Bit Error Rate Calculator (with Examples)

This tool calculates the Bit Error Rate or BER. It is the number of bit errors divided by the total number of transferred bits during a fixed time interval.

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Calculator

Enter

- Total Number of Bits Received
- Number of Bits in Error

Total Number of Bits Transferred

1000

Number of Bits in Error

47

Invalid Witness – how to solve this problem

dB to Frequency (Hz) Converter

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File Transfer Time Calculator

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dBf to dBm Calculator

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Bit Error Rate

0.047

Bit Error Rate Percentage %

4.7

Formula

$$BER = N_{error}/N_{total}$$

where

- N_{error} is the number of bits received in error
- N_{total} is the total number of bits received

BER Calculation Example

If out of a total of 1000 bits received, the total number of bits in error is 50, then the Bit Error rate is 50/1000 = 0.05. Expressed as a percentage the BER is 5%.

Background

What is Bit Error Rate?

Bit Error Rate (BER) is a quantity that determines the reliability of a digital communication system. It is the number of bit errors that occur

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Bit Error Rate is an essential measure of the quality and reliability of a communication system. It allows us to evaluate the impact of noise, interference, and other factors on data transmission. Monitoring the BER helps in identifying and resolving issues that could lead to erroneous data and ultimately affect the performance and user experience of the communication system.

By computing the BER, we can assess how well a system is operating and identify any issues that may be affecting the quality of data communication.

The lower the bit error rate, the better or higher the level of system performance

How is Bit Error Rate calculated?

The Bit Error Rate is calculated by dividing the number of bit errors by the total number of transferred bits within a specific time period. For example, if a communication system has transmitted 1000 bits and 2 of those bits were received with errors, the Bit Error Rate would be 2/1000 = 0.002 or 0.2%.

Who uses Bit Error Rate?

BER is used by electronics engineers, scientists, communications

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In **wireless communication systems** for example, it is used to assess the quality of the wireless link and determine the reliability of data transmission. By monitoring the BER, network operators can identify signal coverage areas with high error rates and optimize the network to improve performance and user experience.

BER is also used by engineers to make recommendations to consumers of wireless equipment on how far a ring doorbell can be relative to the Wi-Fi access point for example. The received signal strength indicator (RSSI) is a measure of signal strength and the higher it is typically the lower the BER and greater the reliability of the wireless link. Ring therefore recommends a range of RSSI for good performance.

What affects Bit Error Rate?

The Communication Channel

The quality of the communication channel affects BER. Factors such as signal loss or attenuation due to increasing distance between the transmitter and receiver, interference due to other signals and signal propagation effects such as fading and shadowing can degrade the transmission quality by introducing errors.

Modulation

In general, the higher the order of modulation the higher the BER. For

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Intuitively the 256 QAM constellation has closer spacing than 16 QAM and as a result noise will cause more errors in the case of the former modulation scheme than the latter.

Equipment

The quality of the transmitter and receiver impacts the BER. For instance as the receiver noise figure is impacted by noise temperature. An increase in noise figure degrades receiver sensitivity and increases the BER. Clock accuracy and jitter impact frequency accuracy and performance. Lower the accuracy (higher PPM), higher the BER.

The video below explains the relationship between BER and Signal-to-noise ratio.

Frequently Asked Questions

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BER is either specified as a ratio or a percentage. It is often plotted on a log scale to show really small values such as 10^{-8} for example which would be difficult to show on a linear plot. *Note that BER is not converted to dB as such.*

The video below explains why you would want to plot BER on a Log Scale

References

[1] Bit Error Rate on Wikipedia

📁 Calculators, Communication Systems
‹ Voltage Ripple Calculator (with Examples)
› Access Point Calculator

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