

Test Report



INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C

Equipment Under Test: Bluetooth Smart Ready Module

Model: BT121

Manufacturer: Silicon Laboratories Finland Oy
PO. BOX 120
FI-02631 ESPOO
FINLAND

Customer: Silicon Laboratories Finland Oy
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FCC Rule Part: 15.247: 2014
KDB: Guidance for Performing Compliance
Measurements on Digital Transmission Systems
(DTS) Operating Under §15.247 (June 5, 2014)

Date: May 30, 2015

Issued by:

A blue ink signature of Niko Kotsalo.

Niko Kotsalo
Testing Engineer

Date: May 30, 2015

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Rauno Repo
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Equipment Under Test (EUT)

Bluetooth Smart Ready Module
 Model: BT121
 Type: -
 Serial no: -
 FCC ID: QQQBT121
 IC: 5123A-BGTBT121

Description of the EUT

The EUT is a Bluetooth Smart Ready module which supports Bluetooth Classic and Bluetooth Smart connectivity. This test report includes only Bluetooth Smart part of the test results.

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

No modifications were applied to the EUT during testing

Ratings and declarations

Operating Frequency Range (OFR): 2402 – 2480 MHz
 Channels: 40
 Channel separation: 2 MHz
 Channel bandwidth: 1.056439942 MHz
 Effective conducted power: 11.88 dBm
 Transmission technique: DSSS
 Modulation: GFSK
 Integral Antenna gain: 1 dBi

Power Supply

Operating voltage range: 2.2 – 3.6 VDC

Mechanical Size of the EUT

Height: 2.0 mm	Width: 11.0 mm	Length: 13.9 mm
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Samples

Two samples were used in the testing. Normal commercial sample with integral antenna for radiated emissions and a sample with integral antenna removed and replaced with coaxial cable and SMA-connector for conducted RF tests. During the tests the EUT was set into continuous transmit and was stopped to the channel under test. Normal test modulation and maximum transmit power was used in all tests. No modifications were done during the tests.

Disclaimer

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only. This document cannot be reproduced except in full, without prior approval of the Company.

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.247(b)(3) / RSS-210 A8.4	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
§15.109 / RSS-GEN 7.2.3.2	Unintentional Radiated Emissions	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 20) = 2442 MHz

Channel High (Ch 39) = 2480 MHz

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

TEST RESULTS

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

Standard: ANSI C63.10 (2009)
Tested by: NKO
Date: 28.5.2015
Temperature: 20 °C
Humidity: 40 % RH
Barometric pressure: 1008.7 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 through the LISN.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	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 Emissions In The Frequency Range 150 kHz – 30 MHz

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

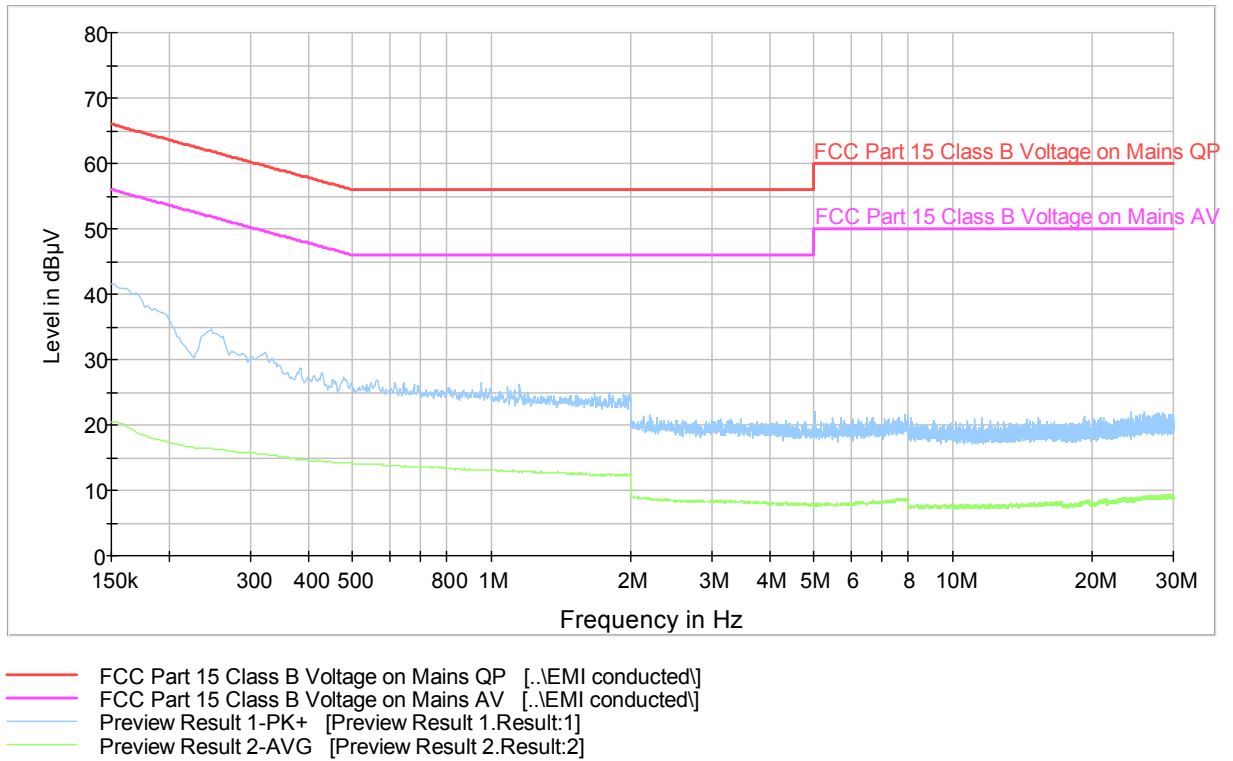


Figure 1. The measured curves with peak- and average detector

Final measurements from the worst frequencies

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

Maximum Peak Conducted Output Power

Standard: ANSI C63.10 (2009)
Tested by: NKO
Date: 12.5.2015
Humidity: 25 %
Temperature: 21 °C
Measurement uncertainty ± 2.87dB Level of confidence 95 % (k = 2)

FCC Rule: 15.247(b)(3)

For systems using digital modulation in the 2400-2483.5 MHz bands the limit is 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.

Results:

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	11.86	30	18.14	PASS
Mid	11.81	30	18.19	PASS
High	11.88	30	18.12	PASS

Maximum Peak Conducted Output Power

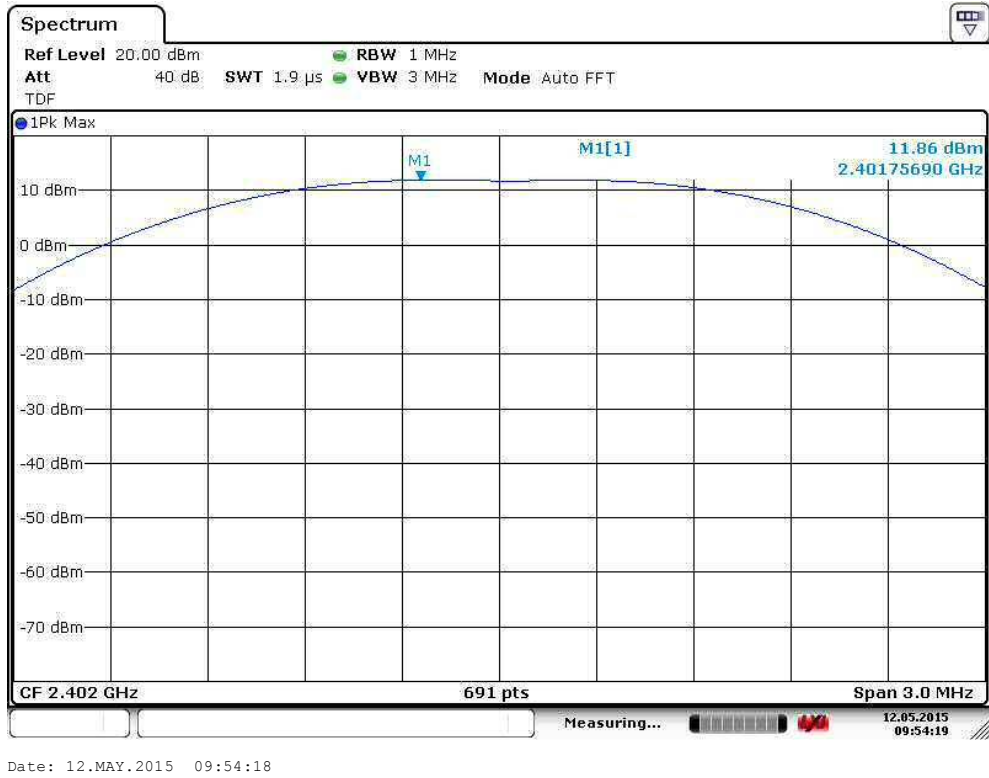


Figure 2. Channel Low.

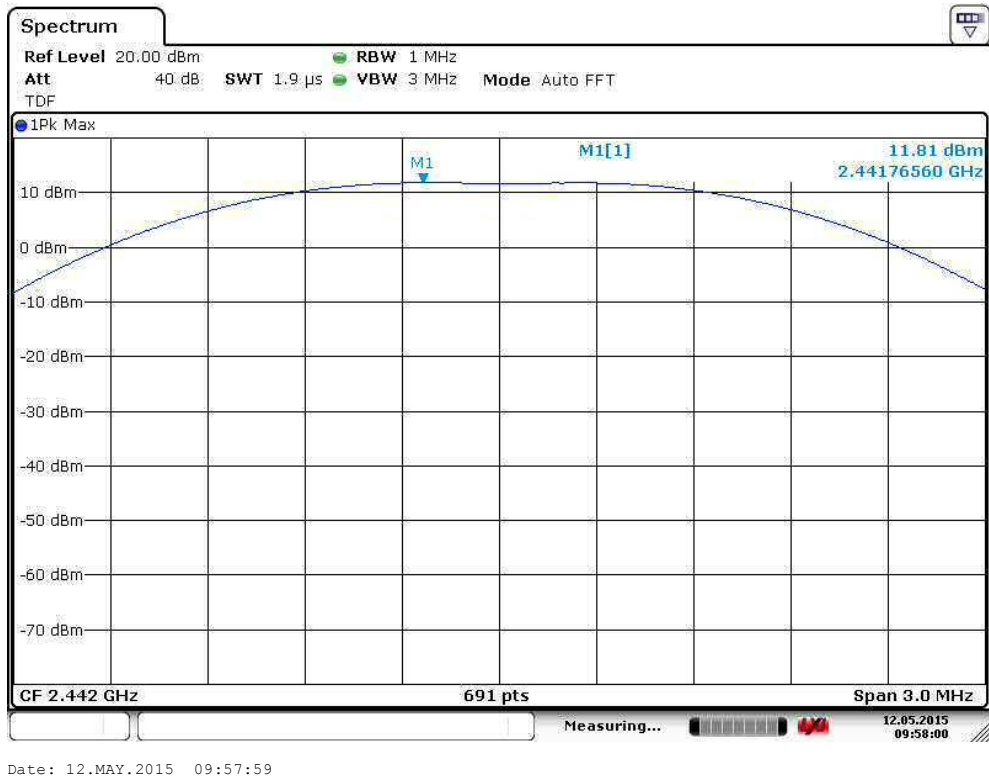
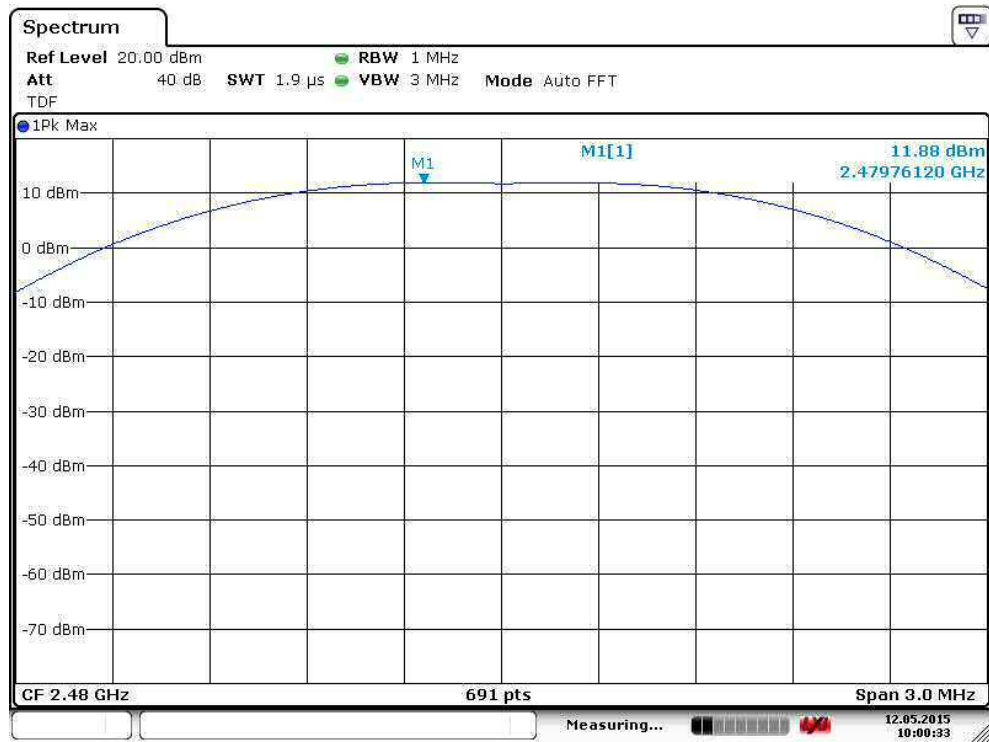


Figure 3. Channel Mid.

Maximum Peak Conducted Output Power



Date: 12.MAY.2015 10:00:33

Figure 4. Channel High.

Transmitter Radiated Spurious Emissions 30 – 1000 MHz

Standard:	ANSI C63.10	(2009)
Tested by:	NKO	
Date:	13.5. – 14.5.2015	
Humidity:	20 – 41 %	
Temperature:	21 – 25 °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. 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.

Transmitter Radiated Spurious Emissions

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

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

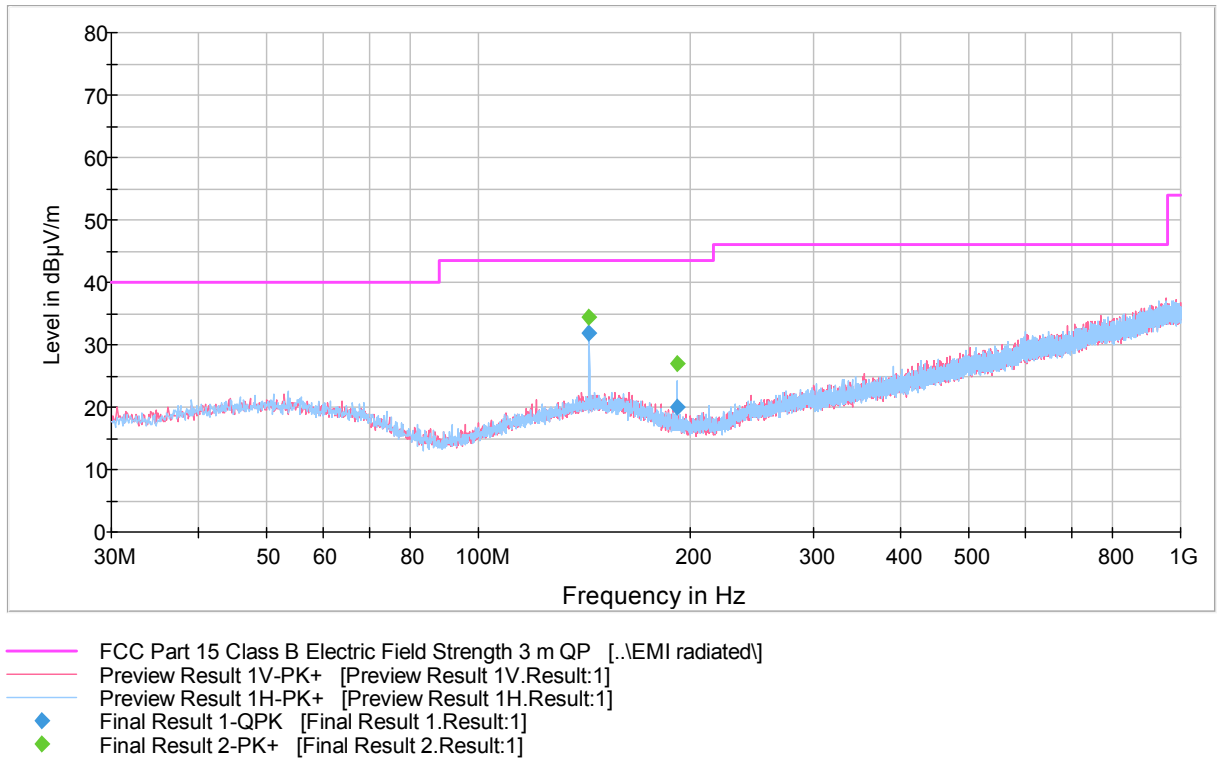


Figure 5. Measured curve with peak-detector channel low.

