MGA Webinar Series : 8
GNSS Raw Data Measurement from Android Device
Background Information

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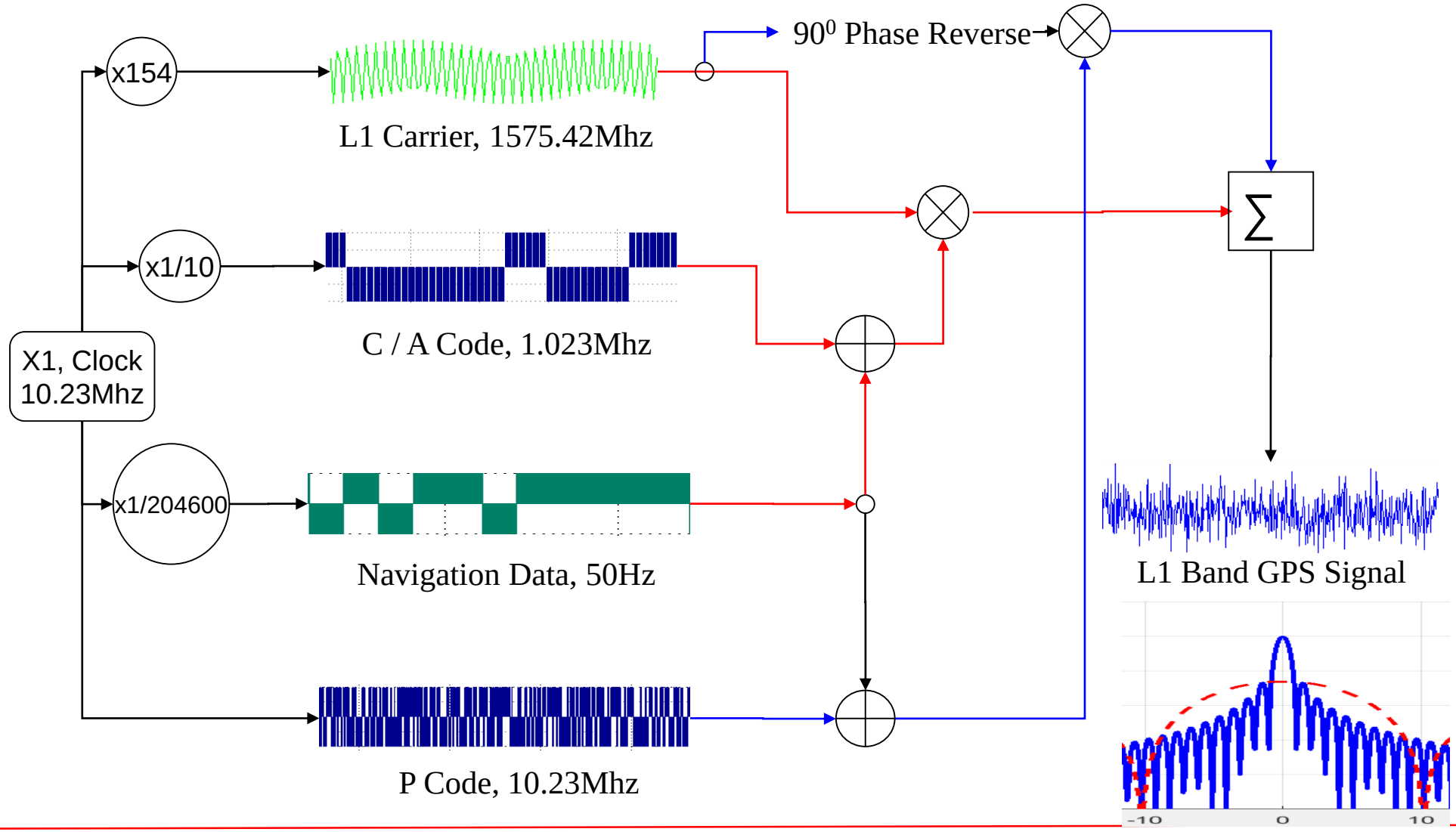
Background Information : GPS Signal Structure



