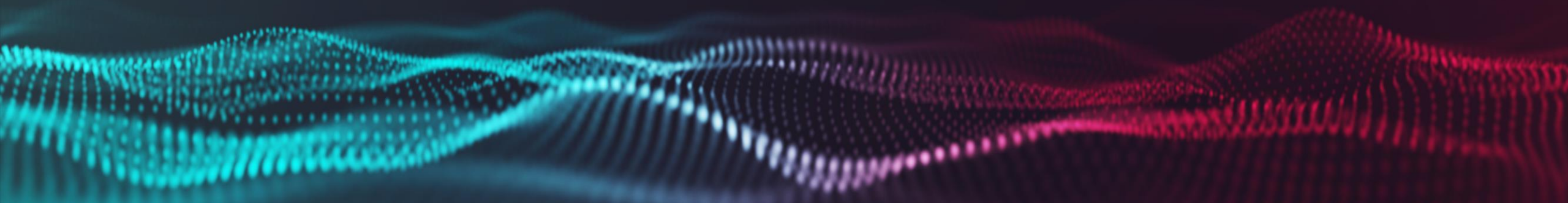
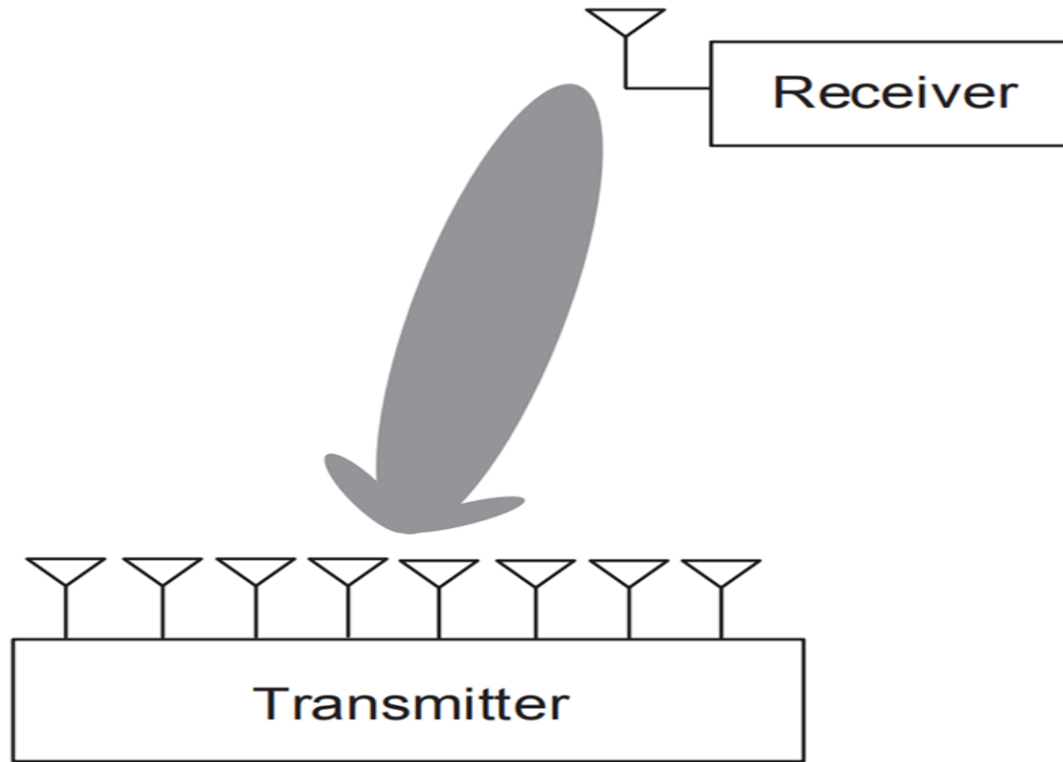


