# TEST REPORT

## Test Report No. : UL-RPT-RP11456397JD13F V2.0

| | | |
|---|---|---|
| **Manufacturer** | : | Neeo AG |
| **Model No. / PMN** | : | 6336-REMOTE |
| **HVIN** | : | 6336-REMOTE |
| **FCC ID** | : | 2AKK7-RM633601 |
| **ISED Certification No.** | : | IC: 22300-RM633601 |
| **Test Standard(s)** | : | FCC Part 15.207 &<br>ISED Canada RSS Gen Issue 4 November 2014 Section 8.8 |

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. This sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

**Date of Issue:** 24 May 2017

**Checked by:**

Ian Watch
Senior Engineer, Radio Laboratory

**Company Signatory:**

Sarah Williams
Senior Engineer, Radio Laboratory
UL VS LTD

0644

This laboratory is accredited by UKAS. The tests reported herein have been performed in accordance with its terms of accreditation.

**UL VS LTD**

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# 1. Customer Information

| | |
|---|---|
| **Company Name:** | Neeo AG |
| **Address:** | Ritterquai 8<br>4500 Solothurn<br>Switzerland |

# 2. Summary of Testing

## 2.1. General Information

| | |
|---|---|
| **Specification Reference:** | FCC 47CFR15.207 |
| **Specification Title:** | Code of Federal Regulations Volume 47 (Telecommunications):<br>Part 15 Subpart C (Intentional Radiators) - Section 15.207 |
| **Specification Reference:** | ISED Canada RSS-Gen Issue 4 November 2014 |
| **Specification Title:** | General Requirements for Compliance of Radio Apparatus |
| **Location of Testing:** | UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park,<br>Basingstoke, Hampshire, RG24 8AH, United Kingdom |
| **Test Date:** | 26 April 2017 |

## 2.2. Summary of Test Results

| FCC Reference (47CFR) | ISED Canada Reference | Measurement | Result |
|---|---|---|---|
| Part 15.207 | RSS-Gen 8.8 | Transmitter AC Conducted Emissions |  |

**Key to Results**

 = Complied  = Did not comply

## 2.3. Methods and Procedures

| | |
|---|---|
| **Reference:** | ANSI C63.10-2013 |
| **Title:** | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
| **Reference:** | KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015 |
| **Title:** | AC Power-Line Conducted Emissions Frequently Asked Questions |

## 2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

# 3. Equipment Under Test (EUT)

## 3.1. Identification of Equipment Under Test (EUT)

| | |
|---|---|
| **Brand Name:** | Neeo |
| **Model No. / PMN:** | 6336-REMOTE |
| **HVIN:** | 6336-REMOTE |
| **Test Sample Serial Number:** | Not marked or stated *(Radiated sample)* |
| **Hardware Version:** | Hardware Rev. 10 |
| **Software Version:** | 0.18.5 |
| **FCC ID:** | 2AKK7-RM633601 |
| **ISED Certification Number:** | IC: 22300-RM633601 |

| | |
|---|---|
| **Description:** | AC/DC Adaptor |
| **Brand Name:** | Liteon |
| **Model Name or Number:** | PA-1100-25 |
| **Serial Number:** | KPO1003005 6088111EPE03 |

| | |
|---|---|
| **Description:** | Docking station |
| **Brand Name:** | Neeo |
| **Model Name or Number:** | Not marked or stated |
| **Serial Number:** | Not marked or stated |

## 3.2. Description of EUT

The Equipment Under Test was a Thinking Remote for home automation. It contains IEEE 802.15.4 and WLAN transceivers. It is powered from a 3.7 Volt rechargeable battery.

