



Thomas Watson

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@wa7son

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[github.com/watson](https://github.com/watson)

```
apt-get install node
```



apt-get install node



apt-get install nodejs

# Build your own

# JavaScript Powered Radio



# Who is this guy anyway?

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



# Build your own

# JavaScript Powered Radio



# An introduction to

# Software Defined Radio

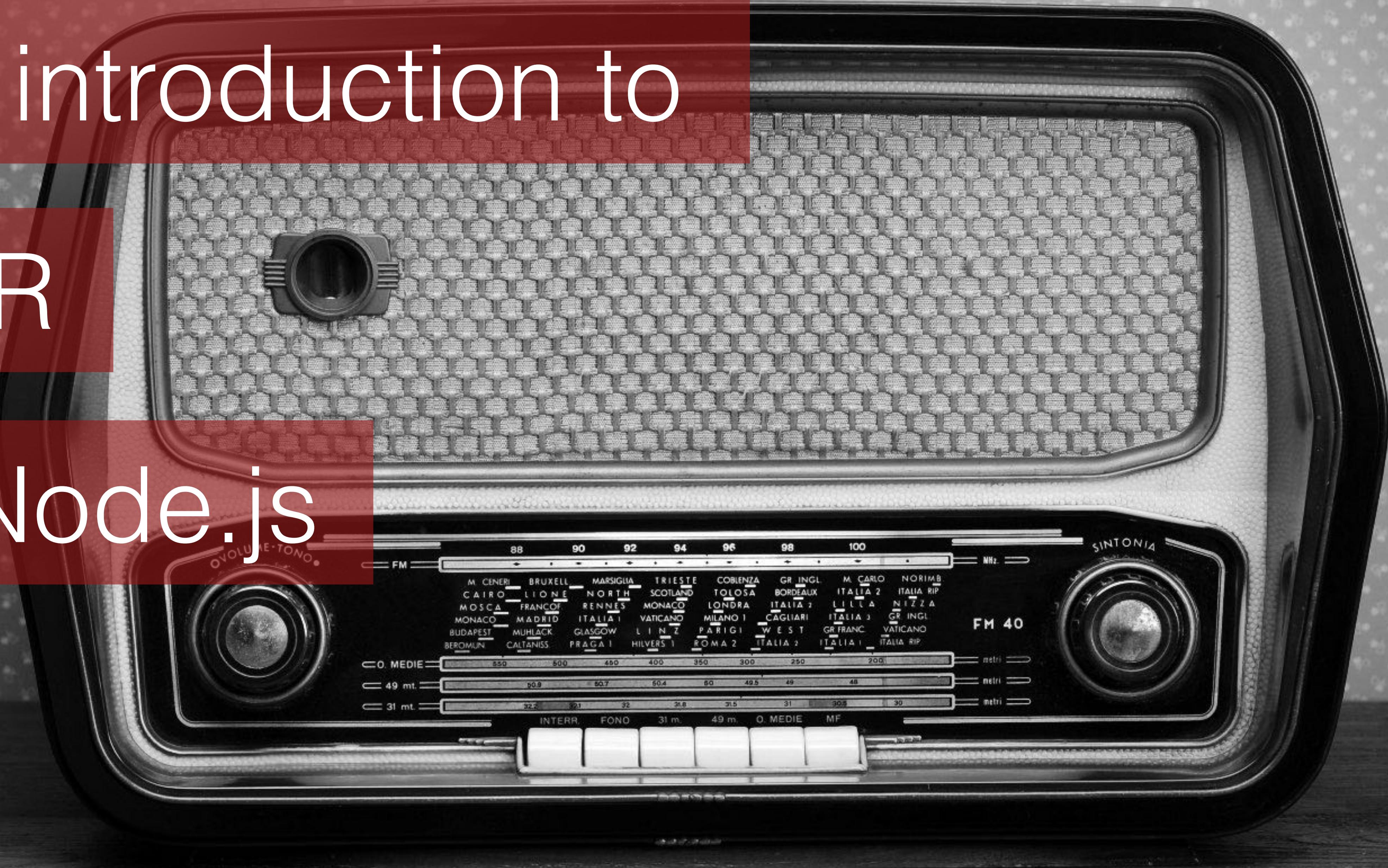
# in Node.js



# An introduction to

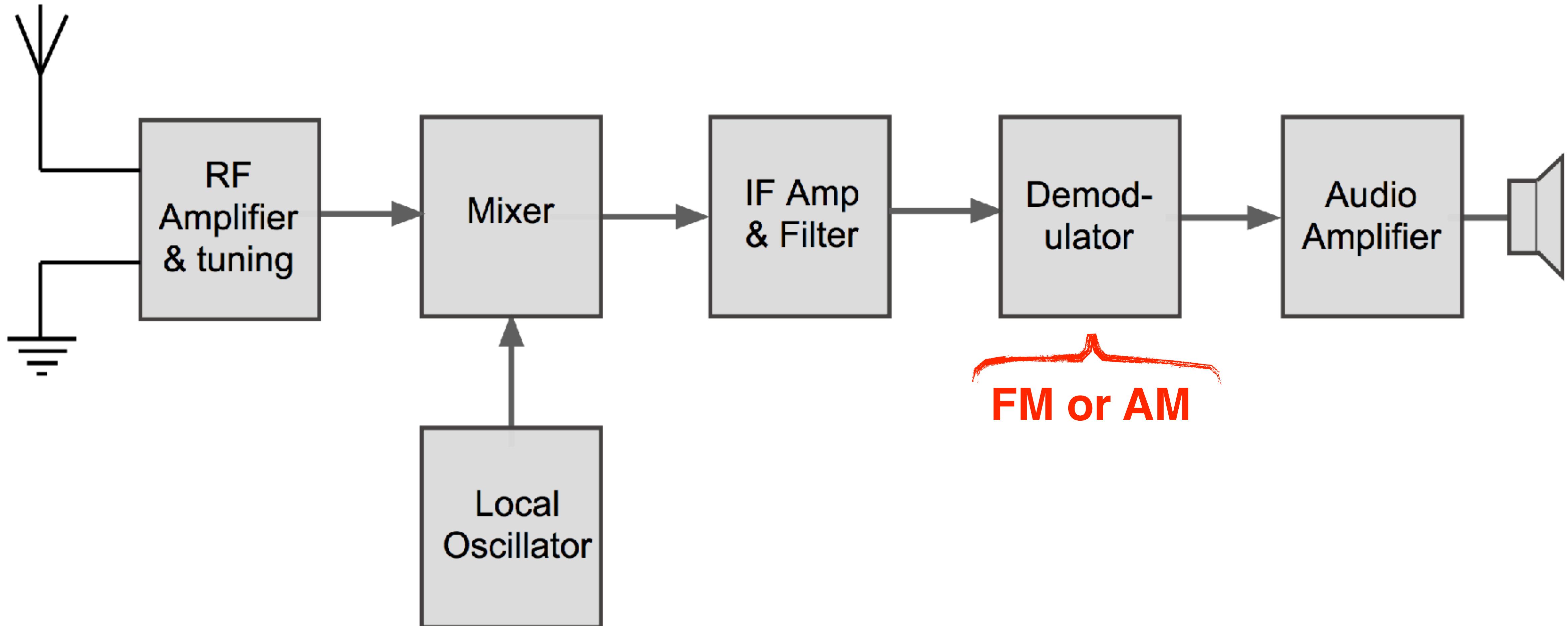
## SDR

### in Node.js

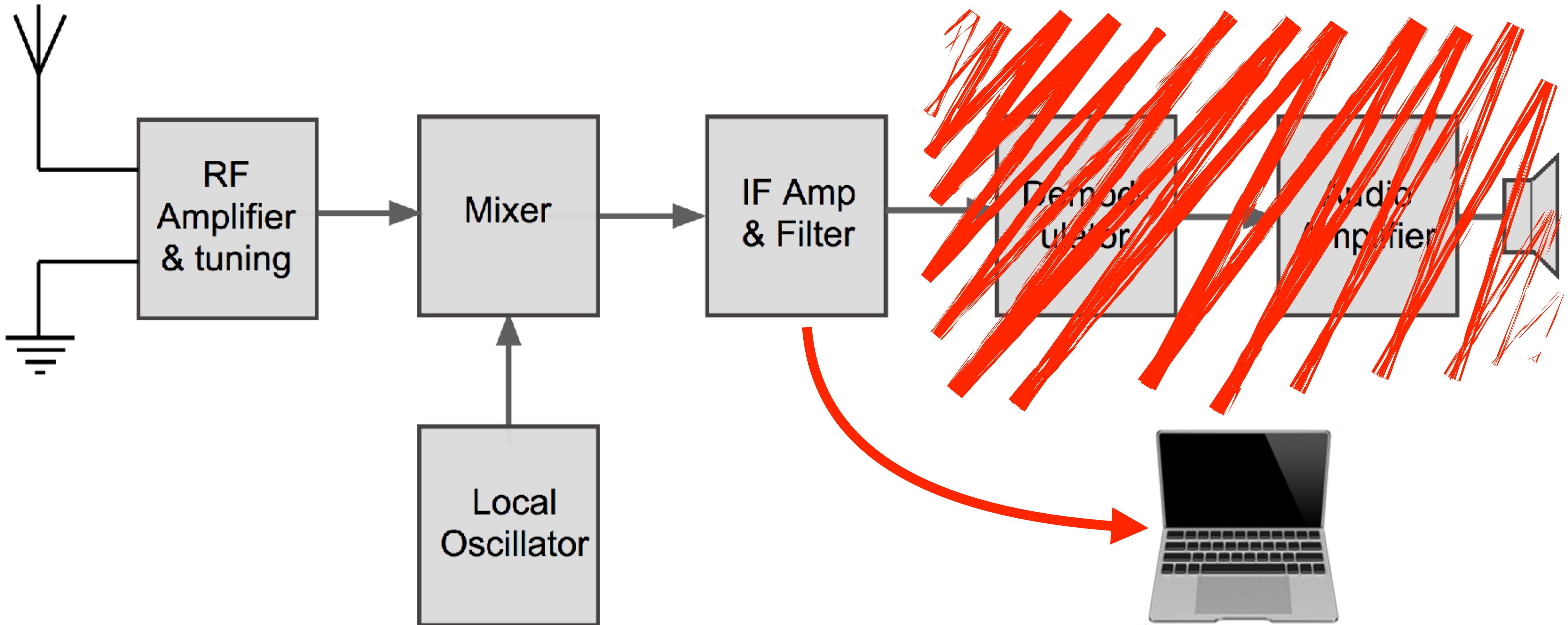


