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From : Pete Bramhall, HP CPB (Fax : +44 272 236091)  
To : Dan Davies, Cipher Data Products, Inc (Fax : +1 619 549 8037)  
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Subject : SCSI-2 Chapter 9 and DDS-Format Helical Scan Tape Drives

Dear Mr Davies,

As we discussed by phone last week and today, I believe that Chapter 9 of the SCSI-2 specification would benefit from taking the requirements of Helical Scan tape drives more into account. At least one such drive is already being marketed, utilizing 8mm tape. Others which use 3.81 mm Digital Audio Tape media and technology and the DDS tape format will be available soon and are expected to achieve significant sales and usage during the lifetime of SCSI-2. Therefore, I believe it is timely to identify now the issues raised by the omission of specific references to helical scan concepts, particularly those of the DDS format from the current SCSI-2 working draft, and to propose solutions to those issues.

I note that a Density Code (13h) has been introduced some time ago, and that Setmarks have recently been proposed. These are indeed necessary elements of support, but more are required. Owing to time pressure, I am unable to provide complete descriptions or proposed solutions and text at this time, so the following list may appear to be just a list of deficiencies and gripes. I'd like to assure you that I don't intend this to be a merely negative contribution, but I feel it is important to at least raise the issues now.

The following comments refer to the SCSI-2 Working Draft Proposal Rev 5.

#### 1. Section 9.1.1

This needs expanding to introduce the concept behind helical scan recording, in particular the sequential ordering of the parallel tracks. For DDS, there is also the collecting of data and segmentation marks into groups which consist of 22 data frames and an ECC frame, with an index to manage the data structure therein.

## 2. Section 9.1.2

DDS supports Partitions within a Volume, but these are based on position along a tape, not on track groups as in serpentine recording. The format also supports non-partitioned tape. If a volume is partitioned, the partition which starts at BOM is called Partition 1, and the other partition is called Partition 0. This starts at the end of Partition 1 and extends to EOM. There is a maximum of 2 partitions on a DDS volume. Partition 0 is the Default Data Partition. The intent is that each partition appears to the host/initiator to be the same as a complete non-partitioned volume, e.g. a half inch reel-to-reel tape, and so includes the same concepts of BOT, EOT and EW.

Because of the sequential location of partitions and the intent that each appears logically to be a complete volume, the Rewind, Erase and Load commands need to function differently.

## 3. Section 9.1.3

With helical scan drives, the physical attributes are very different. Filemarks, setmarks and data record separators are encoded synthetically in data management structures within groups of frames, and do not have a physical representation which corresponds directly with data sent from an initiator.

## 4. Section 9.2.1 Erase

If the Long bit is not set, 25 amble (i.e. null) frames are written.

If the Long bit is set, then after the 25 amble frames, an EOD marker is written from the current position to the end of the Partition.

## 5. Section 9.2.2 Load/Unload

A Load bit of one indicates that the medium on the peripheral device shall be loaded and positioned at the beginning of the Default Data Partition. For a non-partitioned tape, this is the beginning of the only data space thereon, i.e. at BOT. For a partitioned tape, this is the logical cal BOT at the beginning of Partition 0. A drive may choose to leave the tape physically at BOM but logically at the beginning of Partition 0, such that the execution of the next command is preceded by a physical move to the beginning of Partition 0, unless that command selects Partition 1 explicitly.

## 6. Section 9.2.11 Rewind

The Rewind command requests that the target rewind the logical unit to the logical BOT at the beginning of the current Partition.

7. Section 9.3.3 Device Configuration Parameters Page 10h of Mode Select

There are ten data error rate improvers included in the DDS format. Of these, some are not controllable by a host/initiator; others, such as Read-After-Write retries, are controllable using features currently included or proposed for SCSI-2. However, two of them require additional features to be included, and I believe this is the appropriate place.

Firstly, the generation of an ECC frame at the end of a data group, when the group is written to tape, should be controllable by a host/initiator. The requirement is a single bit to switch such generation on and off. Switching the ECC frame off increases transfer rate and volume capacity with some penalty in data reliability.

Secondly, DDS supports a group-repeat mode known as N-Group writing, in which every data group is written to tape N times in a consecutive sequence. This improves data reliability with penalties in transfer rate and volume capacity. The requirement is to select the number of repeats, in the range 0 to 7.

Together, these require 4 extra bits. I propose the use of byte 15 in Page 10h. Bits 0,1,2 form a new field called N-Repeat and contain the number of N-Group repeats. Bit 3 is named ECC; when set to 1 it turns off the generation of the ECC frame at the end of each data group, when zero it enables its generation.

If it is not acceptable to use this Reserved byte, then an alternative would be to use bits 0,1,2,3,4 of byte 2. This is currently the Active Format field, and could have its definition extended so that bit 4 is zero for the current definition to apply, and bit 4 is set to 1 for the definition of bits 0,1,2,3 above to apply. Such an extension appears to be compatible with the current definition.

I hope these descriptions are sufficient to identify the major areas where extension of the current Working Draft is required to accommodate helical scan devices. Please do not hesitate to contact me if you need more. I hope to be able to provide more material if the inclusion of helical scan into SCSI-2 is deemed to be desirable and feasible. I realise all this is a little later than ideal, but we considered it appropriate to raise and discuss these topics first in the meetings of the DDS Manufacturers Group and gain consensus there before proceeding to ANSI.

Best regards,

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