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FCC Test Report for Parts 15.247 and 15.109

Product name : GPS Tracking System Child Module

Applicant : Findster Technologies S.A.

FCC ID : 2AHM8-FND16CUS

Test report No.: 160201125 Ver 2.10

Laboratory information

Accreditation

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The designation number is NL0001.

Documentation

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at Telefication Netherlands.

Testing Location

Test Site	Telefication BV
Test Site location	Edisonstraat 12a 6902 PK Zevenaar The Netherlands Tel. +31316583180 Fax. +31316583189
Test Site FCC	NL0001

Revision History

Version	Date	Remarks	By
2.10	26-01-2017	FCC ID slightly changed	ing. P.A. Suringa
2.00	29-06-2016	Section 3.6.7 (emissions in data communication mode) added	ing. P.A. Suringa
1.00	10-05-2016	Initial release	ing. P.A. Suringa
0.50	11-04-2016	Draft for peer review	ing. P.A. Suringa

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Summary of Test results

FCC	Description	Section in report	Verdict
15.247(a)	6dB Bandwidth	3.1	Pass
15.247(b)	RF output power	3.2	Pass
15.247(e)	Power spectral density	3.3	Pass
15.247(d)	Conducted Spurious emissions	3.4	Pass
15.247(d)	Conducted Band edge	3.4	Pass
15.247(d)	Tx Radiated Spurious emissions	3.5	Pass
15.109(a)	Radiated Spurious emissions	3.6	Pass

1 General Description

1.1 Applicant

Client name:	Findster Technologies S.A.
Address	Rua Pedro Nunes, Edificio C, Coimbra
Zip code:	3030-199
Country:	Portugal
Telephone:	+351 223 248 286
E-mail:	info@getfindster.com

1.2 Manufacturer

Manufacturer name:	Findster Technologies S.A.
Address:	Rua Pedro Nunes, Edificio C, Coimbra
Zip code:	3030-199
Country:	Portugal
Telephone:	+351 223 248 286
E-mail:	info@getfindster.com

1.3 Tested Equipment Under Test (EUT)

Product name:	GPS Tracking System Child Module
Brand name:	Findster Child
FCC ID:	2AHM8-FND16CUS
Serial number:	--
Software version:	--
Hardware version:	--
Date of receipt	28 – 03 - 2016
Tests started:	28 – 03 - 2016
Testing ended:	28 – 06 - 2016

1.4 Product specifications of Equipment under test

Tx Frequencies	917 – 926.8 MHz
Rx frequencies	917 – 926.8 MHz
Maximum output power to antenna	0.025 W
Antenna gain	-0.4 dBi
Type of modulation	Proprietary
Emission designator	125KG1D

1.5 Modification of the Equipment Under Test (EUT)

Not applicable.

1.6 Environmental conditions

- Ambient temperature 24°C
- Humidity 42.2%

1.7 Applicable standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247.
- FCC Part 15 Subpart B, § 15.109

1.8 Measurement guidances:

- FCC KDB Publication No. 558074 D01DTS Meas. Guidance V03r05
- ANSI C63.10:2013
- ANSI C63.4: 2014
- FCC KDB Publication No. 453039

1.9 Observations and remarks

The product, model Child, is part of a location system of which the other part bears the model name Guardian. Communicating through Radio Frequency (RF) enables real-time monitoring of the Child's geo-location and activity. A high-precision GNSS tracking system is used, as well as a proprietary communication in the sub 1 GHz ISM band.
Bluetooth Low Energy (BLE) is used to send information directly from the Guardian to the Findster App.

1.10 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specifications stated in paragraph 1.7 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.7 *"Applicable standards".*

All tests are performed by:

Name : ing. P.A. Suringa

Review of test methods and report by:

Name : ing. R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 26 January 2017

Name : ing. K.A. Roes

Function : Coordinator Radio Laboratory

Signature :

2 Test configuration of the Equipment Under Test

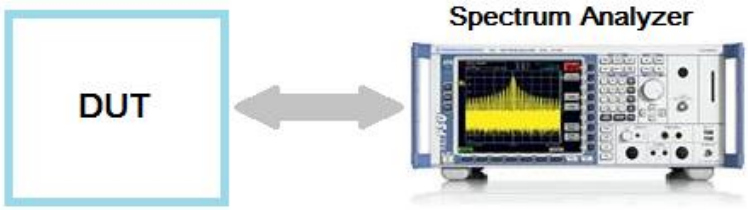
2.1 Test mode

The applicant provided test mode firmware of the EUT, in which it was possible to configure the EUT into different test channels.

2.2 Tested channels and Data rates

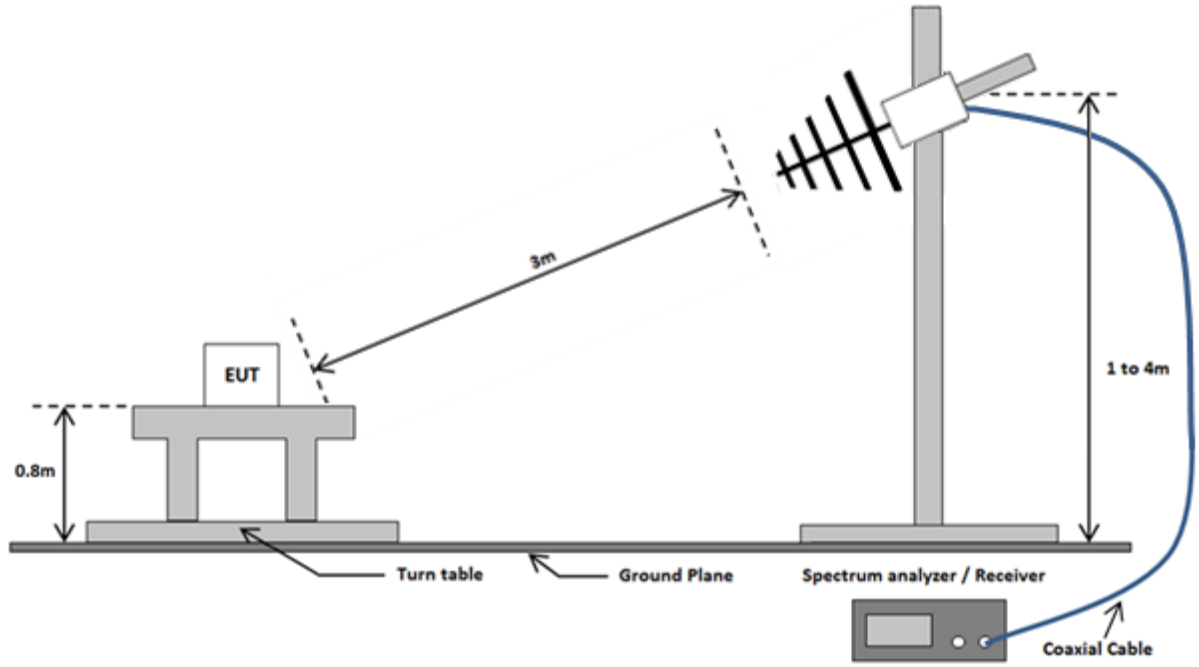
Technology	Channels	Data rate	Frequency (MHz)
Proprietary RF	Low	0.24 – 37.5 kbps	917.0 MHz
	Mid	0.24 - 37.5 kbps	921.8 MHz
	High	0.24 – 37.5 kbps	926.8 MHz

