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consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-1294/16-01-06

Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing Laboratory

CETECOM ICT Services GmbH

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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-12076-01-01

Applicant

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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

RSS - 247 Issue 1

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence - Exempt Local Area Network (LE-LAN) Devices

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

Test Item

Kind of test item:**Smart Terminal****Model name:****iSMPv4****Frequency:**

5180 MHz to 5350 MHz & 5470 MHz to 5875 MHz

Technology tested:

WLAN (DFS requirements only)

Antenna:

Integrated monopole type antenna

Power supply:

3.7V DC by battery



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 authorized:

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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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2.2 Application details

Date of receipt of order:	2016-04-06
Date of receipt of test item:	2016-05-09
Start of test:	2016-05-09
End of test:	2016-05-12
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
RSS - 247 Issue 1	May 2015	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence - Exempt Local Area Network (LE-LAN) Devices

4 Test Environment

Temperature:	T_{nom}	+20 °C during room temperature tests
	T_{max}	Not tested at extreme conditions
	T_{min}	Not tested at extreme conditions
Relative humidity:		55 %
Air pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	3.7 V DC by battery
	V_{max}	Not tested at extreme conditions V
	V_{min}	Not tested at extreme conditions

5 Test item

Kind of test item	:	Smart Terminal
Type identification	:	iSMPv4
HMN	:	N/A
PMN	:	ISMP4
HVIN	:	IMP6 /BCR IMP6
FVIN	:	N/A
S/N serial number	:	16082PP00008735
HW hardware status	:	296194103
SW software status	:	SDK9.x
Frequency band	:	5180 MHz to 5350 MHz & 5470 MHz to 5875 MHz
Type of modulation	:	OFDM
Antenna	:	Integrated monopole type antenna
Power supply	:	3.7 V DC by battery
Temperature range	:	22° C (device tested under normal conditions, room temperature)

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: 1-1294/16-01-20_AnnexA
1-1294/16-01-20_AnnexB
1-1294/16-01-20_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
☒	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
DFS-Testing	CFR Part 15, FCC 06-96	See table	2016-05-23	DFS only (Client device)

Test Standard Clause	Test Case	Bandwidth	C	NC	NA	NP	Remark
7.8.1*3	U-NII Detection Bandwidth	20 MHz 40 MHz	☐	☐	☒	☐	*1*2*4
§15.407 (h)(2)	DFS Detection Threshold	20 MHz	☐	☐	☒	☐	*1*2*4
§15.407 (h)(2) (ii) & 7.8.2*3	Channel Availability Check Time	20 MHz	☐	☐	☒	☐	*1*4
§15.407 (h)(2) (iv) & 7.8.3*3	Non-Occupancy Period	40 MHz	☒	☐	☐	☐	*1
§15.407 (h)(2) (iii) & 7.8.2*3	Channel Move Time / Channel Closing Transmission Time	40 MHz	☒	☐	☐	☐	*2
7.8.3 & 7.8.4*3	In-Service Monitoring / Statistical Performance Check	20 MHz 40 MHz	☐	☐	☒	☐	*2*4

Abbreviations/References:

- C Compliant
- NC Not compliant
- NA Not applicable
- NP Not performed
- *1 Prior to use of a channel
- *2 During normal operation
- *3 See KDB publication 905462 D02 UNII DFS Compliance Procedures New Rules v02
- *4 Not applicable to Client devices without radar detection.

8 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: Iperf was used to generate the required channel load (duty cycle greater 17 percent).

9 RF measurements

9.1 Description of test setup

9.1.1 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

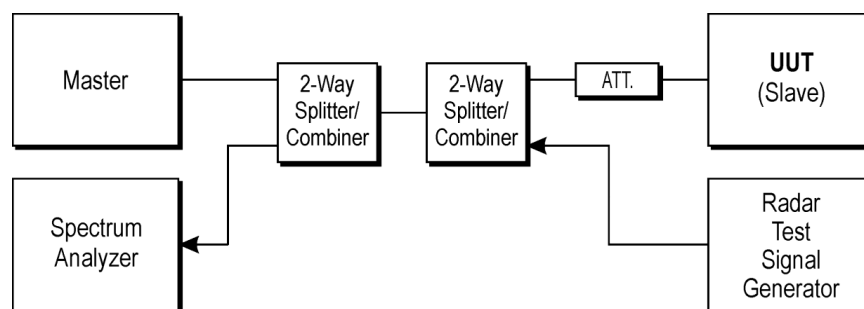


Figure 1: Setup

RPP = SG - CA

(RPP-radar pulse power; SG-signal generator power; CA-loss signal path)

