# Test Report

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

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

| | |
|---|---|
| Equipment Under Test: | Throwable wireless 2.4GHz microphone system receiver |
| Model: | Catchbox 2.4 Receiver |
| Type: | - |
| Manufacturer: | Trick Technologies Oy<br>Betonimiehenkuja 3D<br>02150 ESPOO<br>FINLAND |
| Customer: | Trick Technologies Oy<br>Betonimiehenkuja 3D<br>02150 ESPOO<br>FINLAND |
| FCC Rule Part: | 15.247: 2013 |
| IC Rule Part: | RSS-210, Issue 8, 2010<br>RSS-GEN Issue 3, 2010 |
| KDB: | Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (April 9, 2013) |

| | | | |
|---|---|---|---|
| Date: | 17.6.2014 | Date: | 17.6.2014 |
| Issued by: | Niko Kotsalo<br>Test Engineer | Checked by: | Jari Merikari<br>Technical Manager |

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## Equipment Under Test (EUT)

Catchbox 2.4 Throwable wireless microphone receiver

| | |
|---|---|
| Model: | Catchbox 2.4 Receiver |
| Type: | - |
| Serial no: | - |
| HW version: | CB24RX001 |
| SW version: | Catchbox Basic RX |
| FCC ID: | 2AB78CB24RX001 |
| IC: | - |

## Description of the EUT

The EUT is a receiver for a wireless microphone system operating in the 2.4 GHz frequency band. Microphone system is intended to be used in small and medium sized events. The test results for transmitter microphone are located in SGS Fimko test report with reference number 274725-2-1.

## 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: | 18 |
| Channel separation: | 4 MHz |
| Channel bandwidth: | 3.965267728 MHz |
| Effective conducted power: | 8.27 dBm |
| Transmission technique: | Digital Transmission |
| Modulation: | 8FSK |
| Integral Antenna gain: | 2.2 dBi |

## Power Supply

| | |
|---|---|
| AC/DC adapter | 5.0 VDC / 100-240 VAC, 50-60 Hz |

## Mechanical Size of the EUT

| | | |
|---|---|---|
| Height: 3.5 cm | Width:12.5 cm | Length: 13 cm |

## Samples

A commercial sample was used in the tests. During the tests the EUT was set into continuous transmit mode with Texas Instruments PurePath Wireless Commander computer software. Hopping was stopped into 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 tests. Hopping was stopped and the EUT was configured into the wanted channel. Normal modulation and 98 % duty cycle was applied in all tests. Normal duty cycle of the EUT was measured and it was 2.01 % which is the highest possible duty cycle in normal mode.

Average values for transmitter radiated emissions were calculated from measured peak pulse amplitude and by determining the duty cycle correction factor of the pulse modulation. The duty cycle correction expressed in dB was determined as follows:

Duty Cycle Correction = 20log (Dwell Time/100ms)

Calculated Duty Cycle Correction for the EUT is - 34.0 dB

Following channels were used during the tests when the hopping was stopped:
Channel Low (Ch 1) = 2406 MHz
Channel Mid (Ch 9) = 2442 MHz
Channel High (Ch 18) = 2474 MHz

## Test Facility

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

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

| | | |
|---|---|---|
| **Standard:** | ANSI C63.10 | (2009) |
| **Tested by:** | NKO | |
| **Date:** | 12.6.2014 | |
| **Temperature:** | 23 °C | |
| **Humidity:** | 49 % RH | |
| **Barometric pressure:** | 1010.3 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 (115VAC / 60 Hz) 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.

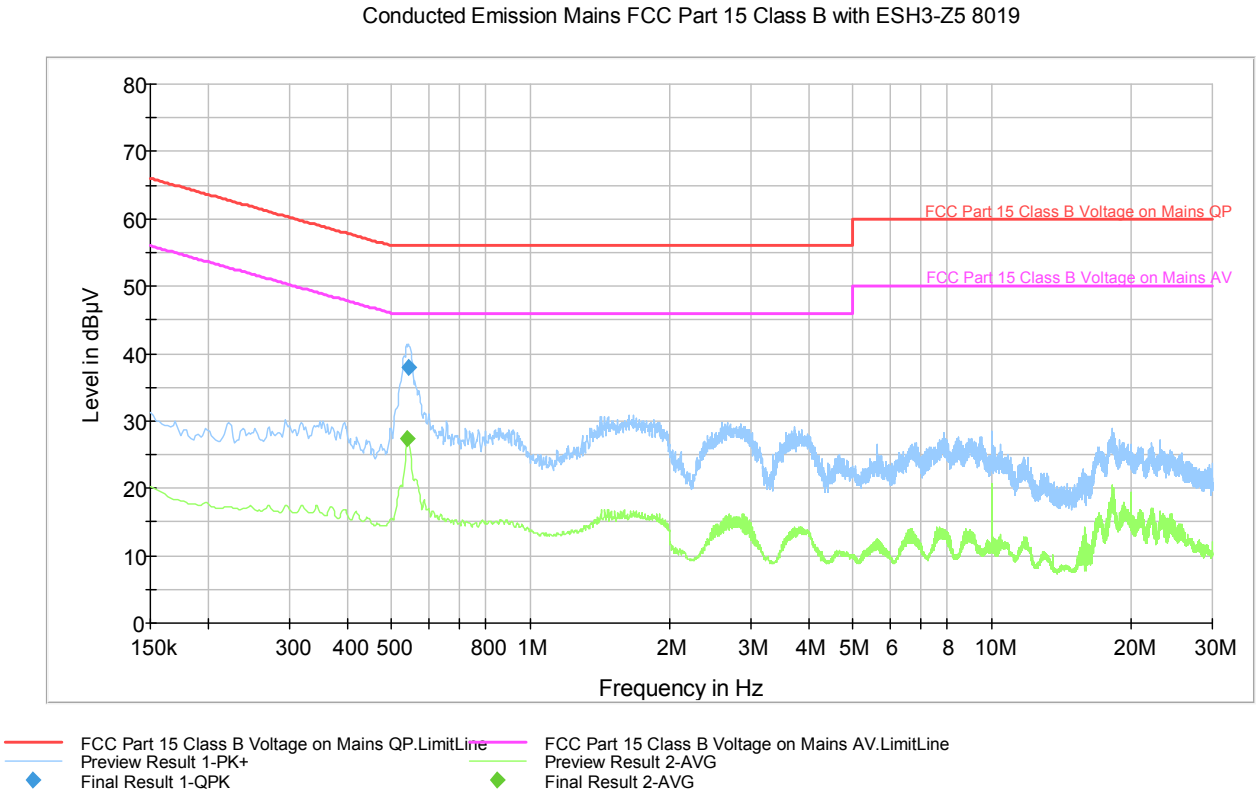


**Figure 1.** The measured curves with peak- and average detector

## Final measurements from the worst frequencies

**Table 1.** Final QuasiPeak results

| Frequency (MHz) | QuasiPeak (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 0.543750 | 37.9 | 1000.0 | 9.000 | GN | N | 10.1 | 18.1 | 56.0 | |

.

**Table 2.** Final Average results

| Frequency (MHz) | Average (dBµV) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dBµV) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 0.541500 | 27.4 | 1000.0 | 9.000 | GN | L1 | 10.1 | 18.6 | 46.0 | |

## Maximum Peak Conducted Output Power

| | | |
|---|---|---|
| **Standard:** | ANSI C63.10 | (2009) |
| **Tested by:** | NKO | |
| **Date:** | 6.6.2014 | |
| **Humidity:** | 48% | |
| **Temperature:** | 24.8 °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 | 8.27 | 30 | 21.73 | PASS |
| Mid | 7.11 | 30 | 22.89 | PASS |
| High | 6.61 | 30 | 23.39 | PASS |

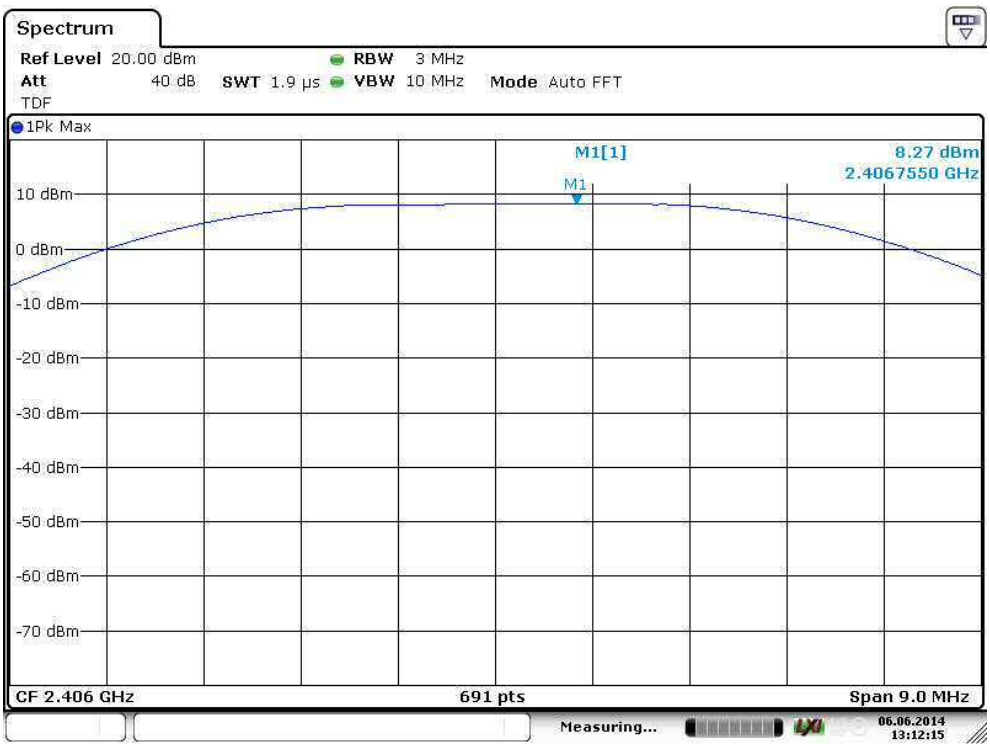


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**Figure 2.** Channel Low.

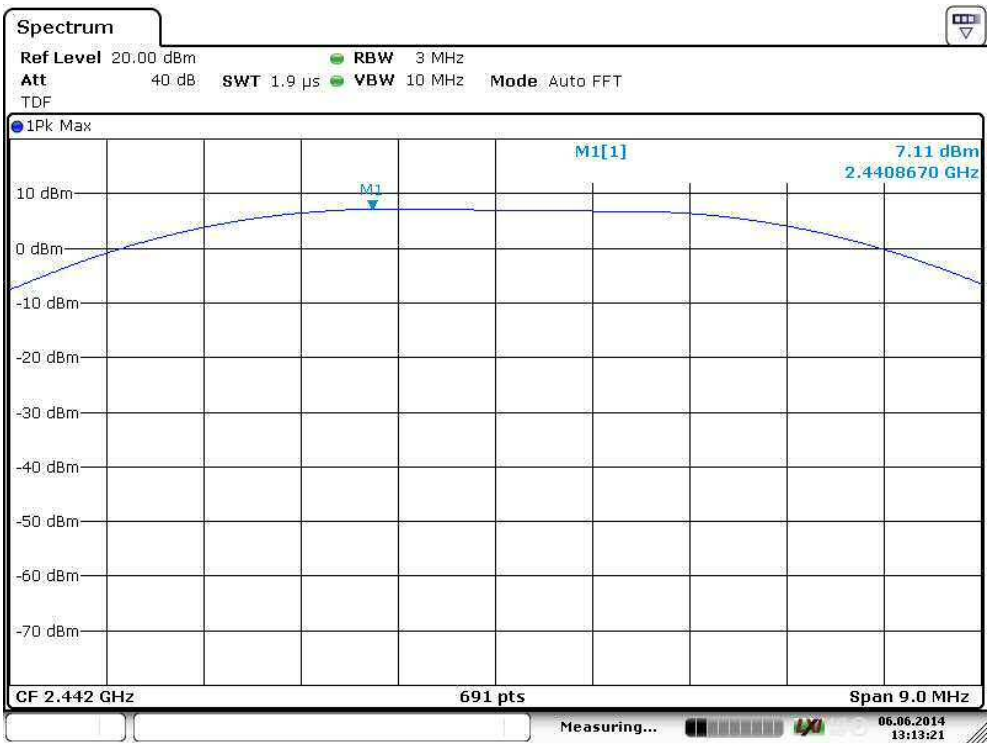


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**Figure 3.** Channel Mid.

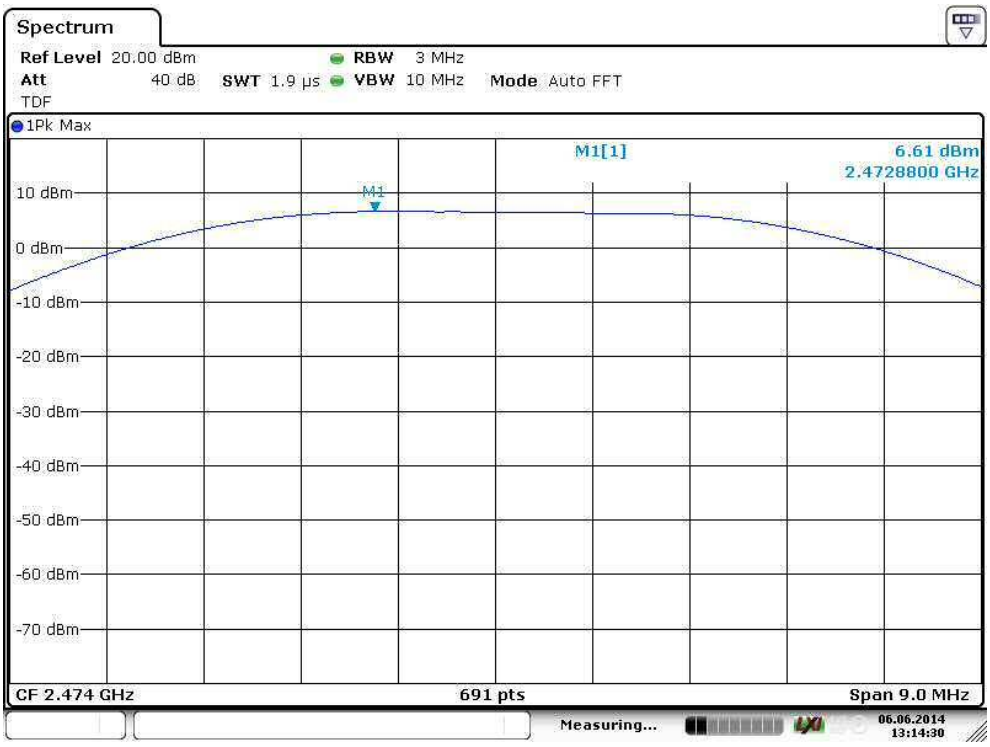


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**Figure 4.** Channel High.

## Transmitter Radiated Spurious Emissions 30 – 1000 MHz

| | | |
|---|---|---|
| **Standard:** | ANSI C63.10 | (2009) |
| **Tested by:** | NKO | |
| **Date:** | 17.4. – 20.5.2014 | |
| **Humidity:** | 20 – 46.5 % | |
| **Temperature:** | 22.0 – 25.6 °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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables). The QuasiPeak value is the measured value corrected with the correction factor.

