

Test Report



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

Equipment Under Test: RFID Module

Type/ Model: NUR-05WL2

Manufacturer: Nordic ID Oy
Myllyojankatu 2 A
24100 Salo
FINLAND

Customer: Nordic ID Oy
Myllyojankatu 2 A
24100 Salo
FINLAND

FCC Rule Part: 15.247: 2012
IC Rule Part: RSS-210, Issue 8, 2010
RSS-GEN Issue 3, 2010

KDB: Filing and Measurement Guidelines for
Frequency Hopping Spread Spectrum Systems
DA 00-705 (March 30, 2000)

Date: June 17, 2013

Issued by:


Niklas Karpatskij
Testing Engineer

Date: June 17, 2013

Checked by:


Jari Merikari
Technical Manager

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Equipment Under Test (EUT)

RFID module
Type/ Model: NUR-05WL2
Serial Number: -

NUR-05WL2 is a frequency hopping spread spectrum RFID module operating in the frequency range of 902 – 928 MHz.

One sample was used in the tests. Conducted measurements were made from the antenna connector (SMA).

Classification of the device

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

RFID:
Operating Frequency Range (OFR): 902 – 928 MHz
Channels: 52
Channel separation: 500 kHz
Conducted power: +25.89 dBm
Transmission technique: FHSS
Modulation: ASK, PR-ASK
Maximum antenna gain: 8 dBi

Power Supply

The module was powered by a laboratory power supply with 3.6 Vdc.

Disclaimer

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Summary of Testing

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.207(a) / RSS-GEN 7.2.2	Conducted Emissions on Power Supply Lines	PASS
§15.247(b)(1) / RSS-210 8.4	Maximum Peak Conducted Output Power	PASS
15.247(a)(1) / RSS-210 A8.1	Hopping Channel Carrier Frequency Separation	PASS
§15.247(a)(1)(iii) / RSS-210 A8.1	Number of Hopping Frequencies	PASS
§15.247(a)(1)(iii) / RSS-210 A8.1	Average Time of Occupancy of Hopping Frequency	PASS
§15.247(a)(1) / RSS-210 A8.1	20 dB Bandwidth	PASS
RSS-GEN 4.6.1	99 % Occupied Bandwidth	PASS
§15.247(d) / RSS-210 A8.5	100 kHz Bandwidth of Frequency Band Edges and Conducted Spurious Emissions	PASS
§15.209(a), §15.247(d) / RSS-210 A8.5	Radiated Emissions Within The Restricted Bands	PASS
§15.209 / RSS-GEN 7.2.3.2	Unintentional Radiated Emissions	PASS

EUT Test Conditions during Testing

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

All of the tests were performed in the PR-ASK modulation, 20 dB bandwidth and 99 % occupied bandwidth measurements were also done in the ASK modulation. The decision was based on the test results of the previous evolution of the NUR05 module, there were no major differences in the results of the other tests than the ones that were made with both modulations.

Following channels were used during the tests:

Channel	Frequency/ MHz
LOW (CH 1)	902.250
MID (CH 40)	914.750
HIGH (CH 79)	927.750

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.

Standard: ANSI C63.10 (2009)
Tested by: NKA
Date: 12.6.2013
Temperature: 23.5 °C
Humidity: 43 % RH
Barometric pressure: 1013.3 hPa
Measurement uncertainty: ± 2.9 dB

Level of confidence 95 % (k = 2)

FCC Rule: 15.207 (a)

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 (115VAC / 60 Hz) through the LISN.

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 Emissions

Conducted Emission Mains FCC Part 15 Class B with ESH3-Z5 8019

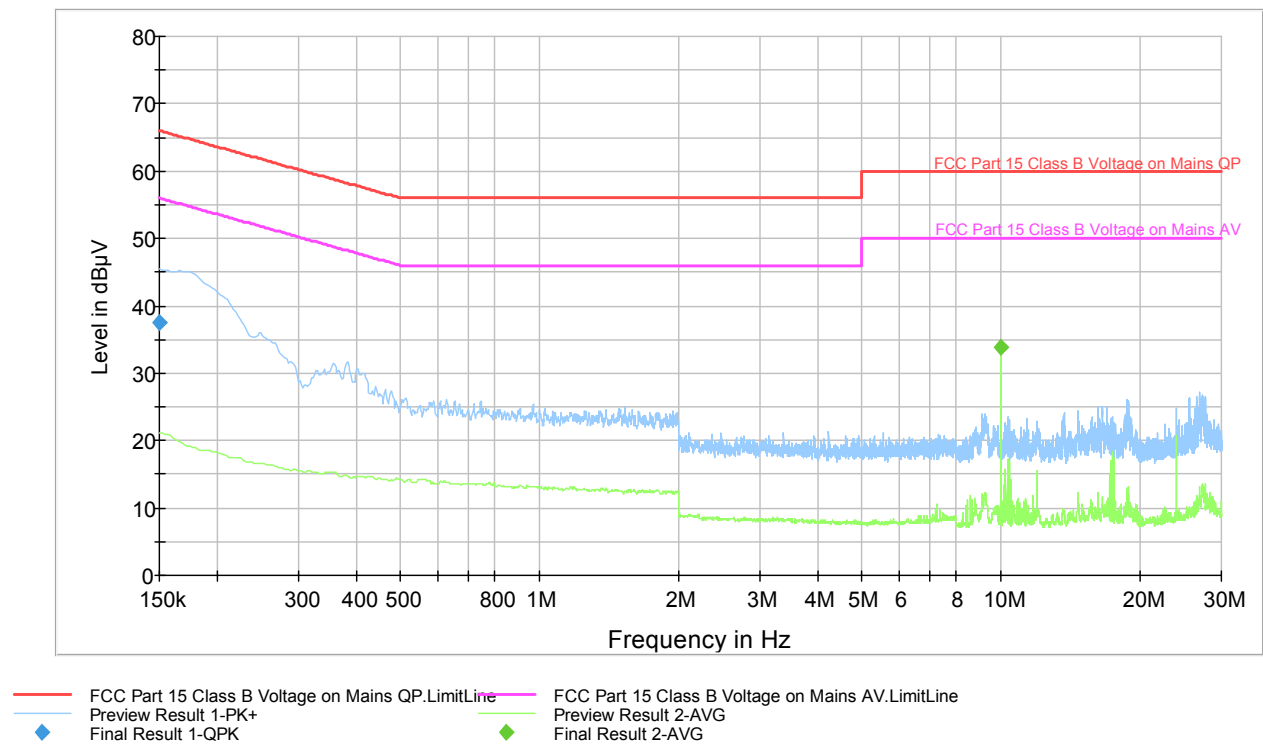


Figure 1. The measured curves with peak- and average detector.

Table 1. Final measurement results with Quasi-peak detector.

Frequency (MHz)	QuasiPeak (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.150000	37.6	1000.0	9.000	GN	N	10.7	28.4	66.0	

Table 2. Final measurement results with Average detector.

Frequency (MHz)	Average (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
10.000000	33.8	1000.0	9.000	GN	N	10.9	16.2	50.0	

Maximum Peak Conducted Output Power

Maximum Peak Conducted Output Power

Standard: ANSI C63.10 (2009)
Tested by: NKA
Date: 13.6.2013
Humidity: 44 % RH
Temperature: 23.3 °C
Measurement uncertainty $\pm 2.87\text{dB}$ Level of confidence 95 % ($k = 2$)

FCC Rule: 15.247(b) (2)

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

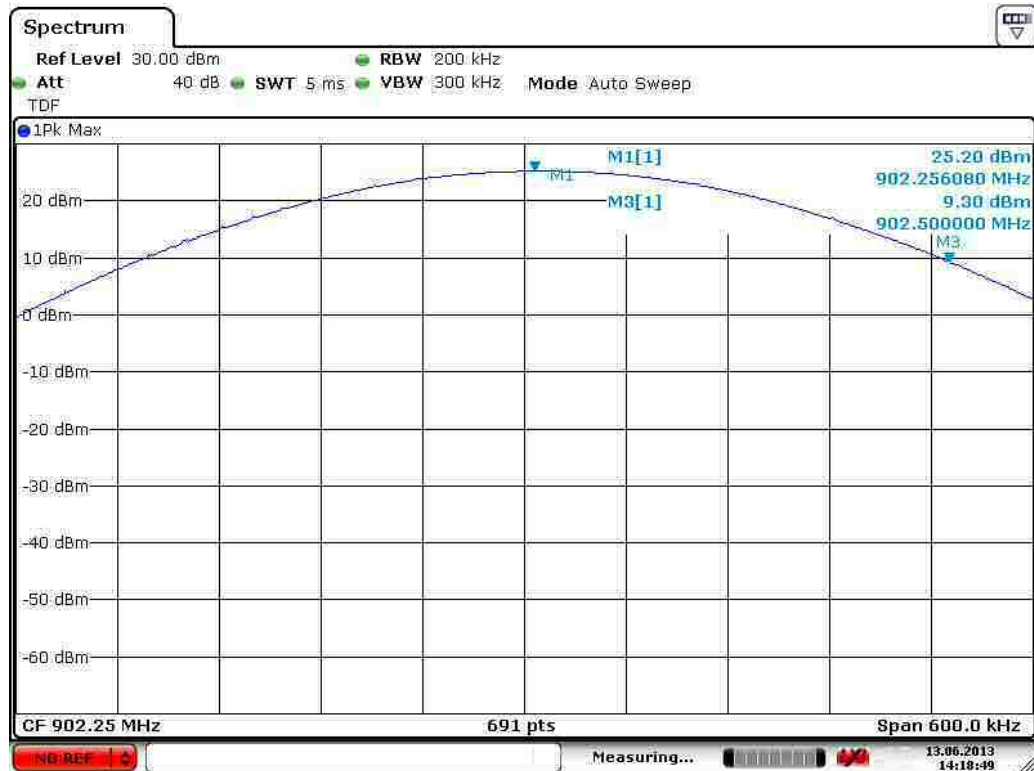
Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements.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

Results:

Channel	Conducted Power [dBm]	Limit [dBm]	Margin [dBm]	Result
Low	25.20	28	2.80	PASS
Mid	25.55	28	2.45	PASS
High	25.89	28	2.11	PASS

Note 1: As required by FCC rule part 15.247(b)(4), the maximum conducted power limit has been reduced from 30 dBm to 28 dBm due to the use of an antenna with the maximum antenna gain of 8 dBi.

Maximum Peak Conducted Output Power



Date: 13.JUN.2013 14:18:49

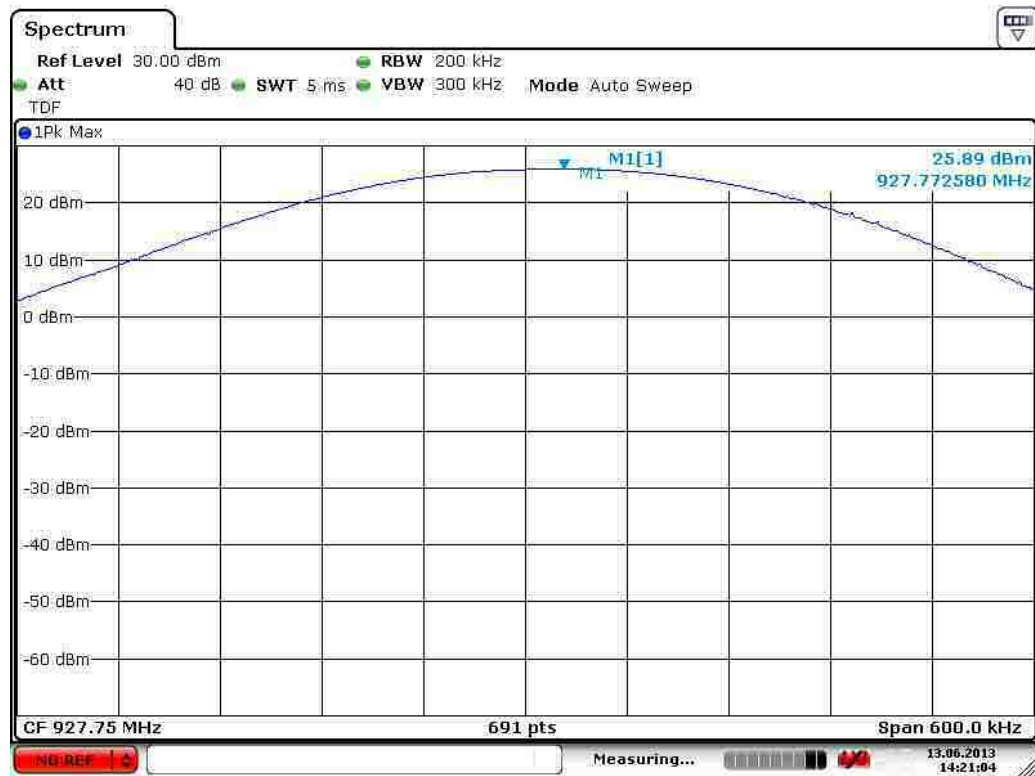
Figure 2. Channel LOW.



Date: 13.JUN.2013 14:20:07

Figure 3. Channel MID.

Maximum Peak Conducted Output Power



Date: 13.JUN.2013 14:21:04

Figure 4. Channel HIGH.

Transmitter Radiated Emissions 30 MHz to 26.5 GHz

Standard:	ANSI C63.10	(2009)
Tested by:	NKA	
Date:	11.6.- 12.6.2013	
Temperature:	23.5 - 24 °C	
Humidity:	33 - 43 % RH	
Measurement uncertainty	± 4.51 dB	Level of confidence 95 % (k = 2)

FCC Rule: 15.247(d), 15.209(a)

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.

