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:	Handheld XRF Analyser
Model:	XMDS2770
Manufacturer:	Oxford Instruments
Customer:	Oxford Instruments Analytical Oy Tarvonsalmenkatu 17 P.O Box 85 FI-02631 Espoo FINLAND
	Oxford Instruments Analytical Oy Tarvonsalmenkatu 17 P.O Box 85 FI-02631 Espoo FINLAND
FCC Rule Part:	15.247: 2014
IC Rule Part:	RSS-210, Issue 8, 2010 RSS-GEN Issue 4, 2014
KDB:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (June 5, 2014)

Date: February 4, 2015

Issued by:

Niko Kotsalo
Testing Engineer

Date: February 4, 2015

Checked by:

Janne Nyman
Compliance Specialist

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Equipment Under Test (EUT)

Handheld XRF Analyser with a 802.11 b/g WLAN and Bluetooth v2.0 + EDR module	
Brand:	Oxford Instruments
Model:	XMDS2770
FCC ID (radio module):	Z64-WL18SBMOD

Description of the EUT

The EUT is a battery or AC-operated handheld XRF Analyser that includes a Texas Instruments (FCC ID: Z64-WL18SBMOD) WL18SBMOD 802.11 b/g WLAN and Bluetooth v2.0 + EDR module This report includes only the Bluetooth test results. The results for the WLAN tests are located in the SGS Fimko test report with the reference number 278706-2.

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:	1 MHz
Conducted power:	12.06 dBm
Transmission technique:	FHSS
Modulation:	GFSK, 8DPSK, π/4-DQPSK
Transmission rate:	1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, 54 Mbps
Antenna gain:	3.99 dBi

Power Supply

Battery / AC operated	7.2 VDC / 100-240 VAC, 50-60 Hz

Disclaimer

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.247(b)(3) / RSS-210 8.4	Average Conducted Output Power	**PASS**
§15.209 / RSS-GEN 8.9	Unintentional Radiated Emissions	**PASS**

EUT Test Conditions during Testing

The EUT was configured into the wanted channel and was in continuous transmit mode during all the tests. The power of all modes and data rates were measured with a spectrum analyzer (low, mid and high channel) and the data rate giving the highest power was selected for the measurements (DH5). The radiated spurious emissions tests were performed with the EUT being in three different orthogonal positions: X, Y, Z.

Following channels were used during the tests:

Channel	Frequency/ MHz
LOW	2402
MID	2441
HIGH	2480

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

Average Conducted Output Power Measurement

Standard:	ANSI C63.10	(2009)
Tested by:	NKO	
Date:	12.01.2015	
Temperature:	22.6 °C	
Humidity:	31 % RH	

FCC Rule: 15.247 (b) (3)

For systems using digital modulation in the 2400-2483.5 MHz band: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling 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 *average conducted output power* is the highest total transmit power occurring in any mode.

Output power was measured with a power meter. The EUT was using “13” parameter for the power setting.

DH5

Data rate [Mbps]	Conducted power [dBm]			Limit [dBm]	Result
	Low channel	Mid channel	High channel		
1	12.06	12.00	11.66	30	PASS

2DH5

Data rate [Mbps]	Conducted power [dBm]			Limit [dBm]	Result
	Low channel	Mid channel	High channel		
2	12.04	11.98	11.65	30	PASS

3DH5

Data rate [Mbps]	Conducted power [dBm]			Limit [dBm]	Result
	Low channel	Mid channel	High channel		
3	12.04	11.99	11.67	30	PASS

Transmitter Radiated Emissions 30 – 26 500 MHz and Band Edge

Standard:	ANSI C63.10	(2009)
Tested by:	NKO	
Date:	12.01 - 14.01.2015	
Temperature:	22.0 – 22.6 °C	
Humidity:	18 – 31 % RH	
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. 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.

Measurements are done with DH5 1 Mbps data rate.

Test results

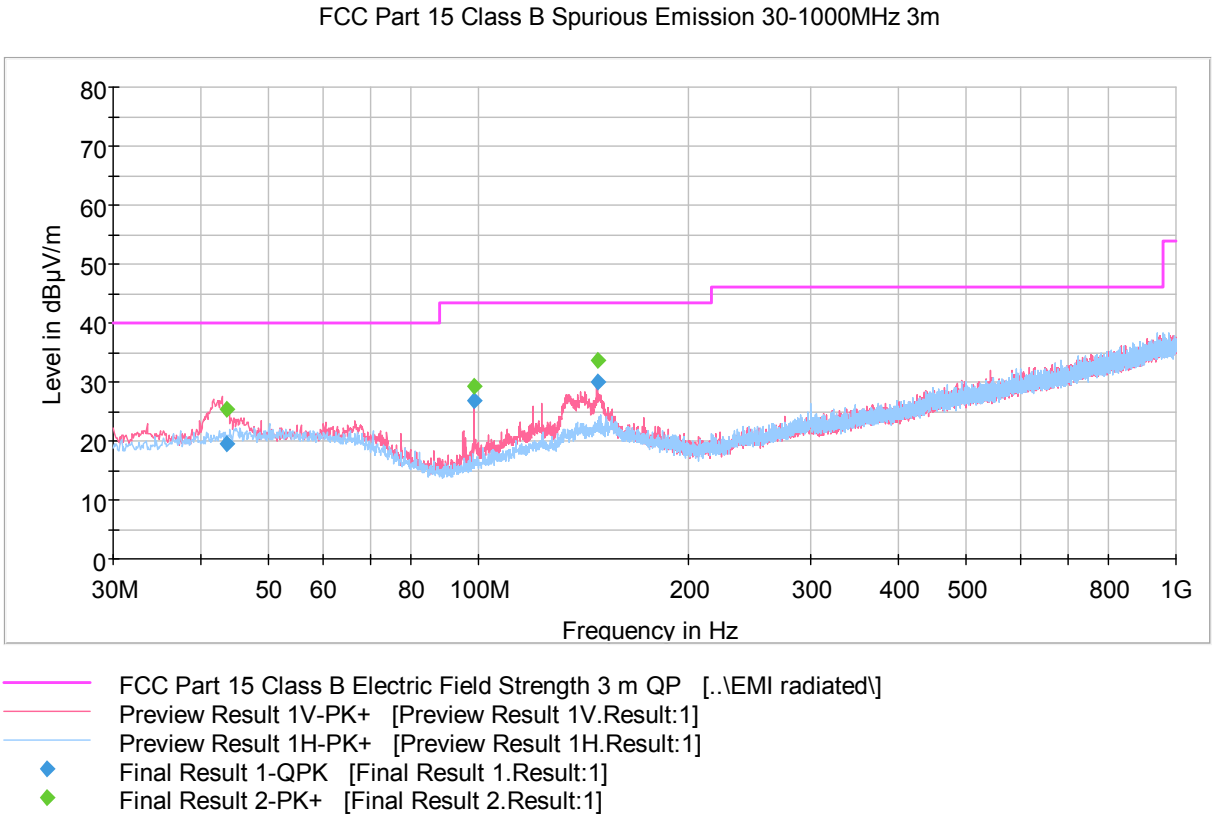

Figure 1. Measured curves with peak-detector (low channel).

