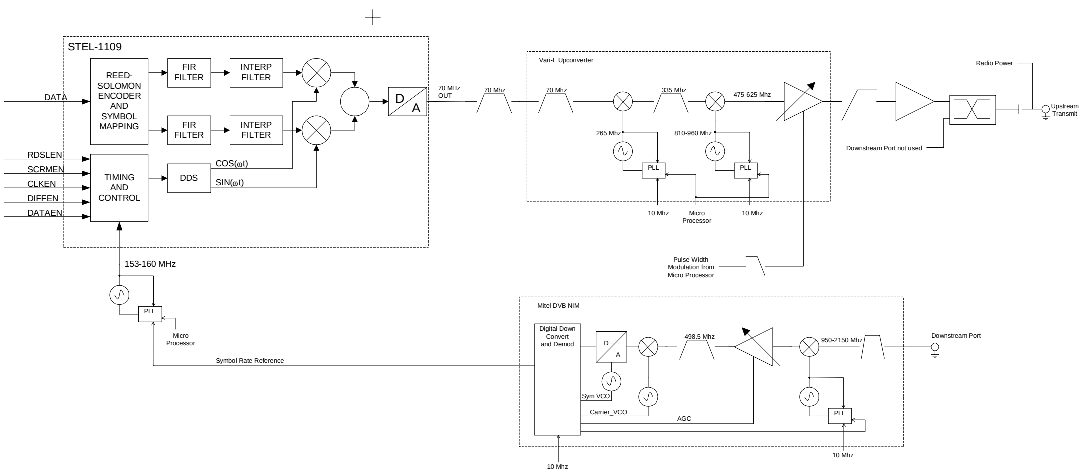
Gateway (NIU) Block Diagram and Operational Description



The transmission of a data burst by a gateway involves both digital and analog circuits. A data burst begins with an ATM cell being placed into one of the Utopia Arbiter (UA) FIFOs. This cell can originate with from the services card (Newbridge NIU-S, or STel TEC), or the cell can come from the 860 microprocessor (Ethernet, MAC, POTS, ISDN). The UA also contains a time slot map which is programmed by the 860 in response to downstream MAC messages from the headend. The time slot map is compared to the time reference which is broadcast by the headend as part of the downstream signal. When the time reference equals an assigned time slot, data is moved from the FIFOs to the physical layer (PHY) chip for formatting. If the FIFOs are empty, an idle cell with pseudorandom data is sent.

The PHY takes the ATM cell from the UA and feeds it to the STEL-1109 QPSK modulation chip. This modulation device adds Reed-Solomon “check bytes”, formats the bits into QPSK symbols, filters the symbols through a 32-tap FIR filter, interpolates the FIR output to match the high clock rate needed at the output, modulates the I and Q data onto a 70 MHz digital carrier, and finally passes the digital modulated carrier to a 10-bit

DAC.   The high clock rate (~160 MHz) and FIR and interpolator filters allow a RRC alpha = 0.25 spectral shape with controlled spurious near the carrier.

Since the digital synthesis technique creates some strong undesired clock –related signals away from the carrier, the DAC is followed by a bandpass filter. This filter is about 15 MHz wide. The clean 70 MHz signal is then unconverted to the 475 to 625 MHz range.

The upconversion process uses two upconversion stages. The first stage uses a mixer and fixed local oscillator at 265 MHz to move the desired signal up to 335 MHz. The mixer is followed by a bandpass filter to select the desired mixing term. The filtered signal is mixed with a variable local oscillator in the 810 MHz to 960 MHz range to move the desired signal to the 475 to 625 MHz range. A low pass filter is used to select the desired mixing term.

The second mixer is followed by a variable gain amplifier which is controlled by the 80C552 microprocessor. This microprocessor receives instructions on setting the power level via MAC messages from the headend via the 860 microprocessor. The power is controlled between –10 dBm and –40 dBm to maintain a constant C/N at the headend. The step size is approximately 0.1 dB

The frequency control of the transmit signal involves many elements to produce an accurate signal. The transmit frequency of the gateway alone (without the microwave radio section) is controlled by a combination of the downstream symbol rate and a local 10 MHz crystal oscillator. The downstream received symbol clock is used as a reference for a PLL to produce a clock which controls the STEL-1109 QPSK modulation chip. This clock determines the accuracy to the 70 MHz IF signal. When the downstream receiver is in lock, the symbol clock is phase locked to the headend clock which is extremely accurate. When the downstream receiver is out of lock , the loss of downstream time signaling data is sensed and generates a command to shut off the transmitter. The local 10 MHz crystal oscillator serves as the reference for the two PLL's in the upconverter chain.

The frequency control of the transmit signal with the microwave radio attached is more complicated. The majority of the frequency error is introduced by the microwave oscillators in the radio. The first algorithm for correcting the microwave frequency relies on the fact the for certain radio block diagrams, the downstream frequency error and the upstream frequency error is correlated. By measuring the receive frequency and comparing it to a stored channel plan, a downstream frequency error is derived. This error is processed using an equation and stored coefficients which model the radio block diagram to predict the transmit frequency error. From this prediction, the gateway transmit frequency is adjusted such that the microwave transmit signal is on frequency. Stanford Telecom received United States Patent number 5,794,119 on this technique. The second frequency control method involves frequency error measurement at the headend. The error at headend can be measured very accurately, and this error is relayed back to the gateway using MAC messages. Adjustments to the transmit signal are then commanded by the microprocessors.