



RF Explorer®

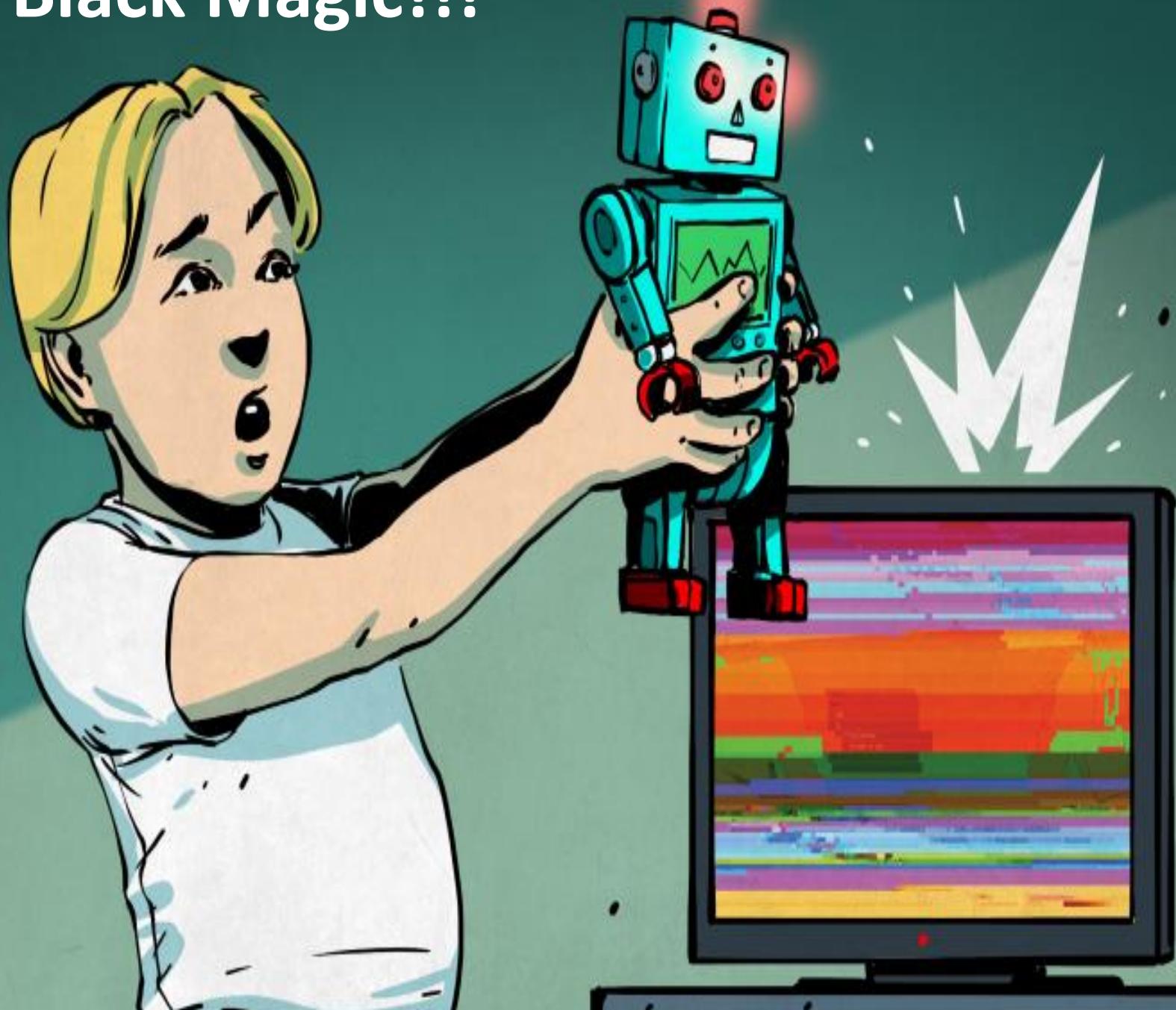
Manuel Ballesteros Carballo

Ingeniero de Diseño y Desarrollo

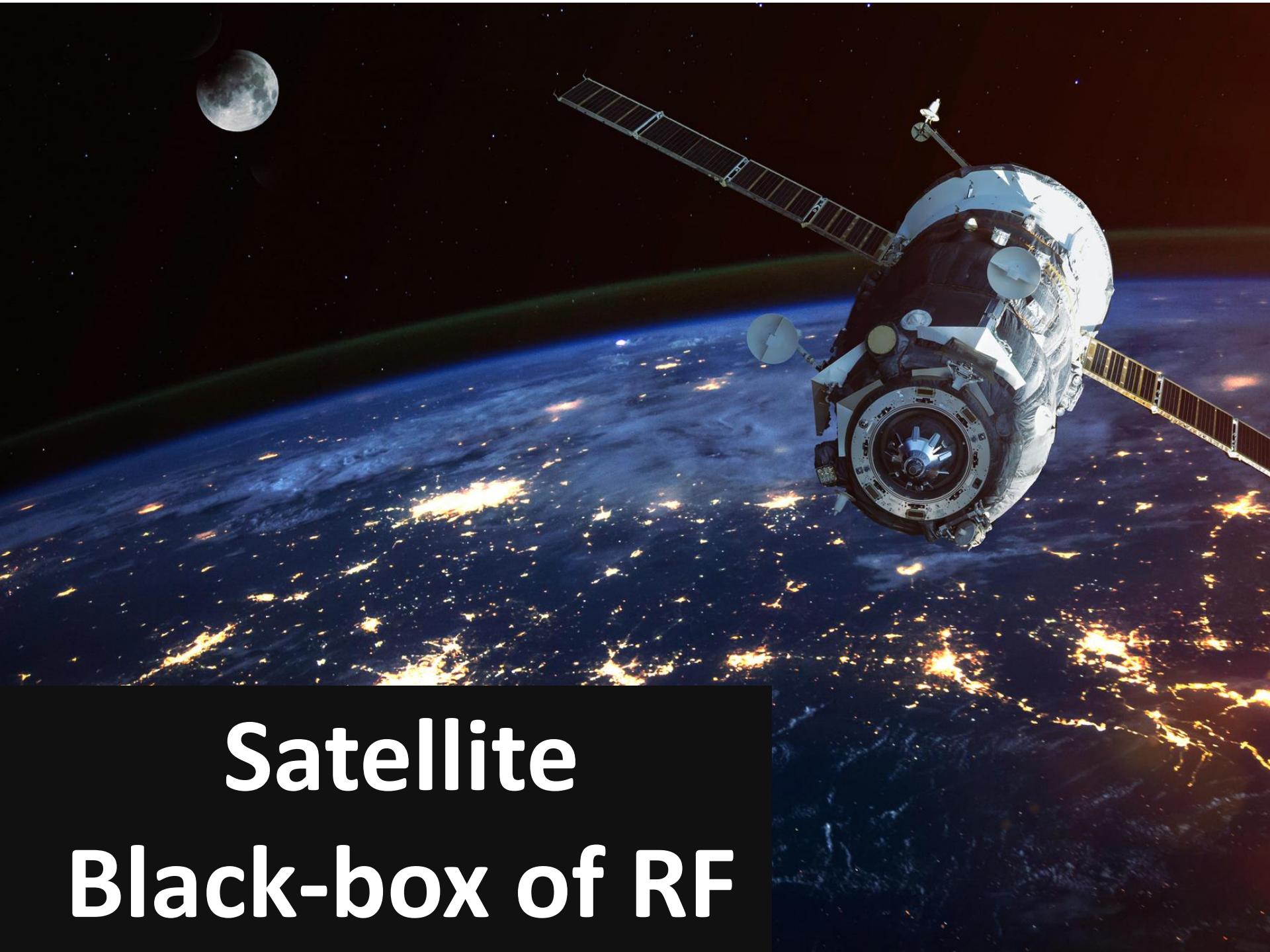
Call Sign EA4HAN

Congreso SWYP'18 - Abril 2018

RF is Black Magic!!!



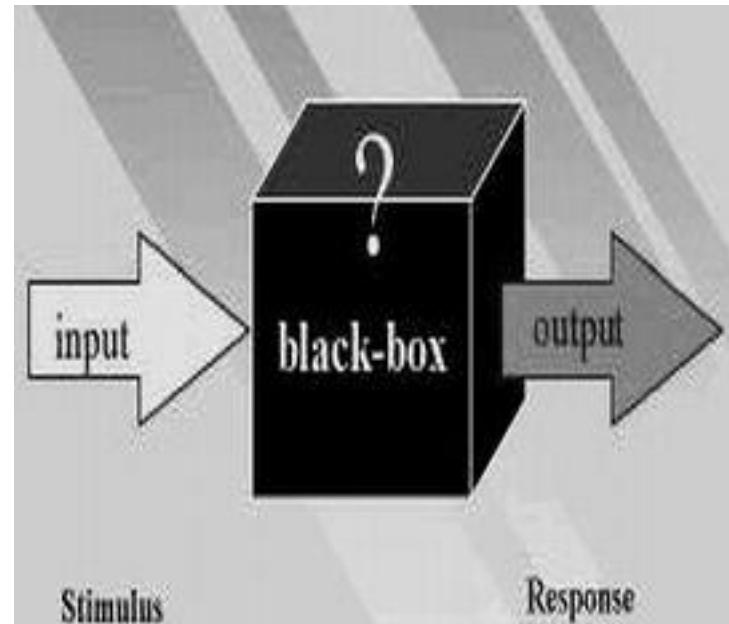
Satellite Black-box of RF



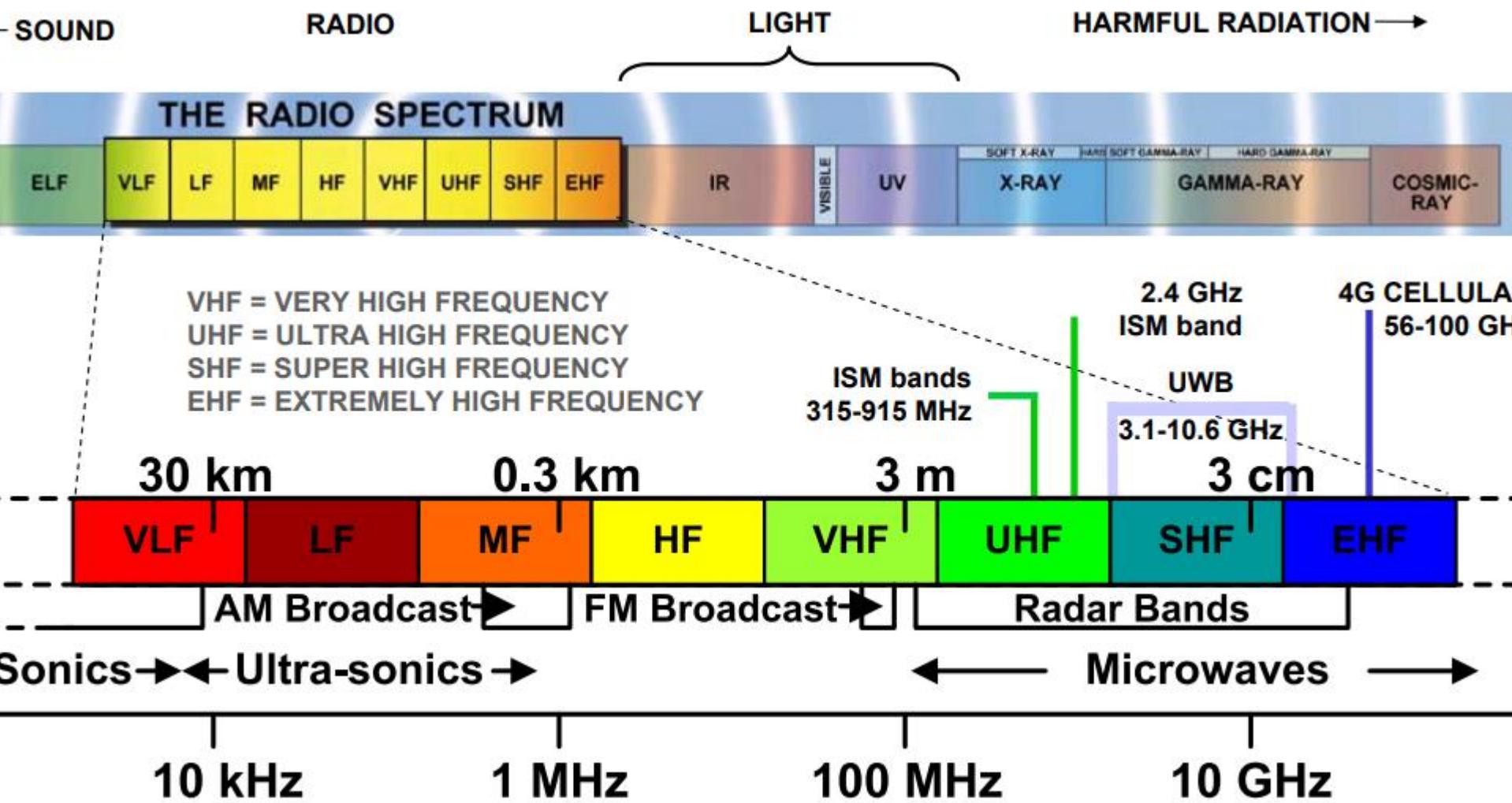
It so easy



- Signals –
 - Analog FM or SSB
 - Digital - GFSK, BPSK, QPSK, AFSK
- Systems –
 - Digital System
 - Filters
 - Amplifiers
 - Antenna



