

Test Report



INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C

Equipment Under Test: Wireless Communication Panel

Model: LCP 103

Manufacturer: Wapice
Hermiankatu 1B
FI-33720 TAMPERE
FINLAND

Customer: Danfoss Drives
Runsorintie 7
FI-65380 VAASA
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: 27 November 2017

Issued by:

A blue ink signature of Mikko Halonen.

Mikko Halonen
Testing Engineer

Date: 27 November 2017

Checked by:

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Rauno Repo
Testing Engineer

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Equipment Under Test (EUT)

Trade mark: VLT®
Model: LCP 103
Type: Wireless Communication Panel
FCC ID: 2ANSELCP-103

Description of the EUT

The EUT is a wireless communication adapter with 802.11b/g 2.4 GHz WiFi module.

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): 2412 - 2462 MHz
Channels: 11
Channel separation: 5 MHz
99% Channel bandwidth: 16.5395 MHz
Effective conducted power: 13.72 dBm
Transmission technique: DSSS, OFDM
Modulation: BPSK, QPSK, 16QAM
Integral Antenna gain: 1.9 dBi

Power Supply

Operating voltage range: 4.75 – 5.25 VDC (tested with 5.0V)

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 EUT during AC emissions test. Supply is not provided by the manufacturer. In other tests the EUT was supplied with laboratory power supply.

Mechanical Size of the EUT

Height: 16 mm

Width: 67 mm

Length: 131 mm

Samples

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

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
§15.207(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 EUT was configured into the wanted channel using software provided by the manufacturer. Normal modulation and duty cycle was applied in all the tests. Tests were performed using power setting 0 in low and high channel and power setting 1 in middle channel.

Conducted measurements were performed using SMA adapter with a short cable connected to EUTs RF connector.

Radiated measurements were performed with EUT integrated 1.9 dBi antenna.

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

Channel Low (Ch 1) = 2412 MHz

Channel Mid (Ch 6) = 2437 MHz

Channel High (Ch 11) = 2462 MHz

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: MIH
Date: 14 September 2017
Temperature: 22 °C
Humidity: 45 % RH
Barometric pressure: 979 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 (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Conducted Emission Mains FCC Part 15 Class B with ENV216

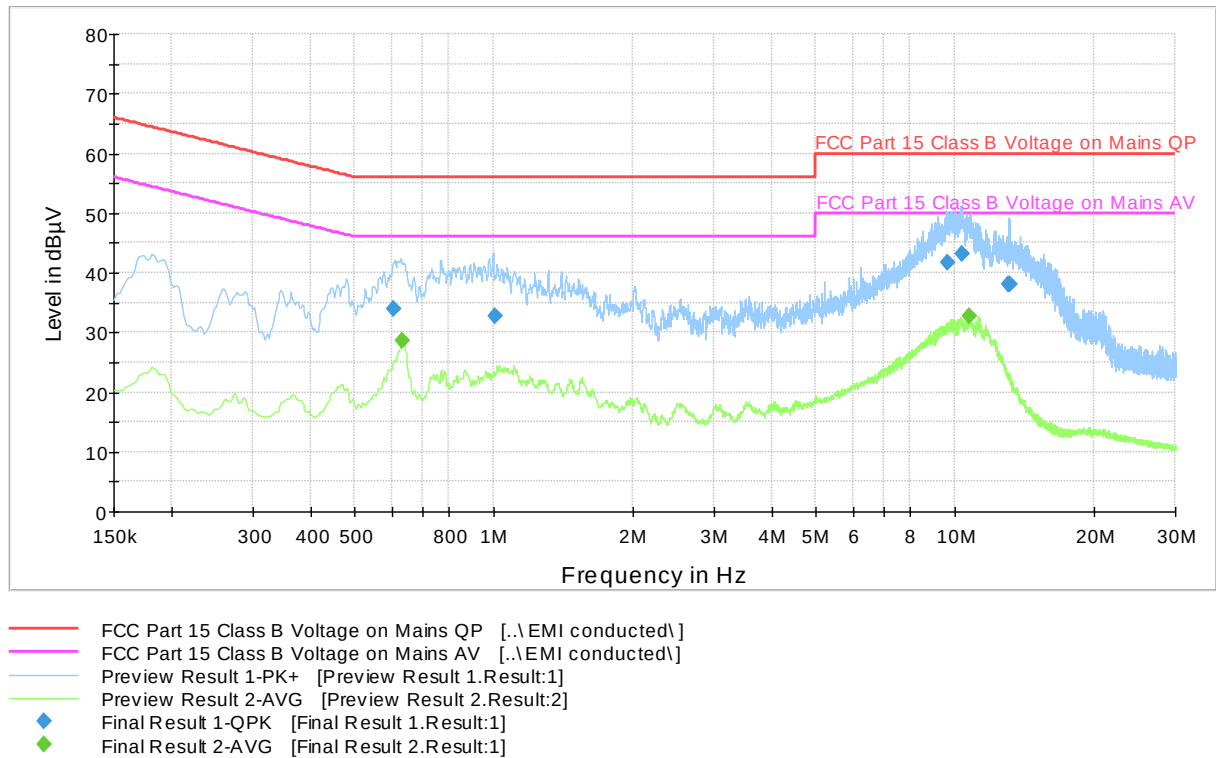


Figure 1: The measured curves with peak- and average detector

Conducted Emissions on Power Supply Lines

Final measurements from the worst frequencies

Table 1: Final QuasiPeak measurements from the worst frequencies

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Margin (dB)	Limit (dBμV)
0.607500	33.8	1000.0	9.000	22.2	56.0
1.007500	32.8	1000.0	9.000	23.2	56.0
9.622250	41.7	1000.0	9.000	18.3	60.0
10.334250	43.0	1000.0	9.000	17.0	60.0
13.038250	38.0	1000.0	9.000	22.0	60.0
13.128000	38.2	1000.0	9.000	21.8	60.0

Table 2: Final Average measurements from the worst frequencies

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Margin (dB)	Limit (dBμV)
0.633250	28.7	1000.0	9.000	17.3	46.0
10.726750	32.8	1000.0	9.000	17.2	50.0

Maximum Peak Conducted Output Power

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10	(2013)
Tested by:	MIH	
Date:	15 August - 8 September 2017	
Temperature:	23 ± 3 °C	
Humidity:	30 - 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.

Measurements were performed using averaging power meter.

Maximum Peak Conducted Output Power

Results:

Table 3: Maximum conducted output power, all data rates

Data Rate [Mbps]	Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
1	Low	12.66	30	17.34	PASS
	Mid	13.72	30	16.28	PASS
	High	13.22	30	16.78	PASS
2	Low	12.74	30	17.26	PASS
	Mid	13.57	30	16.43	PASS
	High	13.20	30	16.80	PASS
5.5	Low	12.89	30	17.11	PASS
	Mid	13.70	30	16.30	PASS
	High	13.33	30	16.67	PASS
11	Low	12.56	30	17.44	PASS
	Mid	13.56	30	16.44	PASS
	High	12.97	30	17.03	PASS
6	Low	12.64	30	17.36	PASS
	Mid	13.60	30	16.40	PASS
	High	13.18	30	16.82	PASS
9	Low	11.37	30	18.63	PASS
	Mid	12.56	30	17.44	PASS
	High	12.70	30	17.30	PASS
12	Low	11.26	30	18.74	PASS
	Mid	12.39	30	17.61	PASS
	High	12.58	30	17.42	PASS
18	Low	10.49	30	19.51	PASS
	Mid	12.16	30	17.84	PASS
	High	12.32	30	17.68	PASS
24	Low	10.25	30	19.75	PASS
	Mid	11.97	30	18.03	PASS
	High	12.05	30	17.95	PASS
36	Low	7.63	30	22.37	PASS
	Mid	9.92	30	20.08	PASS
	High	9.54	30	20.46	PASS
48	Low	6.02	30	23.98	PASS
	Mid	8.26	30	21.74	PASS
	High	7.92	30	22.08	PASS
54	Low	4.77	30	25.23	PASS
	Mid	5.08	30	24.92	PASS
	High	5.20	30	24.80	PASS

Transmitter Radiated Spurious Emissions 9 kHz – 26500 MHz

Standard: ANSI C63.10 (2013)
Tested by: MIH
Date: 17 September – 23 November 2017
Temperature: 23 ± 3 °C
Humidity: 30 - 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.

Low channel, 1 Mbps data rate
Table 4: Quasi-peak results (ch low)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
0.729000	10.1	1000.0	9.000	90.0	V	137.0	-20.1	20.3	30.4
39.971000	28.6	1000.0	120.000	100.0	V	31.0	14.0	11.4	40.0
87.016000	25.3	1000.0	120.000	100.0	V	225.0	8.8	14.7	40.0
108.818000	23.2	1000.0	120.000	100.0	V	189.0	11.3	20.3	43.5
167.275000	28.4	1000.0	120.000	180.0	H	84.0	14.2	15.1	43.5
347.693000	30.5	1000.0	120.000	100.0	V	117.0	16.4	15.5	46.0
607.393000	28.0	1000.0	120.000	100.0	V	208.0	22.9	18.0	46.0

Table 5: Peak results (ch low)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
39.971000	33.1	1000.0	120.000	100.0	V	31.0	14.0	-	-
87.016000	29.6	1000.0	120.000	100.0	V	225.0	8.8	-	-
108.818000	29.1	1000.0	120.000	100.0	V	189.0	11.3	-	-
167.275000	31.5	1000.0	120.000	180.0	H	84.0	14.2	-	-
347.693000	36.7	1000.0	120.000	100.0	V	117.0	16.4	-	-
607.393000	33.1	1000.0	120.000	100.0	V	208.0	22.9	-	-
2389.400000	54.9	1000.0	1000.000	150.0	V	260.0	14.6	19.0	73.9
2398.400000	64.3	1000.0	1000.000	308.0	H	199.0	14.6	16.1	80.4
2411.050000	100.4	1000.0	1000.000	150.0	V	269.0	14.6	-	-
3216.025000	58.4	1000.0	1000.000	150.0	V	9.0	15.5	15.5	73.9
4020.900000	57.8	1000.0	1000.000	219.0	V	336.0	7.7	16.1	73.9
4824.100000	50.0	1000.0	1000.000	150.0	H	315.0	8.3	23.9	73.9
6432.000000	51.5	1000.0	1000.000	206.0	H	243.0	10.8	22.4	73.9

Transmitter Radiated Spurious Emissions

Table 6: Average results (ch low)

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
2389.600000	43.8	1000.0	1000.000	316.0	H	201.0	14.6	10.1	53.9
2397.200000	56.7	1000.0	1000.000	150.0	V	269.0	14.6	20.9	77.6
2411.250000	97.6	1000.0	1000.000	150.0	V	269.0	14.6	-	-
3216.025000	50.7	1000.0	1000.000	179.0	V	9.0	15.5	3.2	53.9
4020.800000	53.7	1000.0	1000.000	205.0	V	334.0	7.7	0.2	53.9
4824.100000	45.7	1000.0	1000.000	205.0	H	318.0	8.3	8.2	53.9
6432.000000	46.9	1000.0	1000.000	150.0	H	244.0	10.8	7.0	53.9
7235.300000	35.0	1000.0	1000.000	150.0	V	31.0	12.1	18.9	53.9
12864.10000	46.0	1000.0	1000.000	192.0	V	205.0	20.2	7.9	53.9

Middle channel, 1Mbps data rate

Table 7: Quasi-peak results (ch mid)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
39.991000	29.4	1000.0	120.000	100.0	V	40.0	14.0	10.6	40.0
87.036000	24.7	1000.0	120.000	100.0	V	186.0	8.8	15.3	40.0
109.115000	23.5	1000.0	120.000	100.0	V	131.0	11.3	20.0	43.5
167.275000	29.1	1000.0	120.000	152.0	H	90.0	14.2	14.4	43.5
170.924000	26.8	1000.0	120.000	152.0	H	98.0	13.9	16.7	43.5
343.037000	28.6	1000.0	120.000	100.0	V	115.0	16.3	17.4	46.0

