

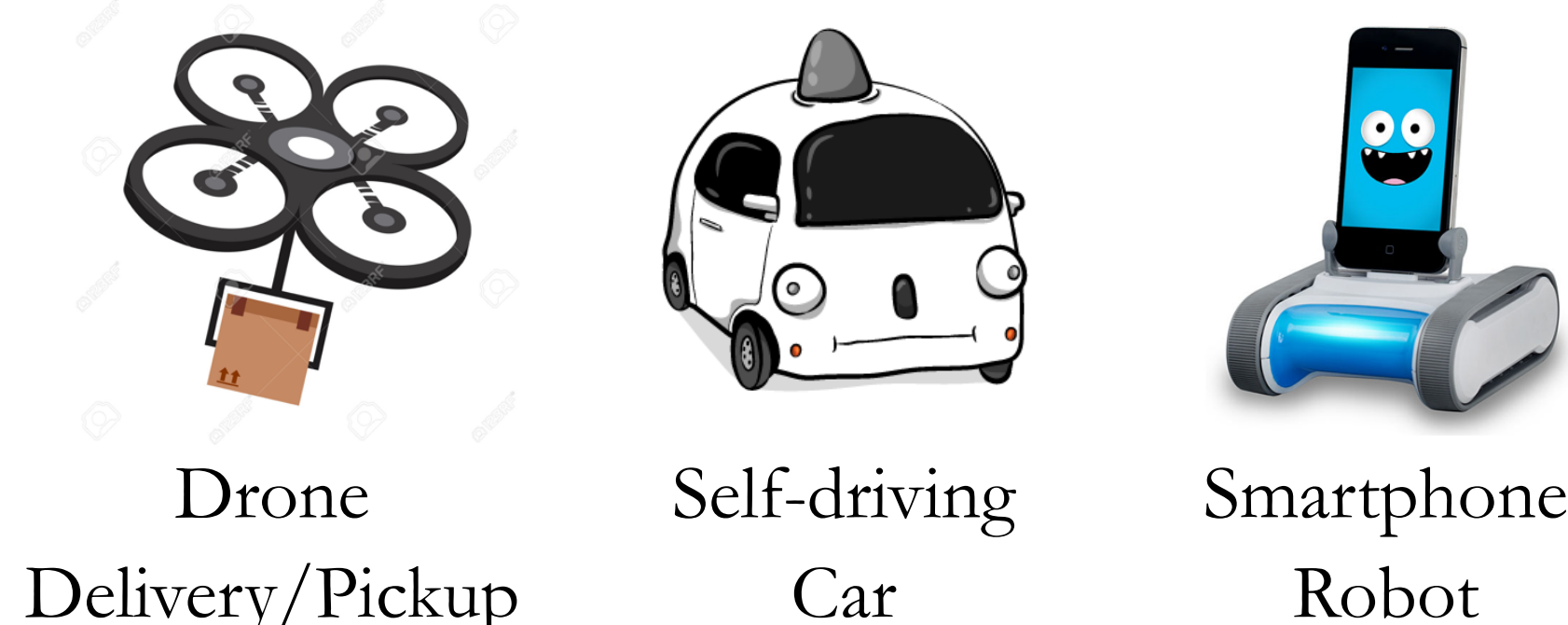
# 60GHz Mobile Radar Imaging

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## A Need for Mobile Imaging



