

**CETECOM™**

**CETECOM ICT Services**  
consulting - testing - certification >>>

## TEST REPORT

Test report no.: 1-9110/14-01-04-A



Deutsche  
Akkreditierungsstelle  
D-PL-12076-01-00

### Testing laboratory

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#### Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS). The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-00

### Applicant

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### Manufacturer

**Ascom AB**  
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### Test standard/s

47 CFR Part 15

Title 47 of the Code of Federal Regulations; Chapter I; Part 15 – Radio frequency devices

For further applied test standards please refer to section 3 of this test report.

### Test Item

**Kind of test item:** Smart phone  
**Model name:** SH1-ABAA  
**FCC ID:** BXZSH1B  
**IC:** 3724B-SH1B  
**Frequency:** 5150 MHz to 5350 MHz, 5470 MHz to 5725 MHz  
**Technology tested:** WLAN  
**Antenna:** Integrated antenna  
**Power supply:** 3.7V DC by Li-ion Battery  
**Temperature range:** -5°C to +45°C



This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

### Test report authorised:

Rene Oelmann  
Radio Communications & EMC

### Test performed:

David Lang  
Radio Communications & EMC

|          |  |    |
|----------|--|----|
| <b>1</b> | <b>Table of contents</b>                                   |    |
| 1        | Table of contents .....                                    | 2  |
| 2        | General information .....                                  | 3  |
| 2.1      | Notes and disclaimer .....                                 | 3  |
| 2.2      | Application details.....                                   | 3  |
| 3        | Test standard/s .....                                      | 3  |
| 3.1      | Measurement guidance.....                                  | 3  |
| 4        | Test environment.....                                      | 4  |
| 5        | Test item .....  | 4  |
| 5.1      | Additional information .....                               | 4  |
| 6        | Test laboratories sub-contracted .....                     | 4  |
| 7        | Summary of measurement results .....                       | 5  |
| 8        | RF measurements .....                                      | 6  |
| 8.1      | Description of test setup .....                            | 6  |
| 8.1.1    | Conducted measurements.....                                | 6  |
| 8.1.2    | Parameters of DFS test signals .....                       | 7  |
| 8.2      | DFS test results .....                                     | 8  |
| 8.2.1    | Channel move time / channel closing transmission time..... | 8  |
| 8.2.2    | Non-Occupancy Period.....                                  | 9  |
| 1        | Test equipment and ancillaries used for tests .....        | 12 |
| 2        | Observations.....  | 12 |
| Annex A  | Document history .....                                     | 13 |
| Annex B  | Further information.....                                   | 13 |
| Annex C  | Accreditation Certificate .....                            | 14 |

## 2 General information

### 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

### 2.2 Application details

|                                    |            |
|------------------------------------|------------|
| Date of receipt of order:          | 2014-12-08 |
| Date of receipt of test item:      | 2015-01-22 |
| Start of test:                     | 2015-01-22 |
| End of test:                       | 2015-02-02 |
| Person(s) present during the test: | -/-        |

## 3 Test standard/s

| Test standard  | Date | Test standard description   |
|----------------|------|---|
| 47 CFR Part 15 | -/-  | Title 47 of the Code of Federal Regulations; Chapter I; Part 15 – Radio frequency devices |

### 3.1 Measurement guidance

|                  |         |   |
|------------------|---------|---|
| UNII: KDB 905462 | 2014-06 | DFS Compliance Procedures New Rules v01 |
|------------------|---------|---|

#### 4 Test environment

|                            |           |                                       |
|----------------------------|-----------|---------------------------------------|
| Temperature:               | $T_{nom}$ | +22 °C during room temperature tests  |
|                            | $T_{max}$ | +45 °C during high temperature tests  |
|                            | $T_{min}$ | -5 °C during low temperature tests    |
| Relative humidity content: |           | 52 %                                  |
| Barometric pressure:       |           | not relevant for this kind of testing |
| Power supply:              | $V_{nom}$ | 3.7 V DC by Li-ion Battery            |
|                            | $V_{max}$ | -/- V                                 |
|                            | $V_{min}$ | -/- V                                 |