# Radio 101

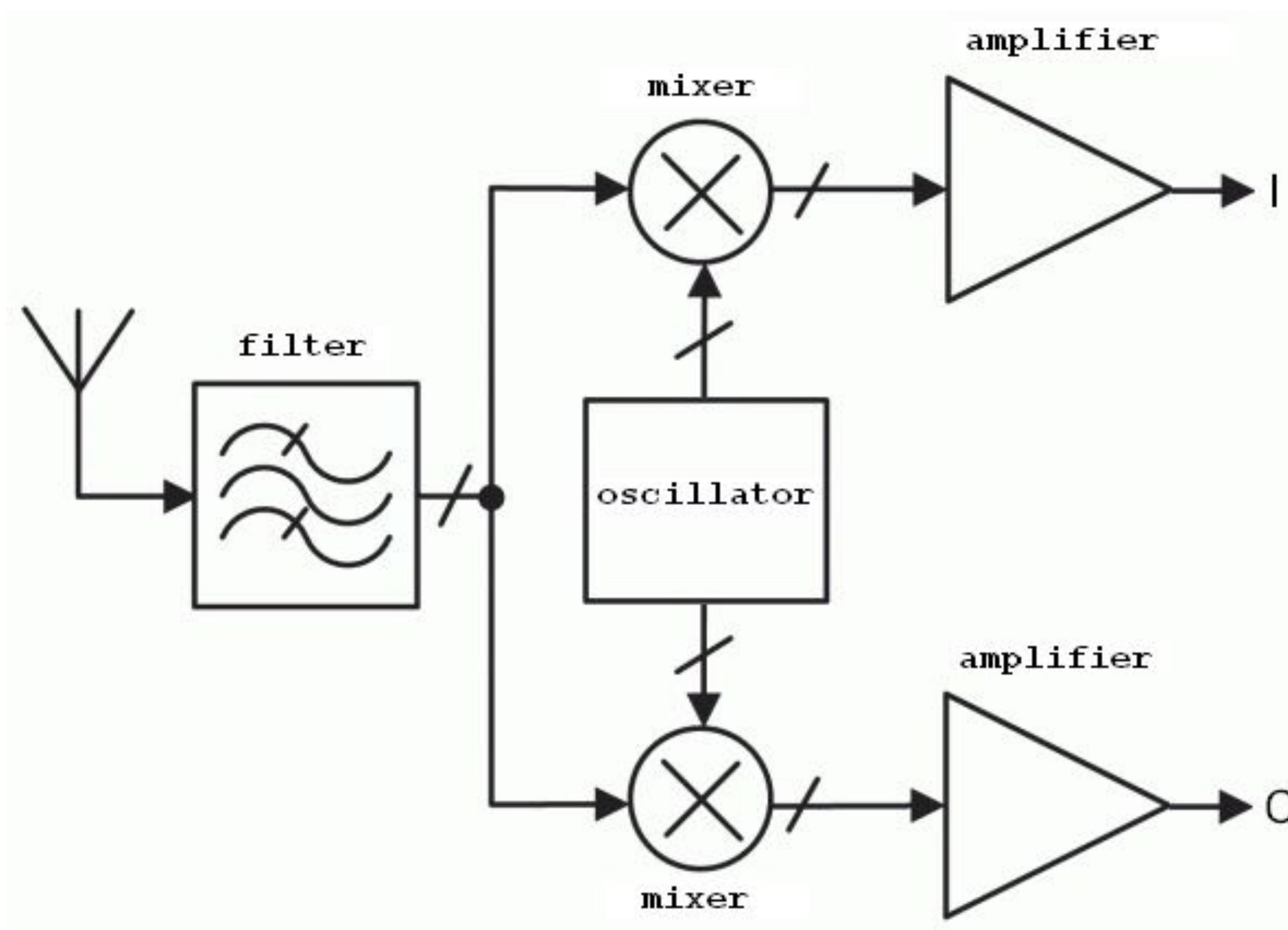
# Normal Radio



# ~~Normal Radio~~

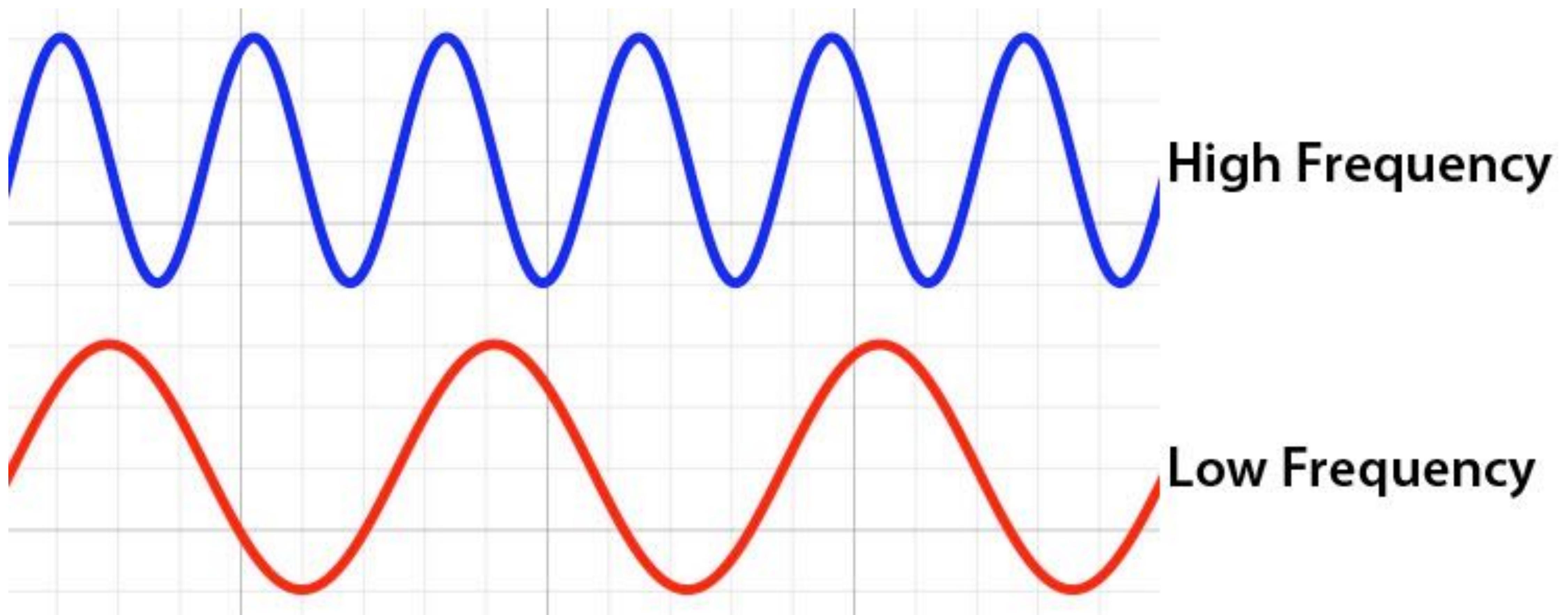


# SDR (quadrature)





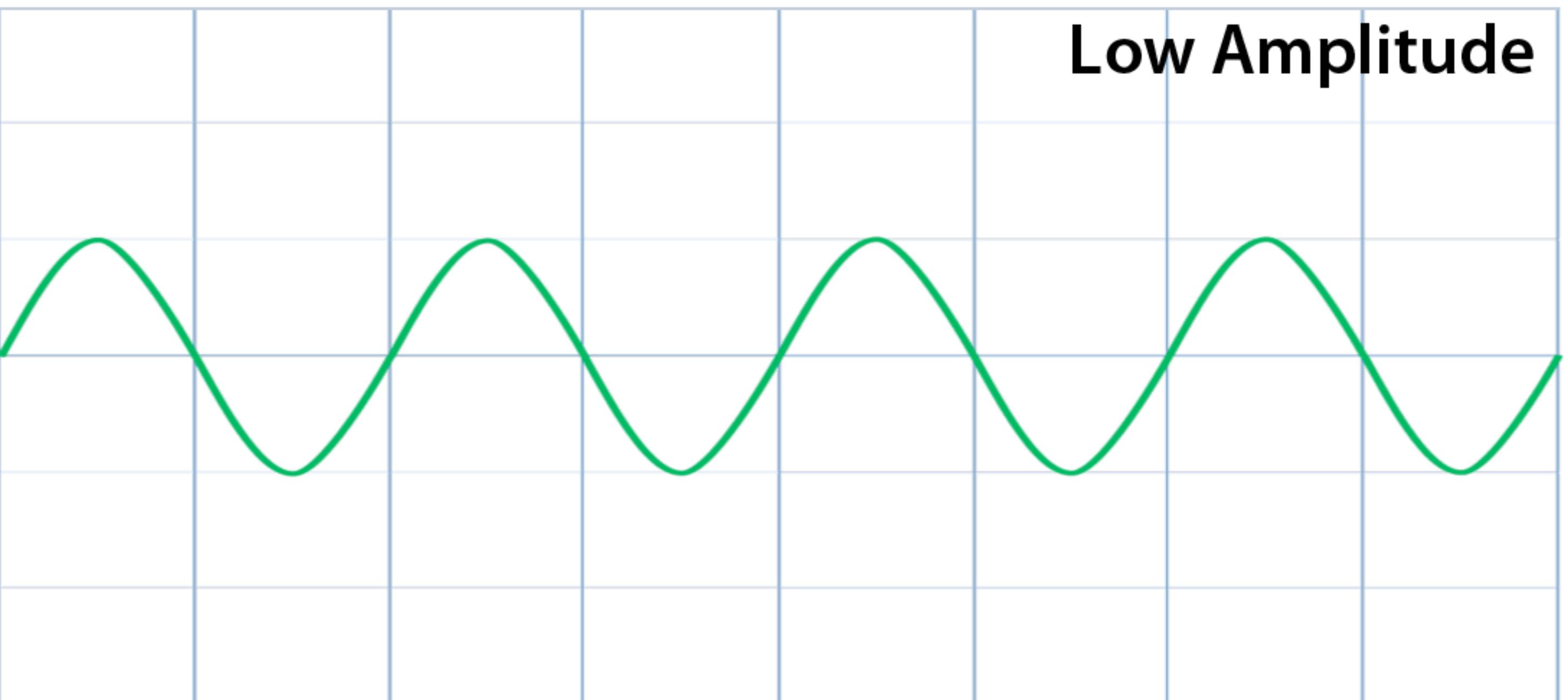
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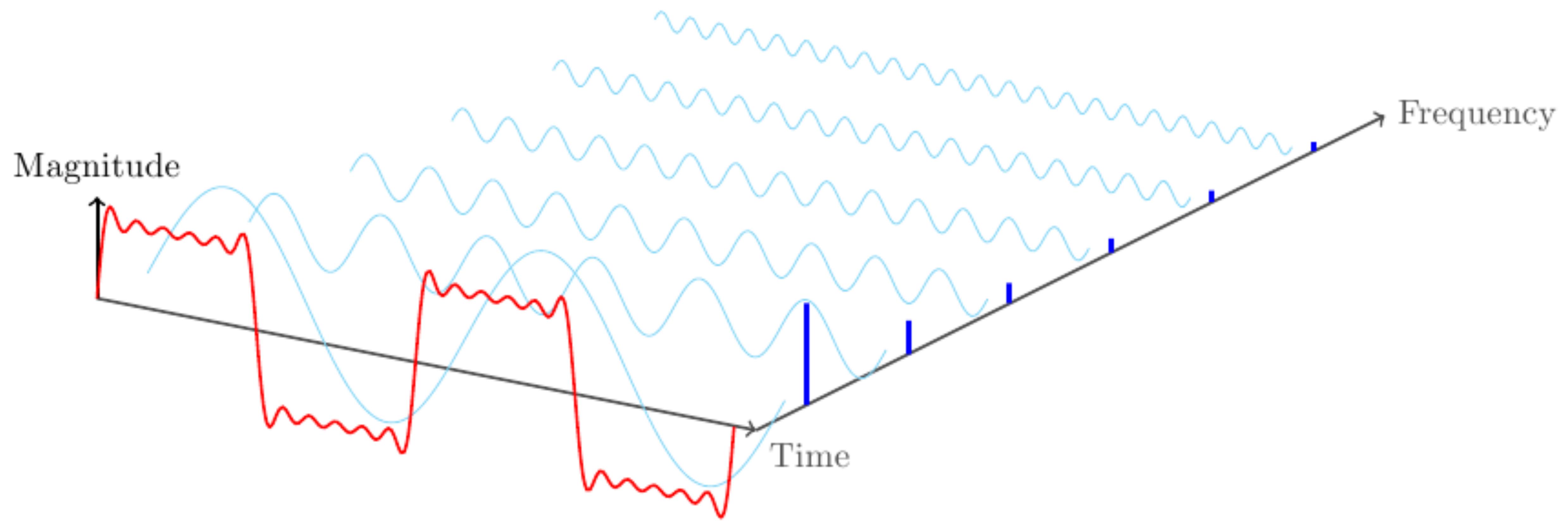


