HY-330

Introduction to telecommunication systems theory

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Rx

- Synchronization

- Carrier Frequency Offset

- Channel Estimation Equalization

Clock Domains
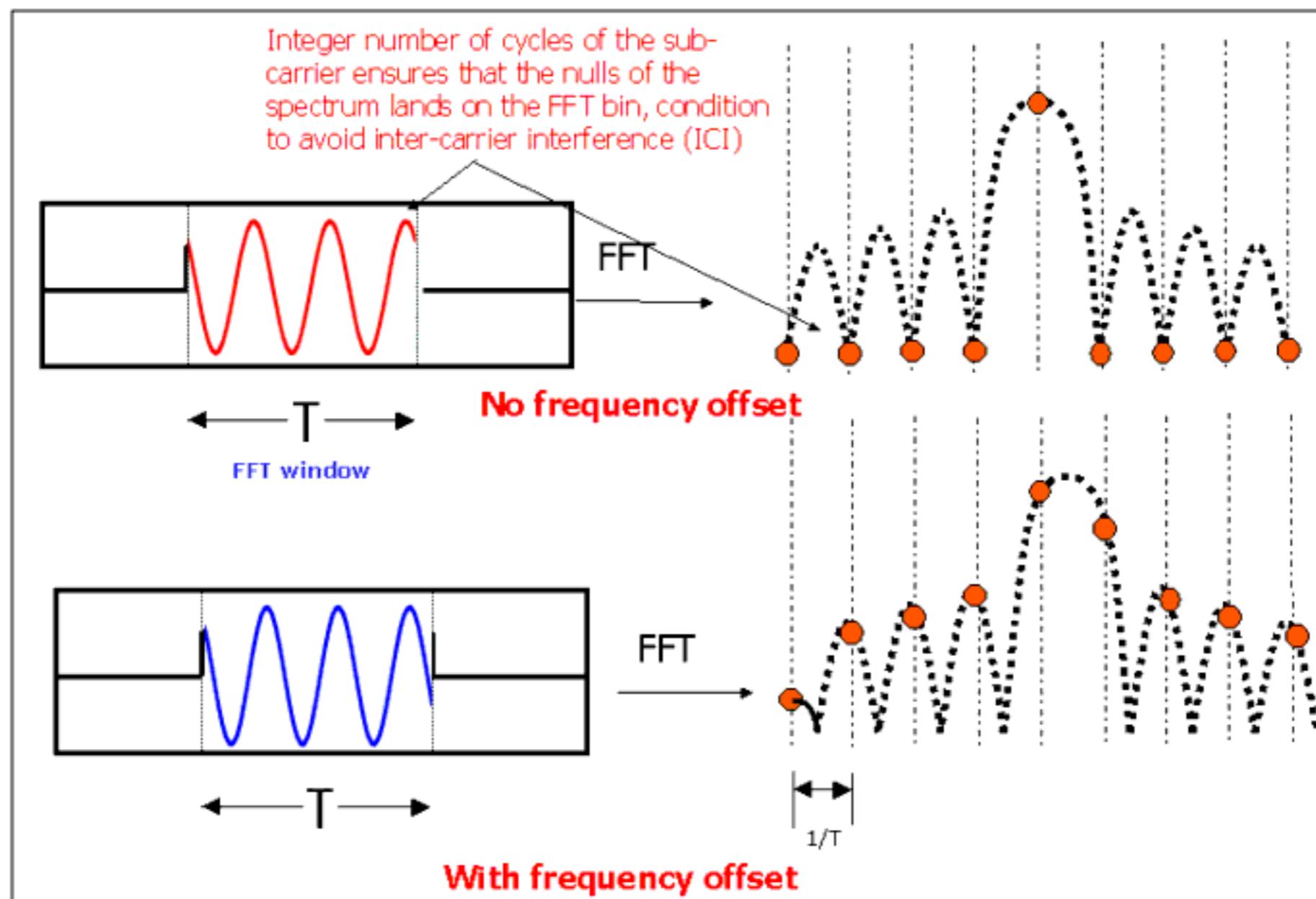
Clocks
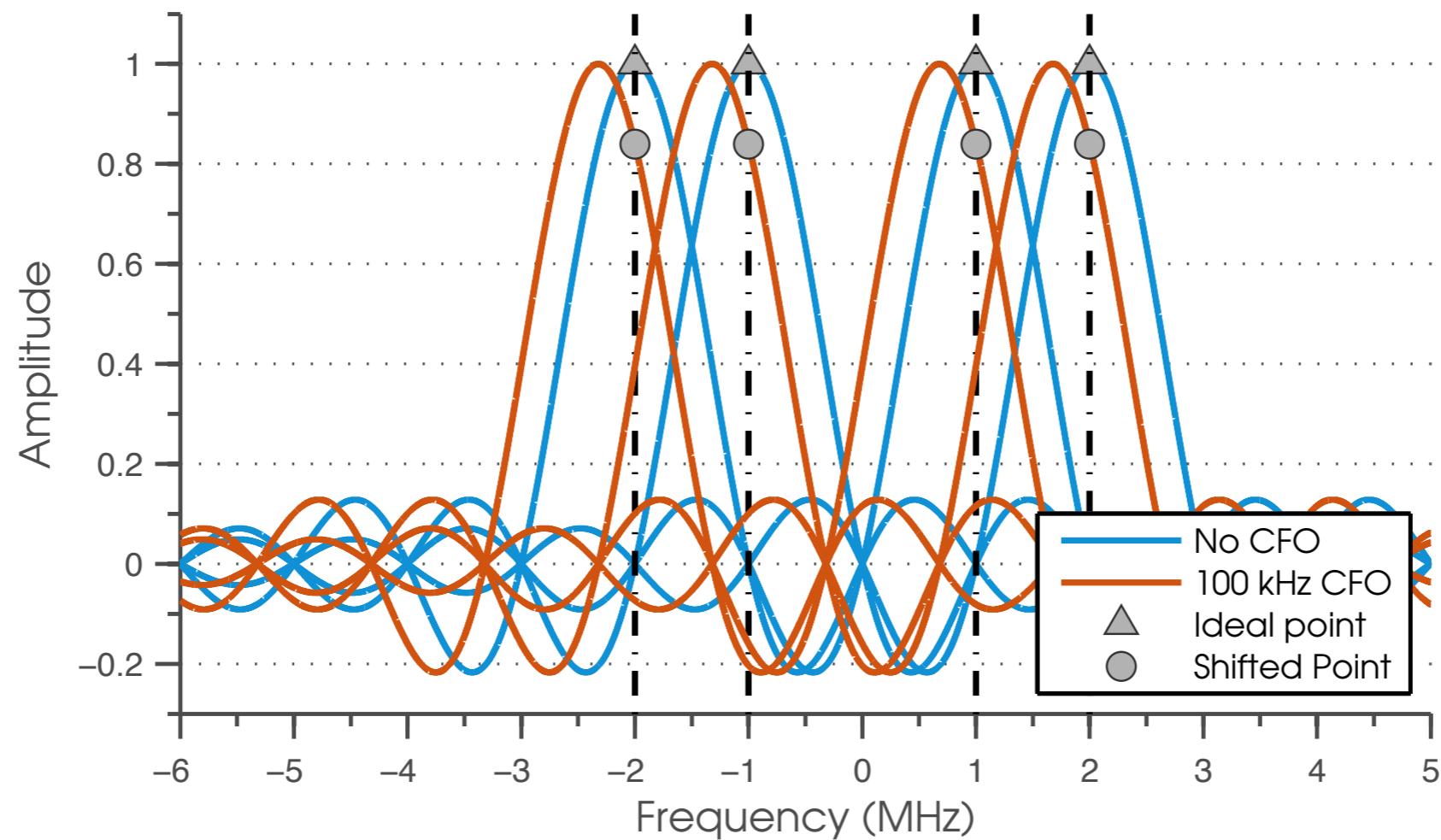
* Crystal oscillator (XO)

