Test Report

FINAS
Finnish Accreditation Service
T004 (EN ISO/IEC 17025)

INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C

Equipment Under Test:	Key operating with Bluetooth 4.0 (BLE)
Marketing name:	Cliq connect key
Customer/Manufacturer:	Abloy Oy Wahlforssinkatu 20 FI-80100 Joensuu FINLAND
FCC Rule Part:	15.247: 2015
IC Rule Part:	RSS-247, Issue 1, 2015 RSS-GEN Issue 4, 2014
KDB:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (June 9, 2015)

Date: September 6, 2015

Issued by:

Rauno Repo
Testing Engineer

Date: September 6, 2015

Checked by:

Janne Nyman
Compliance Specialist

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Equipment Under Test (EUT)

Key operating with Bluetooth 4.0 (BLE)	
FCC ID:	2AI5J-CONNECT
IC:	21724-CONNECT
Type / Model:	CLIQ / YQ(G)B4xx(EX)
Serial no:	-
	Y can be N, T or X (G) optional xx can be 00…99 (EX) used for ATEX/EX approved products

The difference between the models is the basic operation firmware. The BLE firmware is the same with all models. Therefore, results in this report are representative for all the variants.

Description of the EUT

The EUT is a key with electronic properties and it uses Bluetooth Low Energy communication for delivering different key parameters to grant access rights. The lock does not contain any power source. The energy is distributed to the lock through the key contacts.

Classification of the device

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

Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing

Ratings and declarations

Operating Frequency Range (OFR):	2402 – 2480 MHz
Channels:	40
Channel separation:	2 MHz
99% Channel bandwidth:	1.099855282 MHz
Peak conducted output power:	-11.35 dBm
Transmission technique:	DSSS
Modulation:	GFSK
Integral Antenna gain:	1 dBi
Part 15.203 Requirement:	Internal antenna is not changeable by user. Product has no external antenna port.

Power Supply

The EUT has an internal 3.0V battery (CR2450).

Mechanical Size of the EUT

Height: 14 mm	Width:30 mm	Length: 88 mm

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 50Ω coaxial cable and SMA-connector for conducted RF tests. During the tests the EUT was set into continuous transmit and was set to the channel under test. Normal modulation and maximum transmit power was used in all tests. No modifications were done during the testing.

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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-247 5.4(4)	Maximum Peak Conducted Output Power	PASS
§15.247(a)(2) / RSS-247 5.2(1)	6 dB Bandwidth	PASS
§15.247(e) / RSS-247 5.2(2)	Power Spectral Density	PASS
RSS-GEN 6.6	99% Occupied Bandwidth	PASS
§15.247(d) / RSS-247 5.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	PASS
§15.209(a), §15.247(d) / RSS-247 5.5	Radiated Emissions Within The Restricted Bands	PASS

EUT Test Conditions During Testing

The EUT was in continuous transmit mode during all the tests. The hopping was stopped and the EUT was configured into the wanted channel. Normal modulation and duty cycle was applied in all the tests. Tests were done in three orthogonal positions X, Y, Z.

Following channels were used during the tests when the hopping was stopped:
Channel Low (Ch 0) = 2402 MHz
Channel Mid (Ch 19) = 2440 MHz
Channel High (Ch 39) = 2480 MHz

Test Facility

☐ Testing Location / address: FCC registration number: **90598**	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
☒ Testing Location / address: FCC registration number: **178986** Industry Canada registration number: **8708A-2**	SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND

TEST RESULTS

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10	(2013)
Tested by:	NKO	
Date:	4.12.2015	
Temperature:	21 °C	
Humidity:	35 %	
Measurement uncertainty	± 2.87dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(b)(3)
RSS-247 5.4(4)

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	-11.47	30	41.47	PASS
Mid	-11.35	30	41.35	PASS
High	-11.74	30	41.74	PASS

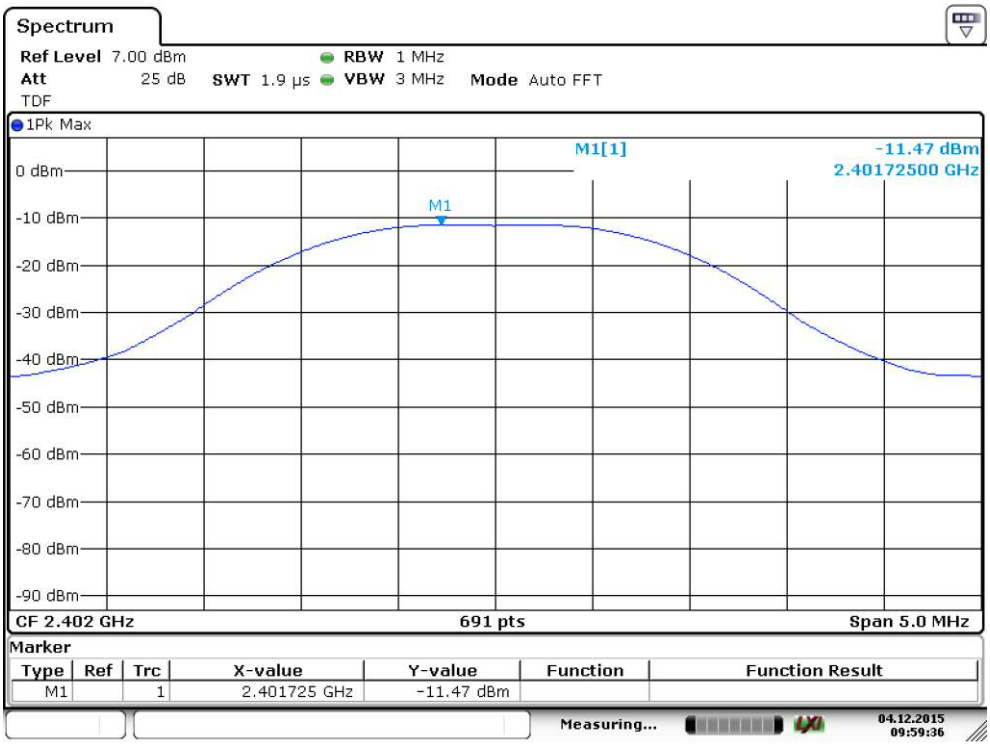


Figure 1. Channel Low.

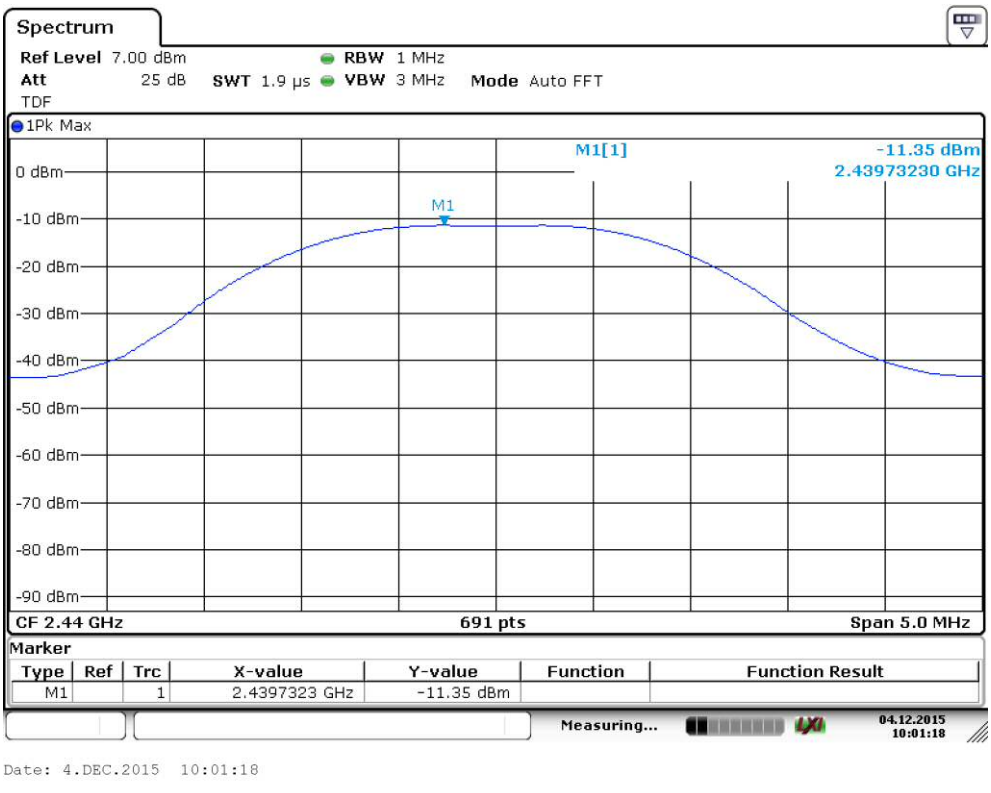


Figure 2. Channel Mid.

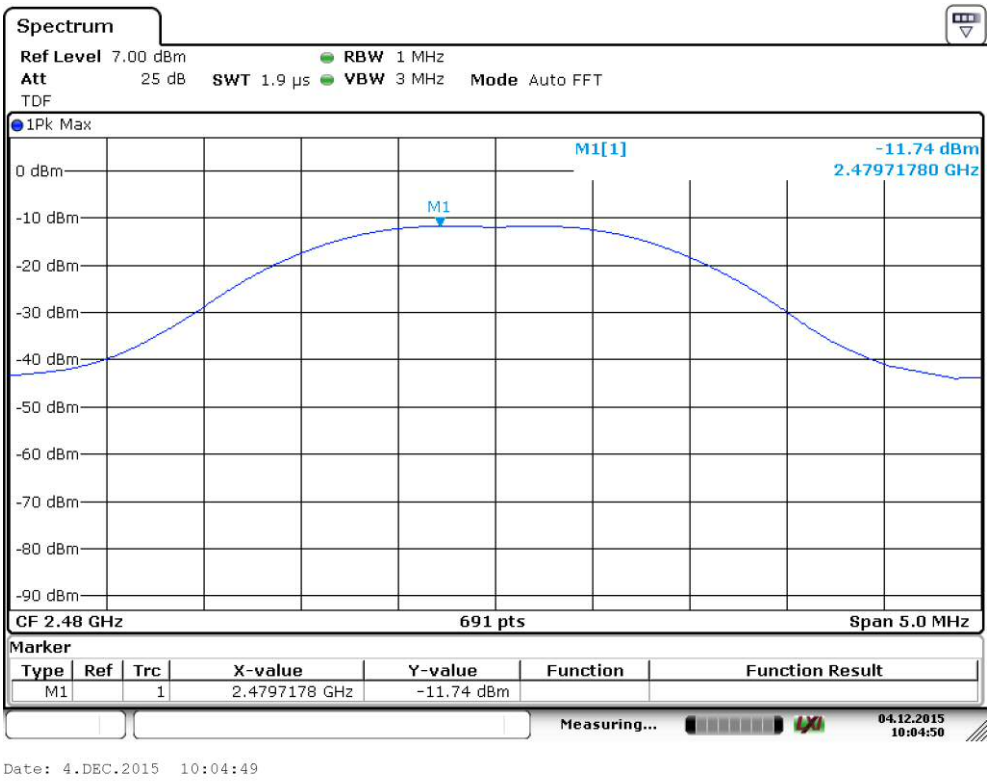


Figure 3. Channel High.

Transmitter Radiated Spurious Emissions 0.030 – 1000 MHz

Standard:	ANSI C63.10	(2013)
Tested by:	NKO	
Date:	27.11 - 3.12.2015 and 15.2.2017	
Humidity:	34 – 38 %	
Temperature:	20 – 22 °C	
Measurement uncertainty	± 4.51 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a), 15.33
RSS-247 5.5

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.

Measured Peak Values In The Frequency Range 0.030 MHz - 30 MHz.

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

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

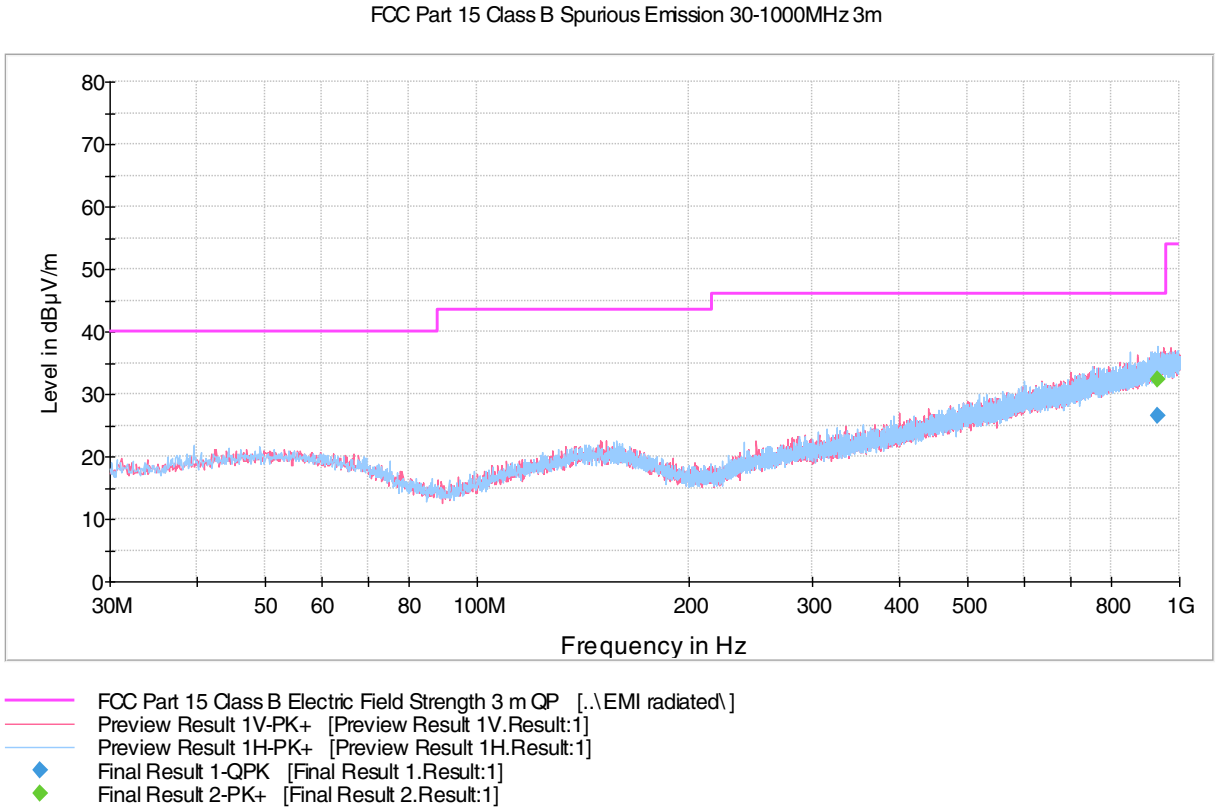


Figure 4. Measured curve with peak-detector channel low.

