



TAMSAT

Amatör Uydu Teknolojileri Derneđi

Turkish Amateur Satellite Technologies Organization (AMSAT-TR)

GnuRADIO ile Yazılım Tabanlı Radyo İletişimi (Software Defined Radio)

Bariş DİNÇ

Teknik Başkan Yardımcısı

ta7w@tamsat.org.tr

Burcu AYBAK

Genel Sekreter

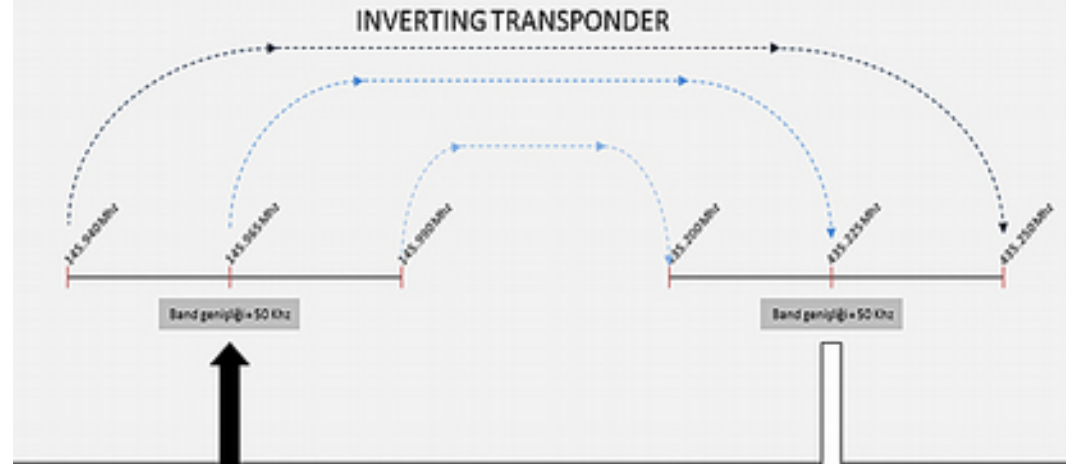
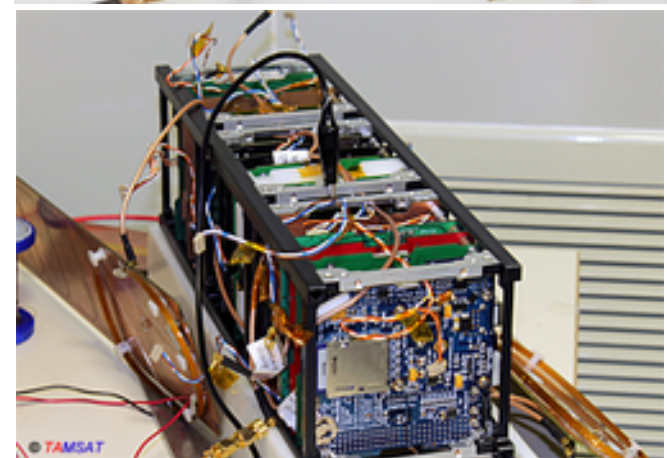
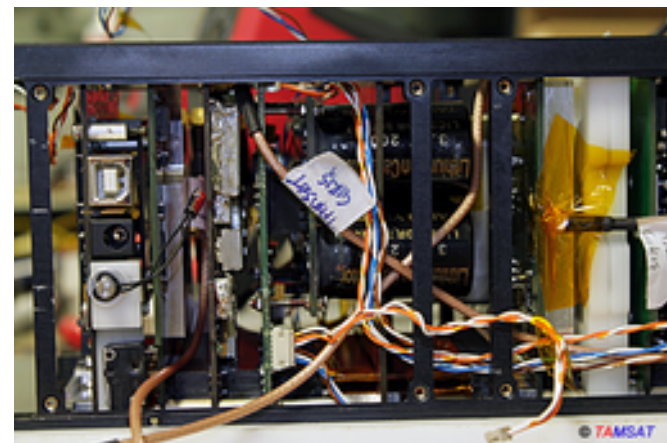
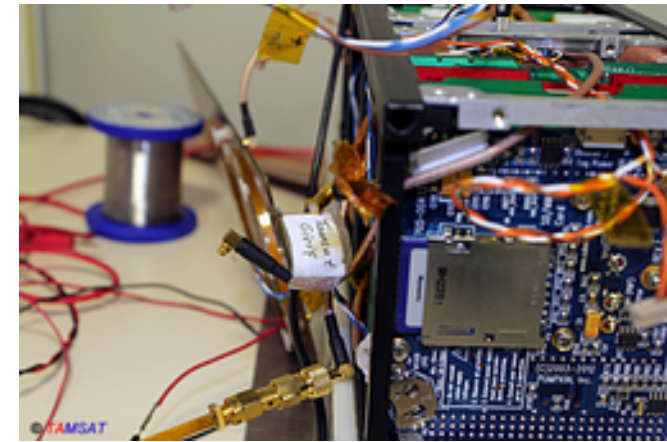
ta2nba@tamsat.org.tr

- TAMSAT Tanıtım
- Radyo Nedir ?
- DSP Nedir ?
- Kompleks Sayıların Dünyası
- Yazılım Tabanlı Radyo (Software Defined Radio) Nedir ?
- Örnek SDR Donanımları
- Örnek SDR Yazılımları
- GNURadio Genel Tanıtım ve Yükleme Adımları
- GnuRadio Uygulamaları
- SDR Proje Örnekleri



- 25 Mart 2010 tarihinde Ankara'da 17 Radyo Amatörü tarafından kuruldu
- Bugün üye sayısı 100'e yaklaşmaktadır
- Pekçok küçük/büyük projede yer aldı
- TAMSAT IHU 2011 yılında tamamlandı
- TAMSAT V/U Transponder 2013 yılında tamamlandı
- İlk Uydu Fırlatması (TURKSAT 3USAT) 2013 yılında gerçekleşti
- TAMSAT OBC 2015 yılında tamamlandı
- TAMSAT MikroSAT 2016 yılında tamamlandı
- TAMSAT OBC çalışmaları devam ediyor
- TAMSAT SDR Transponder çalışmaları devam ediyor
- UBAKUSAT 2017 yılı içinde Uluslar Arası Uzay İstasyonundan fırlatılacak
- TAMSAT web sayfası hergün yeni bir içerikle hizmetlerine devam ediyor



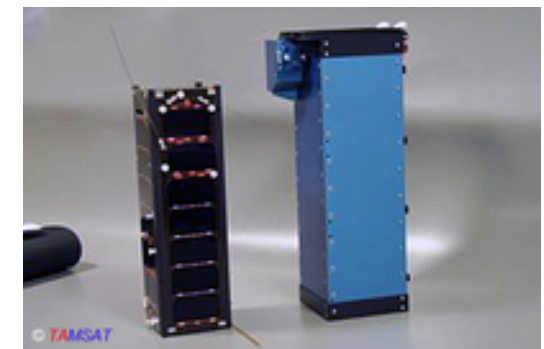
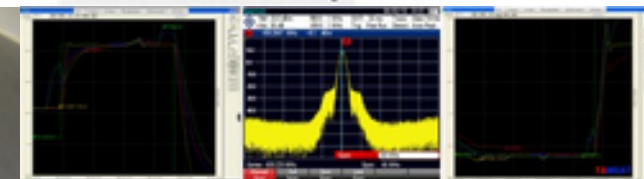


Yer Yüzünden Uyduya Gelen Sinyal
(UPLINK)

145.940 – 145.990 Mhz aralıđı

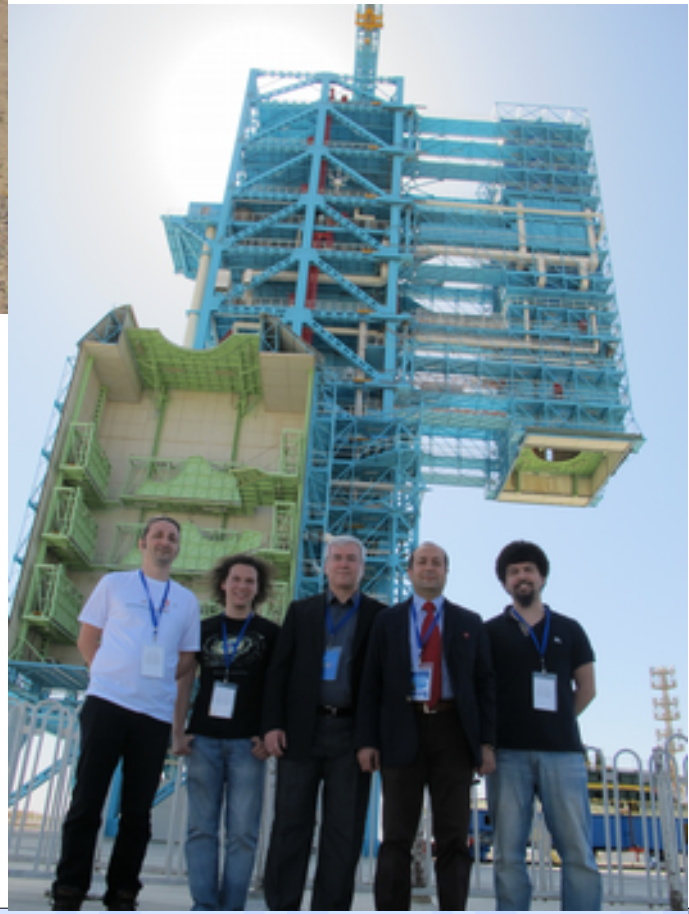
Uydudan Yeryüzüne Gönderilen Sinyal
(DOWNLINK)

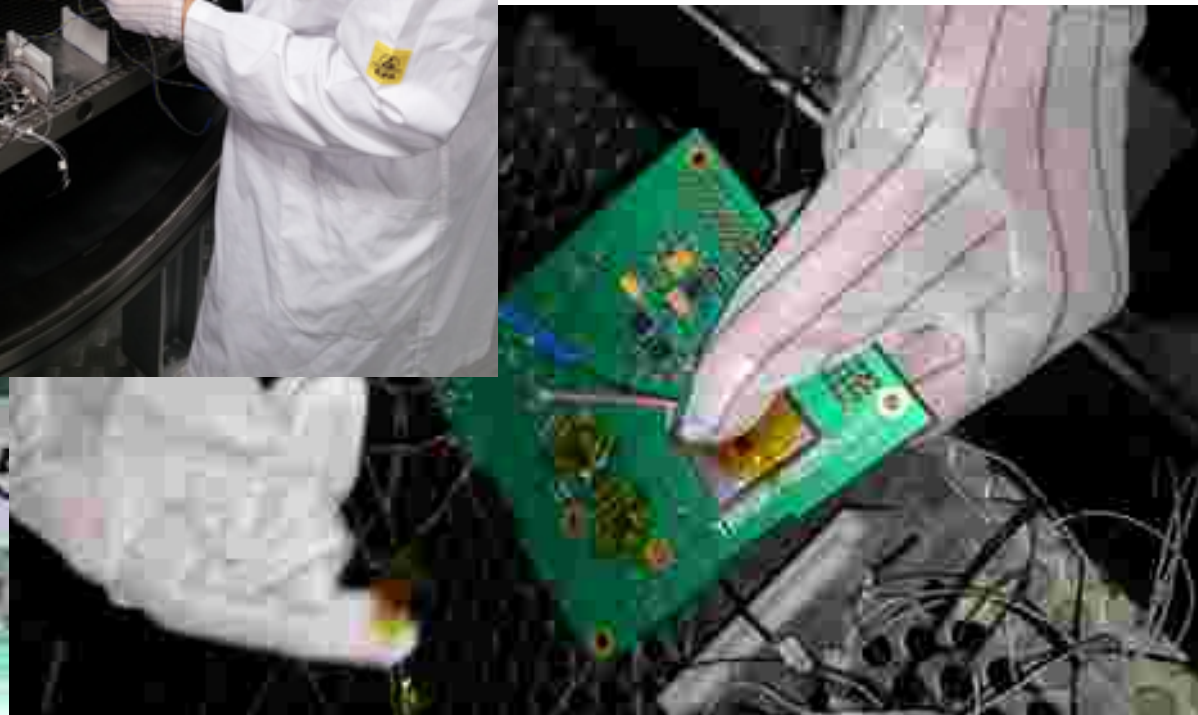
435.200 – 435.250 Mhz aralıđı



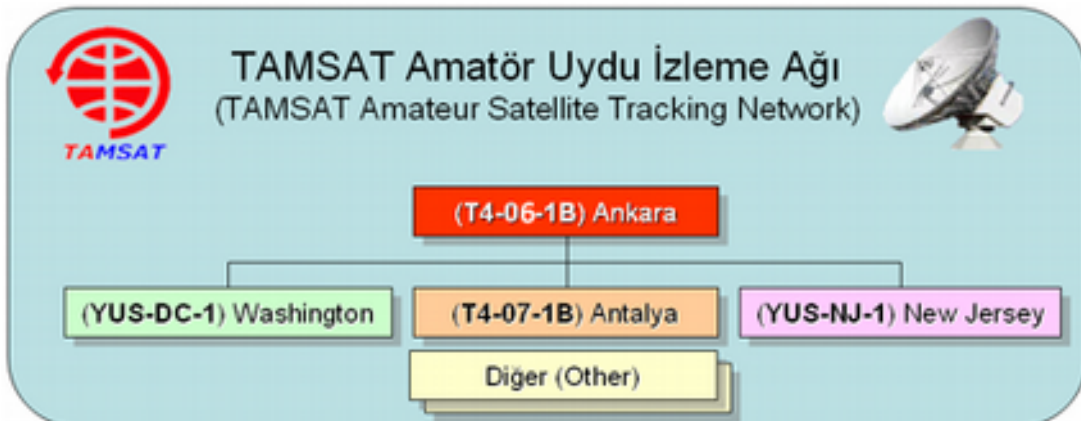
JiGuan Space Center - China May 2013

TAMSAT 3U-SAT TRANSPONDER LAUNCH









MİSYONUMUZ :

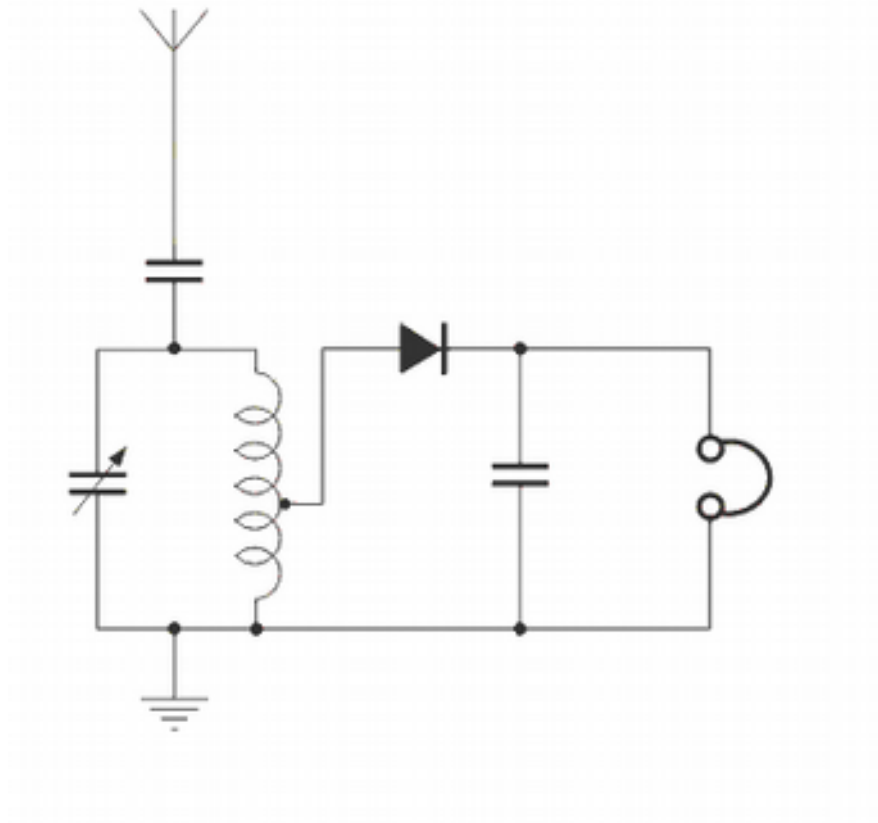
- Yurdumuzda amatör, bilimsel ve benzer amaçlı uyduların projelendirme, **üretim ve işletme çalışmaları** ile ilgili araştırma, geliştirme, **uygulama ve eğitim** hizmetleri vermek;
- Gerçekleştirdiđi projeleri amatör ve bilimsel kullanım için telsiz ve radyo amatörlerinin ve ilgili kullanıcıların hizmetine sunmak ve **bu bilgi ve beceriye sahip gençlerin sayılarının artması** için eğitimler ve seminerler düzenlemek;
- Gelişen ve yaygınlaşan bilişim teknolojileriyle, amatör uydu sistemlerinin ortak konularında ülkemiz gençleri için **araştırma ve geliştirme alanları oluşturmak**, gerektiğinde ulusal ve uluslar arası düzenleyici kuruluşlarla koordinasyonu sağlamak ve işbirliđi yapmaktır.

VİZYONUMUZ:

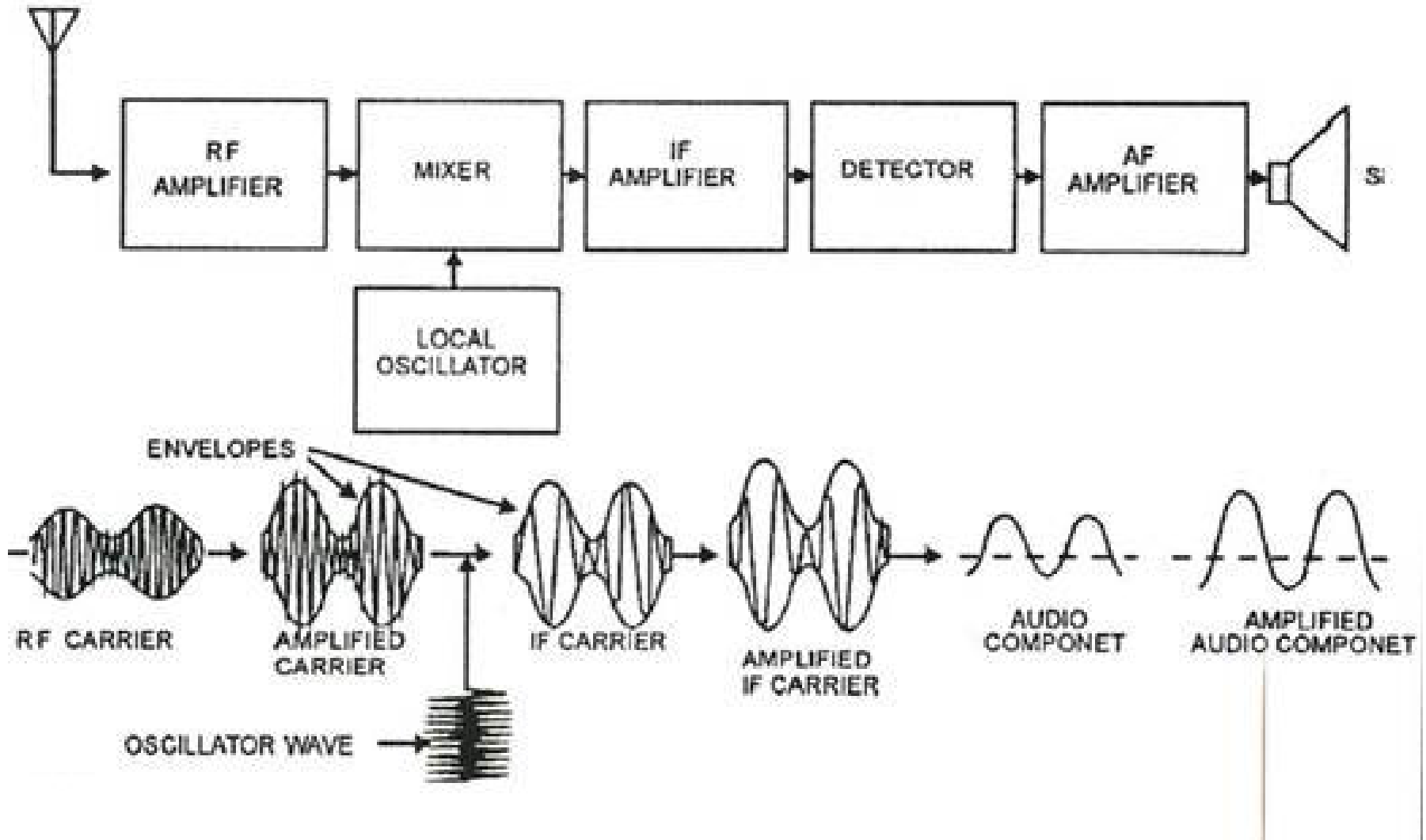
- Türk Gençlerinin ve radyo amatörlerinin **kendi uydu sistemlerini yapmalarına** yardımcı olmak, yurt içinde bulunmayan yedek parça ve cihazları yasal girişimlerle temin etmek, gerekirse ithalatını yapmak,
- **Dođal afetler ve olađanüstü hallerde uydu sistemlerinin azami şekilde kamu yararına kullanılmasına öncülük etmek**,
- Amatör Telsizcilik ile ilgili yönetmeliklerde belirtilen eğitim, araştırma, arama kurtarma ve izcilik kuruluşlarında yasa ve yönetmelikler uyarınca kurulacak olan amatör telsiz istasyonlarına gerektiğinde geçici cihaz, anten, uydu takip sistemi temin ederek, eğitim ve uydu haberleşme desteđi vermek gelecek vizyonumuzu belirtmektedir.

