Test Report

**Customer:**

Inventory Systems GmbH

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14052 Berlin
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# RF test report

**100393-AU02+W02**

Industry Canada Industrie Canada

**Inventory Systems GmbH**

**Pager**

DO-G1164

EMV TESTHAUS

The test result refers exclusively to the model tested.

This report must not be copied without the written authorization by the lab.
Revision: 1.0

Deutscher Akkreditierungs Rat

DGA-PL-224/95-03 / BNetzA-CAB-02/21-02/2

# EMV **TESTHAUS** GmbH

Gustav-Hertz-Straße 35
94315 Straubing
Tel.: +49 9421 56868-0
Fax: +49 9421 56868-100
Email: company@emv-testhaus.com

## Accreditation:


Registration number: DGA-PL-224/95-03
CAB (EMC) registration number: BNetzA-CAB-02/21-02/3
FCC facility registration number: 221458
MRA US-EU, FCC designation number: DE0010

## Location of Testing:

EMV **TESTHAUS** GmbH
Gustav-Hertz-Straße 35
94315 Straubing
Germany

The technical accuracy is guaranteed through the quality management of the
EMV **TESTHAUS** GmbH

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# 1 Test regulations

| | |
|---|---|
| CFR 47 Part 2: 01-2010 | Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC) |
| CFR 47 Part 15: 10-2009 | Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC) |
| ANSI C63.4: December 2003 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| RSS-Gen Issue 2 June 2007 | General Requirements and Information for the Certification of Radiocommunication Equimpment, published by Industry Canada |
| RSS-102: Issue 4 March 2010 | Radio Frequency Exposure Compliance of Radiocommunications Apperatus |
| RSS-210: Issue 7 June 2007 | Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada |

## 1.1 Summary of test results

| Standard | Test result |
|---|---|
| FCC CFR 47 Part 15 | Passed |
| RSS-210 Issue 7 Annex 8 and RSS-Gen Issue 2 | Passed |

# 2 Equipment under Test (EUT)

| | |
|---|---|
| Product type: | Pager |
| Model Name: | DO-G1164 |
| Manufacturer: | Dommel GmbH<br>Westring 15<br>91717 Wassertrüdingen |
| Serial number: | |
| FCC ID: | YRADO-G1164 |
| IC | 9255A-G1164 |
| Application freq. band: | 902 MHz - 928 MHz |
| Frequency range: | 915 MHz |
| Operating frequency: | 915 MHz |
| Channel spacing: | N/A |
| Number of RF-channels: | 1 |
| Antenna type: | Integrated PCB antenna |
| | ☐ detachable ☑ not detachable |
| Power supply: | USB powered<br>nominal: 5.0 V |
| Temperature range: | 0°C to +70°C |

## 2.1 Photo documentation

See annex C

## 2.2 Short description of the EUT

The product is a monitoring system for atypical removal of products. This is the pager which informs the operator about events that occur. The unit operates at a frequency of 915 MHz.

## 2.3 Operation mode

The EUT was tested in the following operation modes:

- Tested in continuous transmit mode with modulation
- Tested in receive mode

## 2.4 Configuration

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

| Device | Model: | S/N |
|---|---|---|
| Pager | DO-G1164 | |
| Testnotebook | Pro 600 IW | N/A |

### Used cables

| Numbers: | Description: (type / lengths / remarks) | Serial No |
|---|---|---|
| 1 | USB cable, shielded, 0.75 m | N/A |
| 1 | AC power cable, unshielded, 1.5 m | N/A |

# 3 AC power line conducted emissions

**according to CFR 47 Part 15, section 15.207**

## 3.1 Test location

| Description | Manufacturer | Inventory No. |
|---|---|---|
| Shielded chamber | Siemens - Matsushita | E00107 |

## 3.2 Test instruments

| | Description | Manufacturer | Inventory No. |
|---|---|---|---|
| ☑ | ESCS 30 | Rohde & Schwarz | E00003 |
| ☐ | ESCI | Rohde & Schwarz | E00001 |
| ☑ | ESH3 Z2 | Rohde & Schwarz | E00028 |
| ☑ | ESH 2-Z5 | Rohde & Schwarz | E00004 |
| ☑ | ESH 2-Z5 | Rohde & Schwarz | E00005 |

## 3.3 Limits

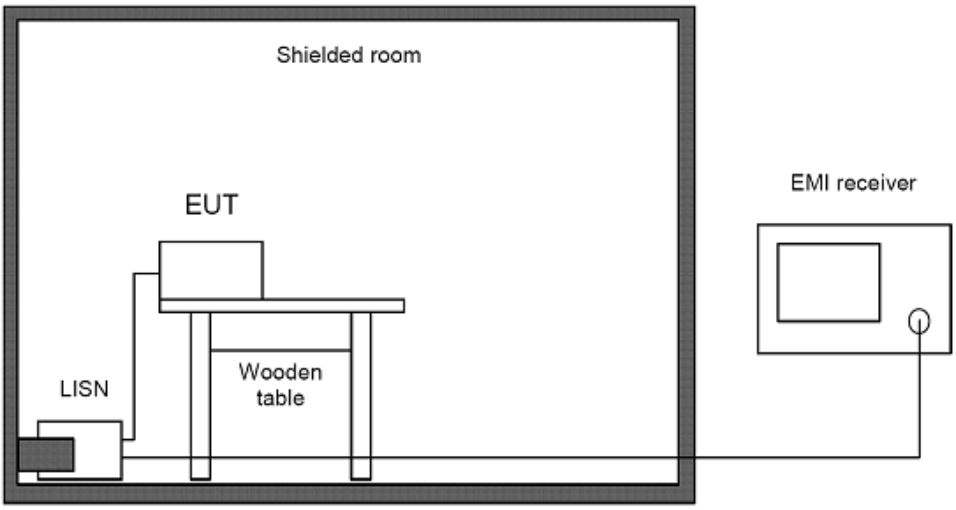
| Frequency [MHz] | Quasi-peak [dBµV] | Avarage [dBµV] |
|---|---|---|
| 0.15 – 0.5 | 66 - 56 | 56 – 46 |
| 0.5 – 5.0 | 56 | 46 |
| 5 – 30 | 60 | 50 |

## 3.4 Test procedure

1. The tests of conducted emission were carried out in a shielded room using a line impedance stabilization network (LISN) 50 µH/50 Ohms and an EMI test receiver.
2. The EMI test receiver was connected to the LISN and set to a measurement bandwidth of 9 kHz in the frequency range form 0.15 MHz to 30 MHz.
3. The EUT was placed on a wooden table and connected via USB to a test notebook. This notebook was connected to the LISN.
4. To accelerate the measurement the detector of the EMI test receiver was set to peak and the whole frequency range form 0.15 MHz to 30 MHz were scanned.
5. After that all peaks values with fewer margins than 10 dB to quasi-peak limit or exceeding the limit were marked and re-measured with quasi-peak detector.
6. If after that all values are under the average limit no addition measurement is necessary. In case there are still values between quasi-peak and average limit than these values were re-measured again with an average detector.
7. These measurements were done on all current carrying conductors.

According to ANSI C63.4, section 13.1.3.1 testing of intentional radiators with detachable antennas shall be done with a dummy load otherwise the tests should be done with connected antenna and if adjustable fully extended.