- Need to “visualize” surroundings
- Need **mobile imaging**

## Requirements



- Not only **location**
- But also **shape** and **material**



- Accurate
- Portable
- Affordable
- Robust

## 60GHz Radios + Mobility

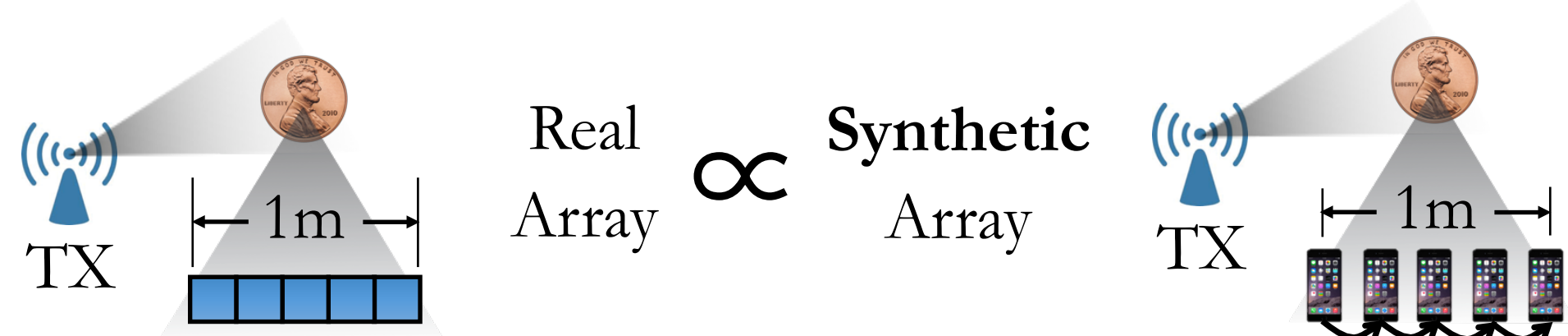
### Benefits of 60GHz Radio

- ✓ Robust (in darkness and rain<sup>[1]</sup>)
- ✓ Portable & affordable (<\$37.5)
- ✓ Stable & predictable signals
- ✓ Short wavelength (better radar resolution)



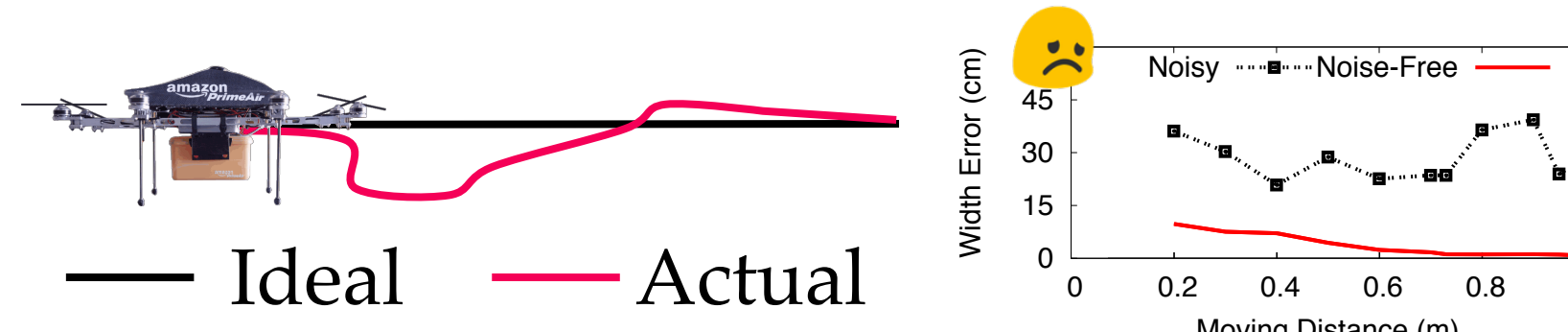
$$\text{resolution} = \text{wavelength} \times \text{distance} / \text{antenna size}$$