**High Amplitude**

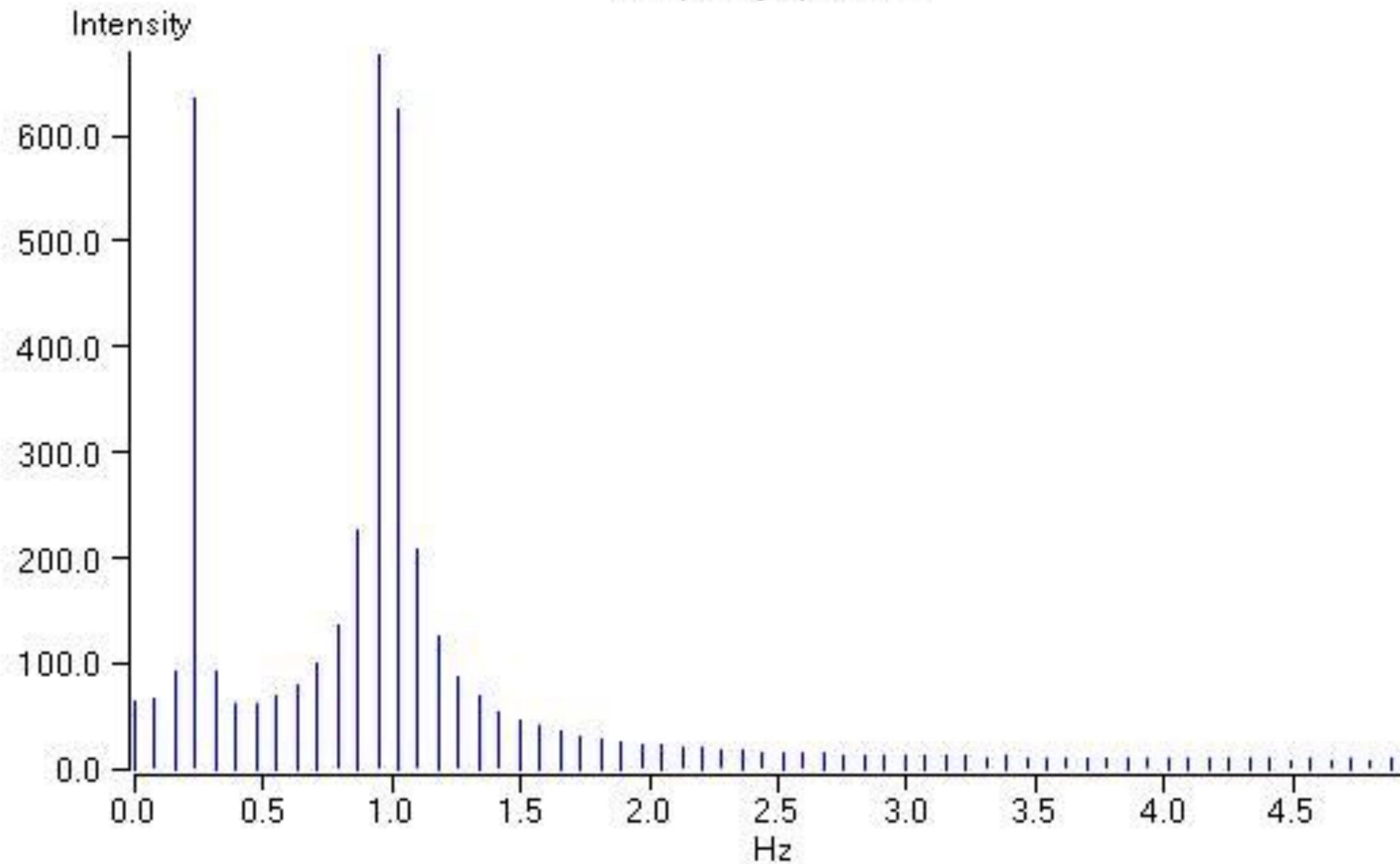


**Low Amplitude**

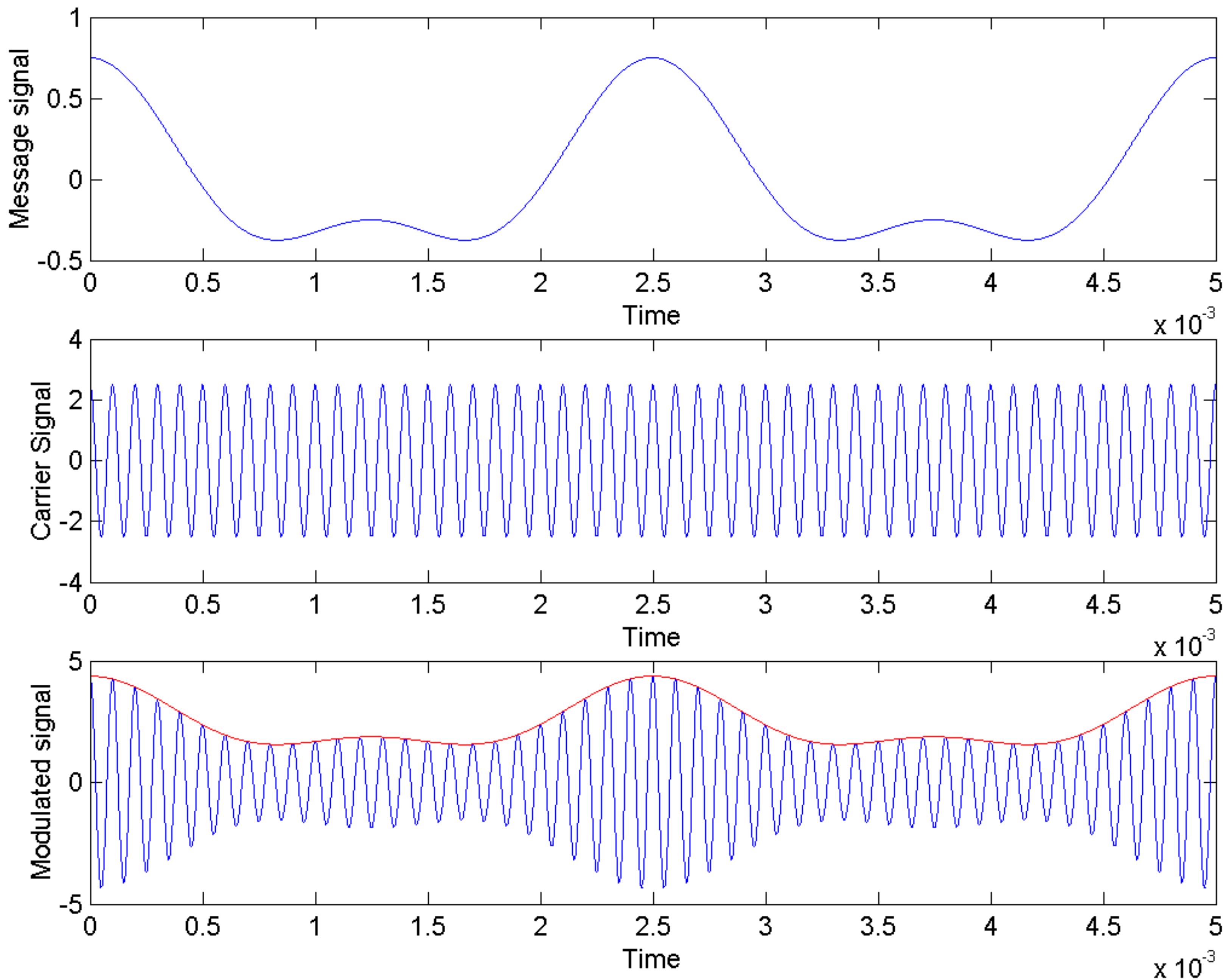


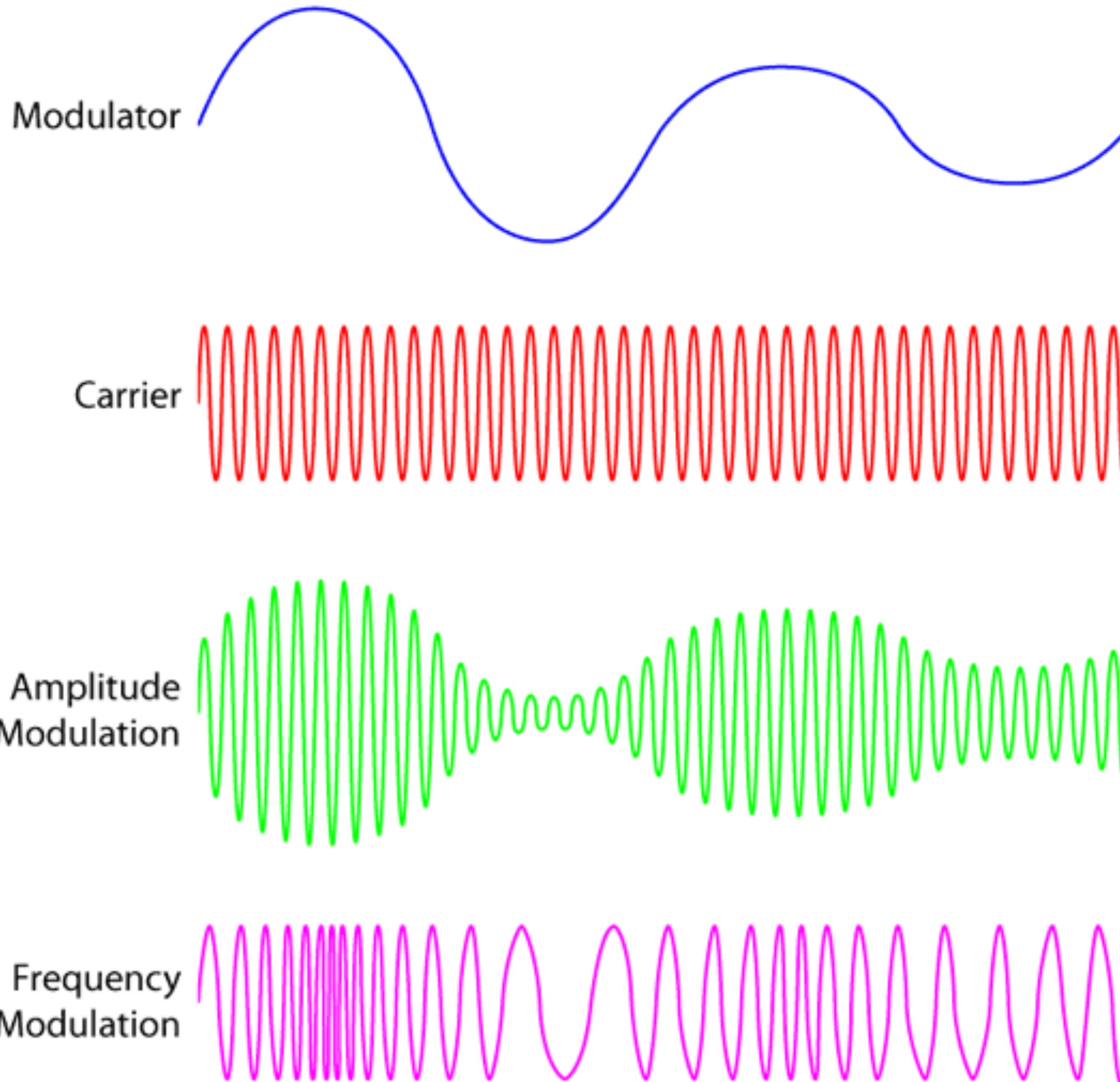


Frequency spectrum



# Modulation





# Commercial SDR

**Ettus**  
Research™  
*A National Instruments Company*

Expensive: €5,350

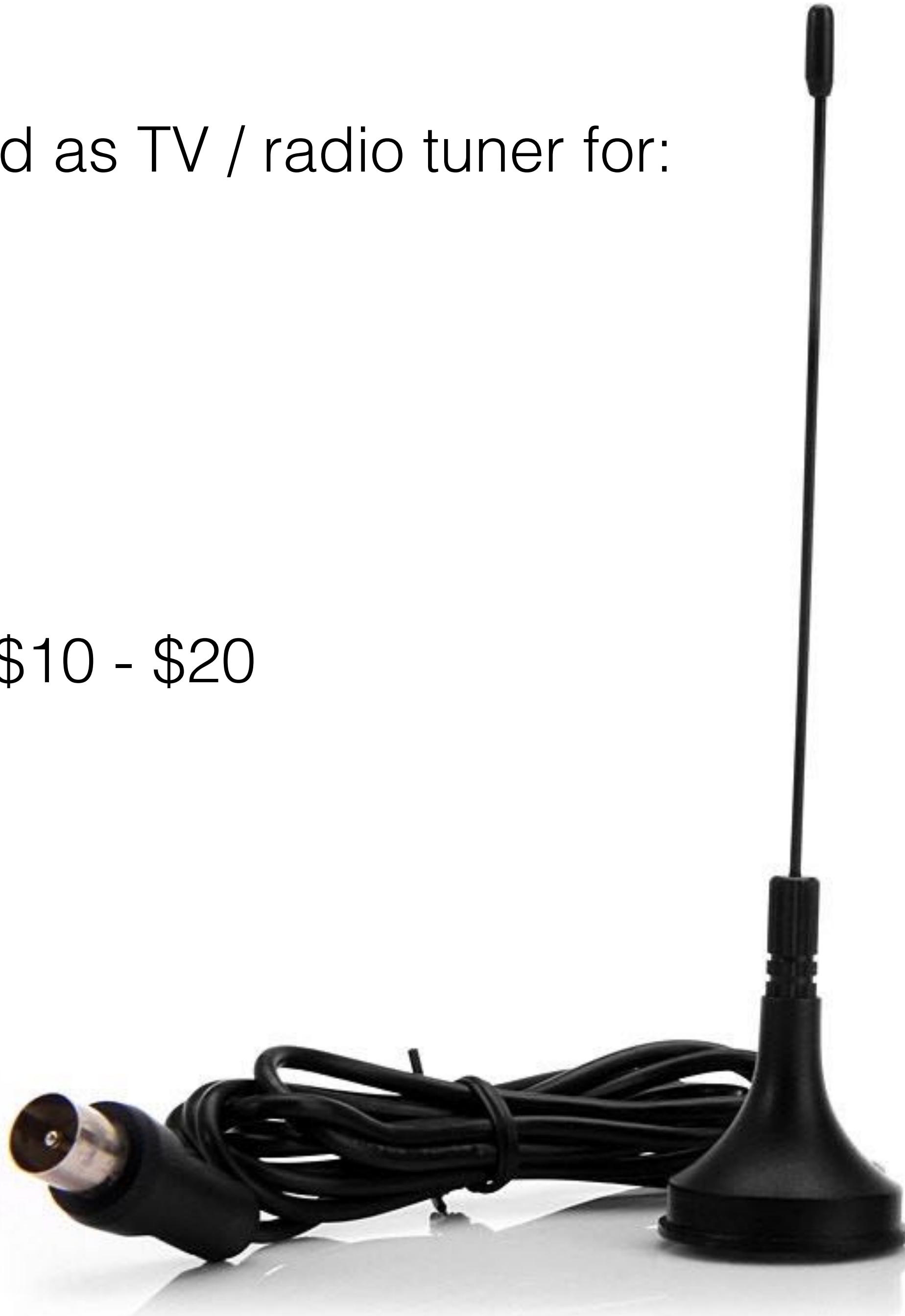


# RTL SDR

Marketed as TV / radio tuner for:

- DVB-T
- DAB
- FM

Cheap: \$10 - \$20



Contains a Realtek RTL2832U chip

💻 Hackable! 💻

Supports approx. 24 MHz – 1766 MHz



# Cue for Demo

Hex	Mode	Sqwk	Flight	Alt	Spd	Hdg	Lat	Long	Sig	Msgs	Ti\
406321	S	5371	EZY36YT	38000	371	048	41.196	1.943	9	48	0
31FF13	S	7020	N	2875					9	81	0
400832	S			29925	421	144			6	4	21
34150F	S	5545		9875	282	331	41.253	1.879	7	55	0
4CA54D	S		IBK3655	18400	413	353	41.667	1.648	5	46	0
49524C	S	5557	0BS455	34000	399	077	41.390	2.576	7	128	6
34254E	S	5503		36000					6	157	0
400DA0	S	0741	BAW2546	37000	461	169	41.284	2.233	12	142	1
