

# RADIO TEST REPORT

**No. 606442R1**

## EQUIPMENT UNDER TEST

|                       |                     |                         |
|-----------------------|---------------------|-------------------------|
| Equipment:            | Fixed Reader        |                         |
| Type / model:         | CG-FR03             |                         |
| Manufacturer:         | Low volume          | High volume             |
|                       | AB Distatic         | GE Security, Tualatin   |
|                       | Gotlundagatan 2-4   | 12345 SW Leveton Drive  |
|                       | Bandhagen S-124 71  | Tualatin, OR 97062-6001 |
|                       | Sweden              | USA                     |
| Tested by request of: | GE CommerceGuard AB |                         |

## SUMMARY

The equipment complies with the requirements of the following standards:

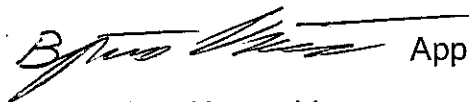
FCC, Part 15, Subpart B (2005) and Subpart C (2005);  
RSS-210, Issue 6 (September 2005); RSS-Gen, Issue 1 (September 2005).

Industry Canada listed test facility No. IC 3481

This test report replaces earlier issued test report with the same ref. no. dated 2006-07-13 due to editorial corrections.

Date of issue: 2006-09-27

Tested by:



Björn Utermöhl

Approved by:

Lars-Olov Johansson

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**1. CLIENT INFORMATION**

The EUT has been tested by request of

Company: GE CommerceGuard AB

Name of contact: Gustavslundsvägen 151A  
S-167 51 Bromma, Sweden  
Contact: Ola Myrin, Project Manager  
Telephone: +46 (709) 2221 85  
E Mail: ola.myrin@allset.se

**2. EQUIPMENT UNDER TEST (EUT)****2.1 Identification of the EUT according to the manufacturer/client declaration**

Equipment: Fixed Reader

Type/Model: CG-FR03

Brand name: CommerceGuard Fixed Reader

Manufacturer (low volume): AB Distatic  
Gotlundagatan 2-4  
Bandhagen S-124 71  
Sweden

Manufacturer (high volume): GE Security, Tualatin  
12345 SW Leveton Drive  
Tualatin, OR 97062-6001  
USA

Rating/Supplying voltage: 9V DC

Rating RF output power (conducted): 2.2 dBm

Antenna gain: 14 dBi or lower

External antenna connector: Yes

Operating temperature range: -20 to +60 °C

Frequency range: 2400 - 2483,5 MHz

Number of channels: 1 channel at 2440 MHz

Modulation characteristics: OFDM

Stand by mode supported: Yes



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## 2.2 Additional hardware information about the EUT

The EUT consists of the following units:

| Unit                 | Type and version information on label                        | Serial number on label            | Used for                                                         |
|----------------------|--------------------------------------------------------------|-----------------------------------|------------------------------------------------------------------|
| Fixed reader         | Label only states "TX"                                       |                                   | Unit used for TX mode tests                                      |
| Fixed reader         | Label only states "RX"                                       |                                   | Unit used for RX mode tests                                      |
| Antenna              | Hyperlink Technologies<br>Model WGEI900-0002<br>Gain: 14 dBi | No serial number printed on label |                                                                  |
| Passive PoE Injector | Hyperlink Technologies<br>Model BT-CAT5-P1                   | No serial number printed on label | Inject supplying DC power to the Fixed Reader via Ethernet Cable |

## 2.3 Additional software information about the EUT

During the tests the EUT supported the following software:

| Software  | Version | Comment                                                                        |
|-----------|---------|--------------------------------------------------------------------------------|
| CRUE-TRA1 | R1A     | Used to set the Fixed reader to continuously transmit at maximum output power. |
| CRUE-REC  | R1A     | Used to set the Fixed reader to continuously receive                           |

## 2.4 Peripheral equipment

Peripheral equipment is defined as equipment needed for correct operation of the EUT during the tests, but not included as a part of the testing and evaluation of the EUT.

| Equipment     | Manufacturer / Type                                                                           | Serial number                     |
|---------------|-----------------------------------------------------------------------------------------------|-----------------------------------|
| AC-DC adaptor | Nordic Power<br>Model:0052L-090050<br>Input: AC 100-240V 50/60Hz 180mA<br>Output: DC 9V 500mA | No serial number printed on label |

## 2.5 Modifications during the test

One reader unit was supplied from the manufacturer with software to continuously transmit at maximum output power. (Measurements called "TX mode" in this report)

One reader unit was supplied from the manufacturer with software to continuously receive. (Measurements called "RX mode" in this report)

No other modifications have been made during the tests



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### 3. TEST SPECIFICATIONS

#### 3.1 Standards

FCC 47 CFR part 15 (2005) Subpart B – Unintentional radiators  
FCC 47 CFR part 15 (2005) Subpart C – Intentional Radiators; §15.247 Operation within the bands 902-928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz.

Measurements methods according to ANSI C63.4-2003

RSS-210, Issue 6 (September 2005): Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment.

RSS-Gen, Issue 1 (September 2005): General Requirements and Information for the Certification of Radiocommunication Equipment.

#### 3.2 Additions, deviations and exclusions from standards

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

#### 3.3 Test set-up

Measurement set-ups for the test of conducted disturbance voltage in the frequency range 0,15-30 MHz and out-of-band spurious emissions test are described in corresponding sections. During other tests the EUT was connected to the spectrum analyser by cable.

#### 3.4 Operating environment

If not additionally specified, the tests were performed under the following environmental conditions:

Air temperature: 20 - 26 °C  
Relative humidity: 30 - 60 %



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#### 4. TEST SUMMARY

The results in this report apply only to the sample tested.

| FCC reference | Industry Canada reference | Test                                      | Result | Note |
|---------------|---------------------------|-------------------------------------------|--------|------|
| 15.247(b)     | A8.4(2)                   | Peak output power                         | PASS   | 1    |
| 15.247(a)     | A8.1(1)                   | 6 dB Bandwidth                            | PASS   | 1    |
| 15.247        | A8.1                      | Band edge compliance                      | PASS   | 1    |
| 15.247(e)     | A8.2                      | Power spectral density                    | PASS   | 1    |
| 15.247(d)     | 2.7, A2.9(1), A8.5        | Out of band spurious emissions, radiated  | PASS   | 1    |
| 15.247(d)     | 2.7, A8.5                 | Out of band spurious emissions, conducted | PASS   | 1    |
| 15B           | 6 (a)(Table1)             | Out of band spurious emissions, radiated  | PASS   | 2    |
| 15B           | 7.2.2 (Table 2)           | Conducted emission at AC port             | PASS   | 2    |

#### Notes:

1. Industry Canada reference: RSS-210, Issue 6 (September 2005)
2. Industry Canada reference: RSS-Gen, Issue 1 (September 2005)



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## 5. PEAK OUTPUT POWER

### 5.1 Test protocol

Date of test: 2006-07-07

EUT mode of operation: TX.

