AMM

FCC FILING INFORMATION

4/30/99

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The AMM is derived from the Stanford Telecom Model 11250 Air Modem Card card used in the Stel-10451 LMDS Air Interface Unit. The AMM will provide point-to-multipoint wireless ATM services for the Newbridge Networks 36170 basestation.

Features

- Dual Demodulators capable of ATM rates up to 10.1 MBPS (12.93 MBPS burst rate capability)
- DAVIC compliant Single channel modulator capable of providing up to a 36 MHz wide channel
- Contention based bandwidth-on-demand Medium Access Control
- HDLC interface with ARIC
- Two TTL compatible serial interfaces
- Single RS-232 Serial Interface for integration and production support
- Physical Layer UTOPIA Data Interface with ARIC
- Designed to meet form factor requirements of Newbridge 36170
- See appended block diagram for the ARIC Modem Module

Downstream Requirements

The AMM shall provide a QPSK modulated IF carrier. The characteristics of this signal are described in the following sections:

Transmit symbol clock

The AMM shall derive the Transmit symbol clock from a 16.384 MHz clock derived from a Stratum Level 3 reference. Note that the accuracy of the symbol clock will be directly related the stability of this reference.

Downstream Bit Rate

The Downstream bit rate is defined as the rate of the clock feeding the Reed-Solomon encoder.

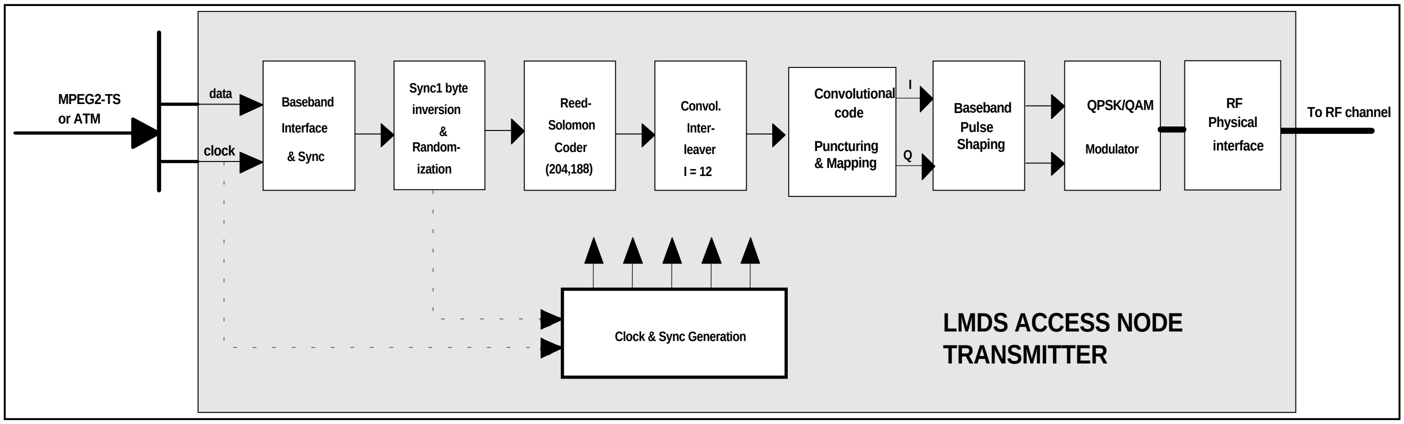
a) Maximum bit rate 51.644 MBPS

b) Minimum bit rate 2.9013 MBPS

c) Default bit rate 45.841 MBPS

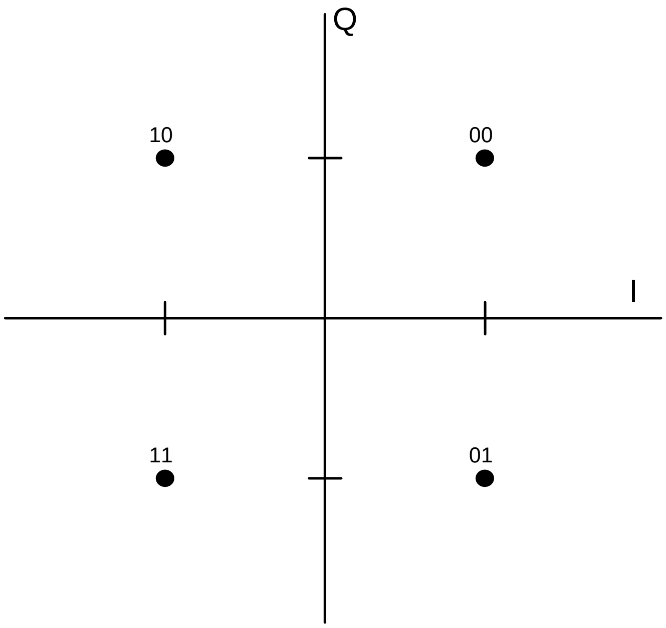
Downstream Encoding

The following diagram shows the conceptual block diagram for the downsream encoding.



