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: IC Rule Part	15.247: 2010 RSS-210, Issue 8, 2010 RSS-GEN Issue 3, 2010

Date: 11.01.2012
Issued by:
Niko Tolonen
Testing Engineer

Date: 11.01.2012
Checked by:
Jari Merikari
Technical Manager

Table of Contents

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. For these tests 802.11 b/g WLAN feature is disabled and these tests concerns the Bluetooth feature only.

The purpose of these tests is to demonstrate that the module complies with the FCC rules when different antenna construction is used, WLAN feature is disabled and the module is installed into the final host. In the original grant module was tested by using the monopole omnidirectinoal 3dBi 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):	2402 – 2480 MHz
Channels:	79
Channel separation:	1 MHz
Channel bandwidth (20 dB):	1.027 MHz
Conducted power:	3.2 dBm
Transmission technique:	Frequency Hopping
Modulation:	GFSK, π/4DQPSK, 8DPSK
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) = 2402 MHz

Channel MID (CH 39) = 2441 MHz

Channel HIGH (CH 79) = 2480 MHz

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:	NTO	
Date:	29.12.2011	
Humidity:	49 %	
Temperature:	21 °C	
Measurement uncertainty	± 2,87dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz, employing less that 75 channels limit is 0.125 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:

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	3.20	30	26.80	PASS
Mid	2.68	30	27.32	PASS
High	2.31	30	27.69	PASS

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

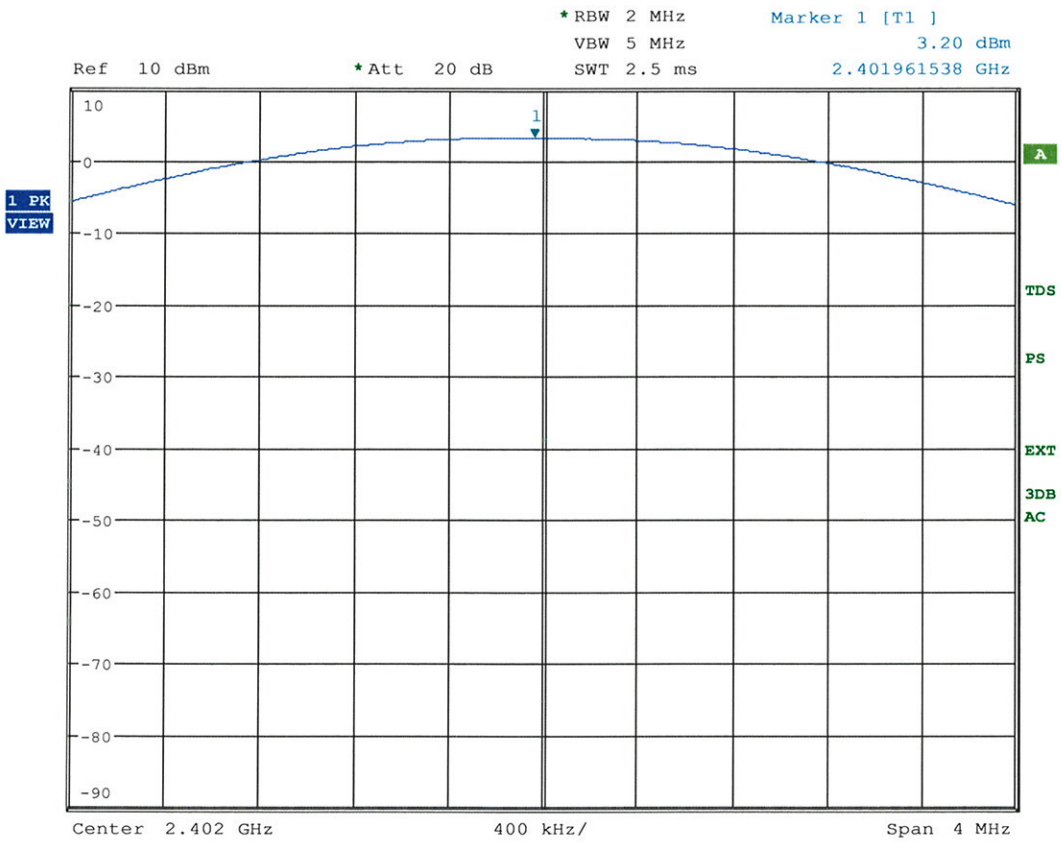

Figure 1. Channel LOW.

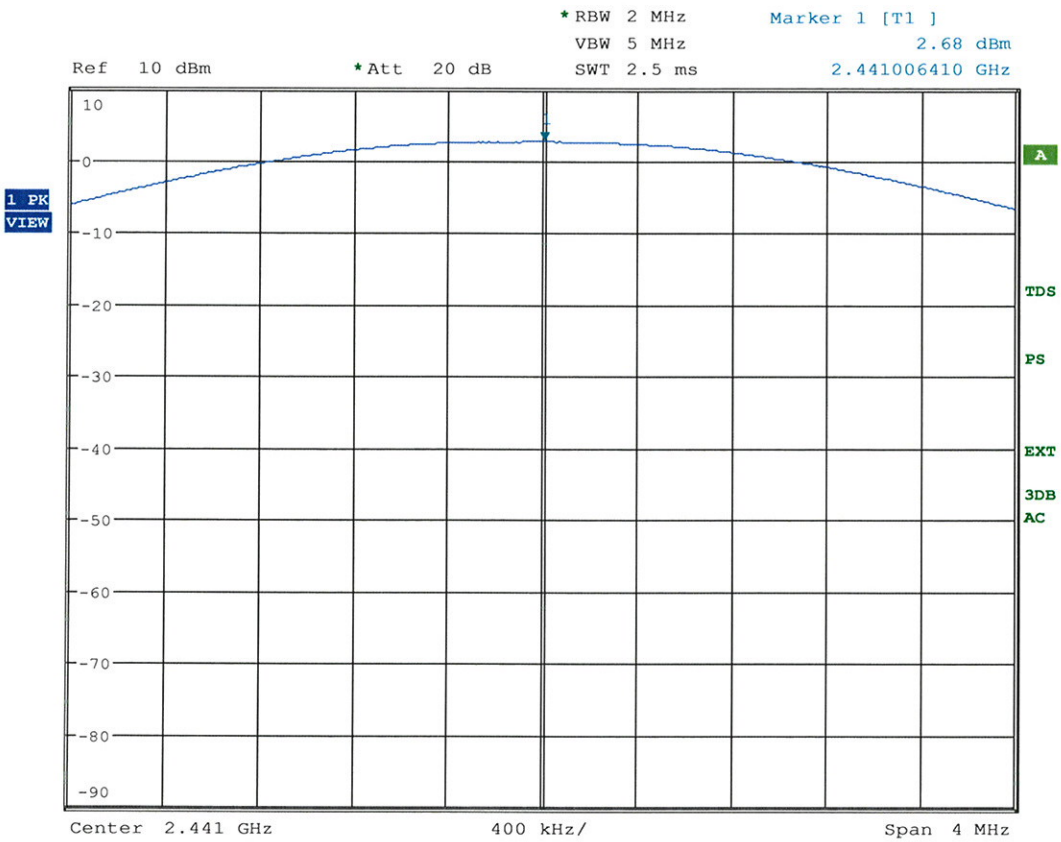

Figure 2. Channel MID.

