Test Report

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

INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C

Equipment Under Test:	Smart watch with Bluetooth Low Energy
Model:	BT002
Manufacturer:	Anima AB Västra Varvsgatan 19 SE-21119 MALMÖ SWEDEN
Customer:	Anima AB Västra Varvsgatan 19 SE-21119 MALMÖ SWEDEN
FCC Rule Part:	15.247: 2015
IC Rule Part:	RSS-247, Issue 1, 2015 RSS-GEN Issue 4, 2014
KDB:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (June 9, 2015)

Date:	25 January 2017	Date:	25 January 2017
Issued by:	Emil Haverinen Testing Engineer	Checked by:	Rauno Repo Testing Engineer

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Equipment Under Test (EUT)

Trade mark:	Kronaby Sweden
Model:	BT002
Type:	Smart watch with Bluetooth Low Energy
Serial no:	RED-FCC-ISED-G1 RED-FCC-ISED-G2
FCC ID:	2AKPL-BT002
IC:	22272-BT002

Description of the EUT

The EUT is a smart watch with Bluetooth Low Energy capabilities. The smart watch uses replaceable CR3032 battery as a power source and it does not have any I/O ports for connecting ancillary equipment.

Classification of the device

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

Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

Ratings and Declarations

Operating Frequency Range (OFR):	2402 - 2480 MHz
Channels:	40
Channel separation:	2 MHz
99% Channel bandwidth:	1.060091872 MHz (ch mid)
Effective conducted power:	3.68 dBm (peak)
Transmission technique:	DSSS
Modulation:	GFSK
Antenna gain:	4 dBi

Power Supply

Operating voltage range: 2.2 - 3.3 VDC (tested with 3 V from laboratory supply)

Normally the EUT is powered from coin battery.

Mechanical Size of the EUT

Ø38 mm x 15 mm

Samples

Two samples were used in tests. One with RF connector replacing antenna for conducted measurements. Both samples were tested with special firmware made for testing purposes. Both samples were equipped with small 3-wire programming cables for controlling the radio.

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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	**N/A**(1)
§15.247(b)(3) / RSS-247 5.4(4)	Maximum Peak Conducted Output Power	**PASS**
§15.247(a)(2) / RSS-247 5.2(1)	6 dB Bandwidth	**PASS**
§15.247(e) / RSS-247 5.2(2)	Power Spectral Density	**PASS**
RSS-GEN 6.6	99% Occupied Bandwidth	**PASS**
§15.247(d) / RSS-247 5.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	**PASS**
§15.209(a), §15.247(d) / RSS-247 5.5	Radiated Emissions Within The Restricted Bands	**PASS**

1) The EUT cannot be connected to public network, no input/output ports.

EUT Test Conditions

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.

The EUT was tested without wristband.

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

Test Facility

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

TEST RESULTS

Maximum Peak Conducted Output Power

Standard:	ANSI C63.10	(2013)
Tested by:	EHA	
Date:	27.1.2017	
Temperature:	23 ± 3 °C	
Humidity:	21 % RH	
Measurement uncertainty:	± 2.87dB	Level of confidence 95 % (k = 2)

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

For systems using digital modulation in the 2400-2483.5 MHz bands the limit is 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.

Measured values are peak values.

Results:

Table 1: Maximum conducted output power

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	3.68	30	26.32	PASS
Mid	3.59	30	26.41	PASS
High	3.49	30	26.51	PASS

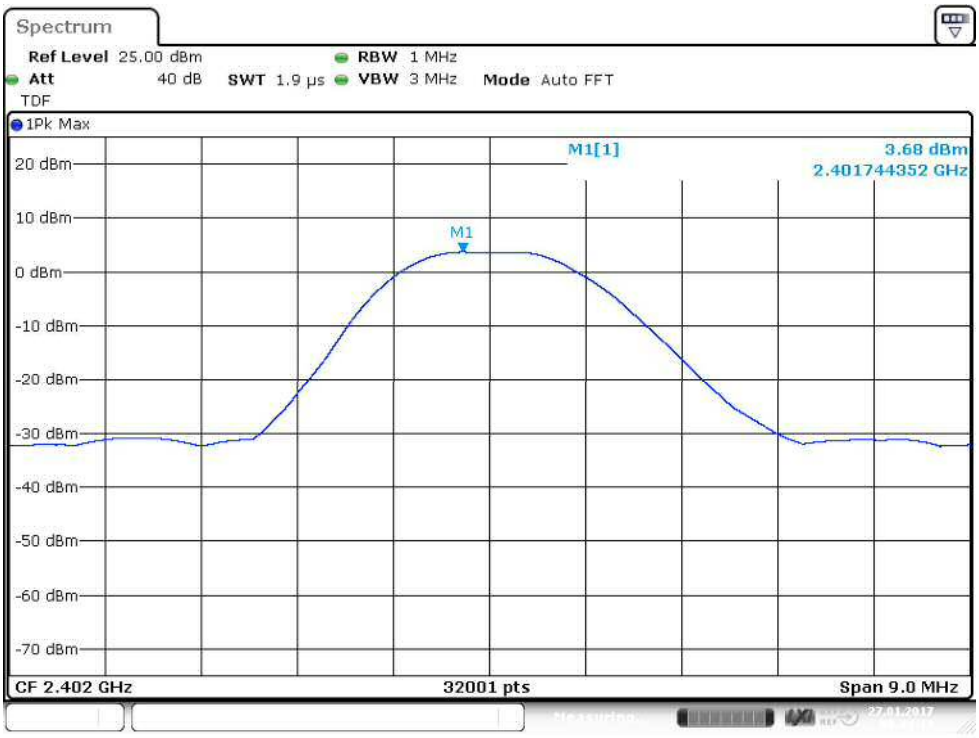

Figure 1: Conducted power (ch low)

