

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

Model number : WRMB
Applicant : SALTO Systems, S.L.
FCC ID : UKCWRMB
ISED ID : 10088A-WRMB

Test report No. : 160400933 007 Ver 1.00

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	19-07-2016	First draft	PS
v1.00	18-04-2017	Initial issue	PS

Table of Contents

Revision History	2
Summary of Test results.....	5
1 General Description.....	6
1.1 Applicant.....	6
1.2 Manufacturer	6
1.3 Tested Equipment Under Test (EUT)	6
1.4 Product specifications of Equipment under test	7
1.5 Modification of the Equipment Under Test (EUT).....	7
1.6 Environmental conditions.....	7
1.7 Measurement standards	7
1.8 Applicable standards	7
1.9 Observation and remarks	7
1.10 Conclusions.....	8
2 Test configuration of the Equipment Under Test	9
2.1 Test mode	9
2.2 Radiated Test setup	9
2.3 Equipment used in the test configuration	10
2.4 Sample calculations	10
3 Test results.....	11
3.1 Field strength of emissions.....	11
3.1.1 Limit.....	11
3.1.2 Measurement instruments	11
3.1.3 Test setup.....	11
3.1.4 Test procedure	11
3.1.5 Test results of Field strength of emissions.....	11
3.1.6 Plots of Field strength of emissions Measurement.....	12
3.2 99% Occupied Bandwidth.....	13
3.2.1 Limit.....	13
3.2.2 Measurement instruments	13
3.2.3 Test setup.....	13
3.2.4 Test procedure	13
3.2.5 Test results of the 99% Occupied Bandwidth Measurement.....	13
3.2.6 Plot of the 99% Occupied Bandwidth Measurement	14
3.3 Field Strength of Unwanted Emissions.....	15
3.3.1 Limit.....	15
3.3.2 Measurement instruments	15
3.3.3 Test setup.....	15

3.3.4	Test procedure	15
3.3.5	Plots of the Field strength of Unwanted Emissions Measurement	16
3.3.6	Measurement Uncertainty	17
3.4	Frequency Tolerance	18
3.4.1	Limit	18
3.4.2	Measurement instruments	18
3.4.3	Test setup	18
3.4.4	Test procedure	18
3.4.5	Test results of Frequency Tolerance Measurements	18
3.4.6	Measurement Uncertainty	18
3.5	Conducted Emissions	19
3.5.1	Limit	19
3.5.2	Measurement instruments	19
3.5.3	Test procedure	19
3.5.4	Test results	19
3.5.5	Measurement Uncertainty	19
3.5.6	Conducted Emissions at the host equipment (0.15 – 30 MHz)	20

Summary of Test results

FCC	IC	Description	Paragraph	Verdict
15.225(a),(b),(c)	RSS-210 Annex B.6(a),(b),(c) RSS-Gen § 8.9	Field strength of emissions	3.1	Pass
--	RSS-GEN § 6.6	99% Bandwidth	3.2	Pass
15.225(d)	RSS-210 Annex B.6(d)	Field strength of unwanted emissions	3.3	Pass
15.225(e)	RSS-210 Annex B.6	Frequency Tolerance	3.4	Pass
15.207 (c)	RSS-Gen § 8.8	Conducted emissions	3.5	Pass

1 General Description

1.1 Applicant

Client name: Salto systems, S.L.
Address: C/Arkotz 9 Pol. Lanbarre, Oiartzun
Zip code: 20180
Telephone: +34 943344550
E-mail: j.gutierrez@saltosystems.com
Contact name: J. Gutierrez

1.2 Manufacturer

Manufacturer name: Salto systems, S.L.
Address: C/Arkotz 9 Pol. Lanbarre, Oiartzun
Zip code: 20180
Telephone: +34 943344550
E-mail: j.gutierrez@saltosystems.com
Contact name: J. Gutierrez

1.3 Tested Equipment Under Test (EUT)

Product name: WRMB
Brand name: SALTO
Product type: BLE capable wall RFID card reader
FCC ID: UKCWRMB
IC ID: 10088A-WRMB
Model(s): WRMB
Software version: Special firmware for testing
Hardware version: --
Date of receipt: 18-05-2016
Tests started: 08-06-2016
Testing ended: 15-03-2017

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	440KK1D

1.5 Modification of the Equipment Under Test (EUT)

None.