* Temperature compensated (VCXO)

* Oven controlled (OCXO)

* Rubidium atomic clock

* GPS clock

* Caesium atomic clock

* Hydrogen maser clock

Method	Typical Stability
Crystal oscillator	5 - 50ppm (5x10-6)
Temperature compensated crystal oscillator (TCXO)	1ppm (1 x 10-6)
Oven controlled crystal oscillator (OCXO)	0.1ppm (1x10-7)
Rubidium oscillator	1 x 10-9
GPS disciplined oscillator (GPSDO)	1x10-11
Cesium oscillator	10-13
Hydrogen maser (Active)	10-15

CFO in frequency domain

Integer number of cycles of the sub-carrier ensures that the nulls of the spectrum lands on the FFT bin, condition to avoid inter-carrier interference (ICI)

FFT

T

FFT window

No frequency offset

FFT

T

1/T

With frequency offset
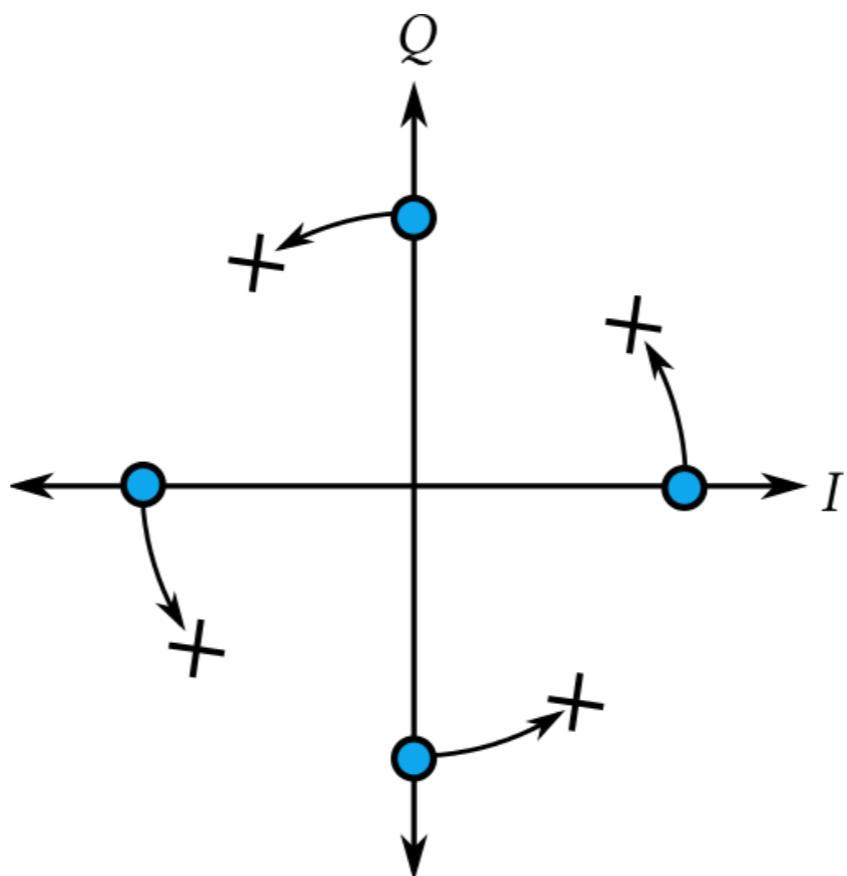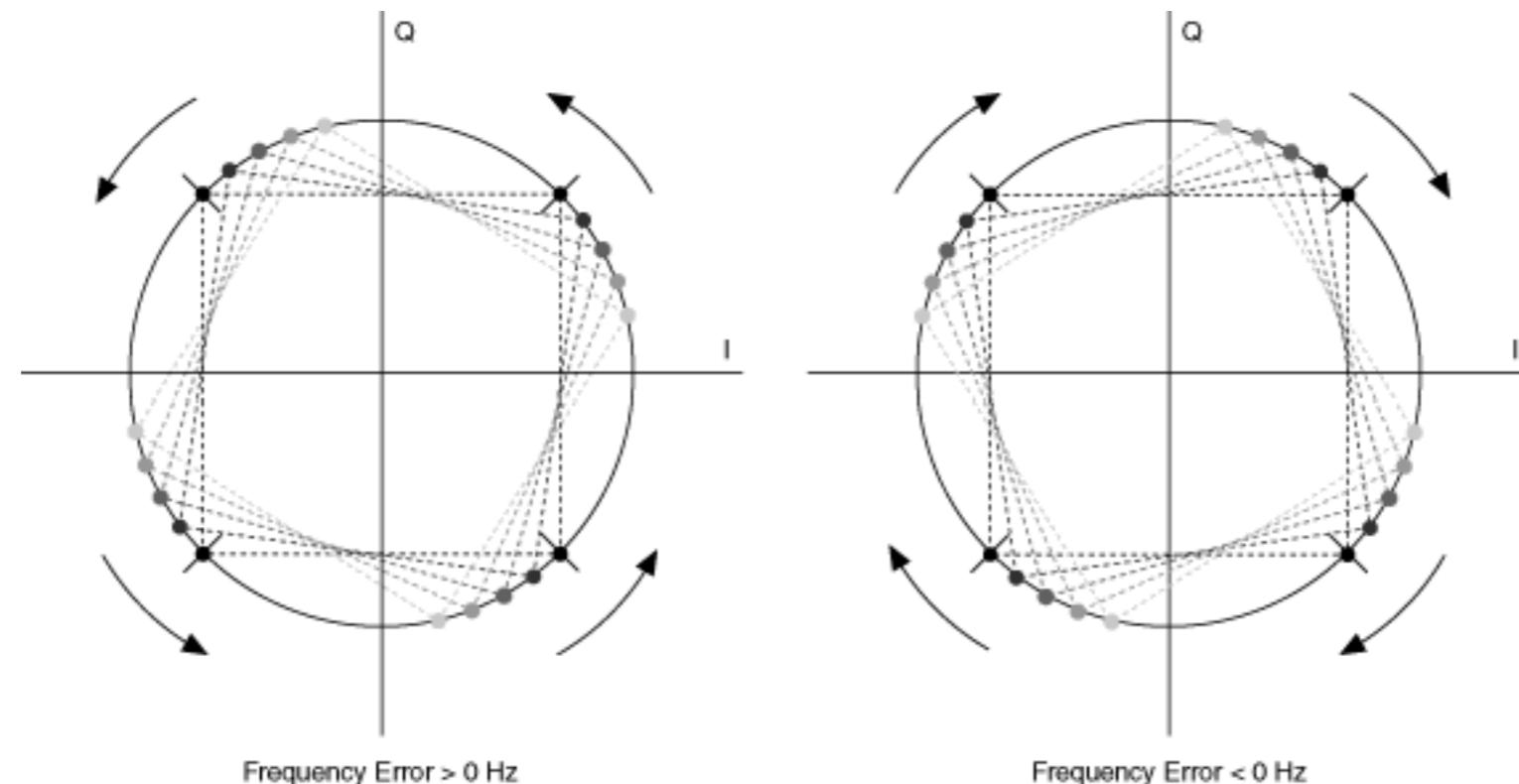
CFO in frequency domain

