

Test Report



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

Equipment Under Test: Patient monitoring system (with WLAN)

Type: VC150 Vital Signs Monitor

Models: Nellcor
Trusignal
Masimo

Manufacturer: Innokas Yhtymä Oy
Tarjusojaantie 12
FI-90440 KEMPELE
FINLAND

Customer: Innokas Medical Oy
Elimäenkatu 9B
FI-00510 HELSINKI
FINLAND

FCC Rule Part: 15.247: 2013
IC Rule Part: RSS-210, Issue 8, 2010
RSS-GEN Issue 3, 2010

KDB: Guidance for Performing Compliance Measurements
on Digital Transmission Systems (DTS) Operating
Under §15.247 (April 9, 2013)

Date: December 5, 2013

Issued by:


Rauno Repo
Testing Engineer

Date: December 9, 2013

Checked by:


Jari Merikari
Technical Manager

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Equipment Under Test (EUT)

Patient monitoring system (with WLAN)
Type: VC150 Vital Signs Monitor
Model: Nellcor (sample 1&2), Masimo (sample 3)
Sample 1 serial number: SK513350008YP (radiated emissions except the frequency range 30 to 1000MHz)
Sample 2 serial number: SK513350001YP (conductive measurements with temporary antenna connector)
Sample 3 serial number: SK513370002YP (radiated emissions at frequency range 30-1000 MHz and verification measurements with one channel 1 to 26.5 GHz)

The EUT is a patient monitoring system with WLAN for 2.4 GHz and 5 GHz frequency ranges. This test report contains only the tests with 2.4 GHz WLAN. There are three different models: Nellcor, Trusignal and Masimo. The difference between the models is the patient module – Nellcor, Trusignal or Masimo. Tests are made with three samples, two for radiated measurements and one with temporary antenna connector for conductive measurements.

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

Sample 3 had the newest main board v. 0.11.

Ratings and declarations

WLAN (802.11 b/g/n):

Operating Frequency Range (OFR):	2412 – 2462 MHz
Channels:	11
Channel separation:	5 MHz
Channel bandwidth:	20 MHz (802.11b-mode) 22 MHz (802.11g/n-mode)
Conducted power:	+25.00 dBm
Transmission technique:	DSSS/OFDM
Modulation:	CCK/OFDM
Transmission rate:	1-72.2 Mbps
Antenna gain:	0.5 dBi

Power Supply

Tests were performed with 120 V/ 60 Hz using AC/DC power adapter:

Manufacturer:	XP Power
Model:	AFM45US24
Input:	110 – 240 V AC, 1.1A
	50 – 60 Hz
Output:	24.0 V DC, 2.01 A

Disclaimer

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SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.207(a) / RSS-GEN 7.2.2	Conducted Emissions on Power Supply Lines	PASS
§15.247(b)(3) / RSS-210 8.4	Maximum Peak Conducted Output Power	PASS
§15.247(a)(2) / RSS-210 A8.2	6 dB Bandwidth	PASS
§15.247(e) / RSS-210 A8.2	Power Spectral Density	PASS
RSS-GEN 4.6.1	99 % Occupied Bandwidth	PASS
§15.247(d) / RSS-210 A8.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	PASS
§15.209(a), §15.247(d) / RSS-210 A8.5	Radiated Emissions Within The Restricted Bands	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

Preliminary tests were performed in different data rates and modulation methods to find the worst case emissions. The following test mode was selected for the final tests:

Mode 802.11b: 11 Mbps

Following channels were used during the tests:

Channel	Frequency/ MHz
LOW	2412
MID	2437
HIGH	2462

Test Facility

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

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

Standard: ANSI C63.10 (2009)
Tested by: RRE
Date: 16.10.2013
Temperature: 24 °C
Humidity: 19 % RH
Barometric pressure: 1008 hPa
Measurement uncertainty: ± 2.9 dB Level of confidence 95 % (k = 2)

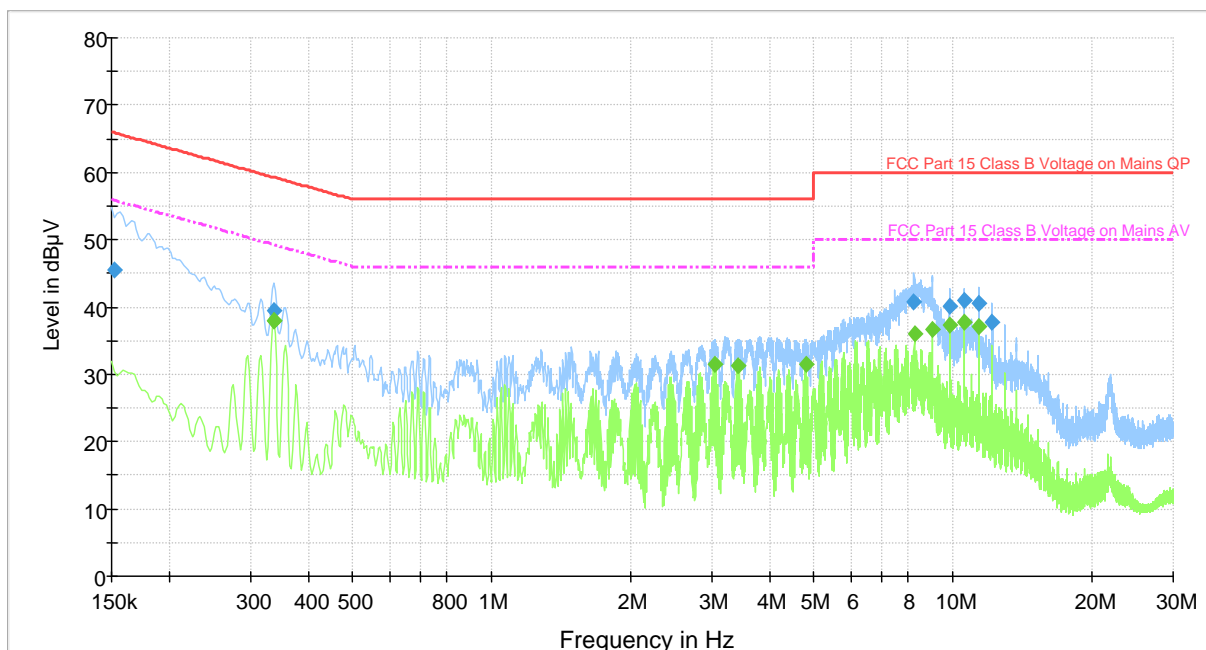
FCC Rule: 15.207 (a)

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with 4.5 kHz steps and a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors. During the test the EUT was powered from the separate power supply (120 VAC / 60 Hz) through the LISN.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Conducted Emission Mains FCC Part 15 Class B with ESH3-Z5 8019



— FCC Part 15 Class B Voltage on Mains QP.LimitLine — FCC Part 15 Class B Voltage on Mains AV.LimitLine
 — Preview Result 1-PK+ — Preview Result 2-AVG
 ◆ Final Result 1-QPK ◆ Final Result 2-AVG

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 15x(ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.152250	45.5	1000.0	9.000	L1	10.7	20.4	65.9	
0.336750	39.5	1000.0	9.000	L1	10.4	19.8	59.3	
8.240500	40.7	1000.0	9.000	N	10.7	19.3	60.0	
9.815500	40.1	1000.0	9.000	N	10.8	19.9	60.0	
10.598500	40.9	1000.0	9.000	N	10.9	19.1	60.0	
11.377000	40.5	1000.0	9.000	N	10.9	19.5	60.0	
12.171250	37.8	1000.0	9.000	N	11.0	22.2	60.0	

Table 2. Final measurement results with Average detector.

Frequency (MHz)	Average (dBµV)	Meas. Time 15x(ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.336750	38.0	1000.0	9.000	L1	10.4	11.3	49.3	
0.336750	38.0	1000.0	9.000	L1	10.4	11.3	49.3	
3.049750	31.4	1000.0	9.000	L1	10.3	14.6	46.0	
3.427750	31.2	1000.0	9.000	L1	10.4	14.8	46.0	
4.793500	31.5	1000.0	9.000	L1	10.5	14.5	46.0	
8.242750	36.1	1000.0	9.000	N	10.7	13.9	50.0	
9.030250	36.7	1000.0	9.000	N	10.8	13.3	50.0	
9.815500	37.2	1000.0	9.000	N	10.8	12.8	50.0	
10.600750	37.8	1000.0	9.000	N	10.9	12.2	50.0	
11.386000	37.2	1000.0	9.000	N	10.9	12.8	50.0	

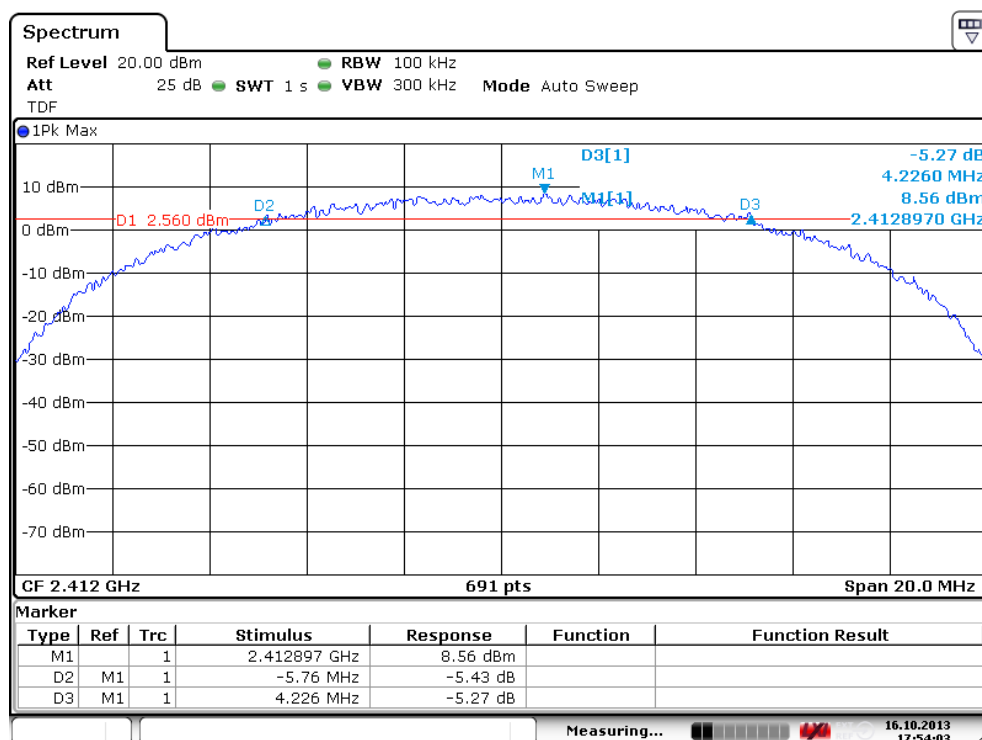
6 dB Bandwidth

Standard: ANSI C63.10 (2009)
Tested by: RRE
Date: 16.10.2013
Temperature: 24 °C
Humidity: 19 % RH

FCC Rule: 15.247 (a) (2)

System using digital modulation techniques may operate in the 2400 – 2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 Hz.

6 dB Bandwidth		
Low channel	Mid channel	High channel
9.986 MHz	10.015 MHz	9.986 MHz



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Figure 2. Low channel 6 dB bandwidth.

6 dB Bandwidth

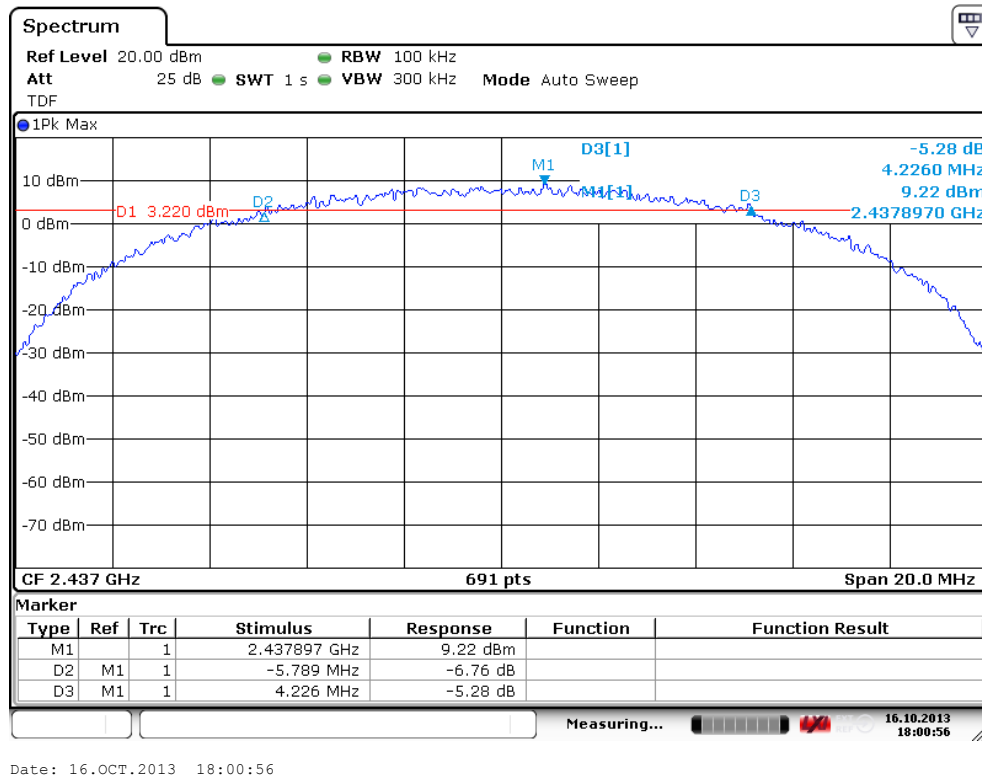


Figure 3. Mid channel 6 dB bandwidth.

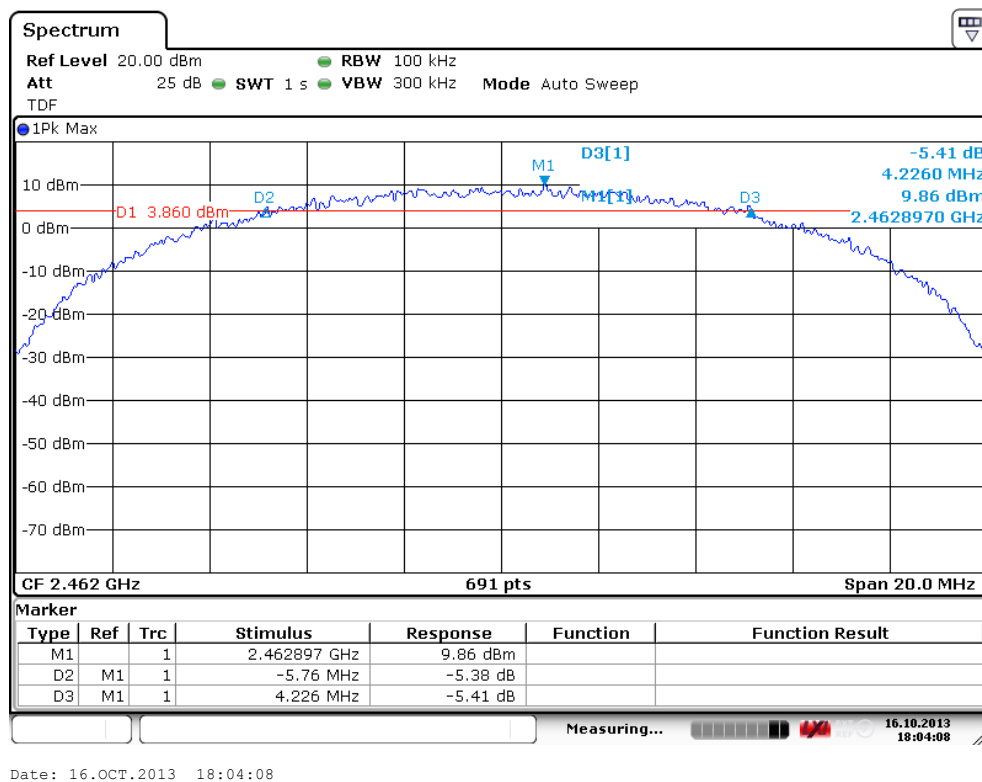


Figure 4. High channel 6 dB bandwidth.

