



Mobile/Handheld DTV Antenna Systems, **Broadband Solutions**

Micro Communications, Inc
A RYMSA Company
CCBE September 17th, 2010

What is all the “Buzz” about Digital* Mobile TV?



- What is available today?
- What could be available in the near future?
- “Clear as Mud”

***ATSC-M/H** (Advanced Television Systems Committee - Mobile/Handheld) is a standard in the USA for mobile digital TV, ATSC-M/H

MediaFLOW (Qualcomm) and MobiTV



MediaFlow (Qualcomm)
716-722 MHz (former UHF TV channel 55). 722-728 MHz (former UHF TV channel 56)

MobiTV, PCS band based now but looking at ATSC-M/H



- Available through Verizon, Sprint and AT&T
 - Limited service (Major metropolitan areas only)
 - Available on 3G phones
 - Subscription base (its not free)

Portable and Handheld TV's



- Many HD DTV ready models available in electronic stores
- Small Percentage of TV sales and viewership

What is Next for Mobile TV?



- 4G Cell Phones
- UHF ATSC-M/H receivers in 4G cell phones
(speculative and not a certainty)
- Laptop Computers with UHF ATSC-M/H receivers
- Very large viewership anticipated for free over the air HD TV

Laptop computers mobile ready?



Pic from CES 2010

- Laptop computers should be Mobile (UHF) DTV ready soon.
- Not so mobile DTV receiver and antenna available on aftermarket today.
- Lets see how popular Dell and Apple Computers DTV receiver options are.



Mobile Phones with UHF Receivers (4G)

- Not ready for prime time.
- Keep an eye on OMVC's Washington DC test market for viewership results of M/H devices.
- Open Mobile Video Coalition's (OMVC)

<http://www.openmobilevideo.com/>



Pic from CES 2010

UHF Terrestrial TV, Is Your Antenna Mobile TV Ready?

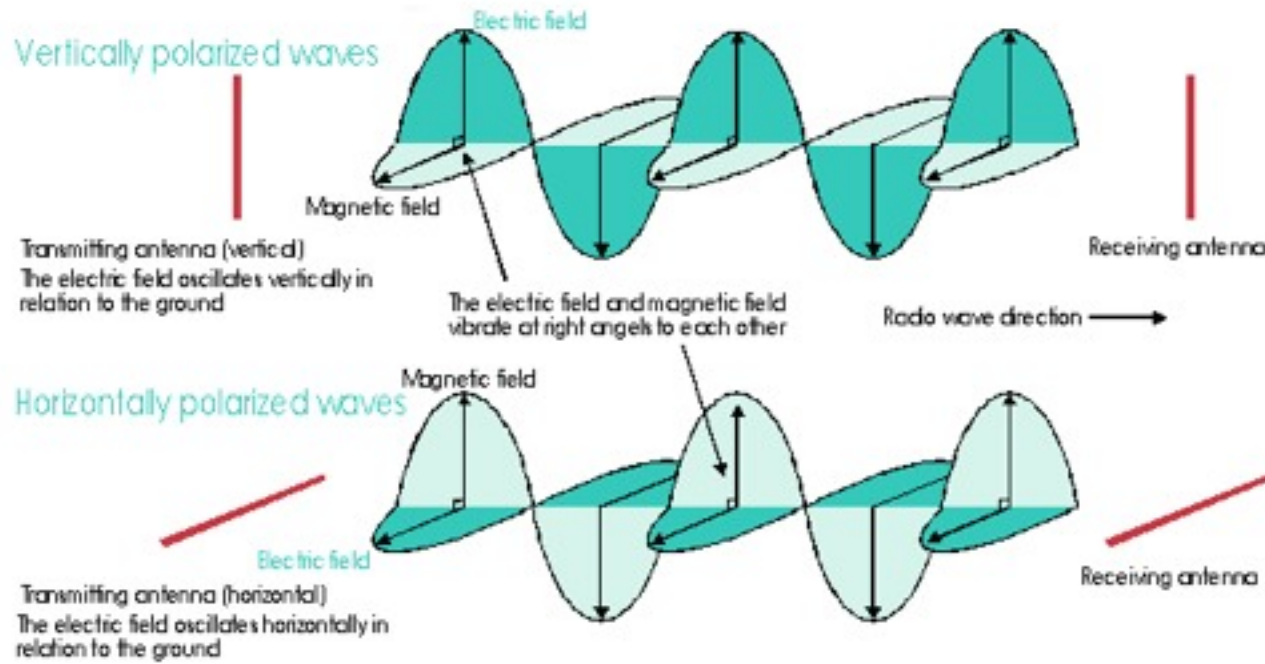


- What is CP and how is it different from Horizontal or Vertical polarized antennas?
- Why do we need CP (circular polarization) for mobile TV?
- What testing has been done to verify CP antenna effectiveness?

Polarization Review

- Vertical Polarization -

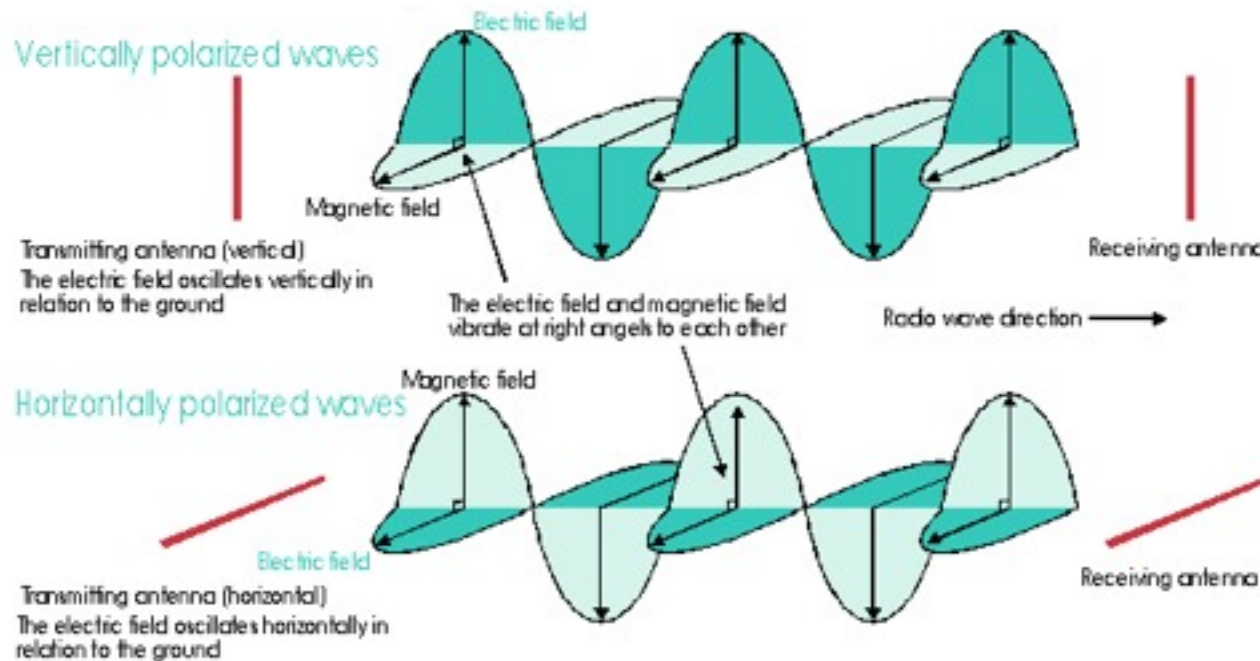
- An antenna is said to be **vertically polarized** (linear) when its electric field is perpendicular to the Earth's surface. An example of a vertical antenna is a broadcast tower for AM radio or the "whip" antenna on an automobile.



Polarization Review

- Horizontal Polarization -

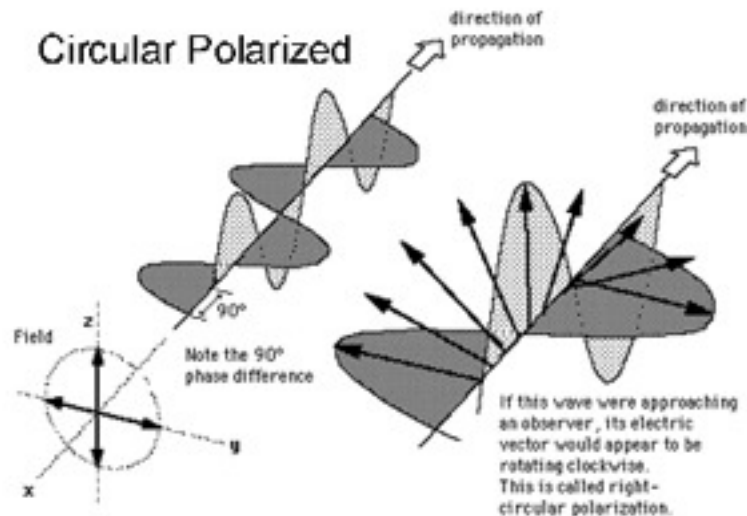
- **Horizontally polarized** (linear) antennas have their electric field parallel to the Earth's surface. Most UHF Television transmissions use horizontal polarization for tabletop fixed position TV's.



