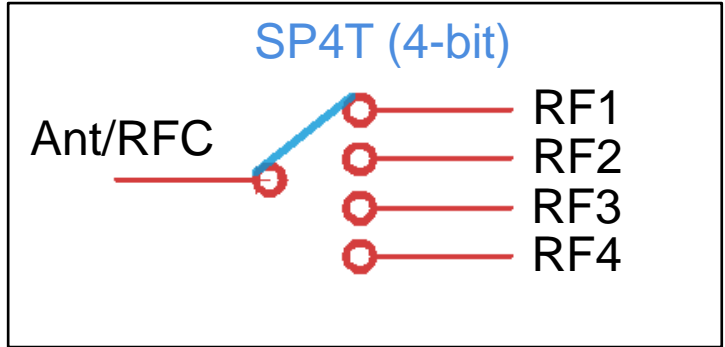
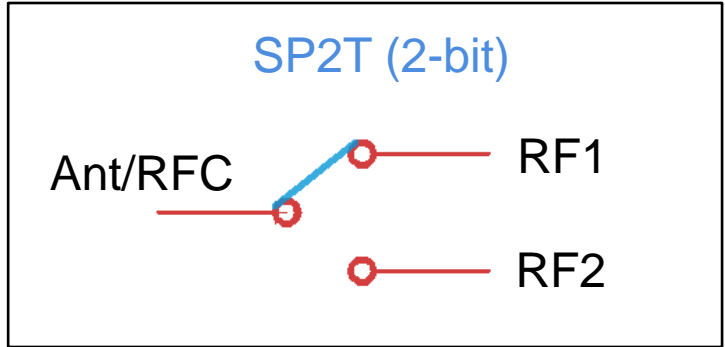

Filter/Antenna Tuning Switches

Application Note


Tagore filter/antenna tuning switches

Tunable RF Switches Features

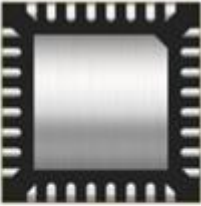
- Low Ron/Coff
- Up to 120V peak handling
- DC supply (2.6-5.5V)
- Ctrl logic (1.2-5.0V) digital
- Individual logic ctrl (4-bit)
- Compact QFN IC package




Compact QFN IC Package



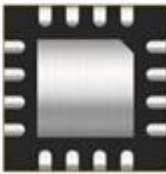
TTSW
TS64210L



32 pin 4x4x0.8mm QFN package



TTSW
TS63420K



16 pin 3x3x0.8mm QFN package

P/N	SPnT	Ron (Ω)	Coff (pF)	Peak RF Voltage (V)	QFN Package
TS64210L	2T	1.6	0.4	120	4x4
TS63210K	2T	1.4	0.4	100	3x3
TS63420K	4T	1.9	0.35	100	3x3
TS63421K	4T	1.9	0.35	100	3x3

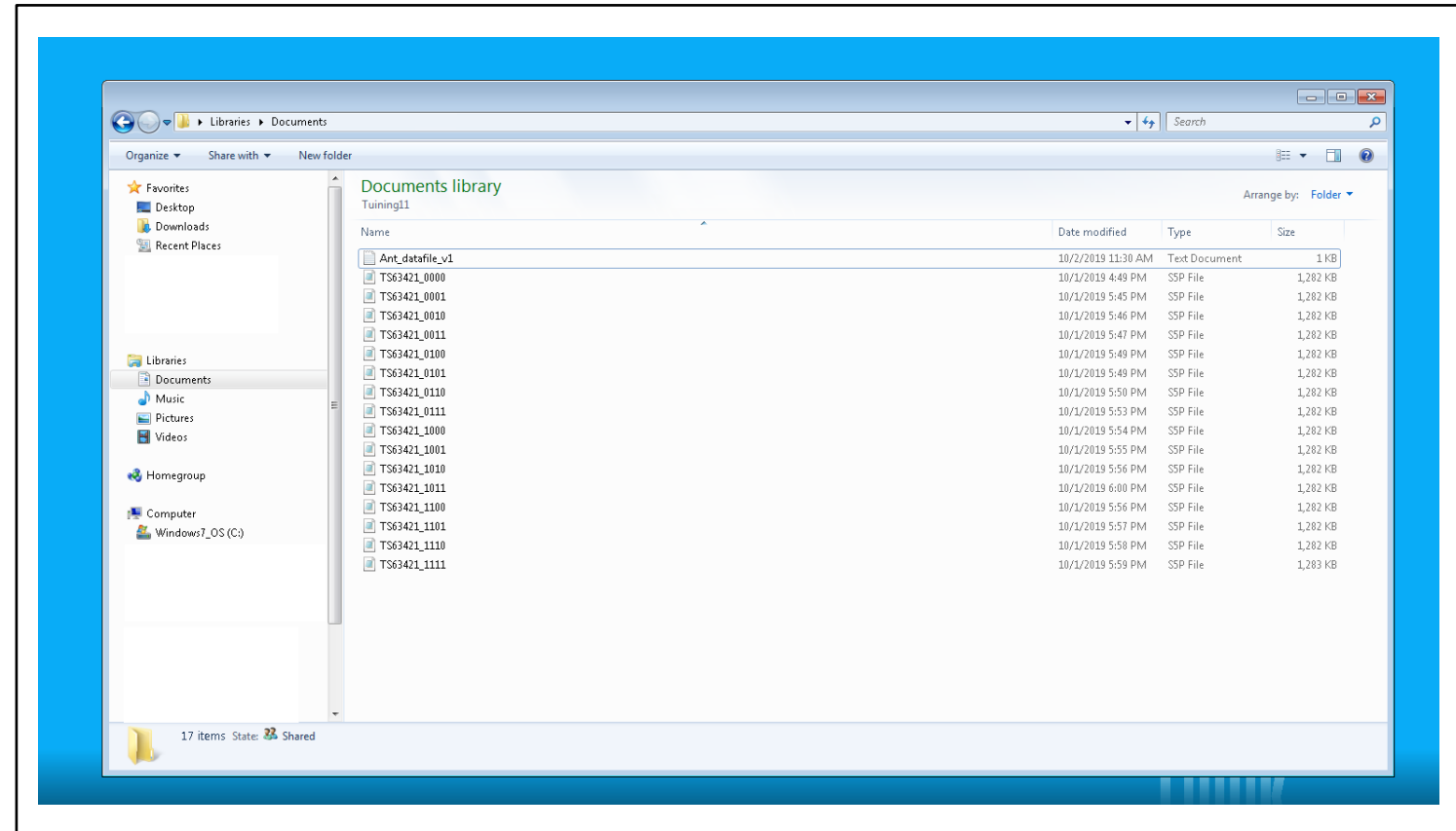
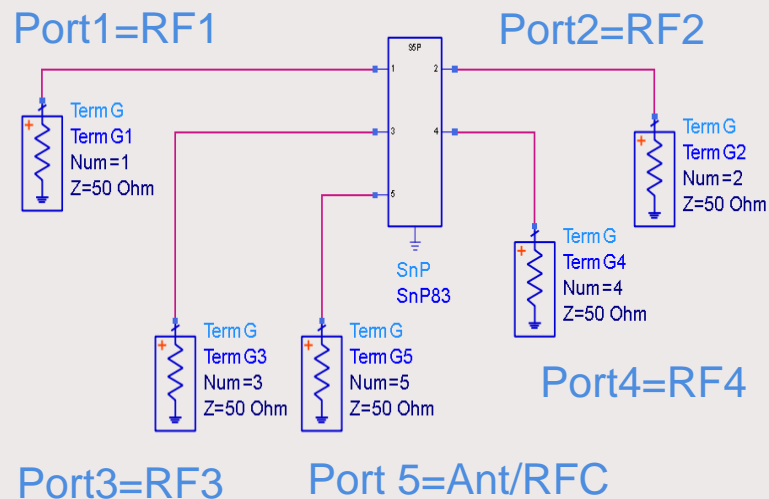
Tuning switch model S-parameter file

