TEST REPORT # EMCC-980398NB, 2019-10-11

This report replaces Test Report # EMCC-980398N, 2019-04-12

EQUIPMENT UNDER TEST:

Trade Name:	iID® DESKTOP smart USB 7.0
Type/Model:	35.29.701.00
Serial Number(s):	122322, 122316
Application:	RFID Reader
Manufacturer:	Micro-Sensys GmbH
Address:	In der Hochstedter Ecke 2 99098 Erfurt GERMANY
Phone:	+49 361 59874-16
E-Mail:	ppeitsch@microsensys.de
RELEVANT STANDARD(S) :	47 CFR 15.225, RSS-210 Issue 9, 47 CFR 15 B, ICES-003 Issue 6
MEASUREMENT PROCEDURE:	ANSI C63.10-2013, RSS-Gen Issue 5, ANSI C63.4-2014

TEST REPORT PREPARED BY:

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Tested:

Dominik Krüger

i.A.

Adem Aldogan

Checked:

Reinhard Sauerschell
- Head of Laboratory -

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0 REVISION HISTORY

Project number	Issue date	Chapter	Description
980398N	2019-04-12	n.a.	Initial issue
980398NB	2019-10-11	1.6	Test date updated
		1.8	Climatic conditions updated
		2.4	Operation Mode Scan added
		4.3.4, 4.4.4	Measurements were in Mode “Scan”, Measurement Plots updated
		4.4.5	Test results corrected
		Annex 2	EUT photos replaced by photos with dimensions, Side view added

1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance with the 47 CFR §15.225 and ISED RSS-210 requirements for the certification of licence-exempt intentional radiator and with the 47 CFR §15.107 / § 15.109 and ICES-003 requirements applicable to unintentional radiators.

1.2 Limits and Reservations

The test results in this report apply only to the particular equipment under test (EUT) as declared in this report. This test report shall not be reproduced except in full without the written permission of EMCCons DR. RAŠEK GmbH & Co. KG.

1.3 Test Laboratory

Test laboratory:	EMCCons DR. RAŠEK GmbH & Co. KG
Accreditation No.:	D-PL-12067-01-03
	D-PL-12067-01-04
FCC Test Firm Registration Number:	368753
ISED Test Site Registration Number:	3464C
Address of Labs I, II, III and Head Office:	EMCCons DR. RAŠEK GmbH & Co. KG Boelwiese 8 91320 Ebermannstadt GERMANY
Address of Labs IV and V:	EMCCons DR. RAŠEK GmbH & Co. KG Stoernhofer Berg 15 91364 Unterleinleiter GERMANY
Phone:	+49 9194 7262-0
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E-Mail:	info@emcc.de
Web:	www.emcc.de

1.4 Customer

Company name:	Micro-Sensys GmbH
Street:	In der Hochstedter Ecke 2
City:	99098 Erfurt
Country:	GERMANY
Name:	Peter Peitsch
Phone:	+49 361 59874-16
Fax:	+49 361 59874-17
E-Mail:	ppeitsch@microsensys.de

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1.5 Manufacturer

Company name:	Micro-Sensys GmbH
Street:	In der Hochstedter Ecke 2
City:	99098 Erfurt
Country:	GERMANY
Phone:	+49 361 59874-16
E-Mail:	ppeitsch@microsensys.de

1.6 Dates and Test Location

Date of receipt of EUT:	2018-09-17
Test date:	2018-11-06, 2019-01-28 – 2019-01-31, 2019-02-15, 2019-03-20, 2019-08-14
Test location:	Lab IV

1.7 Ordering Information

Purchase order:	D-424-18
Date:	2018-08-29
Vendor number:	n/a

1.8 Climatic Conditions

Date	Temperature [°C]	Relative Humidity [%]	Air Pressure [hPa]	Lab	Customer attended tests
2018-11-06	24	45	968	IV	No
2019-01-28	23	33	952	IV	No
2019-01-29	24	35	965	IV	No
2019-01-30	23	34	954	IV	No
2019-01-31	23	31	957	IV	No
2019-02-15	23	36	976	IV	No
2019-03-20	24	34	992	IV	No
2019-08-14	25	45	978	IV	No

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2 PRODUCT DESCRIPTION

2.1 Equipment Under Test (EUT)

The following data is based on customer's information.

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
No of variants:	1
Serial No(s):	EUT #1: 122322 EUT #2: 122316 (modified sample with dummy antenna load)
FCC:	FCC ID: ZLCDESKTOPSHFX
ISED:	IC: 21228-DESKTOPSHFX
Application:	RFID Reader
Transmit frequency:	13.56 MHz
Modulation:	Load modulation
Emission designator:	2K48A1D
Antenna:	Integrated loop antenna
Antenna diameter:	13 mm
Environment:	HF transponders, TELID® system.
Downloaded OP System:	iID® 3000PRO
Software Interface:	iID® driver engine
Firmware version:	98 05
Hardware version:	EUT #1: B6 11 EUT #2: B6 11
Highest internal frequency:	27.12 MHz
Power source:	Via USB Port
Voltage for testing:	5 VDC
Ports:	USB 2.0 HOST Interface
Remarks:	None

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2.2 Intended Use

The following information was delivered by the customer:

The HF-RFID read/write module iID® DESKTOP smart USB 7.0 is a RFID transceiver device with best opportunities for office applications. It is designed to read and write RFID transponders und RFID sensor transponders in a wide range of 13.56 MHz technology based RFID systems. Typical applications of this device are access control with transponder chipcards and programming/reading of TELID® sensor datalogger.

2.3 EUT Peripherals/Simulators

The EUT was tested with

- Notebook Panasonic Toughbook CF-19 to power the EUT and flash the firmware
- Notebook Power Supply Panasonic CF-AA6373A M1
- USB micro cable to connect the EUT to the Notebook

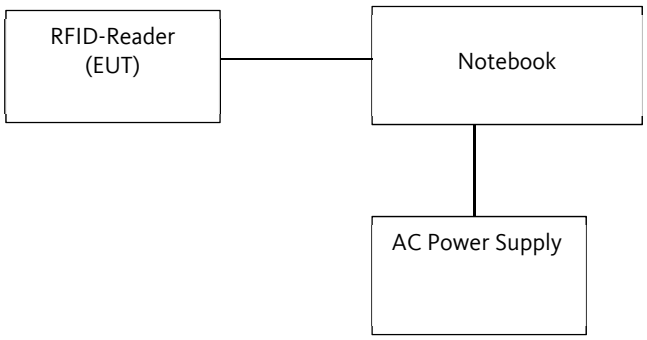
The above listed equipment was provided by the customer.

For detailed pictures see “Annex 4: Photographs of ancillary equipment”.

2.4 Mode of operation during testing and test setup

The equipment under test (EUT) was connected to the Notebook via a USB micro cable.
The Notebook was powered by an AC power supply.
Software was installed on the notebook which allowed to flash the EUTs firmware for turn on/off the RF of the reader.

The test setup for all tests is outlined below:



Block diagram of test setup

The EUT was operated during the tests under the following conditions:

FieldOn: The EUT was continuously transmitting (CW) with normal power (test mode). The EUT was powered by the notebook's USB port, which in turn was powered by the AC power supply.

Scan: The EUT was scanning (modulated) according to ISO 15693 (normal operation). The EUT was powered by the notebook's USB port, which in turn was powered by the AC power supply.

RF-Off: No Firmware was loaded to simulate the RF off phase. The EUT was powered by the notebook's USB port, which in turn was powered by the AC power supply.

2.5 Modifications required for compliance

The USB micro cable has been replaced by one with ferrites (manufacturer's designation: 102-1492-BLF0050).

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3 TEST RESULTS SUMMARY

Summary of test results for the following EUT:

Manufacturer: Micro-Sensys GmbH
Type: 35.29.701.00
Serial No.: 122322
122316

Requirement	RSS/ICES, Section	47 CFR Section	Report Section	Tested EUT	Result
Antenna Requirement	RSS-Gen, 6.8	15.203	4.1	122322	Passed
AC Power Line Conducted Emissions 150 kHz - 30 MHz	RSS-Gen, 8.8 ICES-003, 6.1	15.207 15.107	4.2	122316	Passed
Spectrum Mask	RSS-210, B.6	15.225 (a)-(d)	4.3	122322	Passed
Occupied Bandwidth	RSS-Gen, 6.7	15.215	4.4	122322	Passed
Radiated Emissions 9 kHz – 30 MHz	RSS-210, B.6 RSS-Gen, 8.9	15.205, 15.209, 15.225(d)	4.5	122322	Passed
Radiated Emissions 30 MHz – 1000 MHz	RSS-210, B.6 RSS-Gen, 8.9 ICES-003, 6.2	15.209, 15.225(d) 15.109	4.6	122322	Passed
Carrier Frequency Stability	RSS-210, B.6 RSS-Gen, 8.11	15.225(e)	4.7	122322	Passed

N.A. – not applicable; N.T. – Not tested acc. to applicant's order.

The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units and meet the requirements of the specifications referenced herein.
Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) are factored into the "Correction Factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.
The measurements contained in this report were made in accordance with the procedures described in ANSI C63.10-2013, ANSI C63.4-2014, RSS-Gen Issue 5 and ICES-003 Issue 6. All requirements were found to be within the limits outlined in this report.

The test results in this report apply only to the particular equipment under test (EUT) as declared in this report.

Test personnel: Dominik Krüger, Adem Aldogan
Issuance date: 2019-10-11

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4 DETAILED TEST RESULTS

4.1 Antenna Requirement

Test Requirement: 47 CFR §15.203, ISED RSS-Gen 6.8

4.1.1 Regulation

47 CFR § 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

RSS-Gen 6.8 Transmit antenna:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

> *This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.*

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

No applicable antenna requirement specified in RSS-210.

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4.1.2 Test Result

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No.:	122322
Test date:	2018-11-06
Test personnel:	Dominik Krüger

The EUT's antenna is directly soldered to the PCB.

The EUT meets the requirements of this section.

4.2 AC Power Line Conducted Emissions

Test Requirement: FCC 47 CFR §15.107, §15.207
ISED RSS-Gen 8.8, ICES-003 6.1
Test Procedure: ANSI C63.10-2013, KDB 174176, ISED RSS-Gen 8.8; ANSI C63.4-2014

4.2.1 Regulation

47 CFR § 15.107 Conducted limits

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

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.

47 CFR § 15.207 Conducted limits

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

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.

FCC KDB 174176 D01 Line Conducted FAQ v01r01

Q5. How should the RF power output port of a Part 15 intentional radiator be configured when making AC power-line conducted emissions measurements?

The method used for AC power-line conducted measurements with suitable dummy loads will differ for detachable and non-detachable antennas, depending on whether the operating frequency is above or below 30 MHz.

A suitable dummy load is a radio frequency termination used in place of the antenna, which has the same electrical properties as the intended antenna without radiated emissions. A device with a suitable dummy load must supply identical signals to the dummy load, as it would if an antenna were connected. In the test report, results obtained using a suitable dummy antenna shall be so noted.

Devices Operating Above 30 MHz

For a device with a permanent or detachable antenna operating above 30 MHz, measurements must be performed with the antenna connected as specified in clause 6.2 of ANSI C63.10-2013.

Devices Operating Below 30 MHz

For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements 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.
All measurements must be performed as specified in clause 6.2 of ANSI C63.10-2013

RSS-Gen 8.8 AC power-line conducted emissions limits
Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 µH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.
For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

Table 4 – AC power-line conducted emissions limits

Frequency [MHz]	Conducted limit [dBµV]	
	Quasi-peak	Average
0.15-0.5	66 to 56[1]	56 to 46[1]
0.5-5	56	46
5-30	60	50

Note: The level decreases linearly with the logarithm of the frequency.

For an EUT with a permanent or detachable antenna operating between 150 kHz and 30 MHz, the AC power-line conducted emissions must be measured using the following configurations:
(a) Perform the AC power-line conducted emissions test with the antenna connected to determine compliance with the limits of table 4 outside the transmitter's fundamental emission band.
(b) Retest with a dummy load instead of the antenna to determine compliance with the limits of table 4 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 that simulates the antenna in the fundamental frequency band.

ICES-003 6.1 conducted emissions limits
Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B conducted limits set out in Table 2.

Table 2 – Class B Conducted Limits

Frequency [MHz]	Conducted limit [dBµV]	
	Quasi-peak	Average
0.15-0.5	66 to 56[1]	56 to 46[1]
0.5-5	56	46
5-30	60	50

Note: The level decreases linearly with the logarithm of the frequency.

→ ISED limits are equal to FCC limits.

4.2.2 Test Procedures

Testing is performed acc. to ANSI C63.10-2013 clause 6.2 and ANSI C63.4-2014 clause 7.3.

The EUT and the notebook were placed on a nonconducting table with nominal dimension of 1.0 m by 1.5 m, height 0.8 m above the ground plane. The EUT was centered laterally (left to right facing the tabletop) on the tabletop and its rear was flush with the rear of the table. The notebook and its AC/DC adaptor that are part of the system were placed in a test arrangement on one or both sides of the host with a 10 cm separation between the nearest points of the cabinets.

The USB cable and AC power line that hang closer than 40 cm to the ground plane were folded back and forth in the center forming a bundle 30 cm to 40 cm long.

The notebooks AC/DC adaptor was connected to a LISN.

The measurement receiver was connected via limiter to the 50 Ω RF port of the LISN.

According to FCC KDB 174176 Q5 and RSS-Gen clause 8.8, respectively, the measurement was performed twice, a) with the antenna connected and b) with an inductive dummy load (coil LQH3NPN3R3NJ0L) in lieu of the antenna.

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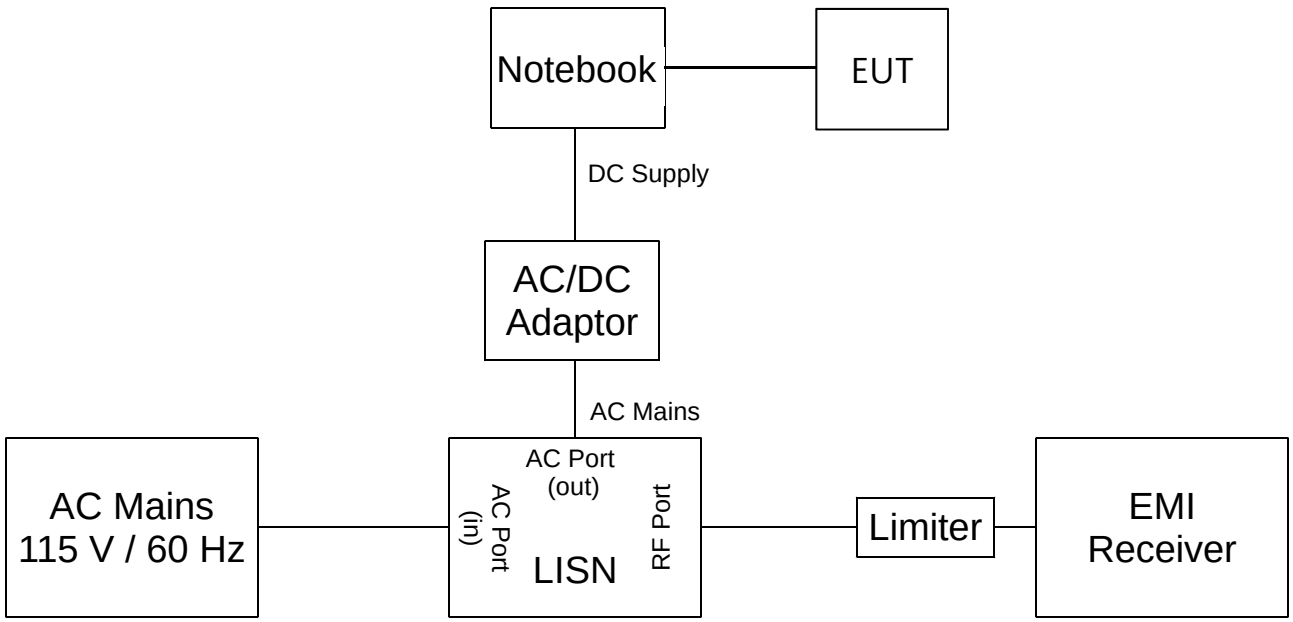
4.2.3 Test setup with antenna connected