Downstream Modulation

The system shall employ conventional Gray-coded QPSK modulation with absolute mapping (no differential encoding). For QPSK modulation, bit mapping in the signal space as given in the constellation diagram below shall be used. The constellation points represent the (IQ) bit couples as output from the convolutional encoder.



Baseband Filter Characteristics

Prior to modulation, the I and Q signals shall be square-root raised cosine filtered. The roll-off factor shall be 0.35. The square-root raised cosine filter shall have a theoretical function defined by the following expression:

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$$
\begin{cases}
H(f) = 1 & for|f| < f_N(1-\alpha) \\
H(f) = \left\{ \frac{1}{2} + \frac{1}{2}\sin\frac{\pi}{2f_N}\left[\frac{f_N - |f|}{\alpha}\right]\right\}^{1/2} & for\ f_N(1-\alpha) \le |f| \le f_N(1+\alpha) \\
H(f) = 0 & for|f| > f_N(1+\alpha)
\end{cases}
$$

where $f_N = \frac{1}{2T_s} = \frac{R_s}{2}$ is the Nyquist frequency

and roll-off factor $\alpha = 0.35$.

Baseband Interface

The AMM shall provide baseband I and Q outputs to the Tuner. These outputs shall be consistent with the input specifications to the RF Microdevices 2730 Quadrature Mixer.

a) I/Q Amplitude mismatch ± 0.2 dB

b) Amplitude variation ± 0.2 dB

Transmit IF

This output will be used for integration testing by Stanford Telecom.

The AMM shall transmit an IF signal with the following properties:

a) Transmit IF Frequency 70 MHz ± 5 KHz
b) Transmit Power (IF Interface) -20 dBm ± 5 dB
c) Max Channel Bandwith 36 MHz
d) Spectral Inversion Not Inverted
e) Out-of-Band Discrete Spurious -60 dBc
f) In-band Discrete Spurious -45 dBc
g) Maximum Phase Noise

OffSet	Level (dBc)
1 kHz	-76
10 KHz	-84
50 kHz	-108
100 kHz	-113
1000 kHz	-122
2000 kHz	-130

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System Gain Control

There are six gain or level control elements in the system. Three elements reside in the AMM and three reside in the NIU.

AMM Gain Control Elements

First, there is an IF gain control. This local loop operates on the measured noise output from the 3803 ASIC. The measured noise output is the 3803 received power output (*RSSI or RSL*) (measured over a 191 symbol-duration period) when the preamble detect flag has not fired. This value is averaged over a long interval and is used to control the IF gain such that the noise level is at the desired value. The objective of this control loop is to compensate for IF gain changes due to aging and temperature. Consequently, this loop can be very slow. In our initial implementation we assume that the noise measurements are only taken in empty slots. The location of these empty or noise slots is provided by the time slot manager. The noise will be measured in one polling response (PR) slot per superframe. This PR slot is measured for the phantom NIU.

A variable loop gain factor of K_n is allowed to permit various bandwidths to be achieved. This loop gain is small and the loop time constant should be in the ten's of seconds.

Second, when the preamble detect flag is high in a polling response slot the 3803 received power output *(RSSI or RSL)* is the signal energy (normalized to power) measured over 191 symbols. One needs to set the threshold level an appropriate amount over the noise level such that the desired probabilities of miss and false alarm are obtained. This a one time setting. Incorrect setting may increase the required Eb/No above that one would expect from the coded portion of the burst

Third, when the preamble detect flag is high the 3803 received power output is the signal power and it is compared against a reference level and the error (ΔP_{sig}) determined. This error is fed back to the NIU on a superframe (about two seconds duration) basis. One purpose of this loop is to compensate for slow changes in the subscriber terminal transmit gain due correlation in D/S and U/S path attenuation. Since this control is based on the superframe structure, the loop is very slow with a bandwidth less than 0.**2**5 Hz. In some environments relatively fast fading can occur. It is desirable to set the reference level high enough such that there is sufficient margin to handle fading that is too fast for the feedforward and long-loop controls. At present we believe 6-dB margin is reasonable. Based on further field testing this value may change.

