# Protecting your RSP from Near-Field Coupling







#### What's this all about?

#### **Quickstart** Guide

DO NOT directly connect the RSP2duo to the same antenna as your transmitter or to an antenna in the near field of a transmitting antenna, as this is likely to result in permanent damage to your RSP2duo and invalidate your warranty. (max. rated input: 0dBm continuous or +10dBm for short durations)

Disconnecting the RSP from the PC does NOT protect the radio from damage due to electrical overstress, so it is essential to disconnect your antennas when transmitting with high power from a nearby antenna. Alternatively, use an antenna switch with sufficient isolation.

Whether using our SDRuno or working with other software, you should always use our 'Start Here' process which will also ensure that our support team can help in the event of any problems. Go to www.sdrplay.com/start-here (SDRuno option recommended)

Documentation a found at: www.S

Contact support contact details ge

Video guides are www.youtube.c

For detailed advi the SDRplay for independent SDI www.facebook.

#### IMPORTANT

DO NOT directly connect the RSPdx to the same antenna as your transmitter or to an antenna in the near field of a transmitting antenna as this is likely to result in permanent damage to your RSPdx and invalidate your warranty. (max. rated input 0dBm continuous or 10dBm for short durations). Disconnecting the USB cable does NOT protect the radio from damage due to electrical overstress, so it is essential to disconnect your antenna when transmitting with high power from a nearby antenna. Alternatively, use an antenna switch with sufficient isolation.



# What is near-field coupling?



#### Why is this a concern now?

• It has always been necessary to protect sensitive receiver inputs from damage from excessively high input signals.

 Has required more attention with SDRs because of how they are used in conjunction with other equipment



## Receive Only Installations



 No nearby transmitters to cause concern

# (unless sharing the shack with active transceivers!)



#### Transceiver Installations



• Internal T/R switching protects sensitive receiver circuitry when transmitting



# SDR Installations

- Sensitive receiver used in close proximity to strong transmitter
- Protection required when:
  - Sharing the transmit antenna
  - Using a separate antenna near to a transmit antenna



# **Contributing factors**

- Transmit Power Level
- Frequency
- Antenna type / length vs wavelength
- Antenna separation
- Antenna relative geometries



### **Resources – Unwanted Antenna Coupling**

#### **Coupled Power Levels**

The following levels are based on EZNEC models. The models use same-band antennas, which is a worse-case condition.

Two 1/4-wave verticals, each with zero ground loss. Transmitter power at attenna = 1000 watts

Band	400-feet spacing	200-field spacing	100-foot spacing	50-foot spacing	25-foot spacing
160	26 water	the water	207 water		
80	1.5 want	29 water	67.5 watte	223 wars	
40	2 watts	7.3 warpi	29 M 888	67.5 millio	223 water
20	0.5 watts	2 watts	2.5 water	29 S 88	67.5 waini
10	0.125 watts	0.5 watts	2 watts	25 wash	29 watts

Dipole-to-vertical that is broadside-to and centered-on the dipole, perfect ground, and 1000 watts

Band	400-foot spacing	200-foot spacing	100-foot spacing	50-foot spacing	25-foot spacing
160	0.13 watts	0.38 watts	0.79 wats		
80	.049 watts	0.13 watts	0.38 watts	0.79 watts	Constant and Constant
40	[.013 watts	049 watts	0.13 watts	0.38 watts	0.79 watts
20		013 watts	.049 watts	0.13 watts	0.38 watts
10	6		013 wate	.049 watts	0.13 watts

Vertical-to-dipole, dipole oriented so vertical is nearly in line with the dipole's end

Band	400-foot spacing	200-foot spacing	100-doot spacing	50-foot spacing	25-foot spacing
160	1.9 watts	4 wate	10.5 water		
80	A1 watts	1.6 watta	ALL MARKS	10.5 water	
40	10 watts	A1 watts	1.6 watts	S.J. Martin	10.5 watts
(20		.11 watts	.41 wans	1.6 watts	6.3 water
10			.11 watts	AI watta	1.6 watts

Dipole-to-dipole, broadside to each other, 1/4 wave above earth, with good conductivity soil

Band	400-foot spacing	200-foot spacing	100-foot spacing	50-foot spacing	25-foot spacing
160	14, 10, 0000	76-2 watti	DV6 watts	ACC MARKS	
80	1.5 watts	14 water	TR.2 wome	296 water	AND WHEN
40	.11 watts	1.5 watts	A water	76-1 water	296 w 404
20	0075 wats*	.11 watts	1.5 watts	Di water	Maxwall
10	200486 wats*	2075 water*	.11 watts	1.5 watte	Of loads

http://www.w8ji.com/antenna\_coupling.htm



## Resources – Calculators

#### Antenna Near Field & Far Field Distance Calculator

This calculator calculates the reactive near field distance, radiating near field distance (Fresnel region) and the far field distance. Just enter the frequency of operation and the dimension of the antenna.

