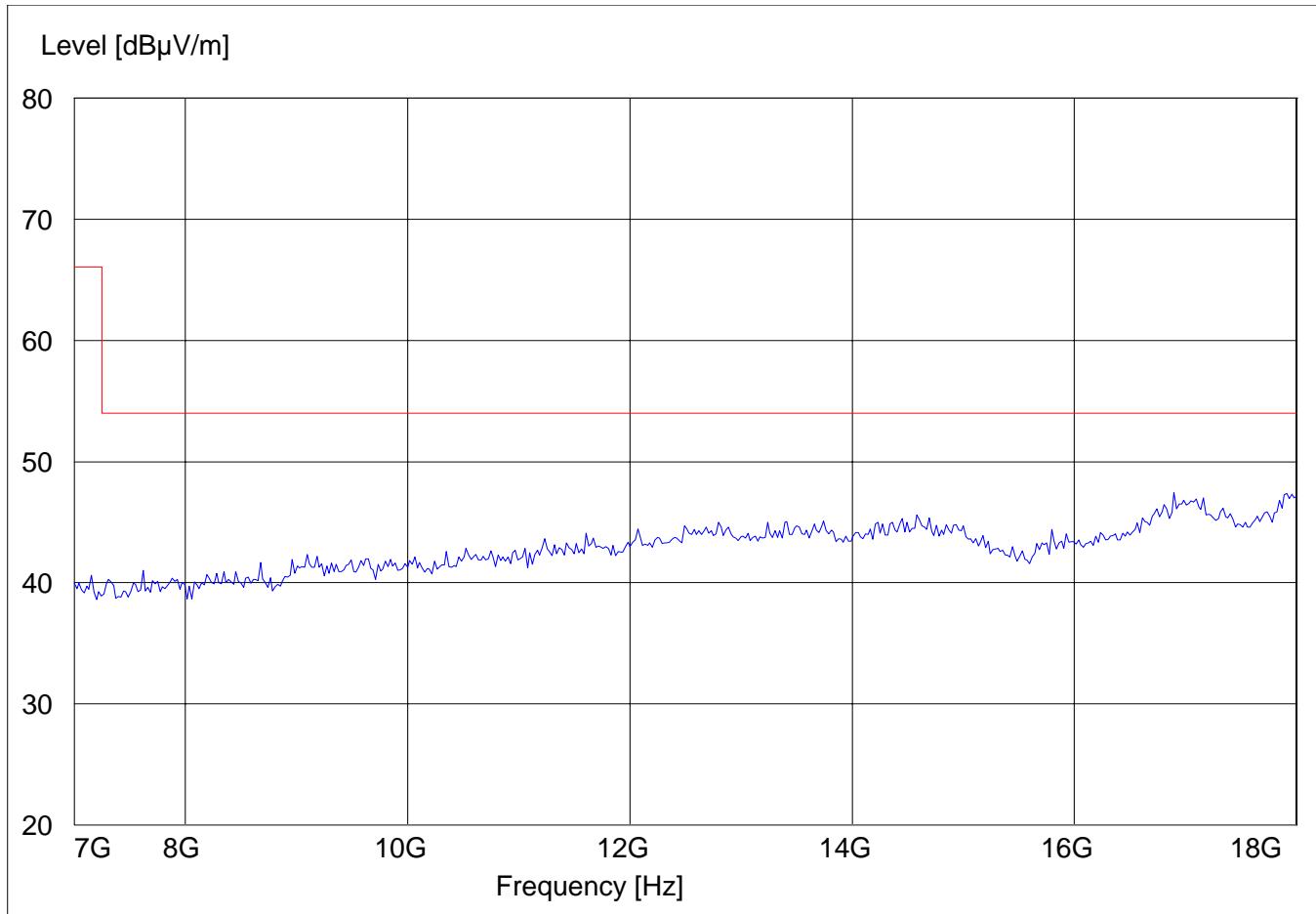
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
1.0 GHz	7.0 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)