Final measurements from the worst frequencies

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
931.466000	26.5	1000.0	120.000	397.0	H	226.0	27.6	19.5	46.0	

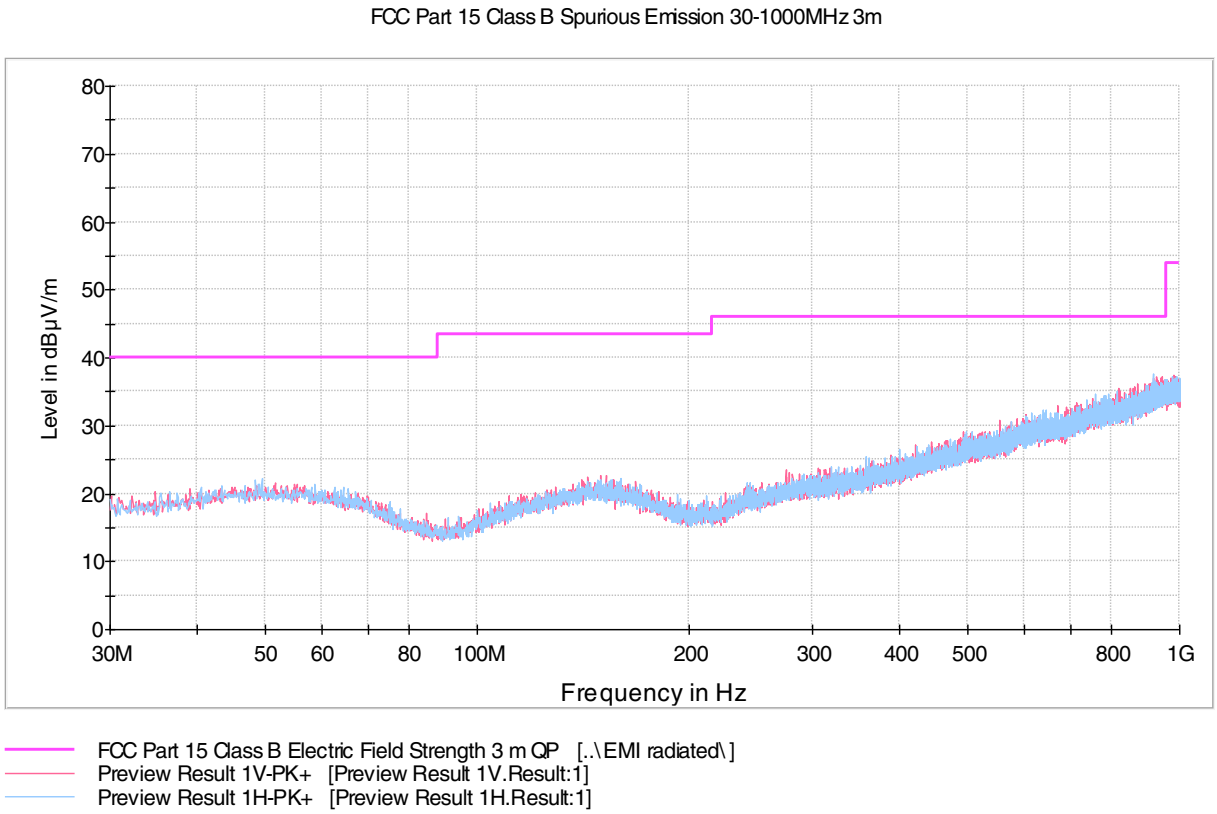


Figure 5. Measured curve with peak-detector channel mid.

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

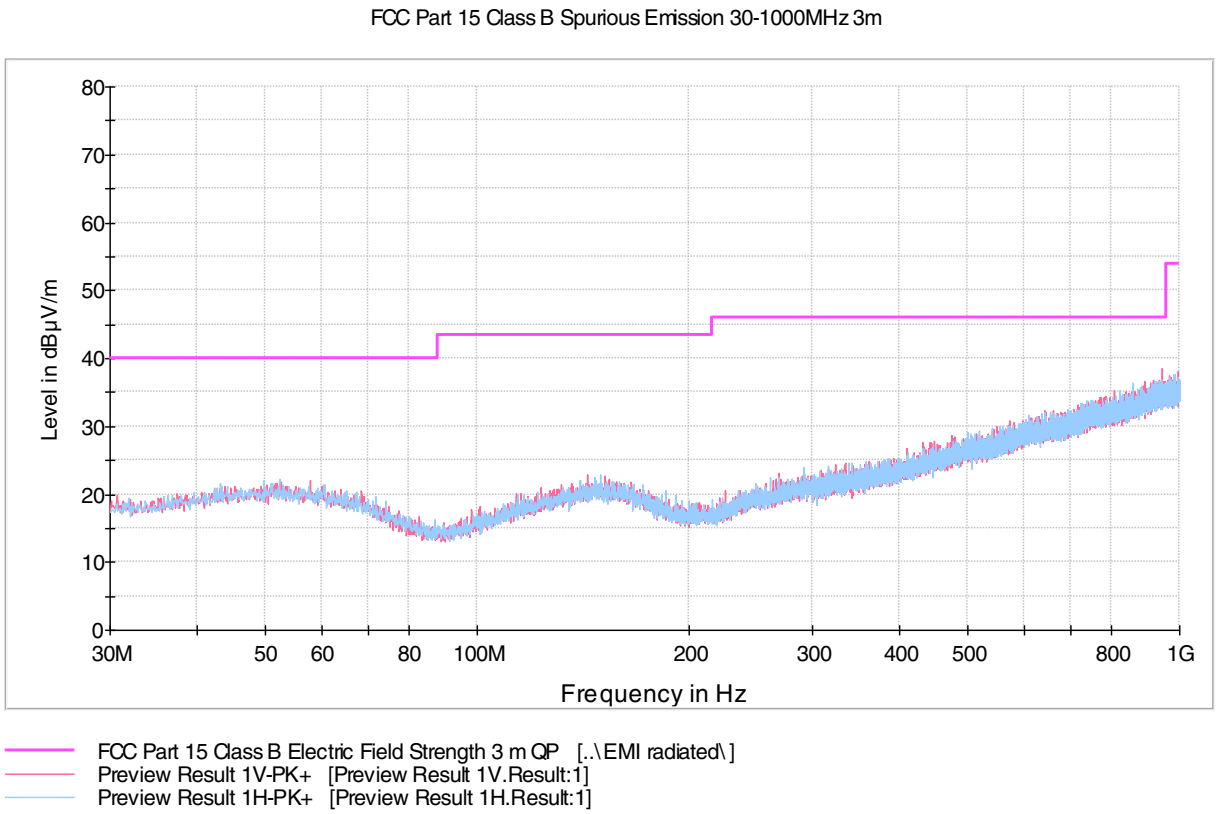


Figure 6. Measured curve with peak-detector channel high.

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

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.

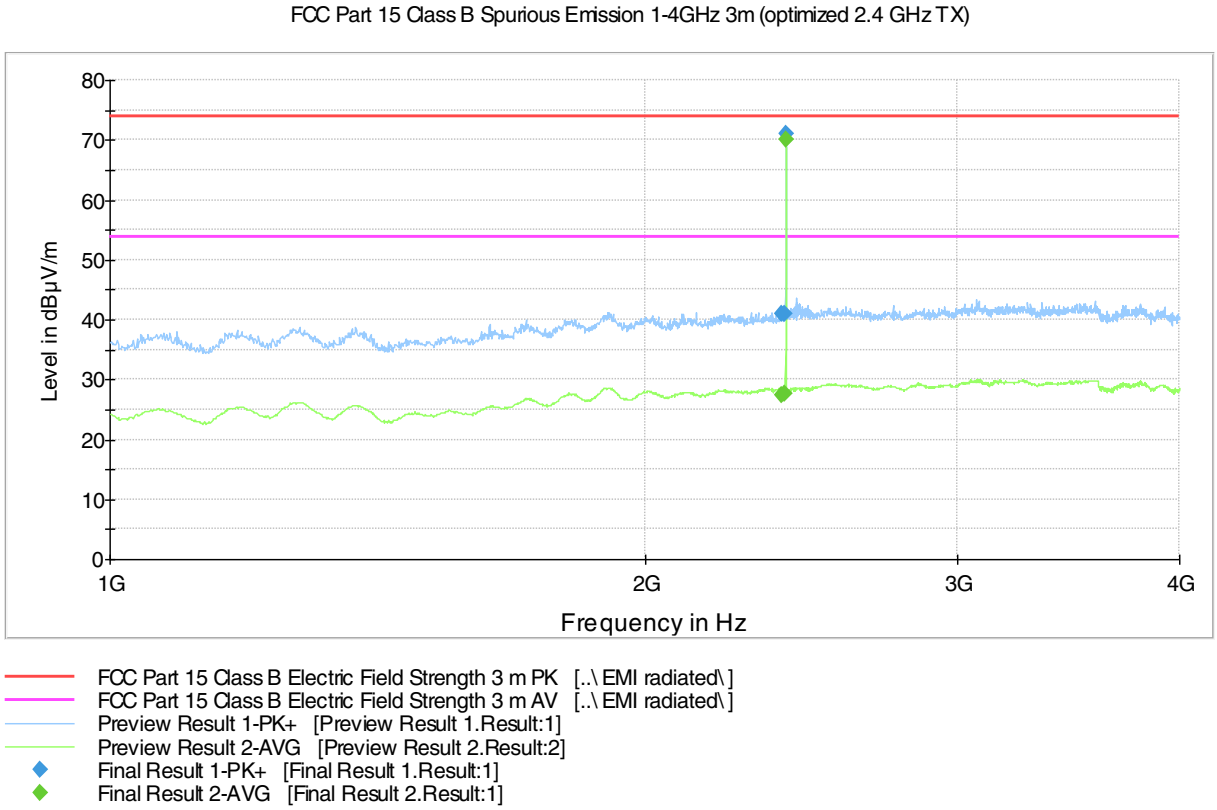


Figure 7. Measured curve with peak- and average detector channel low.

Final measurements from the worst frequencies

Table 2. 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
2388.600000	41.0	1000.0	1000.000	100.0	H	175.0	3.8	32.9	73.9	
2397.000000	41.1	1000.0	1000.000	385.0	H	266.0	3.9	32.8	73.9	
2402.200000	71.1	1000.0	1000.000	207.0	H	60.0	3.9	2.8	73.9	Carrier

Table 3. 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
2389.800000	27.4	1000.0	1000.000	160.0	H	14.0	3.8	26.5	53.9	
2400.000000	27.6	1000.0	1000.000	287.0	V	45.0	3.9	26.3	53.9	
2402.000000	69.9	1000.0	1000.000	208.0	H	60.0	3.9	-16.0	53.9	Carrier

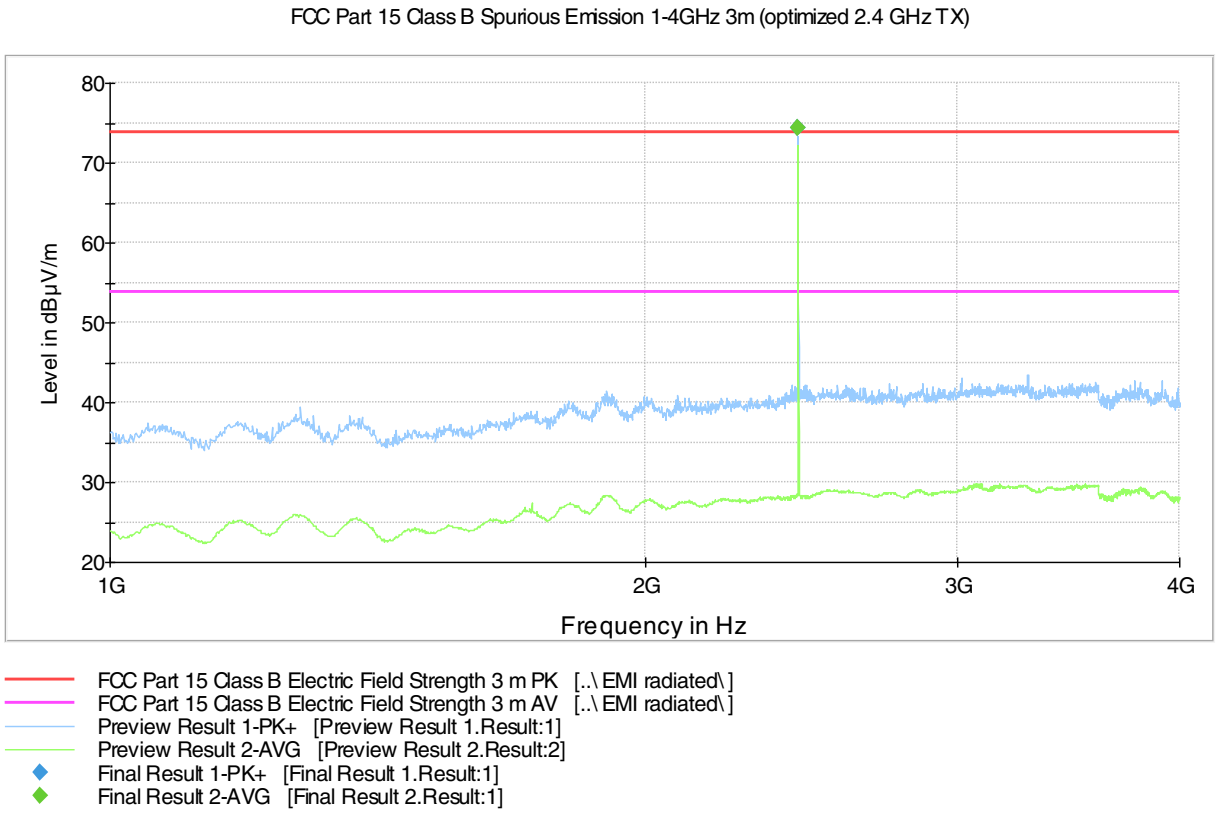


Figure 8. Measured curve with peak- and average detector channel mid.