Tz

SP4T tuning switch simulation model

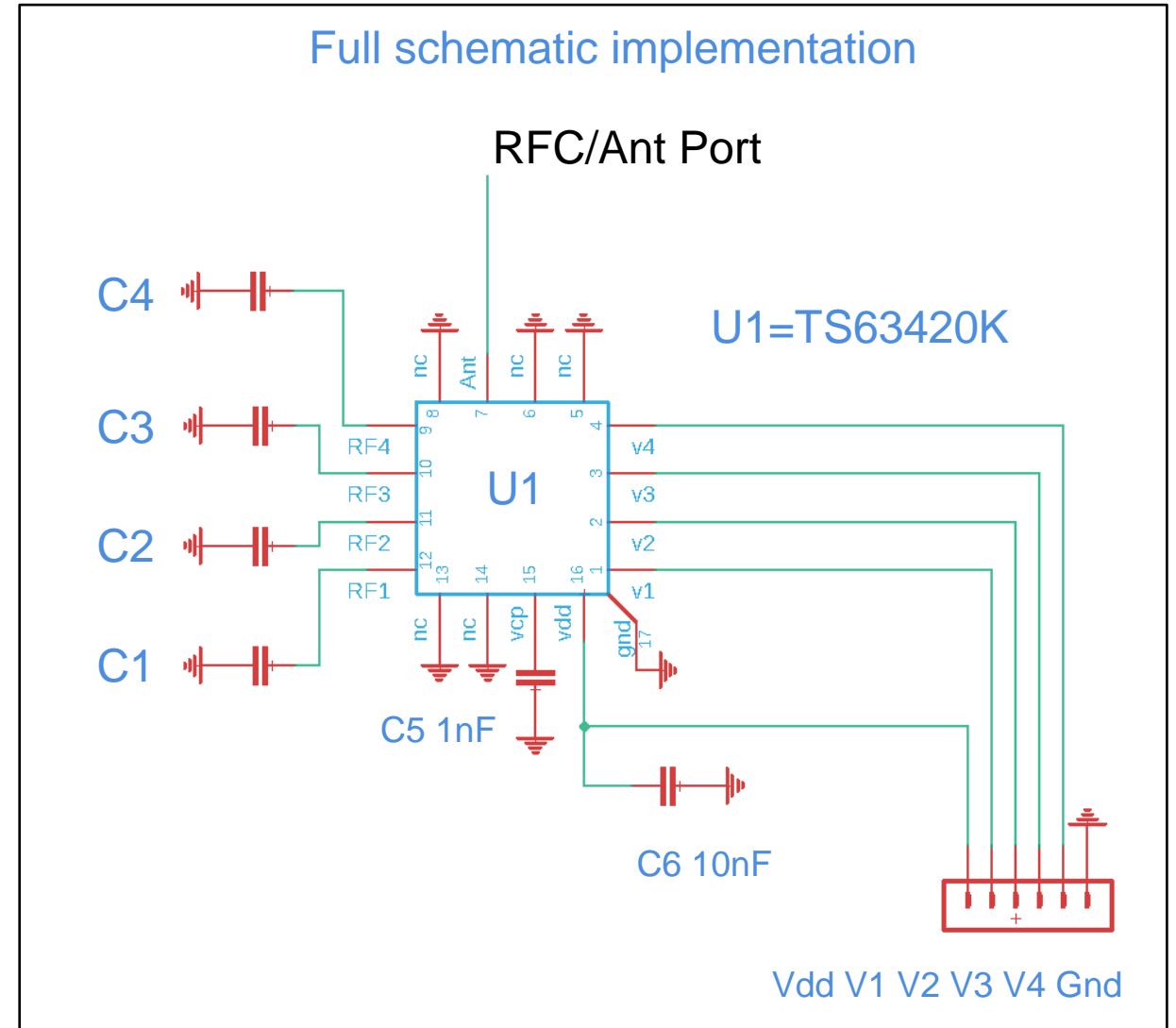
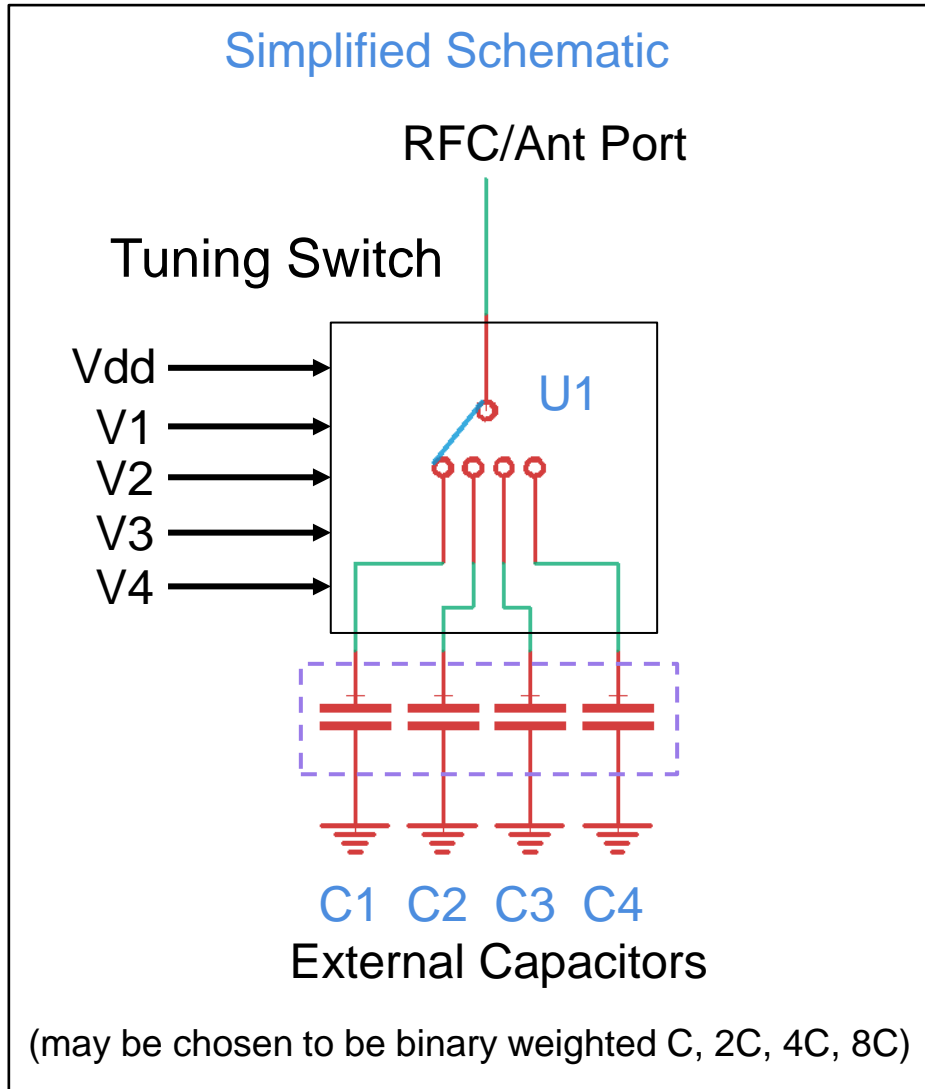
- Derived 5 Port S-parameter file .S5P
- 16 total .S5P files for all 4-bit states
- Frequency up to 3GHz
- Accurately predict Q and losses
- Compatible with ADS/Microwave Office

- Current Model Version **MX3**



Replacing caps with 4-bit switchable shunt capacitor element

Tz

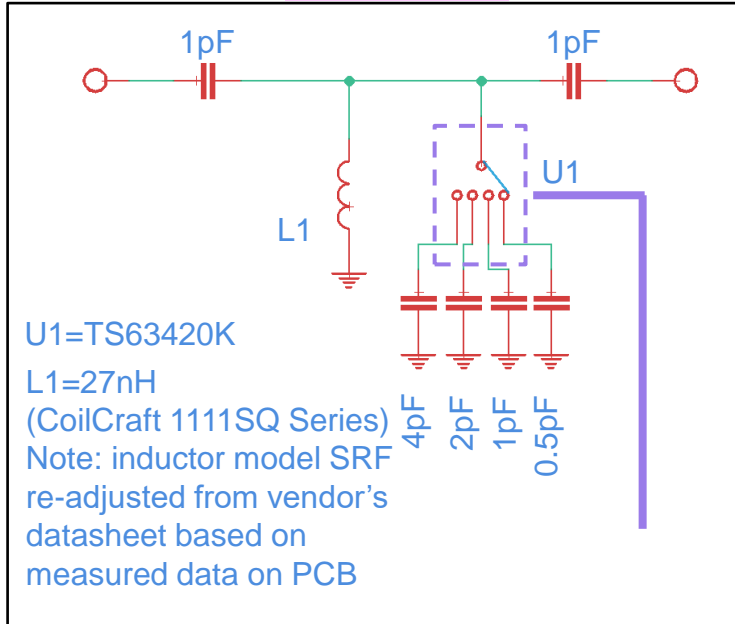


- Model simulation guidelines:
 - Accurate model all circuit external components such as inductors and capacitors is required
 - Component SRF may shift from vendor's datasheet depending on placement of component on PCB
 - Use low-loss component inductors and capacitors if applicable
 - Component tolerances could be as low as +/-0.1pF (enough to cause few MHz shift at 1GHz)
 - Accurate EM simulation of PCB routing to account for parasitic capacitances and inductances
 - Lots of VIAs improves RF ground on PCB

