

What is Our Project?

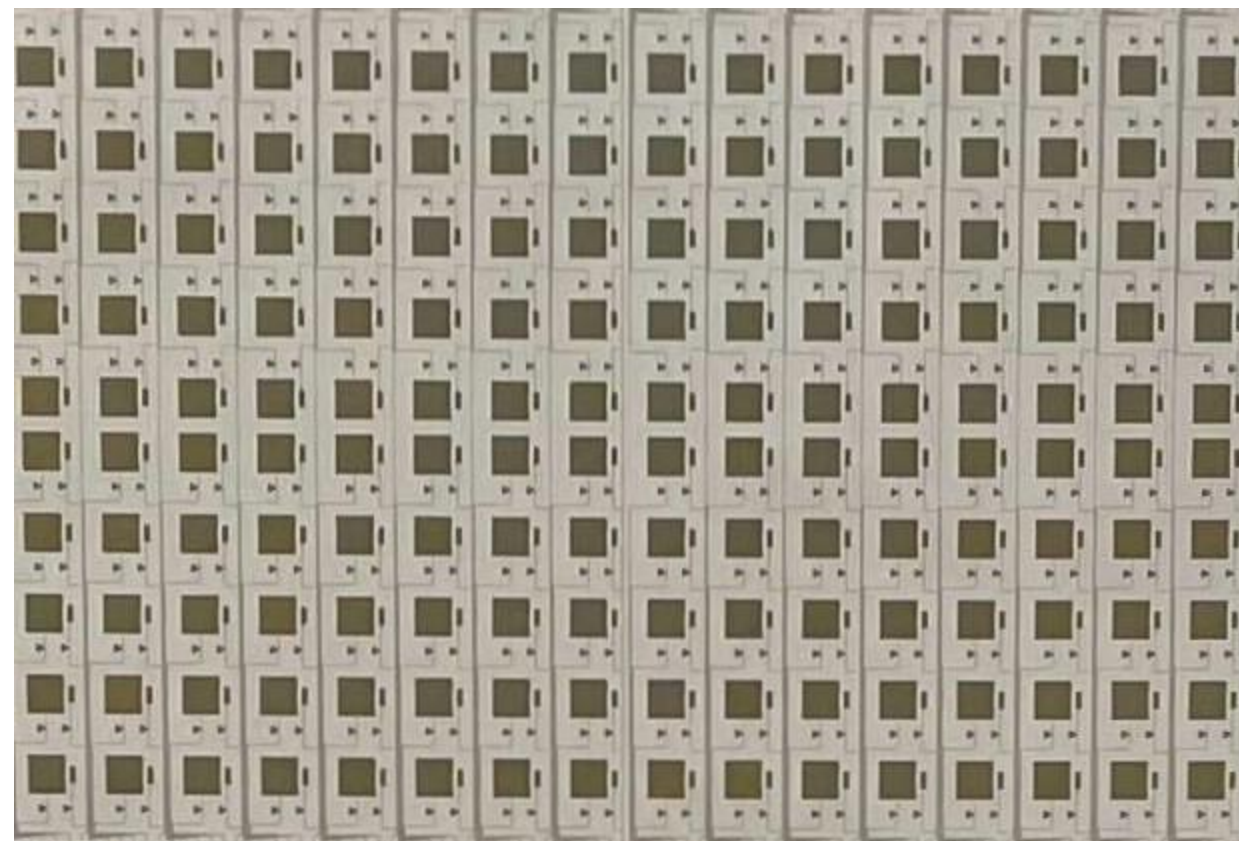


Image Credits: Aditya Shekhawat, Terahertz Research Lab, ASU

To take the current sub-6 GHz PM and redesign it to improve the following:

- Beam switching speed of PM
- Radiating element performance

Current design has a switching speed of 5 kHz. We aim to get that speed above 1 MHz.

What are PMs?