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
2440.250000	74.5	1000.0	1000.000	224.0	H	49.0	3.9	-0.5	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
2440.000000	74.3	1000.0	1000.000	226.0	H	48.0	3.9	-20.4	53.9	Carrier

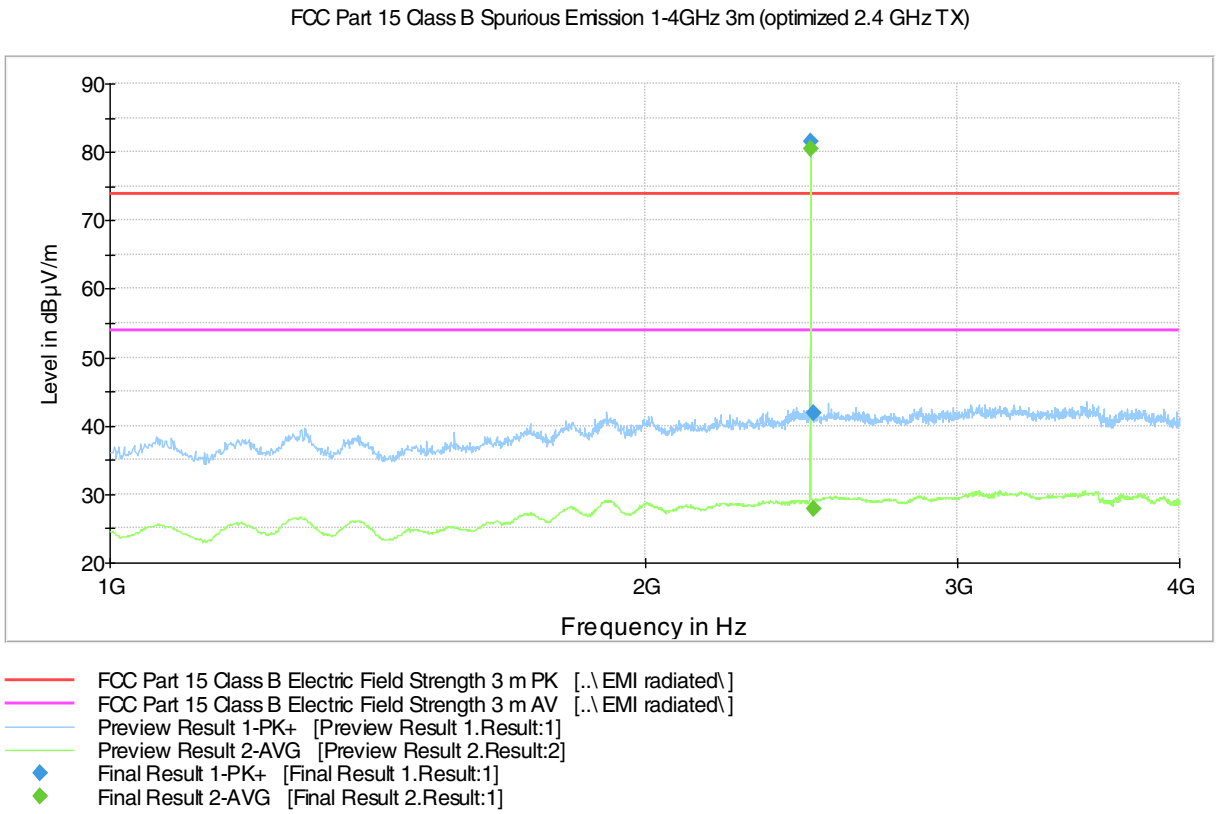


Figure 9. Measured curve with peak- and average detector channel high.

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
2480.250000	81.6	1000.0	1000.000	177.0	H	48.0	4.2	-7.7	73.9	
2489.100000	41.8	1000.0	1000.000	208.0	H	128.0	4.3	32.1	73.9	

Table 7. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2480.000000	80.6	1000.0	1000.000	140.0	H	50.0	4.2	-26.7	53.9	
2491.900000	27.8	1000.0	1000.000	375.0	V	102.0	4.3	26.1	53.9	

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

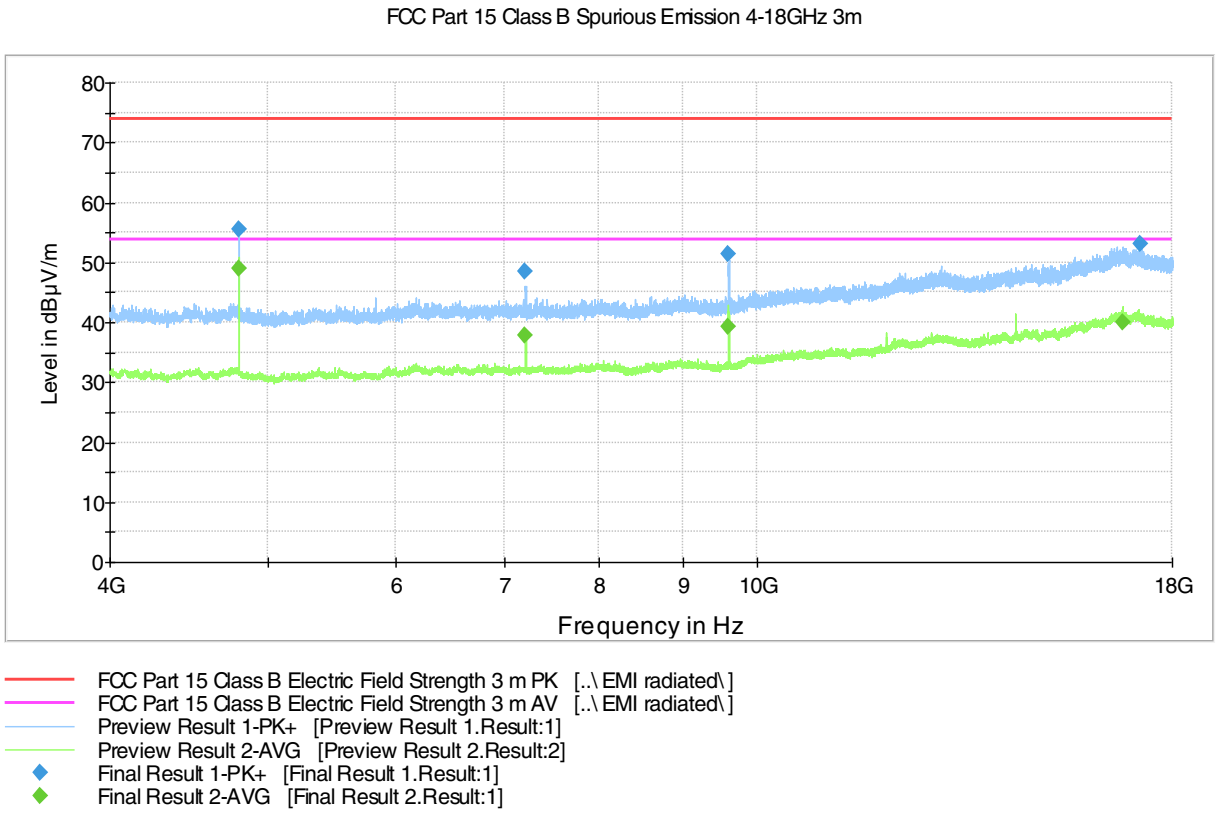


Figure 10. Measured curve with peak- and average detector channel low.

Final measurements from the worst frequencies

Table 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
4804.500000	55.5	1000.0	1000.000	205.0	H	51.0	10.0	18.4	73.9	
7205.300000	48.4	1000.0	1000.000	195.0	H	232.0	12.3	25.5	73.9	
9606.900000	51.3	1000.0	1000.000	227.0	V	248.0	14.9	22.6	73.9	
17200.700000	53.1	1000.0	1000.000	287.0	V	326.0	25.6	20.8	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
4804.000000	49.0	1000.0	1000.000	211.0	H	50.0	10.0	4.9	53.9	
7205.300000	37.9	1000.0	1000.000	185.0	H	244.0	12.3	16.0	53.9	
9607.200000	39.3	1000.0	1000.000	280.0	H	158.0	14.9	14.6	53.9	
16780.900000	39.9	1000.0	1000.000	150.0	V	266.0	25.5	14.0	53.9	

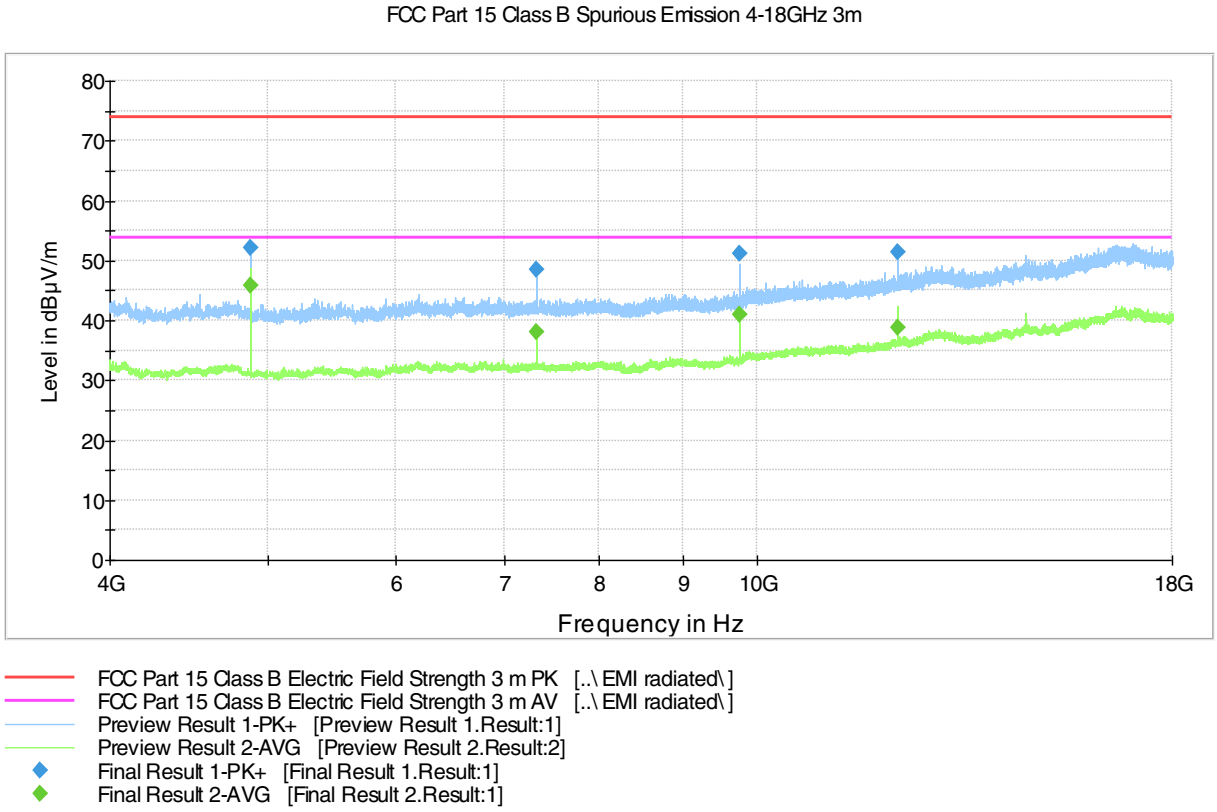


Figure 11. Measured curve with peak- and average detector channel mid.

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
4880.400000	52.1	1000.0	1000.000	211.0	H	41.0	10.0	21.8	73.9	
7319.200000	48.6	1000.0	1000.000	220.0	H	241.0	12.3	25.3	73.9	
9758.800000	51.1	1000.0	1000.000	196.0	H	80.0	14.9	22.8	73.9	
12201.200000	51.3	1000.0	1000.000	275.0	V	344.0	19.1	22.6	73.9	

Table 11. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4879.900000	45.8	1000.0	1000.000	213.0	H	29.0	10.0	8.1	53.9	
7320.600000	38.2	1000.0	1000.000	223.0	H	240.0	12.3	15.7	53.9	
9759.100000	40.9	1000.0	1000.000	203.0	H	80.0	14.9	13.0	53.9	
12201.000000	38.9	1000.0	1000.000	278.0	V	344.0	19.1	15.0	53.9	

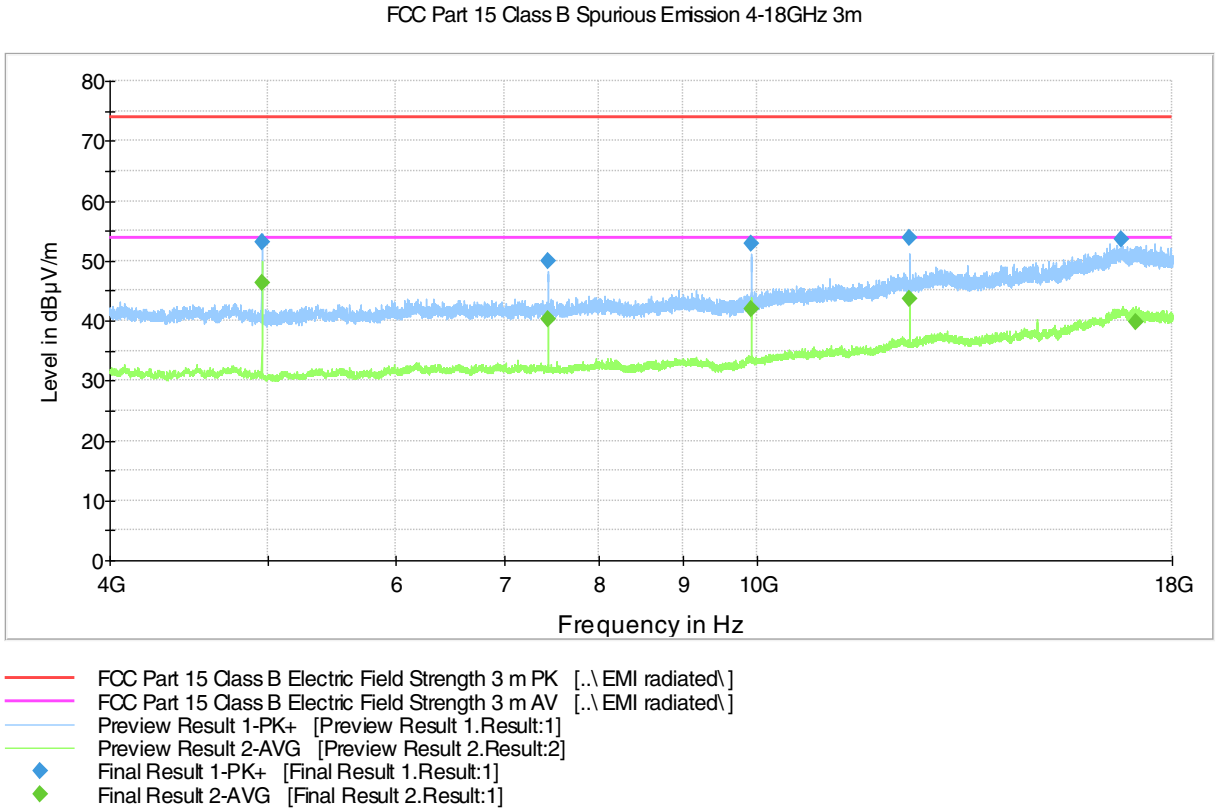


Figure 12. Measured curve with peak- and average detector channel high.

