Coax Cable Selection Guide

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The coaxial cable connecting your LoRa radio to its antenna is a critical component that directly subtracts from your link budget. Every decibel of cable loss is a decibel less of received signal and, equivalently, a decibel less of radiated power. Understanding the tradeoffs between cable types helps you make smart choices for your deployment.

Understanding Cable Loss

Coaxial cable loss is caused by two primary mechanisms:

1. **Conductor (ohmic) loss:** Resistance of the inner and outer conductors dissipates RF energy as heat. Increases with frequency (skin effect drives current to conductor surface, effectively reducing conductor area).
2. **Dielectric loss:** The insulating material between conductors absorbs some RF energy. Also increases with frequency.

Both losses increase with frequency, which is why a cable that seems acceptable at VHF (150 MHz) can be disastrously lossy at 915 MHz. Always check specifications at or near your operating frequency.

Cable Loss Comparison at 915 MHz

Loss figures below are stated per 100 ft at 915 MHz, sourced from the manufacturer (Times Microwave LMR / Andrew-CommScope) and reference coax datasheets; the "per 10 ft" column is simply the per-100-ft figure divided by ten. Use these canonical values for all link-budget planning; other pages in this book reference this same table.

Cable Type	Outer Diam.	Loss (dB/100 ft) @ 915 MHz	Loss per 10 ft	Impedance	Flexibility
RG-174	2.8 mm	~28 dB	~2.8 dB	50 Ω	Very flexible; pigtails only
RG-58/U	5 mm	~20 dB	~2.0 dB	50 Ω	Flexible; common

Cable Type	Outer Diam.	Loss (dB/100 ft) @ 915 MHz	Loss per 10 ft	Impedance	Flexibility
RG-8X (mini 8)	6.1 mm	~12.6 dB	~1.26 dB	50 Ω	Semi-flex; good budget cable
RG-213/U	10.3 mm	~8 dB	~0.8 dB	50 Ω	Stiff; older mil-spec
LMR-100A	2.79 mm	~22.8 dB	~2.28 dB	50 Ω	Very flexible; pigtails/jumpers
LMR-200	5.4 mm	~9.9 dB	~0.99 dB	50 Ω	Semi-flexible; good midrange
LMR-400	10.3 mm	~3.9 dB	~0.39 dB	50 Ω	Semi-rigid; best low-loss practical
LMR-600	15.8 mm	~2.5 dB	~0.25 dB	50 Ω	Rigid; tower/commercial use
Andrew FSJ1-50A (1/4" Superflex)	7.1 mm	~4.4 dB (verify against CommScope datasheet)	~0.44 dB	50 Ω	Flexible hardline; pro installations

Practical Loss Examples

To illustrate the real-world impact, consider a typical outdoor node installation with 20 ft (6 m) of cable between the radio and antenna. The loss figures below are computed directly from the canonical per-100-ft table above (20 ft = 0.2 × the per-100-ft value). Range penalties assume free-space (inverse-square) propagation, where the range ratio = 10^(−loss_dB/20); real-world terrain makes the penalty smaller in some cases and larger in others, so treat these as approximate:

Cable Choice	Loss for 20 ft	Equivalent TX Power Reduction	Range Penalty (free space, approx.)
RG-58	~4.0 dB	17 dBm → 13.0 dBm (effective)	~37% shorter range
LMR-200	~2.0 dB	17 dBm → 15.0 dBm (effective)	~21% shorter range
LMR-400	~0.8 dB	17 dBm → 16.2 dBm (effective)	~9% shorter range

Cable Selection Recommendations

Short runs (under 3 ft / 1 m) - pigtails and jumpers

Use LMR-100A or RG-174. These are flexible enough to route in tight spaces and the short length keeps absolute loss acceptable (under 0.9 dB for a 3 ft run). This is the correct cable for the factory pigtail from the LoRa radio to the connector panel.

Medium runs (3 - 20 ft / 1 - 6 m)

LMR-200 is the best choice: meaningful loss improvement over RG-58, flexible enough to route around obstacles, and connectors are readily available. This is the correct choice for most outdoor node installations where the radio is inside an enclosure and the antenna is a few feet above.

Long runs (20 - 100 ft / 6 - 30 m)

LMR-400 is strongly recommended. The loss reduction over LMR-200 is significant at these lengths. For runs over 50 ft, consider whether you are better served by moving the radio closer to the antenna (POE-powered remote radio, for example).

When to upgrade your cable

Upgrade cable when feedline loss exceeds 3 dB. At 3 dB loss, you are throwing away half your transmit power before it even reaches the antenna, and your receive sensitivity is degraded by approximately 3 dB (feedline loss ahead of the radio raises the system noise figure by close to the cable loss, depending on the radio's own noise figure) - effectively halving your effective radiated power and degrading reception in both directions simultaneously. No antenna upgrade will compensate for this.

Avoiding Common Coax Mistakes

- **Never kink or crush coax.** A sharp kink or bend beyond the cable's minimum bend radius can add significant localized loss and reflections, and can permanently damage the cable. LMR-400 has a minimum bend radius of about 1 inch; exceeding this damages the shield and dielectric.
- **Waterproof all outdoor connectors.** Water ingress between the connector and cable will corrode the connection and introduce significant loss within weeks. Use self-amalgamating tape over all outdoor connections.
- **Do not daisy-chain adapters.** Each adapter adds a small amount of loss (typically well under ~0.5 dB) and a potential failure point. If you need an N to SMA connection, use a single pigtail, not an N-to-PL259 + PL259-to-BNC + BNC-to-SMA chain.
- **Store connectors facing down outdoors.** Connector faces should point downward or be shielded from direct rainfall to prevent standing water in the connector mating face.

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