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m (optimized 900 MHz TX)

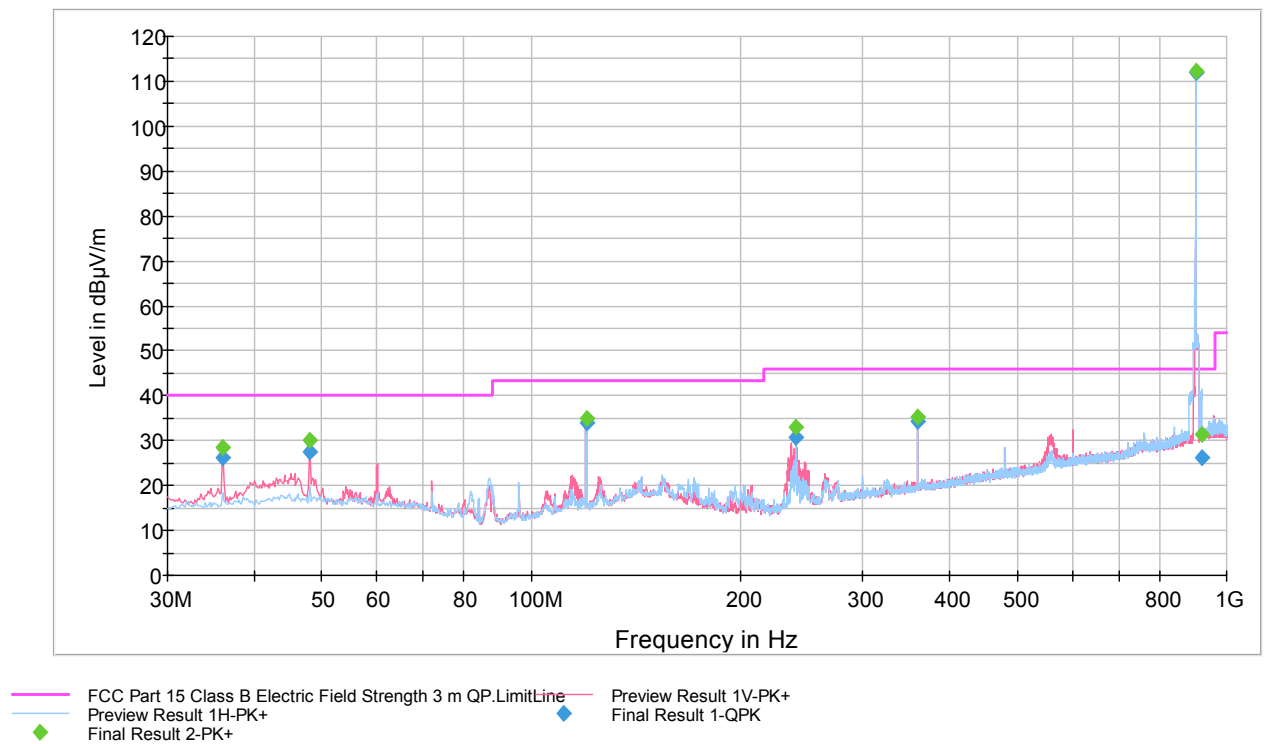


Figure 5. Measured curve with peak-detector Channel LOW.

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m (optimized 900 MHz TX)

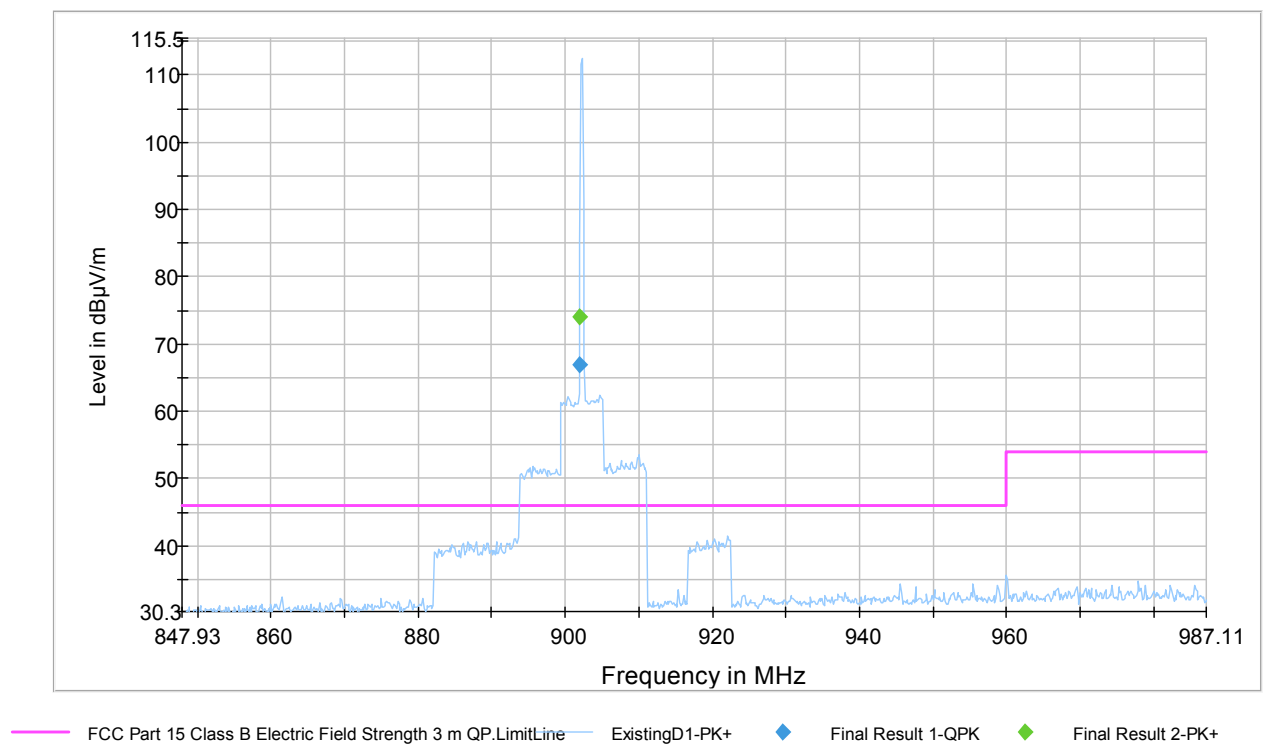


Figure 6. Low channel band edge.

Final measurements from the worst frequencies

Table 3. Final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
35.995000	26.3	1000.0	120.000	150.0	V	-4.0	14.7	13.7	40.0	
47.995000	27.5	1000.0	120.000	100.0	V	2.0	15.4	12.5	40.0	
119.995000	34.0	1000.0	120.000	100.0	V	50.0	13.1	9.5	43.5	
240.015000	30.9	1000.0	120.000	100.0	V	350.0	13.3	15.1	46.0	
359.995000	34.2	1000.0	120.000	100.0	H	300.0	16.6	11.8	46.0	
902.000000	66.9	1000.0	120.000	252.0	V	127.0	26.4	-20.9	46.0	See Note 2
902.245000	112.0	1000.0	120.000	227.0	H	243.0	26.4	---	---	RF signal
922.585000	26.1	1000.0	120.000	150.0	H	237.0	26.9	19.9	46.0	

Note 2: The measurement result at band edge is not on a restricted frequency and it complies with the 20 dB limit described in FCC Rule 15.247(d).

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m (optimized 900 MHz TX)

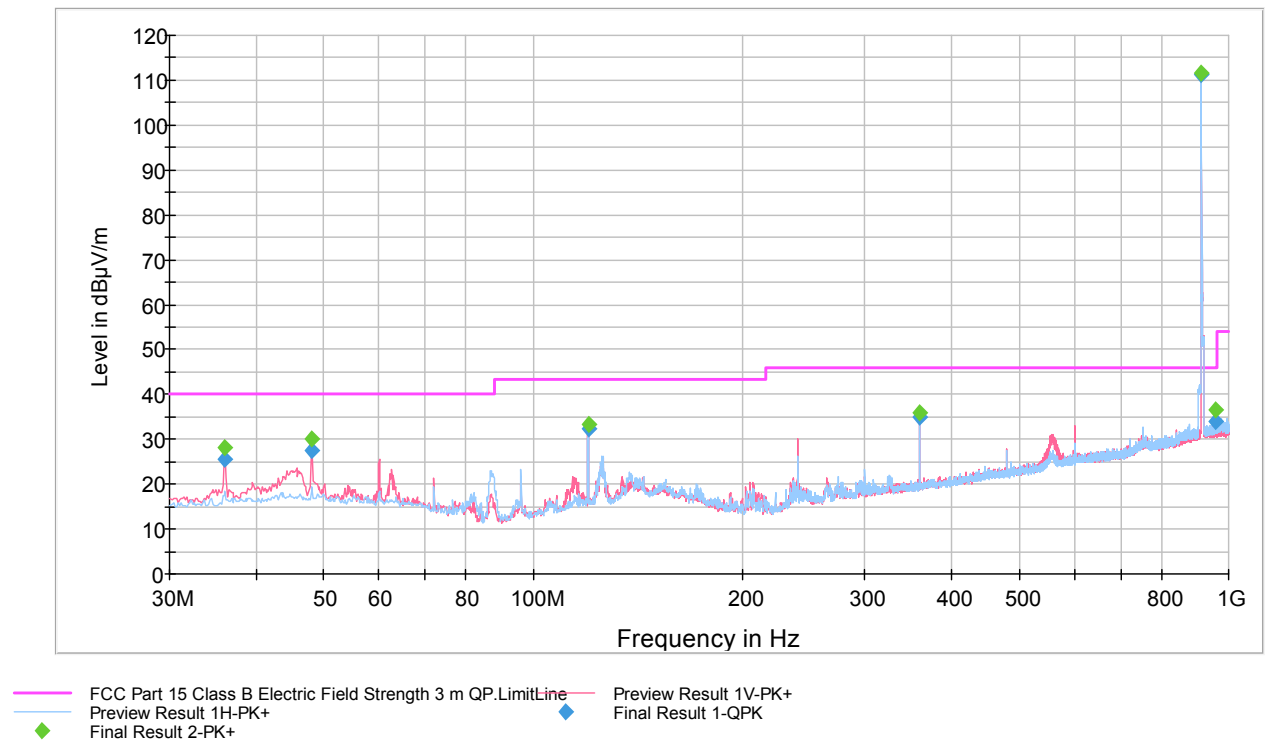


Figure 7. Measured curve with peak-detector Channel MID.

Final measurements from the worst frequencies

Table 4. Final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
35.995000	25.5	1000.0	120.000	150.0	V	1.0	14.7	14.5	40.0	
47.995000	27.4	1000.0	120.000	110.0	V	163.0	15.4	12.6	40.0	
119.995000	32.2	1000.0	120.000	109.0	V	105.0	13.1	11.3	43.5	
359.995000	34.8	1000.0	120.000	100.0	H	289.0	16.6	11.2	46.0	
914.755000	111.2	1000.0	120.000	230.0	H	240.0	26.7	-65.2	46.0	
959.965000	33.9	1000.0	120.000	100.0	H	73.0	27.1	12.1	46.0	

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m (optimized 900 MHz TX)

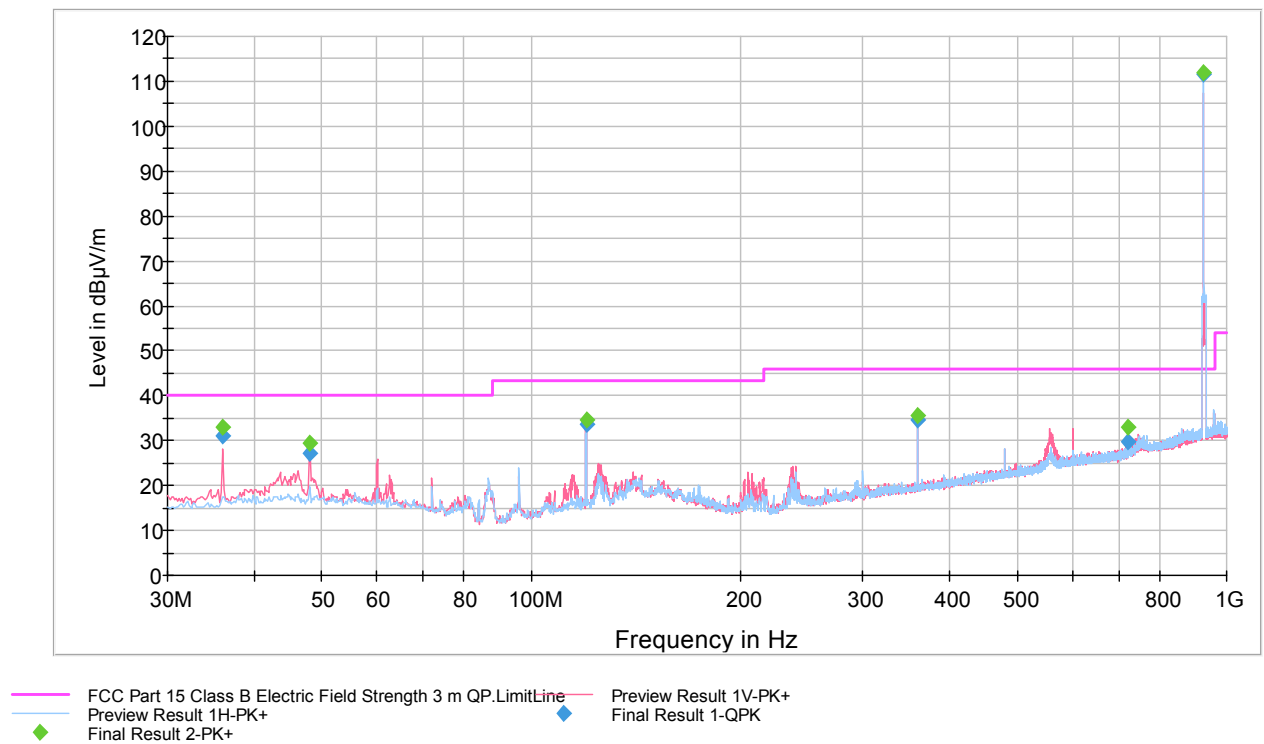


Figure 8. Measured curve with peak-detector Channel HIGH.

