Cohasset Associates

SEC 17a-4(f) Compliance Assessment

IBM TS7700

Abstract

BENEFIT FROM COHASSET'S INDUSTRY INSIGHT AND EXPERIENCE

Cohasset's primary business focus is to provide records management and information governance consulting and educational services to regulated organizations, including the financial services industry. These services align information lifecycle controls with business priorities, resulting in ongoing regulatory compliance, effective risk mitigation and measurable business efficiencies for domestic and multi-national clients.

Cohasset has assessed a spectrum of storage technologies and systems designed to meet the requirements of the Securities and Exchange Commission (SEC) Rule 17a-4(f), (the "Rule"), starting with the No Action Letter in 1993 (allowing broker dealers to use non-erasable, non-rewriteable digital storage media), the issuance of the Rule in 1997, and the Interpretive Release in 2003, which allows the use of erasable storage, conditioned on integrated control codes to prevent premature deletion of records.

The IBM TS7700 storage family ("TS7700") includes three models, the TS7720, TS7740 and the newest model TS7760. The three models differ in their storage capacity and performance.

In July 2010, Cohasset Associates, Inc. ("Cohasset") completed a compliance assessment of the storage capabilities of the TS7720 and TS7740 Models of the IBM TS7700 to the relevant requirements of SEC Rule 17a-4(f).

Cohasset's July 2010 assessment concluded that the TS7700 meets the SEC requirements that are within its capabilities for storing records in digital form, pursuant to the requirements set forth in Rule 17a-4(f), when:

- Storing record files as virtual tape volumes on rewriteable magnetic disk and magnetic tape media using control codes to prevent overwriting of records,

- Properly configured Data Class(es) with the Logical WORM ("LWORM") attribute set to "Yes", and

- Employing effective broker-dealer systems and procedures prevent erasure until the specified retention period and any legal holds have expired.

In this January 2017 update, Cohasset asserts that the compliance features of the TS7760 are equivalent to the other TS7700 models; and therefore, Cohasset concludes that the storage capabilities of the TS7760 meet the relevant requirements of the Rule.

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1 | Introduction

The Securities and Exchange Commission (SEC) defines rigorous and explicit requirements for organizations that elect to retain books and records on electronic storage media. Given the prevalence of electronic retention of books and records, these requirements apply to most broker-dealer firms and other organizations with broker-dealer functions or operations.

Certain features are available with IBM TS7700 storage family ("TS7700") to prevent the overwrite of stored electronic record files and facilitate legal holds in support of compliance with these stringent electronic records storage requirements. To evaluate the capabilities of the TS7700 for compliance with the SEC requirements, IBM engaged Cohasset to complete an independent and objective assessment of the TS7700.

This Introduction briefly summarizes the regulatory environment, explains the purpose and approach for Cohasset's assessment, and provides an overview of the TS7700.

1.1   Overview of the Regulatory Requirements

Recordkeeping requirements for the securities broker-dealer industry are stipulated by the United States Securities and Exchange Commission ("SEC") Regulations, including 17 CFR §§ 240.17a-3 and 240.17a-4. Specifically, SEC Rule 17a-4(f), when adopted on February 12, 1997, expressly allowed books and records[1] to be retained on electronic storage media, subject to meeting certain conditions. Additionally, the Financial Industry Regulatory Authority (FINRA) Rule 4511(c) stipulates:

> *(c) All books and records required to be made pursuant to the FINRA rules shall be preserved in a format and media that complies with SEA Rule 17a-4.*

Three separate foundational documents collectively define and interpret the specific regulatory requirements that must be met for an electronic storage system to be compliant with SEC Rule 17a-4(f). These are:

- The Rule itself, as modified over time by the SEC. These modifications to the original Rule have not affected the requirements for electronic storage media, which are the basis of this assessment. However, certain Interpretive Releases have clarified the context and meaning of certain requirements and conditions of the Rule.

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[1] Regulators use the phrase "*books and records*" to describe all content that must be retained under the Rules. Since this assessment deals with the capabilities of a storage solution relative to SEC Rules, Cohasset has chosen to use the terms "electronic record," "electronic record data set," "record" and "data record" as interchangeable terms to describe an electronic file of information that is defined and regulated by SEC Rules 17a-3 or 17a-4. In the terminology of magnetic tape storage, an "electronic record" would be recorded as part of a data set; there may be one or multiple data sets recorded on a volume of media.

- SEC Interpretive Release No. 34-44238, Commission Guidance to Broker-Dealers on the Use of Electronic Storage Media under the Electronic Signatures in Global and National Commerce Act of 2000 with Respect to SEC Rule 17a-4, dated May 1, 2001 (the "2001 Interpretive Release").

- SEC Interpretive Release No. 34-47806, Electronic Storage of Broker-Dealer Records, dated May 7, 2003 (the "2003 Interpretive Release").

In the Rule and in the two subsequent interpretative releases, the SEC authorizes the use of electronic storage media and devices to satisfy the recordkeeping requirements of SEC Rules 17a-3 and 17a-4, when the system delivers the prescribed functionality. Specifically, Rule 17a-4(f)(1)(ii) states:

(f) The records required to be maintained and preserved pursuant to §§ 240.17a-3 and 240.17a-4 may be immediately produced or reproduced on "micrographic media" (as defined in this section) or by means of "electronic storage media" (as defined in this section) that meet the conditions set forth in this paragraph and be maintained and preserved for the required time in that form.
(1) For purposes of this section:
(ii) The term electronic storage media means any digital storage medium or system and, in the case of both paragraphs (f)(1)(i) and (f)(1)(ii) of this section, that meets the applicable conditions set forth in this paragraph (f).