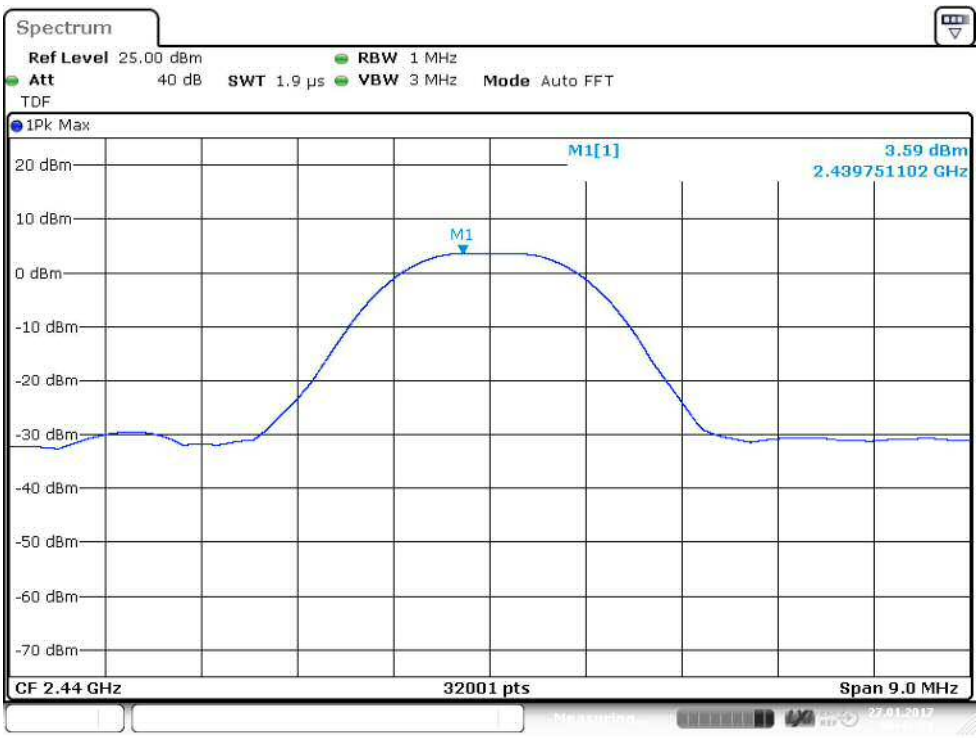

Figure 2: Conducted power (ch mid)

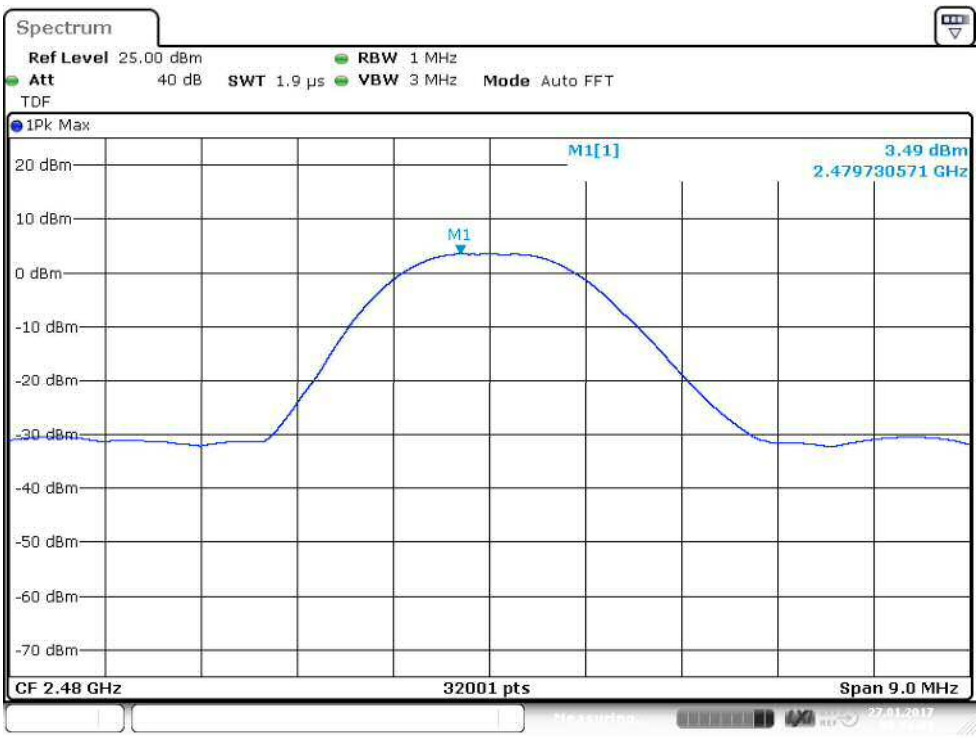

Figure 3: Conducted power (ch high)

Transmitter Radiated Spurious Emissions 9 kHz - 26500 MHz

Standard:	ANSI C63.10	(2013)
Tested by:	EHA / JSU / PKA	
Date:	18.1 - 25.1.2017	
Temperature:	23 ± 3 °C	
Humidity:	20 - 40 % 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).

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

Table 2: 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)
956.167000	**26.7**	**1000.0**	**120.000**	**178.0**	**V**	**257.0**	**27.8**	**19.3**	**46.0**

Table 3: 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)
2384.000000	**61.0**	**1000.0**	**1000.000**	**317.0**	**H**	**330.0**	**14.5**	**12.9**	**73.9**
2390.000000	**55.3**	**1000.0**	**1000.000**	**317.0**	**H**	**330.0**	**14.5**	**18.6**	**73.9**
4803.500000	**46.4**	**1000.0**	**1000.000**	**150.0**	**V**	**52.0**	**8.3**	**27.5**	**73.9**
9616.500000	**44.0**	**1000.0**	**1000.000**	**150.0**	**V**	**210.0**	**15.7**	**29.9**	**73.9**
16803.30000	**50.4**	**1000.0**	**1000.000**	**150.0**	**H**	**337.0**	**26.8**	**23.5**	**73.9**

Table 4: 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)
2384.000000	36.9	1000.0	1000.000	150.0	H	159.0	14.5	17.0	53.9
2390.000000	36.3	1000.0	1000.000	150.0	H	159.0	14.5	17.6	53.9
4804.000000	36.5	1000.0	1000.000	150.0	V	35.0	8.3	17.4	53.9
9607.500000	31.9	1000.0	1000.000	150.0	V	159.0	15.7	22.0	53.9
16519.40000	35.7	1000.0	1000.000	150.0	H	31.0	26.1	18.2	53.9
25488.95000	37.3	1000.0	1000.000	150.0	V	110.0	25.8	16.6	53.9
25805.65000	37.5	1000.0	1000.000	150.0	V	5.0	26.2	16.4	53.9
25990.15000	36.9	1000.0	1000.000	150.0	V	112.0	26.2	17.0	53.9

Middle channel

Table 5: 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)
941.934000	26.6	1000.0	120.000	307.0	H	349.0	27.7	19.4	46.0

Table 6: 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)
1008.125000	48.5	1000.0	1000.000	150.0	H	192.0	10.2	25.4	73.9
4880.500000	46.1	1000.0	1000.000	150.0	H	348.0	8.3	27.8	73.9
16787.30000	50.4	1000.0	1000.000	369.0	V	60.0	26.8	23.5	73.9