## 3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

## 3.4. Additional Information Related to Testing

| | | |
|---|---|---|
| **Technology Tested:** | IEEE 802.15.4 / Digital Transmission System | |
| **Type of Unit:** | Transceiver | |
| **Modulation Type:** | O-QPSK | |
| **Data Rate:** | 250 kbps | |
| **Transmit Frequency Range:** | 2405 MHz to 2480 MHz | |
| **Transmit Channels Tested:** | **Channel Number** | **Channel Frequency (MHz)** |
| | 18 | 2440 |

| | | |
|---|---|---|
| **Technology Tested:** | WLAN (IEEE 802.11b) / Digital Transmission System | |
| **Type of Unit:** | Transceiver | |
| **Modulation Type:** | DBPSK | |
| **Data Rate:** | 802.11b | 2 Mbps |
| **Channel Spacing:** | 20 MHz | |
| **Transmit Frequency Range:** | 2412 MHz to 2462 MHz | |
| **Transmit Channels Tested:** | **Channel Number** | **Channel Frequency (MHz)** |
| | 6 | 2437 |

## 3.5. Support Equipment

None

# 4. Operation and Monitoring of the EUT during Testing

## 4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Pre-scans were performed with the EUT transmitting on the centre channel of IEEE 802.15.4 and WLAN modes individually and simultaneously. The worst case mode was found to be 2.4 GHz WLAN 802.11b and final measurements were performed in this configuration.
- The 6336-REMOTE was simultaneously transmitting and charging.

## 4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The EUT was placed into a docking station that was powered from an AC/DC power adaptor, which was in turn connected to a LISN. The LISN input was connected to a 120/240 VAC 60 Hz single phase power supply.
- The customer had pre-loaded their own test application to the EUT. The test application was configured by using a combination of the EUT front panel and touch screen display. The application was used to enable a continuous transmission mode at full power and to select the test channels, data rates and modulation schemes as required. The procedure to set up and control the EUT was supplied by the customer in a document titled ‘userManual-Radio.txt’ dated 12/12/2016.

# 5. Measurements, Examinations and Derived Results

## 5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

## 5.2. Test Results

### 5.2.1. Transmitter AC Conducted Spurious Emissions

**Test Summary:**

| | | | |
|---|---|---|---|
| **Test Engineer:** | Andrew Edwards | **Test Date:** | 26 April 2017 |
| **Test Sample Serial Number:** | Not marked or stated *(Radiated sample)* | | |

| | |
|---|---|
| **FCC Reference:** | Part 15.207 |
| **ISED Canada Reference:** | RSS-Gen 8.8 |
| **Test Method Used:** | ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below |

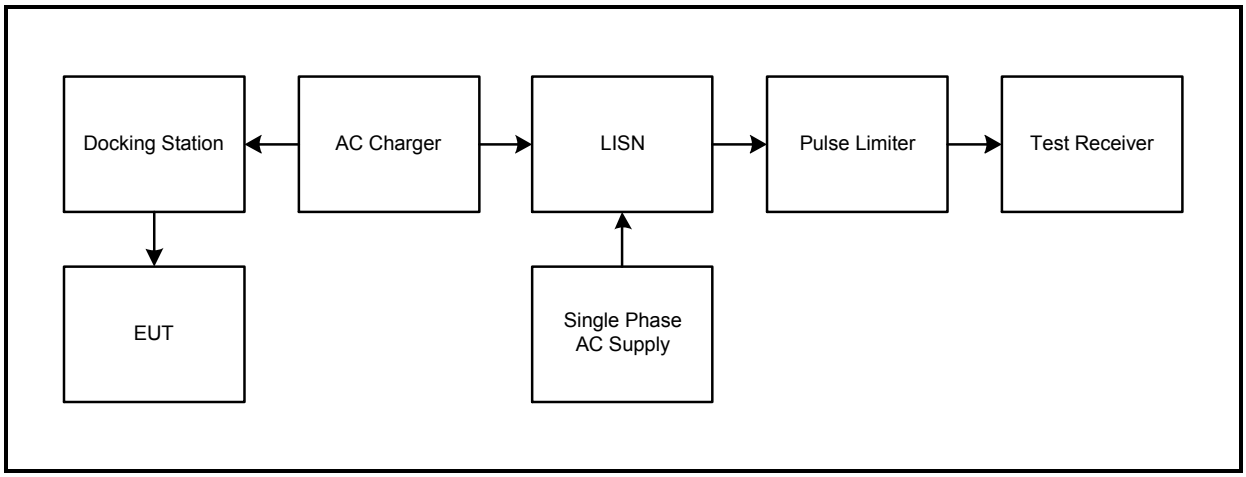
**Environmental Conditions:**

| | |
|---|---|
| **Temperature (°C):** | 22 |
| **Relative Humidity (%):** | 34 |