CFO in constellation

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CFO in constellation

Frequency Error > 0 Hz   Frequency Error < 0 Hz
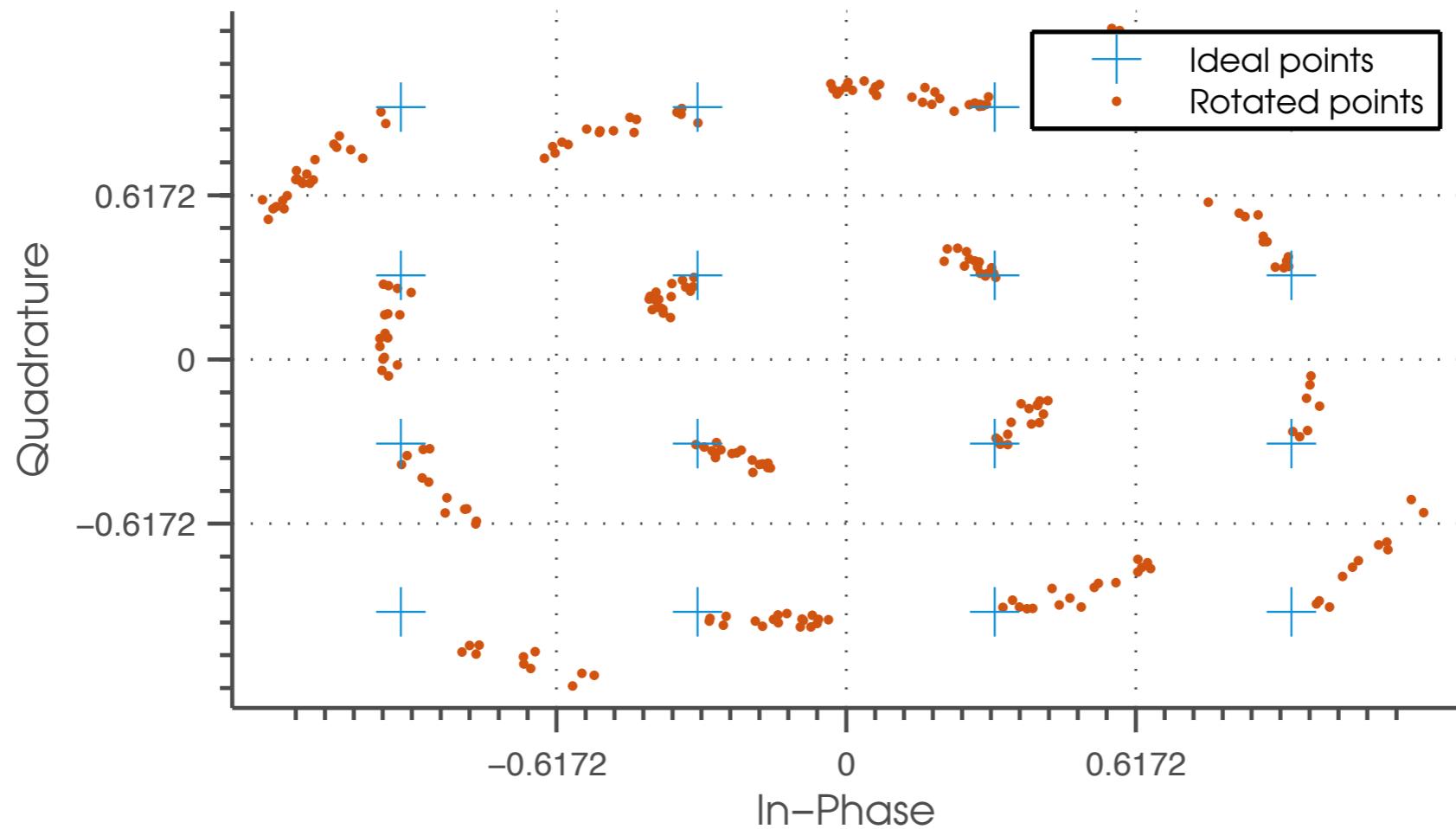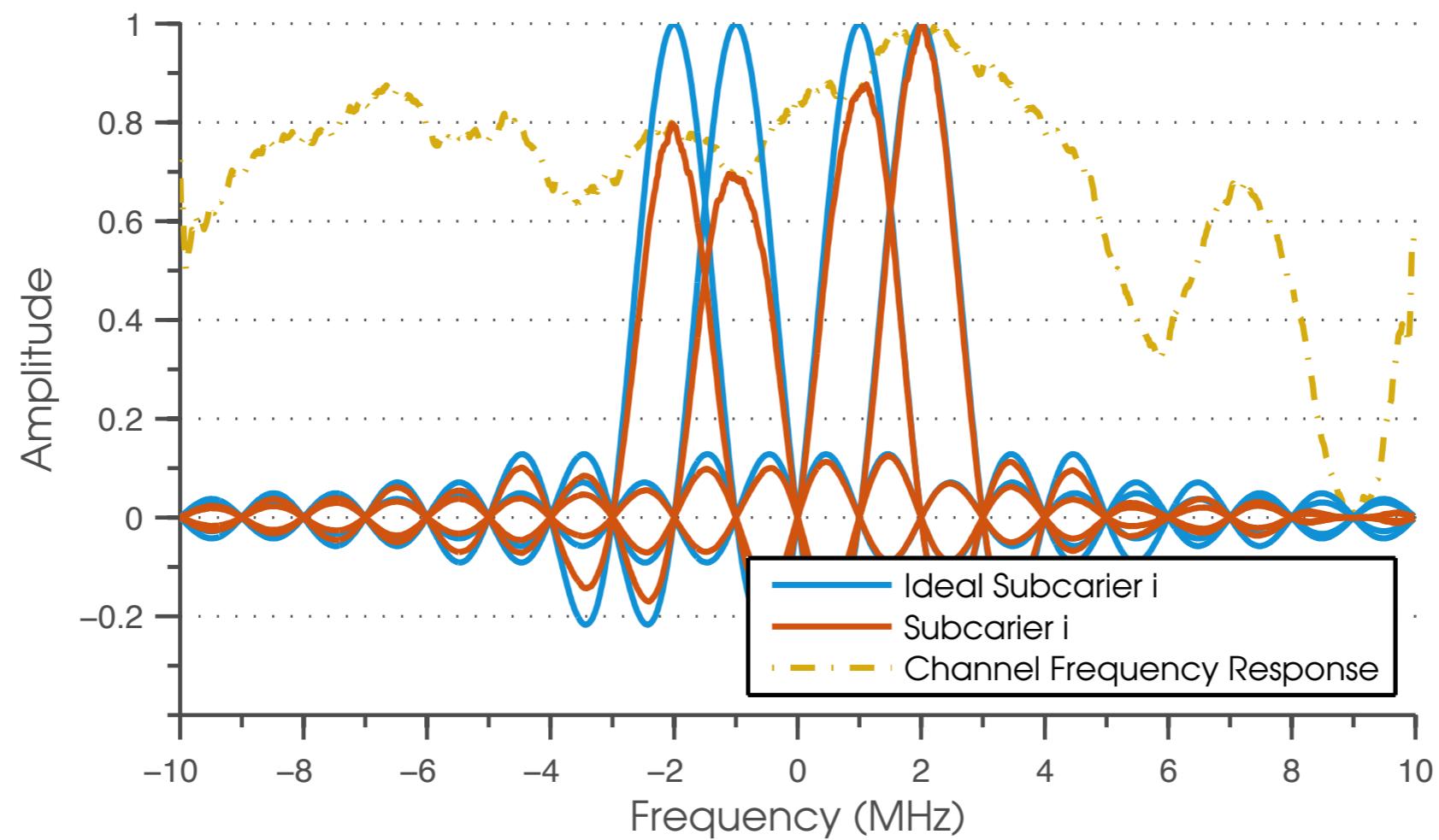
CFO in constellation

Channel Impact

Channel Impact

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