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.

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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 eliminated all benefit of the better antenna.
The 5 dBi antenna with 5 dB of cable loss performs WORSE than a 2 dBi antenna with 5 dB of
cable loss.
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Cable Length Math

To calculate cable loss for a given run, use the loss per 100 ft specification from cable data sheets:

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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: 15.5 dB/100ft × 15/100 = 2.33 dB
 LMR-200: 6.8 dB/100ft × 15/100 = 1.02 dB
 LMR-400: 3.0 dB/100ft × 15/100 = 0.45 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
U.FL-to-SMA pigtail (6")	0.3 - 0.5 dB	RG-178 pigtail from PCB to enclosure panel
SMA to N-type adapter	0.1 - 0.2 dB	If converting at the enclosure panel
Main feedline (LMR-200, 10 ft)	0.68 dB	From enclosure to antenna base
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	**~1.6 - 2.3 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, the main cable alone adds 1.25 dB extra, pushing total loss above 3 dB - where you start losing meaningful range.

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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