SGS

Test Report

FINAS
Finnish Accreditation Service
T004 (EN ISO/IEC 17025)

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

Equipment Under Test:	802.11 b/g + Bluetooth module
Model:	W2CBW003
Type:	-
Manufacturer:	Wi2Wi Inc. 2107 N. 1st Street, Suite 540 San Jose CA 95131 USA
Customer:	Oxford instruments Halifax Road High Wycombe, HP12 3SE United Kingdom
FCC Rule Part:	15.247: 2011
IC Rule Part	RSS-210, Issue 8, 2010 RSS-GEN Issue 3, 2010
Measurement guide:	558074 D01 DTS

Date:	August 27, 2012	Date:	August 27, 2012
Issued by:	Rauno Repo Testing Engineer	Checked by:	Jari Merikari Technical Manager

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Equipment Under Test (EUT)

802.11 b/g + Bluetooth module

Model:	W2CBW003
Type:	-
Serial no:	-
HW version:	-
SW version:	-
FCC ID number:	ZYH-W2CBW003

Description of the EUT

The EUT is a 802.11 b/g and Bluetooth module. These tests corncern only 802.11 b/g WLAN feature. Bluetooth feature has been tested earlier (Test Report 265775-4).

The purpose of these tests is to demonstrate that the module complies with the FCC rules when different antenna construction is used. In the original grant module was tested by using the monopole omnidirectinoal 3 dBi gain antenna. In these test a PCB antenna was used with 2 dBi gain and the signal was routed from the module to the antenna by using the rf-pin connetor cable. Due to these changes radiated emissions and output power was retested for Class II permissive change.

Classification of the device

Fixed device	☐
Mobile Device (Human body distance > 20cm)	☐
Portable Device (Human body distance < 20cm)	☒

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:	11
Channel separation:	5 MHz
Channel bandwidth:	20 MHz (802.11b-mode) 22 MHz (802.11g-mode)
Conducted power:	13.63 dBm
Transmission technique:	DSSS/OFDM
Modulation:	CCK/OFDM
Antenna connector type:	RF-pin
Antenna gain:	2 dBi

Power Supply

Powered from the battery of the host device

Samples

All tests were performed with one sample.

During the radiated emission test the module was installed into the actual host device.

During the conducted test the enclosure of the host device was removed and the measurement cable was connected to RF-pin connector.

Disclaimer

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SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.247(b)(3) / RSS-210 A8.4	Maximum Peak Conducted Output Power	PASS
§15.209(a), §15.247(d) / RSS-210 A8.5	Radiated Emissions Within The Restricted Bands	PASS

EUT Test Conditions during Testing

The EUT was in continuous transmit mode during all the tests.

The hopping was stopped and the EUT was configured into the wanted channel. Normal modulation and duty cycle was applied in all the tests.

Following channels were used during the tests when the hopping was stopped:

Channel LOW (CH 0) = 2412 MHz

Channel MID (CH 6) = 2437 MHz

Channel HIGH (CH 11) = 2462 MHz

Before performing the actual tests 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 1 Mbps data rate.

Test Facility

☐ Testing Location / address: FCC registration number: **90598**	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
☒ Testing Location / address: FCC registration number: **178986** Industry Canada registration number: **8708A-2**	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10	(2009)
Tested by:	RRE	
Date:	24.8.2012	
Humidity:	49 %	
Temperature:	21 °C	
Measurement uncertainty	± 2,87dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(b) (3)

The maximum peak conducted output power of the intentional radiator shall not exceed for the systems using digital modulation operating in the 2400-2483.5 MHz: 1 Watt. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

Results:

Table 1. 802.11b

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	10.14	30	19.86	PASS
Mid	12.19	30	17.81	PASS
High	13.63	30	16.37	PASS

Table 2. 802.11g

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	9.71	30	20.29	PASS
Mid	11.75	30	18.25	PASS
High	12.66	30	17.34	PASS

The attenuation of the measurement cable and the attenuator was taken into account to correct the measurement result.

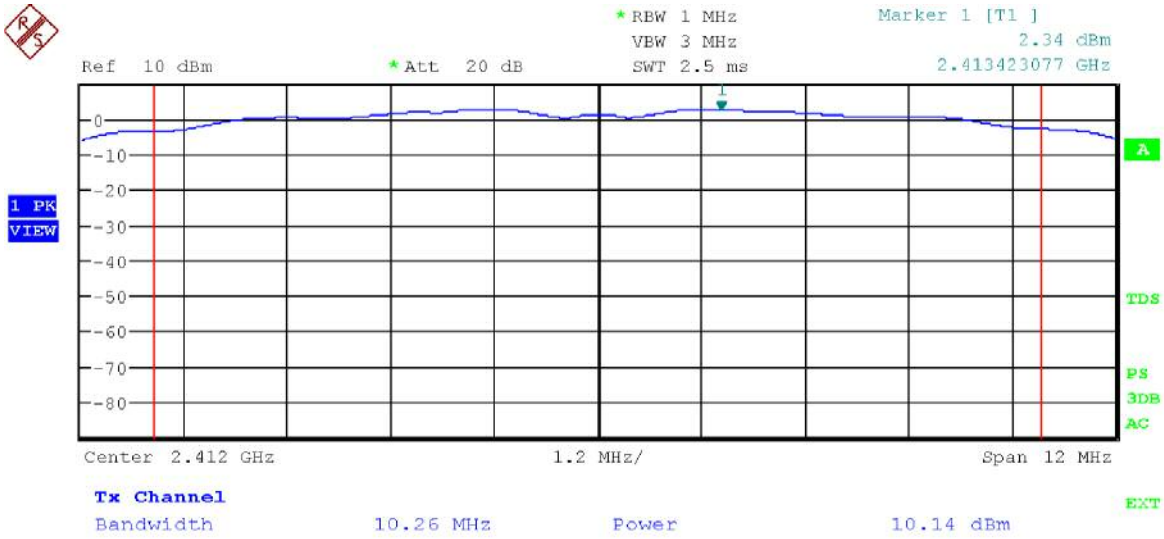

Figure 1. 802.11b low channel.

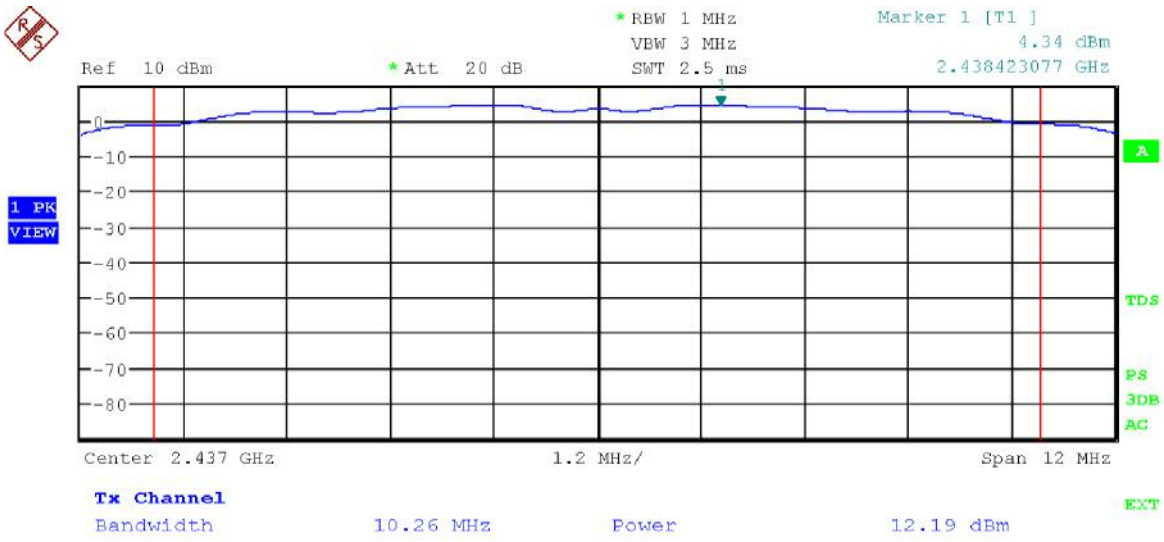

Figure 2. 802.11b middle channel.

