Report No. 405631-04-R04

Test Report

Product	Handheld RFID reader with NFC, BLE module and battery charger
Name and address of the applicant	BioControl AS Gautestadveien 75 1894 Rakkestad, Norway
Name and address of the manufacturer	BioControl AS Gautestadveien 75 1894 Rakkestad, Norway
Model	HHR5000LN, HHR5000SN
Rating	Secondary Battery (7.4V, 2600mAh, Li-Ion)
Trademark	BioControl
Serial number	See page 3
Additional information	NFC, Bluetooth, RFID, ISO reader
Tested according to	**FCC Part 15.225** NFC reader **Industry Canada RSS-210, Issue 10** NFC reader
Order number	405631
Tested in period	2020-10-13 to 2020-10-23 and 2021-09-07 and 2021-11-17
Issue date	2021-11-17
Name and address of the testing laboratory	Nemko Instituttveien 6 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO0470 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50 ilac-MRA NORWEGIAN ACCREDITATION TEST 033 **An accredited technical test executed under the Norwegian accreditation scheme**

Prepared by [Frode Sveinsen]	Approved by [G.Suhanthakumar]
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ENTERPRISE NUMBER NO974404532

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1 INFORMATION

1.1 Test Item

Name	**BioControl**
Model/version	**HHR5000SN** **HHR5000LN**
FCC ID	**VW2-107378**
ISED ID	**7523A-107378**
Serial number	**2040-2 (HHR5000SN)** **2040-7 (HHR5000LN)** **2040-1 (HGC2)**
Hardware identity and/or version	**HHR5000 0.05, IsoModule 0.03, NFCReader 0.01, HandgripCharger 0.01**
Software identity and/or version	**HHR5000: 60.2, ISO_Module: 9.10, NFCReader: 6.6**
Frequency Range	**13.56 MHz**
Number of Channels	**1**
Type of Modulation	**ASK (30%)**
Field Strength	**64.1 dBµV/m @3m**
Antenna Connector	**None (Integral Antenna)**
Number of Antennas	**1**
Antenna Type	**Open Coil**
Power Supply	**Secondary Battery (Li-Ion, 7.4V, 2600mAh)**

Description of Test Item

The EUT is a RFID reader with NFC and ISO reader.

The EUT also contains a certified BLE Module from Ublox (FCC ID: XPYNINAB1; IC: 8595A-NINAB1).

The tested model was a HHR5000LN with LCD display and NFC reader, however the ISO reader is identical on all models.

Model Comparison

Feature	HHR5000S	HHR5000L	HHR5000SN	HHR5000LN
LCD	**No**	**Yes**	**No**	**Yes**
Smartphone holder	**Yes**	**No**	**Yes**	**No**
ISO Reader	**Yes**	**Yes**	**Yes**	**Yes**
NFC Reader	**No**	**No**	**Yes**	**Yes**
BLE Module	**Yes**	**Yes**	**Yes**	**Yes**
HandGrip Charger	**HGC2**			
FCC ID	**VW2-107377**		**VW2-107378**	
IC	**7523A-107377**		**7523A-107378**	

1.2 Normal test condition

Temperature:	**20 - 24 °C**
Relative humidity:	**20 - 50 %**
Normal test voltage:	**7.4 V DC**

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

1.4 Antenna Requirement

Does the EUT have detachable antenna(s)?	☐ **YES**	☒ **NO**
If detachable, is the antenna connector(s) non-standard?	☐ **YES**	☐ **NO**
The tested equipment has only integral antennas. Conducted tests were performed with a temporary antenna connector.		

Requirement: FCC 15.203, 15.204

1.5 EUT Operating Modes

Description of operating modes	Continuous TX
Additional information	The EUT was programmed to transmit continuously from the LCD Interface by using a special test software. It was only possible to select the transmit frequency, no power or modulation settings were available.

1.6 Comments

The EUT is a RFID reader with 13.56 MHz NFC reader and 131 / 134 kHz ISO reader.

The EUT also contains a certified BLE Module.

All measurements were done with the EUT powered by a fully charged battery, or with the EUT charging from 120V 60Hz with the supplied charger.

Measurements with NFC and BT transmitting simultaneously were performed with the EUT Charging.

2 TEST REPORT SUMMARY

2.1 General

All measurements are tracable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.225 and Industry Canada RSS-210 Issue 10 and RSS-GEN Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and and ANSI C63.10-2013.

Radiated tests were made in a semi-anechoic chamber at measuring distances of 3m and 10m.

A description of the test facility is on file with FCC and ISED.

☒ New Submission	☒ Production Unit
☐ Class II Permissive Change	☐ Pre-production Unit
DXX Equipment Code	☐ Family Listing

THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in “Summary of Test Data”.

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 10 ICES-003 Issue 7 RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	5.13	N/A*
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Complies
Power Line Conducted Emission	15.107(a)	3.2 (ICES-003) 8.8 (RSS-GEN)	7.3 (C63.4-2014) 6.2	Complies
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9.3	Complies
Radiated Emissions at Fundamental	15.225(b)(c)	B.6 (a) (RSS-210)	6.4	Complies
Frequency Tolerance	15.225(e)	B.6 (b) (RSS-210) 6.11/ 8.11 (RSS-GEN)	6.8.1	Complies
Spurious Emissions (Radiated)	15.225(c)(d) 15.109(a) 15.209(a)	B.6 (a) (RSS-210) 8.9 (RSS-GEN)	6.3, 6.4, 6.5, 6.6	Complies

*This is a battery-operated device.

