# EMC TEST REPORT

## No. 1015783

## Electromagnetic disturbances

### EQUIPMENT UNDER TEST

| | |
|---|---|
| Equipment : | RFID Reader |
| Type / model : | HR-2 |
| Manufacturer : | TagMaster AB |
| Tested by request of : | TagMaster AB |

### SUMMARY

Referring to emission limits and operating mode during tests specified in this report the equipment complies with the requirements according to the following standard.

**FCC Part 15** (2009): Radio frequency device, Subpart B: Unintentional radiators. Class B equipment.

The equipment complies provided that the modifications described in section 2.4 are implemented.

Date of issue: July 21, 2010

Tested by: Farzad Farzaneh

Approved by: Leif Hinnelund



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## 1. CLIENT INFORMATION

The EUT has been tested by request of

| | |
|---|---|
| Company: | TagMaster AB<br>Kronborgsgränd 1<br>164 87 Kista<br>SWEDEN |
| Name of contact: | Anders Kihlén |

## 2. EQUIPMENT UNDER TEST (EUT)

### 2.1 Identification of the EUT

| | |
|---|---|
| Equipment: | RFID Reader |
| Type/Model: | HR-2 |
| Brand name: | TagMaster |
| Serial number: | 01 |
| Manufacturer: | TagMaster AB |
| Rating RF output power: | 10 mW or 500 mW e.i.r.p. |
| Antenna gain: | 7 dBi |
| External antenna connector: | No |
| Operating temperature range: | -40 to +70 °C |
| Frequency range: | 2400 - 2483,5 MHz (FHSS)<br>2435 – 2465 MHz (CW) |
| Maximum internal clock frequency: | 185 MHz |
| Number of channels: | 400 (FHSS)<br>93 (CW) |
| Channel separation: | 200 kHz (FHSS)<br>300 kHz (CW) |
| Modulation characteristics: | CW / FHSS |
| Stand by mode supported: | No |
| Adapter rating: | 100-240 AC 50/60 Hz |
| Hand unit rating | 24 V DC |
| Class: | II |



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### 2.2 Additional information about the EUT

The EUT was tested in a table top configuration.
The EUT consists of the following units:

| Units | Type |
|---|---|
| RFID reader | HR-2 |
| AC/DC adapter | Mean Well GS25B24,<br>Input100-240 50/60 Hz<br>Out put 24 V DC, 1,04 A (25 W) |

The EUT was tested with the following cables:

| Cable | Type | Length |
|---|---|---|
| Adapter mains power | Two-core | 2 m |
| DC power/service port | Five-core | 2 m |
| Ethernet | Phoenix four-core | 1,5 m |

### 2.3 Peripheral equipment

Peripheral equipment is defined as equipment needed for correct operation of the EUT, but not included as part of the EUT.

| Equipment | Manufacturer | Type |
|---|---|---|
| Laptop computer | HP | Compaq 2510p |

### 2.4 Modifications made to improve EMC:

These modifications were required to obtain the results presented in this report.

The 100 MHz oscillator changed to 25 MHz oscillator.



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## 3. TEST SPECIFICATIONS

### 3.1 Standards

Requirements:
CFR 47: Telecommunication, Chapter I — FCC Part 15 - Radio Frequency Devices — Subpart B: Unintentional radiators (2009).

Test methods:
ANSI C.63.4-2003. 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.

### 3.2 Additions, deviations and exclusions from standards

No additions, deviations or exclusions have been made from standards.

### 3.3 Mode of operation during the test

The EUT was supplied with 120 V AC, 60 Hz.

The EUT was tested in normal operation. During the radiated emission test the EUT was running with the web demo page and tagtest software over Ethernet in mode 7. The output power was set to 500 mW during the test.