2.3 Conducted Test setup

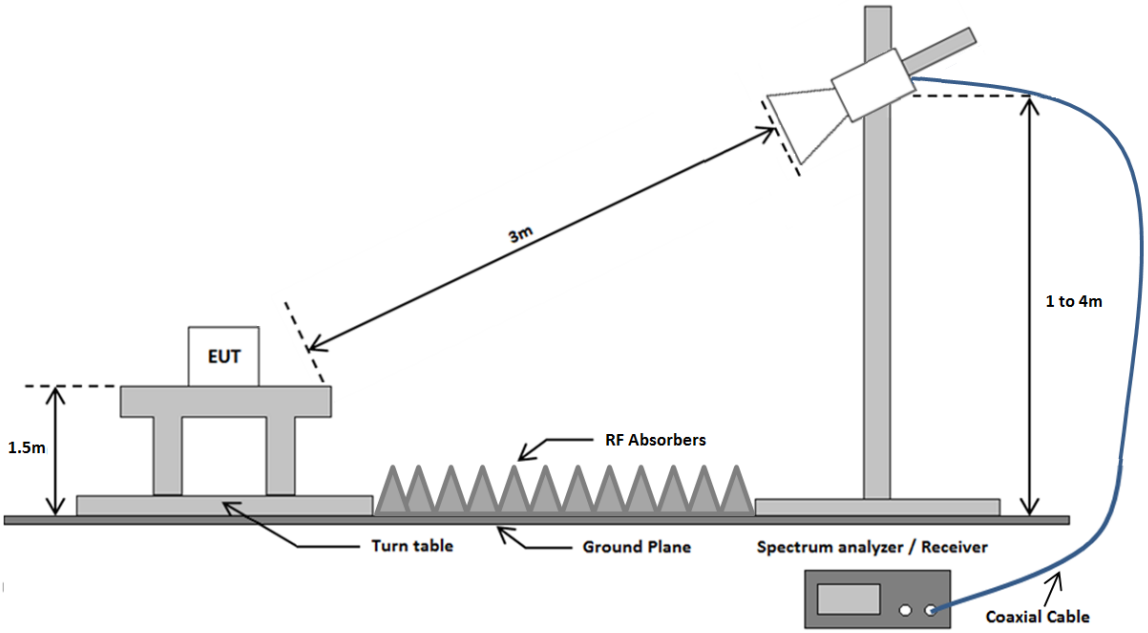


2.4 Radiated Test setup

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.5 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Spectrum Analyzer	Rohde & Schwarz	FSV	TE01269	--
EMI receiver	Rohde & Schwarz	ESR7	TE01220	3.6
Signal Analyzer	Rohde & Schwarz	FSP	TE11125	3.1, 3.2, 3.3, 3.4, 3.5
Biconilog Antenna	Chase	CBL6112A	TE00967	3.6
Horn Antenna	EMCO The Electro – Mechanics Co	3115	TE00531	3.6
Pre-amplifier	Miteq	JF4-18004000-30-8P-A1	TE11131	3.6
Pre-amplifier	Miteq	AFS42-041001800-29-OP-42	TE11132	3.6
Semi Anechoic Chamber (SAC)	Comtest Engineering BV	-	TE00861	3.6
High pass filter	Wainwright instruments	WHk3.0/18G-10EF	TE01140	3.6

2.6 Sample calculations

Field strength measurement example (ref. § 3.5.5 of this report)

Frequency	Polarization	Height	Peak
7,336 GHz	Vertical	4 m	52,2 dBµV/m

The following relation applies:

E (dBµV/m) = U(dBµV) + AF (dB/m) – G (dB) + CL (dB)

Where:

E = Electric field strength
U = Measuring receiver voltage
AF = Antenna Factor
G = Gain of the pre-amplifier
CL = Cable Loss

(52.2 = 46.22 + 36.4 - 37.62 +7.2)

3 Test results 925 MHz band

3.1 Output Power Measurement

3.1.1 Limit

For systems using digital modulation in the 902 - 928 MHz band, the limit for the peak output power is 30 dBm.

If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point to point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.1.4 Test procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
2. The RF output of EUT was connected to the spectrum analyser by RF cable and attenuator.
3. The path loss was compensated to the results for each measurement. This path loss is stored within the transducer table of the Spectrum analyser.

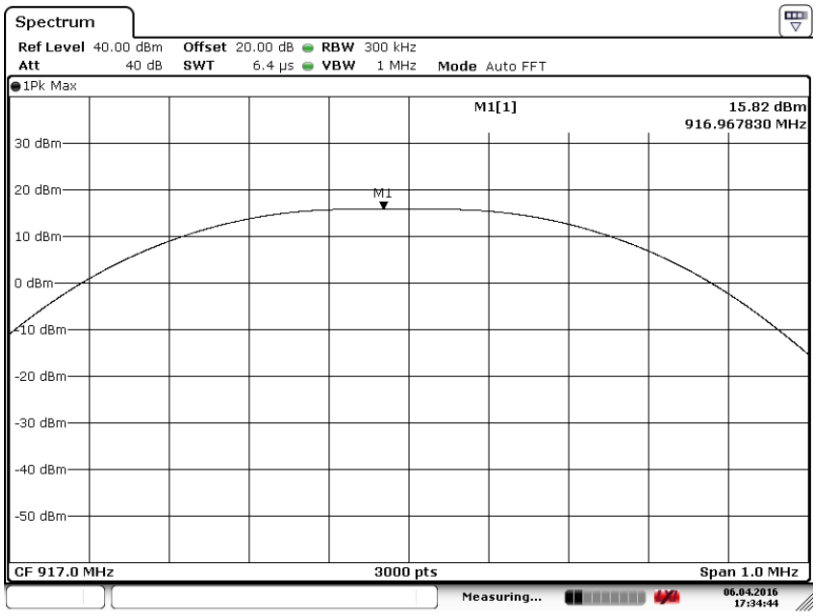
3.1.5 Test results of Output Power Measurement

Peak method

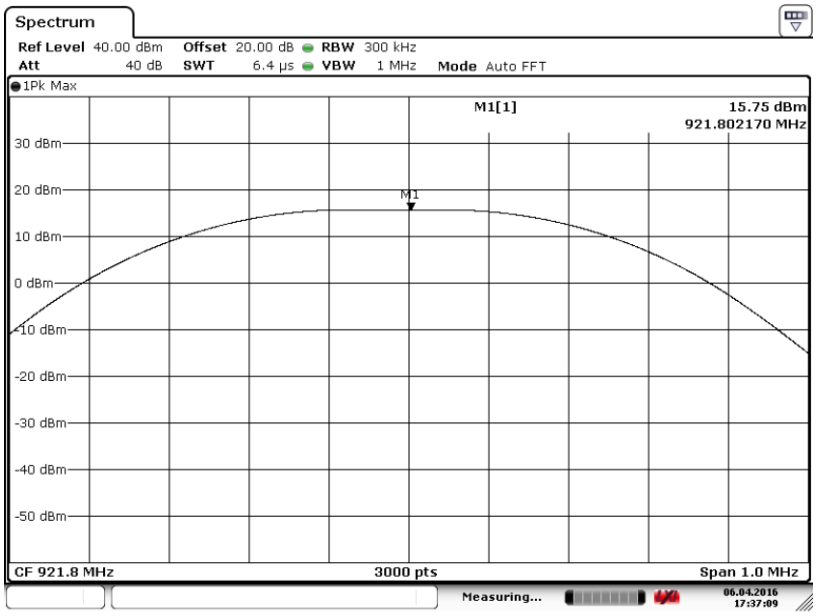
Technology Std.	Channels	Frequency (MHz)	Data rate	Peak output power (dBm)
Proprietary RF	Low	917.0 MHz	0.24 – 37.5 kbps	15.8
	Mid	921.8 MHz	0.24 – 37.5 kbps	15.8
	High	926.8 MHz	0.24 – 37.5 kbps	15.7
Uncertainty	±1.78 dB			

3.1.6 Plots of Peak Output Power Measurement

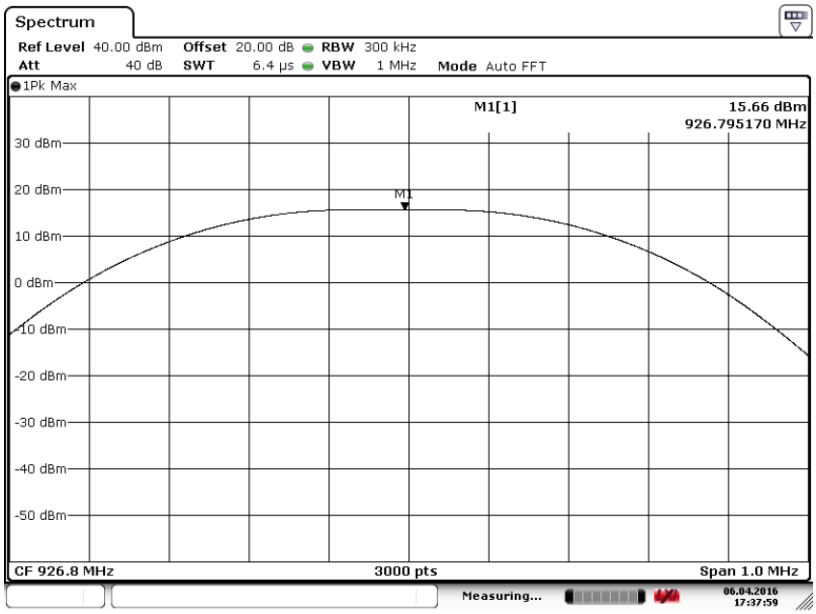
Peak Output Power (Low Channel)