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

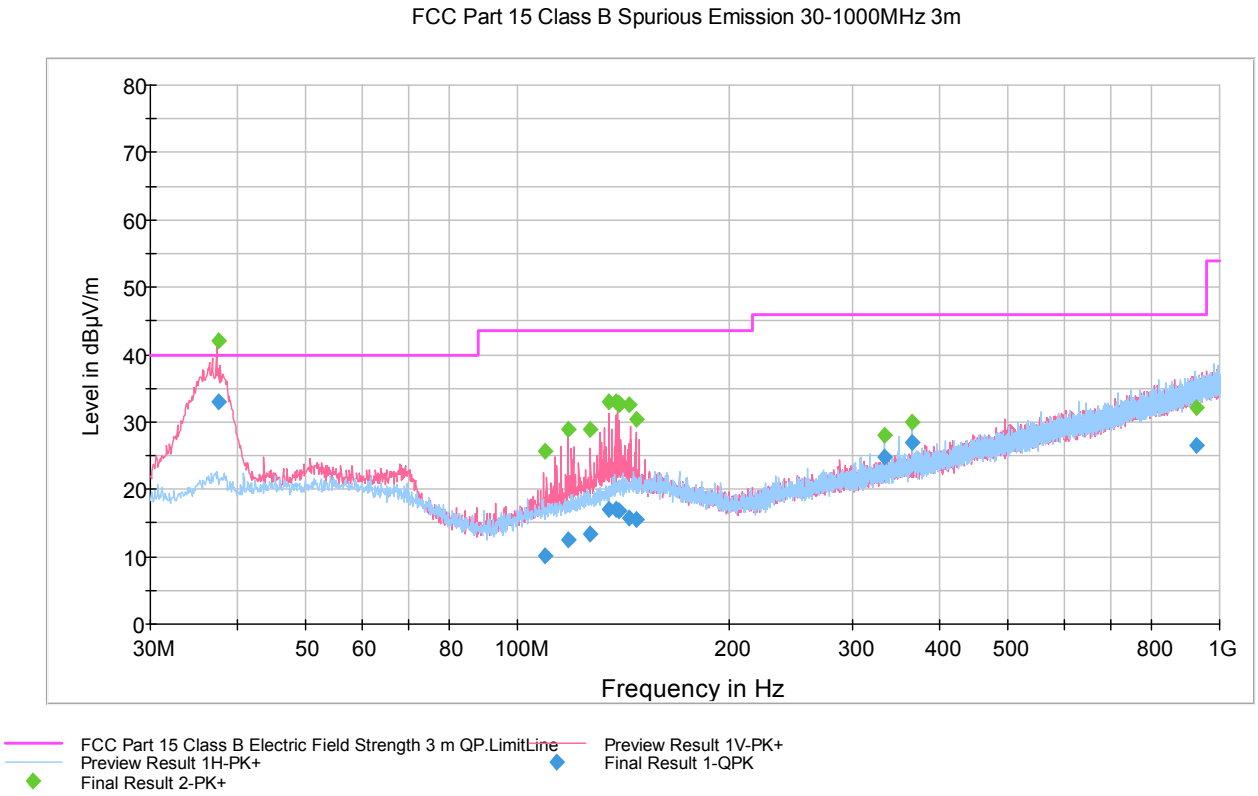



**Figure 5.** Measured curve with peak-detector. Channel Low.

**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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 37.535000 | 33.0 | 1000.0 | 120.000 | 100.0 | V | 50.0 | 14.5 | 7.0 | 40.0 | |
| 109.178000 | 10.1 | 1000.0 | 120.000 | 138.0 | V | 274.0 | 11.1 | 33.4 | 43.5 | |
| 117.916000 | 12.5 | 1000.0 | 120.000 | 121.0 | V | 218.0 | 11.7 | 31.0 | 43.5 | |
| 126.620000 | 13.3 | 1000.0 | 120.000 | 167.0 | V | 304.0 | 12.5 | 30.2 | 43.5 | |
| 135.197000 | 17.0 | 1000.0 | 120.000 | 100.0 | V | 351.0 | 13.5 | 26.5 | 43.5 | |
| 137.864000 | 17.0 | 1000.0 | 120.000 | 121.0 | V | -4.0 | 13.9 | 26.5 | 43.5 | |
| 139.177000 | 16.8 | 1000.0 | 120.000 | 100.0 | V | 227.0 | 14.0 | 26.7 | 43.5 | |
| 139.496000 | 16.8 | 1000.0 | 120.000 | 100.0 | V | 17.0 | 14.1 | 26.7 | 43.5 | |
| 144.445000 | 15.8 | 1000.0 | 120.000 | 100.0 | V | 279.0 | 14.5 | 27.7 | 43.5 | |
| 147.550000 | 15.5 | 1000.0 | 120.000 | 100.0 | V | 249.0 | 14.7 | 28.0 | 43.5 | |
| 333.633000 | 24.8 | 1000.0 | 120.000 | 100.0 | H | 285.0 | 16.9 | 21.2 | 46.0 | |
| 365.466000 | 27.0 | 1000.0 | 120.000 | 100.0 | H | 288.0 | 17.8 | 19.0 | 46.0 | |
| 924.657000 | 26.6 | 1000.0 | 120.000 | 152.0 | H | 191.0 | 27.9 | 19.4 | 46.0 | |

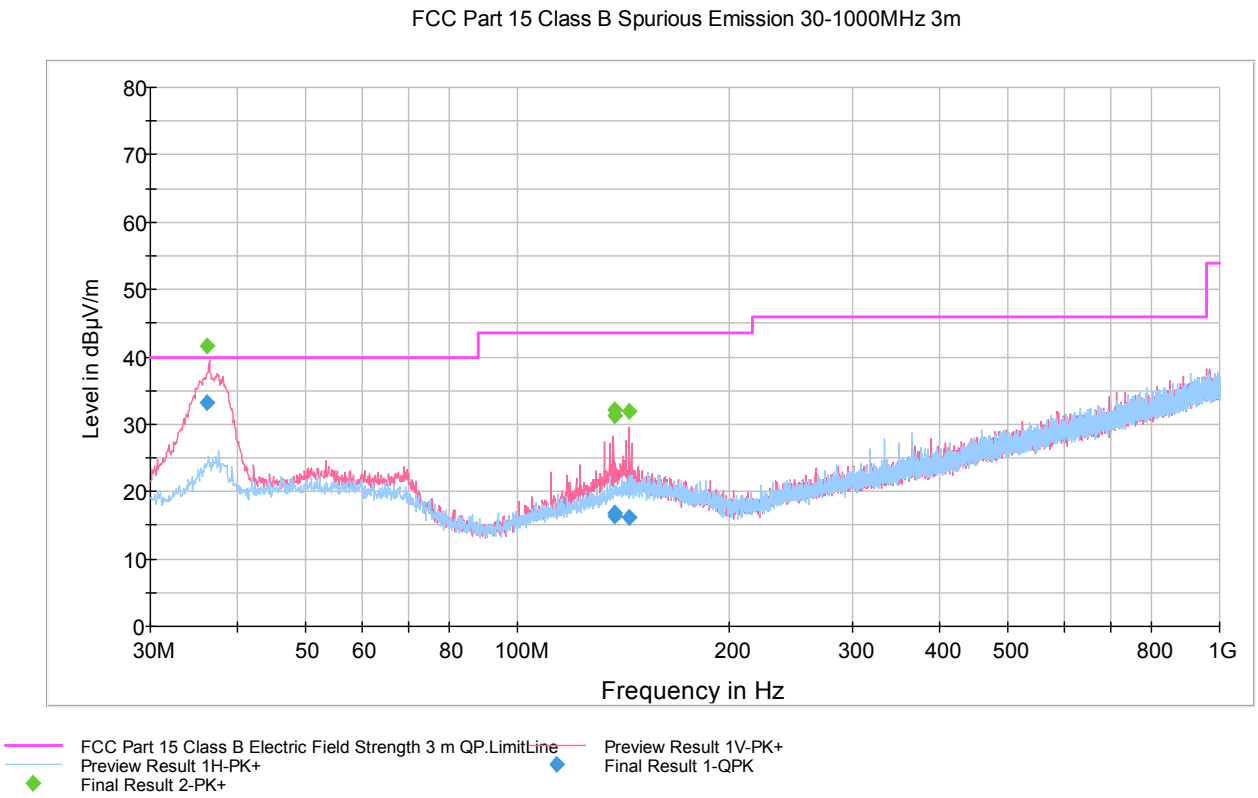



**Figure 6.** Measured curve with peak-detector. Channel Mid.

### Final measurements from the worst frequencies

**Table 4.** Final QuasiPeak results

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| 36.082000 | 33.1 | 1000.0 | 120.000 | 100.0 | V | -5.0 | 14.5 | 6.9 | 40.0 | |
| 137.277000 | 16.4 | 1000.0 | 120.000 | 100.0 | V | 265.0 | 13.8 | 27.1 | 43.5 | |
| 137.525000 | 16.7 | 1000.0 | 120.000 | 100.0 | V | 248.0 | 13.8 | 26.8 | 43.5 | |
| 144.120000 | 16.1 | 1000.0 | 120.000 | 100.0 | V | 313.0 | 14.5 | 27.4 | 43.5 | |

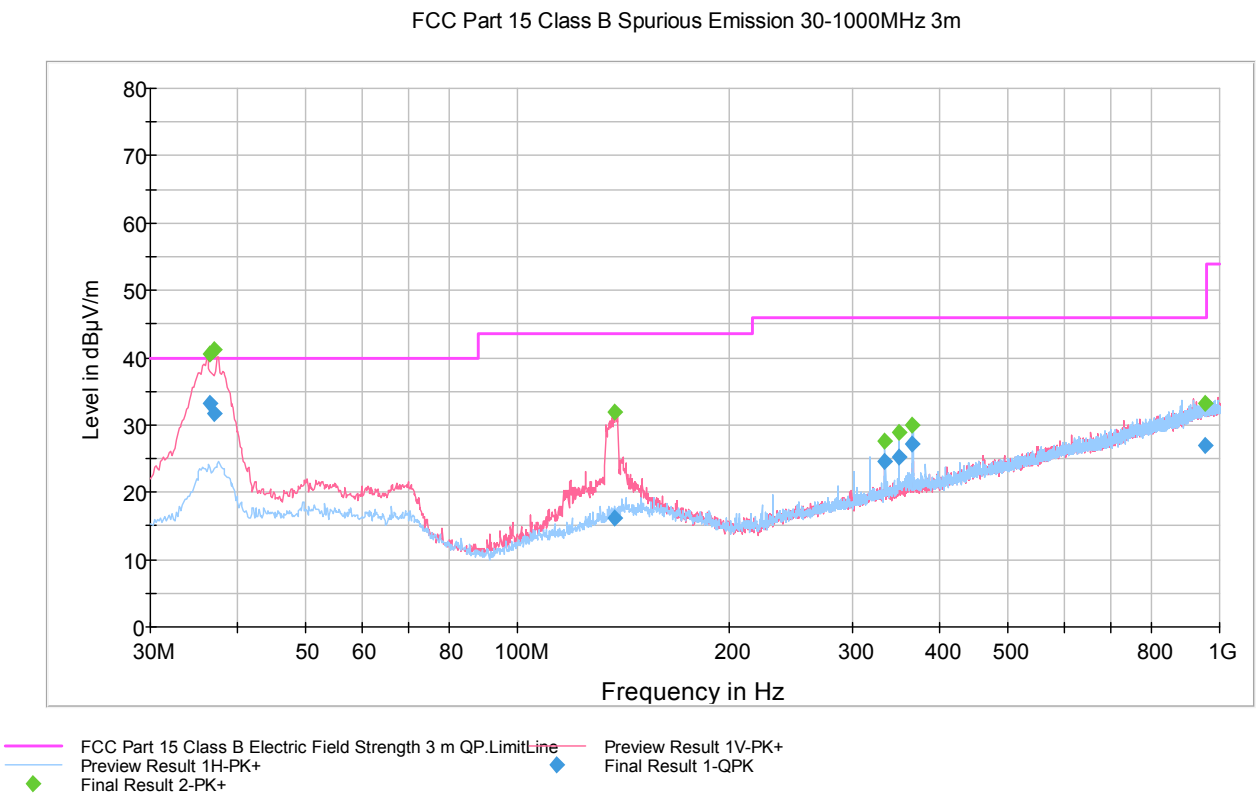



**Figure 7.** Measured curve with peak-detector. Channel High.

### Final measurements from the worst frequencies

**Table 5.** Final QuasiPeak results

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| 36.455000 | 33.2 | 1000.0 | 120.000 | 100.0 | V | 324.0 | 14.5 | 6.8 | 40.0 | |
| 36.905000 | 31.8 | 1000.0 | 120.000 | 132.0 | V | 89.0 | 14.5 | 8.2 | 40.0 | |
| 137.605000 | 16.2 | 1000.0 | 120.000 | 110.0 | V | 231.0 | 13.8 | 27.3 | 43.5 | |
| 333.675000 | 24.7 | 1000.0 | 120.000 | 100.0 | H | 278.0 | 16.9 | 21.3 | 46.0 | |
| 349.585000 | 25.3 | 1000.0 | 120.000 | 100.0 | H | 285.0 | 17.3 | 20.7 | 46.0 | |
| 365.475000 | 27.2 | 1000.0 | 120.000 | 100.0 | H | 289.0 | 17.8 | 18.8 | 46.0 | |
| 955.545000 | 27.0 | 1000.0 | 120.000 | 132.0 | H | 186.0 | 28.2 | 19.0 | 46.0 | |

## 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.

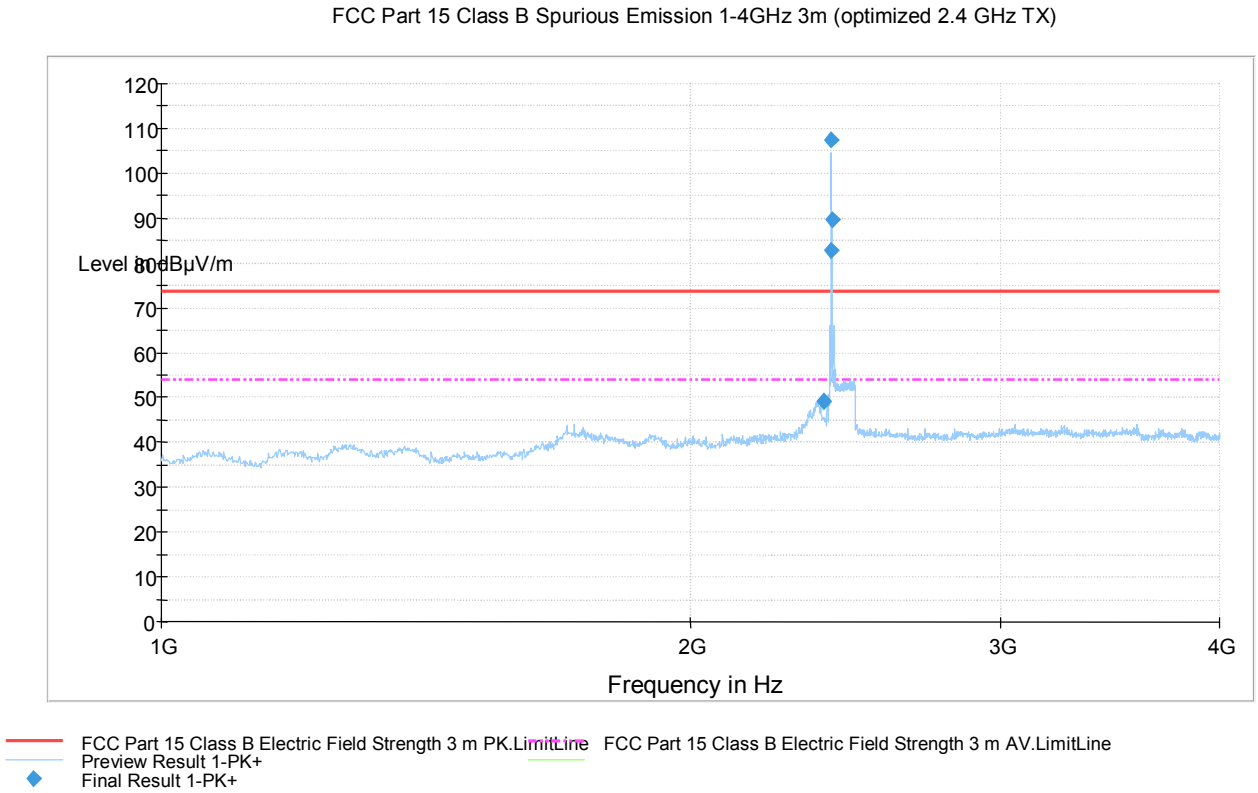



**Figure 8.** Measured curve with peak detector. Channel Low.

### 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) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 2381.000000 | 49.1 | 1000.0 | 1000.000 | 122.0 | V | 195.0 | 24.8 | 73.9 | |
| 2406.000000 | 107.4 | 1000.0 | 1000.000 | 122.0 | V | 204.0 | -33.5 | 73.9 | Carrier |

**Table 7.** Final Average results.

| Frequency (MHz) | Average (dBµV/m) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|
| 2381.000000 | 15.1 | 38.8 | 53.9 | |
| 2406.000000 | 73 | -19.9 | 53.9 | Carrier |

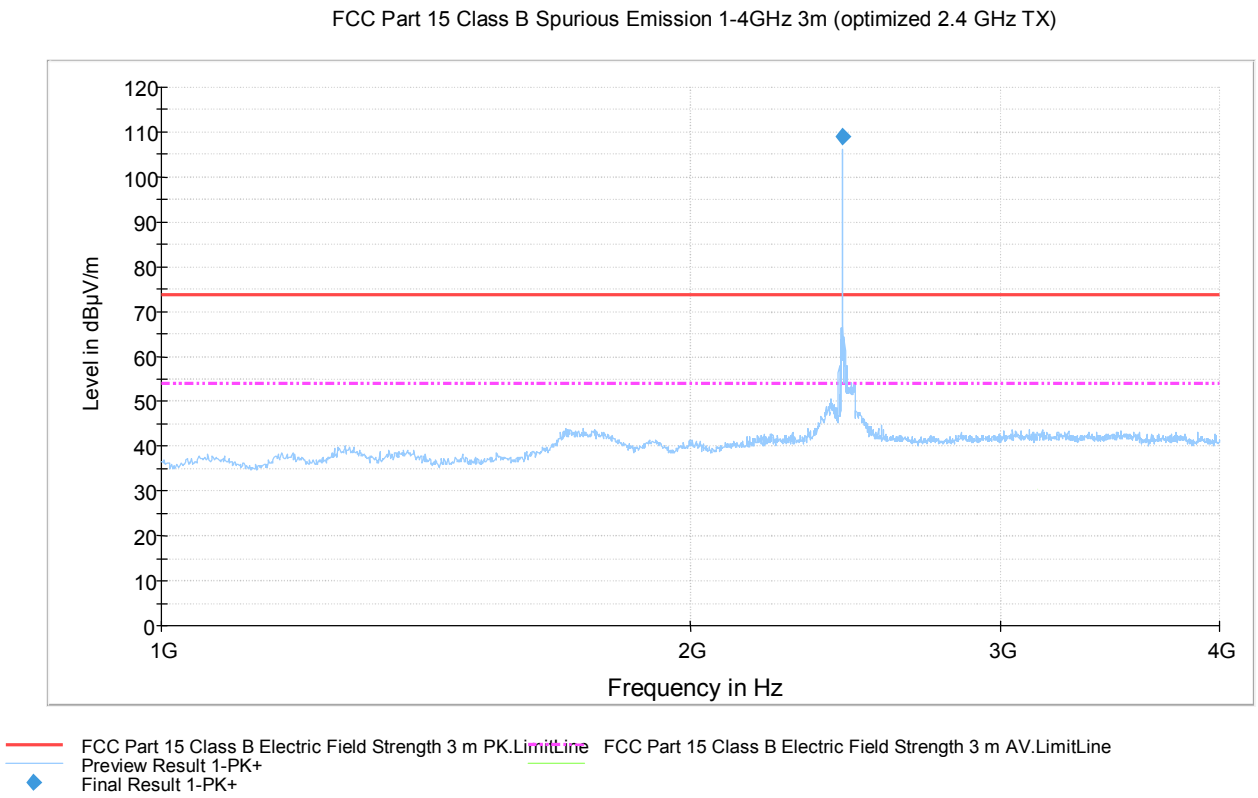



**Figure 9.** Measured curve with peak detector. Channel Mid.

### 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) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 2442.000000 | 108.9 | 1000.0 | 1000.000 | 120.0 | V | 193.0 | -35.0 | 73.9 | Carrier |