Table 7: 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)
1007.925000	37.1	1000.0	1000.000	281.0	H	186.0	10.2	16.8	53.9
4879.900000	34.6	1000.0	1000.000	150.0	V	280.0	8.3	19.3	53.9
17109.30000	36.0	1000.0	1000.000	150.0	H	315.0	27.3	17.9	53.9
19484.85000	33.7	1000.0	1000.000	100.0	H	67.0	19.3	20.2	53.9
22140.90000	35.9	1000.0	1000.000	100.0	V	88.0	22.6	18.0	53.9
24432.55000	37.0	1000.0	1000.000	150.0	V	329.0	23.6	16.9	53.9

High channel

Table 8: 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)
958.660000	26.8	1000.0	120.000	100.0	H	31.0	27.8	19.2	46.0

Table 9: 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)
2488.500000	54.8	1000.0	1000.000	166.0	H	338.0	14.8	19.1	73.9
2498.675000	59.6	1000.0	1000.000	279.0	H	321.0	14.9	14.3	73.9
2506.425000	63.5	1000.0	1000.000	278.0	H	322.0	14.9	10.4	73.9
2576.025000	62.0	1000.0	1000.000	243.0	H	0.0	15.0	11.9	73.9
4960.000000	45.2	1000.0	1000.000	150.0	H	151.0	8.2	28.7	73.9
7440.800000	44.2	1000.0	1000.000	150.0	H	0.0	12.1	29.7	73.9
17017.30000	49.6	1000.0	1000.000	378.0	H	119.0	26.9	24.3	73.9

Table 10: 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)
2491.100000	36.1	1000.0	1000.000	150.0	V	353.0	14.8	17.8	53.9
2506.625000	37.4	1000.0	1000.000	150.0	H	321.0	14.9	16.5	53.9
4959.800000	30.3	1000.0	1000.000	150.0	H	147.0	8.2	23.6	53.9
7435.600000	29.7	1000.0	1000.000	400.0	H	357.0	12.1	24.2	53.9
16786.70000	36.6	1000.0	1000.000	150.0	H	336.0	26.8	17.3	53.9
26172.80000	37.1	1000.0	1000.000	100.0	V	116.0	26.4	16.8	53.9

Radiated Band Edge results

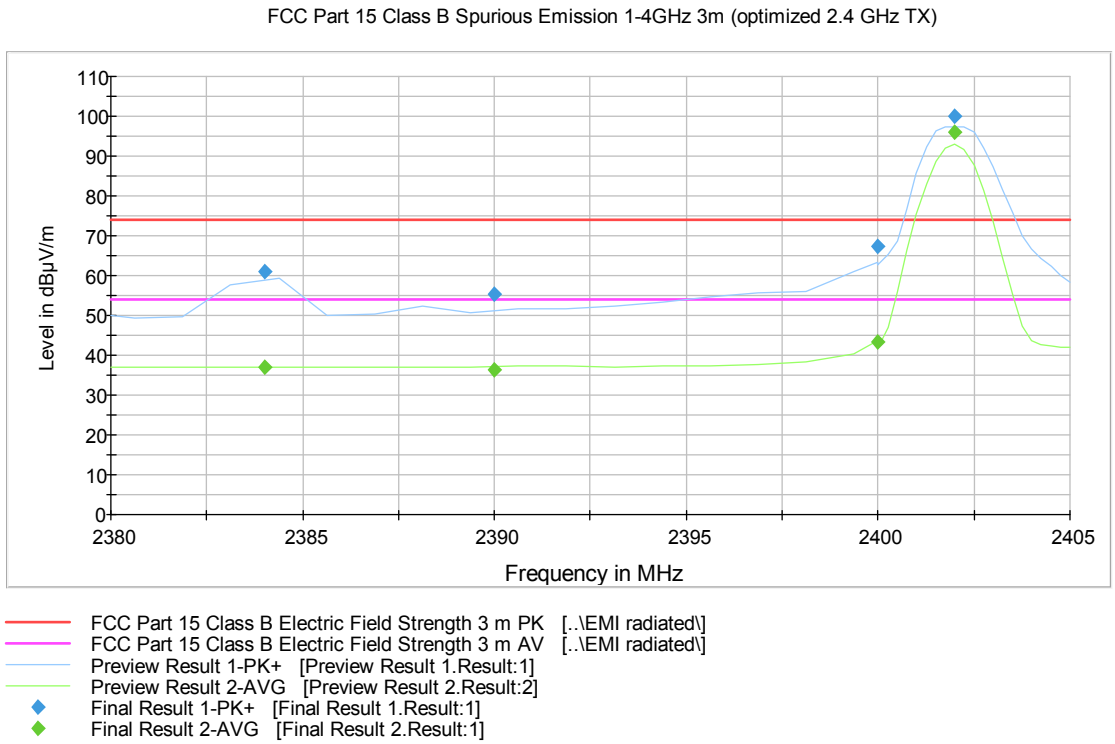

Figure 4: Radiated Band Edge measurement graph (ch low)

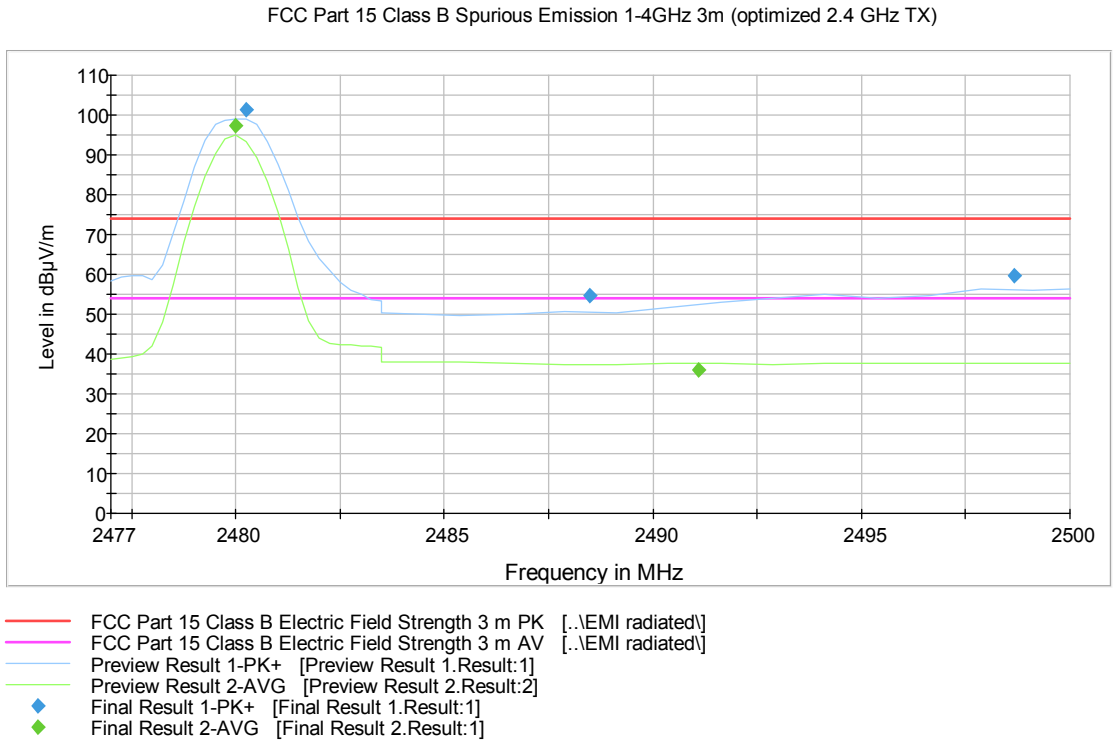

Figure 5: Radiated Band Edge measurement graph (ch high)