FCC Part 15 Class B Spurious Emission 30-1000MHz 3m (optimized 900 MHz TX)

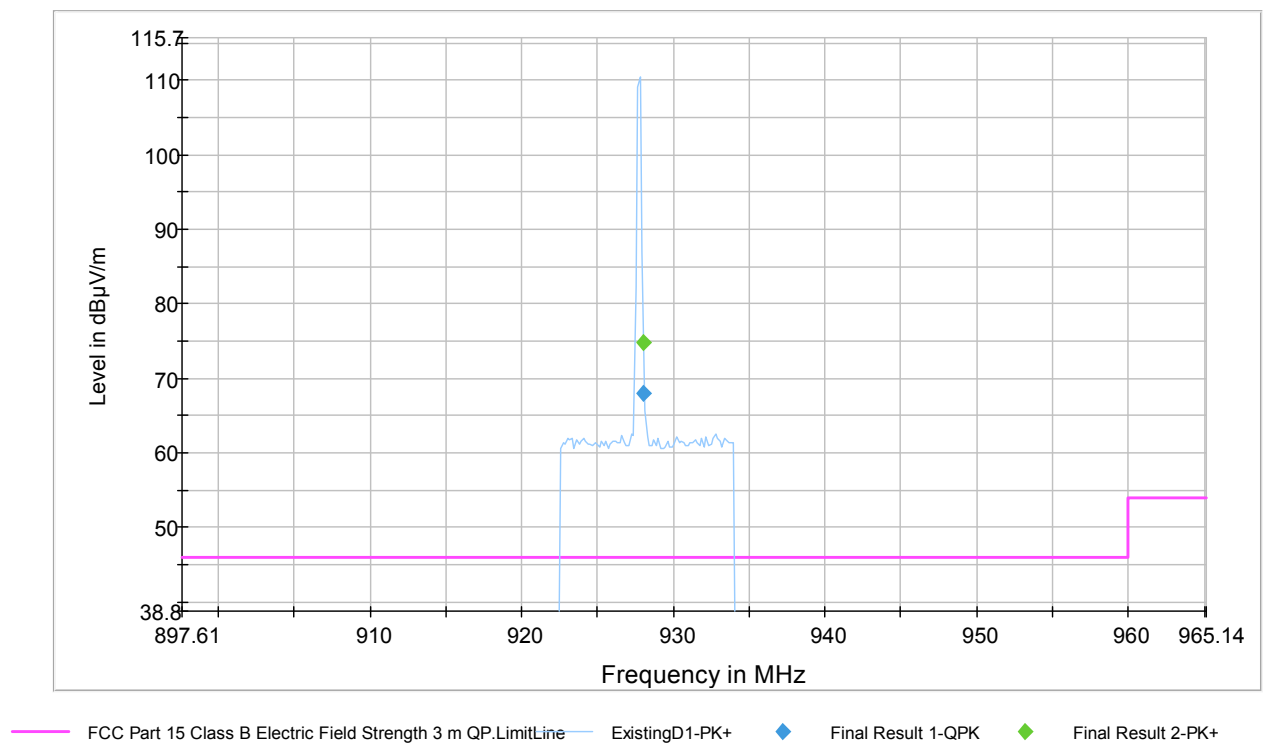


Figure 9. High channel band edge.

Final measurements from the worst frequencies

Table 5. Final results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
35.995000	31.2	1000.0	120.000	100.0	V	20.0	14.7	8.8	40.0	
47.995000	27.1	1000.0	120.000	100.0	V	37.0	15.4	12.9	40.0	
119.995000	33.6	1000.0	120.000	100.0	V	56.0	13.1	9.9	43.5	
359.995000	34.5	1000.0	120.000	100.0	H	293.0	16.6	11.5	46.0	
719.965000	29.9	1000.0	120.000	100.0	V	131.0	23.5	16.1	46.0	
927.745000	111.4	1000.0	120.000	313.0	H	330.0	26.9	---	---	RF Signal
928.000000	68.0	1000.0	120.000	262.0	H	119.0	26.9	-22.0	46.0	See note 3

Note 3: The measurement result at band edge is not on a restricted frequency and it complies with the 20 dB limit described in FCC Rule 15.247(d).

Radiated Emission Test

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

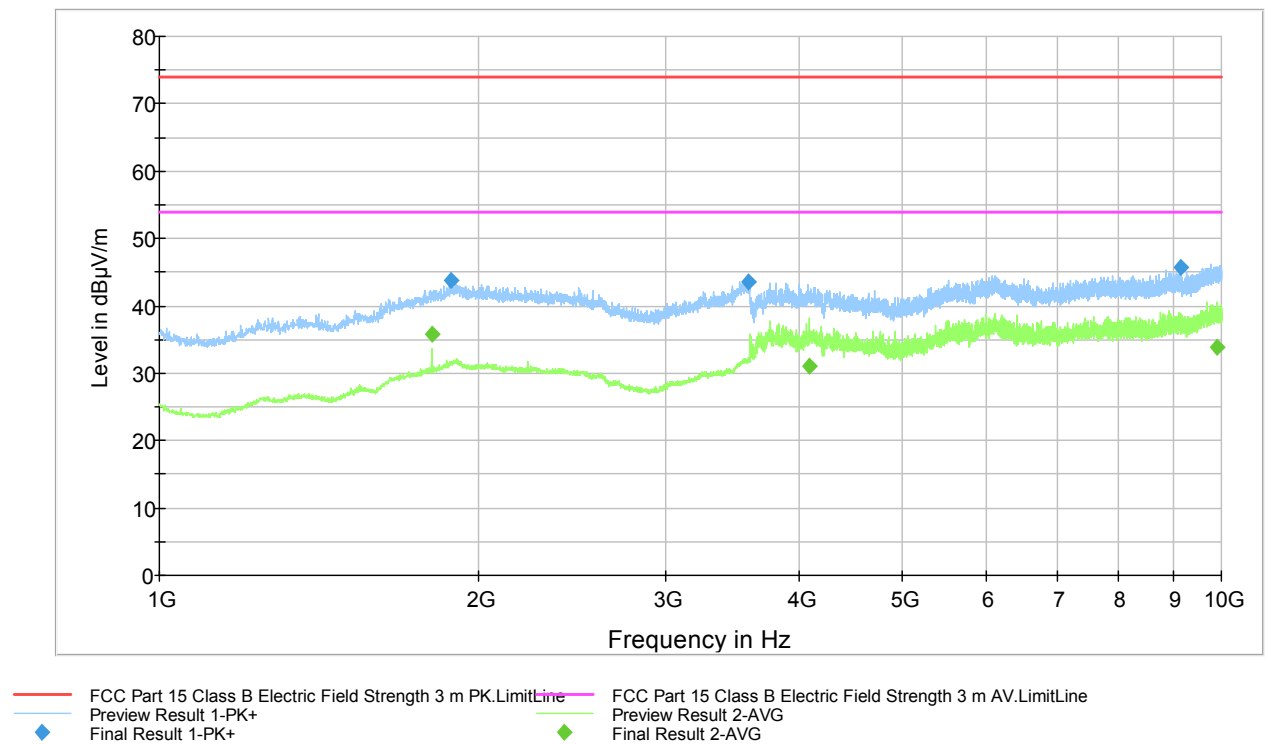


Figure 10. Measured curve with peak- and average detector channel LOW.

Final measurements from the worst frequencies

Table 6. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
1882.100000	43.7	1000.0	1000.000	400.0	H	139.0	2.9	30.2	73.9	
3587.600000	43.5	1000.0	1000.000	159.0	H	96.0	7.1	30.4	73.9	
9146.900000	45.7	1000.0	1000.000	160.0	V	353.0	14.4	28.2	73.9	

Table 7. Final Average results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
1804.400000	35.7	1000.0	1000.000	236.0	H	304.0	1.8	18.2	53.9	
4094.700000	31.0	1000.0	1000.000	130.0	H	286.0	8.5	22.9	53.9	
9917.600000	33.8	1000.0	1000.000	100.0	V	9.0	16.0	20.1	53.9	

Radiated Emission Test

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

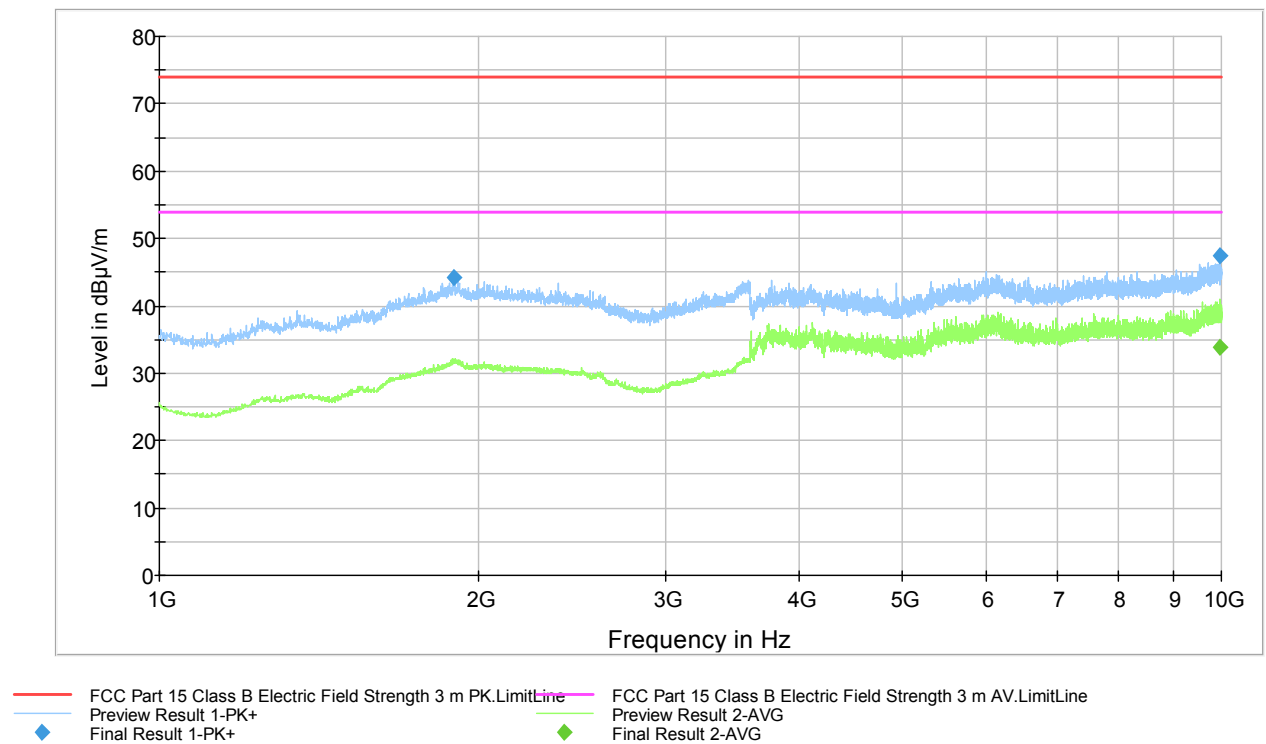


Figure 11. Measured curve with peak- and average detector channel MID.

Final measurements from the worst frequencies

Table 8. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1896.100000	44.1	1000.0	1000.000	311.0	H	10.0	3.2	29.8	73.9	
9957.000000	47.5	1000.0	1000.000	283.0	H	110.0	16.0	26.4	73.9	

Table 9. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
9965.700000	33.8	1000.0	1000.000	100.0	V	175.0	16.0	20.1	53.9	

Radiated Emission Test

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

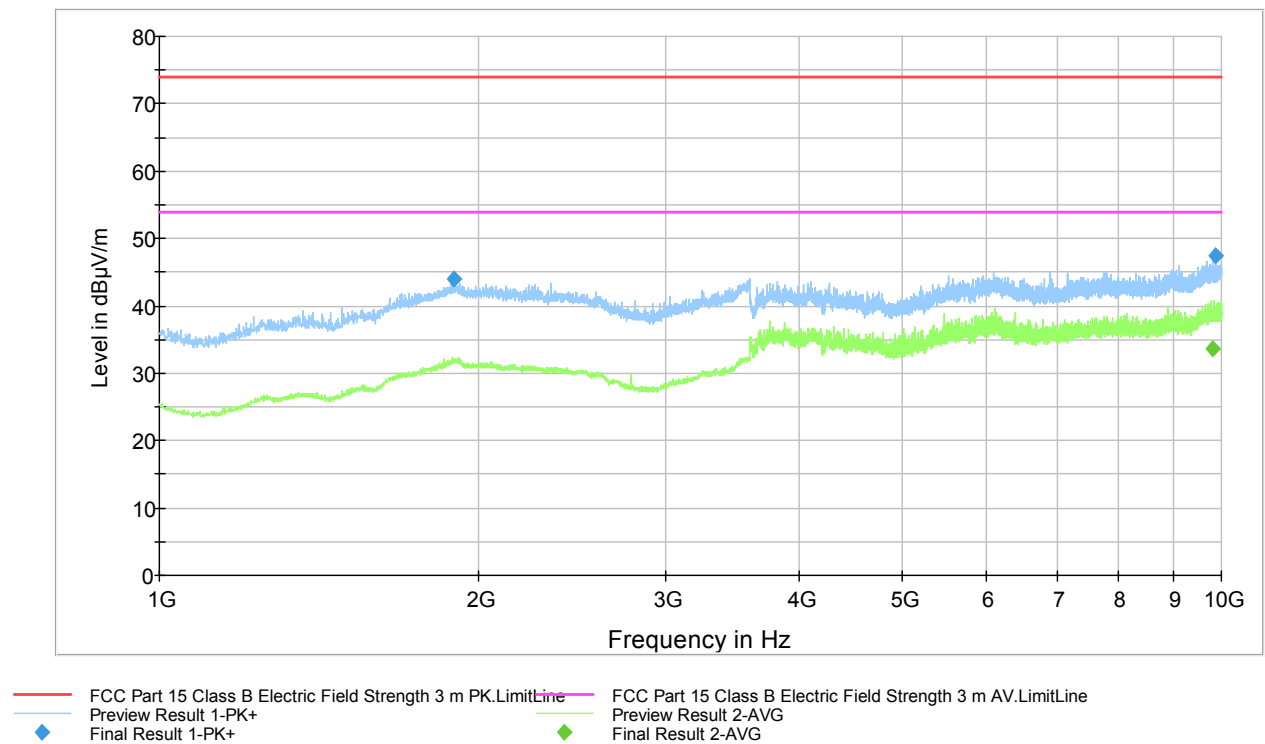


Figure 12. Measured curve with peak- and average detector channel HIGH.

