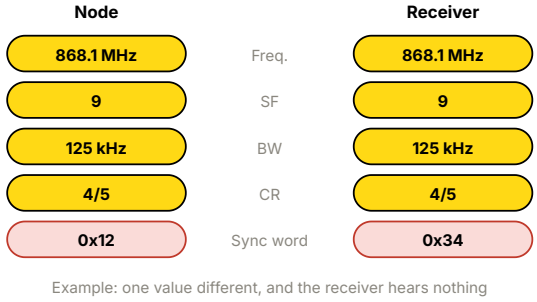
LoRa works on the desk, fails in the field? 6 checks before you install

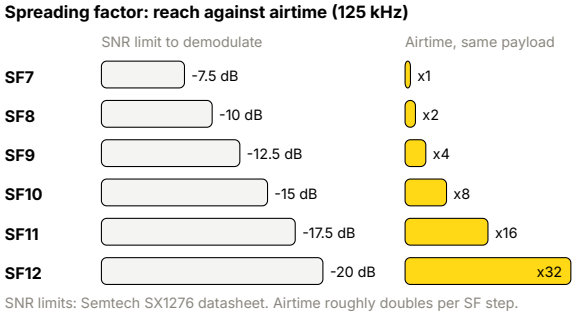
On the desk, two LoRa radios a metre apart almost always talk. In the field, the settings, the antenna, the placement and the airtime decide. Check these six points before you install. Valid for LoRa point to point and LoRaWAN devices with any PLC or gateway; in LoRaWAN, also check the regional plan and the keys in the network server.

What decides the link



Example: one value different, and the receiver hears nothing

Same radio settings at both ends: frequency, spreading factor, bandwidth and coding rate. Also the sync word and header mode, if your library exposes them.



SNR limits: Semtech SX1276 datasheet. Airtime roughly doubles per SF step.

A higher spreading factor reaches further: it demodulates with a lower SNR, but each message stays longer on air.

The desk hides problems

At one metre the signal is so strong that a wrong antenna or a weak setting still works. Measure where the devices will be.

Plan for lost messages

Radio links lose packets. Number your messages, confirm them and keep the data on the PLC until it is confirmed.

Six checks, in this order

Check	What to do	Good result
1. Radio settings	Set the same frequency, spreading factor, bandwidth and coding rate on both ends.	Both ends show the same values.
2. Antenna	Antenna for your band (868 MHz in Europe, 915 MHz in the Americas), connected before the radio transmits.	Right band, connected, cable tight.
3. Placement	As high as you can, outside the metal cabinet, with a clear line of sight between both antennas.	Antennas outside the cabinet and in sight.
4. Test on site	Read RSSI and SNR at the real spot, at different times of day.	SNR well above the limit of your SF, with margin.
5. Spreading factor	Start low and raise it only if the margin is too small.	Lowest SF that keeps the margin.
6. Airtime and retries	Check the transmit time allowed in your sub-band. Add your own acknowledgement and retries.	Within the limit; every message confirmed.

What the symptoms tell you

Symptom	Possible causes	Next step
Nothing received, not even on the desk	Different frequency, SF, bandwidth, coding rate or sync word.	Check 1.
Works on the desk, nothing in the field	Antenna for another band, antenna inside the cabinet, obstacles.	Checks 2 and 3.
Some messages arrive, others do not	SNR close to the limit, interference, collisions with other nodes.	Checks 4 and 5.
Worse on some days or hours	Vehicles, machines, vegetation or weather in the path.	Check 4 at different times.
The node stops sending for a while	Airtime limit of the sub-band reached, often with a high SF.	Checks 5 and 6.
Range much shorter than expected	Damaged radio stage after transmitting without antenna, low gain, long thin cable.	Check 2; replace if needed.
Messages lost with no warning	Point to point has no built-in acknowledgement.	Check 6.

From the datasheet and the rules

- Semtech SX1276, 125 kHz: SNR limit from -7.5 dB at SF7 to -20 dB at SF12.
- Europe 863 to 870 MHz: duty cycle limits per sub-band, 1% in most of 868.0 to 868.6 MHz (ERC Rec. 70-03, ETSI EN 300 220).
- United States 902 to 928 MHz: FCC Part 15 rules.

About the margin

A reading just above the limit works today and fails with rain, a parked truck or a new machine.

A common rule is to keep about 10 dB of SNR above the limit of your SF. Measure and decide for your site.

If it has never worked

- Test both radios side by side with a known example from the library.
- Print the settings on both ends and compare them line by line.
- Check the setup steps of your PLC range: module, pins and library.

Security

Anyone in range with the same settings can receive your messages.

Encrypt or sign the payload if the data or the commands matter.

References: Semtech SX1276/77/78/79 datasheet; Semtech AN1200.22, LoRa Modulation Basics; CEPT ERC Recommendation 70-03; ETSI EN 300 220; LoRa Alliance RP002; FCC 47 CFR Part 15. Device manuals and local regulations take precedence over this general guide.