Final measurements from the worst frequencies

Table 1. Final results.

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
143.844000	31.9	1000.0	120.000	230.0	H	317.0	14.2	11.6	43.5	
191.582000	19.9	1000.0	120.000	138.0	H	145.0	11.7	23.6	43.5	

Transmitter Radiated Spurious Emissions

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

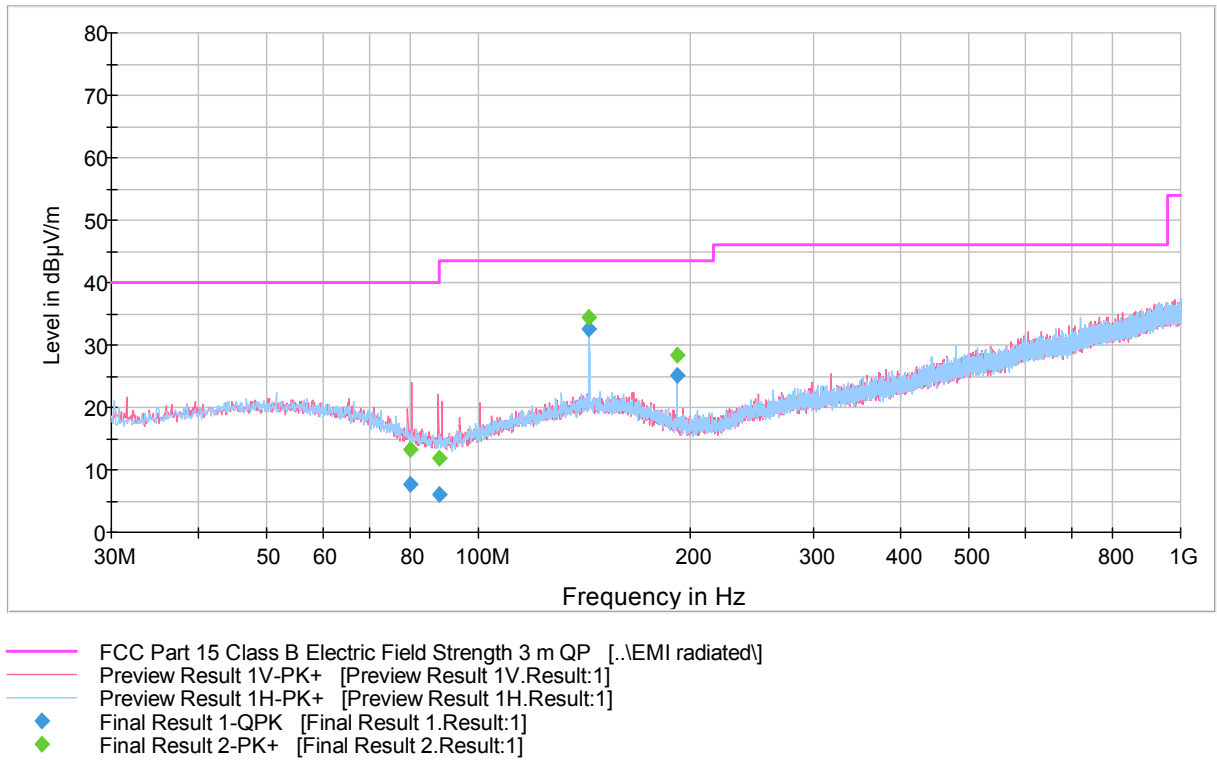


Figure 6. Measured curve with peak-detector channel mid.

Final measurements from the worst frequencies

Table 2. Final results.

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
80.003000	7.8	1000.0	120.000	294.0	V	250.0	9.8	32.2	40.0	
87.995000	5.9	1000.0	120.000	324.0	V	113.0	8.7	34.1	40.0	
143.824000	32.4	1000.0	120.000	230.0	H	312.0	14.2	11.1	43.5	
191.739000	25.2	1000.0	120.000	215.0	H	138.0	11.7	18.3	43.5	

Transmitter Radiated Spurious Emissions

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

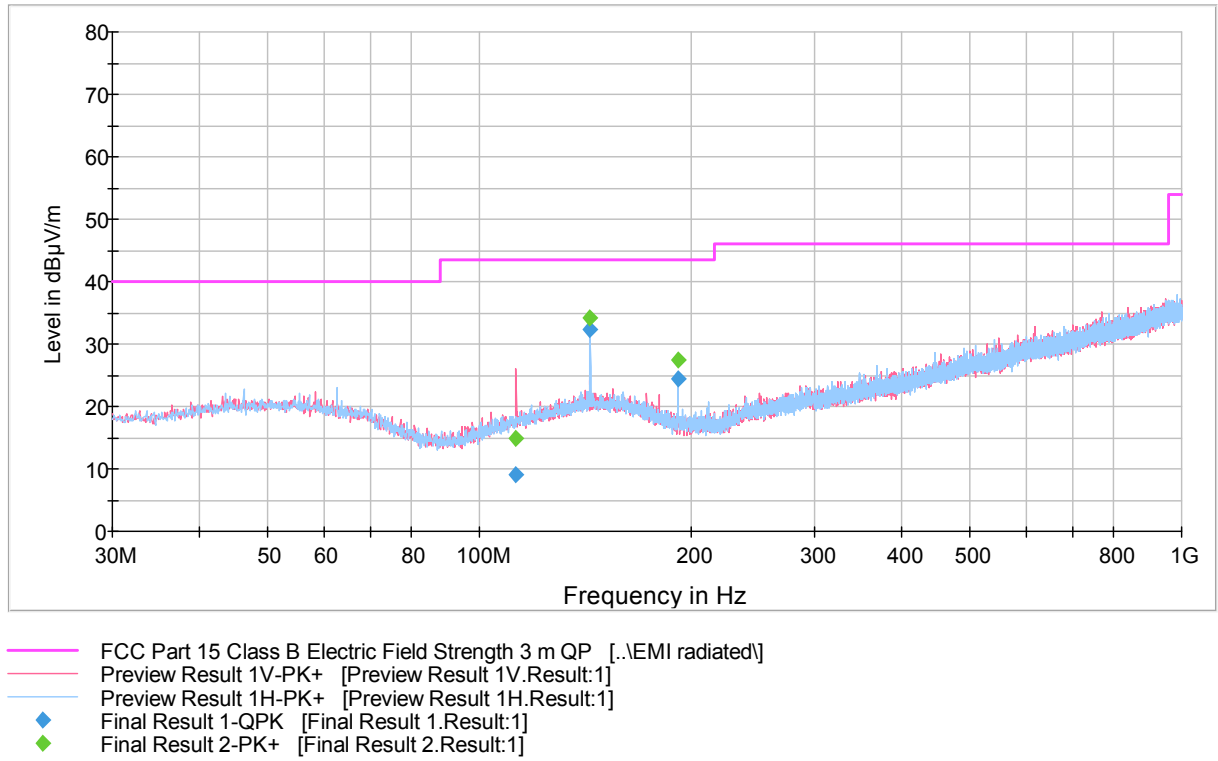


Figure 7. Measured curve with peak-detector channel high.

Final measurements from the worst frequencies

Table 3. Final results.

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
112.718000	9.1	1000.0	120.000	244.0	V	75.0	11.6	34.4	43.5	
143.821000	32.4	1000.0	120.000	230.0	H	297.0	14.2	11.1	43.5	
191.779000	24.4	1000.0	120.000	246.0	H	151.0	11.7	19.1	43.5	

Transmitter Radiated Spurious Emissions 1 000 – 26 500 MHz

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.

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

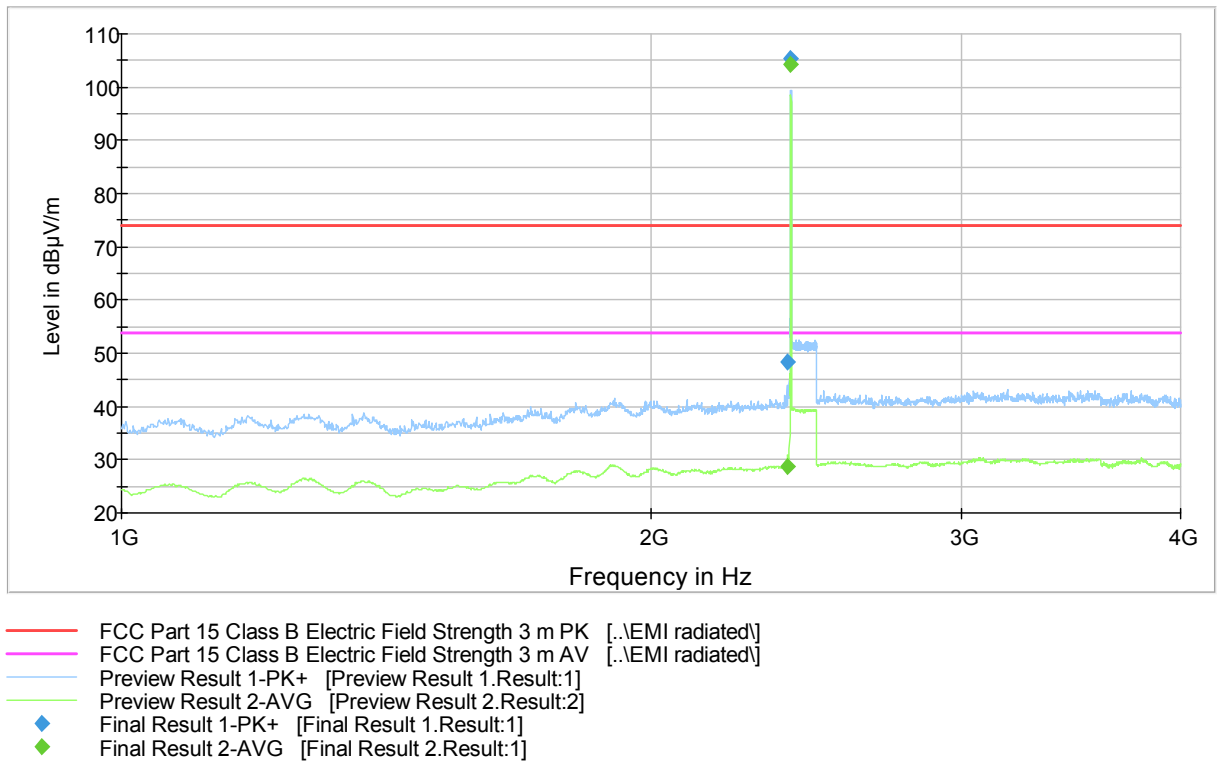


Figure 8. Measured curve with peak- and average detector channel low.

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
2389.200000	48.3	1000.0	1000.000	122.0	H	38.0	3.8	25.6	73.9	
2402.200000	105.3	1000.0	1000.000	195.0	H	323.0	3.9	-31.4	73.9	Carrier

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
2389.400000	28.8	1000.0	1000.000	146.0	V	161.0	3.8	25.1	53.9	
2402.000000	104.4	1000.0	1000.000	192.0	H	325.0	3.9	-50.5	53.9	Carrier

Transmitter Radiated Spurious Emissions

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

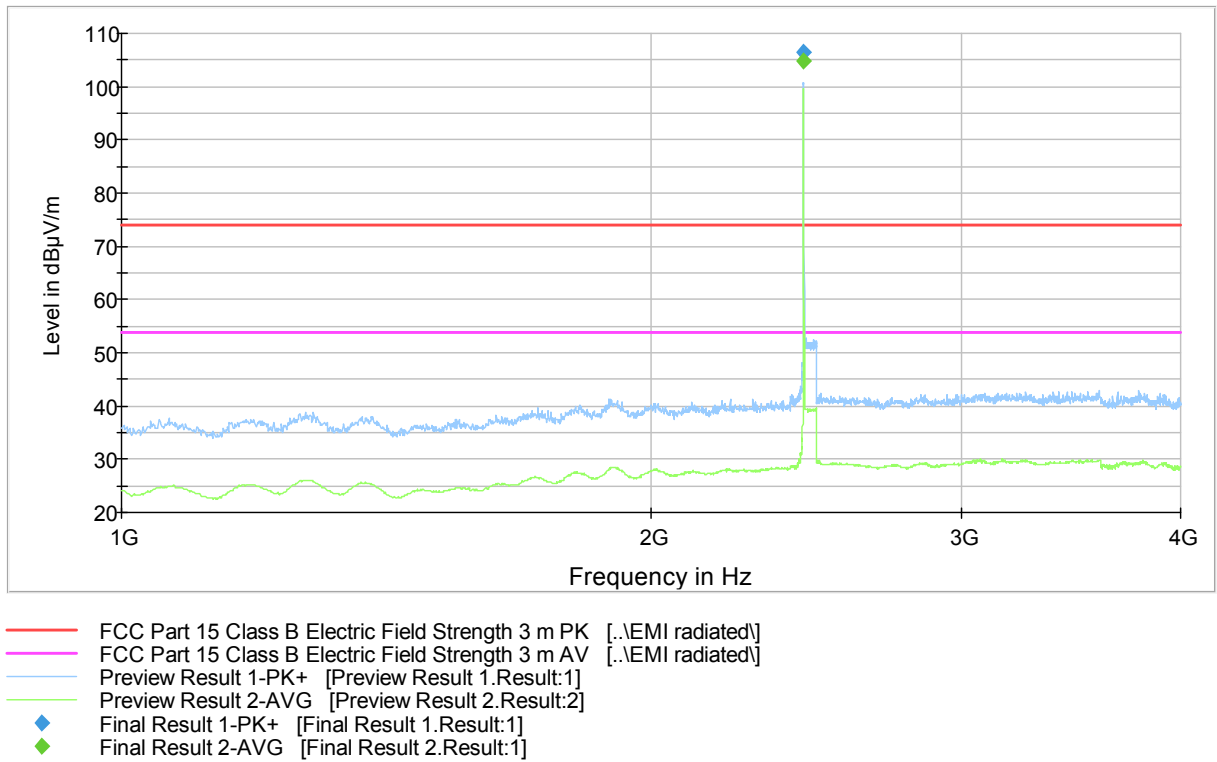


Figure 9. Measured curve with peak- and average detector channel mid.

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
2441.750000	106.5	1000.0	1000.000	226.0	H	309.0	3.8	-32.6	73.9	Carrier

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
2442.000000	104.8	1000.0	1000.000	185.0	H	309.0	3.8	-50.9	53.9	Carrier

Transmitter Radiated Spurious Emissions

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

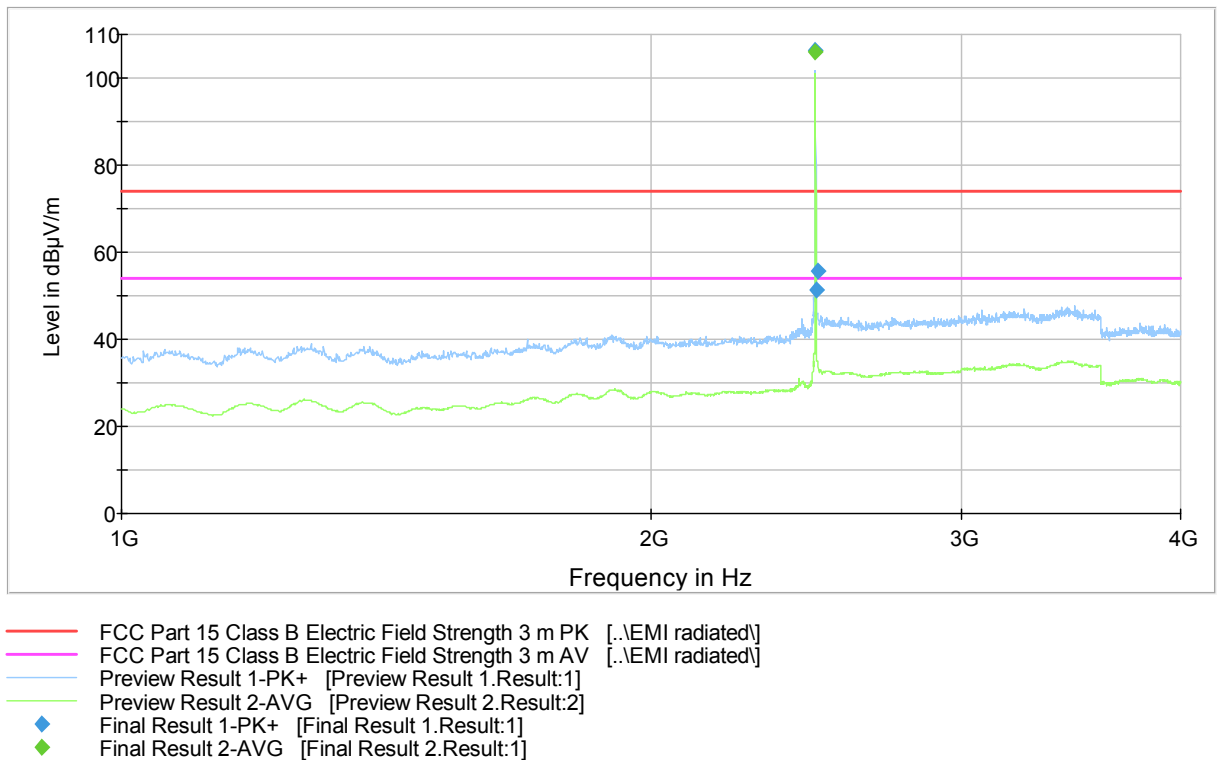


Figure 10. Measured curve with peak- and average detector channel high.

