

## LANforge CLI CT712 DFS / RF Generation, ETSI Functionality

Goal: Show usage of lf\_hackrf\_dfs.py and lf\_pulse\_detect3.py for ETSI DFS testing.

This document describes the command line interface to generate ETSI pulses for DFS (Dynamic Frequency Selection) Testing.

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### ETSI Functionality

Pulse description table starts at page 106 , Table summary at bottom of page

ETSI 2.1.1 en\_301893v020...

ETSI 0 - 6 implemented

#### Known issues

None known

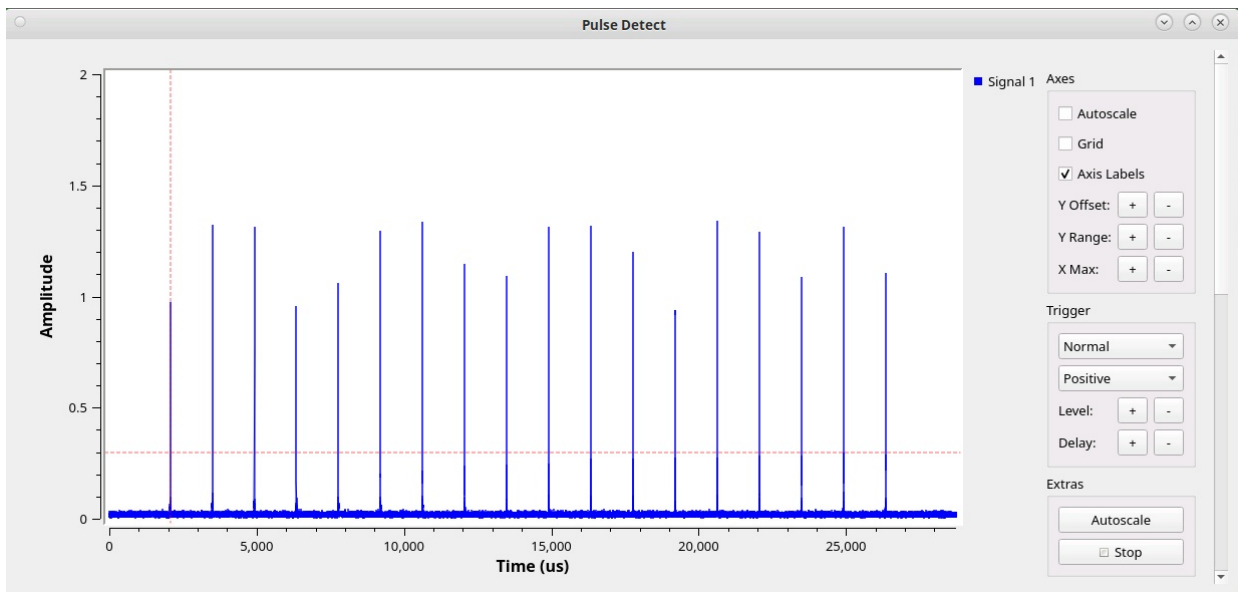
### Pulse Detect

Pulse detect may be used with a second hackrf to monitor the signals produced by the first hackrf.

- command line
  - ./lf\_pulse\_\_detect3\_pw.py --freq <"center frequency" in Mhz> --lf\_hackrf <'hackrf serial'>
  - example
  - ```
./lf_pulse_detect3_pw.py --freq 5320 --lf_hackrf c2b4aa75f
```