Limited and valuable Electromagnetic Spectrum



RF Communications System

- Simplex



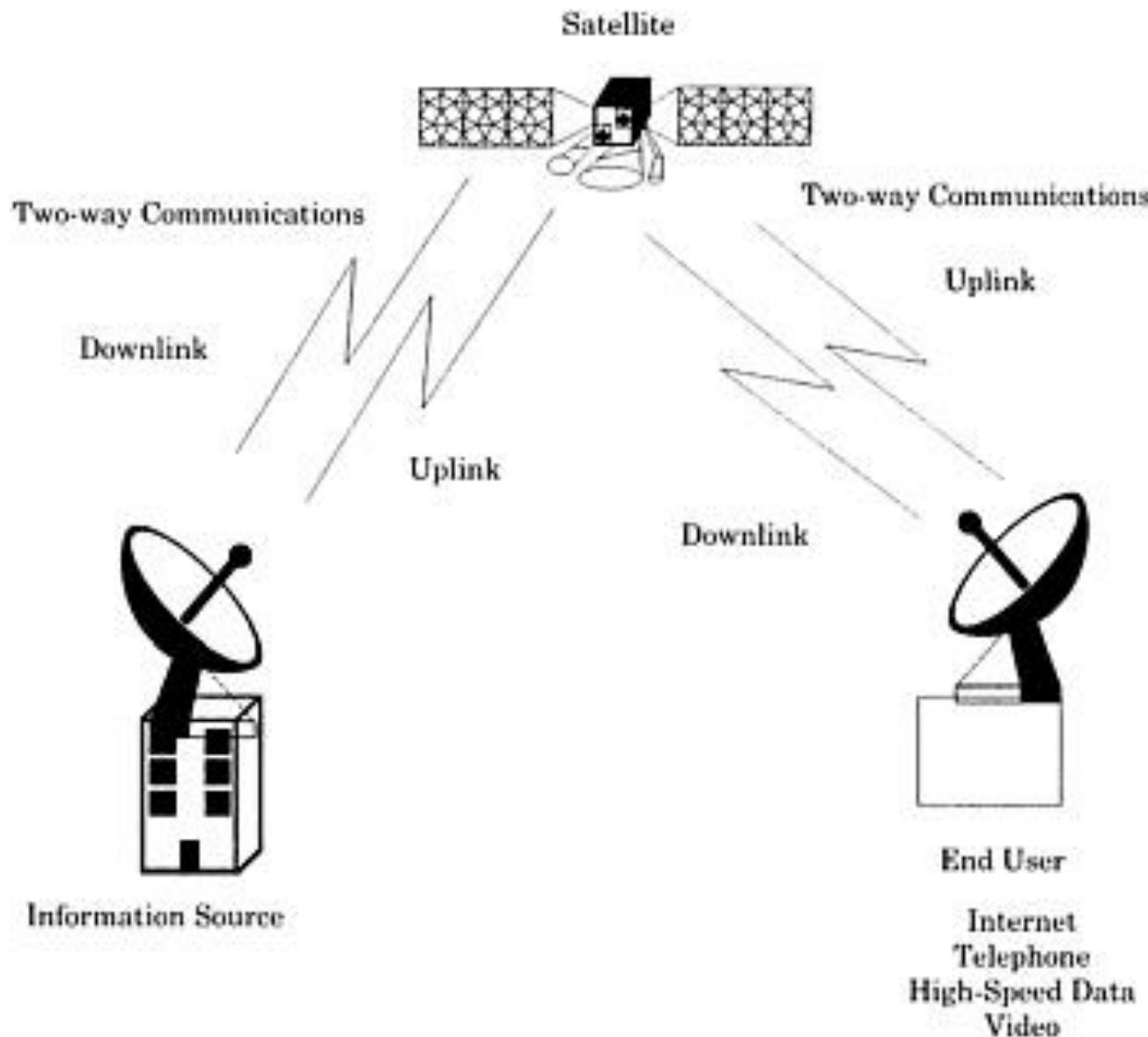
- Half Duplex



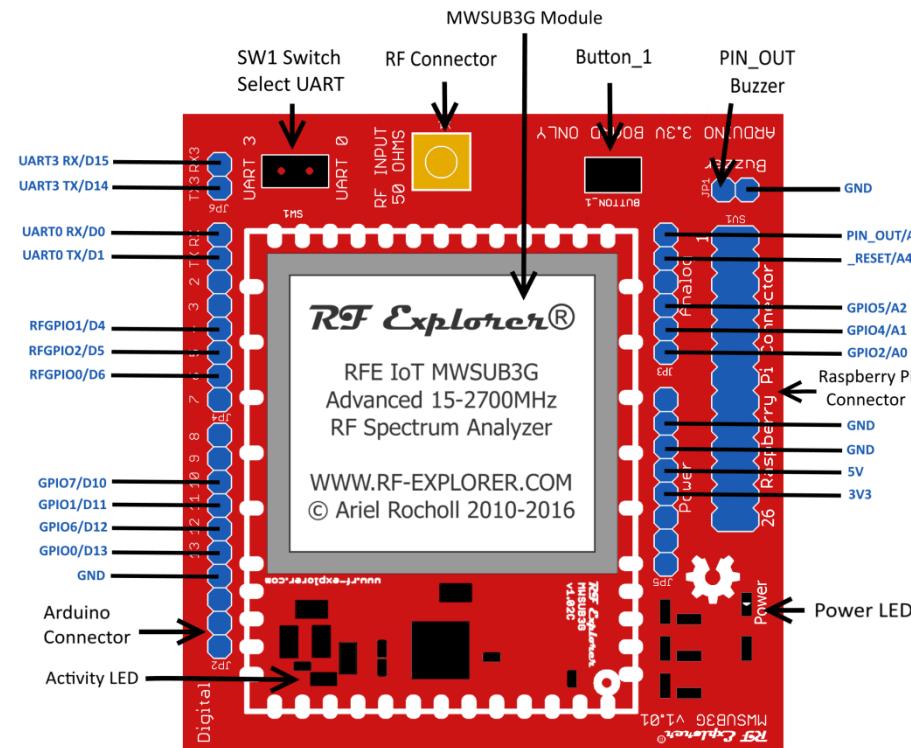
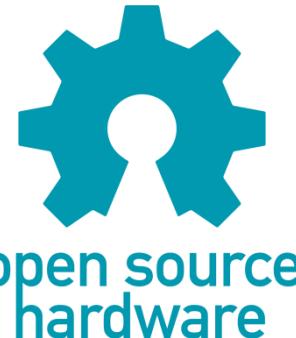
- Full Duplex



RF Communications System



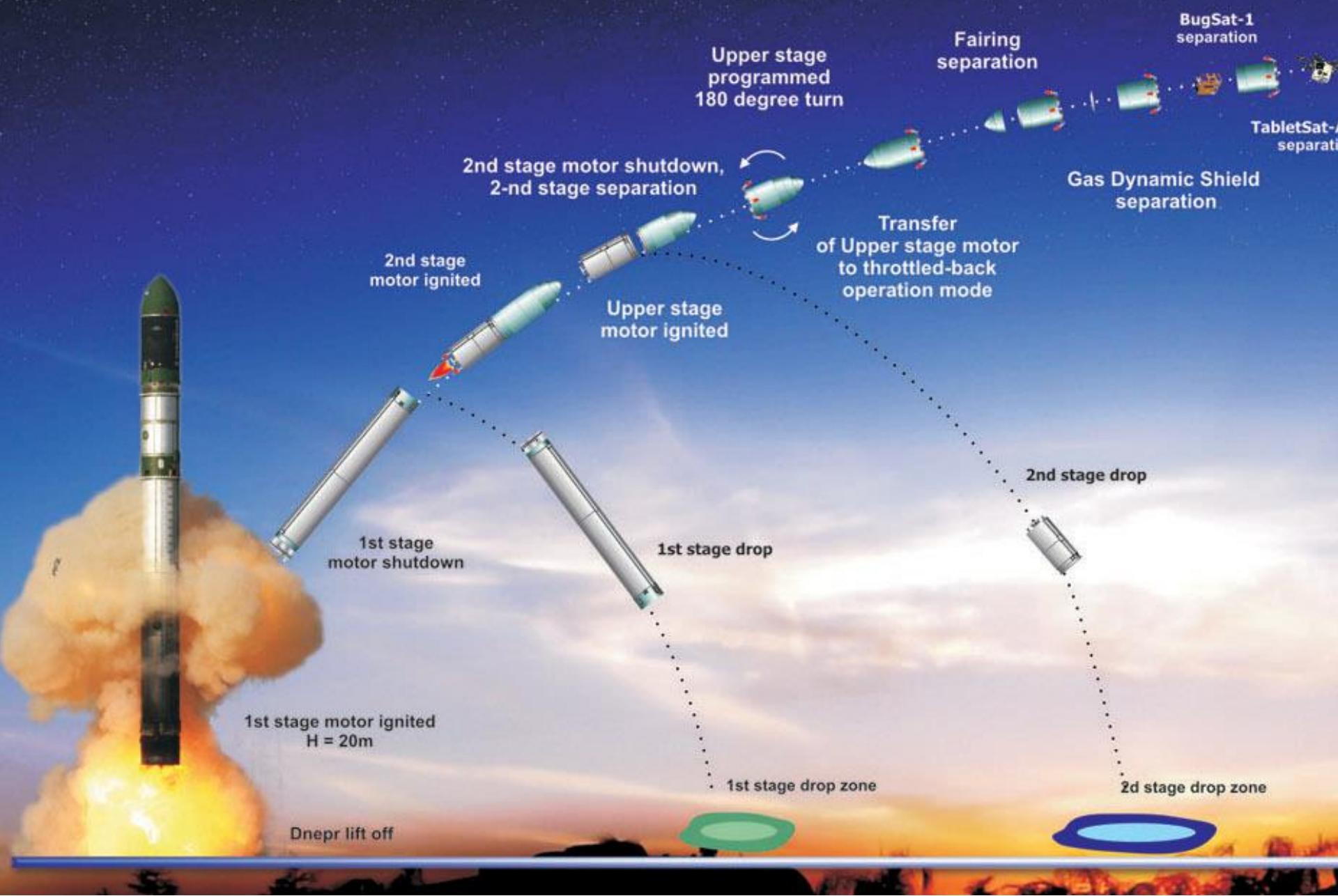
Demo 1 – Portable detect mobile phone





**Amateur Satellite
Operator
Hope KM4IPF**

Cluster Mission Orbit Inject



Most Popular - Satellites

Satélite y denominación OSCAR	Estado	Frecuencia subida y subtono	Frecuencia bajada	Órbita	Disponibilidad habitual	Observaciones
Saudisat 1C (SO-50)	Operativo	145.850 MHz CTCSS 67.0 Hz. 74.4 Hz para activación 10 minutos	436.795 MHz	651 km, inclinación 64.6 grados. Periodo de 97.6 minutos	Siempre disponible	Muy fácil de usar. Siempre disponible. El más popular. Doppler en bajada.
FOX 1A (AO-85)	Operativo	435.172 MHz CTCSS 67.0 Hz	145.850 MHz	523x778 km, inclinación 64.8 grados. Periodo de 97.6 minutos	Siempre disponible	Doppler en la subida. Difícil operar por problemas técnicos. Bajada fácil de escuchar.
LilacSat2	Operativo	144.350 MHz sin subtono	437.200 MHz	518x539, inclinación 97.5 grados. Periodo de 95.2 minutos	Disponible esporádicamente	Muy fácil de usar, pero pocas veces activo. Doppler en bajada. Fácil de escuchar.
QB50p2 (EO-80)	Dañado / pendiente activación	435.080 MHz con subtono 210.7 Hz	145.840 MHz	606x622 km, inclinación 97.9 grados. Periodo de 96.8 minutos	No disponible por el momento	Completando misión científica. Poco probable que pueda utilizarse debido a los daños
CAS-2T	Dañado / activo	145.925 MHz	435.615 MHz	504x1030 km, inclinación 97.4 grados. Periodo de 94.7 minutos	Disponible, pero técnicamente inutilizable.	Los problemas que presenta parecen hacer imposible su utilización
BY70-1	Operativo / pronta reentrada	145.920 MHz con subtono 67 Hz.	436.200 MHz	524x212 km (inyectable)	Siempre disponible excepto cuando hay pruebas de su cámara	Señal muy potente. Keplerianos de corta vida. Doppler en subida y en bajada.

