

Test Report



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

Equipment Under Test: Handheld XRF Analyzer

Type/ Model: XMDS2770

Manufacturer: Oxford Instruments Analytical Oy
Tarvonsalmenkatu 17
P.O. Box 85
FI-02631 ESPOO
FINLAND

Customer: Oxford Instruments Analytical Oy
Tarvonsalmenkatu 17
P.O. Box 85
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FCC Rule Part: 15.247: 2013
IC Rule Part: RSS-210, Issue 8, 2010
RSS-GEN Issue 3, 2010

KDB: Filing and Measurement Guidelines for
Frequency Hopping Spread Spectrum Systems
DA 00-705 (March 30, 2000)

Customer has made modifications for the certified unit. The unit has different antennas. Only partial tests have been performed for C2PC. This report contains the tests made with Classic Bluetooth.

Date: December 4, 2013

Issued by:



Rauno Repo
Testing Engineer

Date: December 4, 2013

Checked by:



Jari Merikari
Technical Manager

Table of Contents

PRODUCT DESCRIPTION	3
Equipment Under Test (EUT)	3
Ratings and declarations	3
Power Supply	3
GENERAL REMARKS.....	4
Disclaimer	4
SUMMARY OF TESTING.....	5
EUT Test Conditions during Testing	5
TEST RESULTS.....	5
Maximum Peak Conducted Output Power Measurement.....	6
Test results.....	6
Transmitter Radiated Emissions 30 – 26 500 MHz and Band Edge.....	11
Test results.....	12
LIST OF TEST EQUIPMENT	26

Equipment Under Test (EUT)

Handheld XRF Analyzer

Type/ Model: XMDS2770

Serial Number: Marked as "SATU" for radiated measurements and "MERI" for antenna port measurements

The EUT contains CE-marked and FCC/IC certified Wi2Wi – WiFi 802.11 b/g and Bluetooth 2.0 + EDR module (ZYH-W2CBW003) with new integral antennas. The EUT has an USB port for PC data transmission and integrated GPS receiver. It is handheld and powered from internal battery which can be recharged with an external AC/DC charger.

Classification of the device

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

Modifications Incorporated in the EUT

More filtering added for DC power input of the EUT (inside) for the radiated emission measurements at frequency range 30 to 1000 MHz.

Ratings and declarations

Operating Frequency Range (OFR):	2402 – 2480 MHz
Channels:	79
Channel separation:	1 MHz
Channel bandwidth:	1 MHz
Conducted power:	+2.84 dBm
Modulation:	BT v2.0: GFSK, BT EDR: $\pi/4$ DQPSK, 8DPSK
Transmission rate:	BT v2.0: up to 1Mbps, BT EDR: 2,3 Mbps
Antenna gain:	2.5 dBi

Power Supply

The EUT has an internal battery. Tests were performed with charger connected with 120 VAC/ 60 Hz.

Charger:

Manufacturer: Sunny Computer Technology Europe s.r.o.

Model: SYS1357-2412

Input: 100-240V – 1.0A max, 50-60Hz

Output: 12VDC, 2.0A

Output power: 24W max

Disclaimer

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SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.247(b)(1) / RSS-210 8.4	Maximum Peak Conducted Output Power	PASS
§15.209 / RSS-GEN 7.2.3.2	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. Radiated spurious emissions tests were performed with a data rate giving the highest power level (DH5).

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

Maximum Peak Conducted Output Power Measurement

Maximum Peak Conducted Output Power Measurement

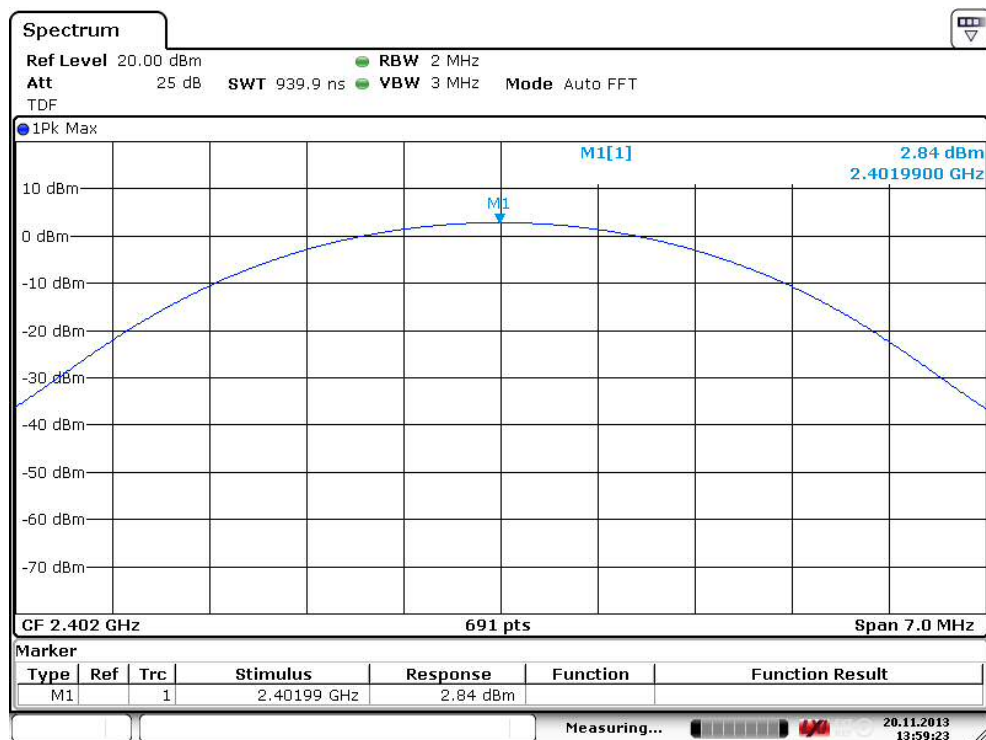
Standard: ANSI C63.10 (2009)
Tested by: RRE
Date: 20.11.2013
Temperature: 22 °C
Humidity: 22 % RH

FCC Rule: 15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz, employing at least 75 channels limit is 1.0 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.

Test results

Mode	Conducted power [dBm]			Limit [dBm]	Result
	Low channel	Mid channel	High channel		
DH5	+2.84	+2.61	+2.13	30	PASS
2DH5	+2.16	+1.96	+1.56	30	PASS
3DH5	+2.16	+1.97	+1.43	30	PASS



Date: 20.NOV.2013 13:59:23

Figure 1. Low channel DH5.

Maximum Peak Conducted Output Power Measurement

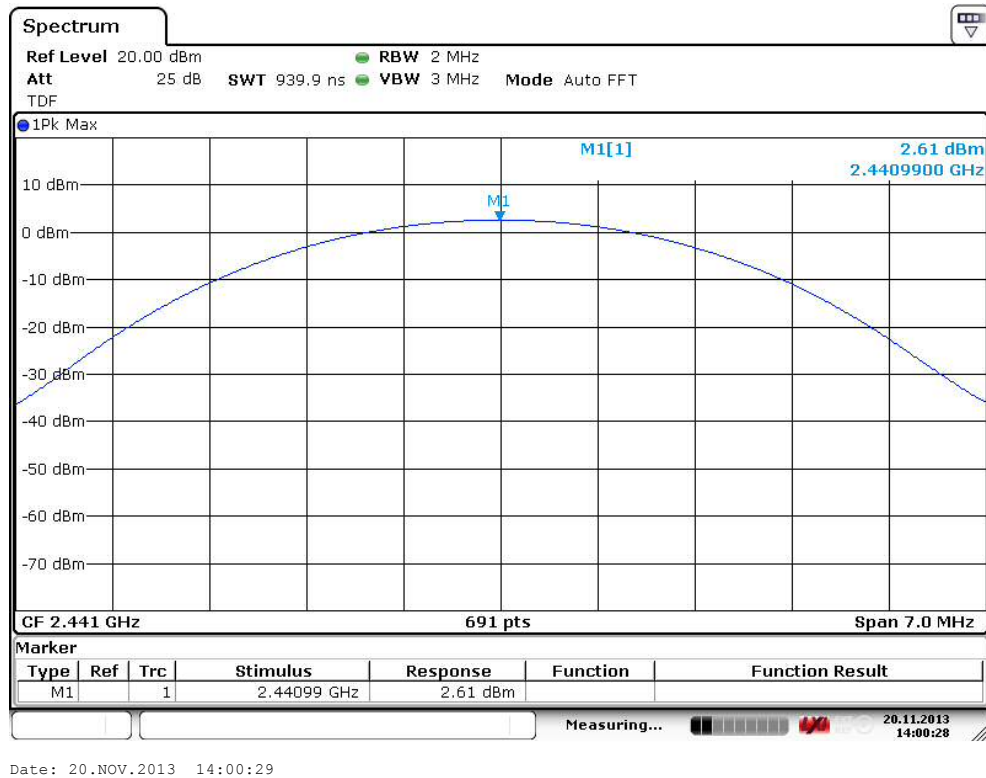


Figure 2. Mid channel DH5.