Peak Output Power (Mid Channel)



Peak Output Power (High Channel)



3.2 Hybrid operation

3.2.1 Power density

3.2.1.1 Limit

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.2.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.2.1.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.2.1.4 Test procedure

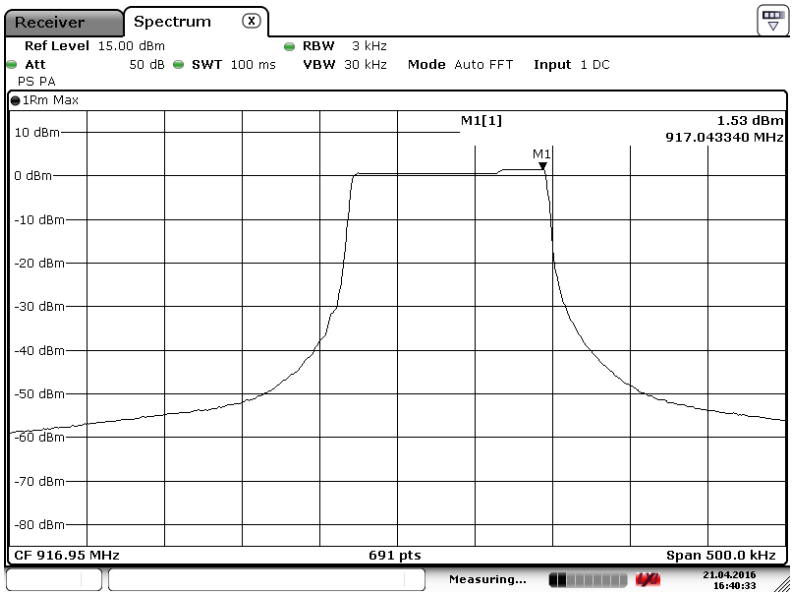
1. As the transmission pulse (or sequence of pulses) does not remain at maximum transmit power throughout each of the 100 sweeps of averaging, a different approach than that described in ANSI C63.10, § 11.10.3 (Method AVGPSD-1) is followed.
2. The RF output of EUT was connected to the spectrum analyser by RF cable and attenuator.
3. The path loss was compensated to the results for each measurement. This path loss is stored within the transducer table of the Spectrum analyser.
4. The procedure as described in method AVGPSD-1 is followed, with the following deviations:
    - trace averaging is disabled,
    - trace mode is set to Max hold

3.2.1.5 Test results of Power Spectral Density Measurement

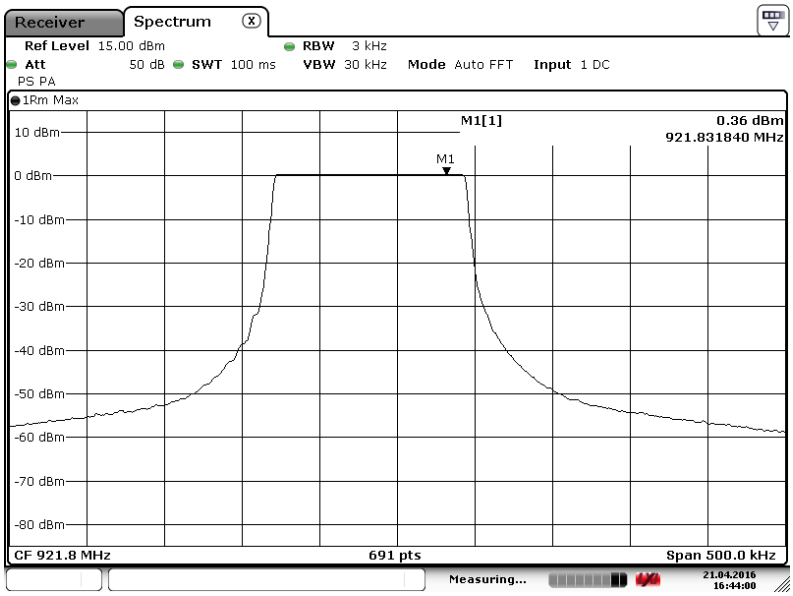
Technology Std.	Channels	Frequency (MHz)	Data rate	PSD/3 kHz (dBm)
Proprietary RF	Low	917.0 MHz	0.24 – 37.5 kbps	1.53
	Mid	921.8 MHz	0.24 – 37.5 kbps	0.36
	High	926.8 MHz	0.24 – 37.5 kbps	0.37
Uncertainty	±0.63 dB			

3.2.1.6 Plots of the Power Spectral Density Measurement

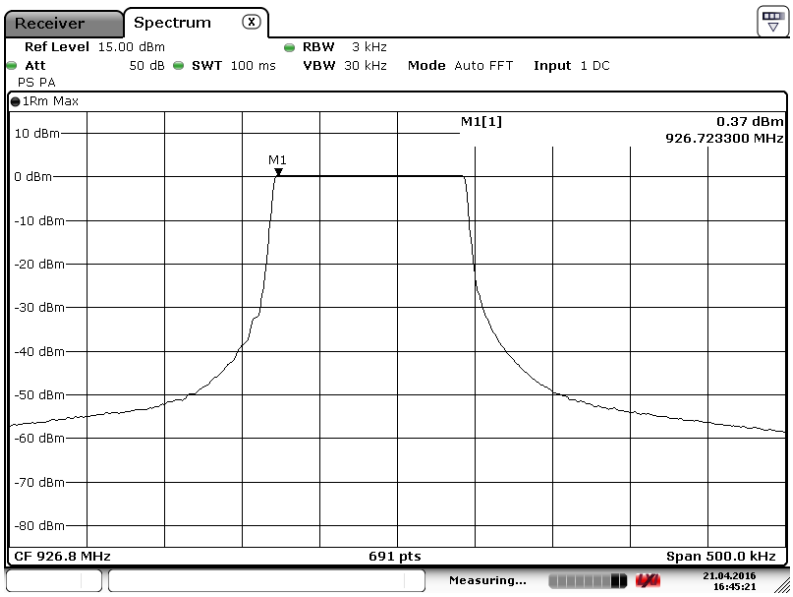
Power Spectral Density (Low channel)



Power Spectral Density (Mid channel)



Power Spectral Density (High channel)



3.2.2 Average time of occupancy

3.2.2.1 Limit

The average time of occupancy on any frequency shall not exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

3.2.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

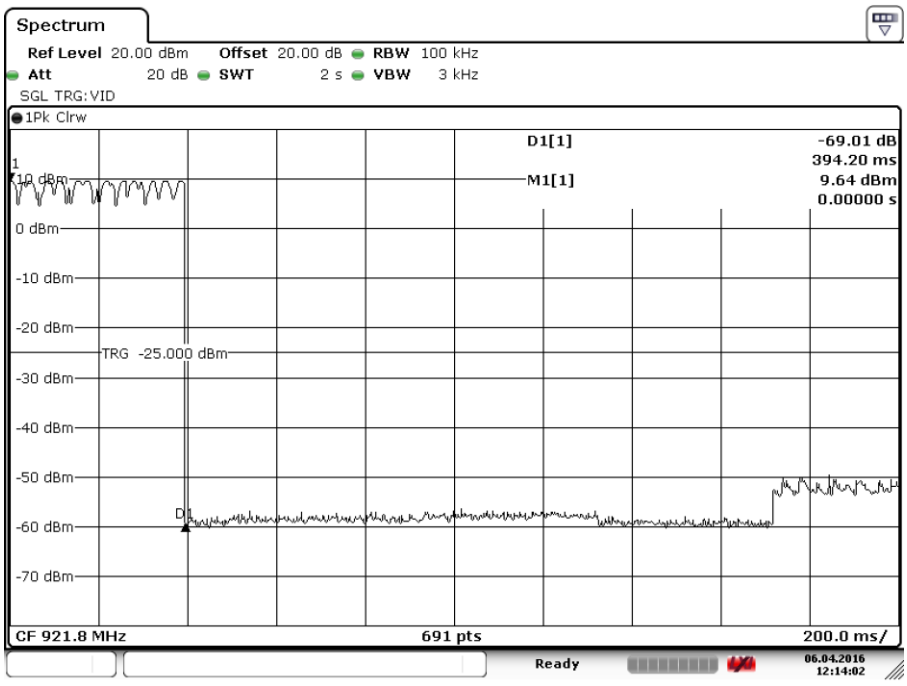
3.2.2.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.2.2.4 Test procedure

According to FCC Public Notice No. DA 00-705.