SCHEMATIC TEST SETUP

Requirement: 47 CFR § 15.207, RSS-Gen 8.8
Procedure: ANSI C63.10-2013, RSS-Gen 8.8

Power Source: #1
Receiver: #516
LISN: #1901

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
1, 516, 1890, 1901, 3184, 5392, 5404, 5551

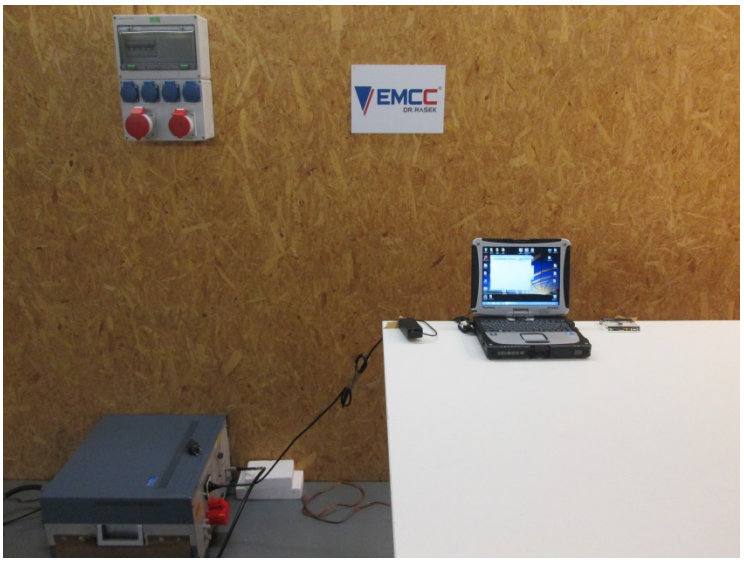
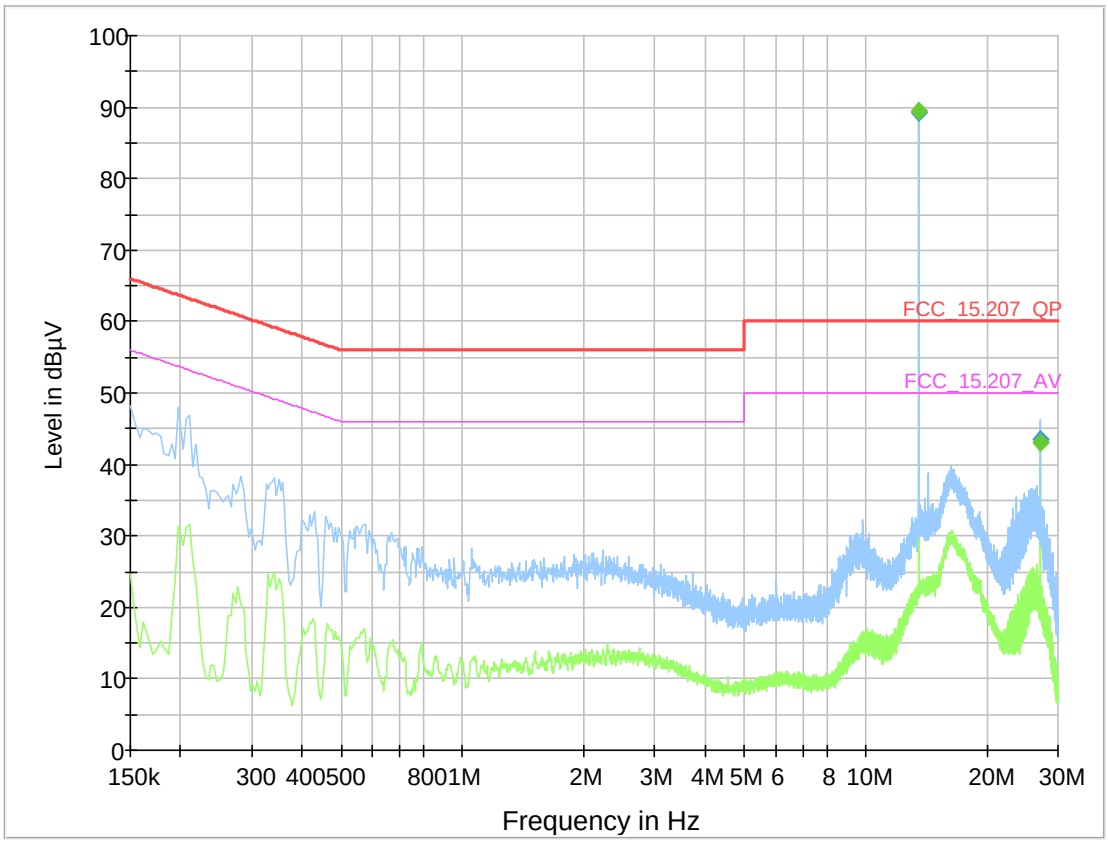


Photo of Setup

4.2.3.1 Detailed Test Data

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	FieldON
Line:	L and N (max hold)



Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
13.561500	89.20	---	60.00	-29.20	1000.0	9.000	N	GND	10.0
13.561500	---	89.35	50.00	-39.35	1000.0	9.000	N	GND	10.0
27.121500	43.57	---	60.00	16.43	1000.0	9.000	N	GND	10.0
27.121500	---	42.99	50.00	7.01	1000.0	9.000	N	GND	10.0

Worst case results listed, only.

The EUT with the antenna connected is compliant with the applicable limits outside the transmitter's fundamental emissions band.

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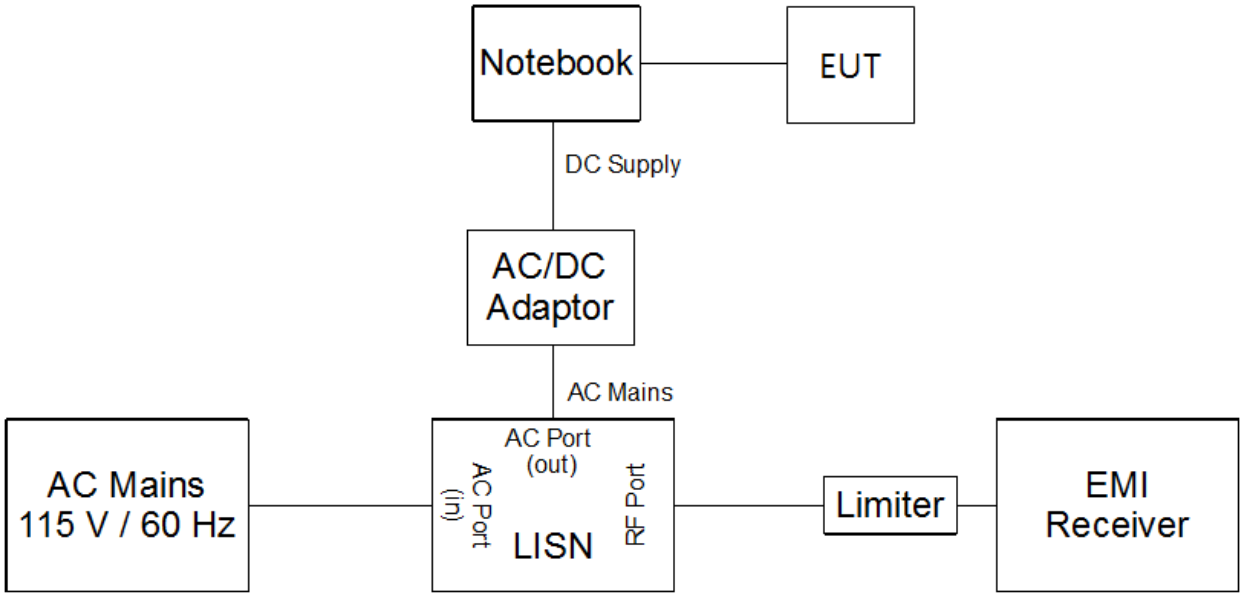
4.2.4 Test setup with dummy load in lieu of antenna



SCHEMATIC TEST SETUP

Requirement: 47 CFR § 15.207, RSS-Gen 8.8
Procedure: ANSI C63.10-2013, RSS-Gen 8.8

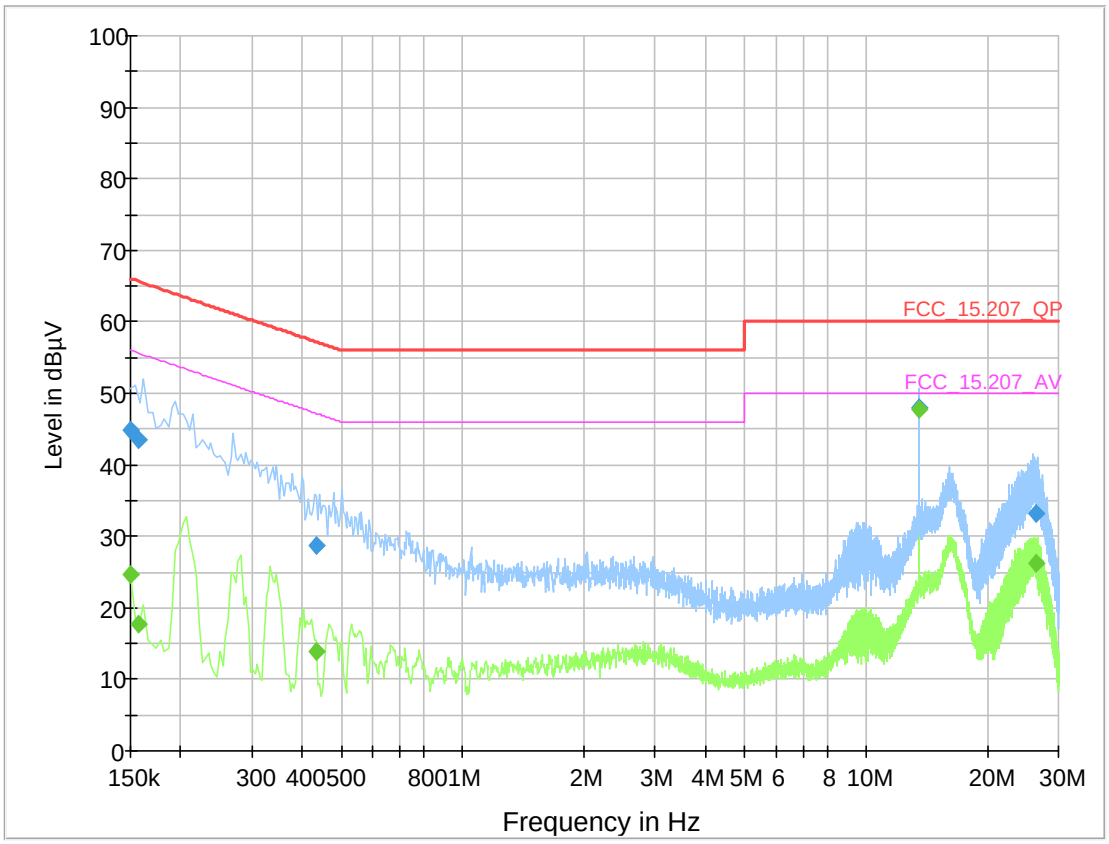
Power Source: #1
Receiver: #3846
LISN: #1901

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
1, 1890, 1901, 3184, 3846, 5392, 5404, 5551

Photo of Setup

4.2.4.1 Detailed Test Data

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122316
Operation Mode:	FieldOn
Line:	L and N (max hold)

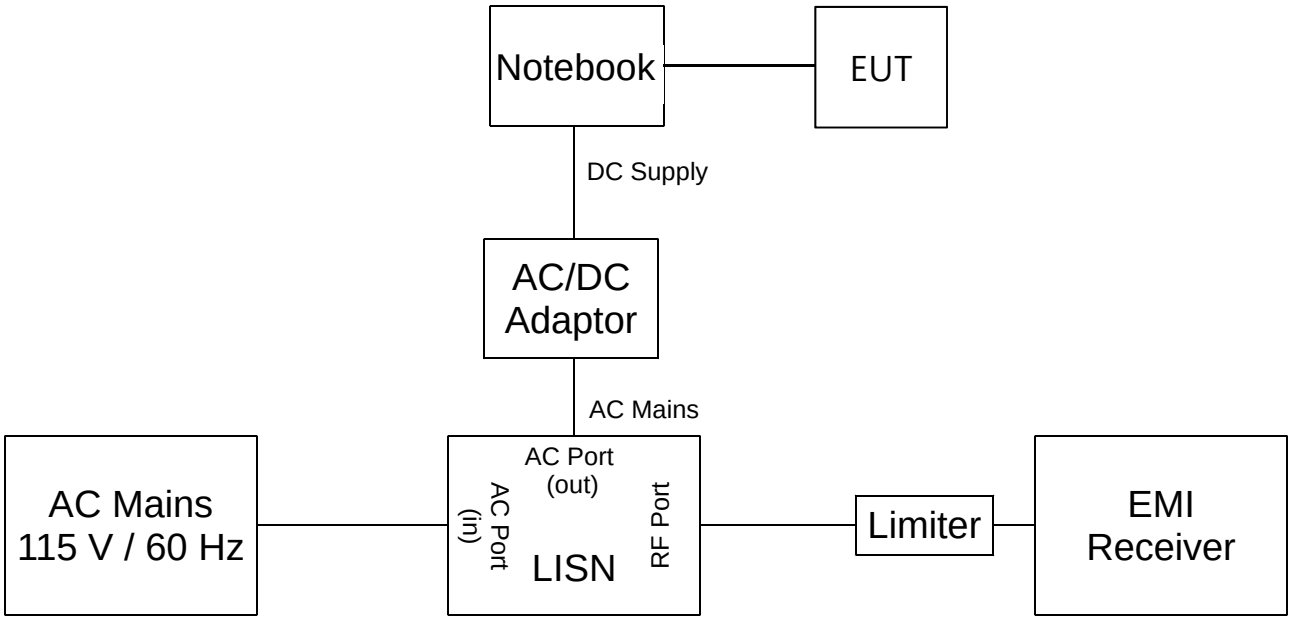


Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.150000	---	24.65	56.00	31.35	1000.0	9.000	N	GND	10.0
0.150000	44.88	---	66.00	21.12	1000.0	9.000	N	GND	10.0
0.157500	---	17.71	55.60	37.88	1000.0	9.000	N	GND	10.0
0.157500	43.50	---	65.60	22.09	1000.0	9.000	N	GND	10.0
0.433500	---	13.85	47.19	33.34	1000.0	9.000	N	GND	10.0
0.433500	28.70	---	57.19	28.49	1000.0	9.000	N	GND	10.0
13.560000	47.95	---	60.00	12.05	1000.0	9.000	N	GND	10.0
13.560000	---	47.68	50.00	2.32	1000.0	9.000	N	GND	10.0
26.509500	---	26.16	50.00	23.84	1000.0	9.000	N	GND	10.0
26.509500	33.27	---	60.00	26.73	1000.0	9.000	N	GND	10.0

Worst case results listed, only.

The EUT with the dummy load in lieu of the antenna is compliant with the applicable limits.