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
2480.250000	106.4	1000.0	1000.000	187.0	H	311.0	4.2	-32.5	73.9	Carrier
2483.500000	51.2	1000.0	1000.000	223.0	H	10.0	4.2	22.7	73.9	
2486.700000	55.5	1000.0	1000.000	179.0	H	309.0	4.3	18.4	73.9	

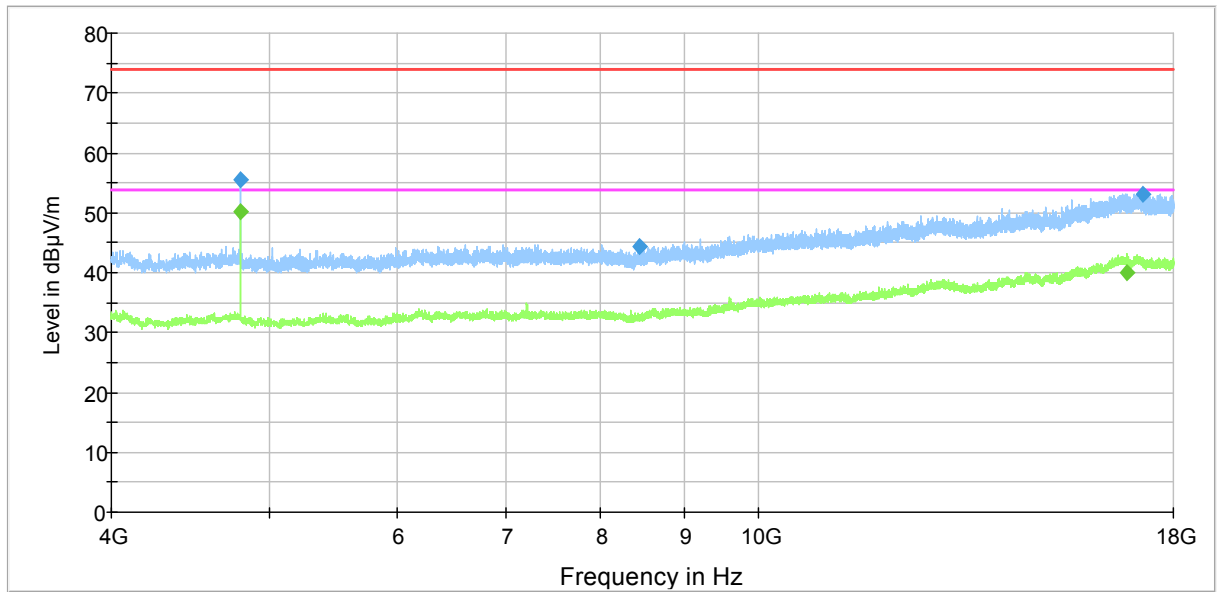
Table 9. Final Average results.

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	105.9	1000.0	1000.000	185.0	H	311.0	4.2	-52.0	53.9	Carrier

Transmitter Radiated Spurious Emissions

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

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



- FCC Part 15 Class B Electric Field Strength 3 m PK [..\EMI radiated]
- FCC Part 15 Class B Electric Field Strength 3 m AV [..\EMI radiated]
- Preview Result 1-PK+ [Preview Result 1.Result:1]
- Preview Result 2-AVG [Preview Result 2.Result:2]
- ◆ Final Result 1-PK+ [Final Result 1.Result:1]
- ◆ Final Result 2-AVG [Final Result 2.Result:1]

Figure 11. Measured curve with peak- and average detector channel low.

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
4804.500000	55.4	1000.0	1000.000	105.0	V	202.0	10.0	18.5	73.9	
8452.500000	44.3	1000.0	1000.000	263.0	V	308.0	13.4	29.6	73.9	
17251.400000	53.2	1000.0	1000.000	113.0	V	82.0	25.4	20.7	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	50.1	1000.0	1000.000	105.0	V	202.0	10.0	3.8	53.9	
16846.600000	40.0	1000.0	1000.000	105.0	V	119.0	25.5	13.9	53.9	

Transmitter Radiated Spurious Emissions

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

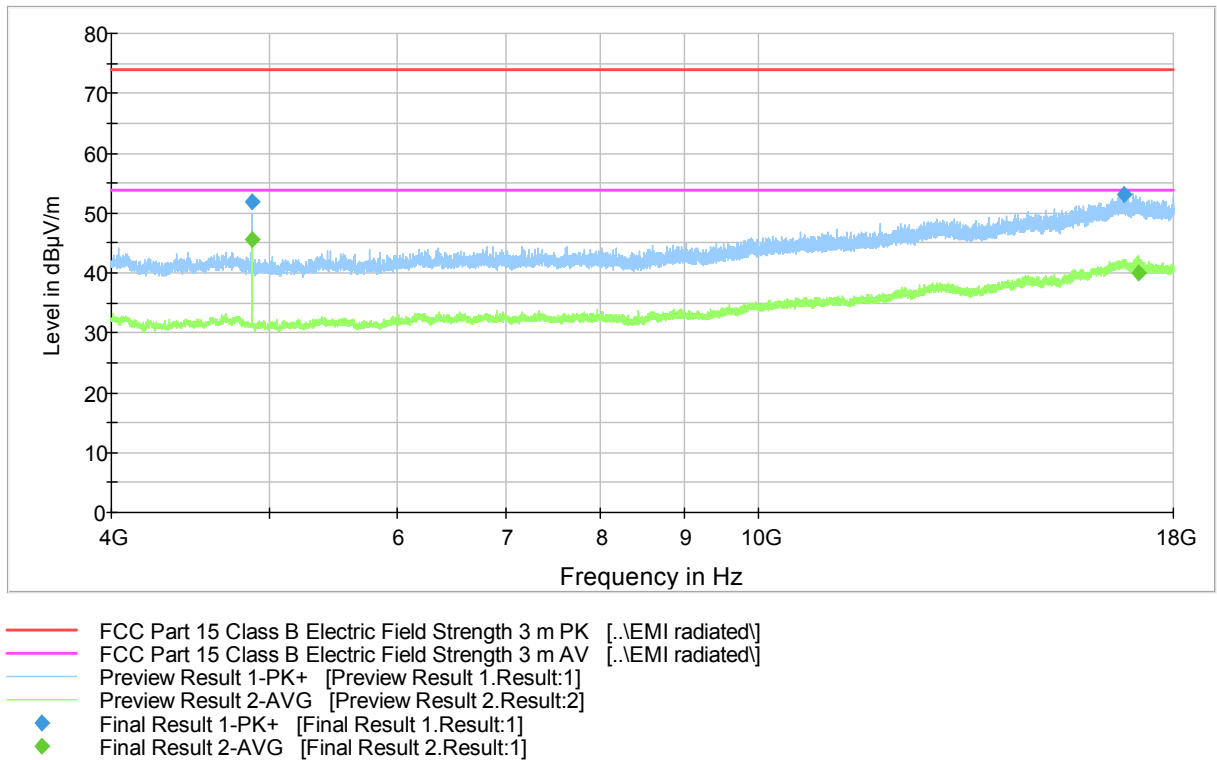


Figure 12. Measured curve with peak- and average detector channel mid.

Final measurements from the worst frequencies

Table 12. Final Max Peak results.

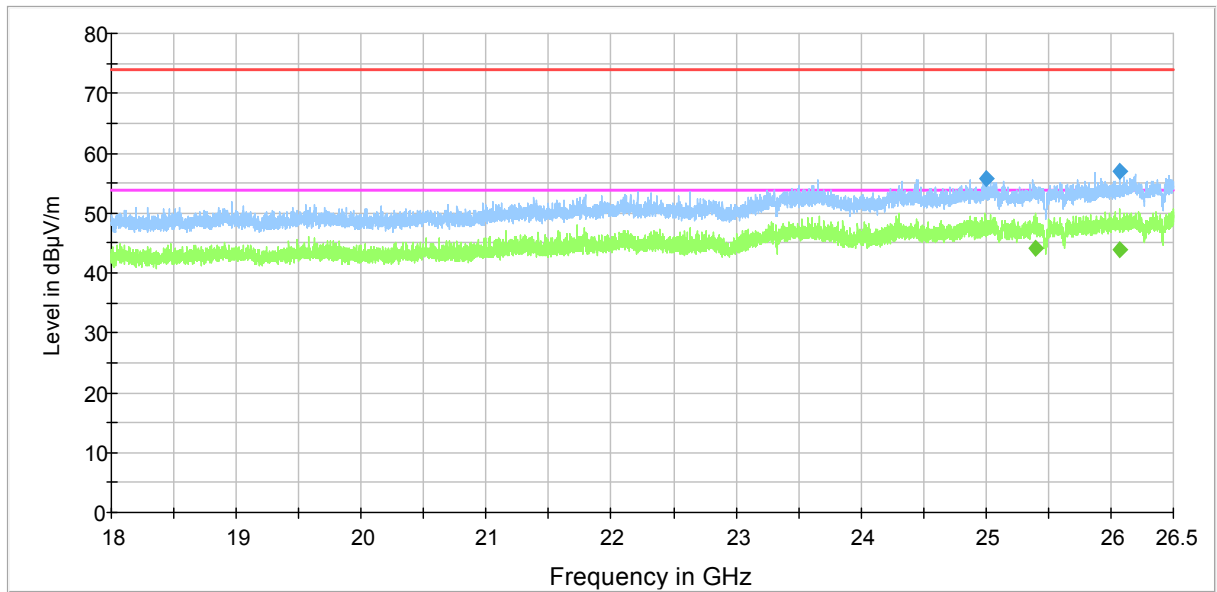
Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4884.400000	52.0	1000.0	1000.000	105.0	H	175.0	10.0	21.9	73.9	
16779.200000	53.1	1000.0	1000.000	226.0	V	8.0	25.5	20.8	73.9	

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
4883.900000	45.5	1000.0	1000.000	100.0	H	174.0	10.0	8.4	53.9	
17140.100000	40.0	1000.0	1000.000	246.0	V	20.0	25.9	13.9	53.9	

Transmitter Radiated Spurious Emissions

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



- FCC Part 15 Class B Electric Field Strength 3 m PK [..\EMI radiated]
- FCC Part 15 Class B Electric Field Strength 3 m AV [..\EMI radiated]
- Preview Result 1-PK+ [Preview Result 1.Result:1]
- Preview Result 2-AVG [Preview Result 2.Result:2]
- ◆ Final Result 1-PK+ [Final Result 1.Result:1]
- ◆ Final Result 2-AVG [Final Result 2.Result:1]

Figure 13. Measured curve with peak- and average detector channel high.

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
24996.300000	55.9	1000.0	1000.000	153.0	V	225.0	32.9	18.0	73.9	
26073.200000	56.9	1000.0	1000.000	304.0	V	313.0	34.9	17.0	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
25399.600000	44.0	1000.0	1000.000	400.0	V	214.0	34.0	9.9	53.9	
26065.800000	43.8	1000.0	1000.000	145.0	V	359.0	34.9	10.1	53.9	

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

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

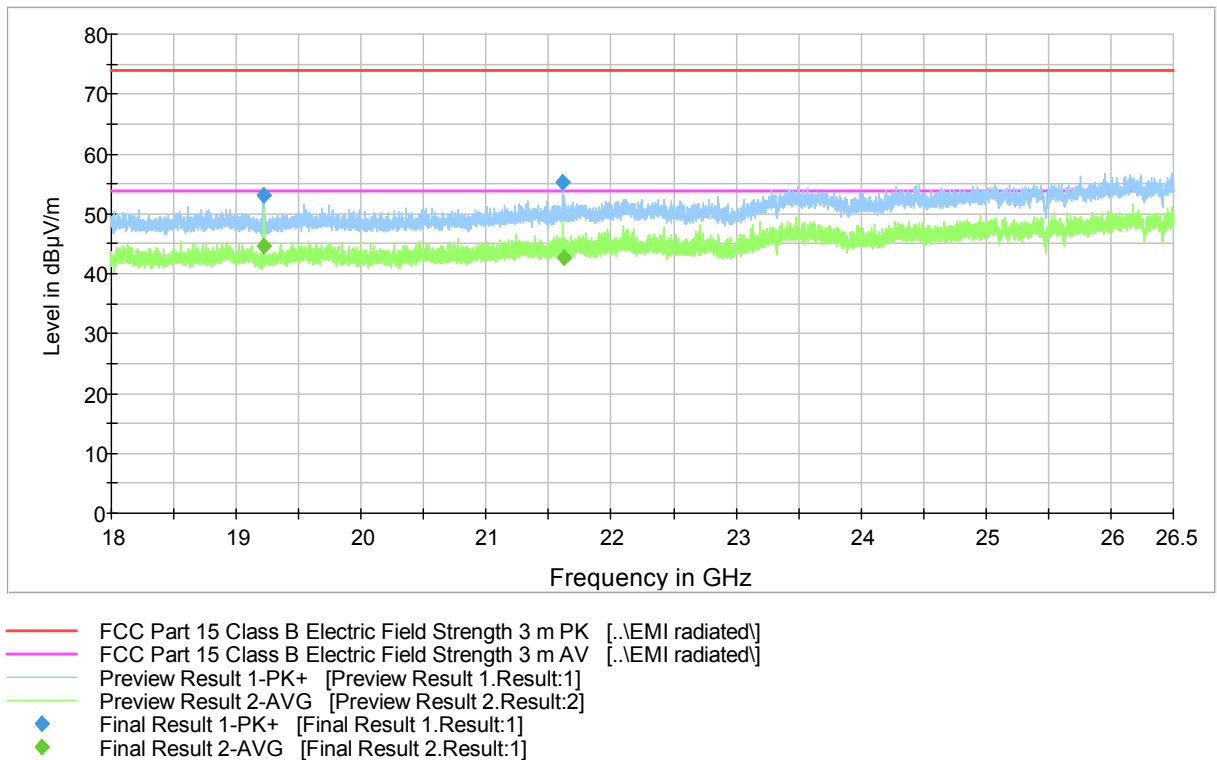


Figure 14. Measured curve with peak- and average detector. Channel Low.