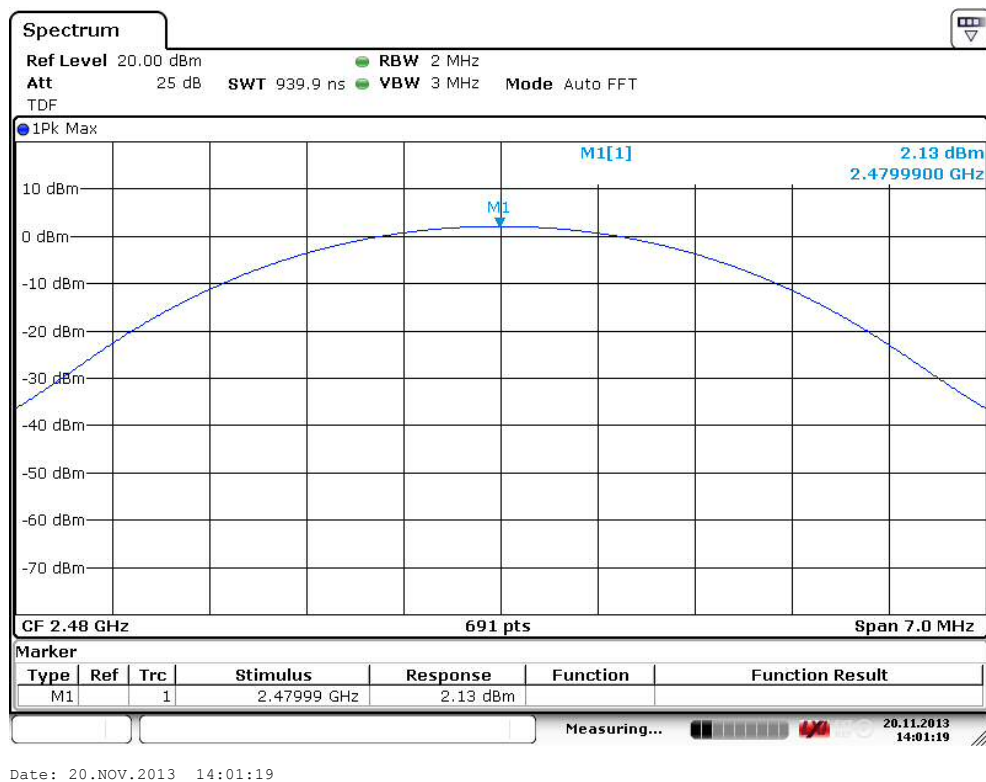


Figure 3. High channel DH5.

Maximum Peak Conducted Output Power Measurement

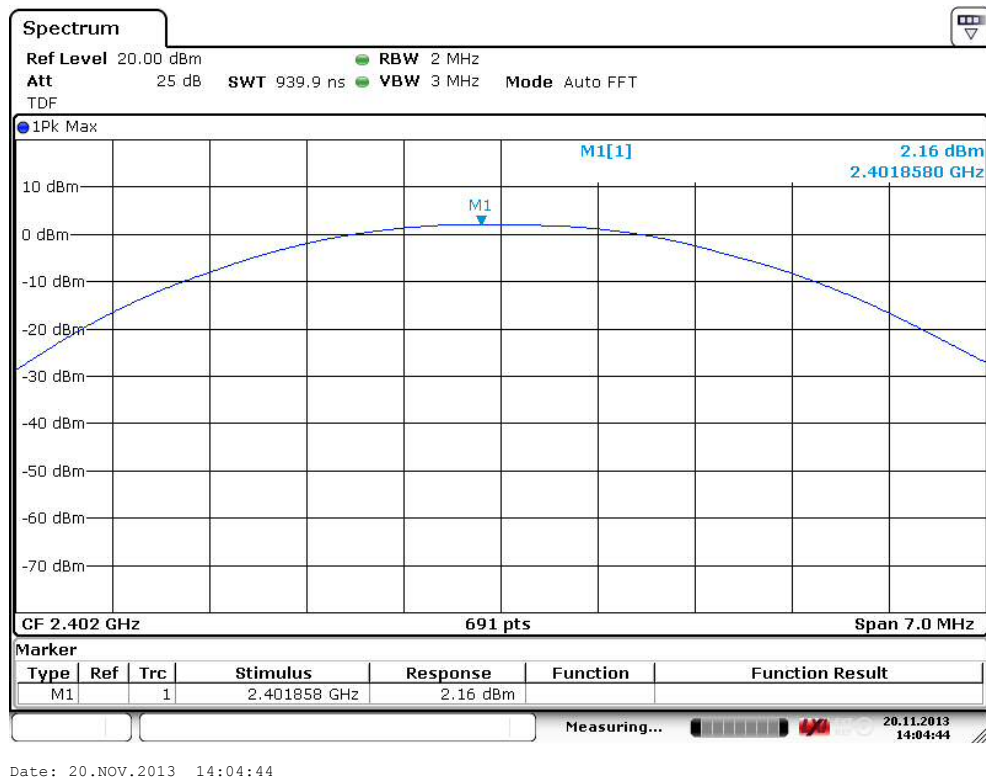


Figure 4. Low channel 2DH5.

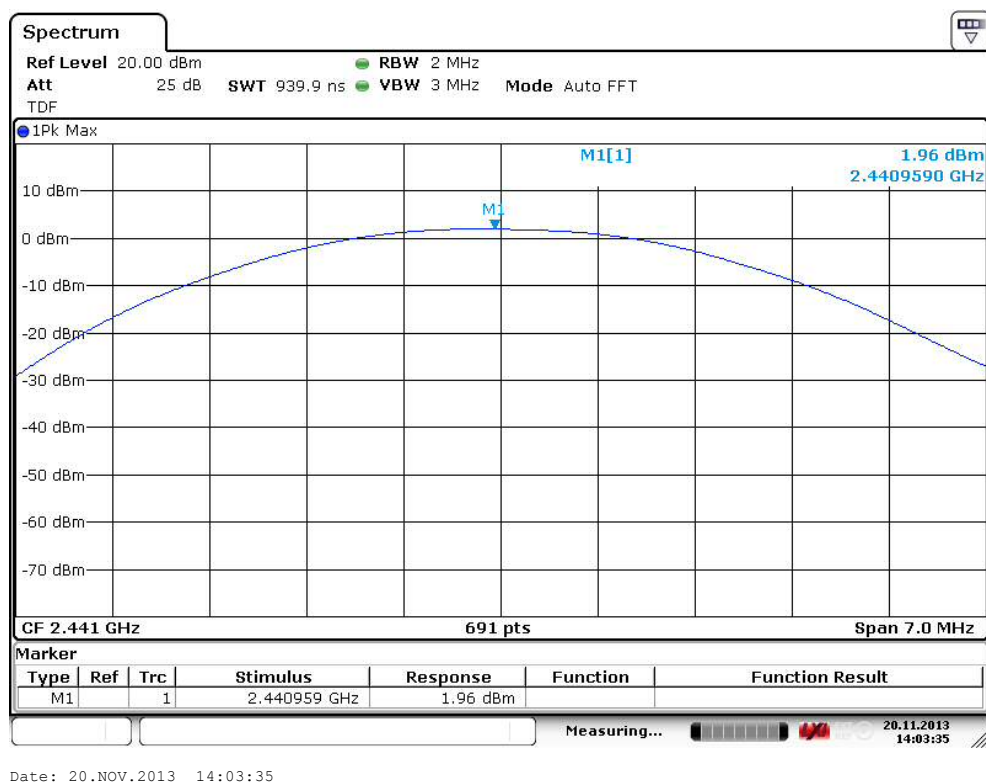


Figure 5. Mid channel 2DH5.

Maximum Peak Conducted Output Power Measurement

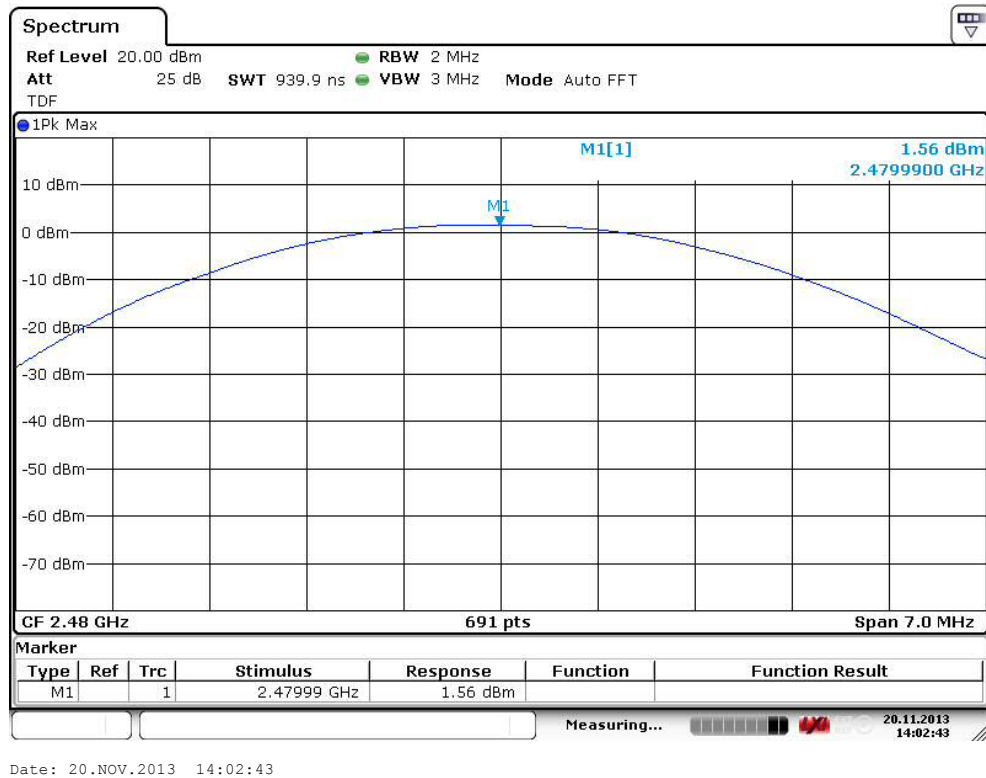


Figure 6. High channel 2DH5.

