
Thomas Watson
@wa7son
github.com/watson

Build you own JavaScript Powered Radio

@wa7son

Who is this guy anyway?

- Thomas Watson
- Open Source developer at github.com/watson
- Node.js Lead at Opbeat
- Member of the Diagnostics Working Group under the Node.js Foundation
- Tweets as @wa7son

opbeat

node JS

Build you own JavaScript Powered Radio

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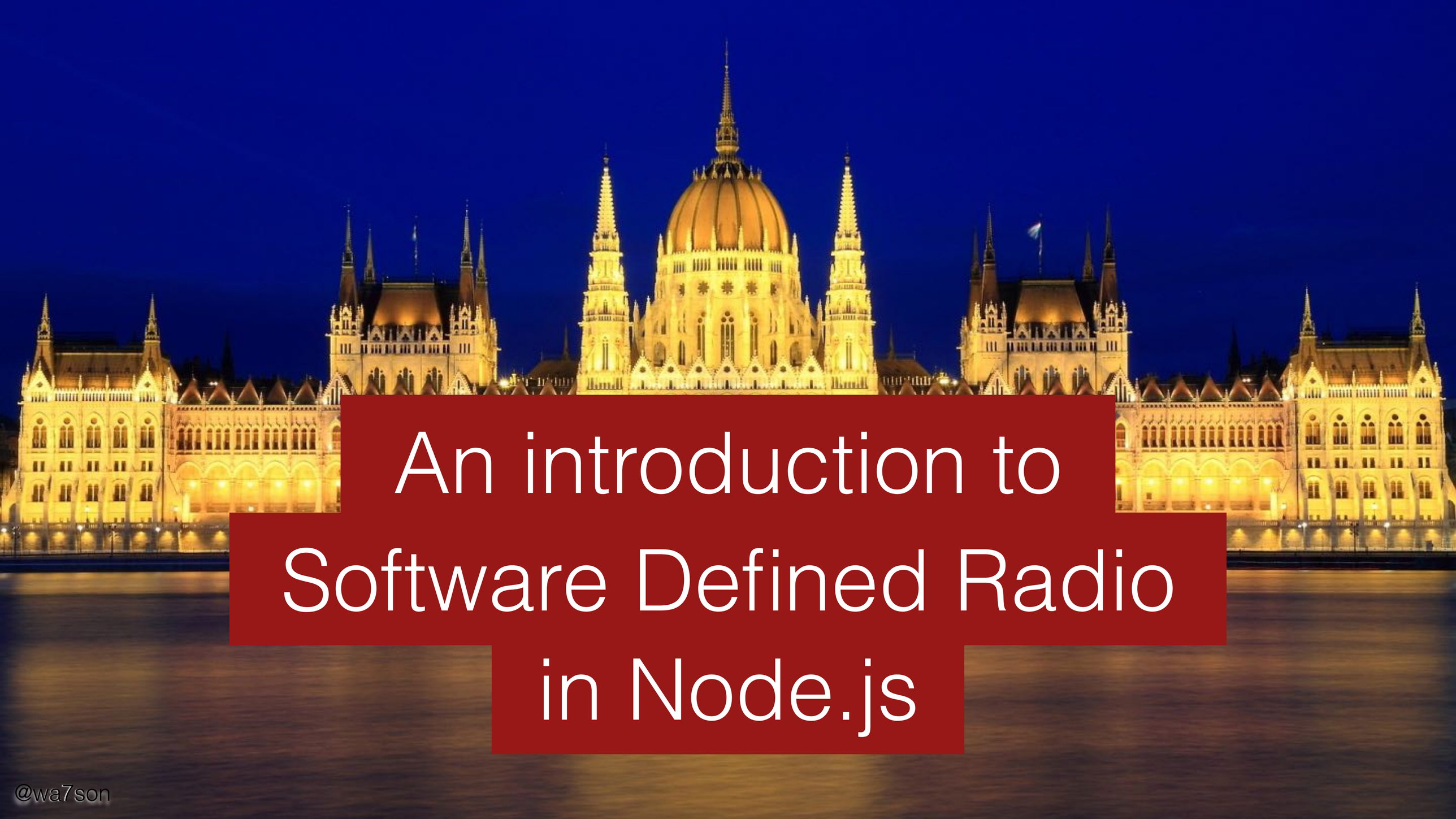

An introduction to Software Defined Radio in Node.js

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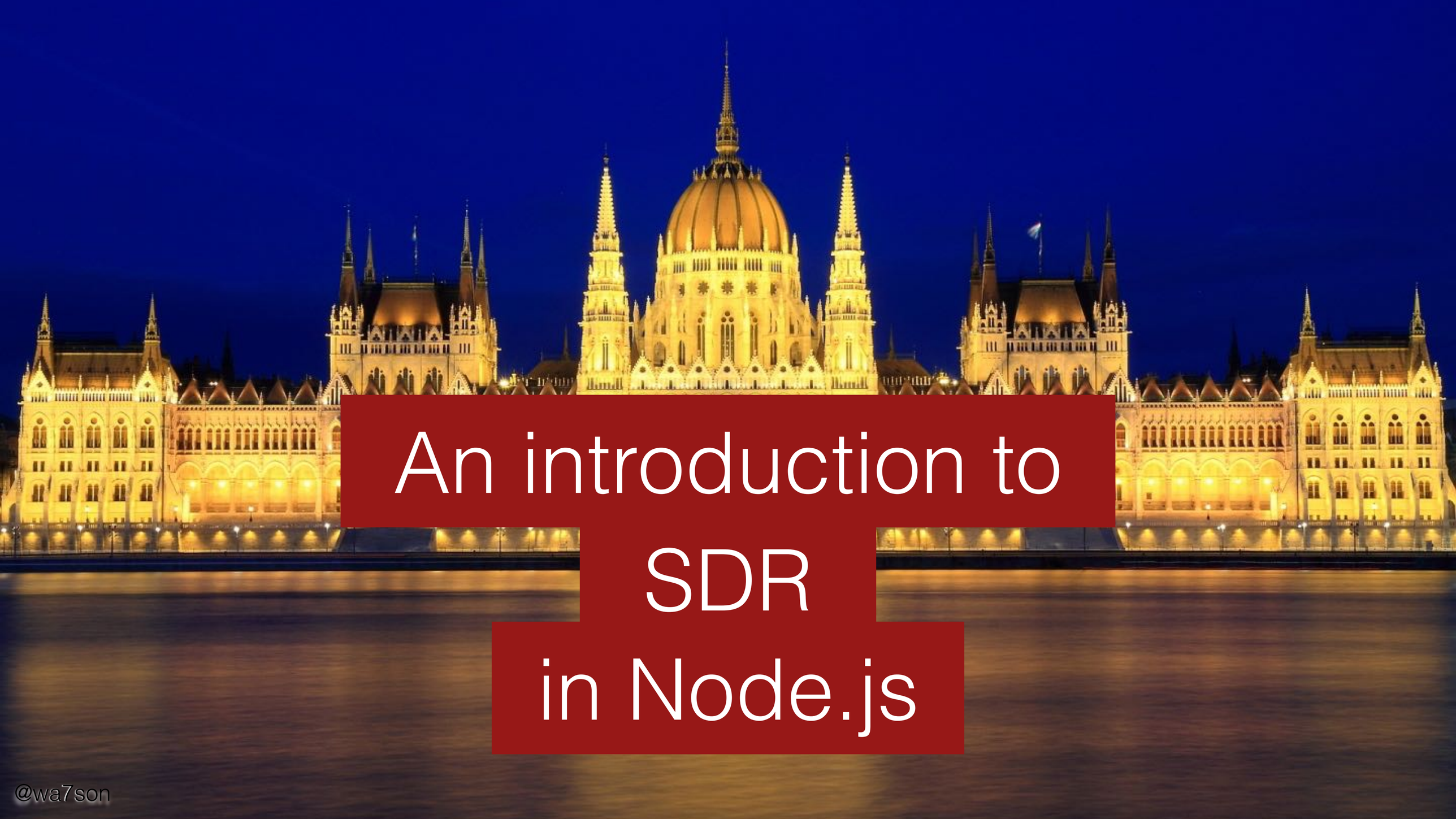

