DMD20
Satellite Control Channel (SCC)

White Paper

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DMD20 Satellite Control Channel (SCC)

Introduction

This white paper discusses the DMD20 Satellite Control Channel. This satellite protocol supports the asynchronous channel. The SCC Protocol was designed to support async compatibility between the DMD20, CM601, CM701, and the DT8000. Its advantage is much lower overhead compared with other Async protocols.

Satellite Control Channel (SCC)

The SCC format uses a variable overhead rate to transmit an asynchronous data channel in addition to the normal data channel. The SCC asynchronous mode implemented on the DMD20 is "PassThru" Mode.

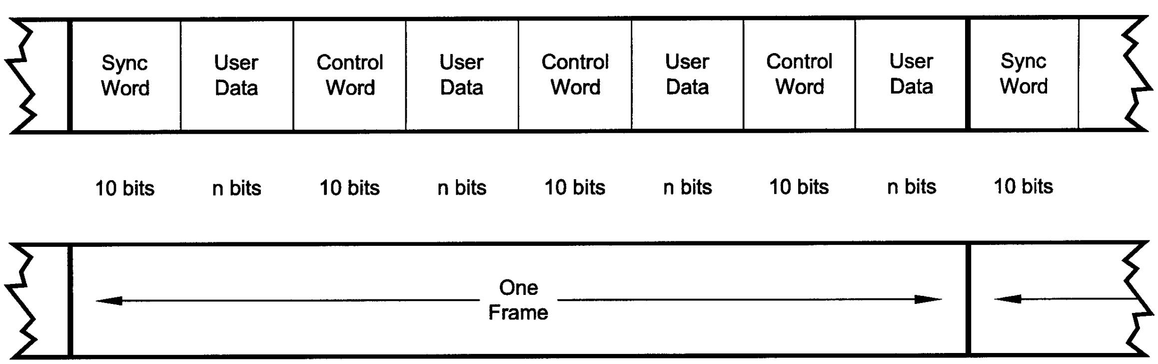
SCC Framing Structure

Each SCC frame consists of the following:

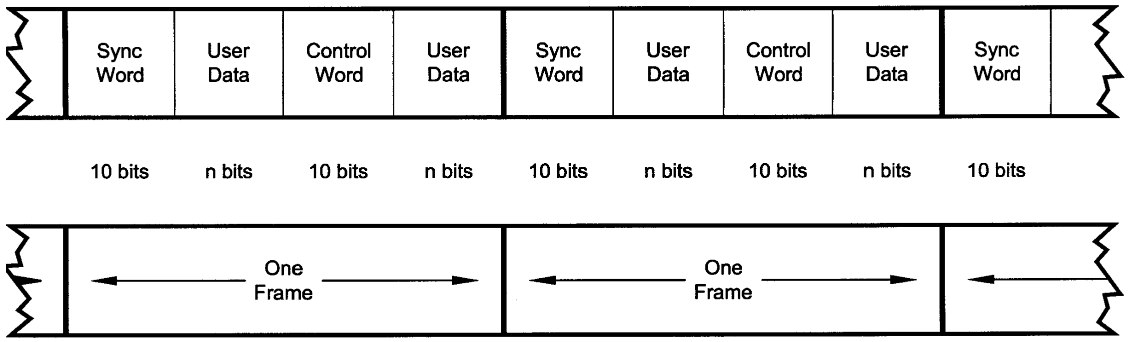
- A 10-bit synchronization pattern called the Synchronizing Word.
- Multiple variable length slots filled with user data.
- Multiple 10-bit control words that contains eight bits of in-band data (the extra two bits are for the async start/stop).

The number of user data slots and control words per frame is selected by the SCC Control Ratio Parameter. This can be any value from 1 to 1 through 1 to 7. A higher ratio allows a lower overhead rate but since there are less Sync Words, there is a higher acquisition time.

The following examples show a control ratio of 1 to 3 and 1 to 1. Example 1 shows three Control Words for every Synchronizing Word, and Example 2 shows one Control Word for every Synchronizing Word.



1 to 3 Control Ratio



1 to 1 Control Ratio

The Control Ratio of the receiving units must match the Control Ratio of the transmitting unit.

