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Tested by:



Timo Leismala, Test Manager

Reviewed by:



Janne Nyman, Compliance Specialist

SORT OF EQUIPMENT:

NFC reader with GSM radio

MARKETING NAME:

NFC TimeClean

TYPE:

NFC TimeClean Plus

MANUFACTURER:

Inoptics Oy, Finland

SERIAL NUMBER:

See page 4

CLIENT:

Inoptics Oy, Finland

ADDRESS:

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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 fulfils 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 Issue 3: 7.2.5	Radiated disturbance 9 kHz – 30 MHz	PASS , margin 3.1 dB
15.209	RSS-Gen Issue 3: 7.2.5	Radiated disturbance 30 MHz – 1000 MHz	PASS , margin 14.2 dB
15.207	RSS-Gen Issue 3: 7.2.4	Conducted emissions at mains ports	PASS , margin 5.6 dB
15.205		Restricted band of operation	PASS , margin 25.5 dB
15.215 c)	RSS-Gen Issue 3: 4.6.1	20 dB and 99% bandwidth	PASS

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 an RFID reader and tag (transponder). The purpose of the performed tests was to see if in regard to these tests the EUT fulfils the radiated and conducted 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.

2. System Configuration

2.1 Test set-up

Equipment under test (EUT):

- NFC reader with GSM (quad band) radio, type NFC TimeClean Plus, S/N: 0404 (radiated)
- NFC reader with GSM (quad band) radio, type NFC TimeClean Plus, HW3/1/039 (conducted)

Peripheral devices:

- Model: UE08WCP-050080SPA, 100-240VAC 50-60Hz, 150mA, output 5.0VDC 800mA

Cables:

From	To	Type	Length [m]
AC adapter	EUT	DC input cable, unshielded	1.0
LISN / power supply network	AC adapter	AC input cable, unshielded	1.0

Operating voltage of the EUT:

- 3.6 VDC rechargeable battery pack
- AC/DC power supply: Rated 115 VAC, 60 Hz, tested with 97.7 – 132.2 VAC and 60 Hz.

2.2 Operating conditions and monitoring of the EUT

The RFID reader was set to transmit continuously

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 / Perkkää, Finland
Date of testing	27.07.2012
Test equipment	98, 350, 566, 680, 709
Test uncertainty U95	± 4.6 dB
Test conditions	21 °C, 31 % 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 / ANSI C63.4
Frequency range	30 – 1000 MHz
Site name	Nemko Oy / Perkkää
Date of testing	30.07.2012
Test equipment	319, 350, 544, 680, 709
Test uncertainty U95	±4.6 dB
Test conditions	23 °C, 65 % 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 / ANSI C63.4
Frequency range	0.150 – 30 MHz
Site name	Nemko Oy / Perkkää
Date of testing	19.06.2012
Test equipment	349, 694, 745
Test uncertainty U95	±3.5 dB
Test conditions	23-25°C, 37-39 % RH

