EE 382: Introduction to Design

Beacon Finder and Identifier Robot

Department of Electrical Engineering
New Mexico Institute of Mining and Technology

Feb 02, 2015

Outline

Team A

- Hime, Adam
- Stephenson, Logan
- Veleta, Moises
- Villegas, Reina

Team B

- Brashar, Connor
- Cronin, Kelsea
- Robinson, Maya
- Snellings, Sarah

Team C

- Akerele, Adeoluwa
- Baer, Jacob
- Cash, Matthew
- LeJeune, Chase

Team D

- Bamonte, Isaac
- Schoen, Arthur
- Steinbach, Logan

Team E

- Cox, Joseph
- Hernandez, Eric
- Lemus, Vincent
- Werne, Tyler

Budget and Placing Orders

Budget

- Each team will receive a budget of $380.
- Use order form to purchase items through the department; fill it out, have it signed by instructor and then ask secretary (Carrol) to place.

Suggested Suppliers:

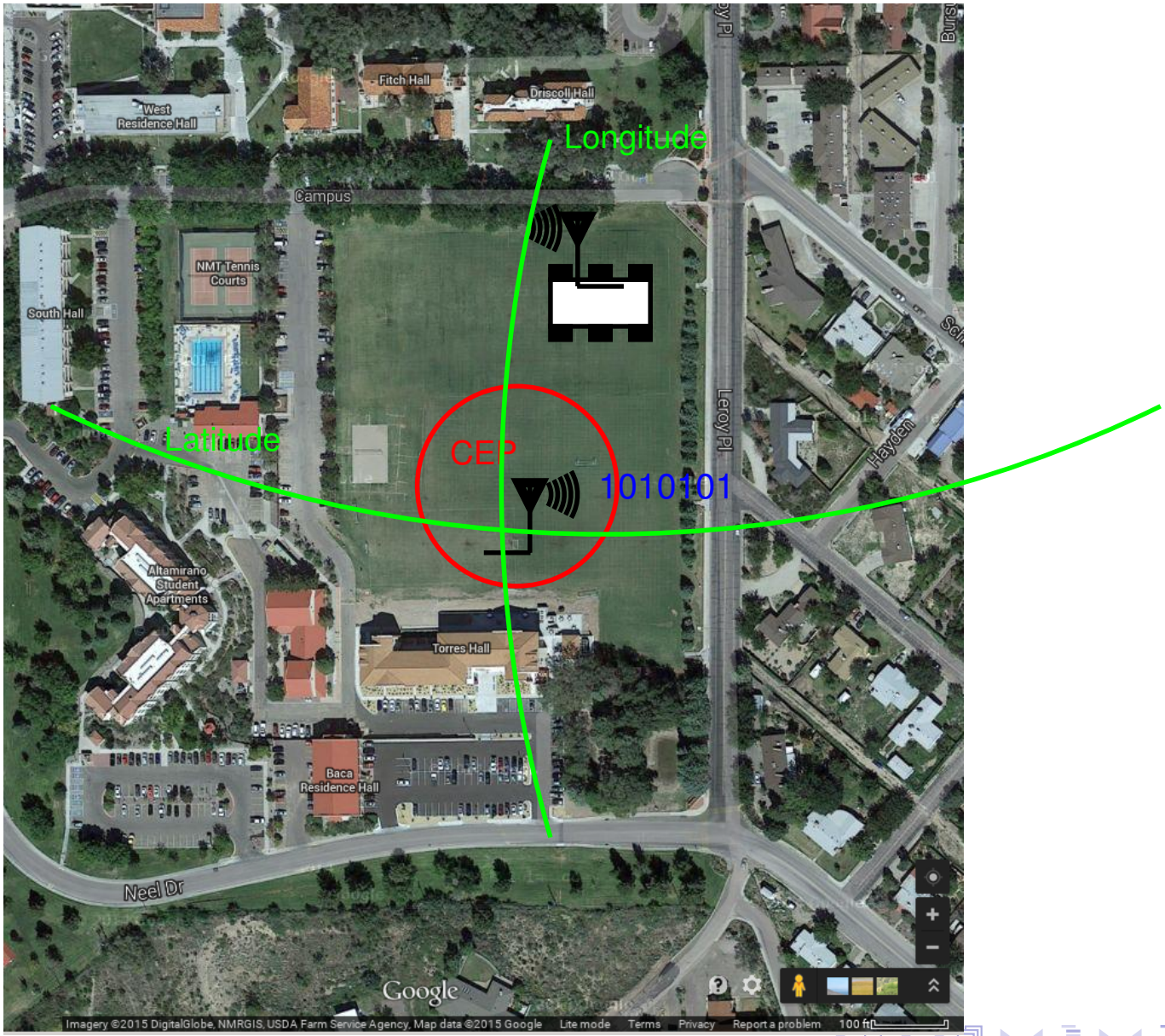
- Acroname Robotics
- Digi-Key
- Mini-Circuits RF/IF & Microwave Components
- Pololu Robotics & Electronics
- SparkFun Electronics