3430CD	S	3741	VLG7365	2275	208	327	41.341	2.326	15	229	0
406CD2	S	5315	EZY87YP	38000	414	349	41.920	1.223	4	74	0
345205	S			24400	360	051	41.257	2.540	7	29	19
4CA816	S	7712		8750	266	182	41.626	2.620	6	37	19
4066FA	S	2714	EXS83C	275	135	245	41.318	2.139	12	22	26
345116	S	7647	VLG80KY	1575	178	246	41.344	2.214	26	269	0
3C49B1	S	5311	NLY7HN	38000	411	354	42.034	1.577	16	504	0
4A91F9	S	5530	SAS81G	18775	429	297	41.495	1.572	6	329	0
400CD6	S	5314	EZY53YH	38000	409	356	42.175	1.062	4	57	0
4CA4E7	S	5565		32350	431	336			5	39	1
3424D1	S	6037	VLG1295	9250	245	109	41.556	1.977	21	361	0
345314	S	6320	VLG3215	5350	241	098	41.476	2.190	17	387	0

DUMP1090

localhost:8080

Thomas

Map 243c

Rubí Cerdanyola del Vallès Sant Cugat del Vallès Parc Natural de la Serra de Collserola Badalona Sant Adrià de Besòs GRÀCIA L'Hospitalet de Llobregat Sant Boi de Llobregat Viladecans Gavà Castelldefels Parc del Garraf Martorell Castellbisbal Vilassar de Mar

