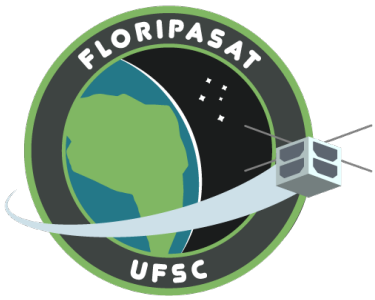
FLORIPASAT - TTC-DOC - REV1



Telemetry, Tracking and Command Module of the FloripaSat Project

Module Documentation
GSE, Federal University of Santa Catarina, Florianópolis - Brazil

December 2017

FloripaSat Project, Telemetry, Tracking and Command Module Documentation

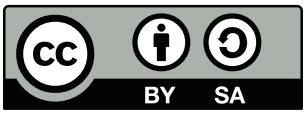
December, 2017

Project Manager:
Eduardo Augusto Bezerra

Author:
Gabriel Mariano Marcelino

Contributing Authors:
Anselmo Luis da Silva Junior
Marcelo Daniel Berejuck
Sara Vega Martinez

Layout:
Gabriel Mariano Marcelino



Abstract

This document...
Keywords: Cubesats. Embedded systems. Telecomunications.

Contents

List of Figures

List of Tables

Nomenclature

ADC Analog-To-Digital Converter.

BSL Bootstrap Loader.

CPU Central Processing Unit.

DMA Direct Memory Access.

GPIO General Purpose Input/Output.

I^2C Inter-Integrated Circuit.

PCB Printed Circuit Board.

RAM Random Access Memory.

SPI Serial Peripheral Interface.

TTC Telemetry, Tracking and Command.

UART Universal Asynchronous Receiver/Transmitter.

USB Universal Serial Bus.

CHAPTER 1

Introduction

INTRODUCTION... [1].

Module Requirements

CHAPTER 2

Hardware

The TTC board is composed by the following main components:

- MSP430F6659, as the beacon microcontroller.
- RF4463F30, as the radio module for the beacon and the telemetry link.

In the figure 2.1, ...

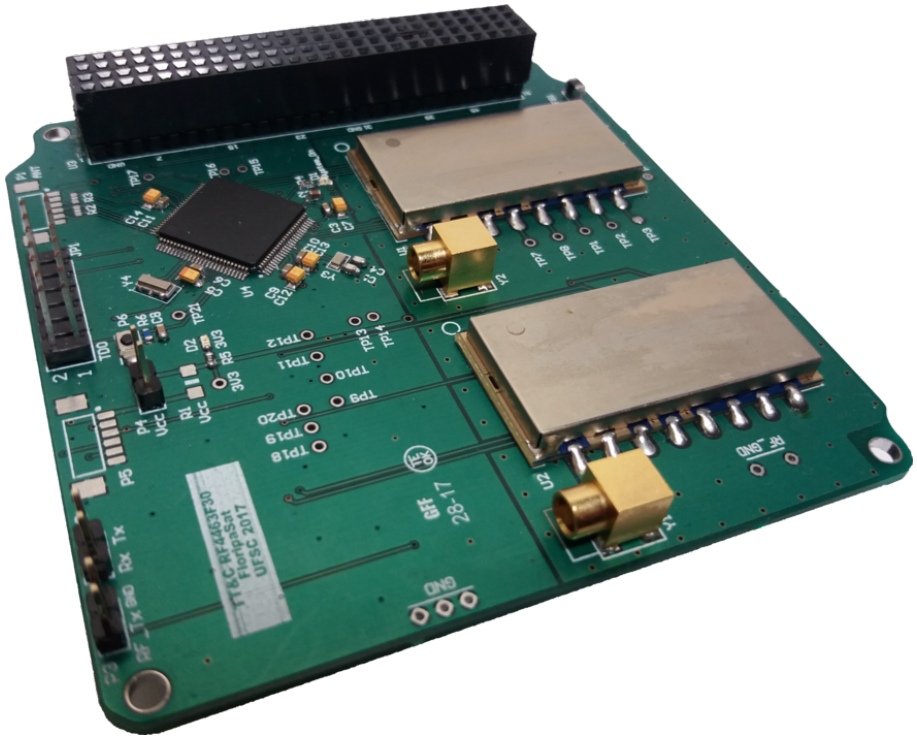


Figure 2.1: TTC PCB.

General Diagram

In the figure 2.2, a general hardware diagram can be seen.