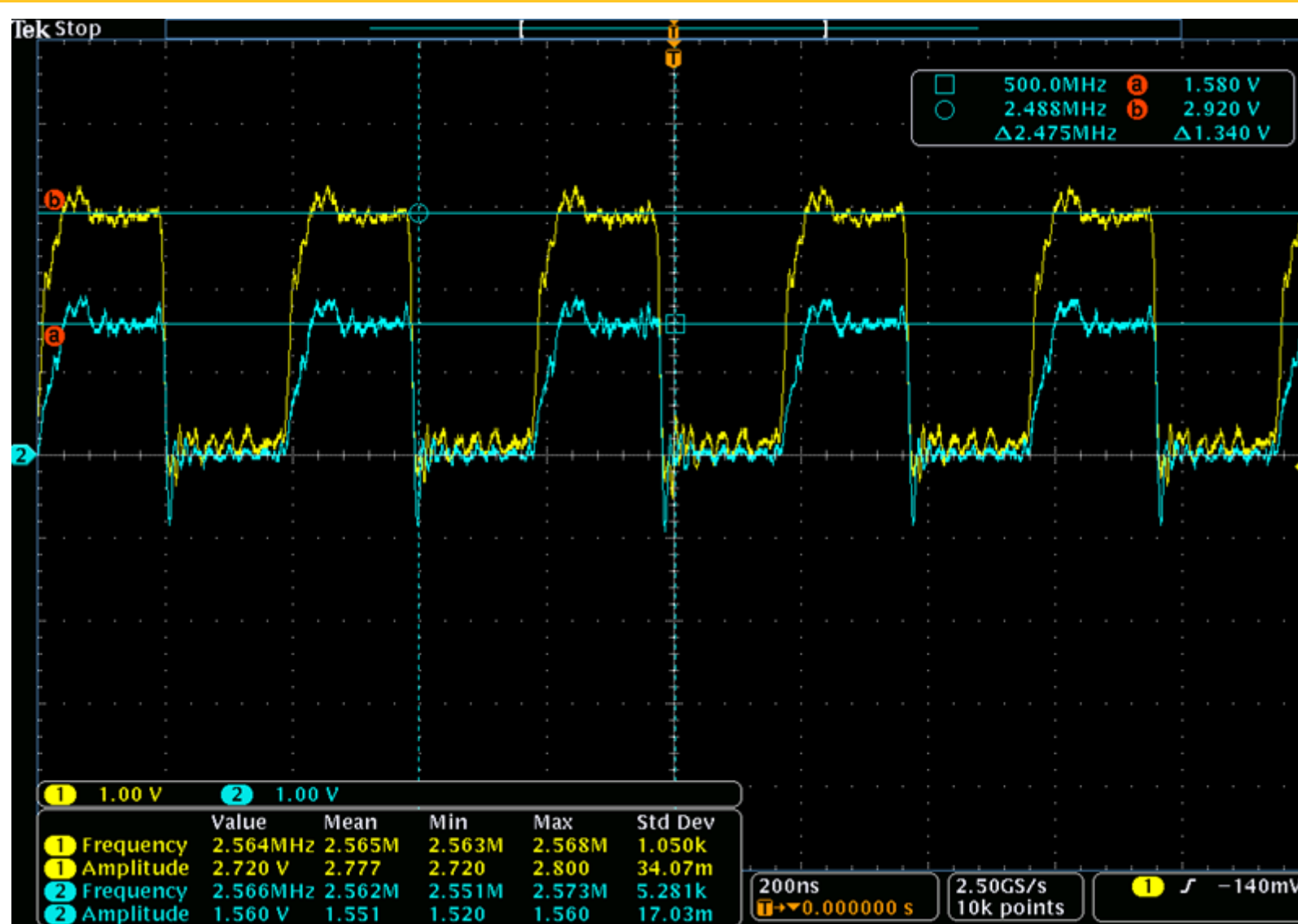
Image Credits: Terahertz Research Lab, ASU

PMs are low power arrays that reflect electromagnetic waves from their surface in different, pre-determined directions. They are especially powerful because they can reflect at an angle different from the angle of incidence.

PMs accomplish this by adjusting the phase of the waves reflected from their many antenna-like elements.

A fast-switching speed directly correlates to increased data throughput when using these devices in communication and imaging architecture.