1.6 Environmental conditions

Test date	8-6-2016	15-03-2017
Ambient temperature	25.6 °C	22 °C
Humidity	45.1 %RH	37.4 %RH

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 §15.107.
- 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. 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 : 19-4-2017

Name : ing. K.A. Roes

Function : Coordinator Radio Laboratory

Signature :



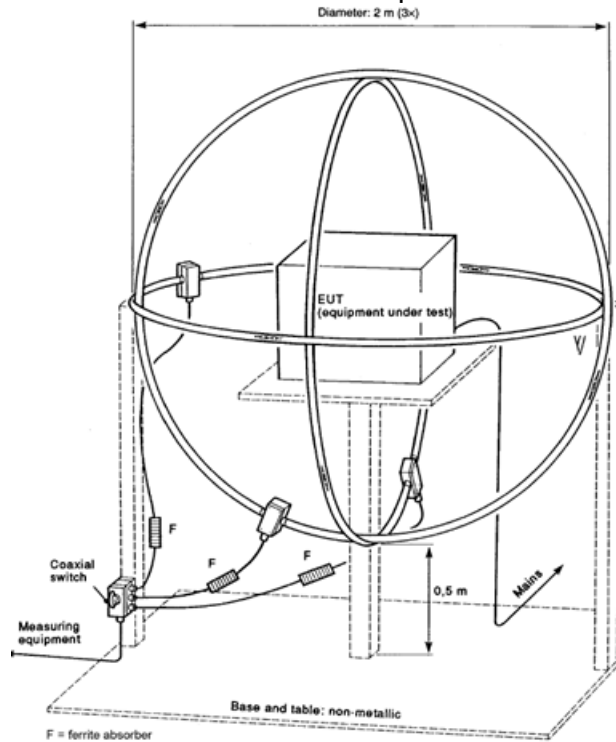
2 Test configuration of the Equipment Under Test

2.1 Test mode

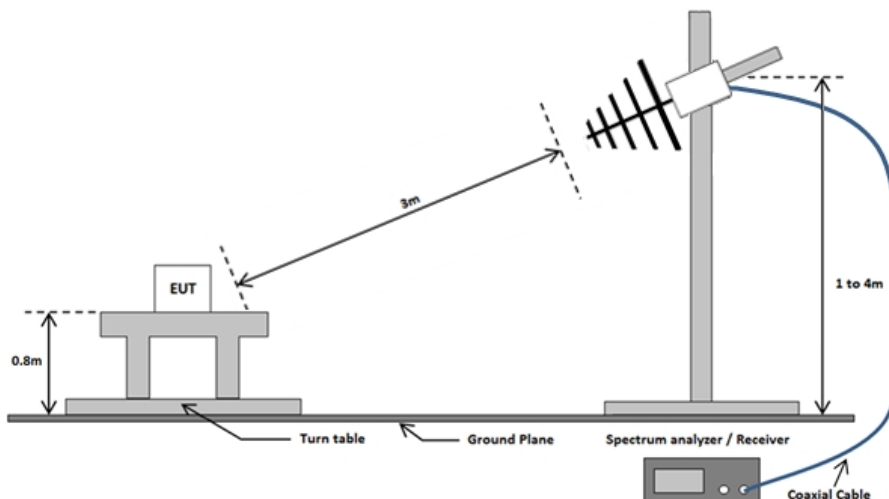
The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT to transmit continuously.