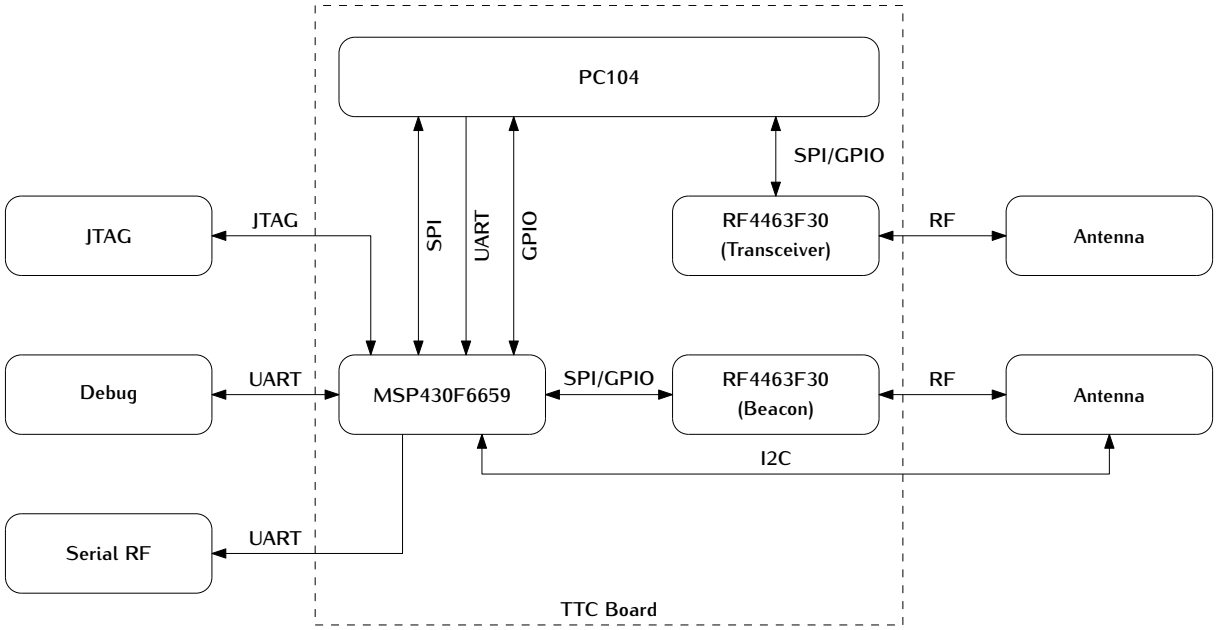


Figure 2.2: Hardware diagram of the TTC module.

Main Components

M...

Microcontroller

The beacon microcontroller is the MSP430F6659IPZR [**?**]. Its main characteristics can be found in the table 2.1.

Radio Modules

The NiceRF RF4463F30 [**?**] is a transceiver module based on the Silicon Labs Si4463 [**?**] radio. This module also contains a PA module to increase the output power up to 31 dBm.

Si4463

External Connections

PCI104 Pins

Characteristic	*Value*
CPU	MSP430
Frequency	Up to 20 MHz
Non-volatile memory	512 kB
RAM	66 kB
GPIO pins	74
I^2C	3
SPI	6
UART	3
DMA	6
ADC	ADC12-12ch
Comparators	12 inputs
Timers - 16-bit	4
Multiplier	32×32
BSL	USB
Min V_{cc}	1,8 V
Max V_{cc}	3,6 V
Active Power	360 $\mu A/MHz$
Standby Power (LMP3)	$2,6$ μA
Wakeup Time	3 μs
Operating Temperature Range	-40 to 80 $°C$

Table 2.1: MSP430F6659 features.

Characteristic	*Value*	*Unit*
Frequency range	119-1050	MHz
Receiver sensitivity	-126	dBm
Modulation	(G)FSK, 4(G)FSK, (G)MSK and OOK	-
Max. output power	+20	dBm
PA support	+27 to 30	dBm
Ultra low current powerdown modes	30 (shutdown), 50 (standby)	nA
Data rate	100 bps to 1 Mbps	-
Power supply	1,8 to 3,6	V
TX and RX FIFOs	64 bytes for each or 129 bytes shared	-

Table 2.2: Si4463 features.

CHAPTER 3

Software

SOFTWARE...

CHAPTER 4

Tests

THIS...

RF Signal Power

P...

CHAPTER 5

Conclusion

Conclusion...

Bibliography

[1] Rafael P. Alevato. Floripasat project, 2017.