RF Beacon Localization

Outdoor robot to remotely locate and identify RF beacon

- Design an outdoor robot capable of navigating a given, unobstructed area to remotely locate a RF beacon that has an identifier encoded via Frequency-shift keying (FSK). You are not required to determine the code
- Location of the beacon will be computed as longitude and latitude along with a metric of error.

Search Area


Longitude
Latitude
CEP
1010101
Fitch Hall
Driscoll Hall
West Residence Hall
Campus
NMT Tennis Courts
South Hall
Leroy Pl
Hayden
Altamirano Student Apartments
Torres Hall
Baca Residence Hall
Neel Dr
Google
Imagery ©2015 DigitalGlobe, NMRGIS, USDA Farm Service Agency, Map data ©2015 Google
Lite mode
Terms
Privacy
Report a problem
100 ft

Specification

- CEP of 3m
- Robot must not use obstacle detection to find the beacon (no penalty if you run the beacon over)
- Robot must attempt to get as close to the beacon as possible, indicate it found the beacon and give coarse indication to where it is
- Data may be recorded on an SD card and used for post processing for more precise location of the beacon
- On the host computer you should display the path the robot took as well as the location of the beacon and a measure of error

Major Design Component

A key requirement

Each team must identify, design and implement a key component using concepts from Analog or Electricity and Magnetism courses.

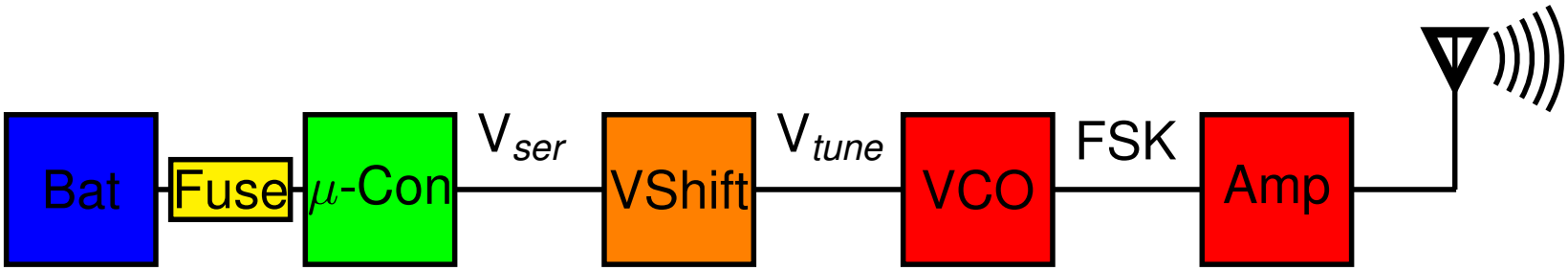
Parts Provided

Parts provided for the project are available through the course website

link

Beacon

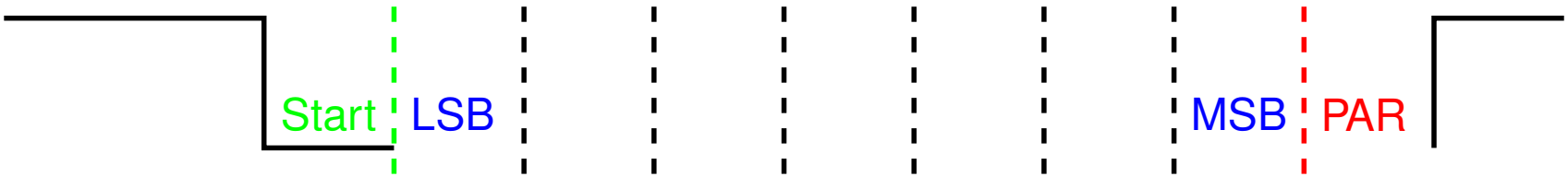
Beacon employs Frequency Shift Keying (FSK) modulation of serial message/identifier. Frequency in the range of 2.4Ghz-2.5GHz.