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 3.6
Climate Chamber	TE 00741	CTS	-40/350	3.3, 3.4
Biconilog Antenna	Chase	CBL6112a	TE00967	3.3, 3.5
Horn antenna	EMCO	3115	TE00531	3.5
Pre-amplifier	Miteq	AFS42-041001800-29-OP-42	TE11132	3.5
SAC Chamber	Comtest Engineering BV	-	TE00861	3.3, 3.5
Triple loop antenna	Schwarzbeck	HXYZ 9170	TE01311	3.1, 3.2
Artificial Mains network (AMN)	Rohde & Schwarz	ESH3-Z5	TE00208	3.6
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	TE00756	3.6

2.4 Sample calculations

Field Strength Measurement example(see chapter 3.3):

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)	$\mu\text{V/m}$ at 30 meter	$\text{dB}\mu\text{V/m}$ at 30 meter	$\text{dB}\mu\text{V/m}$ 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

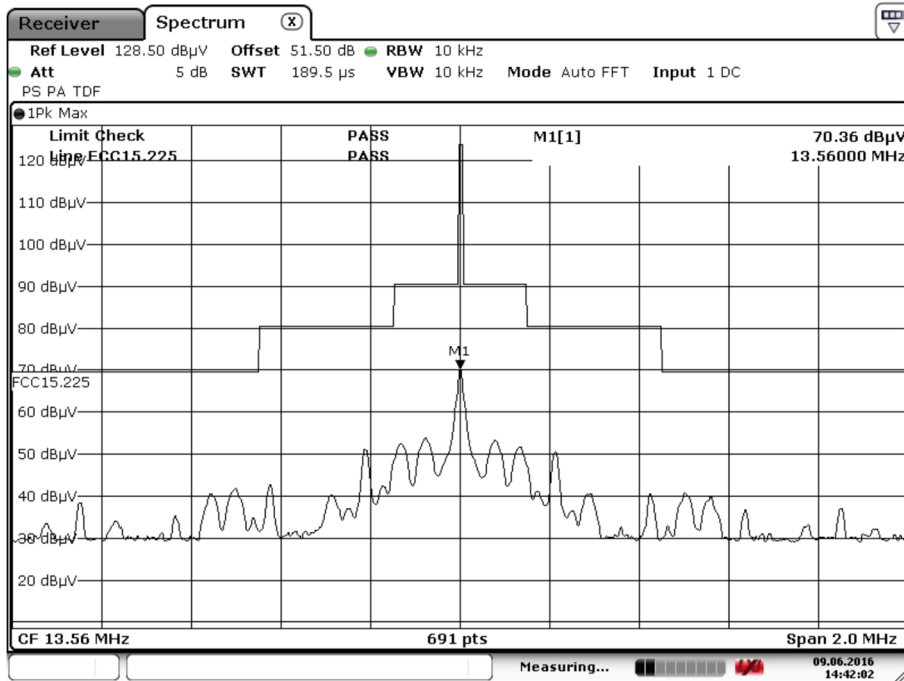
According to ANSI C63.4-2014, section 5.3 and 8.2.1

3.1.5 Test results of Field strength of emissions

Technology Std.	Frequency (MHz)	Max Field strength at 3m ($\text{dB}\mu\text{V/m}$)
NFC	13.56	70.36
Uncertainty	+3.0 / -2.5 dB	

3.1.6 Plots of Field strength of emissions Measurement

Field strength of emissions



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

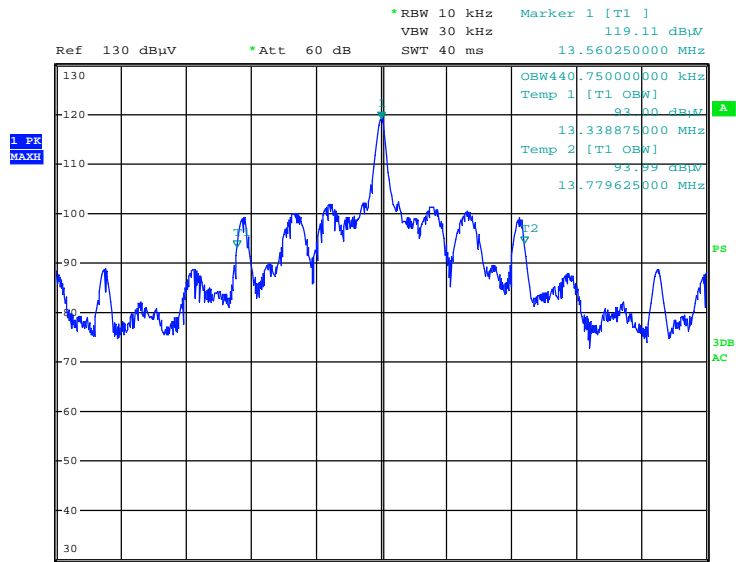
- 1 Set the centre frequency to the nominal EUT channel centre frequency.
- 2 Set span = 1.5 times to 0.5 times the Occupied Bandwidth.
- 3 Set VBW $\geq 3 \times$ RBW.
- 4 Video averaging is not permitted. Where practical detection and single sweep mode shall be used. Otherwise, peak detection and max 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	440.75 kHz
Uncertainty		± 1 kHz

