Modmobtools

Internals, updates and more

By Sébastien Dudek

Troopers - Telco Sec Day

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About me

- Sébastien Dudek (@FlUxIuS)
- Working at Synacktiv: pentests, red team, audits, vuln researches
- Likes radio and hardware
- And to confront theory vs. practice

Introduction

- Pentesting mobile devices (phones, intercoms, connected cars, ...) → right tools
- Data exchanged: (IoT) devices ↔ server are generally trusted
- Spawn a fake station → OpenBTS/OsmoBTS, OpenBTS-UMTS, srsLTE, Amarisoft...
- But we need also to attract the device to this station
- Also sometimes it’s needed to perform cell monitoring on 2G/3G/4G and soon in 5G.

→ we developped some cool&cheap tools to do that!

Our tools

- Modmobmap: monitoring 2G/3G/4G cells and more
- Modmobjam: smart/targeted jamming tools

1 Modmobmap

2 Modmobjam

3 Updates

4 Conclusion

Where can I use this tool?

Cell towers discovery

- have a list and description of surrounding towers
- spot rogue base stations (mature list required!)

Jamming

Where can I use this tool?

Cell towers discovery

Jamming

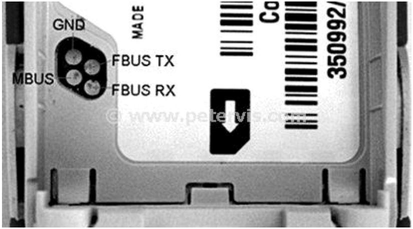
- replace the noisy chineese jammer
- avoid commercial jamming device reworking (bands disabling)

Remember: monitoring with holy relics

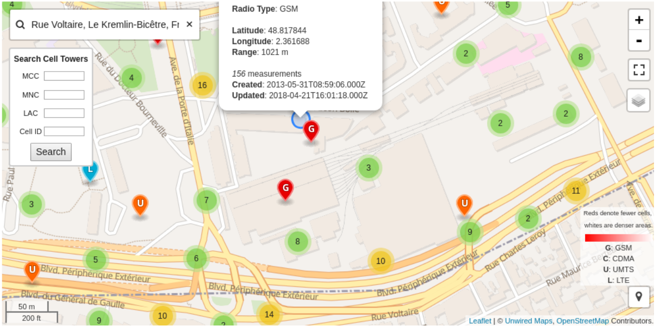
Old Nokia phone have a net monitor mode that could be enabled via FBus or MBUS access.

Tools

- Gnokii, Gammu and others: activate monitor mode, interact with the phone, and capture trace logs.
- DCT3-GSMTAP: evolution of Gammu, capture of GSM Um and SIM-ME via GSMTAP pseudo-header format.



Thing that exists



Rue Voltaire, Le Kremlin-Bicêtre, Fr ×

Search Cell Towers

MCC
MNC
LAC
Cell ID
Search

Radio Type: GSM

Latitude: 48.817844
Longitude: 2.361688
Range: 1021 m

156 measurements
Created: 2013-05-31T08:59:06.000Z
Updated: 2018-04-21T16:01:18.000Z

Reds denote fewer cells, whites are denser areas.

G: GSM
C: CDMA
U: UMTS
L: LTE

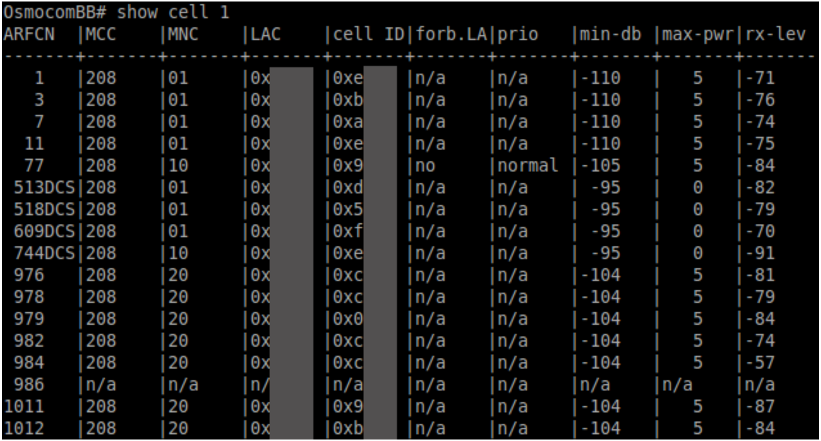
Leaflet | © Unwired Maps, OpenStreetMap Contributors.

+
-
Rue du Docteur Bourneville
Ave. de la Porte d'Italie
Rue Paul
Blvd. Périphérique Extérieur
Blvd. du Général de Gaulle
Rue Voltaire
Rue Charles Leroy
Rue Maurice
50 m
200 ft

OpenCellID example

Very few information... could be used as a database for spotting rogue base stations. But useless for jamming attacks