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
4959.400000	53.0	1000.0	1000.000	212.0	H	40.0	9.9	20.9	73.9	
7440.700000	50.0	1000.0	1000.000	204.0	H	249.0	12.3	23.9	73.9	
9918.800000	52.9	1000.0	1000.000	150.0	V	281.0	15.6	21.0	73.9	
12398.600000	53.7	1000.0	1000.000	268.0	V	261.0	19.2	20.2	73.9	
16747.300000	53.5	1000.0	1000.000	254.0	V	262.0	25.4	20.4	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
4959.900000	46.4	1000.0	1000.000	203.0	H	43.0	9.9	7.5	53.9	
7439.300000	40.3	1000.0	1000.000	195.0	H	249.0	12.3	13.6	53.9	
9919.000000	41.8	1000.0	1000.000	274.0	V	276.0	15.6	12.1	53.9	
12398.800000	43.7	1000.0	1000.000	275.0	V	259.0	19.2	10.2	53.9	
17086.600000	39.8	1000.0	1000.000	150.0	V	221.0	25.9	14.1	53.9	

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

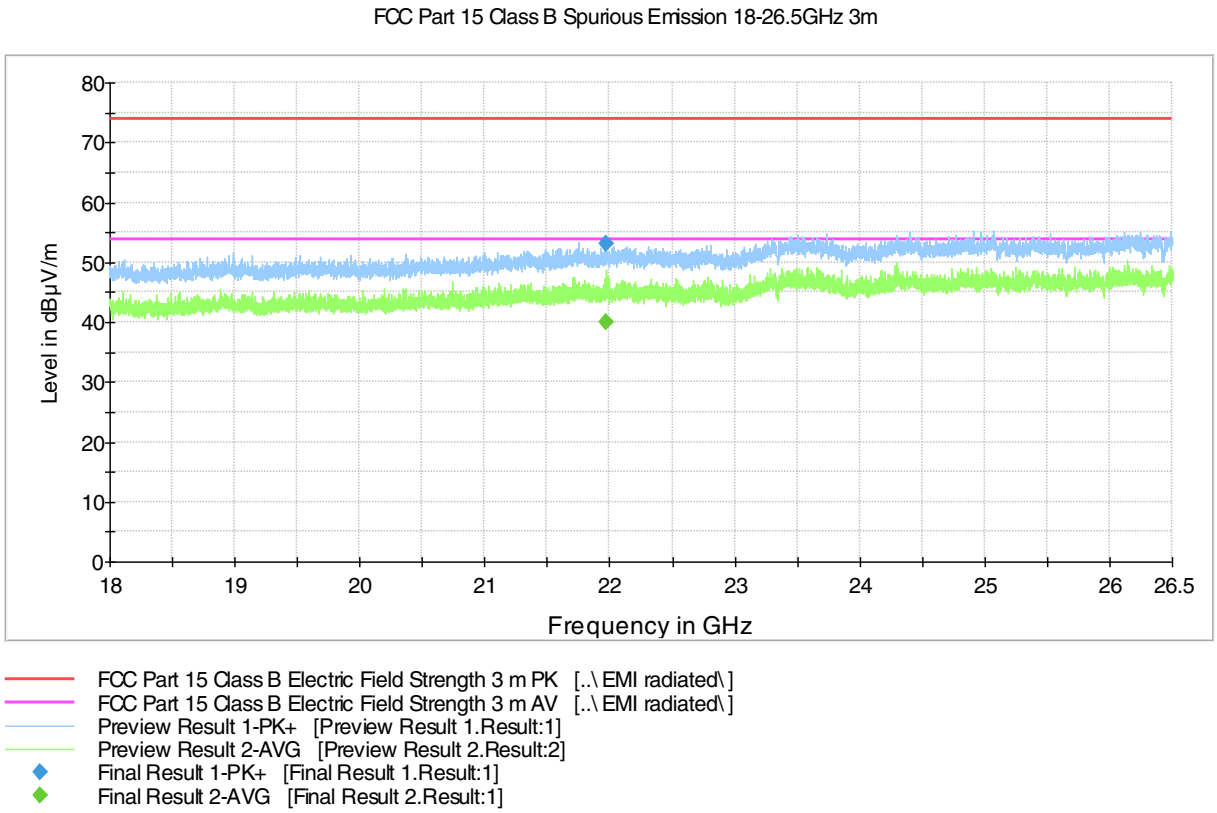


Figure 13. Measured curve with peak- and average detector. Channel Low.

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
21970.800000	53.2	1000.0	1000.000	304.0	H	122.0	28.5	20.7	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
21968.400000	39.9	1000.0	1000.000	311.0	H	104.0	28.5	14.0	53.9	

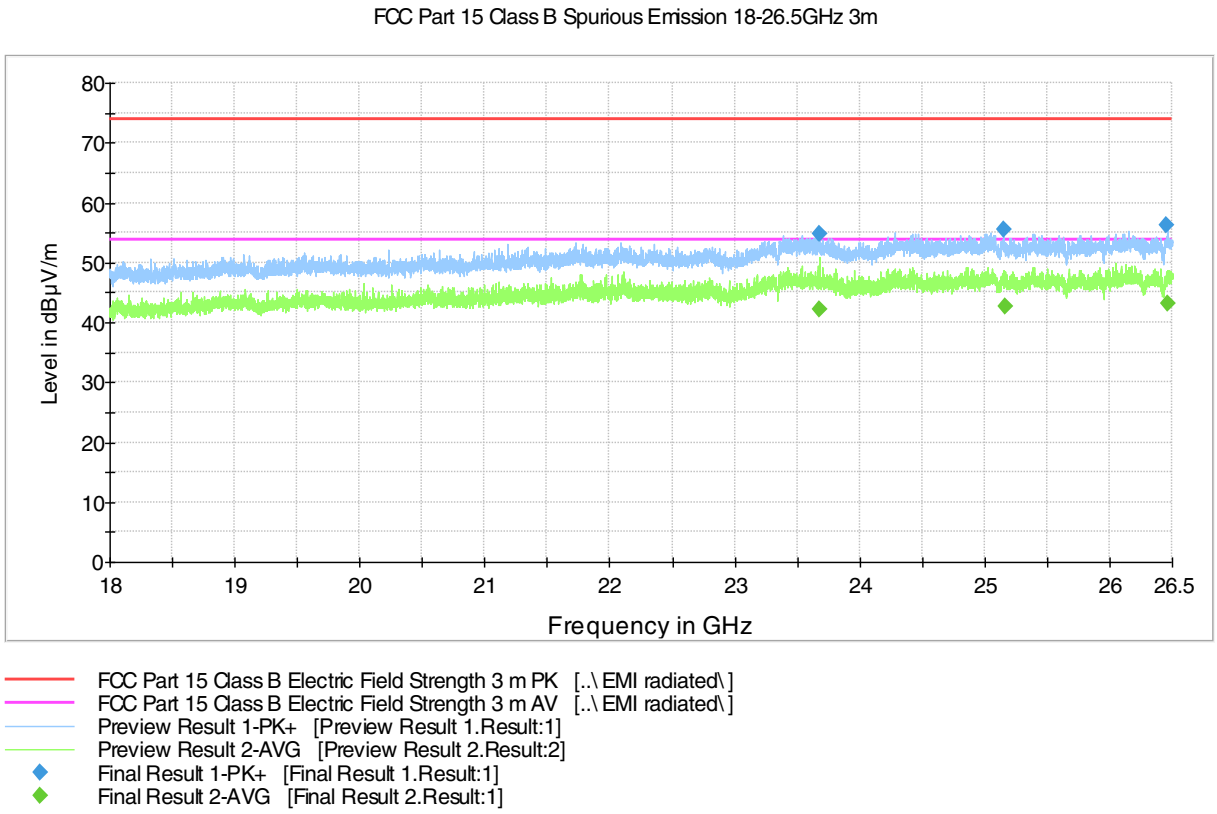


Figure 14. Measured curve with peak- and average detector channel mid.

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
23683.050000	54.8	1000.0	1000.000	208.0	V	333.0	31.9	19.1	73.9	
25153.650000	55.4	1000.0	1000.000	169.0	H	189.0	33.3	18.5	73.9	
26457.250000	56.3	1000.0	1000.000	297.0	H	167.0	35.8	17.6	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
23676.650000	42.2	1000.0	1000.000	383.0	V	315.0	31.9	11.7	53.9	
25162.250000	42.7	1000.0	1000.000	328.0	H	203.0	33.3	11.2	53.9	
26464.250000	43.1	1000.0	1000.000	361.0	H	184.0	35.8	10.8	53.9	

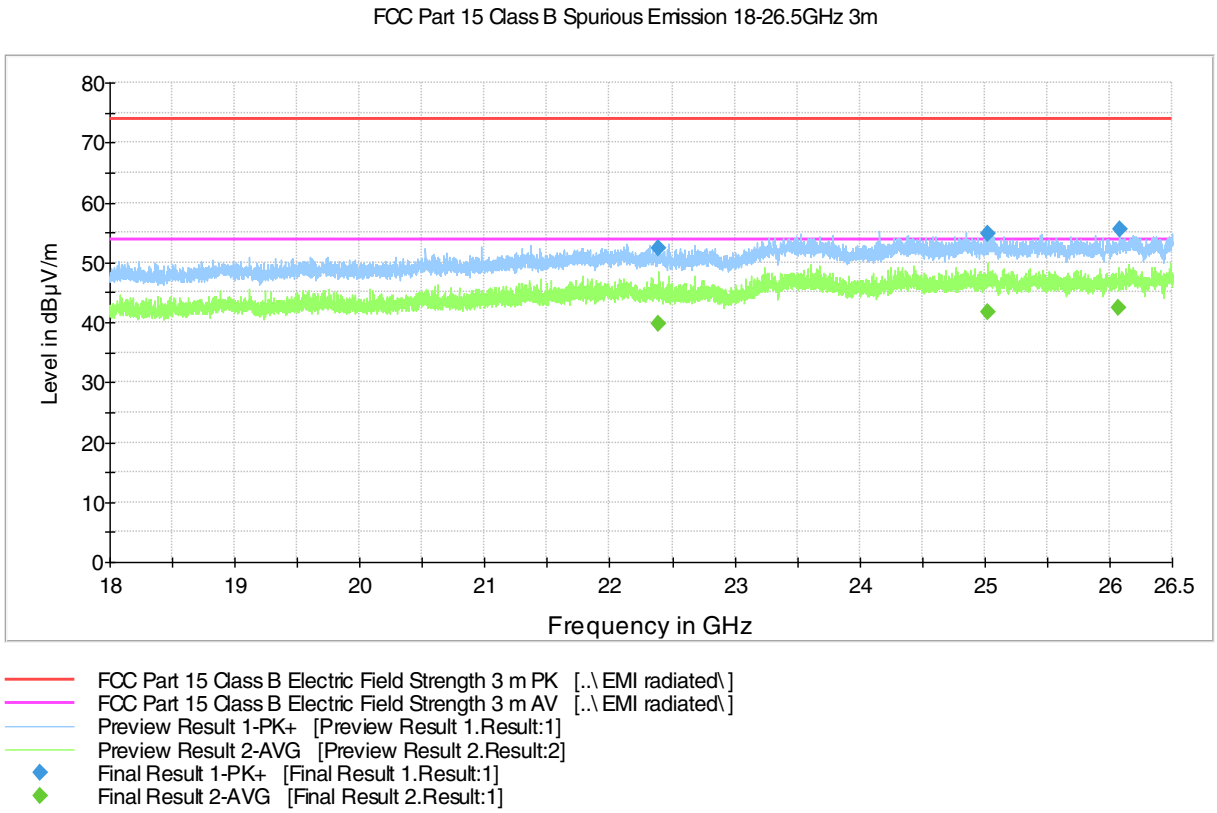


Figure 15. Measured curve with peak- and average detector channel high.

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
22385.450000	52.3	1000.0	1000.000	400.0	H	110.0	29.1	21.6	73.9	
25022.050000	54.8	1000.0	1000.000	304.0	H	255.0	33.0	19.1	73.9	
26080.100000	55.6	1000.0	1000.000	400.0	V	224.0	34.9	18.3	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
22394.450000	39.8	1000.0	1000.000	400.0	H	116.0	29.1	14.1	53.9	
25029.850000	41.6	1000.0	1000.000	326.0	H	256.0	33.0	12.3	53.9	
26071.900000	42.4	1000.0	1000.000	373.0	V	222.0	34.9	11.5	53.9	

Radiated band edge measurement results

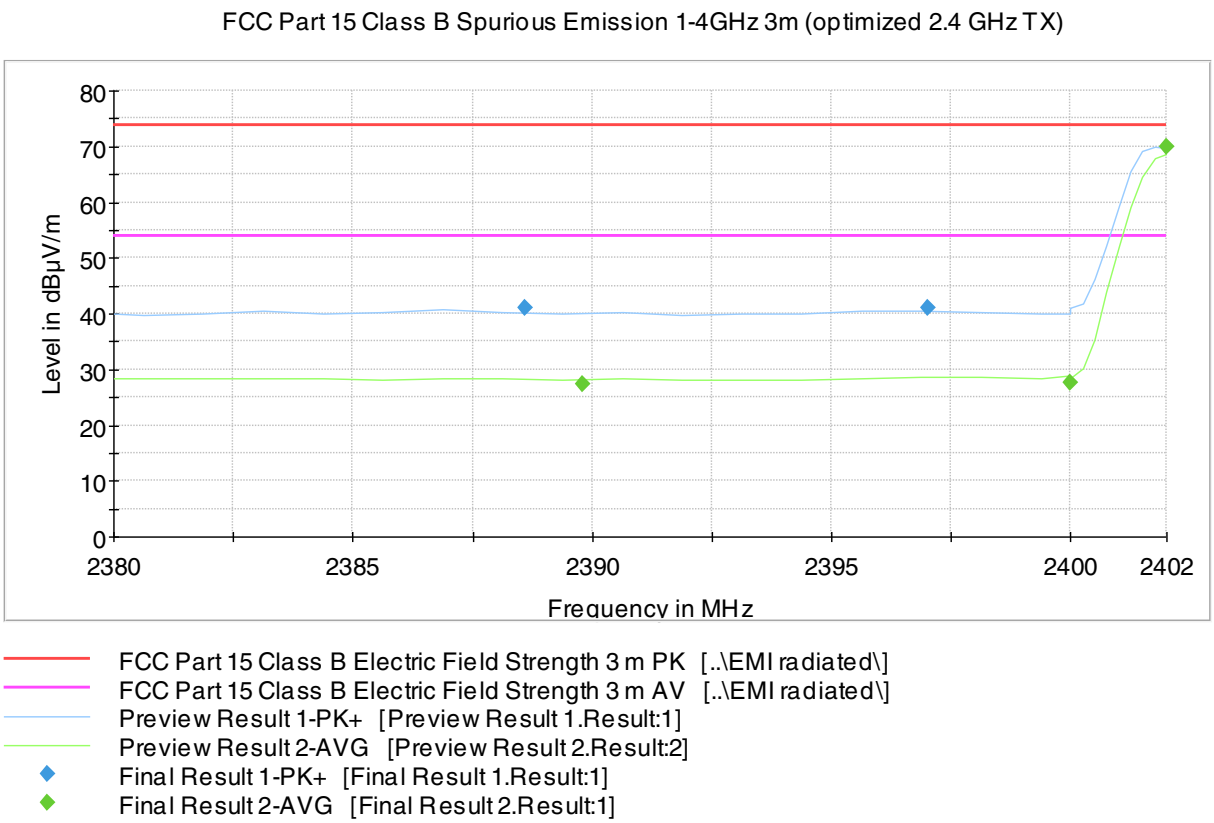


Figure 16. Measured curve with peak- and average detector. Lower band edge.