3.2.6 Plot of the 99% Occupied Bandwidth Measurement

99% Occupied Bandwidth



3.3 Field Strength of Unwanted Emissions

3.3.1 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.

Frequency (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Field strength ($\text{dB}\mu\text{V}/\text{m}$)	Measurement distance(m)
0.009 – 0.49	$2400/f_{\text{kHz}}$	$80 + 67.6 - 20 \log f_{\text{kHz}}$	3 ^{*)}
0.49 – 1.705	$24000/f_{\text{kHz}}$	$40 + 87.6 - 20 \log f_{\text{kHz}}$	3 ^{*)}
1.705 - 30	30	69.5	3 ^{*)}
30 -88	100	40	3
88 - 216	150	43,5	3
216-960	200	46	3
Above 960	500	54	3

^{*)} the limits above are modified for an inverse linear distance extrapolation factor of 40 dB/decade in order to measure at a distance of 3 m.

3.3.2 Measurement instruments

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

3.3.3 Test setup

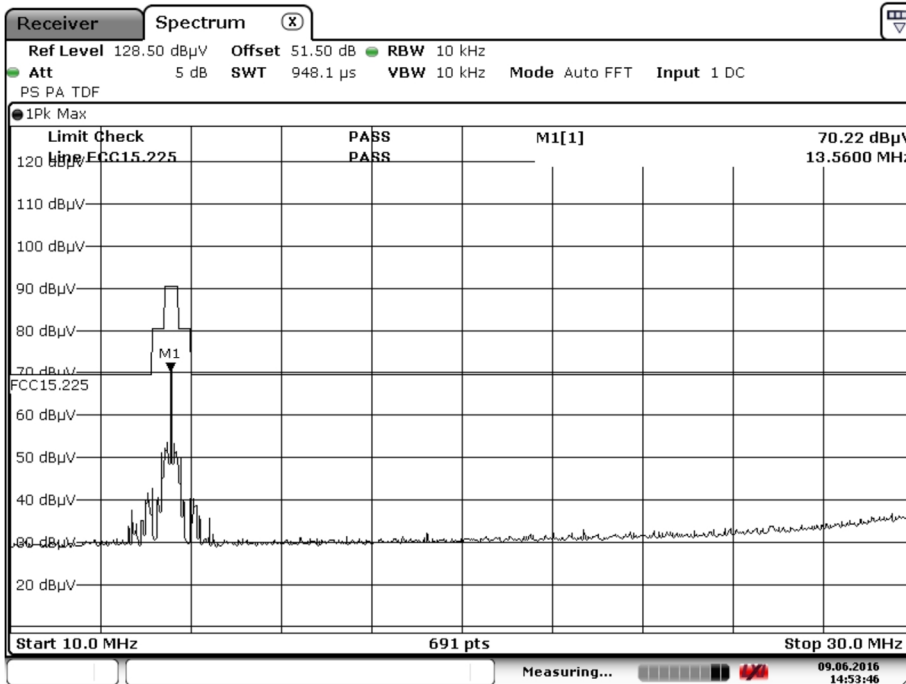
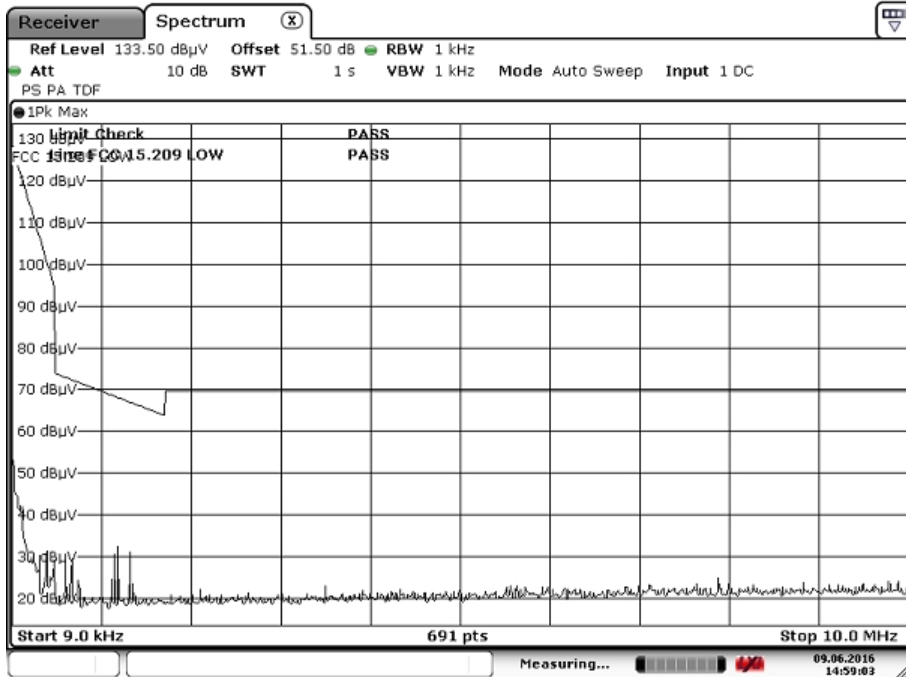
The test setup is as shown in chapter 2.2 of this report.

