

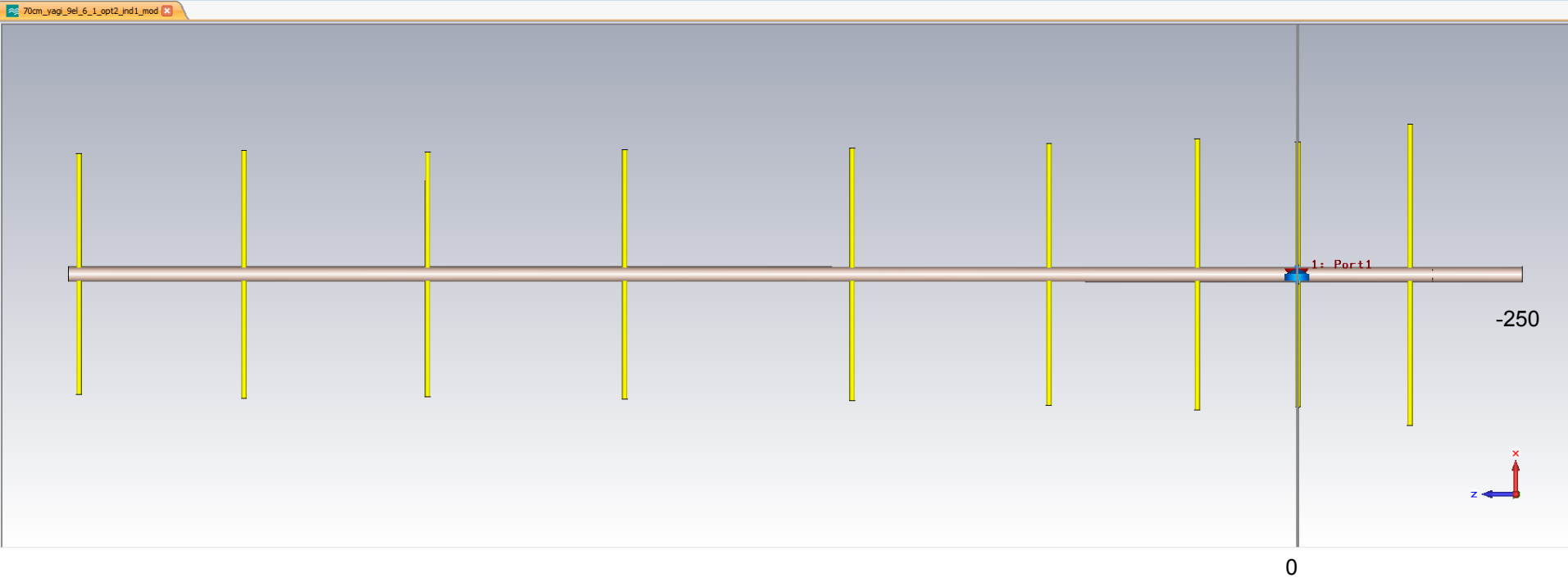
4 x 9 el Yagi for 432 MHz

SM6FHZ

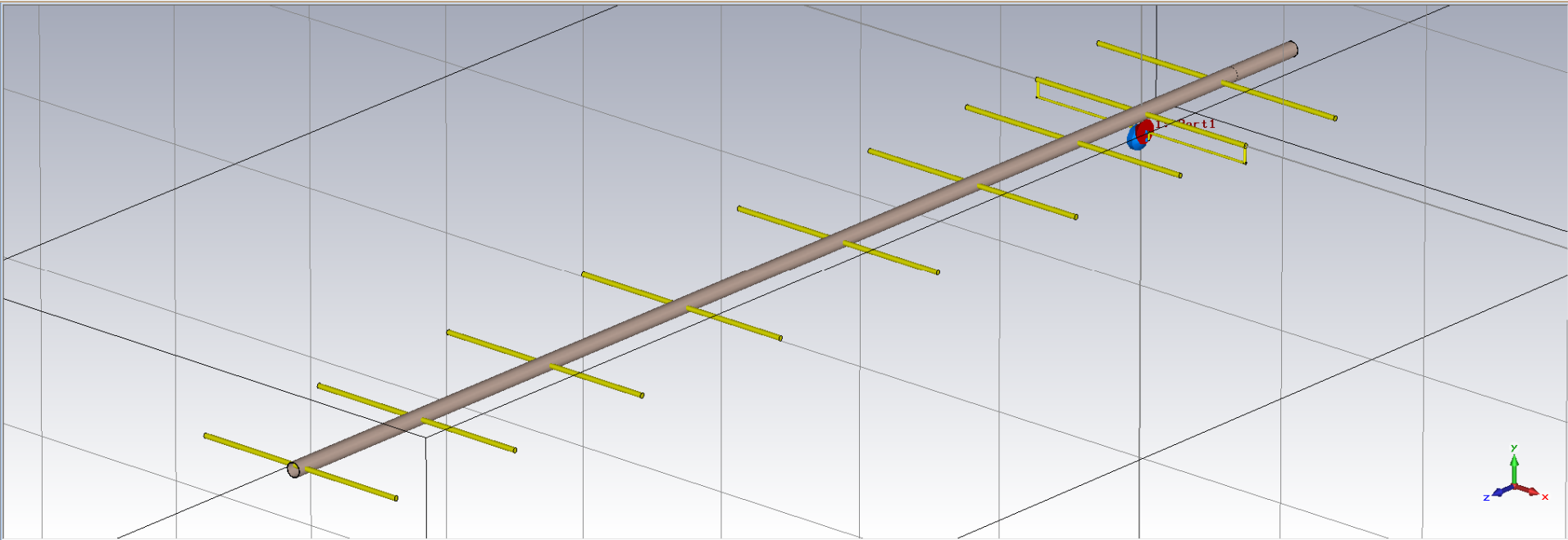
# Background

- Needed a compact, light weight antenna for 432 MHz.
- Specification
  - No metal boom
  - Back mounted
  - Possible to feed with a open ladder feed network i.e. 200 ohm feeding impedance
  - Low noise i.e. low side lobe and back lobe levels
- Using readily available materials

