SGS

Test Report

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

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

Equipment Under Test:	PTT Voice Responder
Model:	APTT1
Trade Mark:	AINA Wireless
Customer / Manufacturer:	Paumax Oy Tehdaskatu 6 / CO HubSalo FI-24100, SALO FINLAND
FCC Rule Part:	15.247: 2015
IC Rule Part:	RSS-247, Issue 1, 2015 RSS-GEN Issue 4, 2014
KDB:	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems DA 00-705 (March 30, 2000)

Date: 6 June 2016

Issued by:

Rauno Repo
Testing Engineer

Date: 6 June 2016

Checked by:

Janne Nyman
Compliance Specialist

Table of Contents

Equipment Under Test (EUT)

PTT Voice Responder	
Model:	APTT1
Trade Mark:	AINA Wireless
Serial Number:	-
FCC ID:	2AH78-APTT1
IC:	21419-APTT1

The equipment under test (EUT) is a wireless remote speaker microphone system with classic Bluetooth and Bluetooth Low Energy. Audio signal is transferred using the classic Bluetooth system and Bluetooth Low Energy is used to transfer push button information, and also control indication leds.

According to manufacturer's declaration, the tested product has alternative model 12082-0800 which has slight changes in logo and software of the product. Due to small differences between two models, only APTT1 was tested.

This report contains test results of classic Bluetooth (+EDR).

Modifications incorporated in the EUT

Two samples were used with the tests. The first sample had a temporary connector for setting the BLE parameters with a PC. The other sample had also temporary antenna cables for BLE and BT antenna ports measurements.

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 :	2402 – 2480 MHz
Channels:	79
Channel separation:	1 MHz
Conducted power:	4.98 dBm
Transmission technique:	FHSS
Modulation:	GFSK, π/4 DQPSK, 8DPSK
Internal chip antenna max gain:	0.5 dBi

Power Supply

Operating voltage range: Nominal 3.7 V

The EUT is a battery operated device which can also be used with a separate AC/DC adaptor connected to the USB-port of the device.

AC/DC adaptor:

Type:	Separate AC/DC adaptor, FW7713
Rated voltage:	100 - 240 V
Rated current:	150 mA
Rated frequency:	50 / 60 Hz
Output voltage:	5 V, USB
Output current:	1000 mA

Tests were performed with AC/DC adaptor using 115V / 60 Hz.

Disclaimer

*This document is issued by the Company under its General Conditions of service accessible at **http://www.sgs.com/terms_and_conditions.htm**. attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.*

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

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
§15.207(a) / RSS-GEN 8.8	Conducted Emissions on Power Supply Lines	PASS
§15.247(b)(1) / RSS-247 5.4(2)	Maximum Peak Conducted Output Power	PASS
15.247(a)(1) / RSS-247 5.1(2)	Hopping Channel Carrier Frequency Separation	PASS
§15.247(a)(1)(iii) / RSS-247 5.1(4)	Number of Hopping Frequencies	PASS
§15.247(a)(1)(iii) / RSS-247 5.1(4)	Average Time of Occupancy of Hopping Frequency	PASS
§15.247(a)(1) / RSS-247 5.1(2)	20 dB Bandwidth	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
§15.209 / RSS-GEN 6.13	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.

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 - 30.6 dB

Following channels were used during the tests when the hopping was stopped:

Channel	Frequency / MHz
LOW (CH 1)	2402
MID (CH 40)	2441
HIGH (CH 79)	2480

Test Facility

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

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

Standard:	ANSI C63.10	(2013)
Tested by:	RRE	
Date:	1 June 2016	
Temperature:	20 °C	
Humidity:	47 % RH	
Barometric pressure:	1016 hPa	
Measurement uncertainty:	± 2.9 dB	Level of confidence 95 % (k = 2)

FCC Rule: §15.207(a)
RSS-GEN 8.8

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.

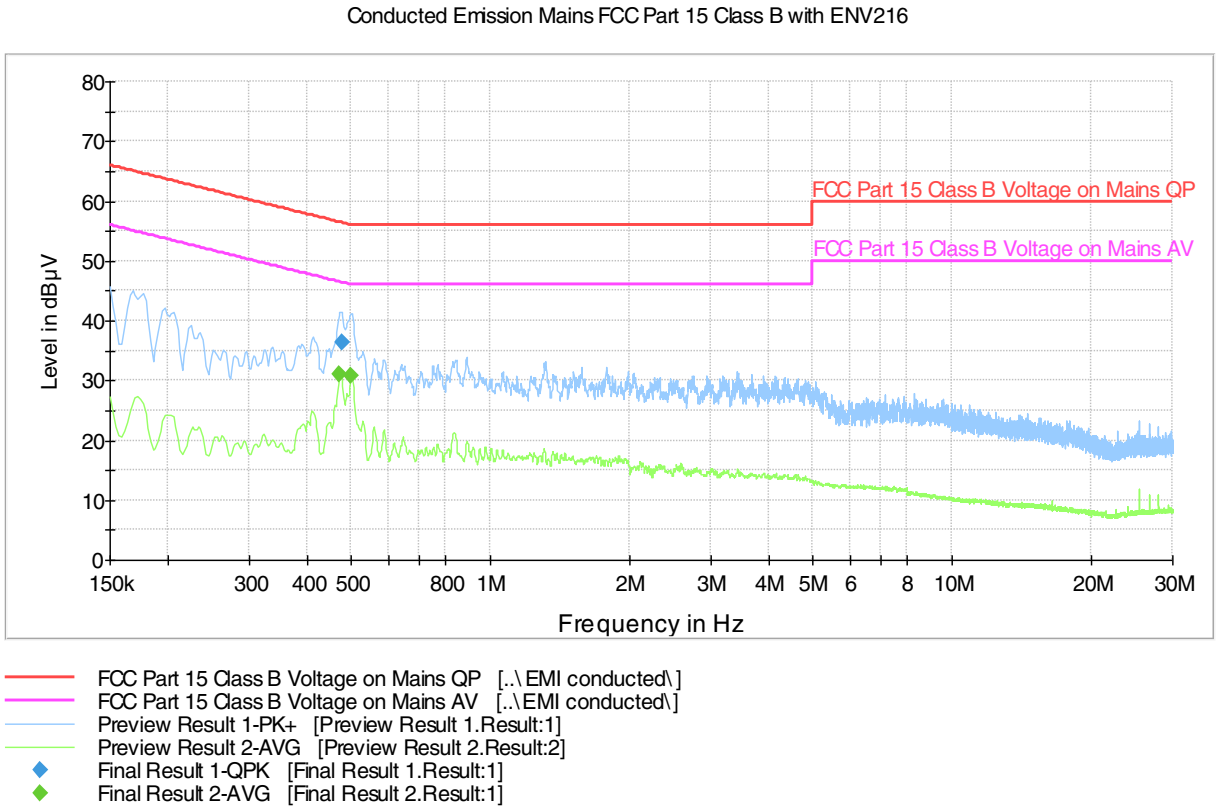


Figure 1. The measured curves with peak- and average detector

Final measurements from the worst frequencies

Table 1. Final results with a QP detector

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.477250	36.4	1000.0	9.000	L1	10.1	20.0	56.4	-

Table 2. Final results with an average detector

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.471250	31.1	1000.0	9.000	L1	10.1	15.4	46.5	-
0.499500	30.7	1000.0	9.000	L1	10.1	15.3	46.0	-

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10	(2013)
Tested by:	RRE	
Date:	2 June 2016	
Temperature:	23 °C	
Humidity:	37 % RH	
Measurement uncertainty:	± 2.87dB	Level of confidence 95 % (k = 2)

FCC Rule: §15.247(b)(1)
RSS-247: 5.4(2)

For frequency hopping systems operating in the 2400-2483.5 MHz, employing at least 75 channels limit is 1.0 Watt. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

Results:

1 Mbps

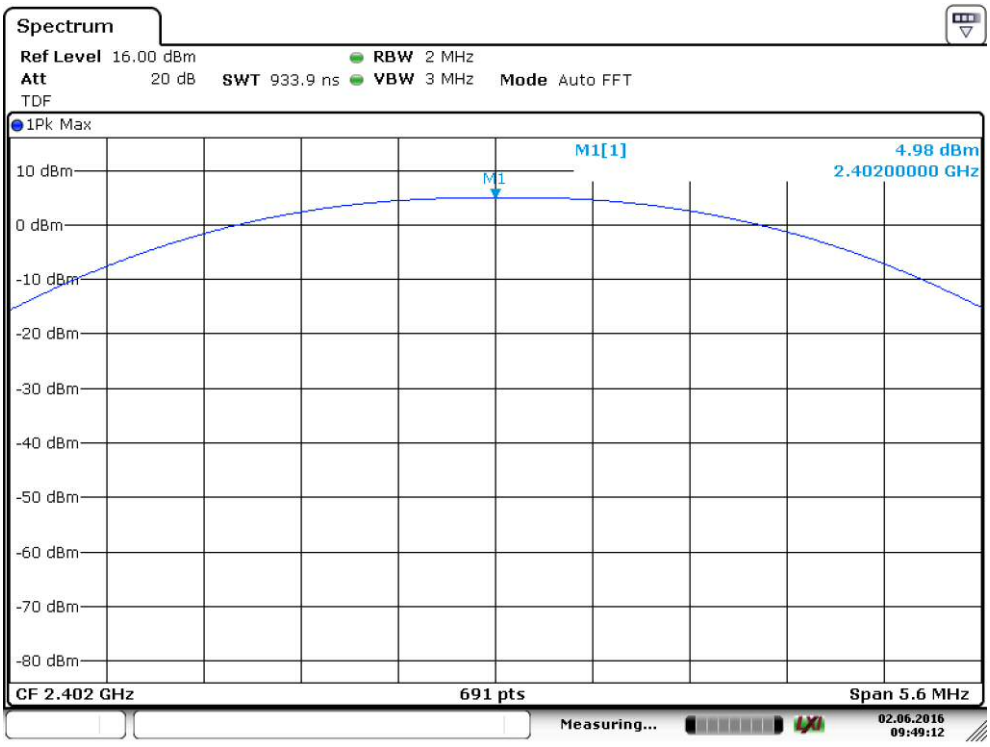
Channel	Conducted Power [dBm]	Limit [dBm]	Result
Low	4.98	30	PASS
Mid	4.82	30	PASS
High	4.31	30	PASS

2 Mbps

Channel	Conducted Power [dBm]	Limit [dBm]	Result
Low	4.28	30	PASS
Mid	4.00	30	PASS
High	3.14	30	PASS

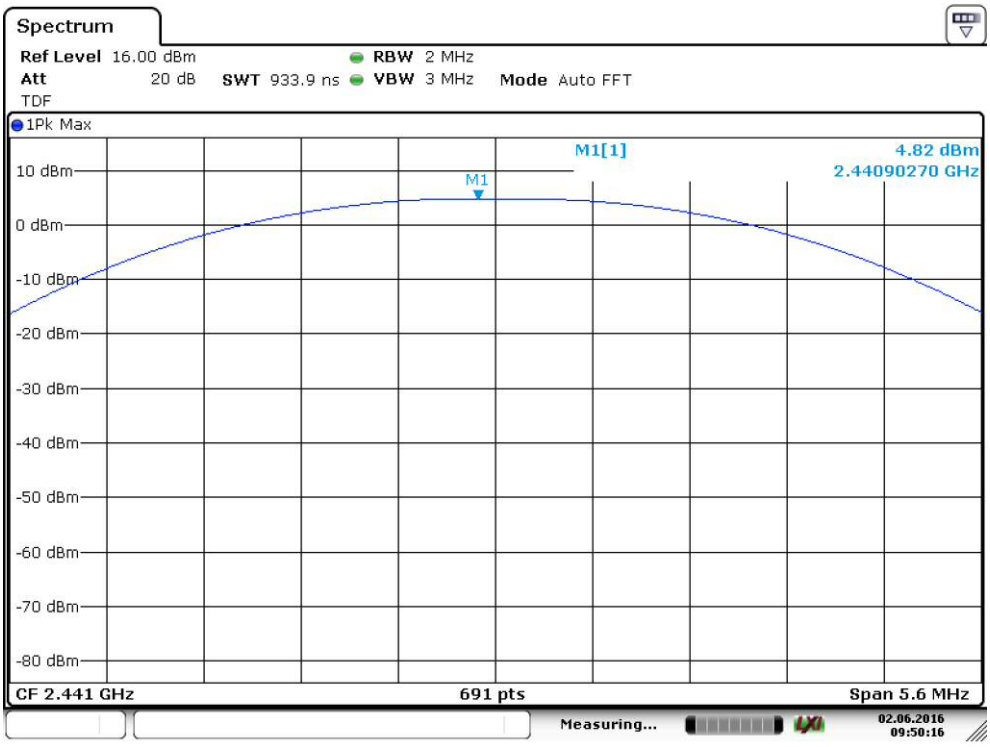
3 Mbps

Channel	Conducted Power [dBm]	Limit [dBm]	Result
Low	4.46	30	PASS
Mid	4.21	30	PASS
High	3.57	30	PASS



Date: 2.JUN.2016 09:49:12

Figure 2. 1 Mbps Channel LOW.



Date: 2.JUN.2016 09:50:16

Figure 3. 1 Mbps Channel MID.

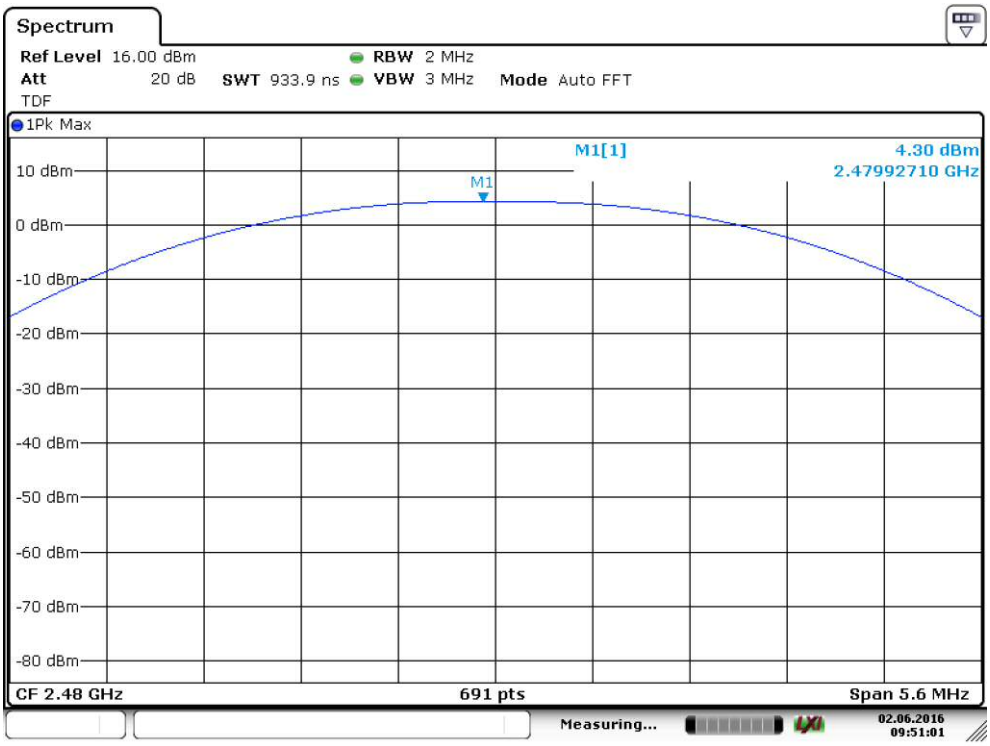


Figure 4. 1 Mbps Channel HIGH.