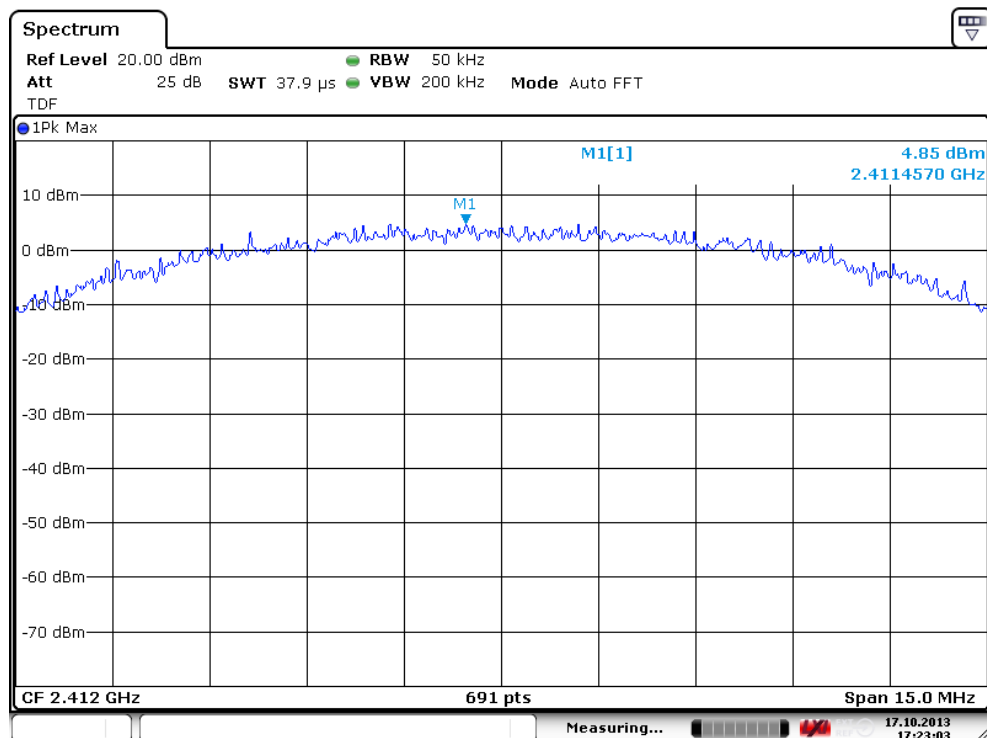
Power Spectral Density

Standard: ANSI C63.10 (2009)
Tested by: RRE
Date: 17.10.2013
Temperature: 23 °C
Humidity: 22 % RH

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 determining the conducted output power shall be used to determine the power spectral density.

Channel	RF Power Density [dBm] with 50 kHz RBW	Limit [dBm]	Result
Low	4.85	8	PASS
Mid	5.89	8	PASS
High	6.44	8	PASS



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Figure 5. Low channel power spectral density.

Power Spectral Density

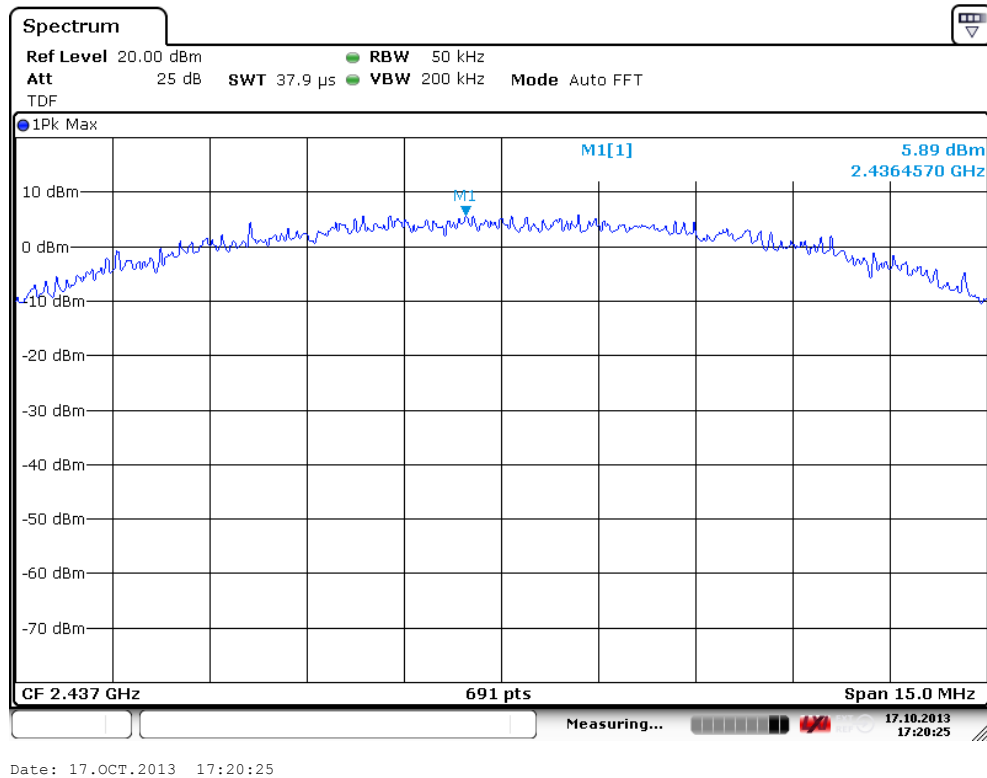


Figure 6. Mid channel power spectral density.

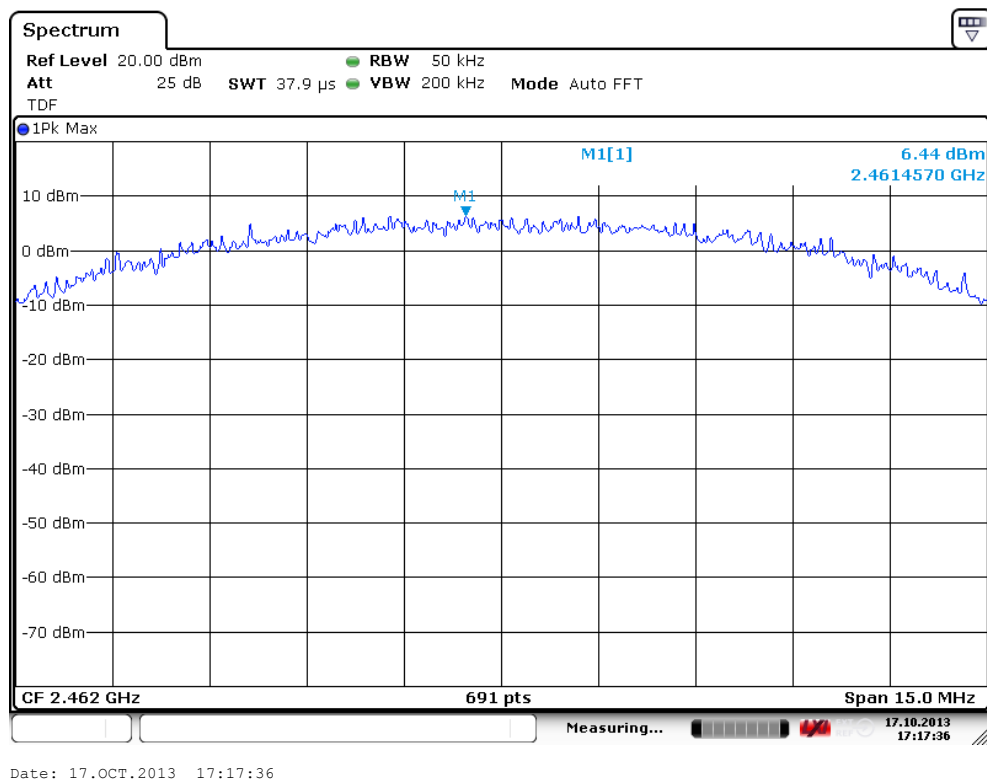


Figure 7. High channel power spectral density

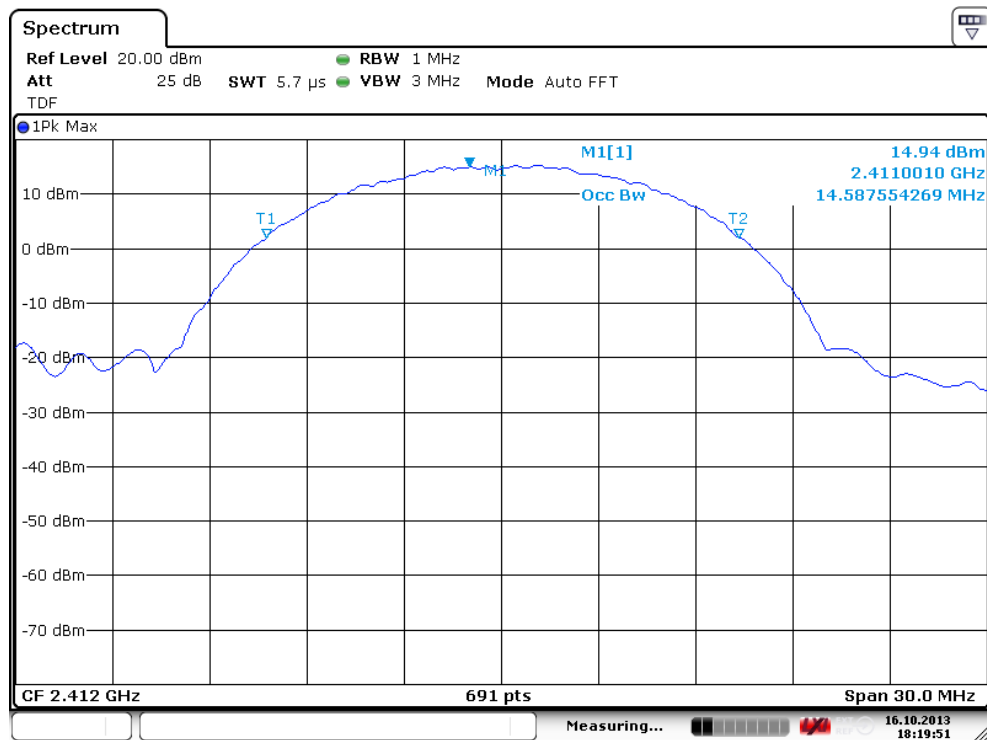
99% Occupied Power Bandwidth

99% Occupied Power Bandwidth

Standard: RSS-GEN (2010)
Tested by: RRE
Date: 16.10.2013
Temperature: 24 °C
Humidity: 19 % RH

RSS-GEN 4.7.

Channel	99% BW [MHz]	Limit	Result
Low	14.500723589	-	PASS
Mid	14.500723589	-	PASS
High	14.500723589	-	PASS



Date: 16.OCT.2013 18:19:51

Figure 8. Low channel 99% Occupied Power Bandwidth.

99% Occupied Power Bandwidth

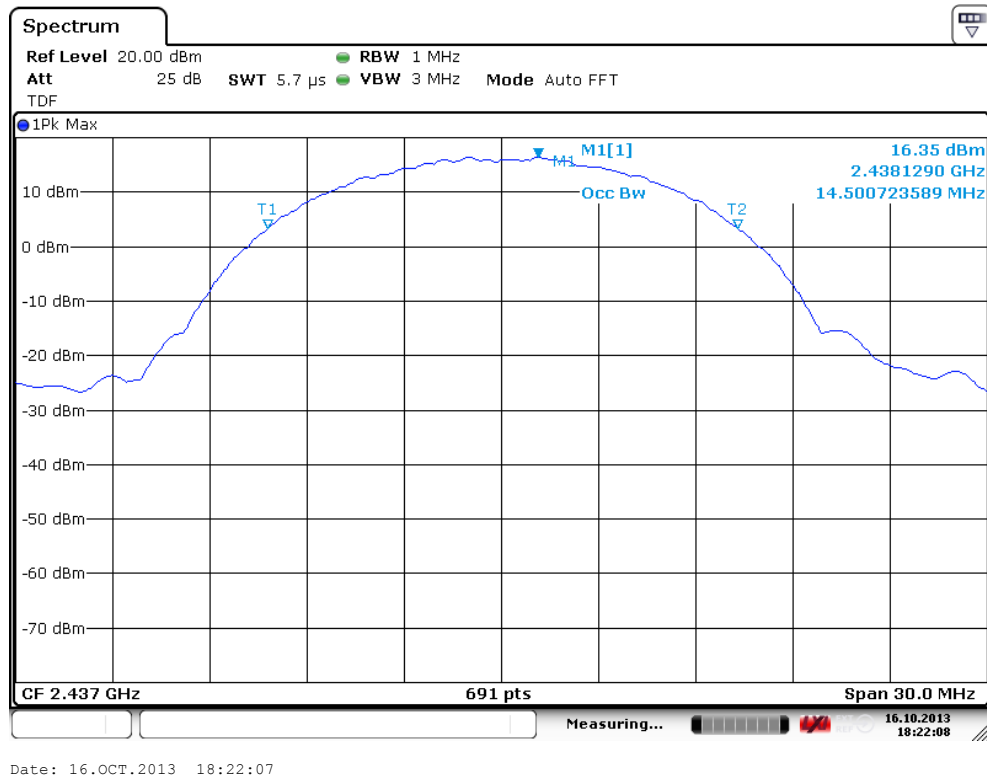


Figure 9. Mid channel 99% Occupied Power Bandwidth.