# Radiative Power Transmission

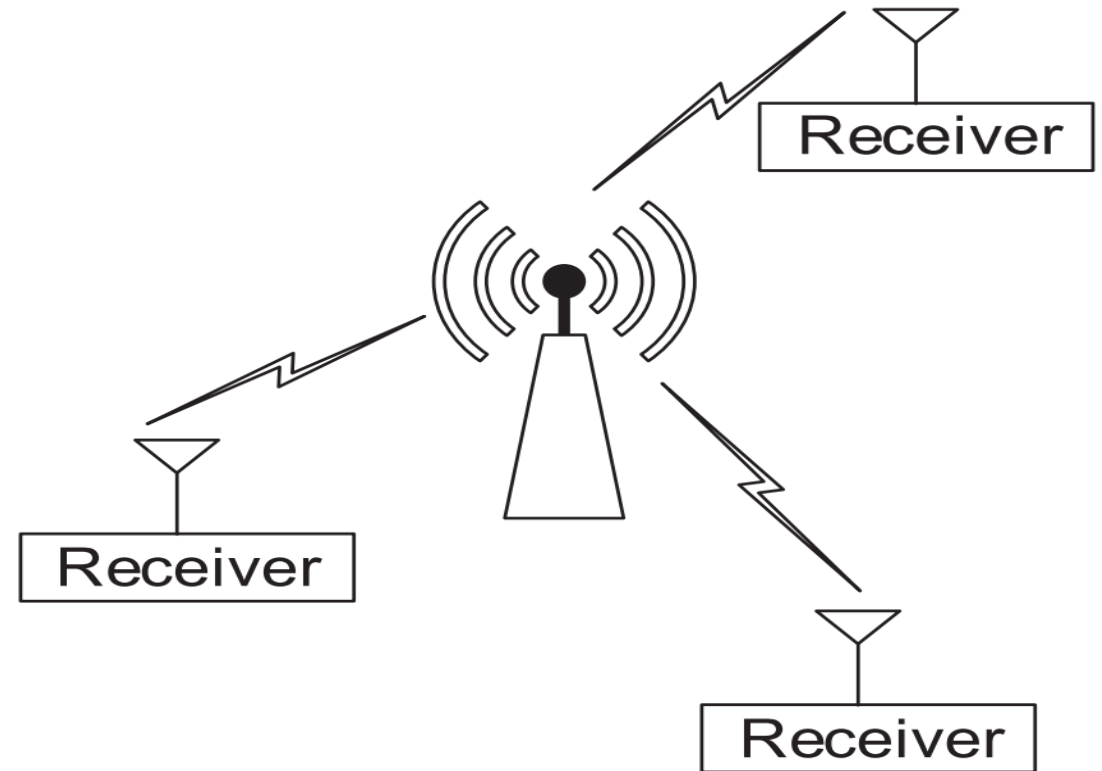


# Types of Radiative Power Transmission:

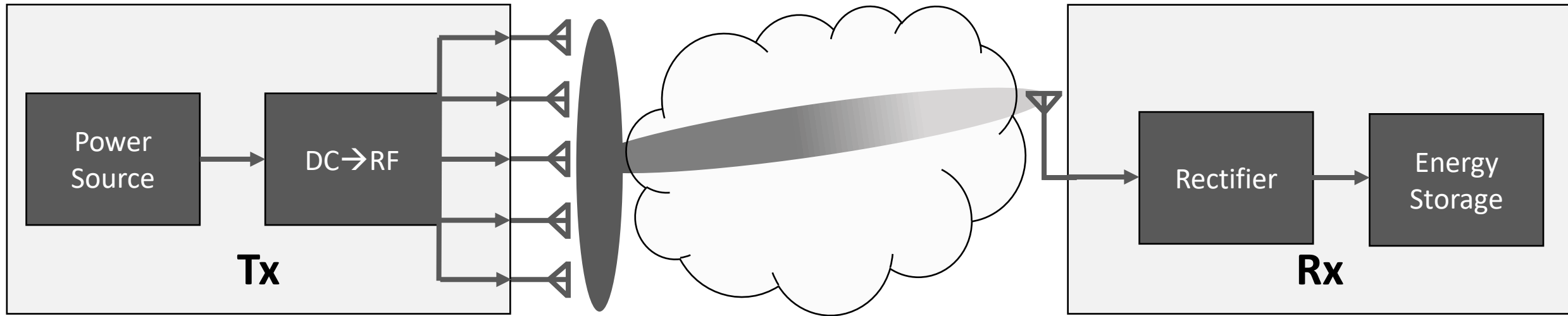
Directive RPT:



Non-directive RPT:



# Block diagram of Directive RPT:

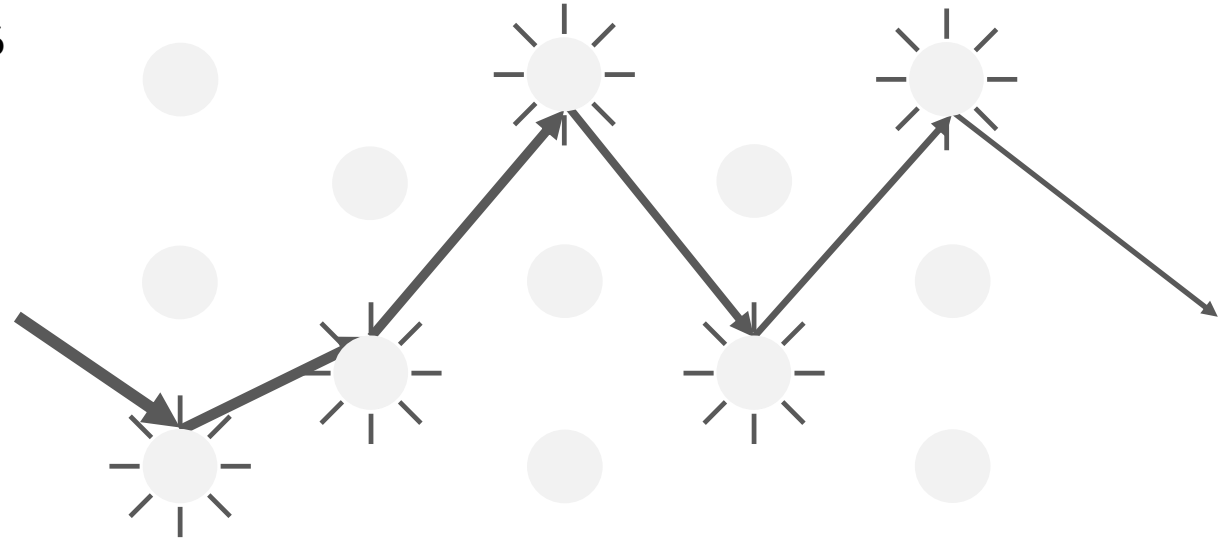


# Rayleigh Scattering:

- Wave bombards air particles and scatters.
- The scattered intensity increases for shorter wavelengths.