Revision history

Revision	Date	Comment	Sign
00	2021-02-22	First edition	FS
01	2021-03-04	Corrected Measuring distance and added Class A comment.	FS
02	2021-03-10	Updated Conducted Emissions test	FS
03	2021-10-14	Updated with interoperability tests for BT	FS
04	2021-11-17	Updated Setup diagrams and interoperability plots	FS

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC Part 15.207

ISED ICES-003 Issue 7, Clause 3.2

RSS-GEN Issue 5, Clause 8.8

Measurement procedure: **ANSI C63.4-2014 using 50 µH/50 ohms LISN.**

Test Results: **Complies with Class B limits**

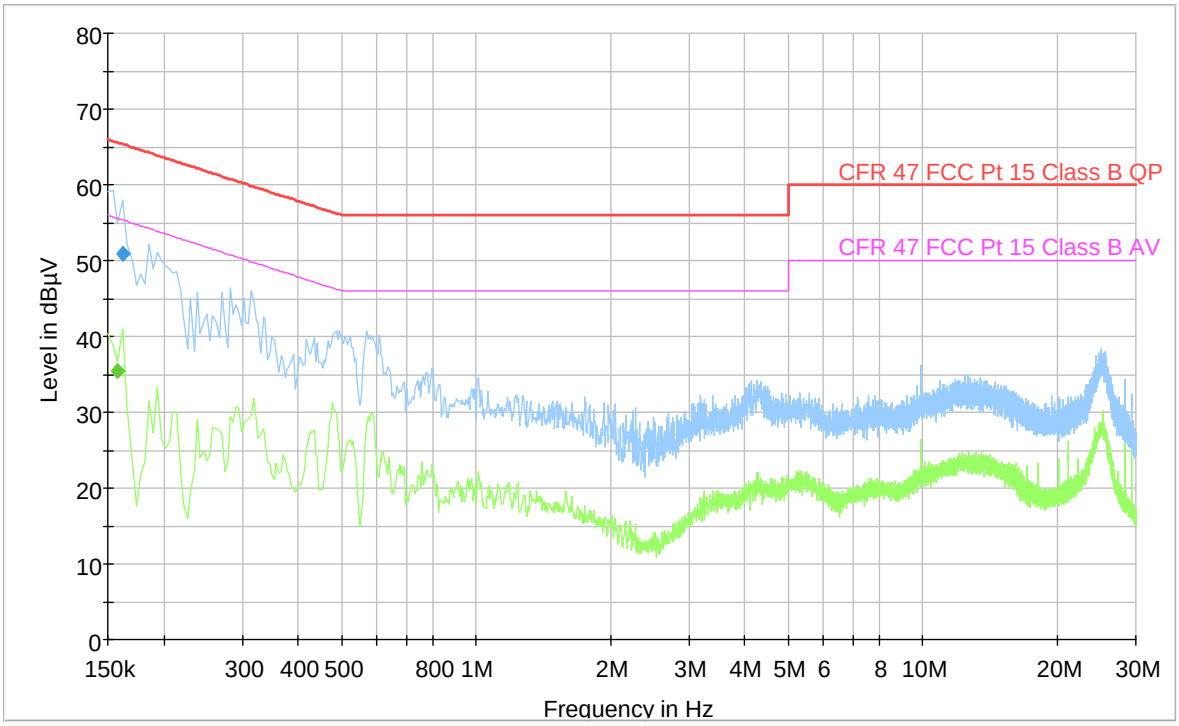
Measurement Data: **See attached plots.**

Highest measured value (L1 and N):

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.158	---	35.45	55.57	20.12	1000	9	N	OFF
0.162	50.84	---	65.36	14.52	1000	9	N	OFF

Charging, 120V 60Hz

Full Spectrum



3.2 Occupied Bandwidth (99% BW)

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.3

Test Results: Complies

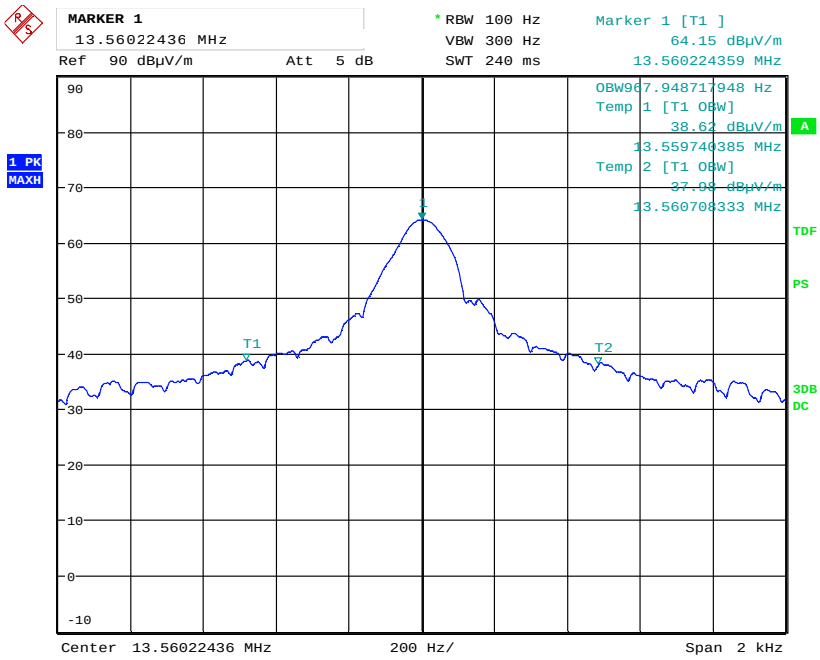
Measurement Data:

Carrier Frequency	Occupied Bandwidth (99% BW)
13.56 MHz	968 Hz

See attached plots.