The February 12, 1997, Federal Register issued the final rule to allow broker-dealers to use electronic storage media. When issuing the rule, the SEC recognized that technology evolves and it set forth standards that the electronic storage media must satisfy, rather than prescribing specific technology, as specified in the following excerpts:

SUMMARY: The Securities and Exchange Commission (''Commission'') is amending its broker-dealer record preservation rule to allow broker-dealers to employ, under certain conditions, electronic storage media to maintain records required to be retained. <u>The amendments reflect a recognition of technological developments that will provide economic as well as time-saving advantages for broker-dealers by expanding the scope of recordkeeping options while at the same time continuing to require broker-dealers to maintain records in a manner that preserves their integrity.</u> The Commission is also issuing an interpretation of its record preservation rule relating to the treatment of electronically generated communications.
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II. Description of Rule Amendments
A. Scope of Permissible Electronic
Storage Media
***<u>The Commission is adopting a rule today which, instead of specifying the type of storage technology that may be used, sets forth standards that the electronic storage media must satisfy to be considered an acceptable method of storage under Rule 17a–4.</u> Specifically, because optical tape, CD–ROM, and certain other methods of electronic storage are available in WORM and can provide the same safeguards against data manipulation and erasure that optical disk provides, the final rule clarifies that broker-dealers may employ any electronic storage media that meets the conditions set forth in the final rule.[2] [emphasis added]

The 2003 Interpretive Release further clarifies that implementation of rewriteable and erasable media, such as magnetic tape or magnetic disk, meets the requirements of a non-erasable and non-rewriteable recording environment, if the system delivers the prescribed functionality and appropriate **integrated control codes** are in place. The 2003 Interpretive Release states:

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[2] Exchange Act Release No. 38245 (Feb. 5, 1997), 62 FR 6469 (Feb. 12, 1997) ("Adopting Release").

A broker-dealer would not violate the requirement in paragraph (f)(2)(ii)(A) of the rule if it used an electronic storage system that prevents the overwriting, erasing or otherwise altering of a record during its required retention period through the use of integrated hardware and software control codes.

The key words within this statement are "integrated" and "control codes." The term "integrated" means that the method used to achieve a non-rewriteable, non-erasable recording environment must be an integral part of the recording hardware and software. The term "control codes" indicates the acceptability of using attribute codes (metadata), which are integral to the hardware and software of the recording process, to protect against overwriting or erasure of any records.

Examples of integrated control codes relevant to a non-rewriteable and non-erasable recording process are:

- A retention period during which the record object cannot be erased, overwritten or otherwise modified;

- A unique record identifier that differentiates each record from all other records; and

- The date and time of recording, which in combination with the unique identifier "serializes" the record.

The 2003 Interpretive Release specifically notes that recording processes or applications which merely mitigate the risk of overwrite or erasure (rather than prevent them), such as relying solely on access control security, will not satisfy the requirements of SEC Rule 17a-4(f).

Further, the 2003 Interpretive Release requires the storage system to be capable of retaining records beyond the SEC-established retention period, when required by a subpoena, legal hold or other similar circumstances. In *Section IV. Discussion*, the 2003 Interpretive Release states:

Moreover, there may be circumstances (such as receipt of a subpoena) where a broker-dealer is required to maintain records beyond the retention periods specified in Rule 17a-4 or other applicable Commission rules. Accordingly, a broker-dealer must take appropriate steps to ensure that records are not deleted during periods when the regulatory retention period has lapsed but other legal requirements mandate that the records continue to be maintained, and the broker-dealer's <u>storage system must allow records to be retained beyond the retentions periods specified in Commission rules.</u> *[emphasis added]*

An important associated requirement of SEC Rule 17a-4(f)(2)(i) is that a member, broker or dealer electing to electronically store its records required by SEC Rules 17a-3 or 17a-4, must notify its designated examining authority at least ninety (90) days prior to employing any technology other than write-once read-many ("WORM") optical media. Examining authorities are self-regulatory organizations (SROs) or Designated Examining Authorities (DEAs) under the jurisdiction of the SEC, such as the Financial Industry Regulatory Authority (FINRA).

1.2   Purpose and Approach

To obtain an independent and objective assessment of the capabilities of the IBM TS7700 storage family ("TS7700"), in comparison to the requirements set forth in SEC Rule 17a-4(f), IBM engaged Cohasset Associates, Inc. ("Cohasset"). As a highly respected consulting firm with specific and relevant knowledge, Cohasset has recognized expertise and more than 40 years of experience with the legal, technical and operational issues associated with the records management practices of companies regulated by the SEC. Additional information about Cohasset is provided in the last section of this report.

Cohasset was engaged to:

- Assess the TS7700 in comparison to the electronic storage requirements of SEC Rule 17a-4(f) and

- Prepare this Assessment Report, enumerating the results of its assessment.

This assessment represents the professional opinion of Cohasset and should not be construed as either an endorsement, or a rejection, by Cohasset of the IBM TS7700 and its capabilities or other IBM products and services. The information utilized by Cohasset to conduct this assessment consisted of (a) oral discussions, (b) system documentation, (c) system administrator guidance, and (d) other directly-related materials provided by IBM.

In addition to applying the information in this Assessment Report, regulated entities must ensure that the combination of its policies, procedures and regulatory submissions, in conjunction with the capabilities of implemented solutions, meet all requirements of SEC Rule 17a-4(f), when applicable.