An introduction to SDR in Node.js

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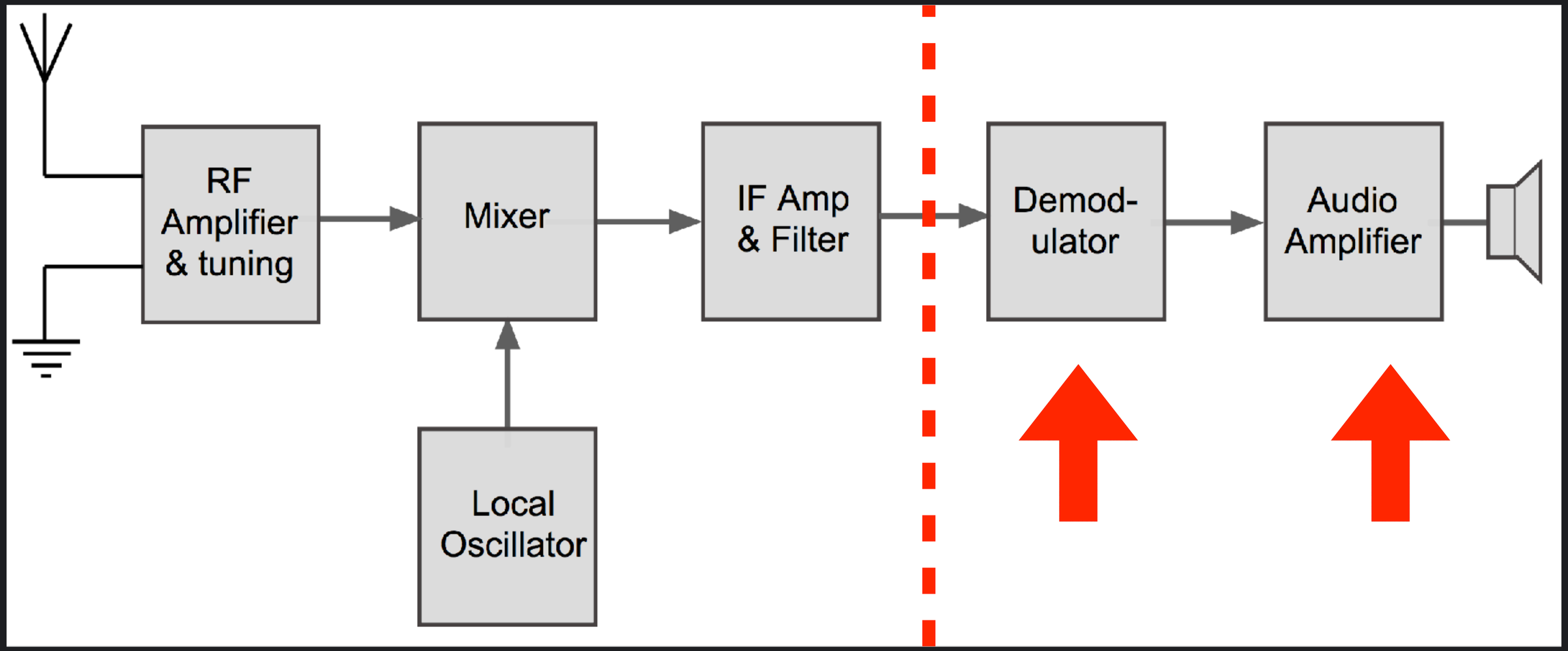