### 3.4 Compliance

Purpose of test: To determine whether the Equipment Under Test (EUT) fulfils the EMC requirements of FCC part 15 subpart B for class B equipment

Limits for emission according to class B:

Conducted emission limits AC mains:

| **Frequency** | **Quasi Peak** | **Average** |
|---|---|---|
| MHz | dBµV | dBµV |
| 0.15 – 0.5 | 66 – 56 | 56 – 46 |
| 0.5 – 5 | 56 | 46 |
| 5.0 – 30 | 60 | 50 |

The emission limits for radiated emission at 3 m distance are:

| **Frequency range** | **Quasi Peak** | **Quasi Peak** |
|---|---|---|
| MHz | µV/m | dBµV/m |
| 30 – 88 | 100 | 40.0 |
| 88 – 216 | 150 | 43.5 |
| 216 – 960 | 200 | 46.0 |
| Above 960 MHz | 500 | 54.0 |

## 4. TEST SUMMARY

The test has been carried out at the Intertek Semko AB premises in Kista, Sweden.
The results in this report apply only to sample tested:

| Basic standard | Description | Result |
|---|---|---|
| **Emission** | | |
| **FCC Part 15B** | **AC power port continuous disturbance voltage in the frequency range 0,15 MHz to 30 MHz**<br><br>The EUT complies with Class B limits.<br>The margin to the limit was at least 10.3 dB, found at 0.190 MHz.<br>See diagram 1 and table 1. | **PASS** |
| **FCC Part 15B** | **Radiated electromagnetic field in the frequency range 30 MHz to 1000 MHz**<br><br>The EUT complies with the Class B limits.<br>The margin to the limit was at least 5.5 dB found at 549.99 MHz.<br>See diagram 2 and table 2. | **PASS** |
| **FCC Part 15B** | **Radiated electromagnetic field in the frequency range 1 GHz to 2 GHz**<br><br>The EUT complies with the Class B limits.<br>The margin to the limit was at least 5.8 dB found at 1595.2 MHz.<br>See diagram 3 and table 3. | **PASS** |



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## 5. TABLES AND DIAGRAMS

**Diagram 1, Conducted emission, AC power port, Peak overview sweep**

Date of test: July 08, 2010

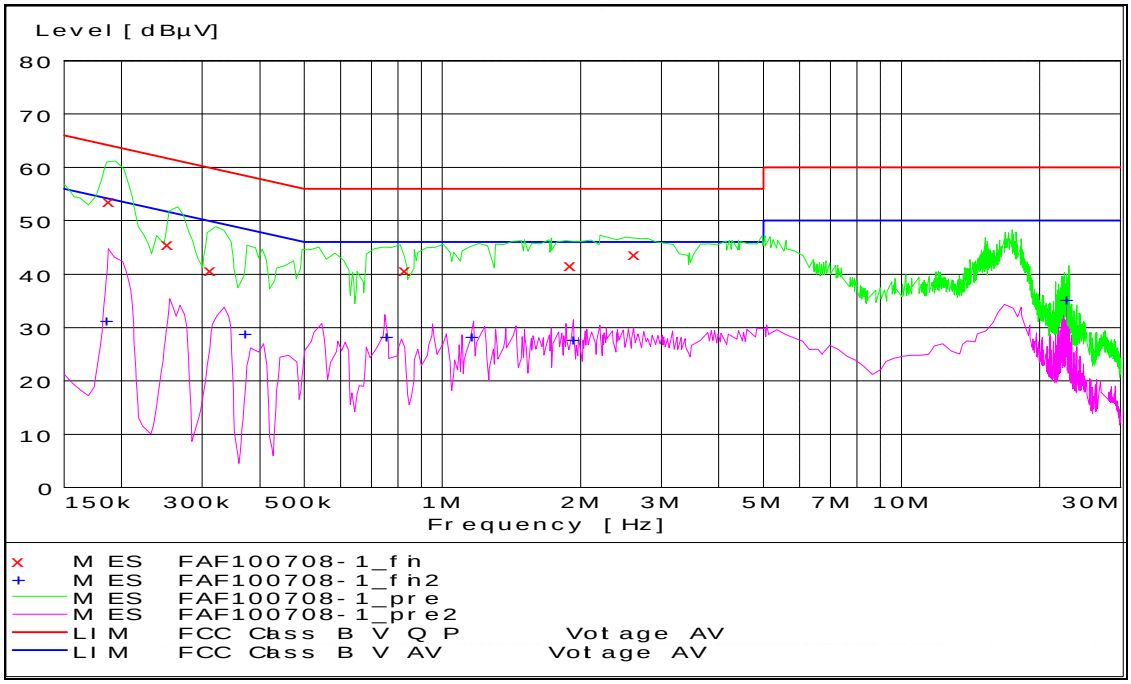


**Table 1, Conducted emission, AC power port, Measurement results**

| Quasi-Peak | | | |
|---|---|---|---|
| Frequency [MHz] | Disturbance level [dBµV] | Limit [dBµV] | Margin [dB] |
| 0.190 | 53.7 | 64.0 | 10.3 |
| 0.255 | 45.9 | 61.6 | 15.7 |
| 0.315 | 40.9 | 59.8 | 18.9 |
| 0.830 | 40.8 | 56.0 | 15.2 |
| 1.910 | 42.0 | 56.0 | 14.0 |
| 2.620 | 44.0 | 56.0 | 12.0 |