3.2.2.5 Plot of the average time of occupancy measurement.



The measured time of occupancy is: 394.2 ms in a time period of 0.4 x 5 = 2 seconds.

Measurement uncertainty: ± 5.7%

3.2.3 Hopping function of a hybrid system: channel separation

3.2.3.1 Limit

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.

3.2.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

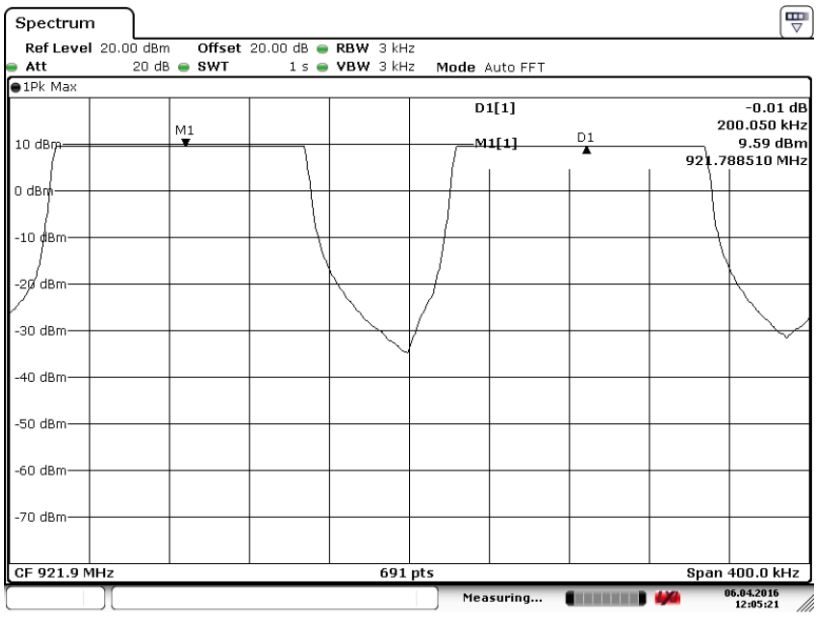
3.2.3.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.2.3.4 Test procedure

According to FCC Public Notice No. DA 00-705.

3.2.3.5 Plot of the channel separation measurement



The measured channel separation is: 200 kHz

Measurement uncertainty: ± 8 kHz

3.3 Conducted Spurious Emissions Measurement

3.3.1 Limit

In any 100 kHz bandwidth outside the operating frequency band, the RF power 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 a RF conducted or a radiated measurement.

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.3.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.3.4 Test procedure

According to KDB Publication 558074 V02r02, sections 11.3 and 12.1

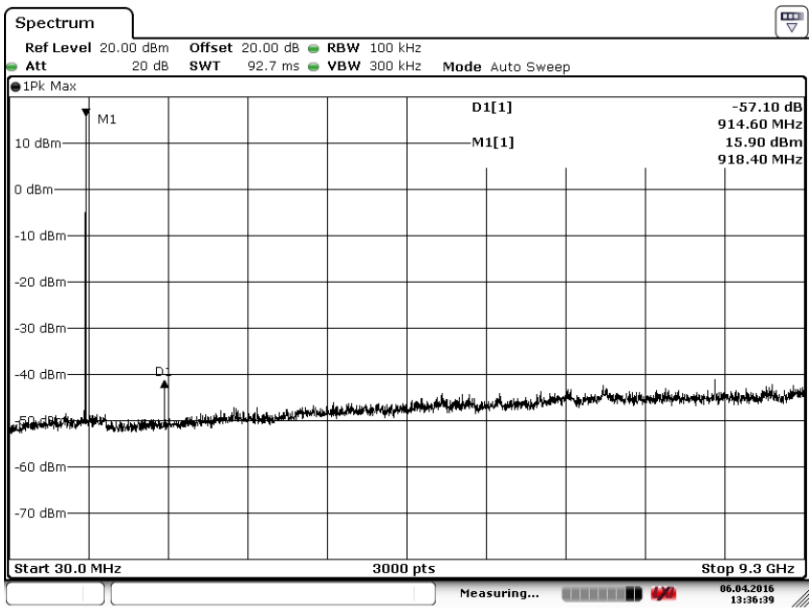
3.3.5 Results of the Conducted Spurious Emissions Measurement

Channel	Frequency	Attenuation below f_c
Low	1.833 GHz	57.1
Mid	1,842 GHz	56.7
High	1.854 GHz	57.1

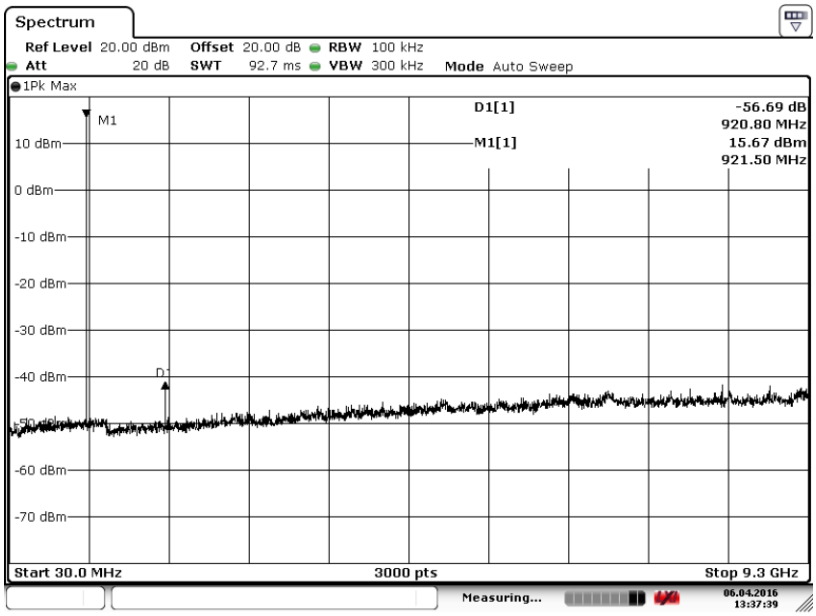
Measurement uncertainty	+0.6/-0.6 dB

3.3.6 Plots of the Conducted Spurious Measurements

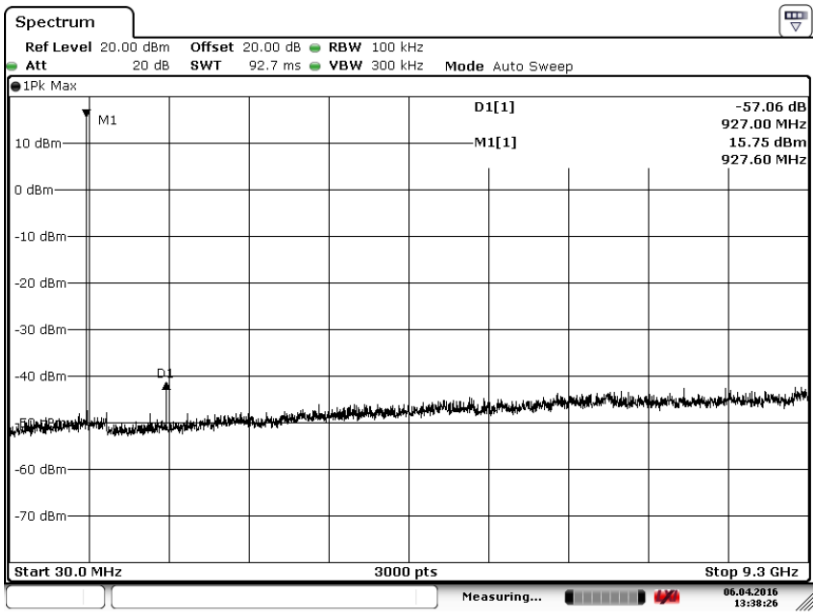
Conducted Spurious Emissions 30 -9300 MHz (Low Channel)



Conducted Spurious Emissions 30 -9300 MHz (Mid Channel)



Conducted Spurious Emissions 30 - 9300 MHz (High Channel)



3.4 Conducted band edge measurements

3.4.1 Limit

At the band edge of the authorized band, the level of the emission shall be at least 20 dB below the peak of the in-band emission, based on either a RF conducted or a radiated measurement.