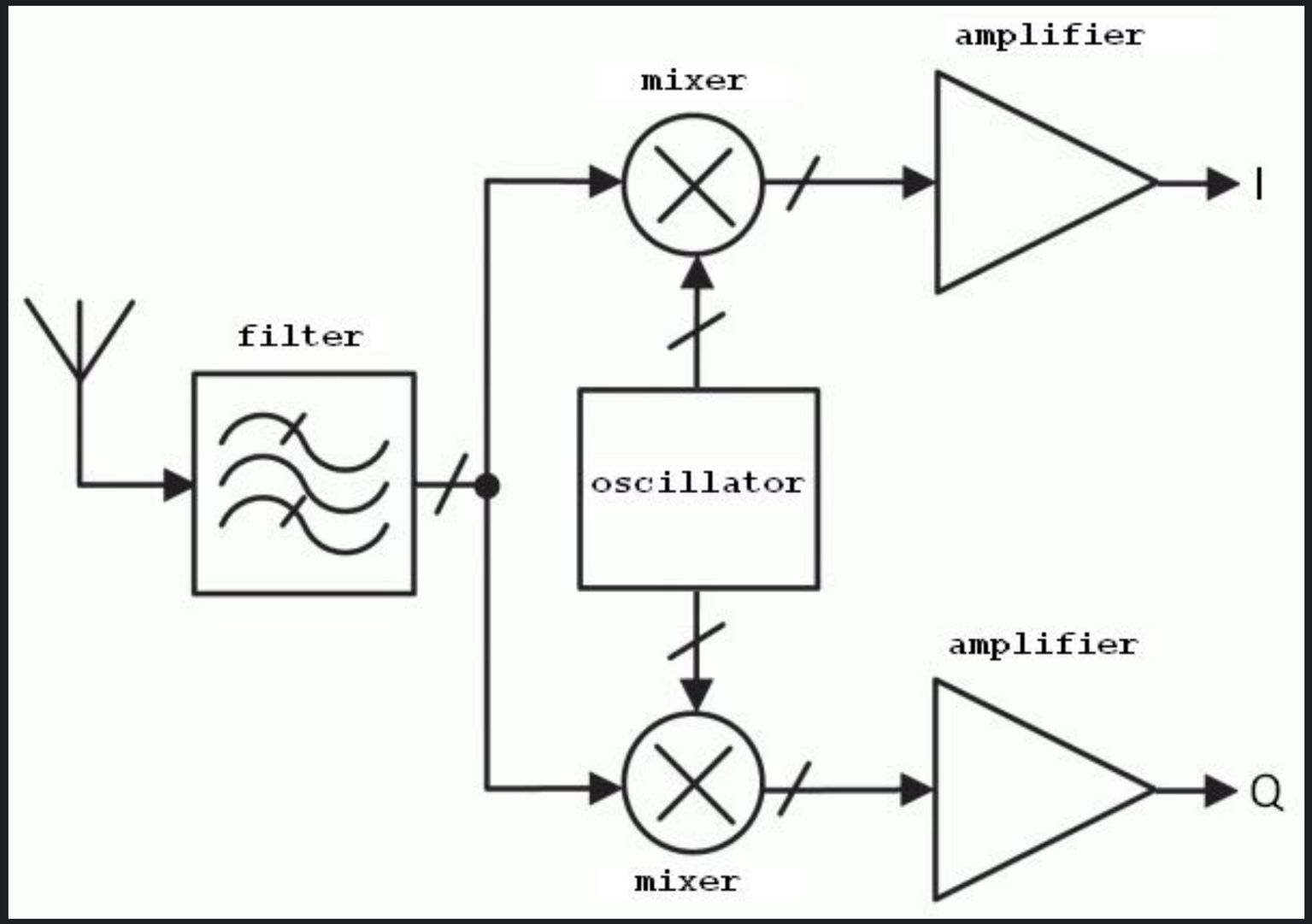
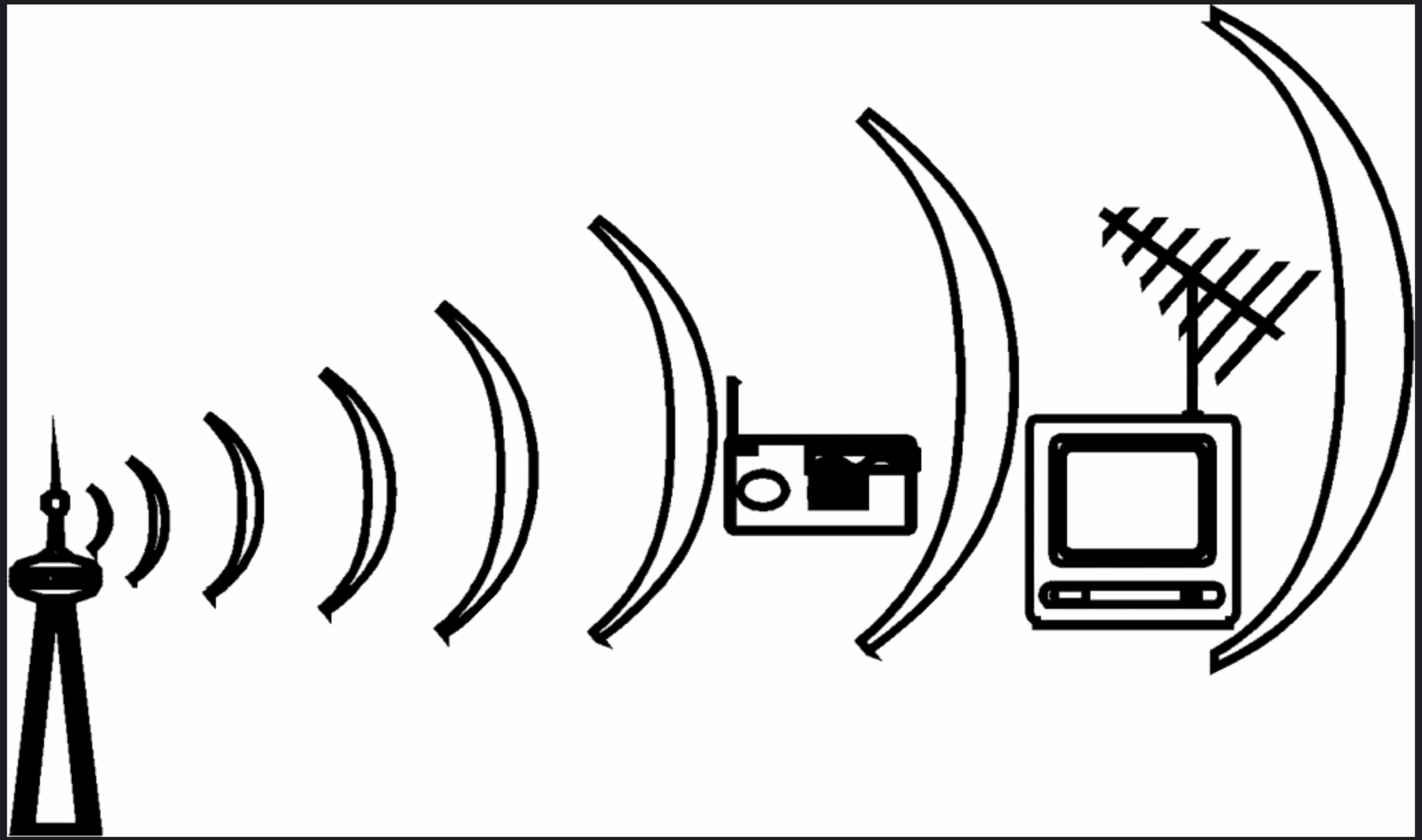
Radio 101

