

Test Report



INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C

Equipment Under Test: RFID reader unit

Type/ Model: PlanID

Customer / Manufacturer: Planmeca Oy
Asentajankatu 6
FI-00880 Helsinki
FINLAND

FCC Rule Part: 15.247: 2014
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: 20 January 2017

Issued by:

A blue ink signature of Pekka Kälviäinen.

Pekka Kälviäinen
Testing Engineer

Date: 20 January 2017

Checked by:

A blue ink signature of Janne Nyman.

Janne Nyman
Compliance Specialist

Table of Contents

PRODUCT DESCRIPTION	3
Equipment Under Test (EUT)	3
Ratings and declarations	3
Power Supply	3
GENERAL REMARKS	4
Disclaimer	4
SUMMARY OF TESTING	5
EUT Test Conditions during Testing	5
TEST RESULTS	6
Conducted Emissions In The Frequency Range 150 kHz - 30 MHz	6
Maximum Peak Conducted Output Power	8
Transmitter and Receiver Radiated Emissions 30 MHz to 10 GHz	11
Conducted Spurious Emissions 30 MHz to 10 GHz	17
20 dB Bandwidth of the Hopping Channel	19
Hopping Channel Carrier Frequencies Separation	21
Number of Hopping Channels	22
Average Time of Occupancy of Hopping Frequency	23
99% Occupied Power Bandwidth	25
TEST EQUIPMENT	27

Equipment Under Test (EUT)

Product: UHF / HF RFID reader unit
 Model/type: PlanID
 Serial: -
 FCC ID: UHF-module: YIIPID002
 IC: UHF-module: 9050A-PID002

Classification of the device

Fixed device	<input checked="" type="checkbox"/>
Mobile Device (Human body distance > 20cm)	<input type="checkbox"/>
Portable Device (Human body distance < 20cm)	<input type="checkbox"/>

Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing

Ratings and declarations, UHF

Operating Frequency Range : 917.5 – 922.5 MHz
 Channels: 51
 Channel separation: 100 kHz
 Conducted power: 22.76 dBm (measured)
 Modulation: -
 Antenna: integral, type: Antenna Kirbii A10472, gain: 1.7 dBi

Power Supply

Operating voltage: 24 VDC
 Operating voltage AC/DC power supply 115 V 60 Hz
 type: Mascot type 9920, s/n: 3707:

Cables

Cable:	Length:	Type:
power / data cable	3m	unshielded cable
AC power	2m	unshielded cable

Samples

Samples: EUT1, EUT2 with temporary antenna connector.

Disclaimer

This document is issued by the Company under its General Conditions of service accessible at [http://www.sgs.com/terms and conditions.htm](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)(2) / RSS-247 5.4	Maximum Peak Conducted Output Power	PASS
§15.247(a)(1)(i) / RSS-247 5.1	Hopping Channel Carrier Frequency Separation	PASS
§15.247(a)(1)(i) / RSS-247 5.1	Number of Hopping Frequencies	PASS
§15.247(a)(1)(i) / RSS-247 5.1	Average Time of Occupancy of Hopping Frequency	PASS
§15.247(a)(1)(i) / RSS-247 5.1	20 dB Bandwidth	PASS
RSS-GEN 6.6	99 % Occupied Bandwidth	PASS
§15.247(d) / RSS-247 5.5	100 kHz Bandwidth of 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	N/A *)
§15.109 / RSS-GEN 7.1	Unintentional Radiated Emissions	N/A *)

*) Transmitter is always operating, no receiver-only state

EUT Test Conditions during Testing

The EUT was configured into the wanted channel and was in continuous transmit mode during all the tests.

Following channels were used during the tests:

Channel	Frequency/ MHz
LOW (CH 0)	917.500
HIGH (CH 50)	922.500

Test Facility

<input type="checkbox"/>	Testing Location / address: FCC registration number: 90598	SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND
<input checked="" type="checkbox"/>	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

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

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 30.12.2016
Temperature: 22 °C
Humidity: 32 % RH
Barometric pressure: -
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.

EUT1 + AC/DC power supply

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.

Conducted Emissions In The Frequency Range 150 kHz – 30 MHz

Conducted Emission Mains FCC Part 15 Class B with ENV216

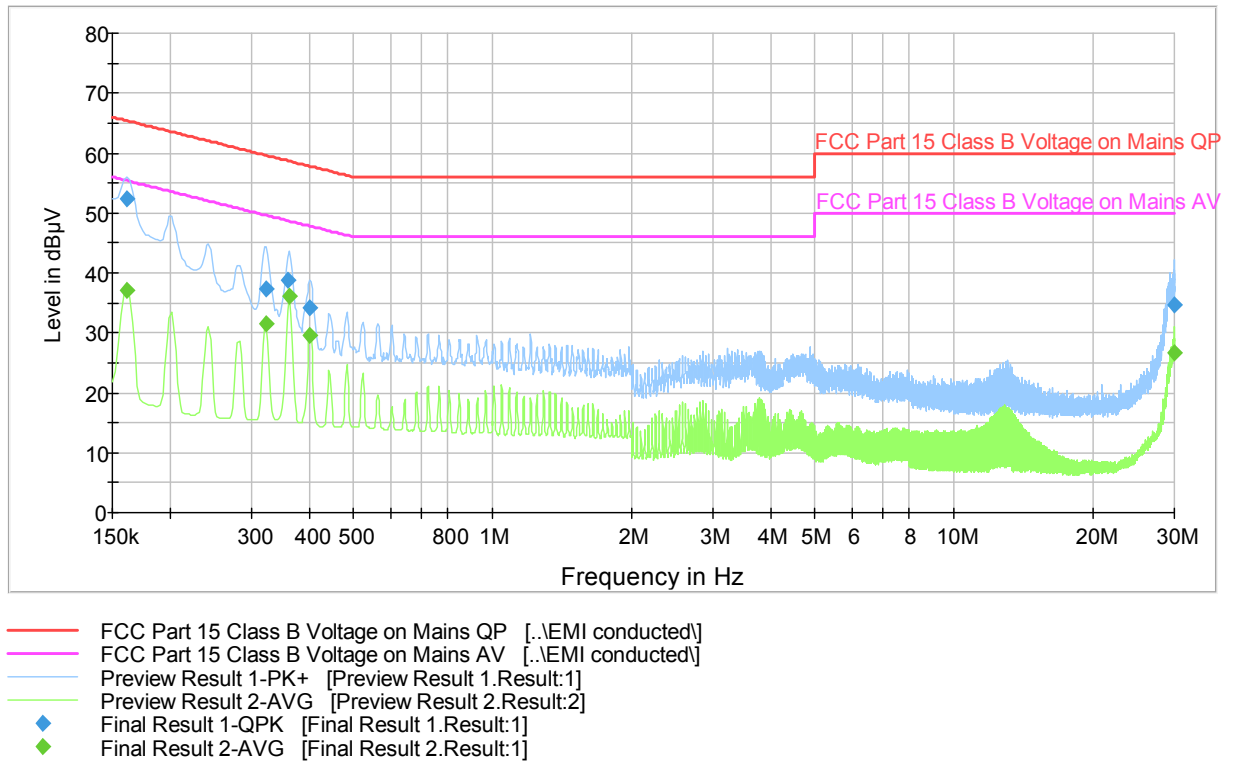


Figure 1. The measured curves with peak- and average detector

Final measurements from the worst frequencies

Table 1. Final results.

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.161000	52.3	1000.0	9.000	On	L1	10.2	13.2	65.4	-
0.322750	37.4	1000.0	9.000	On	N	10.2	22.3	59.6	-
0.361000	38.9	1000.0	9.000	On	L1	10.1	19.8	58.7	-
0.401750	34.2	1000.0	9.000	On	N	10.3	23.7	57.8	-
29.976250	34.7	1000.0	9.000	On	N	10.9	25.3	60.0	-

Table 2. Final results.

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.161000	37.1	1000.0	9.000	On	L1	10.2	18.3	55.4	-
0.322750	31.4	1000.0	9.000	On	L1	10.0	18.2	49.6	-
0.363000	36.2	1000.0	9.000	On	L1	10.1	12.5	48.7	-
0.402500	29.6	1000.0	9.000	On	L1	10.1	18.2	47.8	-
29.969000	26.6	1000.0	9.000	On	N	10.9	23.4	50.0	-

Maximum Peak Conducted Output Power**Maximum Peak Conducted Output Power**

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 28.12.2016
Humidity: 23 %
Temperature: 18 °C
Measurement uncertainty $\pm 2.87\text{dB}$ Level of confidence 95 % (k = 2)

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

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels. 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.