Table 8: Peak results (ch mid)

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
39.991000	33.7	1000.0	120.000	100.0	V	40.0	14.0	-	-
87.036000	28.9	1000.0	120.000	100.0	V	186.0	8.8	-	-
109.115000	28.7	1000.0	120.000	100.0	V	131.0	11.3	-	-
167.275000	32.3	1000.0	120.000	152.0	H	90.0	14.2	-	-
170.924000	29.9	1000.0	120.000	152.0	H	98.0	13.9	-	-
343.037000	35.0	1000.0	120.000	100.0	V	115.0	16.3	-	-
2436.200000	100.0	1000.0	1000.000	150.0	V	265.0	14.5	-	-
4062.500000	59.0	1000.0	1000.000	150.0	V	6.0	7.7	14.9	73.9
4874.000000	51.4	1000.0	1000.000	218.0	H	314.0	8.3	22.5	73.9
6498.700000	51.7	1000.0	1000.000	218.0	H	239.0	10.8	22.2	73.9

Table 9: Average results (ch mid)

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1624.775000	42.6	1000.0	1000.000	150.0	H	176.0	10.7	11.3	53.9
2358.725000	49.7	1000.0	1000.000	321.0	H	208.0	14.3	4.2	53.9
2436.250000	97.3	1000.0	1000.000	150.0	V	265.0	14.5	-	-
2581.625000	47.8	1000.0	1000.000	150.0	H	202.0	15.1	6.1	53.9
3249.325000	47.3	1000.0	1000.000	166.0	V	17.0	15.6	6.6	53.9
4062.400000	53.7	1000.0	1000.000	150.0	V	6.0	7.7	0.2	53.9
4874.000000	47.6	1000.0	1000.000	218.0	H	319.0	8.3	6.3	53.9
6498.700000	47.8	1000.0	1000.000	205.0	H	248.0	10.8	6.1	53.9
7310.300000	34.8	1000.0	1000.000	150.0	V	26.0	12.1	19.1	53.9
12997.40000	46.8	1000.0	1000.000	206.0	V	173.0	20.1	7.1	53.9

Transmitter Radiated Spurious Emissions

High channel, 1Mbps data rate

Table 10: Quasi-peak results (ch high)

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
0.737000	9.8	1000.0	9.000	45.0	V	161.0	-20.1	20.4	30.3
39.991000	27.8	1000.0	120.000	100.0	V	64.0	14.0	12.2	40.0
105.837000	25.5	1000.0	120.000	100.0	V	173.0	10.9	18.0	43.5
167.275000	29.3	1000.0	120.000	178.0	H	100.0	14.2	14.2	43.5
170.904000	27.8	1000.0	120.000	152.0	H	92.0	13.9	15.7	43.5
205.724000	10.2	1000.0	120.000	126.0	H	225.0	11.5	33.3	43.5
346.894000	29.9	1000.0	120.000	100.0	V	114.0	16.4	16.1	46.0

Table 11: Peak results (ch high)

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
39.991000	31.9	1000.0	120.000	100.0	V	64.0	14.0	-	-
105.837000	30.2	1000.0	120.000	100.0	V	173.0	10.9	-	-
167.275000	32.7	1000.0	120.000	178.0	H	100.0	14.2	-	-
170.904000	30.6	1000.0	120.000	152.0	H	92.0	13.9	-	-
205.724000	17.0	1000.0	120.000	126.0	H	225.0	11.5	-	-
346.894000	35.4	1000.0	120.000	100.0	V	114.0	16.4	-	-
2461.200000	98.2	1000.0	1000.000	317.0	H	337.0	14.5	-	-
2487.300000	53.5	1000.0	1000.000	231.0	H	338.0	14.8	20.4	73.9
3282.675000	55.5	1000.0	1000.000	190.0	V	0.0	15.5	18.4	73.9
4102.400000	57.4	1000.0	1000.000	192.0	V	10.0	7.8	16.5	73.9
4924.000000	52.9	1000.0	1000.000	150.0	H	316.0	8.2	21.0	73.9
6565.500000	52.0	1000.0	1000.000	150.0	H	251.0	11.0	21.9	73.9

Table 12: Average results (ch high)

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2366.675000	46.8	1000.0	1000.000	317.0	H	207.0	14.4	7.1	53.9
2462.750000	95.0	1000.0	1000.000	316.0	H	336.0	14.5	-	-
2493.500000	43.6	1000.0	1000.000	316.0	H	332.0	14.8	10.4	53.9
2586.625000	45.3	1000.0	1000.000	150.0	H	201.0	15.1	8.6	53.9
3282.675000	50.1	1000.0	1000.000	150.0	V	0.0	15.5	3.8	53.9
4104.200000	53.2	1000.0	1000.000	192.0	V	10.0	7.8	0.7	53.9
4924.000000	50.5	1000.0	1000.000	205.0	H	319.0	8.2	3.4	53.9
6565.300000	48.3	1000.0	1000.000	150.0	H	248.0	11.0	5.6	53.9
13130.80000	45.1	1000.0	1000.000	218.0	V	167.0	19.8	8.8	53.9