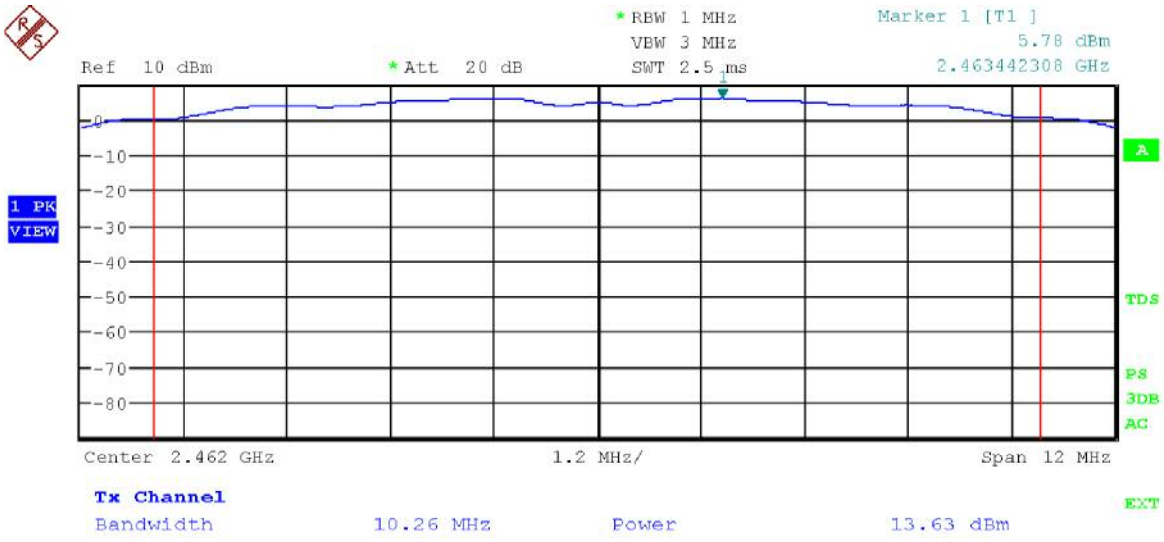

Figure 3. 802.11b high channel.

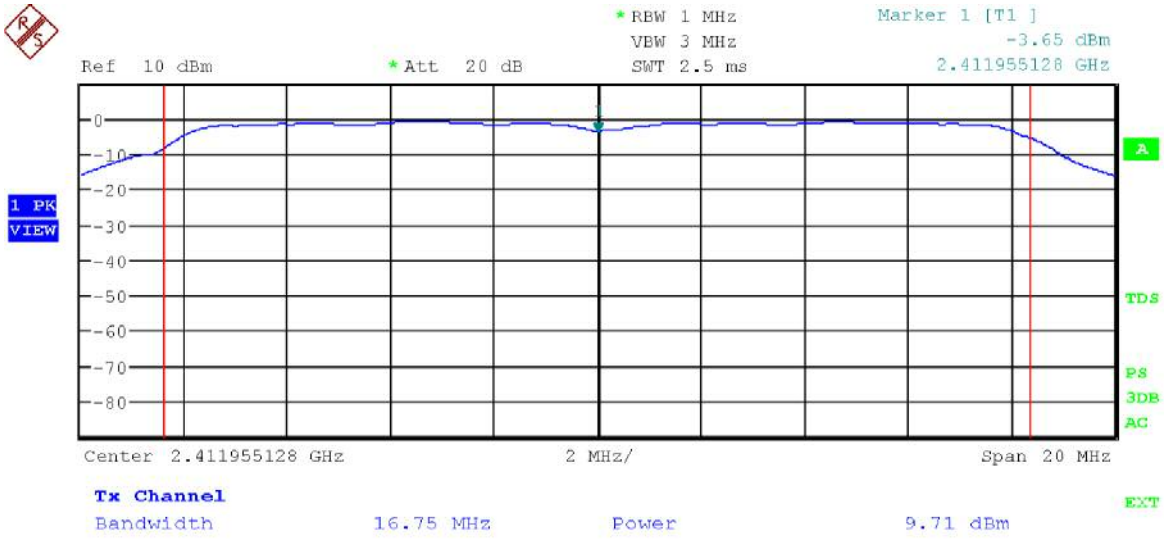

Figure 4. 802.11g low channel.

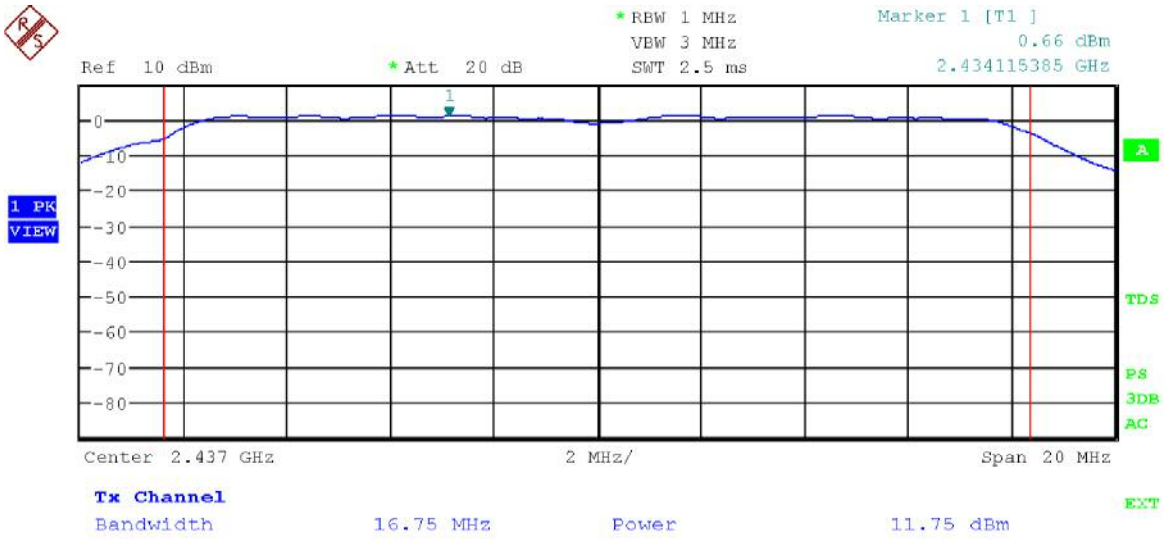

Figure 5. 802.11g middle channel.

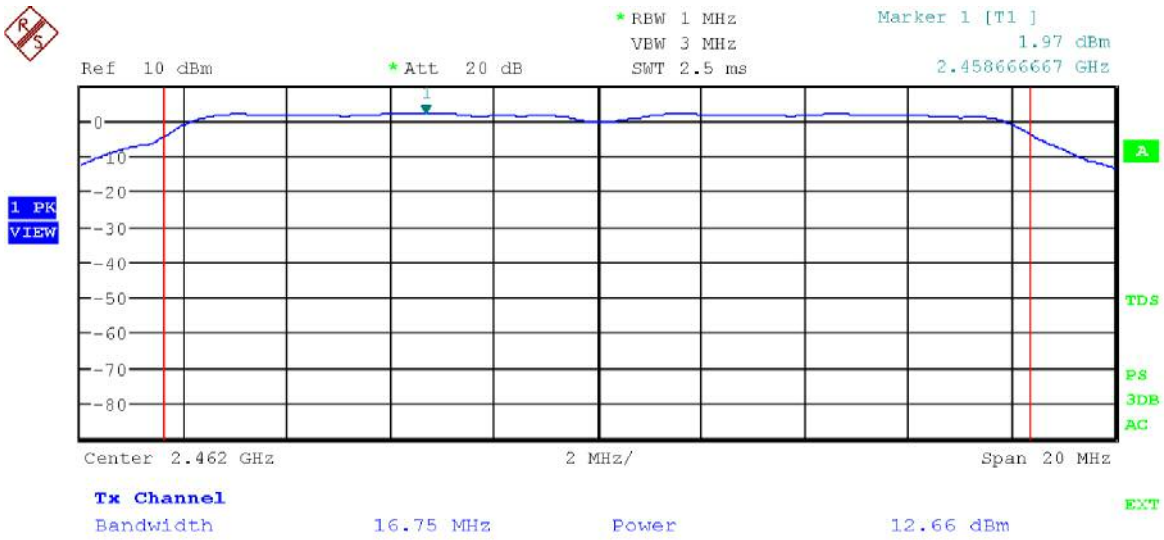

Figure 6. 802.11g high channel.