Ne menem Őeydir bu SDR

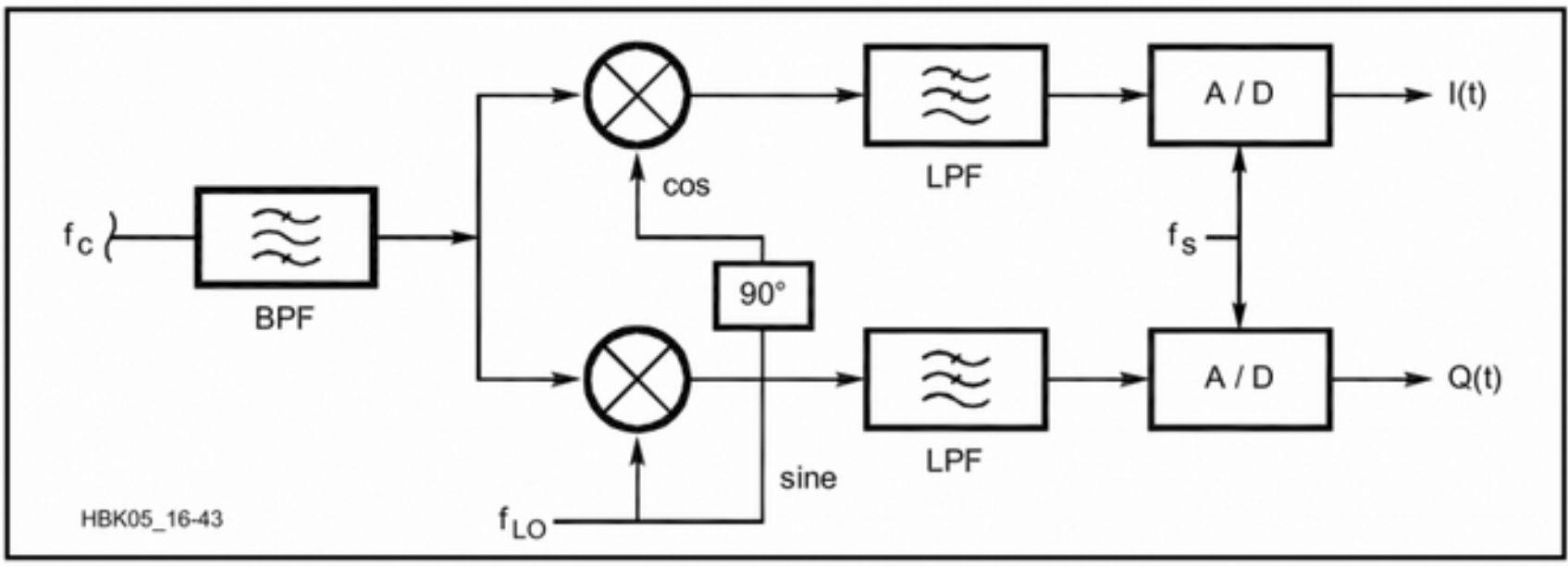


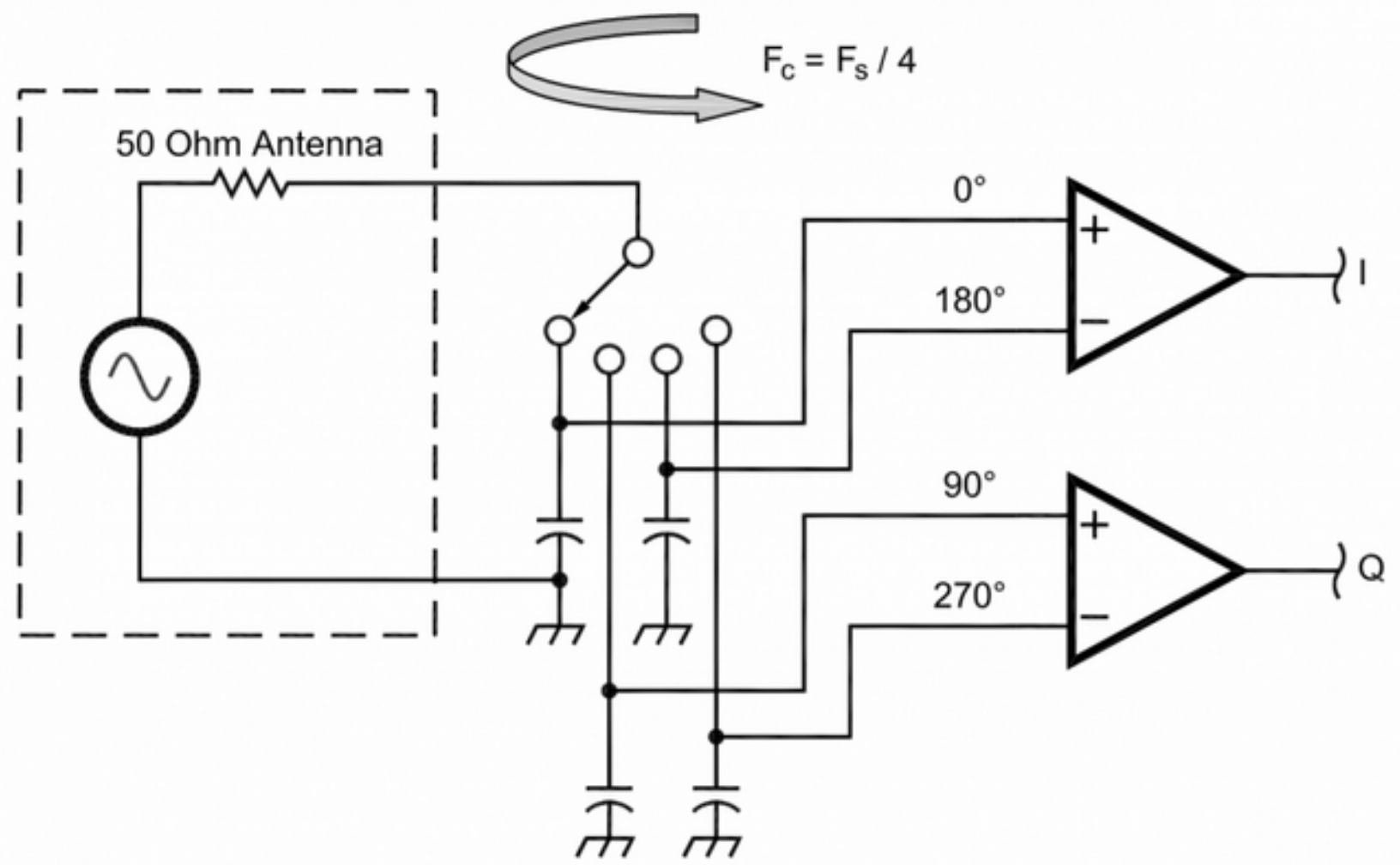


En Basit Radyo Alıcısı

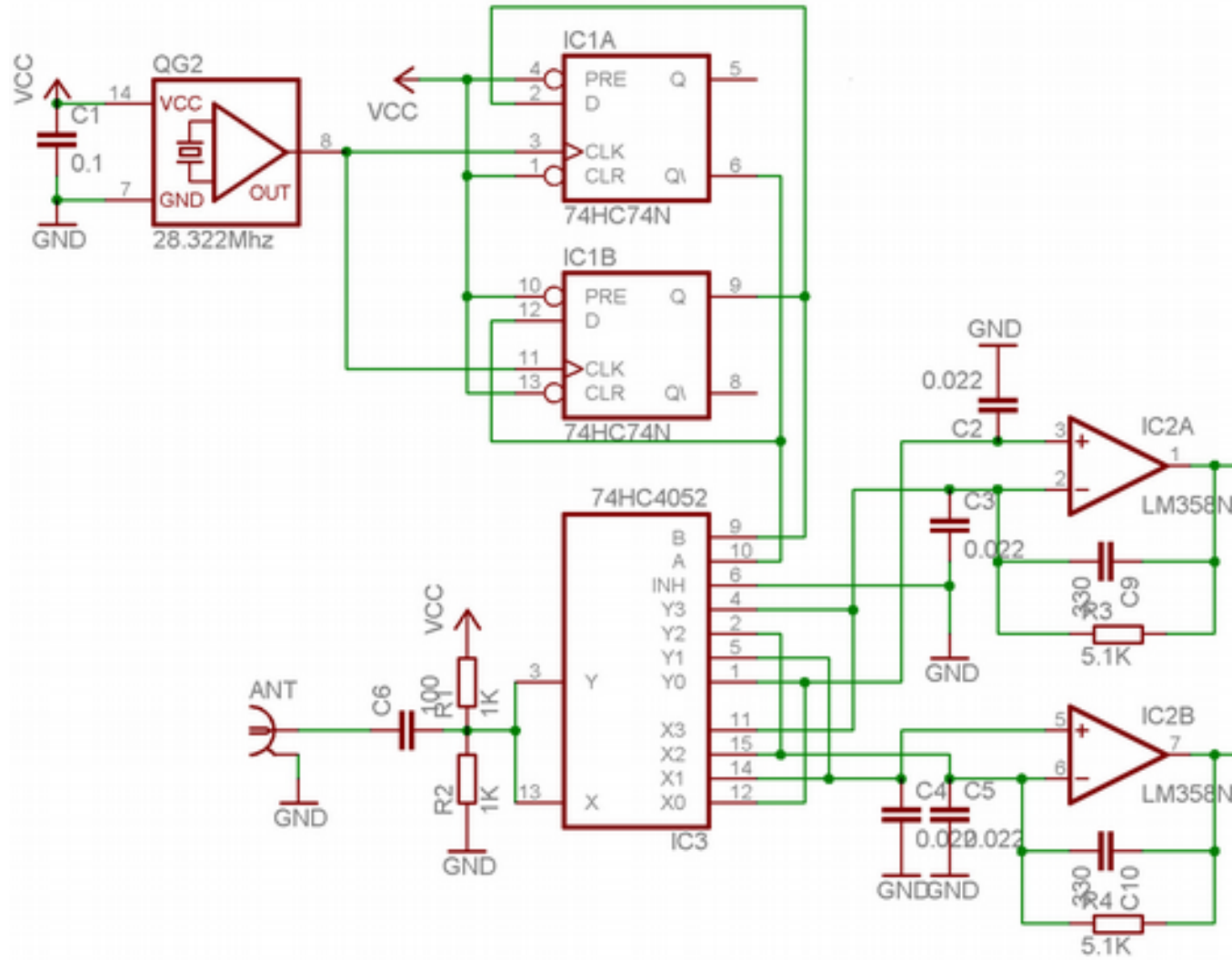


Süperheterodin Radyo Alıcısı





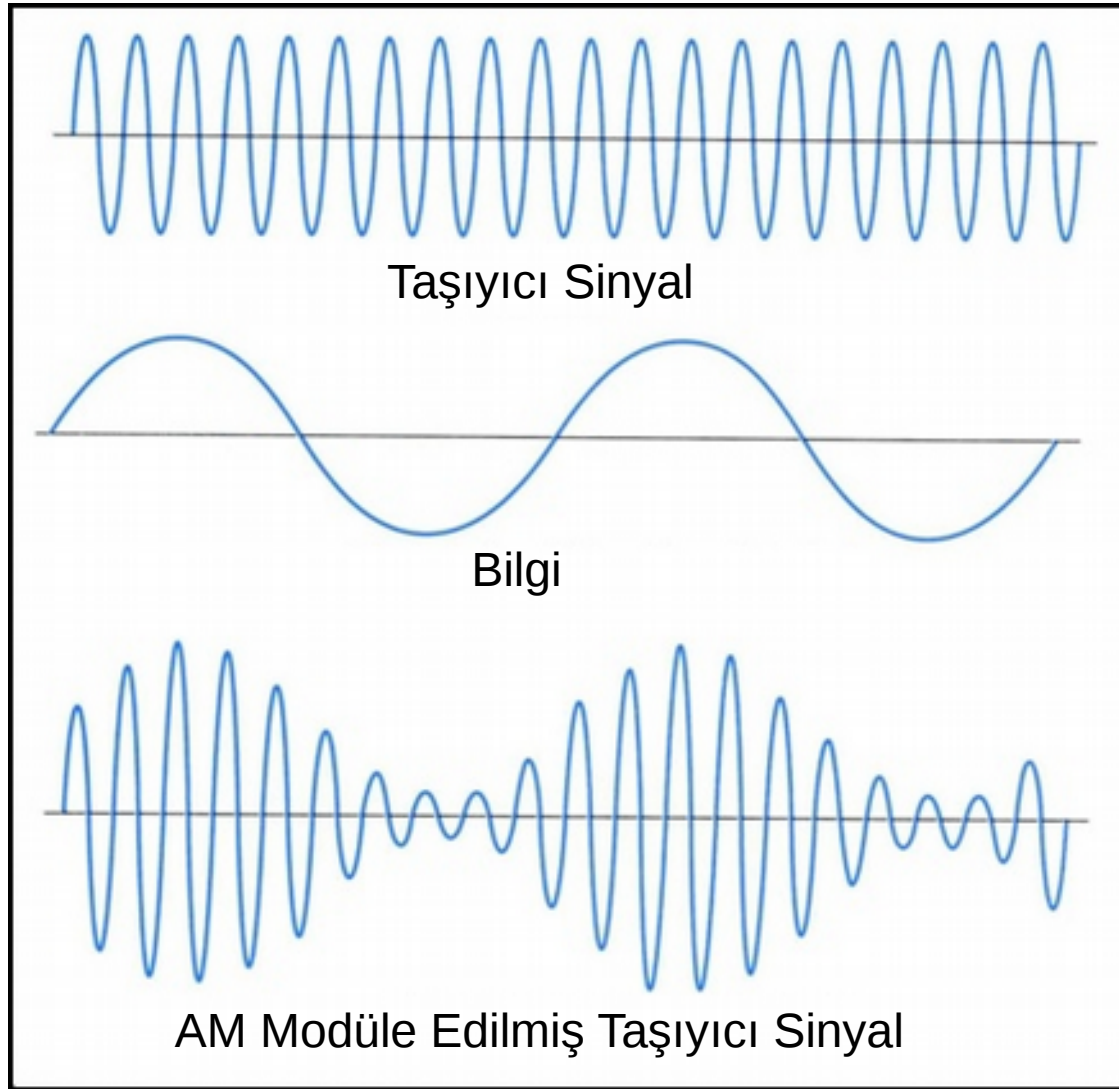
Tyloe Detektörü



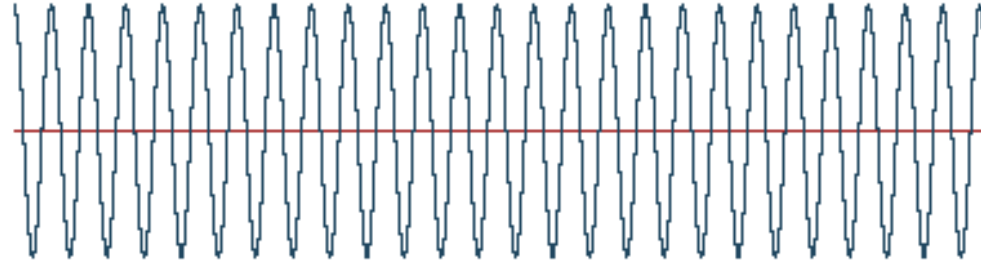
SES KARTI SOL KANAL

SES KARTI SAĞ KANAL

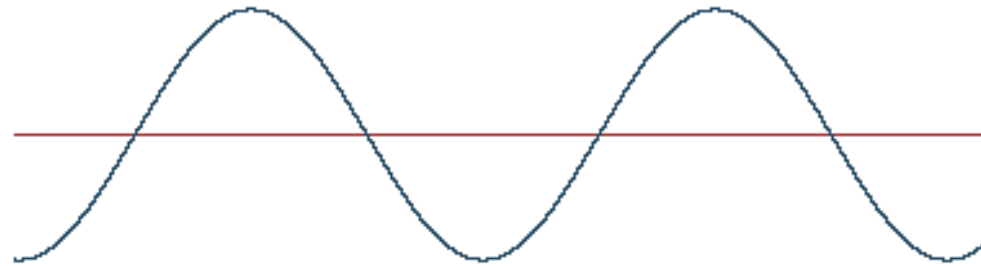
(Yaklaşık Maliyet 10 TL)



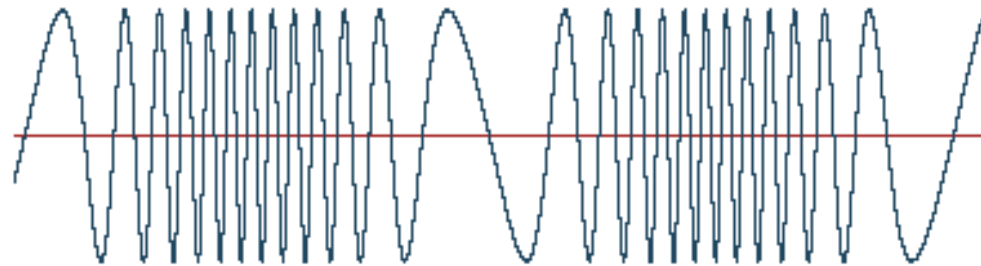
Genlik Modülasyonu (AM)



Taşıyıcı Sinyal



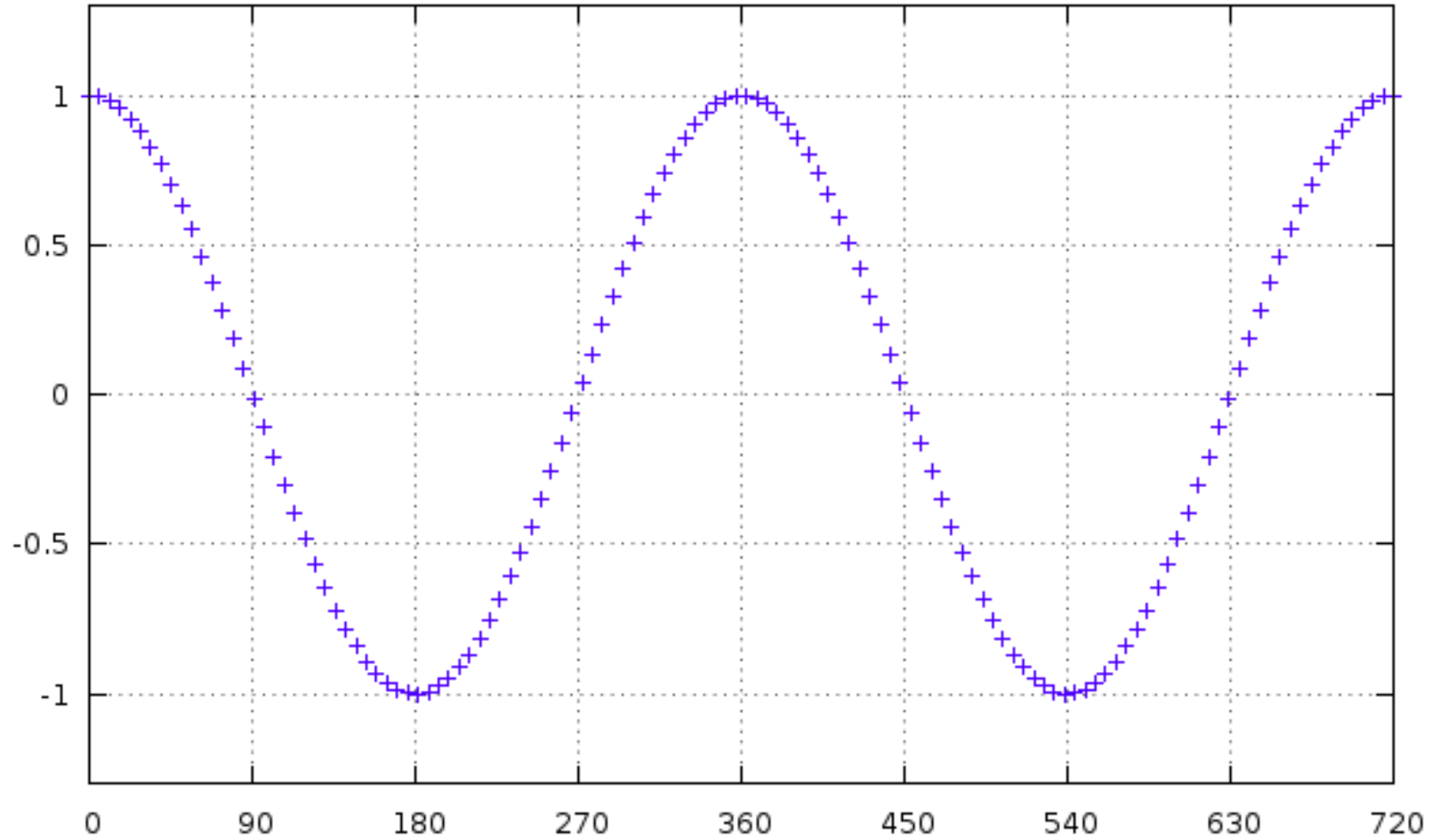
Bilgi



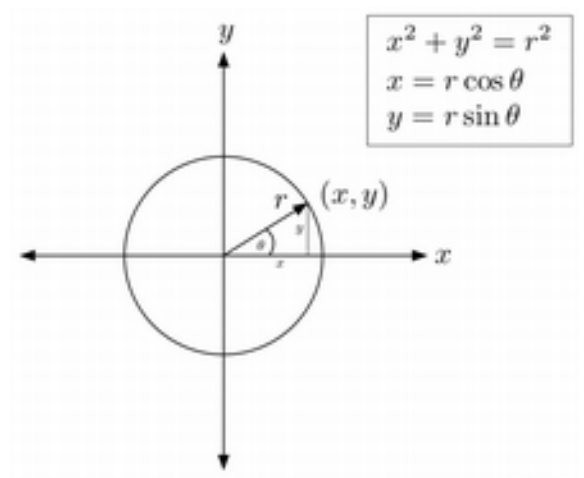
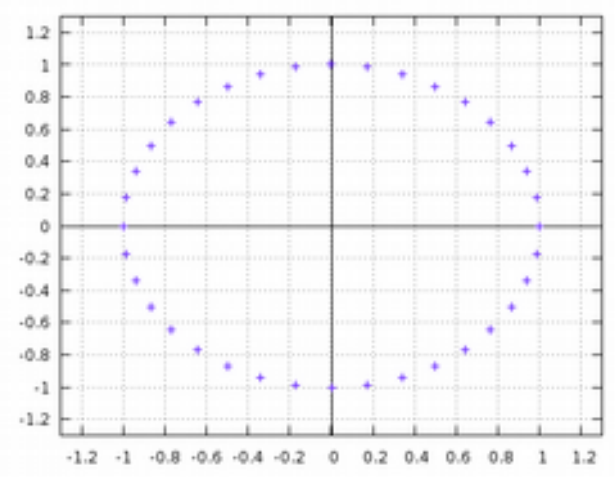
FM Modüle Edilmiş Taşıyıcı Sinyal

Frekans Modülasyonu (FM)

Direk A/D çevrimi yapsaydık

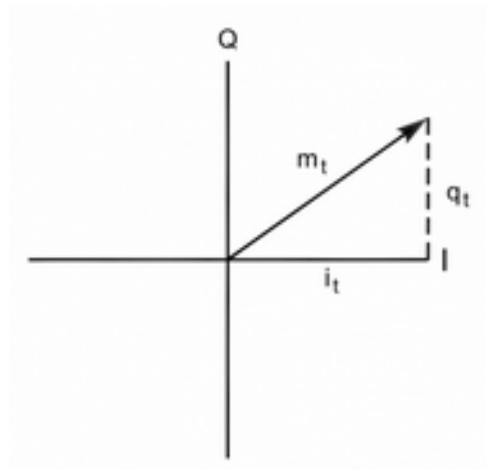


$\cos(\omega t)$ mi, $\cos(-\omega t)$ mi ?
 $\omega = ?$

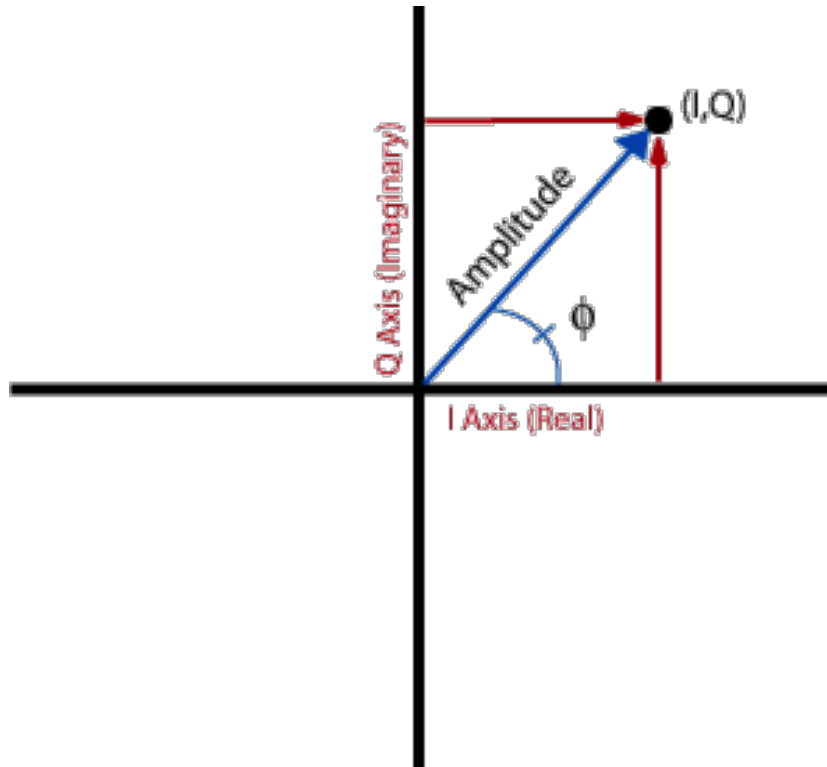


$$\begin{aligned}
 x^2 + y^2 &= r^2 \\
 x &= r \cos \theta \\
 y &= r \sin \theta
 \end{aligned}$$

$$m_t = A \cdot \cos \theta$$



$$m_t = \sqrt{I_t^2 + Q_t^2}$$



Koordinat : (I,Q)

