

# Test Report

## INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C and INDUSTRY CANADA REQUIREMENTS

Equipment Under Test: WLAN module

Model: WF111-A  
WF111-E  
WF111-N

Manufacturer: BlueGiga Technologies Oy  
PL 120  
FI-02631 Espoo  
Finland

Customer: BlueGiga Technologies Oy  
PL 120  
FI-02631 Espoo  
Finland

FCC Rule Part: 15.247:2010  
IC standards: RSS-210 Issue 8, 2010  
RSS-GEN Issue 2, 2007

Measurement guide: 558074 D01 DTS



Date: 28.06.2012

Issued by:

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Date: 28.06.2012

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Product Line Manager

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## Equipment Under Test (EUT)

Brand: Bluegiga  
Model: WF111-A  
WF111-E  
WF111-N  
Serial no: -  
HW version: -  
SW version: -  
FCC ID number: QQQWF111  
Industry Canada number: 5123A-BGT111

## Description of the EUT

WF111 is a general use IEEE 802.11 (Wi-Fi) transceiver module meant to provide wireless connectivity for various microprocessor platforms. WF111 supports the IEEE 802.11b/g/n wireless networking standards with a single spatial stream and 20MHz or 22MHz bandwidth, allowing bitrates of up to 72.2Mbps. WF111 provides embedded system designers with easy add-on connectivity without requiring RF design skills. Differences between the modules are:

WF111-A is equipped with integrated chip antenna

WF111-E is equipped with U.FL connector for external antenna

WF111-N is equipped with a pad on module edge

## Classification of the device

Fixed device	<input type="checkbox"/>
Mobile Device (Human body distance > 20cm)	<input checked="" type="checkbox"/>
Portable Device (Human body distance < 20cm)	<input type="checkbox"/>

## Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing

## Ratings and declarations

Operating Frequency Range (OFR):	2412 – 2462 MHz
Channels:	1-11
Channel separation:	5 MHz
Channel bandwidth:	20 MHz (b-mode) 22 MHz (g/n-mode)
Conducted power:	+19.15dBm
Transmission technique: (DSSS, FHSS, etc)	DSSS/OFDM
Modulation:	CCK/OFDM
Transmission rate:	1-72.2 Mbps
Antenna gain: WF121-A	0.5 dBi
Antenna gain: WF121-E	2.14 dBi
Antenna gain: WF121-N	2.14 dBi

## Power Requirements

<b>DC-operated</b>	
Operating voltage range	2.7 – 3.6VDC
Normal input voltage:	3.3 VDC

## Mechanical Size of the EUT

Height: 2,10 mm	Width: 12,00 mm	Depth: 19.00 mm
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## Cable Lengths and Types

<b>Cable:</b>	<b>Length:</b>	<b>Type:</b>
DC power cable	1,5 m	Unshielded

## Peripherals

<b>Peripheral</b>	<b>Manufacturer</b>	<b>Model</b>	<b>S/N</b>	<b>Connection to the EUT</b>
Switching power supply	Phihong	PSC12R-050	P01900765A1	AC/DC power supply

**Disclaimer**

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## SUMMARY OF TESTING

FCC Rules	Description of Test	Result
§15.207(a)	Conducted Emissions	PASS
§15.247(a)(2)	6 dB Bandwidth	PASS
RSS-GEN §4.6.1	99% Bandwidth	PASS
§15.209(a) §15.247(d)	Radiated Emissions	PASS
§15.247(e)	Power Spectral Density	PASS

## EUT Test Conditions During Testing

During the tests EUT was set into continuous transmit or receive mode into the channel under test. Normal test modulation and maximum transmit power was used in all tests.

## Description of Test Modes

Since all modules contain exactly the same hardware and the only difference is the antenna connection the tests were performed as follows:

WF111-A radiated emission tests only.

WF111-E full testing

WF111-N radiated emission tests only.

Before performing the actual tests a preliminary tests were performed in order to find out which data rate will produce the highest emission level.

The highest emission level was produced by using b-mode 1Mbps data rate, g-mode 6Mbps data rate and n-mode 7.2Mbps data rate.

All tests were performed by using the above mentioned data rates. This report contains test results of the tests performed to all three models by using b-mode and 1Mbps data rate since this mode produced the highest emission levels.

## Test Facility

<input type="checkbox"/> Testing Location / address: FCC registration number: <b>90598</b>	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
<input checked="" type="checkbox"/> Testing Location / address: FCC registration number: <b>178986</b> Industry Canada registration number: <b>8708A-2</b>	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

**Conducted Emissions In The Frequency Range 150 kHz - 30 MHz.**

<b>Standard:</b>	ANSI C63.10	(2009)
<b>Tested by:</b>	SOT	
<b>Date:</b>	04.06.2012	
<b>Humidity:</b>	34 %	
<b>Temperature:</b>	22°C	
<b>Barometric pressure</b>	1003.3 mbar	
<b>Measurement uncertainty</b>	± 2.3 dB	Level of confidence 95 % (k = 2)

**Test Plan**

Conducted disturbance voltage will be measured with an artificial main network from 150 kHz to 30 MHz with 4 kHz steps and a resolution bandwidth of 9 kHz. Measurements will be carried out with Peak- and Average-detectors from Phase-line(s) and Neutral-line.

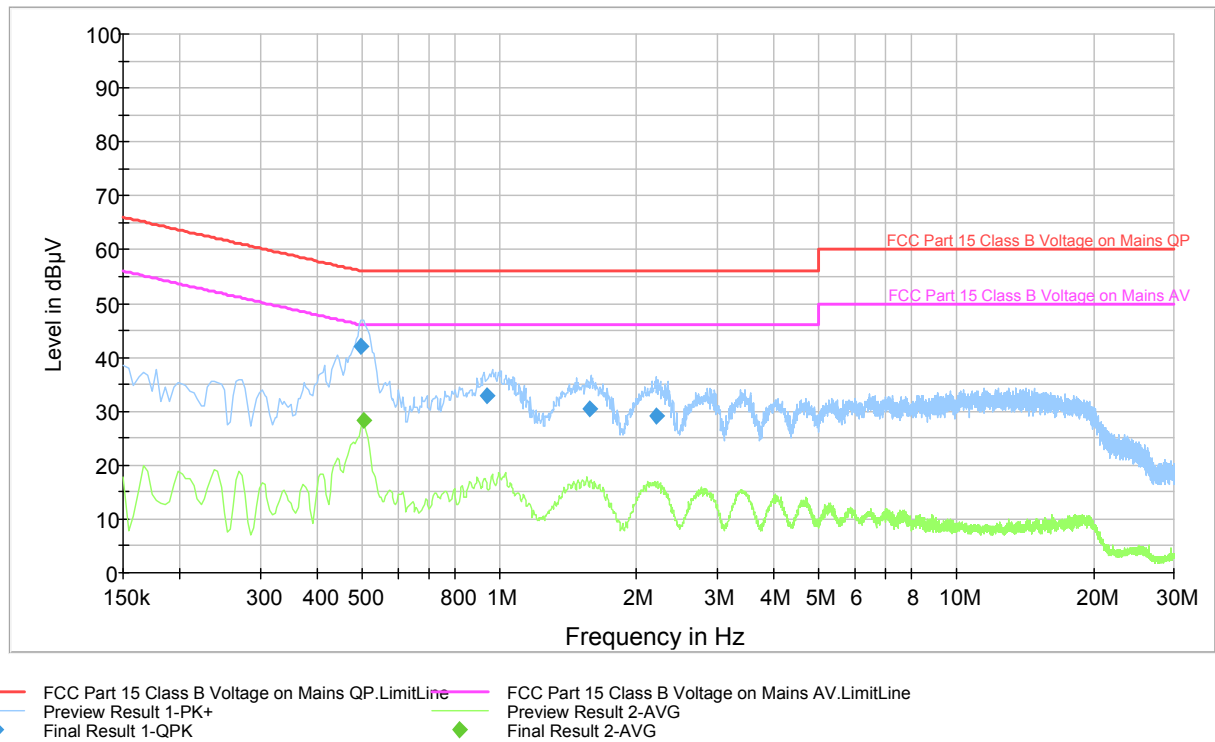
This measurement will be made from the AC-main lines with supply 115VDC / 60 Hz voltage.

The EUT is working as described in the section "EUT Test Conditions".

**Test results**

**WF111-A**

Conducted Emission Mains FCC Class B with ESH2-Z5, 32A

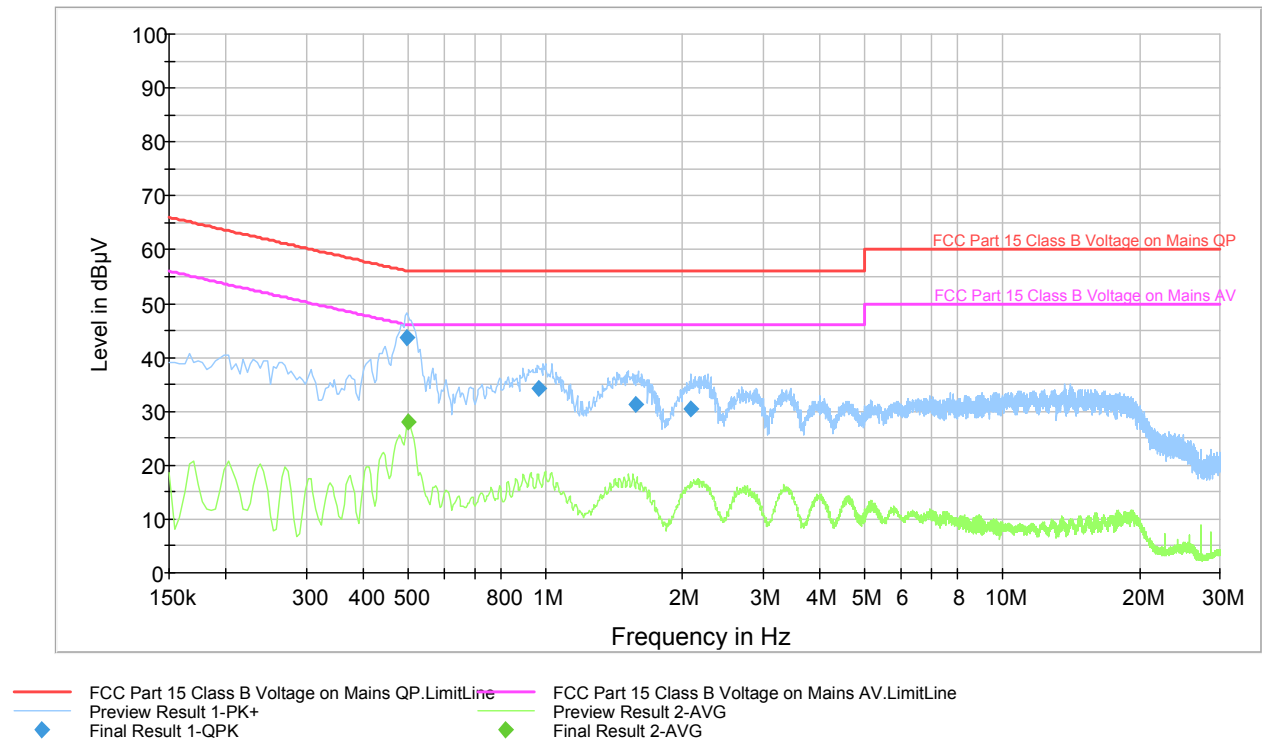

**Figure 1** The measured curves with peak- and average detector.

**Table 1** Final measurement results with Quasi peak detector.

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Margin (dB)	Limit (dBμV)	Comment
0.497000	42.1	1000.0	9.000	GN	L1	13.9	56.0	
0.937000	32.9	1000.0	9.000	GN	L1	23.1	56.0	
1.581000	30.5	1000.0	9.000	GN	L1	25.5	56.0	
2.201000	29.1	1000.0	9.000	GN	L1	26.9	56.0	

**Table 2** Final measurement results with Average detector.

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Margin (dB)	Limit (dBμV)	Comment
0.505000	28.3	1000.0	9.000	GN	L1	17.7	46.0	

**WF111-E**
**Conducted Emission Mains FCC Class B with ESH2-Z5, 32A**

**Figure 2.** The measured curves with peak- and average detector.

**Table 3.** Final measurement results with Quasi peak detector.

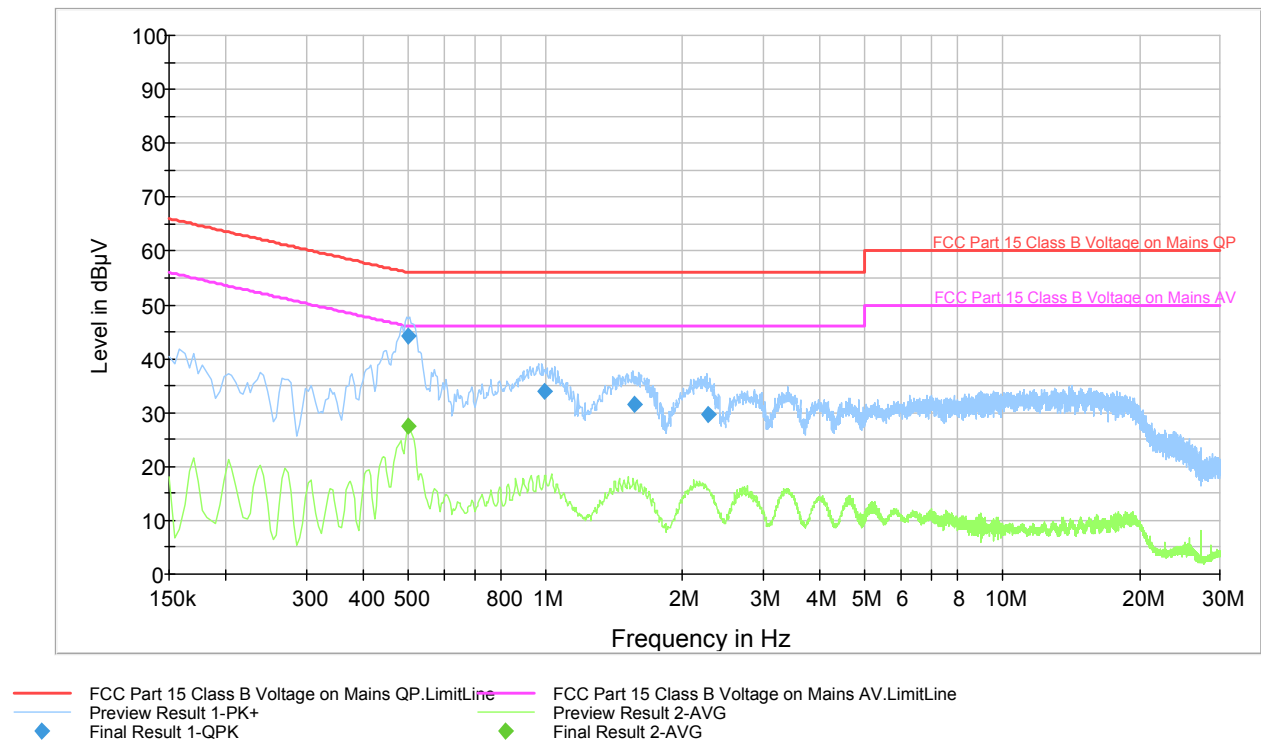
Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Margin (dB)	Limit (dBμV)	Comment
0.497000	43.8	1000.0	9.000	GN	L1	12.3	56.0	
0.965000	34.2	1000.0	9.000	GN	L1	21.8	56.0	
1.573000	31.4	1000.0	9.000	GN	L1	24.6	56.0	
2.089000	30.4	1000.0	9.000	GN	L1	25.6	56.0	

**Table 4.** Final measurement results with Quasi peak detector.

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Margin (dB)	Limit (dBμV)	Comment
0.501000	28.1	1000.0	9.000	GN	L1	17.9	46.0	

WF111-N

Conducted Emission Mains FCC Class B with ESH2-Z5, 32A



**Figure 3.** The measured curves with peak- and average detector.

**Table 5.** Final measurement results with Quasi peak detector.

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Margin (dB)	Limit (dBμV)	Comment
0.501000	44.1	1000.0	9.000	GN	L1	11.9	56.0	
0.993000	34.0	1000.0	9.000	GN	L1	22.0	56.0	
1.565000	31.6	1000.0	9.000	GN	L1	24.4	56.0	
2.269000	29.6	1000.0	9.000	GN	L1	26.4	56.0	

**Table 6.** Final measurement results with Quasi peak detector.

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Margin (dB)	Limit (dBμV)	Comment
0.501000	27.5	1000.0	9.000	GN	L1	18.5	46.0	

**Transmitter Radiated Emissions 30 – 25 000 MHz**

<b>Standard:</b>	ANSI C63.10	(2009)
<b>Tested by:</b>	SOT	
<b>Date:</b>	28.05.2012	
<b>Humidity:</b>	68%	
<b>Temperature:</b>	20.4°C	
<b>Barometric pressure</b>	1004.1 mbar	
<b>Measurement uncertainty</b>	± 4.51dB	Level of confidence 95 % (k = 2)

**FCC Rule: 15.247(d), 15.209(a)**

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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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).

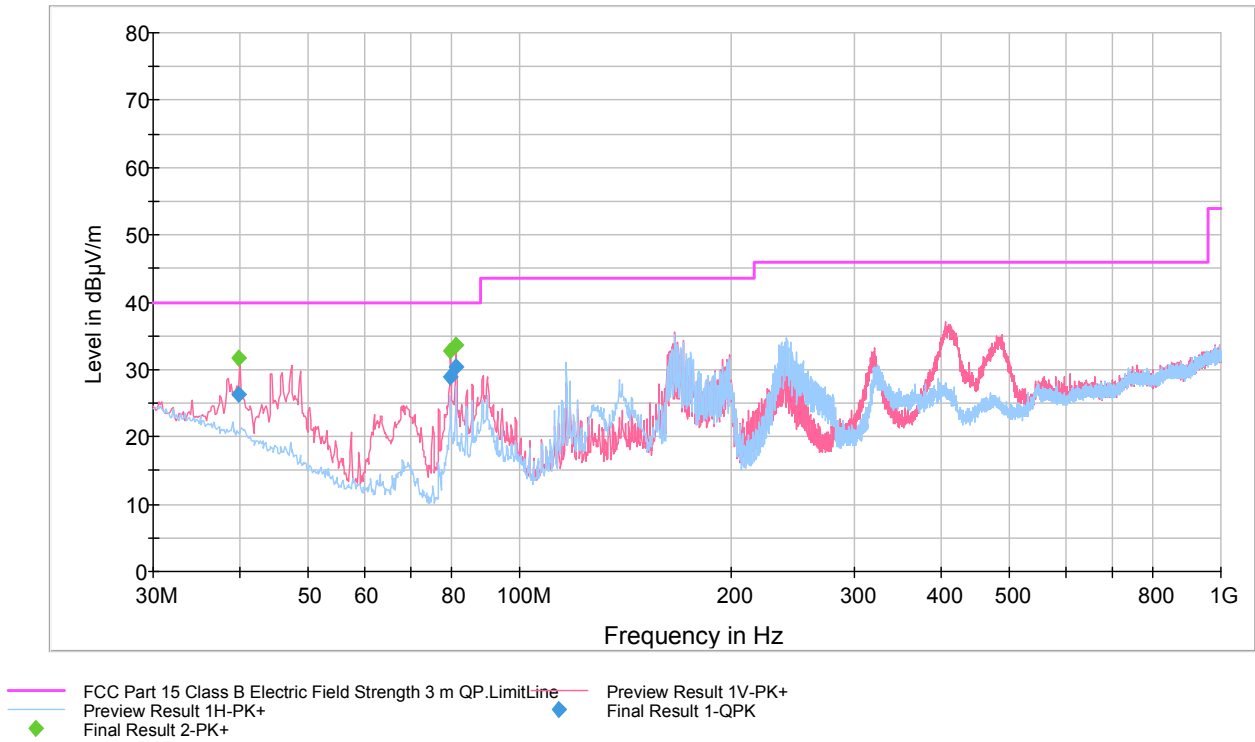
The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables). The QuasiPeak value is the measured value corrected with the correction factor.

**Test results:**

## Transmitter Radiated Measurement

WF111-A

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 4.** Measured curve with peak-detector. Channel low.

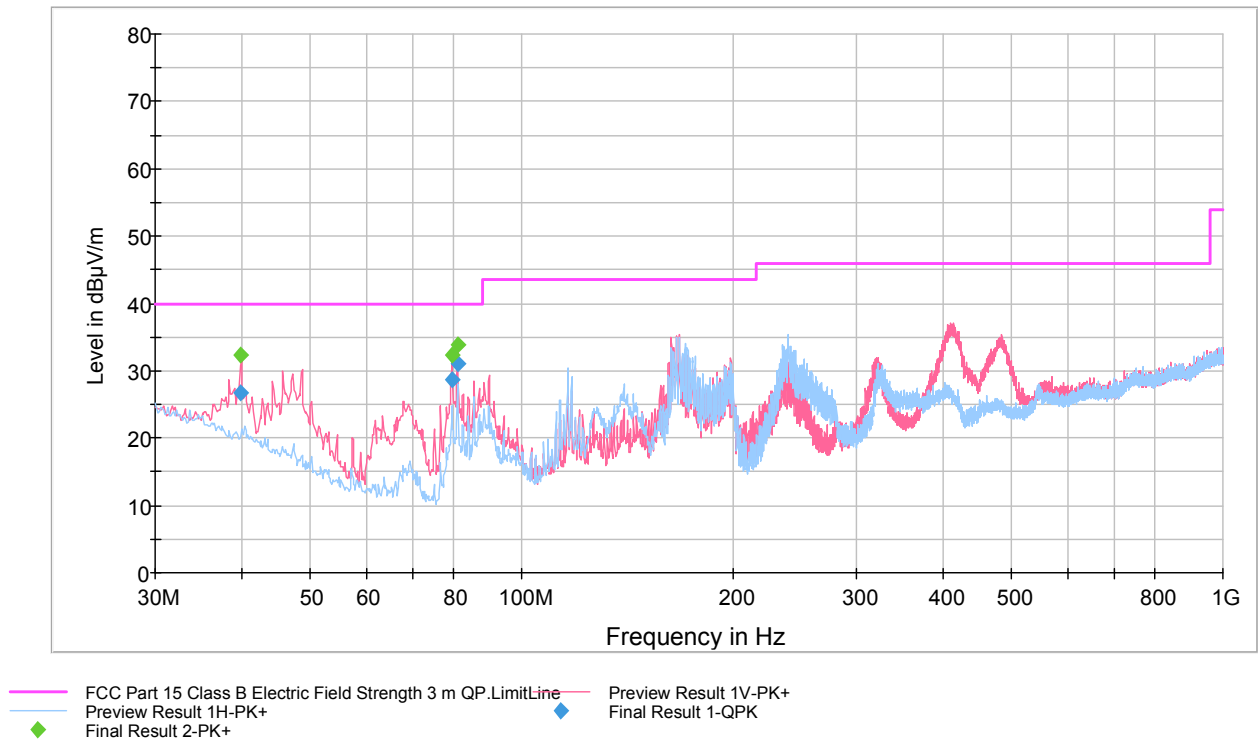
### Final measurements from the worst frequencies

**Table 7.** Final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
39.755000	26.3	1000.0	120.000	100.0	V	43.0	19.2	13.7	40.0	
79.595000	28.9	1000.0	120.000	100.0	V	240.0	8.5	11.1	40.0	
80.995000	30.3	1000.0	120.000	121.0	V	240.0	8.4	9.7	40.0	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 5.** Measured curve with peak-detector. Channel mid.

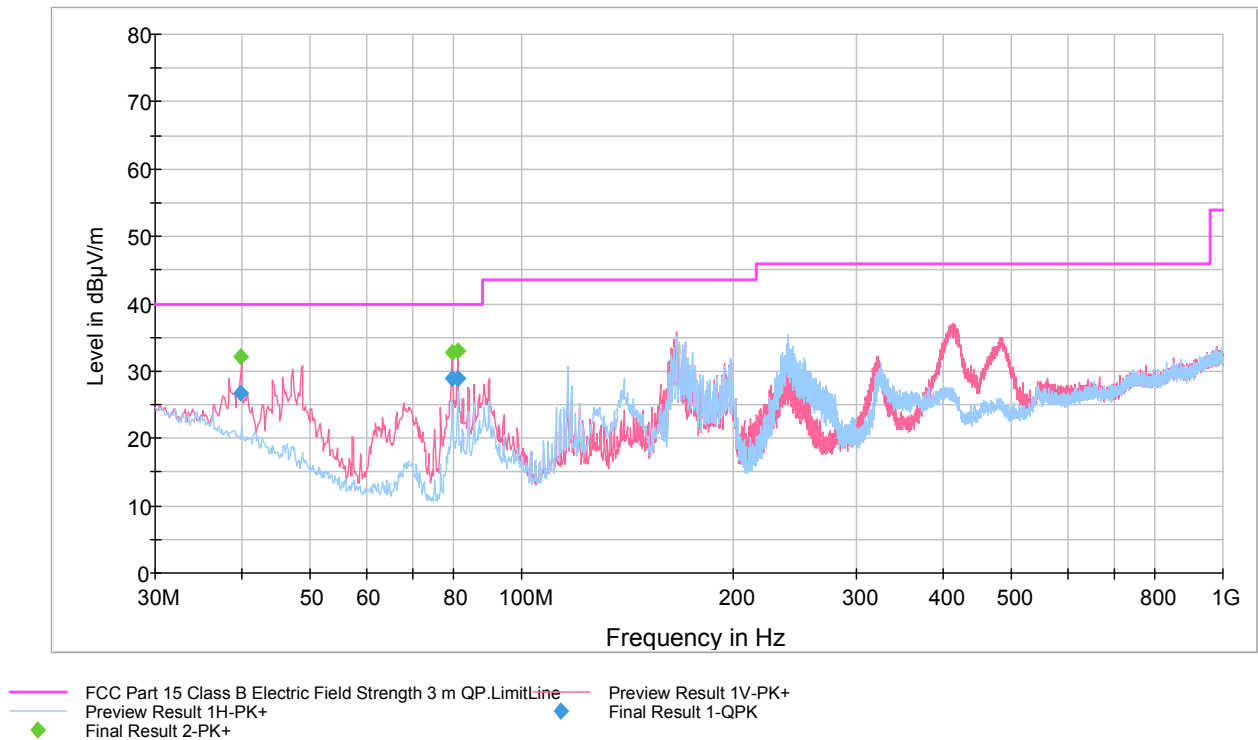
### Final measurements from the worst frequencies

**Table 8.** Final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
39.725000	26.7	1000.0	120.000	100.0	V	330.0	19.2	13.3	40.0	
79.515000	28.7	1000.0	120.000	133.0	V	240.0	8.5	11.3	40.0	
80.975000	31.1	1000.0	120.000	110.0	V	207.0	8.4	8.9	40.0	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 6.** Measured curve with peak-detector. Channel high.

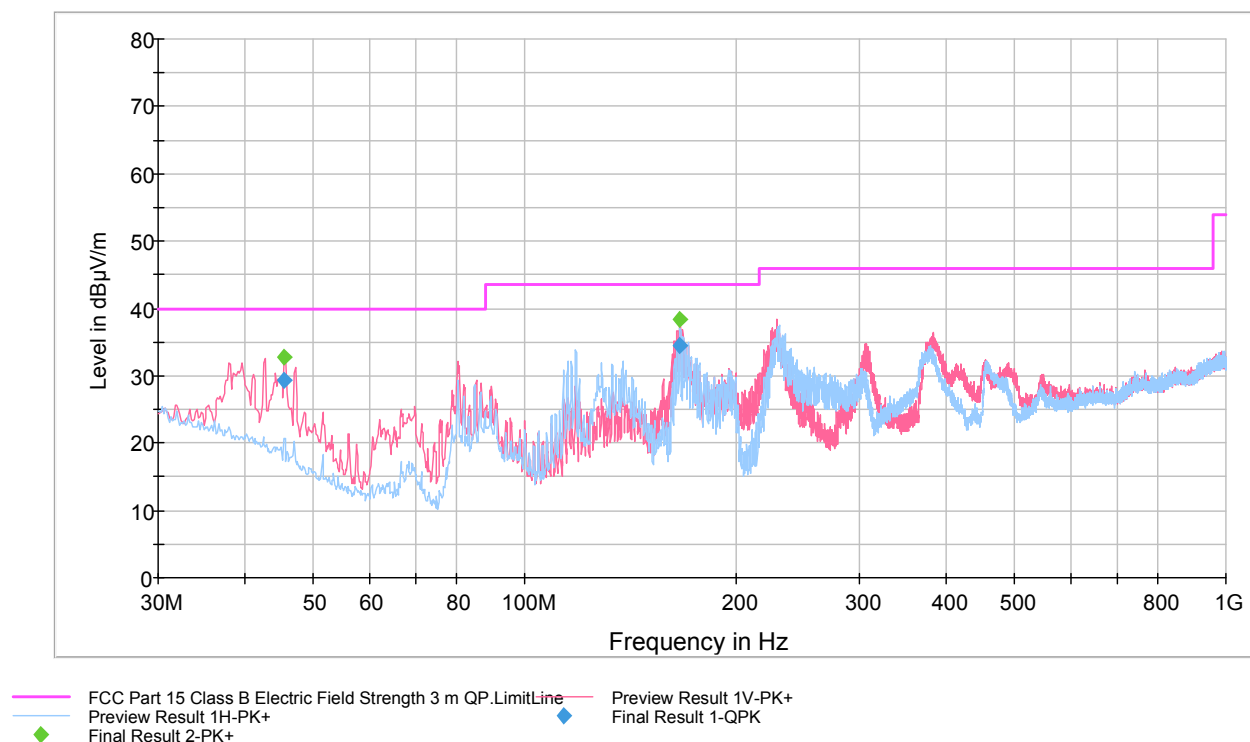
### Final measurements from the worst frequencies

**Table 9.** Final results.

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
39.765000	26.7	1000.0	120.000	116.0	V	-5.0	19.2	13.3	40.0	
79.575000	29.0	1000.0	120.000	127.0	V	234.0	8.5	11.0	40.0	
81.035000	28.9	1000.0	120.000	137.0	V	185.0	8.4	11.1	40.0	

**WF111-E**

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

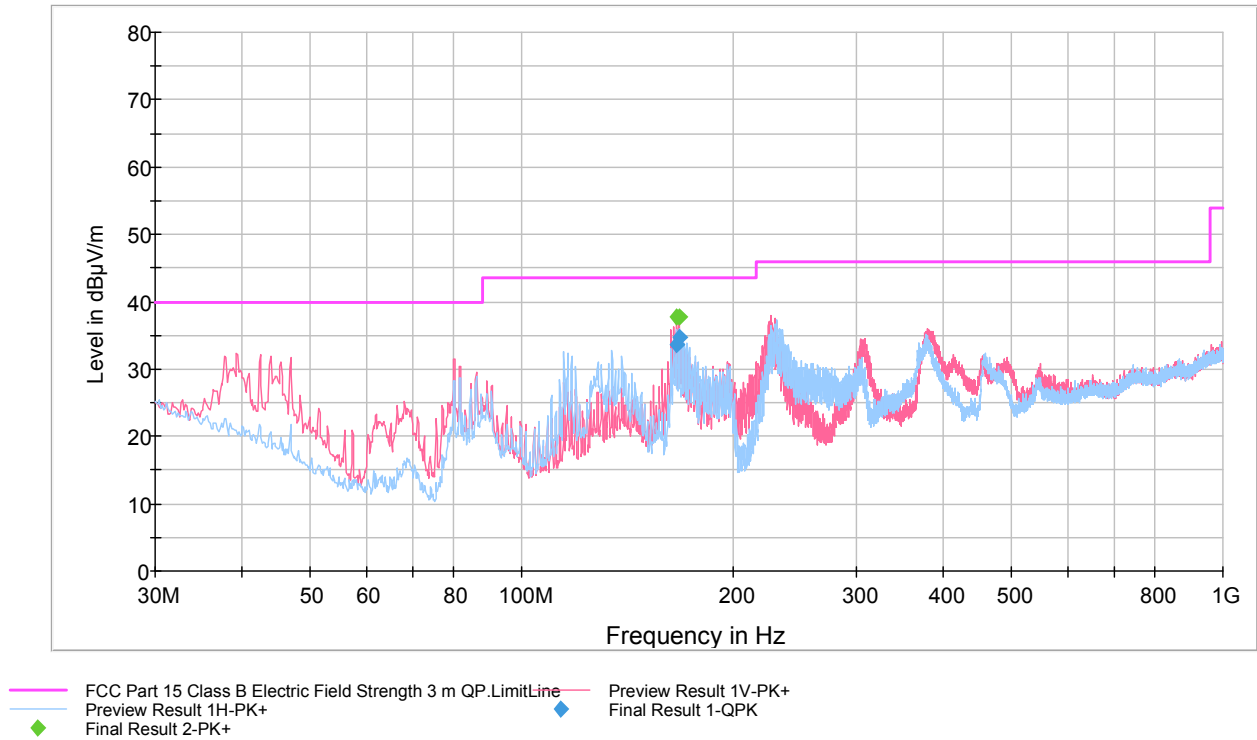

**Figure 7.** Measured curve with peak-detector. Channel low.

**Final measurements from the worst frequencies**
**Table 10.** Final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
45.415000	29.3	1000.0	120.000	100.0	V	9.0	16.6	10.7	40.0	
166.425000	34.6	1000.0	120.000	100.0	V	102.0	12.3	8.9	43.5	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 8.** Measured curve with peak-detector. Channel mid.