Transmitter Radiated Emissions 30 – 26 500 MHz

Standard:	ANSI C63.10	(2009)
Tested by:	RRE	
Date:	22. – 23.8.2012	
Humidity:	62 % RH	
Temperature:	20 °C	
Measurement uncertainty	± 4.51 dB	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.

Measured Peak Values In The Frequency Range 30 MHz - 1000 MHz.

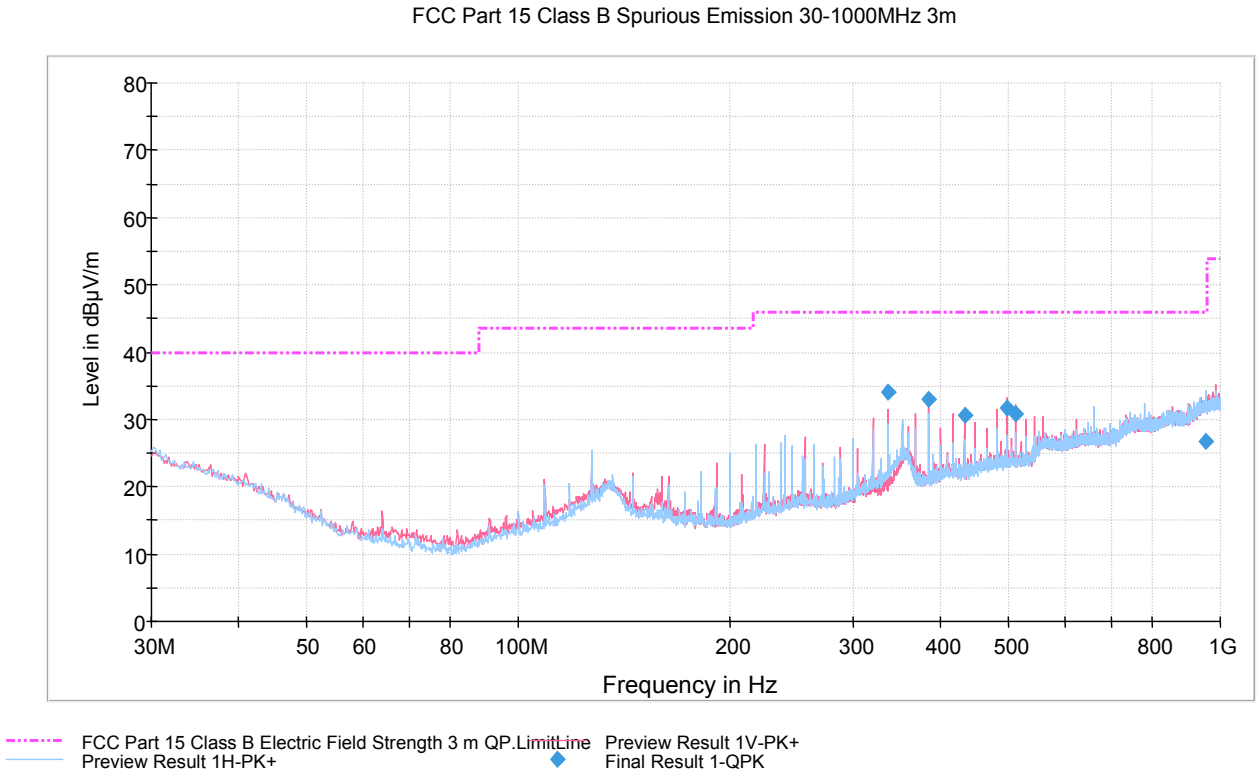

Figure 7. Measured curve with peak-detector. 802.11b low channel.

Final measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
336.015000	34.0	1000.0	120.000	138.0	V	104.0	16.0	12.0	46.0	
384.015000	33.0	1000.0	120.000	133.0	V	67.0	17.6	13.0	46.0	
432.015000	30.6	1000.0	120.000	100.0	V	69.0	18.9	15.4	46.0	
496.015000	31.6	1000.0	120.000	100.0	V	305.0	20.2	14.4	46.0	
512.025000	30.8	1000.0	120.000	100.0	V	300.0	20.3	15.2	46.0	
955.415000	26.7	1000.0	120.000	273.0	H	240.0	27.8	19.3	46.0	

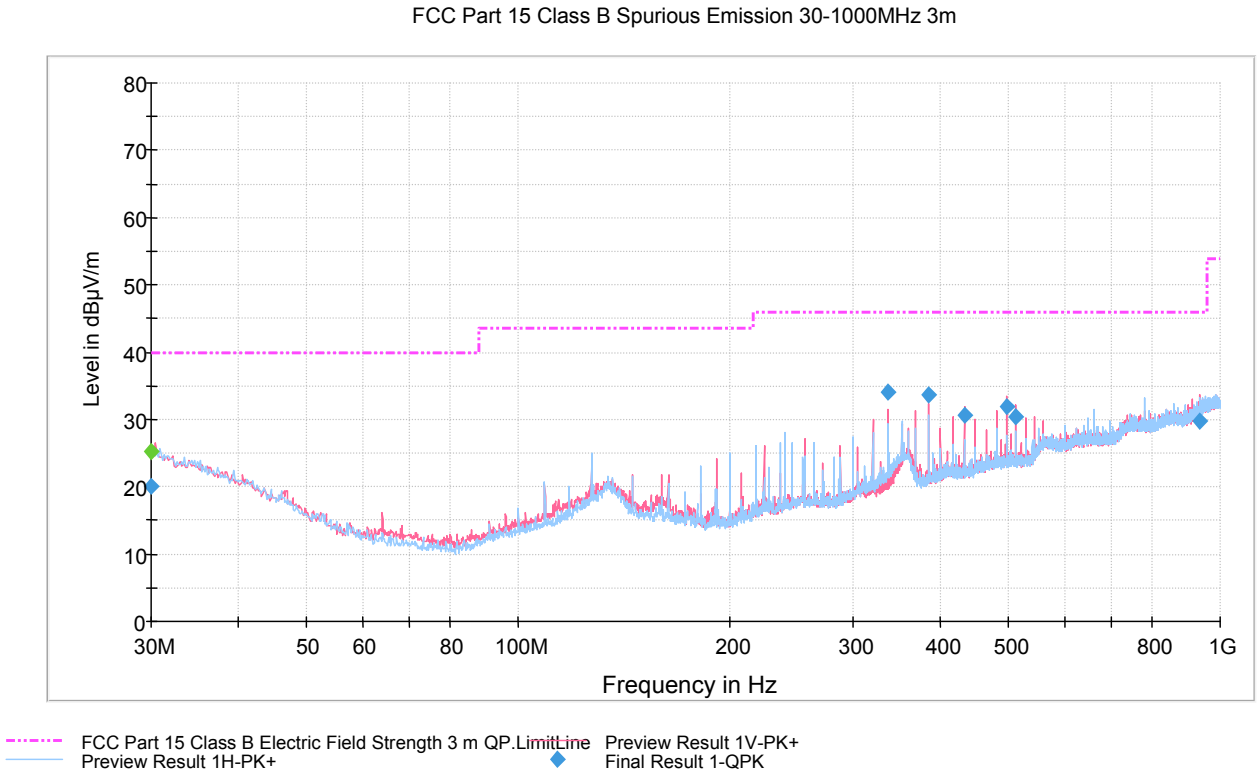

Figure 8. Measured curve with peak-detector. 802.11b middle channel.

