FCC Test Report

Test report no.: EMC_831FCC15.407_2005_C2P_PP07L

FCC Part 15.407 for UNII Devices / CANADA RSS-210 Issue 5 for LELEAN Devices

EUT: WLAN **Model: BCM94318MPAGH**
HOST LAPTOP **Model: PP07L**

FCC ID: QDS-BRCM1017
IC ID: 4324A-BRCM1017
(This test report covers freq. 5180-5320MHz)

Deutscher Akkreditierungs Rat DAR

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

***CETECOM* Inc.**
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2113686
Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

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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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1.3 Details of applicant

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

1.4 Application details

Date of receipt test item	:	2005-01-11
Date of test	:	2005-01-11 to 2005-01-25

1.5 Test item

Manufacturer	:	Applicant
Model No. (EUT)	:	BCM94318MPAGH (sample# 2000)
Host	:	Test Fixture
Description	:	WLAN MiniPCI Multiband card incorporating 2.4GHz and 5GHz radios
FCC ID	:	QDS-BRCM1017
IC ID	:	4324A-BRCM1017
Additional information		
Frequency	:	2412MHz – 2472MHz for 2.4GHz band (not covered in this test report) 5180MHz – 5320MHz for 5GHz band (covered in this test report) 5745MHz – 5825MHz for 5GHz band (not covered in this test report)
Type of modulation	:	DSSS / OFDM (orthogonal frequency division multiplexing)
Number of channels	:	13 for 2.4GHz band 13 for 5GHz band
Antenna	:	2.2dBi max. gain PCB ant. for 2.4GHz band 3.9dBi max gain PCB ant. for 5GHz band
Power supply	:	3.3 VDC from Host
Output power	:	12.77dBm (18.93mW) conducted power for 5150-5250GHz 14.22dBm (26.43mW) conducted power for 5250-5350GHz
Extreme temp. Tolerance	:	0°C to +70°C

1.6 Test standards: **FCC Part 15 §15.407 / CANADA RSS-210**

Measurements done as per DA 02-2138

PROJECT OVERVIEW:
This test report carries all radiated measurements required as per FCC 15.247 on WLAN mini PCI card model# BCM94318MPAGH tested in host laptop model PP07L for freq. range of 5180 – 5320MHz. For conducted measurements in this band please refer to test report# *EMC_831FCC15.407_2005_rev1*

All measurements are done with under-mentioned max gain antenna. WLAN was tested for spurious emissions at different data rates. Test report shows only worst-case test results of all data rates with following power levels.

802.11a Mode:
Channels 36-48:12.0dBm
Channels 52-64:15.0dBm
Channel 149-165:15.0dBm

ANTENNA
PCB Antenna: 2.2dBi for 2.4GHz band
3.9dBi for 5GHz band

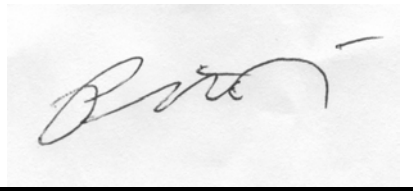
For more information on antennas and host platforms covered under this C2P change please refer to *BCM94318MPAGH_C2P_Declaration_worst_case_platform*

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**

Technical responsibility for area of testing:



Date	Section	Name	Signature
2005-03-29	EMC & Radio	Pete Krebill (EMC Engineer)	

Responsible for test report and project leader:

Date	Section	Name	Signature
2005-03-29	EMC & Radio	Harpreet Sidhu (EMC Engineer)	

2.2 Test report

TEST REPORT

Test report no.: EMC_831FCC15.407_2005_C2P_PP07L

FCC Part 15.407 for UNII Devices / CANADA RSS-210

TEST REPORT REFERENCE

PEAK OUTPUT POWER **§ 15.407 (a)(1)(2)**
(Conducted)
(Data rate – 54Mbps)
54Mbps is found to be worst-case for peak output power.

Test Procedure:
DA02-2138 Method-3.

Test Results

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)			
Frequency (MHz)			5180	5260	5320
T_{nom}(23)°C	V_{nom}(3.3) VDC	Pk	12.77	14.22	14.20
Measurement uncertainty		±0.5dBm			

LIMIT **SUBCLAUSE § 15.407 (a)(1)(2)**

Frequency range (GHz)	Conducted Peak Power
5.15 – 5.25	17dBm
5.25 – 5.35	24dBm

MAXIMUM PEAK OUTPUT POWER (RADIATED) **§ 15.407 (a)(1)(2)**

(Data rate – 54Mbps)

54Mbps is found to be worst-case for peak output power.

EIRP:

Test Results

TEST CONDITIONS		MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)		5180	5260	5320
T_{nom}(23)°C	V_{nom}(3.3) VDC	*16.67	*18.12	*18.1
Measurement uncertainty		±0.5dBm		

***Note: EIRP is calculated based on 3.9dBi antenna gain and conducted peak power measurements.**

LIMIT **SUBCLAUSE § 15.407 (a)(1)(2)**

Frequency range (GHz)	Conducted Peak Power
5.15 – 5.25	17dBm
5.25 – 5.35	24dBm
If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi	

Phycomp PCB antenna

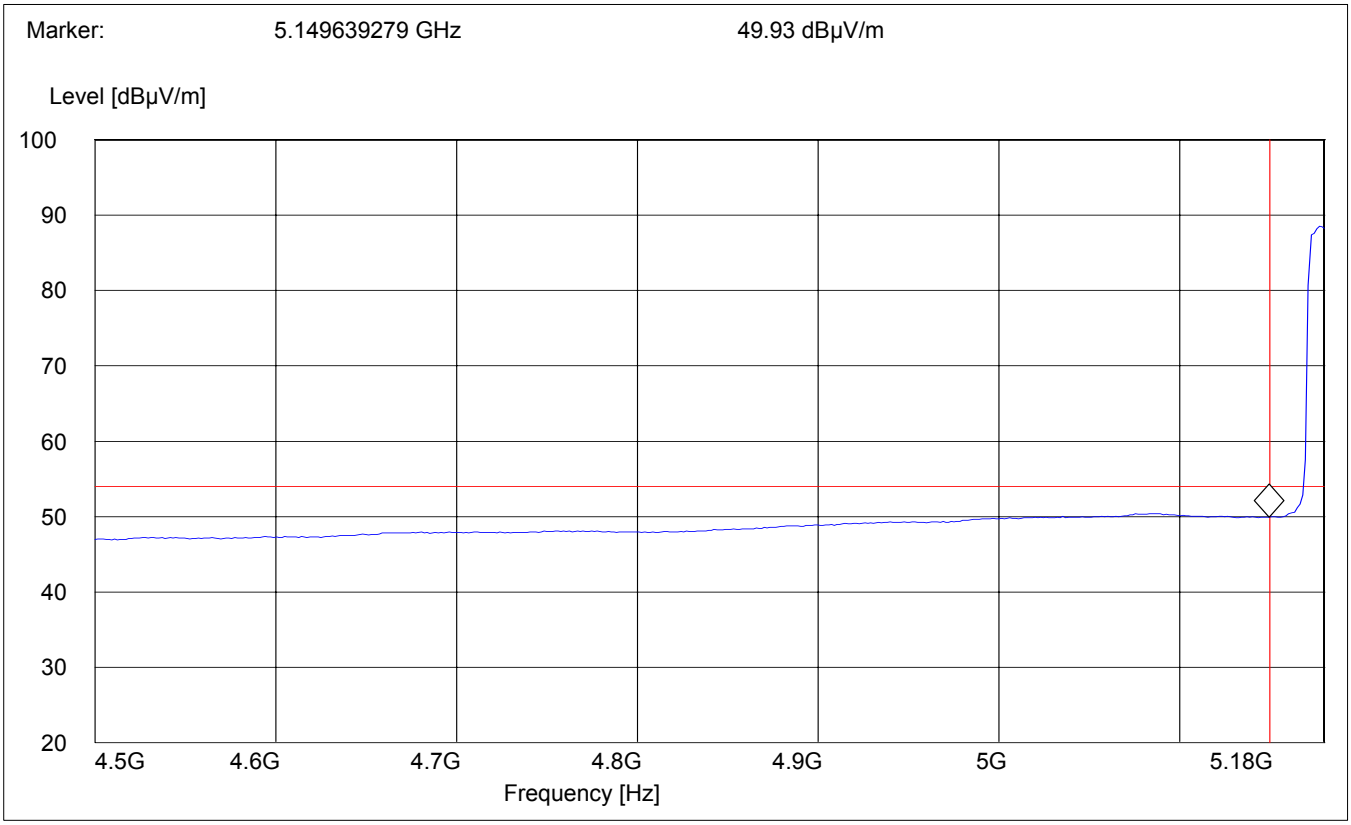
(Freq. band: 5GHz, Gain: 3.9dBi, Model 4313 334 01250/4343 334 02250)

BAND EDGE COMPLIANCE §15.407 (b)(1)(2)(4)(6)
(Data rate – 6Mbps)
Low frequency section (spurious in the restricted band 4500 – 5150 MHz)
(Average measurement)

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

Operating condition	:	Tx at 5180MHz
SWEEP TABLE	:	"FCC15.407 LBE_AVG"
Limit Line horizontal	:	54dBµV
Limit Line vertical	:	5150MHz

Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
4.5 GHz	5.19 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)