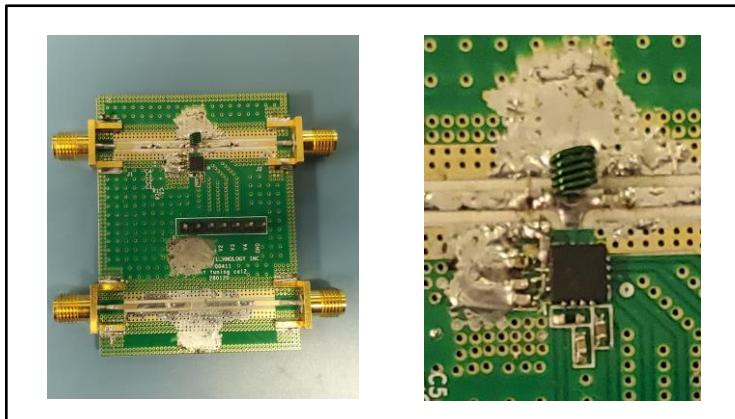
Example 1: Tunable Band-Pass Filter: 280-500MHz (single pole)

Tz

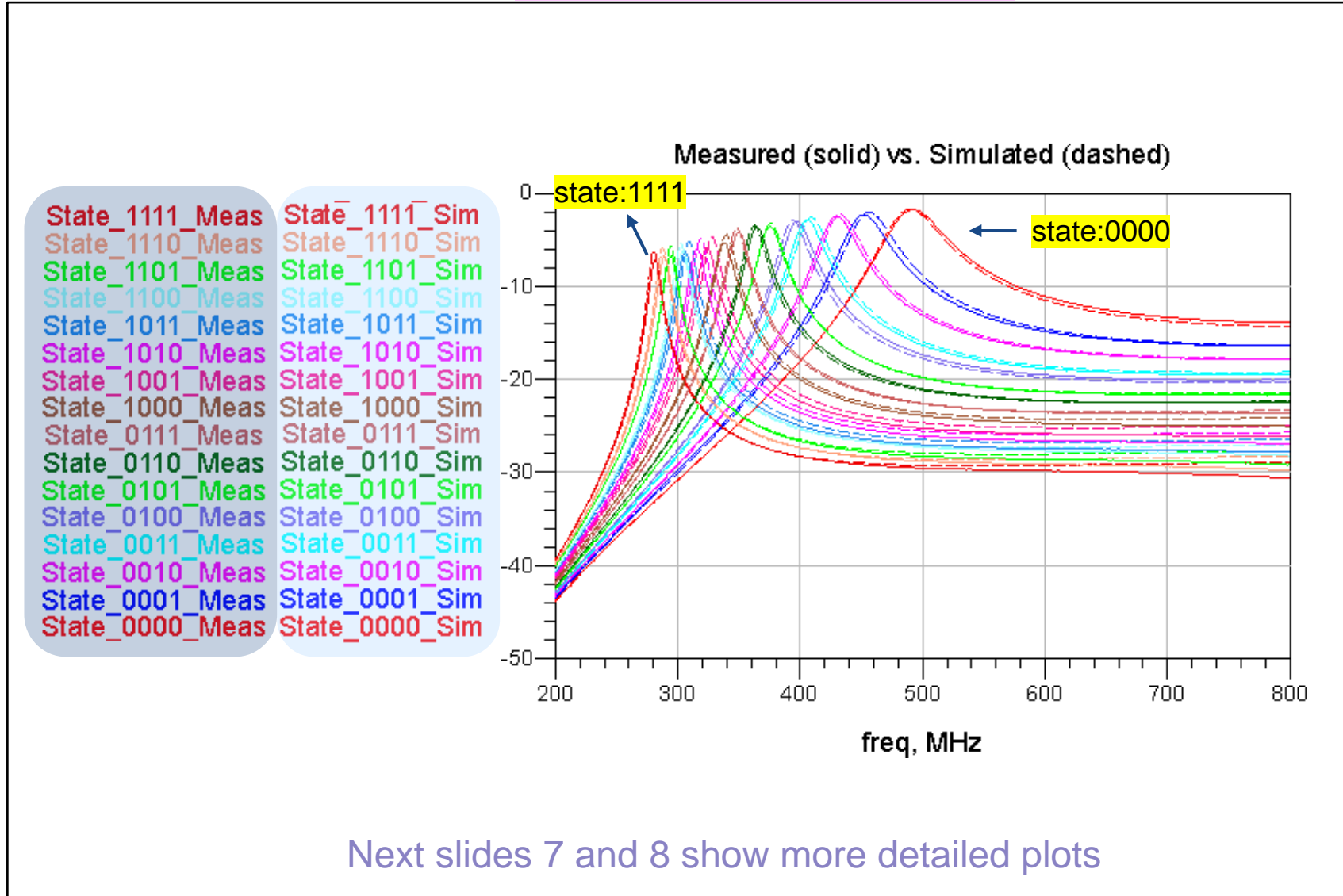
Schematic



Realized prototype



