

FCC and IC Test Report for Part 15.225, Part 15B and RSS 210

Product name	SC2MCSIO RFID
Applicant	Prodrive Technologies
FCC ID	Y2ISC2MCSIO
IC ID	9389A-SC2MCSIO

Test report No. : 161100218 05 Ver 2.00

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

The Industry Canada registration number for the 3 meter test chamber of Telefication is: 4173A-1.

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. +31889983600 Fax. +31316583189
Test Site FCC	NL0001

Revision History

Version	Date	Remarks	By
v0.50	13-12-2016	First draft	RvB
V1.00	16-02-2017	Release version	RvB
V2.00	13-03-2017	Changed FCC and ISED id	RvB

Table of Contents

Revision History	3
Summary of Test results.....	6
1 General Description.....	7
1.1 Applicant.....	7
1.2 Manufacturer	7
1.3 Tested Equipment Under Test (EUT)	7
1.4 Product specifications of Equipment under test	8
1.5 Modification of the Equipment Under Test (EUT).....	8
1.6 Environmental conditions.....	8
1.7 Measurement standards	8
1.8 Applicable standards	8
1.9 Observation and remarks	8
1.10 Conclusions.....	9
2 Test configuration of the Equipment Under Test	10
2.1 Test mode	10
2.2 Radiated Test setup	10
2.3 Equipment used in the test configuration	11
2.4 Sample calculations	11
3 Test results.....	12
3.1 Field strength of emissions.....	12
3.1.1 Limit.....	12
3.1.2 Measurement instruments	12
3.1.3 Test setup.....	12
3.1.4 Test procedure	12
3.1.5 Test results of Field strength of emissions.....	12
3.1.6 Plots of Field strength of emissions Measurement.....	13
3.2 99% Occupied Bandwidth.....	14
3.2.1 Limit.....	14
3.2.2 Measurement instruments	14
3.2.3 Test setup.....	14
3.2.4 Test procedure	14
3.2.5 Test results of the 99% Occupied Bandwidth Measurement.....	14
3.2.6 Plot of the 99% Occupied Bandwidth Measurement	15
3.3 Frequency Tolerance	16
3.3.1 Limit.....	16
3.3.2 Measurement instruments	16
3.3.3 Test setup.....	16

3.3.4	Test procedure	16
3.3.5	Test results of Frequency Tolerance Measurements	16
3.3.6	Measurement Uncertainty	16
3.4	Radiated Spurious Emissions	17
3.4.1	Limit	17
3.4.2	Measurement instruments	17
3.4.3	Test setup	17
3.4.4	Test procedure	17
3.4.5	Measurement Uncertainty	17
3.4.6	Plots of the Radiated Spurious Emissions Measurement	18

Summary of Test results

FCC	IC	Description	Paragraph	Verdict
15.225(a),(b),(c)	RSS-210 A2.6(a),(b),(c)	Field strength of emissions	3.1	Pass
--	RSS-GEN 4.6.1	99% Bandwidth	3.2	Pass
15.225(e)	RSS-210 A2.6(e)	Frequency Tolerance	3.3	Pass
15.225(d)/15.209	RSS-210 A2.6(d)	Radiated Spurious Emissions	3.4	Pass

1 General Description

1.1 Applicant

Client name: Prodrive Technologies
Address: PO Box 28030, Eindhoven, Netherlands
Zip code: 5602 JA
Telephone: 63 17 76 330
E-mail: Bart.huijberts@prodrive-technologies.com
Contact name: Bart Huijberts

1.2 Manufacturer

Manufacturer name: Prodrive Technologies
Address: PO BOX 28030, Eindhoven, Netherlands
Zip code: 5602 JA
Telephone: +31402676222
E-mail: Mark.gijsbers@prodrive-technologies.com
Contact name: Mark Gijsbers

1.3 Tested Equipment Under Test (EUT)

Product name: SC2MCSIO RFID
Brand name: Prodrive Technologies
FCC ID: Y2ISC2MCSIO
IC ID: 9389A-SC2MCSIO
Model number: 9_9450 07 E
Software version: --
Hardware version: --
Date of receipt: 10-11-2016
Tests started: 01-12-2016
Testing ended: 02-12-2016

1.4 Product specifications of Equipment under test

Tx Frequency:	13.56 MHz
Rx frequency:	13.56 MHz
Antenna type and gain:	PCB loop Antenna
Type of modulation:	ASK
Emission designator	424KK1D

1.5 Modification of the Equipment Under Test (EUT)

None.

