

Technical Documentation



0558-APN-M2M-ASTRO

GNSS Antenna sharing Application Note

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Document history

Issue/rev.	Date	Modifications
1/0	26.01.2022	First Release
0/1	09.11.2021	Initial preliminary version

Reference documents

Document name	Document number
Astronode S Datasheet	0532
Astronode Patch Antenna Datasheet & Integration guide	0534
Astronode S APN Low Energy Guidelines	0559
Astronode S, Application Layer Messages	<i>docs.astrocast.com</i>

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This is an information



This is a warning

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1 Introduction

This document will help you understand how to design your system with a single antenna for both data communication over the Astrocast network, and GNSS reception for positioning. This is possible with the Astronode Patch Antenna, optimized to work in the following frequency bands:

Band	Frequency range
L-Band uplink	1626-1660.5 MHz
L-Band downlink	1525-1559 MHz
GNSS L1/E1	1575 MHz

The following GNSS constellations are compatible:

Constellation	Center Frequency
Galileo E1 B/C	1575.42 MHz
GPS L1 C/A	1575.42 MHz
BeiDou B1 C	1575.42 MHz
GLONASS L1 C/A	1602.00 MHz

By adding an RF switch between the Astronode Patch Antenna and the Astronode S, a third party GNSS module can be served by the same antenna. The Astronode S' *ANTN_USE* pin helps routing the antenna to the appropriate user via the RF switch.



All recommendations in this document are based on using the Astronode Patch Antenna. Any other antenna type needs careful validation for compatibility with both the GNSS and Astrocast frequencies

2 ANTN_USE pin description

The pin is default in low state. Any time the Astronode S is using the antenna, the pin is set high until the antenna is released by the Astronode S. This is true as well for the satellite detection mode, where the pin will go high for about 50msec every 17.7sec



See *0559 Astronode S Low Energy Guidelines APN* for details on the Astronode S RF activity

3 Switch driven by application

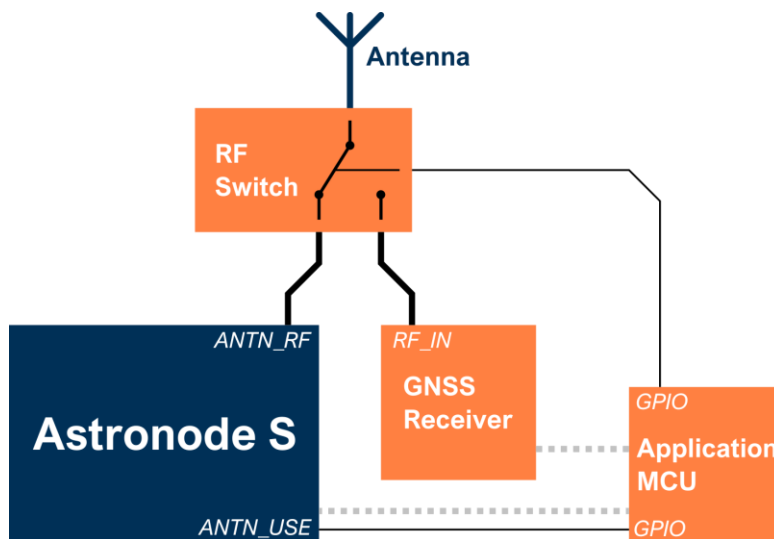


Figure 1 - Application drives RF switch

By connecting the *ANT_N_USE* pin to one of the MCU's GPIO pins, the application has full control by always knowing if the Astronode S needs the antenna or not. The switch must be set actively at any time by the MCU. At least one MCU GPIO is necessary to drive the switch itself, some parts need two.

3.1.1 Advantages

- The application MCU keeps full control at any time on who has access to the antenna.
- Hardware layout is independent from the RF switch configuration, such as number of drive pins, truth table and pin-out

3.1.2 Disadvantages

- The *ANT_N_USE* pin must be monitored constantly, and any change reflected in a timely manner on the RF switch drive pin(s). At least during any scheduled RF activity
- Use of at least two more GPIOs on the application MCU
- Need for firmware (programming & testing) driving the RF switch

4 Switch driven by Astronode S

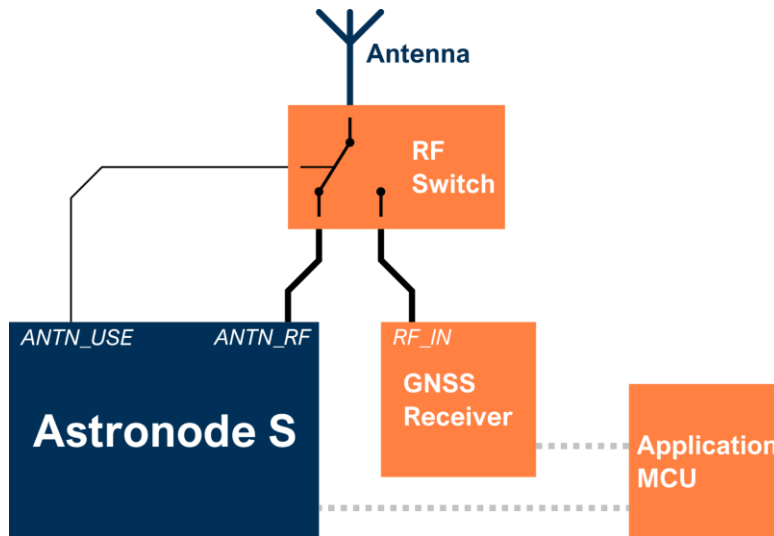


Figure 2 - Astronode S drives RF switch

The *ANTN_USE* pin can be used to directly drive the RF switch. In this configuration the antenna will be unavailable for GNSS acquisition without prior notice whenever the Astronode S RF line is active. At least the MCU could monitor the *ANTN_USE* pin to know when the antenna is unavailable for the GNSS receiver. With this in mind, the MCU needs to carefully plan satellite communication and GNSS acquisition events.

