

**Wireless Power Specifications Document**

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**How to Use This Document**

This document is divided into five major sections. While specification document formats vary from group to group the format presented here is a good representation of what you will encounter in industrial specifications. The sections of the document are:

1. Scope
2. Applicable Documents
3. Stakeholder Requirements
4. Engineering Requirements
5. Verification of Requirements

This document is not only intended to explain engineering specification documents and show the development of a specification through the use of a running example. It also aims to help you produce a specification for your project. In order to achieve this goal each section will be presented in three levels. I will:

1. Attempt to explain the reasons that the section exists and what data goes into that section.
2. Complete that section for the running example and annotate the example to make it more understandable.
3. Strongly suggest that you complete the section for your project. When you see the symbol  it means you are going to get to produce something.

A skeleton template will be available in the same place that you found this document. Fill out that skeleton template as you follow through this document. You will quickly produce a specification in the least painful way I can think of. Note that I didn’t say pain free. Sometimes thinking as hard as you need to think in engineering design just makes your head hurt.

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Revision History

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| **Revision** | **Description** | **Author** | **Date** | **Approval** |
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A simple hardware example will be used throughout this guide to illustrate the writing of a specification document. The USU ECE Controls Lab needs a new power amplifier. The requirements for its design follow the narrative in this document.

From experience I know that I will not get it all right the first time. If you find what you believe to be a mistake or omission, and can make a good case for why you feel that this is so, then I will revise the document and immortalize your name in the revision table.

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# SCOPE

This section is a very top level, simple verbal description of what the item is and where it is used. See the amplifier example under the **General** heading.

1. **General: This document describes the design and verification requirements for a wireless power system using a tesla coil. This will also specify a receiver that is to be installed on sites which use this power.**
2. Additional short descriptive paragraphs can be added only if needed for special classification, designation of alternate versions or other material that is part of a top-level description.



Take time to write this section for your project. Being able to write a simple description of even complex things is a good indicator of how well you understand what you are planning.

# APPLICABLE DOCUMENTS

# STAKEHOLDER REQUIREMENTS

#### The stakeholders for the Tesla Coil Power System are:

#### Anyone living near the implemented system.

#### The company designing the system.

#### The customer who purchases the system.

#### Any personnel who build and maintain the system.

## Stakeholders User Stories

#### The primary stakeholders needs are described below.

* + - **People living in the community around the system will be the daily consumer.**

#### The system must have no adverse health effect or safety concerns to the community.

#### User Story

#### As a community member, I am concerned about the safety of this system. I do not want the electromagnetic field to affect the health of a family and the electronic devices in the vicinity. I do not want to be randomly shocked or have my electronics fried.

#### System does not interfere with commercial and residential signal traffic.

#### User Story

#### As a community member, I do not want the system to interfere with any signals such as Wi-Fi, radio, and cellular signals.

* **The company that makes the system:**

#### System must comply with all legal standards.

#### User Story

#### As the designers of this system, law suits are a thing that should be avoided whenever possible. The design of the system needs to apply to all the rules and regulations that apply to each part.

#### Utilize existing technology whenever possible

#### User Story

#### Due to cost and time restraints, existing technology must be researched and implemented when possible to preserve resources. Don’t reinvent the wheel.

* **The customer is the one who will be purchasing and installing the system.**

#### Must be easy to setup.

#### User Story

#### When our company installs the system, there must be clear instruction on how to set up the system. Whenever possible, use diagrams and images to explain complex mechanisms. The people who will be on site to install the system may not have an engineering background so the process should be made easier to understand.

#### Must be reliable.

#### User Story

#### The system must be able to operate on its own for 35 years without any need for major part replacement and maintenance. Only common inspections and minor maintenance should be required.

#### The system must continue to operate unless there is a blackout. This includes hot summer days over 110 F and winter nights below -20 F. The system must also operate in all weather conditions such as rain, snow, and at any humidity. A backup generator must be installed in case of a blackout for emergency shutdown. The system must also be able to survive an earthquake.

#### The system must be within the following size, cost restrictions, and operating field.

#### User Story

#### Space is limited so the system must fit on a 2,000 sq. ft property with a height restriction of 100 ft. All of the part must be transportable by semi-trucks. The total system weight is not crucial, but the system weight should be close to 40 tons or below.

#### The total system cost needs to be below $100 million with a monthly maintenance and operational cost below $60k.

#### The system will be obtaining its power from another source such as dams and this system will convert this power into wireless energy. The effective radius of power distribution must be 20 miles.

* **Any personnel who build and maintain the system.**

#### Must be a computer on site to interface with the system.

#### User Story

#### There must be a computer module on the site that allows technicians to monitor the current status of the system. The interface must use a keyboard, mouse, and monitor for the user to interact with. The interface must be easy to navigate and understand using easy to read formatting and menus. Alerts must be implemented into the system to alert the technician of any system changes.

#### A manual must be created and easily available for technical training purposes and on site reference. Technicians must undergo technical training before being authorized to work on the system.

# 4 ENGINEERING REQUIREMENTS

1. Receivers must be able to obtain electricity from the source anywhere within a ten-mile radius.
2. The system must be set up and maintained. Users will need a receiver on premise to hook into the building's wiring.
   1. The system must be set up on test site.
   2. A working receiver must be able to convert the wireless electricity to 120 V AC usable in homes
3. System must operate indefinitely unless an outage occurs.
   1. The system is running while maintenance tasks are performed.
   2. The system is running with no outages, without range decreasing, and with no unexpected problems for two months.
4. No health concerns caused by the system
5. No large magnets or uncertified electrical equipment within 100 yards of the coils while operating.
6. The equipment must fit on a 2,000 sq. ft property. Height restriction up to 100 ft. Parts must be able to be transportable on an 18 wheel semi.
   1. Transport equipment on 18 wheel semi
   2. System height when fully assembled must be below 100 feet.
7. After installation, system will weigh 40 tons or less
8. System must run without need of complete major part replacement for 35 years.
9. Existing infrastructure in homes that will need only slight modification. (Receivers)
10. Existing concept
    1. Implement research already done in system design.

# 5 VERIFICATION OF REQUIREMENTS

1. Use a receiver at several locations within the 10-mile radius of the system. Verify that the receiver receives 120 V consistently throughout the radius.
2. Test several types of materials that are safe to be within 100 m of the coils.
3. Weigh individual parts and verify the total is less than 40 tons
4. Perform stress and strain tests all the major components to develop a model for how long a piece of equipment will last before needing to be replaced.
5. Connect 20 receivers to common household loads and verify that the output voltage stays within 120V.
6. Measure how tall the system will be and verify it is below 100 ft. Verify that the space needed for the system is only 2,000 sq. ft.
7. Research of the effect of wireless electromagnetic waves on the human body.

## Verify Coverage of Stakeholder Requirements

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