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)	Margin (dB)	Limit (dBµV/m)	Comment
19214.000000	53.0	1000.0	1000.000	153.0	H	66.0	20.9	73.9	
21615.500000	55.3	1000.0	1000.000	153.0	H	66.0	18.6	73.9	

Table 17. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)	Comment
19214.000000	44.7	1000.0	1000.000	161.0	H	66.0	9.2	53.9	
21620.100000	42.6	1000.0	1000.000	129.0	H	66.0	11.3	53.9	

Transmitter Radiated Spurious Emissions

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

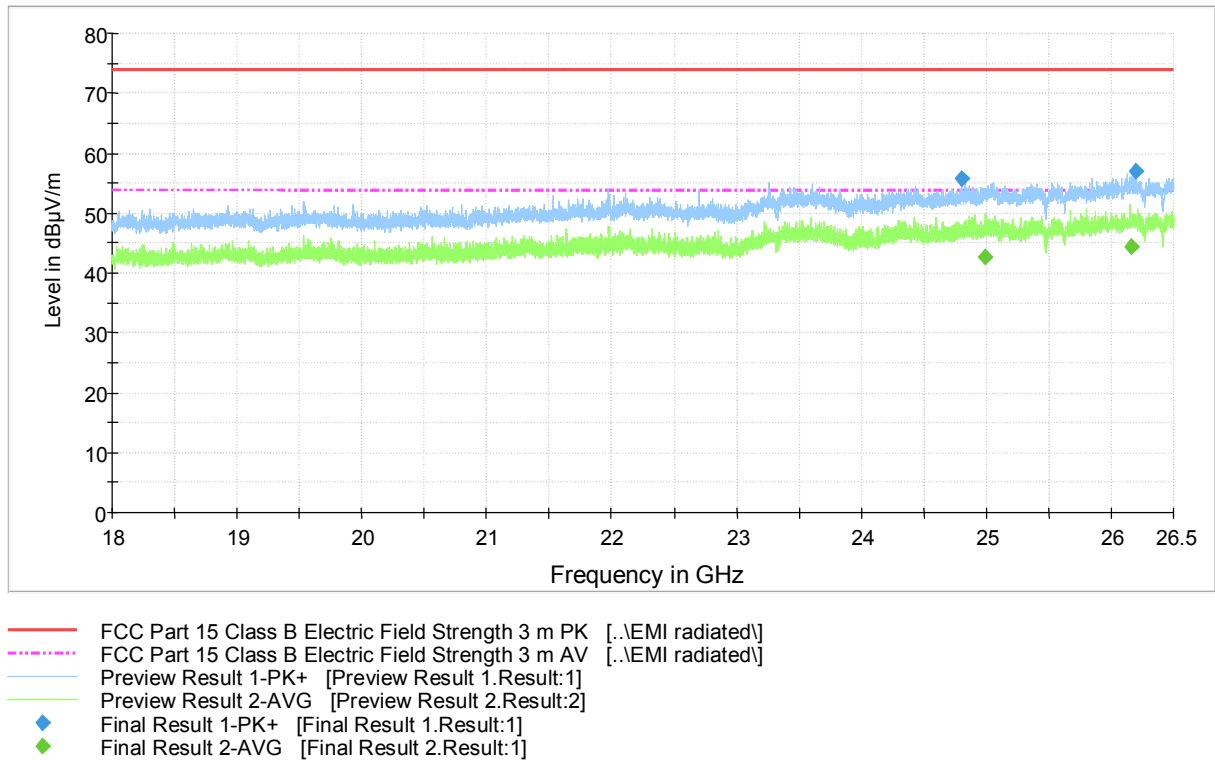


Figure 15. Measured curve with peak- and average detector channel mid.

Final measurements from the worst frequencies

Table 18. 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
24800.400000	55.7	1000.0	1000.000	394.0	H	47.0	32.5	18.2	73.9	
26193.600000	57.1	1000.0	1000.000	400.0	V	222.0	35.3	16.8	73.9	

Table 19. 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
24992.900000	42.7	1000.0	1000.000	145.0	H	356.0	32.9	11.2	53.9	
26159.100000	44.5	1000.0	1000.000	400.0	H	67.0	35.2	9.4	53.9	

Transmitter Radiated Spurious Emissions

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

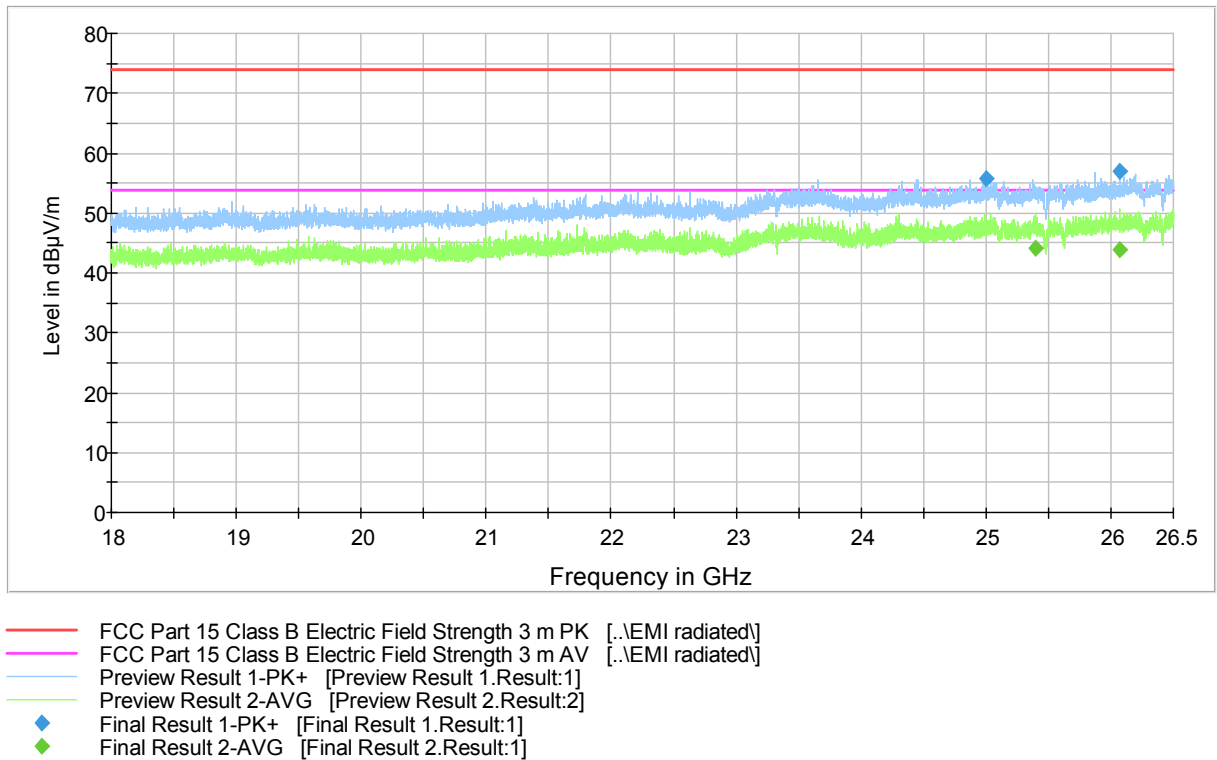


Figure 16. Measured curve with peak- and average detector channel high.

Final measurements from the worst frequencies

Table 20. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)	Comment
24996.300000	55.9	1000.0	1000.000	153.0	V	225.0	18.0	73.9	
26073.200000	56.9	1000.0	1000.000	304.0	V	313.0	17.0	73.9	

Table 21. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)	Comment
25399.600000	44.0	1000.0	1000.000	400.0	V	214.0	9.9	53.9	
26065.800000	43.8	1000.0	1000.000	145.0	V	359.0	10.1	53.9	

Radiated band edge measurement results

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

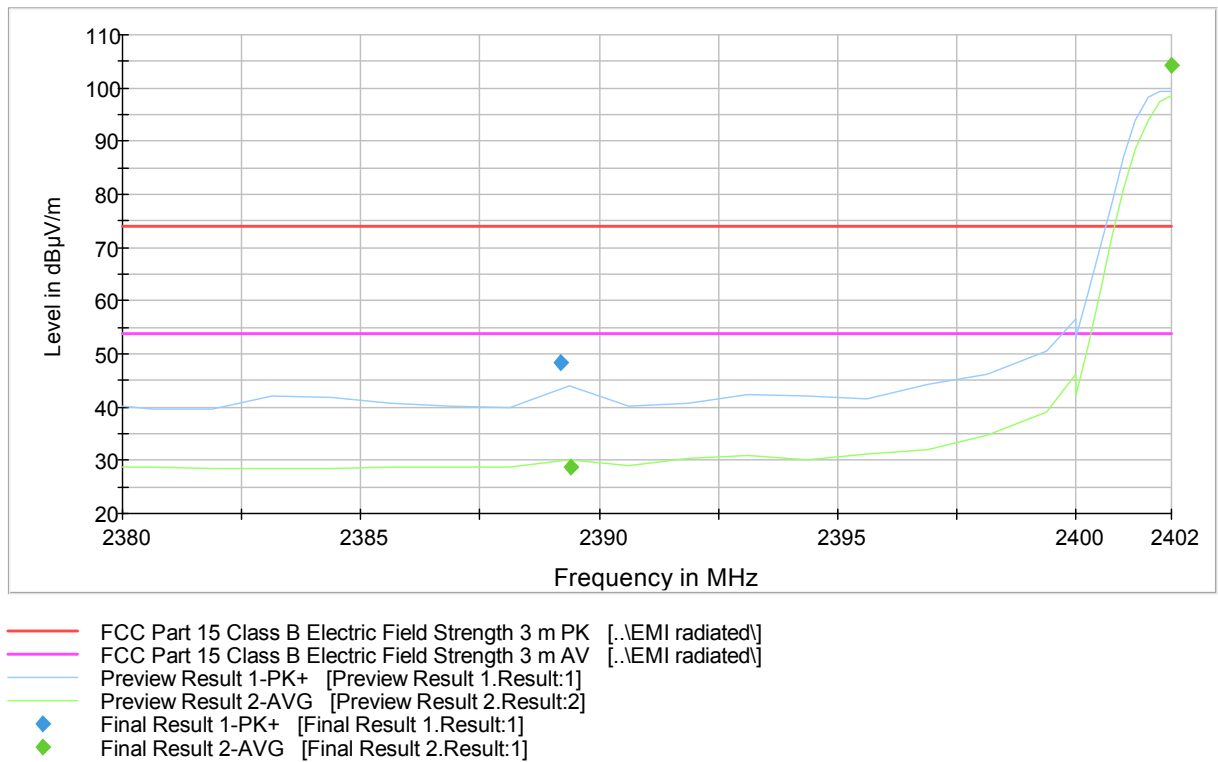


Figure 17. Measured curve with peak- and average detector. Lower band edge.

Final measurements from the worst frequencies

Table 22. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2389.200000	48.3	1000.0	1000.000	122.0	H	38.0	3.8	25.6	73.9	
2402.200000	105.3	1000.0	1000.000	195.0	H	323.0	3.9	-31.4	73.9	Carrier

Table 23. 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
2389.400000	28.8	1000.0	1000.000	146.0	V	161.0	3.8	25.1	53.9	
2402.000000	104.4	1000.0	1000.000	192.0	H	325.0	3.9	-50.5	53.9	Carrier

Transmitter Radiated Spurious Emissions

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

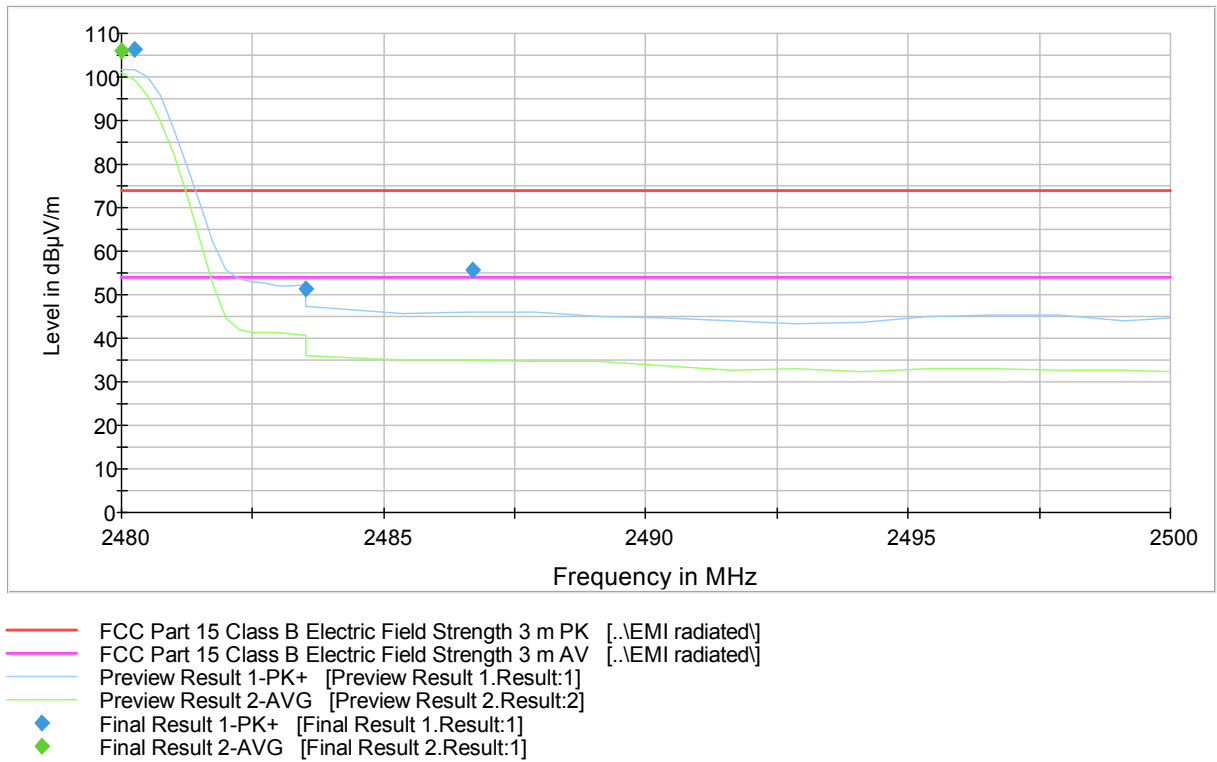


Figure 18. Measured curve with peak- and average detector. Upper band edge.

Final measurements from the worst frequencies

Table 24. 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
2480.250000	106.4	1000.0	1000.000	187.0	H	311.0	4.2	-32.5	73.9	
2483.500000	51.2	1000.0	1000.000	223.0	H	10.0	4.2	22.7	73.9	
2486.700000	55.5	1000.0	1000.000	179.0	H	309.0	4.3	18.4	73.9	

Table 25. 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	105.9	1000.0	1000.000	185.0	H	311.0	4.2	-52.0	53.9	

Transmitter Band Edge Measurement and Conducted Spurious Emissions

Standard: ANSI C63.10 (2009)
Tested by: NKO
Date: 12.5.2015
Humidity: 25 %
Temperature: 21 °C
Measurement uncertainty ± 2.87 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) (see Section 15.205(c)).

Table 26. Band edge attenuation.

Band Edge Attenuation	
Lower Band Edge	Upper Band Edge
-61.41 dBc	-58.21 dBc
Limit: -20dBc	

Table 27. Conducted spurious emissions.

Conducted Spurious Emissions					
Channel	Frequency	Measured Attenuation [dBm]	EIRP Limit [dBm]	Margin [dB]	Result
Low	9.60983 GHz	-31.04	-21.36	9.68	Pass
Mid	9.76704 GHz	-31.58	-21.36	10.22	Pass
High	9.92070 GHz	-32.43	-21.36	11.07	Pass

Conducted spurious emissions limit is calculated from electric field strength result. Following formula was used in calculating electric field strength limit to EIRP:

$$E = \text{EIRP} - 20\log D + 104.8$$

where,

D = specified measurement distance

E = Electric field strength

EIRP = equivalent isotropic radiated

Transmitter Band Edge Measurement and Conducted Spurious Emissions

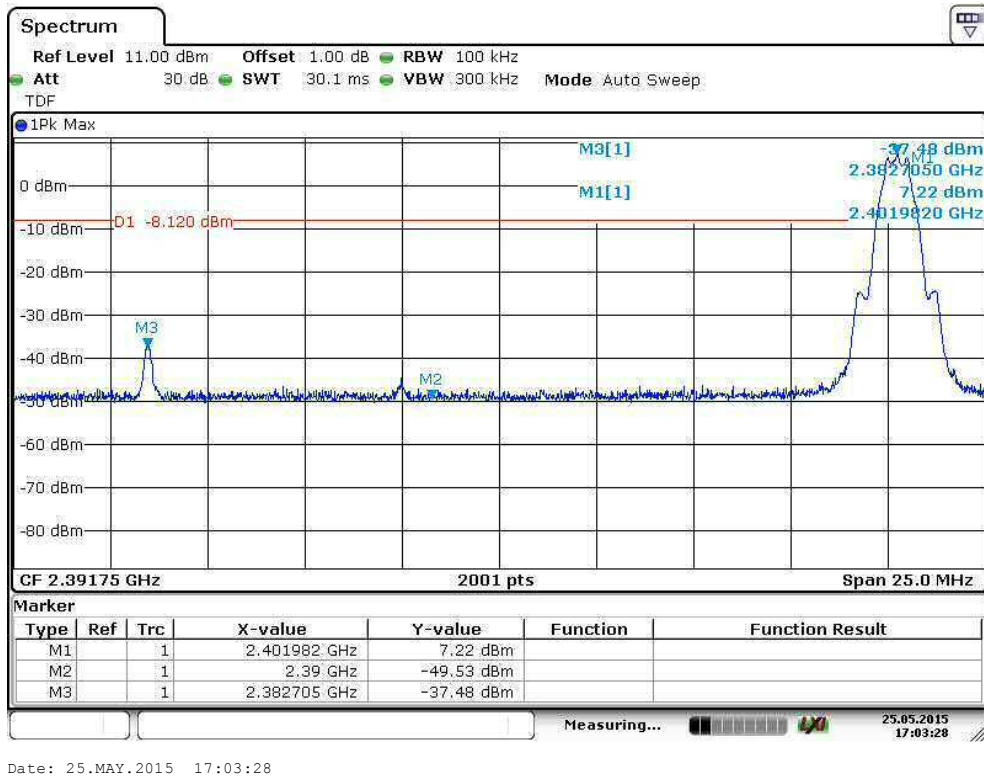


Figure 19. Lower Band Edge.

