

Implentation of a Total Power Radiometer in Software Defined Radios

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Introduction

The goal of this thesis and presentation is to explore other methods that could be used for a remote sensing radiometer and specifically the implementation of a software defined radio as a total power radiometer. The end goal is to develop a radiometer that is more flexible than most radiometers and still maintain the accuracy and stability of a traditional radiometers if not exceed these specifications.

A secondary goal was to use off the shelf components and components that are generally more accessible. This would allow radiometers to be more accessible to a wider scope of researchers in this field.

And finally a tertiary goal was to ensure that the system as a whole is fairly easy to use. This ties to our secondary goal of making radiometers more accessible to a wider range of researchers and research topics.

As stated in the background, ISU currently owns a radiometer that is used for the remote sensing of soil moisture. In many ways, the current ISU radiometer is like a SDR. The RF signal is digitized and then processed by a FPGA to give the total power reading needed for radiometry. However, due to the under-sampling of the signal some information is lost. The ISU radiometer assumes that incoming signal is free of any interference and the power recorded is from the target of interest. However, in recent years the ISU radiometer has not been performing as expected, and without additional information it is almost impossible to diagnose these issues out in the field. The ISU radiometer is also not frequency agile, it is fixed at 1.4 GHz and the bandwidth is also fixed at 20 MHz. All of this means that if an interfering signal is present the current radiometer would not be able to determine this and even if it could, it has no means to try to avoid the signal.

This thesis looks to explore the following questions: (1) Can we use a SDR along with GNURadio to recreate a radiometer in software? (2) If so, what performance can we get from the system? (3) What benefits do we gain (if any) from using a SDR from a more traditional radiometer? The results of this research and experimentation are the subject of this thesis.

Paragraphs of Text

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Bullet Points

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Multiple Columns

Heading

- 1 Statement
- 2 Explanation
- 3 Example

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Table

Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table : Table caption

Theorem

Theorem (Mass–energy equivalence)

$$E = mc^2$$

Verbatim

Example (Theorem Slide Code)

```
\begin{frame}  
\frametitle{Theorem}  
\begin{theorem}[Mass--energy equivalence]  
$E = mc^2$  
\end{theorem}  
\end{frame}
```

Figure

Uncomment the code on this slide to include your own image from the same directory as the template .TeX file.

Citation

An example of the `\cite` command to cite within the presentation:

This statement requires citation [Smith, 2012].

References



John Smith (2012)

Title of the publication

Journal Name 12(3), 45 – 678.

The End