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)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2388.600000	41.0	1000.0	1000.000	100.0	H	175.0	3.8	32.9	73.9	
2397.000000	41.1	1000.0	1000.000	385.0	H	266.0	3.9	32.8	73.9	
2402.200000	71.1	1000.0	1000.000	207.0	H	60.0	3.9	2.8	73.9	Carrier

Table 21. 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
2389.800000	27.4	1000.0	1000.000	160.0	H	14.0	3.8	26.5	53.9	
2400.000000	27.6	1000.0	1000.000	287.0	V	45.0	3.9	26.3	53.9	
2402.000000	69.9	1000.0	1000.000	208.0	H	60.0	3.9	-16.0	53.9	Carrier

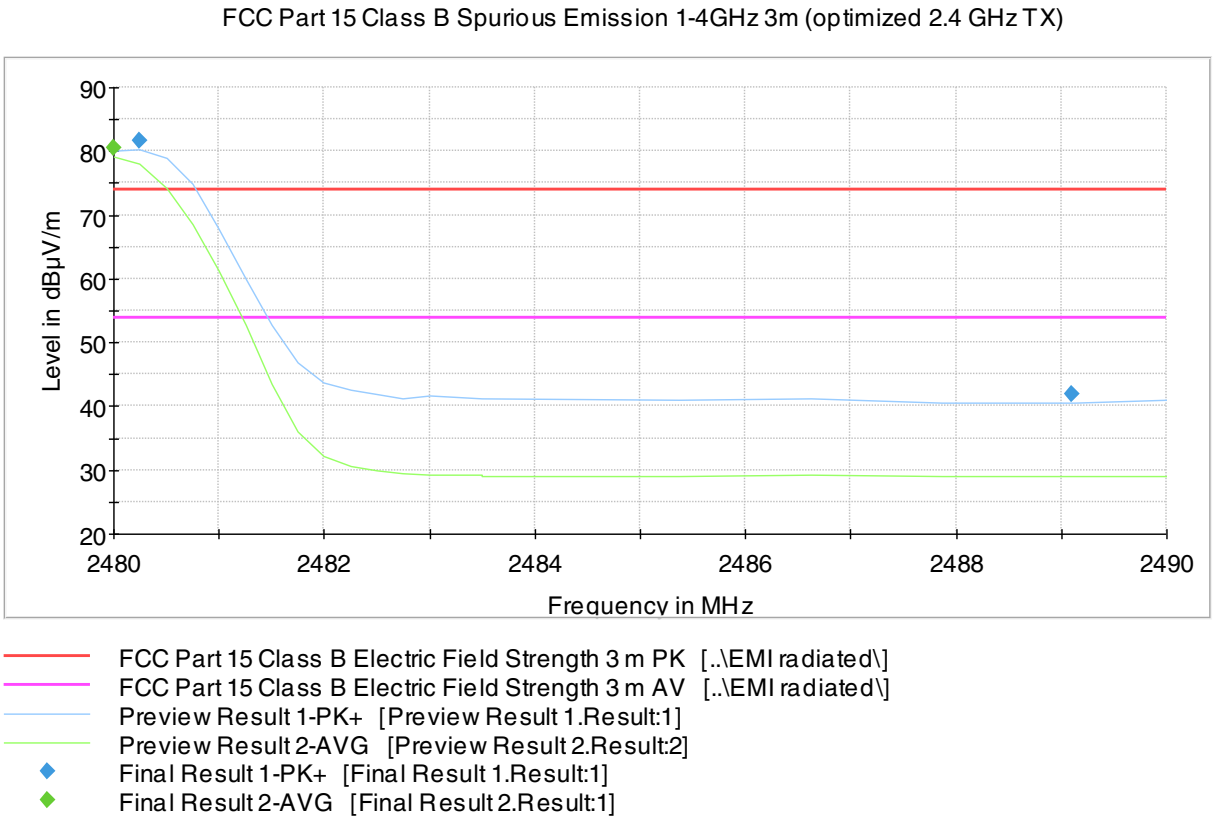


Figure 17. Measured curve with peak- and average detector. Upper band edge.

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
2480.250000	81.6	1000.0	1000.000	177.0	H	48.0	4.2	-7.7	73.9	Carrier
2483.500000	41.8	1000.0	1000.000	140.0	H	130.0	4.2	32.1	73.9	
2489.100000	41.8	1000.0	1000.000	208.0	H	128.0	4.3	32.1	73.9	

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
2480.000000	80.6	1000.0	1000.000	140.0	H	50.0	4.2	-26.7	53.9	Carrier
2483.500000	27.8	1000.0	1000.000	140.0	H	130.0	4.2	26.1	53.9	
2491.900000	27.8	1000.0	1000.000	375.0	V	102.0	4.3	26.1	53.9	

Transmitter Band Edge Measurement and Conducted Spurious Emissions

Standard:	ANSI C63.10	(2013)
Tested by:	NKO	
Date:	4.12.2015	
Humidity:	35 %	
Temperature:	21 °C	
Measurement uncertainty	± 2.87 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)
RSS-247 5.5

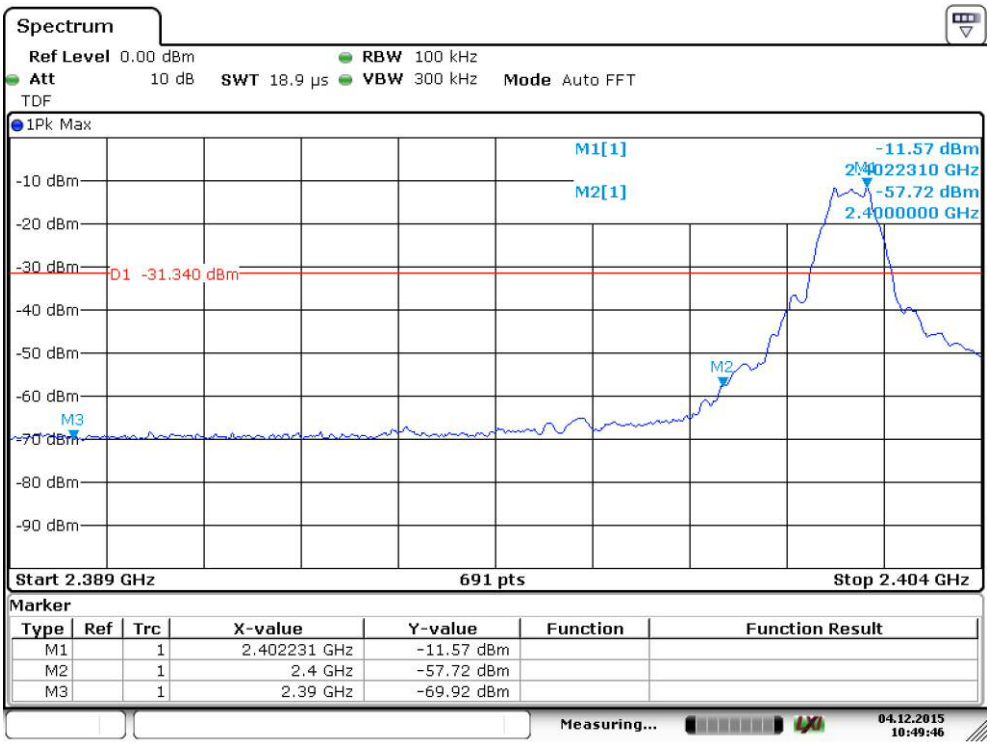
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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 24. Band edge attenuation.

Band Edge Attenuation	
Lower Band Edge	Upper Band Edge
-46.15 dBc	-54.62 dBc
Limit: -20dBc	

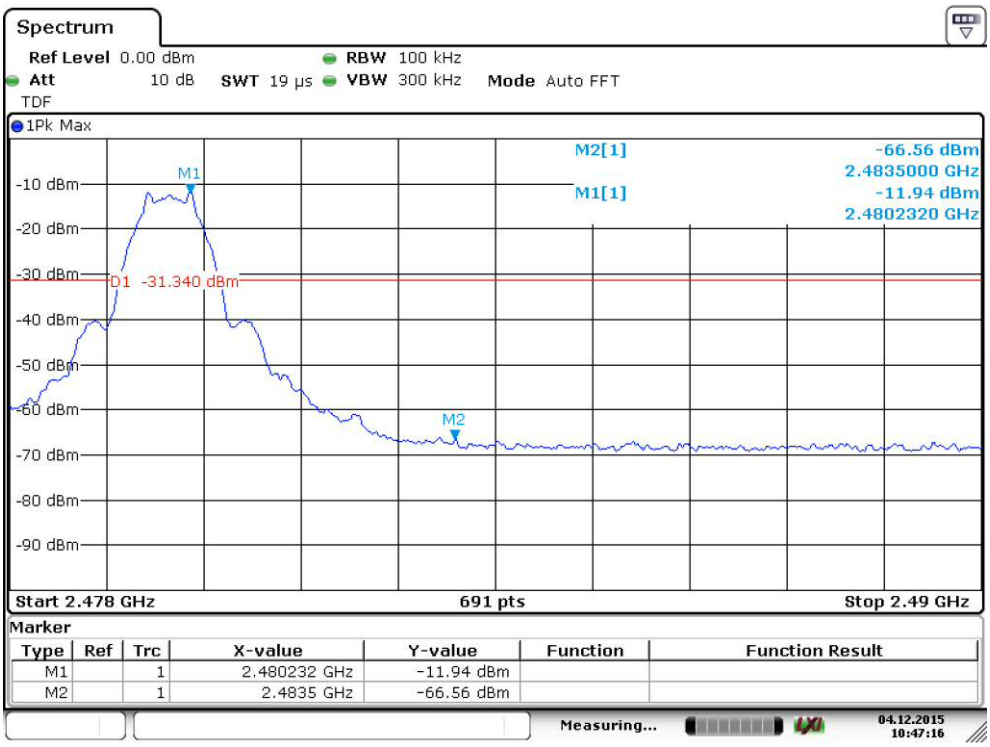
Table 25. Conducted spurious emissions.

Conducted Spurious Emissions					
Channel	**Frequency [MHz]**	**Measured Attenuation [dBm]**	**EIRP Limit [dBc]**	**Margin [dB]**	**Result**
Low	7205.37	-38.61	-20.0	7.27	PASS
Low	6909.04	-37.19	-20.0	5.85	PASS
Mid	9759.04	-35.56	-20.0	4.22	PASS
High	9919.03	-38.41	-20.0	7.07	PASS



Date: 4.DEC.2015 10:49:46

Figure 18. Lower Band Edge.



Date: 4.DEC.2015 10:47:16

Figure 19. Upper Band Edge.

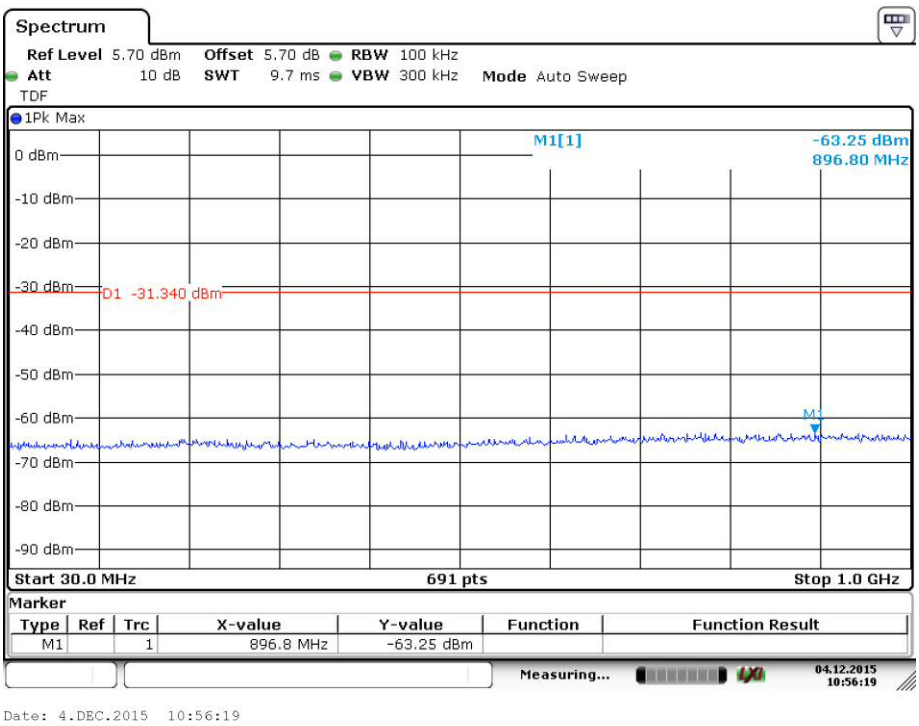


Figure 20. Conducted Spurious Emissions 30 – 1 000 MHz channel low.

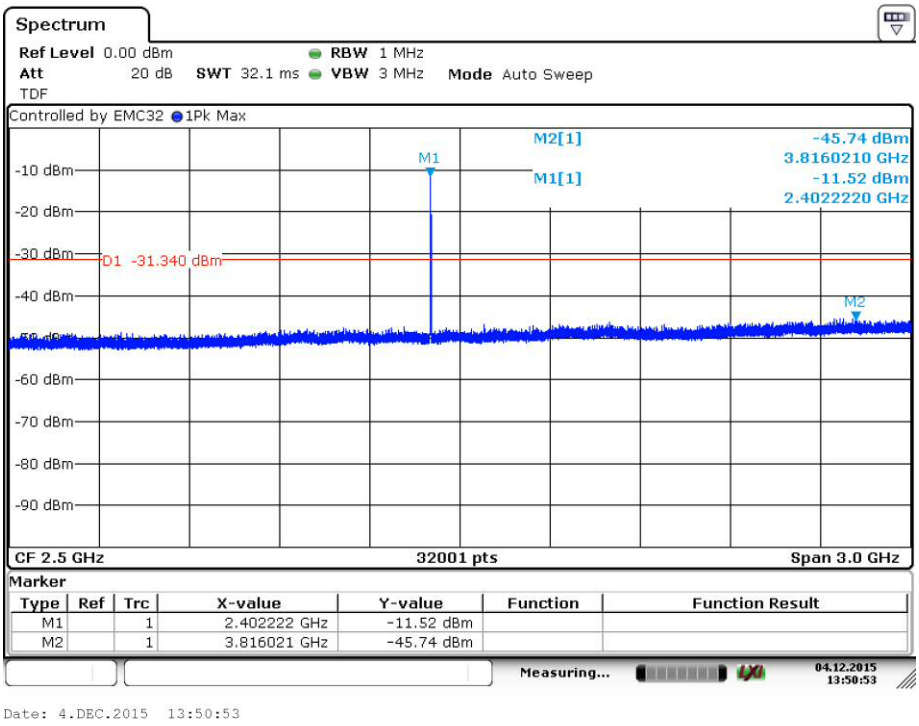


Figure 21. Conducted Spurious Emissions 1 000 – 4 000 MHz. Channel Low.

