InterLab®

# Final Report on

# ELF

**Report Reference:** MDE_DATAL_1103_FCCa

acc. Title 47 CFR chapter I part 15 subpart B

**Date:** July 01, 2011

**Test Laboratory:**

7 layers AG
Borsigstr. 11
40880 Ratingen
Germany

DGA-PL-192/99-02



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Borsigstrasse 11
40880 Ratingen, Germany
Phone: +49 (0) 2102 749 0
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www.7Layers.com

# 1 Administrative Data

## 1.1 Project Data

| | |
|---|---|
| *Project Responsible:* | Carsten Steinröder |
| *Date Of Test Report:* | 2011/07/01 |
| *Date of first test:* | 2011/06/14 |
| *Date of last test:* | 2011/06/27 |

## 1.2 Applicant Data

*Company Name:* Datalogic Mobile s.r.l.

| | |
|---|---|
| *Street:* | Via S. Vitalino, 13<br>Lippo di Calderara di Reno |
| *City:* | 40012 Bologna |

*Contact Person:* Mr. Davide E. Vaccaneo

| | |
|---|---|
| *Function:* | Supervisor |
| *Department:* | Regulatory & Reliability |
| *Phone:* | +39 051 314 72 16 |
| *Fax:* | +39 051 314 75 61 |
| *E-Mail:* | davide.vaccaneo@datalogic.com |

## 1.3 Test Laboratory Data

The following list shows all places and laboratories involved for test result generation:

**7 layers DE**

| | |
|---|---|
| *Company Name :* | 7 layers AG |
| *Street :* | Borsigstrasse 11 |
| *City :* | 40880 Ratingen |
| *Country :* | Germany |
| *Contact Person :* | Mr. Michael Albert |
| *Phone :* | +49 2102 749 201 |
| *Fax :* | +49 2102 749 444 |
| *E Mail :* | michael.albert@7Layers.de |

### Laboratory Details

| *Lab ID* | *Identification* | *Responsible* | *Accreditation Info* |
|---|---|---|---|
| Lab 1 | Conducted Emissions | Mr. Robert Machulec<br>Mr. Andreas Petz | DAR-Registration no. DGA-PL-192/99-02 |
| Lab 2 | Radiated Emissions | Mr. Robert Machulec<br>Mr. Andreas Petz | DAR-Registration no. DGA-PL-192/99-02 |

## 1.4 Signature of the Testing Responsible

Carsten Steinröder
responsible for tests performed in: Lab 1, Lab 2

7 layers AG, Borsigstr. 11
40880 Ratingen, Germany
Phone +49 (0)2102 749 0

## 1.5 Signature of the Accreditation Responsible

B. Retka [B. RETKA]

Accreditation scope responsible person
responsible for Lab 1, Lab 2

# 2 Test Object Data

## 2.1 General OUT Description

The following section lists all OUTs (Object's Under Test) involved during testing.

**OUT: ELF**

| | |
|---|---|
| *Product Category:* | Handheld Device |

***Manufacturer:***

| | |
|---|---|
| *Company Name:* | see applicant data |
| *Contact Person:* | see applicant |

***Parameter List:***

| *Parameter name* | *Value* |
|---|---|

**Ancillary Equipment: ELF Docking station**

***Manufacturer:***

| | |
|---|---|
| *Company Name:* | Please see applicant data |
| *Contact Person:* | . |

**Ancillary Equipment: Power Supply for Cradle 120V / 5V**

***Manufacturer:***

| | |
|---|---|
| *Company Name:* | Please see applicant data |
| *Contact Person:* | . |

**Ancillary Equipment: USB cable (Micro USB to USB)**

***Manufacturer:***

| | |
|---|---|
| *Company Name:* | Please see applicant data |
| *Contact Person:* | . |

**Ancillary Equipment: USB Power Supply 120V / 5V**

***Manufacturer:***

| | |
|---|---|
| *Company Name:* | Please see applicant data |
| *Contact Person:* | . |

## 2.2 Detailed Description of OUT Samples

**Sample : a01**

| | | | |
|---|---|---|---|
| *OUT Identifier* | ELF | | |
| *Sample Description* | ELF RTC | | |
| *Serial No.* | D11E00191 | | |
| *HW Status* | 2.0 | | |
| *SW Status* | 1.60 | | |
| *Date of Receipt* | 2011/06/01 | | |
| *Nominal Voltage* | 120 V | *Normal Temp.* | 20 °C |

**Sample : ACC01**

| | |
|---|---|
| *OUT Identifier* | Power Supply for Cradle 120V / 5V |
| *Sample Description* | PHIHONG PSA15R-050P |
| *Serial No.* | D10N12809 |
| *Date of Receipt* | 2011/06/01 |

**Sample : ACU01**

| | |
|---|---|
| *OUT Identifier* | USB Power Supply 120V / 5V |
| *Sample Description* | PHIHONG PSM08R-050 |
| *Serial No.* | D10N12809 |
| *Date of Receipt* | 2011/06/01 |

**Sample : DOC01**

| | |
|---|---|
| *OUT Identifier* | ELF Docking station |
| *Sample Description* | Docking Single Slot. ELF |
| *Serial No.* | D10N12809 |
| *Date of Receipt* | 2011/06/01 |

**Sample : USB01**

| | |
|---|---|
| *OUT Identifier* | USB cable (Micro USB to USB) |
| *Sample Description* | USB cable |
| *Date of Receipt* | 2011/06/01 |

## 2.3 OUT Features

**Features for OUT: ELF**

| *Designation* | *Description* | *Allowed Values* | *Supported Value(s)* |
|---|---|---|---|
| **Features for scope: FCC_v2** | | | |
| AC | The OUT is powered by or connected to AC Mains | | |
| BT | EUT supports Bluetooth data rate of 1 Mbps with GFSK modulation in the band 2400 MHz - 2483.5 MHz | | |
| EDR2 | EUT supports Bluetooth using data rate of 2 Mbps with PI/4 DQPSK modulation in the band 2400 MHz - 2483.5 MHz | | |
| EDR3 | EUT supports Bluetooth using data rate of 3 Mbps with 8DPSK modulation in the band 2400 MHz - 2483.5 MHz | | |
| Iant | Integral Antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment | | |
| Wa1 | EUT supports WLAN in mode a in the band 5150 MHz - 5250 MHz | | |
| Wa2 | EUT supports WLAN in mode a in the band 5250 MHz - 5350 MHz | | |
| Wa3 | EUT supports WLAN in mode a in the band 5470 MHz - 5725 MHz | | |
| Wa5 | EUT supports WLAN in mode a in the band 5725 MHz - 5850 MHz | | |
| Wb | EUT supports WLAN in mode b in the band 2400 MHz - 2483.5 MHz | | |
| Wg | EUT supports WLAN in mode g in the band 2400 MHz - 2483.5 MHz | | |
| WLAN | EUT supports WLAN channels 2412 MHz - 2462 MHz. | | |

## 2.4 Auxiliary Equipment

| *AE No.* | *Type Designation* | *Serial No.* | *HW Status* | *SW Status* | *Description* |
|---|---|---|---|---|---|
| AE 05 | CHERRY RS 6000 | G 0000273 2P28 | | | Keyboard 1 |
| AE 01 | LG Flatron L1740BQ | 509WANF1W607 | | | TFT 1 |
| AE 04 | Logitech M-BB48 | LZC90505478 | | | Mouse |
| AE 03 | Toshiba PA3378E-3AC3 | G71C0006R310 | | | AC Adapter 1 |
| AE 02 | Toshiba TECRA M9 | 87060248H | | | Laptop 1 |

## 2.5 Operating Mode(s)

| *Ref.-No.* | *Description* |
|---|---|
| 1 | Bluetooth TX at 2441 MHz / 1Mbit and WLAN TX at 2437 MHz / 6Mbit, charging of internal battery |

