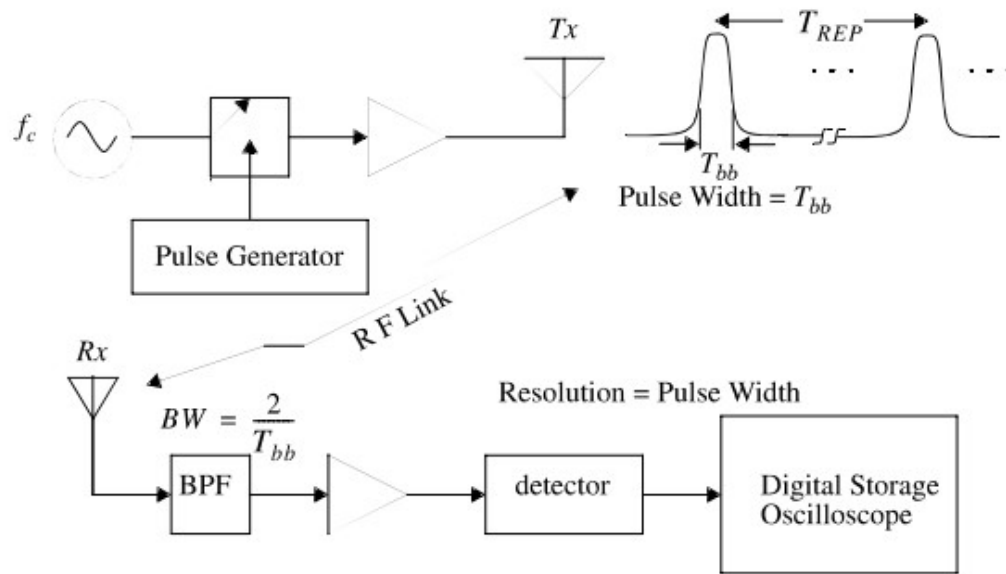


## Direct RF Pulse System



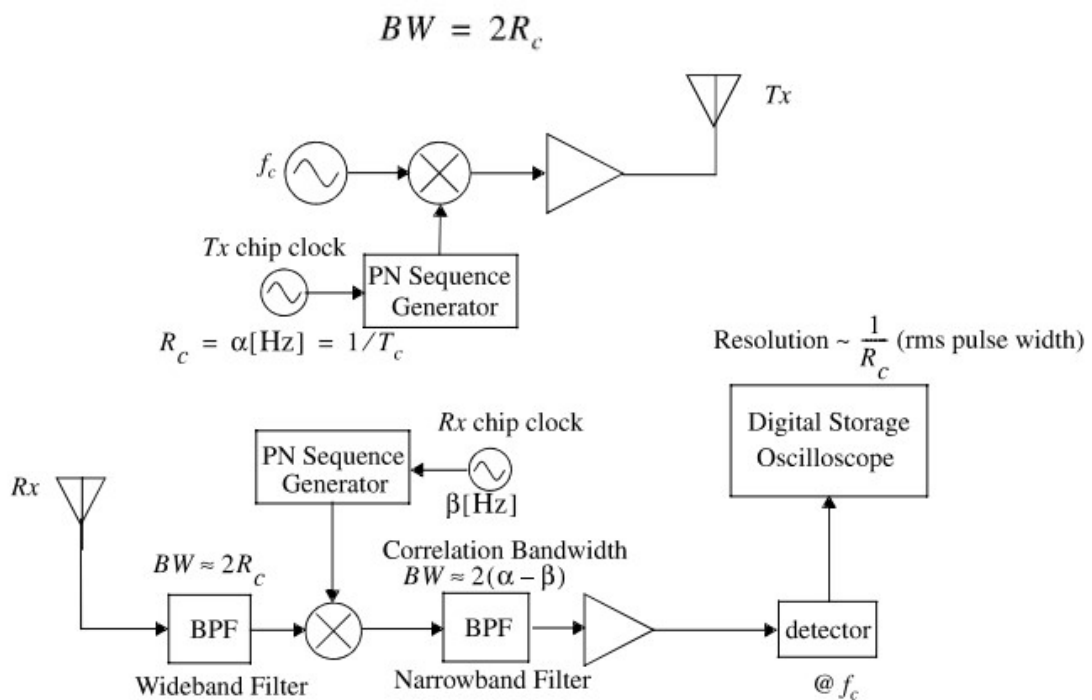
**Figure 5.6** Direct RF channel impulse response measurement system.