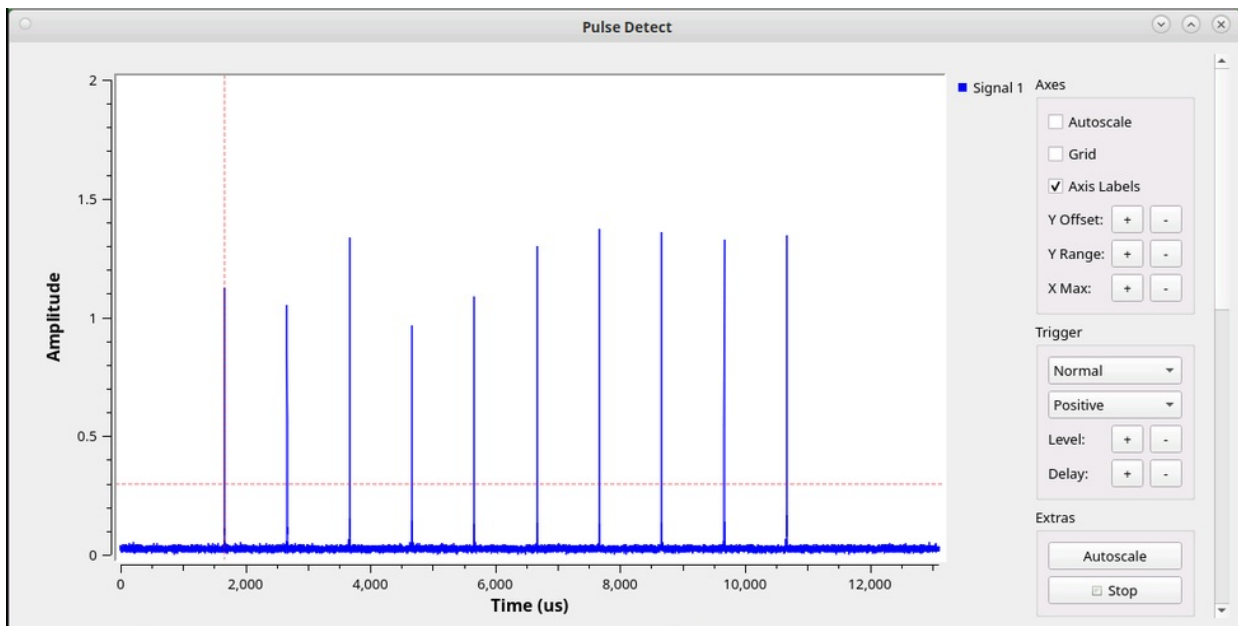
### ETSI-0

- command line
  - ./lf\_hackrf\_dfs.py --freq <'center frequency'> --rf\_type ETSI1,<pulse\_width>,<prf\_1>,<tx\_sample\_rate> --lf\_hackrf <'hackrf serial'>
    - Note: for pulses less the 1 us the tx\_sample\_rate must be 20
  - example
    - ```
./lf_hackrf_dfs.py --freq 5320000 --rf_type ETSI0,1,700,20 --lf_hackrf 22276763
```



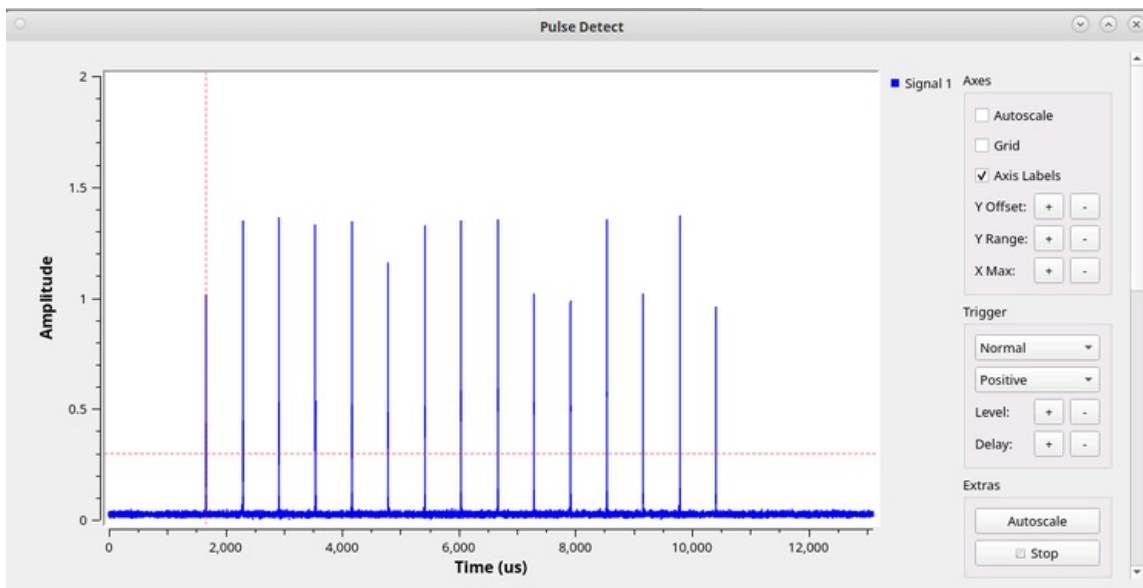
## ETSI-1

- command line
  - `./lf_hackrf_dfs.py --freq <'center frequency'> --rf_type ETSI1,<pulse_width>,<prf_1>,<tx_sample_rate> --lf_hackrf <'hackrf serial'>`