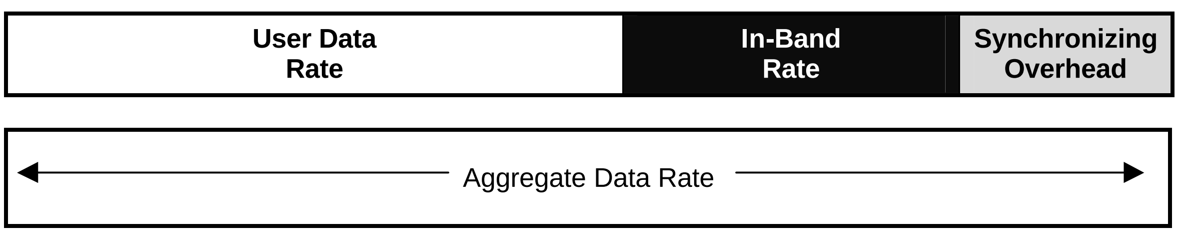
Aggregate Data Rate

The aggregate data rate equals the following:

User Data Rate + In-Band Rate + Synchronizing Overhead Rate

Because SCC must adjust the overhead so that there are an equal number of user data bits in each slot, the synchronizing overhead cannot be easily calculated. However, dividing the In-Band Rate by the Control Ratio can approximate it. The following equation shows the basic calculation of this rate:

Aggregate Date Rate = User Data Rate + In-Band Rate + (In-Band Rate/Control Ratio)



As an example, given the following parameters:

User Data Rate:	1,024,000 bps
In-Band Rate:	19,200 bps
Control Ratio:	1 to 7

Aggregate data rate = 1,024,000 + 19,200 + (19,200/7) or approximately 1,045,942 (actually 1045974).

This gives an overhead ratio of 1,045,974/1,024,000 = 1.021

In addition, another constraint changes the actual Aggregate Data Rate. The user data slot size is limited to 2,500 bits. Because of this, the modem increases the in-band rate to reduce the user data slot size. This only happens at higher user data rates.

Overhead Rate Comparison

The SCC Overhead Ratio varies depending on the User Data Rate, the In-Band Rate, and the Control Ratio. This gives SCC the advantage of lower overhead rates when compared to IBS, which has a fixed overhead ratio of 16/15 or 1.067. The following table gives some example overhead rates for different user data and control ratios.

User Data Rate	In-Band Rate	Control Ratio	Aggregate Data Rate	Overhead Ratio
512,000	19,200	1/7	533,974	1.043
1,024,000	19,200	1/7	1,045,974	1.021
2,048,000	19,200	1/7	2,069,951	1.011
3,072,000	19,200	1/7	3,093,943	1.007
4,096,000	19,200	1/7	4,117,951	1.005
6,312,000	19,200	1/7	6,337,248	1.004
6,312,000	19,200	1/3	6,337,606	1.004
6,312,000	19,200	1/1	6,350,418	1.006

Actual Overhead Rate Calculation

The following is the actual calculation the modem does to calculate the overhead ratio:

1. The modem calculates the minimum in-band rate to limit the size of the user data slots to 2,500 bits (the result is truncated to an integer).

   *Minimum In-Band = (User Data Rate * Control Ratio)/((Control Ratio + 1) * 250)*

2. Using the bigger of Minimum In-Band or the selected In-Band, the modem calculates the number of bits for each user data slot (result is truncated to an integer).

   *Slot Bits = (User Data Rate * (Control Ratio * 10))/(In-band Rate * (Control Ratio + 1))*

The actual ratio the modem uses is:

Actual Ratio = (Slot Bits + 10)/Slot Bits

Examples

Example 1:

User Data Rate:	1,024,000 bps
In-Band Rate:	19,200 bps
Control Ratio:	1 to 7

Minimum In-Band = (1,024,000 * 7)/((7 + 1) * 250) = 3,584 *(less than In-Band Rate)*
Slot Bits = (1,024,000 * (7 * 10))/(19,200 * (7 + 1)) = 466
Actual Ratio = (466 + 10)/466 = 1.021

Example 2:

User Data Rate:	6,312,000 bps
In-Band Rate:	19,200 bps
Control Ratio:	1 to 7

Minimum In-Band = (6,312,000 * 7)/((7 + 1) * 250) = 22,092 (*more than In-Band Rate)*
Slot Bits = (6,312,000 * (7 * 10))/(22,092 * (7 + 1)) = 2,500
Actual Ratio = (2,500+ 10)/2,500= 1.004