Transmitter Band Edge Measurement and Conducted Spurious Emissions

Standard:	ANSI C63.10	(2013)
Tested by:	EHA	
Date:	27.1.2017	
Temperature:	23 ± 3 °C	
Humidity:	21 % 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 11: Band edge attenuation

Band Edge Attenuation	
Lower Band Edge	**Upper Band Edge**
-41.91 dBc	-42.38 dBc
Limit: -20dBc	

Table 12: Conducted spurious emissions channel low

Frequency [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]	Result
996.32	-70.58	-16.61	-53.96	PASS
2333.74	-42.18	-16.61	-25.57	PASS
2401.97	3.39	-	-	Carrier
3603.04	-64.51	-16.61	-47.90	PASS
4804.02	-50.32	-16.61	-33.71	PASS
7206.01	-50.70	-16.61	-34.09	PASS
12507.41	-59.74	-16.61	-43.13	PASS
15799.99	-56.74	-16.61	-40.13	PASS
16189.13	-55.58	-16.61	-38.97	PASS
19833.93	-58.04	-16.61	-41.43	PASS
22467.75	-56.92	-16.61	-40.31	PASS
26188.50	-56.77	-16.61	-40.16	PASS

Table 13: Conducted spurious emissions channel mid

Frequency [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]	Result
997.71	-69.67	-16.54	-53.13	PASS
2389.52	-40.57	-16.54	-24.03	PASS
2439.98	3.46	-	-	Carrier
3719.62	-65.94	-16.54	-49.40	PASS
4879.96	-52.00	-16.54	-35.47	PASS
7320.85	-48.94	-16.54	-32.40	PASS
12531.41	-59.63	-16.54	-43.09	PASS
15794.65	-57.04	-16.54	-40.51	PASS
16222.32	-56.54	-16.54	-40.00	PASS
19189.70	-57.29	-16.54	-40.76	PASS
24475.72	-57.58	-16.54	-41.04	PASS
25575.49	-56.66	-16.54	-40.12	PASS

Table 14: Conducted spurious emissions channel high

Frequency [MHz]	Level [dBm]	Limit [dBc]	Margin [dB]	Result
872.65	-69.98	-16.61	-53.37	PASS
2325.04	-68.18	-16.61	-51.56	PASS
2479.97	3.39	-	-	Carrier
2583.37	-39.17	-16.61	-22.55	PASS
4959.92	-54.40	-16.61	-37.79	PASS
7440.00	-48.74	-16.61	-32.13	PASS
12510.59	-59.57	-16.61	-42.95	PASS
15824.36	-57.77	-16.61	-41.15	PASS
16143.01	-55.72	-16.61	-39.10	PASS
21111.23	-58.08	-16.61	-41.46	PASS
22895.33	-57.28	-16.61	-40.66	PASS
26221.17	-56.97	-16.61	-40.36	PASS