    - Note: for pulses less the 1 us the tx\_sample\_rate must be 20
  - example
    - `./lf_hackrf_dfs.py --freq 5320000 --rf_type ETSI1,.5,1000,20 --lf_hackrf 22276763`



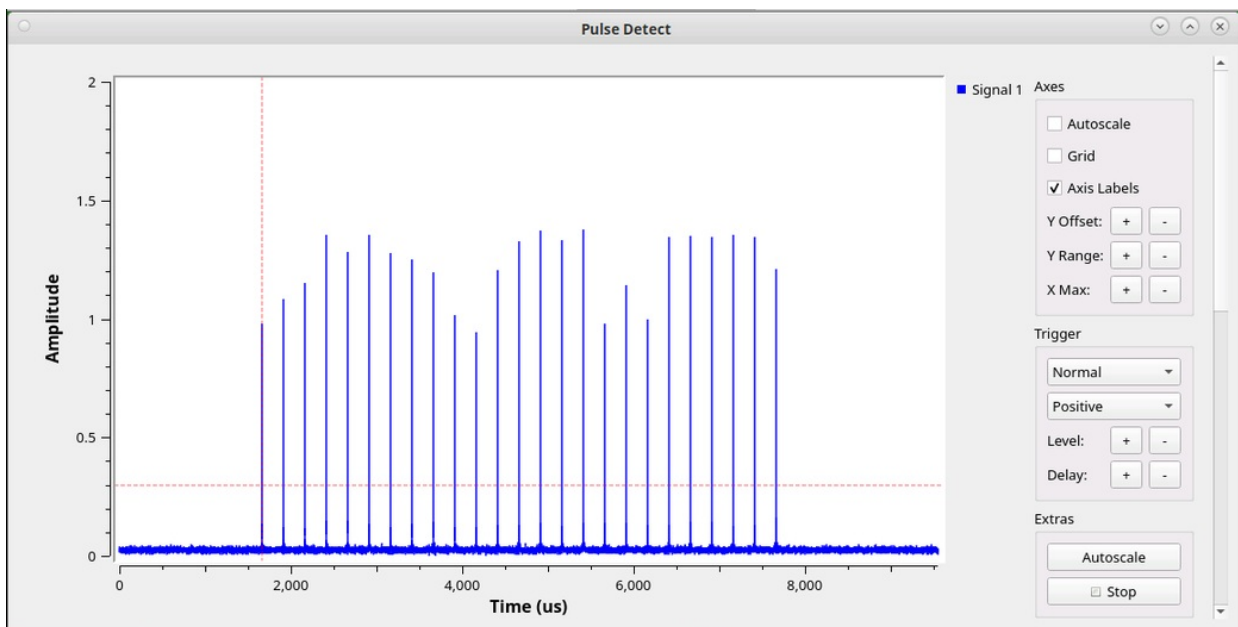
## ETSI-2

- command line
  - `./lf_hackrf_dfs.py --freq <'center frequency'> --rf_type ETSI2,<pulse_width>,<prf_1>,<tx_sample_rate> --lf_hackrf <'hackrf serial'>`
    - Note: for pulses less the 1 us the tx\_sample\_rate must be 20
  - example