Requirements:

No requirement for 99% BW, reported for information only.



Date: 13.OCT.2020 14:46:35

99% Occupied Bandwidth

3.3 Frequency Tolerance

FCC Part 15.225 (e)

ISED Canada RSS-210 Issue 10, Clause B.6 (b)

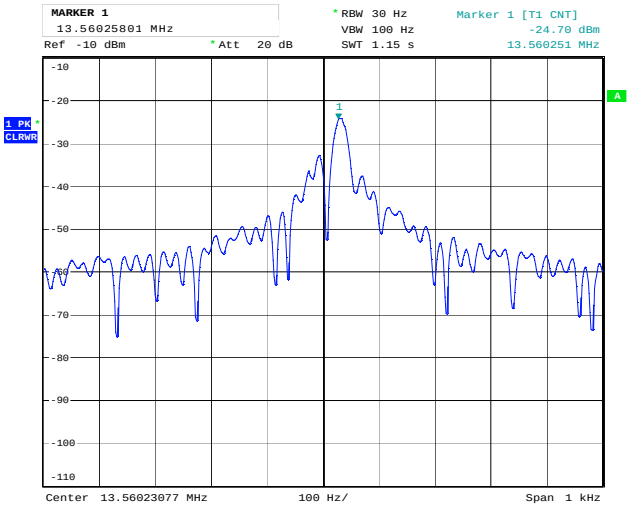
Measurement procedure: ANSI C63.10-2013 Clause 6.8.1

Test Results: Complies

Measurement Data:

Temperature	Nominal Freq (MHz	Measured Freq (MHz)	Deviation (%)	Requirement (%)
Nominal (+20 °C)	13.56	13.560251	0.00185 %	±0.01 %
+50 °C	13.56	13.560230	0.00170 %	±0.01 %
-20 °C	13.56	13.560321	0.00237 %	±0.01 %

Measured with the counter function of the Spectrum Analyzer.



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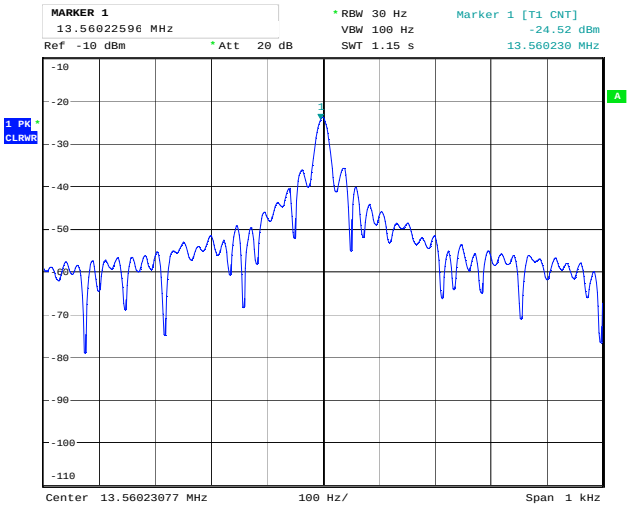
Frequency Tolerance +20 °C



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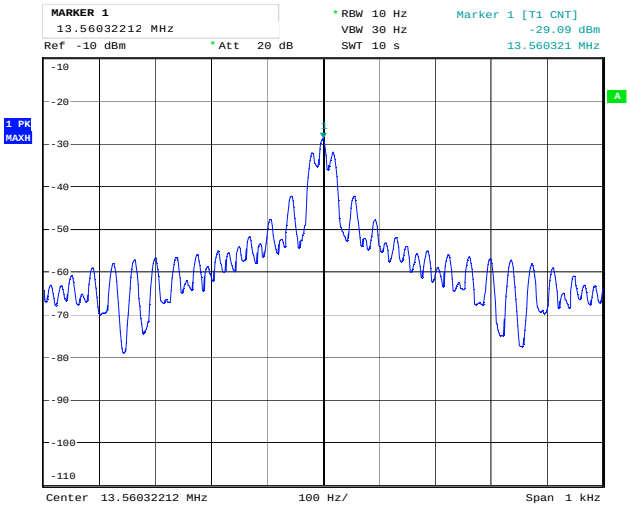
Frequency Tolerance +50 °C



Date: 19.OCT.2020 15:47:34

Frequency Tolerance -20 °C

3.4 Peak Power Output

FCC Part 15.225 (b)(c)

ISED Canada RSS-210 Issue 10, Clause B.6 (a)

Measurement procedure: ANSI C63.10-2013 Clause 6.4

Test Results: Complies

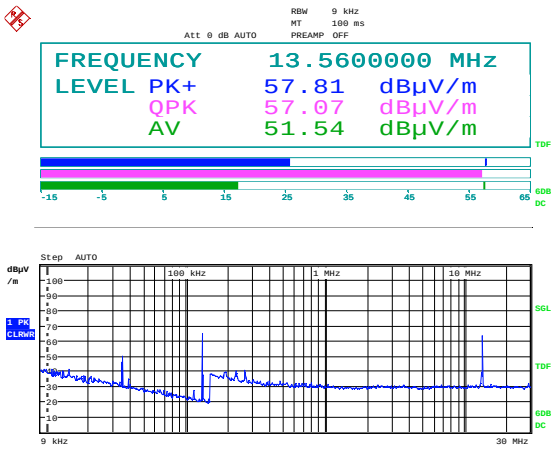
Measurement Data:

Carrier Frequency (MHz)	Measuring Distance	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
13.56	3m	64.1	69.5	5.4

See attached plots.