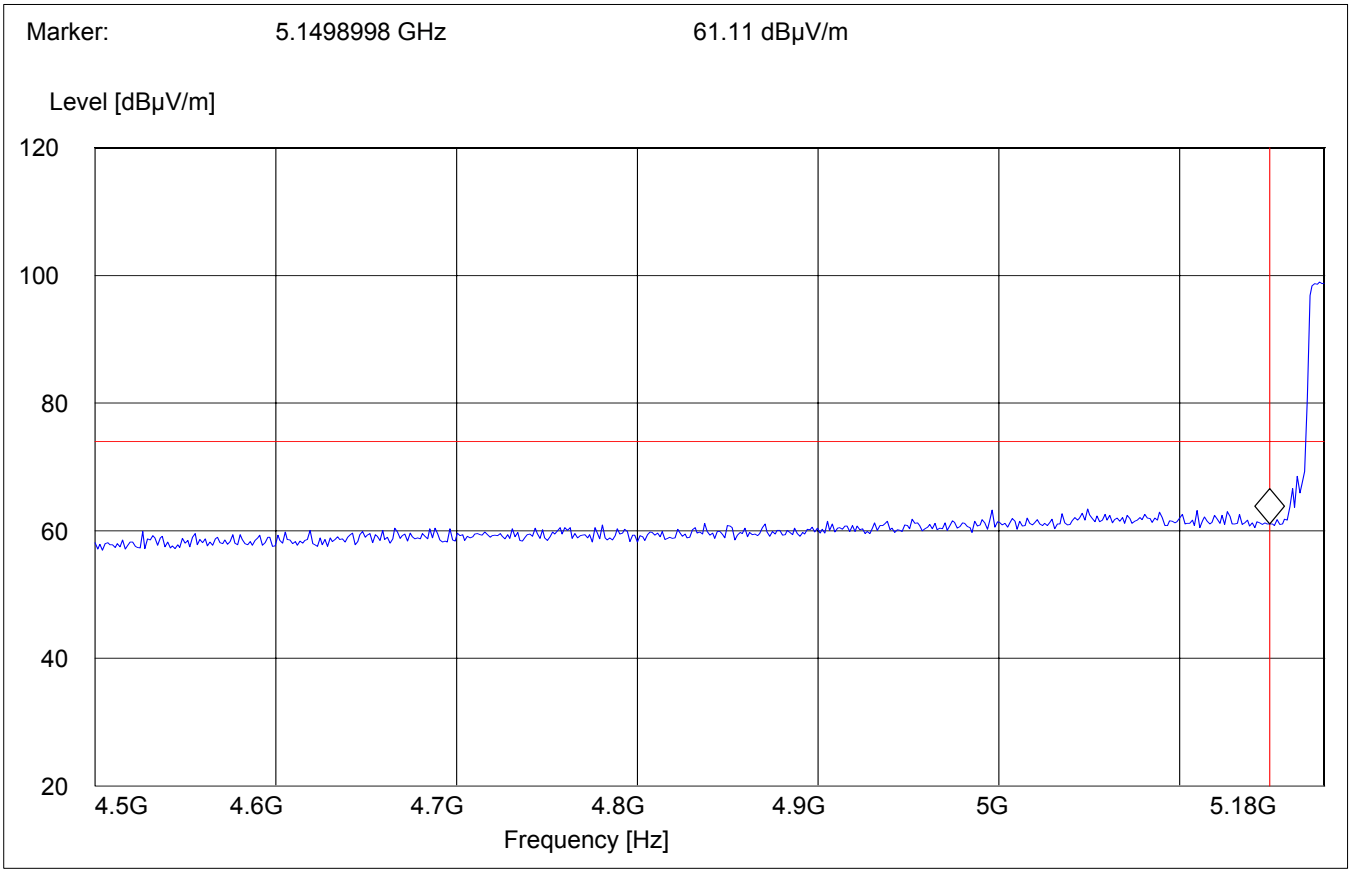


BAND EDGE COMPLIANCE §15.407 (b)(1)(2)(4)(6)
(Data rate – 54Mbps)
Low frequency section (spurious in the restricted band 4500 – 5150 MHz)
(Peak measurement)

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

Operating condition	:	Tx at 5180MHz
SWEEP TABLE	:	"FCC15.407 LBE_Pk"
Limit Line horizontal	:	74dBµV
Limit Line vertical	:	5150MHz

Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
4.5 GHz	5.19 GHz	MaxPeak	Coupled	1MHz	1MHz	#326 horn (dBi)

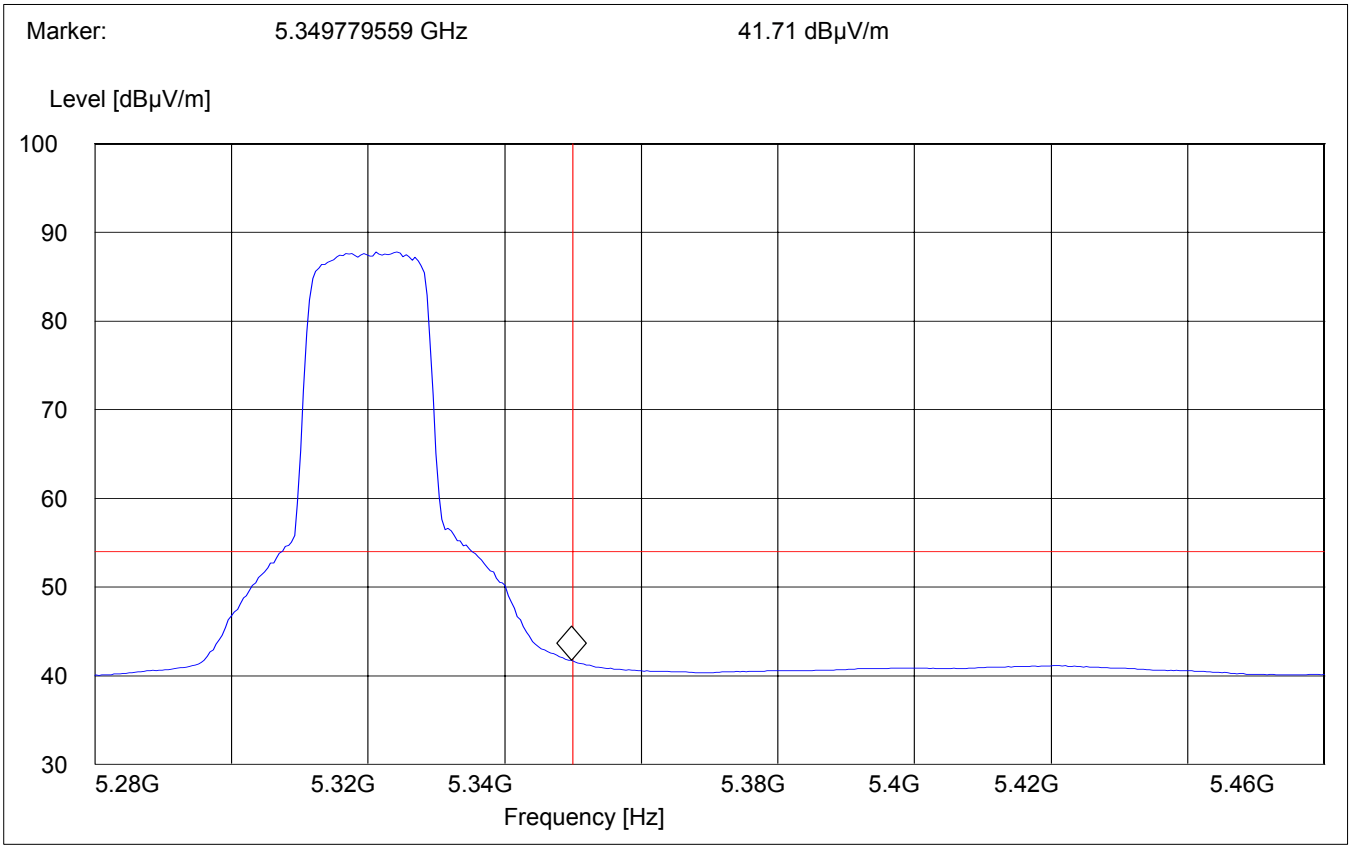


BAND EDGE COMPLIANCE §15.407 (b)(1)(2)(4)(6)
(Data rate – 6Mbps)
High frequency section (spurious in the restricted band 5350 – 5460 MHz)
(Average measurement)

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

Operating condition	:	Tx at 5320MHz
SWEEP TABLE	:	"FCC15.407 HBE_AVG"
Limit Line horizontal	:	54dBµV
Limit Line vertical	:	5350MHz

Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
5.28 GHz	5.46 GHz	MaxPeak	Coupled	1 MHz	10Hz	#326 horn (dBi)

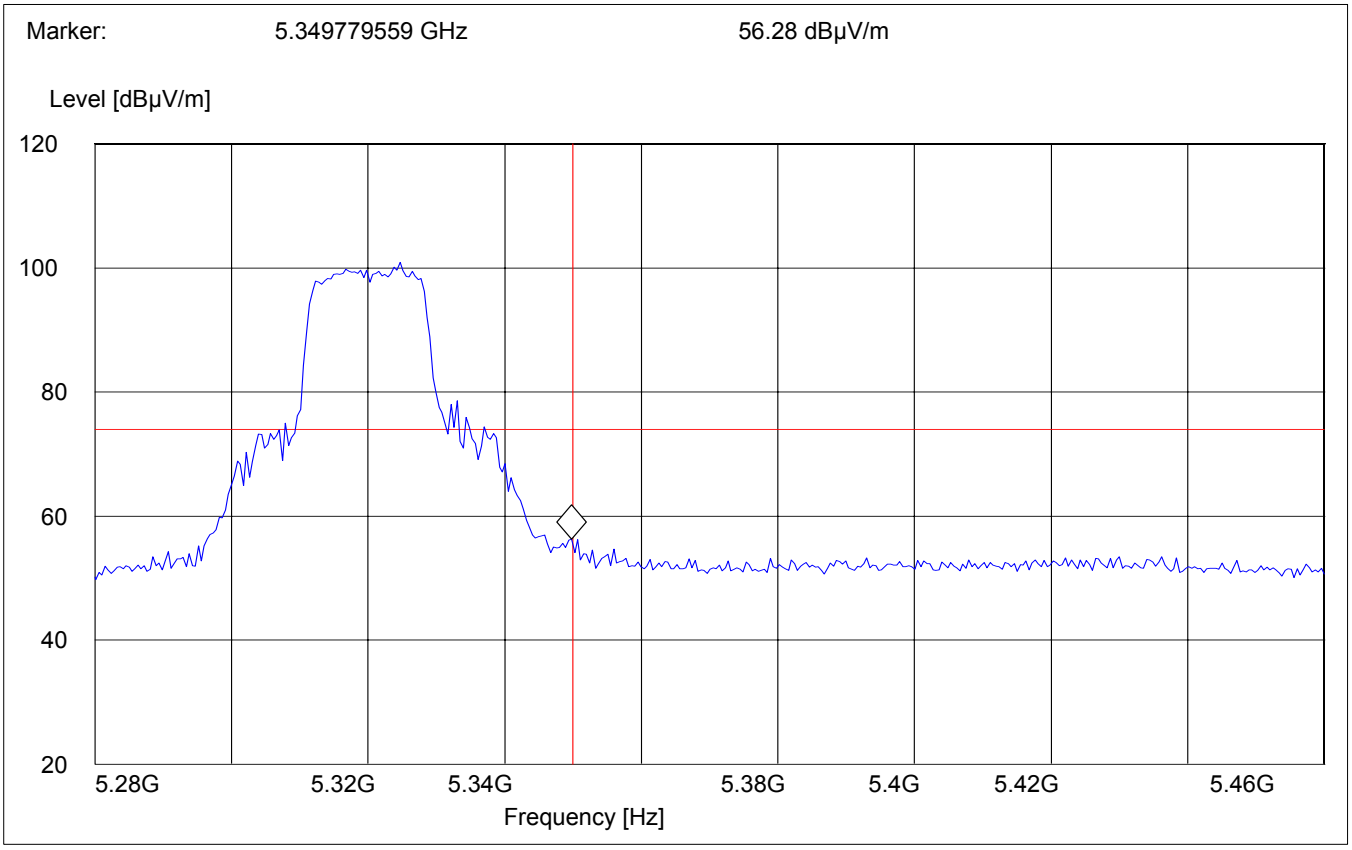


BAND EDGE COMPLIANCE §15.407 (b)(1)(2)(4)(6)
(Data rate – 54Mbps)
High frequency section (spurious in the restricted band 5350 – 5460 MHz)
(Peak measurement)

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

Operating condition	:	Tx at 5320MHz
SWEEP TABLE	:	"FCC15.407 HBE_Pk"
Limit Line horizontal	:	74dBµV
Limit Line vertical	:	5350MHz

Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW	VBW	Transducer
5.28 GHz	5.46 GHz	MaxPeak	Coupled	1 MHz	1MHz	#326 horn (dBi)



EMISSION LIMITATIONS **§ 15.407 (b)(1)(2)(4)(6)**
Transmitter (Radiated)
(Data rate – 54Mbps)

Limits **§ 15.209 / § 15.407**

Freq. (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
0.009-0.490	2400/F (kHz)	
0.490-1.750	24000/F (kHz)	
1.705-30.0	30	29.54
30-88	100	40.00
88-216	150	43.52
216-960	200	46.02
Above 960*	500	53.97
1000-40000**	2013.8	66.08

***) Limit in restricted bands**
****) Limit outside restricted bands**

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.