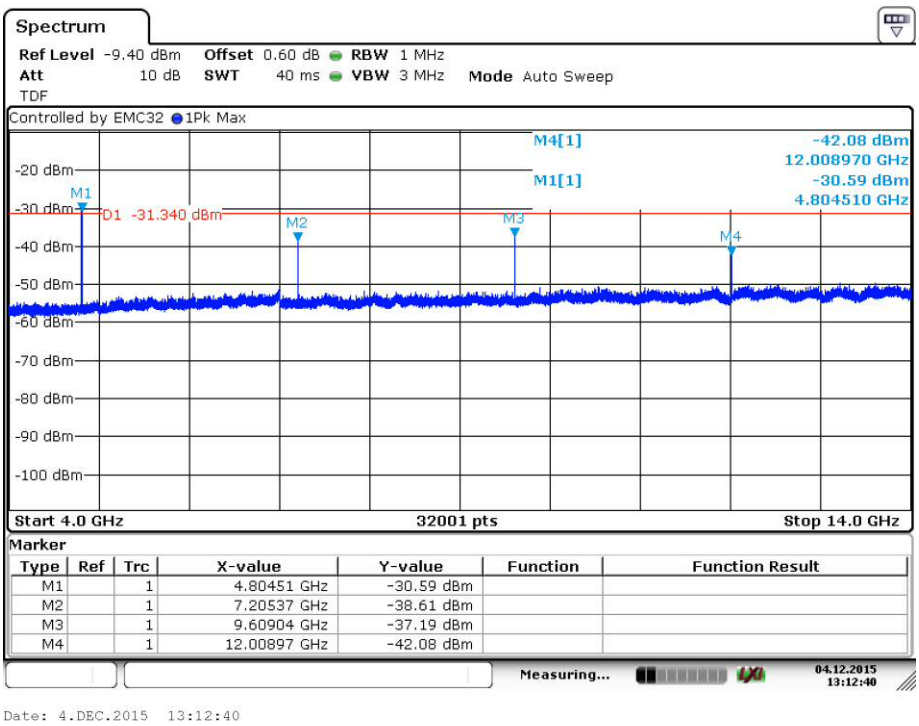


Figure 22. Conducted Spurious Emissions 4 000 – 14 000 MHz channel low. (Note emission in the frequency 4.80451 GHz falls in the restricted band so it must comply with the radiated emission limits specified in section 15.209. Radiated emissions results are presented in figure 10.)

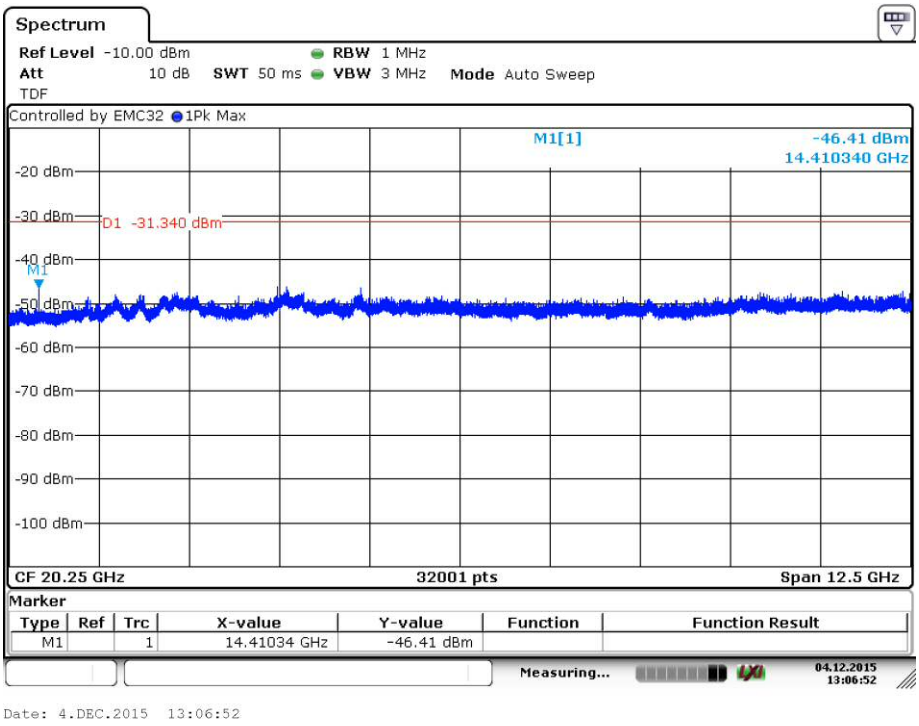


Figure 23. Conducted Spurious Emissions 14 000 – 26 500 MHz channel low.

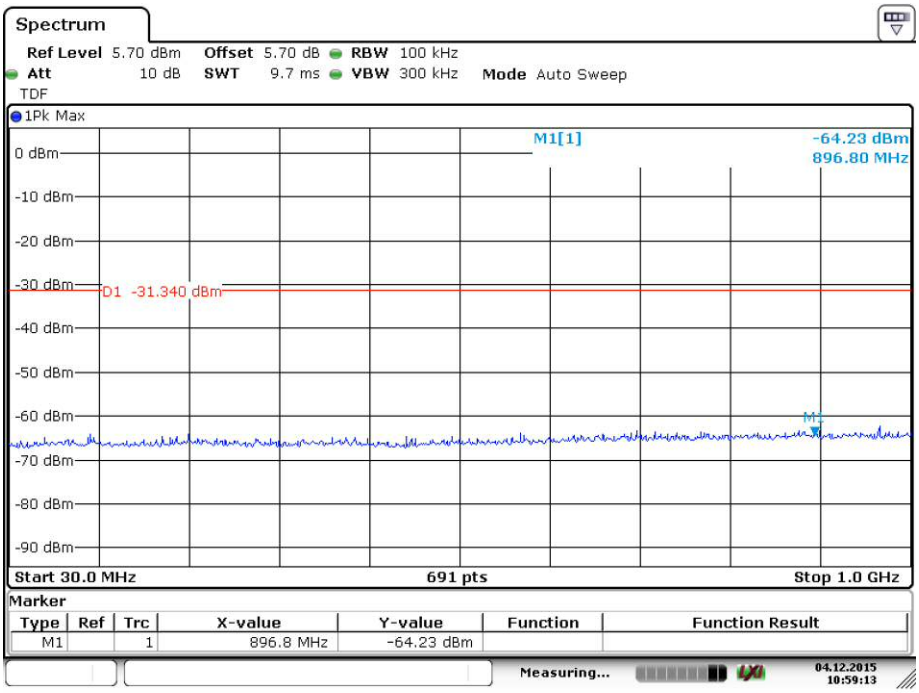


Figure 24. Conducted Spurious Emissions 30 – 1 000 MHz channel mid.

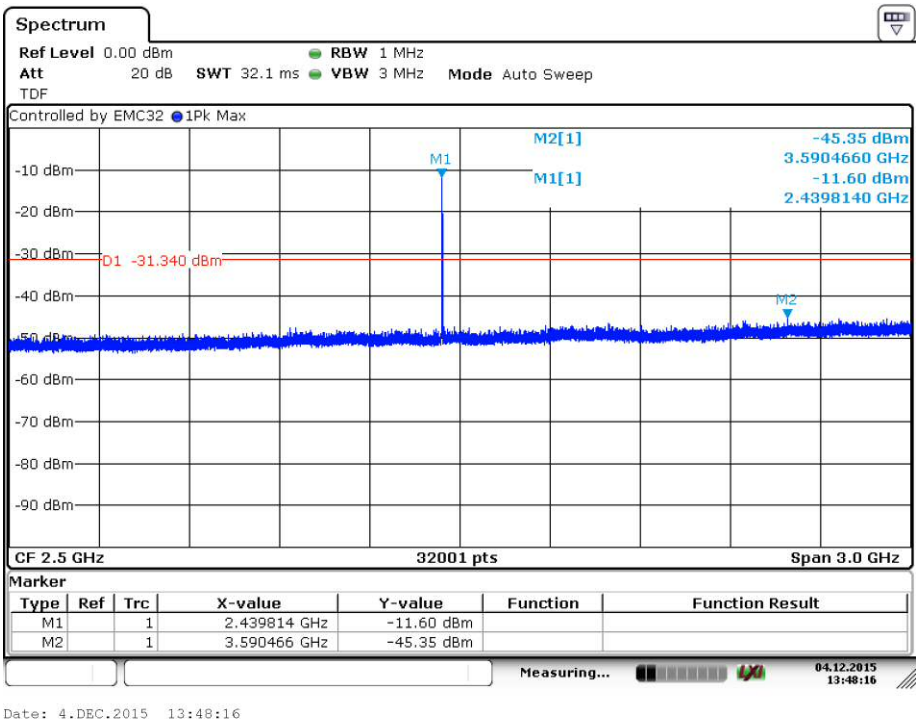


Figure 25. Conducted Spurious Emissions 1 000 – 4 000 MHz channel mid.

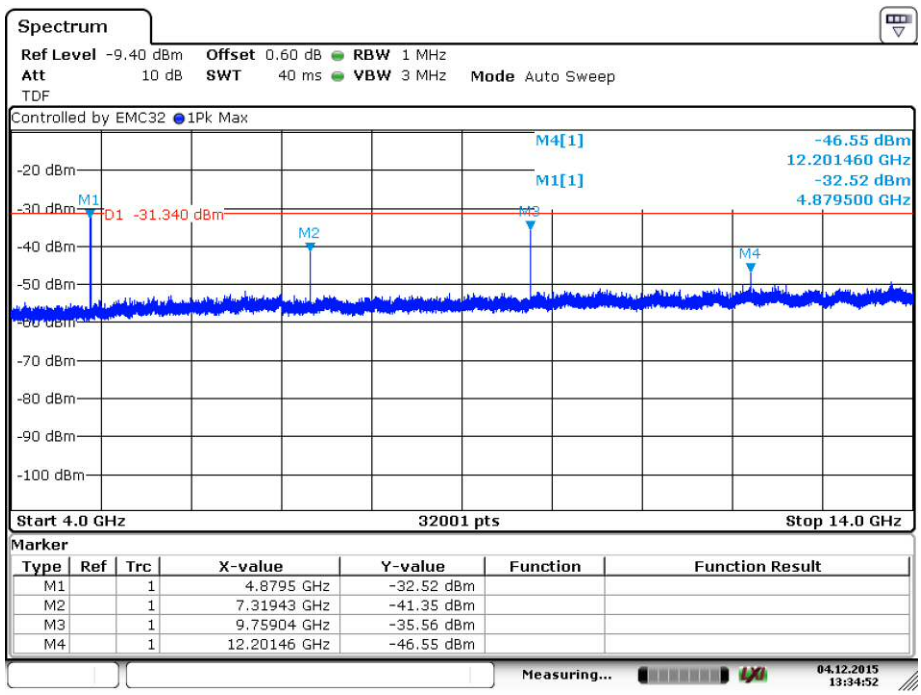


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Figure 26. Conducted Spurious Emissions 4 000 – 14 000 MHz channel mid.

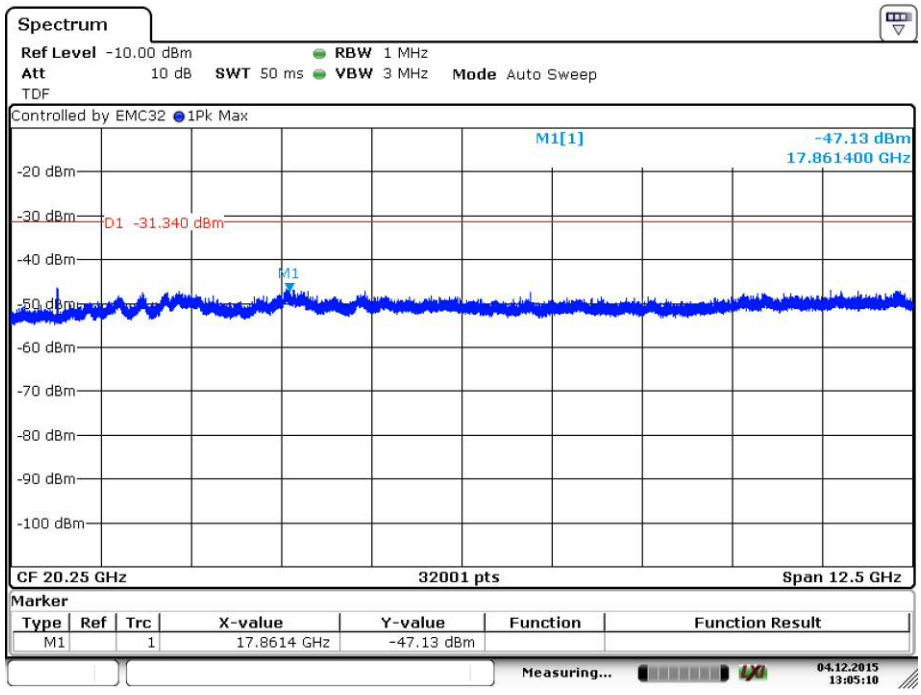

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Figure 27. Conducted Spurious Emissions 14 000 – 26 500 MHz channel mid.

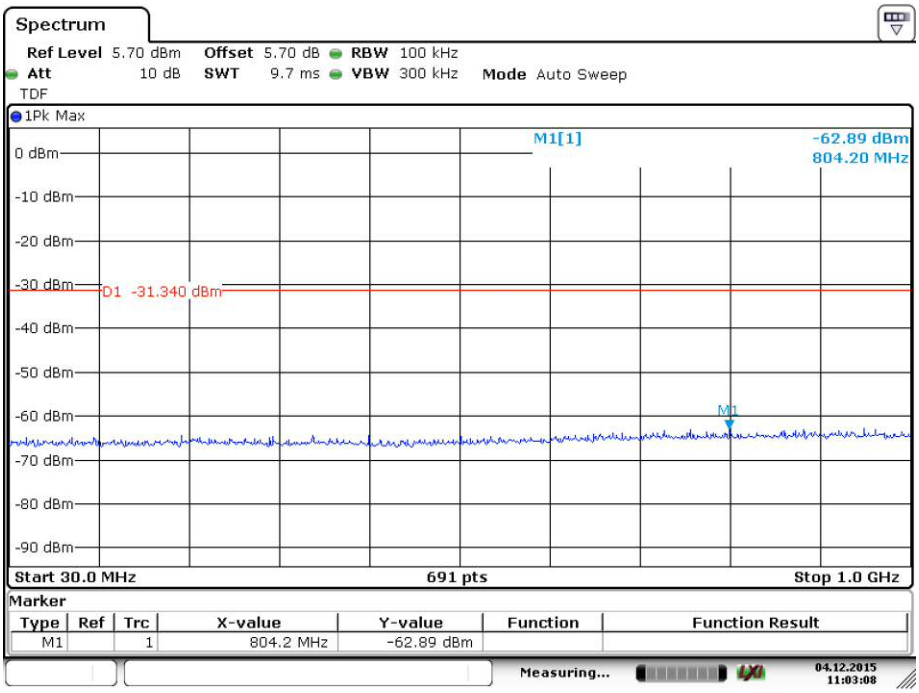


Figure 28. Conducted Spurious Emissions 30 – 1 000 MHz channel high.

