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Report number:	199523-3TRFWL
Apparatus:	RX device for central vacuum cleaners
Applicant:	Tecnoplus srl Via Cilavegna n.53 27020 Gravellona Lomellina (PV) Italy
FCC ID:	DGO-RXFLISY

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: _____ 2012-03-06
Signature Date
G. Curioni, Wireless/EMC Specialist

Reviewed by: _____ 2012-03-06
Signature Date
P. Barbieri, EMC Specialist

The tests included in this report are within the scope of this accreditation.

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 Spa.

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 – 20853 Biassono (MB) – Italy
Registration number:	481407 (10 m semi anechoic chamber)

Note that the results contained in this report relate only to the items tested and were obtained in the period between 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. All results contain in this report are within Nemko Spa ISO/IEC 17025 accreditation.

Section 2: Equipment under test

2.1 Identification of equipment under test (EUT)

The following information identifies the EUT under test:

Type of equipment:	RX device for central vacuum cleaners
Product marketing name:	-
Model number:	Flisy
Serial number:	Not provided
Nemko sample number:	199523
FCC ID:	DGO-RXFLISY
Date of receipt:	2012-02-24

2.2 Accessories and support equipment

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

The EUT has been tested pushing the button when discontinuous working is needed and it has been tested in continuous transmission mode forced with an electrical bridge

2.3 EUT description

The EUT is a radio controller for central vacuum cleaners with the following performance data

CR72 - RECEIVER

TABLE 1 - PERFORMANCE DATA RECEIVER CR72		
Frequency		433.925 MHz
Modulation		AM (OOK)
Receiver sensitivity	AM – 1 kbps	-96 dBm (conducted)
Data rate	Default	1 kbps
	Max	5 kbps
System setup time		50 ms
Supply current	Active	700 µA
	Parzialised	350 µA
	Sleep	250 nA
Supply Voltage	Min	2.6V DC
	Max	3.3V DC
Operating temperature range		+5°C ÷ +35°C - CAT III
Wall contact sensitivity	Min	6V DC ÷ AC
	Max	60V DC ÷ AC
Antenna		Integrated
Dimensions		42 x 30 x 8 mm (h=18mm with battery contact)

The EUT is also provided also with a cleaning inlet valve board supplied by the AC mains (not under test). Conducted emission test has been performed on the AC mains of this module.

Section 2: Equipment under test, continued

2.4 Technical specifications of the EUT

Operating frequency:	433.925 MHz
Modulation type:	OOK
Occupied bandwidth:	-
Emission designator:	P1D
Antenna data:	-
Antenna type:	Integral Permanent fixed antenna, which may be built-in, (Equipment does not have an external 50 Ω RF connector)
Power source	3 VDC internal

2.5 Operation of the EUT during testing

The EUT has been tested in RX mode connected to a cleaning inlet valve board supplied by the AC mains

2.6 Modifications incorporated in the EUT

None
There were no modifications performed to the EUT during this assessment.

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 °C 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 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Nemko Spa Technical Procedure WML1002. 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. Hereafter the best measurement capability for Nemko Spa laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Disturbance	Antenna distance 3m, 10m (30÷200) MHz	5.0 dB	(1)
	Antenna distance 3m (0.2÷6) GHz	5.2 dB	(1)
	Antenna distance 1m, 3m (6÷18) GHz	5.8 dB	(1)
	Antenna distance 1m, 3m (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)

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.	Asset/Serial No.	Next cal.
Trilog Broad Band Antenna	Schwarzbeck	VULB 9168	VULB 9168-242	2015/02
Bilog antenna 1 ÷ 18 GHz	Schwarzbeck	STLP 9148-123	123	2015/02
Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	2013/07
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	2013/02
Turning-table	R&S	HCT	835 803/03	NCR
Antenna mast	R&S	HCM	836 529/05	NCR
Controller	R&S	HCC	836 620/7	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2012/08
Shielded room	Siemens	10m control room	1947	NCR

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	Pass
§15.109(a)	Radiated emissions for class B	Y	Pass

Notes: A signal generator, not the matching transmitter, shall be used to radiate an unmodulated CW signal to a super-regenerative receiver at its operating frequency in order to “cohere” or to resolve the individual components of the characteristic broadband emissions from such a receiver. The level of the signal may need to be increased for this to occur.