## 2.6 Setups used for Testing

For each setup a relation is given to determine if and which samples and auxiliary equipment is used. The left side list all OUT samples and the right side lists all auxiliary equipment for the given setup.

| *Setup No.* | *List of OUT samples* | | *List of auxiliary equipment* | |
|---|---|---|---|---|
| | *Sample No.* | *Sample Description* | *AE No.* | *AE Description* |
| **A01_FCC_15b_AC** | **(EUT + USB Power Supply (direct connection to AC mains))** | | | |
| | *Sample:* ACU01 | PHIHONG PSM08R-050 | | |
| | *Sample:* a01 | ELF RTC | | |
| **A01_FCC_15b_PC1** | **(EUT + AC/DC Adapter of Cradle, USB & RS-232 connection to PC)** | | | |
| | *Sample:* ACC01 | PHIHONG PSA15R-050P | AE 05 | Keyboard 1 |
| | *Sample:* DOC01 | Docking Single Slot. ELF | AE 01 | TFT 1 |
| | *Sample:* USB01 | USB cable | AE 04 | Mouse |
| | *Sample:* a01 | ELF RTC | AE 03 | AC Adapter 1 |
| | | | AE 02 | Laptop 1 |
| **A01_FCC_15b_PC2** | **(EUT + USB connection to PC (charging via USB))** | | | |
| | *Sample:* USB01 | USB cable | AE 05 | Keyboard 1 |
| | *Sample:* a01 | ELF RTC | AE 01 | TFT 1 |
| | | | AE 04 | Mouse |
| | | | AE 03 | AC Adapter 1 |
| | | | AE 02 | Laptop 1 |

# 3 Results

## 3.1 General

**Documentation of tested devices:** Available at the test laboratory.

**Interpretation of the test results:** The results of the inspection are described on the following pages, where 'Conformity' or 'Passed' means that the certification criteria were verified and that the tested device is conform to the applied standard.

In cases where 'Declaration' is printed, the required documents are available in the manufacturers product documentation.

In cases where 'not applicable' is printed, the test case requirements are not relevant to the specific equipment implementation.

## 3.2 List of the Applicable Body

(Body for Scope: FCC_v2)

| *Designation* | *Description* |
|---|---|
| FCC47CFRChIPART15bRADIO FREQUENCY DEVICES | Part 15, Subpart B - Unintentional Radiators |

## 3.3 List of Test Specification

| | |
|---|---|
| *Test Specification:* | **FCC part 2 and 15** |
| *Version* | 10-1-10 Edition |
| *Title:* | PART 2 - GENERAL RULES AND REGULATIONS<br>PART 15 - RADIO FREQUENCY DEVICES |

## 3.4 Summary

| *Test Case Identifier / Name*<br>*Test (condition)* | *Result* | *Date of Test* | *Lab Ref.* | *Setup* |
|---|---|---|---|---|
| **15b.1 Conducted Emissions (AC Power Line) §15.107** | | | | |
| 15b.1; Mode = transmit | Passed | 2011/06/27 | Lab 1 | A01_FCC_15b_AC |
| | operating mode: 1 | | | |
| | Passed | 2011/06/27 | Lab 1 | A01_FCC_15b_PC1 |
| | operating mode: 1 | | | |
| | Passed | 2011/06/14 | Lab 1 | A01_FCC_15b_PC2 |
| | operating mode: 1 | | | |
| **15b.2 Spurious Radiated Emissions §15.109** | | | | |
| 15b.2; Mode = transmit | Passed | 2011/06/15 | Lab 2 | A01_FCC_15b_AC |
| | operating mode: 1 | | | |
| | Passed | 2011/06/15 | Lab 2 | A01_FCC_15b_PC2 |
| | operating mode: 1 | | | |
| | Passed | 2011/06/15 | Lab 2 | A01_FCC_15b_PC1 |
| | operating mode: 1 | | | |

## 3.5 Detailed Results

### 3.5.1 15b.1 Conducted Emissions (AC Power Line) §15.107

**Test1: 15b.1; Mode = transmit**

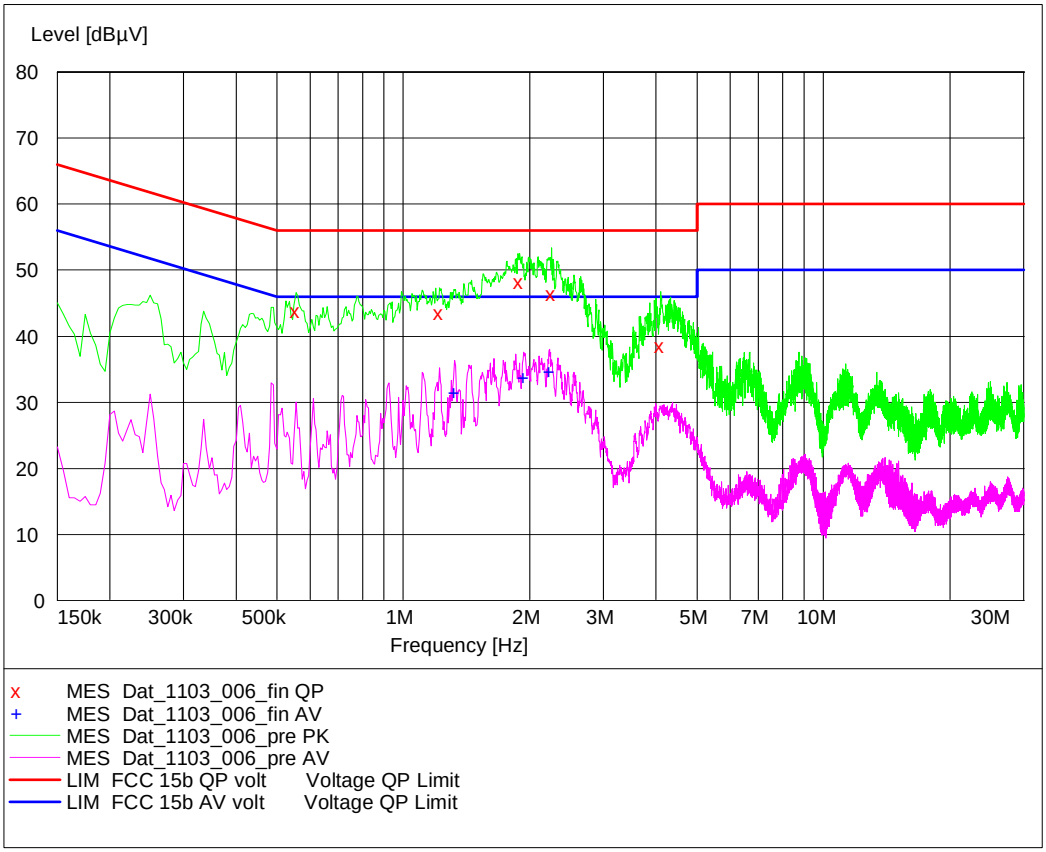
| | |
|---|---|
| *Result:* | Passed |
| *Setup No.:* | A01_FCC_15b_PC2 |
| *Date of Test:* | 2011/06/14 6:04 |
| *Body:* | FCC47CFRChIPART15bRADIO FREQUENCY DEVICES |
| *Test Specification:* | FCC part 2 and 15 |

**Detailed Results:**

***AC MAINS CONDUCTED***
EUT: ELF RTC (EX001a01) / 14.06.2011
Manufacturer: Datalogic
Operating Condition: BT local TX on 2441MHz BDR; WLAN local TX on 2437MHz 6Mbps
Test Site: 7 layers Ratingen
Operator: Doe
Test Specification: ANSI C63.4; FCC 15.107 / 15.207
Comment:
Start of Test: 14.06.2011 / 14:50:20

