

Test Report


Electromagnetic Compatibility (EMC)



Equipment Under Test: RFID module
Type/Model: NUR-10W
Manufacturer: Nordic ID Oy
Myllyojakatu 2A
FI-24100 Salo
FINLAND
Customer: Nordic ID Oy
Myllyojakatu 2A
FI-24100 Salo
FINLAND

The Equipment Under Test Complies With Following Requirements

| | | |
|--------------------------|-----------|---------|
| FCC CFR 47 Part 15, 2014 | Subpart B | Class B |
| RSS-GEN Issue 4, 2014 | | Class B |
| ICES-003 Issue 5, 2012 | | |

Date: 4.11.2015
Issued by: 
Pekka Kälviäinen
Testing Engineer


Date: 4.11.2015
Checked by: 
Janne Nyman
Compliance Specialist

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Equipment Under Test (EUT)

| | |
|----------------|--------------|
| RFID Module | |
| Type/ Model: | NUR-10W |
| Serial Number: | 00100789 |
| FCC ID: | SCCNUR10W |
| IC: | 5137A-NUR10W |

Cross Dipole antenna with reflector: -

Type of the EUT

Type of EUT : NUR-10W is an RFID module using 902-928 MHz frequency band with portable computer

Power requirements

input voltage: 3.6VDC

Conducted emission tests are performed using AC/DC power adapter:

AC/DC power supply: type: Thandar TS3021S, s/n: 099609
input voltage: 230V50Hz

Mechanical Size of the EUT

Height: 2.0 cm Width: 8.5 cm Length: 11.5 cm

Cable lengths and types

| Cable: | Length: | Type: |
|-----------------------------------|---------|------------|
| Antenna cableo | 1.0 m | Coaxial |
| USB to computer | 2.0 m | Shielded |
| DC Power to AC/DC power adapter | 1.5 m | Unshielded |
| AC power, to AC mains | 1.5 m | Unshielded |
| DC power (computer) to AC adapter | 1.8 m | Unshielded |
| AC power (AC adapter) to AC mains | 0.8 m | Unshielded |

Peripherals

Portable computer: model: Lenovo ThinkPad X220, type: 4291-53G, s/n: R9-MFBR3 12/03
 - Dock model: ThinkPadMini Dock Series 3: type: 4337, s/n: M3-B7XE7 11/11
 - AC Adapter model: 92P1154,type: -, s/n: -

EUT Test Conditions during EMC-Testing

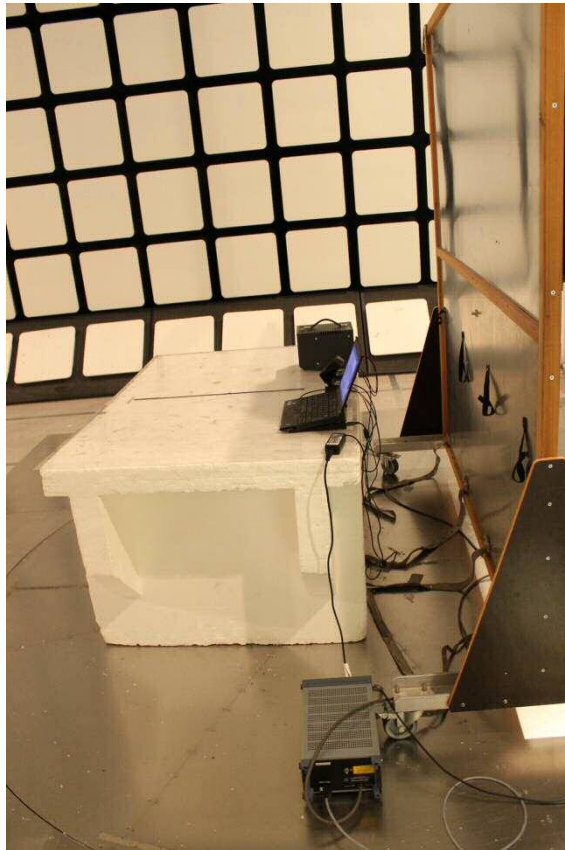
EUT was in standby mode during the tests.