Transmitter Radiated Spurious Emissions

Radiated Band Edge results, 1 Mbps data rate

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

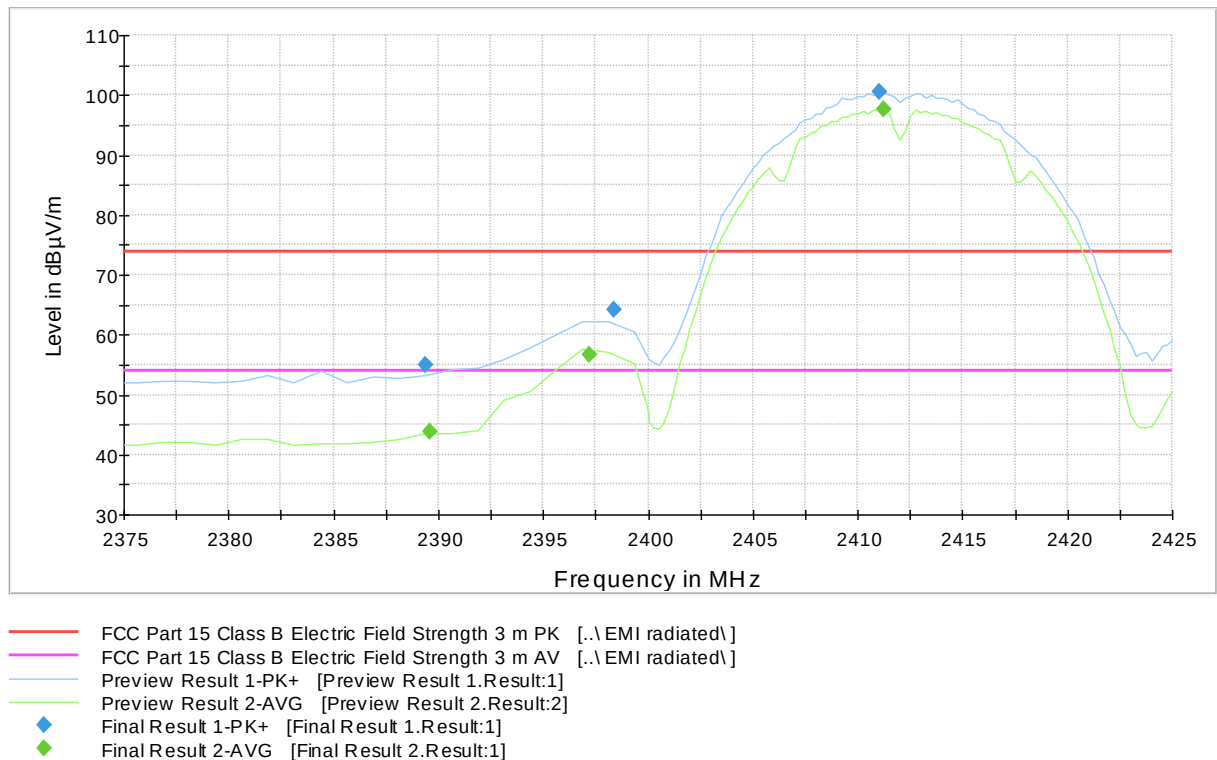


Figure 2: Radiated Band Edge measurement graph (ch low), 1 Mbps data rate

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

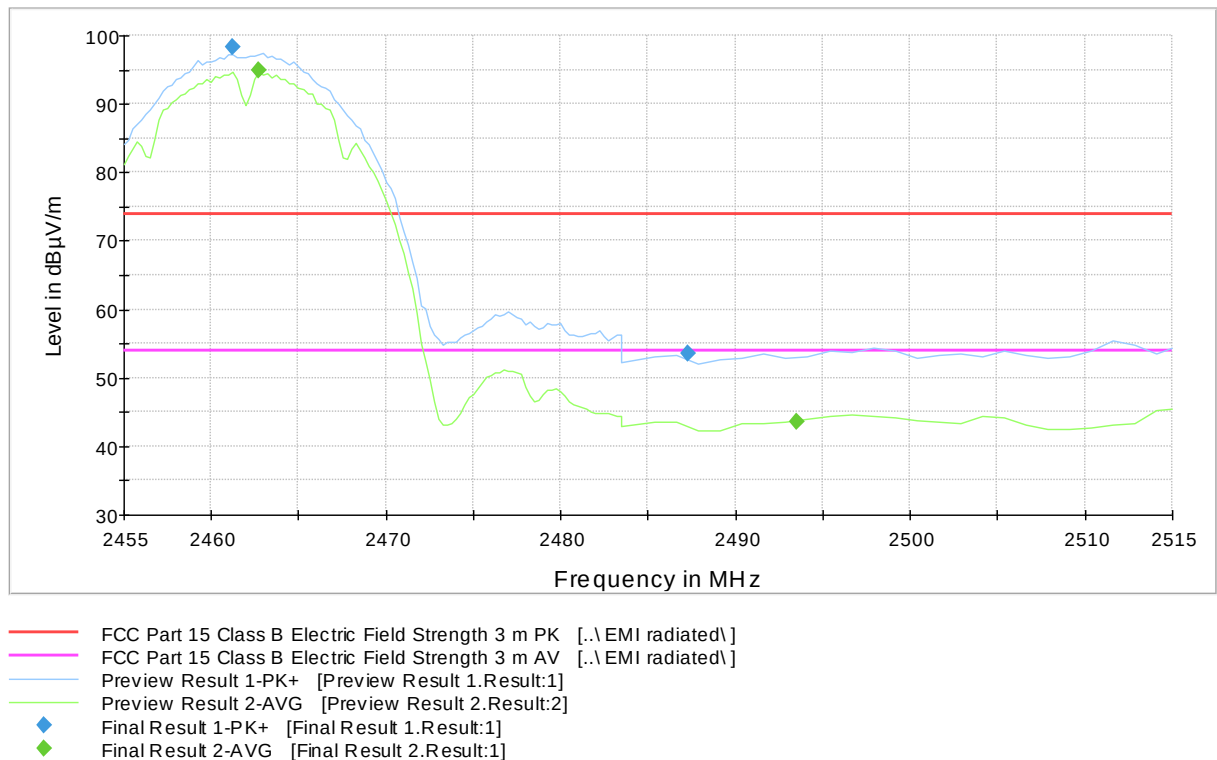


Figure 3: Radiated Band Edge measurement graph (ch high), 1 Mbps data rate

Transmitter Radiated Spurious Emissions

Radiated Band Edge results, 9 Mbps data rate

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

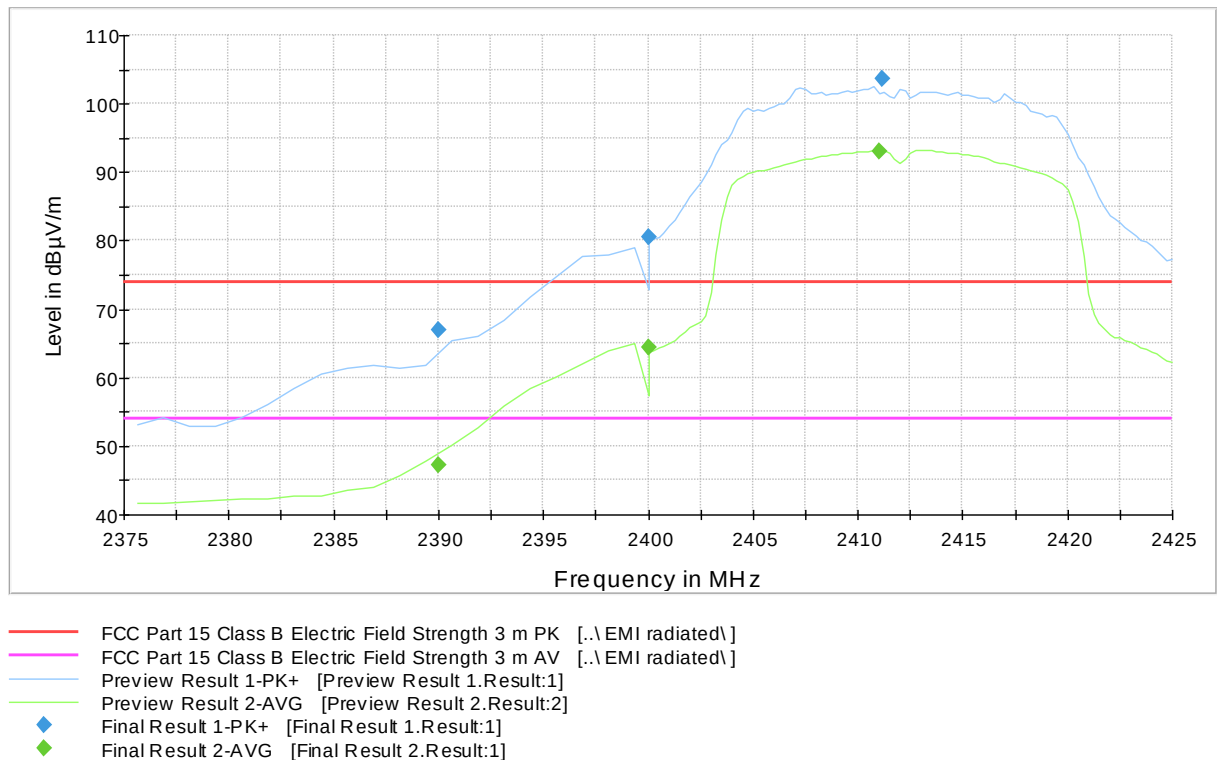


Figure 4: Radiated Band Edge measurement graph (ch low), 9 Mbps data rate

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

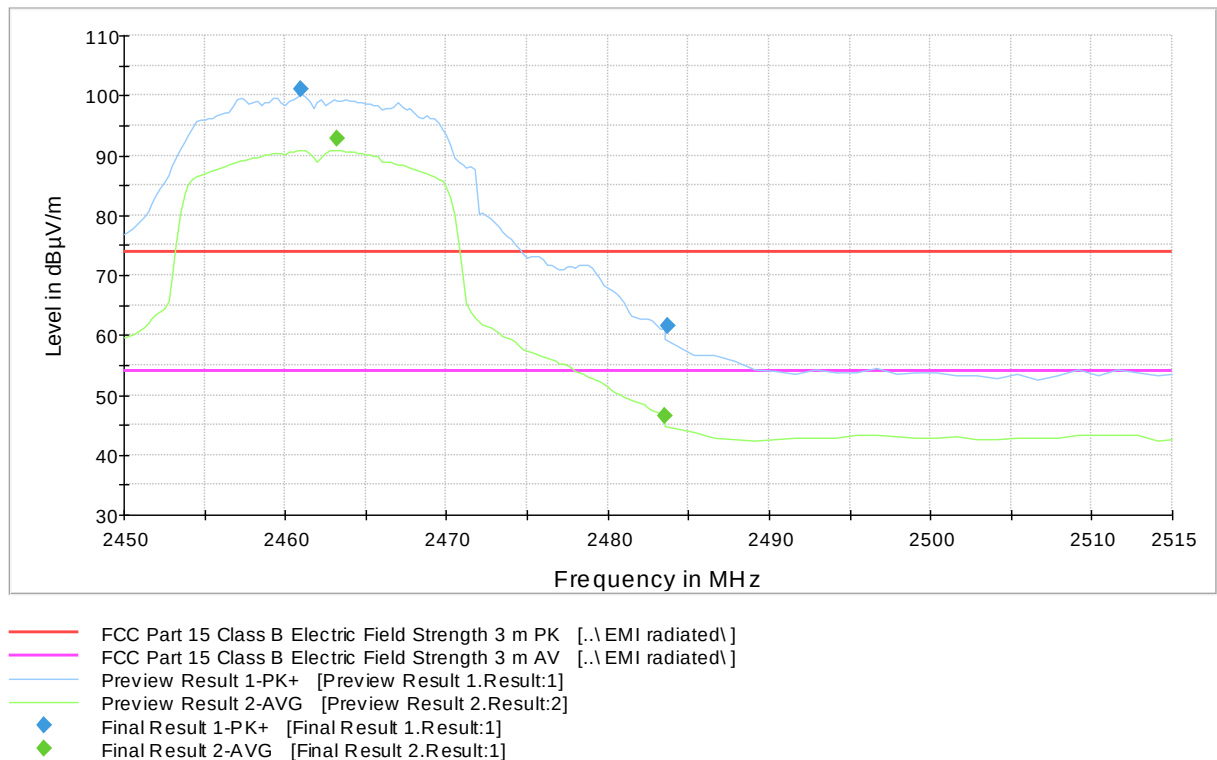


Figure 5: Radiated Band Edge measurement graph (ch high), 9 Mbps data rate

Transmitter Radiated Spurious Emissions

Table 13: Peak results (ch low)

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2390.000000	67.0	1000.0	1000.000	150.0	V	253.0	14.6	6.9	73.9
2400.000000	80.5	1000.0	1000.000	150.0	V	270.0	14.7	3.2	83.7
2411.150000	103.7	1000.0	1000.000	150.0	V	270.0	14.6	-	-

Table 14: Average results (ch low)

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2390.000000	47.3	1000.0	1000.000	318.0	H	204.0	14.6	6.6	53.9
2400.000000	64.3	1000.0	1000.000	150.0	V	270.0	14.7	8.7	73.0
2411.000000	93.0	1000.0	1000.000	150.0	V	266.0	14.6	-	-

Table 15: Peak results (ch high)

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2461.000000	101.0	1000.0	1000.000	150.0	V	265.0	14.5	-	-
2483.700000	61.6	1000.0	1000.000	255.0	H	328.0	14.7	12.3	73.9

Table 16: Average results (ch high)

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
2463.200000	92.8	1000.0	1000.000	320.0	H	337.0	14.5	-	-
2483.500000	46.6	1000.0	1000.000	320.0	H	333.0	14.7	7.3	53.9

Transmitter Band Edge Measurement and Conducted Spurious Emissions

Transmitter Band Edge Measurement and Conducted Spurious Emissions

Standard:	ANSI C63.10	(2013)
Tested by:	MIH	
Date:	15 August – 7 September 2017	
Temperature:	24 °C	
Humidity:	33 - 37 %	
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 17: Band edge attenuation

Band Edge	Band Edge attenuation 1Mbps data rate [dBc]	Band Edge attenuation 9Mbps data rate [dBc]	Minimum limit [dBc]	Result
Lower	-39.95	-28.86	-20	PASS
Upper	-39.87	-38.05	-20	PASS

Table 18: Conducted spurious emissions channel low, 1Mbps data rate

Frequency [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]	Result
946,36	-69,53	-18,67	-50,86	PASS
2398,01	-44,86	-18,67	-26,19	PASS
2412,51	1,33	-	-	Carrier
2499,83	-46,62	-18,67	-27,95	PASS
4824,08	-50,49	-18,67	-31,82	PASS
9759,77	-60,93	-18,67	-42,26	PASS
12548,84	-58,86	-18,67	-40,20	PASS
15516,12	-55,69	-18,67	-37,02	PASS
16135,79	-55,33	-18,67	-36,66	PASS
21887,36	-57,00	-18,67	-38,33	PASS
24430,25	-56,47	-18,67	-37,81	PASS
25546,38	-55,63	-18,67	-36,96	PASS

Transmitter Band Edge Measurement and Conducted Spurious Emissions

Table 19: Conducted spurious emissions channel mid, 1Mbps data rate

Frequency [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]	Result
891,89	-70,05	-17,16	-52,89	PASS
2332,39	-47,31	-17,16	-30,15	PASS
2437,50	2,84	-	-	Carrier
2519,30	-46,36	-17,16	-29,20	PASS
4874,05	-47,64	-17,16	-30,47	PASS
8470,94	-60,83	-17,16	-43,67	PASS
12885,49	-59,07	-17,16	-41,90	PASS
15850,61	-56,35	-17,16	-39,19	PASS
16139,07	-55,90	-17,16	-38,74	PASS
19476,38	-56,81	-17,16	-39,64	PASS
24412,63	-56,67	-17,16	-39,50	PASS
26259,14	-56,13	-17,16	-38,97	PASS

Table 20: Conducted spurious emissions channel high, 1Mbps data rate

Frequency [MHz]	Level [dBm]	Limit [dBc]	Margin [dB]	Result
707,87	-69,89	-18,04	-51,85	PASS
2303,16	-47,08	-18,04	-29,03	PASS
2462,50	1,96	-	-	Carrier
2533,00	-47,81	-18,04	-29,77	PASS
4924,02	-48,87	-18,04	-30,83	PASS
7498,78	-60,22	-18,04	-42,18	PASS
12515,66	-58,83	-18,04	-40,79	PASS
15788,27	-57,01	-18,04	-38,97	PASS
16153,61	-55,19	-18,04	-37,15	PASS
19161,20	-56,76	-18,04	-38,72	PASS
24819,02	-56,75	-18,04	-38,71	PASS
25431,96	-55,80	-18,04	-37,76	PASS

Transmitter Band Edge Measurement and Conducted Spurious Emissions

Table 21: Conducted spurious emissions channel low, 9Mbps data rate

Frequency [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]	Result
888,62	-70,08	-19,08	-50,99	PASS
2399,85	-28,34	-19,08	-9,26	PASS
2413,28	0,92	-19,08	20,00	Carrier
2486,37	-46,41	-19,08	-27,32	PASS
4824,08	-54,76	-19,08	-35,67	PASS
8482,56	-60,45	-19,08	-41,36	PASS
12531,50	-58,35	-19,08	-39,27	PASS
15578,65	-56,81	-19,08	-37,73	PASS
16463,35	-55,28	-19,08	-36,19	PASS
19515,75	-57,28	-19,08	-38,19	PASS
22899,27	-55,84	-19,08	-36,75	PASS
25419,64	-56,18	-19,08	-37,10	PASS

Table 22: Conducted spurious emissions channel mid, 9Mbps data rate

Frequency [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]	Result
712,18	-69,86	-17,68	-52,18	PASS
2313,62	-46,51	-17,68	-28,83	PASS
2438,26	2,32	-17,68	20,00	Carrier
2512,76	-47,11	-17,68	-29,43	PASS
4872,83	-54,07	-17,68	-36,39	PASS
9845,27	-59,93	-17,68	-42,25	PASS
12507,13	-58,91	-17,68	-41,23	PASS
15808,62	-56,52	-17,68	-38,85	PASS
17844,24	-55,55	-17,68	-37,87	PASS
19751,62	-57,14	-17,68	-39,47	PASS
24992,45	-56,29	-17,68	-38,61	PASS
26230,55	-56,24	-17,68	-38,56	PASS

