



# Cboe Titanium U.S. Options Complex Auction Multicast PITCH Specification

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# Cboe Titanium U.S. Options Complex Auction Multicast PITCH Specification

# Introduction

This specification is the standard specification to be used for complex auctions on all Cboe-affiliated Options Exchange platforms.

Cboe customers may use Complex Auction Multicast PITCH to receive real-time auction update and execution information during complex options auctions.

Complex Auction Multicast PITCH cannot be used to enter orders. For order entry, refer to the appropriate US Options FIX or BOE Specifications.

A Gig-Shaped version of the Complex Auction Multicast PITCH feed is available from both of Cboe's datacenters. Customers may choose to take one or more of the following Multicast PITCH feed options depending on their location and connectivity to Cboe.

Multicast PITCH Feed Descriptions:

| Exchange     | Shaping (Gig) | Served From Data Center (Primary/Secondary) | Multicast Feed ID |
|--------------|---------------|---------------------------------------------|-------------------|
| C1 Options   | Gig           | Primary                                     | CAB               |
| C1 Options   | Gig           | Primary                                     | CBB               |
| C1 Options   | Gig           | Secondary                                   | CEB               |
| C2 Options   | Gig           | Primary                                     | WAB               |
| C2 Options   | Gig           | Primary                                     | WBB               |
| C2 Options   | Gig           | Secondary                                   | WEB               |
| EDGX Options | Gig           | Primary                                     | EAB               |
| EDGX Options | Gig           | Primary                                     | EBB               |
| EDGX Options | Gig           | Secondary                                   | EEB               |
| BZX Options  | Gig           | Primary                                     | OAB               |
| BZX Options  | Gig           | Primary                                     | OBB               |
| BZX Options  | Gig           | Secondary                                   | OEB               |

## 24x5 Feed Hours and System Restart (C1 Only)

For C1 Options operating in 24x5 mode, the PITCH feed starts on Sunday at approximately 1:00 p.m. ET and shuts down on Friday at approximately 5:30 p.m. ET. A daily restart occurs between 5:30 and 7:00 p.m. ET each day at which time sequences will be reset. The daily restart is typically observed between 5:30 p.m. and 6:00 p.m. ET, but could occur later (between 6:00 p.m. and 7:00 p.m. ET) if needed for operational reasons. Feed startup and shutdown times may be adjusted without notice.

Under normal operations, it is expected that the order books are cleared (Delete Order messages sent for any open orders, including GTC and GTD orders), prior to the daily restart and reset of sequences. Persisted GTC and GTD orders will be added back onto the order books starting at approximately 10 minutes prior to the scheduled queuing time for each underlying symbol.