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Final measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
30.040000	20.0	1000.0	120.000	291.0	V	114.0	23.7	20.0	40.0	
336.015000	34.1	1000.0	120.000	141.0	V	101.0	16.0	11.9	46.0	
384.015000	33.5	1000.0	120.000	133.0	V	318.0	17.6	12.5	46.0	
432.015000	30.6	1000.0	120.000	115.0	V	67.0	18.9	15.4	46.0	
496.015000	31.9	1000.0	120.000	100.0	V	284.0	20.2	14.1	46.0	
512.025000	30.4	1000.0	120.000	100.0	V	273.0	20.3	15.6	46.0	
936.015000	29.9	1000.0	120.000	100.0	V	116.0	27.3	16.2	46.0	

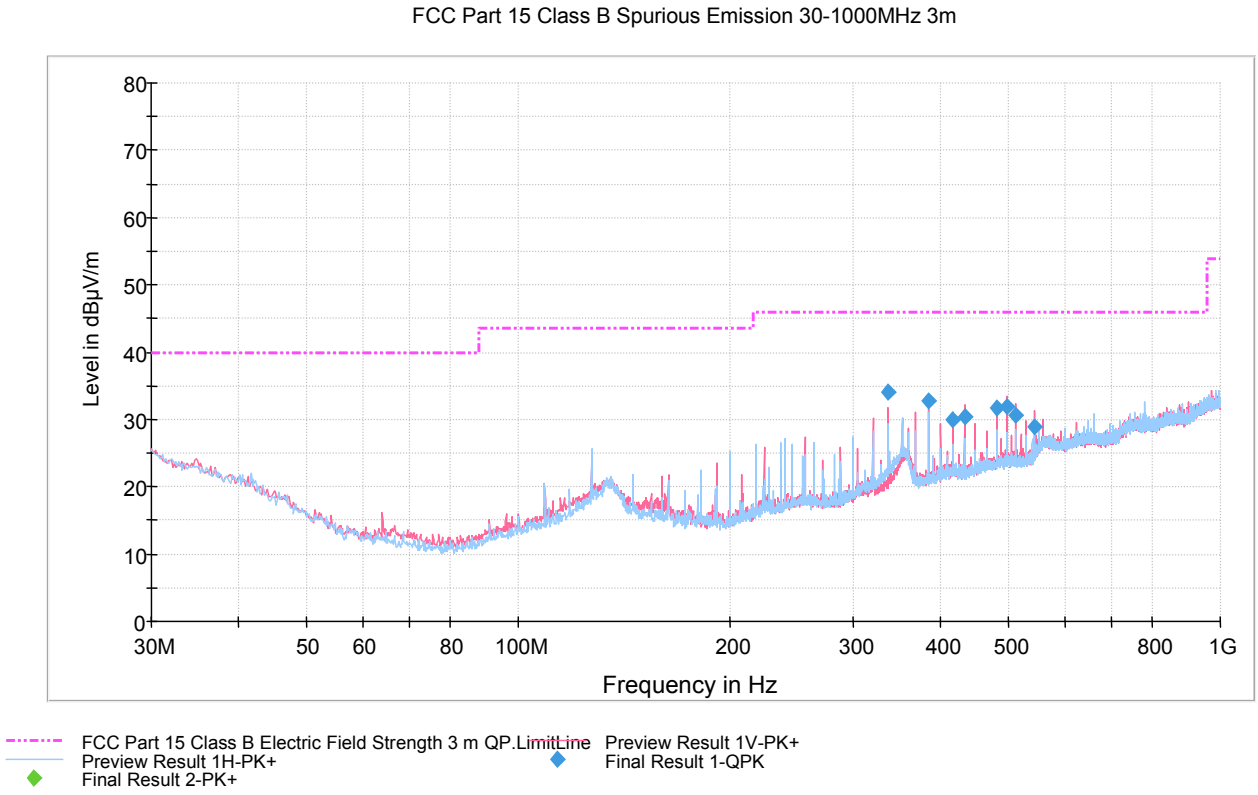

Figure 9. Measured curve with peak-detector. 802.11b high channel.

Final measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
336.015000	34.1	1000.0	120.000	138.0	V	110.0	16.0	11.9	46.0	
384.015000	32.8	1000.0	120.000	133.0	V	75.0	17.6	13.2	46.0	
416.005000	29.6	1000.0	120.000	100.0	V	68.0	18.9	16.4	46.0	
432.015000	30.3	1000.0	120.000	100.0	V	45.0	18.9	15.7	46.0	
480.015000	29.9	1000.0	120.000	100.0	V	250.0	20.0	16.1	46.0	
496.015000	32.0	1000.0	120.000	100.0	V	264.0	20.2	14.0	46.0	
512.025000	30.7	1000.0	120.000	100.0	V	290.0	20.3	15.3	46.0	
544.025000	28.8	1000.0	120.000	100.0	V	52.0	21.1	17.2	46.0	

Measured Peak and Average Values In The Frequency Range 1 000 MHz – 4 000 MHz.

The correction factor in the final result tables contains the sum of the transducers (antenna + amplifier + cables). The Max Peak and Average values are measured values corrected with the correction factor.

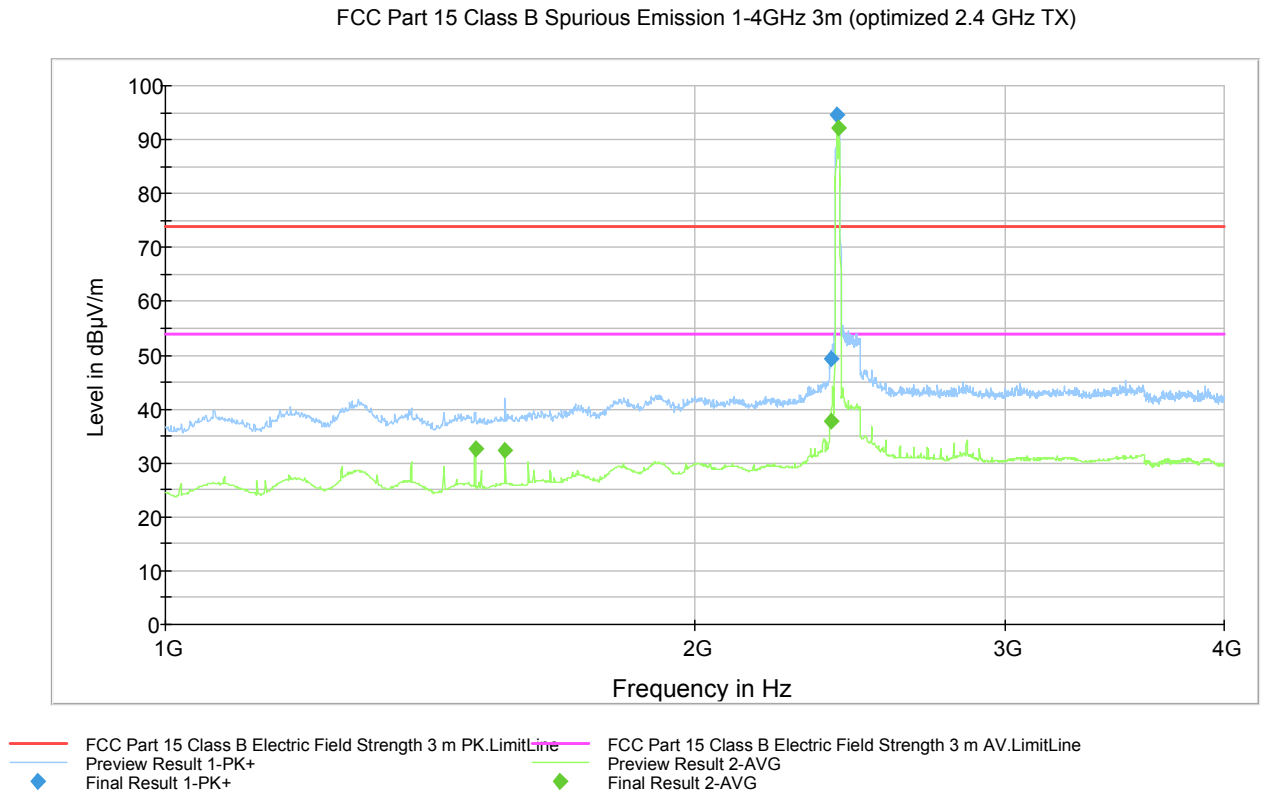

Figure 10. Measured curve with peak- and average detector. 802.11b low channel.

