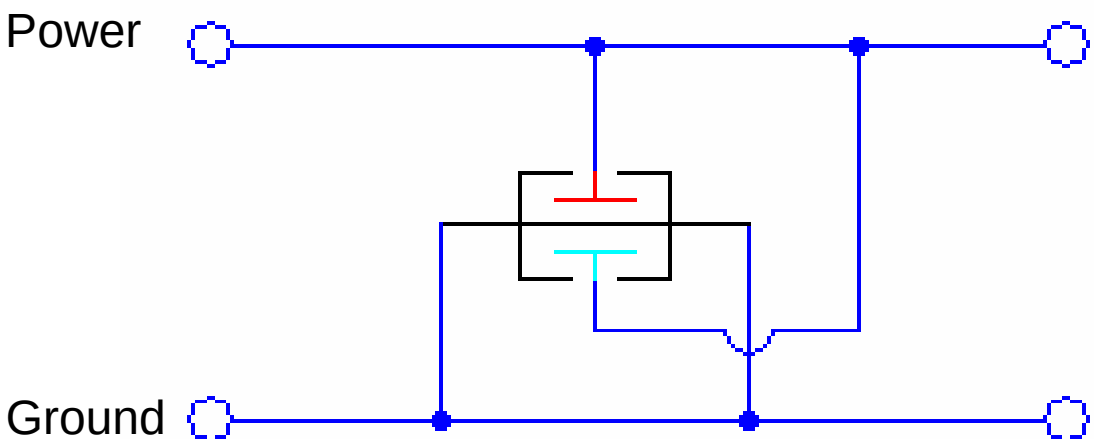
X2Y® S-parameter Extraction

Test Results #TR 6001, v2.0

Equipment Used

- Network Analyzer – Agilent E5071A
- Cables – Agilent N6314A (n-type to n-type)
- Adapters – n-type to 3.5 mm
- Cal Kit - 85033E (3.5mm Calibration kit, 30 kHz to 9 GHz)

X2Y® Circuit 2 Configuration



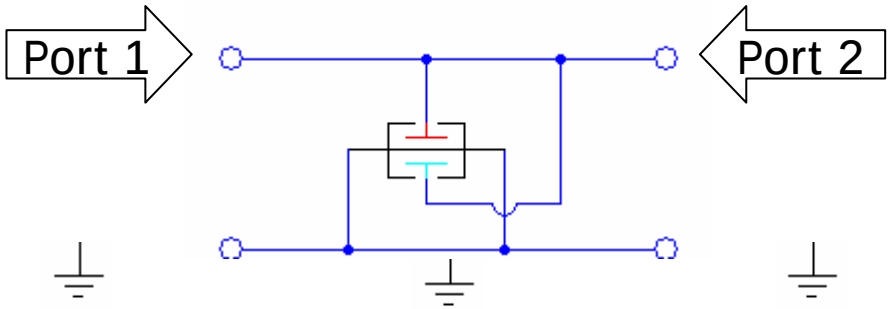
Circuit 2

S-parameter Extraction – Circuit 2

- PCB Characterization
  - ✓ Coplanar PCBs are designed to have 50 ohm characteristic impedance across broadest the frequency band.
  - ✓ Via PCBs are designed to represent power/ground planes on a typical PCB.

- De-embedding – test results are currently not de-embedded from PCB characteristics.
  - ✓ Good correlation between test PCBs used allow a fair A-to-B comparison between samples.
  - ✓ Coplanar PCBs have 50 ohm impedance to minimize the need to de-embed.
  - ✓ The inductance of the DUT can be extracted from the coplanar and Via PCB testing using the method shown in: Application Note #3004 "*Accurate Capacitor Inductance Extraction from s21 Measurements*".