3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.4.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.4.4 Test procedure

According to KDB Publication 558074 V02r02, sections 11.3 and 12.1

3.4.5 Test results of Conducted Band Edges Measurements

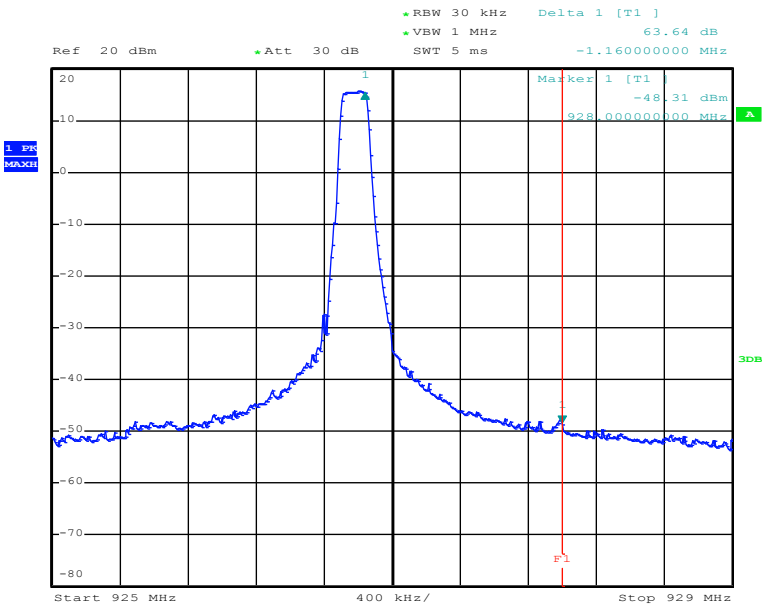
Band edge

Technology Std.	Channels	Frequency (MHz)	Data rate	N dB down (dB)	Limit (dB)
Proprietary RF	High	926.8	0.24 – 37.5 kbps	N = 63.6	≥ 20
	--	--	--	--	--
Uncertainty	±0.63 dB				

Note: the lower band edge is not measured since the lowest channel (917 MHz) is 15 MHz away (902 MHz).

3.4.6 Plot of the conducted band edge measurement

Conducted higher band edge (high Channel)



3.5 Tx Radiated Emissions Measurement

3.5.1 Limit

According to FCC part 15.209(a)

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance(m)
30 -88	100	40	3
88 - 216	150	43,5	3
216-960	200	46	3
Above 960	500	54	3

3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.5.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

3.5.4 Test procedure

According to KDB Publication 558074 V02r02, section 12.1

3.5.5 Test results of the Tx radiated Emissions Measurement

Channel	Frequency	Polarization	Height	Peak
Low	7,336 GHz	Vertical	4 m	52,2 dBµV/m
Low	1,833 GHz	Vertical	3,5 m	41,8 dBµV/m
Mid	7,374 GHz	Vertical	3 m	47,1 dBµV/m
Mid	1,844 GHz	Vertical	4 m	42,9 dBµV/m
High	1,89 GHz	Vertical	2 m	33,9 dBµV/m
High	1,852 GHz	Vertical	4 m	41,4 dBµV/m

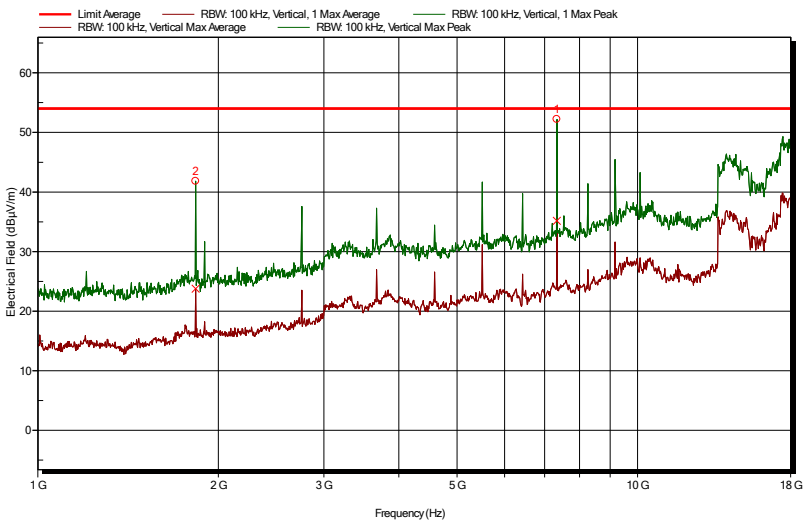
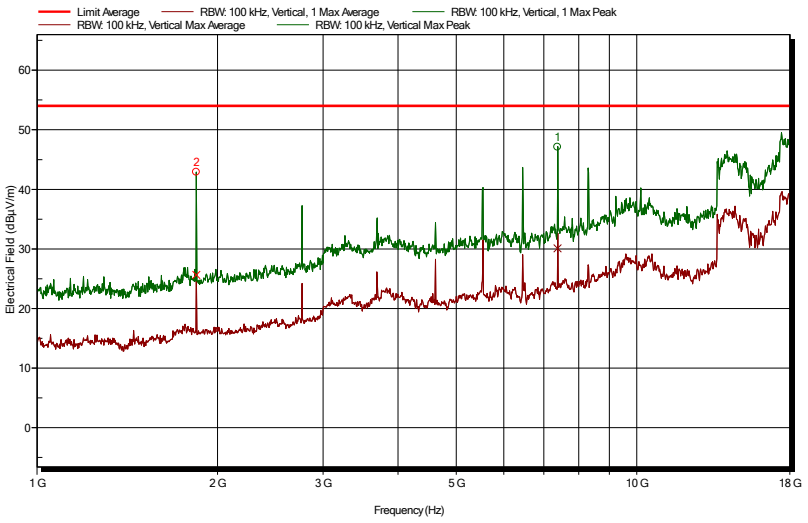
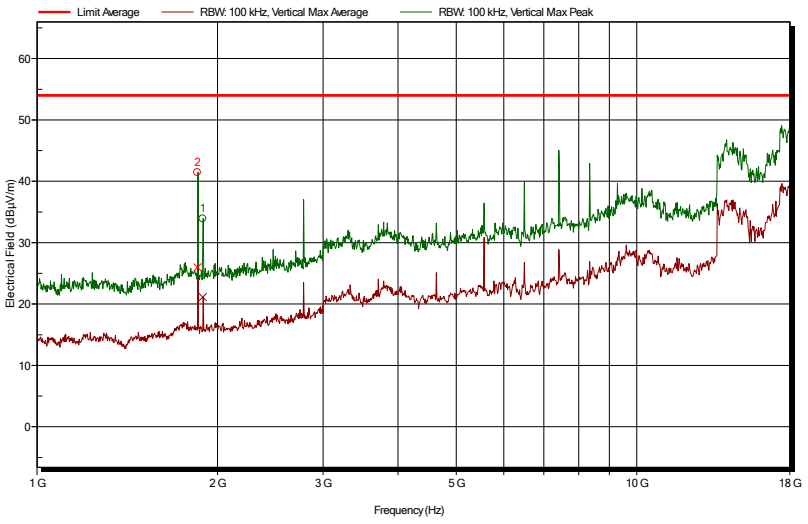
Channel	Frequency	Polarization	Height	Peak
Low	1,833 GHz	Horizontal	3 m	43,1 dBµV/m
Low	7,336 GHz	Horizontal	3,5 m	49,2 dBµV/m
Mid	1,844 GHz	Horizontal	2,5 m	44,2 dBµV/m
High	1,852 GHz	Horizontal	4 m	44,5 dBµV/m