**Note(s):**

1. The EUT was connected to the AC/DC Adaptor output. The AC/DC Adaptor input was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the AC/DC Adaptor.
3. A pulse limiter was fitted between the LISN and the test receiver.
4. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
5. Pre-scans at 120 VAC 60 Hz for Live and Neutral were performed with the EUT transmitting on the centre channel of IEEE 802.15.4 and WLAN modes individually and simultaneously. The worst case mode was found to be 2.4 GHz WLAN 802.11b and final measurements were performed in this configuration at both 120 and 240 VAC. Pre-scan result plots for all other modes are archived on the UL VS LTD IT server and available for inspection if required.

**Test setup:**



## Transmitter AC Conducted Spurious Emissions (continued)

### Results: Live / Quasi Peak / 120 VAC 60 Hz

| Frequency (MHz) | Line | Level (dBµV) | Limit (dBµV) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 0.155 | Live | 46.1 | 65.8 | 19.7 | Complied |
| 0.177 | Live | 43.4 | 64.6 | 21.2 | Complied |
| 0.452 | Live | 31.2 | 56.8 | 25.6 | Complied |
| 0.650 | Live | 30.5 | 56.0 | 25.5 | Complied |
| 0.857 | Live | 24.7 | 56.0 | 31.3 | Complied |
| 1.149 | Live | 24.0 | 56.0 | 32.0 | Complied |

### Results: Live / Average / 120 VAC 60 Hz

| Frequency (MHz) | Line | Level (dBµV) | Limit (dBµV) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 0.173 | Live | 30.1 | 54.8 | 24.7 | Complied |
| 0.573 | Live | 24.2 | 46.0 | 21.8 | Complied |
| 0.600 | Live | 23.2 | 46.0 | 22.8 | Complied |
| 0.672 | Live | 27.2 | 46.0 | 18.8 | Complied |
| 1.248 | Live | 18.5 | 46.0 | 27.5 | Complied |
| 1.676 | Live | 18.5 | 46.0 | 27.5 | Complied |

## Transmitter AC Conducted Spurious Emissions (continued)

### Results: Neutral / Quasi Peak / 120 VAC 60 Hz

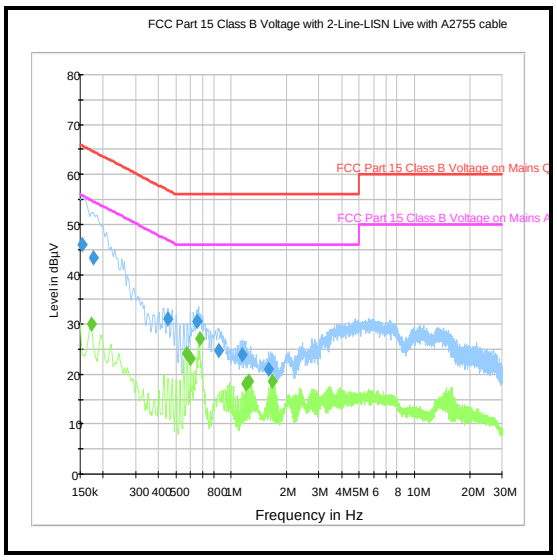
| Frequency (MHz) | Line | Level (dBµV) | Limit (dBµV) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 0.155 | Neutral | 45.8 | 65.8 | 20.0 | Complied |
| 0.186 | Neutral | 41.4 | 64.2 | 22.8 | Complied |
| 0.335 | Neutral | 31.4 | 59.3 | 27.9 | Complied |
| 0.551 | Neutral | 28.6 | 56.0 | 27.4 | Complied |
| 0.672 | Neutral | 36.3 | 56.0 | 19.7 | Complied |
| 0.978 | Neutral | 28.3 | 56.0 | 27.7 | Complied |