Polarization Review

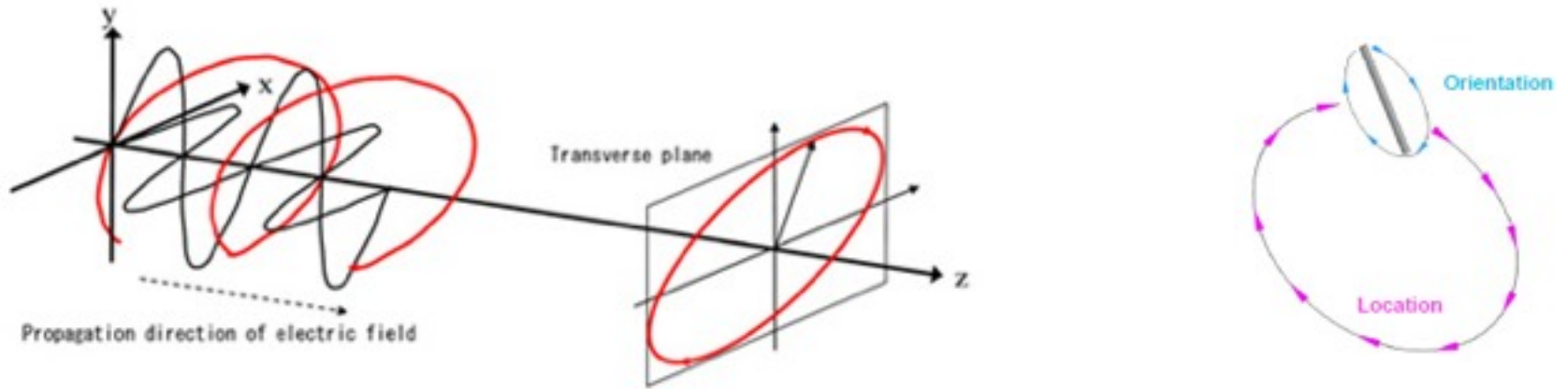
- Circular Polarization -

- A **circular polarized** wave radiates energy in both the horizontal and vertical planes and all planes in between. The difference, if any, between the maximum and the minimum peaks as the antenna is rotated through all angles, is called the axial ratio or ellipticity and is usually specified in decibels (dB). If the axial ratio is near 0 dB**, the antenna is said to be circular polarized. If the axial ratio is greater than 1-2 dB, the polarization is often referred to as elliptical.



** see later slides

Reliable Reception is the “key”



- **The small antennas in mobile device simply excite the long dimension of the phone or the circuit board**
- **Polarization is along the axis of the phone**
- **Mobile devices act like a dipole**





Circularly Polarized Broadband Antennas for UHF TV Broadcast

- Axial Ratios: CP (Circular Polarization) and EP (Elliptical Polarization)
- Example of null filling with an orthogonal (perpendicular) polarization
- Testing
- RYMSA/MCI'S CP PANEL ANTENNA
 - Construction
 - Performance

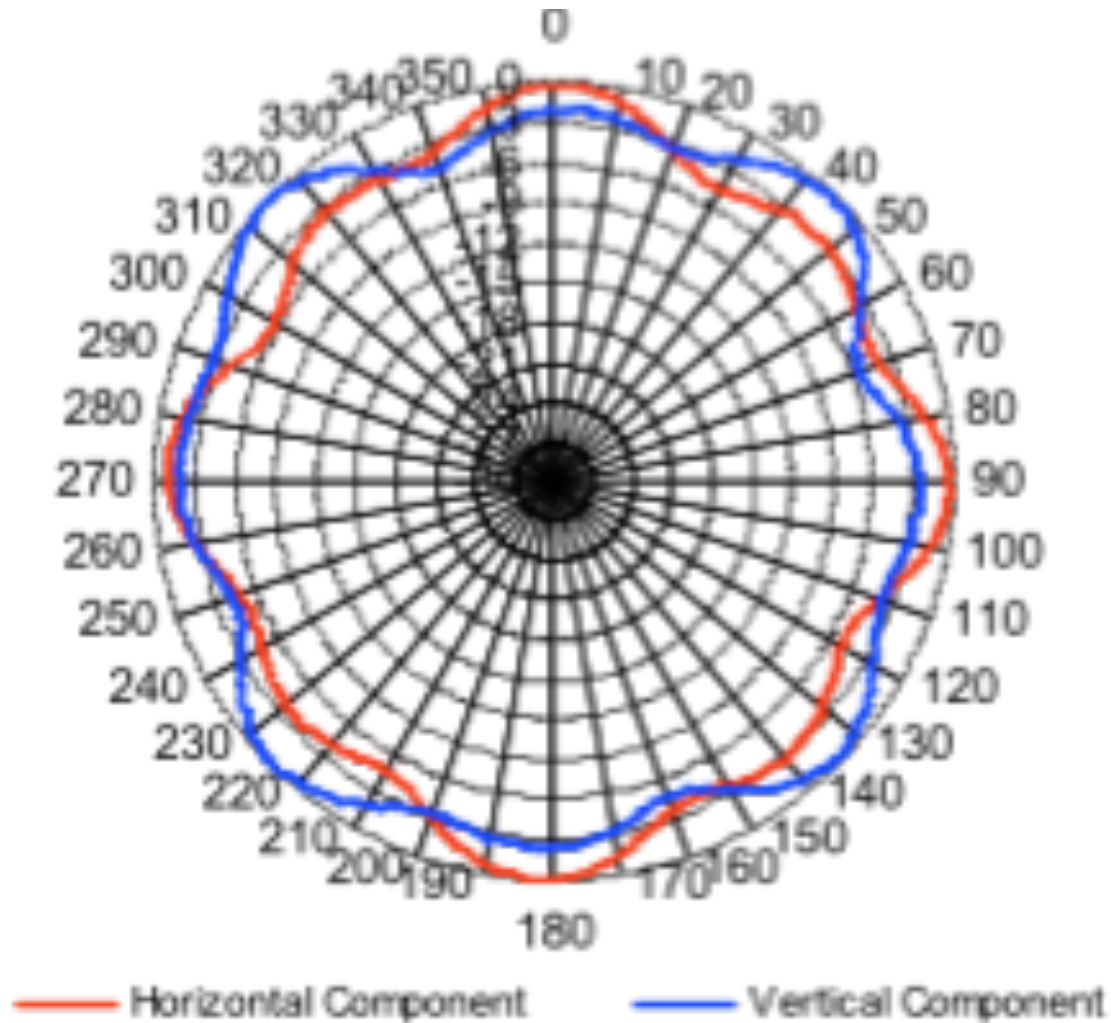
Axial Ratios: CP is EP!

- Real antennas are not perfectly omni-directional
- HPOL and VPOL patterns are generally unequal
 - Axial ratios* vary with azimuth

* The axial ratio is the ratio of the two orthogonal polarizations (max/min) in the radiated field.