Antennas



(a)



(b)



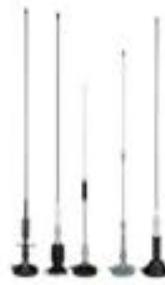
(c)



(d)



(e)



(f)



(g)



(h)



(i)



(j)



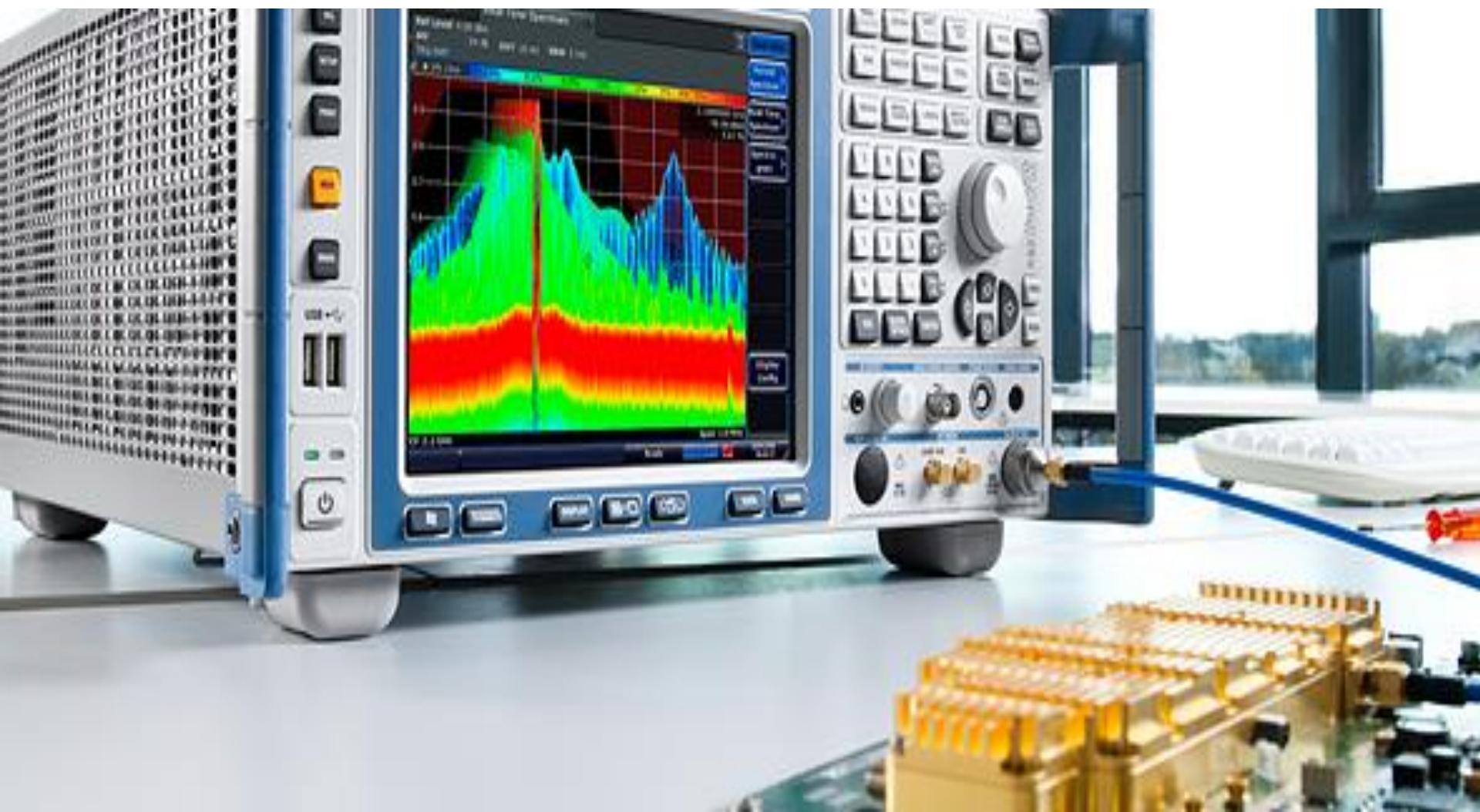
(k)

(l)

Baofeng – Dual Band Hanheld radio



Spectrum Analyzer



Take my money and shut up!!!

N9320B RF Spectrum Analyzer (BSA), 9 kHz to 3 GHz

Sold By: Authorized Sales Partners - [Check availability](#)

US\$ 9,123

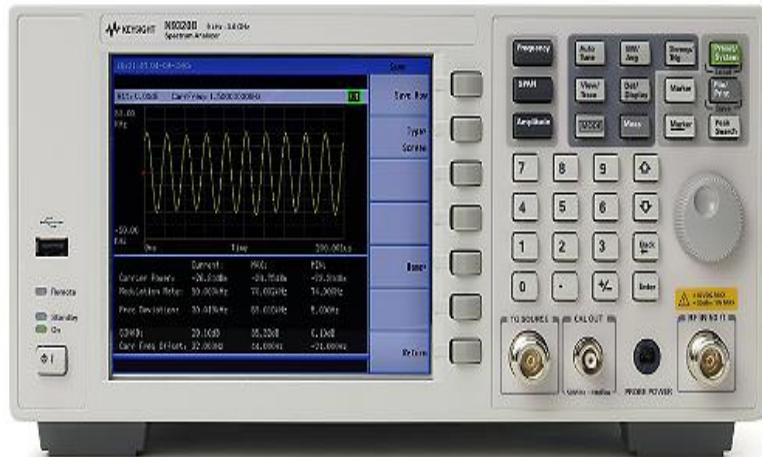
Typical Price*

[Get Quote](#)

[Add to My Watchlist](#)

[Configure](#)

Overview	Specifications	Options & Upgrades	Resource Center	Support
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▼ Key Features and Functions

- Fast spectrum analysis covering frequency 9 kHz to 3 GHz
- 0.5 dB overall amplitude accuracy
- Efficient AM/FM, ASK/FSK demodulation analysis suites for IoT transmitter characterization
- 3 GHz tracking generator provides stimulus response measurement for component characterization
- Automation and communication interface with industry standard SCPI language support and USB/GPIB/LAN connectivity choices
- Ideal for R&D, low cost manufacturing, and RF education



WARRANTY



MEASUREMENT
INTEGRITY



CALIBRATION

UP TO 10 YEARS
WARRANTY

ASSURANCE PLANS

RF Explorer Spectrum Analyzer



RF Explorer - WSUB1G+

- Affordable digital spectrum analyzer
- Frequency band: 0.05 - 960MHz
- Spectrum Analyzer mode with Peak Max and Hold, Normal and Averaging modes
- Windows PC client extension