EUT2, (EUT was equipped with temporary antenna connector)

Results:

Channel	Conducted Power [dBm]	Limit [dBm]	Result
Low	22.51	30	PASS
High	22.75	30	PASS

Maximum Peak Conducted Output Power

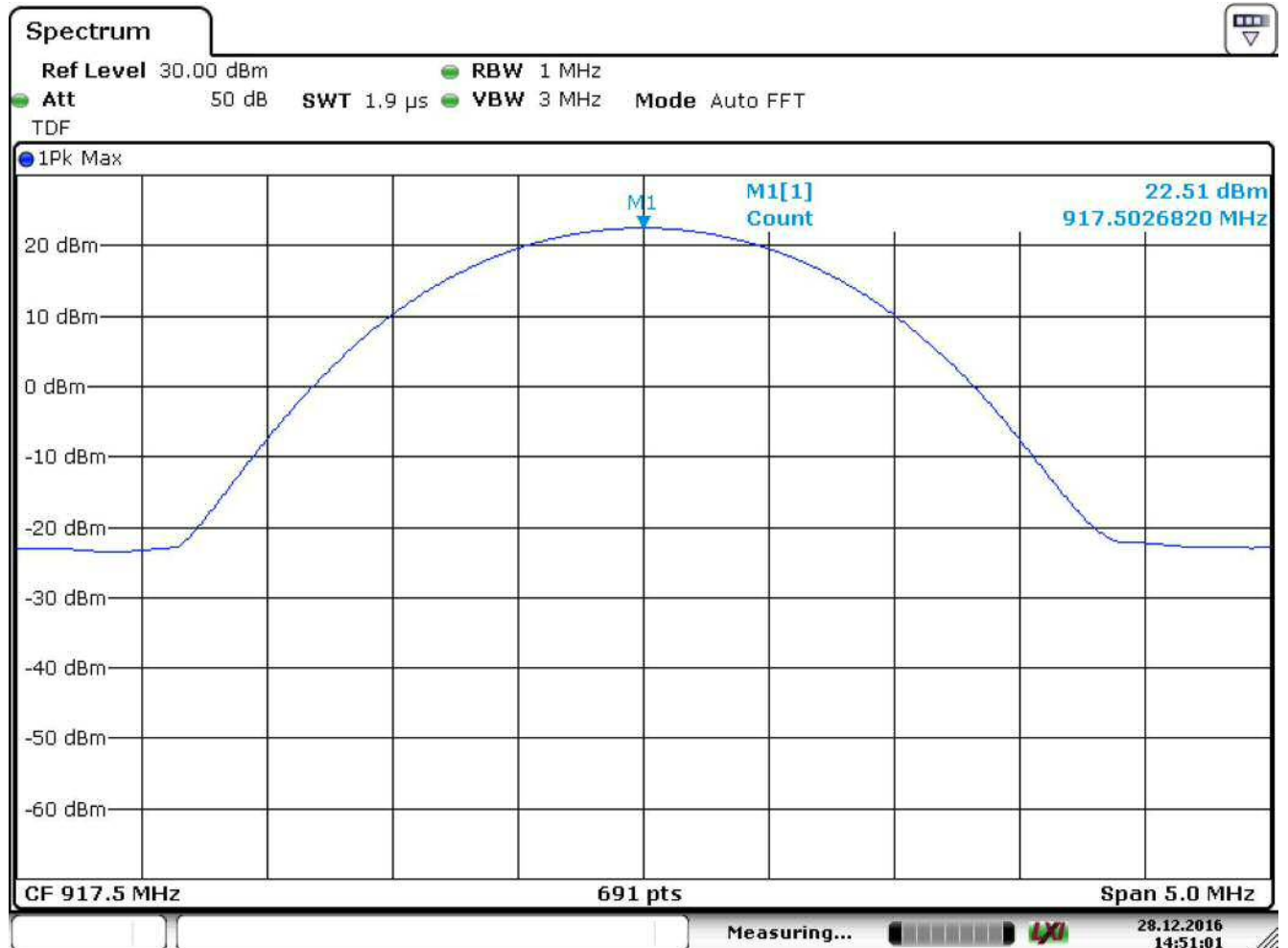


Figure 2. Channel LOW.

Maximum Peak Conducted Output Power

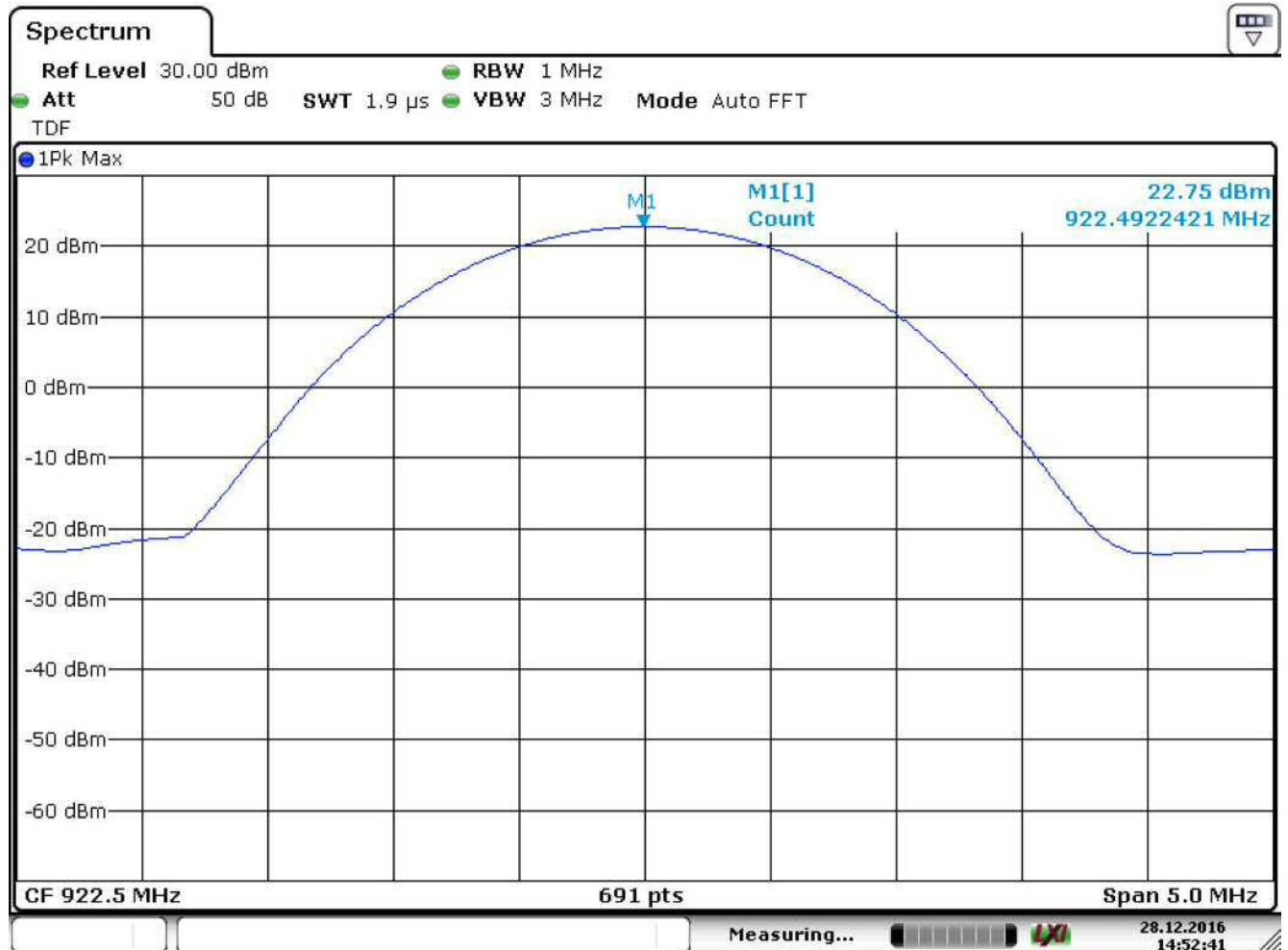


Figure 3. Channel HIGH.

Transmitter and Receiver Radiated Emissions 30 MHz to 10 GHz

Standard:	ANSI C63.10	(2013)
Tested by:	PKA	
Date:	20.-22.12.2016	
Temperature:	22 °C	
Humidity:	34 % RH	
Measurement uncertainty	± 4.51 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a), 15.109
RSS-247 5.5, RSS-GEN 6.13, RSS-GEN 7.1

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.

EUT1

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

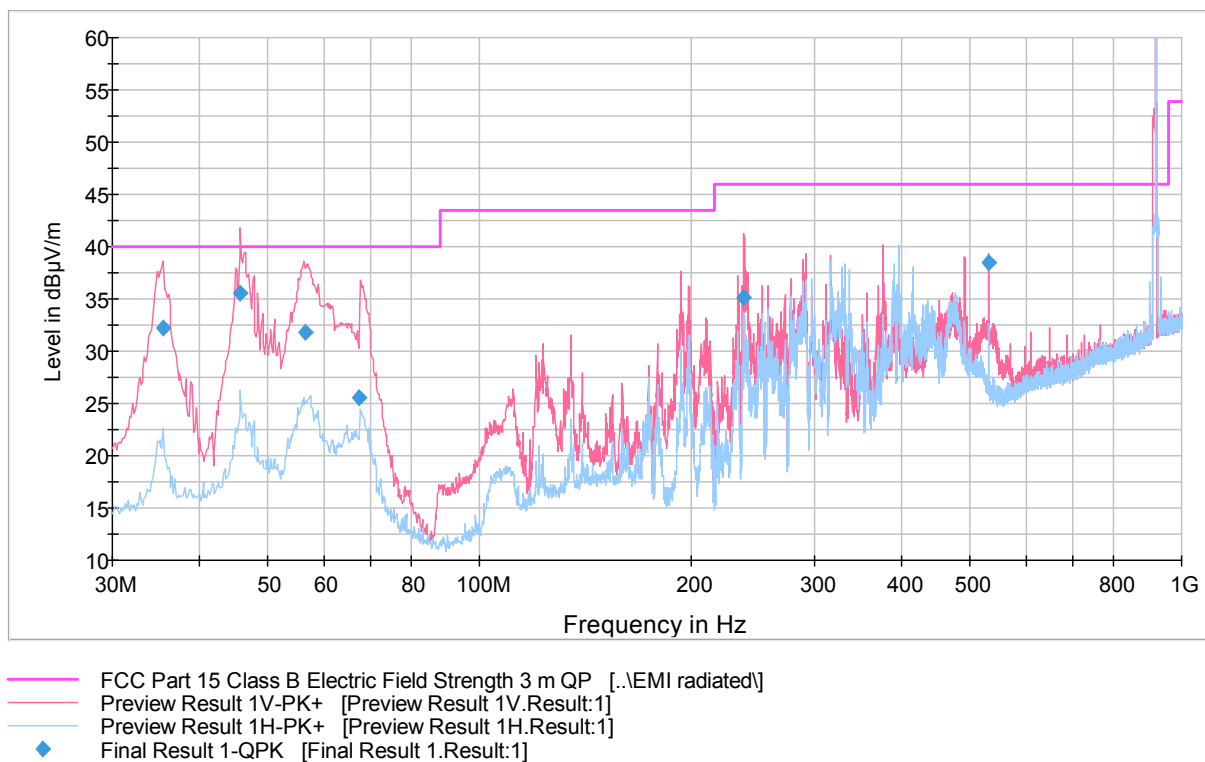


Figure 4. Measured curve with peak-detector. Channel LOW.