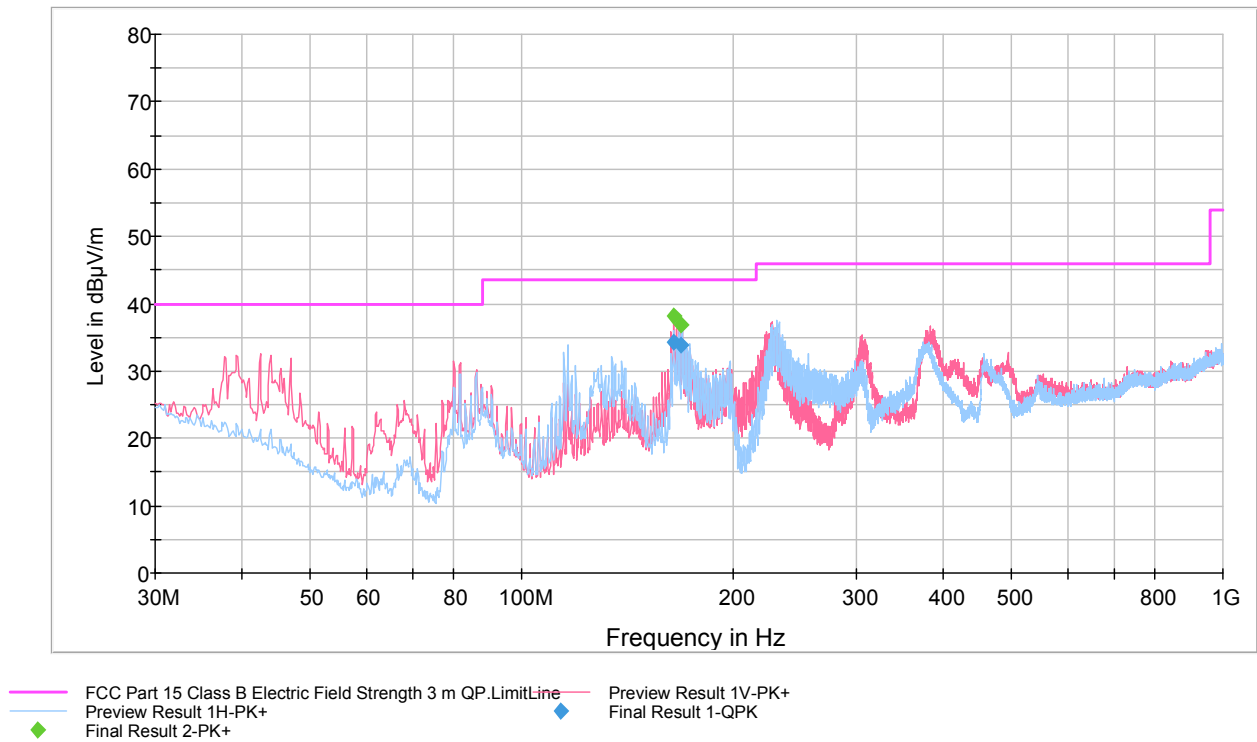
### Final measurements from the worst frequencies

**Table 11.** Final results.

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
166.225000	33.6	1000.0	120.000	100.0	V	83.0	12.3	9.9	43.5	
167.795000	34.8	1000.0	120.000	110.0	V	91.0	12.2	8.7	43.5	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 9.** Measured curve with peak-detector. Channel high.

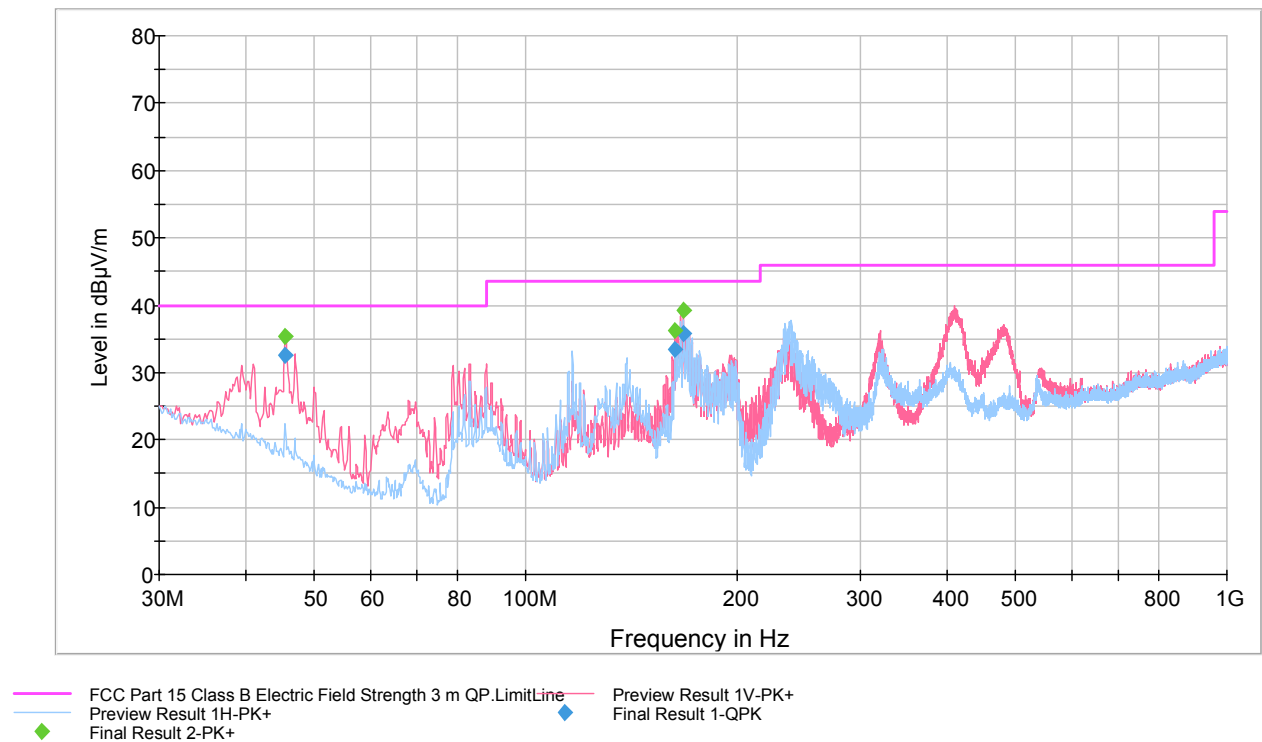
### Final measurements from the worst frequencies

**Table 12.** Final results.

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
164.635000	34.2	1000.0	120.000	100.0	V	107.0	12.4	9.3	43.5	
169.095000	33.9	1000.0	120.000	100.0	V	94.0	12.1	9.6	43.5	

**WF111-N**

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

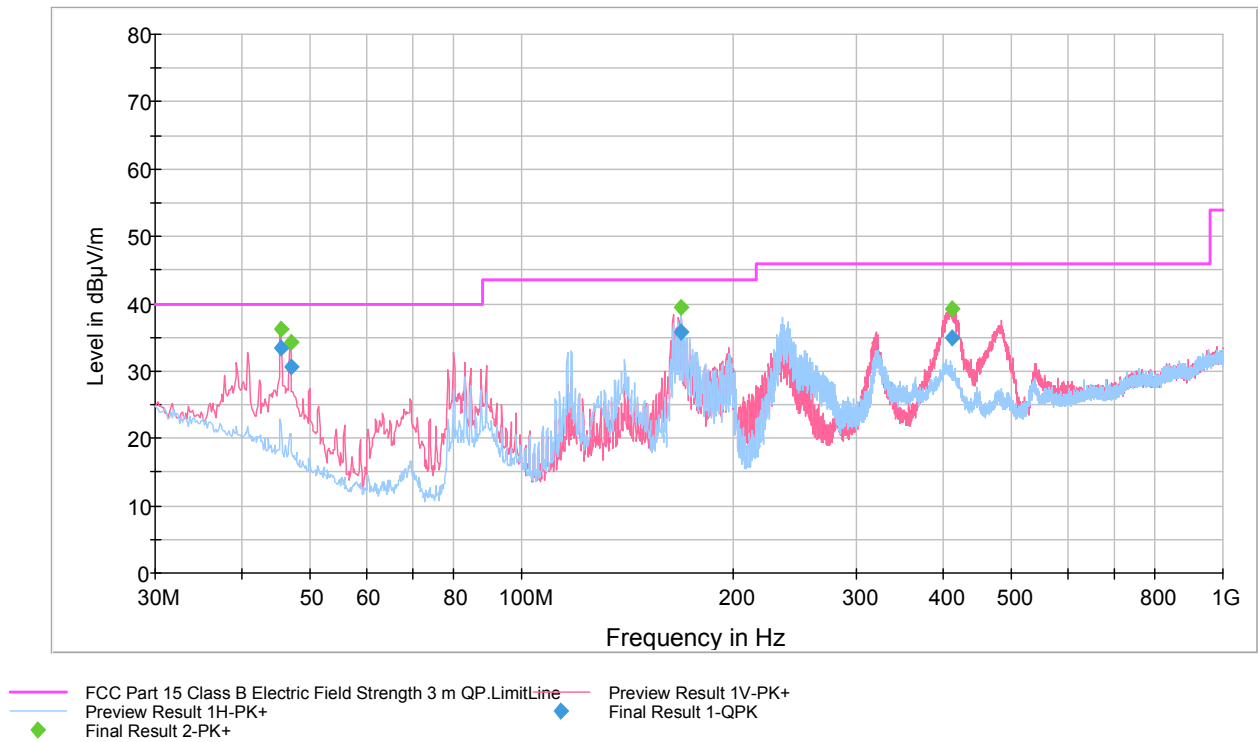

**Figure 10.** Measured curve with peak-detector. Channel low.

**Final measurements from the worst frequencies**
**Table 13.** Final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
45.365000	32.6	1000.0	120.000	110.0	V	9.0	16.6	7.4	40.0	
163.255000	33.5	1000.0	120.000	100.0	V	97.0	12.4	10.0	43.5	
167.735000	35.7	1000.0	120.000	100.0	V	89.0	12.2	7.8	43.5	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 11.** Measured curve with peak-detector. Channel mid.

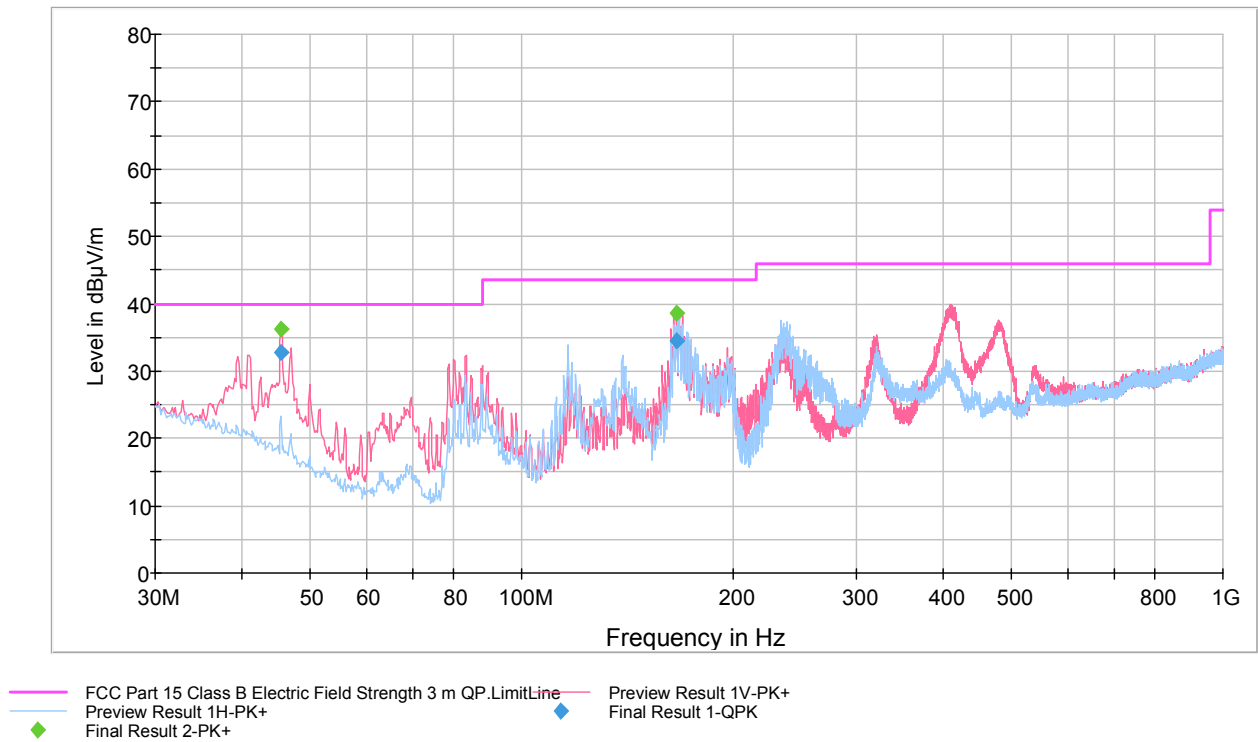
### Final measurements from the worst frequencies

**Table 14.** Final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
45.295000	33.4	1000.0	120.000	100.0	V	167.0	16.7	6.6	40.0	
46.825000	30.7	1000.0	120.000	100.0	V	9.0	15.9	9.3	40.0	
169.115000	35.7	1000.0	120.000	205.0	H	104.0	12.1	7.8	43.5	
410.245000	34.8	1000.0	120.000	100.0	V	189.0	18.9	11.2	46.0	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 12.** Measured curve with peak-detector. Channel high.

### Final measurements from the worst frequencies

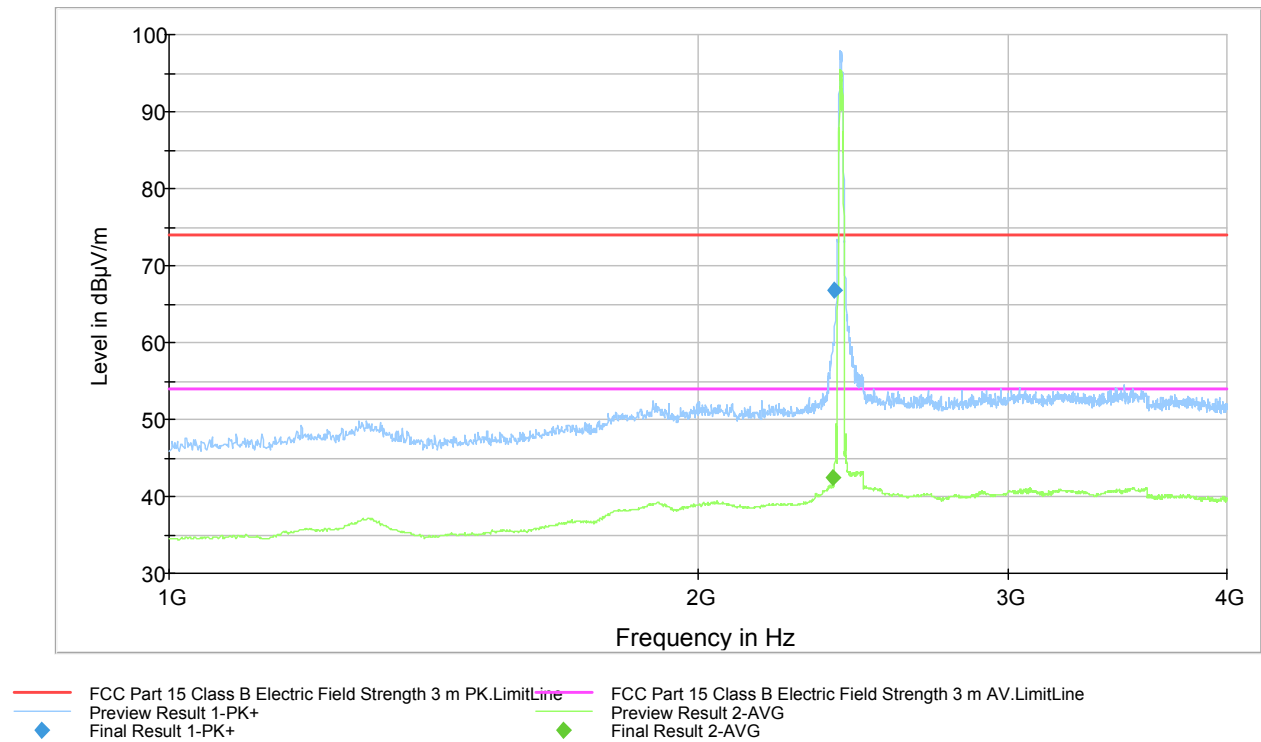
**Table 15.** Final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
45.325000	32.9	1000.0	120.000	100.0	V	-5.0	16.7	7.1	40.0	
165.965000	34.5	1000.0	120.000	100.0	V	85.0	12.3	9.0	43.5	

## Transmitter Radiated Emissions 1 000 – 4 000 MHz

WF111-A

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



**Figure 13.** Measured curve with peak and average detectors. Channel low.

### Final measurements from the worst frequencies

**Table 16.** Final results Max Peak detector.

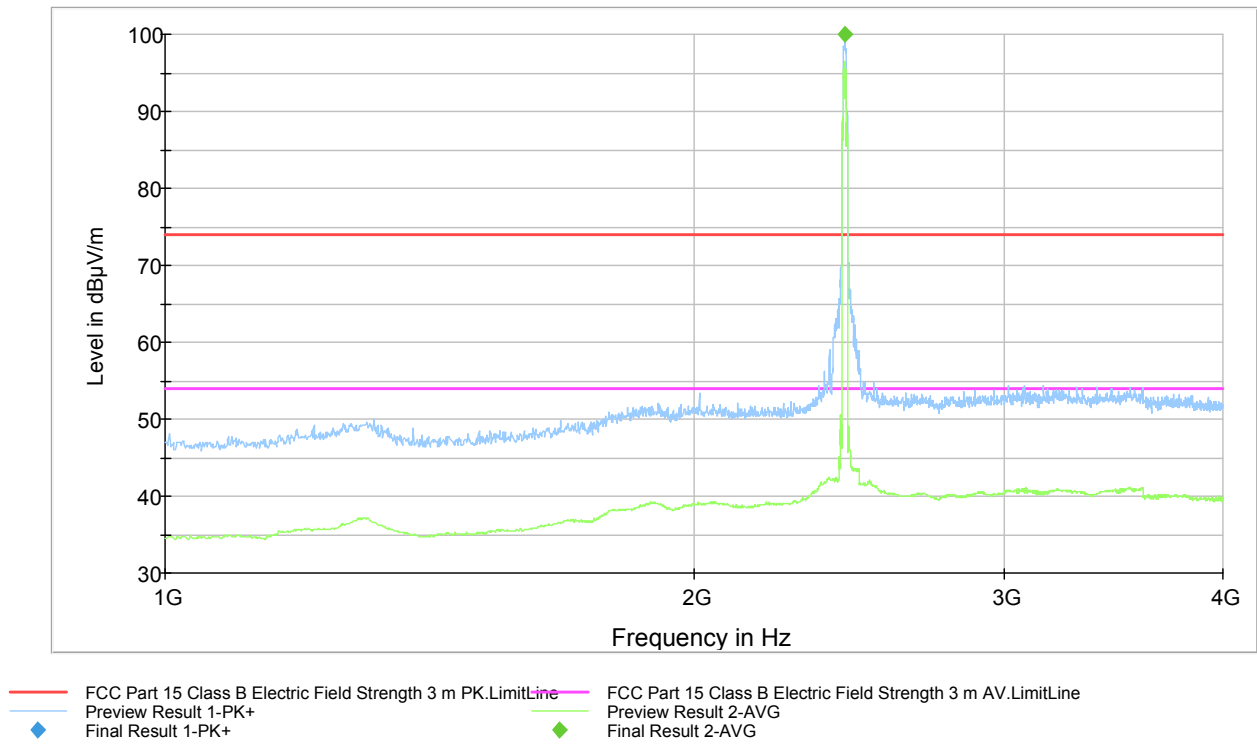
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2389.400000	66.8	1000.0	1000.000	192.0	H	267.0	14.8	7.1	73.9	

**Table 17.** Final results Average detector.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2387.000000	42.5	1000.0	1000.000	224.0	H	90.0	14.8	11.4	53.9	

# Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



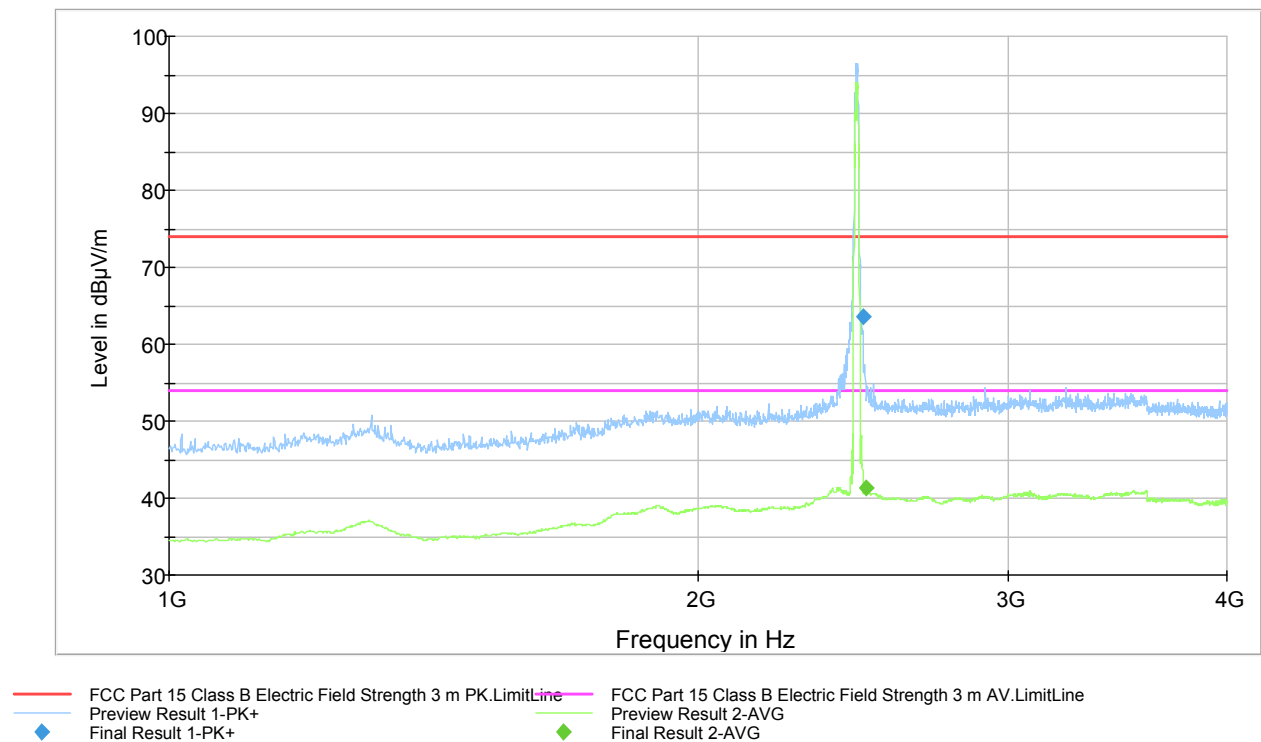
**Figure 14.** Measured curve with peak and average detectors. Channel mid.

## Final measurements from the worst frequencies

No final measurements were made since peak emissions were below the average limit line outside the operating frequency band.