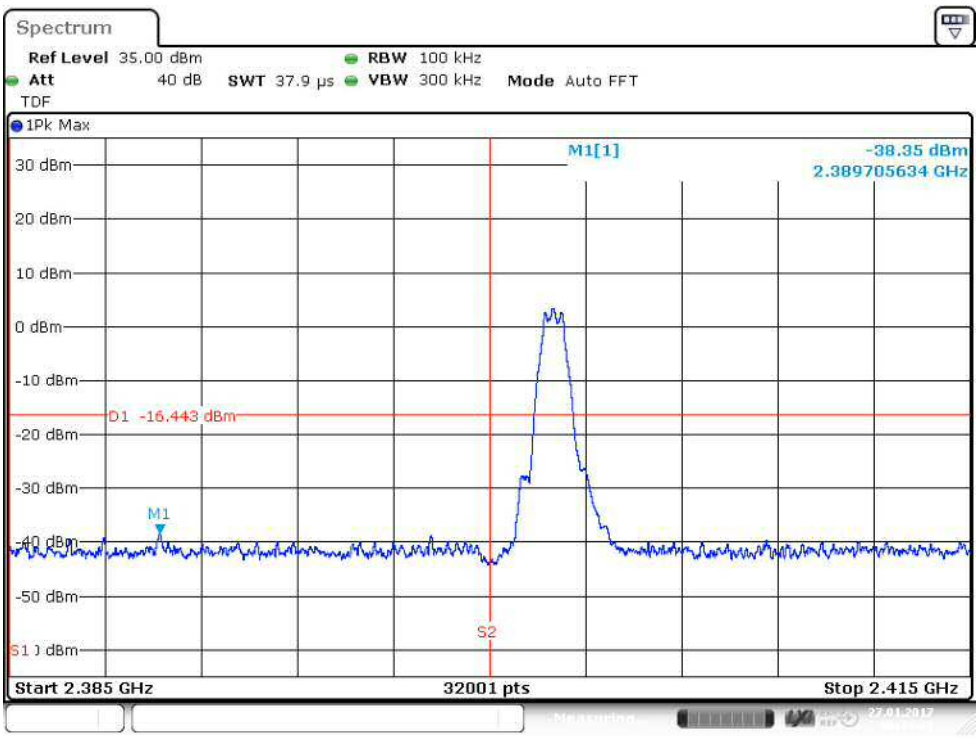

Figure 6: Lower Band Edge

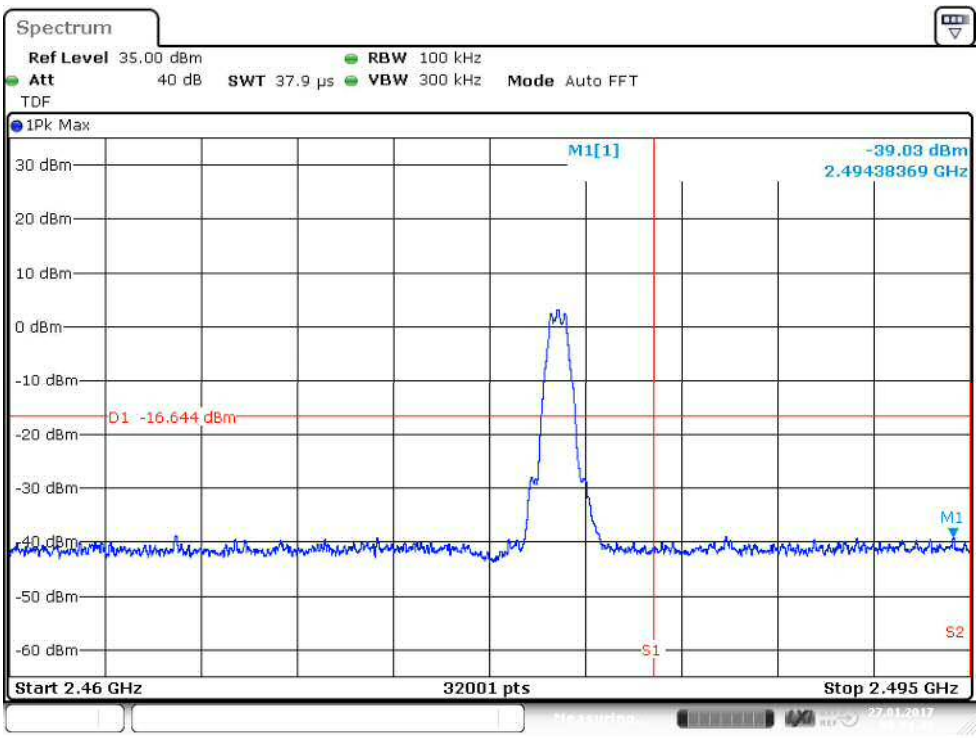

Figure 7: Upper Band Edge

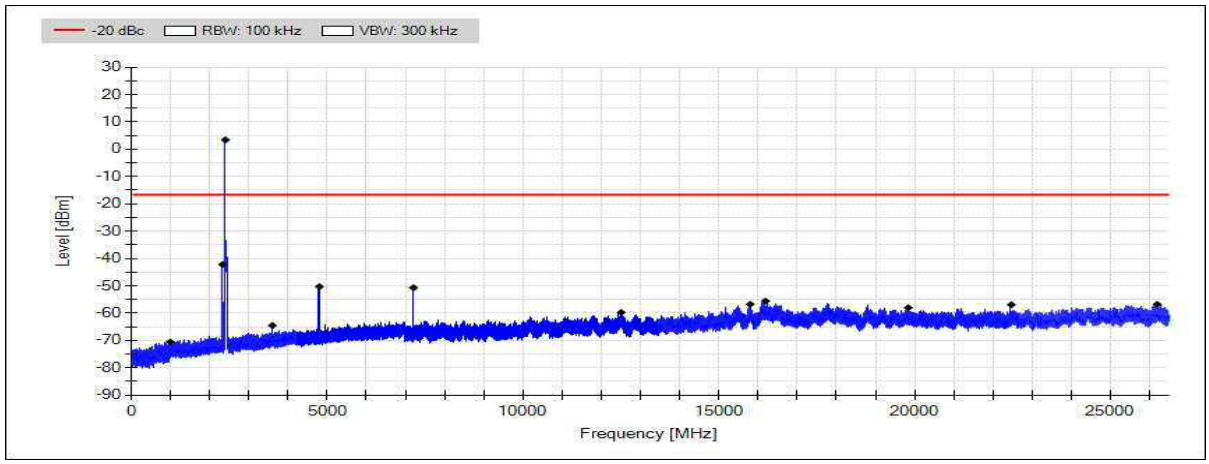

Figure 8: Conducted spurious emissions 30 - 26500 MHz channel low

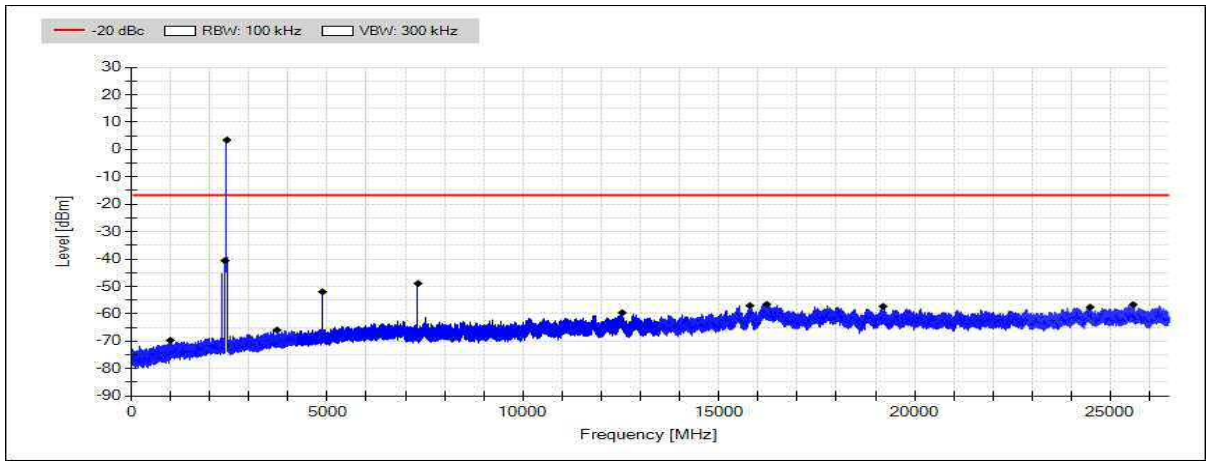

Figure 9: Conducted spurious emissions 30 - 26500 MHz channel mid

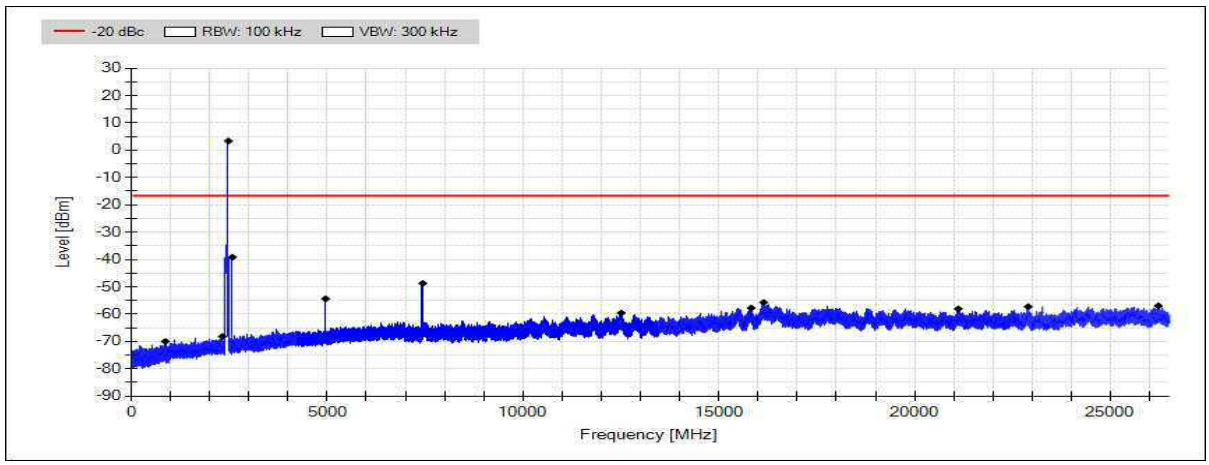

Figure 10: Conducted spurious emissions 30 - 26500 MHz channel high

6 dB Bandwidth of the Channel

Standard:	ANSI C63.10	(2013)
Tested by:	EHA	
Date:	27.1.2017	
Temperature:	23 ± 3 °C	
Humidity:	21 % RH	

