

**Nemko****TEST REPORT**Date: ESPOO 06.05.2013Page: 1 (18)Appendices -Number:  
No. 1 / 1**219872FCC**

Date of handing in: 19.10.2012

Tested by:

Jonas Dahlgren, Test Engineer

Reviewed by:

Timo Leismala, Test Manager

SORT OF EQUIPMENT:

**Wireless charging transmitter and receiver**

MARKETING NAME:

**Heart 2**

TYPE:

**PH2-B1**

MANUFACTURER:

**Powerkiss Oy, Finland**

SERIAL NUMBER:

-

CLIENT:

**Powerkiss Oy, Finland**

ADDRESS:

**Melkonkatu 24, FI – 00210 HELSINKI, FINLAND**

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TEST LABORATORY:

**Nemko Oy**

FCC REG. NO.

**359859 October 20, 2011**

IC FILE NO.

**2040F-1 December 1, 2010****SUMMARY:**

In regard to the performed tests the EUT fulfills the requirements defined in the test specification, see page 2 for details.

The test results are valid for the tested unit only. Without a written permission of Nemko Oy it is allowed to copy this report as a whole, but not partially.

Summary of performed tests and test results

<i>Section in CFR 47, Part 15C</i>	<i>Section in RSS-210 Issue 8 and RSS-Gen Issue 3</i>	<i>Test</i>	<i>Result</i>
15.209	RSS-Gen 7.2.5	<i>Radiated disturbance 9 kHz – 30 MHz</i>	<b>PASS</b> , margin > 24 dB
15.209	RSS-Gen 7.2.5	<i>Radiated disturbance 30 MHz – 1000 MHz</i>	<b>PASS</b> , margin 5.7 dB
15.207	RSS-Gen 7.2.4	<i>Conducted emissions at mains ports</i>	<b>PASS</b> , margin 8.0 dB
-	RSS-Gen 4.6.1	<i>99% occupied bandwidth</i>	<b>PASS</b>

Explanations:

PASS The EUT passed that particular test.

FAIL The EUT failed that particular test.

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## 1. General

The equipment under test (EUT) was a Wireless charging transmitter and receiver. The purpose of the performed tests was to see if in regard to these tests the EUT fulfils the radiated emission requirements defined in CFR 47 Part 15, Subpart C. The test was performed in guidance of the CFR 47 Part 15, Subpart C and ANSI C63.4 - 2003.

## 2. System Configuration

### 2.1 Test set-up

Equipment under test (EUT):

- Wireless charging transmitter: Heart 2, type: PH2-B1, S/N: -
- Wireless charging receiver: Qi Ring, Powerkiss Ring

Auxiliary Equipment:

- External Power Supply, type: Phihong PSA30W-190A

Cables:

From	To	Type	Length [m]
Power Supply	Mains network	AC power cable, unshielded	4.0
EUT	Power Supply	DC power cable with ferrite, unshielded	1.8

Operating voltage of the EUT:

- 19 V DC
- AC/DC adapter: 97.7 - 132.3 V AC 60 Hz

### 2.2 Operating conditions and monitoring of the EUT

The EUT was tested in normal charging operation mode: the receiver (Ring) was placed on top of the EUT Power coil (Heart), antenna to antenna distance representing the normal installation. The right position was indicated in the Ring by a red LED and in the Heart by a red LED. The receiver was connected to a 10 ohm resistive load, which was drawing maximum amount of current simulating the normal operation or charging process. No change in fundamental field strength due to variation of input voltage from 97.7 - 132.3 V AC 60 Hz was observed. The operation of the EUT was monitored visually by watching the LEDs with an eye.

Qi mode:

The frequency of operation from 120-205 kHz was verified by the following two operating modes: maximum antenna to antenna distance with 10 Ohm load (124 kHz) and minimum antenna to antenna distance without a load (203 kHz).

Powerkiss mode:

The frequency of operation was 124 kHz.

### 3. Test procedures

#### 3.1 Emission tests

##### 3.1.1 Radiated disturbance emission test 9 kHz – 30 MHz

The test was performed as a compliance test. The test parameters concerned were as follows:

Parameter	Specification
Test specification	CFR 47 / 15.209
Frequency range	9 kHz – 30 MHz
Site name	Nemko Oy / Perkkaa, Finland
Date of testing	22.10.2012, 21.3.2013 and 20.4.2013
Test equipment	98, 350, 680, 694, 709
Test uncertainty U95	± 4.6 dB
Test conditions	21 °C, 37 % RH

The test was performed in a semi-anechoic shielded room. For the duration of the test the EUT was placed on a non-conductive support 0.8 m high standing on the turntable. During the test the distance from the EUT to the measuring antenna was 3 meters. The final measurement result has been converted to correspond to the measurement result with the defined measurement distance (300 m or 30 m) by using 40 dB / decade rule. In order to find the maximum levels of the disturbance radiation the angle of the turntable and the lay-out of the EUT cables were varied during the tests.

##### 3.1.2 Radiated disturbance emission test 30 MHz – 1000 MHz

The test was performed as a compliance test. The test parameters concerned were as follows:

Parameter	Specification
Test method	CISPR 22
Frequency range	30 – 1000 MHz
Site name	Nemko Oy / Perkkaa
Date of testing	22.10.2012
Test equipment	319, 350, 544, 680, 709
Test uncertainty U95	±4.6 dB
Test conditions	21 °C, 37 % RH

The test was performed in a semi-anechoic shielded room. For the duration of the test the EUT was placed on non-conductive support 0.8 m above the metallic ground plane. During the test the distance from the EUT to the measuring antenna was 10 meters. In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna and the lay-out of the EUT cables were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarisations.

### 3.1.3 Conducted disturbance at mains ports emission test

The test was performed as a compliance test. The test parameters concerned were as follows:

Parameter	Specification
Test method	CISPR 22
Frequency range	0.150 – 30 MHz
Site name	Nemko Oy / Perkkaa
Date of testing	24.10.2012
Test equipment	348, 680, 694, 745
Test uncertainty U95	+2.4 dB / -3.0 dB
Test conditions	22 °C, 32 % RH

The test was performed inside a shielded room where one of the walls and the floor comprised the reference ground plane (RGP). For the duration of the test the EUT was placed on a non-conductive table 0.8 m above the metallic ground plane. The AC power input cable of the EUT was connected to an artificial mains network. The test was performed separately on the phase and also on the neutral wire.