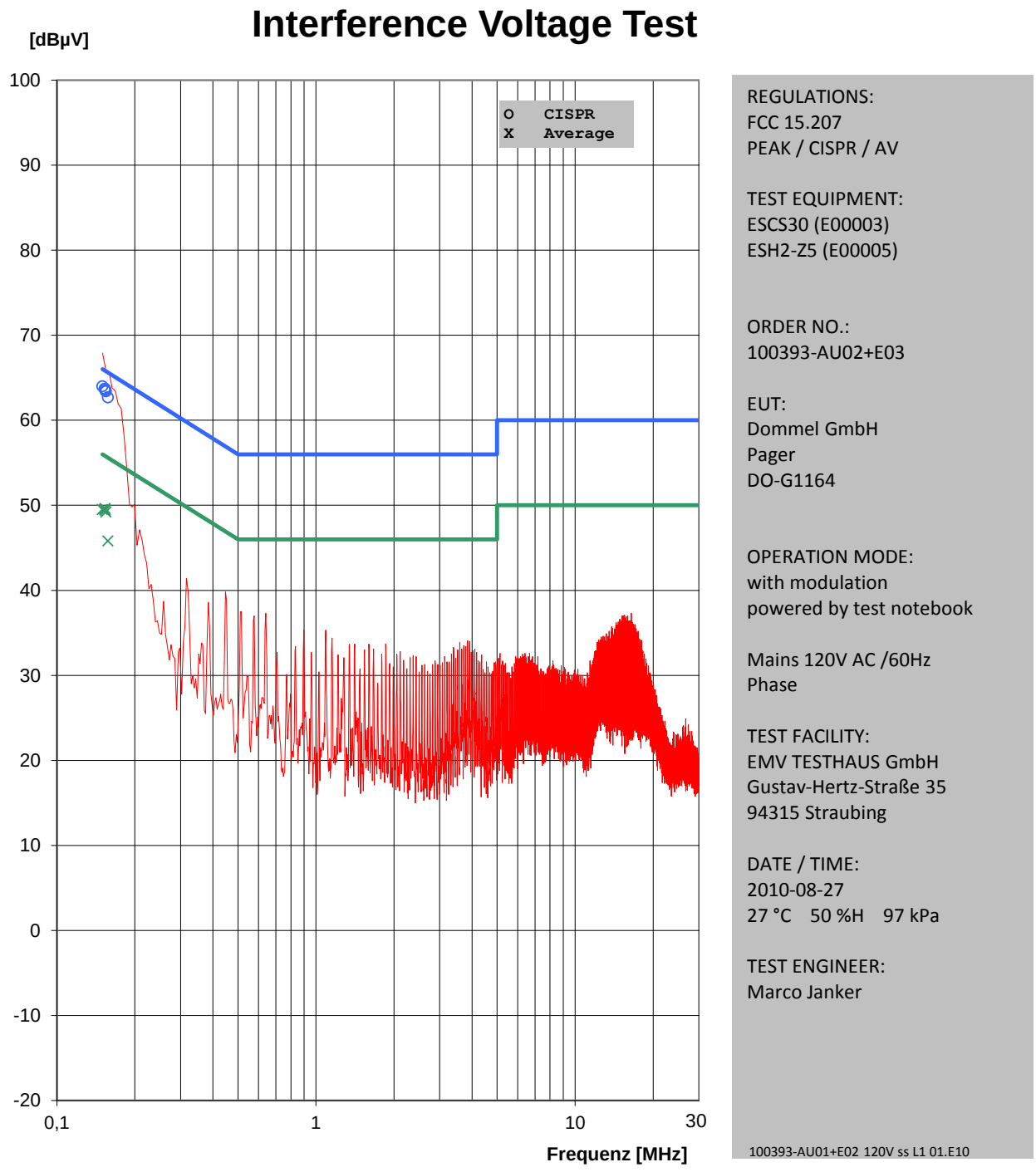
## 3.5 Test setup




Picture 1: Outline of conducted emission test setup

Comments: All peripheral devices were additionally decoupled by means of a line stabilization network.

## 3.6 Test result



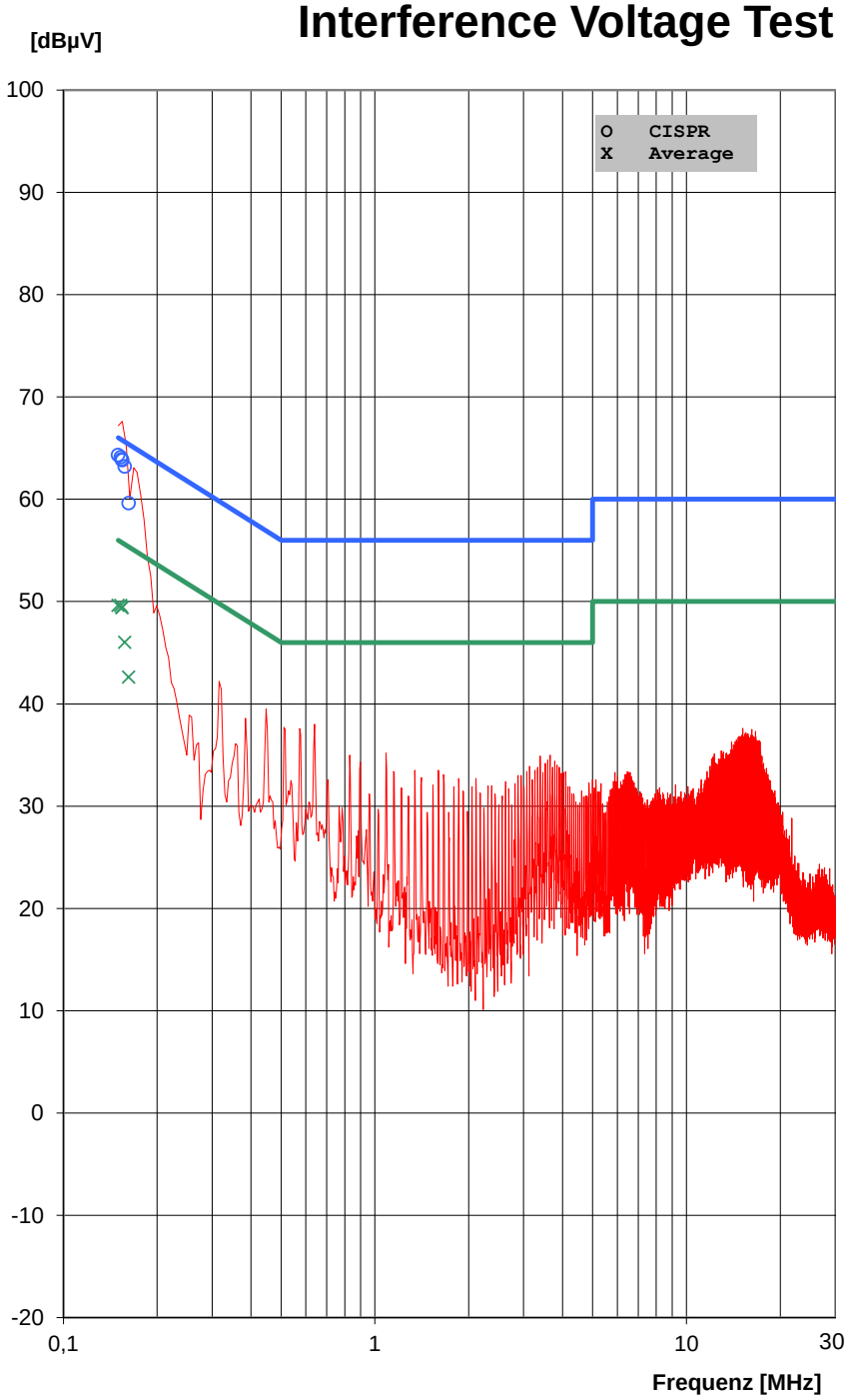

Picture 2: Conducted emission on mains, phase 1 (Chart)

# Interference Voltage Test

| Freq. [MHz] | U_CISPR [dBµV] | Limit [dBµV] | delta_U [dB] | U_AV [dBµV] | Limit [dBµV] | delta_U [dB] | Corr. [dB] | Remark 100393-AU01+E02 120V ss L1 01.E10 |
|---|---|---|---|---|---|---|---|---|
| **0,15** | 64,0 | 66,0 | 2,0 | 49,5 | 56,0 | 6,5 | 0,0 | |
| **0,15** | 63,4 | 65,8 | 2,4 | 49,2 | 55,8 | 6,6 | 0,0 | |
| **0,15** | 63,5 | 65,8 | 2,3 | 49,4 | 55,8 | 6,4 | 0,0 | |
| **0,15** | 63,7 | 65,8 | 2,1 | 49,6 | 55,8 | 6,2 | 0,0 | |
| **0,15** | 63,7 | 65,8 | 2,1 | 49,5 | 55,8 | 6,3 | 0,0 | |
| **0,16** | 62,7 | 65,6 | 2,9 | 45,8 | 55,6 | 9,8 | 0,0 | |

Picture 3: Conducted emission on mains, phase 1 (Table)

# Interference Voltage Test




REGULATIONS:
FCC 15.207
PEAK / CISPR / AV

TEST EQUIPMENT:
ESCS30 (E00003)
ESH2-Z5 (E00005)

ORDER NO.:
100393-AU02+E02

EUT:
Dommel GmbH
Pager
DO-G1164

OPERATION MODE:
with modulation
powered by test notebook

Mains 120V AC /60Hz
Phase

TEST FACILITY:
EMV TESTHAUS GmbH
Gustav-Hertz-Straße 35
94315 Straubing

DATE / TIME:
2010-08-27
27 °C 50 %H 97 kPa

TEST ENGINEER:
Marco Janker

100393-AU01+E02 120V ss N 01.E10

Picture 4: Conducted emission on mains, neutral (Chart)

# Interference Voltage Test

| Freq. [MHz] | U_CISPR [dBµV] | Limit [dBµV] | delta_U [dB] | U_AV [dBµV] | Limit [dBµV] | delta_U [dB] | Corr. [dB] | Remark 100393-AU01+E02 120V ss N 01.E10 |
|---|---|---|---|---|---|---|---|---|
| **0,15** | 64,3 | 66,0 | 1,7 | 49,6 | 56,0 | 6,4 | 0,0 | |
| **0,15** | 63,8 | 65,8 | 2,0 | 49,4 | 55,8 | 6,4 | 0,0 | |
| **0,15** | 63,9 | 65,8 | 1,9 | 49,4 | 55,8 | 6,4 | 0,0 | |
| **0,15** | 64,1 | 65,8 | 1,7 | 49,6 | 55,8 | 6,2 | 0,0 | |
| **0,16** | 63,2 | 65,6 | 2,4 | 46,0 | 55,6 | 9,6 | 0,0 | |
| **0,16** | 59,6 | 65,4 | 5,8 | 42,6 | 55,4 | 12,8 | 0,0 | |