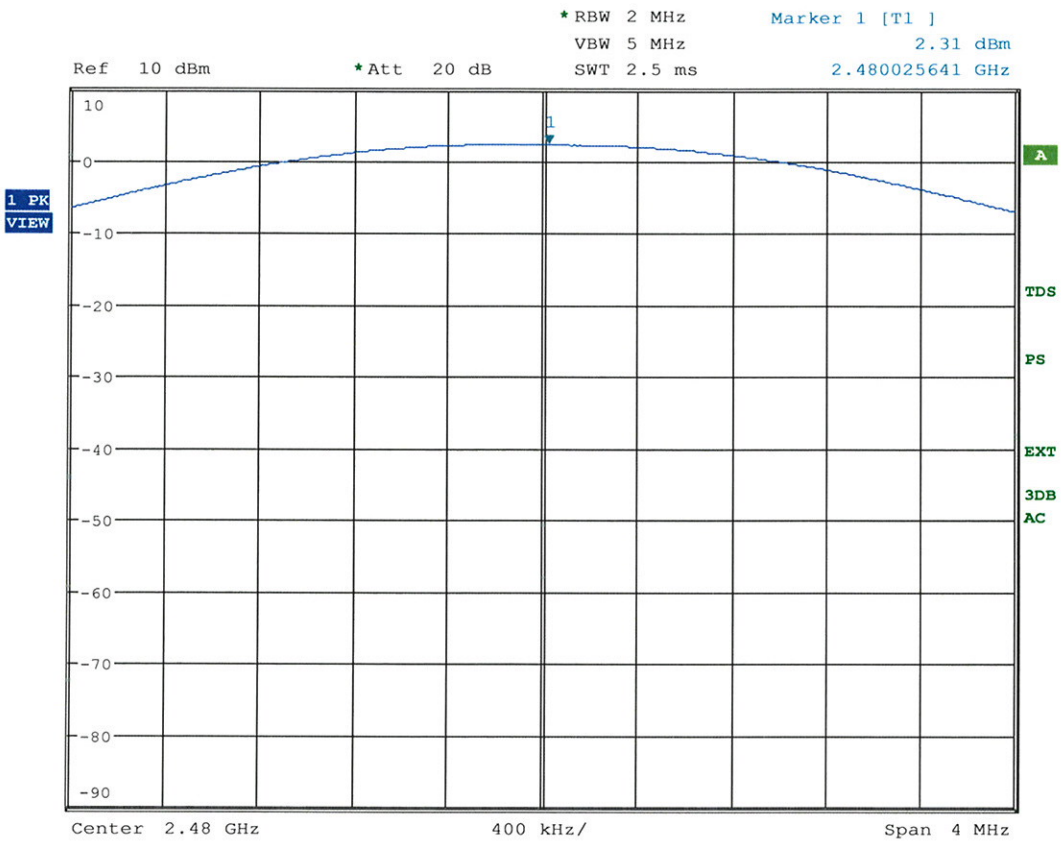

Figure 3. Channel HIGH.

Transmitter Radiated Emissions 30 – 26 500 MHz

Standard:	ANSI C63.10	(2009)
Tested by:	NTO	
Date:	27. – 29.12.2011	
Humidity:	49 - 53 %	
Temperature:	20 - 21 °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.

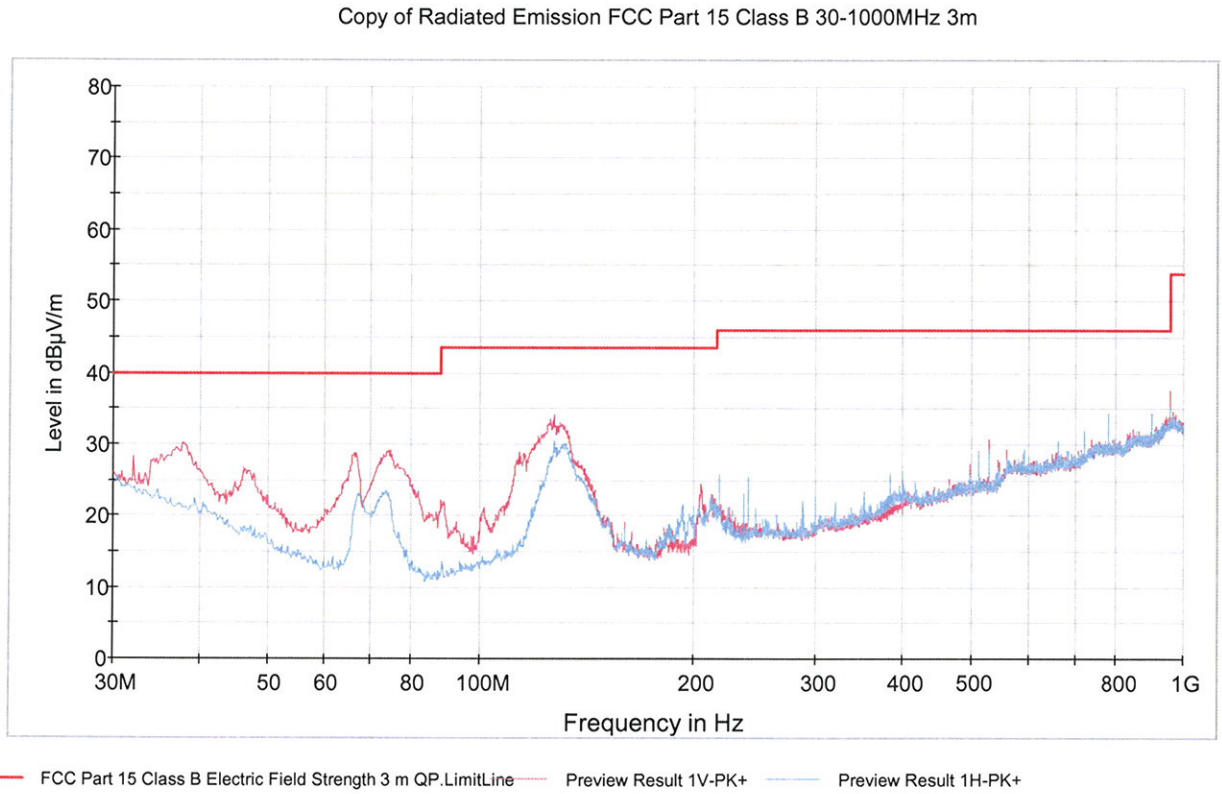

Figure 4. Measured curve with peak-detector. Channel LOW.