The disturbances were first examined by performing a spectrum scan by using a peak detector. The general procedure in the conducted disturbance emission test is that no further measurements are necessary if the disturbance levels measured by using the peak detector are below the limit value defined for the measurement performed by using an average detector. If not, then at the test frequencies concerned the measurement is performed also by using a quasi-peak detector. If the disturbance levels measured by using the quasi-peak detector are below the limit value defined for the measurement performed by using an average detector, then measurements by using the average detector are not necessary.

**3.1.4 99% occupied bandwidth**

<b>NAME OF TEST:</b> Occupied Bandwidth	<b>PARA.NO.:</b> RSS GEN 4.6.1
<b>TESTED BY:</b> Timo Hietala	<b>DATE:</b> 06/05/2013

**Test Results:** Complies.**Test Data:** See attached plot(s).

<b>Operating mode</b>	<b>Frequency (kHz)</b>	<b>Measured 99% Occupied Bandwidth (Hz)</b>
Powerkiss	124.2	<b>102.2</b>
Qi	124.7	<b>176.7</b>
Qi	165.0	<b>119.5</b>
Qi	203.0	<b>116.0</b>

**Equipment used:** 98, 350, 680, 566**Measurement Uncertainty:**  $\pm 0.7$  dB.**Temperature:** 23 °C.**Relative Humidity:** 35 %.

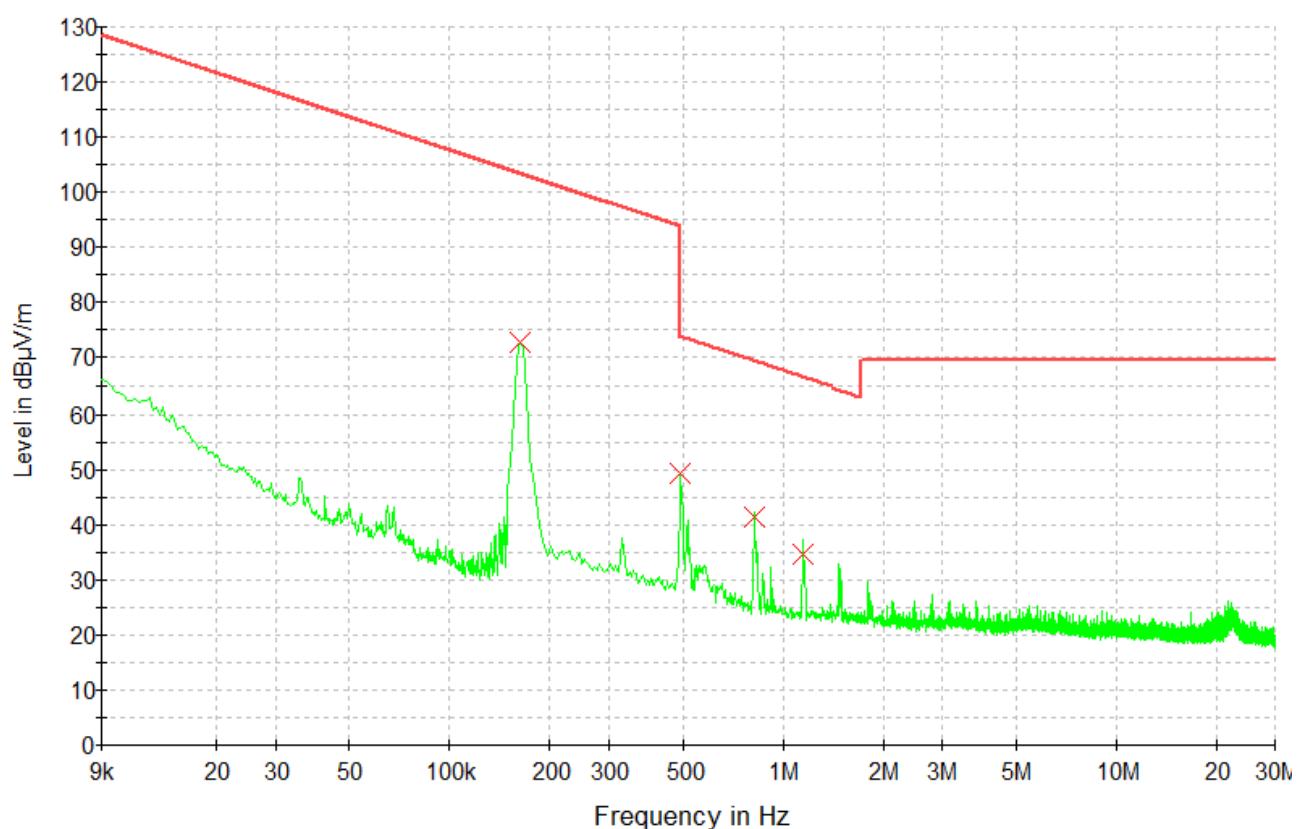
The 99% occupied bandwidth of the carrier emission is measured using a spectrum analyzer with Resolution Bandwidth set to 1% of the necessary bandwidth of the transmitted carrier.

