Test Report

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

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

Equipment Under Test:	Multi-Protocol Wireless Module
Model:	MGM12P32GA MGM12P32GE
Manufacturer:	Silicon Laboratories Finland Oy Bertel Jungin aukio 3 FI-02600 ESPOO FINLAND
Customer:	Silicon Laboratories Finland Oy Bertel Jungin aukio 3 FI-02600 ESPOO FINLAND
FCC Rule Part:	15.247: 2016
IC Rule Part:	RSS-247, Issue 2, 2017 RSS-GEN Issue 4, 2014
KDB:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (April 5, 2017)

Date:	4 December 2017	Date:	4 December 2017
Issued by:	Jani Tuomela Testing Engineer	Checked by:	Rauno Repo Testing Engineer

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Equipment Under Test (EUT)

Trade mark:	Silicon Labs
Model:	MGM12P32GA, MGM12P32GE
Type:	Multi-Protocol Wireless Module
Serial no:	-
FCC ID:	QOQMGM12P3
IC:	5123A-MGM12P3

Description of the EUT

MGM12P32G is a multi-protocol wireless module with two antenna variants. Variant A is equipped with chip antenna while the E variant has RF connector for the use of external antenna.

This test report contains test results for Bluetooth Low Energy.

Classification of the device

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

Modifications Incorporated in the EUT

One sample was modified to allow conducted measurements to be made.

Ratings and declarations

Operating Frequency Range (OFR):	2402 - 2480 MHz
Channels:	40
Channel separation:	2 MHz
Effective conducted power:	16.99 dBm (Peak)
Modulation:	GFSK
Integral Antenna gain:	A-variant: 1 dBi
External Antenna gain:	E-variant: 2.14 dBi

Power Supply

Operating voltage range: 2.0 - 3.8 VDC (tested with 3.3V regulated by the development board)

Separate AC/DC adaptor, Huawei model: HW-050100E01 (115 V, 60 Hz input / 5 V output) was used during the tests to power up the development board which feeds the module (EUT) during AC emissions test. Supply is not provided by the manufacturer. In other tests the development board was supplied with laboratory power supply.

Mechanical Size of the EUT

Height: 2 mm Width: 20 mm Length: 15 mm

Samples

Two samples were used in the tests, one with original antenna assembly. One sample had RF connector with short RF cable and antenna attached to it.

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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
§15.207(a) / RSS-GEN 8.8	Conducted Emissions on Power Supply Lines	**PASS**
§15.247(b)(3) / RSS-247 5.4(d)	Maximum Peak Conducted Output Power	**PASS**
§15.247(a)(2) / RSS-247 5.2(a)	6 dB Bandwidth	**PASS**
§15.247(e) / RSS-247 5.2(b)	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 using software provided by the manufacturer. Normal modulation and duty cycle was applied in all the tests.

Conducted measurements were performed while the EUT was connected to WSTK development board. Conducted measurements were performed to E variant sample.

Radiated measurements with A variant were performed while the EUT was placed on simplified board with reduced functionality.

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

Power setting 199 was used for A variant and power setting 186 for E variant during radiated measurements.

Power setting 186 was used for conducted measurements. Other settings in table below were same for all tests.

PHY	Low energy transmit	Packet Length
1M	PRBS9 (GFSK)	255

Test Facility

Testing Laboratory / address: FCC registration number: **904175**	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
Test Site:	Kara5m

TEST RESULTS

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz

Standard:	ANSI C63.10	(2013)
Tested by:	EHA	
Date:	2 August 2017	
Temperature:	22 °C	
Humidity:	44 % RH	
Barometric pressure:	1001 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.

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.

Final measurements from the worst frequencies

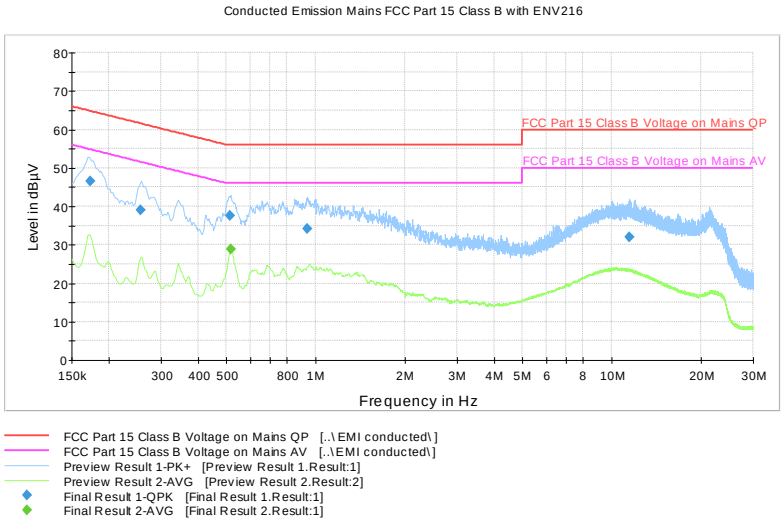

Figure 1: The measured curves with peak- and average detector.

Table 1: Final QuasiPeak measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.173000	46.5	1000.0	9.000	L1	10.3	18.3	64.8
0.256500	38.9	1000.0	9.000	L1	9.7	22.6	61.5
0.515250	37.5	1000.0	9.000	L1	10.1	18.5	56.0
0.938000	34.2	1000.0	9.000	L1	10.0	21.8	56.0
11.470250	32.0	1000.0	9.000	L1	10.3	28.0	60.0

Table 2: Final Average measurements from the worst frequencies

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.517250	28.8	1000.0	9.000	N	10.3	17.2	46.0

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

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10	(2013)
Tested by:	JAT	
Date:	23 November 2017	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % RH	
Measurement uncertainty:	± 2.87dB	Level of confidence 95 % (k = 2)

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

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.

Measured values are peak values.

Results:

Table 3: Maximum conducted output power

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	16.99	30	13.01	PASS
Mid	16.82	30	13.18	PASS
High	16.69	30	13.31	PASS

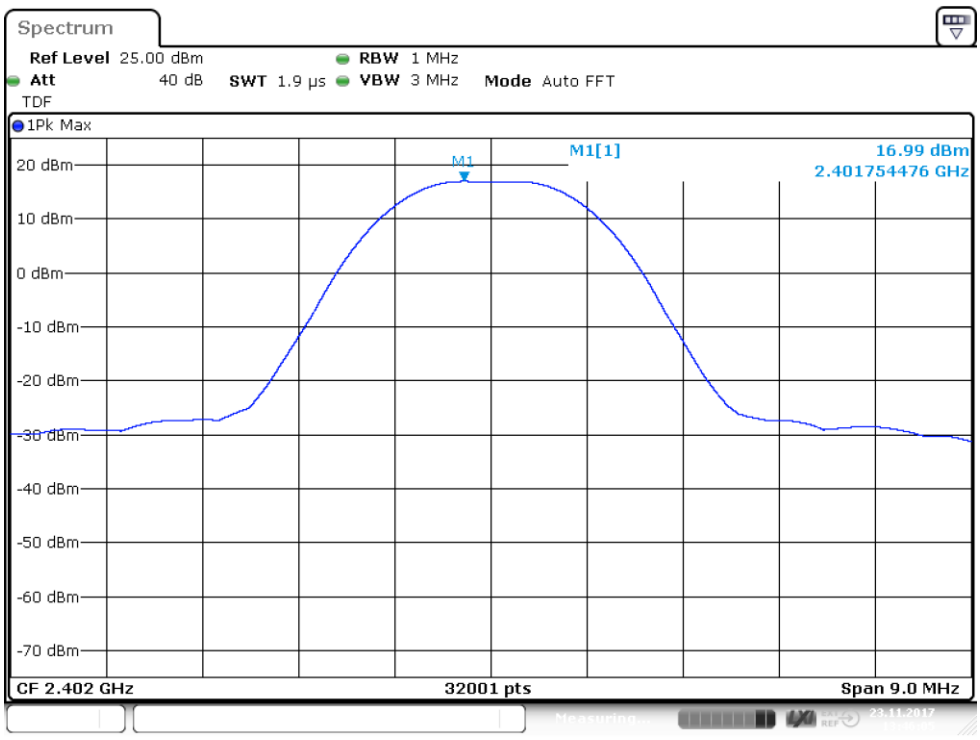

Figure 2: Conducted power (ch low)

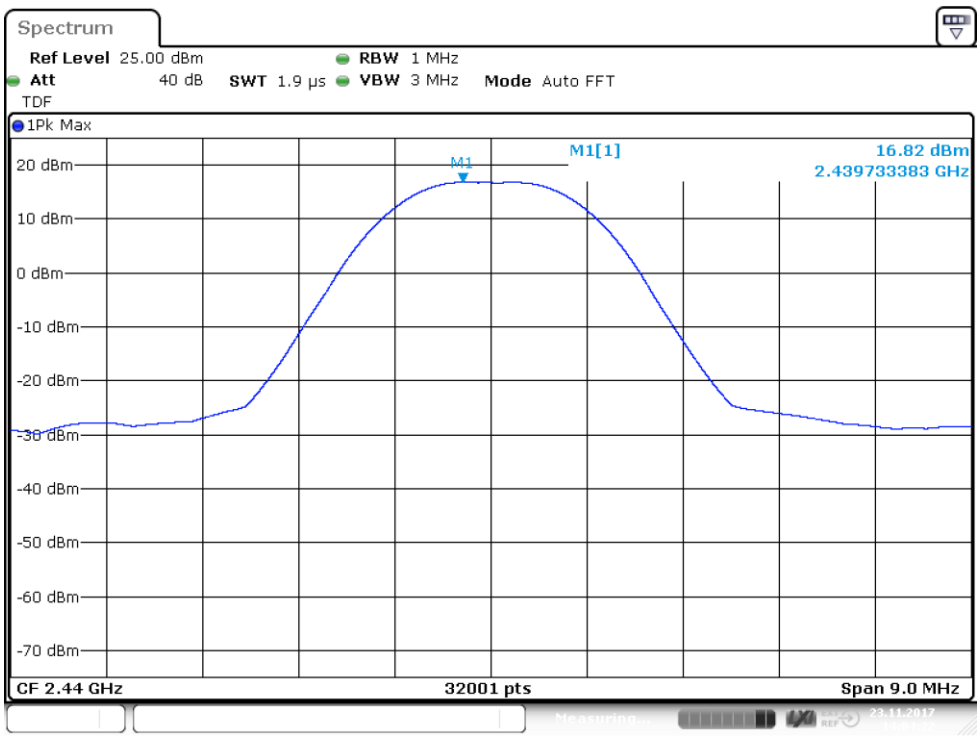

Figure 3: Conducted power (ch mid)

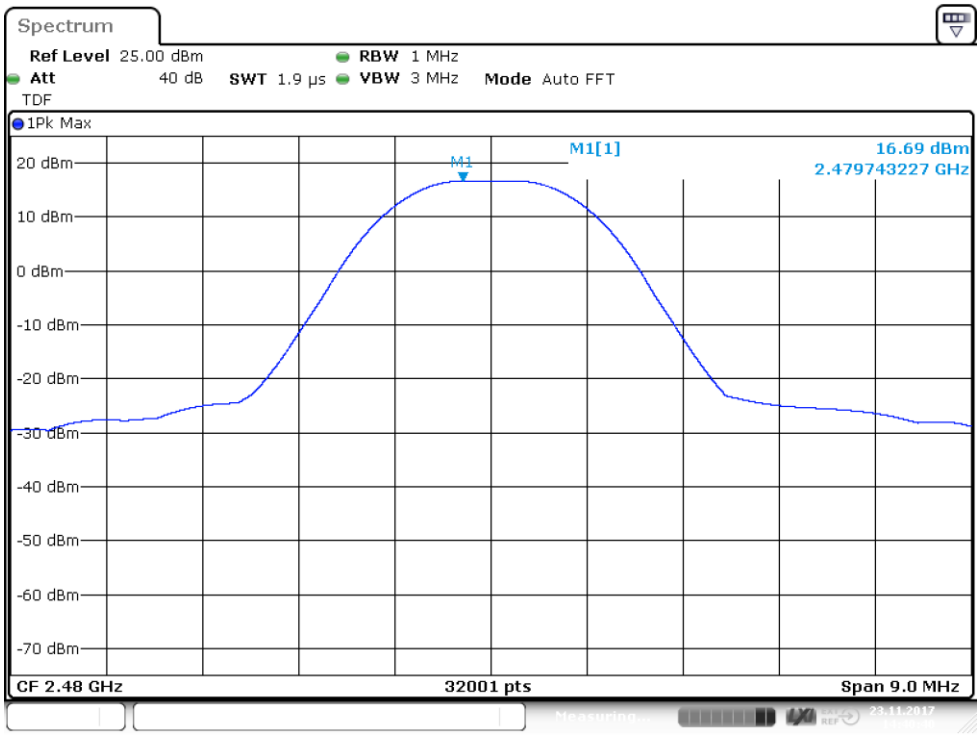

Figure 4: Conducted power (ch high)

Transmitter Radiated Spurious Emissions 30 - 26500 MHz

Standard:	ANSI C63.10	(2013)
Tested by:	EHA & JAT	
Date:	26 July 2017 - 8 August 2017	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % 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. 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).

