

# Cboe Titanium Europe Multicast PITCH Specification

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### 1 Introduction

#### 1.1 Overview

Cboe participants may use Multicast PITCH to receive real-time depth of book quotations, Systematic Internaliser quotes, Indices quotes and execution information direct from Cboe. A WAN-Shaped and Gig-Shaped version of the Multicast PITCH feed is available from Cboe. Participants may choose to utilise either of the Multicast PITCH feeds depending on their location and connectivity to Cboe.

Multicast PITCH feed descriptions:

- Gig-Shaped: Collection of multicast addresses and gap request infrastructure for gigabit connectivity from Cboe. Cboe Trade Reporting Facility ("TRF") Trade feed and Cboe Indices (XIC/XID/XIE) feeds are not available as a Gig-Shaped feed.
- WAN-Shaped: Collection of multicast addresses and gap request infrastructure for WAN connectivity from Choe

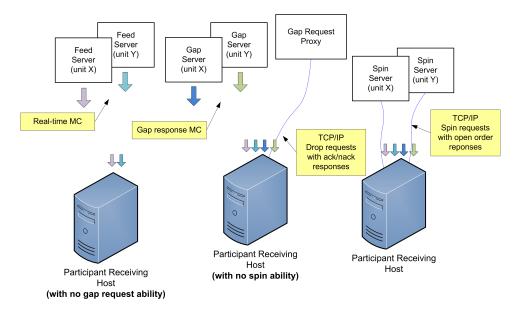
### 1.2 Feed Connectivity Requirements

- Gig-Shaped feeds are available to participants with a minimum of 1 Gb/s of connectivity to Cboe via cross connect or dedicated circuit.
- WAN-Shaped feeds are available to participants who meet the minimum bandwidth requirements to Cboe (see appendix) via cross connect, dedicated circuit, or a supported carrier.

Participants with sufficient connectivity may choose to take both the Gig-Shaped and WAN-Shaped feeds from Cboe and arbitrate the feeds to recover lost data.

Multicast PITCH real-time events are delivered using a published range of multicast addresses divided by market and symbol range. Dropped messages can be requested using a TCP/IP connection to one of the Cboe Gap Request Proxy (GRP) servers with replayed messages being delivered on a separate set of multicast ranges reserved for packet retransmission. Intraday, a spin of all open orders may be requested from a Spin Server. This allows a client to become current without requesting a gap for all messages up to that point in the day.

The following diagram is a logical representation of a Multicast PITCH feed for two units:



### 1.3 Symbol Ranges, Units, and Sequence Numbers

Symbols will be separated into units by a published market and alphabetical distribution. Symbol distribution will not change intraday. Choe does, however, reserve the right to add multicast addresses or change the symbol distribution with prior notice to participants. Care should be taken to ensure that address changes, address additions, and symbol distribution changes can be supported easily.

Message sequence numbers are incremented by one for every sequenced message within a particular unit. It is important to understand that one *or more* units will be delivered on a single multicast address. As with market/symbol ranges, unit distribution across multicast addresses will not change intraday, but may change after notice has been given.

Symbol distribution across units as well as unit distribution across multicast addresses are identical for real-time and gap response multicast addresses.

#### 1.4 Gap Request Proxy and Message Retransmission

Requesting delivery of missed data is achieved by connecting to a Gap Request Proxy (GRP). Participants who do not wish to request missed messages do not need to connect to a GRP for any reason or listen to the multicast addresses reserved for message retransmission. Participants choosing to request missed data will need to connect to their assigned GRP, log in, and request gap ranges as necessary. All gap requests will be responded to with a Gap Response Message. A Gap Response Status code of Accepted signals that the replayed messages will be delivered via the appropriate gap response multicast address. Any other Gap Response status code will indicate the reason that the request can not be serviced.

Gap requests are limited in message count, frequency, and age by the GRP. Gap requests will only be serviced if they are within a defined sequence range of the current multicast sequence number for the requested unit. Participants will receive a total daily allowance of gap requested messages. In addition, each participant is given renewable one second and one minute gap request limits.

If overlapping gap requests are received within a short period of time, the gap server will only send the union of the sequence ranges across grouped gap requests. Participants will receive gap responses for their unit/sequence/count, but received should be prepared for the gap responses to be delivered via multicast in non-contiguous blocks.

Gap acknowledgements or rejects will be delivered to users for every gap request received by the GRP. Users should be prepared to see replayed multicast data before or after the receipt of the gap response acknowledgement from the GRP.

#### 1.5 Spin Servers

A Spin Server is available for each unit. The server allows Participants to connect via TCP and receive a spin of all currently open orders/quotes on that unit. By using the spin, a Participant can get the current book quickly in the middle of the trading session without worry of gap request limits. The spin server for each unit listens on its own address and/or TCP port.

Upon successful login and periodically thereafter, a Spin Image Available message is sent which contains a sequence number indicating the most recent message applied to the book. A Participant may then request the spin for the orders up to the sequence number using a Spin Request message with a sequence number from one of the *last ten* Spin Image Available messages.

The spin consists of Trading Status, Statistics, Add Order (long and/or short) and Time messages. Auction Update messages are also included where relevant. Only open orders will be sent in the spin. Spins will not contain any message for an order which is no longer on the book. While receiving the spin, the Participant must buffer any multicast messages received whose sequence numbers are greater than the sequence number presented in the Spin Request message. When a Spin Finished message is received, the buffered messages must be applied to the spun copy of the book to bring it current.

Trading Status and Statistics messages will be sent for every symbol. These messages are sent before the open orders. The Time Offset is set to zero and no timing should be deduced from these messages.

Appendix C (see p. 89) shows an example flow of messages between a Participant and a Choe Multicast PITCH feed and Spin Server.

#### 1.6 CXE, BXE and DXE Books

The CXE, BXE and DXE integrated and dark pools operate as separate islands of liquidity. The CXE and BXE books represent the UK venue and the DXE books represent the NL venue. Smart order routing capabilities between CXE and BXE are in place.

CXE, BXE and DXE each consist of twelve units. Initially in DXE units 1, 2, 3 and 11 will have no live symbols and will therefore only send heartbeat messages. Participants are advised to configure their Multicast PITCH processing to consume messages from these units in readiness for symbols becoming live on them.

A tradable instrument on each platform is considered distinct. Separate real-time and gap multicast groups, gap request proxies and spin servers will be provided for each market.

#### CXE:

- Gig-Shaped Primary (XA)
- Gig-Shaped Secondary (XB)
- WAN-Shaped Primary (XC)
- WAN-Shaped Secondary (XD)

#### BXE:

- Gig-Shaped Primary (BA)
- Gig-Shaped Secondary (BB)
- WAN-Shaped Primary (BC)
- WAN-Shaped Secondary (BD)

#### DXE:

- Gig-Shaped Primary (DA)
- Gig-Shaped Secondary (DB)
- WAN-Shaped Primary (DC)
- WAN-Shaped Secondary (DD)

In Equinix Park Royal, only a single WAN shaped feed is provided per book:

- CXE: WAN-Shaped Disaster Recovery (XE)
- BXE: WAN-Shaped Disaster Recovery (BE)
- DXE: WAN-Shaped Disaster Recovery (DE)

#### 1.7 Trade Reporting Facility and Systematic Internaliser Quote Publication

The Multicast PITCH protocol is also used to disseminate Systematic Internaliser quote data, furthermore it is used by TRF to disseminate details of OTC or SI trades using the Trade - Extended message.

Systematic Internaliser (SI) Quotes will be published on the Systematic Internaliser Multicast PITCH data using a variation of the existing Multicast PITCH Add Order messages. The Expanded Add Order message adds an attribution field allowing the quote to be attributed to a particular systematic internaliser, and a type field, which identifies the order as an SI Quote.

As a Systematic Internaliser modifies or cancels their existing quotes, this activity will be reflected on the Multicast PITCH feed as a series of Delete Order and Expanded Add Order messages as applicable. Hence, participants who already have systems capable of processing Cboe Multicast PITCH messages may be able to re-use much of the same technology to maintain the current SI Quote book with minimal changes.

Order Executed, Trade and Trade Break messages are not applicable to the TRF Multicast PITCH feed.

Separate Quote and Trade Reporting feeds are provided, with WAN shaped feeds of each being available.

In Equinix Slough, separate Quote and Trade Reporting feeds are provided as below:

- Trade Reporting Facility (TRF):
  - WAN-Shaped Primary Trades (TC)
  - WAN-Shaped Secondary Trades (TD)
- SI Quote Publication:
  - Gig-Shaped Primary Quotes (QA)
  - Gig-Shaped Secondary Quotes (QB)
  - WAN-Shaped Primary Quotes (QC)
  - WAN-Shaped Secondary Quotes (QD)

In Equinix Park Royal, only a single feed of each type is provided:

- Trade Reporting Facility (TRF):
  - WAN-Shaped Primary Trades (TE)
- SI Quote Publication:
  - WAN-Shaped Primary Quotes (QE)

#### 1.8 Indices Quotes

Indices quotes are disseminated only on CXE through the Multicast PITCH protocol, on WAN feeds.

During trading hours quotes are sent once per second. At market close one last quote per index is published, marked with Index Status = 'C'.

On days when the exchange delivery settlement price (EDSP) of an index is calculated, one EDSP quote message is sent per affected index, at market close.

In Equinix Slough feeds are provided as below:

- Wan-Shaped Primary (XIC)
- Wan-Shaped Secondary (XID)

In Equinix Park Royal, only a single WAN shaped feed is provided:

• WAN-Shaped Disaster Recovery (XIE)

#### 1.9 Retail Liquidity Feed

Cboe is adding a new Retail Liquidity Feed to disseminate Retail Liquidity Provider (RLP) Orders and the executions against those orders. The reason for a separate feed is so that participants with no interest in Retail flow will not have to consume the data for the RLP Orders and so will not have to change the design of their existing MC Pitch consumer processes.

RLP Orders will be treated as Hidden Orders on the main feed and matches against them will be published as Extended Trade Messages on that feed (Ref: Extended Format)

RLP Orders will be published as Displayed on the Retail Liquidity Feed but these will only be matchable by Retail Attested Orders (RAOs). These matches will be published as Order Executed Messages (Ref: Order Executed Message).

As displayed orders, RLP Orders will be maintained with the same Modify and Cancel messages as on the Main Feed.

Participants consuming both feeds should ensure they do not double-count these trades. The same execution ID will identify the corresponding message on each feed. Extended Trade Messages on the main feed will be identifiable as originating from RLP orders, through a new values 'G' or 'K' in the Cboe Flags field (See § 4.9.7, p. 25 for details.) If a Retail Trade is subsequently busted the Trade Break message will only be available on the main feed.

Unit Clear Messages will be published on the Retail Liquidity Feed.

Transaction Markers will be published on the Retail Liquidity Feed to indicate the start and end of a block of matches (Ref: Transaction Begin Message).

End of Session Messages will be published on the Retail Liquidity Feed.

Statistics messages will NOT be published on the Retail Liquidity Feed.

Trade Break messages will NOT be published on the Retail Liquidity Feed.

The Retail Liquidity Feed will be available on CXE and DXE (not BXE) and will be provided by a set of Feed Servers, Gap Servers and Spin Servers, in the same way as the Main Feed.

Gig-Shaped A and B feeds will be available but no Wan-Shaped feeds will be provided.

- CXE:
  - Gig-Shaped Primary (XAR)
  - Gig-Shaped Secondary (XBR)
- DXE:
  - Gig-Shaped Primary (DAR)
  - Gig-Shaped Secondary (DBR)

In Equinix Park Royal, a single WAN shaped feed is provided per book:

- CXE: WAN-Shaped Disaster Recovery (XER)
- DXE: WAN-Shaped Disaster Recovery (DER)

### 2 Protocol

Users may use the PITCH 2.X protocol over multicast to receive real-time full depth of book quotations and execution information direct from Cboe.

PITCH 2.X cannot be used to enter orders. For order entry, refer to the Cboe FIX or BOE Specifications.

All visible orders and executions are reflected via the PITCH 2.X feed. All orders and executions are anonymous, and do not contain any Participant identity.

### 2.1 Message Format

The messages that make up the PITCH 2.X protocol are delivered using Cboe Sequenced Unit Header which handles sequencing and delivery integrity. All messages delivered via multicast as well as to/from the Gap Request Proxy (GRP) and Spin Server will use the Sequenced Unit Header for handling message integrity.

All UDP delivered events are self contained. Developers can assume that UDP delivered data will not cross frame boundaries and a single Ethernet frame will contain only one Sequenced Unit Header with associated data.

TCP/IP delivered events from the GRP and Spin Server may cross frames as the data is delivered as a stream of data with the TCP/IP stack controlling Ethernet framing.

The PITCH 2.X data feed is comprised of a series of dynamic length sequenced messages. Each message beings with Length and Message Type fields. Choe reserves the right to add message types and grow the length of any message without notice. Participants should develop their decoders to ignore unknown message types and messages that grow beyond the expected length. Messages will only be grown to add additional data to the end of the message.

### 2.2 Data Types

The following field types are used within the Sequenced Unit Header, GRP messages, Spin Server messages, and PITCH 2.X.

Data Type	Description
Alphanumeric	Left justified ASCII fields, space padded on the right.
Binary	Unsigned and sized to "Length" bytes and ordered using Little Endian convention
	(least significant byte first).
Binary Short Price	Unsigned Little Endian encoded two byte binary fields with two implied decimal
	places (denominator $= 100$ ).
Binary Long Price	Unsigned Little Endian encoded 8 byte binary fields with implied decimal places.
	On The Cboe BXE / CXE systems, four decimal places are implied (denomina-
	tor $= 10,000$ ), while on the Cboe TRF system, six decimal places are implied
	(denominator = 1,000,000).

### 2.3 Message Framing

Depth of book update messages will be combined into a single UDP frame where possible to decrease message overhead and total bandwidth. The count of messages in a UDP frame will be communicated using the Sequenced Unit Header. Framing will be determined by the server for each unit and site. The content of the multicast across feeds (A/B and Gig-Shaped/WAN-Shaped) will be identical, but framing will not be consistent across feeds. Processes that receive and arbitrate multiple feeds cannot use frame level arbitration to fill gaps.

### 2.4 Cboe Sequenced Unit Header

The Cboe Sequenced Unit Header is used for all Multicast PITCH messages and messages to/from the Gap Request Proxy (GRP) and Spin Server.

Sequenced and unsequenced data may be delivered using the Sequenced Unit Header. Unsequenced data will have 0 values for the unit and sequence fields. All messages sent to and from the GRP and Spin Server are unsequenced while multicast may contain sequenced and unsequenced messages.

Sequenced messages have implied sequences with the first message having the sequence number contained in the header. Each subsequent message has an implied sequence one greater than the previous message up to a maximum of count messages. Multiple messages can follow a Sequenced Unit Header, but a combination of sequenced and unsequenced messages cannot be sent with one header.

The sequence numbers for the first message in the next frame can be calculated by adding the Hdr Count field to the Hdr Sequence. This technique will work for sequenced messages and heartbeats.

Sequenced Unit Header						
Field	Offset	Length	Data Type	Description		
Hdr Length	0	2	Binary	Length of entire block of messages. Includes this		
				header and "Hdr Count" messages to follow.		
Hdr Count	2	1	Binary	Number of messages to follow this header.		
Hdr Unit	3	1	Binary	Unit that applies to messages included in this		
				header.		
Hdr Sequence	4	4	Binary	Sequence of first message to follow this header.		
Total Length = 8 bytes						

#### 2.5 Execution Ids

Execution Ids are 12 characters, base 36.

#### 2.6 Trade Amendments

Order-book or reported trades that are subsequently amended will result in two Trade - Extended Form messages to be sent. The first trade will be transmitted using all of the details of the original trade, including MMT flags, but with the Cancellation flag set. The second trade will be transmitted using the amended details, including MMT flags, but with the Modification flag set.

#### 2.7 Heartbeat Messages

The Sequenced Unit Header with a count field set to "0" is used for heartbeat messages. During trading hours, heartbeat messages will be sent from the GRP and all multicast addresses if no data has been delivered within 1 second. Heartbeat messages never increment the sequence number for a unit, but can be used to detect gaps on the real-time multicast channels during low update rate periods.

Heartbeats on the real-time multicast addresses during trading hours will have a Hdr Sequence value equal to the sequence of the next sequenced message to be sent for the unit. Heartbeats on gap multicast addresses always have the Hdr Sequence field set to 0. All heartbeat messages sent to and from the GRP are considered unsequenced and should have sequence and unit fields set to 0.

Outside of trading hours, Cboe sends heartbeat messages on all real-time and gap channels with a sequence of "0" to help users validate multicast connectivity. Heartbeat messages may not be sent from 12:00am - 1:00am London time or during maintenance windows.

Cboe expects heartbeat messages to be sent to the GRP and Spin Server on live connections no less than every five seconds. Failure to receive two consecutive heartbeat messages will result in the GRP or Spin Server terminating the client connection.

# 3 Gap Request Proxy Messages

The following messages are used for initialising a TCP/IP connection to the Gap Request Proxy (GRP) and to request message retransmissions. Participants only need to implement the following messages if gap requests will be made. The following messages will not be delivered using multicast. All messages sent to the GRP and Spin Server must be contained in a Sequenced Unit Header.

Note that message retransmission can't be requested for indices data.

### 3.1 Login Message

The Login Message is the first message sent to the GRP by a user's process after the connection to the GRP is established. Failure to login before sending any other message type will result in the connection being dropped by the GRP.

Login Message	Login Message						
Field	Offset	Length	Data Type	Description			
Length	0	1	Binary	Length of this message including this field			
Message Type	1	1	0×01	Login Message			
SessionSubId	2	4	Alphanumeric	SessionSubId supplied by Cboe			
Username	6	4	Alphanumeric	Username supplied by Cboe			
Filler	10	2	Alphanumeric	(space filled)			
Password	12	10	Alphanumeric	Password supplied by Cboe			
Total Length = 22 bytes							

### 3.2 Login Response Message

The Login Response Message is sent by the GRP to a user's process in response to a Login Message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the Login Response Message is sent.

Login Response						
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0×02	Login Response		
Status	2	1	Alphanumeric	$A = Login \ accepted$		
				${ t N}={ t Not authorised (invalid Username and/or }$		
				Password)		
				B = Session in use		
				S = Invalid session		
Total Length = 3 bytes						

### 3.3 Gap Request Message

The Gap Request Message is used by a user's process to request retransmission of a sequenced message (or messages) by one of the gap servers.

Gap Request						
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0×03	Gap Request Message		
Unit	2	1	Binary	Unit that the gap is requested for		
Sequence	3	4	Binary	Sequence of first message (lowest sequence in		
				range)		
Count	7	2	Binary	Count of messages requested		
Total Length = 9 bytes						

### 3.4 Gap Response Message

The Gap Response Message is sent by the GRP in response to a Gap Request Message. The Unit and Sequence fields will match the values supplied in the Gap Request Message. A Gap Response Message, with a Status of Accepted or reason for failure, will be sent for each Gap Request Message received by the GRP.

Gap Response	Gap Response						
Field	Offset	Length	Data Type	Description			
Length	0	1	Binary	Length of this message including this field			
Message Type	1	1	0×04	Gap Response Message			
Unit	2	1	Binary	Unit the gap was requested for			
Sequence	3	4	Binary	Sequence of first message in request			
Count	7	2	Binary	Count of messages requested			
Status	9	1	Alphanumeric	A = Accepted  D = Out of range (ahead of sequence or too far behind)  D = Daily gap request allocation exhausted  M = Minute gap request allocation exhausted  S = Second gap request allocation exhausted  C = Count request limit for one gap request exceeded  I = Invalid Unit specified in request  All non-A status codes should be interpreted as a reject.  Refer to Section 6 for details on the limits.			
Total Length :	= 10 byt	es		There is decising the decision the limits.			