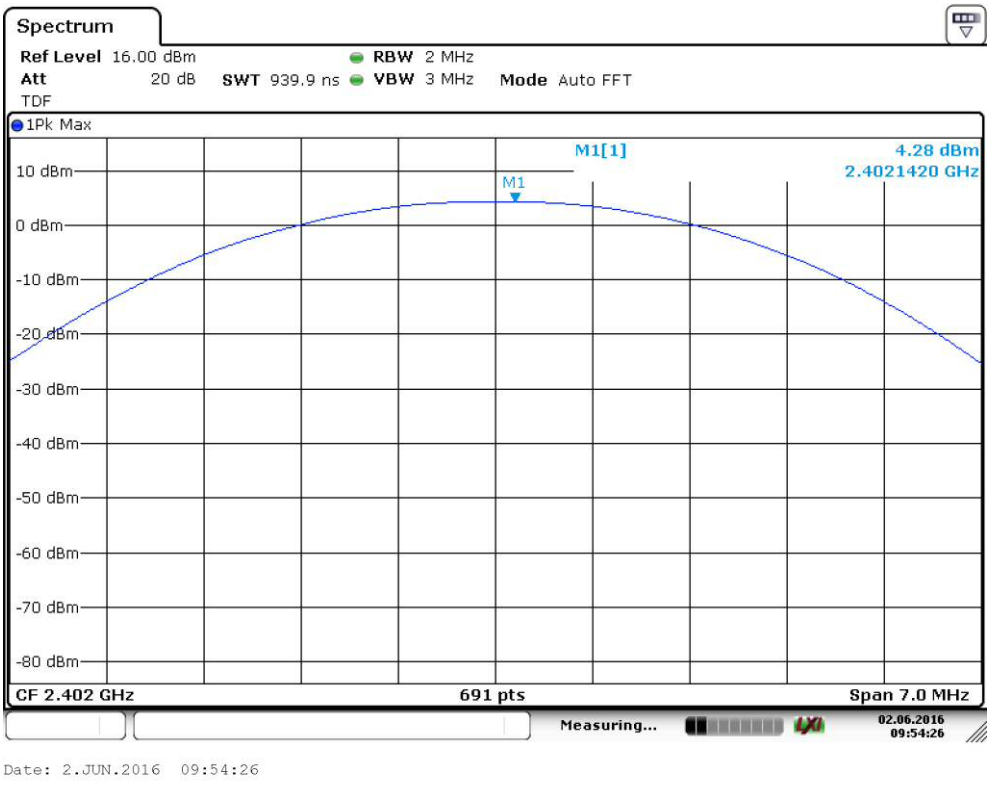
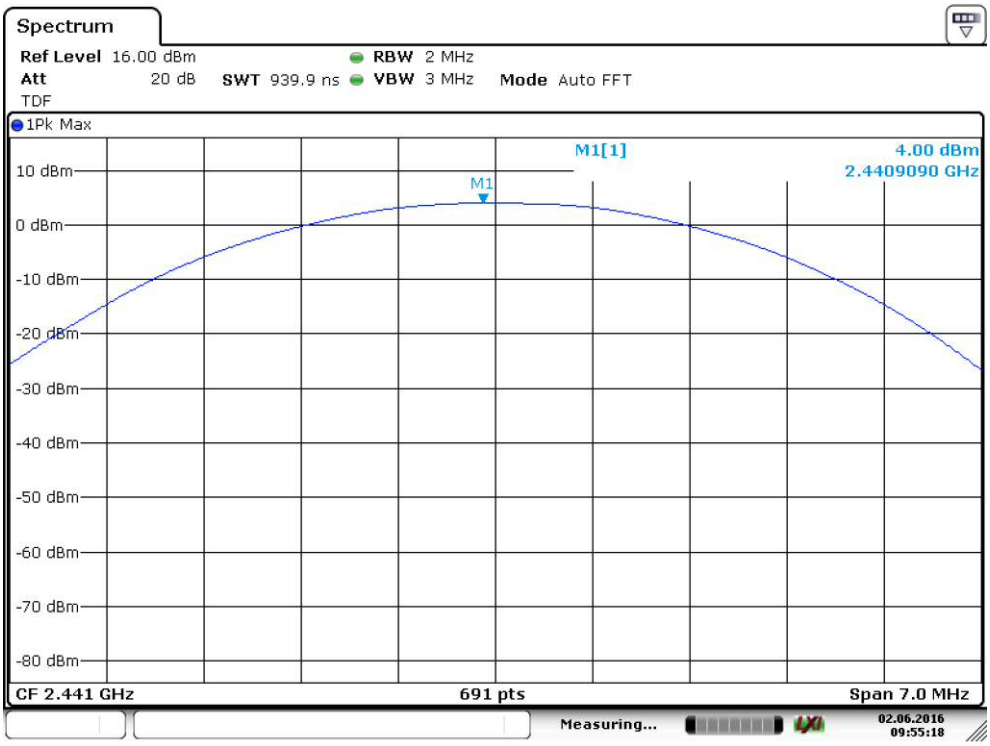
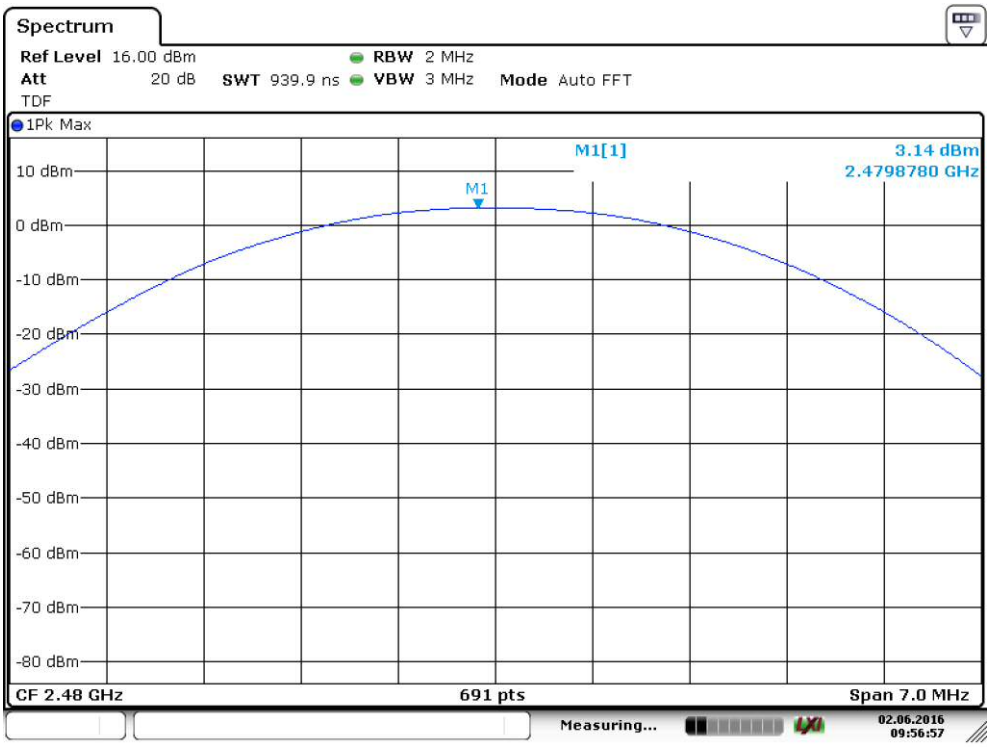


Figure 5. 2 Mbps Channel LOW.



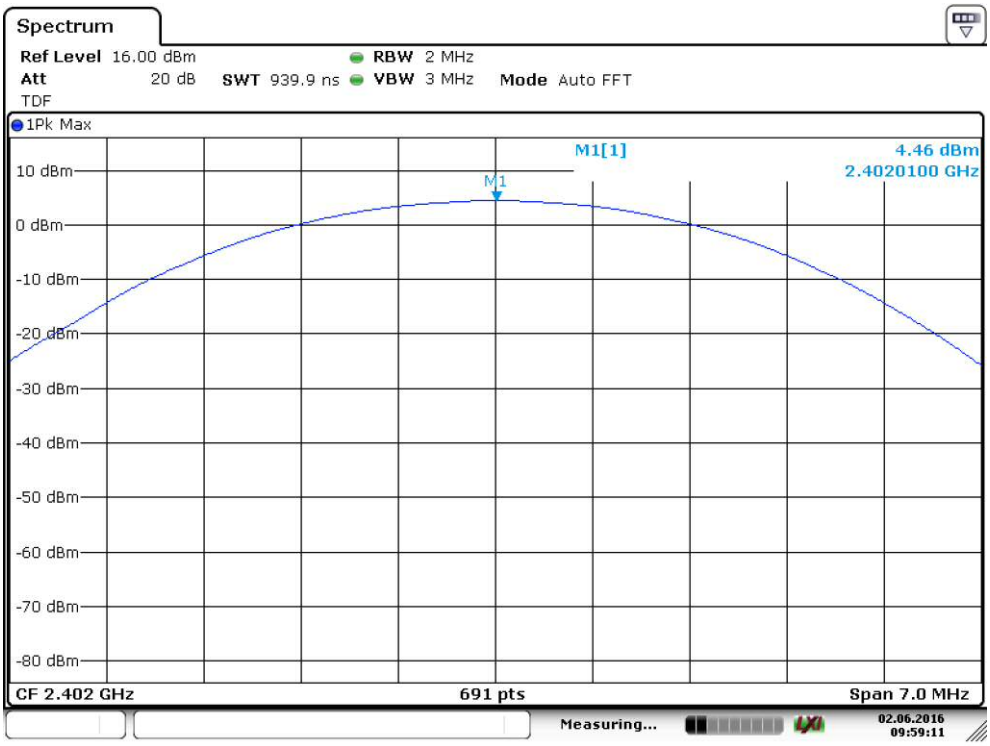
Date: 2.JUN.2016 09:55:18

Figure 6. 2 Mbps Channel MID.



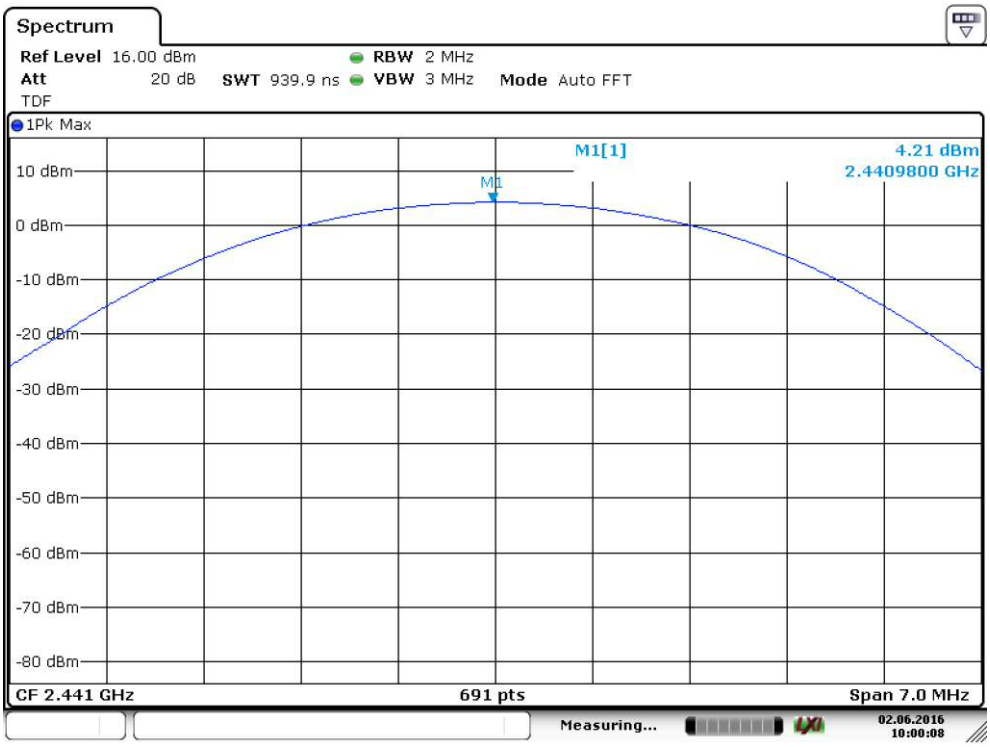
Date: 2.JUN.2016 09:56:57

Figure 7. 2 Mbps Channel HIGH.



Date: 2.JUN.2016 09:59:11

Figure 8. 3 Mbps Channel LOW.



Date: 2.JUN.2016 10:00:08

Figure 9. 3 Mbps Channel MID.

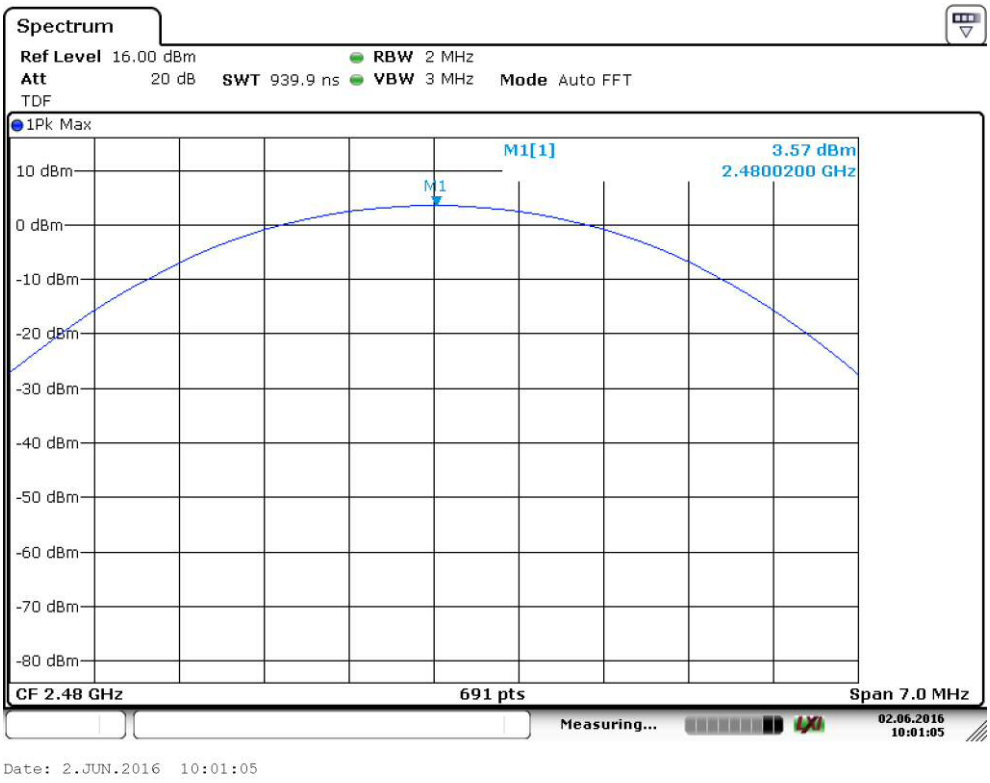


Figure 10. 3 Mbps Channel HIGH.

Transmitter Radiated Emissions 30 MHz to 26.5 GHz

Standard:	ANSI C63.10	(2013)
Tested by:	RRE	
Date:	31 May 2016	
Temperature:	21 °C	
Humidity:	45 % RH	
Measurement uncertainty:	± 4.51 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)**.**

The correction factor in the final result table contains the sum of the transducers (antenna + amplifier + cables).

The result value is the measured value corrected with the correction factor.

Measurements were done with 1 Mbps (worst case).