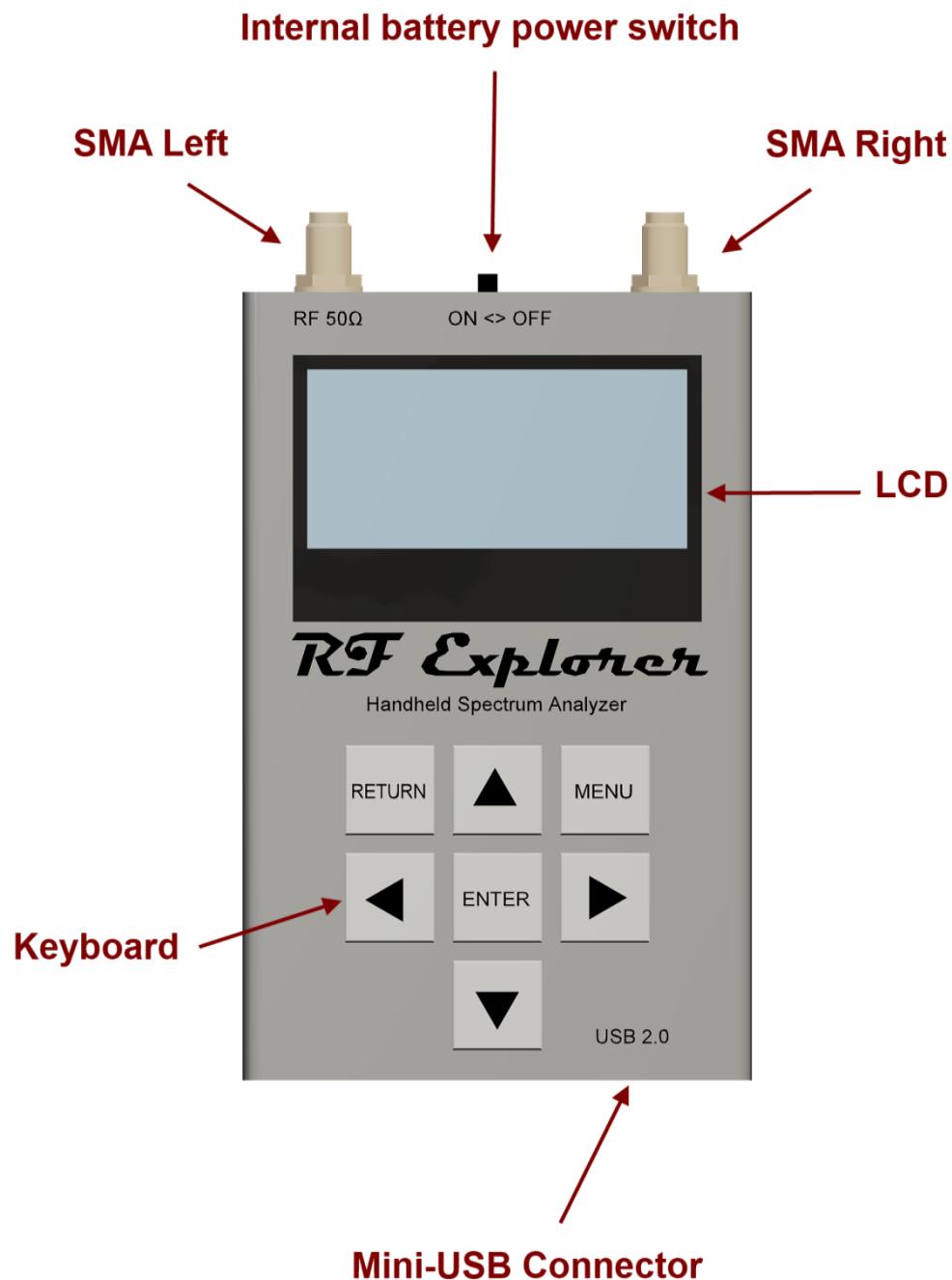
SKU 114991051



Replies
5

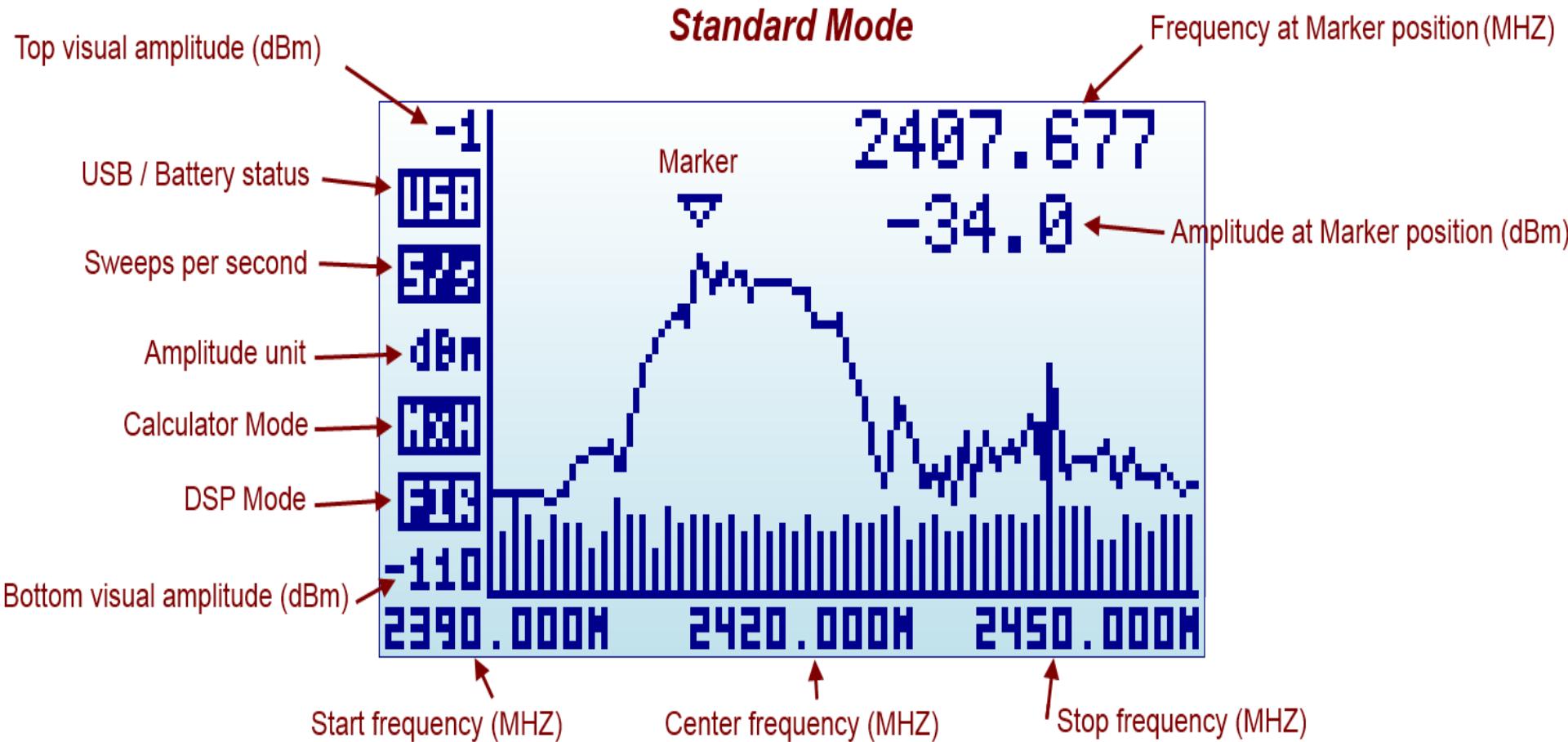
\$165.00

IN STOCK 50+ Available

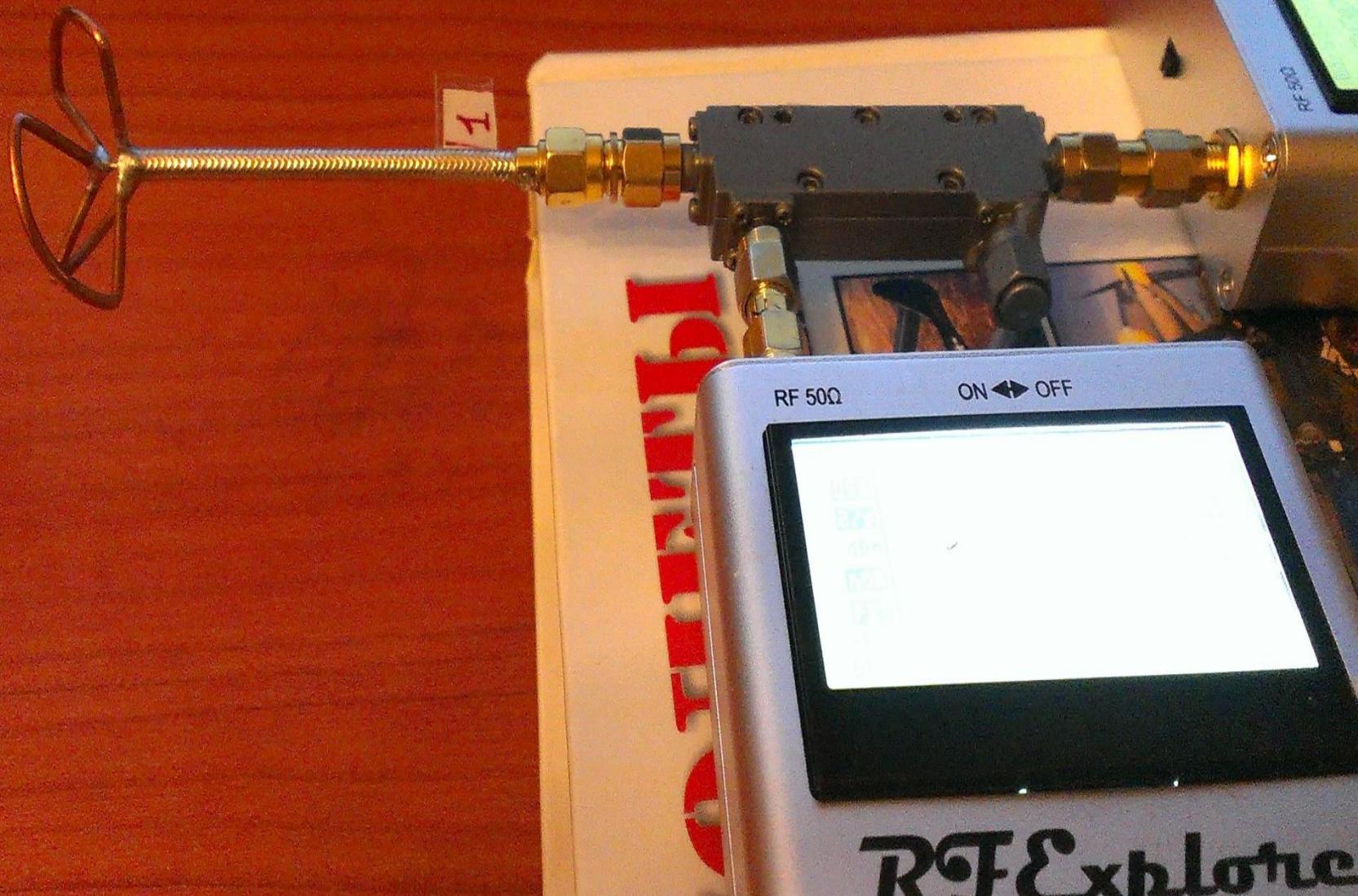


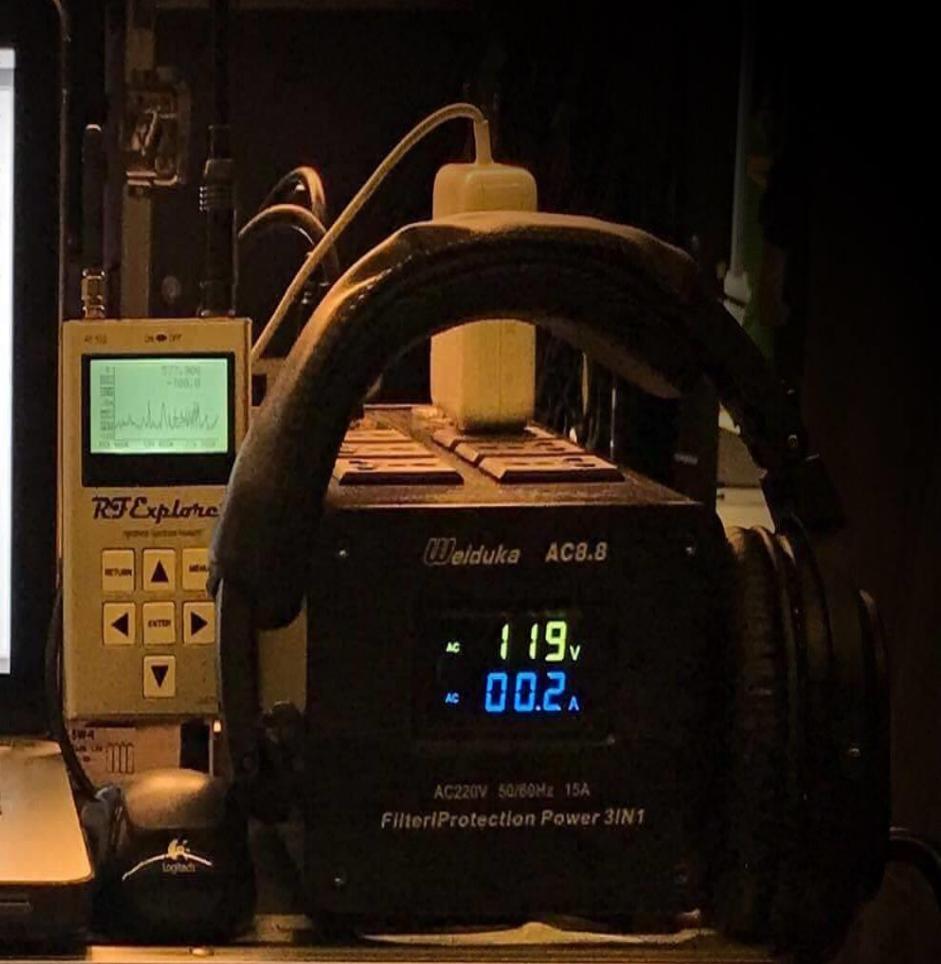
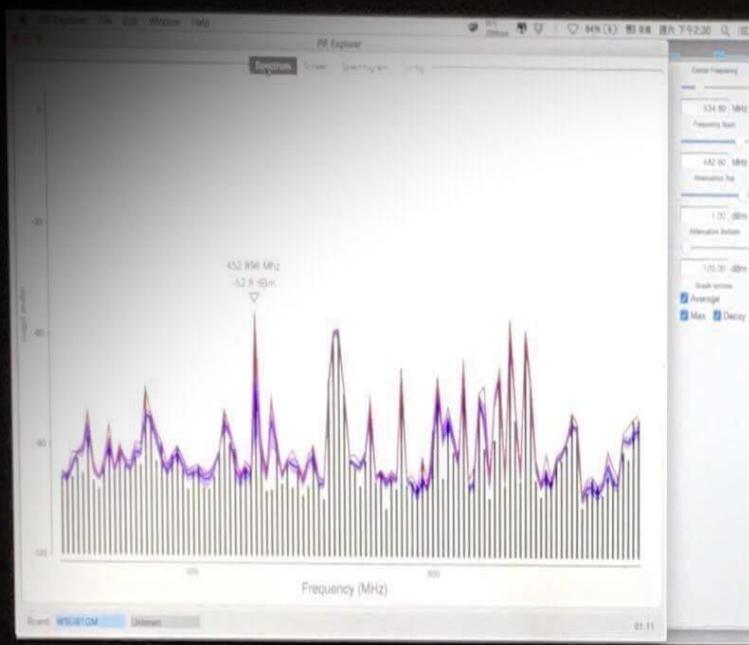
Spectrum Analyzer Screen

