- $e^{j(k_x - wt)}$: PLANE WAVE

- $k = \dfrac{2\pi}{\lambda}$: EQUATION FOR ELECTRO MAGNETIC

- $x = \pm \dfrac{d}{2}$: DISTANCE BETWEEN 2 RX ANTENNA

- $MUL = \displaystyle\sum_{n=0}^{N-1} a_n \cdot e^{j\cdot[k(x\cdot\cos\alpha + y\cdot\sin\alpha) - w(t-\delta)]}$

- $\delta = [0.001 \quad 1]$: TIME DELAY (μs)

- $\alpha = \pm \pi/2$: ANGLE $(R_x^\circ - T_x)$

$\hookrightarrow$ KEEP 2 ANTENNA ALWAYS $\pm \pi/2$ AND TURN AROUND

$\rightarrow$ ALL α GONNA CHANGE BUT THE SAME AMOUNT

$\rightarrow$ <u>SAME RESULT</u>.

$\oplus$ 1. MAKE THESE LOCATION CHANGE AND HOLD THE COORDINATE SYS. FIXED.

$\oplus$ 2. MAKE α CHANGE

$\rightarrow$ <u>SOLUTION</u> : KNOW $(\alpha, \delta, a) \hookleftarrow$ (ANGLE, DELAY, AMPLITUDE)

$\rightarrow$ FOR ANY STATION

$\rightarrow$ AMPLITUDE "a" VERY SMALL $\rightarrow$ MULTIPATH BECOMES NEGLEGIBLE ✓

- SITUATION $\rightarrow$ CONCERN WITH STRONG MULTIPATH :

$\begin{array}{|c|} \hline a_1 = 1/2 \\ \hline a_1 = 1/3 \\ \hline \end{array}$ or

Not $\boxed{a_1 = 1}$ ✗

EX: 1 MULTIPATH SIGNAL:

→ SHOULD SEE CASES WITH 1 MULTIPATH SIGNAL CANCEL SOME OF
THE MAIN SIGNAL.

- "NODE SPACING" → DEPEND ON THE DELAY δ (μs)

↘ ABOUT MHZ

DELAY → DELTA → δ IS LONGER → "NODE" CLOSE TOGETHER.
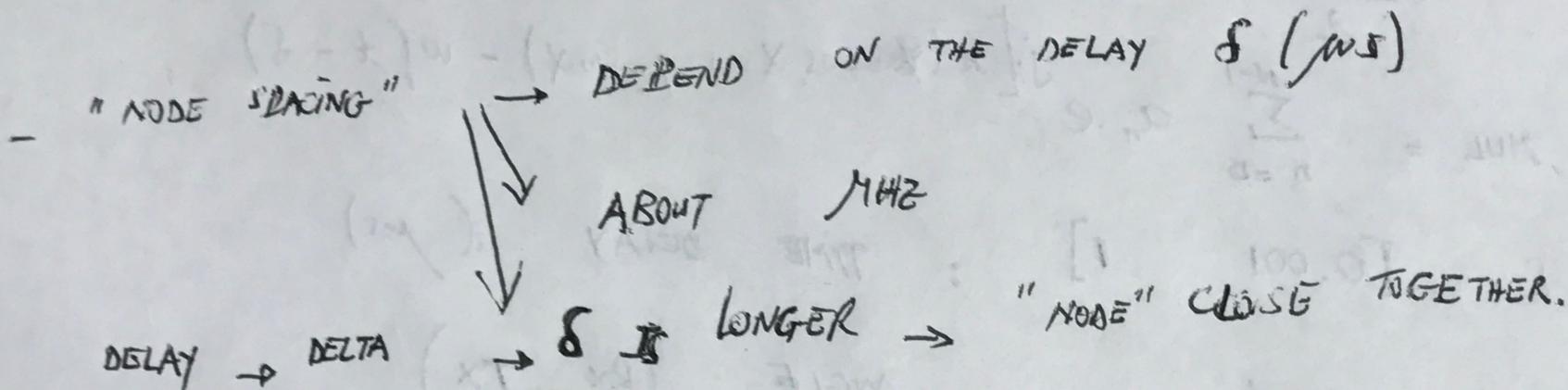
EXPECTATION:

- 2 SIGNALS COMING IN — AND 90° FROM THE OTHER WITH SAME AMPLITUDE

→ SIGNAL IS CANCELED ✓

ROTATE ANTENNAS:

- SHOULD SEE A PLACE WHERE HAVE A LOT CANCELATIONS

→ SIMPLE CASE TO TEST → TO MAKE SURE YOU ARE GETTING RIGHT.

- INTERESTING TO CHANGE TIME DELAY (δ)

→ IT SHOWS IT DOES CHANGE IN THE REALITY.

<u>INDOOR</u> :
- YOU TEND TO HAVE A LOT VERY SMALL DELAY (δ)
    → SO THEY CAN BE VERY STRONG

<u>OUTDOOR</u> :
- YOU HAVE LONGER SPACING BETWEEN THE ECHO
    → WHAT THAT MEAN ? { IF SOMETHING DELAY BY 100 ns = 0.1 μs
    THAT MEAN : THE MULTIPATH SIGNAL FOLLOWING (ABOUT 30M LONGER)
    THAN THE PATH DIRECT SIGNAL).

EX : IN THE PARKING LOT, IF SIGNAL OVER THERE - I'LL SEE :
DIRECTLY AND ALSO SEE BOUND SIGNAL OFF BUILDING .

<u>ASK YOURSELF</u> : <u>HOW MUCH FAR WOULD THAT SIGNAL TRAVEL ?</u>
    → THAT'LL TELL YOU DELAY.

✳ EVERY MULTIPATH EVIRONMENT HAVE DIFFERENT { SET OF <u>DELAY</u>
                                           AND { SET OF <u>AMPLITUDE</u>

AND THOSE CAN BE CHANGED ANYTIME YOU MOVE BY A WAVE LENGTH (λ)

<u>WHAT DO YOU WANT TO DO ?</u>
    → R̶E̶C̶O̶ RECOGNIZE GENERAL THINGS HAPPENING . B/C YOU'LL NEVER
SEEN THE SAME SPECIFIC CASE EXACTLY THE SAME SET OF (α, a, δ)
    → YOU'LL NEVER SEEN THAT TWICE