

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

Intention of this Application Note

All radio systems consist of a transmitter, a radio propagation path and a receiver. In principal, only the following things can cause insufficient range in radio networks.

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

This application note is an easy guide to quickly identify these problems.

Test setup – What's required?

- 1) Equipment in operation (Tx-DUT, Rx-DUT): Tx-DUT sends a telegram to Rx-DUT. The proper signal reception has to be easily visible (e.g. light switching on/off)
- 2) 2 persons for testing (basic technical understanding)
- 3) 1 EPM radio level meter
- 4) 1 reference radio switch (tested for proper range and function with the previously mentioned EPM)
- 5) 2 mobile phones (for communication if the transmitter and receiver are separated by walls)

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, these could be signals from already installed EnOcean transmitters or signals from other (allowed) radio systems.

- a) If jamming occurs only next to the receiver antenna it is probably caused by low power devices such as electronic ballasts, controllers or computers. Move these devices at least 50cm away from the antenna of the EnOcean receiver.
- b) If jamming occurs all over the room, identify the jamming device and remove it. If removing it is not possible you have to accept a reduction in the communication range. In this case it may be possible to use repeaters to improve the range.

Another indication of a high-power jammer is that the range between EPM and the reference radio switch is clearly less than 10 m line-of-sight.

Problem Test Procedure 2 – Defective Transmitter Unit

1. Person 1 remains by the transmitter unit and alternates between operating the reference radio switch and then TX-DUT. If Tx-DUT is a sensor then press the LRN pushbutton to transmit.

2. 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 compared to the reference radio switch, change the transmitter unit. A difference of one meter or less is not critical.

Problem Test Procedure 3 – Defective Receiver Unit

1. Person 1 remains by the receiver with the EPM under the RECEIVING UNI. The EPM should be directed towards the ceiling.
2. The second person moves away while activating the transmitter Tx-DUT until 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 compared to the reference EPM, check the following points below. A difference of one meter or less is not important.

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

Problem Test Procedure 4 – Radio Path

If the previously mentioned problems have not been identified, the problem cause should be in the radio propagation path. Please consult the EnOcean Application Note **AN001 "EnOcean Wireless Systems – RANGE PLANNING GUIDE"** for detailed information.

In practical installations you should have a reliable radio range of at least 10m, even under worst case installation conditions. If not, please consider the following points:

- 1) Screening: Large objects made of metal reflect electromagnetic waves and thus, create what is known as radio shadow. Causes of this could be ceilings or walls which contain metal, reinforced walls and metal foil used in insulation. However small metal studs, e.g. the metal studs of a gypsum dry wall, don't cause a measurable screening effect.
- 2) Metal Walls: In some cases, radio communication can work well in installations with metal walls. Metal or concrete walls reflect electromagnetic waves and they can take alternative paths through non-metallic walls. The radio waves reach the next room through a wooden door or internal glass window. The location of both the Tx and Rx DUT are extremely important, moving them even a few cm can result in complete link loss (dead spots)
- 3) Mounting an additional repeater at a suitable location can provide an optional propagation path.

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