3.3.4 Test procedure

According to ANSI C63.4-2014, section 5.4.2 and 8.2.3

3.3.5 Plots of the Field strength of Unwanted Emissions Measurement

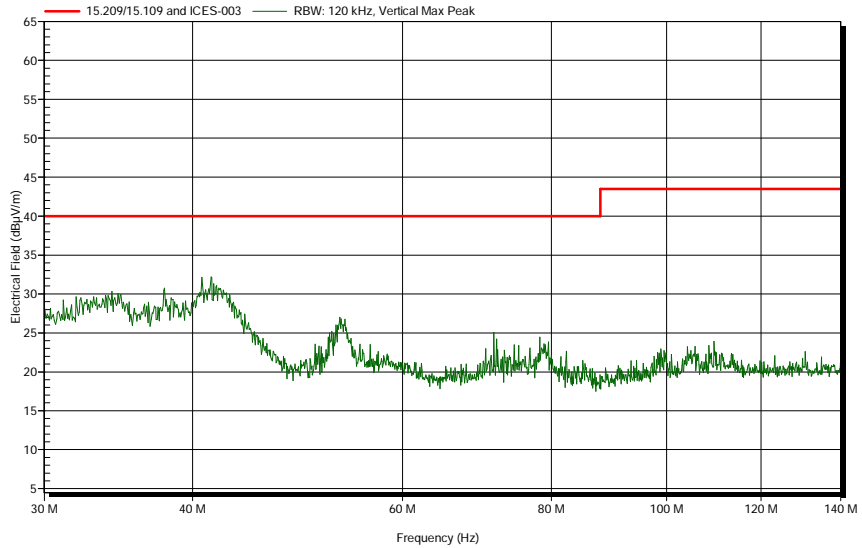
0.009 – 30 MHz



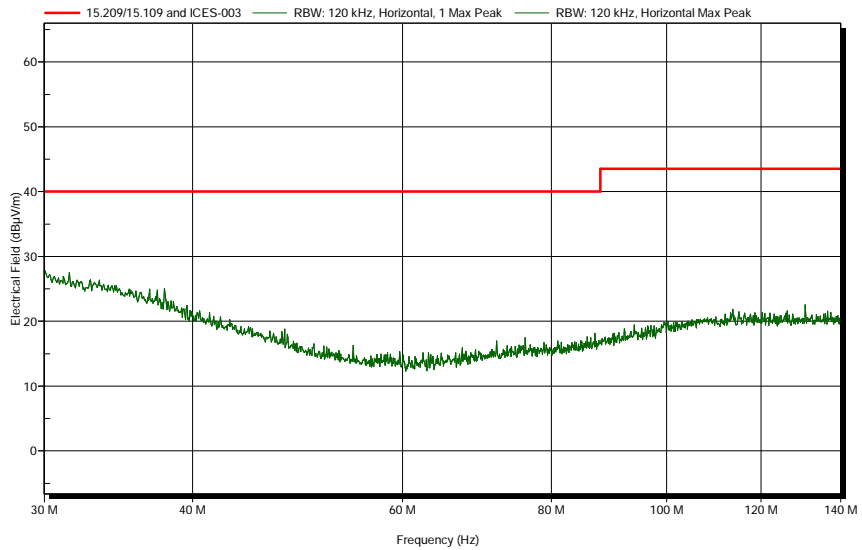
Remark: in the plot the limit is modified for an inverse linear distance extrapolation factor of 40 dB/decade.

30 - 140 MHz

Vertical polarization



Horizontal polarization



3.3.6 Measurement Uncertainty

Horizontal polarization	
30 – 200 MHz	4.5 dB
Vertical polarization	
30 – 200 MHz	5.4 dB

3.4 Frequency Tolerance

3.4.1 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.

3.4.2 Measurement instruments

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

3.4.3 Test setup

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

3.4.4 Test procedure

According to ANSI C63.10-2013, section 6.8

3.4.5 Test results of Frequency Tolerance Measurements

Temperature variation:

Temp. (°C)	-20	-10	0	10	20	30	40	50
Frequency (MHz) At start-up	13.5602	13.5602	13.5602	13.5602	13.5602	13.5601	13.5601	13.5600
After 2 min	13.5602	13.5602	13.5602	13.5602	13.5602	13.5601	13.5601	13.5600
After 5 min	13.5602	13.5602	13.5602	13.5602	13.5602	13.5601	13.5601	13.5600
