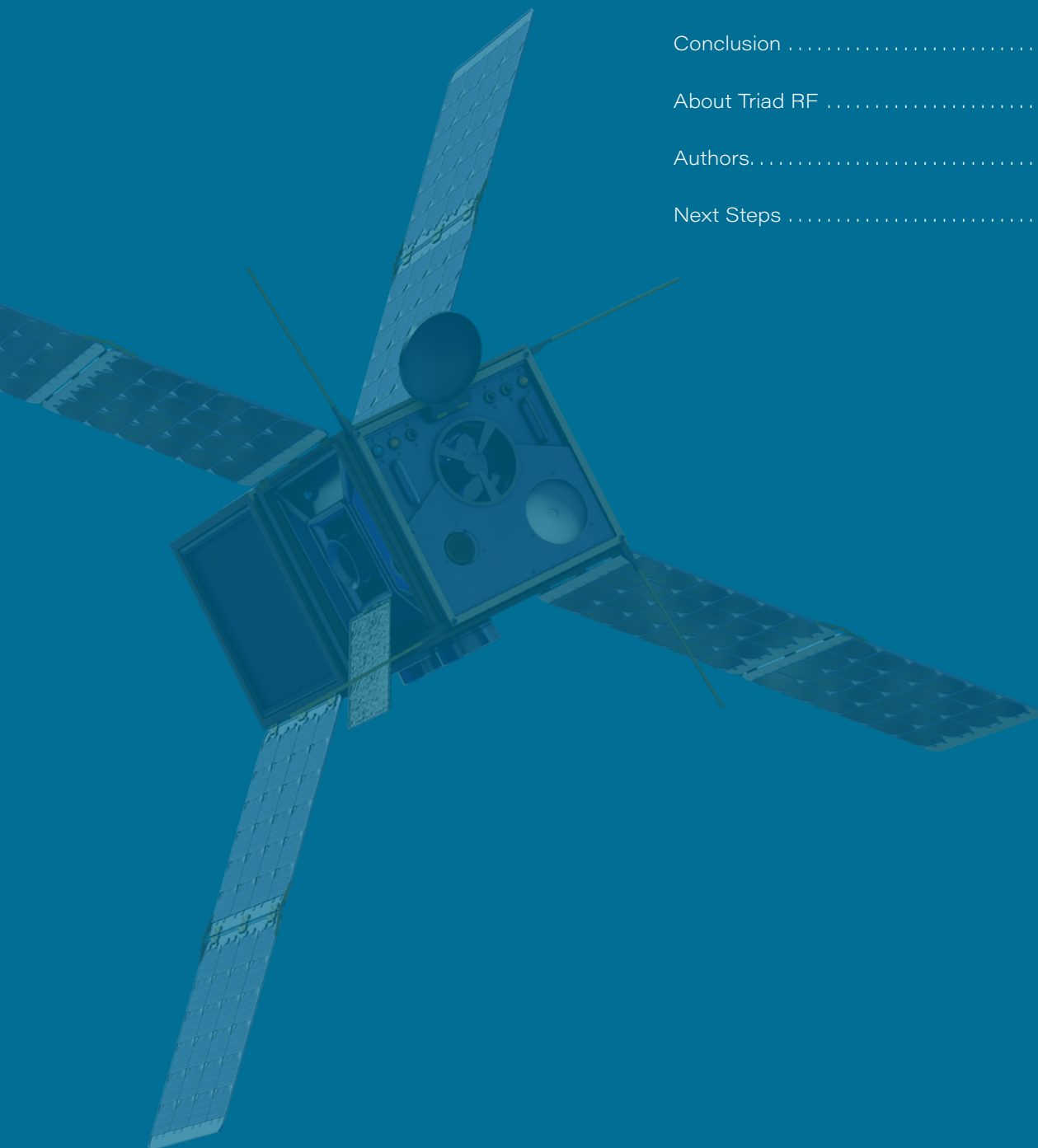


Manual and Auto-Switching RF Amplifiers

A Quick Guide to Selecting the Correct
Amplifier for Pre-Integration Planning



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INTRODUCTION

When selecting an RF amplifier for your system, the decision between manual and auto-switching models can significantly impact system performance, efficiency, and flexibility. Though the distinction might seem subtle initially, understanding the operational differences and limitations of each type is crucial for ensuring optimal performance.