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

Results:

Table 15: 6 dB bandwidth test results

Channel	6 dB BW [kHz]	Minimum limit [kHz]
Low	694.103	500
Mid	697.166	
High	690.103	

Figure 11: 6 dB bandwidth channel low

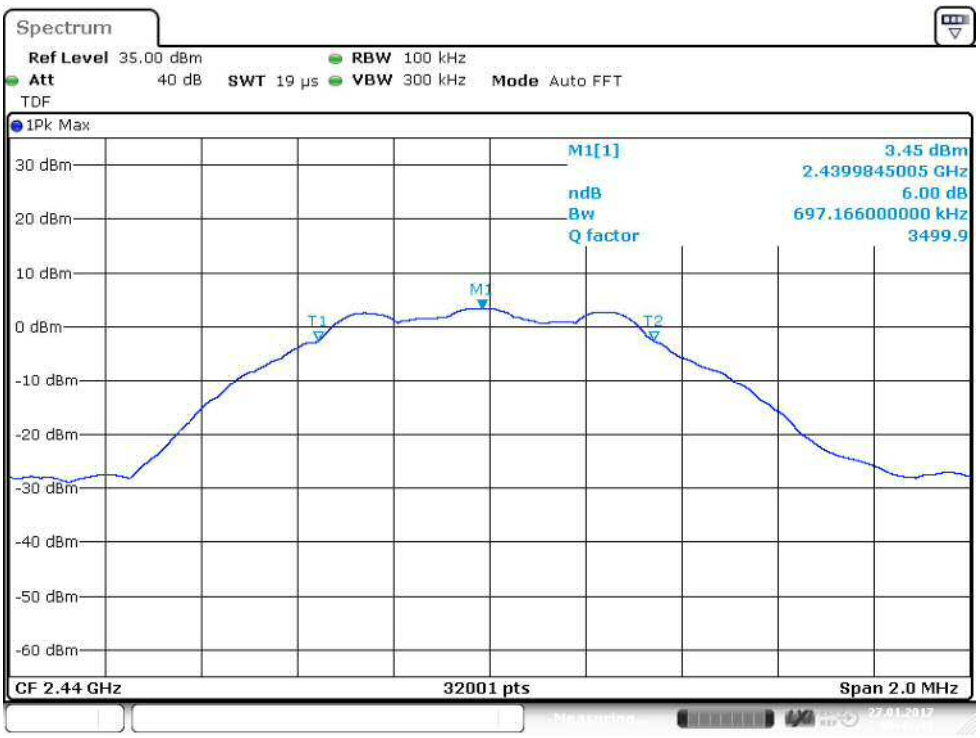

Figure 12: 6 dB bandwidth channel mid

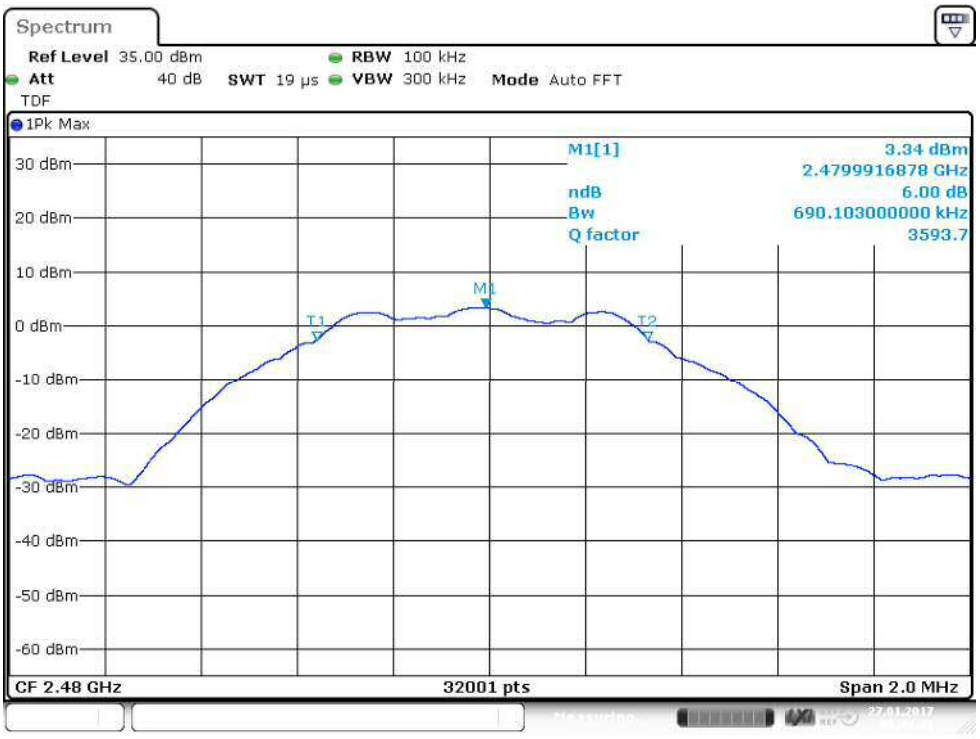

Figure 13: 6 dB bandwidth channel high

Power Spectral Density

Standard:	ANSI C63.10	(2013)
Tested by:	EHA	
Date:	27.1.2017	
Temperature:	23 ± 3 °C	
Humidity:	21 % RH	

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

Results:

Table 16: Power spectral density test results

Channel	PSD dBm/10 kHz	Maximum limit [dBm/3kHz]
Low	-7.92	+8.00
Mid	-7.71	
High	-7.35	

