

RADIO SYSTEM DEBUGGING GUIDE – How to find easily the cause of a range problem

Intension of this Application Note

Any radio system consists of a transmitter (Tx-DUT: transmitter device under test), a radio propagation path (Radio Path), and a receiver (Rx-DUT: receiver device under test). In case of insufficient coverage, also noticed as temporary malfunctions, please note that radio is not a magic and principally only the following problems can occur:

1. **Jammer present**
2. **Transmitter unit defective (Tx-DUT)**
3. **Receiver unit defective (Rx-DUT)**
4. **Range limit reached (Radio Path)**

In the following please find a very easy guide to quickly identify one of those problems.

Test setup – What's required?

- 1) Equipment in operation (Tx-DUT, Rx-DUT): Tx-DUT actuates Rx-DUT, the proper signal reception has to be easily visible (e.g. light on/off)
- 2) 2 persons for testing (technical basic understanding)
- 3) 1 EPM radio level meter
- 4) 1 REFERENCE RADIO SWITCH (tested at another place for proper range and function together with the mentioned EPM)
- 5) 2 mobile phones (for communication in case of separation walls are given)

Problem Test Procedure 1 – JAMMER

Switch on the EPM: A jammer is present if the YELLOW or even GREEN field strength LED of the EPM flashes/shines constantly. Short impulses (< 1 sec) are not critical, can be signals from already installed EnOcean transmitters or signals from other (allowed) radio systems.

- a) If jamming only occurs next to receiver antenna: Remove low-power jammer (e.g. Electronic ballast, computer, controller) at least 50 cm away from the EnOcean receiver antenna.
- b) If jamming occurs all over the room: Remove jammer. If removing is not possible you have to accept eventually strong range reduction (try to use repeaters).

Another easy indication for a high-power jammer is that the range between EPM and REFERENCE RADIO SWITCH is clearly less than 10 m line-of-sight at the jammed area.

Problem Test Procedure 2 – TRANSMITTER UNIT

1. Person 1 remains at the transmitter unit place and operates the REFERENCE RADIO SWITCH consecutively and alternating to the probably defective transmitter unit Tx-DUT. If Tx-DUT is a sensor than operate the LRN pushbutton to transmit.

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- Person 2 moves away with the EPM level meter until the GREEN HI-signal lamp changes to the YELLOW LOW-signal lamp.

If there is a significant range loss of the tested transmitter device Tx-DUT against the REFERENCE RADIO SWICH (it does not depend on one meter more or less), please change the transmitter unit.

Problem Test Procedure 3 – RECEIVER UNIT

- Person 1 remains at the receiving place with the EPM under the RECEIVING UNIT, keeps thereby the EPM in direction of the ceiling (it does not depend on one meter more or less)
- Person 2 moves away at consecutively actuation of the transmitter Tx-DUT so far until Person 1 signalizes that the GREEN HI-signal lamp of the EPM changes to the YELLOW LOW-signal lamp.

If there is a significant range loss of the tested Receiver Unit Rx-DUT against the reference EPM (it does not depend on one meter more or less), please check

- Receiver mounting position (antenna position) and
- Receiver unit functionality (antenna, hardware, software).

RADIO PATH Test

If none of the upper mentioned failures has been identified, the problem cause should be in the radio propagation path. Please consult the EnOcean Application Note **AN 001 “EnOcean Wireless Systems – RANGE PLANNING GUIDE”** for detailed information and also consider the following major problem causes:

- In practical installations you should have a reliable radio range of at least 10 m, even under worst case installation conditions. Otherwise please check for:
- SCREENING:** Massive objects made of metal, such as metallic separation walls and metal inserted ceilings, massive wall reinforcements and the metal foil of heat insulations, reflect electromagnetic waves and thus create what is known as radio shadow. However singularized small metal studs, e.g. the metal studs of a gypsum dry wall, don't show a recognizable screening.
- METAL SEPARATION WALLS:** It can be noticed that radio transmission actually works well with metal indoor separation walls. This happens through reflections: Walls made of metal or concrete reflect electromagnetic waves. The radio waves reach the next room or floor via a non metallic opening, e.g. a wooden door or an indoor glass window. But note that locally the radio range can be strongly reduced (dead spots).
- Mounting an additional repeater at a suited location can easily provide an optional propagation path.

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