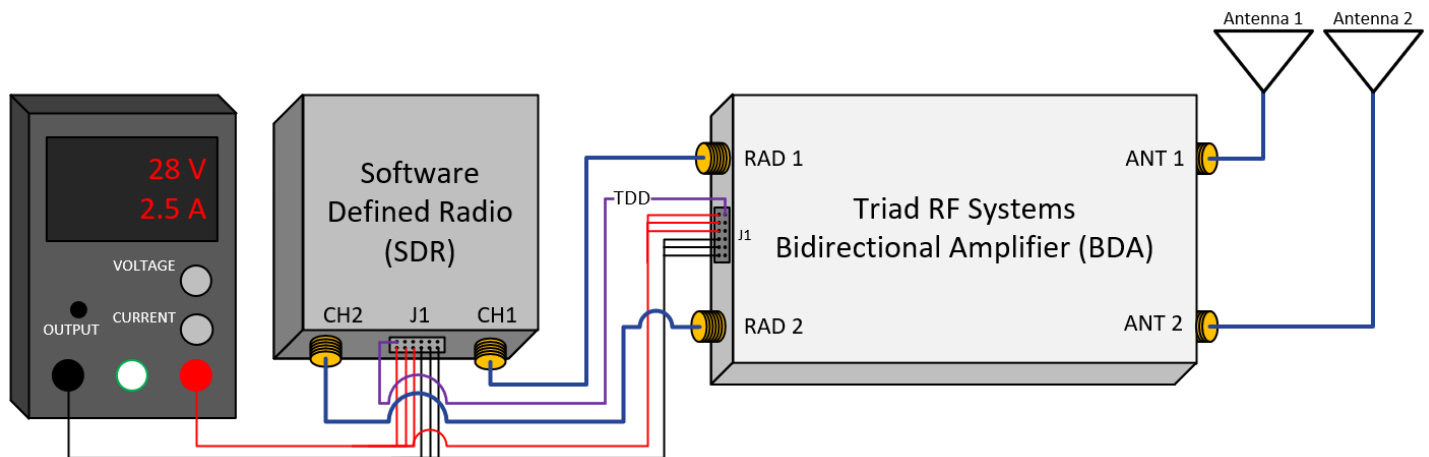
The choice of radio system selected for the application plays a vital role in determining if you can integrate a manual switching or auto-switching amplifier with the radio. The availability of specific options on the radio will determine what type of amplifier is best suited for pairing with a specific radio.

Read on to learn more about the differences between these two types of RF amplifiers and when they should be considered for integration.

MANUAL SWITCHING AMPLIFIERS

Manual switching amplifiers receive direct signals from the radio to toggle between transmit and receive modes. Typically, radios designed explicitly for integration with external amplifiers provide a dedicated control line for this purpose. This manual control offers several distinct advantages:

1. **Immediate Switching Response:** Because manual amplifiers are controlled directly by the radio, they switch rapidly, typically within a few microseconds. This precise synchronization ensures the amplifier is fully active and ready before the radio starts transmitting, avoiding any potential loss of critical data packets at the beginning of a transmission burst.
2. **Greater Operational Flexibility:** Manual amplifiers are not limited by input power thresholds for switching activation. They amplify signals effectively across a broader range of input power levels, providing superior flexibility in diverse operational scenarios. This means manual switching amplifiers are ideal for systems requiring variable output levels or operating in environments with fluctuating power requirements.



Example:

Block diagram of a Manual Switching BDA configuration.

AUTO-SWITCHING AMPLIFIERS

Auto-switching amplifiers, in contrast, automatically detect the presence of an RF signal to determine when to switch between transmit and receive modes. While convenient, this auto-detection mechanism introduces specific operational constraints:

1. **Limited Power Range:** Auto-switching amplifiers depend on internal detectors calibrated to function within defined power input ranges. Typically, these amplifiers operate optimally within about a 10 dB window of input power

(for example, between 5 and 15 dBm). Operating outside this power range can lead to incomplete signal detection, causing the amplifier to either fail to activate or operate inconsistently.