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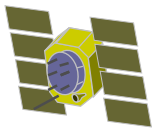
Architecture of a GNSS Receiver



GPS

GPS RF signal at 1575.42MHz

Antenna

Convert to Lower Frequency Defined by Sampling Frequency and IF

Pre-Amp (LNA)

Down Converter

AGC

A/D Converter

Digital Signal Output

Baseband Signal Processing

Position Output (PVT)

Frequency Generator

Oscillator Ref. Clock 10.23MHz

Replica Signal Generator

Output from Base-band Signal Processing

Acquisition

Tracking

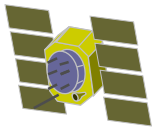
Navigation Data

To find out visible satellites, approximate Doppler and Code-phase

To continuously demodulate the signal to extract the navigation data bits
Done by using DLL, FLL and PLL.
Outputs from Acquisition are used as input for Tracking

Generate Pseudorange, Doppler etc
Extract Ephemeris or Satellite Orbit related Data
Extract Clock related data

Architecture of a GNSS Receiver



GPS RF signal at 1575.42MHz

Antenna

Convert to Lower Frequency Defined by Sampling Frequency and IF

Pre-Amp (LNA)

Down Converter

AGC

A/D Converter

Digital Signal Output

Baseband Signal Processing

Position Output (PVT)

RAW Data
Data necessary to compute Pseudorange, Carrier Phase, Doppler, TimeError etc

Frequency Generator

Oscillator Ref. Clock 10.23MHz

Replica Signal Generator

Output from Base-band Signal Processing

Acquisition

Tracking

Navigation Data

To find out visible satellites, approximate Doppler and Code-phase

To continuously demodulate the signal to extract the navigation data bits
Done by using DLL, FLL and PLL.
Outputs from Acquisition are used as input for Tracking