Figure 14: Power spectral density channel low

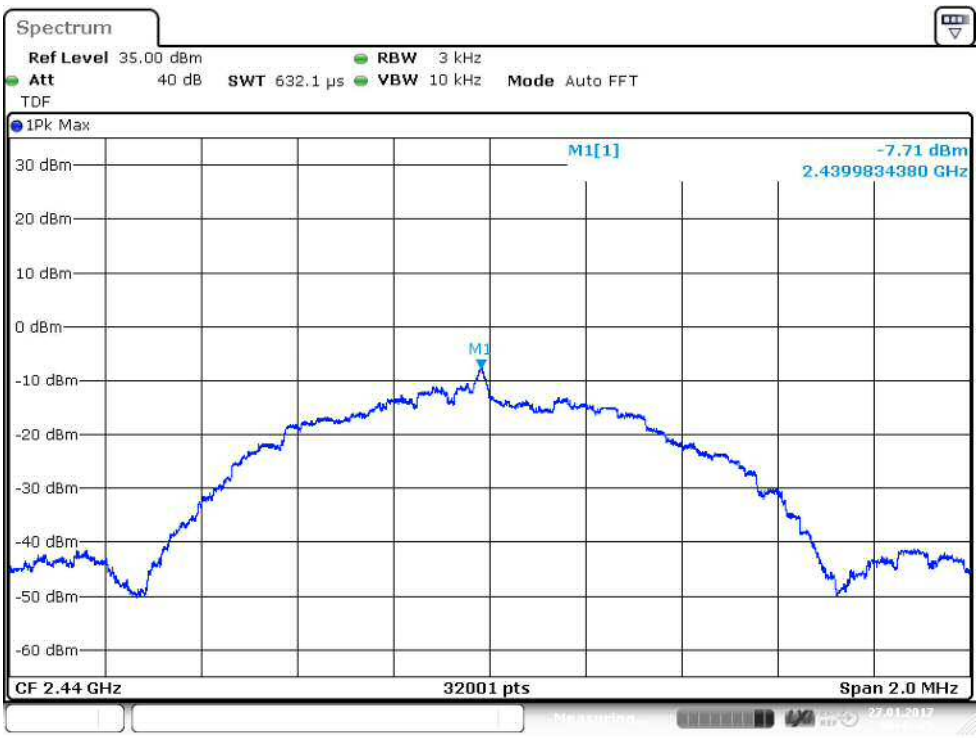

Figure 15: Power spectral density channel mid

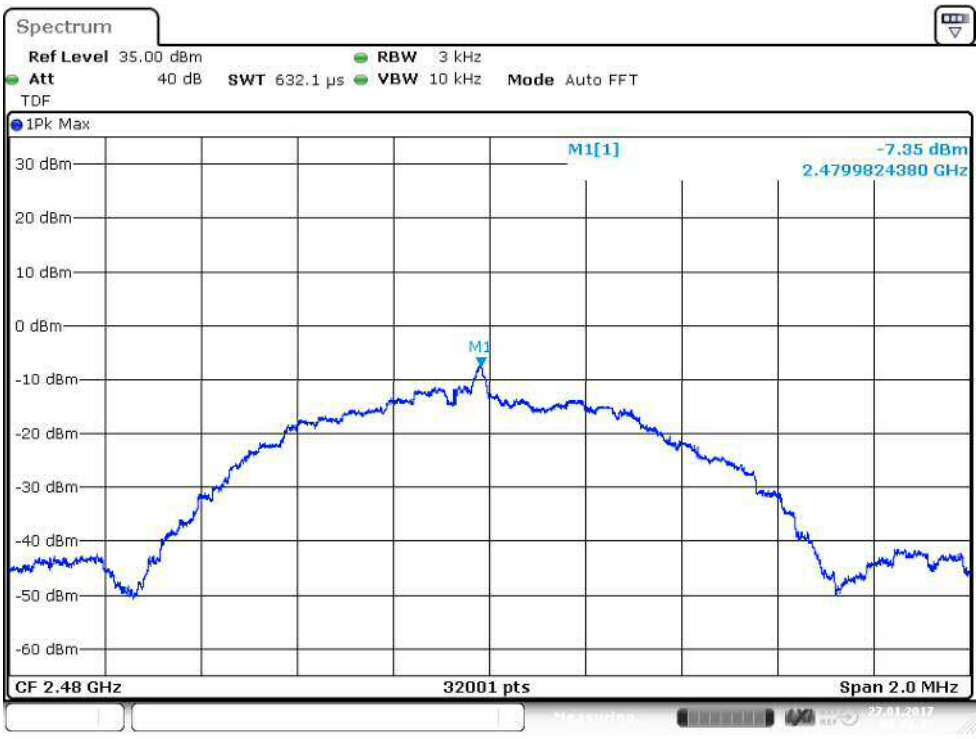

Figure 16: Power spectral density channel high

99% Occupied Bandwidth

Standard:	RSS-GEN	(2014)
Tested by:	EHA	
Date:	27.1.2017	
Temperature:	23 ± 3 °C	
Humidity:	21 % RH	

RSS-GEN 6.6

Table 17: 99% occupied bandwidth test results

Channel	Limit	99 % BW [MHz]	Result
Low	-	1.056466985	PASS
Mid	-	1.060091872	PASS
High	-	1.054717040	PASS