Measurement uncertainty

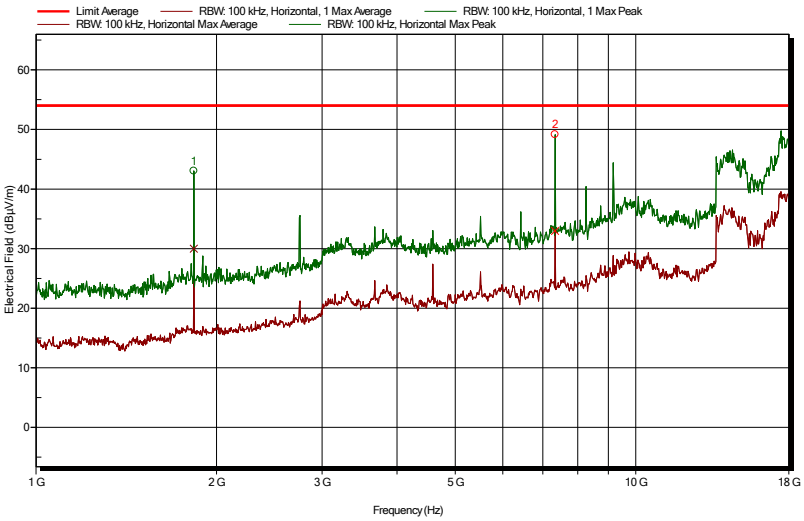
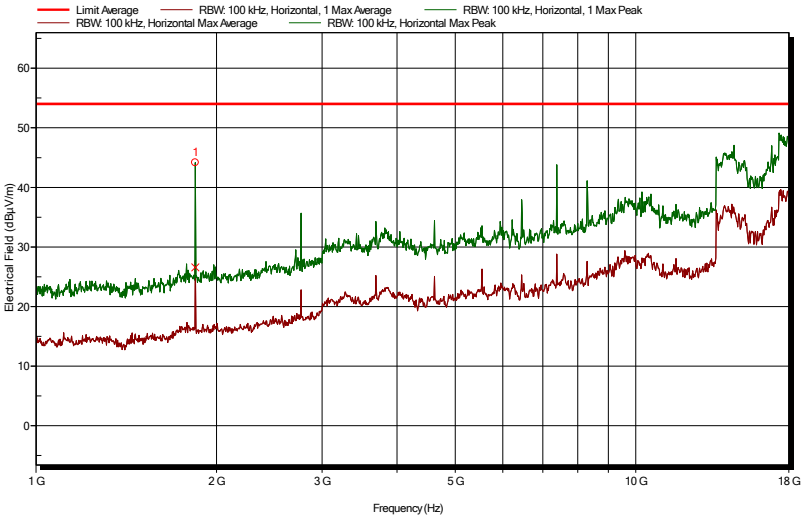
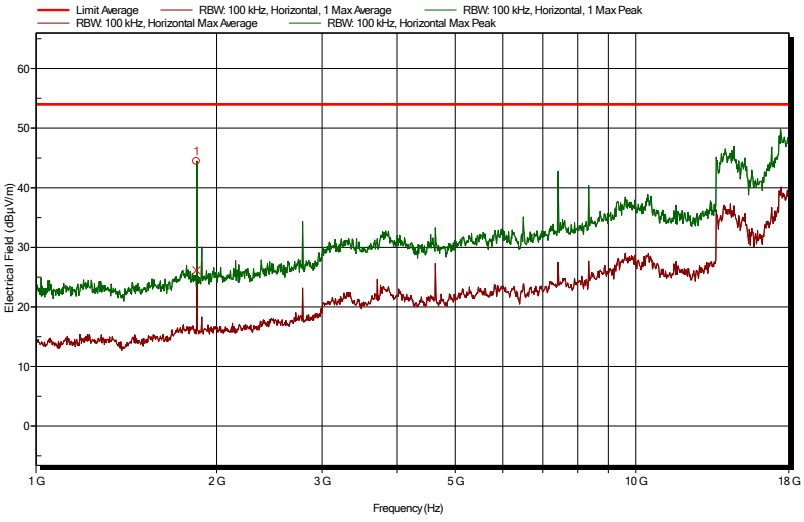
Frequency range (MHz)	Horizontal polarization	Vertical polarization
30 – 200	4.5 dB	5.4 dB
200 – 1000	3.6 dB	4.6 dB
1000 - 18000	5.7 dB	5.7 dB

3.5.6 Plots of the Tx Radiated Emissions Measurement (1 -18 GHz)

Vertical polarization

Low ch	
Mid ch	
High ch	

Horizontal polarization

Low ch	
Mid ch	
High ch	

3.6 Radiated Emissions Measurements acc. to 15.109(a)

3.6.1 Limit

According to FCC part 15.109(a)

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance(m)
30 -88	100	40	3
88 - 216	150	43,5	3
216-960	200	46	3
Above 960	500	54	3

3.6.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.6.3 Test setup

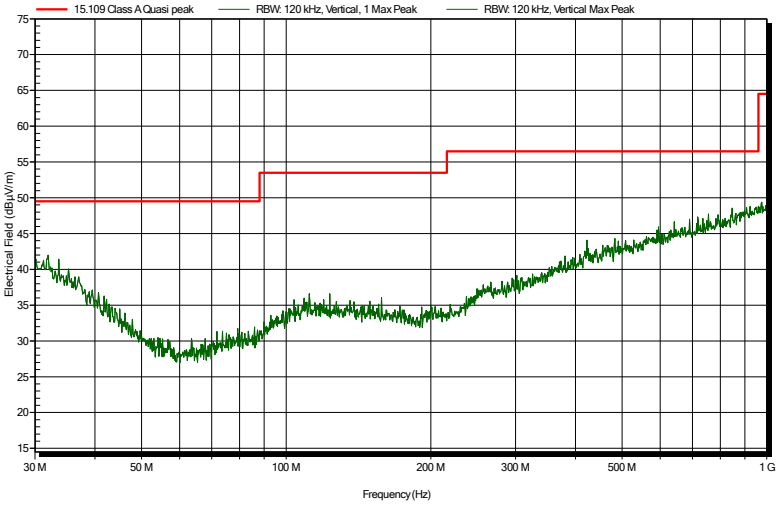
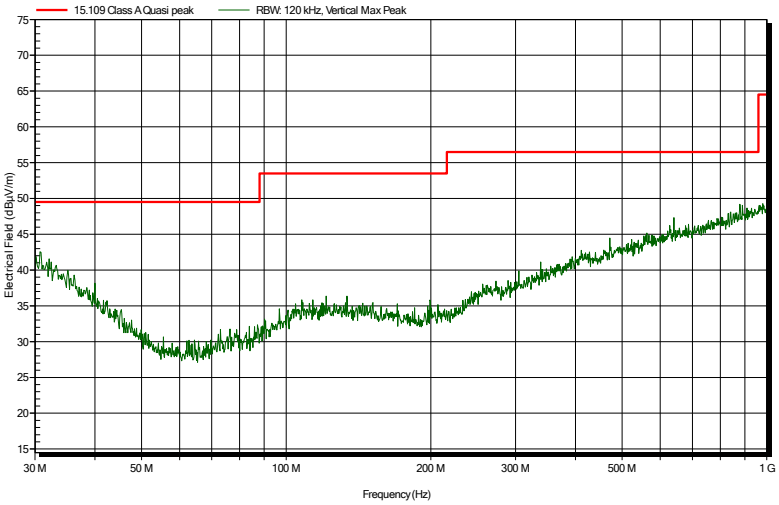
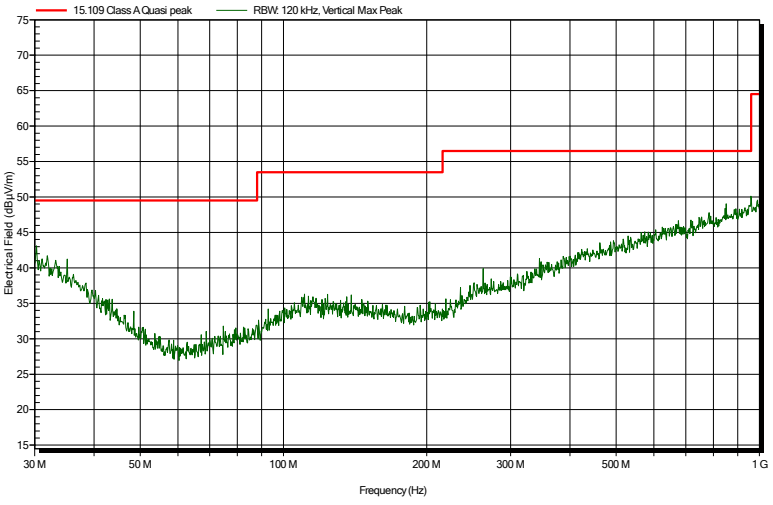
The test setup is as shown in chapter 2.4 of this report.

