Cell Phone Encryption

"Anyone remember the Clipper Chip?"

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Department of Electrical and Computer Engineering
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November 29, 2016

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Security News

- SF LR hacked
  http://www.theverge.com/2016/11/27/13758412/hackers-san-francisco-light-rail-system-ransomware
- Snoopers Charter
  http://www.independent.co.uk/voices/snoopers-charter-theresa-may-online-privacy-invest
  html
- MD5 poisoning https://blog.silentsignal.eu/2016/11/28/an-update-on-md5-poisoning/
- Shodan Membership $5
  https://www.shodan.io/store/member
- RMCCDC is a go
- .mil open to hacking
  https://krebsonsecurity.com/2016/11/dod-opens-mil-to-legal-hacking-within-limits/
- windoes Priv esc via update

2016-11-29 Cell Phone Encryption

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A brief history of cellphones

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- Analog
  - 0G
  - 1G
  - bag phones
  - car phones
  - bricks
- Digital
  - CDMA
  - GSM
  - LTE
  - 4G?

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Analog

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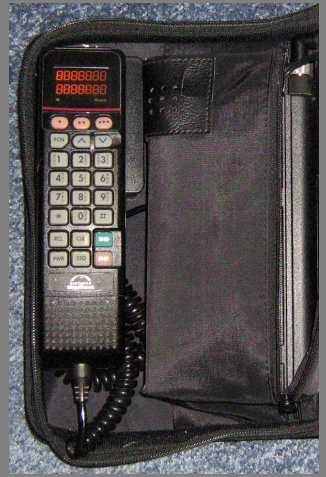
- 0G FM VHF half (later full) duplex (1946–2012)
  - large powerful towers that covered a long range
- 1G
  - smaller 'Cells'
  - digital signaling — analog voice
  - cellphone hackers — phone cloning and call interception
  - 800MHz blocking on scanners in US only



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1. 0G only had 3 frequency pairs at first, everything was operator driven, mobile telephone service Bell/Motorola
2. this was later replaced by IMTS (1964) with the convience of **direct dial**
3. offered by both wireline common carriers and radio common carriers
4. IMTS had 25W at mobile station and 100–250W at base, unlike cellphones w/ 600mW
5. IMTS: limited number of customers, airtime expensive
6. 1G Advanced Mobile Phone System — started 1983 US no longer requiried by 2/2008
7. cloning involved recording the ESN/MDN and then adding it to another phone
8. 47cfr15.121

Bag Phone Full

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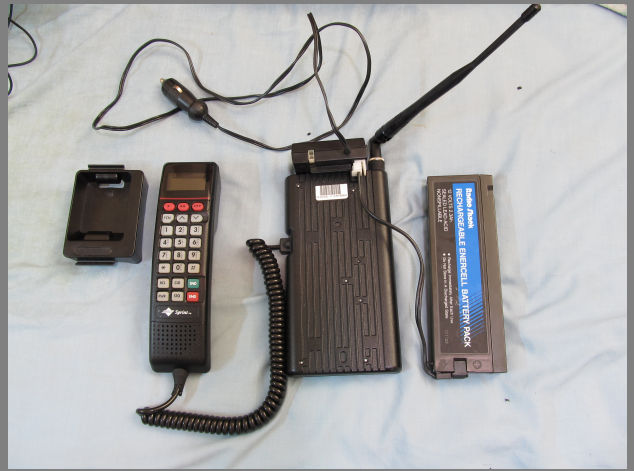

Bag Phone Full

CDMA

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- Code Division Multiple Access
- Propriatary tech first developed by qualcom, later standardized
- Used primarily in US and South Korea, later migrated to Europe and Asia
- 2G was cdmaOne, 3G is CDMA2000 / EVDO (data) / 1x (voice)
- 2G not encrypted?, 3G is

1. does not limit number of active radios

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GSM

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- Time Division Multiple Access (2G) and CDMA (3G)
- 'open' standard
- Primarily deployed in Europe and Asia, but now deployed across world
- had support for encryption
- 2.5G is EDGE
- 3G is UMTS

1. TDMA limits number of active radios per cell

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LTE

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- Not 4G yet
- same system for both CDMA and GSM based carriers.

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1. primary key only used to generate shared secret which is used for signing and auth
2. shared secret is actually 2 64 bit keys, one for auth signatures and one for session key gen

GSM encryption

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- uses A5/1 A5/2 and A5/3 stream ciphers for voice
- GPRS uses GEA/1, GEA/2 (vulnerable) and GEA/3 (secure?)
- most countries do not encrypt GPRS data for snooping porpises
- A5/1 has 54 bit key, originally going to be 128 but Germans
- A5/2 is same as A5/1 but without irregular clocking, used for export
- A5/3 aka KASUMI used in 3G GSM
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1. irregular clocking: essentially randomly chooses shift registers

GSM encryption

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- A5/2 is vulnerable to known-ciphertext attacks
- both of these can be decrypted in realtime by a 1999 era desktop PC

¡WARNING!

Currently, decrypting GSM traffic using these methods are illegal

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Clipper Chip

References

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