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



**Figure 15.** Measured curve with peak and average detectors. Channel high.

### Final measurements from the worst frequencies

**Table 18.** Final results Max Peak detector.

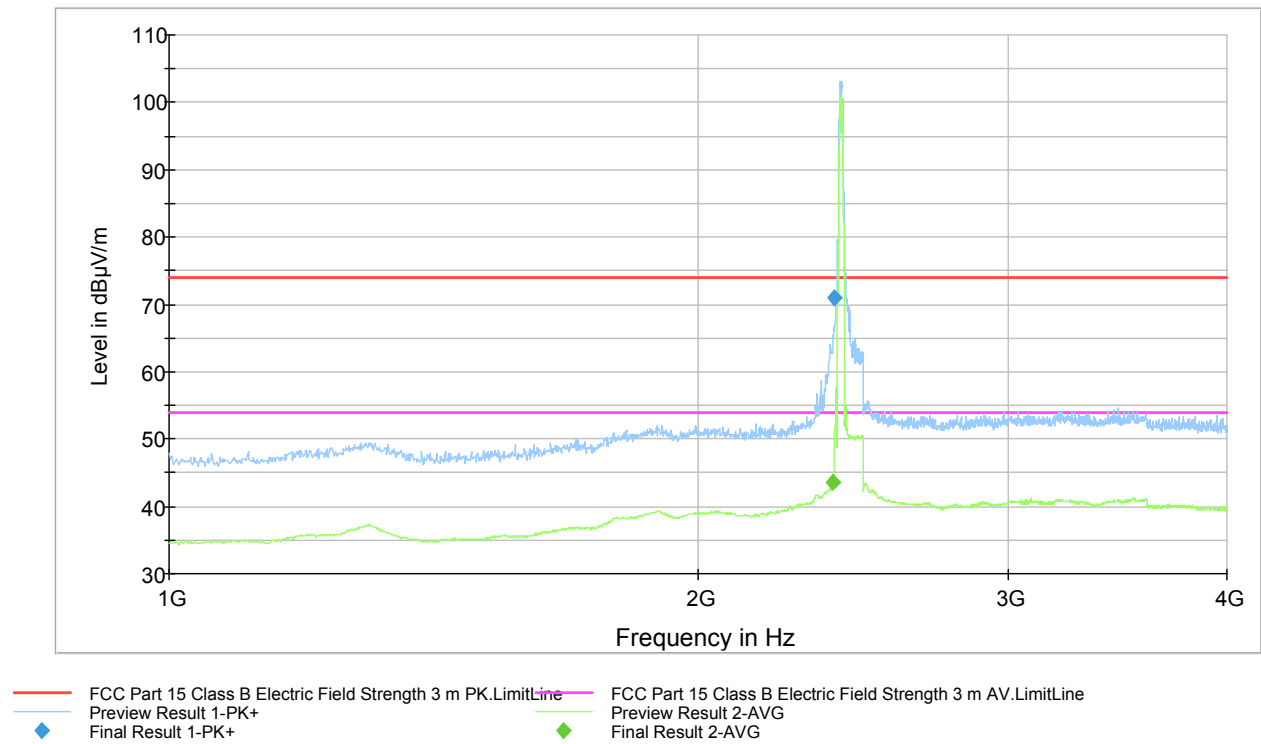
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2483.900000	63.6	1000.0	1000.000	100.0	H	210.0	14.7	10.3	73.9	

**Table 19.** Final results Average detector.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2490.900000	41.4	1000.0	1000.000	113.0	H	212.0	14.8	12.5	53.9	

**WF111-E**

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)


**Figure 16.** Measured curve with peak and average detectors. Channel low.

**Final measurements from the worst frequencies**
**Table 20.** Final results Max Peak detector.

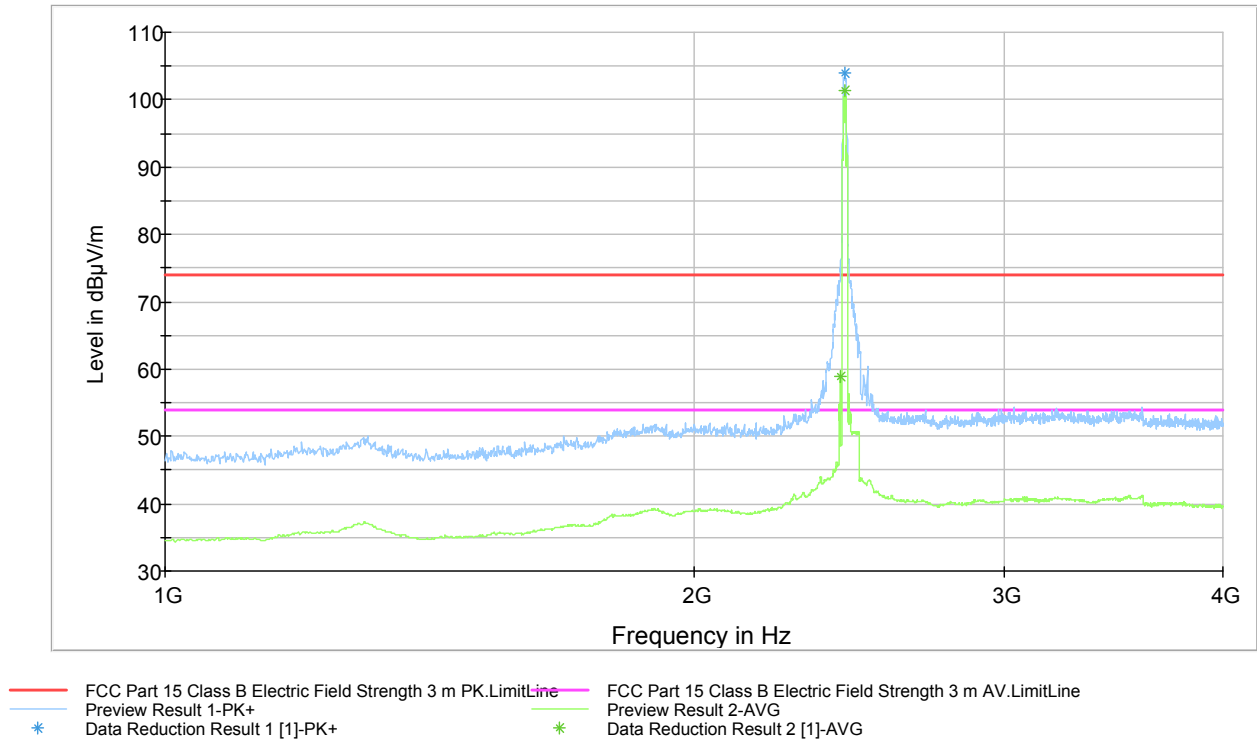
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2389.800000	71.0	1000.0	1000.000	176.0	V	155.0	14.8	2.9	73.9	

**Table 21.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2387.000000	43.6	1000.0	1000.000	100.0	V	157.0	14.8	10.3	53.9	

# Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



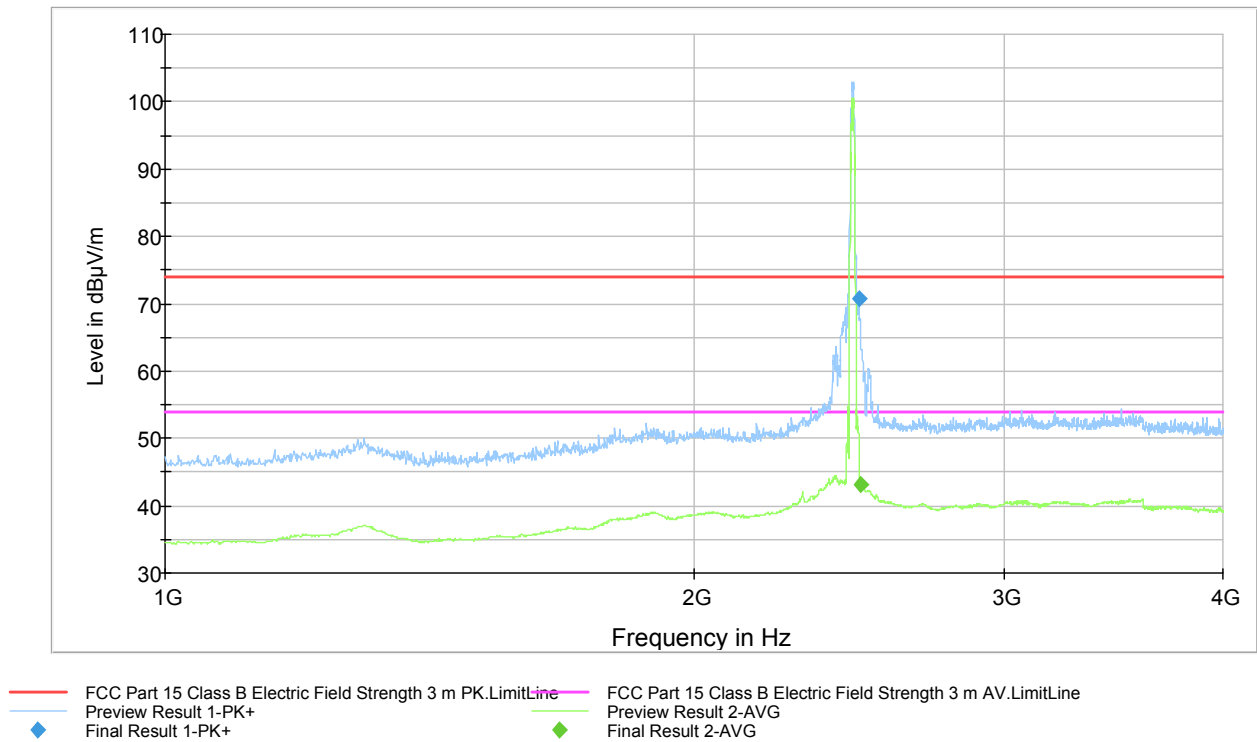
**Figure 17.** Measured curve with peak and average detectors. Channel mid.

## Final measurements from the worst frequencies

No final measurements were made since peak emissions were below the average limit line outside the operating frequency band.

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



**Figure 18.** Measured curve with peak and average detectors. Channel high.

**Table 22.** Final results Max Peak detector.

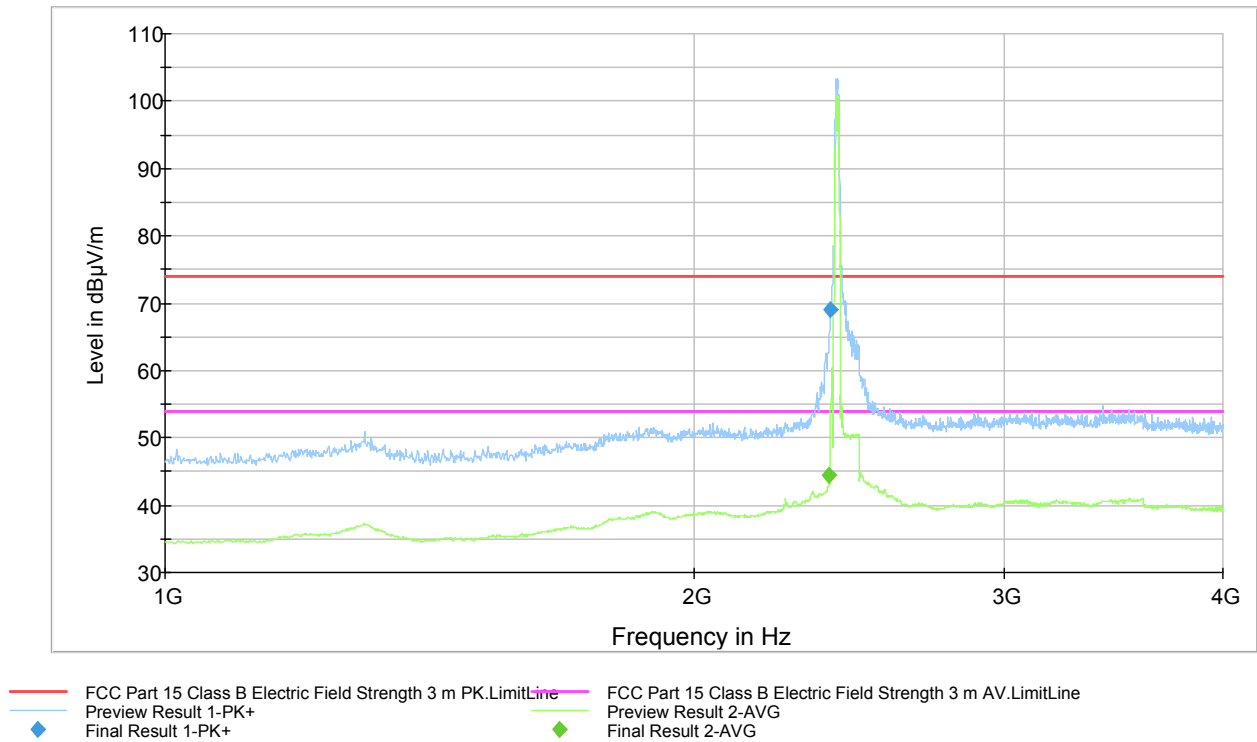
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2483.900000	70.7	1000.0	1000.000	200.0	V	150.0	14.7	3.2	73.9	

**Table 23.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2487.100000	43.2	1000.0	1000.000	131.0	V	133.0	14.8	10.7	53.9	

**WF111-N**

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)


**Figure 19.** Measured curve with peak and average detectors. Channel low.

**Table 24.** Final results Max Peak detector.

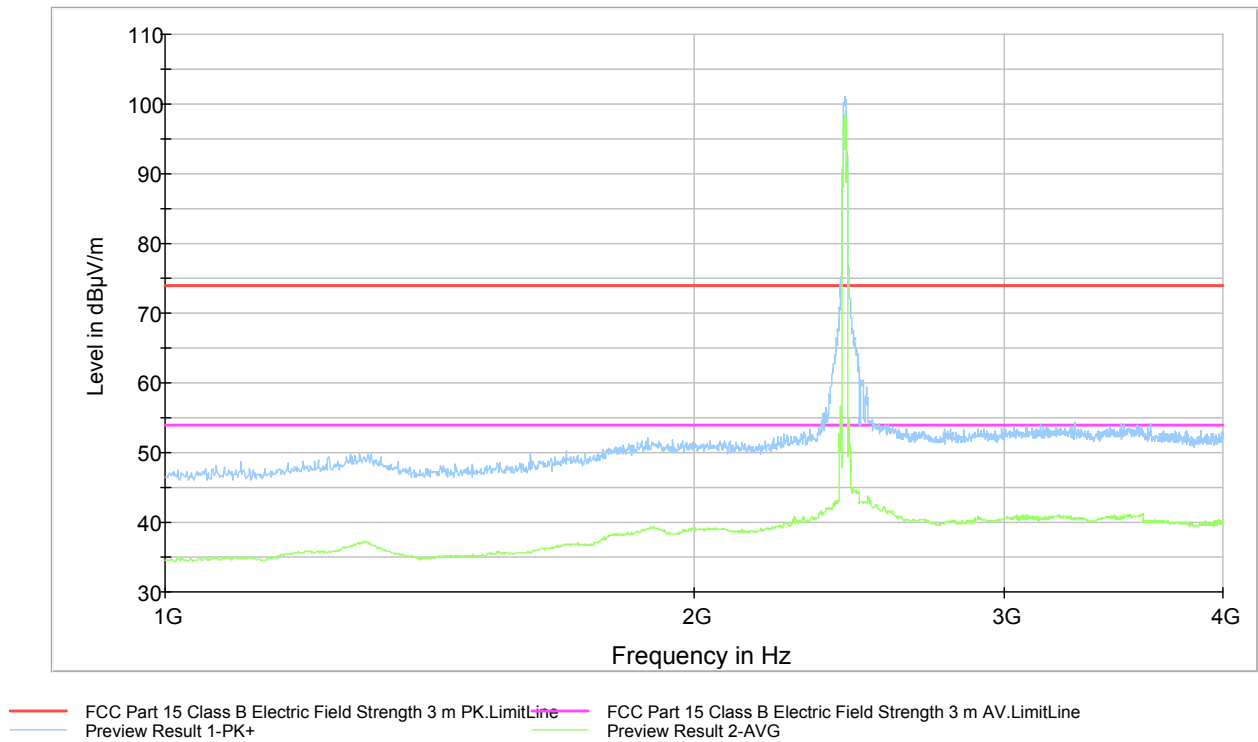
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2390.000000	69.0	1000.0	1000.000	138.0	V	142.0	14.6	4.9	73.9	

**Table 25.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2386.200000	44.4	1000.0	1000.000	179.0	V	207.0	14.6	9.5	53.9	

Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

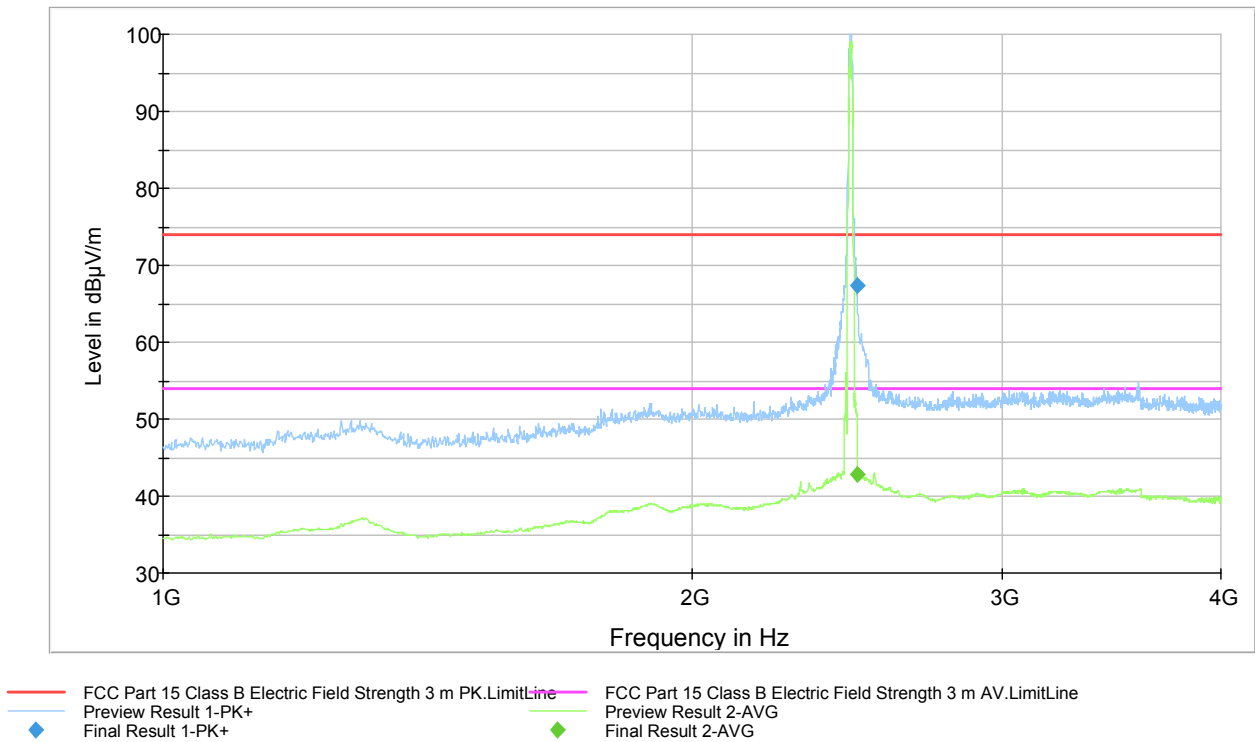


**Figure 20.** Measured curve with peak and average detectors. Channel mid.

No final measurements were made since peak emissions were below the average limit line outside the operating frequency band.

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



**Figure 21.** Measured curve with peak and average detectors. Channel high.

**Table 26.** Final results Max Peak detector.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2483.500000	67.3	1000.0	1000.000	206.0	V	207.0	14.7	6.6	73.9	

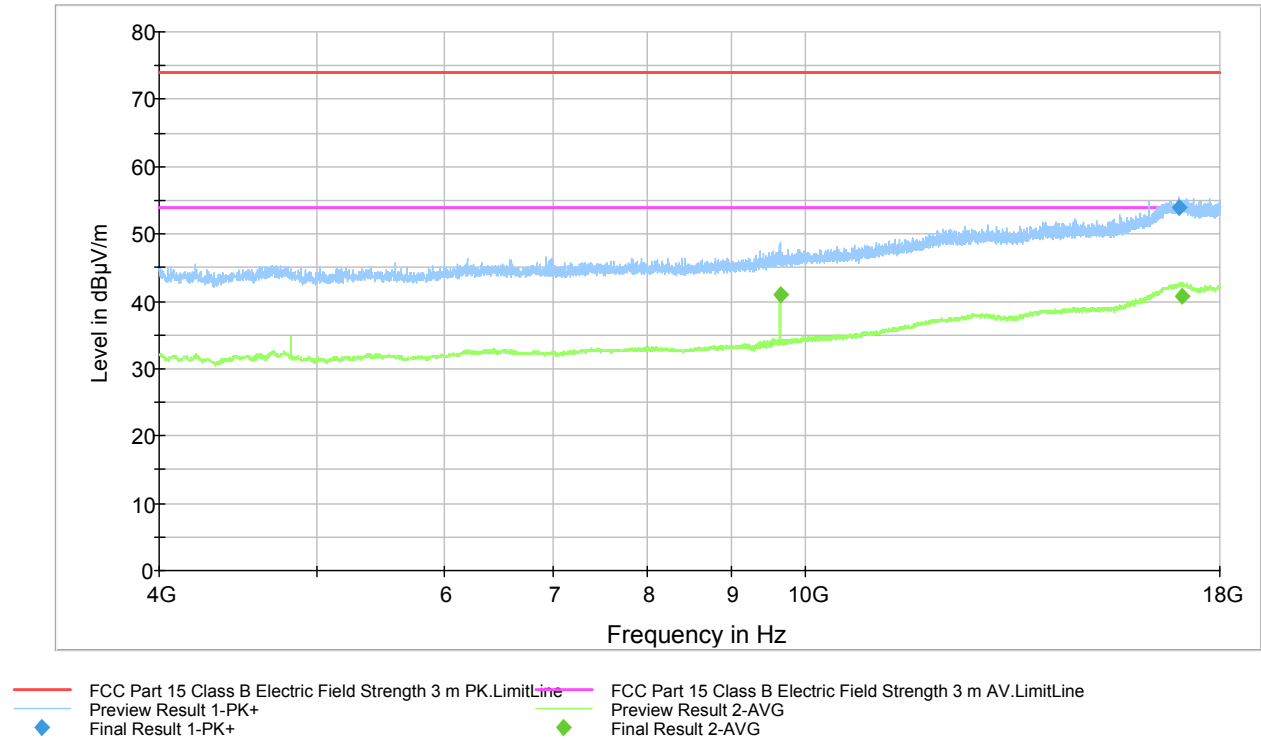
**Table 27.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2483.500000	42.9	1000.0	1000.000	114.0	V	212.0	14.7	11.0	53.9	

## Transmitter Radiated Emissions 4 000 – 18 000 MHz

WF111-A

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 22.** Measured curve with peak and average detectors. Channel low.

**Table 28.** Final results Max Peak detector.

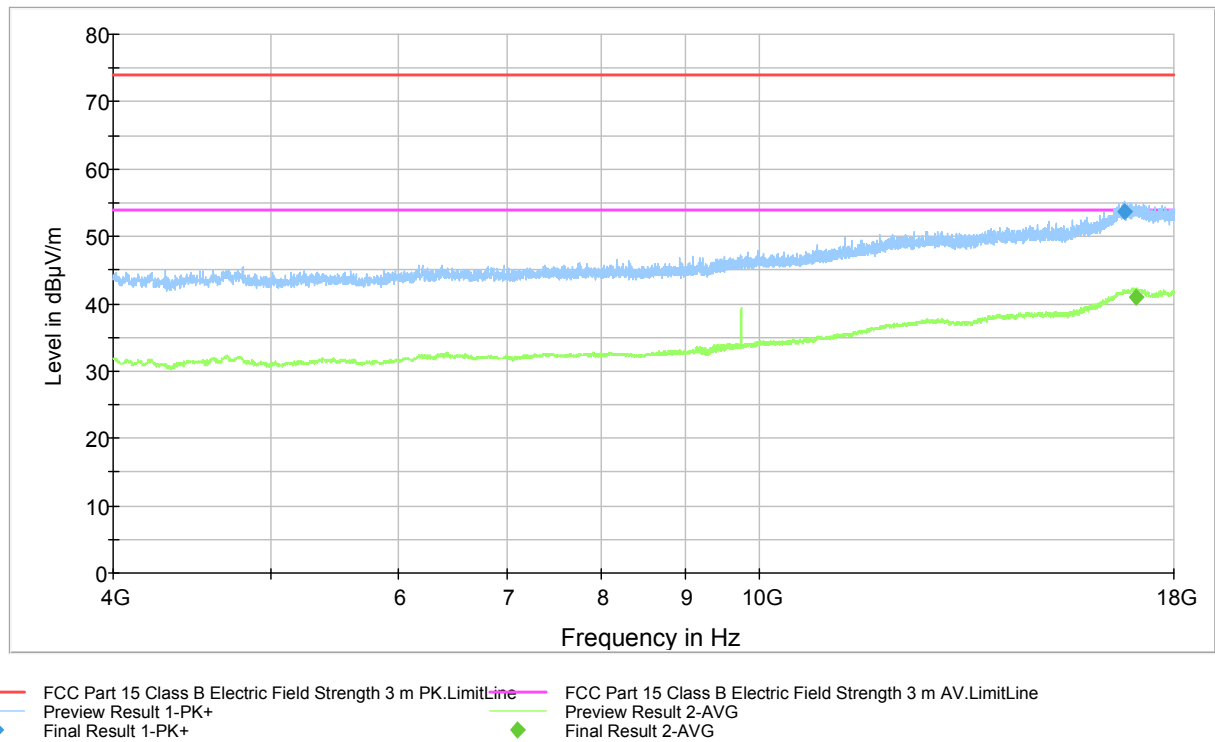
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
17000.425000	53.9	1000.0	1000.000	244.0	V	202.0	25.9	20.0	73.9	

**Table 29.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
9648.125000	41.0	1000.0	1000.000	100.0	V	169.0	15.0	12.9	53.9	
17046.125000	40.8	1000.0	1000.000	100.0	V	338.0	25.8	13.1	53.9	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 23.** Measured curve with peak and average detectors. Channel mid.

**Table 30.** Final results Max Peak detector.

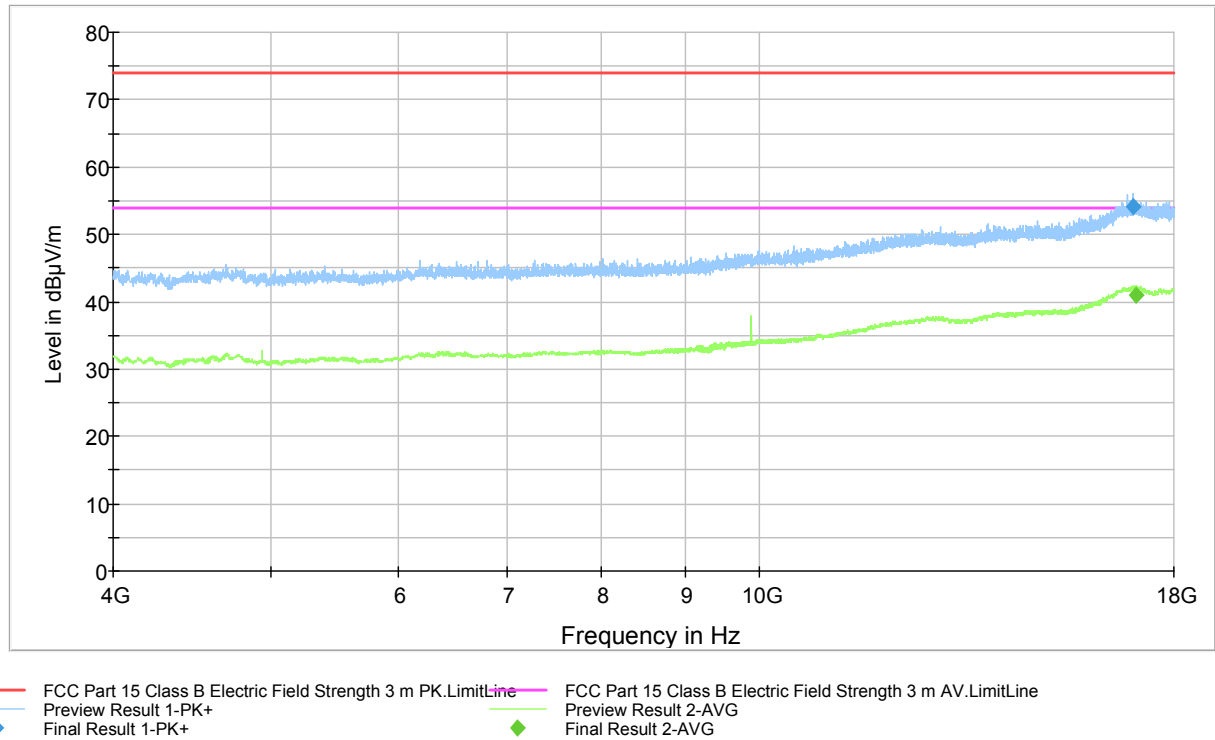
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
16778.725000	53.7	1000.0	1000.000	187.0	V	-4.0	25.4	20.2	73.9	

**Table 31.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
17048.075000	40.9	1000.0	1000.000	105.0	V	16.0	25.8	13.0	53.9	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 24.** Measured curve with peak and average detectors. Channel high.

**Table 32.** Final results Max Peak detector.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
16989.125000	54.0	1000.0	1000.000	181.0	V	0.0	25.9	19.9	73.9	

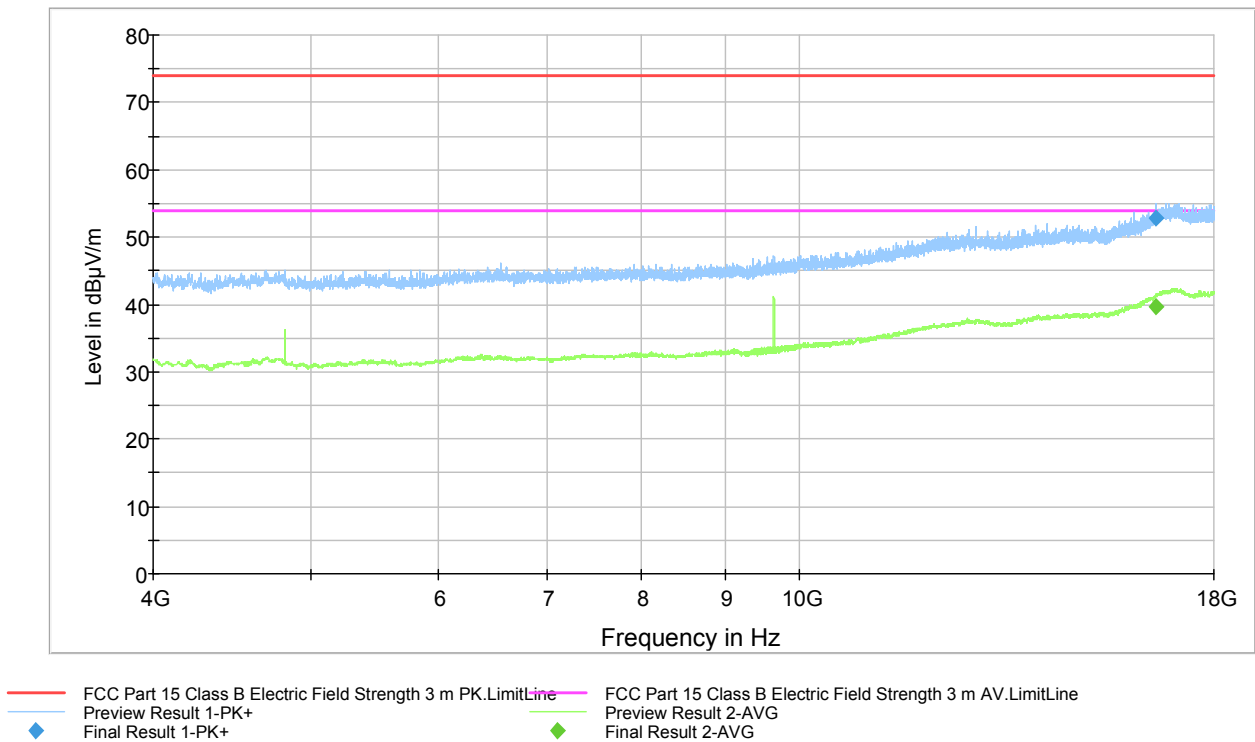
**Table 33.** Final results Average detector.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
17076.675000	40.9	1000.0	1000.000	100.0	V	0.0	25.8	13.0	53.9	

# Transmitter Radiated Measurement

WF111-E

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 25.** Measured curve with peak and average detectors. Channel low.

**Table 34.** Final results Max Peak detector.

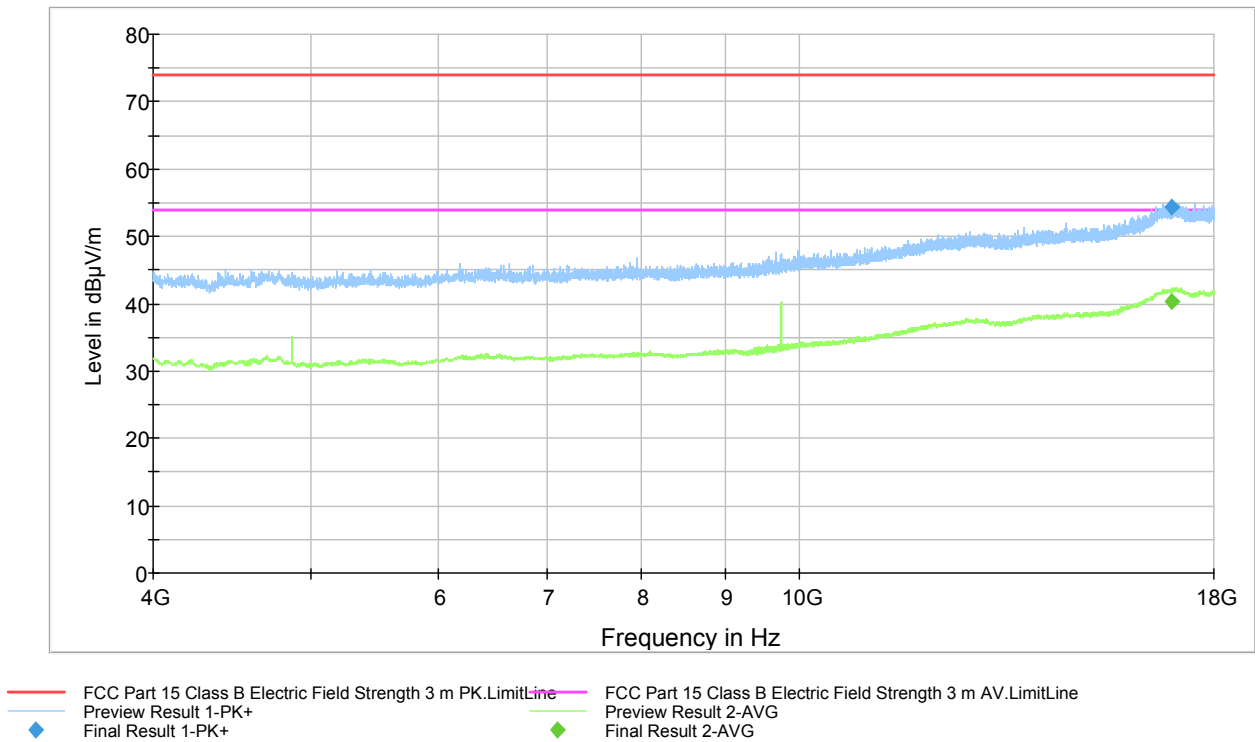
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
16576.875000	52.9	1000.0	1000.000	154.0	V	39.0	24.8	21.0	73.9	

**Table 35.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
16576.875000	39.6	1000.0	1000.000	154.0	V	39.0	24.8	14.3	53.9	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 26.** Measured curve with peak and average detectors. Channel mid.