3.6.4 Test procedure

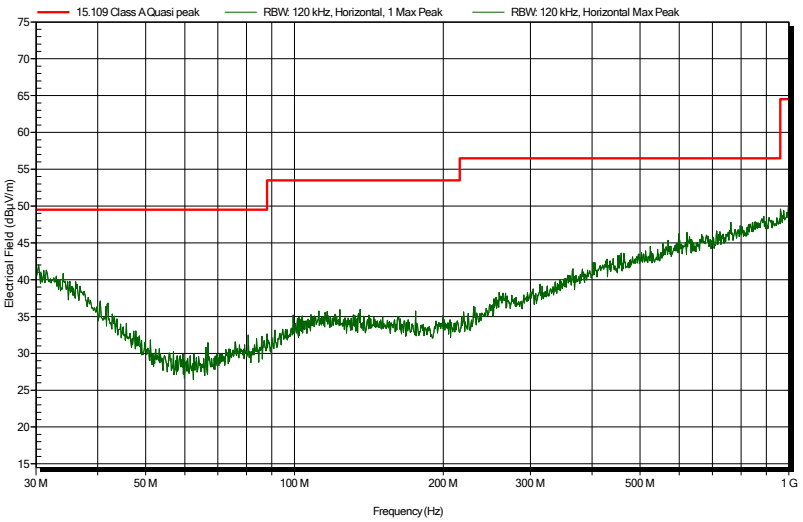
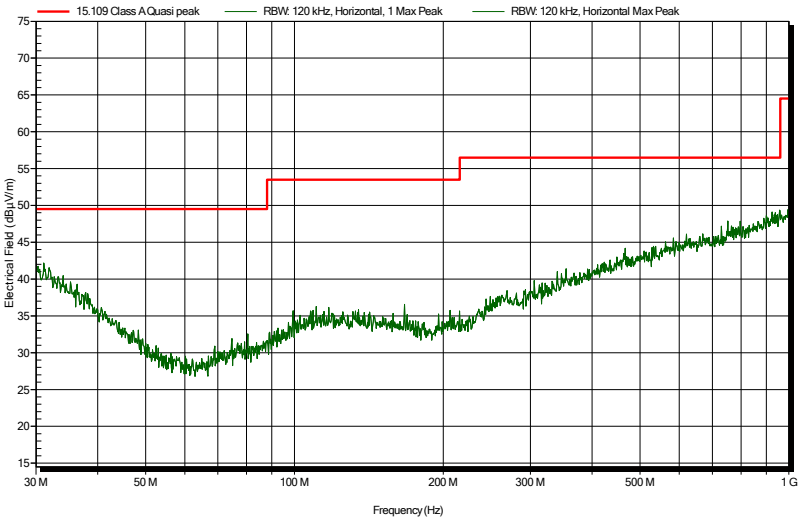
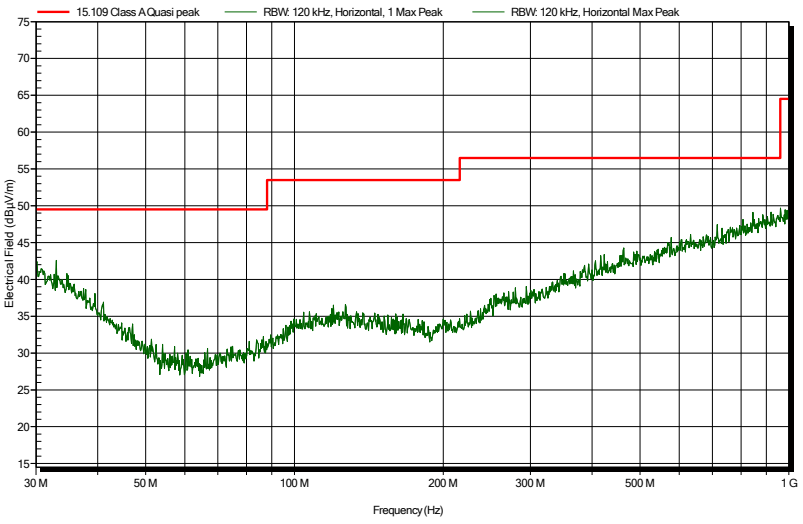
According to ANSI C63.4: 2014, section 8.3

3.6.5 Plots of the Rx Radiated Emissions Measurement (0.03 – 1 GHz)

Vertical polarization

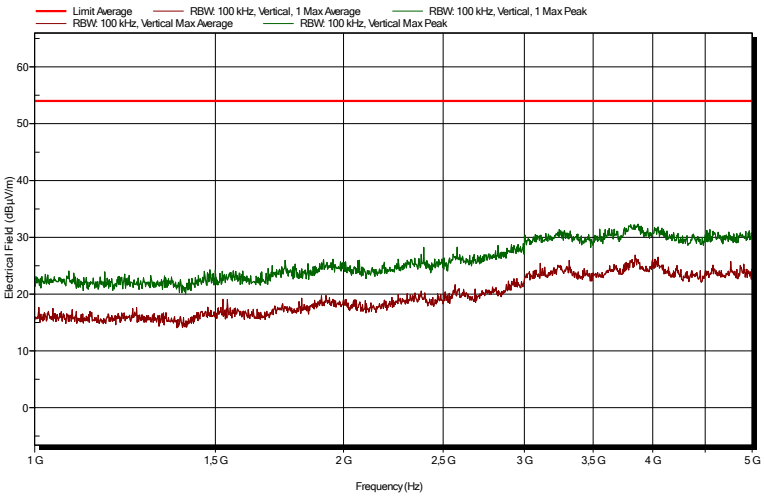
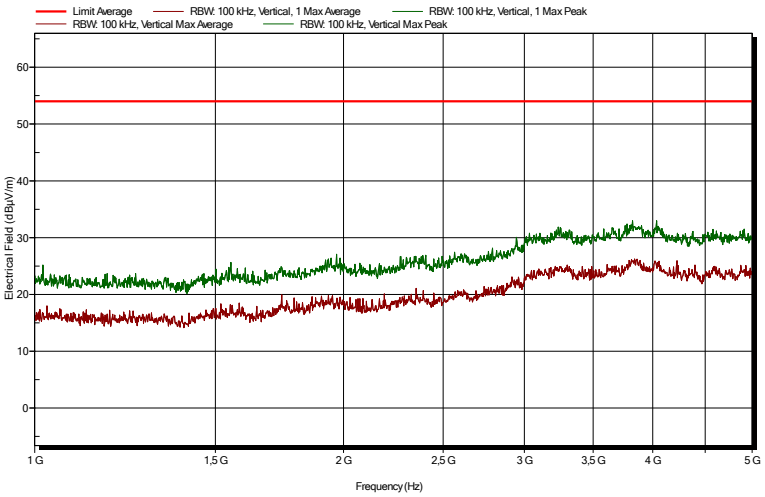
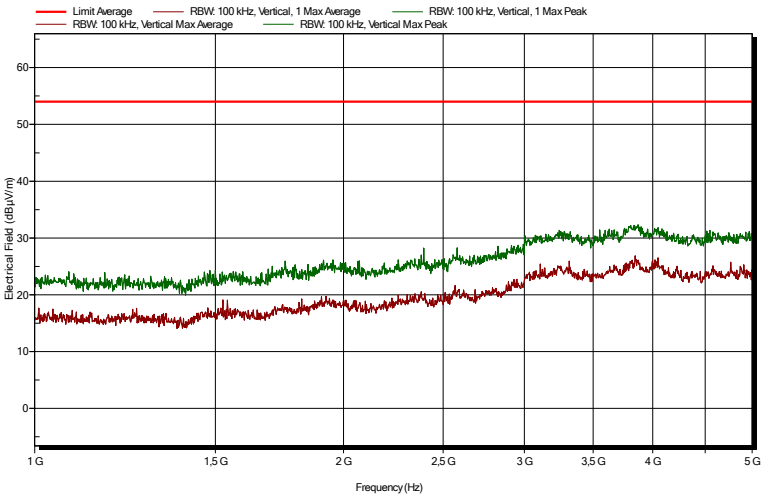
Low ch	
Mid ch	
High ch	