2. **Reduced Flexibility:** Due to the input power range limitation described above, the main disadvantage of an auto-switching amplifier is a reduction of the usable output power range. There is a hard lower limit on the minimum output power that you can operate at with an auto-switching amplifier.

For instance, an auto-switching amplifier capable of 30 watts of peak power output will only be able to function correctly down to approximately 3.8 watts before its input detection circuitry begins to hit the limit of reliable detection. Although this seems to be a disadvantage, operating a 30W amplifier at that low an output power isn't efficient in real-world use scenarios.

10 dB of output power capability below the peak capability of a given output has seemed to be sufficient in practice. For example, if an application needed less than 3-4 watts out of the amplifier to begin with, it would be more prudent to select an amplifier with a lower peak power output.

MAKING THE RIGHT CHOICE

Select a manual switching amplifier when your radio has a dedicated transmit/receive control line, or when your system requires precise, consistent synchronization and operational flexibility across a wide range of power levels. This scenario is common in professional and mission-critical applications, including military, surveillance, and high-performance communication systems.

Triad RF has spent over a decade integrating platform-agnostic amplifiers with many of today's leading MIMO/MANET radio systems. Below is a list of radio manufacturers with dedicated transmit/receive control lines compatible with our manually-switched BDAs:

- **Domo Tactical Communications**
- **Silvus Technologies**

Select an auto-switching amplifier if your radio does not support a dedicated control line for amplifier switching or if your application consistently operates within the amplifier's specified power range. Despite their limitations, auto-switching amplifiers are robust and straightforward for applications that do not demand extensive flexibility.

Below is a list of MIMO/MANET radio manufacturers that currently do not provide a control line to switch a BDA. Therefore, an integration with a Triad RF BDA would need to have the auto-switching option selected:

- **Doodle Labs**
- **Persistent Systems**
- **Rajant**
- **XetaWave**
- **CreoMagic**
- **Microhard**
- **Mobilicom**

For all other radio systems not listed, the best way to know is to ask the manufacturer if their radio systems have a dedicated control line with either a TTL or LVTTTL output. If it does, Triad's BDA products with manual switching are compatible, as nearly every BDA that Triad manufactures offers this configuration.

CONCLUSION

Understanding the nuances of manual and auto-switching amplifiers helps ensure you select the best amplifier for your specific needs, avoiding costly performance issues down the line.

Always consult with an experienced integration partner such as Triad RF Systems to confirm compatibility with your radio system and clarify any operational constraints. Proper selection at the outset streamlines your deployment process and maximizes overall system reliability, reducing downtime and unexpected operational expenses.

About Triad RF

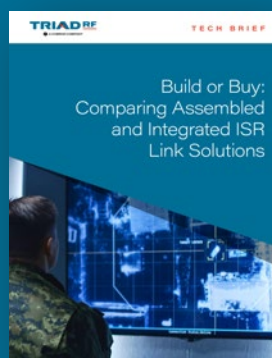
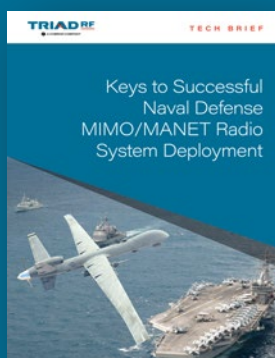
Founded in 2013, Triad RF Systems engineers high-performance RF and microwave amplifiers and subsystems that boost the range, reliability, and data throughput of today's most demanding communication platforms. With a focus on MIMO radio systems, high-data-rate UxV links, and satellite amplification solutions, Triad delivers compact, efficient, and rugged products trusted in defense, aerospace, and space-based applications worldwide. Triad RF Systems is a subsidiary of Comrod Communication AS.

Among Triad's most significant recent efforts is the High Power Radio (THPR) product line. Designed to optimize industry-leading radios for extended range and high throughput, THPR Amplified Radio Systems are the go-to choice when performance, range, and time-to-deployment are paramount. These integrated and optimized systems draw on extensive experience delivering robust, long-range wireless datalinks for defense and aerospace across sea, land, air, and space. To address issues such as power drift, the THPR series incorporates dedicated equalization circuitry, ensuring stable RF output power and signal-to-noise ratio (SNR) under variable operating conditions.

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