The peak output power was measured at the antenna port.

The EUT can be equipped with a 14dBi antenna. According to 15.247(b)(4) the limit of 30 dBm (1Watt) is reduced by 8 dB to 22 dBm since the antenna gain is 8 dB above 6 dBi.

Spectrum analyzer settings:

Span: 10 MHz

RBW: 3 MHz

VBW: 3 MHz

Sweep time: Auto

Detector: Peak

Trace: Max Hold

| Channel<br>(MHz) | Peak Output<br>Power<br>(dBm) | Limit<br>value<br>(dBm) |
|------------------|-------------------------------|-------------------------|
| 2440             | 2.2                           | 22                      |

Measurement results are corrected for attenuations in the set-up.

Example calculation:

Peak output power [dBm] = Analyser reading [dBm] + cable loss [dB] + attenuator loss [dB]



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**5.2 MPE calculations****Directives**

OET Bulletin 65, supplement C  
RSS 102 (Issue 2), November 2005

**Calculations**

EIRP = Peak Power to the Antenna port [dBm] + Maximum Antenna gain [dBi]

EIRP = 2,2 dBm + 14 dBi = 16,2 dBm = 42 mW

The product has a duty cycle (dc) of less than 40 % according to the manufacturer. The manual recommends that the operator is not closer than (r) 20 cm to the transmitter's antenna.

A worst case calculation is as follows:

$$S = \frac{4 \times dc \times EIRP}{4 \times \pi \times r^2} \quad (\text{Power density with 100 \% reflection})$$

$$S = 4 \times 0,4 \times 42 / (4 \times \pi \times 20^2) = 0,013 \text{ mW/cm}^2$$

Reference level limit according to OET Bulletin 65, supplement C and RSS 102 for power density at 2400 MHz is 1 mW/cm<sup>2</sup>.

Considering the calculations above it is determined that the requirements according to the referred directive are fulfilled without further testing.



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## 6. 6 dB BANDWIDTH

### 6.1 Test protocol

Date of test: 2006-06-02

EUT mode of operation: TX.

Spectrum analyzer settings:

Span: 25 MHz

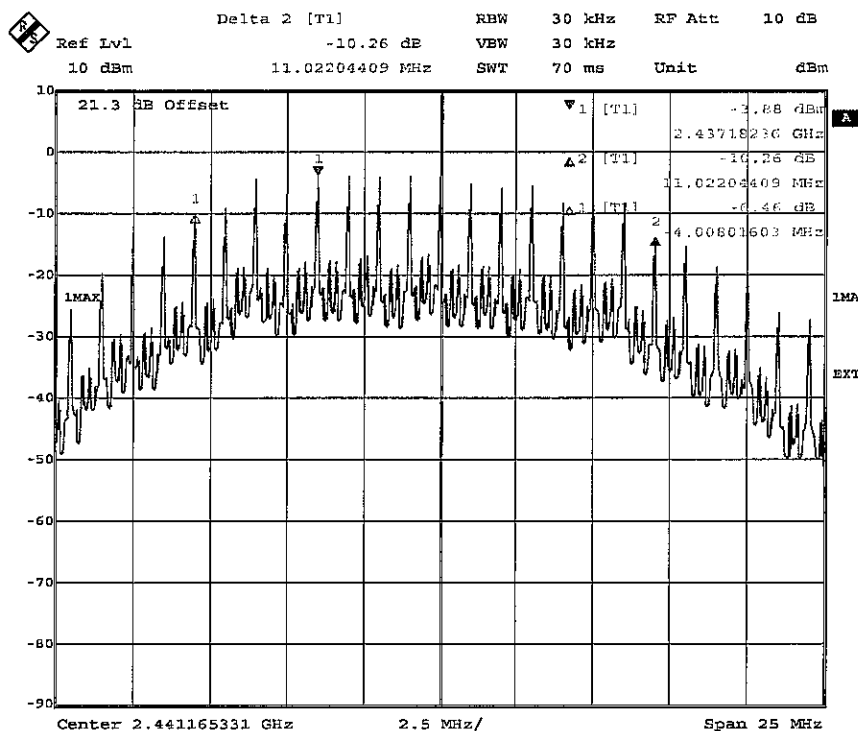
RBW: 30 kHz

VBW: 30 kHz

Sweep time: Auto

Detector: Peak

Trace: Max Hold



Date: 2.JUN.2006 11:17:28

| Channel (MHz) | 6 dB Bandwidth (MHz) | Limit value (kHz) |
|---------------|----------------------|-------------------|
| 2440          | 15,030               | >0,5              |



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## 7. BAND EDGE COMPLIANCE (CONDUCTED MEASUREMENTS)