Local Time UTC Time [ Reset Map ] [ Settings ]

**VLG7365** [FR24] [FlightStats] [FlightAware]  
Altitude: 1775 ft Squawk: 3741  
Speed: 172 kt ICAO (hex): 3430cd  
Track: 248° (W)  
Lat/Long: 41.34686, 2.225168

ICAO	Flight	Squawk	Altitude	Speed	Track	Nsqs	Seen
344693			0	0		1	44
345116	VLG80KY	7647	375	138	247	522	3
3430ed	VLG7365	3741	1775	172	248	496	0
345314	VLG3215	6320	4125	210	142	807	8
3424d1	VLG1295	6037	7625	222	94	1056	0
34150f	VLG1524	5545	12325	364	329	629	0
4ca54d	IBK3655	5515	21750	428	353	480	0
4a91f9	SAS81G	5530	22225	415	1	726	1
49524c	OBB8455	5557	34000	399	77	138	7
34254e	ANE50TJ	5503	36000	0		533	1
400da0	BAW2546	0741	36975	462	169	208	21
3c6dcc			37025	0		5	31
3c49b1	NLY7HN	5311	38000	414	354	1048	5
485061	TRA42G	5532	38000	384	12	53	10
406321	EZY36YT	5371	38000	373	58	217	1
406cd2	EZY87YP	5315	38025	414	350	157	0
400cd6	EZY53YH	5314	38025	409	356	68	53
3440cf	AEA1301	5561	40000	433	91	61	0