**Table 9.** Final Average results.

| Frequency (MHz) | Average (dBµV/m) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|
| 2442.000000 | 74.9 | -21 | 53.9 | Carrier |

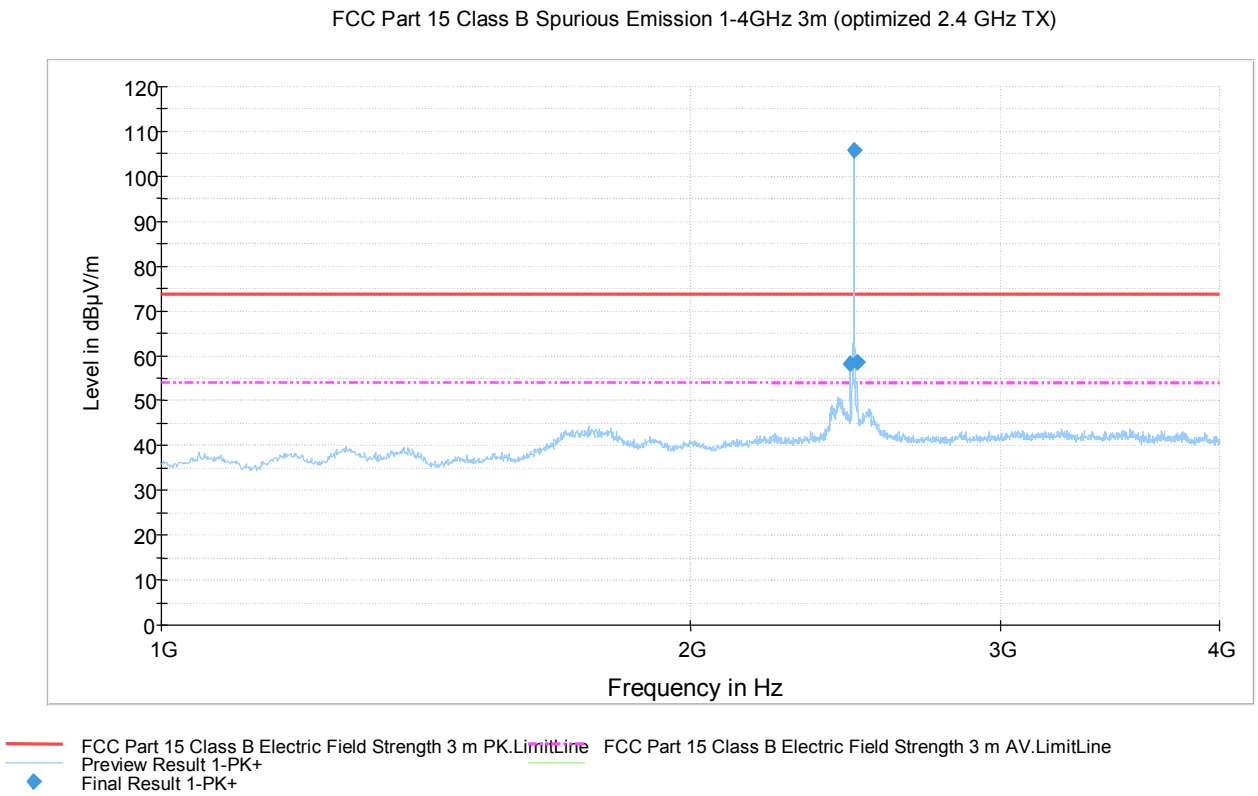



**Figure 10.** Measured curve with peak detector. Channel High.

### 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2478.200000 | 105.7 | 1000.0 | 1000.000 | 100.0 | V | 104.0 | 4.7 | -31.8 | 73.9 | Carrier |
| 2490.100000 | 58.5 | 1000.0 | 1000.000 | 122.0 | V | 201.0 | 4.8 | 15.4 | 73.9 | |

**Table 11.** Final Average results.

| Frequency (MHz) | Average (dBµV/m) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|
| 2478.200000 | 71.7 | -17.8 | 53.9 | Carrier |
| 2490.100000 | 24.5 | 29.4 | 53.9 | |

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

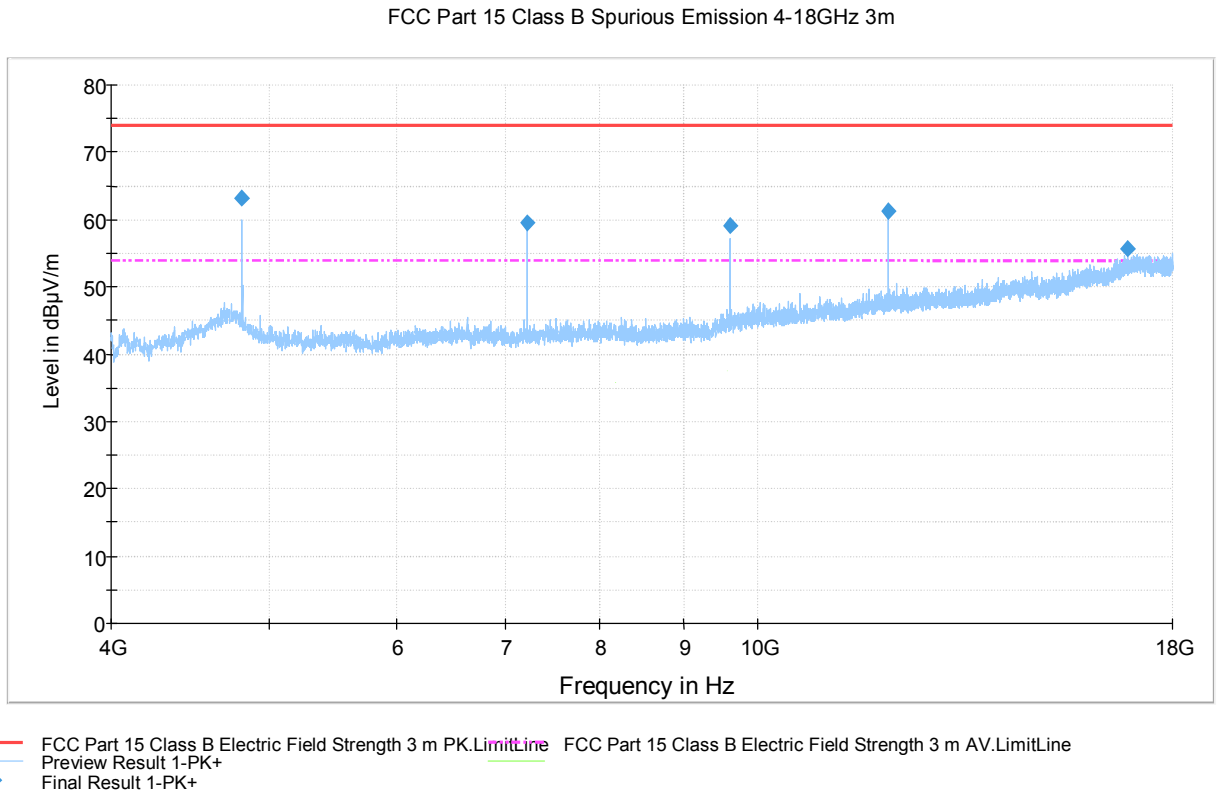



**Figure 11.** Measured curve with peak detector. Channel Low.

**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) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 4812.200000 | 63.3 | 1000.0 | 1000.000 | 100.0 | V | 0.0 | 10.6 | 73.9 | |
| 7218.200000 | 59.6 | 1000.0 | 1000.000 | 114.0 | V | 244.0 | 14.3 | 73.9 | |
| 9624.400000 | 59.0 | 1000.0 | 1000.000 | 100.0 | V | 171.0 | 14.9 | 73.9 | |
| 12030.400000 | 61.3 | 1000.0 | 1000.000 | 105.0 | V | 176.0 | 12.6 | 73.9 | |
| 16885.400000 | 55.6 | 1000.0 | 1000.000 | 321.0 | V | 92.0 | 18.3 | 73.9 | |

**Table 13.** Final Average results.

| Frequency (MHz) | Average (dBµV/m) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|
| 4812.200000 | 29.3 | 24.6 | 53.9 | |
| 7218.200000 | 25.6 | 28.3 | 53.9 | |
| 9624.400000 | 25 | 28.9 | 53.9 | |
| 12030.400000 | 27.3 | 26.6 | 53.9 | |
| 16885.400000 | 21.6 | 32.3 | 53.9 | |

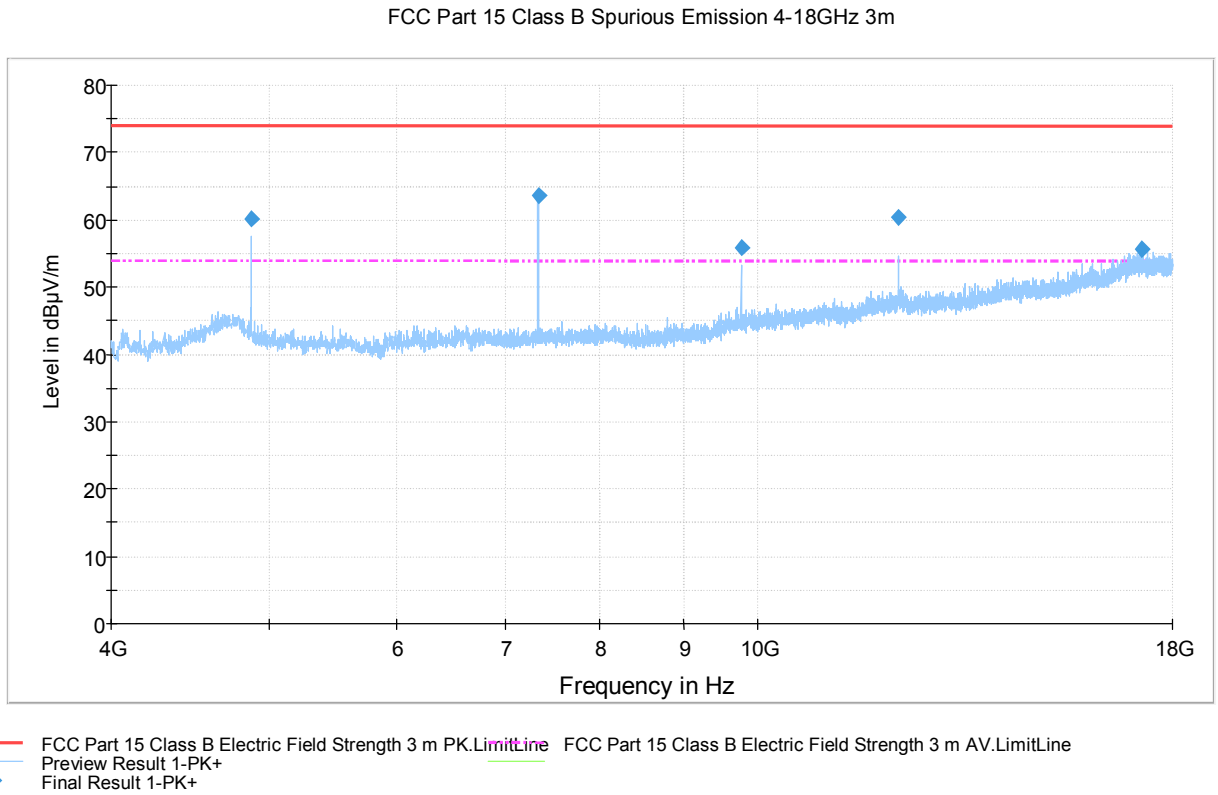



**Figure 12.** Measured curve with peak detector. Channel Mid.

### 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) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 4884.200000 | 60.1 | 1000.0 | 1000.000 | 146.0 | V | 2.0 | 13.8 | 73.9 | |
| 7326.200000 | 63.6 | 1000.0 | 1000.000 | 105.0 | V | 206.0 | 10.3 | 73.9 | |
| 9768.400000 | 55.9 | 1000.0 | 1000.000 | 100.0 | V | 139.0 | 18.0 | 73.9 | |
| 12210.400000 | 60.4 | 1000.0 | 1000.000 | 146.0 | V | 187.0 | 13.5 | 73.9 | |
| 17252.800000 | 55.6 | 1000.0 | 1000.000 | 298.0 | H | 15.0 | 18.3 | 73.9 | |

**Table 15.** Final Average results.

| Frequency (MHz) | Average (dBµV/m) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|
| 4884.200000 | 26.1 | 27.8 | 53.9 | |
| 7326.200000 | 29.6 | 24.3 | 53.9 | |
| 9768.400000 | 21.9 | 32 | 53.9 | |
| 12210.400000 | 26.4 | 27.5 | 53.9 | |
| 17252.800000 | 21.6 | 32.3 | 53.9 | |

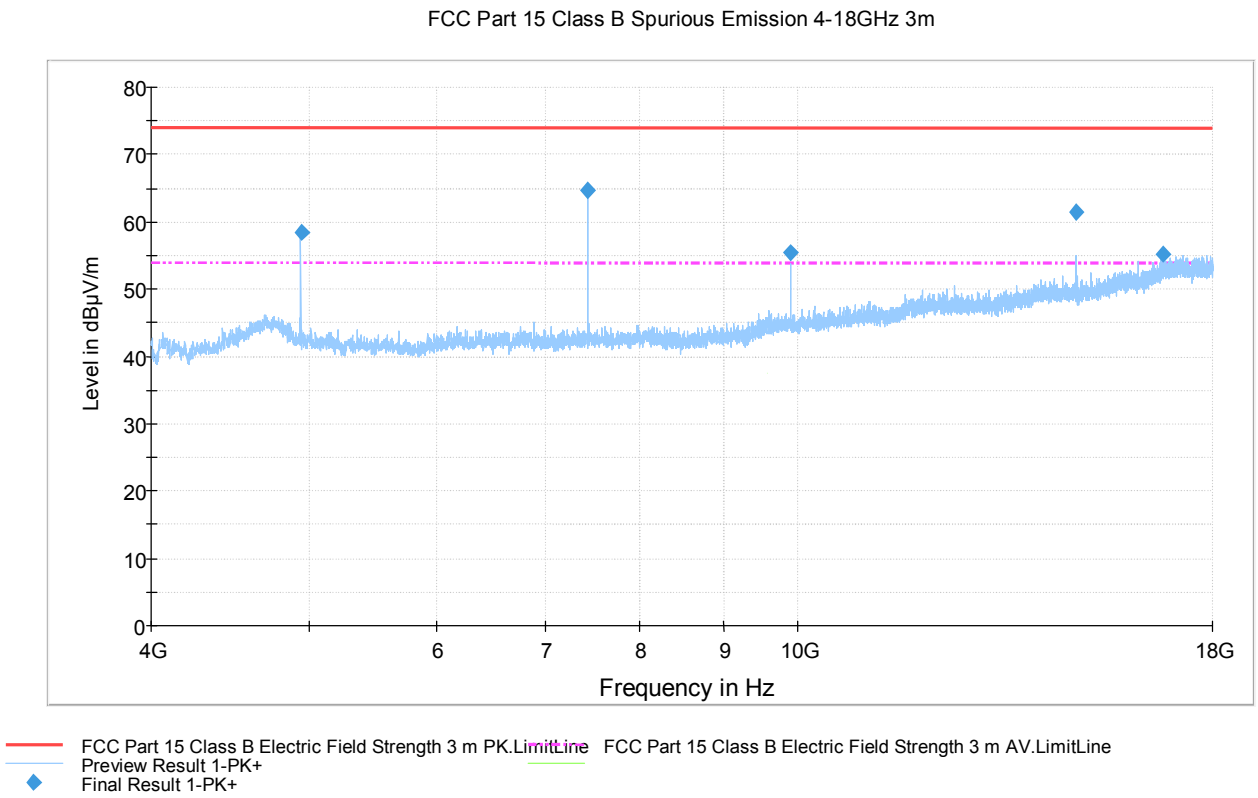



**Figure 13.** Measured curve with peak- detector. Channel High.

**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 |
|---|---|---|---|---|---|---|---|---|---|
| 4948.200000 | 58.4 | 1000.0 | 1000.000 | 154.0 | V | -5.0 | 15.5 | 73.9 | |
| 7422.200000 | 64.7 | 1000.0 | 1000.000 | 105.0 | V | 198.0 | 9.2 | 73.9 | |
| 9896.400000 | 55.4 | 1000.0 | 1000.000 | 100.0 | V | 132.0 | 18.5 | 73.9 | |
| 14844.600000 | 61.4 | 1000.0 | 1000.000 | 130.0 | H | -4.0 | 12.5 | 73.9 | |
| 16801.200000 | 55.2 | 1000.0 | 1000.000 | 369.0 | V | 109.0 | 18.7 | 73.9 | |

