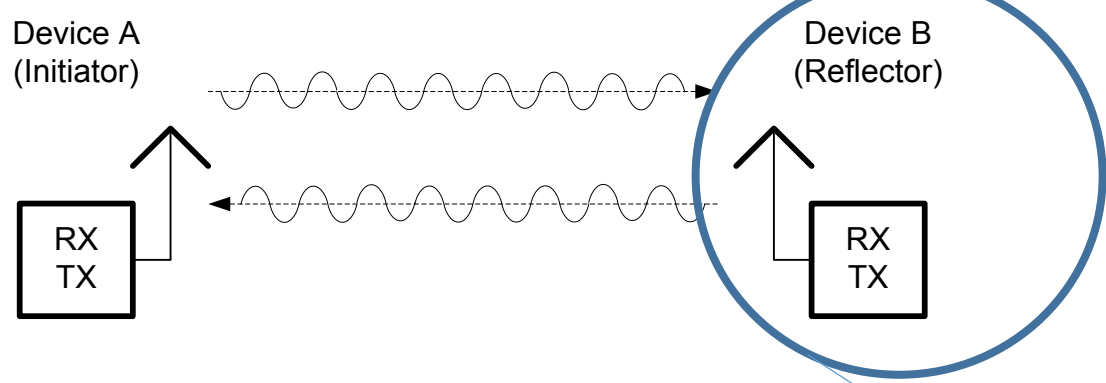
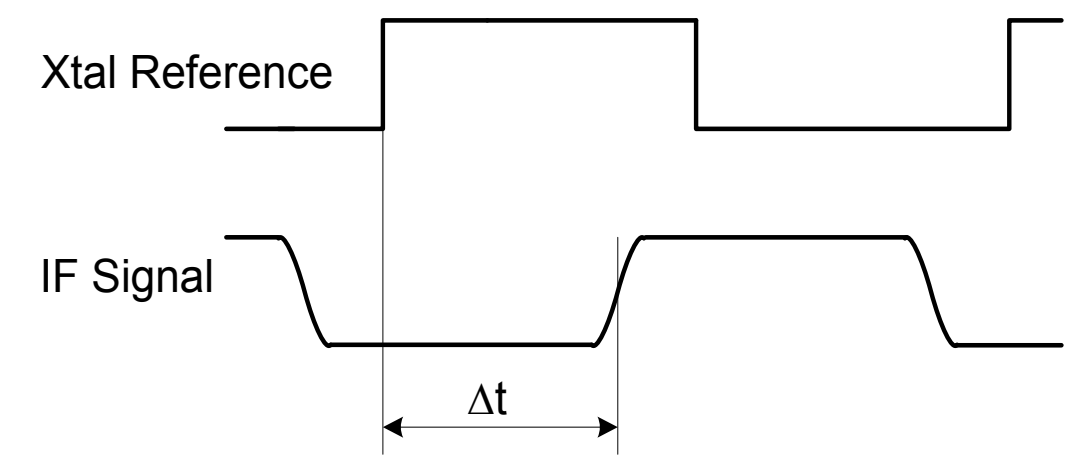