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Photographs of the EUT

Photograph 1. The EUT and test set-up for conducted emission test



Photograph 2. The EUT and test set-up for radiated emission test.

SUMMARY OF TESTING

| Test Specification | Description of Test | Result |
|---|---------------------|--------|
| §15.107, RSS-GEN 8.8, ICES-003 6.1 | Conducted Emissions | PASS |
| §15.109, §15.209, RSS-GEN 8.9, ICES-003 6.2 | Radiated Emissions | PASS |

Test Facility

| | |
|--|--|
| <input type="checkbox"/> Testing Location / address: FCC registration number: 90598 | SGS Fimko Ltd Särkiniementie 3 FI-00210, HELSINKI FINLAND |
| <input checked="" type="checkbox"/> Testing Location / address: FCC registration number: 178986 Industry Canada registration number: 8708A-2 | SGS Fimko Ltd Karakaarenkuja 4 FI-02610, ESPOO FINLAND |

Conducted Emissions In The Frequency Range 150 kHz - 30 MHz.

Standard: ANSI C63.4 (2003)
Tested by: NKO
Date: 5.10.2015
Humidity: 30 – 60 %
Temperature: 22 ± 3 °C
Barometric pressure: 860 – 1 060 mbar
Measurement uncertainty: ± 2.9 dB Level of confidence 95 % (k = 2)

Test Plan

Conducted disturbance voltage was measured with an artificial main network from 150 kHz to 30 MHz with 4.5 kHz steps and a resolution bandwidth of 9 kHz. Measurements were carried out with peak and average detectors from the phase(s) and neutral lines of the power supply cable.

The EUT was working as described in the section “EUT Test Conditions”.