Example calculation:

$RPP [dBm] = -30.0 [dBm] - 33.0 [dB] = -63.0 [dBm]$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Vektor Signal Generator	SMU200A	R&S	101633	300003496	k	07.04.2014	07.04.2017
2	n. a.	Spectrum Analyzer 9kHz to 30GHz - 140...+30dBm	FSP30	R&S	100886	300003575	k	27.01.2016	27.01.2018
3	n. a.	DFS-test site	div. Splitter, Cables, Attenuators	Mini-Circuits	na	300004557	ev	-/-	-/-
4	n. a.	Access point WLAN	BAT54-Rail	Hirschmann	943926021000110207	400000689	ne	-/-	-/-
5	n. a.	Rechner für Schalt- und Steuerplattform OSP	exone Variety	Hirschmann	060931P1302P00109	300004869	ne	-/-	-/-
6	n. a.	Notebook	Latitude 15 6000 Series	Dell	060931P1302P00109	300004737	ne	-/-	-/-
7	n. a.	RF-Cable WLAN-Tester Port 1	ST18/SMAm/SMAm/36	Huber & Suhner	Batch no. 601494	400001216	ev	-/-	-/-
8	n. a.	RF-Cable WLAN-Tester Port 2	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 54877	400001217	ev	-/-	-/-
9	n. a.	RF-Cable WLAN-Tester Port 3	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 54877	400001218	ev	-/-	-/-
10	n. a.	RF-Cable WLAN-Tester Port 4	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 1273777	400001219	ev	-/-	-/-
11	n. a.	RF-Cable WLAN-Tester Analyzer	ST18/SMAm/SMAm/36	Huber & Suhner	Batch no. 54876	400001220	ev	-/-	-/-
12	n. a.	RF-Cable WLAN-Tester Vector Signal Generator	ST18/SMAm/SMAm/60	Huber & Suhner	Batch no. 606844	400001222	ev	-/-	-/-

9.2 Parameters of DFS test signals

9.2.1 DFS Detection Thresholds for Master Devices as well as Client Devices With Radar Detection

Maximum Transmit Power EIRP	Value (see note)
≥ 200 mW	-64 dBm
< 200 mW and power spectral density < 10 dBm/MHz	-62 dBm
< 200 mW and That do not meet the power spectral density < 10 dBm/MHz	-64 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.
Note3: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.

9.2.2 DFS Response Requirement Values

Parameter	Value
Non-occupancy period	minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds See Note 1.
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.

Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.
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 a Channel move (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 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

9.2.3 Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance.

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (μsec)	PRI (μsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a Test B: 15 unique PRI values randomly selected within the range of 518-3066 μsec, with a minimum increment of 1 μsec, excluding PRI values selected in Test A	Roundup $\left\{ \left(\frac{1}{360} \right) \cdot \left(\frac{19 \cdot 10^6}{\text{PRI}_{\mu\text{sec}}} \right) \right\}$	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4.

Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

Long Pulse Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Burst	Number of Bursts	Minimum Percentage of Successful Detection	Minimum Number of Trails
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms.

Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Number of Trails
6	1	333	9	0.333	300	70%	30

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined.

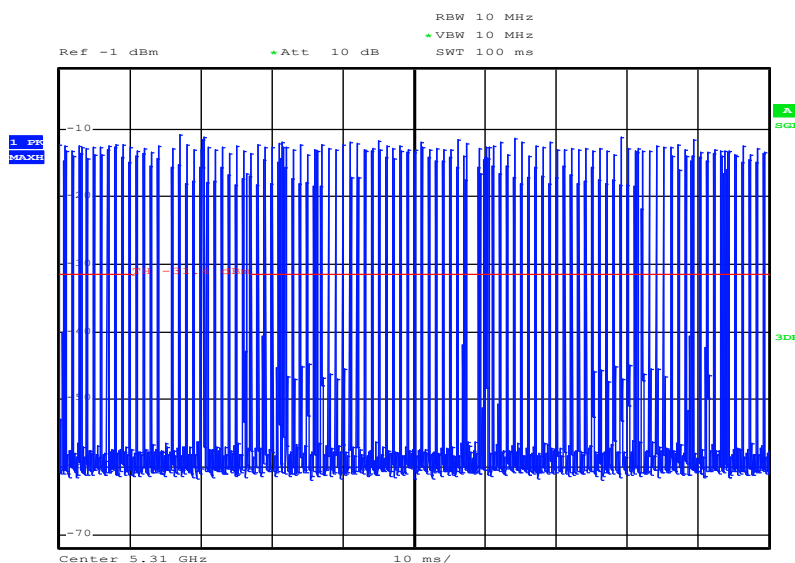
The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set.