***SCAN TABLE: "FCC Voltage"***

| Short Description: | | | FCC Voltage | | | |
|---|---|---|---|---|---|---|
| Start Frequency | Stop Frequency | Step Width | Detector | Meas. Time | IF Bandw. | Transducer |
| 150.0 kHz | 30.0 MHz | 5.0 kHz | MaxPeak<br>Average | 20.0 ms | 9 kHz | ESH3-Z5 |




***MEASUREMENT RESULT: "Dat_1103_006_fin QP"***

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Line | PE |
|---|---|---|---|---|---|---|
| 0.555000 | 43.90 | 9.9 | 56 | 12.1 | N | GND |
| 1.220000 | 43.60 | 10.0 | 56 | 12.4 | N | GND |
| 1.890000 | 48.20 | 10.1 | 56 | 7.8 | N | GND |
| 2.255000 | 46.40 | 10.1 | 56 | 9.6 | L1 | GND |
| 4.095000 | 38.60 | 10.3 | 56 | 17.4 | N | GND |

***MEASUREMENT RESULT: "Dat_1103_006_fin AV"***

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Line | PE |
|---|---|---|---|---|---|---|
| 1.325000 | 31.50 | 10.1 | 46 | 14.5 | L1 | GND |
| 1.935000 | 33.70 | 10.1 | 46 | 12.3 | L1 | GND |
| 2.230000 | 34.60 | 10.1 | 46 | 11.4 | L1 | GND |

**Test1: 15b.1; Mode = transmit**

| | |
|---|---|
| *Result:* | Passed |
| *Setup No.:* | A01_FCC_15b_PC1 |
| *Date of Test:* | 2011/06/27 6:06 |
| *Body:* | FCC47CFRChIPART15bRADIO FREQUENCY DEVICES |
| *Test Specification:* | FCC part 2 and 15 |

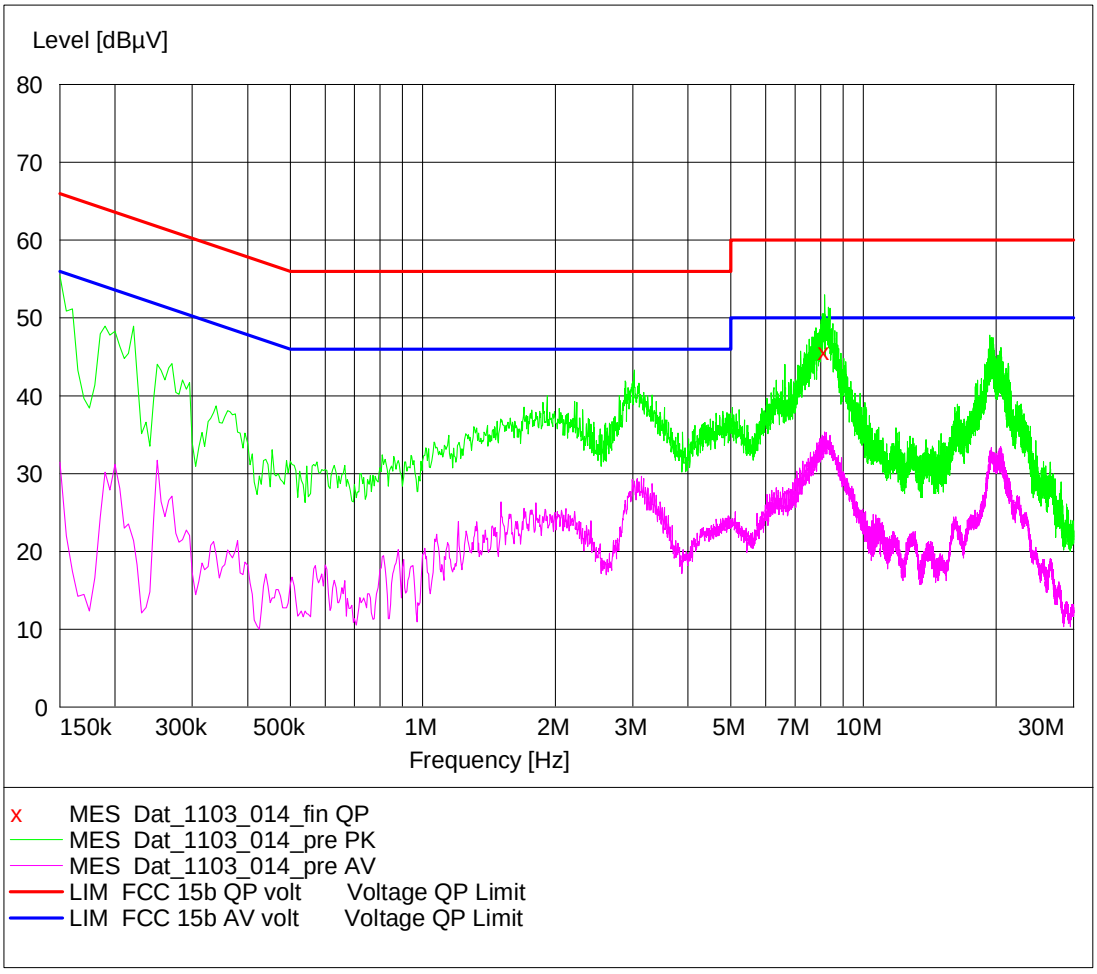
**Detailed Results:**

***AC MAINS CONDUCTED***

```
EUT:                  ELF RTC (EX001a01) / 27.06.2011
Manufacturer:         Datalogic
Operating Condition:  BT local TX on 2441MHz BDR; WLAN local TX on 2437MHz 6Mbps
Test Site:            7 layers Ratingen
Operator:             Gal
Test Specification:   ANSI C63.4; FCC 15.107 / 15.207
Comment:
Start of Test:        27.06.2011 / 13:23:02
```

***SCAN TABLE: "FCC Voltage"***

```
Short Description:              FCC Voltage
Start       Stop        Step        Detector   Meas.     IF       Transducer
Frequency   Frequency   Width                  Time      Bandw.
150.0 kHz   30.0 MHz    5.0 kHz     MaxPeak    20.0 ms   9 kHz    ESH3-Z5
                                    Average
```




***MEASUREMENT RESULT: "Dat_1103_014_fin QP"***

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Line | PE |
|---|---|---|---|---|---|---|
| 8.175000 | 45.70 | 10.3 | 60 | 14.3 | N | GND |

**Test1: 15b.1; Mode = transmit**

| | |
|---|---|
| *Result:* | Passed |
| *Setup No.:* | A01_FCC_15b_AC |
| *Date of Test:* | 2011/06/27 6:07 |
| *Body:* | FCC47CFRChIPART15bRADIO FREQUENCY DEVICES |
| *Test Specification:* | FCC part 2 and 15 |