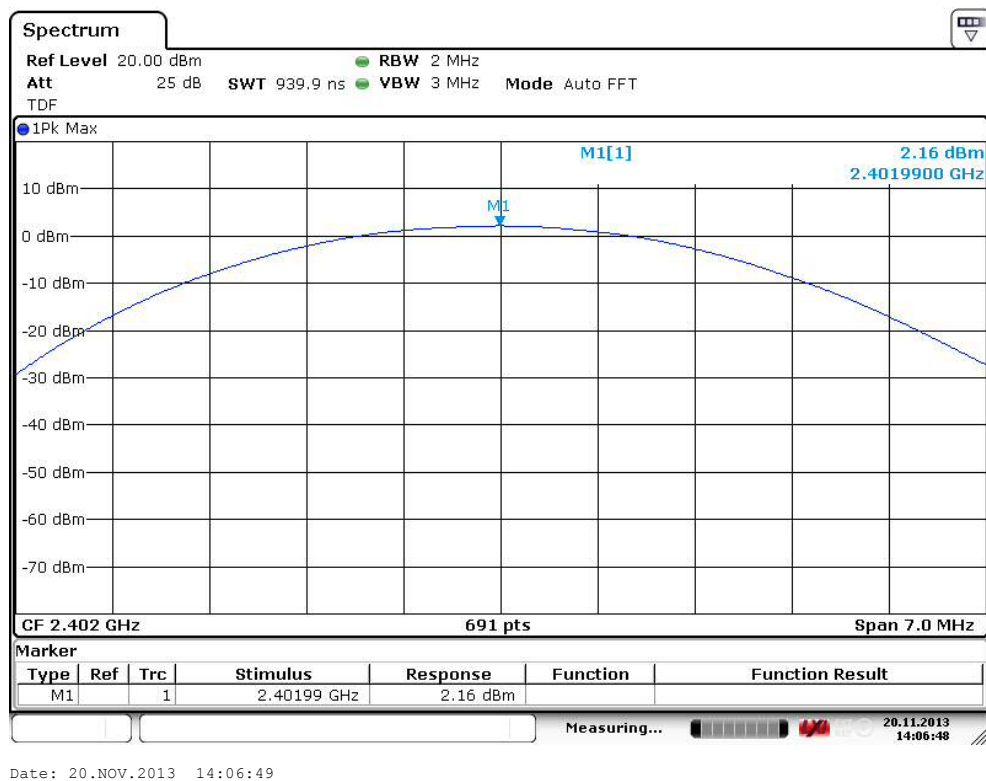


Figure 7. Low channel 3DH5.

Maximum Peak Conducted Output Power Measurement

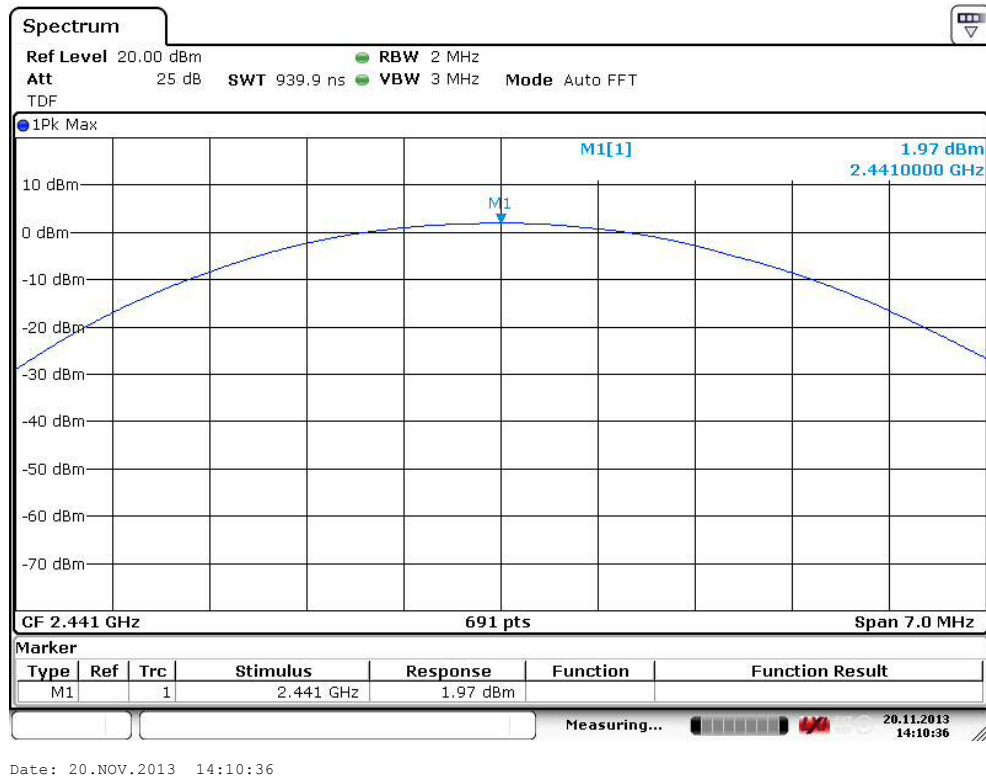


Figure 8. Mid channel 3DH5.

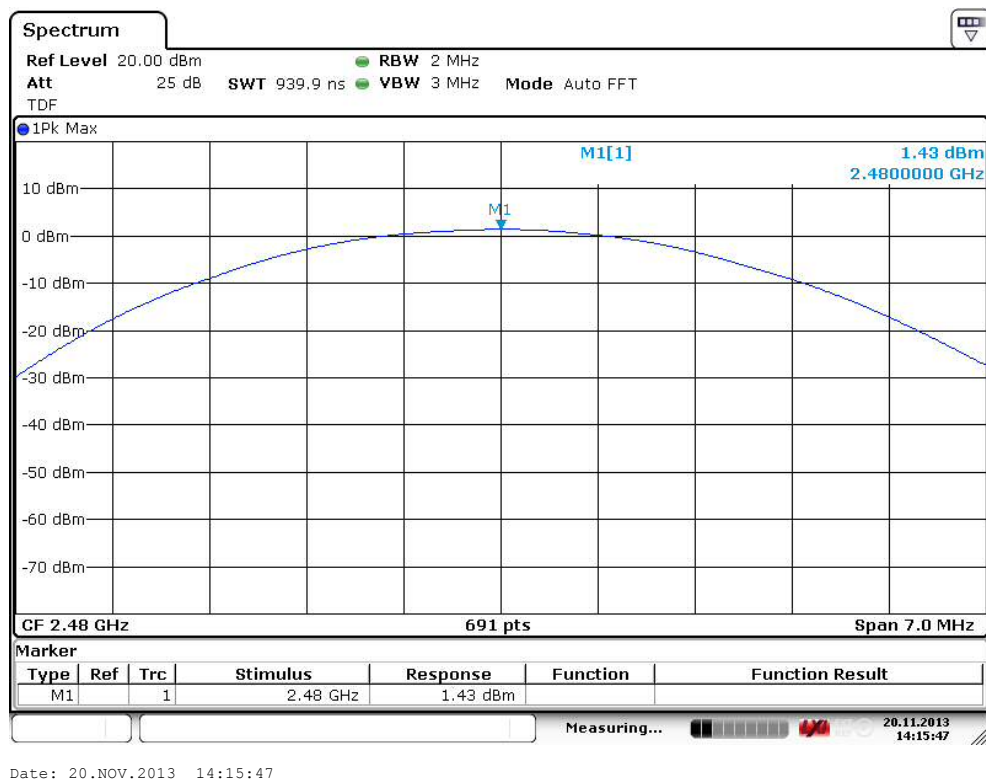


Figure 9. High channel 3DH5.

Transmitter Radiated Emissions 30 – 26 500 MHz and Band Edge

Standard: ANSI C63.10 (2009)
Tested by: RRE
Date: 30.10. – 12.11.2013
Temperature: 22 – 23 °C
Humidity: 21 – 37 % 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, 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 result value is the measured value corrected with the correction factor.

Measurements were done with DH5 (worst case).

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

Test results

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

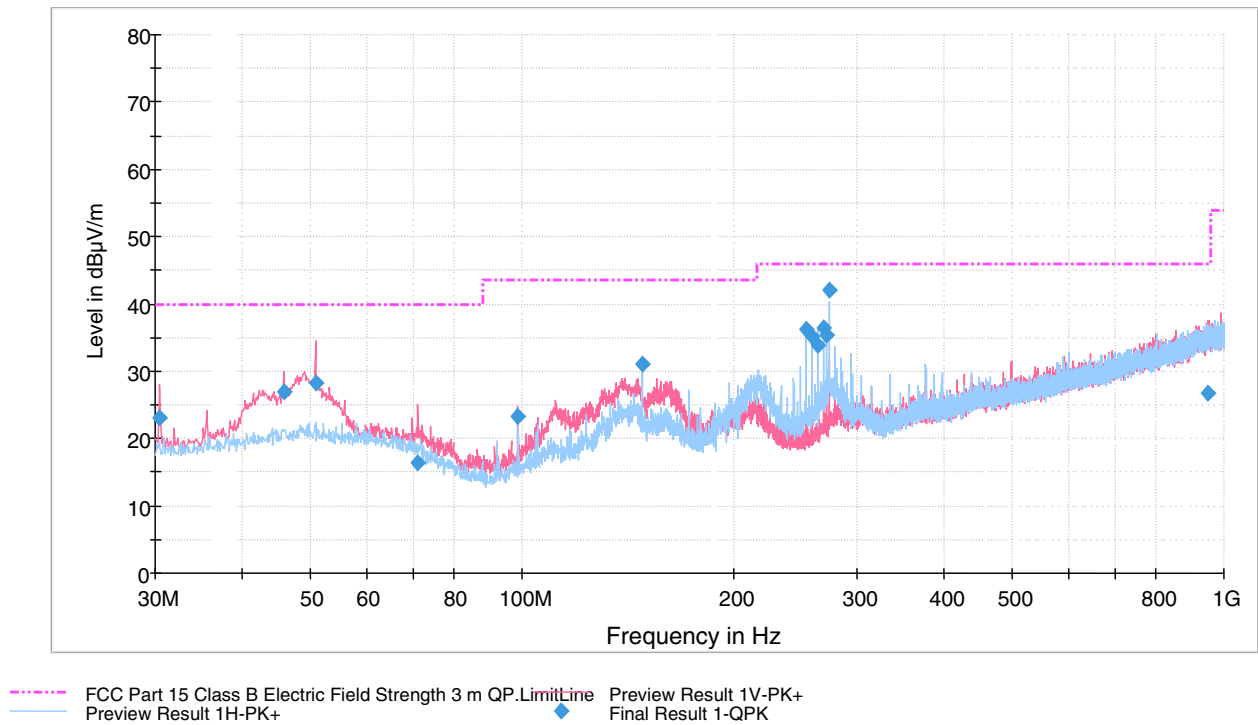


Figure 10. Measured curves with peak-detector (low channel).