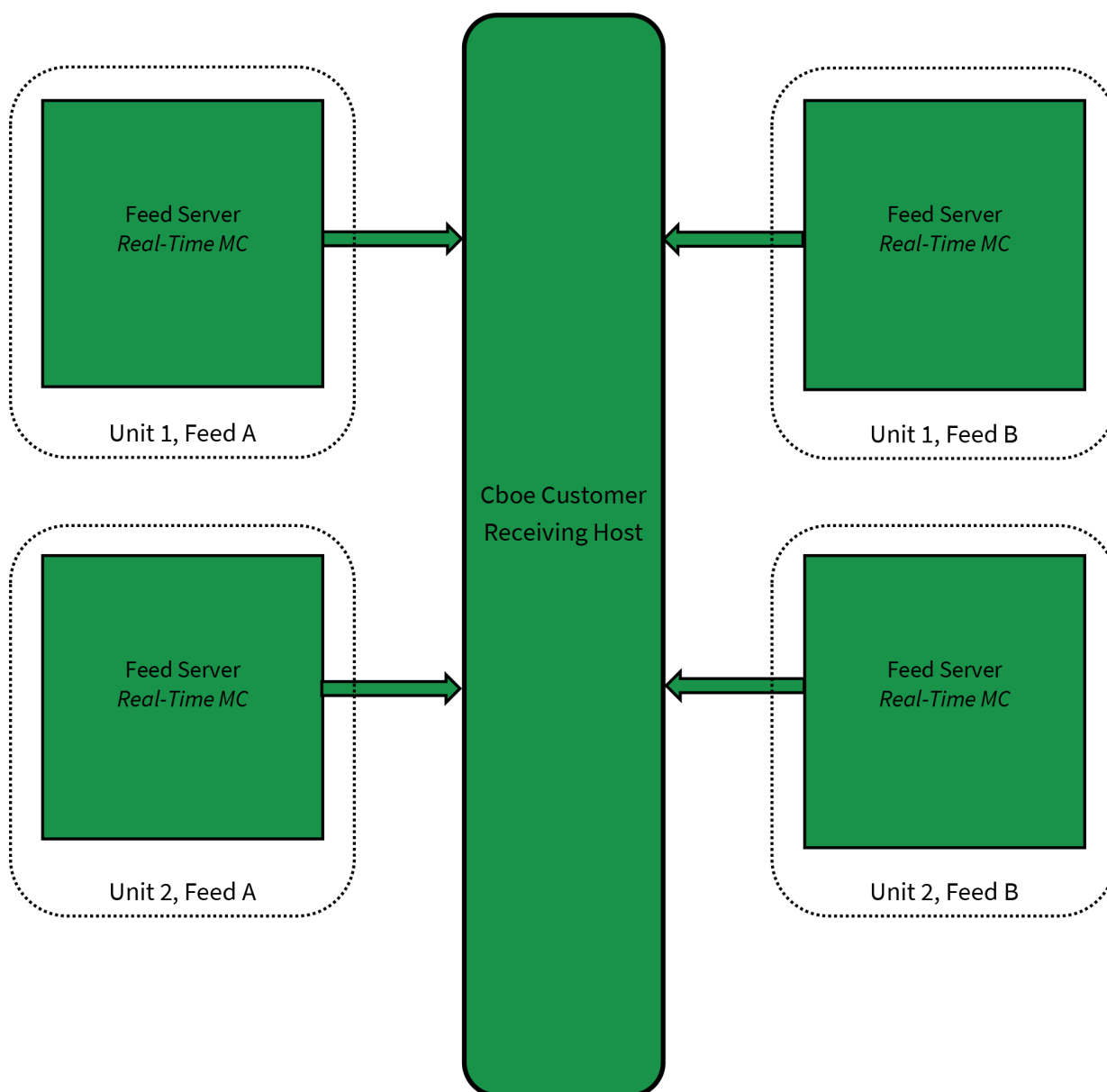
## Feed Connectivity Requirements

Gig Shaped feeds are available to customers with a minimum of 1 Gb/s of connectivity to Cboe via cross connect or dedicated circuit.

Customers with sufficient connectivity may choose to take more than one Gig-Shaped feed from the Cboe datacenters. It should be noted that feeds from the secondary datacenter will have additional latency for those co-located with Cboe in the primary datacenter due to proximity.

Cboe Complex Auction Multicast PITCH real-time events are delivered using a published range of multicast addresses divided by symbol range units. It should be noted dropped messages cannot be recovered on this feed as this feed contains only unsequenced messages.

The following diagram is a logical representation of Complex Auction Multicast PITCH feed message flow between Cboe and a customer feed handler that is listening to the A and B instances of two units:



## Symbol Ranges, Units, and Sequence Numbers

Symbols will be separated by Underlying into units and product distribution will not change intra-day. Cboe does, however, reserve the right to add multicast addresses or change the symbol distribution with prior notice to customers. Care should be taken to ensure that address changes, address additions, and symbol distribution changes can be supported easily.

It is important to understand that one or more units will be delivered on a single multicast address. As with symbol ranges, unit distribution across multicast addresses will not change intra-day, but may change after notice has been given.

It should be noted that this feed only contains unsequenced messages.

## Complex Options Specific Symbol Processing

Cboe has implemented a Complex Instrument Creation (CIC) process due to the seemingly infinite number of combinations that can make up a complex instrument. This allows the Complex Auction Multicast PITCH specification to be consistent with the equities, standard options, and complex options Multicast PITCH specifications. This CIC process significantly reduces the size of the Complex Auction Multicast PITCH feed and allows customers to use the same feed handler for Cboe equities, options, and futures exchanges.

Real-time CIC messages are available on each unit's multicast feed. **Complex Instrument Definition Expanded** messages are used to map the 6 character feed Complex Instrument ID (CID) to complex instrument definition. A complex instrument definition consists of two or more option legs. The complex instrument is valid only for the current trading date on which it was created. **Complex Instrument Definition Expanded** messages are unsequenced messages and can be sent from pre-market through the end of trading. Once a complex instrument is created, it cannot be deleted or modified for the remainder of the trading day.

## Gap Request Proxy and Message Retransmission

Recovery of missed data is not available on the Complex Auction Multicast PITCH feed. There are two main reasons. First this feed contains only unsequenced messages. Second the complex option auctions are short lived by nature making recovery of dropped messages impractical.

