

PTX100R/105R antenna matching simulations for IoT applications using QucsStudio

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QucsStudio is a free and powerful circuit simulator and can be used to simulate and optimize the matching network for the PTX100R/PTX105R.

This is the link <http://dd6um.darc.de/QucsStudio/download.html> to download the SW.

After the SW installation double click on the icon qucs.exe

Organise		New	Open	Select
Simulations > QUCSStudio > QucsStudio-2.5.7 > QucsStudio > bin				Search bi
Name	Date modified	Type	Size	
admsXml.exe	16/09/2016 11:49	Application	542 KB	
ghdl.exe	09/03/2016 18:30	Application	2,272 KB	
history5.dll	12/11/2006 16:51	Application exten...	21 KB	
iverilog.exe	13/12/2007 21:54	Application	37 KB	
msvcp100.dll	11/06/2011 03:58	Application exten...	412 KB	
msvcr100.dll	11/06/2011 03:58	Application exten...	756 KB	
QtCore4.dll	25/07/2015 12:38	Application exten...	2,539 KB	
QtGui4.dll	20/04/2014 03:43	Application exten...	8,386 KB	
QtNetwork4.dll	20/04/2014 03:38	Application exten...	1,029 KB	
qucs.exe	31/05/2018 20:18	Application	2,932 KB	
qucs_de.qm	31/05/2018 20:12	QM File	593 KB	
qucsattenuator.exe	31/05/2018 20:18	Application	113 KB	
qucscomp.exe	31/05/2018 20:18	Application	249 KB	
qucsconv.exe	31/05/2018 20:09	Application	445 KB	
qucsdev.exe	31/05/2018 20:18	Application	82 KB	
qucsfilter.exe	31/05/2018 20:19	Application	339 KB	
qucs-help.exe	31/05/2018 20:11	Application	106 KB	
qucssim.exe	31/05/2018 20:11	Application	433 KB	

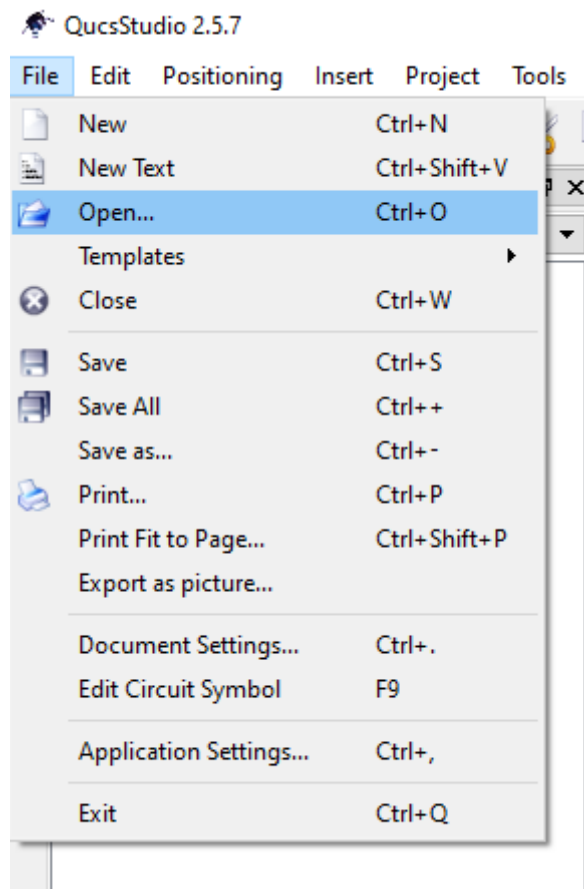
Download the file corresponding to the device you are using, save it and open it.

PTX100R Simulation file.

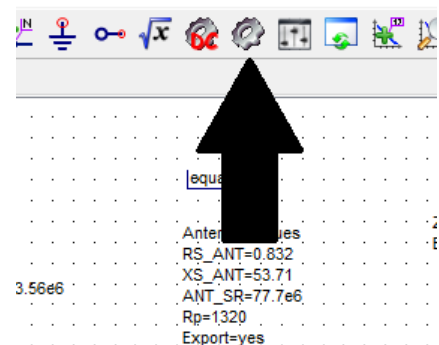
[PTX100R_Eval_1v4_SP.sch](#)