Table 1. Final measurements from the worst frequencies.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
30.500000	23.1	1000.0	120.000	100.0	V	94.0	14.1	16.9	40.0	
45.754000	26.9	1000.0	120.000	100.0	V	356.0	15.2	13.1	40.0	
50.818000	28.3	1000.0	120.000	100.0	V	204.0	15.2	11.7	40.0	
71.128000	16.3	1000.0	120.000	100.0	V	245.0	13.0	23.7	40.0	
98.736000	23.4	1000.0	120.000	100.0	V	123.0	9.8	20.1	43.5	
148.109000	31.0	1000.0	120.000	208.0	H	268.0	14.8	12.5	43.5	
254.130000	36.2	1000.0	120.000	100.0	H	100.0	14.1	9.8	46.0	
259.191000	35.2	1000.0	120.000	100.0	H	104.0	14.3	10.8	46.0	
264.255000	33.9	1000.0	120.000	116.0	H	123.0	14.6	12.1	46.0	
269.376000	36.5	1000.0	120.000	100.0	H	107.0	14.8	9.5	46.0	
271.530000	35.4	1000.0	120.000	110.0	H	295.0	15.0	10.6	46.0	
274.440000	42.1	1000.0	120.000	100.0	H	129.0	15.2	3.9	46.0	
947.146000	26.8	1000.0	120.000	377.0	V	346.0	28.2	19.2	46.0	

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

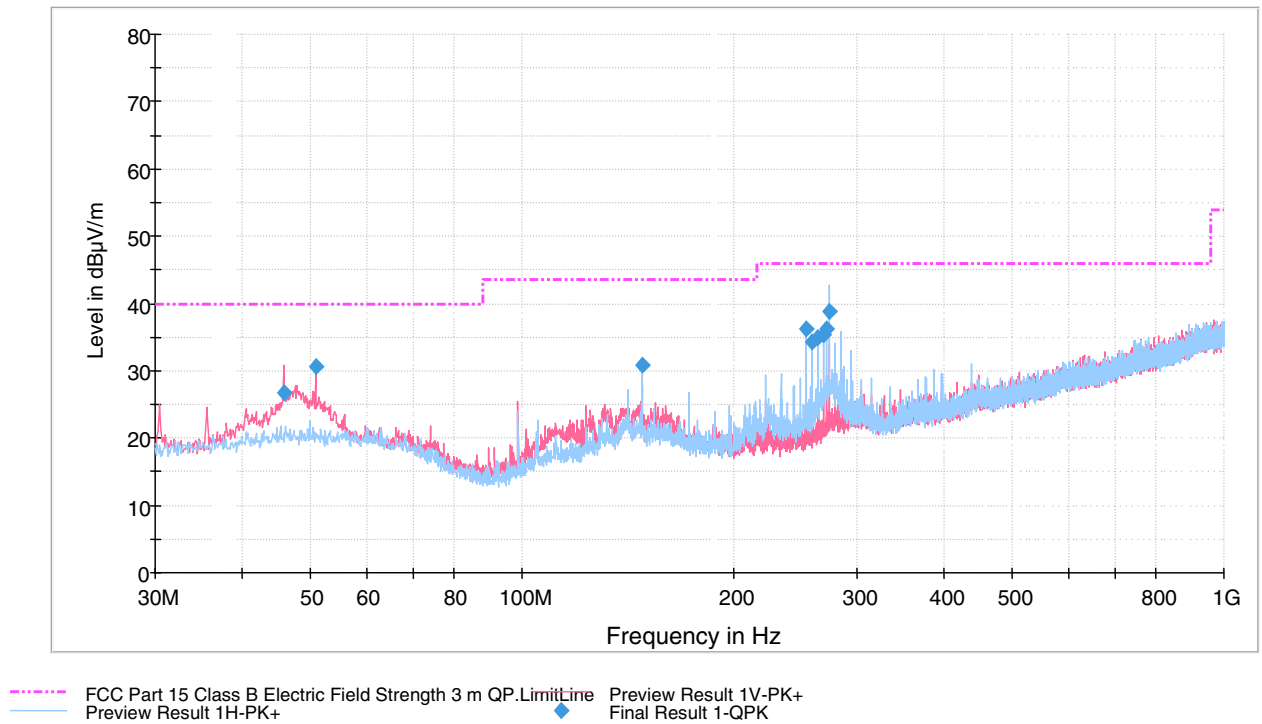


Figure 11. Measured curve with peak-detector (middle channel).

Table 2. Final measurements from the worst frequencies.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
45.734000	26.7	1000.0	120.000	100.0	V	200.0	15.2	13.3	40.0	
50.815000	30.7	1000.0	120.000	100.0	V	211.0	15.2	9.3	40.0	
148.109000	30.8	1000.0	120.000	214.0	H	257.0	14.8	12.7	43.5	
254.130000	36.2	1000.0	120.000	109.0	H	92.0	14.1	9.8	46.0	
259.191000	34.4	1000.0	120.000	118.0	H	102.0	14.3	11.6	46.0	
264.275000	34.9	1000.0	120.000	100.0	H	119.0	14.6	11.1	46.0	
269.336000	35.4	1000.0	120.000	100.0	H	101.0	14.8	10.6	46.0	
271.530000	36.3	1000.0	120.000	100.0	H	104.0	15.0	9.7	46.0	
274.500000	38.8	1000.0	120.000	100.0	H	115.0	15.2	7.2	46.0	

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

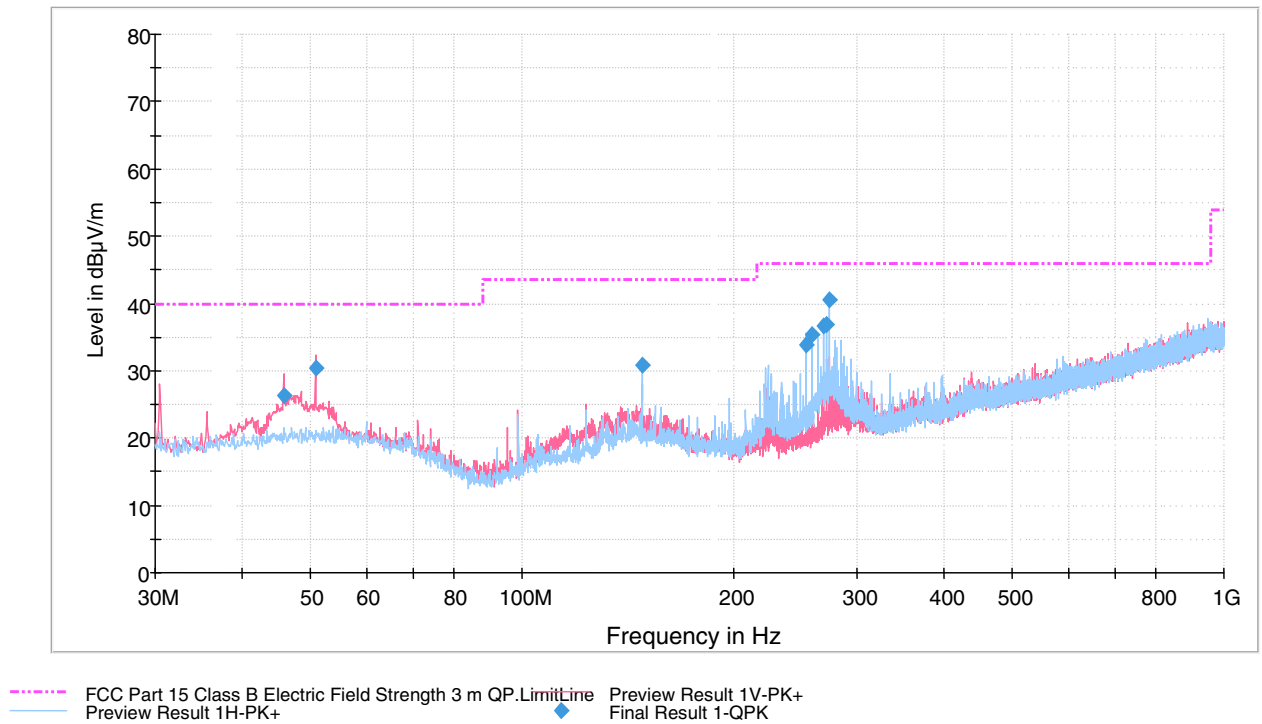


Figure 12. Measured curve with peak-detector (high channel).