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Final measurements from the worst frequencies

Table 3. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2389.000000	49.2	1000.0	1000.000	149.0	V	188.0	4.3	24.7	73.9	
2411.000000	94.6	1000.0	1000.000	176.0	V	204.0	4.3	-20.7	73.9	Carrier

Table 4. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1500.025000	32.7	1000.0	1000.000	154.0	H	329.0	-2.1	21.2	53.9	
1560.025000	32.4	1000.0	1000.000	146.0	H	328.0	-1.5	21.5	53.9	
2390.000000	37.7	1000.0	1000.000	147.0	V	195.0	4.3	16.2	53.9	
2412.750000	92.3	1000.0	1000.000	176.0	V	205.0	4.3	-38.4	53.9	Carrier

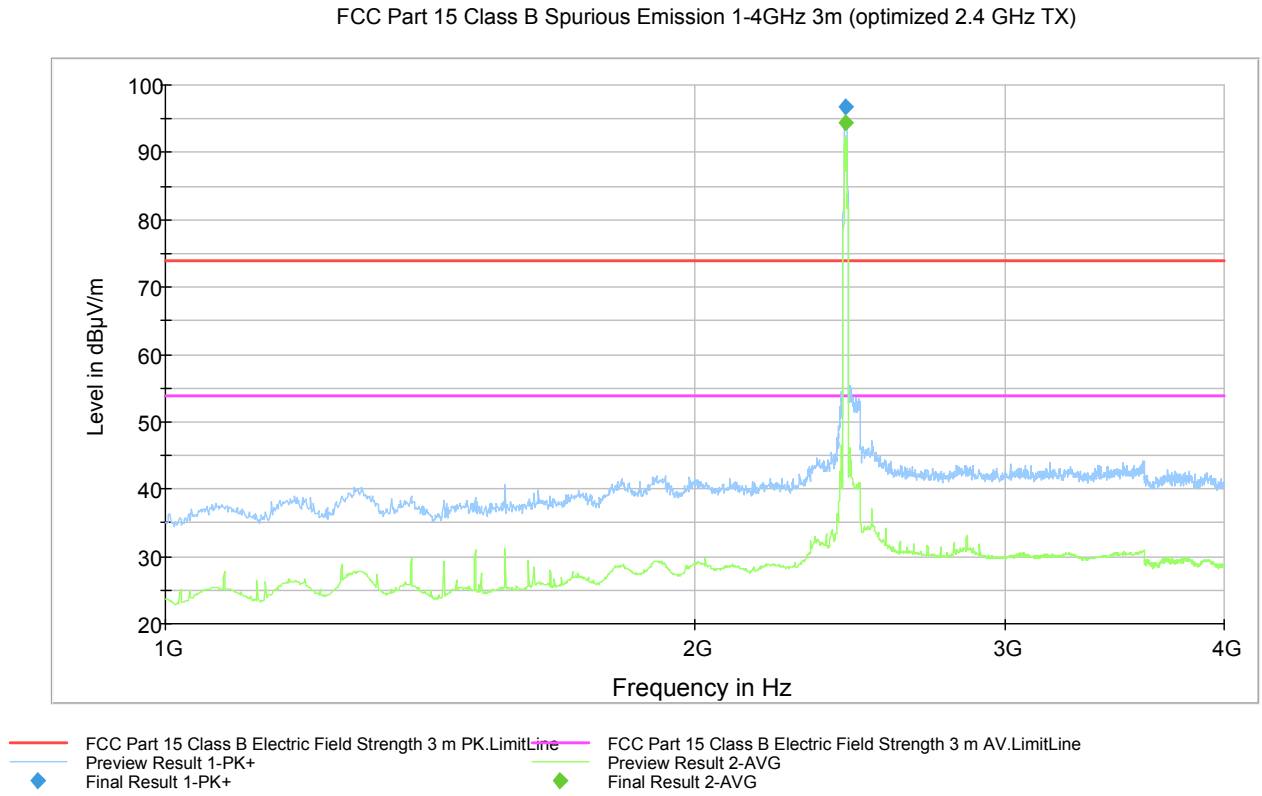

Figure 11. Measured curve with peak- and average detector. 802.11b middle channel.

Final measurements from the worst frequencies

Table 5. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2438.000000	96.8	1000.0	1000.000	146.0	V	217.0	4.1	-22.9	73.9	Carrier

Table 6. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2437.750000	94.5	1000.0	1000.000	146.0	V	213.0	4.1	-40.6	53.9	Carrier

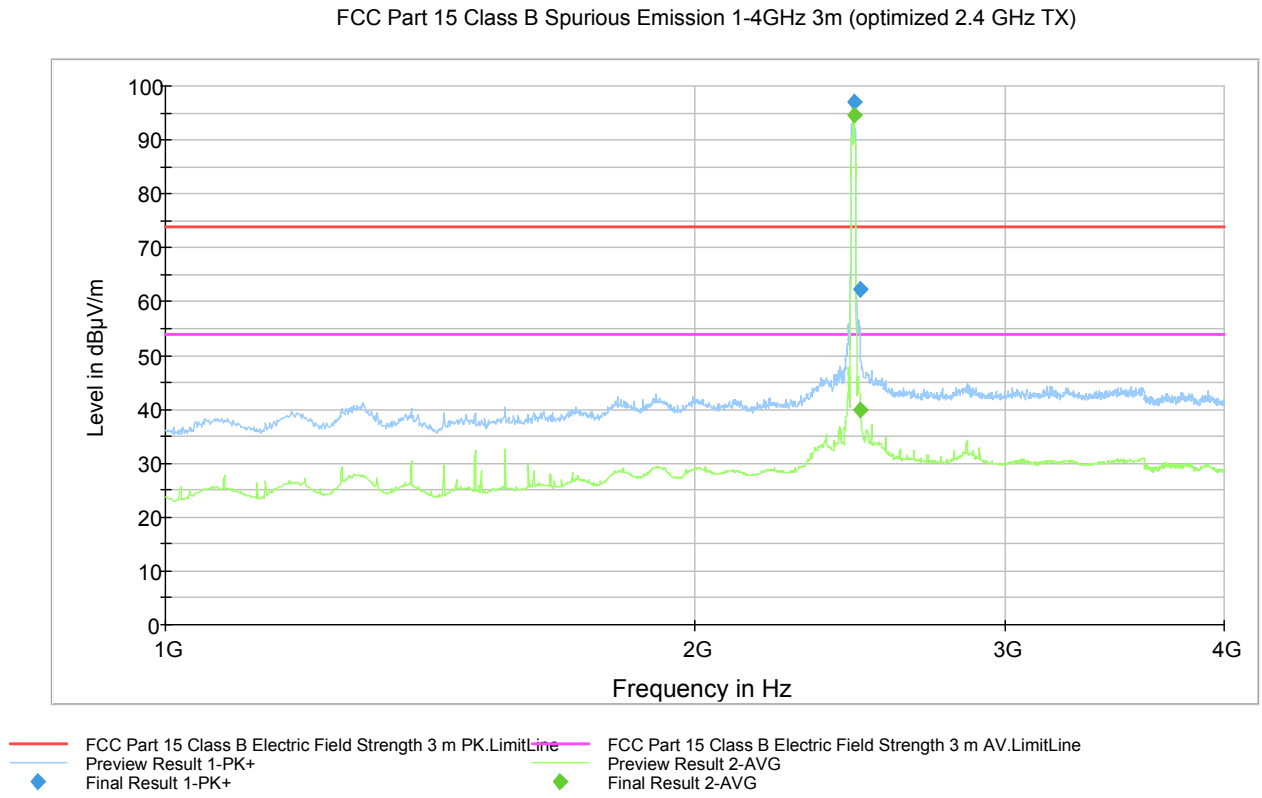

Figure 12. Measured curve with peak- and average detector. 802.11b high channel.