## 4. Test results

### 4.1 Emission tests

#### 4.1.1 Radiated Emission test 9 kHz – 30 MHz

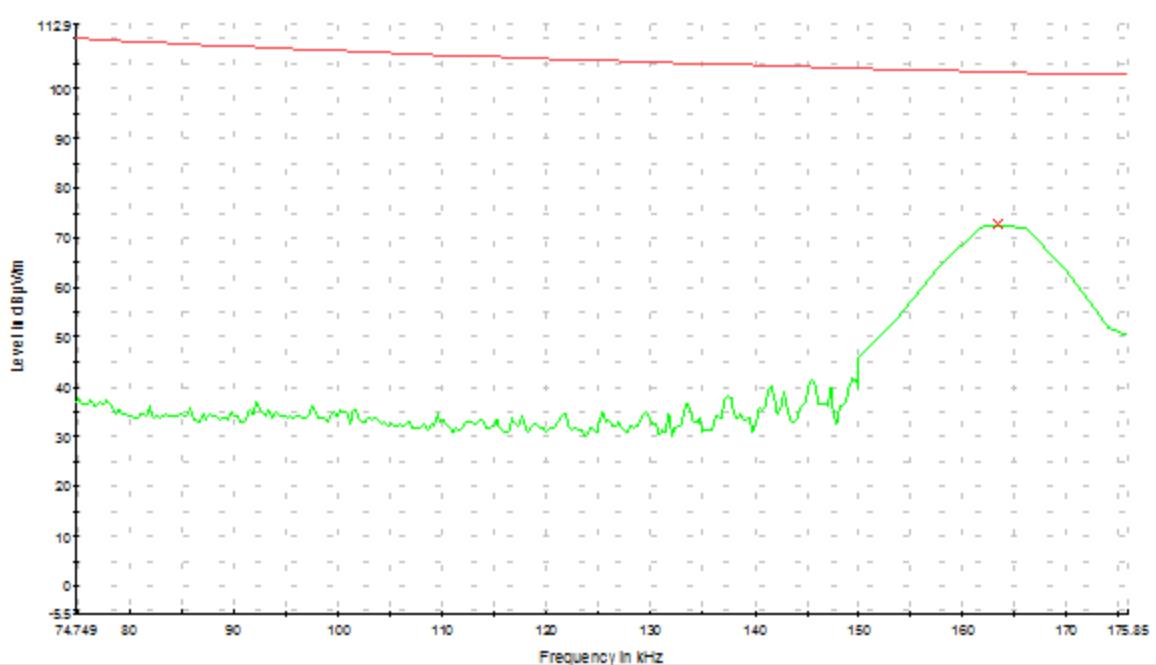
Qi mode: 10 Ohm load, antenna to antenna distance representing the normal installation.



Measurement results for Electric field (Quasi-peak):

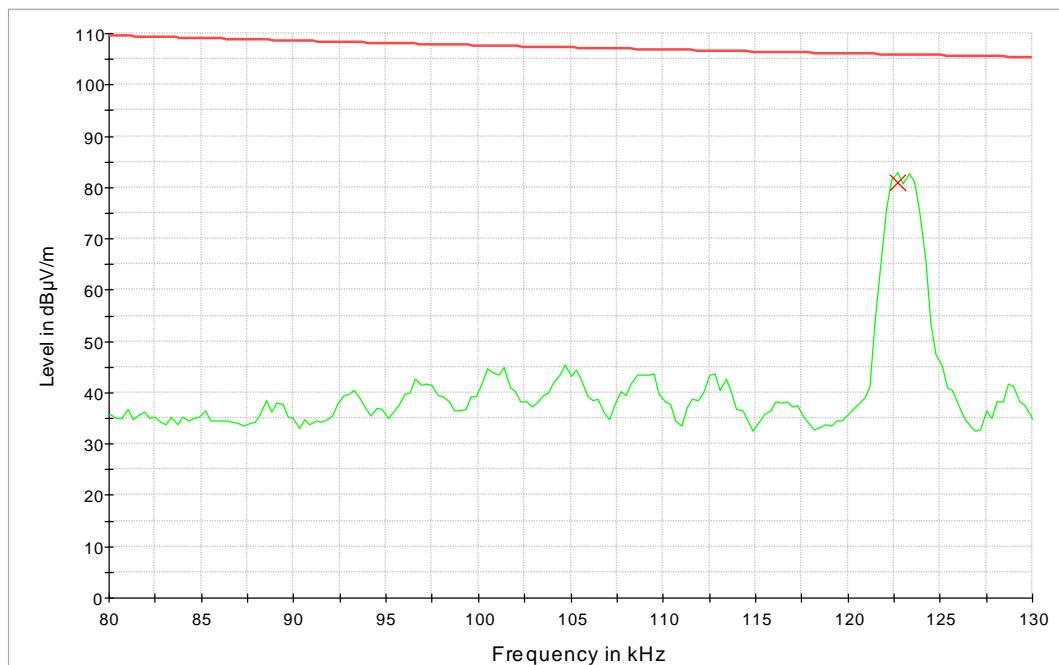
Frequency MHz	Level dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Distance m	Exceed
0.1634	72.8	103.3	30.5	3	–
0.4900	49.3	73.8	24.5	3	–
0.8180	41.4	69.4	27.9	3	–
1.1460	34.7	66.4	31.7	3	–

Qi mode: 10 Ohm load, antenna to antenna distance representing the normal installation.

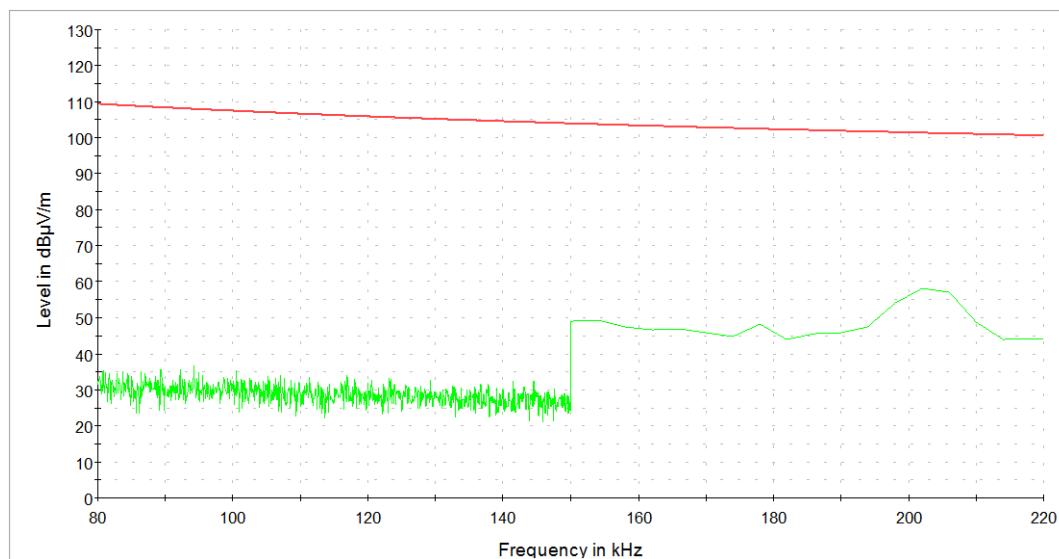


90 kHz – 110 kHz restricted band measured with the peak detector at 3 m measuring distance.

