

Reconfigurable Antenna with Matching Network

Functional Requirements List and Performance Specifications

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Introduction:

Reconfigurable antennas present a new option for antenna capability and technology in wireless devices. They require less space and increase functionality of an antenna system. Reconfigurable antennas are a single system that accesses multiple specific frequencies through various switches, patch antennas and patch networks. This eliminates the need for multiple antennas or wideband antennas. Multiple antennas take up more space, as they require an antenna for each use, and are always on. Wideband antennas, due to their inherent wide-bandwidth, receive more noise at a specific frequency than a single patch antenna. The reconfigurable antenna is an alternative solution to these possible antenna options that we seek to design and analyze its performance.

The goal of this project is to develop an antenna that has the capability of changing its resonance frequency and switch to the corresponding impedance matching network. The two frequencies chosen to switch between are both GPS signals that occur at 1.227GHz and 1.575GHz. Modern design methods will be analyzed for the best practical method concerning performance, cost, and complexity. The system will have two varying sized patches, both with length based upon $\frac{1}{2}\lambda_{\text{desired}}$. These patches will be integrated through various switches in order to create a minimalist system (see Figure 2-1)

High Level System Block Diagram:

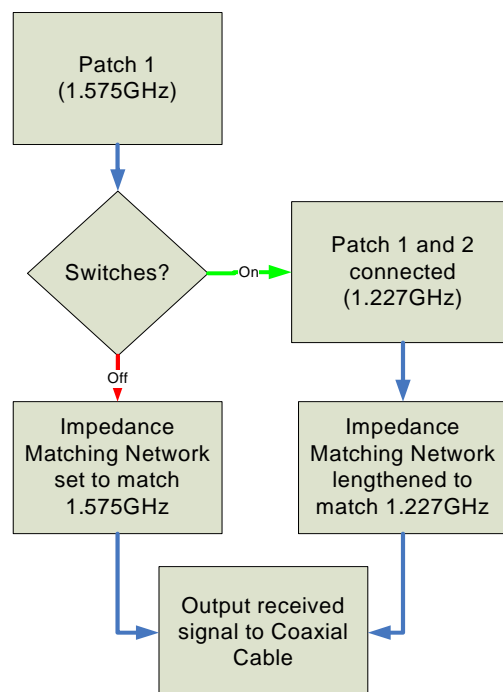


Figure 1-1: High Level System Block Diagram of Reconfigurable Antenna with Matching Network.

Functional Requirements and Specifications:

Antenna System:

- The first patch antenna shall have a center resonant frequency of 1.575GHz, impedance of 50 ohms, and Linear Polarization.
- The connected patch antennas shall have a combined center resonant frequency of 1.227GHz, impedance of 50 ohms, and Linear Polarization.
- The patch antenna shall have the optimal area regarding performance while aiming for minimal patch size.

Switching System:

- The switch package size shall be less than or equal to 2.0mm (for length) to ensure close proximity of patch antennas.
- The switches shall have a Low Insertion Loss (<0.7dB @ 2GHz).
- The switches shall have a High Isolation loss (>15dB @2GHz)
- The switches shall operate at least within 1 to 2 GHz frequency range.
- The switches shall have a fast switching speed (<10us).

Substrate:

- The substrate shall have a high dielectric constant, ϵ_r (~10).
- The substrate shall have as small of thickness as possible without sacrificing durability (> 10mils).
- The substrate shall minimize the bandwidth around the resonant frequencies to reject noise of outside frequencies while meeting the minimum bandwidth required for GPS.
 - 1.575 GHz Bandwidth is 1.563 GHz to 1.587 GHz
 - 1.227 GHz Bandwidth is 1.215 GHz to 1.239 GHz
- The microstrip board shall be gold plated in the areas where wire bonding is required for the MEMS switches.

References:

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Yang, Songnan, Chunna Zhang, Helen K. Pan, Aly E. Fathy, and Vijay K. Nair. "Frequency Reconfigurable Antennas for Multiradio Wireless Platforms." *IEEE Microwave Magazine* (2009): 67-84. Print.