Thing we wanna do for 3G, 4G and more



```
OsmocomBB# show cell 1
ARFCN  |MCC    |MNC    |LAC    |cell ID|forb.LA|prio   |min-db |max-pwr|rx-lev
-------+-------+-------+-------+-------+-------+-------+-------+-------+-------
   1   |208    |01     |0x[redacted]|0xe[redacted]|n/a    |n/a    |-110   |   5   |-71
   3   |208    |01     |0x[redacted]|0xb[redacted]|n/a    |n/a    |-110   |   5   |-76
   7   |208    |01     |0x[redacted]|0xa[redacted]|n/a    |n/a    |-110   |   5   |-74
  11   |208    |01     |0x[redacted]|0xe[redacted]|n/a    |n/a    |-110   |   5   |-75
  77   |208    |10     |0x[redacted]|0x9[redacted]|no     |normal |-105   |   5   |-84
 513DCS|208    |01     |0x[redacted]|0xd[redacted]|n/a    |n/a    | -95   |   0   |-82
 518DCS|208    |01     |0x[redacted]|0x5[redacted]|n/a    |n/a    | -95   |   0   |-79
 609DCS|208    |01     |0x[redacted]|0xf[redacted]|n/a    |n/a    | -95   |   0   |-70
 744DCS|208    |10     |0x[redacted]|0xe[redacted]|n/a    |n/a    | -95   |   0   |-91
 976   |208    |20     |0x[redacted]|0xc[redacted]|n/a    |n/a    |-104   |   5   |-81
 978   |208    |20     |0x[redacted]|0xc[redacted]|n/a    |n/a    |-104   |   5   |-79
 979   |208    |20     |0x[redacted]|0x0[redacted]|n/a    |n/a    |-104   |   5   |-84
 982   |208    |20     |0x[redacted]|0xc[redacted]|n/a    |n/a    |-104   |   5   |-74
 984   |208    |20     |0x[redacted]|0xc[redacted]|n/a    |n/a    |-104   |   5   |-57
 986   |n/a    |n/a    |n/[redacted]|n/a[redacted]|n/a    |n/a    |n/a    |n/a    |n/a
1011   |208    |20     |0x[redacted]|0x9[redacted]|n/a    |n/a    |-104   |   5   |-87
1012   |208    |20     |0x[redacted]|0xb[redacted]|n/a    |n/a    |-104   |   5   |-84
```

OsmocomBB cell monitor

Public tools

Recorded mobile towers

- OpenCellid: Open Database of Cell Towers
- Gsmmap.org
- and so on.

Live scanning tools

Public tools

Recorded mobile towers

- OpenCellid: Open Database of Cell Towers
- Gsmmap.org
- and so on.

Problem!

But these solutions don’t map in live and do not give precise information about cell towers.

Live scanning tools

Public tools

Recorded mobile towers

Live scanning tools

- for 2G cells:
  - Gammu/Wammu, DCT3-GSMTAP, and others
  - OsmocomBB via *cell_log* application
- for 3G, 4G and more:
  - only tricks: use of exposed DIAG interface →decoding →GSMTAP pseudo-header format
  - SnoopSnitch: could be reworked for our purposes ;)

Methods to capture cells information

Possible methods are:

- Software-Defined Radio
- Exposed diagnostic interfaces
- Use of Android RIL

Software-Defined Radio

Existing tools:

- Airprobe or GR-GSM
- OpenLTE: *LTE_fdd_dl_scan*
- srsLTE with srsUE

Software-Defined Radio

Existing tools:

- Airprobe or GR-GSM
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- srsLTE with srsUE

No 3G

No 3G tools to capture cell information.

Exposed diagnostic interface

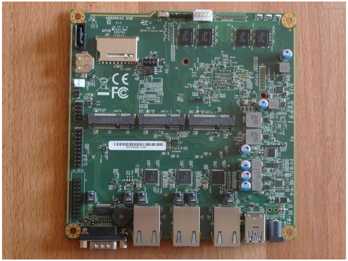
- Diagnostic interface enabled:
  - On old phones and 3G sticks like the *Icon 255*[1] that expose it by default
  - enabling DIAG ourselves: e.g for some LG devices via */sys/devices/platform/lg_diag_cmd/diag_enable*
  - Chips used for development
  - Interfaces kept enabled in production by error (e.g via custome bootmodes →CVE-2016-8467)
- Existing tools:
  - *xgoldmon* for X-Gold Infineon Basebands
  - *diag-parser* for exposed Qualcomm DIAG interfaces

[1] https://events.ccc.de/congress/2011/Fahrplan/attachments/2022_11ccc-qcombbdbg.pdf

Making a development environment

- Good alternative
- Could work with almost all bands we want
- A little expensive: almost 300€
- Requirements:

EC20 LTE modem



PCengines APU2

Supertramp’s version

- U/EC20 3G/LTE modem
- mPCI-E adapter

(Funny story about EC20)

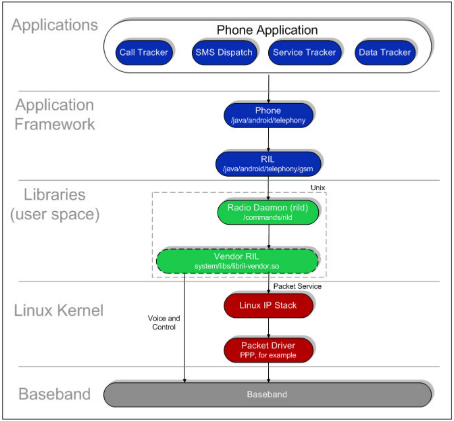
- Seen at 33c3 by Harald Welte[2] →the modem runs an OE base Linux distribution
- It’s also possible to have a shell via the AT command *AT+QLINUXCMD*:

```
# echo −e ’AT+QLINUXCMD=”/sbin/getty −L ttyGS0 115200 console”\r\n’ > /dev/ttyUSB2
# microcom /dev/ttyUSB1

OpenEmbedded Linux 9615−cdp ttyGS0

msm 20160923 9615−cdp ttyGS0

9615−cdp login: root
Password: oelinux123
root@9615−cdp:~#
```

[2] http git.gnumonks.org/laforge-slides/plain/2016/cellular_modems_33c3/33c3modems.html

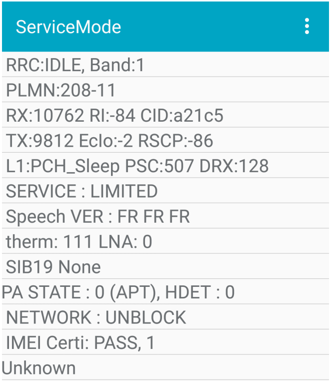
RIL on Android

- Daemon forwards commands/messages: application ⇆Vendor RIL
- vendor library is prorietary and vendor specific
- vendor library knows how to talk to modem:
  - classic AT
  - QMI for Qualcomm
  - (old?) Samsung IPC Protocol
  - and so on.