Table 3. Final measurements from the worst frequencies.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
45.734000	26.4	1000.0	120.000	100.0	V	31.0	15.2	13.6	40.0	
50.818000	30.4	1000.0	120.000	100.0	V	214.0	15.2	9.6	40.0	
148.126000	30.8	1000.0	120.000	214.0	H	256.0	14.8	12.7	43.5	
254.150000	33.9	1000.0	120.000	100.0	H	105.0	14.1	12.1	46.0	
259.231000	35.3	1000.0	120.000	100.0	H	106.0	14.3	10.7	46.0	
269.376000	36.6	1000.0	120.000	100.0	H	110.0	14.8	9.4	46.0	
271.530000	37.0	1000.0	120.000	100.0	H	121.0	15.0	9.0	46.0	
274.440000	40.5	1000.0	120.000	100.0	H	118.0	15.2	5.5	46.0	

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

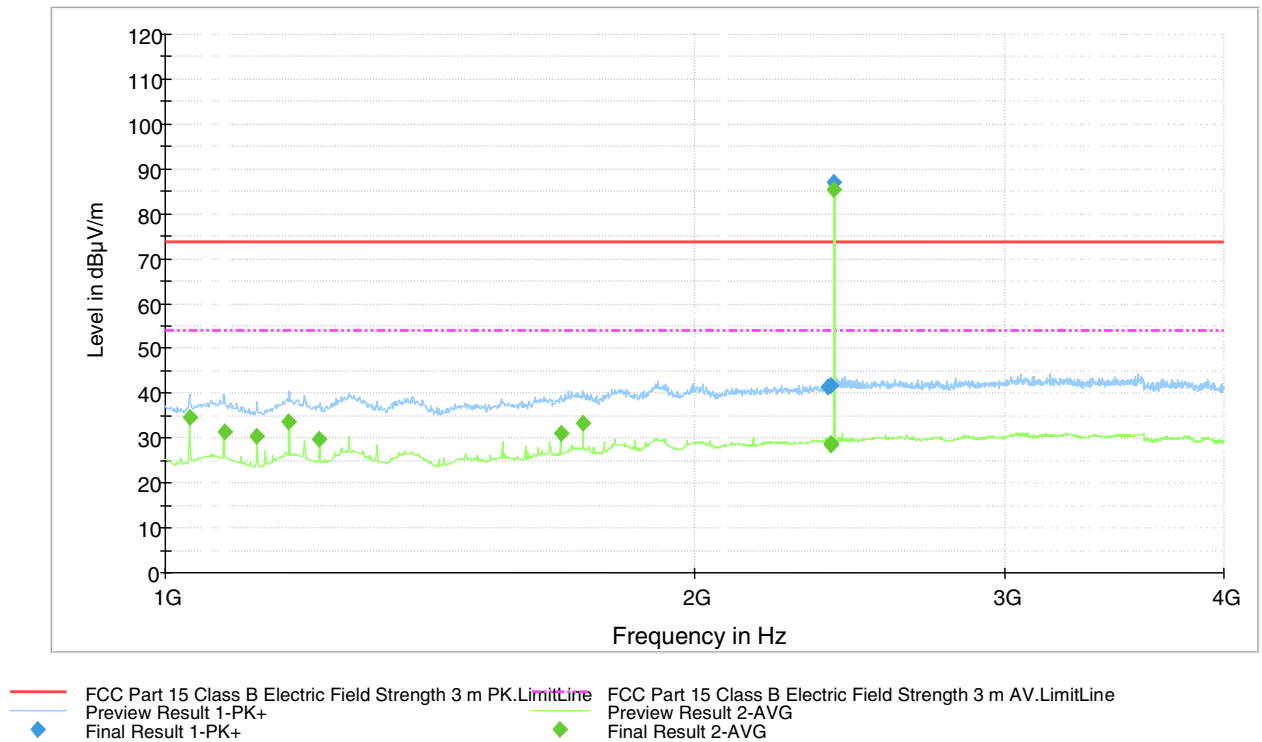


Figure 13. Measured curve with peak- and average detector (low channel).

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

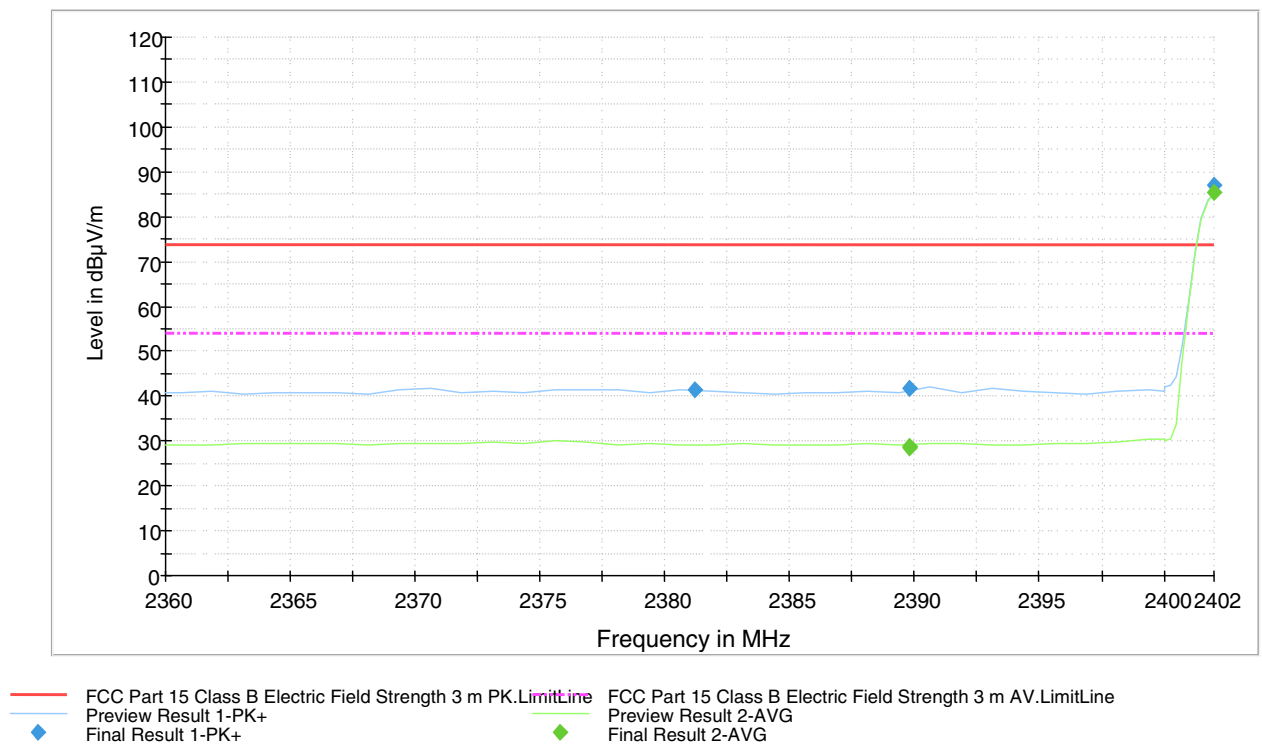


Figure 14. Low channel band edge

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

Final measurements from the worst frequencies

Table 4. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2381.200000	41.5	1000.0	1000.000	337.0	V	41.0	4.3	32.4	73.9	
2389.800000	41.8	1000.0	1000.000	211.0	H	68.0	4.4	32.1	73.9	

Table 5. Final Average results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
1032.075000	34.6	1000.0	1000.000	122.0	H	152.0	-4.0	19.3	53.9	
1080.025000	31.3	1000.0	1000.000	100.0	H	158.0	-4.3	22.6	53.9	
1127.925000	30.6	1000.0	1000.000	100.0	H	171.0	-4.0	23.3	53.9	
1176.025000	33.5	1000.0	1000.000	154.0	H	218.0	-3.4	20.4	53.9	
1223.975000	29.8	1000.0	1000.000	114.0	H	212.0	-2.4	24.1	53.9	
1678.575000	31.0	1000.0	1000.000	105.0	H	163.0	0.4	22.9	53.9	
1727.925000	33.4	1000.0	1000.000	219.0	H	164.0	0.8	20.5	53.9	
2389.800000	28.7	1000.0	1000.000	146.0	H	87.0	4.4	25.2	53.9	
2389.800000	28.4	1000.0	1000.000	138.0	V	37.0	4.4	25.5	53.9	

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

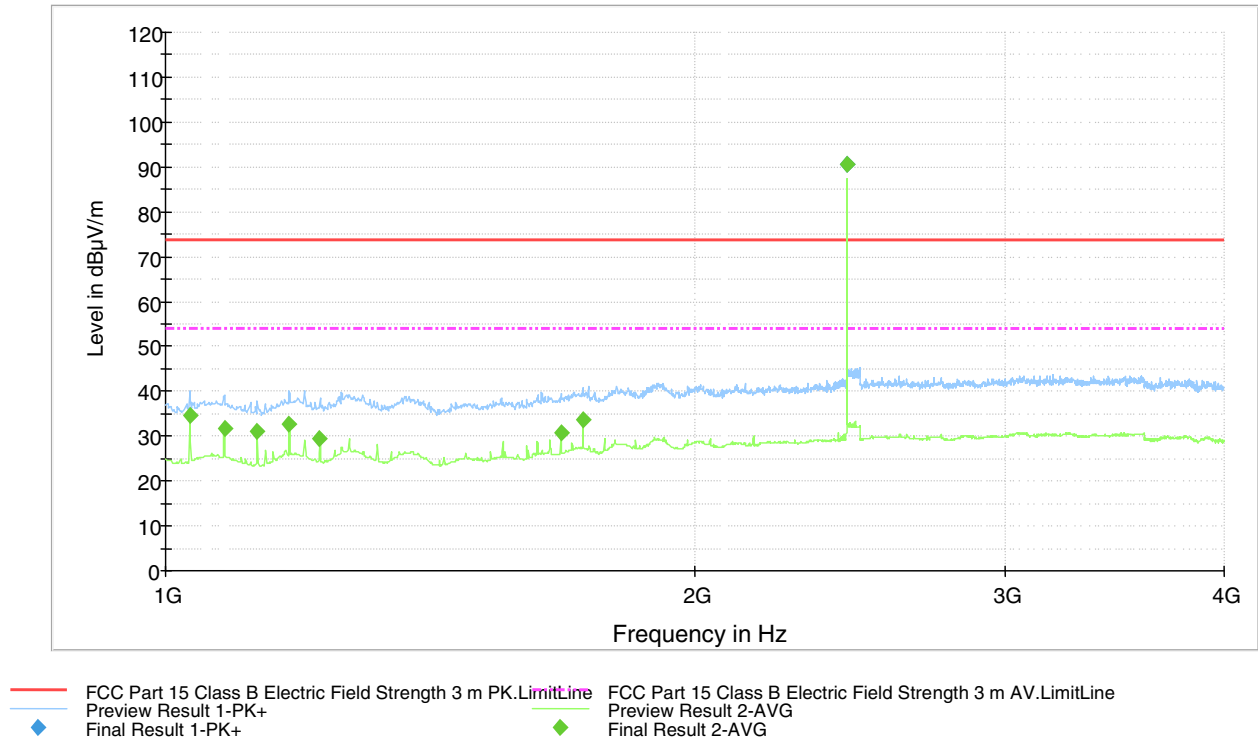


Figure 15. Measured curve with peak- and average detector (middle channel).