After 10 min	13.5602	13.5602	13.5602	13.5602	13.5601	13.5601	13.5601	13.5600
Deviation (%)*)	0.0015	0.0015	0.0015	0.0015	0.0015	0.00075	0.00075	0
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 (V)	Frequency (MHz)	Deviation (%)*)	Limit (%)
93.5	13.5601	0.00075	0.01
110	13.5601	0.00075	0.01
126.5	13.5601	0.00075	0.01

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

3.4.6 Measurement Uncertainty

Measurement uncertainty = ± 16 Hz

3.5 Conducted Emissions

3.5.1 Limit

According to 15.207 (c)

3.5.2 Measurement instruments

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

3.5.3 Test procedure

For a device with a permanent or detachable antenna operating at or below 30 MHz, measurements are performed with a suitable dummy load in lieu of the antenna under the following conditions: (1) perform the AC power-line conducted tests with the antenna connected to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band; (2) retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network which simulates the antenna in the fundamental frequency band.

3.5.4 Test results

See next page

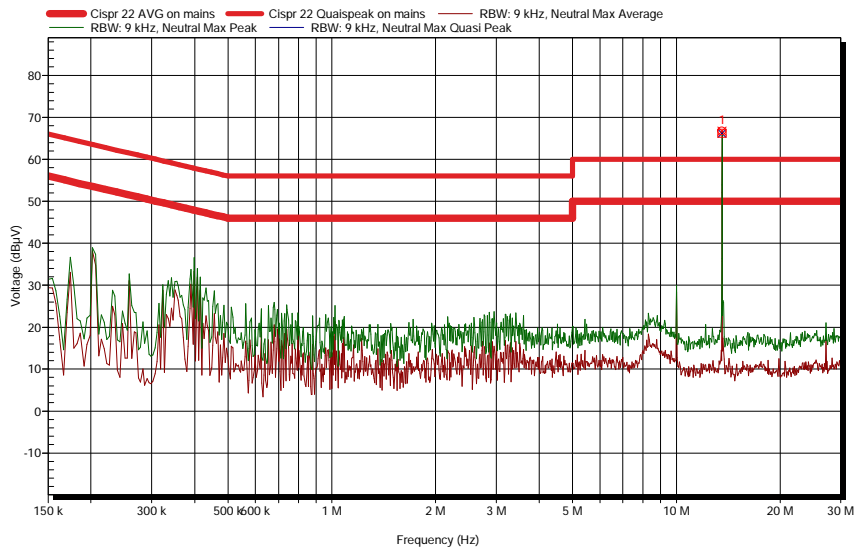
3.5.5 Measurement Uncertainty

Measurement uncertainty = + /- 3.6 dB.

