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# Noise in Telecommunication: Different Types and Methods of dealing with Noise

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**Abstract**

*This article discusses noise in telecommunications: different types and methods of dealing with noise. Noise is arguably a very hated problem because it can interfere with the quality of signal reception and also the reproduction of the signal that will be transmitted. Not only that, but noise can also limit the range of the system to a certain emission power and can affect the sensitivity and sensitivity of the reception signal. Even in some cases, noise can also result in a reduction in the bandwidth of a system. Of course, we've all felt how annoying the noise effect is. For example, when listening to the radio, a hissing sound appears on the loudspeaker due to noise. To overcome noise, it is divided into passive noise control and active noise control. Passive noise control is an effort to overcome noise using components that do not require power. Generally passive noise control uses soundproof materials that act as insulation against noise. The method most commonly used to overcome noise is through increasing the gain. The noise is generally in a specific sound area. Hiss is on high frequencies, while noise and hum are on low frequencies. This is the principle underlying the noise reduction method.*

## Introduction

As defined by Beritelli et.al (2002) there are two kinds of Noise. (1) Internal Noise: Internal noise is a type of noise that is generated by the internal components in a communication system or electronic circuit. This type of noise is divided into four categories, namely thermal noise, shot noise, transit time noise, and flicker noise. (2) External Noise. Meanwhile, external noise is a type of noise that is generated by factors outside the system. So external noise is not caused by the components in the system. This type of noise is divided into two types, namely atmospheric noise and industrial noise.

According to Armada (2001) basic understanding of room noise, background noise, or noise criteria (NC). Actually, all the terms noise have the same meaning in broad outline. These terms are used based on the segmentation of their use and depending on who the individual is. (1) The term room noise is commonly used by the general public for indoors. Noise room is noise contained in our listening room. (2) The term background noise is usually used more freely for any room, indoor or outdoor. Feel it or not, there will always be sounds heard in every room, sounds that are not from the main sound source or unwanted sounds. (3) Used for scientific purposes and by experts (scientist). It is a value determined based on a standard curve of measured background noise in a room. Noise criteria (NC) are also known as indoor noise ratings ( Ho et.al, 2007).



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**Types of Noise**

In the world of communication, both communications using cables or using air as a transmission medium will inevitably experience disturbances in the communication process ( Göbel et.al, 2013). This disturbance is usually called noise. Noise is an unwanted electrical signal. This additional unwanted signal in a communication process is a major limiting factor in data communication systems. When noise occurs in a communication system, the communication system will experience interference. The disruption that occurs can cause the communication process to be interrupted or even break the communication process. Based on the source, noise can be divided into two categories: (1) Internal noise is the noise generated by the components in the communication system. (2) External noise Generated by sources outside the communication system. There are two kinds of external noise, namely man-made noise and natural noise (extra-terrestrial). According to Xu et.al (2011), Noise in the communication system can be grouped into four types, namely:

**Thermal Noise**

This thermal noise is present in all transmission media and on all communication equipment. Caused by hot electrons in the conductor (thermal agitation of the electrons), so they cannot be removed/eliminated. Thermal noise has a uniform energy distribution in the frequency spectrum and has a normal (Gaussian) level distribution. Thermal noise is a determining factor for the lower limit of receiver system sensitivity. Thermal noise is not very influential for voice transmission, but it will greatly affect data communication. In data communication, noise impulses can make the received signal defect, so that the data or information carried can change its meaning. Thermal noise can be approximated by white noise which has a uniform power spectral density in the frequency spectrum. All equipment and transmission media have a share in the generation of thermal noise when the temperature is above 0o (degrees Kelvin).

Ways to reduce thermal noise include: (1) Narrow the bandwidth (2) Reduce the number of resistive elements (3) Reduce the temperature of the electron component (4) Keep the transmission media away from noise sources (5) Giving the jacket on the cable

**Noise Intermodulation**

When signals with different frequencies together use the same transmission medium, resulting in signals at a frequency which is the addition or multiplication of the two original frequencies. For example, signals with frequencies f1 and f2 will interfere with signals with frequencies f1 and f2, this is due to the non-linearity of the transmitter, receiver or transmission system.

