

## Lesson Plan

# Chapter 4 Layer 1 – Electronics and Signals

**Headline** Who's making all that noise ...and what the hell is Fourier analysis and what does it have to do with network cables?

### In Advance

I will prepare a handout to distribute on our website that contains vocabulary to be defined. I will also prepare presentation screens to accompany a lecture on harmonic distortion and signal noise and how it's produced in Layer 1 devices. Finally, I will prepare an Excel mathematical model that shows the effects of harmonic distortion on network cable. Solutions will also be discussed.

### Review

- 4.3.1 Comparing analog and digital signals
- 4.3.2 Using analog signals to build digital signals
- 4.3.3 Representing one bit on a physical medium
- 4.3.4 Network signal propagation
- 4.3.5 Network attenuation
- 4.3.6 Network reflection
- 4.3.7 Noise
- 4.3.8 Dispersion, jitter, and latency
- 4.3.9 Collision

### Materials

- Cat 5e cable
- Multimeter
- Excel Model – Harmonic Distortion

### Preparation for Learning

#### ***Target Indicators***

- 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.3.7, 4.3.8, 4.3.9

#### ***Vocabulary***

Fourier Analysis	Radio Frequency Interference (RFI).
Harmonic Distortion	Dispersion
Noise	Jitter
Thermal Noise	Latency
AC line noise	Collision
Electromagnetic interference (EMI)	

#### ***Focus Question***

How does noise affect data traveling through cables?

### Delivery Of Instruction

**Lecture**

I will show a presentation and explain the different types of noise that interfere with data flow. I will also demonstrate the laboratory experiment using an Excel model of harmonic distortion.

**Key Graphics**

Web base lecture screens

**Online**

The class will start with lecture, which will cover the definitions of the terms. I will show some examples using a Cat 5e cable. I will talk about a real world example of cable that's bent, coiled, or twisted beyond specifications.

**Lab/Activity**

Have two students talk at the same time and demonstrate a verbal collision. Hopefully, this exercise will show that both conversations are lost when the conversations collide. If there is a student who is disabled or on an IEP, that student will have extra time to complete his research and assignments if necessary.

The students will measure the capacitance of thin Ethernet cable and then enter the value into an Excel module demonstrating the effect of capacitance on the level of harmonic distortion and therefore the effective bandwidth of a cable.

**Assessment**

I will give a short written quiz where the students match the new vocabulary words with their definitions.

**Reflection**

Make sure the students write the new vocabulary words in their journal along with the definitions.

**Homework**

The students will research the vocabulary using the internet. They will relate these terms to everyday communication on a telephone, on a CB radio, in a classroom, or at a party.

**Resources**

Web Sites

<http://epics.aps.anl.gov/techpub/lsnotes/ls232/ls232.html>

**Alternate Lesson Plan Ideas****Books**