eurofins | Product Service

# EMC TEST REPORT

**FCC 47 CFR Part 15B**
**Industry Canada ICES-003**

**Electromagnetic compatibility - Unintentional radiators**

| | |
|---|---|
| **Report Reference No.** ..... : | G0M-1709-6886-EF0115B-V01 |
| **Testing Laboratory** ..... : | Eurofins Product Service GmbH |
| Address ..... : | Storkower Str. 38c<br>15526 Reichenwalde<br>Germany |
| Accreditation ..... : | A2LA Accredited Testing Laboratory, Certificate No.: 1983.01<br>FCC Test Firm Designation Number: DE0008<br>IC Testing Laboratory site: 3470A-2 |
| **Applicant's name** ..... : | Wincor Nixdorf Manufacturing GmbH |
| Address ..... : | Rohrdamm 7, Haus 16<br>13629 Berlin<br>GERMANY |
| **Test specification:** | |
| Standard..... : | 47 CFR Part 15 Subpart B<br>ICES-003, Issue 6:2016<br>ANSI C63.4:2014 |
| **Equipment under test (EUT):** | |
| Product description | NFC Reader |
| Model No. | KIT-NFC-KIOSK |
| Additional Models | None |
| Hardware version | Rev. A |
| Firmware / Software version | 01.02 |
| | FCC-ID: 2AO4D-01750304421 IC: 23654-01750304421 |
| **Test result** | **Passed** |

**Possible test case verdicts:**

- not applicable to test object .....: N/A
- test object does meet the requirement.....: P (Pass)
- test object does not meet the requirement.....: F (Fail)

**Testing:**

Date of receipt of test item .....: 2018-01-03

Date (s) of performance of tests .....: 2018-01-03

Compiled by..... : Matthias Handrik

Tested by (+ signature)..... : Matthias Handrik .....

Approved by (+ signature) ..... : Jens Marquardt .....
Head of Lab

Date of issue..... : 2018-01-30

Total number of pages..... : 23

**General remarks:**

**The test results presented in this report relate only to the object tested.**
**The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.**

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

**Additional comments:**

# Version History

| Version | Issue Date | Remarks | Revised by |
|---|---|---|---|
| V01 | 2018-01-30 | Initial Release | |



Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

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# 1 Equipment (Test item) Description

| | |
|---|---|
| **Description** | NFC Reader |
| **Model** | KIT-NFC-KIOSK |
| **Additional Models** | None |
| **Serial number** | None |
| **Hardware version** | Rev. A |
| **Software / Firmware version** | 01.02 |
| **FCC-ID** | 2AO4D-01750304421 |
| **IC** | 23654-01750304421 |
| **Power supply** | 5 VDC (USB) |
| **AC/DC-Adaptor** | None |
| **Manufacturer** | Wincor Nixdorf Manufacturing GmbH<br>Rohrdamm 7, Haus 16<br>13629 Berlin<br>GERMANY |
| **Highest emission frequency** | Fmax[MHz] = 13.56 MHz |
| **Device classification** | Class B |
| **Equipment type** | Tabletop |
| **Number of tested samples** | 1 |