Test results, RFID module

Conducted Emission Mains FCC Part 15 Class B with ESH3-Z5 8019

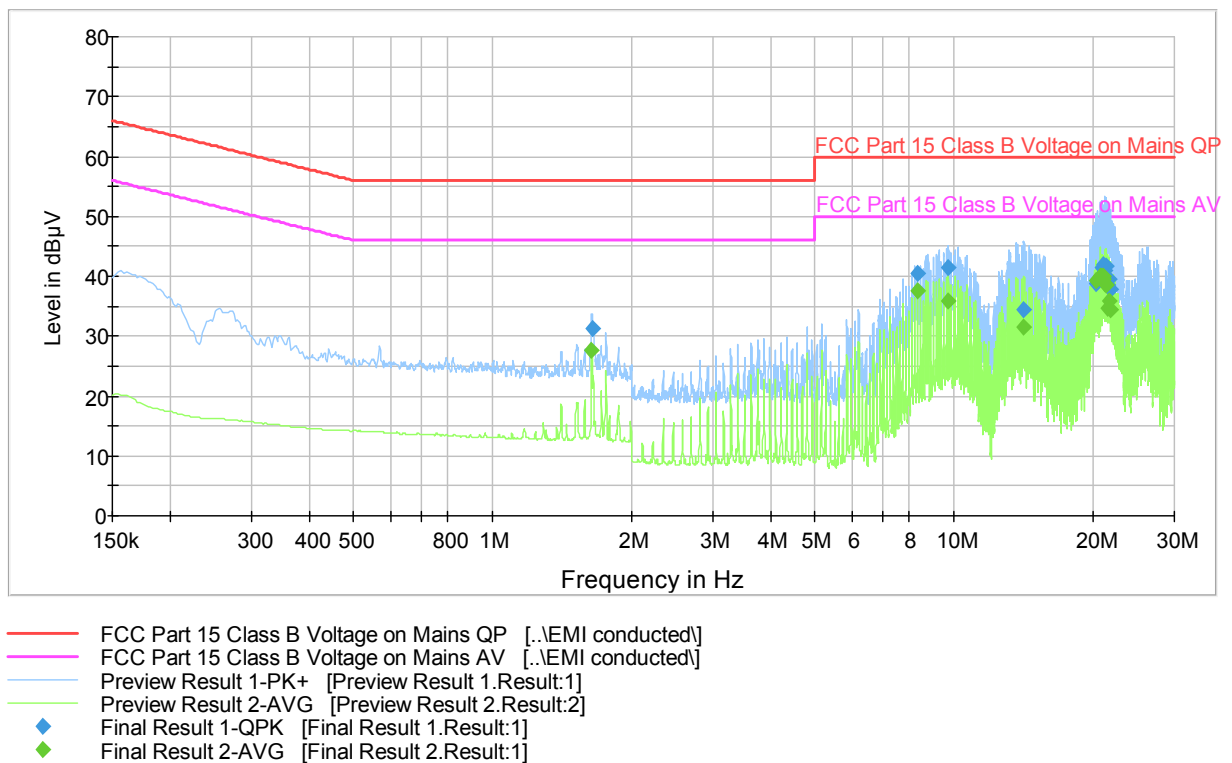


Figure 1. The measured curves with peak-detector and average detector

Final measurements from the worst frequencies
Table 1. Final quasi-peak measurement from the worst frequencies

| Frequency (MHz) | QuasiPeak (dB μ V) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dB μ V) | Comment |
|-----------------|------------------------|-----------------|-----------------|-----|------|------------|-------------|--------------------|---------|
| 1.641250 | 31.2 | 1000.0 | 9.000 | GND | L1 | 10.2 | 24.8 | 56.0 | |
| 8.319250 | 40.6 | 1000.0 | 9.000 | GND | L1 | 10.8 | 19.4 | 60.0 | |
| 9.725500 | 41.4 | 1000.0 | 9.000 | GND | L1 | 11.0 | 18.6 | 60.0 | |
| 14.178250 | 34.3 | 1000.0 | 9.000 | GND | L1 | 11.4 | 25.7 | 60.0 | |
| 20.341000 | 38.7 | 1000.0 | 9.000 | GND | L1 | 11.9 | 21.3 | 60.0 | |
| 20.757250 | 39.9 | 1000.0 | 9.000 | GND | L1 | 11.9 | 20.1 | 60.0 | |
| 20.838250 | 41.4 | 1000.0 | 9.000 | GND | L1 | 11.9 | 18.6 | 60.0 | |
| 20.973250 | 42.0 | 1000.0 | 9.000 | GND | L1 | 11.9 | 18.0 | 60.0 | |
| 21.112750 | 41.3 | 1000.0 | 9.000 | GND | L1 | 11.9 | 18.7 | 60.0 | |
| 21.184750 | 41.0 | 1000.0 | 9.000 | GND | L1 | 11.9 | 19.0 | 60.0 | |
| 21.322000 | 41.8 | 1000.0 | 9.000 | GND | L1 | 11.9 | 18.2 | 60.0 | |
| 21.529000 | 38.6 | 1000.0 | 9.000 | GND | L1 | 11.9 | 21.4 | 60.0 | |
| 21.666250 | 39.4 | 1000.0 | 9.000 | GND | L1 | 11.9 | 20.6 | 60.0 | |
| 21.805750 | 37.8 | 1000.0 | 9.000 | GND | L1 | 11.9 | 22.2 | 60.0 | |

Table 2. Final average measurements from the worst frequencies

| Frequency (MHz) | Average (dB μ V) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dB μ V) | Comment |
|-----------------|----------------------|-----------------|-----------------|-----|------|------------|-------------|--------------------|---------|
| 1.639000 | 27.7 | 1000.0 | 9.000 | GND | L1 | 10.2 | 18.3 | 46.0 | |
| 8.321500 | 37.5 | 1000.0 | 9.000 | GND | L1 | 10.8 | 12.5 | 50.0 | |
| 9.730000 | 35.8 | 1000.0 | 9.000 | GND | L1 | 11.0 | 14.2 | 50.0 | |
| 14.182750 | 31.6 | 1000.0 | 9.000 | GND | L1 | 11.4 | 18.4 | 50.0 | |
| 20.275750 | 39.2 | 1000.0 | 9.000 | GND | L1 | 11.9 | 10.8 | 50.0 | |
| 20.766250 | 40.0 | 1000.0 | 9.000 | GND | L1 | 11.9 | 10.0 | 50.0 | |
| 20.905750 | 39.9 | 1000.0 | 9.000 | GND | L1 | 11.9 | 10.1 | 50.0 | |
| 20.975500 | 40.0 | 1000.0 | 9.000 | GND | L1 | 11.9 | 10.0 | 50.0 | |
| 21.112750 | 39.4 | 1000.0 | 9.000 | GND | L1 | 11.9 | 10.6 | 50.0 | |
| 21.252250 | 38.8 | 1000.0 | 9.000 | GND | L1 | 11.9 | 11.2 | 50.0 | |
| 21.319750 | 38.5 | 1000.0 | 9.000 | GND | L1 | 11.9 | 11.5 | 50.0 | |
| 21.529000 | 34.6 | 1000.0 | 9.000 | GND | L1 | 11.9 | 15.4 | 50.0 | |
| 21.666250 | 35.8 | 1000.0 | 9.000 | GND | L1 | 11.9 | 14.2 | 50.0 | |
| 21.805750 | 34.3 | 1000.0 | 9.000 | GND | L1 | 11.9 | 15.7 | 50.0 | |