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
35.415000	32.2	1000.0	120.000	100.0	V	285.0	13.4	7.8	40.0	-
45.655000	35.6	1000.0	120.000	100.0	V	18.0	14.5	4.4	40.0	-
56.385000	31.8	1000.0	120.000	100.0	V	246.0	14.3	8.2	40.0	-
67.385000	25.5	1000.0	120.000	132.0	V	272.0	12.9	14.5	40.0	-
238.145000	35.1	1000.0	120.000	100.0	V	200.0	13.0	10.9	46.0	-
530.135000	38.5	1000.0	120.000	111.0	V	219.0	20.8	7.5	46.0	-

Transmitter Radiated Emissions 30 MHz to 10 GHz

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m

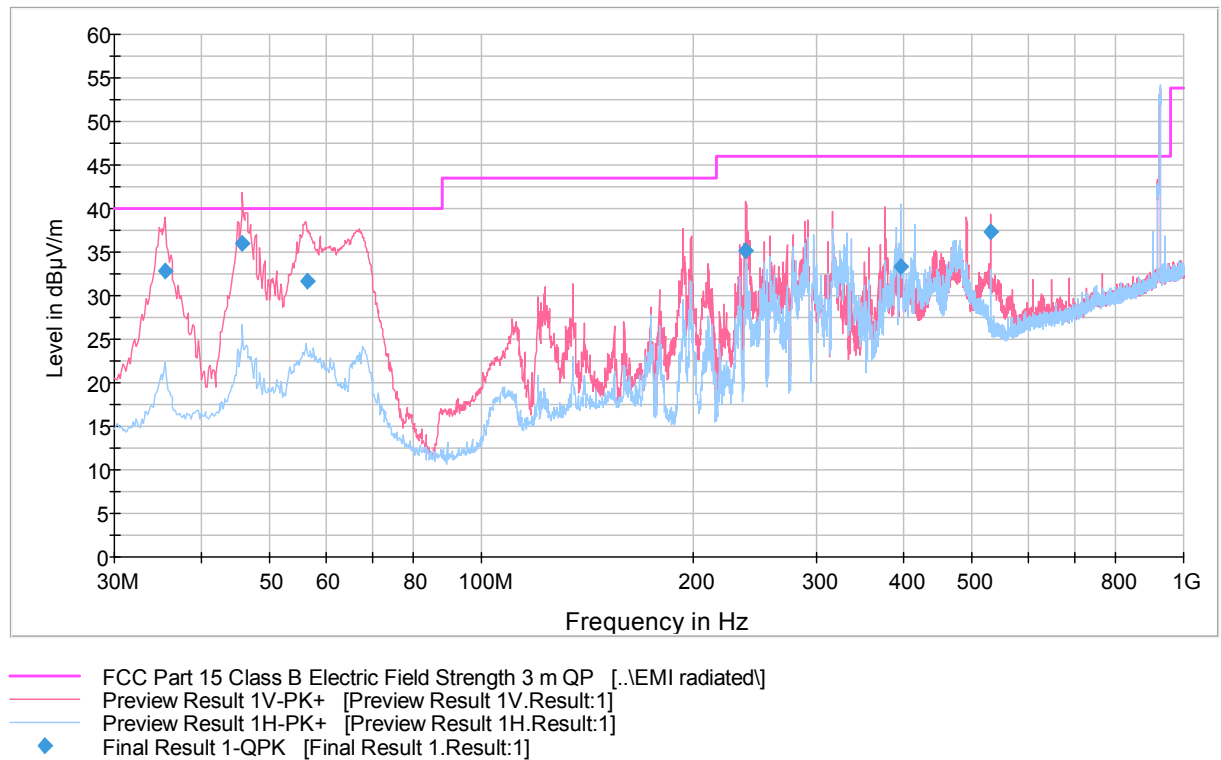


Figure 5. Measured curve with peak-detector. Channel HIGH.

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
35.435000	32.8	1000.0	120.000	100.0	V	135.0	13.4	7.2	40.0	
45.655000	35.9	1000.0	120.000	100.0	V	309.0	14.5	4.1	40.0	
56.355000	31.6	1000.0	120.000	100.0	V	279.0	14.3	8.4	40.0	
238.185000	35.2	1000.0	120.000	100.0	V	194.0	13.0	10.8	46.0	
395.245000	33.3	1000.0	120.000	100.0	H	172.0	17.7	12.7	46.0	
530.155000	37.3	1000.0	120.000	112.0	V	165.0	20.8	8.7	46.0	

Transmitter Radiated Emissions 30 MHz to 10 GHz

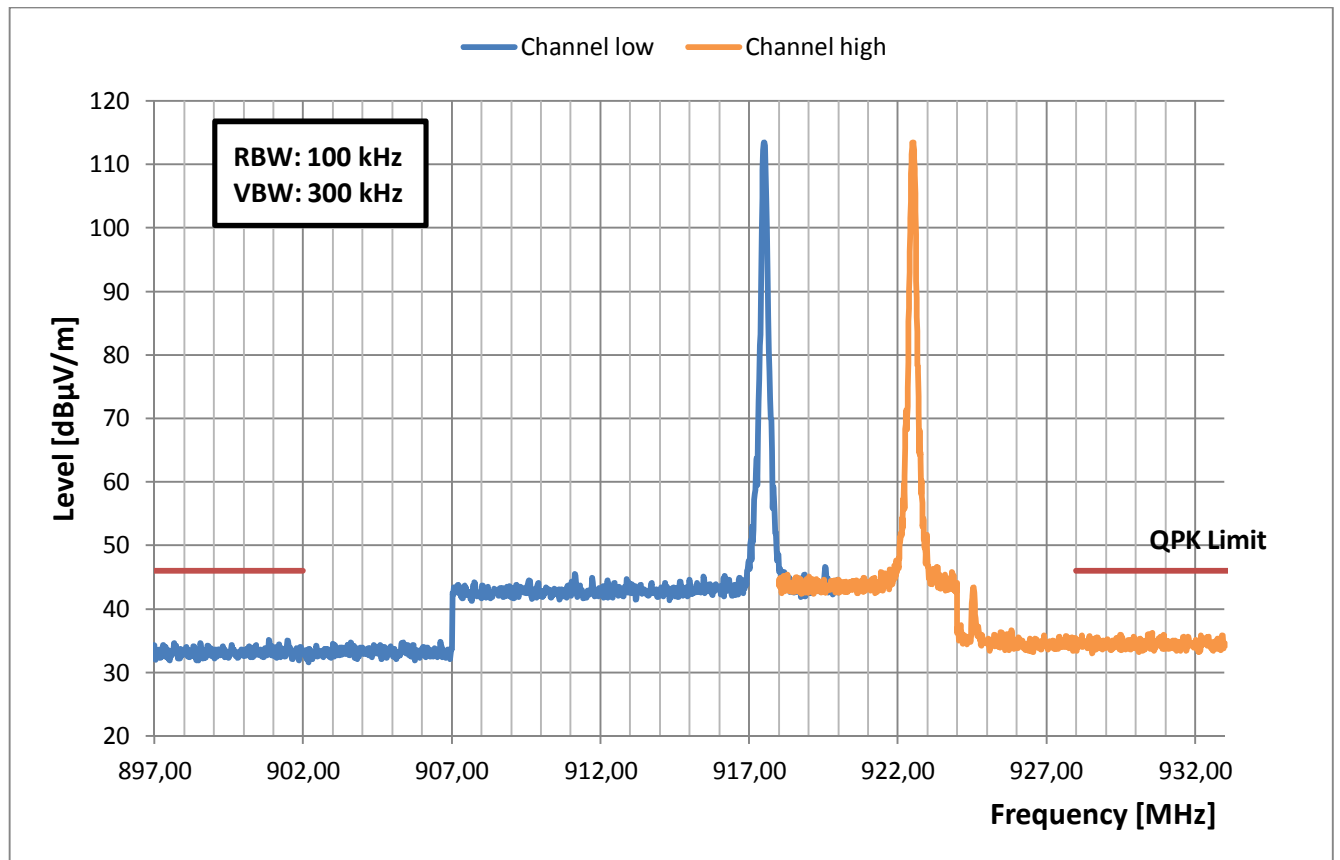


Figure 6. Measured curve with peak-detector. band edges, Channels LOW and HIGH.