Beacon - Serial Stream

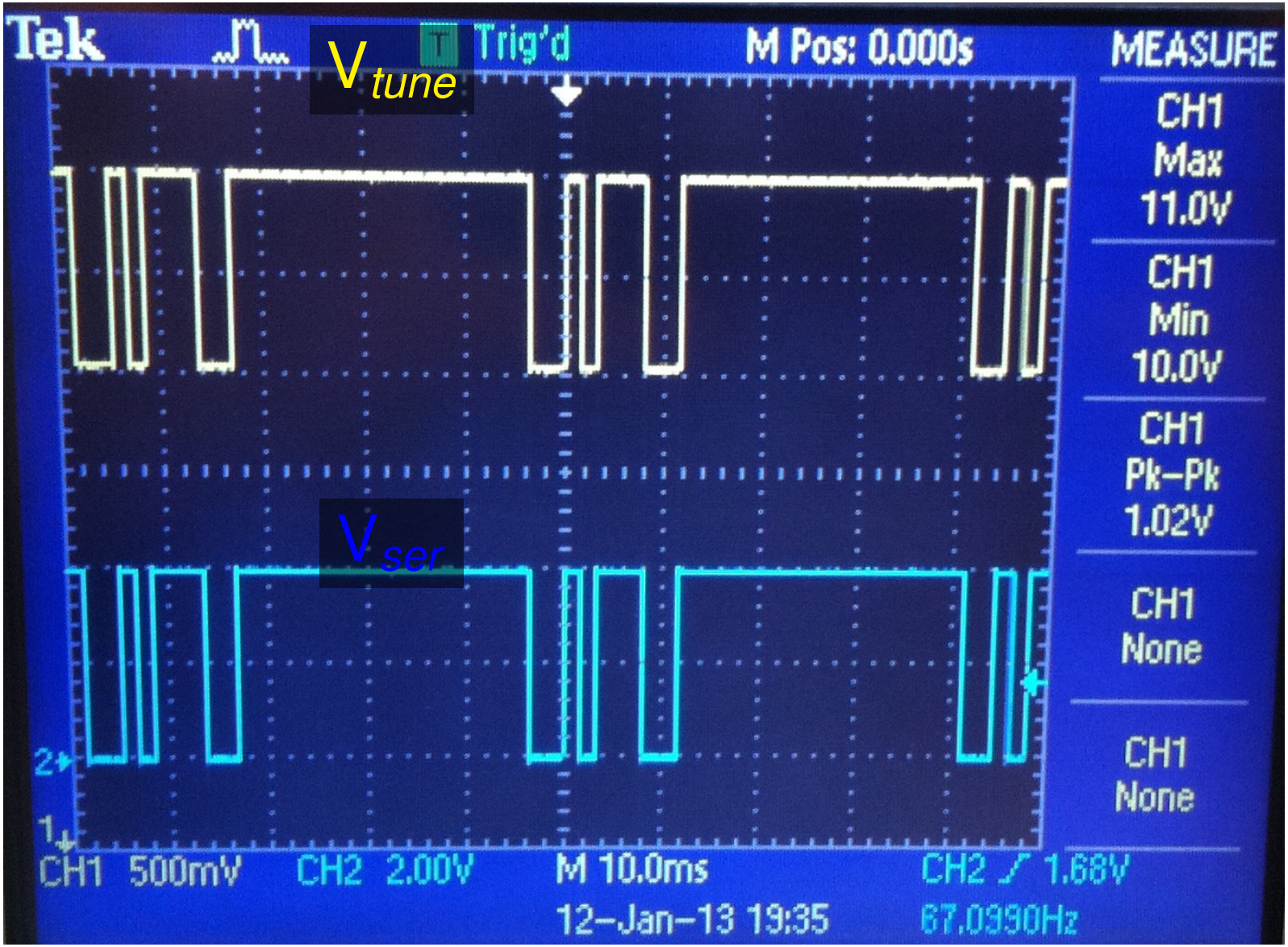
Serial 7-bit at a Baud rate of 600 with even parity bit.