1.6 Environmental conditions

Test date	01-12-2016	02-12-2016
Ambient temperature	21.4°C	22.3°C
Humidity	34.1%	35.6%

1.7 Measurement standards

- ANSI C63.4:2014
- ANSI C63.10:2013

1.8 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 §15.225.
- FCC Part 15 Subpart B §15.109.
- RSS-210, issue 9, RSS-GEN Issue 4.

1.9 Observation and remarks

None.

1.10 Conclusions

The sample of the product showed NO NON-COMPLIANCES to the specifications stated in paragraph 1.8 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 1.8 "*Applicable standards*".

All conducted tests are performed by:

Name : ing R. van Barneveld

Review of test methods and report by:

Name : ing. P.A. Suringa

The above conclusions have been verified by the following signatory:

Date : 18-04-2017

Name : ing. K.A. Roes

Function : Coordinator Radio Laboratory

Signature :



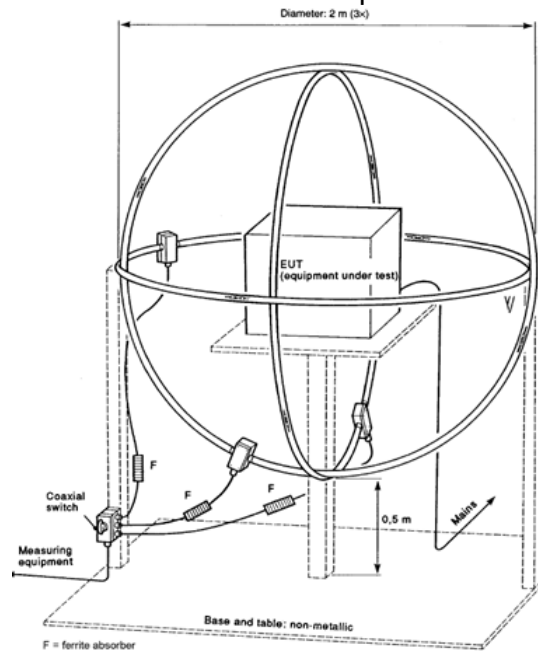
2 Test configuration of the Equipment Under Test

2.1 Test mode

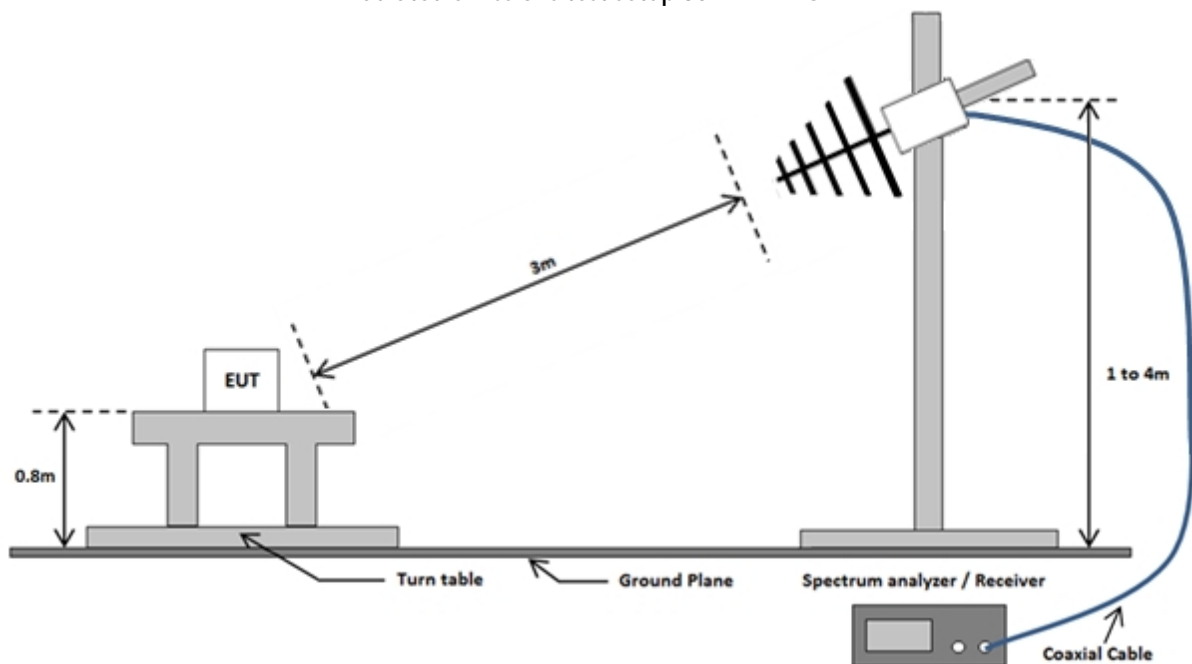
The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT to transmit continuously.