**Table 17.** Final Average results.

| Frequency (MHz) | Average (dBµV/m) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|
| 4948.200000 | 24.4 | 29.5 | 53.9 | |
| 7422.200000 | 30.7 | 23.2 | 53.9 | |
| 9896.400000 | 21.4 | 32.5 | 53.9 | |
| 14844.600000 | 27.4 | 26.5 | 53.9 | |
| 16801.200000 | 21.2 | 32.7 | 53.9 | |

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

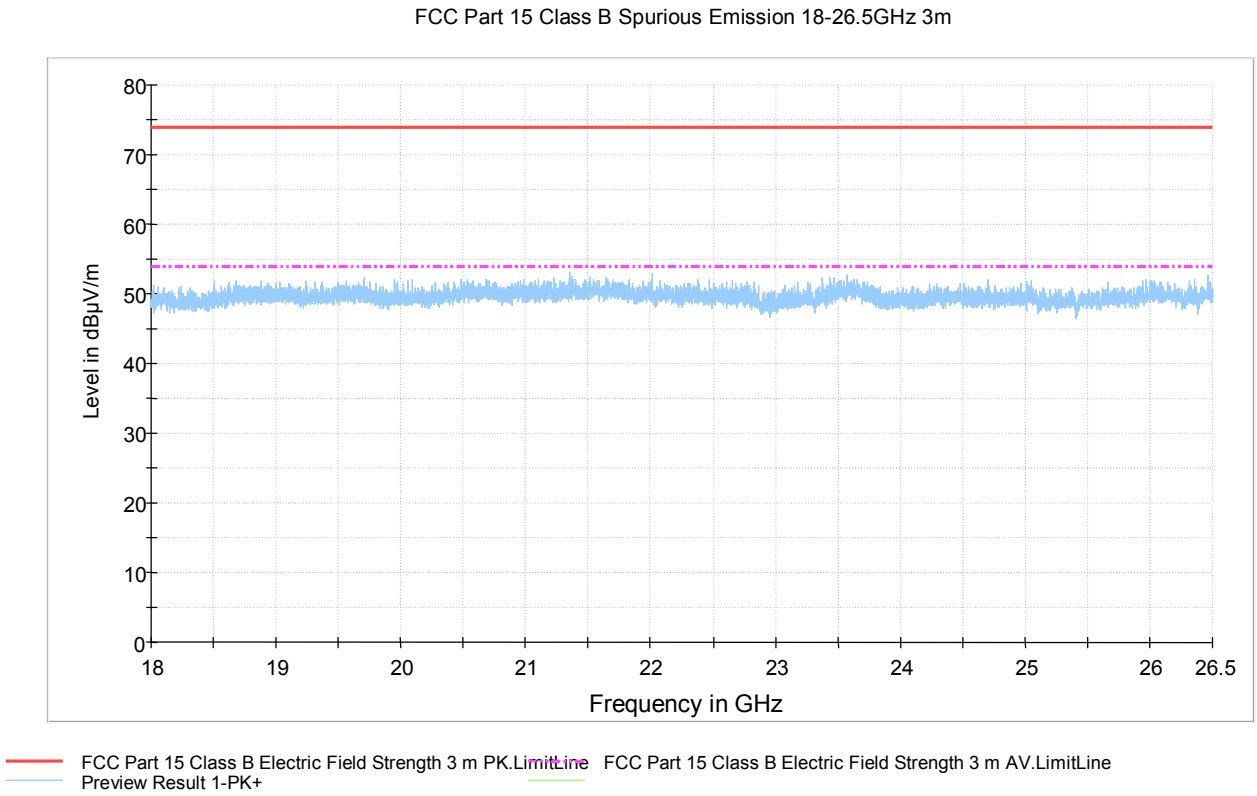



**Figure 14.** Measured curve with peak- and average detector. Channel Low.

**Final measurements from the worst frequencies**

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

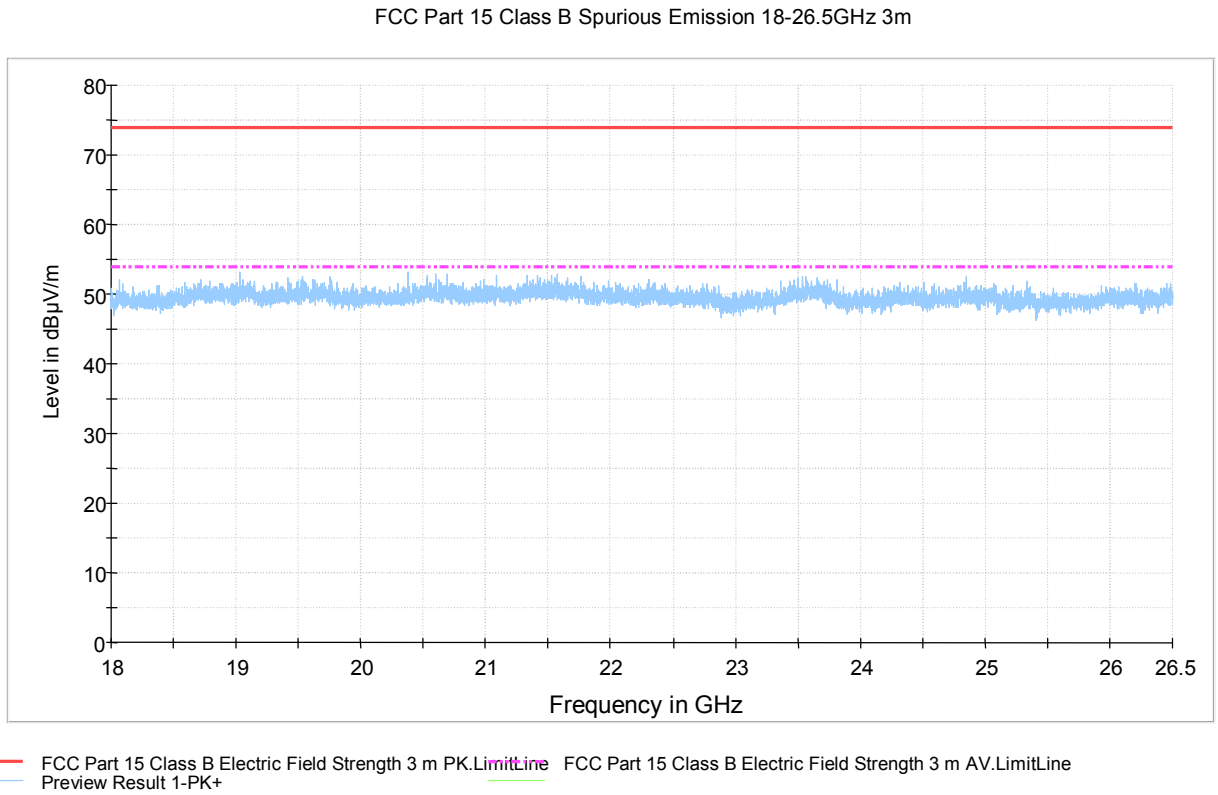



**Figure 15.** Measured curve with peak- and average detector. Channel Mid.

### Final measurements from the worst frequencies

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

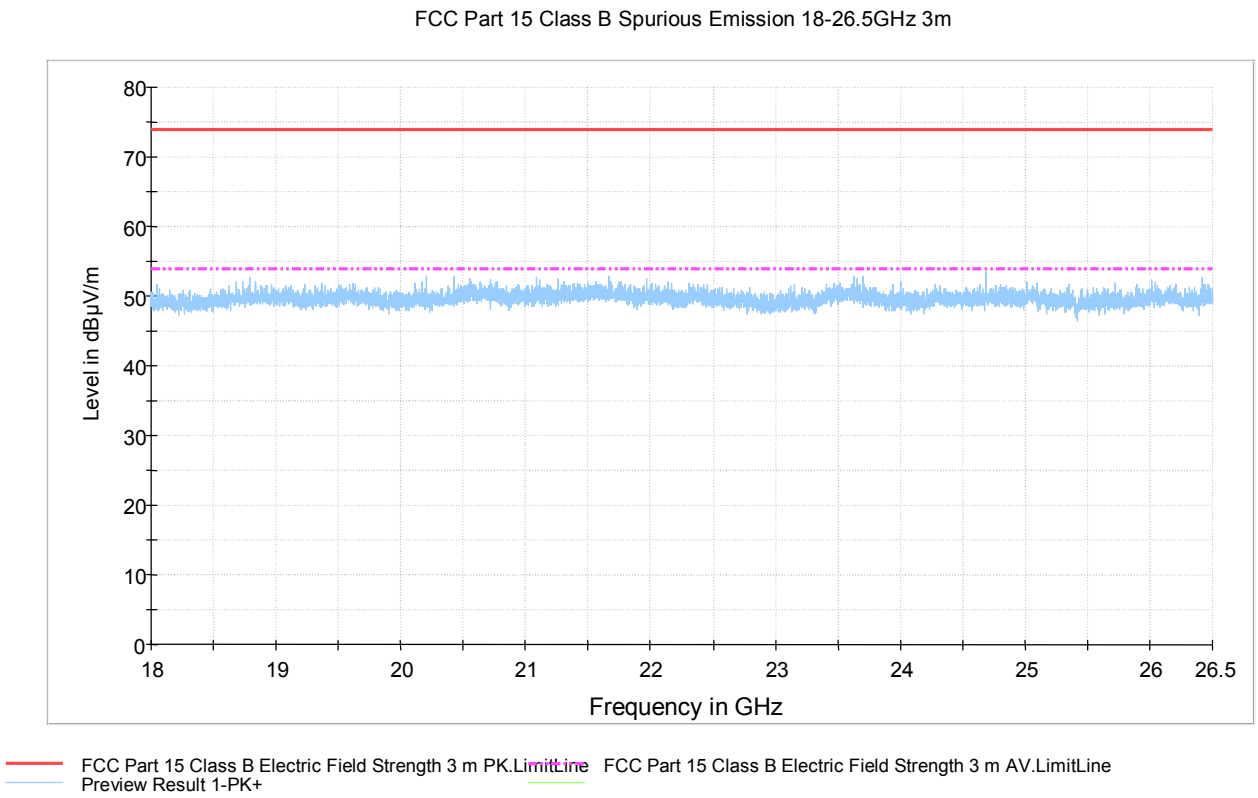



**Figure 16.** Measured curve with peak- and average detector. Channel High.

### Final measurements from the worst frequencies

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

## Radiated band edge measurement results

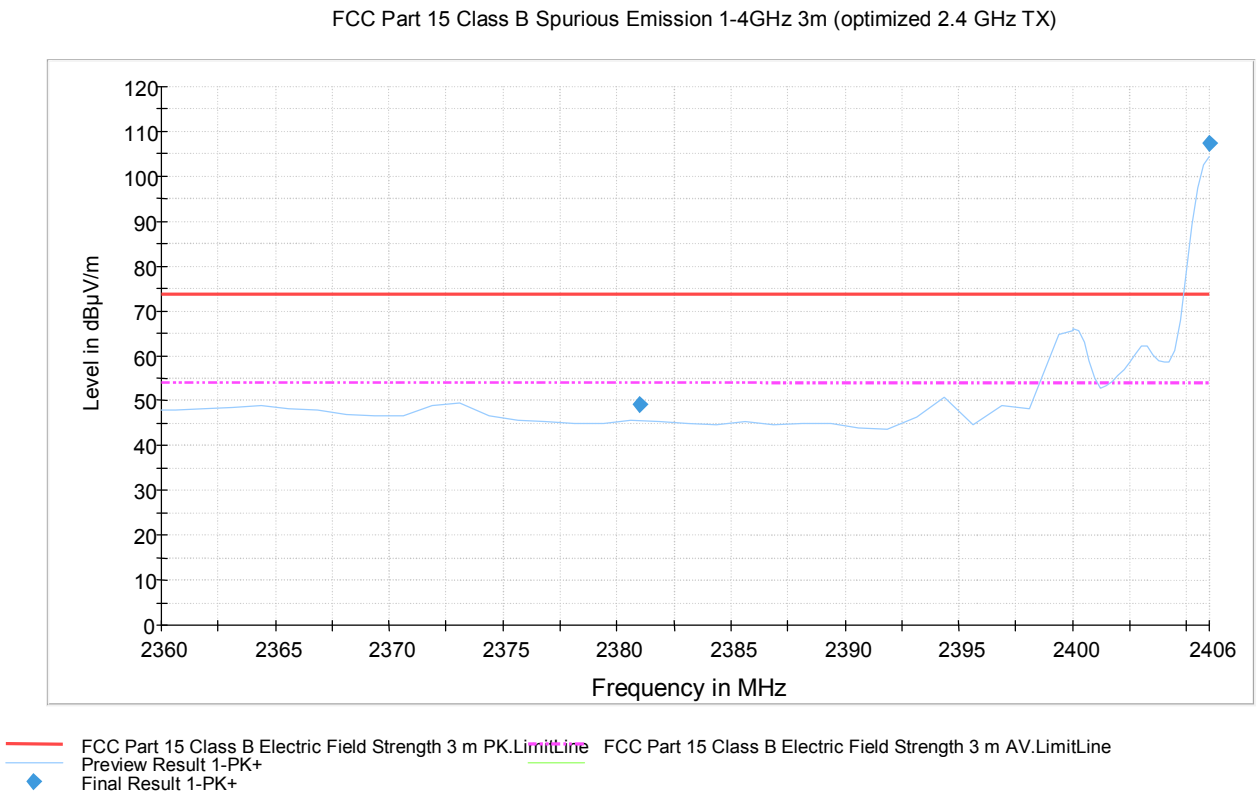



**Figure 17.** Measured curve with peak- and average detector. Lower band edge.

## 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) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 2381.000000 | 49.1 | 1000.0 | 1000.000 | 122.0 | V | 195.0 | 24.8 | 73.9 | |
| 2406.000000 | 107.4 | 1000.0 | 1000.000 | 122.0 | V | 204.0 | -33.5 | 73.9 | Carrier |

**Table 19.** Final Average results.

| Frequency (MHz) | Average (dBµV/m) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|
| 2381.000000 | 15.1 | 38.8 | 53.9 | |
| 2406.000000 | 73 | -19.9 | 53.9 | Carrier |

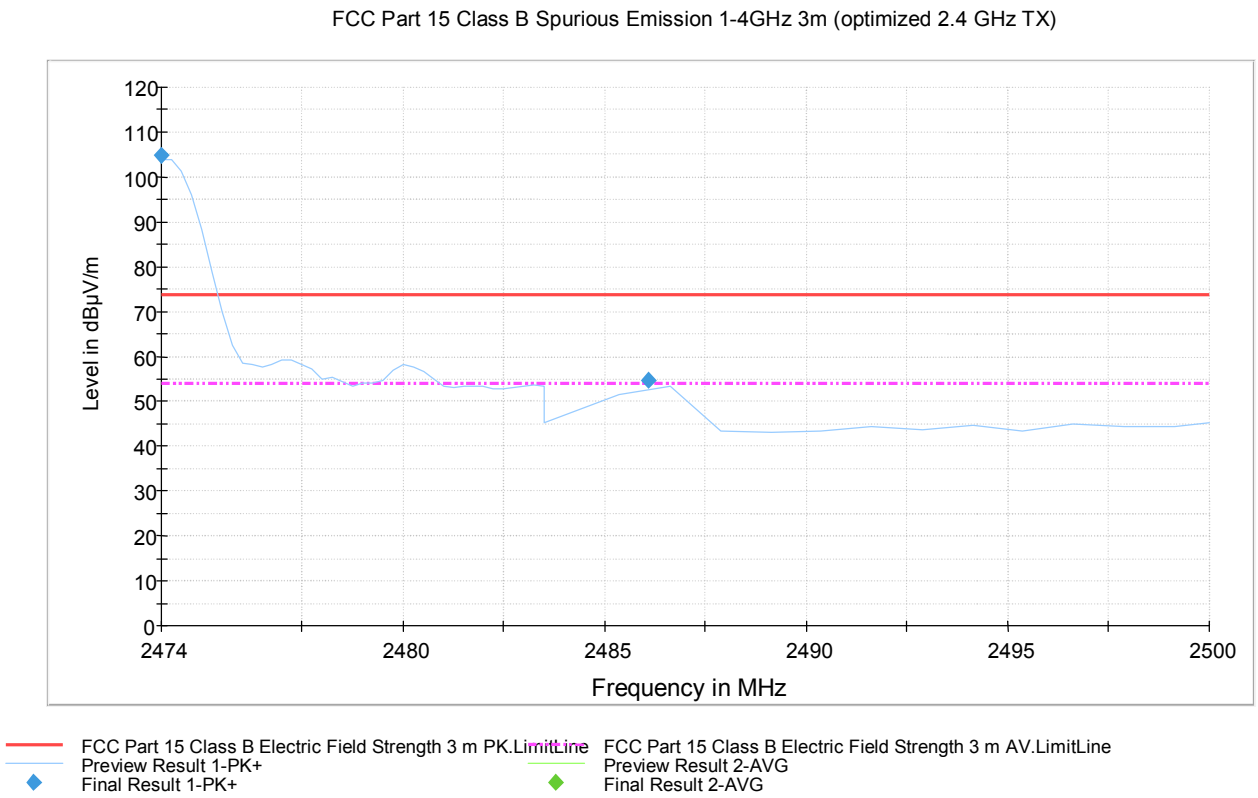



**Figure 18.** Measured curve with peak- and average detector. Upper band edge.

### 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2478.200000 | 105.7 | 1000.0 | 1000.000 | 100.0 | V | 104.0 | 4.7 | -31.8 | 73.9 | Carrier |
| 2490.100000 | 58.5 | 1000.0 | 1000.000 | 122.0 | V | 201.0 | 4.8 | 15.4 | 73.9 | |

**Table 21.** Final Average results.

| Frequency (MHz) | Average (dBµV/m) | Margin (dB) | Limit (dBµV/m) | Comment |
|---|---|---|---|---|
| 2478.200000 | 71.7 | -17.8 | 53.9 | Carrier |
| 2490.100000 | 24.5 | 29.4 | 53.9 | |

## Transmitter Band Edge Measurement and Conducted Spurious Emissions

| | | |
|---|---|---|
| **Standard:** | ANSI C63.10 | (2009) |
| **Tested by:** | NKO | |
| **Date:** | 6.6.2014 | |
| **Humidity:** | 48 % | |
| **Temperature:** | 24.8 °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)).