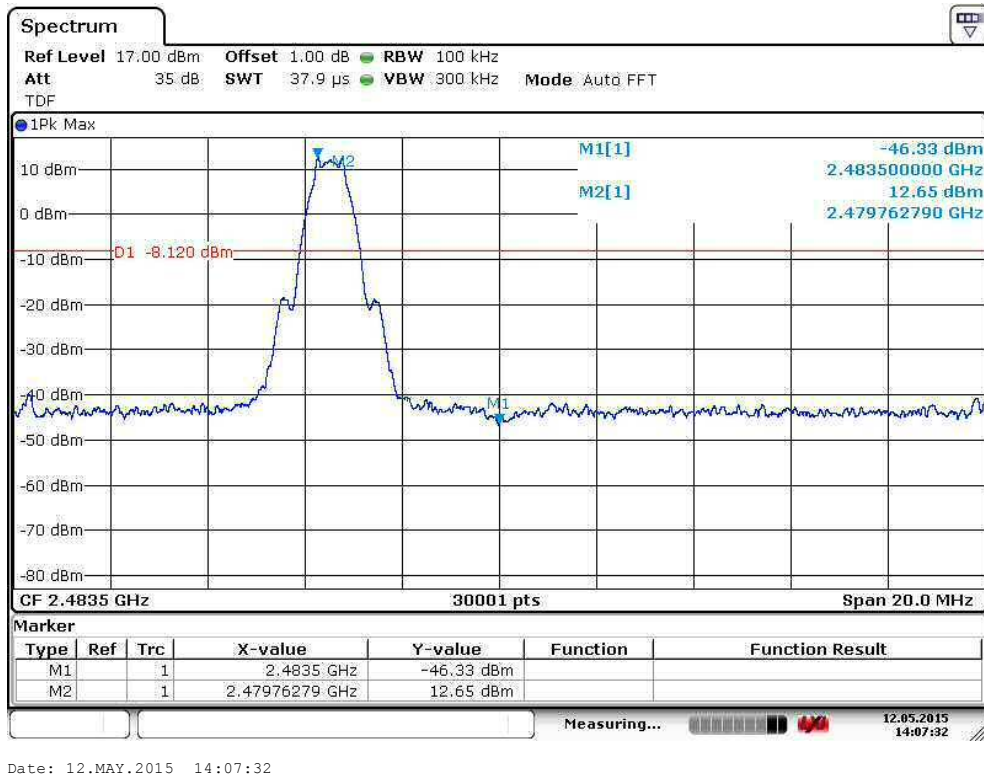


Figure 20. Upper Band Edge.

Transmitter Band Edge Measurement and Conducted Spurious Emissions

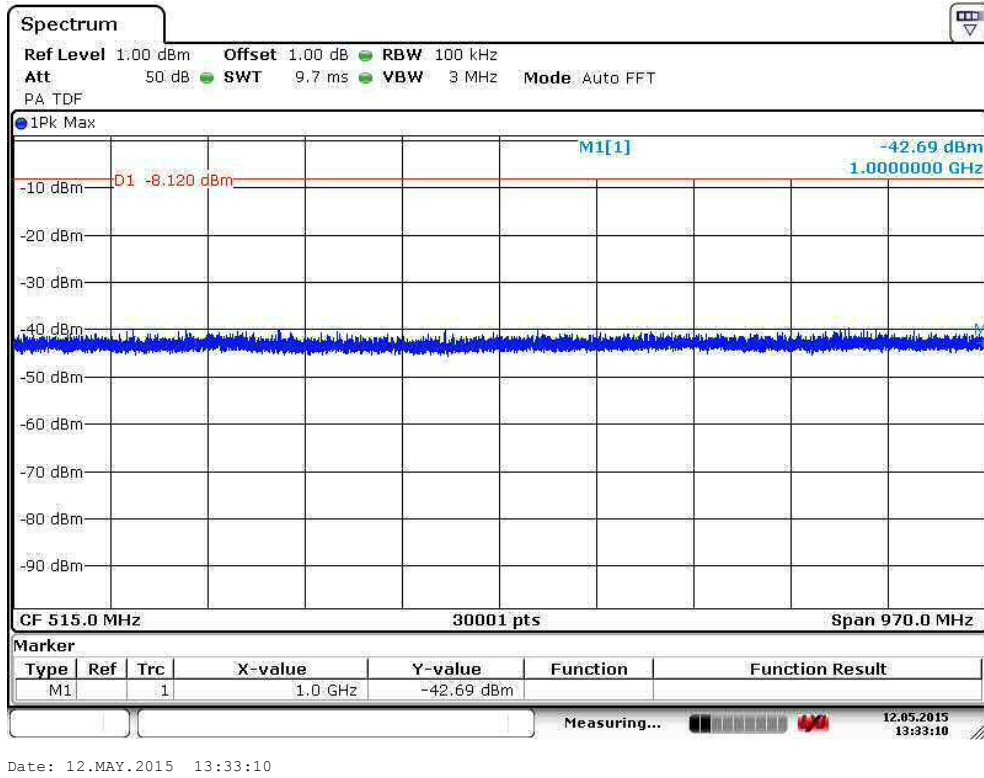


Figure 21. Conducted Spurious Emissions 30 – 1 000 MHz channel low.

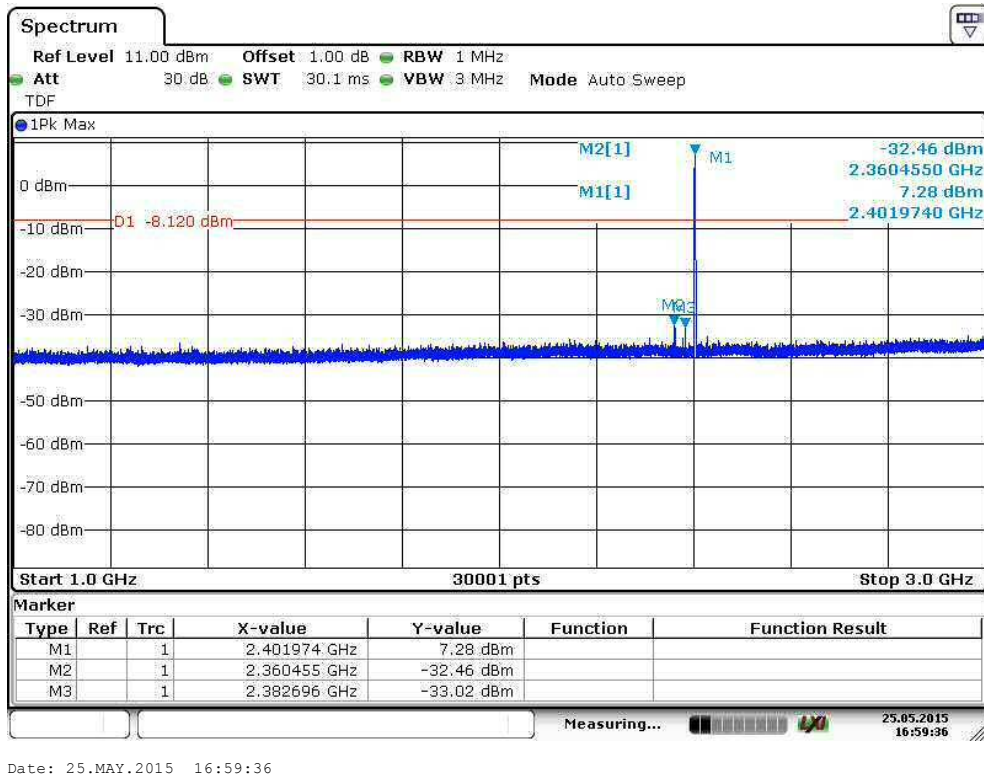
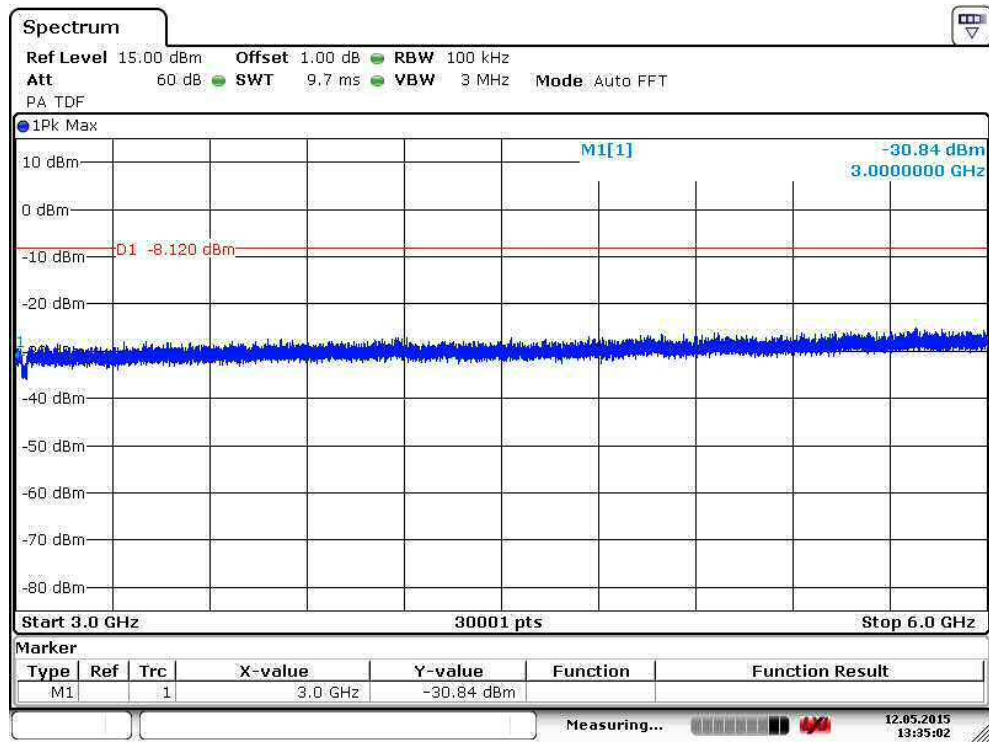


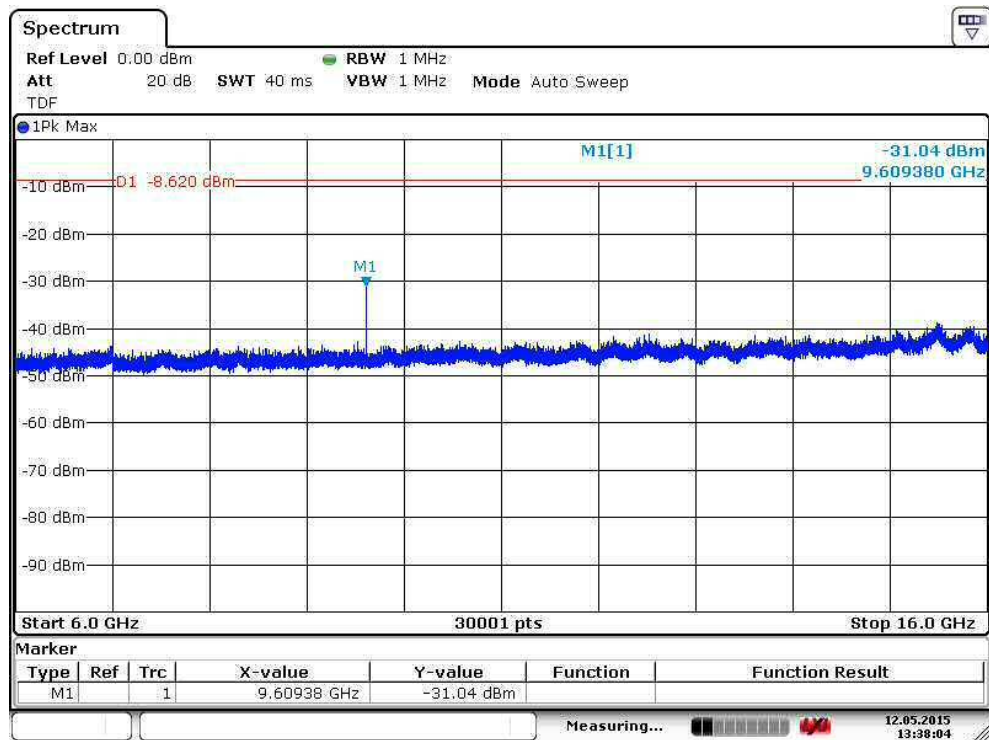
Figure 22. Conducted Spurious Emissions 1 000 – 3 000 MHz. Channel Low.

Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 12.MAY.2015 13:35:01

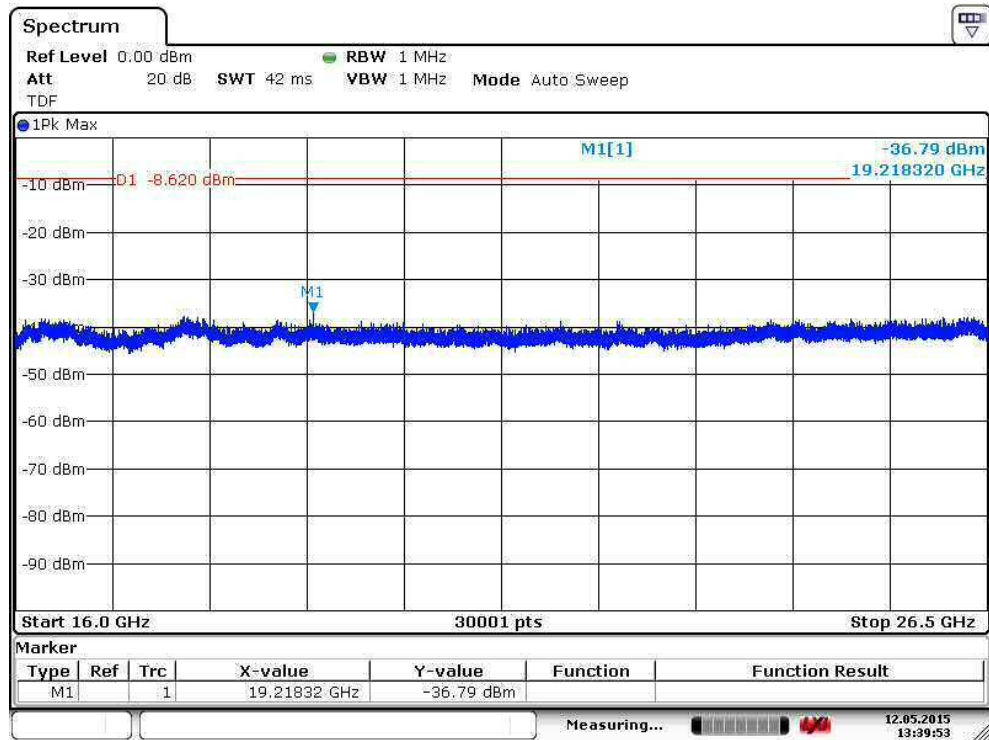
Figure 23. Conducted Spurious Emissions 3 000 – 6 000 MHz channel low.



Date: 12.MAY.2015 13:38:04

Figure 24. Conducted Spurious Emissions 6 000 – 16 000 MHz channel low.