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: 2012-03.02

Test results: Pass

Special notes

Port under test: AC mains

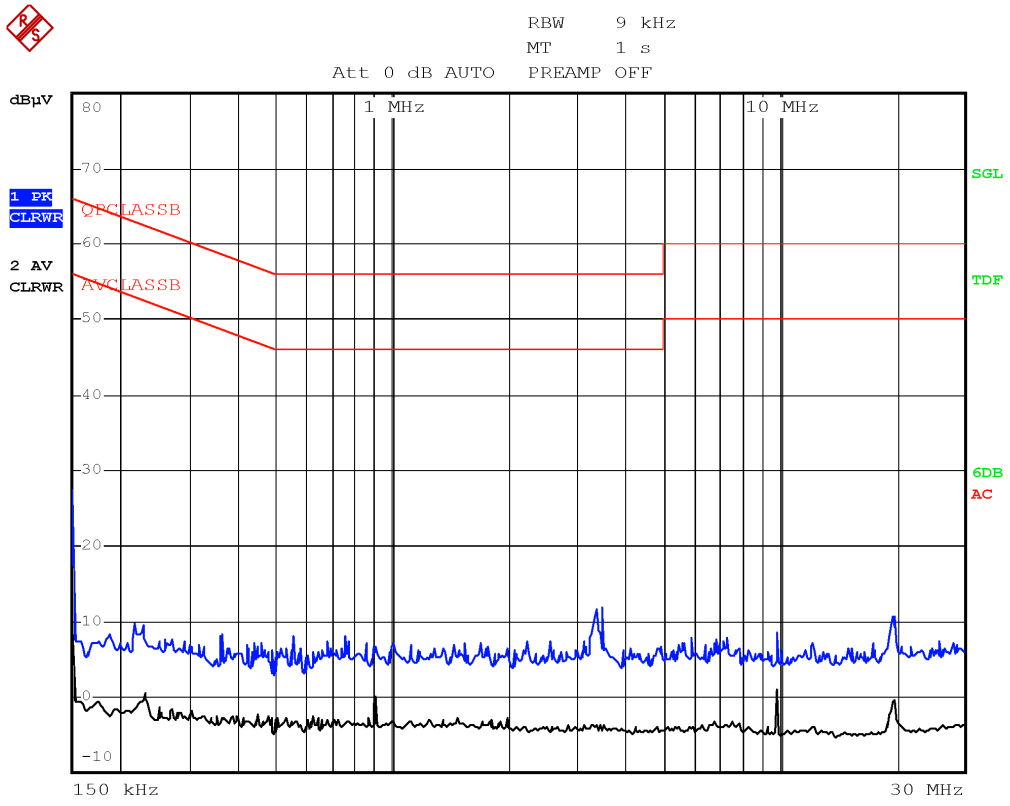
Preview measurements:
0.15 MHz to 30 MHz
Receiver settings:
– Peak and average detector
– 9 kHz RBW