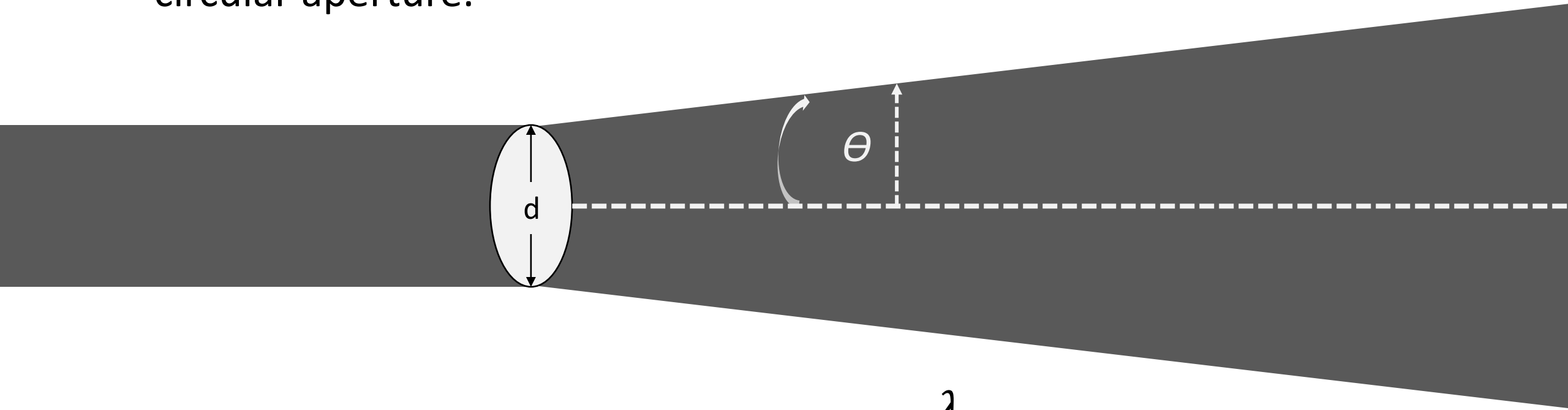
$$I = I_0 \frac{1 + \cos^2(\theta)}{2R^2} \left( \frac{2\pi}{\lambda} \right)^4 \left( \frac{n^2 - 1}{n^2 + 2} \right)^2 \left( \frac{d}{2} \right)^6$$

$$\therefore \alpha_{scatter} \propto f^4$$



## Rayleigh Criterion:

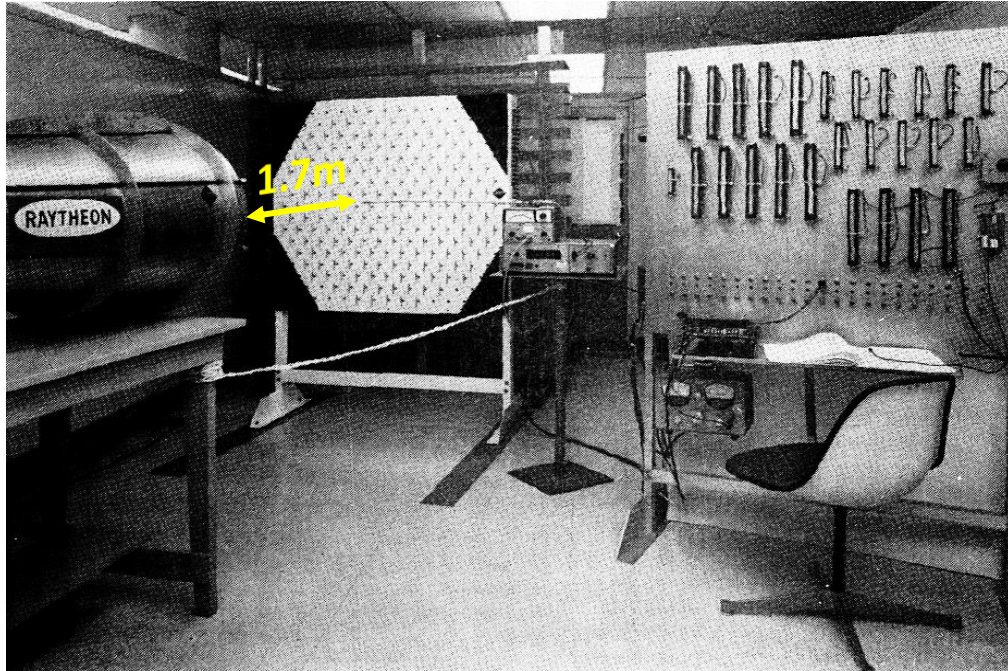
- Usually discussed in lens design and angular resolution.
- Relation applies for power beaming if the beam is passed through a circular aperture.



$$\sin(\theta) = 1.22 \frac{\lambda}{d}$$

# William Brown's RPT experiments:

## Raytheon:



- 495W recovered.
- 54% efficiency.