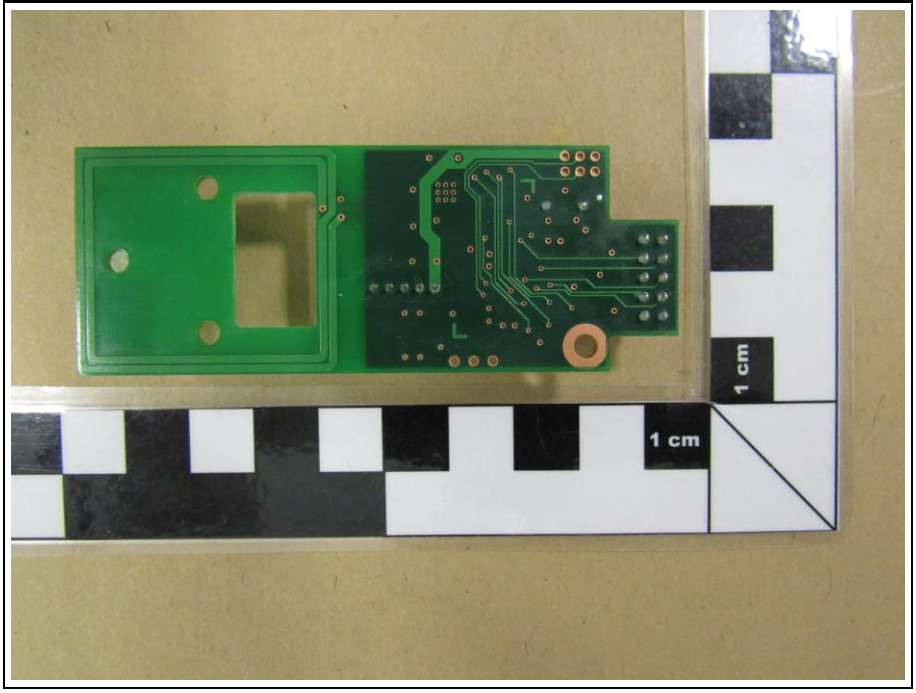
## 1.1 Photos – Equipment external

**EUT FRONT**

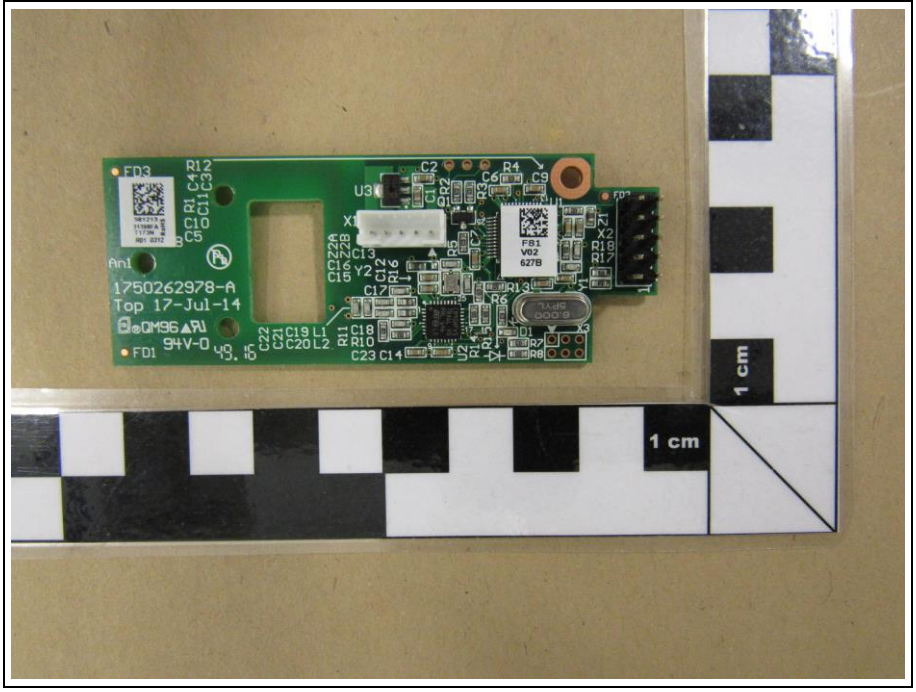
**EUT BACK**

## 1.2 Photos – Equipment internal

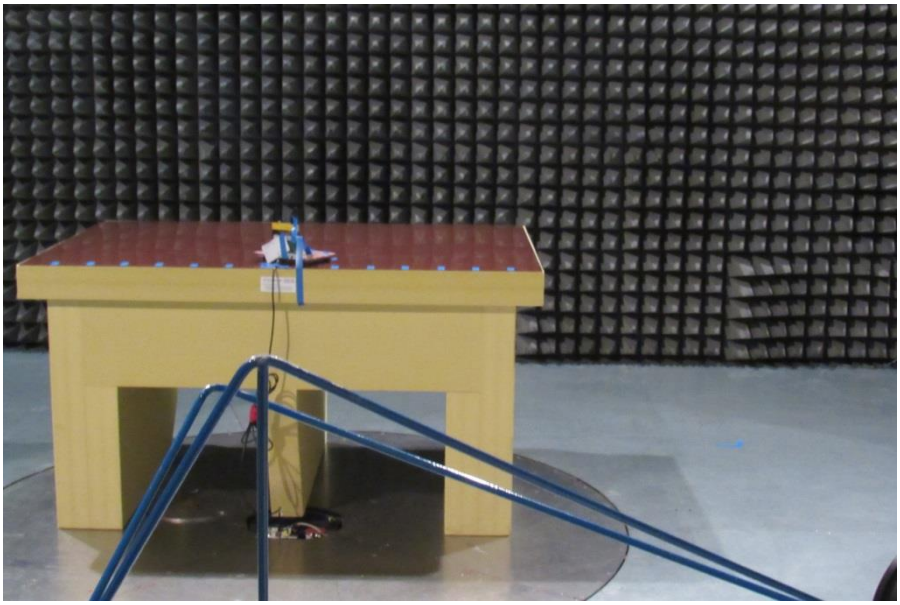
**EUT PCB BOTTOM**

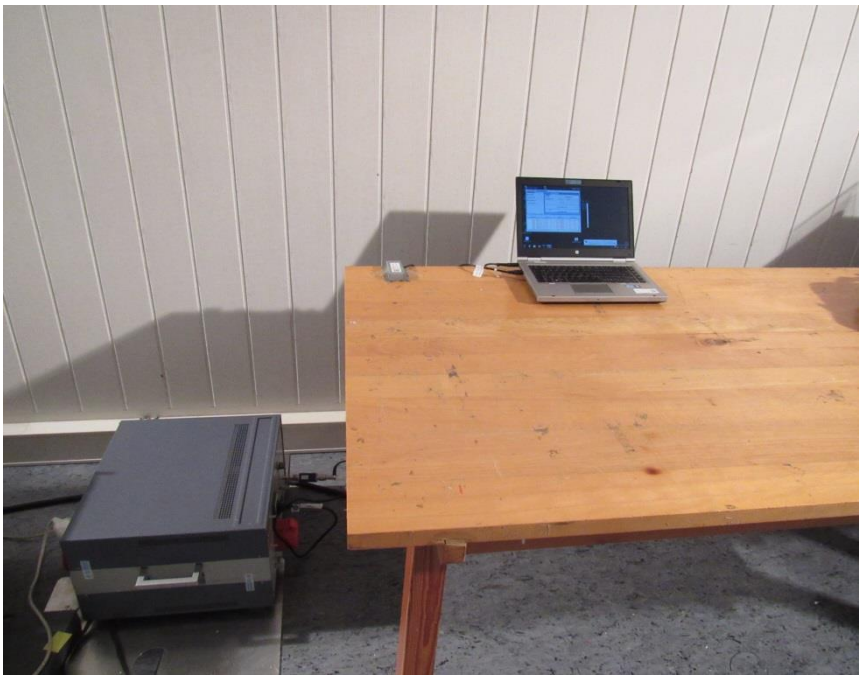



**EUT PCB TOP**



## 1.3 Photos – Test setup

| Test Setup : Radiated Emissions |
|---|
|  |

| Test Setup : Conducted Emissions |
|---|
|  |

### 1.4 Supporting Equipment Used During Testing

| Product Type* | Device | Manufacturer | Model No. | Comments (e.g. serial no.) |
|---|---|---|---|---|
| AE | Laptop | HP | Hp Elitebook 8460p | CZC2067NCN |
| AE | Test software | Diebold Nixdorf | JavaPOS…RFIDScanner – Test program for JPOS.RFIDScanner | Version 1.13 |