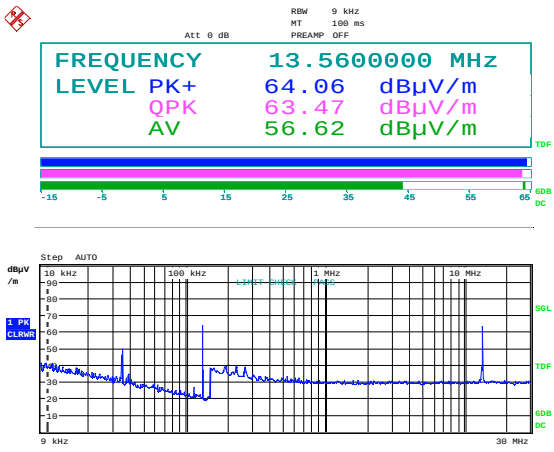
Requirements:

The maximum radiated field strength shall not exceed the following limits:



Date: 13.OCT.2020 15:05:09

Fundamental Emissions, LP @3m



Date: 13.OCT.2020 15:34:40

Fundamental Emissions, HP @3m

3.5 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED RSS-GEN, Issue 5 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISED Canada (MHz)	FCC (GHz)	ISED Canada (GHz)
0.090-0.110		**0.96-1.24** **1.3-1.427**	**0.96-1.427**
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		**2.69-2.9**	**2.655-2.9**
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		**3.6-4.4**	**3.5-4.4**
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 **123-138**	**108-138**	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISED, all other frequencies are common.

3.6 Radiated Emissions, 9 kHz – 30 MHz.

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 8.9

Measurement procedure: ANSI C63.10-2013 Clause 6.4

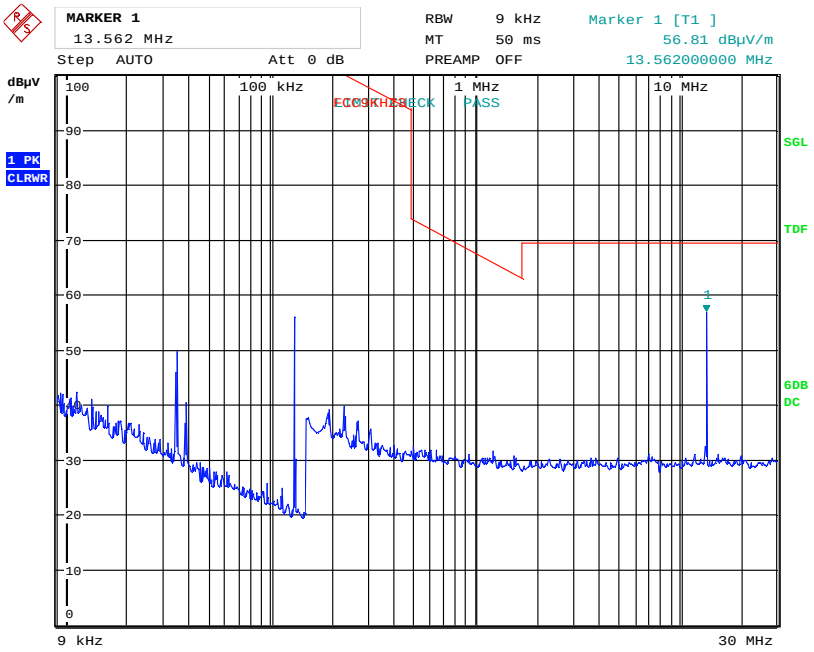
Test Results: Complies

Measuring distance 3m and 10m with Peak detector.

No components detected, see attached plots.

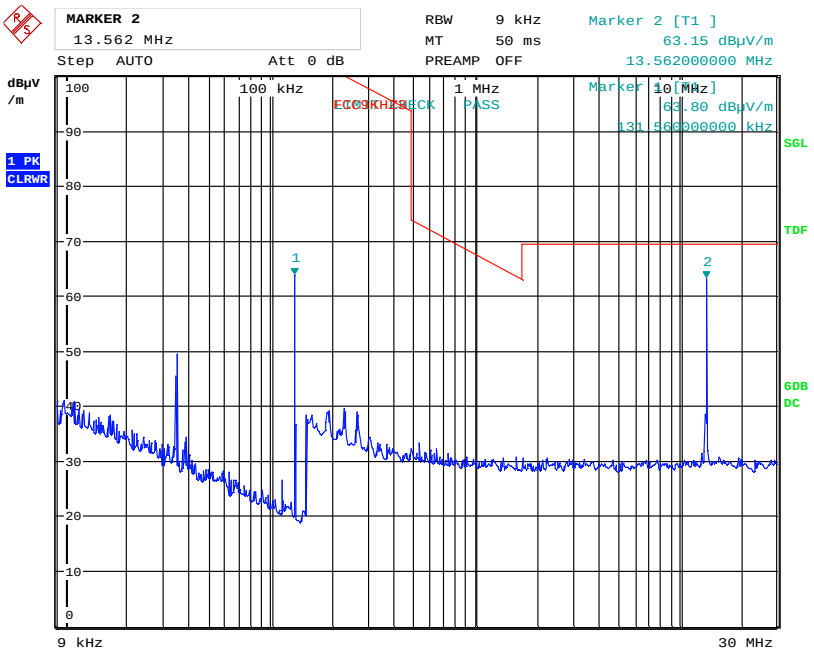
(The component at 34.5Mhz is inherent noise in the chamber)

Limit is converted to 3m and 10m using 40 dB/decade according to 15.31 (f)(2).



