

EMI - TEST REPORT

- FCC Part 15B -



| | | |
|--------------------------|-----------------------|-------------------------------|
| Test Report No. : | T35019-00-08HU | 18. May 2011 Date of issue |
|--------------------------|-----------------------|-------------------------------|

Type / Model Name : RTR-300

Product Description : Wireless Dongle

Applicant : T&D CORPORATION

Address : 817-1 Shimadachi Matsumoto City
NAGANO 390-0852 JAPAN

Manufacturer : T&D CORPORATION

Address : 817-1 Shimadachi Matsumoto City
NAGANO 390-0852 JAPAN

Licence holder : T&D CORPORATION

Address : 817-1 Shimadachi Matsumoto City
NAGANO 390-0852 JAPAN

| | |
|--|-----------------|
| Test Result according to the standards listed in clause 1 test standards: | POSITIVE |
|--|-----------------|



The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart A - General (October, 2010)

| | |
|-----------------------------------|---|
| Part 15, Subpart A, Section 15.31 | Measurement standards |
| Part 15, Subpart A, Section 15.33 | Frequency range of radiated measurements |
| Part 15, Subpart A, Section 15.35 | Measurement detector functions and bandwidths |

FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (October, 2010)

| | | |
|------------------------------------|---|---------|
| Part 15, Subpart B, Section 15.107 | AC Line conducted emissions, | Class B |
| Part 15, Subpart B, Section 15.109 | Radiated emissions, general requirements, | Class B |

| | |
|------------------|---|
| ANSI C63.4: 2003 | Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. |
|------------------|---|

| | |
|--------------------|--------------------------------|
| CISPR 16-4-2: 2003 | Uncertainty in EMC measurement |
|--------------------|--------------------------------|

| | |
|----------------------------------|----------------------------------|
| CISPR 22: 2005 EN 55022: 2006 | Information technology equipment |
|----------------------------------|----------------------------------|

2 SUMMARY

GENERAL REMARKS:

The EuT is capable to exchange data with a PC via USB port. The EuT can also connected to an AC Adapter (sold separately) and used as a Repeater.
This test report describes the radiated disturbance by the data transfer via USB port and conducted disturbance produced by using an AC Adapter.

The measurement has been performed in Standby (Dongle Open).

The EuT is declared as Class B digital device.

FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 07. March 2011

Testing concluded on : 06. April 2011

Checked by:

Tested by:

Harald Buchwald
Dipl. Ing.(FH)
Manager: EMC

Markus Huber

3 EQUIPMENT UNDER TEST

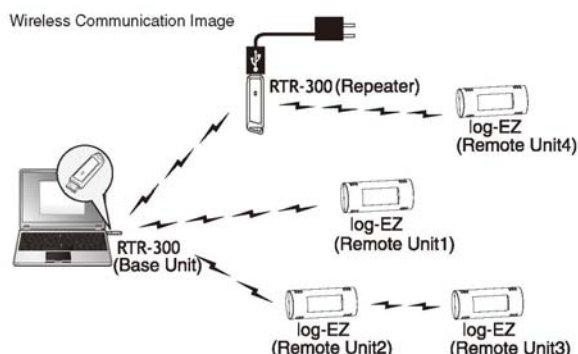
3.1 Photo documentation of the EUT – Detailed photos see Attachment A1

3.2 Power supply system utilised

Power supply voltage : 5.0 V / DC (USB power)

3.3 Short description of the equipment under test (EUT)

The EuT is a wireless dongle. The RTR-300 allows wireless communication between RTR-322 units and a PC.



Number of tested samples: 1

Serial number: see Photo documentation of the EuT / Equipment Under Test

The equipment under test was operated during the measurement under the following conditions:

- Standby (Dongle Open)

-

-

EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

| | |
|-----------------|--|
| - Test Software | Model : Supplied by manufacturer T&D |
| - Laptop | Model : Fa. mikes testingpartners gmbh |
| - | Model : |
| - | Model : |
| - | Model : |
| - | Model : |

mikes

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 Strasskirchen
Germany

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production processes may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests. The manufacturer has the sole responsibility of continued compliance of the EUT.