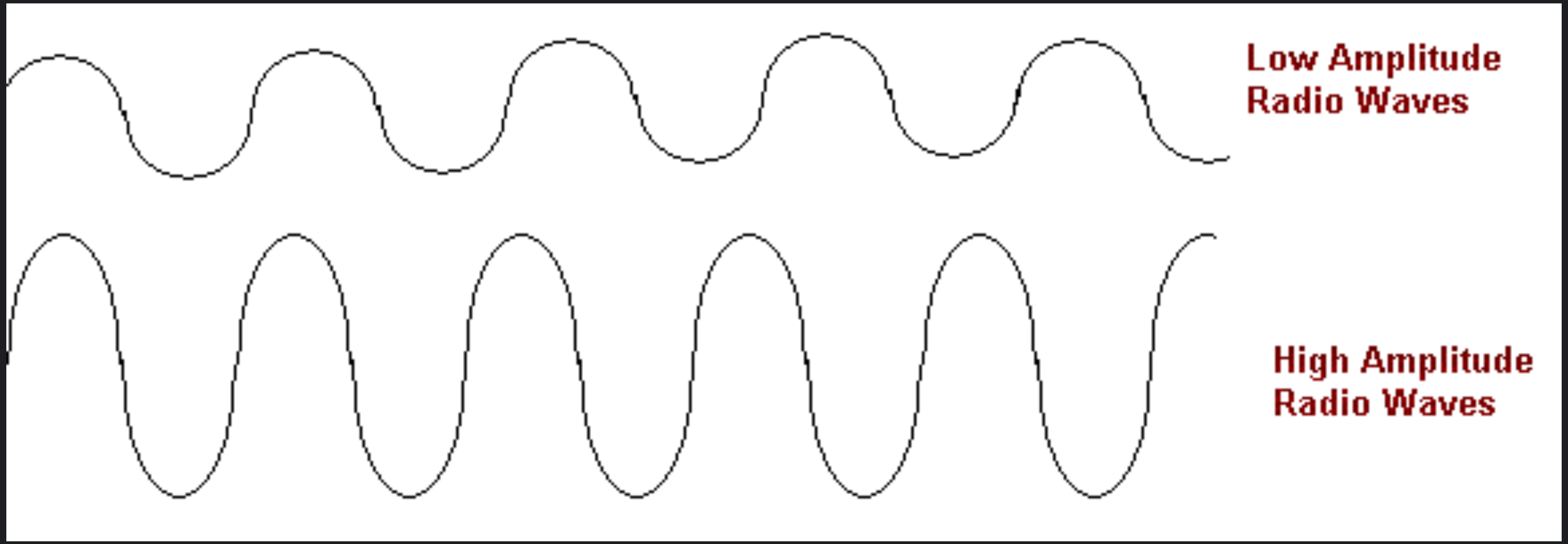
Normal Radio

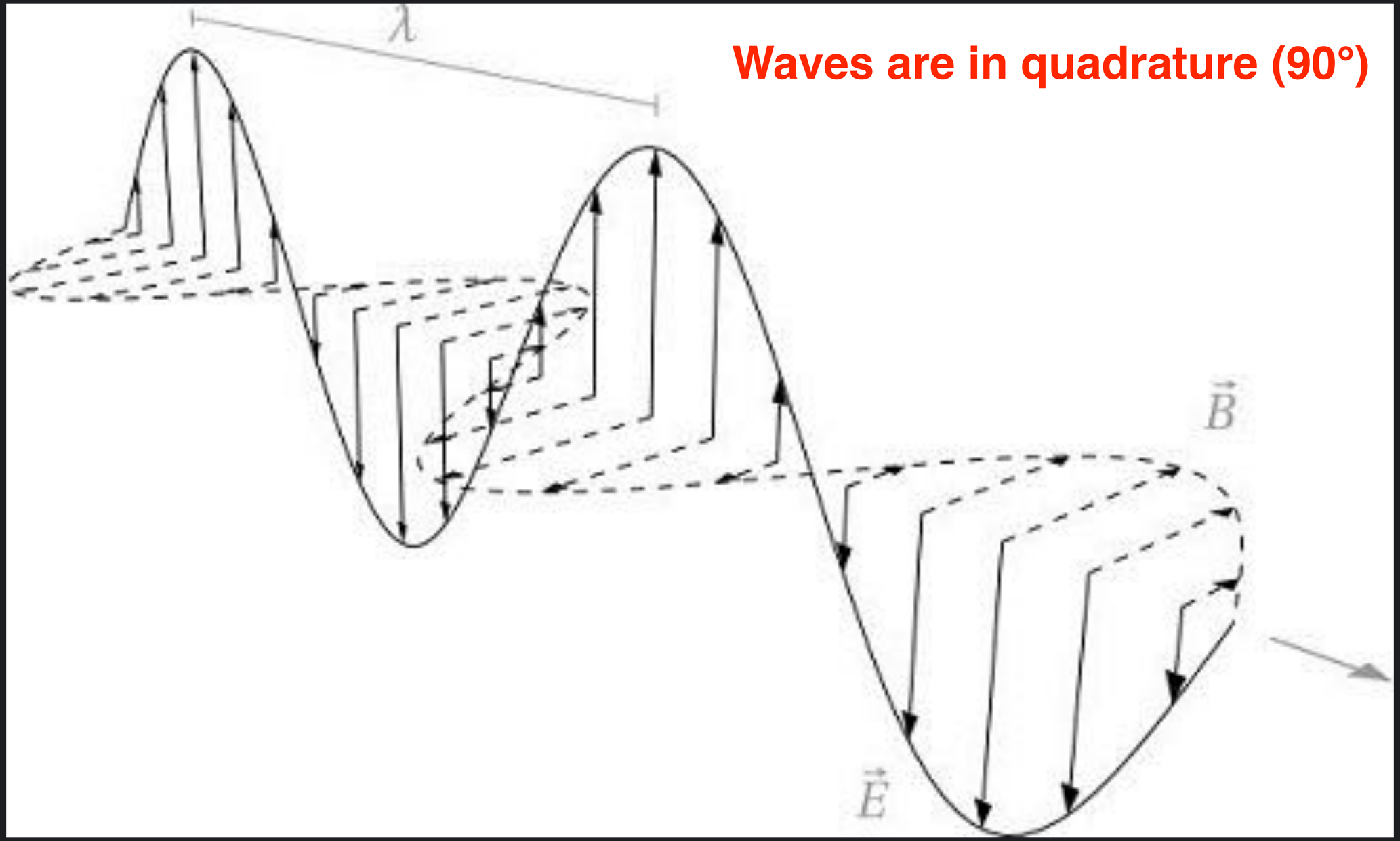


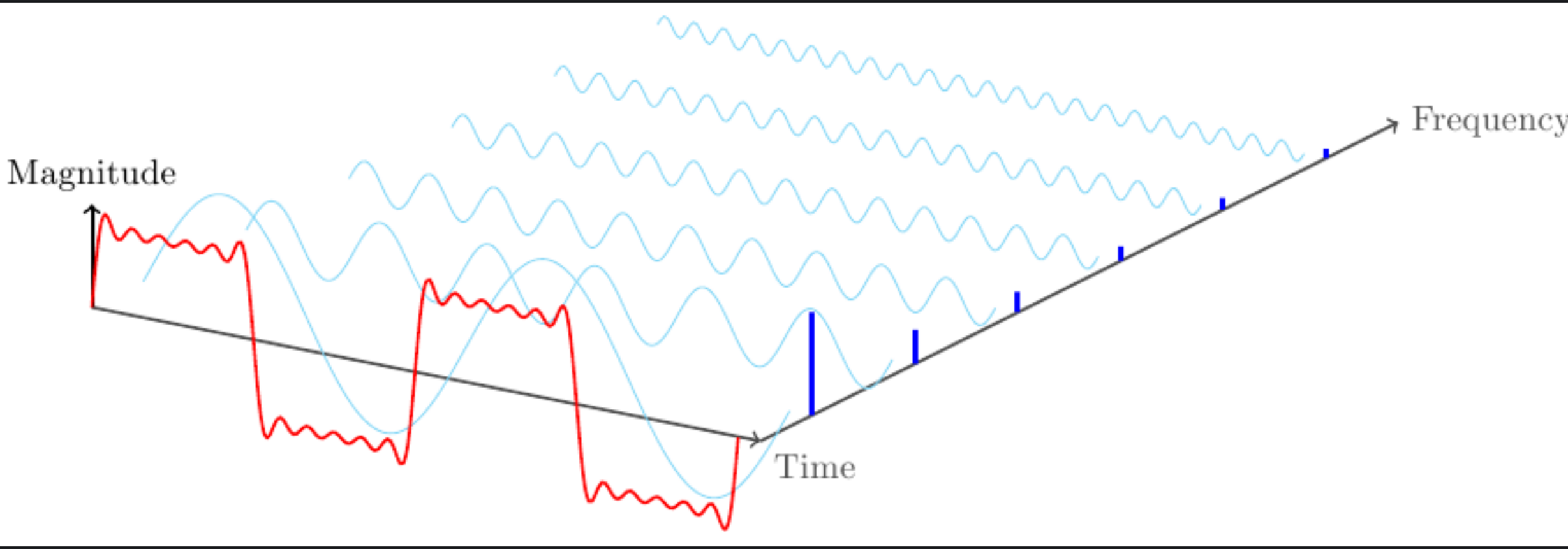
SDR (quadrature)