Table 1. 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
43.598000	19.6	1000.0	120.000	100.0	V	124.0	15.0	20.4	40.0	
98.750000	26.9	1000.0	120.000	100.0	V	170.0	9.8	16.6	43.5	
148.112000	29.9	1000.0	120.000	100.0	V	140.0	14.7	13.6	43.5	

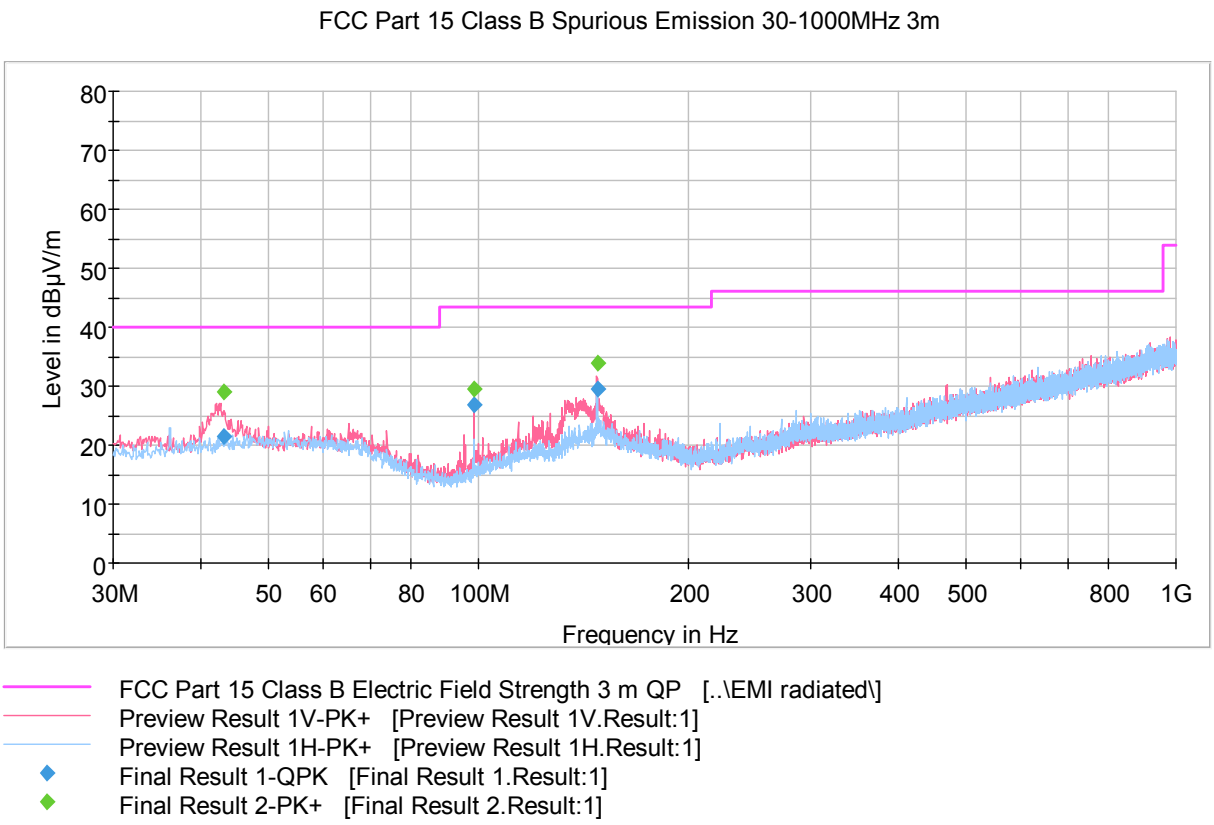

Figure 2. Measured curve with peak-detector (middle channel).

Table 2. 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
43.150000	21.4	1000.0	120.000	100.0	V	85.0	15.0	18.6	40.0	
98.753000	26.9	1000.0	120.000	100.0	V	139.0	9.8	16.6	43.5	
148.109000	29.5	1000.0	120.000	100.0	V	201.0	14.7	14.0	43.5	

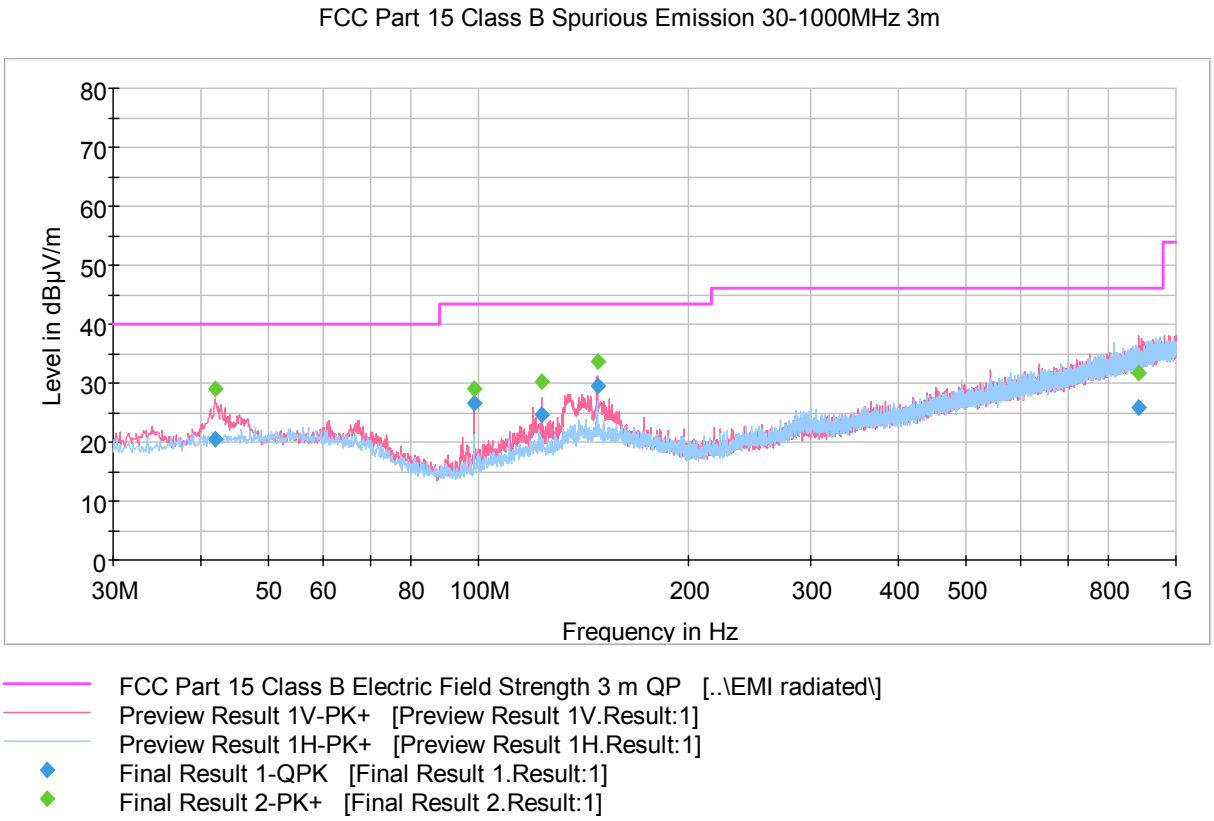

Figure 3. Measured curve with peak-detector (high channel).