# 4 PITCH 2.X Messages

With the exception of Time Messages, each PITCH message reflects the order addition, order deletion, order modification, or execution of an order in the system.

Order modification messages (Order Executed Message, Reduce Size Message, etc.) refer to an order by its Order Id. Multiple order modification messages may modify a single order and the effects are cumulative. Modify messages may update the size and/or price of an order on the book. When the remaining shares for an order reach zero, the order is dead and should be removed from the book.

### 4.1 Time Message

A Time Message is sent whenever the source time for a unit passes over a second boundary. All subsequent time offset fields for the same unit will use the new Time value as the base until another Time Message is received for the same unit.

Time							
Field	Offset	Length	Data Type	Description			
Length	0	1	Binary	Length of this message including this field			
Message Type	1	1	0×20	Time Message			
Time	2	4	Binary	Number of whole seconds from midnight London			
				time			
Total Length = 6 bytes							

### 4.2 Unit Clear Message

The Unit Clear message instructs feed recipients to clear all orders for the Cboe book in the unit specified in the Sequenced Unit Header. This message will be sent in certain recovery events such as a data center fail-over.

Unit Clear						
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0×97	Unit Clear message		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Total Length = 6 bytes						

# 4.3 Add Order Message

An Add Order Message represents a newly accepted visible order on the book. It includes a day-specific Order Id assigned by Cboe to the order.

### 4.3.1 Long Format

Add Order — Long						
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0×40	Add Order Message — Long		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Order Id	6	8	Binary	Day-specific identifier assigned to this order		
Side Indicator	14	1	Alphanumeric	$\mathtt{B} = Buy \; Order$		
				S = Sell Order		
Quantity	15	4	Binary	Number of shares being added to the book (may		
				be less than the number entered)		
Symbol	19	8	Alphanumeric	Symbol right padded with spaces		
Price	27	8	Binary Long Price	The limit order price		
Total Length = 35 bytes						

### 4.3.2 Short Format

Add Order —	Add Order — Short				
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0×22	Add Order Message — Short	
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp	
Order Id	6	8	Binary	Day-specific identifier assigned to this order	
Side Indicator	14	1	Alphanumeric	$\mathtt{B} = Buy \; Order$	
				S = Sell Order	
Quantity	15	2	Binary	Number of shares being added to the book (may	
				be less than the number entered)	
Symbol	17	6	Alphanumeric	Symbol right padded with spaces	
Price	23	2	Binary Short Price	The limit order price	
Total Length :	Total Length = 25 bytes				

### 4.3.3 Expanded Add Order

The Expanded Add Order is used on the Cboe Systematic Internaliser platform to provide visibility of Systematic Internaliser quotes. Such orders are non-executable. This message is not currently used on other Cboe platforms, though is used in a different context on the Cboe US platform.

Add Order —	Add Order — Expanded					
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0x2f	Add Order Message — Expanded		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Order Id	6	8	Binary	Day-specific identifier assigned to this order		
Side Indicator	14	1	Alphanumeric	Valid values:		
				B = Buy Order		
				S = Sell Order		
Quantity	15	4	Binary	Number of shares applicable to this quote.		
Symbol	19	8	Alphanumeric	Symbol, right padded with spaces		
Price	27	8	Binary Long Price	The quote price		
Add Flags	35	1	Binary	Bit 1 - 'SI Quote' indicator. If set, indicates this		
				Add represents an "SI Quote".		
				Bits 0, 2-7 - Reserved for future use.		
ParticipantID	36	4	Alphanumeric	Attributes this quote to a particular participant.		
Total Length :	= 40 byt	es				

### 4.4 Order Executed Message

Order Execution Messages are sent when a visible order on the book is executed in whole or in part. The execution price equals the price found in the original Add Order Message or the price on the latest Modify Order Message referencing the Order Id.

Order Executed	Order Executed					
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0x23	Order Executed Message		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Order Id	6	8	Binary	Order Id of a previously send Add Order Message		
Executed Shares	14	4	Binary	Number of shares executed		
Execution Id	18	8	Binary	Cboe generated day-unique execution identifier		
				of this execution. Execution Id is also referenced		
				in the Trade Break Message.		
Execution Flags	26	4	Alphanumeric	Type flags based on MMT v3.04 standard (Soon		
				to be upgraded to MMT v4.1)		
Total Length =	Total Length = 30 bytes					

#### 4.4.1 Execution Flags

The Order Executed message uses a 4-character flags field to provide detailed type information regarding the execution.

Each character in the flags field corresponds to MMT Level(s) as described in the following table and  $\S$  4.18, p. 35. (MMT v4.1 takes effect from 1 Jan 2024):

Executi	Execution Flags						
Offset	MM	T Level / Fieldname	Description				
0	1	Market Mechanism					
1	2	Trading Mode	See § 4.18, p. 35 for possible values				
2	3.6	Ex/Cum Dividend	See § 4.10, p. 33 for possible values				
3	3.9	Algorithmic Trade					

Implied MMT flags for the Order Executed message are as follows:

- Level 1 populated per Execution Flags offset 0
- Level 2 populated per Execution Flags offset 1
- Levels 3.1 and 3.13 will always be '-' for a standard trade, and not a RFMD Give-up trade
- Levels 3.2 and 3.10 will always be '-' for not being a Negotiated Trade
- Level 3.3 will always be '-' for not being a Crossing Trade
- Level 3.4 will always be '-' for no Modification Indicator
- Levels 3.5, 3.11, and 3.12 will always be '-' for no special Trade Type
- Level 3.6 populated per Execution Flags offset 2
- Level 3.7 will always be '-' for unspecified (as not off book)
- Level 3.8 will always be 'P' for a Plain-Vanilla Trade
- Level 3.9 populated per Execution Flags offset 3
- Levels 4.1, 4.3, and 4.4 will always be '-' for no deferral of publication
- Level 4.2 will always be '-' for not being applicable
- Levels 5.1, 5.2, and 5.3 will always be '-' for not being applicable

### 4.5 Order Executed at Price/Size Message

Order Execution at Price/Size Messages are sent when a visible order on the book is executed in whole or in part at a different price than the price on the Add Order Message or the price on the latest Modify Order Message referencing the Order Id. If the Remaining Shares field contains a 0, the order should be completely removed from the book.

Order Executed a	Order Executed at Price/Size					
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0x24	Order Executed at Price/Size Message		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Order Id	6	8	Binary	Order Id of a previously send Add Order Message		
Executed Shares	14	4	Binary	Number of shares executed		
Remaining Shares	18	4	Binary	Number of shares remaining after the execution		
Execution Id	22	8	Binary	Cboe generated day-unique execution identifier		
				of this execution. Execution Id is also referenced		
				in the Trade Break Message.		
Price	30	8	Binary Long Price	The execution price of the order		
Execution Flags	38	4	Alphanumeric	Type flags based on MMT v3.04 standard (Soon		
				to be upgraded to MMT v4.1)		
Total Length = 4	2 bytes		_			

#### 4.5.1 Execution Flags

The Order Executed at Price/Size message uses a 4-character flags field to provide detailed type information regarding the execution.

Each character in the flags field corresponds to MMT Level(s) as described in the following table and  $\S$  4.18, p. 35. (MMT v4.1 takes effect from 1 Jan 2024):

Executi	Execution Flags						
Offset	MM	T Level / Fieldname	Description				
0	1	Market Mechanism					
1	2	Trading Mode	See § 4.18, p. 35 for possible values				
2	3.6	Ex/Cum Dividend	See § 4.10, p. 33 for possible values				
3	3.9	Algorithmic Trade					

Implied MMT flags for the Order Executed at Price/Size message are as follows:

- Level 1 populated per Execution Flags offset 0
- Level 2 populated per Execution Flags offset 1
- Levels 3.1 and 3.13 will always be '-' for a standard trade, and not a RFMD Give-up trade
- Levels 3.2 and 3.10 will always be '-' for not being a Negotiated Trade
- Level 3.3 will always be '-' for not being a Crossing Trade
- Level 3.4 will always be '-' for no Modification Indicator
- Levels 3.5, 3.11, and 3.12 will always be '-' for no special Trade Type
- Level 3.6 populated per Execution Flags offset 2
- Level 3.7 will always be '-' for unspecified (as not off book)
- Level 3.8 will always be 'P' for a Plain-Vanilla Trade
- Level 3.9 populated per Execution Flags offset 3
- Levels 4.1, 4.3, and 4.4 will always be '-' for no deferral of publication
- Level 4.2 will always be '-' for not being applicable
- Levels 5.1, 5.2, and 5.3 will always be '-' for not being applicable

# 4.6 Reduce Size Message

Reduce Size Messages are sent when a visible order on the book is partially reduced.

# 4.6.1 Long Format

Reduce Size — Long					
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0x25	Reduce Size Message — Long	
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp	
Order Id	6	8	Binary	Order Id of a previously send Add Order Message	
Cancelled Shares	14	4	Binary	Number of shares cancelled	
Total Length = 18 bytes					

### 4.6.2 Short Format

Reduce Size — Short					
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0x26	Reduce Size Message — Short	
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp	
Order Id	6	8	Binary	Order Id of a previously send Add Order Message	
Cancelled Shares 14 2 Binary Number of shares cancelled					
Total Length =	Total Length = 16 bytes				

# 4.7 Modify Order Message

The Modify Order Message is sent whenever an open order is visibly modified. The Order Id refers to the Order Id of the original Add Order Message.

#### 4.7.1 Long Format

Modify Order	Modify Order — Long				
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0x27	Modify Order Message — Long	
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp	
Order Id	6	8	Binary	Order Id of a previously send Add Order Message	
Shares	14	4	Binary	Number of shares associated with this order after this modify (may be less than the number of	
				shares entered)	
Price	18	8	Binary Long Price	The limit order price after this modify	
Total Length :	Total Length = 26 bytes				

#### 4.7.2 Short Format

Modify Order	Modify Order — Short					
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0x28	Modify Order Message — Short		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Order Id	6	8	Binary	Order Id of a previously send Add Order Message		
Shares	14	2	Binary	Number of shares associated with this order after this modify (may be less than the number of shares entered)		
Price	16	2	Binary Short Price	The limit order price after this modify		
Total Length :	Total Length = 18 bytes					

### 4.8 Delete Order Message

The Delete Order Message is sent whenever an open order is completely cancelled. The Order Id refers to the Order Id of the original Add Order Message.

Delete Order					
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0×29	Delete Order Message	
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp	
Order Id	6	8	Binary	Order Id of a previously send Add Order Message	
Total Length :	Total Length = 14 bytes				

### 4.9 Trade Message

The Trade Message provides information about executions of hidden orders on the book and routed executions to other trading centres. Trade Messages are necessary to calculate Cboe execution based data. Trade Messages do not alter the book and can be ignored if you are just building a book.

No Add Order Message is sent for hidden orders, and thus, no modify order messages may be sent when hidden orders are executed. Instead, a Trade Message is sent whenever a hidden order is executed in whole or in part. As with visible orders, hidden orders may be executed in parts.

A complete view of all executions can be built by combining all Order Executed Messages and Trade Messages.

The Order ID of a hidden order is obfuscated by default in the Trade Message but may be optionally disseminated for a Participant's own orders upon request. As such, partial executions against the same hidden order will by default have different Order IDs.

#### 4.9.1 Long Format

Trade — Long	Trade — Long					
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0×41	Trade — Long		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Order Id	6	8	Binary	Obfuscated Order ID or Order ID of the non-		
				displayed executed order		
Side Indicator	14	1	Alphanumeric	Always B for hidden trades.		
Shares	15	4	Binary	Incremental number of shares executed		
Symbol	19	8	Alphanumeric	Symbol right padded with spaces		
Price	27	8	Binary Long Price	The execution price		
Execution Id	35	8	Binary	Cboe generated day-unique execution identifier		
				of this trade. Execution Id is also references in		
				the Trade Break Message.		
Trade Flags	43	5	Alphanumeric	Type flags based on MMT v3.04 standard (Soon		
				to be upgraded to MMT v4.1)		
Total Length :	= 48 byt	es				

#### 4.9.2 Short Format

Trade — Shor	t			
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x2B	Trade — Short
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Order Id	6	8	Binary	Obfuscated Order ID or Order ID of the non-
				displayed executed order
Side Indicator	14	1	Alphanumeric	Always B for hidden trades.
Shares	15	2	Binary	Incremental number of shares executed
Symbol	17	6	Alphanumeric	Symbol right padded with spaces
Price	23	2	Binary Short Price	The execution price
Execution Id	25	8	Binary	Cboe generated day-unique execution identifier
				of this trade. Execution Id is also references in
				the Trade Break Message.
Trade Flags	33	5	Alphanumeric	Type flags based on MMT v3.04 standard (Soon
				to be upgraded to MMT v4.1)

#### Total Length = 38 bytes

#### 4.9.3 Trade Flags

The non-Extended Trade messages use a 5-character flags field to provide detailed type information regarding the trade.

Each character in the flags field corresponds to MMT Level(s), as described in the following table and  $\S$  4.18, p. 35. (MMT v4.1 takes effect from 1 Jan 2024) :

Trade Flags								
Offset	MMT Level(s) / F	ieldname	Description					
0	1	Market Mechanism						
1	2	Trading Mode						
2	3.1 and 3.13	Transaction Category and GiveUp Trade	See § 4.18, p. 35 for possible values					
3	3.5, 3.11, and 3.12	Trade Types						
4	3.9	Algorithmic Trade						

Implied MMT flags for the non-Extended Trade messages are as follows:

- Level 1 populated per Trade Flags offset 0
- Level 2 populated per Trade Flags offset 1
- Levels 3.1 and 3.13 populated per Trade Flags offset 2
- Levels 3.2 and 3.10 will always be '-' for not being a Negotiated Trade
- Level 3.3 will always be '-' for not being a Crossing Trade
- Level 3.4 will always be '-' for no Modification Indicator
- Levels 3.5, 3.11, and 3.12 populated per Trade Flags offset 3
- Level 3.6 will always be '-' for no Special Dividend
- Level 3.7 will always be '-' for unspecified (as not off book)
- Level 3.8 will always be 'P' for a Plain-Vanilla Trade
- Level 3.9 populated per Execution Flags offset 4
- Levels 4.1, 4.3, and 4.4 will always be '-' for no deferral of publication
- Level 4.2 will always be '-' for not being applicable
- Levels 5.1, 5.2, and 5.3 will always be '-' for not being applicable

#### 4.9.4 Extended Format

Only used on the Cboe European platform. This message provides extended details of trades reported to or executed by Cboe. This includes, for example, privately negotiated trades brought 'on-exchange'. Like other Trade messages, these do not alter the book, and can be ignored if you are just building a book.

Trade — Extended				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x32	Trade - Extended
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Shares	6	8	Binary	Number of shares executed
Symbol	14	8	Alphanumeric	Symbol right padded with spaces
Price	22	8	Binary Long Price	The execution price. This may be zero if the
				price is pending, as denoted by Level 3.8 of the
				Extended Trade Flags.
Trade ID	30	8	Binary	Cboe generated identifier of this trade. This
				identifier is guaranteed to be unique for at least
				7 calendar days.
Trade timestamp	38	8	Binary	Date/Time on which the trade occurred, en-
				coded as the number of nanoseconds since the
				January 1st 1970 UTC (also known as the Unix
				epoch).
Execution Venue	46	4	Alphanumeric	The venue on which the trade executed, when
				applicable. This will contain the MIC repre-
				senting the venue on which the trade occurred,
				where applicable. Cboe UK LIS (CXE) trades
				have the value LISX and Choe BIDS Europe
				(DXE) trades have the value LISZ. Choe UK LIS
				(CXE) VWAP trades have the value XWAP and
				Choe BIDS Europe (DXE) VWAP trades have
				the value VWAP. This will contain SINT if the
				trade occurred on a Systematic Internaliser or
				XOFF if OTC. Choe will include third-country
				venue publication here when MMT v4.1 is intro-
Currency	FO	3	Alabaaumaria	duced. See below for details.
Currency Cboe Trade Flags	50	1	Alphanumeric Alphanumeric	Traded currency.
Extended Trade Flags	53	14	Alphanumeric	See § 4.9.7, p. 25 for possible values.  Type flags based on the MMT v3.04 standard.
Extended Trade Flags	) 34	14	Aiphanumeric	
Total Lameth — 60 h	ut oo			(Soon to be upgraded to MMT v4.1)
Total Length = 68 bytes				

From 1 Jan 2024, Choe plans to include third-country venue publication in the Execution Venue field, together with the introduction of MMT v4.1.

Where a firm has executed a trade which is reportable via the EU APA and which has been executed on an organised trading platform outside of the EU which is not included in the Annex to the ESMA Transparency Opinion, this field will contain the 4-character MIC. Additionally, the Cboe Trade Flags field is extended with values indicating the non-recognised third-country status.

#### 4.9.5 Trade Message — Unknown Symbol

Only used on the Cboe European Trade Reporting Facility. This message provides details of trades reported to Cboe, but traded on a symbol not currently known to Cboe. These trades are identified by the ISIN and the reported currency. Like other Trade messages, these do not alter the book, and can be ignored if you are just building a book.

Trade — Unknown S	ymbol			
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x35	Trade - Unknown Symbol
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp
Shares	6	8	Binary	Number of shares traded
Symbol	14	12	Alphanumeric	Symbol in ISIN
Price	26	8	Binary Long Price	The reported price. This may be zero if the price is pending, as denoted by Level 3.8 of the Extended Trade Flags.
Trade ID	34	8	Binary	Cboe generated identifier of this trade. This identifier is guaranteed to be unique for at least 7 calendar days.
Trade timestamp	42	8	Binary	Date/Time on which the trade occurred, encoded as the number of nanoseconds since the January 1st 1970 UTC (also known as the Unix epoch).
Execution Venue	50	4	Alphanumeric	The venue on which the trade executed, when applicable. This will contain the MIC representing the venue on which the trade occurred, where applicable. This field will contain SINT if the trade occurred on a Systematic Internaliser or XOFF if OTC. Cboe will include third-country venue publication here when MMT v4.1 is introduced. See below for details.
Currency	54	3	Alphanumeric	Reported currency.
Cboe Trade Flags	57	1	Alphanumeric	See § 4.9.7, p. 25 for possible values.
Extended Trade Flags	58	14	Alphanumeric	Type flags based on the MMT v3.04 standard. (Soon to be upgraded to MMT v4.1)
Total Length = 72 by	ytes			

From 1 Jan 2024, Cboe plans to include third-country venue publication in the Execution Venue field, together with the introduction of MMT  $\nu$ 4.1.

Where a firm has executed a trade which is reportable via the EU APA and which has been executed on an organised trading platform outside of the EU which is not included in the Annex to the ESMA Transparency Opinion, this field will contain the 4-character MIC. Additionally, the Cboe Trade Flags field is extended with values indicating the non-recognised third-country status.

#### 4.9.6 Extended Trade Flags

The Cboe Trade - Extended message uses a 14 character flags field to provide detailed type information regarding the trade.

The meaning of the flags field is different between different versions of MMT.

For MMT v4.1, please consult § 4.18, p. 35.

#### 4.9.7 Cboe Trade Flags

The Cboe Trade - Extended message uses a 1 character field to provide detailed information about the trade such as timing, the regulated entity the trade was reported to, as well as whether the trade was reported to have been executed under an ESMA non-recognised third-country venue, as described in the following table:

Regu	lated Entity	Description				
UK	EU	Description				
'-'	'4'	The trade was reported to Choe on time and in the Main Session				
'1'	'5'	The trade was reported to Choe 'late'				
'2'	'6'	The trade was reported to Choe out of the Main Session				
'3'	'7'	The trade was reported to Choe late and out of the Main Session				
N/A	'C'	Same as 4, and trade venue is an ESMA non-recognised 3rd Country venue				
N/A	'D'	Same as 5, and trade venue is an ESMA non-recognised 3rd Country venue				
N/A	'E'	Same as 6, and trade venue is an ESMA non-recognised 3rd Country venue				
N/A	'F'	Same as 7, and trade venue is an ESMA non-recognised 3rd Country venue				
'G'	'K'	The trade was an execution against retail-only liquidity				

Please note that values 'C' through 'F' (see bit 3 below), which highlight the trade was executed under an ESMA non-recognised third-country venue, will be introduced alongside the MMT v4.1 enhancements. Such trades should be considered 'XOFF', but will contain the MIC of the ESMA non-recognised third-country trading venue in the Execution Venue field.

