

FINAL UNIT TEST FOR RADIO PERFORMANCE – How to verify your final unit radio performance

1. ABSTRACT

The proposed test procedure helps to verify your final unit radio performance. Three different product types are considered:

1. **Transmitter unit test, unidirectional only (Tx-DUT)**
2. **Receiver unit test, unidirectional only (Rx-DUT)**
3. **Transceiver unit test, bi-directional (TxRx-DUT)**

This test is easy to handle and should not require sophisticated tools, or RF anechoic chamber, only an EnOcean EDK 3x0 Kit. It presents a basic assessment method for quickly estimate relative radio performance of your final product before going into field tests and or certification.

Please note:

- *The DolphinView Advanced RSSI level indication does not replace calibrated "measurement tools"! The basic final unit assessment described hereby has nothing to do with laboratory "measurements" and does not replace any sophisticated radio lab tests and approvals! However, it is a useful, fast indicator of relative performance.*
- *Radio performance depends on antenna type, final housing material, near-field installation environment (recessed in-wall mounted is worse than surface-mounted), and obstacles and reflections in the radio path strongly define results, as will building architecture, furniture, people (that's why these basic tests are based more on unit comparison under real-world situations).*

1.1. Related documents

1. [AN101 POWER SUPPLY LAYOUT](#)
2. [AN102 ANTENNA DESIGN](#)
3. [AN507 Radio approval, AN507SW.zip](#)



Please make sure that you always use the current EnOcean documentation.
Up-to-date documentation <http://www.enocean.com/>

1.2. Revision History

No	Major Changes
Dec. 11	Initial version
Nov. 19	Redactional update

2. TEST SETUP – WHAT'S REQUIRED?

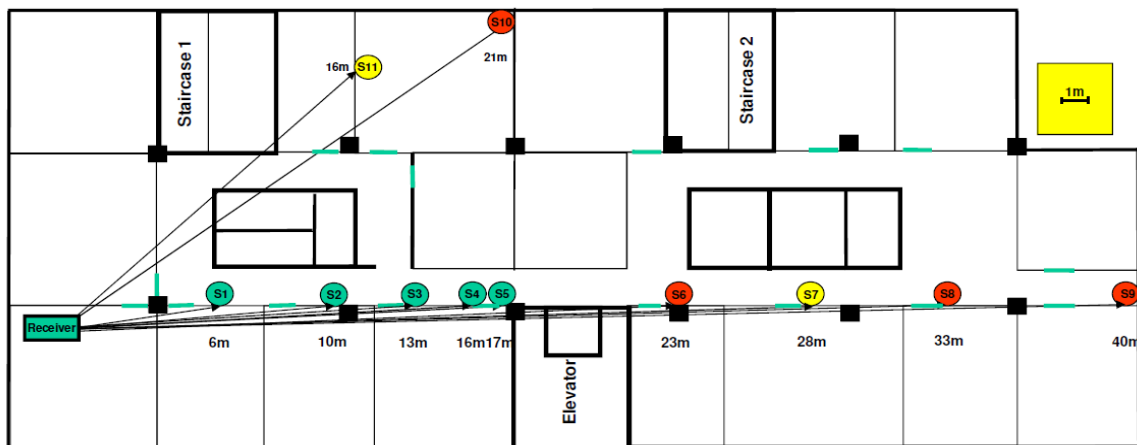
- DUT "Device Under Test" (Tx-DUT, Rx-DUT or Tx/Rx-DUT)
- PTM 21x based wall switch as reference Transmitter, see 3.1. (part of EDK 350)
- EOP 350 & TCM 300, both parts of EDK 350 Kit, as reference Rx connected to PC & DolphinView Advanced = EVA1
- Reference TEST PATHS using different reference TX locations, see following description.

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2.1. Defining representative “TEST PATHS”

Define several typical “radio test paths” between both Tx / Rx units. Because only relative tests will be processed, the path selection is not critical but should be representative for environments where the device will typically be used, e.g. Figure 1:

Figure 1 Office example, reference locations for range evaluation, only as orientation



LEGEND: S1...S11 = orientation marks e.g. for Tx (transmitters), e.g. green good RSSI, yellow less good and red poor received RSSI levels.

