www.nemko.com
Nemko Spa – Via del Carroccio, 4 – 20853 Biassono (MB) – Italy

Report number: 240435TRFFCC

Apparatus: **Model:Udoo**

Applicant: **SECO S.r.l.**
Via Pietro Calamandrei, 91 – 52100 Arezzo (AR) – Italy

Test specification:

Title 47-Telecommunication
Chapter I - Federal Communications Commission
Subchapter A - General
Part 15 - Radio Frequency Devices
Subpart B - Unintentional Radiators

- **§15.107 – Conducted limits**
- **§15.109 – Radiated emission limits**

Reviewed by: _____ 2013-07-30
Signature Date
Daniele Guarnone, Wireless/EMC Specialist

Tested by: _____ 2013-07-30
Signature Date
Simone Loria, Wireless/EMC Specialist

Table of contents

Section 1: Report summary

This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko S.p.A.

Test specification:

FCC Part 15 Subpart B, 15.107 and 15.109
Unintentional radiators

Compliance status:	Complies
Exclusions:	None
Non-compliances:	None
Report release history:	Original release
Test location:	Nemko Spa Via del Carroccio, 4 – I 20853 Biassono (MB) – Italy
Registration number:	481407 (10 m Semi anechoic chamber)

The date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

Nemko S.p.A. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko S.p.A.. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This document reports the results of the tests performed on the sample having type reference P240-LTv and code number 9919 329 89071. This report covers also the variant model with type reference P240-LT-v and code number 9919 329 89061. The only one difference against the P240-Tv (model tested) and P240-LAv is the touchscreen. The variant model has an acrylic screen. No others hardware differences declared by applicant across the tested model and its own variant model.

Section 2: Equipment under test

2.1 Identification of equipment under test (EUT)

The following information identifies the EUT under test:

Type of equipment:	Computer
Trade mark:	--
Manufacturer:	SECO S.r.l.
Address of manufacturer:	Via Pietro Calamandrei, 91 – 52100 Arezzo (AR) – Italy
Model :	Udoo
Variant model	Udoo Quad i.MX6 ARM Cortex-A9 Quad core 1GHz Trade Mark:SECO
Date of receipt:	2013-07-30

2.2 Accessories and support equipment

The following information identifies accessories used to exercise the EUT during testing:

Support equipment: --

2.3 EUT description

The Equipment under Tests (EUT) is a computer

Section 2: Equipment under test, continued

2.4 Technical specifications of the EUT

Electrical ratings:	12Vdc 1A
Internal operating frequency:	1000 MHz
I/O ports:	Mains HDMI USB SATA Headphone and Microphone Jack MicroSD reader

Section 2: Equipment under test, continued

2.5 EUT setup diagram

EUT was connected to power supplied, HDMI cable loaded, Headphone, USB pen driver, SATA Hardisk and MicroSD card

2.6 Operation of the EUT during testing

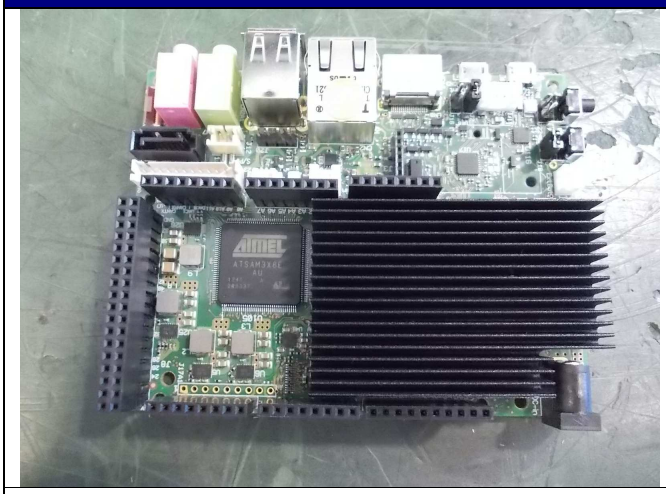
The EUT operated with LINUX Ubuntu 1204 LINARO OS in stress mode (CPU,GPU and IPU at 100%) and continuous polling at peripheral.

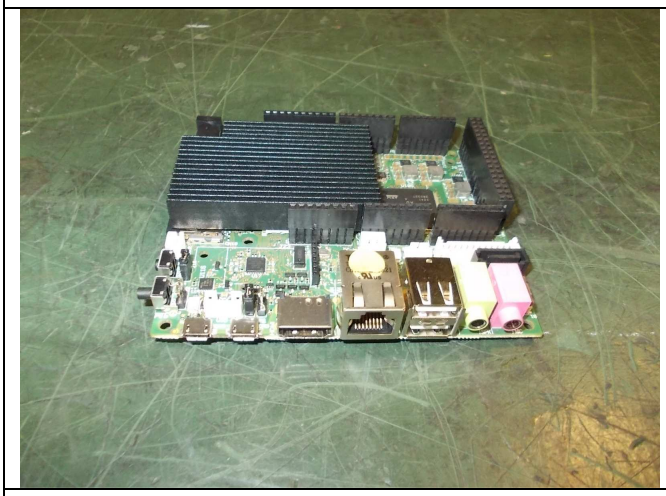
2.7 Modifications incorporated in the EUT