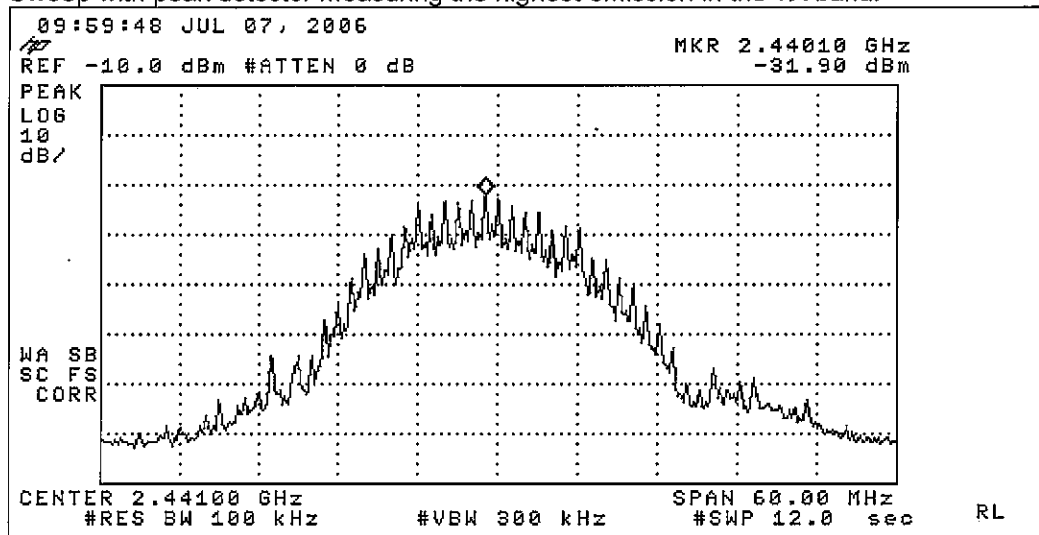
### 7.1 Test protocol

Date of test: 2006-07-07

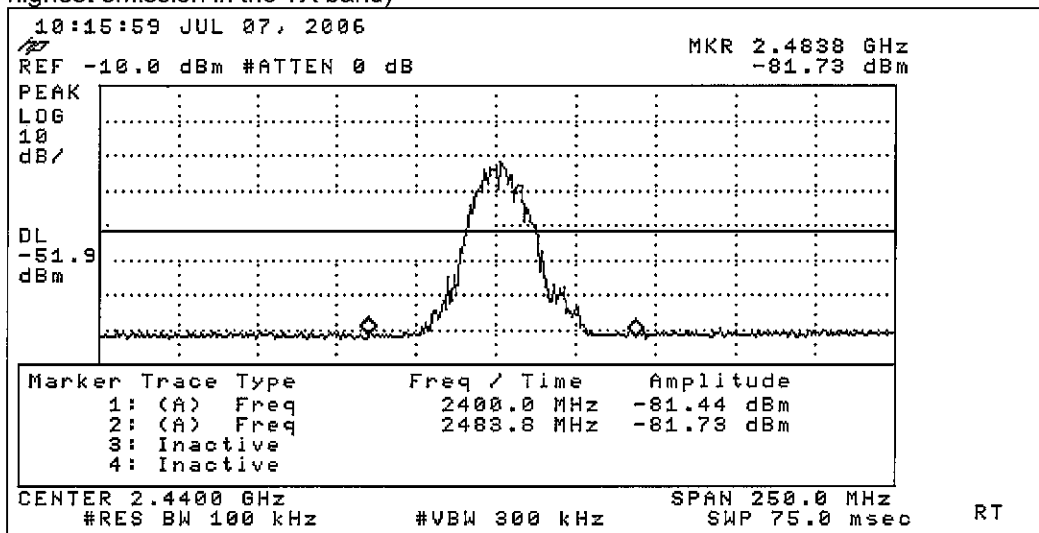
EUT mode of operation: TX

Measured with spectrum analyzer connected to the antenna port of th EUT.

Sweep with peak detector measuring the highest emission in the TX band.



Sweep with peak detector measuring emissions outside the TX band (limit line is 20dB below the highest emission in the TX band)



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## 11. POWER SPECTRAL DENSITY

### 11.1 Test protocol

Date of test: 2006-07-07

EUT mode of operation: TX.

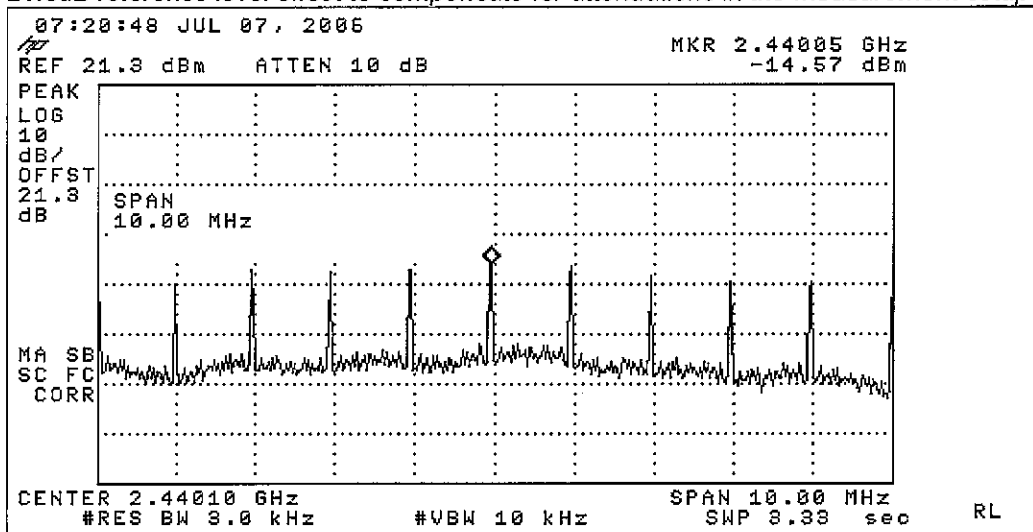
The power spectral density was measured at the antenna port with a spectrum analyzer.

Spectrum analyzer settings:

Span: 1 MHz  
 RBW: 3 kHz  
 VBW: 10 kHz  
 Sweep time: Auto  
 Detector: Peak  
 Trace: Max Hold

Plot

*21.3dB reference level offset to compensate for attenuations in the measurement setup*



| Channel<br>(MHz) | Peak Power Spectral<br>Density<br>(dBm) | Limit value<br>(dBm) |
|------------------|-----------------------------------------|----------------------|
| 2402             | -14,6                                   | < 8                  |

Measurement results are corrected for attenuations in the set-up configuration.

Example calculation:

Peak output power [dBm] = Analyser reading [dBm] + cable loss [dB] + attenuator loss [dB]



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## 12. RADIATED SPURIOUS EMISSIONS

### 12.1 Measurement uncertainty

Radiated disturbance electric field intensity, 30 – 1000 MHz:  $\pm 4,6$  dB

Radiated disturbance electric field intensity, 1000 – 18000 MHz:  $\pm 6,0$  dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT.

Measurement uncertainty is calculated in accordance with EA-4/02-1997.

The measurement uncertainty is given with a confidence of 95%.