S-parameter Extraction – Circuit 2

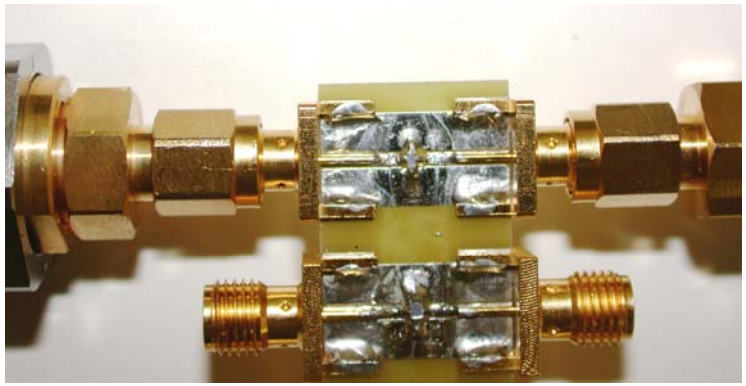


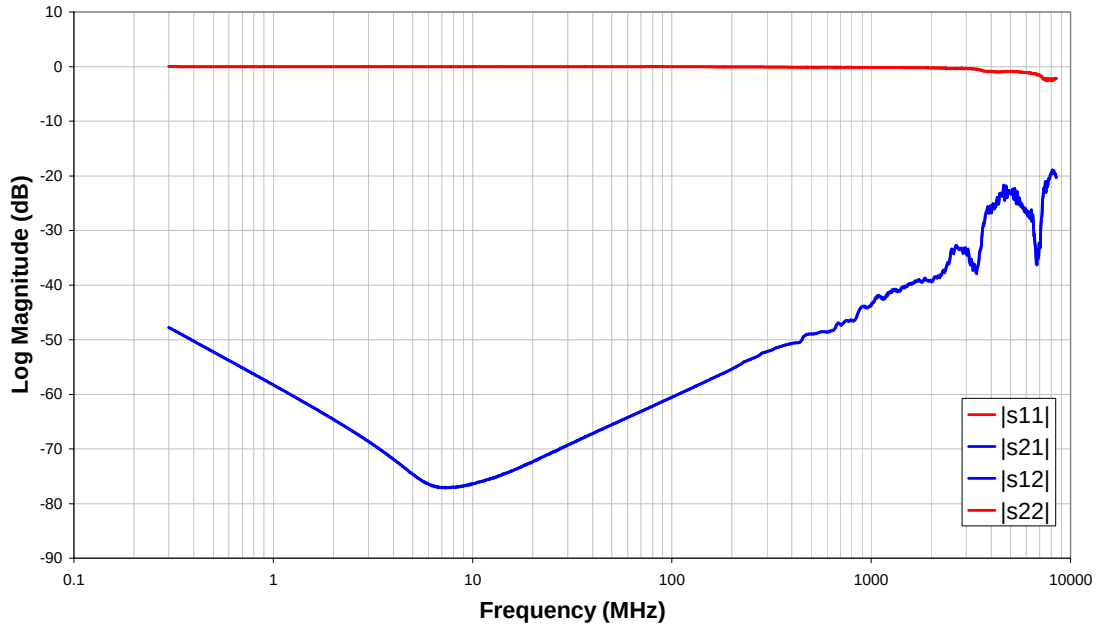
- One port is excited and then the response of each of the 2 ports is measured.
- The process is repeated at each port.
- (4) s-parameters are needed to characterize the X2Y® component for Circuit 2.

Number of Measurements	Port Excited	Port Read
1 (S11)	1	1
2 (S12)	1	2
3 (S21)	2	1
4 (S22)	2	2