Participants may choose to convert this field to a bitfield (mapping '-' to 0) and apply the following bitfield interpretations:

- Bit 0: Set when the trade was reported to Cboe 'late'
- Bit 1: Set when the trade was reported out of the Main Session
- Bit 2: Set when the trade was reported to the ESMA (EU jurisdiction)
- Bit 3: Set when the trade was reported to have been executed on an ESMA non-recognised third-country trading venue (XOFF)
- Bit 4: Set when the trade was an execution against retail-only liquidity

### 4.10 End of Session Message

The End of Session Message is sent for each unit when the unit shuts down. No more sequenced messages will be delivered for this unit, but heartbeats from the unit may be received.

End of Session					
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0×2D	End of Session Message	
Time Offset 2 4 Binary Nanosecond offset from last unit timestamp					
Total Length = 6 bytes					

### 4.11 Transaction Begin Message

The Transaction Begin message indicates any subsequent messages, up to the accompanying Transaction End message, are all part of the same transaction block. One example of where this might be used is when a single aggressive order executes against several resting orders. All PITCH messages corresponding to such an event would be included between a Transaction Begin and Transaction End. It is important to note that any PITCH Message Type may be included in a transaction block and there is no guarantee that the messages apply to the same price level. Transaction Begin messages do not alter the book and can be ignored if messages are being used solely to build a book.

Feed processors can use a transaction block as a trigger to postpone publishing a quote update until the end of the transaction block. In the prior example of a single aggressive order executing against multiple resting orders, a top of book feed would be able to publish a single trade message and quote update resulting from multiple Order Executed messages once it finished processing all of the messages within the transaction block.

Transaction Begin						
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0xBC	Transaction Begin Message		
Time Offset	Time Offset 2 4 Binary Nanosecond offset from last unit timestamp					
Total Length = 6 bytes						

### 4.12 Transaction End Message

The Transaction End message indicates that a transaction indicated by a previous Transaction Begin message has completed. Transaction End messages do not alter the book and can be ignored if messages are being used solely to build a book.

Transaction End					
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0xBD	Transaction End Message	
Time Offset 2 4 Binary Nanosecond offset from last unit timestamp					
Total Length = 6 bytes					

# 4.13 Trading Status Message

The Trading Status Message is used to indicate the current trading status of a security. A Trading Status Message will be sent whenever a security's trading status changes. In addition, Cboe will send a Trading Status Message for all securities that are "Suspended"

before the start of trading hours.

Trading Status	Trading Status					
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0×31	Trading Status Message		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Symbol	6	8	Alphanumeric	Symbol right padded with spaces		
Status	14	1	Alpha	$\mathtt{T} = Trading$		
				$\mathtt{R} = Off ext{-}Book\;Reporting$		
				C = Closed		
				$\mathtt{S} = Suspension$		
				N = No Reference Price		
				$\mathtt{V} = Volatility \; Interruption \; (Static \; Collar)$		
				I = Volatility Auction		
				0 = Opening Auction		
				E = Closing Auction		
				$\mathtt{H} = Halt^1$		
				$\mathtt{M} = Market \; Order \; Imbalance \; Extension$		
				P = Price Monitoring Extension		
				U = Choe Closing Cross		
				Y = Halt Auction		
Reserved1	15	3	Alpha	Reserved		
Total Length :	= 18 byt	es				

See the Participant Manual for details on Trading Status phases.

<sup>&</sup>lt;sup>1</sup>Reserved for future use

### 4.14 Statistics Message

Only used on the Cboe European platform. The Statistics Message is used to disseminate the statistics prices: opening, closing, high, low. When a value changes a new message will be sent. At the start of each trading day a "Previous Closing Price" will be sent with the closing price of the previous trading day.

If a trade that generated the price is subsequently busted another Statistics Message will be sent.

The "Price Determination" will by default be "Normal". The value of "Manual" arises from prices being adjusted by market supervision. A lower "High Price" or higher "Low Price" could result from breaking a trade, these will be flagged with "Manual".

Cboe reserves the right to add additional values to the "Statistics Type" and "Price Determination" fields without notice. Participants should develop their decoders to ignore unknown values.

Statistics Message	Statistics Message					
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0x34	Statistics Message		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Symbol	6	8	Alphanumeric	Symbol right padded with spaces		
Price	14	8	Binary Long Price	Price		
Statistic Type	22	1	Alphanumeric	C = Closing Price		
				$\mathtt{H} = High \; Price$		
				L = Low Price		
				0 = Opening Price		
				P = Previous Closing Price		
Price Determination	23	1	Alphanumeric	0 = Normal		
				1 = Manual (Price override by Market Supervi-		
				sion)		
Total Length = 24	bytes					

# 4.15 Auction Messages

### 4.15.1 Auction Update Message

Auction Update messages are used to disseminate indicative price and size information during auctions for Cboe auction eligible securities. The Auction Update messages are published periodically during the call and extension phases of the auction process.

Auction Update N	Auction Update Message						
Field	Offset	Length	Data Type	Description			
Length	0	1	Binary	Length of this message including this field			
Message Type	1	1	0×AC	Auction Update Message			
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp			
Symbol	6	8	Alphanumeric	Symbol right padded with spaces			
Auction Type	14	1	Alphanumeric	0 = Opening Auction			
				C = Closing Auction			
				$\mathtt{H} = Halt \; Auction$			
				V = Volatility Auction			
				P = Periodic Auction			
				$\mathtt{U} = Cboe\ Closing\ Cross$			
Reference Price	15	8	Binary Long Price	Reference price used in tie-breaker situations			
Indicative Price	23	8	Binary Long Price	Price at which the auction would match if exe-			
				cuted at the time of the message			
Indicative Shares	31	4	Binary	Number of shares at the Indicative Price			
Outside Tolerance	35	1	Alphanumeric	Indicates whether the price on this update is out-			
				side the Cboe EBBO collar:			
				0 = Outside tolerance			
				$\mathtt{I} = Inside$ tolerance			
				- = Not specified			
Includes Primary	36	1	Alphanumeric	Indicates whether the Cboe EBBO used to collar			
				this update includes the Primary Market quotes:			
				P = Includes Primary			
				$N = Excludes \; Primary$			
				- = Not specified			
Total Length = 3	7 bytes						

### 4.15.2 Auction Summary

Auction Summary messages are used to disseminate the results of an auction in a Cboe auction eligible security.

Auction Summary Message						
Field	Offset	Length	Data Type	Description		
Length	0	1	Binary	Length of this message including this field		
Message Type	1	1	0x96	Auction Summary Message		
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp		
Symbol	6	8	Alphanumeric	Symbol right padded with spaces		
Auction Type	14	1	Alphanumeric	0 = Opening Auction		
				C = Closing Auction		
				H = Halt Auction		
				$\mathtt{V} = Volatility \; Auction$		
				P = Periodic Auction		
				$\mathtt{U} = Cboe\ Closing\ Cross$		
Price	15	8	Binary Long Price	Auction price		
Shares	23	4	Binary	Cumulative number of shares executed during		
				the auction		
Total Length :	= 27 byt	es				

# 4.16 Indices Messages

These messages are only available on a dedicated PITCH feed (XIC/XID/XIE)

### 4.16.1 Index Quote

Index Quote Messages are sent every second.

Index Quote	Index Quote			
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xD8	Index Quote Message
Timestamp	2	8	Binary	Nanoseconds since midnight
Index Ticker	10	10	String	Index ticker code eg BUK100P, see reference file
				for the mapping to other identifiers
Price	20	8	Binary Long Price	Price of the index
Index Status	28	1	Alphanumeric	$\mathtt{N} = Normal$
				I = Indicative (this occurs if certain validation
				checks are breached, indicating a potential issue
				with the values)
				C = Closing
Total Length = 29 bytes				

#### 4.16.2 Index Quote EDSP

Index Quote EDSP Messages are sent at end of day.

The end of day EDSP indices values will also be available to download after market hours.

Index Quote EDSP				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xD9	Index Quote EDSP Message
Timestamp	2	8	Binary	Nanoseconds since midnight
Index Ticker	10	10	String	Index ticker code eg BUK100P, see reference file
				for the mapping to other identifiers
Price	20	8	Binary Long Price	Price of the index
Total Length = 28 bytes				

### 4.17 MMT v3.04 Value Mappings

The following tables define type information as detailed by version 3.04 of the Market Model Typology standard ("MMT"). See http://www.fixtradingcommunity.org/pg/group-types/mmt for more details.

Each character in the flags field corresponds to a distinct MMT field, as described in the following table:

Trade 7	Trade Type Flags				
Offset	ffset   MMT Level / Fieldname		Description		
0	1	Market Mechanism			
1	2	Trading Mode			
2	3.1	Transaction Category			
3	3.2	Negotiated Trade			
4	3.3	Crossing Trade			
5	3.4	Modification Indicator			
6	3.5	Benchmark/Reference rice Indicator	See § 4.17, p. 32 for possible values.		
7	3.6	Special Dividend			
8	3.7	Off Book Automated Indicator			
9	3.8	Price Formation/Discovery Process			
10	3.9	Algorithmic Indicator			
11	4.1	Publication Mode/Deferral Reason			
12	4.2	Deferral or Enrichment Type			
13	5	Duplicative Indicator			

#### Special notes regarding Deferral or Enrichment Type

This is for RTS 2 only and currently unsupported in Cboe. A value of "-" should hence be expected for offset 12 (level 4.2).

Not all values are currently applicable to Cboe services. However, participants are advised to design their systems to cope with any of the listed MMT values.

1. Mar	1. Market Mechanism		
Value	Meaning		
'1'	Central Limit Order Book		
'2'	Quote Driven Market		
'3'	Dark Order Book		
'4'	Off Book		
'5'	Periodic Auction		
'6'	Request For Quotes		
'7'	Any Other, Including Hybrid		

2. Trac	2. Trading Mode		
Value	Meaning		
'1'	Undefined Auction		
'2'	Continuous Trading		
'3'	At Market Close Trading		
'4'	Out Of Main Session		
'5'	Trade Reporting (On Exchange)		
'6'	Trade Reporting (Off Exchange)		
'7'	Trade Reporting (Systematic Internaliser)		
'0'	Scheduled Opening Auction		
'K'	Scheduled Closing Auction		
'I'	Scheduled Intraday Auction		
'U'	Unscheduled Auction		

3.1 Tra	3.1 Transaction Category		
Value	Meaning		
'D'	Dark Trade		
'R'	Trade that has Received Price Improvement		
ʻZ'	Packaged trade		
'Υ'	Exchange for Physicals Trade		
'-,	None of the above apply		

3.2 Ne	3.2 Negotiated Trade or Pre-Trade Transparency Waiver		
Value	Meaning		
'1'	Negotiated Trade in Liquid Financial Instruments		
'2'	Negotiated Trade in Illiquid Financial Instruments		
'3'	Negotiated Trade Subject to Conditions Other than the Current Market Price		
'N'	Negotiated Trade Where None of the Above Apply		
'4'	Pre-Trade Transparency Waiver for Illiquid Instrument on an SI		
'5'	Pre-Trade Transparency Waiver for Above Standard Market Size on an SI		
'6'	Pre-Trade Transparency Waivers for Illiquid Instrument on an SI and Above Stan-		
	dard Market Size on an SI		
٠_,	Not specified		

3.3 Cro	3.3 Crossing Trade	
Value	Meaning	
'Х'	Crossing Trade	
(_,	Not specified	

3.4 Mo	3.4 Modification Indicator	
Value	Meaning	
'A'	Indicates a modification of a previously reported trade	
c,	Indicates a cancellation of a previously reported trade	
·_,	Not specified	

3.5 Be	3.5 Benchmark or Reference Price Indicator		
Value	Meaning		
'B'	Benchmark trade if (optionally) set by reporting party		
'S'	Reference Price Trade		
· _ ,	Not specified		

3.6 Ex/Cum Dividend	
Value	Meaning
'E'	Ex/Cum/Special dividend if (optionally) set by reporting party
(_,	Not specified

3.7 Off	3.7 Off Book Automated Indicator		
Value	Meaning		
ʻQ'	Automated		
'M'	Manual		
'_,	Not specified		

3.8 Contribution to Price Formation or the Price Discovery Process		
Value	Meaning	
'P'	Standard trade for the specified Market Mechanism or Trading Mode	
'T'	Non-Price Forming Trade (formerly known as Technical Trade)	
'Ј'	Trade not Contributing to Price Discovery Process (formerly Technical Trade)	
'N'	Price is currently not available but pending	

3.9 Algorithmic Trade	
Value	Meaning
'H'	Algorithmic Trade
(_,	Non-algorithmic Trade

4.1 Publication Mode / Post-Trade Deferral Reason		
Value	Meaning	
'1'	Trade report reported late without permitted deferral	
'2'	Deferral Trade for "Large In Scale"	
'3'	Deferral Trade for "Illiquid Instrument"	
'4'	Deferral Trade for "Size Specific"	
'5'	Deferral Trade for "Illiquid Instrument" and "Size Specific"	
'6'	Deferral Trade for "Illiquid Instrument" and "Large In Scale"	
٠-,	Not specified (Immediate Publication)	

4.2 Post-Trade Deferral or Enrichment Type		
Value	Meaning	
'1'	Limited Details Trade	
'2'	Daily Aggregated Trade	
'3'	Volume Omission Trade	
'4'	Four Weeks Aggregation Trade	
'5'	Indefinite Aggregation Trade	
'6'	Volume Omission Trade, Eligible For Subsequent Enrichment in Aggregated Form	
'7'	Full Details of Earlier Limited Details Trade	
'8'	Full Details of Earlier Daily Aggregated Trade	
'9'	Full Details of Earlier Volume Omission Trade	
٠٧,	Full Details of Four Weeks Aggregation Trade	
·W,	Full Details of Earlier Volume Omission Trade, Eligible For Subsequent Enrichment	
	in Aggregated Form	
· _ ,	Not Applicable	

5. Duplicative Indicator	
Value	Meaning
'1'	Duplicative Trade Report
(_,	Unique Trade Report

### 4.18 MMT v4.1 Value Mappings

From 1 Jan 2024, Cboe's market data will support the Market Model Typology (MMT) v4.1 standard.

The number of characters used to represent a trade remains unchanged in v4.1 - it will remain at 14 characters, just like v3.04.

However, effective from MMT v4.1 onwards, an "efficient encoding string" for MMT is used, which has been decoupled from the MMT v4.1 level structure. It will no longer be the case that each character of the MMT string represents a single level in the MMT, but instead there is an encoding algorithm which decides for each position, which one or more MMT levels are represented, and encoded accordingly.

However, it's important to note that MMT v4.1 is backwards compatible with the encoding for the preceding version v3.04. All values that are present in version 3.04 are still represented in version 4.1, but some encoding values are not applicable to earlier versions of MMT.

#### Special notes regarding Deferral or Enrichment Type

This is for RTS 2 only and currently unsupported in Cboe. A value of "-" should hence be expected for offset 12 (level 4.2).

Not all values are currently applicable to Cboe services. However, participants are advised to design their systems to cope with any of the listed MMT values.

Offset 0 Represents MMT Level 1 Market Mechanism		
Value	Meaning	
'1'	Central Limit Order Book	
'2'	Quote Driven Market	
'3'	Dark Order Book	
'4'	Off Book	
'5'	Periodic Auction	
'6'	Request For Quotes	
'7'	Any Other, Including Hybrid (Original ESMA definition)	
'8'	Hybrid System (Revised ESMA definition)	
'9'	Any Other, Excluding Hybrid (Revised ESMA definition)	

Offset 1 Represents MMT Level 2 Trading Mode		
Value	Meaning	
'1'	Undefined Auction	
'2'	Continuous Trading	
'3'	At Market Close Trading	
'4'	Out Of Main Session	
'5'	Trade Reporting (On Exchange)	
'6'	Trade Reporting (Off Exchange)	
'7'	Trade Reporting (Systematic Internaliser)	
'0'	Scheduled Opening Auction	
'K'	Scheduled Closing Auction	
'I'	Scheduled Intraday Auction	
'υ'	Unscheduled Auction	
'P'	On-Demand Auction	

Note: As Cboe transitions to MMT v4.1, executions from Cboe's Periodic Auction books will be flagged as 'On-Demand Auction' ('P'), rather than ('I').

Offset 2 Encodes MMT Level 3.1 and Level 3.13		
Value	Level 3.1 Transaction Category	Level 3.13 RFMD Give-up Trade
'D'	Dark Trade	-
'R'	Trade that has Received Price Improve-	-
	ment	
ʻZ'	Packaged Trade	-
Υ,	Exchange for Physicals Trade	-
'H'	Exchange for Physicals Trade	GIVE
'G'	None of the above apply	GIVE
(_,	None of the above apply	-

Offset	Offset 3 Encodes MMT Level 3.2 and Level 3.10		
Value	Level 3.2 Negotiation Indicator or	Level 3.10 Pre-Trade Transparency	
	Pre-Trade Transparency Waiver	Waiver Related To Size/Scale	
'1'	NLIQ(Negotiated Trade in Liquid Finan-	-	
	cial Instruments)		
'2'	OILQ(Negotiated Trade in Illiquid Finan-	-	
	cial Instruments)		
'3'	PRIC(Negotiated Trade Subject to Con-	-	
	ditions Other than the Current Market		
	Price)		
'4'	ILQD(Pre-Trade Transparency Waiver for	-	
	Illiquid Instrument on an SI)		
'5'	-	SIZE(Pre-Trade Transparency Waiver for	
		Above Standard Market Size on an SI)	
'6'	ILQD(Pre-Trade Transparency Waiver for	SIZE(Pre-Trade Transparency Waiver for	
	Illiquid Instrument on an SI)	Above Standard Market Size on an SI)	
'7'	_	NTLS(Negotiated Trade Larger Than LIS	
		Brought Onto A Venue)	
'8'	NETW(Negotiated Trade With Pre-		
	Trade Transparency Waiver)		
'9'	NLIQ(Negotiated Trade in Liquid Finan-	NTLS(Negotiated Trade Larger Than LIS	
	cial Instruments)	Brought Onto A Venue)	
'a'	OILQ(Negotiated Trade in Illiquid Finan-	NTLS(Negotiated Trade Larger Than LIS	
	cial Instruments)	Brought Onto A Venue)	
'b'	PRIC(Negotiated Trade Subject to Con-	NTLS(Negotiated Trade Larger Than LIS	
	ditions Other than the Current Market	Brought Onto A Venue)	
	Price)		
'c'	NETW(Negotiated Trade With Pre-	NTLS(Negotiated Trade Larger Than LIS	
	Trade Transparency Waiver)	Brought Onto A Venue)	
'N'	N(Negotiated Trade Where None of the	-	
	Above Apply)		
(_,	Not a Negotiated Trade		

Note that, in MMT v3, the values of 5 and 6 were already representing

- 5: SIZE (Pre-Trade Transparency Waiver For Above Standard Market Size on an SI)
- 6: ILQD+SIZE (Pre-Trade Transparency Waivers for Illiquid Instrument on an SI and Above Standard Market Size on an SI)

While SIZE has now been separated out into its own Level 3.10, the possible values remain the same.