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



Conducted emissions on phase line

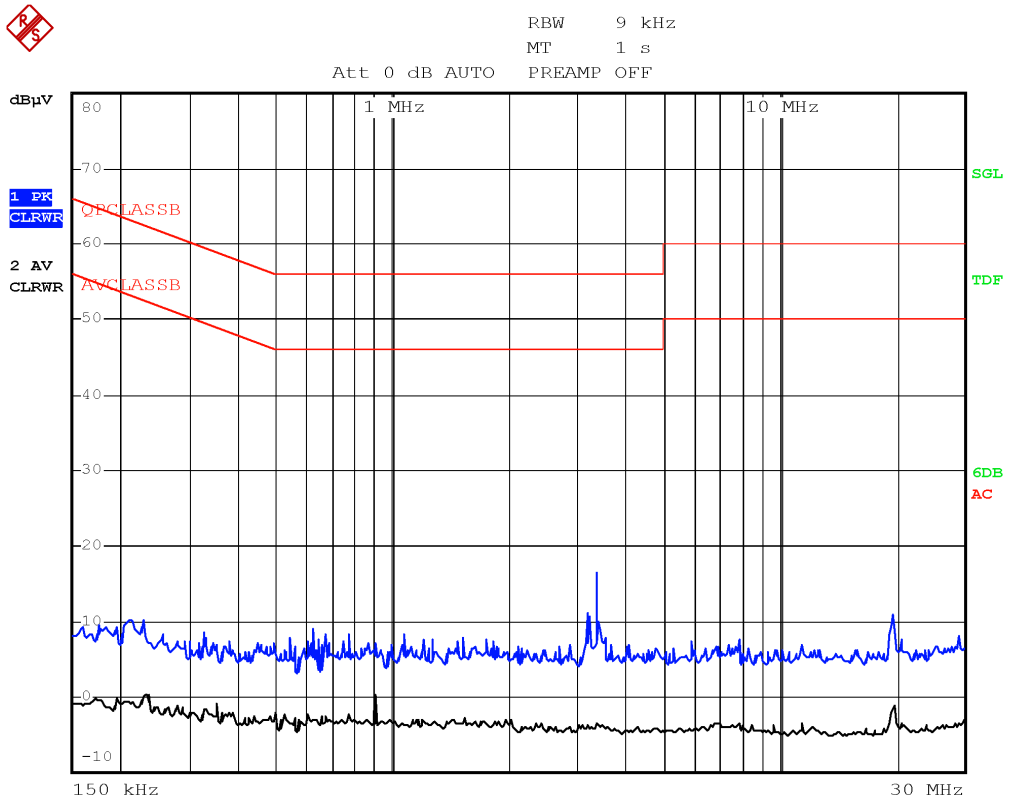
Tabular data

Frequency (MHz)	Q-Peak result (dBµV)	Meas. time (ms)	Bandwidth (kHz)	Filter	Conductor	Correction (dB)	Margin (dB)	Limit (dBµV)
-	-	-	-	-	-	-	-	-
Frequency (MHz)	Average result (dBµV)	Meas. time (ms)	Bandwidth (kHz)	Filter	Conductor	Correction (dB)	Margin (dB)	Limit (dBµV)
-	-	-	-	-	-	-	-	-

Note: Correction factor includes cable loss, LISN, and attenuator.

Clause 15.107(a) Conducted limits, continued

Test data, continued



Conducted emissions on neutral line

Tabular data

Frequency (MHz)	Q-Peak result (dBµV)	Meas. time (ms)	Bandwidth (kHz)	Filter	Conductor	Correction (dB)	Margin (dB)	Limit (dBµV)
-	-	-	-	-	-	-	-	-
Frequency (MHz)	Average result (dBµV)	Meas. time (ms)	Bandwidth (kHz)	Filter	Conductor	Correction (dB)	Margin (dB)	Limit (dBµV)
-	-	-	-	-	-	-	-	-

Note: Correction factor includes cable loss, LISN, and attenuator.

Clause 15.107(a) Conducted limits, continued

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: 2012-03.02

Test results: Pass

Clause 15.109(a) Radiated emissions limit, continued

Special notes

– The spectrum was searched from 30 MHz to the 10th harmonic.
– The EUT was measured on three orthogonal axis.
– All measurements were performed at a distance of 3 m.
– Only the worst data presented in the test report.
– Fresh battery was used throughout the test.

