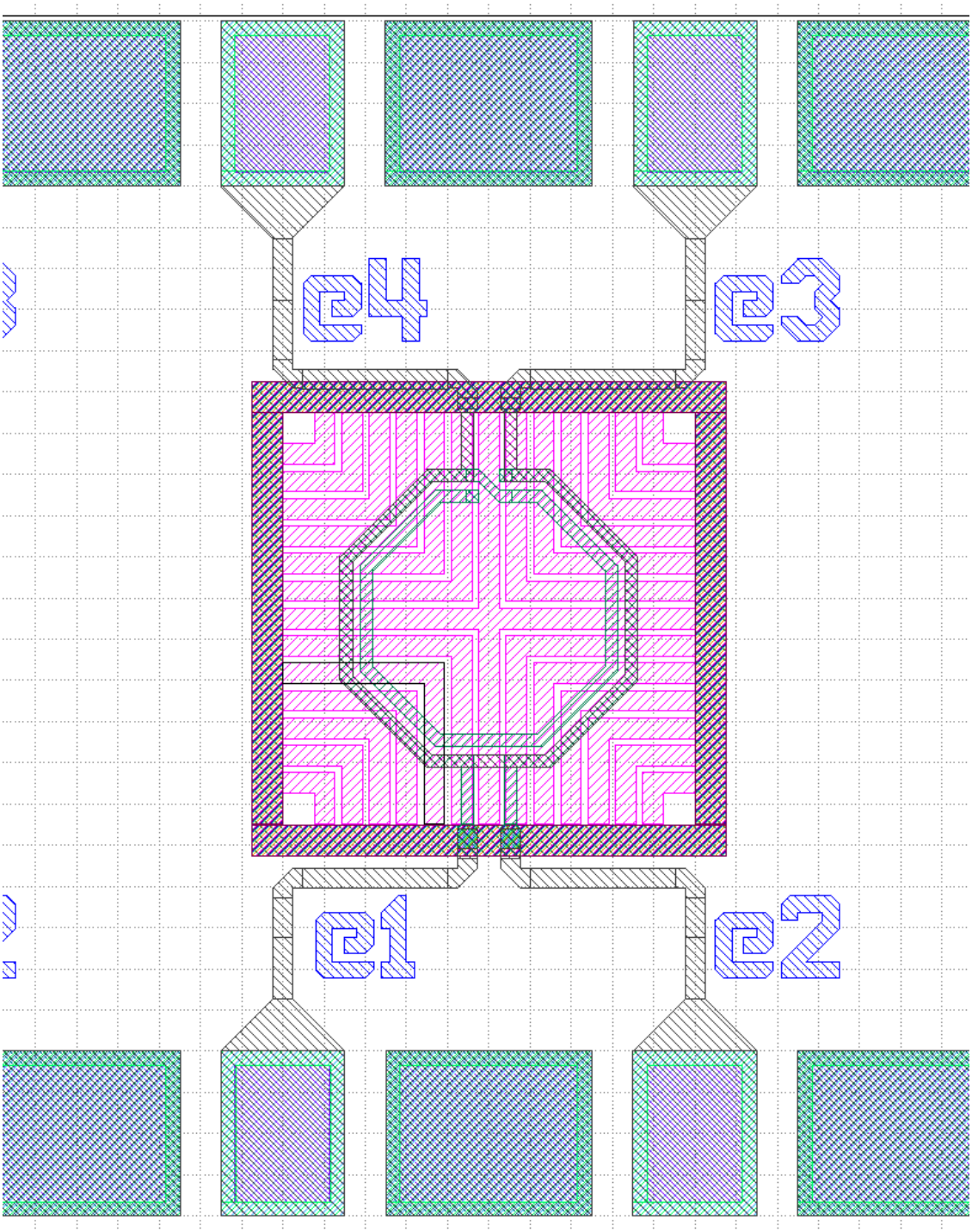
Transformer

November 10, 2024

[1]:
```
import skrf
import numpy as np
from matplotlib import pyplot as plt
%matplotlib inline

import warnings
import glob

warnings.filterwarnings("ignore", category=RuntimeWarning)

plt.rcParams["figure.figsize"] = [12,10]
```

[2]:
```
def calculate_diff_sparams(n):
    dnet = n.copy()
    dnet.se2gmm(p=2) # convert to mixed mode
    return dnet
```