Correction factor (dB) in the final result tables contains the sum of the transducers (cables + transient limiter + LISN).

QuasiPeak and Average values are the measured values corrected with the correction factor.

Test results, Computer

Conducted Emission Mains FCC Part 15 Class B with ESH3-Z5 8019

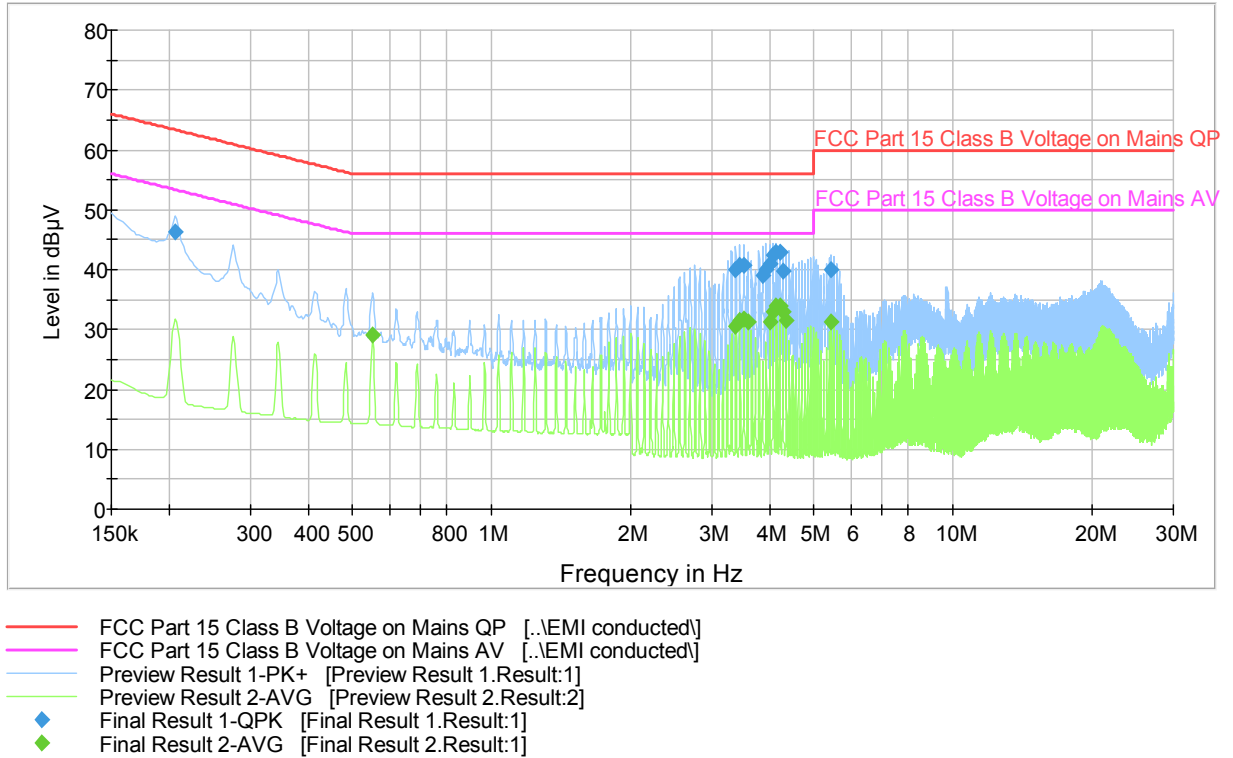


Figure 2. The measured curves with peak-detector and average detector

Final measurements from the worst frequencies
Table 3. Final quasi-peak measurement from the worst frequencies