Omni HRP @ 533 MHz

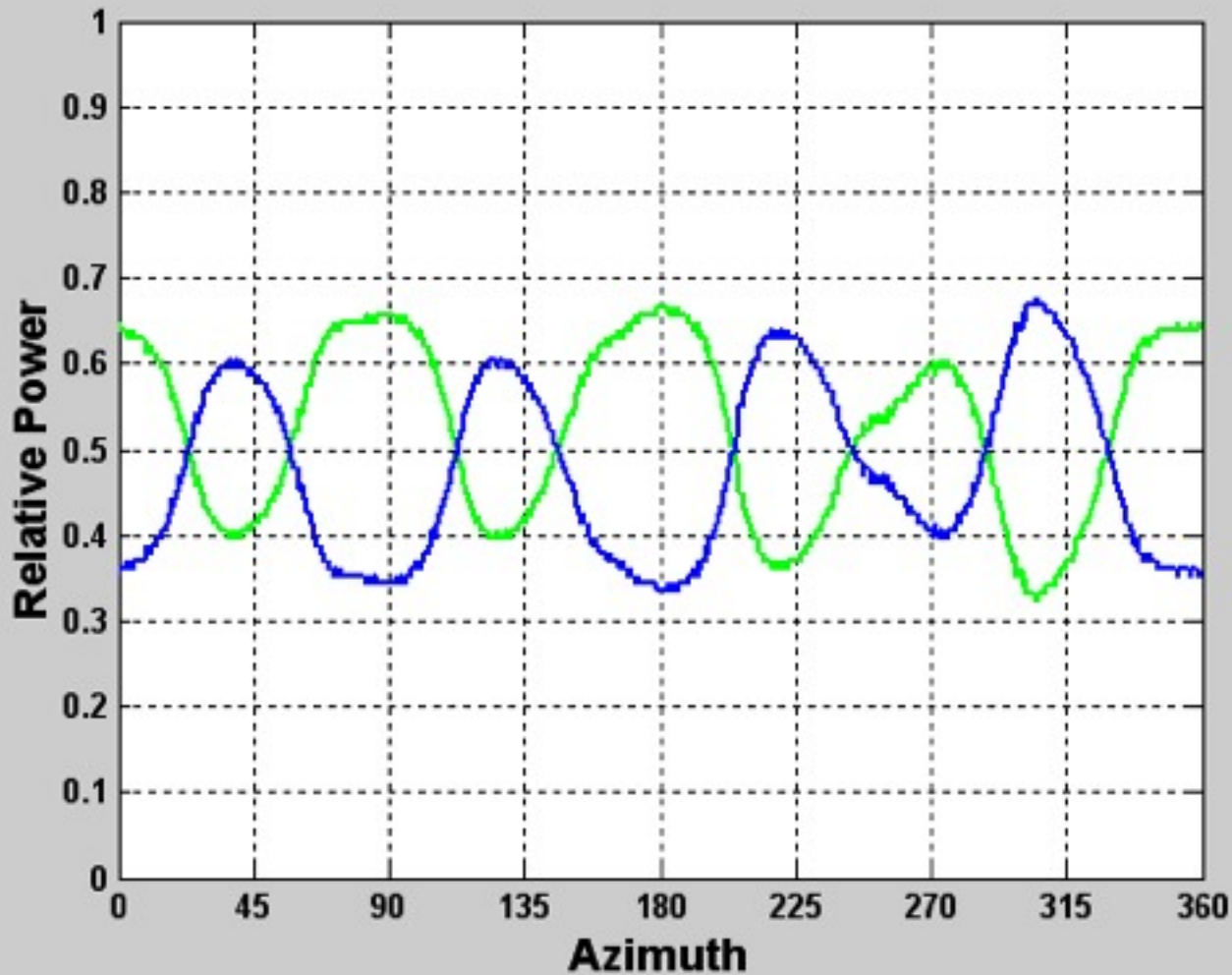
(Axial ratios vary with azimuth.)



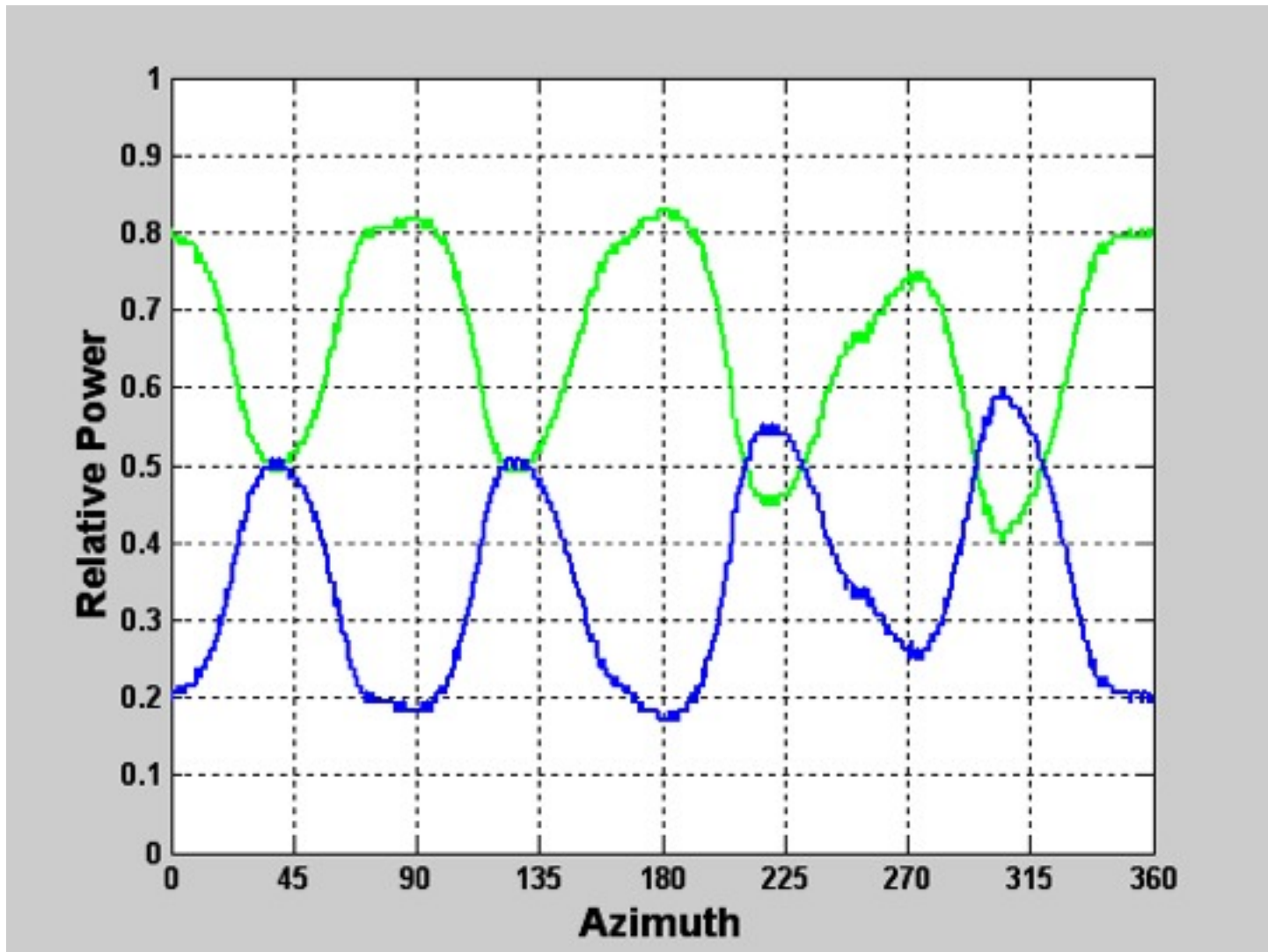
Axial Ratio

- The real axial ratio is the power split to the two polarizations
 - CP = 50/50 input power
 - EP can be 67/33 (33% V-Pol)
(V-Pol is 50% of H-Pol, so with no additional TPO peak H-pol ERP is only -1.74dB lower than an H-pol only system)

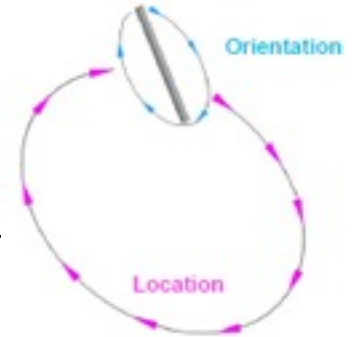
Relative Power w/ 50/50 Input Splitter 533 MHz (65/35 to 35/65 Ratios)



Relative Power w/ 67/33 Input Splitter 533 MHz (80/20 to 45/55 Ratios)



Null filling with an orthogonal (perpendicular) polarization.



You want *reliable* coverage in as many locations and as many receiver orientations as possible.

- Horizontal Polarization (HP): Lots of nulls
- 80/20 Elliptical Polarization (EP): Good null fill
- Circular (50/50) (CP) Polarization: Best null fill



CP/EP Null-filling Test Example

- Consider the case of a dipole receive antenna inside a car.
- Incoming waves are scattered into different polarizations.
 - Some polarizations scatter to match the dipole
 - Some polarizations scattered orthogonally (perpendicularly) to the dipole
 - Multipath