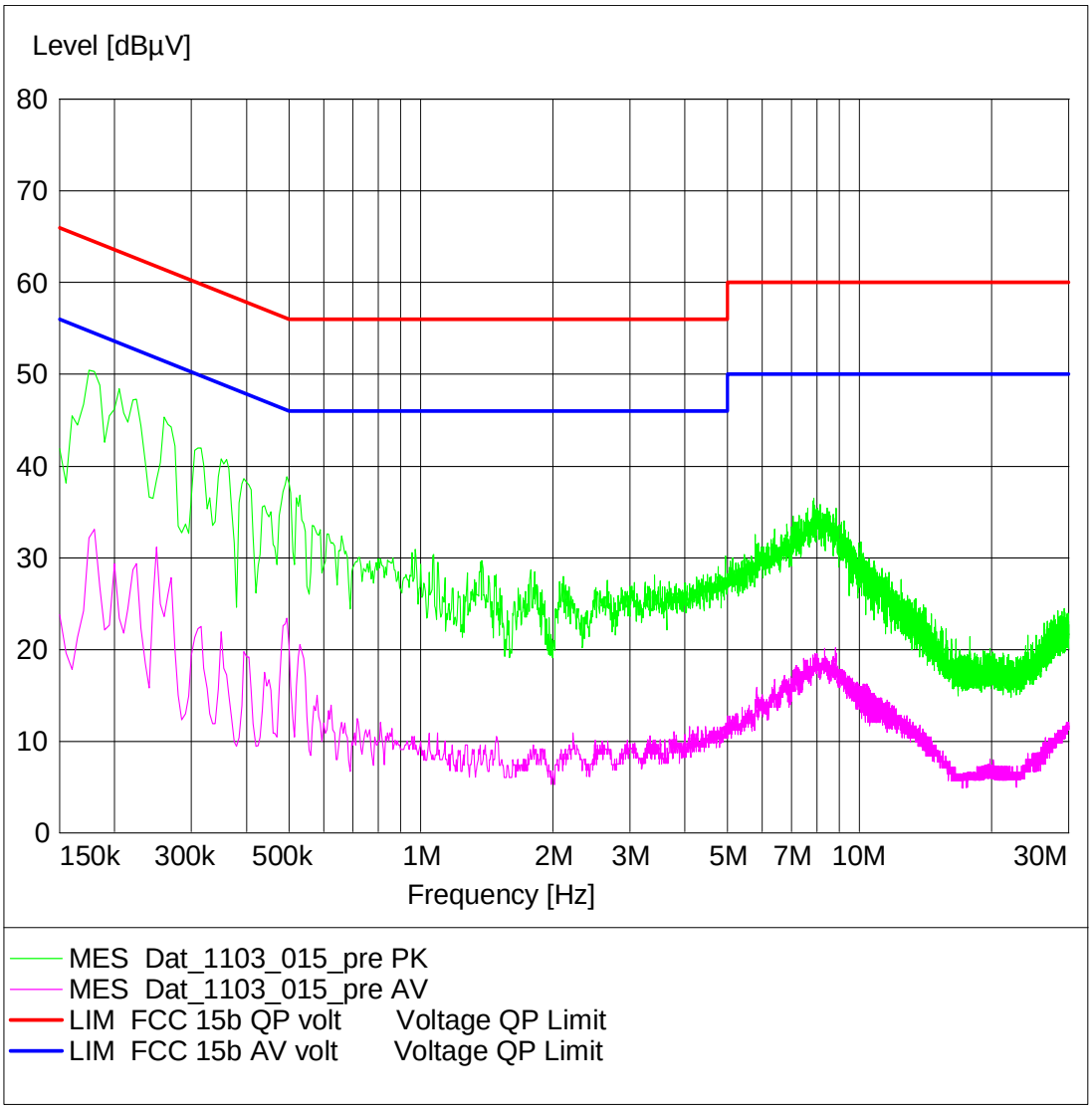
**Detailed Results:**

***AC MAINS CONDUCTED***

```
EUT:                  ELF RTC (EX001a01) / 27.06.2011
Manufacturer:         Datalogic
Operating Condition:  BT local TX on 2441MHz BDR; WLAN local TX on 2437MHz 6Mbps
Test Site:            7 layers Ratingen
Operator:             Gal
Test Specification:   ANSI C63.4; FCC 15.107 / 15.207
Comment:
Start of Test:        27.06.2011 / 13:39:45
```

***SCAN TABLE: "FCC Voltage"***

```
  Short Description:            FCC Voltage
  Start      Stop       Step       Detector  Meas.     IF      Transducer
  Frequency  Frequency  Width                Time      Bandw.
  150.0 kHz  30.0 MHz   5.0 kHz    MaxPeak   20.0 ms   9 kHz   ESH3-Z5
                                   Average
```



### 3.5.2 15b.2 Spurious Radiated Emissions §15.109

**Test1: 15b.2; Mode = transmit**

| | |
|---|---|
| *Result:* | Passed |
| *Setup No.:* | A01_FCC_15b_PC1 |
| *Date of Test:* | 2011/06/15 6:10 |
| *Body:* | FCC47CFRChIPART15bRADIO FREQUENCY DEVICES |
| *Test Specification:* | FCC part 2 and 15 |

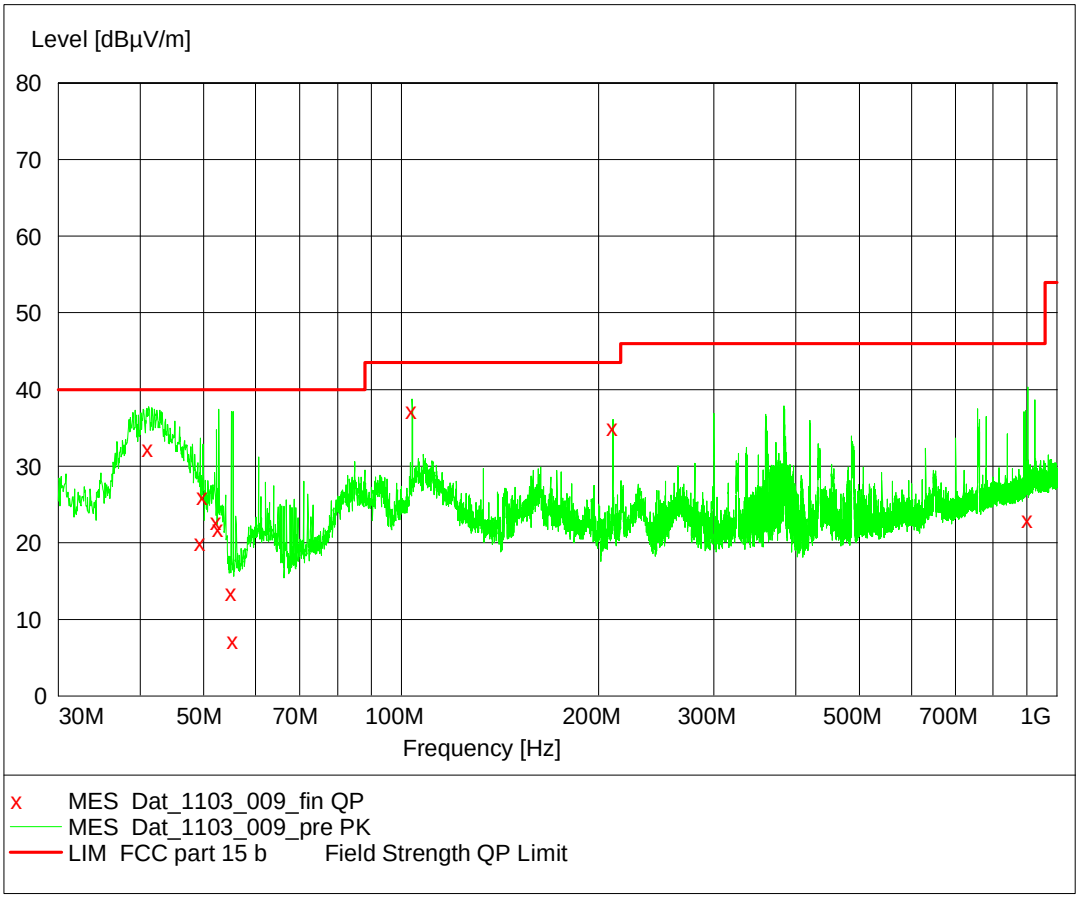
**Detailed Results:**

***EMI RADIATED TEST***

```
EUT:               ELF RTC (EX001a01) / 15.06.2011
Manufacturer:       Datalogic
Operating Condition: BT local TX on 2441MHz BDR; WLAN local TX on 2437MHz 6Mbps
Test Site:          7 layers, Ratingen
Operator:          Doe
Test Specification:  FCC part 15 b
Comment:           Horizontal EUT position
Start of Test:      15.06.2011 / 11:03:49
```

