
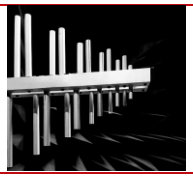
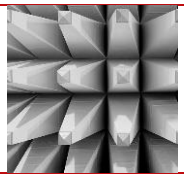

CETECOM™
CETECOM ICT Services
consulting - testing - certification

# TEST REPORT

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

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

## Testing Laboratory


**CETECOM ICT Services GmbH**
Untertuerkheimer Strasse 6 – 10
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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-12076-01-01

## Applicant


**Ingenico Group**
9 Avenue de la Gare Rovaltain
26958 Valence Cedex 9/FRANCE
Contact: Jean-Baptiste Palisse
e-mail: jean-baptiste.palisse@ingenico.com
Phone: +33 4 75 84 21 74


## Manufacturer

**Ingenico Group**
9 Avenue de la Gare Rovaltain
26958 Valence Cedex 9/FRANCE

## 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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2016.05.23 13:09:43 +02'00'

Stefan Bös
Lab Manager
Radio Communications & EMC

## Test performed:

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cn=David Lang, o=CETECOM ICT Services GmbH, ou=LNG-141031, email=david.lang@cetecom.com, c=DE
2016.05.23 11:41:06 +02'00'

David Lang
Lab Manager
Radio Communications & EMC

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

## 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<br>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.<br>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<br>(Client device) |

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

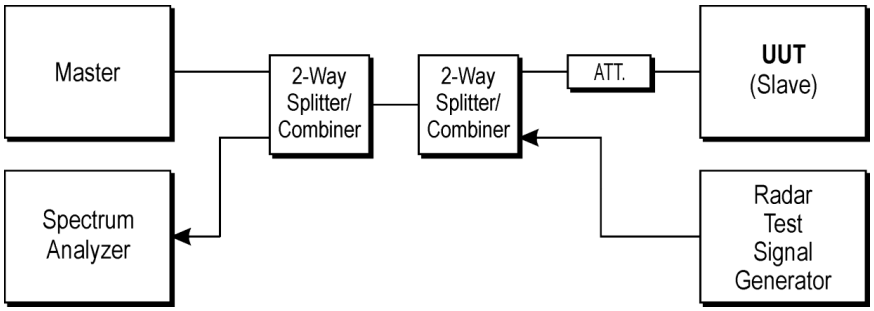



Figure 1: Setup

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 | 9439260210001 10207 | 400000689 | ne | -/- | -/- |
| 5 | n. a. | Rechner für Schalt- und Steuerplattform OSP | exone Variety | Hirschmann | 060931P1302P 00109 | 300004869 | ne | -/- | -/- |
| 6 | n. a. | Notebook | Latitude 15 6000 Series | Dell | 060931P1302P 00109 | 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 | Roundup $\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\mathrm{PRI}_{\mu\mathrm{sec}}}\right)\right\}$ | 60% | 30 |
| | | 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 | | | |
| 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 |

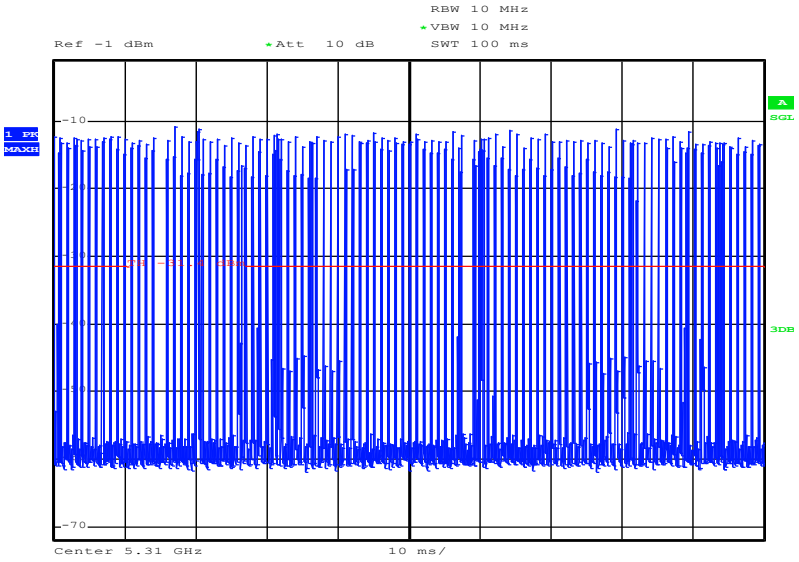
For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined.
The first frequency in a hopping sequence is selected randomly from the group of 475 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%

