

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

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No headings included in this document

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				

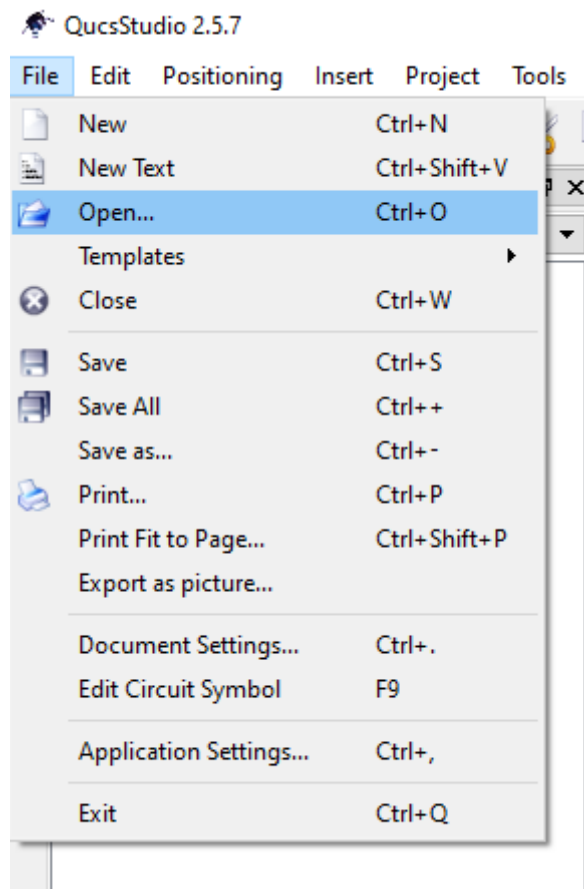
Download the file corresponding to the device you are using, save it and open it.

PTX100R Simulation file.

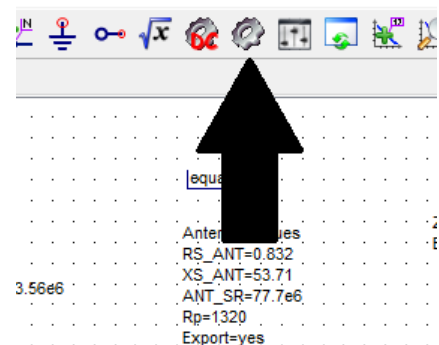
[PTX100R_Eval_1v4_SP.sch](#)

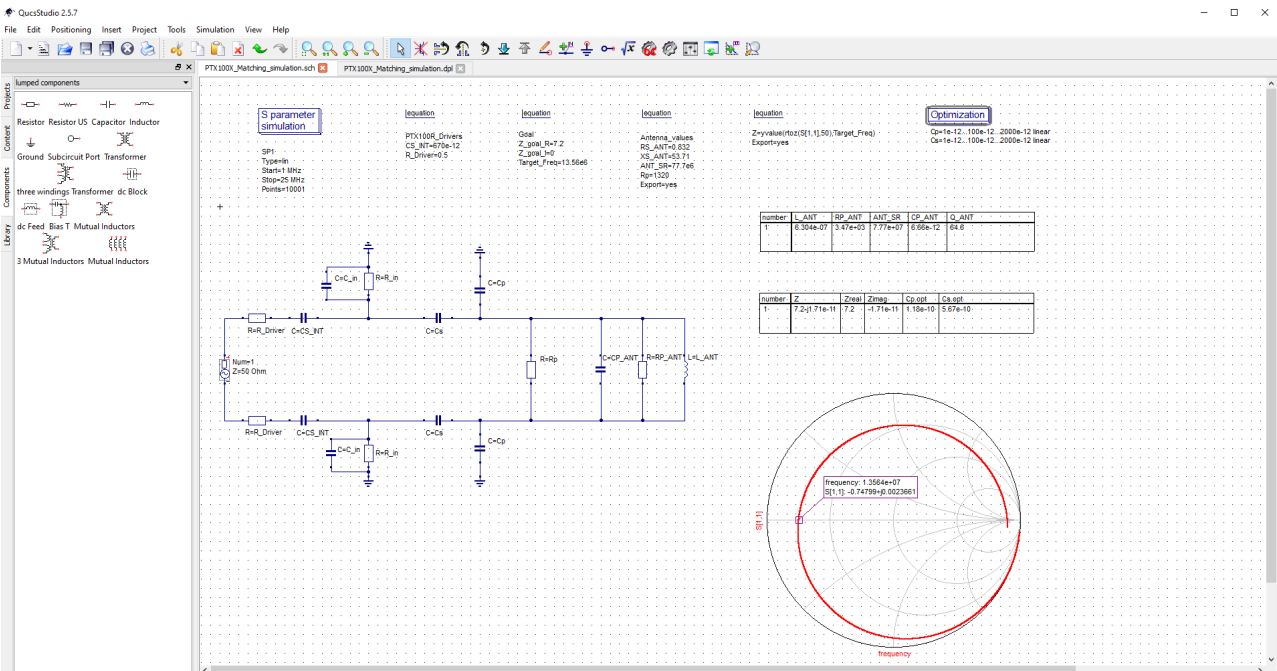
PTX105R Simulation file.

[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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