Test results with integrated antenna

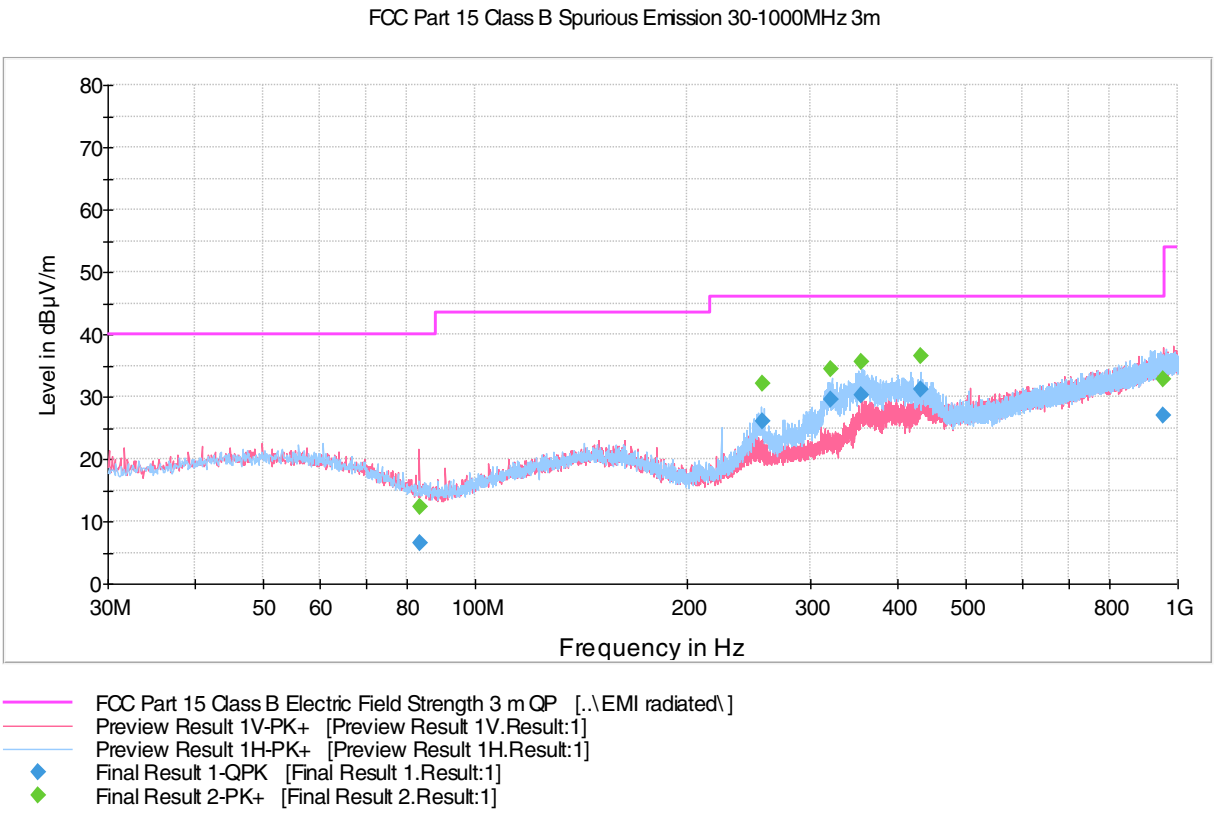


Figure 11. Measured curve with peak-detector. 1 Mbps Channel LOW.

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
83.596000	6.4	1000.0	120.000	230.0	V	333.0	9.2	33.6	40.0	-
255.982000	26.1	1000.0	120.000	138.0	H	359.0	13.7	19.9	46.0	-
321.302000	29.5	1000.0	120.000	100.0	H	144.0	16.0	16.5	46.0	-
354.958000	30.3	1000.0	120.000	100.0	H	144.0	16.6	15.7	46.0	-
431.403000	31.1	1000.0	120.000	230.0	H	241.0	18.8	14.9	46.0	-
955.260000	26.9	1000.0	120.000	219.0	V	134.0	27.8	19.1	46.0	-

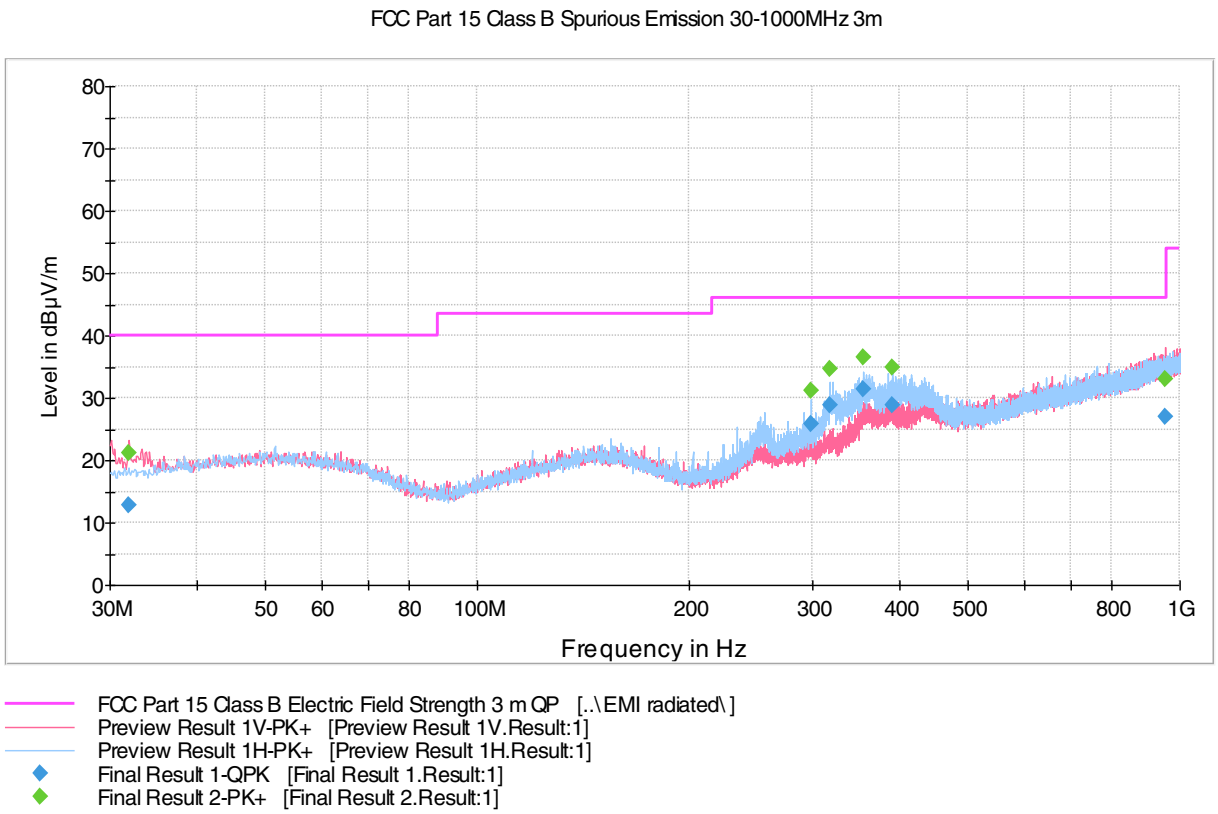


Figure 12. Measured curve with peak-detector. 1 Mbps Channel MID.

Final measurements from the worst frequencies

Table 4. 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
31.960000	12.9	1000.0	120.000	100.0	V	182.0	13.1	27.1	40.0	-
298.670000	25.8	1000.0	120.000	122.0	H	131.0	15.3	20.2	46.0	-
317.376000	28.9	1000.0	120.000	100.0	H	131.0	15.9	17.1	46.0	-
354.702000	31.5	1000.0	120.000	100.0	H	139.0	16.6	14.5	46.0	-
389.505000	28.9	1000.0	120.000	100.0	H	140.0	17.6	17.1	46.0	-
953.141000	27.1	1000.0	120.000	120.0	V	181.0	27.8	18.9	46.0	-

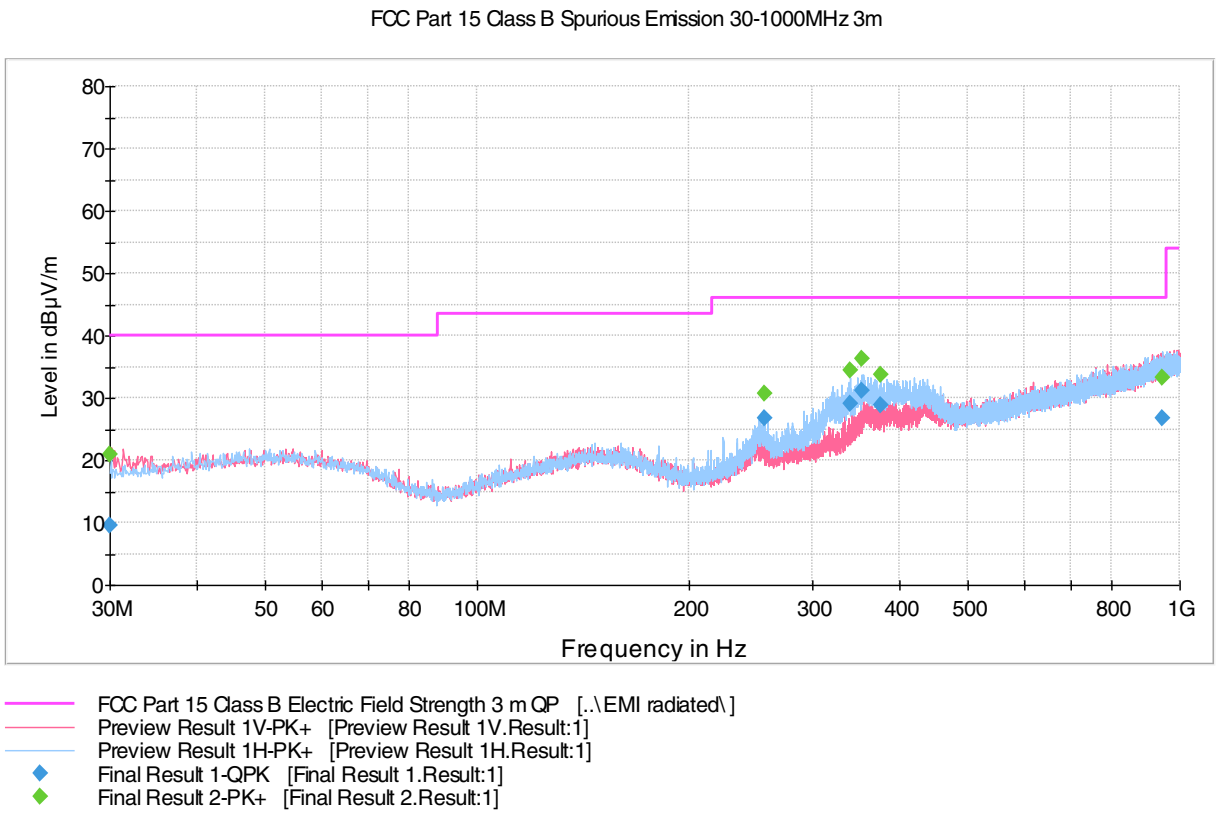


Figure 13. Measured curve with peak-detector. 1 Mbps Channel HIGH.

Final measurements from the worst frequencies

Table 5. 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
30.020000	9.6	1000.0	120.000	100.0	V	189.0	13.0	30.4	40.0	-
255.990000	26.8	1000.0	120.000	121.0	H	334.0	13.7	19.2	46.0	-
339.933000	29.0	1000.0	120.000	100.0	H	134.0	16.2	17.0	46.0	-
353.301000	31.3	1000.0	120.000	100.0	H	141.0	16.6	14.7	46.0	-
375.141000	28.8	1000.0	120.000	100.0	H	143.0	17.2	17.2	46.0	-
944.110000	26.7	1000.0	120.000	168.0	H	333.0	27.7	19.3	46.0	-

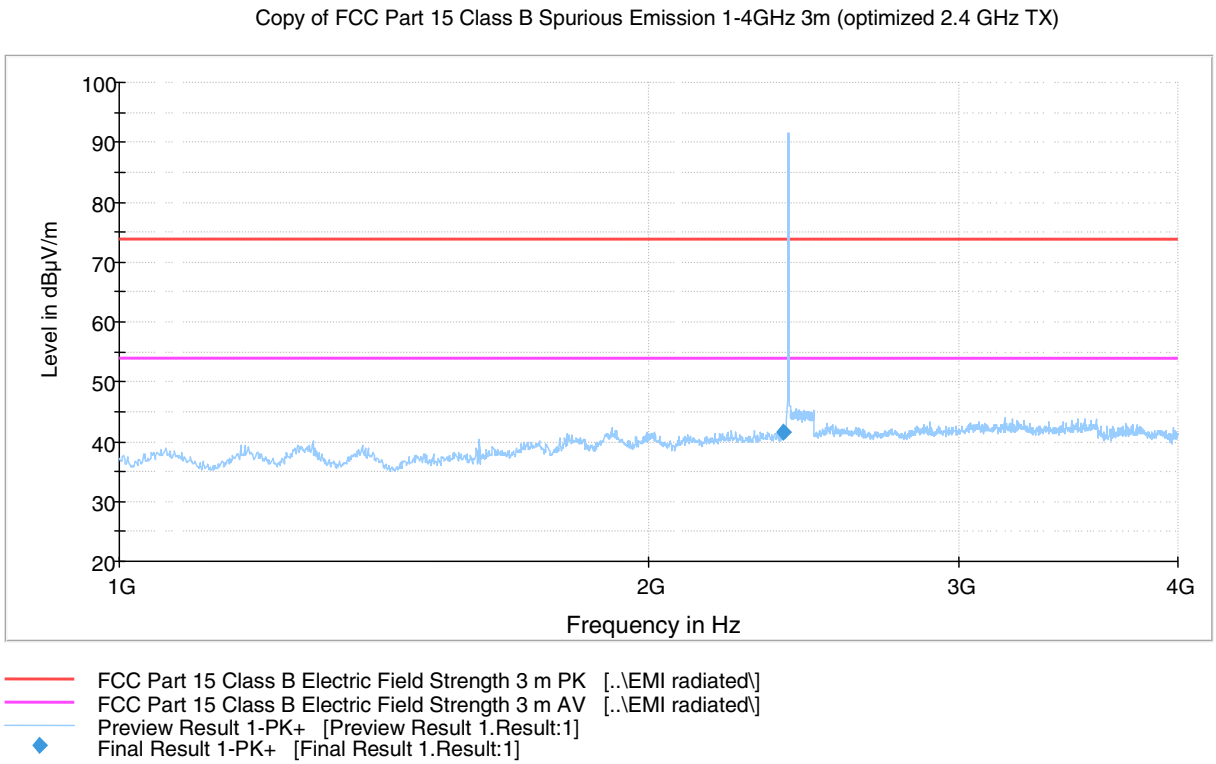


Figure 14. Measured curve with peak detector. 1 Mbps Channel LOW.

Table 6. Final results

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2385.000000	41.7	1000.0	1000.000	193.0	H	147.0	3.9	32.2	73.9	-

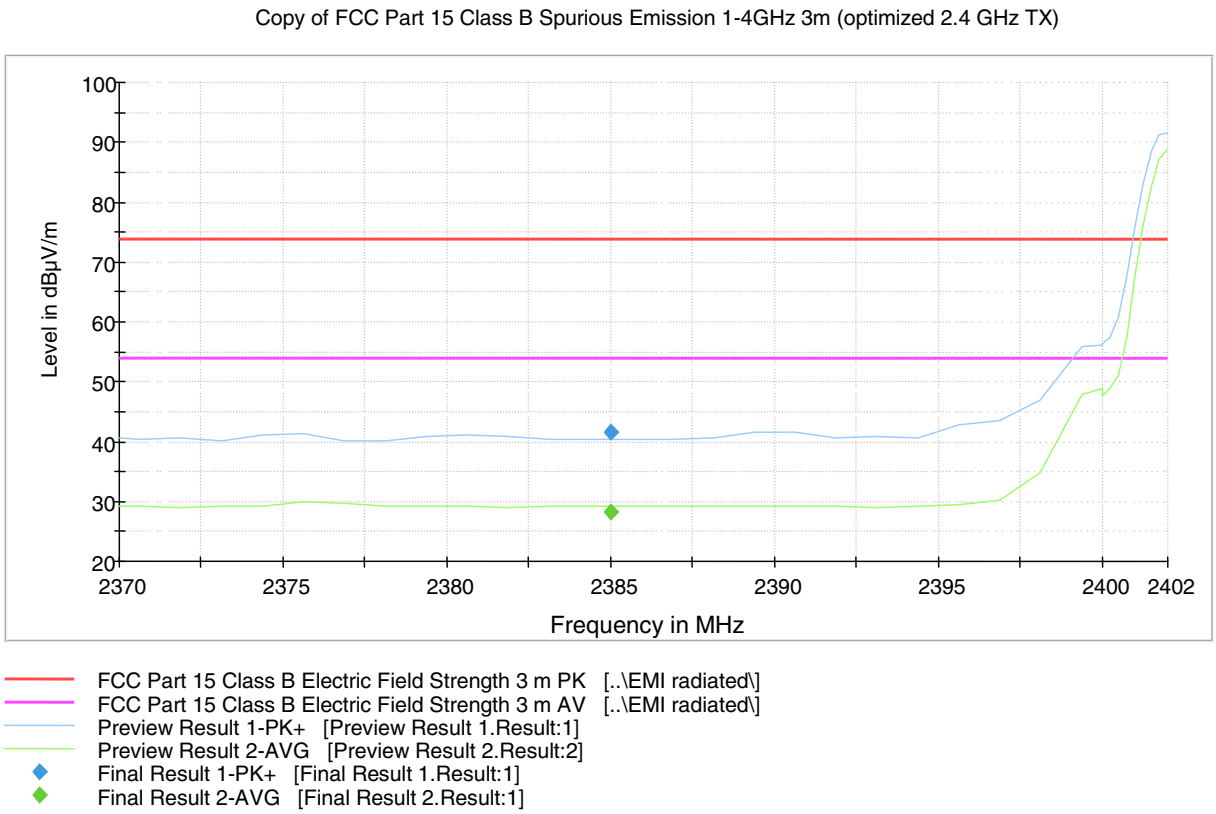


Figure 15. Low channel band edge.

