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ECE 4805 – Major Design Experience

F23-07: L-Band Satellite Tracking

Engineering Standards

1. **First Engineering Characteristic**

a. Number and name of standard:

- 149-2021 – IEEE Recommended Practice for Antenna Measurements

b. Proof of standard development organizer legitimacy:

- The company that produced the standard researched for this project was the IEEE, the world's largest technical organization and the industry standard of industry standards. Currently the IEEE has roughly 3000 active standards for engineering and industry practice, all of which are practiced globally due to the interconnected nature of engineering practices [1]. The presence of the IEEE as the internationally accepted voice on the standards of engineering practices, as well as the widespread uses of the technical standards they produce in industry, gives enough evidence to state that the IEEE is a legitimate source for the purposes of this project.

c. Source of engineering standard:

- I had found this source by searching under the standards tab on the IEEE Xplore website, after I had first reviewed the background information and specifications listed on the provided project description. I had seen that a major portion of our project was to develop and test a satellite detection and communication antenna and used the IEEE directory to find if there were any published antenna testing protocols.

d. Use and application of standard:

- This standard gives an outline for the general practices that should be used in antenna design and testing based on use and configuration, and gives specified antenna design criteria depending on the use case of the produced product. In addition to that, the standard provides the mathematical formulas needed to design proper simulations to more efficiently streamline the process of optimizing antenna design, such as how to minimize reflection leading to errors in data collection and examples of designs for different applications of antennas. This standard also provides restrictions on what is and is not allowed when designing antennas for general use, as to further streamline the process of ensuring a lack of interference from incorrectly designed or implemented products. For the purposes of my project on a satellite tracking antenna, this standard is an excellent resource for understanding the guidelines and proper procedures to design the antenna used for this project, as well as the theory and formulas that are used to produce a simulation of the necessary product.

e. Application of standard to project requirements:

- This standard can be primarily used to solve the issue of the tuning range and antenna gain, as both qualifications are listed as a specified section in the standard. The total gain of the antenna placed onto the gimbal would need to be designed in a way to fit the standard created by this project, which states that for outdoor antenna applications, an increased dB criteria is limited by the diameter of the antenna used, and any outdoor application of long range antennas is required to be calibrated to repress any reflections off of nearby structures, as to not interfere with other nearby radio technologies [3, Page 22].

2. Maximize antenna gain subject to constraints imposed by other requirements. This is both to maximize system sensitivity and to provide a degree of angular selectivity.

f. Application of standard to project requirements:

- If I need more information about the standard and its applications, I can refer to the references listed at the end of the standard, and also check to see how the standard was used in other projects.

2. **Second Engineering Characteristic**

a. **Number and name of standard:**

- C95.7-2014 – IEEE Recommended Practice for Radio Frequency Safety Programs, 3kHz to 300GHz

b. **Proof of standard development organizer legitimacy:**

- The standard was created by the IEEE, which is considered the industry leader for creating standards. As such, since this standard came from the same source as the one used above, I trusted the source once confirming it was an IEEE standard.

c. **Source of engineering standard:**

- I found this standard by first searching up online for a peer reviewed article on radio frequency signals, but when unsuccessful in this regard I checked the IEEE Xplore website and found the associated article.

d. **Use and application of standard:**

- This standard was created to establish operational procedures to avoid the creation of dangerous situations associated with RF research, specifically with the issues associated with dangerous RF exposures. Our project includes a receiver antenna which is operating within the frequencies listed in this project, and as such safety guidelines associated with handling higher frequency ranges and antennas will be helpful to us to ensure our RF safety protocols are up to industry standards.

e. **Application of standard to project requirements:**

- One of the protocols we are required to uphold for this project is the tuning range and bandwidth of the antenna, which are all stated to be within the 1400 – 1700 MHz tuning range with a Bandwidth of 2MHz. These frequency values are within the specifications listed in the standard document, and as such the standards of the RFSP conditions apply for our project.

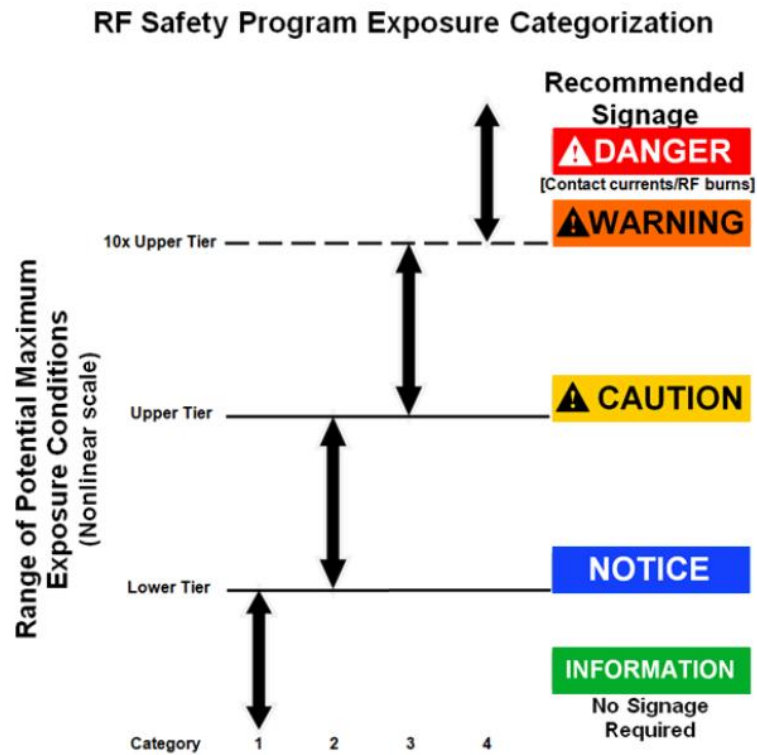


Figure 2: RF Safety Protocols

As such, by the protocol listed above, we are required to restrict our design of this project in a means to limit the RF exposure experienced by the people working on this project, as by working within the frequency bounds of this standard we are required to uphold this standard.

f. Application of standard to project requirements:

- The end of this standard has a list of references used, meaning that if I needed to learn more about RF safety I can check the listed reference standards, as well as the previous edition of this standard.

References

- [1]. <https://www.ieee.org/about/ieee-history.html#growth-and-globalization>
- [2]. <https://canvas.vt.edu/courses/165679/files/folder/Project%20Descriptions?preview=26713199>
- [3]. <https://ieeexplore-ieee-org.ezproxy.lib.vt.edu/stamp/stamp.jsp?tp=&arnumber=9714428>
- [4]. <https://ieeexplore-ieee-org.ezproxy.lib.vt.edu/stamp/stamp.jsp?tp=&arnumber=6874474>