Final measurements from the worst frequencies

Table 7. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2462.900000	97.0	1000.0	1000.000	195.0	V	211.0	4.1	-23.1	73.9	Carrier
2483.700000	62.3	1000.0	1000.000	114.0	V	224.0	4.4	11.6	73.9	

Table 8. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2462.750000	94.6	1000.0	1000.000	146.0	V	211.0	4.1	-40.7	53.9	Carrier
2483.500000	39.9	1000.0	1000.000	138.0	V	210.0	4.4	14.0	53.9	

Measured Peak and Average Values In The Frequency Range 4 000 MHz – 18 000 MHz.

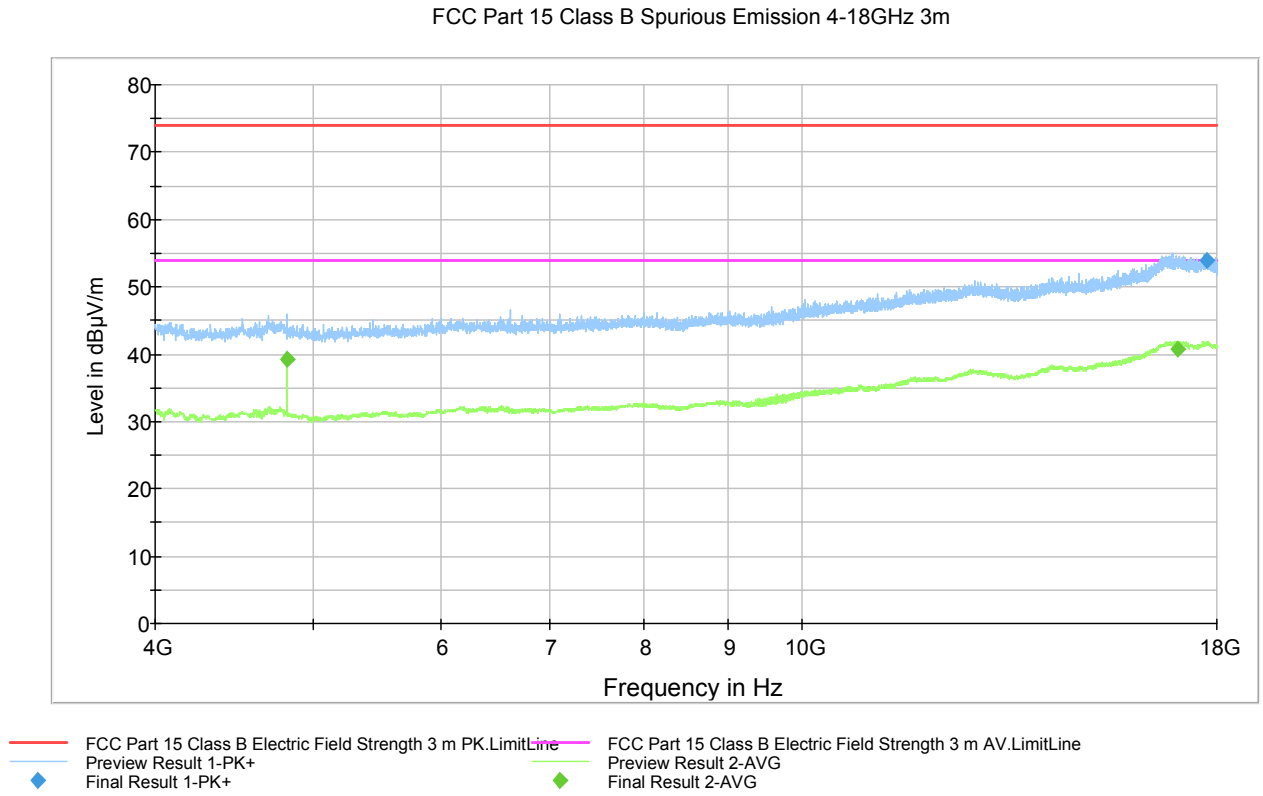

Figure 13. Measured curve with peak- and average detector. 802.11b low channel.

Final measurements from the worst frequencies

Table 9. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
17730.525000	54.0	1000.0	1000.000	187.0	H	298.0	25.5	19.9	73.9	

Table 10. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4823.925000	39.4	1000.0	1000.000	305.0	V	194.0	10.4	16.3	53.9	
17045.225000	40.7	1000.0	1000.000	305.0	V	272.0	25.4	13.2	53.9	

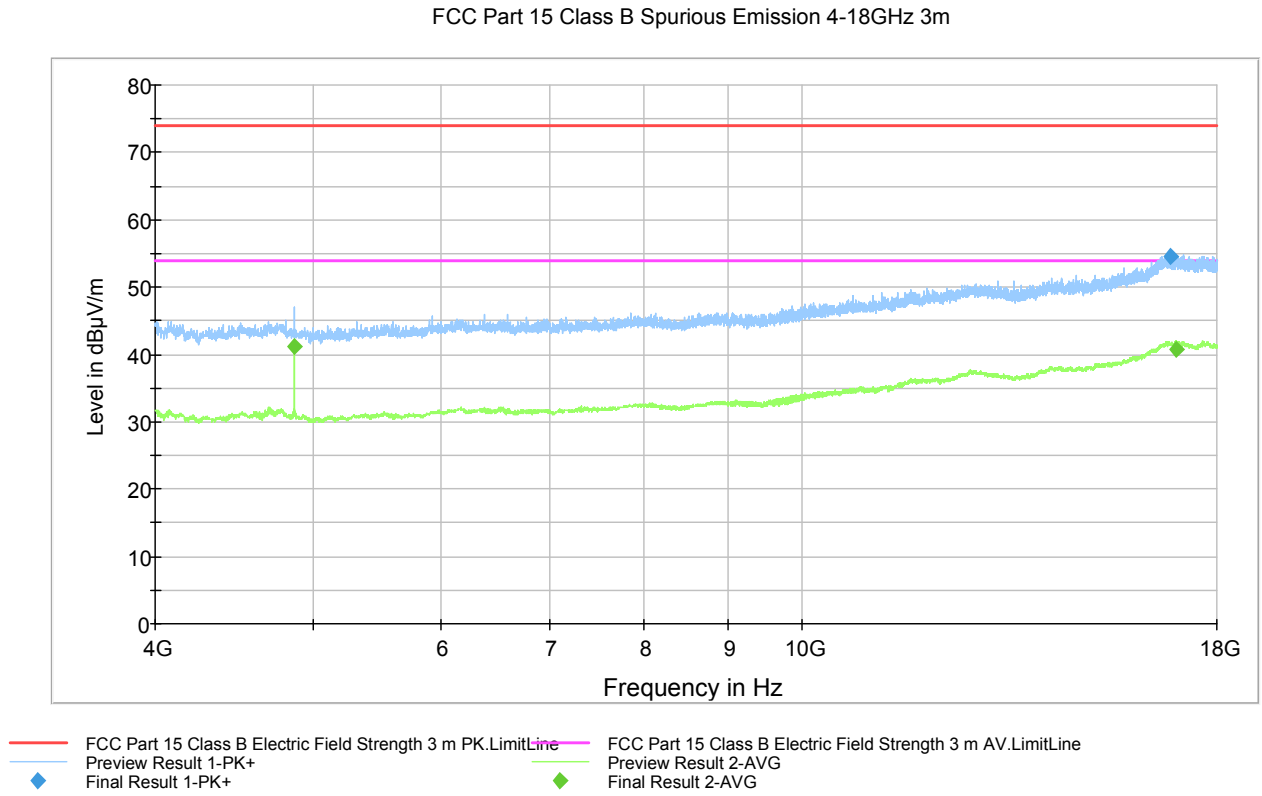

Figure 14. Measured curve with peak- and average detector. 802.11b middle channel.