Google

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DUMP1090

localhost:8080

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Map

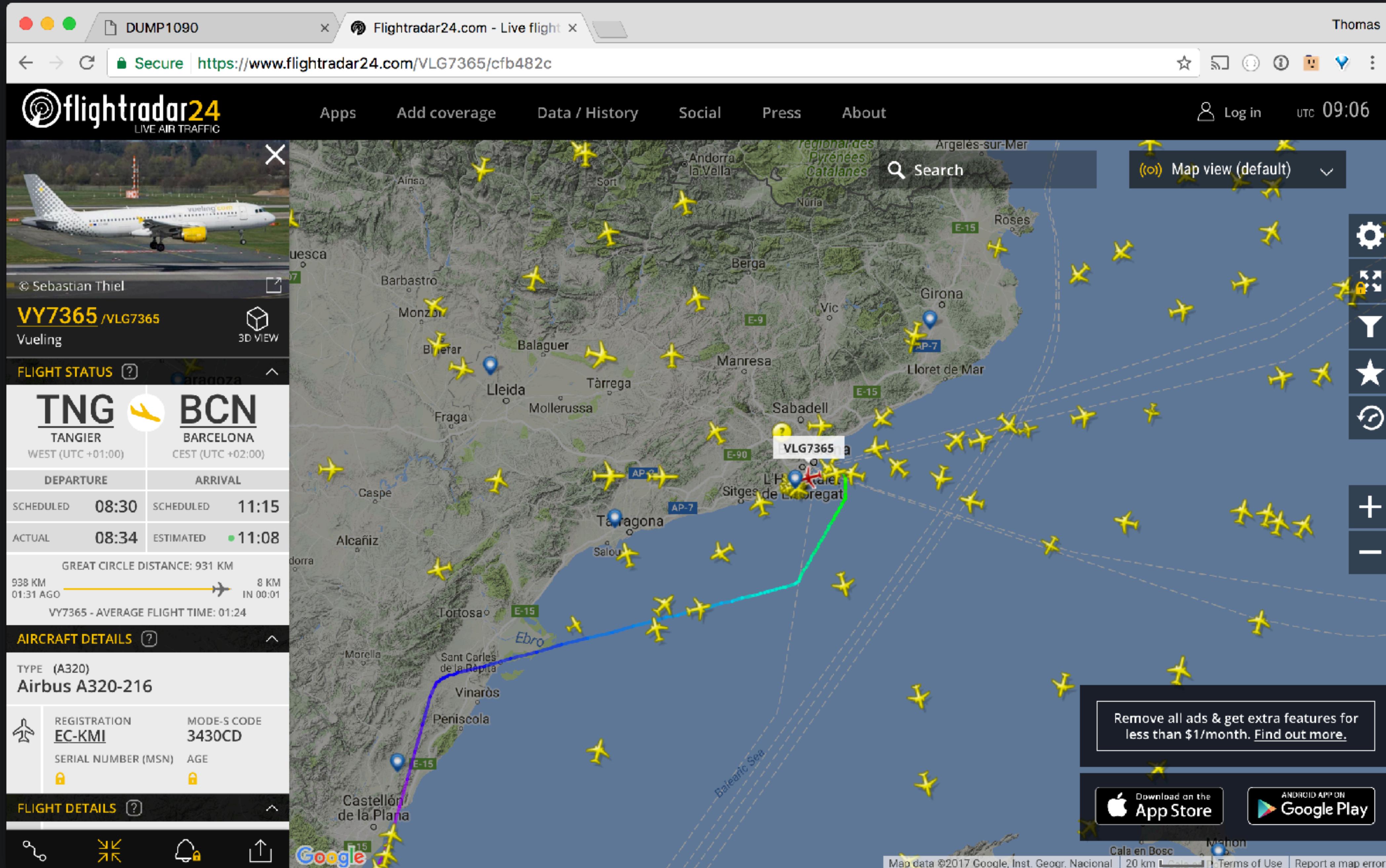
Local Time UTC Time [ Reset Map ] [ Settings ]

**VLG7365** [FR24] [FlightStats] [FlightAware]  
Altitude: 1525 ft Squawk: 3741  
Speed: 167 kt ICAO (hex): 3430cd  
Track: 247° (SW)  
Lat/Long: 41.342148, 2.210571

ICAO	Flight	Squawk	Altitude	Speed	Track	Nsqs	Seen
345116	VLG80KY	7647	250	138	247	525	8
3430cd	VLG7365	3741	1525	167	247	576	0
345314	VLG3215	6320	3625	207	199	873	0
3424d1	VLG1295	6037	7300	222	90	1191	0
34150f	VLG1524	5545	13025	365	328	685	1
4ca54d	IBK3655	5515	22200	431	353	536	1
4a91f9	SAS81G	5530	22550	417	1	787	2
49524c	OB8455	5557	34000	399	77	141	12
34254e	ANE50TJ	5503	36000	0		567	4
400da0	BAW2546	0741	36975	462	169	208	36
3c6dec			37025	0		5	46
3c49b1	NLY7HN	5311	38000	414	354	1048	20
485061	TRA42G	5532	38000	384	12	53	25
406321	EZY36YT	5371	38000	374	64	235	0
406cd2	EZY87YP	5315	38025	413	349	197	1
400cd6	EZY53YH	5314	38025	411	356	72	2
3440cf	AEA1301	5561	40000	433	91	167	0