Generate Pseudorange, Doppler etc
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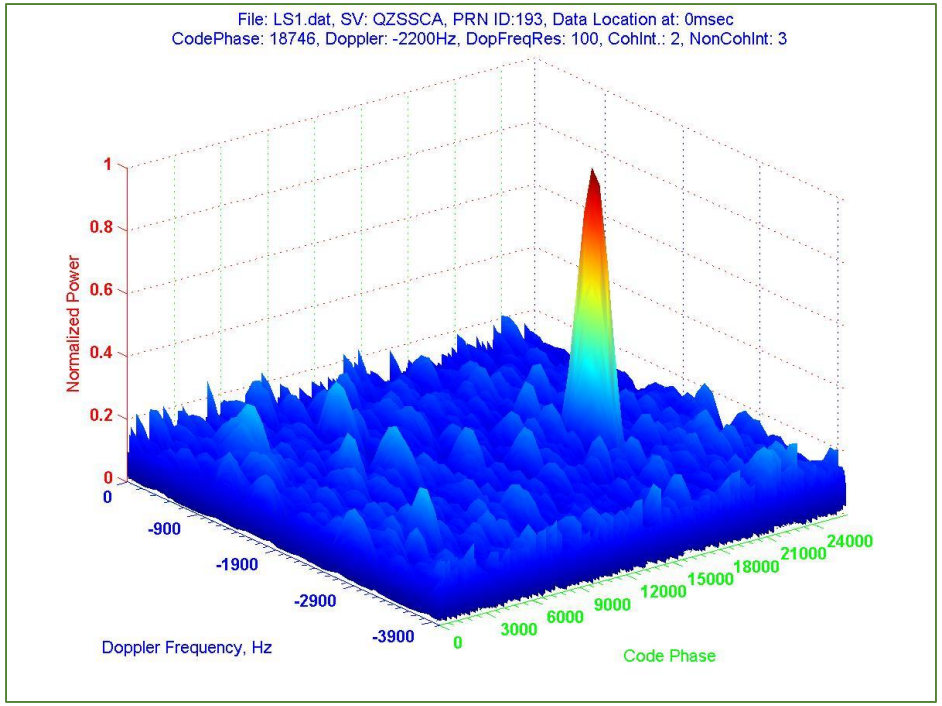
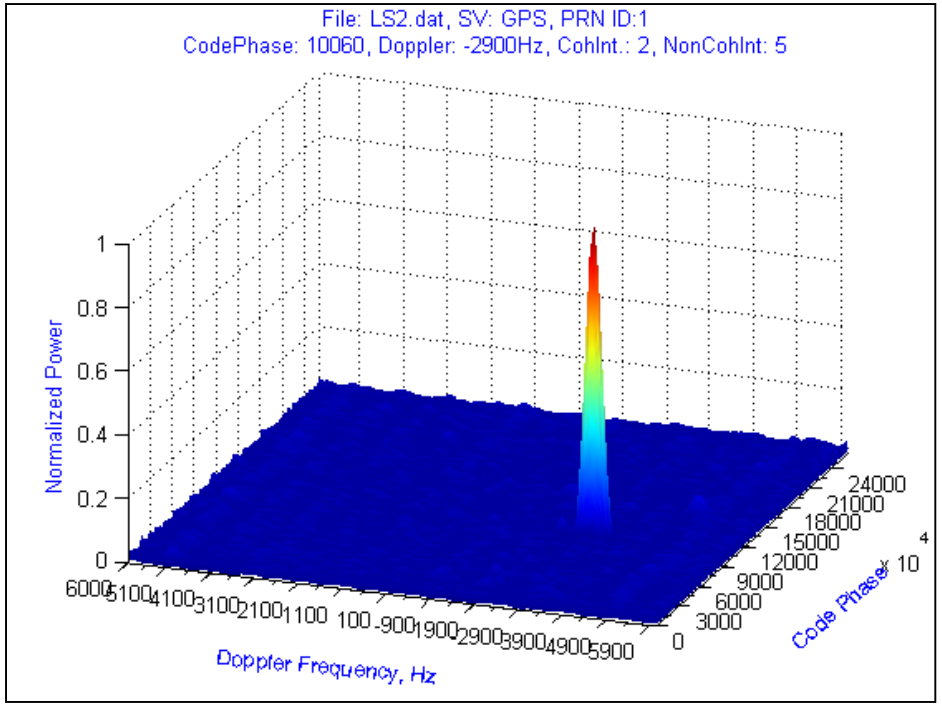
Acquisition of GPS L1C/A Signal