3.5.6 Conducted Emissions at the host equipment (0.15 – 30 MHz)

- 1) Measurement outside the transmitter's fundamental emission band.

Neutral



Note: the EUT is connected to a host, which is AC powered.

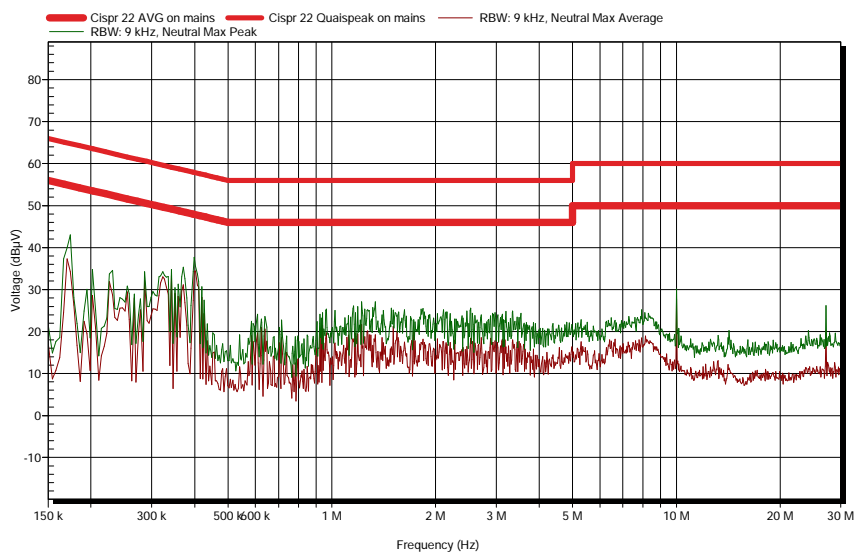
Measured peaks Average

Frequency	Average	Average Limit	Average Difference
13,56 MHz	66,7 dBµV	50 dBµV	16,7 dB

Measured peaks Quasi-peak

Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference
13,56 MHz	66,2 dBµV	60 dBµV	6,2 dB

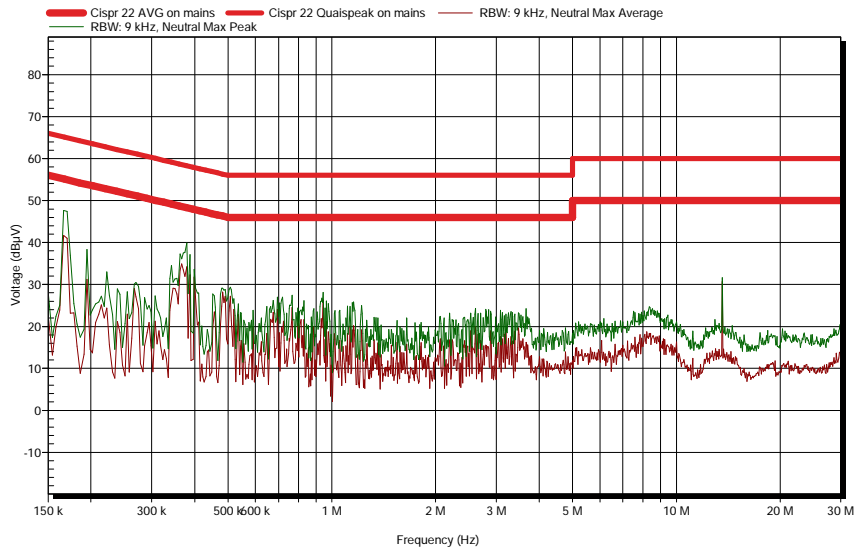
Phase



Note: the EUT is connected to a host, which is AC powered.

2) Measurement within the transmitter's fundamental emission band with permanent antenna simulating network

Neutral



Phase