Final measurements from the worst frequencies

Table 11. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
16852.575000	54.5	1000.0	1000.000	187.0	V	49.0	25.3	19.4	73.9	

Table 12. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4873.925000	41.1	1000.0	1000.000	105.0	V	237.0	10.3	12.8	53.9	
16986.925000	40.7	1000.0	1000.000	284.0	V	171.0	25.5	13.2	53.9	

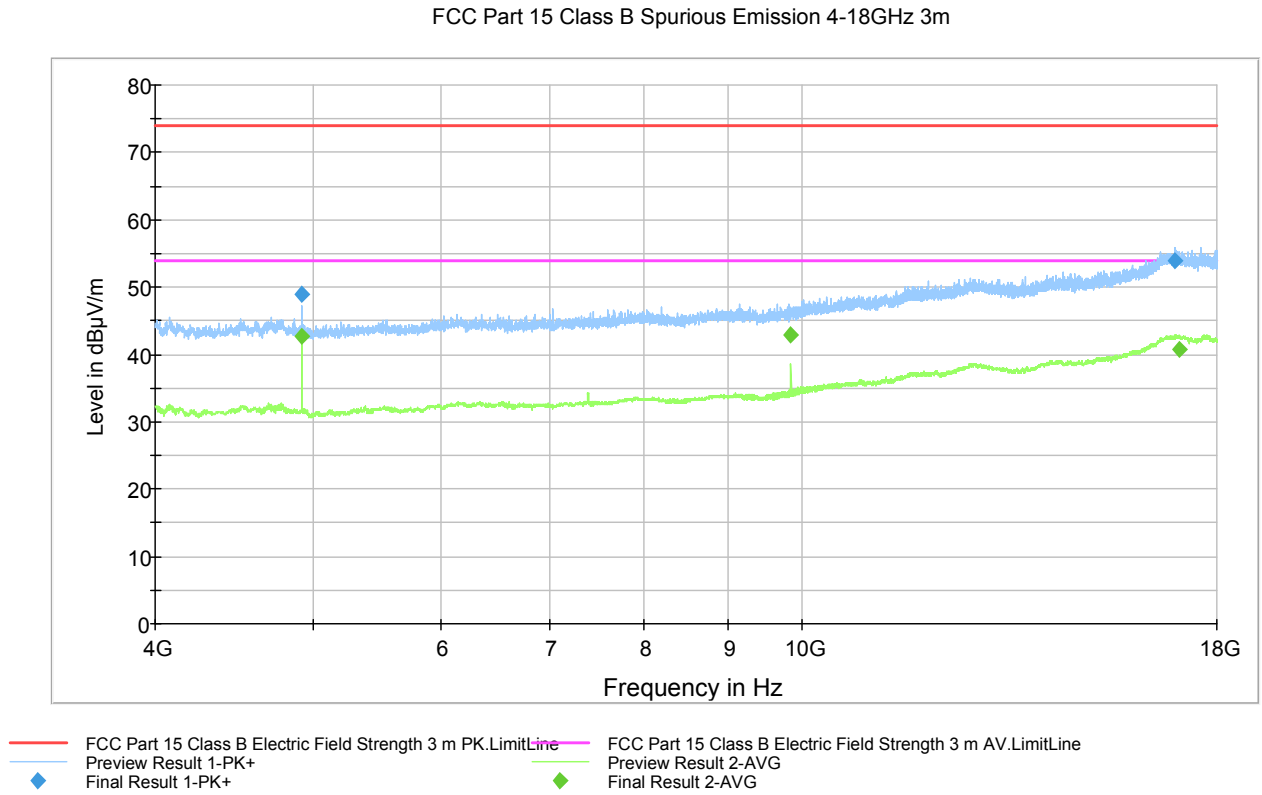

Figure 15. Measured curve with peak- and average detector. 802.11b high channel.

Final measurements from the worst frequencies

Table 13. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4923.925000	48.9	1000.0	1000.000	147.0	V	247.0	10.4	25.0	73.9	
16958.575000	53.9	1000.0	1000.000	268.0	V	307.0	25.4	20.0	73.9	

Table 14. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4923.925000	42.7	1000.0	1000.000	100.0	V	266.0	10.4	11.2	53.9	
9848.075000	42.9	1000.0	1000.000	100.0	H	189.0	15.5	11.0	53.9	
17051.875000	40.7	1000.0	1000.000	284.0	V	274.0	25.4	13.2	53.9	

Measured Peak and Average Values In The Frequency Range 18 000 MHz – 26 500 MHz.

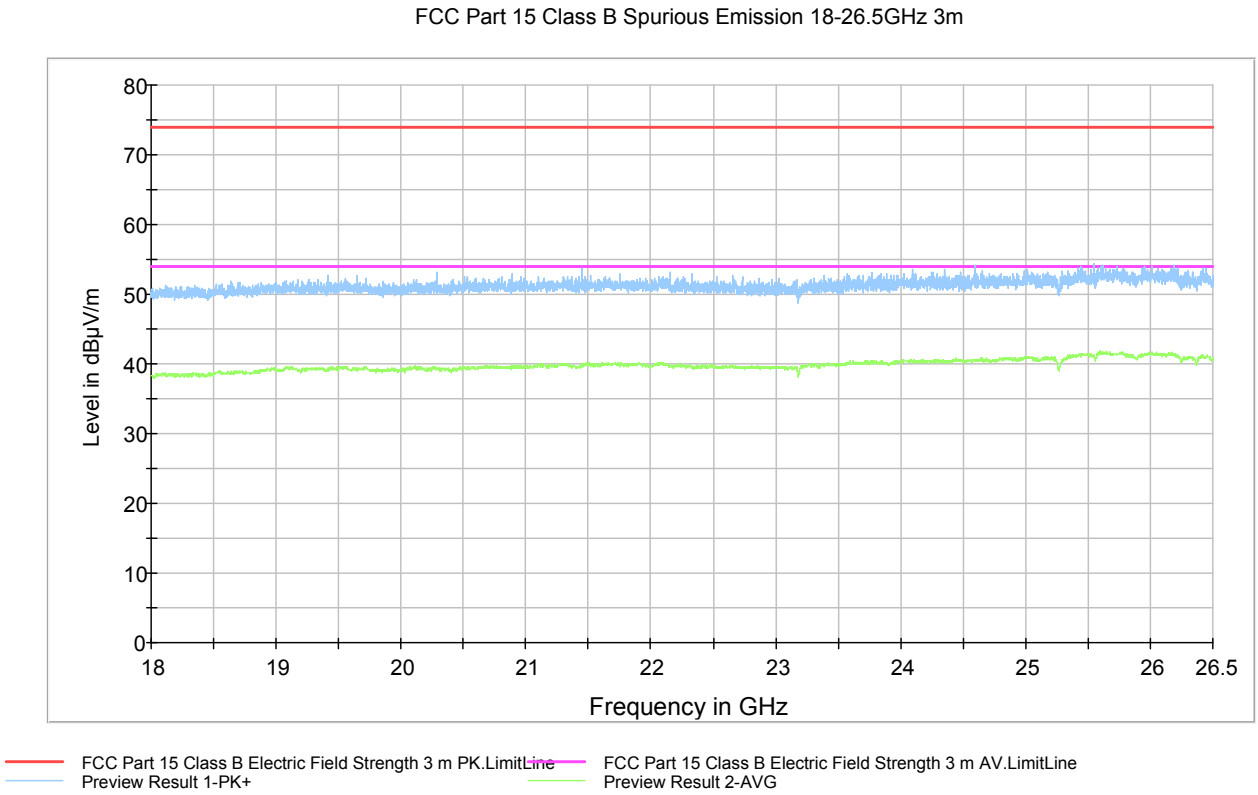

Figure 16. Measured curve with peak- and average detector. 802.11b low channel.

