

# SNR Factor in WiFi Evaluation

## Overview

The SNR Factor, based on the Signal-to-Noise Ratio (SNR), is a critical metric for evaluating WiFi network performance within CONTROL. It measures the relationship between your WiFi signal strength and the background noise level in your environment. A higher SNR value indicates better WiFi performance and connection quality.

## Technical Foundation

### Core Principles

SNR Factor is built on fundamental wireless communication principles:

1. **Signal Strength:** The power of the WiFi signal received by your device
2. **Noise Floor:** The ambient background noise level in the environment
3. **SNR Calculation:**  $SNR = \text{Signal Strength} - \text{Noise Floor}$  (measured in dB)

### Standards Compliance

The SNR Factor aligns with the IEEE 802.11 standard, incorporating key parameters:

- **BeaconSNR:** Signal-to-noise ratio of received Beacon frames
- **DataFrameSNR:** Signal-to-noise ratio of received Data frames

### Implementation Details

CONTROL obtains SNR data using the TR-181 parameter:

```
Device.WiFi.AccessPoint.AssociatedDevice.SNR
```

This parameter is defined as:



"An indicator of signal to noise ratio, in dB, on the uplink from the associated device to the access point, measured in dB, as an average of the last 100 packets received from the device."

# SNR Factor Scale

CONTROL translates raw SNR measurements into a user-friendly scale ranging from 1 to 10:

Rating	Quality Level	SNR Range (dB)
10	Excellent	35 or higher
9	Very Good	30 to 34
8	Good	25 to 29
7	Fair	20 to 24
6	Marginal	15 to 19
5	Poor	10 to 14
4	Very Poor	5 to 9
3	Unreliable	0 to 4
2	Highly Unreliable	-5 to -1
1	No Connection	Below -5

## Interpreting Your SNR Factor

### Performance Expectations

- **10-9 (Excellent):** Optimal connection quality, ideal for high-bandwidth applications such as 4K streaming, video conferencing, and online gaming
- **8-7 (Good):** Reliable connection suitable for most online activities including HD streaming and general browsing
- **6-5 (Adequate):** Sufficient for basic tasks like web browsing and email, but may experience issues with bandwidth-intensive applications
- **4-3 (Poor):** Degraded connection with frequent interruptions, disconnections, and slow data rates
- **2-1 (Critical):** Severely compromised or unusable connection

# Why SNR Factor Matters

Understanding SNR Factor is essential for several reasons:

1. **Connection Quality:** Higher SNR values provide clearer signal reception, resulting in superior WiFi performance with fewer errors
2. **Dynamic Data Rates:** WiFi devices automatically adjust their transmission rates based on SNR—higher SNR enables faster data throughput
3. **Network Stability:** Strong SNR leads to more stable connections with reduced packet loss and fewer dropouts
4. **Effective Range:** Improved SNR can extend the practical usable range of your WiFi network

## Technical Insight: SNR and Modulation Schemes

SNR directly influences the Modulation and Coding Scheme (MCS) that your WiFi connection can utilize. Higher SNR values enable more sophisticated modulation schemes, which deliver higher data rates:

- **SNR > 25 dB:** Supports 256-QAM modulation (highest data rates)
- **SNR  $\approx$  20 dB:** Typically uses 64-QAM modulation
- **Lower SNR values:** Fall back to simpler schemes such as 16-QAM or QPSK for reliability

This adaptive behavior ensures your connection remains stable while maximizing throughput based on current conditions.

## Improving Your SNR Factor

### Optimization Strategies

Consider these approaches to enhance your SNR Factor:

- **Optimize Router Placement:** Position your WiFi router centrally and elevated to improve signal strength throughout your space
- **Minimize Distance:** Move closer to your WiFi router when maximum performance is needed
- **Reduce Interference:** Identify and eliminate sources of noise such as microwaves, cordless phones, and neighboring WiFi networks

- **Channel Optimization:** Use a WiFi analyzer tool to identify the least congested channel in your area
- **Expand Coverage:** Deploy WiFi extenders or mesh networking systems to improve coverage in weak signal areas
- **Hardware Upgrades:** Consider routers with advanced features such as improved antennas, beamforming, or MIMO (Multiple Input Multiple Output) capabilities

# SNR Factor in Context

SNR Factor works in conjunction with other CONTROL metrics to provide a comprehensive assessment of your WiFi network:

- **Signal Factor:** Measures raw signal strength
- **Noise Factor:** Quantifies environmental noise levels
- **SNR Factor:** Combines both metrics to evaluate overall connection quality

While strong signal strength is important, maintaining a low noise floor is equally critical for achieving high SNR and optimal WiFi performance. CONTROL analyzes all these factors together to give you a complete picture of your network health.

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## References

1. [TR-181 Issue 2 Amendment 15](#)
  2. [IEEE 802.11 Standards](#)
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