1 Transformer Port Labels



2 Transformer E0

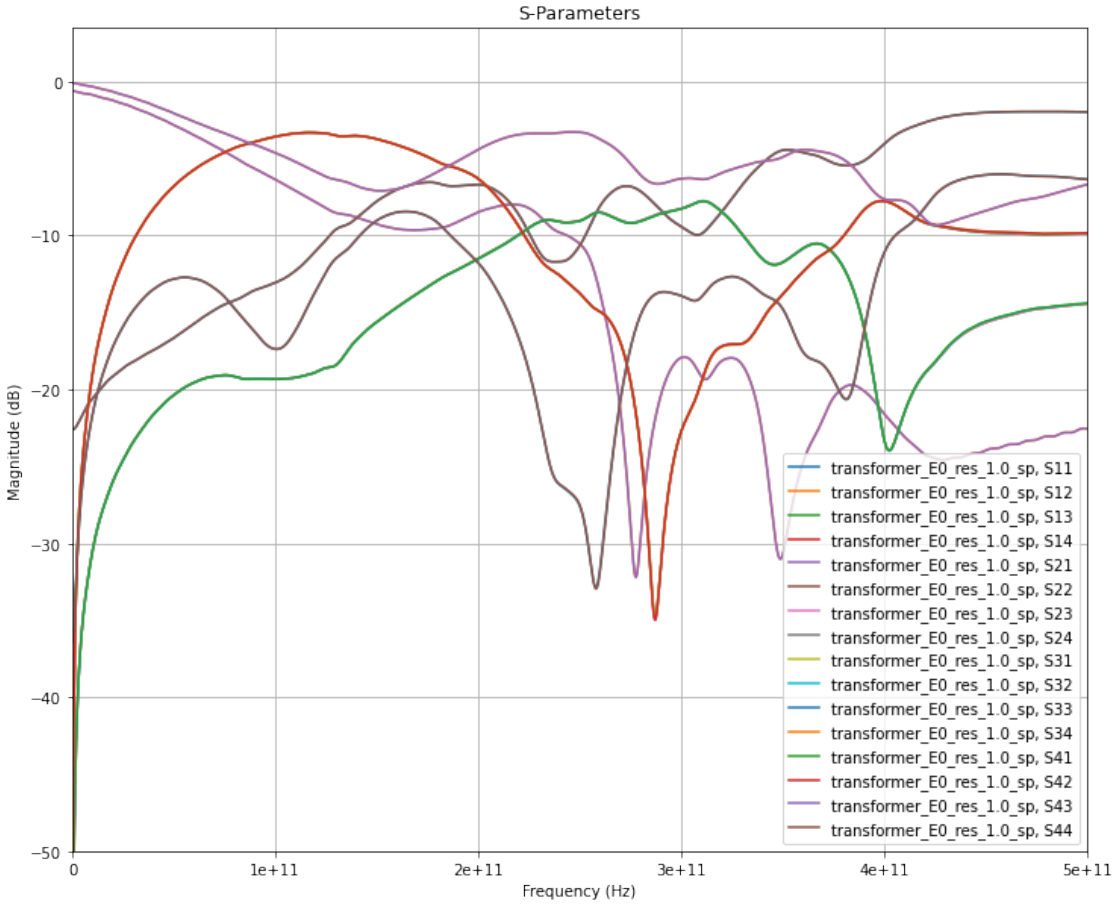
- ratio = 1:1

[3]:
```
net = skrf.Network("transformer_E0_res_1.0_sp.s4p")
```

[4]:
```
print(net)
```

```
4-Port Network: 'transformer_E0_res_1.0_sp',  0.0-500000000000.0 Hz, 20000 pts,
z0=[50.+0.j 50.+0.j 50.+0.j 50.+0.j]
```

[5]:
```
net.plot_s_db()
plt.grid()
plt.ylim(bottom=-50)
plt.title("S-Parameters")
plt.show()
```