#### 5 Test item

|                            |   |  |
|----------------------------|---|--|
| Kind of test item          | : | Smart phone  |
| Type identification        | : | SH1-ABAA   |
| S/N serial number          | : | T26105EEQB   |
| HW hardware status         | : | PF   |
| SW software status         | : | myco-eng 4.4.2 daily_2015-01-19_eng<br>daily_418_2015-01-19 dev-keys |
| Frequency band [MHz]       | : | 5150 MHz to 5350 MHz, 5470 MHz to 5725 MHz                           |
| Type of radio transmission | : | DSSS, OFDM   |
| Use of frequency spectrum  | : |  |
| Type of modulation         | : | BPSK, QPSK, 16-QAM, 64-QAM   |
| Channel bandwidth (B)      | : | 20 MHz   |
| Antenna                    | : | Integrated antenna   |
| Power supply               | : | 3.7 V DC by Li-ion Battery   |
| Temperature range          | : | -5°C to +45 °C   |

#### 5.1 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-9110/14-01-01\_AnnexA  
1-9110/14-01-01\_AnnexB  
1-9110/14-01-01\_AnnexH

#### 6 Test laboratories sub-contracted

None

## 7 Summary of measurement results

- No deviations from the technical specifications were ascertained
- There were deviations from the technical specifications ascertained

| TC Identifier | Description | Verdict | Date       | Remark   |
|---------------|-------------|---------|------------|----------|
| DFS-Testing   | CFR Part 15 | Pass    | 2015-06-11 | DFS only |

| Test Report Clause   | Test Case   | Temperature / Voltage | Pass                                | Fail                     | NA                       | NP                       | Remark   |
|----------------------|---|-----------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|----------|
| §15.407 (h)(2) (iii) | Channel move time and channel closing transmission time | nominal / nominal     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.407 (h)(2) (iv)  | Non-Occupancy Period                                    | nominal / nominal     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | complies |

**Note:** NA = Not Applicable; NP = Not Performed

## 8 RF measurements

### 8.1 Description of test setup

#### 8.1.1 Conducted measurements

##### Setup

Figure 1 shows a setup whereby the UUT is a RLAN device operating in slave mode, without Radar Interference Detection function. This setup also contains a RLAN device operating in master mode. The radar test signals are injected into the master device. The UUT (slave device) is associated with the master device.

Figure 1 shows an example

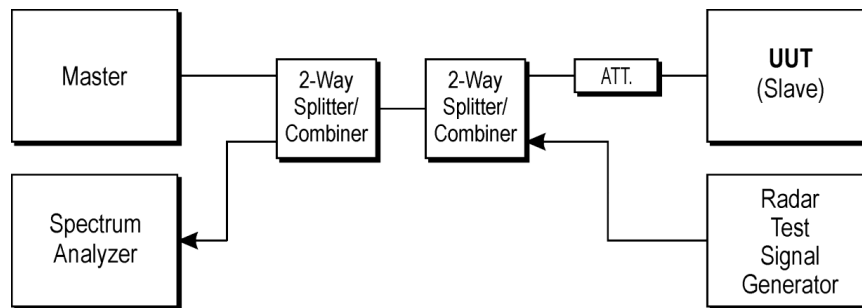


Figure 1: Setup

## 8.1.2 Parameters of DFS test signals

### 1. Interference Threshold values, Master or Client incorporating In-Service Monitoring

| Maximum Transmit Power | Value (see note) |
|------------------------|------------------|
| ≥ 200 mW               | -64 dBm          |
| < 200 mW               | -62 dBm          |

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna  
 Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

### 2. DFS Response requirement values

| Parameter                         | Value   |
|-----------------------------------|---|
| Non-occupancy period              | minimum 30 minutes  |
| Channel Availability Check Time   | 60 seconds  |
| Channel Move Time                 | 10 seconds<br>See Note 1.   |
| Channel Closing Transmission Time | 200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period.<br>See Notes 1 and 2. |
| U-NII Detection Bandwidth         | Minimum 80% of the 99% transmission power bandwidth<br>See Note 3.  |

Note 1: The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows:

- For the Short pulse radar Test Signals this instant is the end of the Burst.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar Burst generated.
- For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.

Note 2: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate Channel changes (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Note 3: During the U-NII Detection Bandwidth detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.