## Spread Spectrum Sliding Correlator Channel Sounding

Power spectrum envelope of the transmitted spread spectrum signal is given by [Dix84] as

$$S(f) = \left[ \frac{\sin \pi(f-f_c)T_c}{\pi(f-f_c)T_c} \right]^2 = \text{Sa}^2(\pi(f-f_c)T_c)$$

The null-to-null RF bandwidth is



**Figure 5.7** Spread spectrum channel impulse response measurement system.

Processing gain (PG) is given as

$$PG = \frac{2R_c}{R_{bb}} = \frac{2T_{bb}}{T_c} = \frac{(S/N)_{out}}{(S/N)_{in}}$$

where  $T_{bb} = 1/R_{bb}$ , is the period of the baseband information

The time resolution ( $\Delta\tau$ ) of multipath components using a spread spectrum system with sliding correlation is

$$\Delta\tau = 2T_c = \frac{2}{R_c}$$

The time between maximal correlations ( $\Delta T$ ) can be calculated from

$$\Delta T = T_c \gamma l = \frac{\gamma l}{R_c}$$

Where  $T_c$  = chip period (s)

$R_c$  = chip rate (Hz)

$\gamma$  = slide factor (dimensionless)

$l$  = sequence length (chips)

The slide factor is defined as the ratio between the transmitter chip clock rate and the difference between the transmitter and receiver chip clock rates expressed as

$$\gamma = \frac{\alpha}{\alpha - \beta}$$

Where  $\alpha$  = transmitter chip clock rate (Hz)

$\beta$  = receiver chip clock rate (Hz)

For a maximal length PN sequence, the sequence length is

$$l = 2^n - 1$$

Where  $n$  is the number of shift registers in the sequence generator

The observed time scale on the oscilloscope using a sliding correlator is related to the actual propagation time scale by

$$\text{Actual Propagation Time} = \frac{\text{Observed Time}}{\gamma}$$

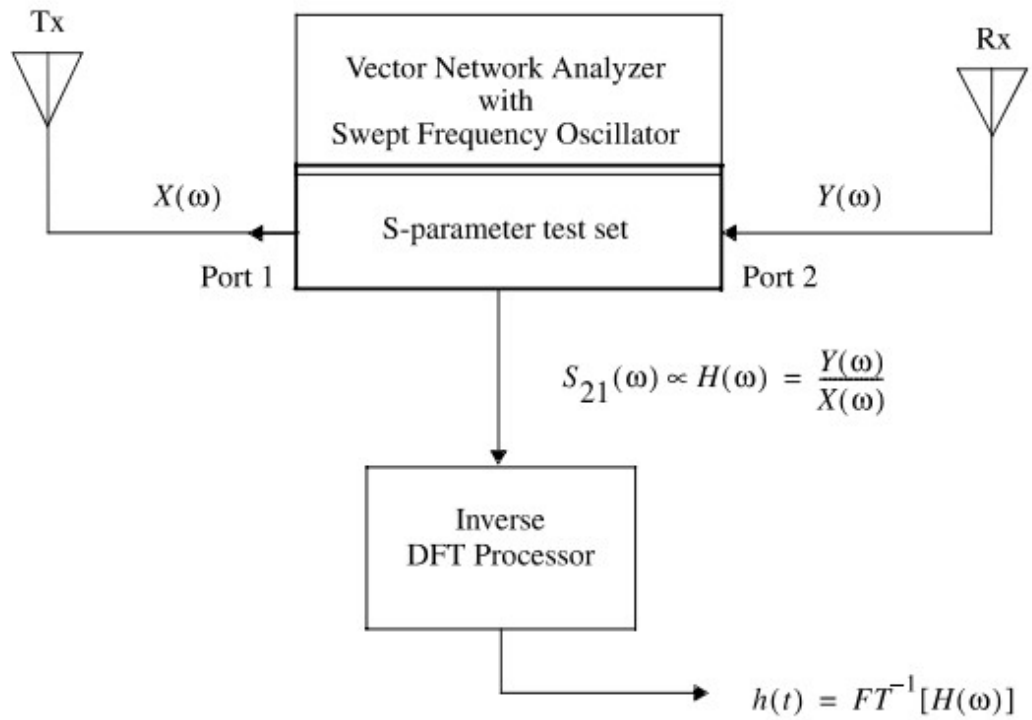
PN sequence period is

$$\tau_{PNseq} = T_c l$$

The sequence period gives an estimate of the maximum unambiguous range of incoming multipath signal components. This range is found by multiplying the speed of light with

$\tau_{PNseq}$ .

## Frequency Domain Channel Sounding



**Figure 5.8** Frequency domain channel impulse response measurement system.