Place first the EVA1 (reference receiver) in the selected location and connect it to PC for visualization, then start DolphinView Advanced. Select the appropriate Com port, then “Firmware Download”, confirm, then “Connect/F5”. Actuate the PTM 21x switch (as reference Tx sender) to identify and select it into the workspace of DolphinView Advanced. Now walk through the floor holding the PTM 21x and locate several reference locations on the wall with very good to poor or no RSSI at the EVA1 receiver. Record and mark those reference values and locations on the building floor plan.

Important note:

Please take care that no radio repeaters are in the test area. Repeaters would lead to false test results. Please use e.g. DolphinView Advanced and DolphinSniffer tool to identify repeated telegrams! Always refer to the actual measurements since propagation conditions, interference noise level are never constant at your location (no laboratory conditions)

Please note that the performance of the DUTs strongly depends on the specific local environment (in-wall, on-wall, near metal, on-to metal, etc.), holding position and so on. Accordingly, the selected reference locations should be similar to expected field installations for the particular products.

3. TEST PROCEDURE FOR RX/TX DUT (DEVICE UNDER TEST)

Please note that test values depend strong on specific environment, multi path effects, moving persons, etc. Therefore, the test interpretation should consider a statistical clear majority (after e.g. 30 reproducible measurements/position). Please do not hold the mobile Tx device in your hand during these evaluations to avoid any external influences of the body (near field) on the antenna.

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3.1. Receiver Unit Test

- 3.1.1. If the Rx-DUT is a Gateway (serial interface device), install the Rx-DUT at the receiver reference location and connect to a PC, similar to EVA1, while actuating the reference Tx sender from different reference locations. It is sufficient to visualize now the RSSI levels of received Telegrams (through same/similar DolphinView Advanced FW.)
- 3.1.2. If the Rx-DUT is e.g. an actuator, you could use therefore a reference PTM 21x based teach in radio switch transmitter with defined antenna shape and known performance.

If the Rx-DUT misses (does not react to) telegrams from locations covered before by the reference receiver, this does indicate potential for improvement.

Important note: especially for receivers, a poor receiver performance is not always an antenna issue, it could also be result of a self-induced interference caused by poor power line/digital noise filtering (own noise). With increasing noise levels emanating from other components within your own device and increasing distance it is possible that the radio will no longer recognize low-level radio signals. In worst case, you will not be able to see ANY EnOcean telegrams with a RSSI lower than e.g. -72 dBm respectively -85 dBm instead of < -92 dBm, see Figure 2 and 3.