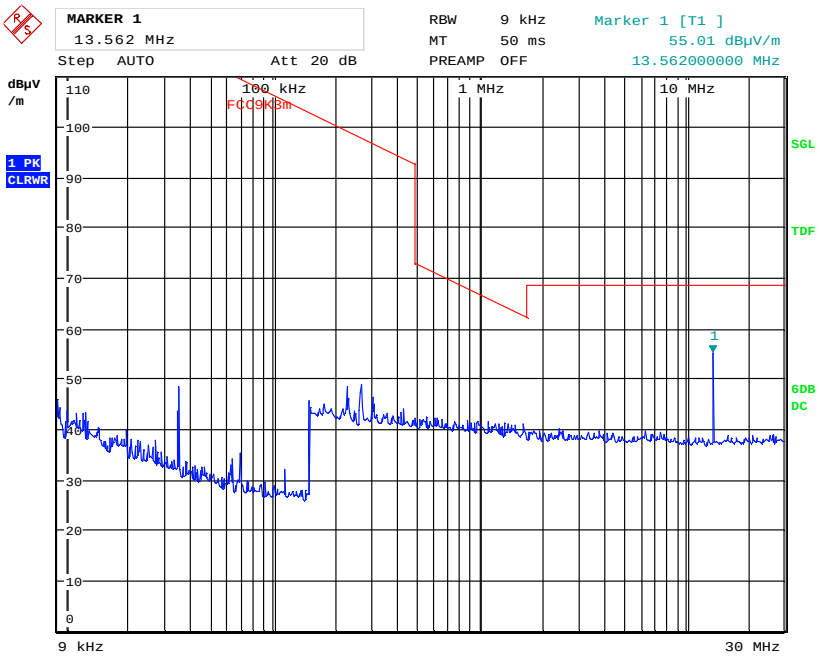
Date: 13.OCT.2020 15:22:16

Radiated Emissions 9 kHz - 30 MHz, LP @3m



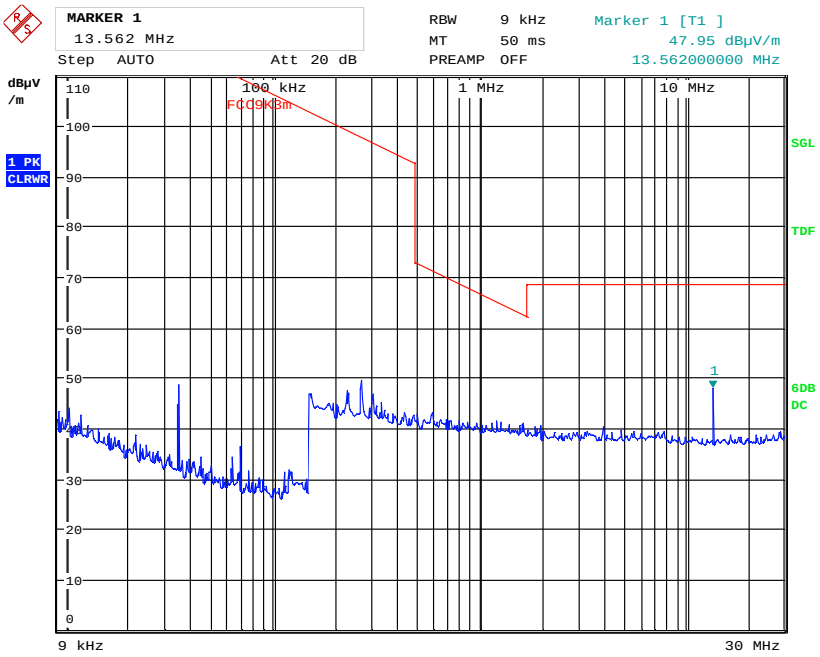
Date: 13.OCT.2020 15:32:41

Radiated Emissions 9 kHz - 30 MHz, HP @3m



Date: 17.NOV.2021 13:49:47

Radiated Emissions 9 kHz - 30 MHz, LP @3m, BT+NFC, EUT Charging, 120V 60Hz



Date: 17.NOV.2021 14:04:16

Radiated Emissions 9 kHz - 30 MHz, HP @3m, BT+NFC, EUT Charging, 120V 60Hz

3.7 Radiated Emission, 30 – 1000 MHz.

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 8.9

Measurement procedure: ANSI C63.10-2013 Clause 6.5

Test Results: Complies

Measurement Data:

Detector: Peak

Measuring distance 3m

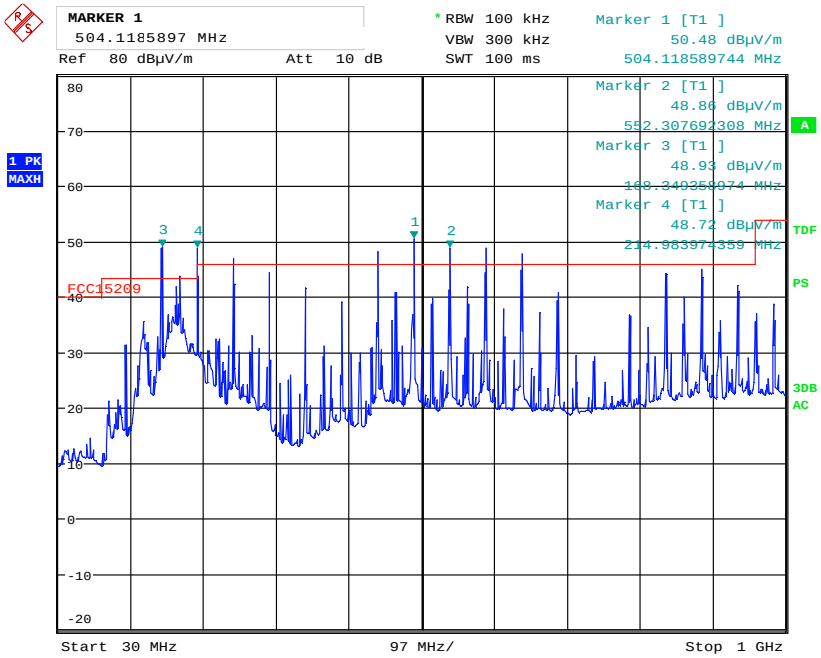
Tested with 13.56 MHz NFC active.