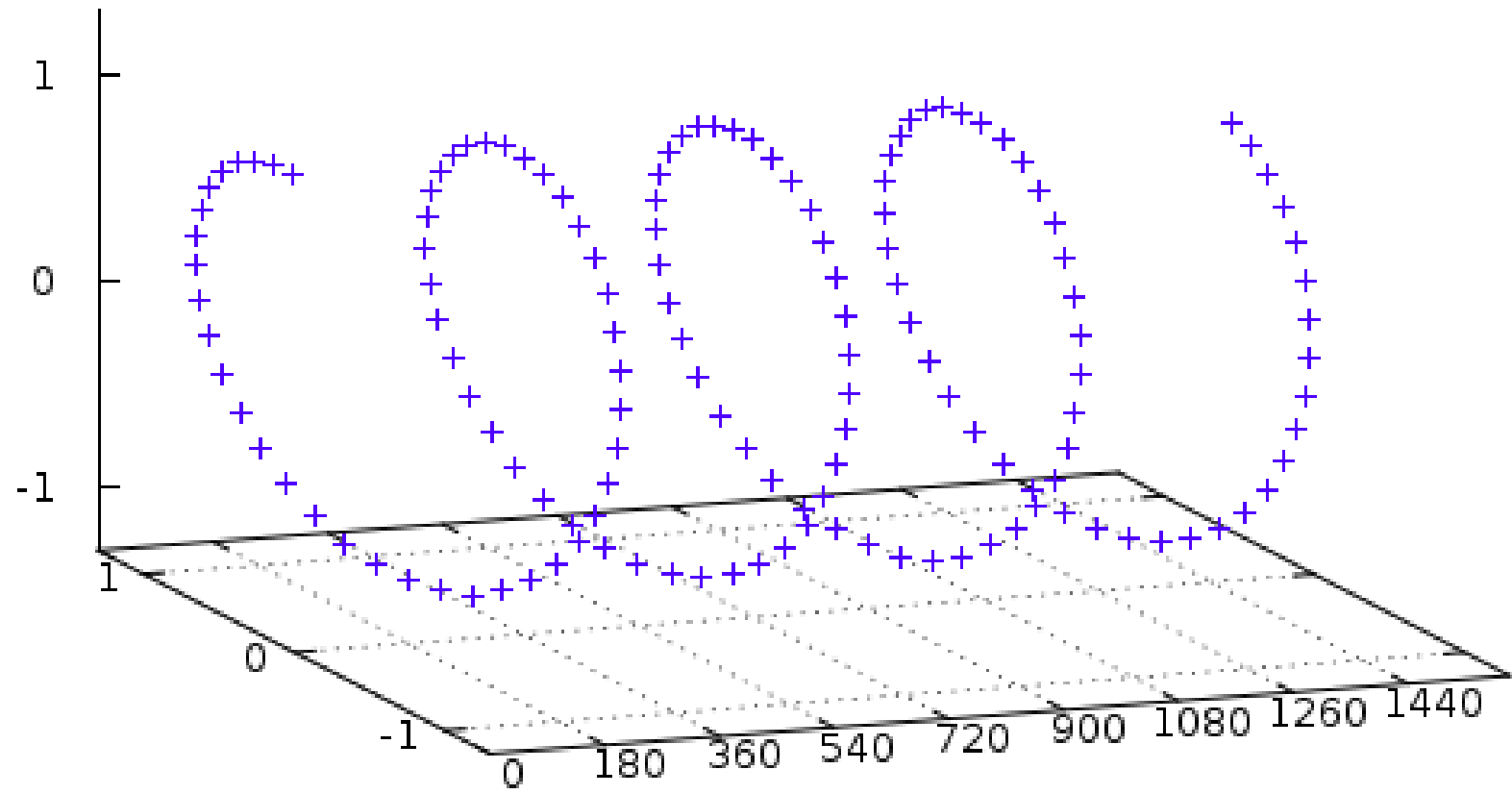
Vektör : [I,Q]

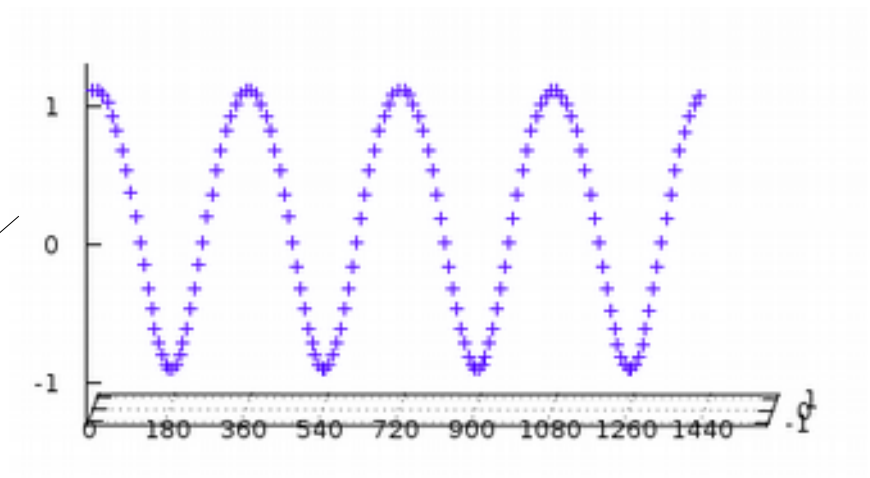
Komplex Sayı : $I+Qi$

Polar : $I=A.\cos(wt)$, $Q=A.\sin(wt)$

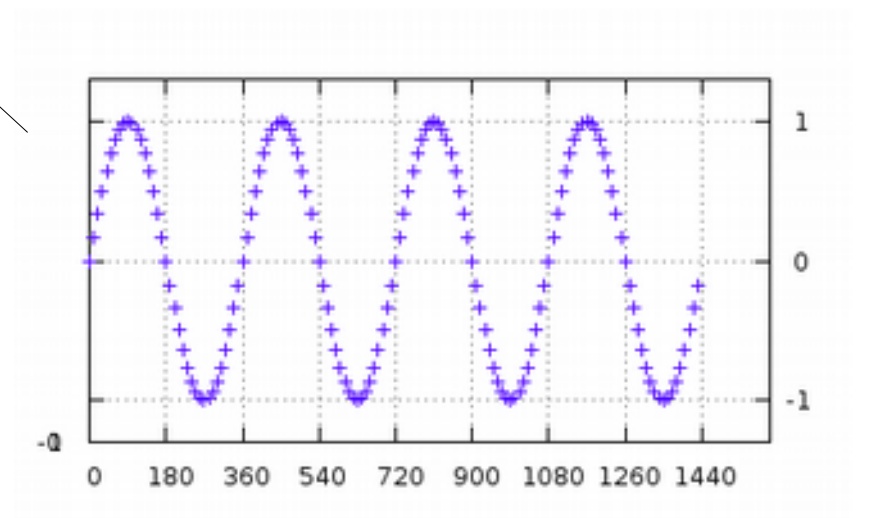
Euler : $A(\cos(\phi) + i\cdot\sin(\phi))$
 $Ae^{i\phi}$

Komplex Sinyal Görünümü

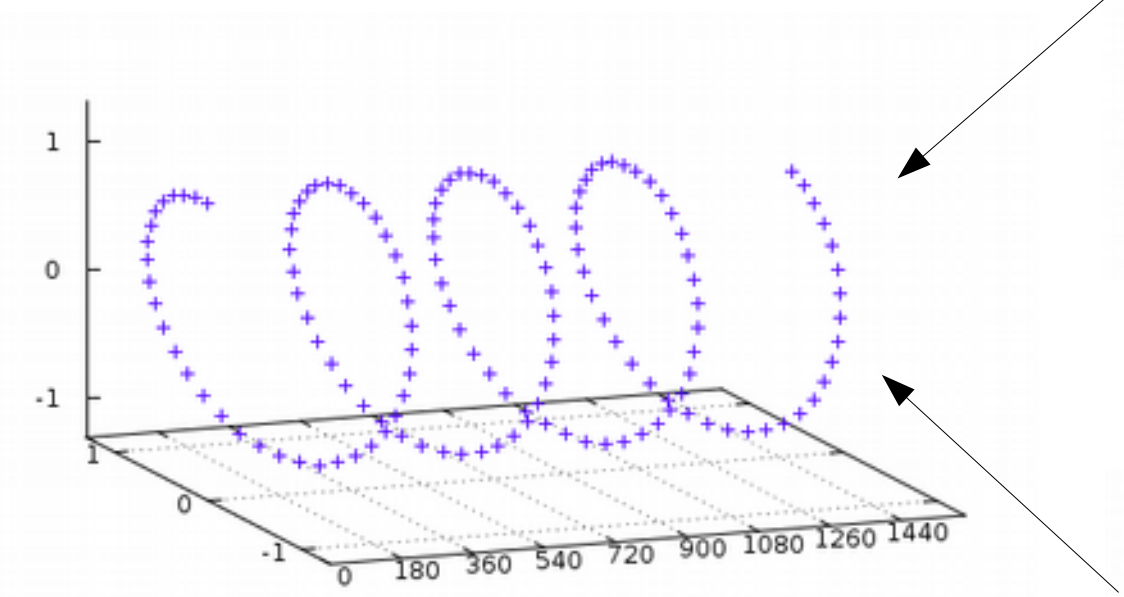




$\cos(\omega t)$



$\sin(\omega t)$



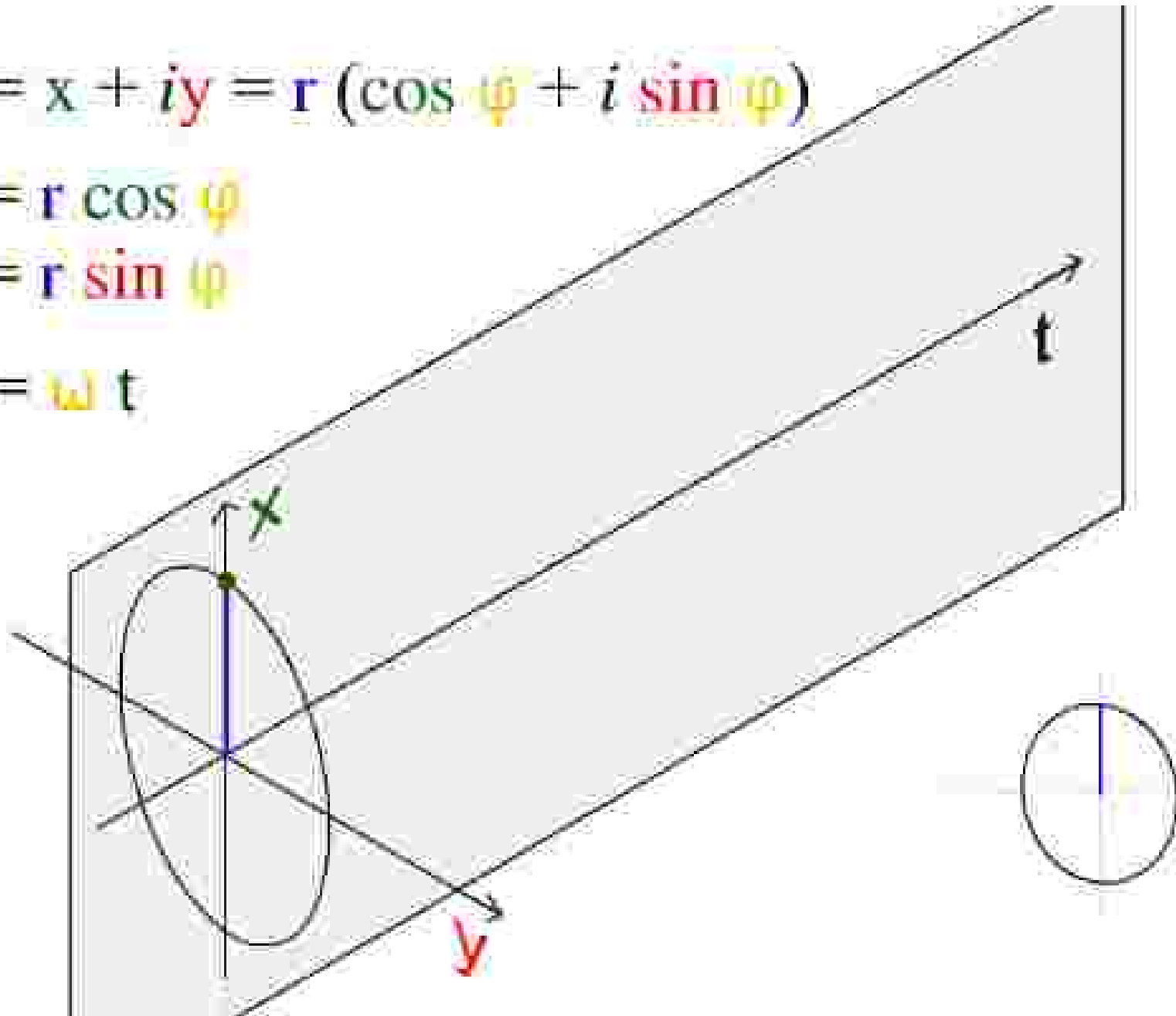
$\cos(\omega t) + i \cdot \sin(\omega t)$

$$z = x + iy = r (\cos \varphi + i \sin \varphi)$$

$$x = r \cos \varphi$$

$$y = r \sin \varphi$$

$$\varphi = \omega t$$



Pozitif Frekans – Negatif Frekans

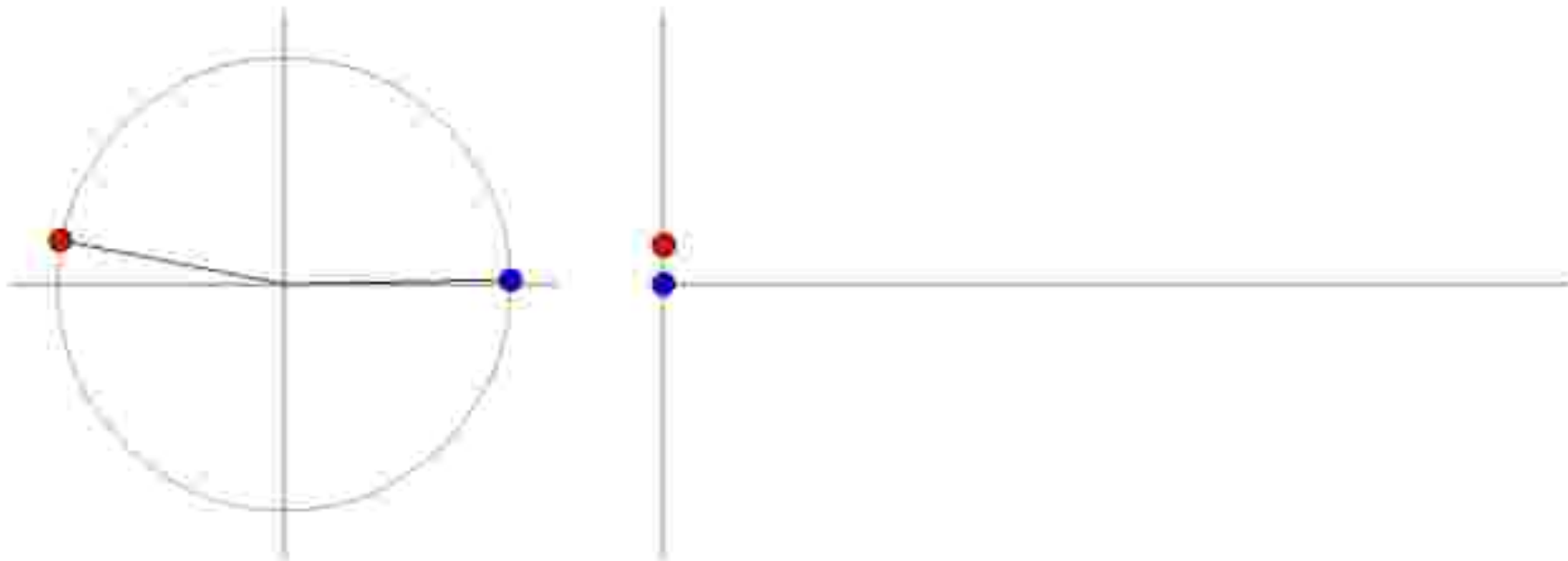
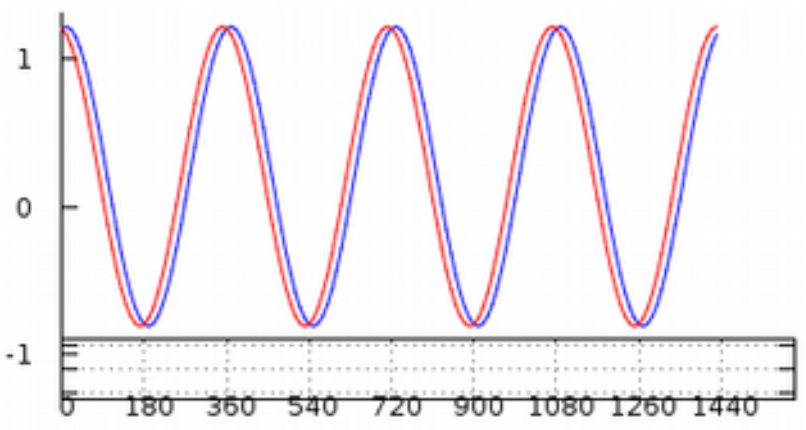
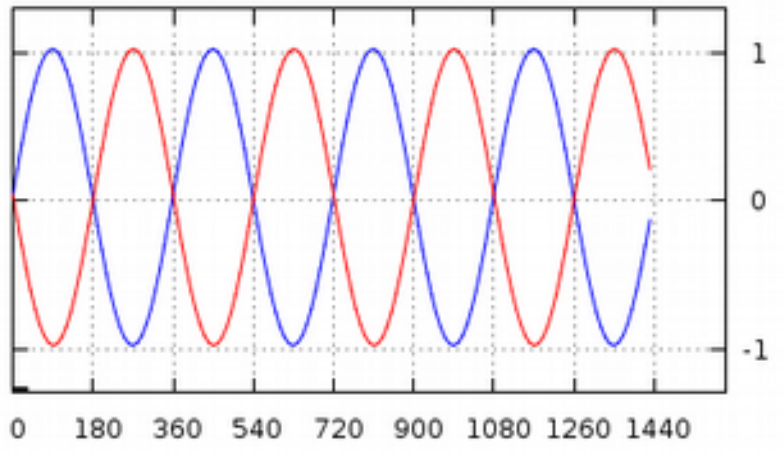
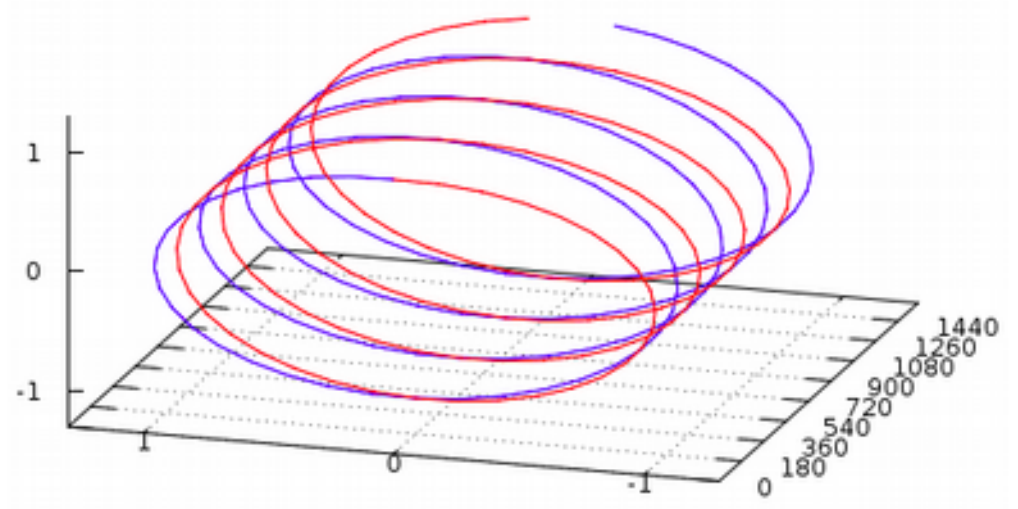


Image courtesy of whiteboard.ping.se



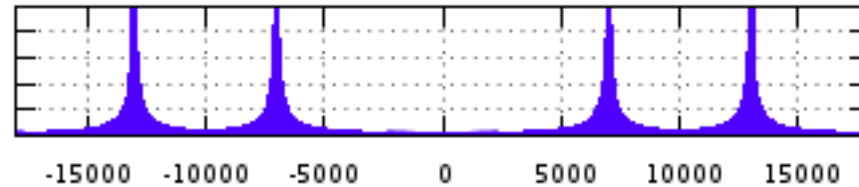
I



Q

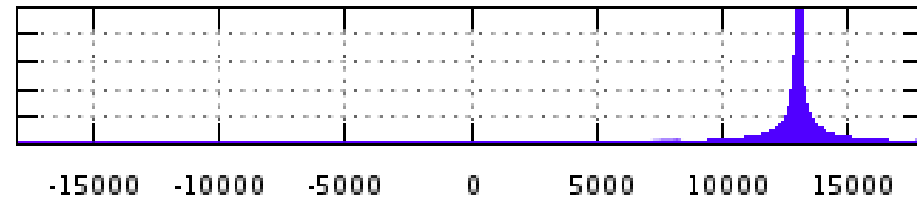
Sinyalleri Toplamak ve arpmak

$$\pm f_1 \otimes \pm f_2 = (\pm)f_1 \pm f_2$$



Komplex formu kullnırken iřaretlerimiz belli olacađı iin problem basitleřecektir ;

$$f_1 \otimes f_2 = f_1 + f_2$$



Euler ifadesi :

$$A_1 \cdot e^{i\phi_1} \cdot A_2 e^{i\phi_2} = A_1 A_2 e^{i(\phi_1 + \phi_2)}$$

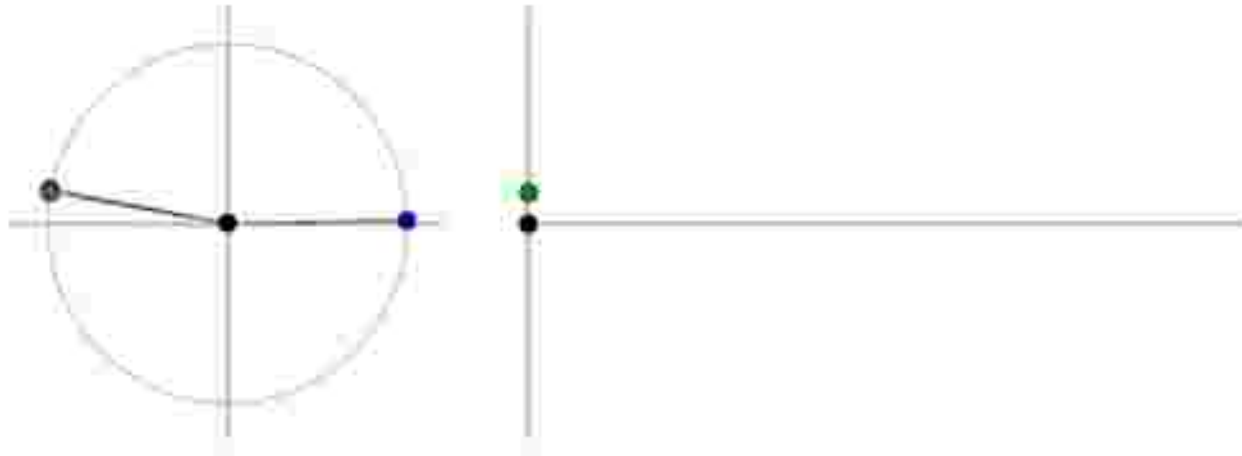


Image courtesy of whiteboard.gitg.se

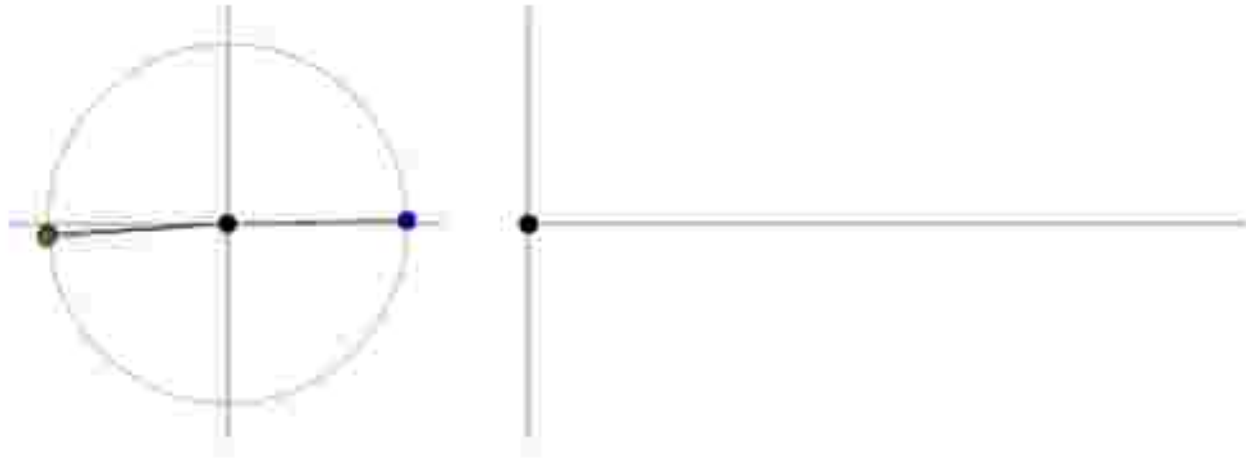
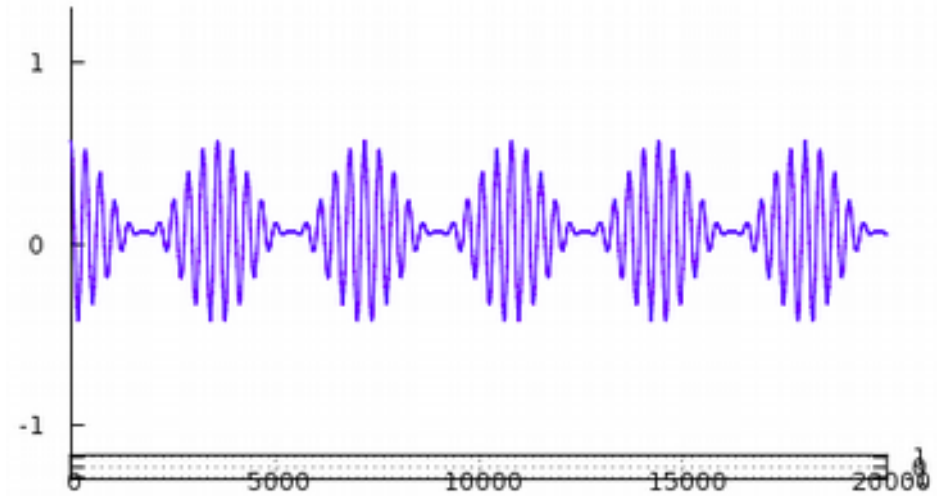
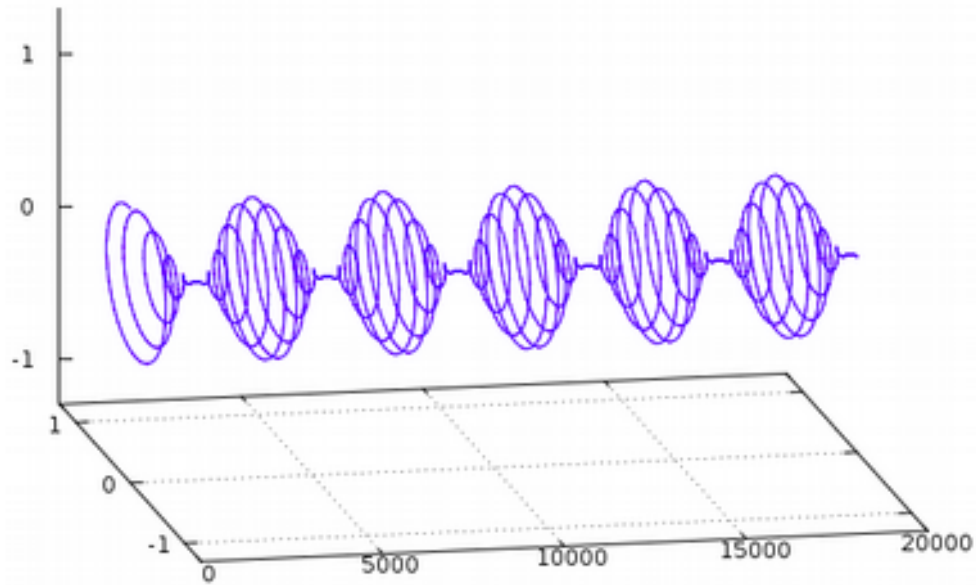


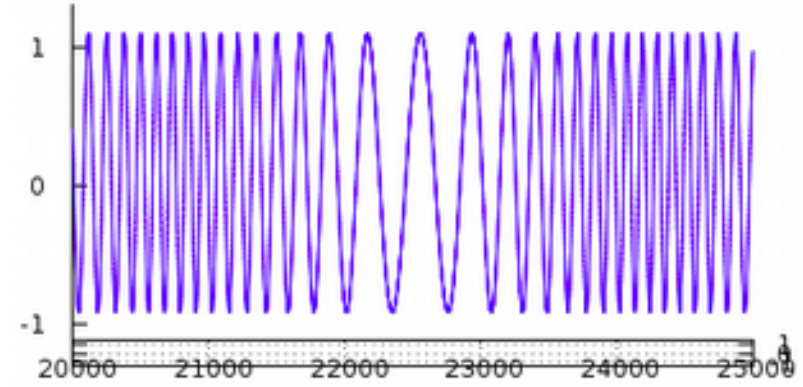
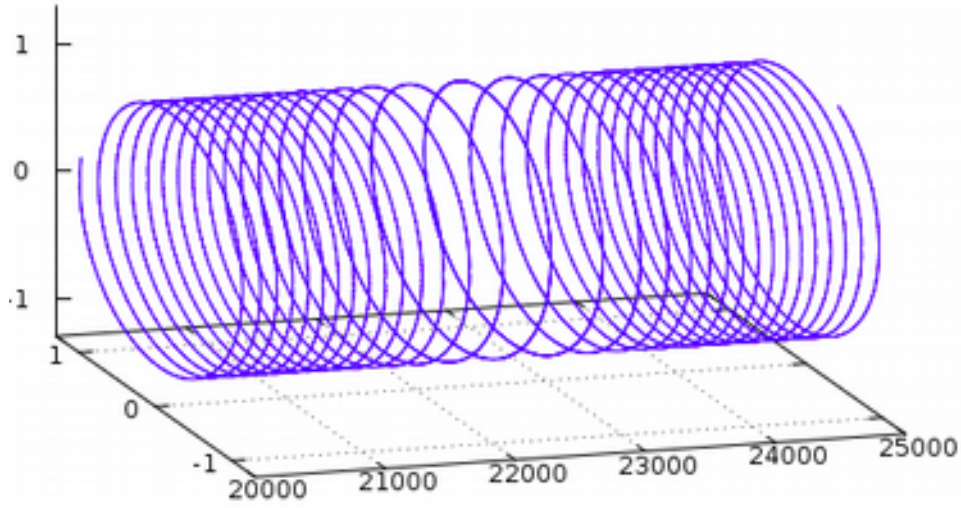
Image courtesy of whitboard.gitg.se



I Görünümü

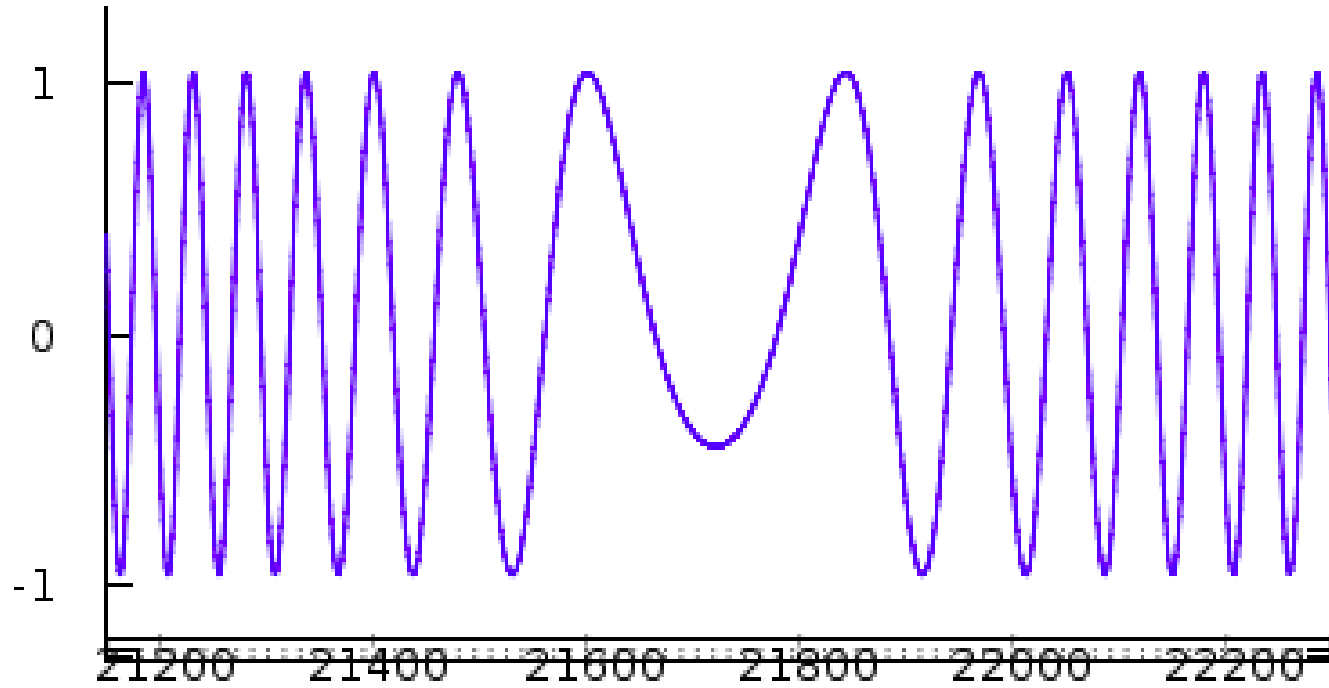
$$\text{Genlik} = (I^2 + Q^2)^{1/2}$$

FM Modülasyonu Görünümü



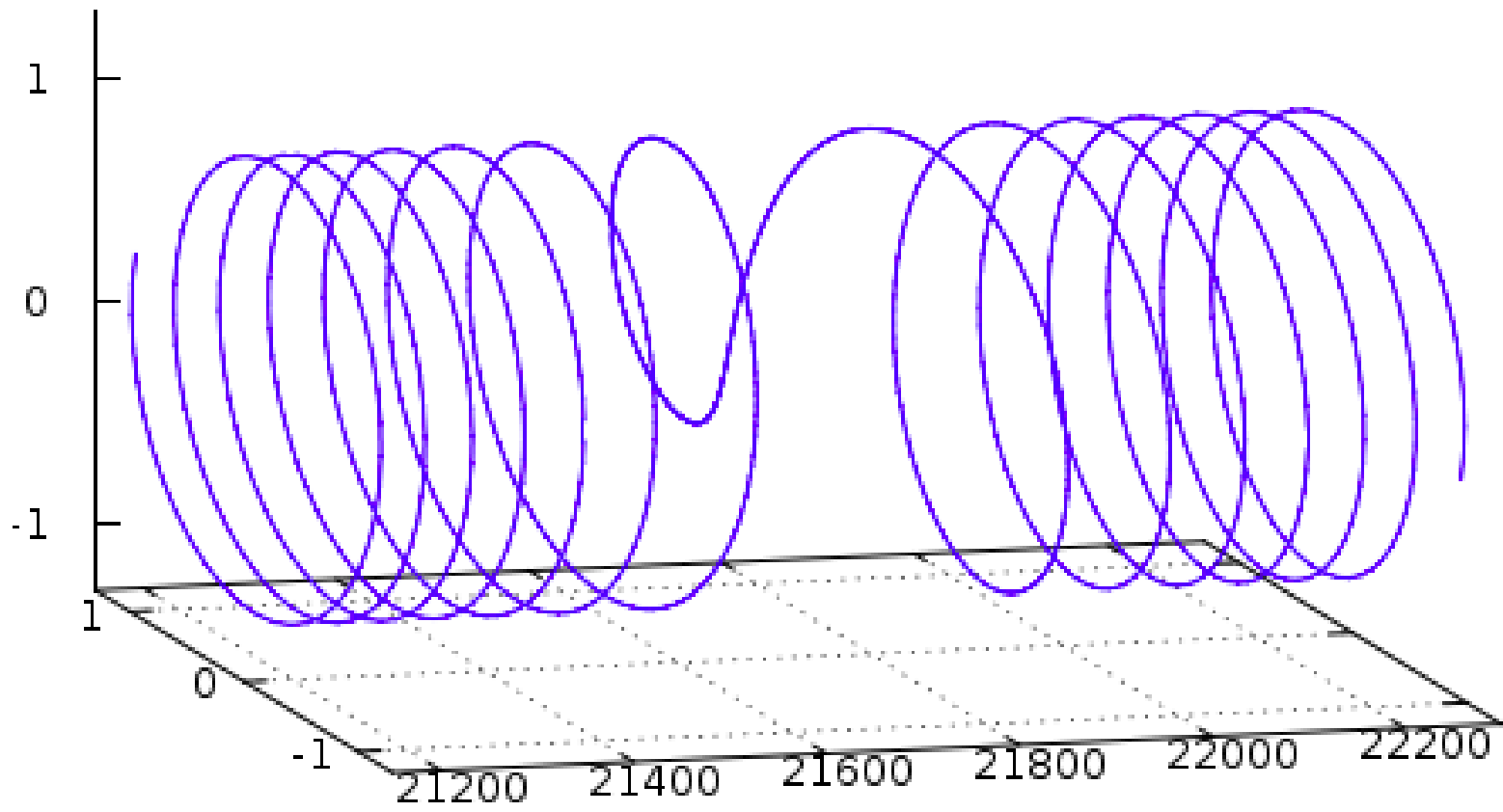
Sadece I Görünümü

FM Modülasyonu Görünümü

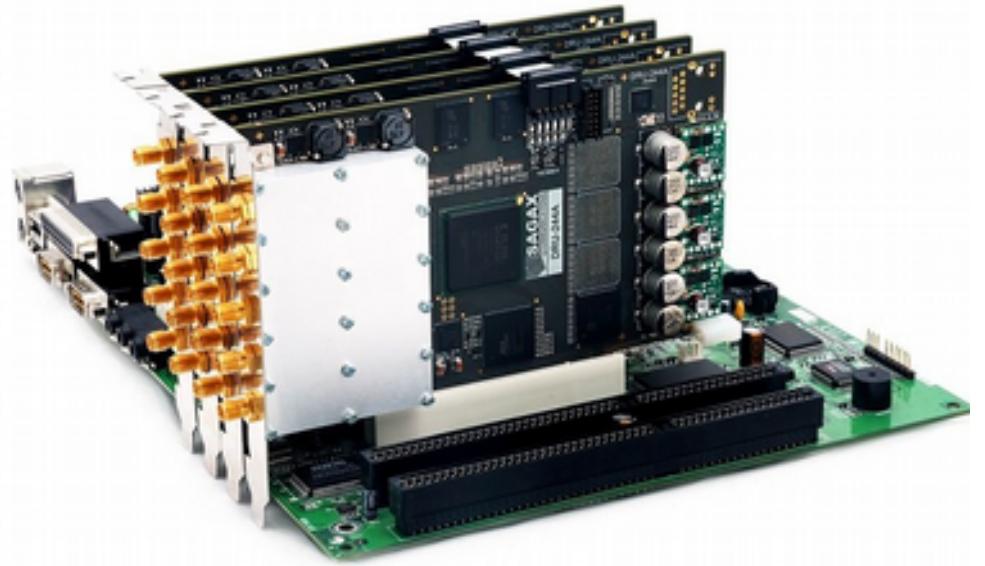
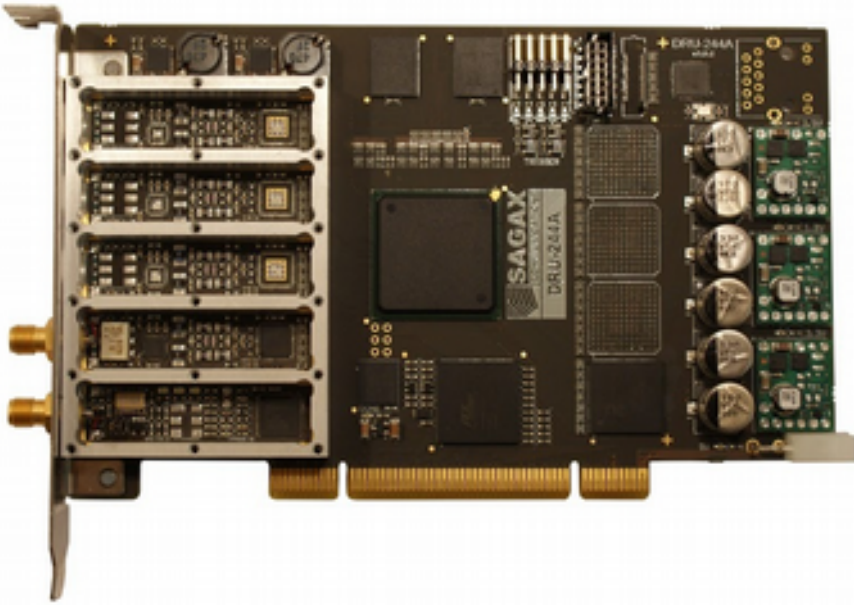


Bu sinyalde ne oluyor olabilir ?

İpucu : Faz modülasyonu



Faz Modülasyonu Görünümü



BW > 500 Mhz
>> \$40.000

SAGAX QUADRUS



B Serisi : < 20Mhz BW, ~\$1500



N Serisi : 25Mhz BW, ~\$2500

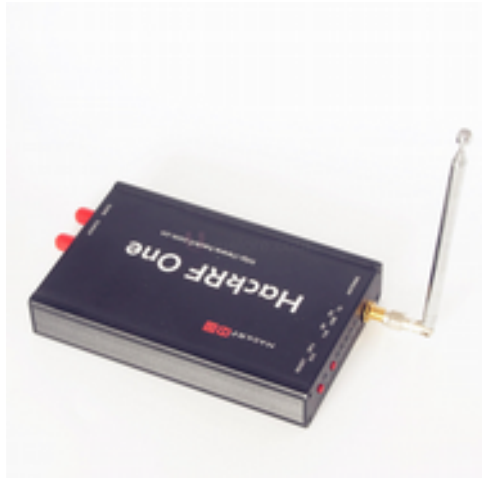
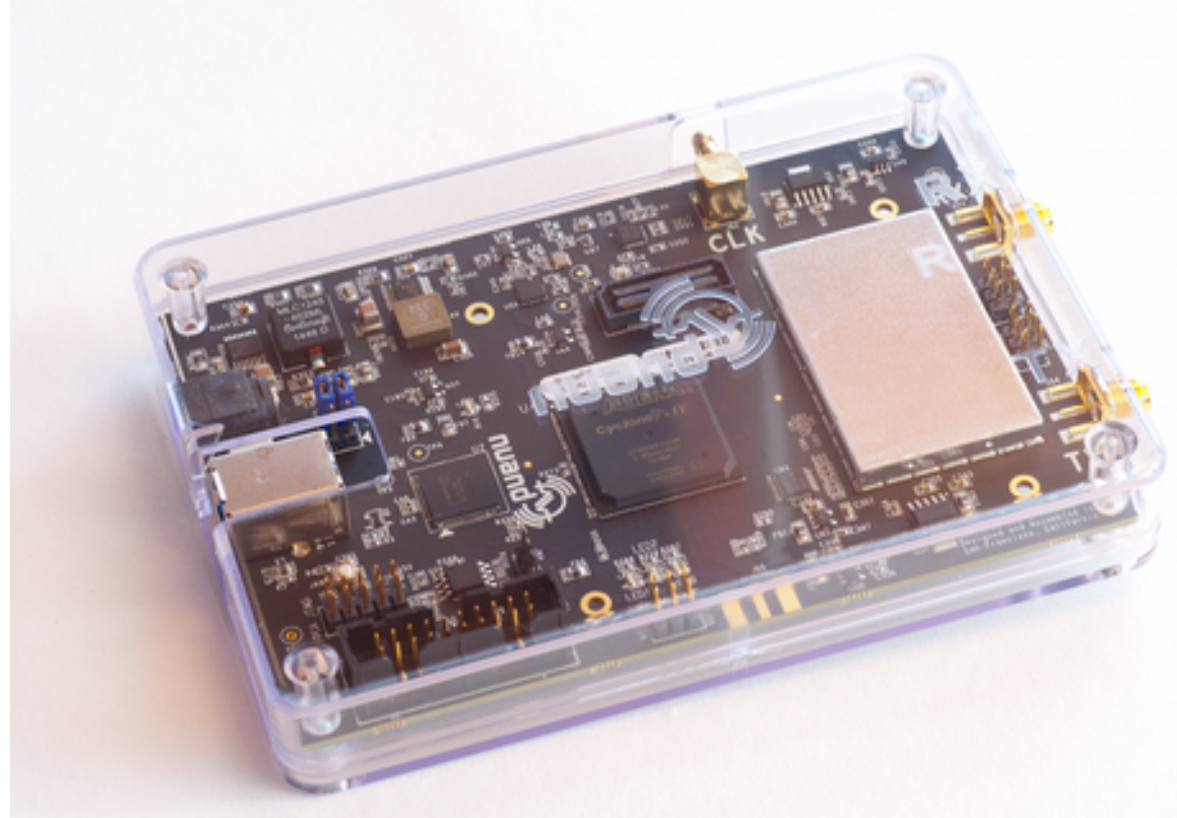


E Serisi : 50Mhz BW, ~\$4500



X Serisi : 150 Mhz BW, ~\$7500

Ettus Research



**BW ~20Mhz
~\$300**

HackRF ve BladeRF

~2.6 Ghz, BW=2Mhz

Generic R820T

Generic R820T2

Nooelec Nano

Nooelec Nano 2

Nooelec Nano 2+

Nooelec Nano-P

Nooelec Mini

Nooelec Mini 2+

Nooelec Mini A1+

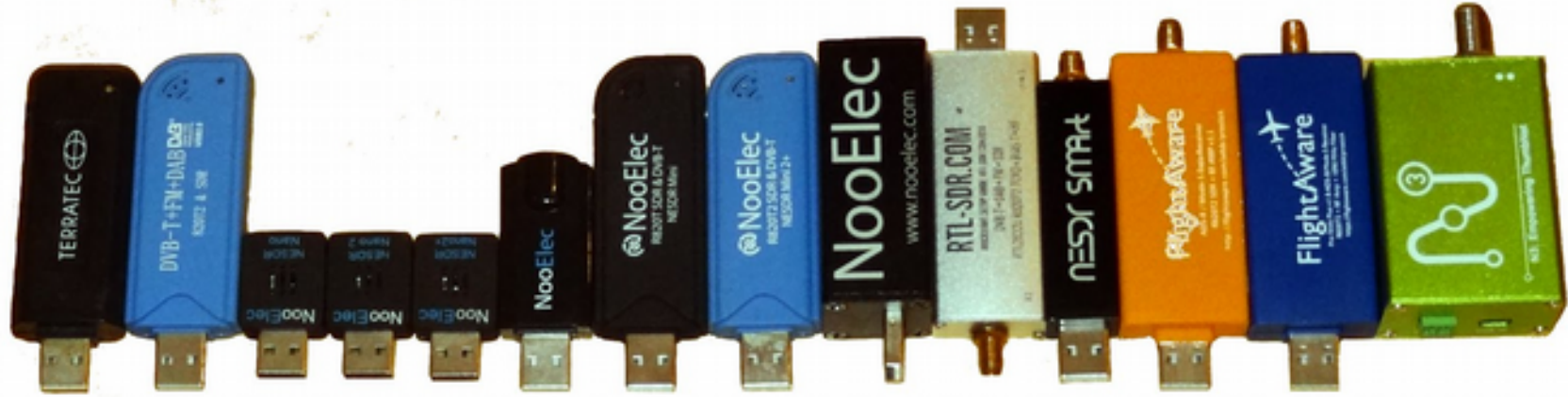
rtl-sdr.com v.3

Nooelec SMART

FlightAware Pro Stick

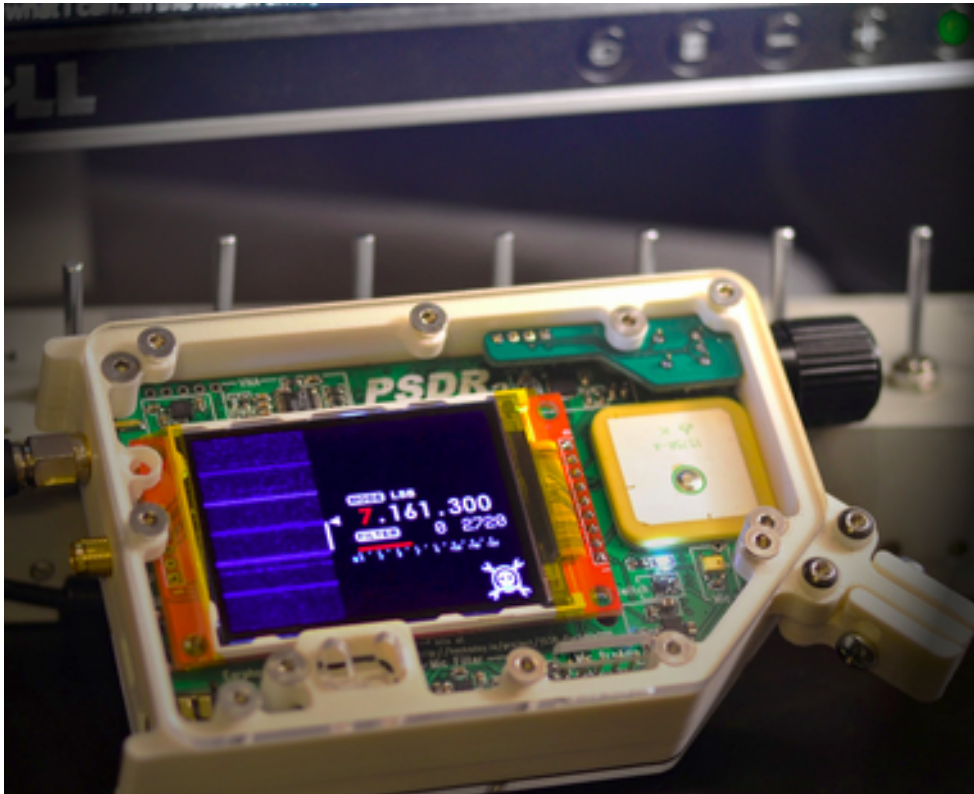
FlightAware Pro Stick Plus

Thumbnet N3



RTL SDR

< \$10



STM32-SDR-RXTX Kit-001








```
onur@onur-Lenovo-G50-70:~$ sudo apt-get install gnuradio
[sudo] password for onur:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  blt fonts-lyx freeglut3 gnuradio-dev libboost-atomic1.58-dev
  libboost-atomic1.58.0 libboost-chrono1.58-dev libboost-chrono1.58.0
  libboost-date-time-dev libboost-date-time1.58-dev libboost-filesystem-dev
  libboost-filesystem1.58-dev libboost-program-options-dev
  libboost-program-options1.58-dev libboost-program-options1.58.0
  libboost-regex1.58.0 libboost-serialization1.58-dev
  libboost-serialization1.58.0 libboost-system-dev libboost-system1.58-dev
  libboost-test-dev libboost-test1.58-dev libboost-test1.58.0
  libboost-thread-dev libboost-thread1.58-dev libboost-thread1.58.0
  libboost1.58-dev libcodec2-0.4 libcomedi0 libcppunit-1.13-0v5 libcppunit-dev
  libdrm-amdgpu1 libdrm-dev libdrm-intel1 libdrm-nouveau2 libdrm-radeon1
  libdrm2 libexpat1-dev libfftw3-bin libfftw3-dev libfftw3-long3
  libfftw3-quad3 libgl1-mesa-dev libgl1-mesa-glx libglade2-0 libglapi-mesa
```





```
Setting up python-ndg-httpsclient (0.4.0-3) ...
Setting up python-networkx (1.11-1ubuntu1) ...
Setting up python-qwt5-qt4 (5.2.1~cvs20091107+dfsg-7build1) ...
Setting up python-urllib3 (1.13.1-2ubuntu0.16.04.1) ...
Setting up python-requests (2.9.1-3) ...
Setting up python-tk (2.7.11-2) ...
Setting up python-yaml (3.11-3build1) ...
Setting up uhd-host (3.9.2-1) ...
Adding group `usrp' (GID 131) ...
Done.
Setting up librtlsdr0:amd64 (0.5.3-5) ...
Setting up python-scipy (0.17.0-1) ...
Setting up rtl-sdr (0.5.3-5) ...
Processing triggers for libc-bin (2.23-0ubuntu3) ...
```

```
onur@onur-Lenovo-G50-70:~$ gnuradio-companion
```

The screenshot displays the GNU Radio Companion (GRC) interface. At the top, the title bar reads "*DERS1.grc - /home/baris - GNU Radio Companion". The main workspace shows a flow graph with two blocks: a "Signal Source" block on the left and a "WX GUI Scope Sink" block on the right, connected by a signal line. The "Signal Source" block has the following properties: Sample Rate: 32k, Waveform: Cosine, Frequency: 1k, Amplitude: 1, Offset: 0. The "WX GUI Scope Sink" block has the following properties: Title: Scope Plot, Sample Rate: 32k, Trigger Mode: Auto, Y Axis Label: Counts. A "Properties: Signal Source" dialog box is open in the foreground, showing the "General" tab with the following settings: ID: analog_sig_source_x_0, Output Type: Float, Sample Rate: samp_rate, Waveform: Cosine, Frequency: 1000, Amplitude: 1, Offset: 0. On the right side, a component palette is visible, listing various GNU Radio components such as [Audio], [Boolean Operators], [Byte Operators], [Channelizers], [Channel Models], [Coding], [Control Port], [Debug Tools], [Deprecated], [Digital Television], [Equalizers], [Error Coding], [FCD], [File Operators], [Filters], [Fourier Analysis], [GUI Widgets], [Impairment Models], [Instrumentation], [IQ Balance], [Level Controllers], [Math Operators], [Measurement Tools], [Message Tools], [Misc], [Modulators], [Networking Tools], [NOAA], [OFDM], [Packet Operators], [Pager], [Peak Detectors], [Resamplers], [Sinks], [Sources], [Stream Operators], [Stream Tag Tools], [Symbol Coding], [Synchronizers], [Trellis Coding], [Type Converters], and [UHD]. At the bottom of the interface, the terminal shows the following output: >>> Done
Generating: '/home/baris/top_block.py'
>>> Warning: This flow graph may not have flow control: no audio or RF hardware blocks found. Add a Misc>>Throttle block to your flow graph to avoid CPU congestion.

Bileşenler ve Özellikleri

The screenshot shows the GNU Radio Companion interface with a flow graph containing a **Signal Source** block and a **WX GUI Scope Sink** block. The **Signal Source** block has the following properties: Sample Rate: 32k, Waveform: Cosine, Frequency: 1k, Amplitude: 1, Offset: 0. The **WX GUI Scope Sink** block has the following properties: Title: Scope Plot, Sample Rate: 32k, Trigger Mode: Auto, Y Axis Label: Counts. A properties dialog for the **Signal Source** block is open, showing the **Output Type** set to **Float**. The dialog also shows other parameters: ID: analog_sig_source_x_0, Sample Rate: samp_rate, Waveform: Cosine, Frequency: 1000, Amplitude: 1, and Offset: 0. The console at the bottom shows the message: >>> Warning: This flow graph may not have flow control: no audio or RF hardware blocks found. Add a Misc>>Throttle block to your flow graph to avoid CPU congestion.

-  **Float**
-  **Complex**
-  **Int**
-  **Short**

Veri Tipleri

Options
ID: top_block
Generate Options: WX GUI

Signal Source
Sample Rate: 32k
Waveform: Cosine
Frequency: 500
Amplitude: 1
Offset: 0

WX GUI Scope Sink
Title: Scope Plot
Sample Rate: 32k
Trigger Mode: Auto
Y Axis Label: Counts

Variable
ID: samp_rate
Value: 32k

WX GUI Slider
ID: frq
Label: frq
Default Value: 500
Minimum: 100
Maximum: 10k
Converter: Float

Properties: WX GUI Slider

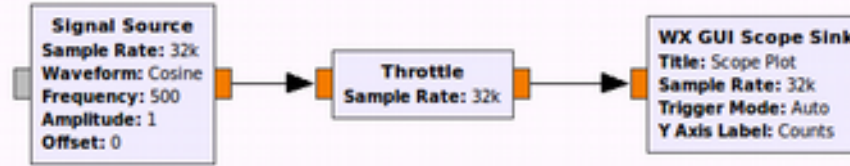
| Property | Value |
|---------------|------------|
| ID | Frekans |
| Label | frq |
| Default Value | 500 |
| Minimum | 100 |
| Maximum | 10000 |
| Num Steps | 1000 |
| Style | Horizontal |
| Converter | Float |
| Grid Position | |
| Notebook | |

Properties: Signal Source

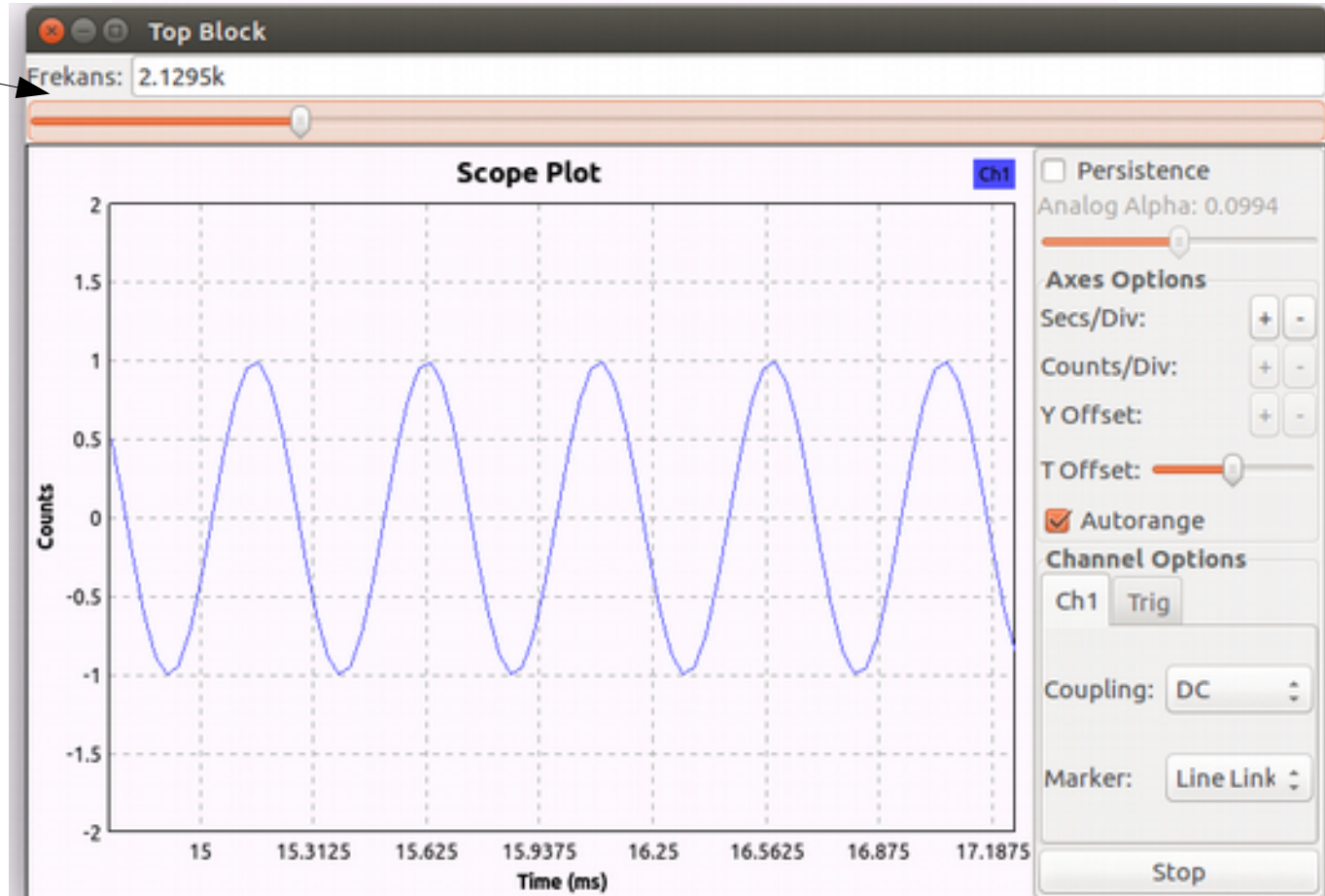
| Property | Value |
|-------------|-----------------------|
| ID | analog_sig_source_x_0 |
| Output Type | Float |
| Sample Rate | samp_rate |
| Waveform | Cosine |
| Frequency | frq |
| Amplitude | 1 |
| Offset | 0 |

[GUI Widgets]
[WX]
 WX GUI Notebook
 WX GUI Check Box
 WX GUI Chooser
 WX GUI Slider
 WX GUI Static Text
 WX GUI Text Box

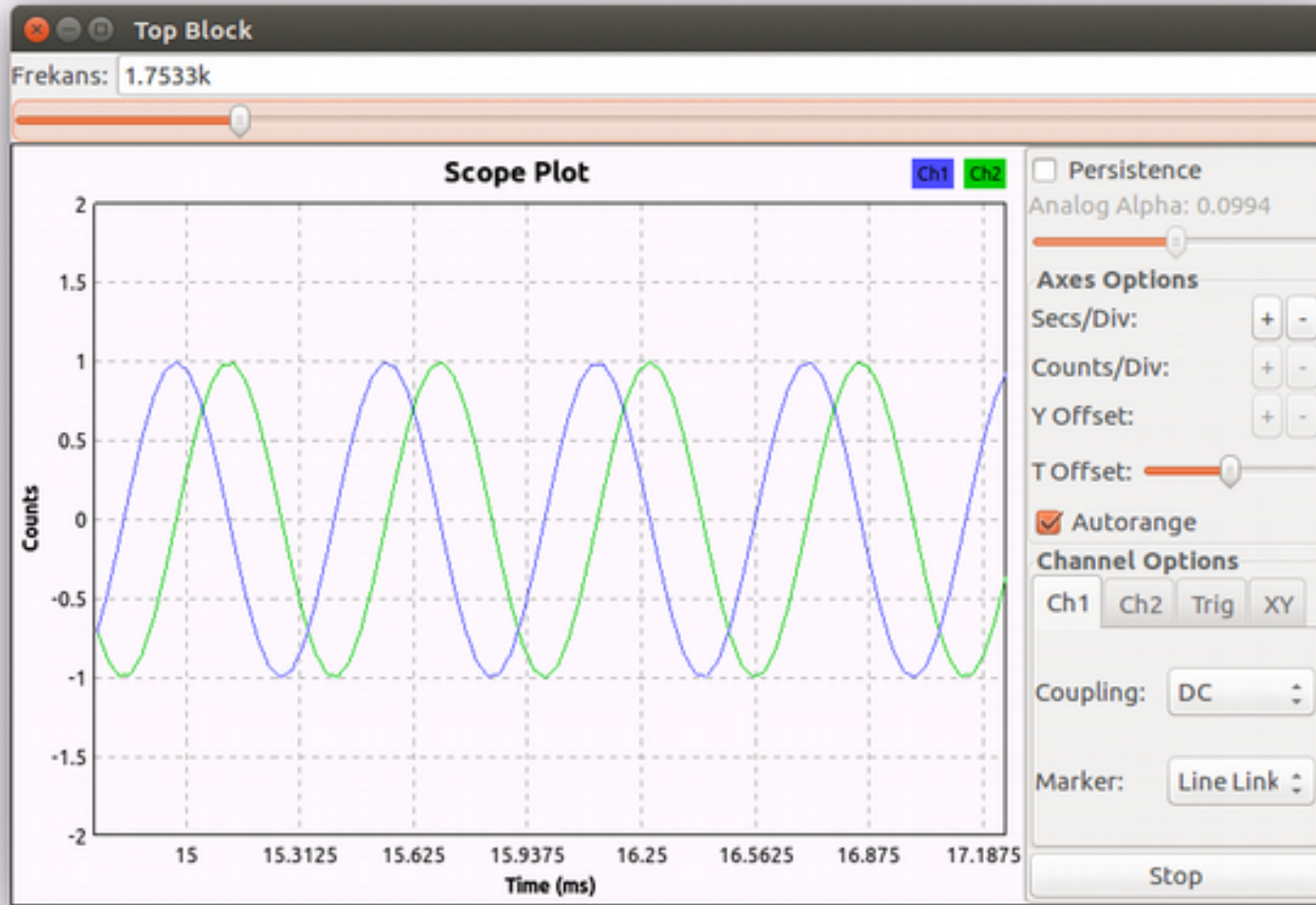
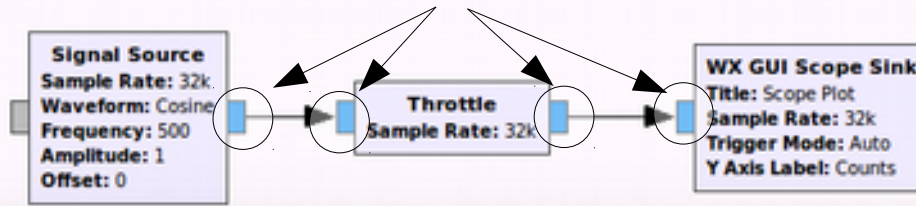
Deđişkenler ve Ayar Araçları



WX GUI Slider
ID: frq
Label: Frekans
Default Value: 500
Minimum: 100
Maximum: 10k
Converter: Float



Throttle Elemanı ve Çıktı Görünümü



Komplex Çıktı Görünümü

Variable
ID: samp_rate
Value: 32k

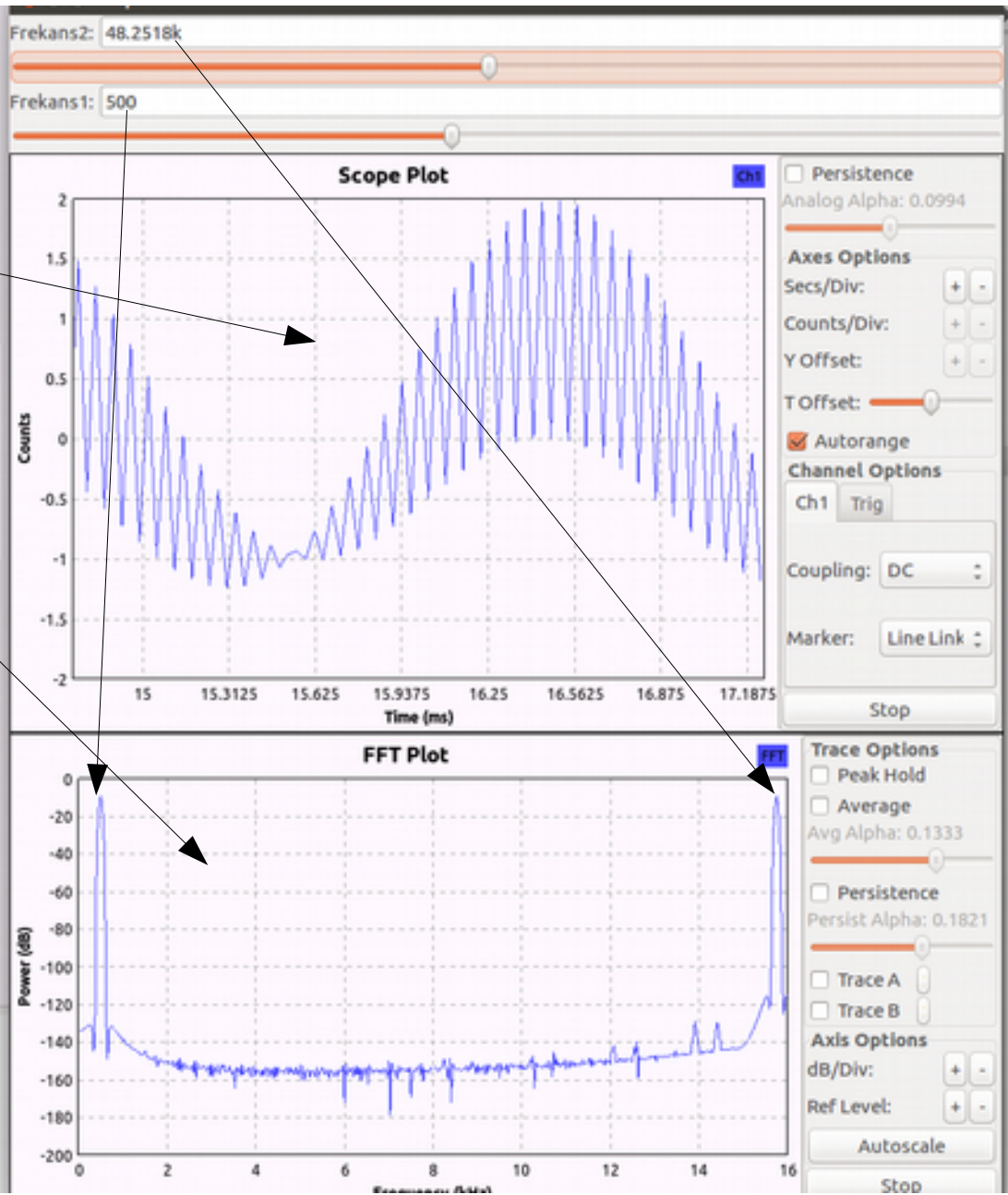
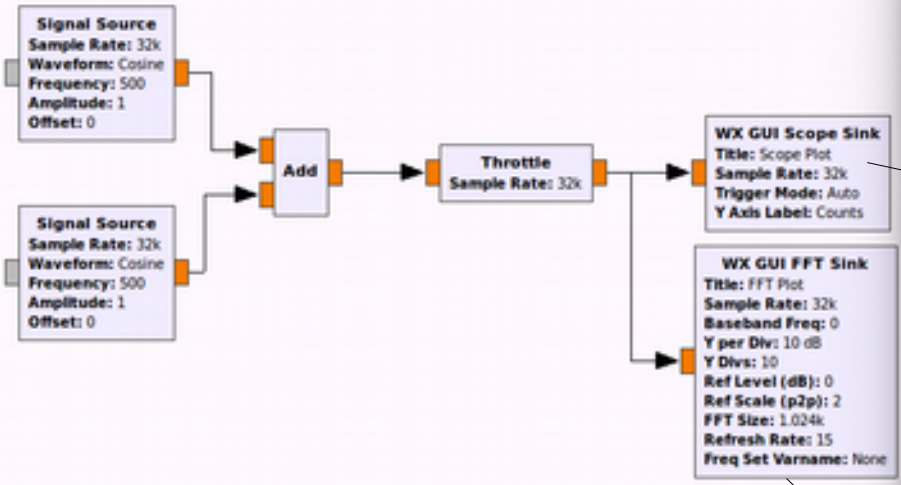
WX GUI Slider
ID: frq1
Label: Frekans1
Default Value: 500
Minimum: 100
Maximum: 1k
Converter: Float

WX GUI Slider
ID: frq2
Label: Frekans2
Default Value: 500
Minimum: 100
Maximum: 1k
Converter: Float

```

Executing: /usr/bin/python -u /home/baris/top_block.py
Using Volk machine: avx2_64_mmx_orc
>>> Done
Generating: '/home/baris/top_block.py'
Executing: /usr/bin/python -u /home/baris/top_block.py
    
```

Toplama İşlemi



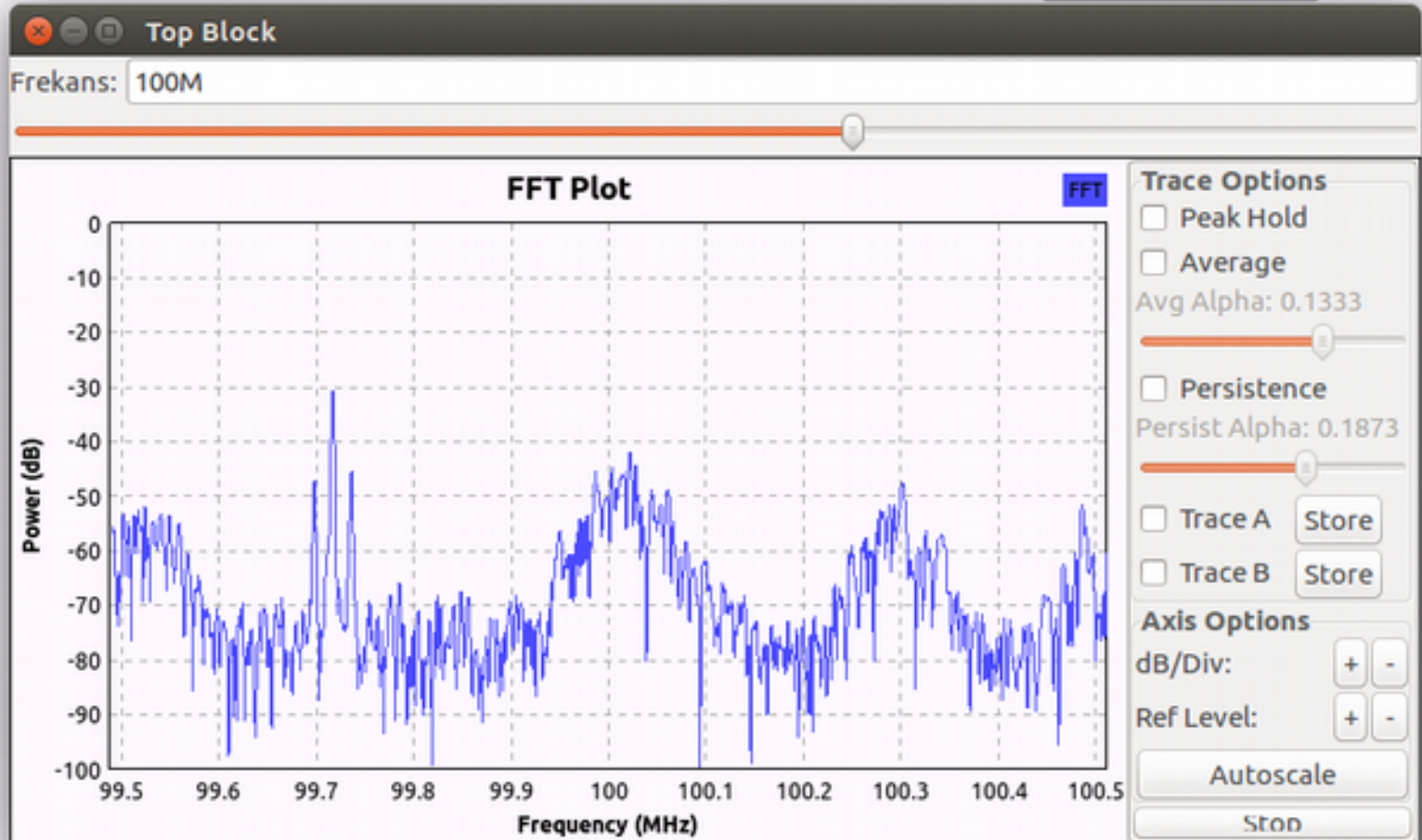
FFT ve Frekans Spektrumu

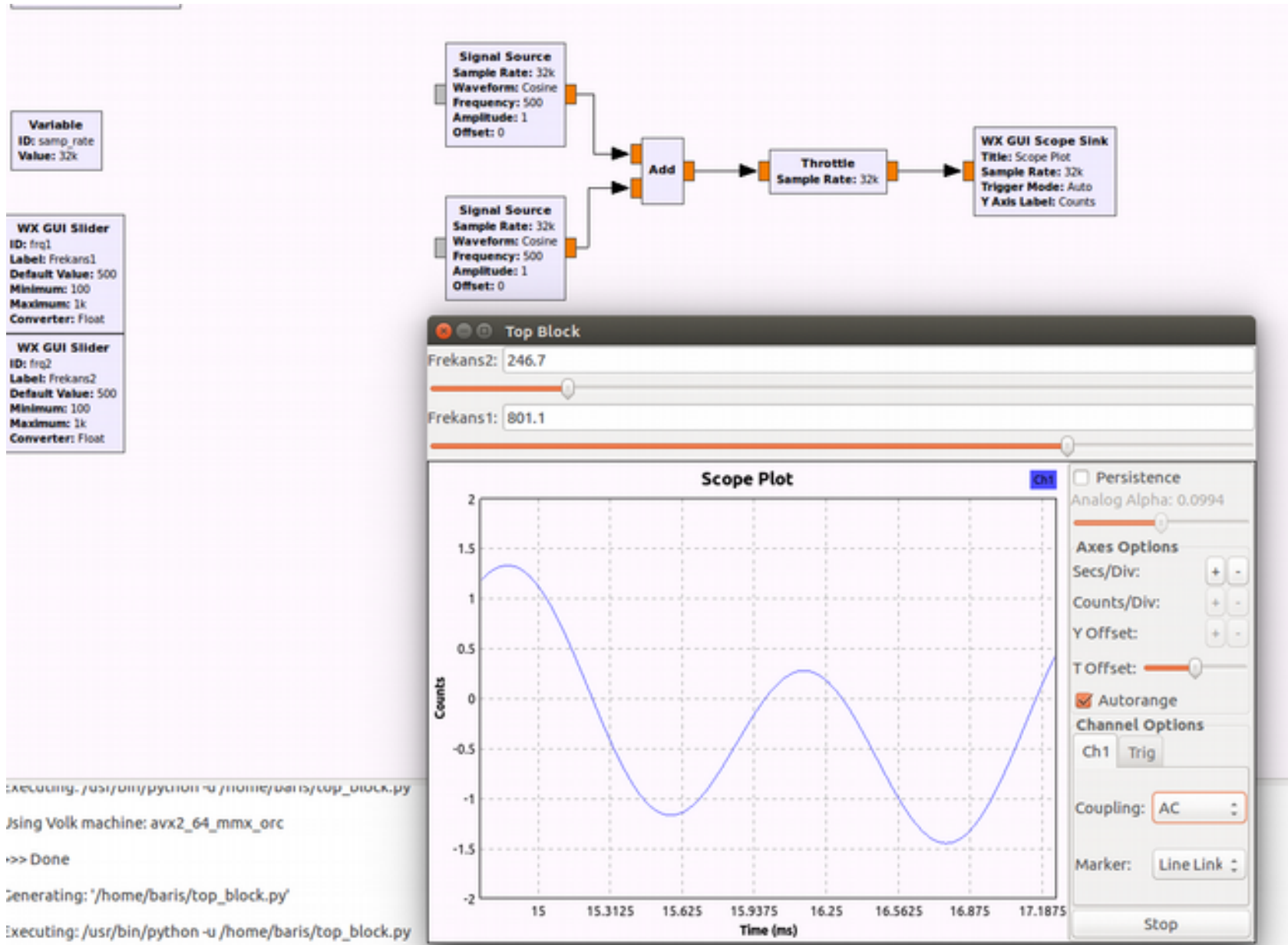
Variable
ID: samp_rate
Value: 1.024M

WX GUI Slider
ID: frq
Label: Frekans
Default Value: 100M
Minimum: 88M
Maximum: 108M
Converter: Float

RTL-SDR Source
Sample Rate (sps): 1.024M
Ch0: Frequency (Hz): 100M
Ch0: Freq. Corr. (ppm): 0
Ch0: DC Offset Mode: Off
Ch0: IQ Balance Mode: Off
Ch0: Gain Mode: Manual
Ch0: RF Gain (dB): 25
Ch0: IF Gain (dB): 20
Ch0: BB Gain (dB): 20

WX GUI FFT Sink
Title: FFT Plot
Sample Rate: 1.024M
Baseband Freq: 100M
Y per Div: 10 dB
Y Divs: 10
Ref Level (dB): 0
Ref Scale (p2p): 2
FFT Size: 1.024k
Refresh Rate: 15
Freq Set Varname: None





Komplex Çıktı Görünümü

RTLSDR'ye bağlantı

```
use Radio::RTLSDR;

my $freq = shift || 104.5;
$freq *= 1_000_000;

my $rf_sample_rate = 2_000_000;

my $radio = Radio::RTLSDR->new(freq => $freq,
                               sample_rate => $rf_sample_rate);
```

Ses Kartına Bağlantı

```
open(my $audio_sink,
      '|-:raw',
      "play -t raw -r $audio_sample_rate -e float -b 32 -c 1 -");
```

Sinyal Gelinece

```
$radio->rx(sub {
  # process raw radio samples in $_[0]
  # this callback will be called several times per second...
});

$radio->run; # enter event loop
```

Veri İşleme

```
use PDL;  
  
my $data = pdl()->convert(byte)->reshape(length($_[0]));  
  
${ $data->get_dateref } = $_[0];  
$data->upd_data();  
  
$data = $data->convert(float);  
  
$data -= 128;  
$data *= 1000000;  
  
my $I = $data->slice([0,-1,2]);  
my $Q = $data->slice([1,-1,2]);
```

RF Filtreler

```
## Decimate 4:1, 2000k -> 500k  
  
$I = PDL::DSP::Fir::Simple::filter($I, { fc => 0.12, N => 81, });  
$Q = PDL::DSP::Fir::Simple::filter($Q, { fc => 0.12, N => 81, });  
  
$I = $I->slice([0,-1,4]);  
$Q = $Q->slice([0,-1,4]);
```


FM Demodüle İşlemi

```
use PDL::Complex;

my $prev = $I->slice([0, -2]) + (i * $Q->slice([0, -2]));
my $curr = $I->slice([1, -1]) + (i * $Q->slice([1, -1]));

my $deriv = ($prev->Cconj() * $curr)->Carg();

## FIXME: retain previous values:
$deriv = $deriv->append($deriv->at(-1));
```

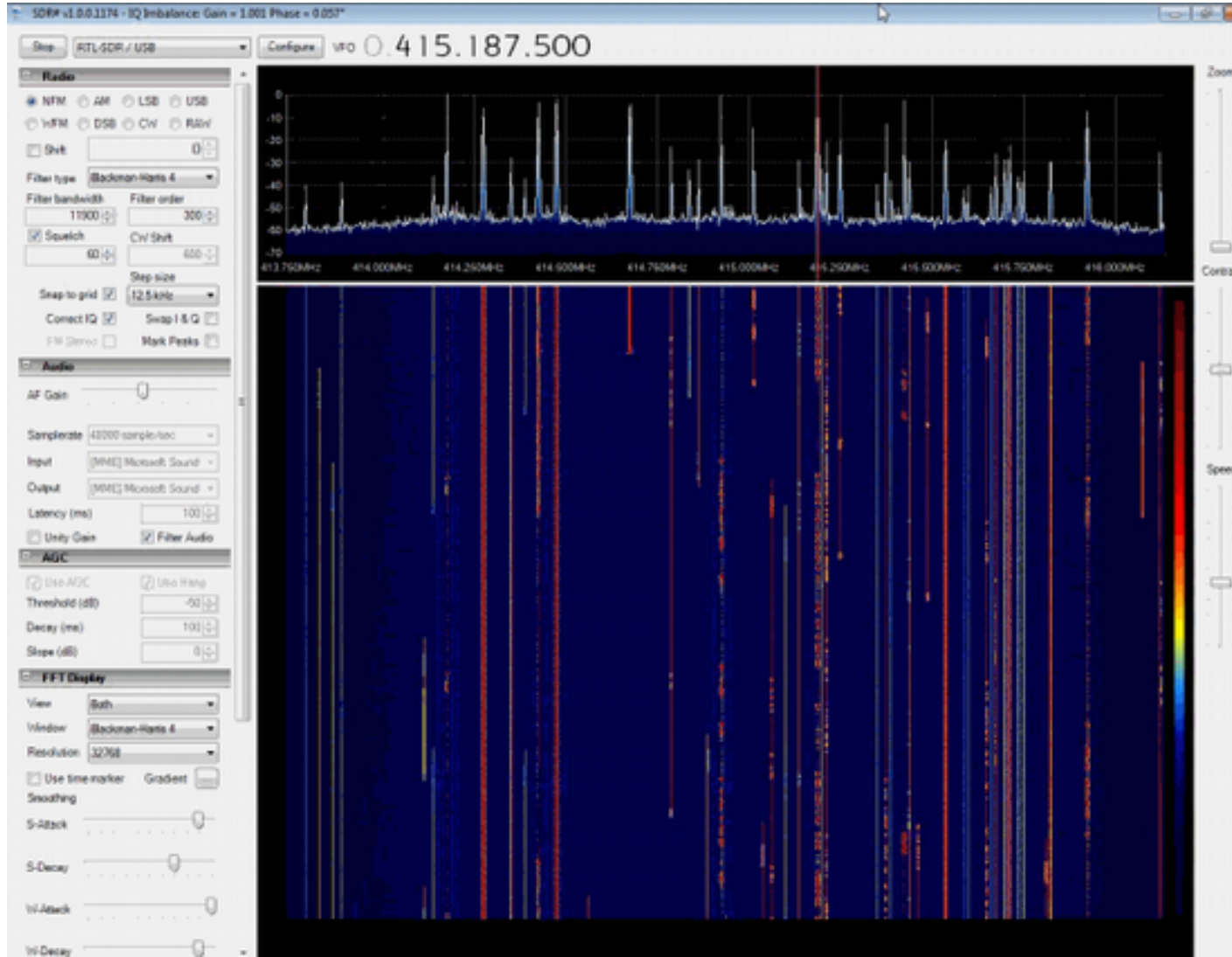
Sese de filtre uygulayalım

```
my $audio =
  PDL::DSP::Fir::Simple::filter($deriv, { fc => 0.4, N => 32 });
$audio = $audio->slice([0, -1, 10]);
```

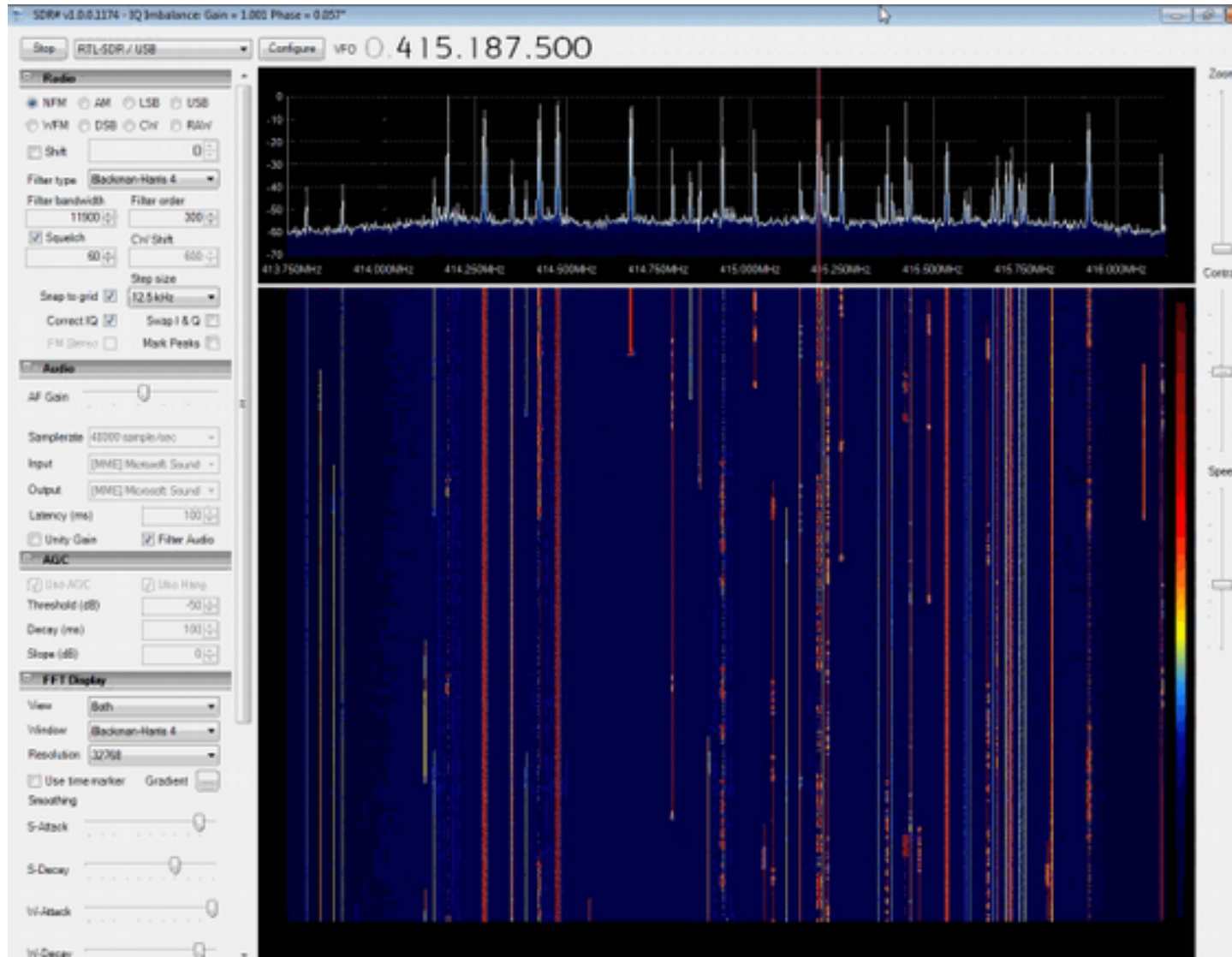
DİNLEYELİM.....

```
print $audio_sink ${ $audio->convert(float)->get_dataref };
```

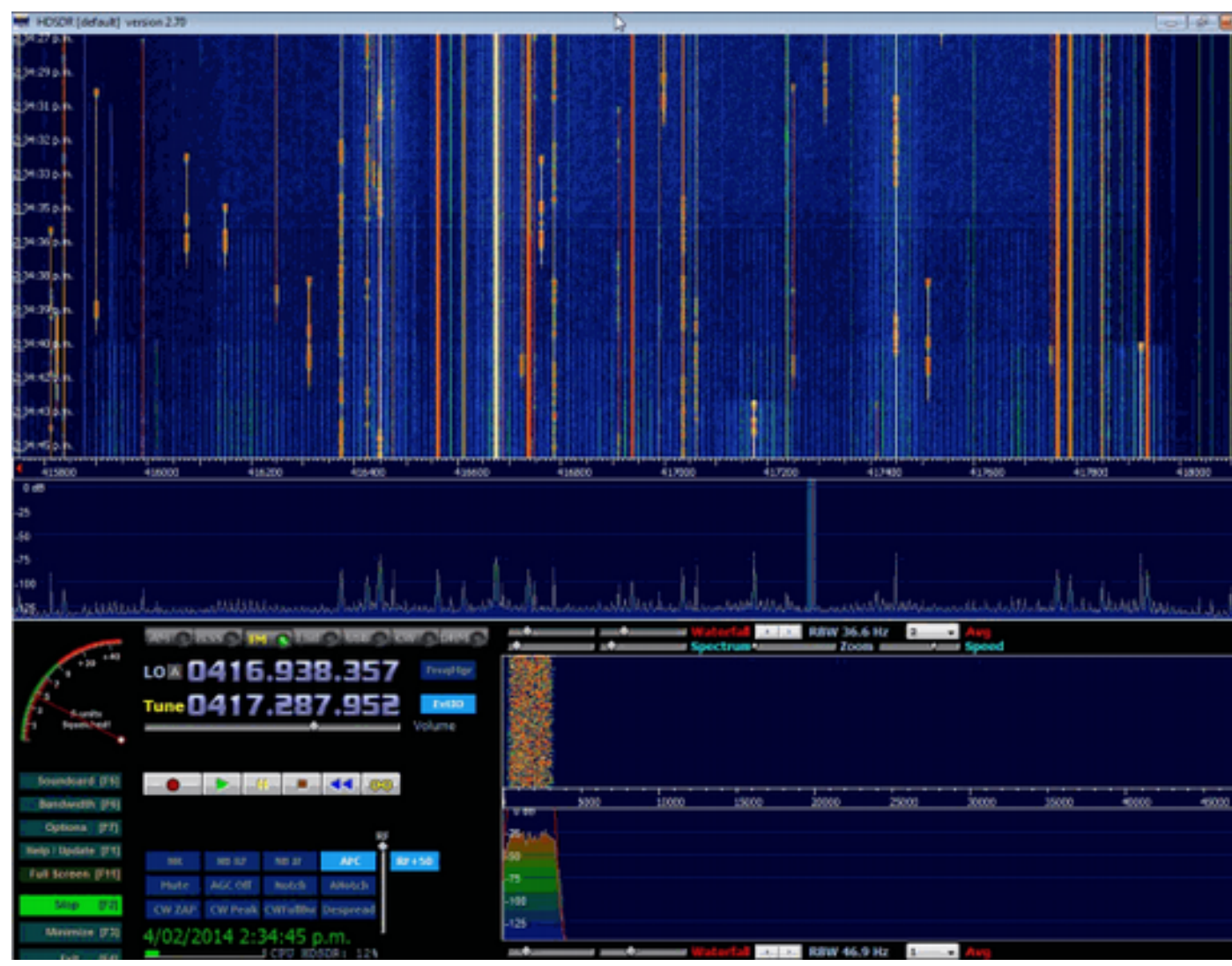

SDR# (Windows) (Free)



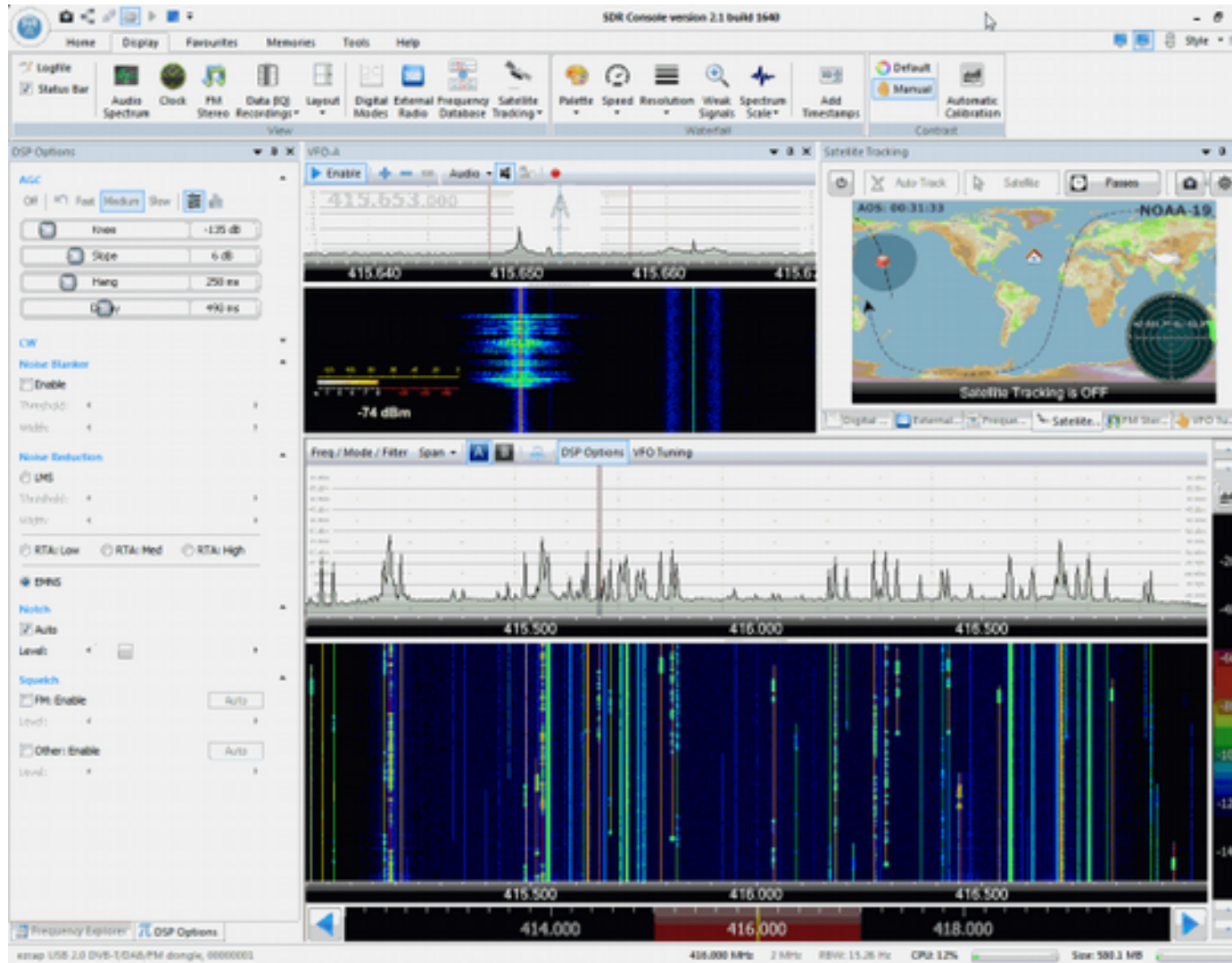
SDR# (Windows) (Free)



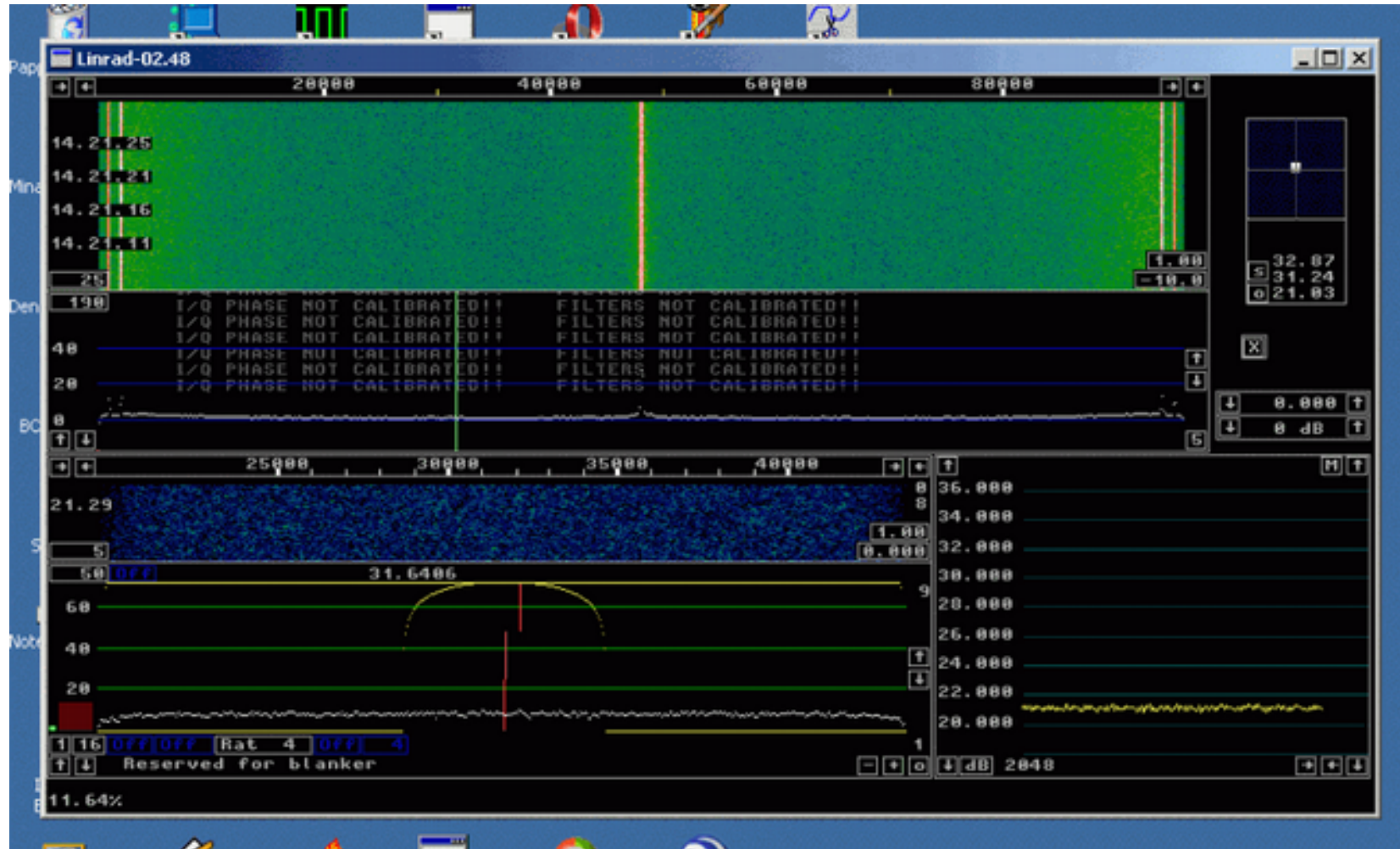
HSDR (Windows) (Free)

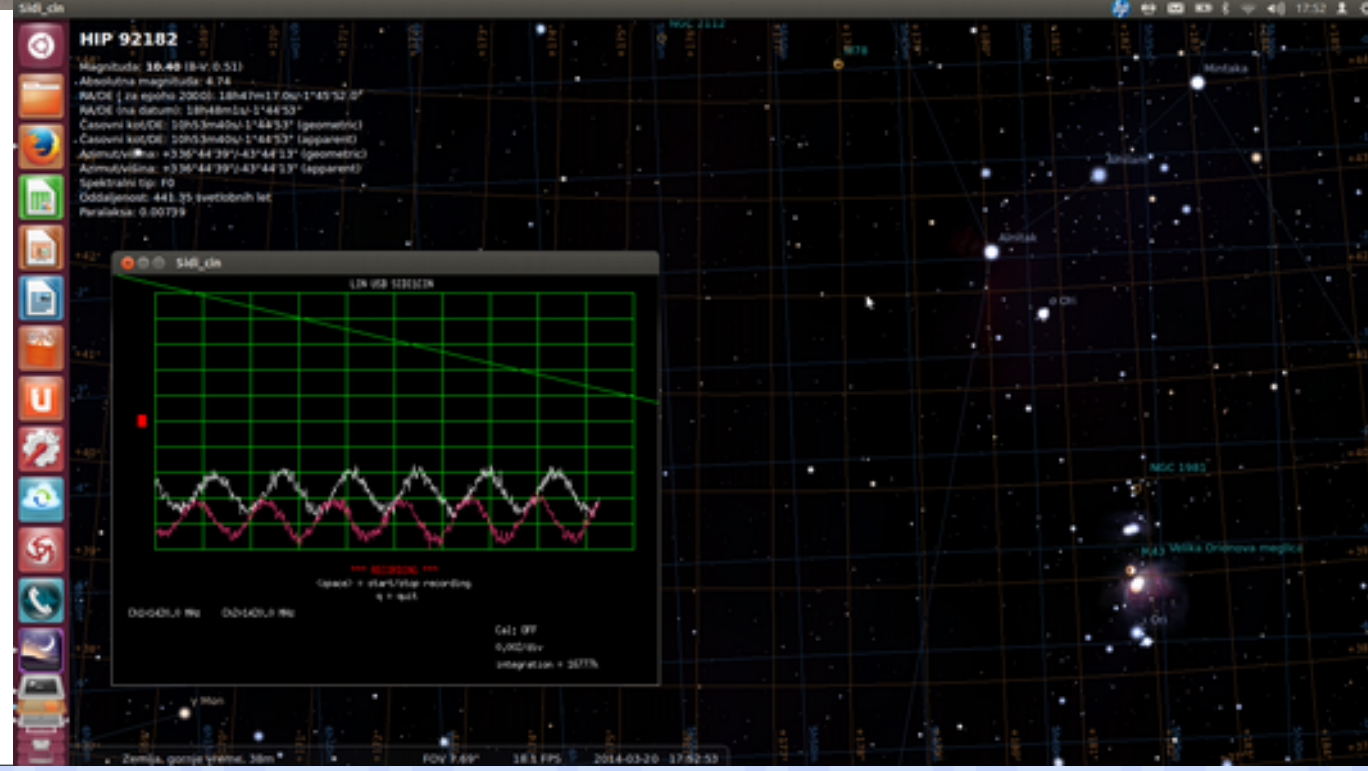
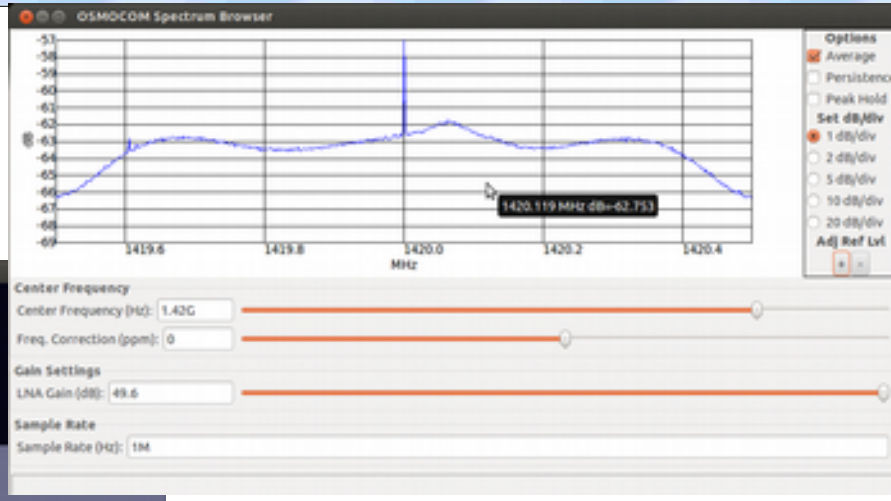
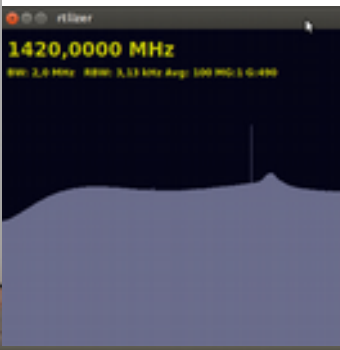


SDR-RADIO.COM V2 (Windows) (Free)



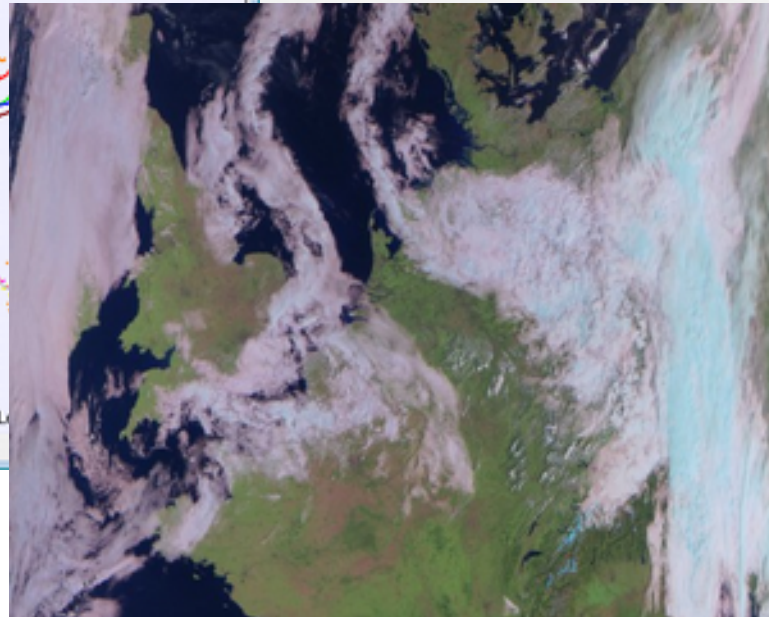
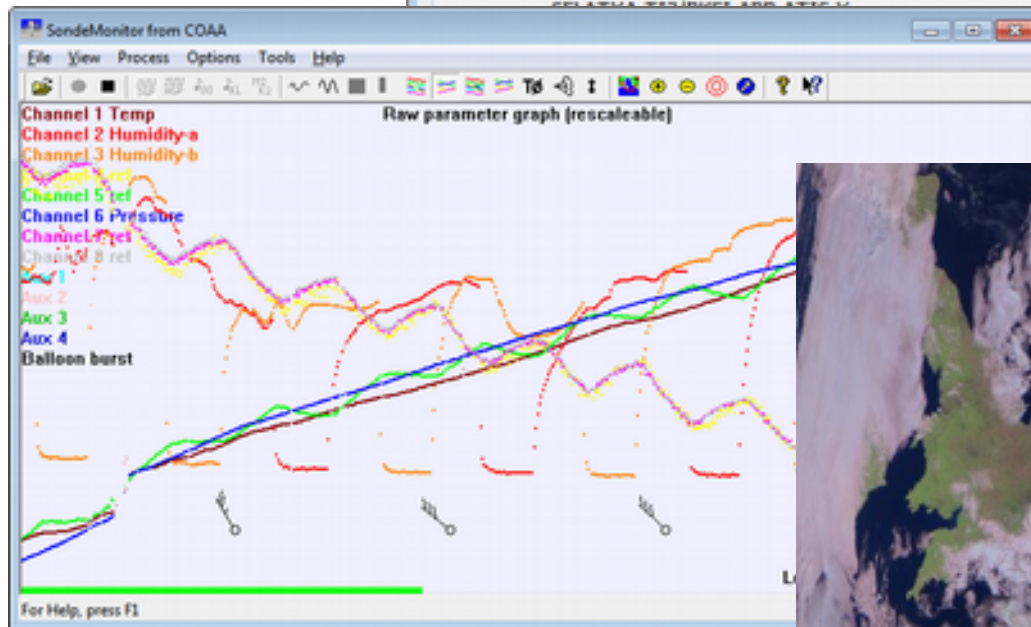
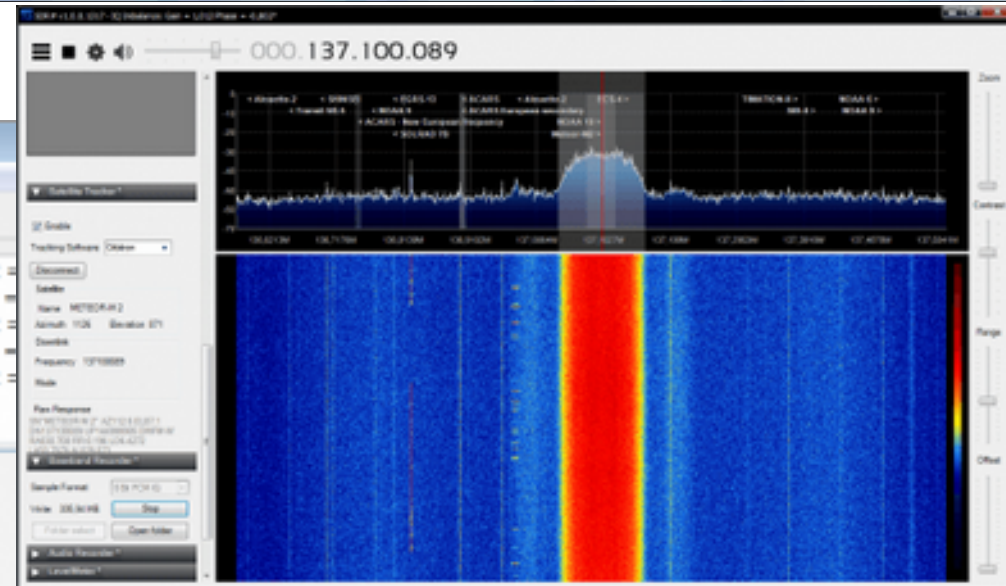
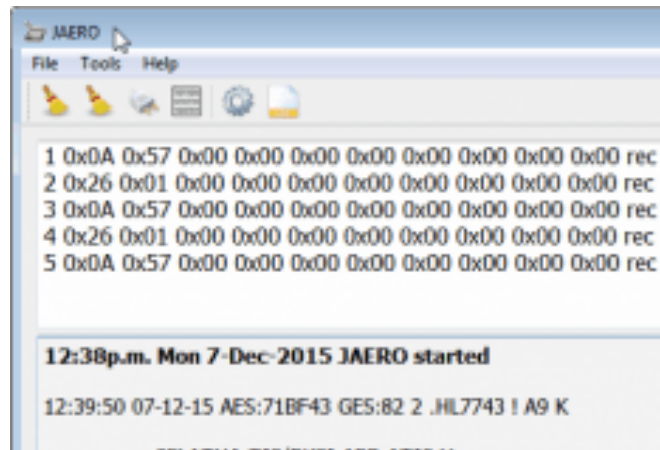
Linrad (Windows/Linux/Mac) (Free) (Related Post)





1420Mhz Hydrogen Line

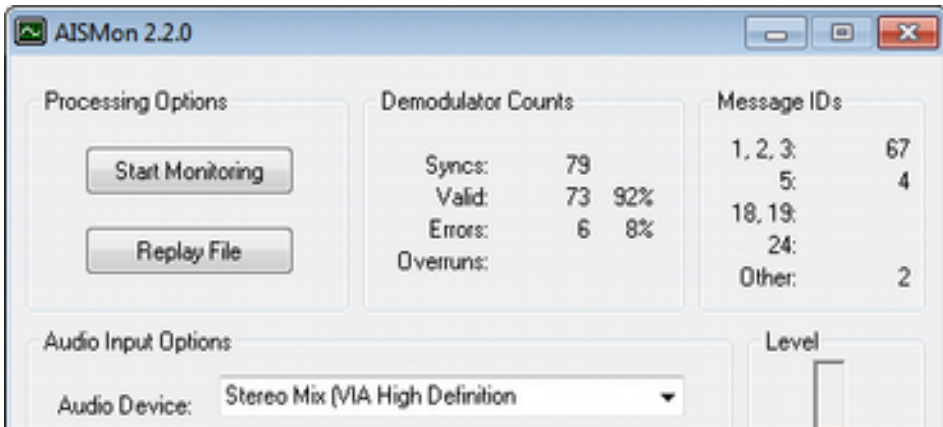
JAERO (Windows) (Free)



INMARSAT

AISSMon (Windows) (Free) (Related Post) – AIS

OpenCPN (Windows) (Free) (Related Post) – AIS



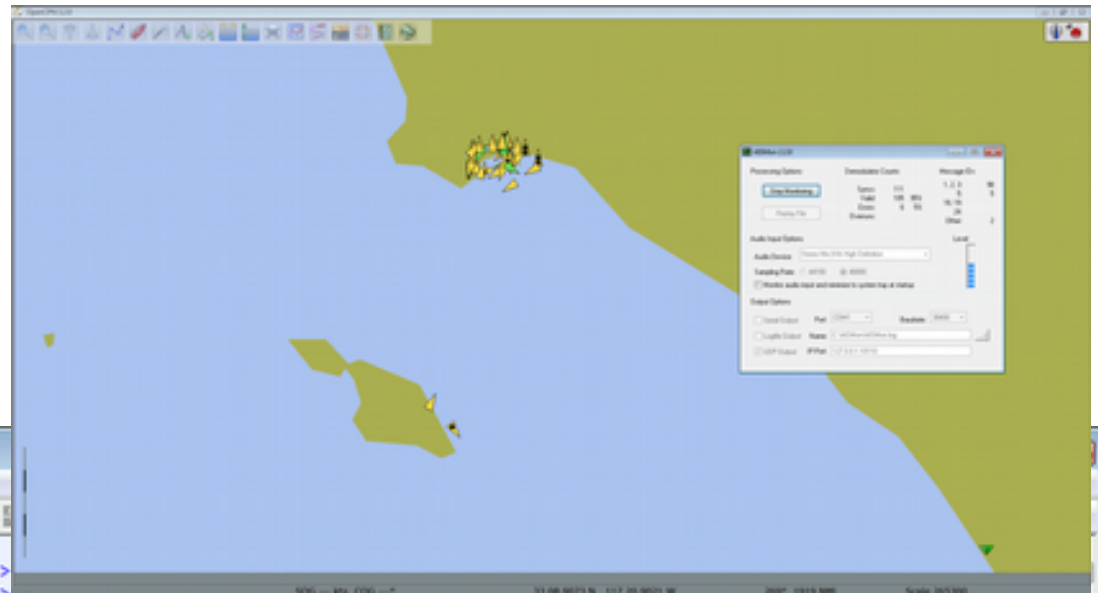
AISSMon 2.2.0

Processing Options: Start Monitoring, Replay File

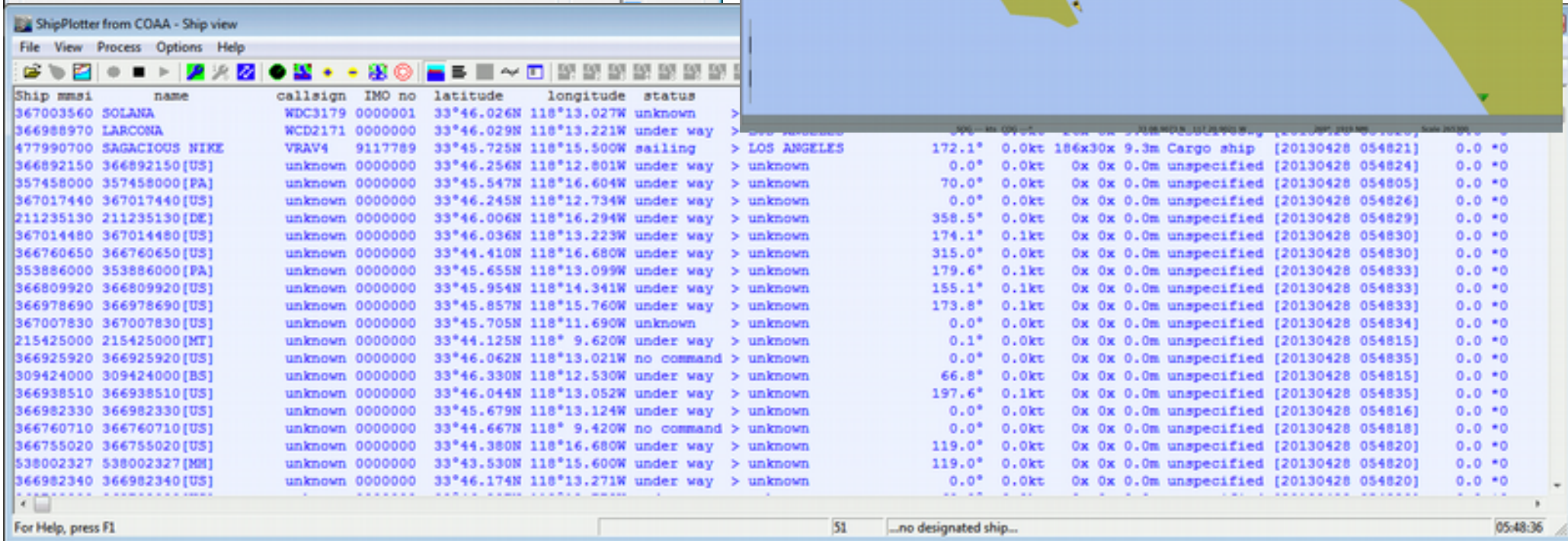
Demodulator Counts: Syncs: 79, Valid: 73 (92%), Errors: 6 (8%), Overruns: [blank]

Message IDs: 1, 2, 3: 67, 5: 4, 18, 19: 24, Other: 2

Audio Input Options: Audio Device: Stereo Mix (VIA High Definition), Level: [slider]



Map interface showing AIS data points (yellow and green icons) overlaid on a satellite map of the Mediterranean Sea region. A small settings window is visible in the top right corner.



ShipPlotter from COAA - Ship view

File View Process Options Help

| Ship | mmsi | name | callsign | IMO no | latitude | longitude | status | |
|-----------|----------------|---------|----------|------------|-------------|------------|--------|-------------|
| 367003560 | SOLANA | WDC3179 | 0000001 | 33°46.026N | 118°13.027W | unknown | > | |
| 366988970 | LARCONA | WCD2171 | 0000000 | 33°46.029N | 118°13.221W | under way | > | |
| 477990700 | SAGACIOUS NIKE | VRAV4 | 9117789 | 33°45.725N | 118°15.500W | sailing | > | LOS ANGELES |
| 366892150 | 366892150[US] | unknown | 0000000 | 33°46.256N | 118°12.801W | under way | > | unknown |
| 357458000 | 357458000[PA] | unknown | 0000000 | 33°45.547N | 118°16.604W | under way | > | unknown |
| 367017440 | 367017440[US] | unknown | 0000000 | 33°46.245N | 118°12.734W | under way | > | unknown |
| 211235130 | 211235130[DE] | unknown | 0000000 | 33°46.006N | 118°16.294W | under way | > | unknown |
| 367014480 | 367014480[US] | unknown | 0000000 | 33°46.036N | 118°13.223W | under way | > | unknown |
| 366760650 | 366760650[US] | unknown | 0000000 | 33°44.410N | 118°16.680W | under way | > | unknown |
| 353886000 | 353886000[PA] | unknown | 0000000 | 33°45.655N | 118°13.099W | under way | > | unknown |
| 366809920 | 366809920[US] | unknown | 0000000 | 33°45.954N | 118°14.341W | under way | > | unknown |
| 366978690 | 366978690[US] | unknown | 0000000 | 33°45.857N | 118°15.760W | under way | > | unknown |
| 367007830 | 367007830[US] | unknown | 0000000 | 33°45.705N | 118°11.690W | unknown | > | unknown |
| 215425000 | 215425000[MT] | unknown | 0000000 | 33°44.125N | 118° 9.620W | under way | > | unknown |
| 366925920 | 366925920[US] | unknown | 0000000 | 33°46.062N | 118°13.021W | no command | > | unknown |
| 309424000 | 309424000[BS] | unknown | 0000000 | 33°46.330N | 118°12.530W | under way | > | unknown |
| 366938510 | 366938510[US] | unknown | 0000000 | 33°46.044N | 118°13.052W | under way | > | unknown |
| 366982330 | 366982330[US] | unknown | 0000000 | 33°45.679N | 118°13.124W | under way | > | unknown |
| 366760710 | 366760710[US] | unknown | 0000000 | 33°44.667N | 118° 9.420W | no command | > | unknown |
| 366755020 | 366755020[US] | unknown | 0000000 | 33°44.380N | 118°16.680W | under way | > | unknown |
| 538002327 | 538002327[MH] | unknown | 0000000 | 33°43.530N | 118°15.600W | under way | > | unknown |
| 366982340 | 366982340[US] | unknown | 0000000 | 33°46.174N | 118°13.271W | under way | > | unknown |

For Help, press F1 | 51 | ...no designated ship... | 05:48:36

ShipPlotter (Windows) (Trial/Paid) (Related Post) AIS AIS



COSMOS Decoder

File Tools

Sat ID: 13 (?)
SMA: 809.712402344 km
Sat ID: 6 (Cosmos 2463)
SMA: 6865.505981445 km
Sat ID: 6 (Cosmos 2463)
SMA: 4158.600341797 km
e.cos(w): 0.5852793157100677
Inclination: 18.07141876220703 radians
1035.4160246515771 degrees
Time of Asc Node: Oct 8 03:11:33.28125 m/d h:m:s
Time of Asc Node: Jan 1 20:29:31.7578125 m/d h:m:s

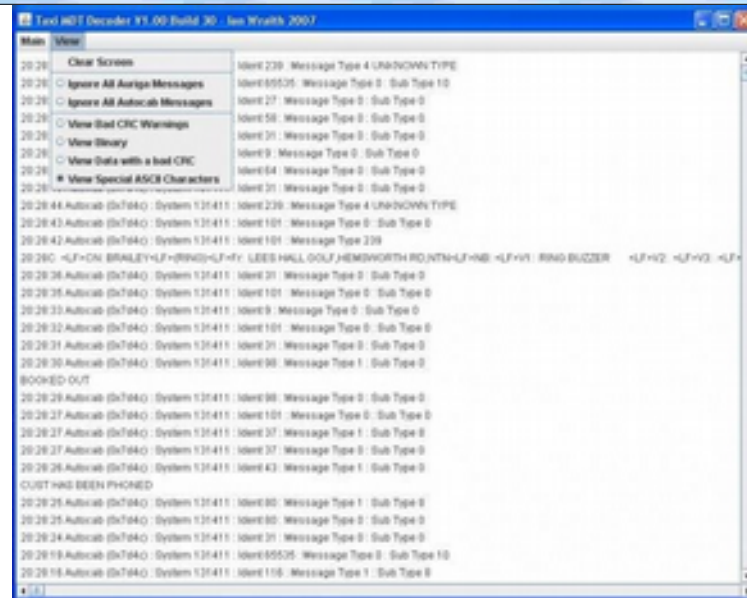
Word 58
Time 23:12:58 Moscow time
Drag values:
A: 0.64013671875
B: 0.04620361328125

Y Coord: -8.505196310579777E-4 km

Word errors: 201

datascopes

Real-time signal processing and visualization interface showing a green waveform.




TSD Decoder v1.00 Build 30 - Jan 19/2007

Main View

- Clear Screen
- Ignore All Airtag Messages
- Ignore All Autocall Messages
- View Bad CRC Warnings
- View Binary
- View Data with a bad CRC
- View Special ASCII Characters

20:28 Ident 239 Message Type 4 URB-DOWN TYPE
20:28 Ident 55535 Message Type 0 Sub Type 10
20:28 Ident 217 Message Type 0 Sub Type 0
20:28 Ident 58 Message Type 0 Sub Type 0
20:28 Ident 31 Message Type 0 Sub Type 0
20:28 Ident 9 Message Type 0 Sub Type 0
20:28 Ident 64 Message Type 0 Sub Type 0
20:28 Ident 31 Message Type 0 Sub Type 0
20:28 44 Autocall (3x794) System 131411 Ident 239 Message Type 4 URB-DOWN TYPE
20:28 43 Autocall (3x794) System 131411 Ident 101 Message Type 0 Sub Type 0
20:28 42 Autocall (3x794) System 131411 Ident 101 Message Type 0 Sub Type 0
20:28 41 Autocall (3x794) System 131411 Ident 217 Message Type 0 Sub Type 0
20:28 38 Autocall (3x794) System 131411 Ident 31 Message Type 0 Sub Type 0
20:28 35 Autocall (3x794) System 131411 Ident 101 Message Type 0 Sub Type 0
20:28 33 Autocall (3x794) System 131411 Ident 9 Message Type 0 Sub Type 0
20:28 32 Autocall (3x794) System 131411 Ident 101 Message Type 0 Sub Type 0
20:28 31 Autocall (3x794) System 131411 Ident 31 Message Type 0 Sub Type 0
20:28 30 Autocall (3x794) System 131411 Ident 38 Message Type 1 Sub Type 0
BOOKED OUT
20:28 29 Autocall (3x794) System 131411 Ident 38 Message Type 0 Sub Type 0
20:28 27 Autocall (3x794) System 131411 Ident 101 Message Type 0 Sub Type 0
20:28 27 Autocall (3x794) System 131411 Ident 37 Message Type 0 Sub Type 0
20:28 26 Autocall (3x794) System 131411 Ident 43 Message Type 1 Sub Type 0
CUST HAD BEEN PHONED
20:28 25 Autocall (3x794) System 131411 Ident 80 Message Type 1 Sub Type 0
20:28 25 Autocall (3x794) System 131411 Ident 80 Message Type 0 Sub Type 0
20:28 24 Autocall (3x794) System 131411 Ident 31 Message Type 0 Sub Type 0
20:28 19 Autocall (3x794) System 131411 Ident 55535 Message Type 0 Sub Type 10
20:28 18 Autocall (3x794) System 131411 Ident 116 Message Type 1 Sub Type 0

SDR-Sharp ricezione testuale D-STAR

SDR-Sharp interface showing a spectrum plot and a list of received messages.

Receiver Detail # 1: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 2: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 3: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 4: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 5: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 6: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 7: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 8: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 9: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 10: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 11: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 12: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 13: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 14: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 15: 10000 010000 000000 100000 0000 0000 0000

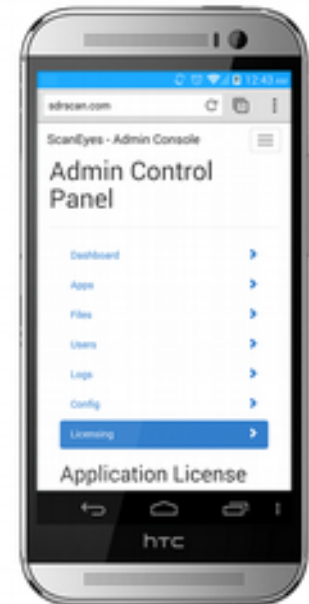
Receiver Detail # 16: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 17: 10000 010000 000000 100000 0000 0000 0000

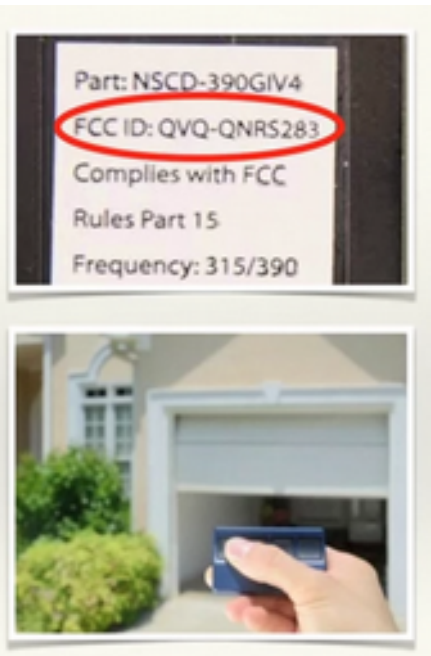
Receiver Detail # 18: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 19: 10000 010000 000000 100000 0000 0000 0000

Receiver Detail # 20: 10000 010000 000000 100000 0000 0000 0000

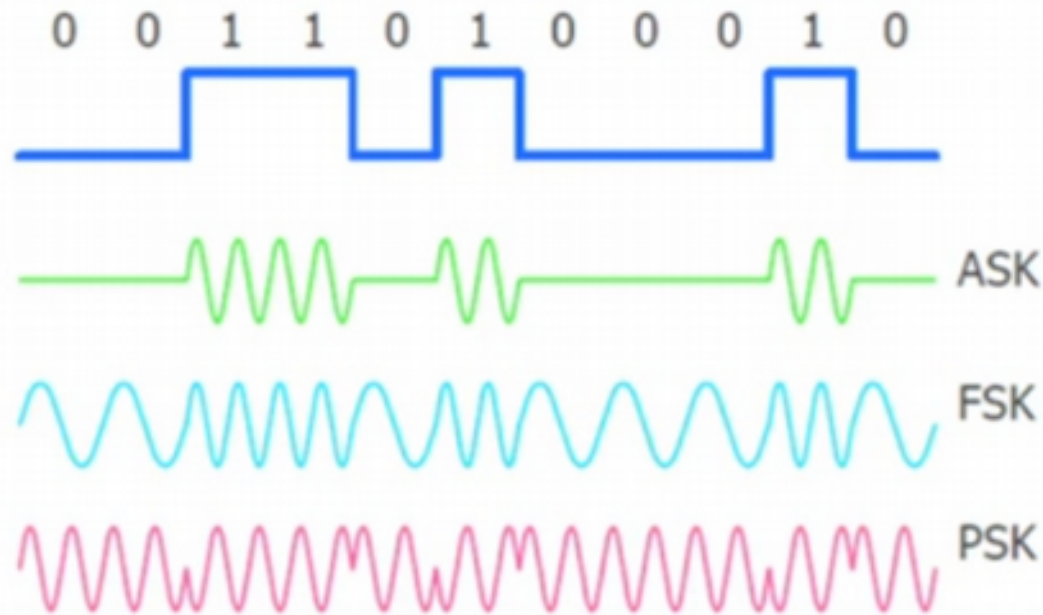
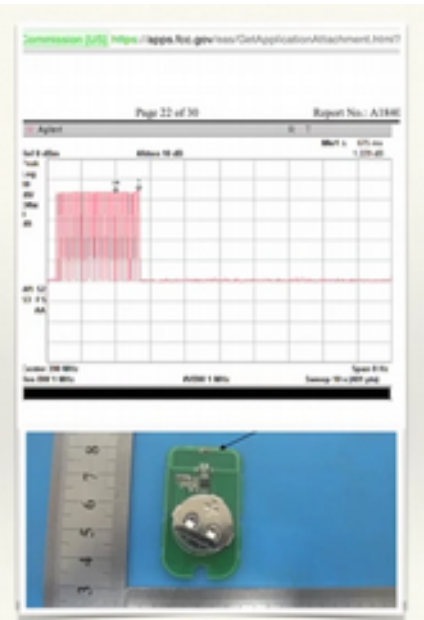


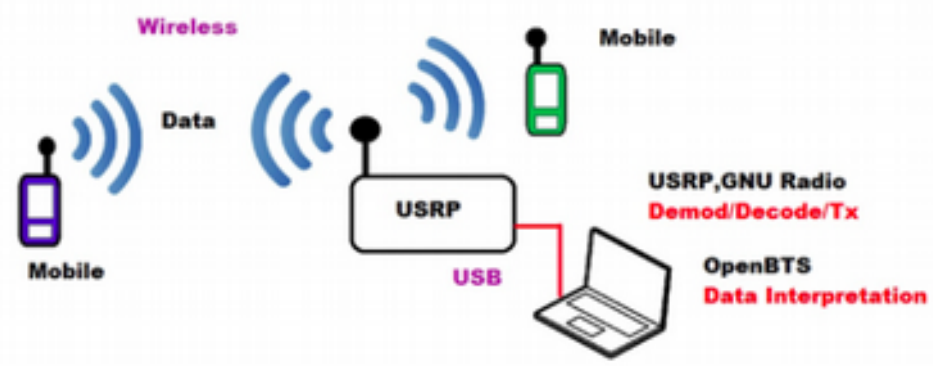
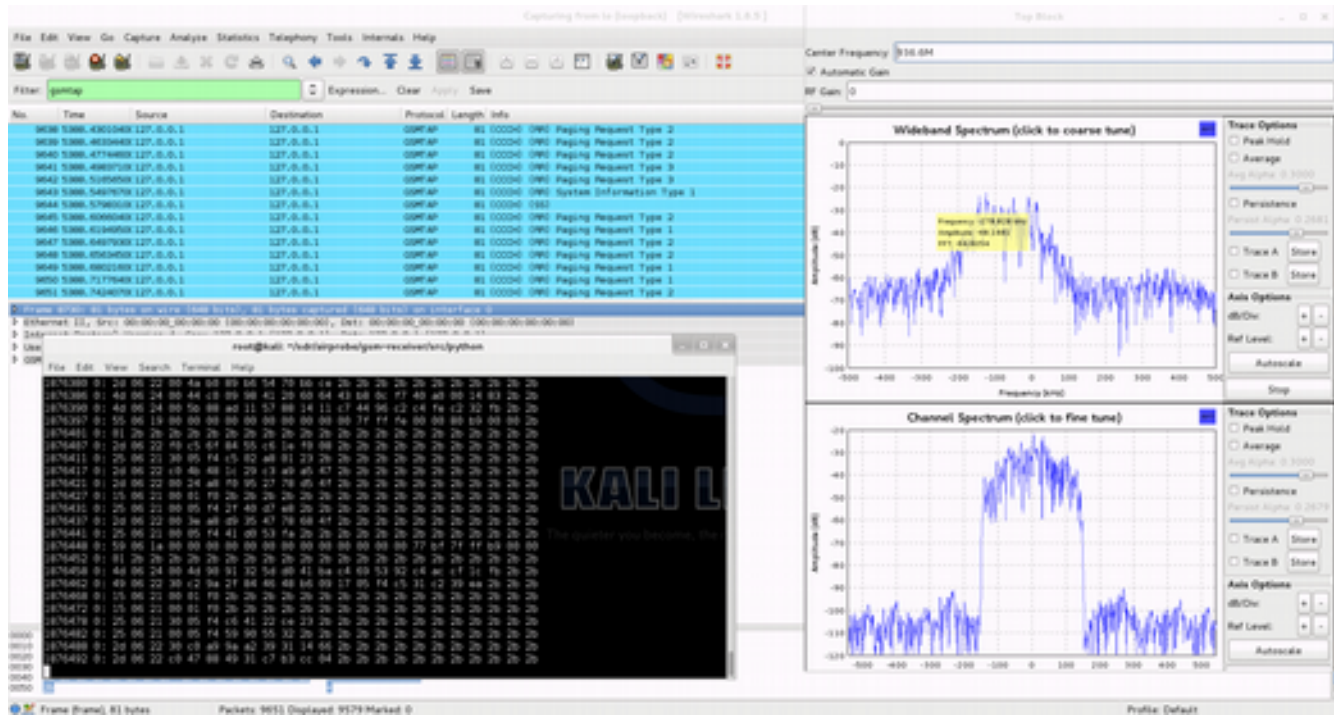
Digital Radio



Federal Communications Commission [US] http

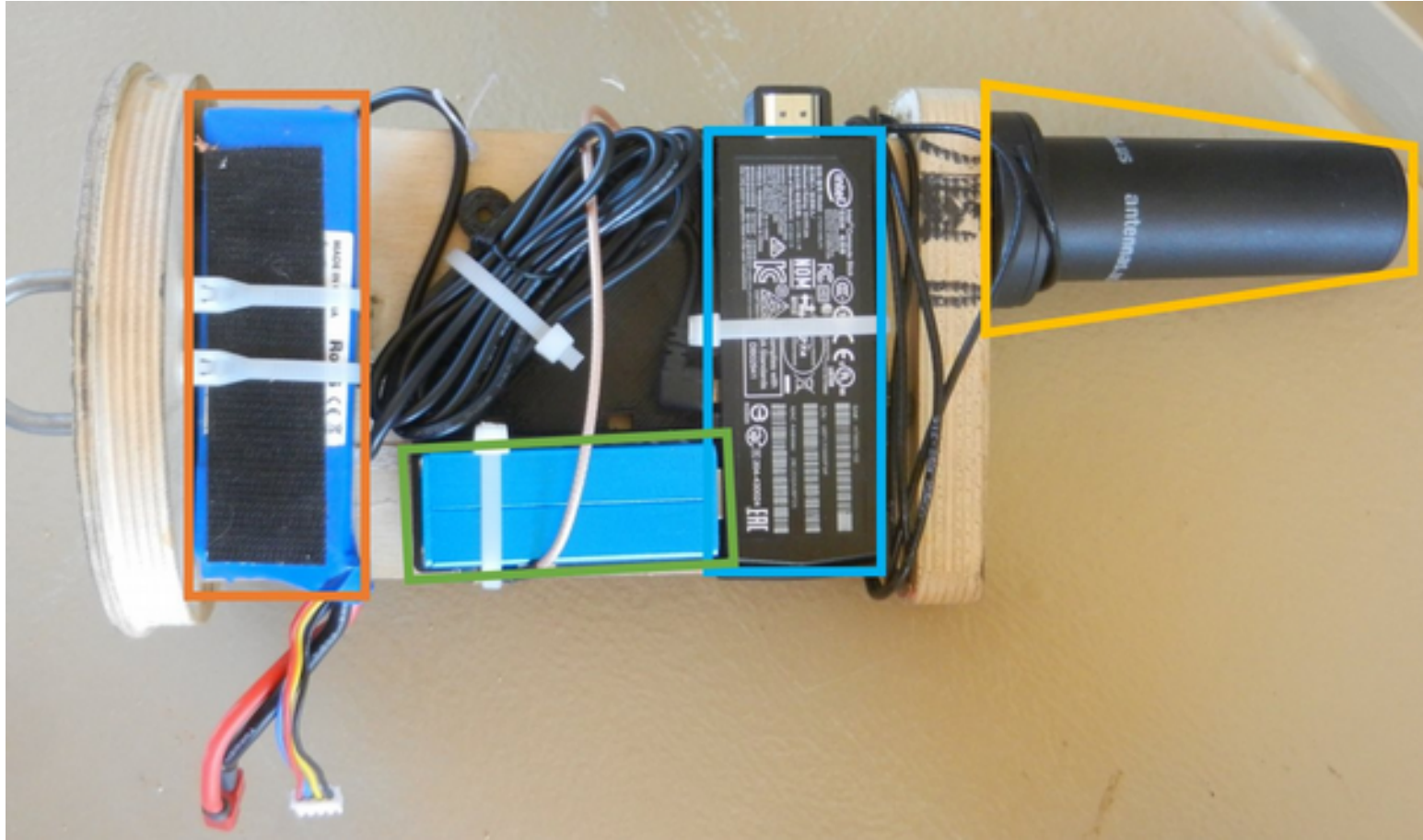
| | |
|---------------------|--------------------------------------|
| Operation Frequency | : 390 MHz |
| Channel number | : 1 |
| Modulation type | : ASK |
| Power Supply | : DC 3V Supply |
| Applicant | : Qimuo Electroni |
| Address | : 3/F, Bldg. A, Yi Fengze, Quanzh |
| Manufacturer | : Qimuo Electroni |
| Address | : 3/F, Bldg. A, Yi Fengze, Quanzh |





GSM





GPS



Teşekkürler...