ServiceMode on Android

- Usually activated by typing a secret code
- Gives interesting details of current cell:
  - implicit network type
  - used band
  - reception (RX/DL) or/and transmission (TX/UP) (E/U)ARFCN (Absolute Radio Frequency Channel Number)
  - PLMN (Public Land Mobile Network) number
  - and so on.



ServiceMode

```
RRC:IDLE, Band:1
PLMN:208-11
RX:10762 RI:-84 CID:a21c5
TX:9812 Eclo:-2 RSCP:-86
L1:PCH_Sleep PSC:507 DRX:128
SERVICE : LIMITED
Speech VER : FR FR FR
therm: 111 LNA: 0
SIB19 None
PA STATE : 0 (APT), HDET : 0
NETWORK : UNBLOCK
IMEI Certi: PASS, 1
Unknown
```

ServiceMode in Samsung

Samsung ServiceMode in brief

1. **#0011#* secret code handled by *ServiceModeApp_RIL ServiceModeApp* activity
2. ServiceModeApp →IPC connection →*SecFactoryPhoneTest SecPhoneService*
3. *ServiceModeApp* starts the service mode →*invokeOemRilRequestRaw()* through *SecPhoneService* (send RIL command *RIL_REQUEST_OEM_HOOK_RAW*)
4. *ServiceModeApp* process in higher level ServiceMode messages coming from RIL.

Best place to listen ServiceMode

Two good places exist: RIL library independent of Vendor RIL library implementation, or use *invokeOemRilRequestRaw()*

Getting SM messages: the lazy way

Ask to our best friend → logcat

```
shell@klte:/ $ logcat
[...]
I/ServiceModeApp_RIL( 1542): in QUERT_SERVM_DONE
I/ServiceModeApp_RIL( 1542): size of result : 1700
I/ServiceModeApp_RIL( 1542): Line 0 :  RRC:IDLE, Band:1_
I/ServiceModeApp_RIL( 1542): Line 1 :  PLMN:208-20_
I/ServiceModeApp_RIL( 1542): Line 2 :  RX:10639 RI:-70 CID:1fc09bd_
I/ServiceModeApp_RIL( 1542): Line 3 :  TX:9689 Eclo:-4 RSCP:-74_
I/ServiceModeApp_RIL( 1542): Line 4 :  L1:PCH_Sleep PSC:83 DRX:64_
I/ServiceModeApp_RIL( 1542): Line 5 :  SERVICE : LIMITED_
I/ServiceModeApp_RIL( 1542): Line 6 :  Speech VER : FR FR FR_
I/ServiceModeApp_RIL( 1542): Line 7 :  therm: 111 LNA: 0 _
I/ServiceModeApp_RIL( 1542): Line 8 :  SIB19 Received_
I/ServiceModeApp_RIL( 1542): Line 9 : PA STATE : 0 (APT), HDET : 0_
I/ServiceModeApp_RIL( 1542): Line 10 :  NETWORK : UNBLOCK_
I/ServiceModeApp_RIL( 1542): Line 11 :  IMEI Certi: PASS, 1_
```

Those messages could be then processed to get our current cell information.

Getting data from DIAG with Xgoldmon

We have reworked Xgoldmon project for that:

- https://github.com/FlUxIuS/xgoldmon

```
$ cat ./celllog.fifo
[...]
[CellInfo]:PLMN=208-15;RAC=0x1;LAC=0x4e71;CID=0x1f****;DL_UARFCN=10737;UL_ARFCN=9787
[CellInfo]:PLMN=208-20;RAC=0x1;LAC=0x4e71;CID=0x1f****;DL_UARFCN=2950;UL_ARFCN=2725
[...]
[CellInfo]:PLMN=208-20;RAC=0x1;LAC=0xb5aa;CID=0x97****;DL_UARFCN=10639;UL_ARFCN=9689
[CellInfo]:PLMN=208-10;RAC=0x1;LAC=0xb5aa;CID=0x97****;DL_UARFCN=65535;UL_ARFCN=2850
[...]
```

What do I need?

At least a phone supporting ServiceMode!

- At least supports following tested phones:
  - Samsung Galaxy S3 via xgoldmon (Modmobmap’s edition);
  - Samsung Galaxy S4;
  - Samsung Galaxy S5;
  - Samsung Galaxy Note 2 with LTE;
  - Samsung Galaxy S4 GT-I9500
  - Samsung Galaxy Nexus GT-I9250
  - Samsung Galaxy S2 GT-I9100
  - Samsung Galaxy Note 2 GT-N7100
  - Samsung Galaxy S6 Exynos SoC
  - Samsung Galaxy S7 Exynos SoC
  - Samsung Galaxy A3 Exynos SoC
  - ...