**Table 36.** Final results Max Peak detector.

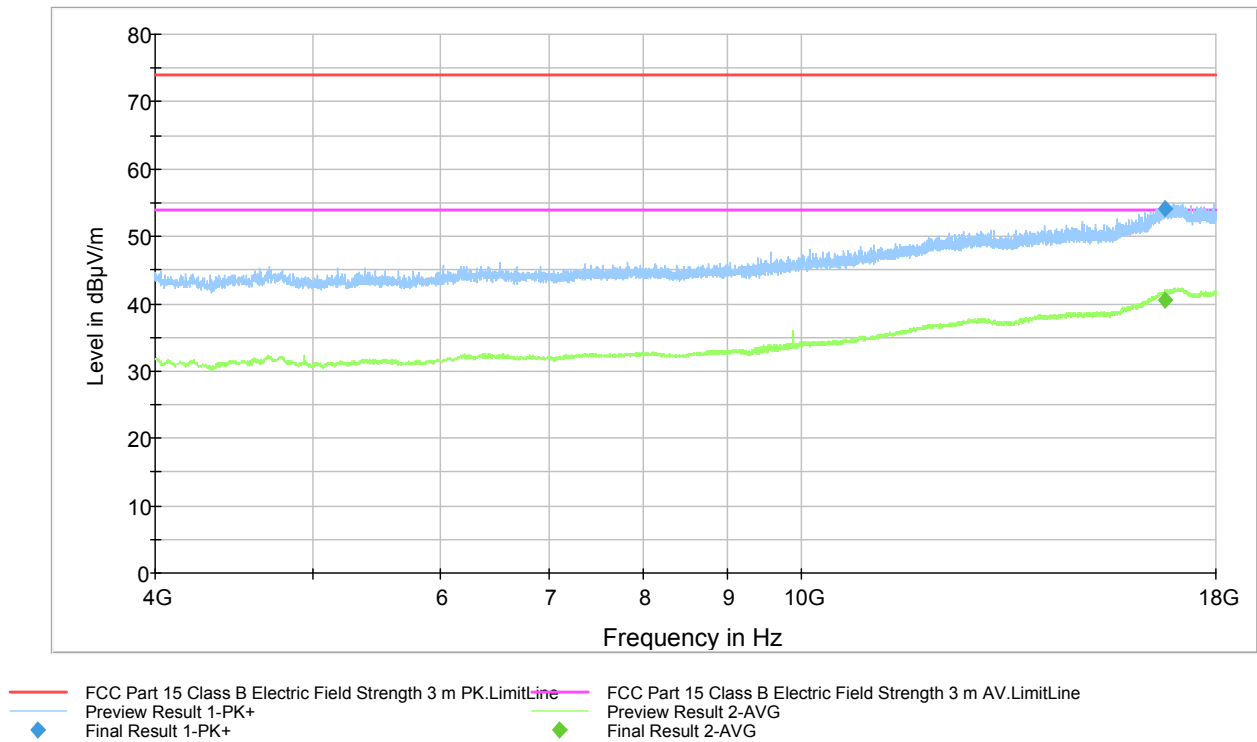
Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
16974.875000	54.3	1000.0	1000.000	183.0	V	21.0	25.8	19.6	73.9	

**Table 37.** Final results Average detector.

Frequency (MHz)	Average (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
16974.875000	40.4	1000.0	1000.000	183.0	V	21.0	25.8	13.5	53.9	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 27.** Measured curve with peak and average detectors. Channel high.

**Table 38.** Final results Max Peak detector.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
16767.475000	54.1	1000.0	1000.000	210.0	V	27.0	25.4	19.8	73.9	

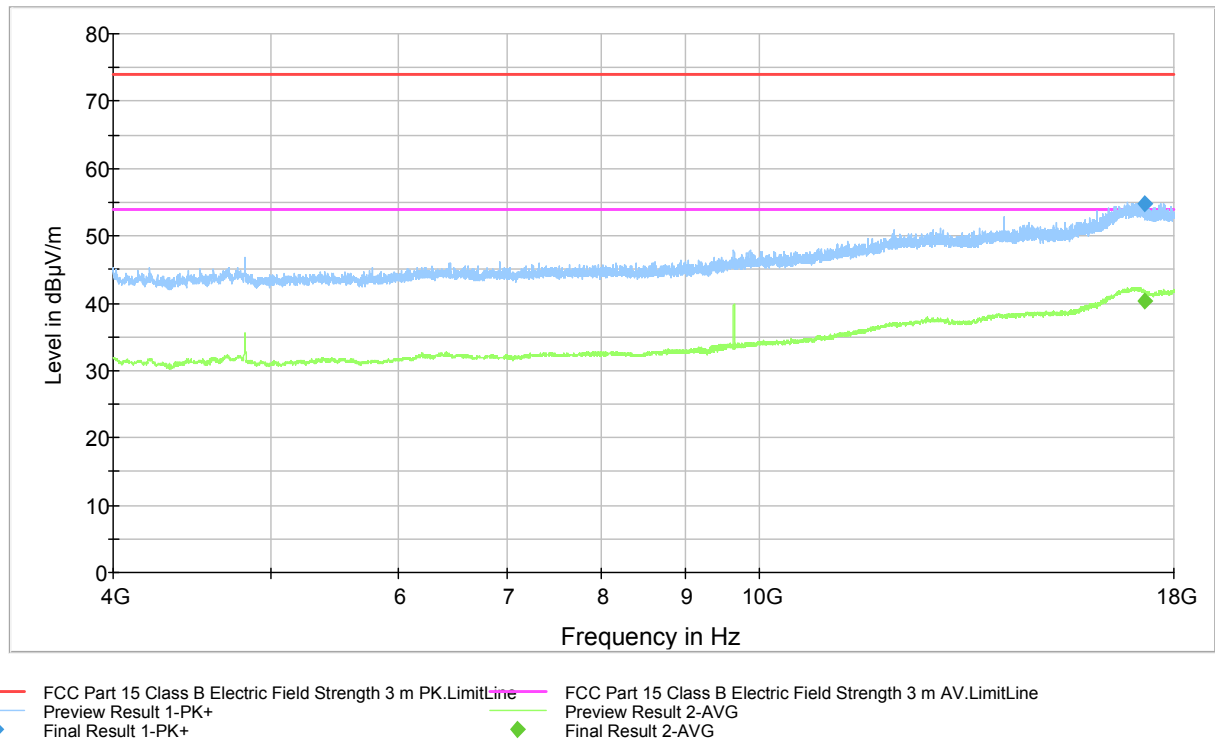
**Table 39.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
16767.475000	40.5	1000.0	1000.000	210.0	V	27.0	25.4	13.4	53.9	

## Transmitter Radiated Measurement

WF111-N

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 28.** Measured curve with peak and average detectors. Channel low.

**Table 40.** Final results Max Peak detector.

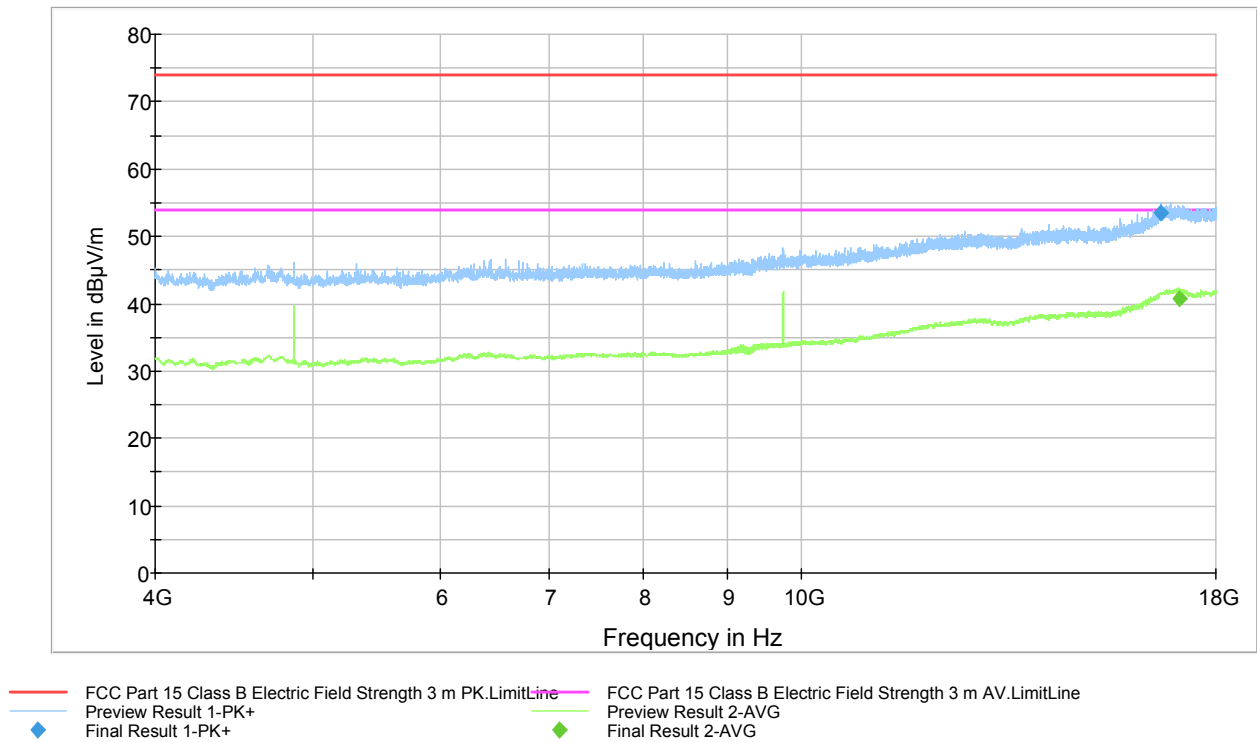
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
17277.775000	54.7	1000.0	1000.000	100.0	V	191.0	25.4	19.2	73.9	

**Table 41.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
17277.775000	40.3	1000.0	1000.000	100.0	V	191.0	25.4	13.6	53.9	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 29.** Measured curve with peak and average detectors. Channel mid.

**Table 42.** Final results Max Peak detector.

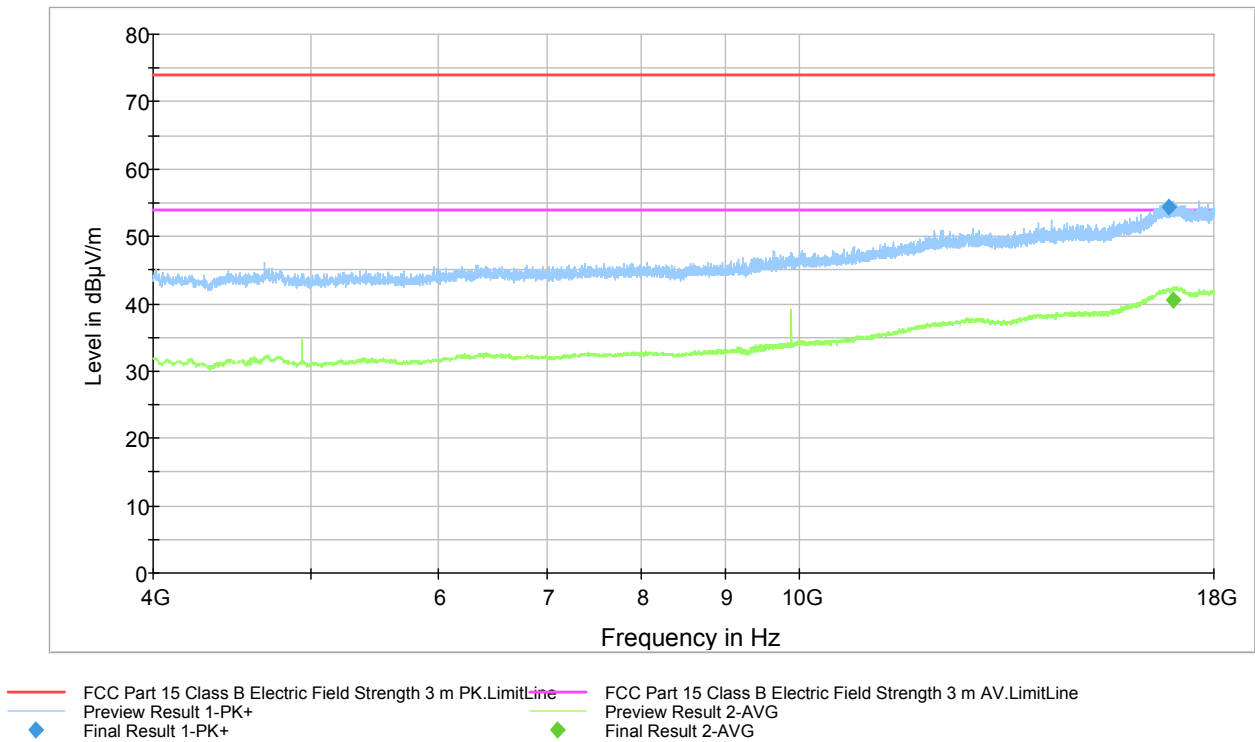
Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
16644.075000	53.4	1000.0	1000.000	171.0	V	294.0	25.1	20.5	73.9	

**Table 43.** Final results Average detector.

Frequency (MHz)	Average (dB $\mu$ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V/m)	Comment
17088.025000	40.7	1000.0	1000.000	105.0	V	65.0	25.8	13.2	53.9	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 30.** Measured curve with peak and average detectors. Channel high.

**Table 44.** Final results Max Peak detector.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
16889.225000	54.3	1000.0	1000.000	154.0	V	77.0	25.6	19.6	73.9	

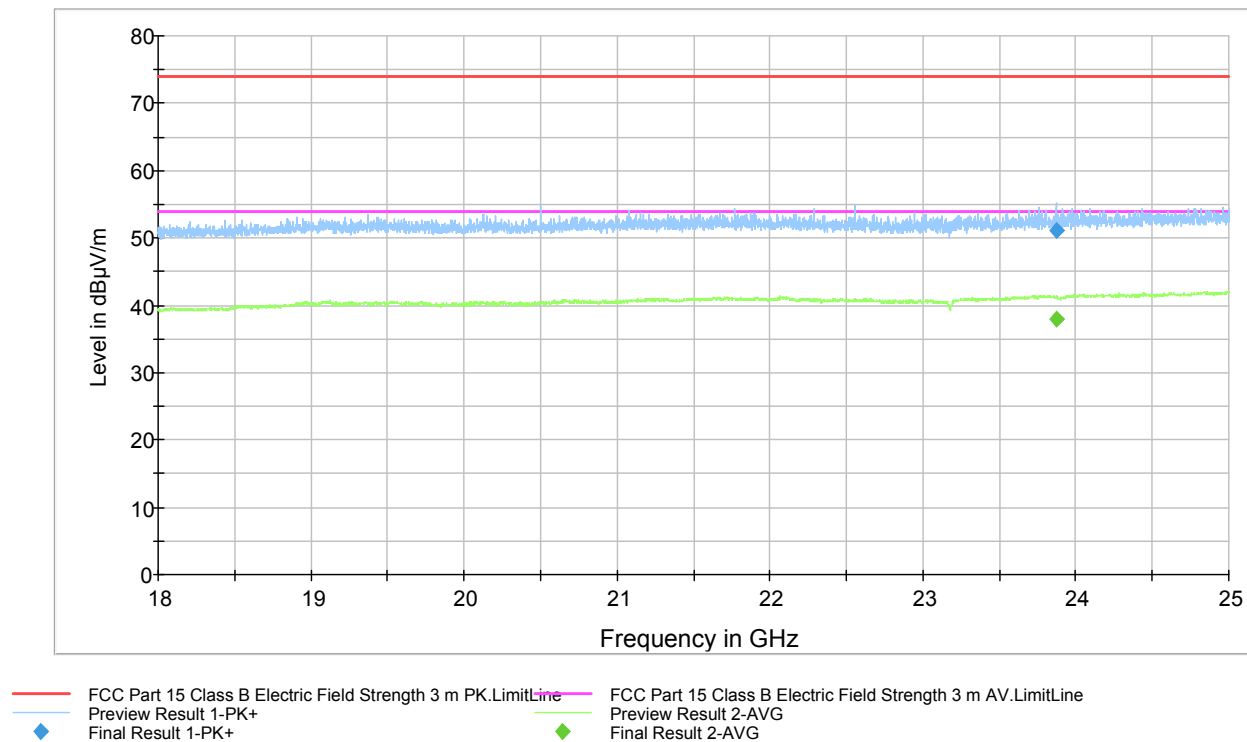
**Table 45.** Final results Average detector.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
17005.625000	40.6	1000.0	1000.000	251.0	V	35.0	25.9	13.3	53.9	

## Transmitter Radiated Emissions 18 000 – 25 000 MHz

**WF111-A**

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 31.** Measured curve with peak and average detectors. Channel low.

**Table 46.** Final results Max Peak detector.

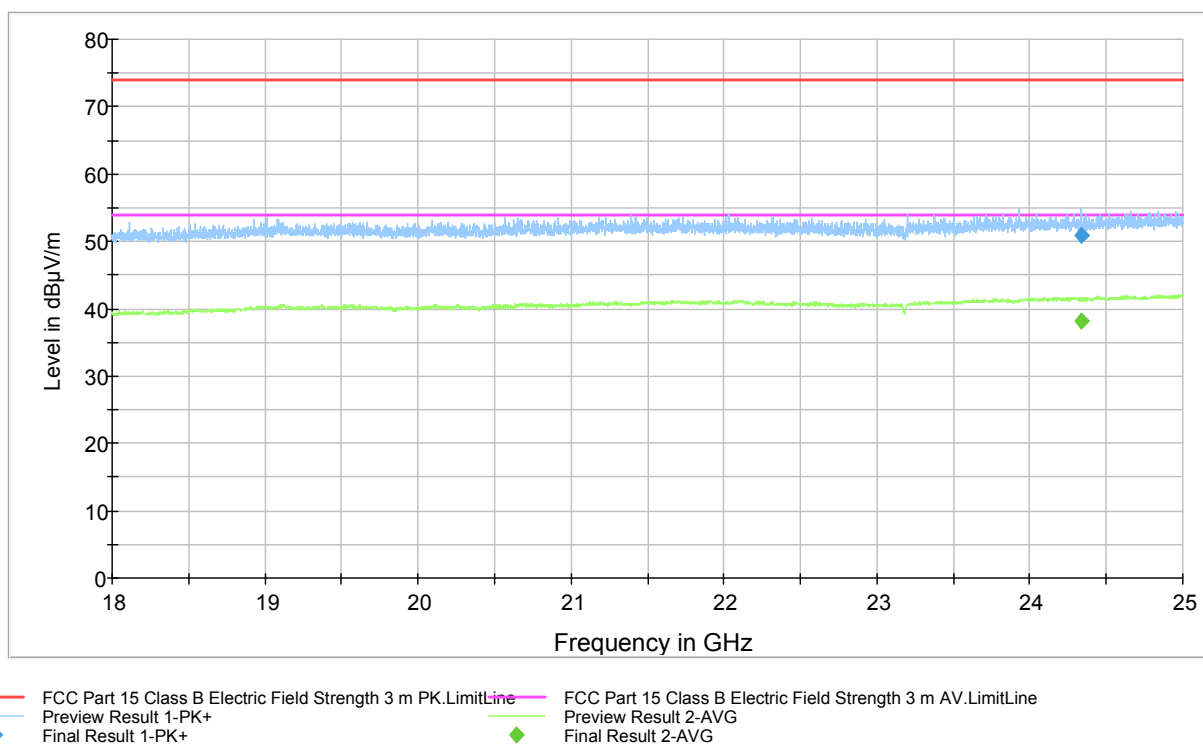
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
23871.525000	51.1	1000.0	1000.000	186.0	V	58.0	27.1	22.8	73.9	

**Table 47.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
23871.525000	38.0	1000.0	1000.000	186.0	V	58.0	27.1	15.9	53.9	

# Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 32.** Measured curve with peak and average detectors. Channel mid.

**Table 48.** Final results Max Peak detector.

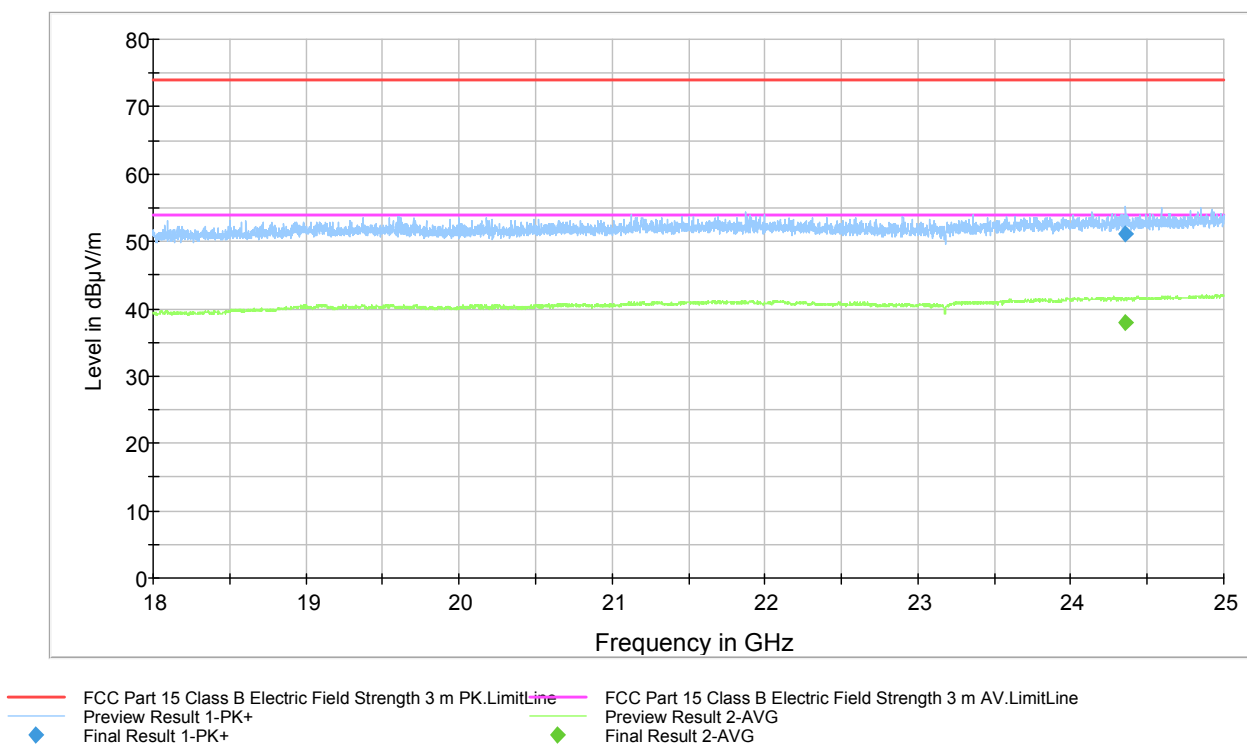
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24334.175000	50.8	1000.0	1000.000	226.0	V	125.0	27.3	23.1	73.9	

**Table 49.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24334.175000	38.1	1000.0	1000.000	226.0	V	125.0	27.3	15.8	53.9	

# Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 33.** Measured curve with peak and average detectors. Channel high.

**Table 50.** Final results Max Peak detector.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24357.175000	51.2	1000.0	1000.000	100.0	V	21.0	27.3	22.7	73.9	

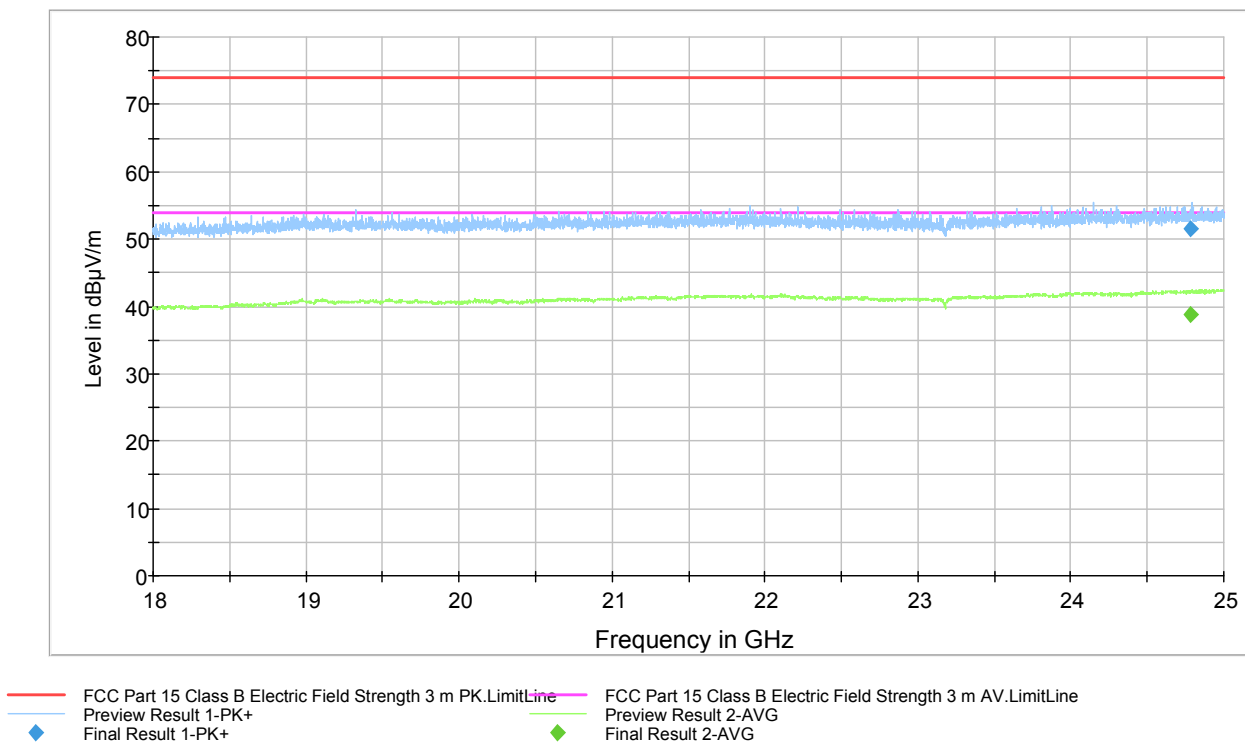
**Table 51.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24357.175000	38.0	1000.0	1000.000	100.0	V	21.0	27.3	15.9	53.9	

# Transmitter Radiated Measurement

WF111-E

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 34.** Measured curve with peak and average detectors. Channel low.

**Table 52.** Final results Max Peak detector.

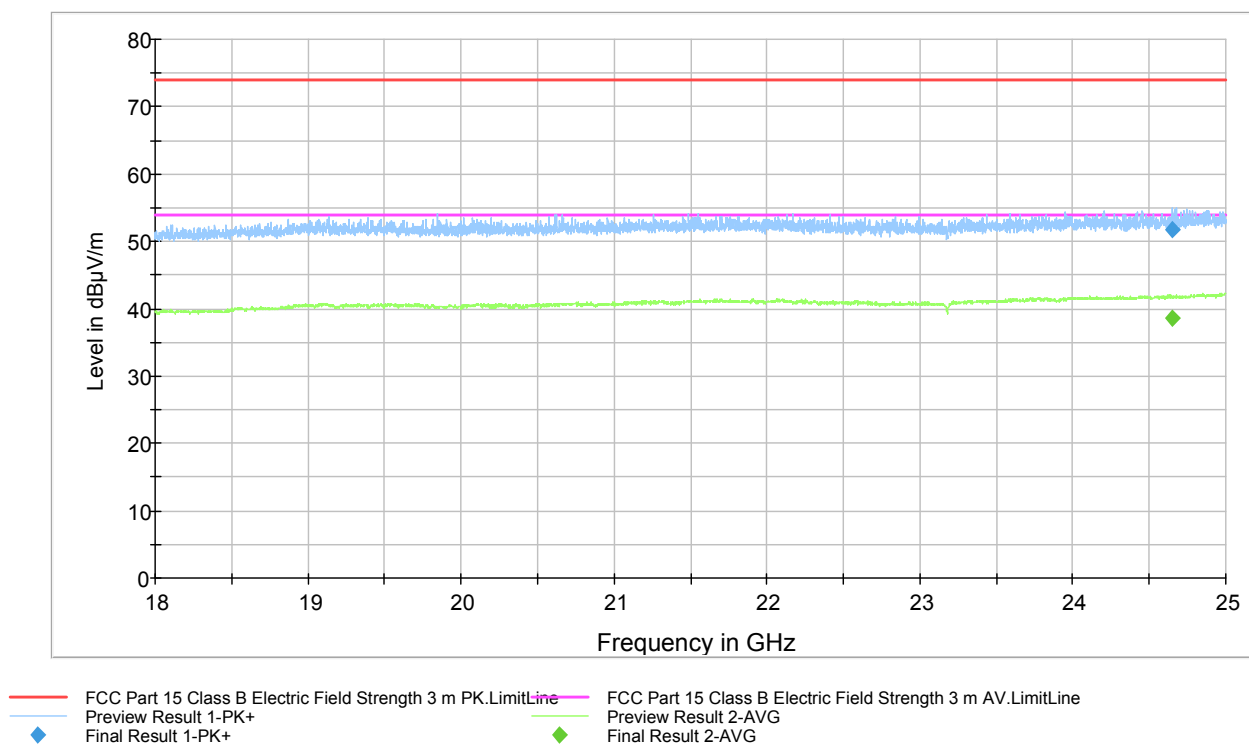
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24785.875000	51.5	1000.0	1000.000	114.0	V	163.0	27.6	22.4	73.9	

**Table 53.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24785.875000	38.7	1000.0	1000.000	114.0	V	163.0	27.6	15.2	53.9	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 35.** Measured curve with peak and average detectors. Channel mid.