Peak values of emissions below 1000 MHz measured for reference as well as transmitter fundamental.

Measurements were performed for both antenna variants.

Frequency range [MHz]	Limit [µV/m]	Limit [dBµV/m]	Detector
30 - 80	100	40.0	Quasi-peak
88 - 216	150	43.5	Quasi-peak
216 - 960	200	46.0	Quasi-peak
960 - 1000	500	53.9	Quasi-peak
Above 1000	500	53.9	Average
Above 1000	5000	73.9	Peak

Low channel

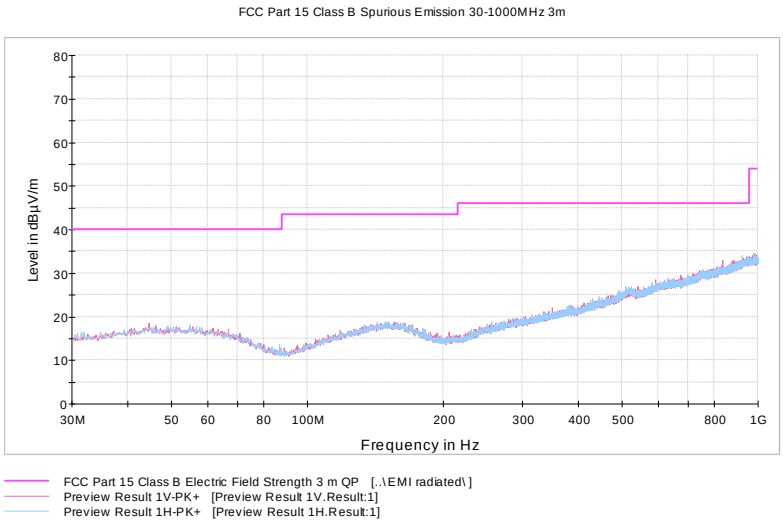

Figure 5: Low channel 30 MHz – 1000 MHz (A)

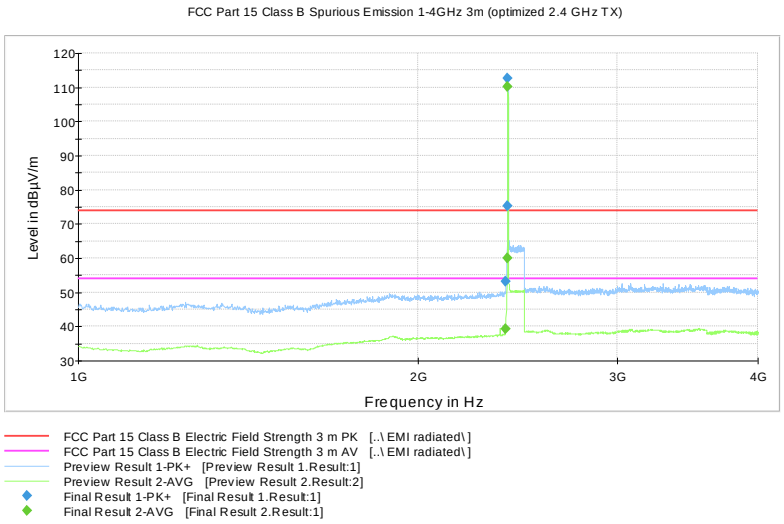

Figure 6: Low channel 1 GHz – 4 GHz (A)

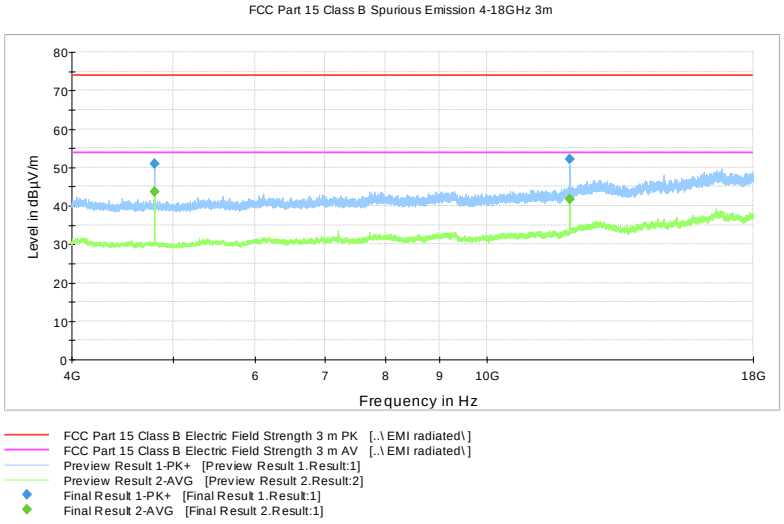

Figure 7: Low channel 4 GHz – 18 GHz (A)

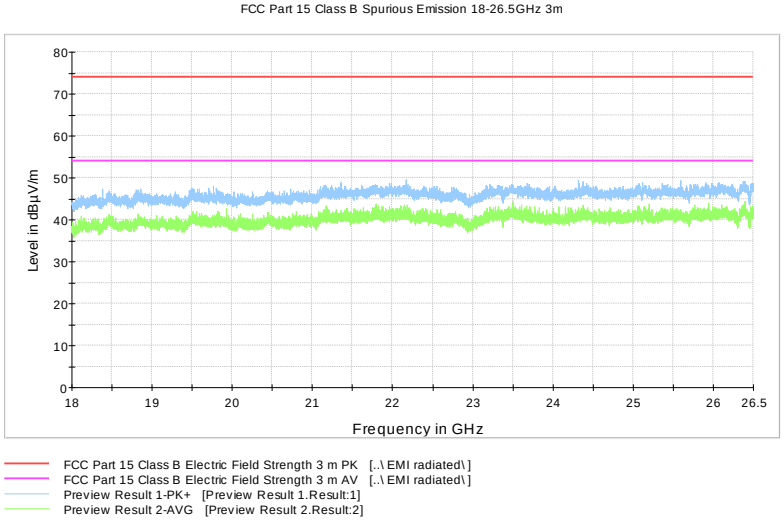

Figure 8: Low channel 18 GHz – 26.5 GHz (A)

Table 4: Peak results (ch low) (A)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2389.600000	53.3	1000.0	1000.000	179.0	H	345.0	14.6	20.6	73.9
2400.000000	75.2	1000.0	1000.000	179.0	H	329.0	14.7	17.5	92.7
4803.300000	51.0	1000.0	1000.000	245.0	V	350.0	8.3	22.9	73.9
12008.70000	52.2	1000.0	1000.000	150.0	H	239.0	18.9	21.7	73.9

Table 5: Average results (ch low) (A)

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2390.000000	39.3	1000.0	1000.000	180.0	H	329.0	14.6	14.6	53.9
4804.000000	43.7	1000.0	1000.000	245.0	V	0.0	8.3	10.2	53.9
12010.90000	41.6	1000.0	1000.000	150.0	H	242.0	18.9	12.3	53.9

Middle channel

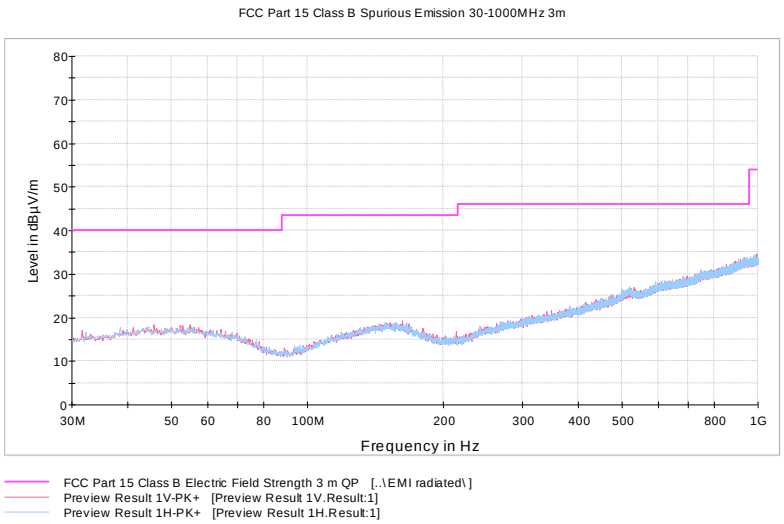

Figure 9: Mid channel 30 MHz – 1000 MHz (A)

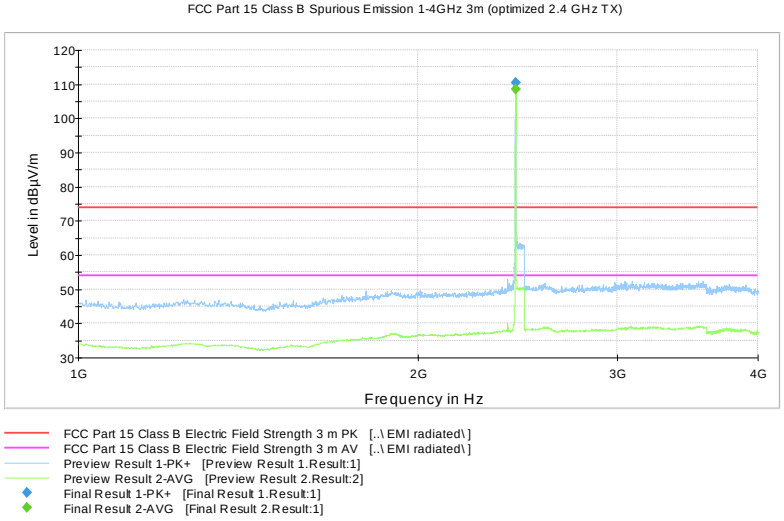

Figure 10: Mid channel 1 GHz – 4 GHz (A)

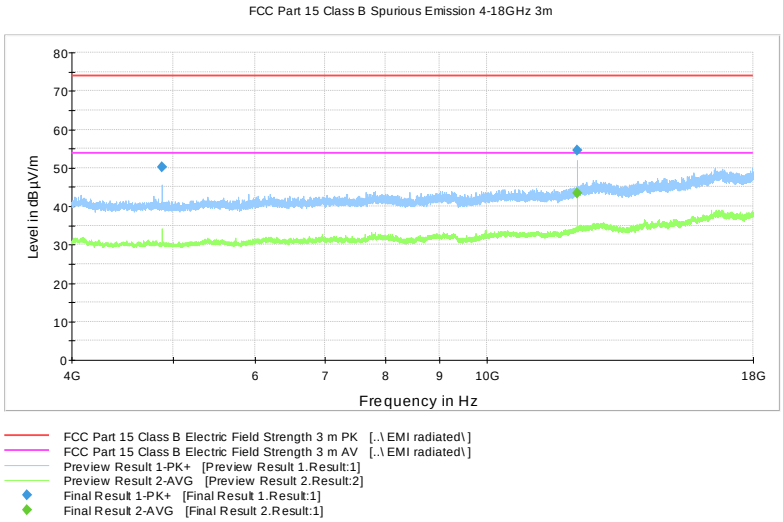

Figure 11: Mid channel 4 GHz – 18 GHz (A)