Few contraints to resolve

"KTHX! But there are 2 questions":

1. how to support other operators than your own SIM card?
2. how to enumerate cells a MS (Mobile Station) is supposed to see?

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2. how to enumerate cells a MS (Mobile Station) is supposed to see?

Answer

The DFR technique!

DFR technique

D.F.R: “D” for Dirty, “F” for Fuzzy, “R” for Registration

The camping concept in brief

Let’s remember 3GPP TS 43.022, ETSI TS 125 304...

- When selecting a PLMN →MS looks for cells satisfying few conditions (cell of the selected PLMN, not barred, pathloss between MS and BTS below a thresold, and so on.)
- Cells are checked in a descending order of the signal strength
- If a suitable is found →MS camps on it and tries to register

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Verified through DIAG and ServiceMode

If registration fails →MS camps to another cell until it can register →verified via DIAG and ServiceMode

Automate the DFR technique with AT commands

Android phones often expose a modem interface (e.g. */dev/smd0)*

```
127|shell@klte:/ $ getprop rild.libargs
–d /dev/smd0
```

It is possible to:

- set network type: *AT^SYSCONFIG*
- list PLNM and select a PLMN: *AT+COPS*

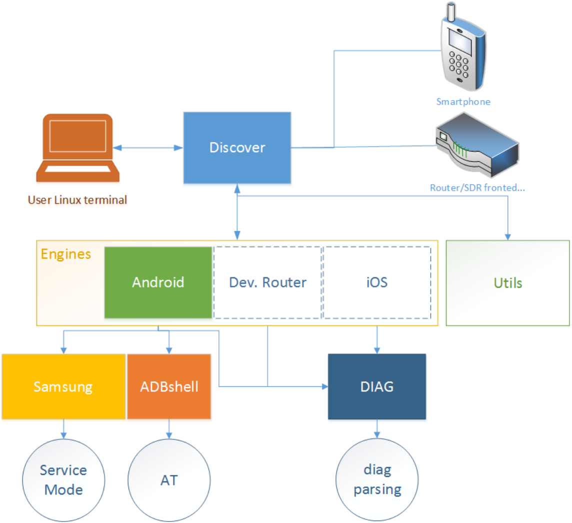
→requires root privileges

We mix all techniques together

Don’t forget...

*the magic cure powder

Here is the frankenstein: Modmobmap



1 Modmobmap

2 Modmobjam

3 Updates

4 Conclusion

In brief

- Uses Modmobmap results to jam mobile cells in a DIY way!
- Cheapest and efficient tricks to jam

Before

With a portable/chineeese device

- cheap
- jam the whole 2G/3G/(4G?) bands but requires some modifications
- poor signal

Desktop jammers

Before

With a portable/chineese device

Desktop jammers

- heavy, cumbersome but powerfull
- also needs a disabling to conserve rogue cells

Software-Defined Radio way

- With Software-Defined Radio
- Many devices could be used even the cheapest:
  - bladeRF;
  - HackRF;
  - ADALM-PLUTO;
  - and so on.

Software-Defined Radio way

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- Many devices could be used even the cheapest:
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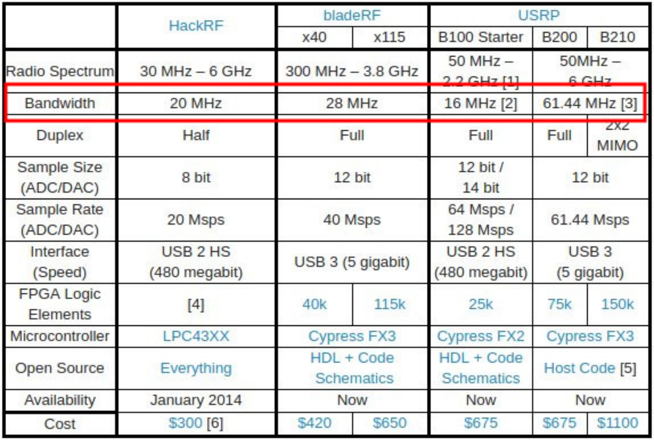
The bandwidth

KTHX! But how do you cover all frequencies with your toys bro?

SDR specs



	HackRF	bladeRF		USRP		
		x40	x115	B100 Starter	B200	B210
Radio Spectrum	30 MHz – 6 GHz	300 MHz – 3.8 GHz		50 MHz – 2.2 GHz [1]	50MHz – 6 GHz	
Bandwidth	20 MHz	28 MHz		16 MHz [2]	61.44 MHz [3]	
Duplex	Half	Full		Full	Full	2x2 MIMO
Sample Size (ADC/DAC)	8 bit	12 bit		12 bit / 14 bit	12 bit	
Sample Rate (ADC/DAC)	20 Msps	40 Msps		64 Msps / 128 Msps	61.44 Msps	
Interface (Speed)	USB 2 HS (480 megabit)	USB 3 (5 gigabit)		USB 2 HS (480 megabit)	USB 3 (5 gigabit)	
FPGA Logic Elements	[4]	40k	115k	25k	75k	150k
Microcontroller	LPC43XX	Cypress FX3		Cypress FX2	Cypress FX3	
Open Source	Everything	HDL + Code Schematics		HDL + Code Schematics	Host Code [5]	
Availability	January 2014	Now		Now	Now	
Cost	$300 [6]	$420	$650	$675	$675	$1100

source: http://www.taylorkillian.com/2013/08/sdr-showdown-hackrf-vs-bladerf-vs-usrp.html