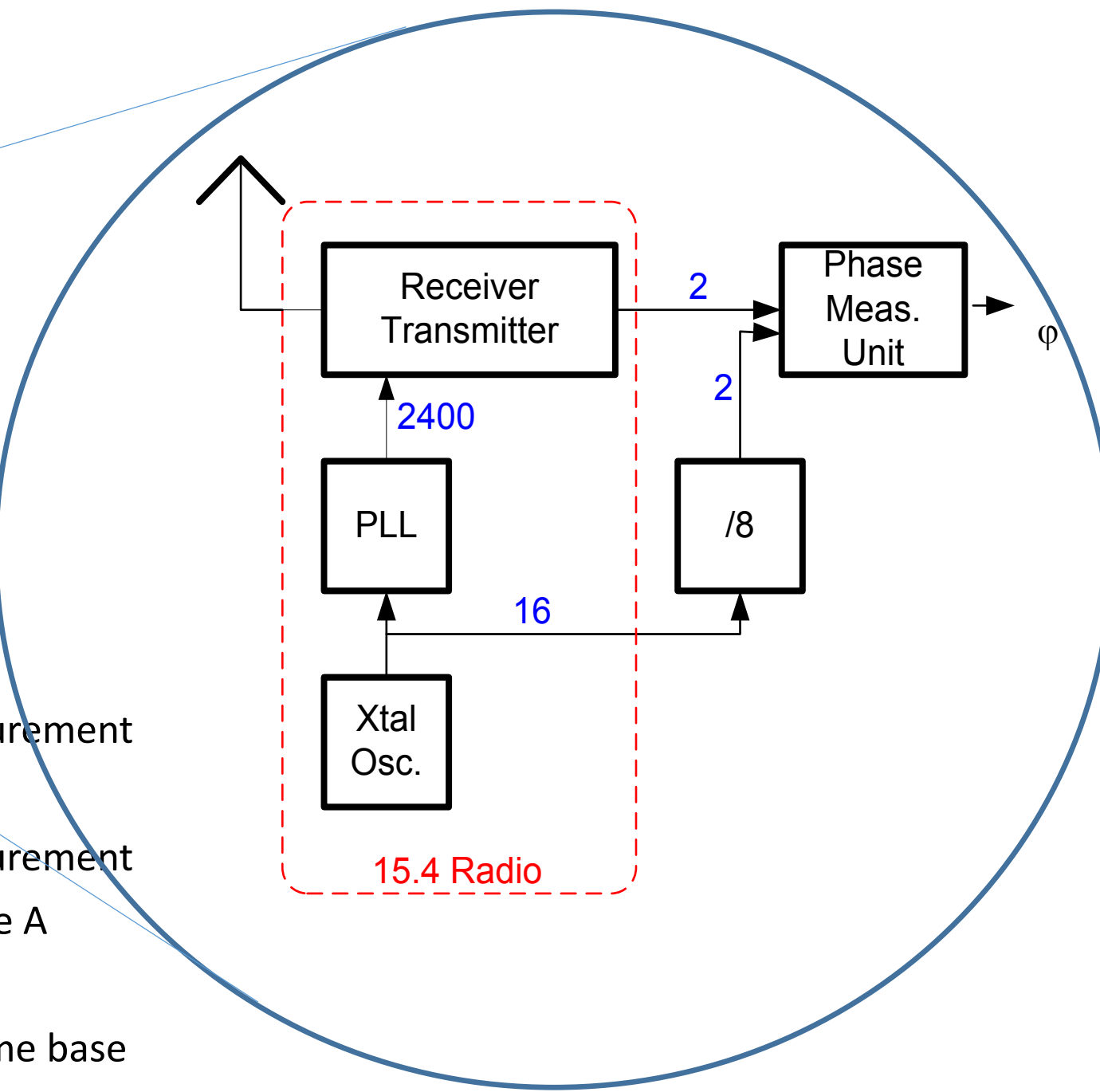