### Leveraging Mobility<sup>[2]</sup> to improve resolution



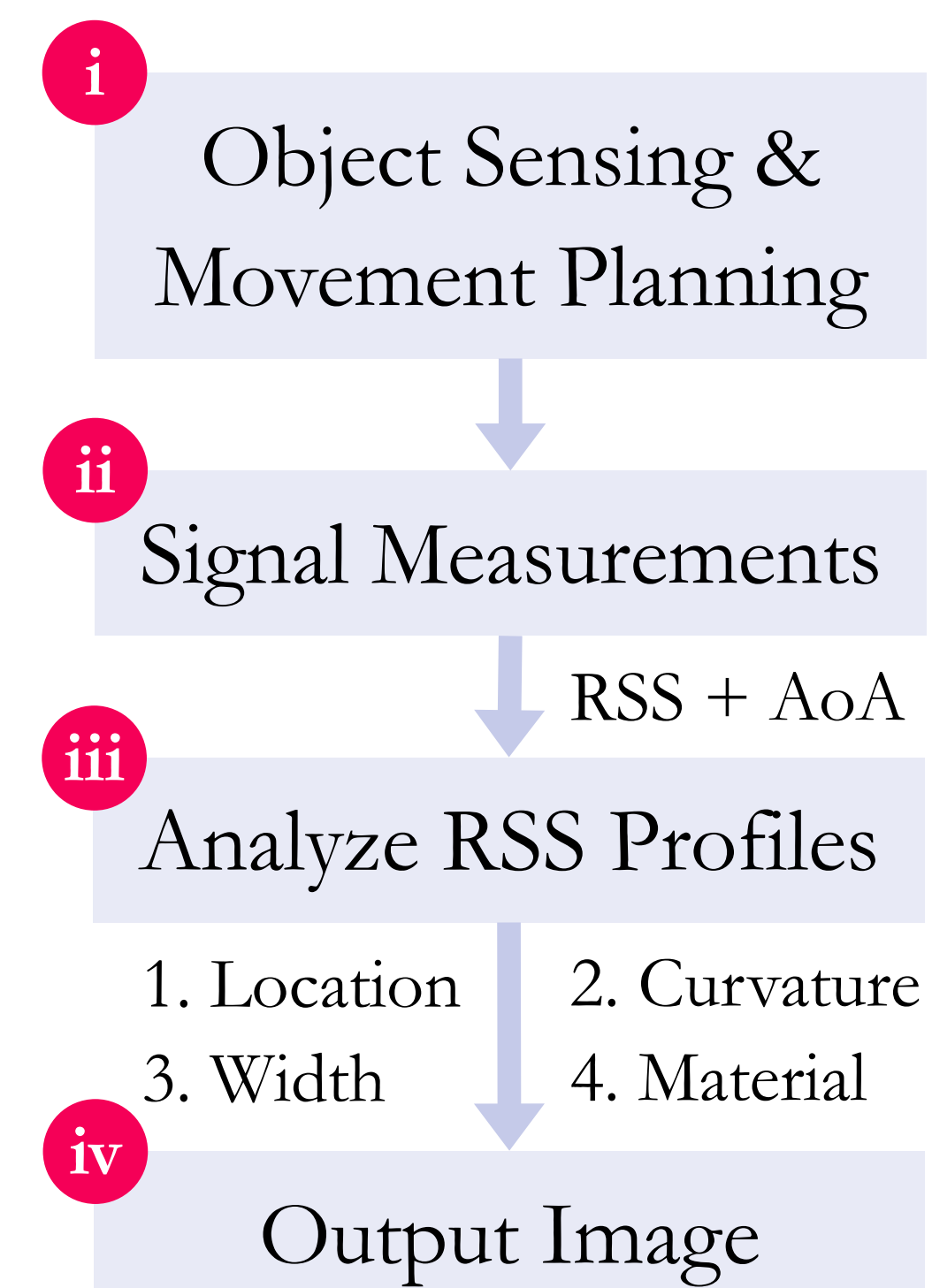
But RX movement is noisy

→ traditional radar algorithms fail



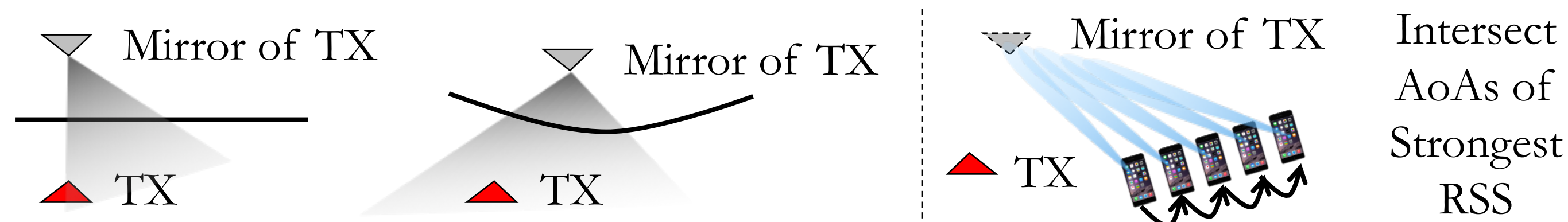
### Need new & robust imaging algorithms!