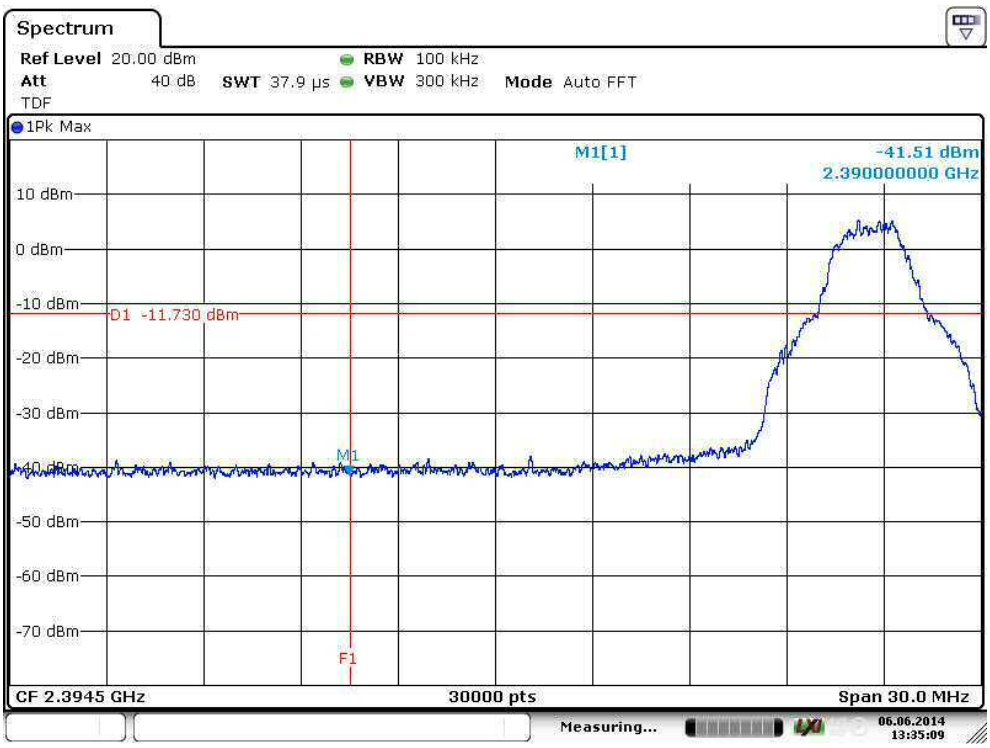
**Table 22.** Band edge attenuation.

| **Band Edge Attenuation** | |
|---|---|
| Lower Band Edge | Upper Band Edge |
| -49.78 dBc | -48.23 dBc |
| **Limit: -20dBc** | |

**Table 23.** Conducted spurious emissions.

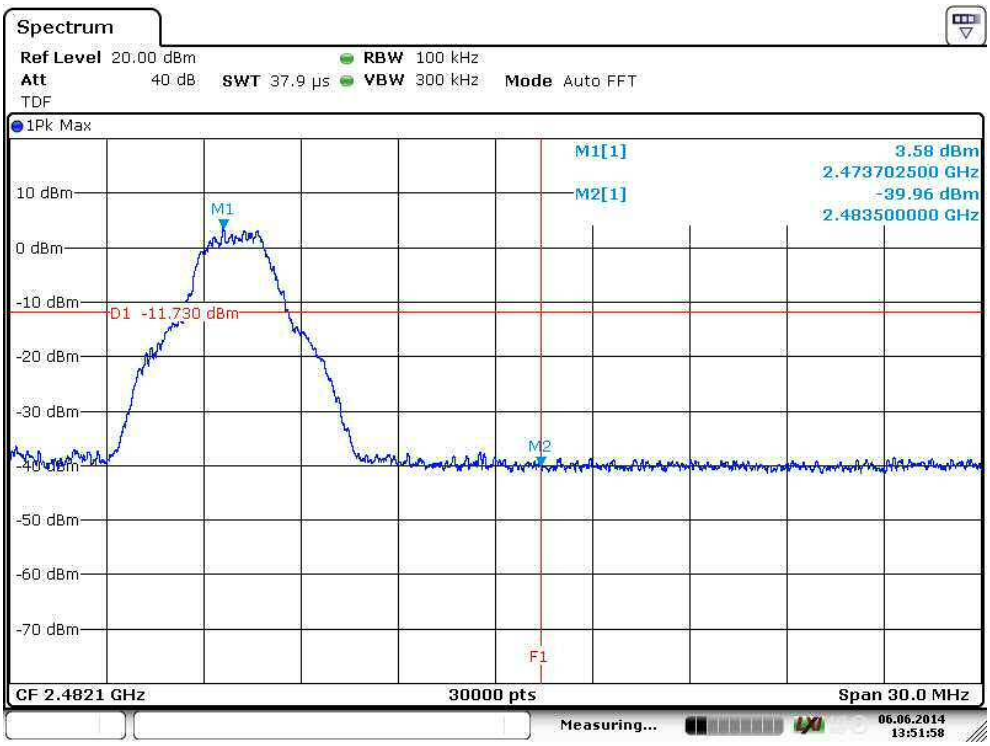
| **Conducted Spurious Emissions** | | | | |
|---|---|---|---|---|
| **Channel** | **Measured Attenuation [dB]** | **Limit [dBc]** | **Margin [dB]** | **Result** |
| Low | - | -20.0 | - | - |
| Mid | - | -20.0 | - | - |
| High | - | -20.0 | - | - |