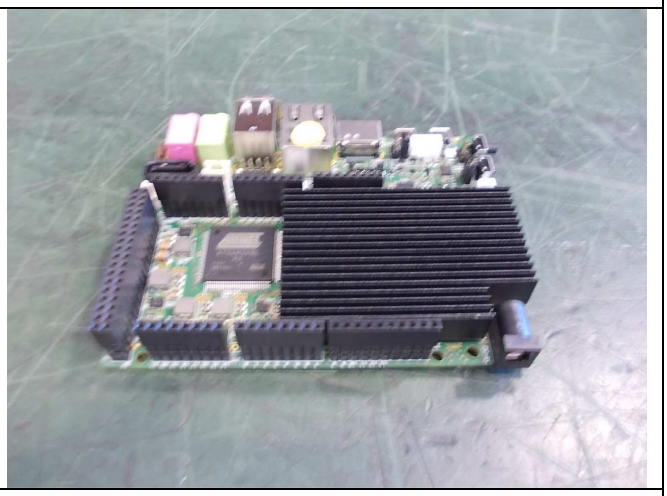
None

Section 2: Equipment under test, continued

2.8 EUT Photo







Section 3: Test conditions

3.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

3.2 Test conditions, power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 ℃ Relative humidity: 20–75 % Air pressure: 86–106 kPa When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.
Power supply range:	The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 3: Test conditions, continued

3.3 Measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to CISPR 16-4-2 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the Nemko Spa Technical Procedure WM L1002. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device

Test	**Range**	**Measurement Uncertainty**	**Notes**
Radiated Disturbance	Antenna distance 3m, 10m (30÷200) MHz	5.0 dB	(1)
	Antenna distance 3m,10m (0.2÷6) GHz	5.2 dB	(1)
	Antenna distance 1m, 3m, 10m (6÷18) GHz	5.8 dB	(1)
	Antenna distance 1m, 3m, 10m (18÷40) GHz	7.2 dB	(1)
Conducted Disturbance	9 kHz ÷ 150 kHz with AMN	3.8 dB	(1)
	150 kHz ÷ 30 MHz with AMN	3.4 dB	(1)
	150 kHz ÷ 30 MHz with AAN	4.6 dB	(1)
	9 kHz ÷ 30 MHz with voltage probe	2.9 dB	(1)
	9 kHz ÷ 30 MHz with current probe	2.9 dB	(1)
Harmonic Current Emission	50 Hz ÷ 2 kHz	2%	(1)
Voltage Fluctuation Emission	--	2%	(1)

NOTES:

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$ which has been derived from the assumed normal probability distribution with infinite degrees of freedom and for a coverage probability of 95 %.

3.4 Test equipment

Equipment	Manufacturer	Model No.	Serial No.
EMI receiver 9 kHz ÷ 3 GHz	R&S	ESCI	100888
Trilog Broad Band Antenna 25 MHz ÷ 8 GHz	Schwarzbeck	VULB 9162	VULB 9162-025
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530
Shielded room	Siemens	10m control room	1947
Turning-table	R&S	HCT	835 803/03
Antenna mast	R&S	HCM	836 529/05
Controller	R&S	HCC	836 620/7
EMI receiver 9 kHz ÷ 3 GHz	R&S	ESCI	100888
LISN 9 kHz ÷ 30 MHz	R&S	ESH2-Z5	872 460/041
Shielded room	Siemens	Conducted emission test room	1862

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use

Section 4: Result summary

4.1 FCC Part 15 Subpart B, 15.107 and 15.109: Test results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N	No : not applicable / not relevant.
Y	Yes : Mandatory i.e. the apparatus shall conform to these tests.
N/T	Not Tested, mandatory but not assessed. (See report summary)

Part	Test description	Required	Result
FCC Part 15 Subpart B requirements			
§15.107(a)	Conducted emissions for class B	Y	P
§15.109(a)	Radiated emissions for class B	Y	P
Notes: --			

Appendix A: Test results

Clause 15.107(a) Conducted limits

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 Ω 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.		

Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

Test date: 2013-07-30

Test results: Pass

Special notes

Port under test: AC mains

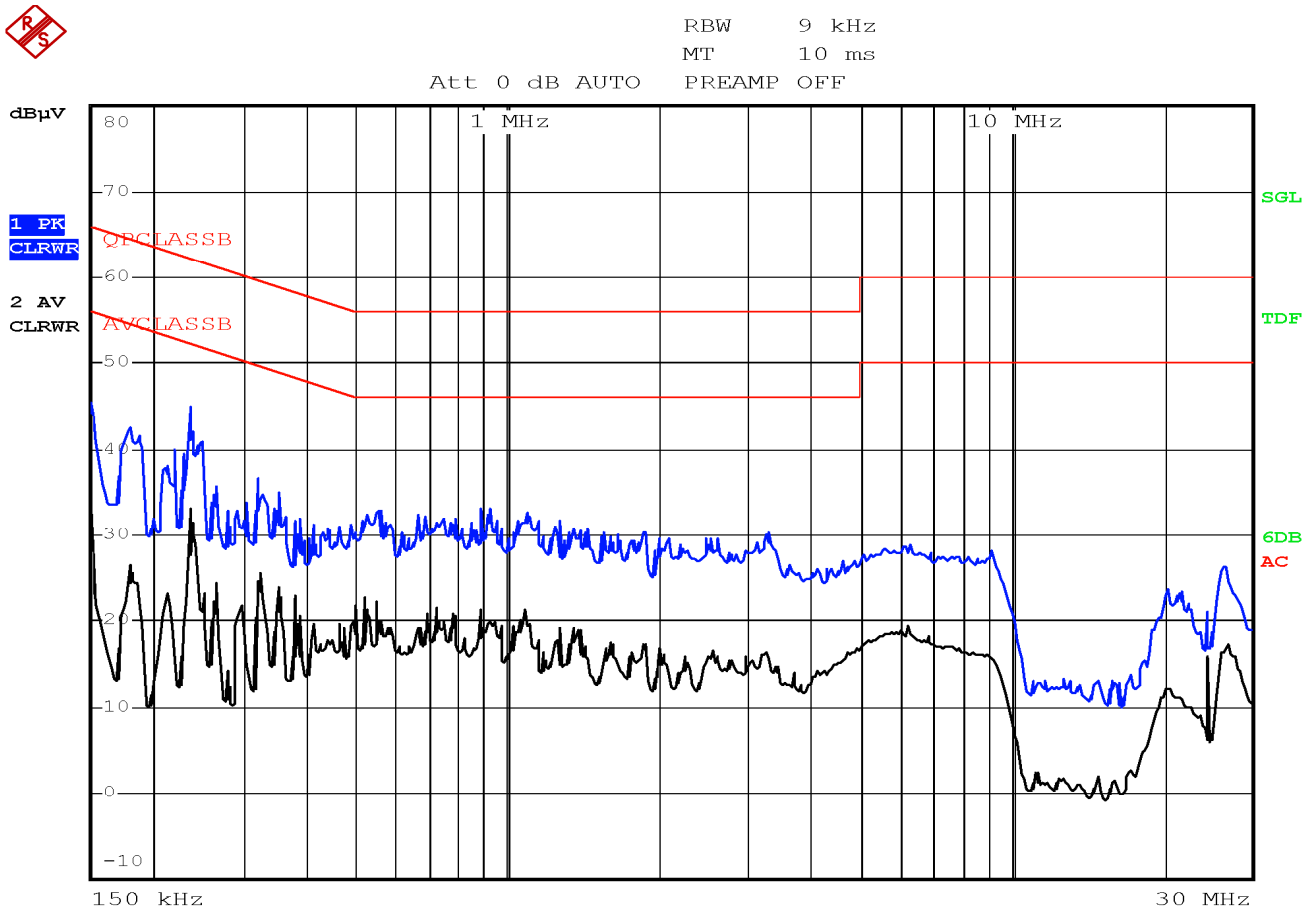
Preview measurements:
0.15 MHz to 30 MHz
Receiver settings:
– Peak and average detector
– 9 kHz RBW

Final measurement:
0.15 MHz to 30 MHz
Receiver settings:
– Q-Peak and average detector
– 9 kHz RBW

– Spectral plots have been corrected for transducer factors; cable loss, LISN, and attenuators.
– Emissions detected within 6 dB of limit were re-measured with a quasi peak or average detector for a final measurement.

