To: List

From: W. Aldrich

Subject: Mark 5B DIM Checking

INTRODUCTION

The purpose of this note is to specify the operational modes of the Mark 5B data input module (DIM), which will be checked to provide verification of the correct operation of the DIM hardware. The number of possible operational modes is in excess of 3×10^{9} and is therefore impractical to check exhaustively. A judiciously chosen subset of the possible modes will allow a verification of the DIM hardware design.

The general plan is to present the DIM with a repeating sequence of the test vector generator (TVG) pattern as defined in the VSI-H specification. The various defined modes will allow the DIM to extract subsets of the TVG sequence and write them on the StreamStor disks. The disk files will then be read and checked for the proper data values.

GENERAL SAMPLE SEQUENCE

In order to describe the DIM behavior precisely, the following notation for the TVG sequence is presented. The TVG sequence consists a sequence of 32 bit values, which can be described as below:

$$S(31,0) \quad S(31,1) \quad S(31,2) \bullet \bullet \bullet S(31,n) \bullet \bullet \bullet$$
$$S(30,0) \quad S(30,1) \quad S(30,2) \bullet \bullet \bullet S(30,n) \bullet \bullet \bullet$$
$$\bullet$$
$$\bullet$$
$$\bullet$$
$$S(0,0) \quad S(0,1) \quad \quad S(0,2) \bullet \bullet \bullet \quad S(0,n) \bullet \bullet \bullet$$

In general $S(k,n)$ is the bit in the kth bit stream which was sampled on the nth clock. If we adopt the convention that the start of a recording is on a second tick, then $S(k,0)$ has the mnemonic TOST (Taken On Second Tick).

The sequence repeats endlessly modulo 32767. At each one-second tick, the sequence is restarted. The next value after the one-second tick is 0xBFFF4000. This is $S(k,1)$ at the start of a recording. Note that each second's recording is identical after the first.

DECIMATION

The DIM may be set to record a subset of the TVG sequence. One way in which a subset can be specified is to require the DIM to "decimate" wherein it takes every jth word, starting with TOST. Decimation is only allowed to be by a factor which is 1 (no decimation) 2,4,8,or 16. For example, the starting sequence when decimating by 4 would be:

$$S(k,0) \quad S(k,4) \quad S(k,8) \bullet\bullet\bullet$$

BIT STREAM MASK

The bit stream mask (BSM) specifies which of the 32 bit streams will actually be recorded. The BSM is a 32 bit parameter, each bit of which is a "1" if the corresponding bit stream is to be recorded. If a bit of the BSM is a "0", the bit stream will not be processed by the DIM. Legal BSM's may only have 1,2,4,8,16, or 32 "1" values set. For example a BSM of 0xA0000003 will only process the four bit streams $S(31,n)$, $S(29,n)$, $S(1,n)$, and $S(0,n)$.

The DIM strives to be efficient in its use of the disk-recording medium and therefore always writes 32 bit words on the disk. If the BSM contains less than 32 "1" bits then the bits from several sample clocks are packed into each 32 bit word. The active bits are placed in the word starting with the least significant bits until 32 bits are accumulated. Then that word is sent to the disk and the next word is started. For example if BSM = 0xA0000003 the word which contains the four TOST bits (no decimation) is:

Bit	Data	
31	S(31,7)	
30	S(29,7)	
29	S(1,7)	
28	S(0,7)	
27	S(31,6)	
26	S(29,6)	
25	S(1,6)	
24	S(0,6)	
23	S(31,5)	
22	S(29,5)	
21	S(1,5)	
20	S(0,5)	
	●	
	●	
	●	
3	S(31,0)	TOST bit
2	S(29,0)	TOST bit
1	S(1,0)	TOST bit
0	S(0,0)	TOST bit

MODES OF OPERATION

In actual operation the DIM may be called on to reduce the number of bit streams by way of the BSM and to decimate by some factor as well. The two processes operate simultaneously in the obvious manner. For example in the following diagram the BSM is 0xA0000003 and decimation by 4 is requested. The • locations are bits written to the disk and the – locations are not processed.

```
●   -   -   -   ●   -   -   -   ●   -   -   -     ← Bit stream 31
-   -   -   -   -   -   -   -   -   -   -   -
●   -   -   -   ●   -   -   -   ●   -   -   -     ← Bit stream 29
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
-   -   -   -   -   -   -   -   -   -   -   -
●   -   -   -   ●   -   -   -   ●   -   -   -     ← Bit stream 1
●   -   -   -   ●   -   -   -   ●   -   -   -     ← Bit stream 0

↑
TOST
```

DISK IMAGE

The actual disk image includes the data as described above and the headers, which are inserted at the beginning and after each 2500 data words. Disk files with no decimation and BSM = 0xFFFFFFFF have been checked at a sample frequency of 32 MHz. Much of the checking for headers and their contents would be identical, but the time codes will vary in cases where the BSM has fewer than 32 "1" bits and where decimation is called for. (Each case takes longer to accumulate 2500 words.)

LIST:

> J. Ball
> R. Cappallo
> B. Fanous
> A. Whitney