4.2.5 Test setup RF-off



SCHEMATIC TEST SETUP

Requirement: 47 CFR § 15.107, ICES-003
Procedure: ANSI C63.4-2014

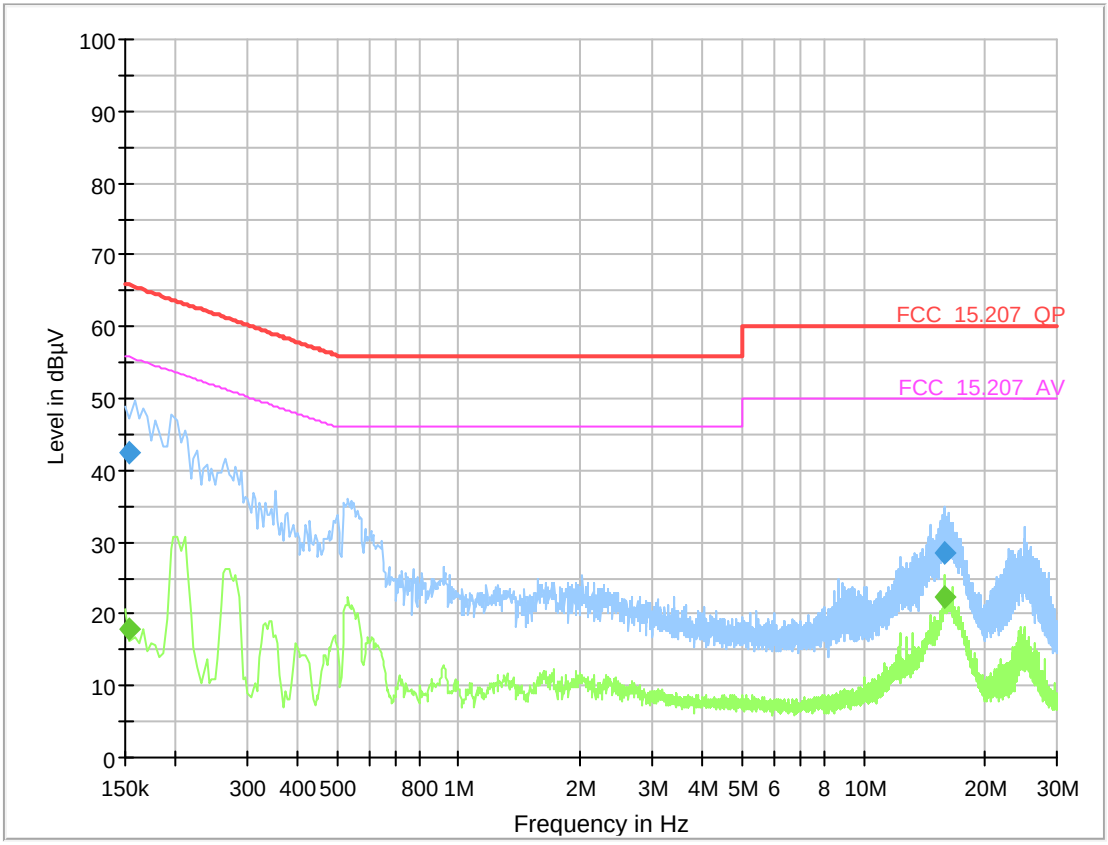
Power Source: #1
Receiver: #516
LISN: #1901

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
1, 516, 1890, 1901, 3184, 5392, 5404, 5551

Photo of Setup

4.2.5.1 Detailed Test Data

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	RF-Off
Line:	L and N (max hold)



Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.154000	---	17.88	55.78	37.90	1000.0	9.000	L1	GND	10.0
0.154000	42.47	---	65.78	23.31	1000.0	9.000	L1	GND	10.0
15.885500	---	22.28	50.00	27.72	1000.0	9.000	N	GND	10.0
15.885500	28.62	---	60.00	31.38	1000.0	9.000	N	GND	10.0

Worst case results listed, only.

4.2.6 Test Result

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No.:	122316
Test date:	2019-02-15, 2019-03-20
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.3 Spectrum Mask

Test Requirement: FCC 47 CFR §15.225, ISED RSS-210 B.6
Test Procedure: ANSI C63.10-2013

4.3.1 Regulation

47 CFR § 15.225

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.
(b) Within the bands 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.
(c) Within the bands 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.
(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§ 15.209.

ISED RSS-210 B.6
The field strength of any emission shall not exceed the following limits:

(a) 15,848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz;
(b) 334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz;
(c) 106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz; and
(d) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

4.3.2 Test Procedures

The measurement was performed in a semi-anechoic room at a test distance of 3 m. A calibrated loop antenna as specified in ANSI C63.10 clause 4.3 was positioned with its plane vertical at the test distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. For certain applications, the loop antenna may also need to be positioned horizontally at the specified distance from the EUT. Instead of changing the loop antenna polarization to horizontal the EUT antenna was rotated by 90 degrees. I.e. tests performed for 2 EUT antenna polarizations (EUT in 3 orientations). The center of the loop antenna was 1 m above the ground.
The EUT was tested on a 0.8 meter high tabletop.
The EUT is connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter.
In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.
Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC listed semi-anechoic room at the specified 3 m test distance.
Worst case emissions are listed under chapter: test results.

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Radiated Emissions Test Characteristics	
Frequency range	13.11 MHz – 14.01 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	10 kHz (150 kHz - 30 MHz)
Receive antenna height	1 m
Receive antenna polarization	Vertical

* According to section 15.31 (f)(2): At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The 40 dB/decade factor was used.

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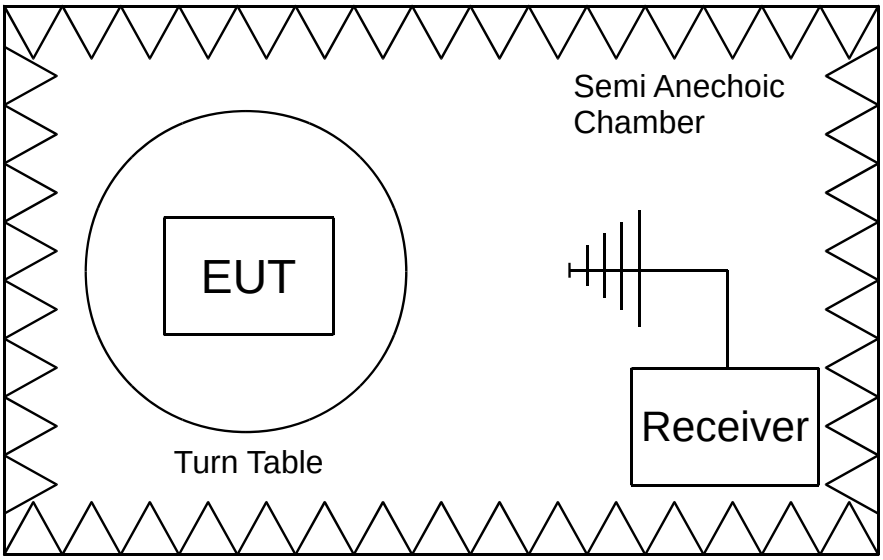
4.3.3 Test Setup



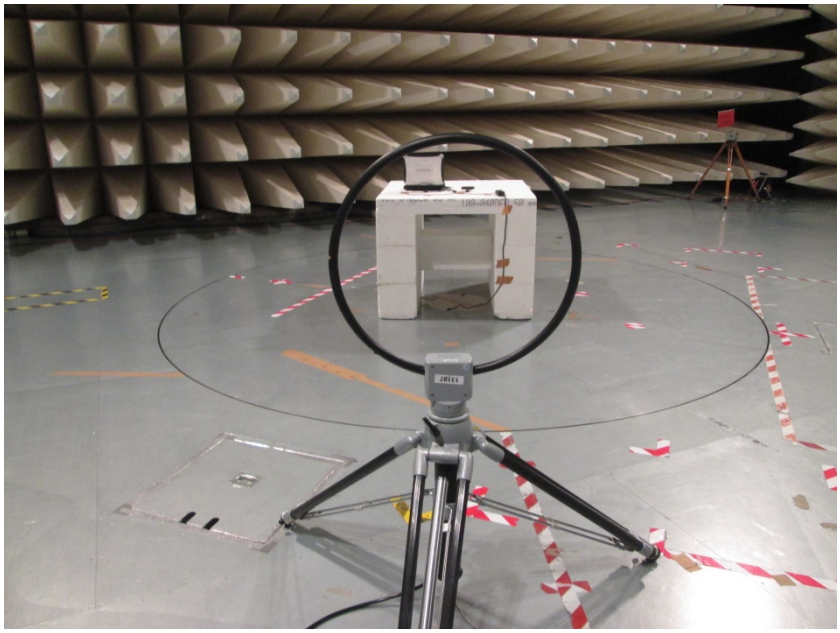
SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.225
Procedure: ANSI C63.10-2013

Receiver: #516
Antenna: #374

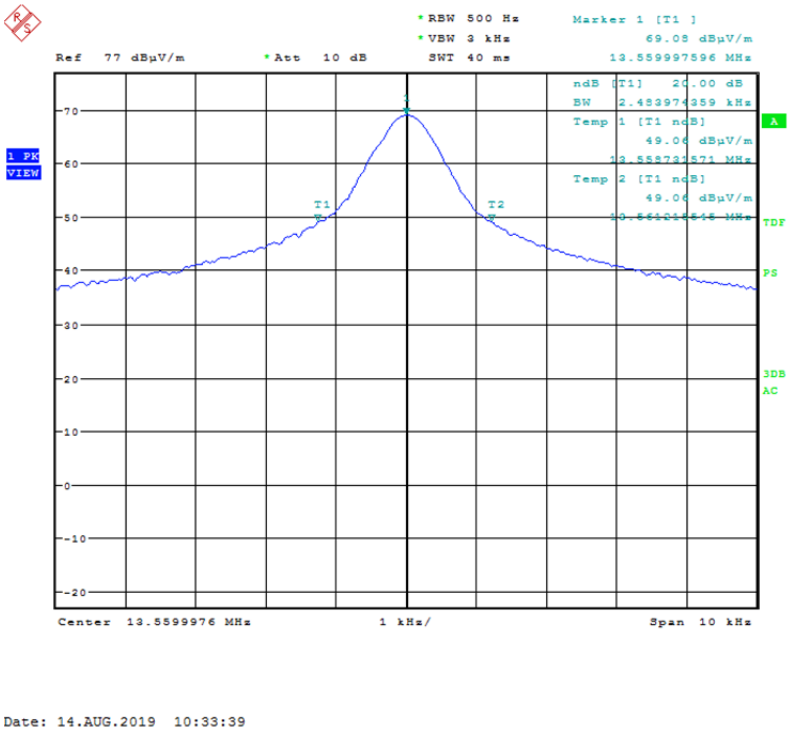
Test distance: 3 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
374, 516, 1291, 1889, 4075, 4717, 5392



4.3.4 Measurement Plot(s)

Operation Mode: Scan



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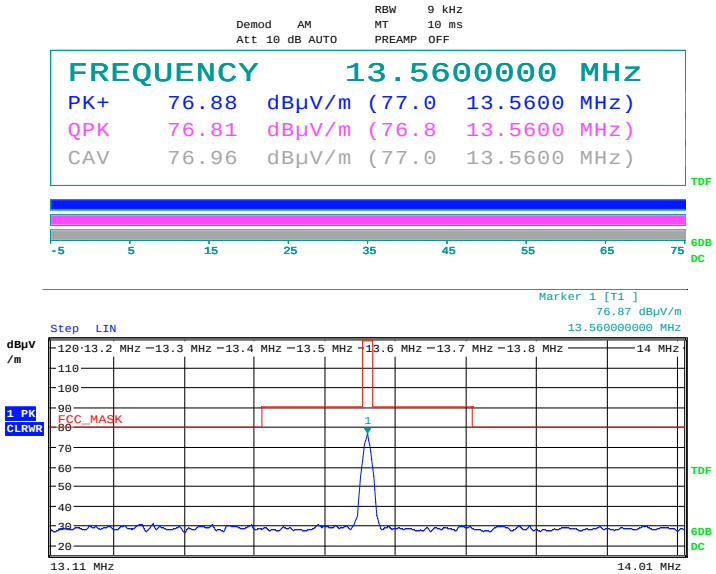

4.3.5 Test Result

Frequency [MHz]	Detector	3m_Result [dBµV/m]	Distance Correction [dB]	30m_Result [dBµV/m]	30m_Limit [dBµV/m]	Margin [dB]
13.56	QP	76.8	40	36.8	84	47.2

Manufacturer: Micro-Sensys GmbH
Type: 35.29.701.00
Serial No.: 122322
Test date: 2019-01-30, 2019-08-14
Test personnel: Dominik Krüger

The EUT meets the requirements of this section.

4.4 Occupied Bandwidth

Test Requirement: FCC 47 CFR §15.225, ISED RSS-Gen 6.7
Test Procedure: ANSI C63.10-2013

4.4.1 Regulation

47 CFR § 15.215 Additional provisions to the general radiated emission limitations.

(a) The regulations in §§15.217 through 15.257 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.
(b) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in §15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.
(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

ISED RSS-Gen 6.7 Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth
The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

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In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.
Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

4.4.2 Test Procedures

Measurement was performed in a semi-anechoic room. The EUT was tested on a 0.8 meter high tabletop and was connected to its associated peripherals. A calibrated loop antenna was positioned with its plane vertical at about 1.5m distance from the EUT. For certain applications, the loop antenna may also need to be positioned horizontally at the specified distance from the EUT. The analyzer was setup at the nominal centre frequency of the EUT. The span was 500 Hz, the resolution bandwidth 10 Hz and the video bandwidth 100 Hz. A max peak hold was used to measure the occupied bandwidth.
Worst case emissions are listed under chapter: test results.

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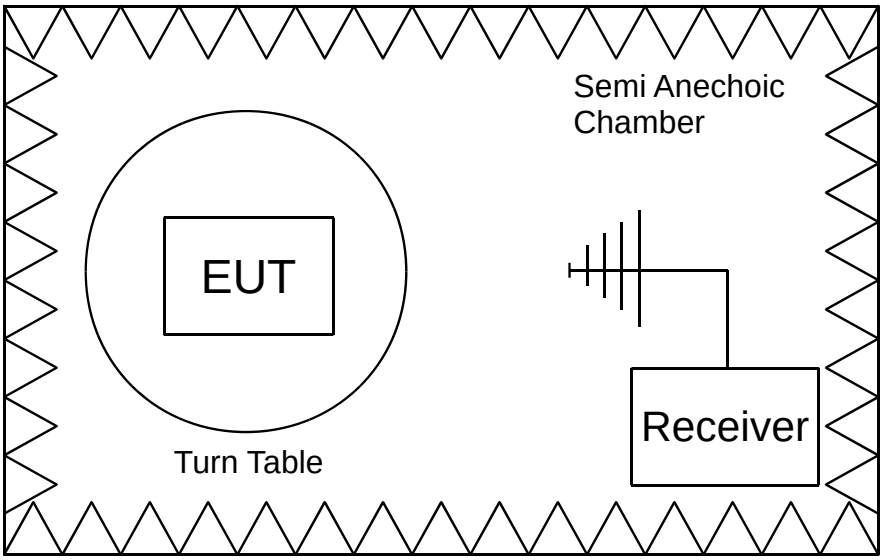
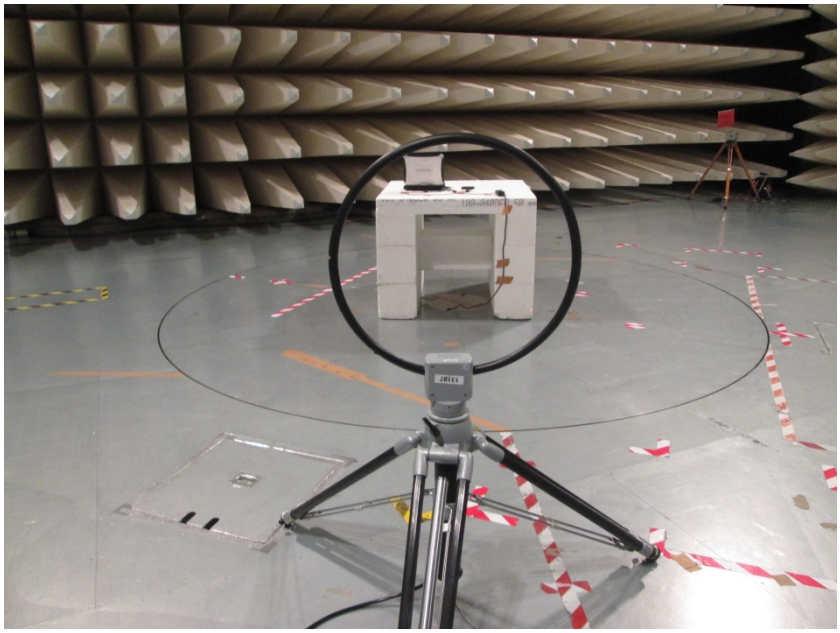
4.4.3 Test Setup