**No significant emissions were detected close to the limit.**



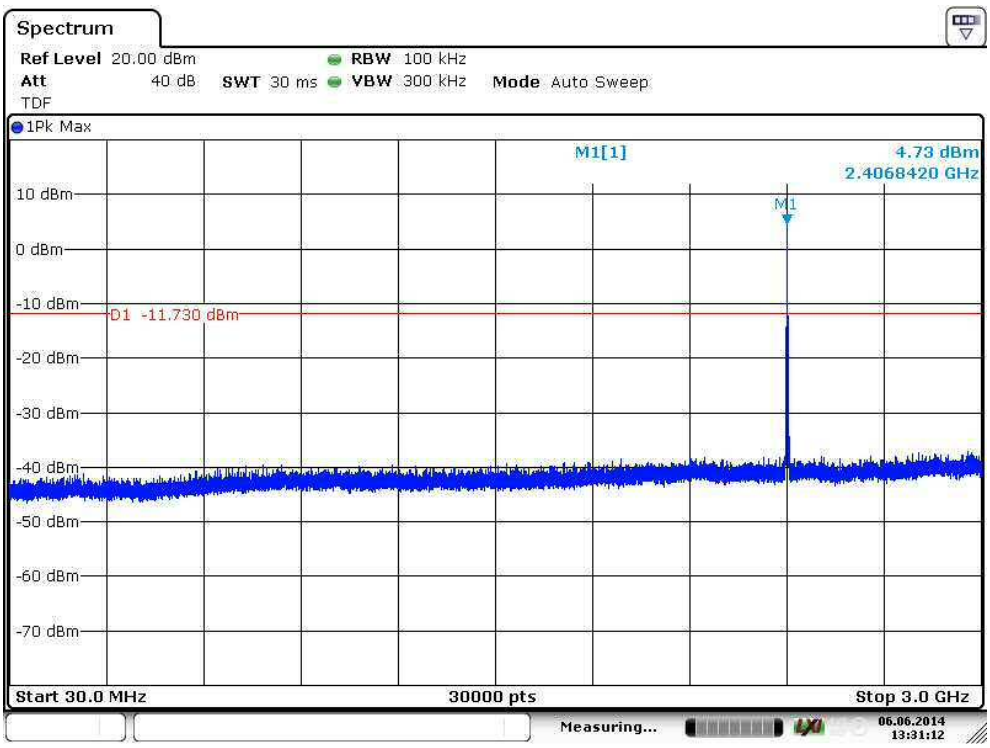

Date: 6.JUN.2014 13:35:09

**Figure 19.** Lower Band Edge.



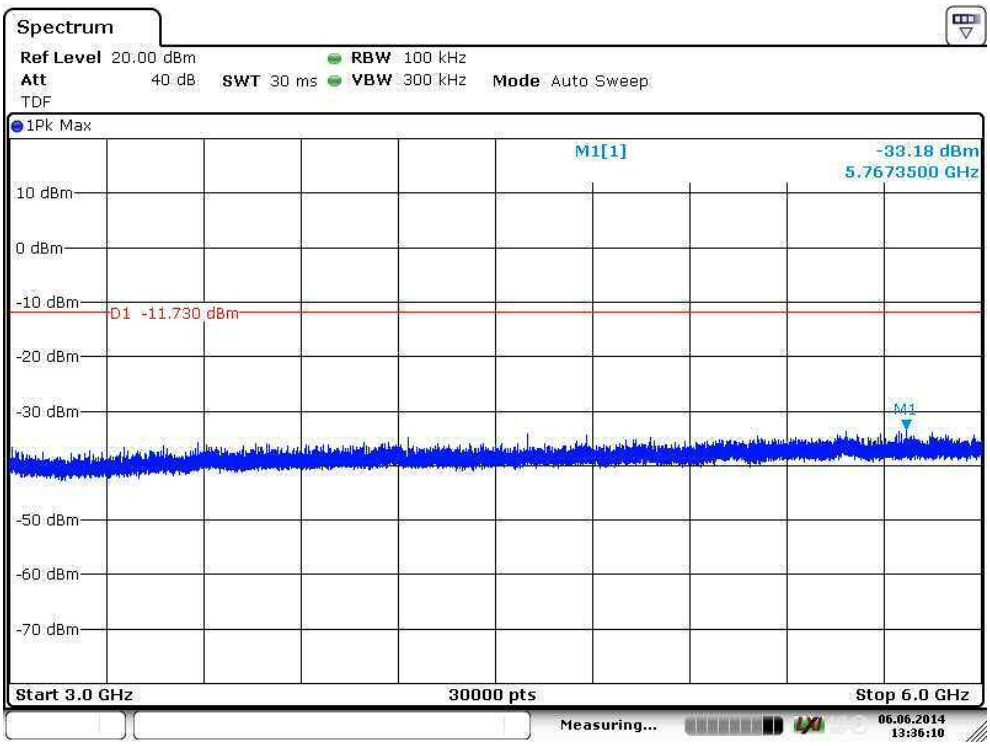

Date: 6.JUN.2014 13:51:58

**Figure 20.** Upper Band Edge.



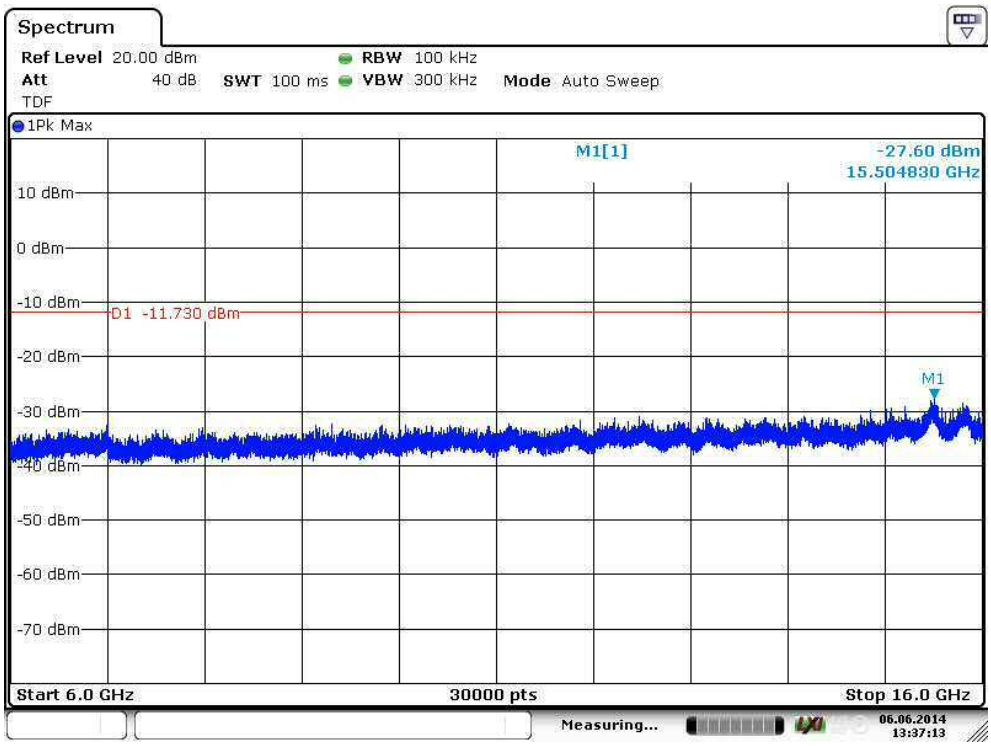

Date: 6.JUN.2014 13:31:11

**Figure 21.** Conducted Spurious Emissions 30 – 3 000 MHz. Channel Low.



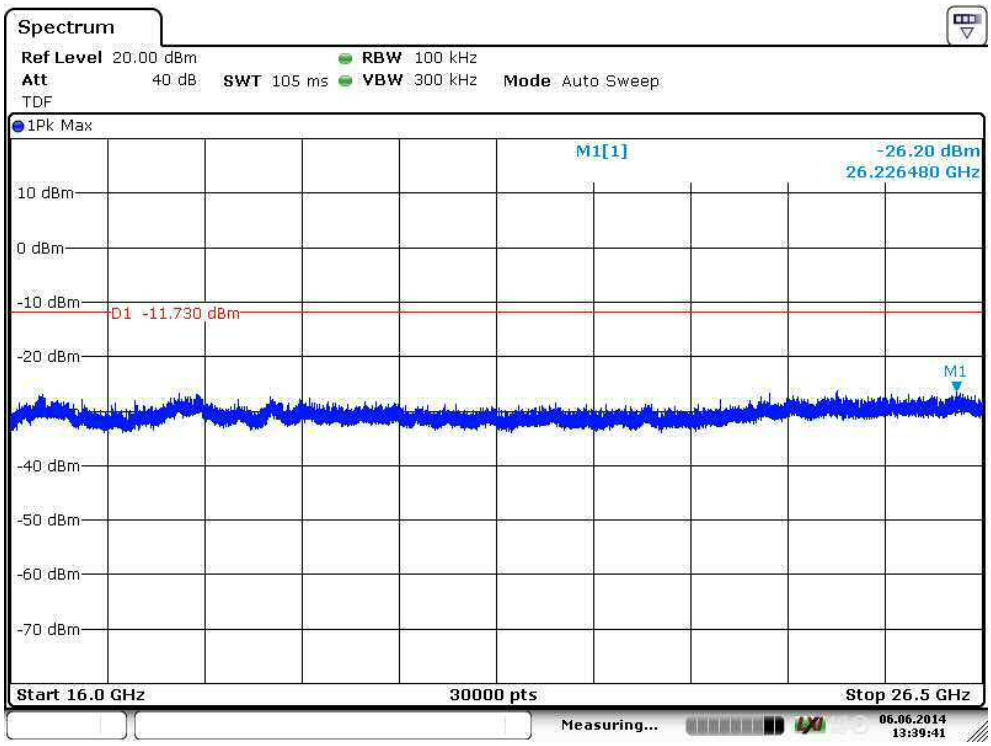

Date: 6.JUN.2014 13:36:09

**Figure 22.** Conducted Spurious Emissions 3 000 – 6 000 MHz. Channel Low.



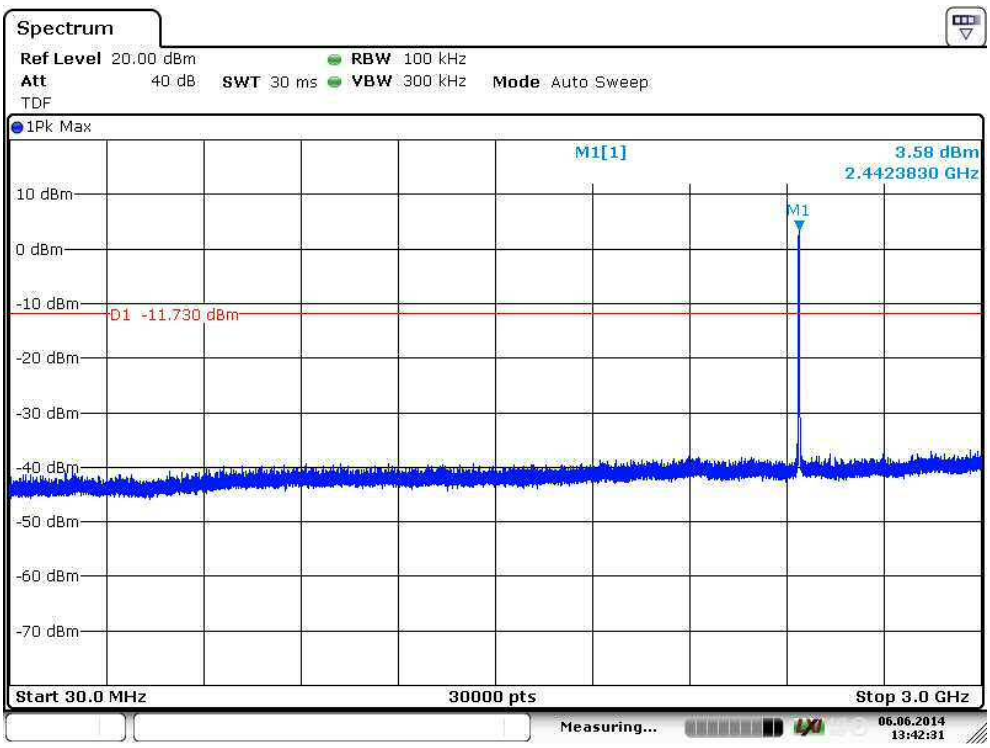

Date: 6.JUN.2014 13:37:13

**Figure 23.** Conducted Spurious Emissions 6 000 – 16 000 MHz. Channel Low.



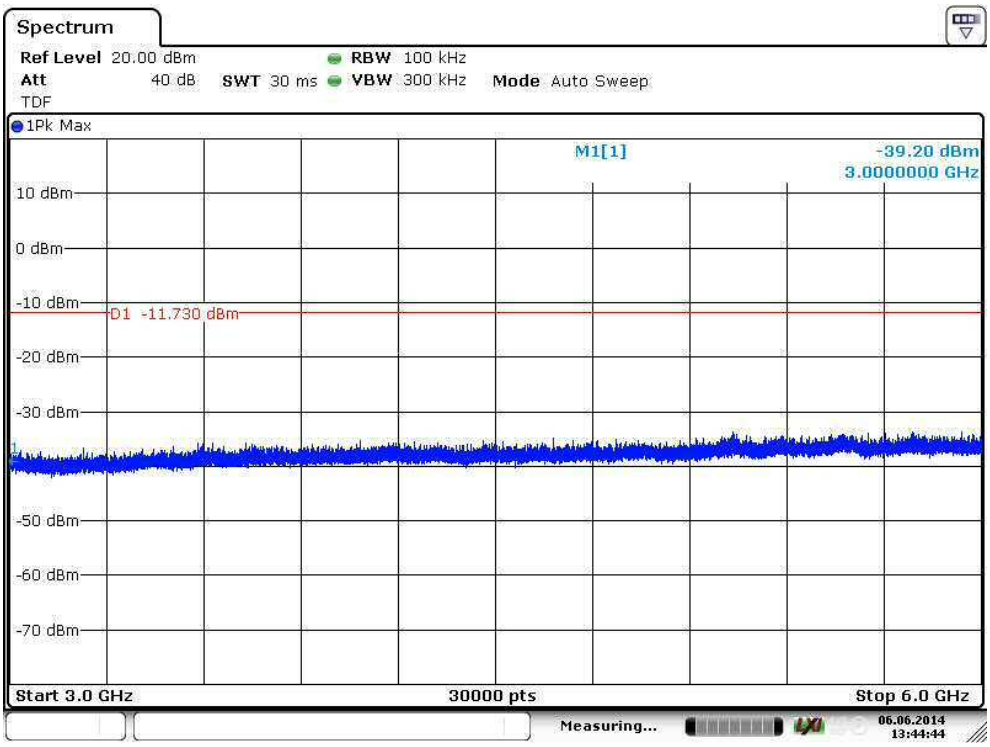

Date: 6.JUN.2014 13:39:40

**Figure 24.** Conducted Spurious Emissions 16 000 – 26 500 MHz. Channel Low.



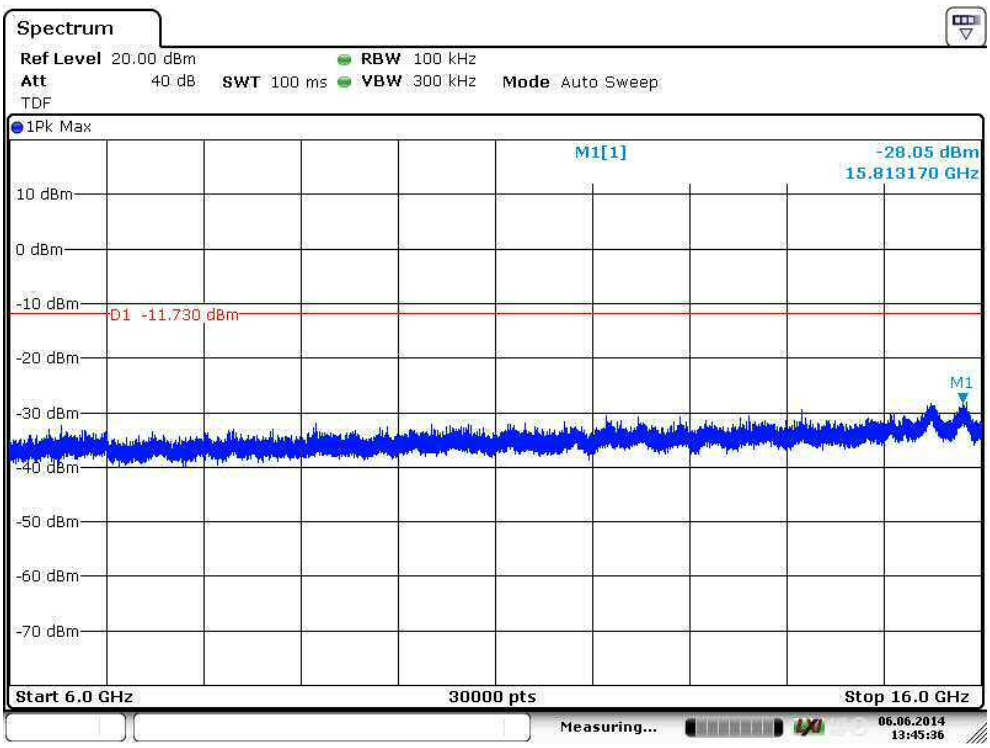

Date: 6.JUN.2014 13:42:32

**Figure 25.** Conducted Spurious Emissions 30 – 3 000 MHz. Channel Mid.



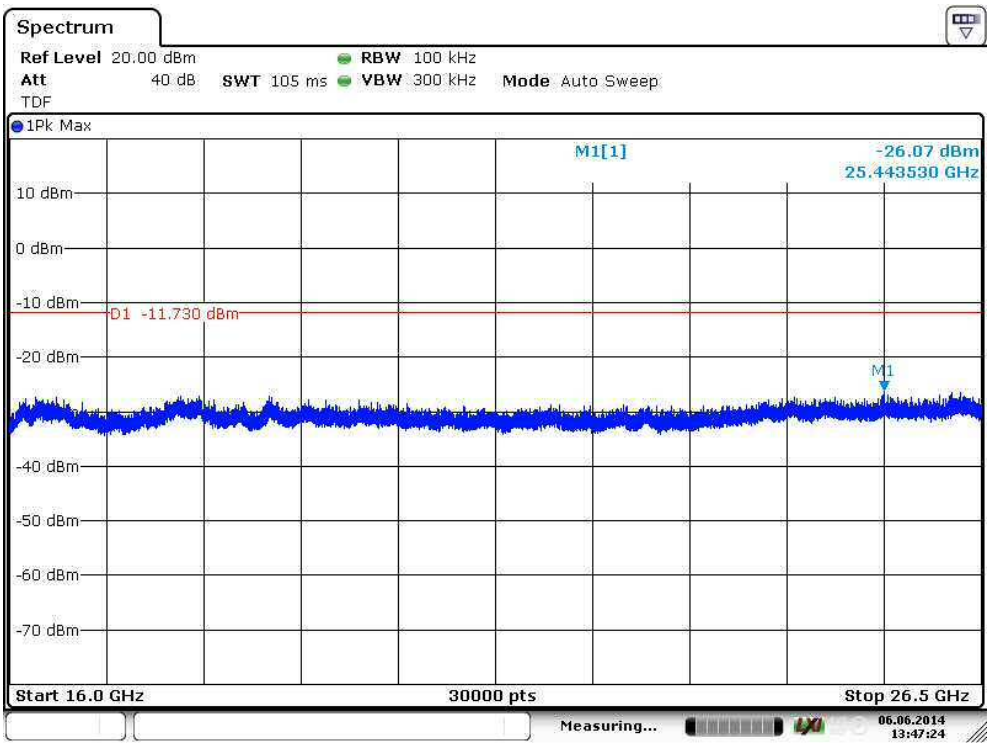

Date: 6.JUN.2014 13:44:45

**Figure 26.** Conducted Spurious Emissions 3 000 – 6 000 MHz. Channel Mid.



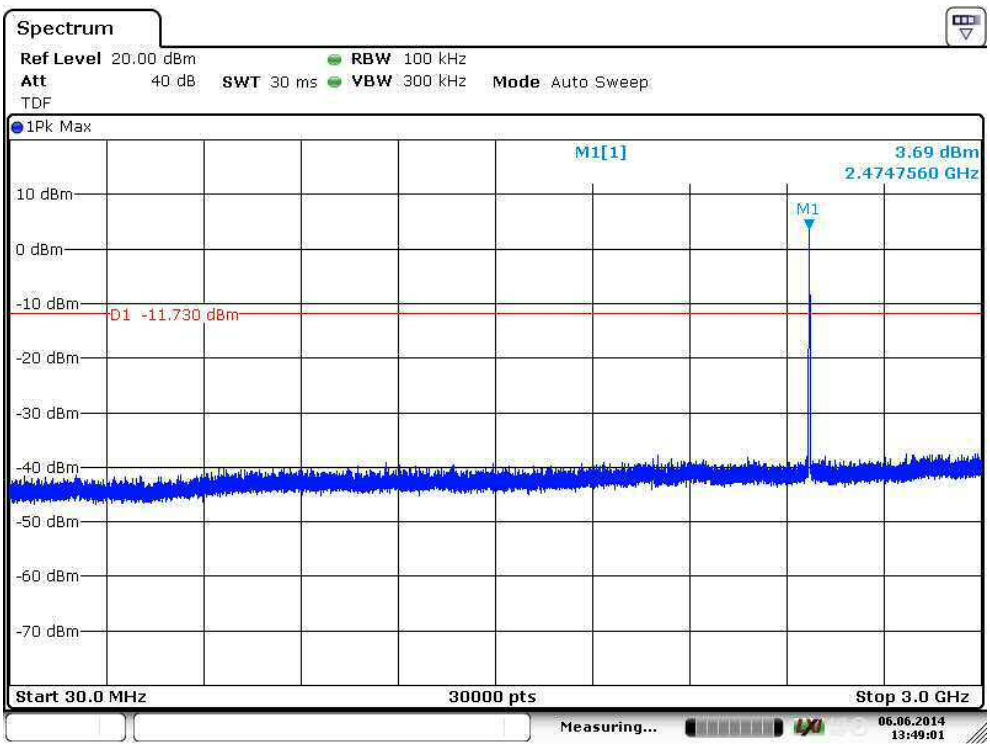

Date: 6.JUN.2014 13:45:36

**Figure 27.** Conducted Spurious Emissions 6 000 – 16 000 MHz. Channel Mid.



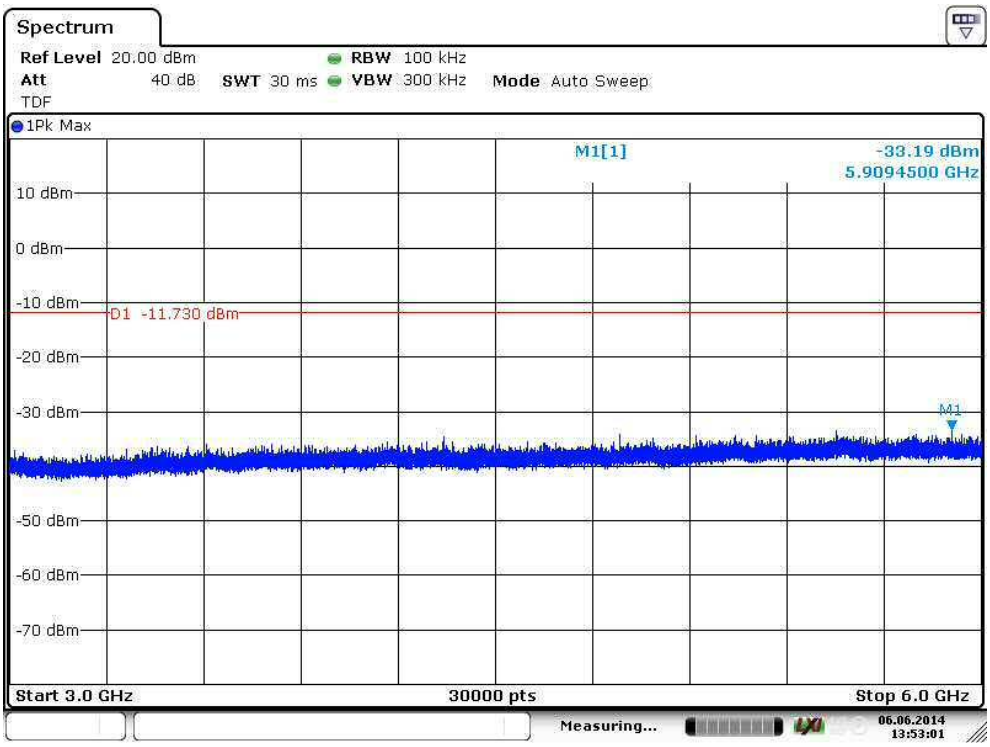

Date: 6.JUN.2014 13:47:24

**Figure 28.** Conducted Spurious Emissions 16 000 – 26 500 MHz. Channel Mid.



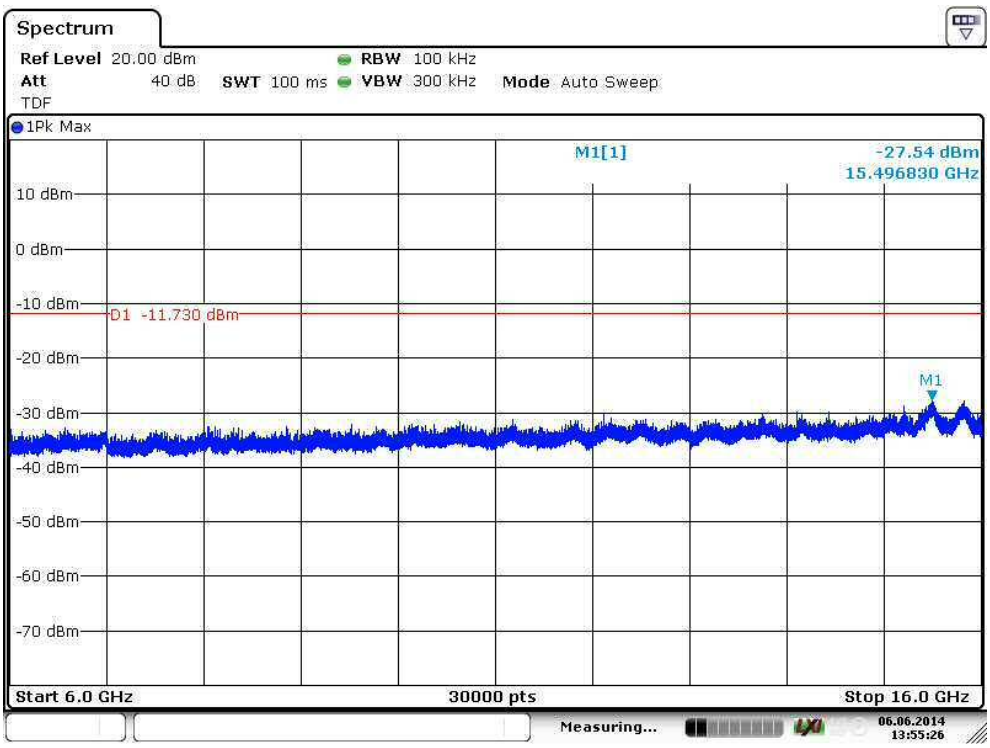

Date: 6.JUN.2014 13:49:00

**Figure 29.** Conducted Spurious Emissions 30 – 3 000 MHz. Channel High.



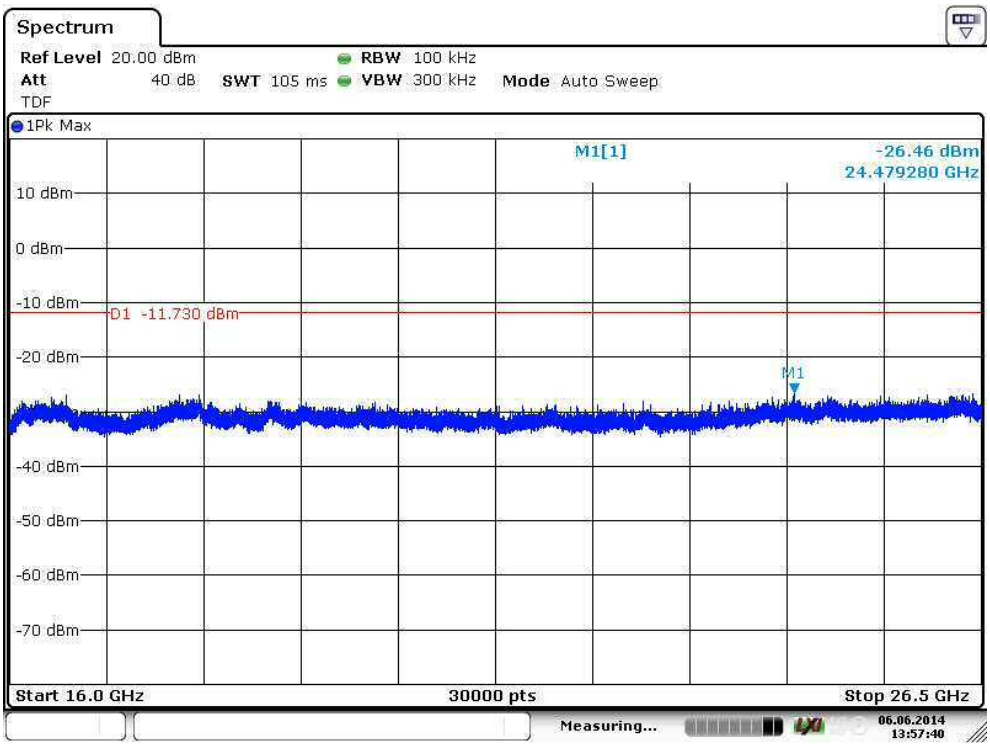

Date: 6.JUN.2014 13:53:00

