

Reed Solomon



High Performance Reed Solomon Option for PSM4900 Satellite Modem Family.

The optional Reed-Solomon/Multiplexer Card provides the PSM-4900 modem family with a greater level of functional capability. This optional daughter card is designed to fit onto the main modem assembly and use the J4 "Aux", (Auxiliary) connector for Input and Output at the rear panel

The option card is provided in one of two possible configurations:

1. Framing and IBS Multiplexer, which provides for both an overhead ESC (Engineering Service Channel) and an available modem-to-modem control channel for AUPC and remote control functions (MCC).
2. Reed-Solomon concatenated codec plus the framing and IBS Multiplexer.



The framing convention used in the PSM4900 Multiplexer and Reed-Solomon adheres to the Intelsat IESS-309 standard. Three possible modes of operation are provided for that include various uses for the available framing bits:

1. "Standard" – Provides usage in accordance with the IESS Standard.
2. "Enhanced" – Provides added capabilities proprietary to the M4 and M5 class modems.
3. "Custom" – Provides added capabilities proprietary to the M5 class modem plus variable terrestrial to framing ratios. This mode is not compatible with M4 class modems.

The framing/multiplexer is capable of multiplexing a (usually) low speed overhead channel and pieces of control information onto the terrestrial data stream resulting in a slightly higher combined or "aggregate" data rate through the modem.

There are two specific channels that the PSM-4900 IBS Multiplexer can add to the terrestrial data stream. The data for the channels is contained within the framing bytes themselves.

- The "ESC" channel available in all modes.
- The control or "MCC" channel available in the proprietary "Enhanced" and "Custom" modes.

The multiplexed channels are recovered and separated from the terrestrial data at the far end of the link.

In addition to the ESC various other information is transferred between the two ends of the link. This information consists of status represented by fixed bits within the frame structure. The "Frame" is the method used to synchronize information at each end, allowing recovery of the separate channels that are multiplexed or "mixed" together for transmission. The standard Intelsat IESS frame structure is shown below in figure RS-2 below.

The MCC or Modem Control Channel is proprietary to Datum Systems' Modems, and provides added valuable facilities. For the M5 class modems the MCC can provide:

- AUPC – Automatic Uplink Power Control in Enhanced and Custom modes.
- RMC – Remote Modem Control in Enhanced and Custom modes. (Not compatible with M4 Modems)
- RFC – Remote Facility Control in Custom mode only.

The MCC facilities are generated using specific normally unused bits in the framing structure. It provides an independent channel by which the two modems themselves may communicate, providing the capability for Automatic Uplink Power Control (AUPC) and Remote Modem Control (RMC) without the necessity of a separate multiplexer. This document and the modem front panel refer to this channel as the "MCC", standing for Modem Control Channel.

The PSM-4900 multiplexer MCC also provides two "single line" backward alarm channels, termed a Remote Facility Control or "RFC". These two independent RFC channels can accept a voltage or contact closure type input on one end and provide a form "C" relay contact presence on the far end. These can be used for alarms and simple commands. One example might be to light an indicator at a hub site when the door is opened at a remote site. The reverse direction of this bit might be used to lock the door electronically. One other possible use for such data transfer would be to provide a "backward" alarm from an unattended site giving the status of the transmit and receive outdoor converter and amplifier equipment.

The AUPC and RMC information is used internally by the modem and does not appear on the rear panel at J4. The RFC "backward alarm" channels do appear on J4. For the pin connections refer to the "Installation" Section 3 of this Appendix.

Reed Solomon FEC Performance

Modes of Operation

Reed-Solomon FEC

The Reed-Solomon FEC provides the following modes of operation.

Mode	Standard/ Compatibility	Overhead Ratio	Notes
Disabled	N/A	1/1	
IESS-308	IESS-308	9/8, 45/41, 73/67	M4 compatible up to 1.544 Mbps
IESS-309	IESS-309	73/67	
Custom	Modified IESS-309	Variable	Allows setting the "n", "k" and "depth" values for special requirements. Can also be set for M4 compatibility to max M4 data rate.

IBS Multiplexer

The Multiplexer provides the following modes of operation.

Mode	Standard/ Compatibility	Overhead Ratio	Notes
Disabled	N/A	1/1	
Standard	IESS-309	16/15	Fixed synchronous ESC, No AUPC, No MCC
Enhanced	Modified IESS-309	16/15	M4 compatible ESC and AUPC (limited MCC).
Custom	Modified IESS-309	Variable	Full ESC and MCC including AUPC, Remote Modem Control, 2 one-bit control channels. Also variable data load per frame.

BER vs. Eb/No Performance

The typical performance with the optional Reed-Solomon codec (concatenated on the Viterbi codec) is shown in the table below. The Eb/No values shown are those referenced to the customer data rate at the decoder output. Performance would appear improved if measured relative to the decoder input (i.e. at the satellite data rate). All values shown are using the standard IESS-308 Reed-Solomon codec values of n = 126, k=112, depth =4, and the synchronous IESS-308 scrambler/descrambler. Significant changes in performance, positive and negative, are achieved using different n, k and depth values.

Concatenated Viterbi FEC plus Reed-Solomon Typical Performance Data							
		Rate 1/2		Rate 3/4		Rate 7/8	
BER	Uncoded Eb/No	Coding Gain	Typical Eb/No	Coding Gain	Typical Eb/No	Coding Gain	Typical Eb/No
10 ⁻⁴	8.4 dB	**	**	**	3.8 dB		5.1 dB
10 ⁻⁵	9.6 dB	6.5 dB	3.1 dB	5.6 dB	4.1 dB	4.2 dB	5.4 dB
10 ⁻⁶	10.5 dB	7.2 dB	3.3 dB	5.7 dB	4.3 dB	4.4 dB	5.7 dB
10 ⁻⁷	11.4 dB	7.4 dB	3.4 dB	5.8 dB	4.5 dB	4.5 dB	6.0 dB
10 ⁻⁸	**		3.6 dB		4.7 dB		6.3 dB
10 ⁻⁹	**		3.8 dB		4.9 dB		6.6 dB

Note: ** indicates that these values are outside of measurement range or available data.

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