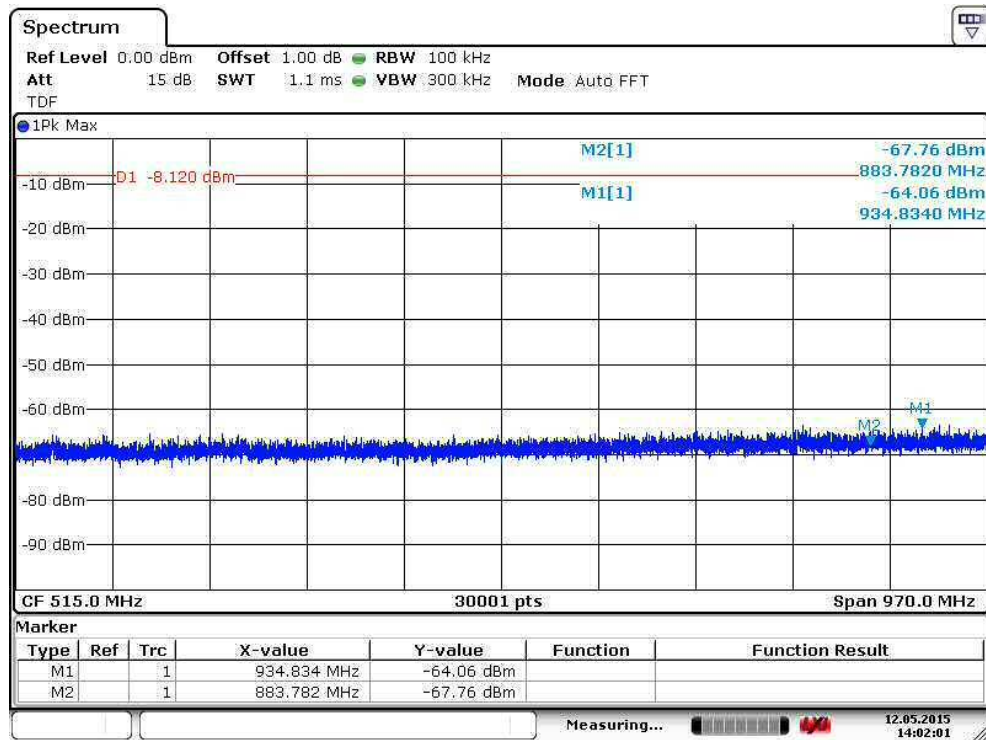
Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 12.MAY.2015 13:39:53

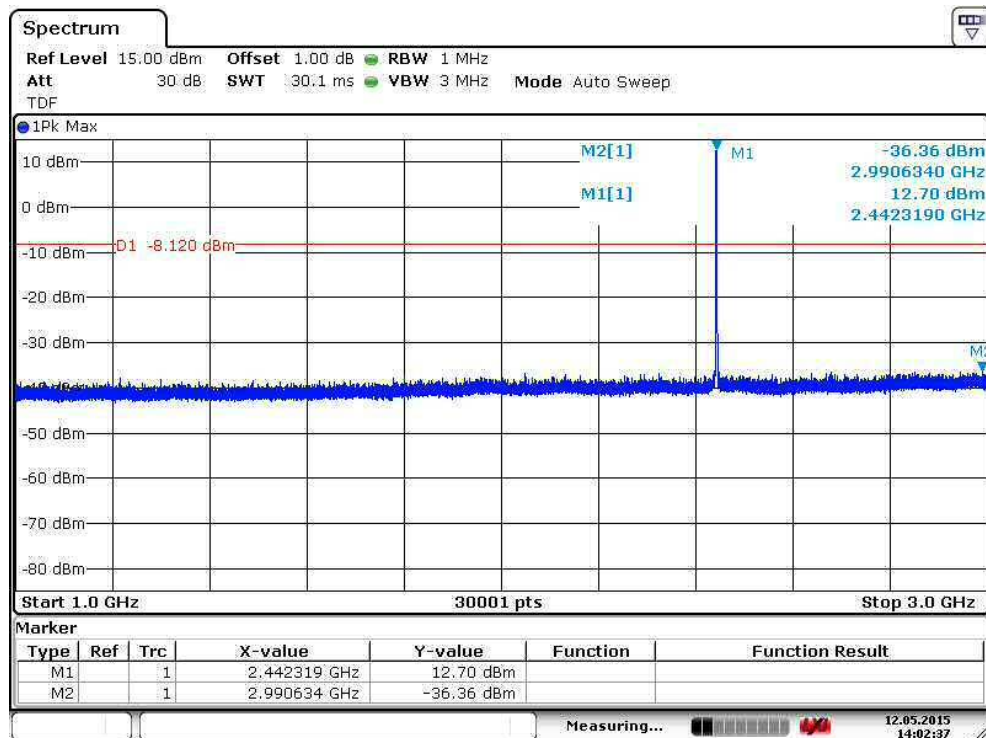
Figure 25. Conducted Spurious Emissions 16 000 – 26 500 MHz channel low

Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 12.MAY.2015 14:02:01

Figure 26. Conducted Spurious Emissions 30 – 1 000 MHz channel mid.



Date: 12.MAY.2015 14:02:36

Figure 27. Conducted Spurious Emissions 1 000 – 3 000 MHz channel mid.

Transmitter Band Edge Measurement and Conducted Spurious Emissions

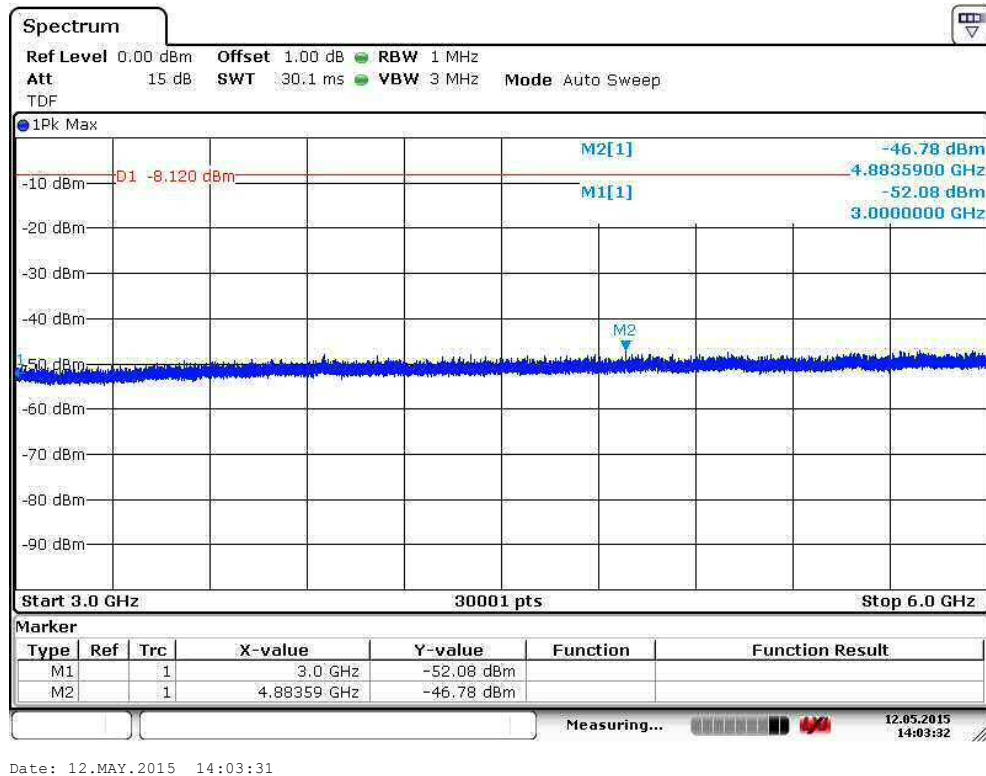


Figure 28. Conducted Spurious Emissions 3 000 – 6 000 MHz channel mid.

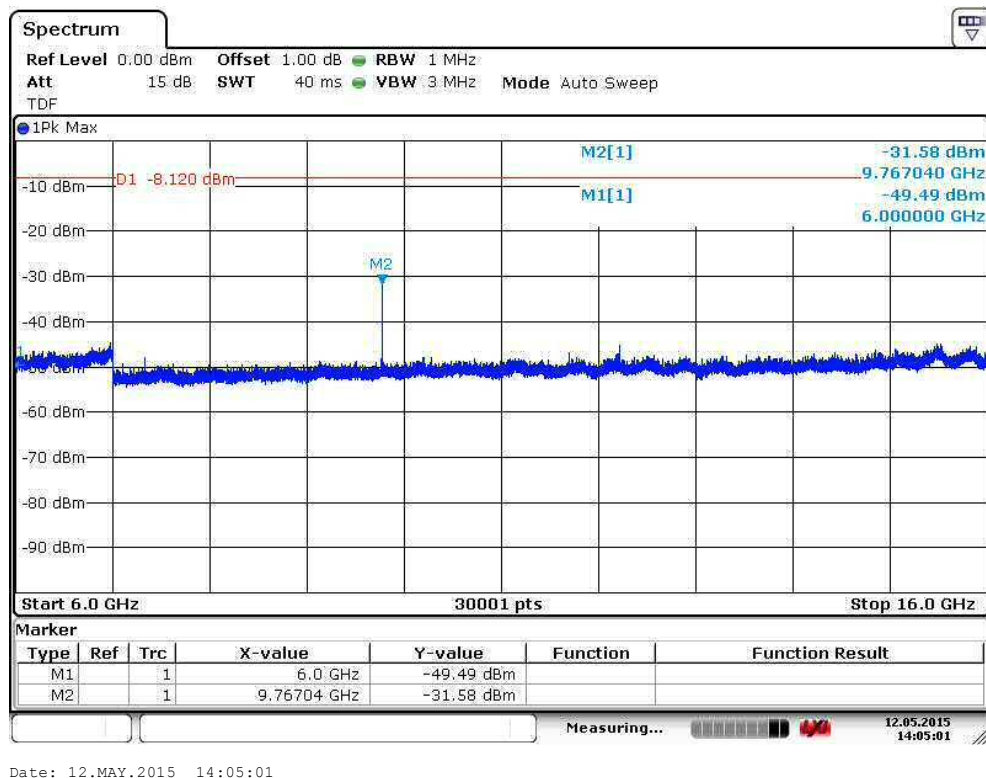
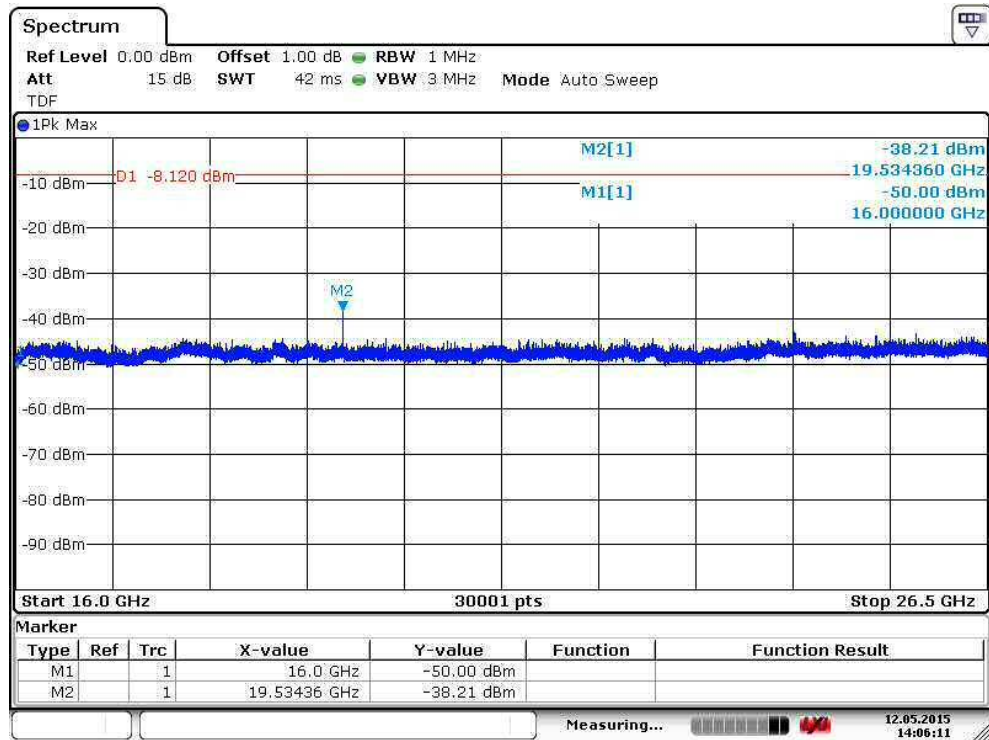


Figure 29. Conducted Spurious Emissions 6 000 – 16 000 MHz channel mid.

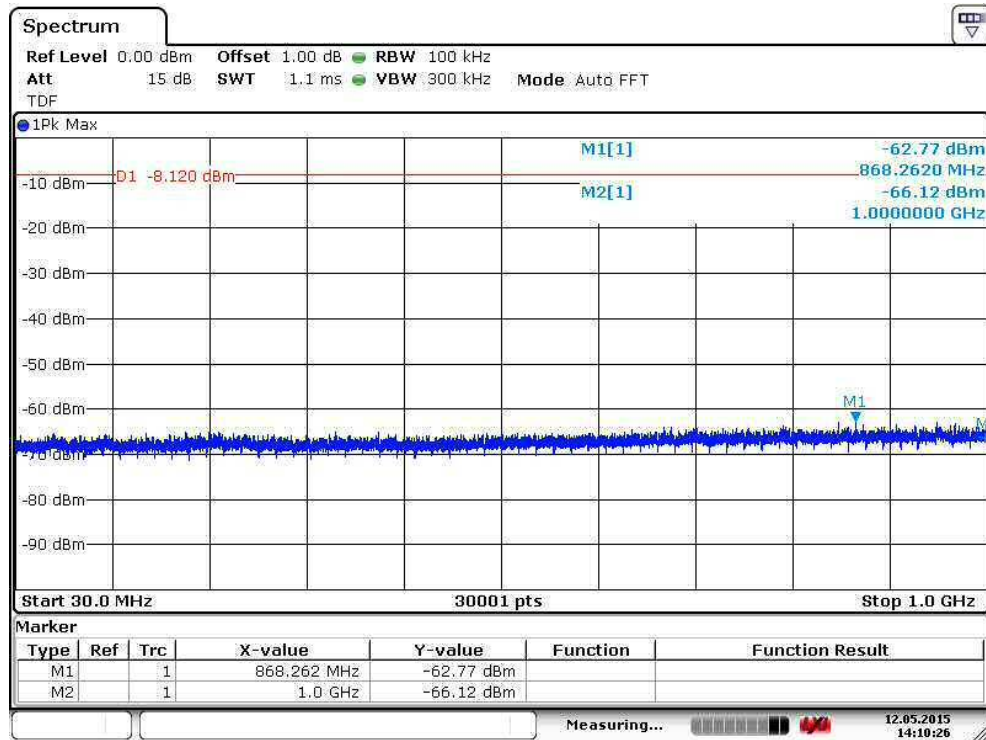
Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 12.MAY.2015 14:06:10

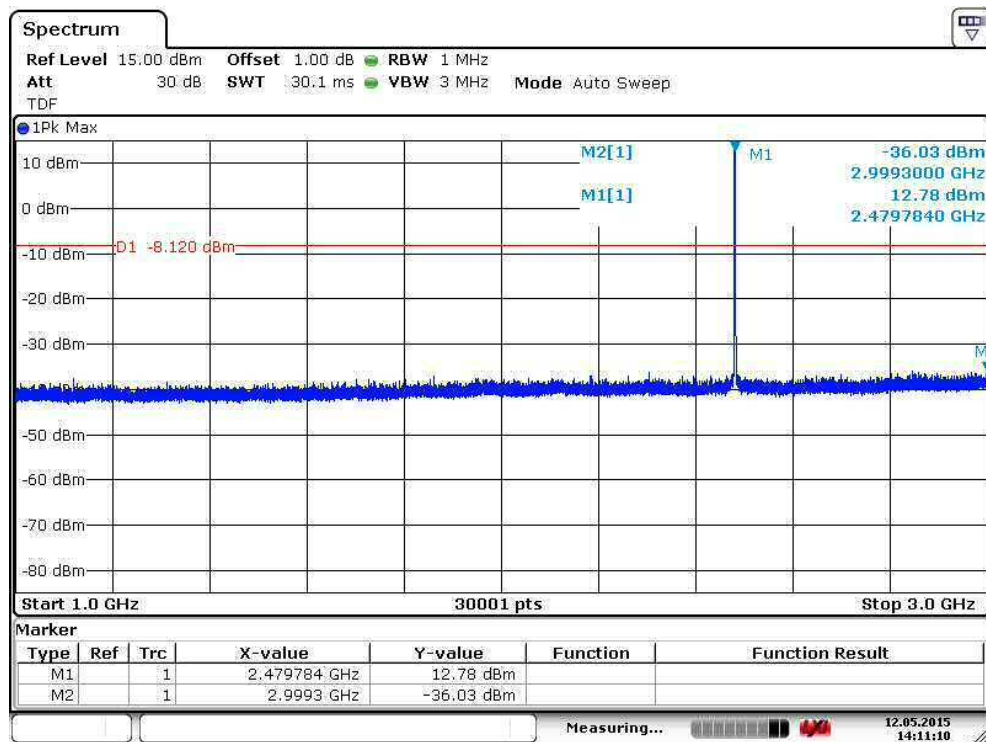
Figure 30. Conducted Spurious Emissions 16 000 MHz – 26 500 MHz channel mid.

Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 12.MAY.2015 14:10:26

Figure 31. Conducted Spurious Emissions 30 – 1 000 MHz channel high.



Date: 12.MAY.2015 14:11:09

Figure 32. Conducted Spurious Emissions 1 000 – 3 000 MHz channel high.

Transmitter Band Edge Measurement and Conducted Spurious Emissions

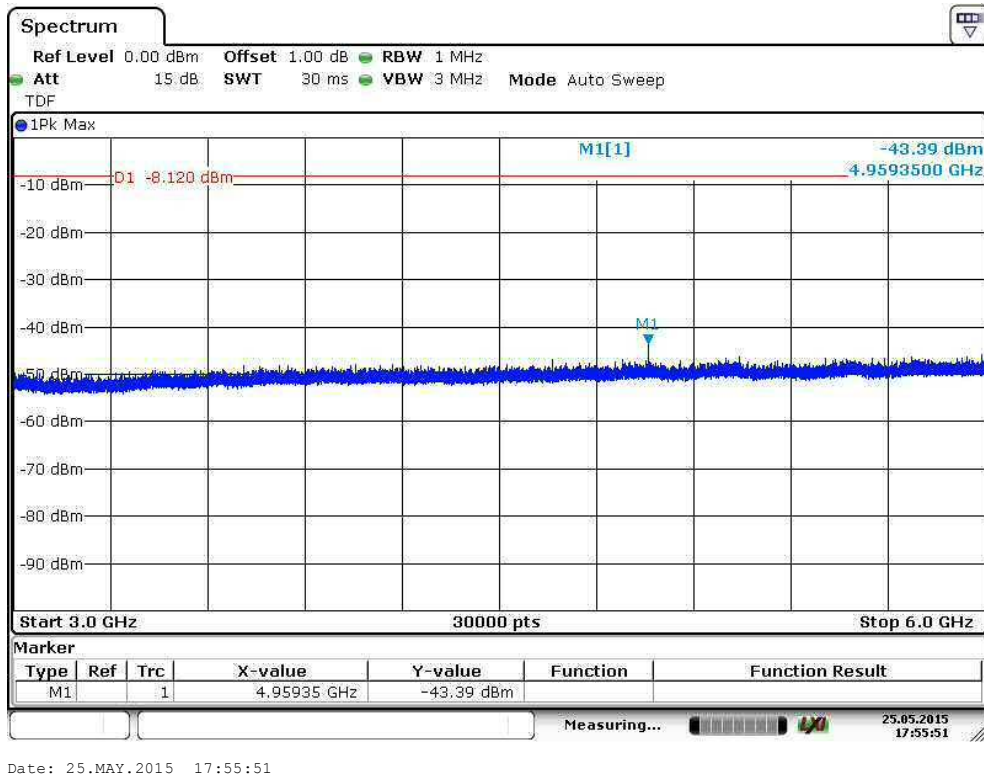


Figure 33. Conducted Spurious Emissions 3 000 – 6 000 MHz channel high.

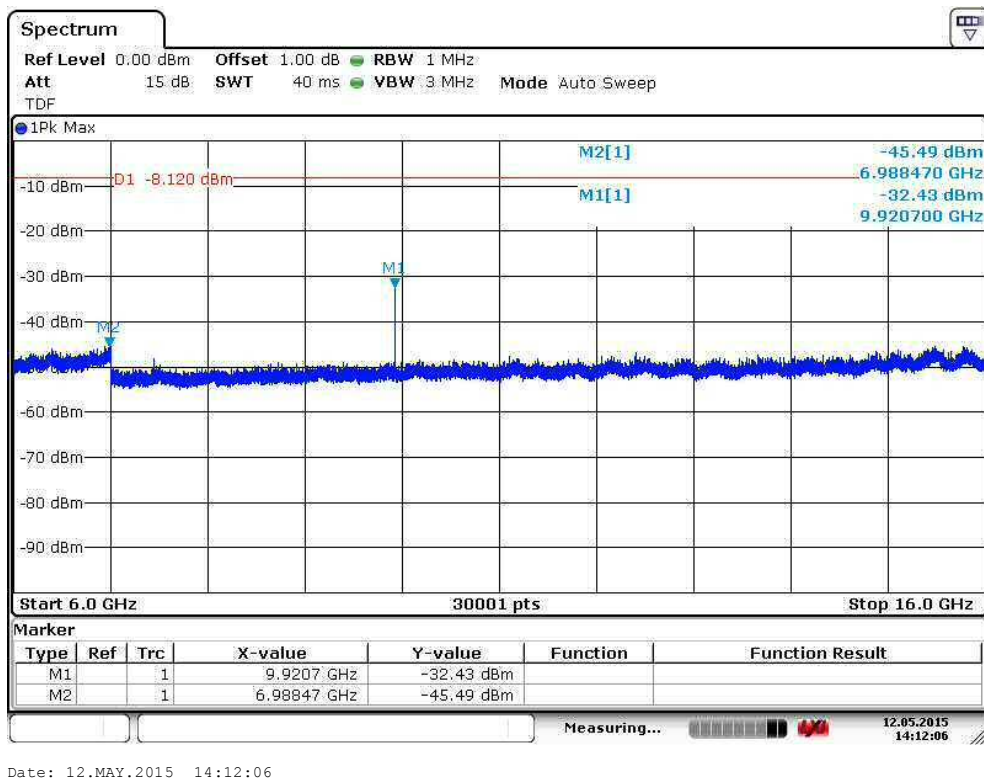
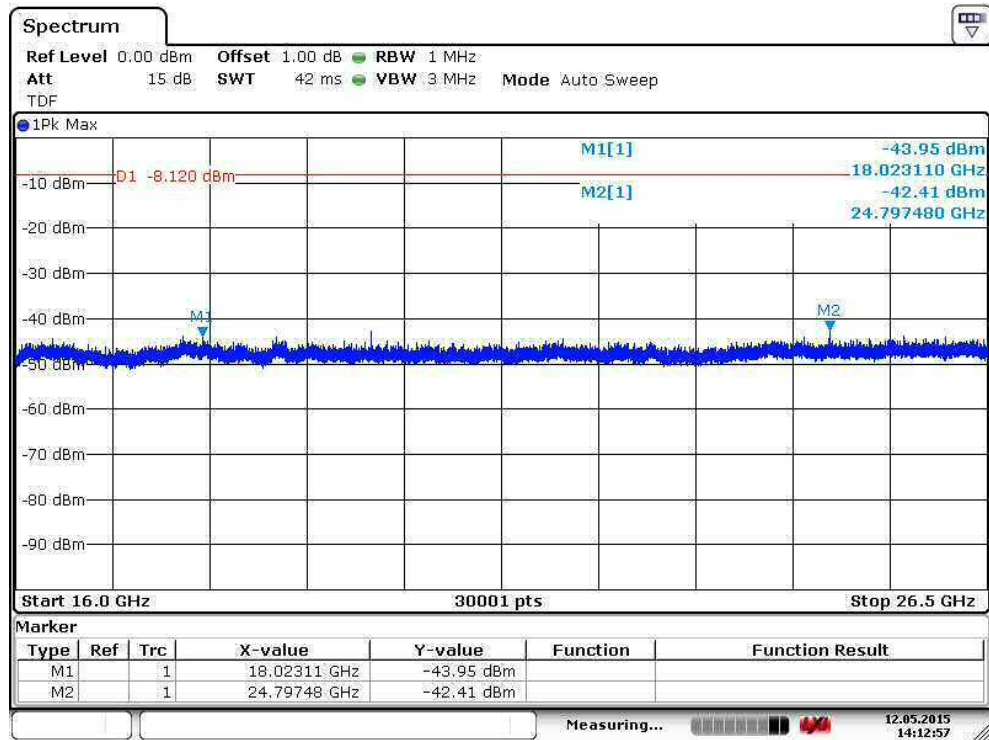


Figure 34. Conducted Spurious Emissions 6 000 – 16 000 MHz channel high.

Transmitter Band Edge Measurement and Conducted Spurious Emissions



Date: 12.MAY.2015 14:12:57

Figure 35. Conducted Spurious Emissions 16 000 – 26 500 MHz channel high.

6 dB Bandwidth of the Channel

Standard: ANSI C63.10 (2009)
Tested by: NKO
Date: 12.5.2015
Humidity: 25 %
Temperature: 21 °C

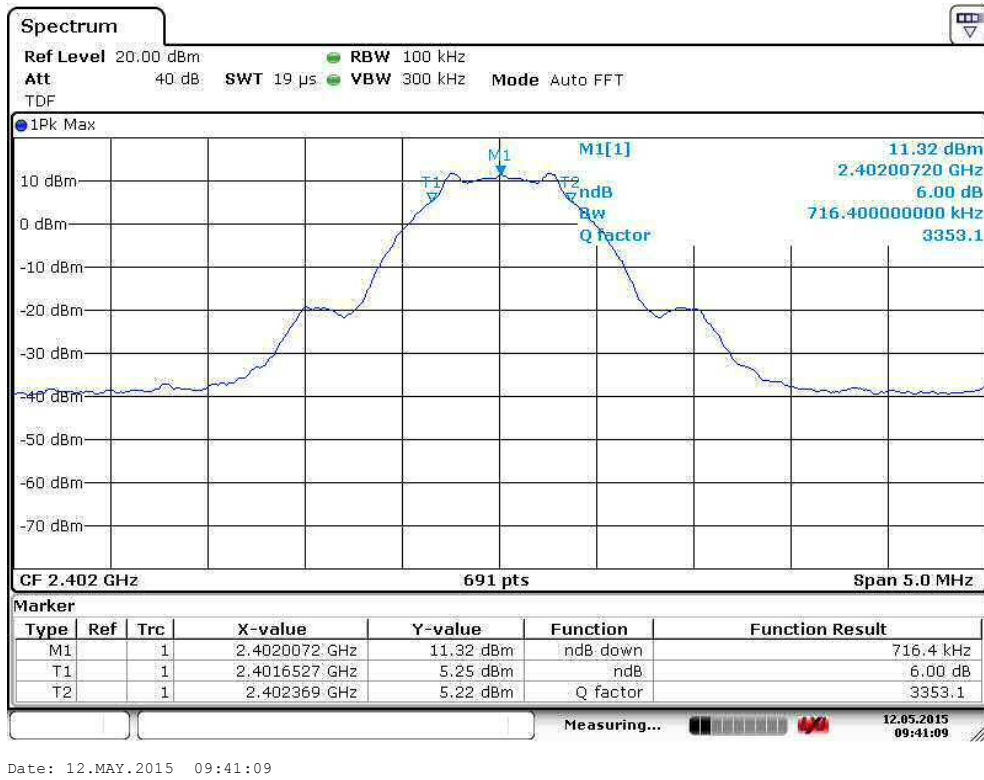
FCC Rule: 15.247(a)(2)
RSS-210 A8.2

Results:

Table 28. 6 dB bandwidth test results.

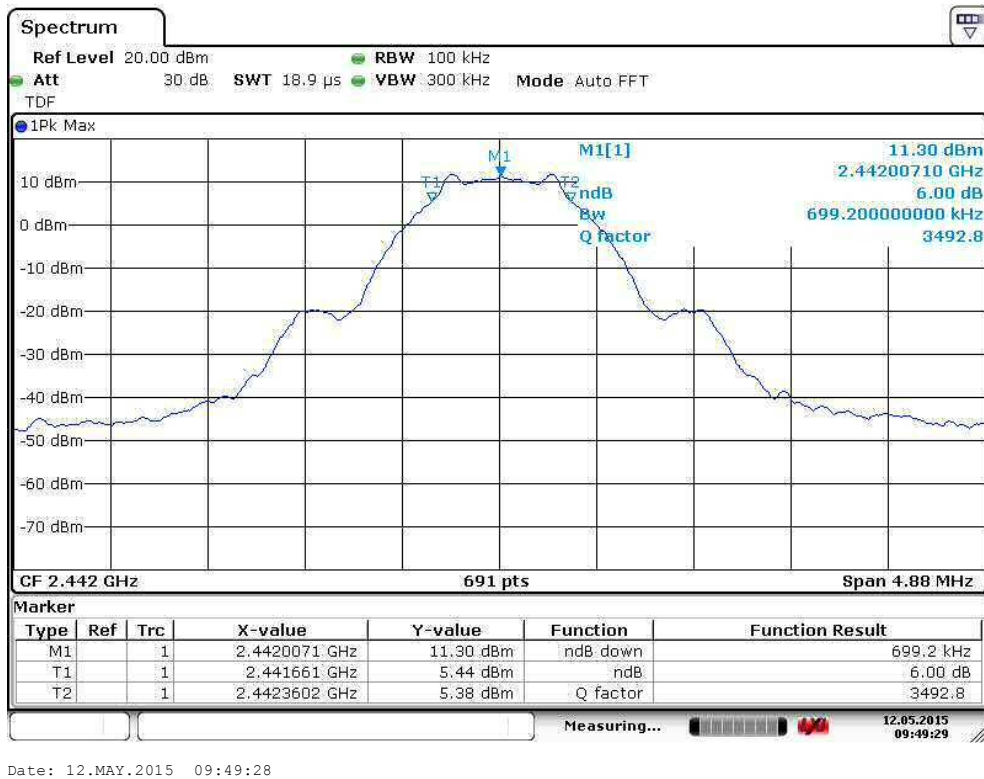
Channel	6 dB BW [kHz]	Minimum limit [kHz]
Low	716.400	500
Mid	699.200	
High	701.900	

6 dB Bandwidth of the Channel



Date: 12.MAY.2015 09:41:09

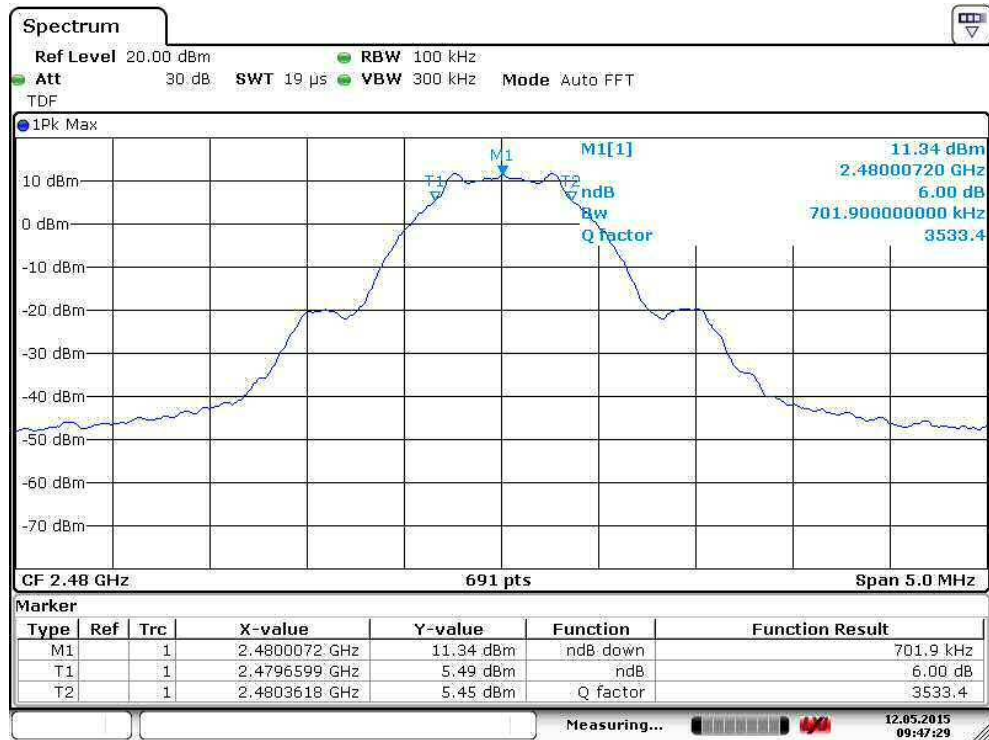
Figure 36. 6 dB bandwidth of the channel low.



Date: 12.MAY.2015 09:49:28

Figure 37. 6 dB bandwidth of the channel mid.

6 dB Bandwidth of the Channel



Date: 12.MAY.2015 09:47:28

Figure 38. 6 dB bandwidth of the channel high.

