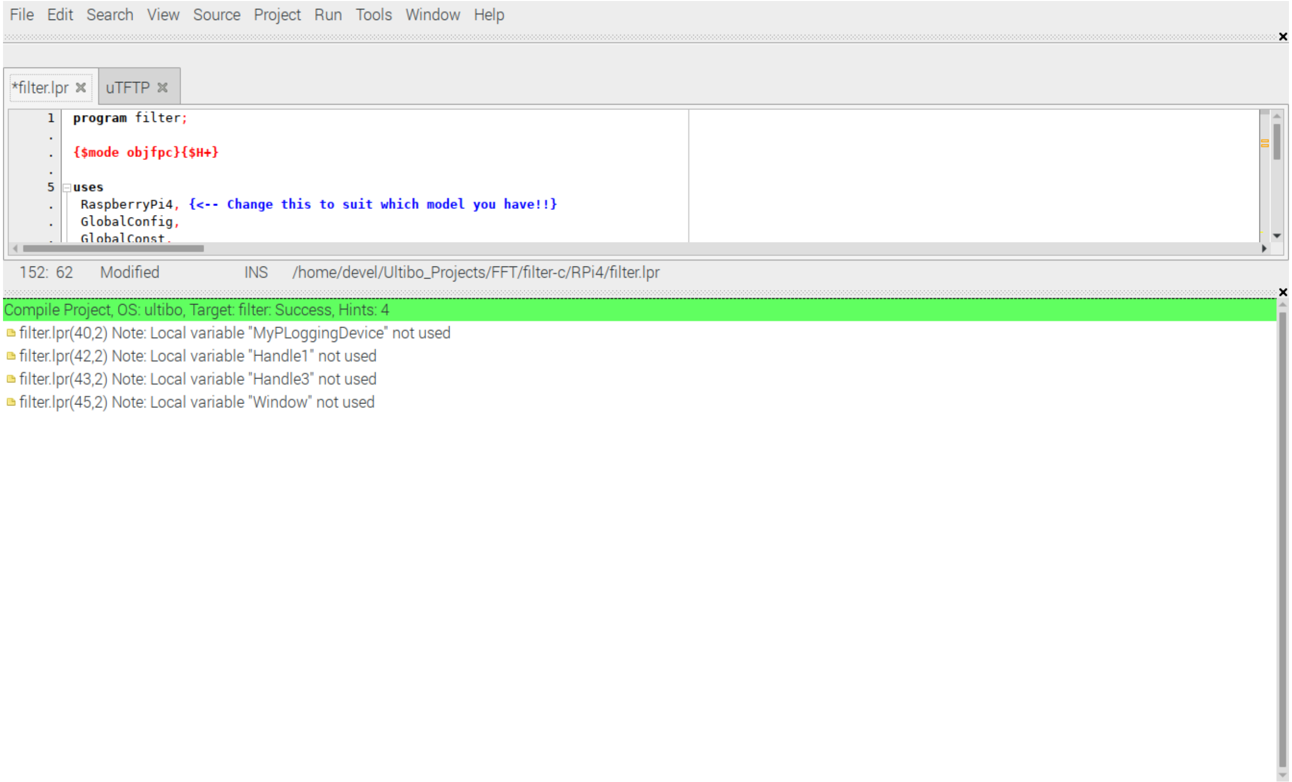
*****************Draft*****************

Testing the high pass filter and low pass filter on a RPi4B

05/20/21

*****************Draft*****************

The Lazarus IDE (Ultibo Edition) is used to link the C library **“libfilter.a”**. The library is created with script **“compile-ultibo.sh”**. Depending in which file is in **“example.c” “example.c.high”** or **“example.c.low”**

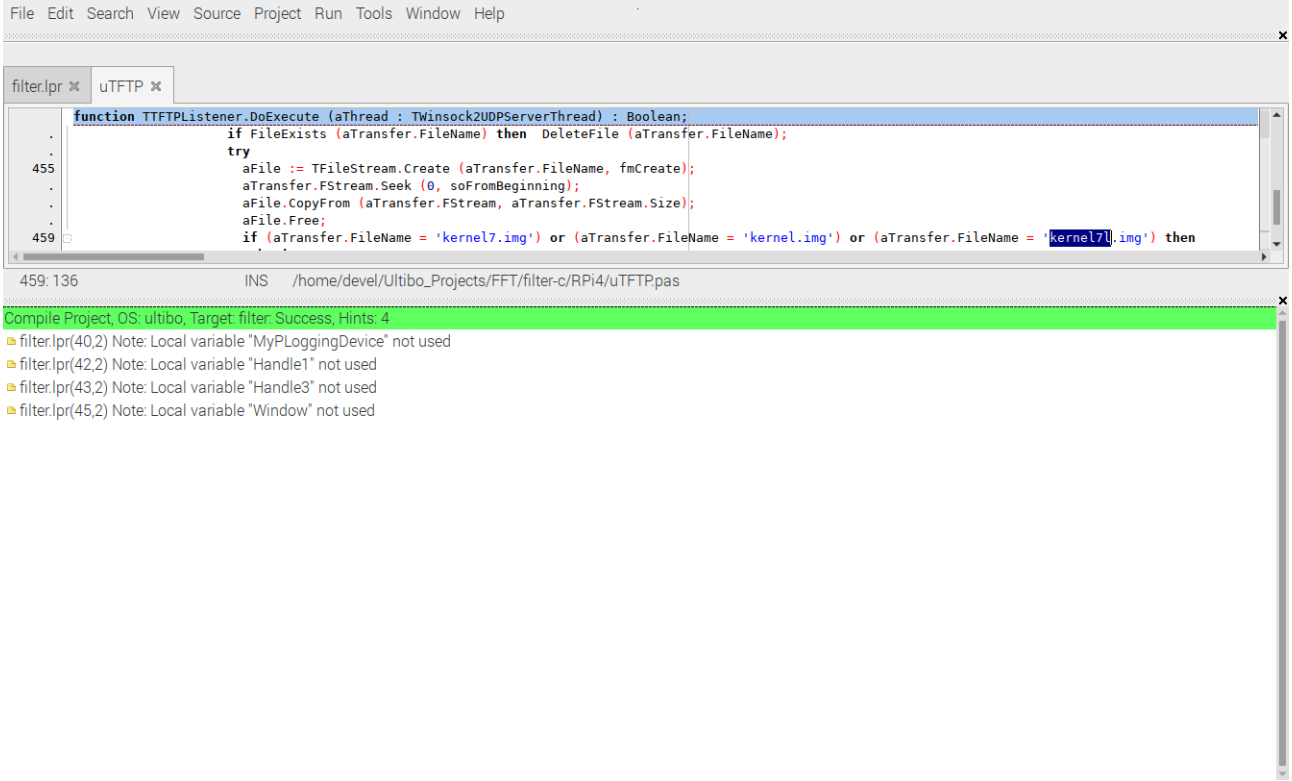


```
program filter;

{$mode objfpc}{$H+}

uses
 RaspberryPi4, {<-- Change this to suit which model you have!!}
 GlobalConfig,
 GlobalConst,
```

```
152: 62     Modified          INS     /home/devel/Ultibo_Projects/FFT/filter-c/RPi4/filter.lpr
```

```
Compile Project, OS: ultibo, Target: filter: Success, Hints: 4
filter.lpr(40,2) Note: Local variable "MyPLoggingDevice" not used
filter.lpr(42,2) Note: Local variable "Handle1" not used
filter.lpr(43,2) Note: Local variable "Handle3" not used
filter.lpr(45,2) Note: Local variable "Window" not used
```

The uTFTP.pas provides the transfer of **“kernel7l.img”**. In addition it provides a method to send/receive files between RPi4B Ultibo System and the development system.



```
function TTFTPListener.DoExecute (aThread : TWinsock2UDPServerThread) : Boolean;
                    if FileExists (aTransfer.FileName) then  DeleteFile (aTransfer.FileName);
                    try
                      aFile := TFileStream.Create (aTransfer.FileName, fmCreate);
                      aTransfer.FStream.Seek (0, soFromBeginning);
                      aFile.CopyFrom (aTransfer.FStream, aTransfer.FStream.Size);
                      aFile.Free;
                      if (aTransfer.FileName = 'kernel7.img') or (aTransfer.FileName = 'kernel.img') or (aTransfer.FileName = 'kernel7l.img') then
```

```
459: 136        INS     /home/devel/Ultibo_Projects/FFT/filter-c/RPi4/uTFTP.pas
```

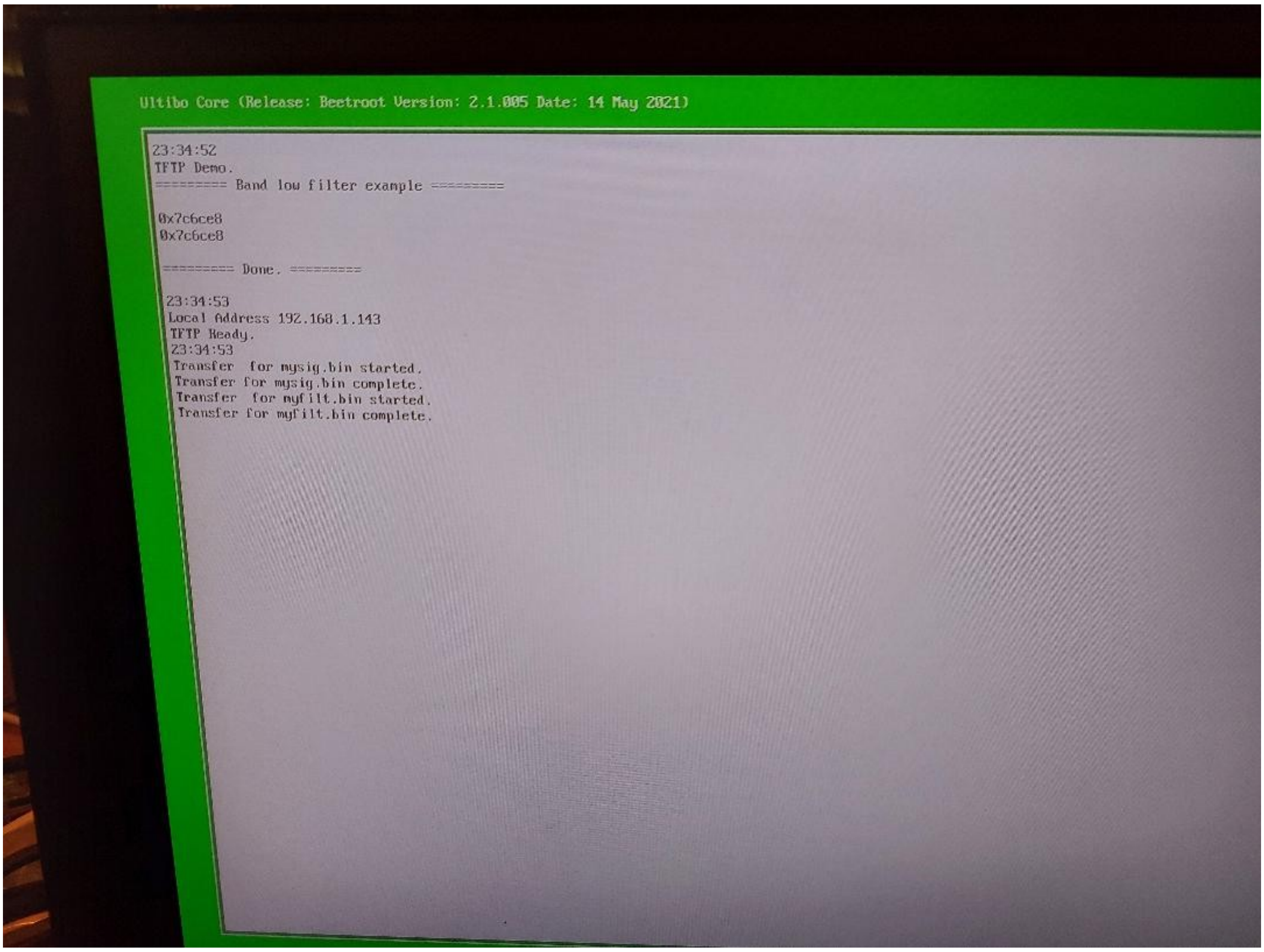
```
Compile Project, OS: ultibo, Target: filter: Success, Hints: 4
filter.lpr(40,2) Note: Local variable "MyPLoggingDevice" not used
filter.lpr(42,2) Note: Local variable "Handle1" not used
filter.lpr(43,2) Note: Local variable "Handle3" not used
filter.lpr(45,2) Note: Local variable "Window" not used
```

The commad to transfer a new **“kernel7l.img”** and reboot is **“tftp 192.168.1.143 < cmdstftp”**

Note: Octave program “sig.m” requires 2 packages “signal-1.4.1.tar.gz” & “control-3.2.0.tar.gz” which first need to be installed. With the commands “pkg install signal-1.4.1.tar.gz” & “pkg install control-3.2.0.tar.gz” the files are extracted in the folder “/home/devel/octave”. There are 14 directories, 487 files.

```
clear
close all
pkg load signal
order = 6;
fs = 1000;
T = 1/fs;             % Sampling period
L = 2048;             % Length of signal
t = (0:L-1)*T;
%mysig was created with gensindata(ptrsignal); in example.c
fid = fopen('mysig.bin','r'); mysig = fread(fid, 2048, 'double');
fid = fopen('myfilt.bin','r'); myfilt = fread(fid, 2048, 'double');
figure

plot(1000*t(1:50),mysig(1:50));

Ys = fft(mysig);

P2 = abs(Ys/L);
P1 = P2(1:L/2+1);
P1(2:end-1) = 2*P1(2:end-1);
f = fs*(0:(L/2))/L;
```

```
figure
plot(f,P1)

%myfilt was created with bw_low_pass(filter, signal[i])); in example.c
figure

plot(1000*t(1:50),myfilt(1:50));

Ys = fft(myfilt);
P2 = abs(Ys/L);
P1 = P2(1:L/2+1);
P1(2:end-1) = 2*P1(2:end-1);
f = fs*(0:(L/2))/L;
figure
plot(f,P1)
```



```
Ultibo Core (Release: Beetroot Version: 2.1.005 Date: 14 May 2021)

23:34:52
TFTP Demo.
========= Band low filter example =========

0x7c6ce8
0x7c6ce8

========= Done. =========

23:34:53
Local Address 192.168.1.143
TFTP Ready.
23:34:53
Transfer  for mysig.bin started.
Transfer for mysig.bin complete.
Transfer  for myfilt.bin started.
Transfer for myfilt.bin complete.
```

fig1

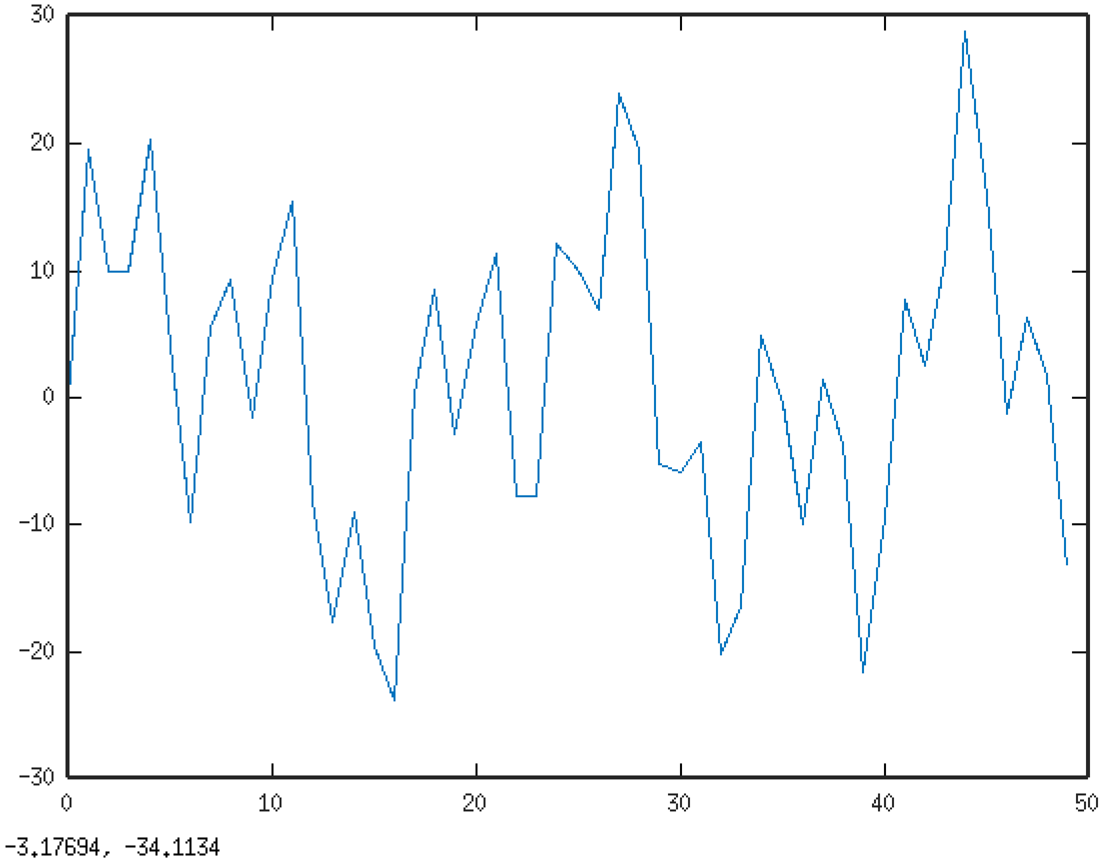

30
20
10
0
-10
-20
-30
0
10
20
30
40
50
-3.17694, -34.1134

fig2

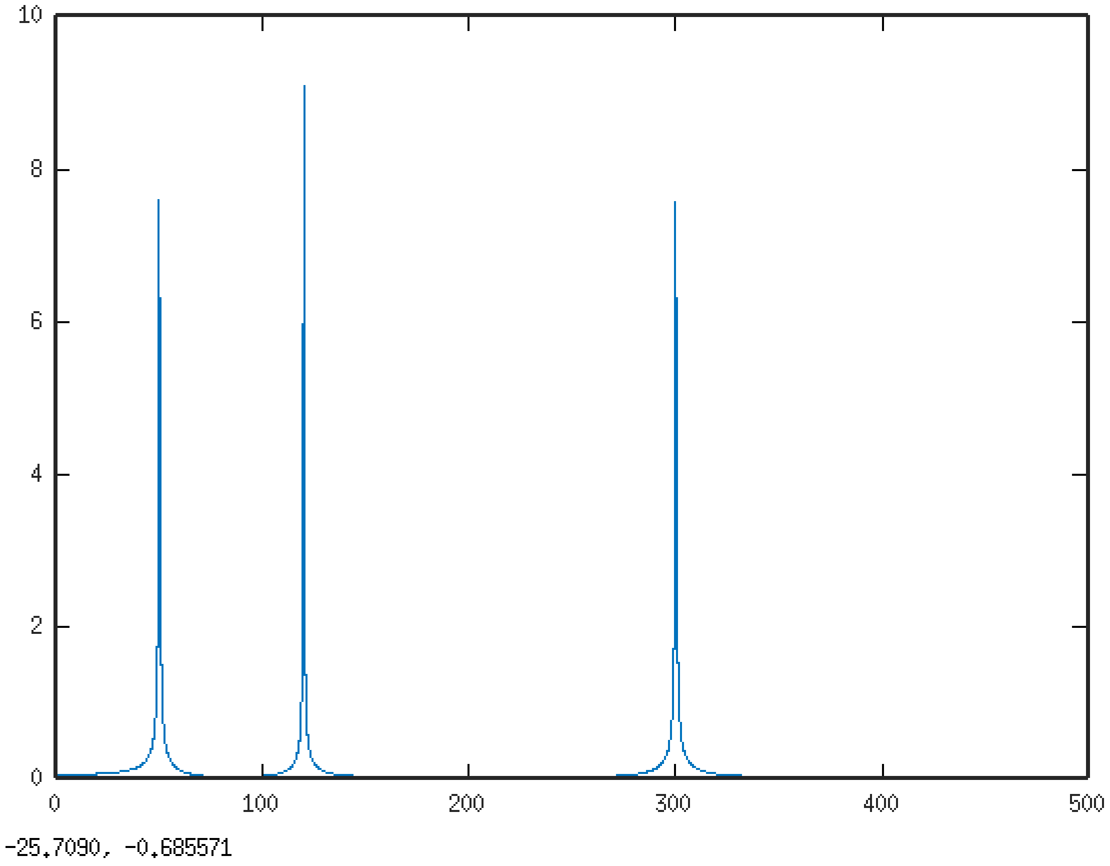

10
8
6
4
2
0
0
100
200
300
400
500
-25.7090, -0.685571

fig3

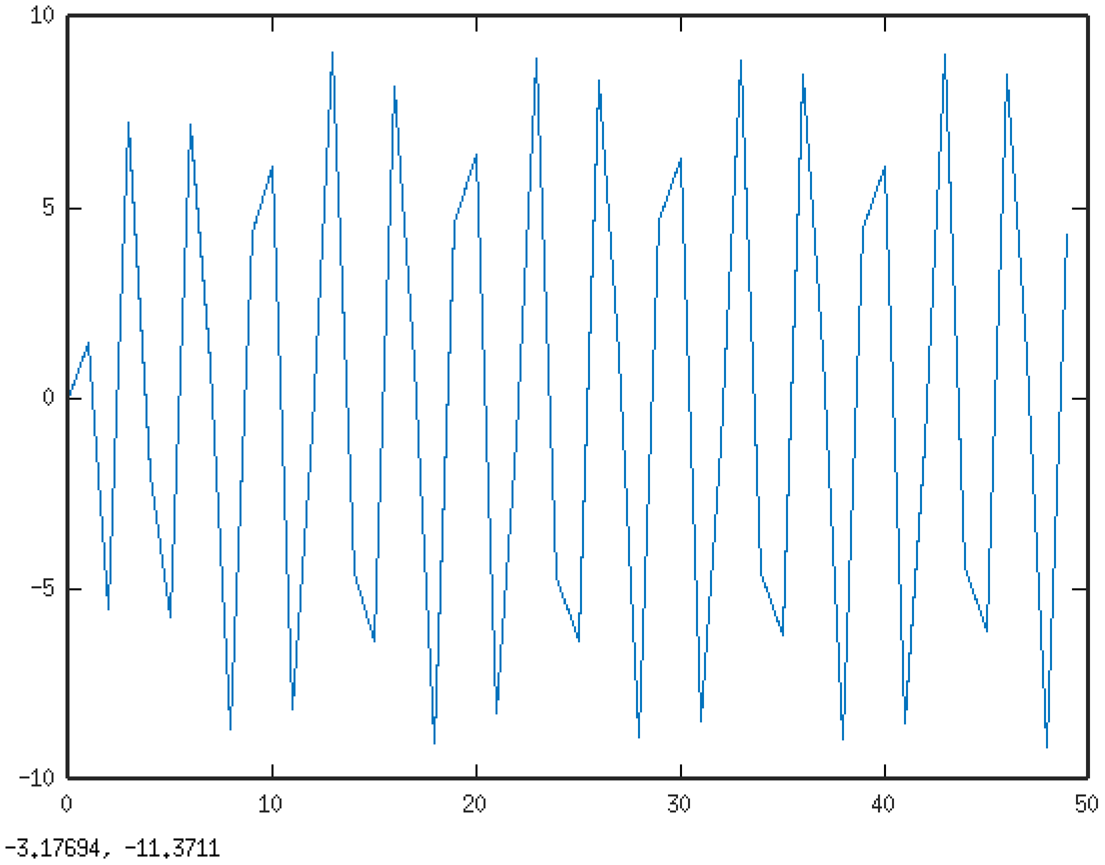
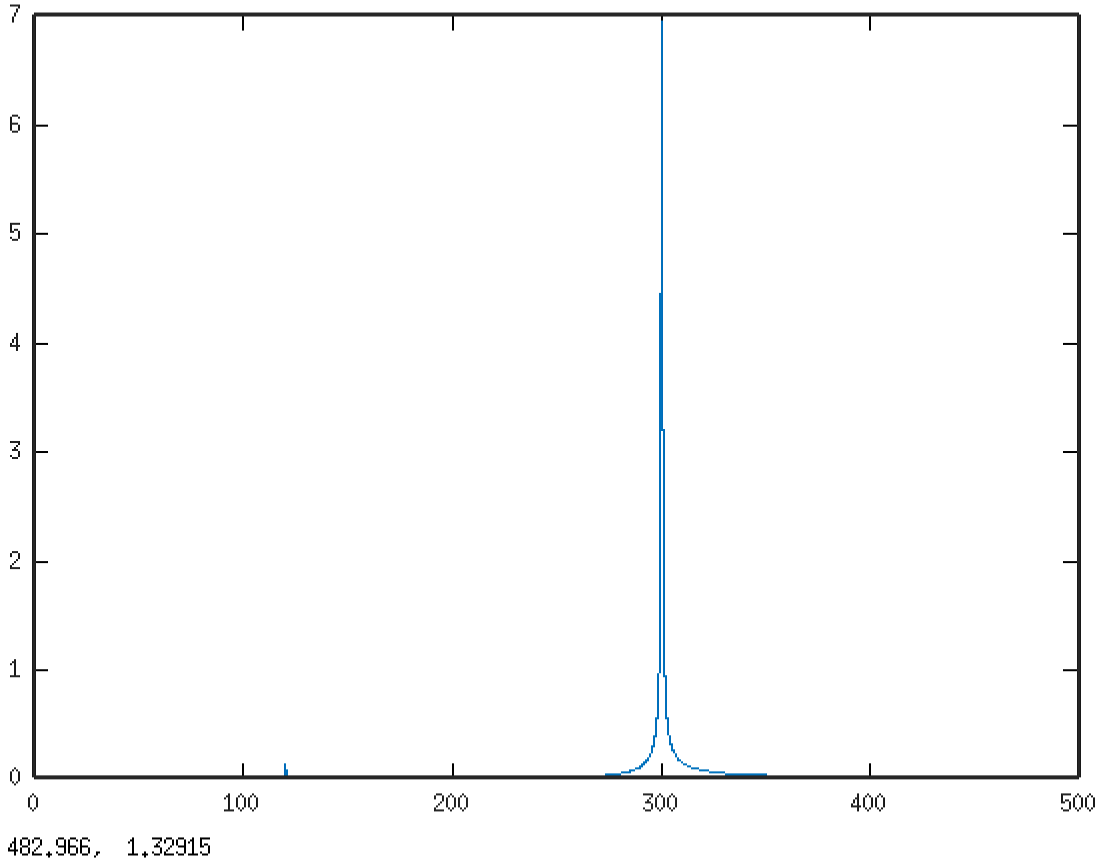


fig4 when example.c.high in example.c



```
cp example.c.low example.c
```

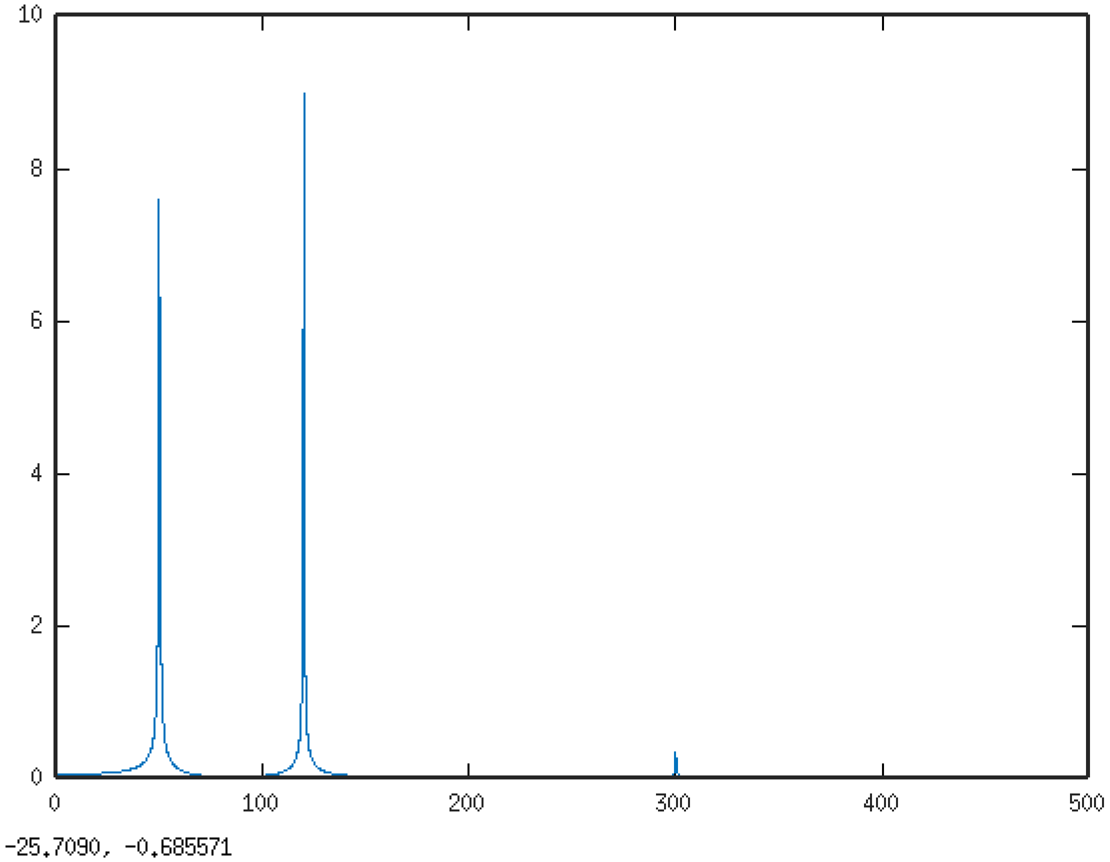
```
./compile-ultibo.sh
```

```
cp libfilter.a RPi4
```

Rebuild the kernel7l.img

```
tftp 192.168.1.143
tftp> binary
tftp> get mysig.bin
Error code 5: 33461
Received 16384 bytes in 5.0 seconds
tftp> get myfilt.bin
Error code 5: 53947
Received 16384 bytes in 5.0 seconds
tftp> quit
```

fig4 when example.c.low in example.c



```
cp example.c.band example.c
```

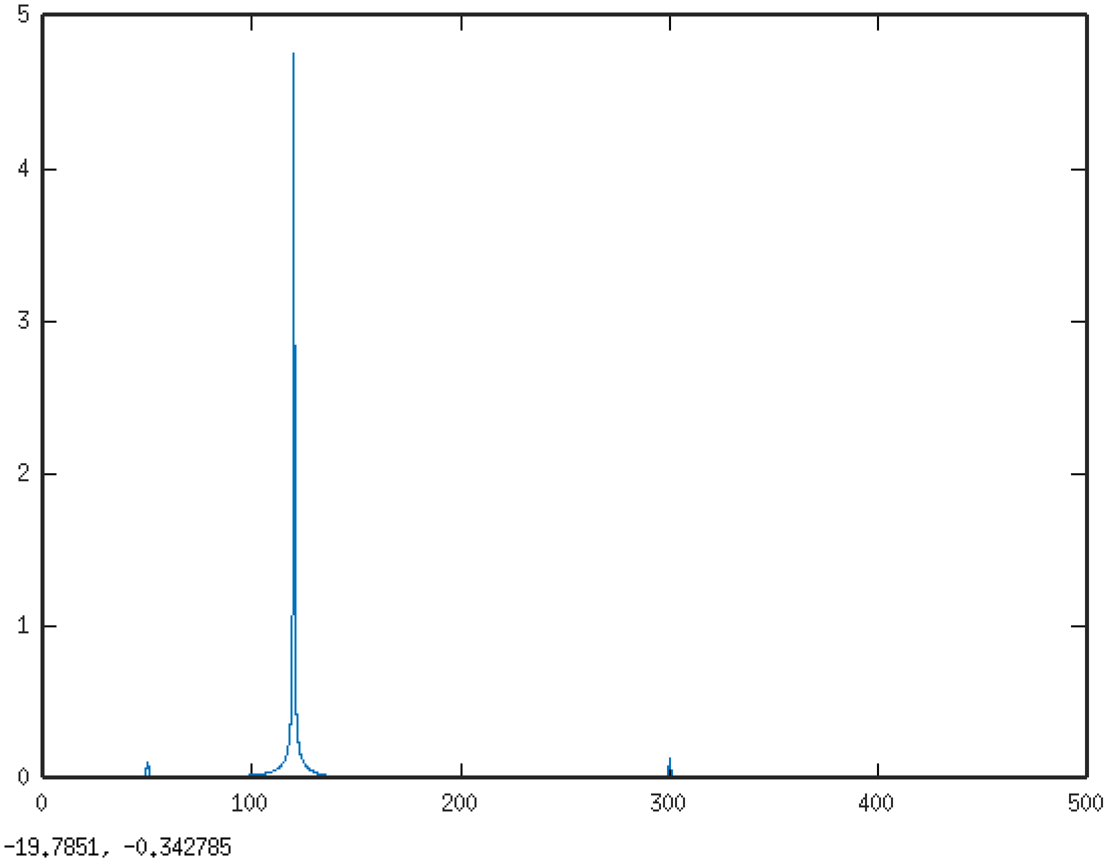
```
./compile-ultibo.sh
```

Rebuild the kernel7l.img

```
tftp 192.168.1.143 < cmdstftp
```

```
tftp 192.168.1.143
tftp> binary
tftp> get mysig.bin
Error code 5: 54353
Received 16384 bytes in 5.1 seconds
tftp> get myfilt.bin
Error code 5: 57225
Received 16384 bytes in 5.0 seconds
tftp> quit
```

fig4 when example.c.band in example.c


5
4
3
2
1
0
0
100
200
300
400
500
-19.7851, -0.342785