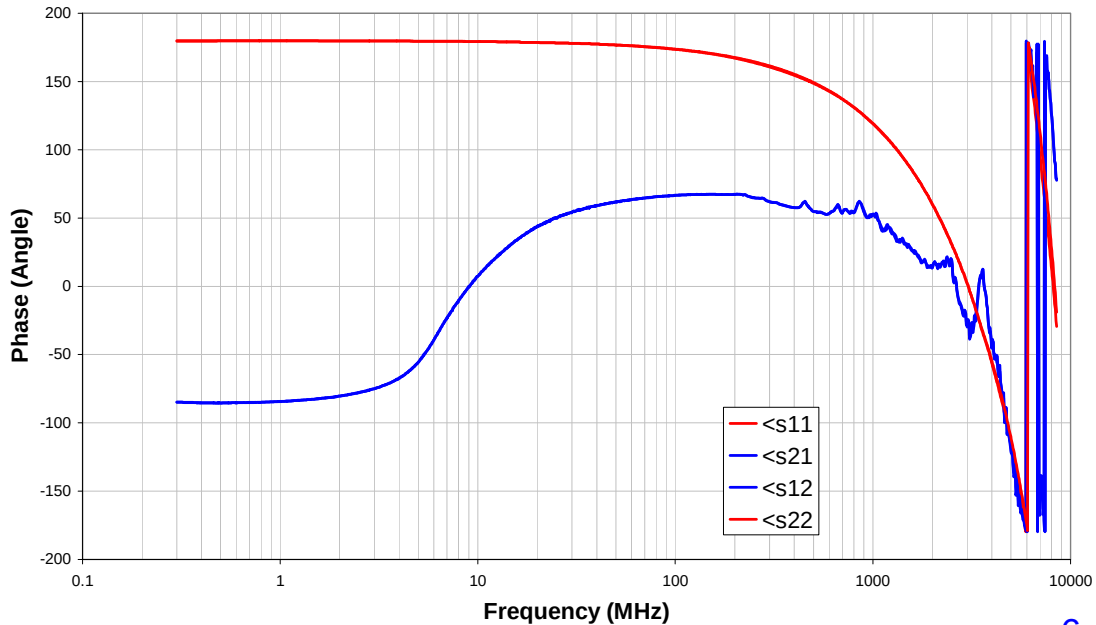
- Note: The amount of measurements need to be taken can be simplified for the X2Y® component because of the symmetry of the set-up and component.
  - ✓ S11 = S22
  - ✓ S12 = S21

S-parameter Extraction – Circuit 2 [COPLANAR PCB]