This is a Class A device. All emissions that are above the limit are from digital circuitry other that the transmitter.

See plots.

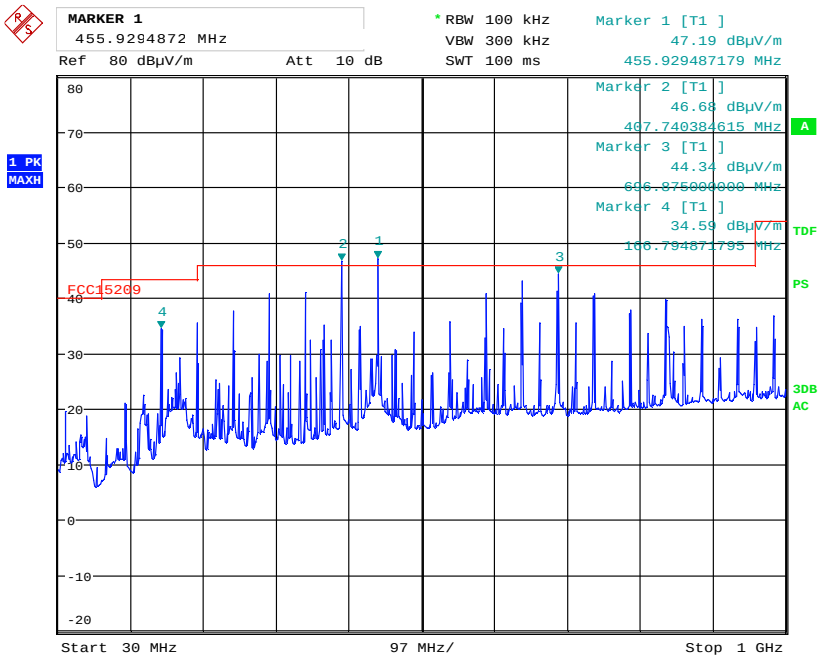
Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 µV/m	40.0 dBµV/m
88 – 216 MHz	150 µV/m	43.5 dBµV/m
216 – 960 MHz	200 µV/m	46.0 dBµV/m
960 – 1000 MHz	500 µV/m	54.0 dBµV/m
	Limits above are with Quasi Peak Detector	