- Baud rate - each bit in stream will be of length 1/600 seconds
- Start bit - 0 (after 1 for awhile)
- Message/identifier sent LSB first
- Even parity - last (8th) bit transmitted will make number of ones in 7-bit identifier/message even



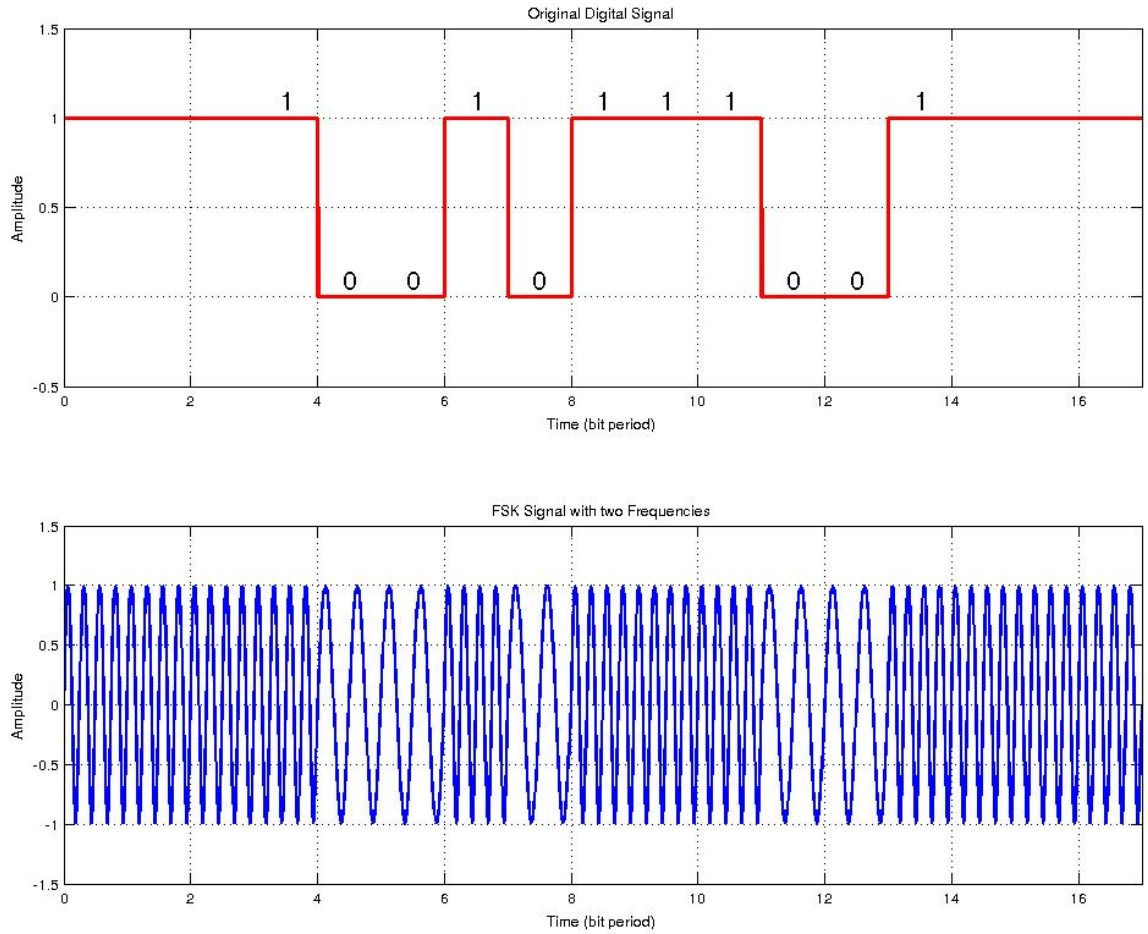
Beacon - Serial Stream (cont.)