#### Calculate the Reactive, Radiating Near Field Distance & Far Field Distance Antenna Length of Diameter (D) Enter the intenna dimension m = Frequency (f) Enter the frequency Hz = Calculate Reset Result Wavelength m Reactive Near Field Distance m Radiating Near Field Distance m Far Field (Greater than this distance) m

#### Field Strength and Power Estimator

Determining the field strength from transmitted power is not an easy job. Various, quite complicated formulas have to be evaluated correctly. This application note explains, how to calculate electric and magnetic field strength and power flux density. A program associated to this application note helps to do the calculation and converts Watts to mW and dBm, Vim to mWm and dBmWm as well as A/m to mWm and dBmA/m. Additional applications are calculation of propagation loss or antenna factors.



#### https://www.everythingrf.com/rf-calculators/antenna-near-field-distance-calculator

https://www.rohde-schwarz.com/us/applications/field-strength-and-power-estimator-application-note\_56280-15837.html?fbclid=IwAR3KKnU1HHBdka9EwoMrAyJ1W4I-A9NLIc\_V1JeAPf7JtuGc9LJhJuhYEKE



# An Empirical Approach

- Utilize the built-in power meter in SDRuno
- Measure the approximate received power levels for a particular setup
- If signal levels remain below the threshold then no further protection required
- Otherwise adequate steps must be taken to protect the RSP





- Q: Is it safe to use my HT radio near the SDR?
- Q: My RSP is next to my rig, is that a problem?
- Q: What if I power down the RSP, will that protect it?
- Q: What if I tune the RSP to a frequency a long way away from my transmitter?
- Q: What is a safe separation? Half a wavelength?





Q: Is it safe to use my HT (handheld) radio near the SDR?A: Relatively low in power: It is distance from the RX antenna not the SDR itself that matters

Let's try it.....





The Setup

#### RSP1A connected to :

- Discone antenna approx. 20 feet above and other side of chimney
- No antenna / open
- Terminated through short pigtail





## HT next to RSP



SDRolau

## HT next to RSP





8 .... 9

\* STR 0 SX .....

# HT across room from RSP





### HT outside





#### HT next to RSP – no antenna





#### HT next to RSP – termination





## HT across room – tabletop antenna





## HT next to RSP – tabletop antenna







#### Q: My RSP is next to my rig, is that a problem?

A: The concern is coupling from antenna to antenna. If there is radiation from the rig itself or your feedline then you have other problems!







### Test steps for your transceiver

• Utilize the built-in power meter in SDRuno

- Set RF Gain to minimum
- Adjust SP1 scale to show 0dBm level
- Incrementally increase transmit power level and/or decrease distance and verify safe power levels:
  - OdBm (1mW) continuous
  - 10dBm (10mw) for short periods
- If signal remains below these levels then no further protection required
- Otherwise adequate steps must be taken to protect the RSP





#### Q: What if I power down the RSP, will that protect it?

A: **NO!** It is the power applied to the antenna input that causes damage, disconnecting the antenna is the best way to prevent this. In fact, the lack of bias to the input protection structures when the RSP is powered off makes it *more* susceptible to overload on the input.





Q: What if I tune the RSP to a frequency a long way away from my transmitter?

A: It is total power applied to the input that potentially causes damage, the tuned frequency of the RSP has no effect on this





Q: What is a safe separation? Half a wavelength?

A: Rules of thumb depend a lot on whether we are talking "short" antenna or "long" antenna. See the references:

<u>Wiki</u>

w8ji.com unwanted antenna coupling

everythingrf.com antenna-near-field-distance-calculator

**Rohde-Schwarz Application Note** 



# Types of protection – T/R switch on RX antenna



- Control signal from rig is required to disconnect RX antenna during transmit
- Control inputs can be used in parallel to protect multiple inputs or when using shared antenna also

# Multiple T/R Switches



- A second T/R switch protects the RSPduo from near-field reception during transmit
- Additional switches can be used to protect multiple inputs
- Control inputs can be used in parallel to activate switch(es) on transmit



## **Other Types of Protection**

#### 1. RF Limiters:



#### DX Engineering Receiver Guard Electronic RF Limiters DXE-RG5000HD

\*\*\*\*\* (16) Review This Product

Receiver Guard 5000HD, Receive Only Front End Protector, BNC Connectors, 50 or 75 Ohm compatible, Each

Availability: In Stock

Estimated Ship Date: Today

#### 2. Antenna switch:

#### Alpha Delta Coax Switches



ALPHA DELTA

#### \*\*\*\* 98 Customer Reviews

Alpha Delta Coax Switches have a precision-machined switch shaft and quadrant mechanism for more accurate and stable switching performance.

These switches have a low-loss micro-strip cavity design, positive detent switching, master antenna ground function, a front panel removable arc-plug surge protection module, and excellent HF through UHF performance. The unselected antenna ports are grounded for protection and maximum isolation.





- 1. The RSP receivers are as robust as other receivers on the market
- 2. When used close to a transmitting antenna steps must be taken to ensure serious/dangerous overload does not occur
- 3. If necessary, external protection circuitry must be used to prevent damage



# Thank you for watching

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For more information please visit our website: www.sdrplay.com