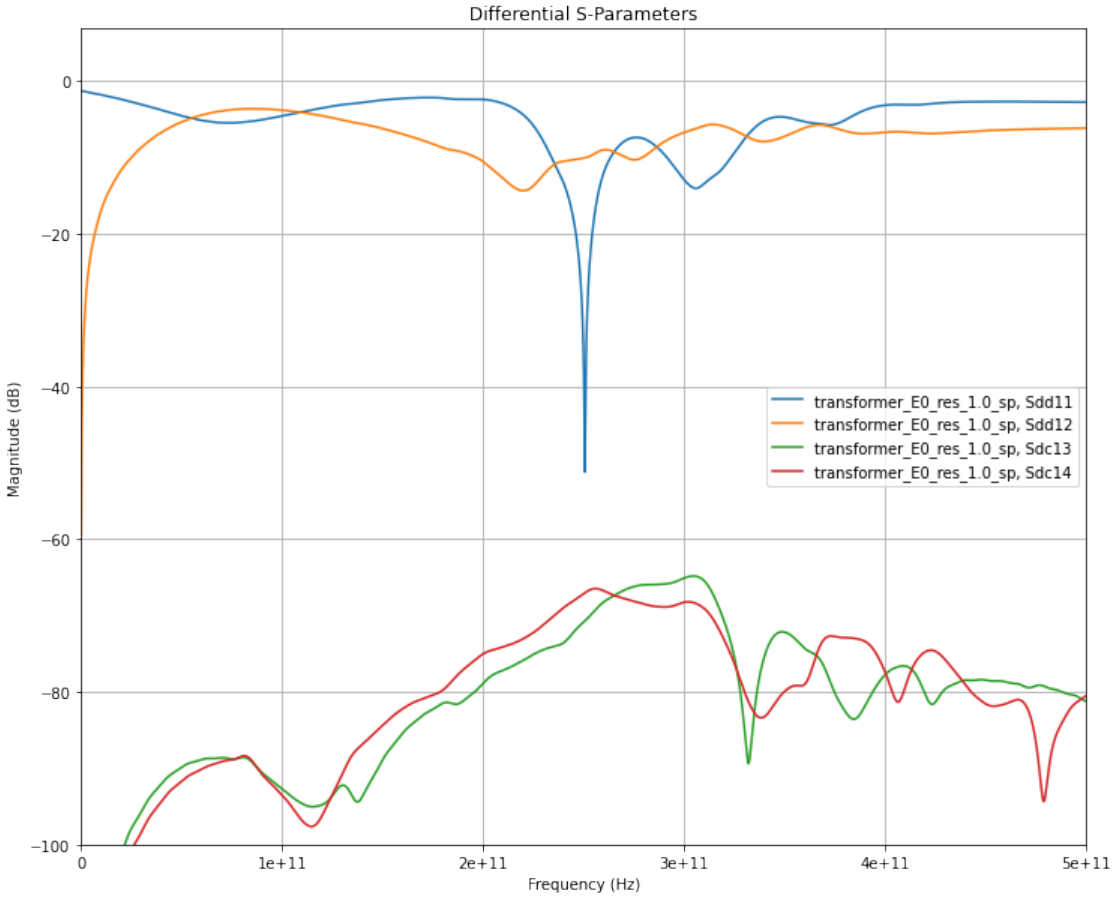


[6]:
```
dnet = calculate_diff_sparams(net)
print(dnet)
```

```
4-Port Network: 'transformer_E0_res_1.0_sp',  0.0-500000000000.0 Hz, 20000 pts,
z0=[100.+0.j 100.+0.j  25.+0.j  25.+0.j]
```

[7]:
```
dnet.plot_s_db(m=0)
plt.grid()
```

```
plt.ylim(bottom=-100)
plt.title("Differential S-Parameters")
plt.show()
```