2.2 Radiated Test setup

Radiated emissions test setup below 30 MHz



Radiated emissions test setup 30 MHz - 1 GHz



2.3 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Spectrum Analyzer	Rohde & Schwarz	ESR7	TE01220	3.1 to 3.5
Climate Chamber	TE 00741	CTS	-40/350	3.3, 3.4
Biconilog Antenna	Chase	CBL6112a	TE00967	3.3, 3.5
SAC Chamber	Comtest Engineering BV	-	TE00861	3.3, 3.5
Triple loop antenna	Schwarzbeck	HXYZ 9170	TE01311	3.1, 3.2

2.4 Sample calculations

Field Strength calculation example:

Frequency (MHz)	Polarization	Height(m)	Quasi-Peak (dB μ V/m)
33	Vertical	1	38,5

The following relation applies:

$$E \text{ (dB}\mu\text{V/m)} = U \text{ (dB}\mu\text{V)} + AF \text{ (dB/m)} + CL \text{ (dB)}$$

Where:

E = Electric field strength

U = Measuring receiver voltage

AF = Antenna factor

CL = Cable loss

$$(38.5 = 19.48 + 18.3 + 0.72)$$

3 Test results

3.1 Field strength of emissions

3.1.1 Limit

15.225(a)

For The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

15.225(b)

Within the band 13.410 – 13.553 MHz and 13.567 – 13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

15.225(c)

Within the band 13.110 – 13.410 MHz and 13.710 – 14.010 MHz, the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

Frequency (MHz)	$\mu\text{V}/\text{m}$ at 30 meter	$\text{dB}\mu\text{V}/\text{m}$ at 30 meter	$\text{dB}\mu\text{V}/\text{m}$ at 3 meter
13.553 – 13.567	15,848	84	124
13.410 – 13.553 and 13.567 – 13.710	334	50.5	90.5
13.110 – 13.410 and 13.710 - 14.010	106	40.5	80.5