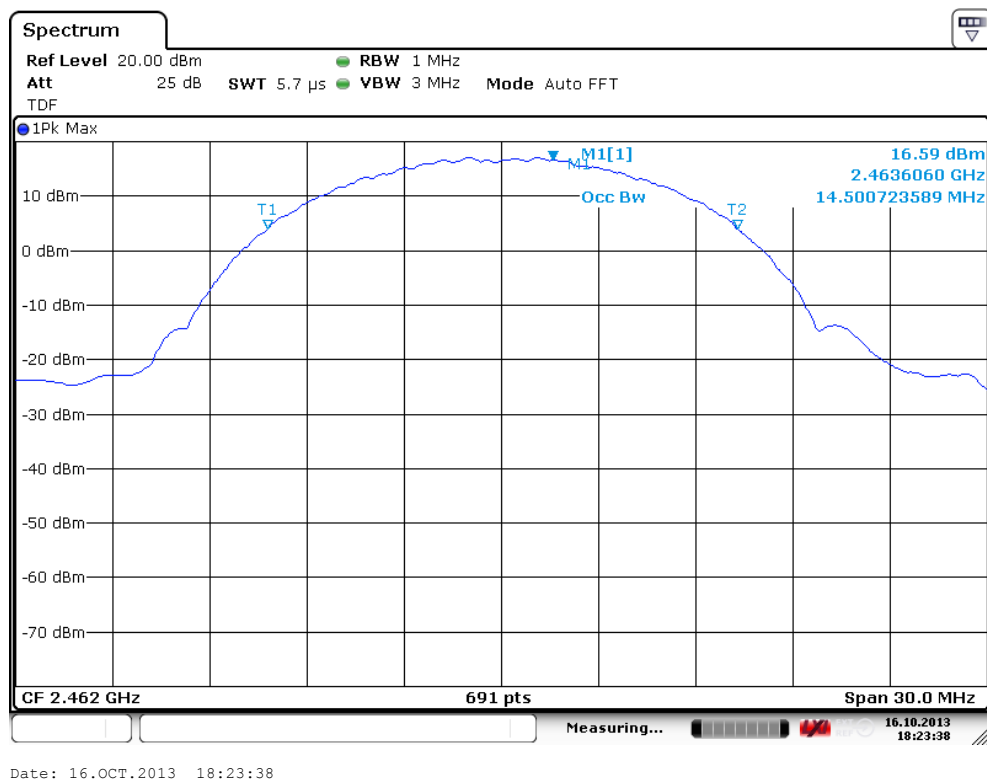


Figure 10. Mid channel 99% Occupied Power Bandwidth.

Maximum Peak Conducted Output Power Measurement

Maximum Peak Conducted Output Power Measurement

Standard: ANSI C63.10 (2009)
Tested by: RRE
Date: 2.5.2013
Temperature: 22 °C
Humidity: 22 % 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 *maximum conducted output power* is the highest total transmit power occurring in any mode.

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	23.25	30	6.75	PASS
Mid	24.39	30	5.61	PASS
High	25.00	30	5.00	PASS

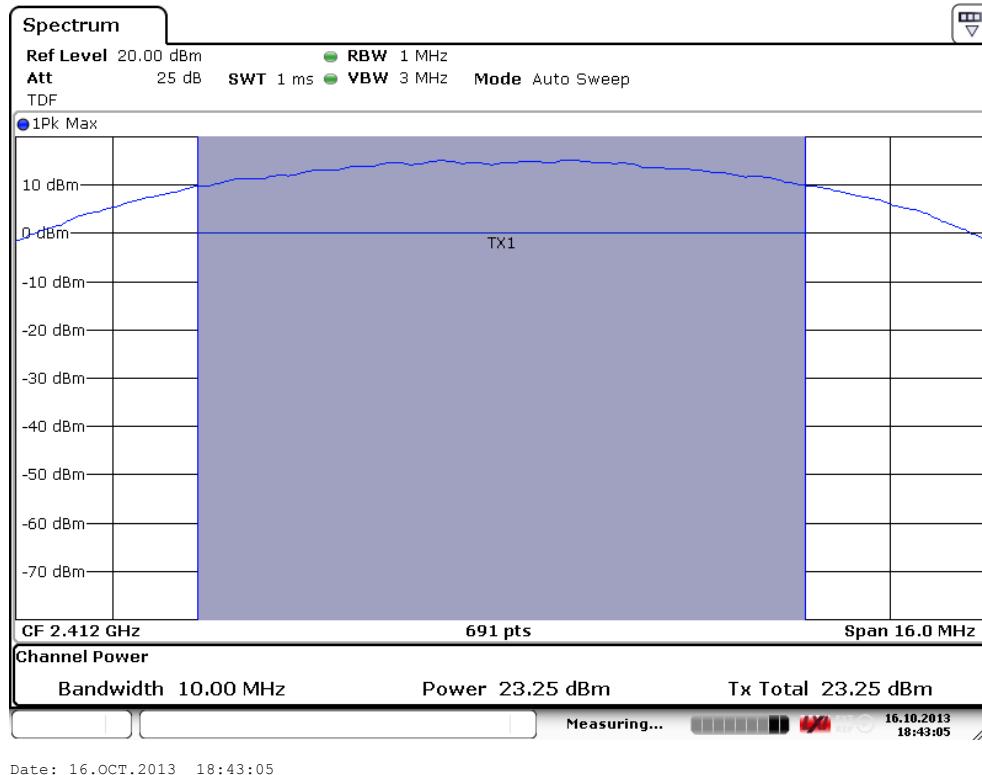


Figure 11. Low channel.

Maximum Peak Conducted Output Power Measurement

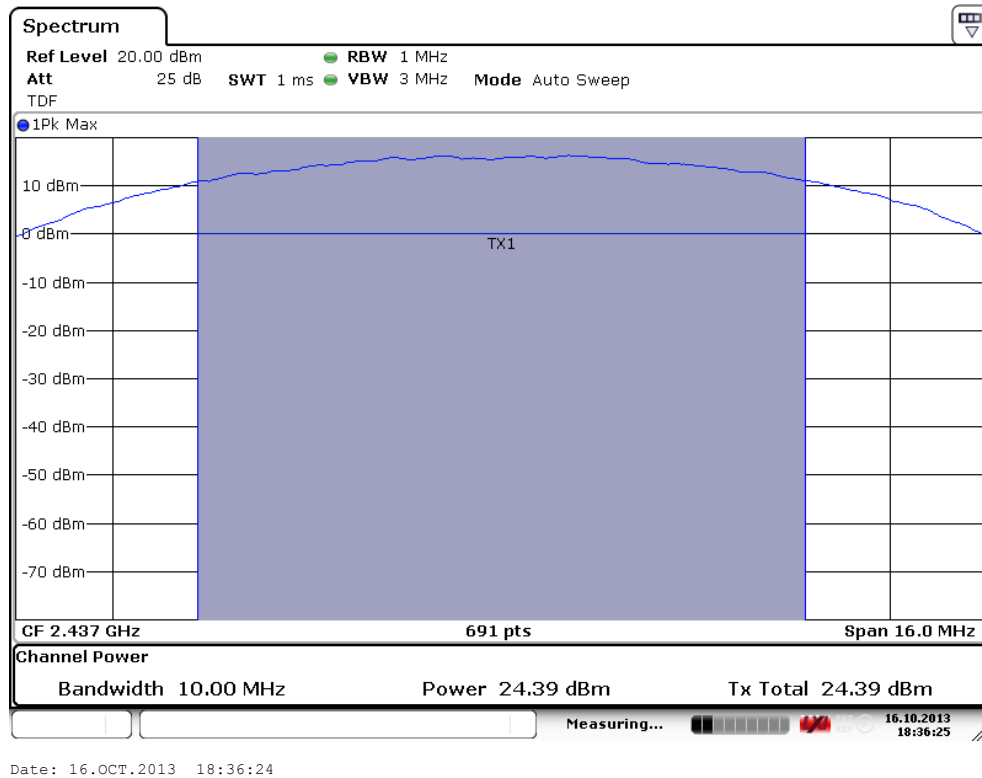


Figure 12. Mid channel.

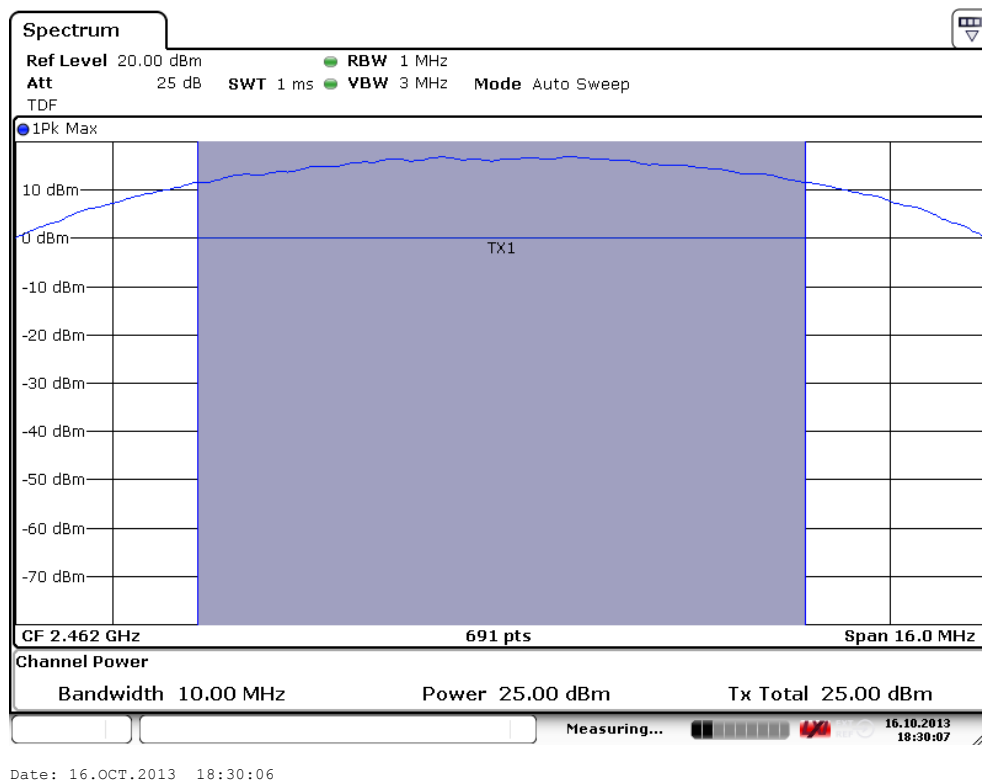


Figure 13. High channel.

Transmitter Radiated Emissions 30 – 26 500 MHz and Band Edge

Standard: ANSI C63.10 (2009)
Tested by: RRE
Date: 14.10 – 28.11.2013
Temperature: 20 – 24 °C
Humidity: 20 – 27 % 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.

Spurious and Band Edge Radiated Emissions

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

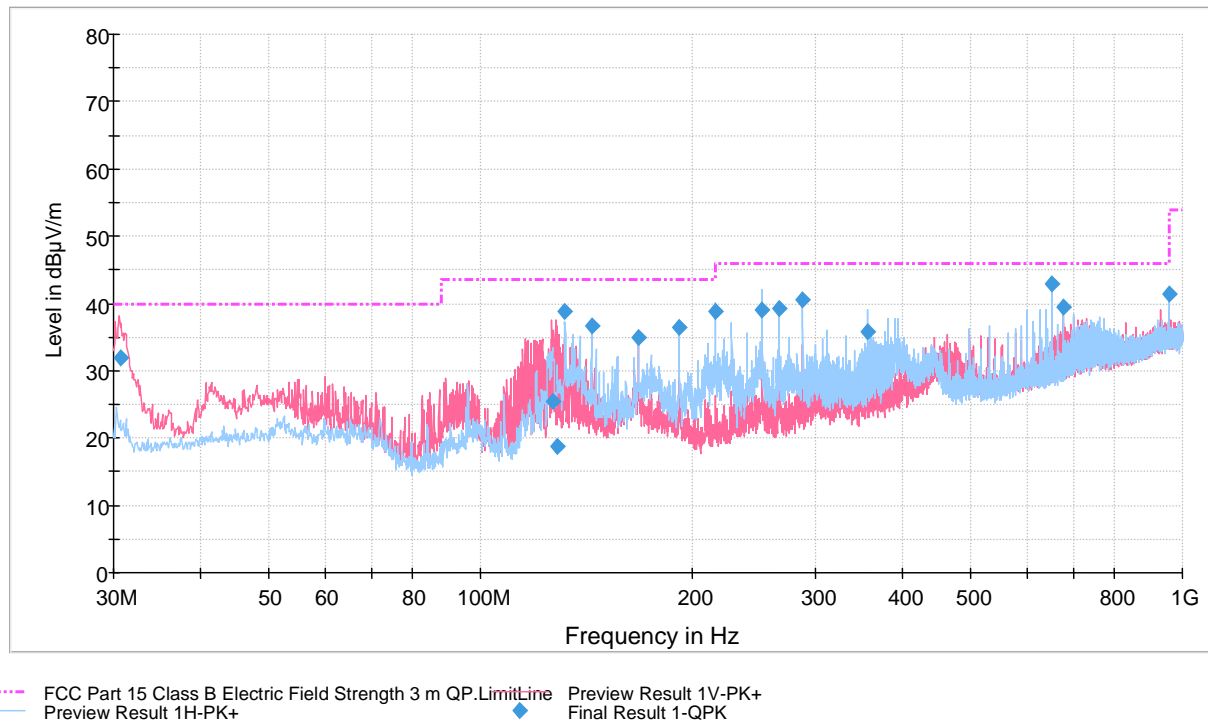


Figure 14. Measured curves with peak-detector (low channel).

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
30.720000	31.9	1000.0	120.000	100.0	V	109.0	14.1	8.1	40.0	
126.775000	25.4	1000.0	120.000	138.0	V	198.0	12.5	18.1	43.5	
128.504000	18.8	1000.0	120.000	209.0	V	247.0	12.7	24.7	43.5	
131.990000	38.7	1000.0	120.000	245.0	H	114.0	13.1	4.8	43.5	
144.015000	36.6	1000.0	120.000	207.0	H	103.0	14.5	6.9	43.5	
168.088000	35.0	1000.0	120.000	166.0	H	101.0	14.7	8.5	43.5	
191.993000	36.4	1000.0	120.000	203.0	H	264.0	13.2	7.1	43.5	
215.989000	38.8	1000.0	120.000	144.0	H	99.0	12.5	4.7	43.5	
251.993000	39.1	1000.0	120.000	100.0	H	202.0	14.1	6.9	46.0	
266.021000	39.3	1000.0	120.000	100.0	H	155.0	14.7	6.7	46.0	
288.000000	40.5	1000.0	120.000	115.0	H	153.0	15.5	5.5	46.0	
356.365000	35.8	1000.0	120.000	100.0	H	117.0	17.4	10.2	46.0	
651.285000	42.9	1000.0	120.000	121.0	H	205.0	23.6	3.1	46.0	
675.863000	39.4	1000.0	120.000	100.0	V	65.0	23.9	6.6	46.0	
960.016000	41.5	1000.0	120.000	100.0	H	215.0	28.1	12.4	53.9	

Spurious and Band Edge Radiated Emissions

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

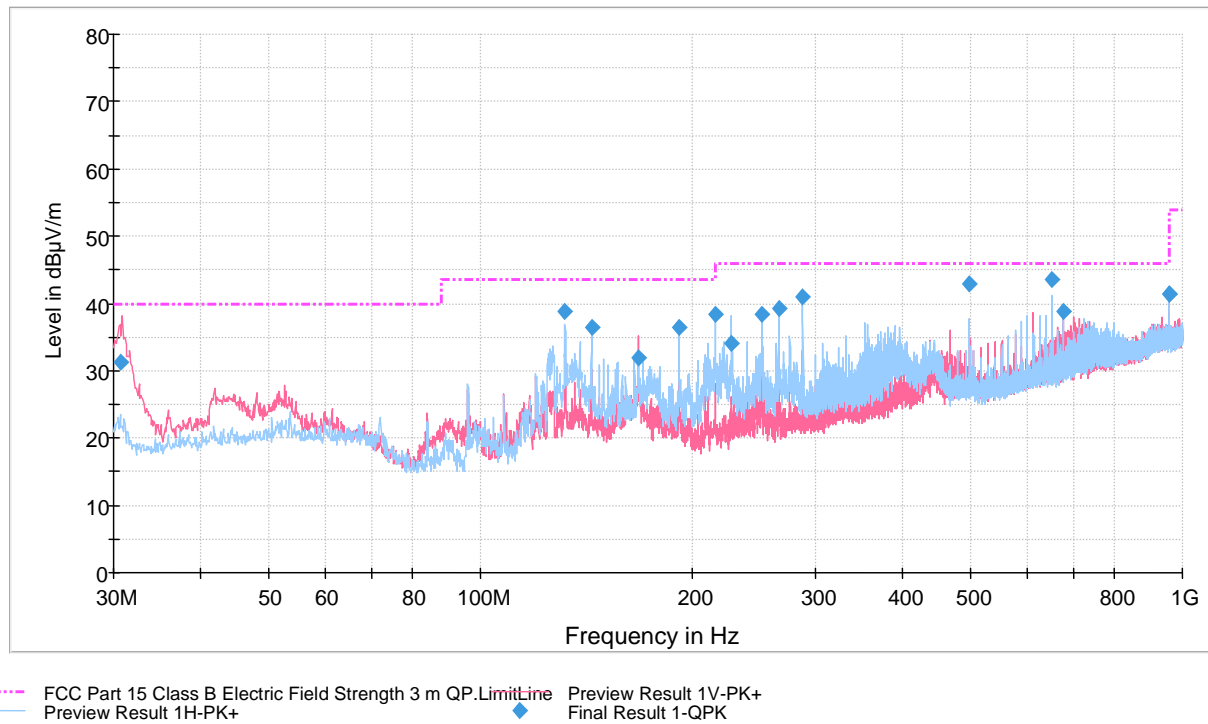


Figure 15. Measured curve with peak-detector (middle channel).