Table 3. 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
41.971000	20.5	1000.0	120.000	100.0	V	311.0	14.9	19.5	40.0	
98.753000	26.7	1000.0	120.000	100.0	V	129.0	9.8	16.8	43.5	
123.431000	24.7	1000.0	120.000	100.0	V	138.0	12.2	18.8	43.5	
148.106000	29.6	1000.0	120.000	100.0	V	162.0	14.7	13.9	43.5	
882.561000	25.9	1000.0	120.000	267.0	V	189.0	27.1	20.1	46.0	

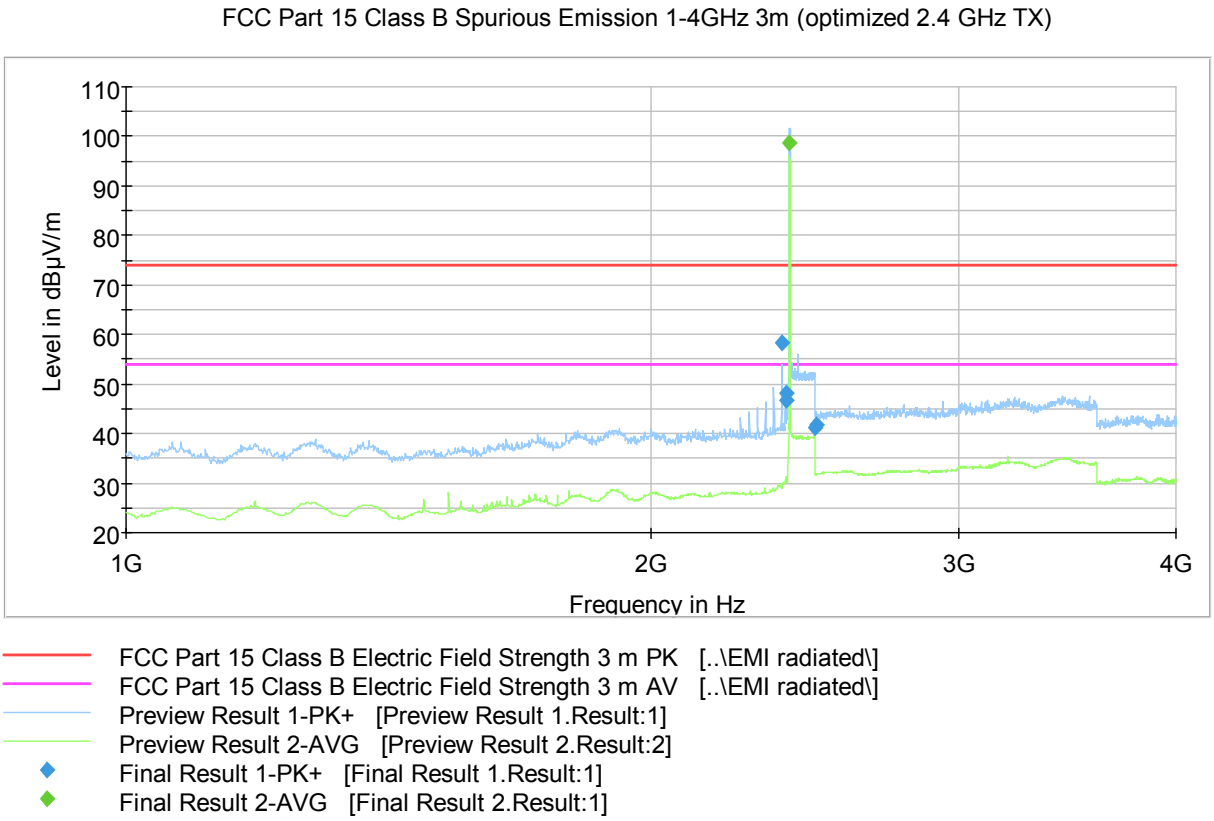

Figure 4. Measured curve with peak- and average detector (low channel).

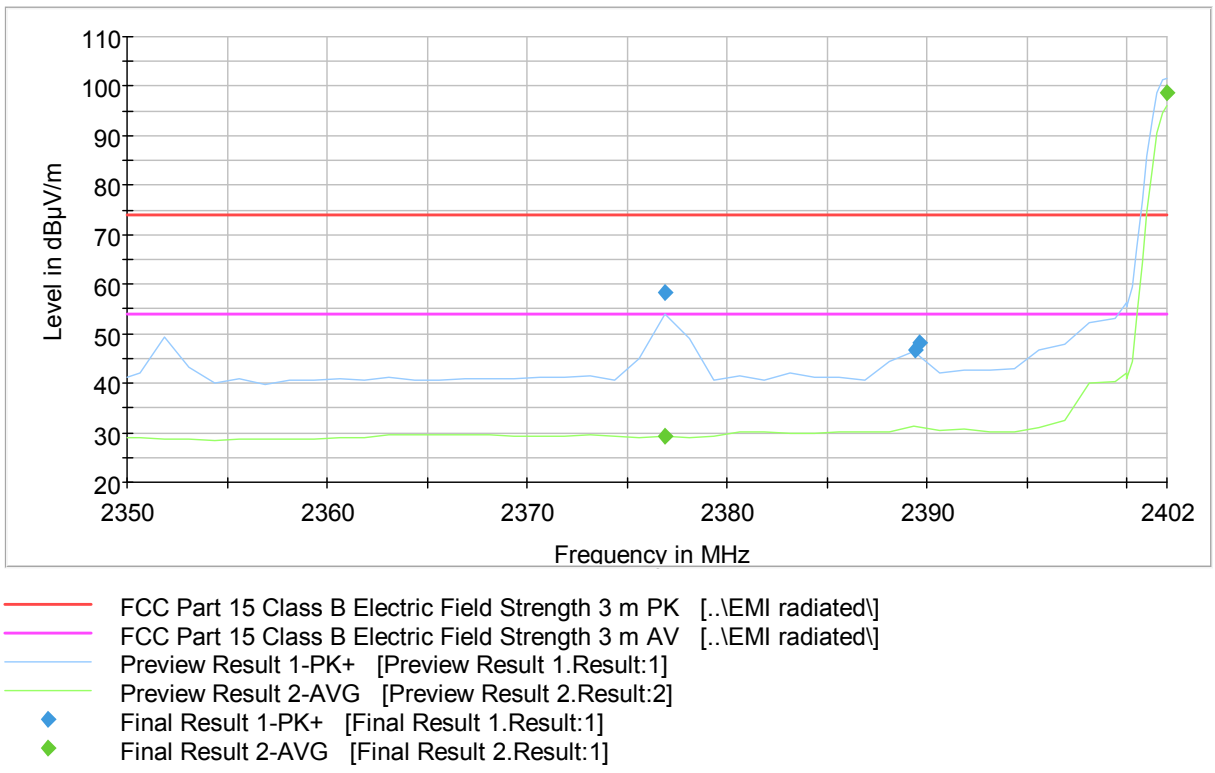

Figure 5. Low channel band edge

Final measurements from the worst frequencies

Table 4. 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
2376.875000	58.2	1000.0	1000.000	114.0	H	7.0	3.7	15.7	73.9	
2389.400000	46.7	1000.0	1000.000	100.0	V	142.0	3.8	27.2	73.9	
2389.600000	48.3	1000.0	1000.000	236.0	H	15.0	3.8	25.6	73.9	
2483.900000	41.3	1000.0	1000.000	122.0	H	120.0	4.2	32.6	73.9	
2488.700000	41.7	1000.0	1000.000	135.0	V	193.0	4.3	32.2	73.9	