| Average | | | |
|---|---|---|---|
| Frequency [MHz] | Disturbance level [dBµV] | Limit [dBµV] | Margin [dB] |
| 0.185 | 31.5 | 54.3 | 22.8 |
| 0.375 | 29.0 | 48.4 | 19.4 |
| 0.755 | 28.4 | 46.0 | 17.6 |
| 1.170 | 28.6 | 46.0 | 17.4 |
| 1.930 | 27.9 | 46.0 | 18.1 |
| 23.130 | 35.7 | 50.0 | 14.3 |



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**Diagram 2, Radiated emission, 30 – 1000 MHz, Peak overview sweep**

Date of test: June 30, 2010

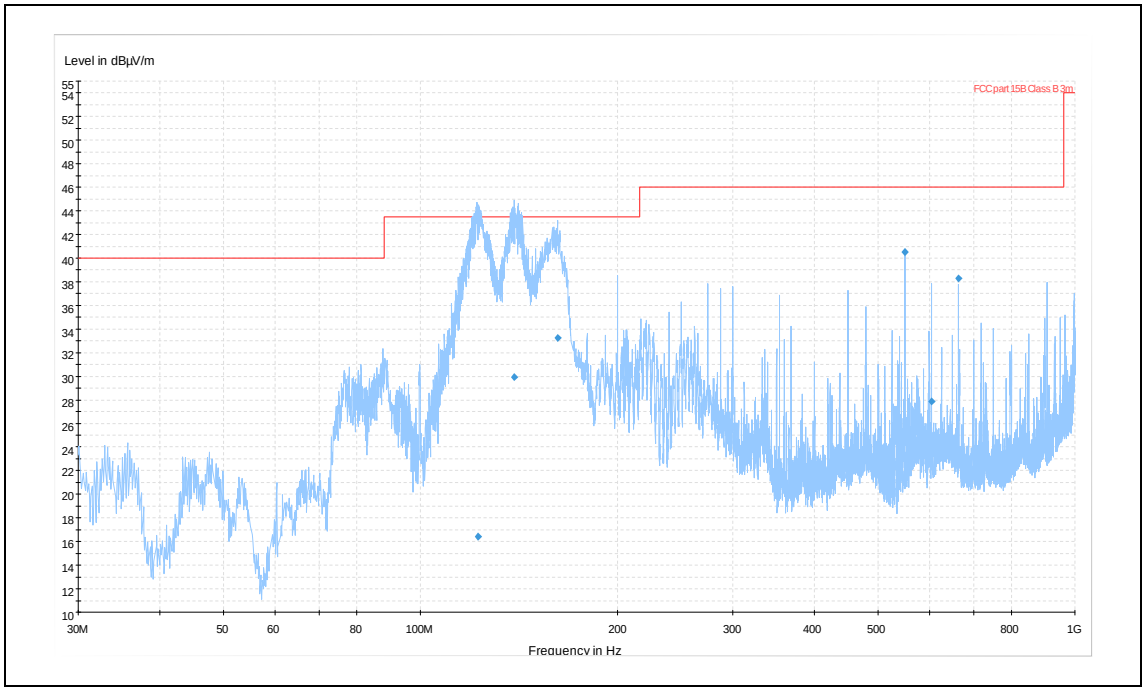


**Table 2, Radiated emission, 30 – 1000 MHz, Measurement results**

| Frequency [MHz] | Quasi-Peak Disturbance level [dBµV/m] | Quasi-Peak Limit [dBµV/m] | Margin [dB] |
|---|---|---|---|
| 122.525 | 16.4 | 43.5 | 27.1 |
| 139.118 | 29.9 | 43.5 | 13.6 |
| 162.107 | 33.3 | 43.5 | 10.2 |
| 549.990 | 40.5 | 46.0 | 5.5 |
| 603.777 | 27.9 | 46.0 | 18.1 |
| 664.138 | 38.3 | 46.0 | 7.7 |

Manually measurements of the frequencies 122.525 MHz, 139.118 MHz, 162.107 MHz and 603.777 MHz have been performed and same results have been obtained.