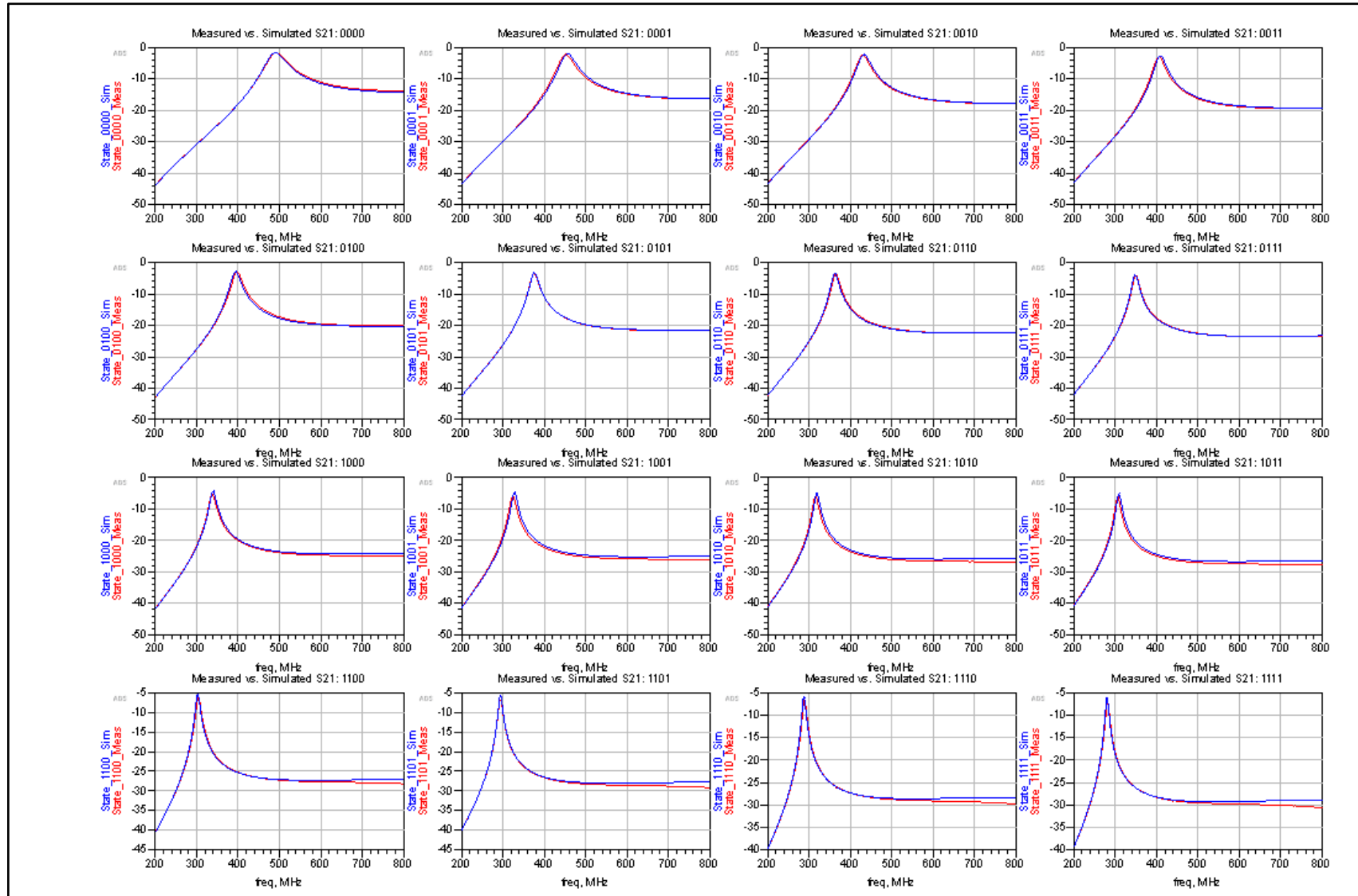
Measured vs. Simulated Data



Example 1: S21 Filter response for every state

Tz

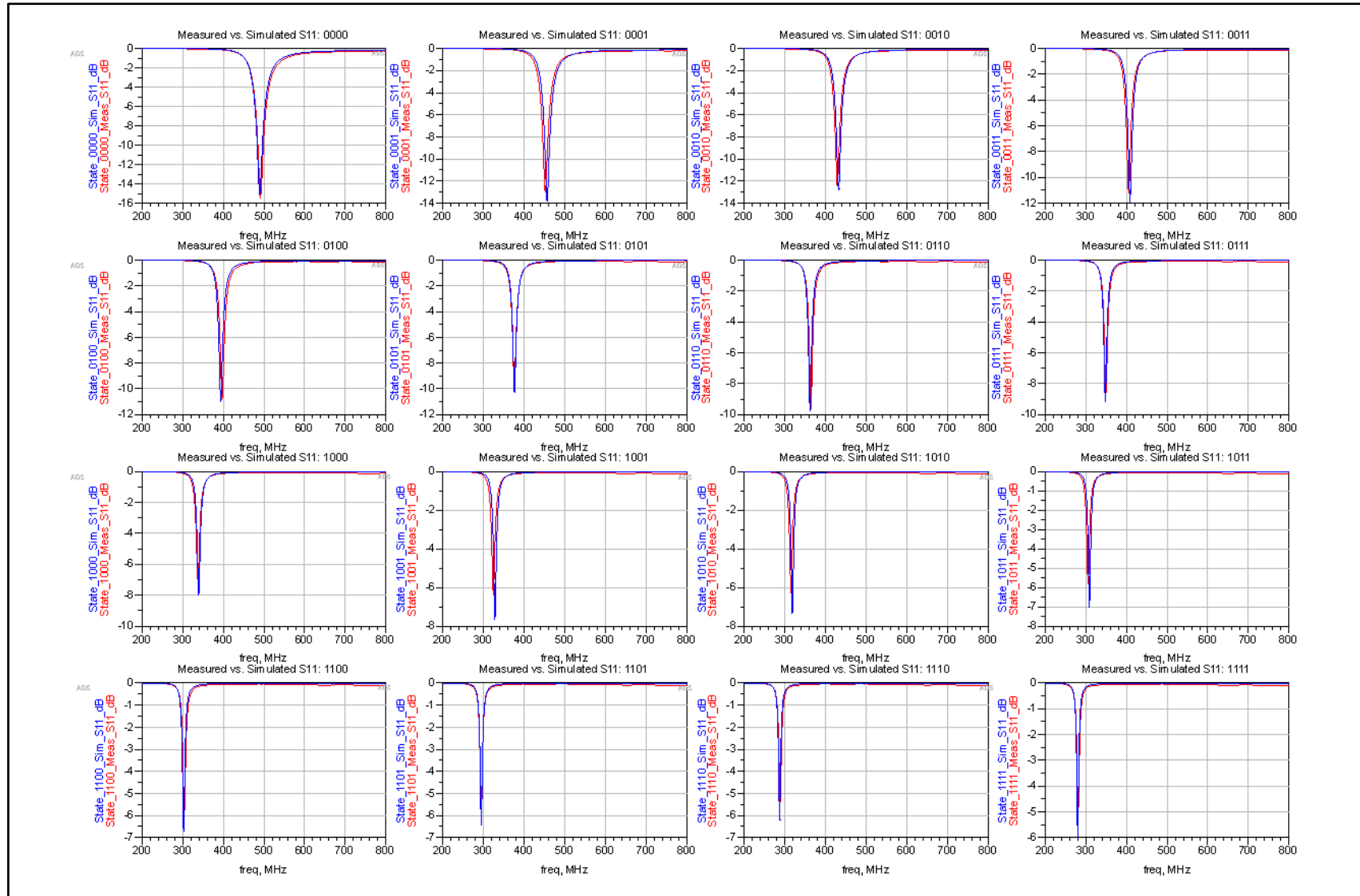
Measured vs. Simulated Data