Picture 5: Conducted emission on mains, neutral (Table)

# 4 Maximum output power

## according to CFR 47 Part 15, section 15.247(b)

## 4.1 Test location

☐ Conducted measurement
☑ Radiated measurement

| Description | Manufacturer | Inventory No. |
|---|---|---|
| CDC | Albatross Projects | E00026 |
| Anechoic chamber | EMV **TESTHAUS** GmbH | E00100 |
| Open area test site | EMV **TESTHAUS** GmbH | E00354 |

## 4.2 Test instruments

| | Description | Manufacturer | Inventory No. |
|---|---|---|---|
| ☐ | ESCS 30 (FF) | Rohde & Schwarz | E00003 |
| ☑ | ESU 26 | Rohde & Schwarz | W00002 |
| ☐ | ESCI (CDC) | Rohde & Schwarz | E00001 |
| ☐ | HFH2-Z2 | Rohde & Schwarz | E00060 |
| ☐ | VULB 9163 (FF) | Schwarzbeck | E00013 |
| ☑ | VULB 9163 (Anechoic) | Schwarzbeck | E00012 |
| ☐ | VULB 9160 (CDC) | Schwarzbeck | E00011 |

## 4.3 Limit

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands is 1 Watt (30dBm). The conducted output power limit is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

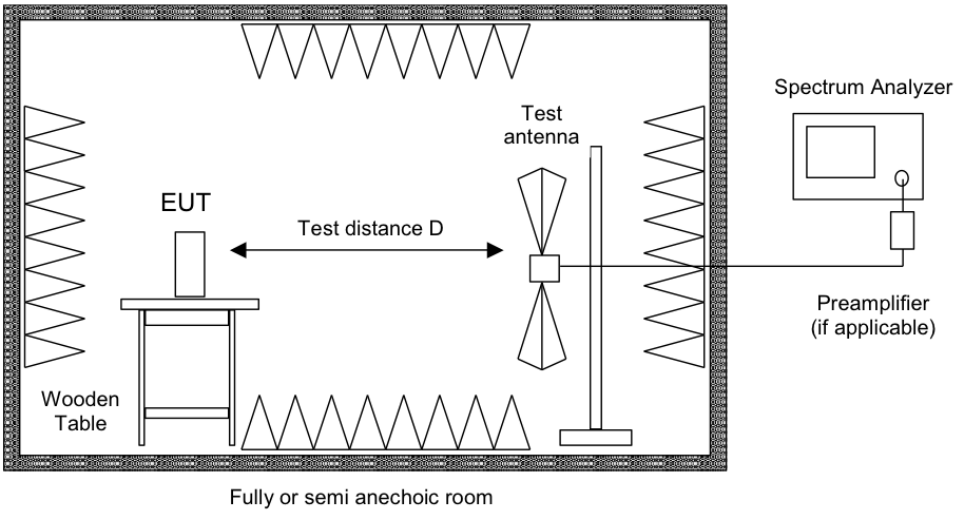
## 4.4 Test procedure

1. The unit was placed on a non conductive table inside an anechoic chamber at a distance of 3 m.
2. The unit was turned on and the transmitter was set to continuous transmit mode.
3. Test was performed in accordance with Measurement of Digital Transmission Systems Operating under Section 15.247 and FCC Public Notice KBD 558074 (Alternative test procedure).
4. To measure the maximum field strength the unit was rotated by 360° and the receiving antenna was set to vertical and horizontal polarization. In addition the unit was rotated around its 3 axis of rotation.
5. The maximum power was calculated with following formula:

$$P = \frac{(E \cdot d)^2}{(30 \cdot G)}$$

E = the measured maximum field strength in V/m
G = numeric gain of transmitting antenna over an isotropic radiator (assumed to be 1)
d = the distance in meters from which the field strength was measured (3 m)
P = the power in watts

## 4.5 Test setup




Picture 6: Test setup for output power measurement

## 4.6 Test deviation

There is no deviation with the original standard.

## 4.7 EUT operation during Test

The EUT was programmed to be in continuously transmitting mode.

## 4.8 Test result of maximum output power

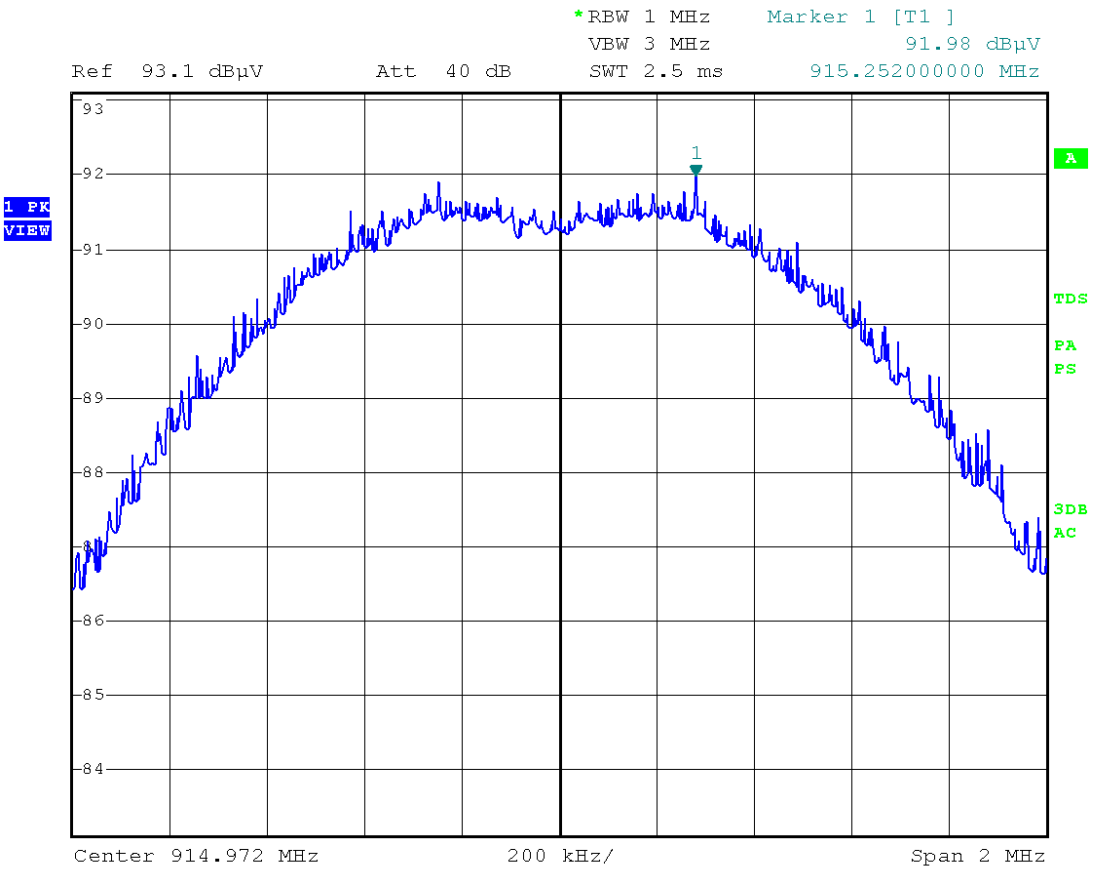
$$P = \frac{(E \cdot d)^2}{(30 \cdot G)}$$

$$P = \frac{(0.03972 \frac{V}{m} \cdot 3m)^2}{30}$$

$$P = 0.4733mW$$

$$P = -3.25dBm$$

| Channel | Frequency (MHz) | Calculated power (dBm) | Max. power (dBm) | Result |
|---|---|---|---|---|
| 1 | 915.25 | -3.25 | 30 | Passed |




Picture 7: Spectrum graph of field strength measurement

# 5 Power spectral density measurement

**according to CFR 47 Part 15 section 2.247(e)**

## 5.1 Test location

☐ Conducted measurement
☑ Radiated measurement

| Description | Manufacturer | Inventory No. |
|---|---|---|
| CDC | Albatross Projects | E00026 |
| Anechoic chamber | EMV **TESTHAUS** GmbH | E00100 |
| Open area test site | EMV **TESTHAUS** GmbH | E00354 |