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

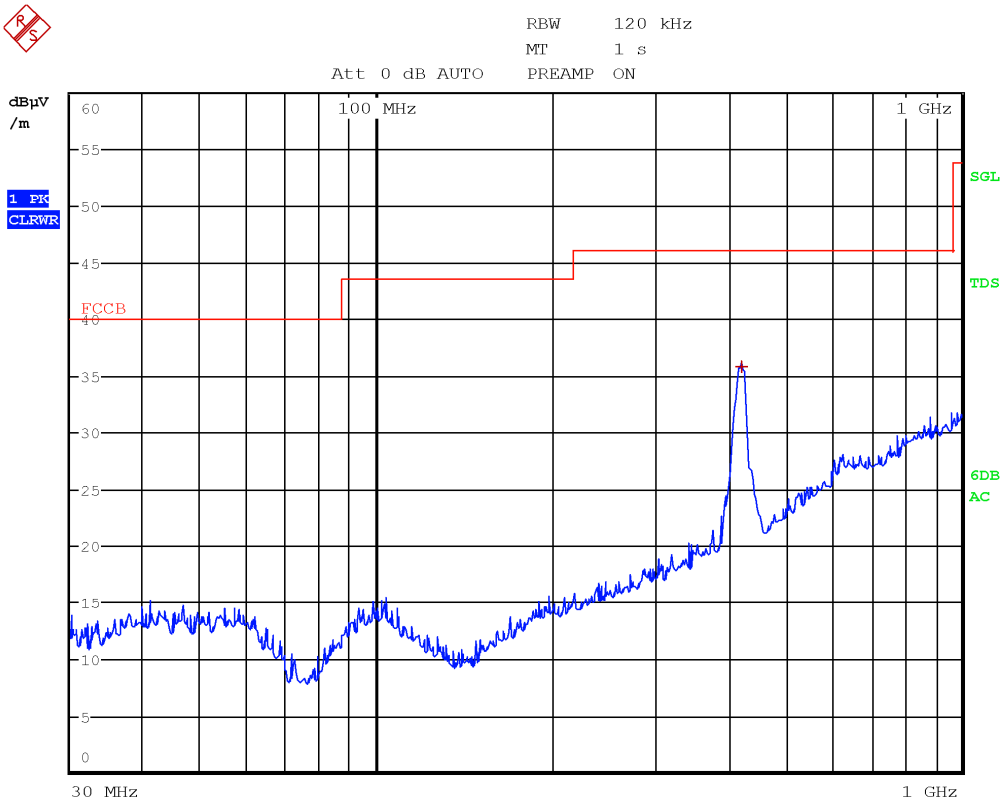
1 GHz to 40 GHz
Spectrum analyzer settings:
– Peak detector, Max hold
– 1 MHz RBW