Table 23: Conducted spurious emissions channel high, 9Mbps data rate

Frequency [MHz]	Level [dBm]	Limit [dBc]	Margin [dB]	Result
819,63	-69,79	-19,26	-50,54	PASS
2341,75	-48,14	-19,26	-28,88	PASS
2464,50	0,74	-19,26	20,00	Carrier
2483,57	-44,49	-19,26	-25,24	PASS
4104,67	-55,90	-19,26	-36,64	PASS
7133,36	-61,17	-19,26	-41,91	PASS
11845,08	-58,71	-19,26	-39,45	PASS
15487,72	-56,61	-19,26	-37,35	PASS
16147,04	-55,07	-19,26	-35,82	PASS
21197,20	-56,28	-19,26	-37,02	PASS
24464,56	-56,26	-19,26	-37,00	PASS
26266,97	-55,05	-19,26	-35,80	PASS

Transmitter Band Edge Measurement and Conducted Spurious Emissions

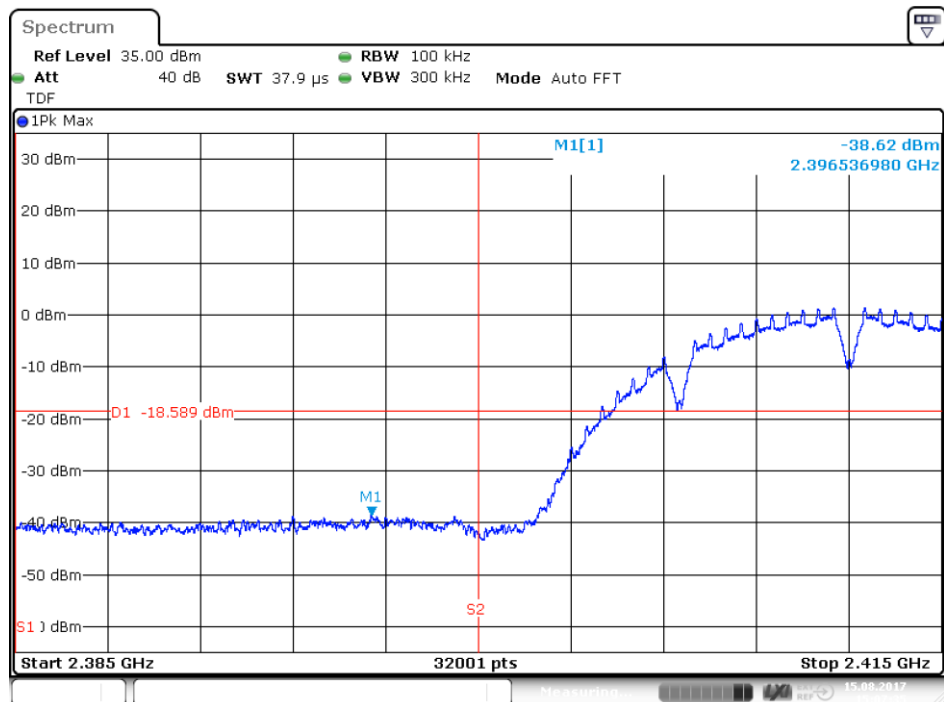


Figure 6: Lower Band Edge, 1Mbps data rate

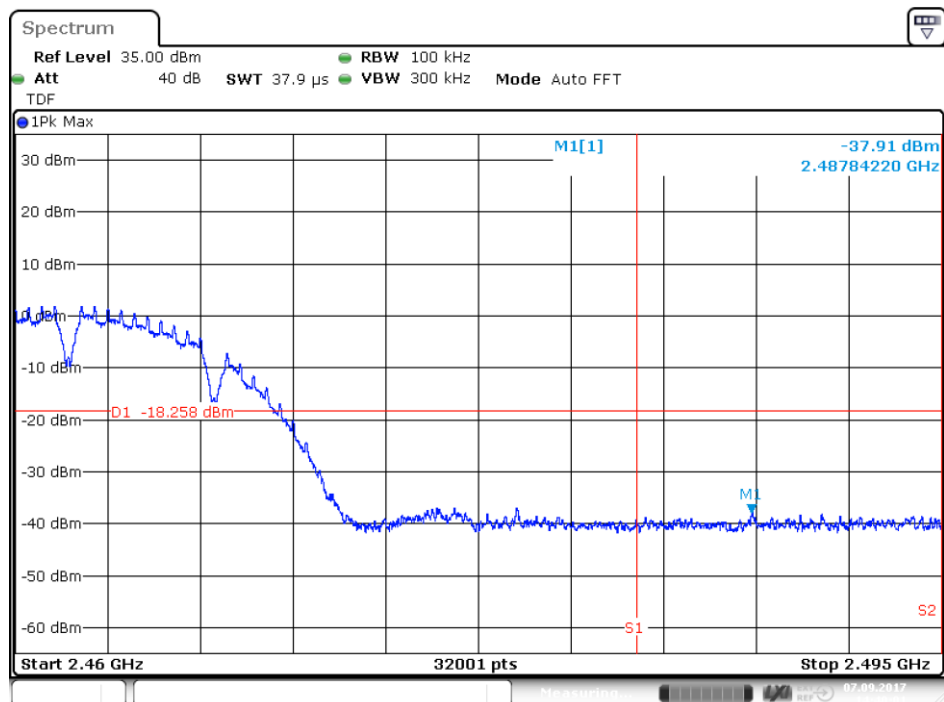


Figure 7: Upper Band Edge, 1Mbps data rate

Transmitter Band Edge Measurement and Conducted Spurious Emissions

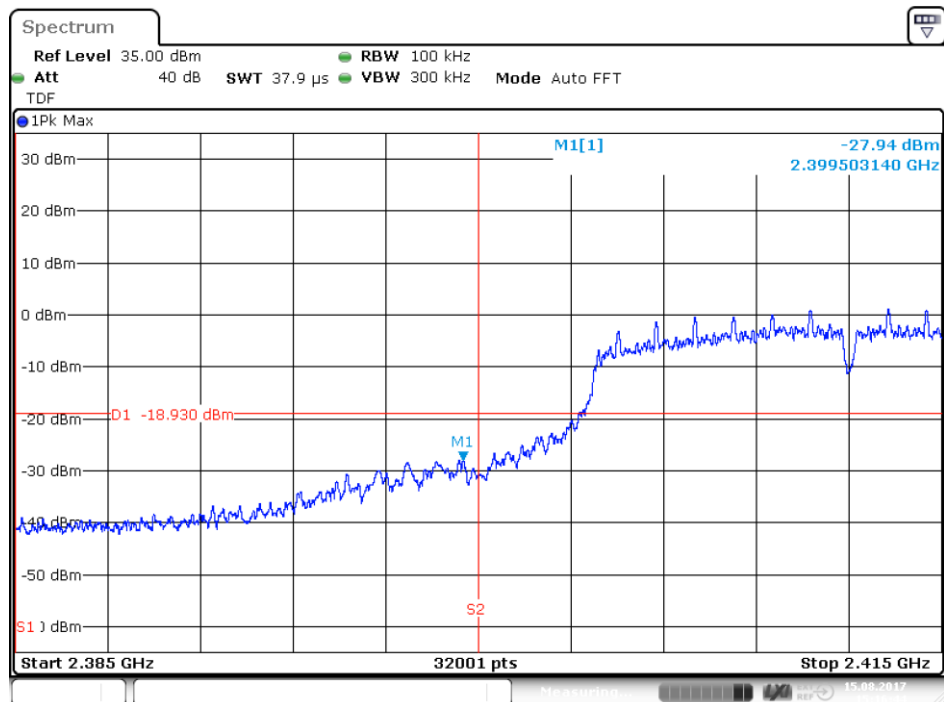


Figure 8: Lower Band Edge, 9Mbps data rate

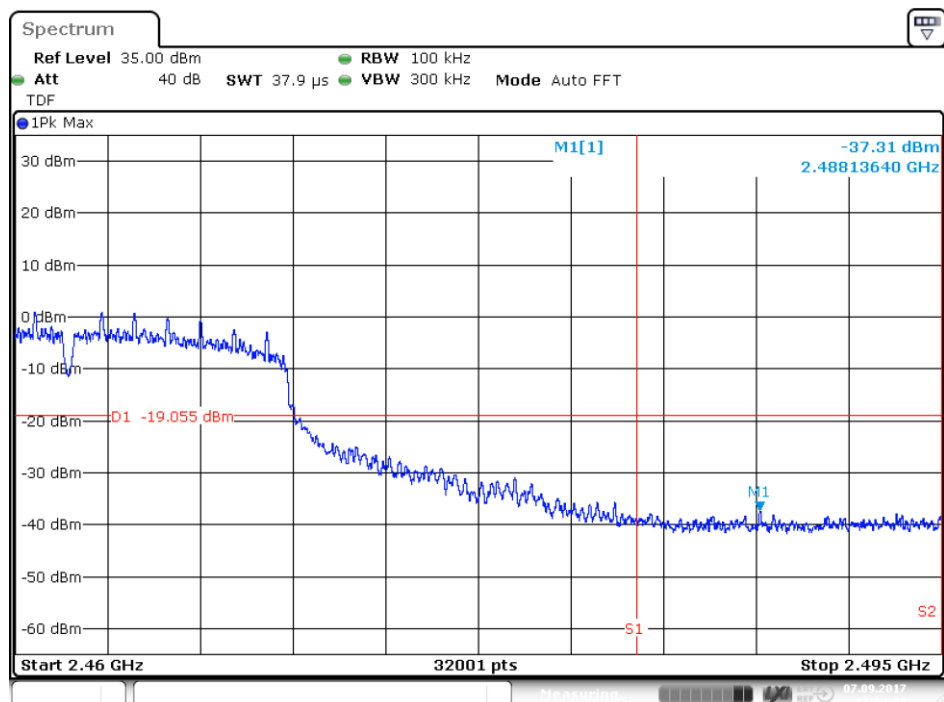


Figure 9: Upper Band Edge, 9Mbps data rate

Transmitter Band Edge Measurement and Conducted Spurious Emissions

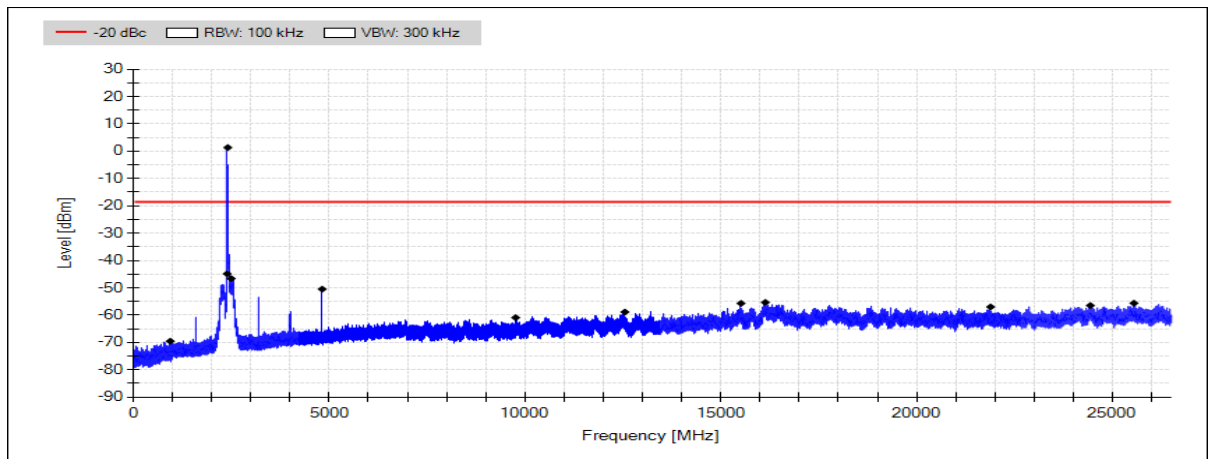


Figure 10: Conducted spurious emissions 30 - 26500 MHz channel low, 1 Mbps data rate