Transmitter Radiated Emissions 30 MHz to 10 GHz

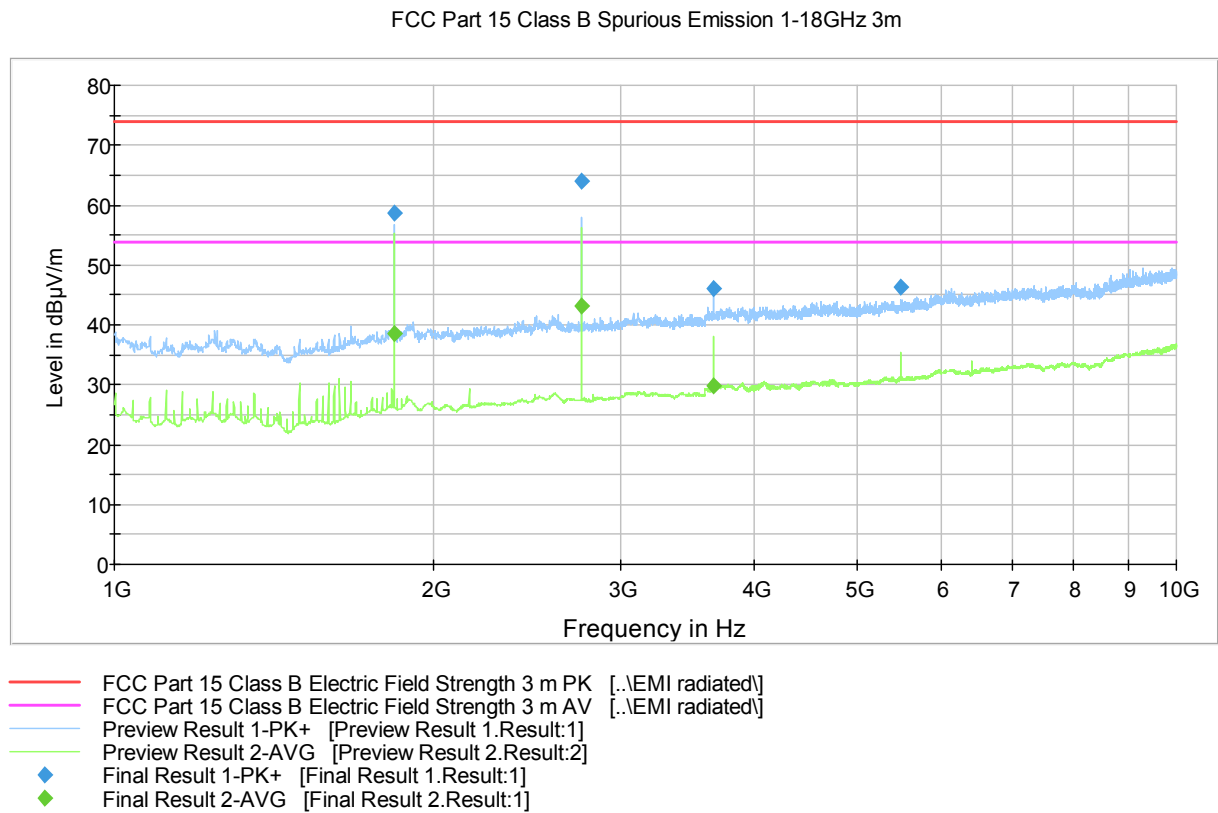


Figure 7. Measured curve with peak- and average detector. Channel LOW.

Table 5. 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
1835.025000	58.6	1000.0	1000.000	100.0	V	342.0	3.3	15.3	73.9	-
2752.525000	64.0	1000.0	1000.000	185.0	V	328.0	4.9	9.9	73.9	-
3670.025000	46.0	1000.0	1000.000	253.0	V	320.0	6.1	27.9	73.9	-
5504.975000	46.3	1000.0	1000.000	100.0	H	336.0	9.2	27.6	73.9	-

Table 6. Final results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
1835.025000	38.6	1000.0	1000.000	129.0	V	0.0	3.3	15.3	53.9	-
2752.525000	43.3	1000.0	1000.000	183.0	V	328.0	4.9	10.6	53.9	-
3670.025000	29.8	1000.0	1000.000	181.0	V	317.0	6.1	24.1	53.9	-

Transmitter Radiated Emissions 30 MHz to 10 GHz

FCC Part 15 Class B Spurious Emission 1-18GHz 3m

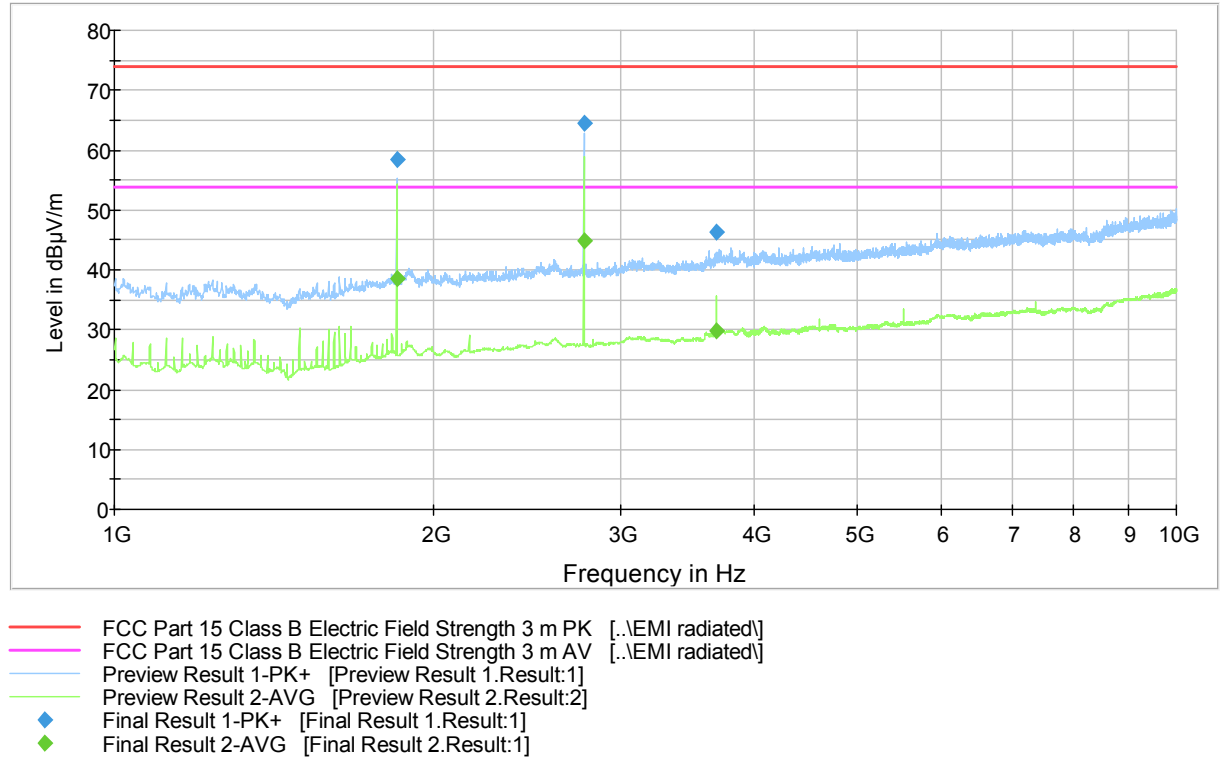


Figure 8. Measured curve with peak- and average detector. Channel HIGH.

Table 7. Final results.

Frequency (MHz)	MaxPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
1845.025000	58.4	1000.0	1000.000	199.0	V	189.0	3.4	15.5	73.9	-
2767.525000	64.6	1000.0	1000.000	146.0	V	333.0	4.9	9.3	73.9	-
3690.075000	46.3	1000.0	1000.000	146.0	H	14.0	6.2	27.6	73.9	-

Table 8. Final results.

Frequency (MHz)	Average (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
1844.975000	38.5	1000.0	1000.000	198.0	V	198.0	3.4	15.4	53.9	-
2767.525000	44.9	1000.0	1000.000	150.0	V	328.0	4.9	9.0	53.9	-
3690.025000	29.7	1000.0	1000.000	234.0	V	319.0	6.2	24.2	53.9	-

Conducted Spurious Emission 30 MHz to 10 GHz and Band Edge

Conducted Spurious Emissions 30 MHz to 10 GHz

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 28.12.2016
Temperature: 23 °C
Humidity: 18 % RH

FCC Rule: 15.247 (d)
RSS-247 5.5

EUT2, (EUT was equipped with temporary antenna connector)

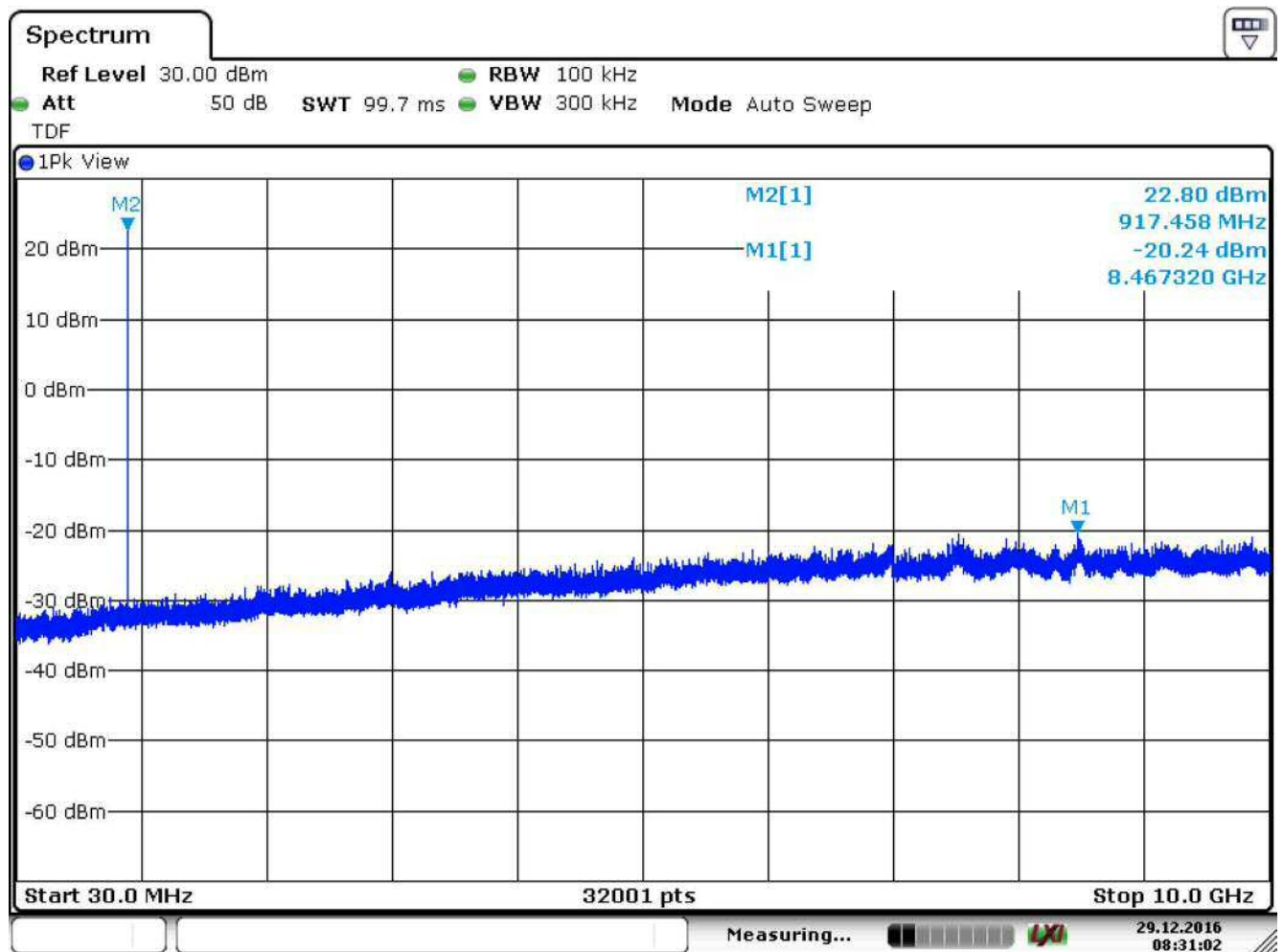


Figure 9. Low channel conducted emission 30 MHz to 10000 MHz.