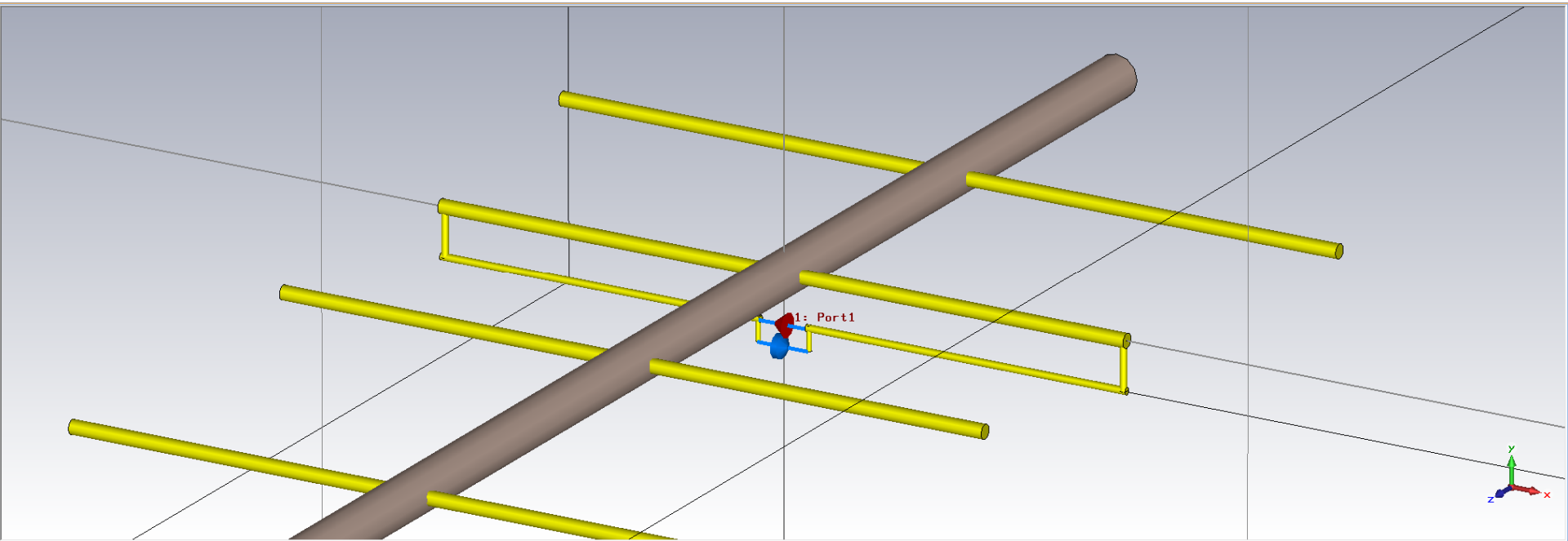
# Model, bottom view



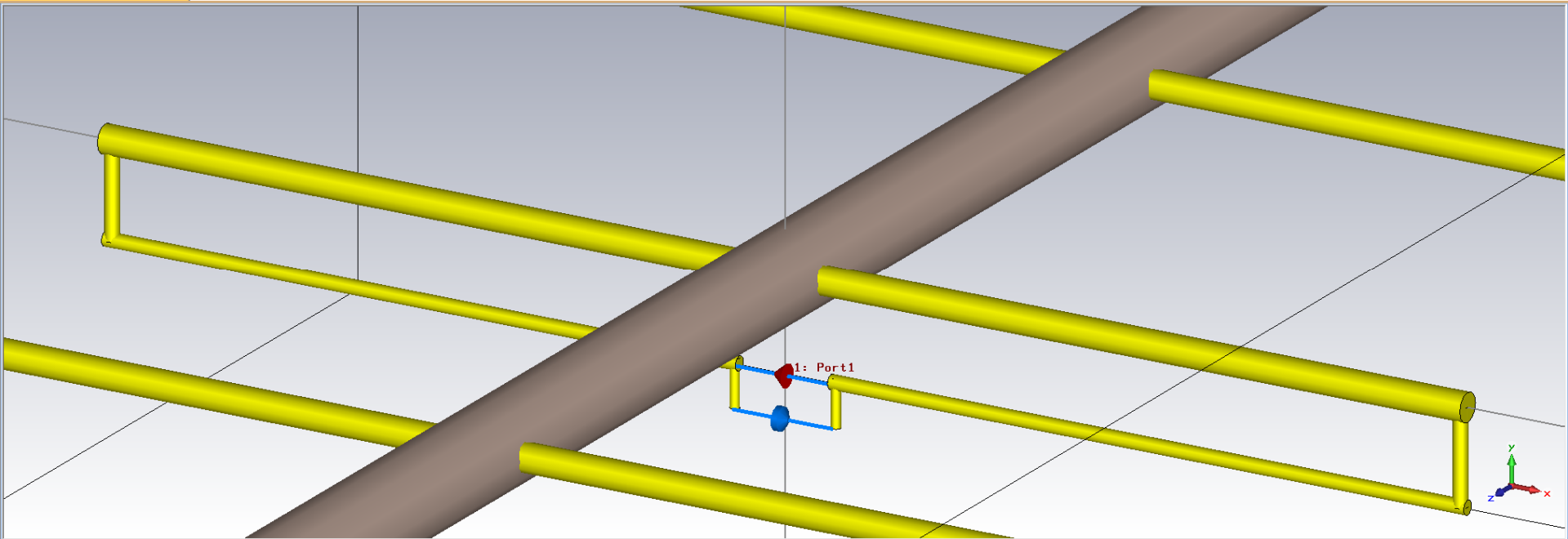
# Model



# Model, close in on feeding



# Model, close in on feeding



# Comments

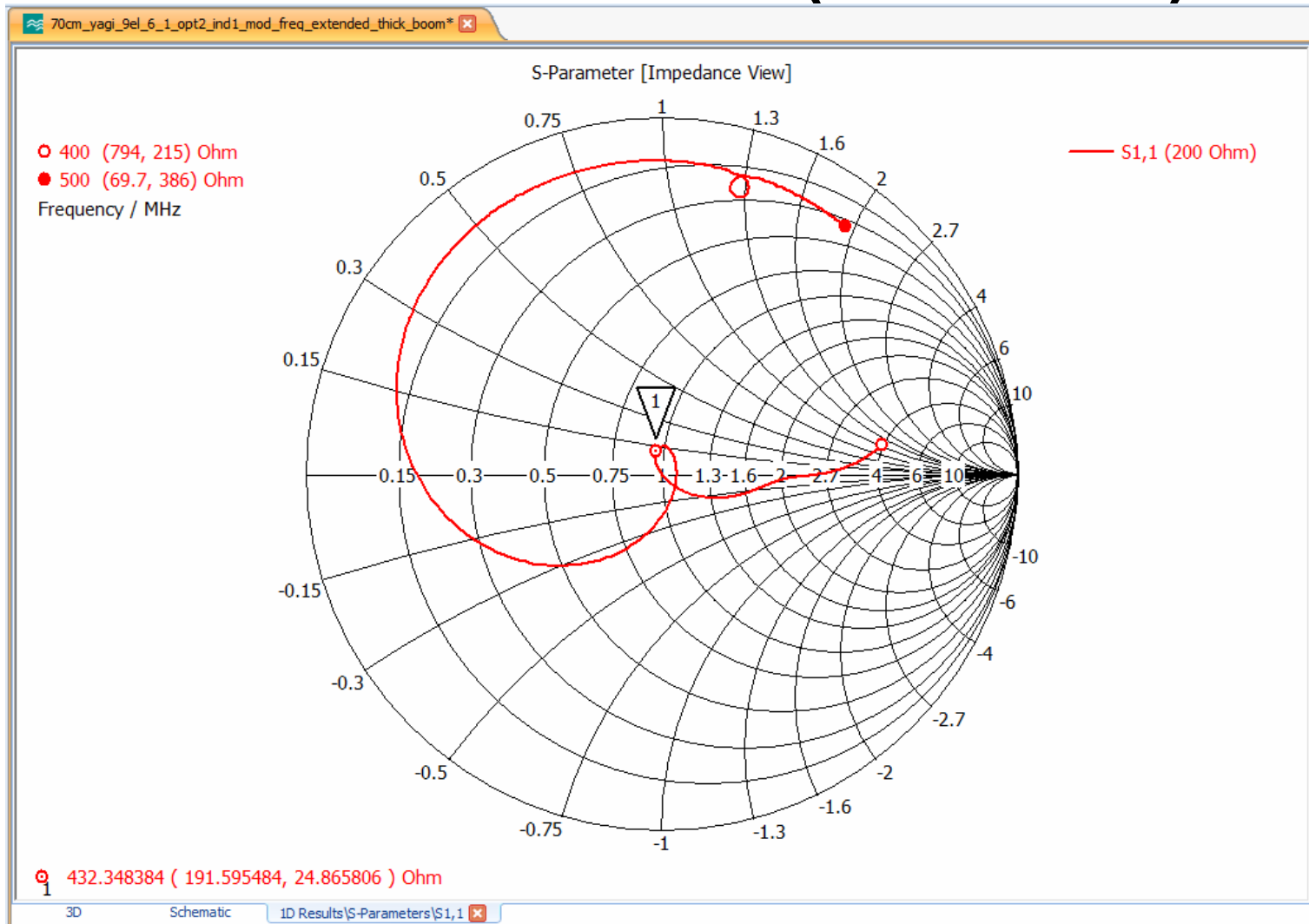
- 20/15 mm fiberglass boom
- Stacking distance 850 mm in E-plane and 880 mm in H-plane
- Matching done by a lumped inductance (100/120 nH) across the feeding point at the dipole. 6 turns, 1.2 mm copper wire, 7 mm inner diameter, 20 mm long, tune inductance by bending coil for best return loss.

# Element dimensions

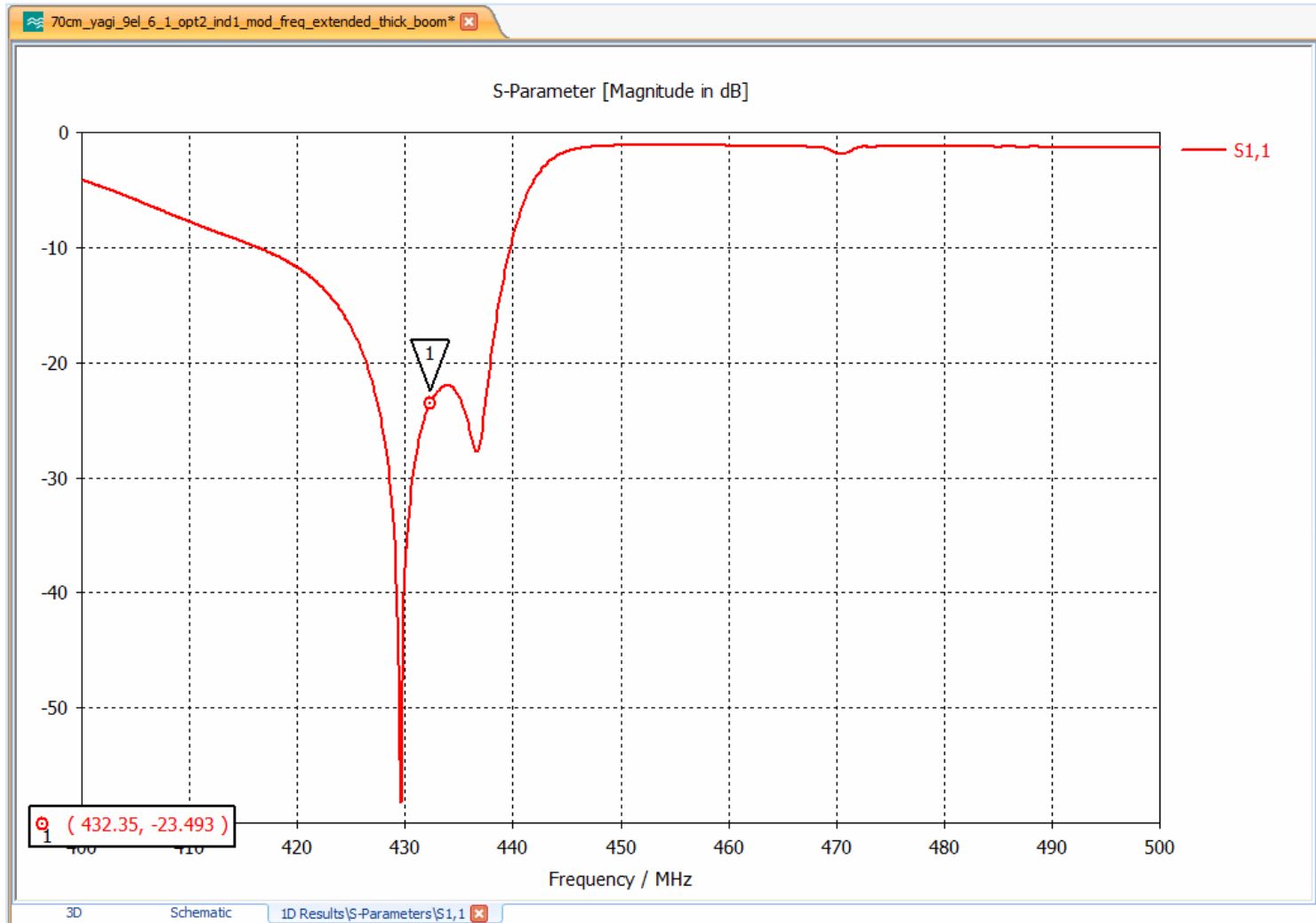
Parameter List		
Name	Value	Description
Dipole_left	-148	Dipole left end
Dipole_right	148	Dipole right end
Dir1_len	151.3	Director1 length/2
Dir1_pos	112	Director1 position
Dir2_len	146	Director2 length/2
Dir2_pos	277.2	Director2 position
Dir3_len	140.8	Director3 length/2
Dir3_pos	496.6	Director3 position
Dir4_len	139.2	Director4 length/2
Dir4_pos	750	Director4 position
Dir5_len	136.7	Director5 length/2
Dir5_pos	969.7	Director5 position
Dir6_len	138.3	Director6 length/2
Dir6_pos	1174.4	Director6 position
Dir7_len	134.5	Director7 length/2
Dir7_pos	1358.4	Director7 position
El_rad	3	Element radius
Refl_len	168	Reflector length/2
Refl_pos	-124.9	Reflector position
StubC_len	1	Matching capacitive Stub length
Stub_len	10	Matching Stub length