***SCAN TABLE: "FCC part 15 b"***

```
  Short Description:          FCC part 15 b
  Start     Stop      Step      Detector  Meas.    IF      Transducer
  Frequency  Frequency  Width             Time     Bandw.
  30.0 MHz   1.0 GHz    60.0 kHz   MaxPeak   1.0 ms   120 kHz HL562
```




***MEASUREMENT RESULT: "Dat_1103_009_fin QP"***

| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Height cm | Azimuth deg | Polarisation |
|---|---|---|---|---|---|---|---|
| 41.160000 | 32.30 | 14.3 | 40.0 | 7.7 | 100.0 | 292.00 | VERTICAL |
| 49.380000 | 20.00 | 9.2 | 40.0 | 20.0 | 175.0 | 342.00 | VERTICAL |
| 49.860000 | 26.00 | 8.9 | 40.0 | 14.0 | 100.0 | 265.00 | VERTICAL |
| 52.320000 | 22.70 | 7.2 | 40.0 | 17.3 | 111.0 | 202.00 | VERTICAL |
| 52.680000 | 21.80 | 7.0 | 40.0 | 18.2 | 103.0 | 247.00 | VERTICAL |
| 55.080000 | 13.50 | 5.6 | 40.0 | 26.5 | 237.0 | 292.00 | VERTICAL |
| 55.440000 | 7.20 | 5.3 | 40.0 | 32.8 | 400.0 | 22.00 | VERTICAL |
| 103.980000 | 37.30 | 10.7 | 43.5 | 6.2 | 100.0 | 112.00 | VERTICAL |
| 210.360000 | 35.00 | 9.3 | 43.5 | 8.5 | 113.0 | 157.00 | VERTICAL |
| 903.420000 | 23.10 | 24.1 | 46.0 | 22.9 | 326.0 | 12.00 | VERTICAL |

**Test1: 15b.2; Mode = transmit**

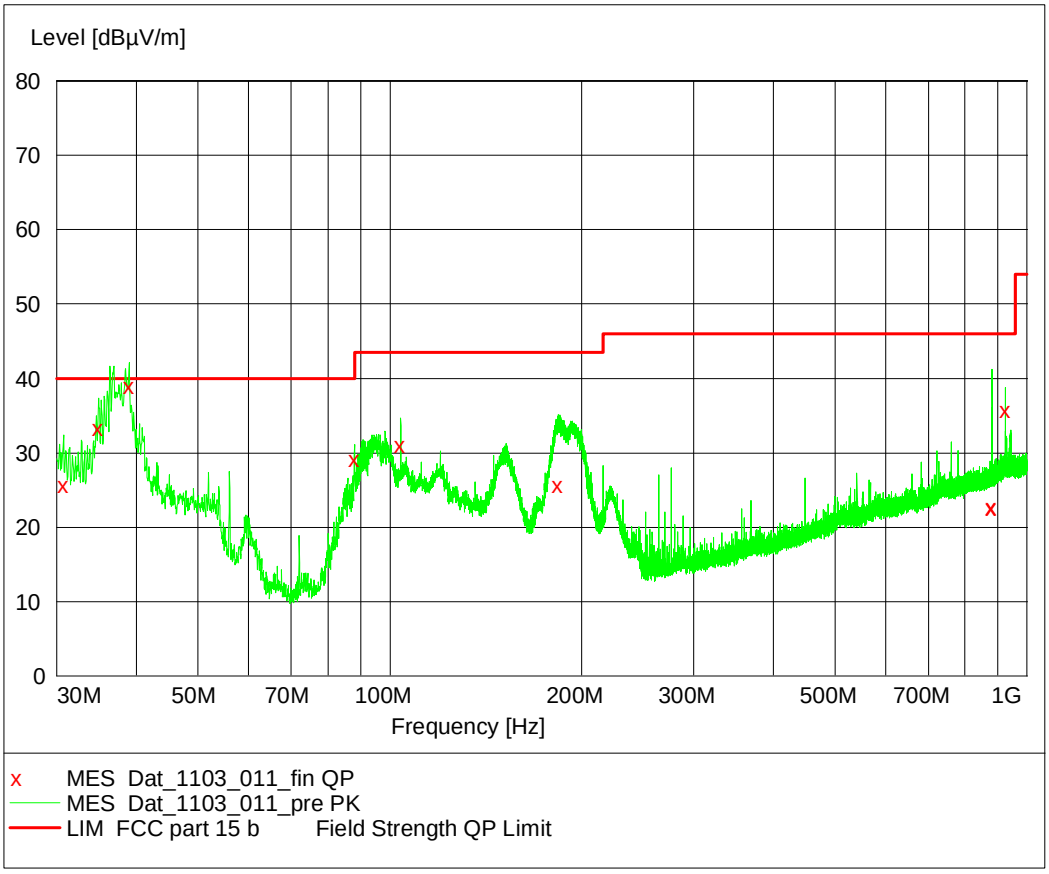
| | |
|---|---|
| *Result:* | Passed |
| *Setup No.:* | A01_FCC_15b_AC |
| *Date of Test:* | 2011/06/15 6:14 |
| *Body:* | FCC47CFRChIPART15bRADIO FREQUENCY DEVICES |
| *Test Specification:* | FCC part 2 and 15 |

**Detailed Results:**

***EMI RADIATED TEST***
EUT: ELF RTC (EX001a01) / 15.06.2011
Manufacturer: Datalogic
Operating Condition: BT local TX on 2441MHz BDR; WLAN local TX on 2437MHz 6Mbps
Test Site: 7 layers, Ratingen
Operator: Doe
Test Specification: FCC part 15 b
Comment: Horizontal EUT position
Start of Test: 15.06.2011 / 13:34:05

***SCAN TABLE: "FCC part 15 b"***

| Short Description: | | FCC part 15 b | | | | |
|---|---|---|---|---|---|---|
| Start Frequency | Stop Frequency | Step Width | Detector | Meas. Time | IF Bandw. | Transducer |
| 30.0 MHz | 1.0 GHz | 60.0 kHz | MaxPeak | 1.0 ms | 120 kHz | HL562 |




***MEASUREMENT RESULT: "Dat_1103_011_fin QP"***

| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Height cm | Azimuth deg | Polarisation |
|---|---|---|---|---|---|---|---|
| 30.720000 | 25.60 | 20.3 | 40.0 | 14.4 | 179.0 | 22.00 | VERTICAL |
| 34.860000 | 33.40 | 17.9 | 40.0 | 6.6 | 100.0 | 22.00 | VERTICAL |
| 38.940000 | 39.00 | 15.5 | 40.0 | 1.0 | 100.0 | 292.00 | VERTICAL |
| 87.960000 | 29.20 | 9.8 | 40.0 | 10.8 | 136.0 | 66.00 | VERTICAL |
| 103.980000 | 31.10 | 10.7 | 43.5 | 12.4 | 175.0 | 22.00 | VERTICAL |
| 183.720000 | 25.70 | 8.4 | 43.5 | 17.8 | 105.0 | 292.00 | VERTICAL |
| 882.060000 | 22.70 | 23.7 | 46.0 | 23.3 | 375.0 | 22.00 | VERTICAL |
| 882.240000 | 22.60 | 23.7 | 46.0 | 23.4 | 325.0 | 67.00 | VERTICAL |
| 926.220000 | 35.80 | 24.6 | 46.0 | 10.2 | 275.0 | 112.00 | HORIZONTAL |

**Test1: 15b.2; Mode = transmit**

| | |
|---|---|
| *Result:* | Passed |
| *Setup No.:* | A01_FCC_15b_PC2 |
| *Date of Test:* | 2011/06/15 6:13 |
| *Body:* | FCC47CFRChIPART15bRADIO FREQUENCY DEVICES |
| *Test Specification:* | FCC part 2 and 15 |