Final measurements from the worst frequencies

Table 10. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1893.200000	44.0	1000.0	1000.000	327.0	H	352.0	3.1	29.9	73.9	
9890.100000	47.5	1000.0	1000.000	345.0	H	41.0	15.9	26.4	73.9	

Table 11. Final Average results.

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
9827.200000	33.7	1000.0	1000.000	224.0	H	315.0	15.7	20.2	53.9	

Receiver Radiated Emissions 30 MHz to 26.5 GHz

Standard: ANSI C63.10 (2009)
Tested by: NKA
Date: 12.6.2013
Temperature: 23.5 °C
Humidity: 43 % RH
Measurement uncertainty ± 4.51 dB Level of confidence 95 % (k = 2)

FCC Rule: 15.109

The EUT was in a receiving mode and measurement was performed on middle channel only.
 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.

Test Results:

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

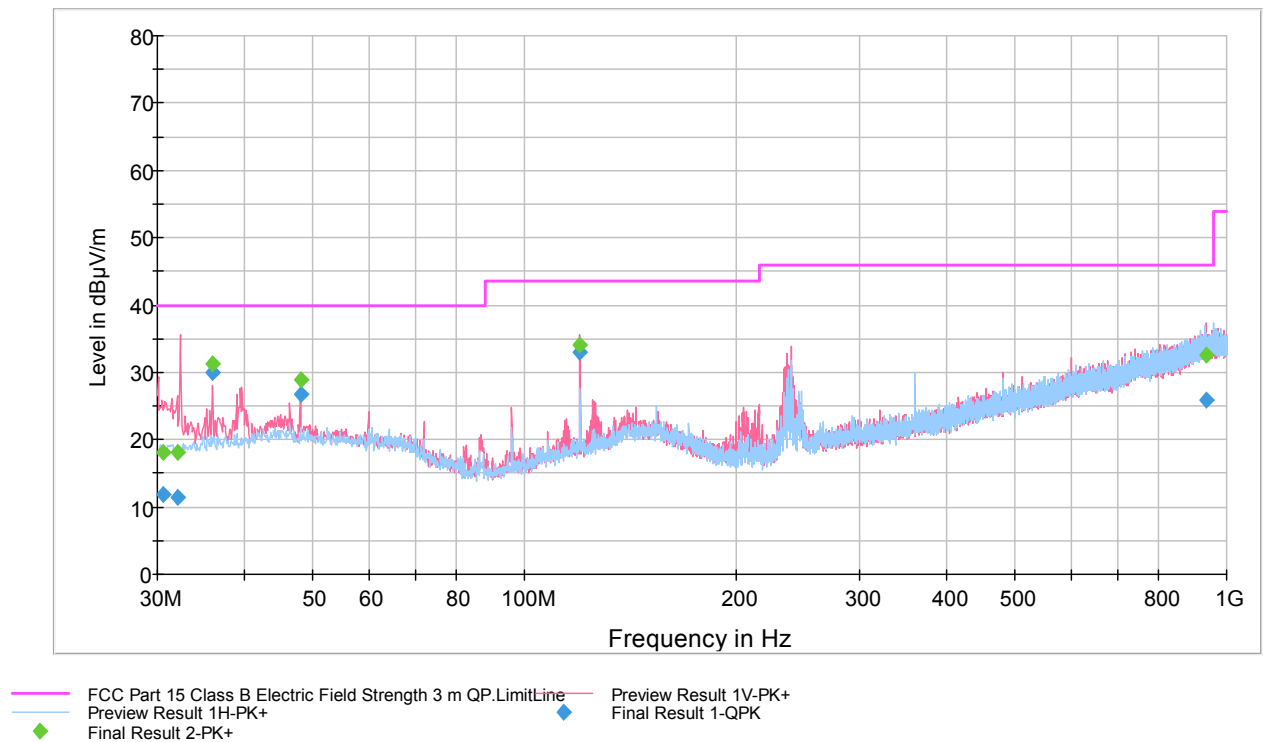


Figure 13. Measured curve with peak-detector.

Final measurements from the worst frequencies

Table 12. Final Quasi Peak results.

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
30.540000	11.8	1000.0	120.000	141.0	V	47.0	14.3	28.2	40.0	
32.068000	11.5	1000.0	120.000	121.0	V	124.0	14.4	28.5	40.0	
35.994000	29.9	1000.0	120.000	100.0	V	25.0	14.7	10.1	40.0	
48.005000	26.8	1000.0	120.000	106.0	V	115.0	15.4	13.2	40.0	
119.996000	32.9	1000.0	120.000	100.0	V	171.0	13.1	10.6	43.5	
934.239000	25.8	1000.0	120.000	363.0	V	72.0	27.0	20.2	46.0	

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge

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

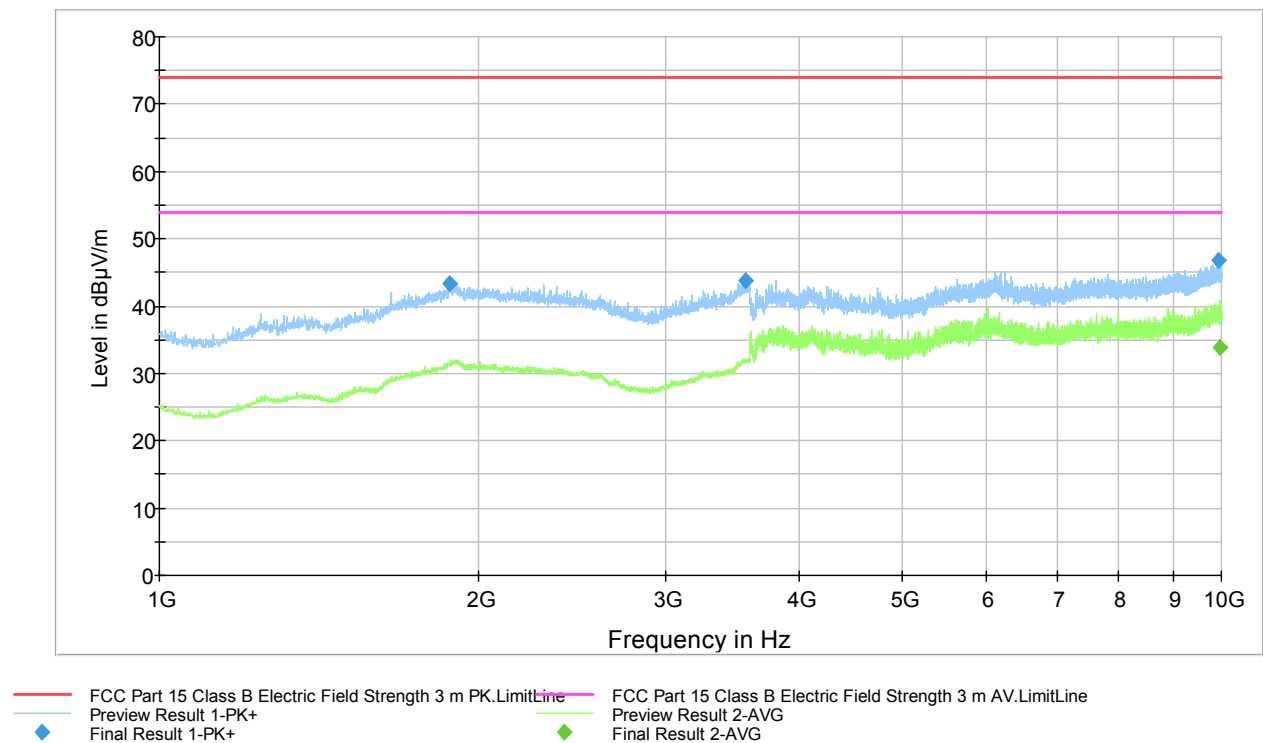


Figure 14. Measured curve with peak-and average detector.

Final measurements from the worst frequencies

Table 13. Final Max Peak results.

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
1878.800000	43.4	1000.0	1000.000	332.0	H	125.0	2.8	30.5	73.9	
3563.500000	43.8	1000.0	1000.000	374.0	V	319.0	7.2	30.1	73.9	
9925.500000	46.9	1000.0	1000.000	243.0	H	118.0	16.0	27.0	73.9	

Table 14. Final Average results.

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)	Comment
9965.700000	33.8	1000.0	1000.000	100.0	V	10.0	16.0	20.1	53.9	

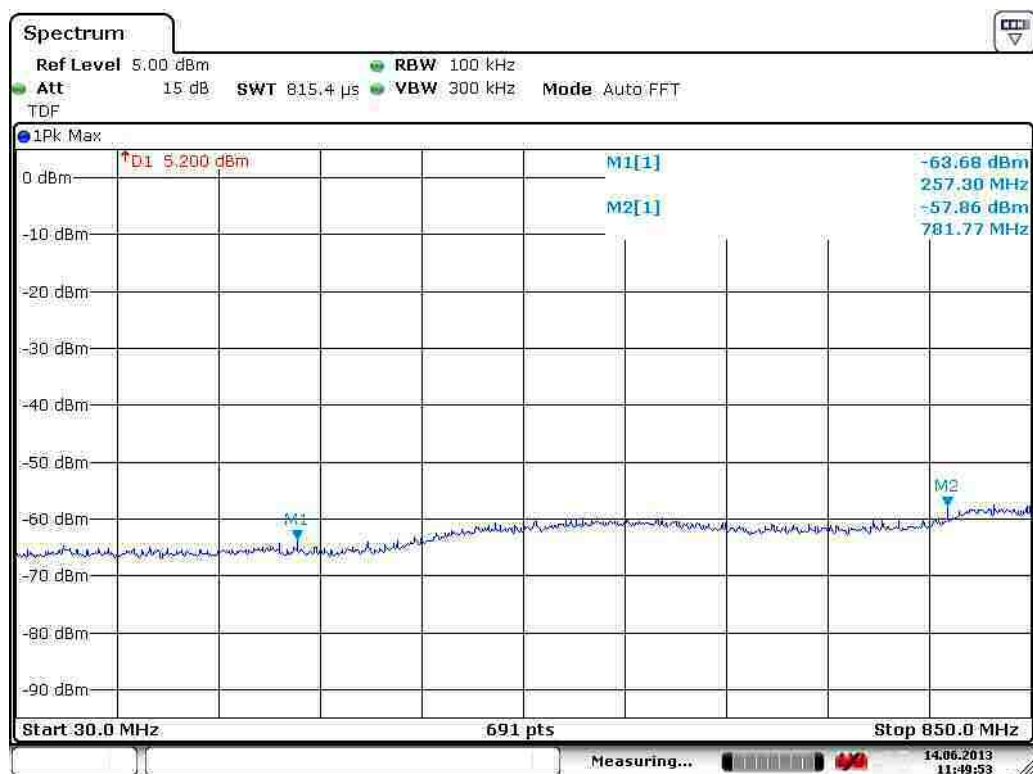
Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge

Conducted Spurious Emissions 30 MHz to 26.5 GHz and Band Edge

Standard: ANSI C63.10 (2009)
Tested by: NKA
Date: 14.6.2013
Temperature: 23 °C
Humidity: 49 % RH

FCC Rule: 15.247 (d)

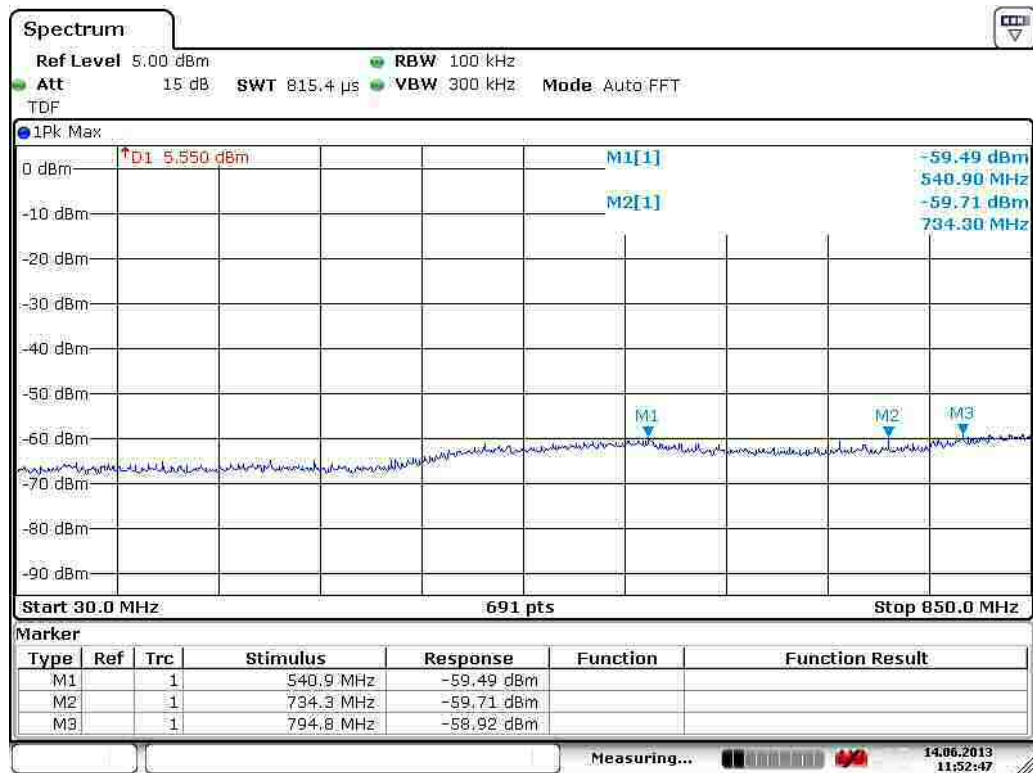
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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.