**Table 54.** Final results Max Peak detector.

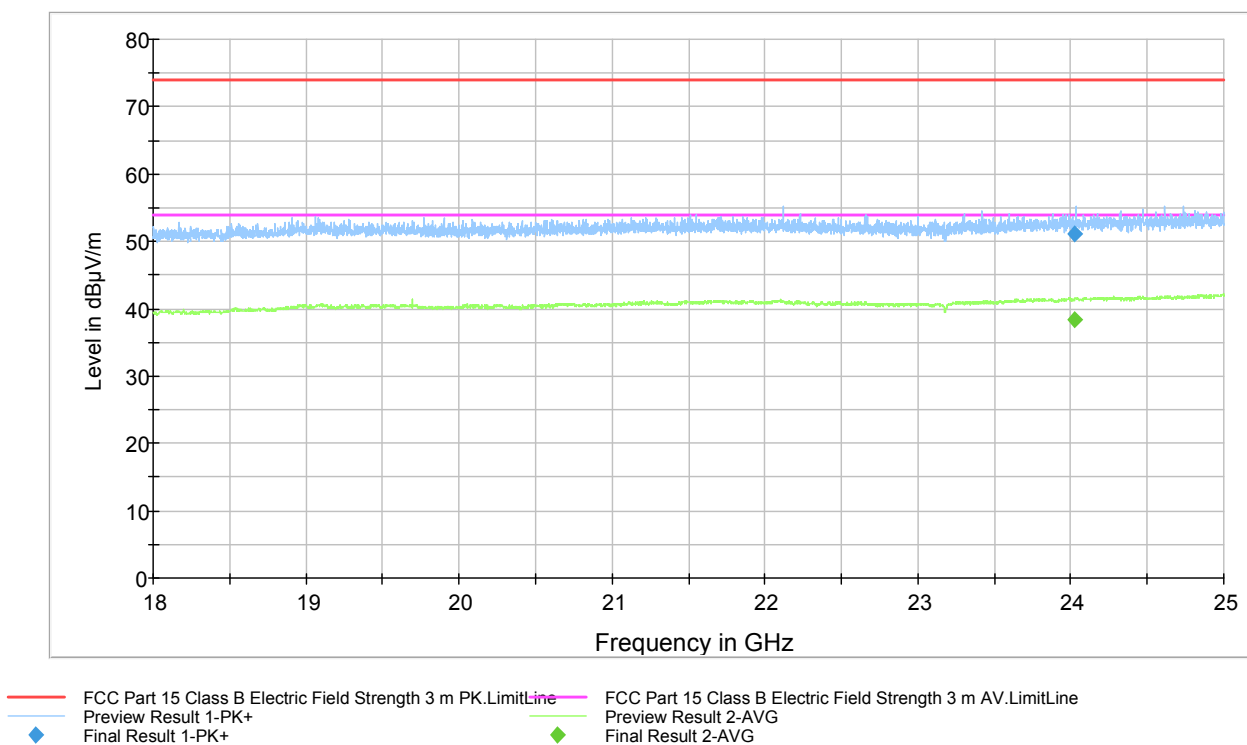
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24649.075000	51.8	1000.0	1000.000	169.0	V	206.0	27.4	22.1	73.9	

**Table 55.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24649.075000	38.5	1000.0	1000.000	169.0	V	206.0	27.4	15.4	53.9	

# Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 36.** Measured curve with peak and average detectors. Channel high.

**Table 56.** Final results Max Peak detector.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24028.675000	51.2	1000.0	1000.000	100.0	V	40.0	27.2	22.7	73.9	

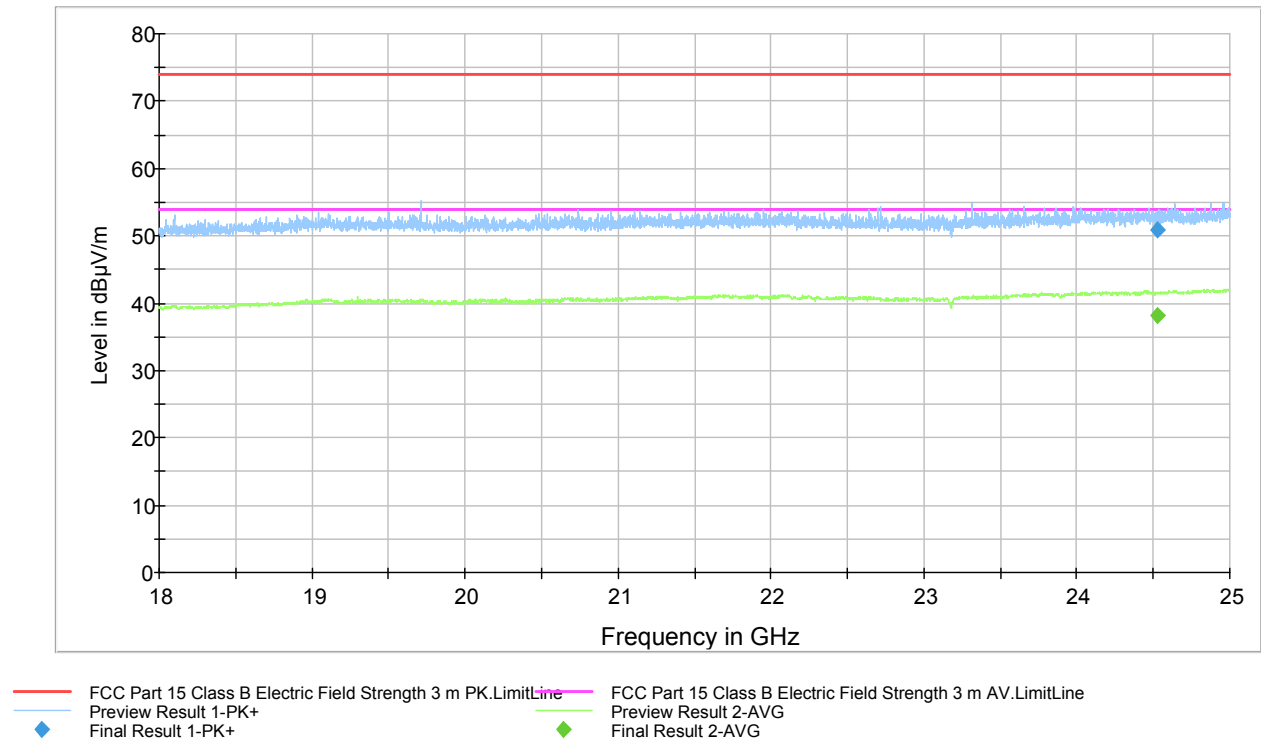
**Table 57.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24028.675000	38.4	1000.0	1000.000	100.0	V	40.0	27.2	15.5	53.9	

# Transmitter Radiated Measurement

WF111-N

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 37.** Measured curve with peak and average detectors. Channel low.

**Table 58.** Final results Max Peak detector.

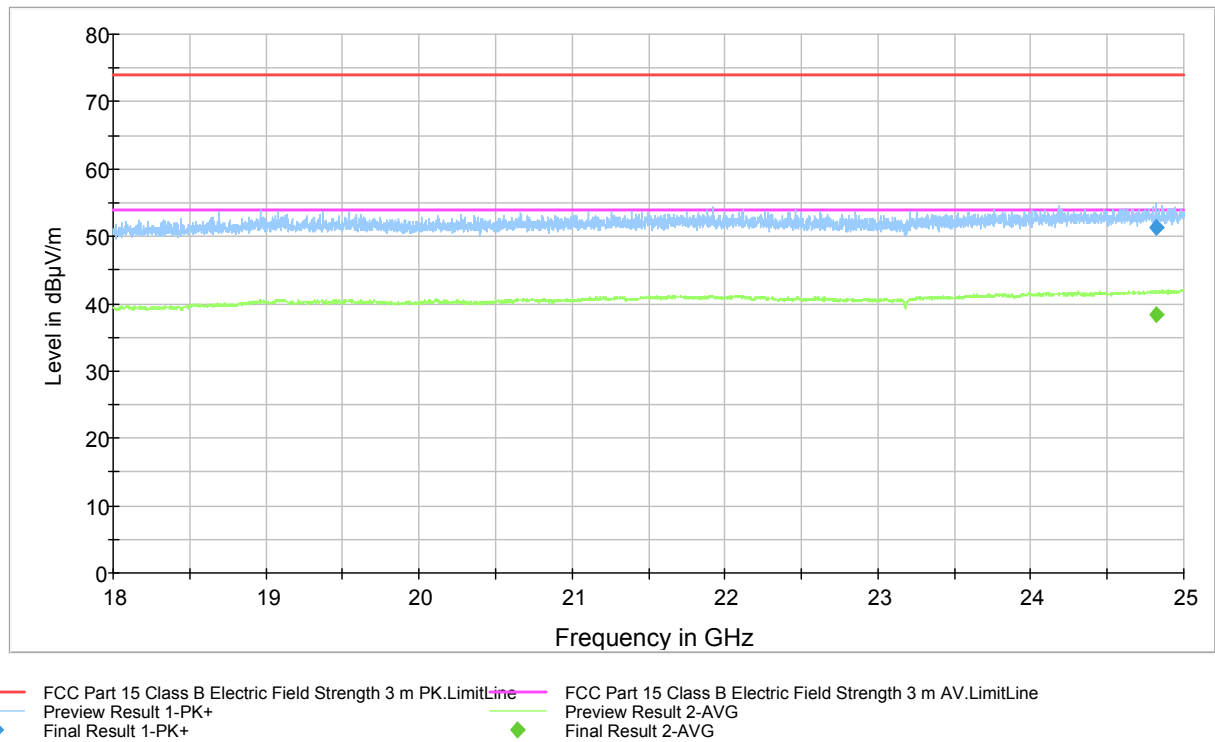
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24528.125000	50.8	1000.0	1000.000	138.0	V	258.0	27.4	23.1	73.9	

**Table 59.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24528.125000	38.1	1000.0	1000.000	138.0	V	258.0	27.4	15.8	53.9	

## Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 38.** Measured curve with peak and average detectors. Channel mid.

**Table 60.** Final results Max Peak detector.

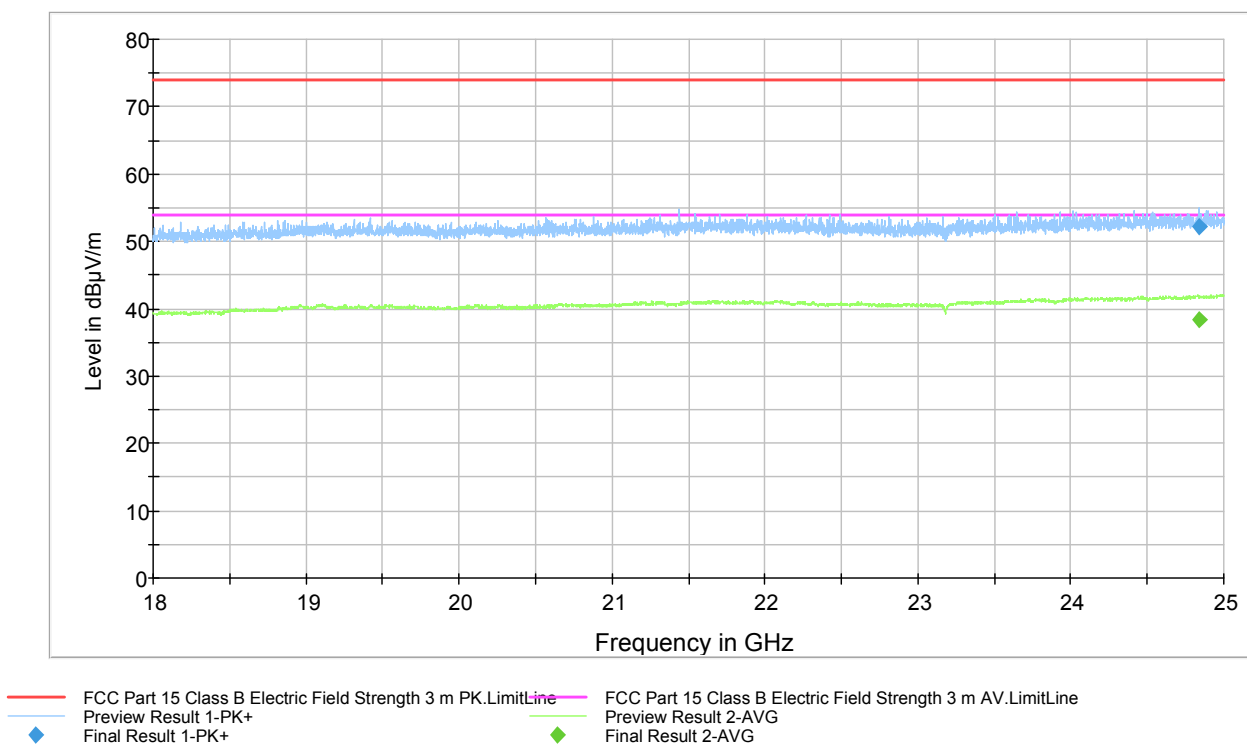
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24820.275000	51.3	1000.0	1000.000	100.0	V	321.0	27.6	22.6	73.9	

**Table 61.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24820.275000	38.3	1000.0	1000.000	100.0	V	321.0	27.6	15.6	53.9	

# Transmitter Radiated Measurement

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 39.** Measured curve with peak and average detectors. Channel high.

**Table 62.** Final results Max Peak detector.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24837.325000	52.2	1000.0	1000.000	178.0	V	163.0	27.6	21.7	73.9	

**Table 63.** Final results Average detector.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24837.325000	38.5	1000.0	1000.000	178.0	V	163.0	27.6	15.4	53.9	

## Transmitter Radiated Measurement

### Transmitter Band Edge Measurement

**Standard:** ANSI C63.10 (2009)  
**Tested by:** JJM  
**Date:** 30.5.2012  
**Humidity:** 31 %  
**Temperature:** 20.3 °C  
**Barometric pressure** 1001 mbar

### FCC Rule: 15.247(d), 15.209(a)

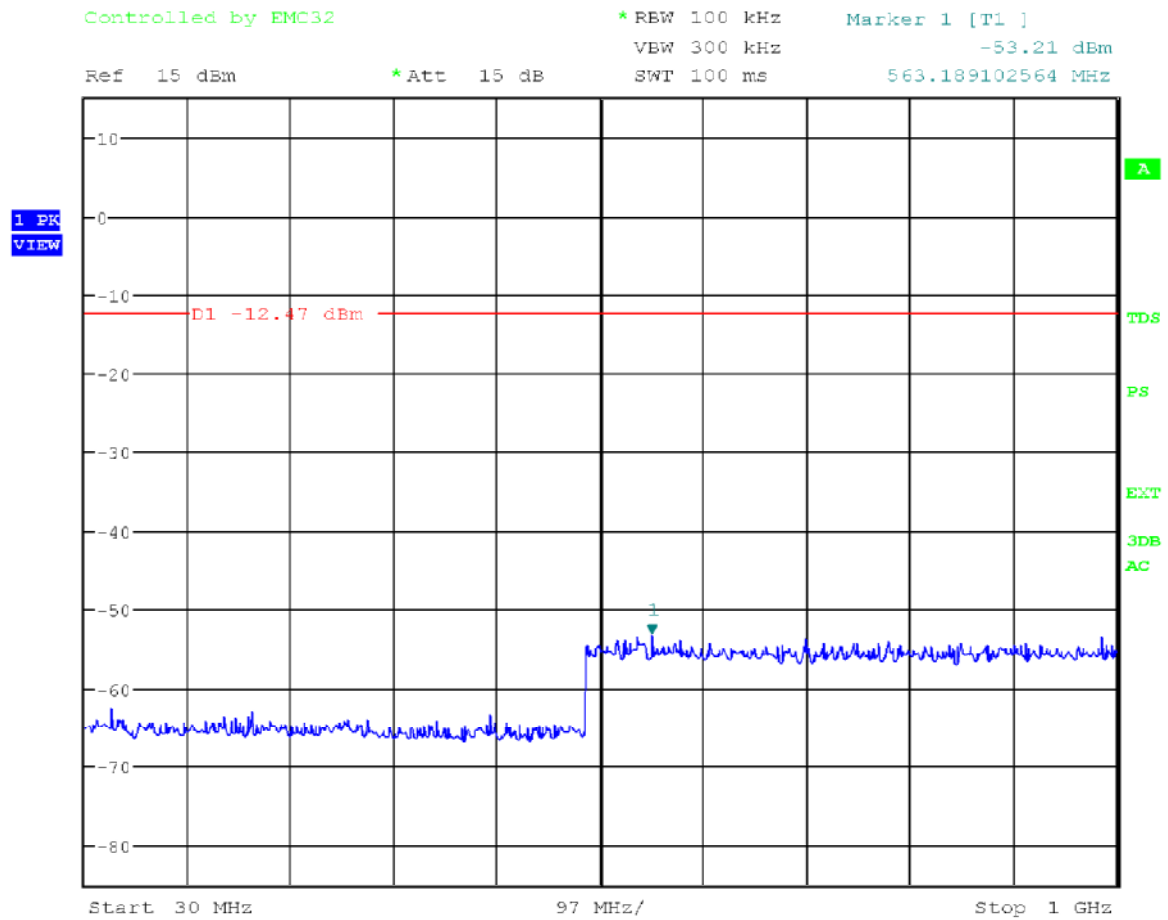
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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 15.205(c)).

	Band Edge Attenuation	
Data mode	Lower Band Edge	Upper Band Edge
b-mode	- 51.11 dBc	- 52.05 dBc
	Limit: -20dBc	

Conducted Spurious Emissions				
Channel	Measured Attenuation [dB]	Limit [dBc]	Margin [dB]	Result
Low	-	-20.0	-	-
Mid	-	-20.0	-	-
High	-	-20.0	-	-

**No significant emissions were detected.**

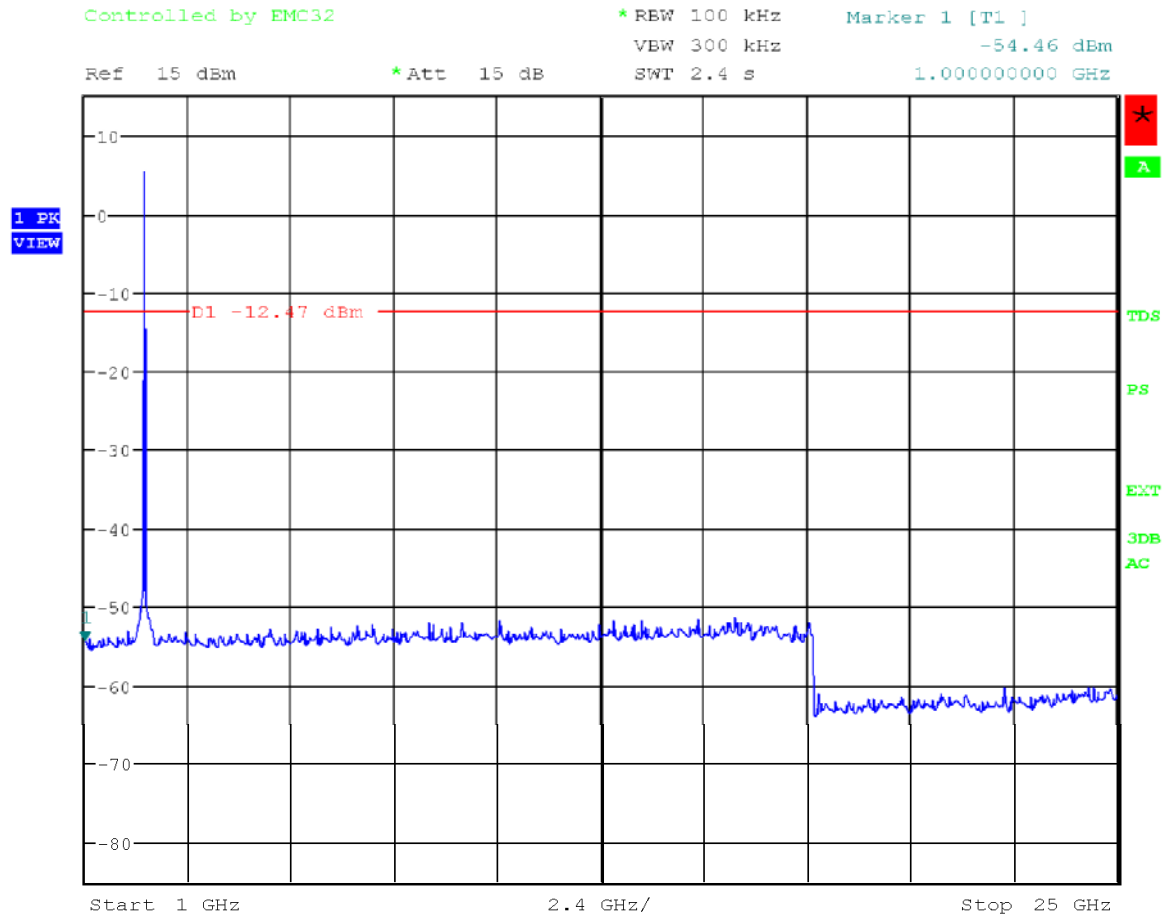
## Transmitter Radiated Measurement



Date: 30.MAY.2012 10:29:48

**Figure 40.** Channel low 30 – 1 000 MHz.

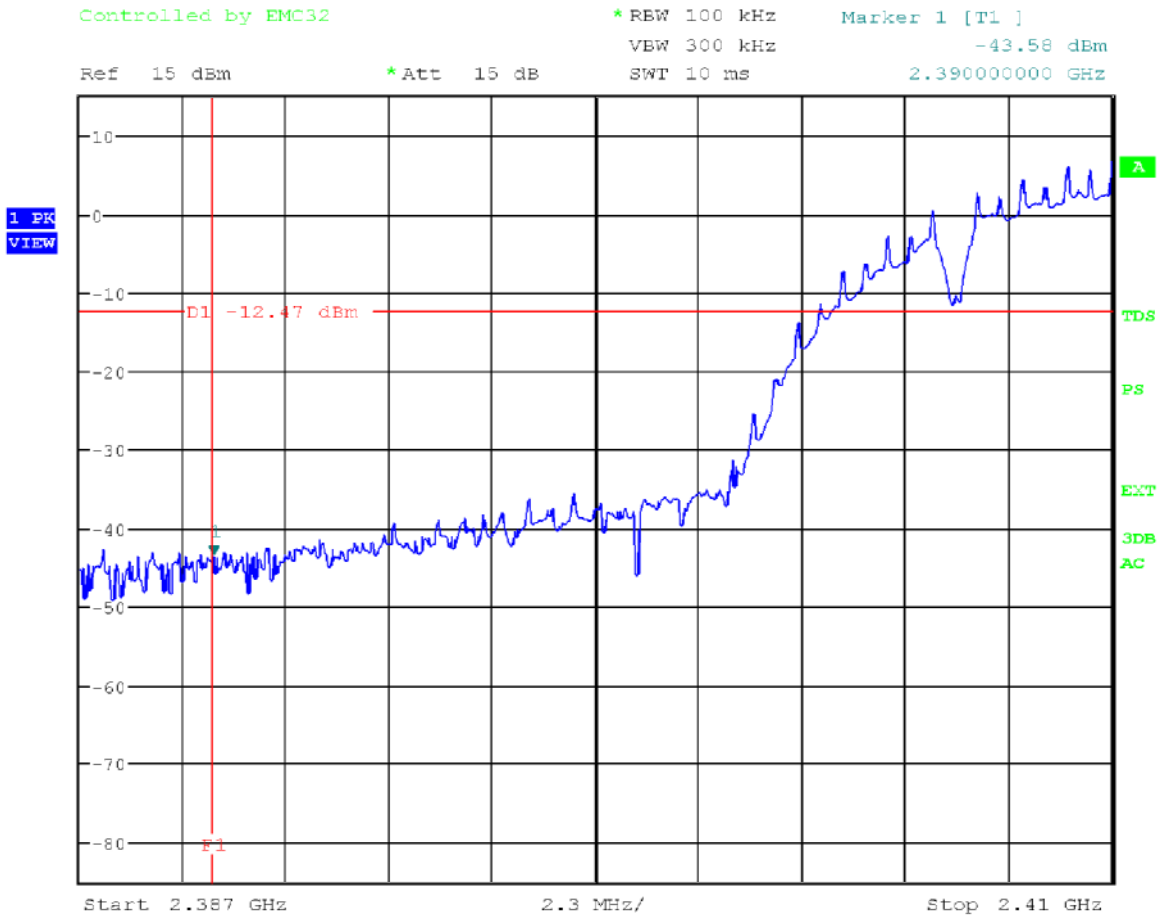
## Transmitter Radiated Measurement



Date: 30.MAY.2012 10:31:02

**Figure 41.** Channel low 1 000 – 25 000 MHz.

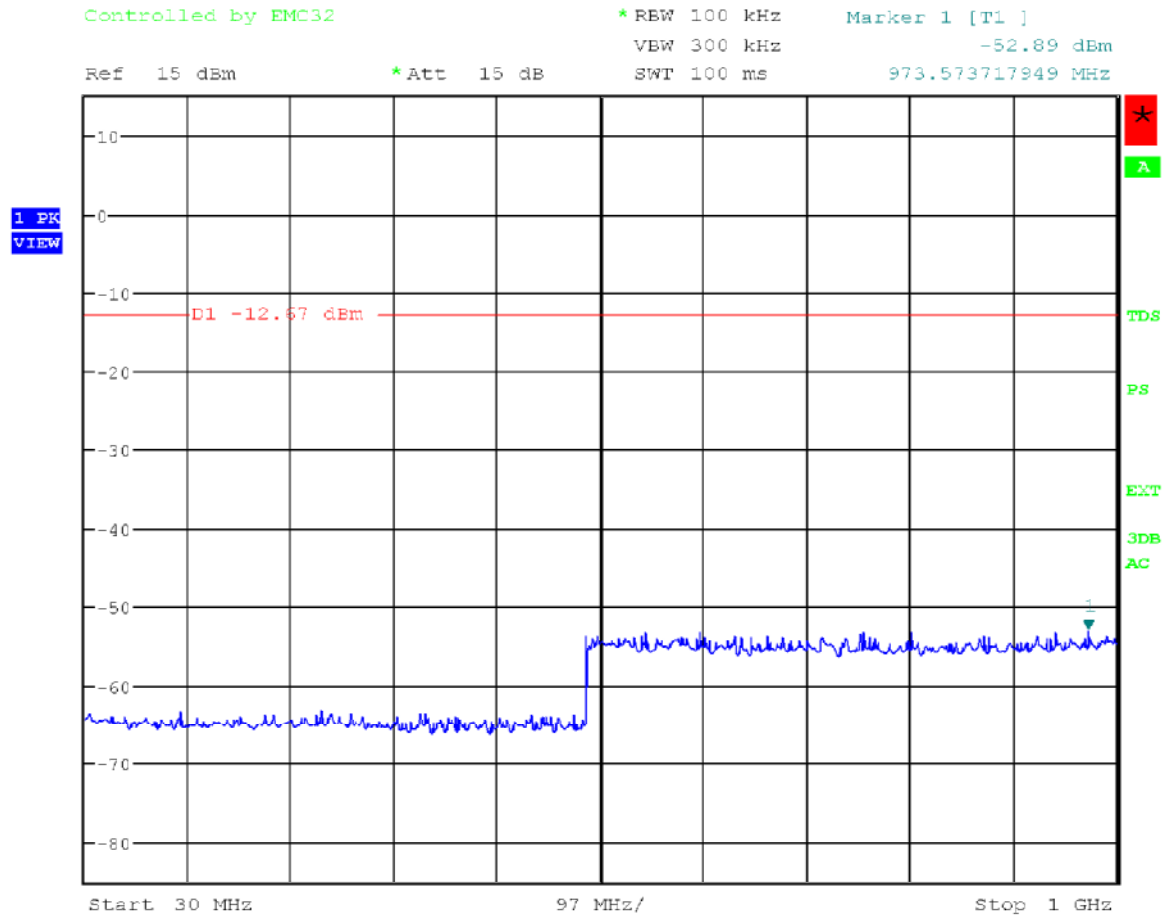
## Transmitter Radiated Measurement



Date: 30.MAY.2012 10:33:43

Figure 42. Lower band edge.