Multipath Signals

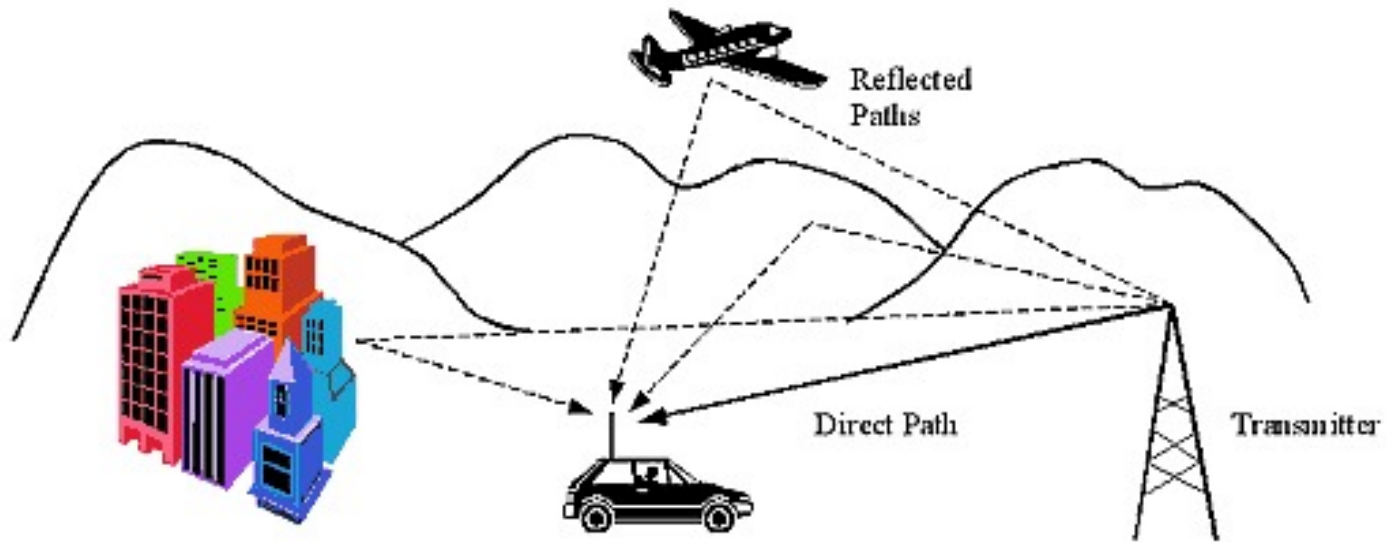


Figure 3 Multipath Signals

Testing

Scattering and Reception Inside a Car

In-car reference antenna

Test antenna- Dipole

(nominally VPOL)

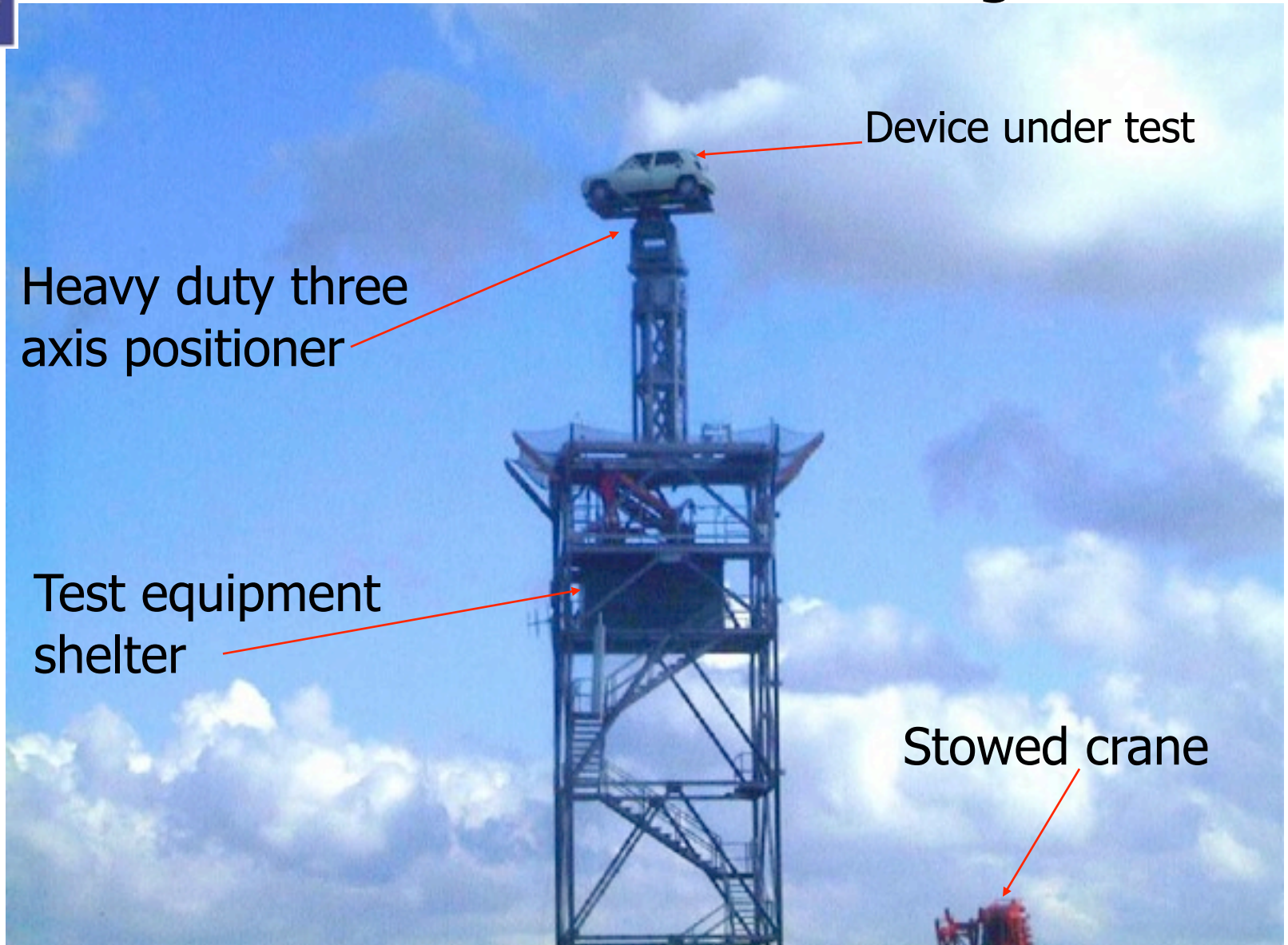


External reference antenna (standard gain dipole)