| Frequency (MHz) | QuasiPeak (dB μ V) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dB μ V) | Comment |
|-----------------|------------------------|-----------------|-----------------|-----|------|------------|-------------|--------------------|---------|
| 0.206250 | 46.3 | 1000.0 | 9.000 | GND | N | 11.0 | 17.1 | 63.4 | |
| 3.380500 | 39.9 | 1000.0 | 9.000 | GND | N | 10.4 | 16.1 | 56.0 | |
| 3.450250 | 40.8 | 1000.0 | 9.000 | GND | N | 10.4 | 15.2 | 56.0 | |
| 3.520000 | 40.8 | 1000.0 | 9.000 | GND | N | 10.4 | 15.2 | 56.0 | |
| 3.864250 | 38.9 | 1000.0 | 9.000 | GND | N | 10.4 | 17.1 | 56.0 | |
| 3.934000 | 40.1 | 1000.0 | 9.000 | GND | N | 10.4 | 15.9 | 56.0 | |
| 4.003750 | 41.0 | 1000.0 | 9.000 | GND | N | 10.4 | 15.0 | 56.0 | |
| 4.073500 | 42.3 | 1000.0 | 9.000 | GND | N | 10.4 | 13.7 | 56.0 | |
| 4.141000 | 42.9 | 1000.0 | 9.000 | GND | N | 10.4 | 13.1 | 56.0 | |
| 4.210750 | 42.9 | 1000.0 | 9.000 | GND | N | 10.4 | 13.1 | 56.0 | |
| 4.280500 | 39.7 | 1000.0 | 9.000 | GND | L1 | 10.5 | 16.3 | 56.0 | |
| 5.452750 | 40.1 | 1000.0 | 9.000 | GND | L1 | 10.6 | 19.9 | 60.0 | |

Table 4. Final average measurements from the worst frequencies

| Frequency (MHz) | Average (dB μ V) | Meas. Time (ms) | Bandwidth (kHz) | PE | Line | Corr. (dB) | Margin (dB) | Limit (dB μ V) | Comment |
|-----------------|----------------------|-----------------|-----------------|-----|------|------------|-------------|--------------------|---------|
| 0.552750 | 29.2 | 1000.0 | 9.000 | GND | N | 10.1 | 16.8 | 46.0 | |
| 3.380500 | 30.6 | 1000.0 | 9.000 | GND | N | 10.4 | 15.4 | 46.0 | |
| 3.450250 | 31.5 | 1000.0 | 9.000 | GND | N | 10.4 | 14.5 | 46.0 | |
| 3.520000 | 31.8 | 1000.0 | 9.000 | GND | N | 10.4 | 14.2 | 46.0 | |
| 3.589750 | 31.3 | 1000.0 | 9.000 | GND | N | 10.4 | 14.7 | 46.0 | |
| 4.003750 | 31.2 | 1000.0 | 9.000 | GND | N | 10.4 | 14.8 | 46.0 | |
| 4.071250 | 32.9 | 1000.0 | 9.000 | GND | N | 10.4 | 13.1 | 46.0 | |
| 4.141000 | 33.9 | 1000.0 | 9.000 | GND | N | 10.4 | 12.1 | 46.0 | |
| 4.210750 | 33.9 | 1000.0 | 9.000 | GND | N | 10.4 | 12.1 | 46.0 | |
| 4.280500 | 32.9 | 1000.0 | 9.000 | GND | N | 10.4 | 13.1 | 46.0 | |
| 4.348000 | 31.6 | 1000.0 | 9.000 | GND | N | 10.4 | 14.4 | 46.0 | |
| 5.452750 | 31.4 | 1000.0 | 9.000 | GND | L1 | 10.6 | 18.6 | 50.0 | |

Correction factor (dB) in the final result tables contains the sum of the transducers (cables + transient limiter + LISN).

QuasiPeak and Average values are the measured values corrected with the correction factor.