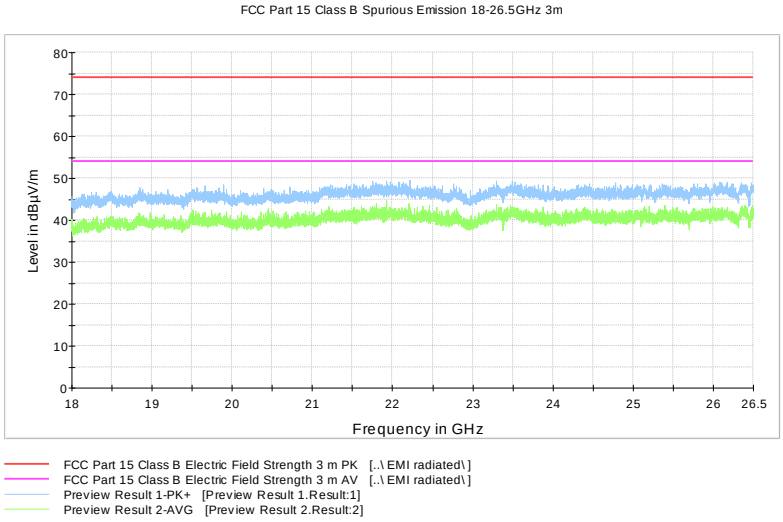

Figure 12: Mid channel 18 GHz – 26.5 GHz (A)

Table 6: Peak results (ch mid) (A)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4880.100000	50.1	1000.0	1000.000	150.0	H	245.0	8.3	23.8	73.9
12201.10000	54.5	1000.0	1000.000	150.0	H	241.0	19.6	19.4	73.9

Table 7: Average results (ch mid) (A)

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
12198.80000	43.3	1000.0	1000.000	150.0	H	234.0	19.6	10.6	53.9

High channel

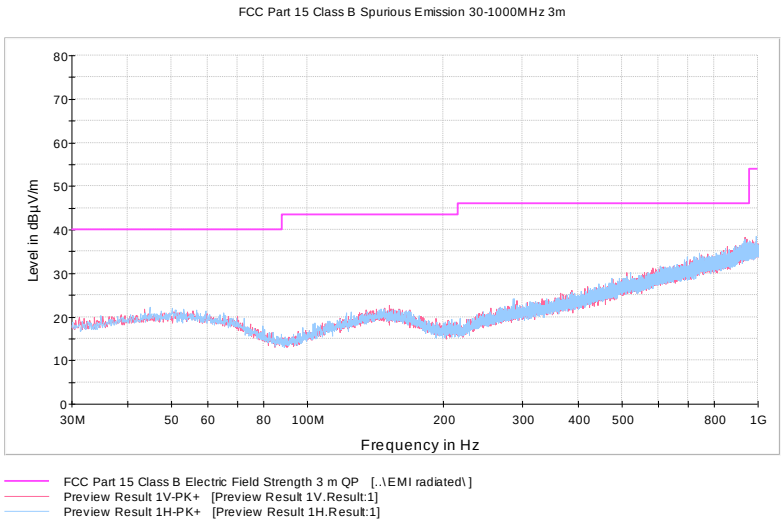

Figure 13: High channel 30 MHz – 1000 MHz (A)

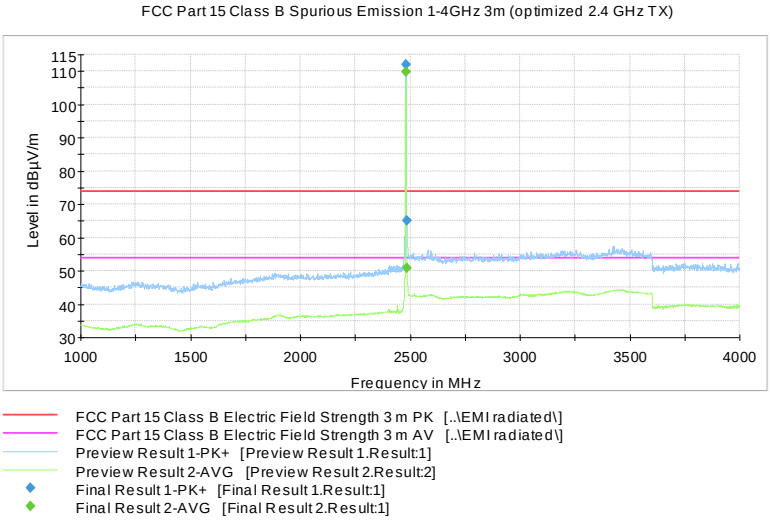

Figure 14: High channel 1 GHz – 4 GHz (A)

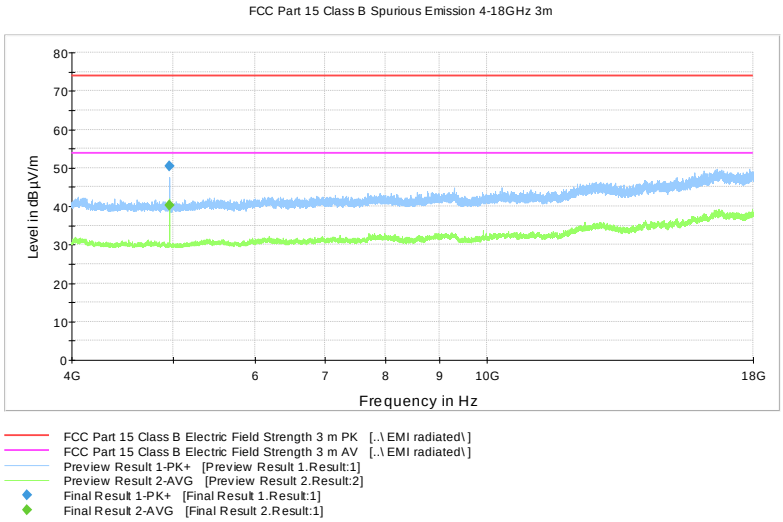

Figure 15: High channel 4 GHz – 18 GHz (A)

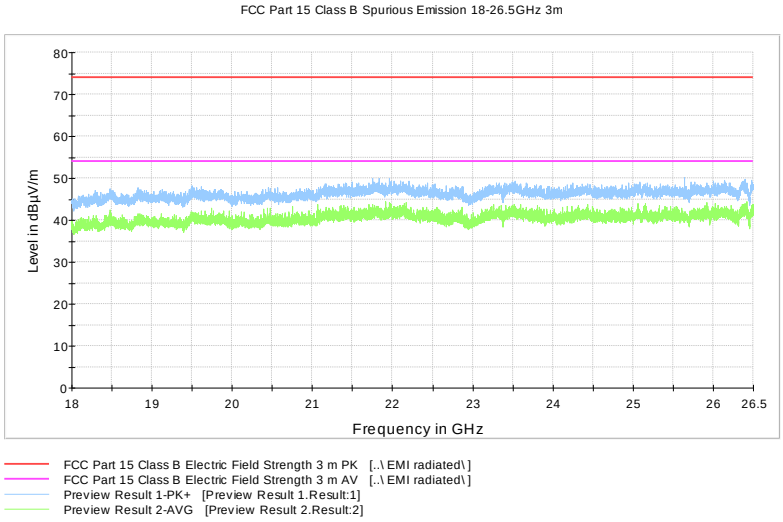

Figure 16: High channel 18 GHz – 26.5 GHz (A)

Table 8: Peak results (ch high) (A)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	65.2	1000.0	1000.000	244.0	H	347.0	14.7	8.7	73.9
4960.100000	50.5	1000.0	1000.000	218.0	V	344.0	8.2	23.4	73.9

Table 9: Average results (ch high) (A)

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	50.7	1000.0	1000.000	243.0	H	348.0	14.7	3.2	53.9
4959.900000	40.2	1000.0	1000.000	261.0	V	0.0	8.2	13.7	53.9

Radiated Band Edge results

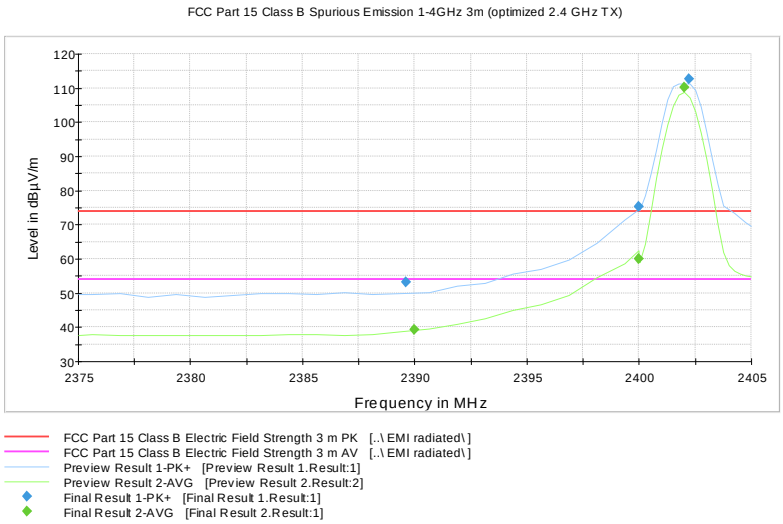

Figure 17: Radiated Band Edge measurement graph (ch low) (A)

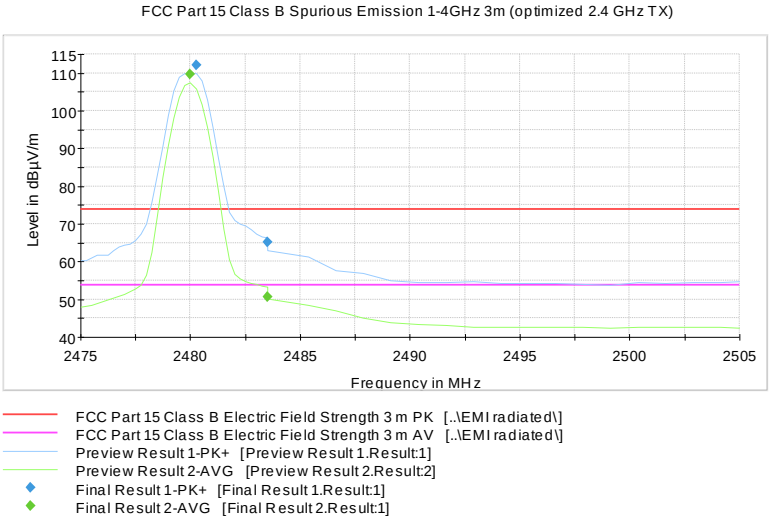

Figure 18: Radiated Band Edge measurement graph (ch high) (A)

Table 10: Peak results (ch high) (A)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	65.9	1000.0	1000.000	241.0	H	340.0	14.7	8.0	73.9

Table 11: Average results (ch high) (A)

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	49.7	1000.0	1000.000	241.0	H	341.0	14.7	4.2	53.9