**RECEIVER SPURIOUS RADIATION
7GHz – 18GHz****§ 15.209**

Antenna: **Horizontal**
EUT plane: **Horizontal with screen vertical @ 90°**

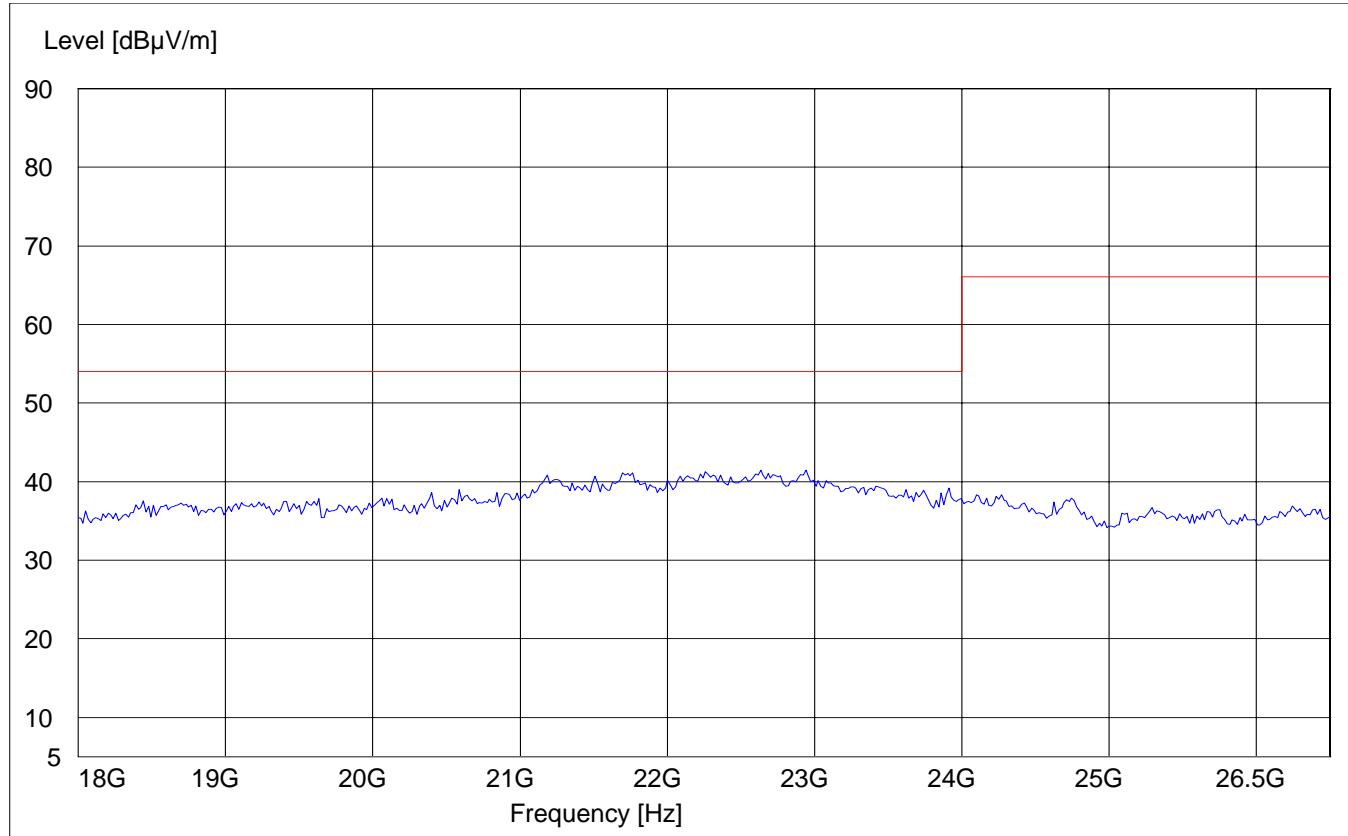
SWEEP TABLE: "WLAN Spuri hi 7-18G"
Start Stop Detector Meas. RBW Transducer
Frequency Frequency Time Bandw. VBW
7.0 GHz 18 GHz MaxPeak Coupled 1 MHz #326 horn (dBi)