## 8.2 DFS test results

### 8.2.1 Channel move time / channel closing transmission time

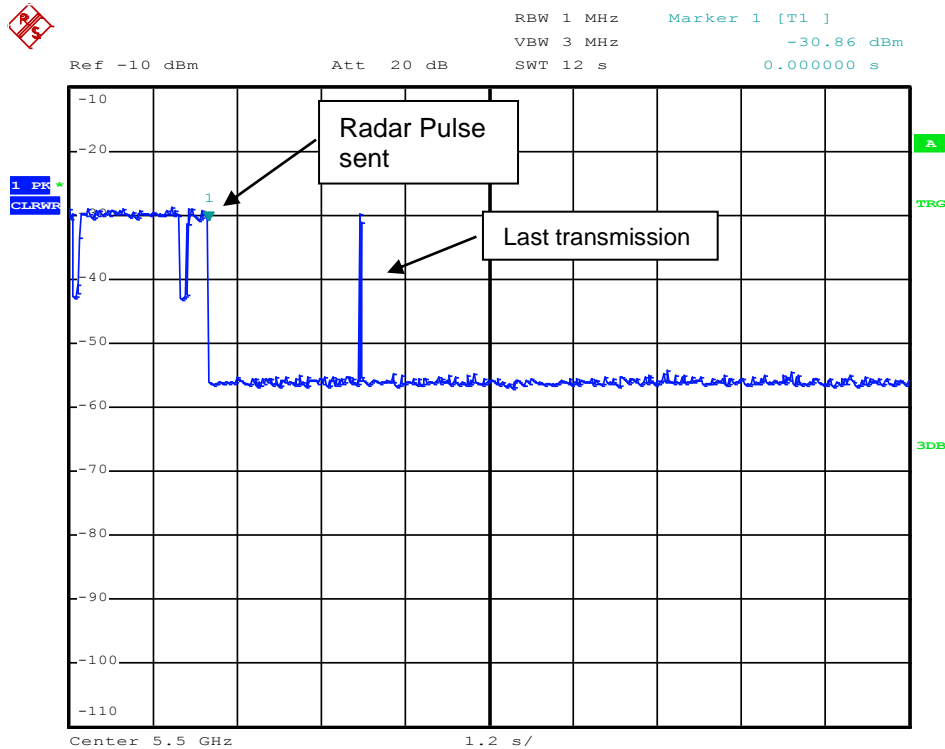
**Description:**

Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

**Test Procedure:**

Perform the test with one of the type 1 to type 4 short pulse radar waveforms.

**Result: Channel 100 (example plot)**



Date: 22.JAN.2015 10:49:00

The arrow shows the time of the radar pulse. On the plot you can see that no transmissions occur from the AP after sending the radar burst. The time difference between the recognition of the radar burst by the AP and its last transmission is called as Channel Move Time (Limit: 10 s). The accumulated transmission time of the AP and for the slave device after detection of a radar signal is called channel closing transmission time (Limit: in total 200 ms + 60 ms).

The accumulated channel closing transmission time after 200ms of the slave device is less than 60 ms.

**Final verdict: Passed**



## 8.2.2 Non-Occupancy Period

### Description:

Non-occupancy Period. A channel that has been flagged as containing a radar system, either by a channel availability check or in-service monitoring, is subject to a non-occupancy period of at least 30 minutes. The non occupancy period starts at the time when the radar system is detected.

### Test Procedure:

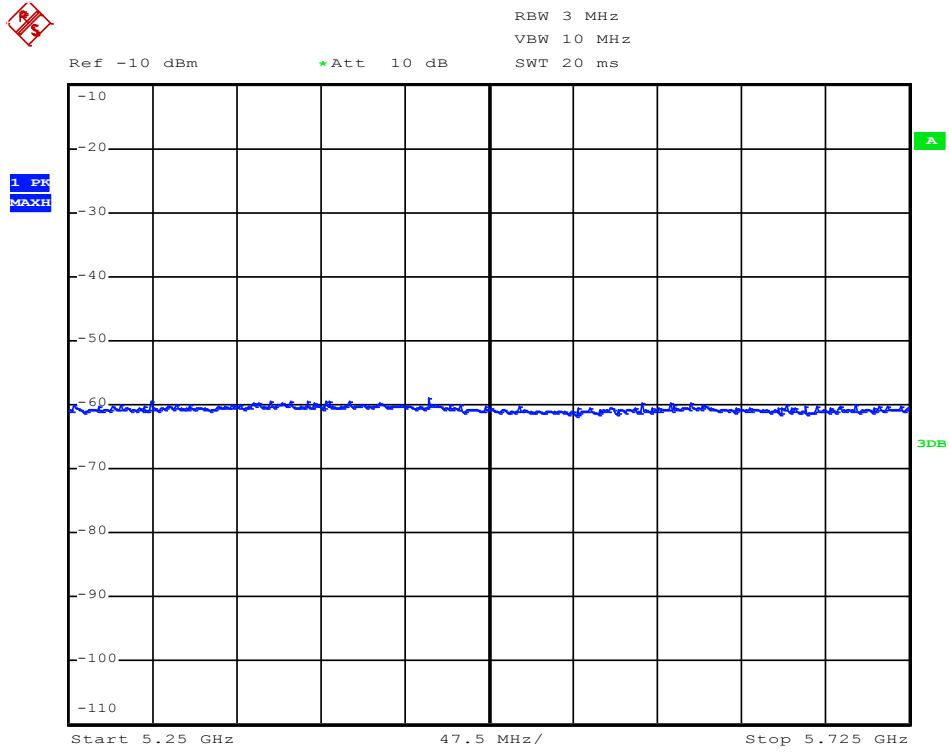
Client device is not permitted to transmit beacons on DFS frequencies.