Offset	Offset 4 Represents MMT Level 3.3 Crossing Trade			
Value	Meaning			
'Х'	Crossing Trade			
(_,	Not specified			

Offset 5 Represents MMT Level 3.4 Modification Indicator			
Value	Meaning		
'A'	Indicates a modification of a previously reported trade		
c,	Indicates a cancellation of a previously reported trade		
'_,	Not specified		

Offset	Offset 6 Encodes three MMT Level 3 Transaction Types - Levels 3.5, 3.11 and 3.12				
Value	Level 3.5 Benchmark	Level 3.11 Portfolio	Level 3.12 Contingent		
	(BENC), Benchmark	Trade (PORT)	Trade (CONT)		
	Transactions Executed				
	at Market Closing Price				
	(CLSE), or Reference				
	Price Indicator (RFPT)				
'B'	BENC	-	-		
c,	-	-	CONT		
'M'	BENC	-	CONT		
'N'	-	PORT	CONT		
'0'	BENC	PORT	CONT		
'P'	-	PORT	-		
'S'	RFPT	-	-		
'Υ'	BENC	PORT	-		
'1'	CLSE	-	-		
'2'	CLSE	PORT	-		
'3'	CLSE	-	CONT		
'4'	CLSE	PORT	CONT		
(_,	-	-	-		

Offset 7 Represents MMT Level 3.6 Special Dividend Indicator			
Value	/alue Meaning		
'E'	Special dividend if (optionally) set by reporting party		
(_,	Not specified		

Offset 8 Represents MMT Level 3.7 Off Book Automated Indicator			
Value	Meaning		
ʻQ'	Automated		
'M'	Manual		
·_,	Not specified		

Offset	Offset 9 Represents MMT Level 3.8 Contribution to Price Formation or the Price Discovery Process			
Value	Meaning			
'P'	Standard trade for the specified Market Mechanism or Trading Mode			
'T'	(NPFT) Non-Price Forming Trade (formerly known as Technical Trade)			
ʻJ'	(TNCP) Trade not Contributing to Price Discovery Process (formerly Technical			
	Trade)			
'N,	(PNDG) Price is currently not available but pending			
ʻZ'	(NOAP) Price is Not Applicable			

Note: TNCP is due to be deprecated by ESMA on new trades from 2024.

Offset 10 Represents MMT Level 3.9 Algorithmic Trade			
Value	Meaning		
'H'	Algorithmic Trade		
(_,	Non-algorithmic Trade		

Offset	Offset 11 Encodes three MMT Levels 4.1, 4.3, and 4.4					
Value	Level 4.1 - Publication	Level 4.3 - Post-Trade	Level 4.4 - Post-Trade			
	Mode / Post-Trade De-	Deferral Reason: Illiquid	Deferral Reason: Size			
	ferral Reason	Instrument (ILQD)	Specific. (SIZE)			
'1'	Trade report reported late without permitted deferral					
'2'	LRGS	-	-			
'3'	-	ILQD	-			
'4'	ī	-	SIZE			
<b>'</b> 5'	-	ILQD	SIZE			
'6'	LRGS	ILQD	-			
(_,	Not specified (Immediate publication)					

#### Key:

LRGS: Deferral Trade for Large In Scale
ILQD: Deferral Trade for Illiquid Instrument

• SIZE: Deferral Trade for Size Specific

Since ILQD and SIZE were originally in Level 4.1 in MMT v3, the relocation of ILQD and SIZE to their own levels does not change the values possible in offset 12, and hence the encoding algorithm essentially keeps the same values.

Offset	12 Represents MMT Level 4.2 Post-Trade Deferral or Enrichment Type
Value	Meaning
'1'	Limited Details Trade
'2'	Daily Aggregated Trade
'3'	Volume Omission Trade
'4'	Four Weeks Aggregation Trade
'5'	Indefinite Aggregation Trade
<b>'</b> 6'	Volume Omission Trade, Eligible For Subsequent Enrichment in Aggregated Form
'7'	Full Details of Earlier Limited Details Trade
'8'	Full Details of Earlier Daily Aggregated Trade
'9'	Full Details of Earlier Volume Omission Trade
ίν,	Full Details of Four Weeks Aggregation Trade
'W'	Full Details of Earlier Volume Omission Trade, Eligible For Subsequent Enrichment
	in Aggregated Form
· _ ·	Not Applicable

Offset	Offset 13 Encodes the three MMT Level 5 Reporting Circumstance flags - Levels 5.1, 5.2 and 5.3					
Value	Level 5.1 Duplicative	Level 5.2 Duplicative	Level 5.3 Intra-Group			
	Within Jurisdiction (Du-	Across Jurisdictions	Trade			
	plicative Trade Report)	(Cross Border Duplica-				
		tive Trade Report)				
'1'	DUPL	-	-			
'2'	-	-	IGRP			
'3'	DUPL	-	IGRP			
'4'	-	XBDT	-			
'5'	DUPL	XBDT	-			
'6'	DUPL	XBDT	IGRP			
'7'	-	XBDT	IGRP			
(_,	-					

### 5 Spin Messages

#### 5.1 Login Message

The Login Message is the first message sent to the Spin Server by a user's process after the connection to the Spin Server is established. Failure to login before sending any other message type will result in the connection being dropped by the Spin Server.

The format of the Login Message for the Spin Server is identical to that of the GRP (see § 3.1, p. 12) and must be sent inside of a Sequenced Unit Header.

Note that message retransmission can't be requested for indices data.

#### 5.2 Login Response Message

The Login Response Message is sent by the Spin Server to a user's process in response to a Login Message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the Login Response Message is sent.

The format of the Login Response Message for the Spin Server is identical to that of the GRP (see § 3.2, p. 12).

#### 5.3 Spin Image Available Message

The Spin Image Available Message is sent once per second and indicates through what sequence number a spin is available.

Spin Image Available					
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0×80	Spin Image Available Message	
Sequence 2 4 Binary Spin is available which is current throu sequence number		Spin is available which is current through this sequence number			
Total Length = 6 bytes					

#### 5.4 Spin Request Message

The Spin Request message is used by a user's process to request transmission of a spin of the unit's order book. The sequence number presented in the Spin Request message must match the sequence sent in one of the last ten Spin Image Available messages. The Participant must buffer all multicast messages for the unit with a sequence number greater than the sequence number requested so that when the spin is finished, the buffered messages can be applied to bring the book current. A Spin Request Message must be sent inside of a Sequenced Unit Header.

Spin Request Message				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0×81	Spin Request Message
		Sequence number from a Spin Image Available Message received by the Participant		
Total Length = 6 bytes				

### 5.5 Spin Response Message

The Spin Response Message is sent in response to a user's Spin Request message, indicating whether a spin will be sent.

Spin Response	Spin Response Message				
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0x82	Spin Response Message	
Sequence	2	4	Binary	Sequence number from a Spin Image Available Message received by the Participant	
Order Count	6	4	Binary	Number of Add Order messages which will be contained in this spin; 0 if spin cannot be satisfied	
Status	10	1	Alphanumeric	A = Accepted  O = Out of range (spin no longer available)  S = Spin already in progress (only one spin can be running at a time)	
				All non-A status codes should be interpreted as a reject.	
Total Length :	= 11 byt	es	_		

#### 5.6 Spin Finished Message

The Spin Finished Message is sent to indicate that all Add Order messages for the spin requested have been sent. A Spin Finished Message is only sent if a Spin Request was not rejected. Upon receipt of a Spin Finished Message, any buffered multicast messages should be applied to the Participant's copy of the book to make it current.

Spin Finished Message					
Field	Offset	Length	Data Type	Description	
Length	0	1	Binary	Length of this message including this field	
Message Type	1	1	0x83	Spin Finished Message	
Sequence	2	4	Binary	Sequence number from the Spin Request Mes-	
sage					
Total Length :	Total Length = 6 bytes				

# 6 Limitations/Configurations

The following table defines the Cboe current configuration for network and gap request limitations. Cboe reserves the right to adjust the gap request limitations to improve the effectiveness of the gap request infrastructure.

Gap request limits are per Multicast PITCH feed, not per GRP session. For example, the request limit is 50 requests/second. If a Participant has two GIG A GRP sessions, the limit is 50 requests/second *combined* across both GRP sessions, and *not* 50 requests/second for each session.

Period/Type	Limit/Setting	Notes
MTU	1,500 bytes	Choe will send UDP messages up to 1,500 bytes. Par-
		ticipants should ensure that their infrastructure is con-
		figured accordingly.
Throttle	1 Gb/s (Gig-Shaped),	The real-time and gap multicast head ends are con-
	50 Mb/s (WAN-Shaped)	figured to shape their output to this level to minimize
		packet loss.
Gap Response	2 ms	The Gap Server will delay resending sequenced mes-
Delay		sages via multicast for the specified limit in order to
		satisfy multiple GRP gap requests with one multicast
		response.
Count	100	Any single gap request may not be for more than this
		number of dropped messages.
1 Second	50 Requests	Users' retransmission requests are limited to this many
		requests per second. This is renewed every clock sec-
		ond.
1 Minute	500 Requests	Users' retransmission requests are limited to this many
		requests per minute. This is renewed every clock
		minute.
Day	100,000 Requests	Users' retransmission requests are limited to this many
		requests per day.
Within Range	1,000,000 Messages	Users' retransmission requests must be within this many
		messages of the most recent sequence sent by the real-
		time feed.

### 7 Multicast Configuration

Cboe reserves the right to add units and/or change symbol distribution within 48 hours notice and no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to, at minimum, support mappings in these tables via software configuration. Symbol ranges are chosen to try to distribute updates evenly. The distribution is reviewed periodically and may be adjusted. Refer to Appendix E (p. 92).

Choe reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.

Data Centre	Market	Feed	Source Range	Destination Range	PIM RP Address
LD4	BXE	BA	95.130.109.128/28	224.0.83.16/28	95.130.109.244
LD4	BXE	BA	95.130.109.144/28	224.0.83.128/28	95.130.109.245
LD4	BXE	BC	95.130.109.128/28	224.0.83.48/28	95.130.109.244
LD4	BXE	BC	95.130.109.144/28	224.0.83.144/28	95.130.109.245
LD4	BXE	BB	95.130.109.160/28	224.0.83.80/28	95.130.109.246
LD4	BXE	BB	95.130.109.176/28	224.0.83.160/28	95.130.109.247
LD4	BXE	BD	95.130.109.160/28	224.0.83.112/28	95.130.109.246
LD4	BXE	BD	95.130.109.176/28	224.0.83.176/28	95.130.109.247
LD3	BXE	BE	95.130.107.80/29	224.0.84.16/28	95.130.107.252
LD3	BXE	BE	95.130.107.88/29	224.0.84.32/28	95.130.107.253
LD4	BXE	UAT	95.130.110.224/27	224.0.85.16/28	95.130.109.255
LD4	CXE	XA	95.130.108.128/28	224.0.82.16/28	95.130.108.244
LD4	CXE	XA	95.130.108.144/28	224.0.82.192/28	95.130.108.245
LD4	CXE	XC	95.130.108.128/28	224.0.82.48/28	95.130.108.244
LD4	CXE	XC	95.130.108.144/28	224.0.82.208/28	95.130.108.245
LD4	CXE	XB	95.130.108.160/28	224.0.82.80/28	95.130.108.246
LD4	CXE	XB	95.130.108.176/28	224.0.82.224/28	95.130.108.247
LD4	CXE	XD	95.130.108.160/28	224.0.82.112/28	95.130.108.246
LD4	CXE	XD	95.130.108.176/28	224.0.82.240/28	95.130.108.247
LD3	CXE	XE	95.130.106.80/29	224.0.84.208/28	95.130.106.252
LD3	CXE	XE	95.130.106.88/29	224.0.84.224/28	95.130.106.253
LD4	CXE	UAT	95.130.110.192/27	224.0.85.0/28	95.130.108.255
LD3	CXE	UAT-DR	95.130.111.192/28	224.0.85.48/28	95.130.106.255
LD4	DXE	DA	5.253.108.80/28	224.0.180.0/28	5.253.108.112
LD4	DXE	DC	5.253.108.80/28	224.0.180.16/28	5.253.108.112
LD4	DXE	DB	5.253.108.96/28	224.0.180.32/28	5.253.108.113
LD4	DXE	DD	5.253.108.96/28	224.0.180.48/28	5.253.108.113
LD3	DXE	DE	5.253.109.80/28	224.0.84.240/28	5.253.109.127
LD4	DXE	UAT	95.130.110.64/27	224.0.85.80/28	95.130.110.126
LD3	DXE	UAT-DR	95.130.111.96/28	224.0.85.96/28	95.130.111.126
LD4	TRF	TC	95.130.104.176/29	224.0.83.248/29	95.130.104.249
LD4	TRF	TD	95.130.104.184/29	224.0.83.232/29	95.130.104.253
LD3	TRF	TE	95.130.106.176/29	224.0.84.160/29	95.130.106.254
LD4	TRF	UATT	95.130.110.0/28	224.0.85.32/29	95.130.104.255
LD4	SI	QA	95.130.104.80/28	224.0.82.160/28	95.130.104.124
LD4	SI	QB	95.130.104.96/28	224.0.82.176/28	95.130.104.125
LD4	SI	QC	95.130.104.80/28	224.0.82.128/28	95.130.104.126

LD4	SI	QD	95.130.104.96/28	224.0.82.144/28	95.130.104.127
LD3	SI	QE	95.130.105.192/28	224.0.84.192/28	95.130.105.255
LD4	SI	UATQ	95.130.110.32/27	224.0.85.64/28	95.130.110.127
LD4	CXE	XIC	95.130.105.208/29	224.0.83.224/29	95.130.105.252
LD4	CXE	XID	95.130.105.216/29	224.0.83.240/29	95.130.105.253
LD3	CXE	XIE	95.130.105.224/29	224.0.84.48/29	95.130.105.254
LD4	CXE	UAT	95.130.110.192/27	224.0.85.112/29	95.130.110.125
LD3	CXE	UAT-DR	95.130.111.192/27	224.0.85.120/29	95.130.111.125
LD4	CXE	XAR	95.130.108.128/28	224.0.85.192/29	95.130.108.244
LD4	CXE	XBR	95.130.108.160/28	224.0.85.200/29	95.130.108.246
LD3	CXE	XER	95.130.106.80/29	224.0.85.224/29	95.130.106.252
LD3	CXE	UATR	195.3.211.64/27	224.0.85.176/29	95.130.108.255
LD4	DXE	DAR	5.253.108.80/28	224.0.85.208/29	5.253.108.112
LD4	DXE	DBR	5.253.108.96/28	224.0.85.216/29	5.253.108.113
LD3	DXE	DER	5.253.109.80/28	224.0.85.232/29	5.253.109.127
LD3	DXE	UATR	195.3.211.96/27	224.0.85.184/29	95.130.110.126

### 7.1 Equinix Slough (LD4) BXE Multicast Configuration

The following describe the setup which will be used in the Equinix Slough (LD4) facility for the BXE book.

#### 7.1.1 BXE Production Primary Multicast PITCH Feed (BA, BC)

		Gig-Shap	` ,	WAN-Sha	ped (BC)
Unit	IP Port	Real-time	Gap Response	Real-time	Gap Response
		MC and (Src) IP	MC and (Src) IP	MC and (Src) IP	MC and (Src) IP
		Addr	Addr	Addr	Addr
1	31201	224.0.83.18	224.0.83.19	224.0.83.50	224.0.83.51
2	31202	(95.130.109.132)	(95.130.109.132)	(95.130.109.133)	(95.130.109.133)
3	31203	(93.130.109.132)	(93.130.109.132)	(95.150.109.155)	(93.130.109.133)
4	31204	224.0.83.130	224.0.83.131	224.0.83.146	224.0.83.147
5	31205	(95.130.109.149)	(95.130.109.149)	(95.130.109.150)	(95.130.109.150)
6	31206	224.0.83.132	224.0.83.133	224.0.83.148	224.0.83.149
		(95.130.109.149)	(95.130.109.149)	(95.130.109.150)	(95.130.109.150)
7	31207	224.0.83.134	224.0.83.135	224.0.83.150	224.0.83.151
		(95.130.109.149)	(95.130.109.149)	(95.130.109.150)	(95.130.109.150)
8	31208	224.0.83.134	224.0.83.135		
		(95.130.109.148)	(95.130.109.148)		
9	31209	224.0.83.136	224.0.83.137	224.0.83.152	224.0.83.153
10	31210	(95.130.109.148)	(95.130.109.148)	(95.130.109.150)	(95.130.109.150)
11	31211	224.0.83.20 224.0.83.21		224.0.83.52	224.0.83.53
		(95.130.109.132) (95.130.109.132)		(95.130.109.133)	(95.130.109.133)
12	31212	224.0.83.138	224.0.83.139	224.0.83.154	224.0.83.155
		(95.130.109.148)	(95.130.109.148)	(95.130.109.150)	(95.130.109.150)

### 7.1.2 BXE Production Secondary Multicast PITCH Feeds (BB, BD)

	Gig-Shaped (BB)		ed (BB)	WAN-Sha	ped (BD)
Unit	IP Port	Real-time	Gap Response	Real-time	Gap Response
		MC and (Src) IP			
		Addr	Addr	Addr	Addr
1	31201	224.0.83.82	224.0.83.83	224.0.83.114	224.0.83.115
2	31202	(95.130.109.164)	(95.130.109.164)	(95.130.109.165)	(95.130.109.165)
3	31203	(93.130.109.104)	(93.130.109.104)	(93.130.109.103)	(93.130.109.103)
4	31204	224.0.83.162	224.0.83.163	224.0.83.178	224.0.83.179
5	31205	(95.130.109.180)	(95.130.109.180)	(95.130.109.182)	(95.130.109.182)
6	31206	224.0.83.164	224.0.83.165	224.0.83.180	224.0.83.181
		(95.130.109.180)	(95.130.109.180)	(95.130.109.182)	(95.130.109.182)
7	31207	224.0.83.166	224.0.83.167	224.0.83.182	224.0.83.183
		(95.130.109.180)	(95.130.109.180)	(95.130.109.182)	(95.130.109.182)
8	31208	224.0.83.166	224.0.83.167		
		(95.130.109.181)	(95.130.109.181)		
9	31209	224.0.83.168	224.0.83.169	224.0.83.184	224.0.83.185
10	31210	(95.130.109.181)	(95.130.109.181)	(95.130.109.182)	(95.130.109.182)
11	31211	224.0.83.84	224.0.83.85	224.0.83.116	224.0.83.117
		(95.130.109.164)	(95.130.109.164)	(95.130.109.165)	(95.130.109.165)
12	31212	224.0.83.170	224.0.83.171	224.0.83.186	224.0.83.187
		(95.130.109.181)	(95.130.109.181)	(95.130.109.182)	(95.130.109.182)

#### 7.1.3 BXE UAT Multicast PITCH Feeds

		WAN-Shaped		
Unit	IP Port	Real-time	Gap Response	
		MC and (Src) IP Addr	MC and (Src) IP Addr	
	01501	Addr	Addr	
1	31501	224.0.85.18	224.0.85.19	
2	31502	(95.130.110.228)	(95.130.110.228)	
3	31503	(33.130.110.220)	(95.130.110.220)	
4	31504	224.0.85.20	224.0.85.21	
5	31505	(95.130.110.228)	(95.130.110.228)	
6	31506	224.0.85.22	224.0.85.23	
		(95.130.110.228)	(95.130.110.228)	
7	31507	224.0.85.24	224.0.85.25	
8	31508	(95.130.110.228)	(95.130.110.228)	
9	31509	224.0.85.26	224.0.85.27	
10	31510	(95.130.110.228)	(95.130.110.228)	
11	31511	224.0.85.28	224.0.85.29	
12	31512	(95.130.110.228)	(95.130.110.228)	

## 7.2 Equinix Slough (LD4) CXE Multicast Configuration

The following describe the setup which will be used in the Equinix Slough (LD4) facility for the CXE book.