3 Transformer E2

- ratio = 1:2

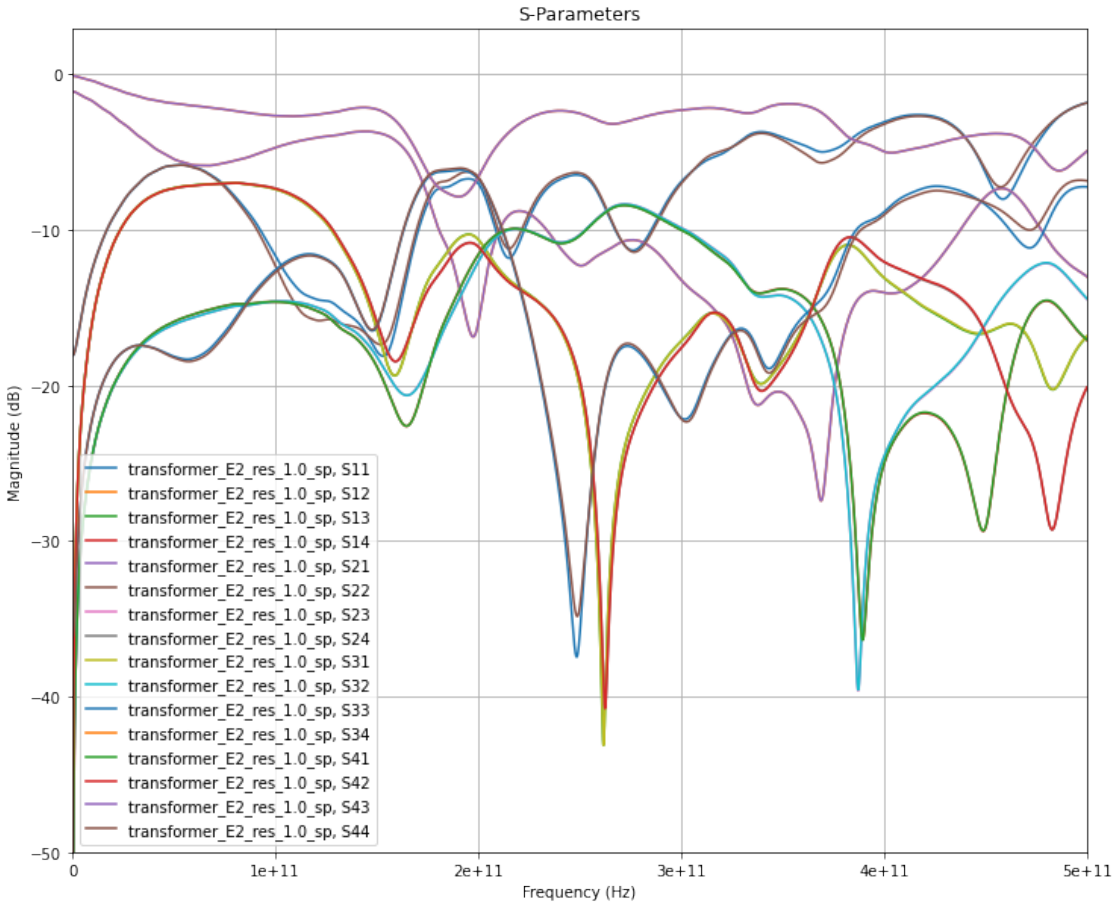
[8]:
```
net = skrf.Network("transformer_E2_res_1.0_sp.s4p")
```

[9]:
```
print(net)
```

```
4-Port Network: 'transformer_E2_res_1.0_sp',  0.0-500000000000.0 Hz, 20000 pts,
z0=[50.+0.j 50.+0.j 50.+0.j 50.+0.j]
```

[10]:
```
net.plot_s_db()
plt.grid()
plt.ylim(bottom=-50)
plt.title("S-Parameters")
```