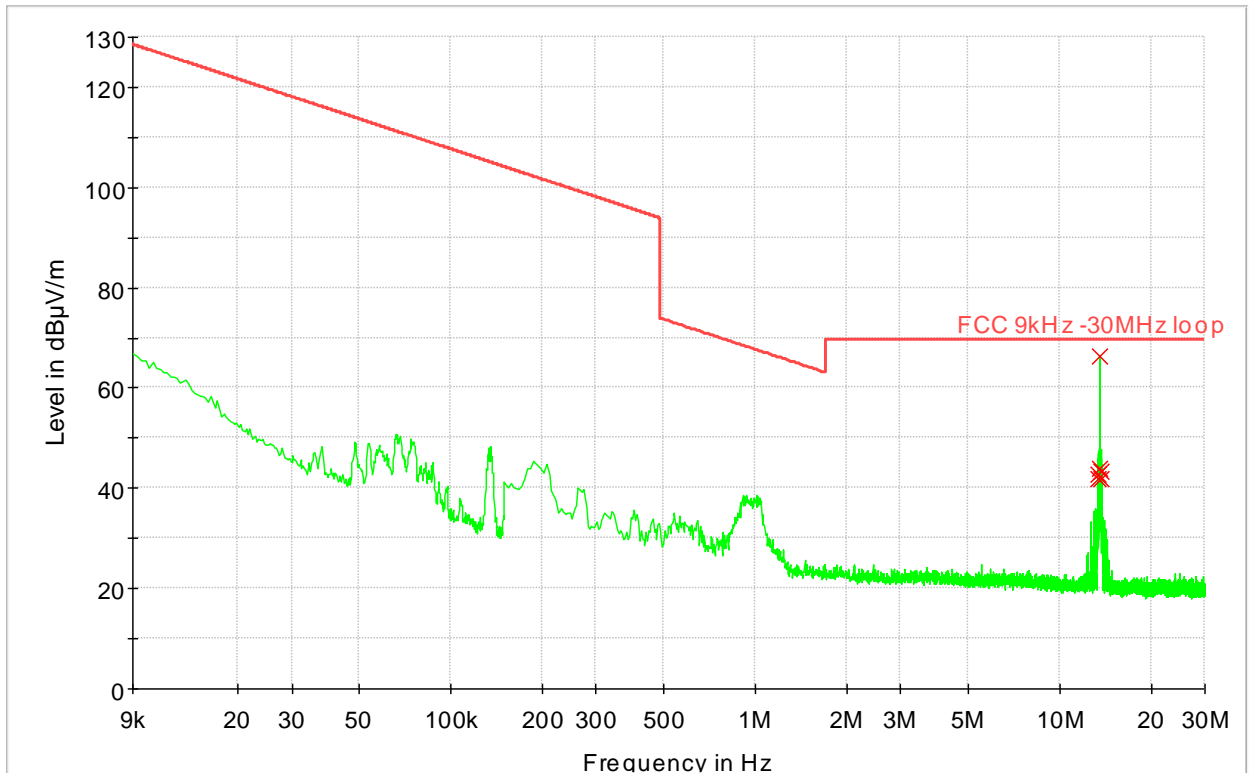
The test was performed inside a shielded room where the floor and one of the walls of the test site comprised the reference ground plane (RGP). For the duration of the test the EUT was placed on a non-conductive table 0.8 m high standing on the reference ground plane. The power input cable of the EUT 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.

4. Test results

4.1 Emission tests

4.1.1 Radiated Emission test 9 kHz – 30 MHz

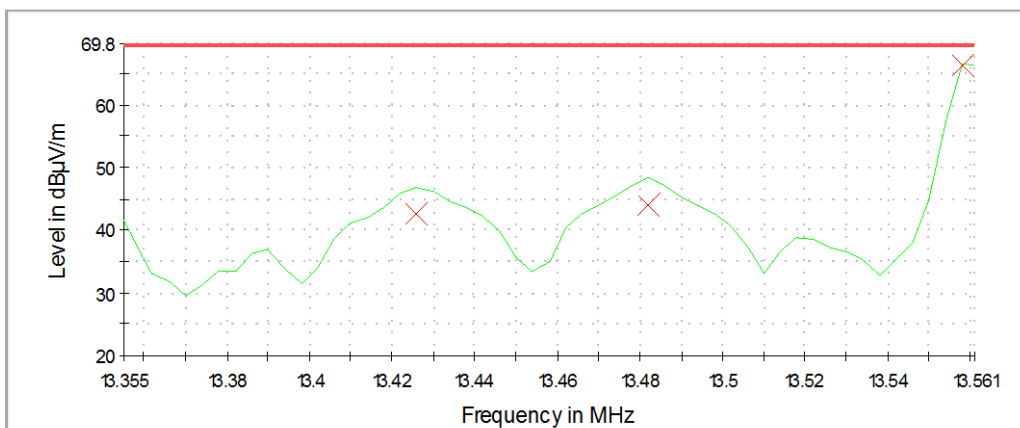


The spectrum of the radiated emissions in the frequency range 9 kHz – 30 MHz measured with the loop antenna.