Date: 14.JUN.2013 11:49:53

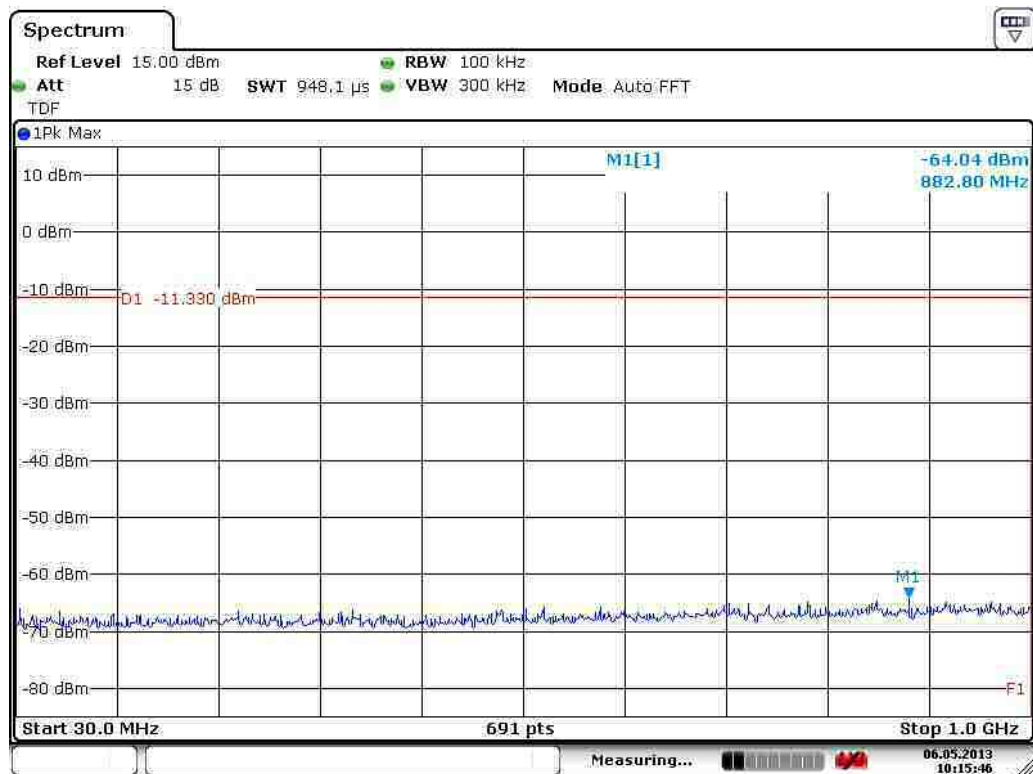
Figure 15. Low channel conducted emission 30 MHz to 850 MHz.

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 14.JUN.2013 11:52:47

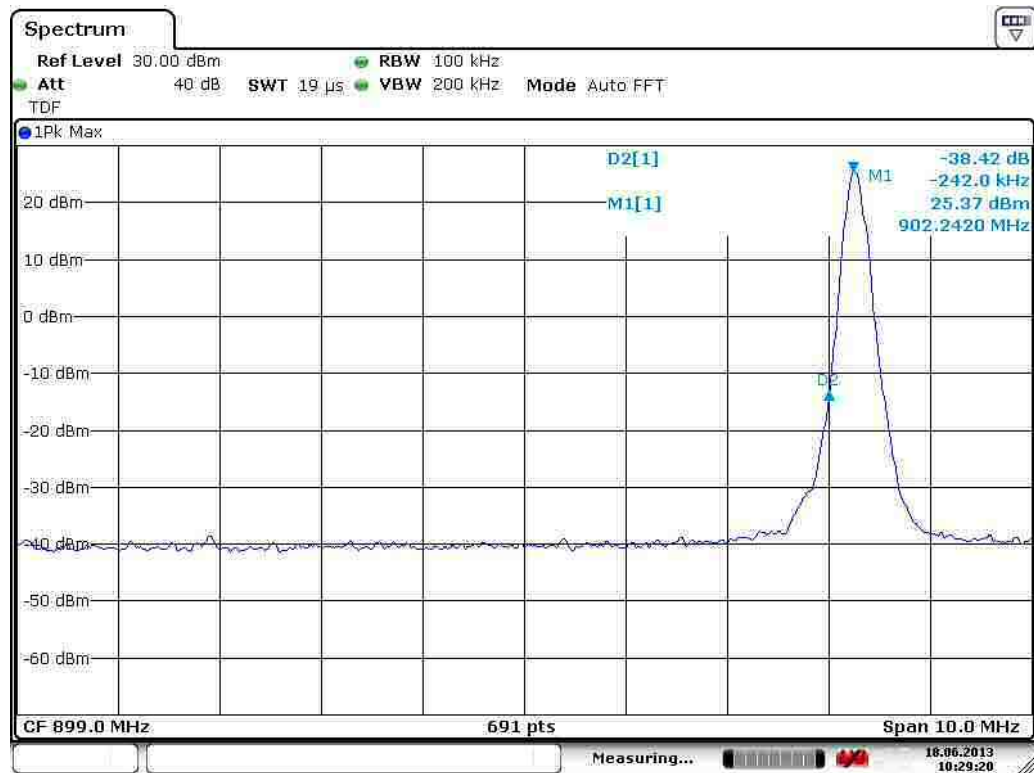
Figure 16. Mid channel conducted emission 30 MHz to 850 MHz.



Date: 6.MAY.2013 10:15:45

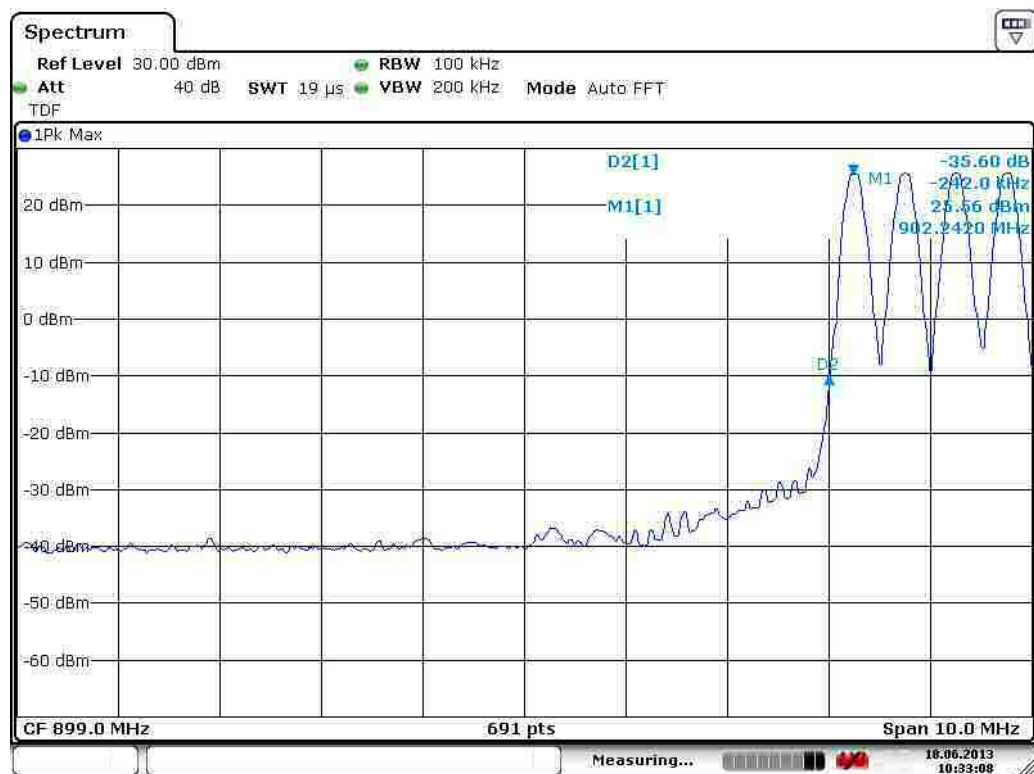
Figure 17. High channel conducted emission 30 MHz to 850 MHz.

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 18.JUN.2013 10:29:19

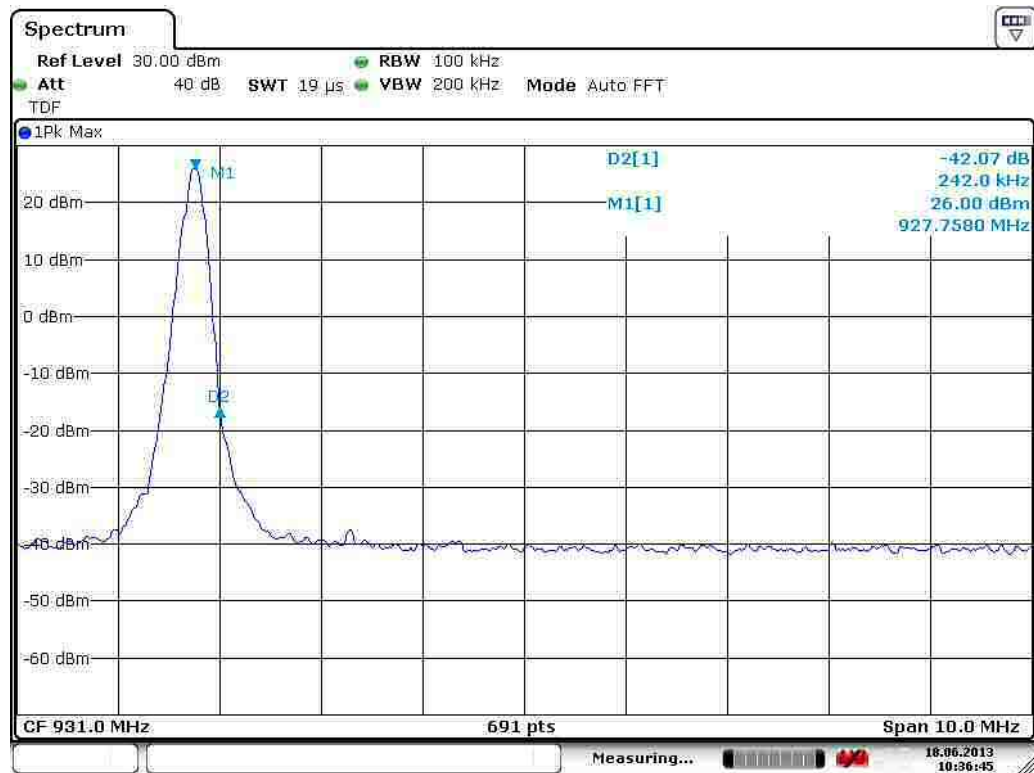
Figure 18. Conducted emission at low band edge (fixed channel).



Date: 18.JUN.2013 10:33:07

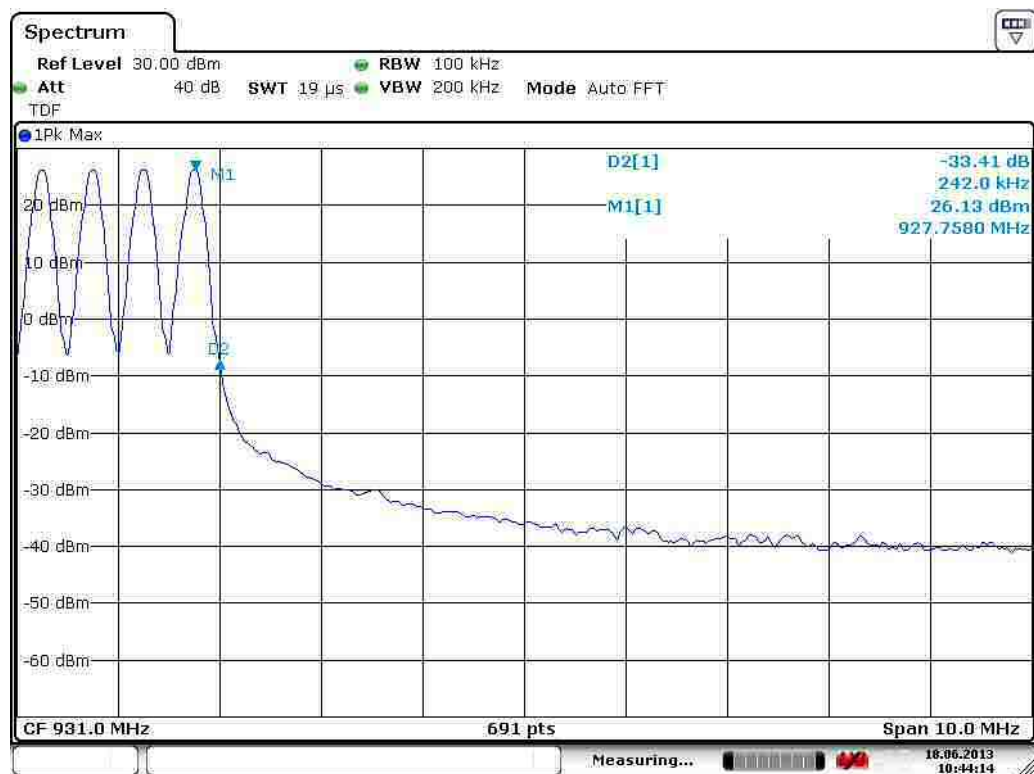
Figure 19. Conducted emission at low band edge (hopping).