### 12.2 Test equipment

| Equipment                                                                            | Manufacturer    | Type                | SEMKO No. |
|--------------------------------------------------------------------------------------|-----------------|---------------------|-----------|
| <i>Test site: Semi-anechoic shielded chamber, 10 x 20 x 8,5 m (W x L x H)</i>        |                 |                     | 30300     |
| Software:                                                                            | Rohde & Schwarz | ES-K1, V1.71        |           |
| Measurement receiver:                                                                | Rohde & Schwarz | ESAI                | 2973/2974 |
| Antenna amplifier:                                                                   | SEMKO           |                     | 7992/7993 |
| Antenna, bilog:                                                                      | Chase           | CBL6111A            | 971       |
| <i>Test site: Bluetooth anechoic shielded chamber, 3,7 x 7,0 x 2,4 m (W x L x H)</i> |                 |                     | 12285     |
| Software:                                                                            | Rohde & Schwarz | ES-K1, V1.70        |           |
| Signal analyser:                                                                     | Rohde & Schwarz | FSIQ 40             | 40023     |
| Preamplifier:                                                                        | MITEQ           | AFS6/AFS44          | 12335     |
| Antennas:                                                                            |                 |                     |           |
| Double Ridge Guide Horn:                                                             | EMCO            | 3115                | 4936      |
| Horn antenna:                                                                        | EMCO            | 3160-08             | 30099     |
| Horn antenna:                                                                        | EMCO            | 3160-09             | 30101     |
| Band rejection filter                                                                | K & L           | 6N45-2450/T 100-0/0 | 12389     |
| Transformer                                                                          | Tufvassons      | AFM-1500            | 30317     |



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### 12.3 Measurement set-up

#### Test site: Semi-anechoic shielded chamber (30 – 1000 MHz)

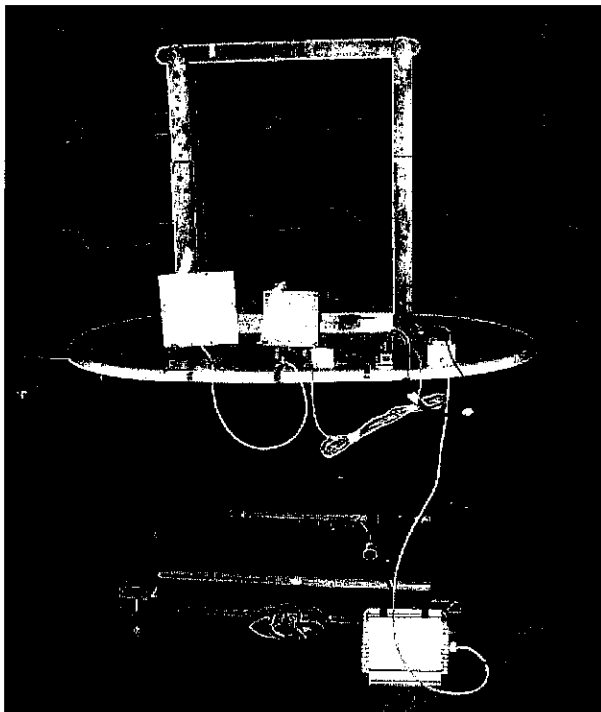
The radiated disturbance electric field intensity was measured in a semi-anechoic chamber at a distance of 10 m and the EUT was placed on a non-metallic table, 0,8 m above the reference ground plane. The specified test mode was enabled. Test set-up photos are given below.

An overview sweep with peak detection of the electric field intensity was performed with the measurement receiver in max-hold and with the antenna placed 1,5 m, 2,5 m and 3,5 m above the floor. The polarisation was horizontal and vertical. The measurements were repeated with the EUT rotated in 90-degree steps.

At the frequencies where high disturbance levels were found a search for max disturbance level was performed. With the EUT and antenna in the worst-case configuration new measurements with quasi-peak detector were carried out.

The EUT was supplied with 120 V AC (60 Hz) during the test.

Test set-up photo:



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Test site: Bluetooth anechoic shielded chamber (1 – 26 GHz)

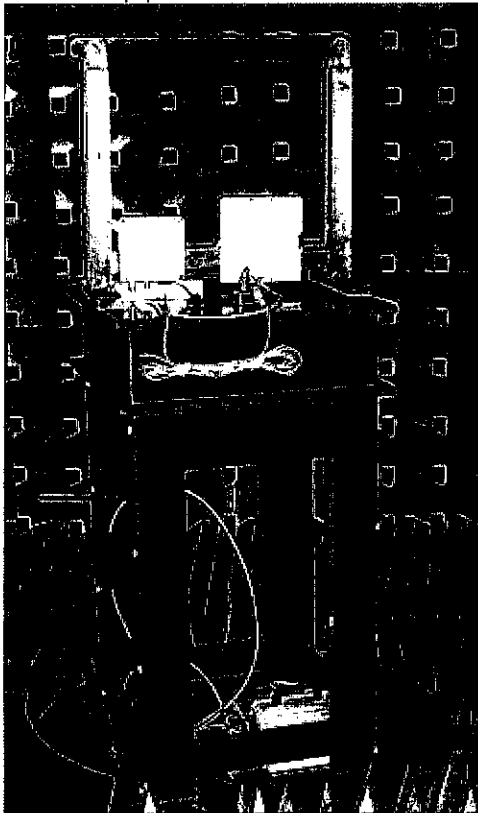
In the Bluetooth anechoic chamber the EUT was placed on a non-metallic table, 1,4 m above the floor. The radiated disturbance electric field intensity was measured at a distance of 3 m. The specified test mode was enabled.

An overview sweep with peak detection of the electric field intensity was performed with the spectrum analyser in max-hold and with the antenna height adjusted at the level of the EUT center. The polarisation was horizontal and vertical. The measurements were repeated with the EUT rotated in 90-degree steps.

At the frequencies where high disturbance levels were found a search for max disturbance level was performed. With the EUT and antenna in the worst-case configuration new measurements with peak and average detectors were carried out.

The EUT was supplied by 120 V AC (50 Hz) during the test.

Test set-up photo:



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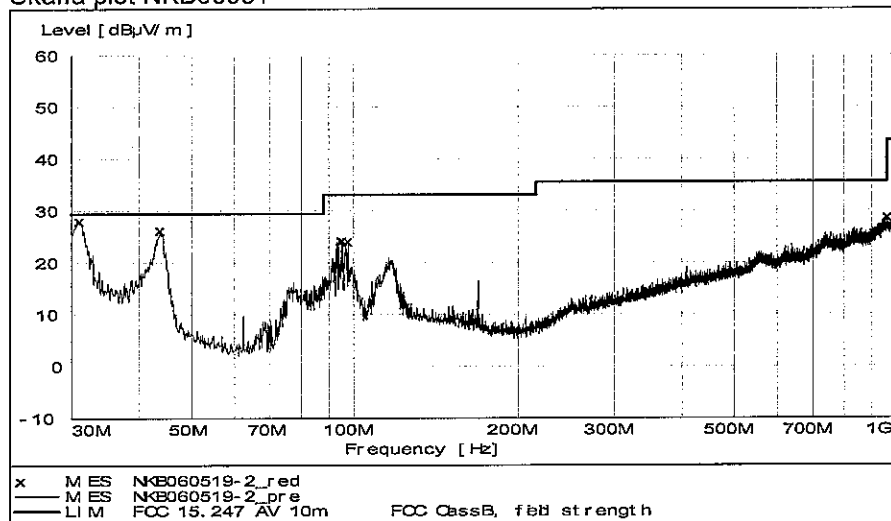
## 12.4 Test protocol