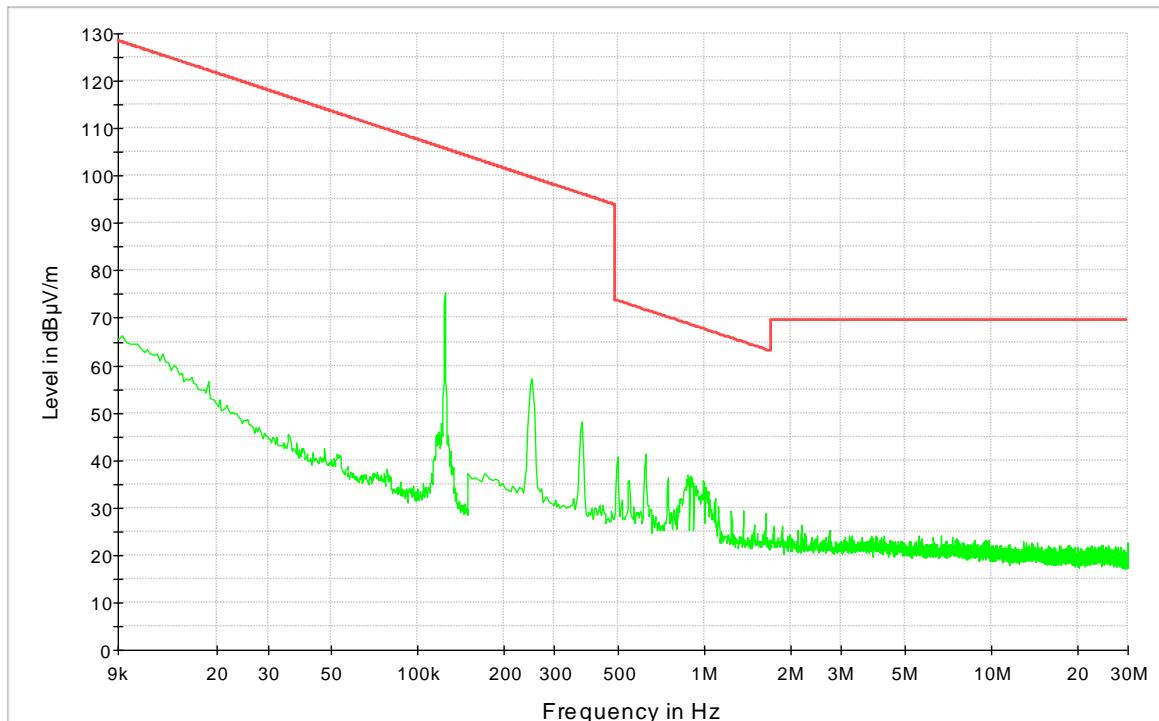
Qi mode: 10 Ohm load, maximum antenna to antenna distance showing the lowest operating frequency



Qi mode: No load, minimum antenna to antenna distance showing the highest operating frequency



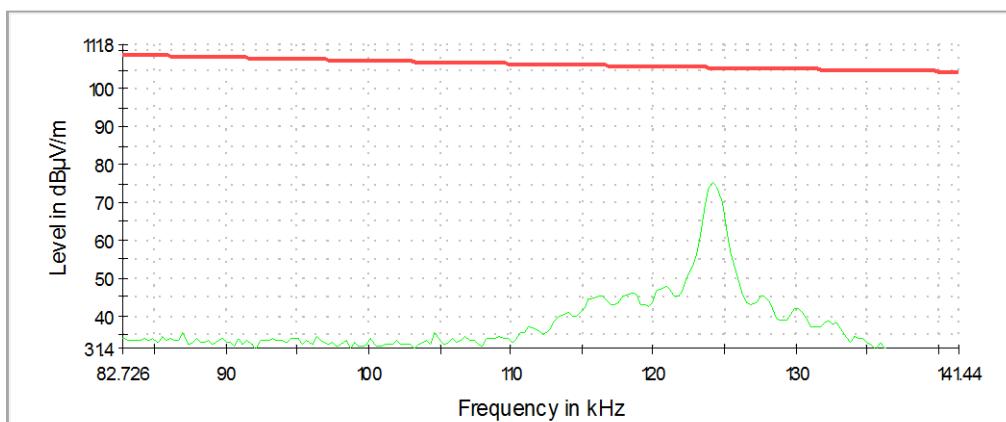
Powerkiss mode: 10 Ohm load, antenna to antenna distance representing the normal installation.



Measurement results for Electric field (Quasi-peak):

Frequency MHz	Level dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Distance m	Exceed
0.124	74.8	105.0	30.2	3	–