Final measurements from the worst frequencies

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

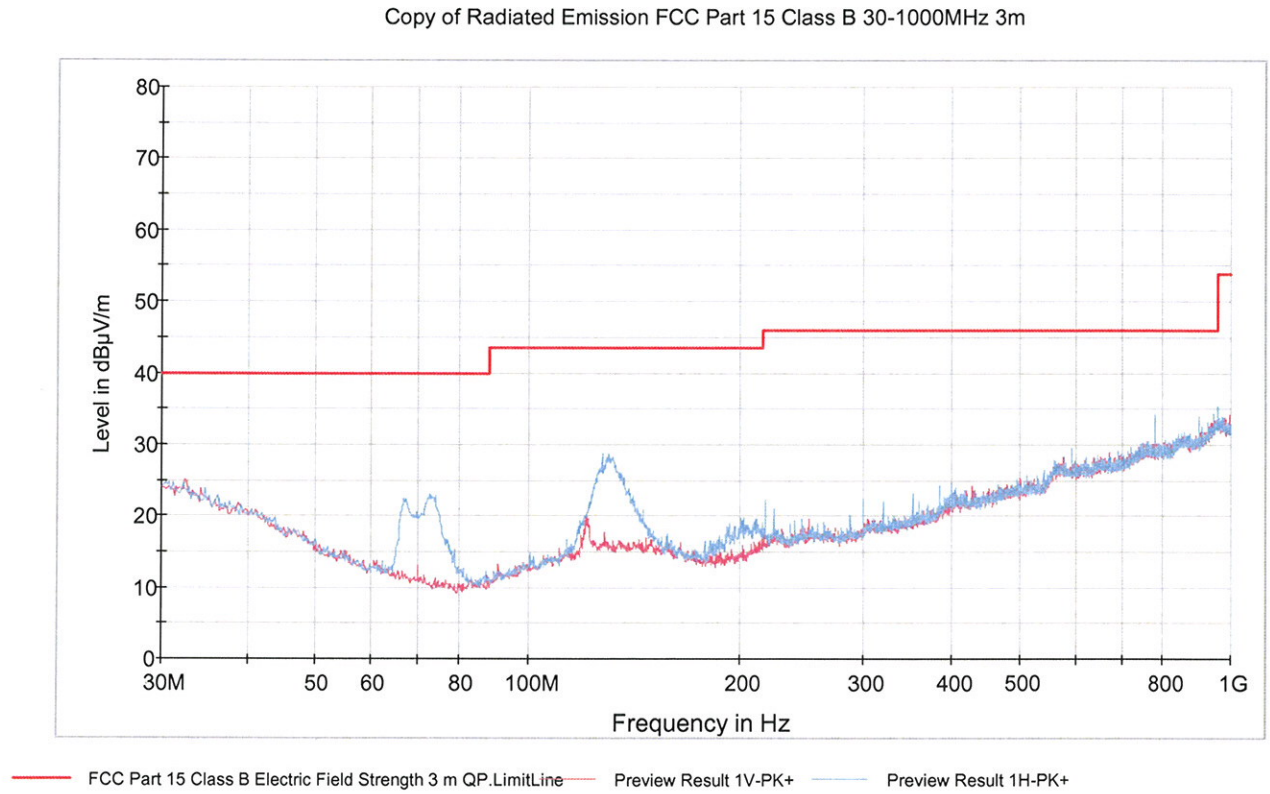

Figure 5. Measured curve with peak-detector. Channel MID.

Final measurements from the worst frequencies

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

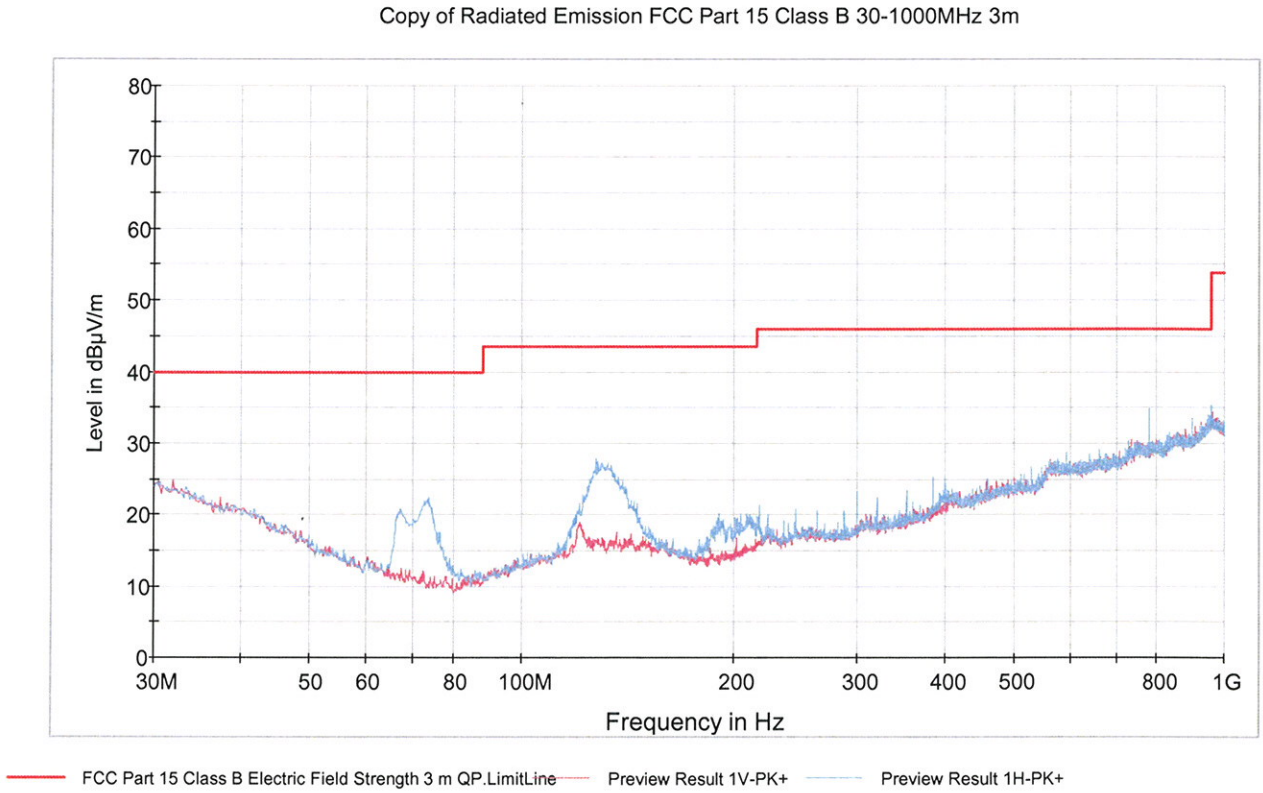

Figure 6. Measured curve with peak-detector. Channel HIGH.

Final measurements from the worst frequencies

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

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.

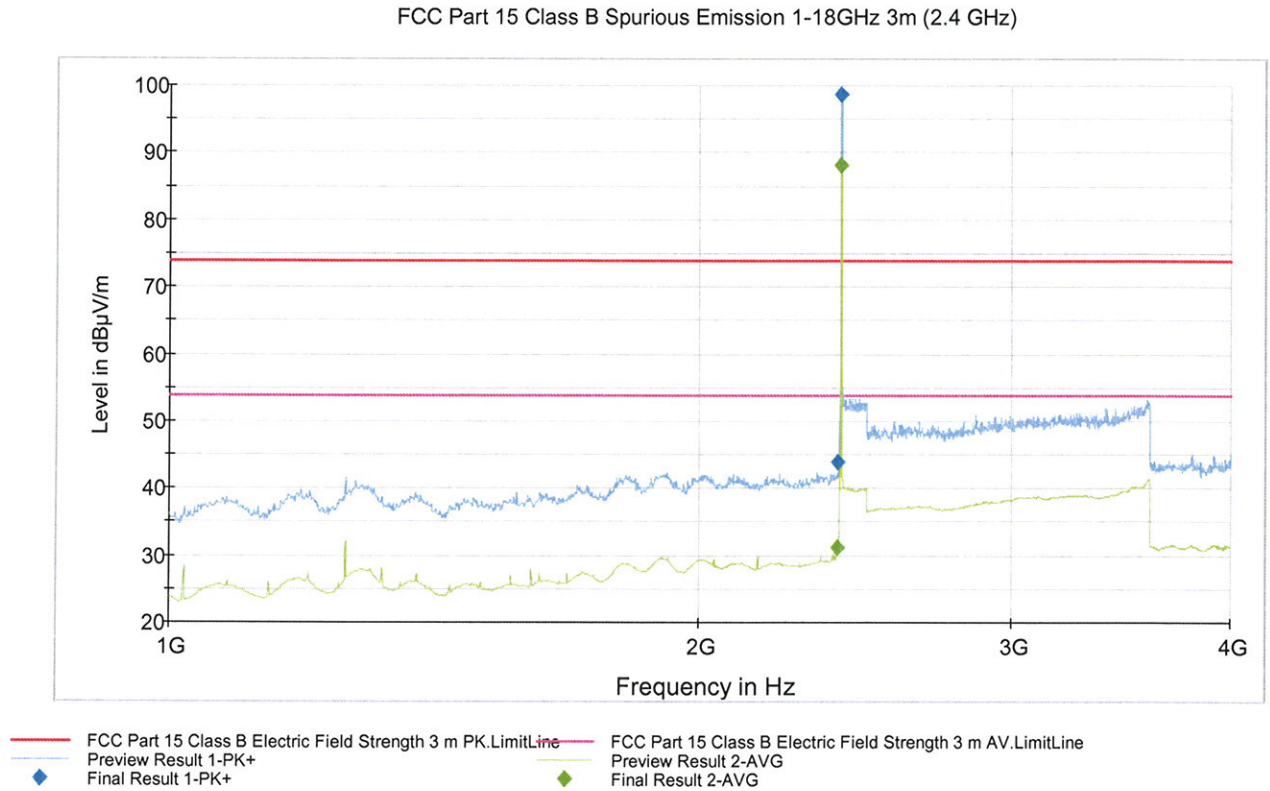

Figure 7. Measured curve with peak- and average detector. Channel LOW.