Low channel

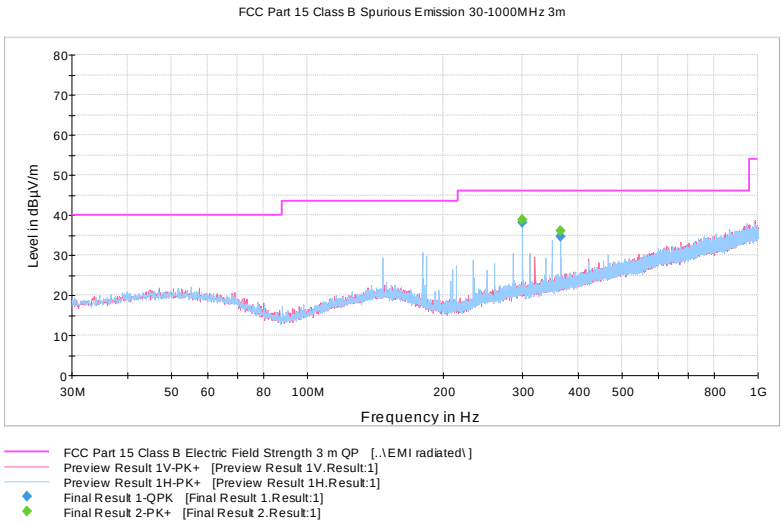

Figure 19: Low channel 30 MHz – 1000 MHz (E)

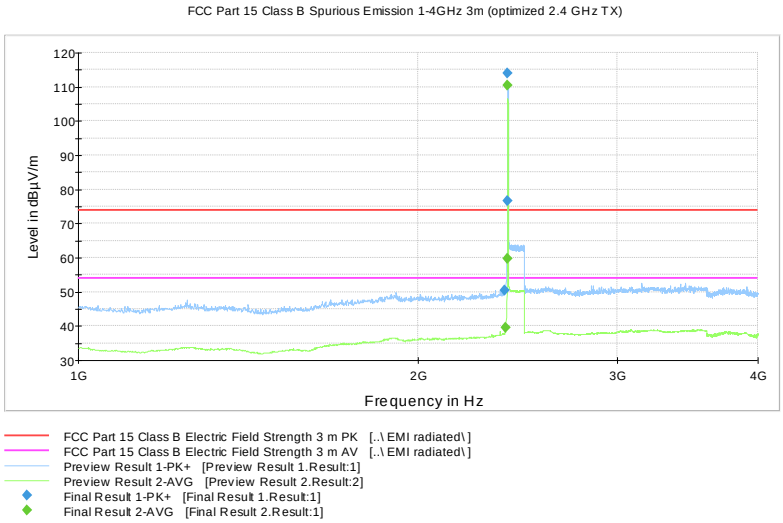

Figure 20: Low channel 1 GHz – 4 GHz (E)

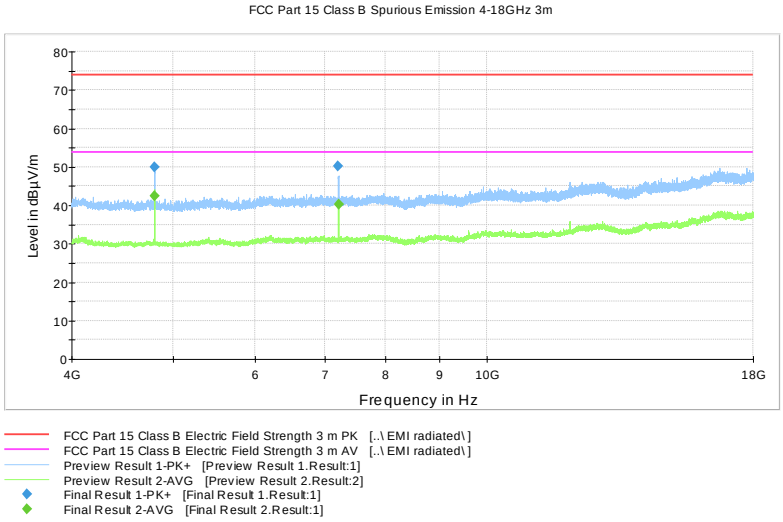

Figure 21: Low channel 4 GHz – 18 GHz (E)

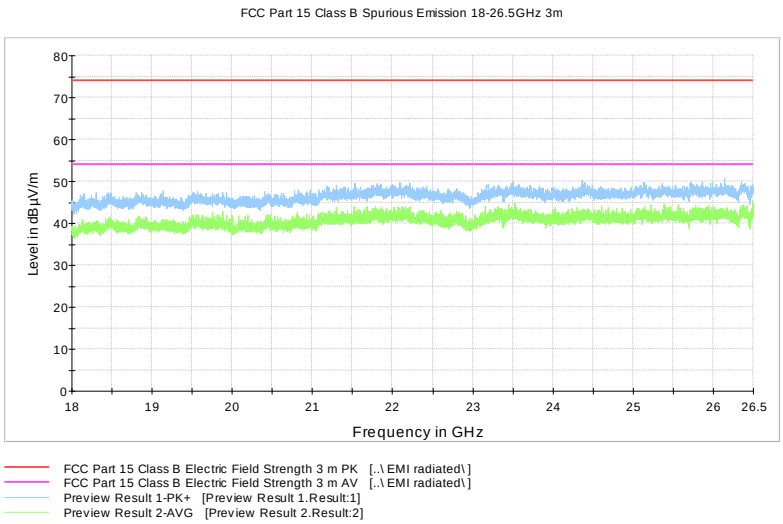

Figure 22: Low channel 18 GHz – 26.5 GHz (E)

Table 12: Peak results (ch low) (E)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2387.800000	50.6	1000.0	1000.000	191.0	H	17.0	14.6	23.3	73.9
2400.000000	76.7	1000.0	1000.000	230.0	V	335.0	14.7	17.3	94.0
4804.500000	50.0	1000.0	1000.000	150.0	V	151.0	8.3	23.9	73.9
7205.300000	50.3	1000.0	1000.000	150.0	V	6.0	12.1	23.6	73.9

Table 13: Average results (ch low) (E)

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2389.800000	39.4	1000.0	1000.000	281.0	V	318.0	14.6	14.5	53.9
4804.000000	42.4	1000.0	1000.000	150.0	V	153.0	8.3	11.5	53.9
7206.500000	40.2	1000.0	1000.000	150.0	V	7.0	12.1	13.7	53.9

Table 14: Quasi-peak results (ch low) (E)

Frequency (MHz)	QuasiP (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
300.011000	38.2	1000.0	120.000	100.0	H	7.0	15.3	7.8	46.0
364.028000	34.7	1000.0	120.000	100.0	H	48.0	16.9	11.3	46.0

Middle channel

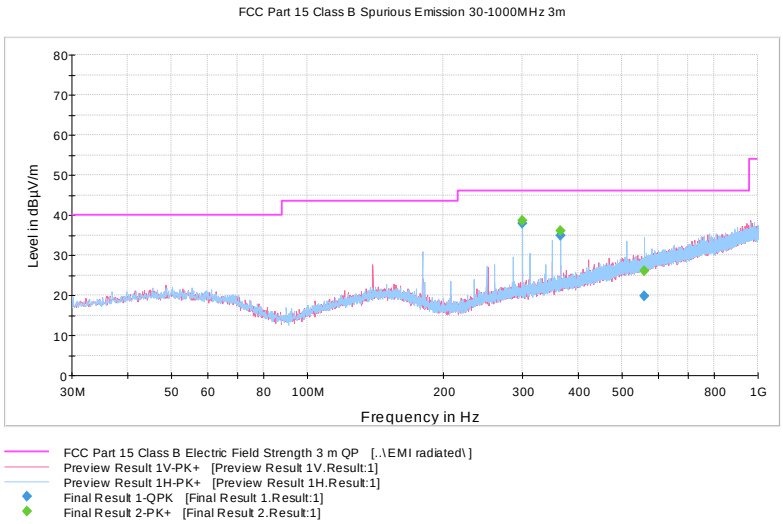

Figure 23: Mid channel 30 MHz – 1000 MHz (E)

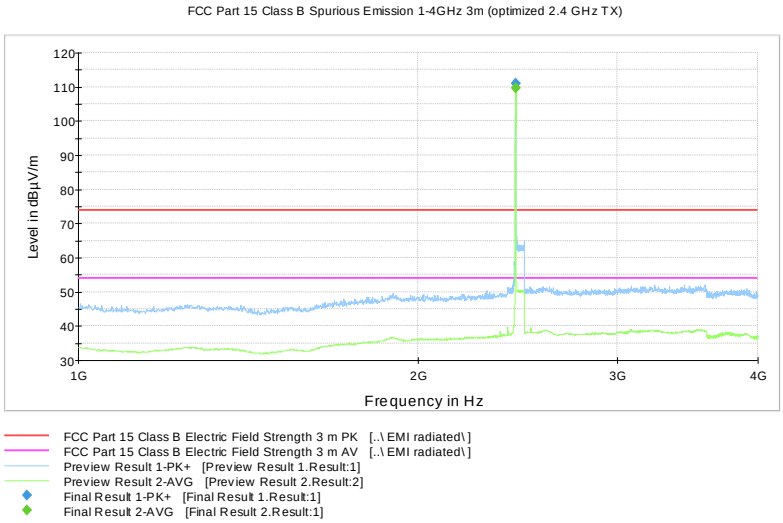

Figure 24: Mid channel 1 GHz – 4 GHz (E)

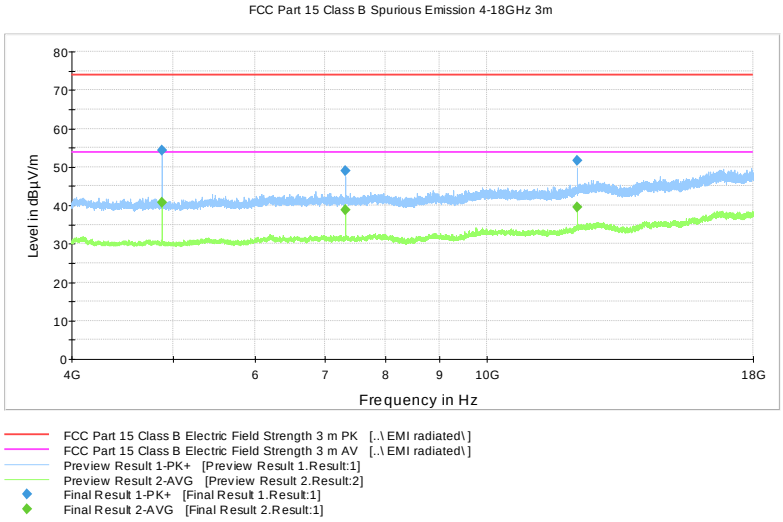

Figure 25: Mid channel 4 GHz – 18 GHz (E)

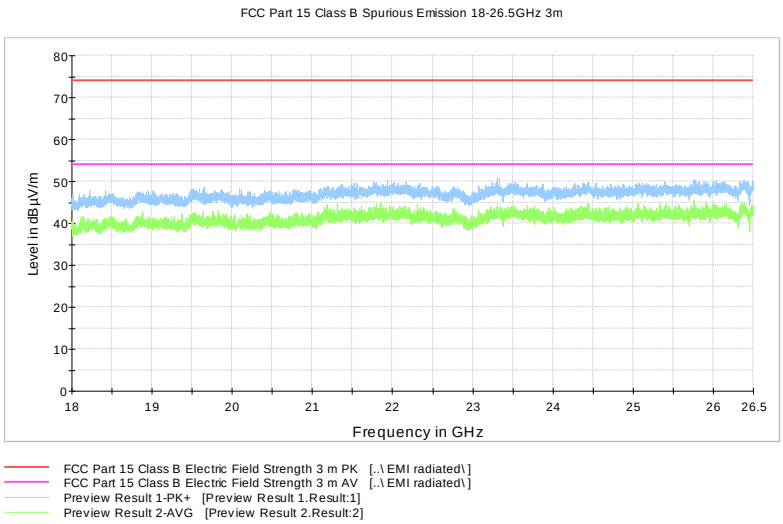

Figure 26: Mid channel 18 GHz – 26.5 GHz (E)