Example 1: S11 Filter response for every state

Tz

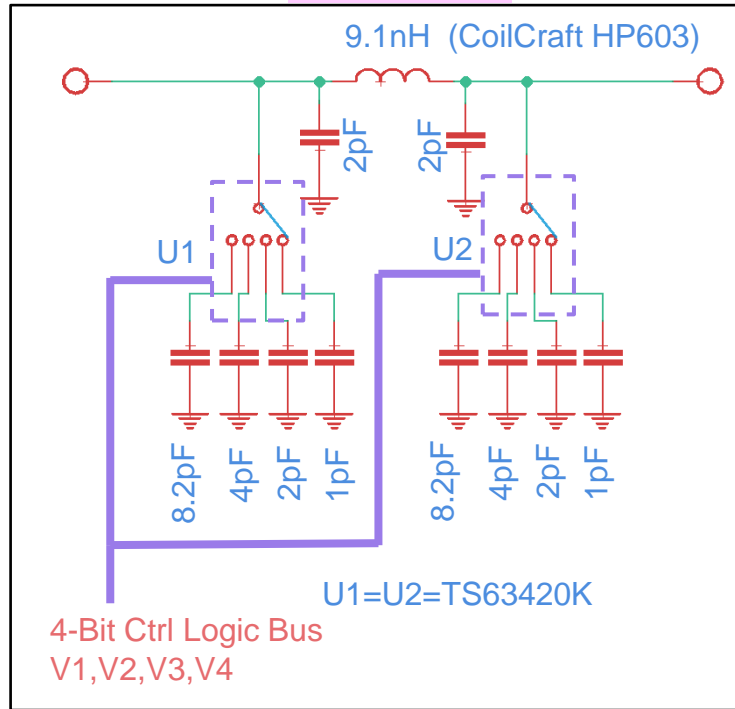
Measured vs. Simulated Data



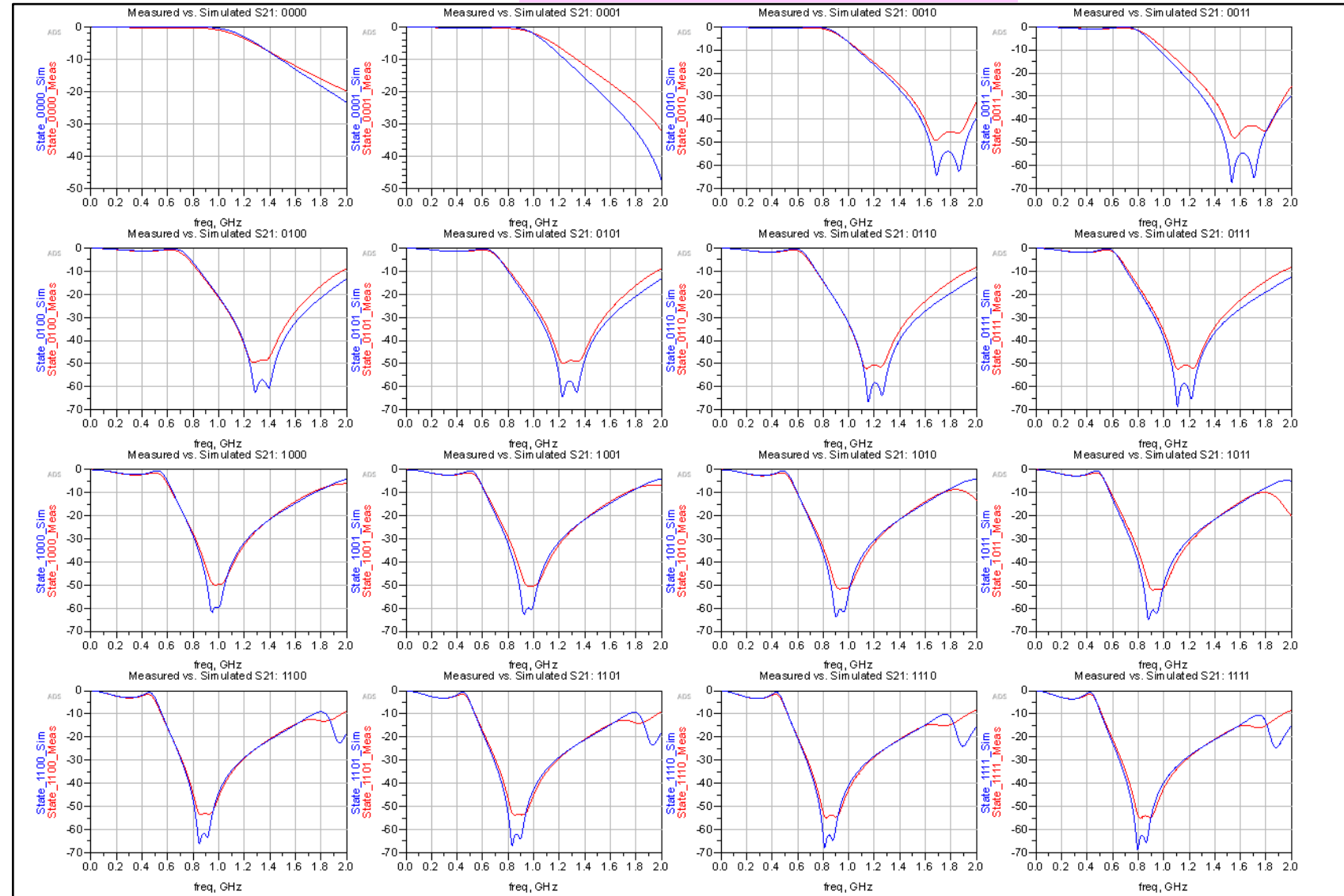
Example 2: 3 Element Low-Pass Filter Stage: 500-1000MHz

