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ECE 4806

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L-Band Satellite Tracking and Characterization System

Engineering Standards

The first engineering characteristic I selected is: “Polarization: RHCP required. Simultaneous RHCP and LHCP preferred”. The standard I identified as being relevant to this characteristic is:

IEEE Std 149™-2021

1. This standard was developed by the Antennas and Propagation Standards Committee of the IEEE Antennas and Propagation Society and approved by the IEEE SA Standards Board. The IEEE SA Standards Board is overseen by the IEEEE SA Board of Governors, who are elected by IEEE SA members. The Standards Board itself oversees the standards development process. IEEE SA works in conjunction with ISO and IEC, which are both internationally recognized standard associations. Because of these accreditations and the long history of IEEE SA, I am willing to trust the legitimacy of this SDO.
2. In order to find the standards information I:
    a. Entered the IEEE Xplore database.
    b. Specified the type of search by “standards”.
    c. Entered the keyword: “antenna”.
    d. Selected the standard that most closely matched the engineering characteristic I am working with.
3. The number is IEEE Std 149-2021, the title is “IEEE Recommended Practice for Antenna Measurements”
4. The purpose of this standard is to provide recommended practices for measuring the transmitting and receiving properties of antennas. This will be useful to guide us in making measurements to determine how effective our antenna will be at receiving satellite signals. It will also guide us through the use of things such as antenna testing ranges, and the practices themselves.
5. Thankfully the target specification for this characteristic is given. The requirement, or “ideal” value is to be RHCP polarized. The preferred or “potential” value is for the antenna to be both RHCP and LHCP polarized simultaneously. Section 9 of the standard, titled “Measurement of polarization” gives us guidelines for determining both the RHCP and LHCP polarization of our antenna. It also gives us formulae for determining the “axial ratio” AR, and tilt ratio, which will be useful for determining effectiveness of our antenna.
6. In order to use this standard to its full extent, we will need to further understand the fundamentals of antenna design and polarization. I will use this standard as a reference to guide my research into the considerations that need to be made for antenna polarization. By cross referencing this standard with the material that I learn in my RF and Microwave, Electromagnetic Fields II, and my electromagnetic research group, I will be able to more effectively tackle the process of designing and testing our antenna.

The second engineering characteristic I identified was the need to include continuous Nyquist-rate sampling and streaming to local non-volatile storage. For this purpose I believe we will need to integrate an Analog-to-Digital converter, which led me to choose the standard:

IEEE Std 1241™-2010

1. This comes from the same SDO as the previous standard, IEEE Standards Association. The difference between the previous standard and this standard is that this standard was Waveform Generation Measurement and Analysis Technical Committee of the IEEE Instrumentation & Measurement Society, and was approved by both the IEEE-SA Standards Board, as well as the American National Standards Institute. This bears both the legitimacy of the IEEE-SA discussed in the previous engineering characteristic, but also the legitimacy of the ANSI, which is a long-standing member of the ISO.
2. I followed the same process as the previous standard, I:
    a. Entered the IEEE Xplore database.
    b. Specified the type of search by “standards”.
    c. Entered the keyword: “Analog to Digital Converter”.
    d. Selected the standard that most closely matched the engineering characteristic I am working with.
3. The standard number is IEEE Std 1241™-2010, and the title is “IEEE Standard for Terminology and Test Methods for Analog-to-Digital Converters.
4. This standard gives us a basis from which to measure the error of our ADC, as well as ways to test and ways to correct for errors such as gain and offset errors.
5. Section 9 of the standard titled “Noise (total)” is relevant in helping us measure and minimize the amount noise generated by our ADC in order to preserve as much of the original satellite signal as possible when stored digitally. There are four sections of this chapter that describe how to measure and calculate noise generated by the ADC, as well as how this noise will affect the quality of the data that is stored.
6. In order to more effectively use this standard we will need to dive further into the process of analog-to-digital conversion, both from the analog and digital side of the process. Analog to Digital conversion is something we have only tackled on the surface level in classes such as Signals and Systems, so we will need to further understand the principles of ADC design in order to make full use of the testing and measurement methods outlined by this standard.