Final measurements from the worst frequencies

Table 1. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2390.000000	44.0	1000.0	1000.000	192.0	V	278.0	4.6	29.9	73.9	
2401.800000	98.6	1000.0	1000.000	124.0	V	225.0	4.7	-24.7	73.9	Carrier

Table 2. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2390.000000	31.3	1000.0	1000.000	122.0	V	213.0	4.6	22.6	53.9	
2402.000000	88.1	1000.0	1000.000	123.0	V	226.0	4.7	-34.2	53.9	Carrier

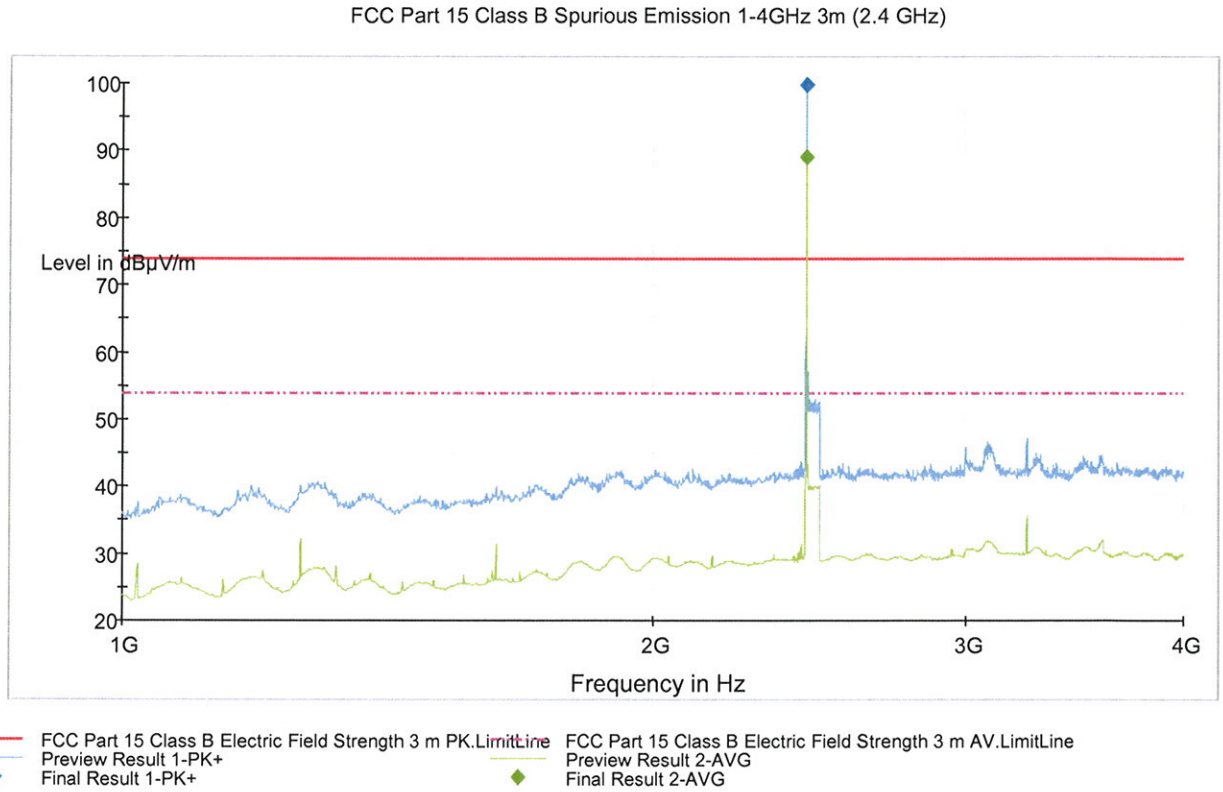

Figure 8. Measured curve with peak- and average detector. Channel MID.

Final measurements from the worst frequencies

Table 3. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2440.800000	99.8	1000.0	1000.000	238.0	V	202.0	4.4	-25.9	73.9	Carrier

Table 4. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2441.000000	89.1	1000.0	1000.000	235.0	V	175.0	4.4	-35.2	53.9	Carrier

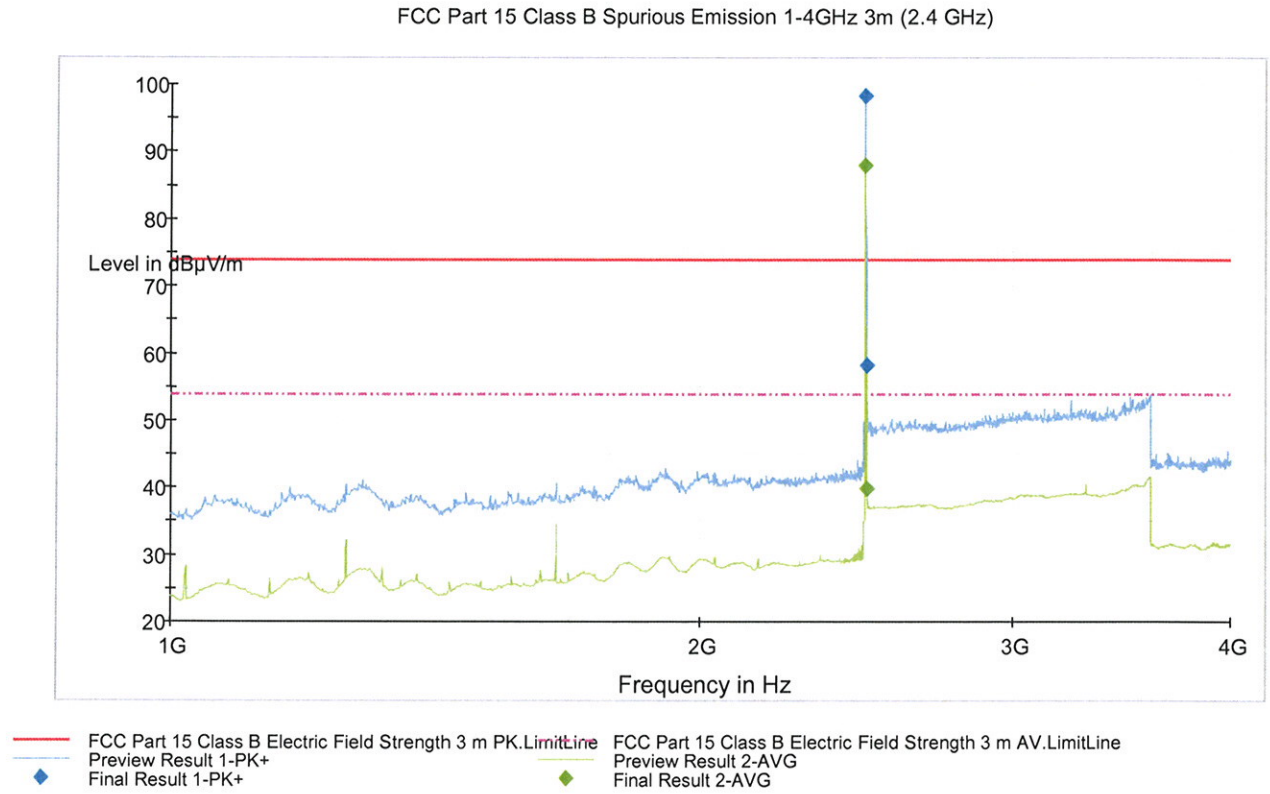

Figure 9. Measured curve with peak- and average detector. Channel HIGH.