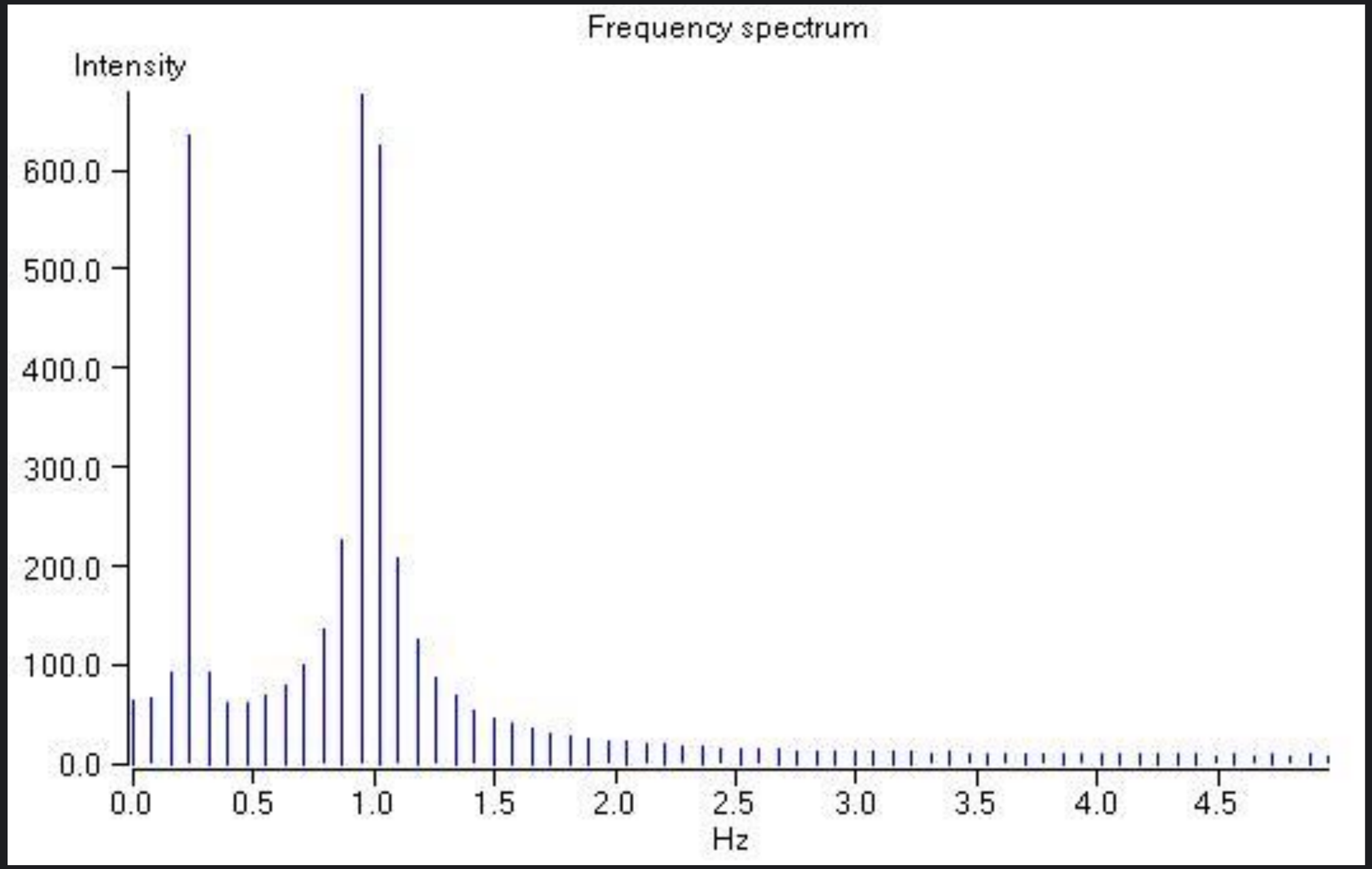





Low Amplitude
Radio Waves
High Amplitude
Radio Waves

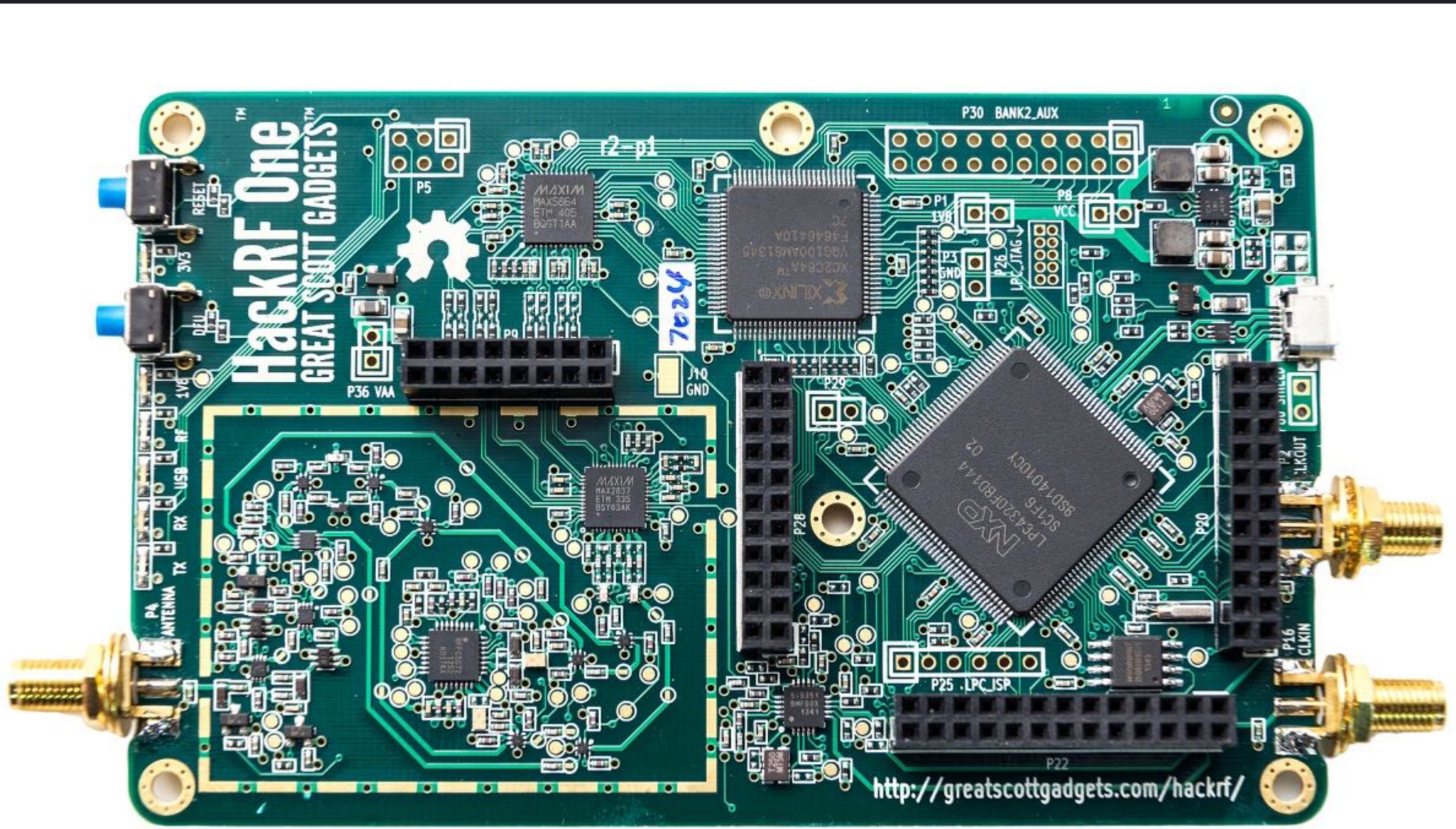

λ
Waves are in quadrature (90°)
$\vec{B}$
$\vec{E}$


Magnitude
Frequency
Time


Frequency spectrum
Intensity
600.0
500.0
400.0
300.0
200.0
100.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Hz

HackRF One


HackRF One
GREAT SCOTT GADGETS
ANTENNA


HackRF One
GREAT SCOTT GADGETS
r2 - p1
P30 BANK2_AUX
P5
P9
P36 VAA
P1
P8
P3
P26
P29
P28
P20
P22
P25 .LPC_JSP
P2
P16
J10
GND
RESET
DFU
3V3
1V8
PA
ANTENNA
TX
RX
USB
RF
CLKOUT
CLKIN
http://greatscottgadgets.com/hackrf/