Measurement results Electric field (Quasi-peak):

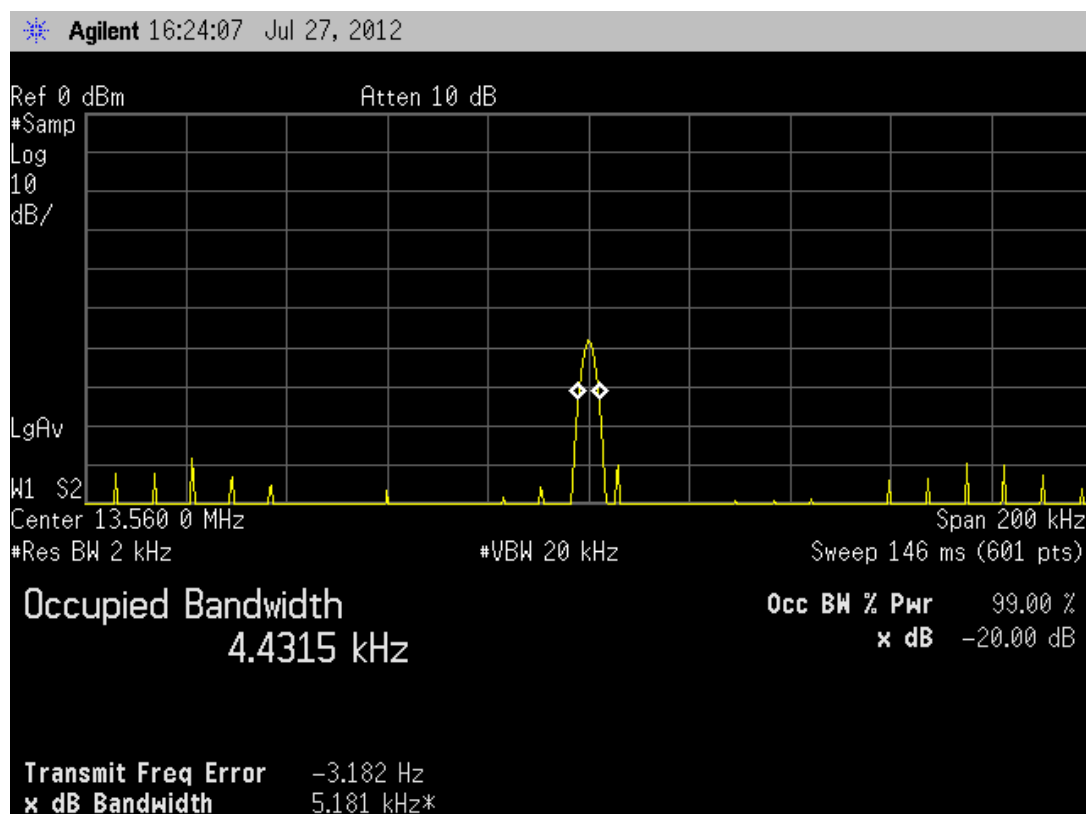
Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Distance m	Exceed
13.35	41.9	69.5	27.6	3	—
13.42	42.7	69.5	26.8	3	—
13.48	44.0	69.5	25.5	3	—
13.55	66.4	69.5	3.1	3	—
13.63	43.4	69.5	26.1	3	—
13.69	41.8	69.5	27.7	3	—

