**COSMOS EDUCATIONAL TOOLKIT: Engineering/CS**

**W1: Introduction to Wireless Communications Technology**

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| **Grade/ Grade Band**: 9-12 | **Topic:** Engineering/CS: Wireless Communication Technologies | **Lesson #** **1 in a series of 4** **lessons** |
| **Brief Lesson Description**: * How do cell phone calls and netflix videos jump around the world to our computers and phones? This lesson explores how humans have used the electromagnetic spectrum to send encoded messages for long distance communications. Students will use radio technology in order to pick up various signals from around the city.
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| **Specific Learning Outcomes:** * SWBAT explain the electromagnetic spectrum.
* SWBAT identify electromagnetic frequencies which are transmitting human communications.
* SWBAT design possible conceptual solutions to the current spectrum crunch.
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| **Narrative / Background Information**  |
| **Prior Student Knowledge Required:** * General knowledge of waves
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| **NYS Science Learning Standards / NGSS:*** **HS-PS4-1.** Use mathematical representations to support a claim regarding relationships among the period, frequency, wavelength, and speed of waves traveling and transferring energy (amplitude, frequency) in various media.
* **HS-ETS1-1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
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| **Science & Engineering Practices:*** Asking Questions and Defining Problems
* Constructing Explanations and Designing Solutions
* Engaging in Argument from Evidence
* Obtaining, Evaluating, and Communicating Information
 | **Disciplinary Core Ideas:*** **PS4.C: Information Technologies and Instrumentation**
* **ETS1.A: Defining and Delimiting Engineering Problems**
* **ETS1.B: Developing Possible Solutions**
 | **Cross-Cutting Concepts:*** **Interdependence of Science, Engineering and Technology**
* **Influence of Engineering, Technology, and Science and the Natural World**
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| **Possible Preconceptions/Misconceptions:** * The internet is magic.
* Sound waves are the same as electromagnetic waves.
* Wireless communication does NOT take many layers of technology.
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| **Materials Needed:*** Worksheets
 | **Tech Setup:*** Computer stations for each group
* RTL-SDR
* BunnyEars Antenna
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| **LESSON PLAN – 5-E Model**  |
| **ENGAGE: “WIRELESS HEADPHONES WHILE SWIMMING”*** Prompt students with the following:
	+ “Can you listen to music with wireless headphones while you are swimming?”
* Think-Pair-Share with groups.
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| **EXPLORE: “WIRELESS OBSTACLES” ACTIVITY*** Students work in small groups at a computer
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| **EXPLAIN:*** Write 3 observations about the data your group collected.
* Which obstacle affected the Power the most?
* Which obstacle affected the Power the least?
* Groups posts data on class chart/spreadsheet
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| **ELABORATE:*** Takeaways:
	+ “Different obstacles will decrease the power of a signal differently.”
	+ “Try to avoid obstacles if possible.”
	+ “Placement of your transmitter and receiver should try to minimize significant obstacles.”
* Vocab:
	+ “Line of Sight” (LOS)
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| **EVALUATE:** * Can you better explain now what happens with wireless headphones for swimmers?
* How do you think trees affect wireless signal strength?
	+ Research another indoor obstacle that may affect wireless signals.
	+ Research another outdoor obstacle that may affect wireless signals.
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| **(ENRICHMENT:)*** Apply today’s insight to your group’s design project. Which technologies might you consider to communicate wirelessly? Explain in clear detail.
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