Table 15: Peak results (ch mid) (E)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4879.900000	54.3	1000.0	1000.000	150.0	V	139.0	8.3	19.6	73.9
7320.600000	48.9	1000.0	1000.000	150.0	V	10.0	12.1	25.0	73.9
12198.60000	51.6	1000.0	1000.000	150.0	V	215.0	19.6	22.3	73.9

Table 16: Average results (ch mid) (E)

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
4879.900000	40.7	1000.0	1000.000	150.0	V	164.0	8.3	13.2	53.9
7320.400000	38.7	1000.0	1000.000	179.0	V	10.0	12.1	15.2	53.9
12198.60000	39.5	1000.0	1000.000	150.0	V	215.0	19.6	14.4	53.9

Table 17: Quasi-peak results (ch mid) (E)

Frequency (MHz)	QuasiP (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
300.008000	38.0	1000.0	120.000	100.0	H	7.0	15.3	8.0	46.0
364.011000	34.8	1000.0	120.000	100.0	H	56.0	16.9	11.2	46.0

High channel

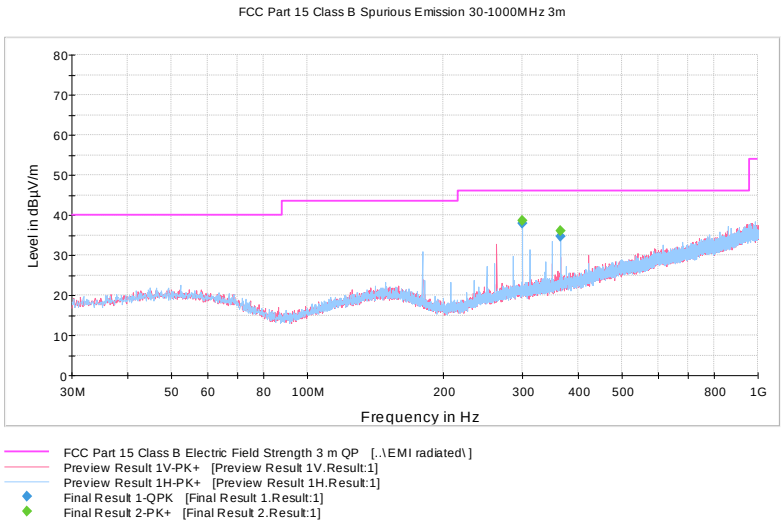

Figure 27: High channel 30 MHz – 1000 MHz (E)

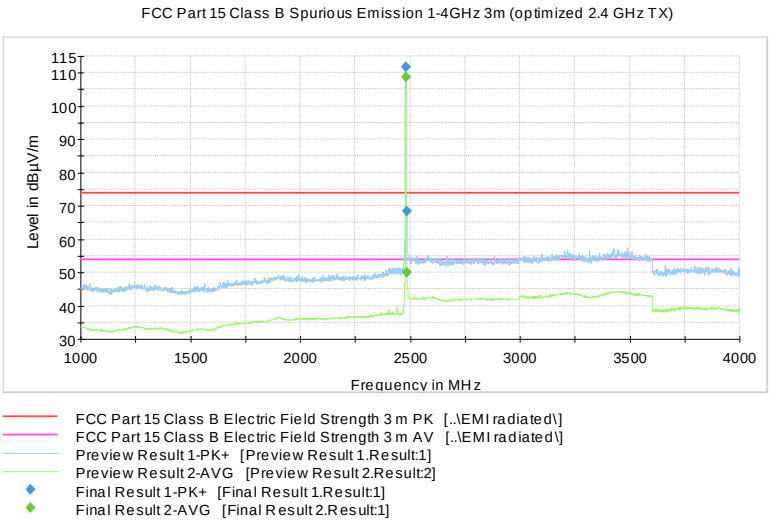

Figure 28: High channel 1 GHz – 4 GHz (E)

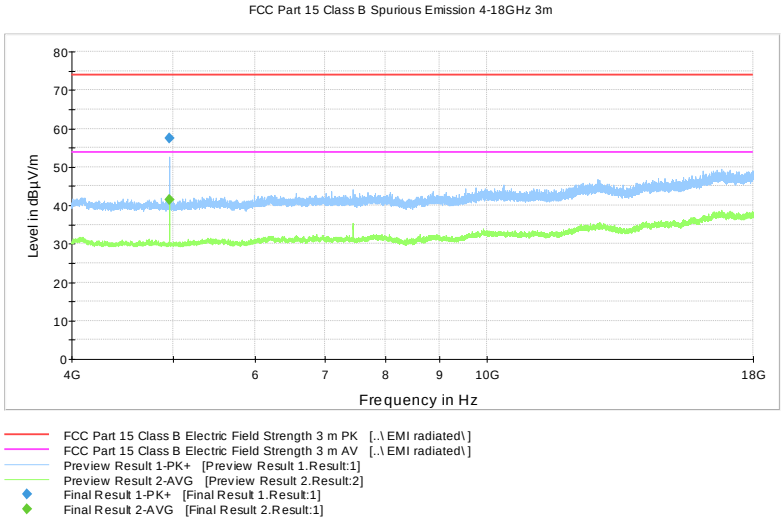

Figure 29: High channel 4 GHz – 18 GHz (E)

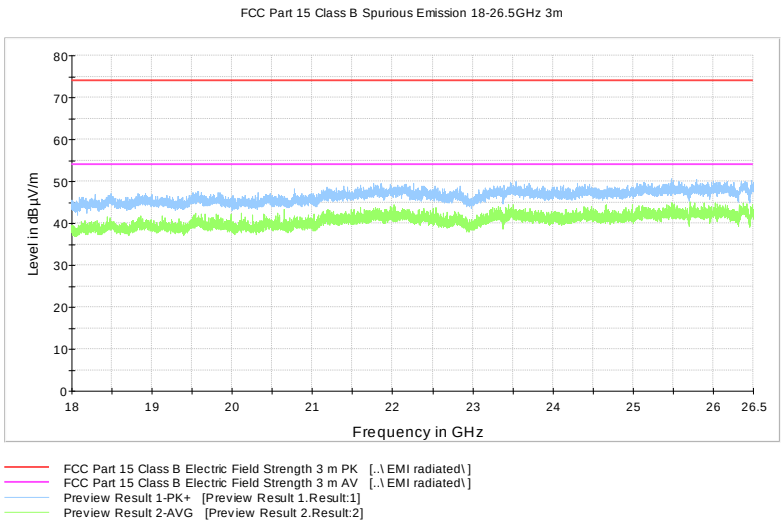

Figure 30: High channel 18 GHz – 26.5 GHz (E)

Table 18: Peak results (ch high) (E)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	68.5	1000.0	1000.000	300.0	V	110.0	14.7	5.4	73.9
4960.000000	57.5	1000.0	1000.000	150.0	V	153.0	8.2	16.4	73.9

Table 19: Average results (ch high) (E)

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2483.500000	50.1	1000.0	1000.000	272.0	V	109.0	14.7	3.8	53.9
4959.900000	41.4	1000.0	1000.000	150.0	V	160.0	8.2	12.5	53.9

Table 20: Quasi-peak results (ch mid) (E)

Frequency (MHz)	QuasiP (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
300.011000	38.0	1000.0	120.000	100.0	H	6.0	15.3	8.0	46.0
364.011000	34.7	1000.0	120.000	100.0	H	48.0	16.9	11.3	46.0

Radiated Band Edge results

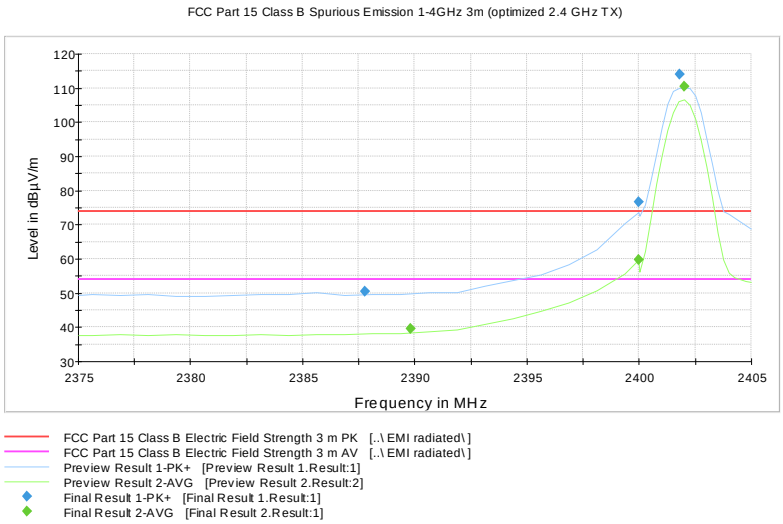

Figure 31: Radiated Band Edge measurement graph (ch low) (E)

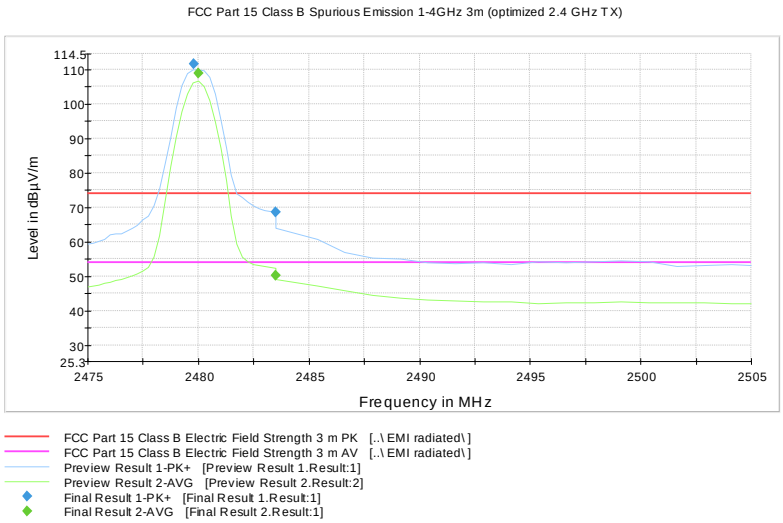

Figure 32: Radiated Band Edge measurement graph (ch high) (E)

Transmitter Band Edge Measurement and Conducted Spurious Emissions

Standard:	ANSI C63.10	(2013)
Tested by:	JAT	
Date:	23 November 2017	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % RH	
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 21: Band edge attenuation

Band Edge Attenuation	
Lower Band Edge	**Upper Band Edge**
-53.90 dBc	-53.44 dBc
Limit: -20 dBc	

Table 22: Conducted spurious emissions (ch low)

Frequency [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]	Result
682.11	-67.87	-3.09	-64.78	PASS
2399.67	-38.77	-3.09	-35.68	PASS
2517.17	-61.09	-3.09	-58.00	PASS
4804.49	-40.96	-3.09	-37.87	PASS
7205.26	-51.67	-3.09	-48.58	PASS
12011.11	-53.89	-3.09	-50.79	PASS
15855.21	-56.99	-3.09	-53.90	PASS
16153.79	-55.28	-3.09	-52.19	PASS
19182.29	-57.42	-3.09	-54.33	PASS
24857.36	-55.65	-3.09	-52.55	PASS
26196.56	-55.44	-3.09	-52.35	PASS

Table 23: Conducted spurious emissions (ch mid)

Frequency [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]	Result
715.00	-67.29	-3.18	-64.11	PASS
2363.23	-61.54	-3.18	-58.36	PASS
2516.84	-61.72	-3.18	-58.53	PASS
4880.52	-40.51	-3.18	-37.33	PASS
7320.76	-51.81	-3.18	-48.63	PASS
12198.79	-57.18	-3.18	-54.00	PASS
15462.97	-56.62	-3.18	-53.44	PASS
16149.01	-55.25	-3.18	-52.07	PASS
20810.96	-57.39	-3.18	-54.21	PASS
24485.47	-56.39	-3.18	-53.21	PASS
25392.78	-56.23	-3.18	-53.04	PASS