Transmit at Lowest channel Frequency 5180MHz			
Frequency (MHz)	Level (dBµV/m)		
	Peak	Quasi-Peak	Average
SEE PLOTS			

Transmit at Middle channel Frequency 5260MHz			
Frequency (MHz)	Level (dBµV/m)		
	Peak	Quasi-Peak	Average
SEE PLOTS			

Transmit at Highest channel Frequency 5320MHz			
Frequency (MHz)	Level (dBµV/m)		
	Peak	Quasi-Peak	Average
SEE PLOTS			

EMISSION LIMITATIONS - Radiated (Transmitter) **§ 15.407 (b)(1)(2)(4)(6)**

Lowest Channel (5180MHz): 30MHz – 1GHz

(Data rate – 54Mbps)

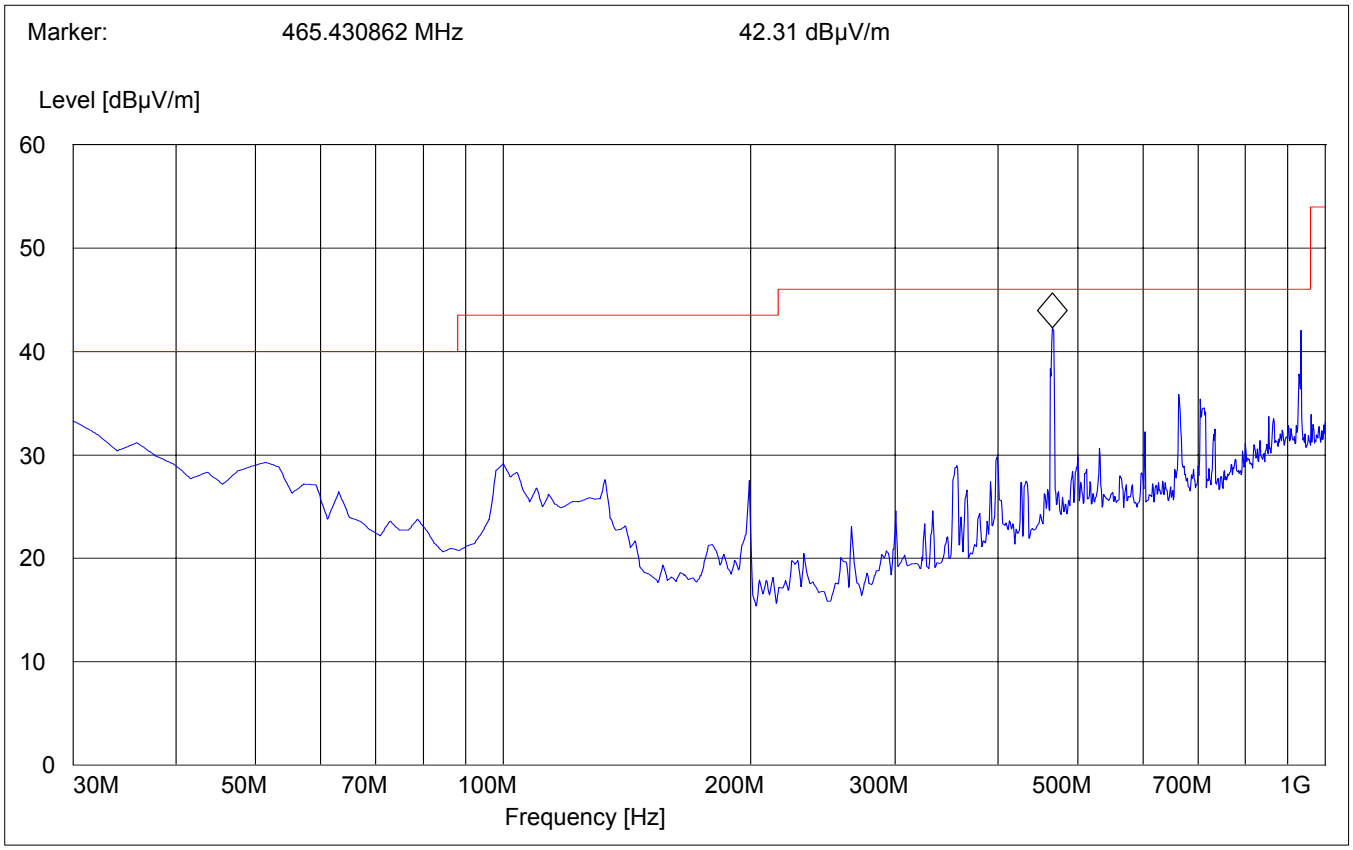
Note: This plot is valid for low, mid, high channels (worst-case plot valid for all channels)

Antenna: **Vertical**

EUT plane: **Horizontal with screen vertical @ 90˚**

SWEEP TABLE: "FCC 15.407 30-1G_V"

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



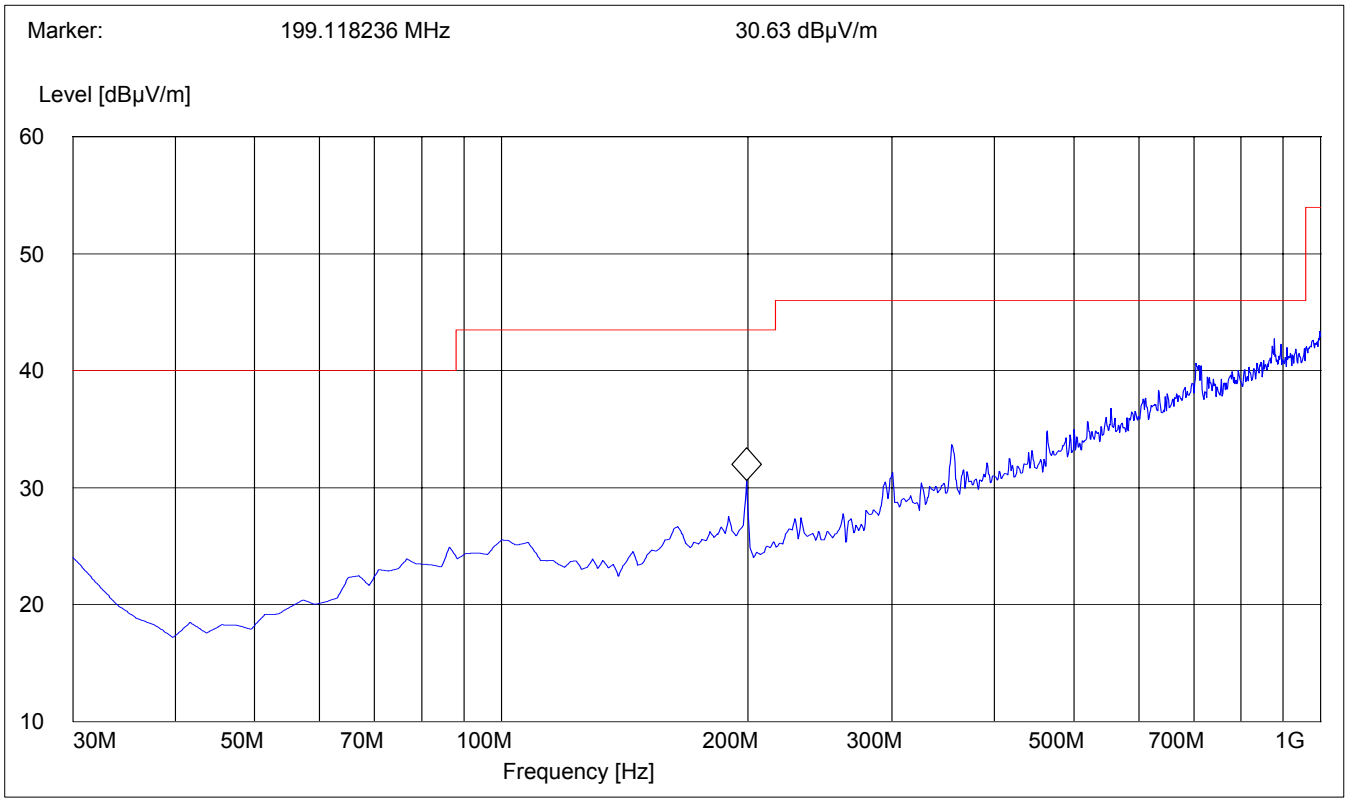
EMISSION LIMITATIONS - Radiated (Transmitter) § 15.407 (b)(1)(2)(4)(6)
Lowest Channel (5180MHz): 30MHz – 1GHz
(Data rate – 54Mbps)

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

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

SWEEP TABLE: "FCC 15.407 30-1G_H"

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



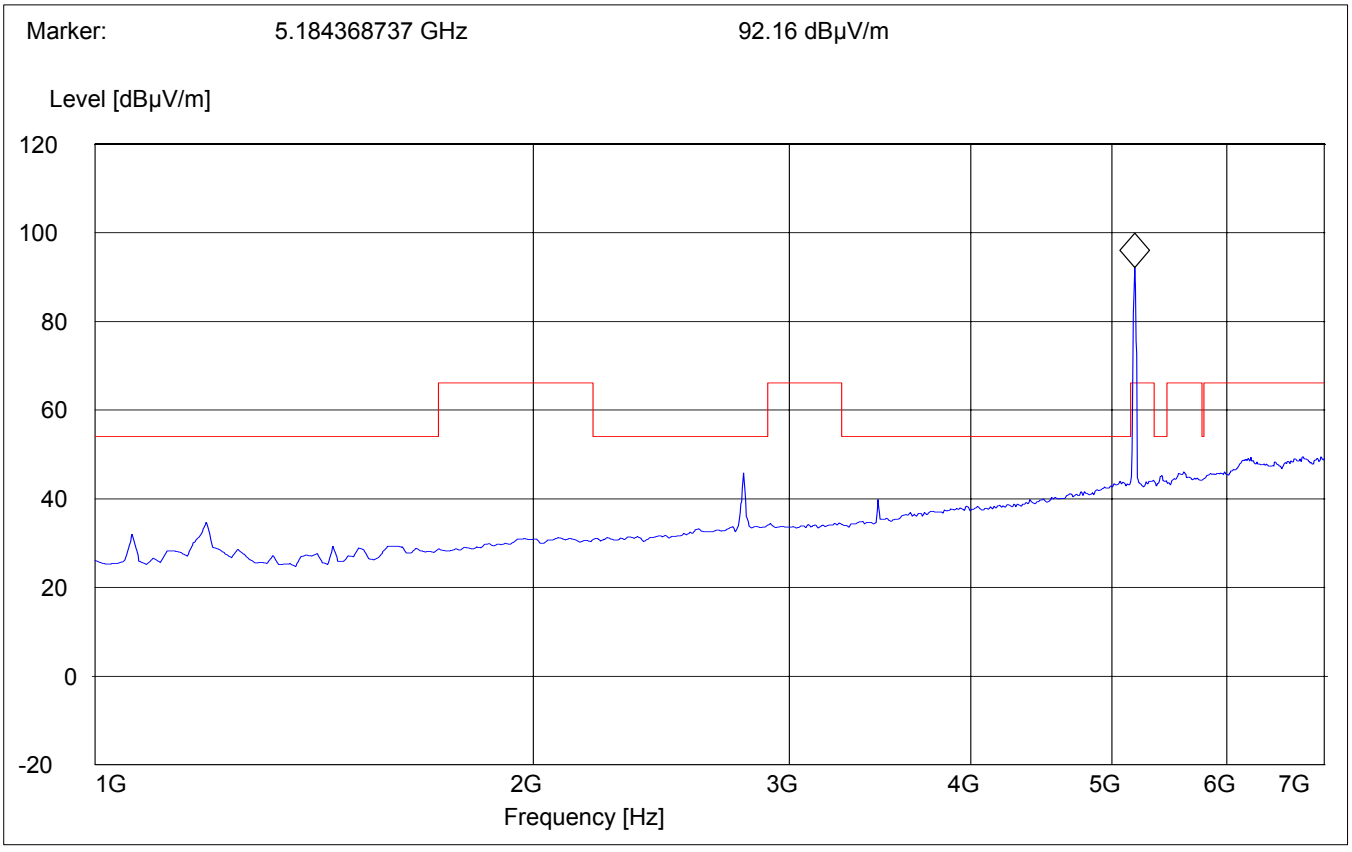
EMISSION LIMITATIONS - Radiated (Transmitter) § 15.407 (b)(1)(2)(4)(6)