The content and conclusions of this assessment are not intended, and must not be construed, as legal advice. Relevant laws and regulations are constantly evolving and legal advice is tailored to the specific circumstances of the organization. Therefore, nothing stated herein should be substituted for the advice of competent legal counsel.

1.3 IBM TS7700 Overview

The IBM TS7700 storage family ("TS7700") is designed to provide a higher-performance storage environment by combining high-performance magnetic disk storage with optional magnetic tape drives to offer a virtual magnetic tape storage solution. The three TS7700 models – the TS7720, TS7740, and the newest model TS7760 – offer different storage capacity and performance.

The TS7700 provides a virtual magnetic tape management system in that electronic records are written to a "virtual volume"[3] (either on magnetic disk only or on a combination of magnetic disk and magnetic tape media; see Section 2.1.3) that emulates the characteristics of recording to physical magnetic tape volumes (i.e. magnetic tape cartridges).

With Release 1.6, the TS7700 provides the capabilities that prevent any overwrite of electronic records by embedding write once, read only ("WORM") control codes which are integral and unique to (a) a specially defined Data Class[4] and (b) individual virtual volumes related to that specific Data Class.

This assessment report was prepared in July 2010 when Cohasset completed its compliance assessment of the storage capabilities of the IBM TS7700, Models TS7720 and TS7740, relative to the requirements and conditions of SEC Rule 17a-4(f). In this January 2017 update, Cohasset asserts that the compliance features of the TS7760 are equivalent to the other TS7700 models, and therefore, Cohasset concludes that the TS7760 meets the requirements of the Rule that are within its capabilities for storing records in digital form.

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[3] A "volume" is a distinct unit of storage on disk, tape or other data recording medium that supports some form of identifier and parameter list, such as a volume label or input/output control. A virtual volume is a tape volume that resides in a tape volume cache or a virtual tape server. (Source: IBM Globalization Terminology.) For purposes of this assessment report, the terms "volume" and "virtual volume" are intended to mean a storage space equivalent to and managed so that it emulates a physical magnetic tape cartridge volume.

[4] A Data Class defines a particular set of electronic records that likely are related from a business operations perspective, e.g., confirms, broker e-mail, etc., and that are to be similarly managed by the TS7700.

2 | Assessment of Compliance with SEC Rule 17a-4(f)

This section presents Cohasset's assessment of the capabilities of the IBM TS7700 for compliance with the four (4) requirements related to recording, storage, retention and management of electronic records, as stipulated in SEC Rule 17a-4(f).

For each of the relevant requirements in SEC Rule 17a-4(f), this assessment is organized into the following four topics:

- ***Compliance Requirement*** – Delineation of the electronic storage requirements required by SEC Rule 17a-4(f)

- ***Compliance Assessment*** – Assessment of the capabilities of the TS7700 in relation to its ability to meet or support efforts to comply with the specific requirements of the Rule

- ***TS7700 Capabilities*** – Description of the capabilities of the TS7700 that are relevant to the specific requirements of the Rule

- ***Additional Considerations*** – Identification of actions performed to meet the specific requirements of the Rule

The following subsections document Cohasset's assessment of the capabilities of the TS7700 relative to each requirement of SEC Rule 17a-4(f).

2.1 Non-Rewriteable, Non-Erasable Record Format

2.1.1 Compliance Requirement [SEC 17a-4(f)(2)(ii)(A)]

As set forth in Section III (B) of the 2001 Interpretive Release, this requirement "*is designed to ensure that electronic records are capable of being accurately reproduced for later reference by maintaining the records in an unalterable form.*"

> **SEC 17a-4(f)(2)(ii)(A):** Preserve the records exclusively in a non-rewriteable, non-erasable format.

The following statement in the 2003 Interpretive Release further clarifies that certain implementations of rewriteable and erasable media, such as magnetic disk or magnetic tape, meet the requirements of a non-erasable and non-rewriteable recording environment provided: (a) the storage solution delivers the prescribed functionality and (b) the functionality is delivered via appropriate integrated control codes for the SEC designated retention period associated with the stored records.

> *A broker-dealer would not violate the requirement in paragraph (f)(2)(ii)(A) of the rule if it used an electronic storage system that prevents the overwriting, erasing or otherwise altering of a record during its required retention period through the use of integrated hardware and software control codes.*

Further, Section IV of the 2003 Release places requirements on the storage system for retaining records beyond the SEC-established retention period when certain circumstances occur, such as a subpoena or hold order:

> *Moreover, there may be circumstances (such as receipt of a subpoena) where a broker-dealer is required to maintain records beyond the retention periods specified in Rule 17a-4 or other applicable Commission rules. Accordingly, a broker-dealer must take appropriate steps to ensure that records are not deleted during periods when the regulatory retention period has lapsed but other legal requirements mandate that the records continue to be maintained, and the broker-dealer's storage system must allow records to be retained beyond the retentions periods specified in Commission rules. [emphasis added]*

This statement by the SEC clarifies that the storage system must have the capability to retain records beyond the retention period established at the time of initial recording when required for legal matters, external investigations or audits, or other similar circumstances.

2.1.2   Compliance Assessment

It is Cohasset's opinion that the TS7700 meets this requirement of the Rule, provided certain recommendations stated in subsection 2.1.4, *Additional Considerations*, are performed.

2.1.3   TS7700 Capabilities

Overwrite Protection

TS7700 Release 1.6 uses multiple control codes that are integral to a) a defined Data Class and b) virtual volumes associated with that defined Data Class. The integral control codes are designed to protect records against overwrite and thereby meet the requirements of the Rule for non-rewriteable recording. The non-erasure controls are addressed in the next subsection, *Erasure Controls and Retention Management*.