***Note:** Use the following abbreviations:

AE : Auxiliary/Associated Equipment, or

SIM : Simulator (Not Subjected to Test)

CABL : Connecting cables

### 1.5 Input / Output Ports

| Port # | Name | Type* | Max. Cable Length | Cable Shielded | Comments (e.g. Cat. of Cable) |
|---|---|---|---|---|---|
| 1 | USB | DC/ I/O | 1m | Yes | - |

***Note:** Use the following abbreviations:

AC : AC power port

DC : DC power port

N/E : Non electrical

I/O : Signal input or output port

TP : Telecommunication port

### 1.6 Operating Modes and Configurations

| Mode # | Description |
|---|---|
| 1 | EUT powered via USB from laptop. Test software on laptop controlled EUT for continuous reading TAG. |

| Configuration # | EUT Configuration |
|---|---|
| 1 | EUT is placed inside measurement chamber. Laptop is placed outside the measurement chamber and powered EUT direct via USB |

### 1.7 Test Equipment Used During Testing

| Measurement Software | | | |
|---|---|---|---|
| Description | Manufacturer | Name | Version |
| EMC Test Software | Dare Instruments | Radimation | 2016.1.10 |

| Conducted emissions SR1 | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal. Date | Cal. Due |
| AMN | R&S | ESH2-Z5 | EF00182 | 2017-01 | 2019-01 |
| AMN | R&S | ESH3-Z5 | EF00036 | 2017-01 | 2019-01 |
| EMI Test Receiver | R&S | ESR7 | EF00943 | 2017-07 | 2018-07 |
| Cable | - | RG223/U | - | System Cal. | System Cal. |

| Radiated emissions AC1 | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal. Date | Cal. Due |
| Biconical Antenna | R&S | HK 116 | EF00030 | 2016-04 | 2019-04 |
| LPD Antenna | R&S | HL 223 | EF00187 | 2016-05 | 2019-05 |
| Horn antenna | Schwarzbeck | BBHA 9120D | EF00018 | 2016-09 | 2019-09 |
| MXE EMI Receiver | Keysight Technologies | N9038A-526/WXP | EF01070 | 2017-08 | 2018-08 |
| RF Cable | | | - | System Cal. | System Cal |
| RF Cable | | | - | System Cal. | System Cal |

## 1.8 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBµV. Any external preamplifiers used are taken into account through internal analyzer settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyzer (dBµV) + A.F. (dB) = Net field strength (dBµV/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

Limit (dBµV/m) = 20*log (µV/m)

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

| Reading | + | AF | = | Net Reading | : | Net reading - FCC limit = Margin |
|---|---|---|---|---|---|---|
| 21.5 dBµV | + | 26 dB | = | 47.5 dBµV/m | : | 47.5 dBµV/m - 57.0 dBµV/m = -9.5 dB |

## 2 Result Summary

| FCC 47 CFR Part 15B, Industry Canada ICES-003 | | | | |
|---|---|---|---|---|
| **Product Specific Standard** | **Requirement – Test** | **Reference Method** | **Result** | **Remarks** |
| 47 CFR 15.109<br>ICES-003 Item 6.2 | Radiated emissions | ANSI C 63.4 | PASS | |
| 47 CFR 15.107<br>ICES-003 Item 6.1 | AC power line conducted emissions | ANSI C63.4 | PASS | |
| **Remarks:** | | | | |

# 3 Test Conditions and Results

## 3.1 Test Conditions and Results – Radiated emissions

| Radiated emissions acc. FCC 47 CFR 15.109 / ICES-003 | | Verdict: PASS |
|---|---|---|
| Laboratory Parameters: | Required prior to the test | During the test |
| Ambient Temperature | 15 to 35 °C | 21°C |
| Relative Humidity | 30 to 60 % | 32% |
| Test according referenced standards | Reference Method | |
| | ANSI C63.4 | |
| Sample is tested with respect to the requirements of the equipment class | Equipment class | |
| | Class B | |
| Test frequency range determined from highest emission frequency | Highest emission frequency | |
| | Fmax [MHz] = 13.56 | |
| Fully configured sample scanned over the following frequency range | Frequency range | |
| | 30 MHz to 1 GHz | |
| Operating mode | 1 | |
| Configuration | 1 | |

| Limits and results Class B | | | | | | |
|---|---|---|---|---|---|---|
| Frequency [MHz] | Quasi-Peak [dBµV/m] | Result | Average [dBµV/m] | Result | Peak [dBµV/m] | Result |
| 30 – 88 | 40 | PASS | - | | - | - |
| 88 – 216 | 43.5 | PASS | - | | - | - |
| 216 – 960 | 46 | PASS | - | | - | - |
| 960 – 1000 | 54 | PASS | - | | - | - |
| > 1000 | - | - | 54 | PASS | 74 | PASS |
| Comments: | | | | | | |

**Test Procedure:**

The test site is in accordance with ANSI C63-4:2014 requirements and is listed by FCC.
The measurement procedure is as follows:

Exploratory measurement:

- The EUT was placed on a non-conductive table at a height of 0.8m.
- The EUT and support equipment, if needed, were set up to simulate typical usage.
- Cables, of type and length specified by the manufacturer, were connected to at least one port of each type and were terminated by a device or simulating load of actual usage.
- The antenna was placed at a distance of 3 or 10 m.
- The received signal was monitored at the measurement receiver.
    - Cables not bundled were manipulated within the range of likely arrangements to produce the highest emission amplitude
    - To maximize the suspected emissions the EUT is rotated 360 degrees. If the signal exceeds the previous amplitude, go back to the corresponding azimuth and manipulate the cables again for maximizing the emissions if possible.
    - Move the antenna from 1 to 4m to maximize the suspected highest amplitude signal.
- This procedure has to be performed in both antenna polarizations, horizontal and vertical.
- The arrangement of the equipment with the maximum emission level is shown on the setup picture at item 1.3.