Table 4. 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
30.693000	31.3	1000.0	120.000	100.0	V	31.0	14.1	8.7	40.0	
131.984000	38.7	1000.0	120.000	253.0	H	122.0	13.1	4.8	43.5	
144.015000	36.4	1000.0	120.000	197.0	H	105.0	14.5	7.1	43.5	
168.031000	31.9	1000.0	120.000	100.0	V	97.0	14.7	11.6	43.5	
192.010000	36.5	1000.0	120.000	178.0	H	265.0	13.2	7.0	43.5	
215.989000	38.4	1000.0	120.000	132.0	H	110.0	12.5	5.1	43.5	
228.060000	34.2	1000.0	120.000	138.0	H	96.0	12.9	11.8	46.0	
251.996000	38.4	1000.0	120.000	100.0	H	206.0	14.1	7.6	46.0	
266.021000	39.3	1000.0	120.000	110.0	H	165.0	14.7	6.7	46.0	
288.020000	41.0	1000.0	120.000	100.0	H	161.0	15.5	5.0	46.0	
497.988000	42.9	1000.0	120.000	165.0	H	1.0	20.7	3.1	46.0	
651.285000	43.6	1000.0	120.000	127.0	H	211.0	23.6	2.4	46.0	
675.863000	38.9	1000.0	120.000	100.0	V	58.0	23.9	7.1	46.0	
960.016000	41.5	1000.0	120.000	100.0	H	211.0	28.1	12.4	53.9	
960.016000	41.3	1000.0	120.000	100.0	H	211.0	28.1	12.6	53.9	

Spurious and Band Edge Radiated Emissions

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

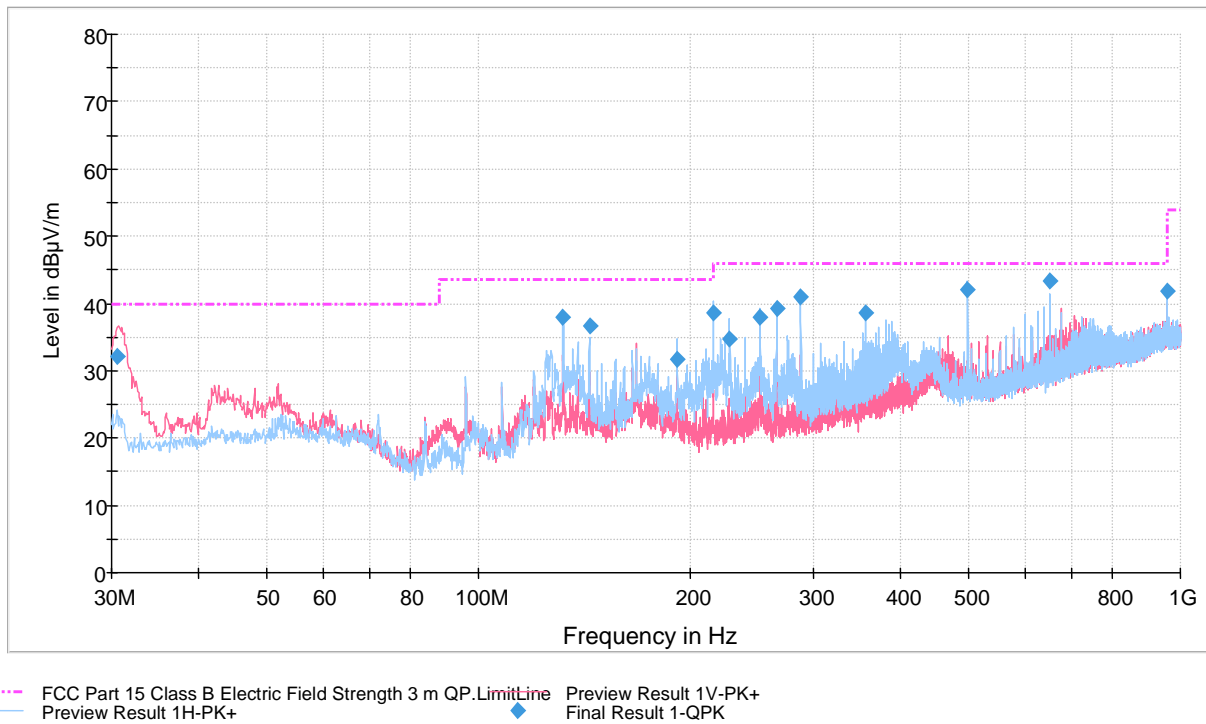


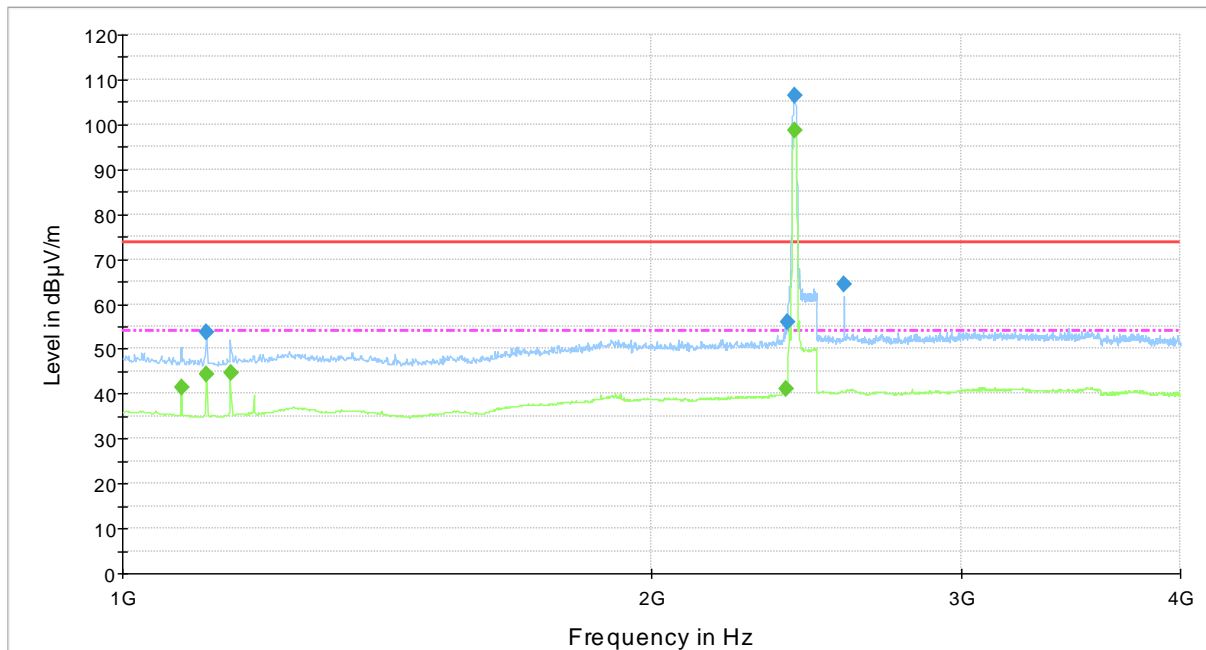
Figure 16. Measured curve with peak-detector (high channel).

Table 5. 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
30.639000	32.1	1000.0	120.000	100.0	V	90.0	14.1	7.9	40.0	
132.027000	38.0	1000.0	120.000	240.0	H	113.0	13.1	5.5	43.5	
143.995000	36.7	1000.0	120.000	215.0	H	108.0	14.5	6.8	43.5	
192.070000	31.7	1000.0	120.000	171.0	H	21.0	13.2	11.8	43.5	
215.989000	38.5	1000.0	120.000	132.0	H	105.0	12.5	5.0	43.5	
228.057000	34.7	1000.0	120.000	158.0	H	100.0	12.9	11.3	46.0	
251.993000	38.1	1000.0	120.000	100.0	H	204.0	14.1	7.9	46.0	
265.981000	39.2	1000.0	120.000	116.0	H	161.0	14.7	6.8	46.0	
288.000000	41.1	1000.0	120.000	100.0	H	153.0	15.5	4.9	46.0	
356.345000	38.5	1000.0	120.000	100.0	H	118.0	17.4	7.5	46.0	
497.945000	42.0	1000.0	120.000	178.0	H	342.0	20.7	4.0	46.0	
651.282000	43.3	1000.0	120.000	127.0	H	208.0	23.6	2.7	46.0	
959.996000	41.8	1000.0	120.000	100.0	H	214.0	28.1	4.2	46.0	

Spurious and Band Edge Radiated Emissions

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



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine
— Preview Result 1-PK+ — Preview Result 2-AVG
◆ Final Result 1-PK+ ◆ Final Result 2-AVG

Figure 17. Measured curve with peak- and average detector (low channel).

Spurious and Band Edge Radiated Emissions

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

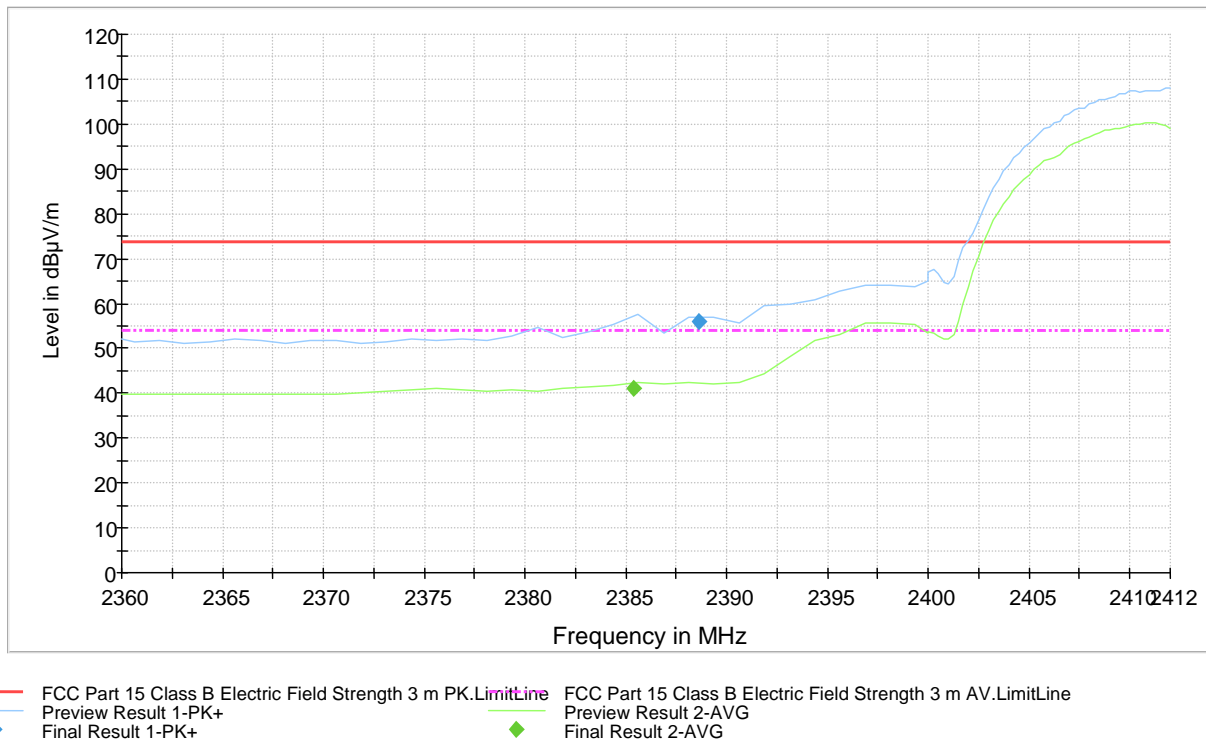


Figure 18. Low channel band edge.

Final measurements from the worst frequencies

Table 6. Final Max Peak results.