    - `./lf_hackrf_dfs.py --freq 5320000 --rf_type ETSI2,.5,1600,20 --lf_hackrf 22276763`



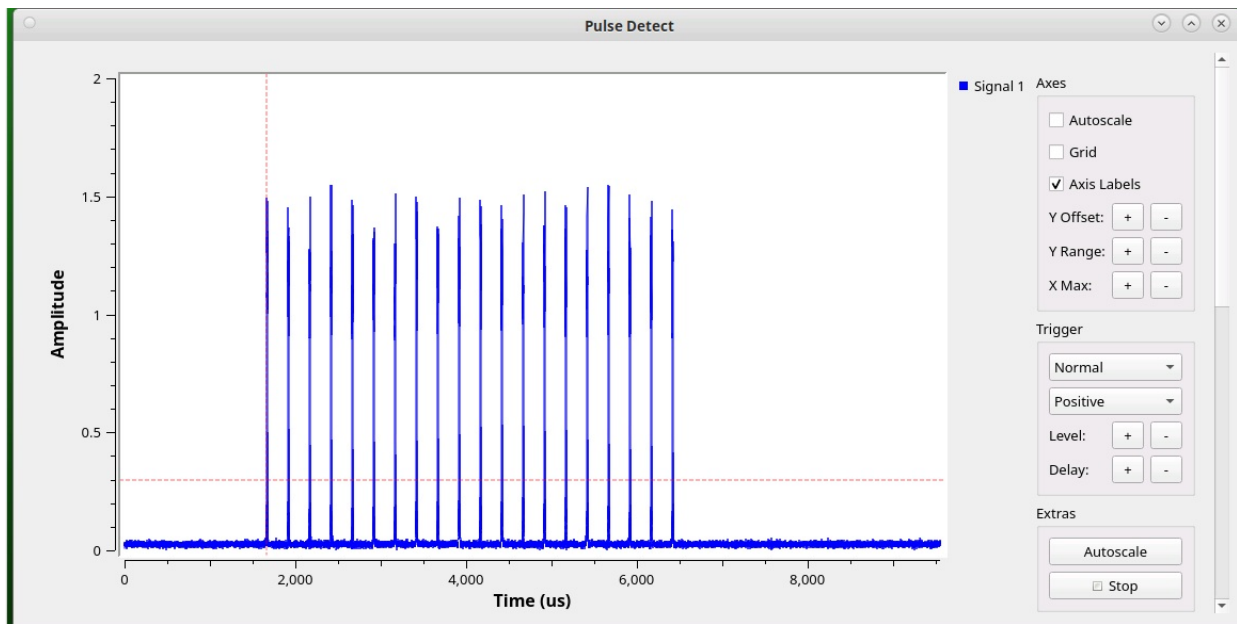
### ETSI-3

- command line
  - `./lf_hackrf_dfs.py --freq <'center frequency'> --rf_type ETSI3,<pulse_width>,<prf_1>,<tx_sample_rate> --lf_hackrf <'hackrf serial'>`
    - Note: for pulses less the 1 us the tx\_sample\_rate must be 20
  - example
    - `./lf_hackrf_dfs.py --freq 5320000 --rf_type ETSI3,.5,4000,20 --lf_hackrf 22276763`



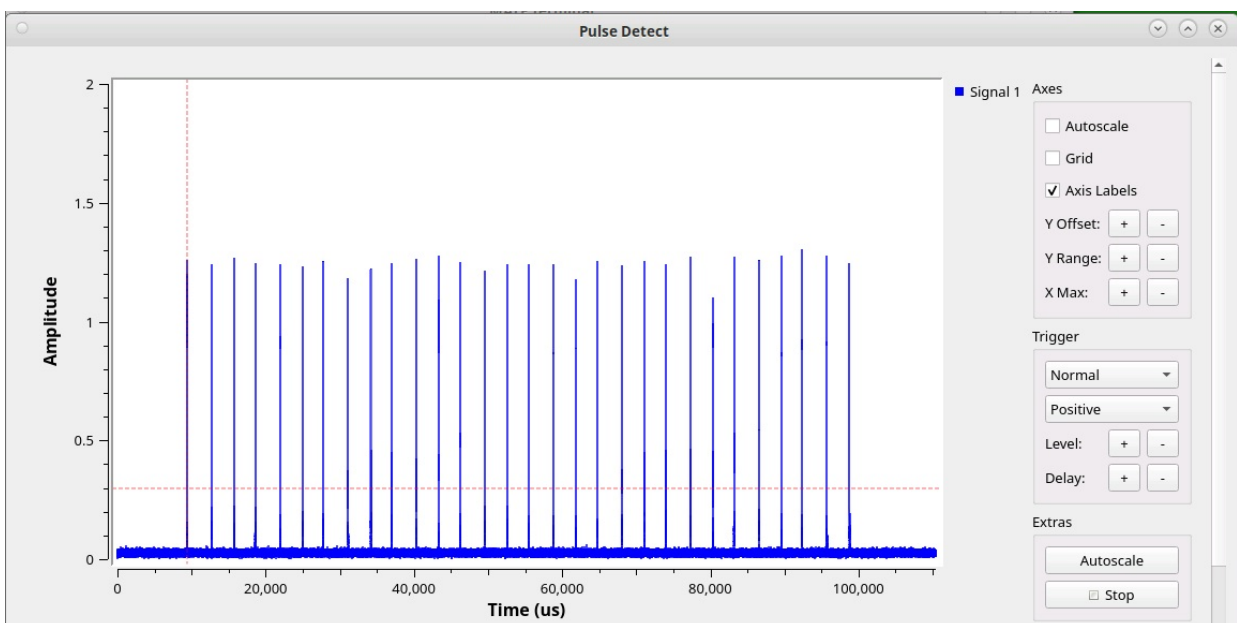
### ETSI-4

- command line