Lowest Channel (5180MHz): 1GHz – 7GHz
(Average)

Antenna: **vertical**
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. Time	RBW	VBW	Transducer
1GHz	7.0 GHz	MaxPeak	Coupled	1MHz	10Hz	326 horn

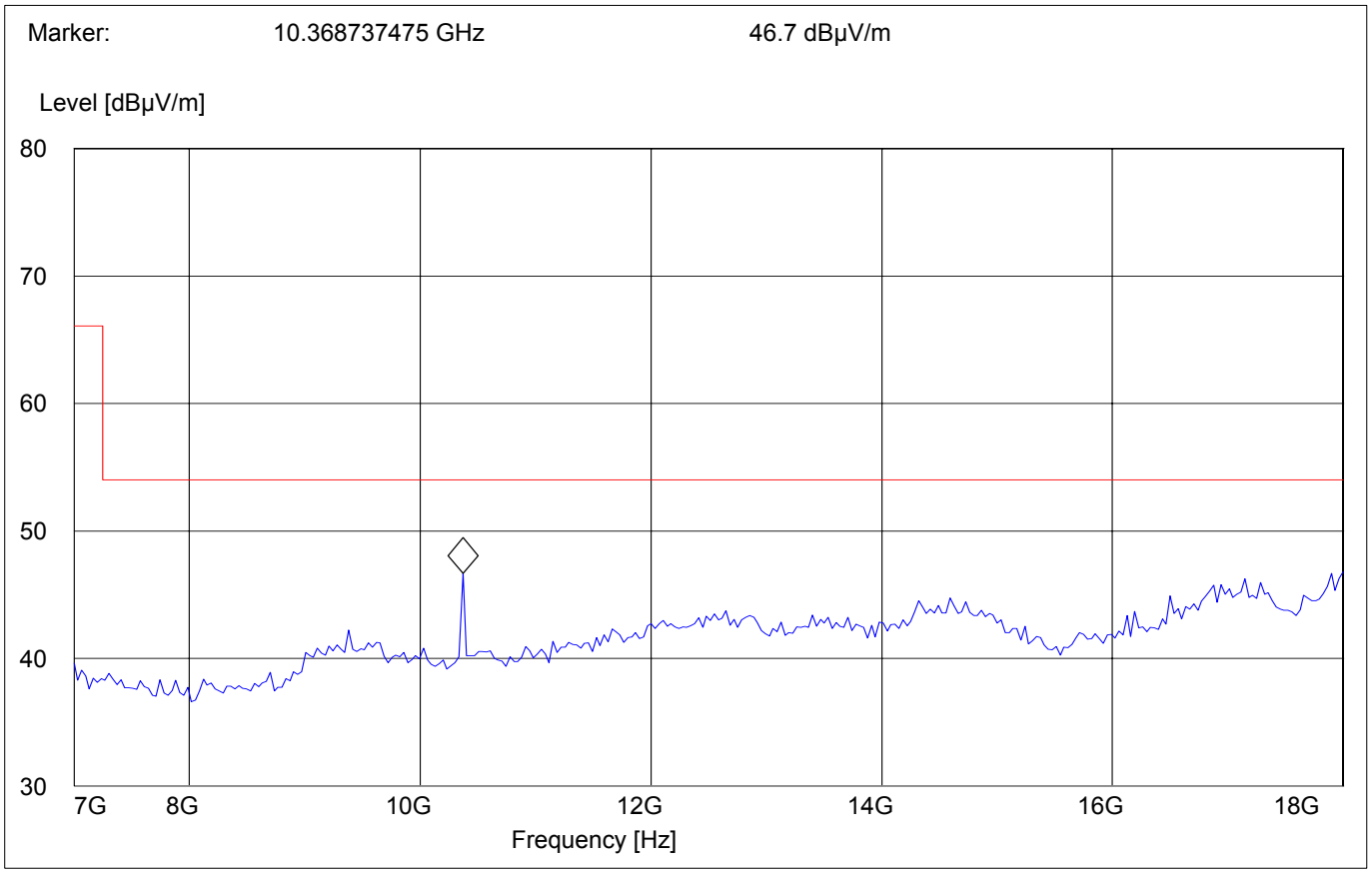


EMISSION LIMITATIONS - Radiated (Transmitter) § 15.407 (b)(1)(2)(4)(6)
Lowest Channel (5180MHz): 7GHz – 18GHz

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

SWEEP TABLE: "FCC 15.407 7-18G"

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



EMISSION LIMITATIONS - Radiated (Transmitter) § 15.407 (b)(1)(2)(4)(6)

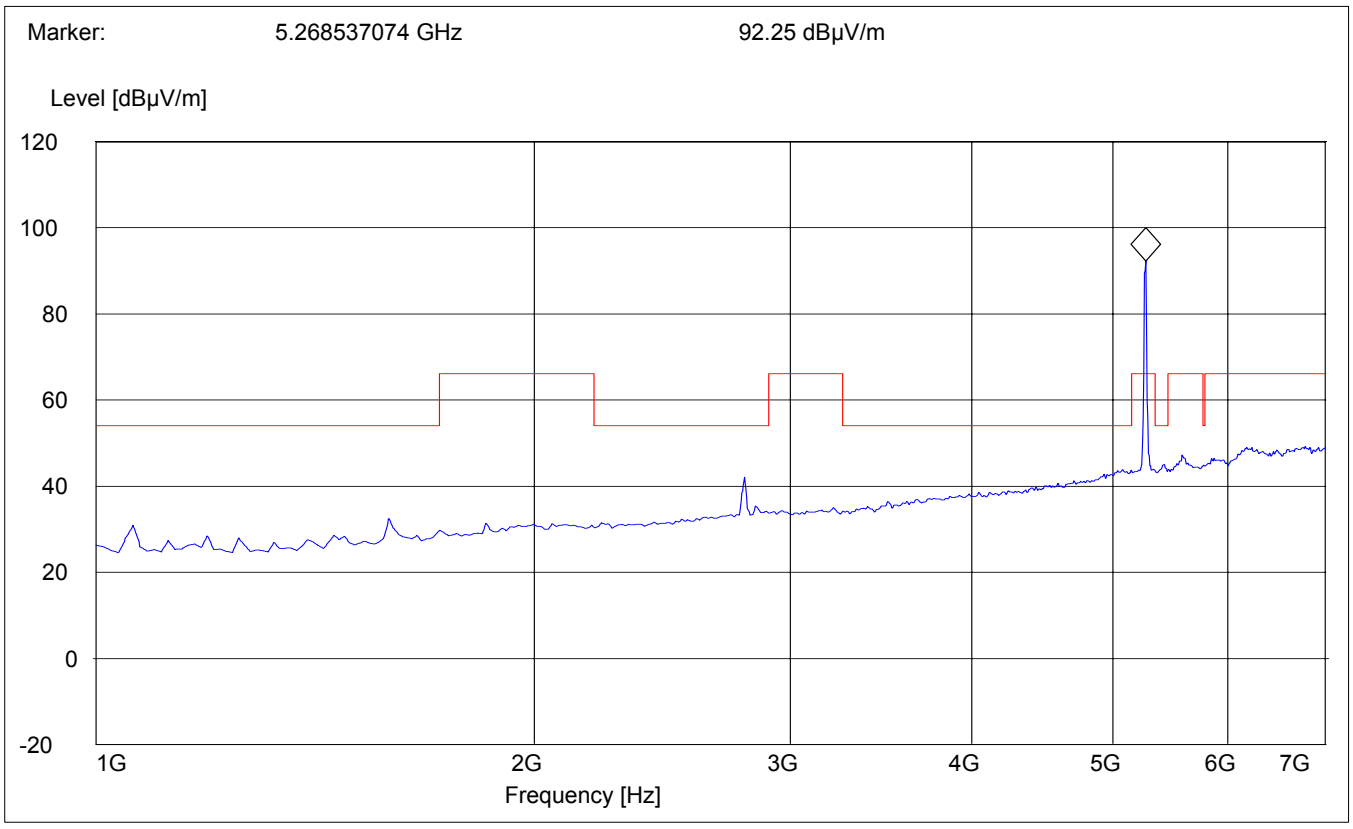
Lowest Channel (5260MHz): 1GHz – 7GHz

(Average)

Antenna: **vertical**
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. Time	RBW	VBW	Transducer
1GHz	7.0 GHz	MaxPeak	Coupled	1MHz	10Hz	326 horn