RF Explorer Spectrum Analyzer screen



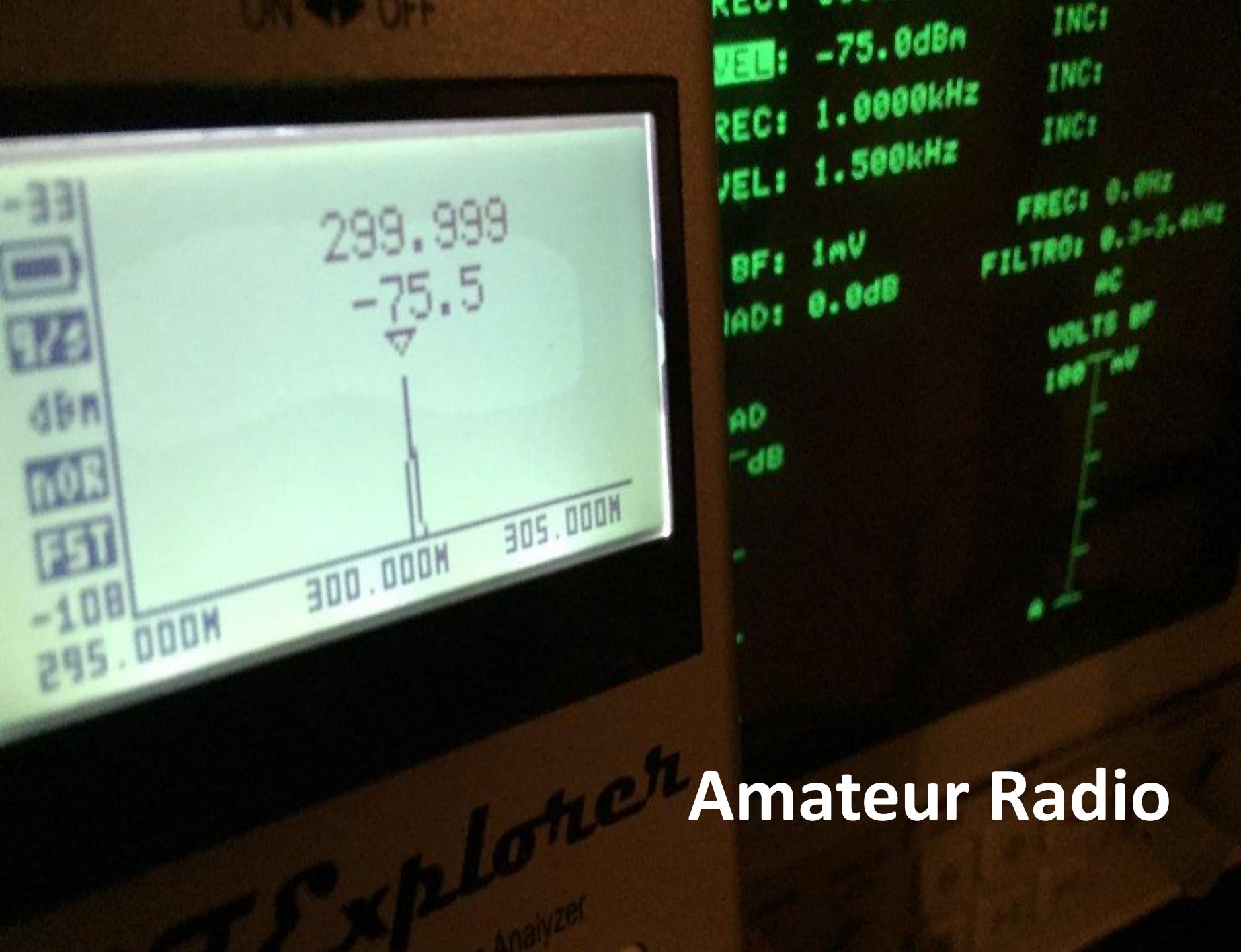
Fans of Radio Control





Audio Engineers

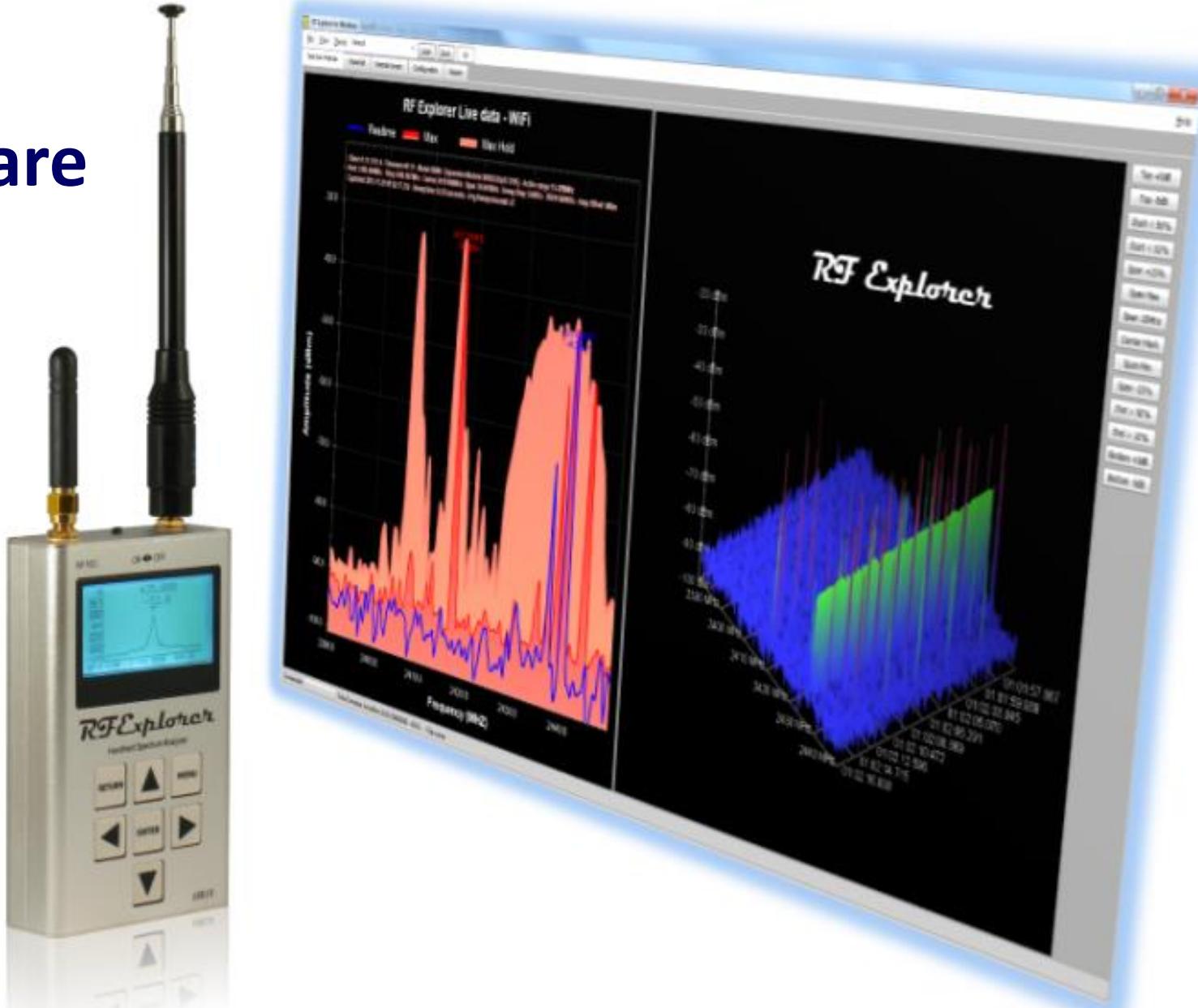




Hackers and Makers

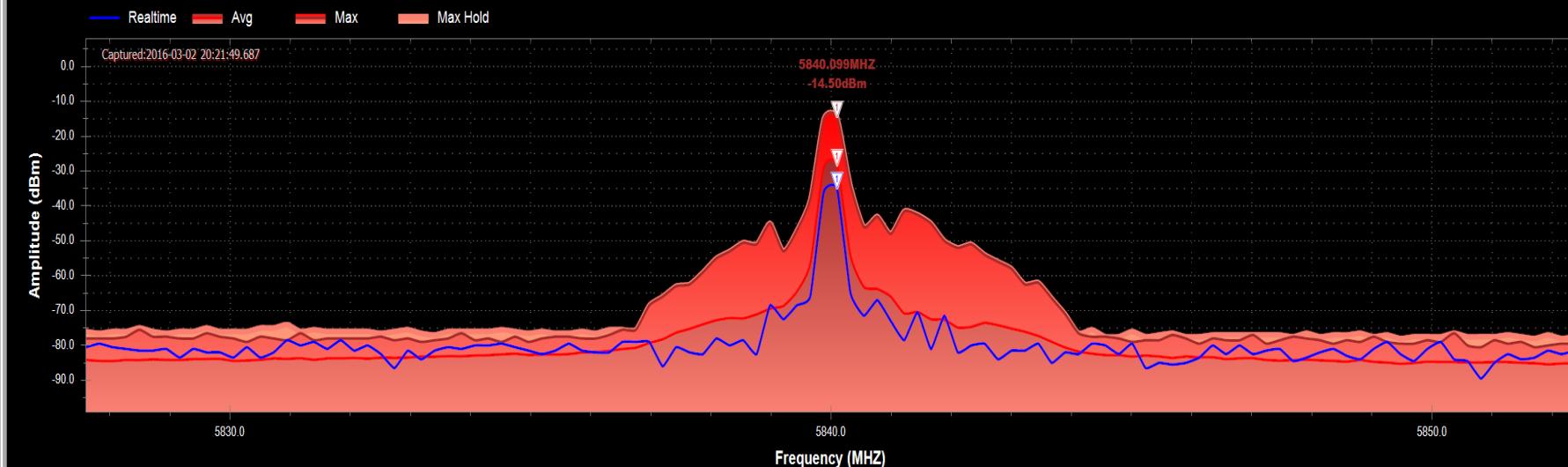


Software



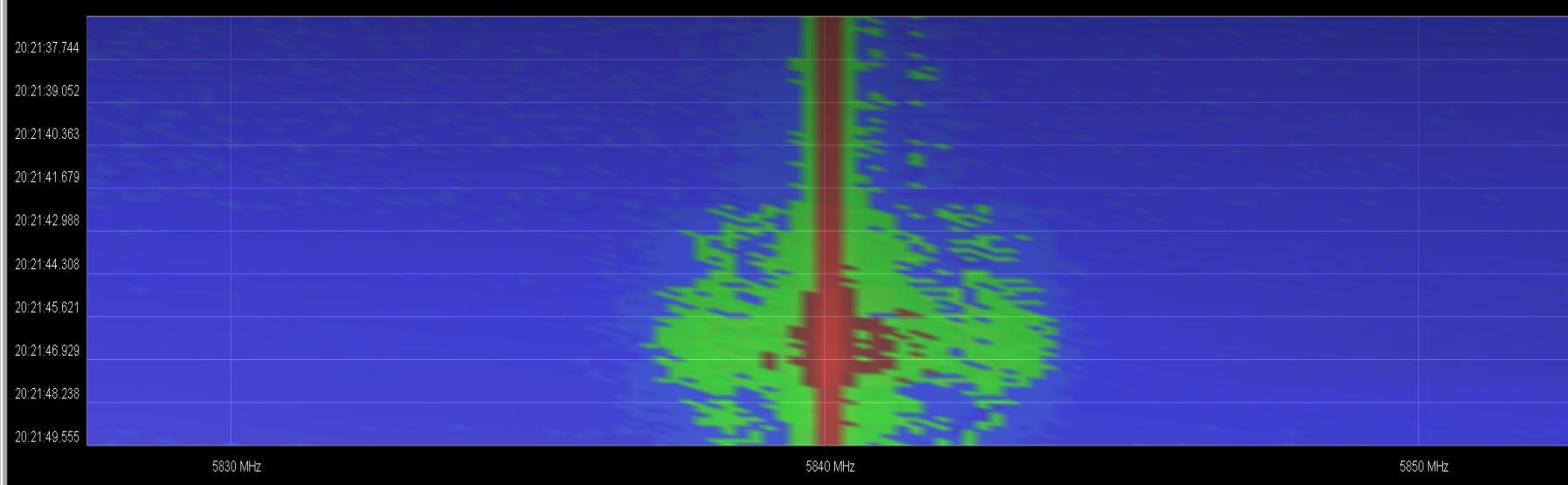
The screenshot shows the 'Spectrum Analyzer Frequency and Power control' section of the software. It includes fields for CENTER frequency (5840.099), SPAN (25.000), and BOTTOM frequency (-99.25). There are also START (5821.599) and STOP (5852.599) frequency controls, and a TOP power control (8.00). The 'Send' button is visible. On the right, 'Markers' are set up with 'Marker ID' 1 at 'FREQ' 5840.099 and 'Track' Max Peak.