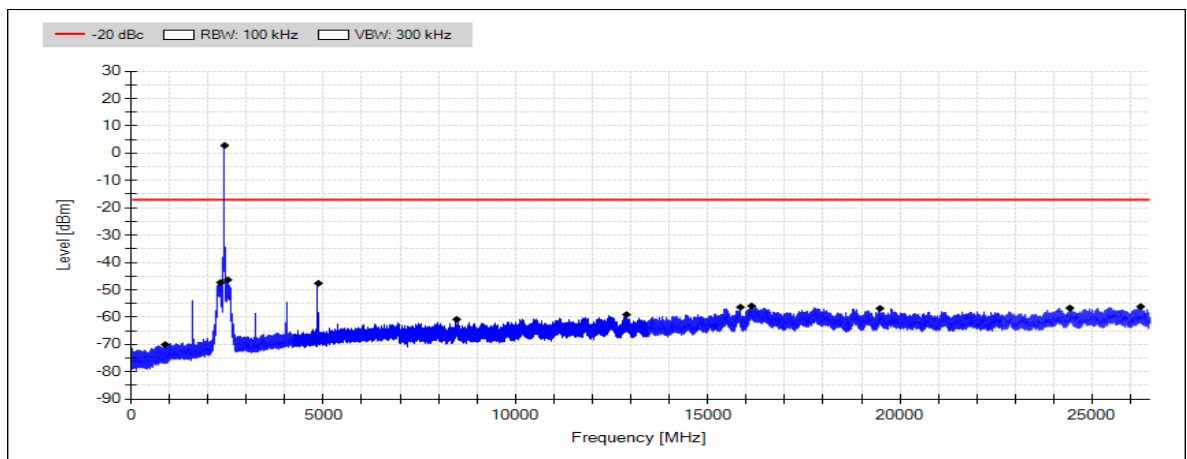


Figure 11: Conducted spurious emissions 30 - 26500 MHz channel mid, 1 Mbps data rate

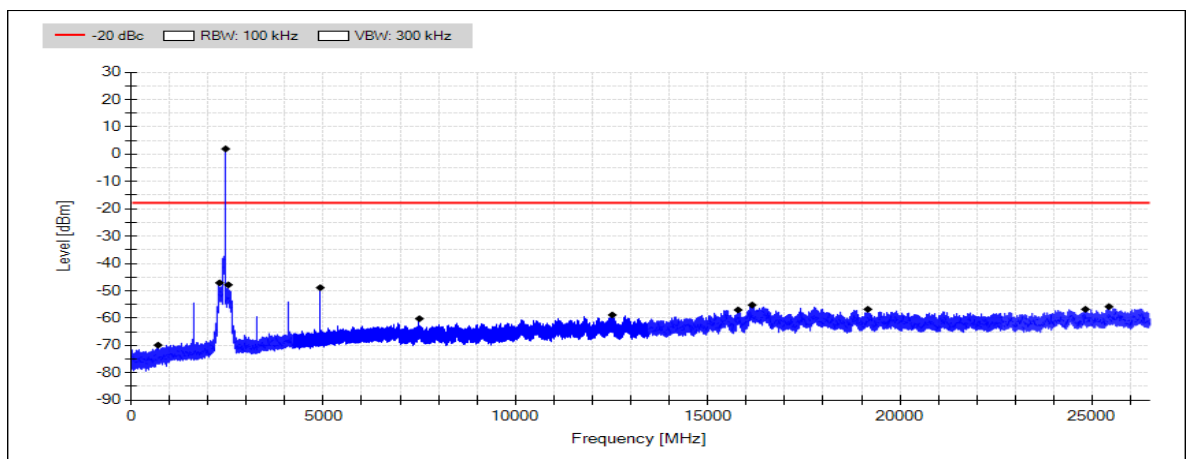


Figure 12: Conducted spurious emissions 30 - 26500 MHz channel high, 1Mbps data rate

Transmitter Band Edge Measurement and Conducted Spurious Emissions

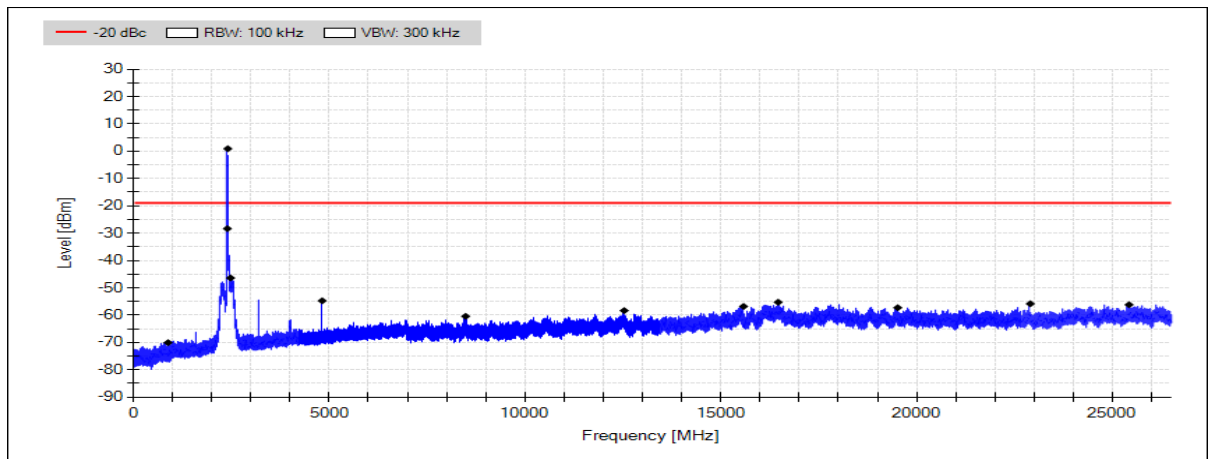


Figure 13: Conducted spurious emissions 30 - 26500 MHz channel low, 9 Mbps data rate

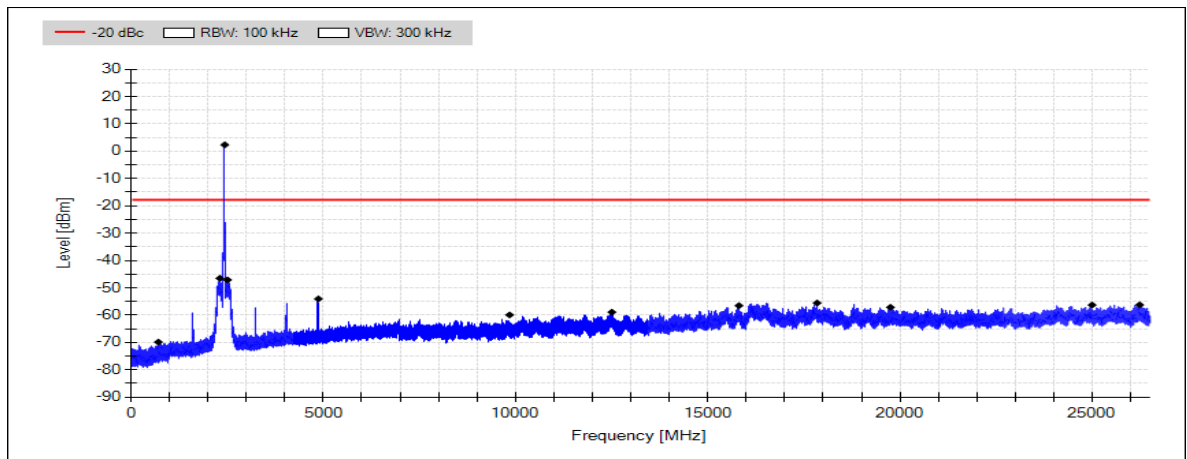


Figure 14: Conducted spurious emissions 30 - 26500 MHz channel mid, 9 Mbps data rate

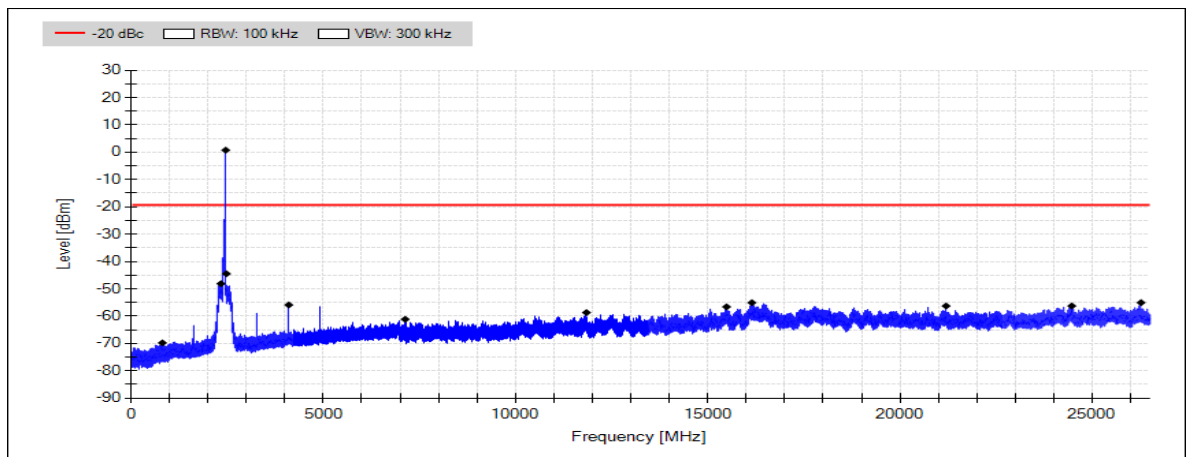


Figure 15: Conducted spurious emissions 30 - 26500 MHz channel high, 9 Mbps data rate

6 dB Bandwidth of the Channel

Standard: ANSI C63.10 (2013)
Tested by: MIH
Date: 15 August - 17 September 2017
Temperature: 24 °C
Humidity: 33-37 %

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

Results:

Table 24: 6 dB bandwidth test results

Channel	6 dB BW [MHz] 1Mbps data rate	6 dB BW [MHz] 9Mbps data rate	Minimum limit [kHz]
Low	9.091	15.098	500
Mid	9.999	15.100	
High	9.095	15.101	