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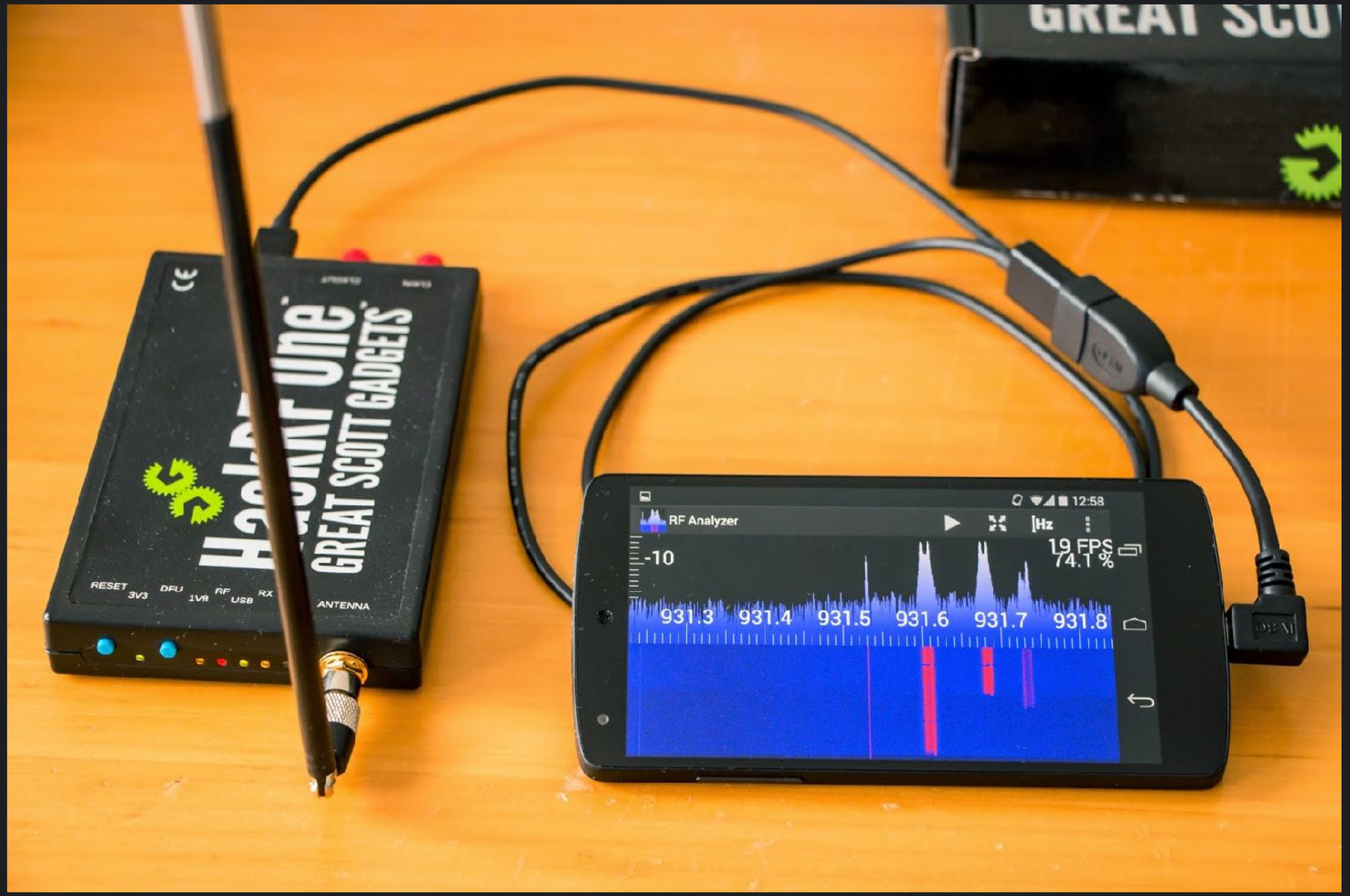
GREAT SCOTT GADGETS
RESET
3V3
DFU
1V8
RF
USB
RX
ANTENNA
12:58
RF Analyzer
[Hz
19 FPS
74.1 %
-10
931.3
931.4
931.5
931.6
931.7
931.8

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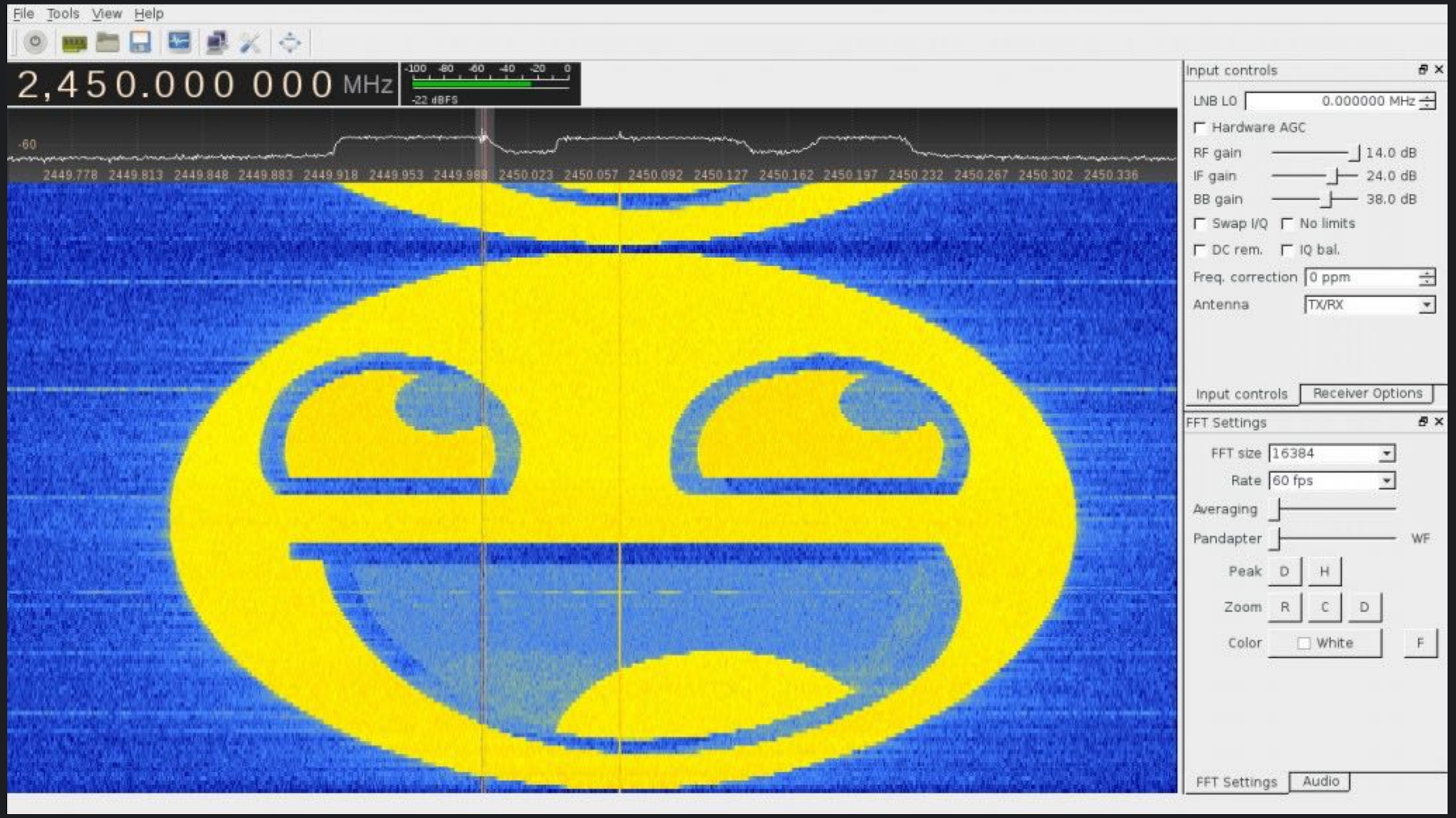
HackRF One Specs

- 1 MHz to 6 GHz operating frequency
- Half-duplex transceiver
- Up to 20 million samples per second
- 8-bit quadrature samples (8-bit I and 8-bit Q)
- Compatible with GNU Radio, SDR#, and more
- Software-configurable RX and TX gain and baseband filter
- Software-controlled antenna port power (50 mA at 3.3 V)
- SMA female antenna connector
- SMA female clock input and output for synchronization
- Convenient buttons for programming
- Internal pin headers for expansion
- Hi-Speed USB 2.0
- USB-powered
- Open source hardware

Demo Time!