4.1.2 Band-edge compliance



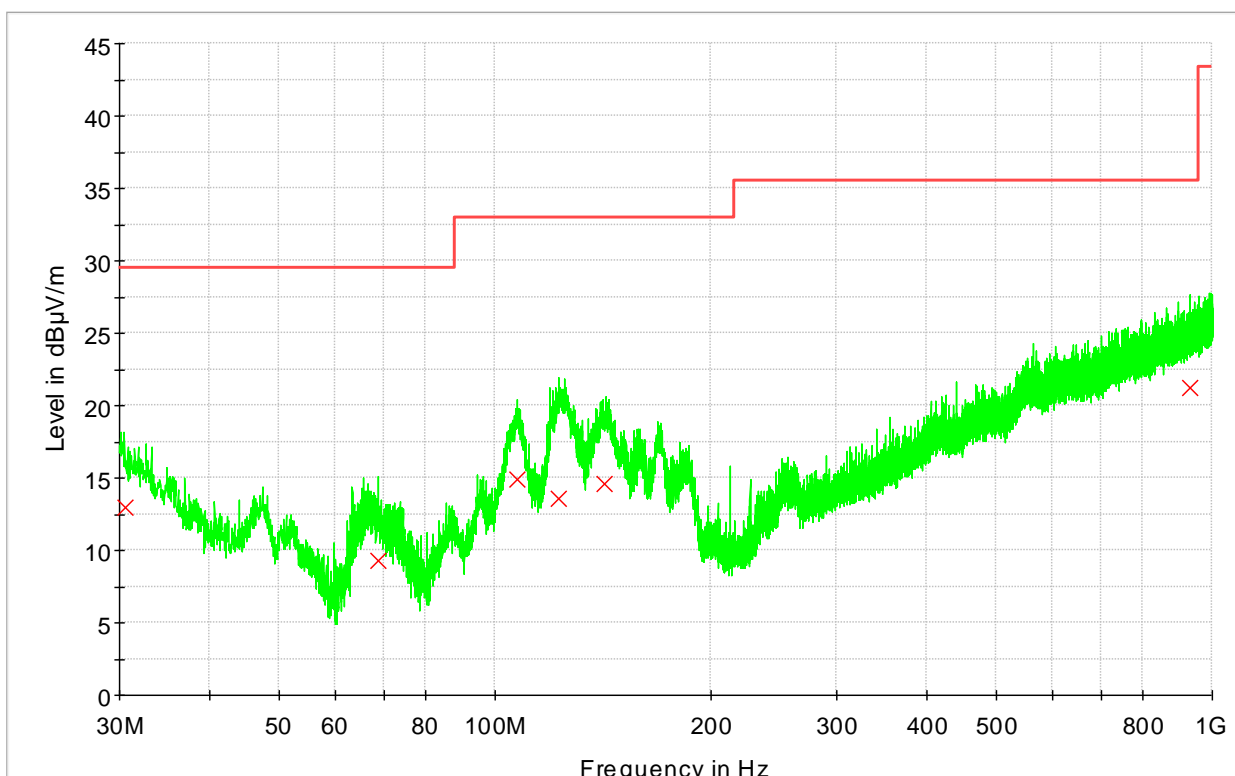
Band-edge spectral plot in the frequency range 13.36 MHz – 13.41 MHz restricted band measured with the loop antenna. QP results, see page 7.