Conducted Spurious Emission 30 MHz to 10 GHz and Band Edge

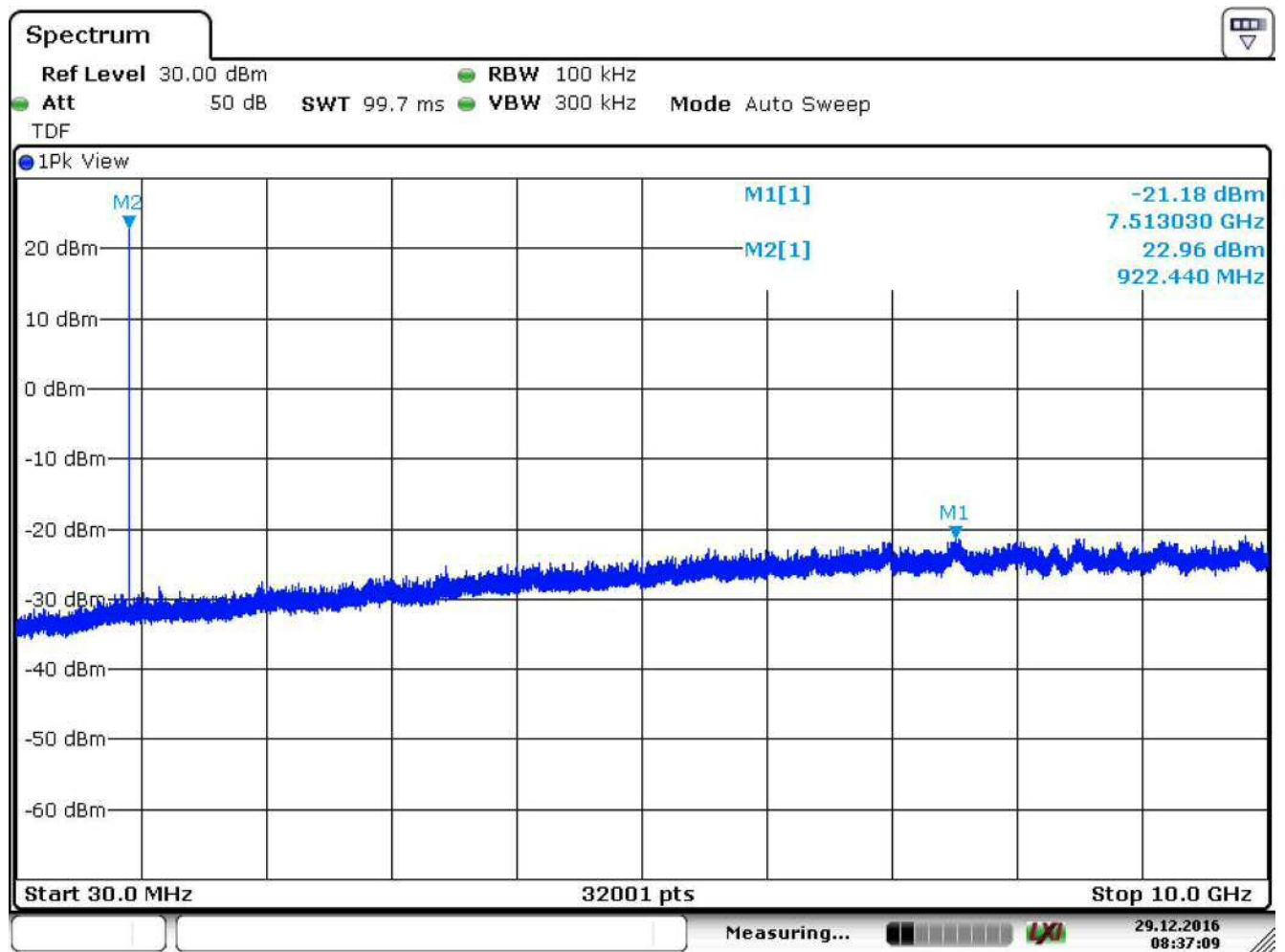


Figure 10. High channel conducted emission 30 MHz to 10000 MHz.

20 dB Bandwidth of the Hopping Channel

20 dB Bandwidth of the Hopping Channel

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 28.12.2016
Temperature: 23 °C
Humidity: 18 % RH

FCC Rule: §15.247(a)(1)(i)
RSS-247 5.1

EUT2, (EUT was equipped with temporary antenna connector)

Results:

Table 9. 20 dB bandwidth test results

Channel	20 dB BW [kHz]
Low	60.060
High	60.060

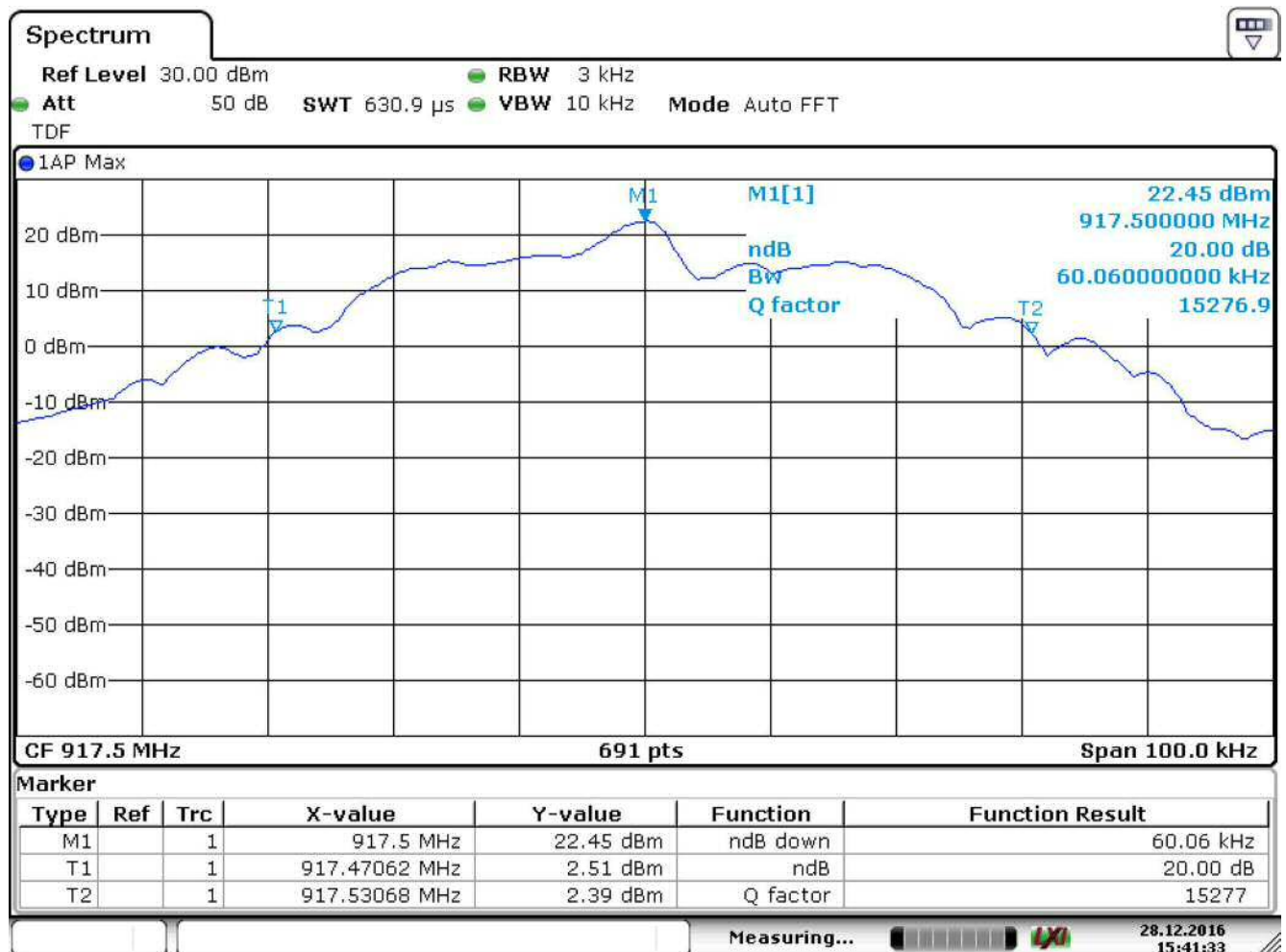


Figure 11. 20 dB channel BW. Channel LOW.