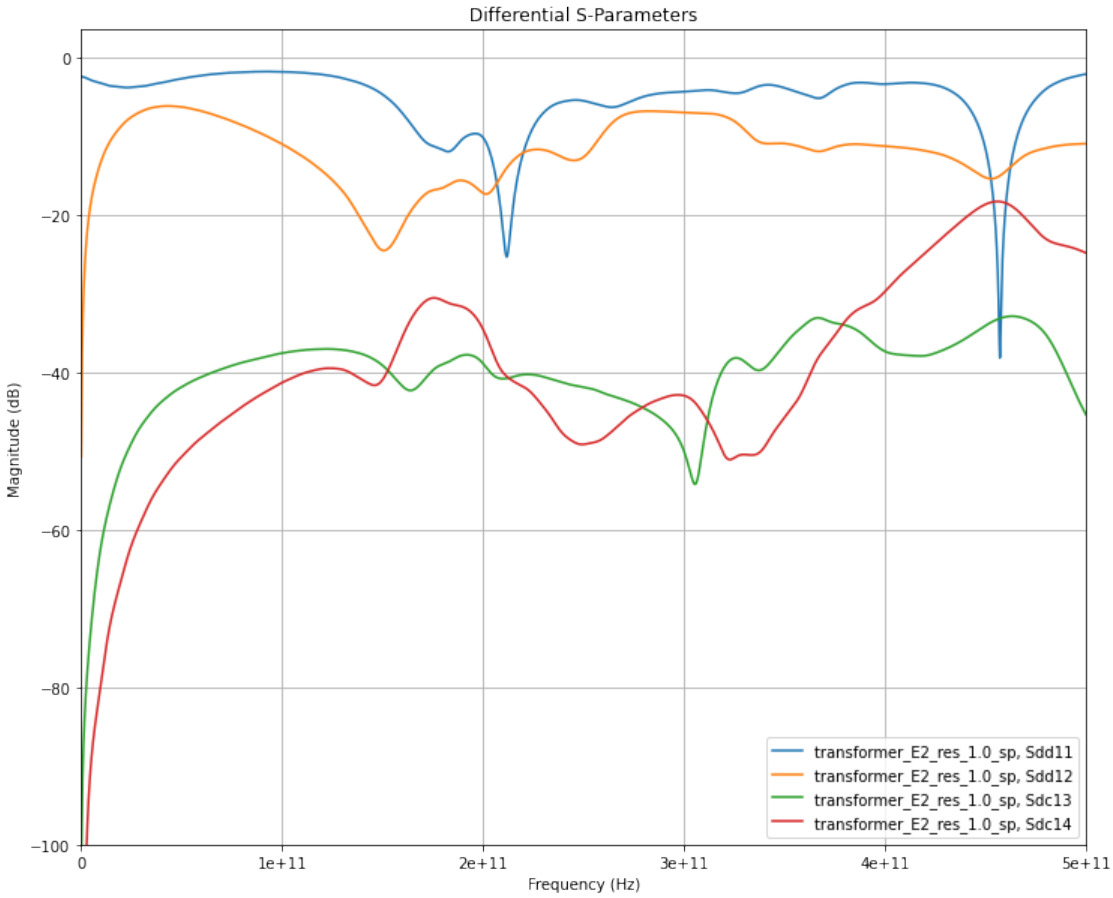
```
plt.show()
```



[11]:
```
dnet = calculate_diff_sparams(net)
print(dnet)
```

```
4-Port Network: 'transformer_E2_res_1.0_sp',  0.0-500000000000.0 Hz, 20000 pts,
z0=[100.+0.j 100.+0.j  25.+0.j  25.+0.j]
```

[12]:
```
dnet.plot_s_db(m=0)
plt.grid()
plt.ylim(bottom=-100)
plt.title("Differential S-Parameters")
plt.show()
```



