Digital to Analogue Radar Video Conversion

How to generate analogue radar signals from a network-based input source

Summary

Conversion of radar video from a digital format stream, such as ASTERIX CAT-240 or Cambridge Pixel SPx, into analogue radar signals can be achieved using Cambridge Pixel's SPxHPxOutput software utility and the HPx-310 PCIe Radar Signal Output Card.

Digital Radar Video

A digital radar video stream feeds the SPxHPxOutput utility. This stream can be in either ASTERIX CAT-240 or Cambridge Pixel's SPx format and is formed of a continuous sequence of messages each containing a spoke of digitised radar video. There are several considerations to take into account including:

A spoke of radar video can be output as multiple messages, for example with returns composed of a large number of samples. Conversely, multiple short spokes can be combined into a single message.

Front end sampling could result in multiple messages for the same azimuth, for example when the source has a high PRF compared to its ACP rate.

Front end sampling may result in a non-continuous series of spokes, i.e. sparse azimuths, for example when the source has a low PRF compared to its ACP rate.

The order in which messages are sent from the host distribution process is not guaranteed to be consecutive, for example due to local host processing priorities and mechanisms.

The underlying distribution system may result in messages being received in a different order to how they were distributed, for example due to network infrastructure.

The underlying radar timing characteristics may not be represented accurately from the rate of arrival of the radar video messages alone, for example due to network delays.

The SPxHPxOutput utility makes every effort to replicate the input radar characteristics as regenerated on its analogue output, while being subject to the constraints of message ordering as described above.

SPxHPxOutput Application

SPxHPxOutput is available as a Windows or Linux command line program.

Upon starting, the SPxHPxOutput application reads a text-based configuration file, which contains parameters such as the source network IP address and port, the number of

output ACP pulses per radar scan to be generated, the radar signal pulse widths and the radar video gain.

SPxHPxOutput receives network messages and the radar video data content contained within is passed to the HPx-310 card over the PCI Express bus.
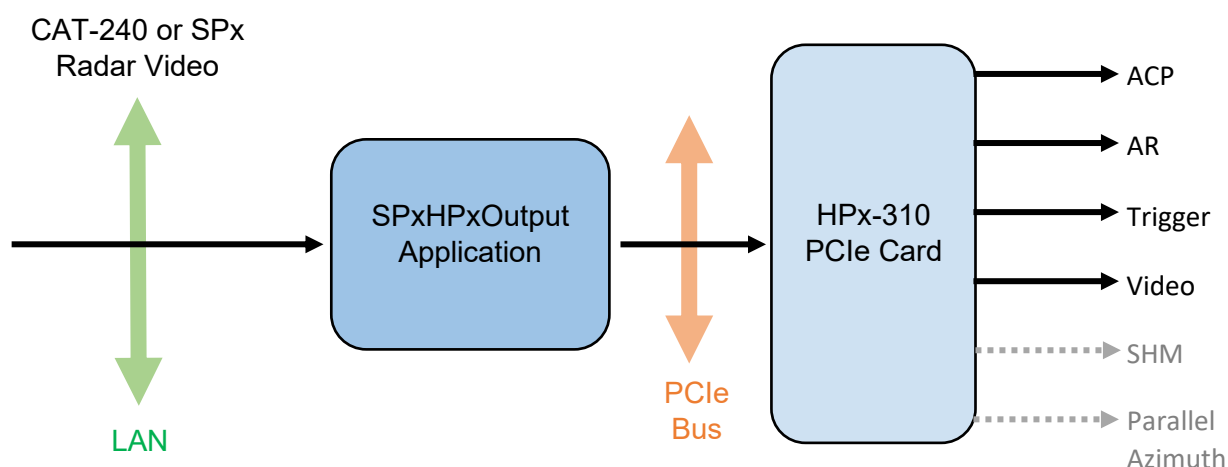
SPxHPxOutput applies very little processing to received radar video. Specifically, it has no provision for azimuth combination or repeating, so that a faithful replication of the input signal is achieved. However, if repeat returns for the same azimuth are received and marked as such (for SPx-formatted radar video), these returns are not passed to the card for output.

HPx-310 Card

The HPx-310 PCIe Radar Signal Output Card generates representative radar signals for system testing, simulation, training or radar video streaming. Time-stamped radar video data is passed to the card over the PCI Express bus and the card generates the appropriate video, trigger and azimuth data signals in real-time.

A first-in-first-out (FIFO) buffer on the card allows SPxHPxOutput to write a number of radar returns into memory, which the HPx-310 card then outputs at the requested times. The typical buffer size is 100ms, which is used to smooth any effects of network congestion. Digital adjustments to the output timing are made to ensure that the output rate of video exactly matches the rate of arrival of data from SPxHPxOutput.

The HPx-310 card supports variable and staggered PRF modes (including variable length returns), sector scanning and random scan, as well as conventional rotating scan radars. Optional output signals include a Ship Heading Marker (SHM) and a 12-bit parallel azimuth output. ACP, ARP and trigger are available as single-ended or RS-422 differential signals. The HPx-310 has support for other radar signal formats including some composite (1-wire and 3-wire) interfaces.

SPxHPxOutput can be supplied in two ways:

- For customers purchasing the SPx development libraries, it is supplied as a source code example, along with HPx-310 drivers and board support libraries.

- Alternatively, SPxHPxOutput can be supplied as a standalone application, with HPx-310 drivers only. The HPx-310 hardware card is purchased as a separate line item.

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