### Results: Neutral / Average / 120 VAC 60 Hz

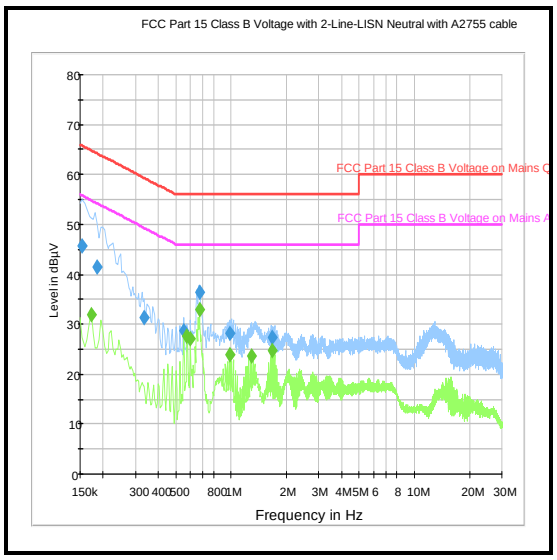
| Frequency (MHz) | Line | Level (dBµV) | Limit (dBµV) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 0.573 | Neutral | 27.7 | 46.0 | 18.3 | Complied |
| 0.600 | Neutral | 27.2 | 46.0 | 18.8 | Complied |
| 0.672 | Neutral | 33.1 | 46.0 | 12.9 | Complied |
| 0.978 | Neutral | 23.9 | 46.0 | 22.1 | Complied |
| 1.298 | Neutral | 23.5 | 46.0 | 22.5 | Complied |
| 1.676 | Neutral | 24.6 | 46.0 | 21.4 | Complied |

## Transmitter AC Conducted Spurious Emissions (continued)

## Results: 120 VAC 60 Hz




**Live**




**Neutral**

*Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*

## Transmitter AC Conducted Spurious Emissions (continued)

### Results: Live / Quasi Peak / 240 VAC 60 Hz

| Frequency (MHz) | Line | Level (dBµV) | Limit (dBµV) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 0.150 | Live | 40.0 | 66.0 | 26.0 | Complied |
| 0.425 | Live | 29.6 | 57.4 | 27.8 | Complied |
| 0.672 | Live | 31.2 | 56.0 | 24.8 | Complied |
| 0.875 | Live | 25.5 | 56.0 | 30.5 | Complied |
| 2.675 | Live | 24.6 | 56.0 | 31.4 | Complied |
| 4.151 | Live | 25.3 | 56.0 | 30.7 | Complied |

### Results: Live / Average / 240 VAC 60 Hz

| Frequency (MHz) | Line | Level (dBµV) | Limit (dBµV) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 0.173 | Live | 29.8 | 54.8 | 25.0 | Complied |
| 0.429 | Live | 24.1 | 47.3 | 23.2 | Complied |
| 0.672 | Live | 27.1 | 46.0 | 18.9 | Complied |
| 1.149 | Live | 22.9 | 46.0 | 23.1 | Complied |
| 1.797 | Live | 21.2 | 46.0 | 24.8 | Complied |
| 3.377 | Live | 19.8 | 46.0 | 26.2 | Complied |