## Jet Propulsion Lab:

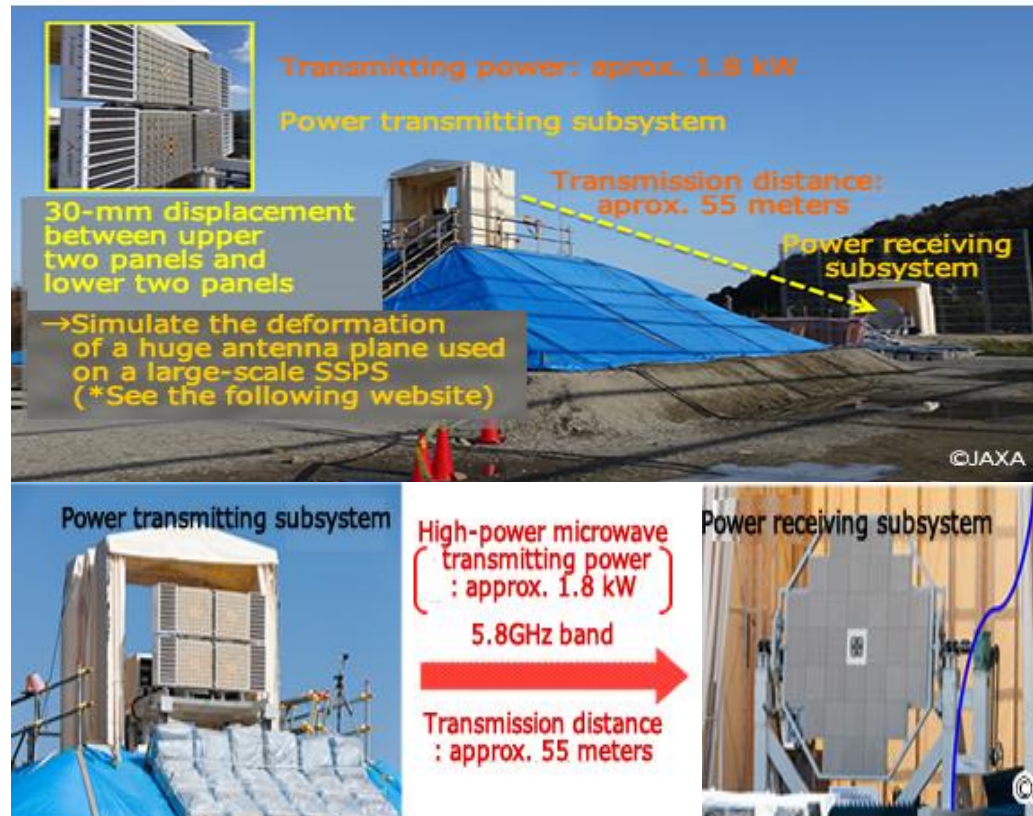


- Beamed over 1.5km.
- 34kW recovered.



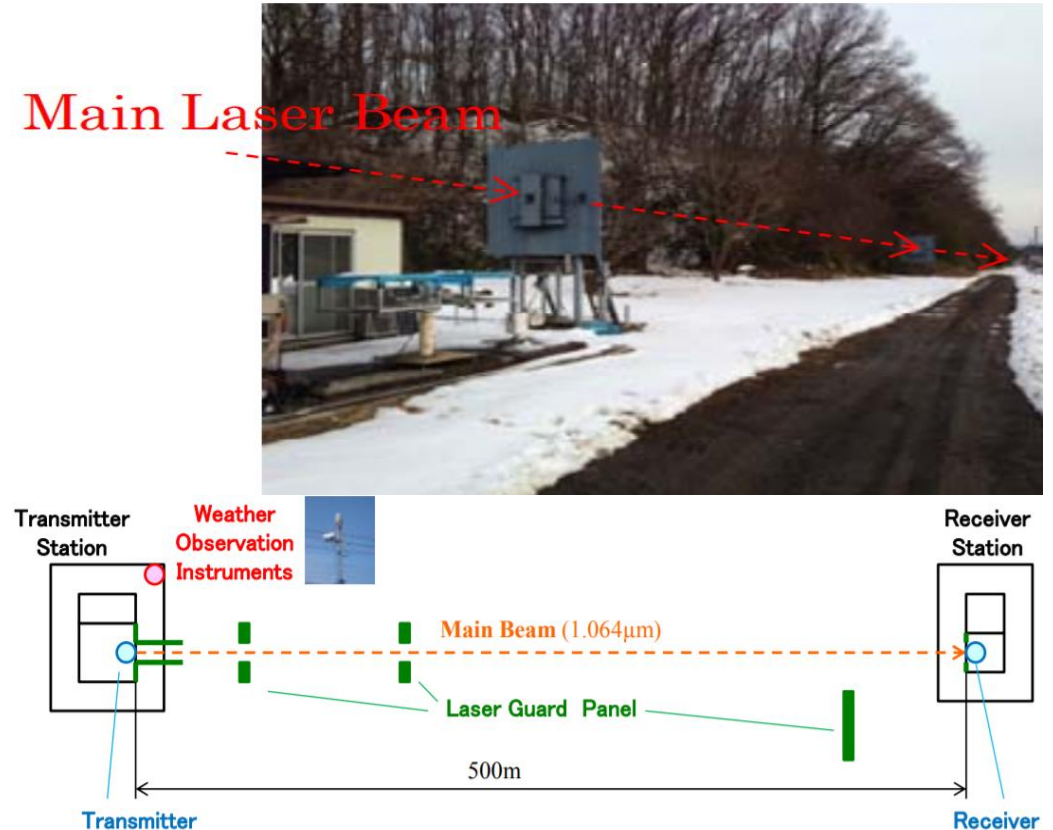
# JAXA's RPT experiments:

## MPT:



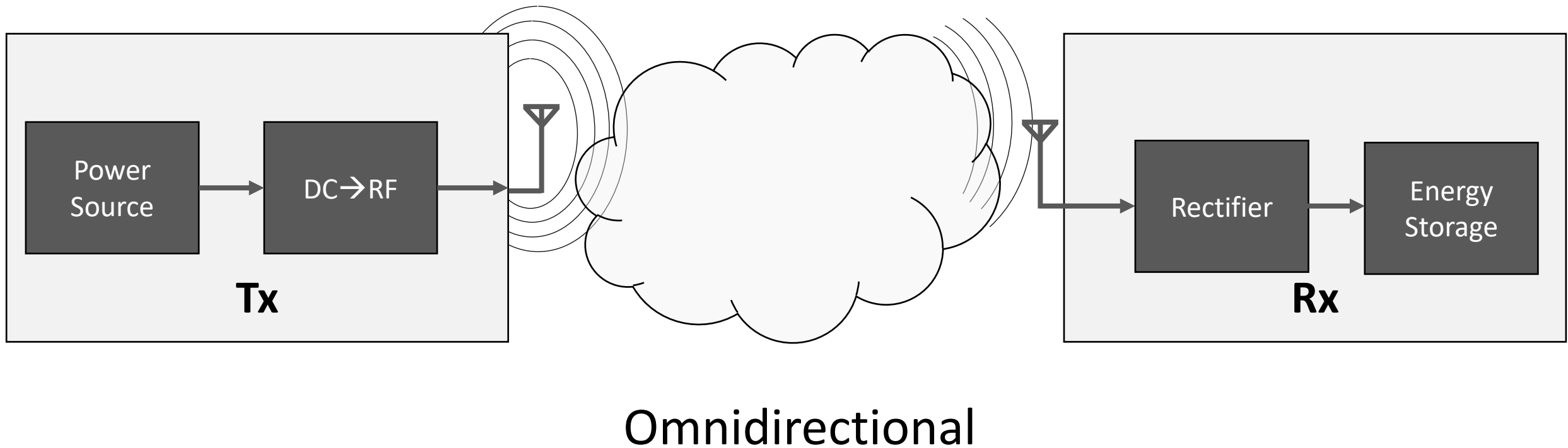
- 320-340W recovered.
- ~20% efficiency.

## LPT:



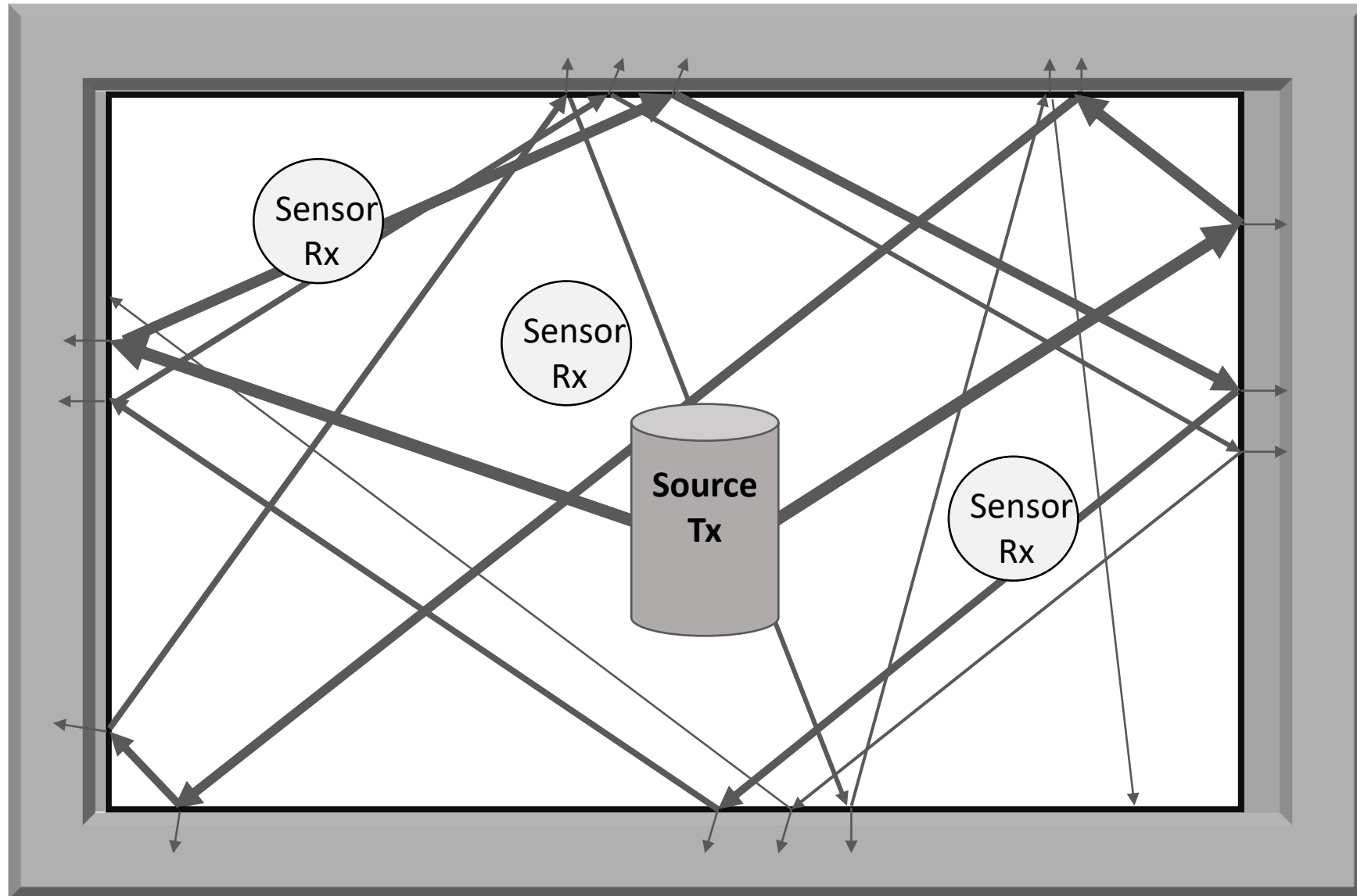
- 1  $\mu$ rad accuracy.
- Highly affected by medium.