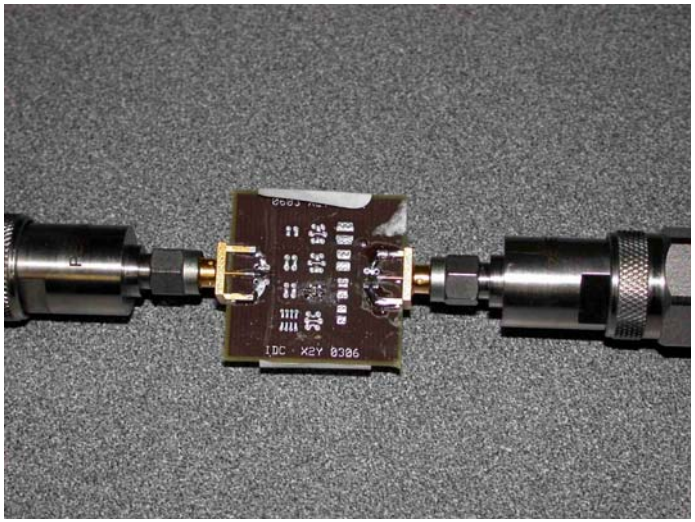




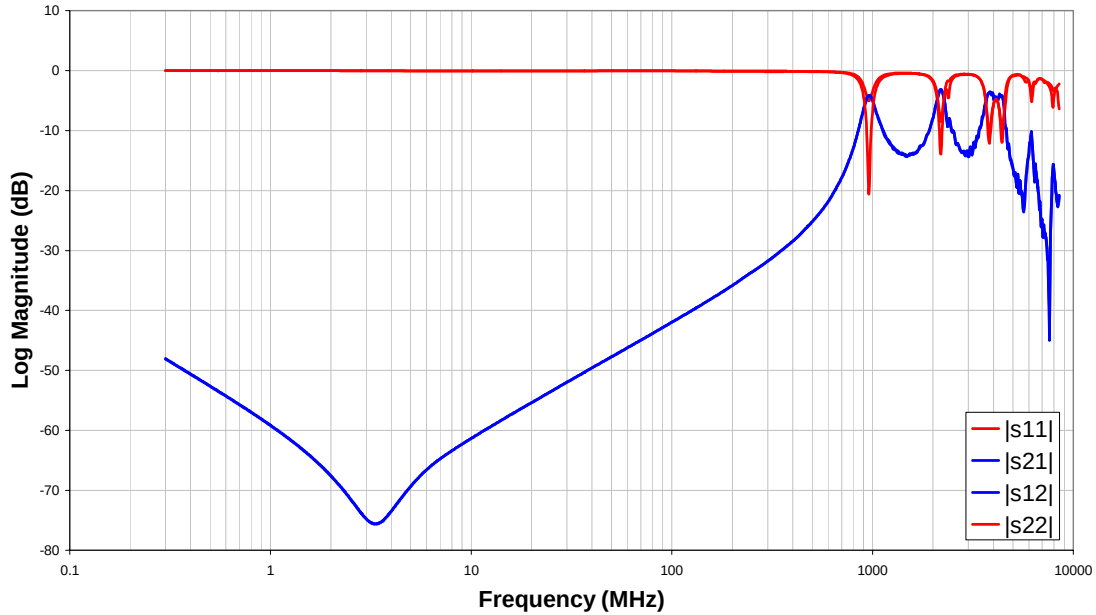
- Measurements
  - ✓ 300 kHz Sweep Start
  - ✓ 8.5 GHz Sweep Stop
  - ✓ 1601 data points
  - ✓ Logarithmic Measurement
  - ✓ 100 Hz Bandwidth

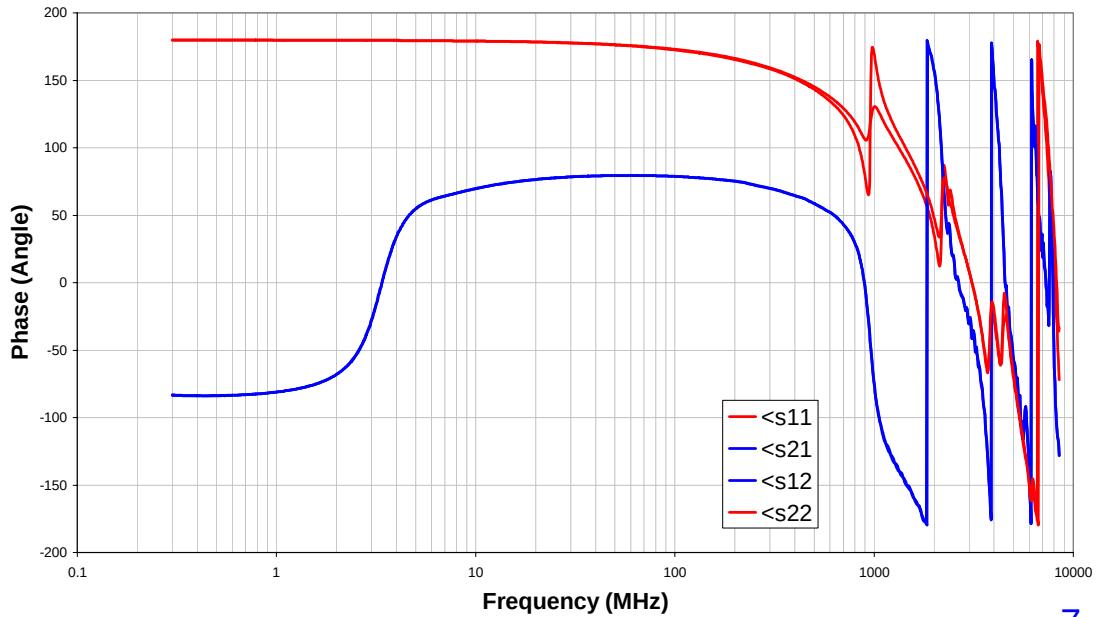


S-parameter Extraction – Circuit 2 [VIA PCB]