RF Explorer File data - Default



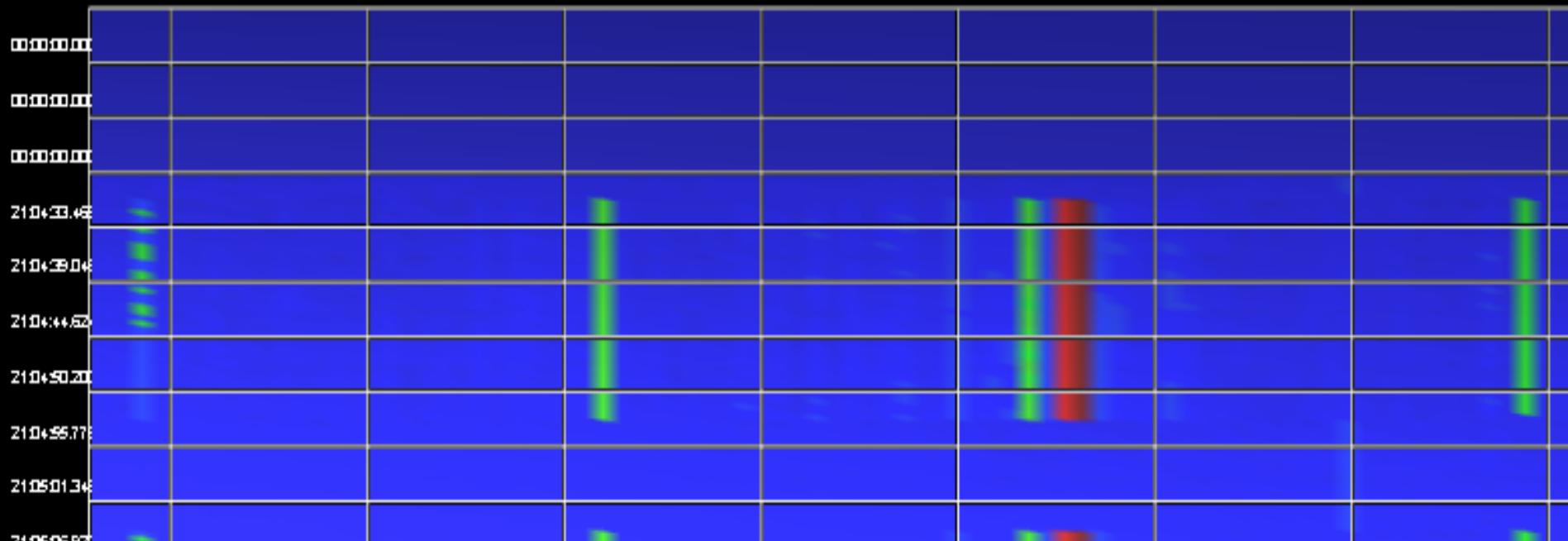
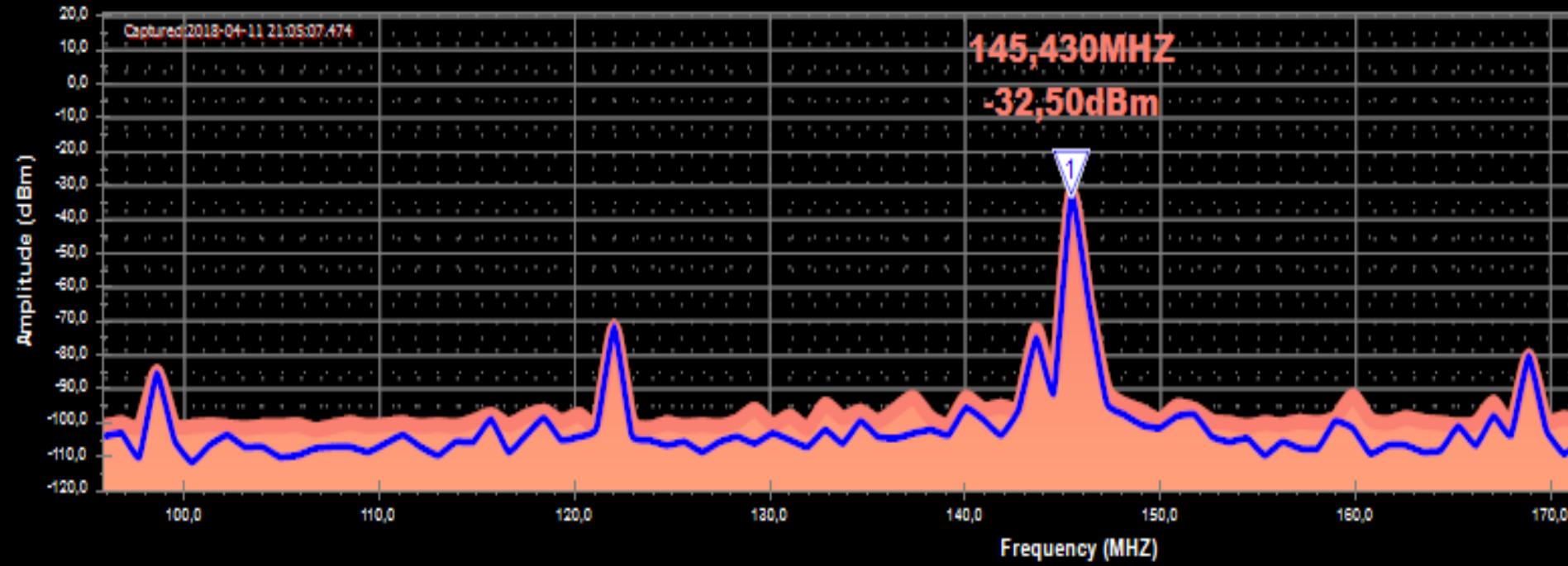
Firmware: 01.12
RF Left: 6G
RF Right: NONE
Client: 1.12.1604.2
Center: 5840.099MHz
Span: 25.000MHz
Step: 223.214kHz
RBW: 460kHz
Offset: 0dB
Cal: Disabled

M1: 5840.099 MHz
RT: -35.00dbm
Avg: -28.33dbm
Max: -14.50dbm
MxHt: -14.50dbm



Measure your transmitter





RF Explorer File data - Default

Realtime Avg Max Hold

Captured:2017-03-07 11:03:28,163

742.607MHZ
-65.50dBm

Measure the environment

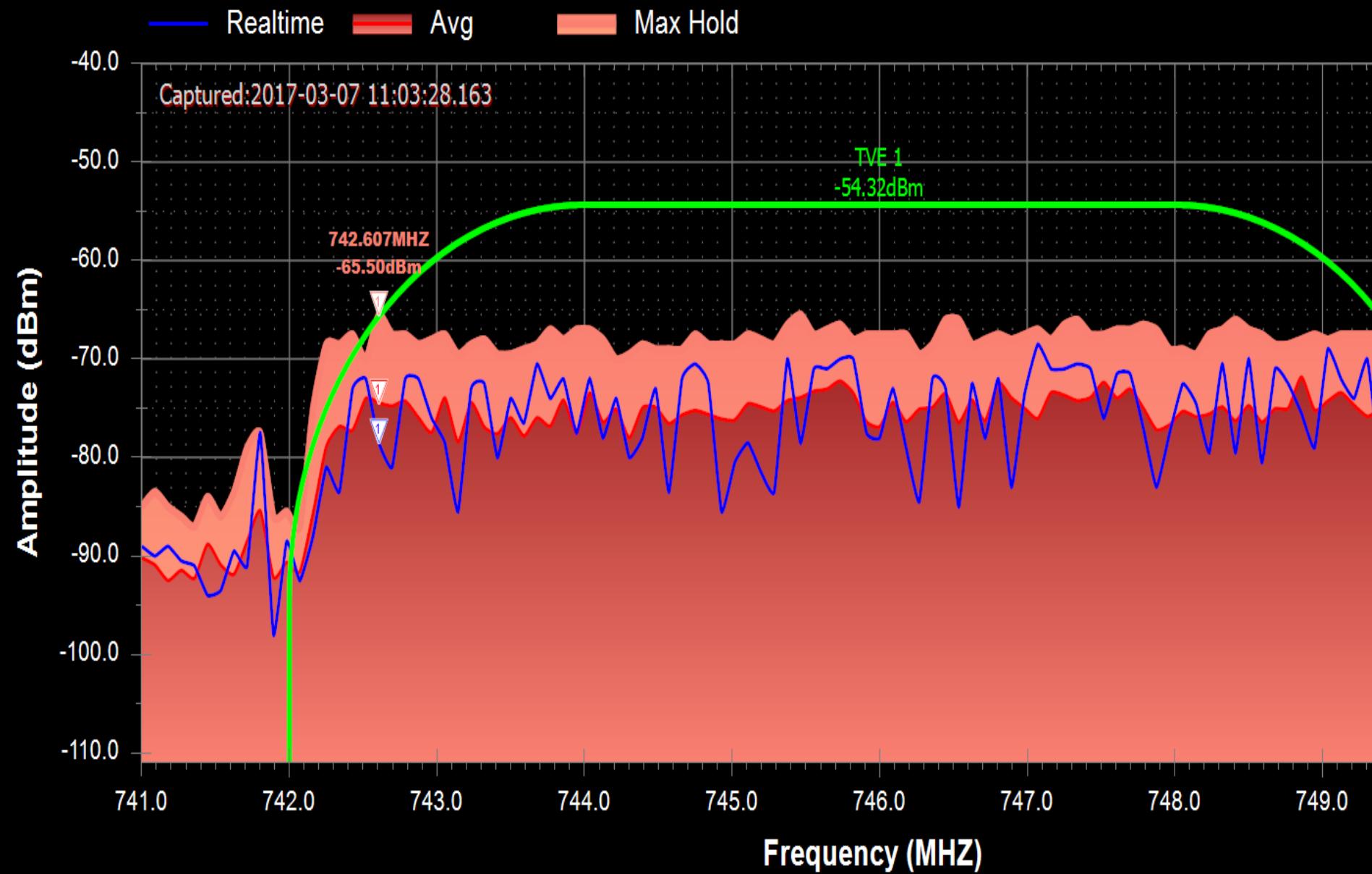
Amplitude (dBm)

-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0

741.0 742.0 743.0 744.0 745.0 746.0 747.0 748.0 749.0

Frequency (MHz)

RF Explorer ON HOLD - TDT Power Channel TVE



— Realtime ■ Max Hold

Captured:2017-03-08 18:24:42.362

Amplitude (dBm)

-30.0

-40.0

-50.0

-60.0

-70.0

-80.0

-90.0

100.0

101.0

102.0

103.0

104.0

105.0

Frequency (MHz)

105.

-38.

