Minimizing Feedline Loss

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Feedline loss is the silent enemy of RF system performance. Unlike antenna gain (which you buy) or transmit power (which you set), feedline loss just silently destroys the performance you already have. This page provides the tools to quantify, minimize, and budget feedline loss in your LoRa mesh installations.

The Link Budget Impact of Feedline Loss

Feedline loss hits you twice - once on transmit and once on receive. On transmit, every dB of cable loss reduces your effective radiated power by 1 dB. On receive, cable loss before the receiver's low-noise amplifier (LNA) degrades the noise figure of the entire receive chain by 1 dB per 1 dB of cable loss. (On the common SX126x/SX127x LoRa transceivers the LNA is on-chip, so essentially all feedline and connector loss precedes it.)

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Example: 20 dBm TX, 5 dB cable loss, 5 dBi antenna
EIRP = 20 dBm + 5 dBi − 5 dB = 20 dBm

Example: Same cable with a 2 dBi antenna
EIRP = 20 dBm + 2 dBi − 5 dB = 17 dBm

Conclusion: 5 dB of cable loss ERODES the benefit of the better antenna.
The 5 dBi antenna with 5 dB of cable loss (EIRP 20 dBm) still beats the 2 dBi
antenna with the same 5 dB of cable loss (EIRP 17 dBm) by 3 dB. What the loss
destroys is the UPGRADE relative to a no-loss case: with no cable loss the 5 dBi
antenna would deliver 25 dBm EIRP, so the 5 dB of cable swallowed the entire
5 dB the antenna could have given. Reducing the cable loss recovers more than the
antenna upgrade itself provided.
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FCC note: these EIRP figures (20 dBm, 17 dBm) are far below the limit. Under 47 CFR 15.247 the regulatory ceiling at 915 MHz is on *conducted* output power - 1 W (30 dBm) into an antenna of up to 6 dBi - with a derived EIRP ceiling of about 36 dBm (4 W). Feedline loss subtracts from EIRP, so adding cable can only move you further below the limit, never above it.

Cable Length Math

To calculate cable loss for a given run, use the loss per 100 ft specification from cable data sheets. The per-100 ft figures below are the canonical 915 MHz values from the book's feedline-loss reference (Times Microwave LMR datasheets):

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Loss (dB) = (Loss per 100 ft at 915 MHz) × (Run length in feet) ÷ 100


Examples for a 15 ft run:
 LMR-100A: 22.8 dB/100ft × 15/100 = 3.42 dB
 LMR-200:   9.9 dB/100ft × 15/100 = 1.49 dB
 LMR-400:   3.9 dB/100ft × 15/100 = 0.59 dB
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For metric calculations (loss per 100 m):

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Loss (dB) = (Loss per 100 m at 915 MHz) × (Run length in meters) ÷ 100
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The Full System Loss Budget

Account for every component in the RF path between radio and antenna:

Component	Typical Loss	Notes
U.FL connector (at PCB)	0.2 - 0.5 dB	Present on most PCB-based LoRa boards (typical U.FL insertion loss at ~1 GHz)
U.FL-to-SMA pigtail (6")	0.3 - 0.5 dB	RG-178 pigtail from PCB to enclosure panel (RG-178 ~0.5-0.8 dB/ft at 900 MHz plus connectors)
SMA to N-type adapter	0.1 - 0.2 dB	Quality adapter, if converting at the enclosure panel
Main feedline (LMR-200, 10 ft)	~1.0 dB	From enclosure to antenna base (9.9 dB/100 ft at 915 MHz × 10/100)
N-type connector at antenna	0.1 dB	Quality N-type connector
Lightning arrestor	0.1 - 0.3 dB	If inline gas discharge tube used
Total example	**~1.8 - 2.6 dB**	

In this example, a real system with 10 ft of LMR-200 would have about 2 dB of total system feedline loss. This is acceptable. If you replace the LMR-200 with RG-58 (~20 dB/100 ft at 915 MHz), the 10 ft main cable alone goes from ~1.0 dB to ~2.0 dB - adding ~1 dB extra and pushing total loss toward 3 dB or more, where you start losing meaningful range. RG-58 is a poor choice at

915 MHz.

Inline Connectors Double Loss

Every barrel connector, adapter, or splice in the cable run adds loss and a potential water ingress point. For outdoor installations:

- Plan your cable routing so you can run a single unbroken cable from the enclosure to the antenna
- If you must make a field splice, use a waterproof N-type barrel connector (not SMA) and seal with self-amalgamating tape
- Adapters at the radio or antenna end are sometimes unavoidable; minimize them everywhere else

When Cable Loss Is Unavoidable: Remote Radio Head

For installations requiring very long cable runs (tower top, building rooftop with equipment room far from the rooftop), consider placing the radio module in a weatherproof enclosure directly at the antenna mounting point. Power is delivered via a long DC cable, and data is retrieved via Ethernet or WiFi (or just on-board storage). This approach reduces feedline loss to the short U.FL pigtail and short jumper, typically under 1 dB total.

Checking Your Cable with SWR

A cable that looks fine externally can have significant internal damage (crushed, kinked, or water-damaged dielectric). A quick SWR check with a NanoVNA or antenna analyzer can reveal the problem. Connect the analyzer to one end with the other end open or shorted. A healthy cable will show predictable impedance; a damaged cable will show irregular spikes or elevated VSWR at unexpected frequencies due to impedance discontinuities at the damage point.

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