## Transmitter AC Conducted Spurious Emissions (continued)

### Results: Neutral / Quasi Peak / 240 VAC 60 Hz

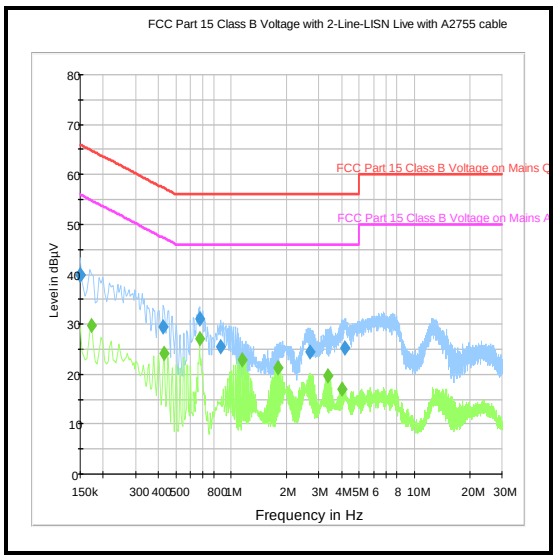
| Frequency (MHz) | Line | Level (dBµV) | Limit (dBµV) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 0.150 | Neutral | 38.0 | 66.0 | 28.0 | Complied |
| 0.551 | Neutral | 31.6 | 56.0 | 24.4 | Complied |
| 0.672 | Neutral | 38.5 | 56.0 | 17.5 | Complied |
| 1.176 | Neutral | 31.6 | 56.0 | 24.4 | Complied |
| 1.874 | Neutral | 30.8 | 56.0 | 25.2 | Complied |
| 2.724 | Neutral | 29.5 | 56.0 | 26.5 | Complied |

### Results: Neutral / Average / 240 VAC 60 Hz

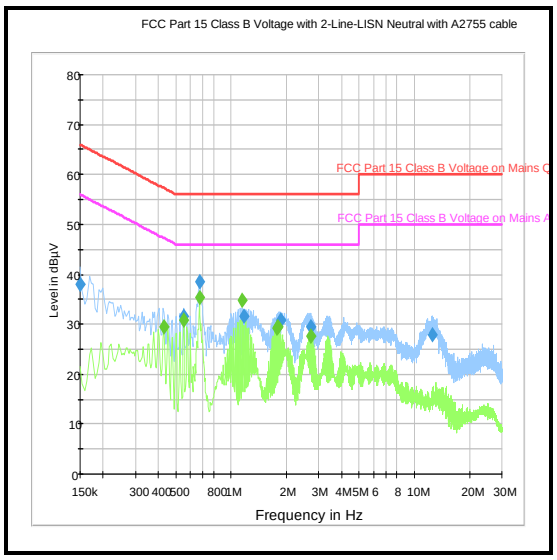
| Frequency (MHz) | Line | Level (dBµV) | Limit (dBµV) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 0.429 | Neutral | 29.6 | 47.3 | 17.7 | Complied |
| 0.551 | Neutral | 30.9 | 46.0 | 15.1 | Complied |
| 0.672 | Neutral | 35.5 | 46.0 | 10.5 | Complied |
| 1.149 | Neutral | 34.7 | 46.0 | 11.3 | Complied |
| 1.775 | Neutral | 29.3 | 46.0 | 16.7 | Complied |
| 1.797 | Neutral | 29.5 | 46.0 | 16.6 | Complied |

## Transmitter AC Conducted Spurious Emissions (continued)

## Results: 240 VAC 60 Hz




**Live**




**Neutral**

*Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*

## Test Equipment Used:

| Asset No. | Instrument | Manufacturer | Type No. | Serial No. | Date Calibration Due | Cal. Interval (Months) |
|---|---|---|---|---|---|---|
| M2013 | Thermohygrometer | Testo | 608-H1 | 45046419 | 10 Jun 2017 | 12 |
| A067 | LISN | Rohde & Schwarz | ESH3-Z5 | 890603/002 | 20 Jul 2017 | 12 |
| A1830 | Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100668 | 22 Mar 2018 | 12 |
| M1263 | Test Receiver | Rohde & Schwarz | ESIB7 | 100265 | 07 Nov 2017 | 12 |
| M1818 | Multimeter | Fluke | 79 Series III | 71811580 | 11 Apr 2018 | 12 |

# 6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

| Measurement Type | Range | Confidence Level (%) | Calculated Uncertainty |
|---|---|---|---|
| AC Conducted Spurious Emissions | 0.15 MHz to 30 MHz | 95% | ±4.69 dB |

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

# 7. Report Revision History

| Version Number | Revision Details | | |
|---|---|---|---|
| | Page No(s) | Clause | Details |
| 1.0 | - | - | Initial Version |
| 2.0 | 8 & 10 | - | Updated Page 8, Section 4.1, Bullet 1 and Page 10, Note 5 |

**--- END OF REPORT ---**