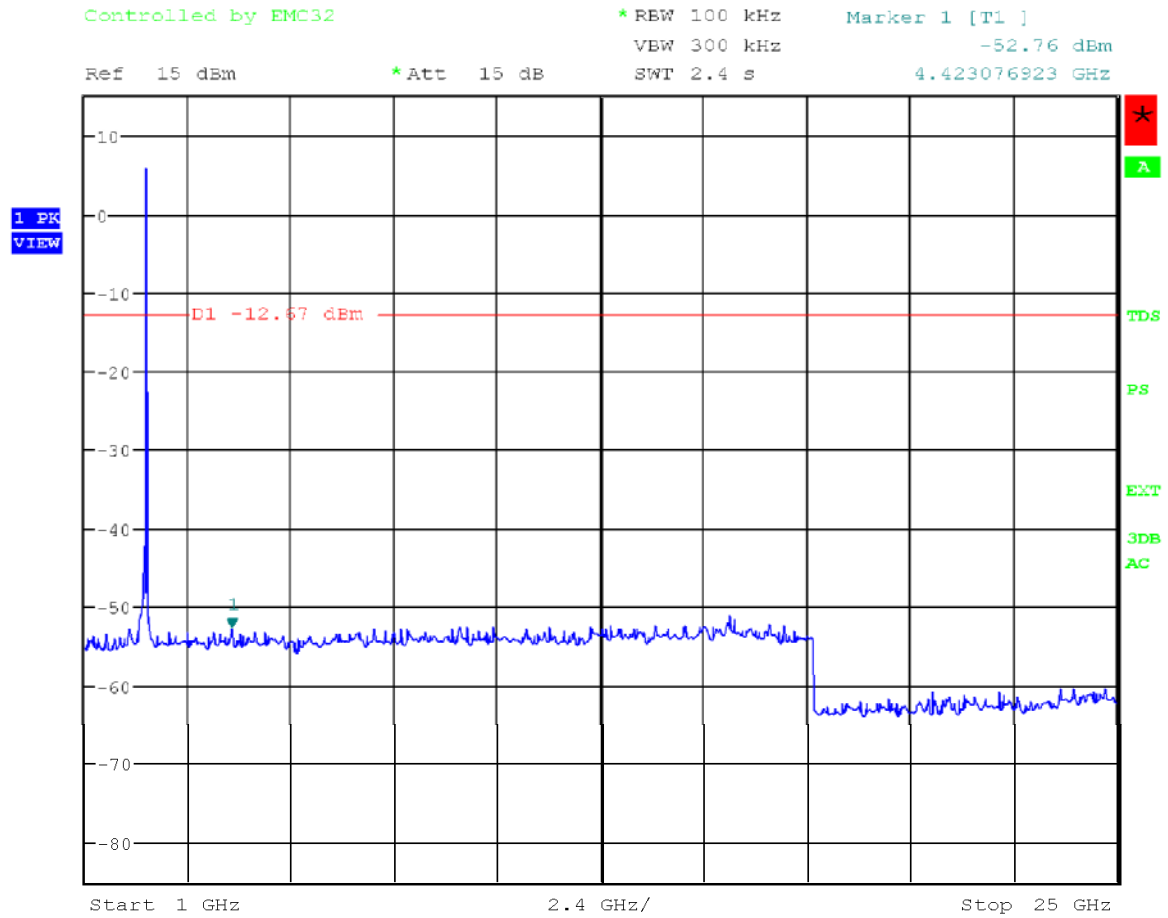
## Transmitter Radiated Measurement



Date: 30.MAY.2012 10:43:53

**Figure 43.** Channel mid 30 – 1 000 MHz.

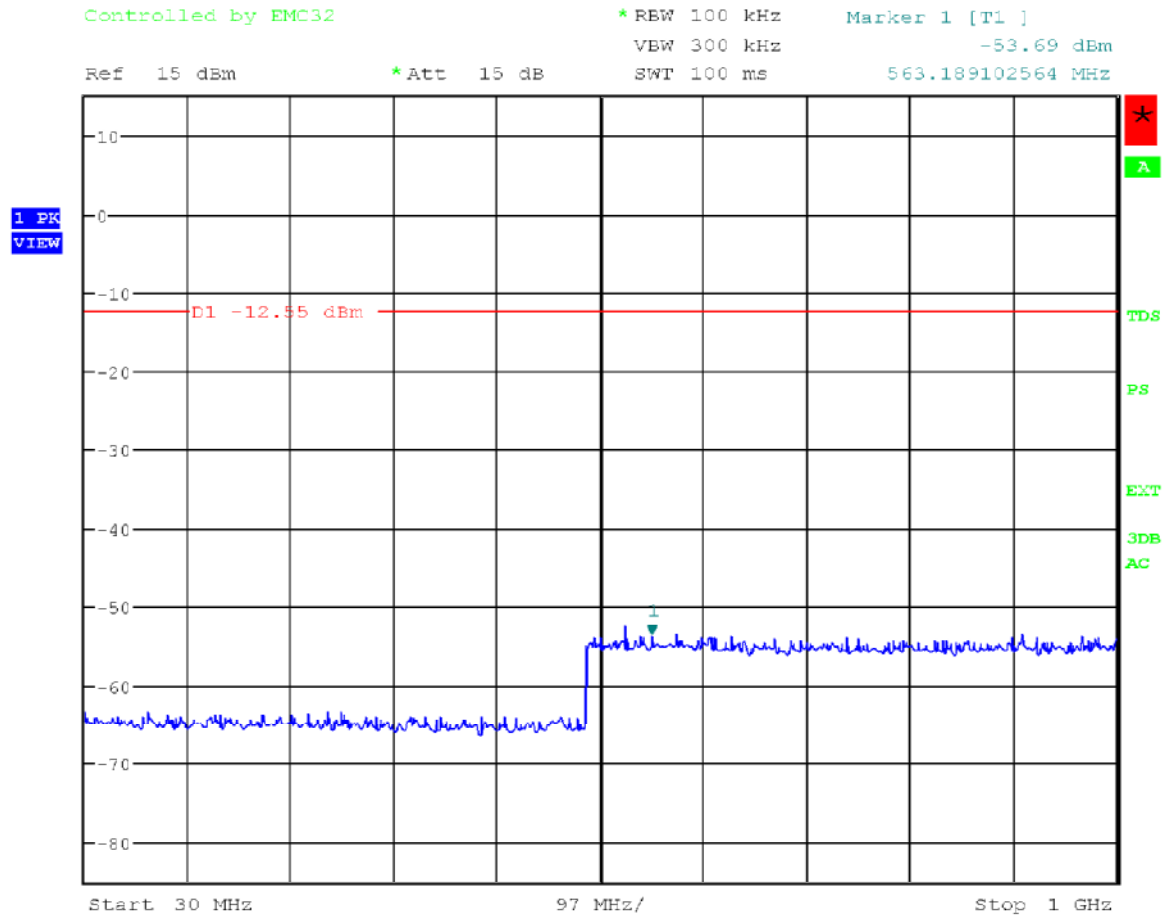
## Transmitter Radiated Measurement



Date: 30.MAY.2012 10:45:41

**Figure 44.** Channel mid 1 000 – 25 000 MHz.

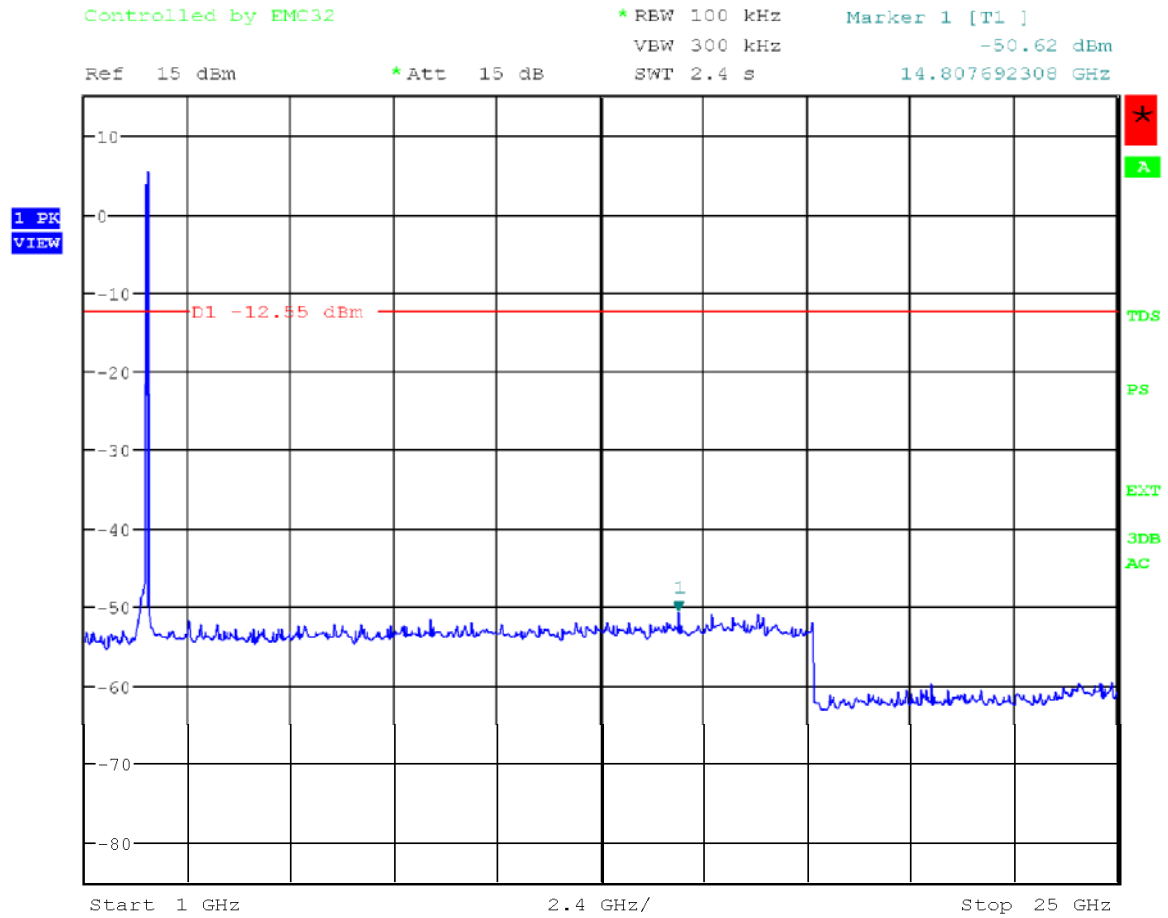
## Transmitter Radiated Measurement



Date: 30.MAY.2012 10:48:36

**Figure 45.** Channel high 30 – 1 000 MHz.

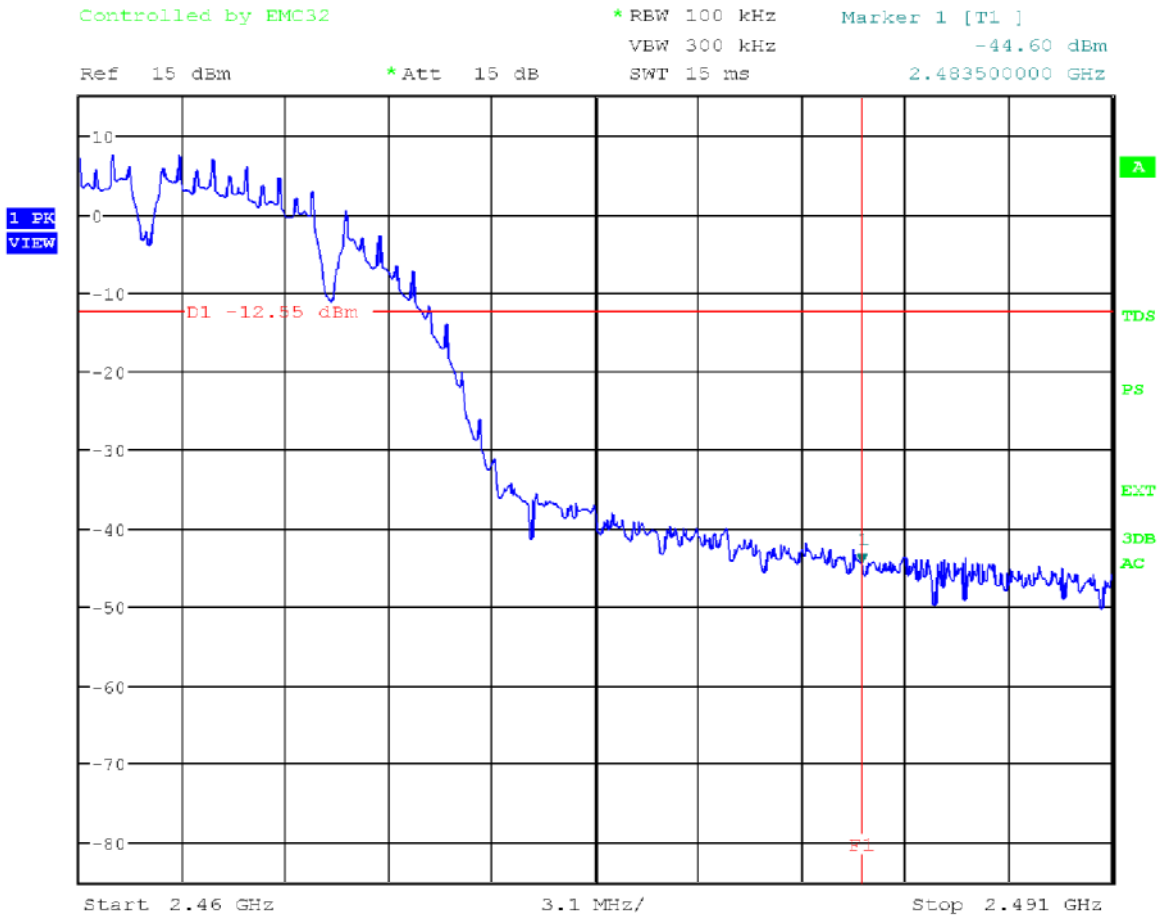
## Transmitter Radiated Measurement



Date: 30.MAY.2012 10:50:46

**Figure 46.** Channel high 1 000 – 25 000 MHz.

## Transmitter Radiated Measurement



Date: 30.MAY.2012 10:55:00

Figure 47. Upper band edge.

## 6dB Bandwidth

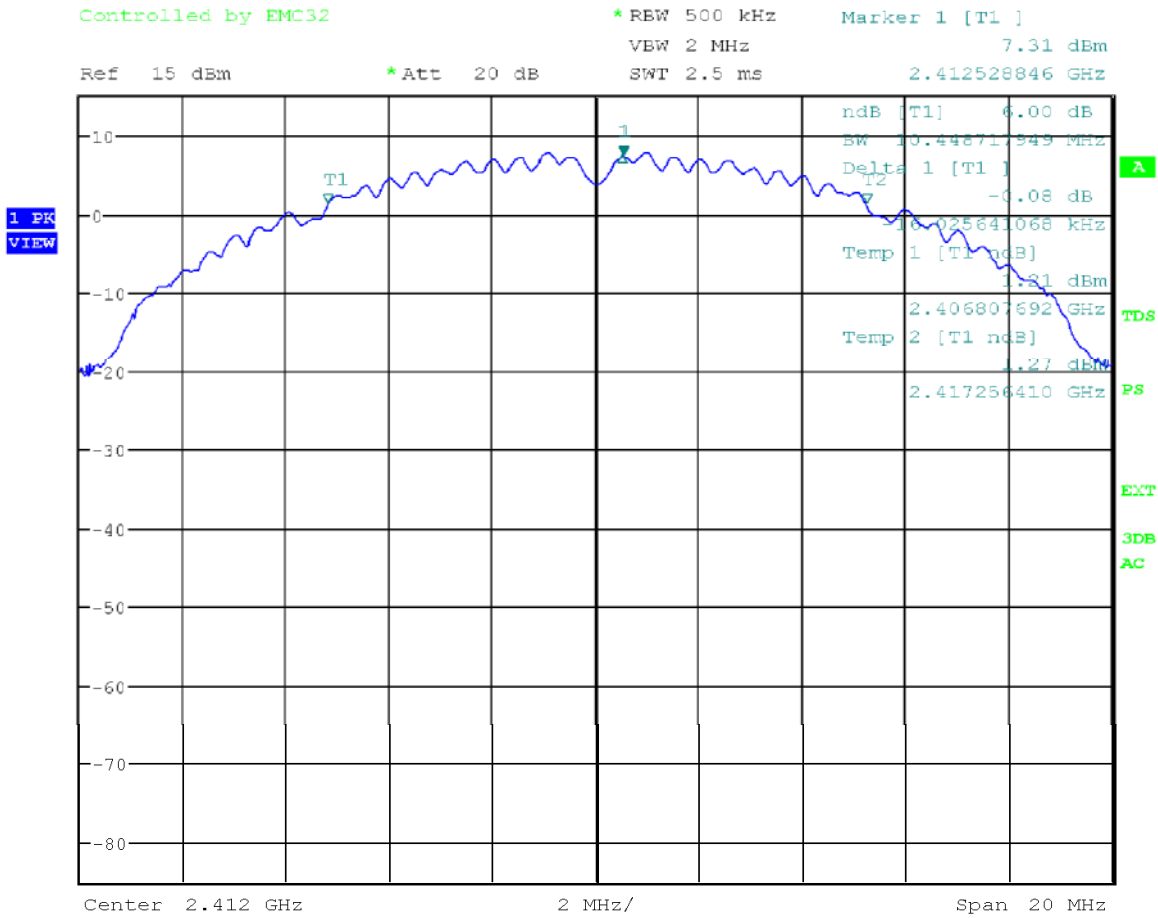
**Standard:** ANSI C63.10 (2009)  
**Tested by:** JJM  
**Date:** 29.5.2012  
**Humidity:** 33 %  
**Temperature:** 19.8 °C  
**Barometric pressure** 1004 Mbar

### FCC Rule: 15.247 (a) (2)

Systems using digital modulation techniques may operate in the 2400 - 2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.

6dB Bandwidth		
Channel low	Channel mid.	Channel high
10.448 MHz	10.352 MHz	10.352 MHz

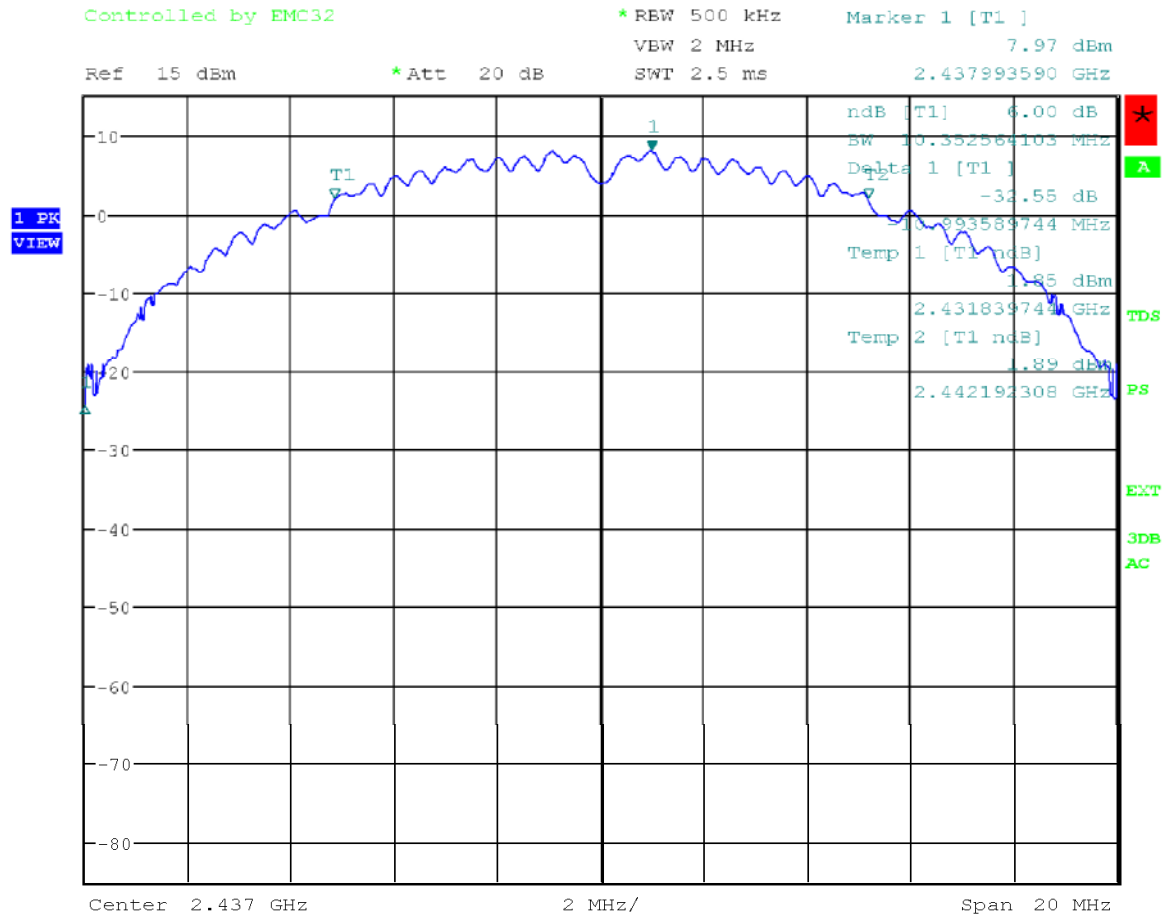
## 6dB Bandwidth Measurement



Date: 29.MAY.2012 08:58:29

Figure 48. Channel low.

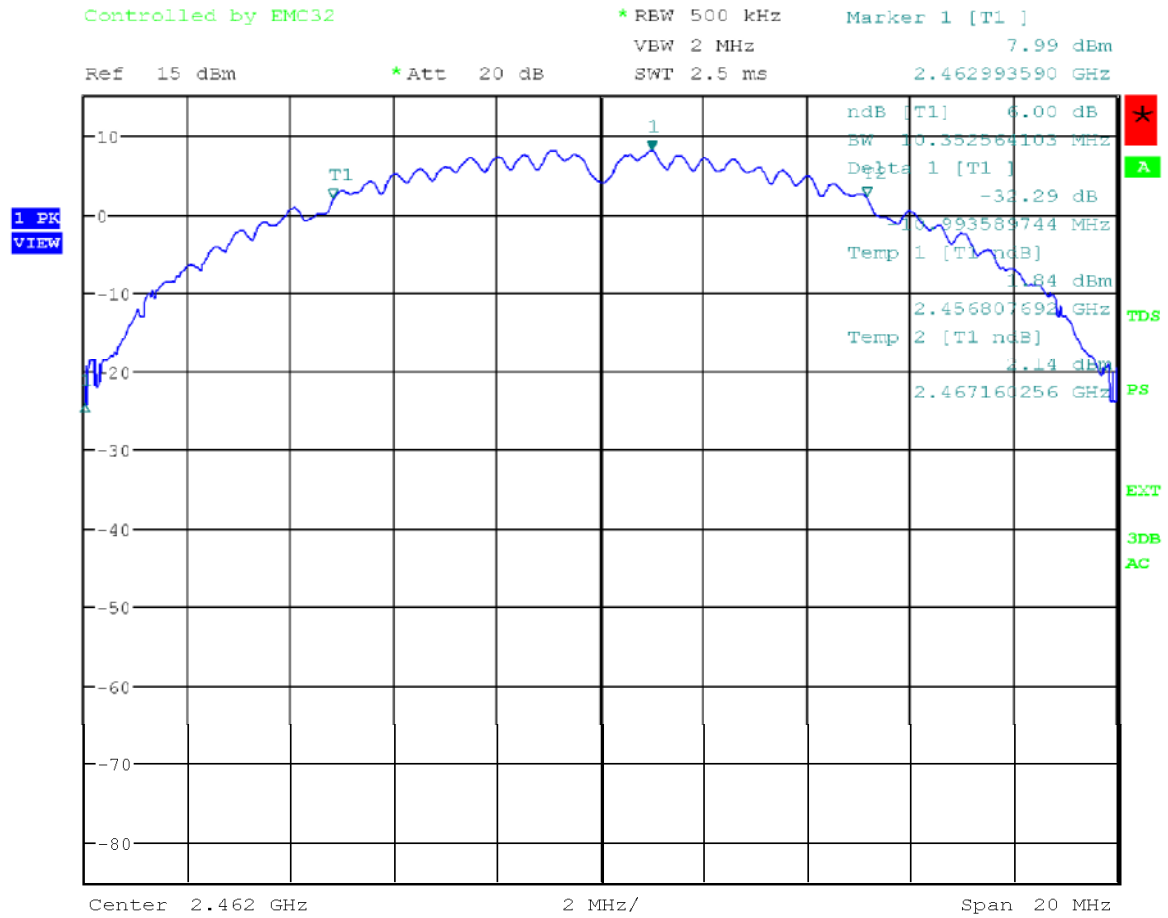
## 6dB Bandwidth Measurement



Date: 29.MAY.2012 09:00:34

**Figure 49.** Channel mid.

## 6dB Bandwidth Measurement



Date: 29.MAY.2012 09:02:35

**Figure 50.** Channel high.

## Power Spectral Density

**Standard:** ANSI C63.10 (2010)  
**Tested by:** JJM  
**Date:** 30.5.2012  
**Humidity:** 26 %  
**Temperature:** 19.8 °C  
**Barometric pressure** 1007 Mbar

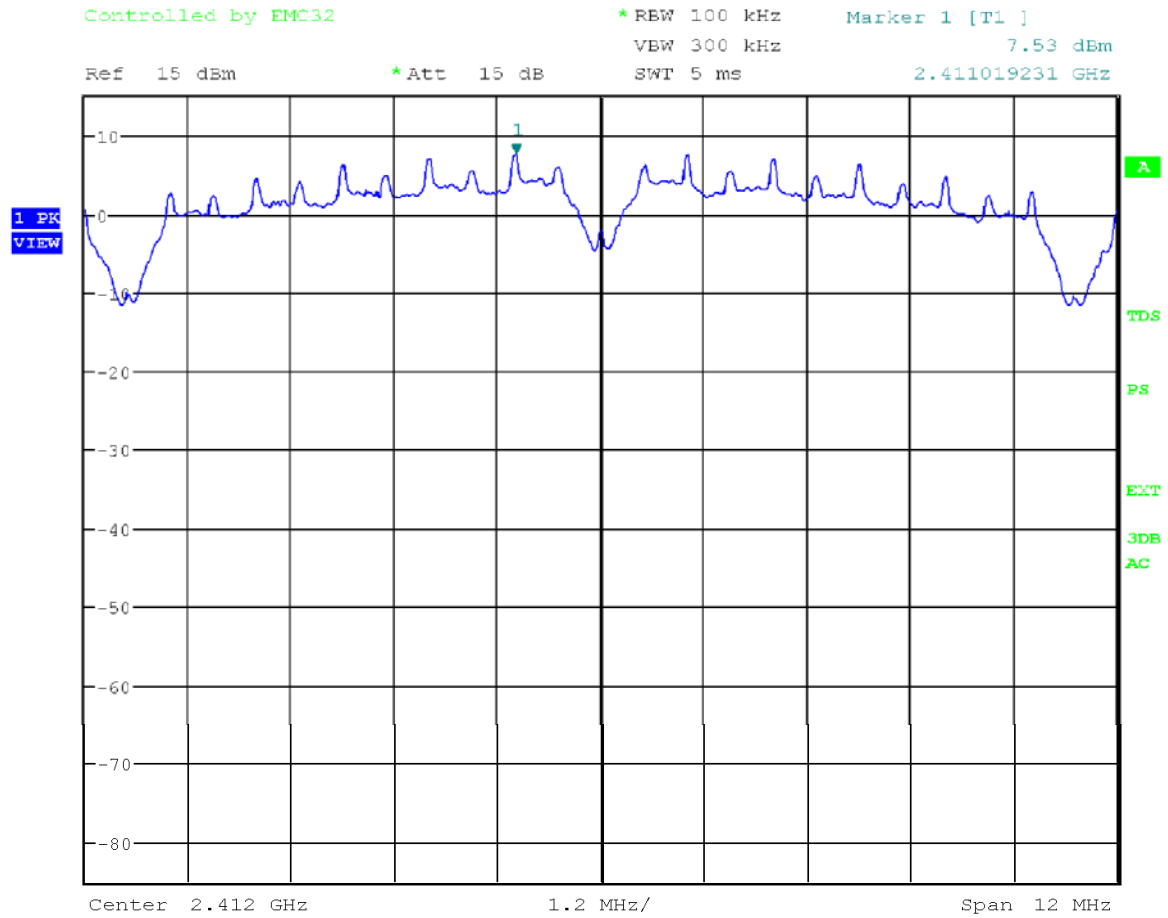
### FCC Rule: 15.247(e)

For digitally modulated systems, the 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of section 15.247. The same method of determining the conducted output power shall be used to determine the power spectral density.

The measured power level is scaled to an equivalent level in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor =  $10\log(3\text{ kHz}/100\text{ kHz}) = -15.2\text{ dB}$ .

Channel	RF Power Density [dBm]	Limit [dBm]
Low	-7.67	8
Mid	-7.87	8
High	-7.75	8

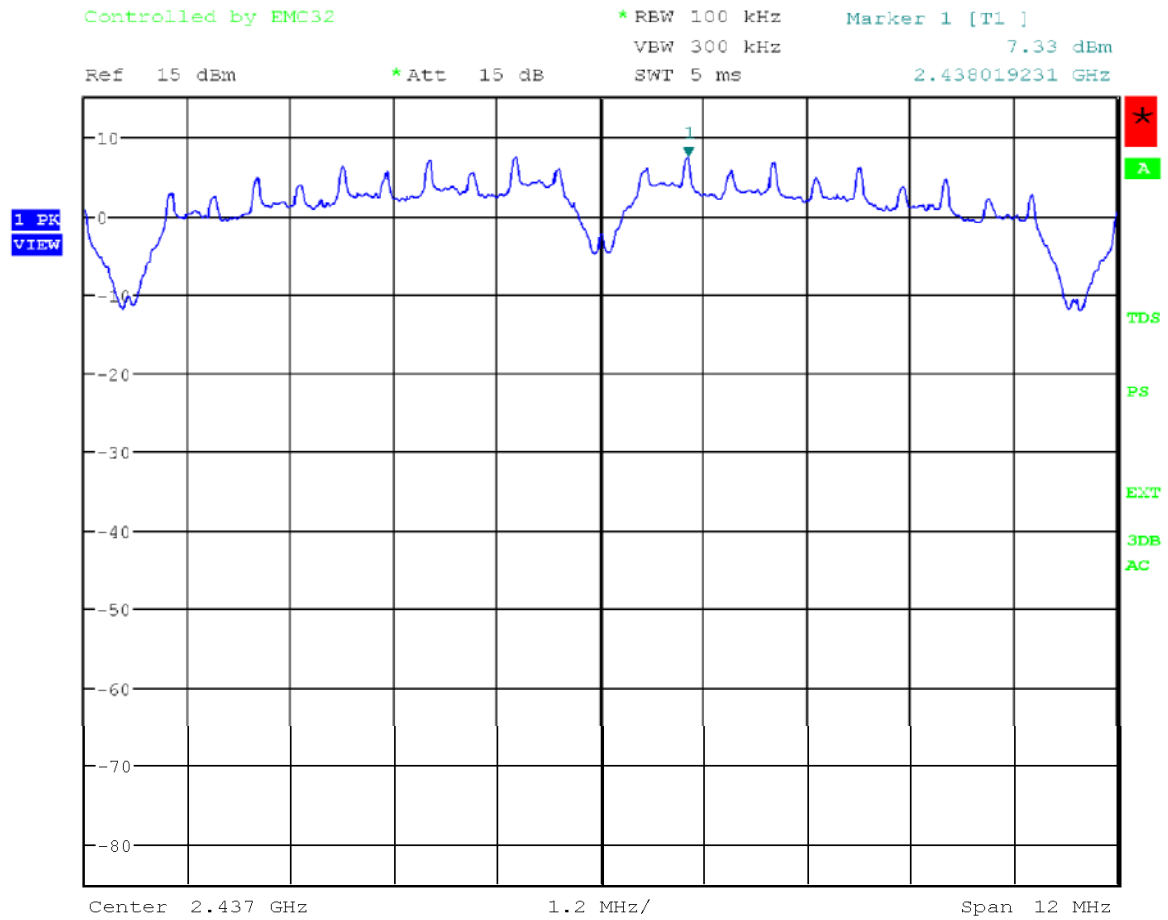
## Power Spectral Density Measurement



Date: 30.MAY.2012 09:48:27

**Figure 51.** Channel low.

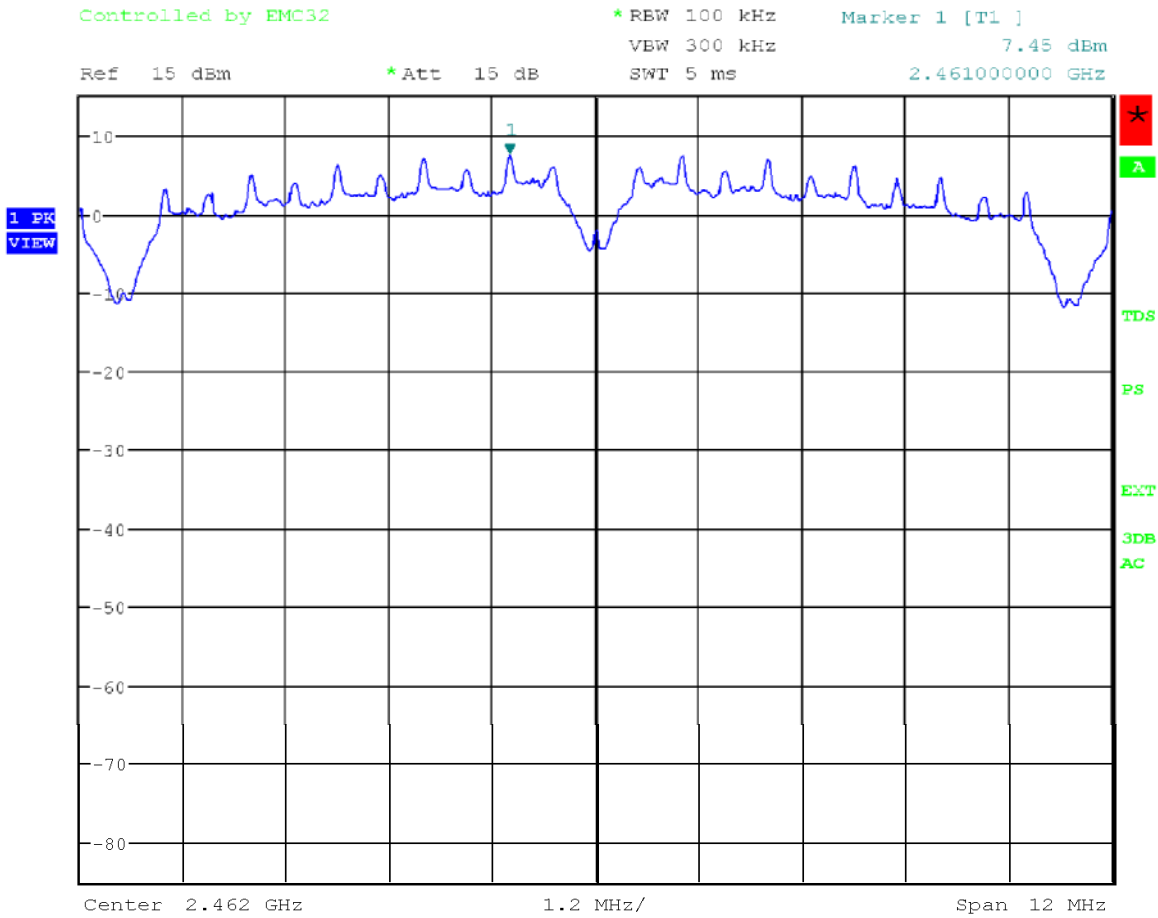
## Power Spectral Density Measurement



Date: 30.MAY.2012 09:49:29

**Figure 52.** Channel mid.

## Power Spectral Density Measurement



Date: 30.MAY.2012 09:50:36

Figure 53. Channel high.