Radiated Emissions In The Frequency Range 30 MHz - 1000 MHz.

| | |
|---------------------------------|--|
| Standard: | ANSI C63.4 (2003) |
| Tested by: | NKO |
| Date: | 5.10.2015 |
| Humidity: | 30 – 60 % |
| Temperature: | 22 ± 3 °C |
| Barometric pressure: | 860 – 1 060 mbar |
| Measurement uncertainty: | ± 5.1 dB (30 – 200 MHz) Level of confidence 95 % (k = 2). ± 4.2 dB (200 – 1 000 MHz) |

Test plan

The radiated emission measurements were done within a semi anechoic screened chamber. The EUT was placed on a table 0.8 m above the reflecting ground plane. The measurement distance was 3 meters. The worst interferences were determined during measurements by rotating the turntable and adjusting the antenna height. The measurements were done in horizontal and vertical antenna polarizations. The supply voltage to the turntable was fed through the filter.

Radiated measurement settings

Preliminary testing:

| | |
|-----------------------|-------------------------|
| Turntable movement: | 20 ° step |
| Turntable position: | 10 ° to 350° |
| Antenna movement: | 1.5 m step |
| Antenna height: | 1.0 m to 4.0 m |
| Antenna polarization: | Vertical and horizontal |

Final testing:

| | |
|-----------------------|-------------------------|
| Turntable movement: | Continuous |
| Turntable position: | ± 15 ° |
| Antenna movement: | Continuous |
| Antenna height: | ± 0.75 m |
| Antenna polarization: | Vertical and horizontal |

Measured Quasi-Peak Values In The Frequency Range 30 MHz - 1000 MHz.