Final measurements from the worst frequencies

Table 6. Final Average results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
1032.075000	34.6	1000.0	1000.000	122.0	H	153.0	-4.0	19.3	53.9	
1080.025000	31.8	1000.0	1000.000	114.0	H	158.0	-4.3	22.1	53.9	
1127.925000	31.1	1000.0	1000.000	233.0	H	169.0	-4.0	22.8	53.9	
1176.025000	32.7	1000.0	1000.000	100.0	H	230.0	-3.4	21.2	53.9	
1223.975000	29.5	1000.0	1000.000	100.0	H	212.0	-2.4	24.4	53.9	
1678.575000	30.7	1000.0	1000.000	227.0	H	164.0	0.4	23.2	53.9	
1727.925000	33.6	1000.0	1000.000	220.0	H	164.0	0.8	20.3	53.9	

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

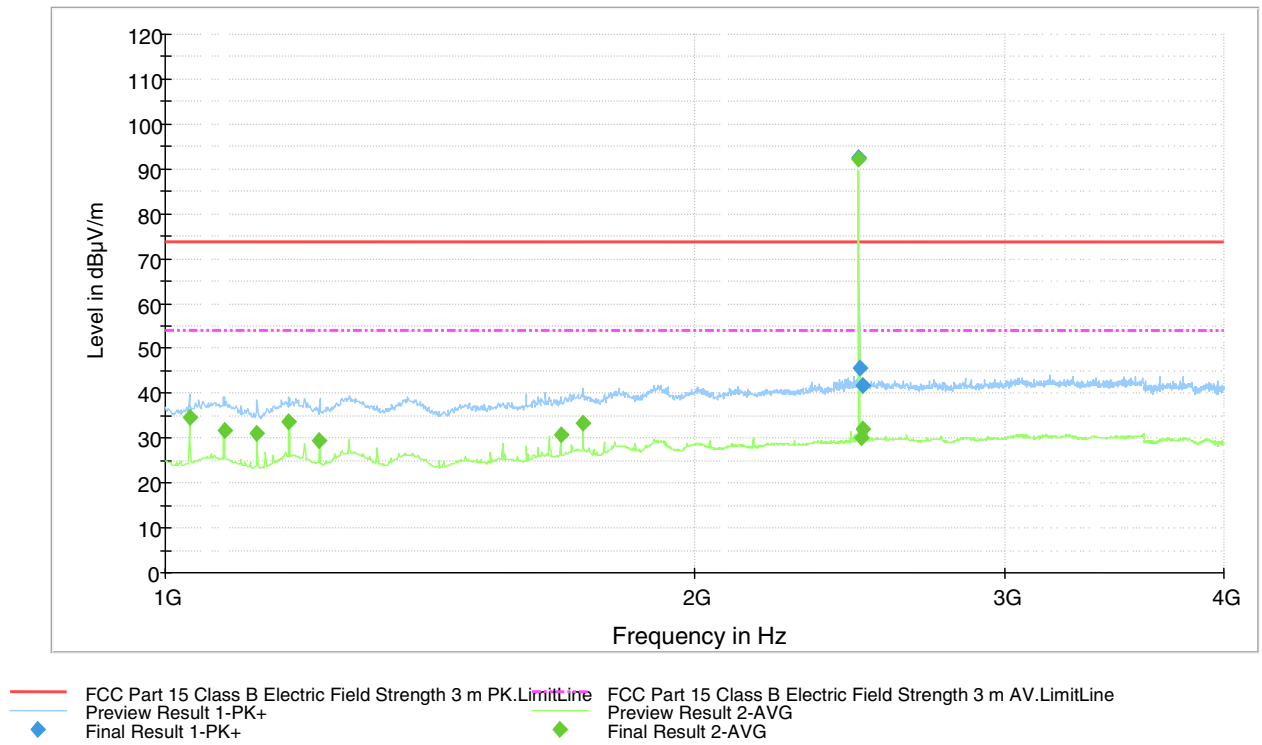


Figure 16. Measured curve with peak- and average detector (high channel).

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

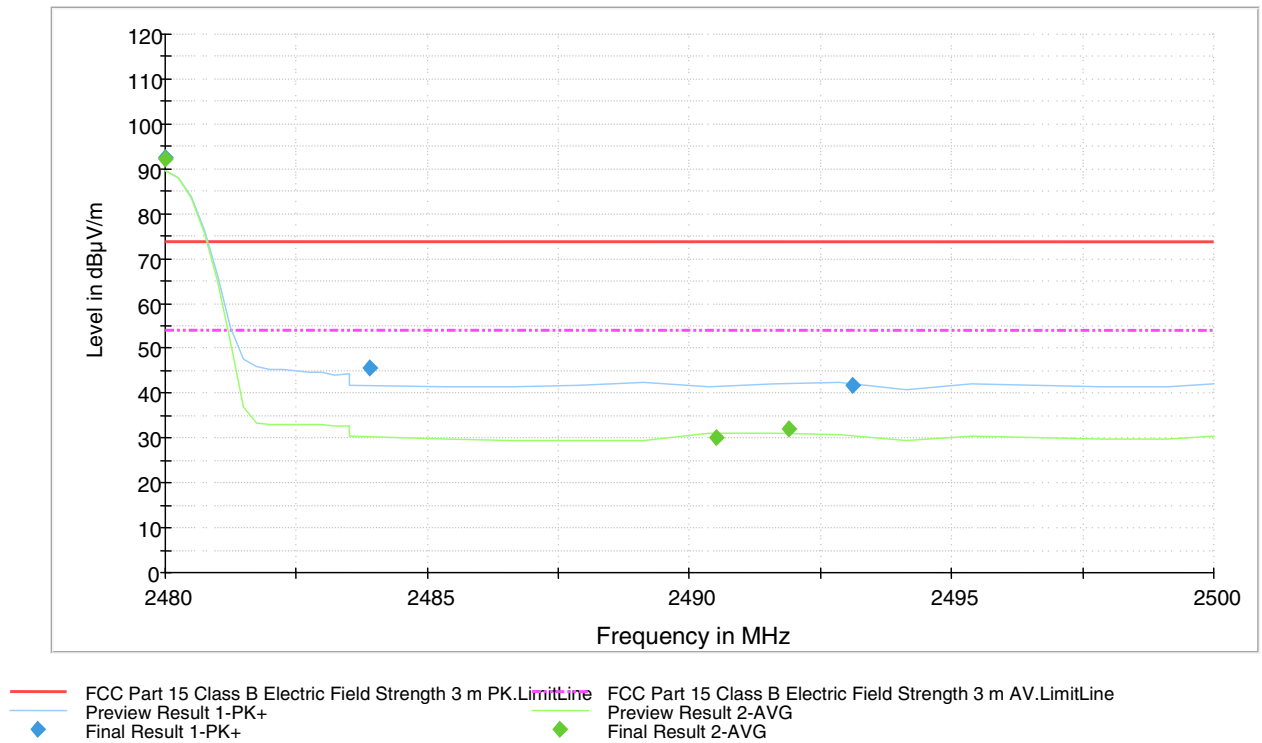


Figure 17. High channel band edge

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

Final measurements from the worst frequencies

Table 7. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
2483.900000	45.6	1000.0	1000.000	225.0	H	3.0	4.8	28.3	73.9	
2493.100000	41.9	1000.0	1000.000	392.0	V	31.0	4.9	32.0	73.9	

Table 8. Final Average results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
1032.075000	34.6	1000.0	1000.000	122.0	H	158.0	-4.0	19.3	53.9	
1080.025000	31.8	1000.0	1000.000	114.0	H	158.0	-4.3	22.1	53.9	
1127.925000	31.0	1000.0	1000.000	238.0	H	170.0	-4.0	22.9	53.9	
1176.025000	33.6	1000.0	1000.000	154.0	H	206.0	-3.4	20.3	53.9	
1223.975000	29.5	1000.0	1000.000	100.0	H	212.0	-2.4	24.4	53.9	
1678.575000	30.6	1000.0	1000.000	100.0	H	164.0	0.4	23.3	53.9	
1727.925000	33.5	1000.0	1000.000	226.0	H	176.0	0.8	20.4	53.9	
2490.500000	29.9	1000.0	1000.000	130.0	V	27.0	4.8	24.0	53.9	
2491.900000	31.9	1000.0	1000.000	227.0	H	357.0	4.9	22.0	53.9	