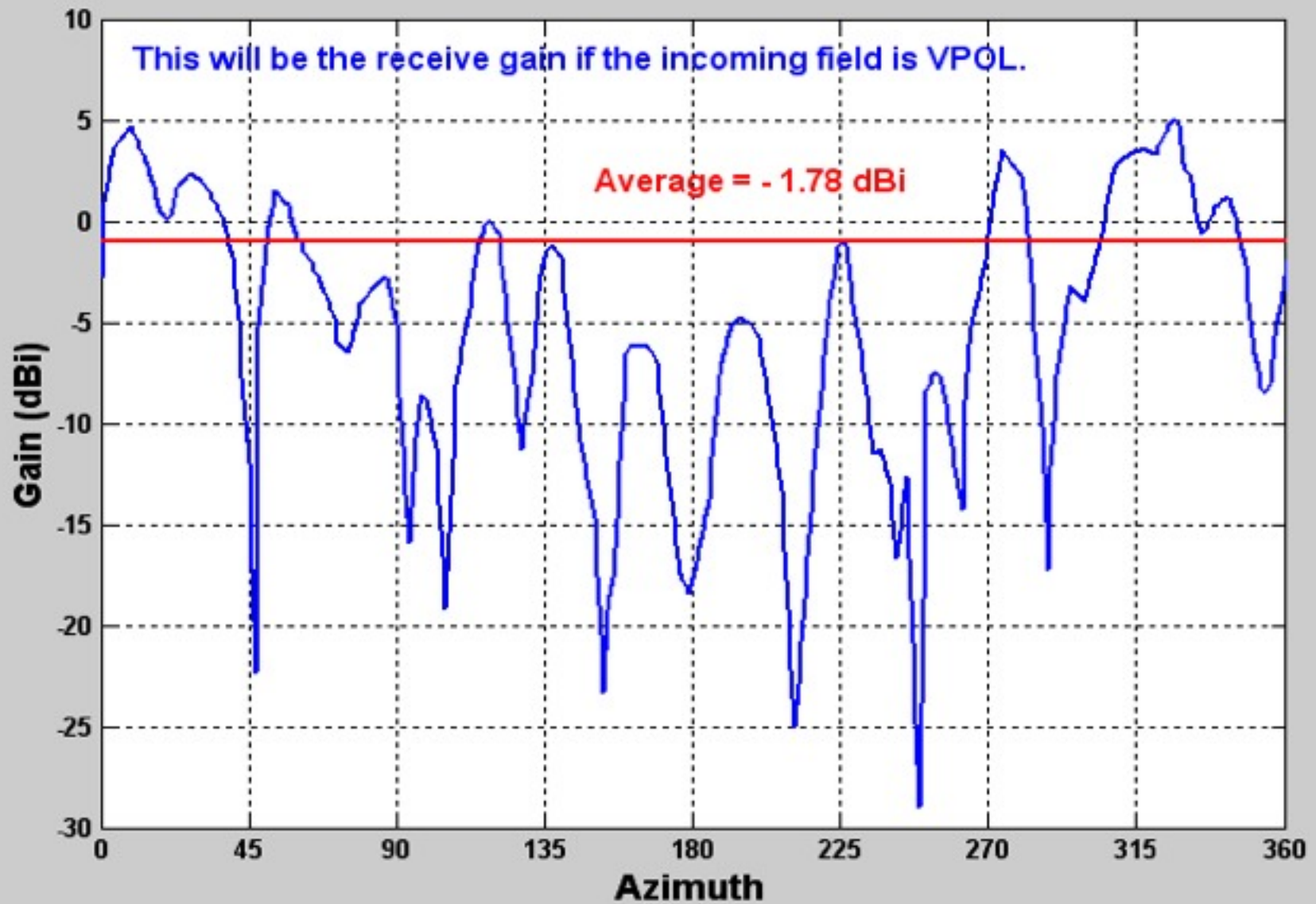




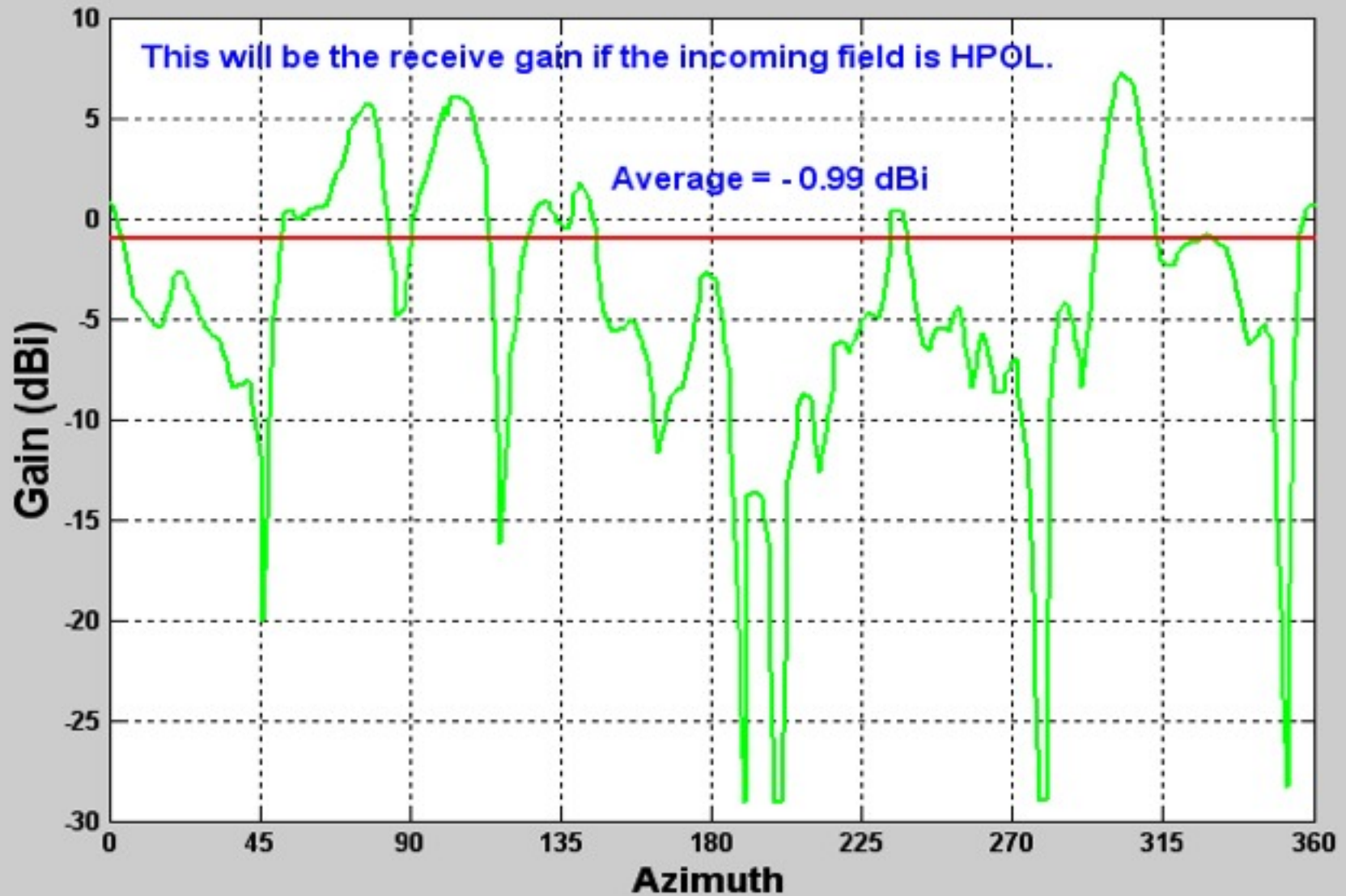
Car in Elevated Test Range.



