WP Impulsive Interference from Digital Devices

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In 2016 we noticed very intense pulses received by a λ/4 monopole attached to a heterodyne receiver operating at 1420 MHz with a 10 MHz bandwidth. Realising that these could set serious limitations to searches for transient signals from ETI, the experiments were repeated in October 2018. This time the antenna used was the prototype L-Bass horn, a 55 cm diameter 2 m long horn designed to have low side lobes and good sensitivity for radio background studies at L-band. The outputs of the intermediate frequency amplifier and filter centred at 30 MHz were detected by square law detectors, most of the analysis was performed using an Omni Spectra zero offset detector with a 2 μsec time constant. The signals were recorded on a Tektronix MSO4054C digital oscilloscope.

Pulses were found from a Panasonic Lumix compact camera and a Canon 500D SLR camera, whereas the results from an iPhone 4 were inconclusive. Background pulses (mostly from power switch transients and motor vehicles) were also found. Short pulses of < 2 μsec were found from both cameras and longer ones 3 ms wide corresponding to processing in the Lumix in automatic mode were found. The signals exceed the total noise power of the receiver by 10 dB or more.

The noise temperature of the system was measured, using a dummy load at ambient temperature in front of the horn, and found to be 200 ± 40 K, resulting in an estimated flux density of around $10^7$ Jy. It is clear that pulses from nearby cameras potentially limit the performance of most radio astronomy telescopes. The signals from near Earth orbit satellites at 160 km altitude exceed the noise level in 1 sec for SKA1-Mid at 1420 MHz by a factor of 170 if using similar high speed electronics to that of digital cameras. The prospect of several thousand satellites in the LEO communication system is daunting.

The RFI from the cameras were also investigated at low frequencies by using a loop wrapped around the camera and connected to the oscilloscope. String pulses with short rise times of < 1 nsec (hence signals at 1420 MHz) were found along with intense emission at 100-200 MHz. SKA1-Low would also be strongly affected.

Relying on the pulses from ETI being dispersed by the interstellar medium will be essential to discriminate against man-made interference, though if ETI pre-chirp the signals (for higher signal to noise) then this becomes self-defeating.