Clause 15.107(a) Conducted limits, continued

Test data

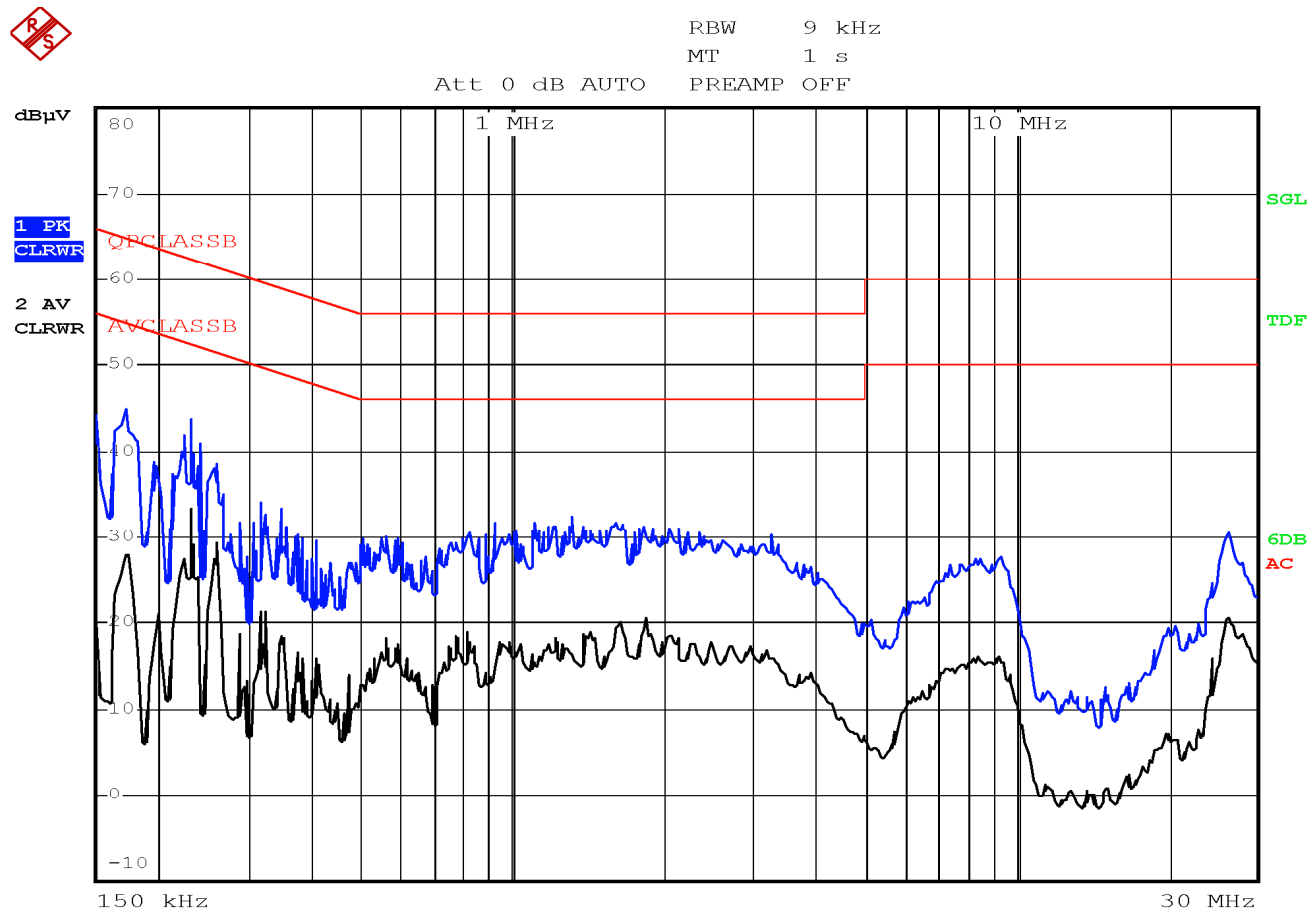


Date: 30.JUL.2013 16:38:04

Phase line

Clause 15.107(a) Conducted limits, continued

Test data



Date: 30.JUL.2013 16:34:40

Neutral line

Set up photo

Clause 15.109(a) Radiated emissions limit

The field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength (µV/m)	Field strength (dBµV/m)
30–88	100	40.0
88–216	150	43.5
216–960	200	46.0
Above 960	500	54.0

In the emission table 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.

For CB receivers, the field strength of radiated emissions within the frequency range of 25–30 MHz shall not exceed 40 µV/m at a distance of 3 meters. The field strength of radiated emissions above 30 MHz from such devices shall comply with the limits in paragraph (a) of this section.

For a receiver which employs terminals for the connection of an external receiving antenna, the receiver shall be tested to demonstrate compliance with the provisions of this section with an antenna connected to the antenna terminals unless the antenna conducted power is measured as specified in §15.111(a). If a permanently attached receiving antenna is used, the receiver shall be tested to demonstrate compliance with the provisions of this section.

§ 15.111 Antenna power conduction limits for receivers.

In addition to the radiated emission limits, receivers that operate (tune) in the frequency range 30 to 960 MHz and CB receivers that provide terminals for the connection of an external receiving antenna may be tested to demonstrate compliance with the provisions of §15.109 with the antenna terminals shielded and terminated with a resistive termination equal to the impedance specified for the antenna, provided these receivers also comply with the following: With the receiver antenna terminal connected to a resistive termination equal to the impedance specified or employed for the antenna, the power at the antenna terminal at any frequency within the range of measurements specified in §15.33 shall not exceed 2.0 nW.

Test date: 2013-07-30

Test results: Pass

Clause 15.109(a) Radiated emissions limit, continued

Special notes

– The spectrum was searched from 20 MHz to the 8 GHz.
– All measurements were performed at a distance of 3 m.
– Only the worst data presented in the test report.

Preview measurements:
30 MHz to 1 GHz
Receiver settings:
– Peak detector, Max hold
– 120 kHz RBW