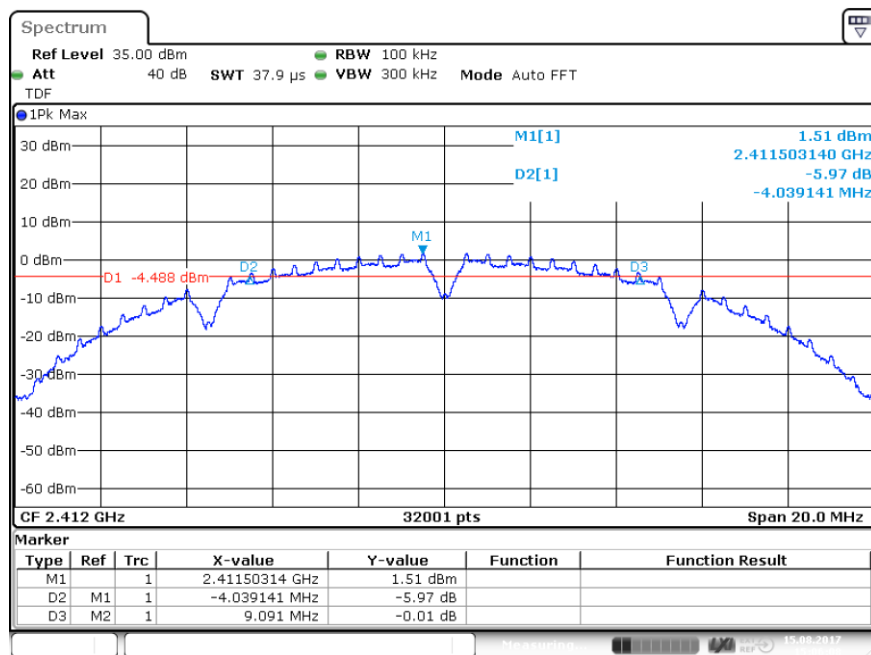


Figure 16: 6 dB bandwidth channel low, 1Mbps data rate

6 dB Bandwidth of the Channel

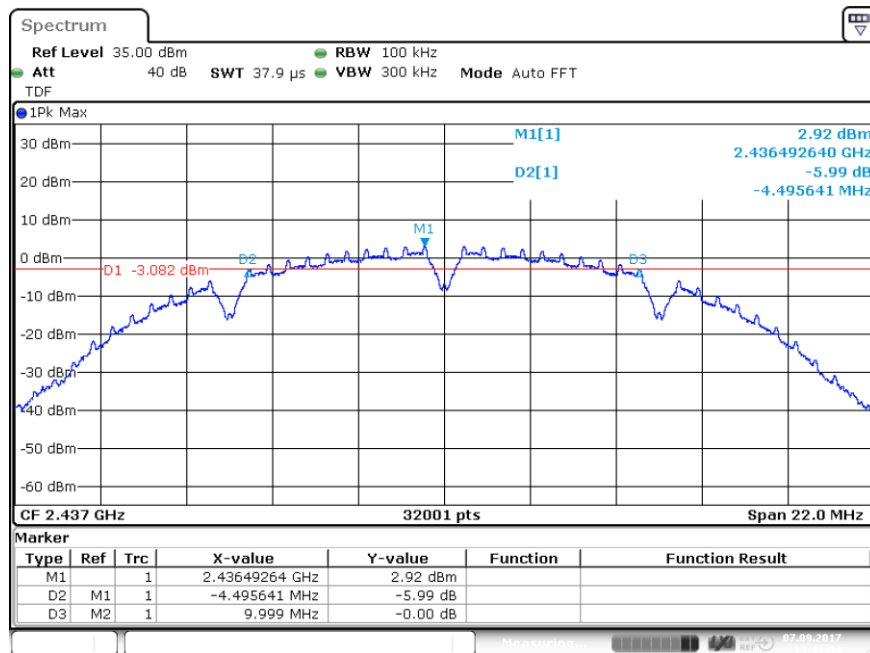


Figure 17: 6 dB bandwidth channel mid, 1Mbps data rate

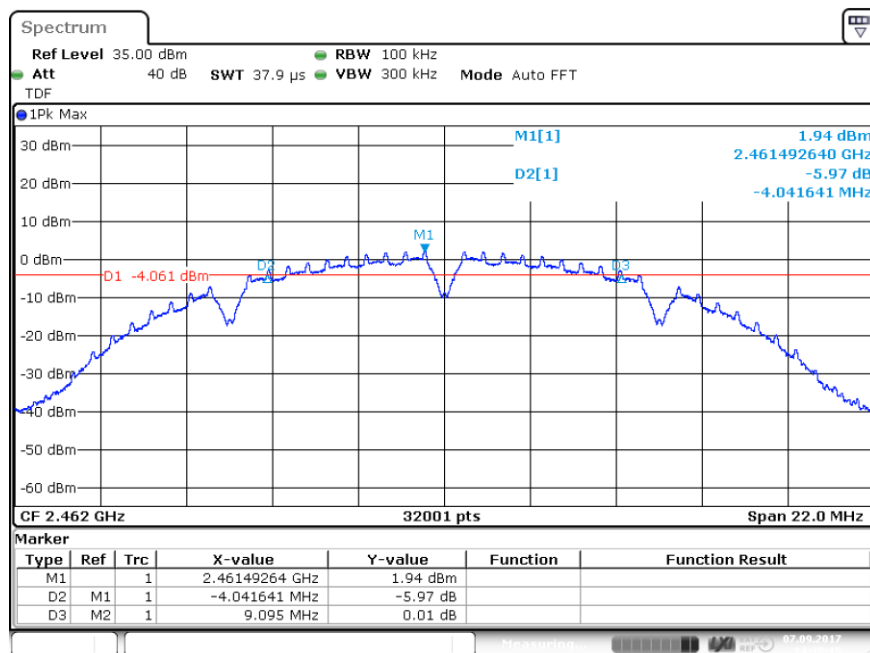


Figure 18: 6 dB bandwidth channel high, 1Mbps data rate

6 dB Bandwidth of the Channel

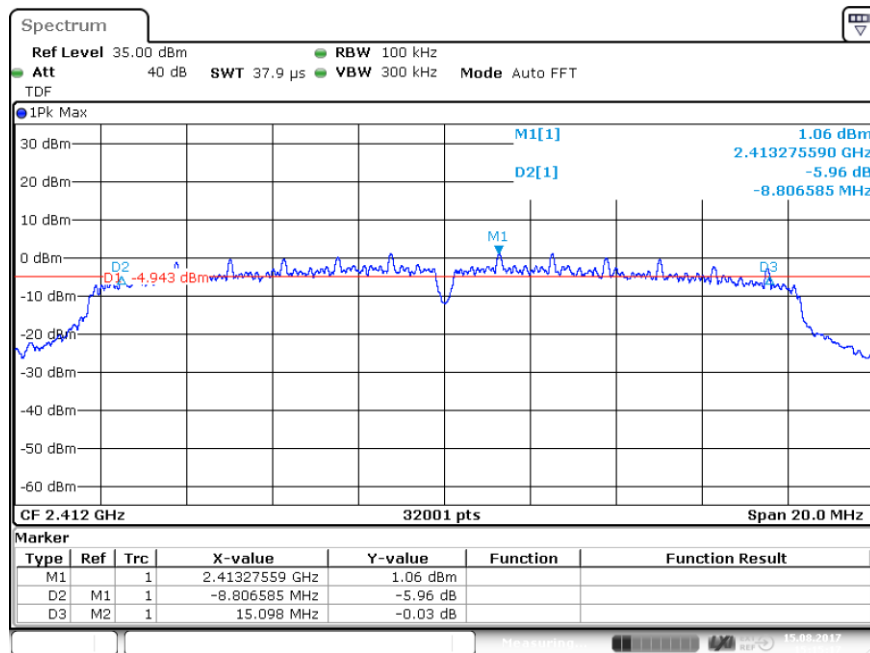


Figure 19: 6 dB bandwidth channel low, 9Mbps data rate

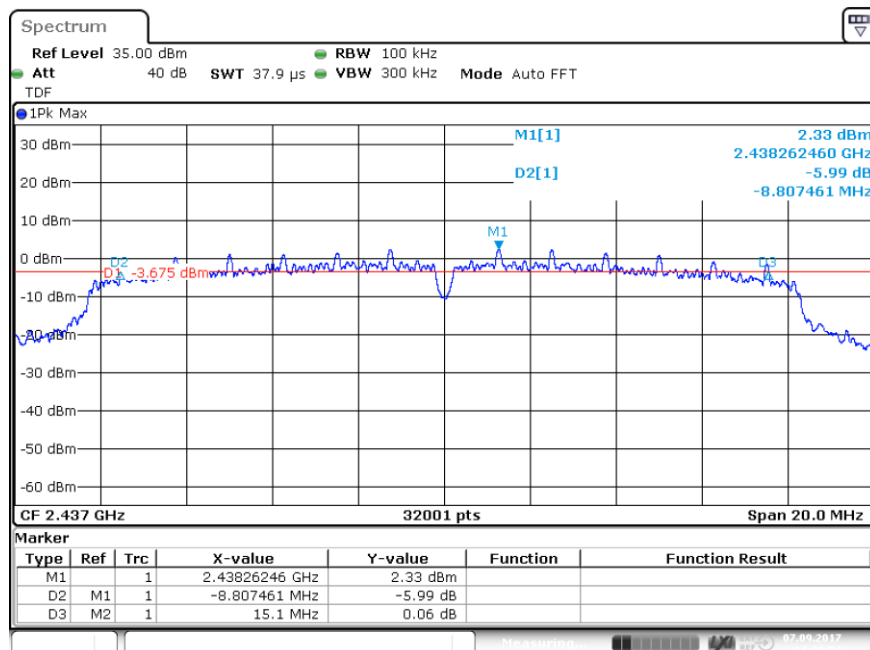


Figure 20: 6 dB bandwidth channel mid, 9Mbps data rate

6 dB Bandwidth of the Channel

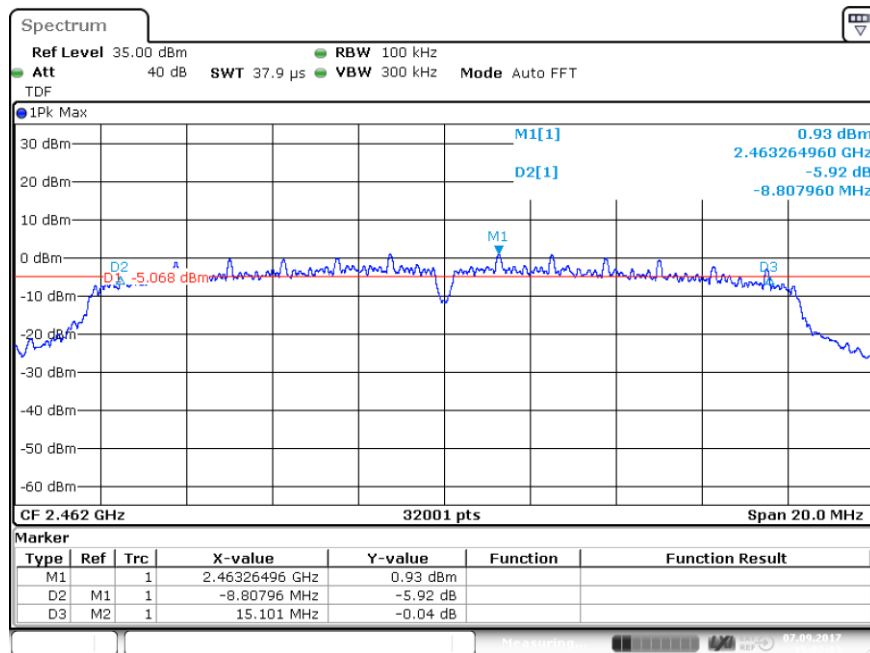


Figure 21: 6 dB bandwidth channel high, 9Mbps data rate

Power Spectral Density

Standard: ANSI C63.10 (2013)
Tested by: MIH
Date: 15 August – 17 September 2017
Temperature: 24 °C
Humidity: 33-37 %

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

Results:

Table 25: Power spectral density test results

Channel	PSD dBm/3 kHz 1Mbps data rate	PSD dBm/3 kHz 9Mbps data rate	Maximum limit [dBm/3kHz]
Low	-13.25	-14.33	+8.00
Mid	-11.75	-11.54	
High	-12.61	-14.21	