Our Progress



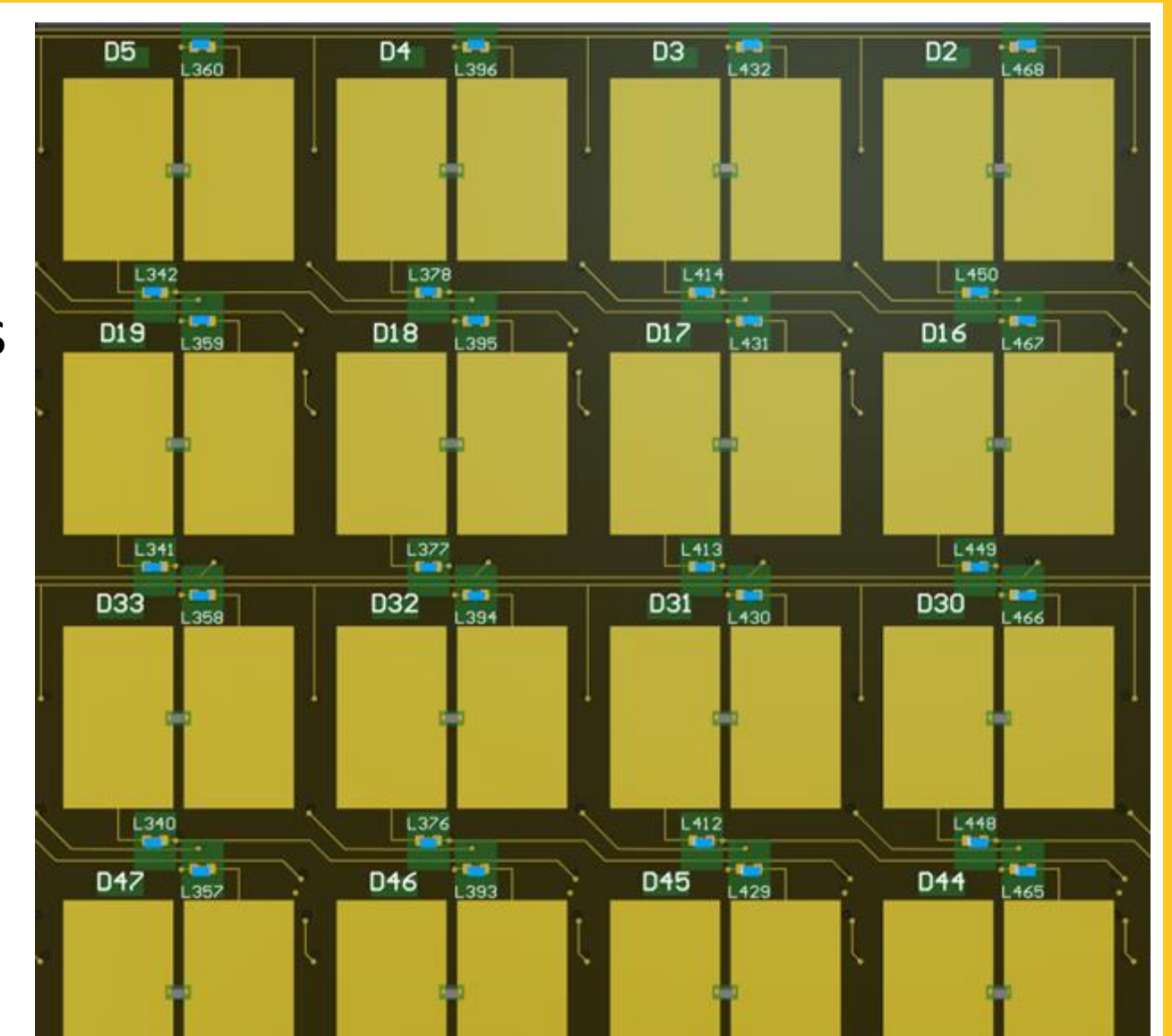
To measure the PM's switching speed, the test setup consists of 10 shift registers connected in series. The output of the last shift register is terminated in a PIN diode. The figure above depicts the voltage waveforms of the anode (yellow) and cathode (blue). These measurements represent one antenna element switching phase.

Based on the above, when testing 10 shift registers in series, we were able to achieve a switching speed of approximately 2.6 MHz, well above our goal of 1 MHz.

Our Design

New design component breakdown:

- 234 Radiating elements
- 234 Diodes
- 468 15 nH Inductors
- 234 0.1uF Capacitors
- 234 165 ohm Resistors
- 2 7-pin headers
- 126 Shift registers (SN74LS194A)



Depicted above is a snippet of our current design. On the back of this PM are 126 shift registers connected in 9 branches of 14 shift registers in series controlling their respective radiating elements.

This design has a new radiating element with two equally sized patches that increases bandwidth to 9.7%, up from 3.3% in the previous PM.