SCHEMATIC TEST SETUP

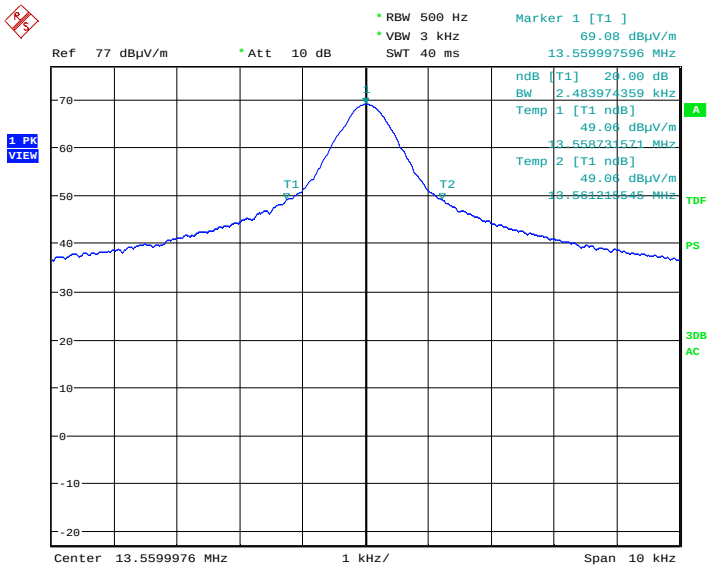
Requirement:	47 CFR, § 15.215
Procedure:	ANSI C63.10-2013
Receiver:	#516
Antenna:	#374
Test distance:	3 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
374, 516, 1291, 1889, 4075, 4717, 5392

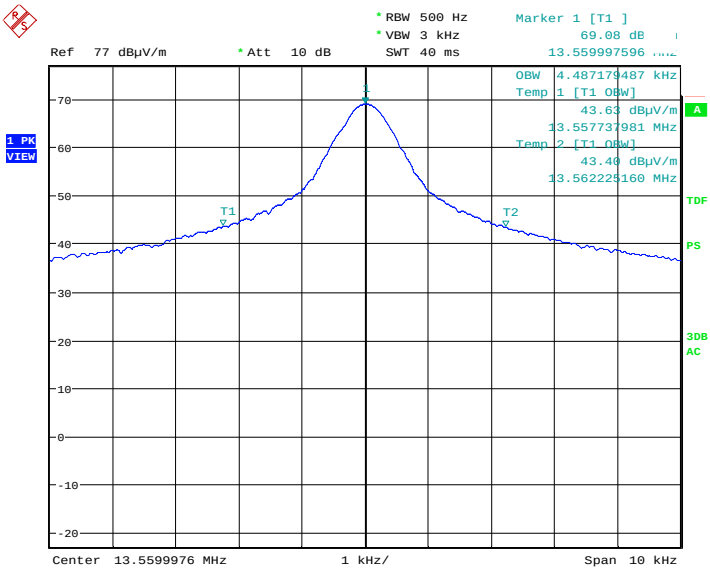


4.4.4 Measurement Plots

Operation Mode: Scan



Occupied Bandwidth (20 dB)



Occupied Bandwidth (99%)

4.4.5 Test Result

Occupied Bandwidth (20 dB) [kHz]
2.48

Occupied Bandwidth (99%) [kHz]
4.49

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Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No.:	122322
Test date:	2019-08-14
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.5 Radiated Emissions 9 kHz – 30 MHz

Test Requirement: FCC 47 CFR §§15.205, 15.209, 15.225(d), ISED RSS-210 B.6, RSS-Gen 6.7
Test Procedure: ANSI C63.10-2013, RSS-Gen

4.5.1 Regulation

47CFR § 15.33 Frequency range of radiated measurements

(a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:
(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

47CFR § 15.205 Restricted bands of operation

(d)(7) Devices operated pursuant to § 15.225 are exempt from complying with this section for the 13.36–13.41 MHz band only.

47CFR § 15.225 Operation within the band 13.110–14.010 MHz.

(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 § 15.209.

47CFR § 15.209 Radiated emission limits.

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency	Field Strength		Measurement distance
[MHz]	[µV/m]	[dBµV/m]	[m]
0.009–0.490	2400/F[kHz]	67.6 – 20 logF[kHz]	300
0.490–1.705	24000/F[kHz]	87.6 – 20 logF[kHz]	30
1.705–30.0	30	29.5	30

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in §§15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

ISED RSS-210 B.6

The field strength of any emission shall not exceed the following limits:

(a) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

ISED RSS-Gen 8.9 Transmitter emission limits

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

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Table 6 – General field strength limits at frequencies below 30 MHz

Frequency	Field Strength	Equivalent Field Strength[2]	Measurement distance
	[µA/m]	[µV/m]	[m]
9 – 490 kHz[1]	6.37/F[kHz]	2401/F[kHz]	300
490 – 1705 kHz	63.7/F[kHz]	24015/F[kHz]	30
1.705–30 MHz	0.08	30.16	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

Note 2: Equivalent electrical field strength according to ANSI C63.10-2013 chapter 4.3.2:
"For the United States, the regulatory limits below 30 MHz are in terms of µV/m. By convention, magnetic field strength is converted to an electric field strength based on free-space impedance."

→ The ISED limits are in practice identical with the FCC limits (deviations below 1 %). Measurements in this report are related to the insignificant stronger FCC limits.

47 CFR § 15.35 Measurement detector functions and bandwidths.

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrumentation using the CISPR quasi-peak detector can be found in ANSI C63.4-2014, clause 4 (incorporated by reference, see §15.38). As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function as long at the same bandwidth as indicated for CISPR quasi-peak measurements are employed.

ISED RSS-Gen 6.13.1 Detector

When the unwanted emissions limits are defined in relative terms, the same parameter, peak power or average power, shall be used as the reference for both the transmitter's output power and the unwanted emissions measurements. When the unwanted emissions limits are expressed in absolute terms, unless otherwise stated in the applicable RSS, the following conditions shall apply:
(a) Below 1 GHz, compliance with the limits shall be demonstrated using a CISPR quasi-peak detector and the related measurement bandwidth (see section 6.10).
(b) Above 1 GHz, compliance with the limits shall be demonstrated using a linear average detector (see section 6.10) with a minimum resolution bandwidth of 1 MHz.

4.5.2 Test Site Correlation for H Field Measurement in Semi-Anechoic Chamber (SAC)

Test procedure following KDB 414788.

The carrier at 13.56 MHz was measured in the semi-anechoic room (SAC) at a test distance of 3 m and at an open field site at a test distance of 3 m with the same calibrated loop antenna. The measurement was performed in a set-up with transmit antennas with a diameter of 0.122 m and 0.249 m, respectively.

These measurements were used to evaluate a correction of the open field measurement to the semi-anechoic room measurement.

Ant. Diameter	Freq	Detector	Distance	FSAC	Fopen	fc
	[MHz]		[m]	[dBµV/m]	[dBµV/m]	[dB]
0.122 m	13.56	QP	3	72.2	70.8	-1.4
0.249 m	13.56	QP	3	71.8	68.5	-3.3

Test date: 2016-09-14

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As the correction factor fc is negligible compared to the margin found below the correction has not been taken into account.

4.5.3 Calculation of Field Strength Limits

E.g. radiated emissions field strength limits for the frequency band 1.705–30.0 MHz:

30 µV/m at 30 meters

Using the equation:

$E_{dB\mu V/m} = 20 \log (E_{\mu V/m})$

where

$E_{dB\mu V/m}$ = Field Strength in logarithmic units (in dBµV/m)

$E_{\mu V/m}$ = Field Strength in linear units (in µV/m)

A field strength limit of 30 µV/m corresponds with 29.5 dBµV/m.

Distance correction (limit)
Remark: The preferred method is the correction of the measured field strength instead of limit correction. Only one correction method shall be applied to a particular measurement.

In case of testing being performed in a distance other than specified, the limit may be adjusted by a Distance Extrapolation Factor DF of 40 dB per decade, which is calculated by the following equation:

$DF = 40 \log (D_{test}/D_{specification})$
where

DF = Distance Extrapolation Factor (in dB)

D_{test} = Distance, where measurement was performed (in m)

$D_{specification}$ = Distance acc. to specification (in m)

Example: Assume a limit specified in 30 m and a measurement performed at 3 m: The distance correction factor is 40 log (30 / 3) = 40. This factor is mathematically added to the limit by the following equation:
$E_{dB\mu V/m\_new} = E_{dB\mu V/m} + DF$
where

$E_{dB\mu V/m}$ = Field Strength limit in logarithmic units (in dBµV/m)

$E_{dB\mu V/m\_new}$ = Corrected Field Strength limit in logarithmic units (in dBµV/m)

DF = Distance Extrapolation Factor (in dB)

Example: Assume a limit of 29.5 dBµV/m specified in 30 m distance and the measurement performed at 3 m. The limit is adjusted by the distance correction factor of 40 dB to the new limit of 69.5 dBµV/m.

4.5.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF
where
FS = Field Strength (in dBµV/m)
RA = Receiver Amplitude (in dBµV)
AF = Antenna Factor (in dB (1/m))
CF = Cable Attenuation Factor (in dB)

Assume a receiver reading of 40 dBµV is obtained. The Antenna Factor of 10 dB(1/m) and a Cable Factor of 0.5 dB are added, giving a field strength of 50.5 dBµV/m in the measurement distance. The field strength of 50.5 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 40 + 10 + 0.5 = 50.5
Level (in µV/m) = Common Antilogarithm (50.5/20) = 335

Distance correction (field strength)
Remark: The preferred method is the correction of the measured field strength instead of limit correction. Only one correction method shall be applied to a particular measurement.

If a measurement is performed at a different distance other than specified, the field strength at the specified distance can be obtained by the following equation:

$FS_{Dspecified} = FS_{Dtest} + 40 \log (D_{test}/D_{specified})$
where
$FS_{Dspecified}$ = Field Strength at specified distance $D_{specified}$ (in dBµV/m)
FS_{DTest} = Field Strength at specified distance D_{Test} (in dBµV/m)
D_{test} = Measurement distance where test was performed (in m)
$D_{specified}$ = Measurement distance as specified by the rules (in m)

Assuming a recorded field strength of 50.5 dBµV/m in a distance of 3 m. If the rules are specifying a limit in a distance of 30 m, the field strength recorded in 3 m is corrected by the distance. Therefore, the field strength $FS_{Dspecified}$ is 50.5 + 40 log (3 / 30) = 10.5 (in dBµV/m).
Remark: Using EMC32 software corrections are combined in the Corr. Factor as listed in the results' table.
"Result" represents the FS Result, "Corr." is the combined correction factor.

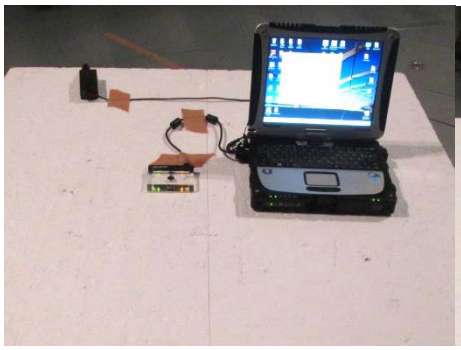
4.5.5 Test Procedures

Measurement was performed in a semi-anechoic room at a test distance of 3 m. A calibrated loop antenna as specified in ANSI C63.4 clause 4.3.2 was positioned with its plane vertical at the test distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. For certain applications, the loop antenna may also need to be positioned horizontally at the specified distance from the EUT. Instead of changing the loop antenna polarization to horizontal the EUT antenna was rotated by 90 degrees. I.e. tests performed for 2 EUT antenna polarizations (EUT in 3 orientations). The center of the loop antenna was 1 m above the ground.
The EUT was tested on a 0.8 meter high tabletop.
The EUT is connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter.
In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.
Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in modulated mode with and without RFID tags.
Worst case emissions are listed under chapter: Final test results.

Radiated Emissions Test Characteristics	
Frequency range	9 kHz - 30 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	200 Hz (9 kHz - 150 kHz)
	10 kHz (150 kHz - 30 MHz)
Receive antenna height	1 m
Receive antenna polarization	Vertical
Measurement location	Semi Anechoic Chamber (SAC)

* According to Section 15.31 (f)(2): At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The 40 dB/decade factor was used.

EUT Orientations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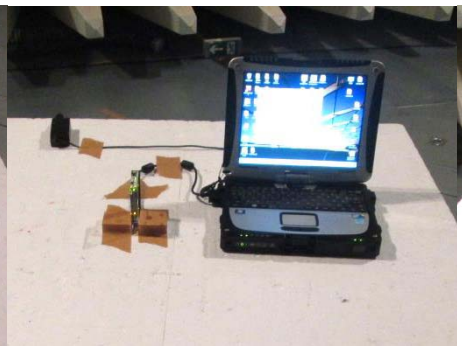
Orientation Y


Orientation Z

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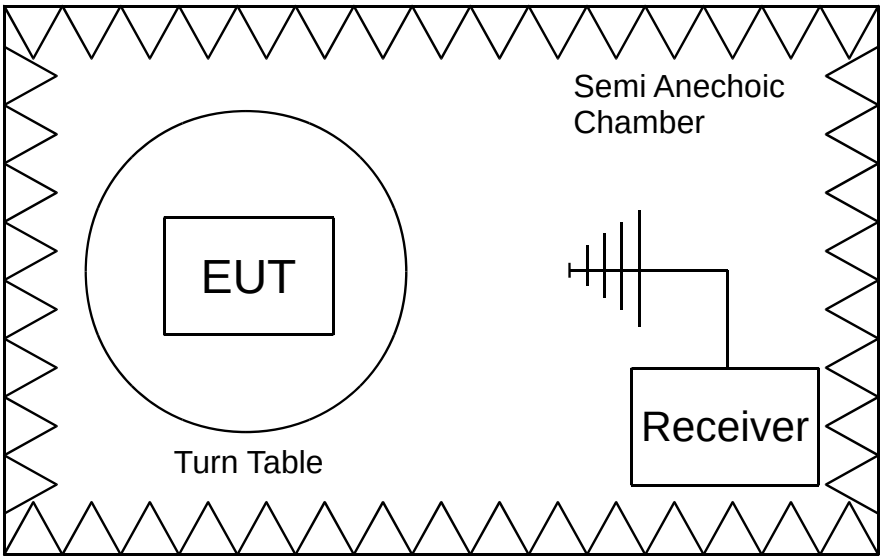
4.5.6 Test Setup



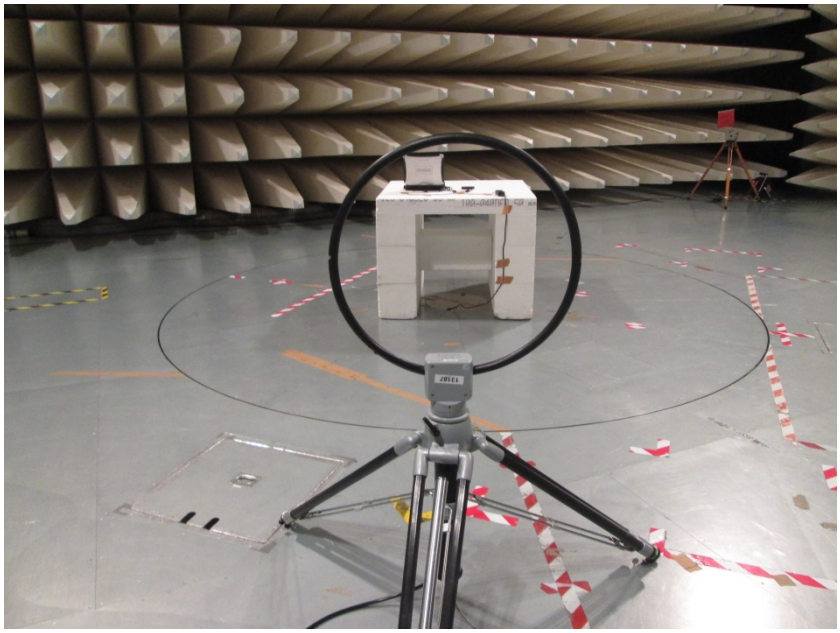
SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.209
Procedure: ANSI C63.10-2013