  - `./lf_hackrf_dfs.py --freq <'center frequency'> --rf_type ETSI4,<pulse_width>,<prf_1>,<tx_sample_rate> --lf_hackrf <'hackrf serial'>`
  - example
    - `./lf_hackrf_dfs.py --freq 5320000 --rf_type ETSI4,20,4000,20 --lf_hackrf 22276763`



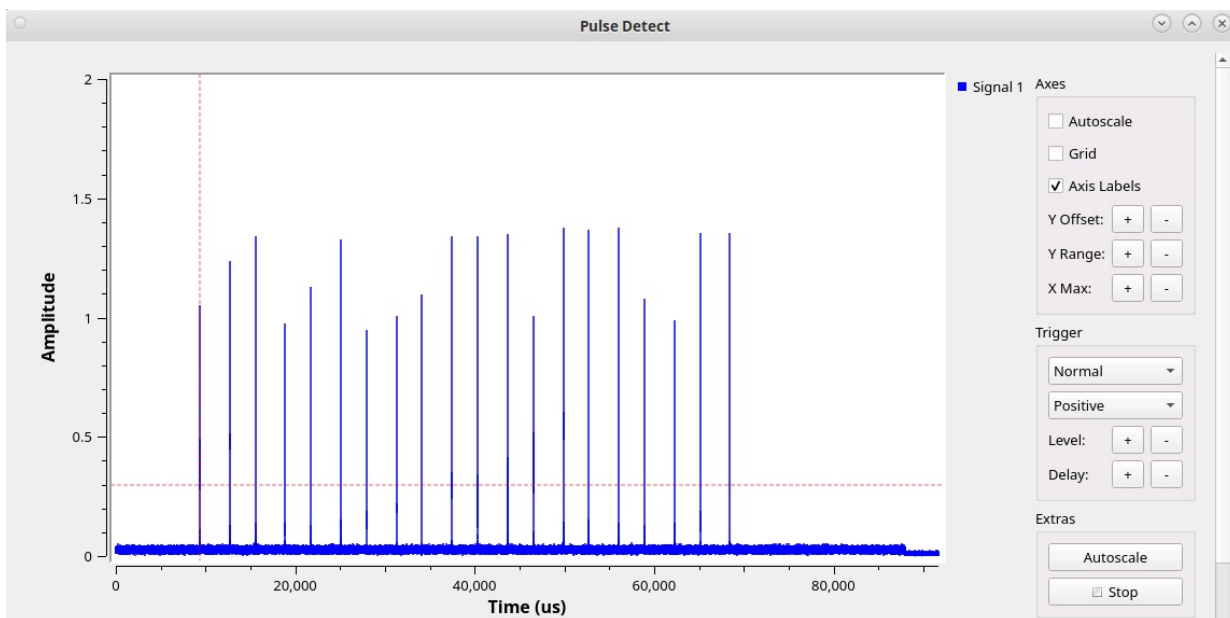
## ETSI-5

- Characterizations
  - The min, max range of [300,400] applies to all the pulses
  - The difference between any 2 pulses among the 2 (or) 3 pulses should be between 20Hz (min) and 50 Hz (max)
    - PRF2 - PRF1 needs to be greater then 20 Hz yet less then 50 Hz