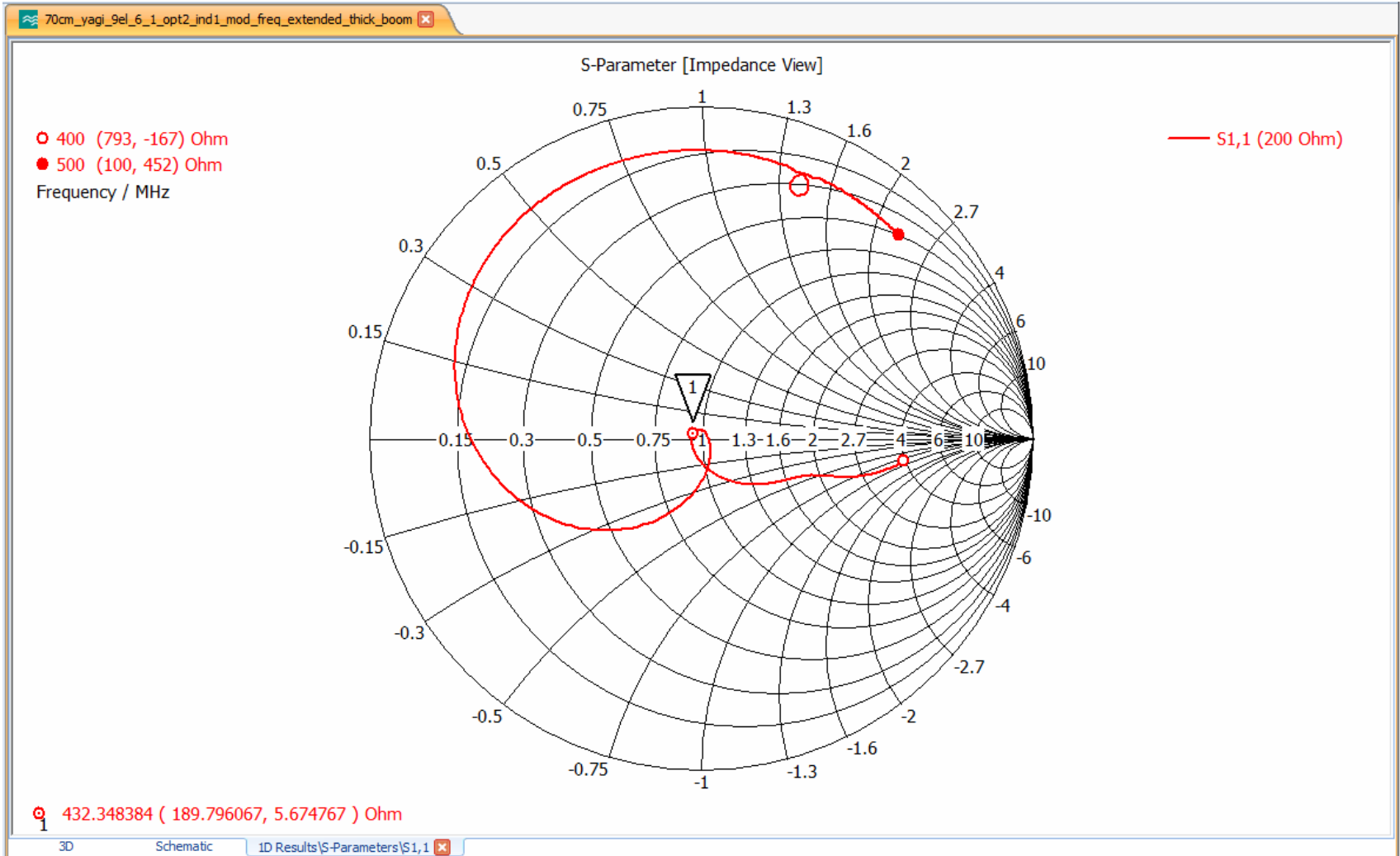
# Simulated S11 (100 nH)