**RECEIVER SPURIOUS RADIATION
18GHz – 26.5GHz****§ 15.209**

Antenna: **Horizontal**
EUT plane: **Horizontal with screen vertical @ 90°**

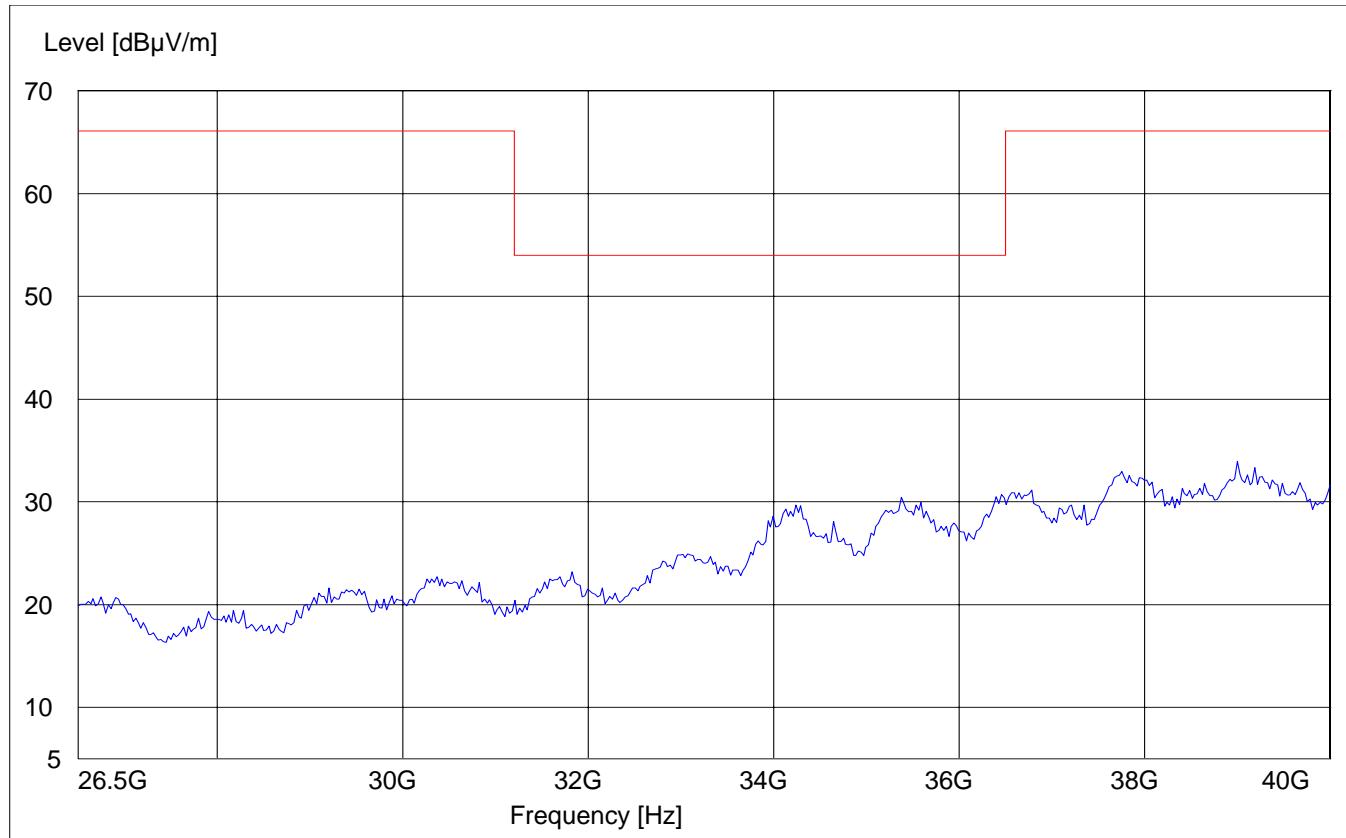
SWEEP TABLE: "WLAN Spuri hi 18-26.5G"
Start Stop Detector Meas. RBW Transducer
Frequency Frequency Time Bandw. VBW
18 GHz 26.5 GHz MaxPeak Coupled 1 MHz #141 horn (dBi)



**RECEIVER SPURIOUS RADIATION
26.5GHz – 40GHz****§ 15.209**

Antenna: **Horizontal**
EUT plane: **Horizontal with screen vertical @ 90°**

SWEEP TABLE: "WLAN Spuri hi 26.5-40G"
Start Stop Detector Meas. RBW Transducer
Frequency Frequency Time Bandw. VBW
26.5 GHz 40 GHz MaxPeak Coupled 1 MHz 3160-10 horn



TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Type	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	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02
08	Pre-Amplifier	TS-ANA	Rohde & Schwarz	--
09	Pre-Amplifier	JS4-00102600	Miteq	00616

BLOCK DIAGRAMS
Radiated Testing**ANECHOIC CHAMBER**