    - PRF3 - PRF2 needs to be greater then 20 Hz yet less then 50 Hz
    - PRF3 - PRF1 needs to be less then 50 Hz
- Note: for pulses less the 1 us the tx\_sample\_rate must be 20
- command line
  - `./lf_hackrf_dfs.py --freq <'center frequency'> --rf_type ETSI5,<pulse_width>,<prf_1>,<prf_2>,<prf_3>,<tx_sample_rate> --lf_hackrf <'hackrf serial'>`
  - example using 3 prfs
    - `./lf_hackrf_dfs.py --freq 5320000 --rf_type ETSI5,.5,300,329,350,20 --lf_hackrf 22276763`



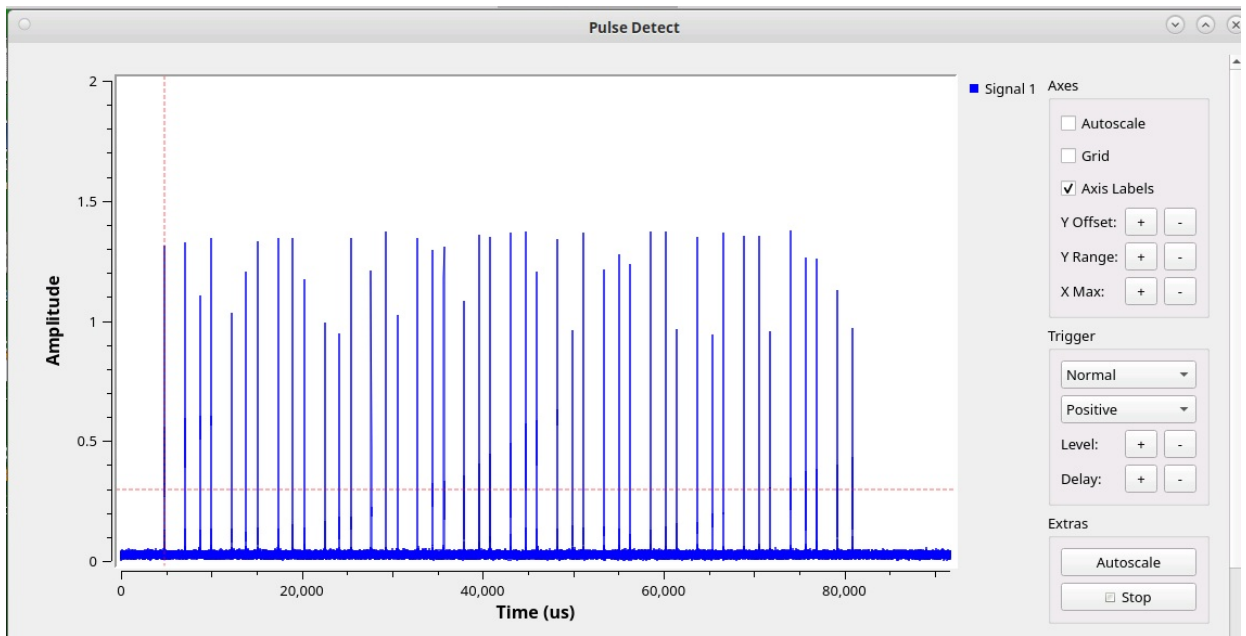
- example using 2 prfs