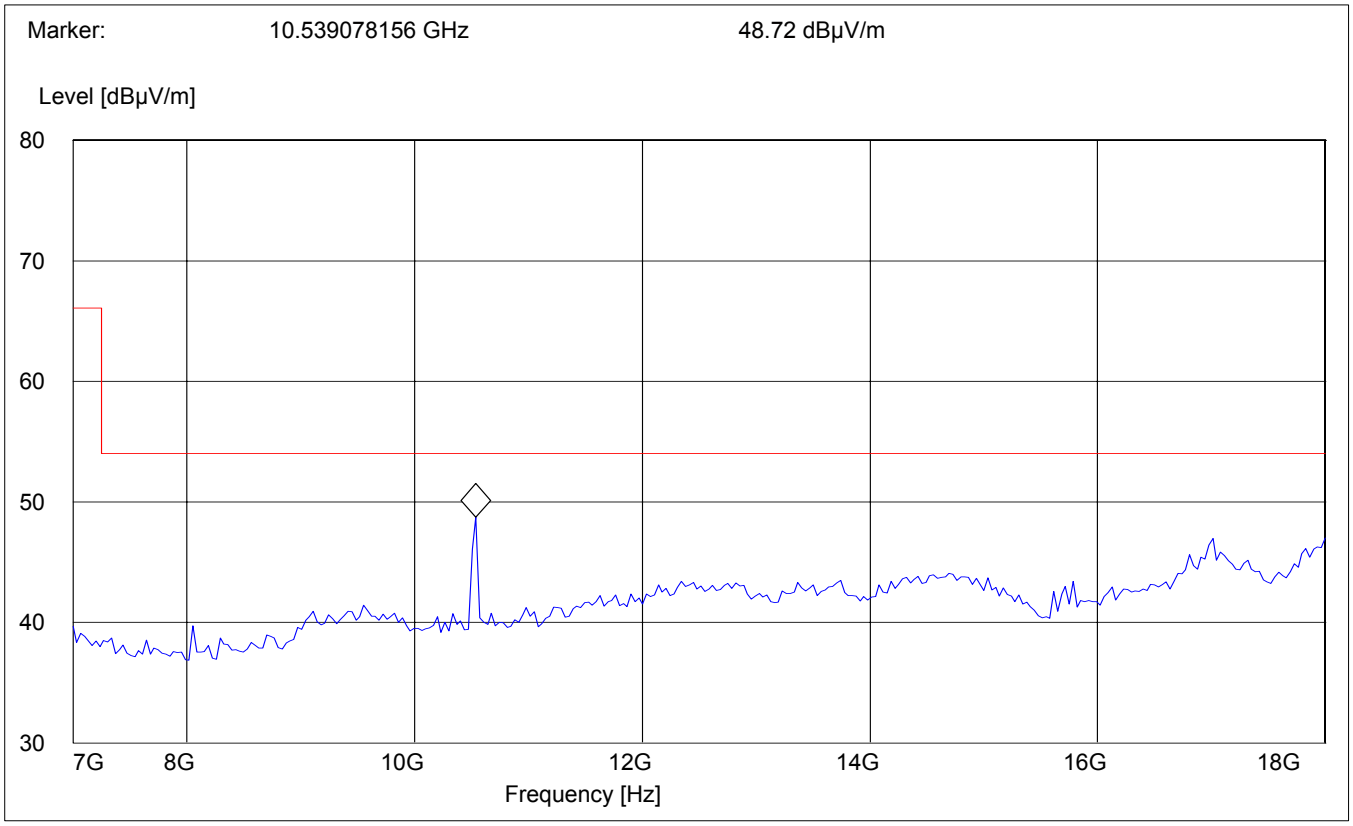


EMISSION LIMITATIONS - Radiated (Transmitter) § 15.407 (b)(1)(2)(4)(6)
Lowest Channel (5260MHz): 7GHz – 18GHz

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

SWEEP TABLE: "FCC 15.407 7-18G"

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



EMISSION LIMITATIONS - Radiated (Transmitter) § 15.407 (b)(1)(2)(4)(6)

Lowest Channel (5320MHz): 1GHz – 7GHz

(Average)

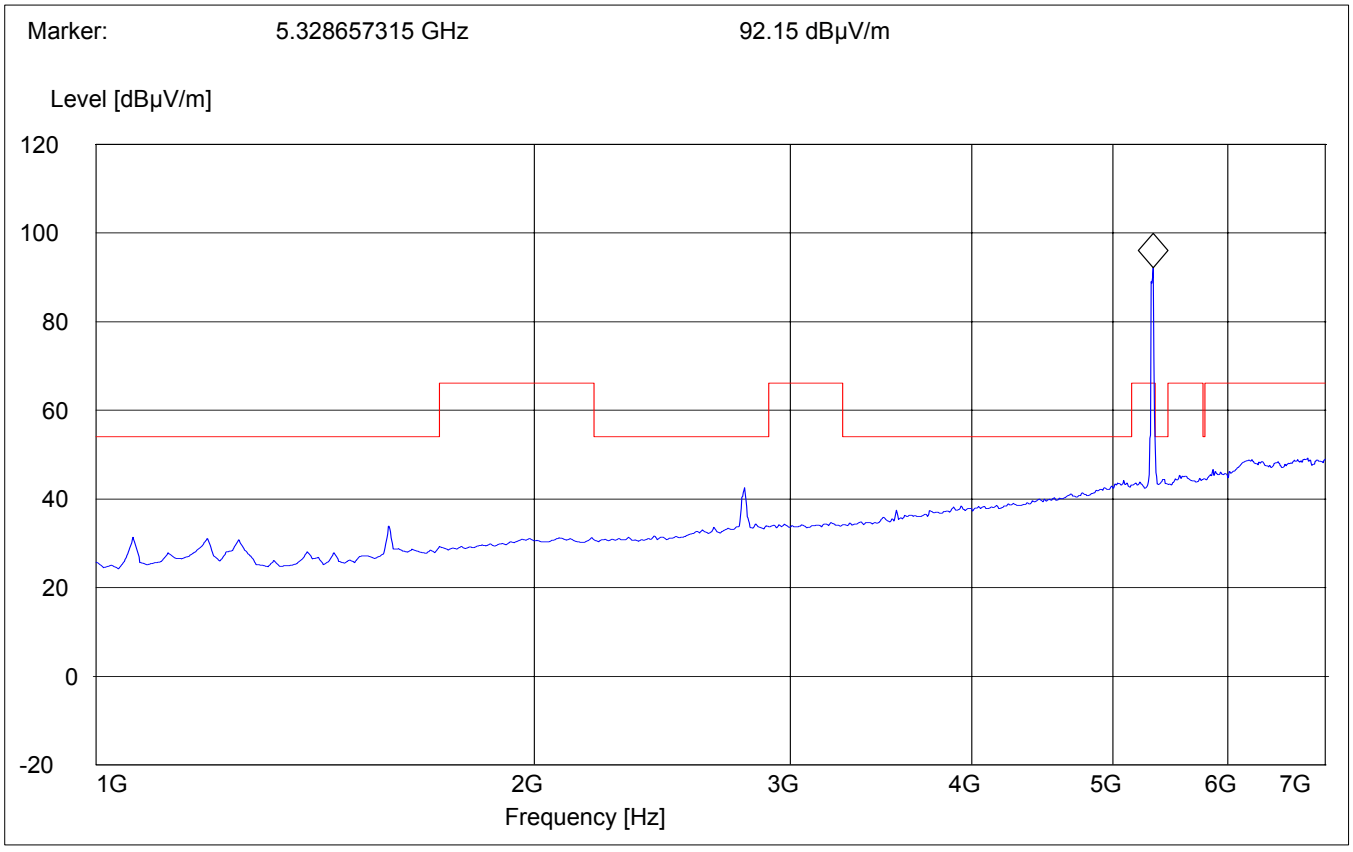
Antenna: **vertical**

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. Time	RBW	VBW	Transducer
1GHz	7.0 GHz	MaxPeak	Coupled	1MHz	10Hz	326 horn

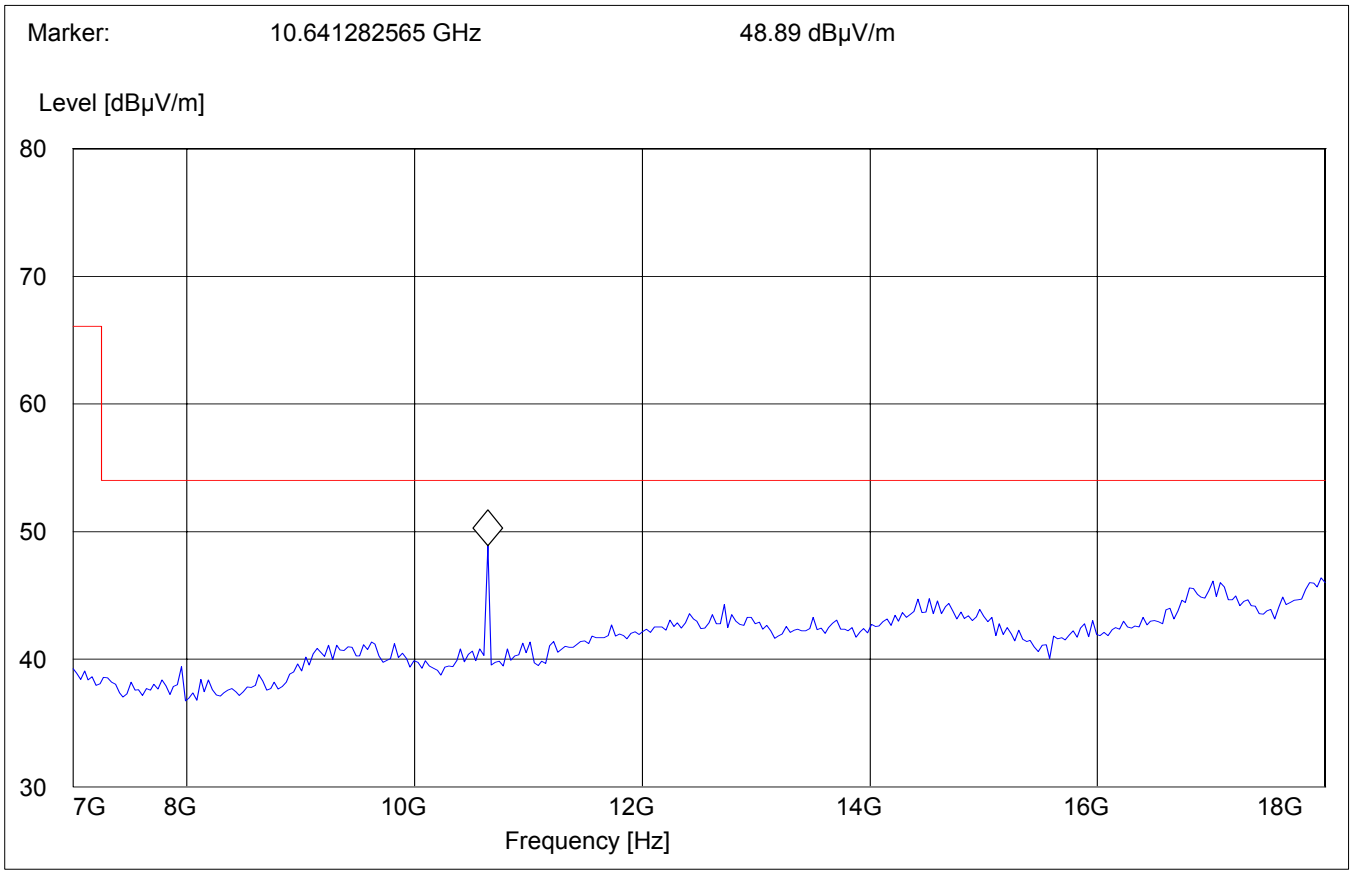


EMISSION LIMITATIONS - Radiated (Transmitter) § 15.407 (b)(1)(2)(4)(6)
Lowest Channel (5320MHz): 7GHz – 18GHz

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

SWEEP TABLE: "FCC 15.407 7-18G"

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



EMISSION LIMITATIONS - Radiated (Transmitter) § 15.407 (b)(1)(2)(4)(6)