4 Transformer E4

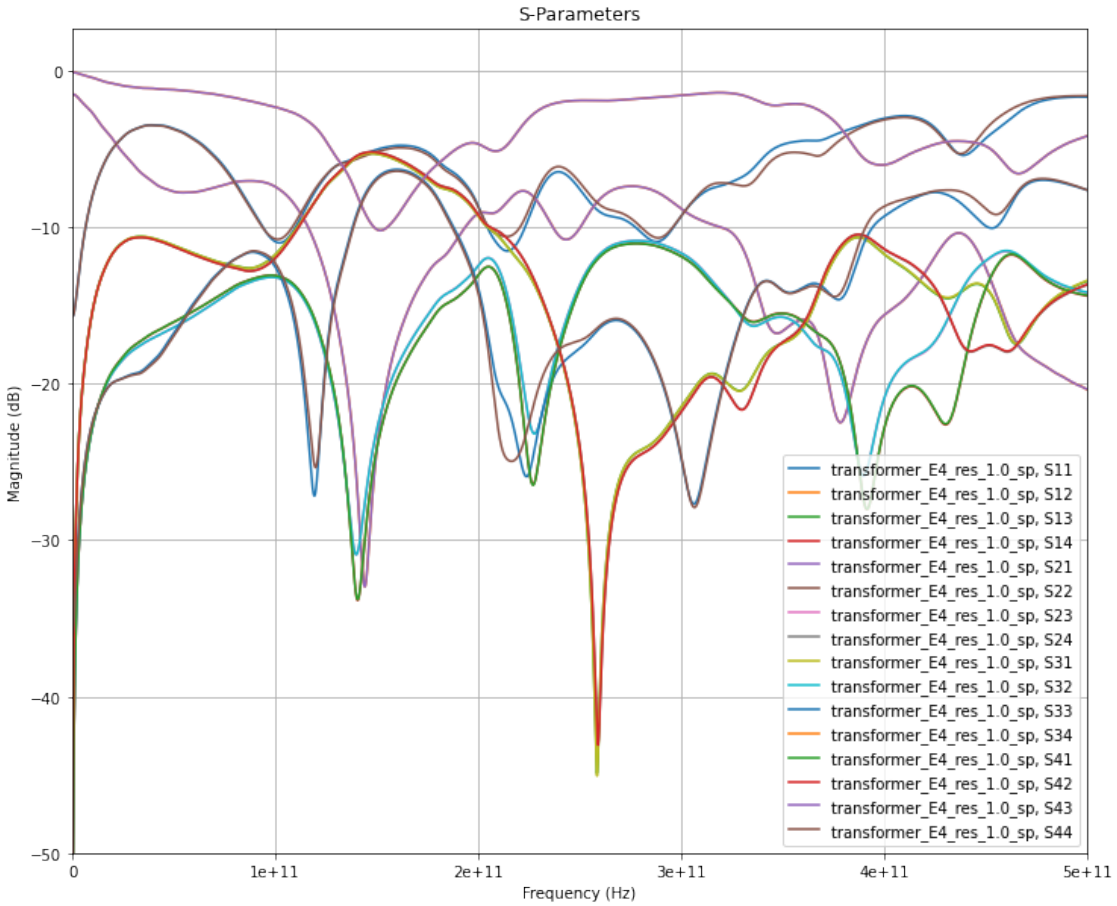
- ratio = 1:3

[13]:
```
net = skrf.Network("transformer_E4_res_1.0_sp.s4p")
```

[14]:
```
print(net)
```

```
4-Port Network: 'transformer_E4_res_1.0_sp',  0.0-500000000000.0 Hz, 20000 pts,
z0=[50.+0.j 50.+0.j 50.+0.j 50.+0.j]
```

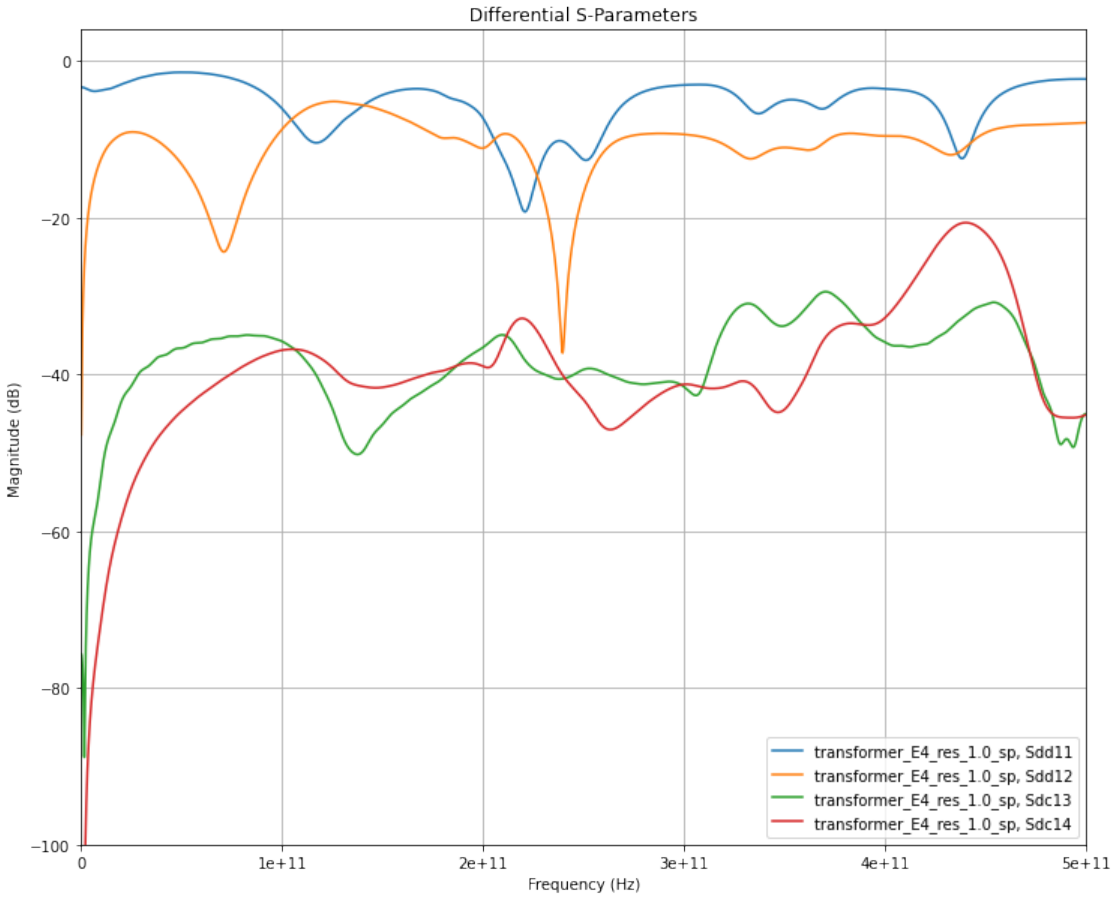
[15]:
```
net.plot_s_db()
plt.grid()
plt.ylim(bottom=-50)
plt.title("S-Parameters")
plt.show()
```