In the administrative setup of the TS7700 each Data Class must be defined, named and configured with the Logical WORM ("LWORM") attribute set to "Yes." Once set, the LWORM functionality automatically ensures that electronic records written to virtual volumes associated with an LWORM-configured Data Class will be protected against subsequent erasure or overwrite.

In conjunction with the Data Class LWORM setting, the TS7700 employs other integral control codes to prevent overwrite. The primary control code is the worldwide identifier ("WWID") – a unique identifier that is cryptographically generated and temporarily assigned to each virtual volume in a Data Class with the LWORM attribute at the time the virtual volume is initially mounted. The WWID then is "bound" to each virtual volume at the point in time when the initial block of data is recorded. The process of "binding" stores the WWID in a) the TS7700 volume management metadata and b) the protected header information area of each virtual volume. Once the WWID is bound to a virtual volume, subsequent recording of data can only be appended after the point at which the previous recording ended. Therefore, previously recorded data cannot be overwritten or erased. A second integrated control code, a Write-Mount-Count ("WMC"), is used to track the number of times a virtual volume has been mounted for recording purposes.

The LWORM Data Class name, the WWID, and WMC (for each LWORM virtual volume) are recorded to the TS7700 management metadata and to the volume header information. The control codes also are made available to the

host operating system (e.g., IBM z/OS/DFSMS) and passed to the removable media management system (e.g., IBM DFSMSrmm or Computer Associates CA-1) for storage, tracking, and comparison purposes.

When a recording process is initiated, both the WWID and the WMC of the virtual volume specified for recording by the host operating system must agree with: a) the WWID stored by the removable media management system, b) the WWID stored in the virtual volume metadata on the TS7700, and c) the WWID stored in the header information of the virtual volume. This ensures that all elements of the recording chain are in agreement that the correct virtual volume is being used for an LWORM recording process.

Once the retention period (controlled externally from the TS7700) for all data records on a virtual volume has expired, the LWORM virtual volume may be released (into a scratch pool4) for reuse.5 Note: The TS7700 does not provide retention management capabilities because it is emulating a physical magnetic tape storage system, which does not provide for retention management. See the additional information in the sub-sections on "Retention Management" and "Legal Hold" below.

The status of a Data Class can be modified administratively at any time by setting the LWORM attribute to "no" or non-LWORM. All virtual volumes of electronic records recorded up to the time of a status change will continue to be protected as non-rewritable. See additional information in sub-section "Additional Considerations."

Because the TS7700, like physical magnetic tape storage systems, operates only at the volume management level and has no knowledge of the content or context of the individual electronic records or data sets stored, Cohasset's believes there is no possibility that individual electronic records or sets of electronic stored records could be erased or overwritten by the TS7700 itself.

Both the magnetic disk virtual volumes and physical magnetic tape volumes recorded by VSM on TS7700 storage systems must have the LWORM, WWID and WMC control codes stored in the metadata or header information to ensure that they are recognized as being "non-overwrite" volumes. Additionally, in order for erasable physical tape media to be compliant, it must be under the exclusive control of VSM and be stored in a secure robotic tape library.

Erasure Controls and Retention Management

Retention management must be accomplished at the level of the individual electronic record or data set; however, because all magnetic tape systems (both virtual and physical) intrinsically have no content-level knowledge of the information being stored, they have no capability to manage the retention of the individual electronic records or data sets that they store. Accordingly, since the TS7700 emulates a physical magnetic tape storage system, the TS7700 also has no capability of providing retention management.

Therefore, preventing erasure of the virtual volumes stored in a TS7700 for the SEC-required retention periods is the responsibility of the member, broker, or dealer. Two ways that retention management of records stored in a TS7700 could be accomplished are:

- Using procedures and tools as defined and executed by the member, broker or dealer, or

- Employing the electronic record retention management capabilities provided by a content or records management application such as the IBM Object Access Method or by the volume management capabilities of the removable media management system (e.g., IBM DFSMSrmm or Computer Associates CA-1).

The second way is preferable since it is the most automated and therefore the least prone to human error or possible malfeasance.

See Appendix A for additional information regarding IBM product capabilities that could be utilized by a broker-dealer to prevent erasure during a specified retention period.

Legal Hold

It is the member, broker or dealer that has the responsibility of ensuring that virtual volumes of electronic records are preserved in accordance with a legal discovery order or a regulatory audit "hold."

To support organizations in meeting their legal/audit "hold" requirements, the TS7700 administrator has the capability to place records on "hold" by setting a "hold" on an LWORM virtual volume when it is released to scratch status by the host operating system or the removable media management system.

As long as the "hold" condition is active, the released scratch virtual volumes cannot be mounted for reuse. This allows TS7700 LWORM virtual volumes to be retained, as necessary, beyond the required retention period for as long as a legal hold order or other longer-term regulatory hold is active.

2.1.4   Additional Considerations

The member, broker, or dealer should consider the following to ensure that the TS7700 is appropriately configured and managed to protect electronic records against erasure or overwrite:

- The TS7700 must be at Release 1.6, since prior releases do not support the non-rewriteable functionality. All operating systems (e.g., z/OS/DFSMS) and removable tape management systems (e.g., DFSMSrmm) must be at a release level that supports TS7700 Release 1.6 LWORM capabilities.

- The TS7700 must be administratively configured so that the Data Classes defined for storing regulated electronic records have the LWORM attribute set to "yes."