Final measurements from the worst frequencies

Table 7. 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
2385.000000	41.7	1000.0	1000.000	193.0	H	147.0	3.9	32.2	73.9	-

Table 8. 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
2385.000000	28.2	1000.0	1000.000	200.0	H	185.0	3.9	25.7	53.9	-

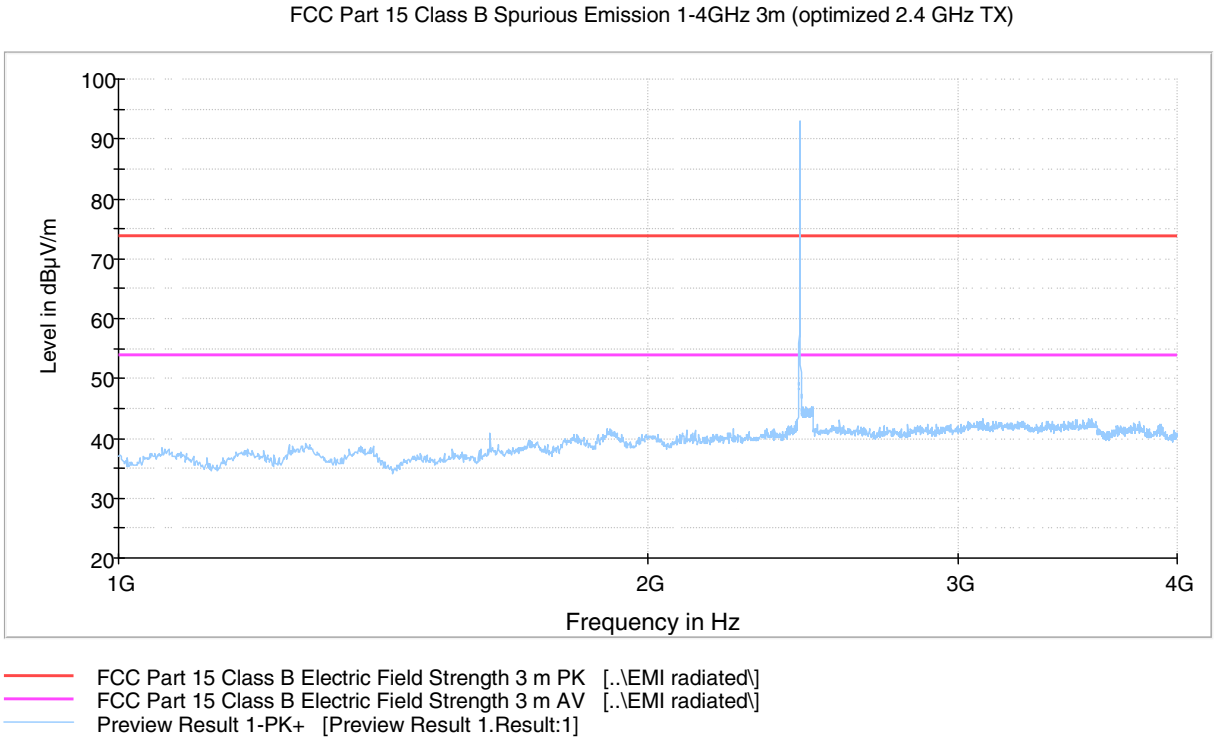


Figure 16. Measured curve with peak detector. 1 Mbps Channel MID.

Final measurements from the worst frequencies

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

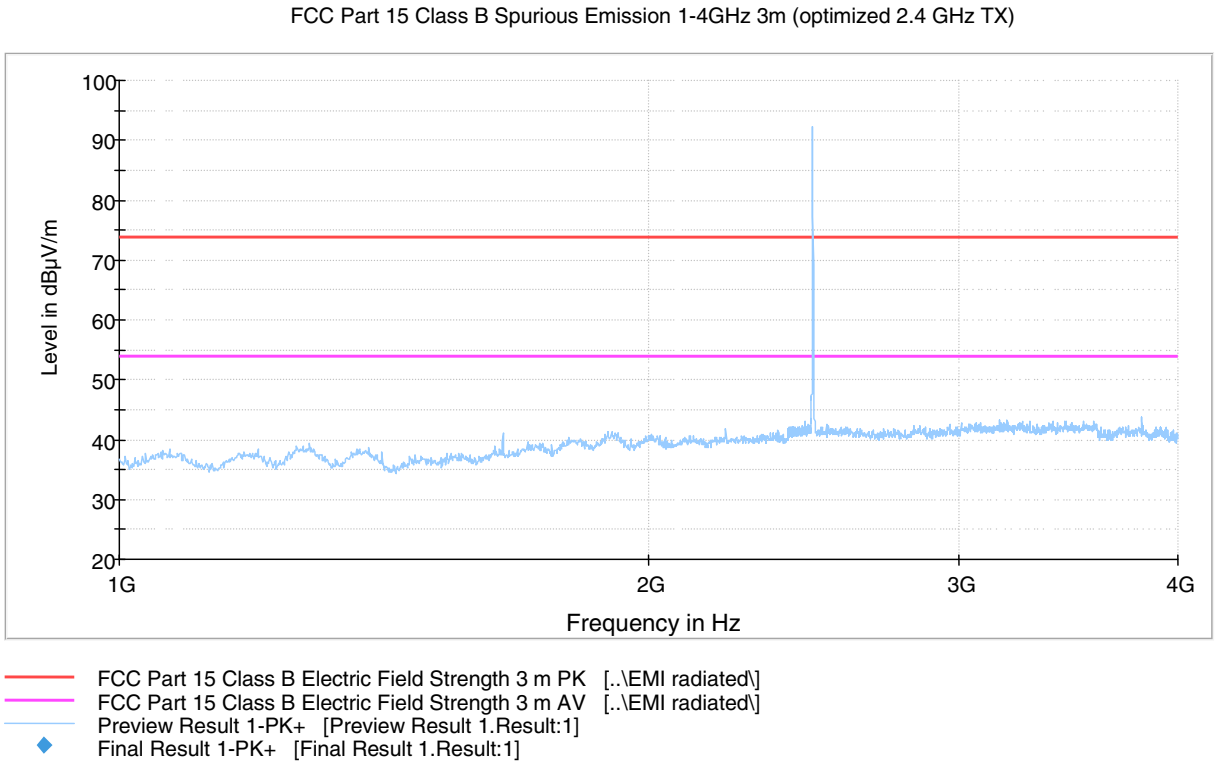


Figure 17. Measured curve with peak detector. 1 Mbps Channel HIGH.

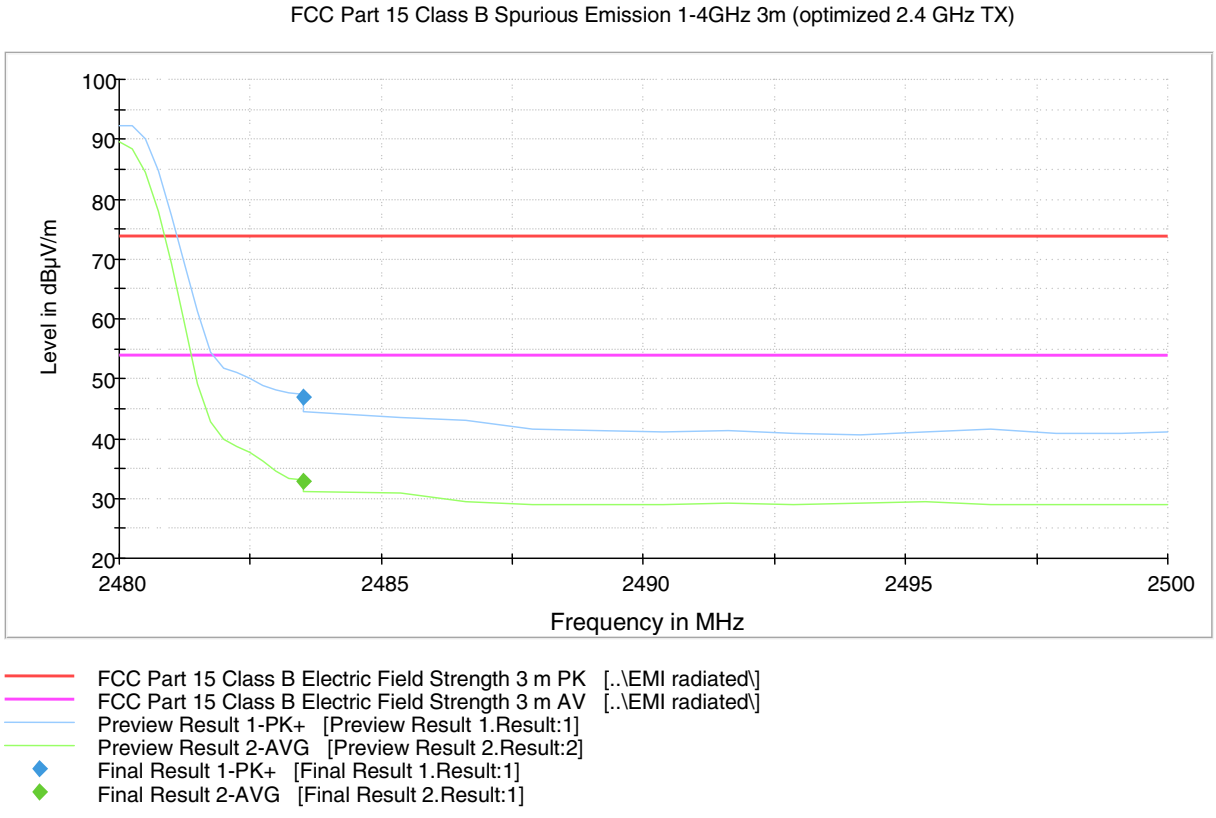


Figure 18. High channel band edge 1 Mbps.

Final measurements from the worst frequencies

Table 9. 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
2483.500000	47.0	1000.0	1000.000	266.0	H	181.0	4.4	26.9	73.9	-

Table 10. 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
2483.500000	32.8	1000.0	1000.000	298.0	H	204.0	4.4	21.1	53.9	-

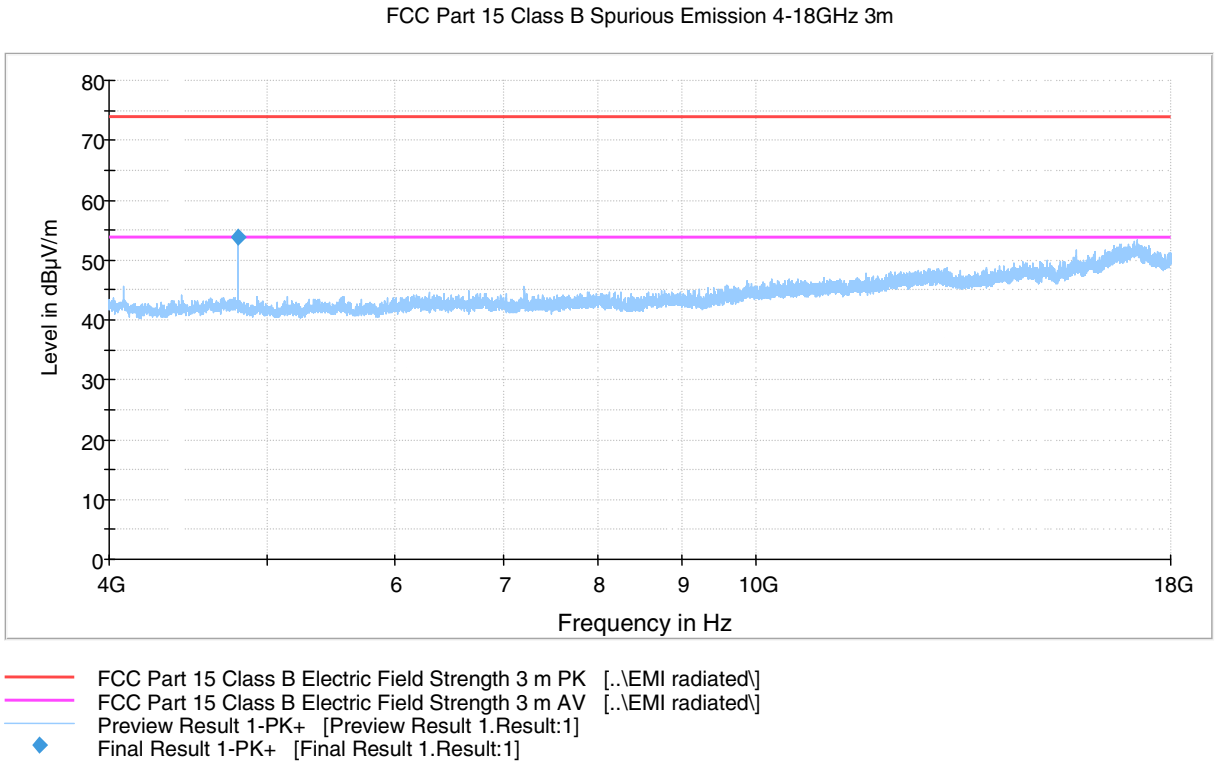


Figure 19. Measured curve with peak detector. 1 Mbps Channel LOW.

Final measurements from the worst frequencies

Table 11. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
4804.300000	53.7	150.0	V	73.0	10.4	20.2	73.9	-

Table 12. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Margin (dB)	Limit (dBµV/m)	Comment
4804.300000	23.1	30.8	53.9	-

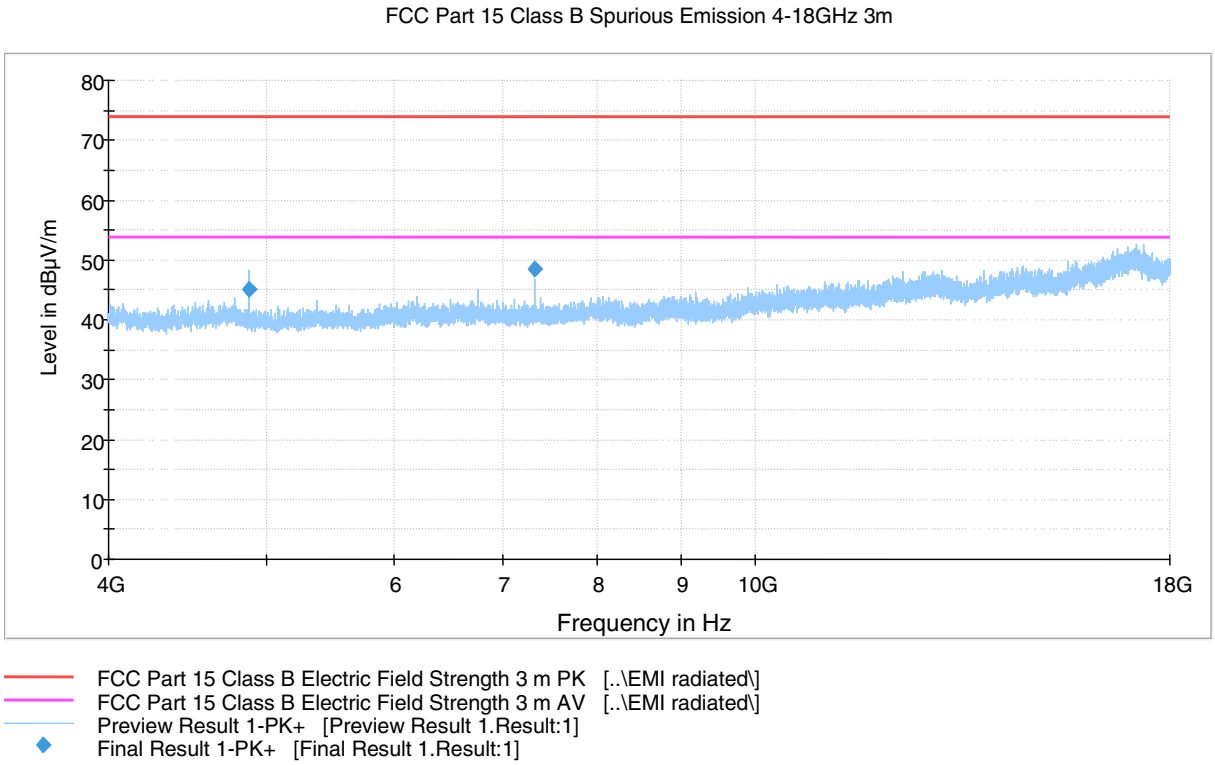


Figure 20. Measured curve with peak detector. 1 Mbps Channel MID.