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

1 GHz to 40 GHz
Receiver settings:
– Average and Peak detector
– 1 MHz RBW

Clause 15.109(a) Radiated emissions limit, continued

Test data, continued



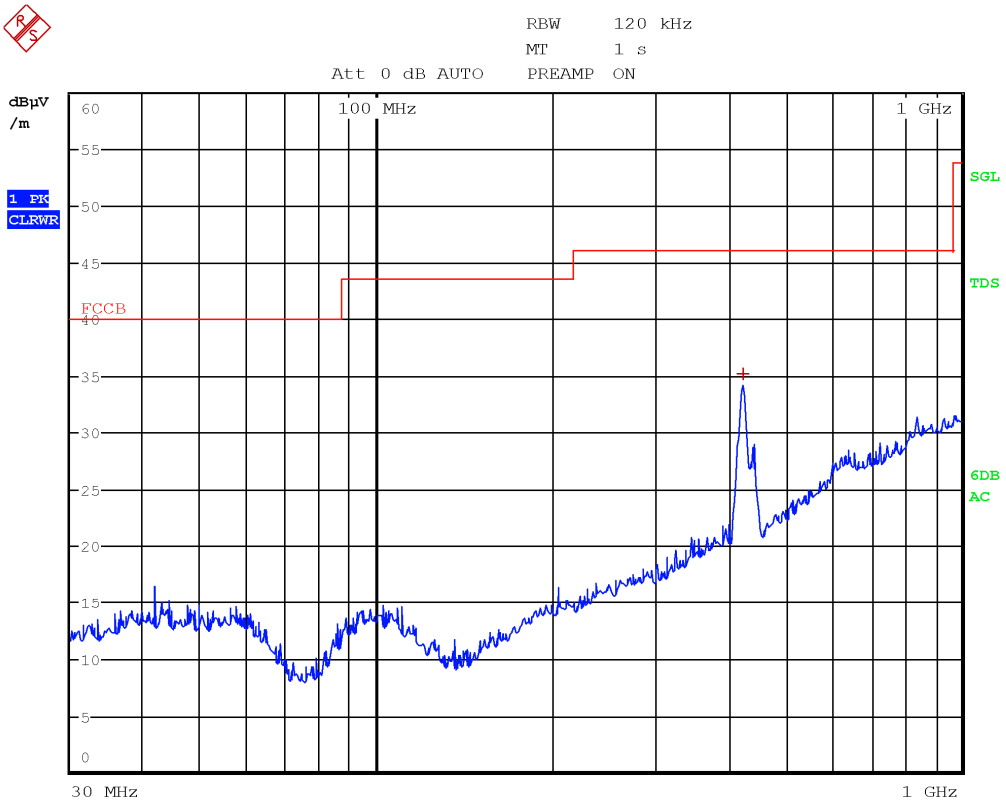
Antenna in horizontal polarization

Tabular data

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
420.7250	35.8	46.0	-10.2	QP

Clause 15.109(a) Radiated emissions limit, continued

Test data, continued



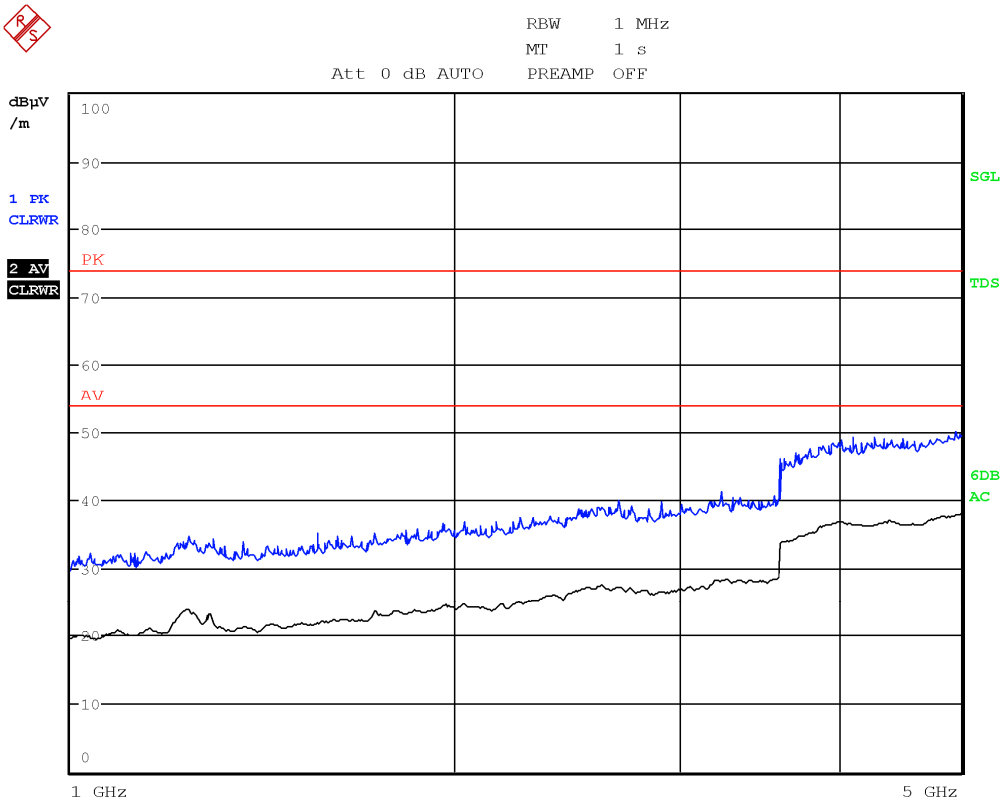
Antenna in vertical polarization

Tabular data

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
423.6250	35.3	46.0	-10.8	QP