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

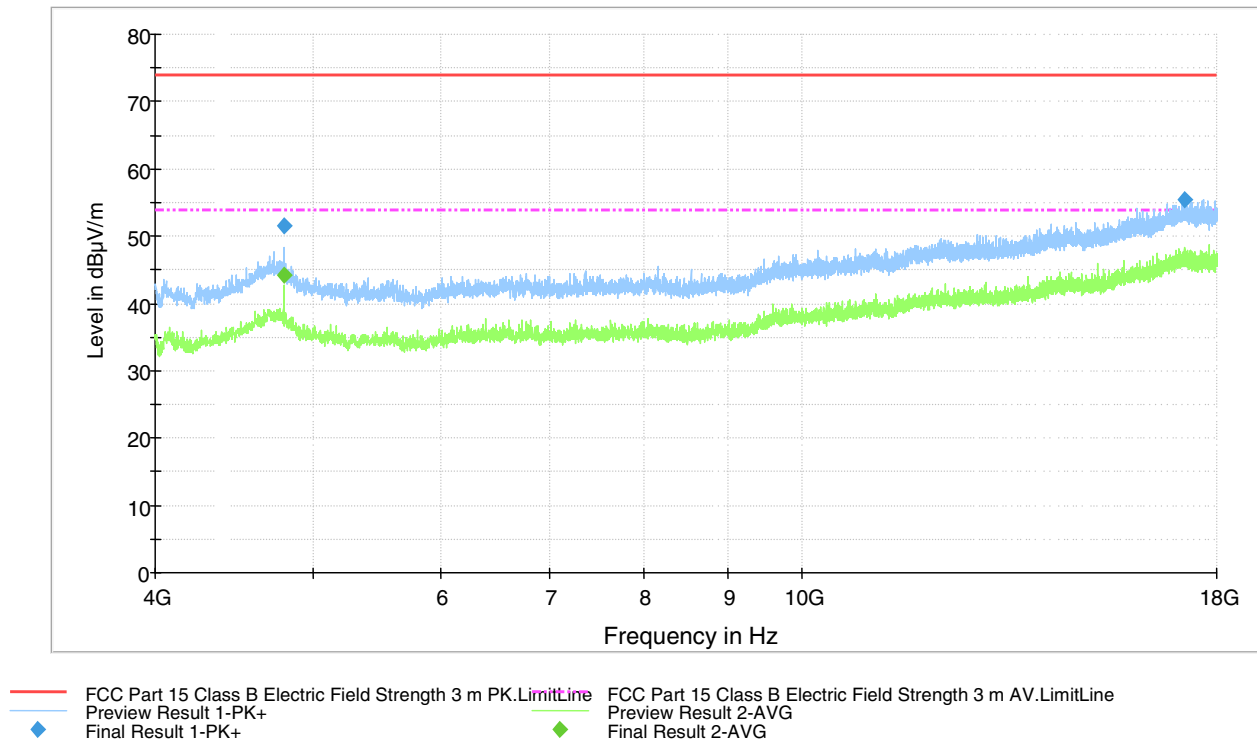


Figure 18. Measured curve with peak- and average detector (low channel).

Final measurements from the worst frequencies

Table 9. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
4803.800000	51.5	1000.0	1000.000	100.0	H	237.0	13.8	22.4	73.9	
17204.800000	55.4	1000.0	1000.000	391.0	H	136.0	28.3	18.5	73.9	

Table 10. Final Average results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
4804.000000	44.2	1000.0	1000.000	114.0	V	313.0	13.8	9.7	53.9	

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

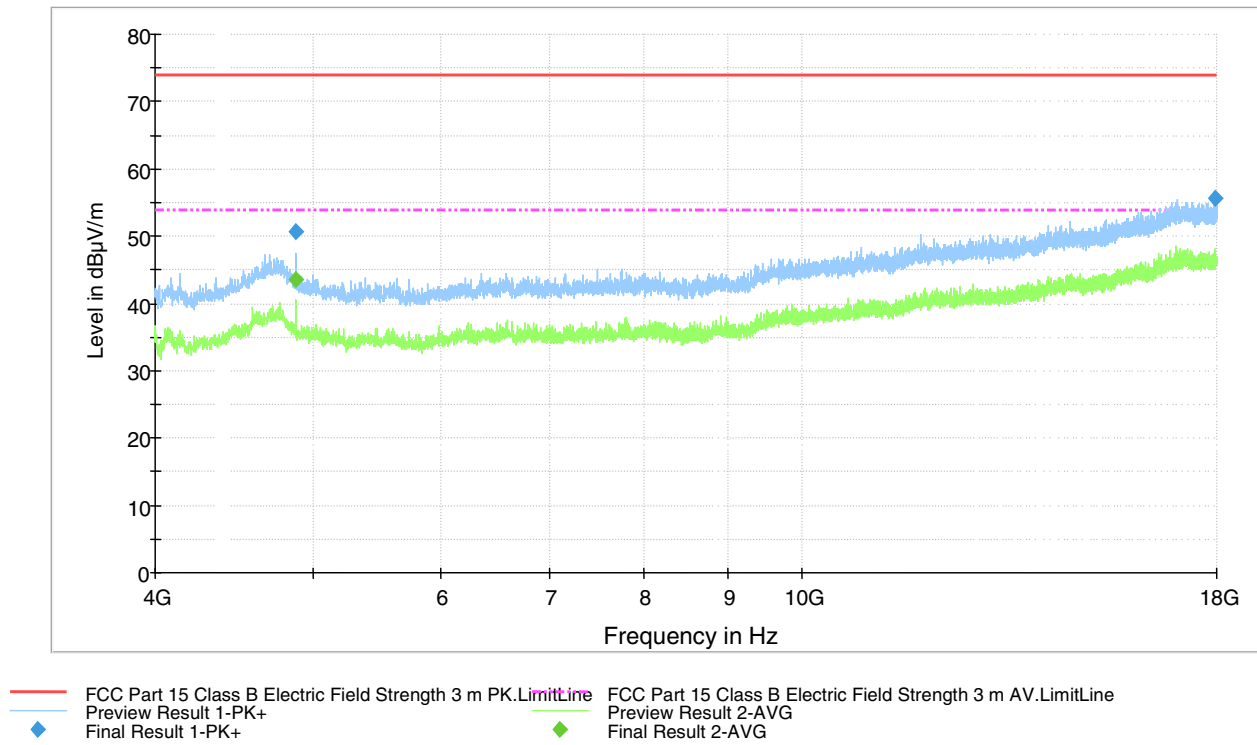


Figure 19. Measured curve with peak- and average detector (middle channel).

Final measurements from the worst frequencies

Table 11. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
4882.000000	50.6	1000.0	1000.000	100.0	H	241.0	12.8	23.3	73.9	
17957.000000	55.6	1000.0	1000.000	369.0	H	221.0	28.7	18.3	73.9	

Table 12. Final Average results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
4882.000000	43.5	1000.0	1000.000	105.0	H	244.0	12.8	10.4	53.9	

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

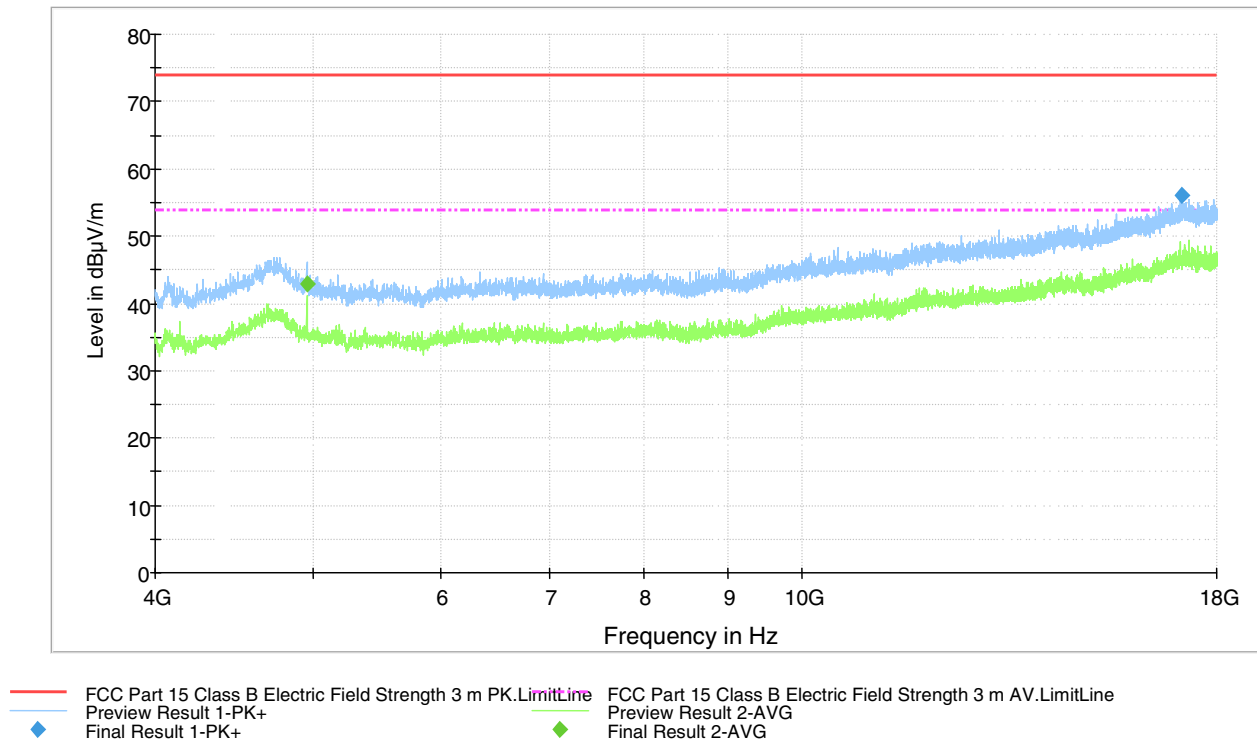


Figure 20. Measured curve with peak- and average detector (high channel).