File Tools View Help
2,450.000 000 MHz
-100 -80 -60 -40 -20 0
-22 dBFS
-60
2449.778 2449.813 2449.848 2449.883 2449.918 2449.953 2449.988 2450.023 2450.057 2450.092 2450.127 2450.162 2450.197 2450.232 2450.267 2450.302 2450.336
Input controls
LNB LO 0.000000 MHz
Hardware AGC
RF gain 14.0 dB
IF gain 24.0 dB
BB gain 38.0 dB
Swap I/Q
No limits
DC rem.
IQ bal.
Freq. correction 0 ppm
Antenna TX/RX
Input controls
Receiver Options
FFT Settings
FFT size 16384
Rate 60 fps
Averaging
Pandapter
WF
Peak D H
Zoom R C D
Color White
F
FFT Settings
Audio

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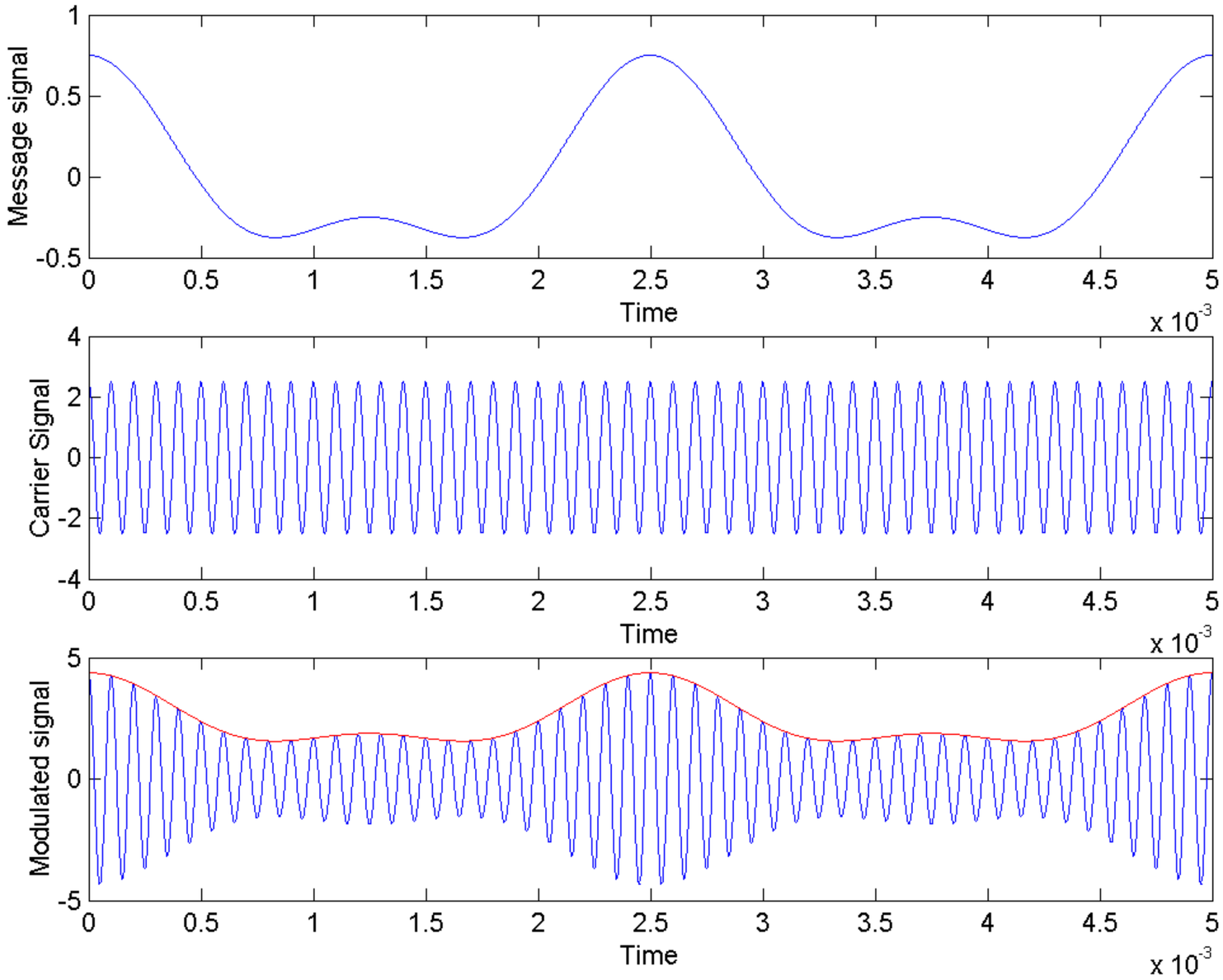
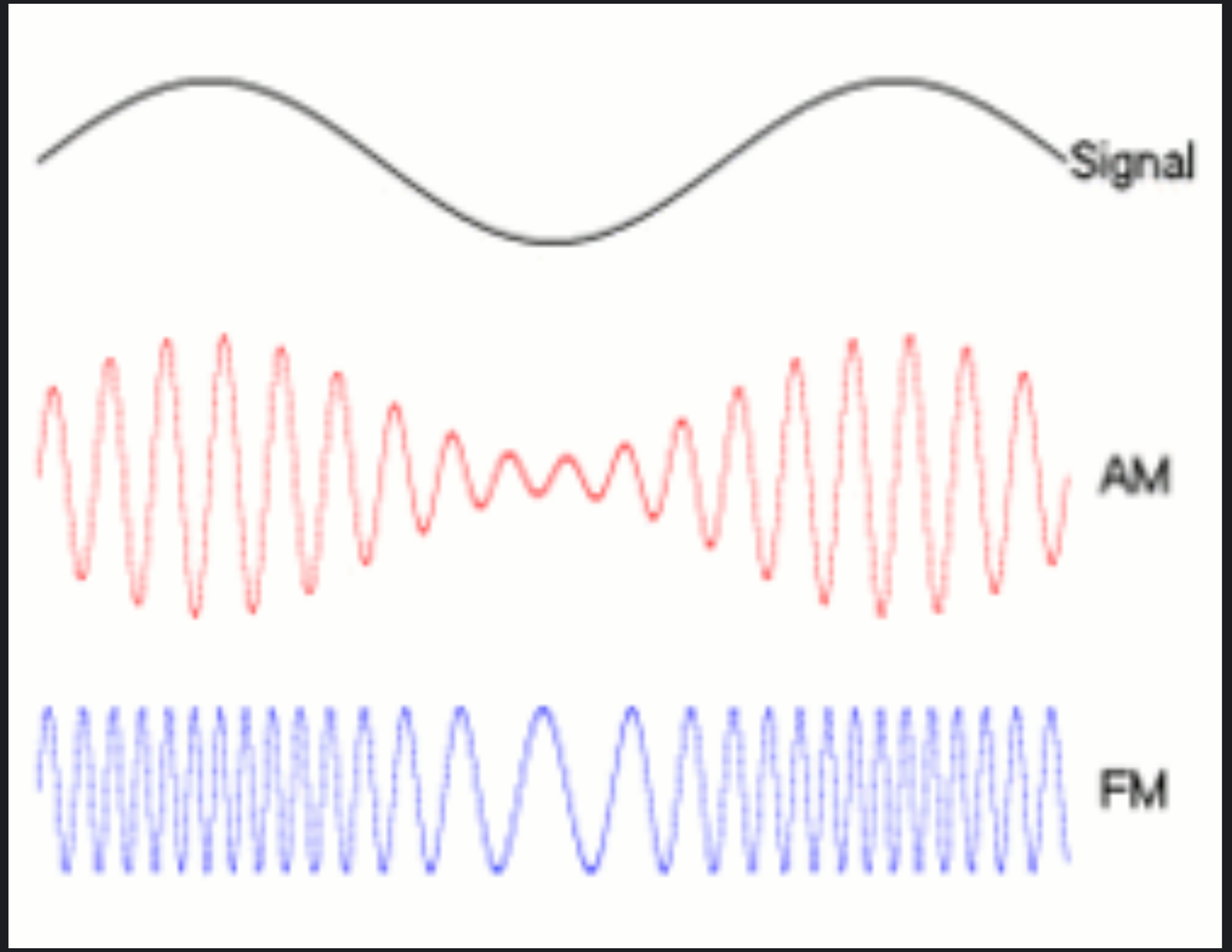
Modulation


