



Creating and managing tons of documentation

How we use \LaTeX in AcubeSAT

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Open Source CubeSat Workshop

Documents

- Simple
- Fast
- Consistent



Step 1: Tool

```
\section{Clock drift tests}
\subsection{USB}
We have performed no tests on USB's operation on clock drift.
According to the USB specifications:
\begin{quote}
\begin{itemize}
\item High speed data is clocked at 480.00Mb/s
\item Full speed data is clocked at 12.000Mb/s
\item Low speed data is clocked at 1.50Mb/s
\end{itemize}
\end{quote}
USB 1 clock speed is specified as
\(\ \SI{48}{\mega\hertz} \) with
a tolerance of \(\ \pm 500 \ \mathrm{ppm} \),
often reduced to a \(\ \pm 100 \ \mathrm{ppm} \) by
systems engineers \footnote{doc, p. 6}

\subsection{Communication between STM32F1 \& STM32L4}
We performed CAN communication tests between the STM32L4S9ZIT6
MCU on the OBC EM, and the STM32F103C8T6 MCU on the blue pill,
using the following parameters:
\begin{itemize}
\item Time Quantum: \(\ \SI{1000}{\nano\second} \)
\end{itemize}
```

LaTeX



- Open-source
- Flexibility
- Consistency
- Version-controlled documents
- ...



- Learning curve
- Difficult to install
- ...



Step 2: Document ID

AcubeSAT-###-**-\$\$\$



Step 2: Document ID

AcubeSAT-OBC-BT-o28



Step 2: Document ID

AcubeSAT-EPS-MI-003



Step 3: Create

The image displays three sequential screenshots of a web-based interface titled "Documentation Numbering Helper".

First Screenshot: The interface prompts the user to "First, choose the type of document you are about to write:". It features a grid of buttons for document types: GEN: General, ADC: Attitude Determination & Control, COM: Communications, EPS: Electrical Power, OBC: On-Board Data Handling, SCI: Science Unit, STR: Structural, SYE: Systems Engineering, THE: Thermal, TRA: Trajectory, and COL: Collaboration.

Second Screenshot: The interface shows the "Current result:" as "AcubeSAT-COM". It prompts the user to "Choose the type of your document:". The buttons are: E: Experimentation & Development, B: Research & Technical Background, M: Meeting Outcomes, T: Technical Specification, G: Technical Guides & Handbooks, and O: Generic & Operational.

Third Screenshot: The interface displays the final result: "AcubeSAT-COM-G-011". It includes a message: "You are done! [Download your .tex file](#) | For more information about the next steps, [read here](#). The resulting documentation ID is: AcubeSAT-COM-G-011". Below the ID, there is a list of selected categories: COM: Communications and G: Technical Guides & Handbooks. A "Start over" button is also present.



Step 4: Write

The screenshot displays the Overleaf editor interface. On the left, the source code for a LaTeX document is visible, with line numbers 182 through 299. The code discusses clock drift, mentioning a low speed data clocked at 1.59MHz/s and the impact of clock drift on bit error rates. It includes sections for CAN communication tests and a discussion on clock failure testing.

The right pane shows the rendered PDF. It features a diagram titled "Figure 1: Crystal resonator drift with age" showing a signal waveform. Below it, the text discusses control times (TIM1/TIM8 and TIM11/16/17) and an interrupt generated to inform the software about the failure of Clock Security System Interrupt (CSSI). A section titled "1.1 Impact of clock drift on Bit Error Rate" includes a diagram titled "Figure 2: Impact of clock drift on bit sampling" showing a digital signal sampler. Below this, the text explains that a naive digital signal sampler that samples every T_s (or with a sampling frequency f_s) will lose a bit when the difference between the clock becomes a factor of T_s , i.e. when $\Delta t > nT_s$ for the first time ($n \in \mathbb{N}^+$). It then provides the equations for clock failure testing:

$$\Delta t = T_s \quad (1)$$
$$nT_s = nT_2 = T_s \quad (2)$$

The rendered PDF also includes a footer with the text "Clock Failure Testing" and "AcubeSAT-OBC-EC-01 Clock failure test".