```
◦ ./lf_hackrf_dfs.py --freq 5320000 --rf_type ETSI5, .5,300,349,0,20 --lf_hackrf 22276763
```



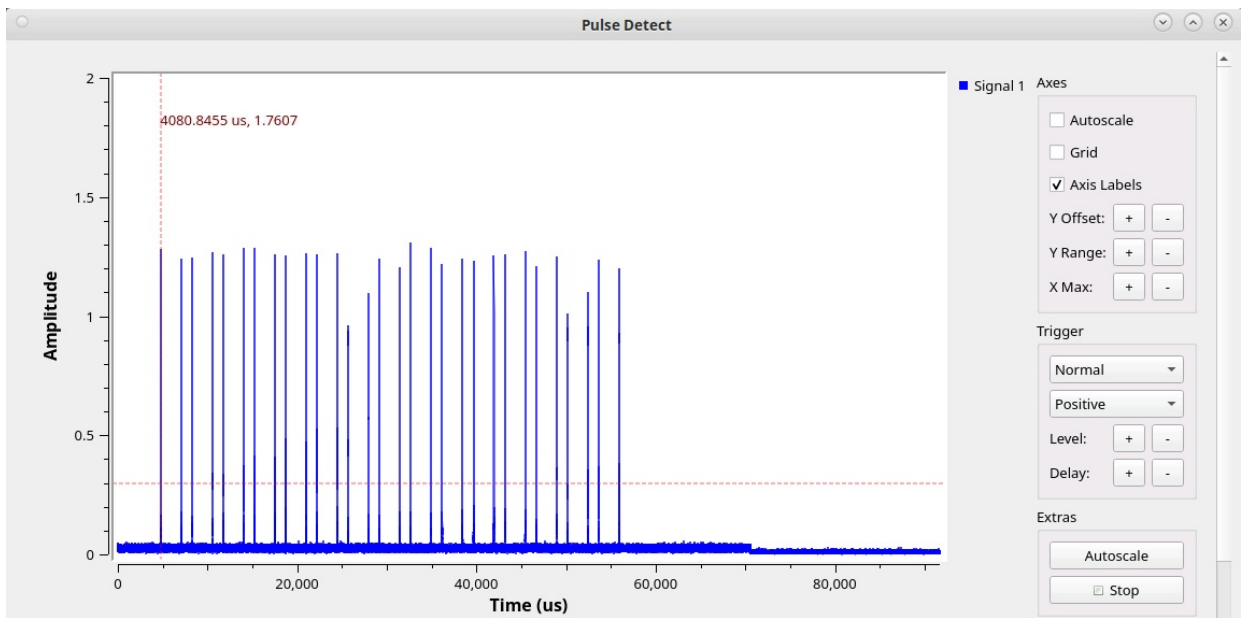
## ETSI-6

- The min, max range of [400,1200] applies to all the pulses
- The difference between any 2 pulses among the 2 (or) 3 pulses should be between 80Hz (min) and 400 Hz (max)
  - PRF2 - PRF1 needs to be greater then 80 Hz yet less then 400 Hz
  - PRF3 - PRF2 needs to be greater then 80 Hz yet less then 400 Hz
  - PRF3 - PRF1 needs to be less then 400 Hz
- Note: for pulses less the 1 us the tx\_sample\_rate must be 20
- command line
  - ./lf\_hackrf\_dfs.py --freq <'center frequency'> --rf\_type ETSI6,<pulse\_width>,<prf\_1>,<prf\_2>,<prf\_3>,<tx\_sample\_rate> --lf\_hackrf <'hackrf serial'>
  - example using 3 prfs
    - ```
./lf_hackrf_dfs.py --freq 5320000 --rf_type ETSI6, .5,440,600,820,20 --lf_hackrf 22276763
```