- Different surfaces have different RSS profiles
- RSS & AoA are robust to noise

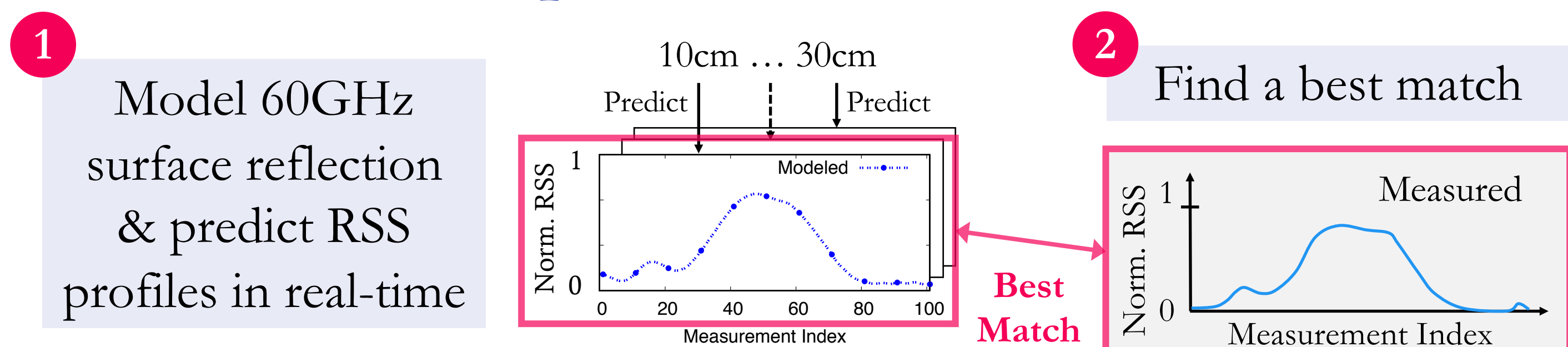


## Design Details<sup>[3]</sup>

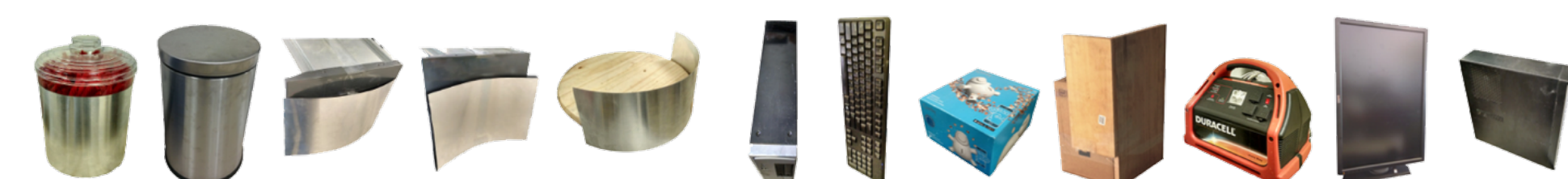
### ✓ Curvature: surface reflects signals like a mirror



### ✓ Width: RSS shape varies with surface width

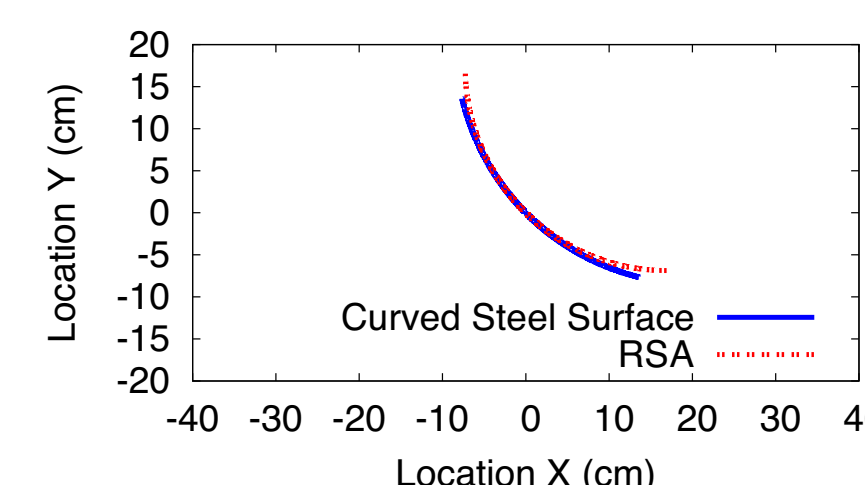


## Results & Todos



Experiments w/ 12 real objects in presence of random movement noise

- ✓ **Centimeter accuracy**
  - Location error < 10cm
  - Width error < 4.5cm
- ✓ **Narrow down materials to 3 candidates**
- ❖ Focus on static objects
- ❖ TX & RX need line-of-sight to objects



[1] Demystifying 60GHz Outdoor Picocells. MobiCom, 2014

[2] 60GHz Mobile Imaging Radar. HotMobile, 2015

[3] Reusing 60GHz Radios for Mobile Radar Imaging. MobiCom, 2015

[Project Web Link] <https://www.cs.ucsb.edu/~yanzi/project.php?proj=60gradar>