### 7.2.1 CXE Production Primary Multicast PITCH Feeds (XA, XC)

		Gig-Shap		WAN-Sha	ped (XC)
Unit	IP Port	Real-time	Gap Response	Real-time	Gap Response
		MC and (Src) IP			
		Addr	Addr	Addr	Addr
1	31201	224.0.82.18	224.0.82.19	224.0.82.50	224.0.82.51
2	31202	(95.130.108.132)	(95.130.108.132)	(95.130.108.133)	(95.130.108.133)
3	31203	(93.130.106.132)	(93.130.106.132)	(93.130.106.133)	(93.130.106.133)
4	31204	224.0.82.194	224.0.82.195	224.0.82.210	224.0.82.211
5	31205	(95.130.108.148)	(95.130.108.148)	(95.130.108.150)	(95.130.108.150)
6	31206	224.0.82.196	224.0.82.197	224.0.82.212	224.0.82.213
		(95.130.108.148)	(95.130.108.148)	(95.130.108.150)	(95.130.108.150)
7	31207	224.0.82.198	224.0.82.199	224.0.82.214	224.0.82.215
		(95.130.108.148)	(95.130.108.148)	(95.130.108.150)	(95.130.108.150)
8	31208	224.0.82.198	224.0.82.199		
		(95.130.108.149)	(95.130.108.149)		
9	31209	224.0.82.200	224.0.82.201	224.0.82.216	224.0.82.217
10	31210	(95.130.108.149)	(95.130.108.149)	(95.130.108.150)	(95.130.108.150)
11	31211	224.0.82.20	224.0.82.21	224.0.82.52	224.0.82.53
		(95.130.108.132)	(95.130.108.132)	(95.130.108.133)	(95.130.108.133)
12	31212	224.0.82.202	224.0.82.203	224.0.82.218	224.0.82.219
		(95.130.108.149)	(95.130.108.149)	(95.130.108.150)	(95.130.108.150)

#### 7.2.2 CXE Production Secondary Multicast PITCH Feeds (XB, XD)

		Gig-Shaր	oed (XB)	WAN-Shaped (XD)	
Unit	IP Port	Real-time	Gap Response	Real-time	Gap Response
		MC and (Src) IP			
		Addr	Addr	Addr	Addr
1	31201	224.0.82.82	224.0.82.83	224.0.82.114	224.0.82.115
2	31202				
3	31203	(95.130.108.164)	(95.130.108.164)	(95.130.108.165)	(95.130.108.165)
4	31204	224.0.82.226	224.0.82.227	224.0.82.242	224.0.82.243
5	31205	(95.130.108.180)	(95.130.108.180)	(95.130.108.182)	(95.130.108.182)
6	31206	224.0.82.228	224.0.82.229	224.0.82.244	224.0.82.245
		(95.130.108.180)	(95.130.108.180)	(95.130.108.182)	(95.130.108.182)
7	31207	224.0.82.230	224.0.82.231	224.0.82.246	224.0.82.247
		(95.130.108.180)	(95.130.108.180)	(95.130.108.182)	(95.130.108.182)
8	31208	224.0.82.230	224.0.82.231		
		(95.130.108.181)	(95.130.108.181)		
9	31209	224.0.82.232	224.0.82.233	224.0.82.248	224.0.82.249
10	31210	(95.130.108.181)	(95.130.108.181)	(95.130.108.182)	(95.130.108.182)
11	31211	224.0.82.84	224.0.82.85	224.0.82.116	224.0.82.117
		(95.130.108.164)	(95.130.108.164)	(95.130.108.165)	(95.130.108.165)
12	31212	224.0.82.234	224.0.82.235	224.0.82.250	224.0.82.251
		(95.130.108.181)	(95.130.108.181)	(95.130.108.182)	(95.130.108.182)

### 7.2.3 CXE Production Primary Multicast PITCH Retail Liquidity Feeds (XAR)

		GIG-Shaped		
Unit	IP Port	Real-time	Gap Response	
		MC and (Src) IP	MC and (Src) IP	
		Addr	Addr	
1	31201			
2	31202			
3	31203	224.0.85.194	224.0.85.195	
4	31204	(95.130.108.134)	(95.130.108.134)	
5	31205			
6	31206			
7	31207			
8	31208			
9	31209	224.0.85.196	224.0.85.197	
10	31210	(95.130.108.135)	(95.130.108.135)	
11	31211			
12	31212			

### 7.2.4 CXE Production Secondary Multicast PITCH Retail Liquidity Feeds (XBR)

		GIG-Shaped		
Unit	IP Port	Real-time	Gap Response	
		MC and (Src) IP	MC and (Src) IP	
		Addr	Addr	
1	31201			
2	31202			
3	31203	224.0.85.202	224.0.85.203	
4	31204	(95.130.108.166)	(95.130.108.166)	
5	31205			
6	31206			
7	31207			
8	31208			
9	31209	224.0.85.204	224.0.85.205	
10	31210	(95.130.108.167)	(95.130.108.167)	
11	31211			
12	31212			

### 7.2.5 CXE UAT Multicast PITCH Feeds

		WAN-Shaped			
Unit	IP Port	Real-time	Gap Response		
		MC and (Src) IP	MC and (Src) IP		
		Addr	Addr		
1	31501				
2	31502	224.0.85.2	224.0.85.3		
3	31503	(95.130.110.196)	(95.130.110.196)		
4	31504	224.0.85.4	224.0.85.5		
5	31505	(95.130.110.196)	(95.130.110.196)		
6	31506	224.0.85.6	224.0.85.7		
		(95.130.110.196)	(95.130.110.196)		
7	31507	224.0.85.8	224.0.85.9		
8	31508	(95.130.110.196)	(95.130.110.196)		
9	31509	224.0.85.10	224.0.85.11		
10	31510	(95.130.110.196)	(95.130.110.196)		
11	31511	224.0.85.12	224.0.85.13		
12	31512	(95.130.110.196)	(95.130.110.196)		

## 7.2.6 CXE UAT Multicast PITCH Retail Liquidity Feeds

		WAN-Shaped			
Unit	IP Port	Real-time	Gap Response		
		MC and (Src) IP	MC and (Src) IP		
		Addr	Addr		
1	31552				
2	31553				
3	31554	224.0.85.178	224.0.85.179		
4	31555	(195.3.211.92)	(195.3.211.92)		
5	31556				
6	31557				
7	31558				
8	31559				
9	31560	224.0.85.180	224.0.85.181		
10	31561	(195.3.211.93)	(195.3.211.93)		
11	31562				
12	31563				

### 7.2.7 CXE Production Primary Indices Multicast PITCH Feeds (XIC)

		WAN-Shaped (XIC)		
Unit	IP Port	Real-time		
		MC and (Src) IP Addr		

#### 7.2.8 CXE Production Secondary Indices Multicast PITCH Feeds (XID)

		WAN-Shaped (XID)		
Unit	IP Port	Real-time		
		MC and (Src) IP Addr		
1	33201	224.0.83.240 (95.130.105.220)		

#### 7.2.9 CXE UAT Indices Multicast PITCH Feeds

		WAN-Shaped		
Unit	IP Port	Real-time		
		MC and (Src) IP Addr		
1	33001	224.0.85.114 (95.130.110.218)		

### 7.3 Equinix Slough (LD4) DXE Multicast Configuration

The following describe the setup which will be used in the Equinix Slough (LD4) facility for the DXE book.

### 7.3.1 DXE Production Primary Multicast PITCH Feeds (DA, DC)

		Gig-Shaped (DA)		WAN-Shaped (DC)	
Unit	IP Port	Real-time	Gap Response	Real-time	Gap Response
		MC and (Src) IP			
		Addr	Addr	Addr	Addr
1	31201	224.0.180.2	224.0.180.3	224.0.180.18	224.0.180.19
2	31202	(5.253.108.81)	(5.253.108.81)	(5.253.108.84)	(5.253.108.84)
3	31203	(3.233.100.01)	(3.233.100.01)	(3.233.100.04)	(3.233.100.04)
4	31204	224.0.180.4	224.0.180.5	224.0.180.20	224.0.180.21
5	31205	(5.253.108.82)	(5.253.108.82)	(5.253.108.84)	(5.253.108.84)
6	31206	224.0.180.6	224.0.180.7	224.0.180.22	224.0.180.23
		(5.253.108.82)	(5.253.108.82)	(5.253.108.84)	(5.253.108.84)
7	31207	224.0.180.8	224.0.180.9	224.0.180.24	224.0.180.25
		(5.253.108.82)	(5.253.108.82)	(5.253.108.84)	(5.253.108.84)
8	31208	224.0.180.8	224.0.180.9		
		(5.253.108.83)	(5.253.108.83)		
9	31209	224.0.180.10	224.0.180.11	224.0.180.26	224.0.180.27
10	31210	(5.253.108.83)	(5.253.108.83)	(5.253.108.84)	(5.253.108.84)
11	31211	224.0.180.12	224.0.180.13	224.0.180.28	224.0.180.29
		(5.253.108.81)	(5.253.108.81)	(5.253.108.84)	(5.253.108.84)
12	31212	224.0.180.14	224.0.180.15	224.0.180.30	224.0.180.31
		(5.253.108.83)	(5.253.108.83)	(5.253.108.84)	(5.253.108.84)

#### 7.3.2 DXE Production Secondary Multicast PITCH Feeds (DB, DD)

		Gig-Shaped (DB)		WAN-Shaped (DD)	
Unit	IP Port	Real-time	Gap Response	Real-time	Gap Response
		MC and (Src) IP			
		Addr	Addr	Addr	Addr
1	31201	224.0.180.34	224.0.180.35	224.0.180.50	224.0.180.51
2	31202				
3	31203	(5.253.108.97)	(5.253.108.97)	(5.253.108.100)	(5.253.108.100)
4	31204	224.0.180.36	224.0.180.37	224.0.180.52	224.0.180.53
5	31205	(5.253.108.98)	(5.253.108.98)	(5.253.108.100)	(5.253.108.100)
6	31206	224.0.180.38	224.0.180.39	224.0.180.54	224.0.180.55
		(5.253.108.98)	(5.253.108.98)	(5.253.108.100)	(5.253.108.100)
7	31207	224.0.180.40	224.0.180.41	224.0.180.56	224.0.180.57
		(5.253.108.98)	(5.253.108.98)	(5.253.108.100)	(5.253.108.100)
8	31208	224.0.180.40	224.0.180.41		
		(5.253.108.99)	(5.253.108.99)		
9	31209	224.0.180.42	224.0.180.43	224.0.180.58	224.0.180.59
10	31210	(5.253.108.99)	(5.253.108.99)	(5.253.108.100)	(5.253.108.100)
11	31211	224.0.180.44	224.0.180.45	224.0.180.60	224.0.180.61
		(5.253.108.97)	(5.253.108.97)	(5.253.108.100)	(5.253.108.100)
12	31212	224.0.180.46	224.0.180.47	224.0.180.62	224.0.180.63
		(5.253.108.99)	(5.253.108.99)	(5.253.108.100)	(5.253.108.100)

### 7.3.3 DXE Production Primary Multicast PITCH Retail Liquidity Feeds (DAR)

		GIG-Shaped			
Unit	IP Port	Real-time	Gap Response		
		MC and (Src) IP	MC and (Src) IP		
		Addr	Addr		
1	31201				
2	31202				
3	31203	224.0.85.210	224.0.85.211		
4	31204	(5.253.108.88)	(5.253.108.88)		
5	31205				
6	31206				
7	31207				
8	31208				
9	31209	224.0.85.212	224.0.85.213		
10	31210	(5.253.108.89)	(5.253.108.89)		
11	31211				
12	31212				

### 7.3.4 DXE Production Secondary Multicast PITCH Retail Liquidity Feeds (DBR)

		GIG-Shaped			
Unit IP Port		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr		
1	31201				
2	31202				
3	31203	224.0.85.218	224.0.85.219		
4	31204	(5.253.108.104)	(5.253.108.104)		
5	31205				
6	31206				
7	31207				
8	31208				
9	31209	224.0.85.220	224.0.85.221		
10	31210	(5.253.108.105)	(5.253.108.105)		
11	31211				
12	31212				

#### 7.3.5 DXE UAT Multicast PITCH Feeds

		WAN-Shaped			
Unit	IP Port	Real-time	Gap Response		
		MC and (Src) IP	MC and (Src) IP		
		Addr	Addr		
1	31201				
2	31202	224.0.85.82	224.0.85.83		
3	31203	(95.130.110.68)	(95.130.110.68)		
4	31204	224.0.85.84	224.0.85.85		
5	31205	(95.130.110.68)	(95.130.110.68)		
6	31206	224.0.85.86	224.0.85.87		
		(95.130.110.68)	(95.130.110.68)		
7	31207	224.0.85.88	224.0.85.89		
8	31208	(95.130.110.68)	(95.130.110.68)		
9	31209	224.0.85.90	224.0.85.91		
10	31210	(95.130.110.68)	(95.130.110.68)		
11	31211	224.0.85.92	224.0.85.93		
		(95.130.110.68)	(95.130.110.68)		
12	31212	224.0.85.94	224.0.85.95		
		(95.130.110.68)	(95.130.110.68)		

### 7.3.6 DXE UAT Multicast PITCH Retail Liquidity Feeds

		WAN-Shaped			
Unit IP Port		Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr		
1	31552				
2	31553				
3	31554	224.0.85.186	224.0.85.187		
4	31555	(195.3.211.124)	(195.3.211.124)		
5	31556				
6	31557				
7	31558				
8	31559				
9	31560	224.0.85.188	224.0.85.189		
10	31561	(195.3.211.125)	(195.3.211.125)		
11	31562				
12	31563				

## 7.4 Equinix Slough (LD4) Trade Reporting Facility (TRF) Multicast Configuration

The following describe the setup which will be used in the Equinix Slough (LD4) facility for the Trade Reporting Facility.

### 7.4.1 TRF Production Multicast PITCH Trade Feeds (TC, TD)

		WAN-Shaped	Primary (TC)	WAN-Shaped Secondary (TD)	
Unit	IP Port			Real-time	Gap Response
		MC and (Src) IP Addr	MC and (Src) IP Addr	MC and (Src) IP Addr	MC and (Src) IP Addr
1	31104	224.0.83.250	224.0.83.251	224.0.83.234	224.0.83.235
2	31105	(95.130.104.180)	(95.130.104.180)	(95.130.104.188)	(95.130.104.188)
3	31106	(95.150.104.100)	(93.130.104.100)	(95.150.104.100)	(95.130.104.100)

#### 7.4.2 TRF UAT Multicast PITCH Trade Feeds

		WAN-S	Shaped
Unit	IP Port	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr
1	31504	224.0.85.34	224.0.85.35
2	31505	(95.130.110.13)	(95.130.110.13)
3	31506	(95.150.110.15)	(95.150.110.15)

### 7.4.3 Systematic Internaliser Production Multicast PITCH Quote Feeds

		Gig-Shap	ed (QA)	WAN-Sha	ped (QC)
Unit	IP Port	Real-time	Gap Response	Real-time	Gap Response
		MC and (Src) IP			
		Addr	Addr	Addr	Addr
1	30001	224.0.82.162	224.0.82.163		
2	30002	(95.130.104.84)	(95.130.104.84)	224.0.82.130	224.0.82.131
3	30003	224.0.82.162	224.0.82.163	(95.130.104.87)	(95.130.104.87)
		(95.130.104.85)	(95.130.104.85)		
4	30004	224.0.82.164	224.0.82.165		
		(95.130.104.85)	(95.130.104.85)	224.0.82.132	224.0.82.133
5	30005	224.0.82.164	224.0.82.165	(95.130.104.87)	(95.130.104.87)
		(95.130.104.86)	(95.130.104.86)		
6	30006	224.0.82.166	224.0.82.167	224.0.82.134	224.0.82.135
		(95.130.104.86)	(95.130.104.86)	(95.130.104.87)	(95.130.104.87)
7	30007	224.0.82.168	224.0.82.169	224.0.82.136	224.0.82.137
8	30008	(95.130.104.84)	(95.130.104.84)	(95.130.104.88)	(95.130.104.88)
9	30009	224.0.82.170	224.0.82.171	224.0.82.138	224.0.82.139
10	30010	(95.130.104.85)	(95.130.104.85)	(95.130.104.88)	(95.130.104.88)
11	30011	224.0.82.172	224.0.82.173	224.0.82.140	224.0.82.141
12	30012	(95.130.104.86)	(95.130.104.86)	(95.130.104.88)	(95.130.104.88)

		Gig-Shap	ed (QB)	WAN-Sha	ped (QD)
Unit	IP Port	Real-time Gap Response		Real-time	Gap Response
		MC and (Src) IP	MC and (Src) IP	MC and (Src) IP	MC and (Src) IP
		Addr	Addr	Addr	Addr
1	30001	224.0.82.178	224.0.82.179		
2	30002	(95.130.104.100)	(95.130.104.100)	224.0.82.146	224.0.82.147
3	30003	224.0.82.178	224.0.82.179	(95.130.104.102)	(95.130.104.102)
		(95.130.104.100)	(95.130.104.100)		
4	30004	224.0.82.180	224.0.82.181		
		(95.130.104.100)	(95.130.104.100)	224.0.82.148	224.0.82.149
5	30005	224.0.82.180	224.0.82.181	(95.130.104.102)	(95.130.104.102)
		(95.130.104.100)	(95.130.104.100)		
6	30006	224.0.82.182	224.0.82.183	224.0.82.150	224.0.82.151
		(95.130.104.100)	(95.130.104.100)	(95.130.104.102)	(95.130.104.102)
7	30007	224.0.82.184	224.0.82.185	224.0.82.152	224.0.82.153
8	30008	(95.130.104.101)	(95.130.104.101)	(95.130.104.103)	(95.130.104.103)
9	30009	224.0.82.186	224.0.82.187	224.0.82.154	224.0.82.155
10	30010	(95.130.104.101)	(95.130.104.101)	(95.130.104.103)	(95.130.104.103)
11	30011	224.0.82.188	224.0.82.189	224.0.82.156	224.0.82.157
12	30012	(95.130.104.101)	(95.130.104.101)	(95.130.104.103)	(95.130.104.103)

### 7.4.4 Systematic Internaliser UAT Multicast PITCH Quote Feeds

		WAN-Shaped		
Unit	IP Port	Real-time	Gap Response	
		MC and (Src) IP Addr	MC and (Src) IP Addr	
1	32001	224.0.85.66	224.0.85.67	
2	32002	(95.130.110.40)	(95.130.110.40)	
3	32003	(93.130.110.40)	(93.130.110.40)	
4	32004	224.0.85.68	224.0.85.69	
5	32005	(95.130.110.40)	(95.130.110.40)	
6	32006	224.0.85.70	224.0.85.71	
		(95.130.110.40)	(95.130.110.40)	
7	32007	224.0.85.72	224.0.85.73	
8	32008	(95.130.110.40)	(95.130.110.40)	
9	32009	224.0.85.74	224.0.85.75	
10	32010	(95.130.110.40)	(95.130.110.40)	
11	32011	224.0.85.76	224.0.85.77	
12	32012	(95.130.110.40)	(95.130.110.40)	

# 7.5 Equinix Park Royal (LD3) BXE Multicast Configuration

## 7.5.1 BXE Disaster Recovery Multicast PITCH Feed (BE)

		WAN-Shaped (BE)		
Unit	IP Port	Real-time	Gap Response	
		MC and (Src) IP	MC and (Src) IP	
		Addr	Addr	
1	31201	224.0.84.18	224.0.84.19	
2	31202	(95.130.107.84)	(95.130.107.84)	
3	31203	(93.130.107.04)	(93.130.107.04)	
4	31204	224.0.84.34	224.0.84.35	
5	31205	(95.130.107.92)	(95.130.107.92)	
6	31206	224.0.84.36	224.0.84.37	
		(95.130.107.92)	(95.130.107.92)	
7	31207	224.0.84.38	224.0.84.39	
8	31208	(95.130.107.92)	(95.130.107.92)	
9	31209	224.0.84.40	224.0.84.41	
10	31210	(95.130.107.92)	(95.130.107.92)	
11	31211	224.0.84.20	224.0.84.21	
		(95.130.107.84)	(95.130.107.84)	
12	31212	224.0.84.42	224.0.84.43	
		(95.130.107.92)	(95.130.107.92)	