4.4 Measurement Protocol for FCC, VCCI and AUSTEL

4.4.1 GENERAL INFORMATION

4.4.1.1 Test Methodology

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

4.4.1.2 Justification

The Equipment under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each in order to obtain maximum disturbances from the unit.

4.4.2 DETAILS OF TEST PROCEDURES

4.4.2.1 General Standard Information

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

5 TEST CONDITIONS AND RESULTS

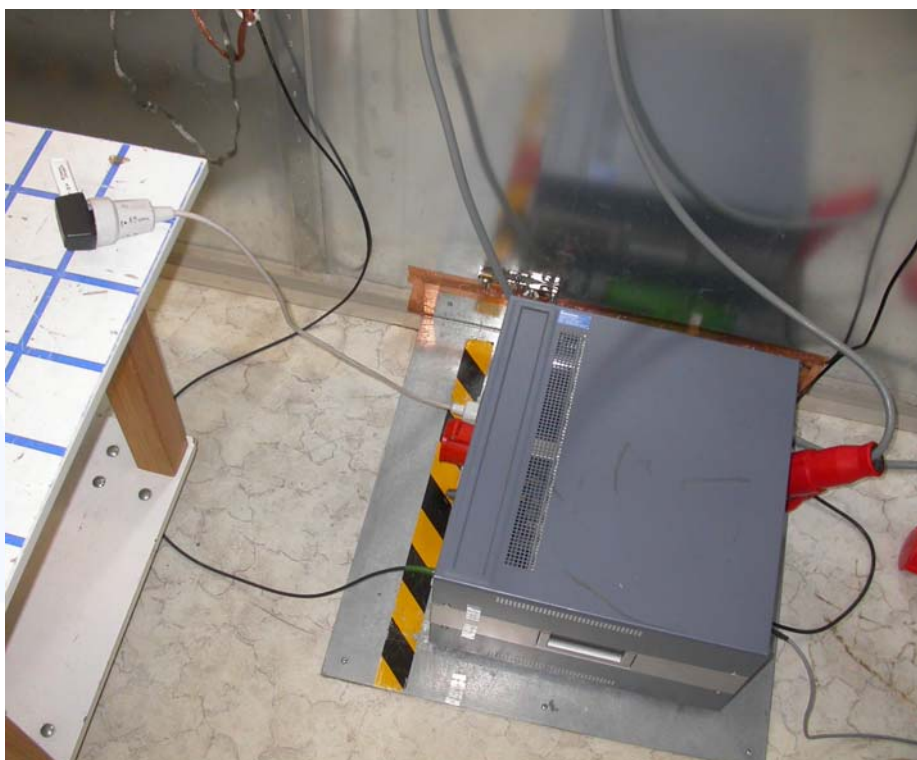
5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up



5.1.3 Applicable standard

According to FCC Part 15B, Section 15.107(a):

Except as shown in paragraphs (b) and (c) of this Section, for an unintentional radiator 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.

| Frequency of emission (MHz) | Conducted limit (dB μ V) | |
|--------------------------------|------------------------------|------------|
| | 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

5.1.4 Description of Measurement

The correction factors for cable loss and antenna gain are stored in the memory of the EMI receiver therefore the final level (dB μ V) appears directly in the reading of the EMI receiver. This level is compared to the FCC limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = 10^{(\text{dB}\mu\text{V}/20)}$$

The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a line impedance stabilization network (LISN) with 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 16.7 dB at 395 kHz