Horizontal polarization

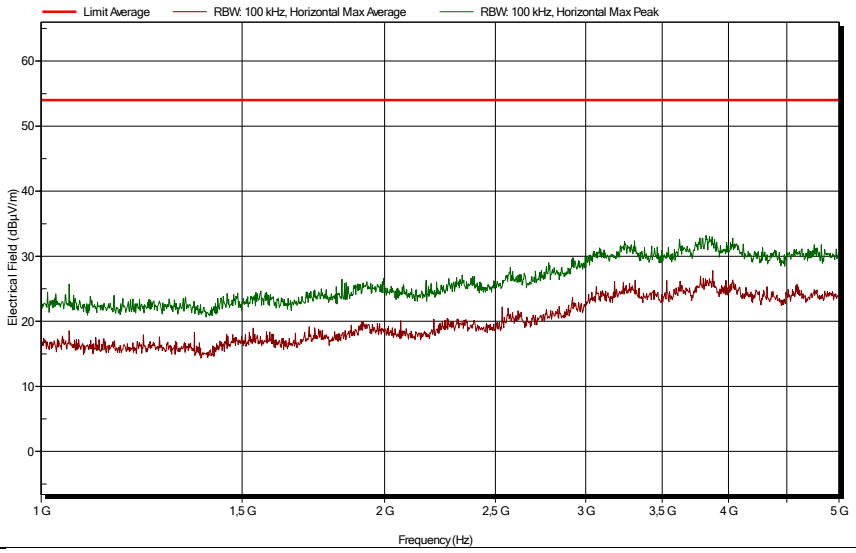
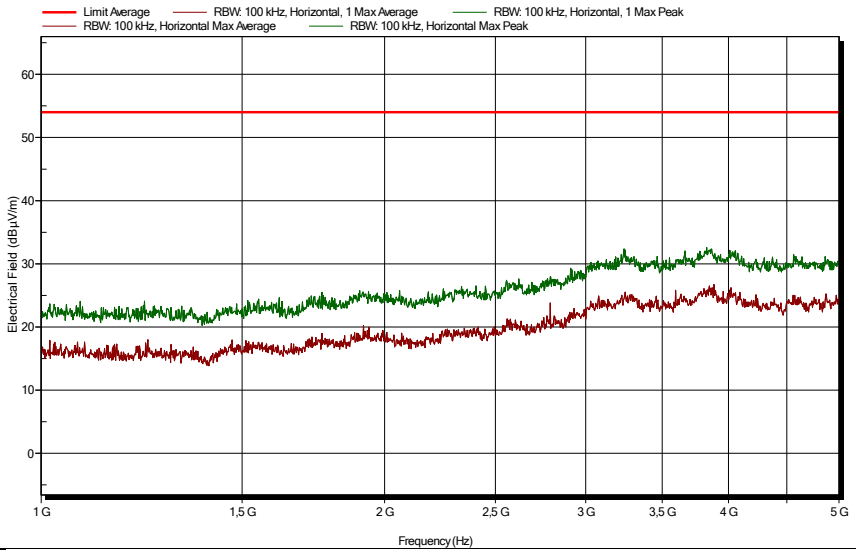
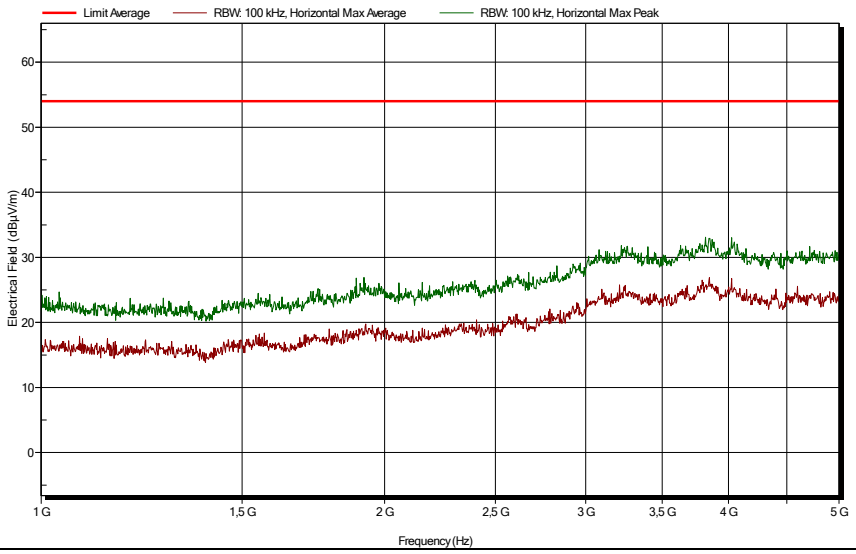
Low ch	
Mid ch	
High ch	

3.6.6 Plots of the Rx Radiated Emissions Measurement (1 – 5 GHz)

Vertical polarization

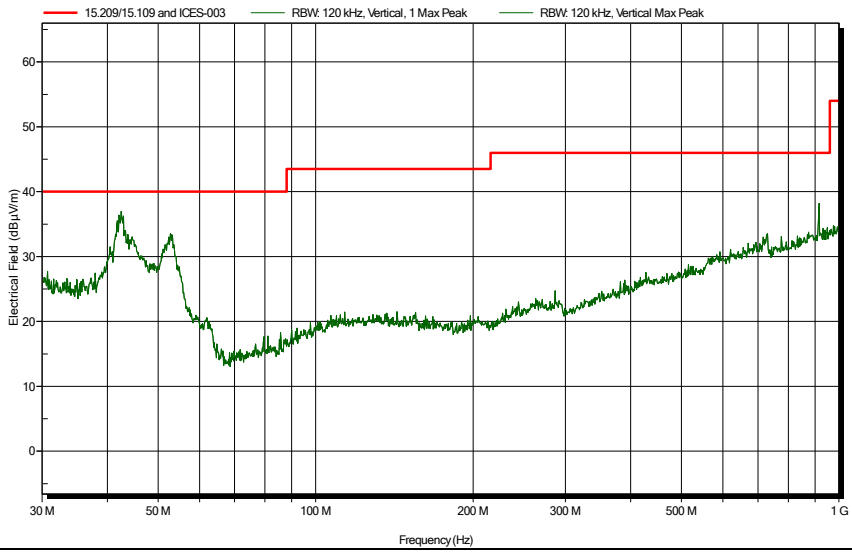
Low ch	
Mid ch	
High ch	

Horizontal polarization

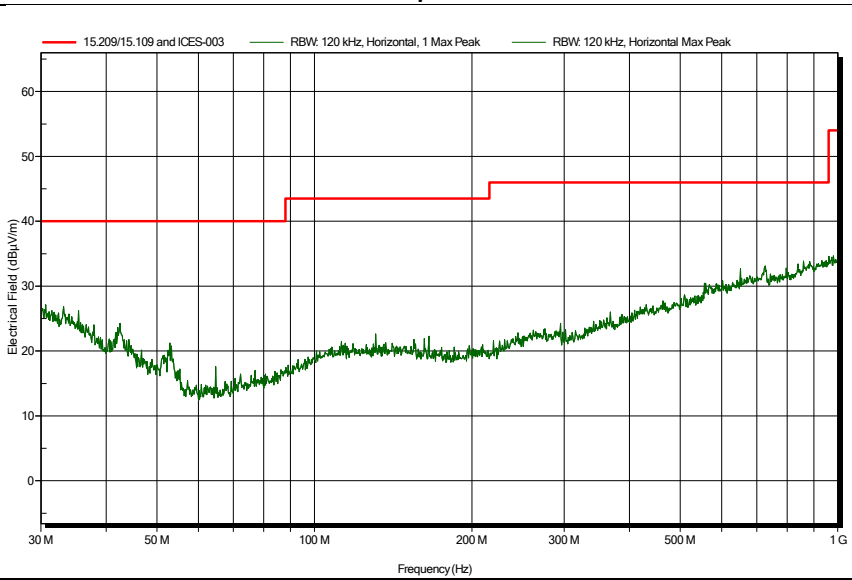
Low ch	
Mid ch	
High ch	

3.6.7 Plots of Radiated Emissions Measurement (Data communication mode)

Vertical polarization

0.03 – 1 GHz	

Horizontal polarization

0.03 - 1 GHz	

Measurement uncertainty

Frequency range (MHz)	Horizontal polarization	Vertical polarization
30 – 200	4.5 dB	5.4 dB
200 – 1000	3.6 dB	4.6 dB
1000 - 18000	5.7 dB	5.7 dB