Final measurement:

- The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver
- A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 1000 MHz. Above one 1 GHz a Double Ridged Broadband Horn antenna was used. The antenna was placed on an adjustable height antenna mast
- The EUT and cable arrangement were based on the exploratory measurement results
- Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.
- The test data of the worst-case conditions were recorded and shown on the next pages.

**Radiated emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1709-6886

| | |
|---|---|
| Applicant: | Wincor Nixdorf Manufacturing GmbH |
| EUT Name: | NFC Reader |
| Model: | KIT-NFC-KIOSK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Handrik |
| Test Conditions: | Tnom: 21°C, Unom: 5 VDC (USB) |
| Antenna: | Rohde & Schwarz HK 116, Vertical |
| Measurement distance: | 3m |
| Mode: | Mode#1 |
| Test Date: | 2018-01-03 |
| Note: | |

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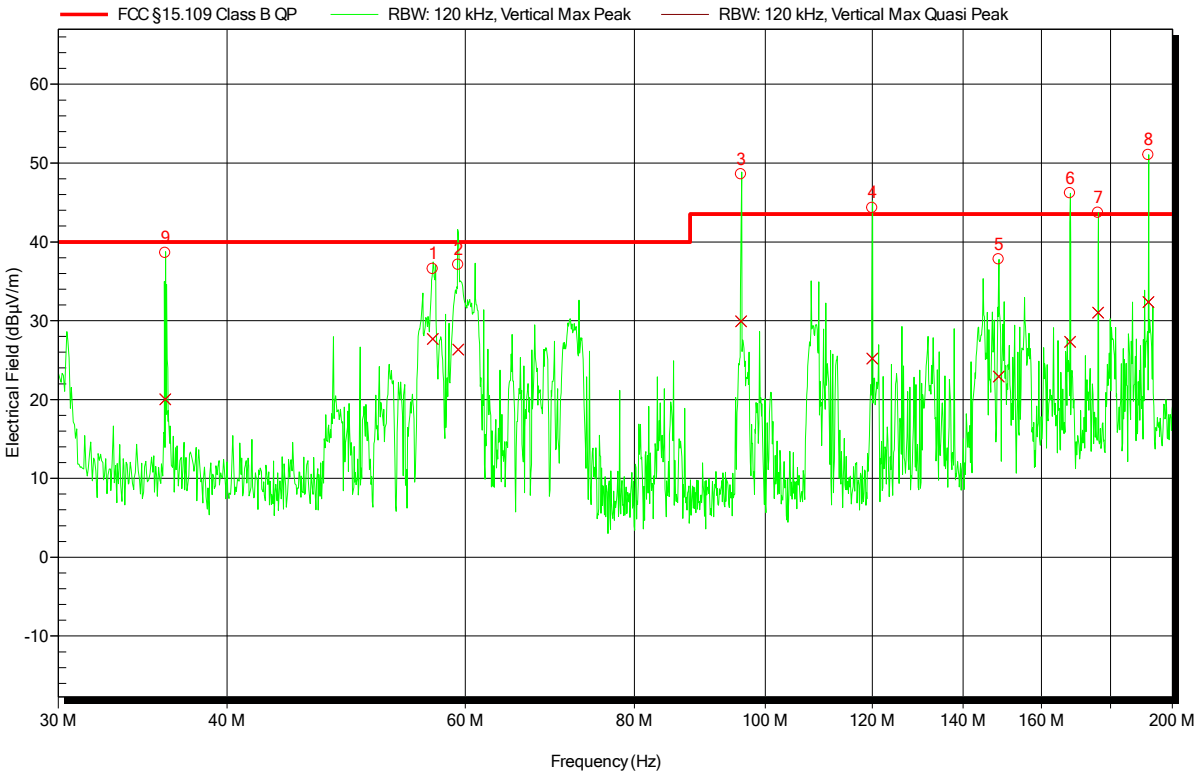


| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|---|---|---|---|---|---|---|---|
| 1 | 56.782 MHz | 27.69 dBµV/m | 40 dBµV/m | -12.31 dB | Pass | 5 Degree | 1 m |
| 2 | 59.304 MHz | 26.35 dBµV/m | 40 dBµV/m | -13.65 dB | Pass | 5 Degree | 1 m |
| 3 | 95.976 MHz | 29.92 dBµV/m | 43.52 dBµV/m | -13.6 dB | Pass | 5 Degree | 1 m |
| 4 | 119.972 MHz | 25.21 dBµV/m | 43.52 dBµV/m | -18.31 dB | Pass | 5 Degree | 1 m |
| 5 | 148.826 MHz | 22.9 dBµV/m | 43.52 dBµV/m | -20.62 dB | Pass | 5 Degree | 1 m |
| 6 | 167.994 MHz | 27.33 dBµV/m | 43.52 dBµV/m | -16.19 dB | Pass | 5 Degree | 1 m |
| 7 | 176.238 MHz | 31.04 dBµV/m | 43.52 dBµV/m | -12.49 dB | Pass | 5 Degree | 1 m |
| 8 | 192.001 MHz | 32.37 dBµV/m | 43.52 dBµV/m | -11.15 dB | Pass | 5 Degree | 1 m |
| 9 | 36.011 MHz | 20.05 dBµV/m | 40 dBµV/m | -19.95 dB | Pass | 5 Degree | 1 m |