## 5.2 Test instruments

| | Description | Manufacturer | Inventory No. |
|---|---|---|---|
| ☐ | ESCS 30 (FF) | Rohde & Schwarz | E00003 |
| ☑ | ESU 26 | Rohde & Schwarz | W00002 |
| ☐ | ESCI (CDC) | Rohde & Schwarz | E00001 |
| ☐ | HFH2-Z2 | Rohde & Schwarz | E00060 |
| ☐ | VULB 9163 (FF) | Schwarzbeck | E00013 |
| ☑ | VULB 9163 (Anechoic) | Schwarzbeck | E00012 |
| ☐ | VULB 9160 (CDC) | Schwarzbeck | E00011 |

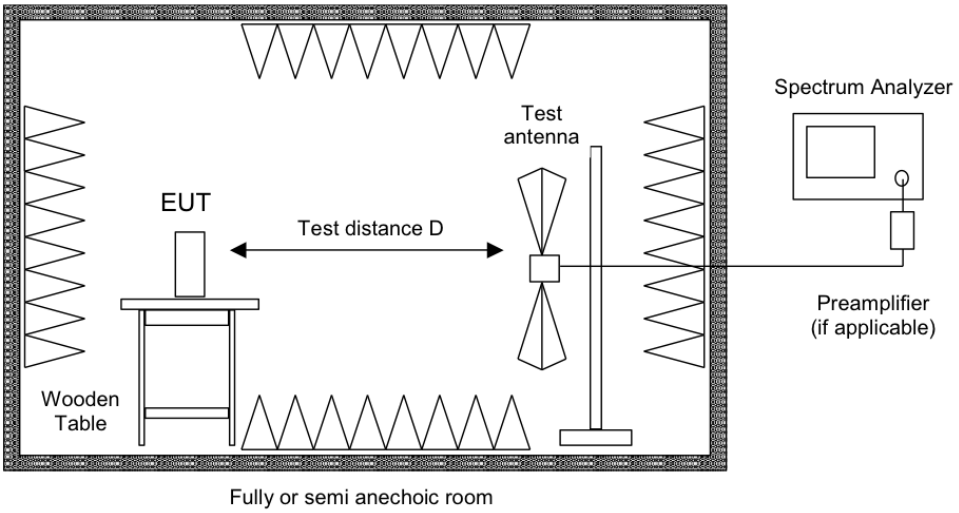
## 5.3 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## 5.4 Test procedure

1. The unit was placed on a non conductive table inside an anechoic chamber at a distance of 3 m.
2. The unit was turned on and the transmitter was set to continuous transmit mode.
3. Test was performed in accordance with Measurement of Digital Transmission Systems Operating under Section 15.247 and FCC Public Notice KBD 558074 (Alternative test procedure).
4. To measure the maximum field strength the unit was rotated by 360° and the receiving antenna was set to vertical and horizontal polarization. In addition the unit was rotated around its 3 axis of rotation.
5. Set RBW of spectrum analyzer to 3kHz and VBW to 10kHz. Set Detector to Peak, Trace to Max Hold.
6. Set the span to 300 kHz and the sweep time to 100s and record the maximum peak value.
7. Mark the frequency with highest point of the maximized fundamental emission.
8. From the peak level obtained in (7), derive the field strength E. Using the equation
   $$P = \frac{(E \cdot d)^2}{(30 \cdot G)}$$
   calculate the power level for comparison to the +8 dBm limit.

## 5.5 Test setup




Picture 8: Test setup for spectral density measurement

## 5.6 Test Deviation

There is no deviation with the original standard.

## 5.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

## 5.8 Test result of power spectral density

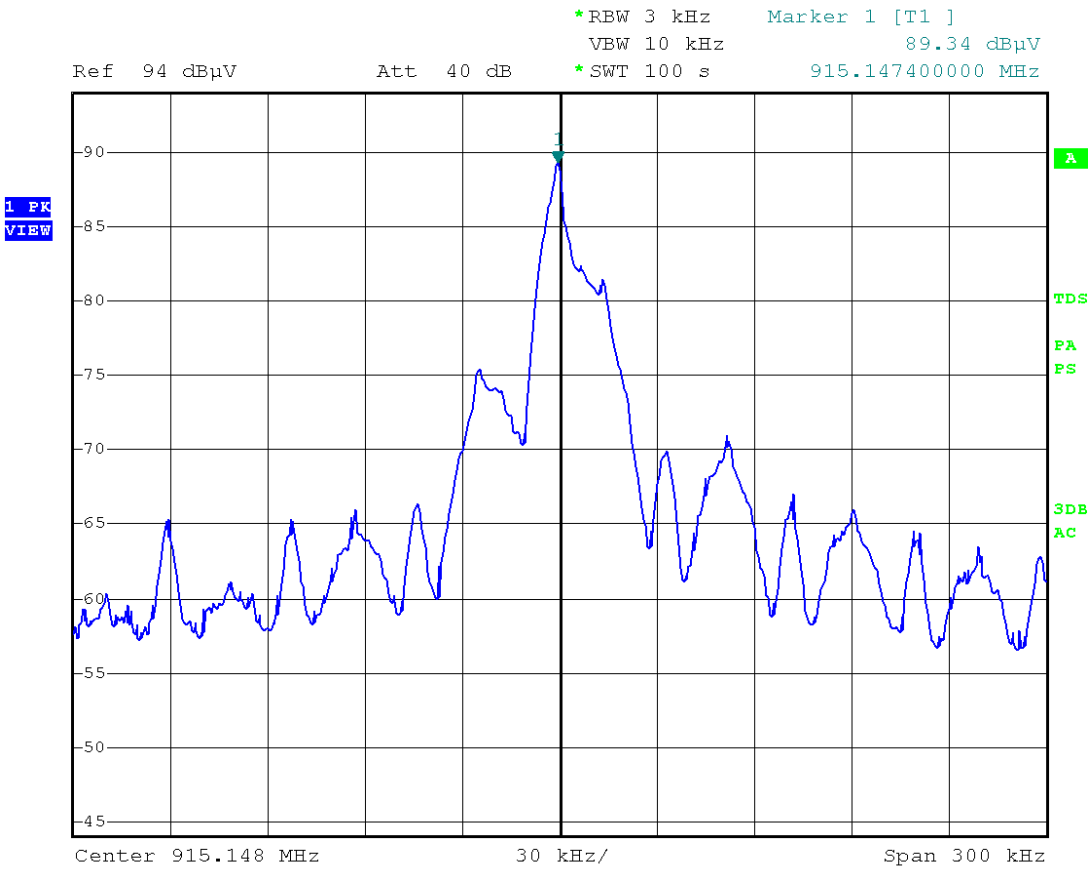
$$P = \frac{(E \cdot d)^2}{(30 \cdot G)}$$

$$P = \frac{(0.02931 \frac{V}{m} \cdot 3m)^2}{(30 \cdot G)}$$

$$P = 0.2577mW$$

$$\Rightarrow P = -5.89dBm$$

| Channel | Frequency (MHz) | Power density (dBm) | Max. limit (dBm) | Result |
|---|---|---|---|---|
| 1 | 915.1474 | -5.89 | +8 | Passed |




Picture 9: Spectrum graph of power spectral density measurement

# 6 6dB spectrum bandwidth measurement

## according to CFR 47 Part 15 section 2.247(a)(2)

## 6.1 Test location

☐ Conducted measurement
☑ Radiated measurement

| Description | Manufacturer | Inventory No. |
|---|---|---|
| CDC | Albatross Projects | E00026 |
| Anechoic chamber | EMV **TESTHAUS** GmbH | E00100 |
| Open area test site | EMV **TESTHAUS** GmbH | E00354 |

## 6.2 Test instruments

| | Description | Manufacturer | Inventory No. |
|---|---|---|---|
| ☐ | ESCS 30 (FF) | Rohde & Schwarz | E00003 |
| ☑ | ESU 26 | Rohde & Schwarz | W00002 |
| ☐ | ESCI (CDC) | Rohde & Schwarz | E00001 |
| ☐ | HFH2-Z2 | Rohde & Schwarz | E00060 |
| ☐ | VULB 9163 (FF) | Schwarzbeck | E00013 |
| ☑ | VULB 9163 (Anechoic) | Schwarzbeck | E00012 |
| ☐ | VULB 9160 (CDC) | Schwarzbeck | E00011 |