### Semi-anechoic shielded chamber

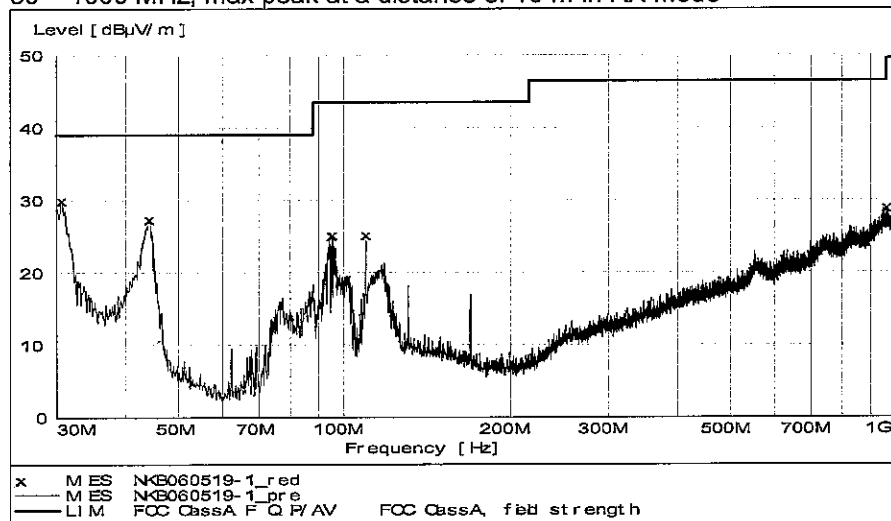
Date of test: 2006-05-19

30 – 1000 MHz, max peak at a distance of 10 m in TX mode

Skaffa plot NKB06051



30 – 1000 MHz, max peak at a distance of 10 m in RX mode



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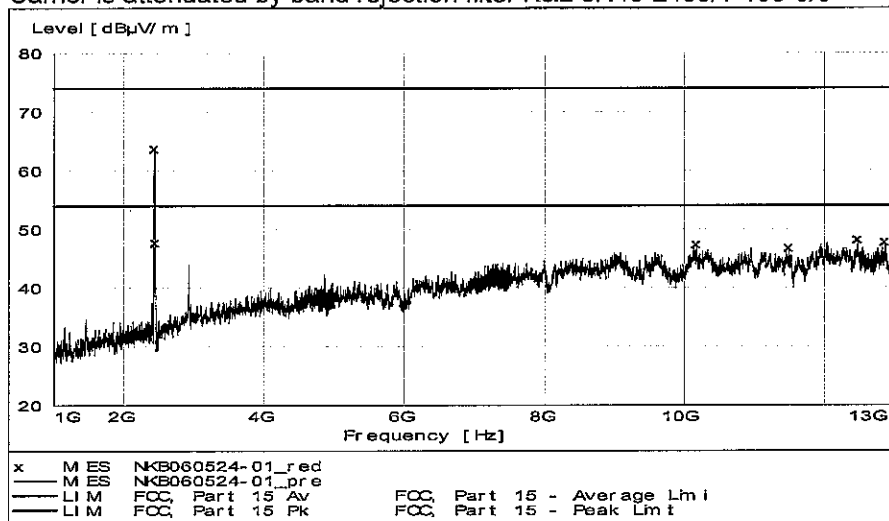
Registered in Sweden: No SE556024059901, Registered office: As address