Tz

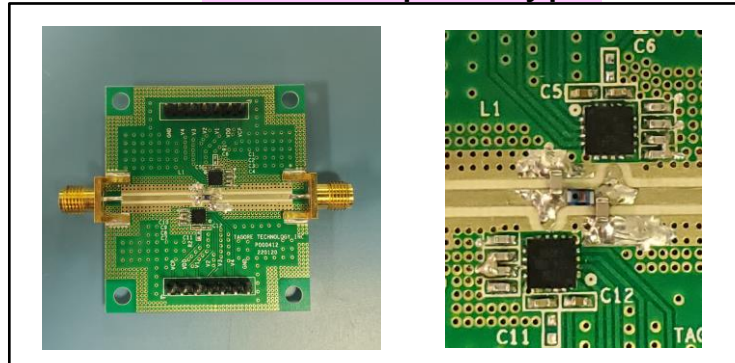
Schematic



Measured vs. Simulated Data



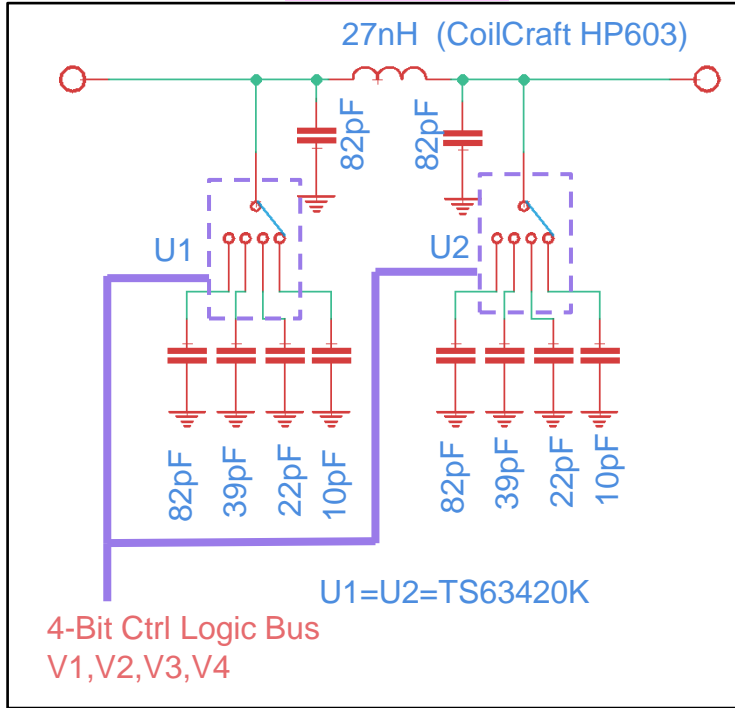
Realized prototype



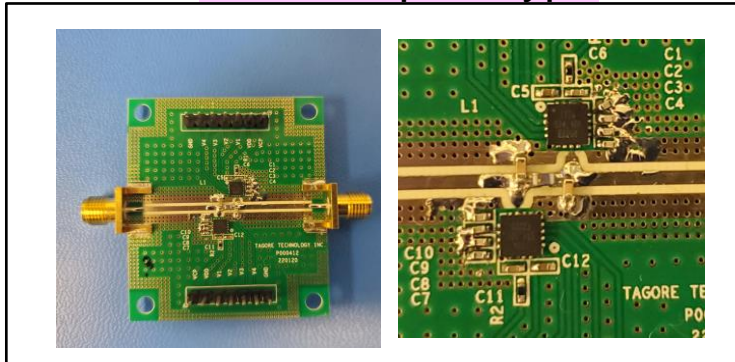
Example 3: 3 Element Low-Pass Filter Stage: 30MHz

