TangerineSDR

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RF Receiver Module (RXM-5001D)

Application Notes

Version Number: 0.1

Version Date: December 10, 2019

Document Number: TSDR-RXM-5001D-APP_NOTES

VERSION HISTORY

Version Number	Implemented By	Revision Date	Approved By	Approval Date	Description of Change
0.1	T. McDermott	12/10/2019			Original Issue

1. Introduction

1.1. Scope

The Tangerine SDR receiver RXM-5001D has a number of options and configuration capabilities. This document describes some of those options and provides a guide to configuring the options.

1.2. References

- The RF module detailed form factor, mechanical layout, electrical signal interconnection, connectors and pinouts, and electrical specifications are described in the Interface Control Document (ICD) for the RXM-5001D module.
- Tangerine SDR Clock Module Specification. Sets the jitter, frequency accuracy, channel-to-channel coherence and phase noise of the clock inputs to the RF Module.
- Data Engine ICD.
- Dual channel ADC, and ADC driver integrated circuit manufacturer data sheets.

2. RF Configuration Options

The receiver has two independent receive channels. These may be used to provide phase-synchronous reception from two independent antennas. The front end may be configured as shown in the table.

Function	Configuration	Application
Isolated ground	Do not connect a strap nor an active amplifier to the Filter Power header.	High common mode rejection without the need of a common mode choke or transformer. (This assumes that the antenna is not grounded somewhere else such as by an active powered antenna, or a ground connection.). Good practice (and possible code requirement) is to provide a low-impedance ground to the

		antenna. Receiver ground isolation is provided as an option so that other external means may be used to provide safety ground and prevent ground loops.
Bonded Ground	Connect a strap between pins 1 and 2 of the channel Filter Power header. No active front-end amplifier is installed. Be careful not to install the jumper in the wrong position or it will short out the system power supply 3.3v or 5v lines.	Antenna connector needs to be directly connected to system ground. Adequate common-mode isolation must be provided elsewhere in the system.
Active Antenna	Provide either: 1. A balanced bias-Tee, or 2. A single ended bias-T plus a (current-mode) common mode choke between the bias-T and the antenna.	1. Active antenna without common mode rejection. Do not connect ground strap. 2. Active antenna plus common-mode rejection provided by common-mode choke. Do connect ground strap.
Low Noise Amplifier (instead of passive filter)	Add an optional low noise amplifier module (not yet designed nor available) (one per channel) in the filter header slot. The active amplifier has a third connector that bonds the grounds together plus provide power to the amplifier. Note that if the active amplifier is installed, a passive filter cannot be installed in the filter header slot).	Lower noise figure receiver. Installing the active amplifier automatically bonds the receiver ground to the system ground. This may sacrifice common-mode rejection by the receiver. An external common mode choke may be added but if it adds significant attenuation, the Noise Figure may be degraded slightly.
AM Broadcast Band Rejection (passive filter)	Add the optional AM Bandstop filter to the filter slots (one per channel).	Prevention of receiver overload by strong AM Broadcast band signals.

	Group delay is greatly impacted (see Figure 1).	The difference in group delay of the two AM BCB filters (one per channel) will significantly impact the phase coherence of the two receiver channels, particularly at the edges of the AM broadcast band, see attached chart of typical filter group delay. For specialized measurement needs, each filter will need to have its group delay characterized because filter component variation will inject different delays between the two channels.
Attenuator Settings	The attenuators are controlled via the I2C control register. Use may prevent ADC overload without the need of an optional filter.	0 dB, 10 dB, 20 dB, and 30 dB attenuation values are selectable. The attenuator may be enabled to reduce ADC overload in the presence of strong signals, perhaps avoiding an LC filter in the filter slot (and the attendant group-delay issues).
Noise Injection	There is a strap (JPxx) which may be installed to enable the noise source. The noise source can be independently injected into one or both receiver channels under control of the SPI control register.	The noise source provides 5 dB excess noise ratio wideband noise. By measuring the change in signal level with the source on and off, one may: 1. If a receive antenna is connected, estimate the background noise level being received. 2. If a dummy load is connected to the receiver antenna connector, estimate the Noise Figure of the receiver.