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

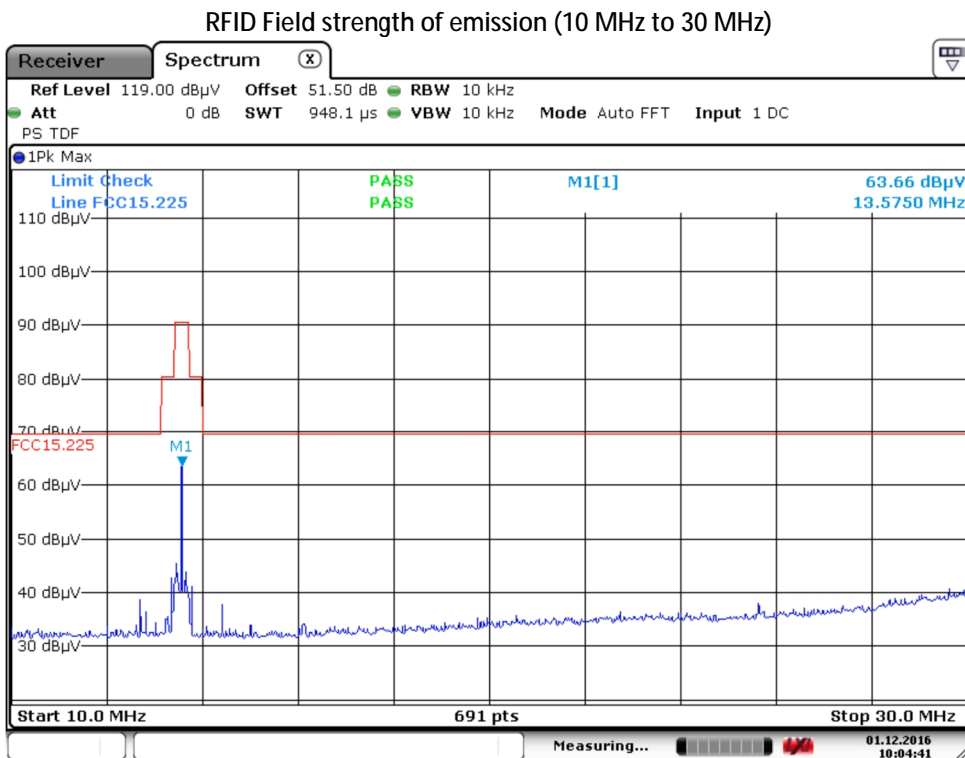
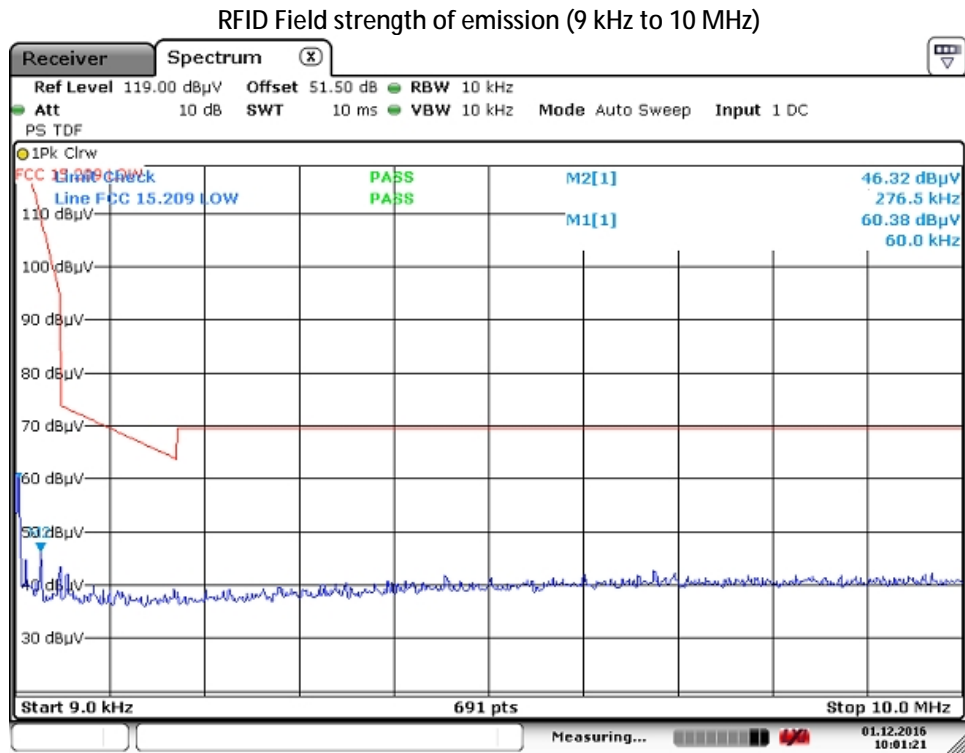
3.1.4 Test procedure

According to ANSI C63.4-2014, section 5.3 and 8.2.1

3.1.5 Test results of Field strength of emissions

Technology Std.	Frequency (MHz)	Max Field strength at 3m ($\text{dB}\mu\text{V}/\text{m}$)
RFID	13.56	63.69
Uncertainty	+3.0 / -2.5 dB	

3.1.6 Plots of Field strength of emissions Measurement



Remark: in the plot the limit is modified for an inverse linear distance extrapolation factor of 40 dB/decade.