Final measurements from the worst frequencies

Table 13. 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
4882.100000	45.0	1000.0	1000.000	228.0	V	87.0	10.4	28.9	73.9	-
7322.600000	48.5	1000.0	1000.000	220.0	V	94.0	12.6	25.4	73.9	-

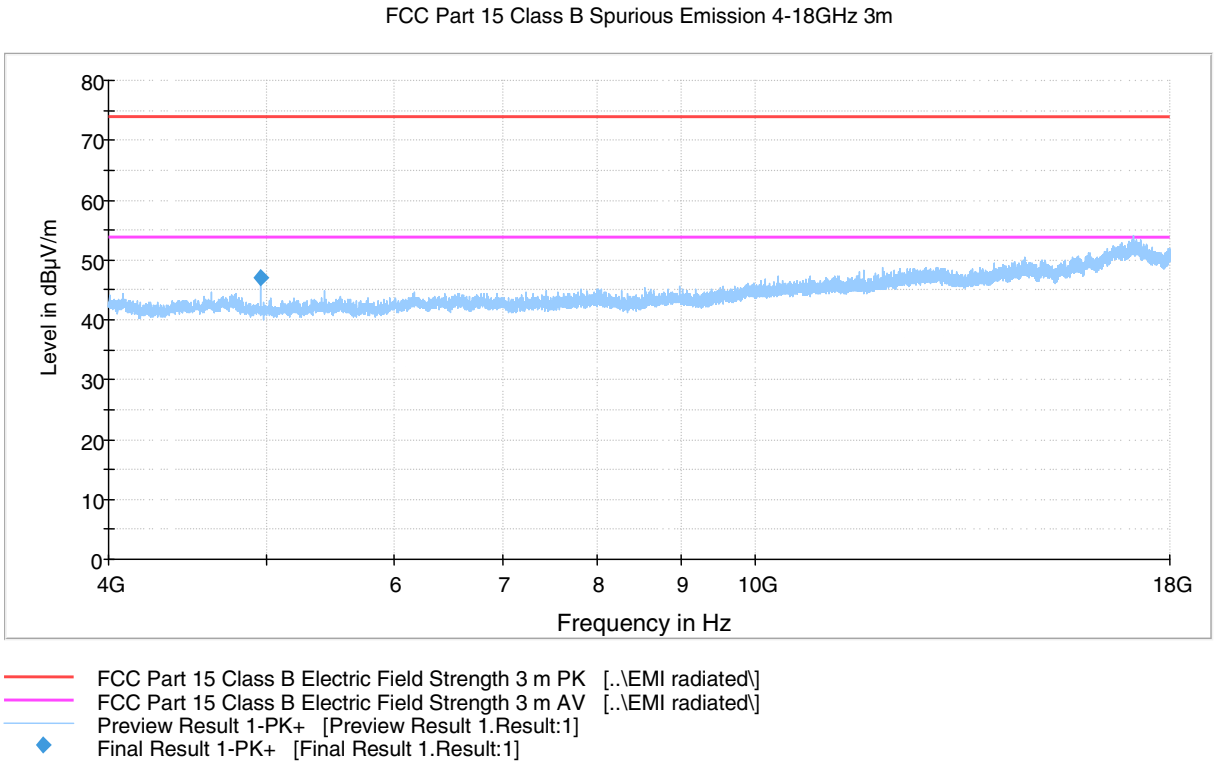


Figure 21. Measured curve with peak detector. 1 Mbps Channel HIGH.

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
4960.100000	47.1	1000.0	1000.000	244.0	V	74.0	10.4	26.8	73.9	-

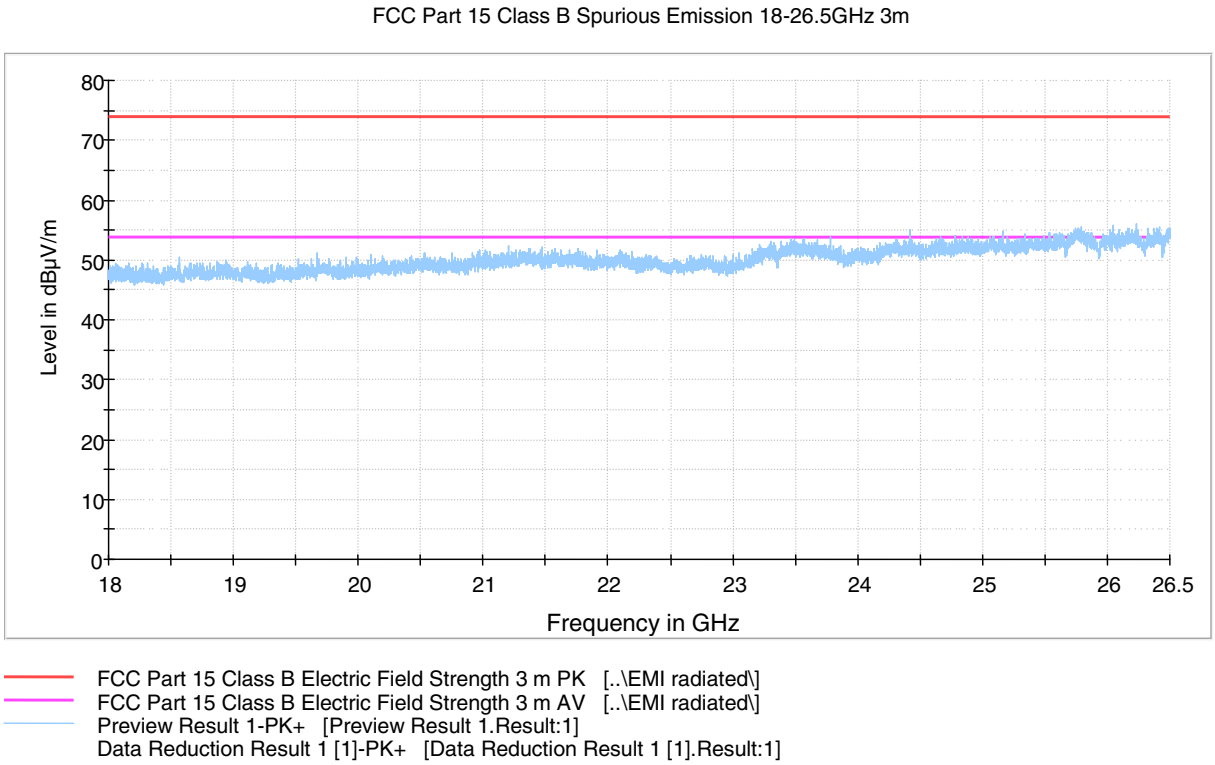


Figure 22. Measured curve with peak detector. 1 Mbps Channel LOW.

Final measurements from the worst frequencies

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

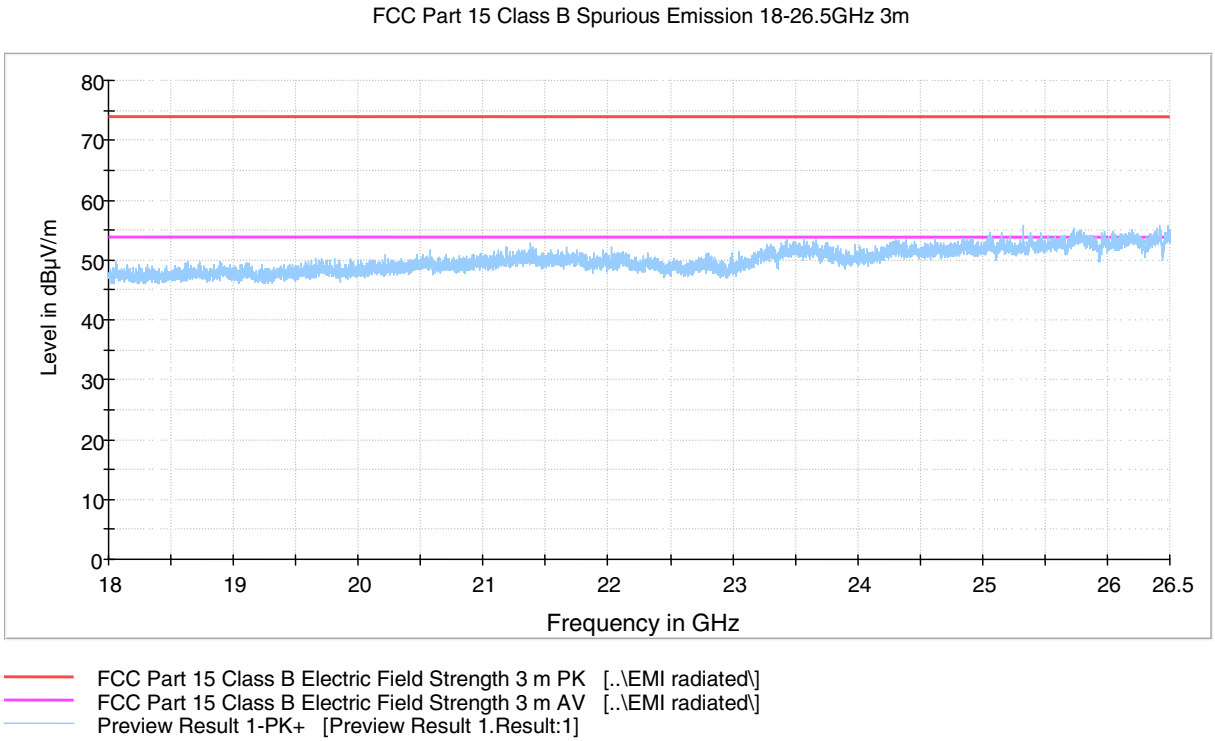


Figure 23. Measured curve with peak detector. 1 Mbps Channel MID.

Final measurements from the worst frequencies

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

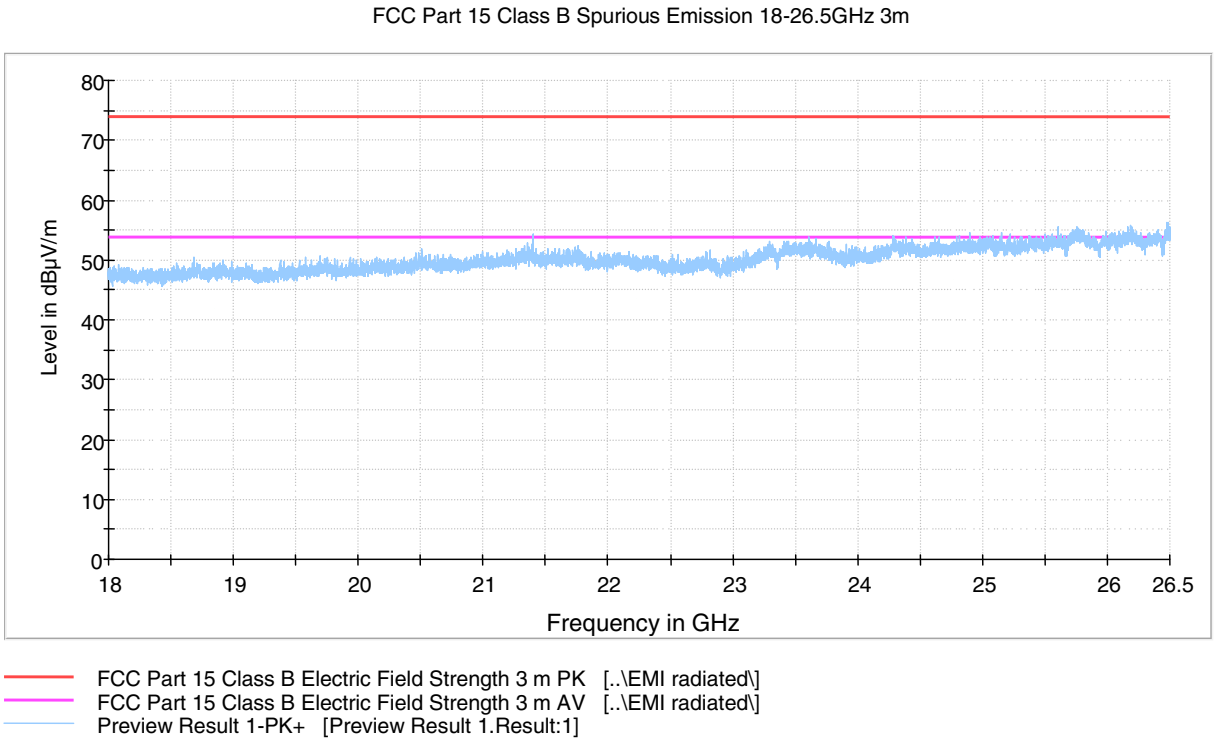


Figure 24. Measured curve with peak detector. 1 Mbps Channel HIGH.

Final measurements from the worst frequencies

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

Conducted Spurious Emissions 30 MHz to 26.5 GHz and Band Edge

Standard:	ANSI C63.10	(2014)
Tested by:	RRE	
Date:	2 June 2016	
Temperature:	23 °C	
Humidity:	37 % RH	

FCC Rule: §15.247(d)
RSS-247 5.5

Data rate 1 Mbps

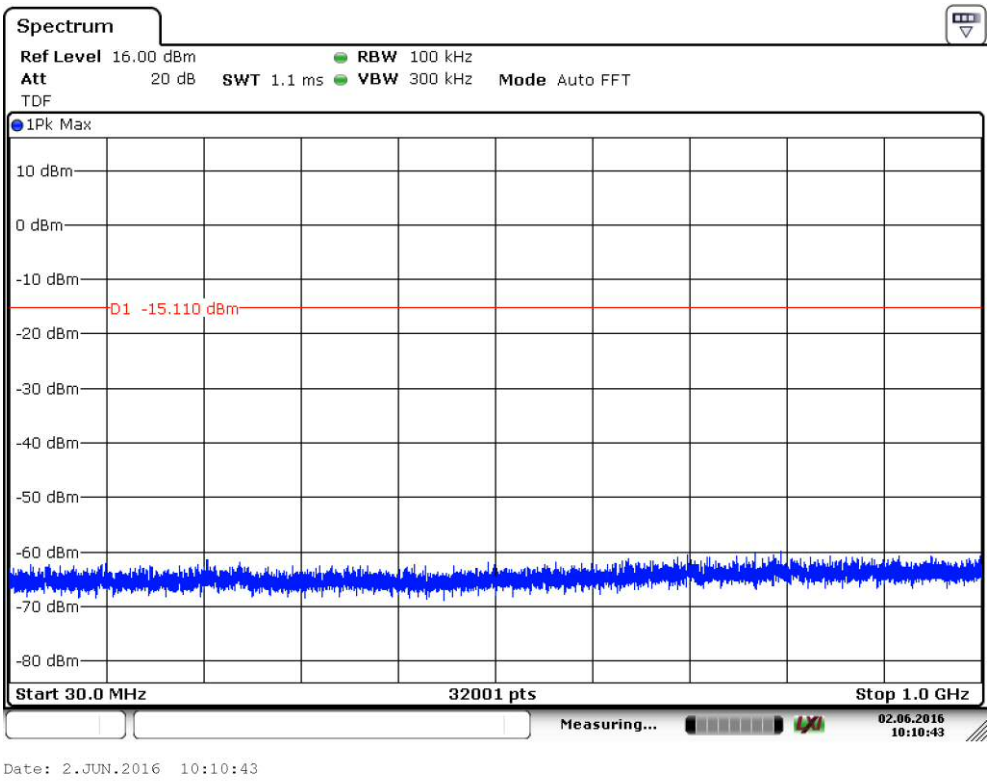


Figure 25. Low channel conducted emission 30 MHz to 1000 MHz (1 Mbps).