[16]:
```
dnet = calculate_diff_sparams(net)
print(dnet)
```

```
4-Port Network: 'transformer_E4_res_1.0_sp',  0.0-500000000000.0 Hz, 20000 pts,
z0=[100.+0.j 100.+0.j  25.+0.j  25.+0.j]
```

[17]:
```
dnet.plot_s_db(m=0)
plt.grid()
plt.ylim(bottom=-100)
plt.title("Differential S-Parameters")
plt.show()
```



5 Transformer E6

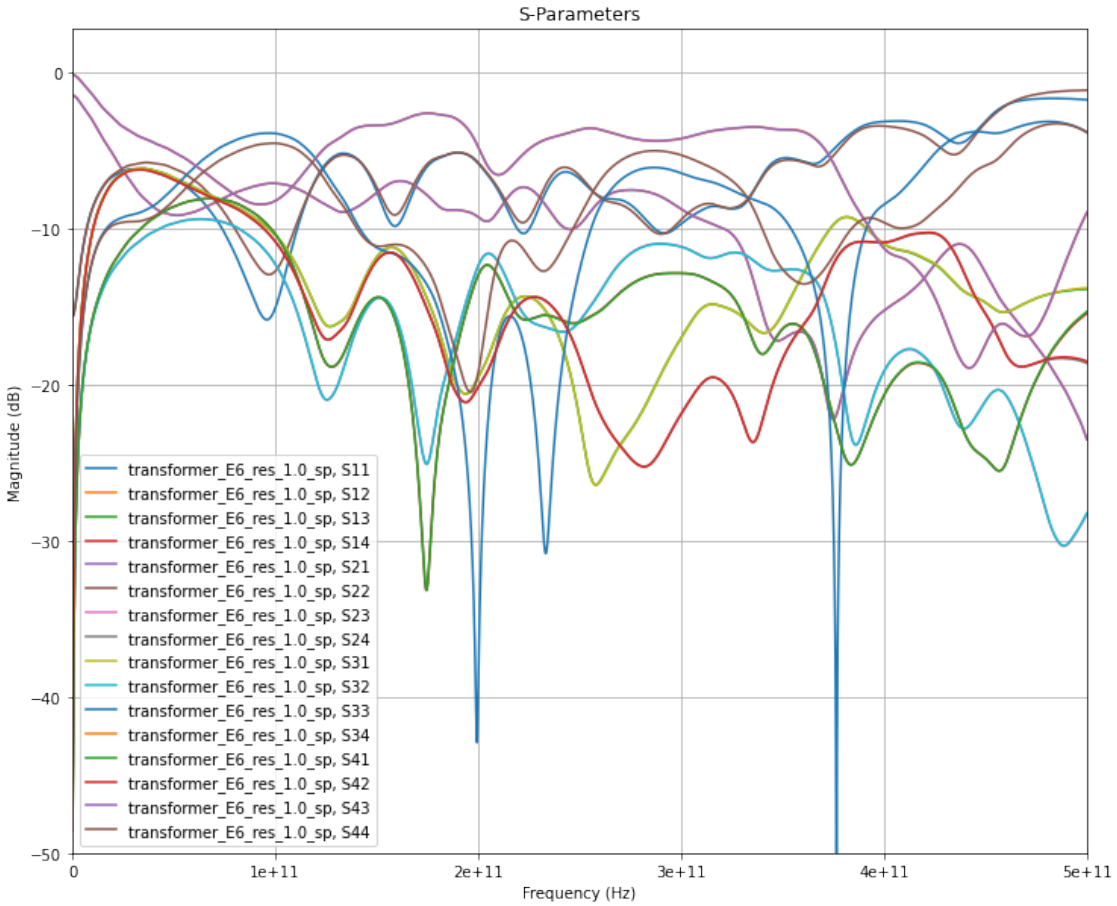
- ratio = 2:3

[18]:
```
net = skrf.Network("transformer_E6_res_1.0_sp.s4p")
```

[19]:
```
print(net)
```

```
4-Port Network: 'transformer_E6_res_1.0_sp',  0.0-500000000000.0 Hz, 20000 pts,
z0=[50.+0.j 50.+0.j 50.+0.j 50.+0.j]
```