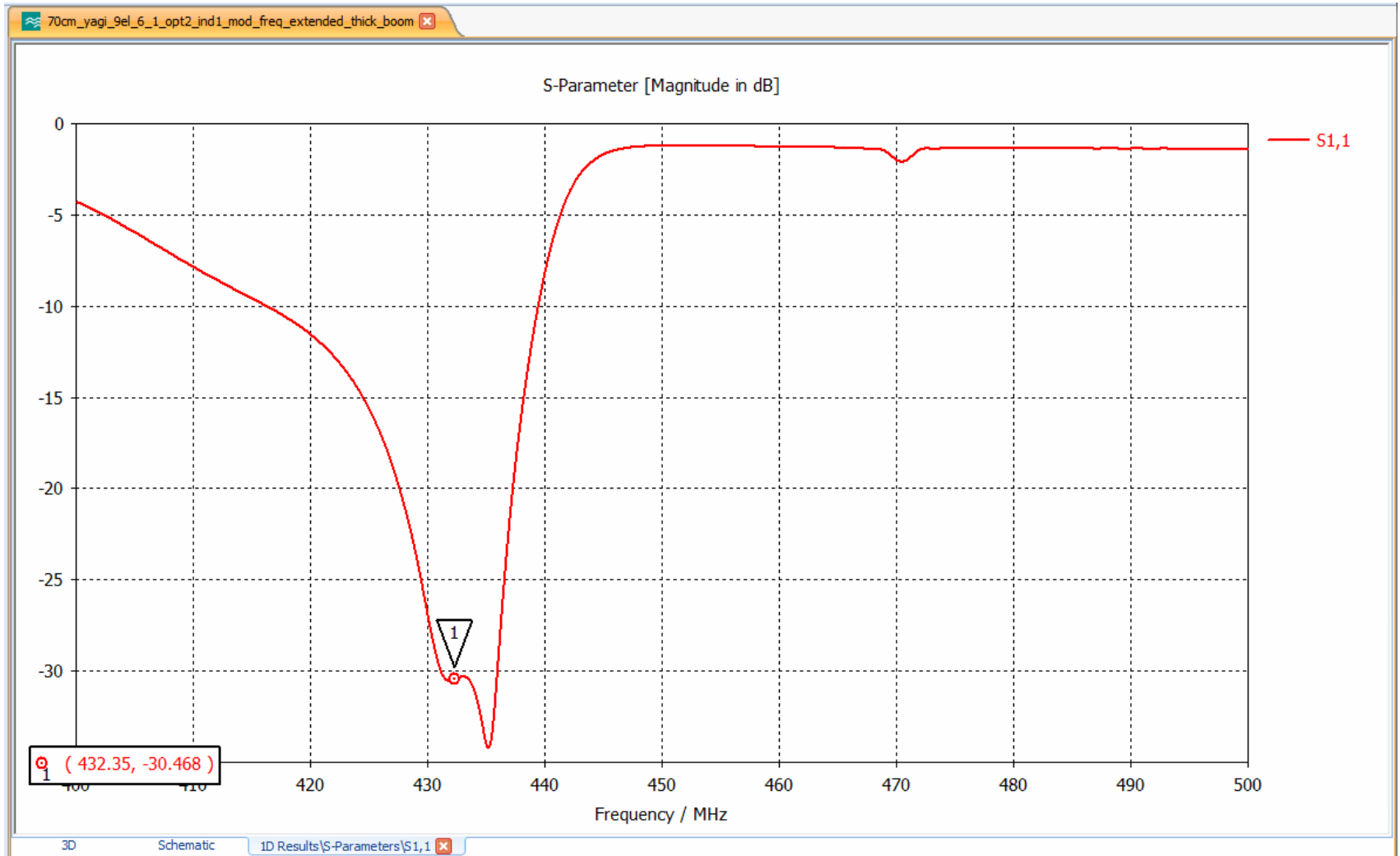
# Simulated S11 (100 nH)



# Simulated S11 (120 nH)



# Simulated S11 (120 nH)



# Inductor dimensions

**Air Core Inductor**

Dimensional units:  mm  mils

ID (inner diameter) =	6
AWG (magnet wire gauge) =	12
N (number of turns) =	6

Calculate

L (Inductance - no leads, nH) =	144.15
D (wire diameter) =	2.05
d (inductor diameter) =	8.05
Len (Inductor Length) =	12.32
WI (Wire Length - no leads) =	164.10
Rdc (DC Resistance, copper, no leads, mOhm) =	0.85

$$L = \frac{d^2 N^2}{0.4572 \cdot d + 1.016 \cdot Len} \quad (\text{mm to nH})$$

$$d = ID + D \quad D = 0.127 \cdot 92^{\frac{36-AWG}{39}}$$

$$Len = D \cdot N \quad (\text{AWG to mm})$$

**Calculator Group:** Discrete Inductance

**Air Core Inductor**

Dimensional units:  mm  mils

ID (inner diameter) =	7
AWG (magnet wire gauge) =	16
N (number of turns) =	4

Calculate

L (Inductance - no leads, nH) =	121.71
D (wire diameter) =	1.29
d (inductor diameter) =	8.29
Len (Inductor Length) =	5.16
WI (Wire Length - no leads) =	109.35
Rdc (DC Resistance, copper, no leads, mOhm) =	1.44

$$L = \frac{d^2 N^2}{0.4572 \cdot d + 1.016 \cdot Len} \quad (\text{mm to nH})$$

$$d = ID + D \quad D = 0.127 \cdot 92^{\frac{36-AWG}{39}}$$

$$Len = D \cdot N \quad (\text{AWG to mm})$$

**Air Core Solenoid**

Dimensional units:  mm  mils

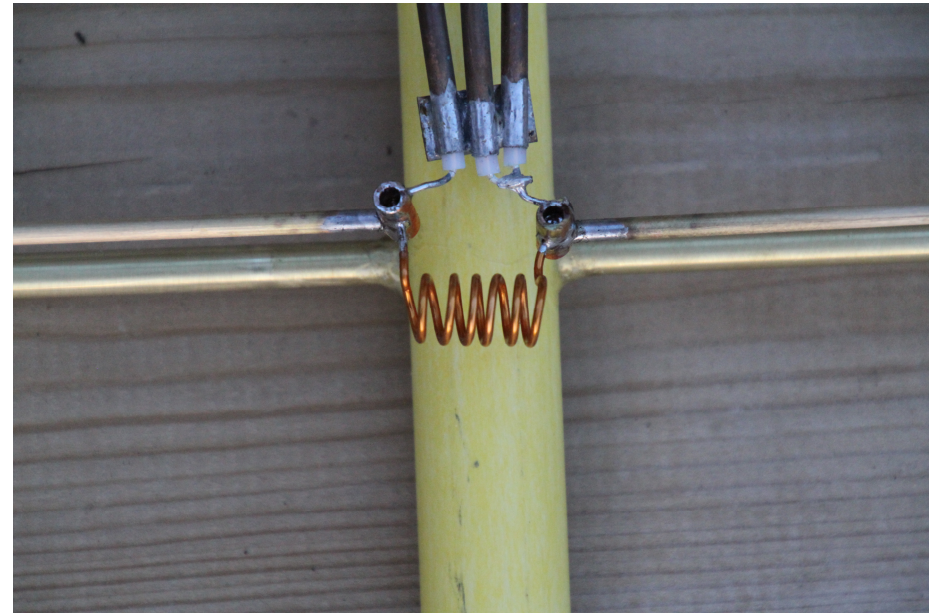
d (diameter) =	8.0
len (length) =	15.0
N (number of turns) =	6