4.1.3 20 dB and 99% bandwidth



Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz
13.56	5.18	4.43

4.1.4 Radiated Emission test 30 MHz – 1000 MHz



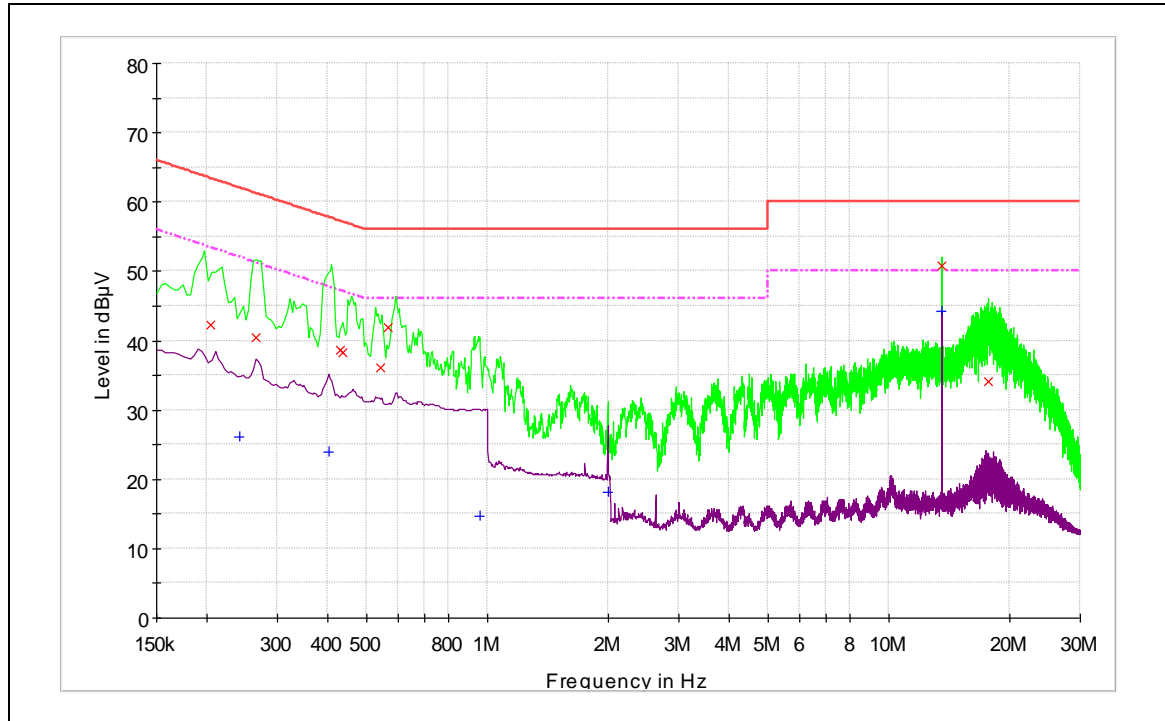
Horizontal and vertical polarizations in the frequency range 30 - 1000 MHz measured by using the peak detector. During the peak detector scan, the turntable was rotated from 0° to 360° with 30° steps with the antenna heights 1.0 m and 3.0 m. The highest levels of the radiated interference field strength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

Measurement results (QP):

Frequency MHz	Level dBμV/m	Limit dBμV/m	Margin dB	Height cm	Azimuth deg	Polarization
30.51	12.9	29.50	16.6	213.0	327	Ver
68.94	9.3	29.50	20.2	312.0	5	Ver
107.48	14.9	33.00	18.1	100.0	313	Ver
122.73	13.6	33.00	19.4	136.0	221	Ver
142.53	14.6	33.00	18.4	123.0	226	Ver
933.27	21.3	35.50	14.2	155.0	87	Ver