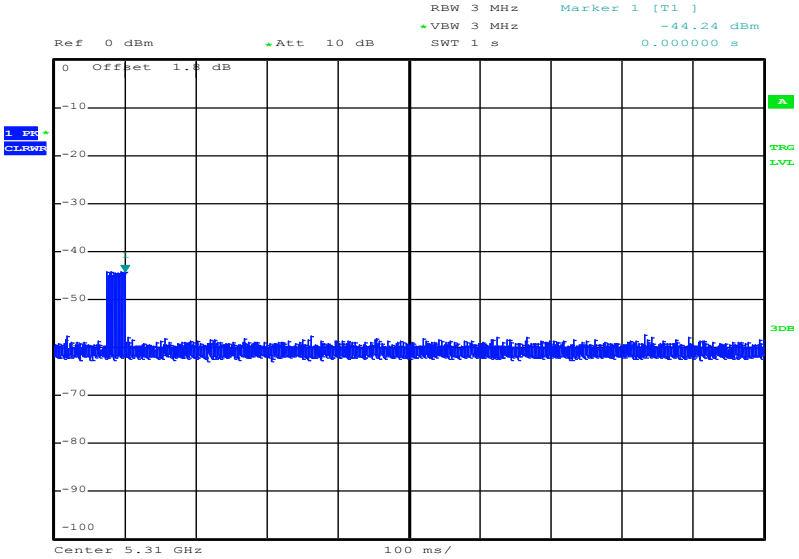



Date: 12.MAY.2016 10:22:45

**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* = 0ms in the example plot below).



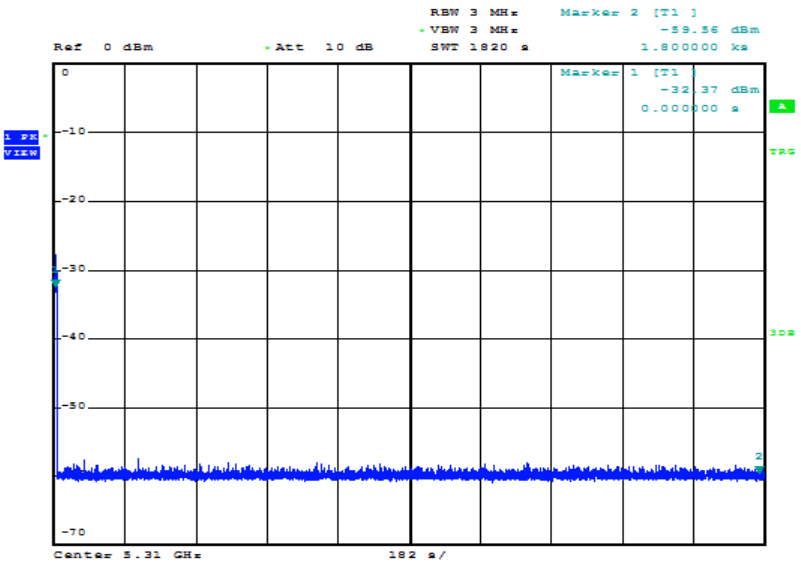

Date: 27.OCT.2015 11:05:04

**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.




**Plot 3**

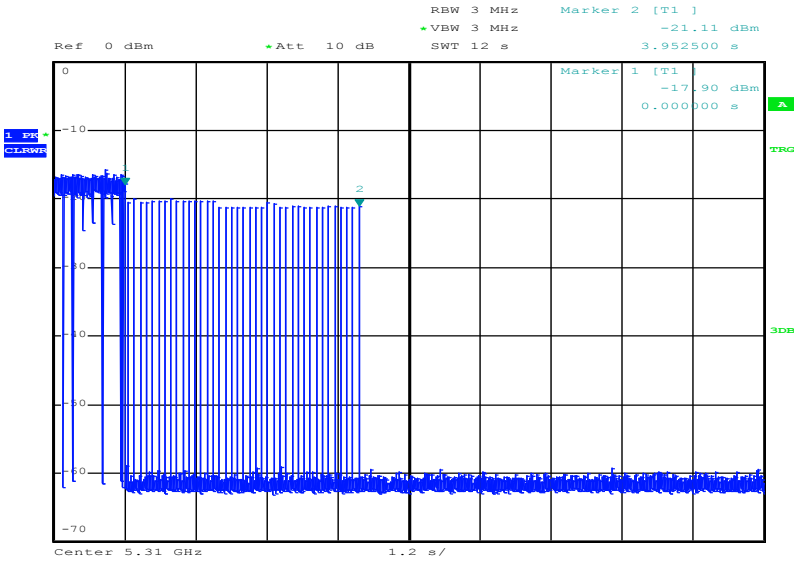
## 9.2 Test results (during normal operation)

### 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.

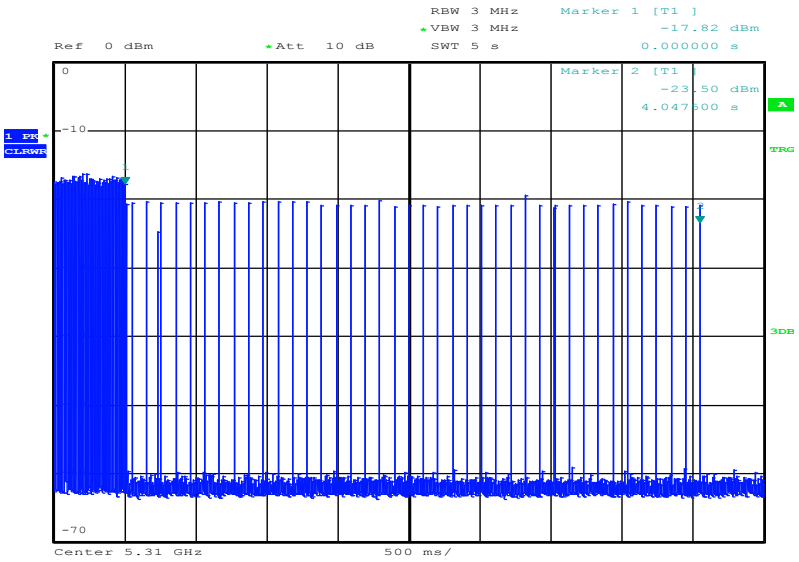
**Channel Closing Time**




**Plot 4**

Note: With Marker 1 at the end of the radar pulse ($t$ = 0ms) 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




**Plot 5**

Note: The accumulated transmission time is calculated by the number of bins occurring after t = 0ms 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

DAkkS
Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

**Beliehene 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:

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**Elektromagnetische Verträglichkeit (EMV)**
**Produktsicherheit**
**SAR / EMF**
**Umwelt**
**Smart Card Technology**
**Bluetooth***
**Automotive**
**WI-FI-Services**
**Kanadische Anforderungen**
**US-Anforderungen**
**Akustik**
**Near Field Communication (NFC )**

Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 04.05.2016 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig bis 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 63 Seiten.

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

Frankfurt, 04.05.2016

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

Siehe Hinweise auf der Rückseite

Back side of certificate

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38116 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate Weiterverbreitung des Deckblattes durch die umseitig genannte Konformitätsbewertungsstelle in unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30).
Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und 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
ILAC: www.ilac.org
IAF: www.iaf.nu

**Note:**
**The current certificate including annex may be received from CETECOM ICT Services GmbH on request.**