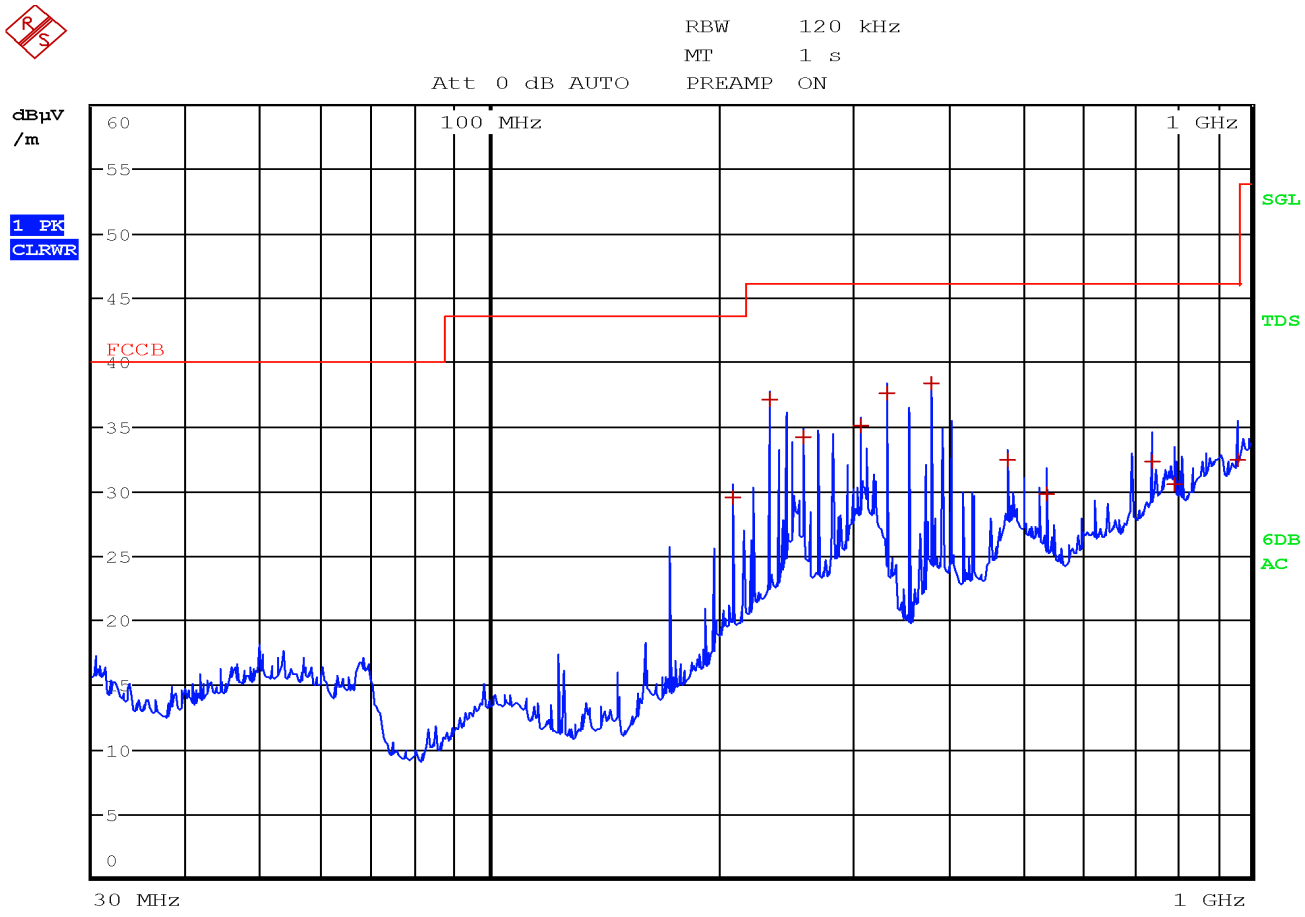
1 GHz to 25 GHz
Spectrum analyzer settings:
– Peak detector, Max hold
– 1 MHz RBW

Final measurement:
30 MHz to 1 GHz
Receiver settings:
– Quasi-Peak detector
– 120 kHz RBW