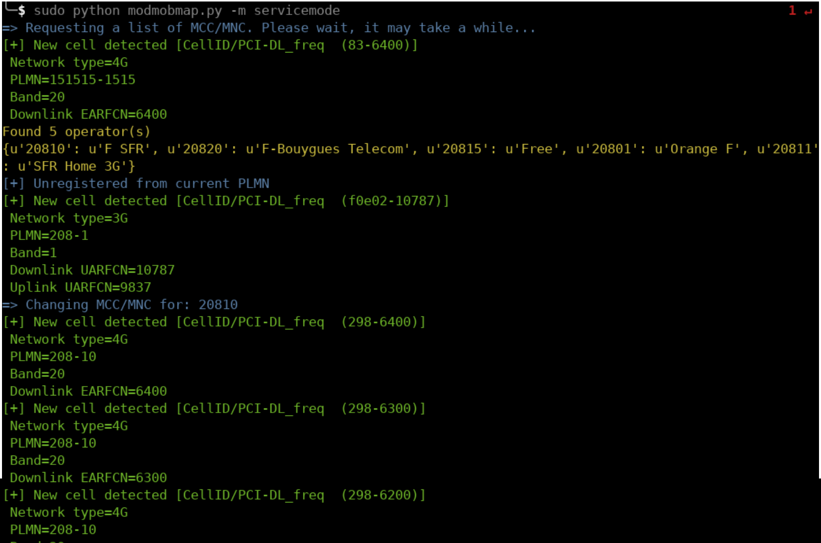
Solution: ”Smart” jamming

In 3 steps:

1. scan cells with Modmobmap;
2. target an operator;
3. and jam only targeted channels;

Scanning with Modmobmap

Modmobmap recovers 2G/3G/4G and more cells pretty much like OsmocomBB monitor mode for 2G only.



```
└$ sudo python modmobmap.py -m servicemode                                                              1 ↵
=> Requesting a list of MCC/MNC. Please wait, it may take a while...
[+] New cell detected [CellID/PCI-DL_freq  (83-6400)]
 Network type=4G
 PLMN=151515-1515
 Band=20
 Downlink EARFCN=6400
Found 5 operator(s)
{u'20810': u'F SFR', u'20820': u'F-Bouygues Telecom', u'20815': u'Free', u'20801': u'Orange F', u'20811'
: u'SFR Home 3G'}
[+] Unregistered from current PLMN
[+] New cell detected [CellID/PCI-DL_freq  (f0e02-10787)]
 Network type=3G
 PLMN=208-1
 Band=1
 Downlink UARFCN=10787
 Uplink UARFCN=9837
=> Changing MCC/MNC for: 20810
[+] New cell detected [CellID/PCI-DL_freq  (298-6400)]
 Network type=4G
 PLMN=208-10
 Band=20
 Downlink EARFCN=6400
[+] New cell detected [CellID/PCI-DL_freq  (298-6300)]
 Network type=4G
 PLMN=208-10
 Band=20
 Downlink EARFCN=6300
[+] New cell detected [CellID/PCI-DL_freq  (298-6200)]
 Network type=4G
 PLMN=208-10
```

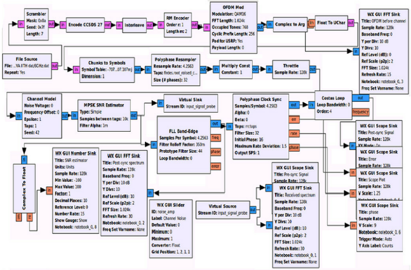
Results

JSON file → needed cells information to be reused with other tools, like Modmobjam!

```
{
    ”4b***−76”: {
        ”PLMN”: ”208−10”,
        ”arfcn”: 76,
        ”cid”: ”4b**”,
        ”type”: ”2G”
    },
    ”60****−2950”: {
        ”PLMN”: ”208−20”,
        ”RX”: 2950,
        ”TX”: 2725,
        ”cid” : 60***,
        ”band”: 8,
        ”type”: ”3G”
    },
[...]
}
```

GnuRadio: playing with blocks

GnuRadio companion is really nice →can add, make, and remove blocks →generates Python code



Scrambler
Mask: 0x8a
Seed: 0x7f
Length: 7

Encode CCSDS 27

Interleave

RM Encoder
Order r: 1
Length m: 2

OFDM Mod
Modulation: QAM16
FFT Length: 1.024k
Occupied Tones: 768
Cyclic Prefix Length: 256
Pad for USRP: Yes
Payload Length: 0

Complex to Arg

Float To UChar

WX GUI FFT Sink
Title: OFDM before channel
Sample Rate: 128k
Baseband Freq: 0
Y per Div: 10 dB
Y Divs: 10
Ref Level (dB): 0
Ref Scale (p2p): 2
FFT Size: 1.024k
Refresh Rate: 15
Notebook: notebook_0, 3
Freq Set Varname: None

File Source
File: ...VA IITH dat/6GHz.dat
Repeat: Yes

Chunks to Symbols
Symbol Table: -707...07.107mj
Dimension: 1

Polyphase Resampler
Resample Rate: 4.2563
Taps: firdes.root_raised_c...
Size (# phases): 32

Multiply Const
Constant: 1

Throttle
Sample Rate: 128k

Channel Model
Noise Voltage: 0
Frequency Offset: 0
Epsilon: 1
Taps: 1
Seed: 42

MPSK SNR Estimator
Type: Simple
Samples between tags: 10k
Filter Alpha: 1m

Virtual Sink
Stream ID: input_signal_probe

Polyphase Clock Sync
Samples/Symbol: 4.2563
Alpha: 0
Beta: 0
Taps: rrctaps
Filter Size: 32
Initial Phase: 16
Maximum Rate Deviation: 1.5
Output SPS: 1