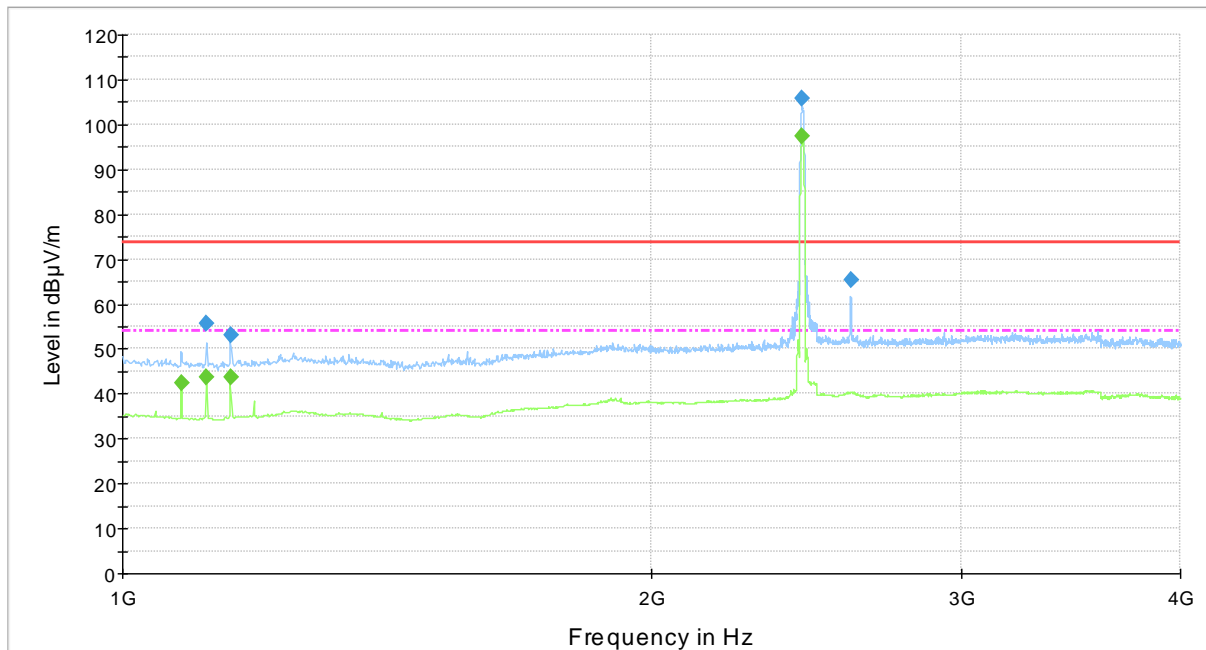
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1115.825000	53.6	1000.0	1000.000	100.0	H	131.0	5.8	20.3	73.9	
2388.600000	55.9	1000.0	1000.000	100.0	V	152.0	14.4	18.0	73.9	
2573.325000	64.3	1000.0	1000.000	154.0	H	31.0	15.2	9.6	73.9	

Table 7. 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
1080.025000	41.3	1000.0	1000.000	124.0	H	320.0	5.7	12.6	53.9	
1116.025000	44.3	1000.0	1000.000	130.0	H	320.0	5.9	9.6	53.9	
1152.075000	44.6	1000.0	1000.000	227.0	H	212.0	6.2	9.3	53.9	
2385.400000	41.2	1000.0	1000.000	100.0	V	134.0	14.3	12.7	53.9	

Spurious and Band Edge Radiated Emissions

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



— FCC Part 15 Class B Electric Field Strength 3 m PK Limit
— Preview Result 1-PK+
— Preview Result 2-AVG
◆ Final Result 1-PK+
◆ Final Result 2-AVG

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

Final measurements from the worst frequencies

Table 8. 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
1116.225000	55.7	1000.0	1000.000	218.0	H	218.0	5.9	18.2	73.9	
1152.075000	53.2	1000.0	1000.000	100.0	H	332.0	6.2	20.7	73.9	
2598.425000	65.4	1000.0	1000.000	162.0	H	38.0	15.6	8.5	73.9	

Table 9. 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
1080.025000	42.3	1000.0	1000.000	146.0	H	320.0	5.7	11.6	53.9	
1116.025000	43.6	1000.0	1000.000	130.0	H	313.0	5.9	10.3	53.9	
1152.075000	43.7	1000.0	1000.000	218.0	H	218.0	6.2	10.2	53.9	

Spurious and Band Edge Radiated Emissions

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

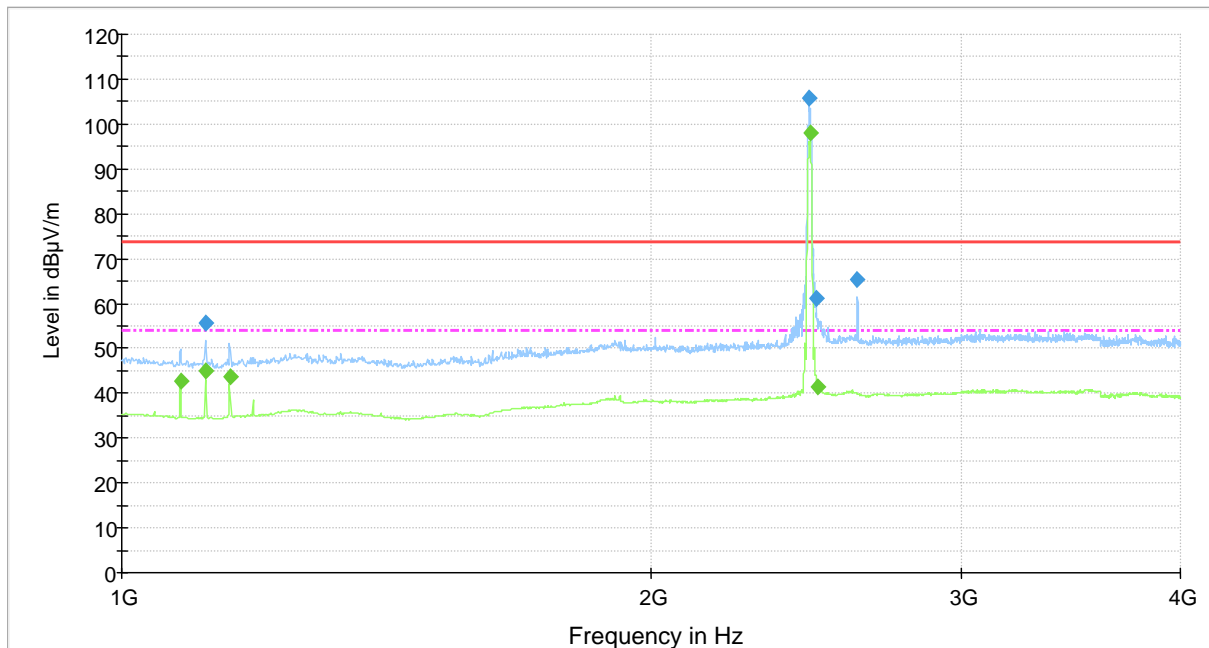


Figure 20. Measured curve with peak- and average detector (high channel).

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

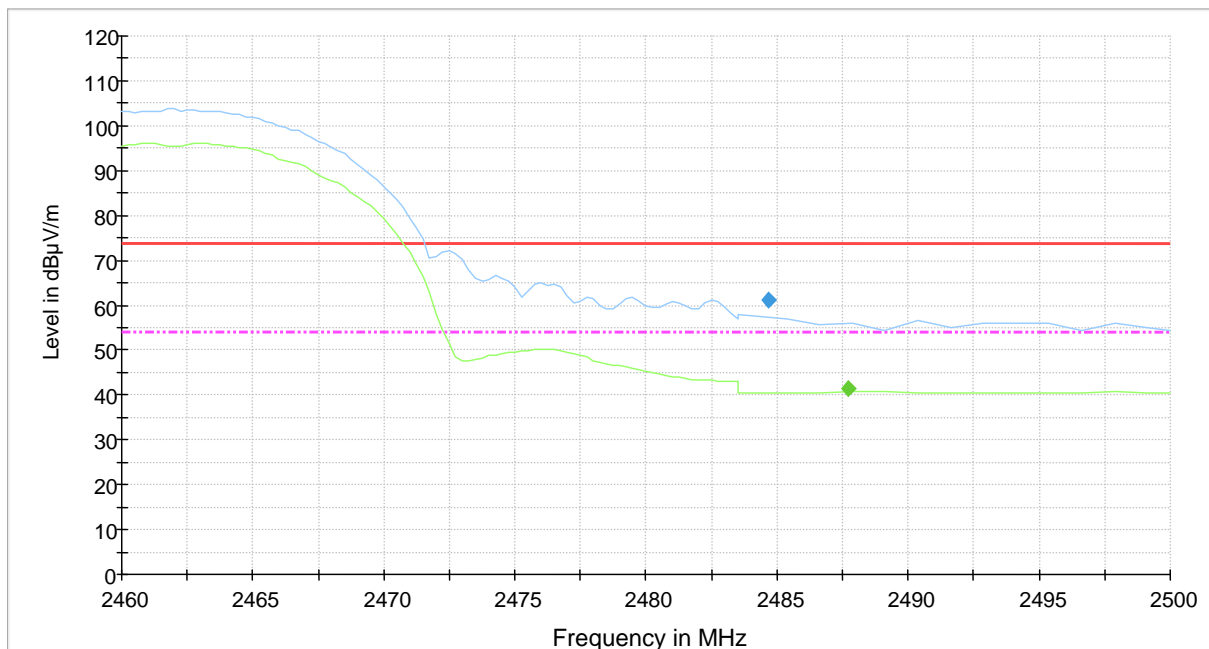


Figure 21. High channel band edge.

Spurious and Band Edge Radiated Emissions

Final measurements from the worst frequencies

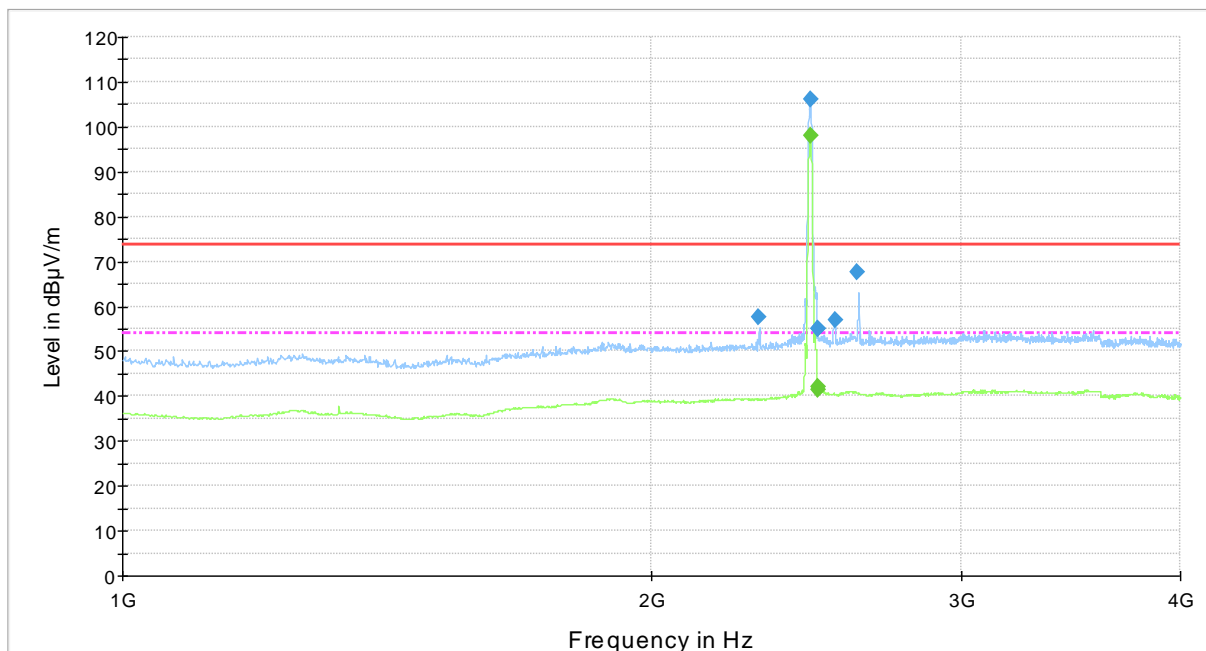
Table 10. Final Max Peak results.

Frequency (MHz)	MaxPeak (dB μ V/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
1116.025000	55.6	1000.0	1000.000	211.0	H	217.0	5.9	18.3	73.9	
2484.700000	61.2	1000.0	1000.000	203.0	V	109.0	14.8	12.7	73.9	
2620.775000	65.2	1000.0	1000.000	217.0	H	163.0	15.3	8.7	73.9	

Table 11. Final Average results.

Frequency (MHz)	Average (dB μ V/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
1080.025000	42.6	1000.0	1000.000	153.0	H	314.0	5.7	11.3	53.9	
1116.025000	45.1	1000.0	1000.000	224.0	H	220.0	5.9	8.8	53.9	
1152.075000	43.8	1000.0	1000.000	225.0	H	217.0	6.2	10.1	53.9	
2487.700000	41.3	1000.0	1000.000	234.0	V	112.0	14.8	12.6	53.9	

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

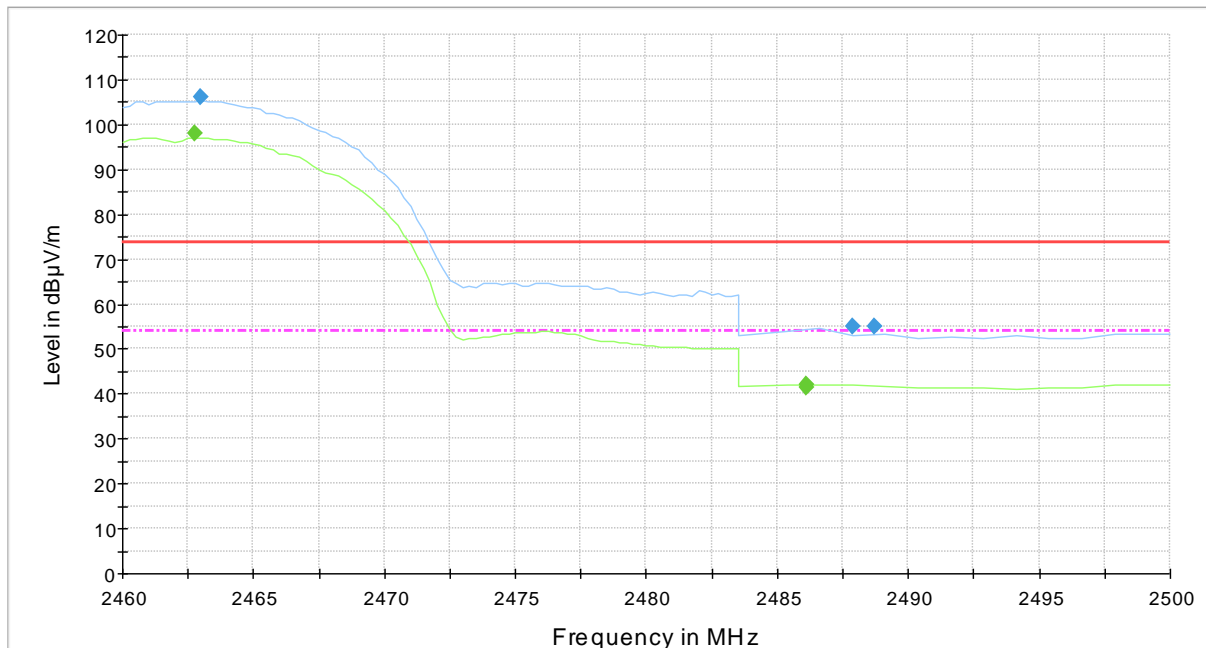


— FCC Part 15 Class B Electric Field Strength 3 m PK.Limit
— Preview Result 1-PK+
◆ Final Result 1-PK+
— Preview Result 2-AVG
◆ Final Result 2-AVG

Figure 22. Measured curve with peak- and average detector (main board v.0.11, high channel).

Spurious and Band Edge Radiated Emissions

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



— FCC Part 15 Class B Electric Field Strength 3 m PK Limit
— Preview Result 1-PK+ — Preview Result 2-AVG
◆ Final Result 1-PK+ ◆ Final Result 2-AVG

Figure 23. High channel band edge (main board v.0.11, high channel).

Table 12. Final Max Peak results.