## 7.6 Equinix Park Royal (LD3) CXE Configuration

### 7.6.1 CXE Disaster Recovery Multicast PITCH Feed (XE)

		WAN-Shaped (XE)		
Unit	IP Port	Real-time	Gap Response	
		MC and (Src) IP	MC and (Src) IP	
		Addr	Addr	
1	31201	224.0.84.210	224.0.84.211	
2	31202	(95.130.106.84)	(95.130.106.84)	
3	31203	(95.150.100.04)	(95.150.100.04)	
4	31204	224.0.84.226	224.0.84.227	
5	31205	(95.130.106.92)	(95.130.106.92)	
6	31206	224.0.84.228	224.0.84.229	
		(95.130.106.92)	(95.130.106.92)	
7	31207	224.0.84.230	224.0.84.231	
8	31208	(95.130.106.92)	(95.130.106.92)	
9	31209	224.0.84.232	224.0.84.233	
10	31210	(95.130.106.92)	(95.130.106.92)	
11	31211	224.0.84.212	224.0.84.213	
		(95.130.106.84)	(95.130.106.84)	
12	31212	224.0.84.234	224.0.84.235	
		(95.130.106.92)	(95.130.106.92)	

### 7.6.2 CXE Disaster Recovery Multicast PITCH Retail Liquidity Feeds (XER)

		WAN-S	Shaped
Unit	IP Port	Real-time	Gap Response
		MC and (Src) IP Addr	MC and (Src) IP Addr
1	31201		
2	31202		
3	31203	224.0.85.226	224.0.85.227
4	31204	(95.130.106.84)	(95.130.106.84)
5	31205		
6	31206		
7	31207		
8	31208		
9	31209	224.0.85.228	224.0.85.229
10	31210	(95.130.106.84)	(95.130.106.84)
11	31211		
12	31212		

### 7.6.3 CXE UAT Disaster Recovery Multicast PITCH Feed (UAT-DR)

		WAN-Shaped		
Unit	IP Port	Real-time	Gap Response	
		MC and (Src) IP	MC and (Src) IP	
		Addr	Addr	
1	31801	224.0.85.50	224.0.85.51	
2	31802	(95.130.111.196)	(95.130.111.196)	
3	31803	(95.150.111.190)	(95.150.111.190)	
4	31804	224.0.85.52	224.0.85.53	
5	31805	(95.130.111.196)	(95.130.111.196)	
6	31806	224.0.85.54	224.0.85.55	
		(95.130.111.196)	(95.130.111.196)	
7	31807	224.0.85.56	224.0.85.57	
8	31808	(95.130.111.196)	(95.130.111.196)	
9	31809	224.0.85.58	224.0.85.59	
10	31810	(95.130.111.196)	(95.130.111.196)	
11	31811	224.0.85.60	224.0.85.61	
12	31812	(95.130.111.196)	(95.130.111.196)	

subsubsectionCXE UAT Disaster Recovery Multicast PITCH Retail Liquidity Feeds (UAT-DR)

		WAN-Shaped		
Unit	IP Port	Real-time	Gap Response	
		MC and (Src) IP	MC and (Src) IP	
		Addr	Addr	
1	31852			
2	31853			
3	31854			
4	31855			
5	31856			
6	31857	224.0.85.0	224.0.85.1	
7	31858	(95.130.111.196)	(95.130.111.196)	
8	31859			
9	318160			
10	31861			
11	31862			
12	31863			

### 7.6.4 CXE Disaster Recovery Indices Multicast PITCH Feed (XIE)

		WAN-Shaped (XIE)		
Unit	IP Port	Real-time		
		MC and (Src) IP Addr		
		IVIC and (SIC) II Addi		

### 7.6.5 CXE UAT Disaster Recovery Indices Multicast PITCH Feed (UAT-DR)

		WAN-Shaped		
Unit	IP Port	Real-time		
		MC and (Src) IP Addr		
1	33101	224.0.85.122 (95.130.111.218)		

## 7.7 Equinix Park Royal (LD3) DXE Configuration

### 7.7.1 DXE Disaster Recovery Multicast PITCH Feed (DE)

		WAN-Shaped (DE)		
Unit	IP Port	Real-time	Gap Response	
		MC and (Src) IP Addr	MC and (Src) IP Addr	
1	31201	224.0.84.242	224.0.84.243	
2	31202	(5.253.109.81)	(5.253.109.81)	
3	31203	(3.233.109.01)	(3.233.109.01)	
4	31204	224.0.84.244	224.0.84.245	
5	31205	(5.253.109.81)	(5.253.109.81)	
6	31206	224.0.84.246	224.0.84.247	
		(5.253.109.81)	(5.253.109.81)	
7	31207	224.0.84.248	224.0.84.249	
8	31208	(5.253.109.81)	(5.253.109.81)	
9	31209	224.0.84.250	224.0.84.251	
10	31210	(5.253.109.81)	(5.253.109.81)	
11	31211	224.0.84.252	224.0.84.253	
		(5.253.109.81)	(5.253.109.81)	
12	31212	224.0.84.254	224.0.84.255	
		(5.253.109.81)	(5.253.109.81)	

### 7.7.2 DXE Disaster Recovery Multicast PITCH Retail Liquidity Feeds (DER)

		WAN-Shaped				
Unit	IP Port	Real-time	Gap Response			
		MC and (Src) IP	MC and (Src) IP			
		Addr	Addr			
1	31201					
2	31202					
3	31203	224.0.85.234 224.0.85.235				
4	31204	(5.253.209.82)	(5.253.209.82)			
5	31205					
6	31206					
7	31207					
8	31208					
9	31209	224.0.85.236	224.0.85.237			
10	31210	(5.253.209.83)	(5.253.209.83)			
11	31211					
12	31212					

### 7.7.3 DXE UAT Disaster Recovery Multicast PITCH Feed (UAT-DR)

		WAN-Shaped			
Unit	IP Port	Real-time	Gap Response		
		MC and (Src) IP	MC and (Src) IP		
		Addr	Addr		
1	31201	224.0.85.98	224.0.85.99		
2	31202	(95.130.111.100)	(95.130.111.100)		
3	31203	(93.130.111.100)	(93.130.111.100)		
4	31204	224.0.85.100	224.0.85.101		
5	31205	(95.130.111.100)	(95.130.111.100)		
6	31206	224.0.85.102 224.0.85.103			
		(95.130.111.100)	(95.130.111.100)		
7	31207	224.0.85.104	224.0.85.105		
8	31208	(95.130.111.100)	(95.130.111.100)		
9	31209	224.0.85.106	224.0.85.107		
10	31210	(95.130.111.100)	(95.130.111.100)		
11	31211	224.0.85.108 224.0.85.109			
		(95.130.111.100)	(95.130.111.100)		
12	31212	224.0.85.110	224.0.85.111		
		(95.130.111.100)	(95.130.111.100)		

### 7.7.4 DXE UAT Disaster Recovery Multicast PITCH Retail Liquidity Feeds (UAT-DR)

		WAN-Shaped				
Unit	IP Port	Real-time Gap Response				
		MC and (Src) IP	MC and (Src) IP			
		Addr	Addr			
1	31552					
2	31553					
3	31554					
4	31555					
5	31556					
6	31557	224.0.85.80	224.0.85.80			
7	31558	(95.130.111.100)	(95.130.111.100)			
8	31559					
9	31560					
10	31561					
11	31562					
12	31563					

## 7.8 Equinix Park Royal (LD3) Trade Reporting Facility (TRF) Configuration

### 7.8.1 TRF Disaster Recovery Multicast PITCH Trade Feed (TE)

		WAN-Shaped (TE)		
Unit	IP Port	Real-time MC and (Src) IP Addr	Gap Response MC and (Src) IP Addr	
1	31304	224.0.84.162	224.0.84.163 (95.130.106.180)	
2	31305	(95.130.106.180)		
3	31306	(95.150.100.100)	(95.150.100.100)	

### 7.8.2 Systematic Internaliser Quotes Disaster Recovery Multicast PITCH Feed (QE)

		WAN-Shaped (QE)			
Unit	IP Port	Real-time	Gap Response		
		MC and (Src) IP	MC and (Src) IP		
		Addr	Addr		
1	31001	224.0.84.194	224.0.84.195		
2	31002	(95.130.105.196)	(95.130.105.196)		
3	31003	(95.150.105.190)	(95.130.105.196)		
4	31004	224.0.84.196	224.0.84.197		
5	31005	(95.130.105.196)	(95.130.105.196)		
6	31006	224.0.84.198	224.0.84.199		
		(95.130.105.196)	(95.130.105.196)		
7	31007	224.0.84.200	224.0.84.201		
8	31008	(95.130.105.197)	(95.130.105.197)		
9	31009	224.0.84.202	224.0.84.203		
10	31010	(95.130.105.197)	(95.130.105.197)		
11	31011	224.0.84.204	224.0.84.205		
12	31012	(95.130.105.197)	(95.130.105.197)		

#### 7.9 General Bandwidth Recommendations

The order book UAT feeds require 0.5 Mb/s (0.4 Mb/s real-time + 0.1 Mb/s gap) per unit per market making a total of 6 Mb/s of bandwidth for the full feed for each market (or 18 Mb/s for BXE, CXE and DXE books). The UAT feed for the new MiFID II focused SI Quote publication requires the same allocation, also totalling 6 Mb/s. The minimum requirement is 1 Mb/s if a single multicast address comprising two units is consumed for a single market.

The TRF UAT feeds requires a total of 1.0 Mb/s (0.95 Mb/s real-time + 0.05 Mb/s gap) per unit making a total of 3 Mb/s of bandwidth for the full feed.

The table below shows the bandwidth split per unit.

Cboe operations staff monitors bandwidth usage across units and reserves the right to adjust bandwidth allocations per unit at any time without prior notice provided that the total allocation across all units would not exceed the previously published limit.

Cboe operations staff may increase the total bandwidth allocation across all units, but only with appropriate prior notice to all Participants.

In the event that market data rates exceed the allocated bandwidth for a unit, messages will be queued by Cboe and delivered as quickly as possible.

# 7.10 BXE Bandwidth Requirements

	Gig-Sha <sub>l</sub>	ped (BA,BB)	WAN-Shap	ed (BC,BD,BE)
Unit	Real-time	Gap Response	Real-time	Gap Response
1	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.2 Mb/s
2	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.2 Mb/s
3	27 Mb/s	2.0 Mb/s	2.4 Mb/s	0.2 Mb/s
4	35 Mb/s	2.0 Mb/s	3.0 Mb/s	0.2 Mb/s
5	35 Mb/s	2.0 Mb/s	3.0 Mb/s	0.2 Mb/s
6	35 Mb/s	2.0 Mb/s	3.0 Mb/s	0.2 Mb/s
7	35 Mb/s	2.0 Mb/s	3.2 Mb/s	0.2 Mb/s
8	35 Mb/s	2.0 Mb/s	3.2 Mb/s	0.2 Mb/s
9	32 Mb/s	2.0 Mb/s	3.2 Mb/s	0.2 Mb/s
10	1 Mb/s	1.0 Mb/s	0.1 Mb/s	0.1 Mb/s
11	27 Mb/s	2.0 Mb/s	1.4 Mb/s	0.2 Mb/s
12	35 Mb/s	2.0 Mb/s	2.2 Mb/s	0.2 Mb/s
Total	40	0 Mb/s	3!	Mb/s

# 7.11 CXE Bandwidth Requirements

	Gig-Sha <sub>l</sub>	ped (XA,XB)	WAN-Shap	ed (XC,XD,XE)
Unit	Real-time	Gap Response	Real-time	Gap Response
1	45 Mb/s	2.0 Mb/s	4.9 Mb/s	0.3 Mb/s
2	45 Mb/s	2.0 Mb/s	4.9 Mb/s	0.3 Mb/s
3	30 Mb/s	2.0 Mb/s	3.2 Mb/s	0.3 Mb/s
4	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
5	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
6	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
7	40 Mb/s	2.0 Mb/s	4.2 Mb/s	0.3 Mb/s
8	40 Mb/s	2.0 Mb/s	4.2 Mb/s	0.3 Mb/s
9	34 Mb/s	2.0 Mb/s	3.0 Mb/s	0.3 Mb/s
10	3 Mb/s	1.0 Mb/s	0.5 Mb/s	0.3 Mb/s
11	30 Mb/s	2.0 Mb/s	2.4 Mb/s	0.3 Mb/s
12	40 Mb/s	2.0 Mb/s	3.1 Mb/s	0.3 Mb/s
Total	450 Mb/s		4(	Mb/s

Dedicated feeds for index data:

	WAN-Shaped (XIC,XID,XIE)			
Unit	Real-time			
1	0.1 Mb/s			
Total	0.1 Mb/s			

# 7.12 DXE Bandwidth Requirements

	Gig-Sha	ped (DA,DB)	WAN-Shap	ed (DC,DD,DE)
Unit	Real-time	Gap Response	Real-time	Gap Response
1	45 Mb/s	2.0 Mb/s	4.9 Mb/s	0.3 Mb/s
2	45 Mb/s	2.0 Mb/s	4.9 Mb/s	0.3 Mb/s
3	30 Mb/s	2.0 Mb/s	3.2 Mb/s	0.3 Mb/s
4	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
5	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
6	40 Mb/s	2.0 Mb/s	4.0 Mb/s	0.3 Mb/s
7	40 Mb/s	2.0 Mb/s	4.2 Mb/s	0.3 Mb/s
8	40 Mb/s	2.0 Mb/s	4.2 Mb/s	0.3 Mb/s
9	34 Mb/s	2.0 Mb/s	3.0 Mb/s	0.3 Mb/s
10	3 Mb/s	1.0 Mb/s	0.5 Mb/s	0.3 Mb/s
11	30 Mb/s	2.0 Mb/s	2.4 Mb/s	0.3 Mb/s
12	40 Mb/s	2.0 Mb/s	3.1 Mb/s	0.3 Mb/s
Total	450 Mb/s		4(	6 Mb/s

### 7.13 Trade Reporting Facility (TRF) Bandwidth Requirements

	WAN-Shaped Trade (TC,TD,TE)				
Unit	Real-time Gap Response				
1	3.8 Mb/s	0.4 Mb/s			
2	3.8 Mb/s	0.4 Mb/s			
3	3.4 Mb/s 0.3 Mb/s				
Total	12 Mb/s				

### 7.14 SI Quote bandwidth requirements

	Gig-Shap	ped (QA,QB)	WAN-Shaped (QC,QD,QE)	
Unit	Real-time	Gap Response	Real-time	Gap Response
1	45 Mb/s	2.0 Mb/s	9 Mb/s	0.4 Mb/s
2	45 Mb/s	2.0 Mb/s	9 Mb/s	0.4 Mb/s
3	30 Mb/s	2.0 Mb/s	6 Mb/s	0.4 Mb/s
4	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
5	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
6	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
7	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
8	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
9	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
10	45 Mb/s	2.0 Mb/s	9 Mb/s	0.4 Mb/s
11	30 Mb/s	2.0 Mb/s	6 Mb/s	0.4 Mb/s
12	40 Mb/s	2.0 Mb/s	8 Mb/s	0.4 Mb/s
Total	499 Mb/s		99	.8 Mb/s

### 7.15 Multicast Test Program

The ZIP file located at https://cdn.cboe.com/resources/membership/mcast\_pitch.zip contains a sample program that may be used to test Multicast PITCH feed connections and to troubleshoot multicast issues. Refer to the included README file for build and usage information.

# 8 TCP Configuration

Details of the Retail Liquidity Feeds in CXE and DXE will be provided later.

## 8.1 BXE Production Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address	
	( 11)	1000		(LD3)	
Gig-Shaped (BA) GRP	(all)	18987	95.130.109.89	_	
Gig-Shaped (BB) GRP	(all)	18985	95.130.109.93	_	
WAN-Shaped (BC) GRP	(all)	18986	95.130.109.89	_	
WAN-Shaped (BD) GRP	(all)	18984	95.130.109.93	_	
WAN-Shaped (BE) GRP	(all)	18971	_	95.130.107.241	
	1	18999			
	2	18998	95.130.109.90	95.130.107.242	
	3	18997			
	4	18996			
	5	18995			
Spin Server #1	6	18994	95.130.109.82		
Spin Server #1	7	18993		95.130.107.186	
	8	18992			
	9	18991			
	10	18990			
	11	18989	95.130.109.90	95.130.107.242	
	12	18988	95.130.109.82	95.130.107.186	
	1	18983		_	
	2	18982	95.130.109.94		
	3	18981			
	4	18980			
	5	18979			
   Spin Server #2	6	18978			
Spin Server #2	7	18977	95.130.109.86	_	
	8	18976			
	9	18975			
	10	18974			
	11	18973	95.130.109.94	_	
	12	18972	95.130.109.86	_	

# 8.2 CXE Production Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address (LD3)
Gig-Shaped (XA) GRP	(all)	19987	95.130.108.89	_
Gig-Shaped (XB) GRP	(all)	19985	95.130.108.93	_
WAN-Shaped (XC) GRP	(all)	19986	95.130.108.89	_
WAN-Shaped (XD) GRP	(all)	19984	95.130.108.93	_
WAN-Shaped (XE) GRP	(all)	19971	_	95.130.106.241
	1	19999	95.130.108.90	95.130.106.242
	2	19998		
	3	19997		
	4	19996		95.130.106.186
	5	19995		
Spin Server #1	6	19994		
Spill Server #1	7	19993	95.130.108.82	
	8	19992		
	9	19991		
	10	19990		
	11	19989	95.130.108.90	95.130.106.242
	12	19988	95.130.108.82	95.130.106.186
Spin Server #2	1	19983	95.130.108.94	_
	2	19982		
	3	19981		
	4	19980	95.130.108.86 —	
	5	19979		
	6	19978		
	7	19977		
	8	19976		
	9	19975		
	10	19974		
	11	19973	95.130.108.94	_
	12	19972	95.130.108.86	_

# 8.3 CXE Production Retail Feed Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address
				(LD3)
Gig-Shaped (XAR) GRP	(all)	21071	95.130.108.136	_
Gig-Shaped (XBR) GRP	(all)	21070	95.130.108.168	_
WAN-Shaped (XER) GRP	(all)	21069	_	95.130.106.242
	1	21099		
	2	21098		
	3	21097		
	4	21096		
	5	21095		95.130.106.242
Spin Server #1	6	21094	95.130.108.136	
Spill Server #1	7	21093	95.150.100.150	
	8	21092		
	9	21091		
	10	21090		
	11	21089		
	12	21088		
G : G	1	19983	95.130.108.168	_
	2	19982		
	3	19981		
	4	19980		
	5	19979		
	6	19978		
Spin Server #2	7	19977		
	8	19976		
	9	19975		
	10	19974		
	11	19973		
	12	19972		

# 8.4 DXE Production Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address (LD3)
Gig-Shaped (DA) GRP	(all)	19987	5.253.108.69	(LD3)
dig-Shaped (DA) diti	(all)	19901	5.253.108.70	
Gig-Shaped (DB) GRP	(all)	19985	5.253.108.73	
dig-Shaped (DB) ditt	(all)	19903	5.253.108.74	
WAN-Shaped (DC) GRP	(all)	19986	5.253.108.69	
www.tiv-Shaped (DC) GIVE	(all)	13300	5.253.108.70	
WAN-Shaped (DD) GRP	(all)	19984	5.253.108.73	_
Will Shaped (BB) did	(un)	13301	5.253.108.74	
WAN-Shaped (DE) GRP	(all)	19971	—	5.253.109.65
wat shaped (BE) sta	(a)	13311		5.253.109.66
	1	19999		0.200.100.00
	2	19998		5.253.109.65
	3	19997	5.253.108.65	
	4	19996	5.253.108.66	5.253.109.66
	5	19995		
6 : 6 "11	6	19994		
Spin Server #1	7	19993		
	8	19992	5.253.108.67 5.253.108.68	5.253.109.67 5.253.109.68
	9	19991		
	10	19990		
	11	19989		
	12	19988		
	1	19983	5.253.108.75	N/A
	2	19982		
	3	19981		
	4	19980		
	5	19979		
Spin Server #2	6	19978		
	7	19977	5.253.108.76	'•', '`
	8	19976		
	9	19975		
	10	19974		
	11	19973		
	12	19972		