Bluetooth anechoic shielded chamber

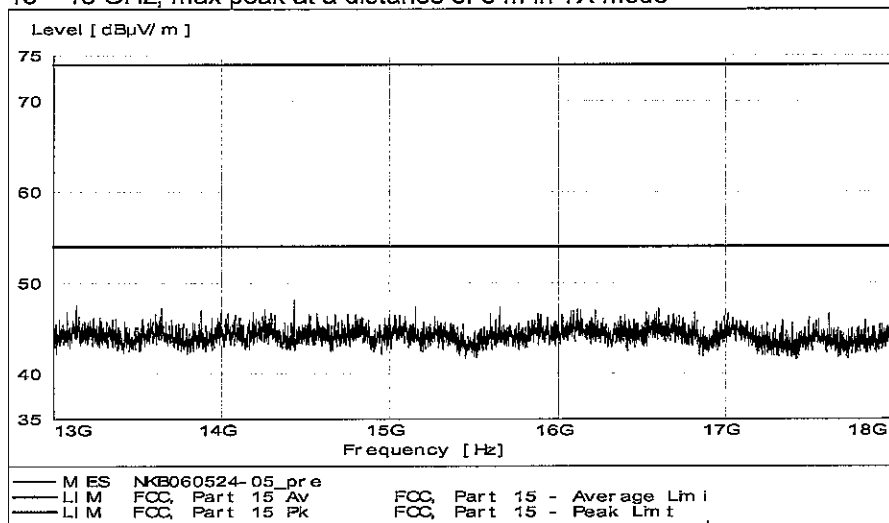
Date of test: 2006-05-24

1000 – 13000 MHz, max peak at a distance of 3 m in TX mode

Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0



13 – 18 GHz, max peak at a distance of 3 m in TX mode



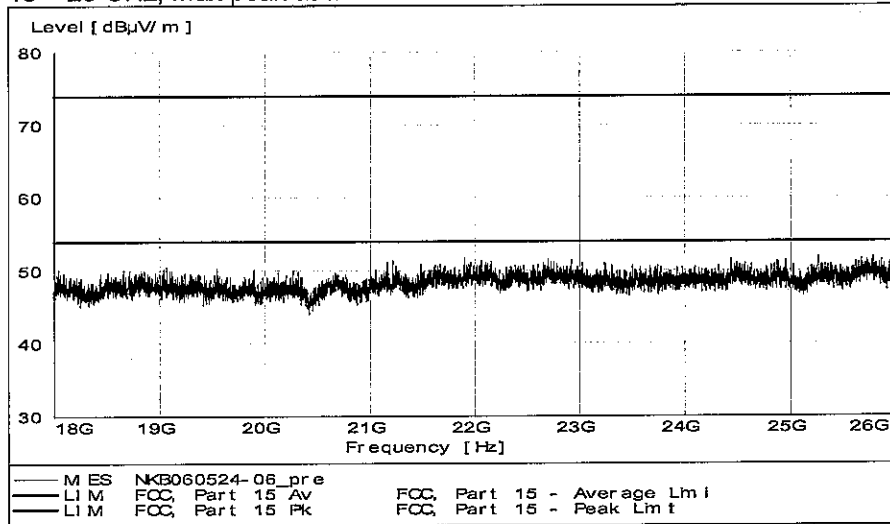
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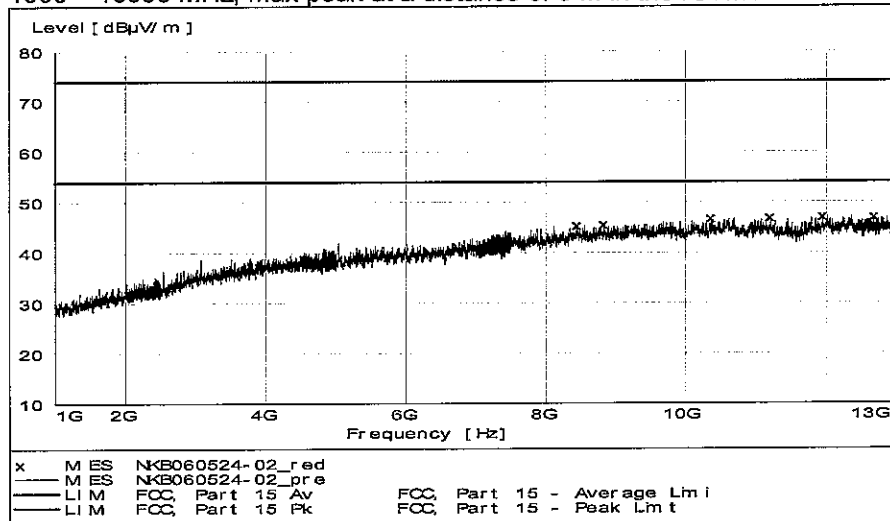
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18 – 26 GHz, max peak at a distance of 3 m on the lower TX channel



1000 – 13000 MHz, max peak at a distance of 3 m in the RX mode



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Data summary (TX mode)

| Field strength of spurious emissions |              |                    |                     |                    |                     |               |
|--------------------------------------|--------------|--------------------|---------------------|--------------------|---------------------|---------------|
| Frequency<br>[MHz]                   | RBW<br>[kHz] | Measured level     |                     | Limit              |                     | Note          |
|                                      |              | Peak<br>[dB(μV/m)] | QP/AV<br>[dB(μV/m)] | Peak<br>[dB(μV/m)] | QP/AV<br>[dB(μV/m)] |               |
| 31,1                                 | 120          | -                  | 21,2                | -                  | 29,5                | 10 m distance |
| 43,7                                 | 120          | -                  | 19,4                | -                  | 29,5                | 10 m distance |
| 95,5                                 | 120          | -                  | 20,7                | -                  | 33                  | 10 m distance |
| 97,7                                 | 120          | -                  | 21,0                | -                  | 33                  | 10 m distance |
| 216 – 960                            | 120          | < 28               | -                   | -                  | 35,6                | Noise floor   |
| 960 – 1000                           | 120          | < 29               | -                   | -                  | 43,5                | Noise floor   |
| 2928,4                               | 1000         | 46,9               | -                   | 74                 | 54                  | 3 m distance  |
| 4869,3                               | 1000         | 44,1               | -                   | 74                 | 54                  | 3 m distance  |
| 4880,9                               | 1000         | 43,8               | -                   | 74                 | 54                  | 3 m distance  |
| 4892,2                               | 1000         | 42,7               | -                   | 74                 | 54                  | 3 m distance  |
| 13000 – 18000                        | 1000         | < 48               | -                   | 74                 | 54                  | Noise floor   |
| 18000 – 26000                        | 1000         | < 52               | -                   | 74                 | 54                  | Noise floor   |

Data summary (RX mode)

| Field strength of spurious emissions |              |                    |                     |                    |                     |                               |
|--------------------------------------|--------------|--------------------|---------------------|--------------------|---------------------|-------------------------------|
| Frequency<br>[MHz]                   | RBW<br>[kHz] | Measured level     |                     | Limit*             |                     | Note                          |
|                                      |              | Peak<br>[dB(μV/m)] | QP/AV<br>[dB(μV/m)] | Peak<br>[dB(μV/m)] | QP/AV<br>[dB(μV/m)] |                               |
| 30,7                                 | 120          | -                  | 22,0                | -                  | 39,1                | 10 m distance                 |
| 44,3                                 | 120          | -                  | 20,0                | -                  | 39,1                | 10 m distance                 |
| 94,2                                 | 120          | -                  | 22,1                | -                  | 39,1                | 10 m distance                 |
| 110,0                                | 120          | -                  | 24,1                | -                  | 43,5                | 10 m distance                 |
| 960 – 1000                           | 120          | < 29               | -                   | -                  | 49,5                | 10 m distance,<br>Noise floor |
| 1000 – 13000                         | 1000         | < 48               | -                   | 80                 | 60                  | 3 m distance,<br>noise floor  |

\* The limit is for Class A equipment.

Example calculation:

Measured level [dBμV/m] = Analyser reading [dBμV] + cable loss [dB] – preamplifier gain [dB] + antenna factor [1/m]



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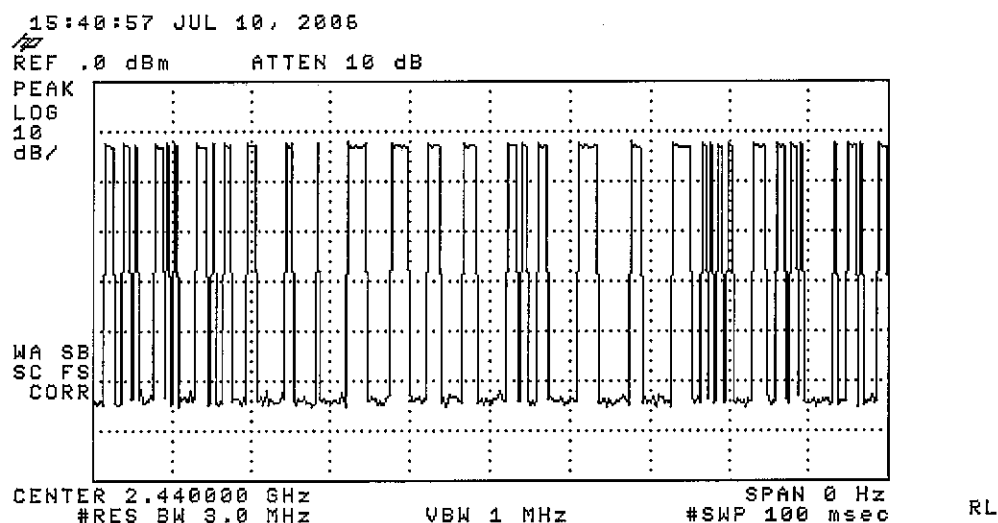
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## 12.5 Duty cycle calculations

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEEP function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display:



Counting the ON and OFF samples in this sweep gives a 39,15 % duty cycle.