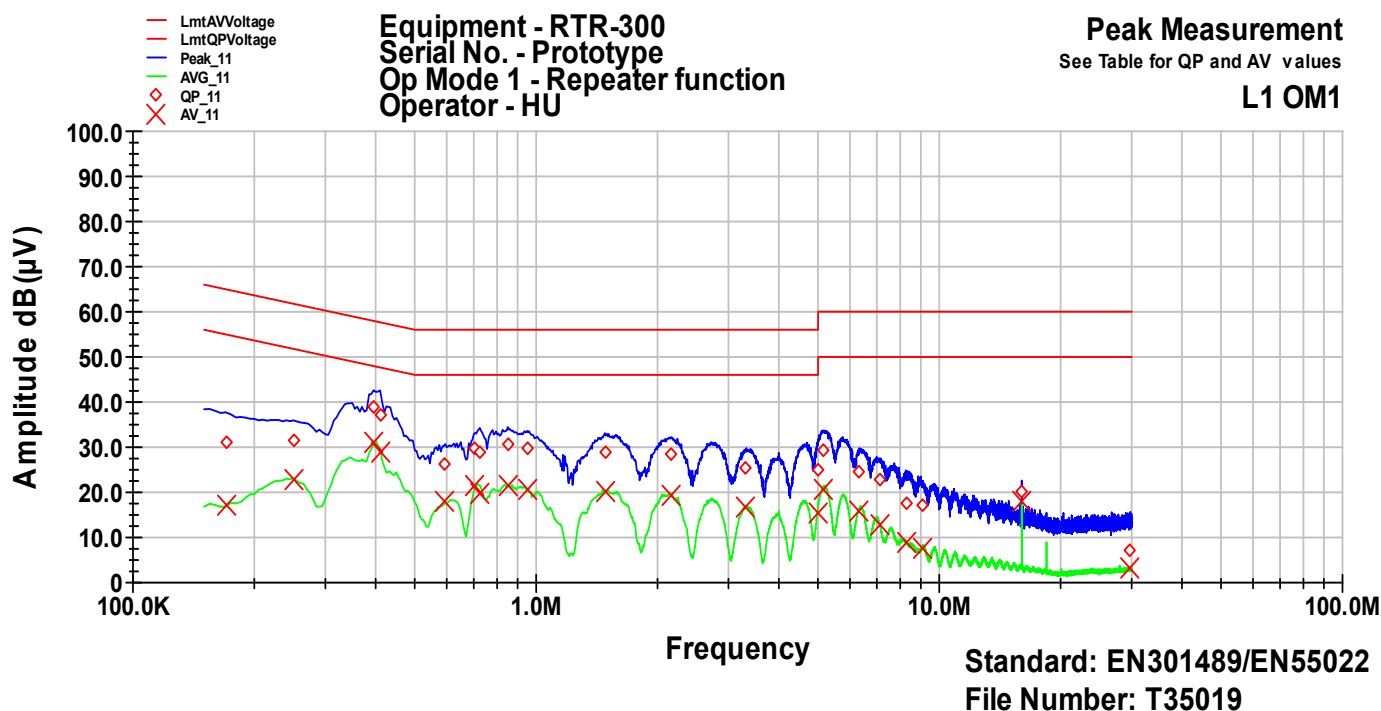
The requirements are **FULFILLED**.

Remarks:

5.1.6 Test protocol

Test point L1
Operation mode:
Remarks:

Result: passed



| Frequency MHz | QP Level dB(μV) | QP Margin dB | QP Limit dB | AV Level dB(μV) | AV Margin dB | AV Limit dB |
|------------------|--------------------|-----------------|----------------|--------------------|-----------------|----------------|
| 0.17 | 31.2 | -33.8 | 65.0 | 17.3 | -37.7 | 55.0 |
| 0.25 | 31.6 | -30.1 | 61.8 | 22.8 | -28.9 | 51.8 |
| 0.395 | 38.7 | -19.2 | 58.0 | 31.3 | -16.7 | 48.0 |
| 0.41 | 37.0 | -20.6 | 57.6 | 28.8 | -18.9 | 47.6 |
| 0.595 | 26.4 | -29.6 | 56.0 | 18.0 | -28.0 | 46.0 |
| 0.7 | 29.6 | -26.4 | 56.0 | 21.3 | -24.7 | 46.0 |
| 0.725 | 28.9 | -27.1 | 56.0 | 19.8 | -26.2 | 46.0 |
| 0.85 | 30.4 | -25.6 | 56.0 | 21.5 | -24.5 | 46.0 |
| 0.95 | 29.9 | -26.1 | 56.0 | 20.5 | -25.5 | 46.0 |
| 1.48 | 29.1 | -26.9 | 56.0 | 20.4 | -25.6 | 46.0 |
| 2.165 | 28.3 | -27.7 | 56.0 | 19.4 | -26.6 | 46.0 |
| 3.32 | 25.2 | -30.8 | 56.0 | 16.6 | -29.4 | 46.0 |
| 5 | 25.1 | -30.9 | 56.0 | 15.2 | -30.8 | 46.0 |
| 5.145 | 29.5 | -30.5 | 60.0 | 20.5 | -29.5 | 50.0 |
| 6.335 | 24.3 | -35.7 | 60.0 | 15.7 | -34.3 | 50.0 |
| 7.145 | 23.0 | -37.0 | 60.0 | 13.0 | -37.0 | 50.0 |
| 8.255 | 17.6 | -42.4 | 60.0 | 8.8 | -41.2 | 50.0 |
| 9.11 | 17.1 | -42.9 | 60.0 | 7.5 | -42.5 | 50.0 |
| 16 | 20.2 | -39.8 | 60.0 | 18.0 | -32.0 | 50.0 |
| 29.75 | 7.3 | -52.7 | 60.0 | 3.1 | -46.9 | 50.0 |