Calculate

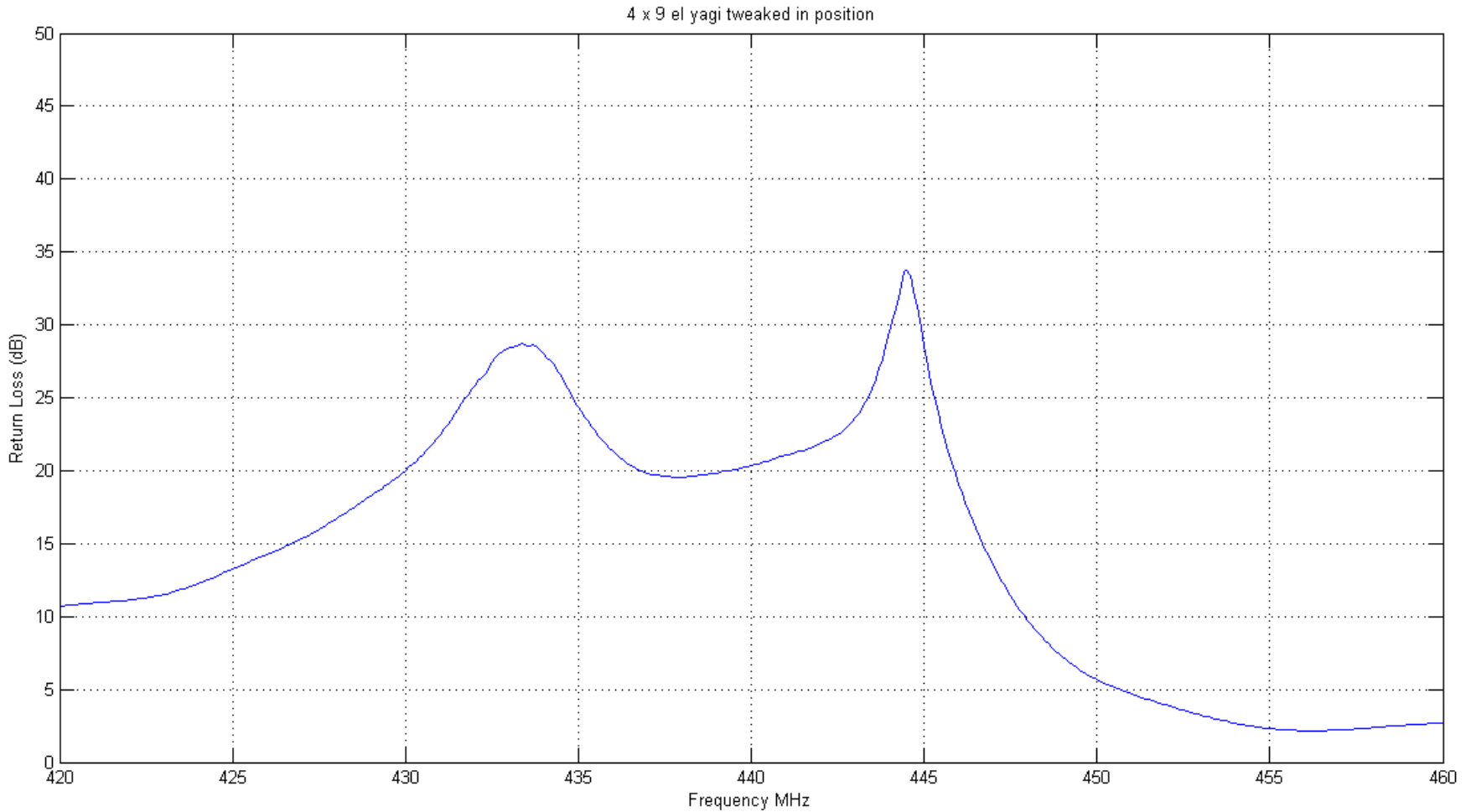
L (Inductance, nH) =	121.920
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$$L = \frac{d^2 N^2}{0.4572 \cdot d + 1.016 \cdot len}$$