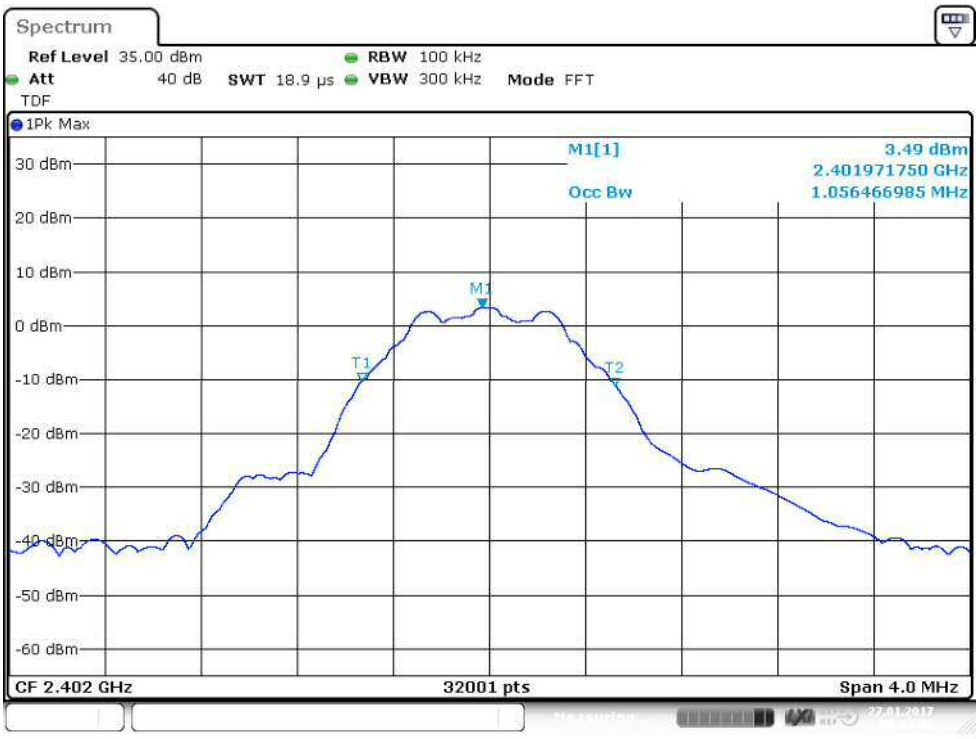

Figure 17: 99% OBW channel low

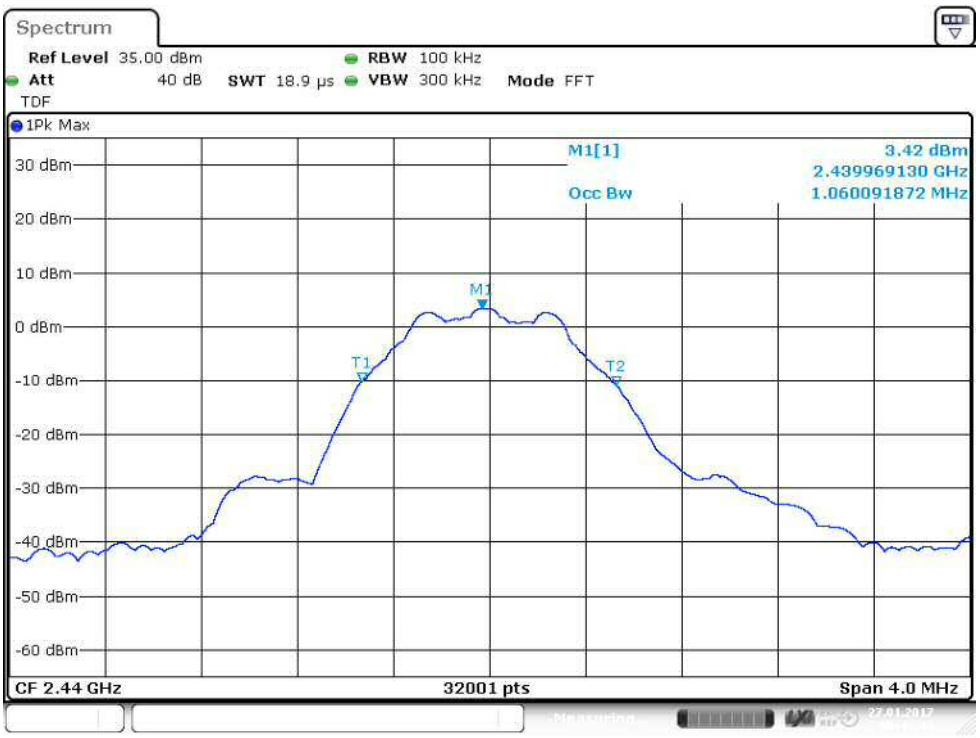

Figure 18: 99% OBW channel mid

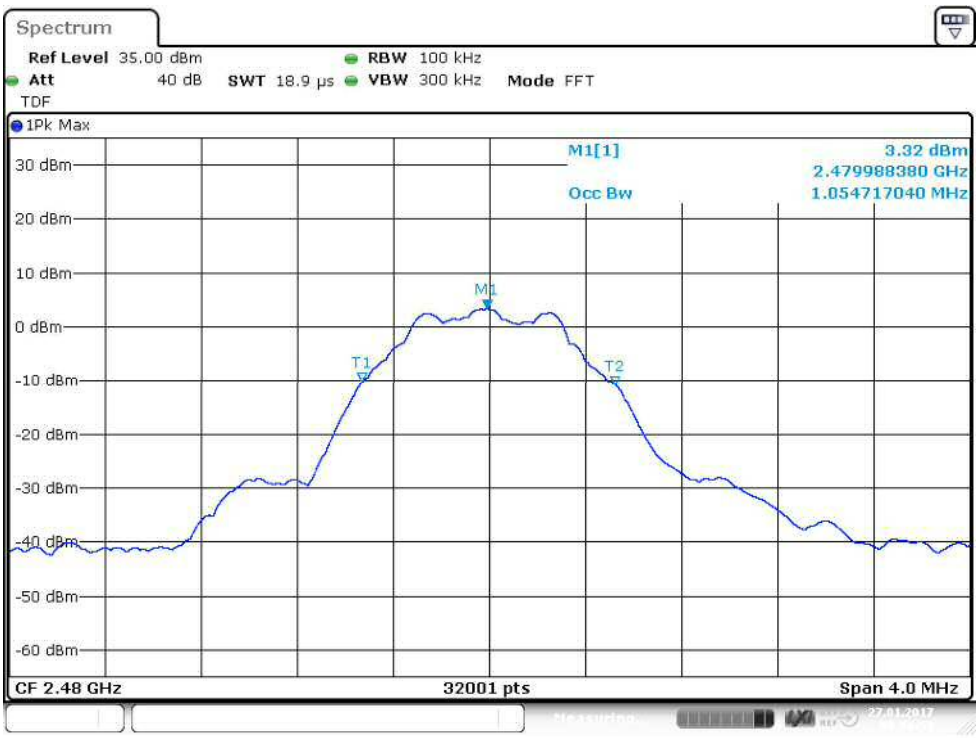

Figure 19: 99% OBW channel high

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
PREAMPLIFIER	ALC MICROWAVE	AWB-2018-40-08	inv:9749	2016-08-30	2017-08-30
DC-POWER SUPPLY	DELTA ELEKTRONIKA	SM 130-25D	sn:03494	-	-
ANTENNA	EMCO	3117	inv:7293	2016-03-16	2018-03-06
ANTENNA	EMCO	3160-09	inv:7294	2016-03-16	2017-03-16
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	-	-
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	-	-
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	-	-
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	inv:8453	2016-06-10	2017-06-10
SIGNAL ANALYZER	ROHDE & SCHWARZ	FSV40	inv:9093	2016-06-10	2017-06-10
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv:8013	2016-08-29	2017-08-29
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2016-10-25	2018-10-25
TEMPERATURE/ HUMIDITY METER	VAISALA	HMT 333	inv:8638	2016-03-01	2017-03-01
HIGH PASS FILTER	WAINWRIGHT	WHKX4.0/18G-10SS	sn:10	2016-01-22	2017-01-22
ATT SMAM/F 50 Ω 18 GHZ 10 DB 1 W	HUBER&SUHNER	6610.19.AA	sn:RF ATTEN 07	2016-02-02	2017-02-02