<https://github.com/overleaf/overleaf>



Step 5: Browse

GEN COL ADC COM EPS OBC
SCI STR SYE THE TRA

ACubeSAT

INVALID DOCUMENTATION CATEGORIES

AcubeSAT Documentation List

ID	SUBSYSTEM	TITLE	DOWNLOAD	THUMBNAIL	AUTHOR	DATE
AcubeSAT-5YE-TG-001	Systems Engineering	AcubeSAT System Modes Technical Specification, Generic	  		Retselis Anastasios...	23 September 2019
AcubeSAT-0BC-G-010	OBC	YAFFS Specification Technical Guides & Handbooks	  		Orestis Ousoultzoglou	22 September 2019
AcubeSAT-0BC-EC-010	OBC	Clock Failure Testing Experimentation & Development, Components	  		Konstantinos Kanavo...	21 September 2019
AcubeSAT-0BC-BH-029	OBC	Research on Dual MCU Architecture Research & Technical Background, Theoretical	  		Orestis Ousoultzoglou	21 September

<https://helit.org/mm/docList/public>



Step 6: Final Result



AcubeSAT System Modes

AcubeSAT-SYE-TG-001
Retselis Anastasiou-Faloutsou

September 23, 2019
Version: 0.5



Aristotle University of Thessaloniki
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CubeSat Project

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Turnstile antenna design and feeding study AcubeSAT-COM-BS-026 Contents

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Changelog

Date	Version	Document Status	Comments
19/08/2019	0.5	INTERNALLY RELEASED	Final Version
18/08/2019	0.4	DRAFT	Spelling and Grammatical check
17/08/2019	0.3	DRAFT	Antenna Design
16/08/2019	0.2	DRAFT	Theory
15/08/2019	0.1	DRAFT	Initial revision

This is the latest version of this document (0.5) as of August 19, 2019. Newer versions might be available at <https://hailit.org/ua/doclist/acubesat-com-bs-026>.

Documentation template version vrt.5-dev

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Turnstile antenna design and feeding study AcubeSAT-COM-BS-026 Theory background

1 Introduction

AcubeSAT is going to use the UHF band when it comes to telemetry and telecommands (TTAC), which is commonly used in CubeSat missions for the same purpose. In launchers' interior we must have the predicted dimensions for our 3U CubeSat and at the same time our antenna (which I'm going to present to you later in this report) because it occupies a lot of space. So, there is a need to deploy it because the existence of mechanical part protrusion is forbidden. Our deployment system will be approximately the same with UPlace.

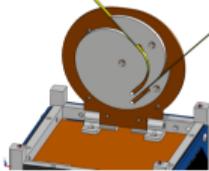


Figure 1: UPlace's deployment system

We were interested in using an omnidirectional antenna which can provide circular polarization so that we do not have that much polarization losses (the enormous distance of our link imposes it). The deployment system above gives us the capability to use two monopole antennas. So, the idea is to examine if we could combine two monopoles in a way that will make them operate-radiate as a turnstile antenna. The turnstile antenna is a combination of two orthogonal dipoles fed with equal amplitudes and quadrature phase and this antenna is capable of producing circularly polarized field in the direction normal to the dipoles' plane (0° and -90° for Right Handed Circular polarization, called RHCP). Let's say that the dipoles are along the x - and y -axes. The combination radiates Left Handed Circular polarization in the $-z$ direction. The existence of a ground plane changes the sense of circular polarization of the wave radiated in the $-z$ direction and aside to the direct radiated wave (z direction).

2 Theory background

2.1 Boundary Conditions

Suppose that we have a locally plane boundary in space described by a point and a unit normal vector if that points from region 1 (x, y, z_1) to region 2 (x, y, z_2). We

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