Table 5. 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
2376.875000	29.2	1000.0	1000.000	114.0	H	7.0	3.7	15.7	73.9	
2402.000000	98.6	1000.0	1000.000	114.0	H	20.0	3.9	-44.7	53.9	Carrier

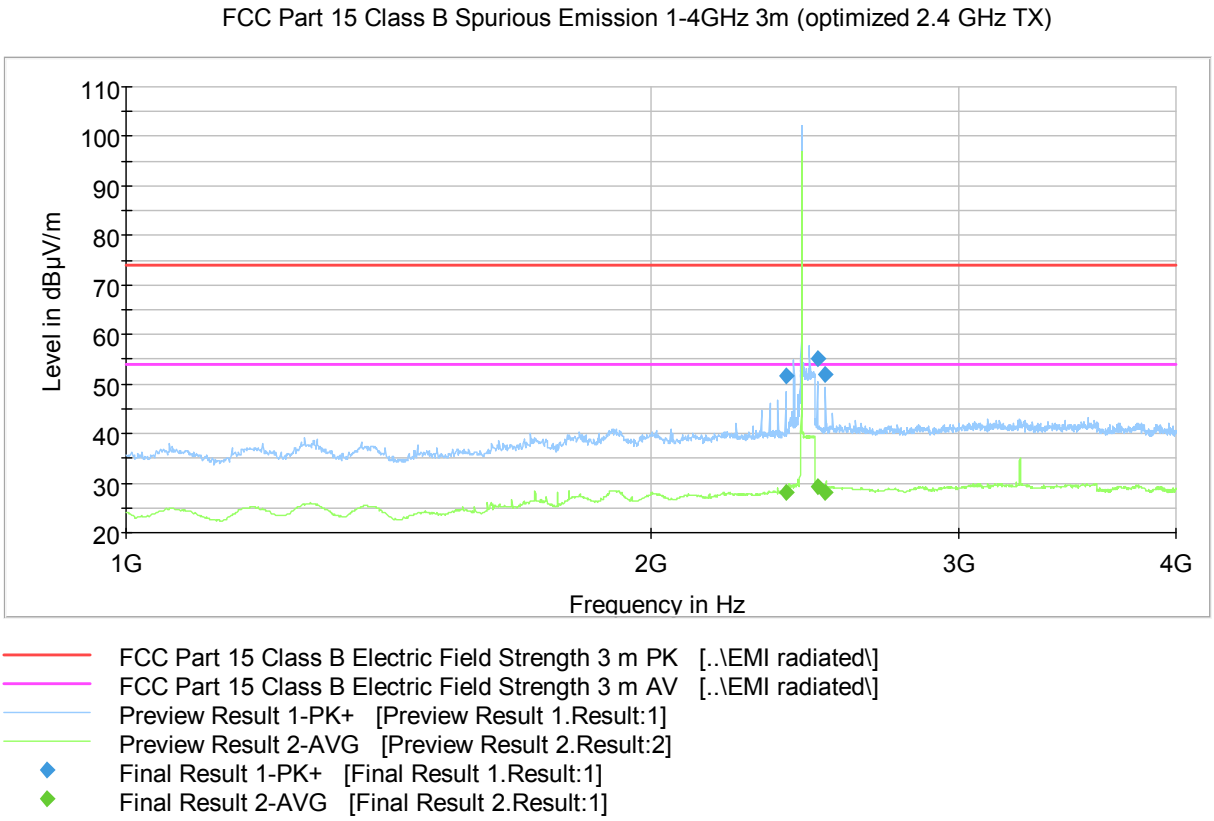

Figure 6. Measured curve with peak- and average detector (middle channel).

Final measurements from the worst frequencies

Table 6. 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
2390.025000	51.6	1000.0	1000.000	191.0	H	1.0	3.8	22.3	73.9	
2491.825000	55.0	1000.0	1000.000	212.0	H	315.0	4.3	18.9	73.9	
2517.225000	52.0	1000.0	1000.000	212.0	H	330.0	4.4	21.9	73.9	

Table 7. 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
2390.025000	28.2	1000.0	1000.000	191.0	H	1.0	3.8	25.7	53.9	
2491.825000	29.2	1000.0	1000.000	212.0	H	315.0	4.3	24.7	53.9	
2517.225000	28.1	1000.0	1000.000	212.0	H	330.0	4.4	25.8	53.9	

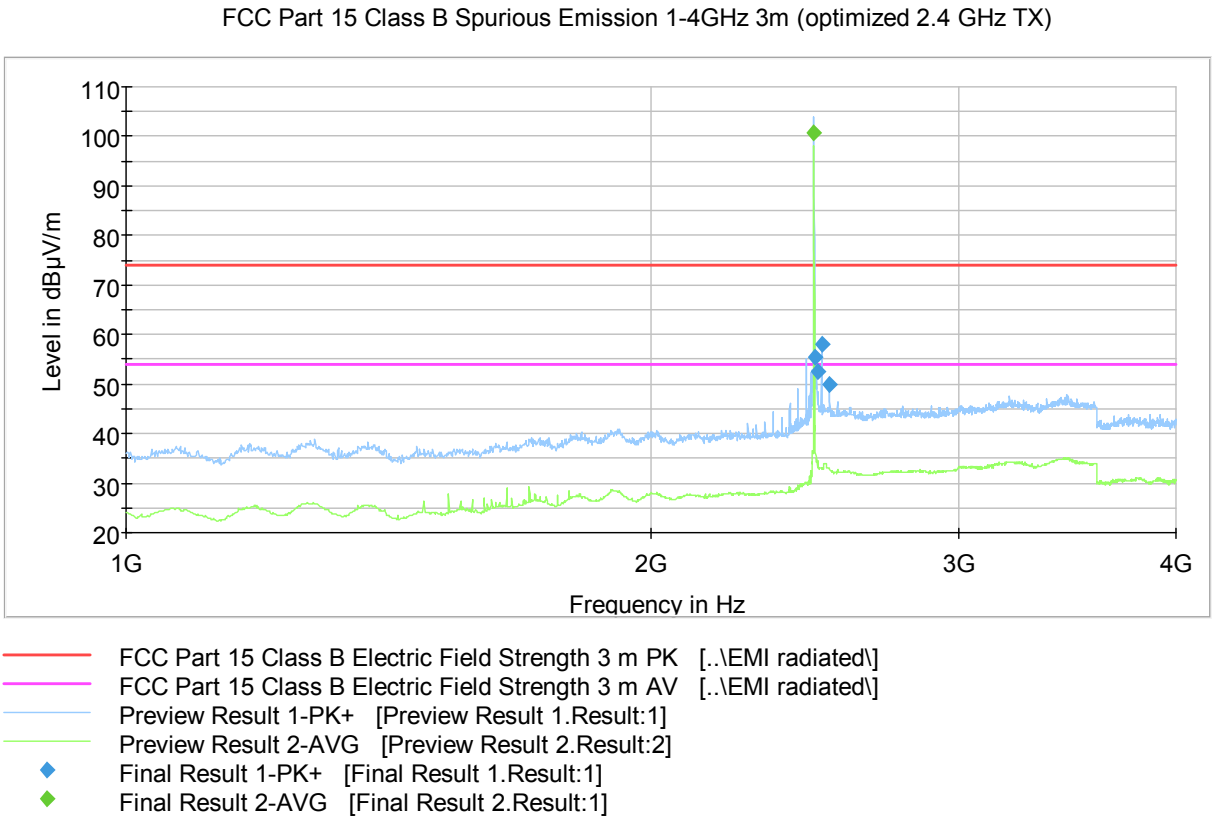

Figure 7. Measured curve with peak- and average detector (high channel).