20 dB Bandwidth of the Hopping Channel

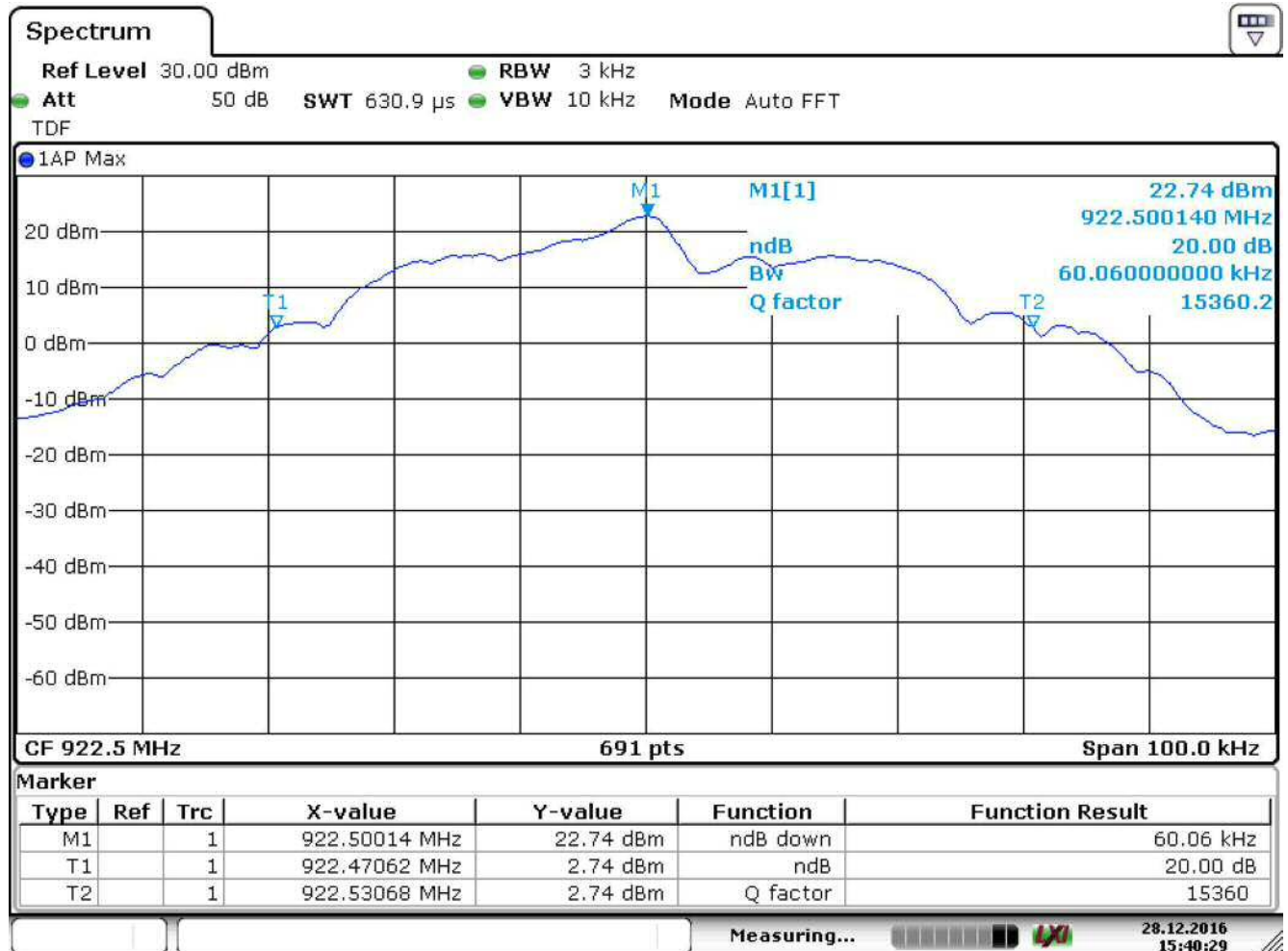


Figure 12. 20 dB channel BW. Channel HIGH.

Hopping Channel Carrier Frequencies Separation

Hopping Channel Carrier Frequencies Separation

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 28.12.2016
Temperature: 23 °C
Humidity: 18 % RH

FCC Rule: 15.247(a)(1)(i)
RSS-247 5.1

EUT2, (EUT was equipped with temporary antenna connector)

Test result

Table 10. Hopping channel carrier frequencies separation test result.

Measured separation
100.290 kHz

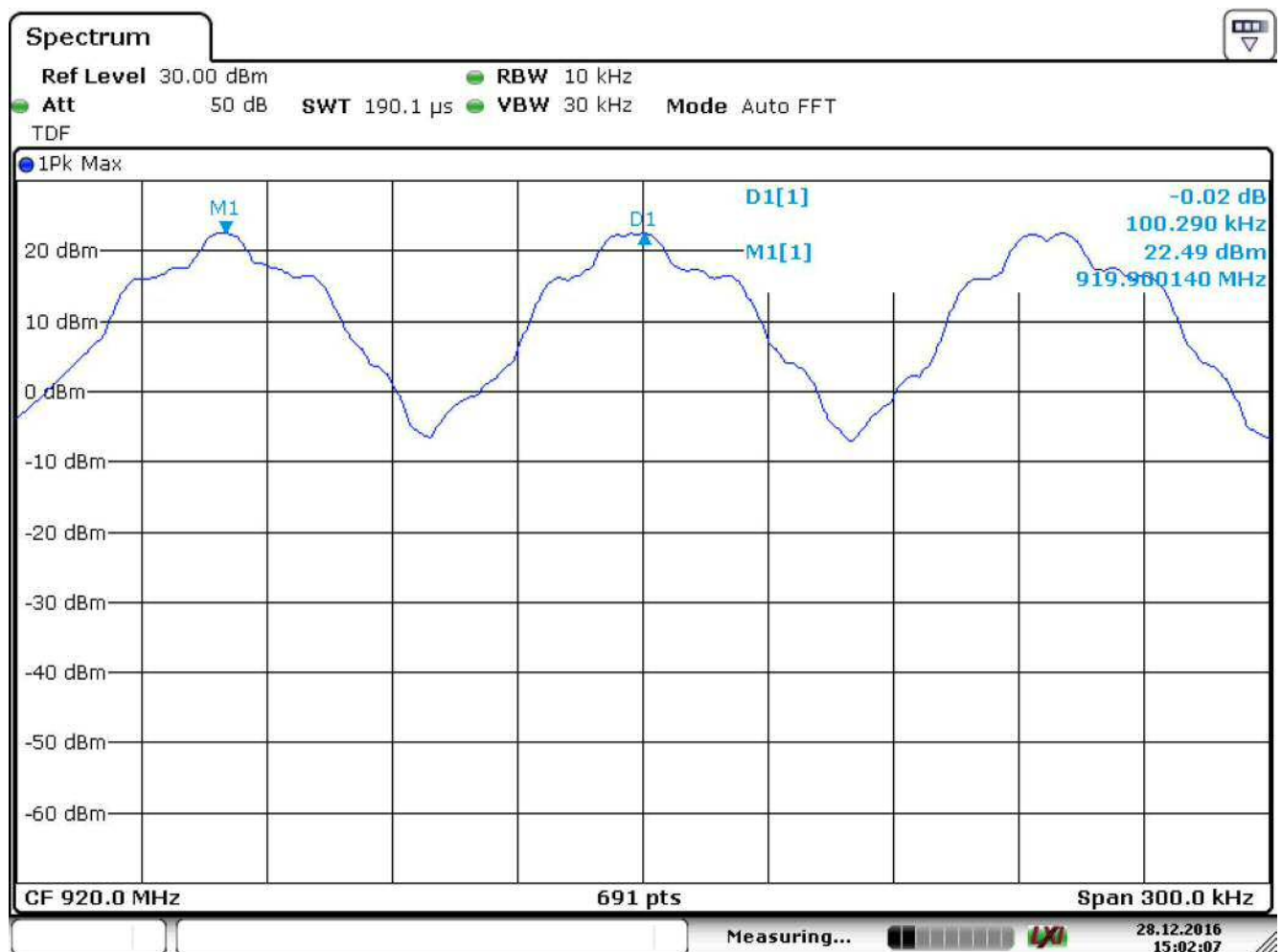


Figure 13. Measured hopping channels carrier frequency separation.

Number of Hopping Channels

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 28.12.2016
Temperature: 23 °C
Humidity: 18 % RH

FCC Rule: 15.247(a)(1)(i)
RSS-247 5.1

EUT2, (EUT was equipped with temporary antenna connector)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping

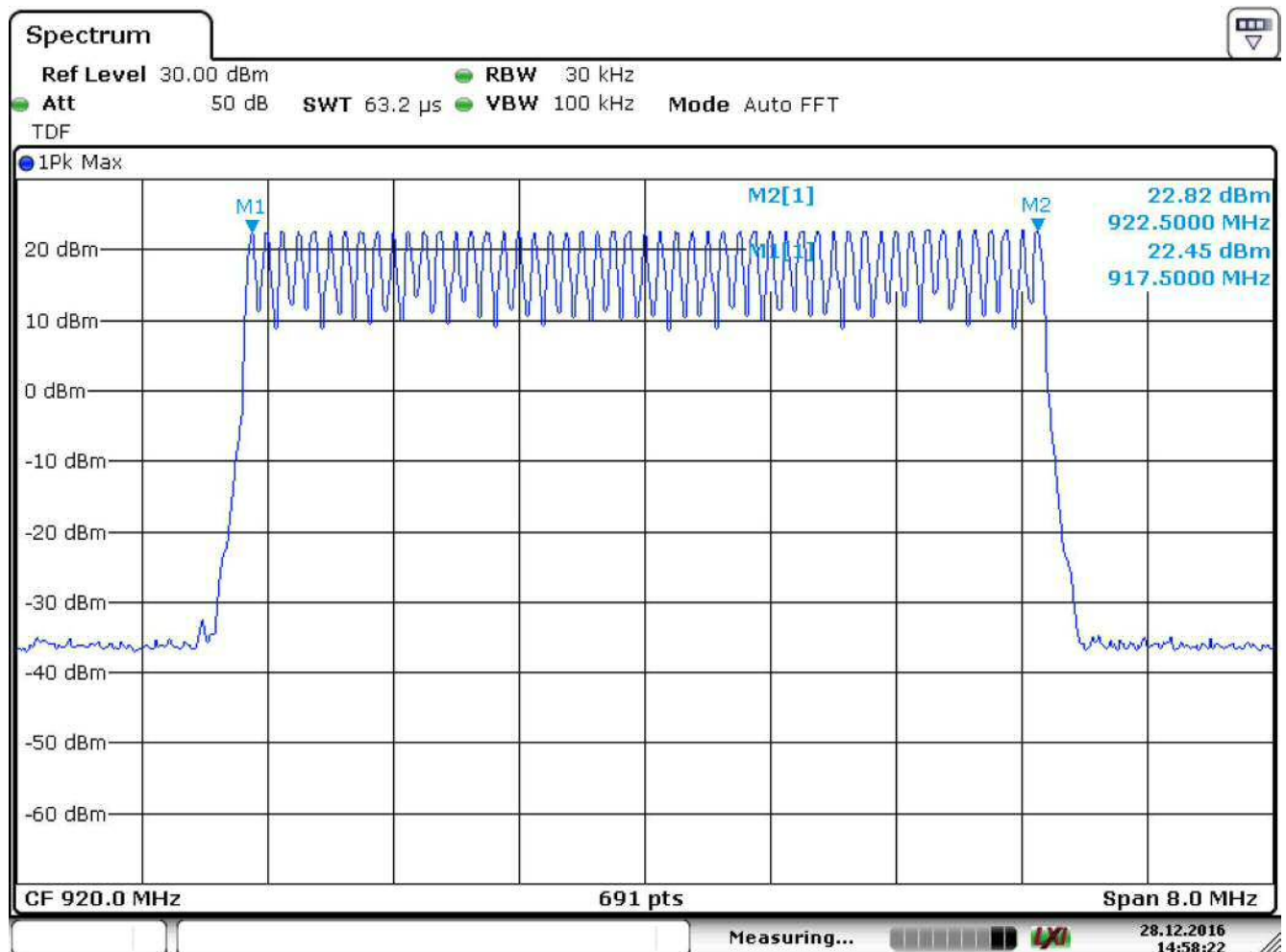


Figure 14. 51 channels.

Average Time of Occupancy of Hopping Frequency

Average Time of Occupancy of Hopping Frequency

Standard: ANSI C63.10 (2013)
Tested by: PKA
Date: 28.12.2016
Temperature: 23 °C
Humidity: 18 % RH

FCC Rule: 15.247(a)(1)(i)
RSS-247 5.1

EUT2, (EUT was equipped with temporary antenna connector)

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20.4 second period

Time of occupancy calculation:

Number of channels = 51

Measurement period = $51 \times 0.4\text{s} = 20.4\text{ s}$

One channel occupancy time = 27.2239 ms

Number of transmission cycles in measurement period = 2

Time of occupancy = (single duration) x (repetition) = $27.2239\text{ ms} \times 2 = 54.4478\text{ ms}$

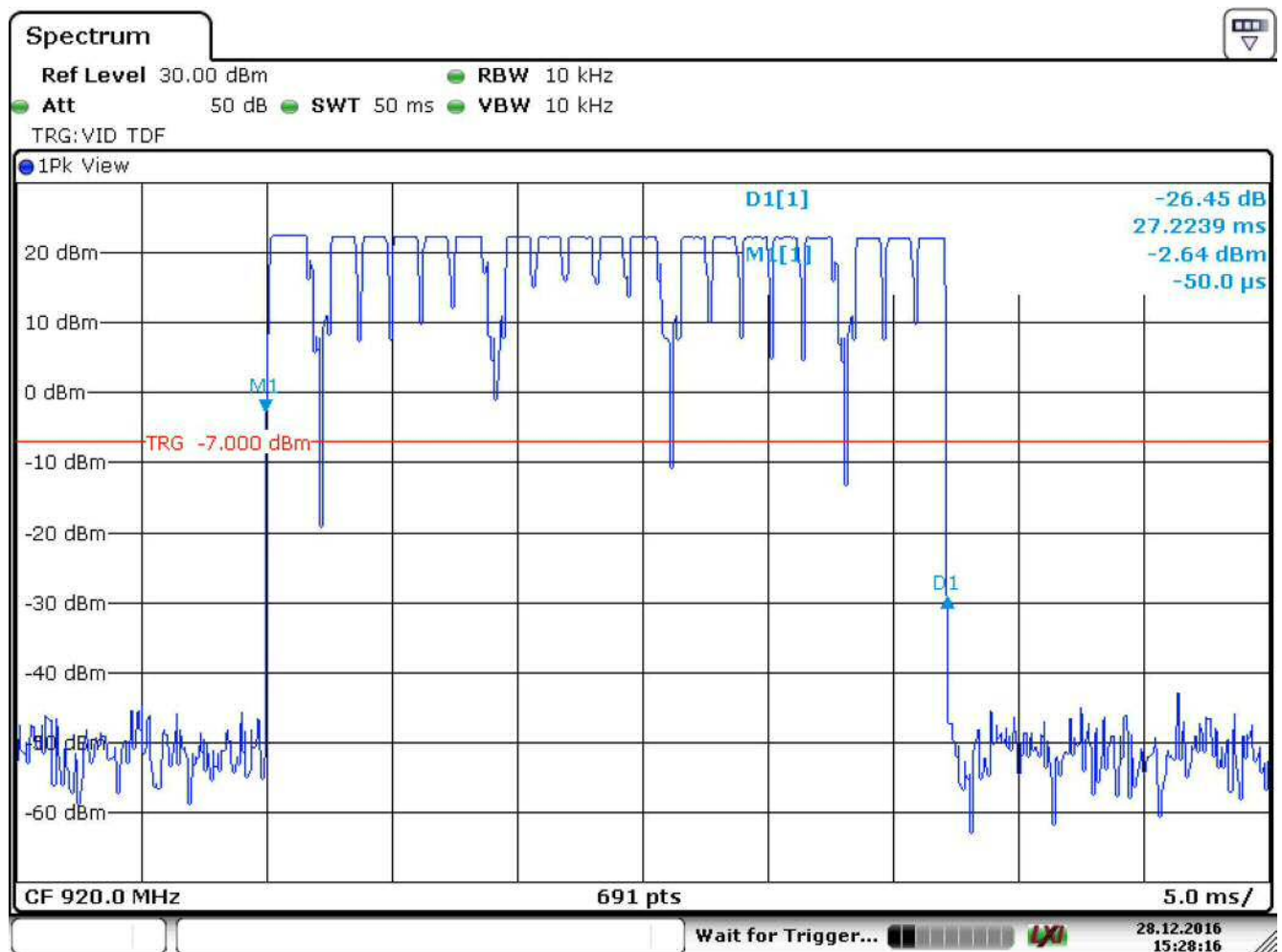


Figure 15. One channel dwell time.

Average Time of Occupancy of Hopping Frequency

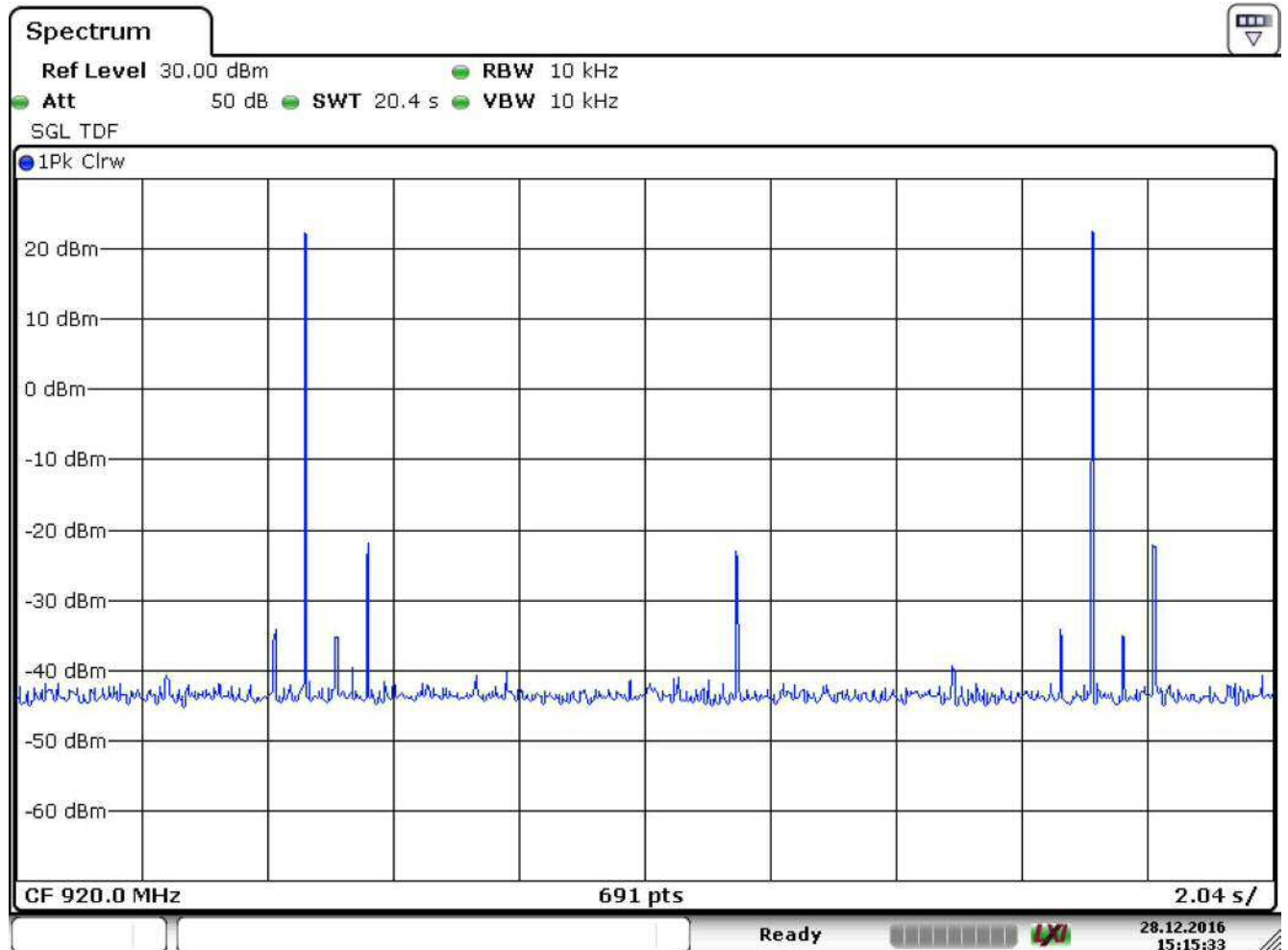


Figure 16. Measured repetition of the channel occupancy

99% Occupied Power Bandwidth

Standard: RSS-GEN (2013)
Tested by: PKA
Date: 28.12.2016
Temperature: 23 °C
Humidity: 18 % RH

RSS-GEN 6.6

EUT2, (EUT was equipped with temporary antenna connector)

Table 11.