1 GHz to 25 GHz
Receiver settings:
– Average and Peak detector
– 1 MHz RBW

Clause 15.109(a) Radiated emissions limit, continued

Test data



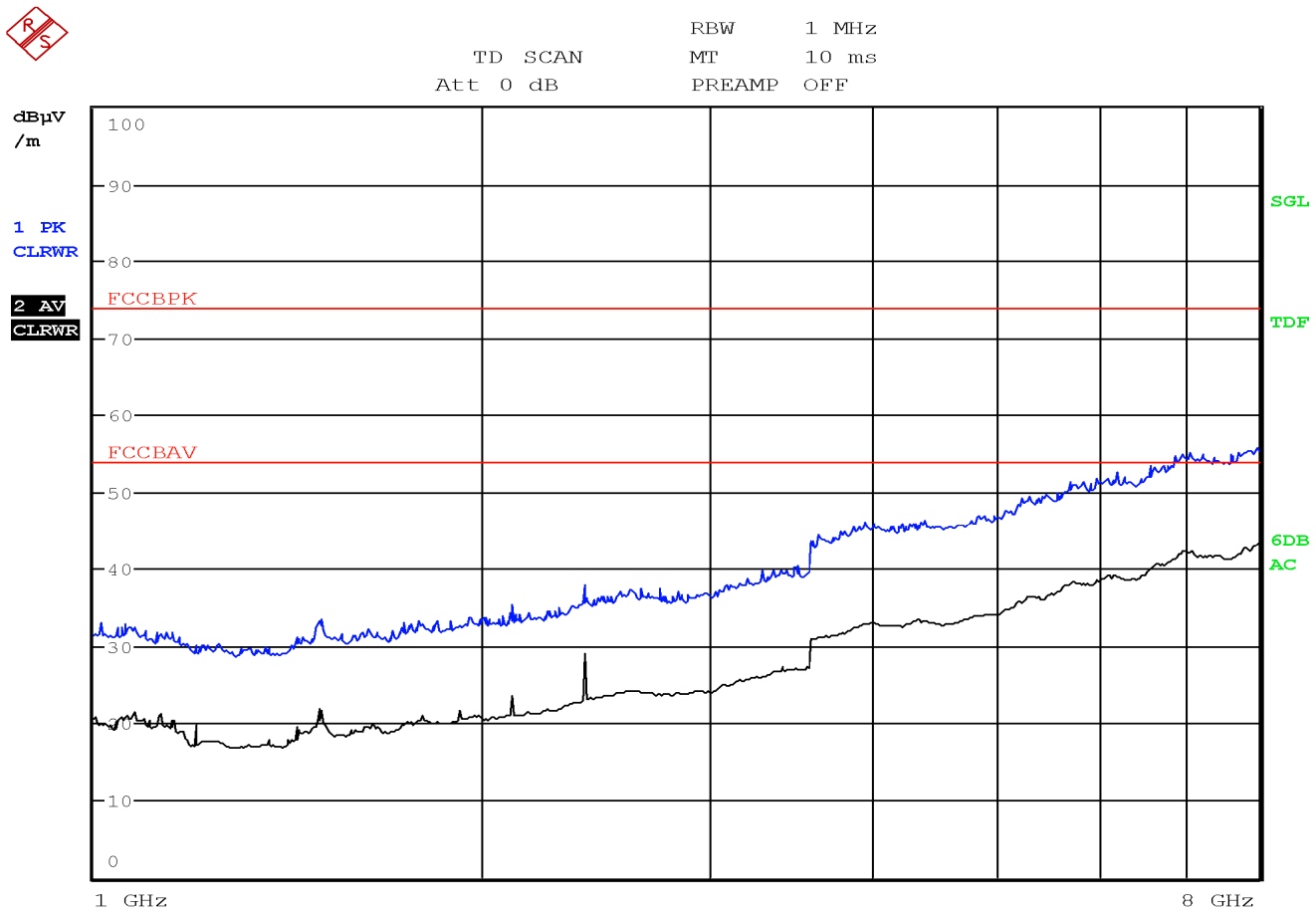
Date: 30.JUL.2013 15:19:45

Antenna in horizontal polarization

Clause 15.109(a) Radiated emissions limit, continued				
Tabular data				
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
208.9000	29.5	43.5	-14.0	QP
233.4750	37.1	46.0	-8.9	QP
258.0500	34.2	46.0	-11.8	QP
307.2000	35.2	46.0	-10.9	QP
331.7750	37.6	46.0	-8.4	QP
380.9500	38.3	46.0	-7.7	QP
480.0000	32.5	46.0	-13.5	QP
540.0000	29.8	46.0	-16.2	QP
744.0250	32.4	46.0	-13.6	QP
792.0250	30.5	46.0	-15.5	QP
959.9750	32.5	46.0	-13.5	QP