**Maximum Peak Conducted Output Power**

<b>Standard:</b>	ANSI C63.10	(2009)
<b>Tested by:</b>	JJM	
<b>Date:</b>	30.5.2012	
<b>Humidity:</b>	26 %	
<b>Temperature:</b>	19.8 °C	
<b>Barometric pressure:</b>	1007 Mbar	

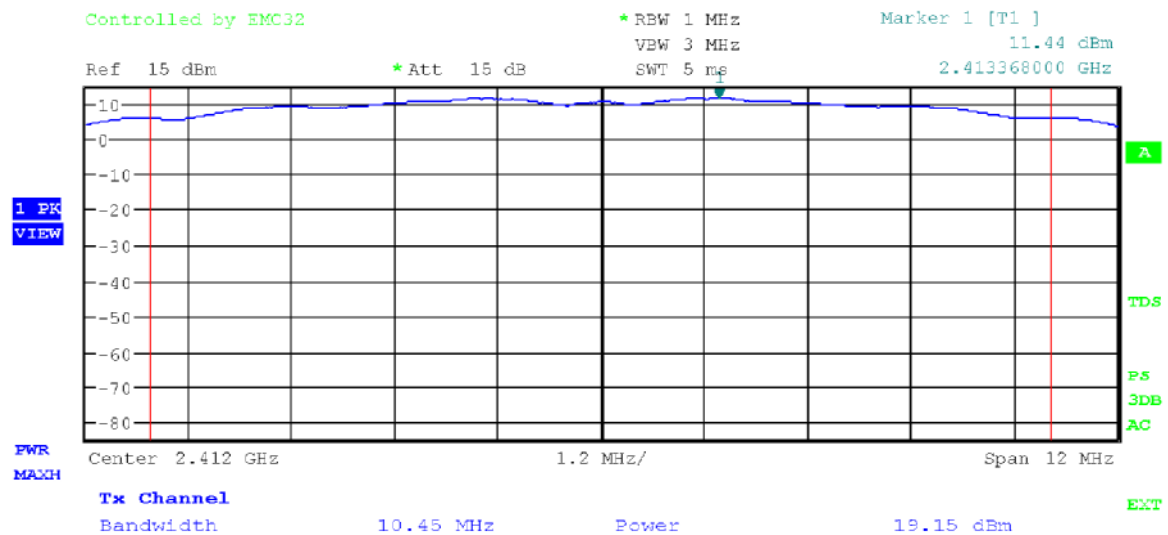
**FCC Rule: 15.247(b) (4)**

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

## Maximum Peak Conducted Output Power Measurement

### Results:

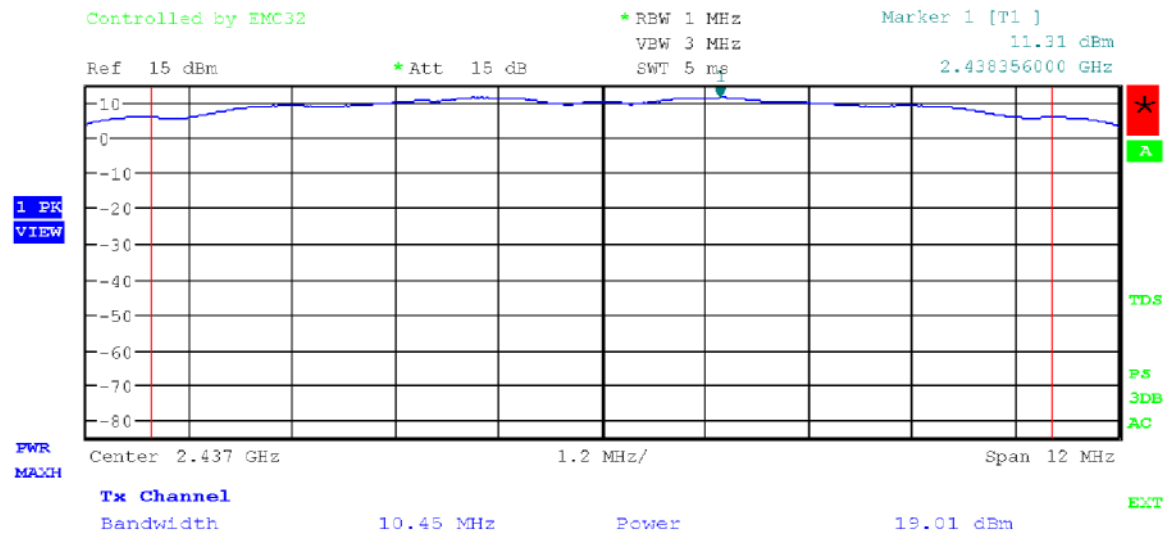
Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	19.15	30	10.85	PASS
Mid	19.02	30	10.98	PASS
High	19.03	30	10.97	PASS



Date: 30.MAY.2012 09:30:22

**Figure 54.** Channel low.

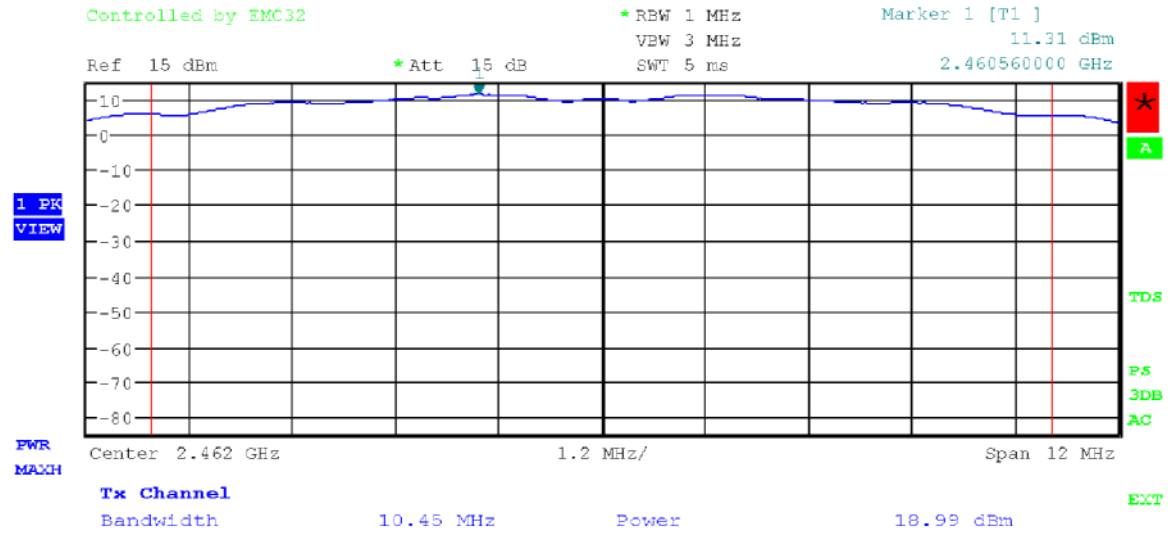
## Maximum Peak Conducted Output Power Measurement



Date: 30.MAY.2012 09:28:44

**Figure 55.** Channel mid.

## Maximum Peak Conducted Output Power Measurement



Date: 30.MAY.2012 09:31:38

**Figure 56.** Channel high.

## Receiver Radiated Emissions 30 – 25 000 MHz

<b>Standard:</b>	ANSI C63.10	(2009)
<b>Tested by:</b>	SOT	
<b>Date:</b>	28.05.2012	
<b>Humidity:</b>	68%	
<b>Temperature:</b>	20.4°C	
<b>Barometric pressure:</b>	1004.1 mbar	
<b>Measurement uncertainty:</b>	± 4.51dB	Level of confidence 95 % (k = 2)

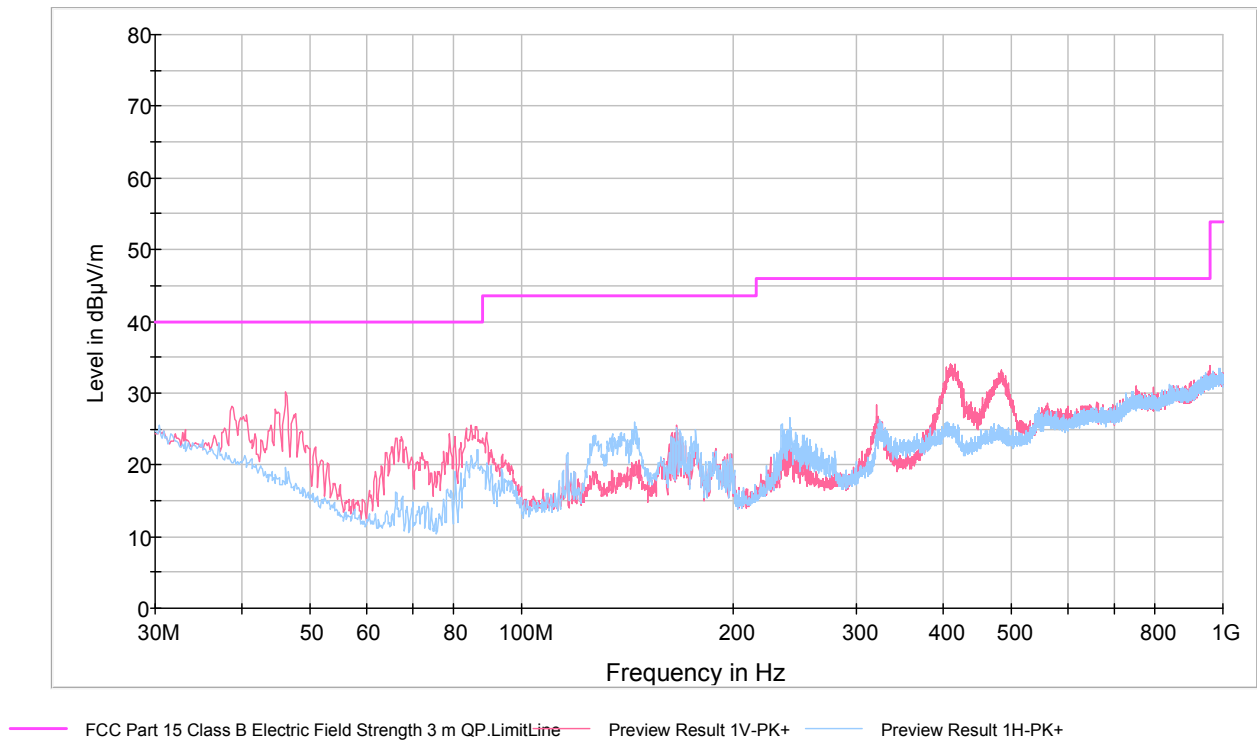
### FCC Rule: 15.247(d), 15.209(a)

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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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).

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables). The QuasiPeak value is the measured value corrected with the correction factor.

WF111-A

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

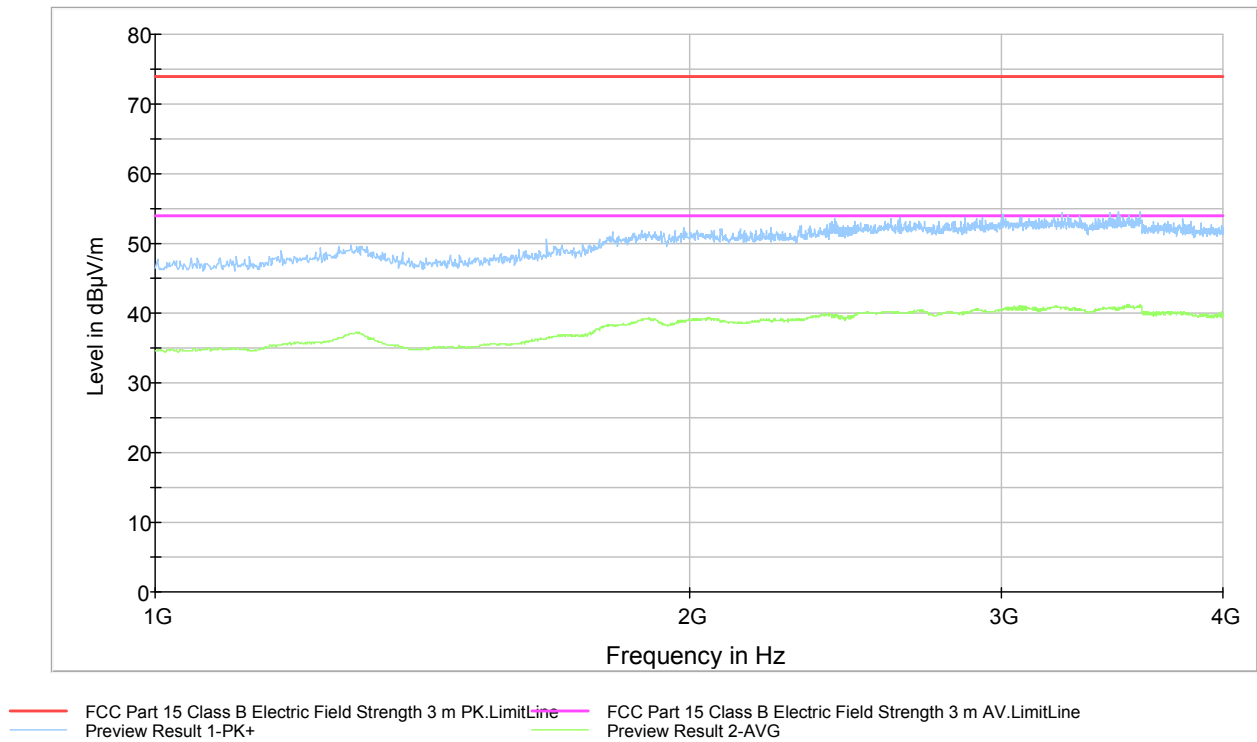


**Figure 57.** Measured curve with peak-detector. Channel mid.

**No final measurements since emission level was more than 6dB below the limit line.**

Receiver radiated emissions

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

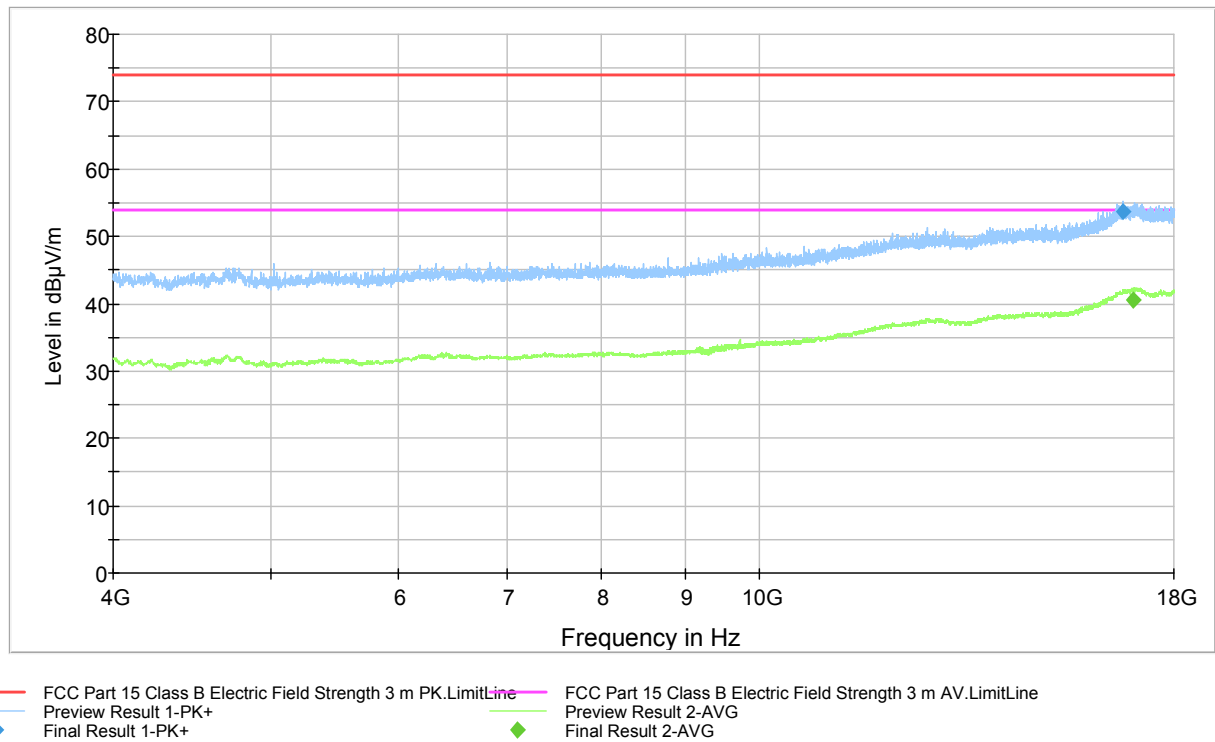


**Figure 58.** Measured curve with peak and average detector. Channel mid.

**No final measurements were made since emission level is below the Average limit.**

## Receiver radiated emissions

### FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 59.** Measured curve with peak and average detector. Channel mid.

### Final measurements from the worst frequencies

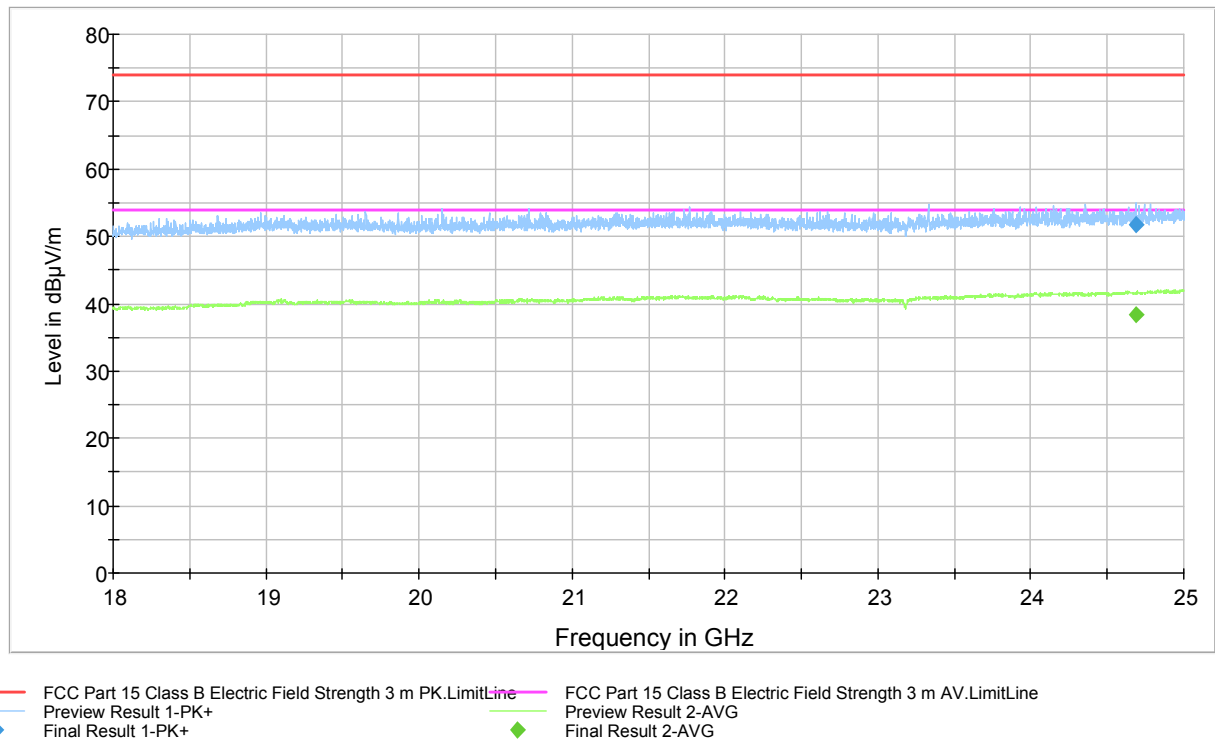
**Table 64.** Final results Max Peak.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
16744.925000	53.8	1000.0	1000.000	219.0	V	4.0	25.3	20.1	73.9	

**Table 65.** Final results Average.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
17003.025000	40.5	1000.0	1000.000	100.0	V	2.0	25.9	13.4	53.9	

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m


**Figure 60.** Measured curve with peak and average detector. Channel mid.

#### Final measurements from the worst frequencies

**Table 66.** Final results Max Peak.

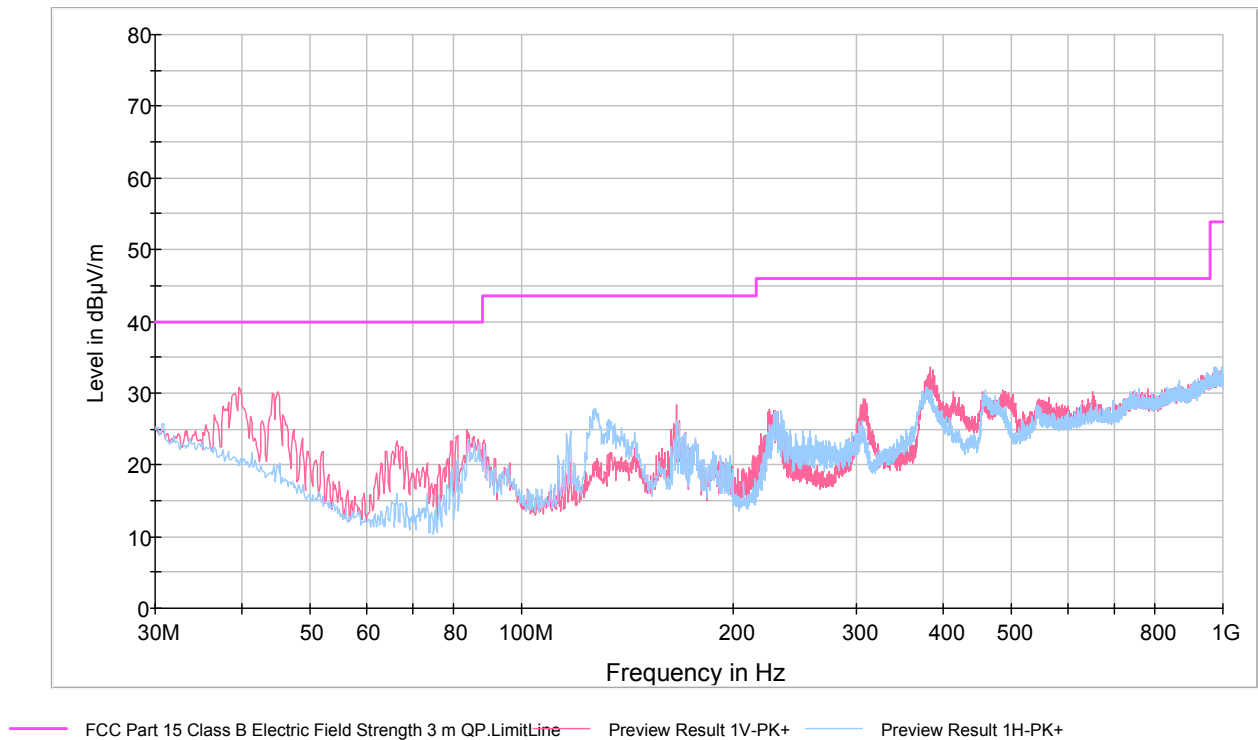
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24691.975000	51.7	1000.0	1000.000	245.0	V	-4.0	27.5	22.2	73.9	

**Table 67.** Final results Average.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24691.975000	38.4	1000.0	1000.000	245.0	V	-4.0	27.5	15.5	53.9	

WF111-E

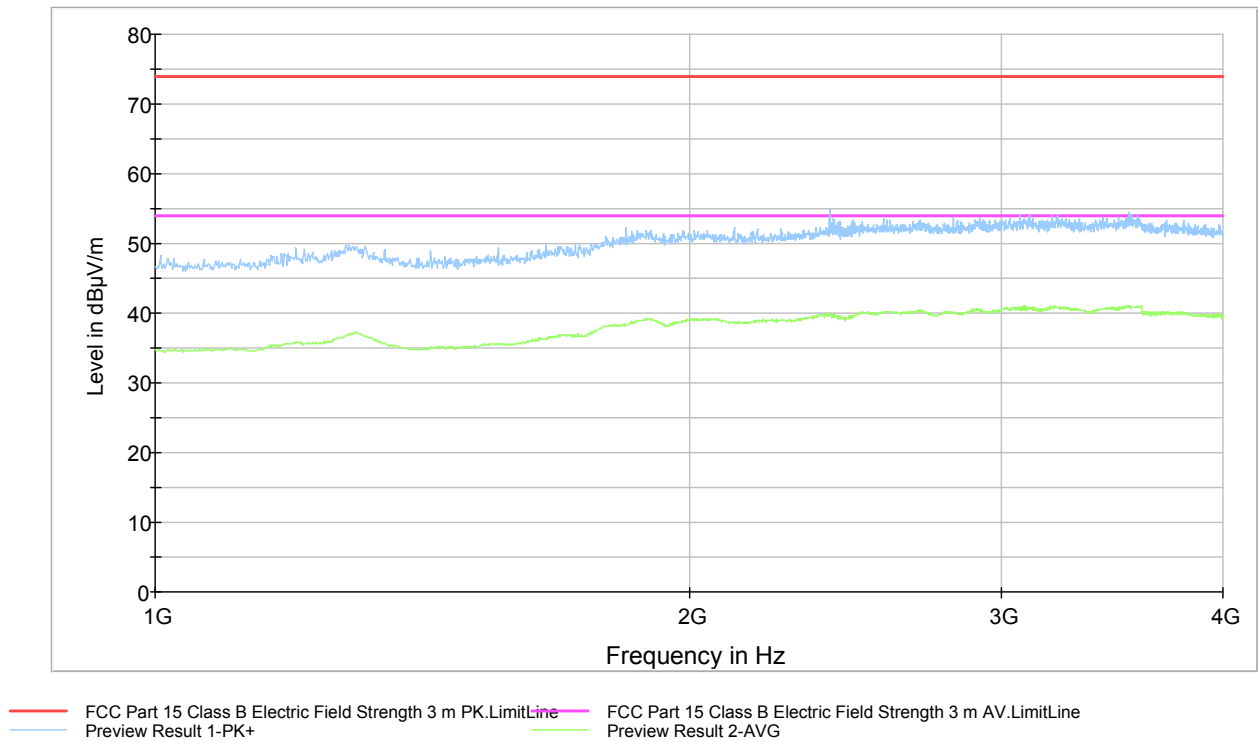
FCC Part 15 Class B Spurious Emission 30-1000MHz 3m