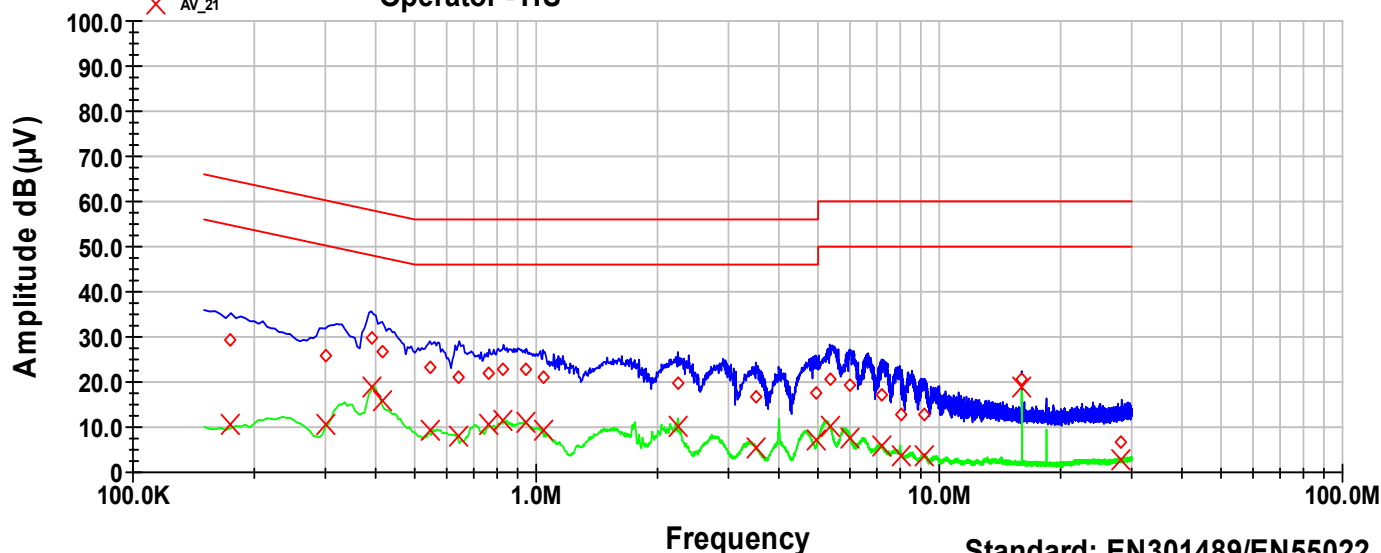
Test point N
Operation mode:
Remarks:

Result: passed

— LmtAVVoltage
— LmtQPVoltage
— Peak_21
— AVG_21
◇ QP_21
× AV_21

Equipment - RTR-300
Serial No. - Prototype
Op Mode 1 - Repeater function
Operator - HU