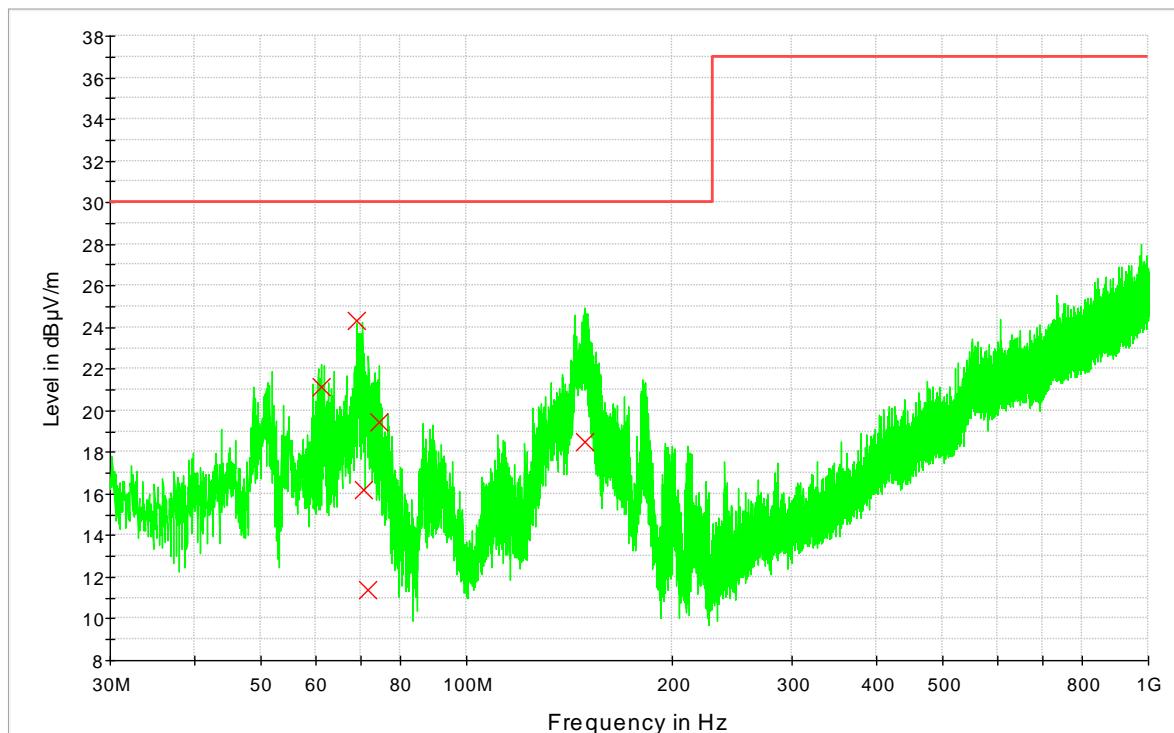
Powerkiss mode: 10 Ohm load, antenna to antenna distance representing the normal installation.



90 kHz – 110 kHz restricted band measured with the peak detector at 3 m measuring distance.

#### 4.1.2 Radiated Emission test 30 MHz – 1000 MHz

Qi mode: 10 Ohm load, antenna to antenna distance representing the normal installation.



Horizontal and vertical polarizations in the frequency range 30 - 1000 MHz measured by using the peak detector. During the peak detector scan, the turntable was rotated from 0° to 360° with 30° steps with the antenna heights 1.0 m and 3.0 m. The highest levels of the radiated interference field strength measured by using the quasi-peak detector were recorded.

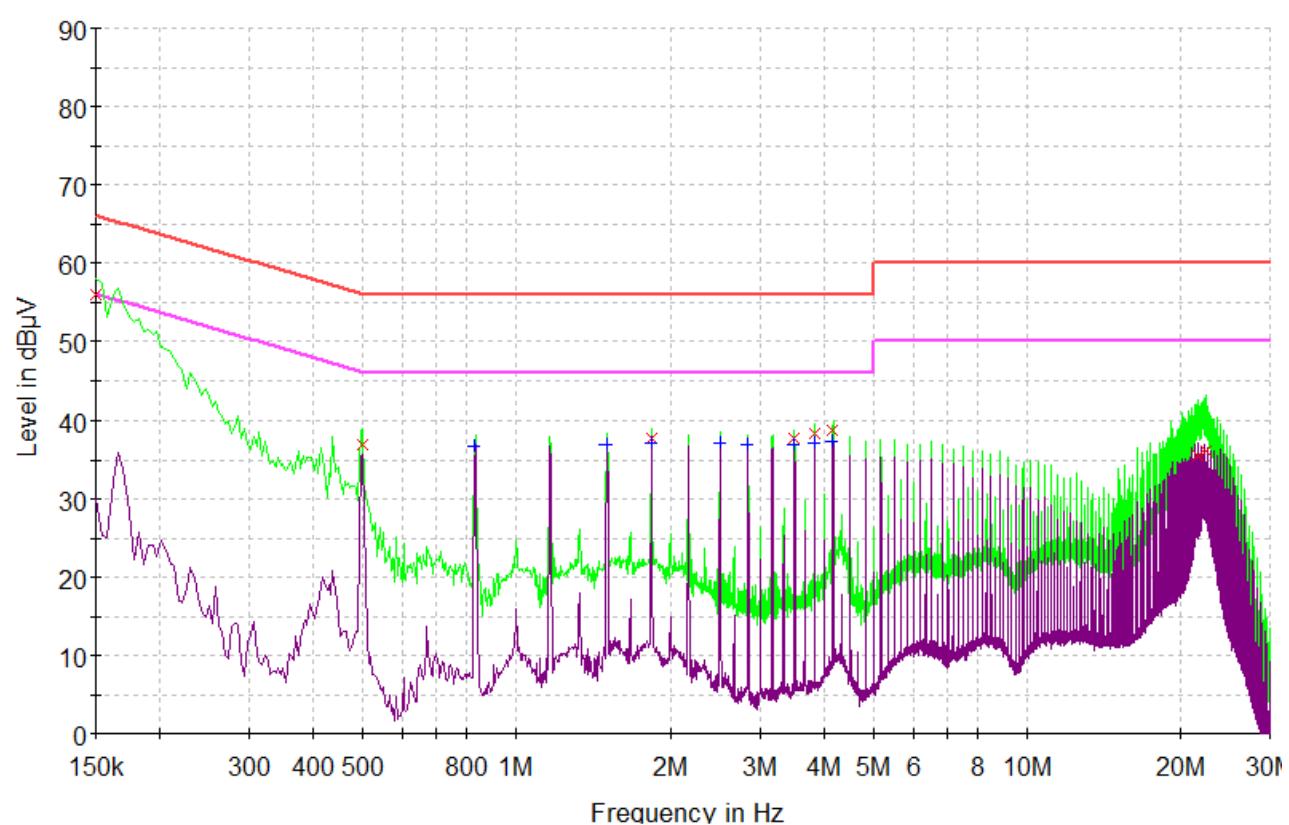
Measurement results (QP):

Frequency MHz	Level dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
61.31	21.1	30	8.9	191	276	VERTICAL
69.14	24.3	30	5.7	314	65	VERTICAL
70.60	16.2	30	13.8	301	84	VERTICAL
71.63	11.4	30	18.6	343	60	VERTICAL
74.40	19.4	30	10.6	155	88	VERTICAL
149.11	18.5	30	11.5	100	43	VERTICAL