- The host operating system and the removable media management system must be configured to write regulated records only to LWORM Data Classes and associated virtual volumes.

- Cohasset recommends that the member, broker, or dealer establish administrative procedures that do not allow the LWORM attribute of a defined Data Class to be modified from "yes" to "no" or to non-LWORM.

- Although modifying the status of a Data Class from LWORM to non-LWORM does not compromise the virtual volumes of electronic records previously recorded, to ensure that regulated records are not (unintentionally or intentionally) written to virtual volumes in a non-LWORM Data Class, all such modifications must be carefully coordinated so the correct Data Class is assigned.

- As stated in Section 2.1.3, above, the magnetic disk virtual volumes and physical magnetic tape volumes recorded by VSM on TS7700 storage systems must have the LWORM, WWID and WMC control codes stored in the metadata or header information to ensure that they are recognized as being "non-overwrite" volumes. Additionally, in order for erasable physical tape media to be compliant, it must be under the exclusive control of VSM and be stored in a secure robotic tape library.

- To meet the SEC's requirements for record retention, the member, broker, or dealer must put in place appropriate procedures or, preferably, utilize automated records management capabilities such as those detailed in Appendix B.

2.2   Accurate Recording Process

2.2.1   Compliance Requirement [SEC 17a-4(f)(2)(ii)(B)]

The intent of this requirement is to ensure both the accuracy and quality of the recording process to make certain that the records read from the storage media are precisely the same as those that were recorded. This requirement includes both a quality verification of the recording process and post-recording verification processes.

> **SEC 17a-4(f)(2)(ii)(B):** Verify automatically the quality and accuracy of the storage media recording process.

2.2.2   Compliance Assessment

Cohasset believes that the TS7700 has the capabilities to meet the SEC requirement to verify the accuracy and completeness of the recording process. See additional comments in subsection 2.2.4, "Additional Considerations."

2.2.3   TS7700 Capabilities

The TS7700 relies on state-of-the-art magnetic disk and magnetic tape technologies to meet the quality and accuracy requirements of the Rule.

The following TS7700 capabilities directly support the verification of the quality and accuracy of the recording process:

- The use of cyclical redundancy checks ("CRC")6 to verify the quality and accuracy of the recording process.

  A CRC of the electronic record data set is generated by the host operating system (e.g., z/OS) channel recording component and sent to the TS7700. The TS7700, in turn, recalculates and checks the CRC to ensure that the information sent by the host operating system has been completely and accurately received.

  The TS7700 then calculates a separate CRC based on the content of the electronic record data set, which then is recorded with the related electronic record data sets to a virtual tape volume.

- When an electronic record data set is read-back as part of the information retrieval process, the following two-step quality and accuracy check is executed.

  First, the TS7700 reads the electronic record data set from magnetic disk or magnetic tape with the stored CRC, then recalculates the CRC and compares it to the stored CRC.

  Second, the TS7700 calculates a new CRC that it sends with the electronic record data set to the host operating system channel component, which then recalculates the CRC and compares it to the one sent by the TS7700.

Both of these CRC validations are performed to ensure that no errors have occurred during storage or retrieval. If the CRC comparisons do not agree, the recording or readback process is aborted. The read-back process then is attempted multiple times. If also unsuccessful, an error message is generated so that an administrative recovery can be initiated.

2.2.4 Additional Considerations

Cohasset believes that state-of-the-art magnetic disk and magnetic tape recording technologies meet both the letter and the spirit of the SEC Rule for these reasons:

- They provide quality and accuracy checks and monitoring during the magnetic disk storage recording process (such as CRCs) and, where applicable, direct read-after-write bit recording verification in the magnetic tape drives.

- They have advanced techniques for detecting and correcting both minor and relatively major data errors during read back, and

- They are relied upon by private and public entities, in the regular course of their business operations, to store critical business and regulatory electronic data with the highest levels of accuracy.

See Appendix B for additional discussion regarding verification of recording quality and accuracy using magnetic and disk magnetic tape technologies.

2.3 Serialize the Original and Duplicate Units of Storage Media

2.3.1 Compliance Requirement [SEC 17a-4(f)(2)(ii)(C)]

This requirement, according to Section III(B) of the SEC's 2001 Interpretive Release, "*is intended to ensure both the accuracy and accessibility of the records by indicating the order in which records are stored, thereby making specific records easier to locate and authenticating the storage process.*"

> **SEC 17a-4(f)(2)(ii)(C):** Serialize the original and, if applicable, duplicate units of storage media, and time-date for the required period of retention the information placed on such electronic storage media.

While this requirement is thought to be more pertinent to tracking the individual units of removable media related to micrographic or optical storage, the SEC Rule may be satisfied by capturing index data or metadata associated with each electronic record that: (a) *uniquely* identifies the record and (b) associates the *date and time of recording* with each record.

2.3.2 Compliance Assessment

Cohasset believes that IBM's TS7700 meets the SEC requirement to serialize both the original record and each duplicate copy stored.

2.3.3   TS7700 Capabilities

The TS7700 automatically performs serialization and tracking of electronic records to virtual volumes using the following capabilities:

- The TS7700 serializes each virtual volume by recording a header (containing the volume serial number as well as the unique WWID and WMC) at the beginning of each virtual volume.

- The TS7700 maintains a metadata database that includes serialization and tracking information, specifically, the volume serial number, as well as the WWID and the WMC attributes for each virtual volume.

- The TS7700's identification and serialization information (including the virtual volume serial number, as well as the WWID and the WMC attributes) are made available to the operating system and are stored and tracked by the removable media management system.

2.3.4   Additional Considerations

There are no additional considerations related to this requirement.

2.4   Duplicate Copy of the Records Stored Separately

2.4.1   Compliance Requirement [SEC 17a-4(f)(3)(iii)]

The intent of this requirement is to provide an alternate storage source for accessing the records, should the primary source be compromised, i.e., lost or damaged.

> **SEC 17a-4(f)(3)(iii):** Store separately from the original, a duplicate copy of the record stored on any medium acceptable under §240.17a-4 for the time required.

Note: A *duplicate copy* is different from a *backup copy*. A *duplicate copy* is the recording of each record to a second compliant storage system or media, which is then retained for the same time period as the originally stored record. A *backup copy*, in contrast, is typically overwritten as it is "rotated" on a periodic basis, which usually results in a much shorter retention period than the original.

2.4.2   Compliance Assessment

It is Cohasset's opinion that the TS7700 complies with this SEC requirement.

2.4.3   TS7700 Capabilities

The following capabilities of the TS7700 facilitate meeting this SEC requirement:

- When electronic records are written to virtual volumes on a primary TS7700 cluster, a duplicate copy of those records can be written automatically to a second TS7700 cluster. When this occurs, the LWORM Data Class information, as well as the WWID and WMC, is recorded automatically with the copy. Such duplicate copies can be produced either synchronously (immediately when recording of the primary virtual volume is complete) or asynchronously (at a designated point subsequent to completion of the recording of the primary virtual volume).

- Duplicate copies of TS7720, TS7740 and TS7760 virtual volumes can be recorded to a second TS7700 cluster or to rewriteable magnetic tape drives and cartridges.

  - If physical rewritable magnetic tape media are used, the media must be overwrite-protected by storing the LWORM, WWID and WMC control codes in the tape header information, be under the exclusive control of VSM, and be housed in a secure robotic tape library.

2.4.4   Additional Considerations

If a second TS7700 cluster is not configured, the member, broker, or dealer must ensure that appropriate procedures and duplicate copy capabilities are provided in order to create the duplicate copies necessary to meet the requirements of the Rule.

2.5   Other Requirements of the Rule

A number of other requirements of SEC 17a-4(f) are not the direct responsibility of the TS7700 virtual tape storage system. These other requirements of the Rule must be met by other product capabilities or by procedures and processes provided by the member, broker, or dealer in order for the overall electronic records management environment that utilizes the TS7700 to meet all of the requirements of the Rule.

The other requirements fall into areas such as:

- Providing, managing and retaining index information for search and retrieval of individual electronic records,

- Reproducing a copy of each individual electronic record,

- Providing and retaining an audit trail that logs events affecting the life cycle of individual electronic records, and

- Providing procedures to be followed by the member, broker or dealer to assure that access to electronic records is provided in the case of a disaster.

Appendix C lists each of the other requirements that are beyond those for which the TS7700 is directly responsible.

3 | Conclusions

This compliance assessment has addressed whether the functional capabilities of the TS7700 meet the requirements and conditions of SEC Rule 17a-4(f) for which it is directly responsible.

Cohasset's conclusion is that the capabilities of the TS7700, Release 1.6:

- Meet the requirement of the Rule for preserving electronic records in a non-rewriteable format when (a) the Data Class recording mode is set to LWORM and (b) the WWID and WMC attributes are generated by the TS7700, stored in the metadata of the TS7700 and the virtual volume header, obtained by the operating system, and stored by the removable media management system.

  - To meet the requirements for non-erasure and retention management, the broker-dealer must ensure that the TS7700 is used in conjunction with systems and/or procedures that have been assessed for compliance with the Rule to ensure that the record files are protected against erasure for the SEC-specified retention period. If the TS7760 is interfaced with other systems to achieve these requirements, Cohasset recommends that the interface between the systems and the TS7700 be a tightly coupled or, preferably, an exclusive relationship.

- Meet the letter of the Rule relating to the automatic verification of the accuracy and quality of the recording process – because the TS7700 relies on trusted quality and accuracy checks inherent in state-of-the-art magnetic disk and magnetic tape recording technology.

- Uniquely identify and serialize the original and duplicate copy of each LWORM volume stored – by generating and binding a unique WWID to each virtual volume and duplicate copy that identifies them as non-rewriteable, LWORM.

- Supports storing a compliant duplicate copy of each record on a second TS7700 cluster using magnetic disk volumes and physical magnetic tape volumes that are also LWORM designated and contain the WWID and WMC control codes.

Note: TS7700 users (members, brokers, or dealers) must ensure a) the LWORM parameter (for each TS7700 Data Class where regulated records are to be stored) is set to "yes," b) appropriate secondary clusters of model TS7740 or TS7720 are configured to automatically create a duplicate copy or put in place other compliant procedures and that duplicate copy capabilities are provided, and c) procedures are established so the LWORM attribute in a previously defined Data Class cannot be reset to "no."

Cohasset's conclusion: The three models of the TS7700 – the TS7720, TS7740 and TS7760 – meet the SEC non-rewritable and other storage requirements that are within their capabilities for retaining and storing in digital form 17a-3 and 17a-4 records – pursuant to the requirements set forth in Rule 17a-4(f), which expressly allows records to be retained on electronic storage media.