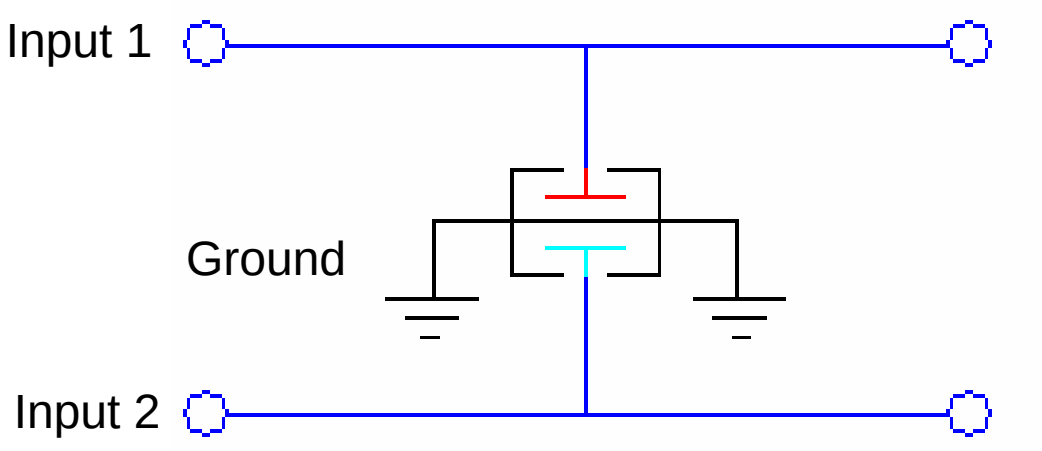


- Measurements
  - ✓ 300 kHz Sweep Start
  - ✓ 8.5 GHz Sweep Stop
  - ✓ 1601 data points
  - ✓ Logarithmic Measurement
  - ✓ 100 Hz Bandwidth





X2Y® Circuit 1 Configuration



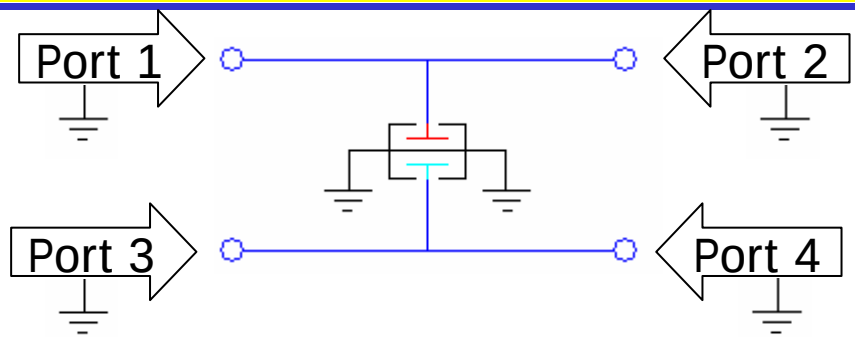
Circuit 1

S-parameter Extraction – Circuit 1

- PCB Characterization
  - ✓ Coplanar PCB with ground planes are designed to have 50 ohm characteristic impedance across broadest frequency band.

- De-embedding – test results are currently not de-embedded from PCB characteristics.
  - ✓ Good correlation between test PCBs used allow a fair A-to-B comparison between samples.
  - ✓ Coplanar PCB with ground planes have 50 ohm impedance to minimize the need to de-embed.