- 1) Non-associated test:  
The master has been off, monitor the analyzer on the test mode frequency that have been selected for testing, power up the client for 30 minutes to make sure no beacons have been transmitted.
- 2) Associated test:  
Associate the master and client and stream the movie as specified for non- occupancy test. Transmit Radar type 1; monitor the test frequency to make sure no beacons have been transmitted for 30 minutes.

| Mode           | Results             |
|----------------|---------------------|
| Non-Associated | No Beacons transmit |
| Associated     | No transmissions    |

Please refer to the following plots.

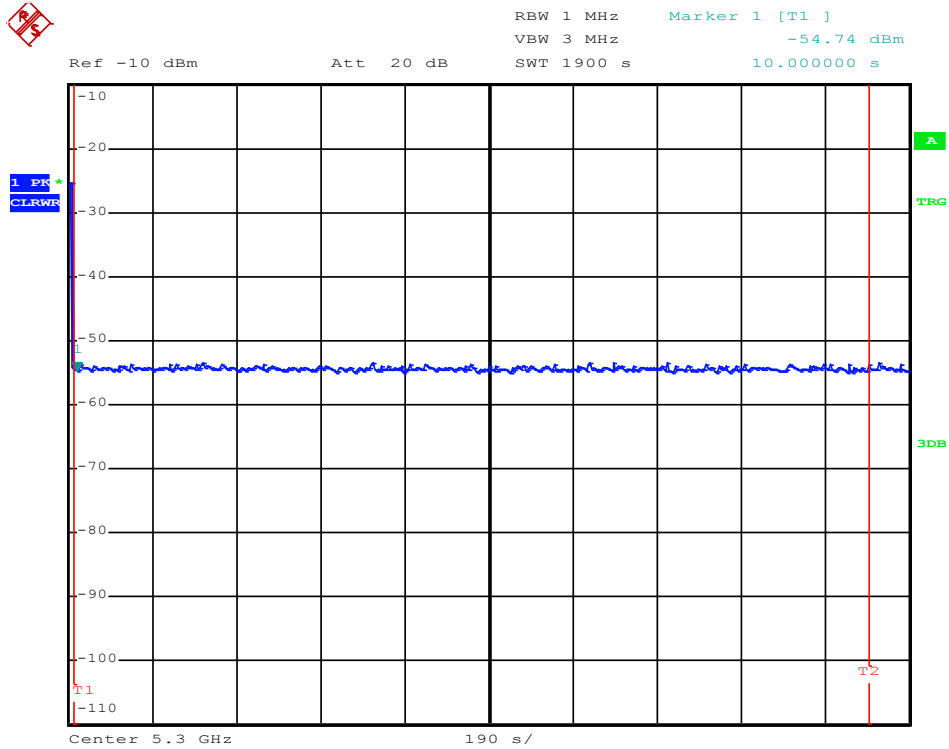
1) Non-associated:



Date: 2.FEB.2015 12:12:15

The plot shows no transmissions over a 30 minutes period over the whole frequency band 5.25 GHz – 5.725 GHz.

2) Associated:



Date: 22.JAN.2015 12:34:42

In the plot above you can see, that the client does not transmit any emission within 30 minutes after having received the “stop transmit” order from the Access Point (DFS-Master).