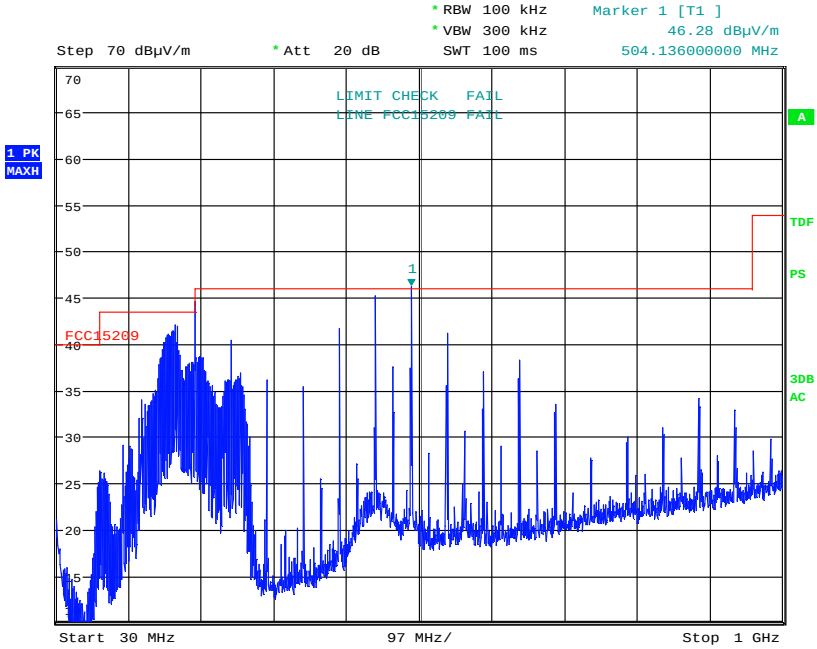
Date: 15.OCT.2020 11:08:23

Radiated Emissions 30 - 1000 MHz, HP @3m



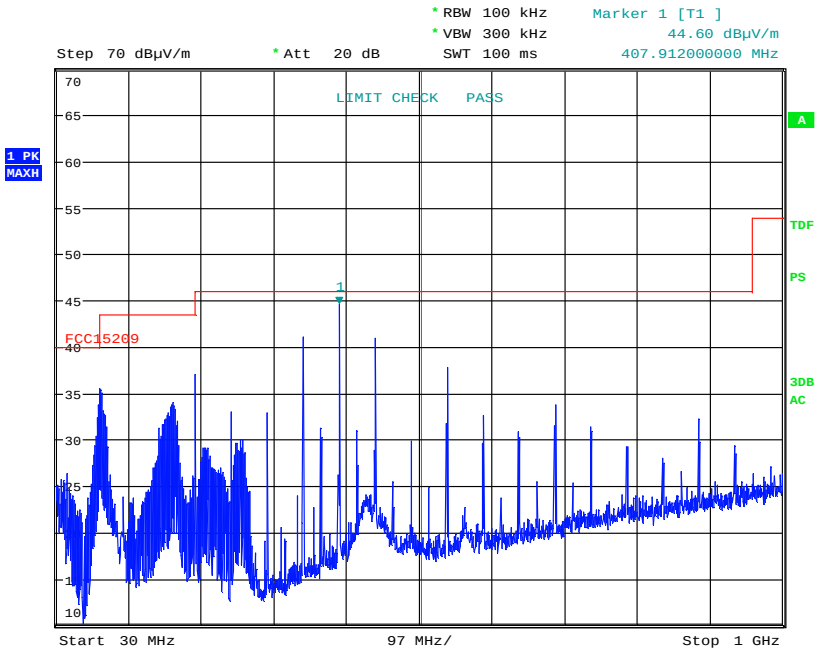
Date: 15.OCT.2020 11:12:07

Radiated Emissions 30 - 1000 MHz, VP @3m



Date: 7.SEP.2021 14:36:26

Radiated Emissions 30 - 1000 MHz, HP @3m, Bluetooth + NFC, EUT Charging 120V 60Hz



Date: 7.SEP.2021 14:34:29

Radiated Emissions 30 - 1000 MHz, VP @3m, Bluetooth + NFC, EUT Charging 120V 60Hz

3.8 Radiated Emissions, 1-18 GHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 8.9

Measurement procedure: **ANSI C63.10-2013 Clause 6.6**

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 – 18 GHz)

A pre-scan was performed above 18 GHz and no spurious emissions were detected.

No emssions were detected. See plots.

Tested with BT active.

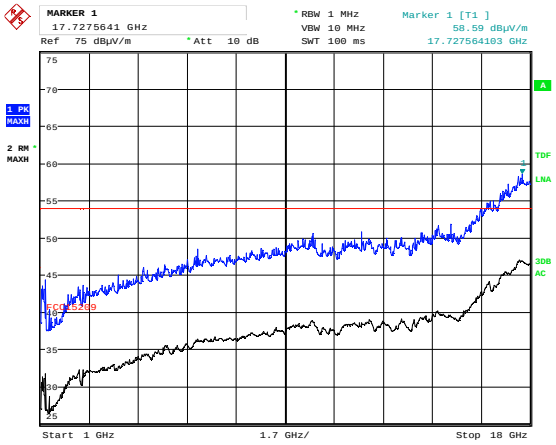
A Band Reject Filter for the 2.4Ghz band was used for measurements from 1 GHz to 18 GHz.

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer “Transducer factor”

See plots.

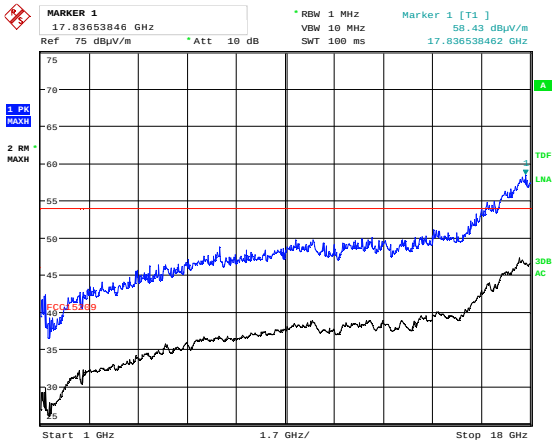
Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector	Peak Detector
1 – 26 GHz	54.0 dBµV/m	74.0 dBµV/m



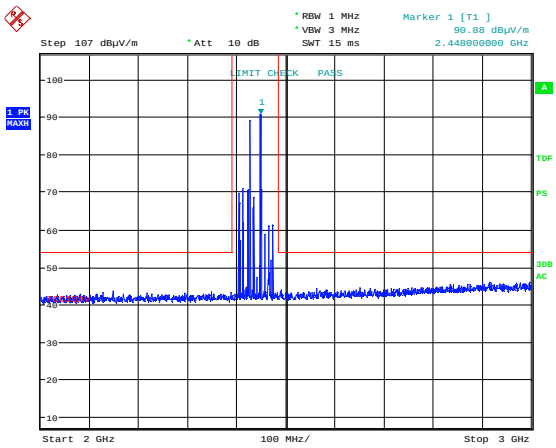
Date: 15.OCT.2020 11:36:25

Radiated Emissions 1 - 18 GHz, HP @3m



Date: 15.OCT.2020 11:31:59

Radiated Emissions 1 - 18 GHz, 2402 MHz, VP @3m



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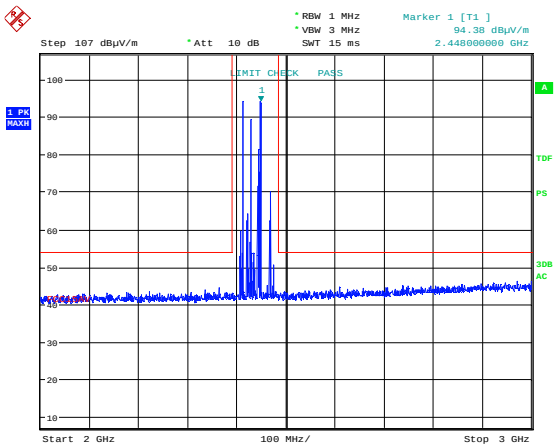
Radiated Emissions, HP @3m, BT+NFC, EUT Charging