Intermodulation noise usually arises as a result of intermodulation symptoms. When we pass two signals each with a frequency, for example f1 and f2 through a medium or non-linear device, spurious frequencies originating from signal harmonic frequencies will be generated. located within or outside the desired working frequency band. This intermodulation can be formed from the harmonic frequency of a signal.

**Crosstalk**

This is caused by the electrical coupling between the wires that are placed close together, for example between a twisted pair / coaxial cable that carries multiple signals, which is a link between unwanted signals. Cross Talk (Cross Talk) will be clearer or increase if the distance traveled is further, the transmitted signal is getting stronger / bigger or greater in frequency.

For example, in a telephone conversation hearing other sounds, the transmitter signal is captured by the antenna. There are 3 (three) important things that cause crosstalk. These are (1) Electrical coupling between transmission media, for example between pairs of wires in a



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communication system that uses cables as the transmission medium. (2) Poor control of the response frequency, for example, a poor filter design. (3) Non-linearity in the analog multiplex system (FDM).

There are two types of crosstalk: (1) Intelligible crosstalk. When crosstalk causes at least four words to be heard (from unwanted sources) for a 7-second conversation. (2) Unintelligible crosstalk. Any other forms of interference due to crosstalk.

**Impulse Noise**

Consists of irregular pulses or noise spikes of short duration and of relatively high amplitude, generated by lightning, and errors and defects in communication systems or is a minor disturbance to analog data due to electromagnetic interference and is a major source of data communication digital, so impulse noise is very disruptive to data transmission.

For a conversation, this impulse noise does not have any effect, therefore when talking about voice communication, this is not really considered. However, this impulse noise will defect the received signal so that the information carried changes its meaning. To overcome the impulse noise, things that need to be done are: (1) Move the transmission medium away from electric fields (2) Increase SNR (3) Using Isolated Cables ( Wu & Bar-Ness, 2002).

**Methods for dealing with Noise**

To overcome noise, it is divided into passive noise control and active noise control. Passive noise control is an effort to control noise using components that do not require power. Generally, passive noise control uses soundproof materials that act as insulation against noise. These insulation materials are common to find in recording studios. With the insulation of these materials, general ambiance and reverberation can be eliminated. This is because reflected sound, the source of ambiance and reverberation, is absorbed by these insulating materials. Active noise control is an effort to control noise using components that require power. Unlike the passive noise control method, the active noise control method overcomes noise by manipulating the audio source or noise. The active noise control methods commonly used include the gain adjustment method, the noise cancellation method, and the noise reduction method. One of the devices that uses this method is noise reduction headphones.

The method most commonly used to overcome noise is through increasing the gain. In this method, the value of the power output by the audio source is adjusted to produce a louder sound. It is expected that the increase in power can cover noise which generally has constant power and tends to be weak. The advantage of this method is that it is easy to apply to existing systems. Almost all audio systems feature a gain setting which is commonly known as an audio volume control. Meanwhile, the main drawback is the absence of adaptive ability in dealing with noise which is not a constant value so that generally volume control is operated manually by the user. This deficiency can be overcome by automating the gain increase process.

The noise is generally in a specific sound area. Hiss is on high frequencies, while noise and hum are on low frequencies. This is the principle underlying the noise reduction method. Through various signal processing techniques, the signal can be broken down into smaller pieces. After the solving process, some parts of the signal are removed which occupy the frequency area which is considered noise. It is from this subtraction that this method got its name.

## Conclusion

Telecommunication system performances related to the Noise works that divided into the external and internal system. There are two kinds of Noise. (1) Internal Noise: Internal noise is a type of noise that is generated by the internal components in a communication system or



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