Receiver: #516
Antenna: #374

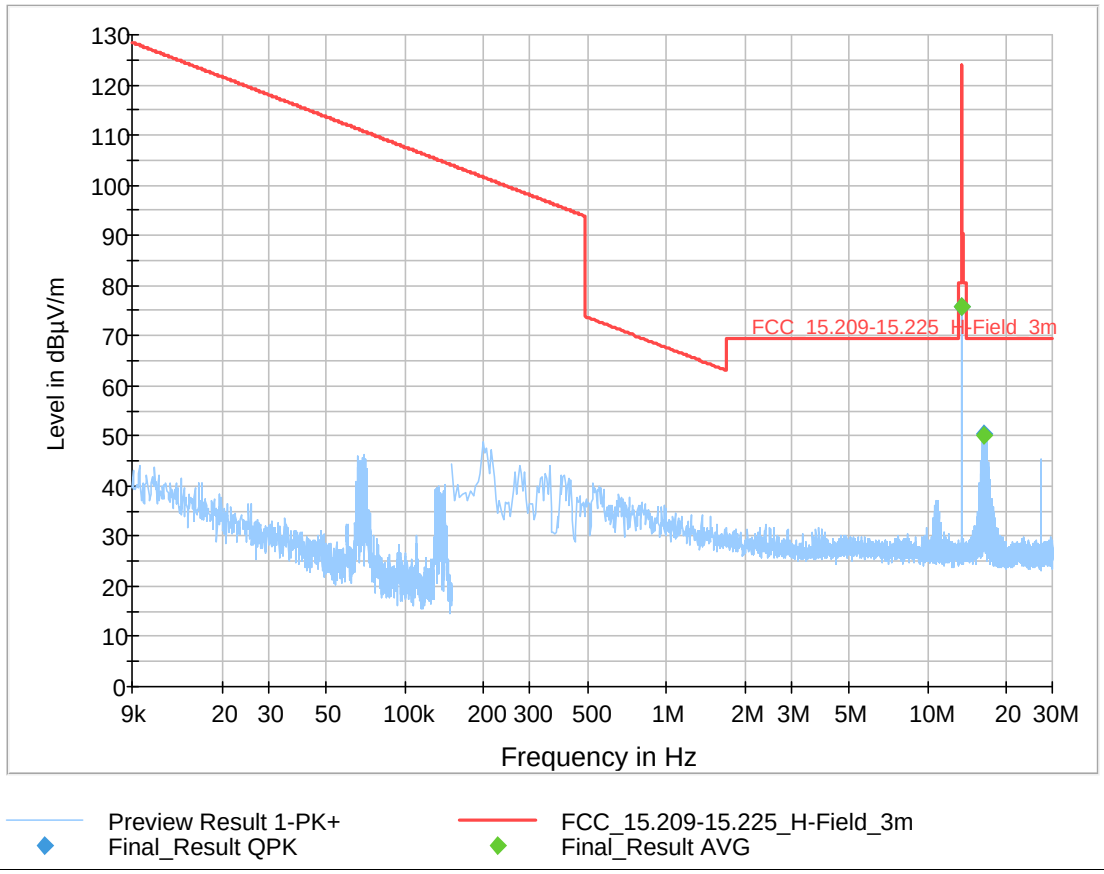
Test distance: 3 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
374, 516, 1291, 1889, 4075, 4717, 5392



4.5.6.1 Detailed Test Data

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	FieldON
EUT Orientation:	X



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
13.56*	---	75.8	---	---	1000	10.0	100.0	V
13.56*	75.8	---	124.0	48.2	1000	10.0	100.0	V
16.54	---	50.2	---	---	1000	10.0	100.0	H
16.54	50.4	---	69.5	19.1	1000	10.0	100.0	H

* fundamental emission in the band 13.110–14.010 MHz

All tests performed at 3 m distance. The table above contains worst-case emissions, only. Only two final measurements performed because the measured values are far below the limit (> 20 dB). For further details refer to the pre-scan test plot above.

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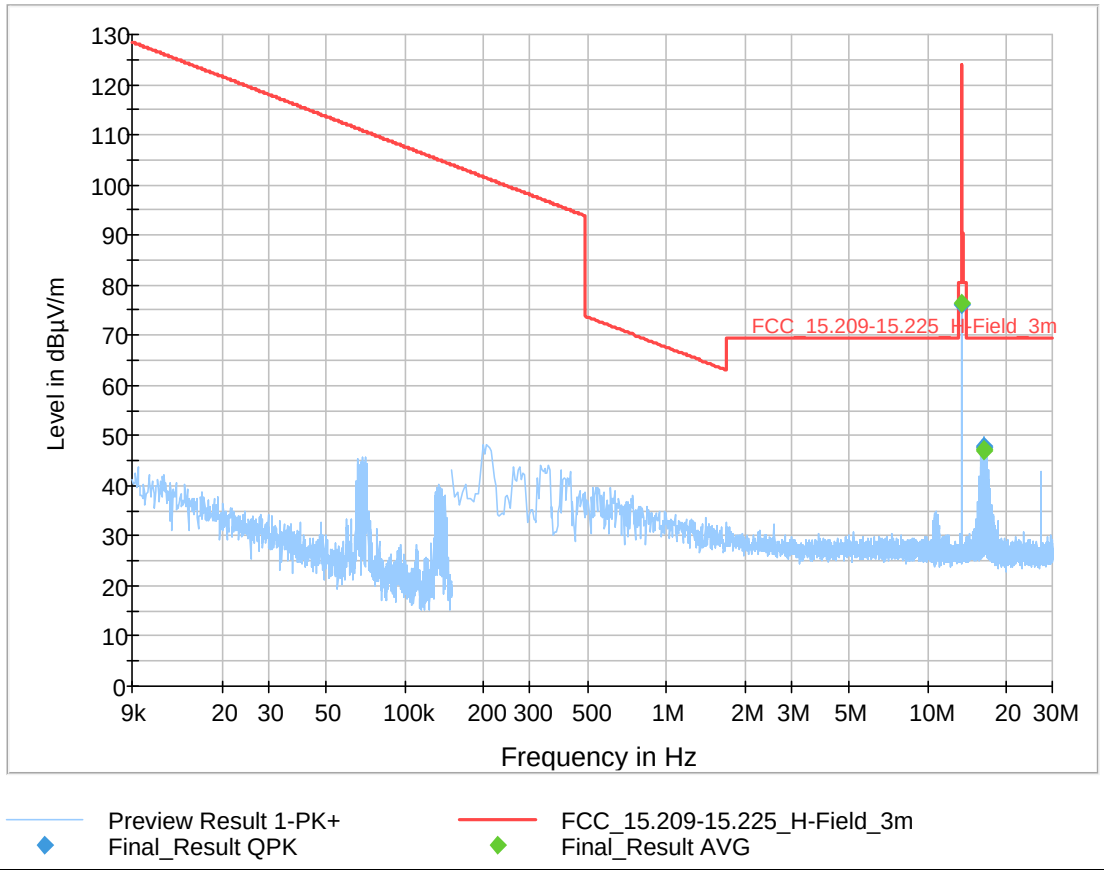
Test on Micro-Sensys GmbH iID® DESKTOP smart USB 7.0 Type 35.29.701.00 to 47 CFR 15.225 and RSS-210 Issue 9

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	FieldON
EUT Orientation:	Y



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
13.56*	76.2	---	124.0	47.8	1000	10.0	100.0	V
13.56*	---	76.3	---	---	1000	10.0	100.0	V
16.43	---	47.0	---	---	1000	10.0	100.0	H
16.43	47.6	---	69.5	21.9	1000	10.0	100.0	H
16.54	---	47.4	---	---	1000	10.0	100.0	H
16.54	47.8	---	69.5	21.7	1000	10.0	100.0	H

* fundamental emission in the band 13.110–14.010 MHz

All tests performed at 3 m distance. The table above contains worst-case emissions, only. Only three final measurements performed because the measured values are far below the limit (> 20 dB). For further details refer to the pre-scan test plot above.

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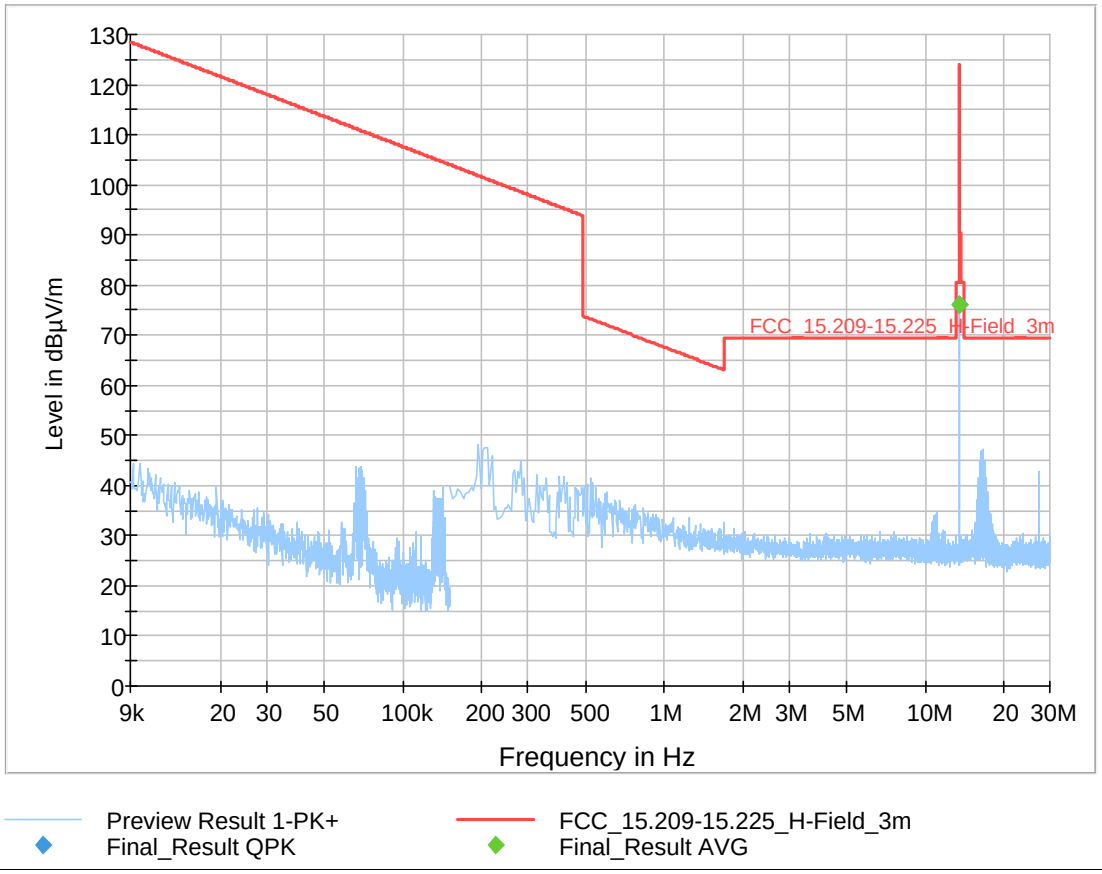
Test on Micro-Sensys GmbH iID® DESKTOP smart USB 7.0 Type 35.29.701.00 to 47 CFR 15.225 and RSS-210 Issue 9

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	FieldON
EUT Orientation:	Z



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
13.56*	76.2	---	69.5	-6.7	1000	10.0	100.0	V
13.56*	---	76.2	---	---	1000	10.0	100.0	V

* fundamental emission in the band 13.110–14.010 MHz

All tests performed at 3 m distance. The table above contains worst-case emissions, only. Only one final measurement performed because the measured values are far below the limit (> 20 dB). For further details refer to the pre-scan test plot above.

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4.5.7 Test Result

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No.:	122322
Test date:	2019-01-29
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.6 Radiated Emissions 30 MHz – 1000 MHz

Test Requirement: FCC 47 CFR § 15.109, 15.205, 15.209, 15.225(d), ISED RSS-210 B.6, RSS-Gen 6.7, ICES-003
Test Procedure: ANSI C63.10-2013, RSS-Gen, ANSI C63.4-2014

4.6.1 Regulation

47CFR § 15.33 Frequency range of radiated measurements

(a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:
(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1) through (a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.
(b) For unintentional radiators:
(1) Except as otherwise indicated in paragraphs (b)(2) or (b)(3) of this section, for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes	Upper frequency of measurement range (MHz)
[MHz]	[MHz]
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

47CFR § 15.205 Restricted bands of operation
(d)(7) Devices operated pursuant to § 15.225 are exempt from complying with this section for the 13.36–13.41 MHz band only.

47CFR § 15.225 Operation within the band 13.110–14.010 MHz.
(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 § 15.209.

47CFR § 15.109 Radiated emission limits.

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency	Field Strength		Measurement distance
[MHz]	[µV/m]	[dBµV/m]	[m]
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

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(c) In the emission tables above, the tighter limit applies at the band edges. Sections 15.33 and 15.35 which specify the frequency range over which radiated emissions are to be measured and the detector functions and other measurement standards apply.

47CFR § 15.209 Radiated emission limits.

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency	Field Strength		Measurement distance
[MHz]	[µV/m]	[dBµV/m]	[m]
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
(e) The provisions in §§15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

ISED RSS-210 B.6 Band 13.110-14.010 MHz

The field strength of any emission shall not exceed the following limits:
15.848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz;
334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz;
106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz; and
RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

ISED RSS-Gen 8.9 Transmitter emission limits

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 – General field strength limits at frequencies above 30 MHz

Frequency	Field Strength
[MHz]	[µV/m at 3 m]
30–88	100
88–216	150
216–960	200
above 960	500

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ICES-003 6.2.1 Radiated emissions limits below 1 GHz

Class B: ITE that does not meet the conditions for Class A operation shall comply with the Class B radiated limits set out in Table 5 determined at a distance of 3 metres.

Table 5 — Class B Radiated limits below 1 GHz

Frequency	Class B Radiated Limit QP
[MHz]	[dBµV/m]
30–88	100
88–216	150
216–960	200
above 960	500

→ The ISED limits are identical with the FCC limits.

47 CFR § 15.35 Measurement detector functions and bandwidths.

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrumentation using the CISPR quasi-peak detector can be found in ANSI C63.4-2014, clause 4 (incorporated by reference, see §15.38). As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function as long at the same bandwidth as indicated for CISPR quasi-peak measurements are employed.

ISED RSS-Gen 6.13.1 Detector

When the unwanted emissions limits are defined in relative terms, the same parameter, peak power or average power, shall be used as the reference for both the transmitter's output power and the unwanted emissions measurements.
When the unwanted emissions limits are expressed in absolute terms, unless otherwise stated in the applicable RSS, the following conditions shall apply:
(a) Below 1 GHz, compliance with the limits shall be demonstrated using a CISPR quasi-peak detector and the related measurement bandwidth (see section 6.10).
(b) Above 1 GHz, compliance with the limits shall be demonstrated using a linear average detector (see section 6.10) with a minimum resolution bandwidth of 1 MHz.

4.6.2 Calculation of Field Strength Limits

E.g. radiated emissions field strength limits for the frequency band 88 - 216 MHz:

150 µV/m at 3 meters

Using the equation:

$E_{dB\mu V/m} = 20 \log (E_{\mu V/m})$

where

$E_{dB\mu V/m}$ = Field Strength in logarithmic units (in dBµV/m)

$E_{\mu V/m}$ = Field Strength in linear units (in µV/m)

A field strength limit of 150 µV/m corresponds with 43.5 dBµV/m.