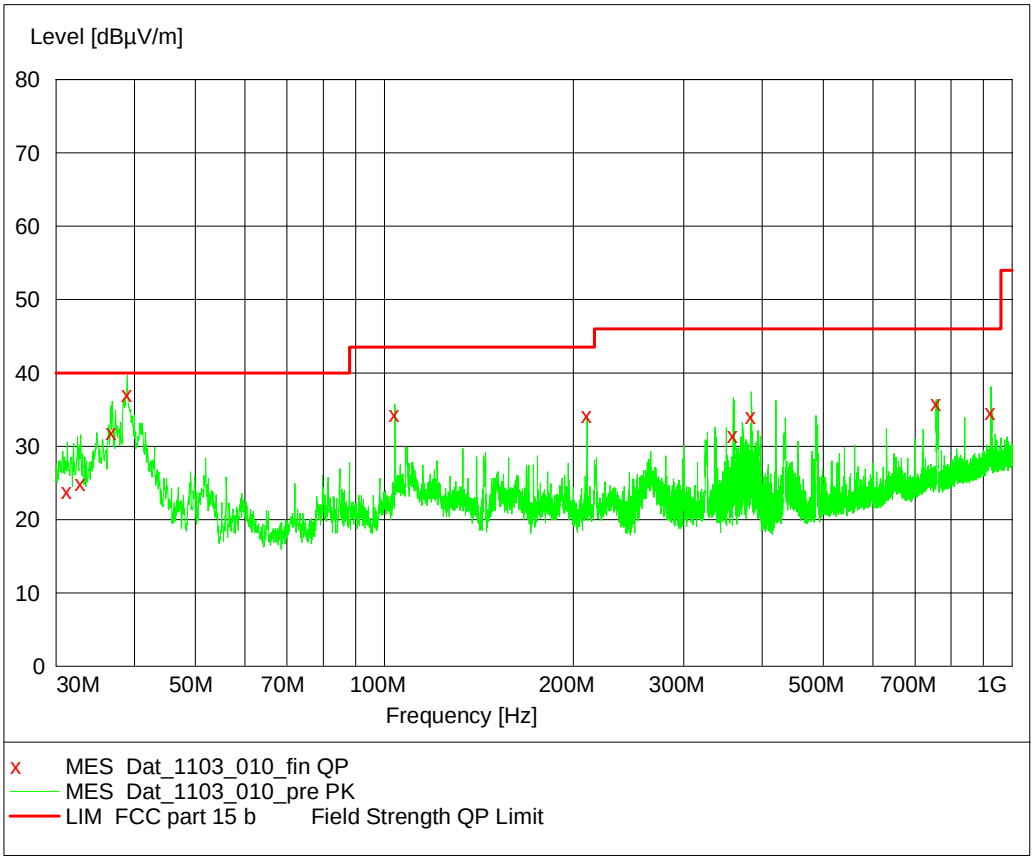
**Detailed Results:**

***EMI RADIATED TEST***

```
EUT:                ELF RTC (EX001a01) / 15.06.2011
Manufacturer:        Datalogic
Operating Condition: BT local TX on 2441MHz BDR; WLAN local TX on 2437MHz 6Mbps
Test Site:          7 layers, Ratingen
Operator:           Doe
Test Specification:  FCC part 15 b
Comment:            Horizontal EUT position
Start of Test:       15.06.2011 / 12:19:34
```

***SCAN TABLE: "FCC part 15 b"***

```
  Short Description:           FCC part 15 b
  Start      Stop       Step       Detector  Meas.    IF      Transducer
  Frequency  Frequency  Width                Time     Bandw.
  30.0 MHz   1.0 GHz    60.0 kHz   MaxPeak   1.0 ms   120 kHz HL562
```




***MEASUREMENT RESULT: "Dat_1103_010_fin QP"***

| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Height cm | Azimuth deg | Polarisation |
|---|---|---|---|---|---|---|---|
| 31.260000 | 23.90 | 20.0 | 40.0 | 16.1 | 191.0 | 247.00 | VERTICAL |
| 32.820000 | 25.00 | 19.0 | 40.0 | 15.0 | 193.0 | 202.00 | VERTICAL |
| 36.840000 | 31.90 | 16.7 | 40.0 | 8.1 | 225.0 | 247.00 | VERTICAL |
| 38.940000 | 37.10 | 15.5 | 40.0 | 2.9 | 100.0 | 187.00 | VERTICAL |
| 103.980000 | 34.40 | 10.7 | 43.5 | 9.1 | 100.0 | 22.00 | VERTICAL |
| 210.360000 | 34.20 | 9.3 | 43.5 | 9.3 | 102.0 | 186.00 | VERTICAL |
| 359.700000 | 31.60 | 14.6 | 46.0 | 14.4 | 105.0 | 88.00 | HORIZONTAL |
| 384.660000 | 34.10 | 15.3 | 46.0 | 11.9 | 102.0 | 83.00 | HORIZONTAL |
| 757.680000 | 35.80 | 22.1 | 46.0 | 10.2 | 100.0 | 235.00 | VERTICAL |
| 926.280000 | 34.70 | 24.6 | 46.0 | 11.3 | 202.0 | 156.00 | VERTICAL |

# 4 Test Equipment Details

## 4.1 List of Used Test Equipment

The calibration, hardware and software states are shown for the testing period.

### Test Equipment Anechoic Chamber

| | |
|---|---|
| ***Lab ID:*** | **Lab 2** |
| *Manufacturer:* | Frankonia |
| *Description:* | Anechoic Chamber for radiated testing |
| *Type:* | 10.58x6.38x6 m³ |

### Single Devices for Anechoic Chamber

| *Single Device Name* | *Type* | *Serial Number* | *Manufacturer* | |
|---|---|---|---|---|
| Air compressor | none | - | Atlas Copco | |
| Anechoic Chamber | 10.58 x 6.38 x 6.00 m³ | none | Frankonia | |
| | *Calibration Details* | | *Last Execution* | *Next Exec.* |
| | FCC listing 96716 3m Part15/18 | | 2011/01/11 | 2014/01/10 |
| | IC listing 3699A-1 3m | | 2011/02/07 | 2014/02/06 |
| Controller Maturo | MCU | 961208 | Maturo GmbH | |
| EMC camera | CE-CAM/1 | - | CE-SYS | |
| EMC camera Nr.2 | CCD-400E | 0005033 | Mitsubishi | |
| Filter ISDN | B84312-C110-E1 | | Siemens&Matsushita | |
| Filter Universal 1A | BB4312-C30-H3 | - | Siemens&Matsushita | |

### Test Equipment Auxiliary Equipment for Conducted emissions

| | |
|---|---|
| ***Lab ID:*** | **Lab 1** |
| *Manufacturer:* | Rohde & Schwarz GmbH & Co.KG |
| *Description:* | EMI Conducted Auxiliary Equipment |

### Single Devices for Auxiliary Equipment for Conducted emissions

| *Single Device Name* | *Type* | *Serial Number* | *Manufacturer* | |
|---|---|---|---|---|
| Cable "LISN to ESI" | RG214 | W18.03+W48.03 | Huber&Suhner | |
| | *Calibration Details* | | *Last Execution* | *Next Exec.* |
| | Path Calibration | | 2010/11/06 | 2011/11/05 |
| | Path Calibration | | 2011/05/11 | 2012/05/10 |
| Two-Line V-Network | ESH 3-Z5 | 828304/029 | Rohde & Schwarz GmbH & Co. KG | |
| Two-Line V-Network | ESH 3-Z5 | 829996/002 | Rohde & Schwarz GmbH & Co. KG | |
| | *Calibration Details* | | *Last Execution* | *Next Exec.* |
| | DKD calibration | | 2008/10/13 | 2011/10/12 |
| | DKD calibration | | 2011/01/20 | 2013/01/19 |

## Test Equipment Auxiliary Equipment for Radiated emissions

| | |
|---|---|
| ***Lab ID:*** | **Lab 2** |
| *Description:* | Equipment for emission measurements |
| *Serial Number:* | see single devices |