# Block diagram of Non-directive RPT:

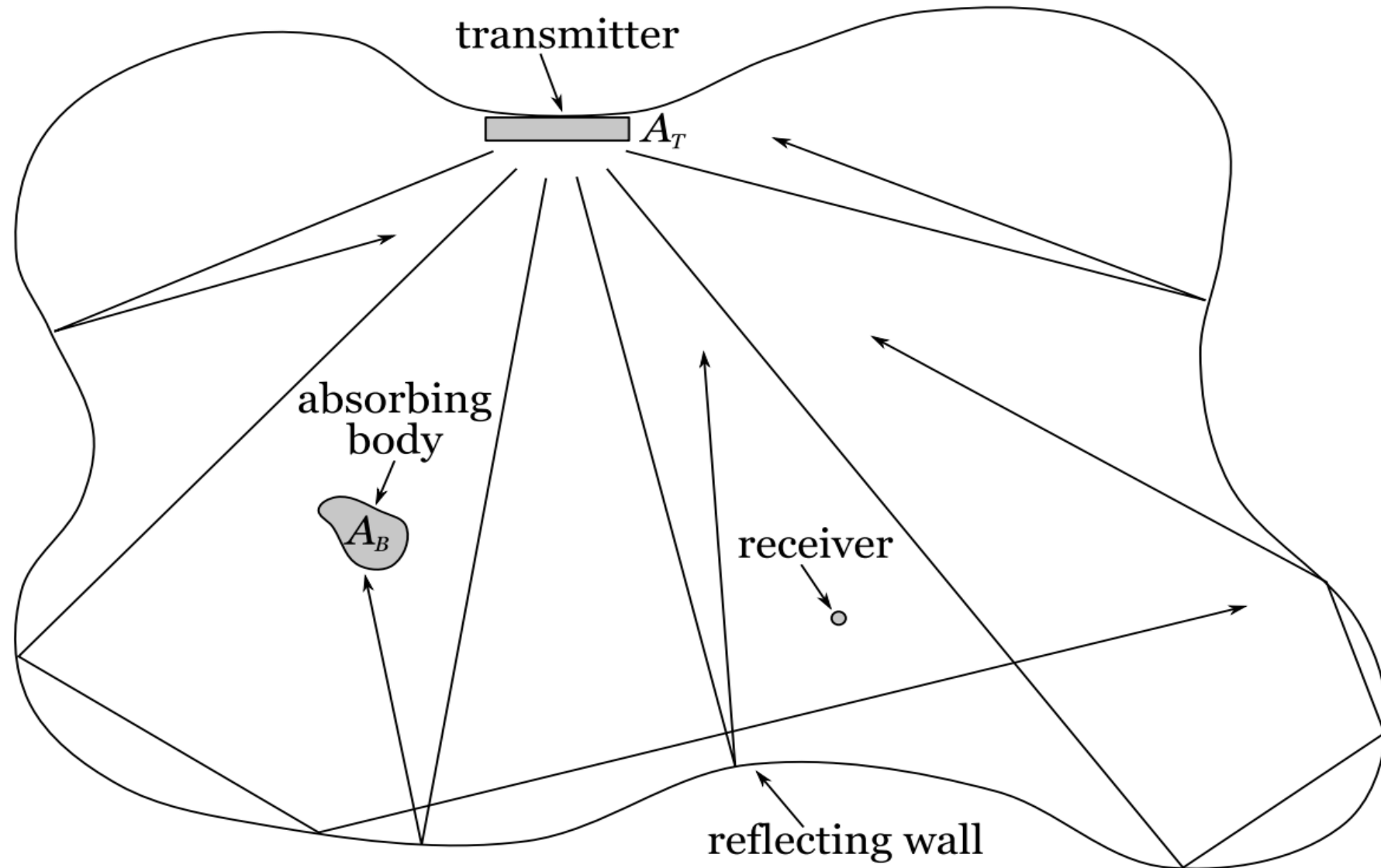