4.6.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF

where
FS = Field Strength (in dBµV/m)
RA = Receiver Amplitude (in dBµV)
AF = Antenna Factor (in dB (1/m))
CF = Cable Attenuation Factor (in dB)

If the measurement unit is dBm instead of dBµV, the conversation constant of 107 dB has to be added to the reading in dBm.

Assume a receiver reading of -30.1 dBm is obtained. The Antenna Factor of 39.2 dB(1/m) and a Cable Factor of 1.2 dB are added, giving a field strength of 117.3 dBµV/m in the measurement distance. The field strength of 117.3 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = -30.1 + 39.2 + 1.2 + 107 = 117.3
Level (in µV/m) = Common Antilogarithm (117.3/20) = 732825

Distance correction (field strength)

If a measurement is performed at a different distance other than specified, the field strength at the specified distance can be obtained by the following equation:

$FS_{Dspecified} = FS_{Dtest} + 20 \log (D_{test}/D_{specified})$
where
$FS_{Dspecified}$ = Field Strength at specified distance $D_{specified}$ (in dBµV/m)
FS_{DTest} = Field Strength at specified distance D_{Test} (in dBµV/m)
D_{test} = Measurement distance where test was performed (in m)
$D_{specified}$ = Measurement distance as specified by the rules (in m)

Assuming a recorded field strength of 117.3 dBµV/m in a distance of 1 m. If the rules are specifying a limit in a distance of 3 m, the field strength recorded in 1 m is corrected by the distance. Therefore, the field strength $FS_{Dspecified}$ is 117.3 + 20 log (1 / 3) = 107.8 (in dBµV/m).
Remark: Using EMC32 software corrections are combined in the Corr. Factor as listed in the results' table.
"Result" represents the FS Result, "Corr." is the combined correction factor.

4.6.4 Test Procedures

According to customer information the highest fundamental frequency of the intentional radiator is 27.12 MHz.
With this frequency and taking 47CFR § 15.33 (a) (1) into account the spectrum shall be investigated up to 271.2 MHz, and according to 47CFR § 15.33 (b) (1) up to 1000 MHz.

The EUT was tested on a 0.8 meter high tabletop.
In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.
With the EUT operating in "worst case" mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions [Remark: Not applicable]. All tests performed with the EUT placed in both vertical and horizontal polarizations on the nonconductive table as shown in chapter .
Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in modulated mode.

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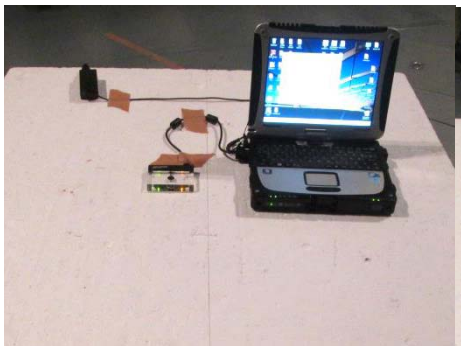
Worst case emissions are listed under chapter: test results.

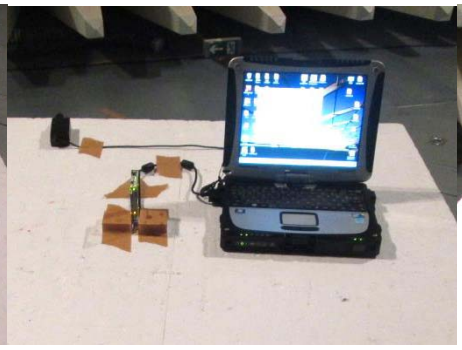
Radiated Emissions Test Characteristics	
Frequency range	30 MHz – 1000 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	120 kHz
Receive antenna height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal
Measurement location	Semi Anechoic Chamber (SAC)

* According to Section 15.31 (f)(1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. (...) When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

EUT Orientations



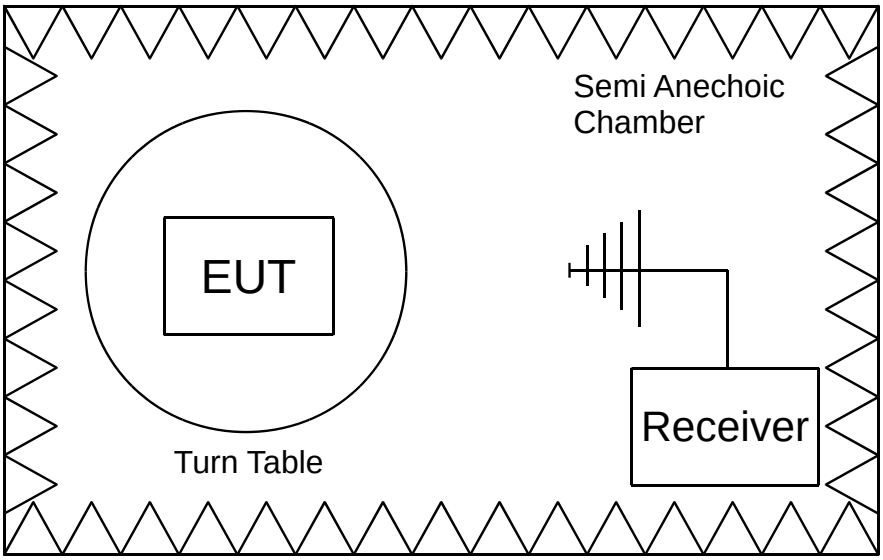
Orientation X



Orientation Y

Orientation Z

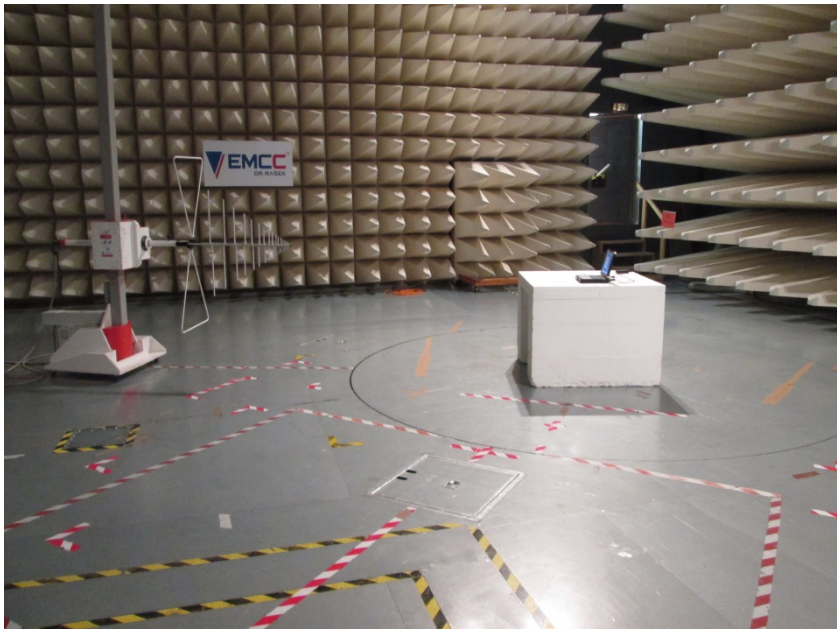
4.6.5 Test Setup



SCHEMATIC TEST SETUP

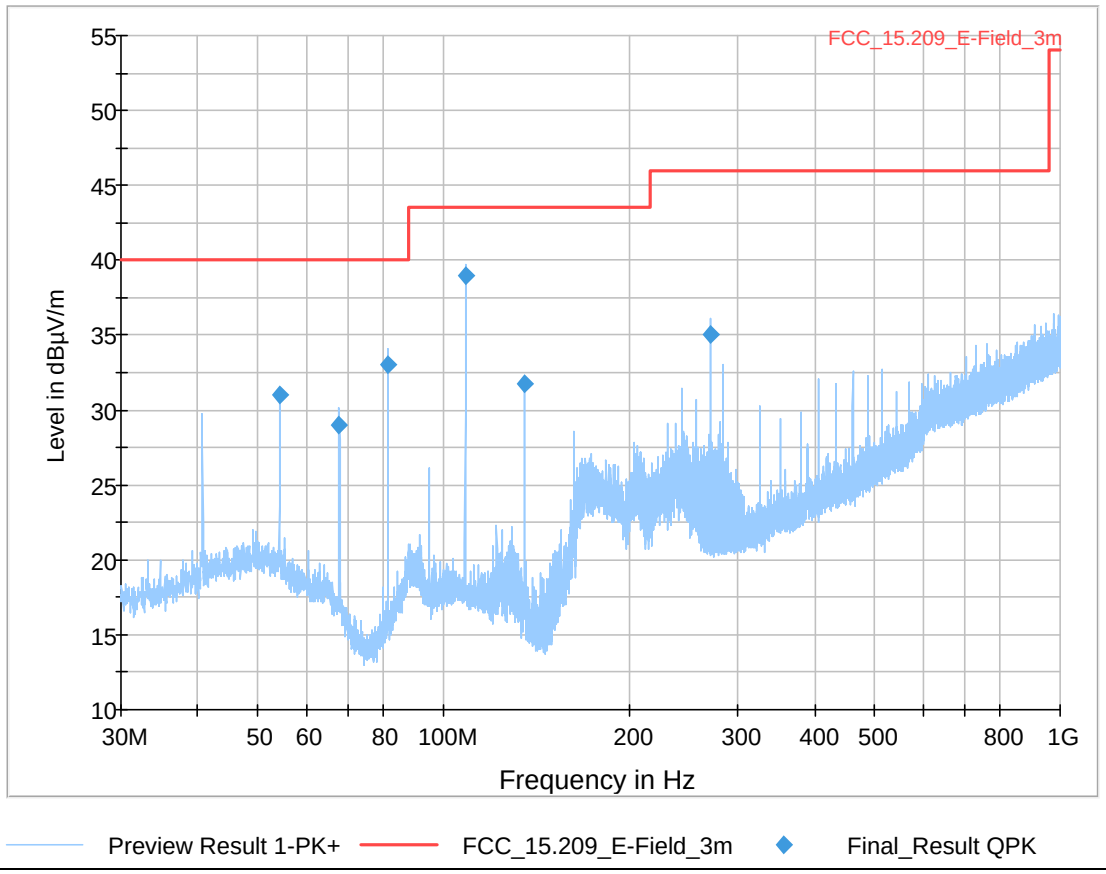
Requirement:	47 CFR, § 15.209 § 15.109, ICES-003
Procedure:	ANSI C63.10-2013 ANSI C63.4-2014
Receiver:	#516
Antenna:	#6041
Test distance:	3 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
54, 516, 1291, 1292, 1889, 2724, 3195, 4717, 5392, 6041



4.6.6 Detailed Test Data

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	FieldON
EUT Orientation:	X



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
54.22	31.0	40.0	9.0	1000	120.0	100.0	V	142	19.3
67.82	29.0	40.0	11.0	1000	120.0	318.0	H	2	16.2
81.38	33.0	40.0	7.0	1000	120.0	400.0	H	-1	13.6
108.46	39.0	43.5	4.5	1000	120.0	293.0	H	168	17.5
135.58	31.8	43.5	11.7	1000	120.0	243.0	H	-42	13.8
271.22	35.1	46.0	10.9	1000	120.0	107.0	H	-106	19.3

All tests performed at 3 m distance. The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

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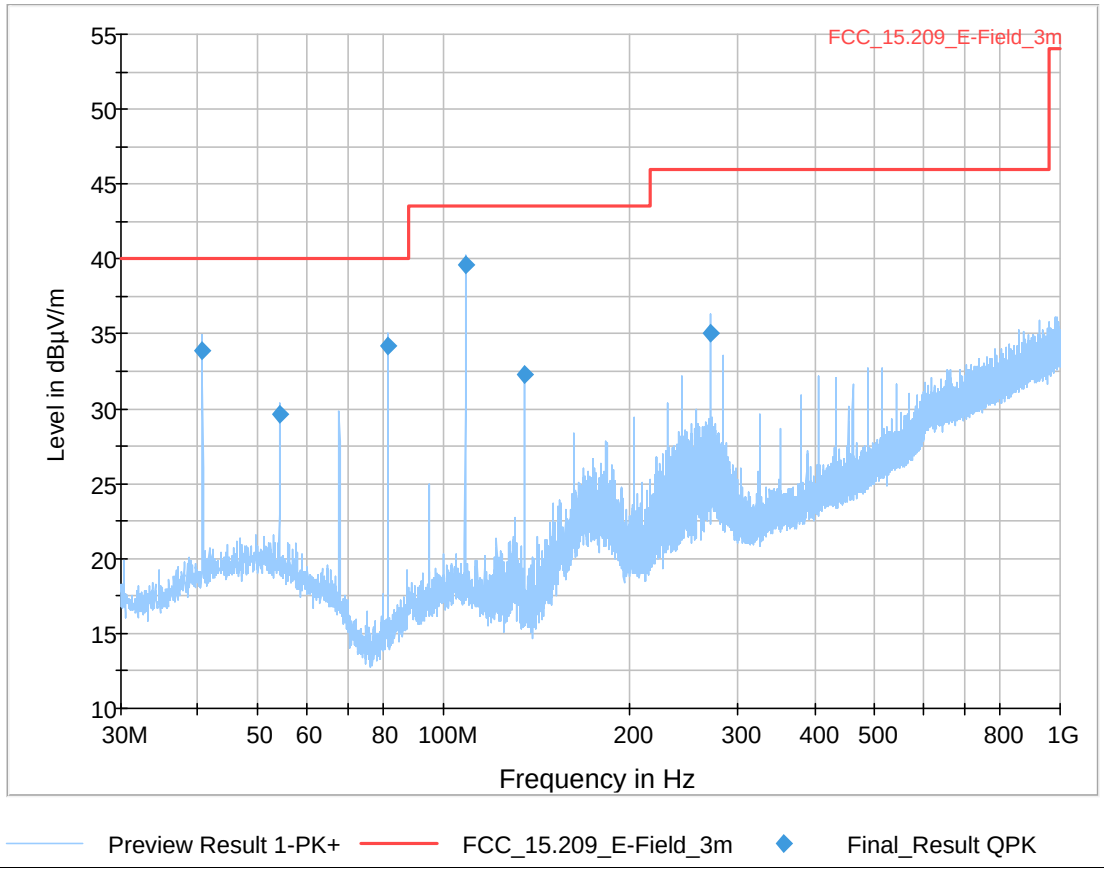
Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	FieldON
EUT Orientation:	Y



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.70	33.9	40.0	6.1	1000	120.0	100.0	V	-14	18.8
54.22	29.6	40.0	10.4	1000	120.0	100.0	V	122	19.3
81.34	34.2	40.0	5.8	1000	120.0	218.0	H	175	13.6
108.46	39.6	43.5	3.9	1000	120.0	278.0	H	168	17.5
135.58	32.3	43.5	11.2	1000	120.0	174.0	H	156	13.8
271.18	35.1	46.0	10.9	1000	120.0	108.0	H	-105	19.3

All tests performed at 3 m distance. The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

