X-Sat / Mitsubishi Protocol

Originally I've called this the X-Sat protocol because it was used in the X-Sat CDTV 310 Satellite receiver made by the French company Xcom. This protocol is probably also used in other X-Sat receivers, but I have no means to verify that.

Update: David Turner informed me that he has seen this protocol being used by Mitsubishi. It could well be that the protocol originally was created by Mitsubishi. I have found a PDF on the internet describing the SC-33B remote control, which is exactly the same protocol. The only difference is that they use a 40kHz carrier, instead of the 38kHz carrier I have seen on the X-Sat receiver.
David also mentioned that he had to transmit each command twice with a 30ms pause between them.

Features

- 8 bit address and 8 bit command length.
- Pulse distance modulation.
- Carrier frequency of 38kHz.
- Bit time of 1ms or 2ms.

Modulation
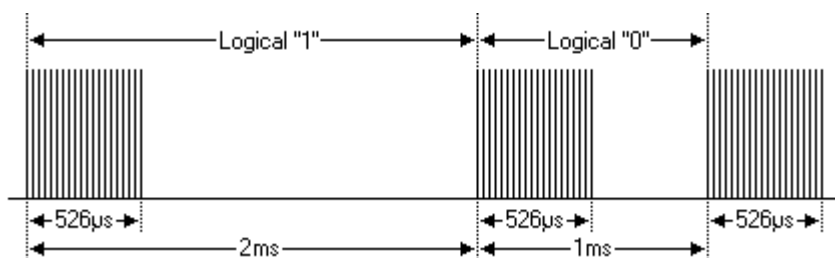
The X-Sat protocol uses pulse distance encoding of the bits. Each pulse is a 526µs long 38kHz carrier burst (about 20 cycles). A logical "1" takes 2.0ms to transmit, while a logical "0" is only 1.0ms. The recommended carrier duty cycle is 1/4 or 1/3.

Protocol
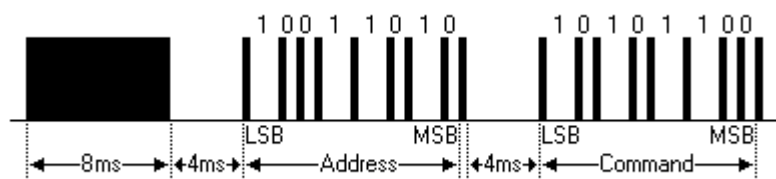
The picture above shows a typical pulse train of the X-Sat protocol. With this protocol the LSB is transmitted first. In this case Address $59 and Command $35 is transmitted. A message is started by a 8ms AGC burst, which was used to set the gain of the earlier IR receivers. This AGC burst is then followed by a 4ms space, which is then followed by the Address and Command. A peculiar property of the X-Sat protocol is the 4ms gap between the address and the command. The total transmission time is variable because the bit times are variable.
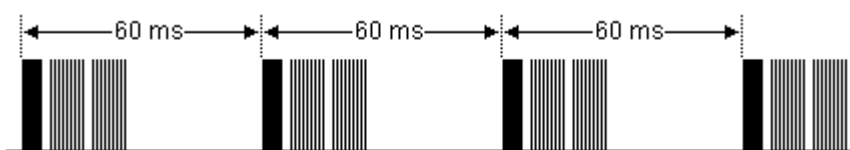
An IR command is repeated every 60ms for as long as the key on the remote is held down.