4.1.5 Conducted disturbance at mains ports emission test

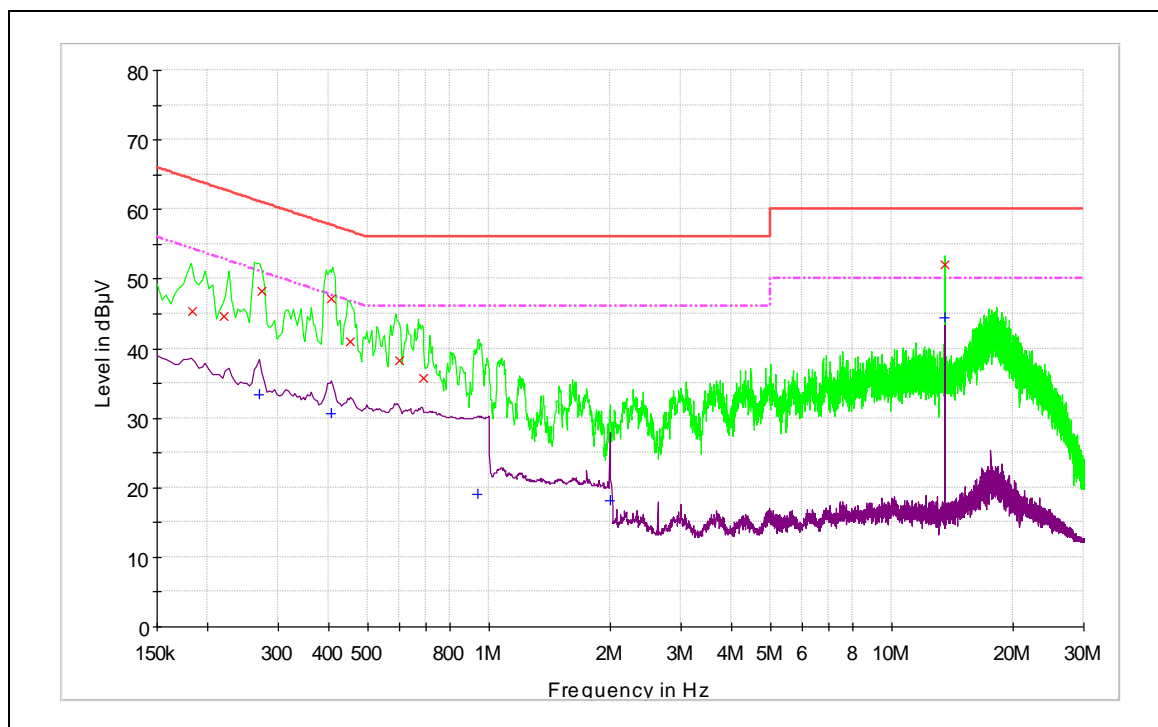
Phase line:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.204	42.2	1000.0	10.000	On	L1	9.7	21.3	63.4	
0.265	40.4	1000.0	10.000	On	L1	9.7	20.9	61.3	
0.429	38.6	1000.0	10.000	On	L1	9.6	18.7	57.3	
0.438	38.3	1000.0	10.000	On	L1	9.6	18.8	57.1	
0.543	36.1	1000.0	10.000	On	L1	9.6	19.9	56.0	
0.568	41.9	1000.0	10.000	On	L1	9.6	14.1	56.0	
13.560	50.7	1000.0	10.000	On	L1	10.0	9.3	60.0	
17.728	34.2	1000.0	10.000	On	L1	10.2	25.8	60.0	

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.242	26.1	1000.0	10.000	On	L1	9.7	25.9	52.0	
0.402	23.9	1000.0	10.000	On	L1	9.6	23.9	47.8	
0.956	14.7	1000.0	10.000	On	L1	9.6	31.3	46.0	
2.000	18.1	1000.0	10.000	On	L1	9.7	27.9	46.0	
13.560	44.2	1000.0	10.000	On	L1	10.0	5.8	50.0	

Neutral line:



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.183	45.3	1000.0	10.000	On	L1	9.7	19.1	64.3	
0.220	44.6	1000.0	10.000	On	L1	9.7	18.3	62.8	
0.273	48.3	1000.0	10.000	On	L1	9.7	12.8	61.0	
0.406	47.2	1000.0	10.000	On	L1	9.6	10.6	57.7	
0.451	41.0	1000.0	10.000	On	L1	9.6	15.9	56.9	
0.601	38.2	1000.0	10.000	On	L1	9.6	17.8	56.0	
0.686	35.7	1000.0	10.000	On	L1	9.6	20.3	56.0	
13.559	52.1	1000.0	10.000	On	L1	10.0	7.9	60.0	

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.270	33.5	1000.0	10.000	On	L1	9.7	17.7	51.1	
0.406	30.6	1000.0	10.000	On	L1	9.6	17.2	47.7	
0.940	19.1	1000.0	10.000	On	L1	9.6	26.9	46.0	
1.999	18.2	1000.0	10.000	On	L1	9.7	27.8	46.0	
13.560	44.4	1000.0	10.000	On	L1	10.0	5.6	50.0	

5. List of test equipment

No.	Equipment	Type	Manufacturer	Serial Number
709	Test receiver	ESU8	Rohde & Schwarz	100297
338	Test receiver	ESS	Rohde & Schwarz	847151/009
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
349	Shielded room	RFSD-100	Euroshield Oy	1319
350	Semi-anechoic shielded room	RFD-F-100	Euroshield Oy	1327