Tz

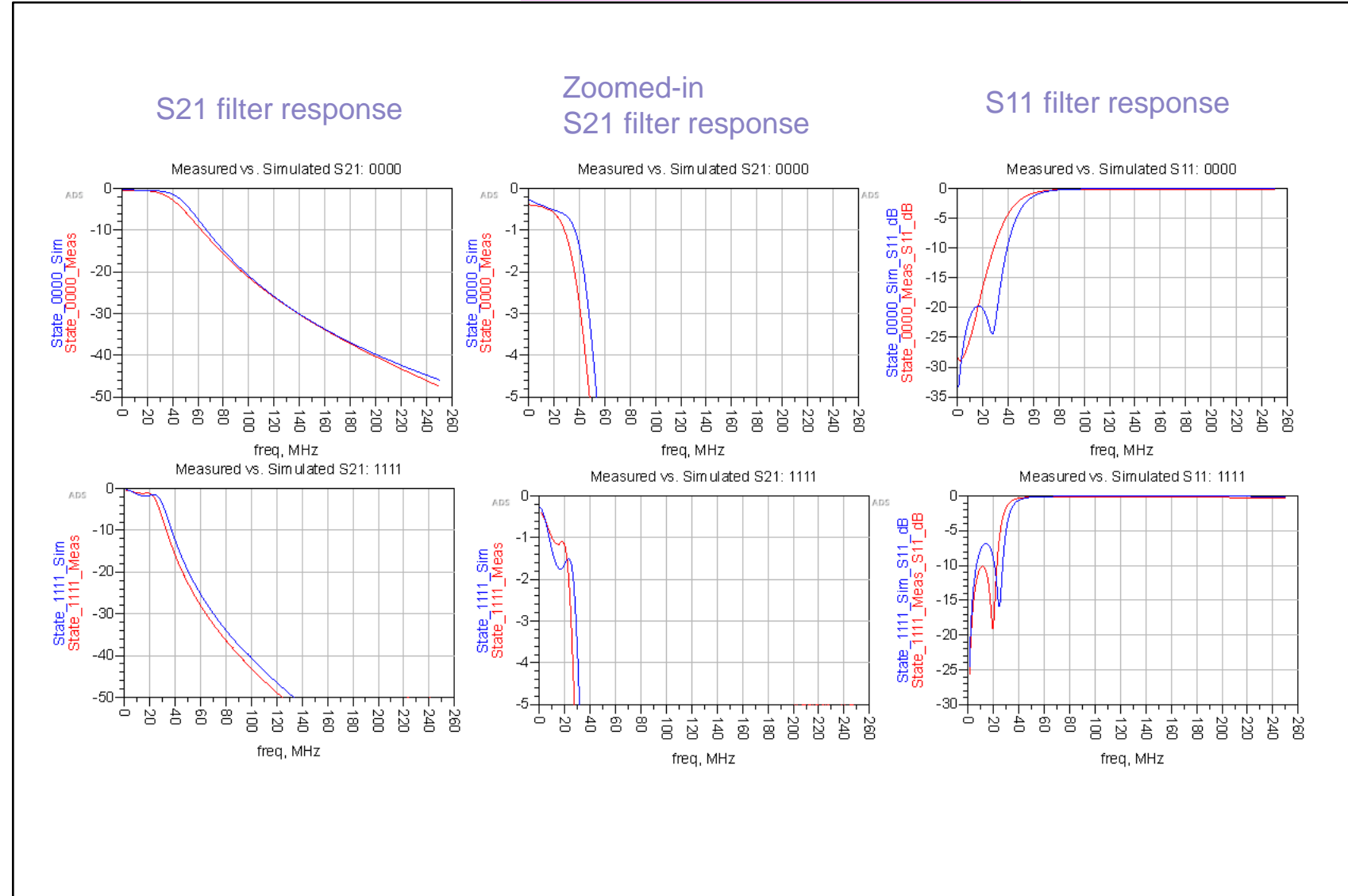
Schematic



Realized prototype



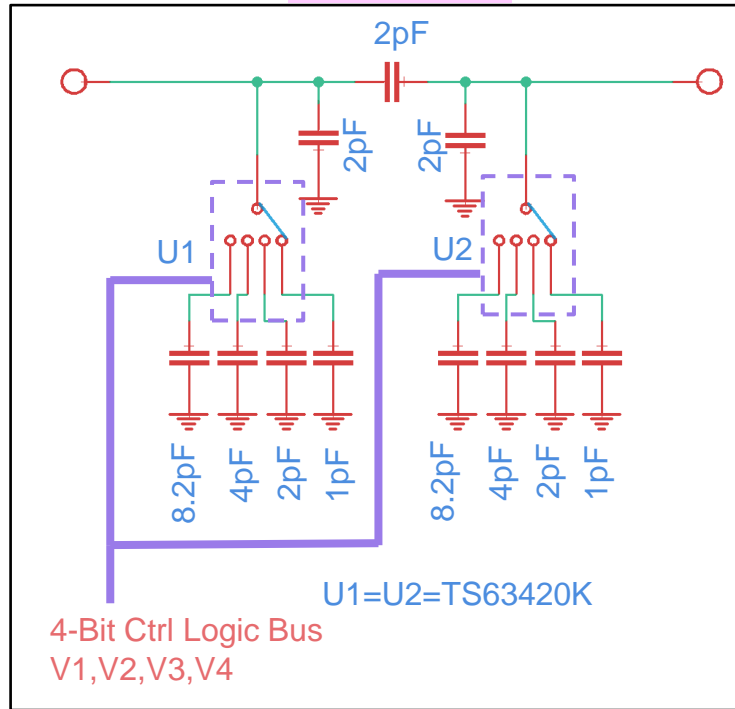
Measured vs. Simulated Data



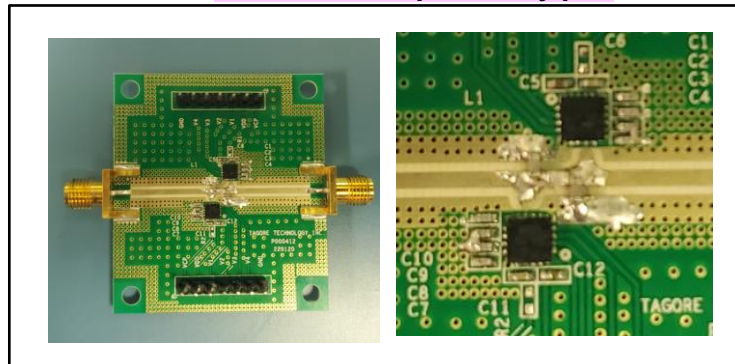
Example 4: 3 element Tunable Capacitor Network 0-2GHz

Tz

Schematic



Realized prototype



Measured vs. Simulated Data