Costas Loop
Loop Bandwidth: 0
Order: 4

FLL Band-Edge
Samples Per Symbol: 4.2563
Filter Rolloff Factor: 350m
Prototype Filter Size: 44
Loop Bandwidth: 0

WX GUI Scope Sink
Title: Post-sync Signal
Sample Rate: 128k
XY Mode: On

WX GUI Scope Sink
Title: Error
Sample Rate: 128k

WX GUI Scope Sink
Title: Scope Plot
Sample Rate: 128k
V Scale: 1.25

WX GUI Scope Sink
Title: phase
Sample Rate: 128k
V Scale: 9
Notebook: notebook_0, 6
Trigger Mode: Auto
Y Axis Label: Counts

Complex To Float

WX GUI Number Sink
Title: SNR estimator
Units: Units
Sample Rate: 128k
Min Value: -100
Max Value: 100
Factor: 1
Decimal Places: 10
Reference Level: 0
Number Rate: 15
Show Gauge: Show
Notebook: notebook_0, 8

WX GUI FFT Sink
Title: Post-sync spectrum
Sample Rate: 128k
Baseband Freq: 0
Y per Div: 10 dB
Y Divs: 10
Ref Level (dB): 10
Ref Scale (p2p): 2
FFT Size: 1.024k
Refresh Rate: 30
Notebook: notebook_0, 2
Freq Set Varname: None

WX GUI Slider
ID: noise_amp
Label: Channel Noise
Default Value: 0
Minimum: 0
Maximum: 1
Converter: Float
Grid Position: 1, 2, 1, 1

Virtual Source
Stream ID: input_signal_probe

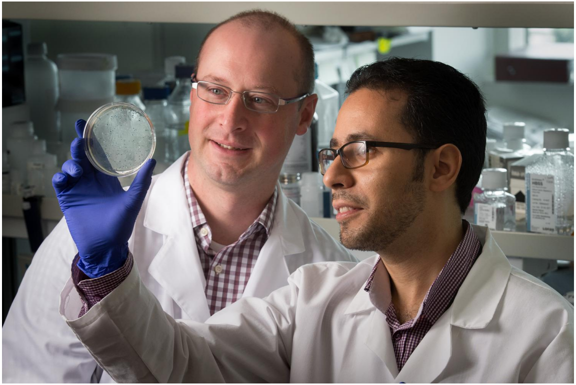
WX GUI Scope Sink
Title: Pre-sync Signal
Sample Rate: 128k

WX GUI FFT Sink
Title: Received spectrum
Sample Rate: 128k
Baseband Freq: 0
Y per Div: 10 dB
Y Divs: 10
Ref Level (dB): 10
Ref Scale (p2p): 2
FFT Size: 1.024k
Refresh Rate: 30
Notebook: notebook_0, 1
Freq Set Varname: None

Perfect to build the bases of our jammer. But we still need an idea of how to design the schema.

After many years of research...

Lot of experiments with blocks != #blockchains... blablabla

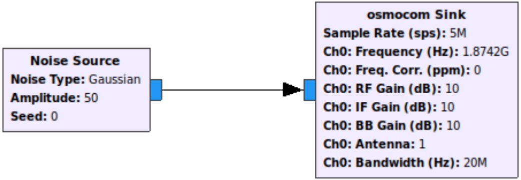


The formula

We have finally found THE formula!

Experimentation with GnuRadio

So we’ve started with a simple schema:

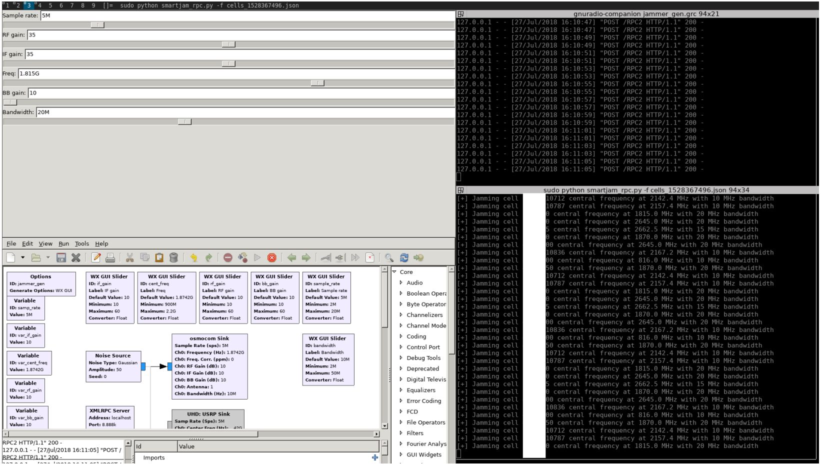


Noise Source
Noise Type: Gaussian
Amplitude: 50
Seed: 0

osmocom Sink
Sample Rate (sps): 5M
Ch0: Frequency (Hz): 1.8742G
Ch0: Freq. Corr. (ppm): 0
Ch0: RF Gain (dB): 10
Ch0: IF Gain (dB): 10
Ch0: BB Gain (dB): 10
Ch0: Antenna: 1
Ch0: Bandwidth (Hz): 20M

But still needed some work...