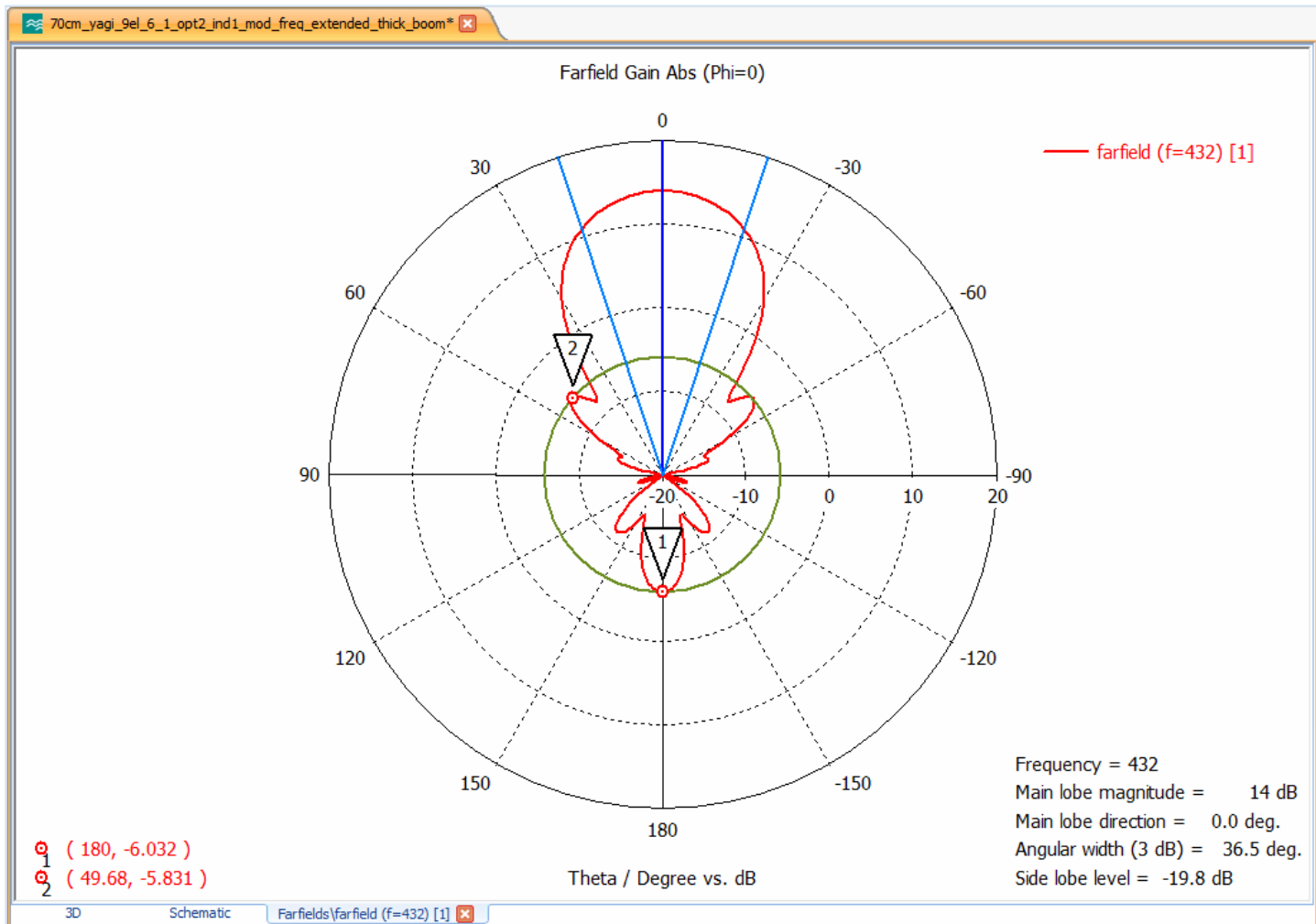
# 120 nH inductance



# Measured Return Loss for 4x9 el

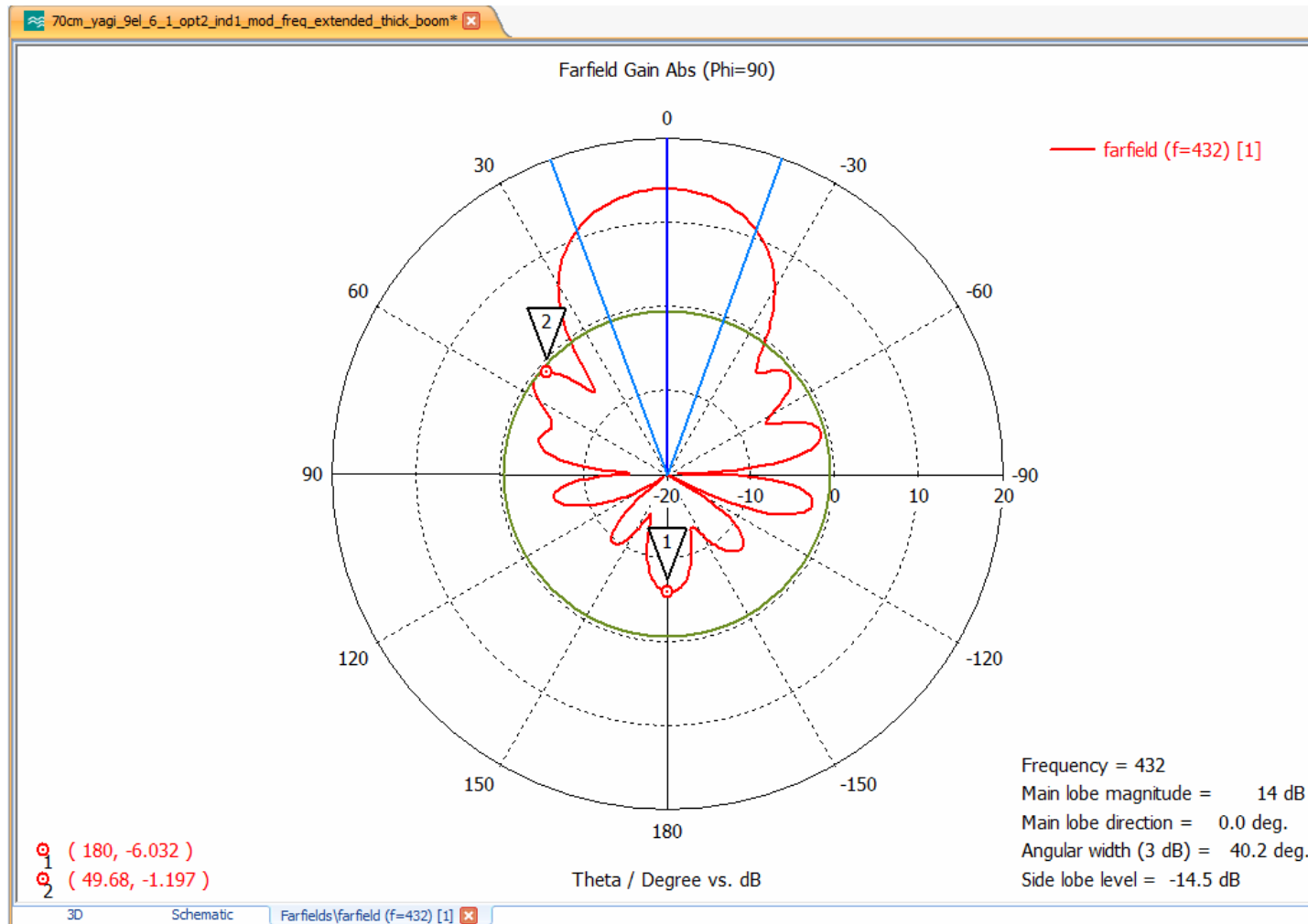


# Simulated E-plane pattern 9 element 432 MHz

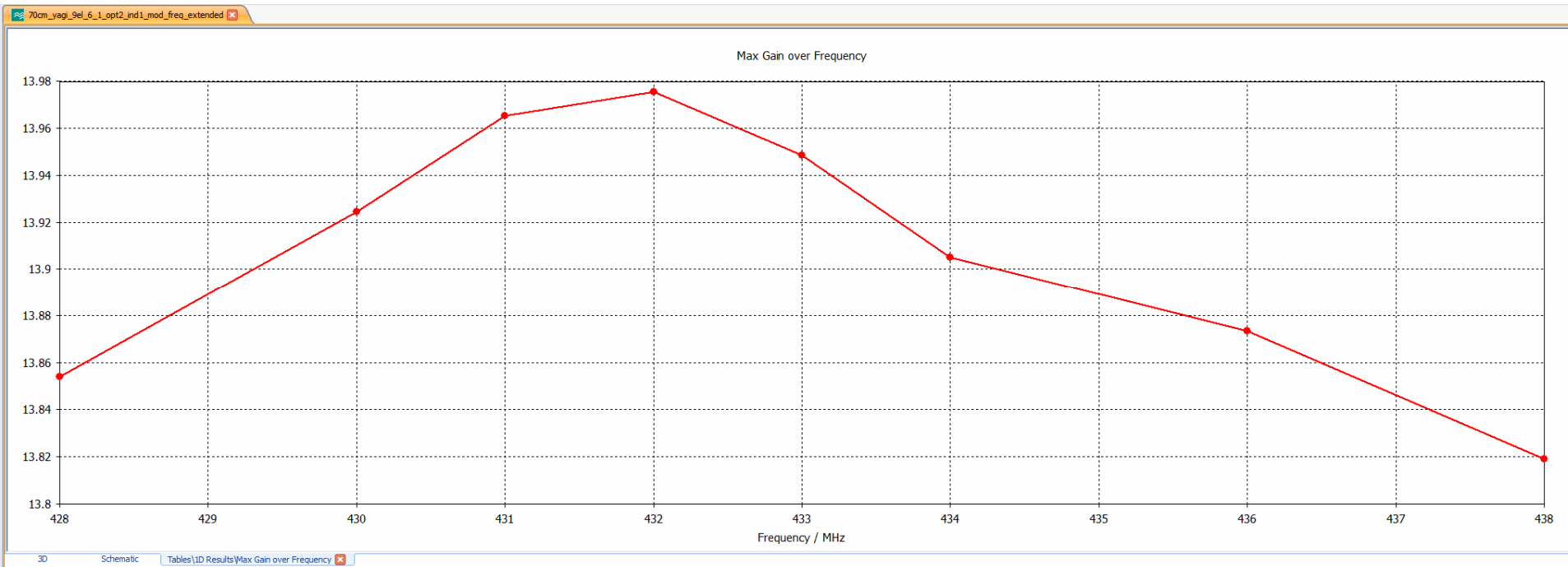




# Simulated H-plane pattern 9 element 432 MHz



# Simulated Gain