Peak Measurement
See Table for QP and AV values
N OM1



Standard: EN301489/EN55022
File Number: T35019

| Frequency MHz | QP Level dB(μV) | QP Margin dB | QP Limit dB | AV Level dB(μV) | AV Margin dB | AV Limit dB |
|------------------|--------------------|-----------------|----------------|--------------------|-----------------|----------------|
| 0.175 | 29.3 | -35.4 | 64.7 | 10.7 | -44.0 | 54.7 |
| 0.3 | 26.0 | -34.3 | 60.2 | 10.6 | -39.6 | 50.2 |
| 0.39 | 29.7 | -28.4 | 58.1 | 18.9 | -29.2 | 48.1 |
| 0.415 | 26.6 | -30.9 | 57.5 | 15.6 | -31.9 | 47.5 |
| 0.545 | 23.3 | -32.7 | 56.0 | 9.4 | -36.6 | 46.0 |
| 0.645 | 21.3 | -34.8 | 56.0 | 7.9 | -38.1 | 46.0 |
| 0.765 | 21.9 | -34.1 | 56.0 | 10.6 | -35.4 | 46.0 |
| 0.83 | 23.0 | -33.0 | 56.0 | 11.6 | -34.5 | 46.0 |
| 0.945 | 23.0 | -33.0 | 56.0 | 11.2 | -34.8 | 46.0 |
| 1.04 | 21.0 | -35.0 | 56.0 | 9.3 | -36.7 | 46.0 |
| 2.245 | 19.8 | -36.2 | 56.0 | 10.0 | -36.0 | 46.0 |
| 3.505 | 16.8 | -39.2 | 56.0 | 5.6 | -40.4 | 46.0 |
| 4.935 | 17.4 | -38.6 | 56.0 | 6.9 | -39.0 | 46.0 |
| 5.345 | 20.7 | -39.3 | 60.0 | 10.1 | -40.0 | 50.0 |
| 6.02 | 19.3 | -40.7 | 60.0 | 7.4 | -42.6 | 50.0 |
| 7.19 | 17.0 | -43.0 | 60.0 | 5.8 | -44.2 | 50.0 |
| 8.06 | 12.6 | -47.4 | 60.0 | 3.7 | -46.3 | 50.0 |
| 9.145 | 12.9 | -47.1 | 60.0 | 3.7 | -46.3 | 50.0 |
| 16 | 20.6 | -39.4 | 60.0 | 18.7 | -31.3 | 50.0 |
| 28.31 | 6.9 | -53.1 | 60.0 | 2.7 | -47.3 | 50.0 |

5.2 Radiated emissions

For test instruments and accessories used see section 6 Part **SER 1**, **SER 2**.

5.2.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.2.2 Photo documentation of the test set-up

Open area test site



5.2.3 Applicable standard

According to FCC Part 15B, Section 15.109 (a):

Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 m shall not exceed the given limit.

According to FCC Part 15C, Section 15.209:

The emissions from intentional radiators shall not exceed the effective field strength limits.

5.2.4 Description of Measurement

The spurious emissions from the EUT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The antenna was positioned 3, 10 or 30 m horizontally from the EUT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions. In the case where larger measuring distances are required the results will extrapolated based on the values measured on the closer distances according to Section 15.31(f)(2). The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209(d)(2).

Radiated emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 dB(μ V/m) non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The set up of the equipment under test will be in accordance to ANSI C63.4. The interface cables that are closer than 40 cm to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 cm from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3 m horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres, measurement scans are made with horizontal and vertical antenna polarization and the EUT is rotated 360 degrees. The radiated emissions from the EUT are measured in the frequency range of 1 GHz to maximum frequency as specified in section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. The set up of the equipment under test will be in accordance to ANSI C63.4. The Interface cables that are closer than 40 cm to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 cm from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3 m horizontally from the EUT.

Measurements are made in horizontal and vertical polarization in a fully anechoic chamber. All tests are performed at a test distance of 3 m. Hand-held or body-worn devices are rotated through three orthogonal axes to determine the attitude of the highest emission shall be used for final testing. During the tests the EUT is rotated 360° and the cables and equipment are placed and moved in position in such a way to find the maximum emission level. For testing above 1 GHz, the emission level of the EUT in peak mode complies to the average limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.