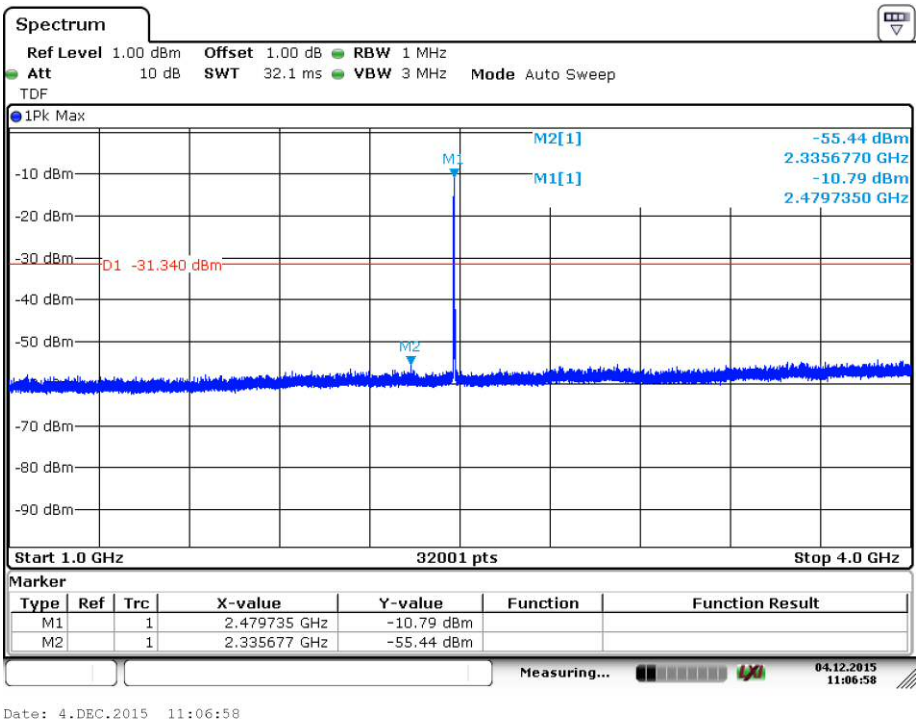


Figure 29. Conducted Spurious Emissions 1 000 – 4 000 MHz channel high.

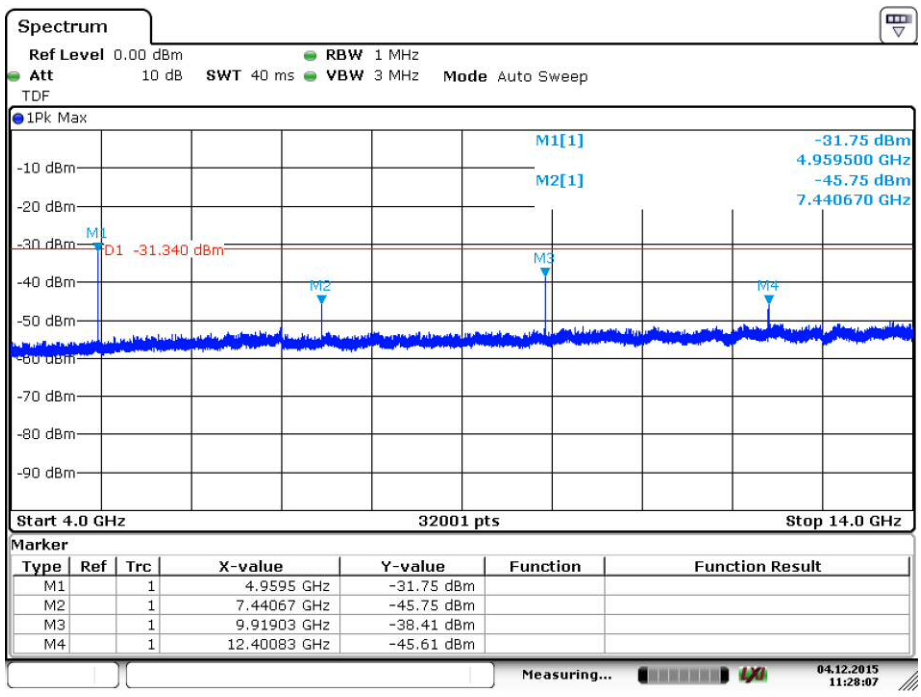


Figure 30. Conducted Spurious Emissions 4 000 – 14 000 MHz channel high.

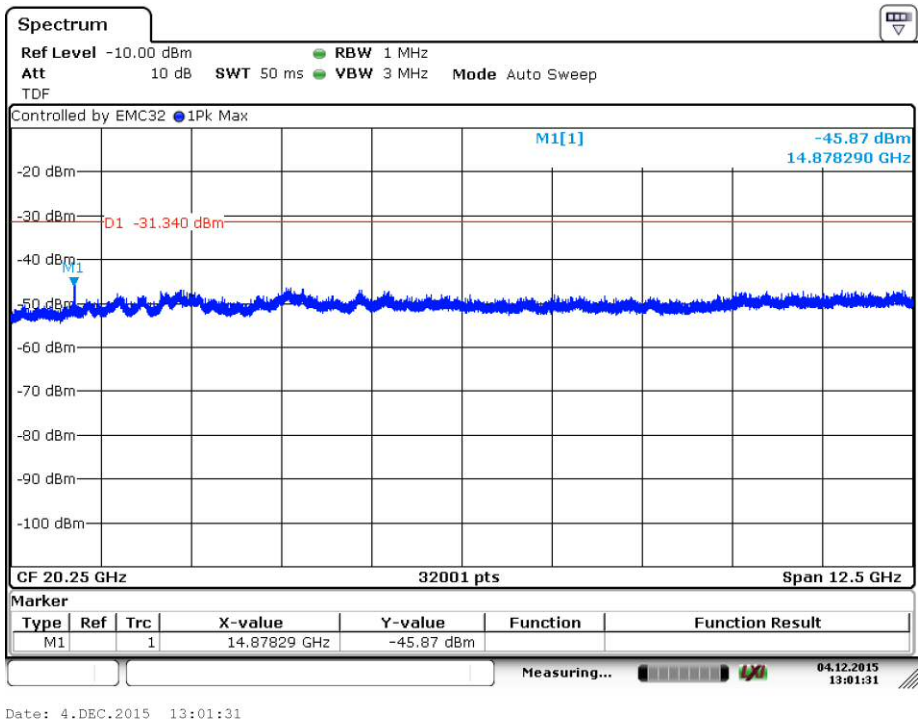


Figure 31. Conducted Spurious Emissions 14 000 – 26 500 MHz channel high.

6 dB Bandwidth of the Channel

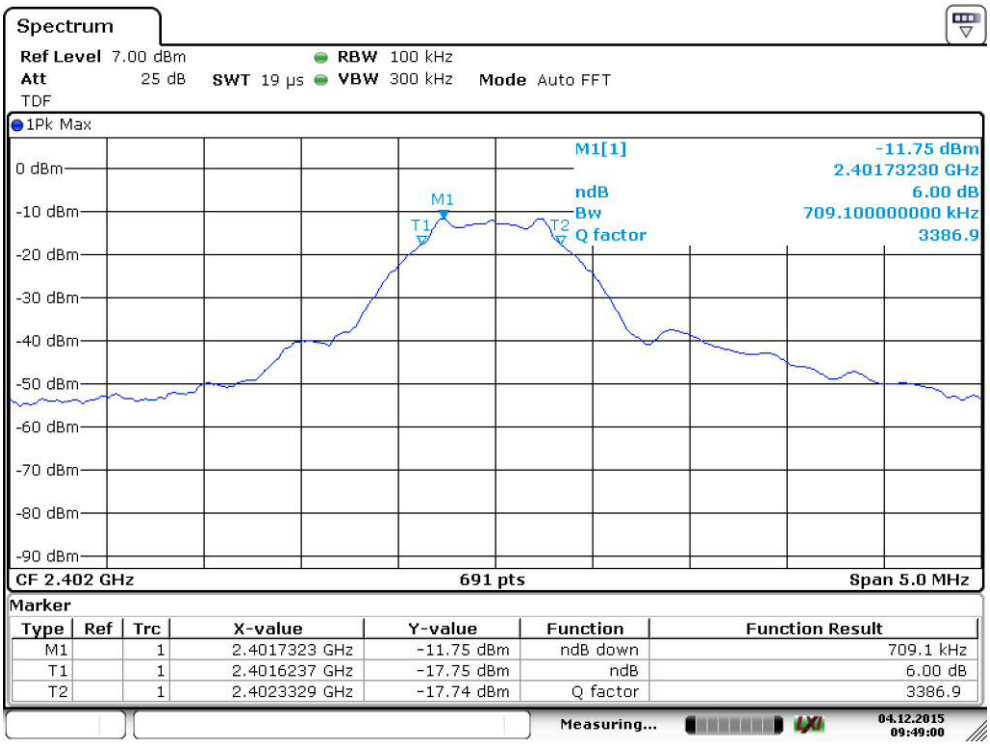
Standard:	ANSI C63.10	(2013)
Tested by:	NKO	
Date:	4.12.2015	
Humidity:	35 %	
Temperature:	21 °C	

FCC Rule: 15.247(a)(2)
RSS-247 5.2(1)

Results:

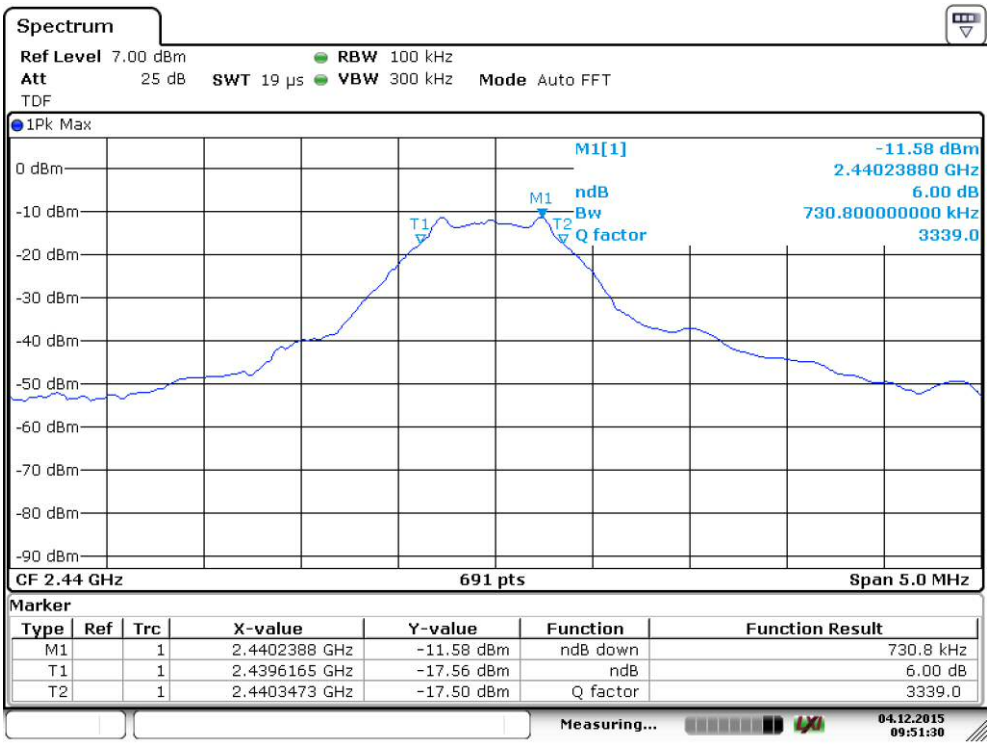
Table 26. 6 dB bandwidth test results.

Channel	6 dB BW [kHz]	Minimum limit [kHz]
Low	709.1	≥ 500
Mid	730.8	
High	738.1	



Date: 4.DEC.2015 09:49:00

Figure 32. 6 dB bandwidth of the channel low.



Date: 4.DEC.2015 09:51:29

Figure 33. 6 dB bandwidth of the channel mid.

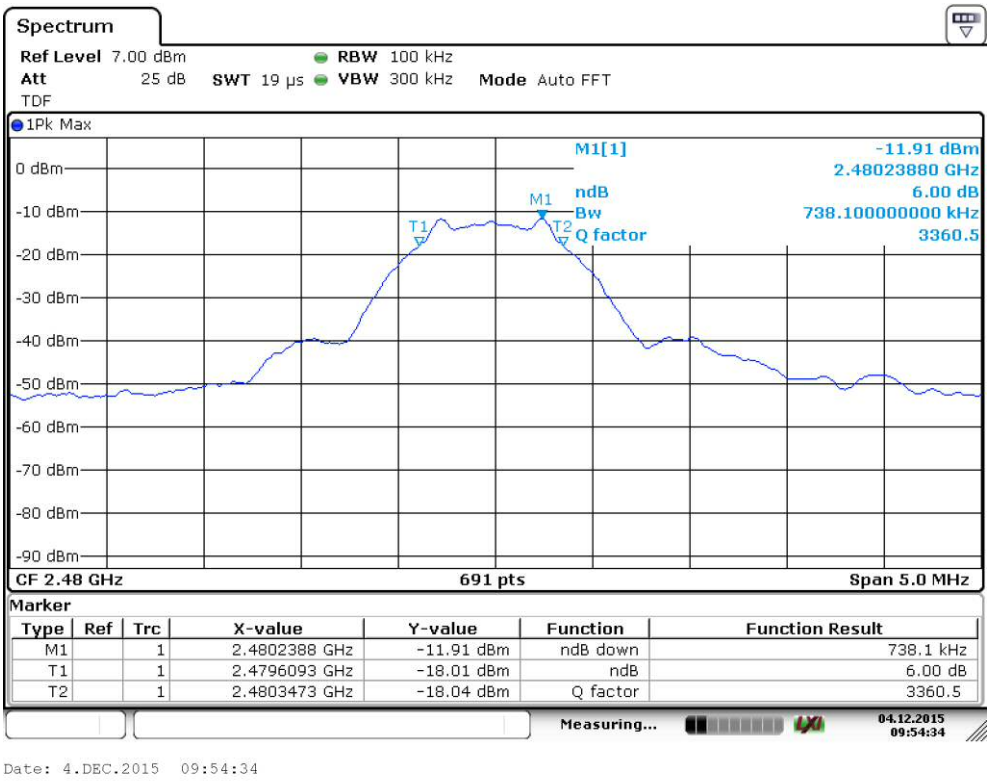


Figure 34. 6 dB bandwidth of the channel high.