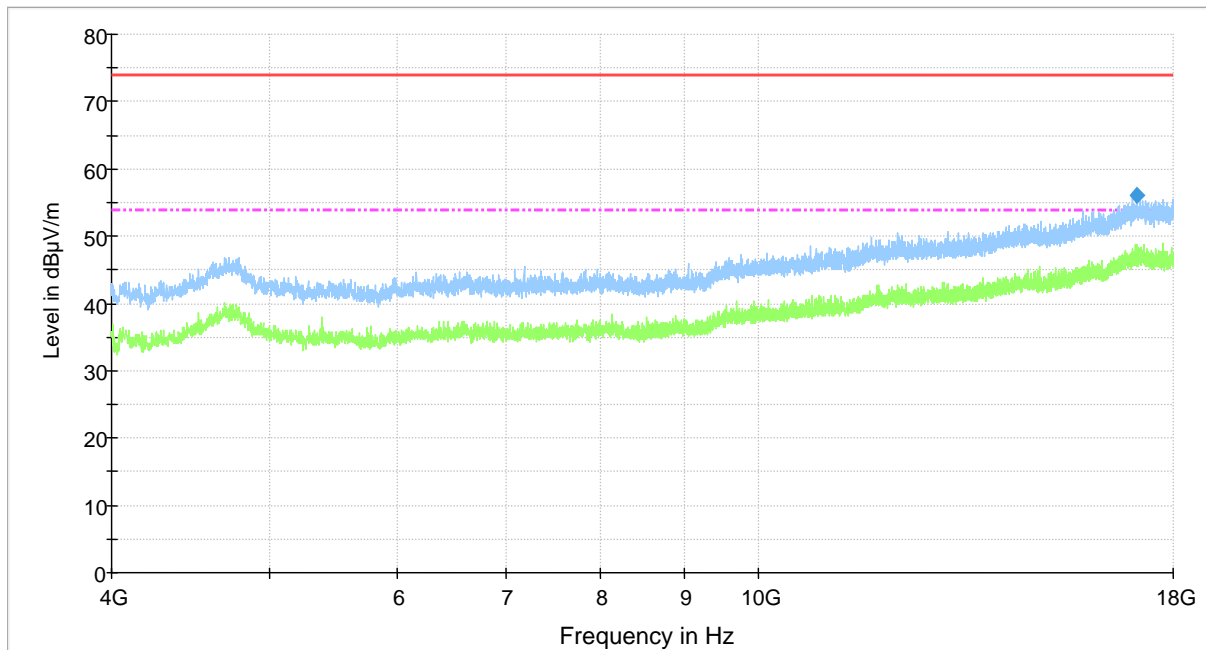
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time 15x(ms)	Bandwidth (kHz)	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2303.775000	57.6	1000.0	1000.000	163.0	V	103.0	13.7	16.3	73.9	
2487.900000	54.9	1000.0	1000.000	172.0	V	120.0	14.8	19.0	73.9	
2488.700000	54.9	1000.0	1000.000	116.0	H	152.0	14.8	19.0	73.9	
2543.275000	57.0	1000.0	1000.000	227.0	H	152.0	14.8	16.9	73.9	
2620.325000	67.5	1000.0	1000.000	114.0	H	44.0	15.3	6.4	73.9	

Table 13. 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
2486.100000	42.0	1000.0	1000.000	114.0	H	146.0	14.8	11.9	53.9	
2486.100000	41.5	1000.0	1000.000	237.0	V	152.0	14.8	12.4	53.9	

Spurious and Band Edge Radiated Emissions

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



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine
— FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine
— Preview Result 1-PK+
— Preview Result 2-AVG
◆ Final Result 1-PK+

Figure 24. Measured curve with peak- and average detector (low channel).

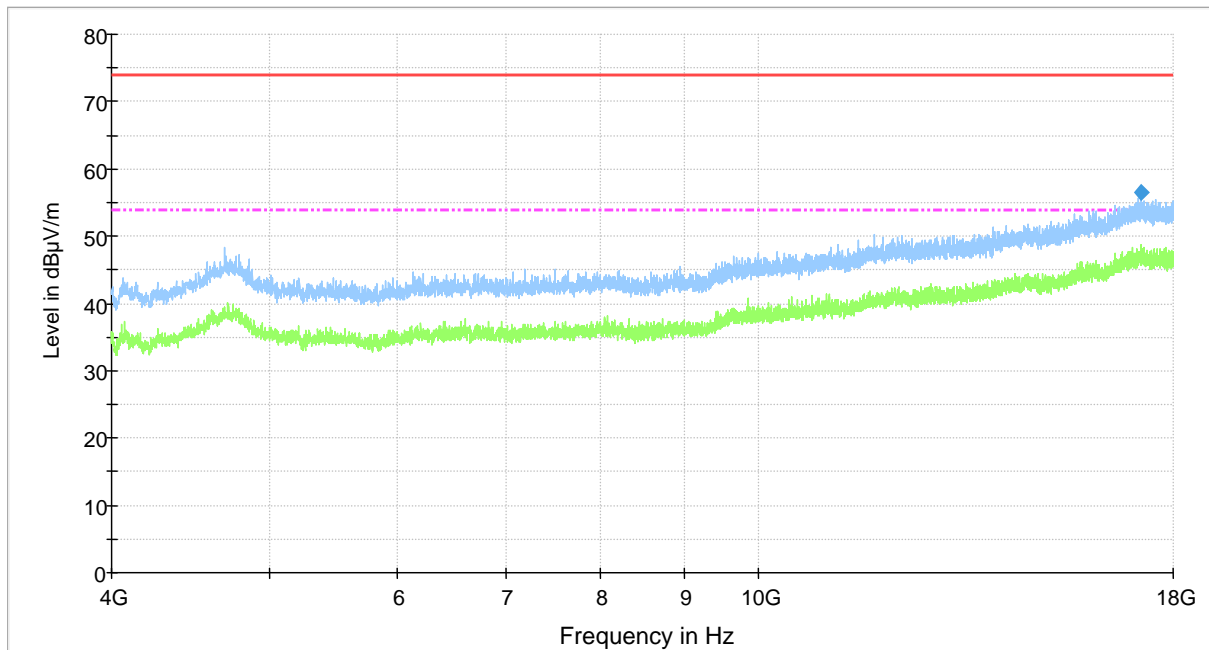
Final measurements from the worst frequencies

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
17102.600000	56.1	1000.0	1000.000	345.0	H	25.0	28.2	17.8	73.9	

Spurious and Band Edge Radiated Emissions

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



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine
— Preview Result 1-PK+
◆ Final Result 1-PK+
— FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine
— Preview Result 2-AVG

Figure 25. Measured curve with peak- and average detector (middle channel).

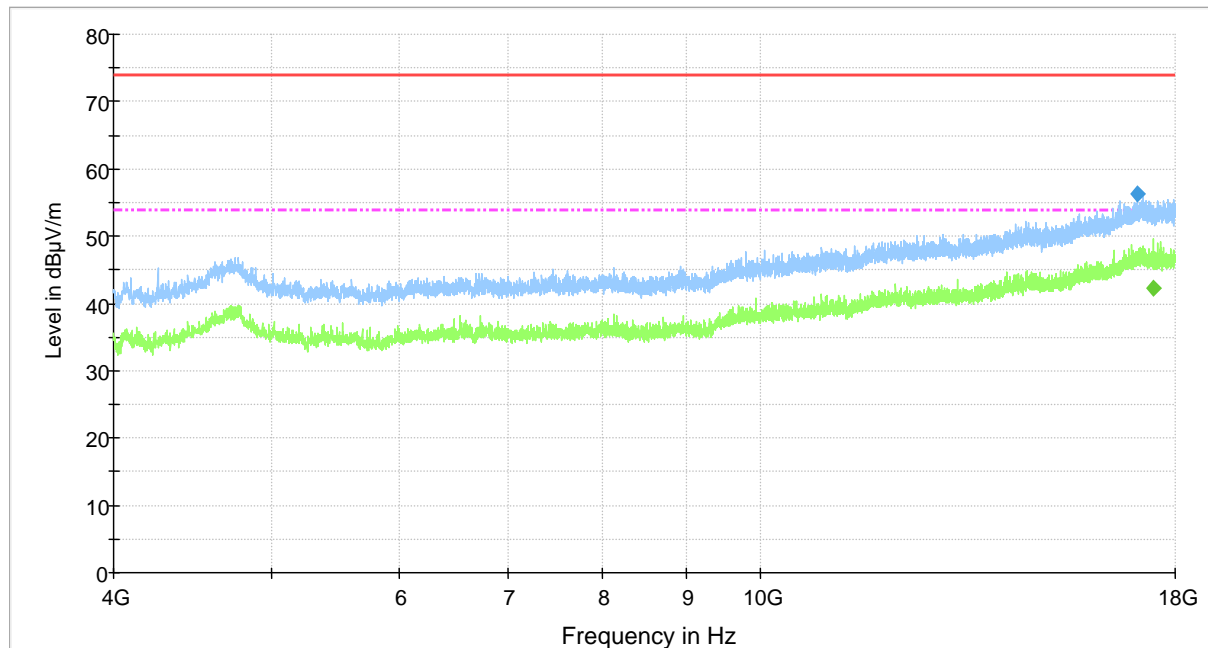
Final measurements from the worst frequencies

Table 15. 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
17201.200000	56.4	1000.0	1000.000	361.0	H	148.0	28.3	17.5	73.9	

Spurious and Band Edge Radiated Emissions

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



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine — FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine
— Preview Result 1-PK+ — Preview Result 2-AVG
◆ Final Result 1-PK+ ◆ Final Result 2-AVG

Figure 26. Measured curve with peak- and average detector (high channel).

Final measurements from the worst frequencies

Table 16. Final Max Peak results.

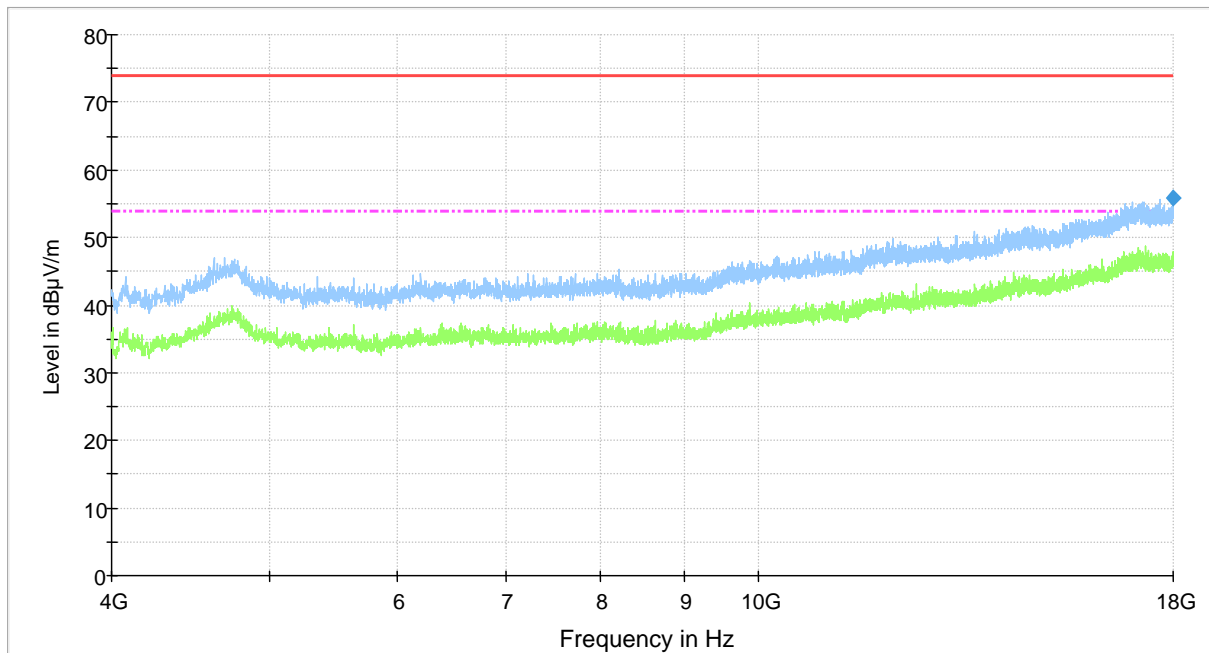
Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
17077.000000	56.2	1000.0	1000.000	138.0	V	179.0	28.2	17.7	73.9	

Table 17. 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
17468.200000	42.2	1000.0	1000.000	100.0	H	91.0	28.1	11.7	53.9	

Spurious and Band Edge Radiated Emissions

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



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine - - - FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine
— Preview Result 1-PK+ — Preview Result 2-AVG
◆ Final Result 1-PK+

Figure 27. Measured curve with peak- and average detector (main board v.0.11, high channel).

Table 18. 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
4620.200000	47.0	1000.0	1000.000	235.0	V	126.0	13.5	26.9	73.9	
17991.200000	55.9	1000.0	1000.000	122.0	H	332.0	28.9	18.0	73.9	

Spurious and Band Edge Radiated Emissions

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

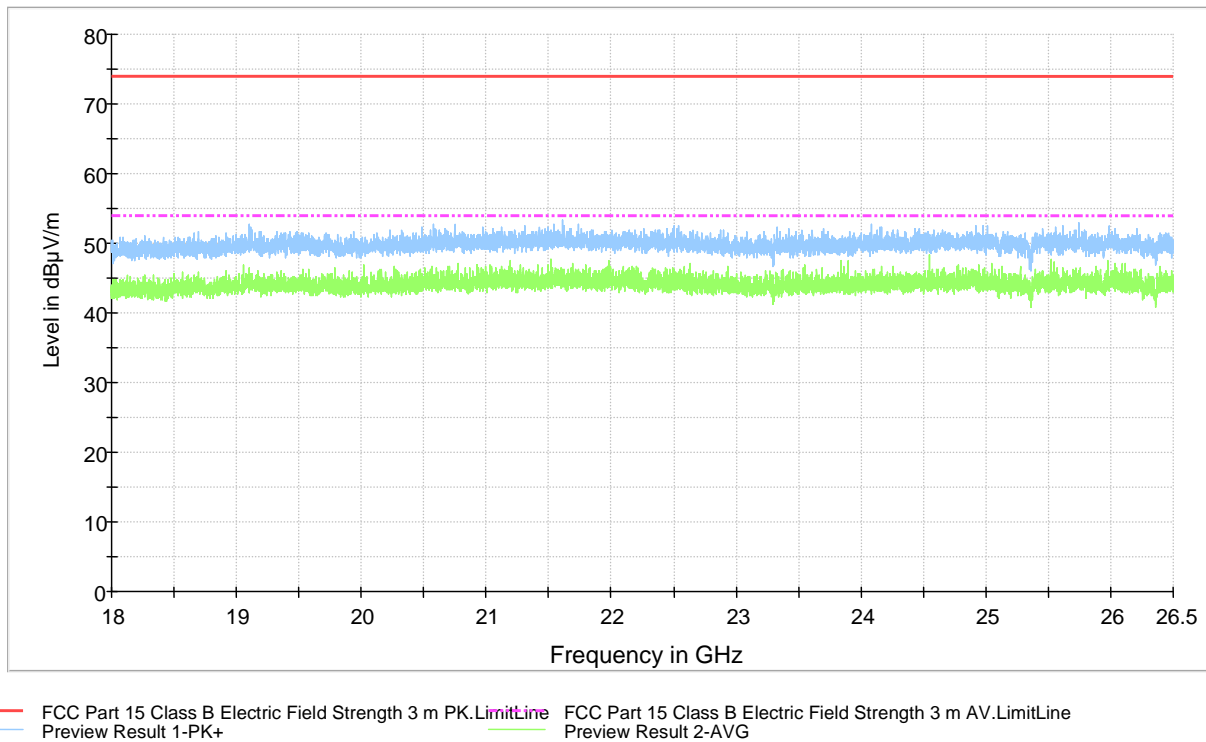


Figure 28. Measured curve with peak- and average detector (low channel).