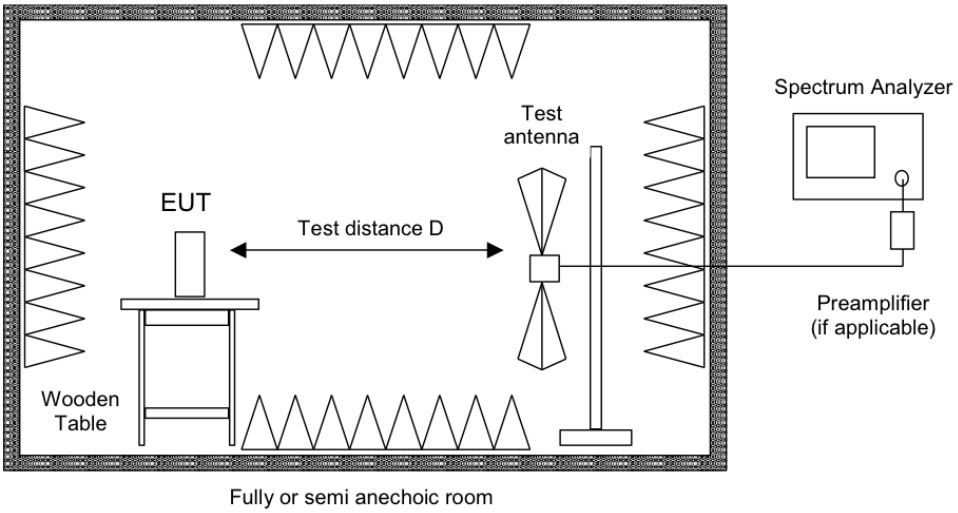
## 6.3 Limit

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

## 6.4 Test procedure

1. The unit was placed on a non conductive table inside an anechoic chamber at a distance of 3 m.
2. The unit was turned on and the transmitter was set to continuous transmit mode.
3. Test was performed in accordance with Measurement of Digital Transmission Systems Operating under Section 15.247 and FCC Public Notice KBD 558074.
4. To measure the maximum bandwidth the unit was rotated by 360° and the receiving antenna was set to vertical and horizontal polarization. In addition the unit was rotated around its 3 axis of rotation.
5. The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were used.
6. To derive the 6 dB bandwidth the marker of the spectrum analyzer was set to 6 dB below the carrier and the value was recorded.

## 6.5 Test setup




Picture 10: Test setup for 6dB spectrum bandwidth measurement

## 6.6 Test deviation

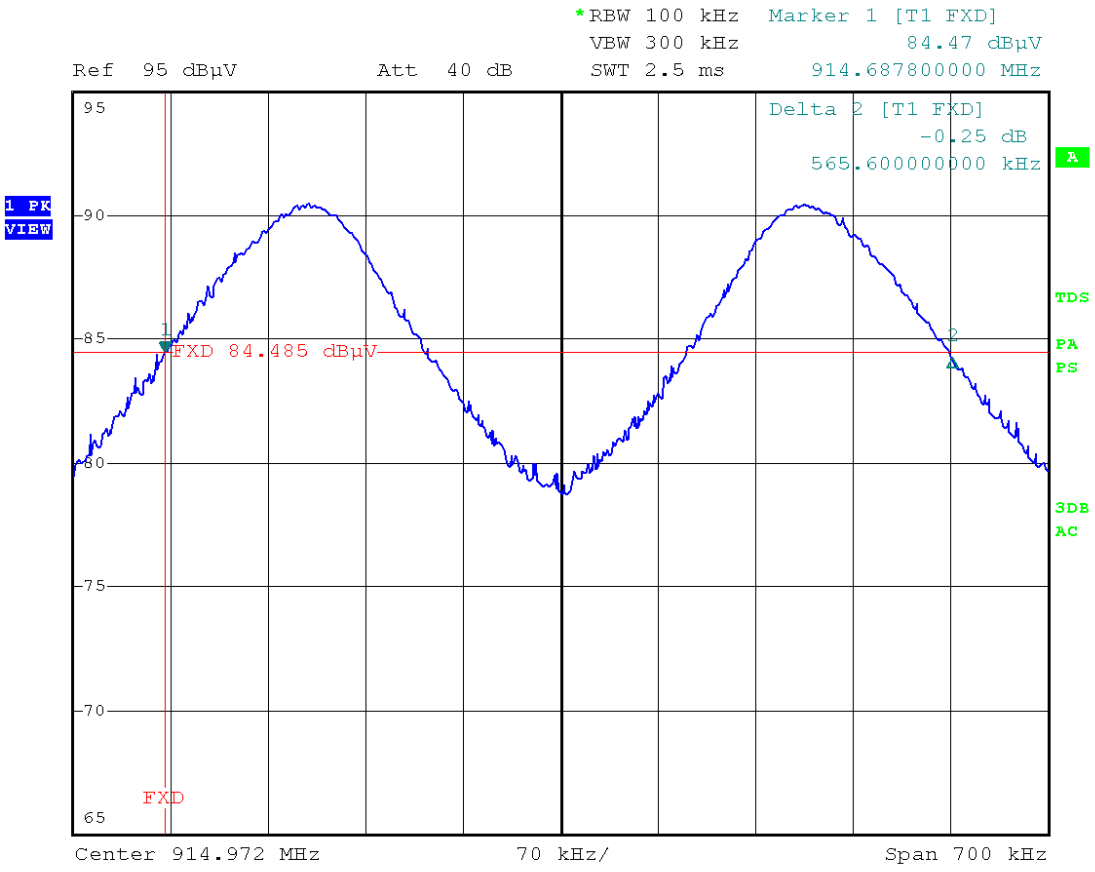
There is no deviation with the original standard.

## 6.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

## 6.8 Test result of 6dB spectrum bandwidth

| 6 dB bandwidth (kHz) | Min. limit (kHz) | Result |
|---|---|---|
| 565.6 | 500 | Passed |




26.Aug 10 11:24

Picture 11: Spectrum graph of 6dB spectrum bandwidth measurement

# 7 Radiated emission measurement (<1 GHz)

**according to CFR 47 Part 15, section 15.205(a), 15.209(a), 15.247(d)**

## 7.1 Test Location

☑ Scan with peak detector in 3 m CDC.

☑ Final CISPR measurement with quasi peak detector on 3 m open area test site.

| Description | Manufacturer | Inventory No. |
|---|---|---|
| CDC | Albatross Projects | E00026 |
| Open site area | EMV **TESTHAUS** GmbH | E00354 |

## 7.2 Test instruments

| | Description | Manufacturer | Inventory No. |
|---|---|---|---|
| ☑ | ESCS 30 (FF) | Rohde & Schwarz | E00003 |
| ☐ | ESU 26 | Rohde & Schwarz | W00002 |
| ☑ | ESCI (CDC) | Rohde & Schwarz | E00001 |
| ☑ | VULB 9163 (FF) | Schwarzbeck | E00013 |
| ☑ | VULB 9160 (CDC) | Schwarzbeck | E00011 |
| ☐ | HFH2-Z2 | Rohde & Schwarz | E00060 |
| ☑ | Feedline OATS | Huber & Suhner | 200024 |

## 7.3 Limit

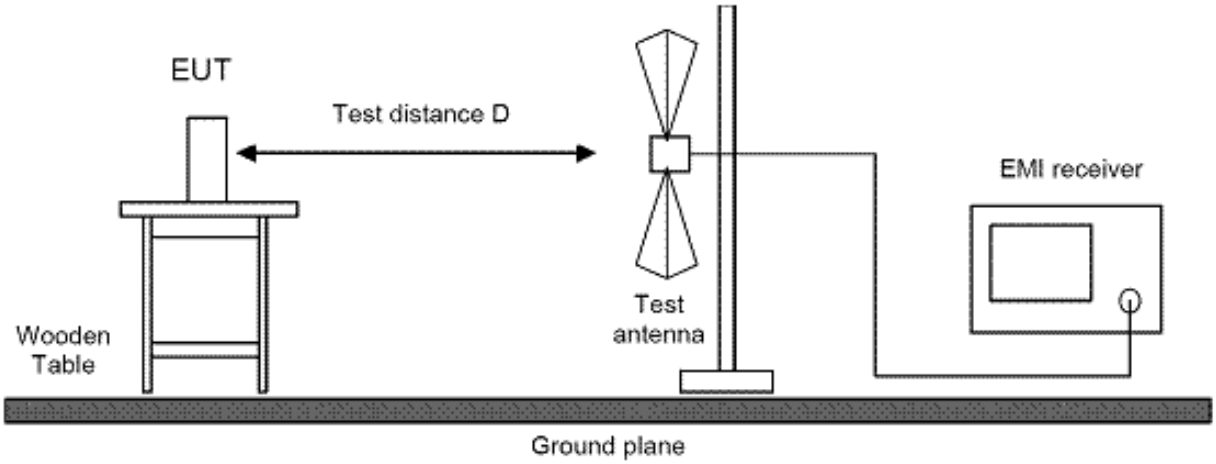
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.
In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequency [MHz] | Field strength Fs [µV/m] | Field strength [dBµV/m] | Measurement distance d [m] |
|---|---|---|---|
| 30 – 88 | 100 | 40 | 3 |
| 88 – 216 | 150 | 43.5 | 3 |
| 216 - 960 | 200 | 46 | 3 |
| Above 960 | 500 | 54 | 3 |

## 7.4 Test procedure

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a compact diagnostic chamber.
2. Power on the EUT and all peripherals.
3. The broadband antenna was set to vertical polarization.
4. The EMI receiver performed a scan from 30MHz to 1000MHz with the detector set to peak and the measurement bandwidth to 120 kHz.
5. The turn table was rotated to 6 different positions (360° / 6) and the antenna polarization was changed to horizontal.
6. Repeat the test procedure at step 4 and 5.
7. The test setup was then placed in an OATS at 3 m distance and all peak values over or with less distance to limit then 6dB were marked and re-measured with a quasi-peak detector.
8. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
9. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization. The highest value was recorded.