Power Spectral Density

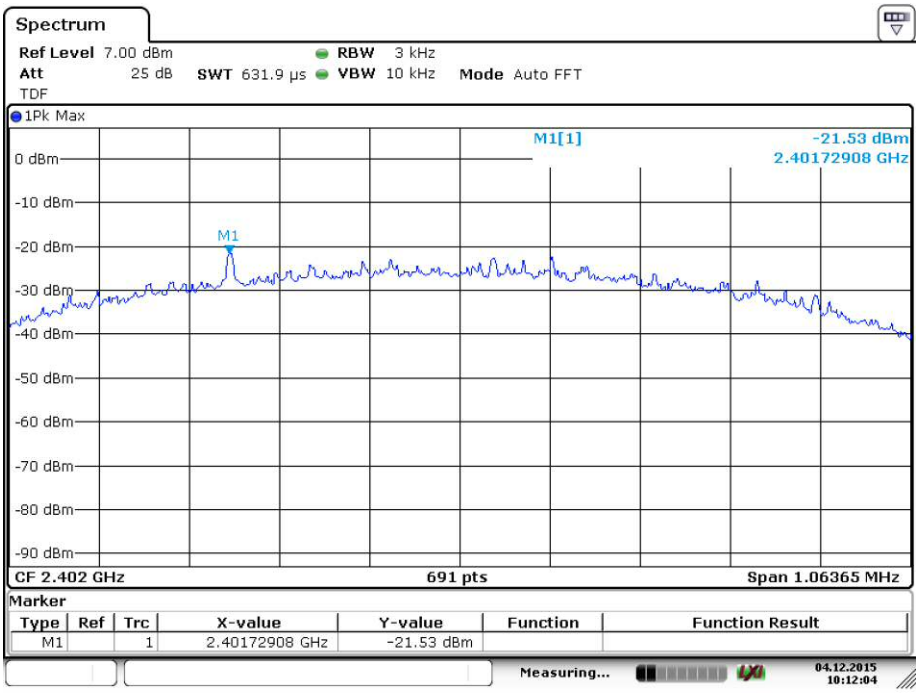
Standard:	ANSI C63.10	(2013)
Tested by:	NKO	
Date:	1.12.2015	
Humidity:	35 %	
Temperature:	21 °C	

FCC Rule: 15.247(e)
RSS-247 5.2(2)

Results:

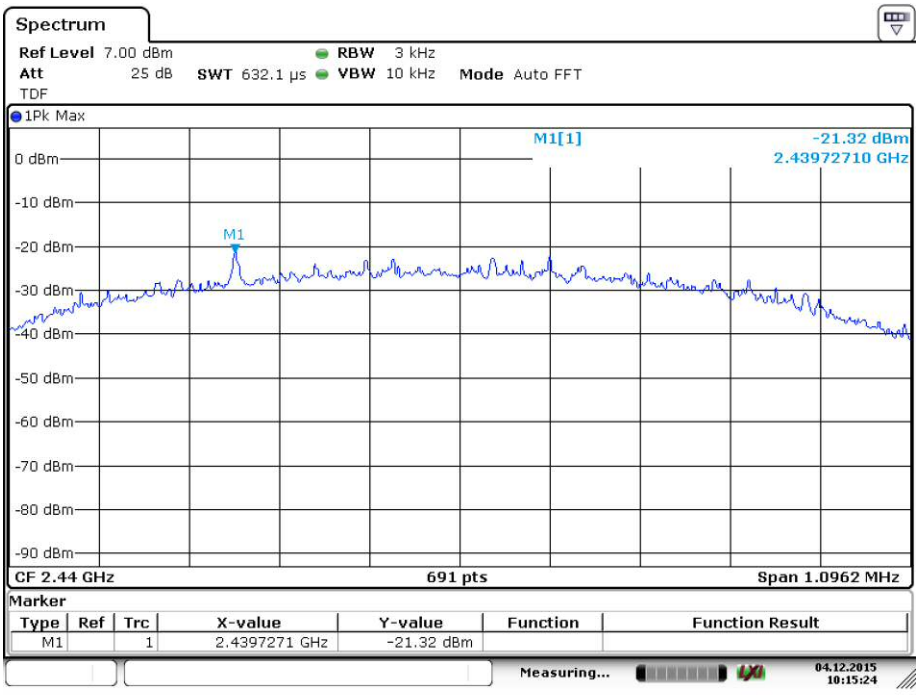
Table 27. Power Spectral Density test results.

Channel	PSD dBm/3 kHz	Maximum limit [dBm/3kHz]
Low	-21.53	+8.00
Mid	-21.32	
High	-21.49	



Date: 4.DEC.2015 10:12:04

Figure 35. Power Spectral Density of the channel low.



Date: 4.DEC.2015 10:15:24

Figure 36. Power Spectral Density of the channel mid.

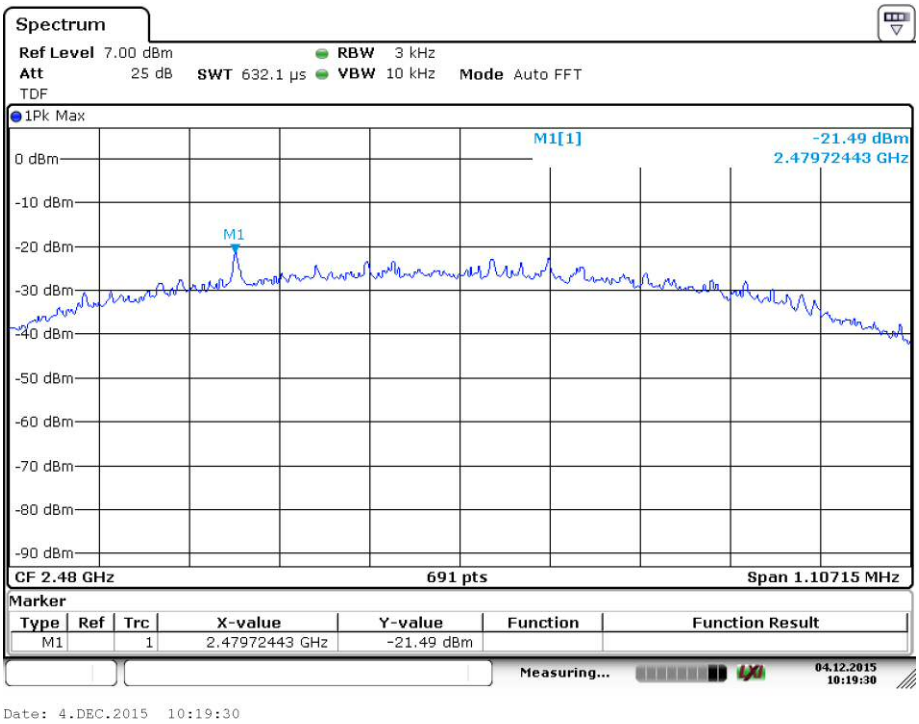


Figure 37. Power Spectral Density of the channel high.

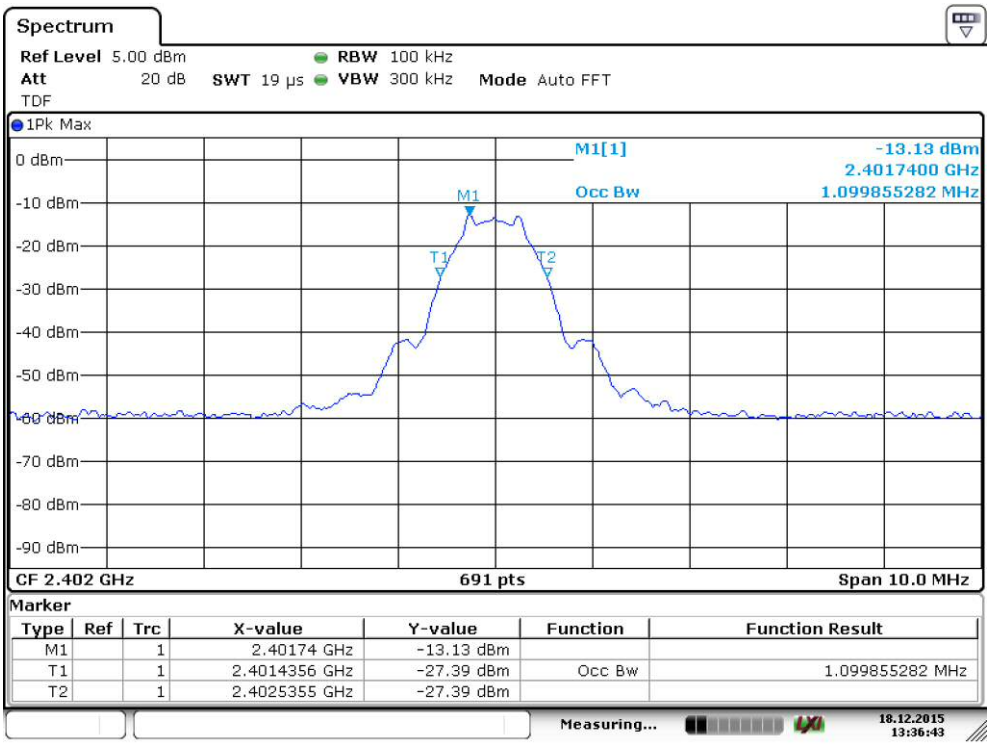
99% Occupied Bandwidth

Standard:	RSS-GEN	(2014)
Tested by:	NKO	
Date:	18.12.2015	
Humidity:	25 %	
Temperature:	21 °C	

RSS-GEN 6.6

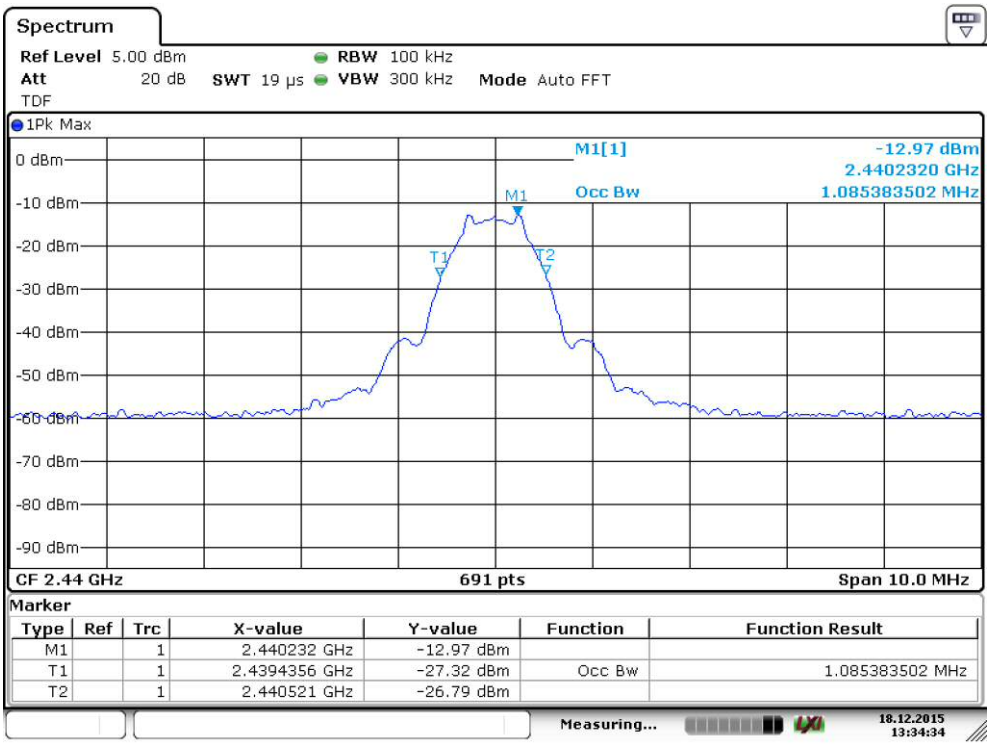
Table 28. 99 % OBW test results.

Channel	Limit	99 % BW [MHz]	Result
Low	-	1.099855282	PASS
Mid	-	1.099855282	PASS
High	-	1.085383502	PASS



Date: 18.DEC.2015 13:36:44

Figure 38. 99 % OBW channel low.



Date: 18.DEC.2015 13:34:35

Figure 39. 99 % OBW channel mid.

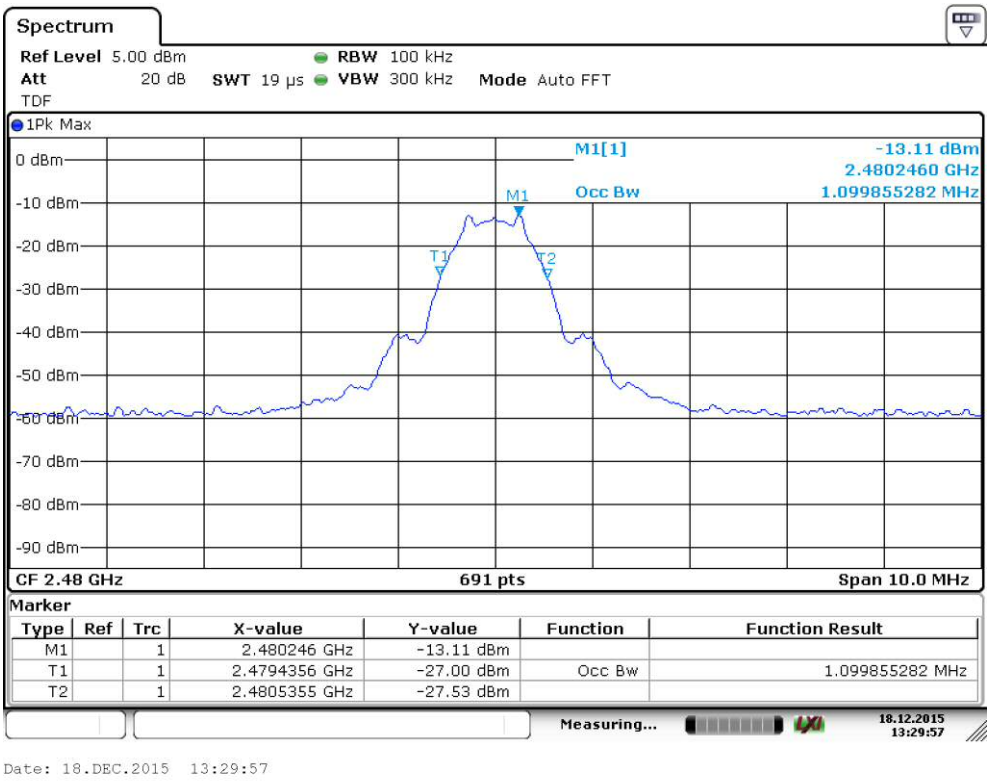


Figure 40. 99 % OBW channel high.

TEST EQUIPMENT

Equipment	Manufacturer	Type	Serial no	Inv.no	Cal. due
EMI RECEIVER	ROHDE & SCHWARZ	ESU 26	100185	8453	2016-07-01
EMI RECEIVER	ROHDE & SCHWARZ	ESU 8	100297	9602	2017-06-13
SIGNAL ANALYZER	ROHDE & SCHWARZ	FSV40	101068	9093	2016-07-01
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
ANTENNA (30-1000 MHz)	SCHWARZBECK	VULB 9168	8168-503	8911	2016-05-04
ANTENNA (0.009-30 MHz)	ROHDE & SCHWARZ	HFH2-Z2	860004/016	8013	2018-08-29
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	2017-03-03
ANTENNA (18-26.5 GHz)	EMCO	3160- 09	030232-022	7294	2016-06-28
PREAMPLIFIER (0.5-26GHz)	HP	83017A	3950M00102	5226	2016-08-26
ATTENUATOR 10 dB	HUBER & SUHNER	6810.17B	-	-	2016-08-26
HIGH PASS FILTER	WAINWRIGHT	WHKX	10	8267	2016-08-26
AC Power Source	CALIFORNIA INSTRUMENTS	5001 iX Series II	58209	7826	-

All used measurement equipment was calibrated (if required).