Enhancing Spectral Usage Through Full Duplex Communication

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Today’s average phone data speed is 26.1 Mbps, what will the average data speed be in the year 2020?  
A: 52.1 Mbps  
B: 62.1 Mbps  
A: 42.1 Mbps
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- Many services leave frequencies unused.
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- FCC allocates bands to services.
- Many services leave frequencies unused.
- Need to understand how spectrum works now.
- Spectrum will be prioritized.
Analysing the Radio Spectrum

What frequencies are being used?
Analysing the Radio Spectrum

What frequencies are being used?

What services own these frequencies?
Analysing the Radio Spectrum

What frequencies are being used?

What services own these frequencies?

How they use it?
Analysing the Radio Spectrum

What frequencies are being used?

What services own these frequencies?

How they use it?

Hypothetical Radio Spectrum (now)

Used
Unused
Analysing the Radio Spectrum

What frequencies are being used?

What services own these frequencies?

How they use it?

Frequent Users

Less Frequent Users

Night Users

Day Users

Free Spectrum

Hypothetical Radio Spectrum (future)
Acquiring Signals from a Software Defined Radio

SDR
Acquiring Signals from a Software Defined Radio

SDR \rightarrow \text{Matlab} \rightarrow \text{LabView} \rightarrow \text{Amplitude}

Time
Acquiring Signals from a Software Defined Radio

SDR → Matlab → LabView → Amplitude

Time

Power

Fast Fourier Function (FFT)

Frequency
Detecting the Power of Signals

Identifies the frequencies being used.
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Identifies the frequencies being used.

Noise floor.
Detecting the Power of Signals

Identifies the frequencies being used.

Noise floor.

Threshold = 10 dBm above noise floor.
Detecting the Power of Signals

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Signals will fluctuate due to noise.
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Threshold = 10 dBm above noise floor.

Signals will fluctuate due to noise.

Increase samples to reduce error.
T-Mobile (699 MHz - 716 MHz) and AT&T (704 MHz - 716 MHz)
Verizon Preferred Band (777 MHz - 787 MHz)
Sprint Preferred Band (1850 MHz - 1915 MHz)
Small Portion of Radio Spectrum
Small Portion of Radio Spectrum

699 MHz - 716 MHz
Small Portion of Radio Spectrum

699 MHz - 716 MHz

777 MHz - 787 MHz
Small Portion of Radio Spectrum

699 MHz - 716 MHz  777 MHz - 787 MHz  1850 MHz - 1915 MHz
The Tip of the Iceberg

Future work should:

● Look to analyze a larger range of frequencies

● Increase the efficiency of looking for used frequencies
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