Date: 17.NOV.2021 14:38:38

Radiated Emissions, VP @3m, BT+NFC, EUT Charging

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		**Uncertainty**
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	**< 3.6 GHz**	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	**< 1 GHz**	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	**Frequency**	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSU26	Spectrum Analyzer	Rohde & Schwarz	LR 1504	2020-01	2022-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2020-01 2021-02	2021-01 2022-02
3	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 1660	2019-06	2022.06
4	6502	Active Loop	EMCO	N 3488	N/A	
5	VULB 9163	BiLog Antenna	Schwarzbech	LR 1616	2020-01	2023-01
6	N0324415	Bandstop Filter (2.4GHz)	Microwave Circuits	LR1760	COU	
7	317	Preamplifier	Sonoma Inst.	LR 1687	2020-07 2021-08	2021-07 2022-08
8	3117-PA	Horn Antenna with PA	EMCO	LR 1717	2018-12 2021-08	2021-12 2022-08
9	RG223	RF Cables	Suhner	N/A	COU	
10	ENV216	LISN	Rohde & Schwarz	LR 1665	2019-11	2021-11
11	ESCI3	EMI Receiver	Rohde & Schwarz	N 4259	2019-10	2021-10*

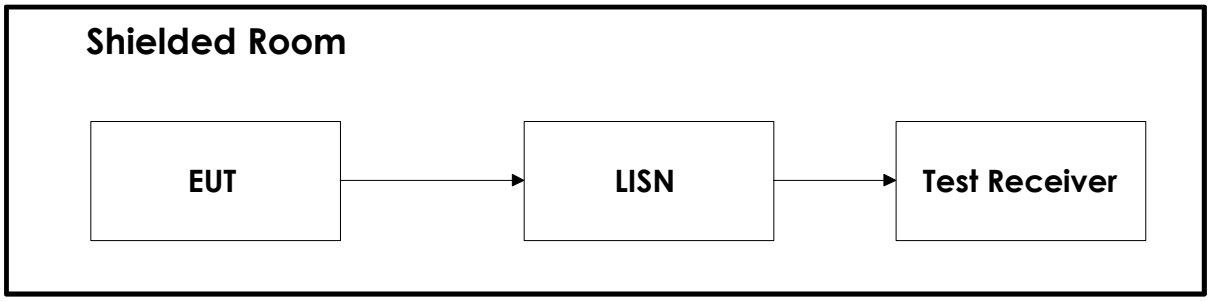
*Only used for Power-Line Conducted Tests, not used after 2020-10

The software listed below has been used for one or more tests.

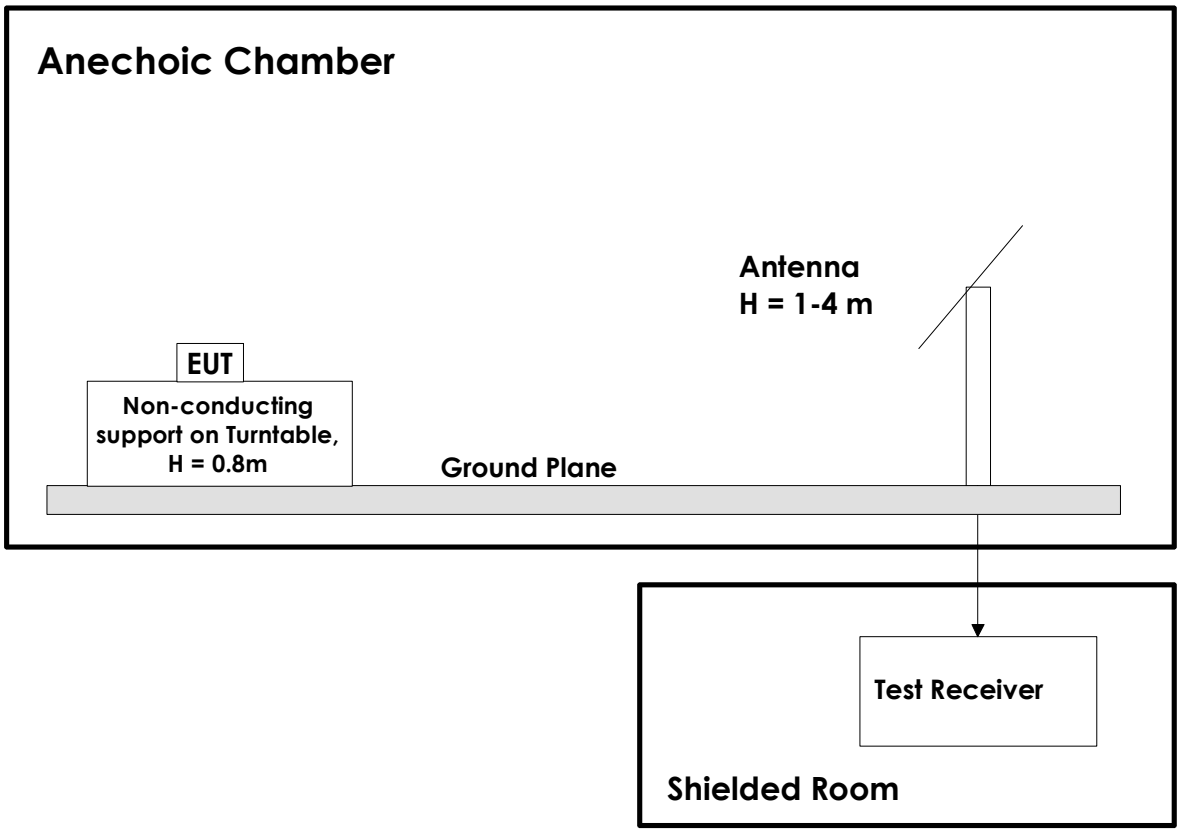
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.30.10	Power Line Conducted test software
2	Rohde & Schwarz	EMC32	10.30.10	Radiated Emission test software
3	Nemko AS	RSPlot	1.0.1.0	Screenshots from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics.