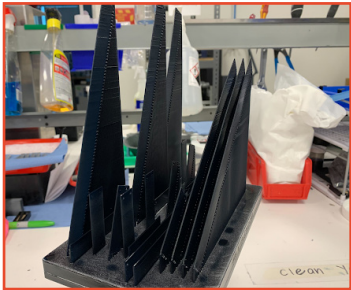


# INSERTION LOSS OF 3D PRINTED METALLIZED MICROSTRIPS ON 30MIL SUBSTRATES

## EXPERIMENT

- Designed microstrip geometries on 30MIL substrates, at 2" and 8" lengths.
- Printed pairs of substrates on Fortify FLUX CORE printer using Rogers Radix™ low-loss dielectric
  - Dk = 2.8, Df = 0.0043 @ 10GHz
  - Pairs printed in different orientations to induce different surface roughnesses



- › Signal side flat to build plate
- › Signal side flat to film
- › Signal side perpendicular to build plate, plus combinations of device tilt in z-axis
  - › 0°, 30°, 40°, 70°, 90°

## MEASUREMENT

- Measured surface roughness of printed parts on Keyence One-Shot 3D VR Laser Profilometer

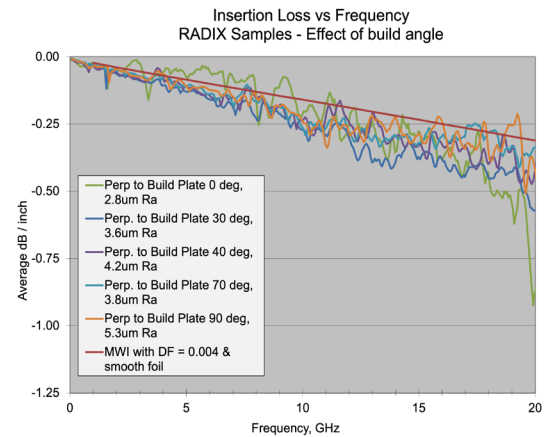
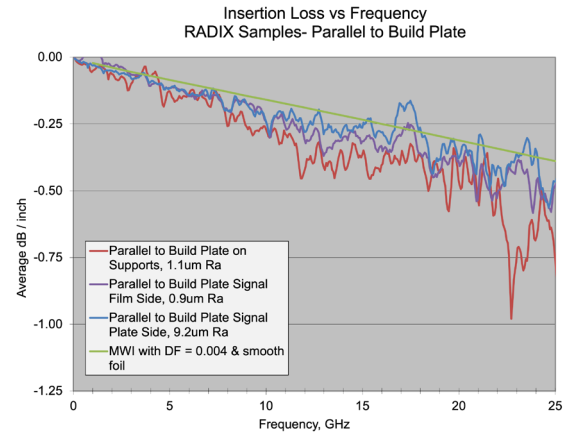
Parallel		
Offset on supports	Signal to Plate	Signal to Film
1.1um Ra	9.2um Ra	0.9um Ra

Perpendicular				
0°	30°	40°	70°	90°
2.8um Ra	3.6um Ra	4.2um Ra	3.8um Ra	5.3um Ra

- Patterned signal and ground planes with ½ oz copper
- Measured insertion loss of devices using Intercontinental Microwave W7000 fixture driven by N5230C PNA-L network analyzer from Keysight
  - Swept from 50MHz to 20GHz



- Insertion loss results of 2" sample sweep subtracted (in dB) from results of 8" sample sweep to normalize for fixture effects, then divided by delta length to find insertion loss per inch.



## FINDINGS

- Roughness from different print orientations ranges from 0.9um Ra to 9.2um Ra
- Insertion loss across all variations ranges from 0.21 to 0.29 dB/inch
- Insertion loss range is much tighter than expected given surface roughness range. This is due to periodicity of roughness from Fortify processing being large.