7-bit identifier sent: 0111010



Beacon - FSK

FSK uses VCO to generate two sinusoids of different frequencies that correspond to 0s and 1s in serial stream



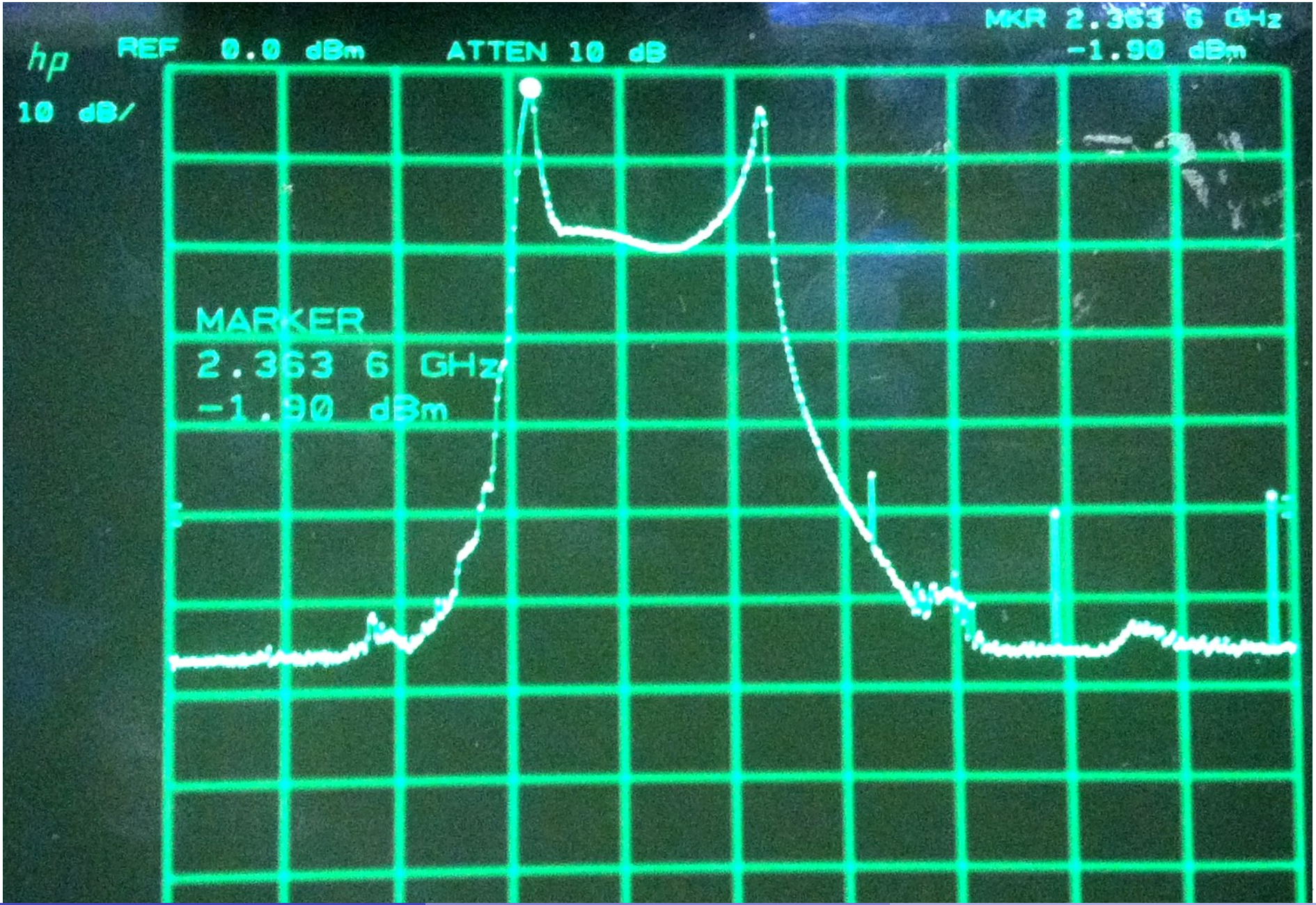
Beacon - FSK (cont.)

Recall Fourier Transform of sinusoid

$$f(t) = \cos(\omega_0 t) \Leftrightarrow F(\omega) = \pi(\delta(\omega - \omega_0) + \delta(\omega + \omega_0))$$

and that our FSK is made up of two (truncated/windowed) sinusoids of different frequencies.

Beacon - FSK


hp
REF 0.0 dBm
ATTEN 10 dB
MKR 2.363 6 GHz
-1.90 dBm
10 dB/
MARKER
2.363 6 GHz
-1.90 dBm