Message signal
1
0.5
0
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Time
x 10^-3
Carrier Signal
4
2
0
-2
-4
Time
x 10^-3
Modulated signal
5
0
-5
Time
x 10^-3

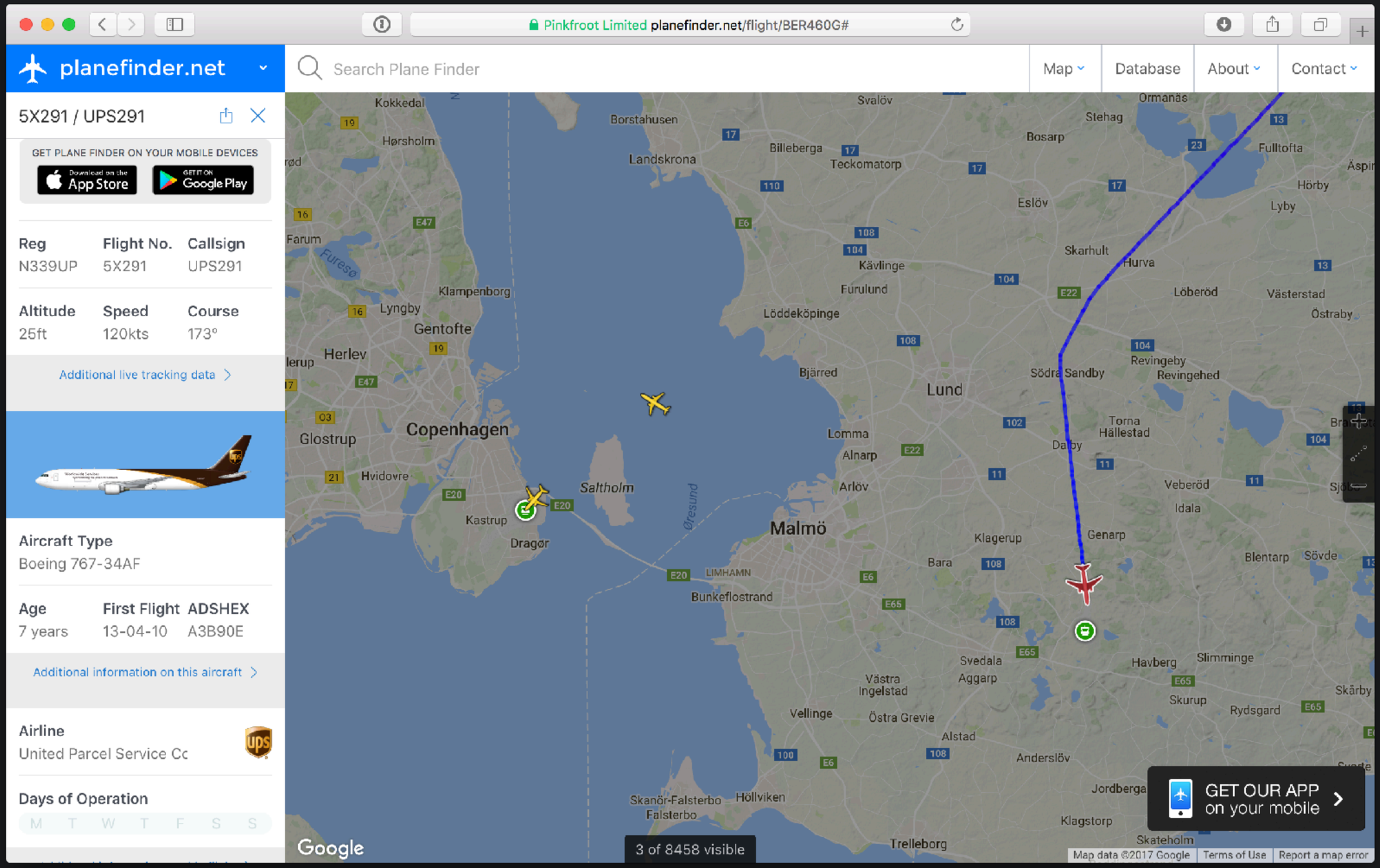

Signal
AM
FM

Use Cases

Use Cases

- FM
- ADS-B
- GSM (Wireshark)
- GPS
- Streaming data over radio

- Doorbells
- Car keys
- Wi-Fi jamming


Pinkfroot Limited planefinder.net/flight/BER460G#
planefinder.net
Search Plane Finder
Map
Database
About
Contact
5X291 / UPS291
GET PLANE FINDER ON YOUR MOBILE DEVICES
Download on the App Store
GET IT ON Google Play
Reg
N339UP
Flight No.
5X291
Callsign
UPS291
Altitude
25ft
Speed
120kts
Course
173°
Additional live tracking data
Aircraft Type
Boeing 767-34AF
Age
7 years
First Flight
13-04-10
ADSHEX
A3B90E
Additional information on this aircraft
Airline
United Parcel Service Cc
Days of Operation
M T W T F S S
Kokkedal
Hørsholm
Borstahusen
Landskrona
Billeberga
Teckomatorp
Svalöv
Ormanäs
Stehag
Bosarp
Fulltofta
Hörby
Lyby
Eslöv
Skarhult
Hurva
Löberöd
Västerstad
Östraby
Kävlinge
Furulund
Löddeköpinge
Farum
Furesø
Klampenborg
Lyngby
Gentofte
Herlev
Bjärred
Lund
Revingeby
Revingehed
Södra Sandby
Copenhagen
Glostrup
Hvidovre
Saltholm
Kastrup
Dragør
Øresund
Lomma
Alnarp
Arlöv
Malmö
Torna Hällestad
Dalby
Veberöd
Idala
Klagerup
Genarp
Bara
Blentarp
Sövde
LIMHAMN
Bunkeflostrand
Svedala
Aggarp
Västra Ingelstad
Havberg
Slimminge
Skurup
Rydsgard
Skärby
Vellinge
Östra Grevie
Alstad
Anderslöv
Jordberga
Skanör-Falsterbo
Falsterbo
Höllviken
Klagstorp
Skateholm
Trelleborg
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Cue for Demo

References

github.com / watson / monster-drift

github.com / mappum / node-hackrf

greatscottgadgets.com / sdr

Köszönöm

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github.com/watson

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(Pssst, we're hiring)