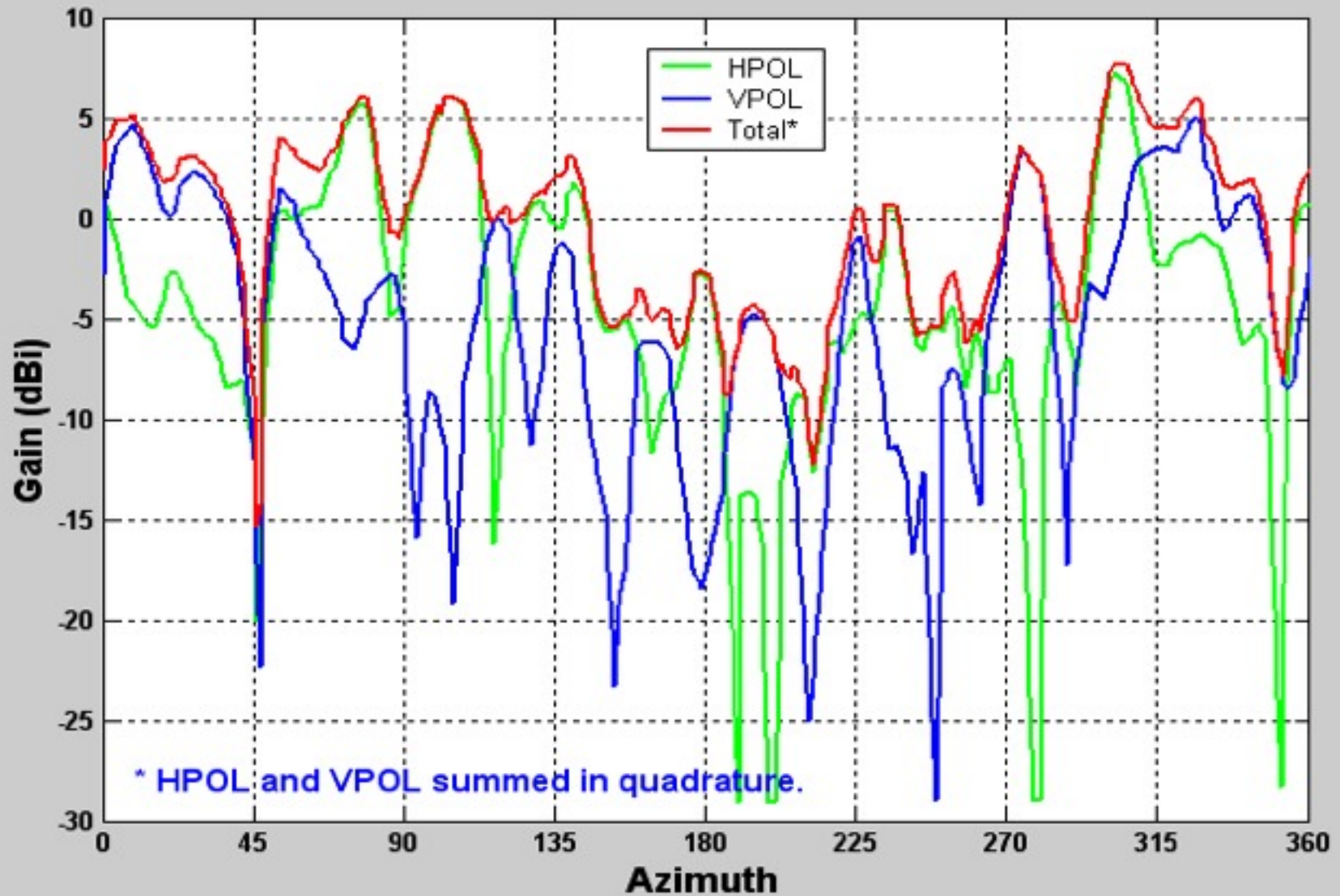
Dipole in Car: VPOL Gain



Dipole in Car: HPOL Gain



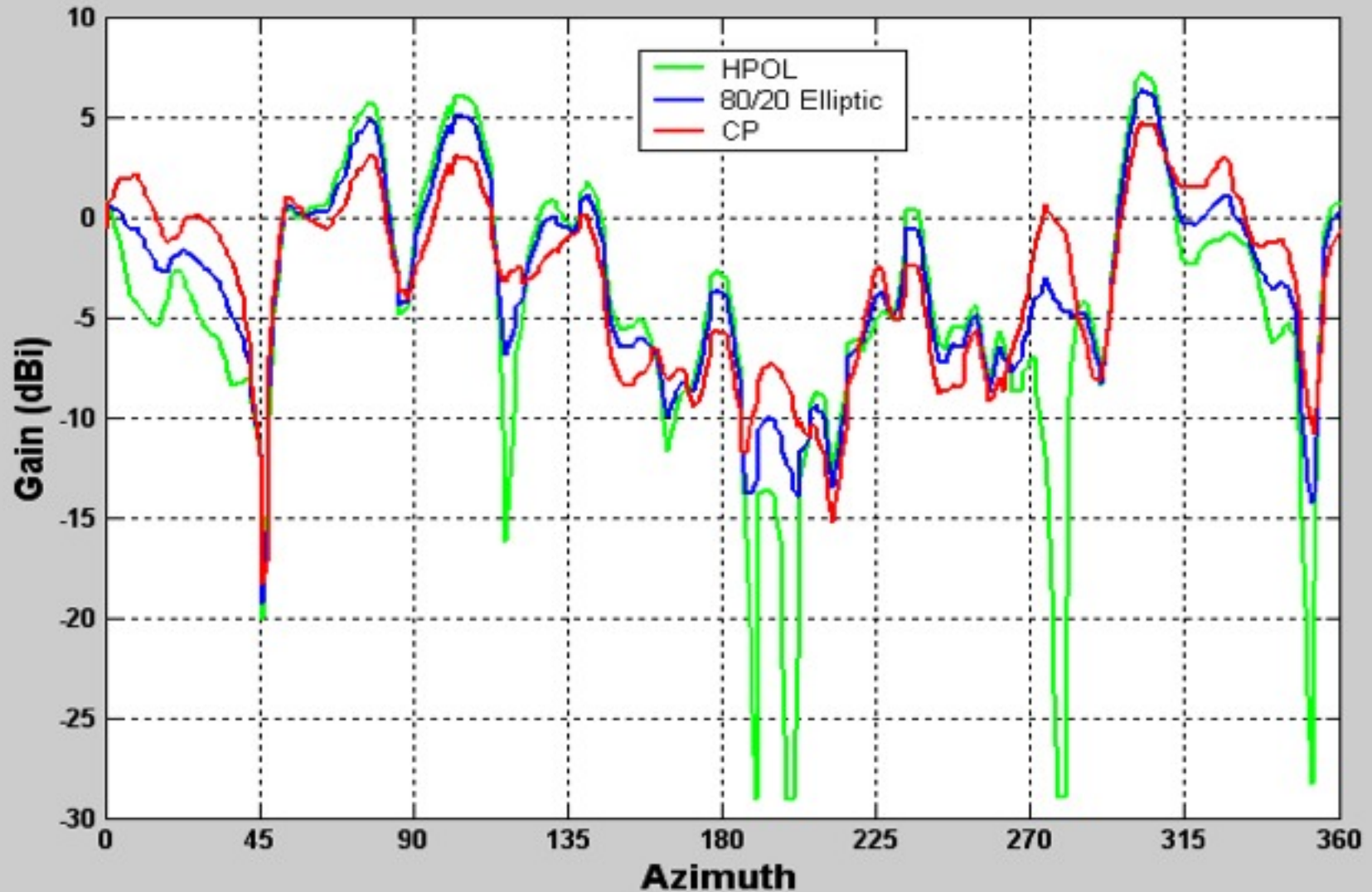
Dipole in Car: HPOL, VPOL and Total Gain



Dipole Inside a Car: Gain Comparisons

- We calculated the receive gain for three different incident field polarizations:
 - HPOL 100%
 - Same as previously shown HPOL gain
 - 80/20 elliptic
 - 80% HPOL Gain + 20% VPOL Gain
 - CP
 - 50% HPOL Gain + 50% VPOL Gain

Receive Gain Comparisons (dipole inside a car)



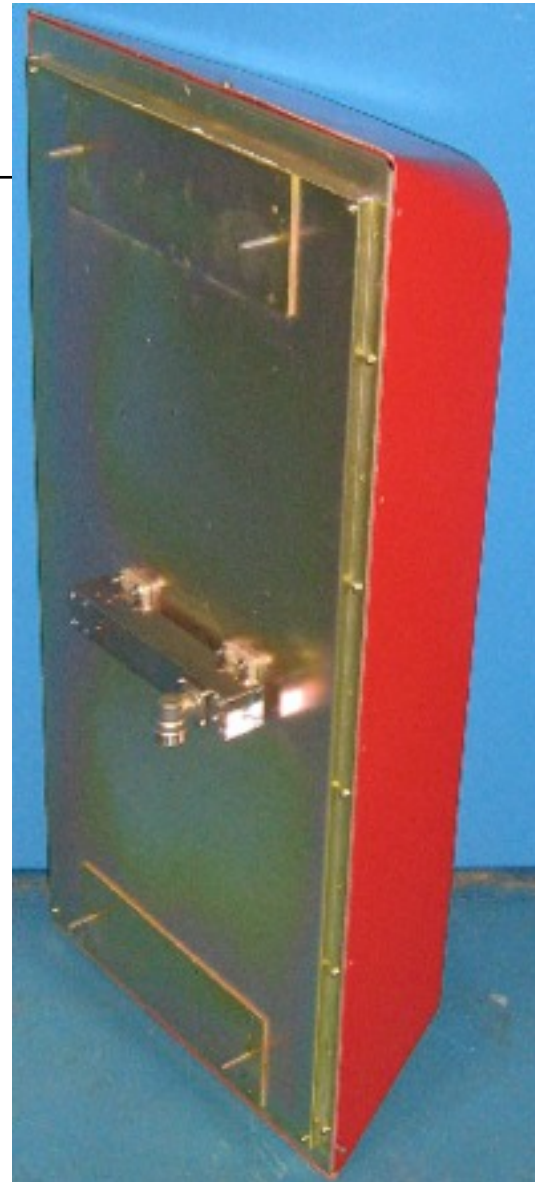
Construction:

- Traditional HPOL panel has one layer containing the four dipoles and the entire power distribution network.
- CP panel with eight dipoles requires a more complex arrangement
 - Power division (hybrid splitter)
 - Dipoles