9.3 Test preparation

9.3.1 Channel loading

Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater. For example, channel loading can be estimated by setting the spectrum analyzer for zero span and approximate the Time On/ (Time On + Off Time). This can be done with any appropriate channel BW and modulation type.

HT40-Mode: Calculated duty cycle = 17.7%

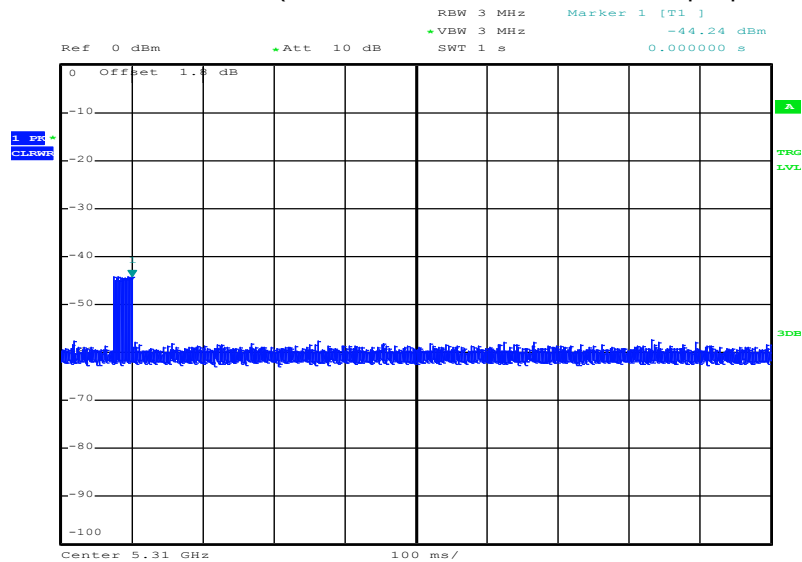


Date: 12.MAY.2016 10:22:45

Plot 1

9.3.2 Radar burst timing signal

To accurately determine the channel closing time and channel closing transmission time the spectrum analyser is triggered at the end of the radar burst (see marker at $t = 0$ ms in the example plot below).



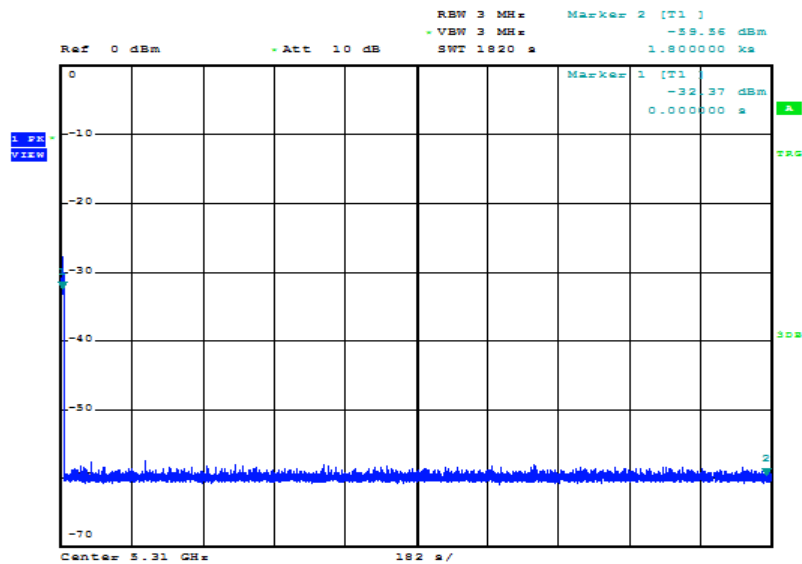
Date: 27.OCT.2015 11:05:04

Plot 2

9.1 Test results (prior to use of a channel)

9.1.1 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.