This gives a correction factor of  $20 * \log_{10} ( 0,3915 ) \text{ dB} = - 8,2 \text{ dB}$



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### 13. CONDUCTED SPURIOUS EMISSIONS AT ANTENNA PORT

#### 13.1 Measurement uncertainty

Measurement uncertainty for conducted disturbances at the antenna port:  $\pm 3,6$  dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT. Measurement uncertainty is calculated in accordance with EA-4/02-1997. The uncertainty is given with a level of confidence of approximately 95% ( $k=2$ ).

#### 13.2 Test protocol

Date of test: 2006-07-07

| Strength of conducted spurious emissions |           |                           |              |             |
|------------------------------------------|-----------|---------------------------|--------------|-------------|
| Frequency [MHz]                          | RBW [kHz] | Measured peak level [dBm] | Limit* [dBm] | Note        |
| 30 - 500                                 | 100       | < -83                     | -51,9        | Noise floor |
| 500 - 1000                               | 100       | < -83                     | -51,9        | Noise floor |
| 1000 - 2000                              | 100       | < -82                     | -51,9        | Noise floor |
| 2000 - 2400                              | 100       | < -82                     | -51,9        | Noise floor |
| 2483,5 - 2700                            | 100       | < -80                     | -51,9        | Noise floor |
| 2700 - 5000                              | 100       | < -80                     | -51,9        | Noise floor |
| 5000 - 10000                             | 100       | < -74                     | -51,9        | Noise floor |
| 10000 - 15000                            | 100       | < -71                     | -51,9        | Noise floor |
| 15000 - 20000                            | 100       | < -66                     | -51,9        | Noise floor |
| 20000 - 25000                            | 100       | < -65                     | -51,9        | Noise floor |

\* Measured level of emission in the operating frequency band is equal to -18,4 dBm.

**Limit:** In any 100 kHz bandwidth outside the operating frequency band (2400 – 2483,5 MHz), 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.

Measurement results are corrected for attenuation in the set-up configuration and antenna gain declared by the manufacturer.

Example calculation:

Measured level [dB( $\mu$ V)] = Analyser reading [dB( $\mu$ V)] + cable loss [dB] + EUT antenna gain [dBi]



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**14. CONDUCTED DISTURBANCE VOLTAGE IN THE FREQUENCY RANGE 0,15 - 30 MHZ****14.1 Measurement uncertainty**

Conducted disturbance voltage, quasi-peak detection:  $\pm 2,0$  dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT.

Measurement uncertainty is calculated in accordance with EA-4/02-1997.

The measurement uncertainty is given with a confidence of 95%.

**14.2 Test equipment**

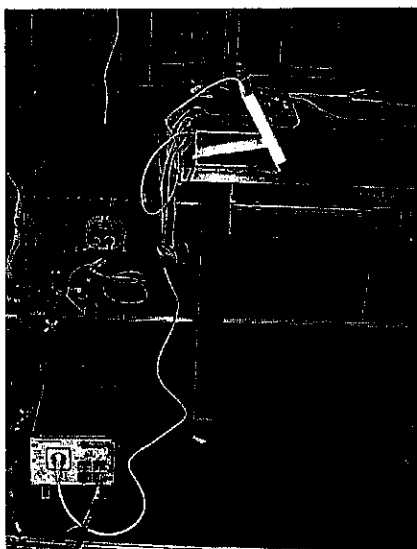
Test site: FCC

| Equipment                 | Manufacturer    | Type        | SEMKO No. |
|---------------------------|-----------------|-------------|-----------|
| Software:                 | Rohde & Schwarz | ES-K1 V1.60 |           |
| Measurement receiver:     | Rohde & Schwarz | ESHS 30     | 4946      |
| Artificial mains network: | Rohde & Schwarz | ESH3-Z5     | 2727      |
| Transformer               | Tufvassons      | AFM-1500    | 30317     |

**14.3 Measurement set-up**

The mains terminal disturbance voltage was measured with the EUT located 0,8 m above the ground plane and 0,4 m from the vertical ground plane. The EUT was connected to an artificial mains network (AMN). The AMN was placed on the ground plane. Amplitude measurements were performed with a quasi-peak detector. The EUT was supplied by 120 VAC (60 Hz) during the test.

Test set-up photo:



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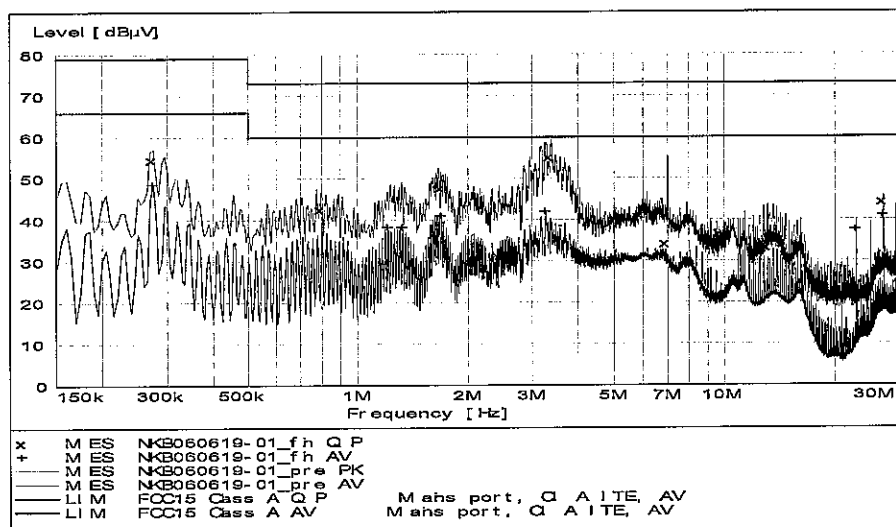
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#### 14.4 Test protocol

Date of test: 2006-06-19

| Frequency<br>/MHz | Quasi-Peak                      |                               |
|-------------------|---------------------------------|-------------------------------|
|                   | Disturbance<br>Level<br>/dB(μV) | Permitted<br>limit<br>/dB(μV) |
| 0,275             | 54,7                            | 79                            |
| 0,800             | 42,6                            | 73                            |
| 1,695             | 47,7                            | 73                            |
| 3,370             | 55,1                            | 73                            |
| 6,960             | 34,2                            | 73                            |
| 13,125            | 33,3                            | 73                            |
| 27,160            | 44,2                            | 73                            |