Realtime Max Hold

-20

Captured:2017-03-08 18:23:17.047 - Data points:112
Sweep time: 0.2 seconds - Avg Sweeps/second: 4.6

-30

Onda Madrid

-41.23dBm

Rock FM

-44.64dBm

MegaStar FM

-57.12dBm

Kiss FM

-41.92dBm

Radio Marca

-51.56dBm

RNE

-53.48dBm

Amplitude (dBm)

-40

-50

-60

-70

-80

-90

100

101

102

103

104

105

Frequency (MHz)

105.4

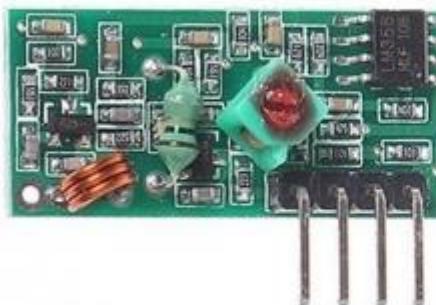
-38.1

Cader

-39.7

Demo 2 - Arduino Decode ASK RF

- Low Low Low Cost



5V - DATA - DATA - GND
RECEPTOR

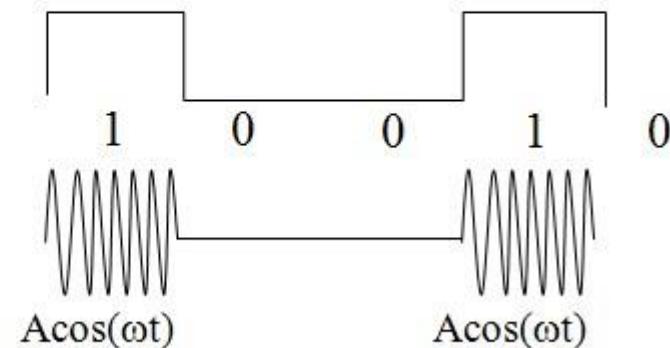


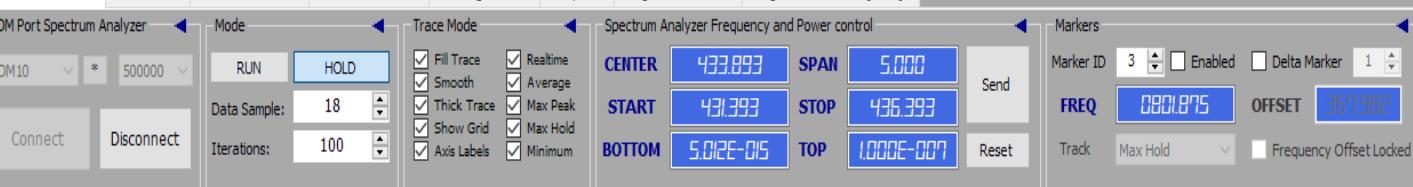
DATA - 5V - GND
EMISOR

Amplitude Shift Keying (ASK)