### Single Devices for Auxiliary Equipment for Radiated emissions

| *Single Device Name* | *Type* | *Serial Number* | *Manufacturer* |
|---|---|---|---|
| Antenna mast | AS 620 P | 620/37 | HD GmbH |
| Biconical dipole | VUBA 9117 | 9117-108 | Schwarzbeck |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard Calibration | | 2008/10/27 2013/10/26 |
| Broadband Amplifier 18MHz-26GHz | JS4-18002600-32-5P | 849785 | Miteq |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Path Calibration | | 2011/05/11 2011/11/10 |
| Broadband Amplifier 1GHz-4GHz | AFS4-01000400-1Q-10P-4 | - | Miteq |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Path Calibration | | 2011/05/11 2011/11/10 |
| Broadband Amplifier 30MHz-18GHz | JS4-00101800-35-5P | 896037 | Miteq |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Path Calibration | | 2011/05/11 2011/11/10 |
| Cable "ESI to EMI Antenna" | EcoFlex10 | W18.01-2+W38.01-2 | Kabel Kusch |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Path Calibration | | 2011/05/11 2011/11/10 |
| Cable "ESI to Horn Antenna" | UFB311A+UFB293C | W18.02-2+W38.02-2 | Rosenberger Micro-Coax |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Path Calibration | | 2011/05/11 2011/11/10 |
| Double-ridged horn | HF 906 | 357357/001 | Rohde & Schwarz GmbH & Co. KG |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard Calibration | | 2009/04/16 2012/04/15 |
| Double-ridged horn | HF 906 | 357357/002 | Rohde & Schwarz GmbH & Co. KG |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard Calibration | | 2009/04/28 2012/04/27 |
| High Pass Filter | 4HC1600/12750-1.5-KK | 9942011 | Trilithic |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Path Calibration | | 2011/05/11 2011/11/10 |
| High Pass Filter | 5HC2700/12750-1.5-KK | 9942012 | Trilithic |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Path Calibration | | 2011/05/11 2011/11/10 |
| High Pass Filter | 5HC3500/12750-1.2-KK | 200035008 | Trilithic |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Path Calibration | | 2011/05/11 2011/11/10 |
| High Pass Filter | WHKX 7.0/18G-8SS | 09 | Wainwright |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Path Calibration | | 2011/05/11 2011/11/10 |

### Single Devices for Auxiliary Equipment for Radiated emissions (continued)

| *Single Device Name* | *Type* | *Serial Number* | *Manufacturer* |
|---|---|---|---|
| Log.-per. Antenna | HL 562 Ultralog | 830547/003 | Rohde & Schwarz GmbH & Co. KG |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard Calibration | | 2009/05/27 2012/05/26 |
| Loop Antenna | HFH2-Z2 | 829324/006 | Rohde & Schwarz GmbH & Co. KG |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | DKD calibration | | 2008/10/07 2011/10/06 |
| Network Analyzer | E5071B | MY42200813 | Agilent |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard Calibration | | 2010/11/09 2011/11/09 |
| Pyramidal Horn Antenna 26,5 GHz | 3160-09 | 00083069 | EMCO Elektronik GmbH |
| Pyramidal Horn Antenna 40 GHz | 3160-10 | 00086675 | EMCO Elektronik GmbH |
| Tilt device Maturo (Rohacell) | Antrieb TD1.5-10kg | TD1.5-10kg/024/3790709 | Maturo GmbH |

### Test Equipment Auxiliary Test Equipment

| | |
|---|---|
| ***Lab ID:*** | **Lab 2** |
| *Manufacturer:* | see single devices |
| *Description:* | Single Devices for various Test Equipment |
| *Type:* | various |
| *Serial Number:* | none |

### Single Devices for Auxiliary Test Equipment

| *Single Device Name* | *Type* | *Serial Number* | *Manufacturer* |
|---|---|---|---|
| AC Power Source | Chroma 6404 | 64040001304 | Chroma ATE INC. |
| Broadband Power Divider N (Aux) | 1506A / 93459 | LM390 | Weinschel Associates |
| Broadband Power Divider SMA | WA1515 | A855 | Weinschel Associates |
| Digital Multimeter 03 (Multimeter) | Fluke 177 | 86670383 | Fluke Europe B.V. |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard calibration | | 2009/10/07 2011/10/06 |
| Fibre optic link Satellite (Aux) | FO RS232 Link | 181-018 | Pontis |
| Fibre optic link Transceiver (Aux) | FO RS232 Link | 182-018 | Pontis |
| Isolating Transformer | LTS 604 | 1888 | Thalheimer Transformatorenwerke GmbH |
| Notch Filter Ultra Stable (Aux) | WRCA800/960-6EEK | 24 | Wainwright |
| Vector Signal Generator | SMIQ 03B | 832492/061 | Rohde & Schwarz GmbH & Co.KG |

## Test Equipment Digital Signalling Devices

***Lab ID:*** **Lab 1, Lab 2**
*Description:* Signalling equipment for various wireless technologies.

### Single Devices for Digital Signalling Devices

| *Single Device Name* | *Type* | *Serial Number* | *Manufacturer* |
|---|---|---|---|
| Bluetooth Signalling Unit CBT | CBT | 100589 | Rohde & Schwarz GmbH & Co. KG |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard Calibration | | 2008/08/14 2011/08/13 |
| Universal Radio Communication Tester | CMU 200 | 102366 | Rohde & Schwarz GmbH & Co. KG |
| | *HW/SW Status* | | *Date of Start* *Date of End* |
| | Hardware:<br>B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04<br>Software:<br>K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22<br>Firmware:<br>µP1 8v50 02.05.06<br>--- | | 2007/07/16 |
| Universal Radio Communication Tester | CMU 200 | 837983/052 | Rohde & Schwarz GmbH & Co. KG |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard calibration | | 2008/12/01 2011/11/30 |
| | *HW/SW Status* | | *Date of Start* *Date of End* |
| | HW options:<br>B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02<br>SW options:<br>K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10,<br>Firmware:<br>µP1 8v40 01.12.05<br>--- | | 2007/01/02 |
| | SW:<br>K62, K69 | | 2008/11/03 |

**Test Equipment Emission measurement devices**

| | |
|---|---|
| ***Lab ID:*** | **Lab 1, Lab 2** |
| *Description:* | Equipment for emission measurements |
| *Serial Number:* | see single devices |

**Single Devices for Emission measurement devices**

| *Single Device Name* | *Type* | *Serial Number* | *Manufacturer* |
|---|---|---|---|
| Personal Computer | Dell | 30304832059 | Dell |
| Power Sensor | NRV-Z1 | 836219/005 | Rohde & Schwarz GmbH & Co. KG |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard Calibration | | 2009/10/20 2011/10/19 |
| Powermeter | NRVS | 836333/064 | Rohde & Schwarz GmbH & Co. KG |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard calibration | | 2009/10/15 2011/10/14 |
| Signal Generator | SMR 20 | 846834/008 | Rohde & Schwarz GmbH & Co. KG |
| Spectrum Analyzer | ESIB 26 | 830482/004 | Rohde & Schwarz GmbH & Co. KG |
| | *Calibration Details* | | *Last Execution* *Next Exec.* |
| | Standard Calibration | | 2009/12/03 2011/12/02 |

**Test Equipment Shielded Room 02**

| | |
|---|---|
| ***Lab ID:*** | **Lab 1** |
| *Manufacturer:* | Frankonia |
| *Description:* | Shielded Room for conducted testing |
| *Type:* | 12 qm |
| *Serial Number:* | none |

## 4.2 Laboratory Environmental Conditions

| *Laboratory* | *Date* | *Temperature* | *Humidity* | *Air Pressure* |
|---|---|---|---|---|
| Lab 1 | 2011/06/14 | 24 °C | 39 % | 1004 hPa |
| | 2011/06/27 | 27 °C | 43 % | 1010 hPa |
| Lab 2 | 2011/06/15 | 25 °C | 45 % | 1012 hPa |

# 5 Annex

## 5.1 Additional Information for Report

Test Description

Conducted emissions (AC power line)

Standard FCC Part 15
Subpart B

The test was performed according to: ANSI C 63.4, 2009

Test Description
The test set-up was made in accordance to the general provisions of ANSI C 63.4-2009.
The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50µH || 50 Ohm Line Impedance Stabilization Network (LISN) which meets the requirements of ANSI C63.4–2009, Annex B, in the frequency range of the measurements. The LISN's unused connections were terminated with 50 Ohm loads.