#### 4.1.3 Conducted disturbance at mains ports emission test

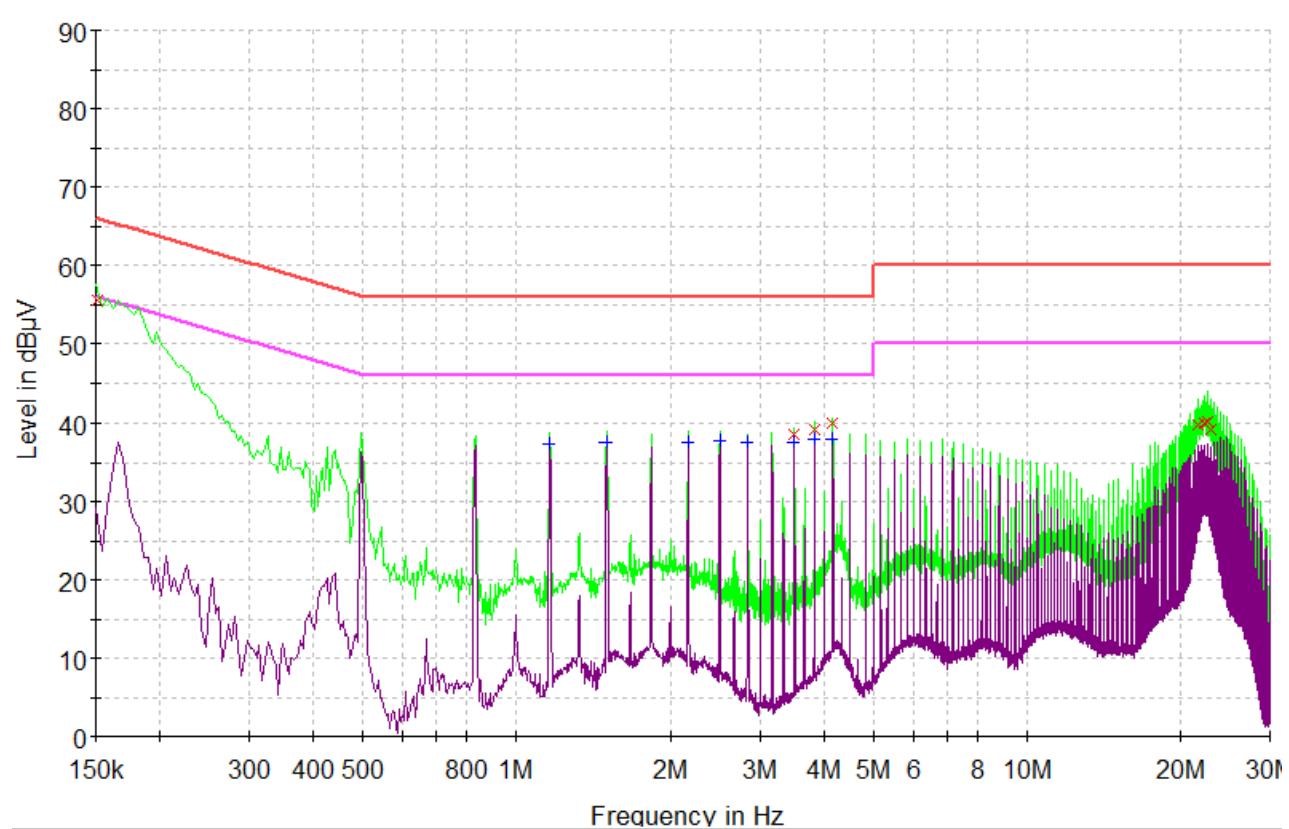
Qi mode: 10 Ohm load, antenna to antenna distance representing the normal installation.

AC/DC power: Phihong PSA30W-190A, Neutral line:



Qi mode: 10 Ohm load, antenna to antenna distance representing the normal installation.

AC/DC power: Phihong PSA30W-190A, Phase line:



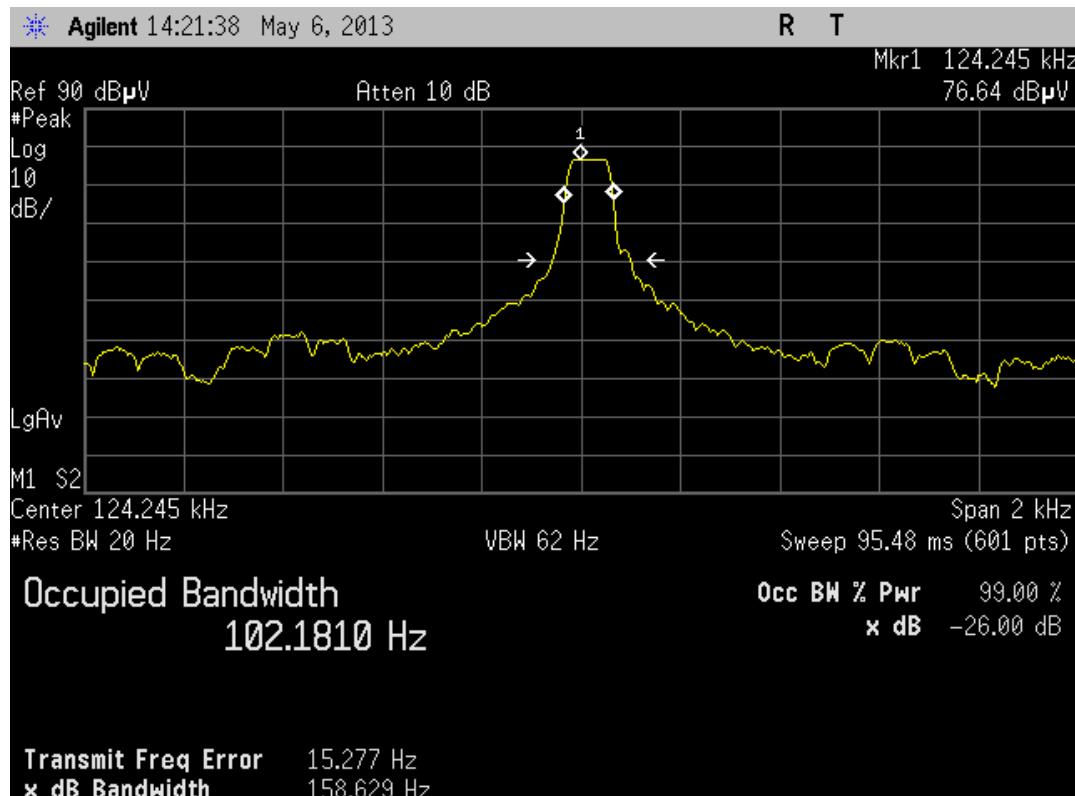
#### MEASUREMENT RESULTS (QP):