Active Reflector Principle



- Device A initiates ranging measurement
- Device A transmits carrier → device B performs phase measurement
- changing transmit direction in both devices
- Device B transmits carrier → device A performs phase measurement
- Device B transmits frame with measurement results to Device A
- Device A is able to calculate range
- Bidirectional traffic needed for devices with asynchronous time base

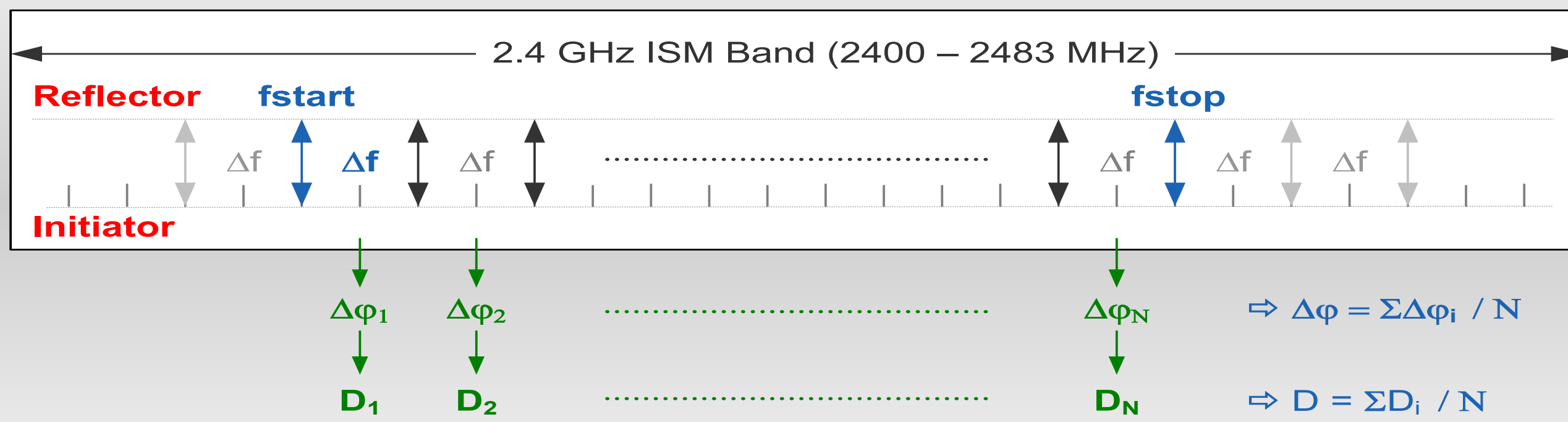


$$\phi = 2\pi\Delta t/T$$

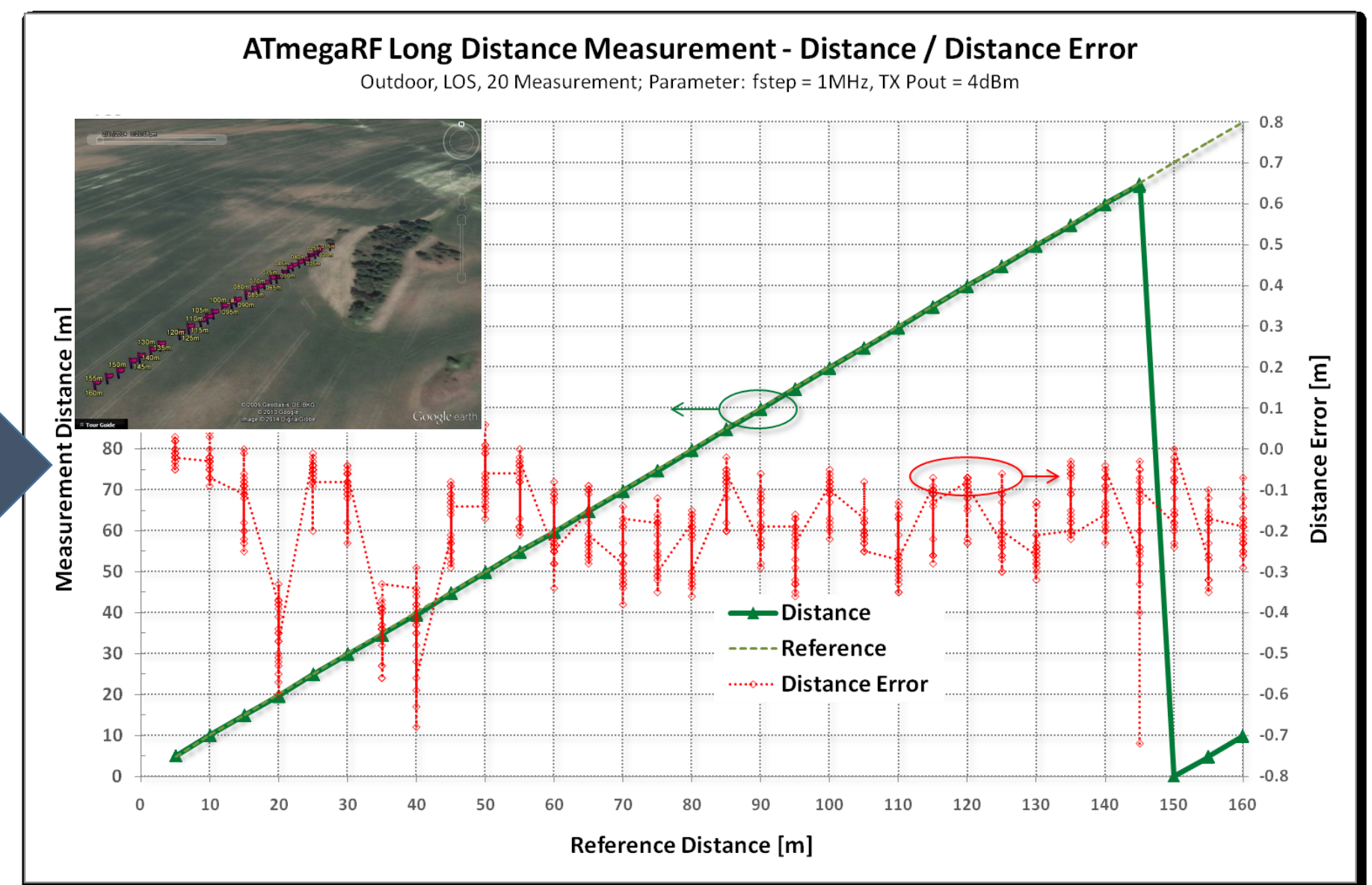
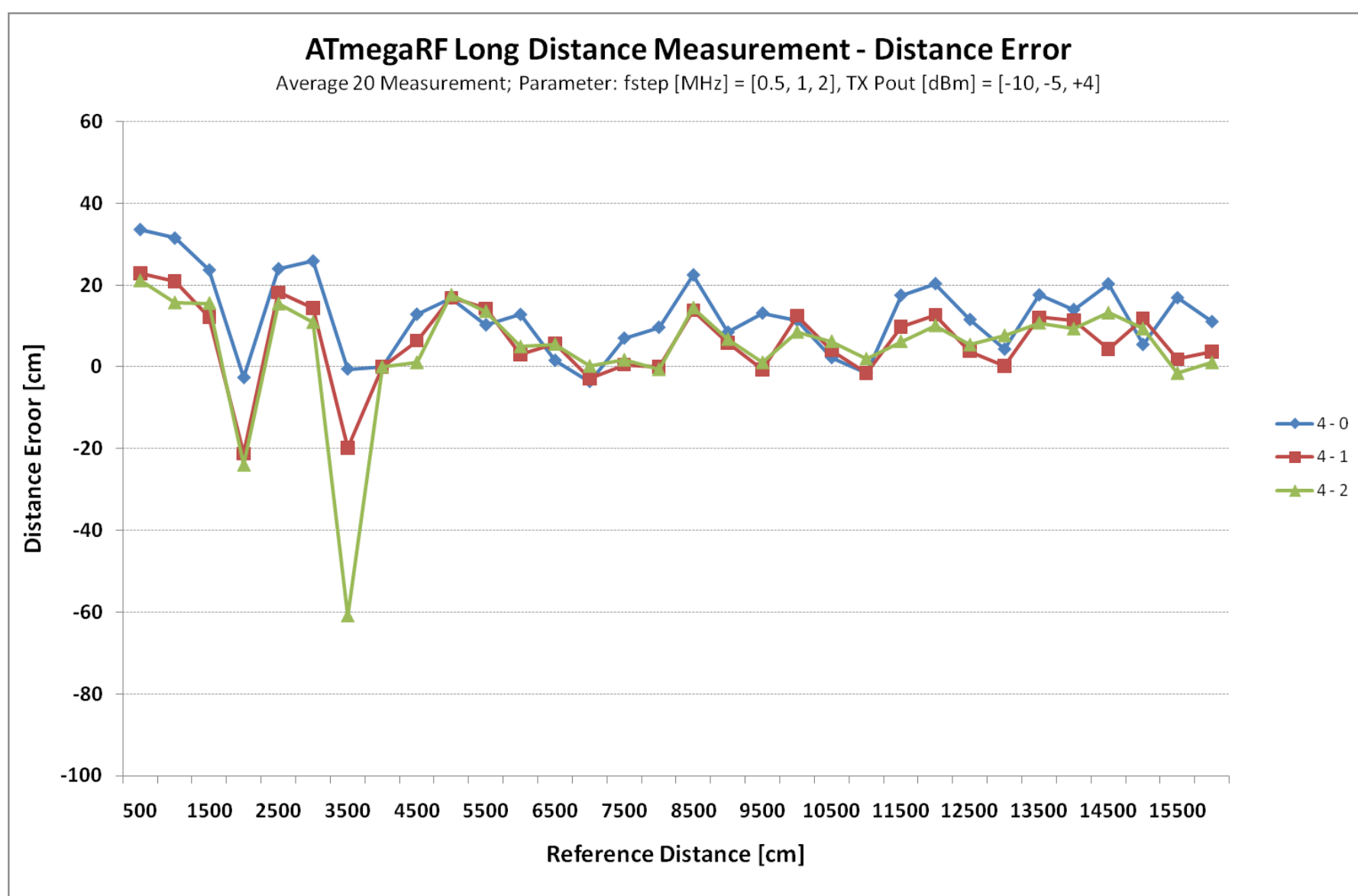
- PLL is running at same frequency at TX and RX mode
- Receiver measures phase between LO signal and received carrier
- Phase measurement can be done at any down-converted signal since frequency conversion maintains phase information
- Convenient Phase measurement at IF frequency in low-IF receiver