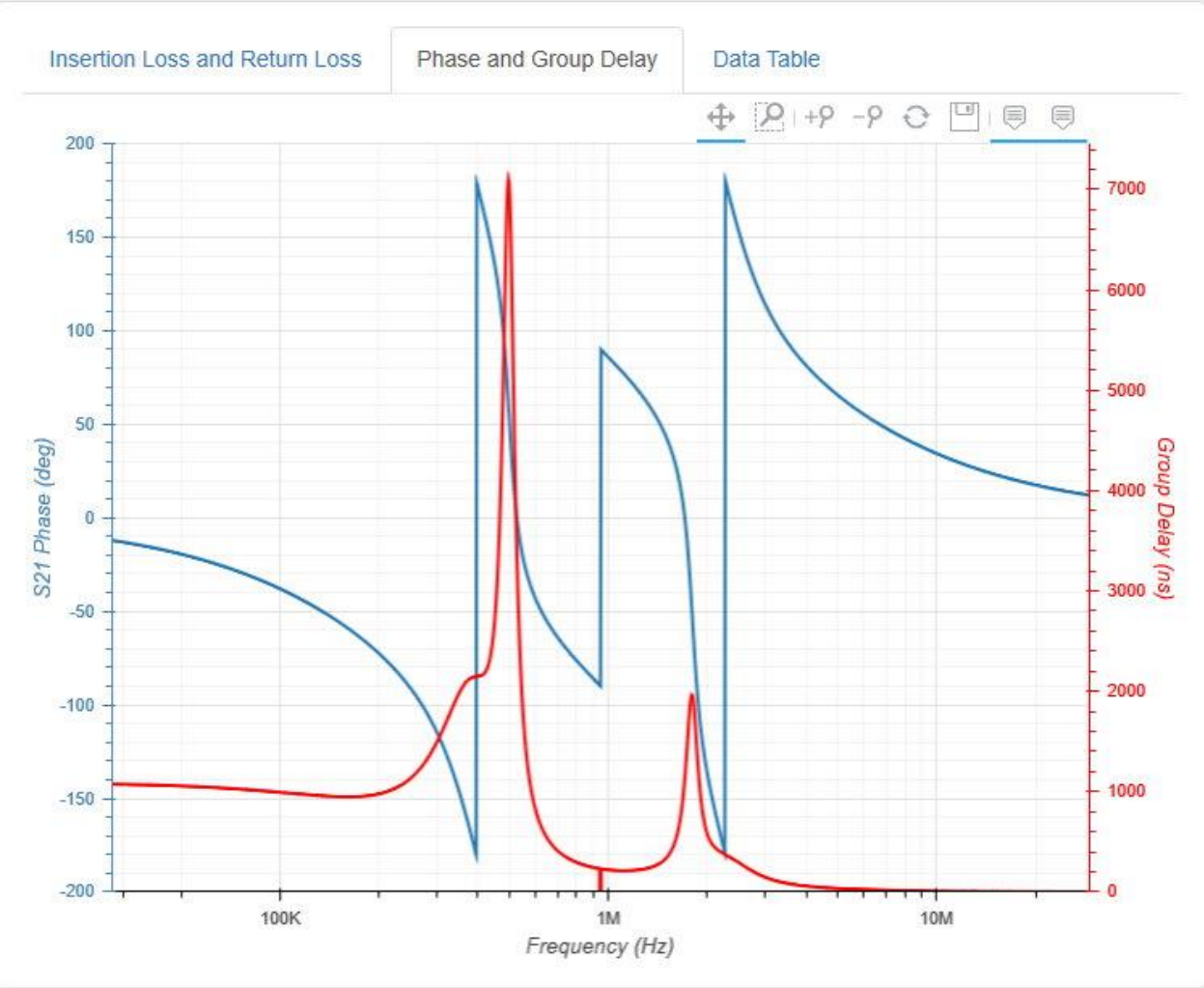

Figure 1 - AM Broadcast Bandstop filter typical group delay (red line). Due to component variation, each individual filter will have somewhat different group delay.