Clause 15.109(a) Radiated emissions limit, continued

Test data

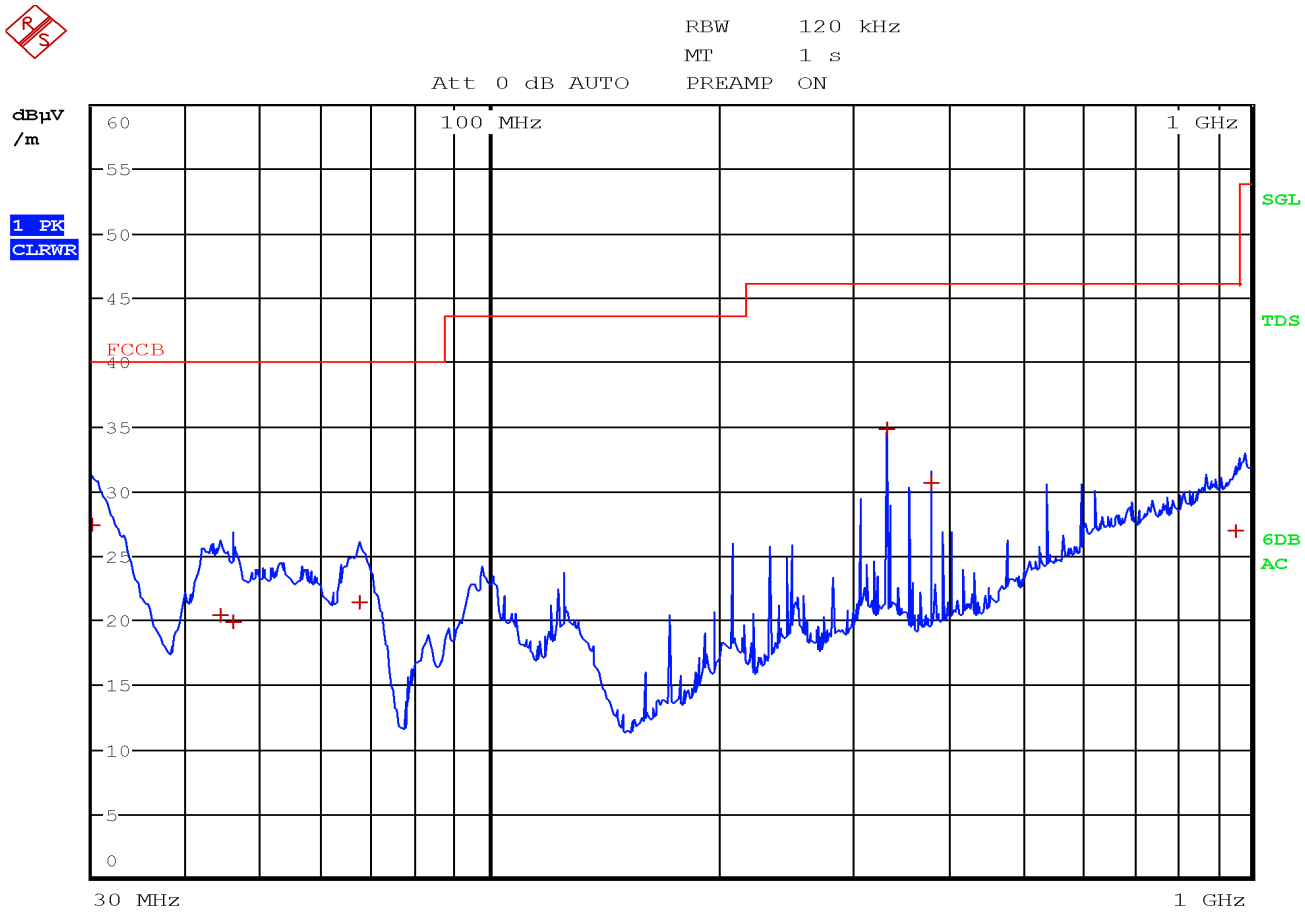


Date: 30.JUL.2013 15:53:20

Antenna in horizontal polarization

Clause 15.109(a) Radiated emissions limit, continued

Test data



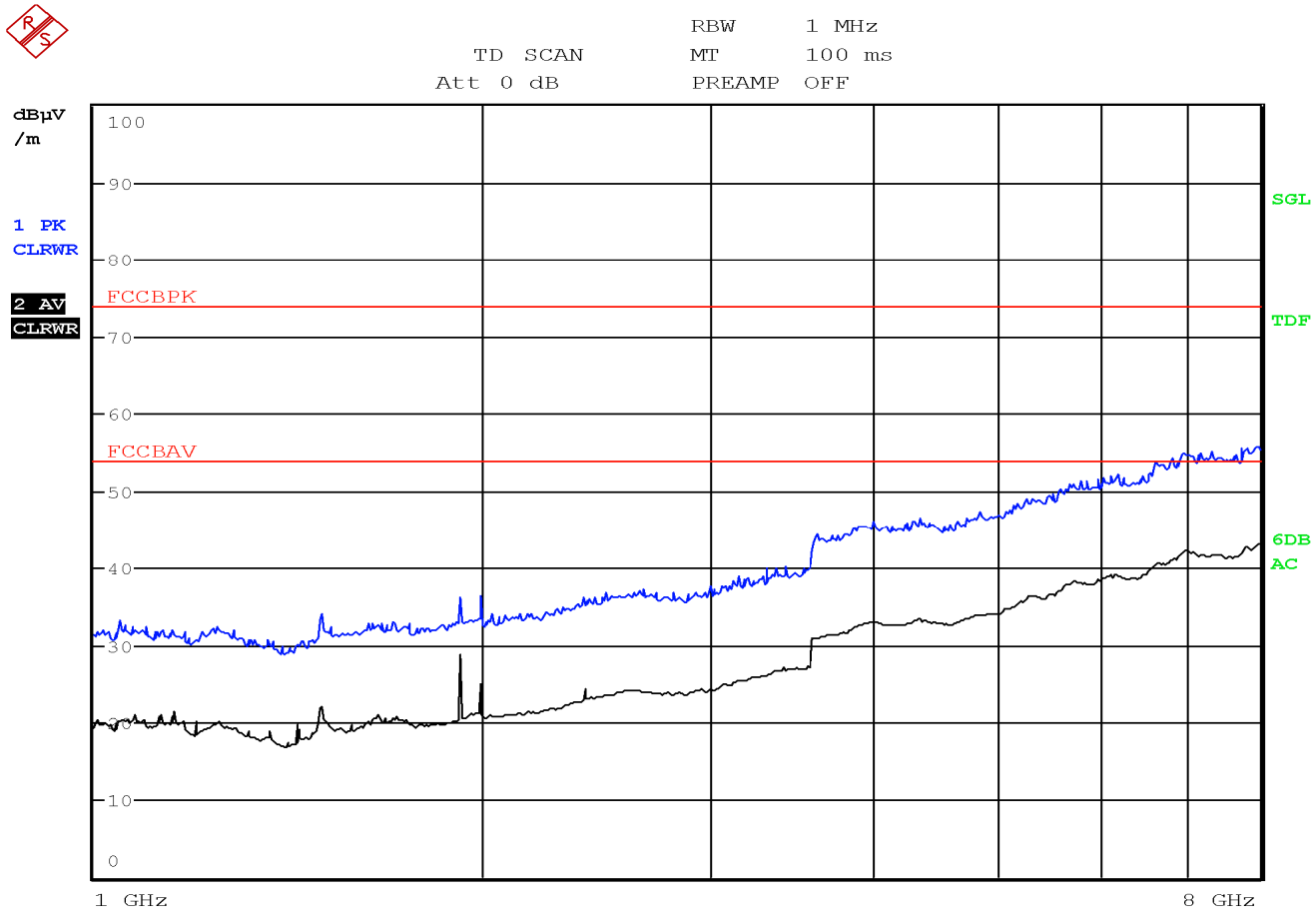
Date: 30.JUL.2013 15:14:33

Antenna in vertical polarization

Tabular data				
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.0000	27.4	40.0	-12.6	QP
44.1250	20.4	40.0	-19.6	QP
45.9750	19.8	40.0	-20.2	QP
67.4750	21.4	40.0	-18.6	QP
331.7750	34.9	46.0	-11.1	QP
380.9500	30.7	46.0	-15.4	QP
955.6750	26.9	46.0	-19.1	QP