**Radiated emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1709-6886

| | |
|---|---|
| Applicant: | Wincor Nixdorf Manufacturing GmbH |
| EUT Name: | NFC Reader |
| Model: | KIT-NFC-KIOSK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Handrik |
| Test Conditions: | Tnom: 21°C, Unom: 5 VDC (USB) |
| Antenna: | Rohde & Schwarz HK 116, Horizontal |
| Measurement distance: | 3m |
| Mode: | Mode#1 |
| Test Date: | 2018-01-03 |
| Note: | |

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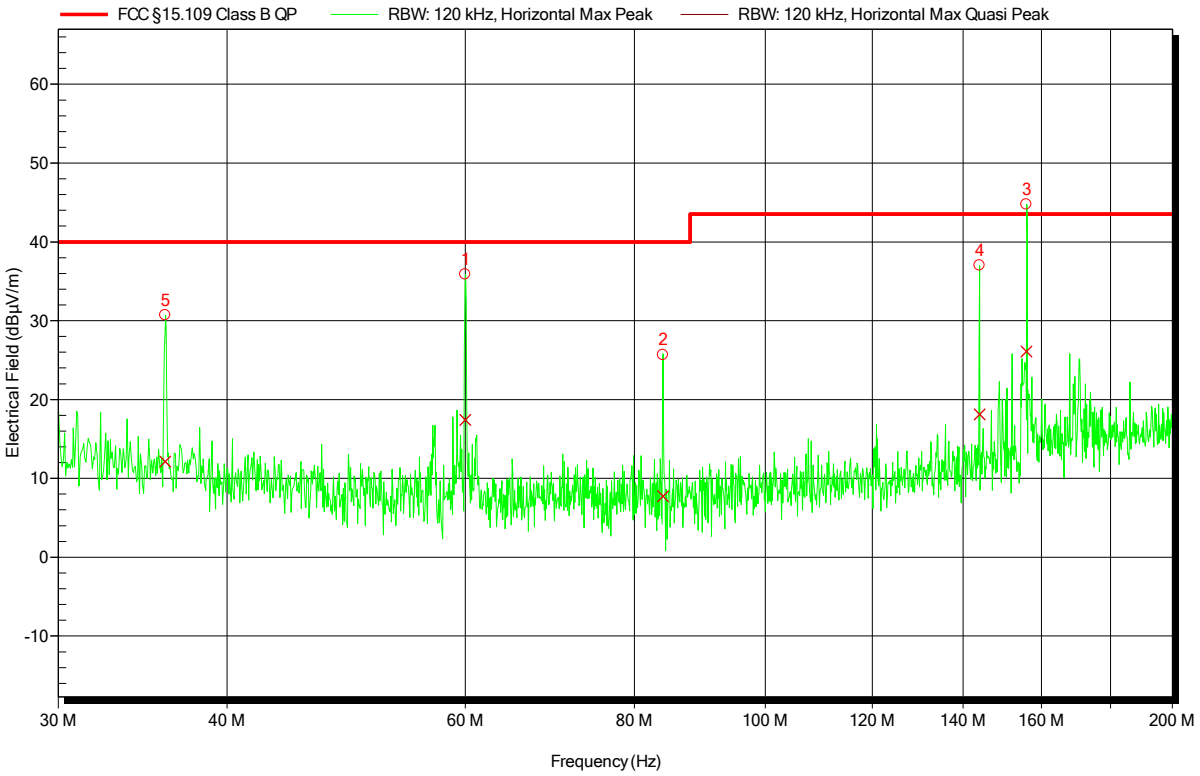


| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|---|---|---|---|---|---|---|---|
| 1 | 59.994 MHz | 17.41 dBµV/m | 40 dBµV/m | -22.59 dB | Pass | 0 Degree | 1 m |
| 2 | 84.02 MHz | 7.73 dBµV/m | 40 dBµV/m | -32.27 dB | Pass | 0 Degree | 1 m |
| 3 | 155.995 MHz | 26.11 dBµV/m | 43.52 dBµV/m | -17.41 dB | Pass | 0 Degree | 1 m |
| 4 | 144.015 MHz | 18.12 dBµV/m | 43.52 dBµV/m | -25.4 dB | Pass | 0 Degree | 1 m |
| 5 | 36.011 MHz | 12.12 dBµV/m | 40 dBµV/m | -27.88 dB | Pass | 0 Degree | 1 m |

**Radiated emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1709-6886

| | |
|---|---|
| Applicant: | Wincor Nixdorf Manufacturing GmbH |
| EUT Name: | NFC Reader |
| Model: | KIT-NFC-KIOSK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Handrik |
| Test Conditions: | Tnom: 21°C, Unom: 5 VDC (USB) |
| Antenna: | Rohde & Schwarz HL 223, Vertical |
| Measurement distance: | 3m |
| Mode: | Mode#1 |
| Test Date: | 2018-01-03 |
| Note: | |

