What is channel utilization and why does it matter?

What Channel Utilization Means

Channel utilization is the percentage of time the LoRa radio channel is occupied by transmissions. It's displayed in the Meshtastic app as a percentage (visible in the channel info or device telemetry).

Think of it like a single-lane road. If utilization is 10%, there's plenty of room for everyone. At 25%, it's getting busy. Around 40-50%, there's constant congestion and collisions. At 80%+, the channel is saturated and very few packets get through.

Why the 25% Threshold Matters

Meshtastic's flood routing uses random backoff timing to reduce collisions - nodes wait a random short period before retransmitting a packet. At low utilization, these collisions are rare. The ~25% figure is a community rule of thumb (not a hard physical constant): around 25% utilization, rising collision probability starts to degrade throughput noticeably, and once you reach roughly 40-50% the network becomes largely unusable.

What Drives High Channel Utilization

In order of typical impact:

1. **Position broadcast interval too short** - The default fixed position broadcast interval is 15 minutes, but users can lower it, and with smart broadcast enabled a moving node can transmit as often as every 30 seconds (the smart-broadcast minimum). On a 100-node network with everyone broadcasting every 30 seconds, position traffic alone saturates the

channel. Fix: set position broadcast to 5-30 minutes for fixed nodes, 1-5 minutes for mobile nodes. `meshtastic --set position.position_broadcast_secs 1800`
2. **Telemetry too frequent** - If many nodes broadcast device/environment telemetry at 5-minute intervals, the aggregate airtime adds up. Fix: set telemetry intervals to 15-30 minutes.
3. **Long-range preset with many nodes** - The Long Slow preset uses a high spreading factor, so each packet takes on the order of several seconds of airtime (the exact figure depends on payload size and bandwidth). With 50+ nodes, even moderate message rates saturate the channel. Fix: migrate to Medium Slow or Medium Fast, which cut airtime per packet substantially; note this trades some range for much lower airtime.
4. **High hop limits creating more retransmissions** - Total airtime for a packet scales with the number of nodes that actually rebroadcast it, so lowering the hop limit (for example from 5 to 3) reduces airtime by an amount that depends on how many relays would otherwise have re-transmitted, not a fixed percentage.
5. **Too many Router role nodes** - Every node set to ROUTER retransmits every packet it hears. In a dense area, CLIENT nodes should outnumber ROUTER nodes significantly. Fix: set personal handheld devices to CLIENT role, not ROUTER.

Target Values for a Healthy Network

Channel Utilization	Status	Action
0-10%	Healthy	None needed
10-25%	Moderate	Monitor; consider reducing position intervals
25-40%	Congested	Reduce intervals; consider faster preset
40%+	Saturated	Immediate action needed: reduce broadcasts, change preset

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