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Google



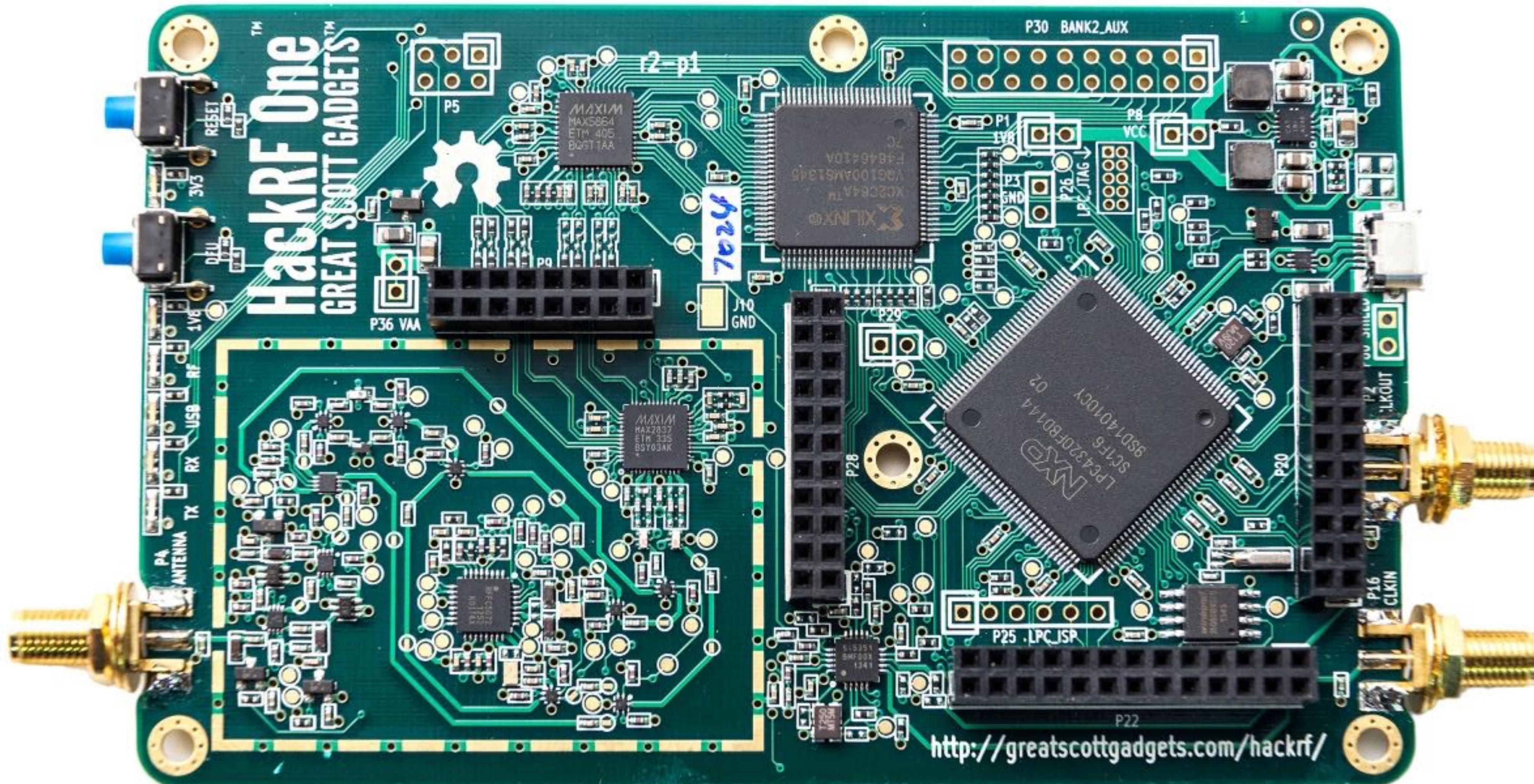
# HackRF One

Funded by:



Affordable: \$299



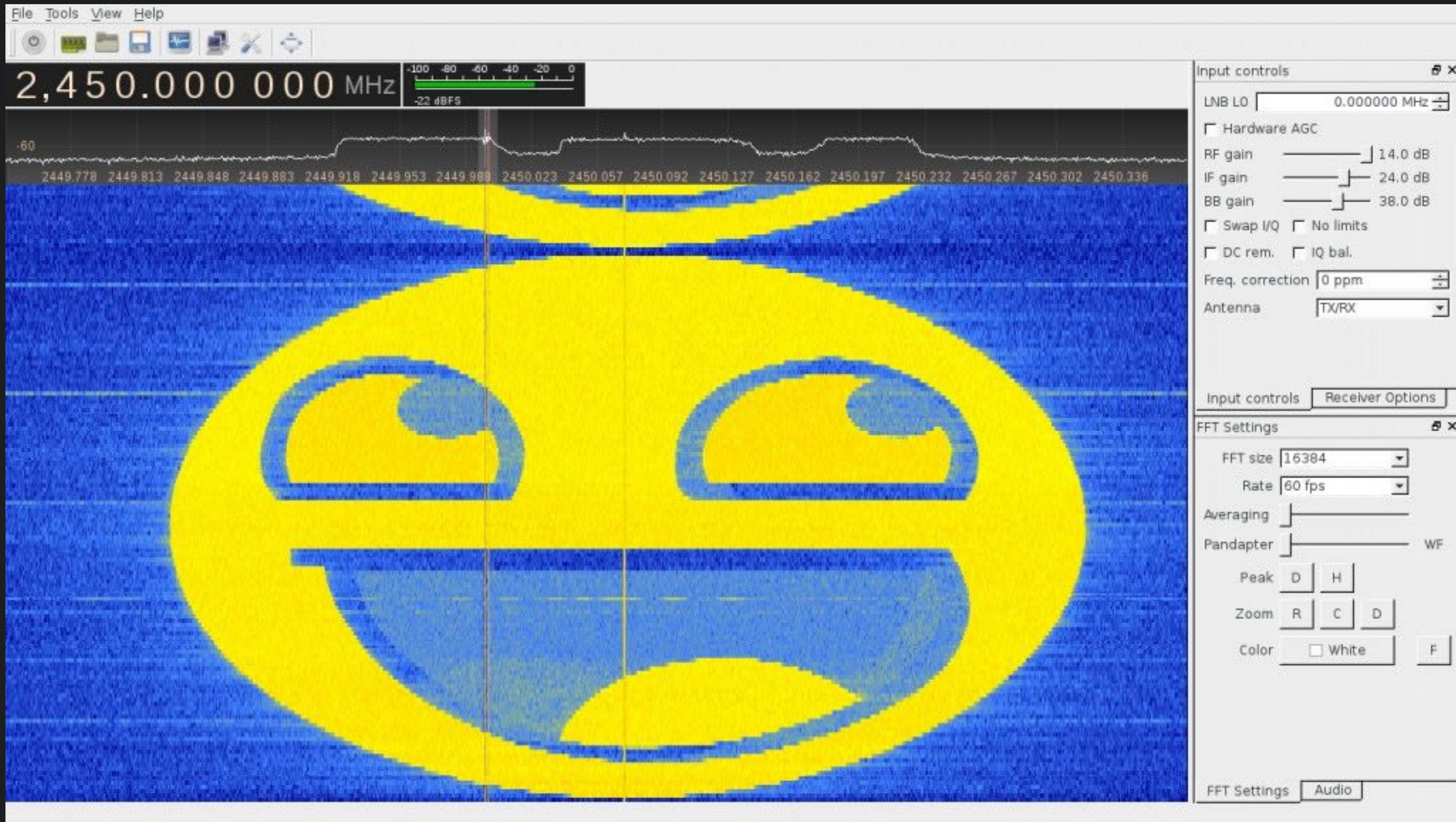




# HackRF One Specs

- 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!



# Use Cases

# Use Cases

- FM
- ADS-B
- GSM (Wireshark)
- GPS
- Streaming data over radio
- Doorbells
- Car keys
- Wi-Fi jamming



# References

[github.com / watson / monster-drift](https://github.com/watson/monster-drift)

[github.com / mappum / node-hackrf](https://github.com/mappum/node-hackrf)

[greatscottgadgets.com / sdr](http://greatscottgadgets.com/sdr)

# Gracias

@wa7son

[github.com/watson](https://github.com/watson)

 opbeat

(Pssst, we're hiring)