Final measurements from the worst frequencies

Table 5. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2479.800000	98.3	1000.0	1000.000	232.0	V	183.0	4.6	-24.4	73.9	Carrier
2483.500000	58.1	1000.0	1000.000	264.0	V	202.0	4.7	15.8	73.9	

Table 6. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2480.000000	88.0	1000.0	1000.000	230.0	V	182.0	4.7	-34.1	53.9	Carrier
2483.500000	39.8	1000.0	1000.000	268.0	V	205.0	4.7	14.1	53.9	

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

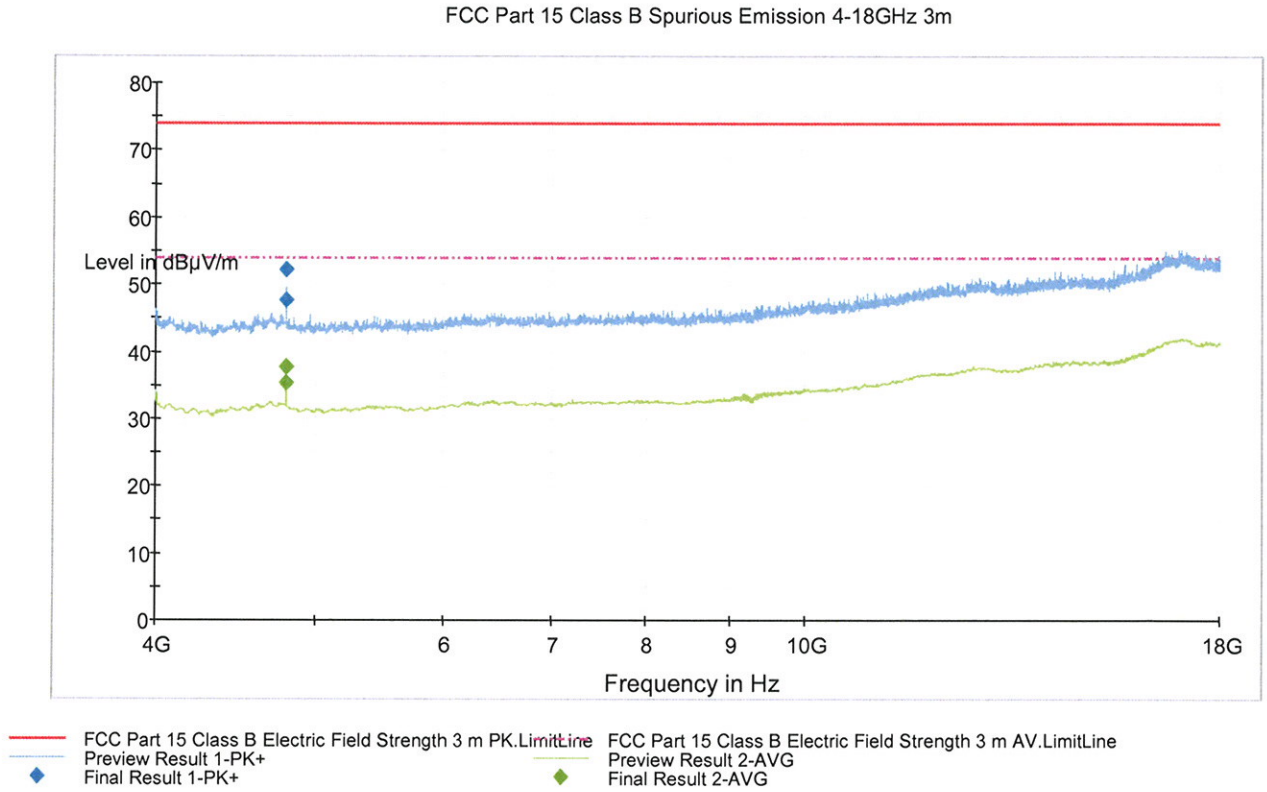

Figure 10. Measured curve with peak- and average detector. Channel LOW.

Final measurements from the worst frequencies

Table 7. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4804.125000	52.2	1000.0	1000.000	118.0	H	212.0	10.8	21.7	73.9	
4804.525000	47.7	1000.0	1000.000	106.0	V	216.0	10.8	26.2	73.9	

Table 8. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4803.925000	37.8	1000.0	1000.000	109.0	H	213.0	10.8	16.1	53.9	
4803.925000	35.3	1000.0	1000.000	122.0	V	207.0	10.8	18.6	53.9	

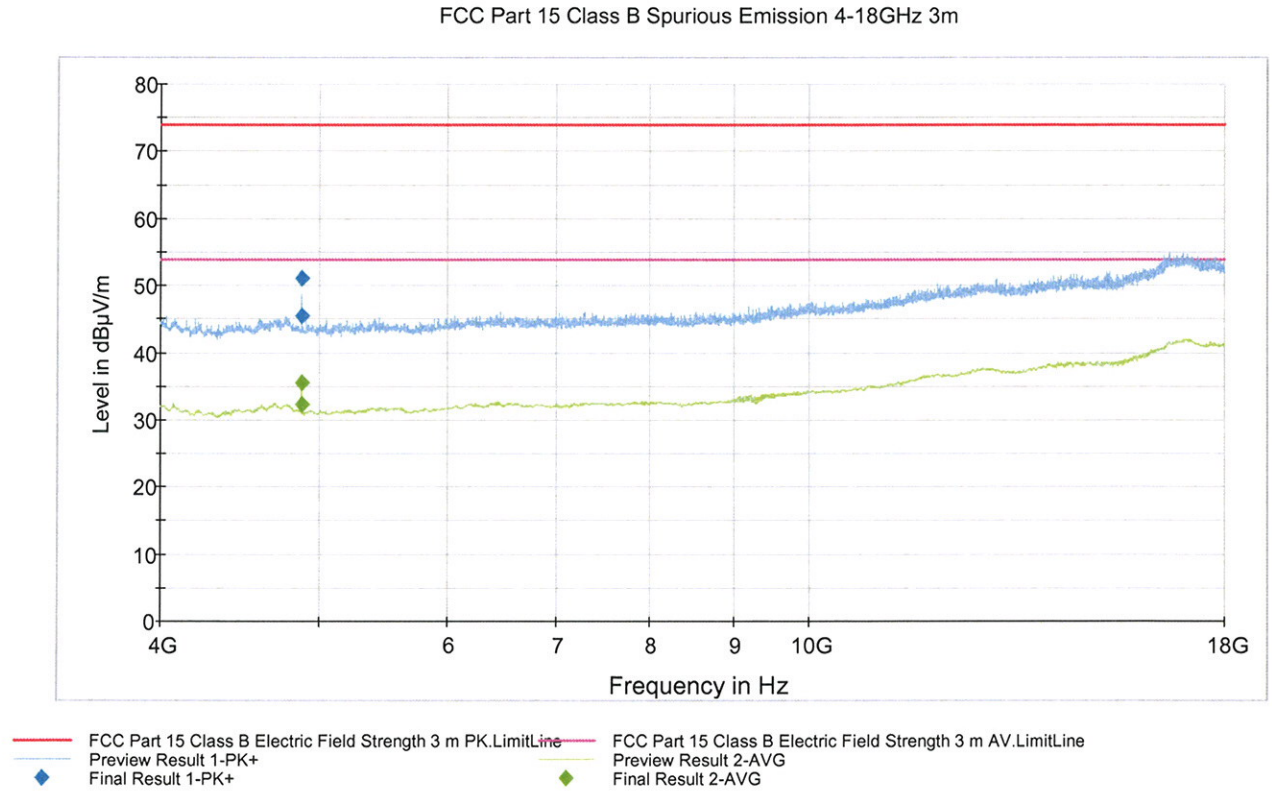

Figure 11. Measured curve with peak- and average detector. Channel MID.