# 8.5 DXE Production Retail Feed Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Address (LD3)
Gig-Shaped (DAR) GRP	(all)	21071	5.253.108.90	_
Gig-Shaped (DBR) GRP	(all)	21070	5.253.108.106	_
WAN-Shaped (DER) GRP	(all)	21069	_	5.253.109.65
				5.253.109.66
	1	21099		
	2	21098		
	3	21097		
	4	21096		
	5	21095		
Spin Server #1	6	21094	5.253.108.90	5.253.109.65
Spill Server #1	7	21093	5.253.108.90	5.253.109.66
	8	21092		
	9	21091		
	10	21090		
	11	21089		
	12	21088		
	1	19983		
	2	19982		
	3	19981		
	4	19980		
	5	19979		
Spin Server #2	6	19978	5.253.108.106	
Spin Server #2	7	19977	3.233.100.100	
	8	19976		
	9	19975		
	10	19974		
	11	19973		
	12	19972		

# 8.6 Trade Reporting Facility (TRF) Production Gap Request Proxies (GRPs)

Service	Unit	TCP Port	IP Addresses	IP Address
			(LD4)	(LD3)
WAN-Shaped (TC) GRP	(all)	20985	95.130.104.155	_
			95.130.104.156	
WAN-Shaped (TD) GRP	(all)	20983	95.130.104.157	_
			95.130.104.158	
WAN-Shaped (TE) GRP	(all)	20981	_	95.130.106.155
				95.130.106.156

# 8.7 Systematic Internaliser Quotes Production Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses	IP Address
			(LD4)	(LD3)
Gig-Shaped (QA) GRP	(all)	18987	95.130.104.49	_
Gig-Shaped (QB) GRP	(all)	18985	95.130.104.73	_
WAN-Shaped (QC) GRP	(all)	18986	95.130.104.49	_
WAN-Shaped (QD) GRP	(all)	18984	95.130.104.73	_
WAN-Shaped (QE) GRP	(all)	18971	_	95.130.105.169
	1	18999		
Spin Server #1	2	18998	95.130.104.49	95.130.105.169
	3	18997		
	4	18996		
	5	18995		
	6	18994		
	7	18993		
	8	18992		
	9	18991		
	10	18990		
	11	18989		
	12	18988		
	1	18983		
Spin Server #2	2	18982	95.130.104.73	_
	3	18981		
	4	18980		
	5	18979		
	6	18978		
	7	18977		
	8	18976		
	9	18975		
	10	18974		
	11	18973		
	12	18972		

# 8.8 BXE UAT Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses
			(LD4)
WAN-Shaped UAT GRP	(all)	18986	95.130.110.226
	1	18999	
	2	18998	
	3	18997	
	4	18996	
	5	18995	
UAT Spin Server	6	18994	95.130.110.226
OAT Spill Server	7	18993	95.150.110.220
	8	18992	
	9	18991	
	10	18990	
	11	18989	
	12	18988	

# 8.9 CXE UAT Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Addresses (LD3)
WAN-Shaped UAT GRP	(all)	18986	95.130.110.194	95.130.111.197
	1	18999		
	2	18998		
	3	18997		
	4	18996	95.130.110.194	95.130.111.197
	5	18995		
UAT Spin Server	6	18994		
OAT Spill Server	7	18993		
	8	18992		
	9	18991		
	10	18990		
	11	18989		
	12	18988		

## 8.9.1 CXE UAT Retail Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Addresses (LD3)
WAN-Shaped UAT GRP	(all)	18984	195.3.211.94	95.130.111.200
	1	18979		
	2	18978		
	3	18977		
	4	18976	195.3.211.94	
	5	18975		95.130.111.200
UAT Spin Server	6	18974		
OAT Spill Server	7	18973	195.5.211.94	95.150.111.200
	8	18972		
	9	18971		
	10	18970		
	11	18969		
	12	18968		

# 8.10 DXE UAT Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Addresses (LD3)
WAN-Shaped UAT GRP	(all)	18987	95.130.110.69	95.130.111.101
	1	18999		
	2	18998		
	3	18997		95.130.111.101
	4	18996	95.130.110.69	
	5	18995		
UAT Spin Server	6	18994		
OAT Spill Server	7	18993		
	8	18992		
	9	18991		
	10	18990		
	11	18989		
	12	18988		

# 8.10.1 DXE UAT Retail Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses (LD4)	IP Addresses (LD3)
WAN-Shaped UAT GRP	(all)	18986	195.3.211.126	95.130.111.103
	1	18979		
	2	18978		
	3	18977		
	4	18976		
	5	18975	195.3.211.126	95.130.111.103
UAT Spin Server	6	18974		
OAT Spill Server	7	18973		
	8	18972		
	9	18971		
	10	18970		
	11	18969		
	12	18968		

# 8.11 Trade Reporting Facility (TRF) UAT Gap Request Proxies (GRPs)

Service	Unit	TCP Port	IP Addresses
			(LD4)
WAN-Shaped UAT Trade GRP	(all)	18987	95.130.110.12

# 8.12 Systematic Internaliser Quotes UAT Gap Request Proxies (GRPs) and Spin Servers

Service	Unit	TCP Port	IP Addresses
			(LD4)
WAN-Shaped UAT Quote GRP	(all)	18986	95.130.110.40
	1	18999	
Spin Server #1	2	18998	
	3	18997	
	4	18996	
	5	18995	
	6	18994	95.130.110.40
	7	18993	95.150.110.40
	8	18992	
	9	18991	
	10	18990	
	11	18989	
	12	18988	

# 9 Support

Please email support questions or comments regarding this specification to:

tradedeskeurope@cboe.com

# **Appendix A: Message Types**

#### **Gap Request Proxy Messages**

0x01 Login
0x02 Login Response
0x03 Gap Request
0x04 Gap Response

#### **Spin Server Messages**

0x01Login0x02Login Response0x80Spin Image Available0x81Spin Request0x82Spin Response0x83Spin Finished

#### PITCH 2.X Messages

0x20 Time 0x40  $\mathsf{Add}\;\mathsf{Order} - \mathsf{Long}$  $\mathsf{Add}\ \mathsf{Order} -\!\!\!\!\!- \mathsf{Short}$ 0x22 Order Executed 0x23 Order Executed at Price/Size 0x240x25Reduce Size — Long  ${\sf Reduce\ Size-Short}$ 0x26 0x27 Modify Order — Long Modify Order — Short 0x28 Delete Order 0x29  $\mathsf{Trade} - \mathsf{Long}$ 0x41 0x2BTrade — Short 0x2C Trade Break End of Session 0x2DExpanded Add Order 0x2F**Trading Status** 0x31 0x32 Trade - Extended Message Statistics 0x34 Auction Update OxAC**Auction Summary** 0x96

# **Appendix B: Example Messages**

#### Login Message

 Length
 16
 22 bytes

 Type
 01
 Login

 SessionSubId
 30 30 30 31
 0001

 Username
 46 49 52 4D
 FIRM

Filler 20 20

Password 41 42 43 44 30 30 20 20 20 20 ABCD00

#### Login Response Message

Length033 bytesType02Login ResponseStatus41Login accepted

#### **Gap Request Message**

Length099 bytesType03Gap RequestUnit01Unit 1

Sequence 3B 10 00 00 First message: 4155 Count 32 00 50 messages

#### Gap Response Message

Length0A10 bytesType04Gap ResponseUnit01Unit 1

Unit 01 Unit 1
Sequence 3B 10 00 00 First message: 4155

Status 41 Accepted

#### Spin Image Available Message

Length 06 6 bytes

Type 80 Spin Image Available Sequence 3B 10 00 00 Sequence: 4155

#### Spin Request Message

Length066 bytesType81Spin RequestSequence3B 10 00 00Sequence: 4155

#### Spin Response Message

 Length
 0B
 11 bytes

 Type
 82
 Spin Response

 Sequence
 3B 10 00 00
 Sequence: 4155

 Order Count
 42 00 00 00
 66 orders

 Status
 41
 Accepted

#### Spin Finished Message

Length066 bytesType83Spin FinishedSequence3B 10 00 00Sequence: 4155Status41Accepted

#### Time Message

 Length
 06
 6 bytes

 Type
 20
 Time

 Sequence
 98 85 00 00
 34,200 seconds = 09:30 AM UK time

## Add Order — Long

Length 23 35 bytes

Type 40 Add Order — Long

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Buy

Order Id 05 40 5B 77 8F 56 1D 0B

Side Indicator 42

 Shares
 20
 4E
 00
 00
 20,000 shares

 Symbol
 5A
 5A
 5A
 5A
 6C
 20
 20
 ZVZZTI

 Price
 5A
 23
 00
 00
 00
 00
 00
 00
 0.9050

#### Add Order — Short

Length 19 25 bytes
Type 22 Add Order — Short

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Order Id 05 40 5B 77 8F 56 1D 0B

Side Indicator 42 Buy
Shares 20 4E 20,000 shares

 Symbol
 46 50 70 20 20 20
 FPp

 Price
 0A 28
 102.50

#### **Order Executed**

Length1D29 bytesType23Order Executed

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Order Id 05 40 5B 77 8F 56 1D 0B

Executed Shares 64 00 00 00 100 shares

Execution Id C8 00 00 00 01 40 57 3A

Execution Flags 31 32 2D 1 = Central Limit Order Book

2 = Continuous Trading

- = Not specified

#### Order Executed at Price/Size

Length 29 41 bytes

Type 24 Order Executed at Price/Size
Time Offset 18 D2 06 00 447,000 ns since last Time Message

Order Id 05 40 5B 77 8F 56 1D 0B

Executed Shares 64 00 00 00 100 shares
Remaining Shares BC 4D 00 00 19,900 shares

Price E8 A3 0F 00 00 00 00 00 102.50

Execution Flags 31 4B 2D 1 = Central Limit Order Book

 $\mathsf{K} = \mathsf{Scheduled} \ \mathsf{Closing} \ \mathsf{Auction}$ 

- = Not specified

#### Reduce Size — Long

Length 12 18 bytes

Type 25 Reduce Size — Long

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Order Id 05 40 5B 77 8F 56 1D 0B

Cancelled Shares F8 24 01 00 75,000 shares

#### Reduce Size — Short

Length 10 16 bytes

Type 26 Reduce Size — Short

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Order Id 05 40 5B 77 8F 56 1D 0B

Cancelled Shares 64 00 100 shares

#### Modify Order — Long

Length 1A 26 bytes

Type 27 Modify Order — Long

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Order Id 05 40 5B 77 8F 56 1D 0B

 Shares
 F8
 24
 01
 00
 75,000 shares

 Price
 E8
 A3
 0F
 00
 00
 00
 00
 102.50

#### Modify Order — Short

Length 12 18 bytes

Type 28 Modify Order — Short

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Order Id 05 40 5B 77 8F 56 1D 0B

Shares	64 00	100 shares
Price	0A 28	102.50

#### **Delete Order**

Length	0E	14 bytes
Type	29	Delete Order

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Order Id 05 40 5B 77 8F 56 1D 0B

#### Trade — Long

Length	2F	47 bytes
Type	41	Trade — Long
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	For dark book trade, all zeroes
Side Indicator	42	Buy
Shares	F8 24 01 00	75,000 shares
Symbol	56 4F 44 6C 20 20 20 20	VOD1
Б.		100 50

102.50 Price E8 A3 OF OO OO OO OO Execution Id C8 00 00 00 01 40 57 3A

Trade Flags 33 32 44 45 3 = Dark Book

2 = Continuous Trading

102.50

D = Dark TradeE = Ex/Cum Dividend

#### Trade — Short

Length	25	37 bytes
Type	2B	Trade — Short
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Order Id	05 40 5B 77 8F 56 1D 0B	For dark book trade, all zeroes
Side Indicator	42	Buy
Shares	64 00	100 shares
Symbol	56 4F 44 6C 20 20	VOD1

Symbol 56 4F 44 6C 20 20

Price OA 28

Execution Id C8 00 00 00 01 40 57 3A

Trade Flags 31 4F 50 2D  $1 = \mathsf{Central}\;\mathsf{Limit}\;\mathsf{Order}\;\mathsf{Book}$ 

O = Scheduled Opening Auction

P = Plain-Vanilla Trade

- = Not specified

#### Trade — Extended

Length	43	67 bytes
Туре	32	Trade — Extended

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Shares F8 24 01 00 00 00 00 00 75,000 shares 56 4F 44 6C 20 20 20 20 Symbol VOD1 Price E8 A3 OF OO OO OO OO 102.50

Execution Id C8 00 00 00 01 40 57 3A

Trade Timestamp 00 00 00 00 00 00 00 00 nanoseconds since the January 1st 1970 UTC

Venue MIC of the venue 00 00 00 00

Currency 47 42 50 **GBP** 

Cboe Flag 52 'R' - Retail

Extended Flags 2D 2D 2D 2D 2D 2D 2D 14 char MMT Flags field

Extended Flags 2D 2D 2D 2D 2D

#### Trade Break

Length ΟE 14 bytes Type 2C Trade Break

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Execution Id C8 00 00 00 01 40 57 3A

#### **End of Session**

Length 06 6 bytes Type 2D End of Session

Time Offset 18 D2 06 00 447,000 ns since last Time Message

#### **Expanded Add Order**

28 40 bytes Length Type 2F End of Session

Time Offset 18 D2 06 00

447,000 ns since last Time Message Order Id For dark book trade, all zeroes 05 40 5B 77 8F 56 1D 0B

Side Indicator 42

Shares 64 00 00 00 100 shares 56 4F 44 6C 20 20 20 20 Symbol VOD1

Price AO 06 1C 06 00 00 00 00 102.50, with implied 6 d.p (assumes TRF system)

Buy

SI Quote bit set

Add Flags 02

Participant ID 41 42 43 44 Attributed to participant ABCD

### **Trading Status**

Length 12 18 bytes **Trading Status** Type 31

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Symbol 56 4F 44 6C 20 20 20 20 VOD1 Status 54 T = Trading

00 00 00 Reserved

#### **Statistics**

Length 18 24 bytes Type 34 Statistics

Time Offset 447,000 ns since last Time Message 18 D2 06 00

56 4F 44 6C 20 20 20 20 Symbol VOD1 Price 5A 23 00 00 00 00 00 00 0.9050

Statistic Type 4F O = Opening PricePrice Determination 30 0 = Normal

#### **Auction Update**

Length 25 37 bytes

Type AC Auction Update

Time Offset C8 47 17 06 102,189,000 ns since last Time Message

Symbol 4C 45 4D 44 6C 20 20 20 LEMD1

Auction Type 50 P = Periodic Auction

Reference Price 7B 88 01 00 00 00 00 10.0475 Indicative Price 7B 88 01 00 00 00 00 10.0475 Indicative Shares 88 13 00 00 5000 5000 shares

Outside Tolerance 49 I = Inside Tolerance Includes Primary 50 P = Includes Primary

#### **Auction Summary**

Length 1B 27 bytes

Type 96 Auction Summary

Time Offset C8 47 17 06 102,189,000 ns since last Time Message

Symbol 4C 45 4D 44 6C 20 20 20 LEMDI

Auction Type 4F O = Opening Auction

Price 7B 88 01 00 00 00 00 10.0475 Shares 88 13 00 00 5000 shares

#### Sequenced Unit Header with 2 Messages

Sequenced Unit Header:

Hdr Length31 0049 bytes, including headerHdr Count022 messages to follow

Hdr Unit 01 Unit 1

Hdr Sequence 01 00 00 00 First message has sequence number 1

Message 1: (Add Order — Short)

Length 19 25 bytes

Type 22 Add Order — Short

Time Offset 18 D2 06 00 447,000 ns since last Time Message

Order Id 05 40 5B 77 8F 56 1D 0B 631WC4000005

Side Indicator 42 Buy
Shares E1 02 737 shares

 Symbol
 56 4F 44 6C 20 20
 VOD1

 Price
 01 00
 0.01

Message 2: (Reduce Size — Short)

Length Type 16 bytes 10

Reduce Size — Short 26

449,000 ns since last Time Message Time Offset 18 D9 06 00

Order Id 05 40 5B 77 8F 56 1D 0B 631WC4000005

Cancelled Shares 64 00  $100 \ \text{shares}$ 

#### Index Quote

Length	19	25 bytes
Type	D8	Index Quote
Timestamp	00 68 64 73 8F 21	10:15:00+000
Index Ticker	42 41 54 32 30 4E 00 00 00 00	BAT20N
Price	E8 A3 OF 00 00 00 00 00	102.5
Index Status	49	Indicative

## Index Quote EDSP

Length	18										24 bytes
Type	D9										Index Quote EDSP
Timestamp	00	68	64	73	8F	21					10:15:00+000
Index Ticker	42	41	54	32	30	4E	00	00	00	00	BAT20N
Price	E8	АЗ	OF	00	00	00	00	00			102.5

## **Appendix C: Spin Server Usage Example**

The following diagram (see next page) shows the exchange of messages over time between a Participant and a Cboe Multicast PITCH feed and Spin Server.

At time 1, the Participant has no state of the book and desires to become current. The Participant caches the received Multicast PITCH messages (sequences 310172 and 310173) for later use. Since the Participant has no book, they cannot yet be applied.

At time 5, the Participant has successfully logged into the Spin Server and has cached another message, sequence 310174.

At time 7, the Participant receives a Spin Image Available message which indicates that the Spin Server is capable of giving them a spin of all open orders as of sequence 310169. The Participant does not have all messages cached after 310169 (they are missing 310170 and 310171), so this spin is not useful to the Participant.

At time 10, the Participant receives a Spin Image Available message which is useful since it would be a spin of all orders up to and including sequence 310175, and the Participant has all messages after 310175 cached.

At time 11, the Participant sends a Spin Request for all messages up to and including 310175 and continues to cache Multicast PITCH messages received.

At time 14, the Spin Server acknowledges the Spin Request and indicates that three open orders will be sent.

At time 24, the Spin Server indicates that it has finished sending all open orders. The Participant must then apply the cached messages from sequence number 310176 through current.

#### Notes:

- A Spin Request may only be sent for a sequence number which was present in a Spin Image Available message. Arbitrary sequence numbers cannot be sent.
- Spin Servers are available for each unit. Participants may need to employ multiple Spin Servers depending upon their architecture.



## **Appendix D: Specification Differences**

This section describes the differences between the Cboe BZX Exchange Equities Multicast PITCH specification and the Cboe Europe Multicast PITCH Specification.

- Some Cboe BZX Multicast PITCH messages have an additional field called "Add Flags" on the end which are not present on the corresponding Cboe Europe messages. (Add Order Short (0x22))
- Some Cboe BZX Multicast PITCH messages have an additional field called "Modify Flags" on the end which are not present on the corresponding Cboe Europe messages. (Modify Order Long (0x27), Modify Order Short (0x28))
- Cboe BZX Multicast PITCH sends a number of messages which are not present on Cboe Europe Multicast PITCH. (Trade Expanded (0x30))
- Cboe Europe Multicast PITCH sends a number of messages which are not present on Cboe BZX Multicast PITCH. (Trade Report (0x32))
- Cboe Europe Multicast PITCH sends a number of messages which serve the same function in Cboe BZX Multicast PITCH but are binary incompatible. (Add Order Long (0x40), Trade Long (0x41))
- Some Cboe Europe Multicast PITCH messages have an additional field called "Execution Flags" on the end which are not present on the corresponding Cboe BZX messages. (Order Executed (0x23) and Order Executed at Price/Size (0x24))
- Some Choe Europe Multicast PITCH messages have an additional field called "Trade Flags" on the end which are not present on the corresponding Choe BZX messages. (Trade Short (0x2B))

# Appendix E: Symbol distribution across units

The following table illustrates how symbology is distributed across the 12 matching units for BXE, CXE, DXE and SI Quote feeds. The Cboe TRF system is distributed across 3 matching units. The downloadable reference data file <sup>2</sup> may be used by participants that require knowledge of the symbol-to-unit mappings.