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 18.JUN.2013 10:36:44

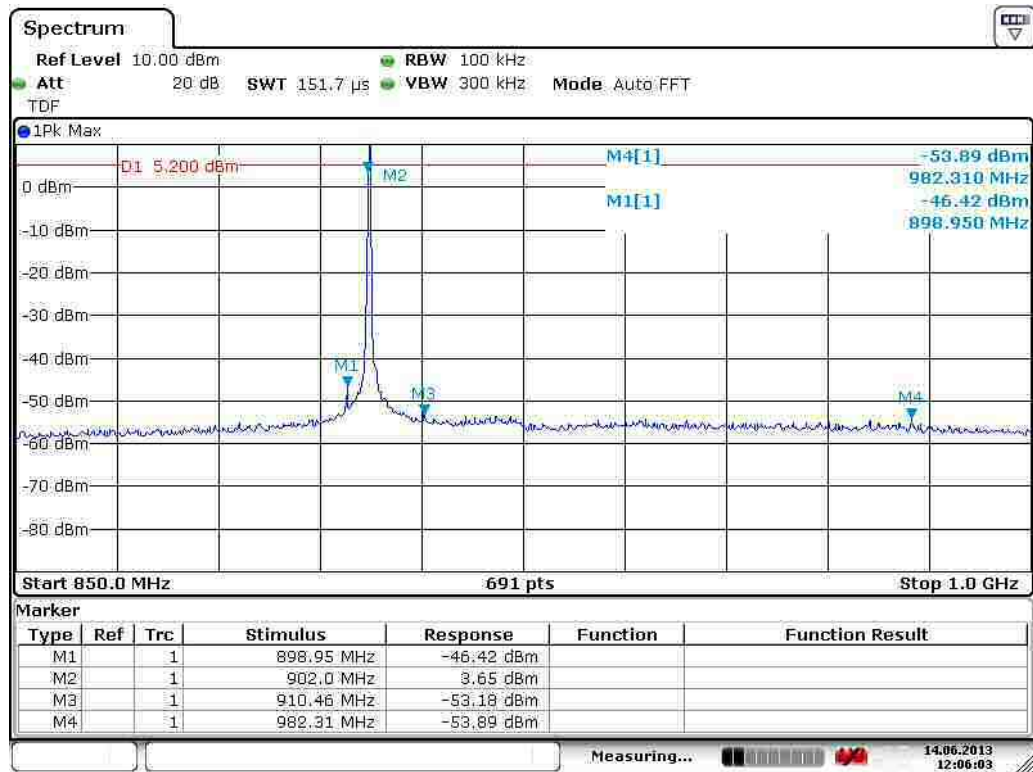
Figure 20. Conducted emission at high band edge (fixed channel).



Date: 18.JUN.2013 10:44:13

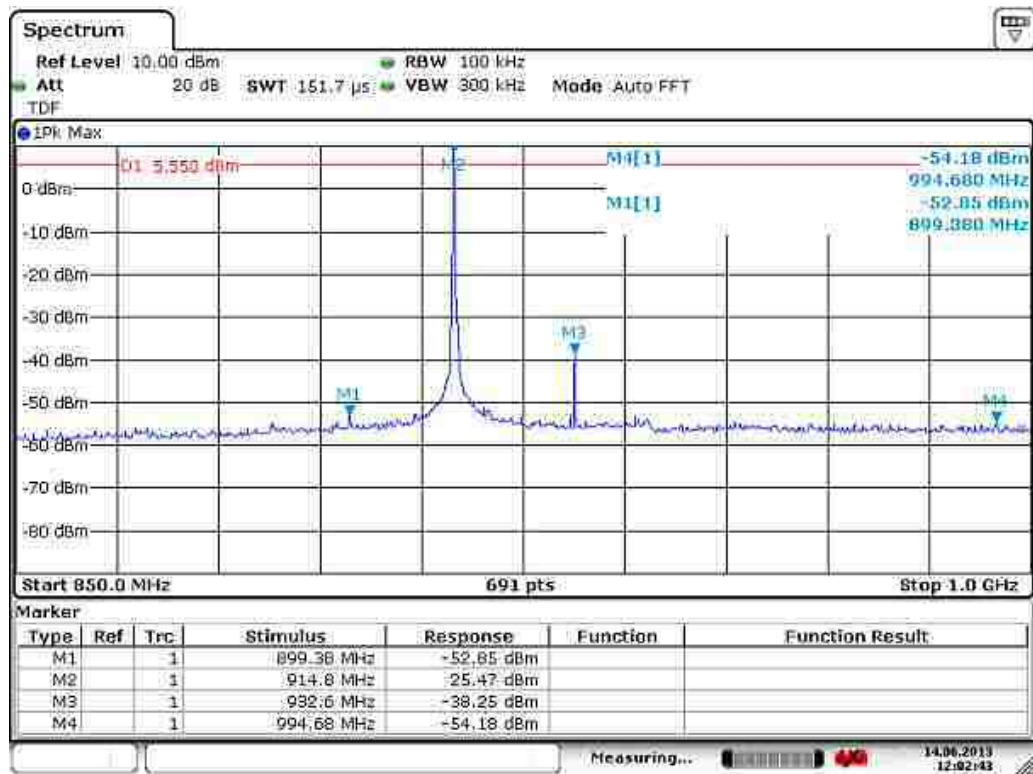
Figure 21. Conducted emission at high band edge (hopping).

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 14.JUN.2013 12:06:02

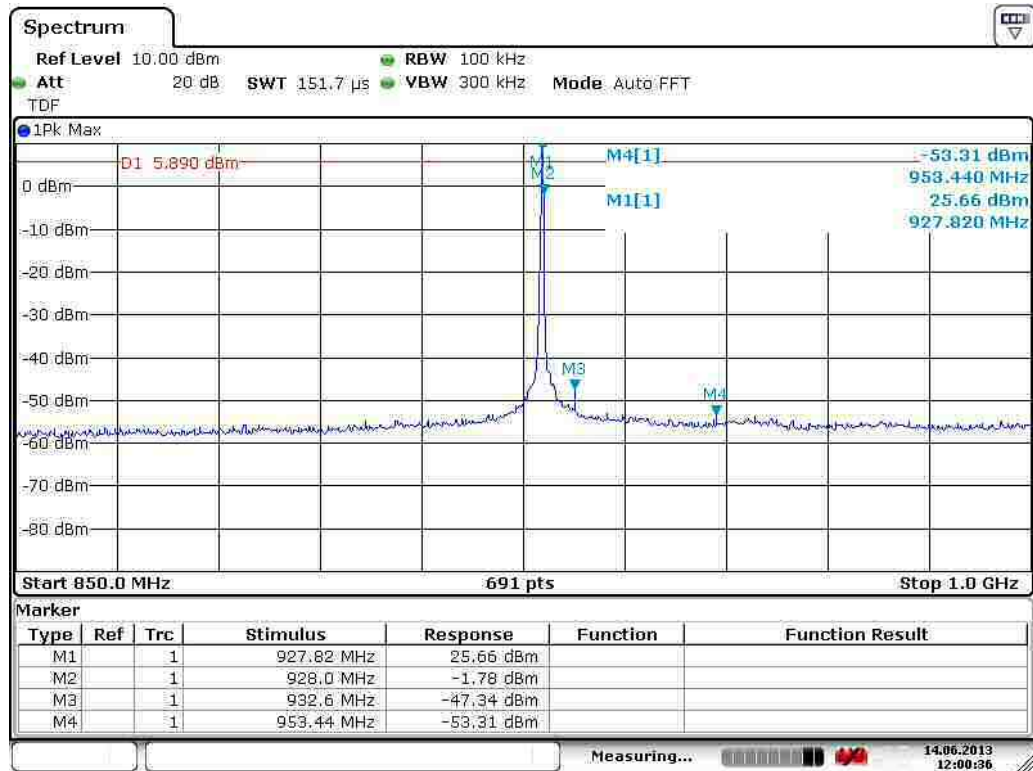
Figure 22. Low channel conducted emission 850 MHz to 1 GHz.



Date: 14.JUN.2013 12:02:43

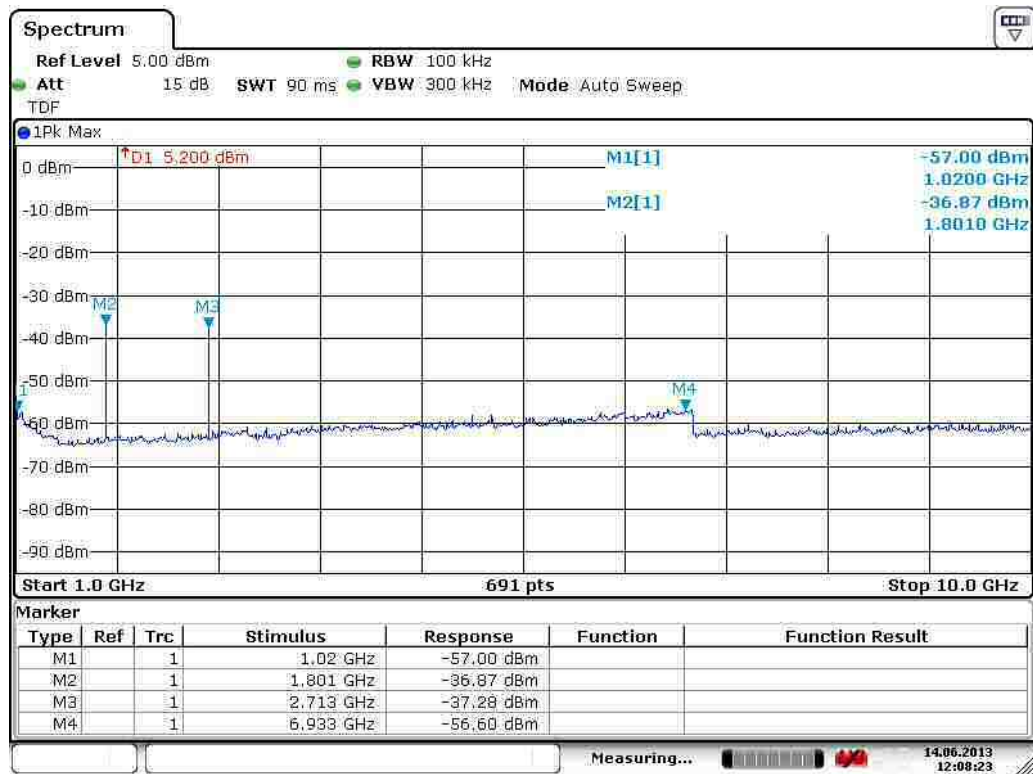
Figure 23. Mid channel conducted emission 850 MHz to 1 GHz.

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 14.JUN.2013 12:00:36

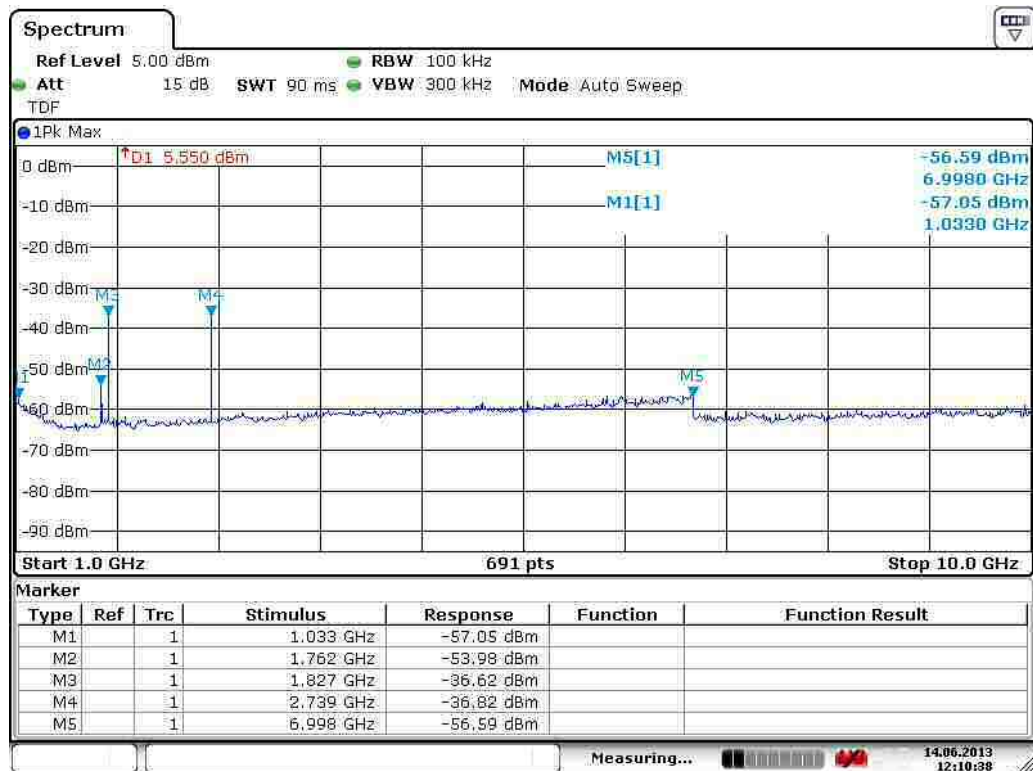
Figure 24. High channel conducted emission 850 MHz to 1 GHz.