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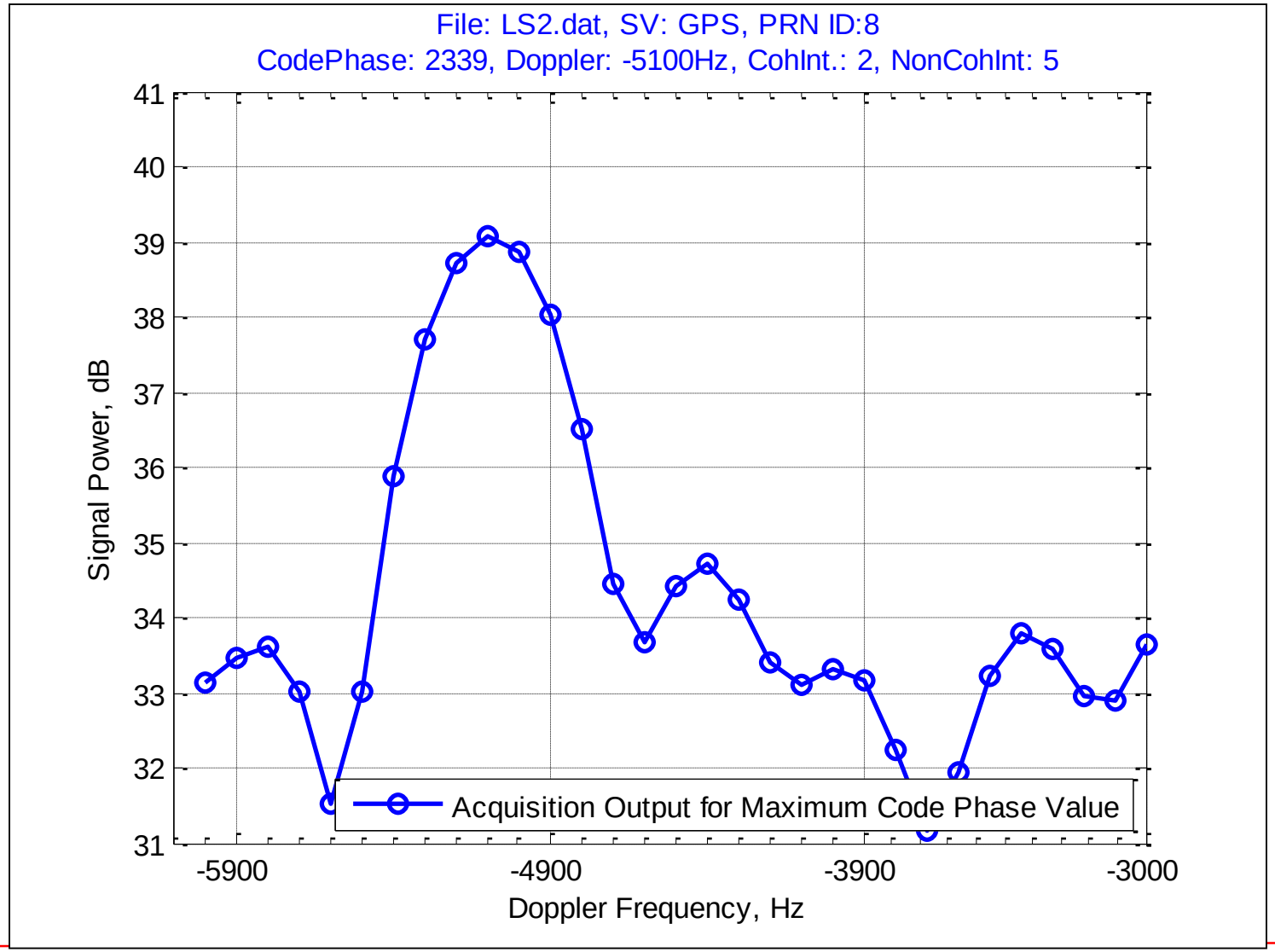
Acquisition Output shown for Doppler Frequency