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**Diagram 2, Radiated emission, 1 – 2 GHz, Peak overview sweep**

Date of test: June 30, 2010

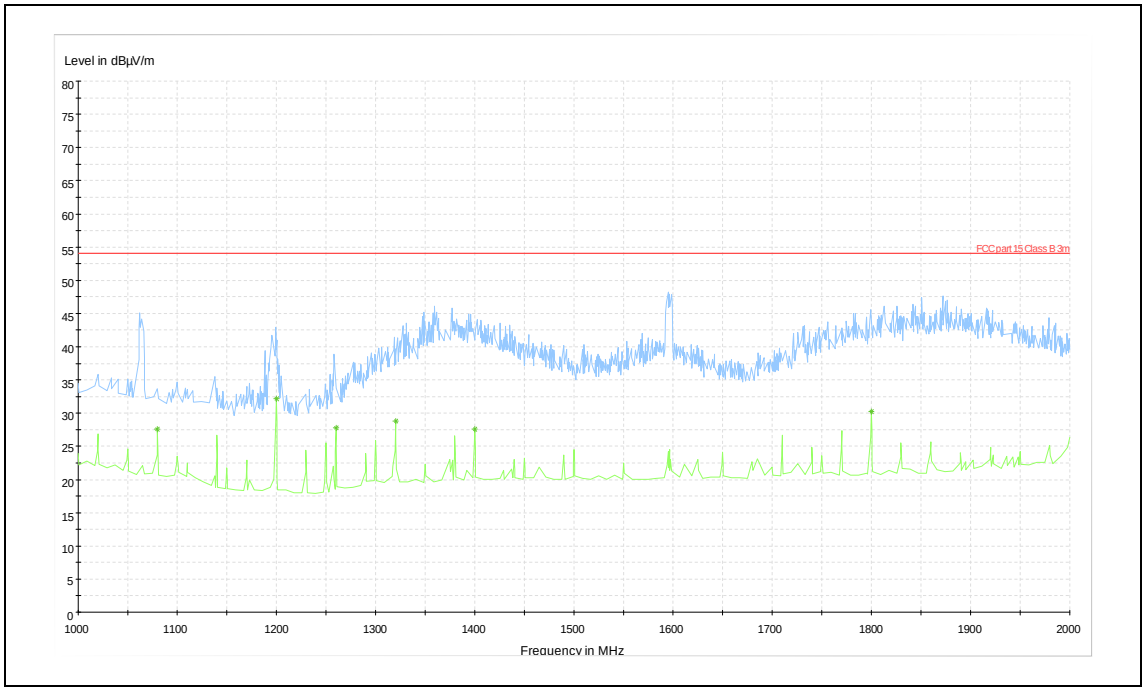


**Table 3, Radiated emission, 1 – 2 GHz, Measurement results**

| Frequency [MHz] | Peak Disturbance level [dBµV/m] | Average Limit [dBµV/m] | Margin [dB] |
|---|---|---|---|
| 1066.0 | 44.9 | 54.0 | 9.1 |
| 1199.6 | 42.9 | 54.0 | 11.1 |
| 1359.6 | 46.0 | 54.0 | 8.0 |
| 1377.2 | 45.8 | 54.0 | 8.2 |
| 1595.2 | 48.2 | 54.0 | 5.8 |
| 1598.8 | 47.8 | 54.0 | 6.2 |