**Figure 30.** Conducted Spurious Emissions 3 000 – 6 000 MHz. Channel High.




Date: 6.JUN.2014 13:55:26

**Figure 31.** Conducted Spurious Emissions 6 000 – 16 000 MHz. Channel High.




Date: 6.JUN.2014 13:57:40

**Figure 32.** 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:** | 6.6.2014 | |
| **Humidity:** | 48 % | |
| **Temperature:** | 24.8 °C | |

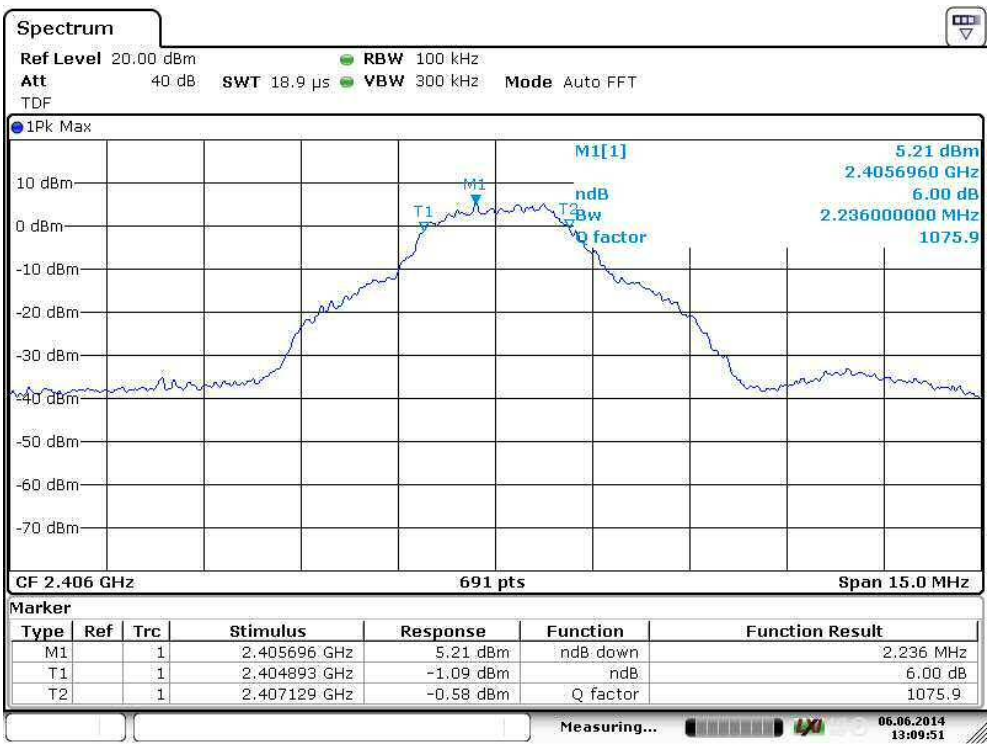
**FCC Rule: 15.247(a)(2)**
**RSS-210 A8.2**

**Results:**

**Table 24.** 6 dB bandwidth test results.

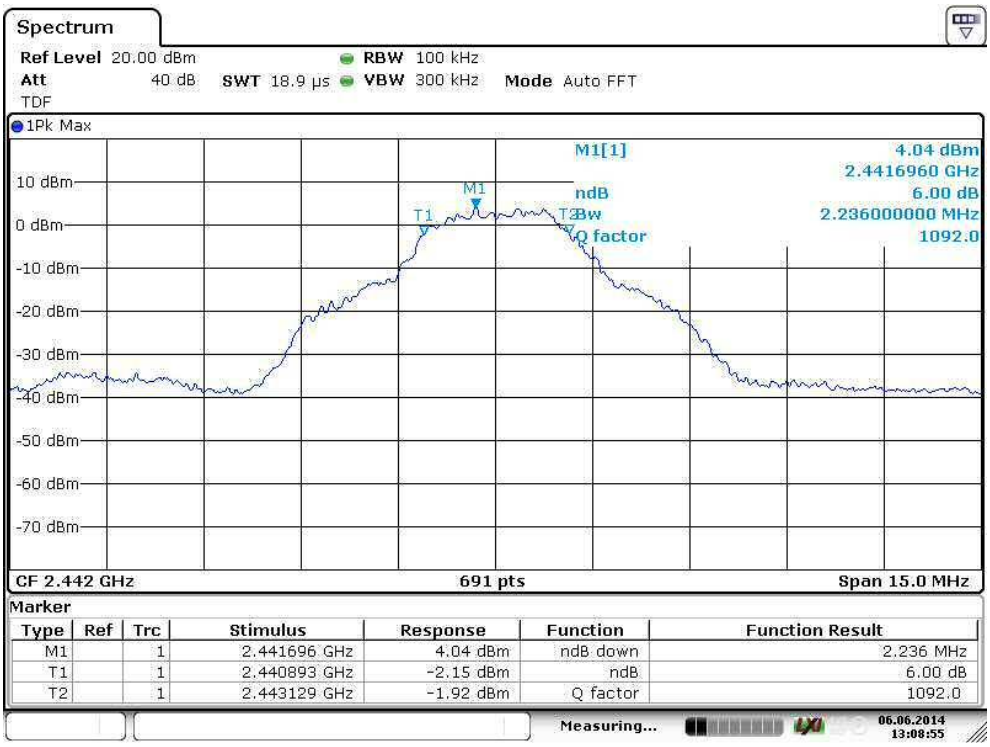
| Channel | 6 dB BW [kHz] | Minimum limit [kHz] |
|---|---|---|
| Low | 2360.0 | 500 |
| Mid | 2236.0 | |
| High | 2236.0 | |

## 6 dB Bandwidth of the Channel




Date: 6.JUN.2014 13:09:51

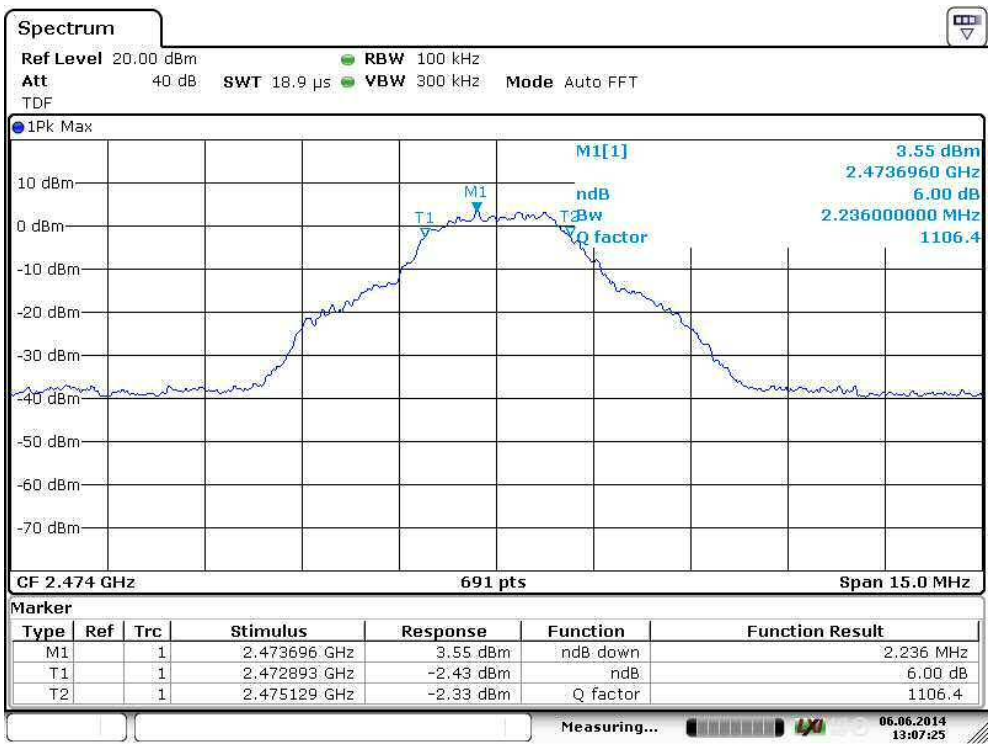
**Figure 33.** 6 dB bandwidth of the channel Low.




Date: 6.JUN.2014 13:08:55

**Figure 34.** 6 dB bandwidth of the channel Mid.

## 6 dB Bandwidth of the Channel




Date: 6.JUN.2014 13:07:26

**Figure 35.** 6 dB bandwidth of the channel High.

## Power Spectral Density

| | | |
|---|---|---|
| **Standard:** | ANSI C63.10 | (2009) |
| **Tested by:** | NKO | |
| **Date:** | 6.6.2014 | |
| **Humidity:** | 48% | |
| **Temperature:** | 24.8°C | |

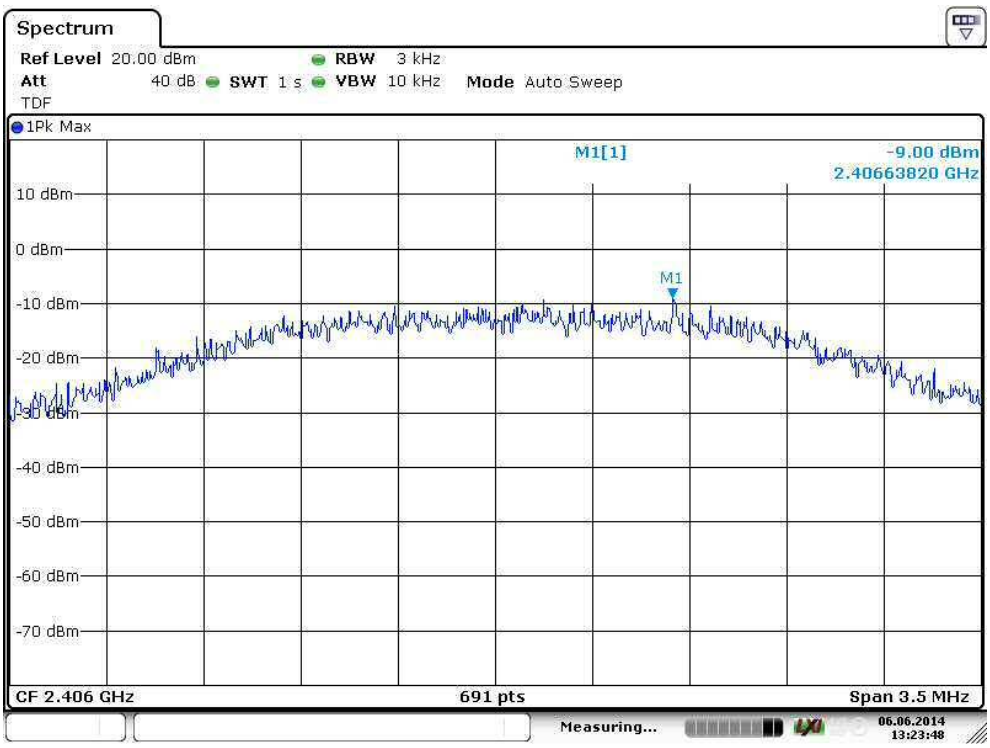
**FCC Rule: 15.247(e)**
**RSS-210 A8.2**

**Results:**

**Table 25.** Power Spectral Density test results.

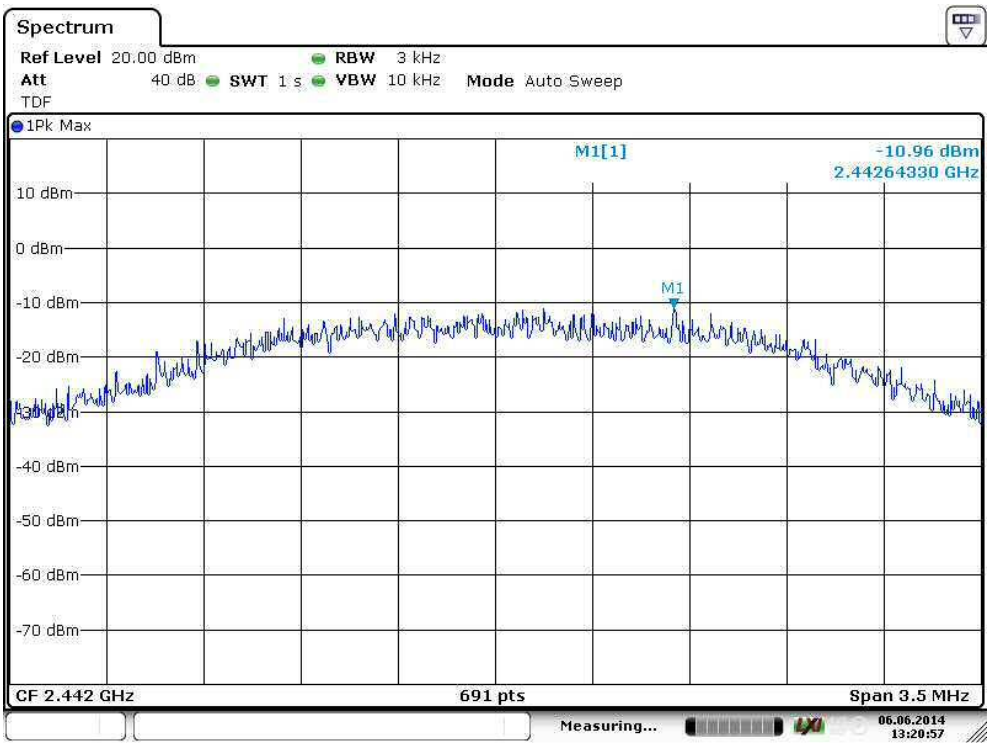
| Channel | PSD dBm/3 kHz | Maximum limit [dBm/3kHz] |
|---|---|---|
| Low | -9.00 | +8.00 |
| Mid | -10.96 | |
| High | -11.13 | |

## Power Spectral Density




Date: 6.JUN.2014 13:23:49

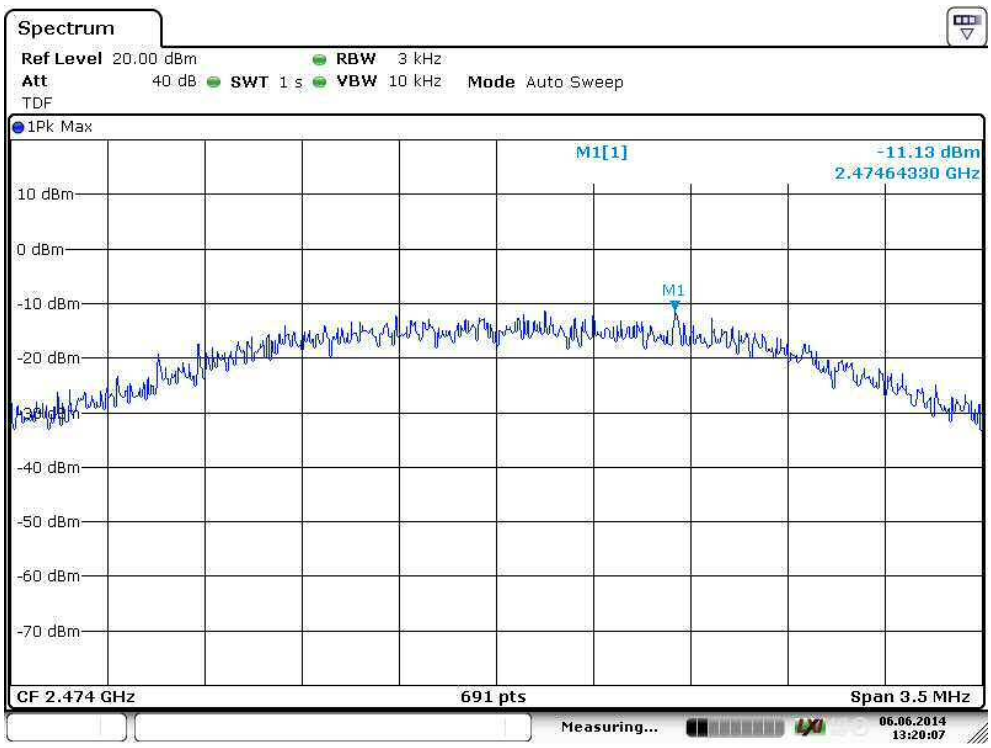
**Figure 36.** Power Spectral Density of the channel Low.