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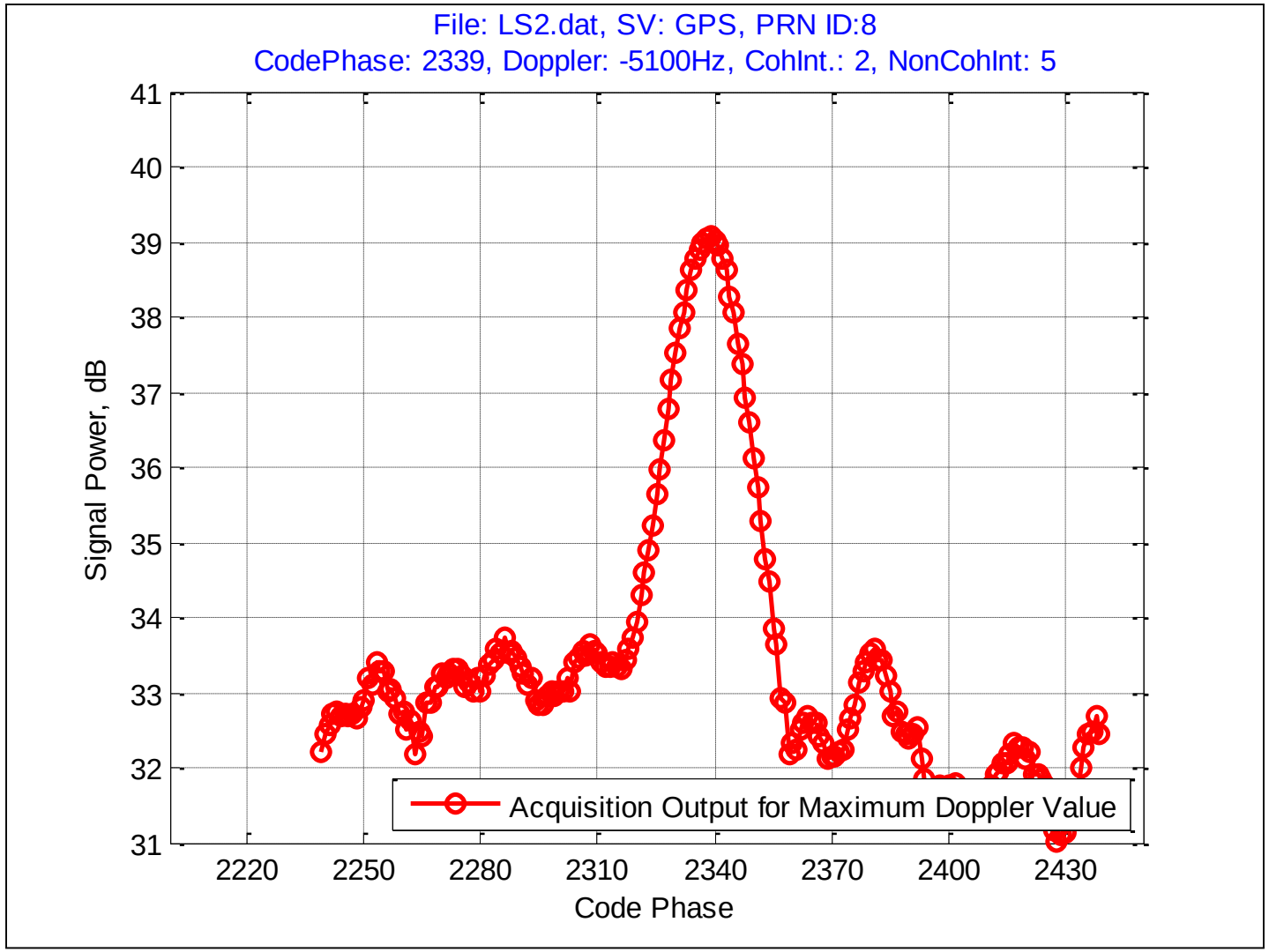
Acquisition Output shown for Code Phase (PRN Code Chip Delay)



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GPS Signal Tracking

- Tracking Loops (PLL & DLL) are used to continuously lock the incoming signal and demodulate it by using the carrier frequency and code phase values detected in Acquisition.
- PLL
  - Phase Lock Loop
  - To Track the Carrier Frequency
- DLL
  - Delay Lock Loop
  - To Track the Code Phase (PRN Code Delays)