Final product: Modmobjam



```
1 2 3 4 5 6 7 8 9 []= sudo python smartjam_rpc.py -f cells_1528367496.json
```

Sample rate: 5M

RF gain: 35

IF gain: 35

Freq: 1.815G

BB gain: 10

Bandwidth: 20M

Options
ID: jammer_gen
Generate Options: WX GUI

Variable
ID: samp_rate
Value: 5M

Variable
ID: var_if_gain
Value: 10

Variable
ID: var_cent_freq
Value: 1.8742G

Variable
ID: var_rf_gain
Value: 10

Variable
ID: var_bb_gain
Value: 10

WX GUI Slider
ID: if_gain
Label: IF gain
Default Value: 10
Minimum: 10
Maximum: 60
Converter: Float

WX GUI Slider
ID: cent_freq
Label: Freq
Default Value: 1.8742G
Minimum: 900M
Maximum: 2.2G
Converter: Float

WX GUI Slider
ID: rf_gain
Label: RF gain
Default Value: 10
Minimum: 10
Maximum: 60
Converter: Float

WX GUI Slider
ID: bb_gain
Label: BB gain
Default Value: 10
Minimum: 10
Maximum: 60
Converter: Float

WX GUI Slider
ID: sample_rate
Label: Sample rate
Default Value: 5M
Minimum: 2M
Maximum: 20M
Converter: Float

Noise Source
Noise Type: Gaussian
Amplitude: 50
Seed: 0

osmocom Sink
Sample Rate (sps): 5M
Ch0: Frequency (Hz): 1.8742G
Ch0: Freq. Corr. (ppm): 0
Ch0: RF Gain (dB): 10
Ch0: IF Gain (dB): 10
Ch0: BB Gain (dB): 10
Ch0: Antenna: 1
Ch0: Bandwidth (Hz): 10M

WX GUI Slider
ID: bandwidth
Label: Bandwidth
Default Value: 10M
Minimum: 2M
Maximum: 50M
Converter: Float

XMLRPC Server
Address: localhost
Port: 8.888k

UHD: USRP Sink
Samp Rate (Sps): 5M
Ch0: Center Freq (Hz): ...42G

```
RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:11:05] "POST /
RPC2 HTTP/1.1" 200 -
```

gnuradio-companion jammer_gen.grc 94x21

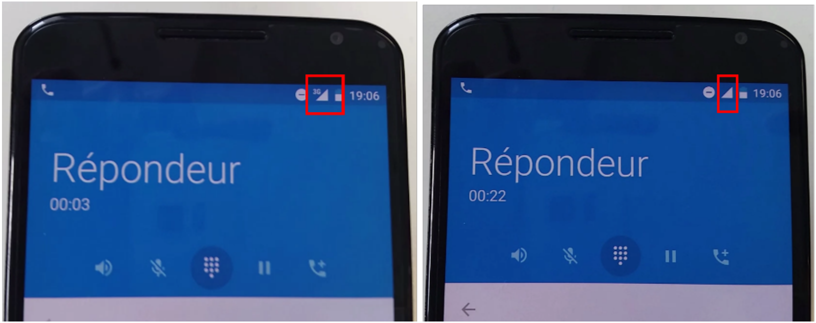
```
127.0.0.1 - - [27/Jul/2018 16:10:47] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:47] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:49] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:49] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:51] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:51] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:53] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:53] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:55] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:55] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:57] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:57] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:59] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:10:59] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:11:01] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:11:01] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:11:03] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:11:03] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:11:05] "POST /RPC2 HTTP/1.1" 200 -
127.0.0.1 - - [27/Jul/2018 16:11:05] "POST /RPC2 HTTP/1.1" 200 -
```

sudo python smartjam_rpc.py -f cells_1528367496.json 94x34

```
[+] Jamming cell [redacted] 10712 central frequency at 2142.4 MHz with 10 MHz bandwidth
[+] Jamming cell            10787 central frequency at 2157.4 MHz with 10 MHz bandwidth
[+] Jamming cell            0 central frequency at 1815.0 MHz with 20 MHz bandwidth
[+] Jamming cell            0 central frequency at 2645.0 MHz with 20 MHz bandwidth
[+] Jamming cell            5 central frequency at 2662.5 MHz with 15 MHz bandwidth
[+] Jamming cell            0 central frequency at 1870.0 MHz with 20 MHz bandwidth
[+] Jamming cell            00 central frequency at 2645.0 MHz with 20 MHz bandwidth
[+] Jamming cell            10836 central frequency at 2167.2 MHz with 10 MHz bandwidth
[+] Jamming cell            00 central frequency at 816.0 MHz with 10 MHz bandwidth
[+] Jamming cell            50 central frequency at 1870.0 MHz with 20 MHz bandwidth
[+] Jamming cell            10712 central frequency at 2142.4 MHz with 10 MHz bandwidth
[+] Jamming cell            10787 central frequency at 2157.4 MHz with 10 MHz bandwidth
[+] Jamming cell            0 central frequency at 1815.0 MHz with 20 MHz bandwidth
[+] Jamming cell            0 central frequency at 2645.0 MHz with 20 MHz bandwidth
[+] Jamming cell            5 central frequency at 2662.5 MHz with 15 MHz bandwidth
[+] Jamming cell            0 central frequency at 1870.0 MHz with 20 MHz bandwidth
[+] Jamming cell            00 central frequency at 2645.0 MHz with 20 MHz bandwidth
[+] Jamming cell            10836 central frequency at 2167.2 MHz with 10 MHz bandwidth
[+] Jamming cell            00 central frequency at 816.0 MHz with 10 MHz bandwidth
[+] Jamming cell            50 central frequency at 1870.0 MHz with 20 MHz bandwidth
[+] Jamming cell            10712 central frequency at 2142.4 MHz with 10 MHz bandwidth
[+] Jamming cell            10787 central frequency at 2157.4 MHz with 10 MHz bandwidth
[+] Jamming cell            0 central frequency at 1815.0 MHz with 20 MHz bandwidth
[+] Jamming cell            0 central frequency at 2645.0 MHz with 20 MHz bandwidth
[+] Jamming cell            5 central frequency at 2662.5 MHz with 15 MHz bandwidth
[+] Jamming cell            0 central frequency at 1870.0 MHz with 20 MHz bandwidth
[+] Jamming cell            00 central frequency at 2645.0 MHz with 20 MHz bandwidth
[+] Jamming cell            10836 central frequency at 2167.2 MHz with 10 MHz bandwidth
[+] Jamming cell            00 central frequency at 816.0 MHz with 10 MHz bandwidth
[+] Jamming cell            50 central frequency at 1870.0 MHz with 20 MHz bandwidth
[+] Jamming cell            10712 central frequency at 2142.4 MHz with 10 MHz bandwidth
[+] Jamming cell            10787 central frequency at 2157.4 MHz with 10 MHz bandwidth
[+] Jamming cell            0 central frequency at 1815.0 MHz with 20 MHz bandwidth
```