Final measurements from the worst frequencies

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

Spurious and Band Edge Radiated Emissions

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

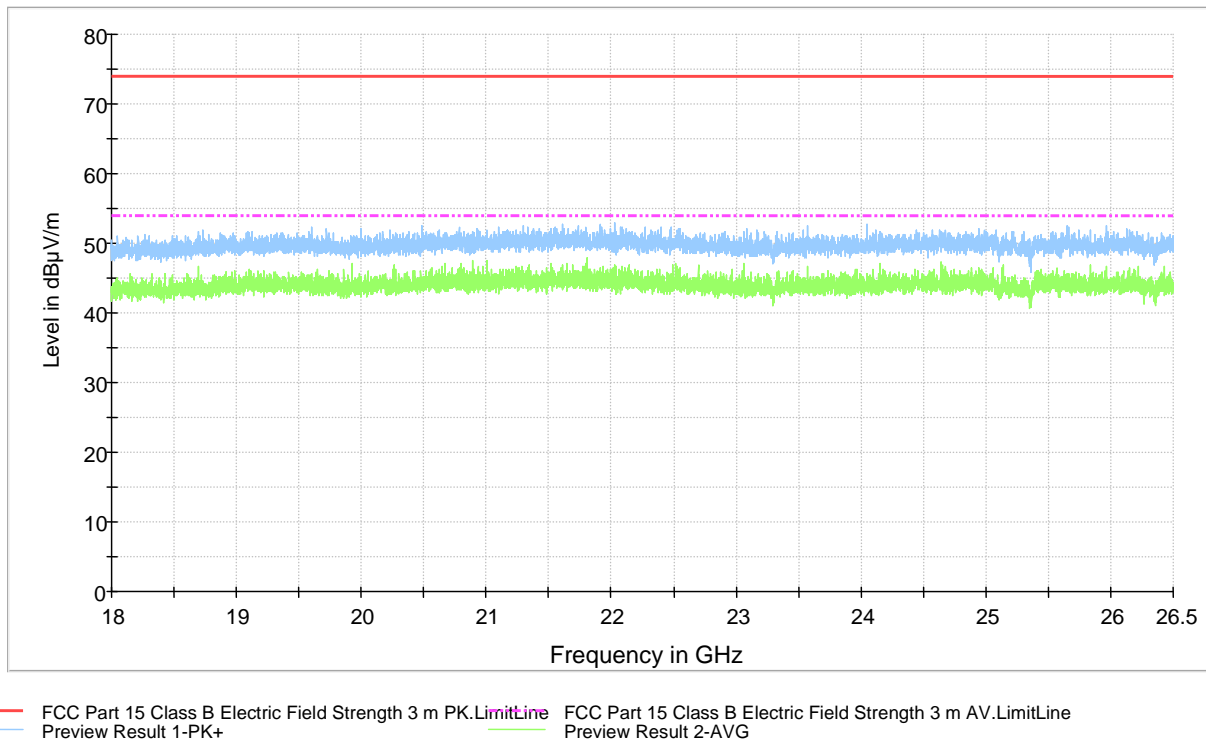


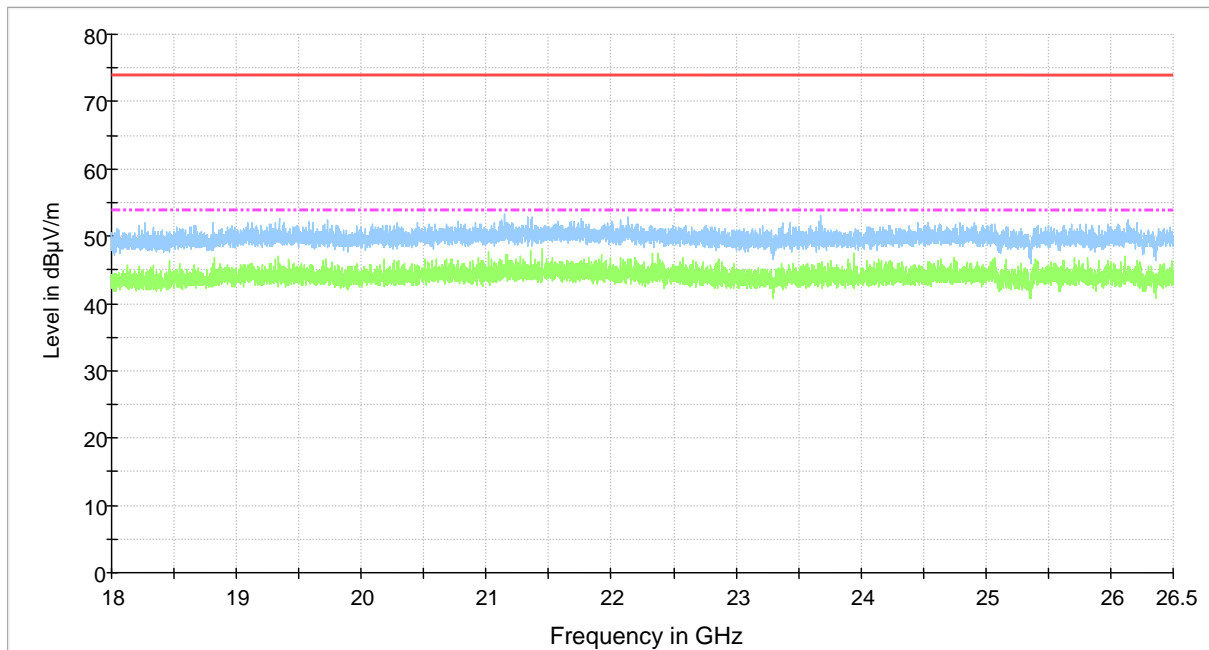
Figure 29. Measured curve with peak- and average detector (middle channel).

Final measurements from the worst frequencies

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

Spurious and Band Edge Radiated Emissions

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



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine
— FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine
— Preview Result 1-PK+
— Preview Result 2-AVG

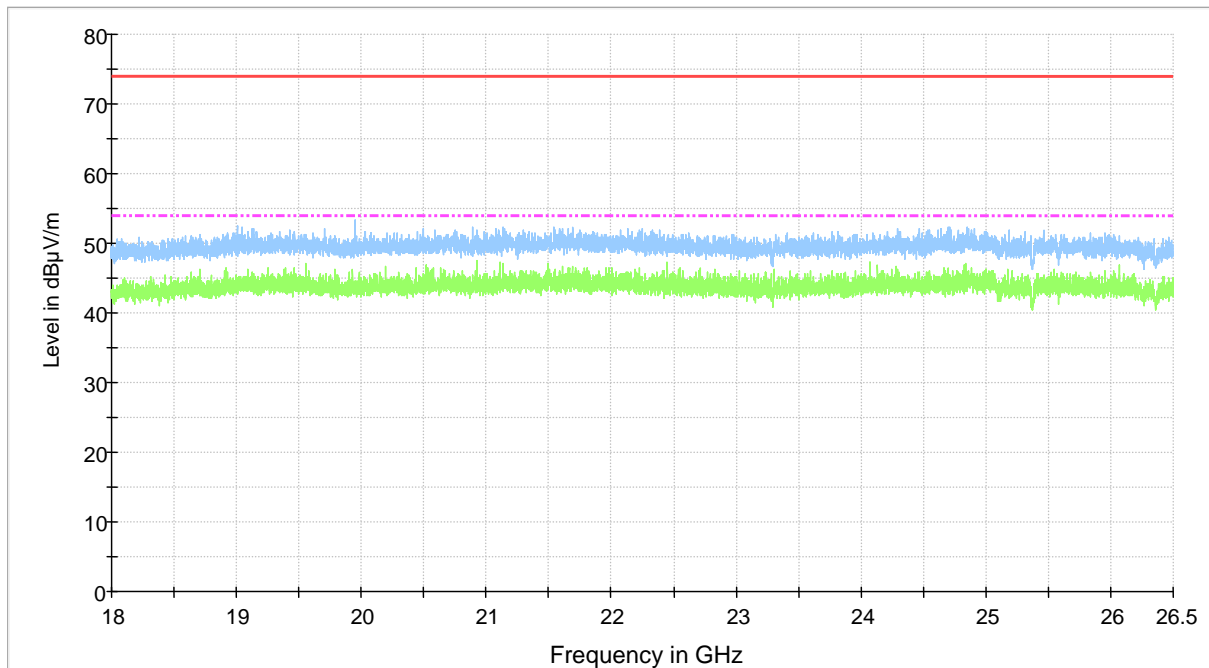
Figure 30. Measured curve with peak- and average detector (high channel).

Final measurements from the worst frequencies

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

Spurious and Band Edge Radiated Emissions

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



— FCC Part 15 Class B Electric Field Strength 3 m PK.LimitLine
— Preview Result 1-PK+
- - - FCC Part 15 Class B Electric Field Strength 3 m AV.LimitLine
— Preview Result 2-AVG

Figure 31. Measured curve with peak- and average detector (main board v.0.11, high channel).

Final measurements from the worst frequencies

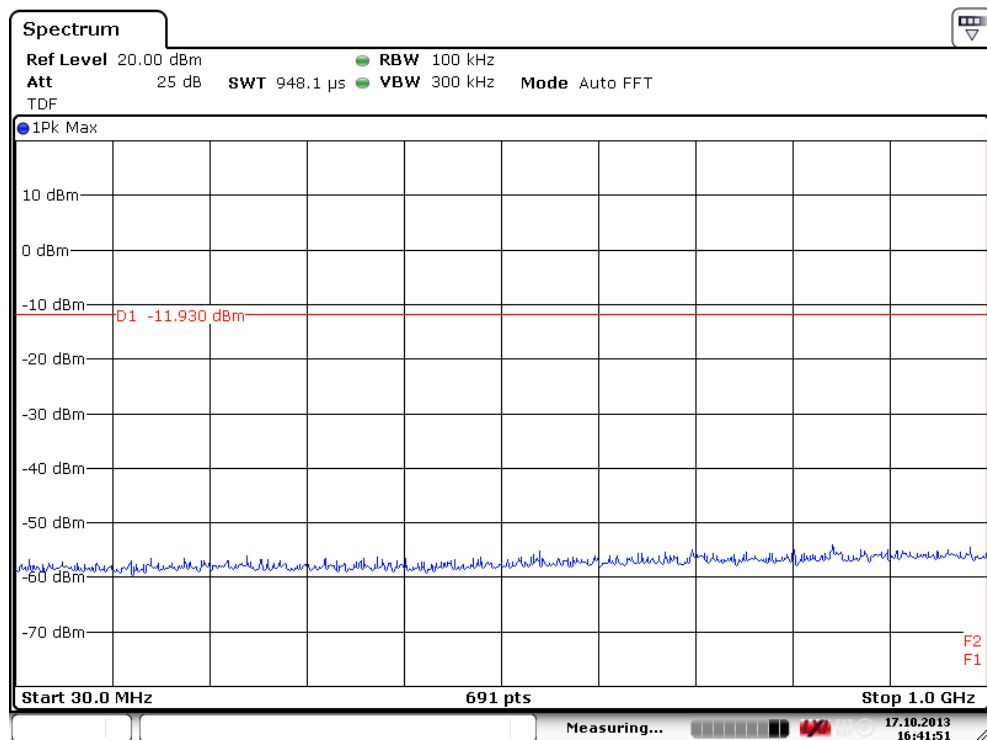
Due to the low emission level no final measurements were made.

Conducted Spurious emissions 30 to 26 500 MHz and Band Edge

Conducted Spurious Emissions 30 – 26 500 MHz and Band Edge

Standard: ANSI C63.10 (2009)
Tested by: RRE
Date: 17.10.2013
Temperature: 23 °C
Humidity: 22 % RH

FCC Rule: 15.247 (d)



Date: 17.OCT.2013 16:41:51

Figure 32. Low channel conductive emission 30 MHz to 1000 MHz.

Conducted Spurious emissions 30 to 26 500 MHz and Band Edge

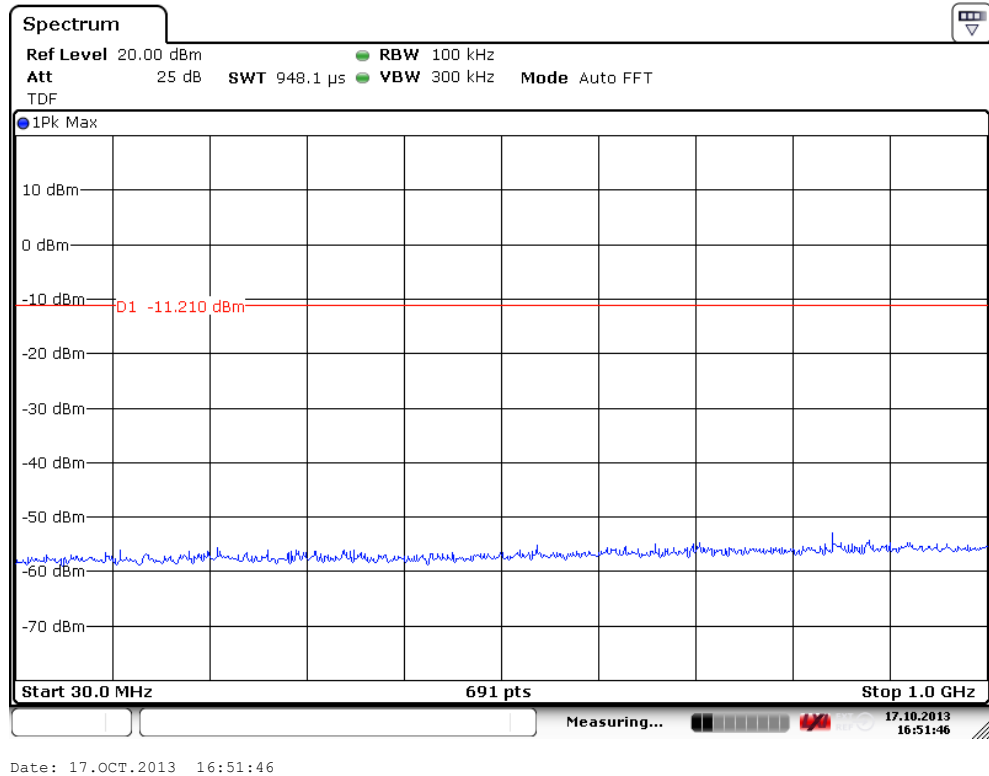


Figure 33. Mid channel conductive emission 30 MHz to 1000 MHz.