over frequency



# Mounting details

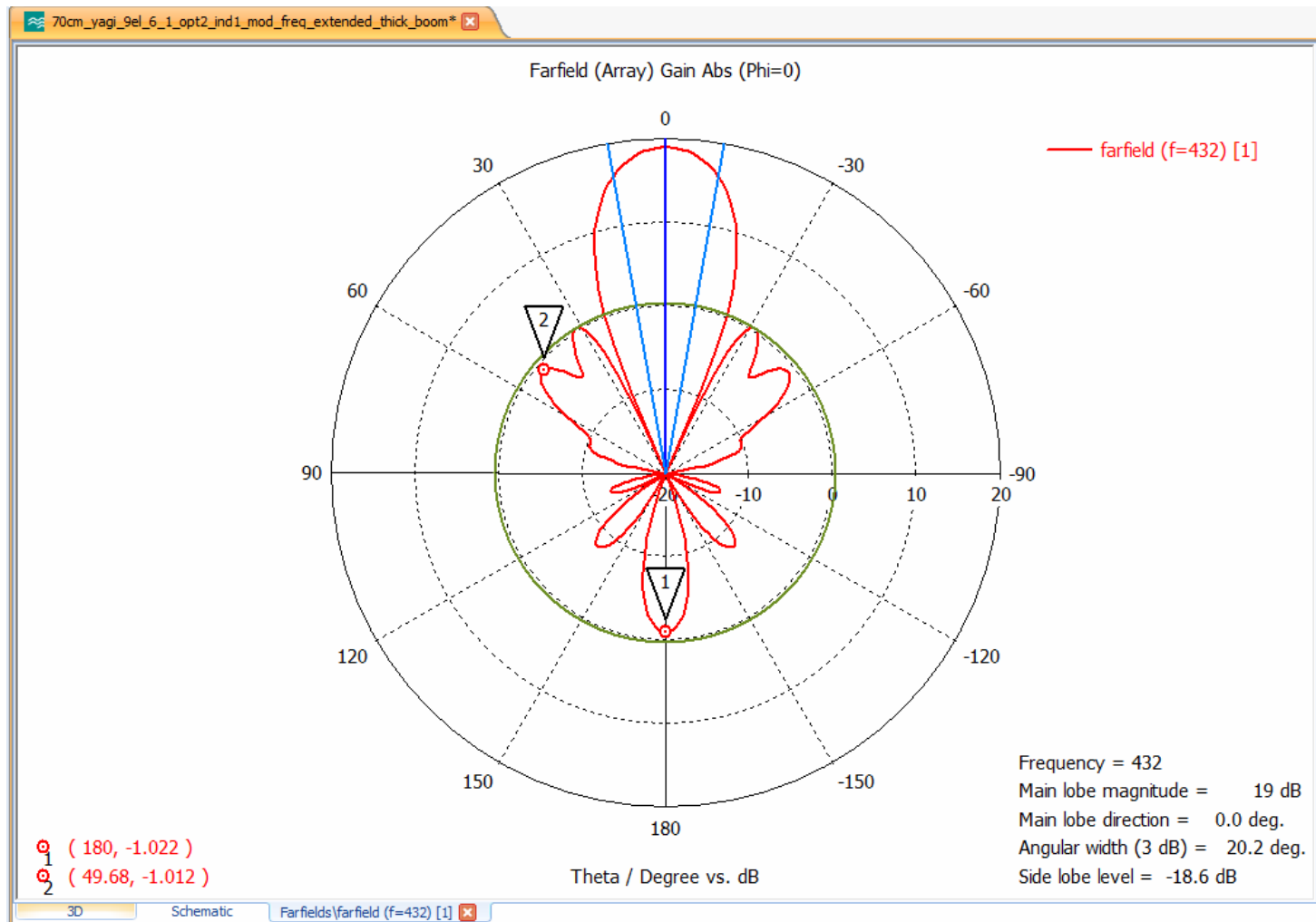


# Full array in situ



SM6FHZ 2016-07-31 Rev. PA5

# Simulated E-plane pattern for 4 x 9 element at 850 (E-plane) x 880 (H-plane) mm



# Simulated H-plane pattern for 4 x 9 element at 850 (E-plane) x 880 (H-plane) mm