- example using 2 prfs

- `./lf_hackrf_dfs.py --freq 5320000 --rf_type ETSI6,1.7,440,820,0,20 --lf_hackrf 22276763`



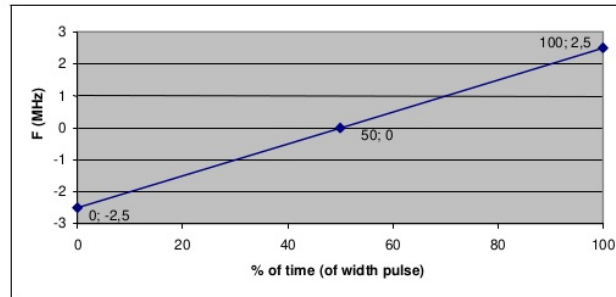
## Table Summary

Table D.4: Parameters of radar test signals

| Radar test signal #<br>(see note 1 to note 3) | Pulse width<br>W ( $\mu$ s) |     | Pulse repetition frequency<br>PRF (PPS) |       | Number of different PRFs | Pulses per burst for each PRF (PPB)<br>(see note 5) |
|-----------------------------------------------|-----------------------------|-----|-----------------------------------------|-------|--------------------------|-----------------------------------------------------|
|                                               | Min                         | Max | Min                                     | Max   |                          |                                                     |
| 1                                             | 0,5                         | 5   | 200                                     | 1 000 | 1                        | 10<br>(see note 6)                                  |
| 2                                             | 0,5                         | 15  | 200                                     | 1 600 | 1                        | 15<br>(see note 6)                                  |
| 3                                             | 0,5                         | 15  | 2 300                                   | 4 000 | 1                        | 25                                                  |
| 4                                             | 20                          | 30  | 2 000                                   | 4 000 | 1                        | 20                                                  |
| 5                                             | 0,5                         | 2   | 300                                     | 400   | 2/3                      | 10<br>(see note 6)                                  |
| 6                                             | 0,5                         | 2   | 400                                     | 1 200 | 2/3                      | 15<br>(see note 6)                                  |

NOTE 1: Radar test signals #1 to #4 are constant PRF based signals. See figure D.1. These radar test signals are intended to simulate also radars using a packet based Staggered PRF. See figure D.2.

NOTE 2: Radar test signal #4 is a modulated radar test signal. The modulation to be used is a chirp modulation with a  $\pm 2,5$  MHz frequency deviation which is described below.



NOTE 3: Radar test signals #5 and #6 are single pulse based Staggered PRF radar test signals using 2 or 3 different PRF values. For radar test signal #5, the difference between the PRF values chosen shall be between 20 PPS and 50 PPS. For radar test signal #6, the difference between the PRF values chosen shall be between 80 PPS and 400 PPS. See figure D.3.

NOTE 4: Apart for the Off-Channel CAC testing, the radar test signals above shall only contain a single burst of pulses. See figure D.1, figure D.3 and figure D.4. For the Off-Channel CAC testing, repetitive bursts shall be used for the total duration of the test. See figure D.2 and figure D.5. See also clause 4.2.6.2.3, clause 5.4.8.2.1.4.2 and clause 5.4.8.2.1.4.3.

NOTE 5: The total number of pulses in a burst is equal to the number of pulses for a single PRF multiplied by the number of different PRFs used.

NOTE 6: For the CAC and Off-Channel CAC requirements, the minimum number of pulses (for each PRF) for any of the radar test signals to be detected in the band 5 600 MHz to 5 650 MHz shall be 18.