Final measurements from the worst frequencies

Table 9. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4881.875000	51.1	1000.0	1000.000	109.0	H	221.0	10.6	22.8	73.9	
4882.475000	45.6	1000.0	1000.000	200.0	V	222.0	10.6	28.3	73.9	

Table 10. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4882.075000	35.5	1000.0	1000.000	100.0	H	221.0	10.6	18.4	53.9	
4882.075000	32.2	1000.0	1000.000	196.0	V	221.0	10.6	21.7	53.9	

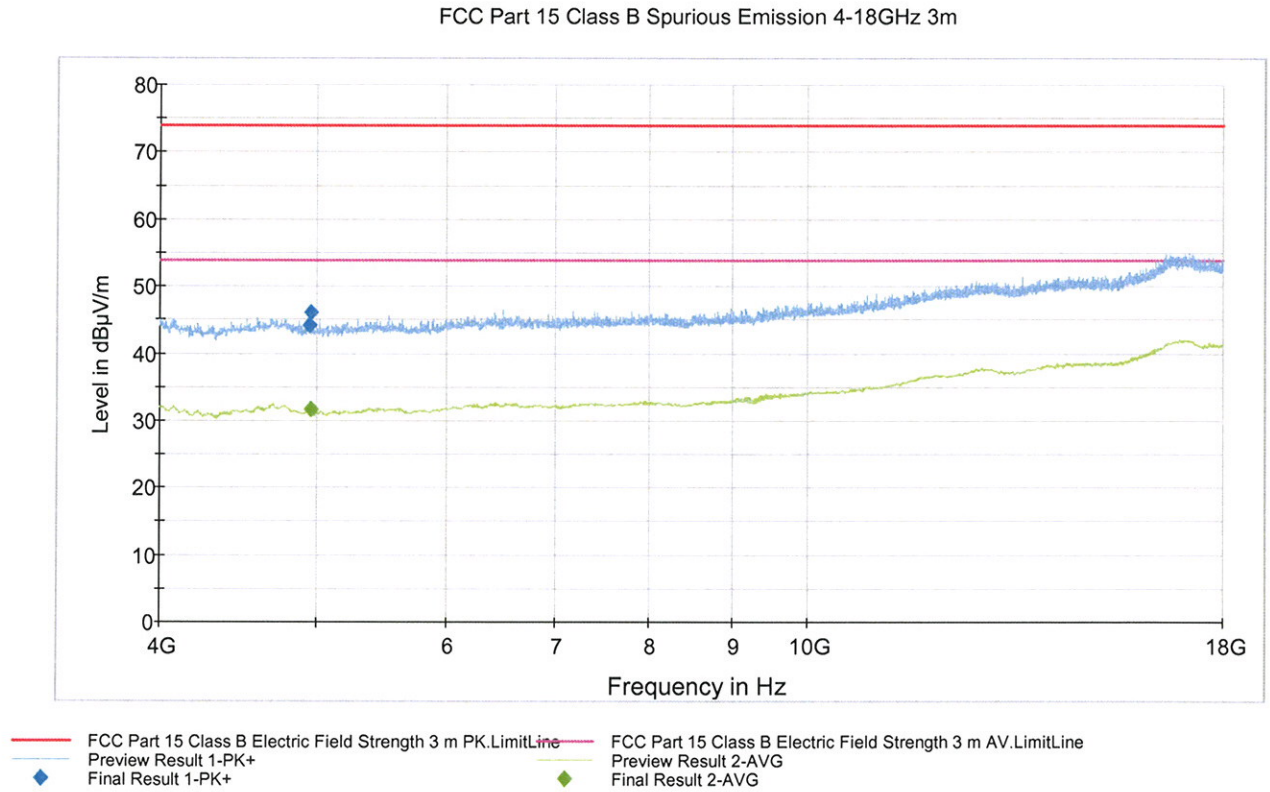

Figure 12. Measured curve with peak- and average detector. Channel HIGH.

Final measurements from the worst frequencies

Table 11. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4955.575000	44.2	1000.0	1000.000	109.0	V	219.0	10.6	29.7	73.9	
4959.975000	46.2	1000.0	1000.000	113.0	H	270.0	10.6	27.7	73.9	

Table 12. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4959.775000	31.6	1000.0	1000.000	110.0	V	270.0	10.6	22.3	53.9	
4960.175000	31.6	1000.0	1000.000	110.0	H	270.0	10.6	22.3	53.9	

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

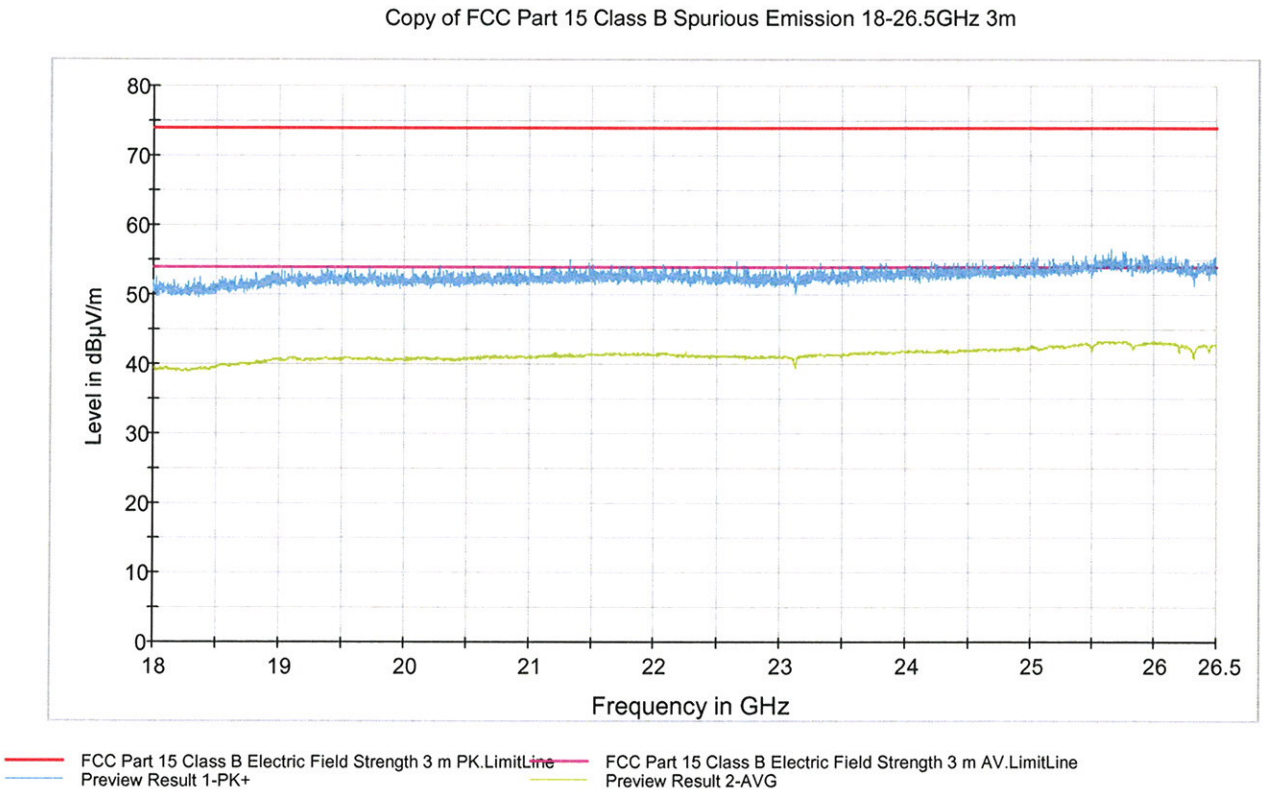

Figure 13. Measured curve with peak- and average detector. Channel LOW.

Preliminary measurement was made by using 8 degree turntable angle and 50 cm antenna step between the scans. Due to the low emission level no final measurements were made.

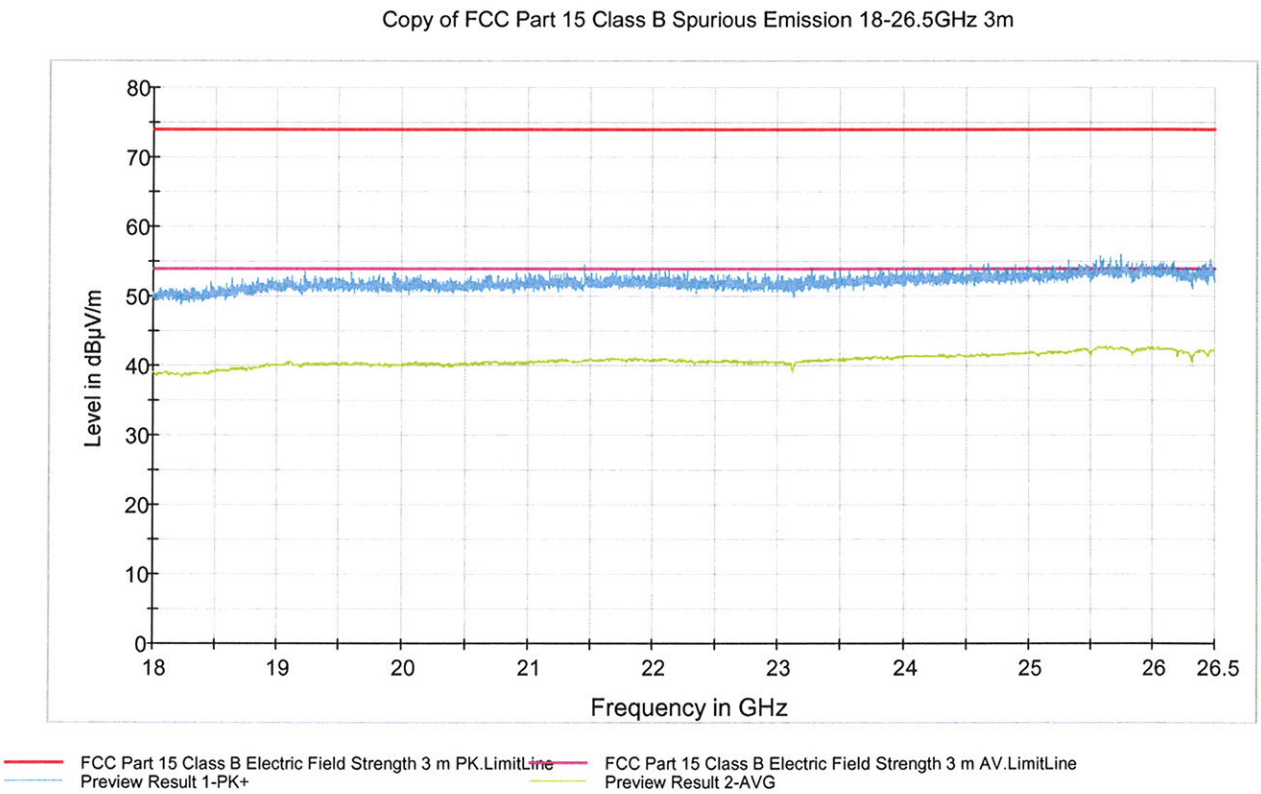

Figure 14. Measured curve with peak- and average detector. Channel MID.

Preliminary measurement was made by using 8 degree turntable angle and 50 cm antenna step between the scans. Due to the low emission level no final measurements were made.

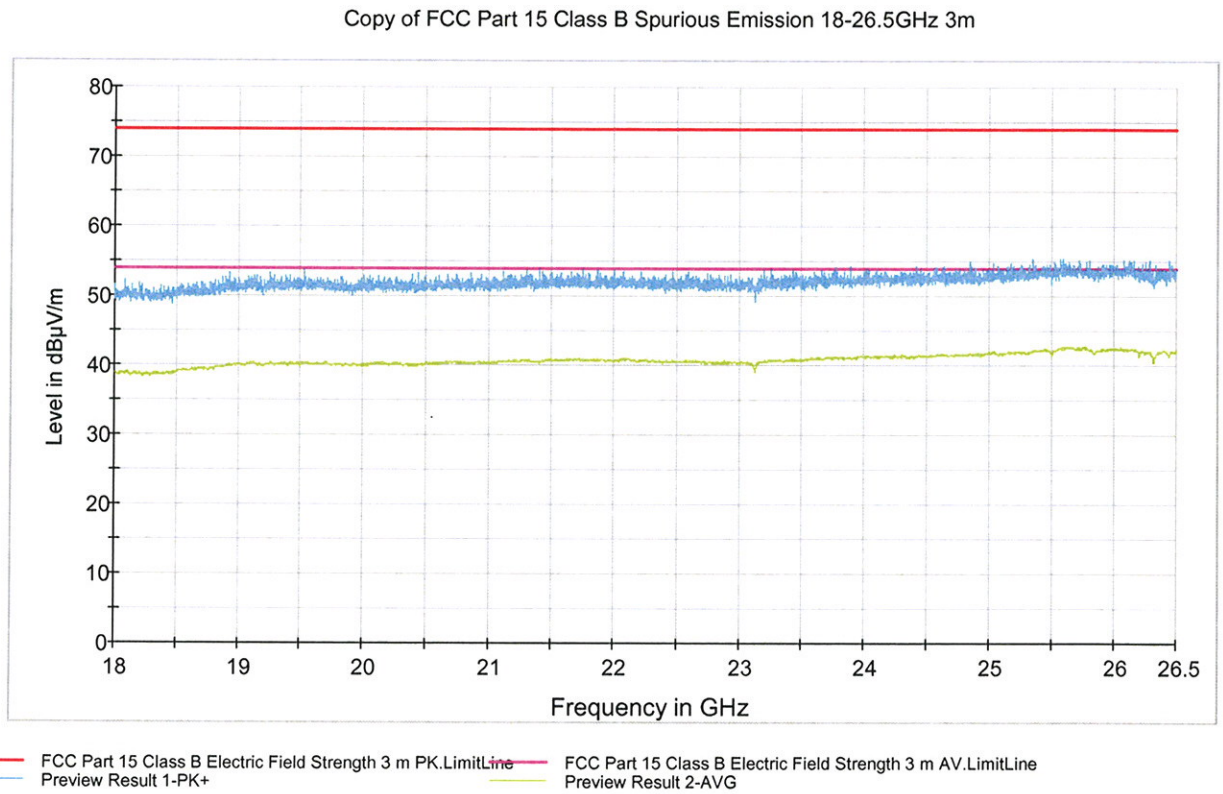

Figure 15. Measured curve with peak- and average detector. Channel HIGH.

Preliminary measurement was made by using 8 degree turntable angle and 50 cm antenna step between the scans. Due to the low emission level no final measurements were made.

Radiated band edge measurement results

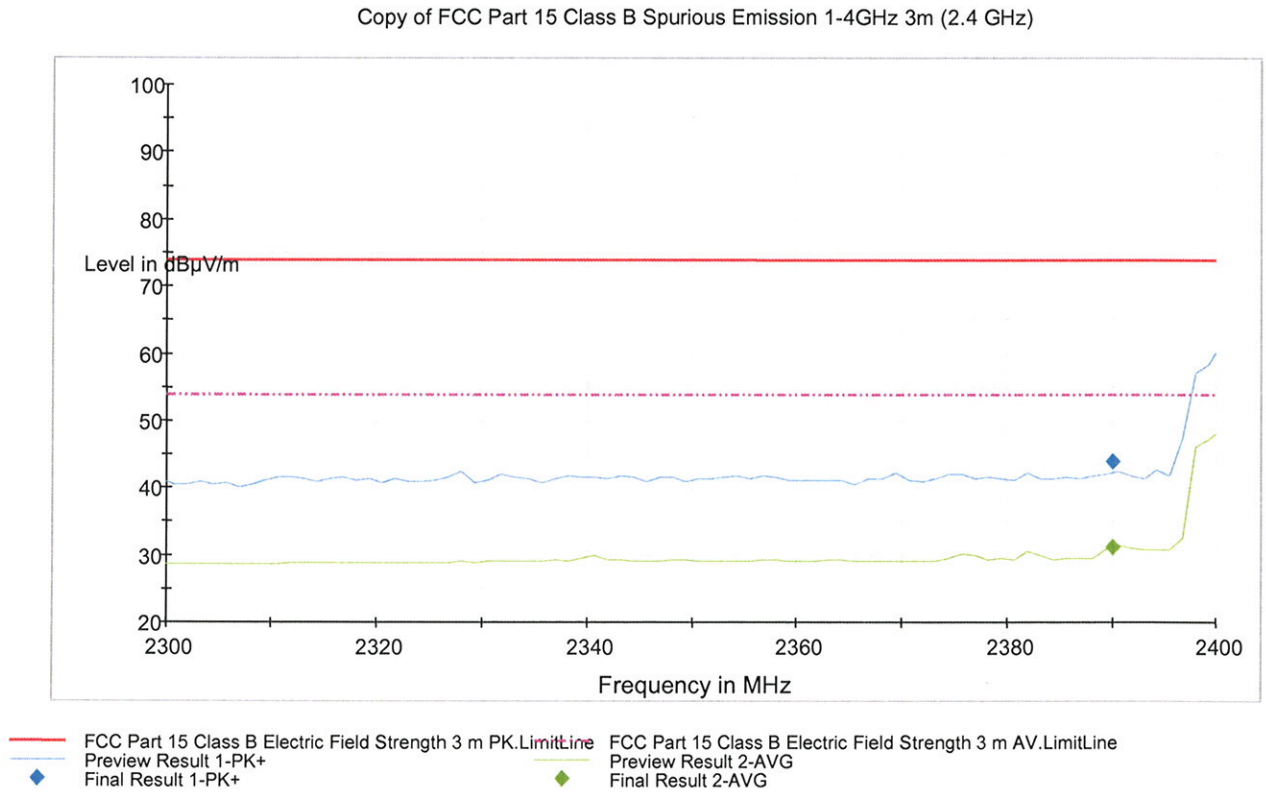

Figure 16. Measured curve with peak- and average detector. Lower band edge.

Final measurements from the worst frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2390.000000	44.0	1000.0	1000.000	192.0	V	278.0	4.6	29.9	73.9	

Table 13. Final Max Peak results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2390.000000	31.3	1000.0	1000.000	122.0	V	213.0	4.6	22.6	53.9	

Table 14. Final Average results.

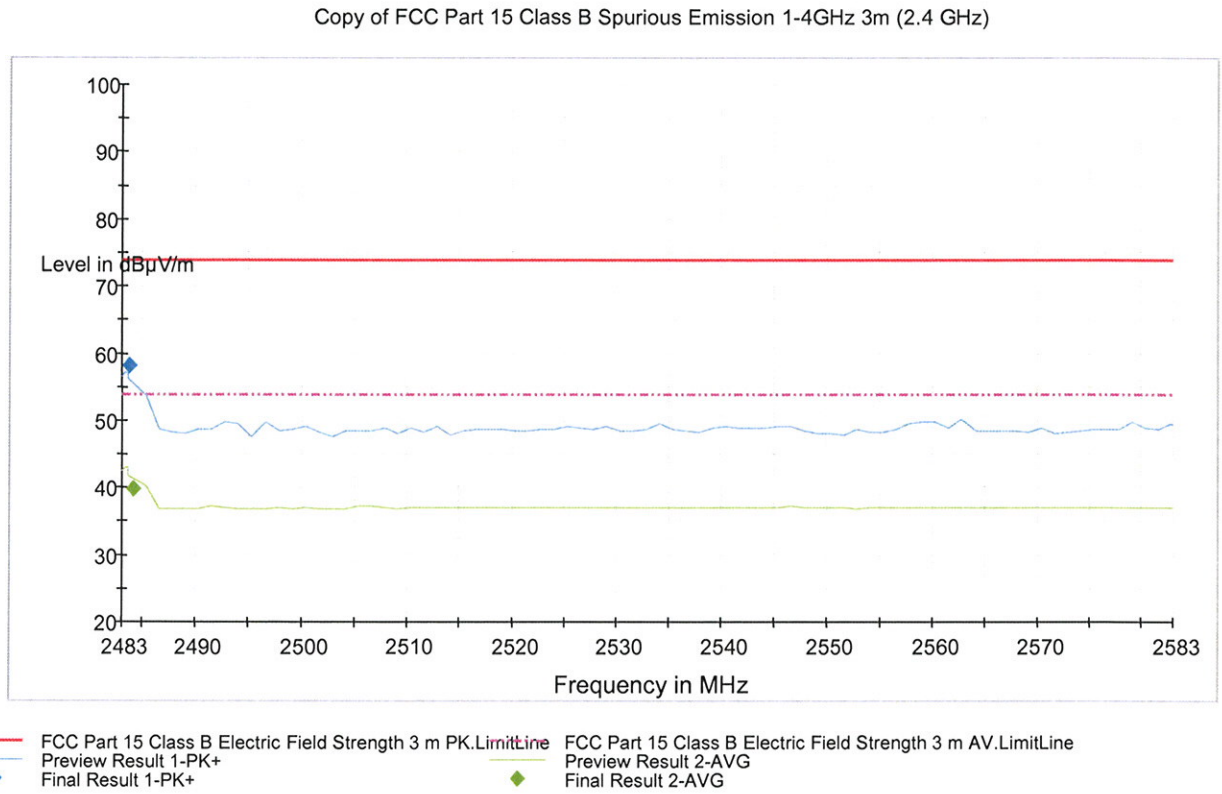

Figure 17. Measured curve with peak- and average detector. Upper band edge.

Final measurements from the worst frequencies

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2483.500000	58.1	1000.0	1000.000	264.0	V	202.0	4.7	15.8	73.9	

Table 15. Final Max Peak results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2483.500000	39.8	1000.0	1000.000	268.0	V	205.0	4.7	14.1	53.9	

Table 16. Final Average results.

List of test equipments

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