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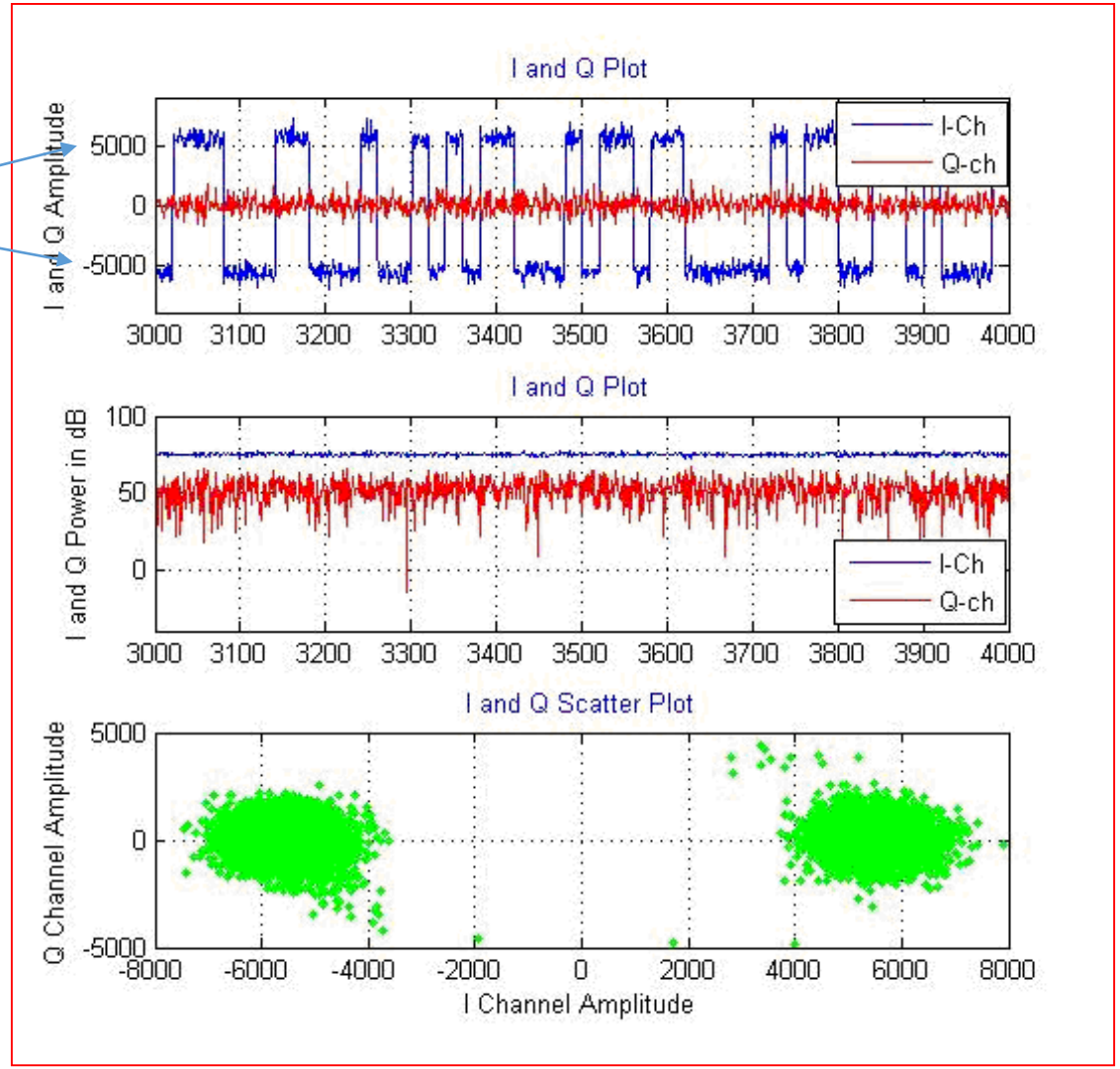
GPS Signal Tracking Output

Navigation Data Bits
1's and 0's



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SNR & C/No

- SNR
  - Signal to Noise Ratio, unit is dB
  - S: Signal Power in dBm or dBW
  - N: Noise power in a given bandwidth in dBm or dBW
- C/No
  - Carrier to Noise Density, unit is dB-Hz
  - C: Carrier power in dBm or dBW
  - No: Noise power density in dBm-Hz or dBW-Hz
- SNR = C/No-BW (BW = bandwidth of the Front End)
  - If BW = 4Mhz = 10*log10(4000000) = 66dB
  - If C/No = 48dB-Hz
  - SNR = C/No-BW = 45-66 = -21dB
- Noise Density (No) at Room Temperature (290K): -204dBW/Hz
- Received Power (GPS L1C/A Signal) at Antenna: -158.5dBW
- C/No = -158.5-(-204) = 45.5dB-Hz

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