Straight-forward Distance Calculation (LOS):
(Direct Path dominates)

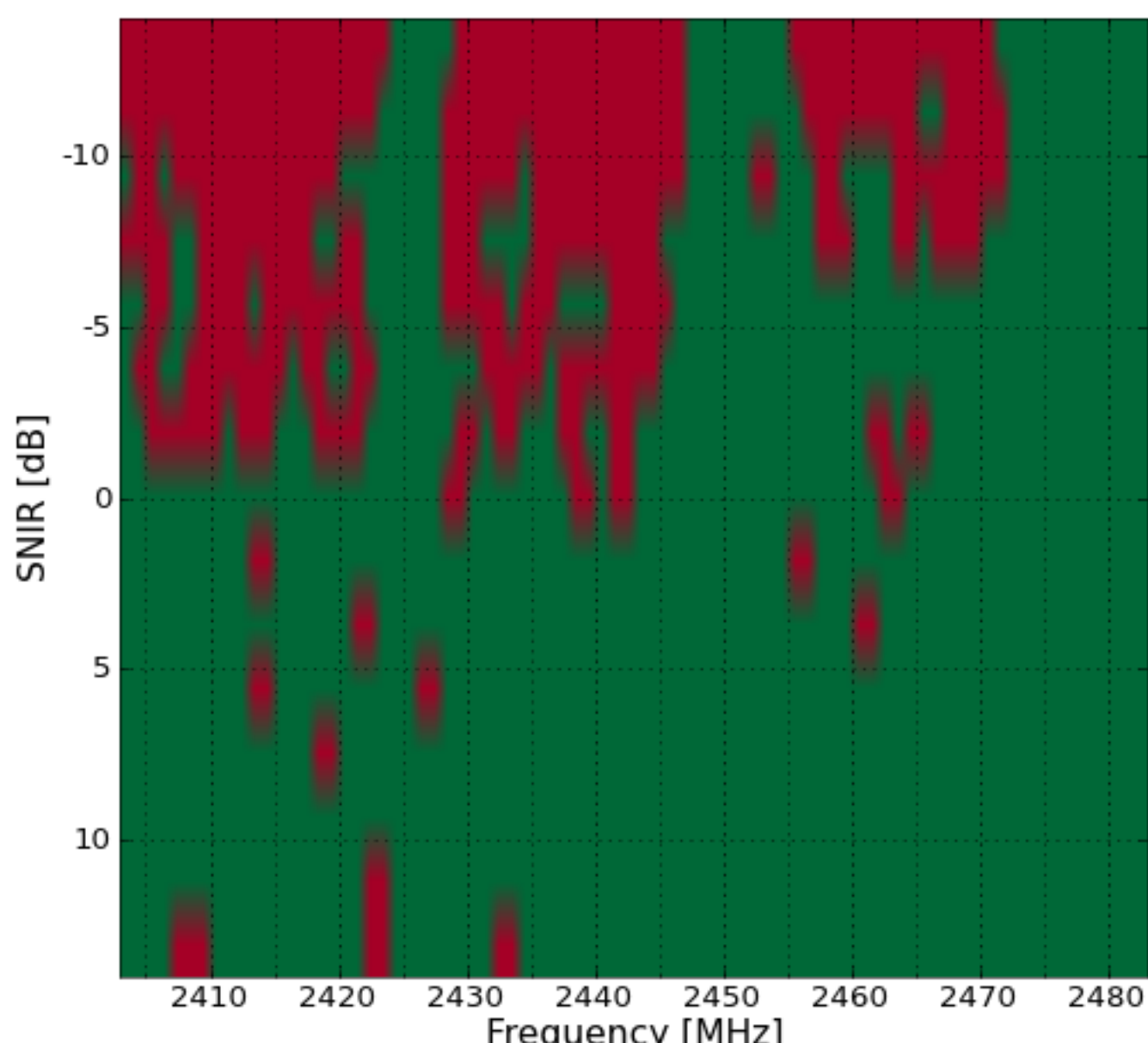
$$D = \frac{c}{4 \cdot \pi} \cdot \frac{-1 \cdot \sum_{N-1} \Delta\phi_n}{(N-1) \cdot \Delta f}$$