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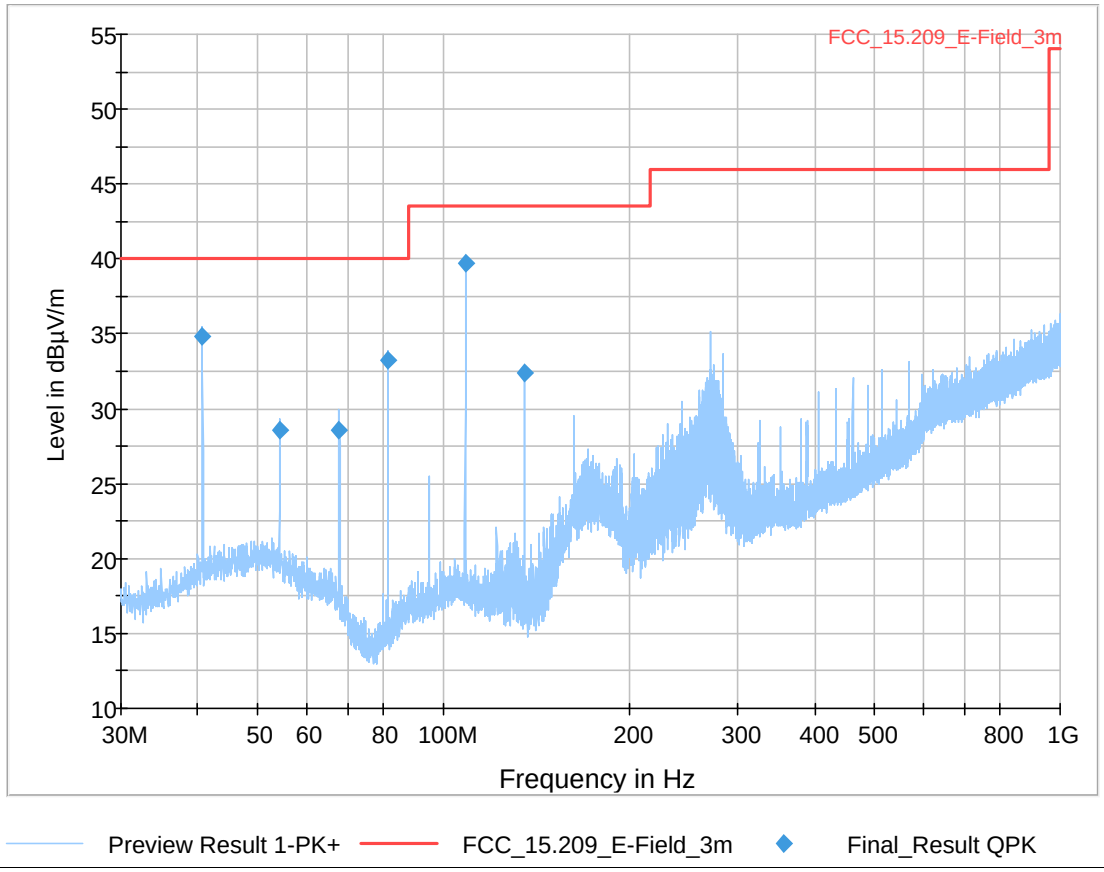
Test on Micro-Sensys GmbH iID® DESKTOP smart USB 7.0 Type 35.29.701.00 to 47 CFR 15.225 and RSS-210 Issue 9

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	FieldON
EUT Orientation:	Z



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.66	34.8	40.0	5.2	1000	120.0	100.0	V	-21	18.8
54.22	28.6	40.0	11.4	1000	120.0	101.0	V	130	19.3
67.78	28.6	40.0	11.4	1000	120.0	323.0	H	-8	16.2
81.34	33.2	40.0	6.8	1000	120.0	400.0	H	-14	13.6
108.46	39.7	43.5	3.8	1000	120.0	282.0	H	161	17.5
135.58	32.4	43.5	11.1	1000	120.0	223.0	H	157	13.8

All tests performed at 3 m distance. The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

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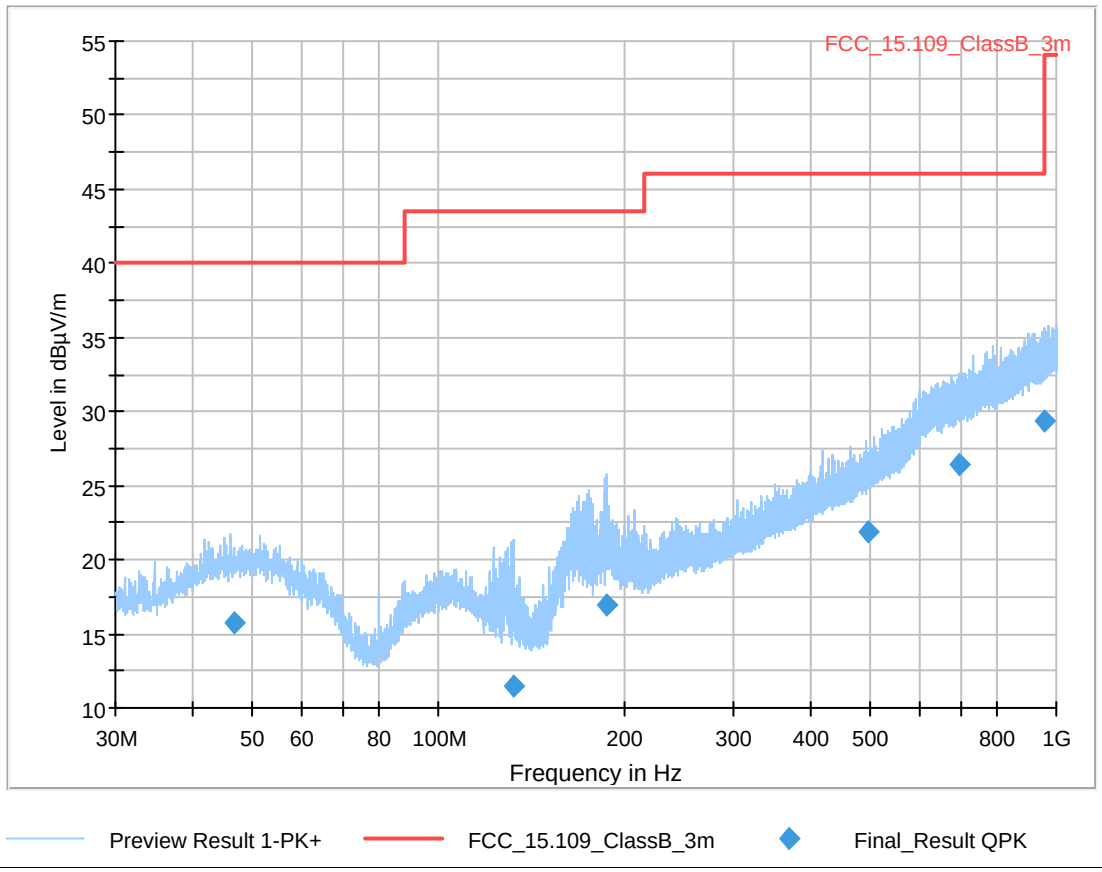
Test on Micro-Sensys GmbH iID® DESKTOP smart USB 7.0 Type 35.29.701.00 to 47 CFR 15.225 and RSS-210 Issue 9

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	RF_OFF
EUT Orientation:	X



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
46.62	15.8	40.0	24.2	1000	120.0	309.0	V	180	19.5
131.86	11.5	43.5	32.0	1000	120.0	117.0	V	7	14.0
187.06	17.0	43.5	26.5	1000	120.0	103.0	H	158	16.2
494.22	22.0	46.0	24.1	1000	120.0	264.0	V	-73	24.2
695.46	26.4	46.0	19.6	1000	120.0	400.0	H	59	27.3
953.50	29.4	46.0	16.6	1000	120.0	100.0	H	11	30.1

All tests performed at 3 m distance. The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

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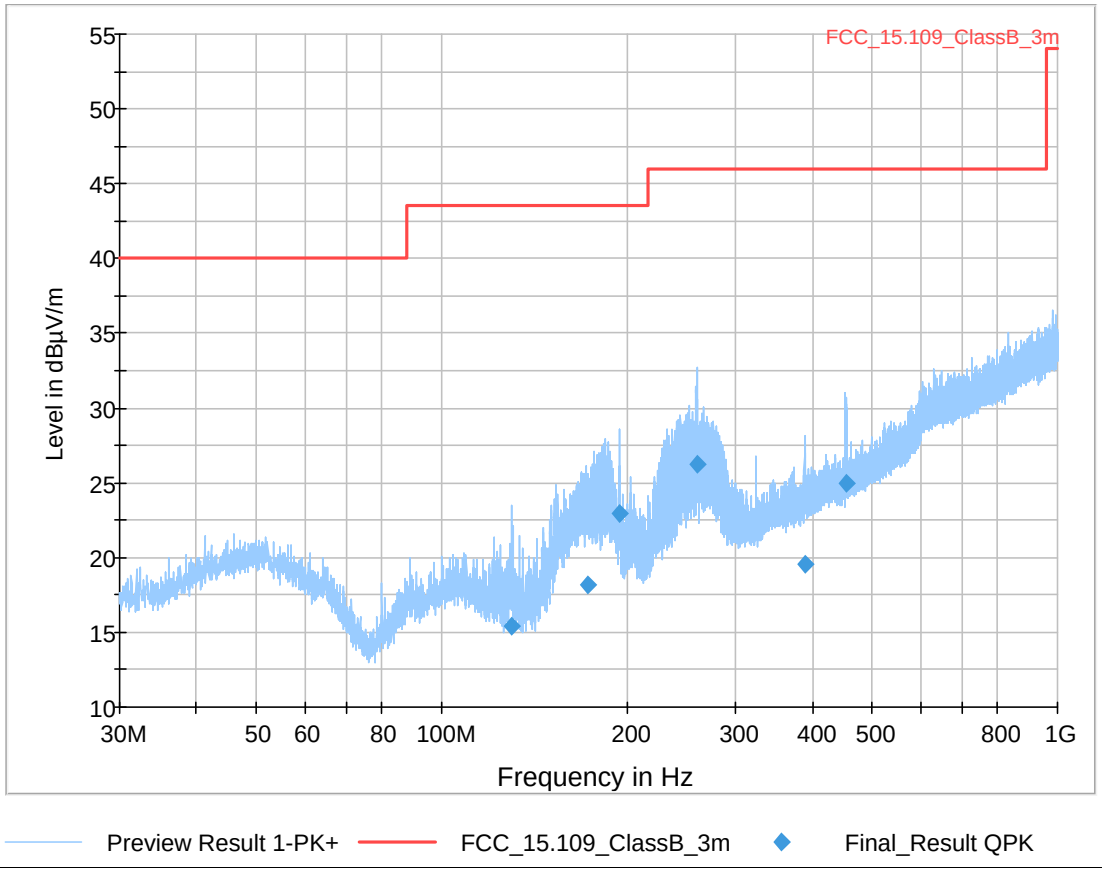
Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	RF_OFF
EUT Orientation:	Y



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
129.86	15.4	43.5	28.1	1000	120.0	101.0	V	-50	14.2
172.22	18.2	43.5	25.3	1000	120.0	115.0	H	-150	15.0
194.86	22.9	43.5	20.6	1000	120.0	247.0	V	-27	17.1
259.82	26.2	46.0	19.8	1000	120.0	209.0	V	12	19.2
388.34	19.6	46.0	26.4	1000	120.0	127.0	V	-105	22.2
452.98	25.0	46.0	21.0	1000	120.0	109.0	V	164	23.3

All tests performed at 3 m distance. The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

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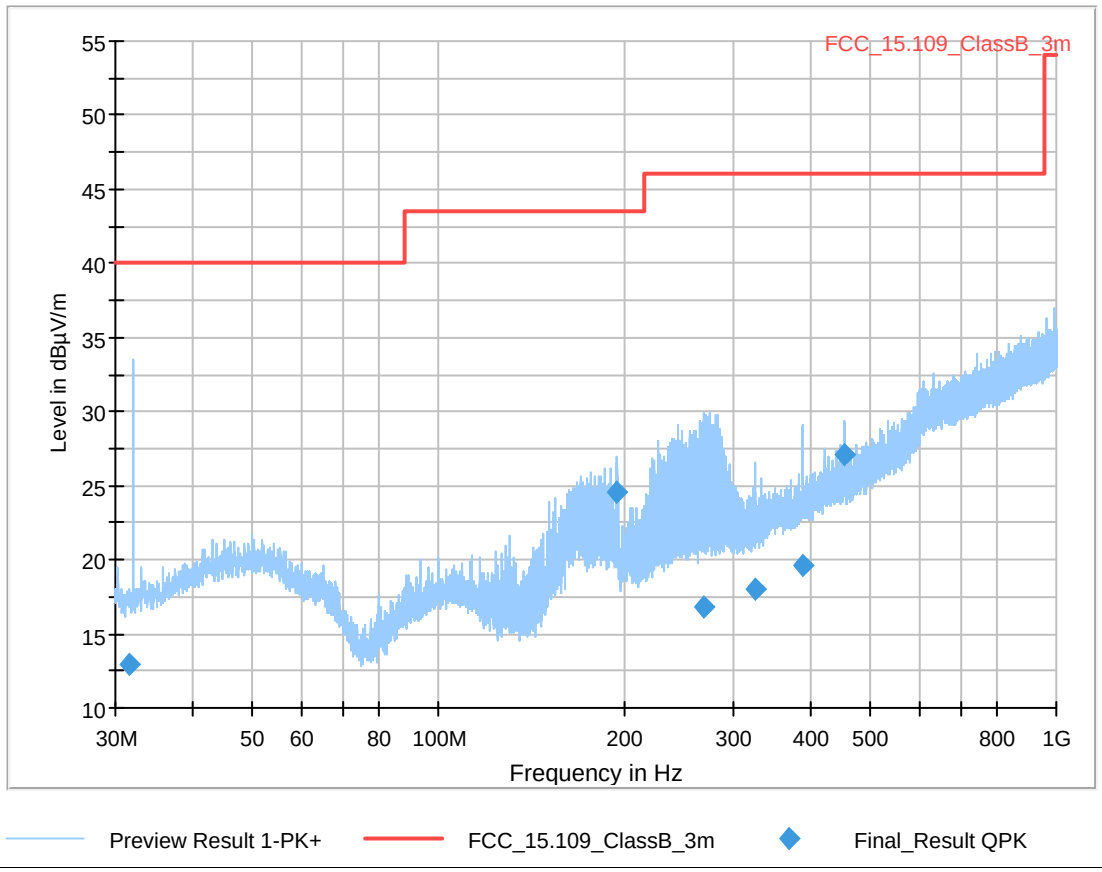
Test on Micro-Sensys GmbH iID® DESKTOP smart USB 7.0 Type 35.29.701.00 to 47 CFR 15.225 and RSS-210 Issue 9

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No:	122322
Operation Mode:	RF_OFF
EUT Orientation:	Z



Final Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
31.58	13.0	40.0	27.0	1000	120.0	372.0	H	135	16.4
194.86	24.6	43.5	18.9	1000	120.0	241.0	V	10	17.1
269.34	16.8	46.0	29.2	1000	120.0	104.0	H	58	19.3
325.10	18.0	46.0	28.0	1000	120.0	100.0	V	180	20.7
387.90	19.6	46.0	26.4	1000	120.0	160.0	V	120	22.2
453.06	27.1	46.0	18.9	1000	120.0	104.0	V	175	23.3

All tests performed at 3 m distance. The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

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4.6.7 Test Result

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No.:	122322
Test date:	2019-01-28
Test personnel:	Dominik Krüger

The EUT meets the requirements of this section.

4.7 Carrier Frequency Stability vs Temperature

Test Requirement: FCC 47 CFR §15.225(e), ISED RSS-210 B.6
Test Procedure: ANSI C63.10-2013, RSS-Gen 6.11

4.7.1 Regulation

47 CFR § 15.225 Operation within the band 13.110–14.010 MHz.

(e) The frequency tolerance of the carrier signal shall be maintained within ±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. For battery operated equipment, the equipment tests shall be performed using a new battery.

RSS-210 B.6 Band 13.110-14.010 MHz
Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

4.7.2 Test Procedures

Frequency stability with respect to ambient temperature:
The EUT was supplied with the nominal DC voltage (5 V) by the USB-port of a notebook. The EUT was placed in the centre of the environmental test chamber. The measurement antenna was placed in the environmental test chamber next to the EUT and connected to a receiver. It was verified that the receiver had an adequate signal level to allow the measurement.
The temperature control of the environmental test chamber was set to the highest temperature for sufficient time to allow the EUT to stabilize at the temperature.

a) While maintaining a constant temperature inside the environmental chamber, the EUT was turned on and the operating frequency was measured at start-up, two, five and ten minutes after the EUT was energized. Four measurements in total were made.
b) The EUT was switched off.
c) The chamber temperature was lowered by 10 °C and sufficient time was waited until the test chamber and the EUT did stabilize at the temperature.
d) The step a) through step c) were repeated down to the lowest specified temperature.
The highest deviation from the nominal carrier frequency was reported in the test result table.