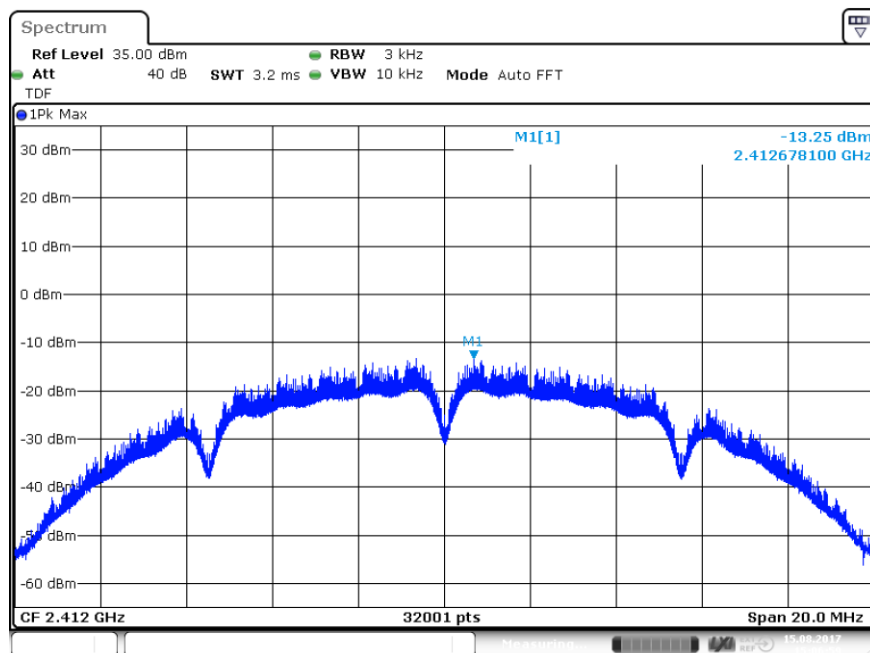


Figure 22: Power spectral density channel low, 1Mbps data rate

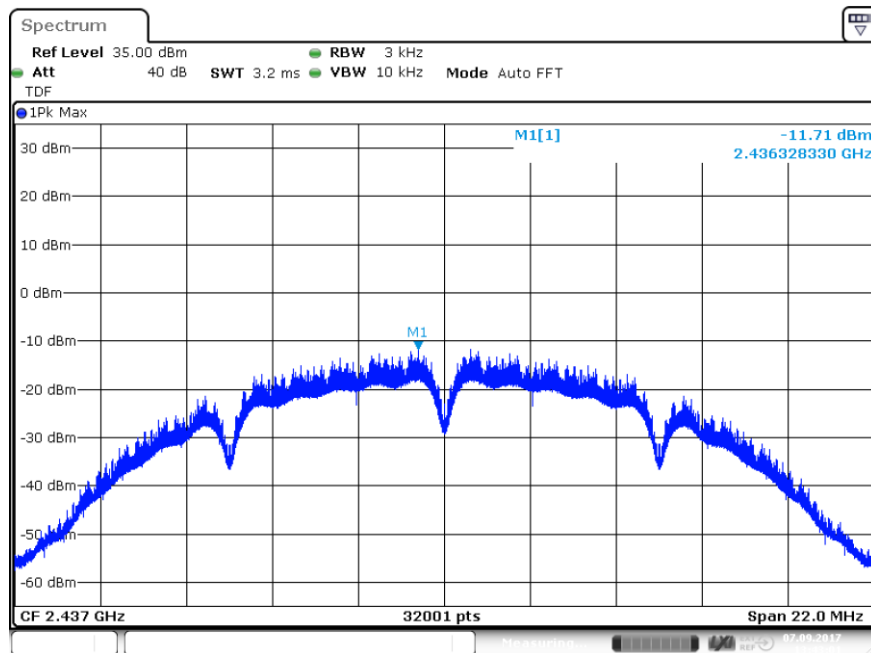


Figure 23: Power spectral density channel mid, 1Mbps data rate

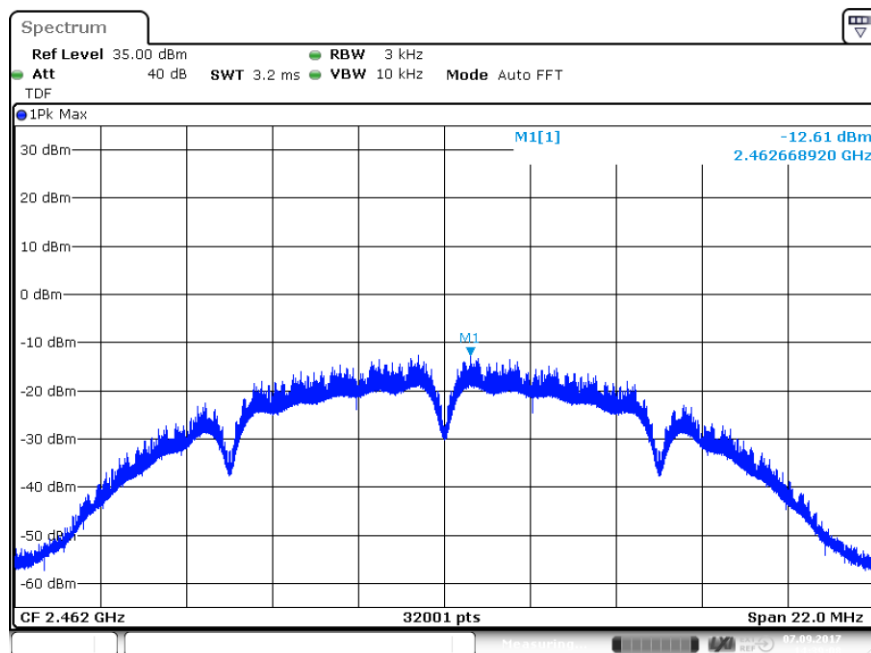


Figure 24: Power spectral density channel high, 1Mbps data rate

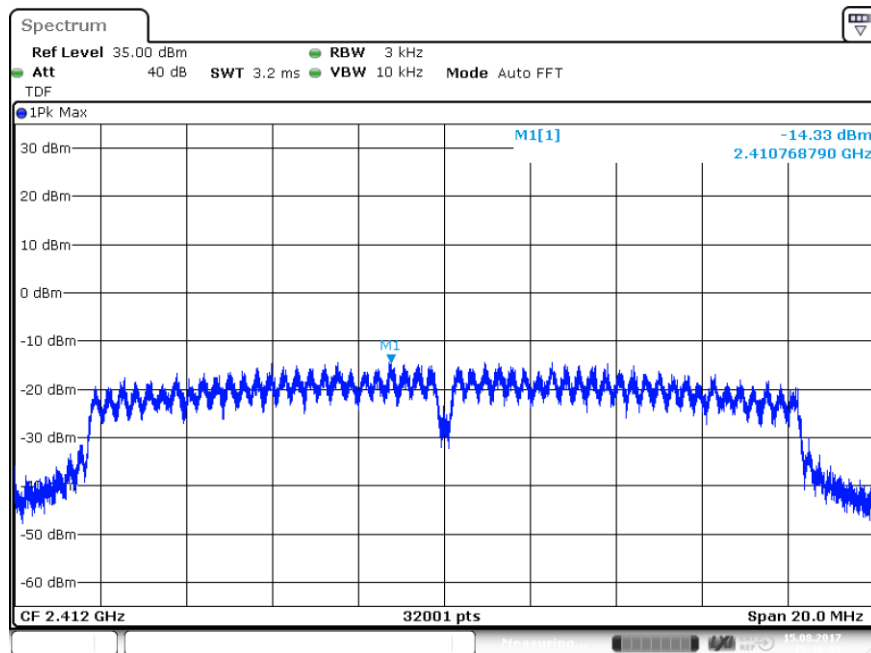


Figure 25: Power spectral density channel low, 9Mbps data rate

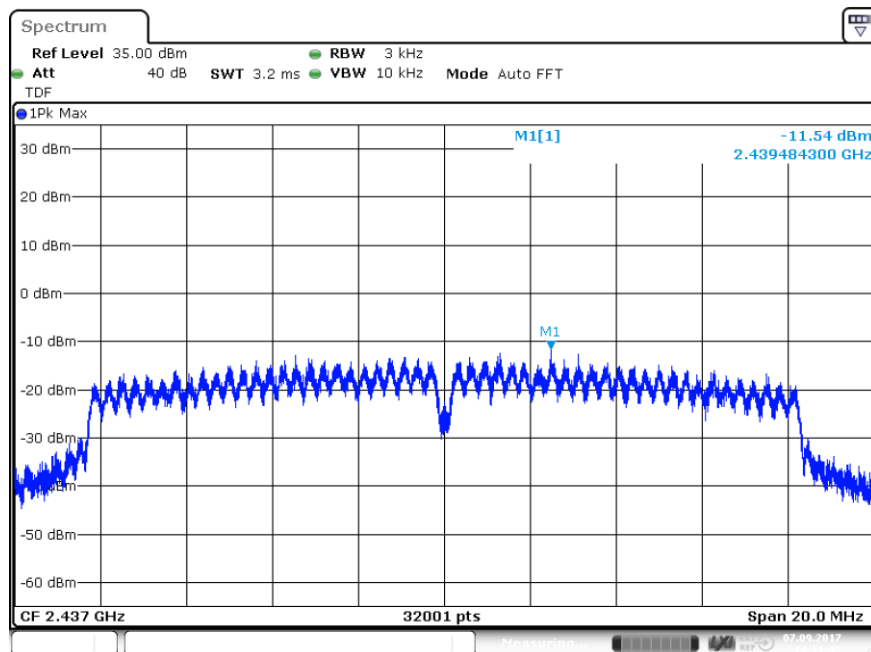


Figure 26: Power spectral density channel mid, 9Mbps data rate

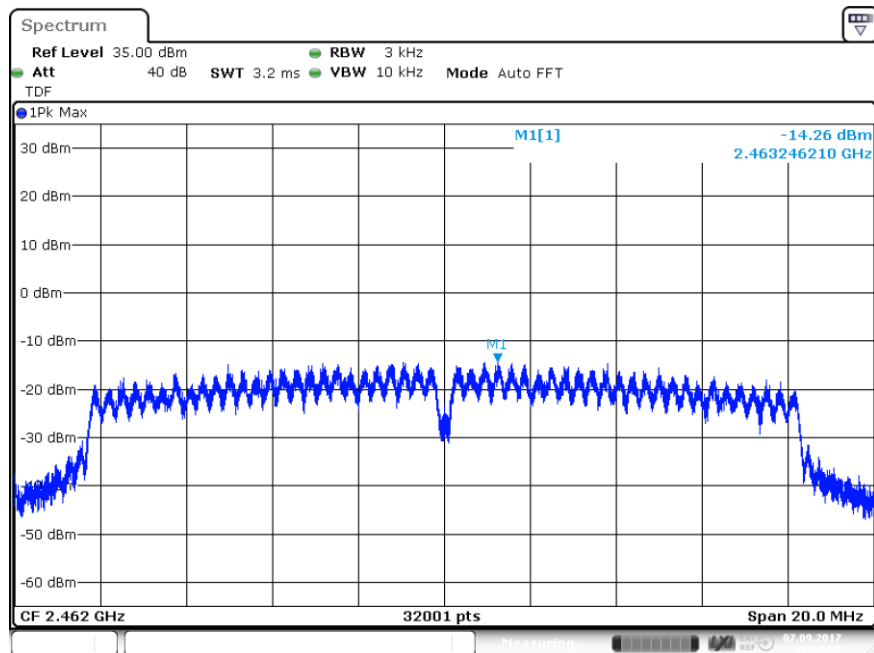


Figure 27: Power spectral density channel high, 9Mbps data rate

99% Occupied Bandwidth

Standard: RSS-GEN (2014)
Tested by: MIH
Date: 15 August – 17 September 2017
Temperature: 24 °C
Humidity: 33-37 %

RSS-GEN 6.6

Table 26: 99% occupied bandwidth test results

Channel	Limit	99 % BW [MHz] 1Mbps data rate	99 % BW [MHz] 9Mbps data rate	Result
Low	-	13.979563139	16.374488297	PASS
Mid	-	14.123558639	16.539483141	PASS
High	-	13.972313365	16.411987125	PASS