Due to the low emission level no final measurements were made.

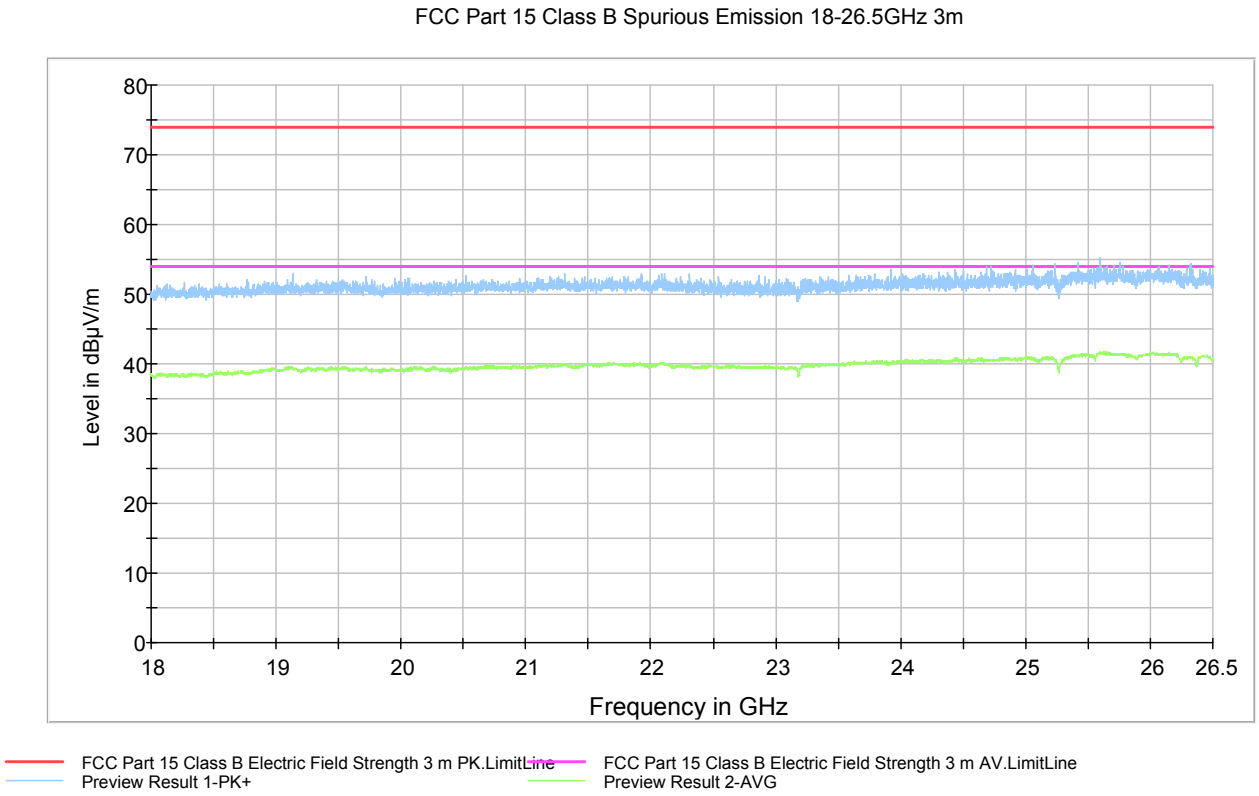

Figure 17. Measured curve with peak- and average detector. 802.11b middle channel.

Due to the low emission level no final measurements were made.

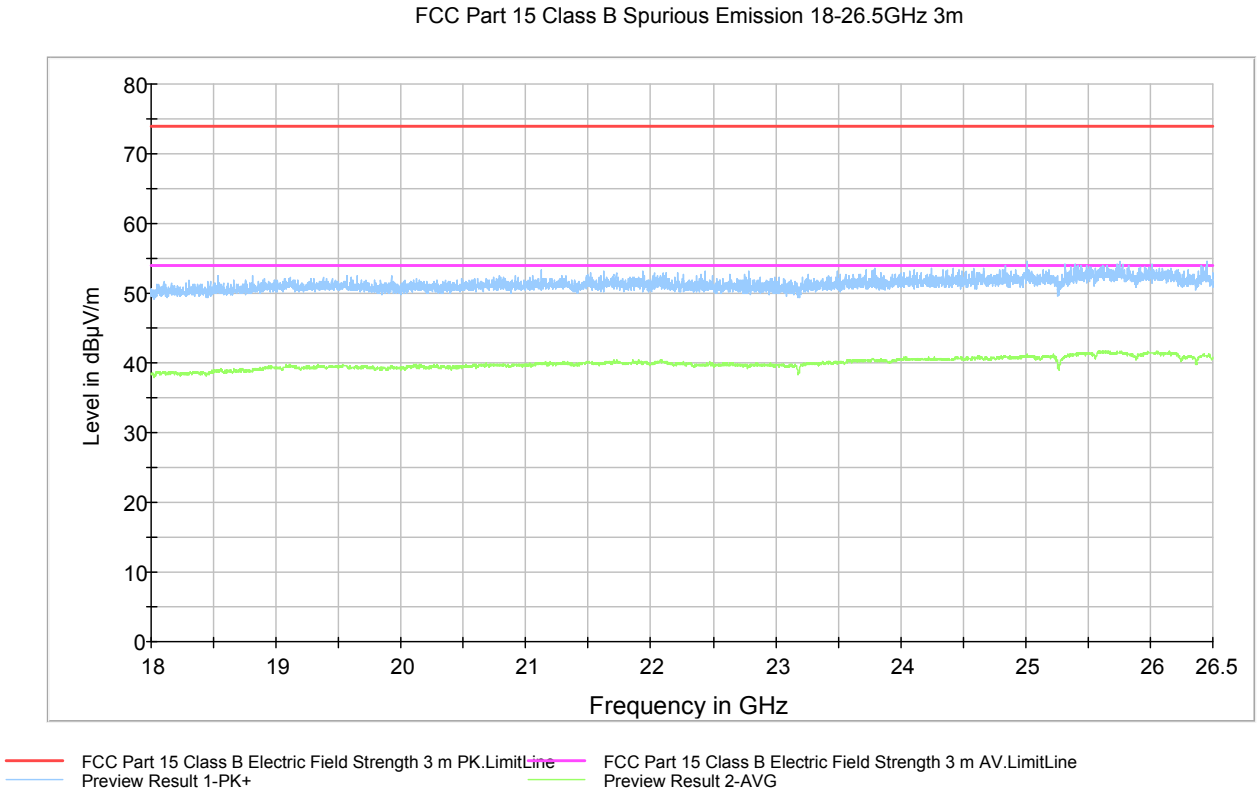

Figure 18. Measured curve with peak- and average detector. 802.11b high channel.

Due to the low emission level no final measurements were made.

List of test equipment

Manufacturer	Type	Serial no	Inv. no
ROHDE & SCHWARZ			
EMI Test receiver	ESU 26	100185	8453
Test software	EMC32	-	-
DAVIS			
Weather station	Vantage Pro	-	5297
EMCO			
Antenna (1 - 18 GHz)	3117	29617	7293
CHASE			
Antenna (30 MHz - 1 GHz)	6141A	4102	7895
HEWLETT- PACKARD			
Microwave amplifier	83017A	-	5226
DEISEL			
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
WAINWRIGHT			
High Pass Filter	WHKX	10	8267