Final measurements from the worst frequencies

Table 13. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
17141.200000	56.0	1000.0	1000.000	138.0	H	109.0	28.2	17.9	73.9	

Table 14. Final Average results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
4960.000000	42.9	1000.0	1000.000	105.0	H	239.0	12.0	11.0	53.9	
17305.000000	42.1	1000.0	1000.000	400.0	V	175.0	28.2	11.8	53.9	

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

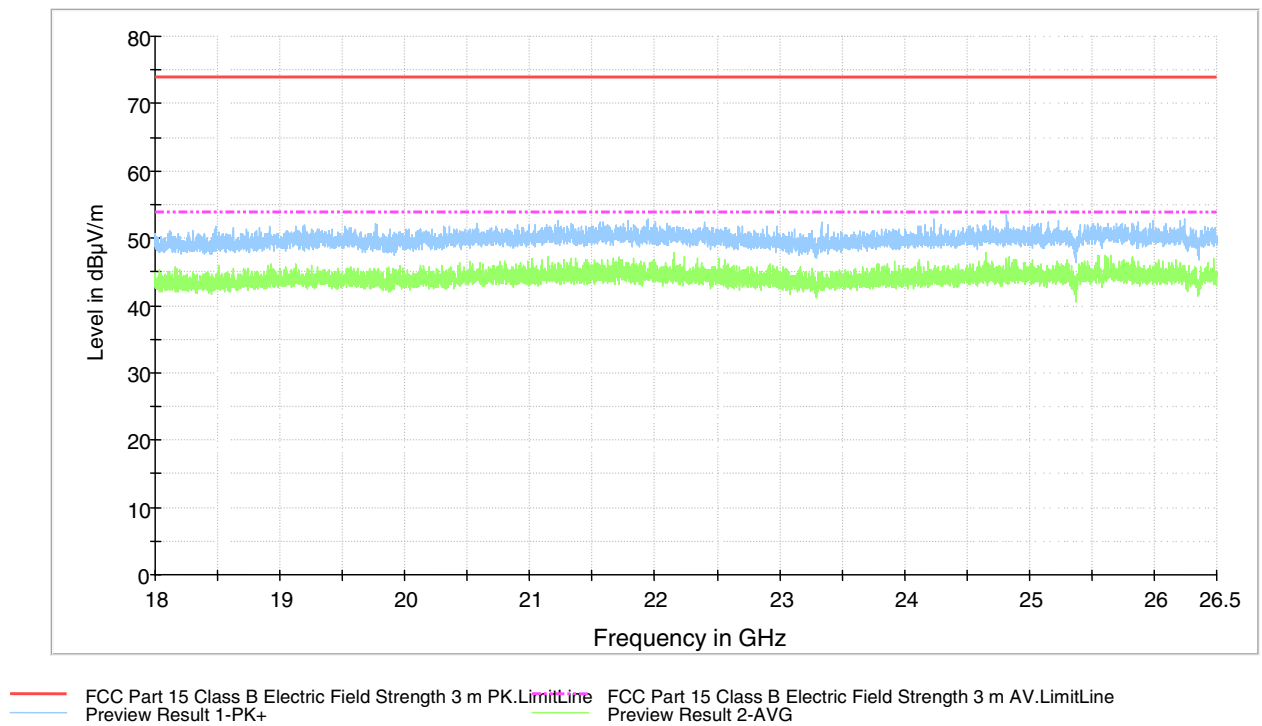


Figure 21. Measured curve with peak- and average detector (low channel).

Final measurements from the worst frequencies

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

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

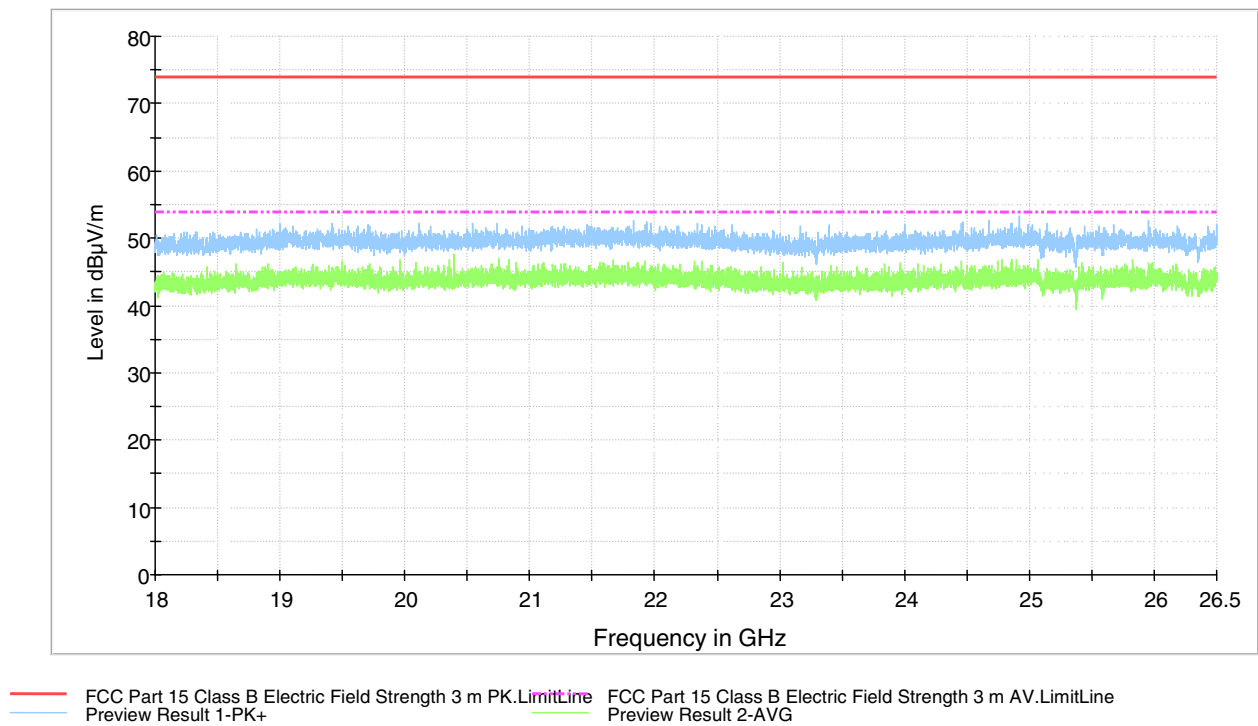


Figure 22. Measured curve with peak- and average detector (middle channel).

Final measurements from the worst frequencies

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

Radiated Spurious emissions 30 to 26 500 MHz and Band Edge

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

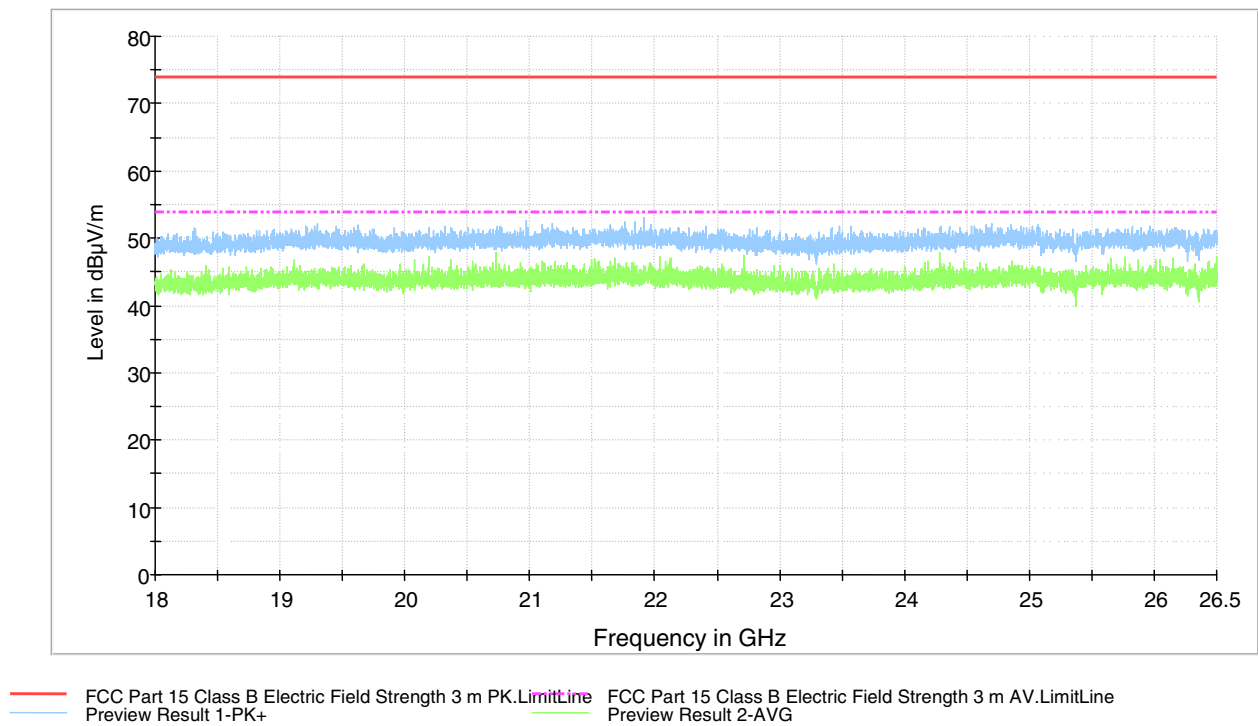


Figure 23. Measured curve with peak- and average detector (high channel).

Final measurements from the worst frequencies

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

List of Test Equipment

LIST OF 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	-	-
BOONTON			
RF power meter	4300	87105ED	5029
Power sensor	51075	34999	8266
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).