## 7.5 Test setup




Picture 12: Test setup for radiated emission measurement (< 1 GHz)

## 7.6 Test deviation

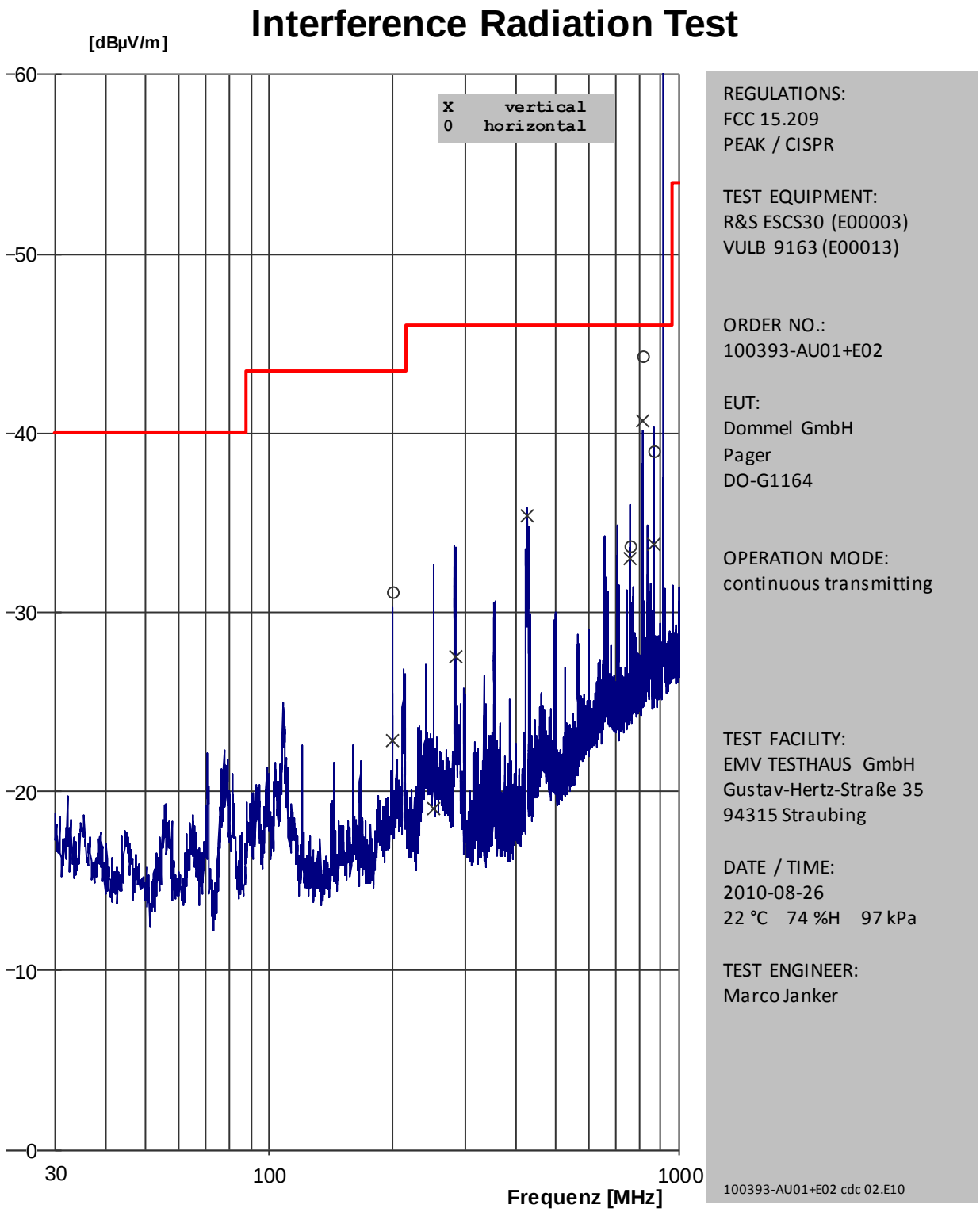
There is no deviation with the original standard.

## 7.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

Comments: The disturbance at 915MHz is the fundamental frequency which is excluded from the measurement result.

## 7.8 Test result

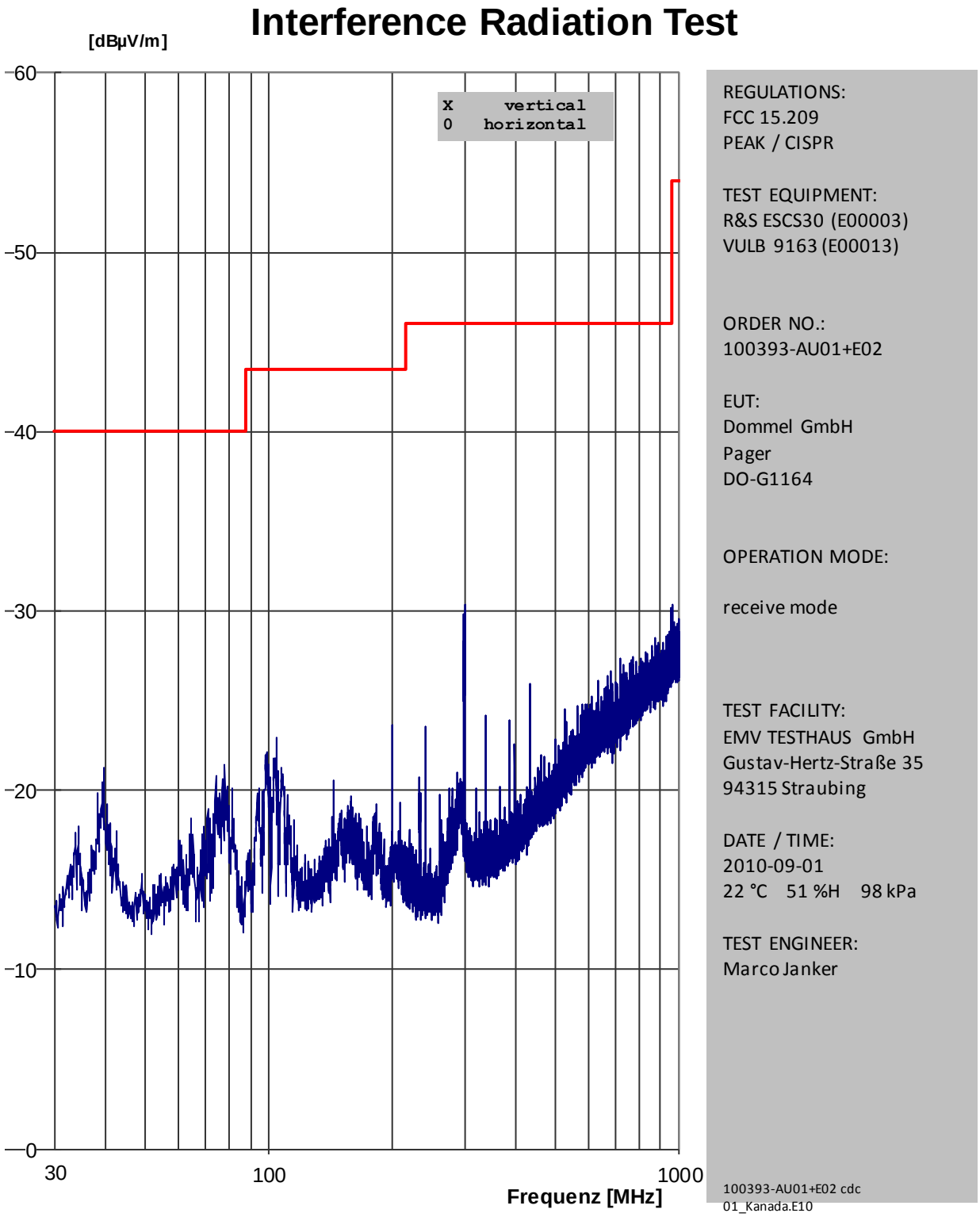



Picture 13: Radiated emission 30 MHz – 1000MHz

# Interference Radiation Test

| Freq. [MHz] | U_Rec [dBµV/m] | Limit [dBµV/m] | Corr. [dB] | U_Ant. [dBµV] | delta_U [dB] | Turn-table | Antenna | Pol. | Remark 100393-AU01+E02 cdc 02.E10 |
|---|---|---|---|---|---|---|---|---|---|
| **200,00** | 22,8 | 43,5 | 12,0 | 10,8 | 20,7 | 117° | 100 cm | V | |
| **200,00** | 31,1 | 43,5 | 12,0 | 19,1 | 12,4 | 141° | 138 cm | H | |
| **251,60** | 19,0 | 46,0 | 13,7 | 5,3 | 27,0 | 6° | 100 cm | V | |
| **284,70** | 27,5 | 46,0 | 14,5 | 13,0 | 18,5 | 214° | 100 cm | V | |
| **426,80** | 35,4 | 46,0 | 17,5 | 17,9 | 10,6 | 263° | 100 cm | V | |
| **758,80** | 33,0 | 46,0 | 22,5 | 10,5 | 13,0 | 60° | 100 cm | V | |
| **758,80** | 33,7 | 46,0 | 22,5 | 11,2 | 12,3 | 166° | 156 cm | H | |
| **810,80** | 40,7 | 46,0 | 23,3 | 17,3 | 5,3 | 232° | 100 cm | V | |
| **810,80** | 44,3 | 46,0 | 23,3 | 21,0 | 1,7 | 186° | 124 cm | H | |
| **862,80** | 33,8 | 46,0 | 24,0 | 9,8 | 12,2 | 247° | 100 cm | V | |
| **862,80** | 39,0 | 46,0 | 24,0 | 15,1 | 7,0 | 222° | 175 cm | H | |