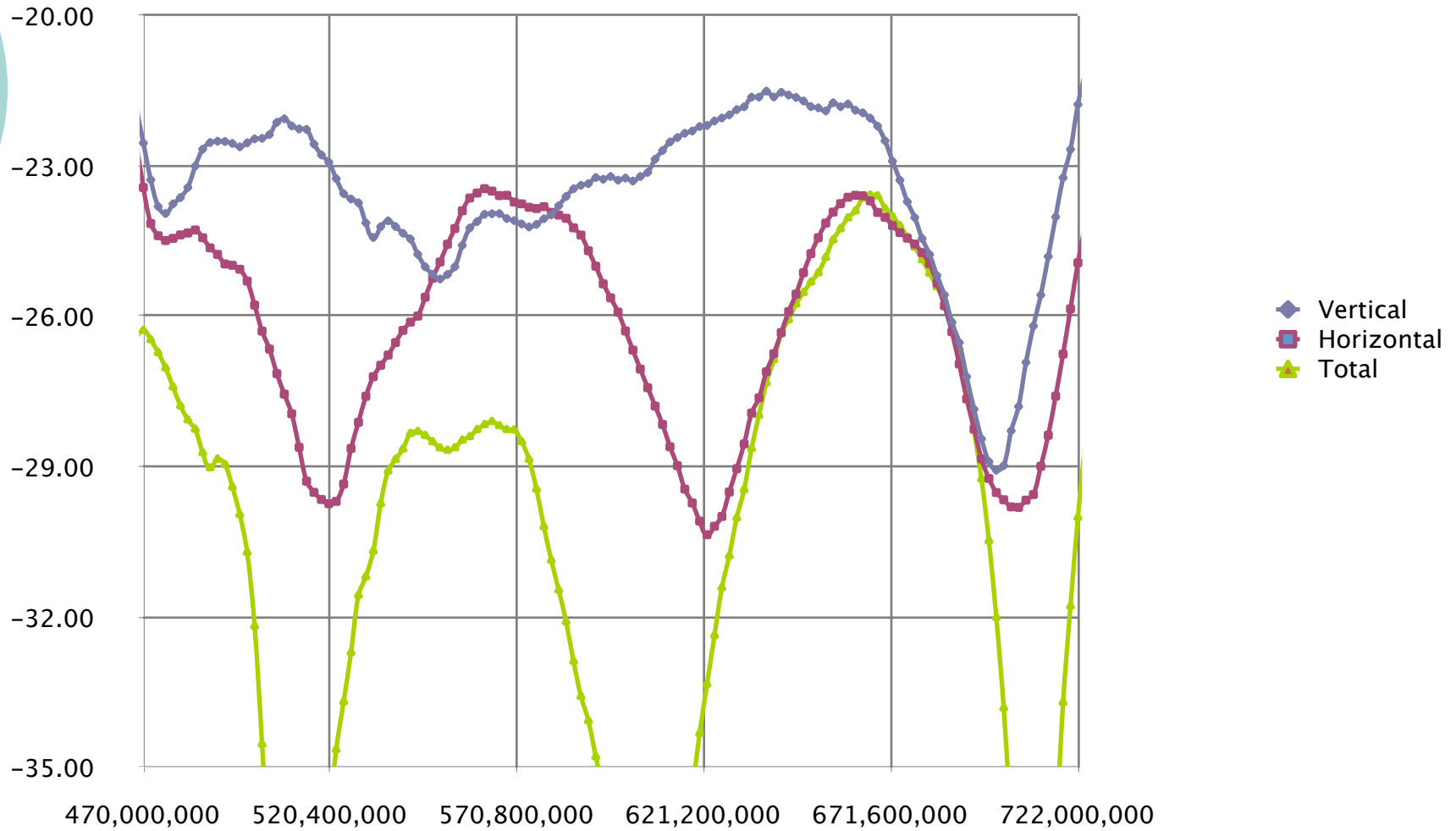
CP Panel Antenna with external Hybrid



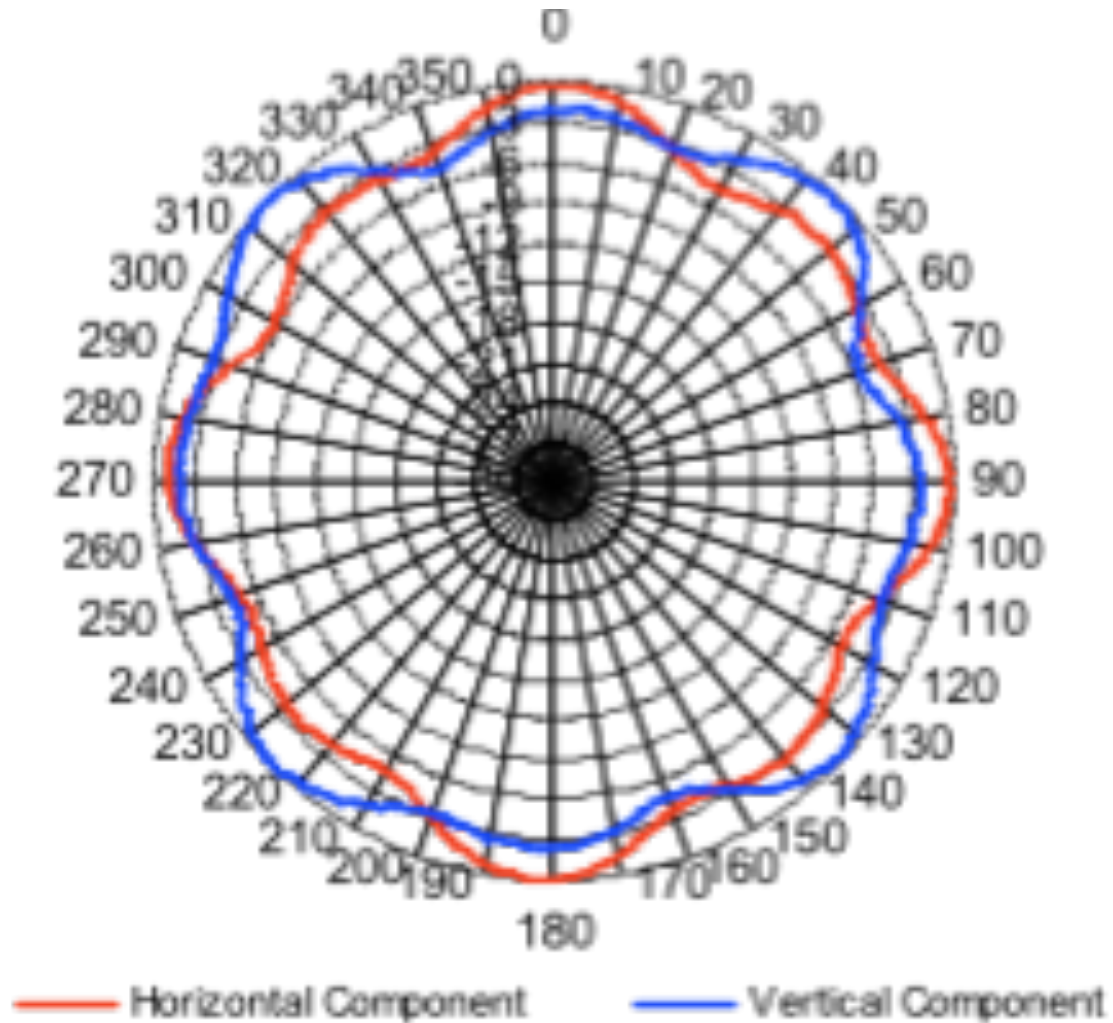
Performance: Specifications

- 470-722 MHz
- Power Handling:
 - 2.5 KW with single input connector
 - 5.0 KW with dual input connectors and external power divider
- VSWR: 1.15 worst case (panel alone)
- Polarization: CP or EP
- Half-power beam width 70°
 - suitable for four-around configurations