Appendix A: Retention Management Options

Retention management must be accomplished at either a) the volume level or b) the electronic record (object) sets of electronic records, which is frequently referenced as the data set-level. Managing retention at the electronic record/data set level is not possible with virtual (or physical) magnetic tape storage systems, such as the TS7700, since they have no content-level knowledge of the information being stored. Ensuring that the required retention period is applied therefore must be provided outside of the TS7700. This can be done in either of two ways:

- Volume retention management capabilities provided by a removable media management system (e.g., IBM DFSMSrmm or Computer Associates CA-1) or,

- Electronic record retention provided by an application-level records management capability (e.g., through IBM Object Access Method).

DFSMSrmm Removable Media Management System

In DFSMSrmm, retention can be managed by establishing one or more vital record specifications that define retention policies for electronic record data sets (such as a computer report, large e-mail archive or a contiguous set of document-based information) or virtual volumes. The electronic record data set vital record specifications then apply to the volume on which the electronic record data set resides. Volume vital record specifications assume nothing about the content of the electronic record data sets on the volume.

IBM Object Access Method (OAM)

OAM has three electronic records management capabilities that are available with the OAM Archive Retention Enhancement support in z/OS V1R11.

1. *Retention-protection.* Retention-protection provides OAM's most stringent protection to ensure that an object has not been modified or deleted prior to its expiration date. When retention-protection is enabled for a given object, OAM will not allow that object to be deleted prior to its expiration date. Additionally, OAM will not allow the expiration date to be changed to an earlier date. It will however, allow the expiration date to be changed to a later date. If an object is stored into an object storage group that has retention-protection enabled, that object is considered retention-protected for the life of the object. Installations cannot disable retention-protection for a retention-protected object.

2. *Event-based-retention.* When an object is in event-based-retention mode, its expiration date is not calculated until OAM has received notification that an external event has occurred. The external event notification event is received by OAM via the OAM application programming interface ("API") for triggering event-based retention period calculation.

3. _Deletion-hold._ When an object is in deletion-hold mode, it cannot be deleted from the OAM. Deletion holds are set and released using OAM's APIs.

The retention management capabilities of OAM are utilized by IBM OnDemand content management applications, such as OnDemand for Enterprise Report Management.

Other Retention Options

Electronic record retention management also can be implemented using specialized applications such as IBM Records Manager or IBM FileNet Records Manager.

Appendix B: Magnetic Disk Recording Quality and Accuracy

In the early 1990s, when the SEC first was considering the use of digital media for storing regulated records, the only non-rewritable, non-erasable media available was write-once, read-many ("WORM") optical disk. At that time, WORM optical disk required either a) a direct read after write ("DRAW") capability or b) a second rotation of the media with a read-back and comparison operation to verify the quality and accuracy of the recording process. Optical recording technology was in its early stages and, therefore, was deemed to require a more thorough, read-after-write check to ensure recording accuracy.

When the Rule was promulgated in 1997, no specific methodology or time requirement for accomplishing the verification of recording quality and accuracy is mentioned in Rule 17a-4(f)(2)(ii)(B). As it relates to the spirit in which the initial Rule was developed, Cohasset's interpretation of this requirement is that automatic verification of the media recording process should be done as close to the recording event as possible. In this context, magnetic disk and magnetic tape technologies are ideal in that they provide quality and accuracy checks in real time – as the recording process is being executed.

Today, when evaluating the level of recording quality and accuracy provided by state-of-the-art magnetic disk technology, these points should be considered:

- Magnetic disk technology has produced significant advances in the electronic controls, checks, and monitoring capabilities that are designed to provide a high degree of accuracy during the recording process.

- The degree to which a) the accuracy and quality of recording data or records is accomplished and b) the recording process can ensure that data or records are not lost (and can be fully corrected or recovered if found later in error) is critical to the reputation and the livelihood of the electronic information storage industry.

- The largest corporate and public entities have relied on the quality and accuracy of magnetic recording (appropriately backed up for recovery) for many decades. During this period, the systems employing magnetic recording have shown that mission-critical, vital business and regulatory records can be preserved and retained over time as well as readily retrieved on demand.

- Significant error correction advances, such as the RAID 6 (redundant array of inexpensive disks), have been made in detecting and correcting errors that are encountered when reading records back from magnetic disk media.

Cohasset believes state-of-the-art WORM-protected magnetic tape technologies meet the SEC Rule for these reasons:

- The IBM Total Storage 3592 magnetic tape drive and the IBM System Storage TS1120 and TS1130 magnetic tape drives automatically perform a bit-level write verification check as an integral part of its recording operation. A separate read/write head is positioned immediately behind the primary write head that reads back and verifies that the bit-level information intended to be recorded has indeed been accurately written.

- A multi-level error correction capability ("ECC"), which is an inherent part of the magnetic tape format, ensures that all data written to tape are written with no uncorrectable errors so, when read back, the data will be an accurate and complete representation of what was written.

- Additionally, data path integrity checks within the drive and between the drive and the media ensure that no external error situations cause data to be written incorrectly to the media.

Appendix C: Other Non-Applicable Rules

Appendix C contains those provisions of Rule 17a-4(f) that are not applicable to the functionality provided by the IBM TS7700 virtual tape storage solution. These other requirements of the Rule must be met by other product capabilities or by procedures and processes provided by the member, broker, or dealer in order for the overall electronic records management environment that utilizes the TS7700 to meet all of the requirements of the Rule.

17a-4(f)(2)(ii)(D) Have the capacity to readily download indexes and records preserved on the electronic storage media to any medium acceptable under this paragraph (f) as required by the Commission or the self-regulatory organizations of which the member, broker, or dealer is a member.