Carefully check compatibility of the digital interface between the Astronode S and the RF switch (drive pins and voltage levels), as well as the RF switch's Truth table as the *ANTN_USE* pin's logic cannot be inverted (default low).

4.1.1 Advantages

- Hardwired logic prevents switching errors
- Application MCU is not implicated, no need for firmware and additional GPIOs

4.1.2 Disadvantages

- Simultaneous satellite communication and position fix acquisition must be avoided by planning in the application firmware, in order to avoid wasting energy (Running GNSS fix without access to the antenna)
- The RF Switch's Antenna output is set by the drive pin logic (truth table), limiting possibilities in hardware layout

5 Antenna sharing strategy

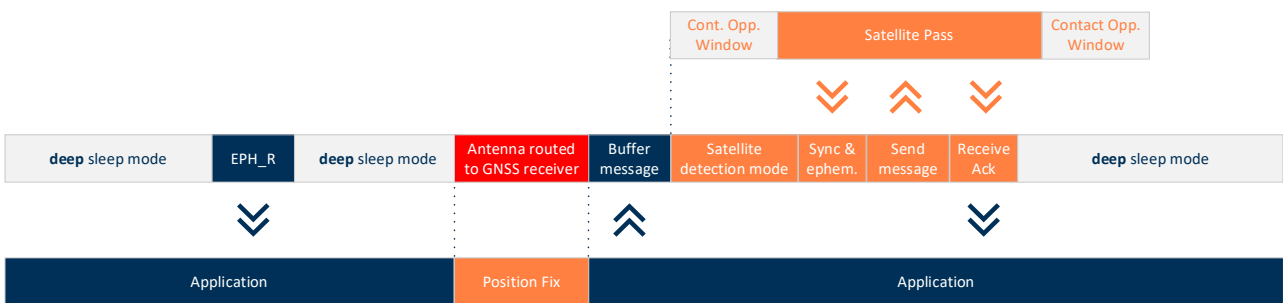
See *0559 Astronode S Low Energy Guidelines APN* for information about the Astrocast satellite constellation development

A GNSS fix can be initiated while the Astronode S is in satellite detection mode. But the Time To First Fix (TTFF) will be about doubled as the GNSS reception is interrupted every 17.7 seconds.

5.1 Initial constellation

To avoid collision of the antenna use between Astronode S and the GNSS receiver, make sure the message buffer is empty when starting a GNSS fix. This way the Astronode S will not start any RF activity during the GNSS acquisition.

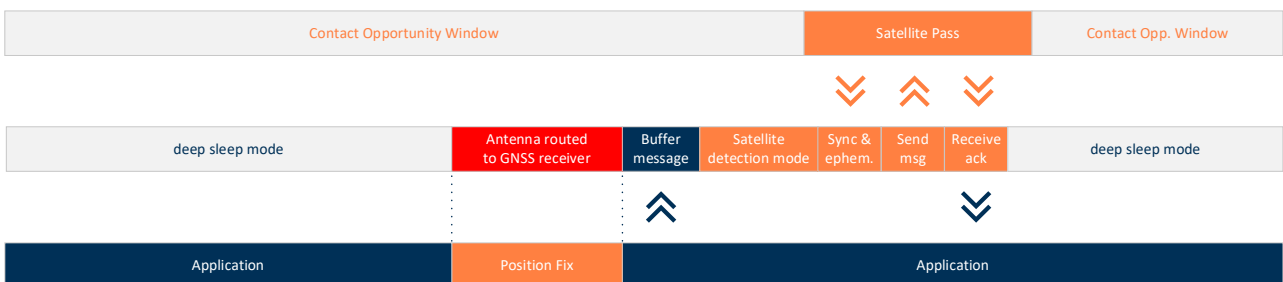
If the application does buffer messages on a regular basis, use the [EPH_R](#) command to plan the start of the GNSS fix just upfront of the next contact opportunity window. This avoids collisions in antenna use and the application has access to the latest possible position to send over the Astrocast network.



5.2 Full constellation

At full Astrocast satellite constellation, the application will always be in a contact opportunity window and therefore no need any longer to align the schedule of the GNSS fix to the network.

However, it will still be highly recommended to start the GNSS fix with an empty message buffer to avoid collision of the antenna use between the Astronode S and the GNSS receiver during the fix.



6 Hardware recommendations

Item Number	Manufacturer - Description
JRC NJG1806K75	New Japan Radio - SPDT RF Switch
AST50127-00	Astrocast - Astronode Patch Antenna

Astrocast did validate the proposed setup during tests. The Astronode Patch Antenna showed a comparable performance to a conventional GNSS receiver setup, using a specialized active GNSS antenna.



Carefully follow the RF layout recommendations from the *0532 Astronode S Datasheet* and the layout recommendations provided by the switch manufacturer