Overview sweeps performed with peak and average detectors



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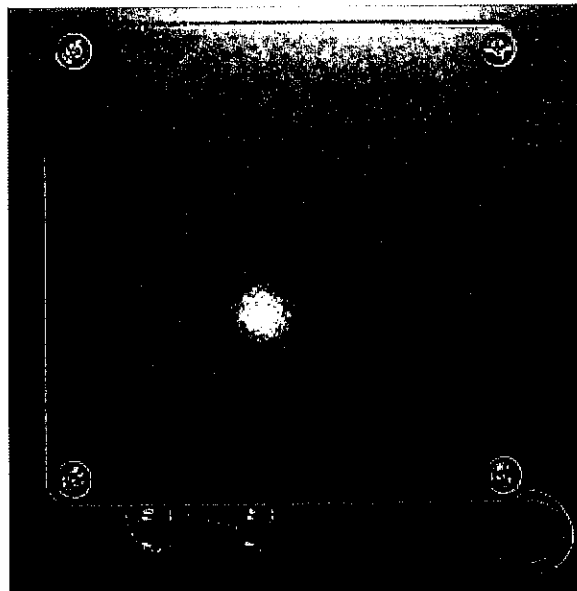
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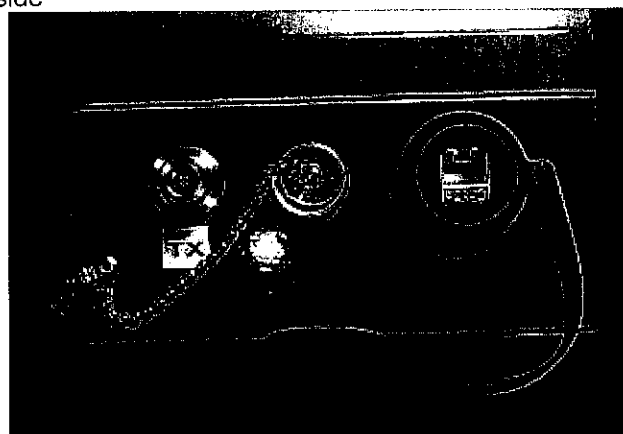
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**APPENDIX I – PHOTOS OF THE EUT**

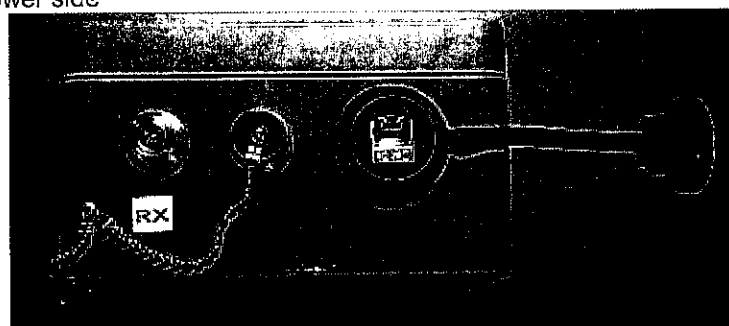
EUT, front side



EUT (TX unit), lower side



EUT (RX unit), lower side



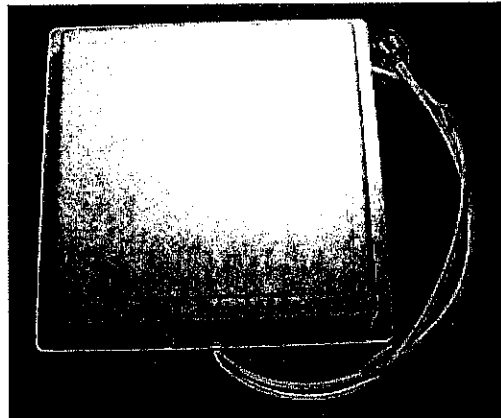
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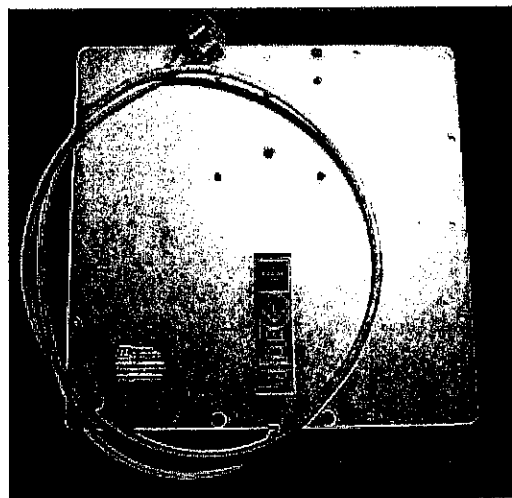
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Antenna, front side



Antenna, back side



Antenna, identification label



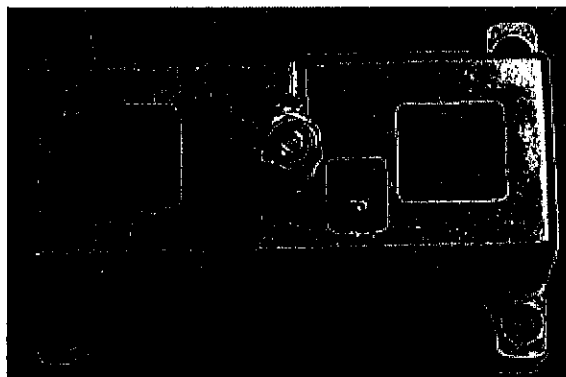
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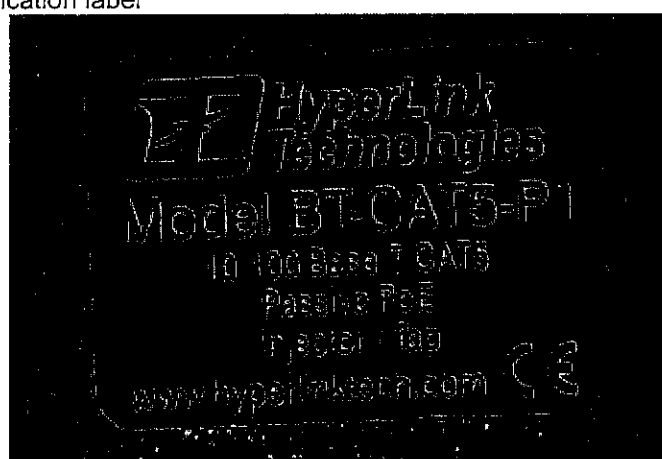
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PoE Injector



PoE Injector, identification label



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