BXE, CXE, DXE and Systematic Internaliser Quotes:

Unit	Markets		
1	London, Great Britain (0-H) (BXE and CXE only) <sup>3</sup>		
2	London, Great Britain (I-R) (BXE and CXE only) 3		
3	London, Great Britain (S-Z); Cboe UK (BXE and CXE only) <sup>3</sup>		
4	Euronext Paris, France (0-F)		
5	Euronext Paris, France (G-Z)		
6	Euronext (Lisbon, Portugal; Brussels, Belgium; Amsterdam, Netherlands); Dublin, Ireland		
7	XETRA, Germany (0-E); XFRA, Germany (0-E)		
8	XETRA, Germany (F-Z); XFRA, Germany (F-Z); Vienna, Austria		
9	Milan, Italy; SIBE, Spain		
10	Choe EU		
	Warsaw, Poland; Prague, Czech Republic; Budapest, Hungary		
	Athens, Greece; Bucharest, Romania; Bratislava, Slovakia		
	Nicosia, Cyprus; Zagreb, Croatia; Ljubljana, Slovenia; Luxembourg		
	Valletta, Malta; Riga, Latvia; Sofia, Bulgaria; Tallinn, Estonia		
	Vilnius, Lithuania; Johannesburg; Ex-Europe, Ex-US		
11	SIX Swiss Exchange (BXE and CXE only) 3		
12	Helsinki, Finland; Copenhagen, Denmark; Oslo, Norway; Stockholm, Sweden;		
	Reykjavik, Iceland; US Securities Traded in Europe		

<sup>&</sup>lt;sup>2</sup>https://www.bats.com/europe/equities/support/reference\_data/

<sup>&</sup>lt;sup>3</sup>In DXE this unit will have no live symbols at launch. Heartbeat messages will be emmitted from this unit.

# Trade Reporting Facility (TRF):

TRF Unit	Markets	
1	Choe UK	
	London, Great Britain	
	Euronext (Lisbon, Portugal; Brussels, Belgium; Amsterdam, Netherlands)	
	Dublin, Ireland	
2	Euronext Paris, France	
	XETRA, Germany	
	XFRA, Germany	
	Vienna, Austria	
3	Choe EU	
	Athens, Greece; Bratislava, Slovakia; Bucharest, Romania	
	Budapest, Hungary; Copenhagen, Denmark; Ex-Europe, Ex-US	
	Helsinki, Finland; Johannesburg	
	Ljubljana, Slovenia; Luxembourg; Milan, Italy	
	Nicosia, Cyprus; Oslo, Norway; Prague, Czech Republic	
	Reykjavik, Iceland; Riga, Latvia; SIBE, Spain	
	SIX Swiss Exchange; Sofia, Bulgaria; Stockholm, Sweden;	
	Tallinn, Estonia; US Securities Traded in Europe; Valletta, Malta	
	Vilnius, Lithuania; Warsaw, Poland; Zagreb, Croatia	

# **Revision History**

6 March 2009	Initial draft version
19 March 2009	Version 1.2
	Final Cboe Europe version. Finalized multicast addresses and bandwidth require-
	ments.
23 March 2009	Version 1.3
	Multicast address changed for unit 3. Symbol and market distribution rebalanced.
14 April 2009	Version 1.4
·	Corrected multicast rendezvous address. Corrected source address for Gig-Shaped
	Unit 3 real-time and gap feeds.
22 June 2009	Version 1.5
	Unit 6 will contain data for Euronext Lisbon (XLIS) securities.
30 June 2009	Version 1.6
	Additional clarification that all messages sent to the GRP and Spin Server must
	be contained in a Choe Sequenced Unit Header.
23 July 2009	Version 1.7
	Published multicast addresses and ports for UAT/Certification environment.
31 July 2009	Version 1.8
01 3u.) <b>2</b> 003	Trades for hidden orders will now always show the side of the trade as B (buy).
6 August 2009	Version 1.9
o riagast 2005	Corrected multicast ports for UAT/Certification environment.
16 October 2009	Version 1.10
10 October 2003	Added XSWX on unit 11.
11 December 2009	Version 1.11
11 December 2009	Added XMCE. Corrected UAT/Certification multicast ports.
16 December 2009	Version 2.0
To December 2009	Added XDUB on unit 12. Added section on interpreting Execution Ids (see § 2.5,
	p. 11). Corrected currency in some example messages (showed US dollars).
19 January 2010	Version 2.1
19 January 2010	Added secondary production Gig- and WAN-shaped feeds.
4 February 2010	Version 2.2
4 Tebruary 2010	Corrections for new secondary production Gig- and WAN-shaped feeds.
5 February 2010	Version 2.3
5 February 2010	
23 February 2010	UAT multicast groups published.  Version 2.4
23 February 2010	
10 M   0010	WAN-Shaped (D) feed multicast group addresses corrected.
10 March 2010	Version 2.5
15 4 1 0010	Moved XDUB symbols from unit 12 to unit 3.
15 April 2010	Version 2.6
	Added a table in Bandwidth Recommendations (§ 7.9, p. 64) which lists the current
	bandwidth allocations for Gig- and WAN-shaped Multicast PITCH feeds for each
10.4 11.0010	unit.
19 April 2010	Version 2.7
	Updated UAT symbol distribution table to have 12 units with distribution matching
	the production feeds.
20 May 2010	Version 2.8
	Trades for dark book orders will now always have an Order Id of all zeroes.
18 June 2010	Version 2.9
	Order IDs in Trade Messages are now obfuscated by default. This obsoletes the
	change made to Order IDs on 20 May 2010.

8 October 2010	Version 2.10
	Modified UAT multicast groups and ports to reflect new setup. Added a UAT
	bandwidth recommendation.
3 December 2010	Version 2.11
	Modified WAN-Shaped (C) and WAN-Shaped (D) source IP addresses, effective
	from 15 December 2010 onwards.
18 January 2011	Version 2.12
Ž	WBAH was missing from unit 12 on some tables.
1 April 2011	Version 2.13
•	Updated URL to sample program.
11 May 2011	Version 2.14
,	Minor changes to WAN feed bandwidth allocations.
17 June 2011	Version 2.15
17 June 2011	Corrected Execution Id offset in Order Executed at Price/Size.
23 June 2011	Version 2.5
25 Julie 2011	
	Included information on setup in Equinix Slough LD4 data centre. Updated band-
10.0 . 1 . 0011	width recommendations. Added spin server and GRP information.
12 October 2011	Version 3.0
	Removed multicast information from LHC data centre now that the move to LD4
	is complete.
13 October 2011	Version 3.1
	Clarification on GRP limits being per Multicast PITCH feed, not per GRP session.
9 November 2011	Version 3.2
	Added Appendix D.
21 November 2011	Version 3.3
	Corrected LD4 Production Spin Server addresses.
13 December 2011	Version 3.4
	Remove reference to MOC/TAL.
18 January 2012	Version 4.0
, , ,	Added information around Chi-X Europe migration.
23 January 2012	Version 4.1
	Noted future move of Austrian feed (WBAH) to unit 8.
25 January 2012	Version 4.2
25 Junuary 2012	Added UAT port and address details for GRP and Spin Servers.
6 February 2012	Version 4.3
0 Tebruary 2012	Corrected some TCP addresses and ports for Park Royal (LD3) GRP and Spin
C.F.I. 0010	Servers for both BATS Europe and Chi-X Europe.
6 February 2012	Version 4.4
	Corrected TCP addresses for Chi-X Europe GRPs.
8 February 2012	Version 4.5
	Updated source IP addresses for upcoming Park Royal (LD3) Multicast PITCH
	feeds (BE, XE).
22 February 2012	Version 4.6
	Added Spin Server #2 to Park Royal (LD3) environments to match Spin Server
	#2 in Slough (LD4) environments.
27 February 2012	Version 4.7
-	Added XFRA and ETFP MICs for completeness.
2 March 2012	Version 4.8
	Formatting changes only.
17 April 2012	Version 4.9
· · · · · · · · · · · · · · · · · · ·	Remove extraneous 'execution'.
	The state of the s

22 April 2012	Version 4.10
22 / Ipin 2012	Updated § 7, p. 43 to include source and destination ranges per multicast feed.
17 May 2012	Version 4.11
1,a) =01=	Fixed the link to the Multicast test program.
8 June 2012	Version 4.12
0 000 1011	Removed Chi-X migration notes. Updated branding.
7 February 2013	Version 5.0
•	New Off-Book Trade, Off-Book Trade Break and Unit Clear messages.
28 March 2013	Version 5.1
	Support for indicating an off-book trade was reported out of the Main Session.
9 April 2013	Version 5.2
	Updated link to FESE website
20 June 2013	Version 5.3
	Section 1.7 added, introducing use of PITCH by the Trade Reporting Facility. Re-
	worded 'Binary Long Price' definition to specify 6 implied decimal places for TRF.
	Addition of Expanded Add Order message to support SI Quote publication. Added
	multicast and TCP configuration information for the TRF. Adjusted bandwidth
	recommendations. Addition of Trading Status message. Addition of Statistics
	message to disseminate Open/High/Low/Close.
5 August 2013	Version 5.4
	Updated symbol distribution. Spanish and Italian symbols are affected and CXE
	listed symbols are allocated space.
15 August 2013	Version 5.5
	Additional information given on the new Trading Status and Statistics messages.
19 September 2013	Version 5.6
	MIC update: WBAH to XWBO
27 September 2013	Version 5.7
	Updated wording on Spin message types.
3 October 2013	Version 5.8
	Support for new markets
20 November 2013	Version 5.9
	Layout improvements

6 December 2013	Version 6.0
o December 2015	Renamed Off-Book Trade Message to Trade Report Message.
	Removed the Off-Book Trade Break Message. Use a Modification Indicator of 'C'
	in the Trade Type Flags field to delete a Trade Report.
	Widened the Shares field from 4 to 8 bytes in the Trade Report (previously Off-Book Trade) message.
	Added a special value of 'BCS' to the Execution Venue field in the Trade Report (previously Off-Book Trade) message to indicate a 'Broker Crossing System' trade. Added a new Cboe specific Transaction Sub-Category flag to the end of the Trade Report Flags field in the Trade Report (previously Off-Book Trade) message. Widened the Symbol field from 6 to 8 bytes in the Add Order - Long and Trade - Long messages.
	The Add Order - Long message type has been changed from 0x21 to 0x40 to indicate binary incompatibility with the US version of this message. The Trade - Long message type has been changed from 0x2A to 0x41 to indicate binary incompatibility with the US version of this message. Expanded the Status flag in the Trading Status message to include values for
	Regulatory Halts ('H'), Market Order Imbalance ('M') and Price Monitoring ('P') extensions. Additionally the Auction ('A') status has been removed and sub-divided into Opening Auction ('O') and Closing Auction ('E').
	Added an Execution Flags field to the Order Executed and Order Executed at Price/Size messages.
	Added a Trade Flags field to the Trade message. Section 4.15 added, introducing the Auction Update and Auction Summary messages.
24 December 2013	Version 6.1
24 December 2013	Made Trade Report Message's Transaction Sub-Category field reserved for future use.
21 January 2014	Version 6.2
, and the second	Renamed 'Regulatory Halt' trading status to 'Halt'. Clarified the trading statuses that are reserved for future use. Corrected the implied value for the level 3.1 MMT flag in the Execution Flags section. VenueField indicator for BCS becomes AUT.
10 June 2014	Version 6.3
10 Julie 2014	Add XZAG to TRF Unit Three markets
12 June 2014	Version 6.4
	Deprecate usage of the fourth character of the Execution ID to help differentiate the nature of the trade in favour of MMT flags directly. Rename the Cboe Transaction Sub-Category Trade Report flag for the new MMT 3.7 trade flag. Added support for the new MMT 2 flag for an undefined auction.
23 September 2014	Version 6.5 Added XIST (Turkey) to unit 11 in BCE and unit 3 in BXTR.
7 October 2014	Version 6.6 Removed 'effective from' labels.
29 March 2015	Version 6.6 Clarify trade timing indicator.
2 June 2015	Version 6.7
2 Julie 2013	Remove deprecated AUT flag. Rename Trade Report to Trade - Extended. New Auction Update message type. Extended the Auction Type flag in the Auction Update and Auction Summary messages to include Periodic Auctions ('P').
	, , , , , , , , , , , , , , , , , , , ,

14 December 2015	Varion 6.0
14 December 2015	Version 6.8 Added XQMH to unit 11 in BCE and unit 3 in BXTR.
8 January 2016	Version 6.9
O January 2010	SINT and XOFF as possible values for the Execution Venue field of the Trade
	- Extended Form message. Details on semantic change for Trade Amendments.
	Removal of Trade Break messages.
19 February 2016	Version 6.10
19 Tebruary 2010	Updated with new branding.
29 April 2016	Version 6.11
29 April 2010	Removed 'Effective' content related to Q2 2016 Release.
17 June 2016	Version 6.12
17 34110 2010	Renamed a few dangling 'Trade Reporting message' to 'Trade - Extended message'.
8 July 2016	Version 6.13
0 July 2010	Added MTAH market
31 August 2016	Version 6.14
017146430 2010	Updated with multi-cast details for the new certification CXE book in LD3.
14 September 2016	Version 6.15
1. Coptoso. 2010	Correction to the multicast source range netmask for CXE UAT-DR.
1 February 2017	Version 6.16
	MMT v3 support
23 May 2017	Version 6.17
,	New IP addresses for BXE/CXE GRP B and D.
	Removed the Modify Order message from the list of possible message types in the
	SI Quote introduction text. For technical reasons SI Quote modifies are modeled
	as Cancel/New on the MC PITCH feed.
	Clarified valid values for the Cboe Trade Timing Indicator and Execution Venue
	fields.
19 July 2017	Version 6.18
	MMT v3.04 support for Q4 2017 release.
2 August 2017	Version 6.19
	Removed XIST (Turkey) as a supported market.
14 August 2017	Version 6.20
	Added details for new 12-unit SI Quote publication. Various multi-cast tables
	reformatted for clarity.
24 November 2017	Version 6.21
	Branding updates. Removal of highlighting relevant to the October release.
26 January 2018	Version 6.22
	Updated MIC used in Execution Venue for Cboe NT trades in BXE and CXE.
19 July 2018	Version 6.23
	Added begin and end transaction messages.
31 August 2018	Version 6.24
	Added XWAR, XBUD, XPRA as supported markets.
25 October 2018	Version 6.25
	Renamed Choe Trade Timing Indicator Field to Choe Trade Flags and added new
	possible values. Removed references to old multi-cast groups and servces, no longer
	applicable since the Q4 2017 release. Added new multi-cast groups and services
	applicable post-Brexit.

6 F.I. 2010	V' 6.06
6 February 2019	Version 6.26
	Corrections to LD3 IP GRP and Spin addresses: From 95.130.106.233 to 95.130.106.241
	From 95.130.106.234 to 95.130.106.242
	From 95.130.106.235 to 95.130.106.243
	From 95.130.107.233 to 95.130.107.241
	From 95.130.107.234 to 95.130.107.242
	From 95.130.107.235 to 95.130.107.243
6 March 2019 31 May 2019	Version 6.27
	Removed IP addresses for LD3 for Spin Server. #2.
	Version 6.28
	Add DXE environment.
	Add Choe Closing Cross.
26 July 2019	Version 6.29
	Updated IP addresses for DXE GRP GIG A and C (Highlighted in yellow).
21 August 2019	Version 6.30
	Updated DXE Production GRP and Spin TCP ports.
10 September 2019	Version 6.31
·	Decomission of legacy MC PITCH feed infrastructure postponed.
	GIG B (BB and XB), WAN D (BD and XD) and WAN E (BE and XE) infrastructure
	will be decommissioned effective Friday 29th November 2019.
	GIG A (BA and XA), and WAN C (BC and XC) infrastructure will be decommis-
	sioned effective Monday 27th January 2020.
7 November 2019	Version 6.32
1 MOVELLING ZOTA	Clarified when Unit Clear messages are sent.
6 February 2020	Version 6.33
O I CUITUALY 2020	Updated Execution Ids
28 February 2020	Version 6.34
20 1 cbruary 2020	Add indices feeds and messages.
26 March 2020	Version 6.35
	Update Indices MC addresses
9 April 2020	Version 6.36
	Correct multicast configuration for indices feeds
30 April 2020	Version 6.37
	Removed legacy MC PITCH feed infrastructure details. Removed the 'n' post-
	suffix from what was previously described as the 'new' feed infrastructure, as that
	is the only feed infrastructure that exists, now the legacy feed instructure has been
	removed.
26 May 2020	Version 6.38
	Updated CXE UAT Indices Multicast section(§ 7.2.9, p. 50), to remove UAT-DR
	designation.
28 August 2020	Version 6.39
	Add a more detailed description for the indicies messages.
14 October 2020	Version 6.40
	Update location of multicast test program zip file.
27 October 2020	Version 6.41
	Added LISZ as Execution Venue for Choe BIDS Europe (DXE) ETRs.
8 February 2023	Version 6.42
	Update BXE Production Primary Multicast PITCH Feed (BA, BC) section(§ 7.1.1,
	p. 45) for units 4, 5, 6, 9, 10 and 12.
6 April 2023	Version 6.43
	Added the XFRA (Boerse, Germany) market to the symbol ranges tables for on-
	exchange and TRF
	5.5

9 May 2023	Version 6.44
y Ividy 2023	
6 July 2022	Clarify the usage of systematic internaliser quotes.  Version 6.45
6 July 2023	
	Added MMT v4 support and new values in Execution Venue field.  Version 6.46
17 July 2023 1 September 2023	
	Removed NTLS from MMT v4 Level 3.2.
	Version 6.47
	Added new values supported in Cboe Trade Flags.
16 October 2023	Version 6.48
	Added MMT v4.1 support.
16 November 2023	Version 6.49
	Updated description for Execution Flags, and Trade Flags.
21 May 2024	Version 6.50
	Added halt and volatility auction support for corporate listings.
15 Jul 2024	Version 6.51
	Added BIDS VWAP and XWAP execution venue fields, for VWAP-X trades in their
	respective jurisdictions.
06 February 2025	Version 6.52
•	Updated with Cboe Titanium branding.
14 April 2025	Version 6.53
•	Add Retail Liquidity Provider updates.
4 July 2025	Version 6.54
	Update Retail Liquidity Provider details - Prod LD4 and LD3. Clarify justification
	for separate Retail Feed. Trading Status Messages are included on the Retail Feed.
	Typos fixed. UAT Disaster Recovery Retail Multicast Sections Removed.
17 July 2025	Version 6.55
	Restore UAT Retail Multicast Sections incorrectly removed in previous version.
	(p. 49, 53)
	Add XER and DER Multicast Summary information including Src/Dest IP Ranges
	and PIM RP Addresses (p. 43).
	Correct IP for DXE UAT Retail Gap Replay. (p. 77)
	Correct CXE Disaster Recovery (XER) Spin Src IP. (p. 58)
18 July 2025	Version 6.56
	Correct transposed Src IPs in units 7 and 8 of the BXE Feeds (BA, BC) (p. 45)
01 August 2025	Version 6.57
	Explain Trade Breaks not present on Retail Feed (p. 9)
11 August 2025	Version 6.58
	Add UAT Disaster Recovery details. (p. 59, 62, 76, 77)
29 September 2025	Version 6.59
	Add dedicated trading status 'I' to distinguish Volatility Auctions
	The first state of the state of