

Test Plan

Portable MRI Scanner

by



MRI SOLUTIONS

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Testing overview

Our test plan is split into three phases. The first is the transmitting phase where we will test the functionality of the transmitting module. The second is the receiver phase where we will test the receiving module to ensure we are receiving a response and correctly processing it. Third and final phase will be testing the system as whole to observe the signals for 1D and 2D image reconstruction.

Phase 1

Test	Halbach Magnet Array
Description of test	<ol style="list-style-type: none"> 1. Create a grid pattern within the array 2. Use Hall effect sensor and an Arduino to measure the field strength at each point
Expected Result	Field strength of at least 0.1 T and magnetic gradient of less than 3 mT/cm ²

Test	Direct Digital Synthesizer (DDS)
Description of test	<ol style="list-style-type: none"> 1. Connect output of DDS to oscilloscope 2. Measure the frequency and magnitude of current of the sine signal
Expected Result	Signal is a 9 MHz sine wave with magnitude of at least 5 mA

Test	Blanking Switch
Description of test	<ol style="list-style-type: none"> 1. Connect DDS to RF common and connect RF1 to oscilloscope 2. Connect control signals to FPGA
Expected Result	Switch correctly pass and block input from DDS as programmed in FPGA

Test	Power Amplifier
Description of test	<ol style="list-style-type: none"> 1. Input a signal into the power amplifier 2. Measure the signal at the output
Expected Result	The signal the power amplifier outputs is at 9 MHz and the current is at least 0.25 A

Test	Transmit/Receive switch
Description of test	<ol style="list-style-type: none"> 1. Send in a signal of known amplitude and frequency 2. Connect control signals to FPGA 3. Monitor the output with an oscilloscope
Expected Result	Switch passes transmit signals and isolate receiving chain when transmit control signal is on. Switch passes receiving signals and isolates transmission chain when receiving control signal is on.

Test	Coil Tuning and Matching
Description of test	<ol style="list-style-type: none"> 1. Input a signal from function generator 2. Observe the response of the inductor by using a stationary pick up coil and oscilloscope from 1 MHz to 15 MHz.
Expected Result	Coil should show maximum voltage at 9 MHz and be matched approximately to 50Ω

Phase 2

Test	Low Noise Amplifier
Description of test	<ol style="list-style-type: none"> 1. Input a sinusoid signal 2. Measure the signal at the output
Expected Result	Input signal is amplified by at least 30 dB

Test	Analog to Digital Converter
Description of test	<ol style="list-style-type: none"> 1. Input known sinusoidal signal into the ADC 2. Read the output of the ADC using an FPGA 3. Reconstruct the digital signal
Expected Result	The reconstructed digital signal is consistent with the known input signal

Phase 3

Test	1D Signal
Description of test	<ol style="list-style-type: none"> 1. Place a sample within the static magnetic field 2. Observe the response using oscilloscope (inside the transmitting coil)
Expected Result	Observe free induction decay response signals

Test	2D Image
Description of test	<ol style="list-style-type: none"> 1. Place a sample within the magnets and observe response using oscilloscope 2. Rotate magnet by a known angle 3. Acquire data at different angles (0° to 360°) 4. Use algebraic reconstruction technique to obtain a 2D image
Expected Result	Obtain signals for 2D image reconstruction and produce a 2D image