Results with a simple HackRF

Works pretty well when downgrading a call from 3G to 2G



But the number of cells to jam could raise the number of needed SDR devices.

Go cheaper

Could also be cheaper using *OsmoFL2k*

TODO

Some work is required target specific frequencies →right sample rate, carrier frequency and harmonics + better ant & amp

1 Modmobmap

2 Modmobjam

3 Updates

4 Conclusion

Next updates

- Add RSSI when possible
- Add support of mPCI-E modems with exposed DIAG
- Add more mobile phone supports → based on SCAT tool
- And more! → add also your contribution

Getting data from exposed DIAG on mPCI-E modems

- Just use *diag-parser* tool from Moiji Mobile

The rest could be parser with *pycrate_mobile* library of Benoit Michau →ASN.1 and CSN.1 compilers included for our purposes (RRC, and so on)!

tshark with Wireshark dissectors

But in the train for Troopers, I got lazy:

- Launch *diag-parser* and output result in a FIFO file:

```
$ sudo ./diag_parser –g 127.0.0.1 –p /tmp/fifoin –i /dev/ttyUSB0 –vvv
```

- and dissect all LTE and UTRA_FDD carrier list:

```
 cat /tmp/fifoin|tshark –i– –l –n –T json –e gsmtap.arfcn –e lte_rrc
–e lte–rrc.trackingAreaCode –e lte–rrc.cellIdentity –e lte–rrc.q_RxLevMin
–e lte–rrc.freqBandIndicator –e lte–rrc.MCC_MNC_Digit
–e lte–rrc.carrierFreqListUTRA_FDD
–e lte–rrc.carrierFreq –e lte–rrc.interFreqCarrierFreqList –e lte–rrc.dl_CarrierFreq
–e lte–rrc.q_RxLevMin –e lte–rrc.physCellId –Y 'gsmtap.arfcn!=0' > /tmp/fifoout
```

tshark result

tshark gives us a nice JSON render:

```
{
    "layers": {
      "gsmtap.arfcn": ["6200"],
      "lte_rrc": ["lte_rrc"],
      "lte-rrc.trackingAreaCode": ["75:c2"],
      "lte-rrc.cellIdentity": ["7a:2a:20:80"],
      "lte-rrc.freqBandIndicator": ["20"],
      "lte-rrc.MCC_MNC_Digit": ["2","0","8","2","0"],
      "lte-rrc.q_RxLevMin": ["-61"]
    }
  }
}
[...]
  {
    "layers": {
      "gsmtap.arfcn": ["6200"],
      "lte_rrc": ["lte_rrc"],
      "lte-rrc.interFreqCarrierFreqList": ["3"],
      "lte-rrc.dl_CarrierFreq": ["1850","3175","251"],
      "lte-rrc.q_RxLevMin": ["-63","-62","-63"],
      "lte-rrc.physCellId": ["158"]
    }
  }
}
[...]
        "lte-rrc.carrierFreq": ["10639","10688","10664","2950"]
[...]
```

DIAG for the rock!

- Less abstracted data
- Carrier lists → catch a bunch of 3G and LTE DL freqs in the same time
- More optimized for mobile monitoring and attacks...
- Support with the tshark JSON output will be comitted soon
- Another support with *pycrate_mobile* to parse RRC messages → in the TODO stack!

1. Modmobmap
2. Modmobjam
3. Updates
4. **Conclusion**

Conclusion

- Modmobmap:
  - is a cheap way to scan mobile cells
  - supports 2 useful interfaces:
    - ServiceMode;
    - host DIAG (could be easily extended for guest DIAG);
    - srsLTE and OpenLTE captures soon...
- Modmobjam:
  - is a cheap way to jam mobile cells with only a phone and a HackRF
  - but if cells to jam are important more SDR devices are needed

Downloads

- Modmobmap:
  - https://github.com/Synacktiv/Modmobmap
- Modmobjam:
  - https://github.com/Synacktiv/Modmobjam

Thanks =)

- Joffrey Czarny (@_Sn0rkY)
- Priya Chalakkal (@priyachalakkal)
- Troopers staff (@WEareTROOPERS)
- And of course → You all ;)

ANY QUESTIONS?

THANK YOU FOR YOUR ATTENTION,

SYNACKTIV
DIGITAL SECURITY