Clause 15.109(a) Radiated emissions limit, continued

Test data, continued



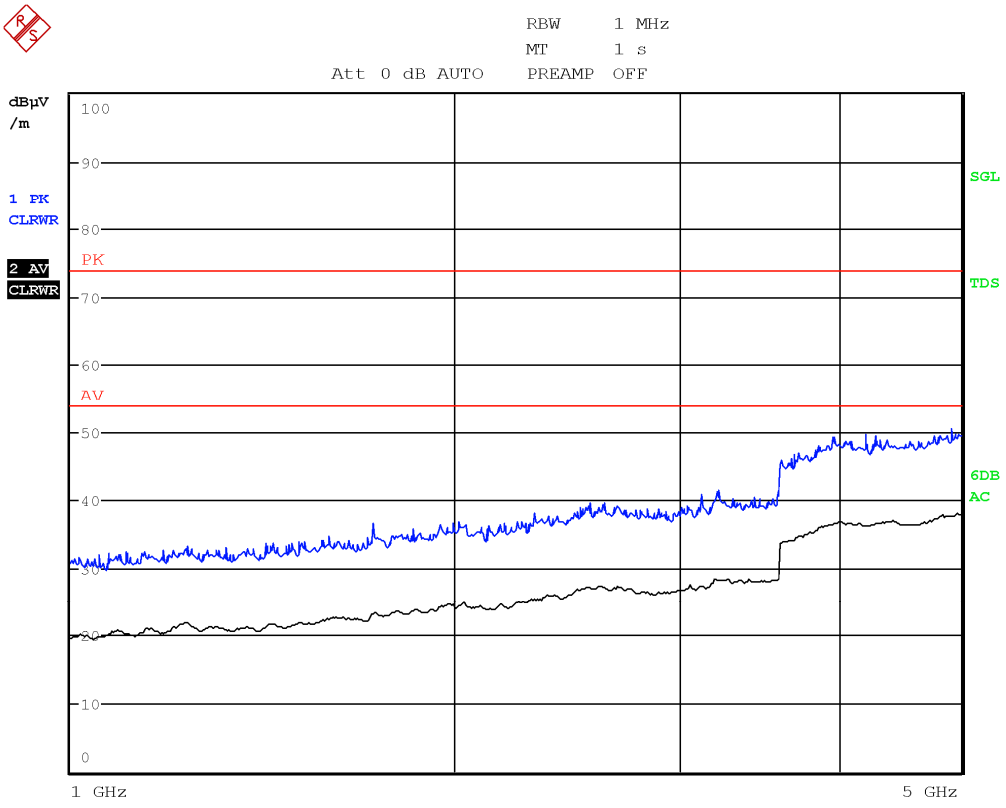
Antenna in horizontal polarization

Tabular data

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
-	-	-	-	-

Clause 15.109(a) Radiated emissions limit, continued

Test data, continued



Antenna in vertical polarization

Tabular data

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