Date: 6.JUN.2014 13:20:57

**Figure 37.** Power Spectral Density of the channel Mid.

## Power Spectral Density




Date: 6.JUN.2014 13:20:06

**Figure 38.** Power Spectral Density of the channel High.

## 99% Occupied Bandwidth

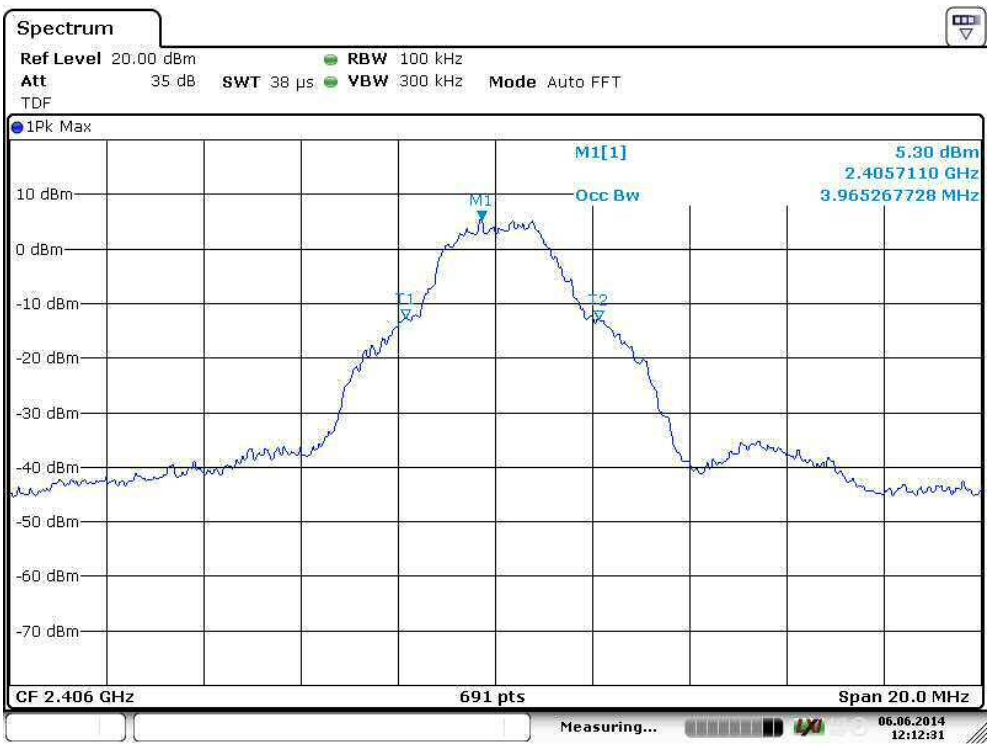
| | | |
|---|---|---|
| **Standard:** | RSS-GEN | (2010) |
| **Tested by:** | NKO | |
| **Date:** | 6.6.2014 | |
| **Humidity:** | 48% | |
| **Temperature:** | 24.8°C | |

**RSS-GEN 4.7**

**Table 26.** 99 % OBW test results.

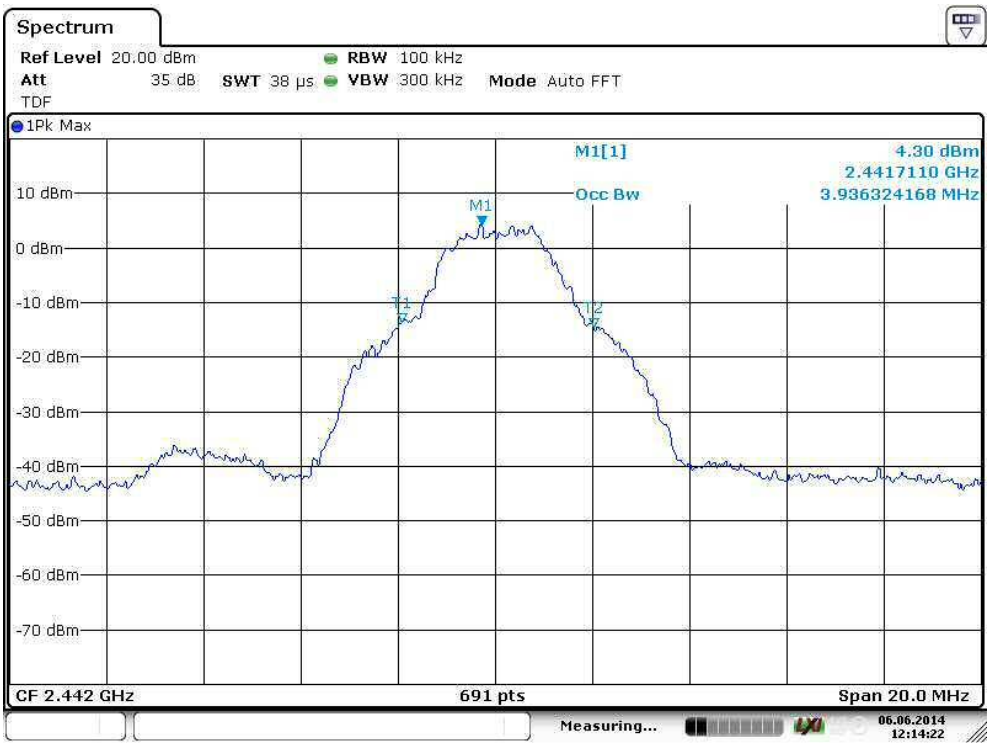
| Channel | Limit | 99 % BW [MHz] | Result |
|---|---|---|---|
| Low | - | 3.965267728 | PASS |
| Mid | - | 3.936324168 | PASS |
| High | - | 3.936324168 | PASS |

## 99 % Occupied Bandwidth




Date: 6.JUN.2014 12:12:30

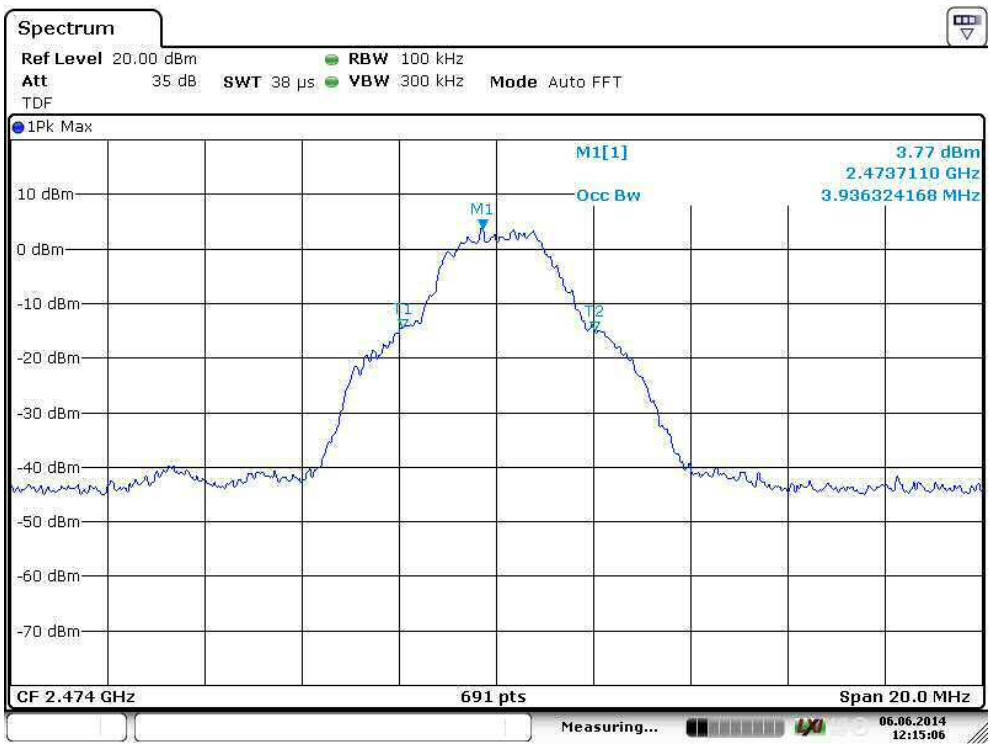
**Figure 39.** 99 % OBW. Channel Low.




Date: 6.JUN.2014 12:14:21

**Figure 40.** 99 % OBW. Channel Mid.

## 99 % Occupied Bandwidth




Date: 6.JUN.2014 12:15:06

**Figure 41.** 99 % OBW. Channel High.

## Time Of Occupancy (Dwell Time)

| | | |
|---|---|---|
| **Standard:** | ANSI C63.10 | (2009) |
| **Tested by:** | NKO | |
| **Date:** | 14.5.2014 | |
| **Humidity:** | 22 % | |
| **Temperature:** | 21.5 °C | |
| **Measurement uncertainty** | ± 2.87 dB | Level of confidence 95 % (k = 2) |

**FCC Rule: 15.247(a)**

**Table 27.** Dwell time of the lowest channel.

| Channel | Dwell Time [ms] | Tx off [ms] | Comment |
|---|---|---|---|
| Low | 0.148522 | 7.3228 | |

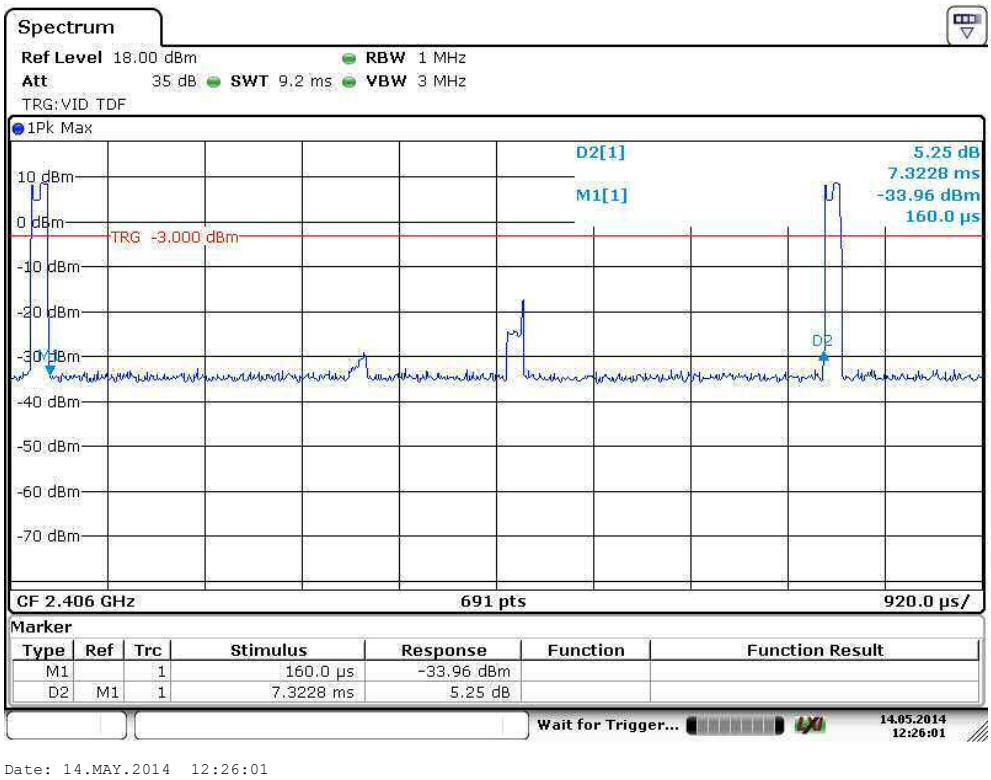
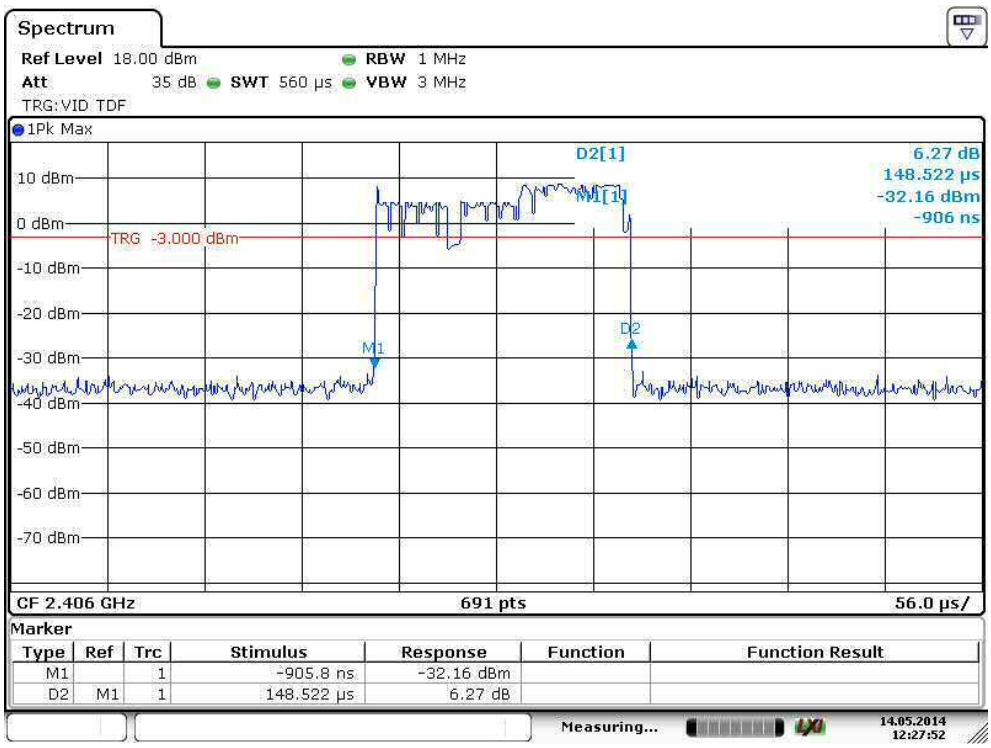



**Figure 42.** Tx off time Channel Low.

## 99 % Occupied Bandwidth




Date: 14.MAY.2014 12:27:52

**Figure 43.** Dwell Time Channel Low

## List of test equipments

| Manufacturer | Type | Serial no | Inv. no |
|---|---|---|---|
| **ROHDE & SCHWARZ** | | | |
| Spectrum Analyzer | FSV 40 | 101068 | 9093 |
| EMI Test receiver | ESU 26 | 100185 | 8453 |
| Test software | EMC32 | - | - |
| **DAVIS** | | | |
| Weather station | Vantage Pro | - | 5297 |
| **ETS-LINDGREN** | | | |
| Antenna (18 GHz – 26 GHz) | 3160-09 | 28535 | 7294 |
| **EMCO** | | | |
| Antenna (1 - 18 GHz) | 3117 | 29617 | 7293 |
| **SCHWARZBECK** | | | |
| Antenna (30 MHz - 1 GHz) | VULB 9168 | 9168-503 | 8911 |
| **HEWLETT- PACKARD** | | | |
| Microwave amplifier | 83017A | - | 5226 |
| **HUBER-+ SUHNER** | | | |
| Attenuator 10dB | 6810.17B | - | - |
| **DEISEL** | | | |
| Antenna mast | MA 240 | 240/455 | 7896 |
| Turntable | DS 430 | - | - |
| **WAINWRIGHT** | | | |
| High Pass Filter | WHKX | 10 | 8267 |

All used measurement equipment was calibrated (if required).