18GHz – 26.5GHz

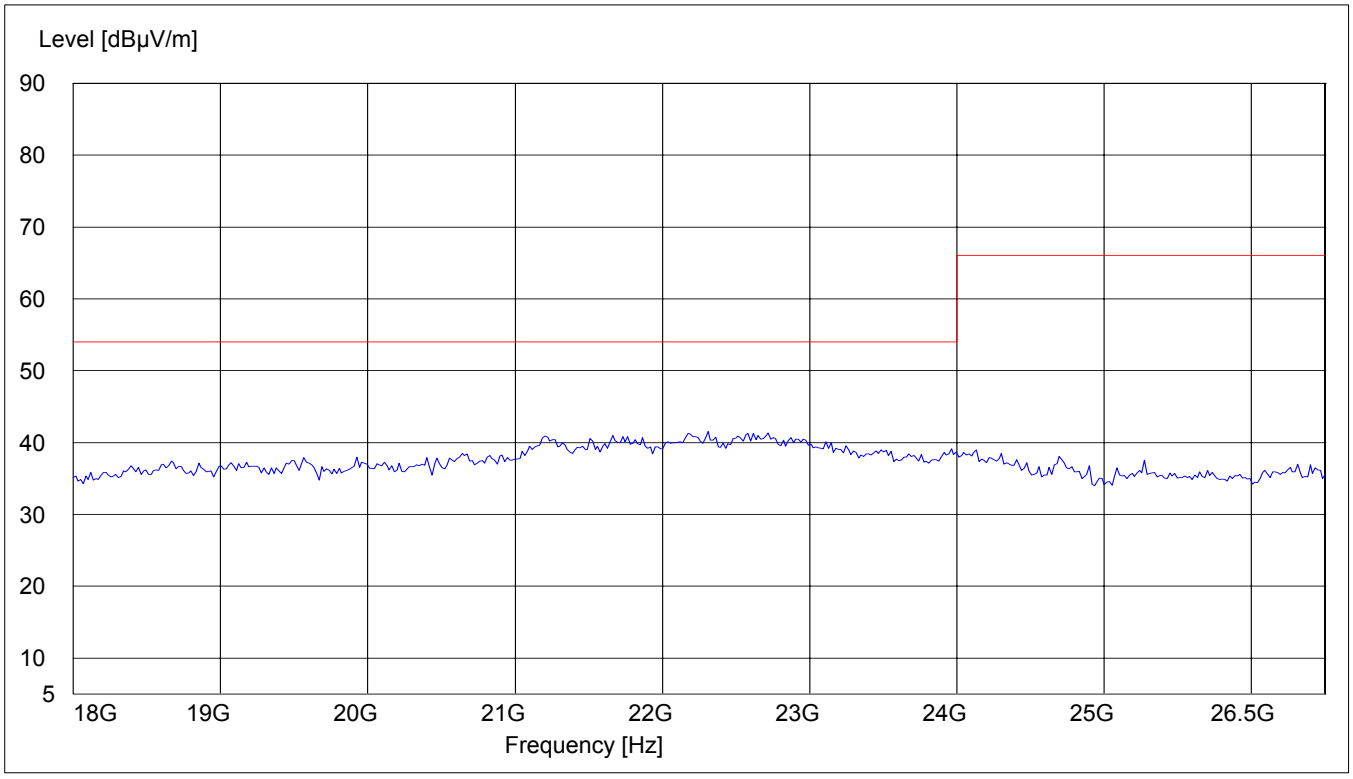
Antenna: **vertical**

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

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

SWEEP TABLE: "FCC 15.407 18-26.5G"

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



EMISSION LIMITATIONS - Radiated (Transmitter) § 15.407 (b)(1)(2)(4)(6)

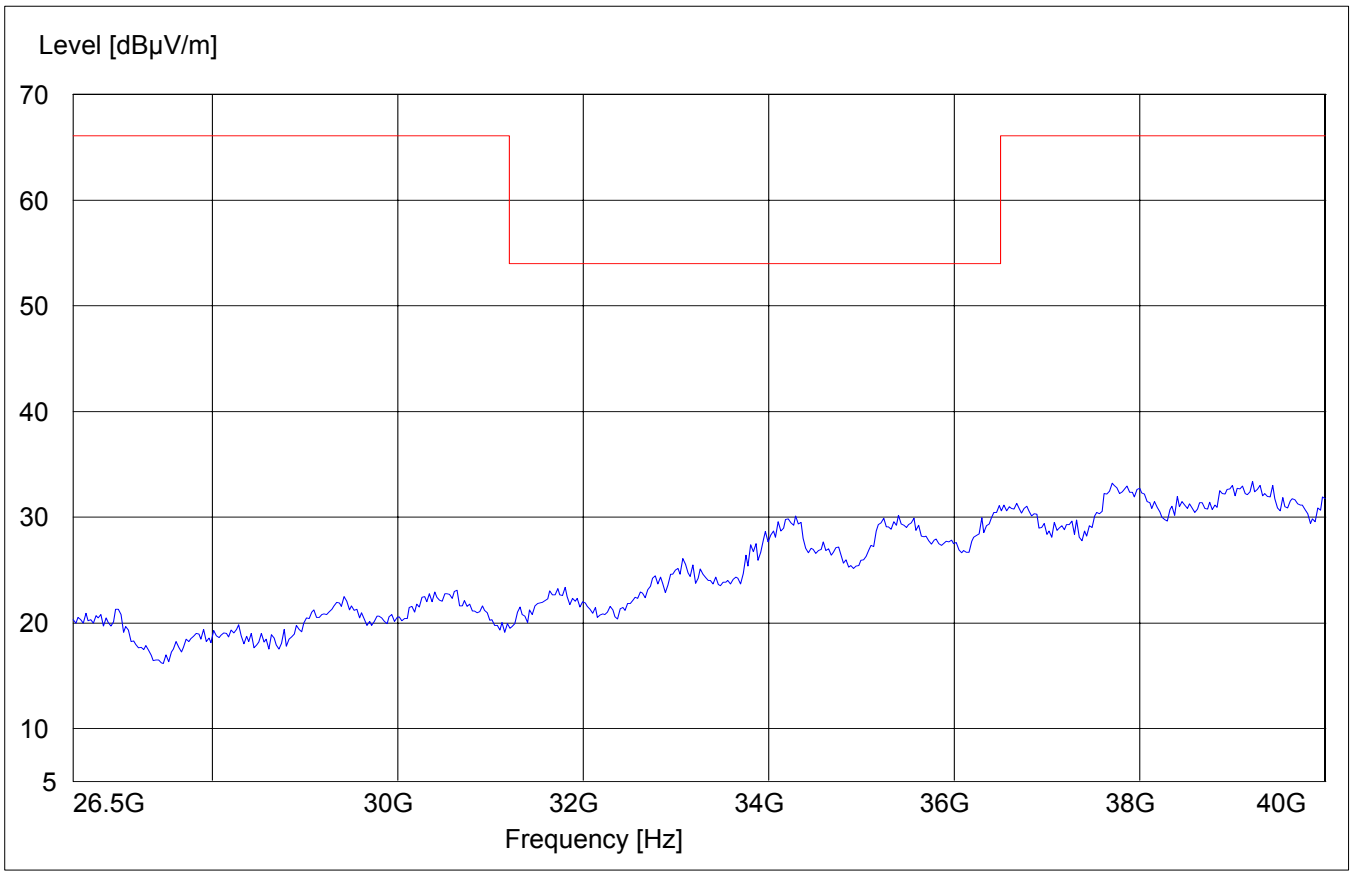
26.5GHz – 40GHz

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

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

SWEEP TABLE: "FCC 15.407 26.5-40G"

Start Frequency	Stop Frequency	Detector	Meas. Time	RBW VBW	Transducer
26.5GHz	40 GHz	MaxPeak	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

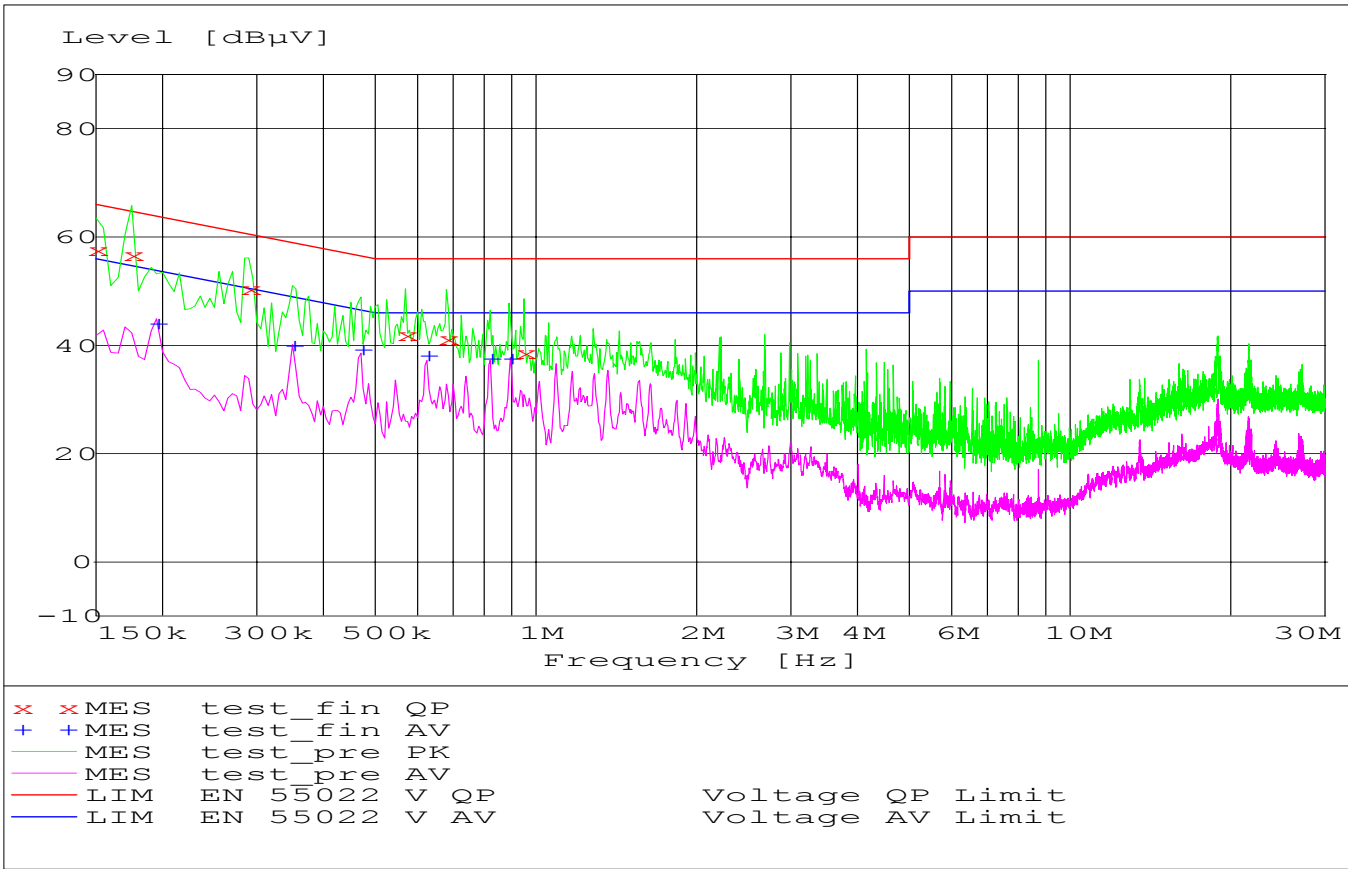
Start Frequency	Stop Frequency	Detector	Meas Time	IF Bandw.	Transducer
150.0 kHz	30.0 MHz	MaxPeak	Coupled	10 kHz	None

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

Limit

Frequency of Emission (MHz)	Conducted Limit (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