Date: 14.JUN.2013 12:08:22

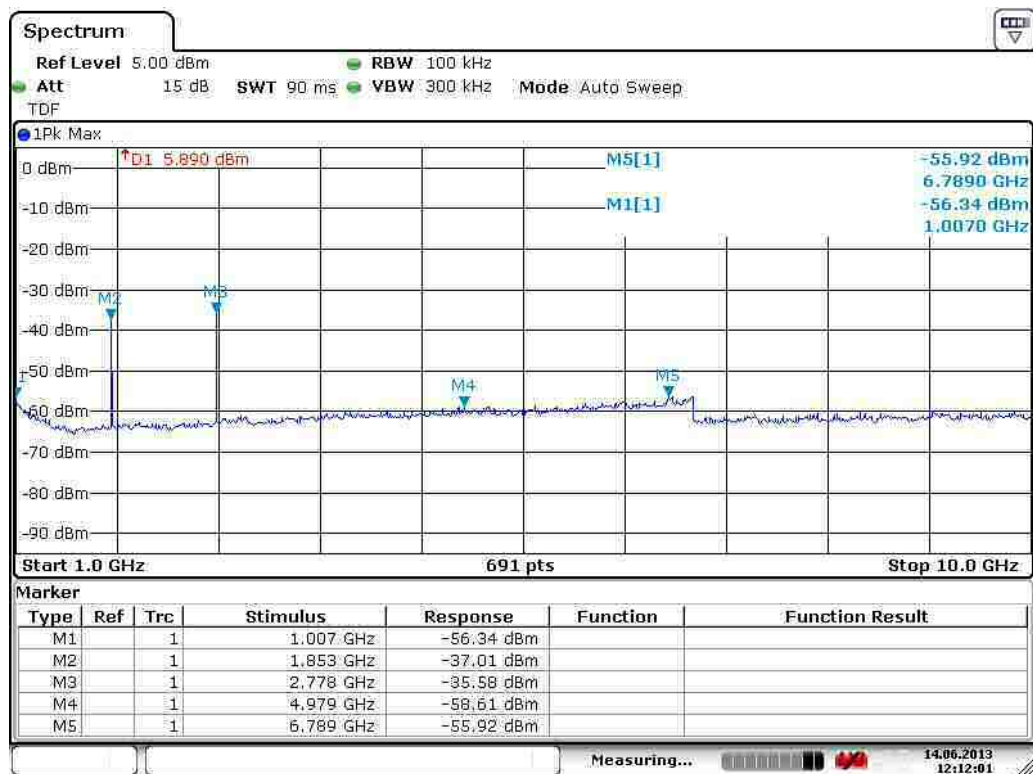
Figure 25. Low channel conducted emission 1 GHz to 10 GHz.

Conducted Spurious Emission 30 MHz to 26.5 GHz and Band Edge



Date: 14.JUN.2013 12:10:38

Figure 26. Mid channel conducted emission 1 GHz to 10 GHz.



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Figure 27. High channel conducted emission 1 GHz to 10 GHz.

20 dB Bandwidth of the Hopping Channel

Standard: ANSI C63.10 (2009)
Tested by: NKA
Date: 14.6.2013 / 18.6.2013
Temperature: 23.0 °C / 23.3 °C
Humidity: 49 % RH / 34 % RH

FCC Rule: 15.247(a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

The test was performed with two different modulations, PR-ASK and ASK.

Results:

Table 15. 20 dB bandwidth test results.

Channel	20 dB BW [kHz]	
	PR-ASK	ASK
Low	112.88	173.660
Mid	123.01	173.660
High	112.16	173.660

20 dB Bandwidth of the Hopping Channel



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Figure 28. 20 dB BW modulation PR-ASK Channel LOW.



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Figure 29. 20 dB BW modulation PR-ASK Channel MID.

20 dB Bandwidth of the Hopping Channel



Date: 14.JUN.2013 16:11:28

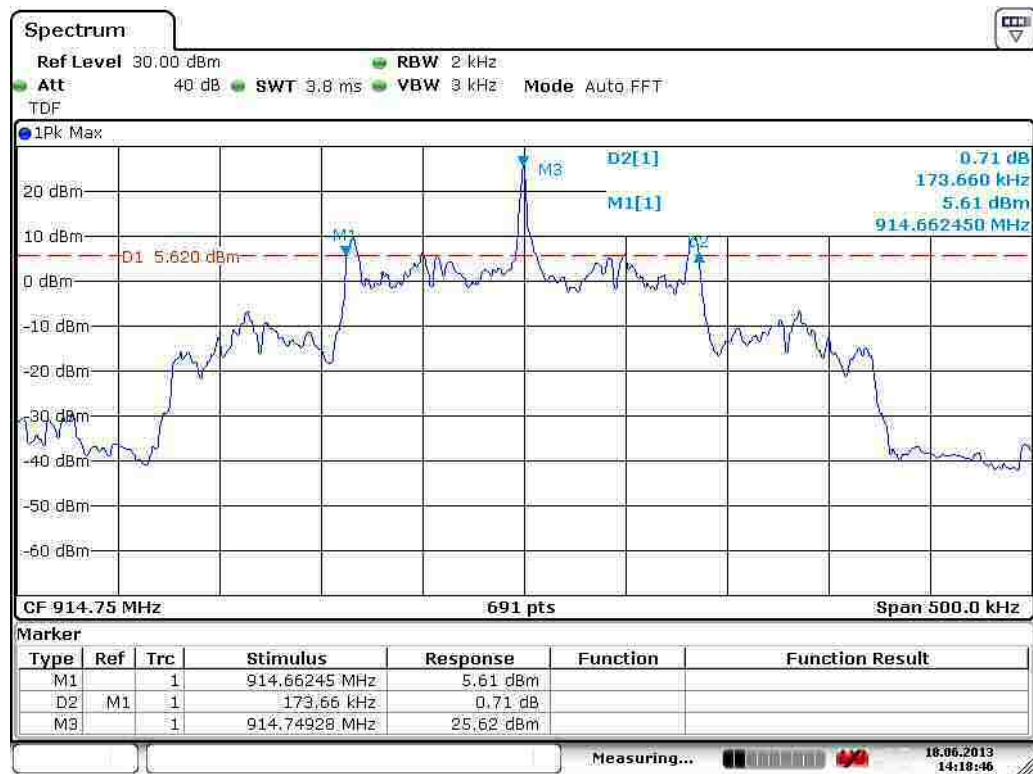
Figure 30. 20 dB BW modulation PR-ASK Channel HIGH.



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Figure 31. 20 dB BW modulation ASK Channel LOW.

20 dB Bandwidth of the Hopping Channel



Date: 18.JUN.2013 14:18:45

Figure 32. 20 dB BW modulation ASK Channel MID.



Date: 18.JUN.2013 14:16:48

Figure 33. 20 dB BW modulation ASK Channel HIGH.

Hopping Channel Carrier Frequencies Separation

Standard: ANSI C63.10 (2009)
Tested by: NKA
Date: 14.6.2013
Temperature: 23 °C
Humidity: 49 % RH

FCC Rule: 15.247(a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test result

Table 16. Hopping channel carrier frequencies separation test result.

Measured separation	Measured 20 dB Bandwidth	Result
499.30 kHz	123.01 kHz	PASS



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Figure 34. Measured hopping channels carrier frequency separation.

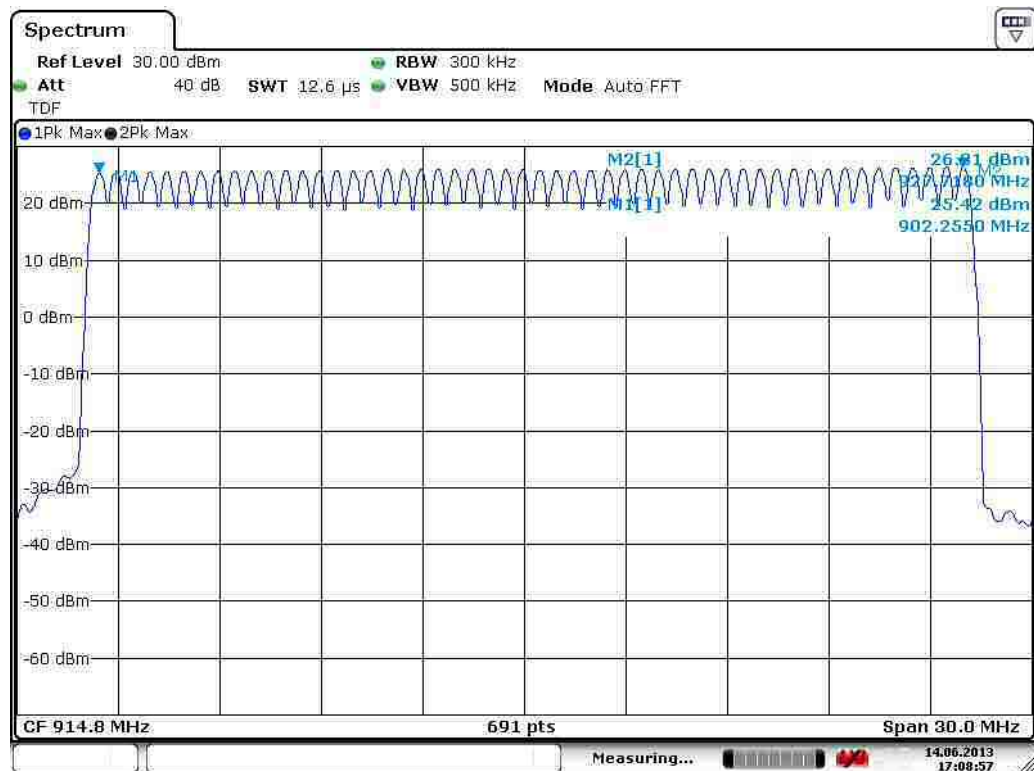
Average Time of Occupancy of Hopping Frequency

Number of Hopping Channels

Standard: ANSI C63.10 (2009)
Tested by: NKA
Date: 14.6.2013
Temperature: 23 °C
Humidity: 49 % RH

FCC Rule: 15.247(a)(1)(i)

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 frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.



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Figure 35. Number of hopping channels.

Average Time of Occupancy of Hopping Frequency

Average Time of Occupancy of Hopping Frequency

Standard:	ANSI C63.10	(2009)
Tested by:	NKA	
Date:	14.6.2013	
Temperature:	23 °C	
Humidity:	49 % RH	

FCC Rule: 15.247(a)(1)(i)

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 frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Time of occupancy calculation:

Number of channels = 52

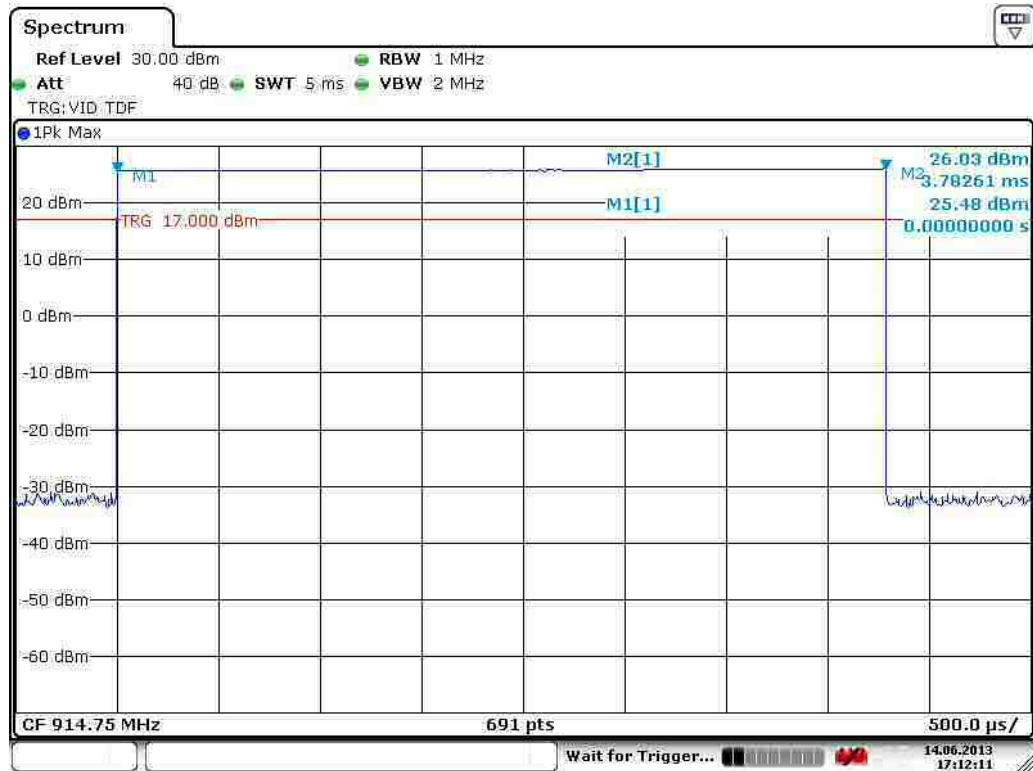
Measurement period = 20 s

One channel occupancy time = 3.78261 ms

Number of transmission cycles in measurement period = 39

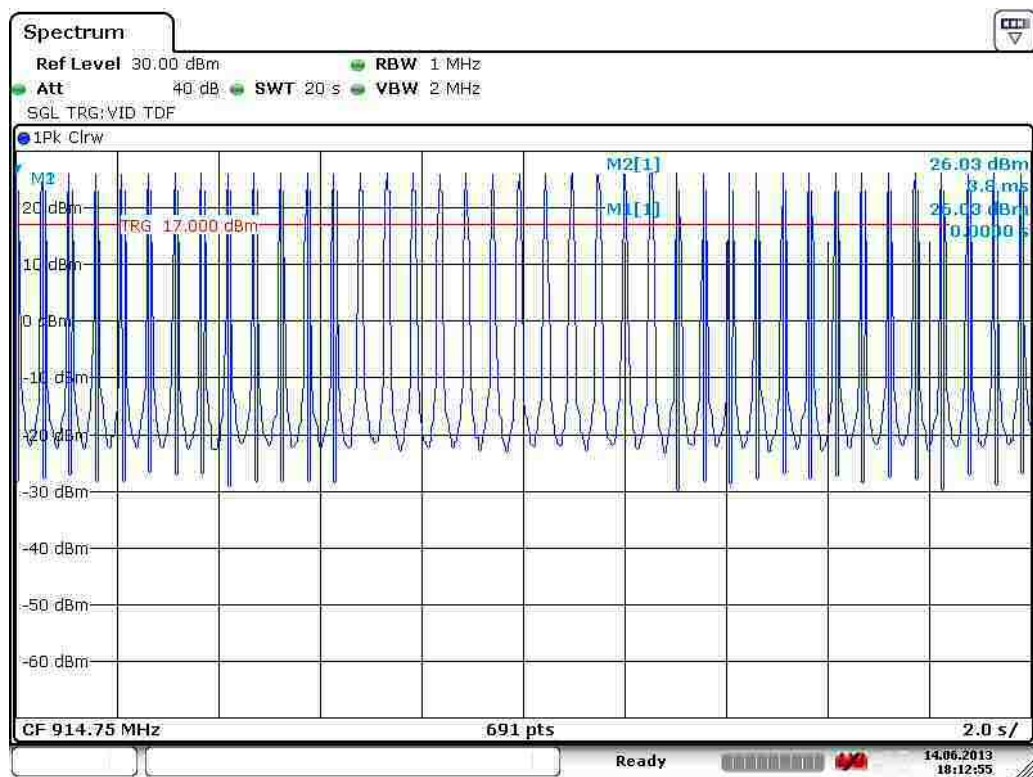
Time of occupancy = (single duration) x (repetition) = 3.78261ms x 39 times = 147.52179 ms

Average Time of Occupancy of Hopping Frequency



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Figure 36. Dwell time on one channel.