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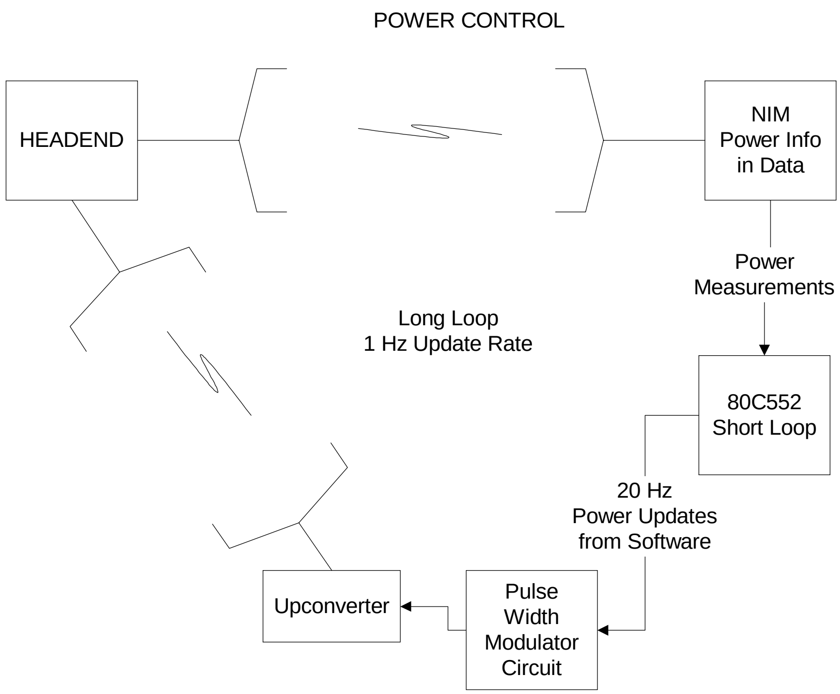

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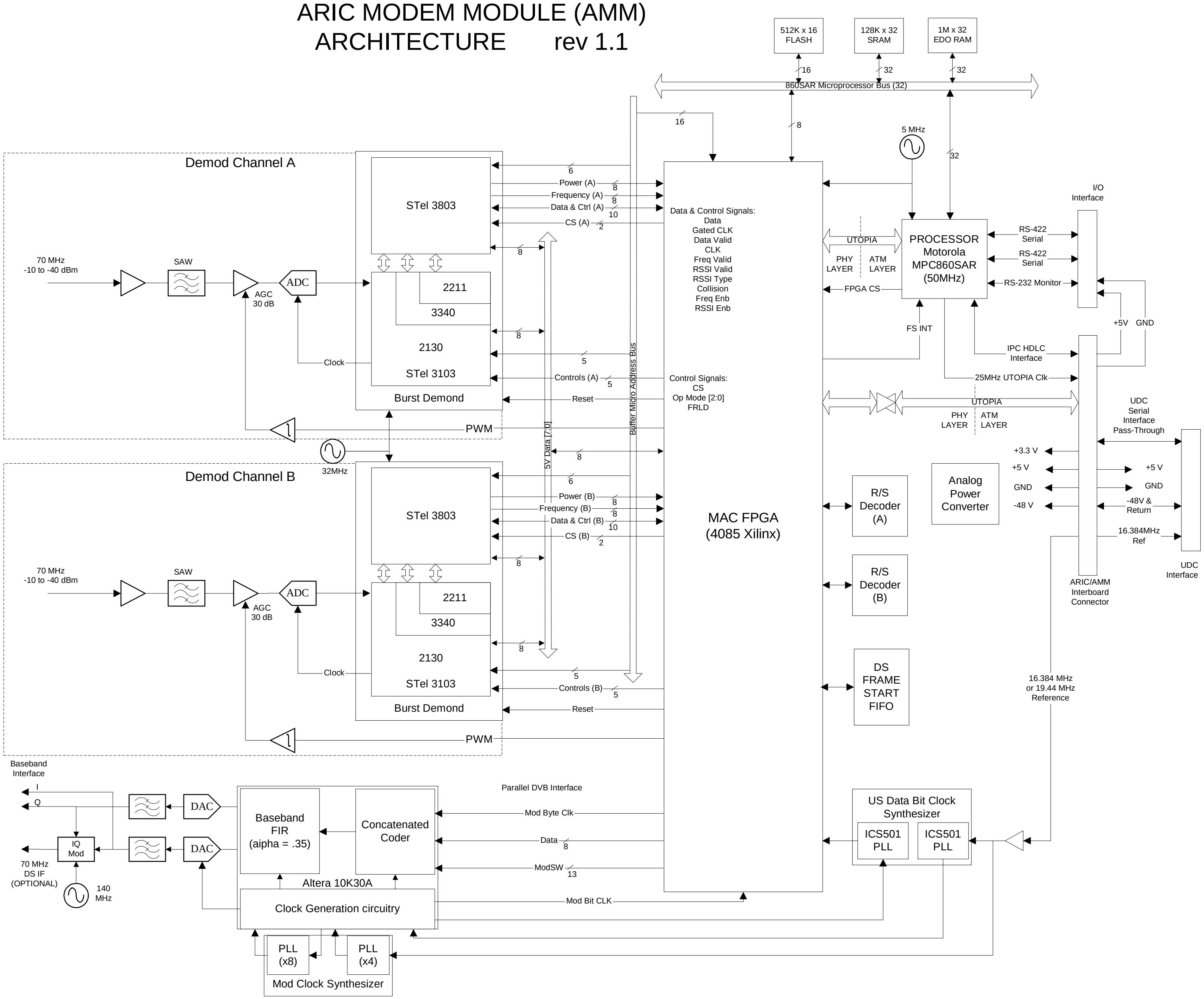
ARIC MODEM MODULE (AMM) ARCHITECTURE rev 1.1



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