Table 24: Conducted spurious emissions (ch high)

Frequency [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]	Result
779.89	-67.65	-3.33	-64.32	PASS
2326.39	-63.46	-3.33	-60.13	PASS
2483.57	-41.87	-3.33	-38.54	PASS
4959.55	-38.97	-3.33	-35.63	PASS
7440.66	-52.98	-3.33	-49.65	PASS
12516.69	-58.60	-3.33	-55.26	PASS
15503.19	-56.13	-3.33	-52.80	PASS
16151.82	-54.79	-3.33	-51.45	PASS
19481.34	-56.66	-3.33	-53.33	PASS
24119.01	-56.09	-3.33	-52.76	PASS
25434.73	-56.35	-3.33	-53.01	PASS

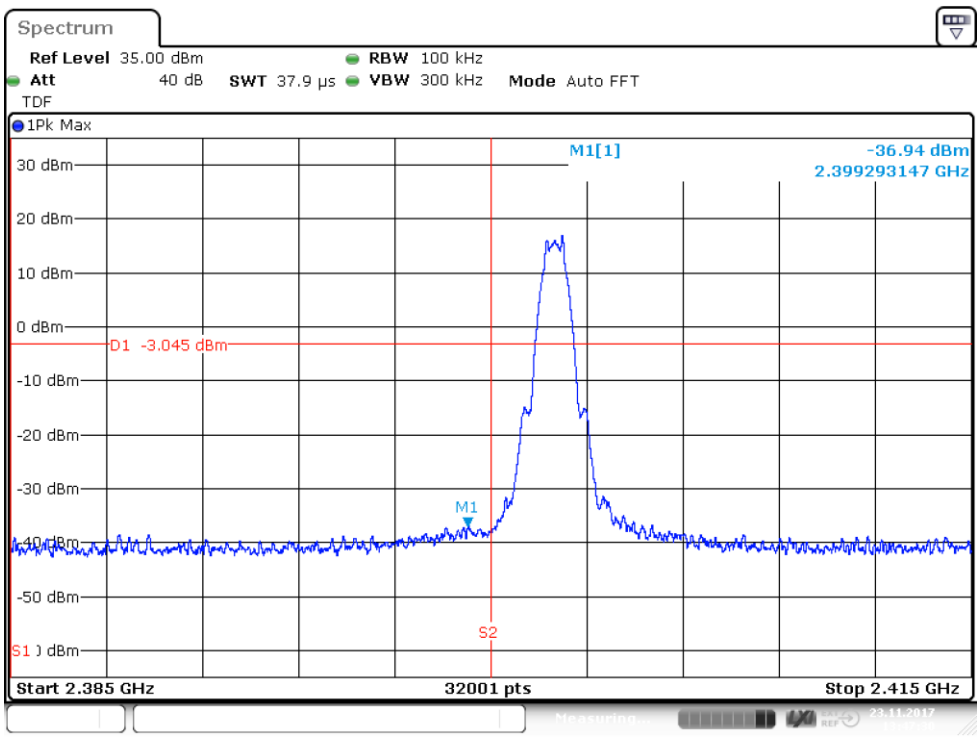

Figure 33: Lower Band Edge

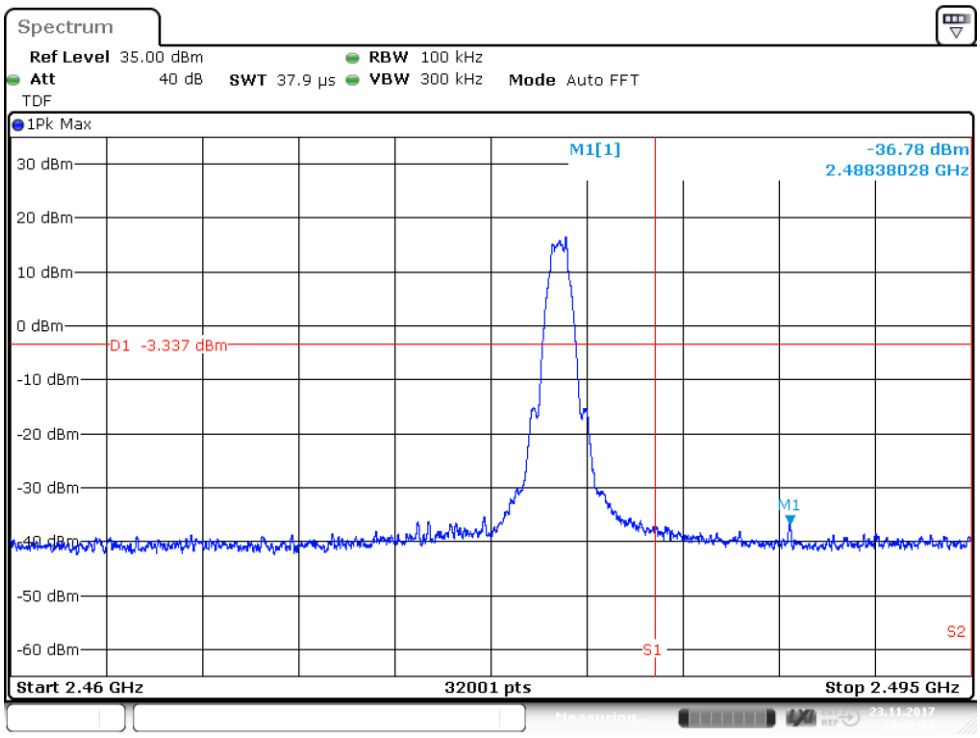

Figure 34: Upper Band Edge

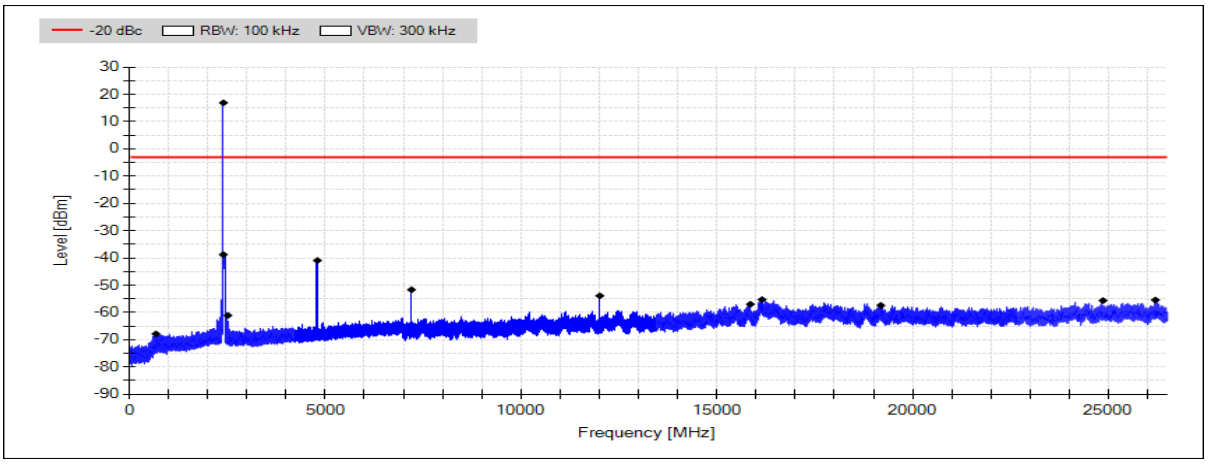

Figure 35: Conducted spurious emissions 30 - 26500 MHz channel low

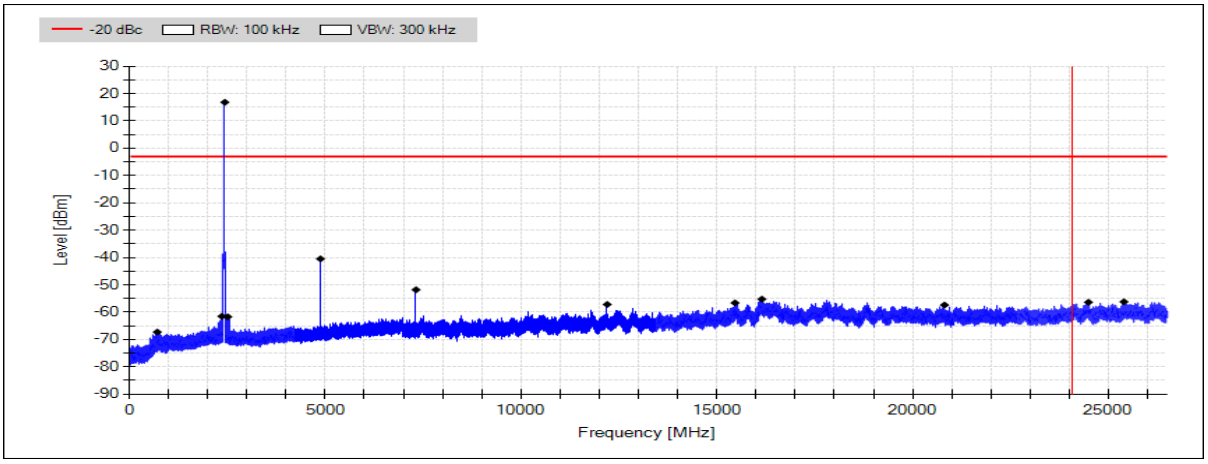

Figure 36: Conducted spurious emissions 30 - 26500 MHz channel mid

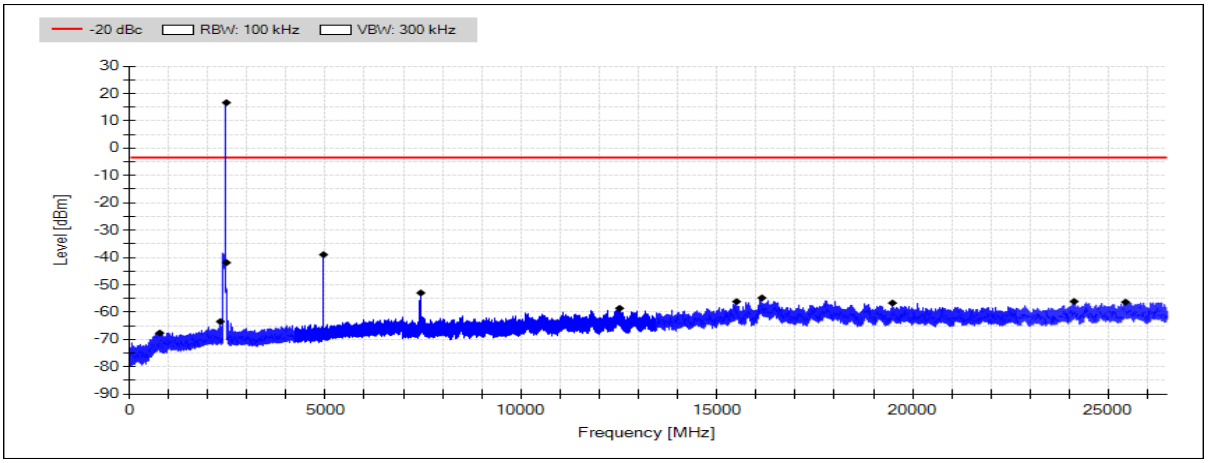

Figure 37: Conducted spurious emissions 30 - 26500 MHz channel high

6 dB Bandwidth of the Channel

Standard:	ANSI C63.10	(2013)
Tested by:	JAT	
Date:	23 November 2017	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % RH	

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

Results:

Table 25: 6 dB bandwidth test results

Channel	6 dB BW [kHz]	Minimum limit [kHz]
Low	651.0	500
Mid	648.0	
High	645.0	

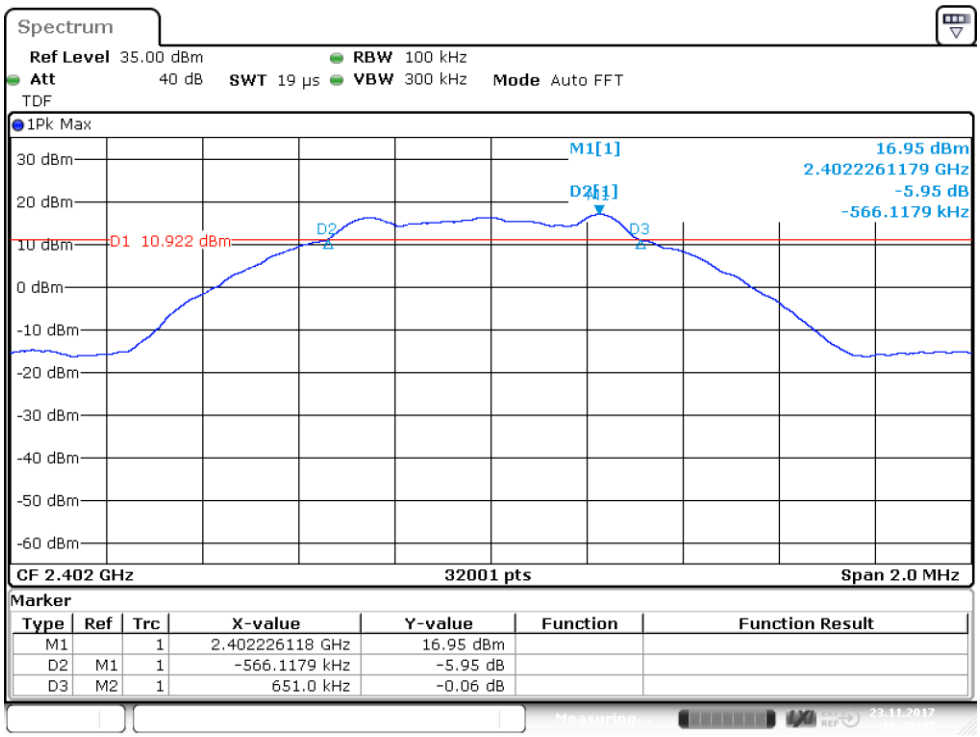

Figure 38: 6 dB bandwidth (ch low)

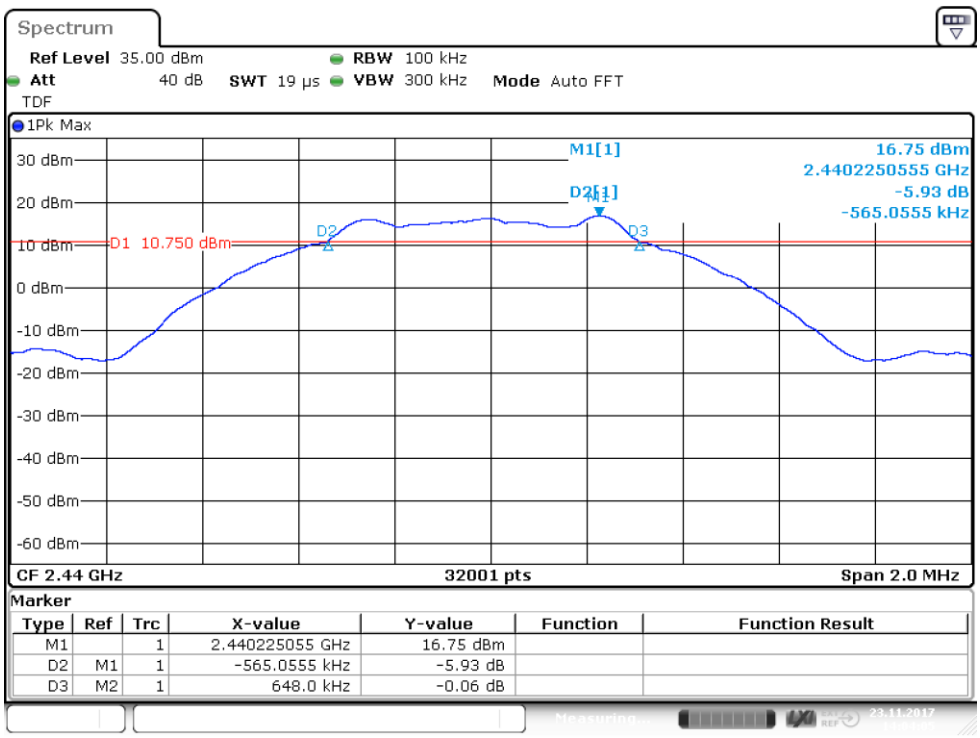

Figure 39: 6 dB bandwidth (ch mid)

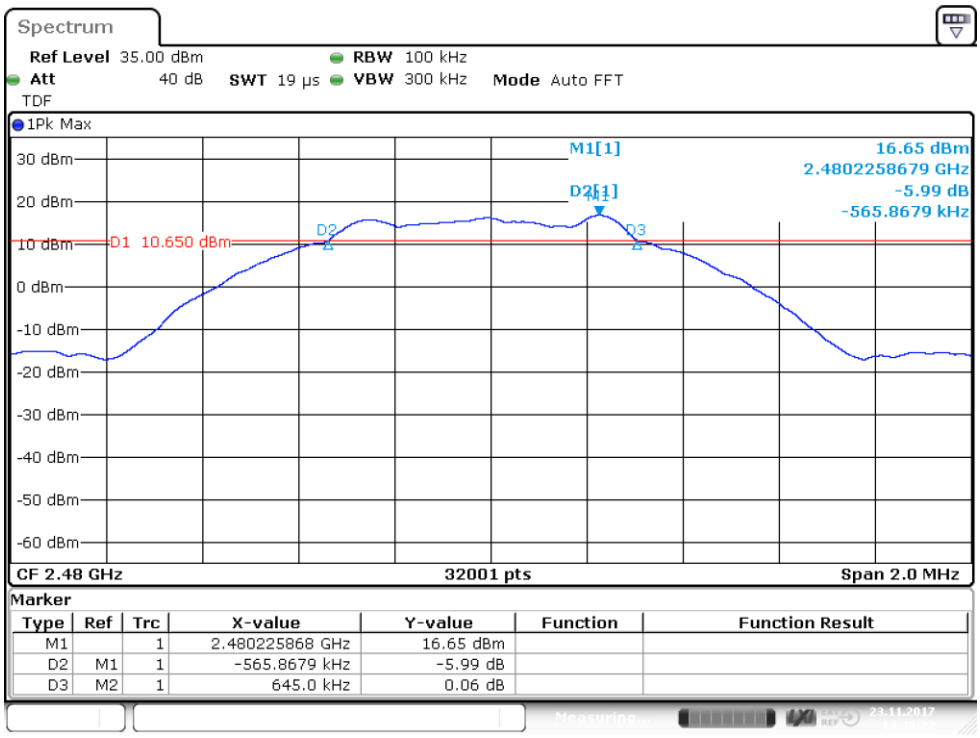

Figure 40: 6 dB bandwidth (ch high)

Power Spectral Density

Standard:	ANSI C63.10	(2013)
Tested by:	JAT	
Date:	23 November 2017	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % RH	

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

Results:

Table 26: Power spectral density test results

Channel	PSD dBm/3 kHz	Maximum limit [dBm/3kHz]
Low	0.61	+8.00
Mid	0.44	
High	0.32	

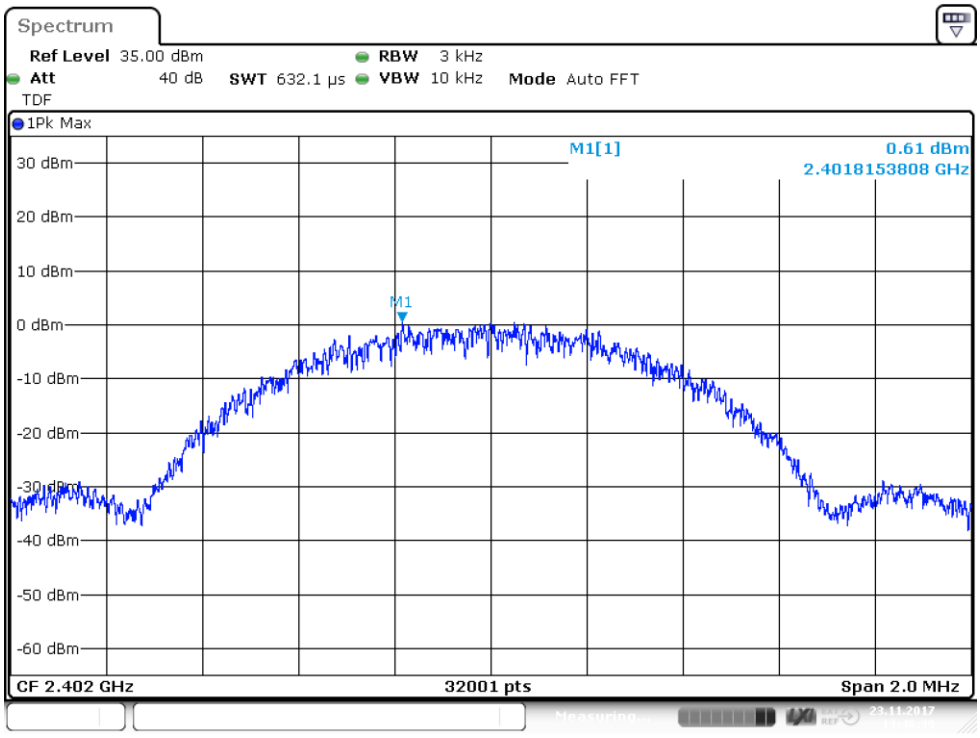

Figure 41: Power spectral density (ch low)

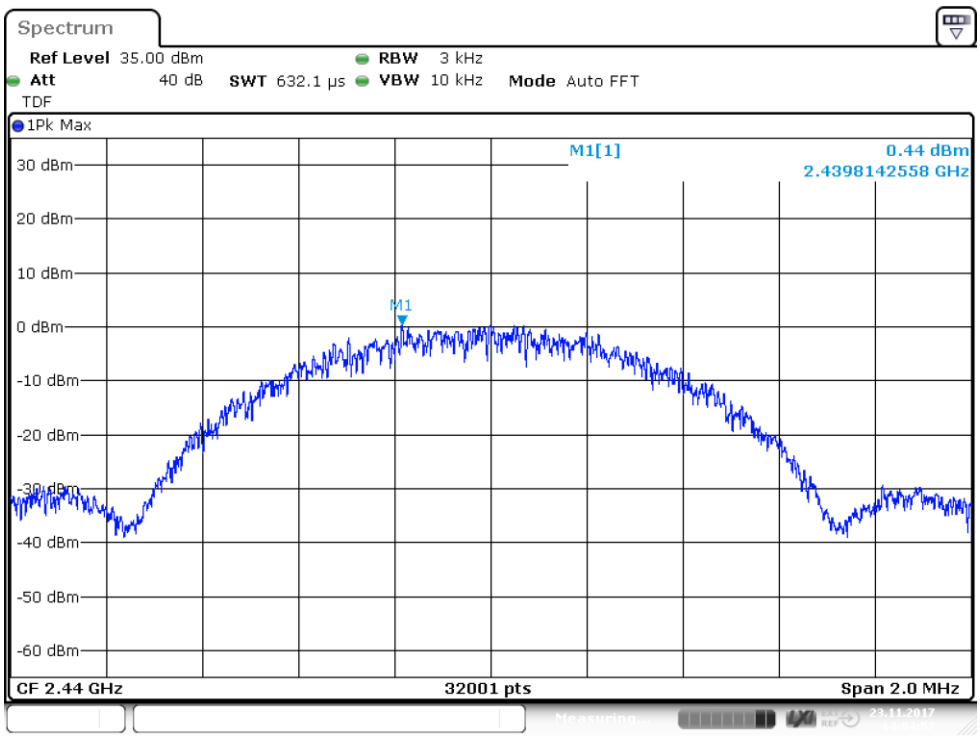

Figure 42: Power spectral density (ch mid)