3.2 99% Occupied Bandwidth

3.2.1 Limit

According to RSS-Gen 6.6

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

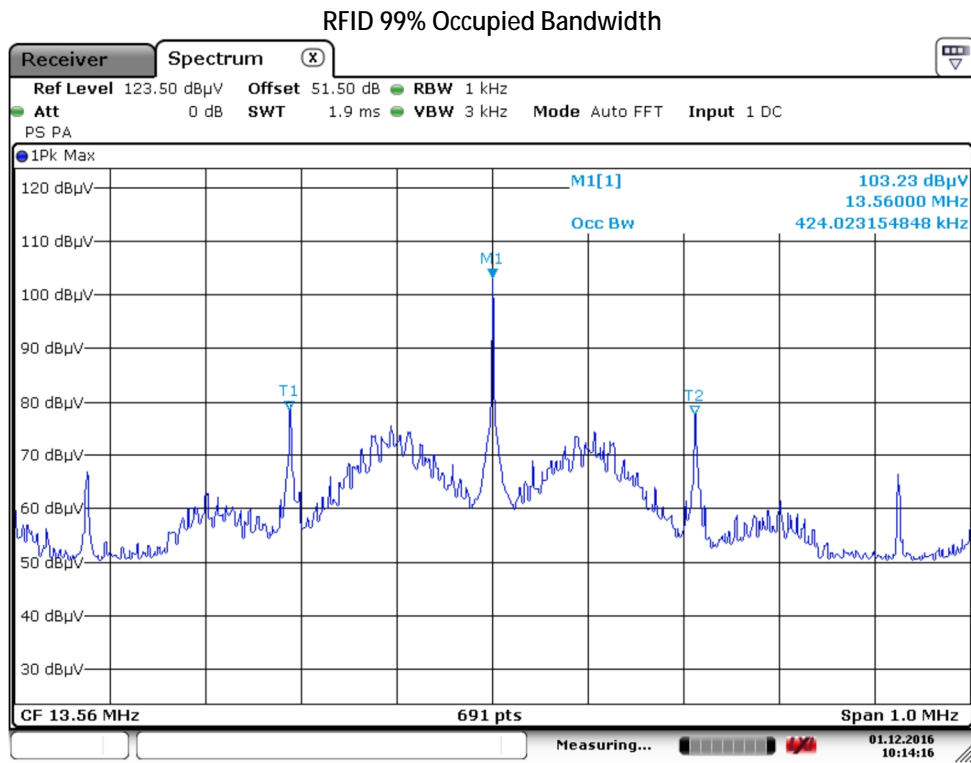
3.2.4 Test procedure

- 1 Set the centre frequency to the nominal EUT channel centre frequency.
- 2 Set span = 1.5 times to 0.5 times the Occupied Bandwidth.
- 3 Set VBW $\geq 3 \times$ RBW.
- 4 Video averaging is not permitted. Where practical detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode(until the trace stabilizes) shall be used.

3.2.5 Test results of the 99% Occupied Bandwidth Measurement

Technology Std.	Frequency (MHz)	99% Occupied Bandwidth (kHz)
RFID	13.56	424
Uncertainty		± 1 kHz

3.2.6 Plot of the 99% Occupied Bandwidth Measurement



3.3 Frequency Tolerance

3.3.1 Limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.3.3 Test setup

The test has been performed in a climatic chamber using a test fixture

3.3.4 Test procedure

According to ANSI C63.10-2013, section 6.8

3.3.5 Test results of Frequency Tolerance Measurements

Temperature variation:

Temp. (°C)	-20	-10	0	10	20	30	40	50
Frequency (MHz)	13.560	13.560	13.560	13.560	13.560	13.560	13.560	13.560
Frequency At start-up	13.56017	13.56017	13.56025	13.56025	13.56025	13.56025	13.56025	13.56025
After 2 min	13.56017	13.56017	13.56025	13.56025	13.56017	13.56017	13.56017	13.56017
After 5 min	13.56017	13.56017	13.56025	13.56025	13.56017	13.56017	13.56017	13.56017
After 10 min	13.56017	13.56017	13.56025	13.56025	13.56017	13.56017	13.56017	13.56025
Deviation (%)*)	0.0013	0.0013	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018
Limit (%)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

*) w.r.t. nominal frequency of 13.560 MHz

Voltage variation:

Voltage	Frequency (MHz)	Deviation (%)*)	Limit (%)
19.68 V	13.56016	0.0013	0.01
24 V	13.56016	0.0013	0.01
27.6 V	13.56016	0.0013	0.01

*) w.r.t. nominal frequency of 13.560 MHz

3.3.6 Measurement Uncertainty

Measurement uncertainty = ± 16 Hz

3.4 Radiated Spurious Emissions

3.4.1 Limit

15.225(d)

The field strength of any emissions appearing outside of the 13.110 -14.010 MHz band shall not exceed the general radiated emission limits in part 15.209.