-	-	-	-	-

Clause 15.109(a) Radiated emission limits, continued

Set up photo

Clause 15.109(a) Radiated emission limits, continued

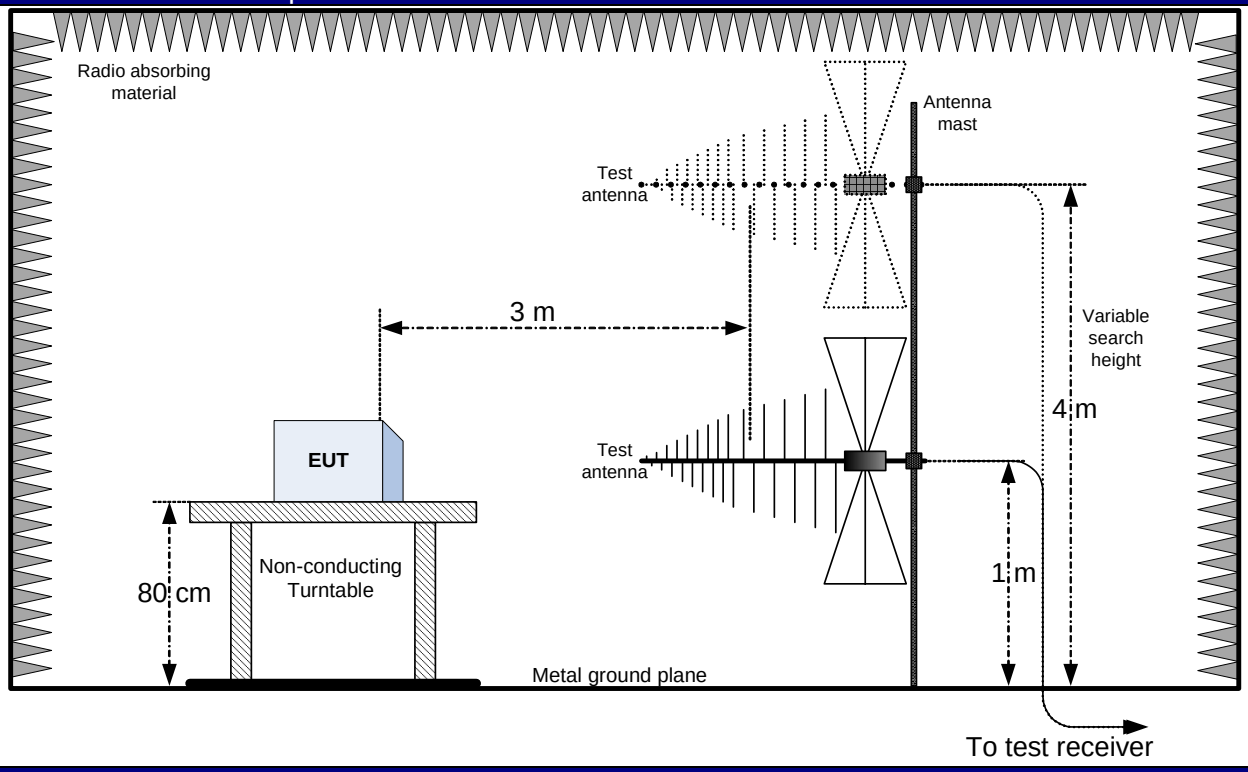
Set up photo

Clause 15.109(a) Radiated emission limits, continued

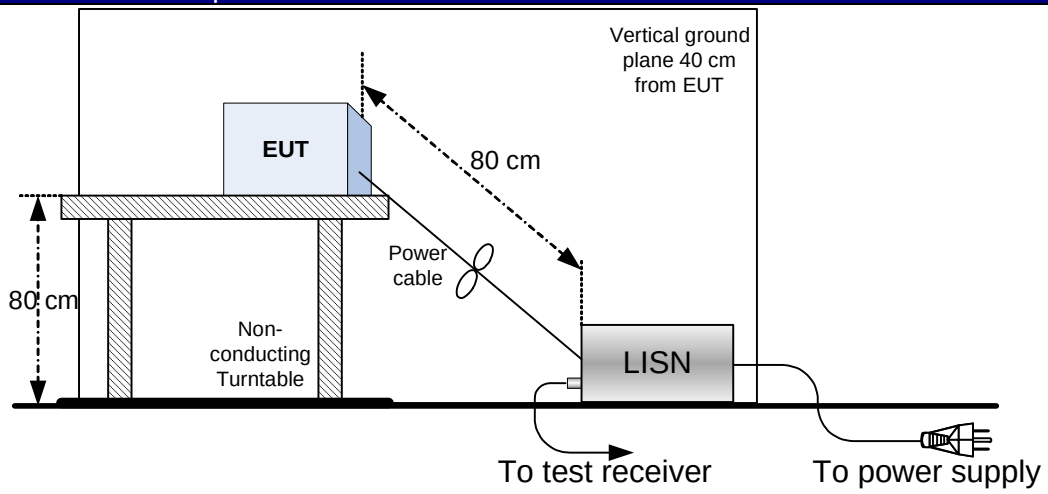
Set up photo

Appendix B: Block diagrams of test set-ups

Radiated emissions set-up



Conducted emissions set-up



Appendix C: Photos