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## 6. PHOTOS

Photo of the EUT

Photo of the EUT


Photo of the EUT



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Photo of the EUT

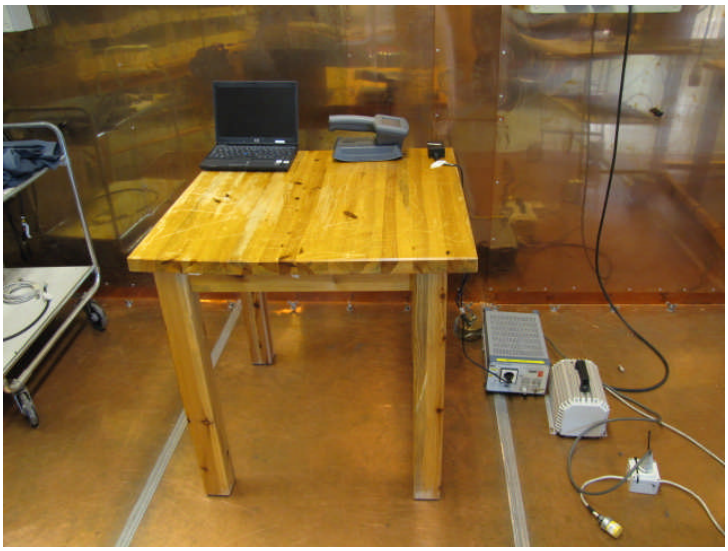

Photo of test set-up during the conducted emission test

Photo of test set-up during the conducted emission test



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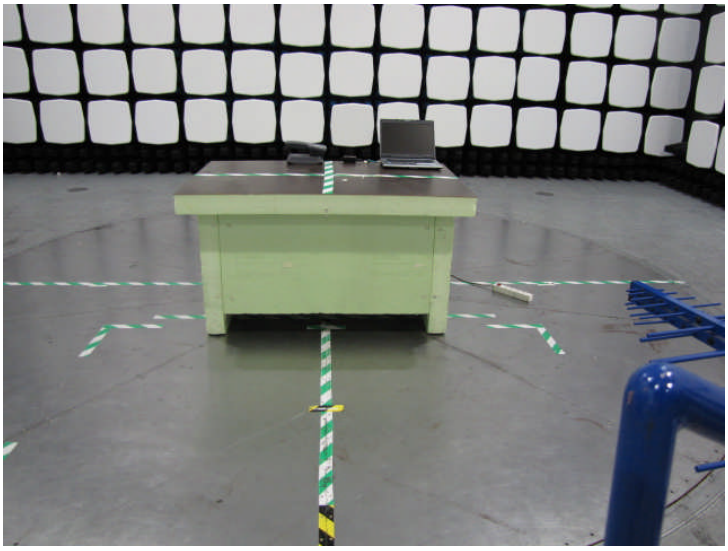

Photo of test set-up during the radiated emission test

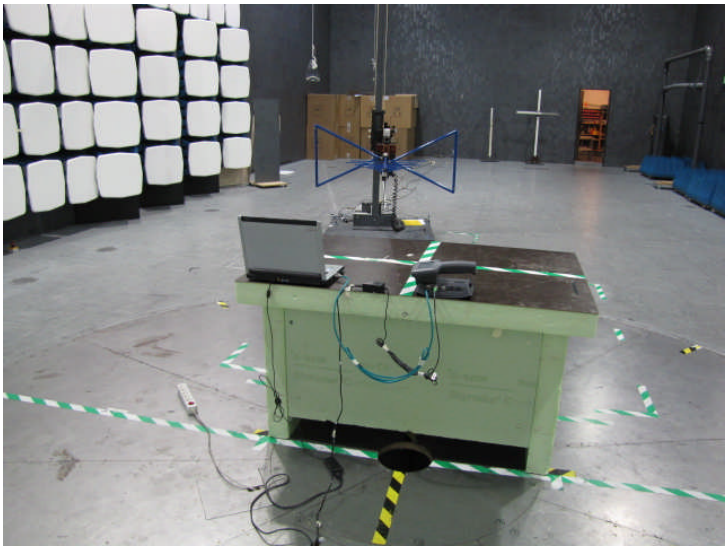

Photo of test set-up during the radiated emission test


Label of the AC/DC adapter



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## 7. INTERTEK SEMKO EMC CENTER MEASUREMENT UNCERTAINTIES

All uncertainties are given with a level of confidence of approximately 95% (k=2) and are the maximum values within the complete range. Measurement uncertainties are calculated in accordance with EA-4/02:1997.

| | |
|---|---|
| Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz | ± 3,6 dB |

Measurement uncertainty for radiated disturbance

| | |
|---|---|
| Uncertainty for the frequency range 30 to 1000 MHz at 3 m | ± 4,8 dB |
| Uncertainty for the frequency range 1,0 to 2,75 GHz at 3 m | ± 6,2 dB |



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