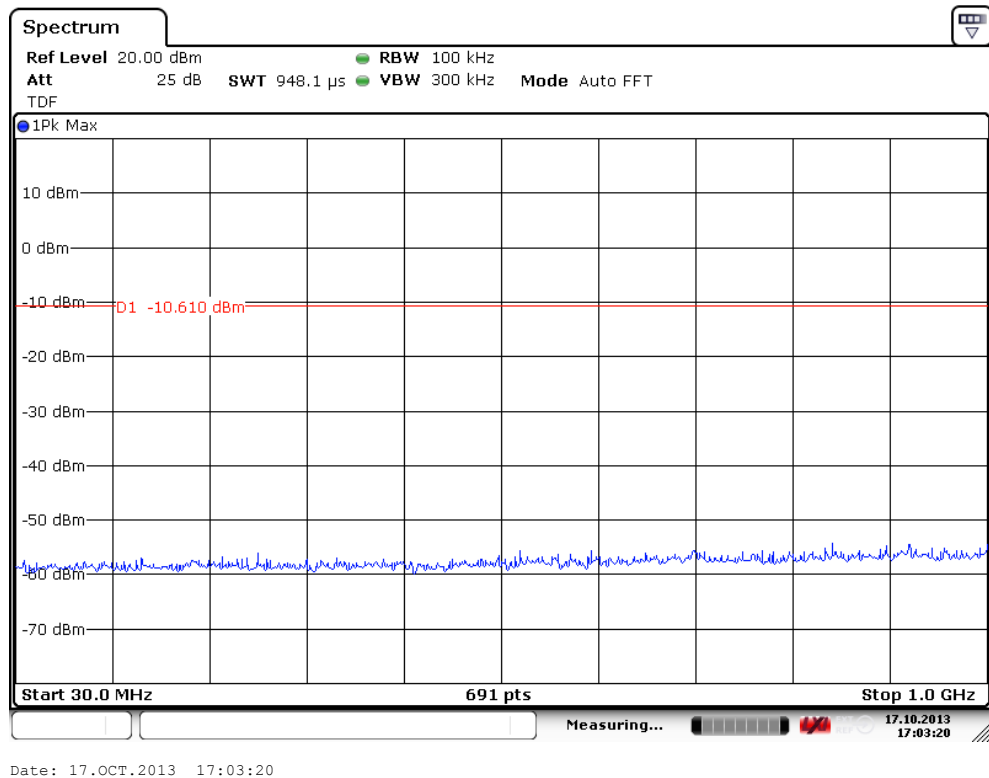


Figure 34. High channel conductive emission 30 MHz to 1000 MHz.

Conducted Spurious emissions 30 to 26 500 MHz and Band Edge

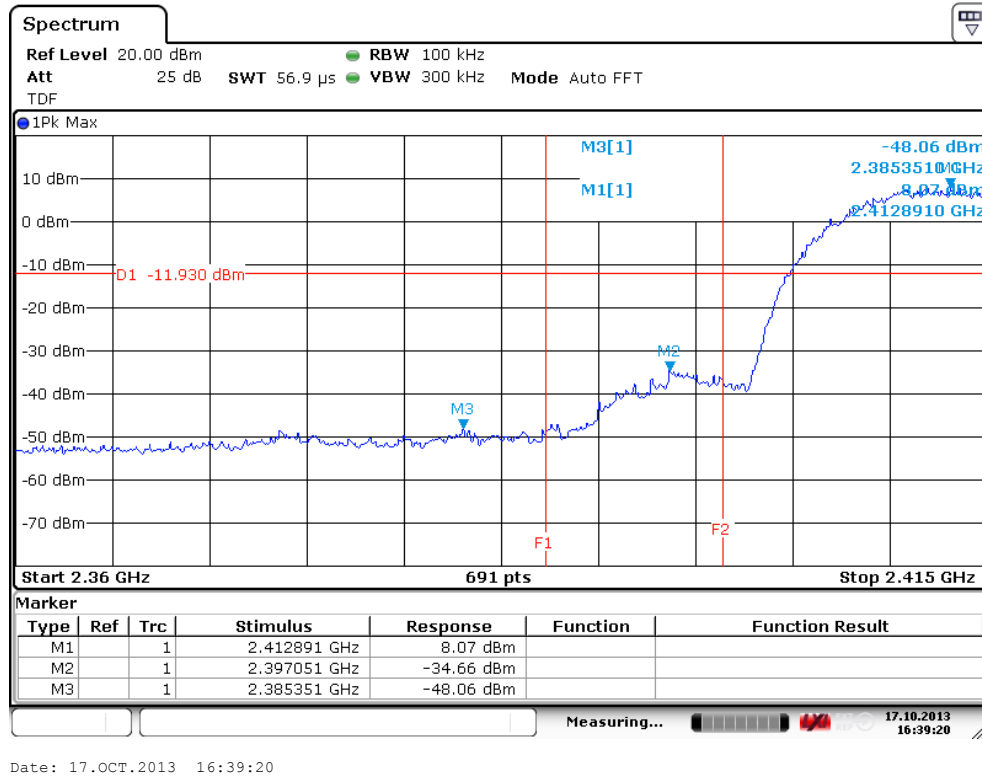


Figure 35. Low channel conductive emission at low band edge.

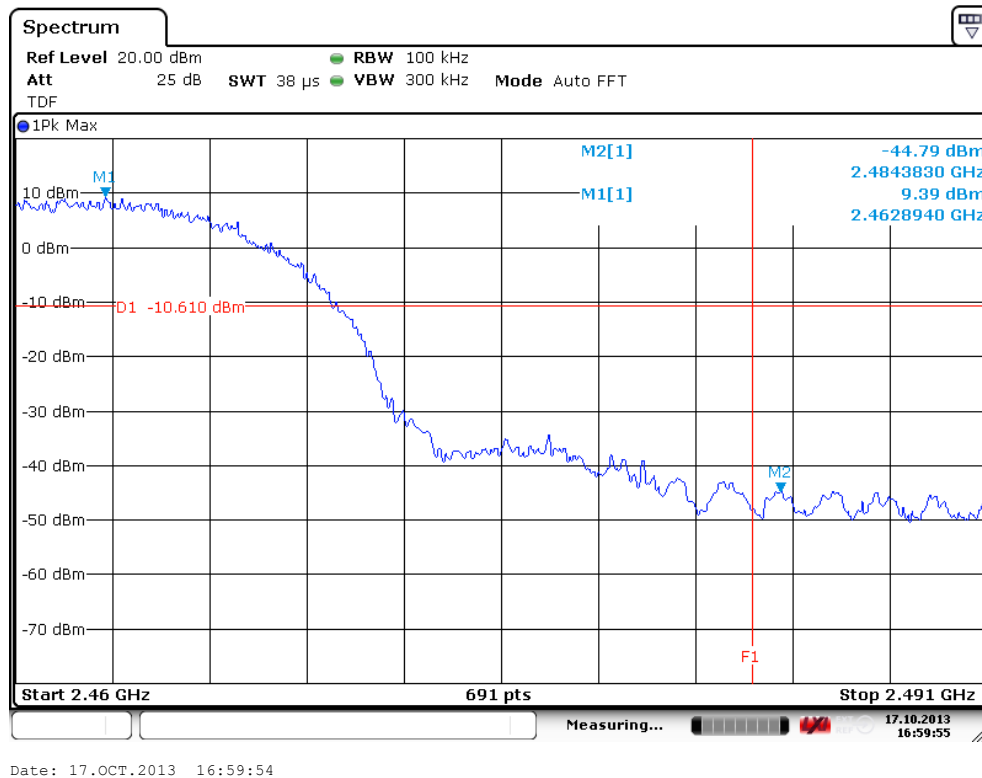


Figure 36. High channel conductive emission at high band edge.

Conducted Spurious emissions 30 to 26 500 MHz and Band Edge

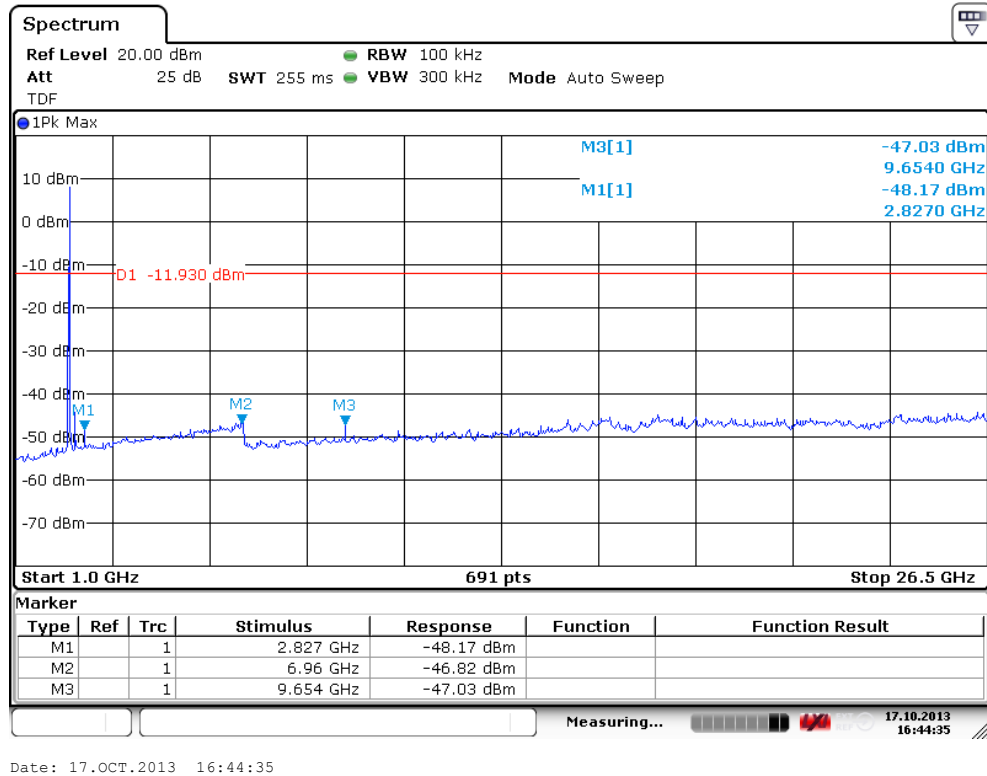


Figure 37. Low channel conductive emission 1 GHz to 26.5 GHz.

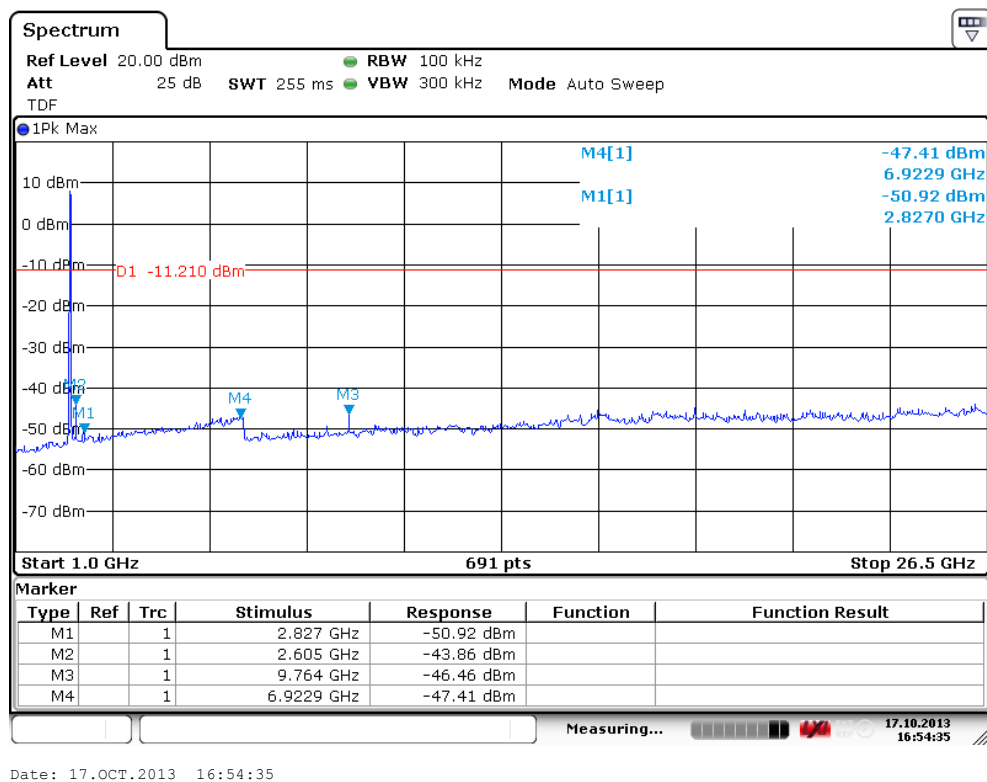
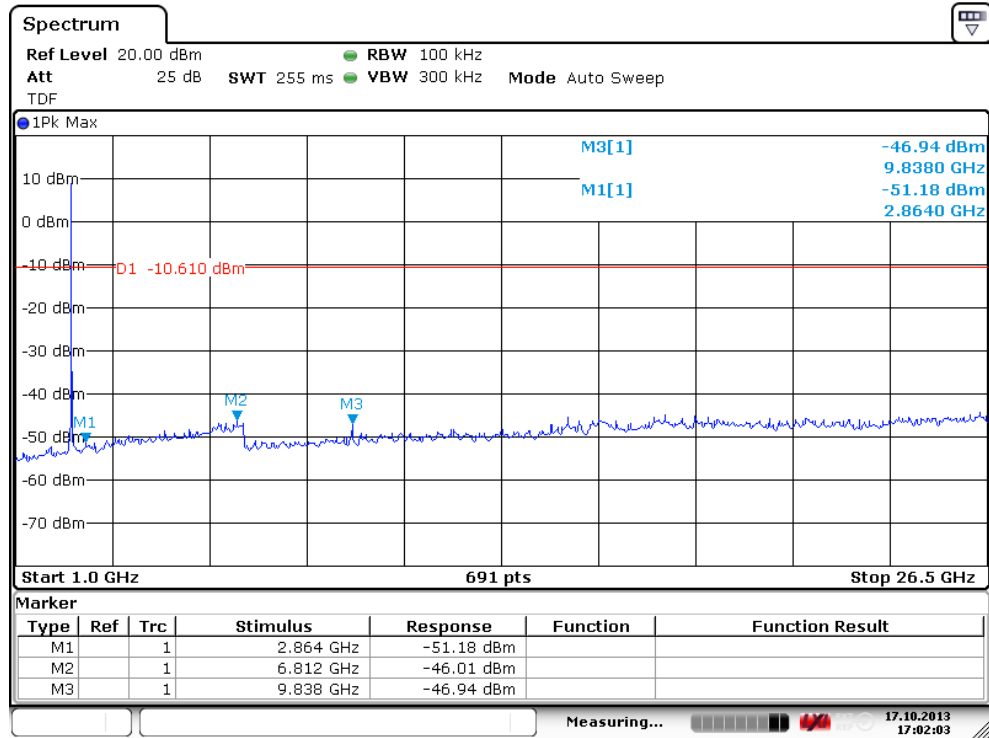


Figure 38. Mid channel conductive emission 1 GHz to 26.5 GHz.

Conducted Spurious emissions 30 to 26 500 MHz and Band Edge



Date: 17.OCT.2013 17:02:03

Figure 39. High channel conductive emission 1 GHz to 26.5 GHz.

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	-	-
Artificial mains network	ESH3-Z5	863794/014	8019
Pulse limiter	ESH3-Z2	#2	8396
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
CALIFORNIA INSTRUMENTS			
Power Supply	5001 iX Series II	58209	7826

All used measurement equipment was calibrated (if required).