17a-4(f)(3)(i) At all times have available, for examination by the staffs of the Commission and self-regulatory organizations of which it is a member, facilities for immediate, easily readable projection or production of micrographic media or electronic storage media images and for producing easily readable images.

17a-4(f)(3)(ii) Be ready at all times to provide, and immediately provide, any facsimile enlargement which the staffs of the Commission, any self-regulatory organization of which it is a member, or any State securities regulator having jurisdiction over the member, broker or dealer may request.

17a-4(f)(3)(iv) Organize and index accurately all information maintained on both original and any duplicate storage media.

17a-4(f)(3)(iv)(A) At all times, a member, broker, or dealer must be able to have such indexes available for examination by the staffs of the Commission and the self- regulatory organizations of which the broker or dealer is a member.

17a-4(f)(3)(iv)(B) Each index must be duplicated and the duplicate copies must be stored separately from the original copy of each index.

17a-4(f)(3)(iv)(C) Original and duplicate indexes must be preserved for the time required for the indexed records.

17a-4(f)(3)(v) The member, broker, or dealer must have in place an audit system providing for accountability regarding inputting of records required to be maintained and preserved pursuant to §§240.17a-3 and 240.17a-4 to electronic storage media and inputting of any changes made to every original and duplicate record maintained and preserved thereby.

17a-4(f)(3)(v)(A) At all times, a member, broker, or dealer must be able to have the results of such audit system available for examination by the staffs of the Commission and the self-regulatory organizations of which the broker or dealer is a member.

17a-4(f)(3)(v)(B) The audit results must be preserved for the time required for the audited records.

17a-4(f)(3)(vi) The member, broker, or dealer must maintain, keep current, and provide promptly upon request by the staffs of the Commission or the self-regulatory organizations of which the member, broker, or broker-dealer is a member all information necessary to access records and indexes stored on the electronic storage media; or place in escrow and keep current a copy of the physical and logical file format of the electronic storage media, the field format of all different information types written on the electronic storage media and the source code, together with the appropriate documentation and information necessary to access records and indexes.

17a-4(f)(3)(vii) For every member, broker, or dealer exclusively using electronic storage media for some or all of its record preservation under this section, at least one third party ("the undersigned"), who has access to and the ability to download information from the member's, broker's, or dealer's electronic storage media to any acceptable medium under this section, shall file with the designated examining authority for the member, broker, or dealer the following undertakings with respect to such records:

The undersigned hereby undertakes to furnish promptly to the U.S. Securities and Exchange Commission ("Commission"), its designees or representatives, any self-regulatory organization of which it is a member, or any State securities regulator having jurisdiction over the member, broker or dealer, upon reasonable request, such information as is deemed necessary by the staffs of the Commission, any self-regulatory organization of which it is a member, or any State securities regulator having jurisdiction over the member, broker or dealer to download information kept on the broker's or dealer's electronic storage media to any medium acceptable under Rule 17a-4.

Furthermore, the undersigned hereby undertakes to take reasonable steps to provide access to information contained on the broker's or dealer's electronic storage media, including, as appropriate, arrangements for the downloading of any record required to be maintained and preserved by the broker or dealer pursuant to Rules 17a-3 and 17a-4 under the Securities Exchange Act of 1934 in a format acceptable to the staffs of the Commission, any self-regulatory organization of which it is a member, or any State securities regulator having jurisdiction over the member, broker or dealer. Such arrangements will provide specifically that in the event of a failure on the part of a broker or dealer to download the record into a readable format and after reasonable notice to the broker or dealer, upon being provided with the appropriate electronic storage medium, the undersigned will undertake to do so, as the staffs of the Commission, any self-regulatory organization of which it is a member, or any State securities regulator having jurisdiction over the member, broker or dealer may request.

About Cohasset Associates, Inc.

Cohasset Associates, Inc. (www.cohasset.com) is one of the nation's foremost management consulting firms specializing in records management and information governance. Spanning 40 years and serving both domestic and international clients, Cohasset provides award-winning professional services in four areas: management consulting, education, thought-leadership and legal research.

Management Consulting: Working with multi-national clients, Cohasset develops effective records and information management programs that promote interdisciplinary governance. Cohasset also engages in implementation activities to achieve business goals, improve compliance and mitigate risk. Distinguished as a leader of the transition from records management to information governance, Cohasset held its first Managing Electronic Records (MER) Conference in 1993.

Education: Cohasset is renowned for its longstanding commitment to education on information governance and records and information lifecycle management.

Thought-Leadership: Cohasset regularly publishes thought-leadership white papers and surveys to promote continuous improvement in the lifecycle management of information.

Legal Research: Cohasset is nationally respected for its direction on records and information management legal issues – from retention schedules to compliance with regulatory requirements associated with the use of electronic or digital storage media.

For domestic and international clients, Cohasset:
- *Formulates information governance implementation strategies*
- *Develops policies and standards for records management and information governance*
- *Creates clear and streamlined retention schedules*
- *Prepares training and communications for executives, the RIM network and all employees*
- *Leverages content analytics to improve lifecycle controls for large volumes of eligible information, enabling clients to classify information, separate high-value information and delete unneeded information*
- *Designs and assists with the implementation of information lifecycle practices that avoid the cost and risk associated with over-retention*
- *Defines technical and functional requirements and assists with the deployment of enterprise content management and collaboration tools*

Cohasset has been described as *the only management consulting firm in its field with its feet in the trenches and its eye on the horizon*. It is this blend of practical experience and a clear vision of the future, which, combined with its commitment to excellence, has resulted in Cohasset's extraordinary record of accomplishments and innovation.