ATF1: The First Car Telephone System

Calling from the car: a necessity for some, a status symbol for many more. For a few, a brilliant way to extract money from willing-to-pay yuppies — and for a select group, the perfect hack.

Telecommunication in the Netherlands involves more than just making calls at home. There are currently three systems in use, known as Car Telephone 1, 2, and 3. Network 1 uses frequencies in the regular mobile radio band and can therefore be received with a scanner. Network 2 works with a digital connection (not the same as a V.22 modem), somewhere around 400 MHz. Network 3 has only just been launched and uses the 900 MHz band.

This article deals solely with Car Telephone 1, or ATF1 for short.

The developers of this first car telephone network weren't exactly sticklers for security; there's not a single code or safeguard in the protocol — the whole thing leaks like a sieve!
ATF is a **full duplex** system: meaning you can talk and listen at the same time. This means each call uses **two frequencies**.

One frequency is called the **base channel**: the repeater of the car telephone network transmits on this. These repeaters are set up all over the country and are directly connected to the **BTD** (Special Telephony Services), also known as the **06-central** in Rotterdam.
The other frequency is the **mobile channel**: the vehicle transmits on this one (and it's not always a car — inland skippers use ATF1 heavily).
See **Table 1** for the base and mobile channels. They're always 0.03 MHz apart, with the mobile channel **446 MHz higher** than the corresponding base channel.

When you scan the base channels, you'll notice a few things: there's a **constant data chirp** when there's no call active. This chirp indicates the region number and is otherwise unimportant.

However, it **interferes** with scanning calls, as there's always a signal present.
Thanks to **crosstalk**, you can usually hear bits of what the caller says on the base channel — so you don't necessarily need two scanners to follow a full conversation.
On the mobile channels, you'll sometimes hear a loud **data chirp** before the call starts. The elements of such a chirp are shown in **Table 2**.

As you can see, the **first 5 bits** are always the same. Also, there's a **mirror pattern** in the digits: the second block is the mirror of the fourth block. However, it's possible to transmit the "head" of one number and the "tail" of another — allowing **two numbers** in a single telegram; this cancels the mirroring.

This is done to include the **channel number** in the call signal and to compose the **"channel available" chirp**. These chirps are formed by bluntly stringing the required telegrams together into one long stream of beeps — **without pauses**.

Confused yet? Here are a few examples:

Example: Incoming Call — Telephone Network → Car Phone

On channel 19, the base station comes on and starts chirping immediately:

```
0111010100000101    1
0111010010001001    2
0111010001010001    3
0111001100000110    4
0111001010001010    5
0111010100000110    14
```
Then the base disappears again.

This chirp says: **Car phone 12345**, there's a call for you on **channel 14**.
(Note: that 14 is a double digit, disrupting the mirror pattern in the telegram.)

The car phone must now **immediately switch to channel 14**, transmitting a **sustained 1950Hz tone** (which represents "1"). The central station acknowledges this on its channel by also transmitting a 1950Hz tone. Meanwhile, the car phone rings and the caller on the landline hears a ringtone.

If the car phone doesn't respond within a few seconds, the caller gets a recorded message:

"The car phone you are trying to reach is currently unavailable."

If the phone **is answered within 1 minute**, the car phone sends a **brief 2070Hz beep** to indicate the call is picked up, and the conversation begins.

When the car phone sends the **cancel telegram**, the connection ends.
(Note: the central keeps sending the disconnect signal until you're actually off the air.)

Example: Outgoing Call — Car → Landline

The car phone searches for a free channel. On this channel, the central constantly sends the same telegram. It consists of a **double digit**: the first is always **9**, the second is the **region number** (not the channel number). For example, **Amsterdam is region 5**.

So in Amsterdam, a free channel might be broadcasting:
0111000011001010011100001100101 etc.

The car phone interrupts this signal by transmitting a **600ms 2070Hz beep**. Then comes the data chirp, for example:

```
M Start – 1-2-3-4-5-2-0-7-1-7-6-6-6 – Stop
B 12345
```
M = Mobile channel, B = Base channel

This means: "This is car phone 12345. I want to call 020-717666."
(Note: the leading 0 in the phone number is not transmitted.)

Sending the chirp **twice** (without pause) is not required, but car phones often do it anyway.
After the last chirp, the connection is made.

The system then **echoes back** the number you dialed to avoid mistakes (though nobody says you have to listen to it…).

If the central station **starts repeatedly sending the cancel telegram** right after your number, it means the car phone number you're using has been **disconnected**.

Table 1: Chirps in ATF1

These data chirps are made up of 16-bit data telegrams.
Each bit lasts **10 ms**.

- A 1 is represented by a **1950 Hz beep**

- A 0 is represented by a **2070 Hz beep**

Digit	Coding
0	01110 11000 000011
1	01110 10100 000101
2	01110 10010 001001
3	01110 10001 010001
4	01110 01100 000110
5	01110 01010 001010
6	01110 01001 010010
7	01110 00110 000110
8	01110 00101 010100
9	01110 00011 011000
Start	01110 01000100010
Stop	01110 10000100001
Cancel	01110 10101010101

Usage, Hacks, and Limitations

International calls via ATF1 from the Netherlands are no longer possible. That's because a whole bunch of clever guys were selling stolen or grey-imported car phones where you could **set your own number** (via an EPROM or even jumper wires).

If you live **close enough to the German border**, you can still call **anywhere in the world for free** using the German repeaters. The call doesn't have to be full duplex — you can be off-air for up to **10 seconds** before the central ends the call. You can use those 10 seconds to listen, meaning a **simple transceiver** might be enough.

So the trick is to make a **computer program** that assembles and plays the required chirps.

In Conclusion

It goes without saying that it is **highly illegal** to transmit using an unapproved transmitter (although it can be quite fun). It's also **not allowed (and morally questionable)** to call using someone else's car phone number.

However, the **PTT does have a mobile phone store… and that store has a phone too…**