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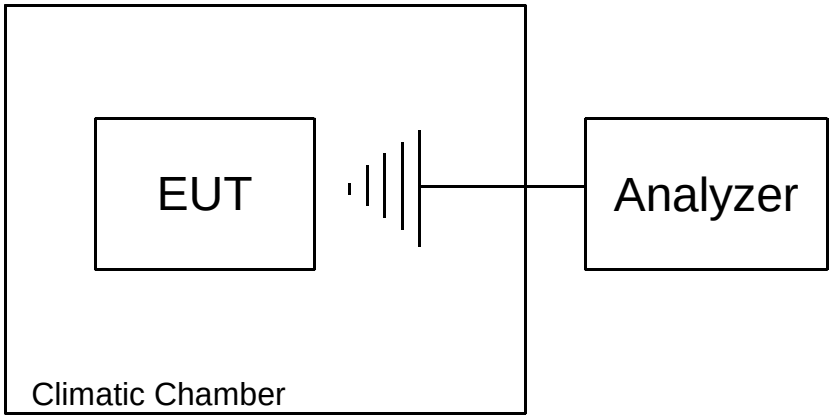
4.7.3 Test Setup



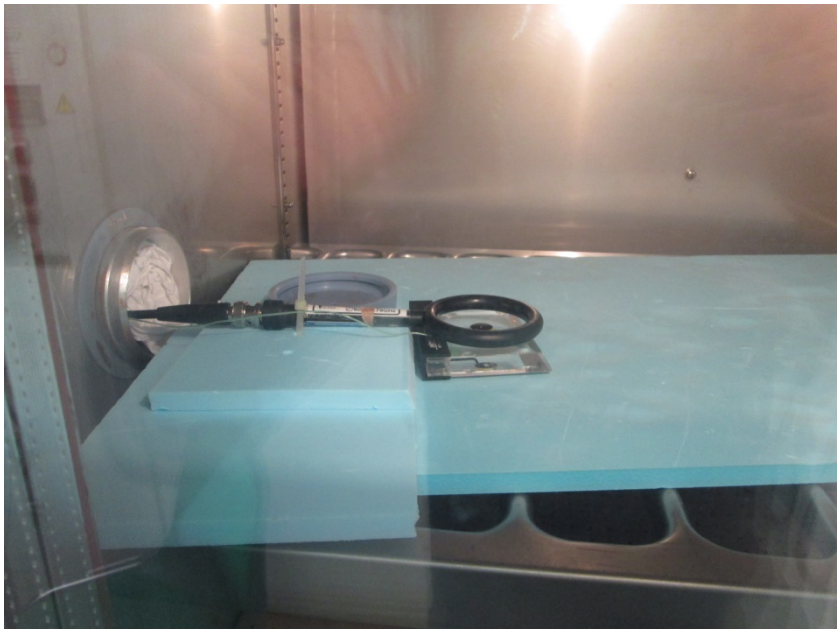
SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.225
Procedure: ANSI C63.10-2013

Receiver: #3831
Antenna: #1731

Test distance: 3 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
1064, 1731, 3026, 3831, 4493, 6344



4.7.4 Test Result

Test conditions: Supply voltage = 5 VDC
f_{ref} = 13.560018 MHz

Temperature	Time	Frequency	Deviation from reference		Limit	Lower limit	Upper Limit
[°C]	[min]	[MHz]	[Hz]	[ppm]	[ppm]	[MHz]	[MHz]
50	0 (start-up)	13.560051	33	2.434	±100	13.558662	13.561374
50	2	13.560051	33	2.434	±100	13.558662	13.561374
50	5	13.56005	32	2.360	±100	13.558662	13.561374
50	10	13.560048	30	2.212	±100	13.558662	13.561374
40	0 (start-up)	13.560013	-5	0.369	±100	13.558662	13.561374
40	2	13.560017	-1	0.074	±100	13.558662	13.561374
40	5	13.560019	1	0.074	±100	13.558662	13.561374
40	10	13.56002	2	0.147	±100	13.558662	13.561374
30	0 (start-up)	13.560017	-1	0.074	±100	13.558662	13.561374
30	2	13.560014	-4	0.295	±100	13.558662	13.561374
30	5	13.560012	-6	0.442	±100	13.558662	13.561374
30	10	13.560012	-6	0.442	±100	13.558662	13.561374
20	0 (start-up)	13.560025	7	0.516	±100	13.558662	13.561374
20	2	13.560021	3	0.221	±100	13.558662	13.561374
20	5	13.560018	0	0.000	±100	13.558662	13.561374
20	**10**	**13.560018**	**0**	0.000	**±100**	**13.558662**	**13.561374**
10	0 (start-up)	13.560048	30	2.212	±100	13.558662	13.561374
10	2	13.56004	22	1.622	±100	13.558662	13.561374
10	5	13.560033	15	1.106	±100	13.558662	13.561374
10	10	13.560031	13	0.959	±100	13.558662	13.561374
0	0 (start-up)	13.560054	36	2.655	±100	13.558662	13.561374
0	2	13.56005	32	2.360	±100	13.558662	13.561374
0	5	13.560047	29	2.139	±100	13.558662	13.561374
0	10	13.560045	27	1.991	±100	13.558662	13.561374
-10	0 (start-up)	13.560048	30	2.212	±100	13.558662	13.561374
-10	2	13.560054	36	2.655	±100	13.558662	13.561374
-10	5	13.560055	37	2.729	±100	13.558662	13.561374
-10	10	13.560055	37	2.729	±100	13.558662	13.561374
-20	0 (start-up)	13.560053	35	2.581	±100	13.558662	13.561374
-20	2	13.560053	35	2.581	±100	13.558662	13.561374
-20	5	13.560053	35	2.581	±100	13.558662	13.561374
-20	10	13.560053	35	2.581	±100	13.558662	13.561374

Test performed at nominal supply voltage and within the temperature range of -20 °C up to +50 °C starting at nominal ambient temperature and continuing with the highest specified temperature and proceeding with temperature lowered in 10 degree steps down to the lowest specified.

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Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No.:	122322
Test date:	2019-01-31
Test personnel:	Adem Aldogan

Carrier frequency stability is within the specified limits.

The EUT meets the requirements of this section.

4.8 Carrier Frequency Stability vs Supply Voltage

Test Requirement: FCC 47 CFR §15.225(e), ISED RSS-210 B.6
Test Procedure: ANSI C63.10-2013, RSS-Gen

4.8.1 Regulation

47 CFR § 15.225 Operation within the band 13.110–14.010 MHz.

(e) The frequency tolerance of the carrier signal shall be maintained within ±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. For battery operated equipment, the equipment tests shall be performed using a new battery.

RSS-210 B.6 Band 13.110-14.010 MHz
Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

4.8.2 Test Procedures

Frequency stability when varying supply voltage:
The tests were made at ambient room temperature (+15 °C to +25 °C).The EUT was placed on a wooden table 0.8 meter high tabletop.
The EUT was supplied with the nominal DC voltage (5 V) by the USB-port of a notebook.
An antenna was placed above the EUT antenna and connected to a receiver. It was verified that the receiver had an adequate signal level to allow the measurement.

The primary input voltage of the notebook was set to 115 V / 60 Hz, 97.8 V / 60 Hz (U_{nom} - 15 %) and 132.3 V / 60 Hz (U_{nom} + 15 %).
The measurement of the centre frequency was measured at each voltage step.

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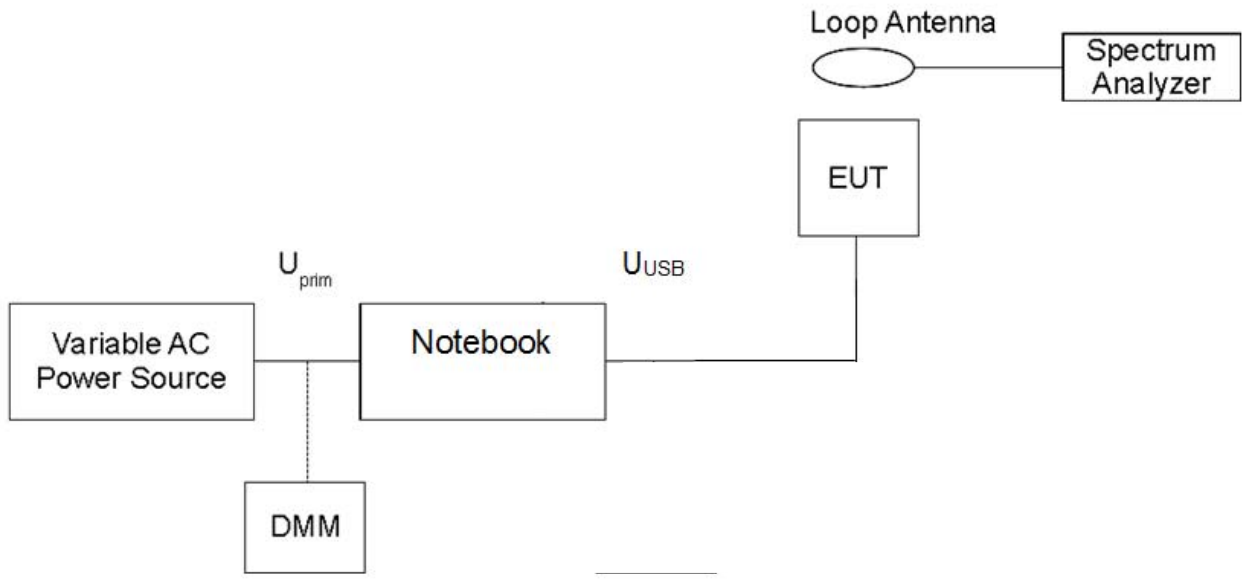
4.8.3 Test Setup

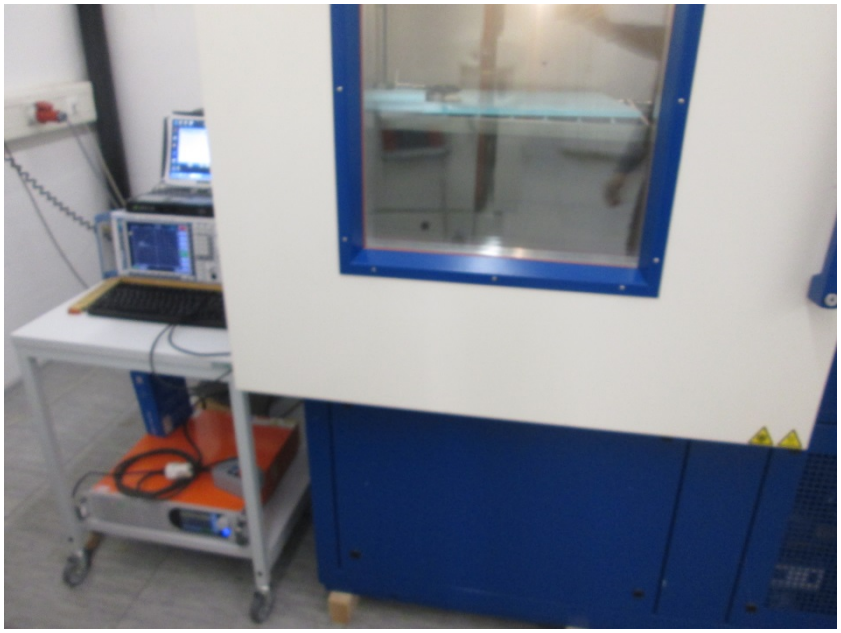


SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.225
Procedure: ANSI C63.10-2013

Receiver: #3831
Antenna: #1731

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
1731, 2717, 3831, 6344



4.8.4 Test Result

Test conditions: Temperature = 20 °C
f_{ref} = 13.560021 MHz

Supply Voltage U_{prim}	USB Voltage U_{USB}	Frequency	Deviation from reference		Limit	Lower limit	Upper Limit
[V]	[V]	[MHz]	[Hz]	[ppm]	[ppm]	[MHz]	[MHz]
97.8	5.010	13.560027	6	0.442	±100	13.558665	13.561377
115	**5.010**	**13.560021**	**0**	**0.000**	**±100**	**13.558665**	**13.561377**
132.3	5.010	13.560022	1	0.074	±100	13.558665	13.561377

Test performed at normal ambient temperature and within the manufacturer's specified supply voltage range.

Manufacturer:	Micro-Sensys GmbH
Type:	35.29.701.00
Serial No.:	122316
Test date:	2019-02-01
Test personnel:	Dominik Krüger

Carrier frequency stability is within the specified limits.

The EUT meets the requirements of this section.

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5 TEST INSTRUMENTS

EMCC ID #	Instrument	Manufacturer	Model No.	Last Calibration	Calibration valid until
1	60-Hz-Converter	AEG	DAMK4/DAGK4	n/a	n/a
54	N-Cable N/50	Rohde & Schwarz	HFU2-Z5	2018-12	2019-12
374	Loop Antenna	Rohde & Schwarz	HFH 2-Z2	2018-11	2021-02
516	EMI Test Receiver	Rohde & Schwarz	ESIB40	2018-03	2019-03
1064	Thermoconnector	Ahlborn	ZA9020FS	2018-02	2020-02
1291	Antenna Mast	Frankonia	FAM4	n/a	n/a
1292	Multi Device Controller	Frankonia	FC02	n/a	n/a
1731	Sniffer Loop Probe	EMCO	7405-901	n/a	n/a
1889	SR-ULL-01, Semi-Anechoic Chamber (SAC)	EMCC/FRANK.	SAC-10	n/a	n/a
1890	SR-ULL-05, Absorber-Lined Shielded Chamber	EMCC / SIEM / FRANK	SC2-ULL	n/a	n/a
1901	V-LISN 50 ohms//(50 uH + 5 ohms)	Rohde & Schwarz	ESH2-Z5	2018-11	2019-11
2717	Digital Multimeter	Agilent	U1241A	2018-02	2020-02
2724	5 W Attenuator 6dB	Weinschel	2	2017-06	2019-06
3026	Thermal Chamber	Feutron	3416/16	2017-09	2019-09
3184	Pulse Limiter	MTS	MTA-IMP-136	2017-07	2019-07
3195	Notebook	Samsung	P560	n/a	n/a
3831	Spectrum Analyzer	Rohde & Schwarz	FSU50	2018-10	2019-10
3846	EMI Test Receiver	Rohde & Schwarz	ESU8	2019-02	2020-02
4075	Workstation	Dell	Optiplex 7010	n/a	n/a
4493	Data Logger	Ahlborn	ALMEMO 2890-9	2017-10	2019-10
4717	Web-Thermo-Hygrobarograph	Wiesemann & Theis GmbH WUT	57613 Web-T/Rh/P	2018-01	2020-01
5392	EMC Measurement Software	Rohde & Schwarz	EMC32	n/a	n/a
5404	Notebook	DELL	Latitude E5450	n/a	n/a
5551	BNC cable	EMCC	BNC003m0	n/a	n/a
6041	TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	2017-09	2019-09
6344	Power Supply	Preen	AFV-P-600A	n/a	n/a

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6 MEASUREMENT UNCERTAINTY

Measurement	Measurement Uncertainty
Conducted Emissions, AC mains (150 kHz – 30 MHz)	±3.5 dB
Radiated Emissions, H field (9 kHz – 30 MHz)	±3.0 dB
Radiated Emissions 30 – 1000 MHz	±5.6 dB
Frequency accuracy above 13 MHz	$\pm 1.3 \cdot 10^{-7}$

The reported uncertainty values are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of 95%.

The given values have been calculated on the basis of the following documents:

CISPR 16-4-2:2011+A1:2014, Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-2: Uncertainties, statistics and limit modelling - Measurement instrumentation uncertainty.

JCGM 100:2008, Evaluation of measurement data - Guide to the expression of uncertainty in measurement.

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7 LIST OF ANNEXES

The following annexes are separated parts from this test report.

Description	Pages
Annex 1: Photographs of test setup	5
Annex 2: External photographs of equipment under test	4
Annex 3: Internal photographs of equipment under test	7
Annex 4: Photographs of ancillary equipment	4
Annex 5: Photographs of EUT modifications	2

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