S-parameter Extraction – Circuit 1

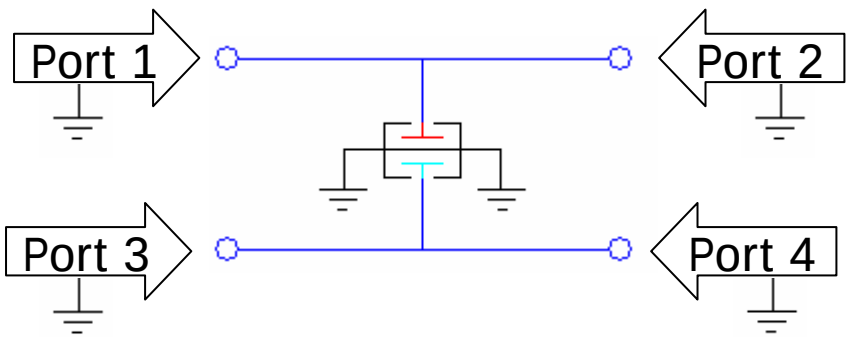


- One port is excited and then the response of each of the 4 ports is measured.
- The process is repeated at each port.
- 16 s-parameters are needed to characterize the X2Y® component for Circuit 1.
- Note: The amount of measurements need to be taken can be simplified for the X2Y® component.

Number of Measurements	Port Excited	Port Read
1 (S11)	1	1
2 (S12)	1	2
3 (S13)	1	3
4 (S14)	1	4
5 (S22)	2	2
6 (S21)	2	1
7 (S23)	2	3
8 (S24)	2	4
9 (S33)	3	3
10 (S31)	3	1
11 (S32)	3	2
12 (S34)	3	4
13 (S44)	4	4
14 (S41)	4	1
15 (S42)	4	2
16 (S43)	4	3

S-parameter Extraction – Circuit 1

- The following measurements are equivalent measurements due to the symmetry of the set-up and component:
  - ✓ [S11 = S22]
  - ✓ [S33 = S44]
  - ✓ [S13 = S14 = S31 = S41]
  - ✓ [S23 = S24 = S32 = S42]
  - ✓ [S21 = S12]
  - ✓ [S43 = S34]