**Final verdict: Passed**

## 1 Test equipment and ancillaries used for tests

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

| No. | Lab / Item | Equipment                       | Type                               | Manufact.     | Serial No.             | INV. No Cetecom | Kind of Calibration | Last Calibration | Next Calibration |
|-----|------------|---------------------------------|------------------------------------|---------------|------------------------|-----------------|---------------------|------------------|------------------|
| 1   | n. a.      | Spectrum Analyzer 9kHz - 30 GHz | FSP30                              | R&S           | 100623                 | 300003464       | Ve                  | 15.01.2013       | 29.01.2017       |
| 2   | n. a.      | Vektor Signal Generator         | SMU200A                            | R&S           | 101633                 | 300003496       | k                   | 07.04.2014       | 07.04.2017       |
| 3   | n. a.      | DFS-test site                   | div. Splitter, Cables, Attenuators | Mini-Circuits | na                     | 300004557       | ev                  |                  |                  |
| 4   | n. a.      | Access point WLAN               | BAT54-Rail                         | Hirschmann    | 9439260210001<br>10207 | 400000689       | ne                  |                  |                  |
| 5   | n. a.      | Access point WLAN               | Cisco Aironet 3700e                | Cisco         | FTX1824R16T            | 300004822       | ne                  |                  |                  |

### Agenda: Kind of Calibration

|      |  |     |  |
|------|--|-----|--|
| k    | calibration / calibrated                   | EK  | limited calibration                                  |
| ne   | not required (k, ev, izw, zw not required) | zw  | cyclical maintenance (external cyclical maintenance) |
| ev   | periodic self verification                 | izw | internal cyclical maintenance                        |
| Ve   | long-term stability recognized             | g   | blocked for accredited testing                       |
| vk!! | Attention: extended calibration interval   |     |  |
| NK!  | Attention: not calibrated                  | *)  | next calibration ordered / currently in progress     |

## 2 Observations

No observations except those reported with the single test cases have been made.

**Annex A Document history**

| Version | Applied changes   | Date of release |
|---------|-------------------|-----------------|
|         | Initial release   | 2015-02-27      |
| A       | Editorial changes | 2015-06-11      |

**Annex B Further information****Glossary**

|          |   |  |
|----------|---|--|
| AVG      | - | Average  |
| DUT      | - | Device under test                              |
| EMC      | - | Electromagnetic Compatibility                  |
| EN       | - | European Standard                              |
| EUT      | - | Equipment under test                           |
| ETSI     | - | European Telecommunications Standard Institute |
| FCC      | - | Federal Communication Commission               |
| FCC ID   | - | Company Identifier at FCC                      |
| HW       | - | Hardware                                       |
| IC       | - | Industry Canada                                |
| Inv. No. | - | Inventory number                               |
| N/A      | - | Not applicable                                 |
| PP       | - | Positive peak                                  |
| QP       | - | Quasi peak                                     |
| S/N      | - | Serial number                                  |
| SW       | - | Software                                       |

**Annex C Accreditation Certificate**

Front side of certificate

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

Befähigung gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV  
 Unterzeichnerin der Multilateralen Abkommen  
 von EA, ILAC und IAF zur gegenseitigen Anerkennung

**Akkreditierung**



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium  
**CETECOM ICT Services GmbH**  
 Untertürkheimer Straße 6-10, 66117 Saarbrücken  
 die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen  
 durchzuführen:

- Drahtgebundene Kommunikation einschließlich xDSL
- Voice and DECT
- Akustik
- Funk einschließlich WLAN
- Short Range Devices (SRD)
- RFID
- WiFiMax und Richtfunk
- Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)
- Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
- Produktsicherheit
- SAR und Hearing Aid Compatibility (HAC)
- Umweltsimulation
- Smart Card Terminals
- Bluetooth
- Wi-Fi Services

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der  
 Akkreditierungsnummer D-PL-12076-01 und ist gültig 17.01.2018. Sie besteht aus diesem Deckblatt, der  
 Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

Registrierungsnummer der Urkunde: D-PL-12076-01-00

Frankfurt am Main, 07.03.2014

Stelle des Vorsitzenden der DAkkS

Im Auftrag  
 Dr. Ingrid Hoffmann  
 stellv. Vorsitzende

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- Standort Frankfurt am Main  
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- Standort Braunschweig  
 Bundesallee 100  
 38115 Braunschweig

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 der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen  
 erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:  
 EA: [www.european-accreditation.org](http://www.european-accreditation.org)  
 IAF: [www.iaf.or.jp](http://www.iaf.or.jp)  
 ILAC: [www.ilac.org](http://www.ilac.org)

**Note:**

The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

<http://www.cetecom.com/eu/de/cetecom-group/europa/deutschland-saarbruecken/akkreditierungen.html>