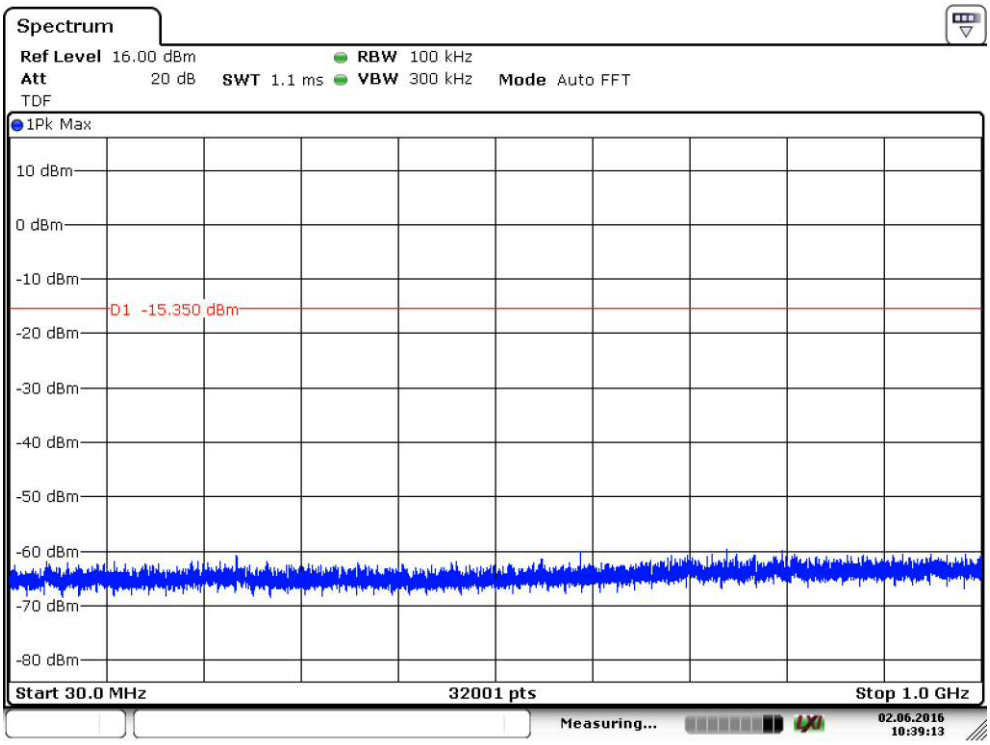


Figure 26. Mid channel conducted emission 30 MHz to 1000 MHz (1 Mbps).

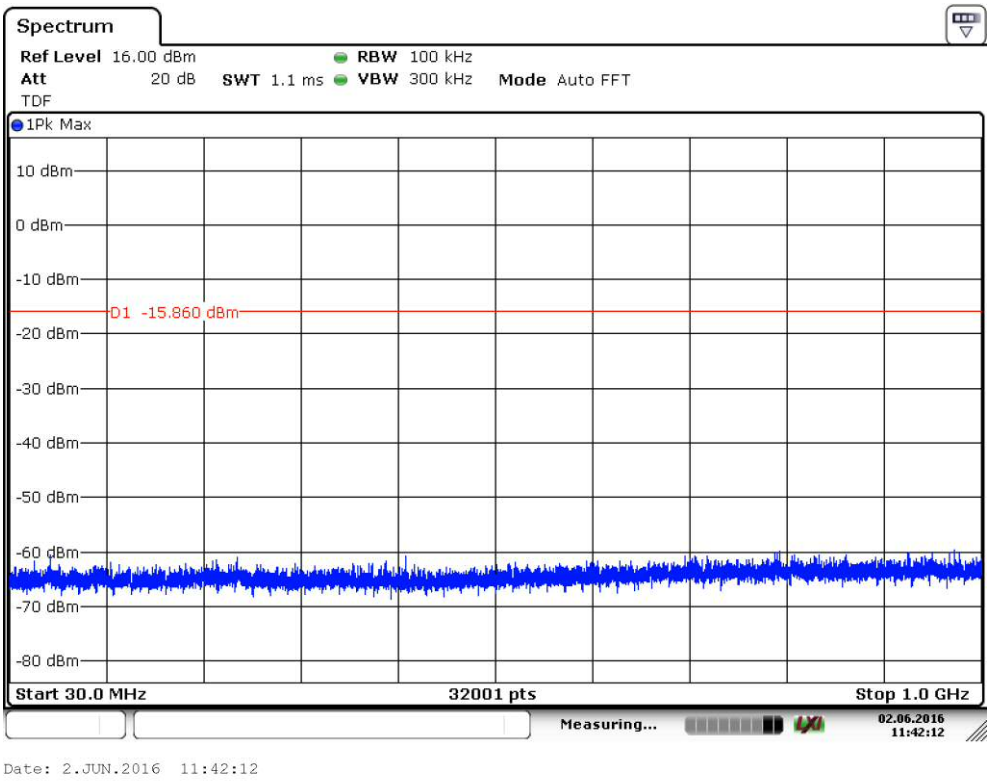


Figure 27. High channel conducted emission 30 MHz to 1000 MHz (1 Mbps).

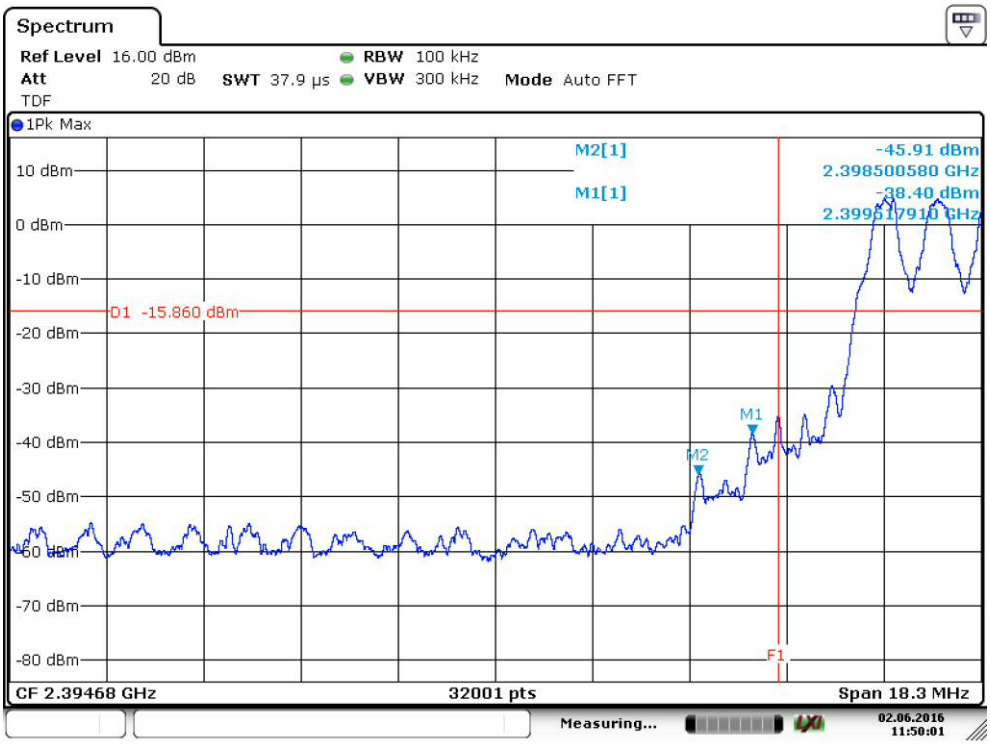


Figure 28. Conducted emission at low band edge hopping enabled (1 Mbps).

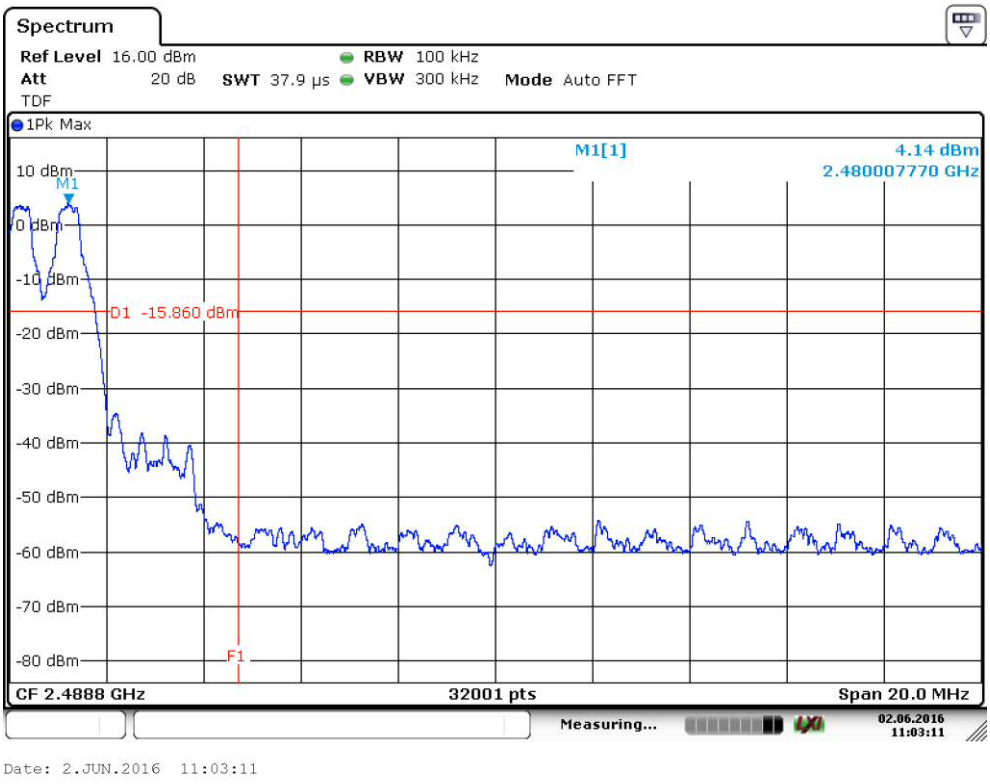


Figure 29. Conducted emission at high band edge hopping enabled (1 Mbps).

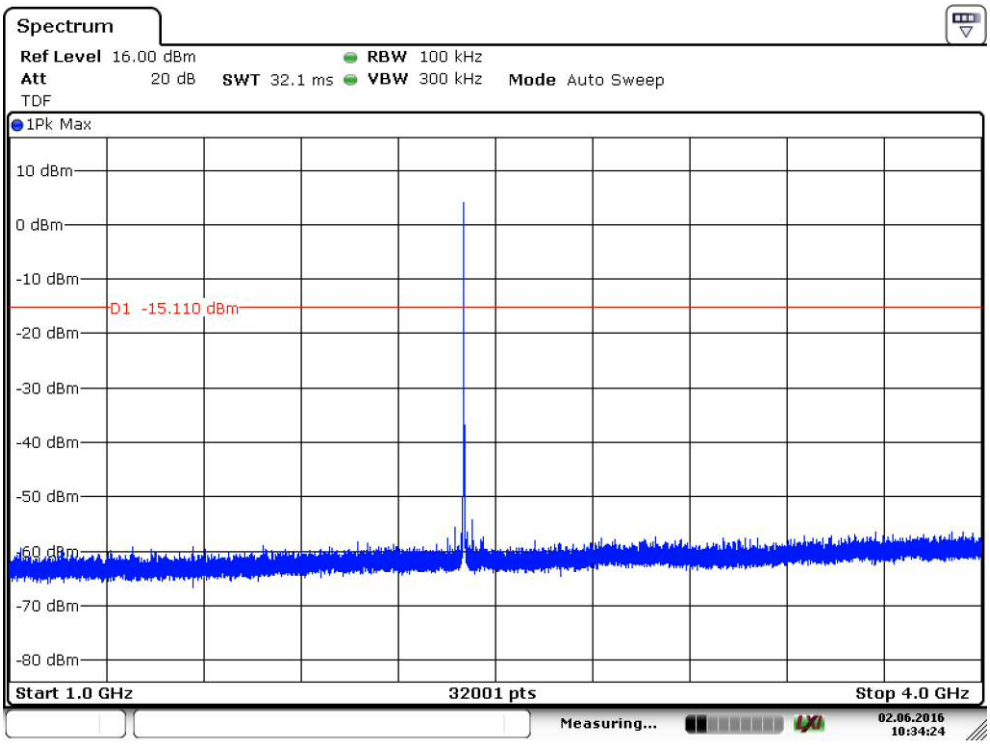


Figure 30. Low channel conducted emission 1 GHz to 4 GHz (1 Mbps).

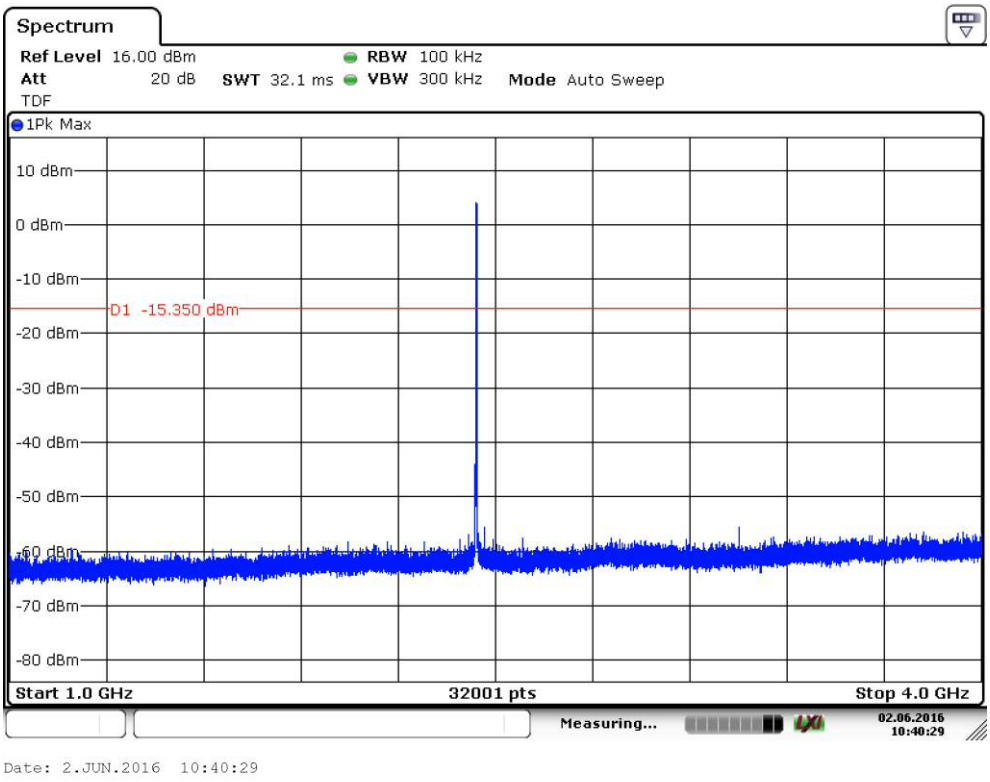


Figure 31. Mid channel conducted emission 1 GHz to 4 GHz (1 Mbps).