Picture 14: Radiated emission 30 MHz – 1000MHz (Table)




Picture 15: Radiated emission 30 MHz – 1000MHz (RX mode)

# 8 Radiated emission measurement (>1 GHz)

**according to CFR 47 Part 15, section 15.205(a), 15.209(a), 15.247(d)**

## 8.1 Test location

☑ Scan with peak detector in 3 m anechoic chamber

☑ Final measurement with average and max peak detector.

### 8.1.1 Location of measurement

| Description | Manufacturer | Inventory No. |
|---|---|---|
| Anechoic chamber | EMV **TESTHAUS** GmbH | E00100 |

### 8.1.2 Measurement equipment

| | Description | Manufacturer | Inventory No. |
|---|---|---|---|
| ☑ | ESU26 | Rohde & Schwarz | W00002 |
| ☑ | AMF-5D-00501800-28-13P | Parzich | W00089 |
| ☐ | AMF-6F-16002650-25-10P | Parzich | W00090 |
| ☑ | BBHA 9170 | Schwarzbeck | W00054 |
| ☐ | BBHA 9170 | Schwarzbeck | W00055 |
| ☑ | COSB 4-1-26 | Conformitas | W00091 |

## 8.2 Limit

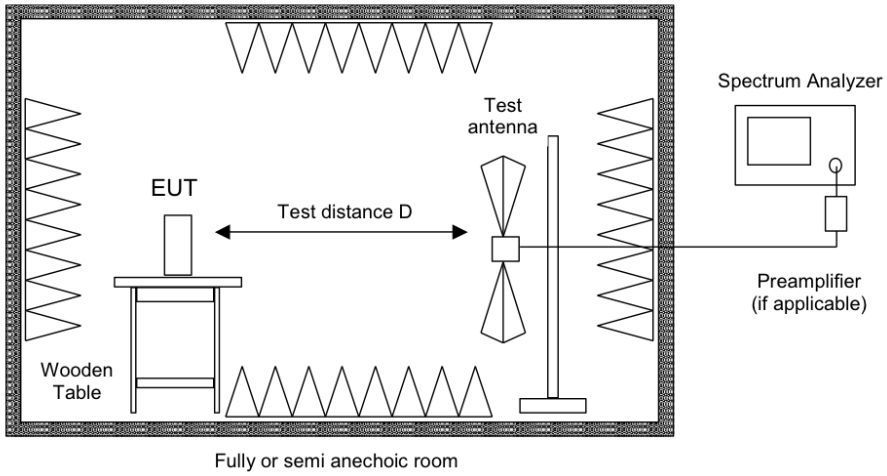
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.
In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequency [MHz] | Field strength Fs [µV/m] | Field strength [dBµV/m] | Measurement distance d [m] |
|---|---|---|---|
| 30 – 88 | 100 | 40 | 3 |
| 88 – 216 | 150 | 43.5 | 3 |
| 216 - 960 | 200 | 46 | 3 |
| Above 960 | 500 | 54 | 3 |

## 8.3 Test procedure

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a fully anechoic chamber.
2. Power on the EUT and all peripherals.
3. The broadband antenna was set to vertical polarization.
4. The EMI receiver performed a scan from 1000 MHz to 10$^{th}$ harmonic of the fundamental frequency with the detector set to peak and the measurement bandwidth set to 100 kHz (VBW ≥ 300 kHz). The trace data was recorded with the receiver Max Hold function.
5. The turn table was rotated in intervals of 15°.
6. After a full 360°-turn the antenna polarization was changed to horizontal and the test was repeated at step 4 and 5.
7. After the scan suspicious frequencies were selected and the RBW was set to 1 MHz and the VBW was set to 10Hz and the detector was changed to average reading.
8. The receiving antenna was set to vertical polarization.
9. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
10. The receiving antenna was then set to horizontal polarization and the measurement was repeated at step 9.
11. The highest recorded level was noted.

## 8.4 Test setup




Picture 16: Test setup for radiated emission measurement (> 1 GHz)

## 8.5 Test deviation

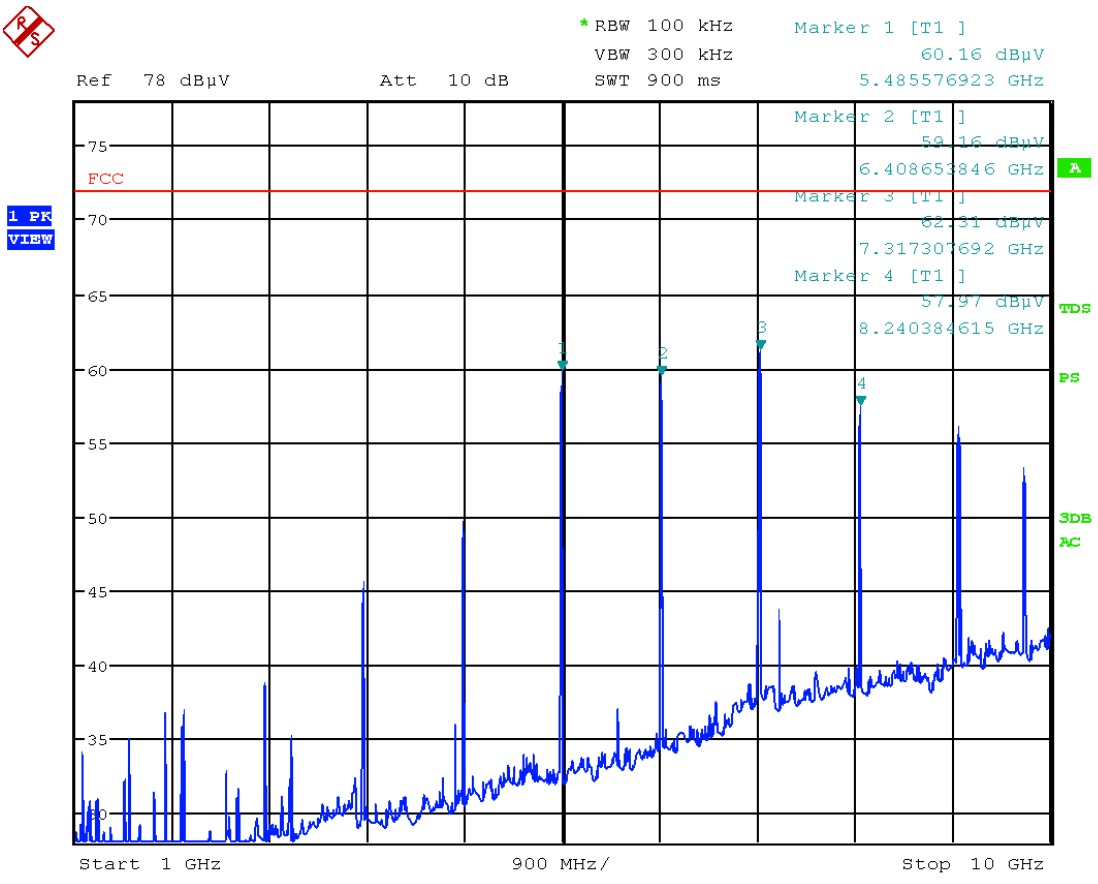
There is no deviation with the original standard.