Date: 17.MAY.2016 13:47:34

Plot 3

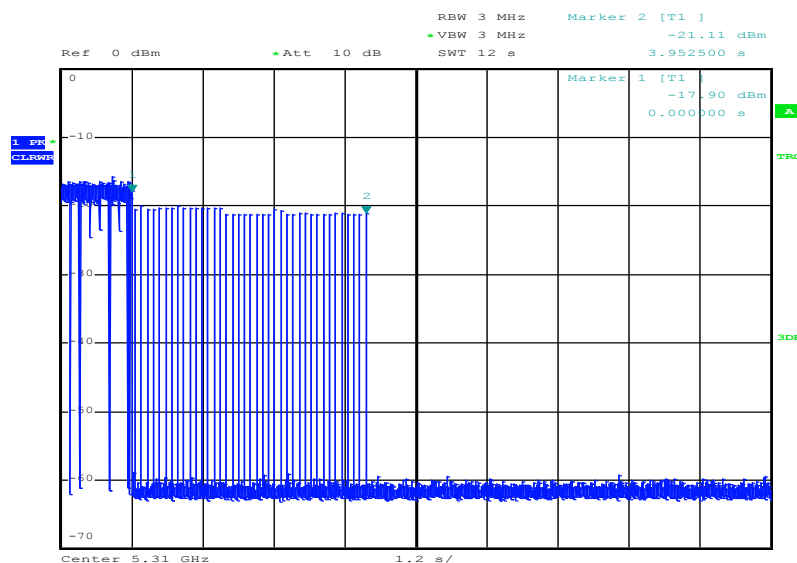
9.2 Test results (during normal operation)

9.2.1 Channel move time / channel closing transmission 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 not exceeding 60ms.

The test is performed during normal operation with the highest bandwidth supported by the DUT.

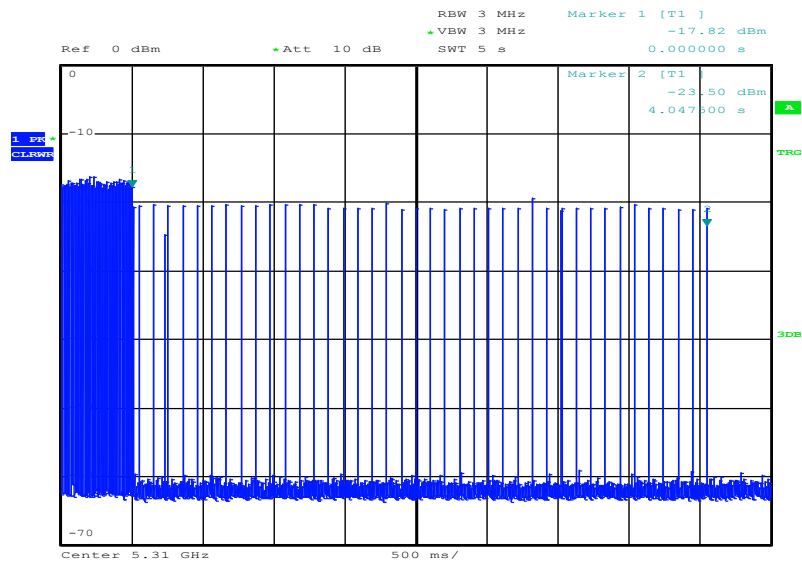
Channel Closing Time



Date: 12.MAY.2016 11:01:19

Plot 4

Note: With Marker 1 at the end of the radar pulse ($t = 0$ ms) the Channel Closing Time is determined by setting a Delta-Marker to the point where the last transmission occurred. The Channel Closing Time is 3.95 sec.

Channel Closing Transmission Time

Date: 12.MAY.2016 11:14:15

Plot 5

Note: The accumulated transmission time is calculated by the number of bins occurring after $t = 0$ ms multiplied with the Time-per-sweep point-factor resulting from the Sweep Time and number of Sweep Points of the Spectrum Analyser.
The Channel Closing Transmission Time is 47.5 msec.

10 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	2016-05-23

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
PMN	-	Product marketing name
HMN	-	Host marketing name
HVIN	-	Hardware version identification number
FVIN	-	Firmware version identification number

Annex C Accreditation Certificate

Front side of certificate



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Unterzeichnerin der Multilateralen Abkommen
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Akkreditierung



Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

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Produktsicherheit
SAR / EMF
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Wi-Fi-Services
Kanadische Anforderungen
US-Anforderungen
Akustik
Near Field Communication (NFC)

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

Frankfurt, 04.05.2016

Siehe Hinweise auf der Rückseite

Im Auftrag Dipl.-Ing. (FH) Ralf Egnier
Abteilungsleiter

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