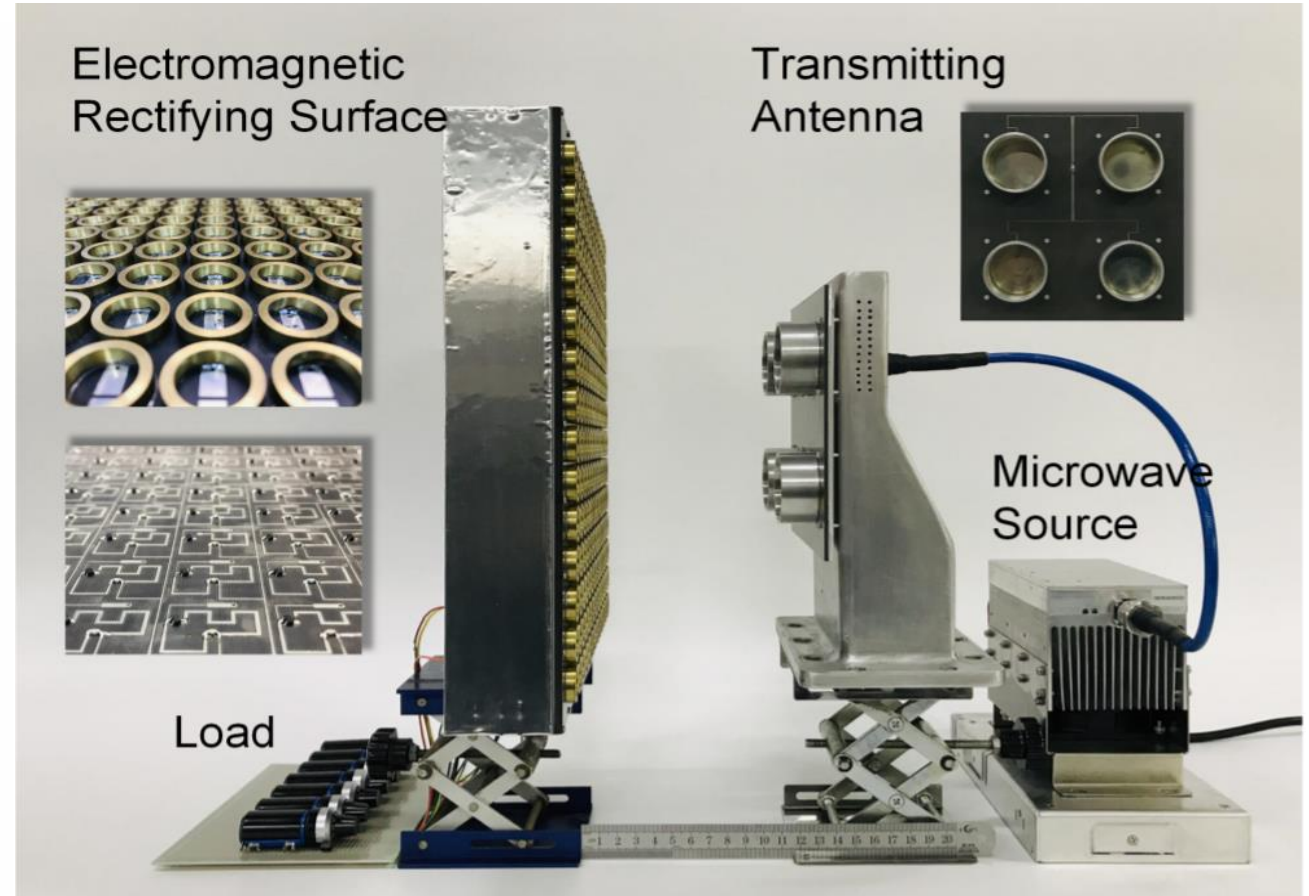
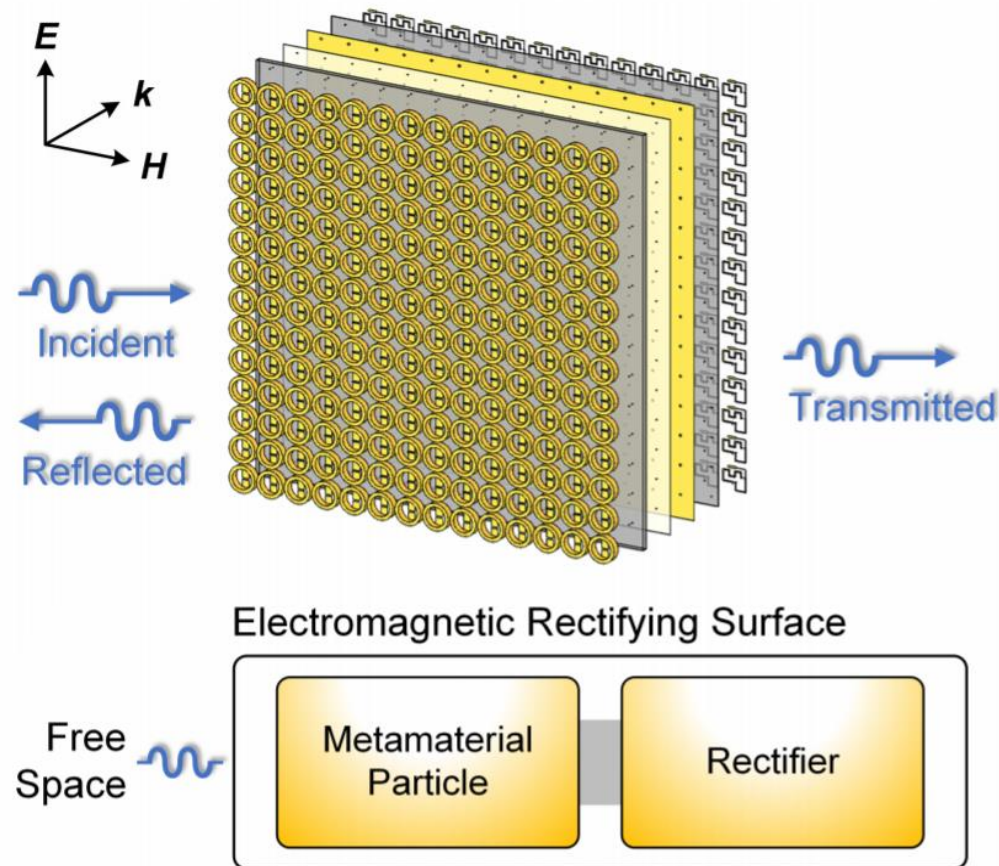
# Enclosed Wireless Sensor Network:



## R. Moffatt's receiver in an enclosed space:

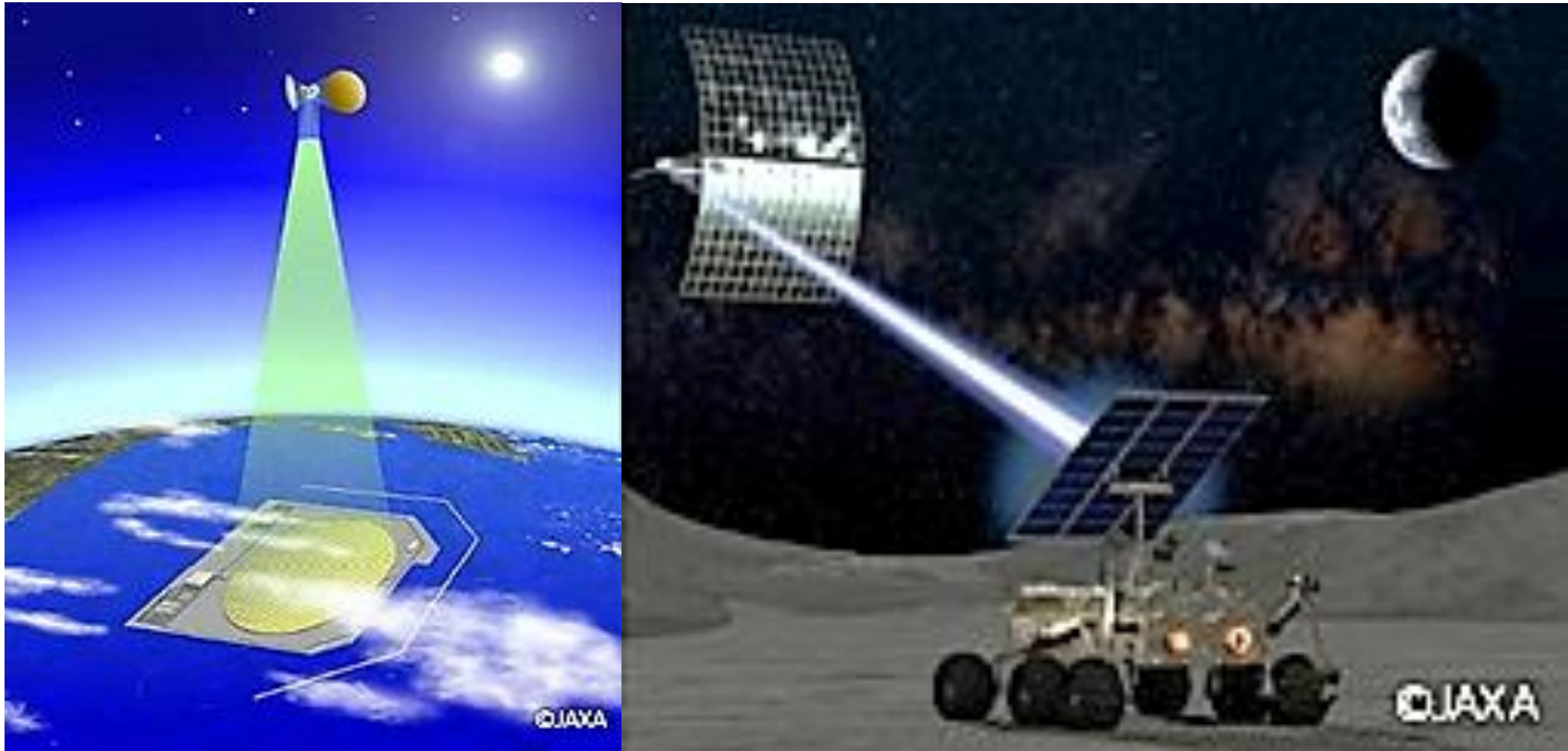


# Metamaterials in RPT: Duan et al.



- 52.3% efficiency for 5cm transfer distance.
- 12% efficiency drop for  $\pm 52.5^\circ$

## RPT Future Application:



JAXA to launch GEO SSPS in 2030s



# Questions & Discussion