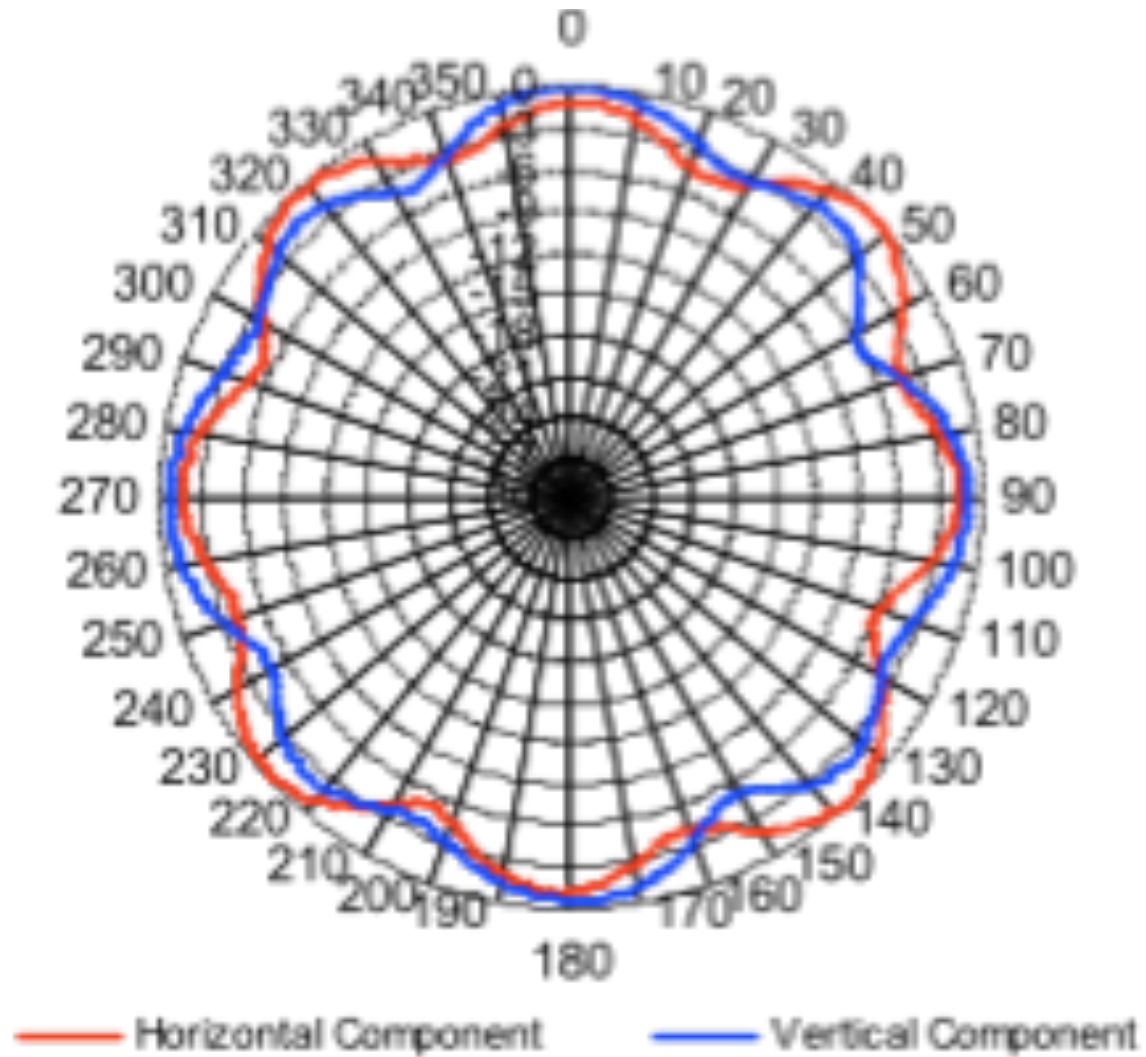
Return Loss



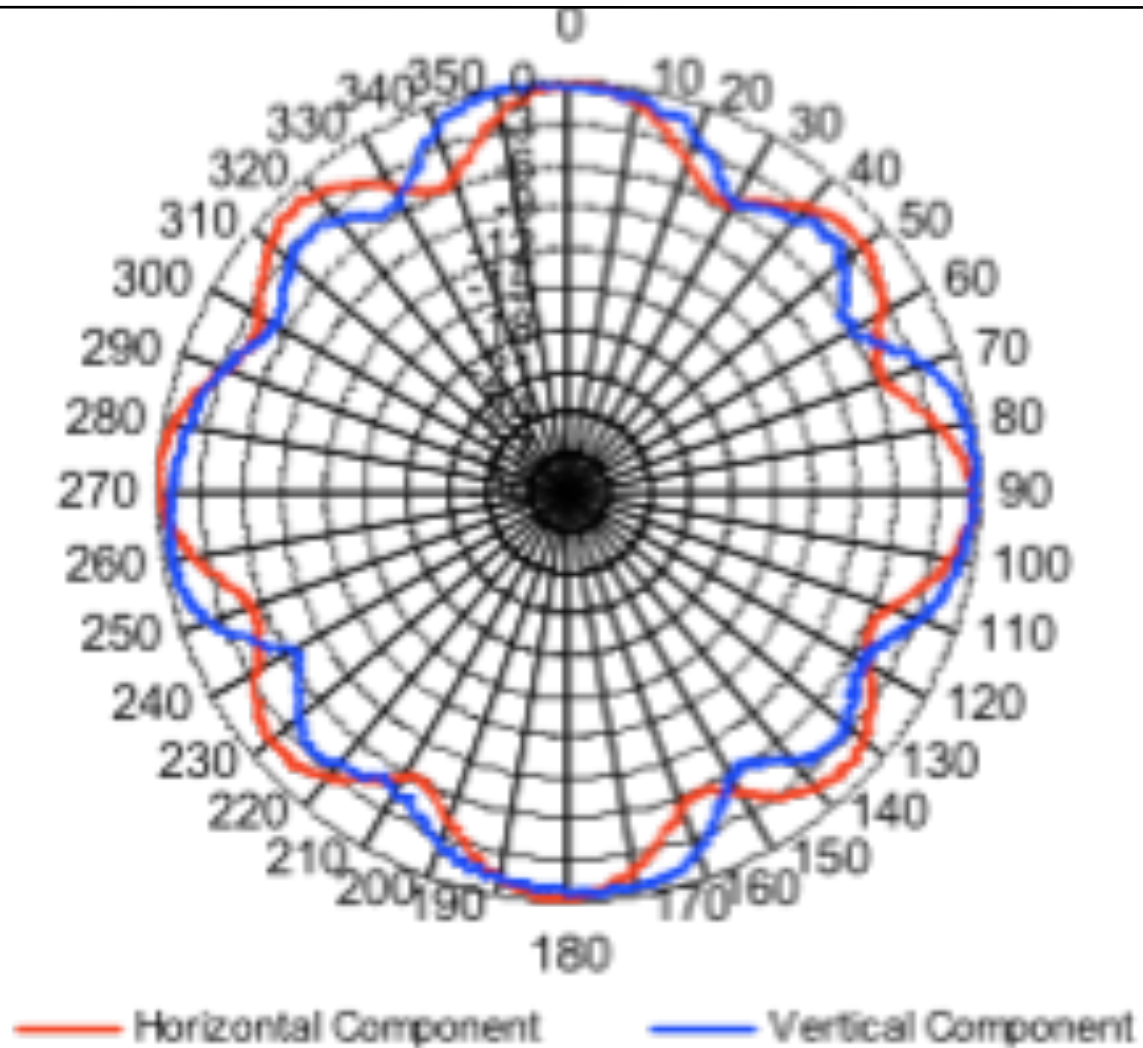
Omni HRP @ 533 MHz



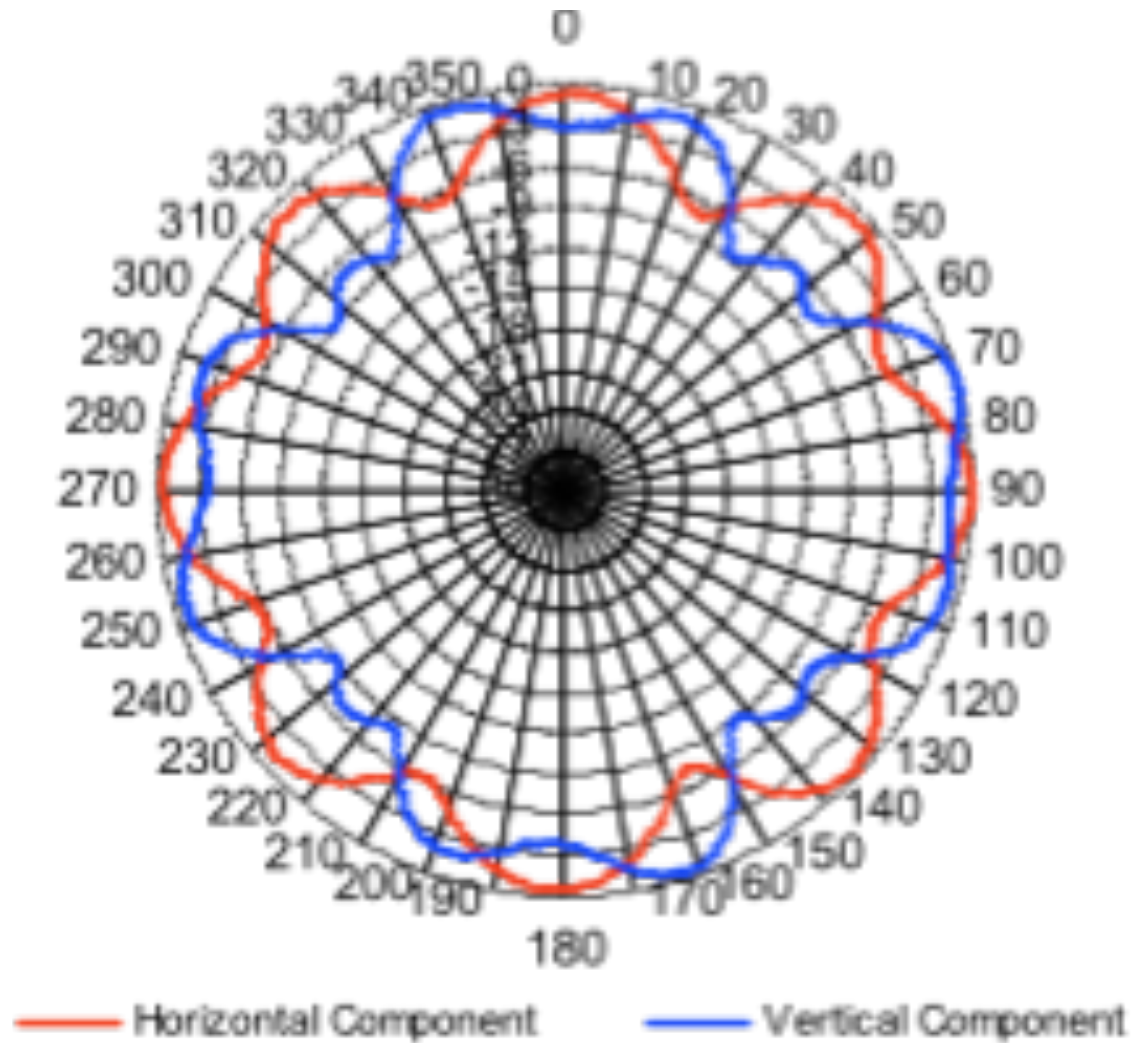
Omni HPR @ 596 MHz



Omni HRP @ 659 MHz



Omni HRP @ 722 MHz





THANK YOU