The resolution bandwidth during the measurement is as following:

9 kHz – 150 kHz: RBW: 200 Hz

150 kHz – 30 MHz: RBW: 9 kHz

30 MHz – 1000 MHz: RBW: 120 kHz

5.2.5 Test result

| Frequency (MHz) | L: QP (dBµV) | L: AV (dBµV) | Bandwidth (kHz) | Correct. (dB) | L: QP dB(µV/m) | L: AV dB(µV/m) | Limit dB(µV/m) | Delta (dB) |
|-----------------|--------------|--------------|-----------------|---------------|----------------|----------------|----------------|------------|
| 0.009 – 0.490 | --- | --- | 0.2 | | | | 108.5 - 13.8 | >20 |
| 0.490 – 1.705 | --- | --- | 9 | | | | 33.8 - 22.9 | >20 |
| 1.705 - 30 | --- | --- | 9 | | | | 29.5 | >20 |
| 30 – 88 | --- | --- | 120 | | | | 40 | >20 |
| 88 – 216 | --- | --- | 120 | | | | 43.5 | >20 |
| 216 - 960 | --- | --- | 120 | | | | 46 | >20 |
| Above 960 | --- | --- | 120 | | | | 54 | >20 |

Note: No unwanted emissions could be measured!

Limit according to FCC Part 15 Subpart 15.209(a):

| Frequency (MHz) | Field strength of spurious emissions (µV/m) | dB(µV/m) | Measurement distance (metres) |
|--------------------|---|----------|-------------------------------|
| 0.009-0.490 | 2400/F(kHz) | -- | 300 |
| 0.490-1.705 | 24000/F (kHz) | -- | 30 |
| 1.705-30.0 | 30 | 29.5 | 30 |

Limit according to FCC part 15B, Section 15.109(a):

| Frequency (MHz) | Limit (µV/m) | Limit dB(µV/m) |
|-----------------|--------------|----------------|
| 30 - 88 | 100 | 40 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46 |
| Above 960 | 500 | 54 |

The requirements are **FULFILLED**.

Remarks: The measurement was performed according to FCC Part 15A, Section 15.33(b), up to 1 GHz.

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

| Test ID | Model Type | Equipment No. | Next Calib. | Last Calib. | Next Verif. | Last Verif. |
|---------|-----------------|-----------------|-------------|-------------|-------------|-------------|
| A 4 | ESHS 30 | 02-02/03-05-002 | 18/06/2011 | 18/06/2010 | | |
| | NNLK 8129 | 02-02/20-05-001 | | | 22/06/2011 | 22/12/2010 |
| | ESH 2 - Z 5 | 02-02/20-05-004 | 13/03/2011 | 13/03/2008 | 22/06/2011 | 22/12/2010 |
| | N-4000-BNC | 02-02/50-05-138 | | | | |
| | N-1500-N | 02-02/50-05-140 | | | | |
| | ESH 3 - Z 2 | 02-02/50-05-155 | | | 06/10/2011 | 06/04/2011 |
| | SP 103 /3.5-60 | 02-02/50-05-182 | | | | |
| SER 1 | FMZB 1516 | 01-02/24-01-018 | | | 16/02/2012 | 16/02/2011 |
| | ESCI | 02-02/03-05-005 | 19/11/2011 | 19/11/2010 | | |
| | S10162-B | 02-02/50-05-031 | | | | |
| | KK-EF393-21N-16 | 02-02/50-05-033 | | | | |
| | NW-2000-NB | 02-02/50-05-113 | | | | |
| SER 2 | ESVS 30 | 02-02/03-05-006 | 11/06/2011 | 11/06/2010 | | |
| | VULB 9168 | 02-02/24-05-005 | 07/03/2012 | 07/03/2011 | 17/09/2011 | 17/03/2011 |
| | S10162-B | 02-02/50-05-031 | | | | |
| | KK-EF393-21N-16 | 02-02/50-05-033 | | | | |
| | NW-2000-NB | 02-02/50-05-113 | | | | |