**Figure 61.** Measured curve with peak detector. Channel mid.

**No final measurements since emission level was more than 6dB below the limit line.**

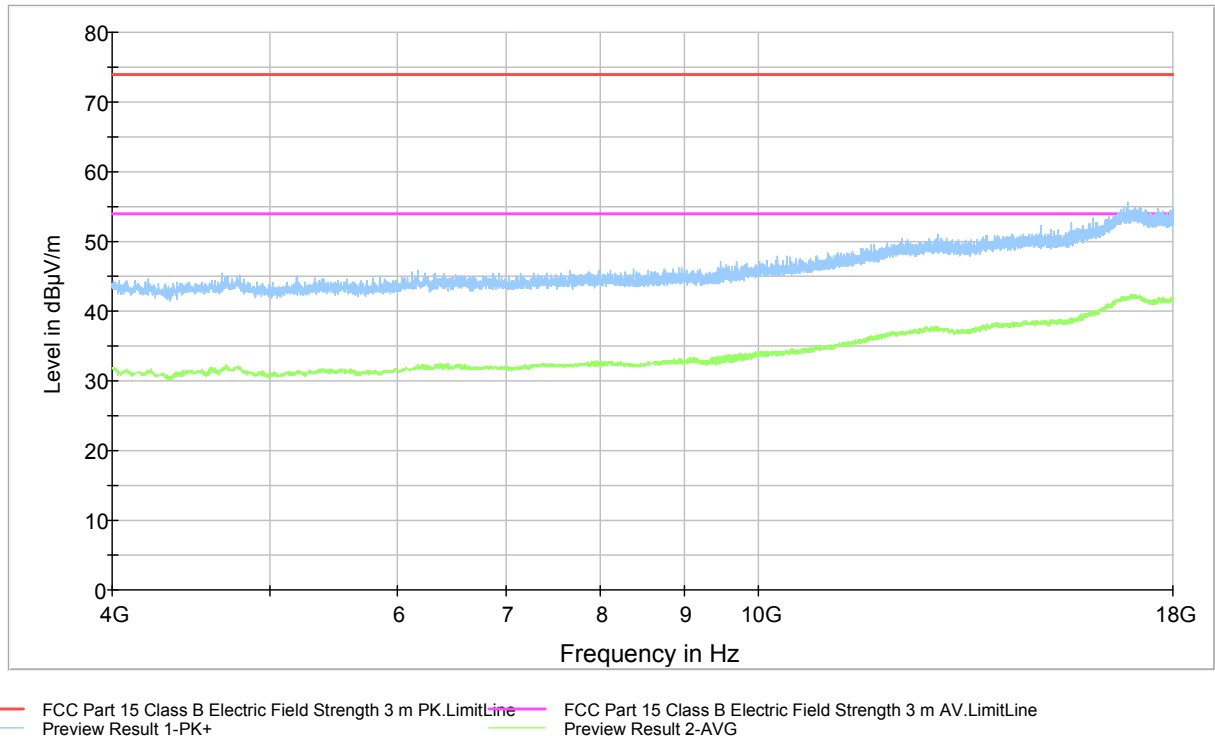
FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)



**Figure 62.** Measured curve with peak and average detector. Channel mid.

**No final measurements were made since emission level is below the Average limit.**

FCC Part 15 Class B Spurious Emission 4-18GHz 3m

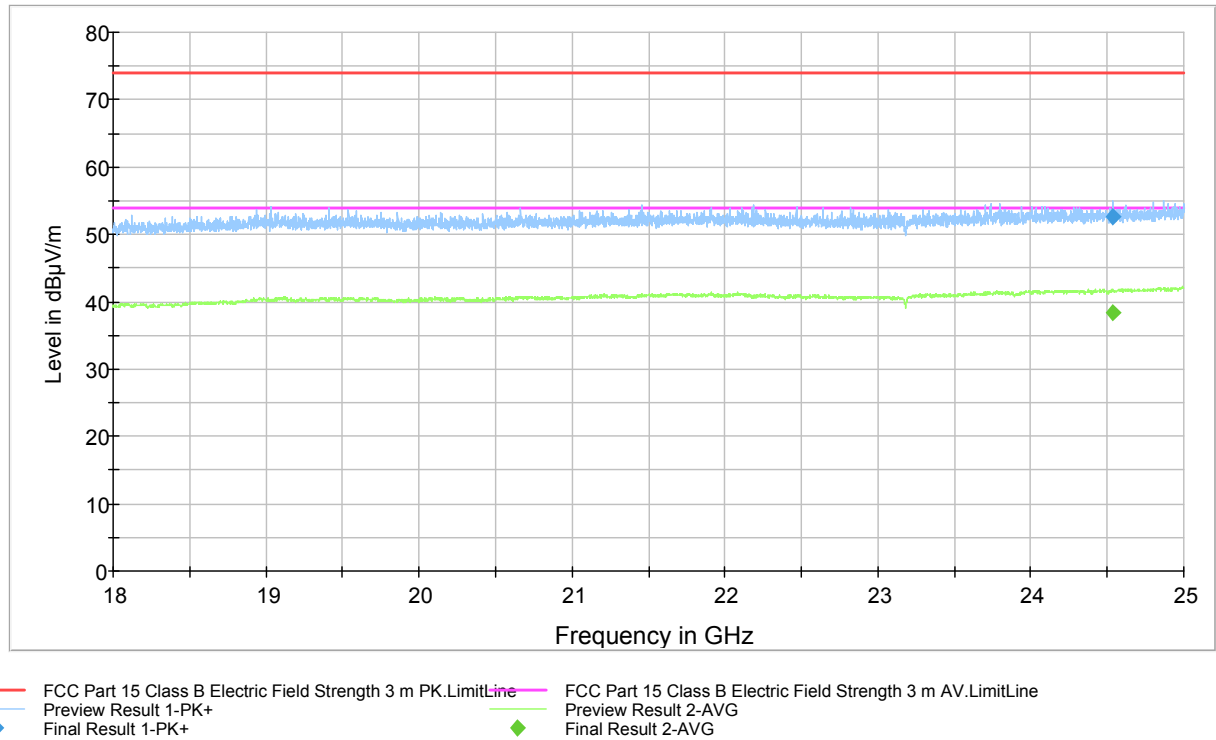


**Figure 63.** Measured curve with peak and average detector. Channel mid.

**No final measurements were made since emission level is below the Average limit.**

# Receiver radiated emissions

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 64.** Measured curve with peak and average detector. Channel mid.

**Table 68.** Final results Max Peak.

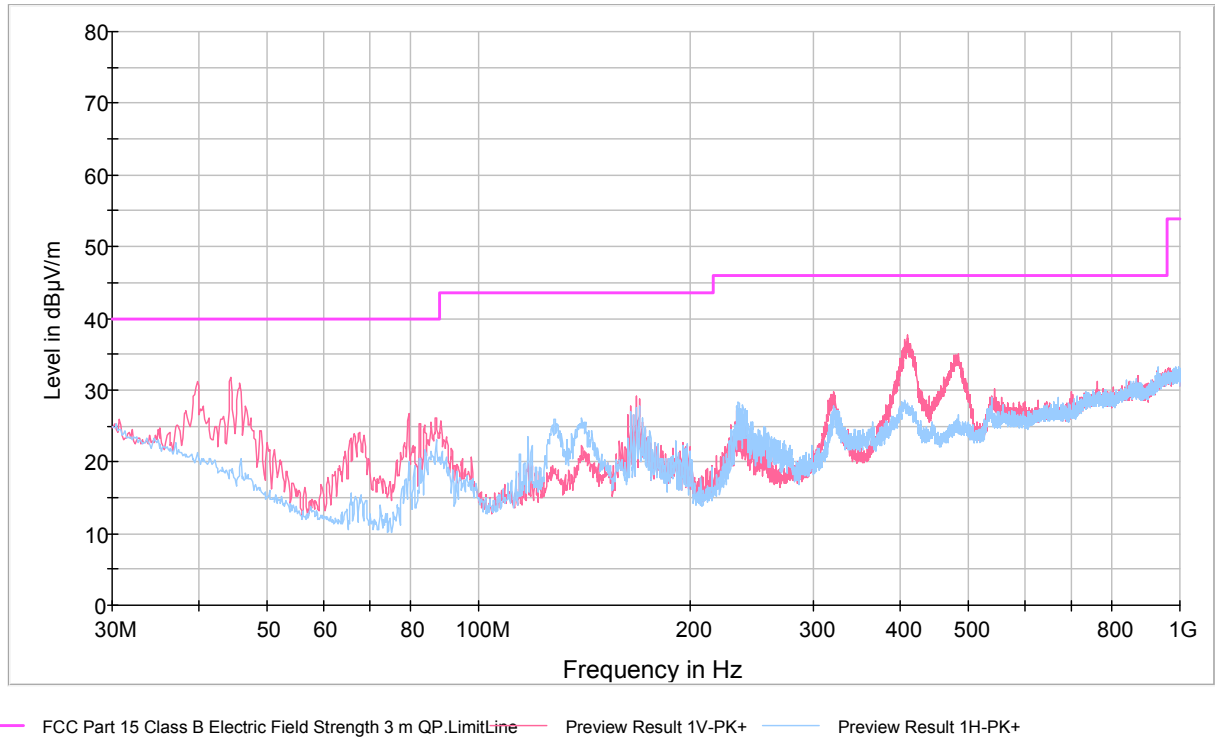
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24540.325000	52.7	1000.0	1000.000	100.0	V	3.0	27.4	21.2	73.9	

**Table 69.** Final results Average.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
24540.325000	38.4	1000.0	1000.000	100.0	V	3.0	27.4	15.5	53.9	

WF111-N

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

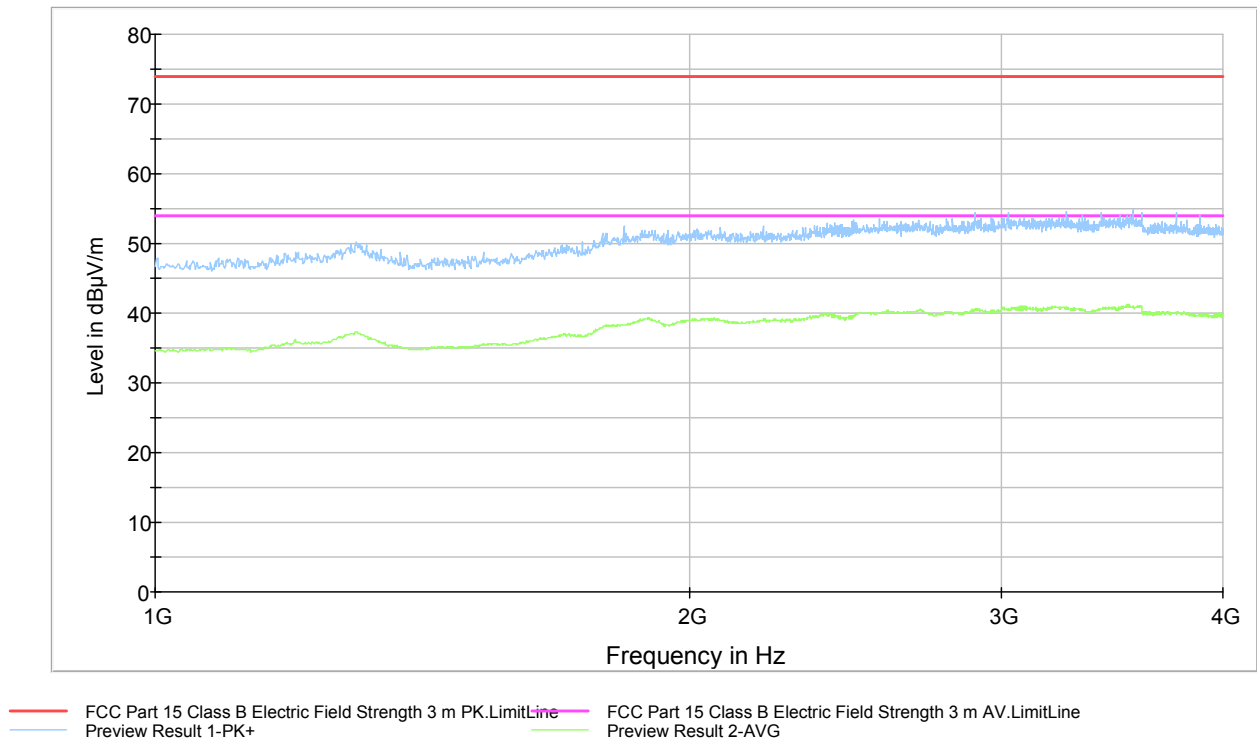


**Figure 65.** Measured curve with peak detector. Channel high.

**No final measurements since emission level was more than 6dB below the limit line.**

Receiver radiated emissions

FCC Part 15 Class B Spurious Emission 1-4GHz 3m (optimized 2.4 GHz TX)

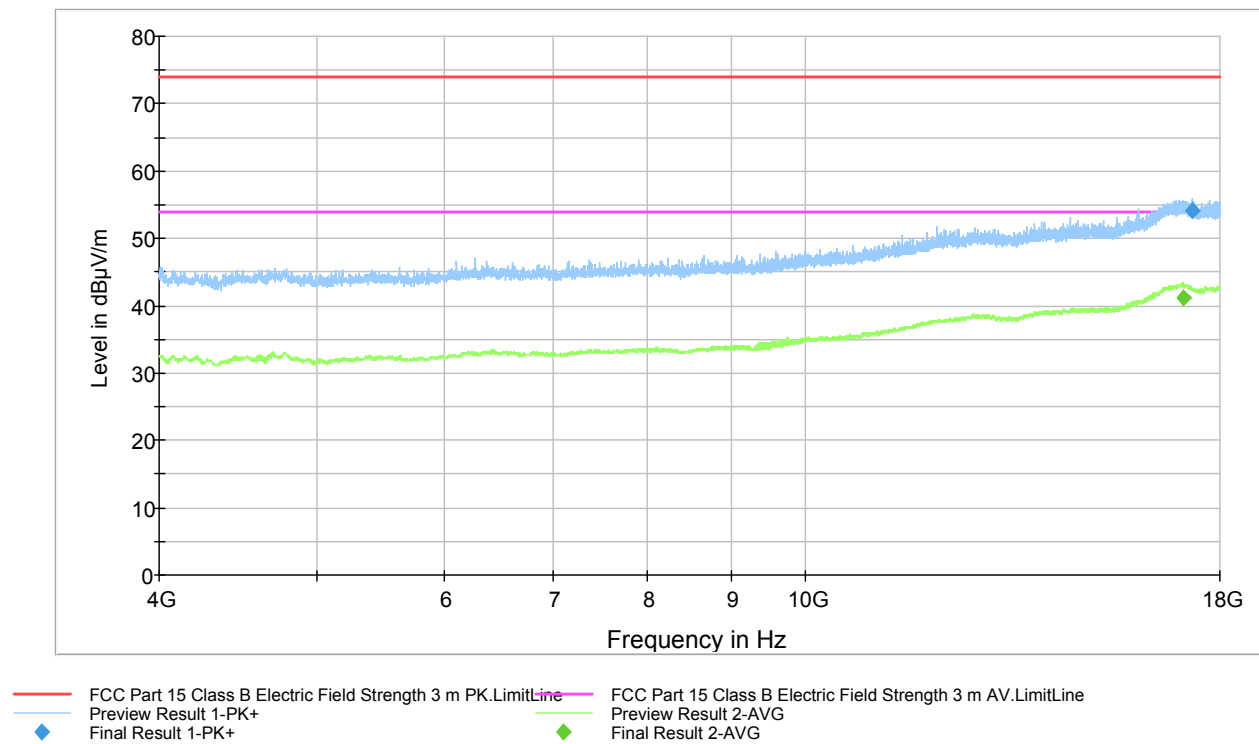


**Figure 66.** Measured curve with peak and average detector. Channel high.

**No final measurements were made since emission level is below the Average limit.**

## Receiver radiated emissions

### FCC Part 15 Class B Spurious Emission 4-18GHz 3m



**Figure 67.** Measured curve with peak and average detector. Channel high.

**Table 70.** Final results Max Peak.

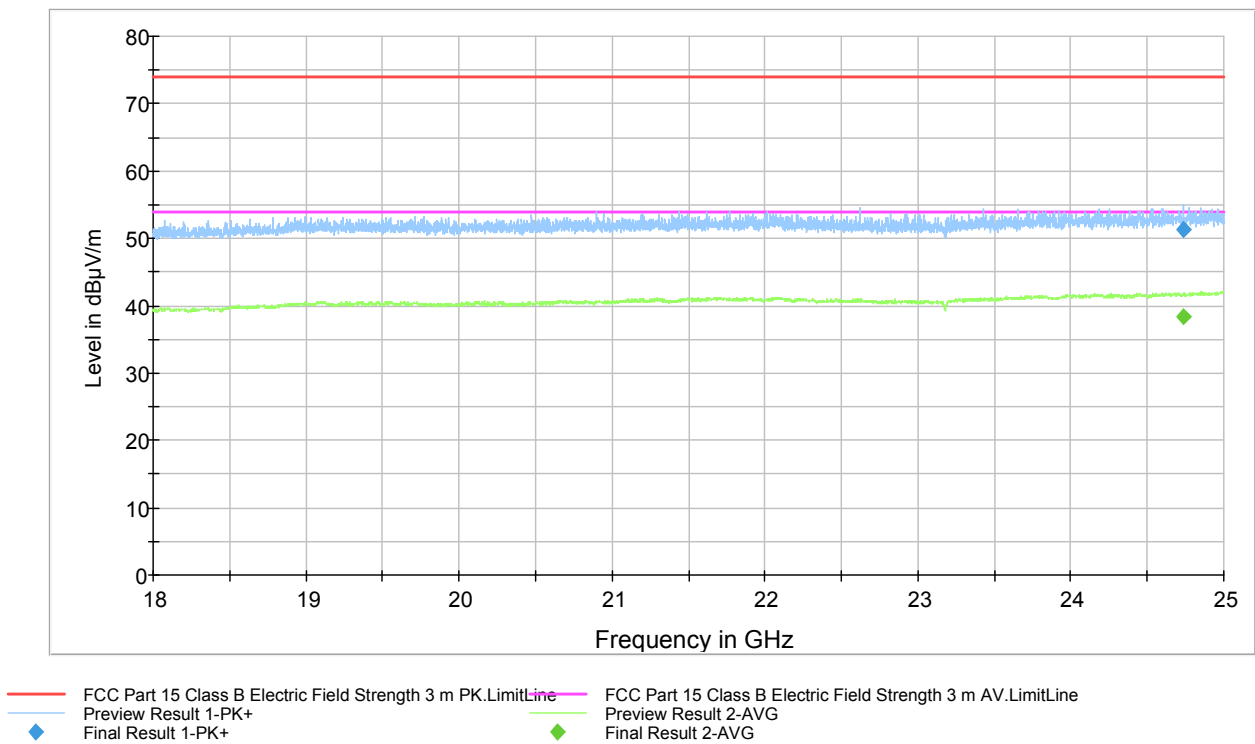
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
17306.875000	54.1	1000.0	1000.000	240.0	H	255.0	25.4	19.8	73.9	

**Table 71.** Final results Average.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
17085.825000	41.2	1000.0	1000.000	105.0	V	109.0	25.8	12.7	53.9	

# Receiver radiated emissions

FCC Part 15 Class B Spurious Emission 18-26.5GHz 3m



**Figure 68.** Measured curve with peak and average detector. Channel high.

**Table 72.** Final results Max Peak.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
24739.025000	51.2	1000.0	1000.000	114.0	V	230.0	27.5	22.7	73.9	

**Table 73.** Final results Average.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
24739.025000	38.3	1000.0	1000.000	114.0	V	230.0	27.5	15.6	53.9	

## 99% Occupied Bandwidth

**Standard:** ANSI C63.10 (2009)  
**Tested by:** RRE  
**Date:** 27.6.2012  
**Humidity:** 43 %  
**Temperature:** 22 °C  
**Barometric pressure** 997 hPa

**RSS-GEN Rule:** 4.4.1

CHANNEL LOW

EUT frequency [MHz]	Limit [kHz]	99% BW [MHz]	Result
2412	---	16.923	PASS

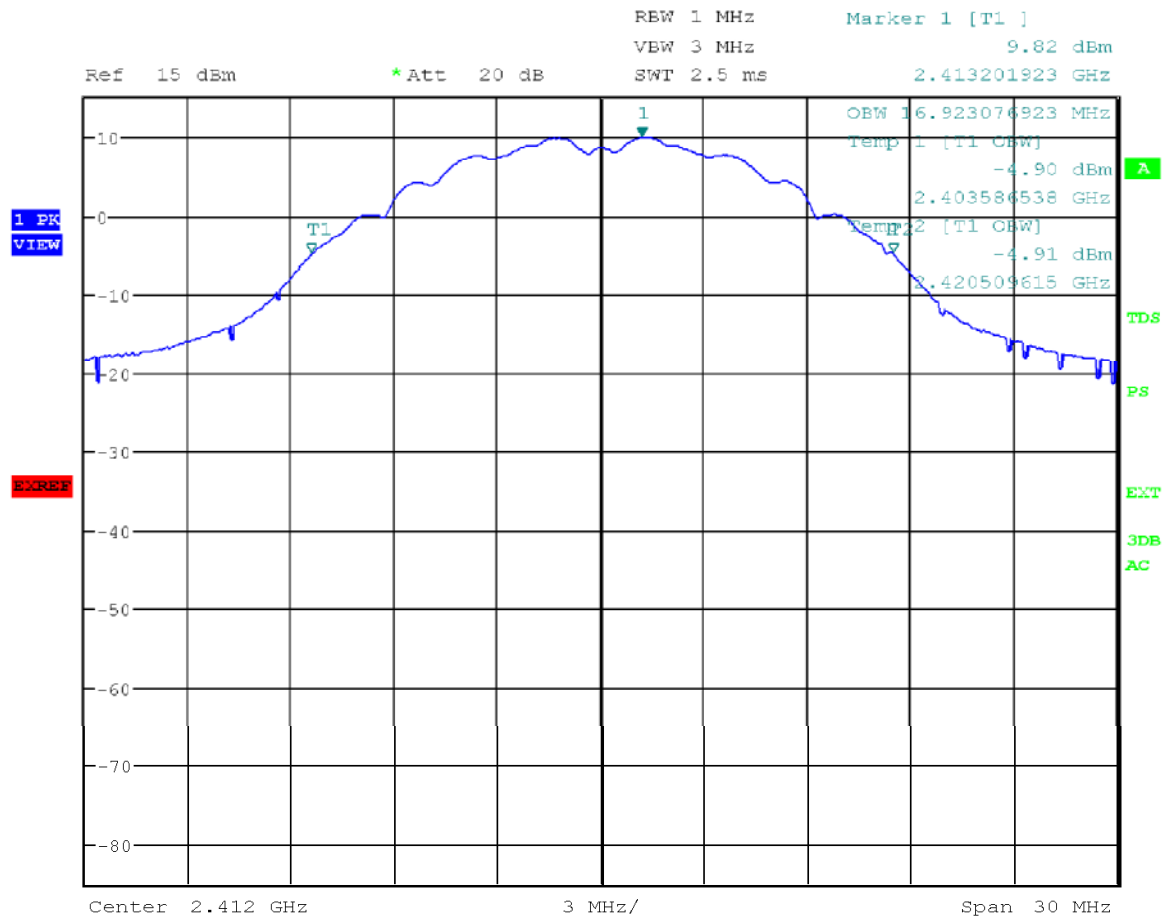
CHANNEL MID

EUT frequency [MHz]	Limit [kHz]	99% BW [MHz]	Result
2437	---	16.731	PASS

CHANNEL HIGH

EUT frequency [MHz]	Limit [kHz]	99% BW [MHz]	Result
2462	---	16.923	PASS

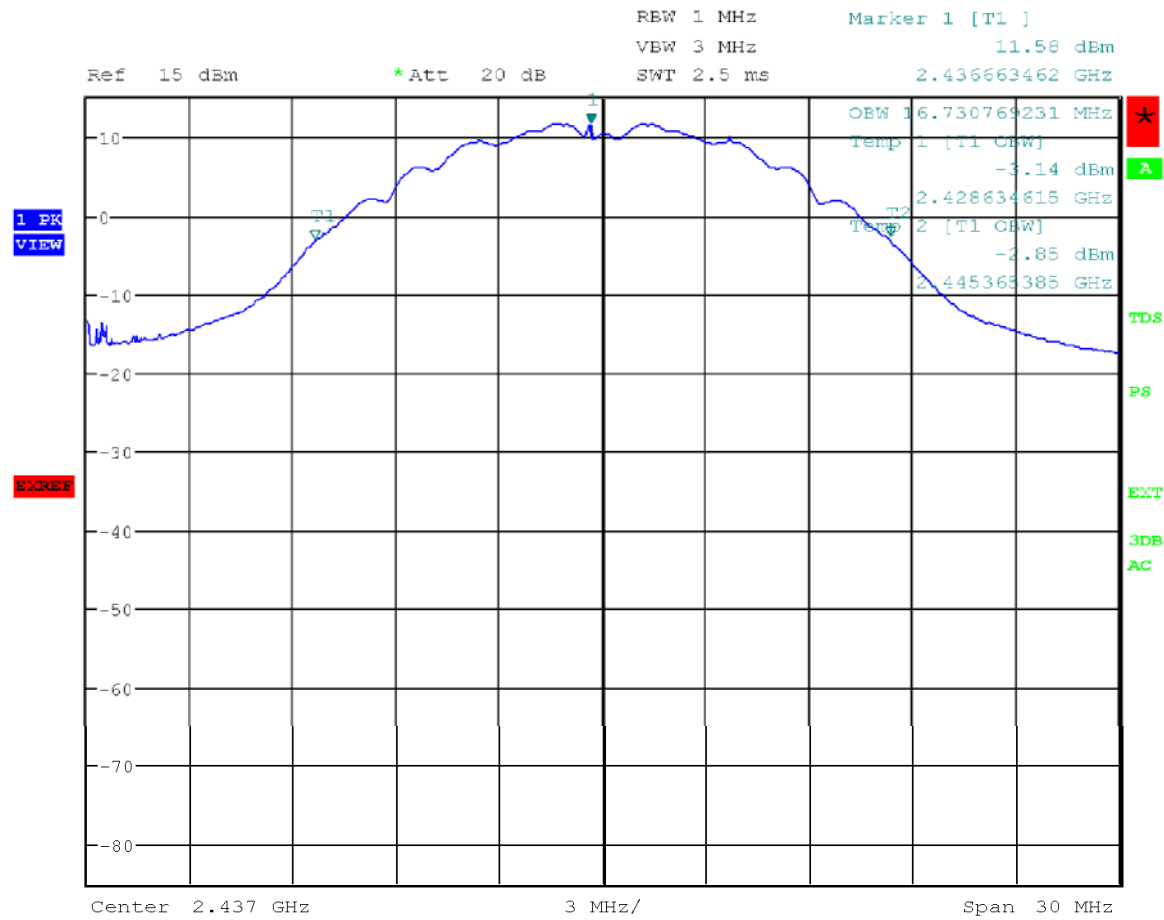
## 99% Occupied Bandwidth



Date: 27.JUN.2012 14:21:19

**Figure 69.** 99% occupied bandwidth. Channel low.

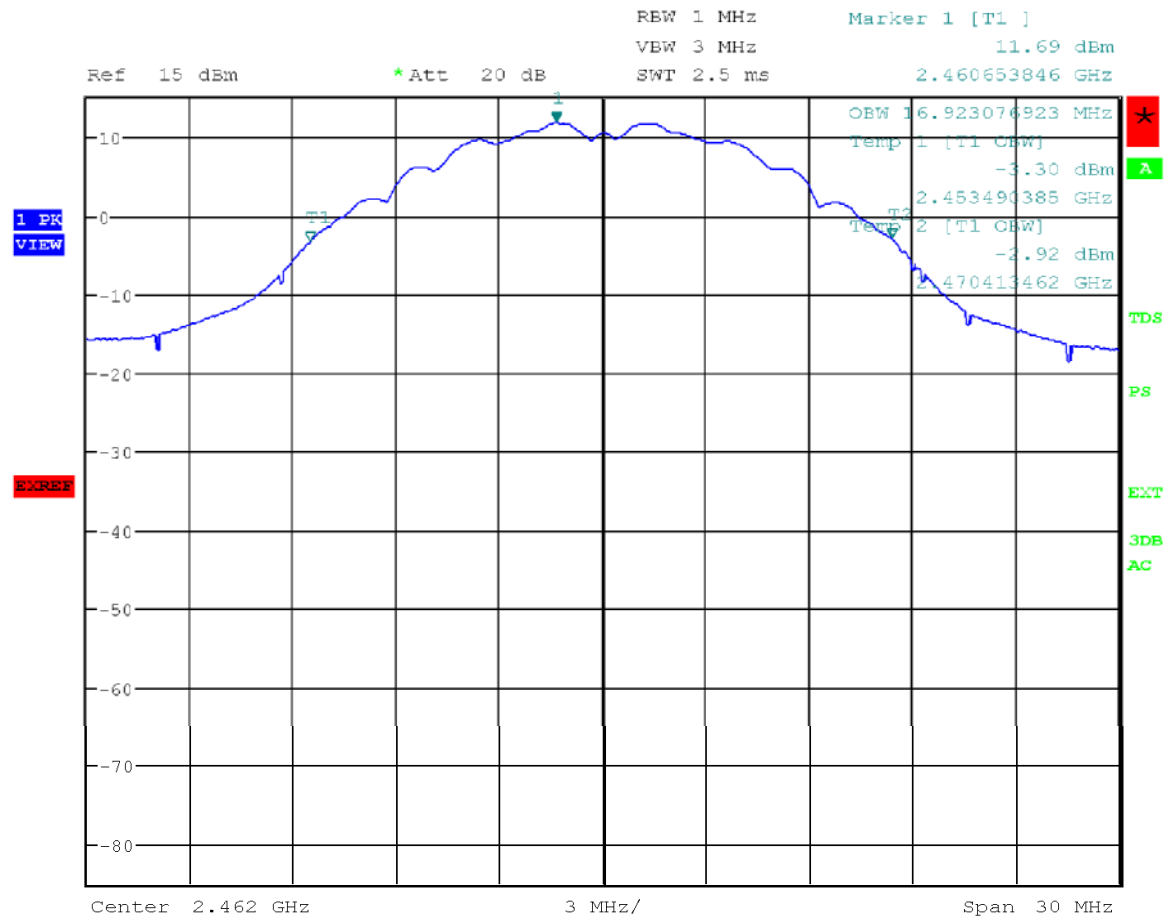
## 99% Occupied Bandwidth



Date: 27.JUN.2012 14:34:11

Figure 70. 99% occupied bandwidth. Channel mid.

## 99% Occupied Bandwidth



Date: 27.JUN.2012 14:40:09

**Figure 71.** 99% occupied bandwidth. Channel high.

**List of test equipments**
**Conducted and radiated emissions**

<b>Manufacturer</b>	<b>Type</b>	<b>Serial no</b>	<b>Inv. no</b>
<b>ROHDE &amp; SCHWARZ</b>			
EMI Test receiver	ESU 26	100185	8453
EMI Test receiver	ESCI 3	100885	8264
Test software	EMC32	-	-
<b>CHASE</b>			
Antenna (30 MHz - 1 GHz)	6141A	4102	7895
<b>EMCO</b>			
Antenna (1 - 18 GHz)	3117	29617	7293
Antenna (18 - 26 GHz)	3160-9	28535	7294
<b>HEWLETT- PACKARD</b>			
Microwave amplifier	83017A	-	5226
<b>HUBER+SUHNER</b>			
Attenuator 10dB	6810.17B	-	-
<b>DEISEL</b>			
Antenna mast	MA 240 T	240/394/96	5017
Tilt option	KE 220	220/307/96	-
Controller	HD 100	100/413/96	5018
Turntable	DS 420	420/420/96	5015
<b>WAINWRIGHT</b>			
High Pass Filter	WHKX	10	8267
<b>CALIFORNIA INSTRUMENTS</b>			
AC power source	13500L/3-3PT-4708	4009-419-1 Rev B	4970

**NOTE!** All testing equipment were calibrated.