The measurement procedure consists of two steps. It is implemented into the EMI test software ES-K1 from R&S.

Step 1: Preliminary scan
Intention of this step is, to determine the conducted EMI-profile of the EUT.
EMI receiver settings:
- Detector: Peak - Maxhold
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 5 kHz
- IF–Bandwidth: 9 kHz
- Measuring time / Frequency step: 20 ms
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2: Final measurement
Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.
EMI receiver settings:
- Detector: Quasi-Peak
- IF - Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:
1) Neutral lead - reference ground (PE grounded)
2) Phase lead - reference ground (PE grounded)
3) Neutral lead - reference ground (PE floating)
4) Phase lead - reference ground (PE floating)

The highest value is reported.

Test Requirements / Limits

If not stated within the measurement plot and/or test result, class B limits are applied.

FCC Part 15, Subpart B, §15.107, Class B Limit

| Frequency Range (MHz) | QP Limit (dBµV) | AV Limit (dBµV) |
|---|---|---|
| 0.15 – 0.5 | 66 to 56 | 56 to 46 |
| 0.5 – 5 | 56 | 46 |
| 5 – 30 | 60 | 50 |

FCC Part 15, Subpart B, §15.107, Class A Limit

| Frequency Range (MHz) | QP Limit (dBµV) | AV Limit (dBµV) |
|---|---|---|
| 0.15 - 0.5 | 79 | 66 |
| 0.5 - 30 | 73 | 60 |

Used conversion factor: Limit (dBµV) = 20 log (Limit (µV)/1µV).

NOTES:
A missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.
The chosen operating mode is selected as representative mode to generate "worst-case" conditions, i.e. high power consumption.

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Spurious radiated emissions

---

Standard FCC Part 15, Subpart B

The test was performed according to: ANSI C 63.4, 2009

Test Description

Measurement below 1 GHz:
The test set-up was made in accordance to the general provisions of ANSI C 63.4-2009.
The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.
The test was performed at the distance of 3 m between the EUT and the receiving antenna. The measurement procedure is implemented into the EMI test software ES-K1 from R&S. The radiated emissions measurements were made in a typical installation configuration. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is performed at 2 axes. A pre-check is also performed while the EUT is powered from both AC and DC (battery) power in order to find the worst-case operating condition.

Step 1: Preliminary scan (test to identify the highest amplitudes relative to the limit)
Intention of this step is, to determine the radiated EMI-profile of the EUT.
Settings for step 1:
- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF–Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 µs
- Turntable angle range: –180° to +180°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2:
A further measurement will be performed on the frequencies determined in step 1. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.
Settings for step 2:
- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms

- Turntable angle range: –180° to +180°
- Turntable step size: 45°
- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m
- Polarisation: horizontal + vertical

After this step the EMI test system has determined the following values for each frequency (of step 1):
- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:
- Azimuth value (of turntable): 45°
- Antenna height: 0.5 m

Step 3: final measurement
In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.
For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by +/- 22.5° around this value. During this action the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by +/- 25 cm around the antenna height determined. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.
- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100ms
- Turntable angle range: –22.5° to +22.5° around the determined value
- Height variation range: -0.25 m to +0.25 m around the determined value

Step 4: Final measurement (with QP detector)
With the settings determined in step 3, the final measurement will be performed:
EMI receiver settings for step 4:
- Detector: Quasi-Peak(< 1GHz)
- Measured frequencies: in step 3 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

Measurement above 1 GHz:
The following modifications apply to the measurement procedure for the frequency range above 1 GHz:
The measurement distance was reduced to 1 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse-linear-distance-squared for the power density measurements). Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 GHz) and a horn antenna (18–25 GHz) are used, the steps 2-4 as described before, are omitted. Step 1 was performed at one height of the receiving antenna only.
Detector: Peak, Average (simultaneously)
RBW = VBW = 1 MHz; above 7 GHz 100 kHz

Test Requirements / Limits

If not stated within the measurement plot and/or test result, class B limits are applied.

FCC Part 15, Subpart B, §15.109, Radiated Emission Limits
Frequency Range (MHz): Class B Limit (dBµV/m)

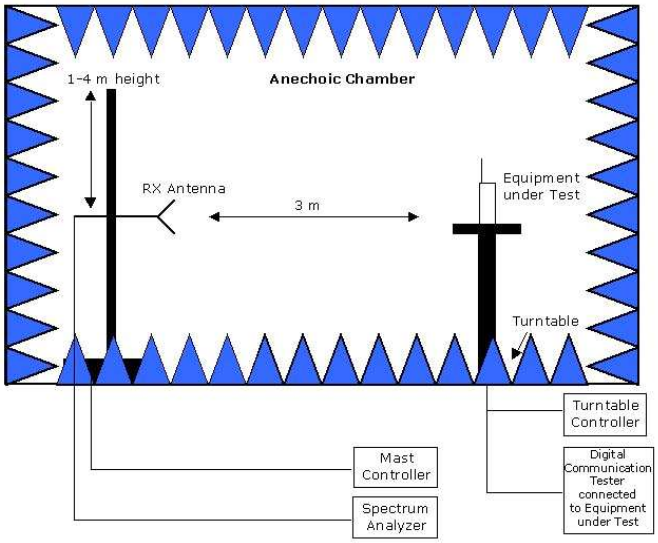
| Frequency Range (MHz) | Class B Limit (dBµV/m) |
|---|---|
| 30 – 88 | 40.0 |
| 88 – 216 | 43.5 |
| 216 – 960 | 46.0 |
| above 960 | 54.0 |

| Frequency Range (MHz) | Class A Limit (dBµV/m) / @ 3m ! |
|---|---|
| 30 - 88 | 49.5 |
| 88 - 216 | 54.0 |
| 216 - 960 | 56.9 |
| above 960 | 60.0 |

§15.35(b)
..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....
Used conversion factor: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

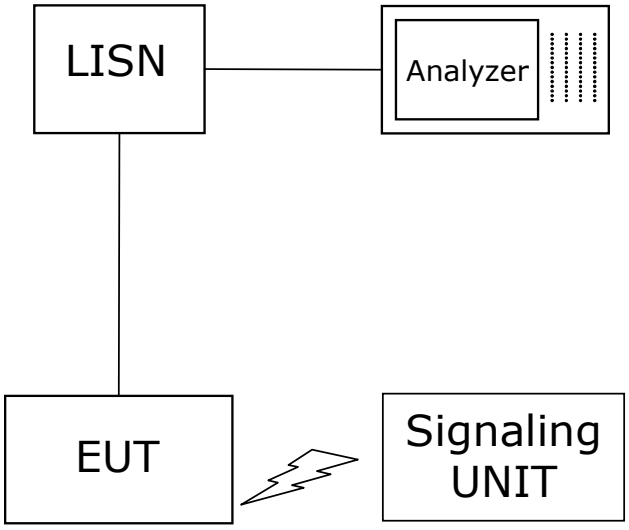
NOTE: A missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.

## Setup Drawings




Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting ground plane.




Setup in the shielded room for conducted measurements at AC mains port

# 6 Index