Power Spectral Density

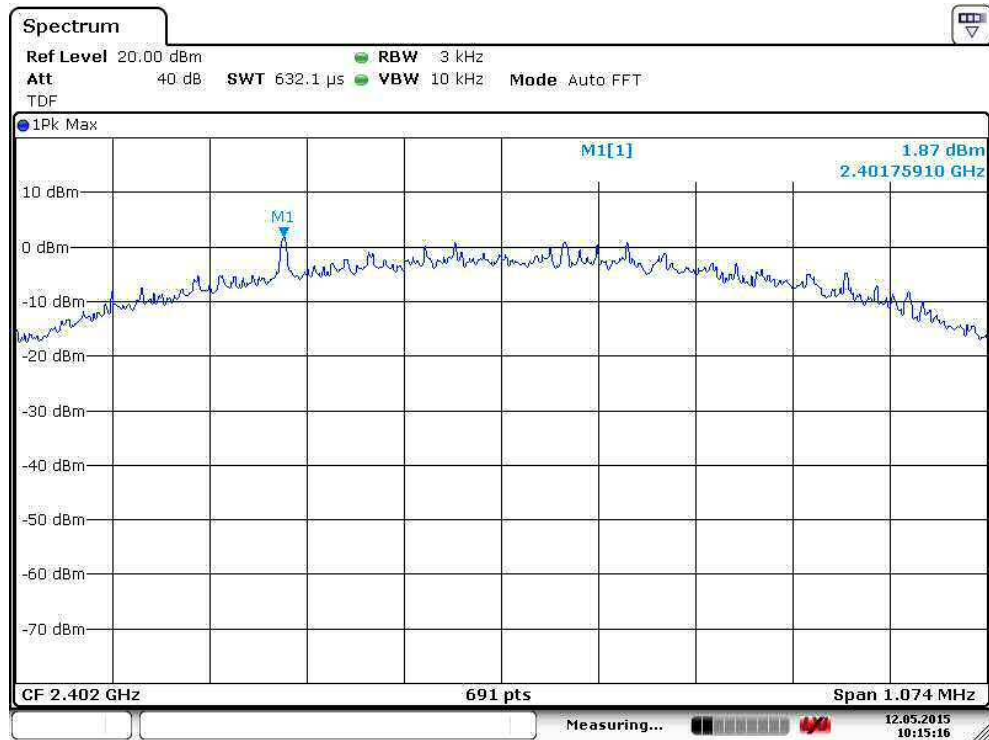
Standard: ANSI C63.10 (2009)
Tested by: NKO
Date: 12.5.2015
Humidity: 25 %
Temperature: 21 °C

FCC Rule: 15.247(e)
RSS-210 A8.2

Results:

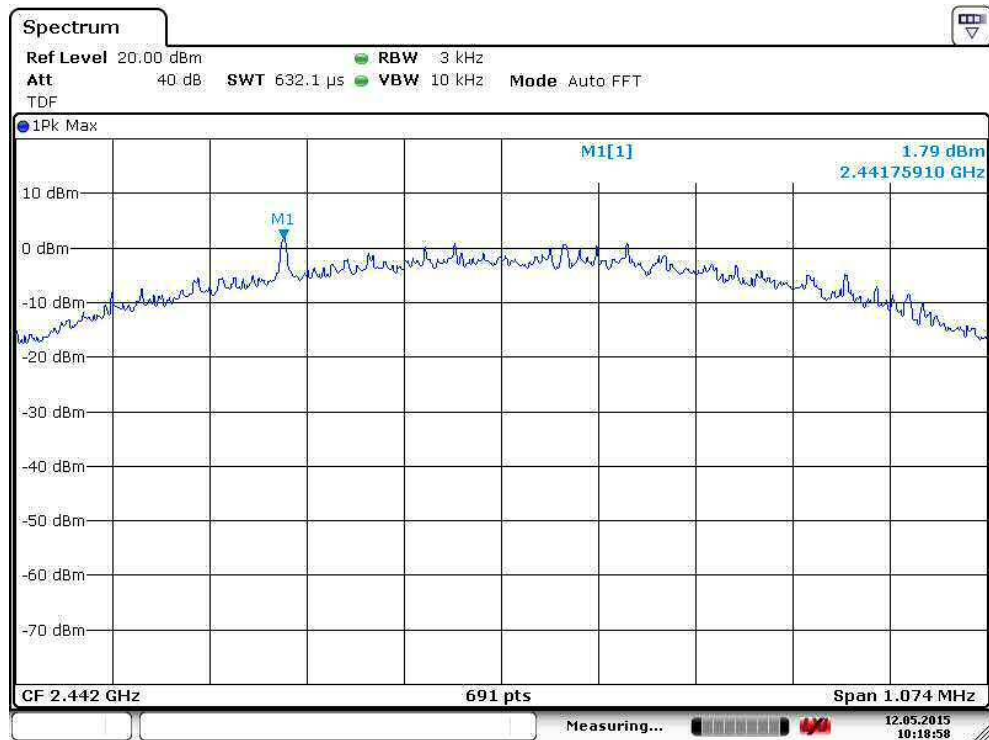
Table 29. Power Spectral Density test results.

Channel	PSD dBm/3 kHz	Maximum limit [dBm/3kHz]
Low	1.87	+8.00
Mid	1.79	
High	1.87	



Date: 12.MAY.2015 10:15:16

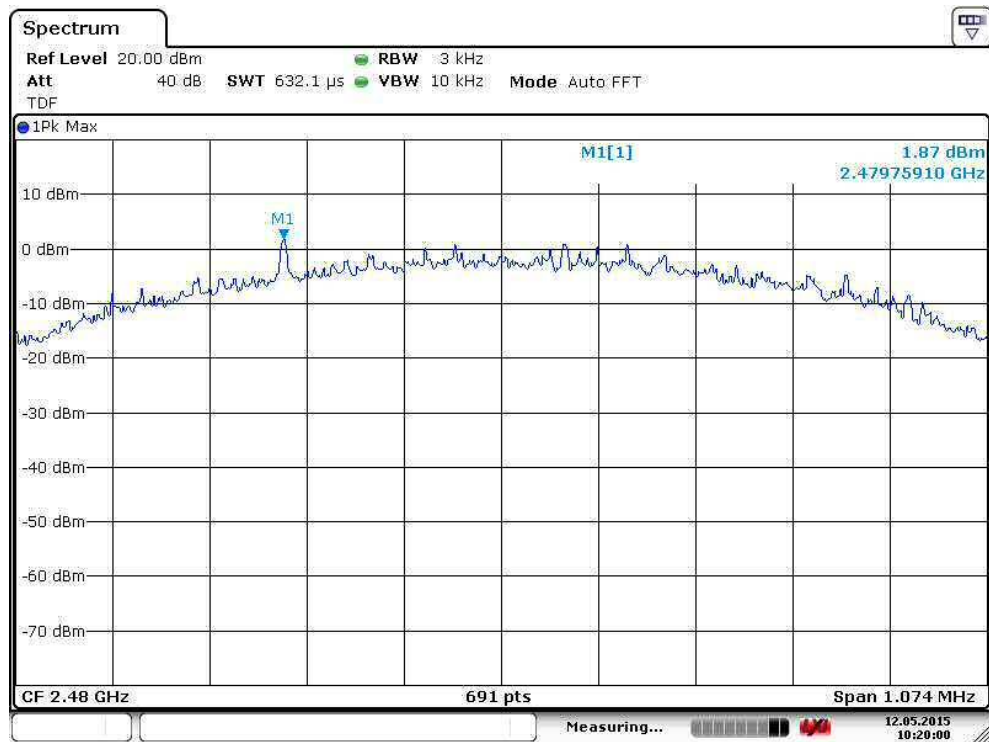
Figure 39. Power Spectral Density of the channel low.



Date: 12.MAY.2015 10:18:58

Figure 40. Power Spectral Density of the channel mid.

Power Spectral Density



Date: 12.MAY.2015 10:20:00

Figure 41. Power Spectral Density of the channel high.

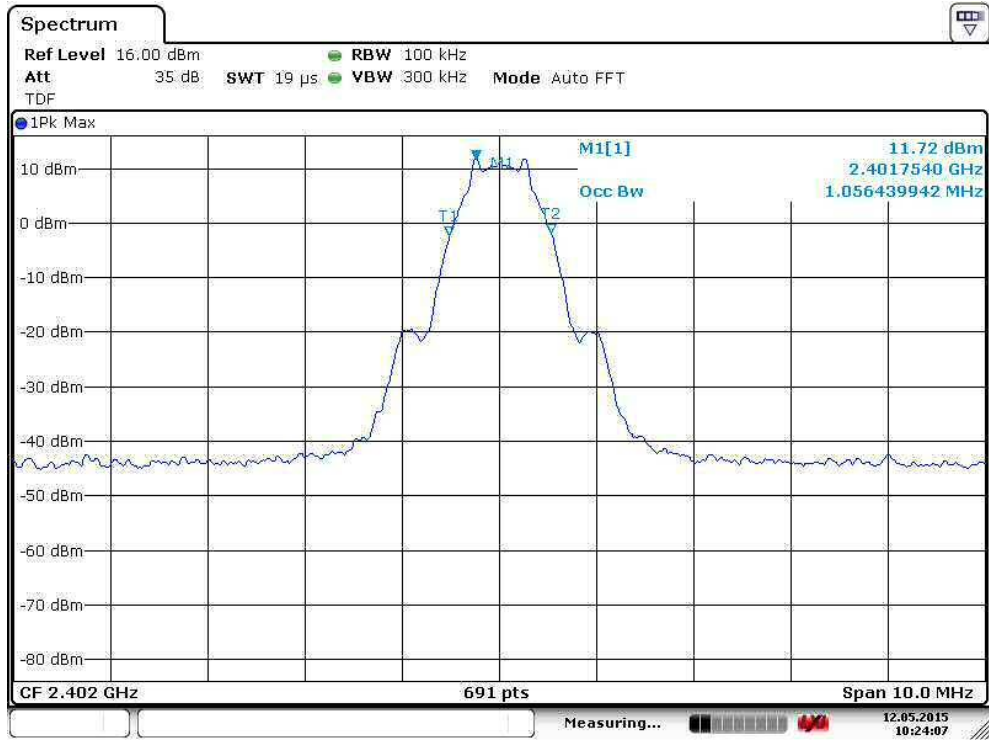
99% Occupied Bandwidth

Standard: RSS-GEN (2010)
Tested by: NKO
Date: 12.5.2015
Humidity: 25 %
Temperature: 21 °C

RSS-GEN 4.7

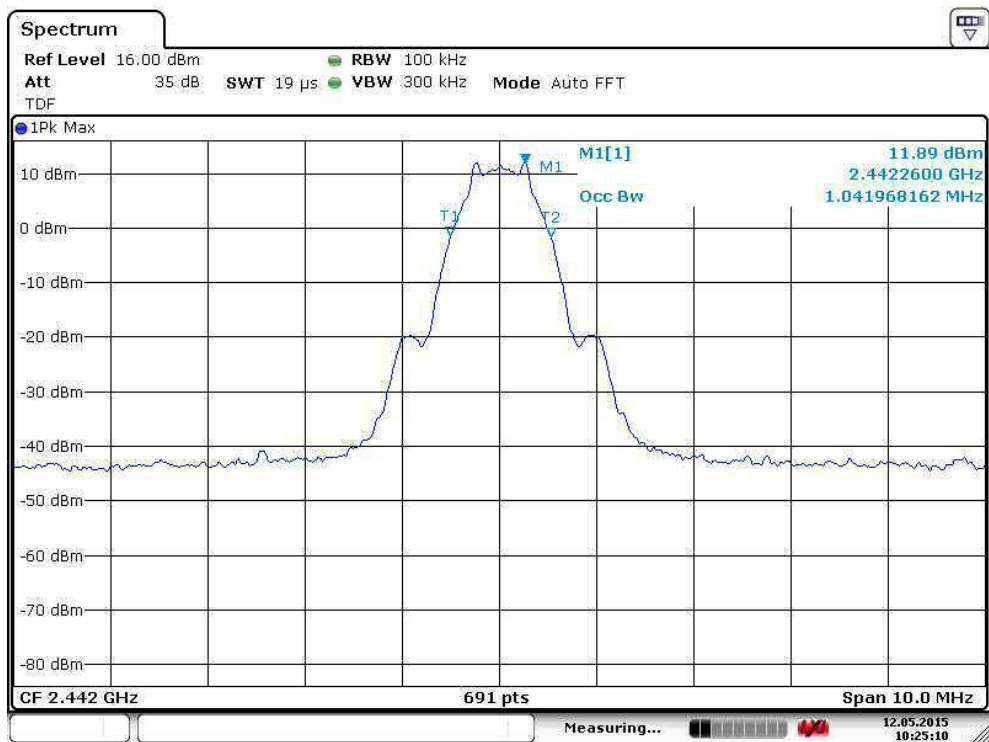
Table 30. 99 % OBW test results.

Channel	Limit	99 % BW [MHz]	Result
Low	-	1.056439942	PASS
Mid	-	1.041968162	PASS
High	-	1.056439942	PASS



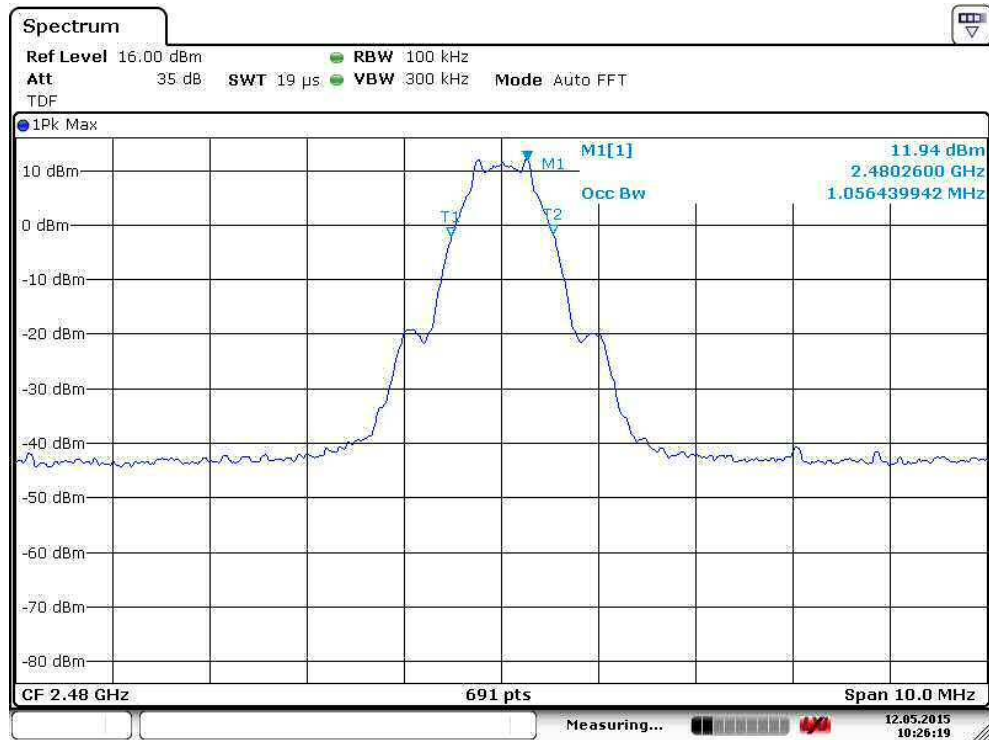
Date: 12.MAY.2015 10:24:07

Figure 42. 99 % OBW channel low.



Date: 12.MAY.2015 10:25:10

Figure 43. 99 % OBW channel mid.



Date: 12.MAY.2015 10:26:19

Figure 44. 99 % OBW channel high.

TEST EQUIPMENT

Equipment	Manufacturer	Type	Serial no	Inv.no
TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	100185	8453
SIGNAL ANALYZER	ROHDE & SCHWARZ	FSV40	101068	9093
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-
ANTENNA (30-1000 MHz)	SCHWARZBECK	VULB 9168	8168-503	8911
ANTENNA MAST	DEISEL	MA240	240/455	5017
TURNTABLE	DEISEL	DS420	-	5015
CONTROLLER	COMTEST	HD100	100/457	5018
ANTENNA (1-18 GHz)	EMCO	3117	29617	7293
ANTENNA (18-26.5 GHz)	EMCO	3160- 09	030232-022	7294
PREAMPLIFIER (0.5-26GHz)	HP	83017A	3950M00102	5226
ATTENUATOR 10 dB	HUBER & SUHNER	6810.17B	-	-
HIGH PASS FILTER	WAINWRIGHT	WHKX	10	8267
AC Power Source	CALIFORNIA INSTRUMENTS	5001 iX Series II	58209	7826

All used measurement equipment was calibrated (if required).