15.209(a)

Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Field strength ($\text{dB}\mu\text{V}/\text{m}$)	Measurement distance(m)
30 -88	100	40	3
88 - 216	150	43,5	3
216-960	200	46	3
Above 960	500	54	3

3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.4.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.4.4 Test procedure

According to ANSI C63.4-2014, section 8.3 and ANSI C63.10-2013

3.4.5 Measurement Uncertainty

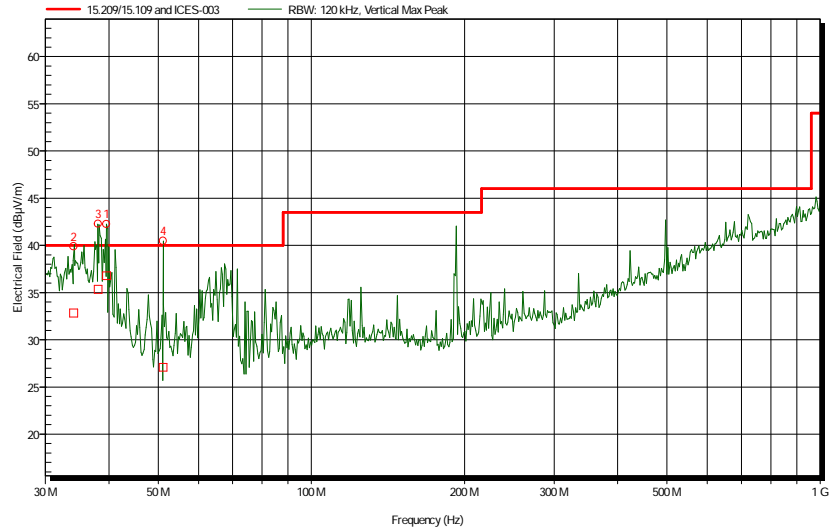
Measurement uncertainty Radiated emissions below 1 GHz

Horizontal polarization	
30 – 200 MHz	4.5 dB
200 – 1000 MHz	3.6 dB
Vertical polarization	
30 – 200 MHz	5.4 dB
200 – 1000 MHz	4.6 dB

3.4.6 Plots of the Radiated Spurious Emissions Measurement

30 -1000 MHz

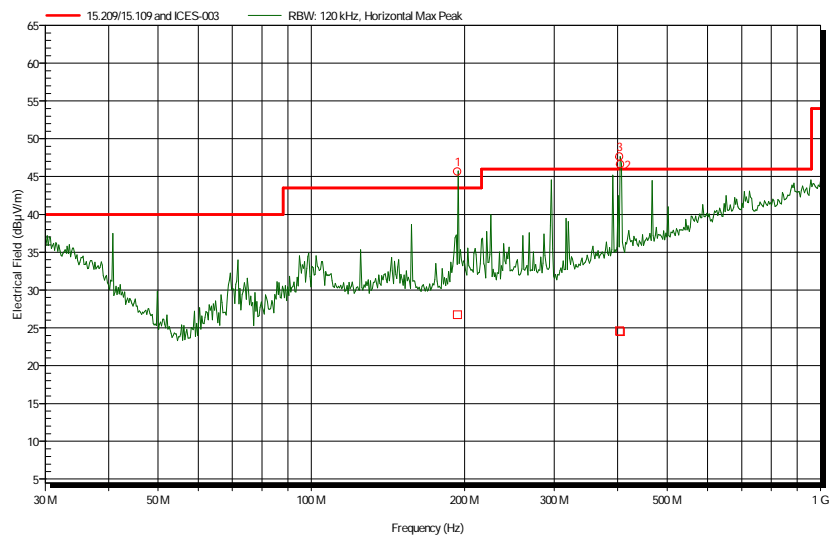
Vertical polarization



Measured peaks Vertical 30 – 1000 MHz

Frequency (MHz)	Polarization	Height (m)	Quasi-Peak (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Margin (dB)
39,564	Vertical	1,5	36,8	40	-3,2
38,1	Vertical	1,5	35,4	40	-4,6
34,086	Vertical	1	32,8	40	-7,2
51,12	Vertical	1	27,1	40	-12,9

Horizontal polarization



Measured peaks Horizontal 30 – 1000 MHz

Frequency (MHz)	Polarization	Height (m)	Quasi-Peak (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Margin (dB)
193,68	Horizontal	1	26,7	43,5	-16,8
402,9	Horizontal	3	24,6	46	-21,4
404,7	Horizontal	3	24,5	46	-21,5