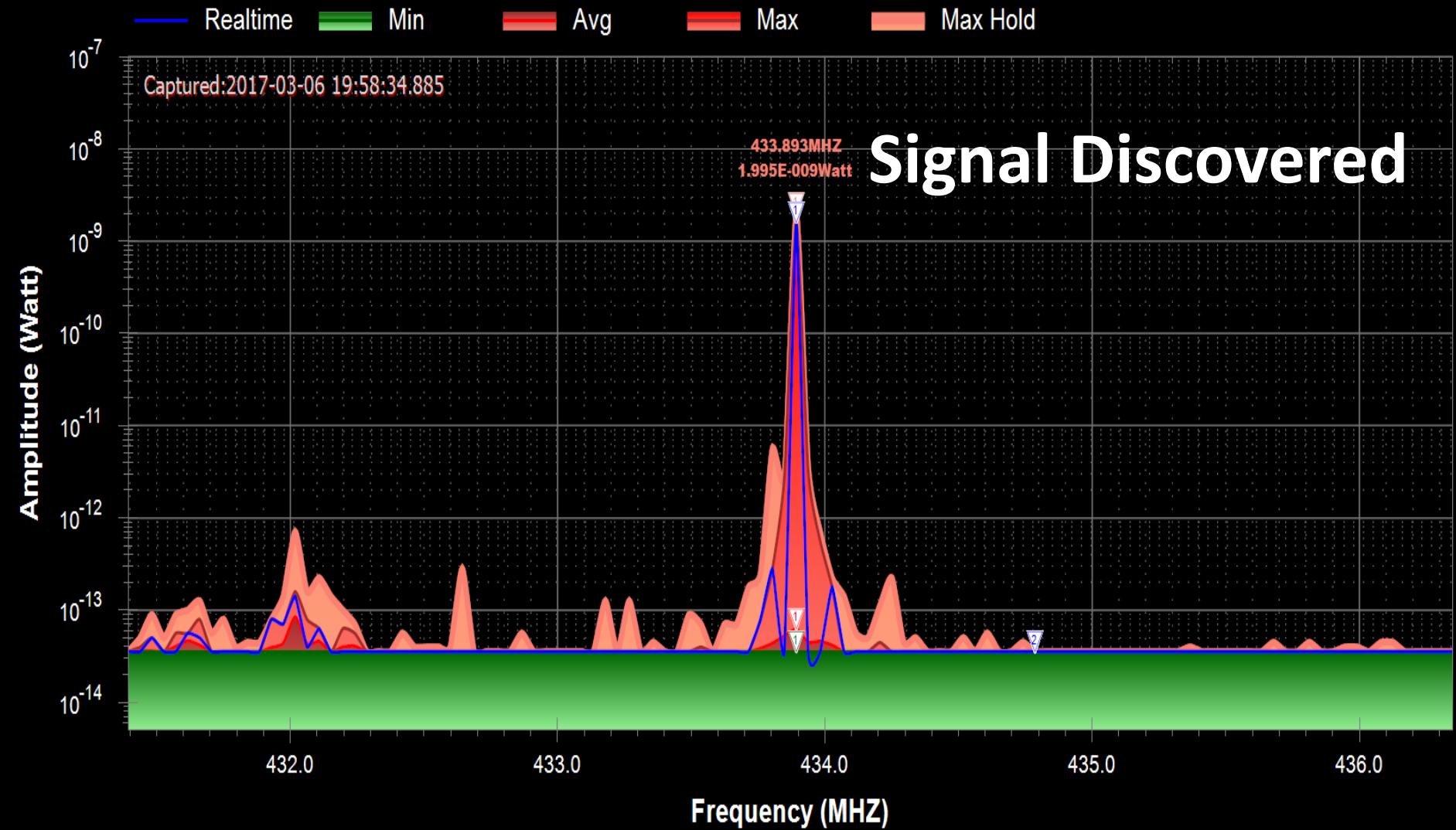
Baseband Data

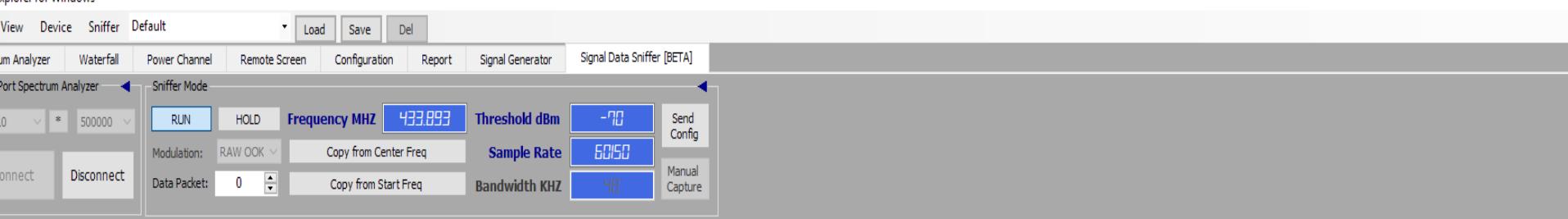
d



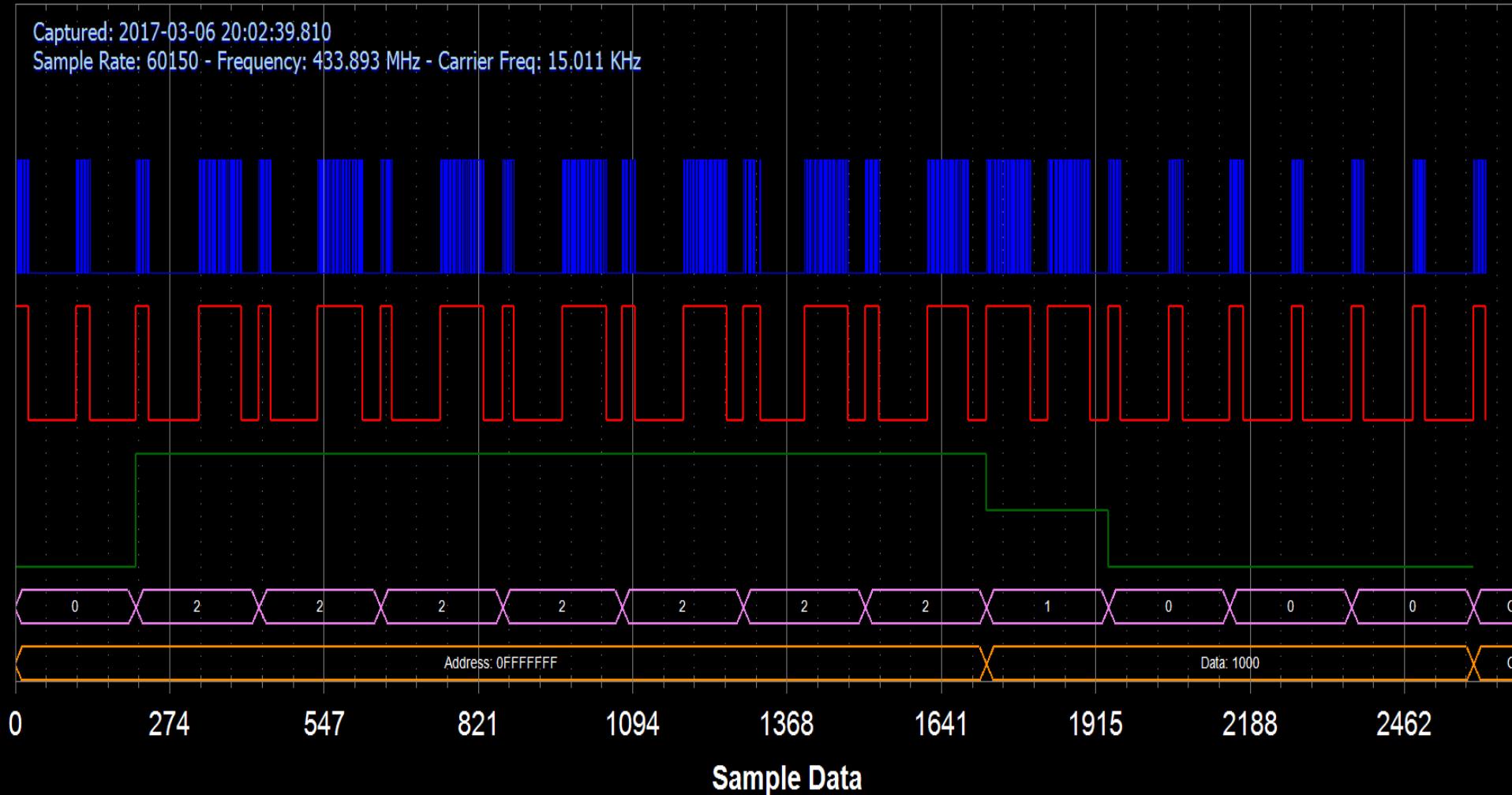


RF Explorer ON HOLD - Default





RF Explorer Decoder Live Data - Detailed Demo: Sniffer



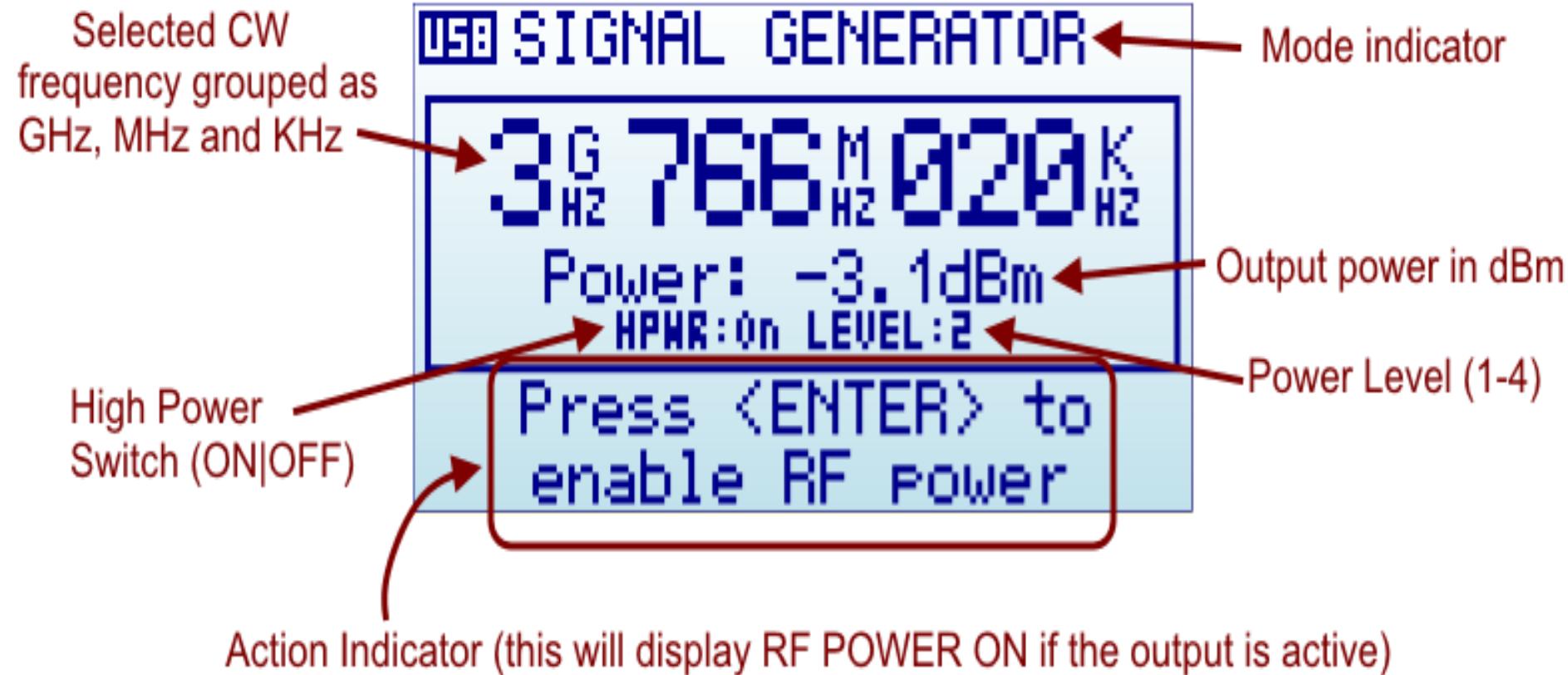
RF Explorer

Signal Generator

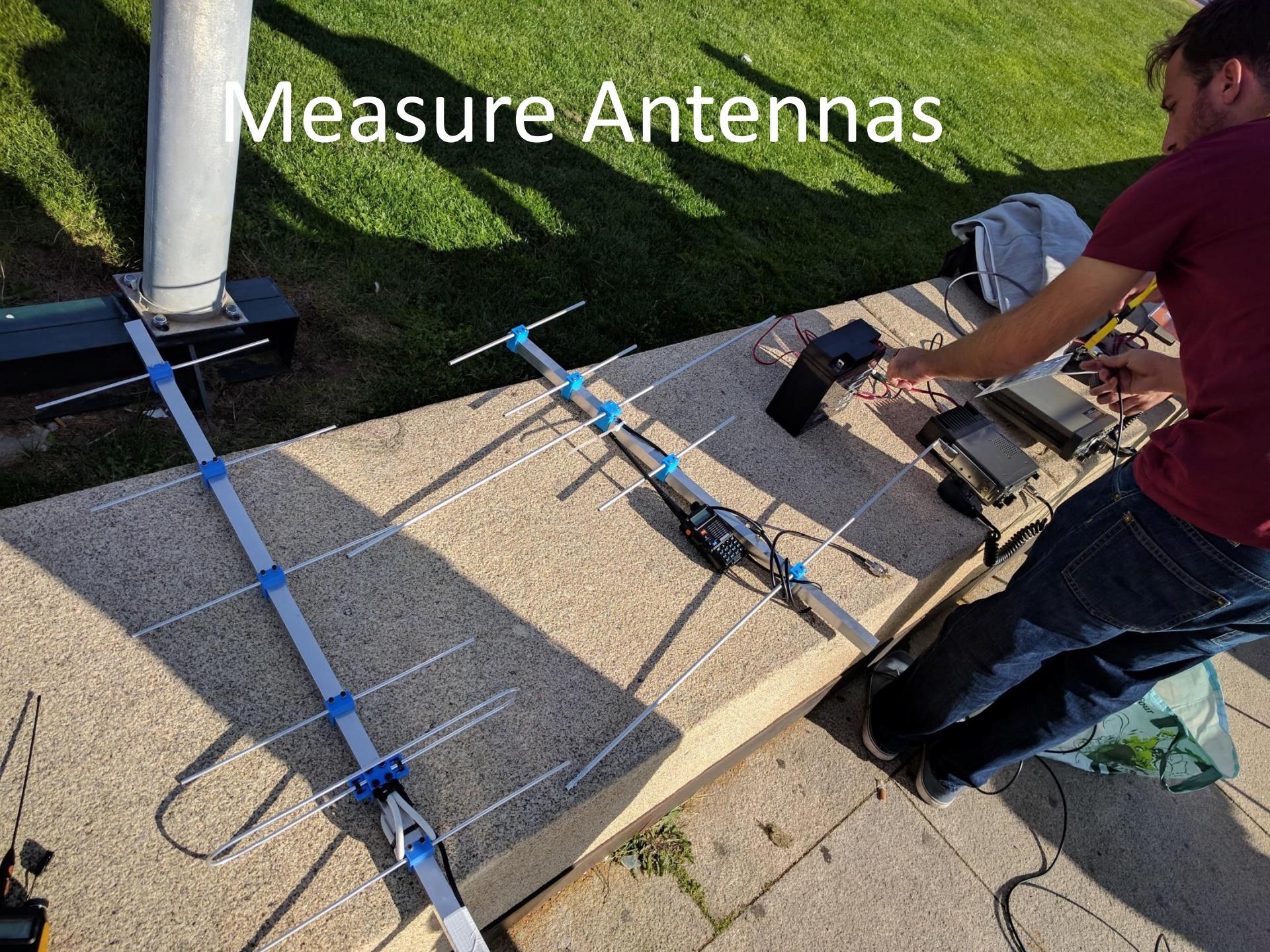


Signal Generator

RF Signal Generator Main Screen



Measure Antennas





8867 BMW

Measure Loss - VSWR (Return Loss - VSWR)

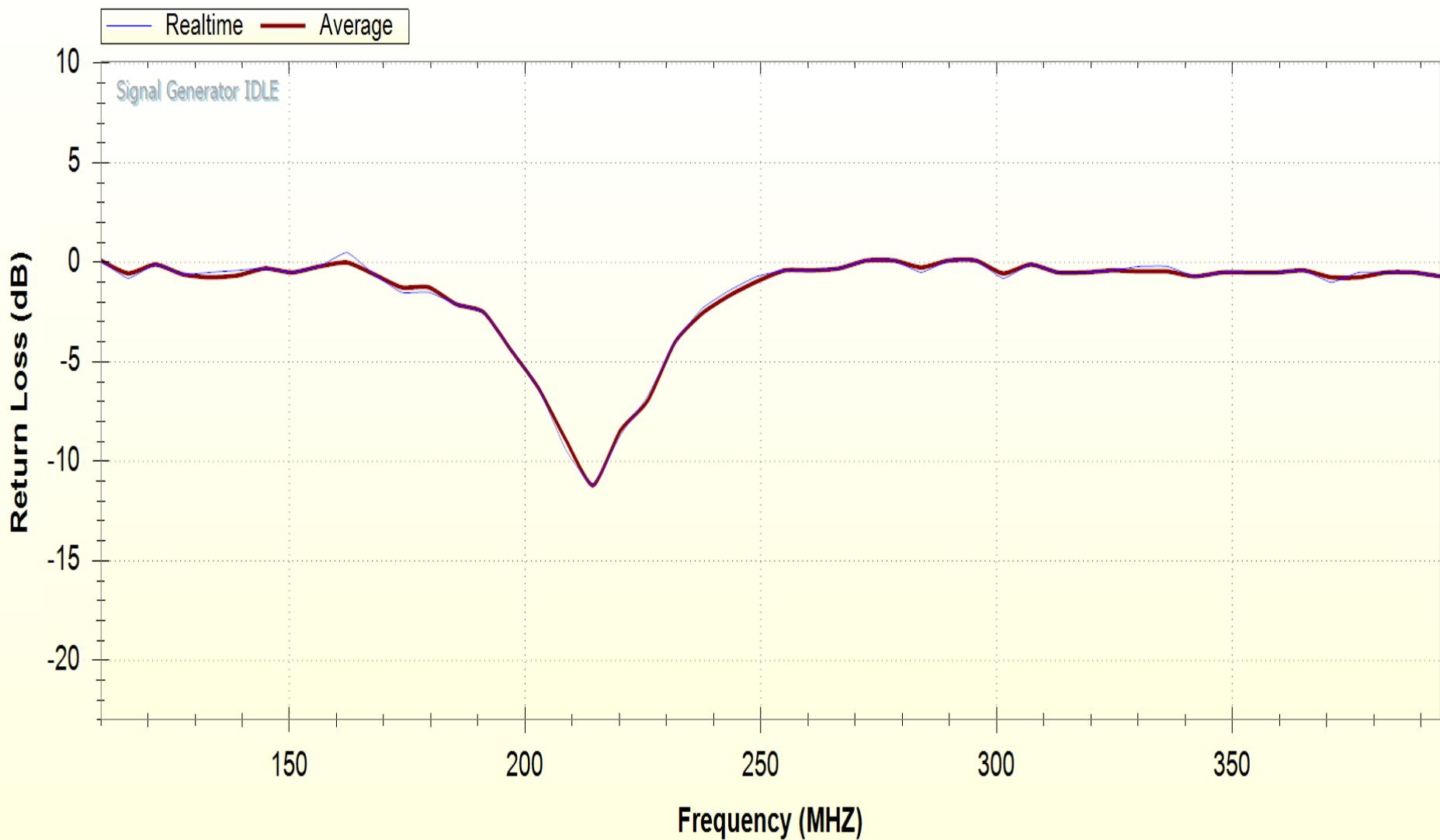


COM9 * 500000 CW 400.0000 START 10.000 Run 1 sweep... Normalize SNA... Average: 5

POWER -30dBm STOP 400.0000 Run continuous... Start SNA... Stop auto Avg

RF Power OFF Stop STEPS 50 Stop sweep Stop SNA

RF Explorer SNA Tracking - Default

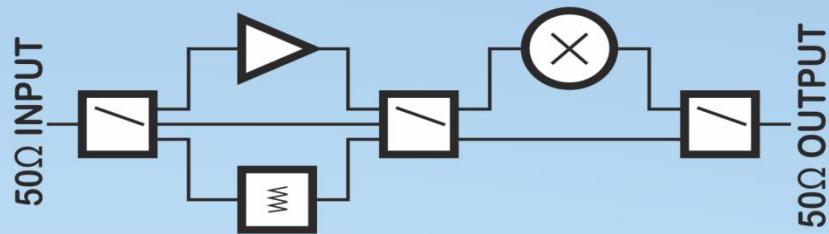


RF Explorer®

Near Field Antennas



Upconverter RF Mixer with Attenuator and LNA



RF Explorer®

Showroom



RF Explorer 3G+ IoT for Raspberry Pi
SKU 114990814

\$100 \$125



EVA carrying case for 3G Combo
SKU 328050001

\$4.95



RF Explorer Signal Generator (RFE6GEN)
SKU 114990081

\$189

★★★★★



RF Explorer 6G Combo
SKU 109990063

\$365

★★★★★



RF Explorer Protection Boot (Yellow)
SKU 322100012

\$9.95



Rubber Duck UHF 400-900MHz SMA
Articulated Antenna
SKU 109990205

\$9.5



SMA Termination Male
SKU 320160014

\$8.5



RF Explorer model WSUB1G
SKU 109990010

\$129

Conclusions

- RF is not Black Magic
- Satellite is a black box of RF
- RF Explorer makes instrumentation economical and user- friendly
- Discover Signals on Environment – Spectrum Analyzer
- Felipe and Manuel are the best

IEEE

young
professionals



Radio Satellite

GRACIAS!!!