Frequency MHz	Phase	Limit value QP (dBμV)	Result QP (dBμV)	Conclusion Pass/Fail
0.150	N	66.0	55.9	Pass
0.499	N	56.0	37.0	Pass
1.831	N	56.0	37.8	Pass
3.495	N	56.0	37.8	Pass
3.828	N	56.0	38.4	Pass
4.161	N	56.0	38.8	Pass
21.677	N	60.0	35.4	Pass
22.477	N	60.0	36.2	Pass
0.151	L	65.9	55.5	Pass
3.498	L	56.0	38.5	Pass
3.831	L	56.0	39.1	Pass
4.164	L	56.0	39.9	Pass
21.650	L	60.0	39.7	Pass
22.318	L	60.0	40.1	Pass
22.649	L	60.0	40.3	Pass
22.985	L	60.0	39.2	Pass

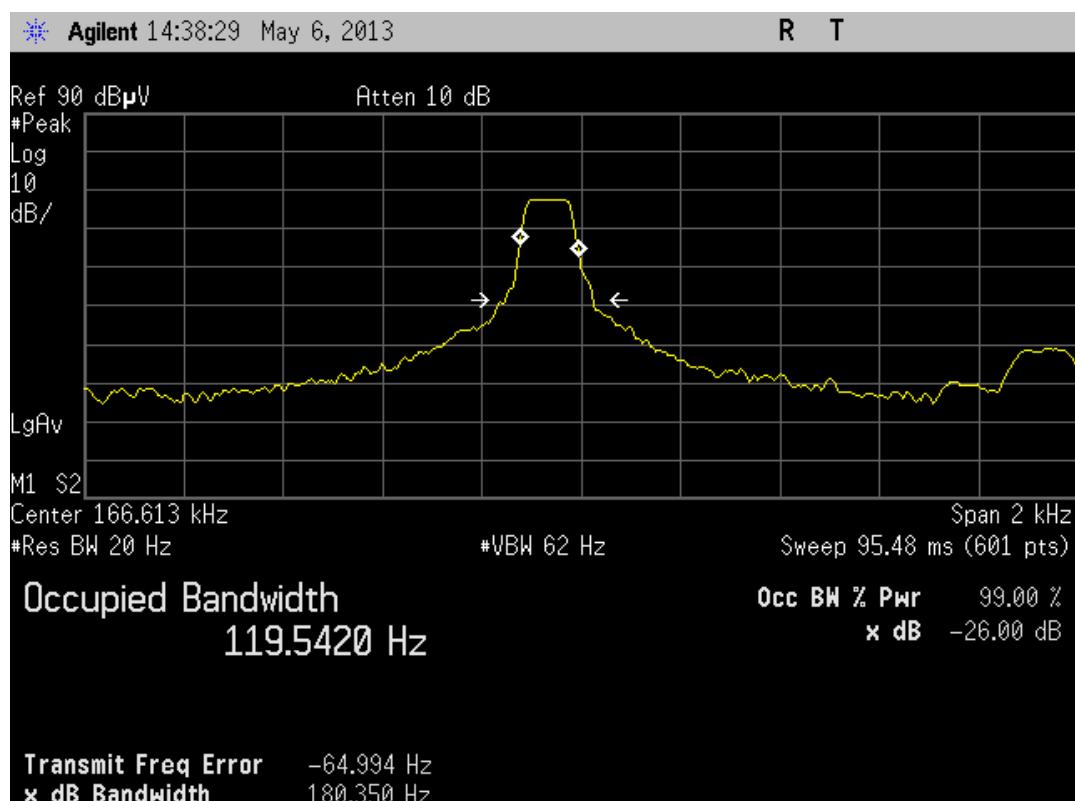
## MEASUREMENT RESULTS (AV):

Frequency MHz	Phase	Limit value AV (dB $\mu$ V)	Result AV (dB $\mu$ V)	Conclusion Pass/Fail
0.832	N	46.0	36.8	Pass
1.498	N	46.0	37.0	Pass
1.831	N	46.0	37.2	Pass
2.497	N	46.0	37.2	Pass
2.830	N	46.0	37.0	Pass
3.495	N	46.0	37.0	Pass
3.828	N	46.0	37.2	Pass
4.160	N	46.0	37.3	Pass
1.166	L	46.0	37.4	Pass
1.499	L	46.0	37.5	Pass
2.166	L	46.0	37.6	Pass
2.498	L	46.0	37.7	Pass
2.832	L	46.0	37.6	Pass
3.498	L	46.0	37.6	Pass
3.831	L	46.0	37.9	Pass
4.164	L	46.0	38.0	Pass