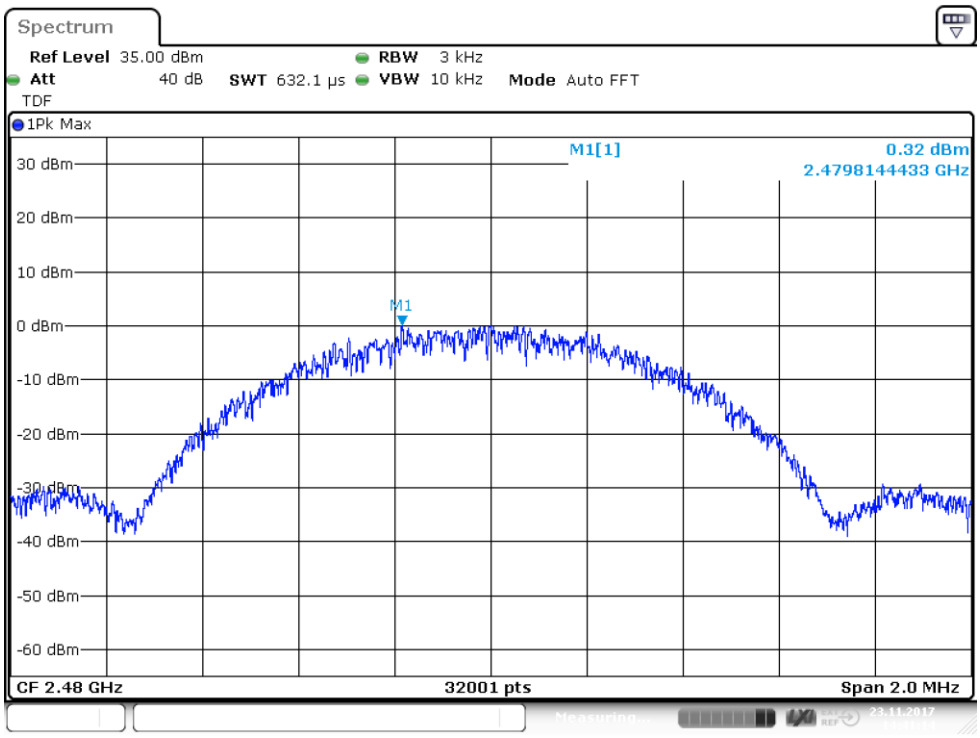

Figure 43: Power spectral density (ch high)

99% Occupied Bandwidth

Standard:	RSS-GEN	(2014)
Tested by:	JAT	
Date:	23 November 2017	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % RH	

RSS-GEN 6.6

Table 27: 99% occupied bandwidth test results

Channel	Limit	99 % BW [MHz]	Result
Low	-	1.037842567	PASS
Mid	-	1.042092435	PASS
High	-	1.047092278	PASS

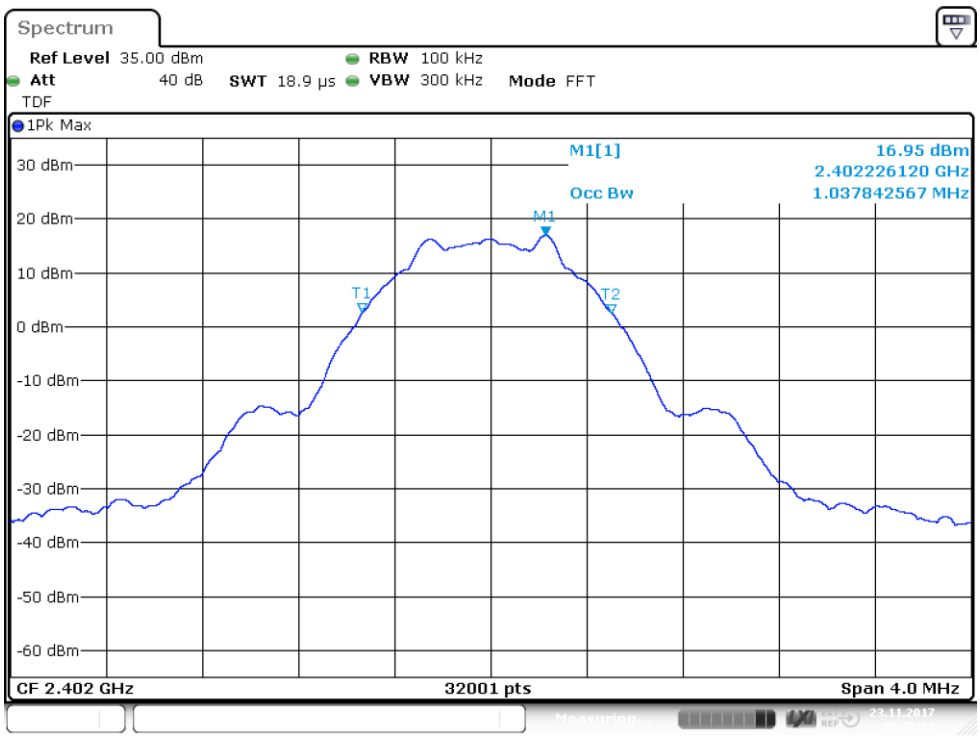

Figure 44: 99% OBW (ch low)

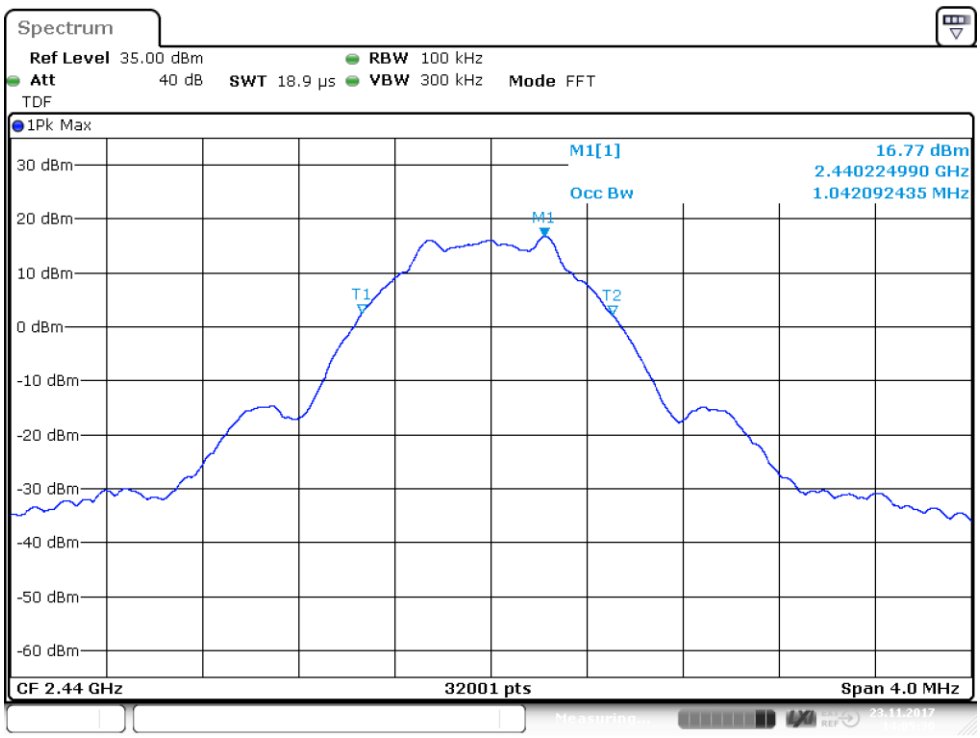

Figure 45: 99% OBW (ch mid)

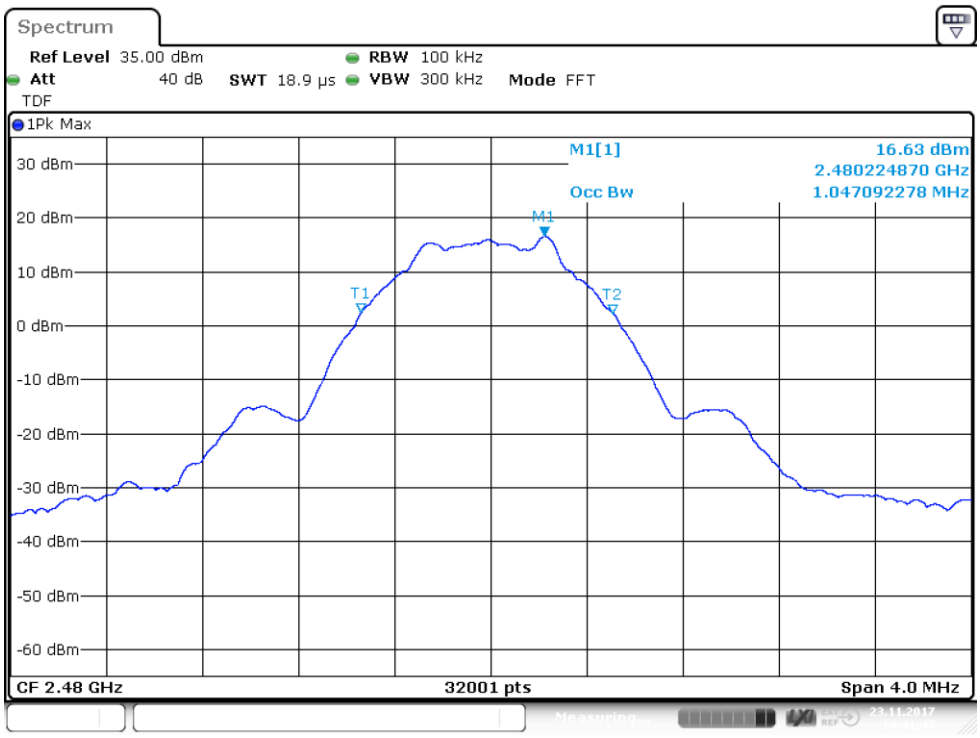

Figure 46: 99% OBW (ch high)

TEST EQUIPMENT

RF-Test Equipment

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
ANTENNA	A.H. SYSTEMS	SAS-200/518	inv:7873	-	-
SPECTRUM ANALYZER	AGILENT	E7405A	inv:9746	2016-01-07	2018-01-07
PREAMPLIFIER	CIAO	CA118-3123	inv:10278	2016-11-28	2017-11-28
POWER SUPPLY	DELTA	SM 130-25D	inv:10406	-	-
ANTENNA	EMCO	3117	inv:7293	2016-03-16	2018-03-06
ANTENNA	EMCO	3160-09	inv:7294	2017-03-16	2018-03-16
ANTENNA	ETS LINDGREN	3160-10	inv:9151	2013-08-06	2018-08-06
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	-	-
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	-	-
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	-	-
ATTENUATOR	PASTERNACK	10dB DC-40GHz	-	-	-
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	inv:8453	2017-07-10	2018-07-10
SIGNAL ANALYZER	ROHDE & SCHWARZ	FSV40	inv:9093	2017-07-07	2018-07-07
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2016-10-25	2018-10-25
TEMPERATURE/ HUMIDITY METER	VAISALA	HMT 333	inv:8638	2017-02-21	2018-02-21
HIGH PASS FILTER	WAINWRIGHT	WHKX4.0/18G-10SS	inv:10403	2017-03-01	2019-03-01