Channel	99% BW [kHz]	Limit	Result
Low	58.611	-	PASS
High	58.900	-	PASS

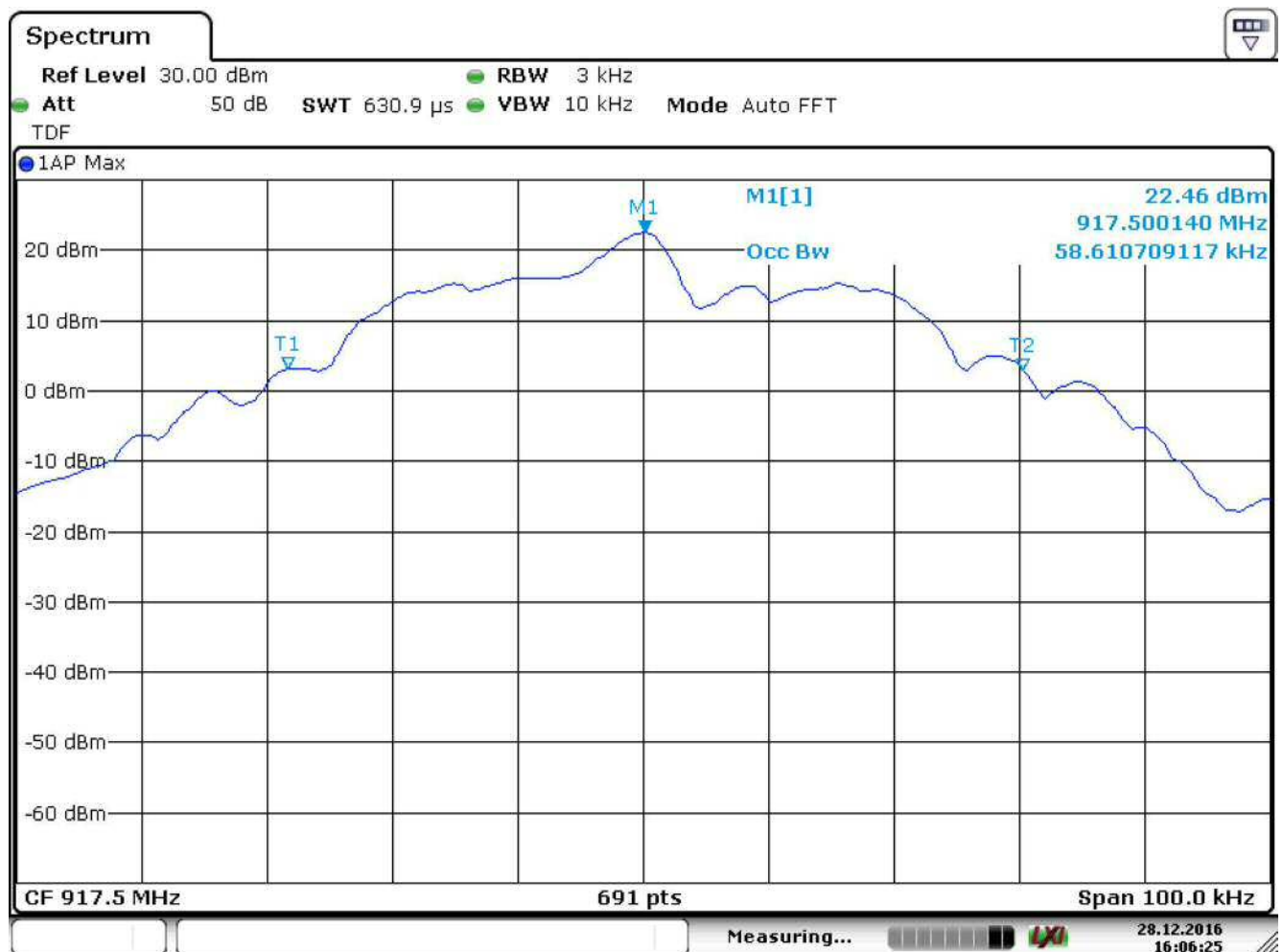


Figure 17. Low channel 99% Occupied Power Bandwidth.

99% Occupied Bandwidth

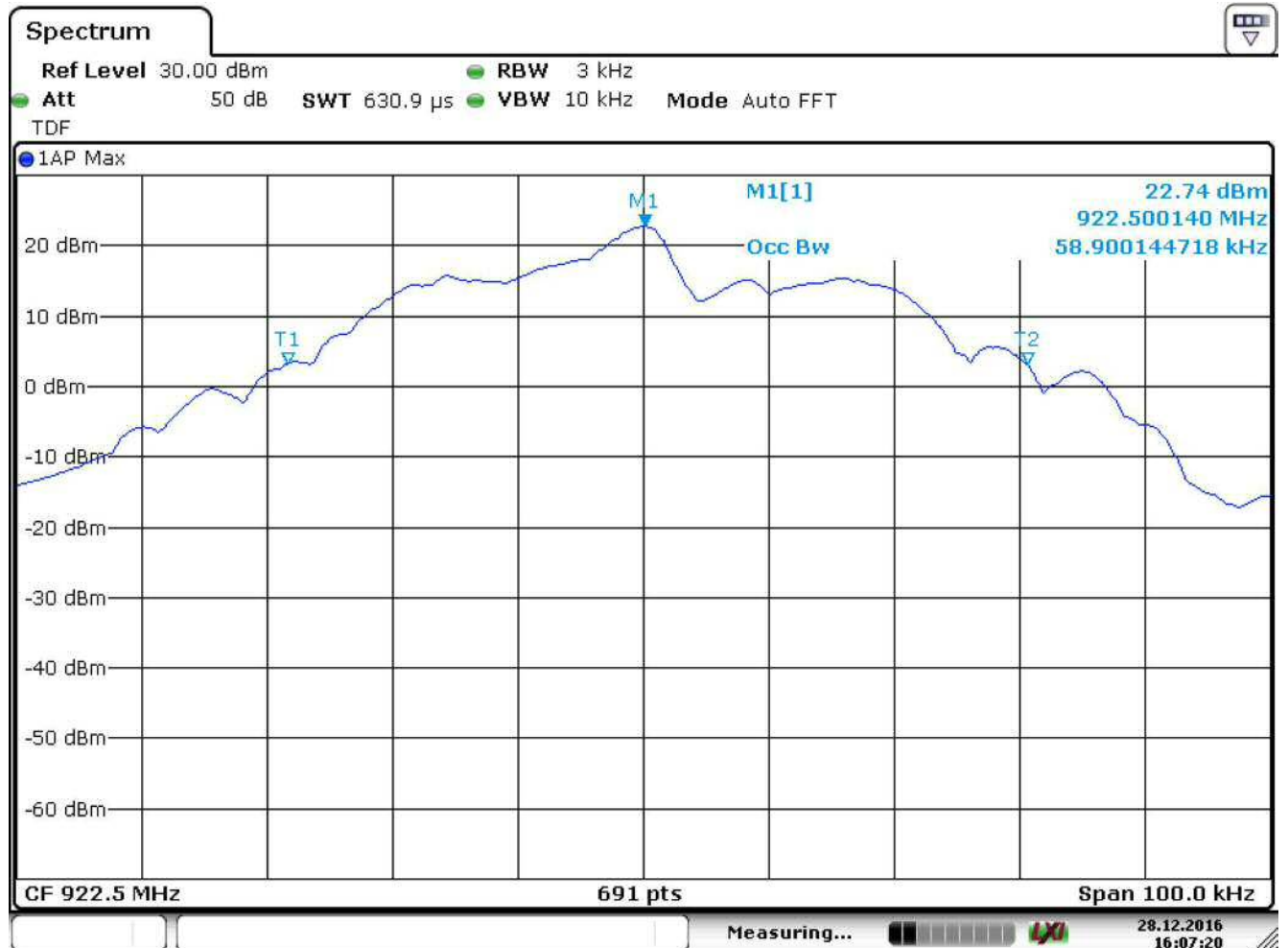


Figure 18. High channel 99% Occupied Power Bandwidth.

TEST EQUIPMENT

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
POWER SUPPLY	CALIFORNIA INSTR.	5001 iX Series II	inv:7826	-	-
PREAMPLIFIER	CIAO	CA118-3123	inv:10278	2016-11-28	2017-11-28
DC-POWER SUPPLY	DELTA ELEKTRONIKA	SM 130-25D	sn:03494	-	-
ANTENNA	EMCO	3117	inv:7293	2016-03-16	2018-03-06
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2016-10-25	2018-10-25
PREAMPLIFIER	HEWLETT PACKARD	83017A (25 dB)	inv:5226	2016-02-03	2017-02-03
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	-	-
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	-	-
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	-	-
ATTENUATOR	PASTERNAK	PE 7004-4	inv:10126	-	-
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	-	-
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU 26	inv:8453	2016-06-10	2017-06-10
LISN	ROHDE & SCHWARZ	ENV216	inv:9611	2016-02-24	2017-02-24
SIGNAL ANALYZER	ROHDE & SCHWARZ	FSV40	inv:9093	2016-06-10	2017-06-10
HIGH PASS FILTER	WAINWRIGHT	WHKX1.0/15G-10SS	inv:8267	2016-01-22	2017-01-22