Radiated Emission FCC Part 15 Class B 30-1000MHz 3m

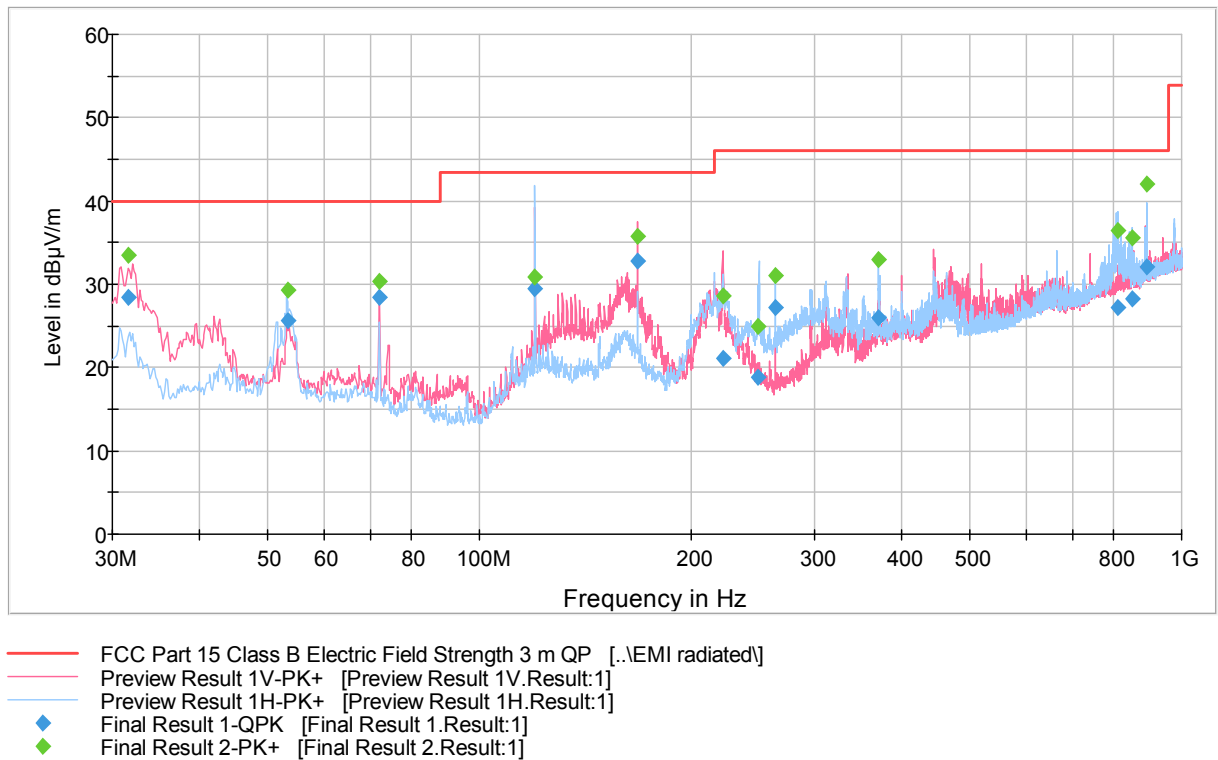


Figure 3. Measured curve with peak-detector.

Final measurements from the worst frequencies

Table 5. Final quasi-peak measurement from the worst frequencies

| Frequency (MHz) | QuasiPeak (dBµV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBµV/m) | Comment |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|---------|
| 31.585000 | 28.5 | 1000.0 | 120.000 | 100.0 | V | 114.0 | 13.0 | 11.5 | 40.0 | |
| 53.335000 | 25.6 | 1000.0 | 120.000 | 400.0 | H | 12.0 | 14.5 | 14.4 | 40.0 | |
| 71.995000 | 28.5 | 1000.0 | 120.000 | 100.0 | V | 103.0 | 11.9 | 11.5 | 40.0 | |
| 119.995000 | 29.5 | 1000.0 | 120.000 | 192.0 | H | 110.0 | 12.3 | 14.0 | 43.5 | |
| 168.015000 | 32.8 | 1000.0 | 120.000 | 100.0 | V | 134.0 | 14.0 | 10.7 | 43.5 | |
| 221.945000 | 21.1 | 1000.0 | 120.000 | 100.0 | V | 202.0 | 11.4 | 24.9 | 46.0 | |
| 249.435000 | 18.9 | 1000.0 | 120.000 | 100.0 | H | 142.0 | 13.3 | 27.1 | 46.0 | |
| 263.995000 | 27.2 | 1000.0 | 120.000 | 127.0 | H | 130.0 | 13.9 | 18.8 | 46.0 | |
| 369.855000 | 26.0 | 1000.0 | 120.000 | 100.0 | H | 46.0 | 16.9 | 20.0 | 46.0 | |
| 809.735000 | 27.3 | 1000.0 | 120.000 | 100.0 | H | 147.0 | 25.4 | 18.8 | 46.0 | |
| 851.325000 | 28.2 | 1000.0 | 120.000 | 117.0 | H | 159.0 | 25.9 | 17.8 | 46.0 | |
| 891.135000 | 32.0 | 1000.0 | 120.000 | 223.0 | H | 87.0 | 26.5 | 14.0 | 46.0 | |

Correction factor (dB) in the final result tables contains the sum of the transducers (antenna + amplifier + cables).

QuasiPeak values are measured values corrected with the correction factor.

TEST EQUIPMENT

| Manufacturer | Type | Serial no | Cal. date | Cal. due |
|-------------------------------|-------------------|------------------|------------------|-----------------|
| ROHDE & SCHWARZ | | | | |
| EMI Test receiver | ESU 26 | 100185 | 01.07.2015 | 07.2016 |
| Test software | EMC32 | Ver. 8.30.0 | - | - |
| LISN | ESH2-Z5 | 863794/014 | 14.10.2014 | 14.10.2015 |
| Transient limiter | ESH3-Z2 | #2 | 17.09.2014 | 17.09.2015 |
| SCHWARZBECK | | | | |
| Antenna (30 MHz - 1 GHz) | VULB9168 | 9168-503 | 4.11.2014 | 4.5.2016 |
| HEWLETT- PACKARD | | | | |
| Microwave amplifier | 83017A | 3950M00102 | 15.08.2014 | 15.08.2015 |
| DEISEL | | | | |
| Antenna mast | MA 240 T | 240/394/96 | - | - |
| Tilt option | KE 220 | 220/307/96 | - | - |
| Controller | HD 100 | 100/413/96 | - | - |
| Turntable | DS 420 | 420/420/96 | - | - |
| CALIFORNIA INSTRUMENTS | | | | |
| Power Supply | 5001 iX Series II | 58209 | - | - |