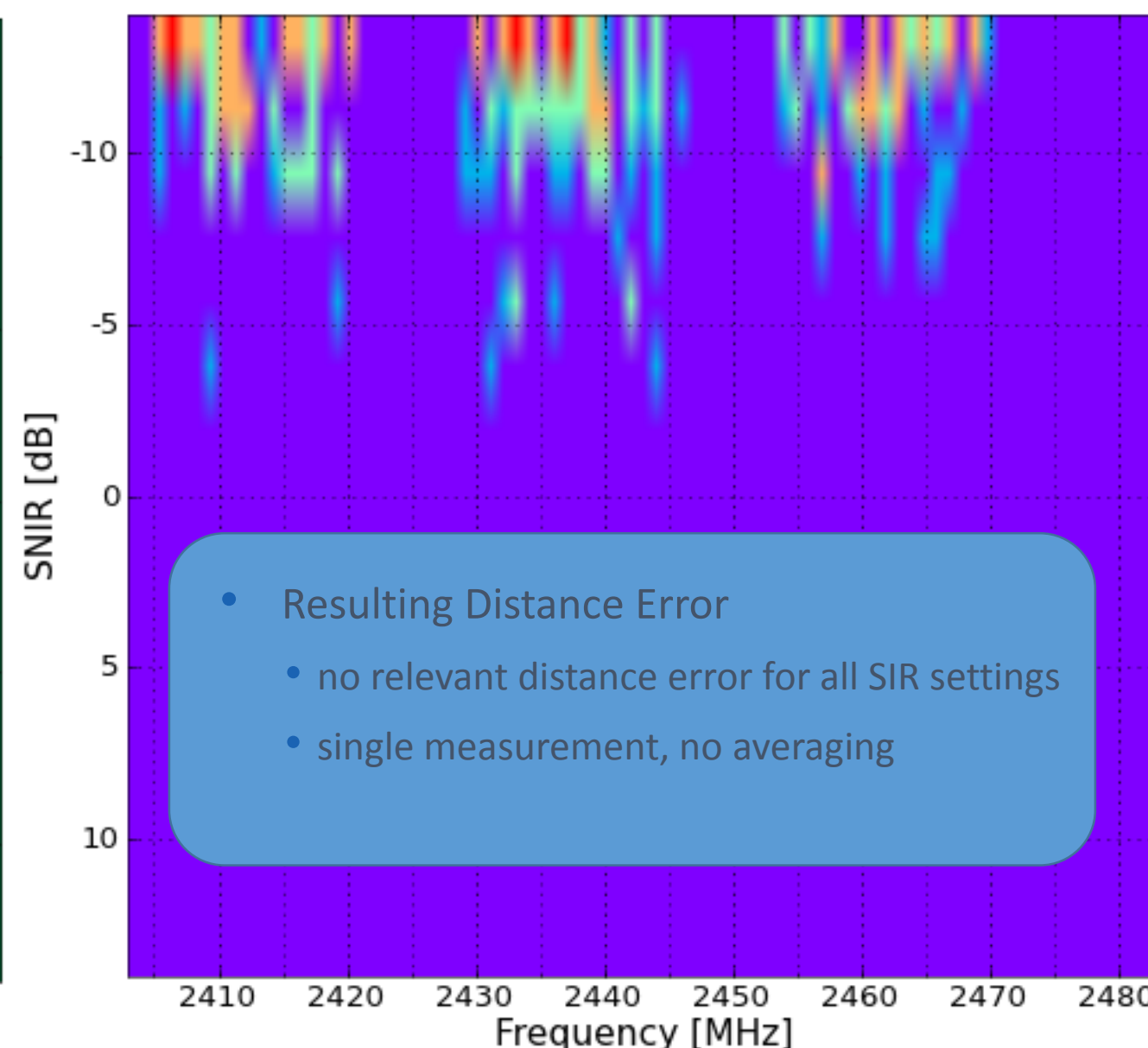
Measurement Accuracy



Unique Characteristic: Interference Detection & Mitigation



Valid Vector: Ch's: 01 + 06 + 11



Valid Vector: all SIR

- Resulting Distance Error
- no relevant distance error for all SIR settings
- single measurement, no averaging