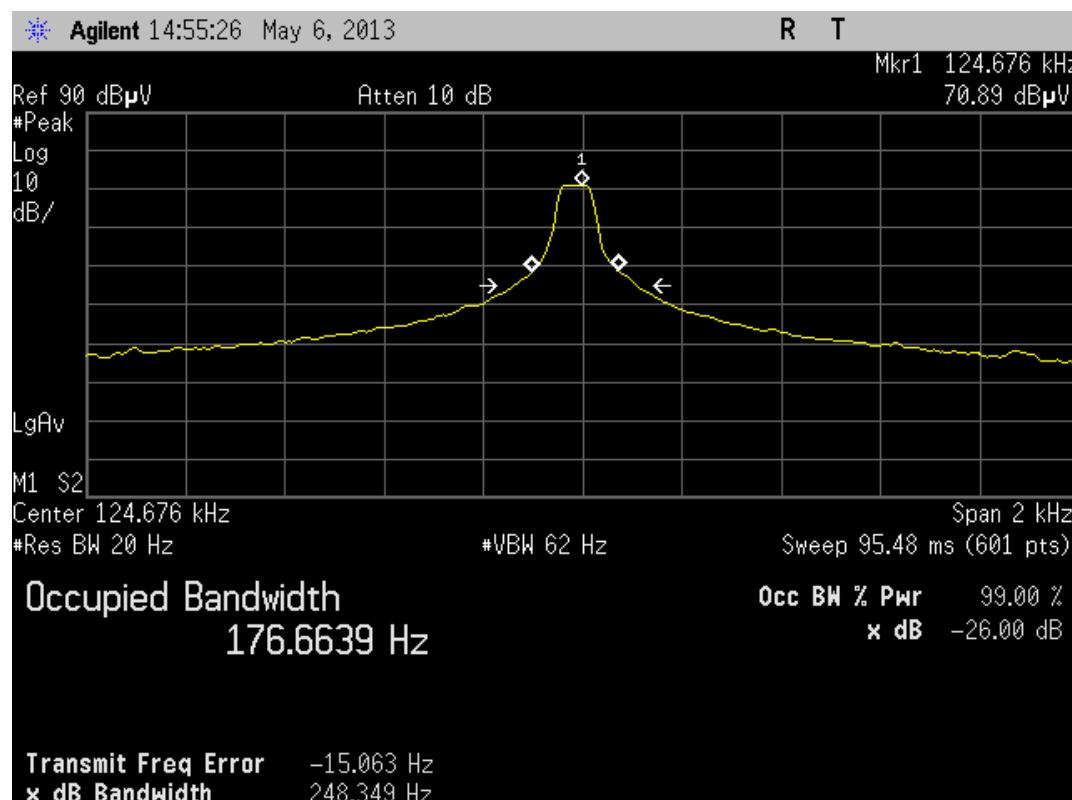
#### 4.1.4 99% occupied bandwidth results



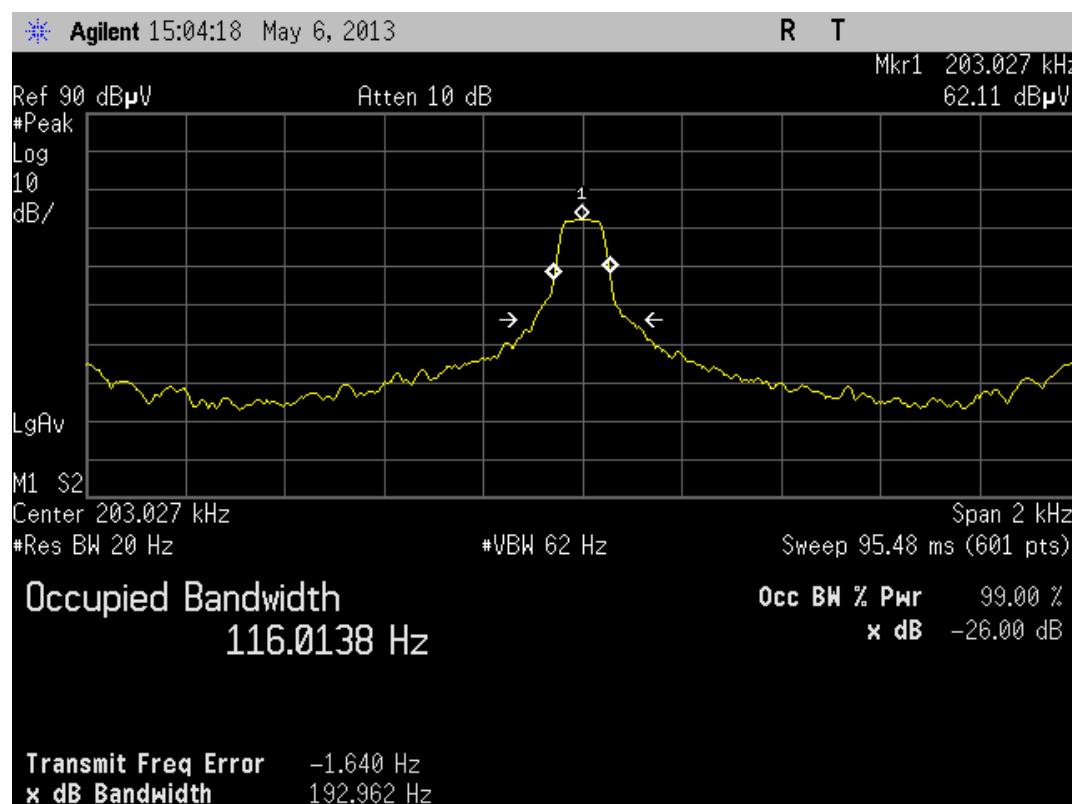
Powerkiss mode: 10 Ohm load, antenna to antenna distance representing the normal installation.



Qi mode: 10 Ohm load, antenna to antenna distance representing the normal installation.



Qi mode: 10 Ohm load, maximum antenna to antenna distance showing the lowest operating frequency



Qi mode: No load, minimum antenna to antenna distance showing the highest operating frequency

## 5. List of test equipment

No.	Equipment	Type	Manufacturer	Serial Number
709	Test receiver	ESU8	Rohde & Schwarz	100297
694	EMI Test Receiver	ESPC	Rohde & Schwarz	842888/023
566	Spectrum analyzer	E4448A	Agilent	US42510236
98	Antenna, loop	HFH2	Rohde & Schwarz	871336/45
319	Antenna	CBL6112	Chase	2018
680	Temp. & humidity measurement network	1Wire	Nemko Oy	-
544	RF amplifier	ZFL-1000VH2	Mini-Circuits	D01080
745	2-Line V-Network	ENV216	Rohde & Schwarz	101466
348	Shielded room	RFSD-100	Euroshield Oy	1320
350	Semi-anechoic shielded room	RFD-F-100	Euroshield Oy	1327