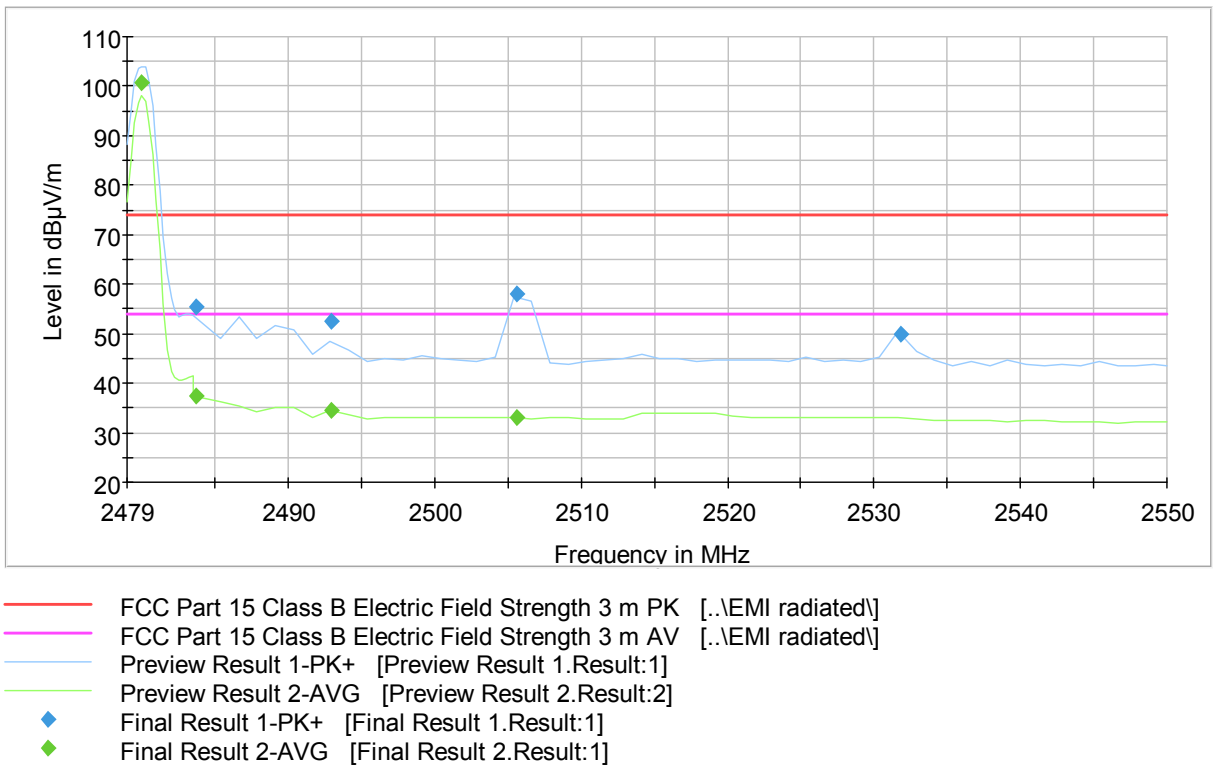

Figure 8. High channel band edge

Final measurements from the worst frequencies

Table 8. 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
2483.700000	55.4	1000.0	1000.000	168.0	H	295.0	4.2	18.5	73.9	
2492.900000	52.5	1000.0	1000.000	187.0	V	12.0	4.3	21.4	73.9	
2505.575000	57.9	1000.0	1000.000	204.0	H	324.0	4.4	16.0	73.9	
2531.825000	49.8	1000.0	1000.000	167.0	V	8.0	4.4	24.1	73.9	

Table 9. 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
2480.000000	100.7	1000.0	1000.000	212.0	H	324.0	4.2	-46.8	53.9	Carrier
2483.700000	37.4	1000.0	1000.000	168.0	H	295.0	4.2	16.5	53.9	
2492.900000	34.4	1000.0	1000.000	187.0	V	12.0	4.3	19.5	53.9	
2505.575000	33.0	1000.0	1000.000	204.0	H	324.0	4.4	20.9	53.9	

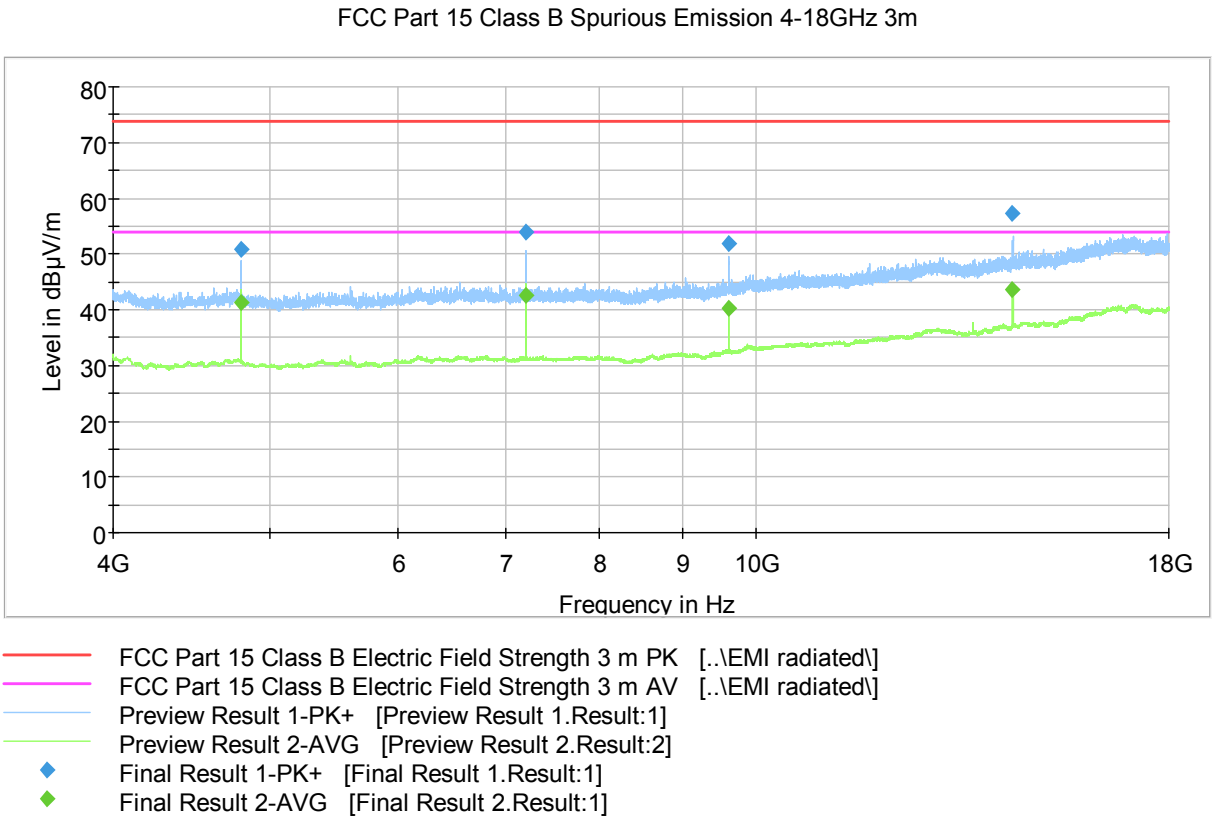

Figure 9. Measured curve with peak- and average detector (low channel).

Final measurements from the worst frequencies

Table 10. 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
4804.300000	50.8	1000.0	1000.000	100.0	H	179.0	10.0	23.1	73.9	
7205.500000	53.9	1000.0	1000.000	176.0	V	255.0	12.3	20.0	73.9	
9607.300000	52.0	1000.0	1000.000	130.0	V	217.0	14.9	21.9	73.9	
14411.200000	57.3	1000.0	1000.000	100.0	H	186.0	21.6	16.6	73.9	

Table 11. 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
4804.000000	41.3	1000.0	1000.000	105.0	H	182.0	10.0	12.6	53.9	
7206.000000	42.5	1000.0	1000.000	170.0	V	249.0	12.3	11.4	53.9	
9607.700000	40.1	1000.0	1000.000	105.0	V	247.0	14.9	13.8	53.9	
14411.400000	43.6	1000.0	1000.000	105.0	H	188.0	21.6	10.3	53.9	

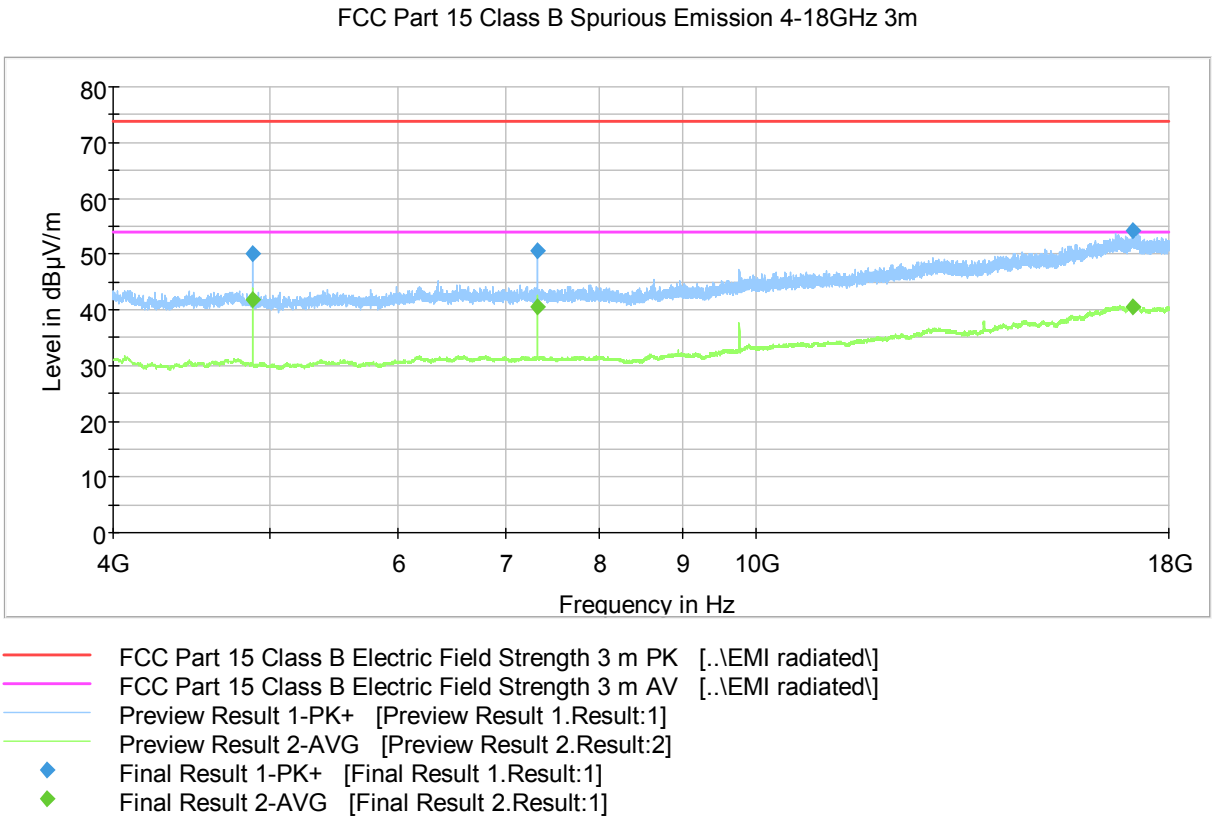

Figure 10. Measured curve with peak- and average detector (middle channel).

Final measurements from the worst frequencies

Table 12. 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
4882.400000	50.1	1000.0	1000.000	100.0	H	234.0	10.0	23.8	73.9	
7323.200000	50.7	1000.0	1000.000	122.0	V	295.0	12.3	23.2	73.9	
17087.500000	54.1	1000.0	1000.000	194.0	H	228.0	25.9	19.8	73.9	

Table 13. 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
4882.000000	41.8	1000.0	1000.000	105.0	H	234.0	10.0	12.1	53.9	
7323.100000	40.6	1000.0	1000.000	114.0	H	237.0	12.3	13.3	53.9	
17086.100000	40.6	1000.0	1000.000	105.0	H	216.0	25.9	13.3	53.9	

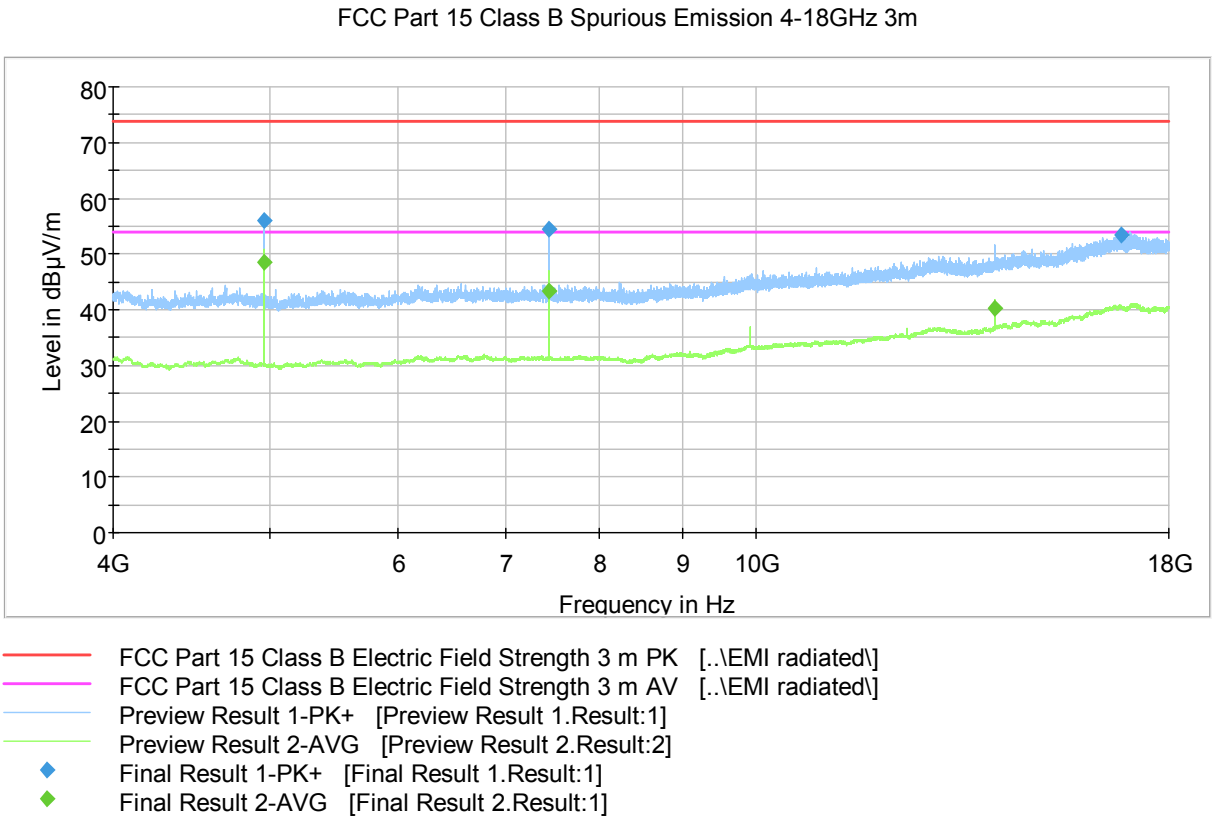

Figure 11. Measured curve with peak- and average detector (high channel).

Final measurements from the worst frequencies

Table 14. 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
4959.700000	56.0	1000.0	1000.000	130.0	H	242.0	9.9	17.9	73.9	
7439.500000	54.4	1000.0	1000.000	100.0	V	256.0	12.3	19.5	73.9	
16831.700000	53.5	1000.0	1000.000	100.0	V	17.0	25.5	20.4	73.9	

Table 15. 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
4960.100000	48.4	1000.0	1000.000	132.0	H	242.0	9.9	5.5	53.9	
7440.000000	43.2	1000.0	1000.000	189.0	V	256.0	12.3	10.7	53.9	
14052.700000	40.1	1000.0	1000.000	121.0	H	193.0	21.0	13.8	53.9	

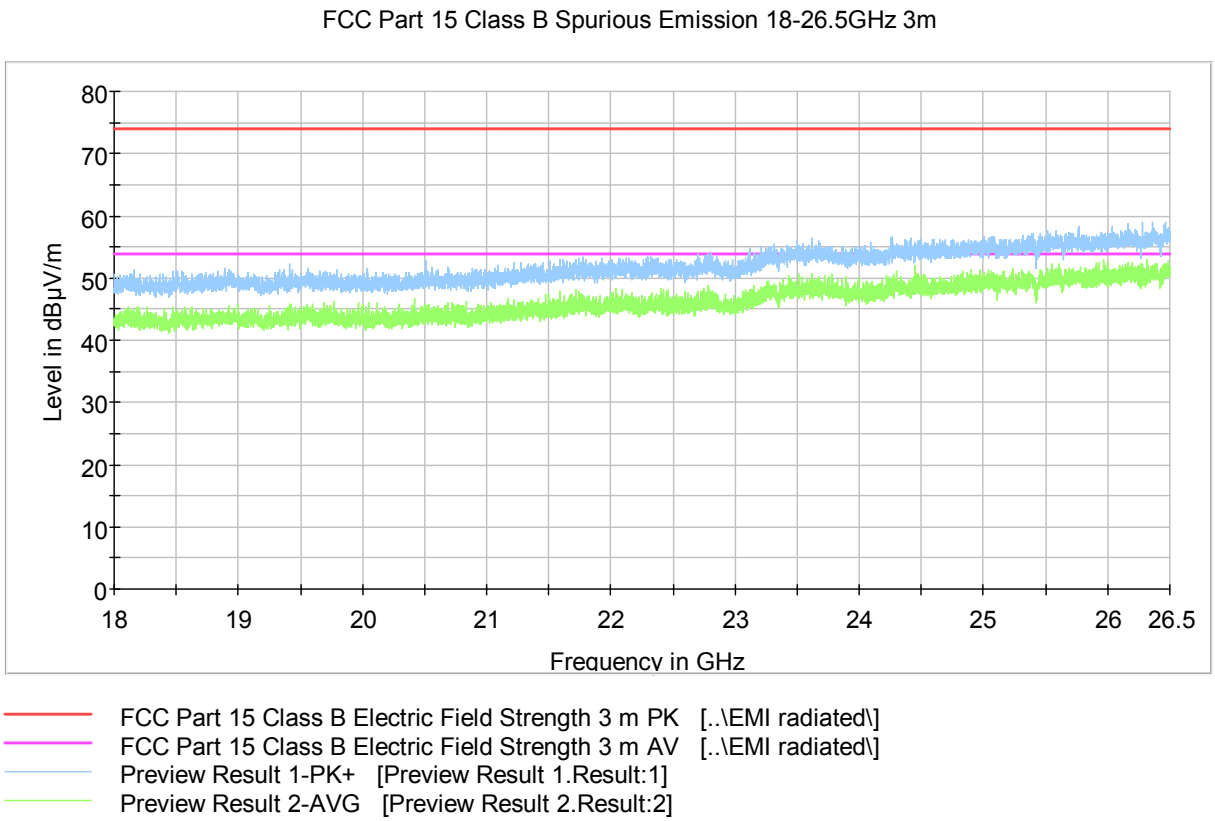

Figure 12. Measured curve with peak- and average detector (low channel).

No final measurements were made due to the low emissions level.

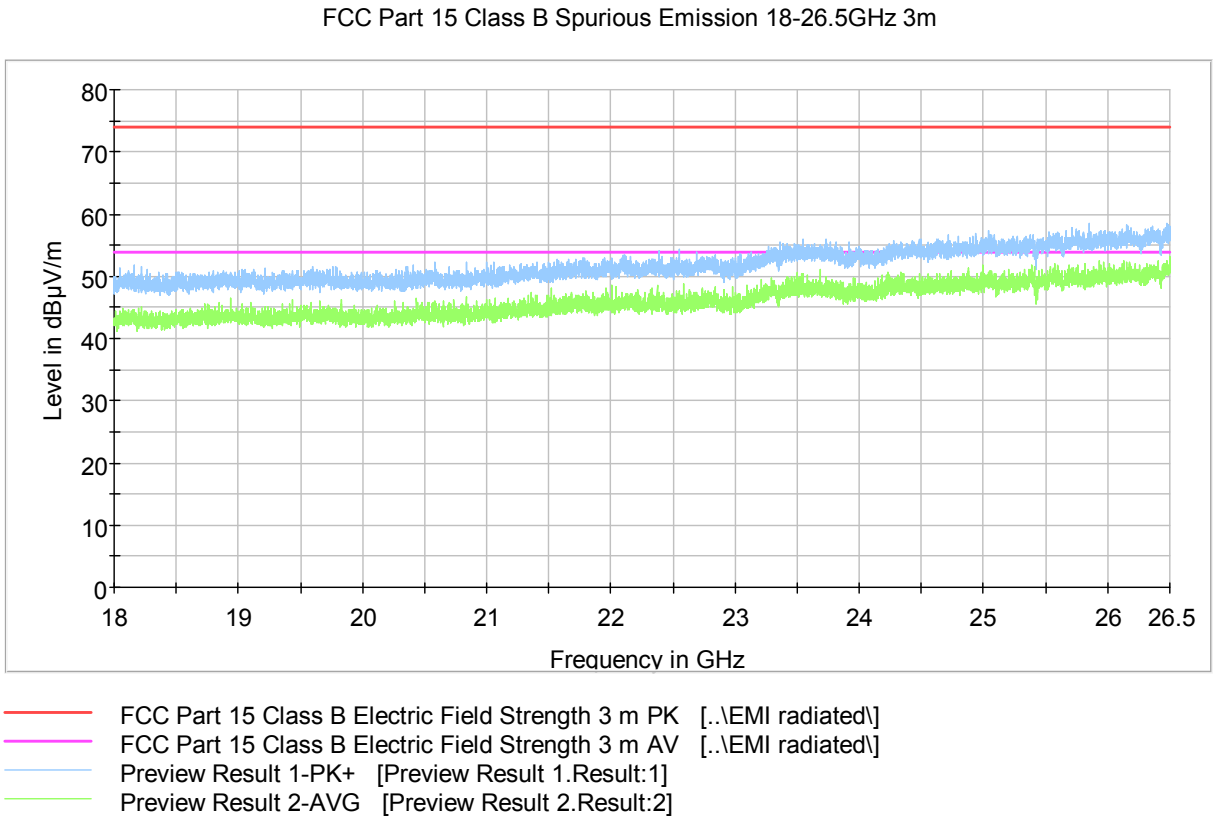

Figure 13. Measured curve with peak- and average detector (middle channel).

No final measurements were made due to the low emissions level.

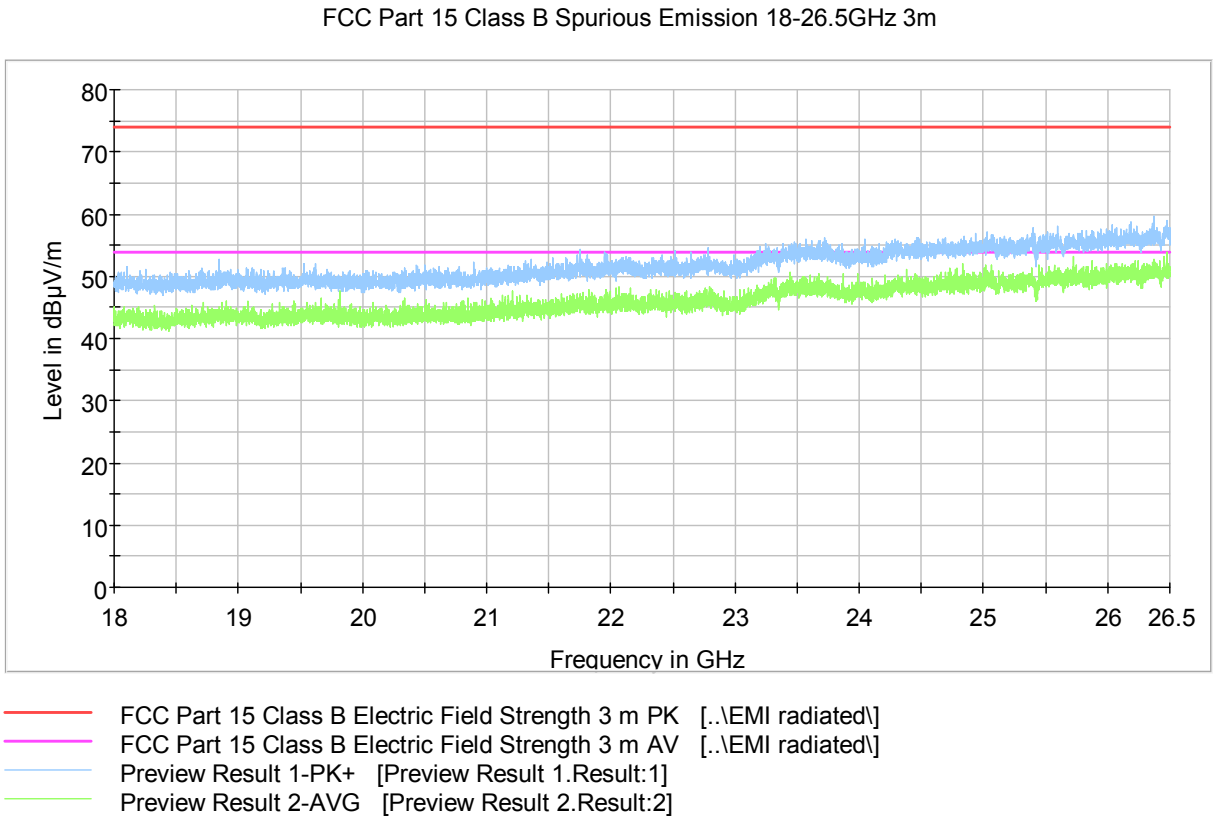

Figure 14. Measured curve with peak- and average detector (high channel).

No final measurements were made due to the low emissions level.

TEST EQUIPMENT

Manufacturer	Type	Serial no	Inv. no
ROHDE & SCHWARZ			
Signal Analyzer	FSV40	101068	9093
EMI Test receiver	ESU 26	100185	8453
Test software	EMC32	-	-
Average Power Sensor	NRP-Z91	100267	9878
DAVIS			
Weather station	Vantage Pro	-	5297
EMCO			
Antenna (1 - 18 GHz)	3117	29617	7293
ETS-LINDGREN			
Antenna (18 GHz – 26 GHz)	3160-09	28535	7294
SCHWARZBECK			
Antenna (30 MHz - 1 GHz)	VULB 9168	9168-503	8911
HEWLETT- PACKARD			
Microwave amplifier	83017A	-	5226
HUBER-SUHNER			
Attenuator 10dB	6810.17B	-	-
DEISEL			
Antenna mast	MA 240	240/455	7896
Turntable	DS 430	-	-
WAINWRIGHT			
High Pass Filter	WHKX	10	8267

All used measurement equipment was calibrated (if required).