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Figure 37. Measured repetition of the channel occupancy in 20 seconds

99% Occupied Power Bandwidth

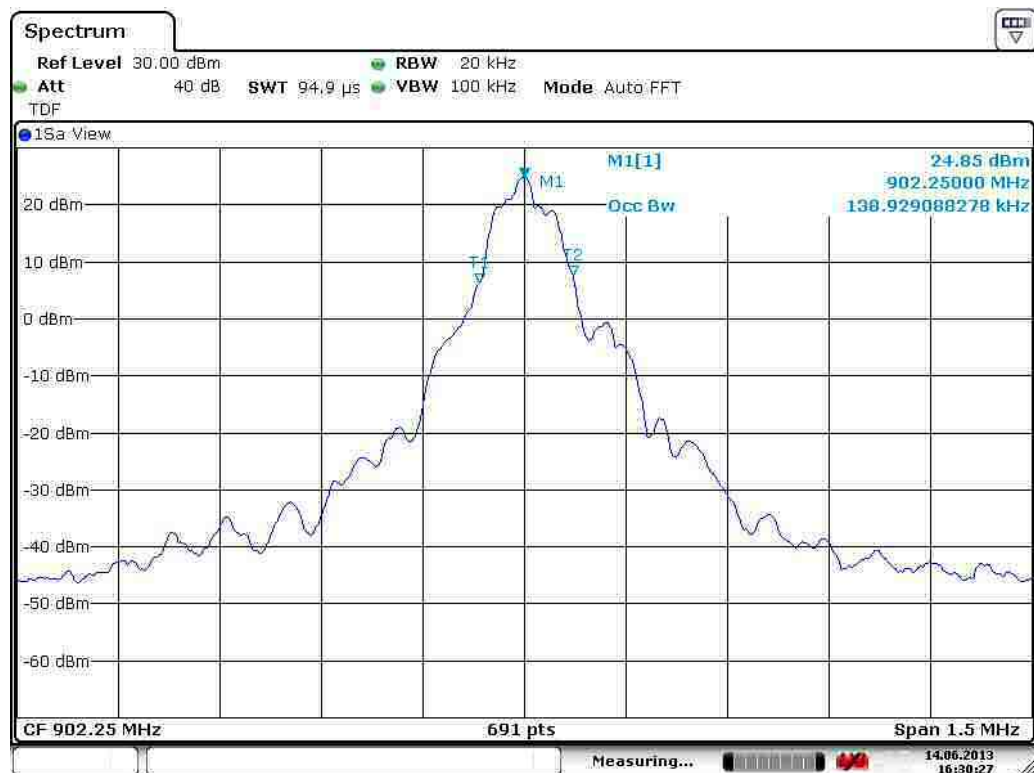
Standard: RSS-GEN (2010)
Tested by: NKA
 14.6.2013 / 18.6.2013 14.6.2013 / 18.6.2013
 23.0 °C / 23.3 °C 23.0 °C / 23.3 °C
 49 % RH / 34 % RH 49 % RH / 34 % RH

RSS-GEN 4.6.

The test was performed with two different modulations, PR-ASK and ASK.

Table 17. Occupied Bandwidth

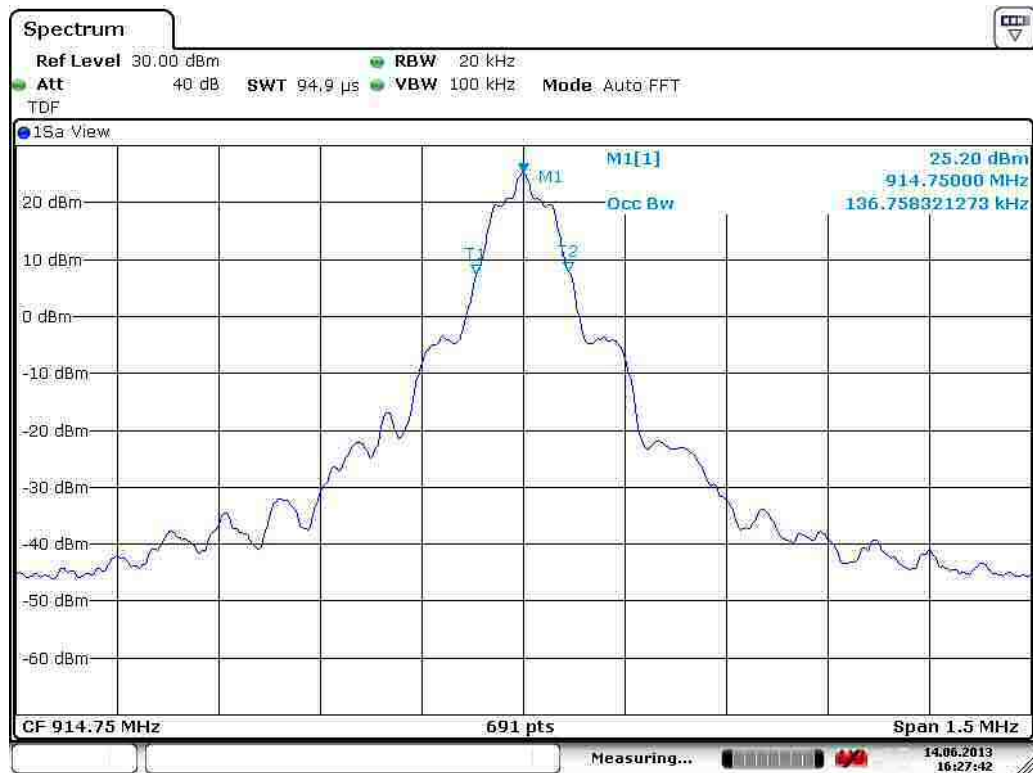
Channel	99% BW [kHz]		Limit	Result
	PR-ASK	ASK		
Low	138.929088278	193.198263386	-	PASS
Mid	136.758321273	193.198263386	-	PASS
High	156.295224313	195.369030391	-	PASS



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Figure 38. Low channel 99% Occupied Power Bandwidth with PR-ASK modulation.

99% Occupied Power Bandwidth



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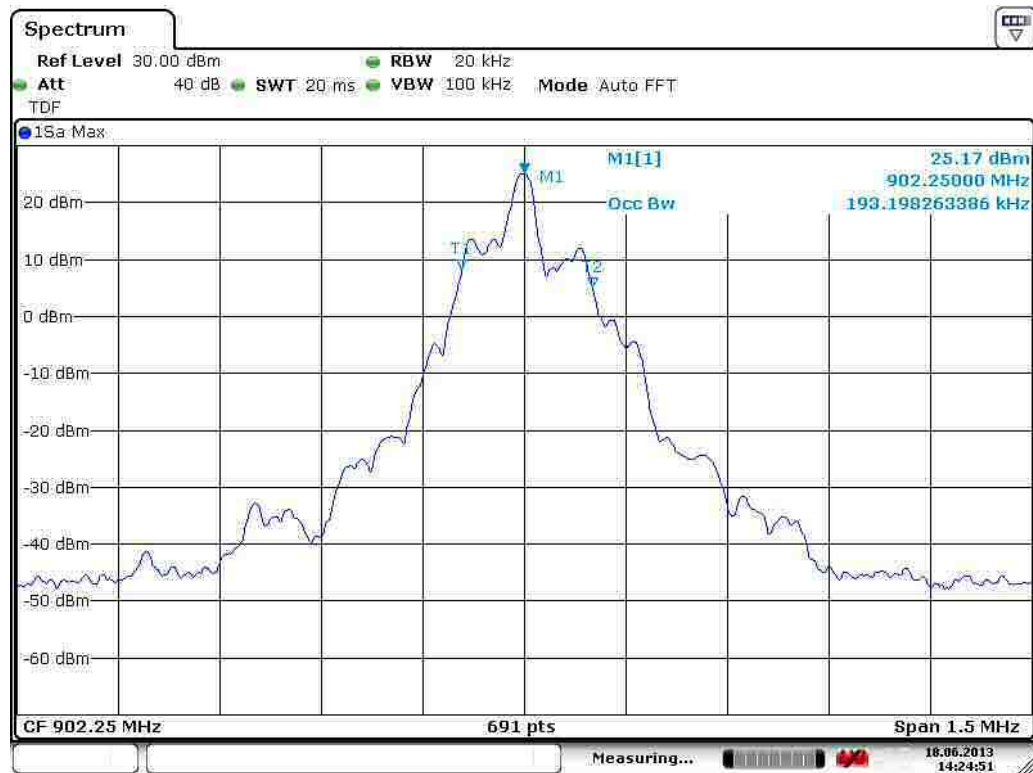
Figure 39. Mid channel 99% Occupied Power Bandwidth with PR-ASK modulation.



Date: 14.JUN.2013 16:24:47

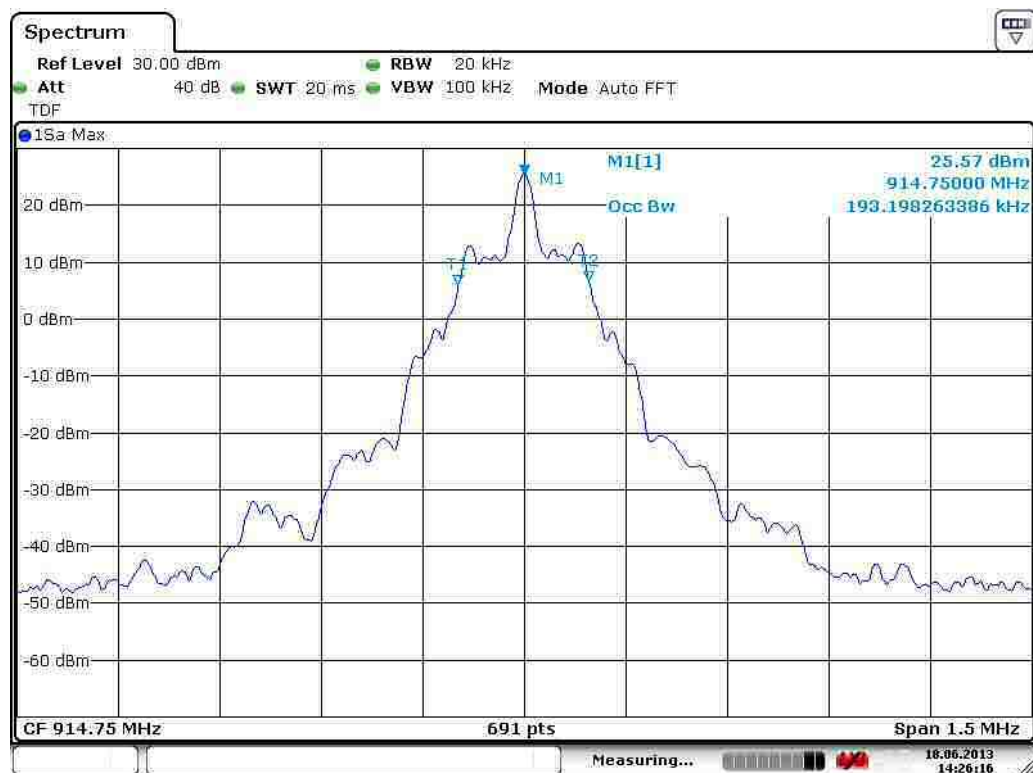
Figure 40. High channel 99% Occupied Power Bandwidth with PR-ASK modulation.

99% Occupied Power Bandwidth



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Figure 41. Low channel 99% Occupied Power Bandwidth with ASK modulation.



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Figure 42. Mid channel 99% Occupied Power Bandwidth with ASK modulation.

99% Occupied Power Bandwidth



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Figure 43. High channel 99% Occupied Power Bandwidth with ASK modulation.

List of Test Equipment

LIST OF TEST EQUIPMENT

Manufacturer	Type	Serial no	Inv. no
ROHDE & SCHWARZ			
Signal Analyzer	FSV40	101068	9093
EMI Test receiver	ESU 26	100185	8453
Test software	EMC32	-	-
DAVIS			
Weather station	Vantage Pro	-	5297
EMCO			
Antenna (1 - 18 GHz)	3117	29617	7293
SCHWARZBECK			
Antenna (30 MHz - 1 GHz)	VULB 9168	9168-503	8911
HEWLETT- PACKARD			
Microwave amplifier	83017A	-	5226
HUBER-SUHNER			
Attenuator 10dB	6810.17B	-	-
DEISEL			
Antenna mast	MA 240	240/455	7896
Turntable	DS 430	-	-
WAINWRIGHT			
High Pass Filter	WHKX1.0/15G-10SS	5	8267

All used measurement equipment was calibrated (if required).