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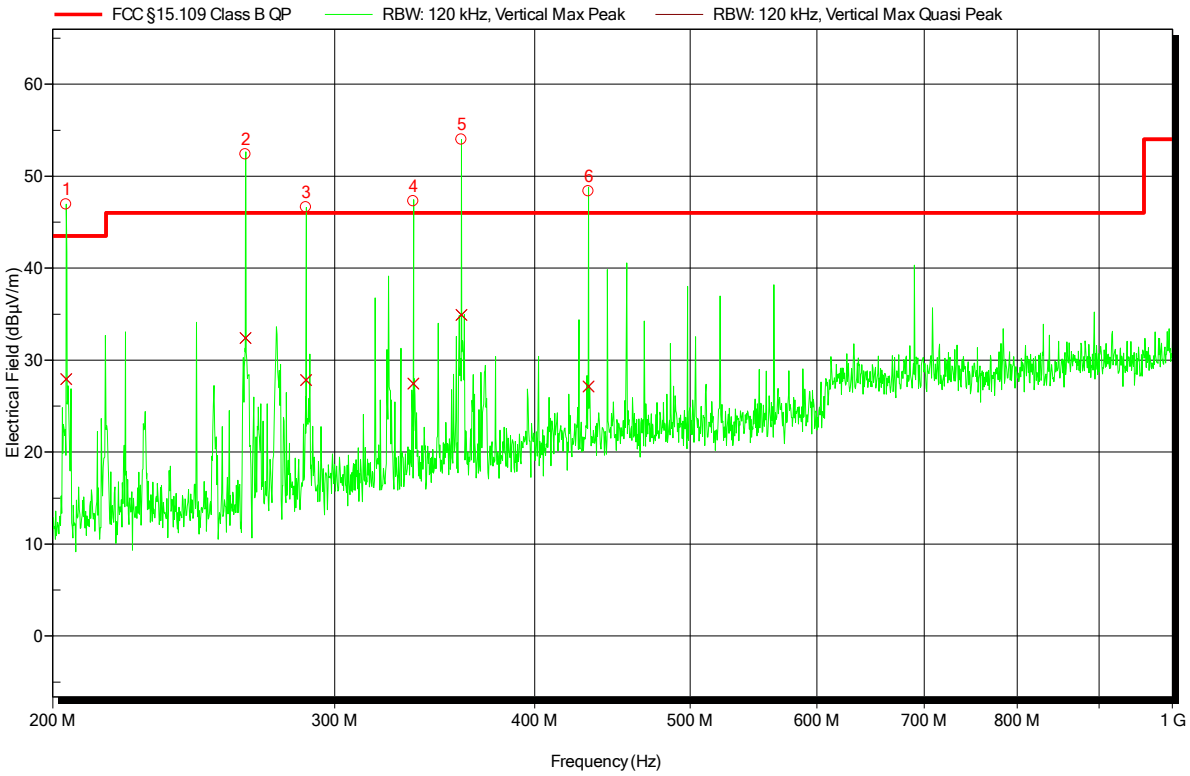


| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|---|---|---|---|---|---|---|---|
| 1 | 204.017 MHz | 27.95 dBµV/m | 43.52 dBµV/m | -15.57 dB | Pass | 0 Degree | 1 m |
| 2 | 264.035 MHz | 32.42 dBµV/m | 46.02 dBµV/m | -13.6 dB | Pass | 0 Degree | 1 m |
| 3 | 288.01 MHz | 27.82 dBµV/m | 46.02 dBµV/m | -18.2 dB | Pass | 0 Degree | 1 m |
| 4 | 335.983 MHz | 27.44 dBµV/m | 46.02 dBµV/m | -18.58 dB | Pass | 0 Degree | 1 m |
| 5 | 360 MHz | 34.91 dBµV/m | 46.02 dBµV/m | -11.11 dB | Pass | 0 Degree | 1 m |
| 6 | 432.044 MHz | 27.14 dBµV/m | 46.02 dBµV/m | -18.88 dB | Pass | 0 Degree | 1 m |

**Radiated emissions under normal conditions according to FCC Part 15b**

Project number: G0M-1709-6886

| | |
|---|---|
| Applicant: | Wincor Nixdorf Manufacturing GmbH |
| EUT Name: | NFC Reader |
| Model: | KIT-NFC-KIOSK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Handrik |
| Test Conditions: | Tnom: 21°C, Unom: 5 VDC (USB) |
| Antenna: | Rohde & Schwarz HL 223, Horizontal |
| Measurement distance: | 3m |
| Mode: | Mode#1 |
| Test Date: | 2018-01-03 |
| Note: | |

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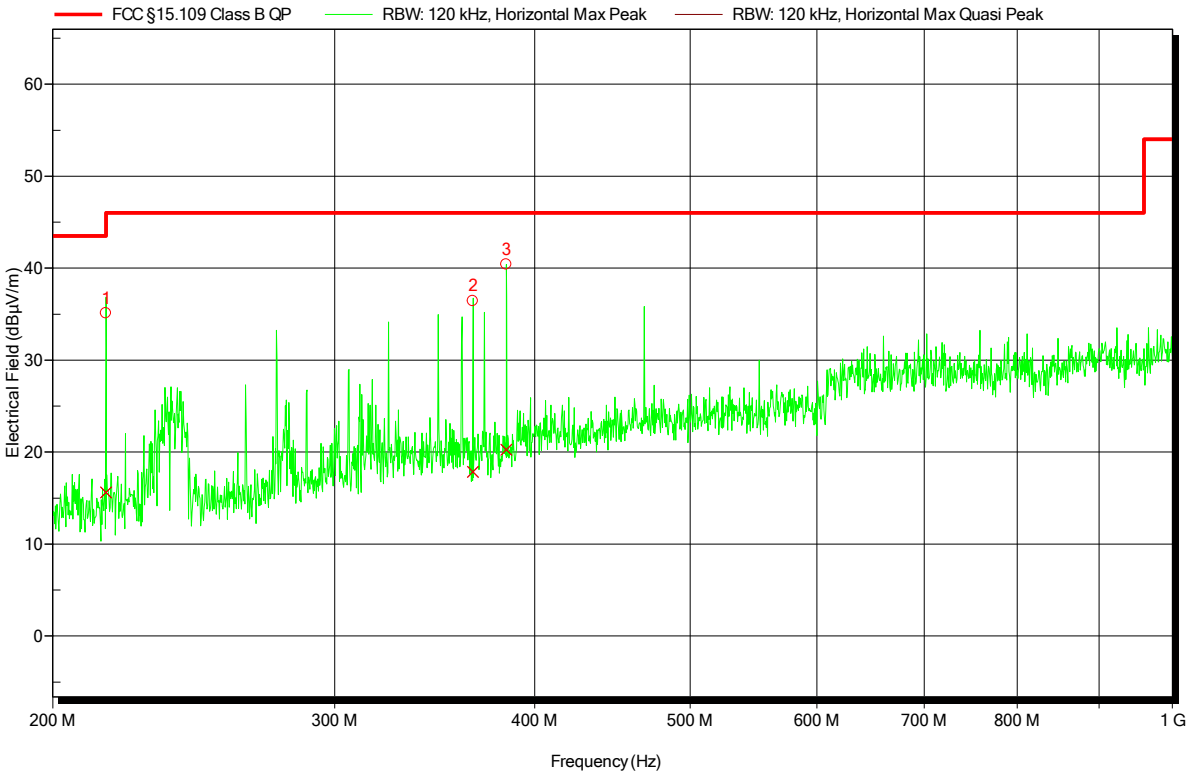


| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|---|---|---|---|---|---|---|---|
| 1 | 216.031 MHz | 15.6 dBµV/m | 46.02 dBµV/m | -30.42 dB | Pass | 0 Degree | 1 m |
| 2 | 366.022 MHz | 17.87 dBµV/m | 46.02 dBµV/m | -28.15 dB | Pass | 0 Degree | 1 m |
| 3 | 383.987 MHz | 20.25 dBµV/m | 46.02 dBµV/m | -25.77 dB | Pass | 0 Degree | 1 m |

### 3.2 Test Conditions and Results – AC power line conducted emissions

| Conducted emissions acc. FCC 47 CFR 15.107 / ICES-003 | | Verdict: PASS |
|---|---|---|
| Laboratory Parameters: | Required prior to the test | During the test |
| Ambient Temperature | 15 to 35 °C | 24°C |
| Relative Humidity | 30 to 60 % | {Humidity} |
| Test according referenced standards | Reference Method | |
| | ANSI C63.4 | |
| Fully configured sample scanned over the following frequency range | Frequency range | |
| | 0.15 MHz to 30 MHz | |
| Sample is tested with respect to the requirements of the equipment class | Equipment class | |
| | Class B | |
| Points of Application | Application Interface | |
| AC Mains | LISN | |
| Operating mode | 1 | |
| Configuration | 1 | |

| Limits and results Class B | | | | |
|---|---|---|---|---|
| Frequency [MHz] | Quasi-Peak [dBµV] | Result | Average [dBµV] | Result |
| 0.15 to 5 | 66 to 56* | PASS | 56 to 46* | PASS |
| 0.5 to 5 | 56 | PASS | 46 | PASS |
| 5 to 30 | 60 | PASS | 50 | PASS |

Comments:
* Limit decreases linearly with the logarithm of the frequency.

**Test Procedure:**

The test site is in accordance with ANSI C63-4:2014 requirements and is listed by FCC.
The measurement procedure is as follows:

Exploratory measurement:

- The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
- The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
- The LISN measurement port was connected to a measurement receiver
- I/O cables were bundled not longer than 0.4 m
- Measurement was performed in the frequency range 0.15 – 30MHz on each current-carrying conductor
- To maximize the emissions the cable positions were manipulated
- The worst configuration of EUT and cables is shown on a test setup picture at item 1.3

**Test Procedure:**

Final measurement:

- The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1)
- The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN.
- The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length).
- The LISN measurement port was connected to a measurement receiver
- The EUT and cable arrangement were based on the exploratory measurement results
- The test data of the worst-case conditions were recorded and shown on the next pages.

**EMI voltage test in the ac-mains according to FCC Part 15b**

Project number: G0M-1709-6886

| | |
|---|---|
| Applicant: | Wincor Nixdorf Manufacturing GmbH |
| EUT Name: | NFC Reader |
| Model: | KIT-NFC-KIOSK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Suckow |
| Test Conditions: | Tnom: 24°C, Unom: 120V AC |
| LISN: | ESH2-Z5 L |
| Mode: | Mode#1 |
| Test Date: | 2017-11-27 |
| Note: | |

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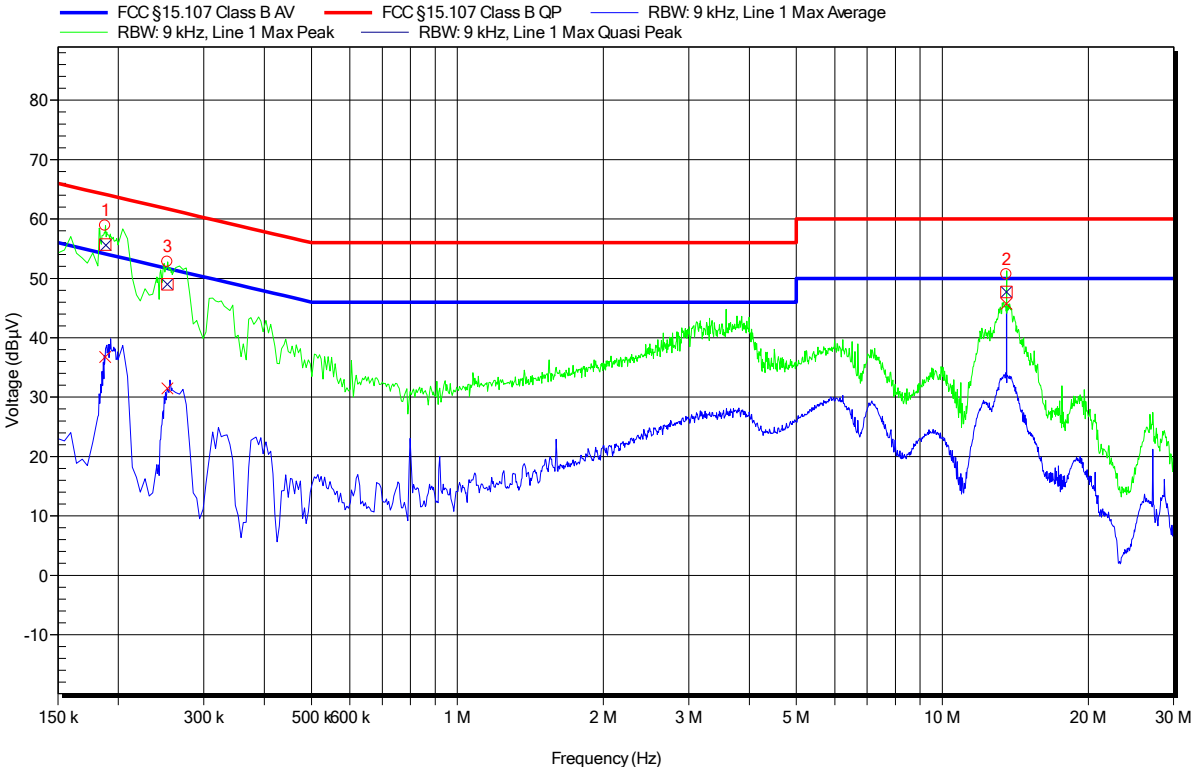


| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 187.8 kHz | 55.68 dBµV | 64.13 dBµV | -8.45 dB | Pass |
| 2 | 13.56 MHz | carrier | | | |
| 3 | 252.15 kHz | 49.03 dBµV | 61.69 dBµV | -12.66 dB | Pass |

| Peak Number | Frequency | Average | Average Limit | Average Difference | Average Status |
|---|---|---|---|---|---|
| 1 | 187.8 kHz | 36.74 dBµV | 54.13 dBµV | -17.4 dB | Pass |
| 2 | 13.56 MHz | carrier | | | |
| 3 | 252.15 kHz | 31.49 dBµV | 51.69 dBµV | -20.2 dB | Pass |

**EMI voltage test in the ac-mains according to FCC Part 15b**

Project number: G0M-1709-6886

| | |
|---|---|
| Applicant: | Wincor Nixdorf Manufacturing GmbH |
| EUT Name: | NFC Reader |
| Model: | KIT-NFC-KIOSK |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Suckow |
| Test Conditions: | Tnom: 24°C, Unom: 120V AC |
| LISN: | ESH2-Z5 N |
| Mode: | Mode#1 |
| Test Date: | 2017-11-27 |
| Note: | |

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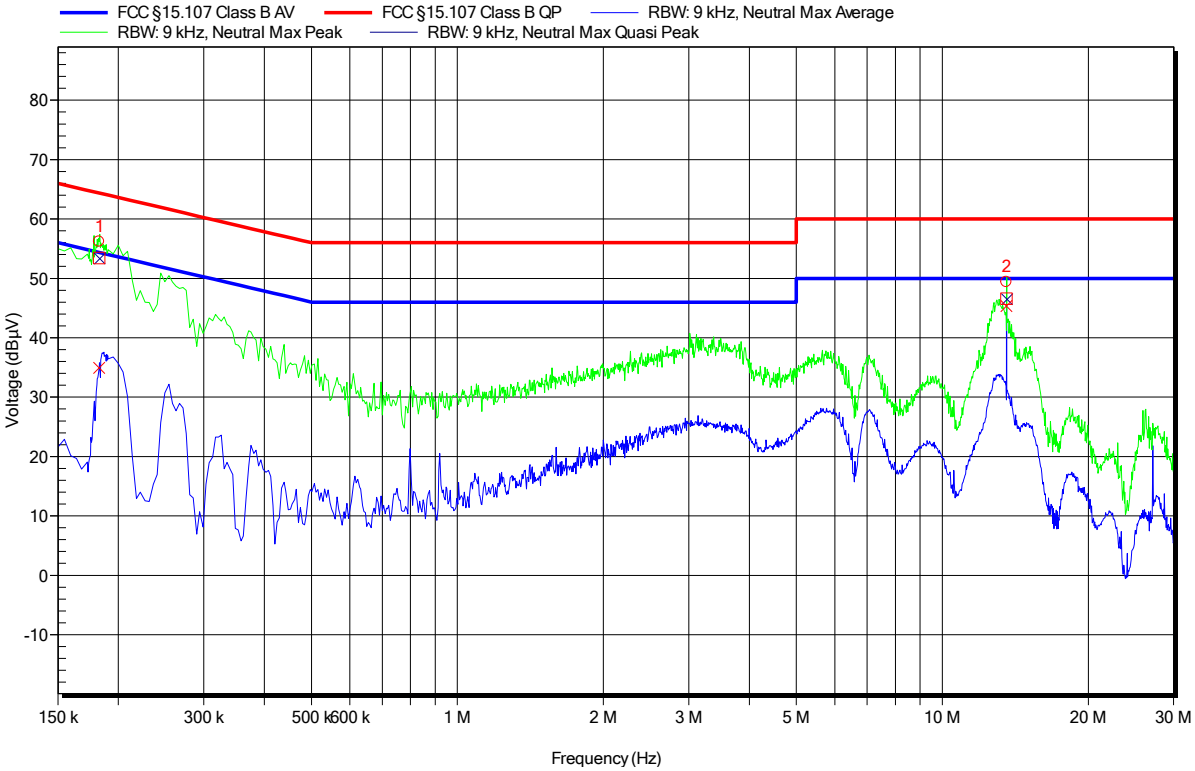


| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status |
|---|---|---|---|---|---|
| 1 | 182.4 kHz | 53.42 dBµV | 64.38 dBµV | -10.95 dB | Pass |
| 2 | 13.56 MHz | carrier | | | |

| Peak Number | Frequency | Average | Average Limit | Average Difference | Average Status |
|---|---|---|---|---|---|
| 1 | 182.4 kHz | 34.94 dBµV | 54.38 dBµV | -19.44 dB | Pass |
| 2 | 13.56 MHz | carrier | | | |