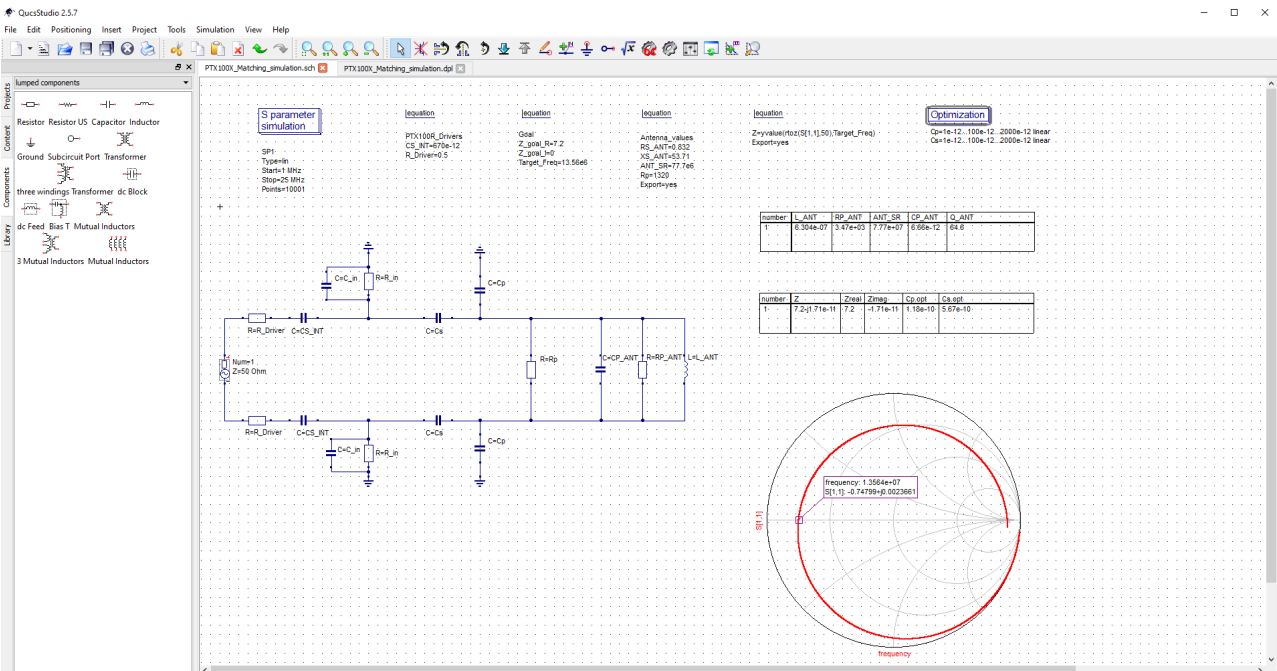
PTX105R Simulation file.

[PTX105R_Eval_1v0_SP.sch](#)



Hit the button simulate and the result should be like in the picture below





The simulation performed is an S-parameter simulation where the port is applied to the driver input. The driver resistance and the internal series capacitors are fixed the antenna electrical characteristics are measured as described in the [PTX100R/105R antenna matching guidelines for IoT applications](#). In order to match the antenna, the serial and parallel capacitors (Cs, Cp) need to be tuned, and an Optimizer has been set to quickly find the correct values for the components. The optimized value is related to the desired matching impedance selected that is dependent on the system. The example proposed reflects the matching from the PTX100R, PTX105R, and the PTX130R Eval Board.

In the two tables is displayed info on the antenna matching impedance (Z) and the optimized values for Cp and Cs (Cp_opt Cs_opt).

number	L_ANT	RP_ANT	ANT_SR	CP_ANT	Q_ANT
1	6.304e-07	3.47e+03	7.77e+07	6.66e-12	64.6

number	Z	Zreal	Zimag	Cp.opt	Cs.opt
1	7.2-j1.71e-11	7.2	-1.71e-11	1.18e-10	5.67e-10



The target matching impedance can be set by entering a value in the field **Z_goal_R**. The imaginary part and the target frequency can stay the same.

```
equation
Antenna_values
RS_ANT=0.832
XS_ANT=53.71
ANT_SR=77.7e6
Rp=1320
Export=yes
```

The equation containing the antenna electrical characteristics is the one filled with the value measured with a VNA, in this page [PTX10xR Eval-Board antenna and matching](#) an extract of the antenna of the Eval Board.

Every time new data is entered in this field a new simulation needs to be performed. The values for Cp and Cs simulated to represent a starting point for the matching network, a fine-tuning could be required in the real device. The q-factor measurement performed with the Config Tool can guide in the fine-tuning. An accurate antenna measurement will help to speed up the matching process.

```
equation
Goal
Z_goal_R=7.2
Z_goal_I=0
Target_Freq=13.56e6
```

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