MEASUREMENT RESULT: "test_fin QP"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.150000	57.60	0.0	66	8.4	N	GND
0.175000	56.70	0.0	65	8.0	N	GND
0.290000	50.50	0.0	61	10.0	N	GND
0.570000	42.00	0.0	56	14.0	L1	GND
0.680000	41.10	0.0	56	14.9	N	GND
0.950000	38.70	0.0	56	17.3	N	GND

MEASUREMENT RESULT: "test_fin AV"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.195000	44.10	0.0	54	9.7	L1	GND
0.350000	40.00	0.0	49	8.9	L1	GND
0.470000	39.10	0.0	47	7.5	L1	GND
0.625000	38.10	0.0	46	7.9	N	GND
0.820000	37.50	0.0	46	8.5	L1	GND
0.895000	37.50	0.0	46	8.5	N	GND

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

RECEIVER SPURIOUS RADIATION § 15.209

(Data rate – 54Mbps)

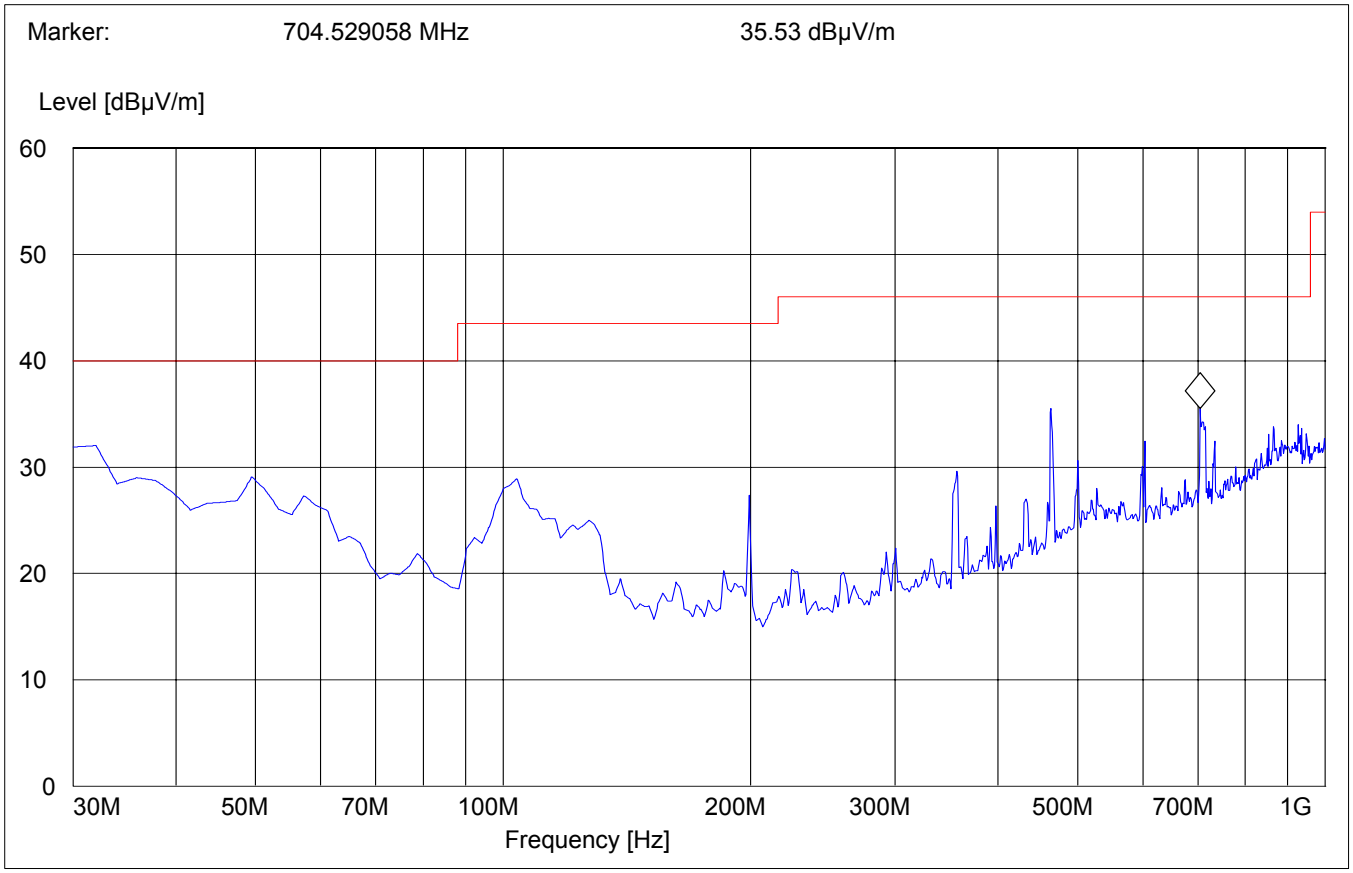
Antenna: **vertical**

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

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

SWEEP TABLE: "WLAN Spuri hi 30-1G"

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

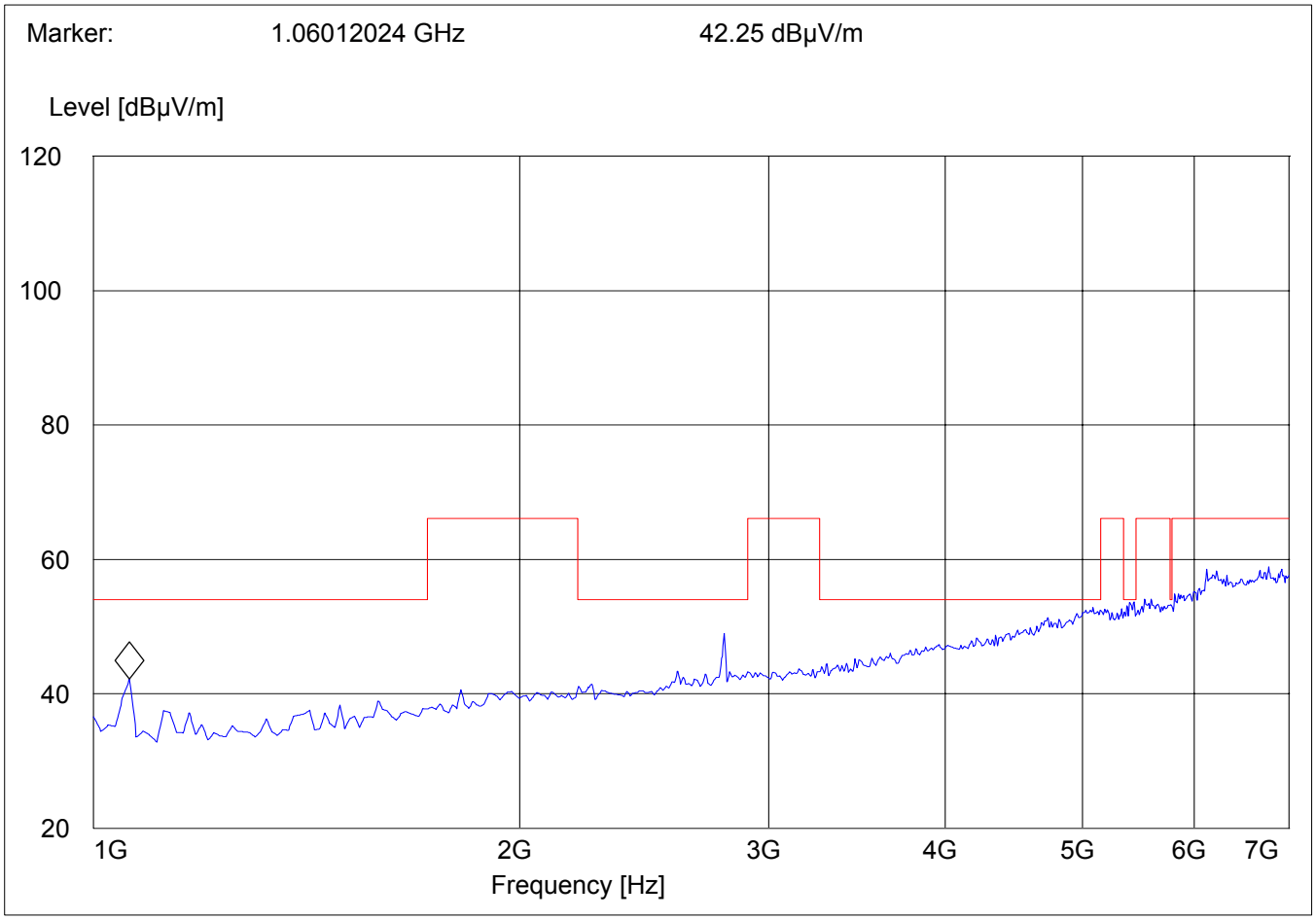


RECEIVER SPURIOUS RADIATION § 15.209
1GHz – 7GHz

Antenna: **Vertical**
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	1MHz	#326 horn (dBi)

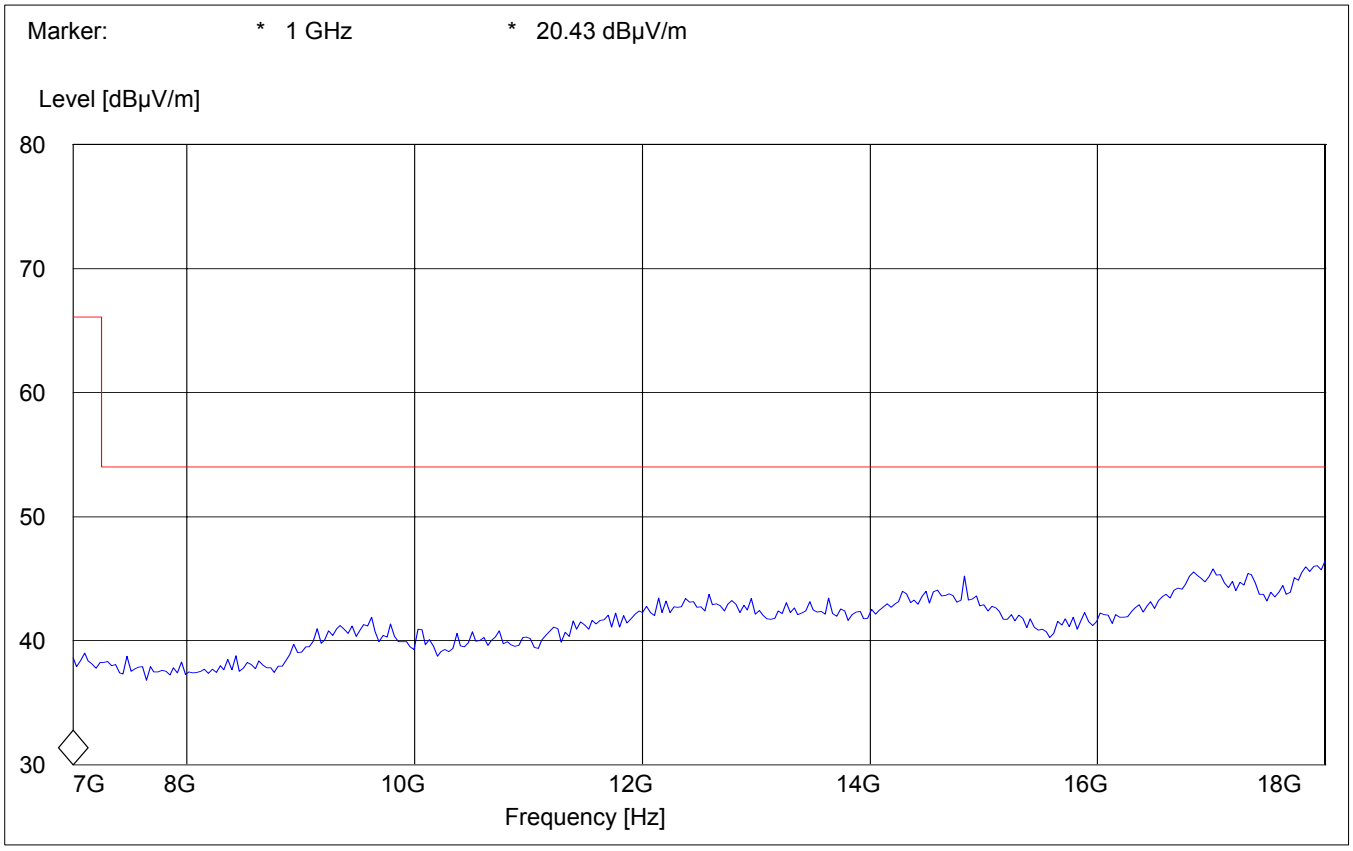


RECEIVER SPURIOUS RADIATION § 15.209
7GHz – 18GHz

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

SWEEP TABLE: "WLAN Spuri hi 7-18G"

Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW VBW	Transducer
7.0 GHz	18 GHz	MaxPeak	Coupled	1 MHz	#326 horn (dBi)

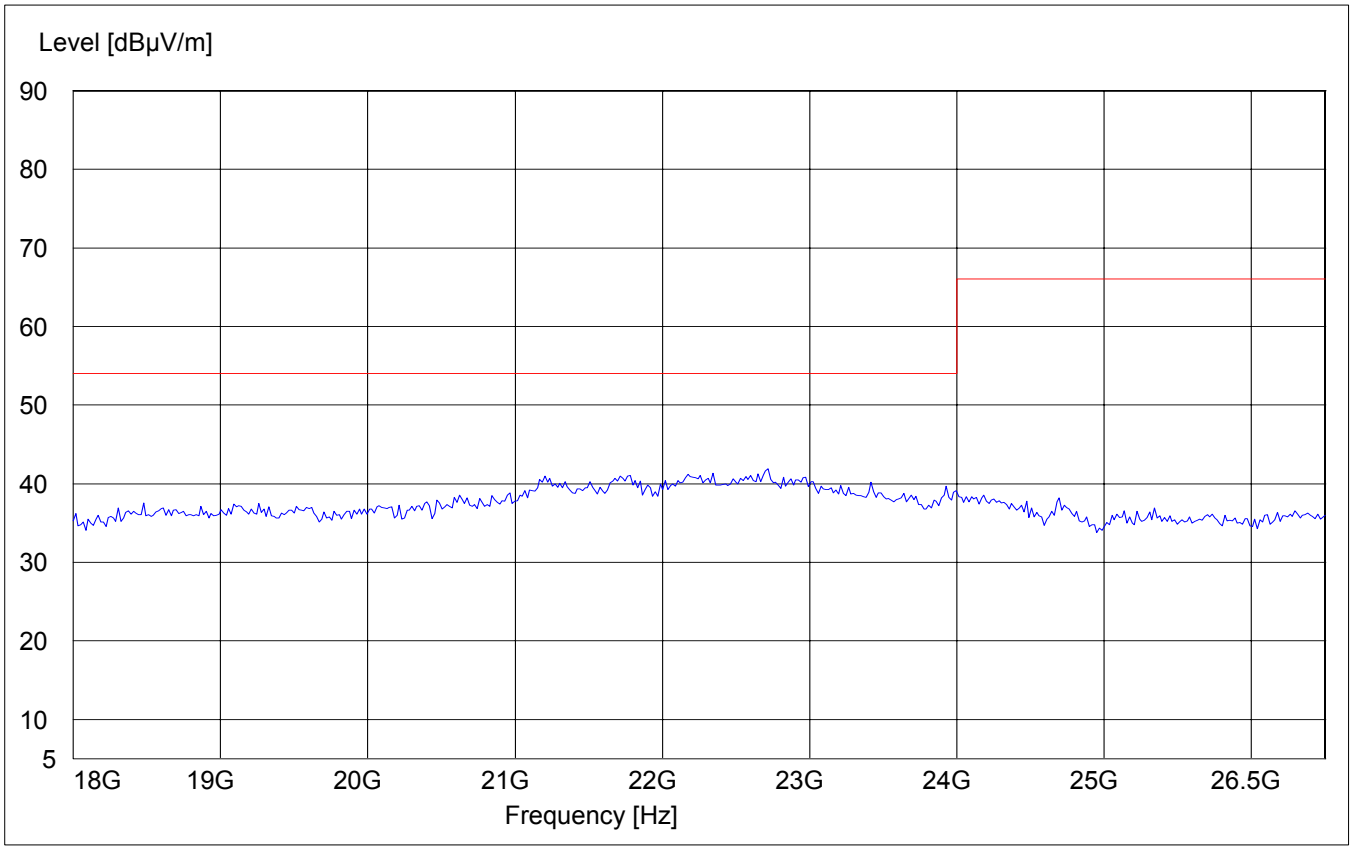


RECEIVER SPURIOUS RADIATION § 15.209
18GHz – 26.5GHz

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

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

Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW VBW	Transducer
18 GHz	26.5 GHz	MaxPeak	Coupled	1 MHz	#141 horn (dBi)

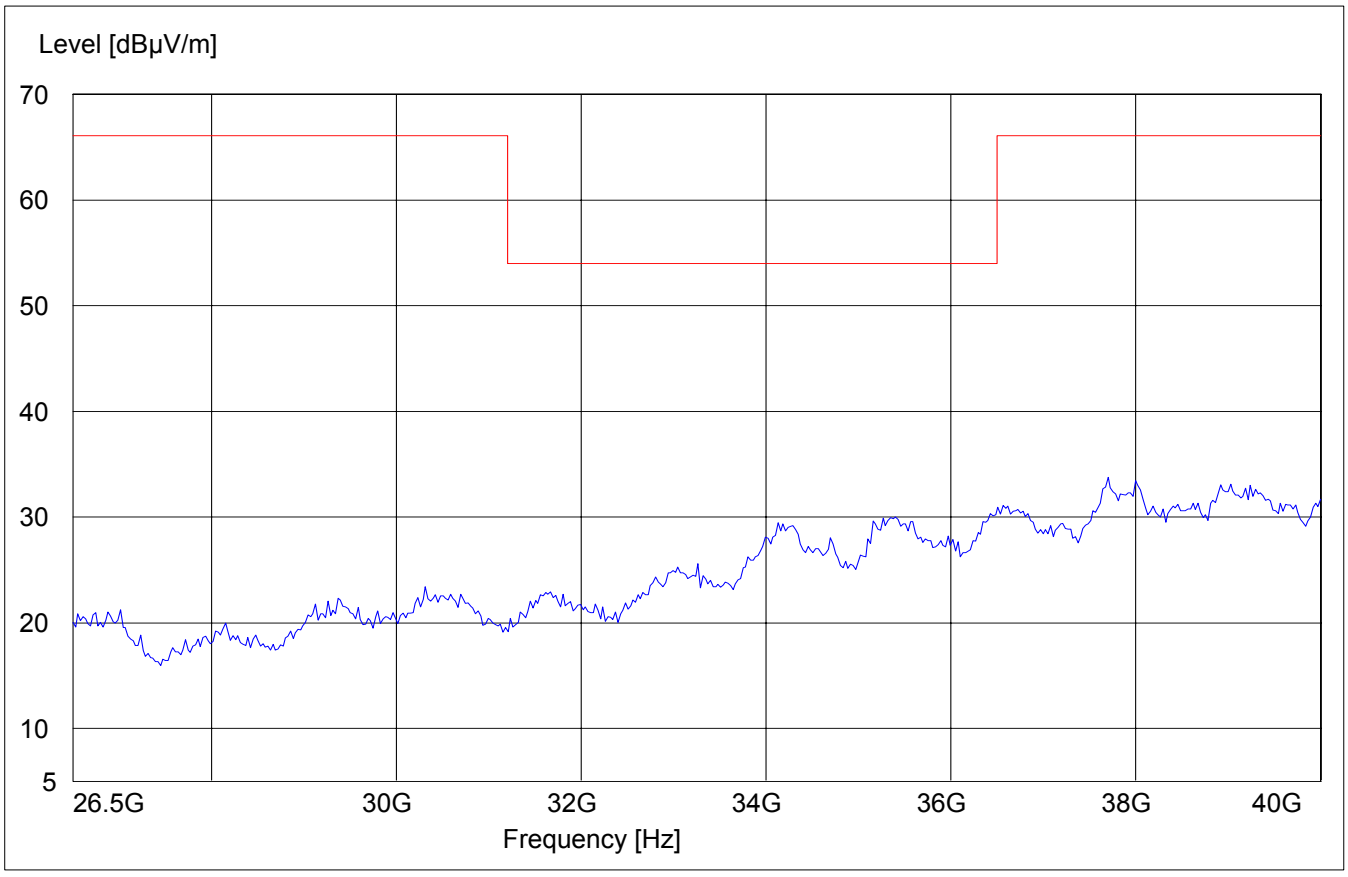


RECEIVER SPURIOUS RADIATION § 15.209
26.5GHz – 40GHz

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

SWEEP TABLE: "WLAN Spuri hi 26.5-40G"

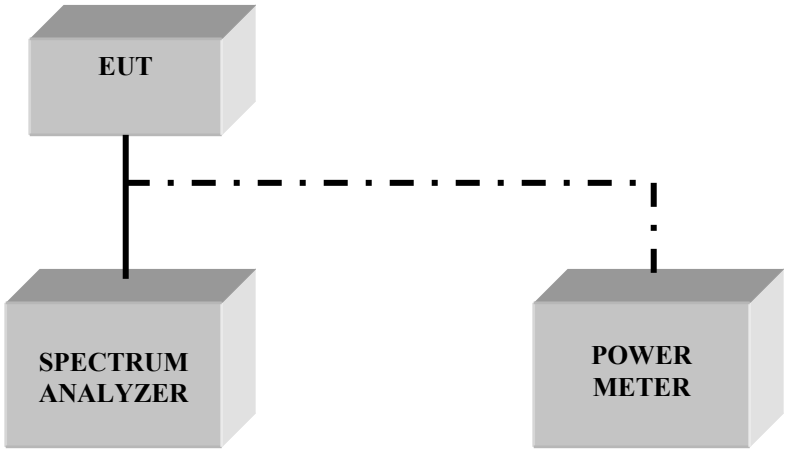
Start Frequency	Stop Frequency	Detector Time	Meas. Bandw.	RBW VBW	Transducer
26.5 GHz	40 GHz	MaxPeak	Coupled	1 MHz	3160-10 horn



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	Horn Antenna (26.5-40GHz)	3160-10	EMCO	1156
07	2-3GHz Band reject filter	BRM50701	Microtronics	6
08	Power-Meter	NRVD	Rohde & Schwarz	0857.8008.02
09	Pre-Amplifier	TS-ANA	Rohde & Schwarz	--
10	Pre-Amplifier	JS4-00102600	Miteq	00616

BLOCK DIAGRAMS
Conducted Testing



Radiated Testing