Clause 15.109(a) Radiated emissions limit, continued

Test data

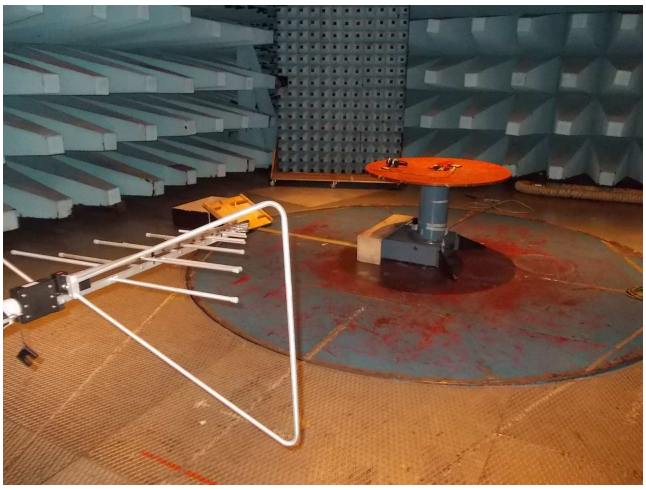


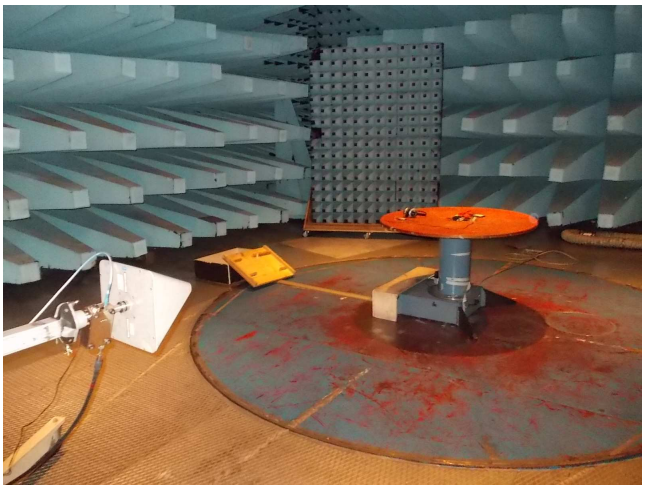
Date: 30.JUL.2013 15:37:50

Antenna in vertical polarization

Clause 15. 209 Field Strength, continued

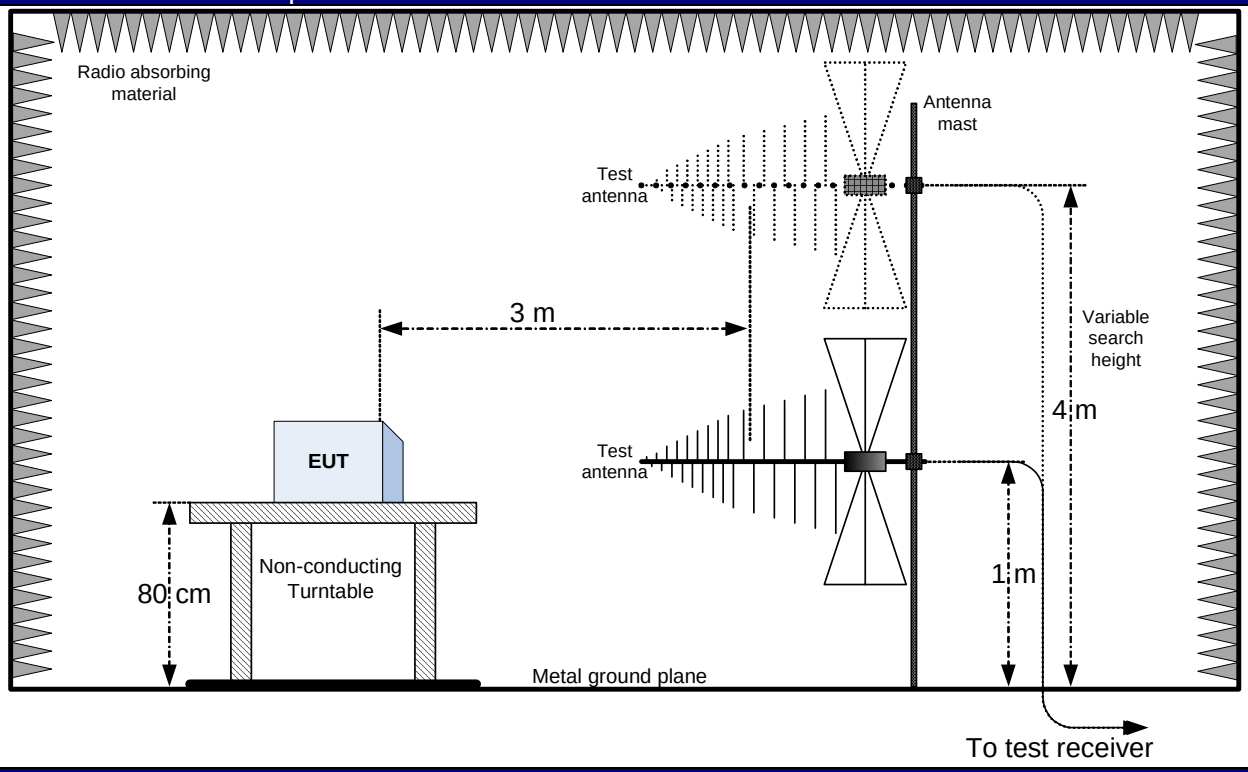
Set up photo





Appendix B: Block diagrams of test set-ups

Radiated emissions set-up above 30 MHz



Conducted emissions set-up