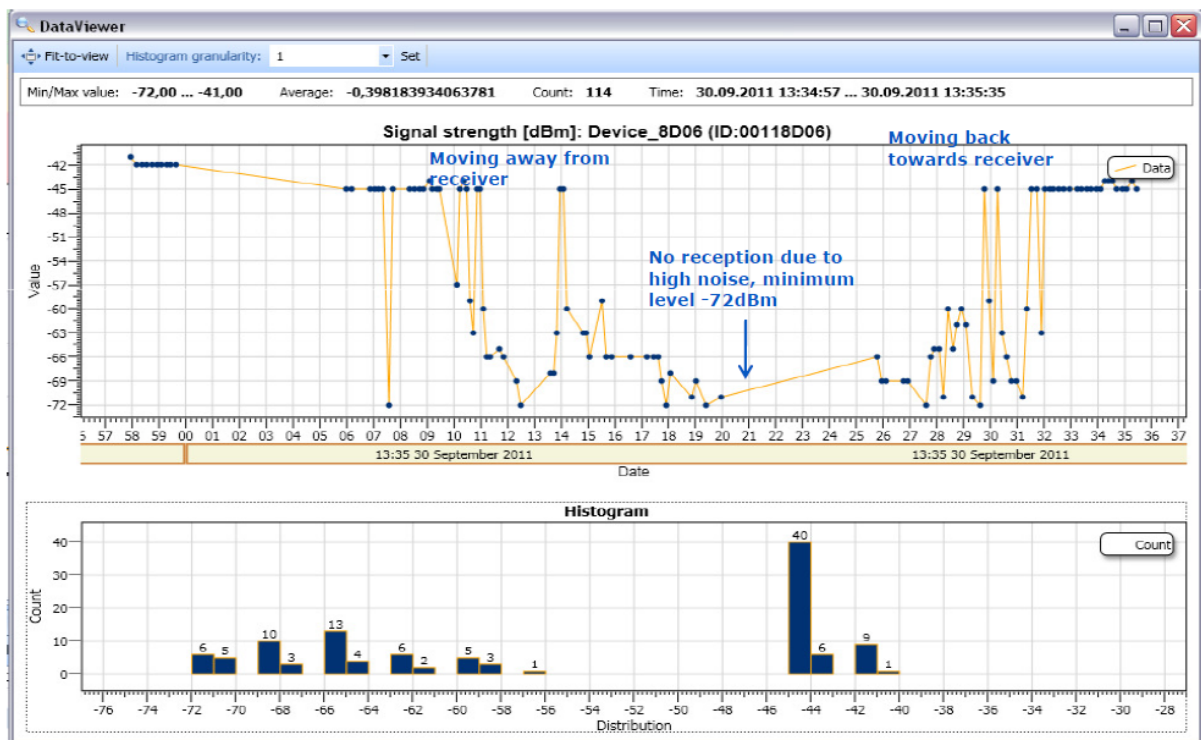


Figure 2

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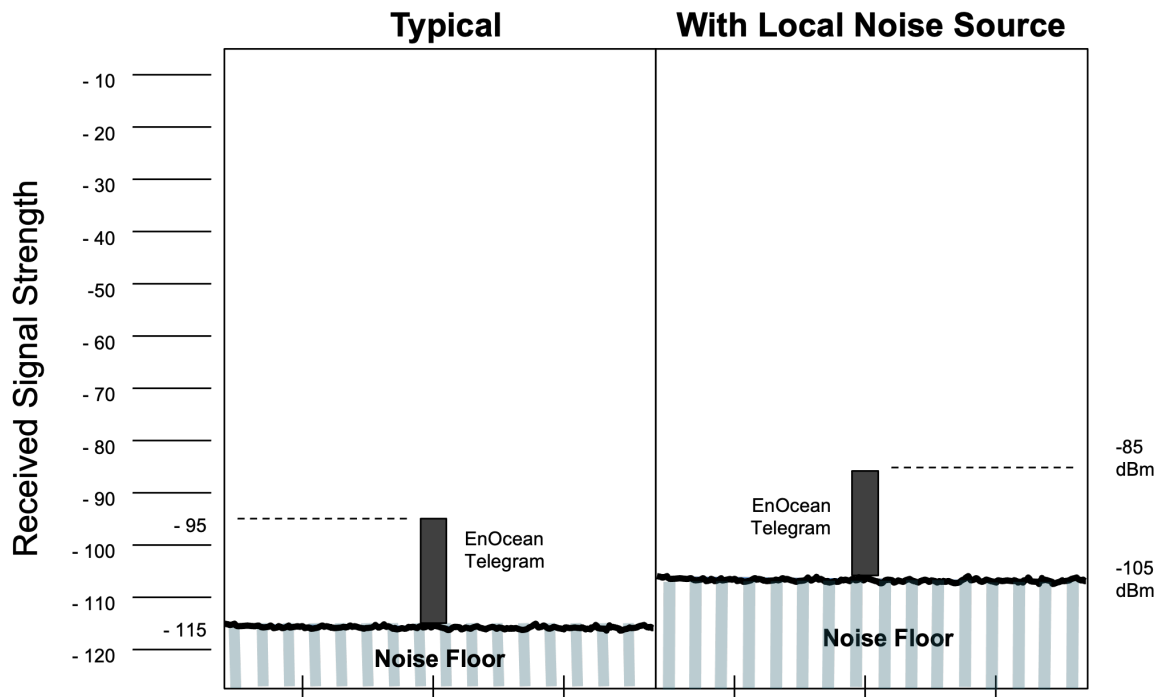


Figure 3

EnOcean Telegram Detected At:	-95 dBm Maximum Range	-85 dBm 10 dB loss of Range
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3.2. Transmitter Unit Test

Replace reference sender PTM 21x reference Tx by the Tx-DUT. Test the received signal strength with EVA1 at the predefined reference receiver location. If there is significant range loss respectively lower RSSI values of the Tx-DUT compared to the TX reference transmitter you need to improve the radio performance of your Tx-DUT (Please consider therefore possible improvements regarding antenna, noise filtering and/or radio settings, see related documents).

3.3. Transceiver Unit Test

To determine the performance of each single function on their own merits, please test the transmitter and receiver separately vs. e.g. a known reference. This will allow you better identifying of single potential RF trouble sources (e.g. own noise issues).

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