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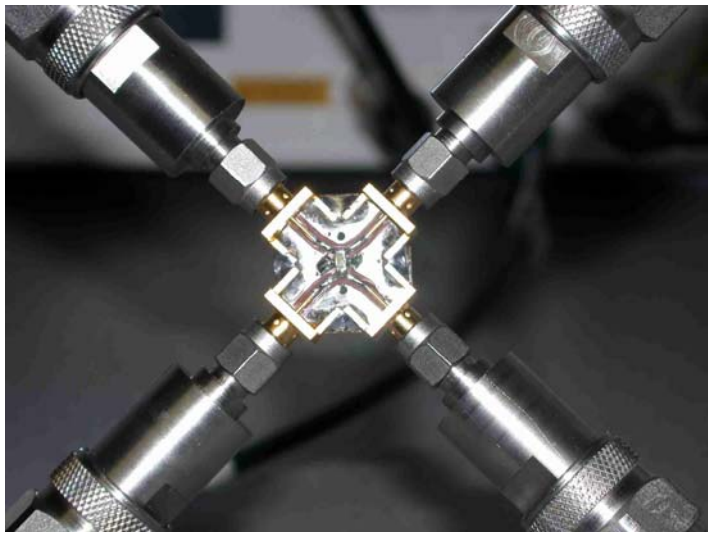
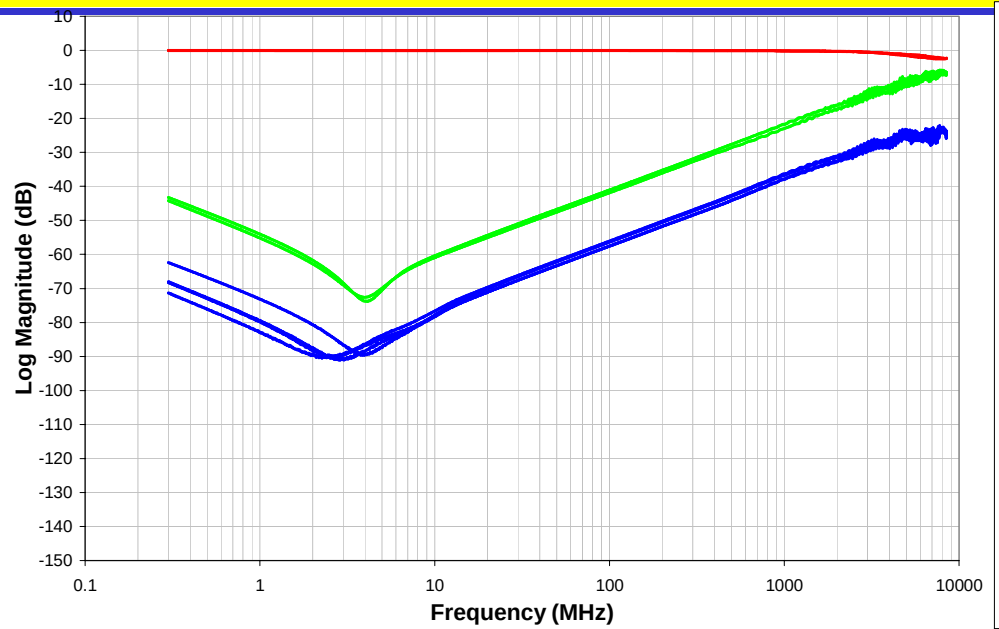
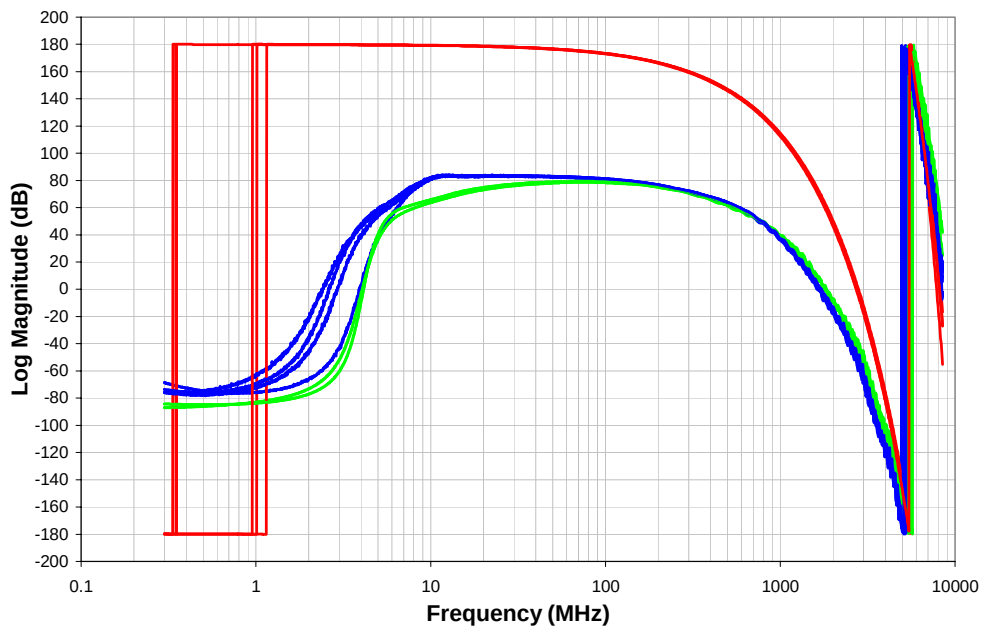
8 (S24)	2	4
9 (S33)	3	3
10 (S31)	3	1
11 (S32)	3	2
12 (S34)	3	4
13 (S44)	4	4
14 (S41)	4	1
15 (S42)	4	2
16 (S43)	4	3

S-parameter Extraction – Circuit 1



- Measurements
  - ✓ 300 kHz Sweep Start
  - ✓ 8.5 GHz Sweep Stop
  - ✓ 1601 data points
  - ✓ Logarithmic Measurement
  - ✓ 100 Hz Bandwidth





Contact Information

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