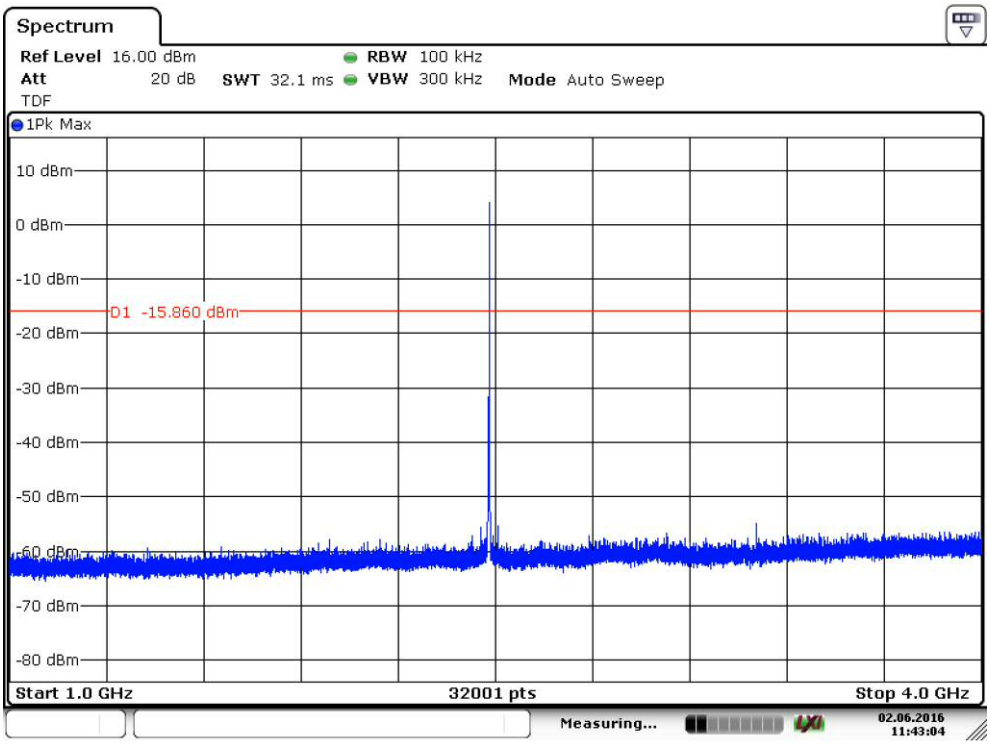


Figure 32. High channel conducted emission 1 GHz to 4 GHz (1 Mbps).

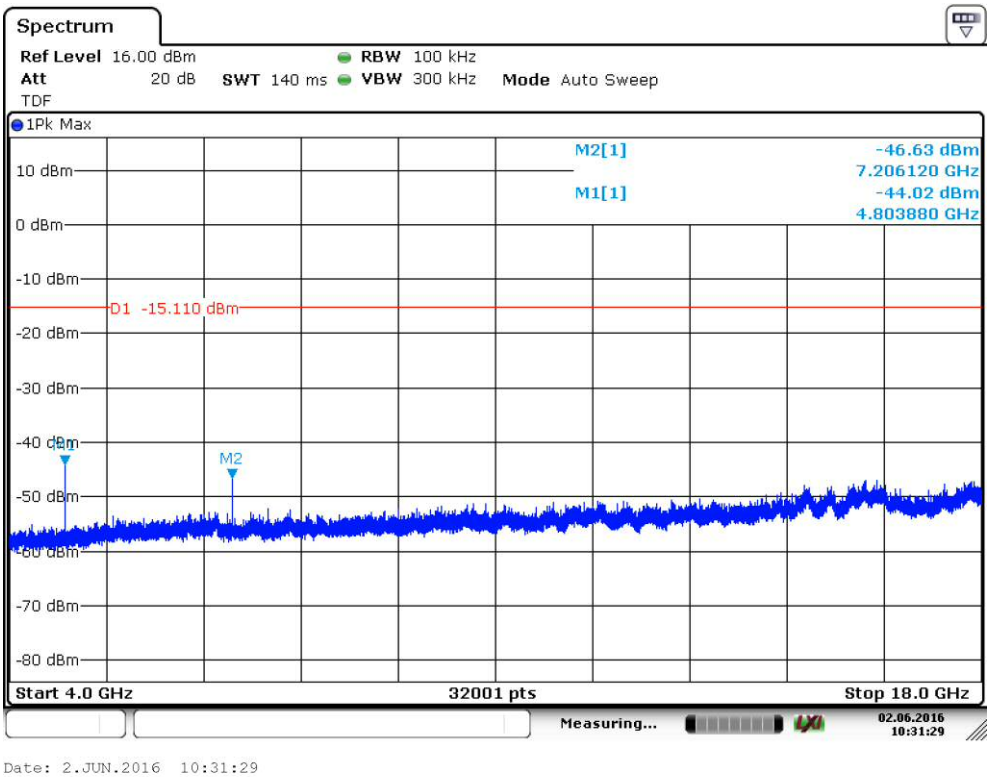
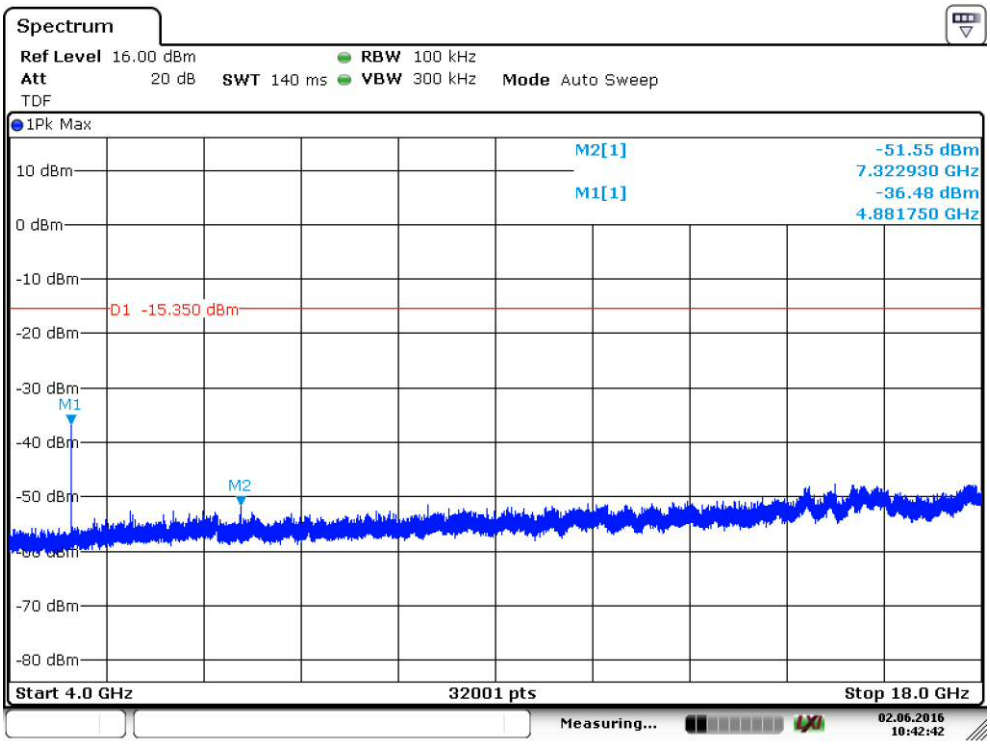
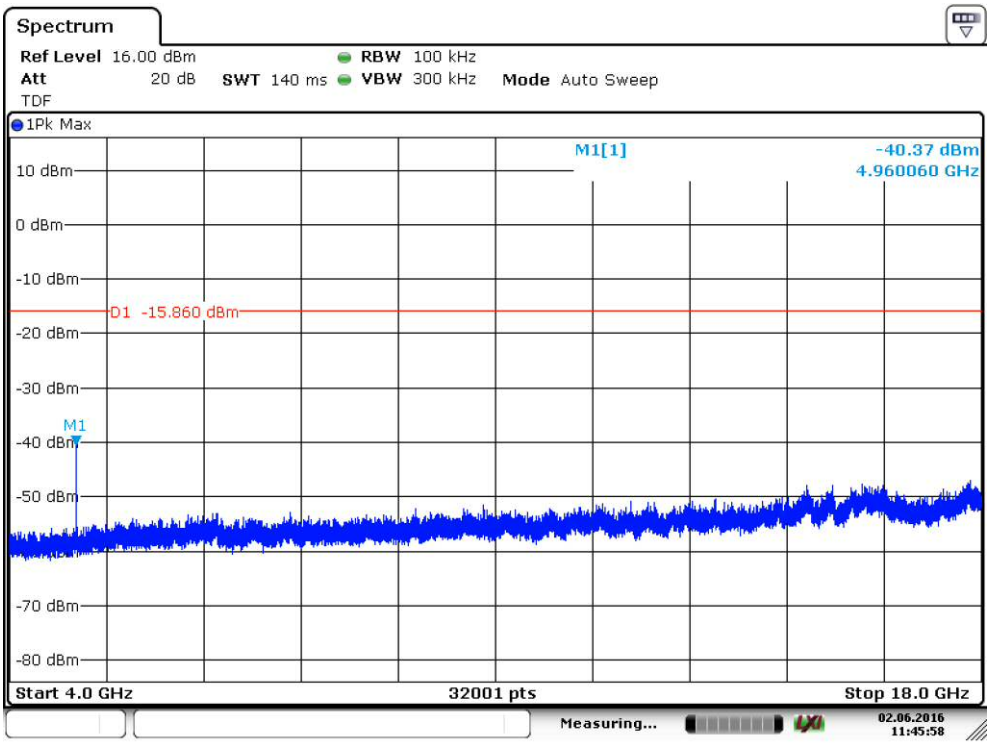


Figure 33. Low channel conducted emission 4 GHz to 18 GHz (1 Mbps).



Date: 2.JUN.2016 10:42:42

Figure 34. Mid channel conducted emission 4 GHz to 18 GHz (1 Mbps).



Date: 2.JUN.2016 11:45:58

Figure 35. High channel conducted emission 4 GHz to 18 GHz (1 Mbps).

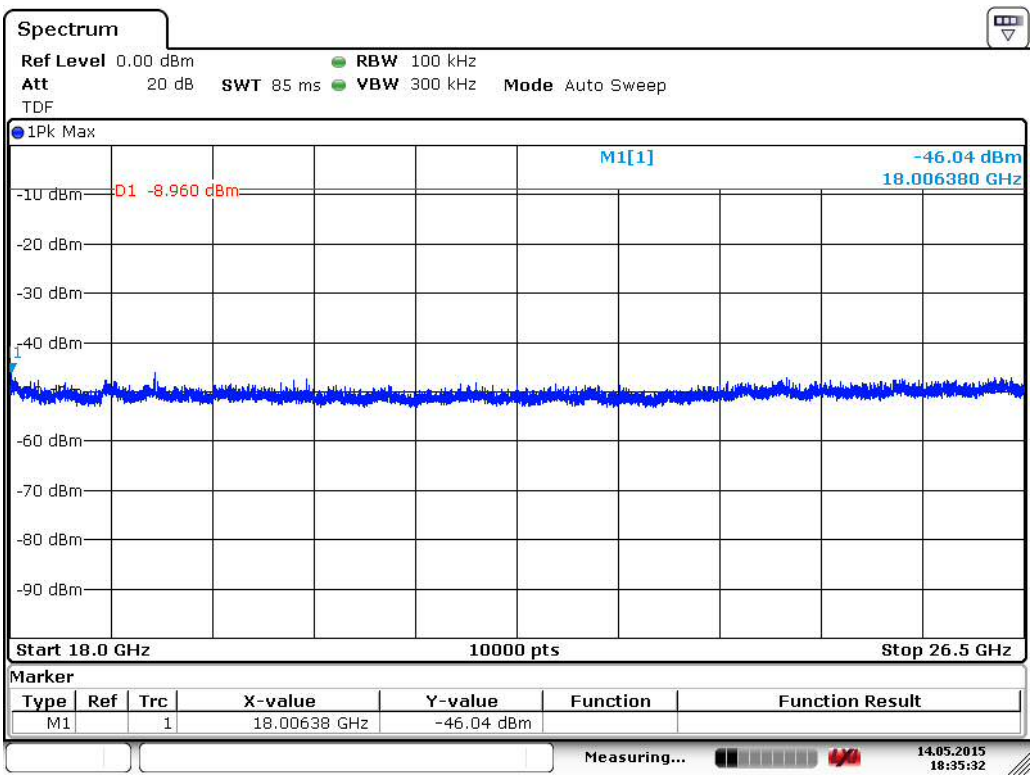


Figure 36. Low channel conducted emission 18 GHz to 26.5 GHz (1 Mbps).

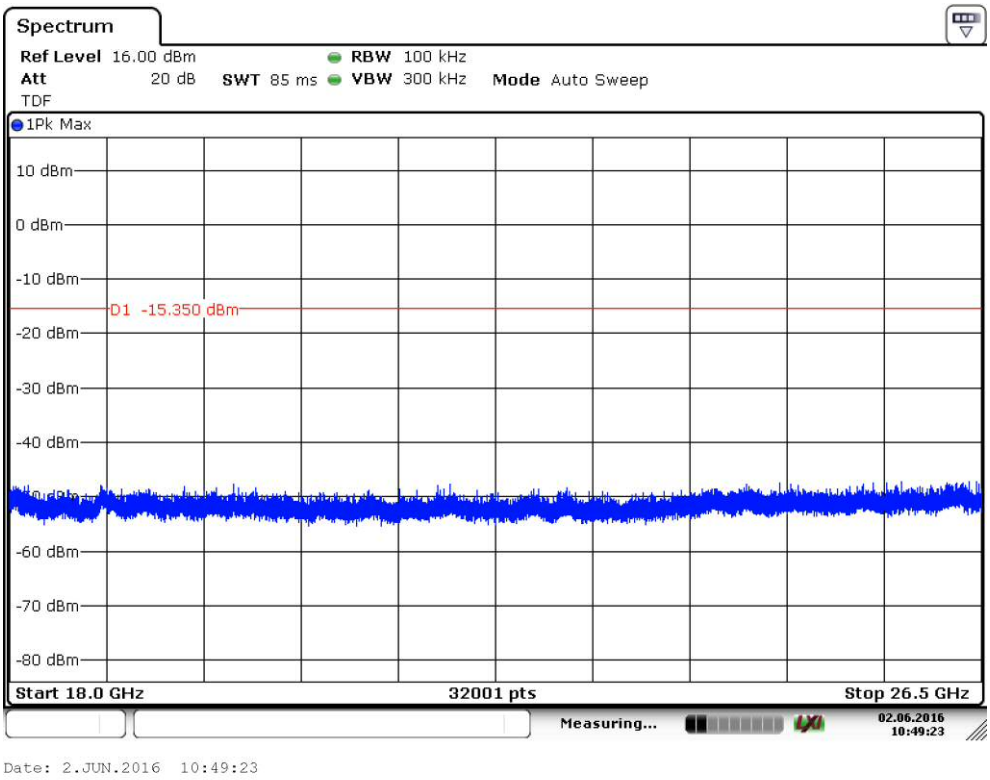


Figure 37. Mid channel conducted emission 18 GHz to 26.5 GHz (1 Mbps).

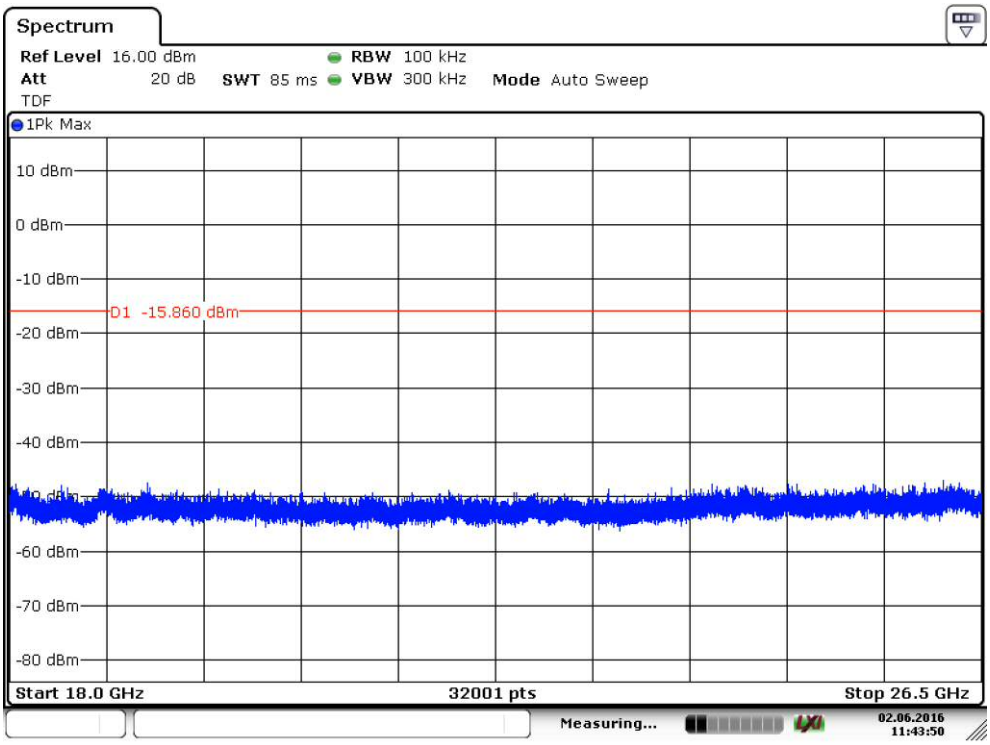


Figure 38. High channel conducted emission 18 GHz to 26.5 GHz (1 Mbps).

Data rate 2 Mbps

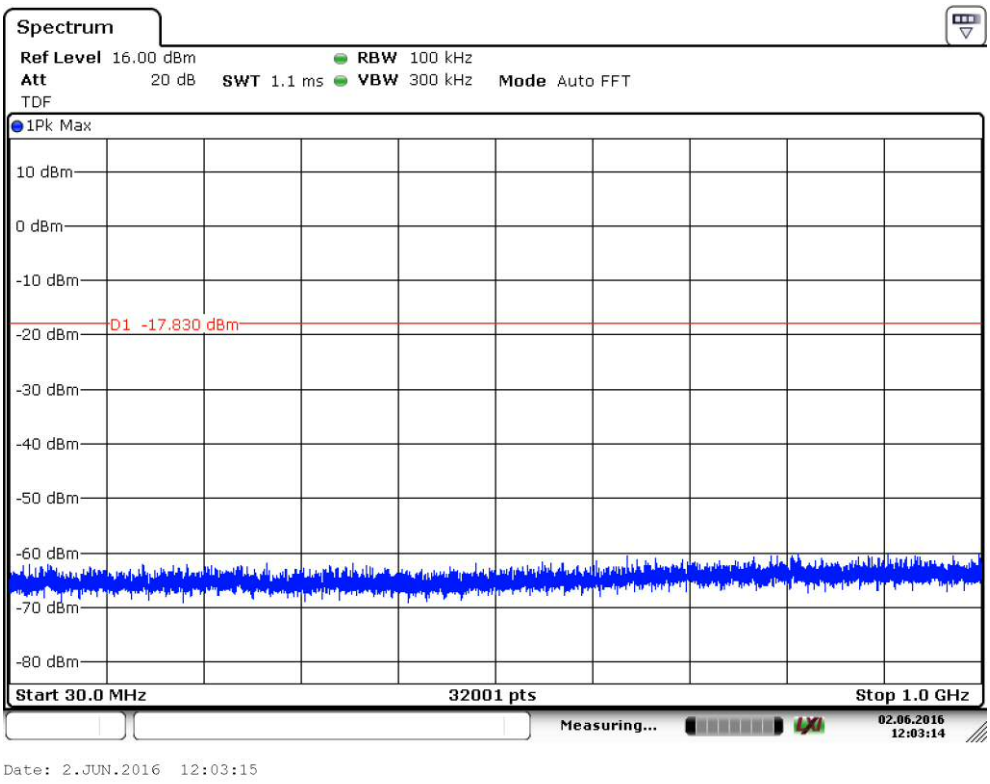


Figure 39. Low channel conducted emission 30 MHz to 1000 MHz (2 Mbps).

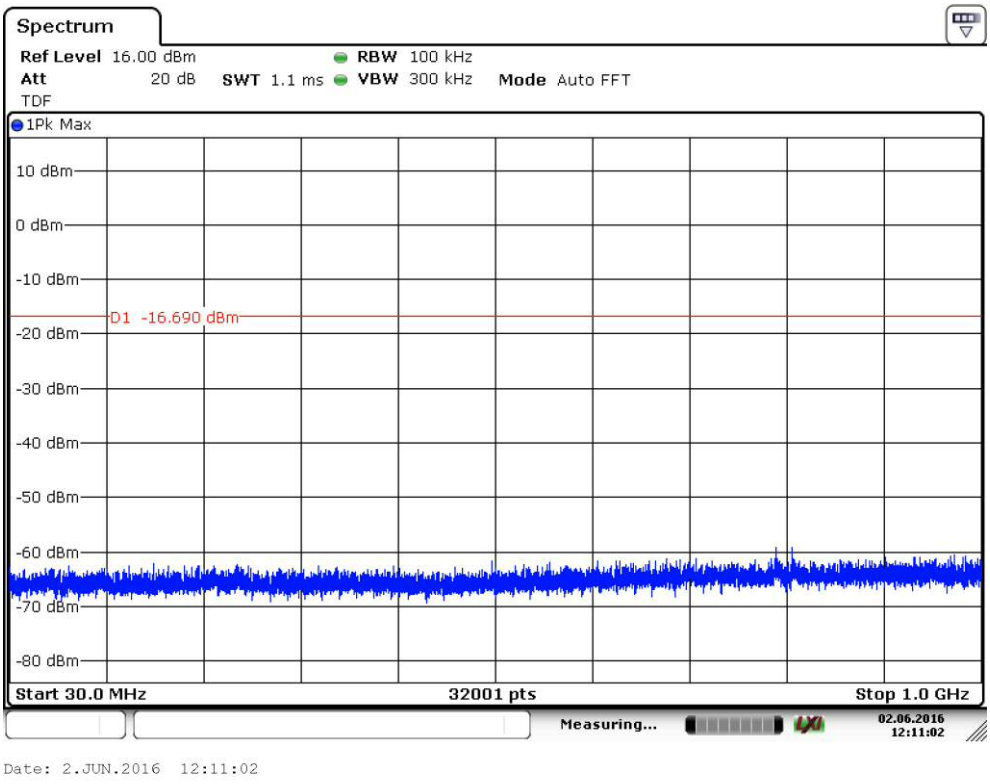


Figure 40. Mid channel conducted emission 30 MHz to 1000 MHz (2 Mbps).

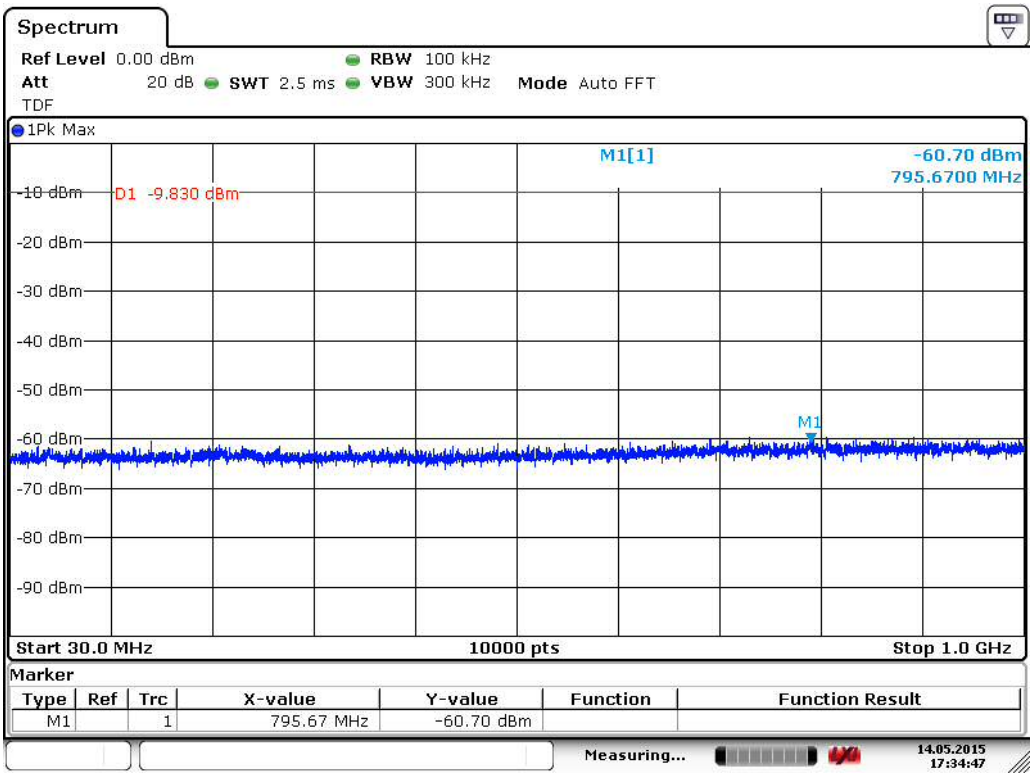


Figure 41. High channel conducted emission 30 MHz to 1000 MHz (2 Mbps).

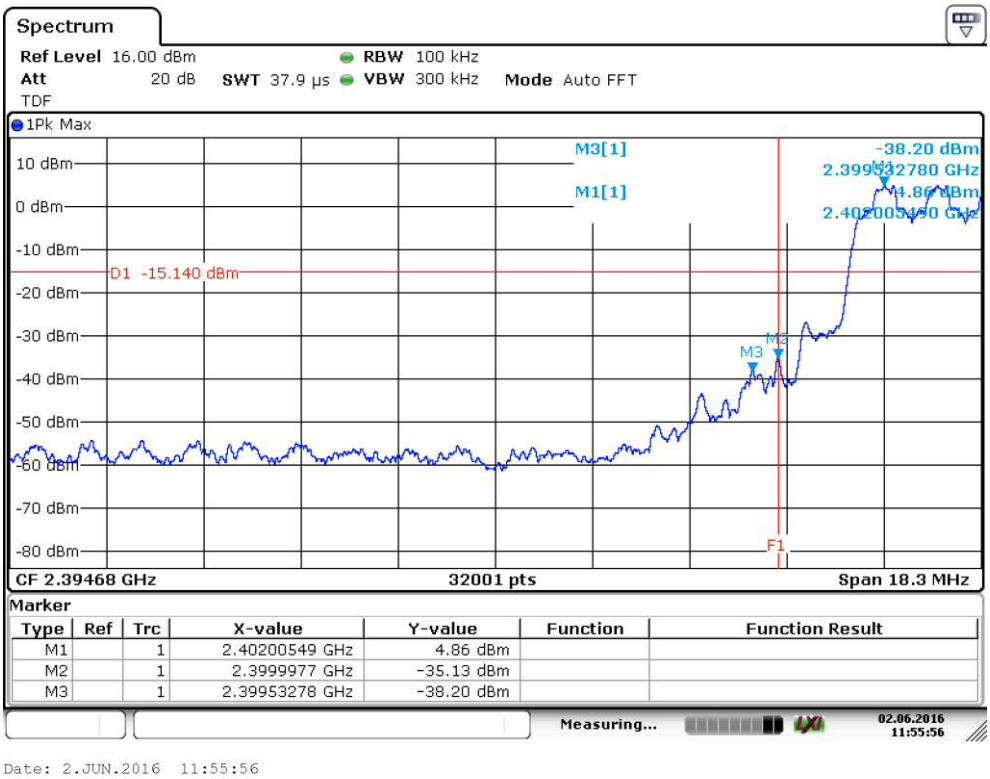


Figure 42. Low channel conducted emission at low band edge hopping enabled (2 Mbps).

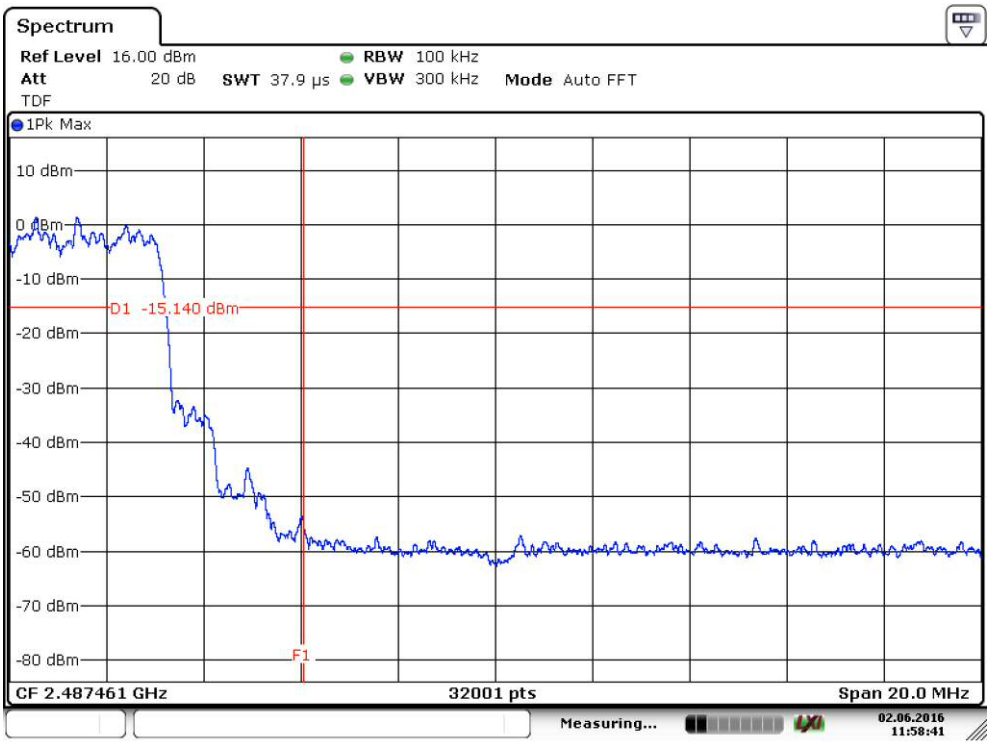


Figure 43. High channel conducted emission at high band edge hopping enabled (2 Mbps).

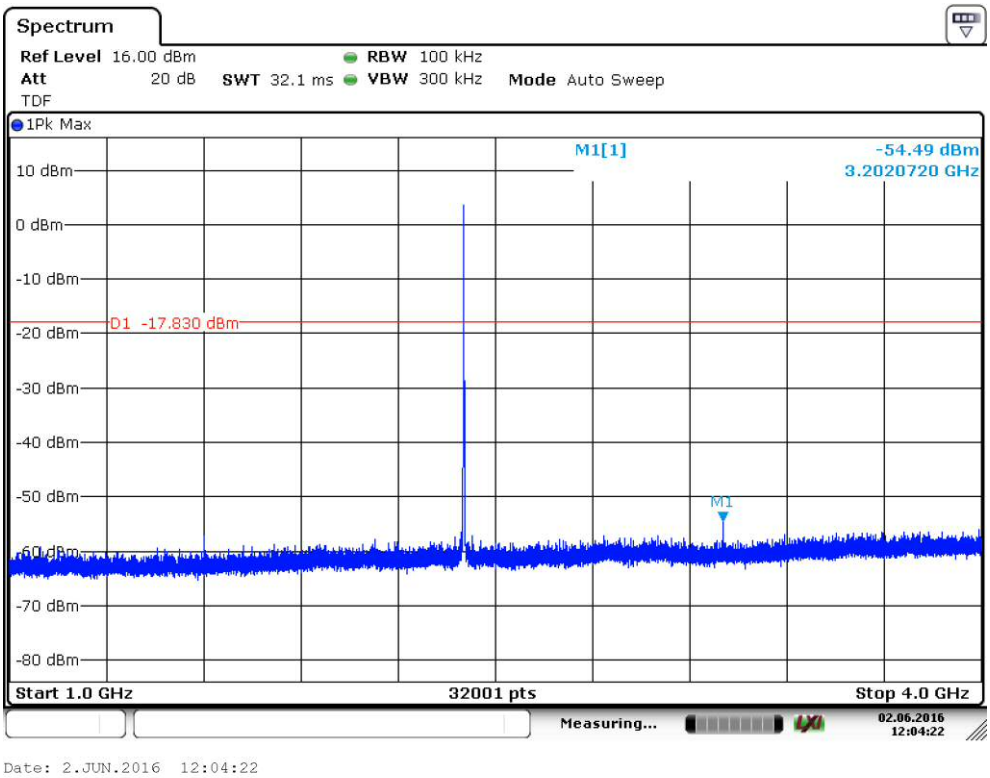


Figure 44. Low channel conducted emission 1 GHz to 4 GHz (2 Mbps).