## 8.6 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

## 8.7 Test result of radiated emission measurement (> 1 GHz) Transmit mode

| Frequency (GHz) | Reading (dBµV/m) | Detector | Reading (dBµV/m) | Detector | Limit (dBµV/m) | Margin (dB) | Result |
|---|---|---|---|---|---|---|---|
| 3.6538 | *46,01* | *Peak* | 40,23 | Average | 54 | 13,77 | Passed |
| 4.5769 | *49,90* | *Peak* | 43,57 | Average | 54 | 10,43 | Passed |
| 5.4855 | *59,97* | *Peak* | 51,27 | Average | 71.98 | 20,71 | Passed |
| 6.4086 | *58,80* | *Peak* | 52,68 | Average | 71.98 | 19,3 | Passed |
| 7.3173 | *62,15* | *Peak* | 53,80 | Average | 54 | 0,2 | Passed |
| 8.2403 | *57,11* | *Peak* | 52,13 | Average | 54 | 1,87 | Passed |
| 9.1634 | *56,23* | *Peak* | 49,87 | Average | 54 | 4,13 | Passed |

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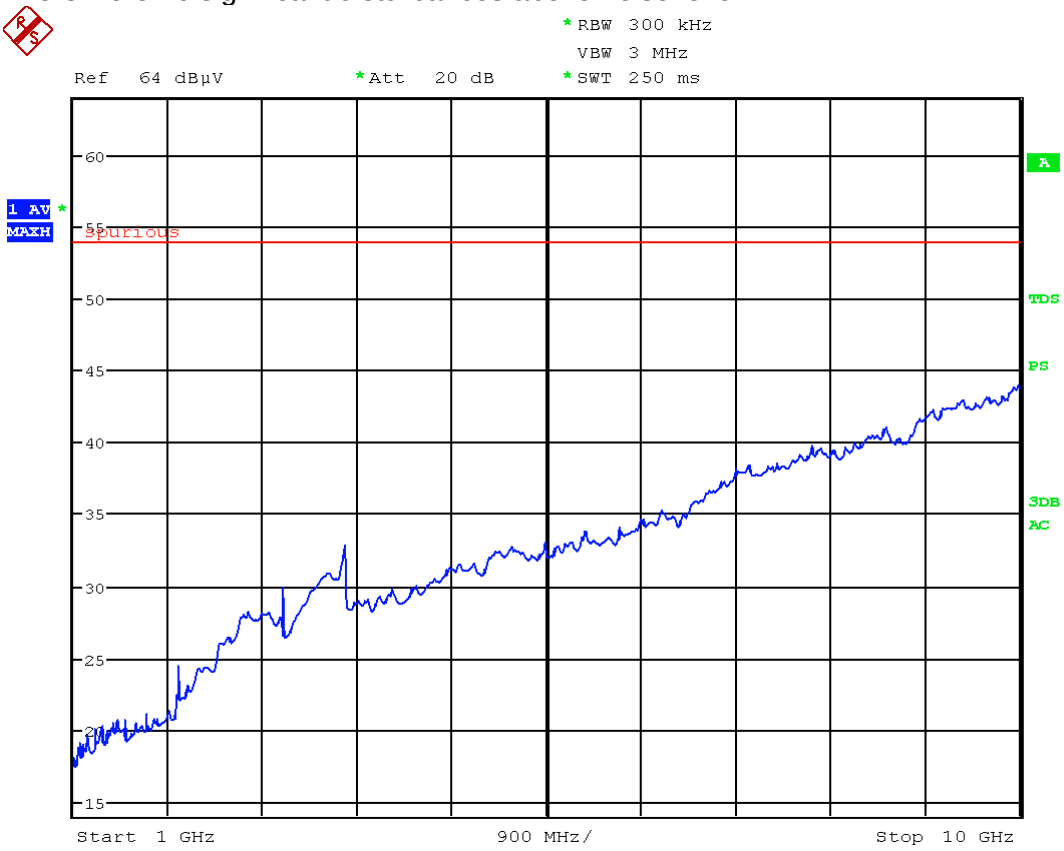
Picture 17: Radiated emission: Spectrum of radiated emission > 1GHz (pre-scan)

## 8.8 Test result of radiated emission measurement (> 1 GHz) Receive mode

There were no significant disturbances above noise level!

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Picture 18: Radiated emission: Spectrum of radiated emission > 1GHz (RX mode)

# 9 Exposure of humans to RF fields

**according to RSS-Gen Issue 2, section 5.5 and RSS-102 Issue 2, section 2.5**

## 9.1 Antenna type and power calculation

☐ Antenna detachable

$$EIRP = G \cdot CP$$

G: numerical antenna gain
CP: conducted output power [W]

☑ Antenna not detachable

$$EIRP = \frac{(F_s \cdot D)^2}{30}$$

$F_s$: field strength [V/m]
D: distance between antennas [m]

$$EIRP = \frac{(0.03972 \cdot 3)^2}{30} = 0.4733\,mW$$

Limit:
$$60 / f\,[GHz]$$
$$= 60 / 0.915$$
$$= \underline{\underline{65.6\,mW}}$$

Output power is less than 65.6 mW, therefore no MPE necessary.

# 10 Equipment calibration status

| Inventory Number | Model Number | Manufacturer | Last calibration | Next calibration | Cycle of calibration |
|---|---|---|---|---|---|
| W00002 | ESU26 | Rohde & Schwarz | Sep 09 | Sep 11 | 2 Years |
| E00001 | ESCI | Rohde & Schwarz | Sep 09 | Mar 11 | 2 Years |
| E00003 | ESCS 30 | Rohde & Schwarz | Aug 10 | Aug 12 | 2 Year |
| E00004 | ESH 2-Z5 | Rohde & Schwarz | Oct. 08 | Oct. 10 | 2 Years |
| E00005 | ESH 2-Z5 | Rohde & Schwarz | Sep 09 | Sep 11 | 2 Years |
| E00060 | HFH2-Z2 | Rohde & Schwarz | Oct 08 | Oct 11 | 2 Years |
| E00012 | VULB 9163 | Schwarzbeck | Apr. 09 | Apr. 11 | 2 Years |
| E00013 | VULB 9163 | Schwarzbeck | Apr. 08 | Apr. 10 | 2 Years |
| E00011 | VULB 9160 | Schwarzbeck | Sep. 09 | Sep. 11 | 2 Years |
| C00015 | VC34034 | Vötsch | Jan 08 | Jan 12 | 4 Years |
| C00014 | VC4100 | Vötsch | Jan 07 | Jan 11 | 4 Years |

Table 1: Equipment Calibration status

# 11 Measurement uncertainty

| Standard | Description | Max. deviation | k= |
|---|---|---|---|
| DIN EN 55022 | Conducted emission AMN (9kHz to 30 MHz) | +/- 4,0 dB | 2 |
| DIN EN 55022 | Conducted emission ISN LAN (9kHz to 30 MHz) | +/- 4,1 dB | 2 |
| DIN EN 55022 | Radiated emission open field (30 MHz to 1 GHz) | +/- 4,5 dB | 2 |
| DIN EN 55022 | Radiated emission absorber chamber (> 1000 MHz) | +/- 5,4 dB | 2 |
| DIN EN 61000-4-2 | ESD | inside specification * | |
| DIN EN 61000-4-3 | Radiated immunity | +/- 2,7 dB a.) | 1,64 |
| DIN EN 61000-4-4 | Burst | inside specification * | |
| DIN EN 61000-4-5 | Surge | inside specification * | |
| DIN EN 61000-4-6 | Conducted immunity with CDN (150 kHz to 230 MHz) | +/- 2,6 dB b.) | 1,64 |
| DIN EN 61000-4-6 | Conducted immunity with BCI (150 kHz to 230 MHz) | +/- 2,8 dB c.) | 1,64 |
| DIN EN 61000-4-8 | Magnetic field | +/- 1,5 dB | 2 |
| DIN EN 61000-4-11 | Dips | inside specification * | 2 |
| DIN EN 61000-3-2 | Harmonic currents | +/- 0,2 % d.) | 1 |
| DIN EN 61000-3-3 | Flicker | annotation e.) | |

Table 2: Measurement uncertainty

Comment: The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. If k=2 the value of the measurements lies within the assigned range of values with a probability of 95 %.

* The specific requirements regarding to the standard was kept

a.) To maintain the claimed test level with a probability of 90 % an additional test level of 38 % percent must be added.

b.) To maintain the claimed test level with a probability of 90 % an additional test level of 35 % percent must be added.

c.) To maintain the claimed test level with a probability of 90 % an additional test level of 39 % percent must be added.

d.) Measuring uncertainty (current): +/- 0,2% (fundamental oscillation), +/- 0,2% (rated current), voltage metering +/- 0,2% of the reading. Impacts on the measuring system by the EUT are not included.

e.) Measuring uncertainty (flicker): dc and dmax +/- 5%, Pst +/- 8%. Impacts on the measuring system by the EUT are not included.

# 12 Summary

The EMC Regulations according to the marked specifications are

## ☑ KEPT

The EUT does fulfill the general approval requirements mentioned.

## ☐ NOT KEPT

The EUT does not fulfill the general approval requirements mentioned.

Place, Date: Straubing, September 26, 2010

| | |
|---|---|
| Marco Janker | Rudolf Klein |
| EMI / EMC Test Engineer | GM / EMV **TESTHAUS** GmbH |