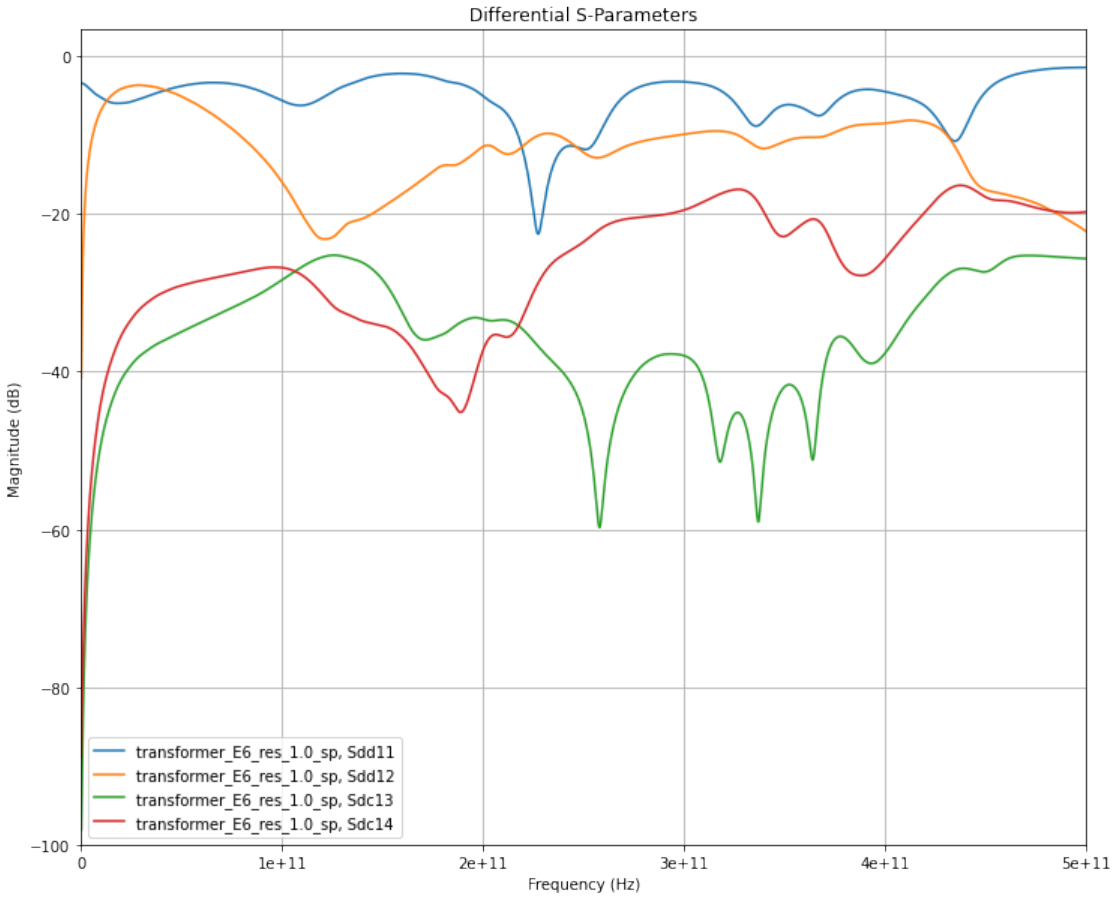
[20]:
```
net.plot_s_db()
plt.grid()
plt.ylim(bottom=-50)
plt.title("S-Parameters")
plt.show()
```



[21]:
```
dnet = calculate_diff_sparams(net)
print(dnet)
```

```
4-Port Network: 'transformer_E6_res_1.0_sp',  0.0-500000000000.0 Hz, 20000 pts,
z0=[100.+0.j 100.+0.j  25.+0.j  25.+0.j]
```

[22]:
```
dnet.plot_s_db(m=0)
plt.grid()
plt.ylim(bottom=-100)
plt.title("Differential S-Parameters")
plt.show()
```


Differential S-Parameters
0
−20
−40
−60
−80
−100
Magnitude (dB)
0
1e+11
2e+11
3e+11
4e+11
5e+11
Frequency (Hz)
transformer_E6_res_1.0_sp, Sdd11
transformer_E6_res_1.0_sp, Sdd12
transformer_E6_res_1.0_sp, Sdc13
transformer_E6_res_1.0_sp, Sdc14