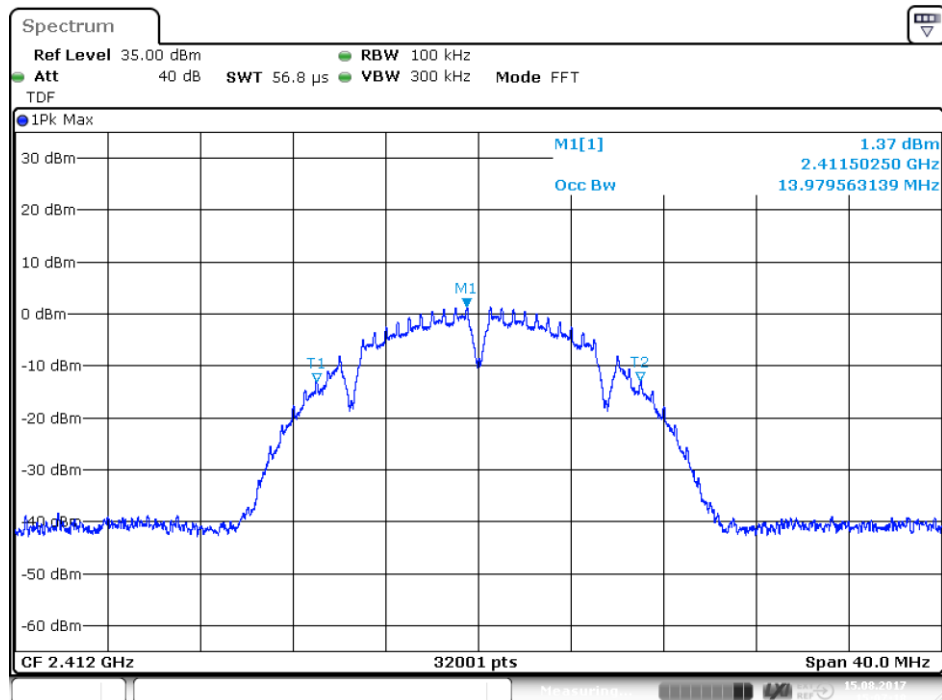


Figure 28: 99% OBW channel low, 1Mbps data rate

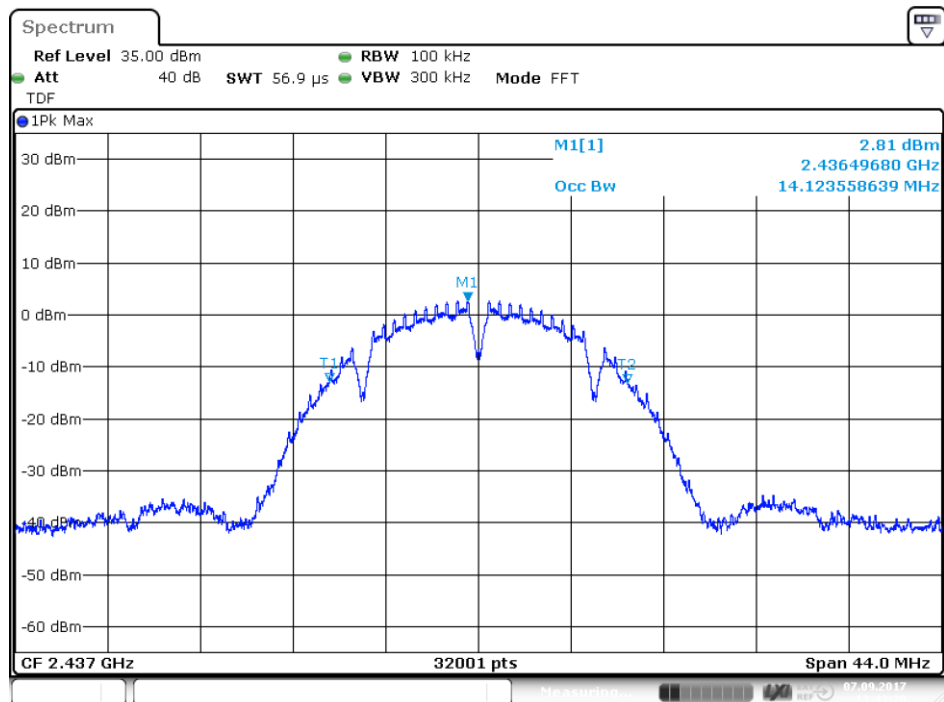


Figure 29: 99% OBW channel mid, 1Mbps data rate

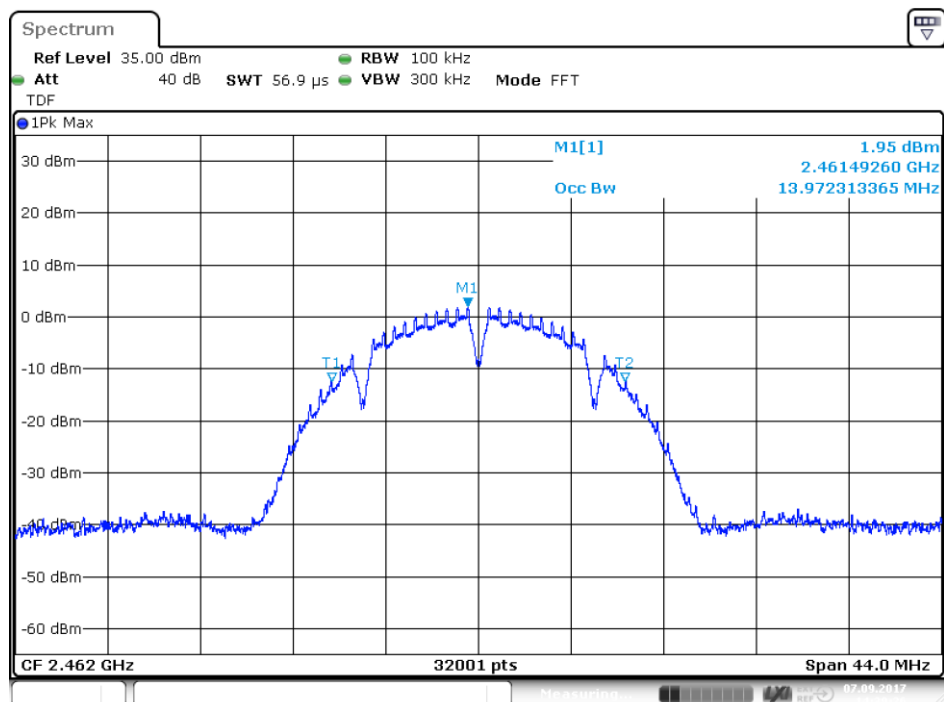


Figure 30: 99% OBW channel high, 1Mbps data rate

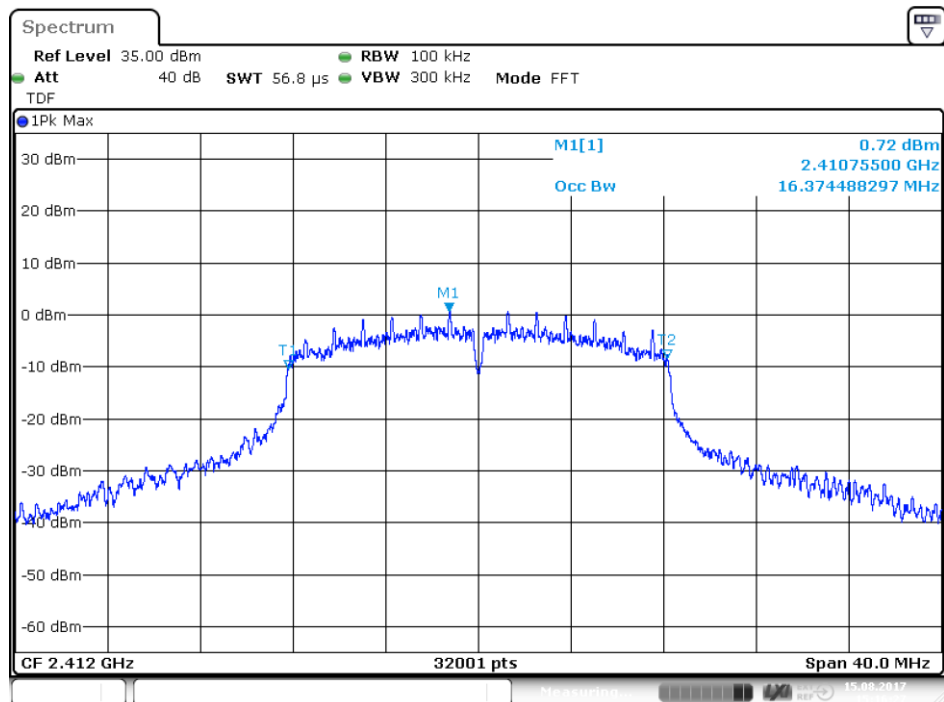


Figure 31: 99% OBW channel low, 9Mbps data rate

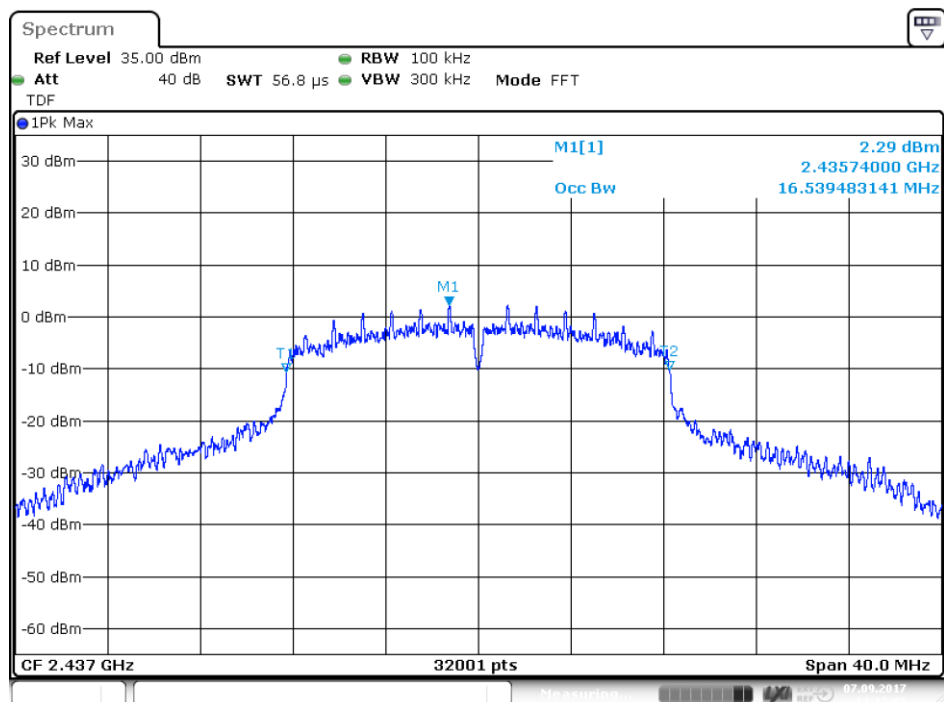


Figure 32: 99% OBW channel mid, 9Mbps data rate

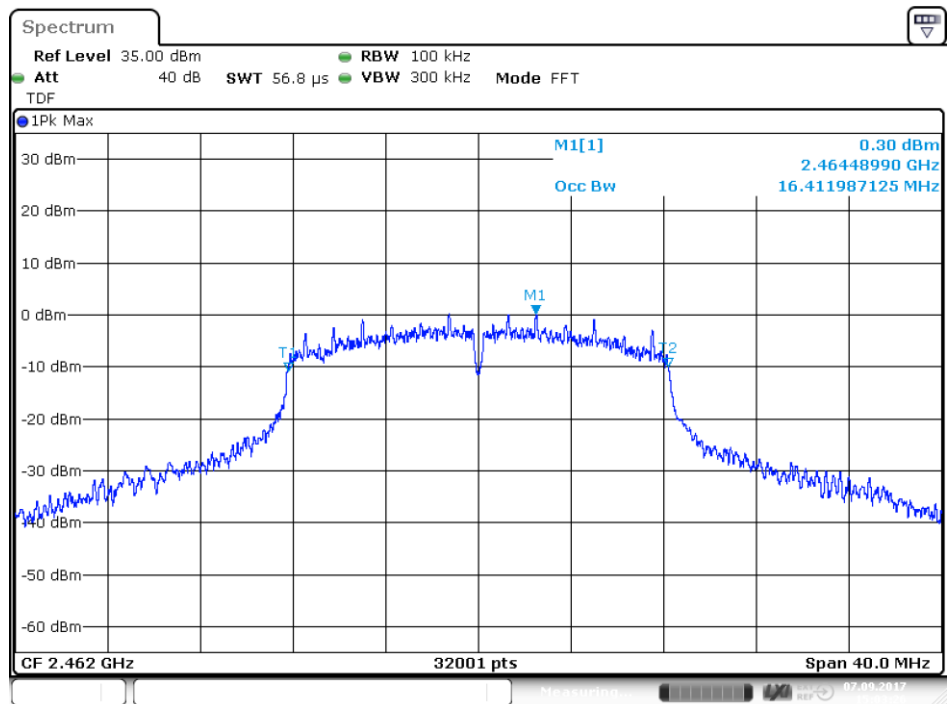


Figure 33: 99% OBW channel high, 9Mbps data rate

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	PASTERNAK	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
LISN	ROHDE & SCHWARZ	ENV216	inv:9611	2017-02-23	2018-02-23
POWER SUPPLY	CALIFORNIA INSTR.	5001 iX Series II	inv:7826	-	-