Prior to the start of any new auction, the corresponding **Complex Instrument Definition Expanded** message will be sent to ensure the customer has correct complex instrument information.

## Spin Servers

A spin is not available on the Complex Auction Multicast PITCH feed as this feed is unsequenced.

# Protocol

Cboe users may use the PITCH 2.X protocol over multicast to receive auction update and execution information direct from Cboe.

PITCH 2.X cannot be used to enter orders. For order entry, refer to the appropriate US Options FIX or BOE Specification.

## 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 will use the **Sequenced Unit Header** for handling message integrity.

All UDP delivered events will be 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.

This PITCH data feed is comprised of a series of dynamic length unsequenced messages. Each message begins with Length and Message Type fields. Cboe reserves the right to add message types and grow the length of any message without notice. Customers should develop their decoders to deal with unknown message types and messages that grow beyond the expected length. Messages will only be grown to add additional data to the end of a message.

## Data Types

The following field types are used within the **Sequenced Unit Header** and PITCH 2.X.

- Alphanumeric fields are left justified ASCII fields and space padded on the right.
- Binary fields are unsigned and sized to Length bytes and ordered using Little Endian convention (least significant byte first).
- Signed Binary fields are signed and sized to Length bytes and ordered using Little Endian convention (least significant byte first).
- Binary Signed Short Price fields are signed Little Endian encoded 2 byte binary fields with 2 implied decimal places (denominator=100). The short price range is -327.68 to +327.67. Prices outside of this range will use the long price.
- Binary Signed Long Price fields are signed Little Endian encoded 8 byte binary fields with 4 implied decimal places (denominator=10,000).
- Bit Field fields are fixed width fields with each bit representing a Boolean flag (the 0 bit is the lowest significant bit; the 7 bit is the highest significant bit).
- Printable ASCII fields are left justified ASCII fields that are space padded on the right that may include ASCII values in the range of 0x20 - 0x7e.
- Binary Date fields are 4 byte unsigned Little Endian values where the base-10 representation is the YYYYMMDD representation of that date. For example, October 30, 2023 would be represented as 20,231,030 (20231030).
- Time Offset fields are 4 byte unsigned Little Endian values that represent the number of nanoseconds since the last **Time** message. These fields are populated to nanosecond precision. For example, a nano time of 1,737,580,407,123,456,789 ("Wednesday, January 22, 2025 9:13:27.123456789") would return value = 123456789.

## Message Framing

Messages will be combined into 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 (e.g. A/B Gig-Shaped) will be identical, but framing will not be consistent across feeds. Receiving processes that receive and arbitrate multiple feeds cannot use frame level arbitration to fill gaps.

## Sequenced Unit Header

The **Sequenced Unit Header** is used for all Cboe Multicast PITCH messages.

This feed will deliver only unsequenced data using the **Sequenced Unit Header**. Unsequenced headers will have a 0 value for the sequence field and potentially for the unit field.

**Table 1. Sequenced Unit Header**

| Field                      | Offset | Length | Value/Type | Description                                                                                              |
|----------------------------|--------|--------|------------|----------------------------------------------------------------------------------------------------------|
| <b><i>Hdr Length</i></b>   | 0      | 2      | Binary     | Length of entire block of messages. Includes this header and <b><i>Hdr Count</i></b> messages to follow. |
| <b><i>Hdr Count</i></b>    | 2      | 1      | Binary     | Number of messages to follow this header.                                                                |
| <b><i>Hdr Unit</i></b>     | 3      | 1      | Binary     | Unit that applies to messages included in this header.                                                   |
| <b><i>Hdr Sequence</i></b> | 4      | 4      | Binary     | Always zero.                                                                                             |
| Total Length = 8 bytes     |        |        |            |                                                                                                          |

## Heartbeat Messages

The **Sequenced Unit Header** with a count field set to 0 will be used for heartbeat messages. During trading hours heartbeat messages will be sent from all multicast addresses if no data has been delivered within 1 second. Heartbeat messages never increment the sequence number for a unit.

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

## PITCH 2.X Messages

### Time Reference (C1 Only)

The **Time Reference** message is used to provide a midnight reference point for recipients of the feed. It is sent whenever the system starts up and when the system crosses a midnight boundary. All subsequent **Time** messages for the same unit will use the last **Midnight Reference** until another **Time Reference** message is received for that unit. The **Time Reference** message includes the **Trade Date**, so most other sequenced messages will not include that information.

**Time Reference** messages will be included in a spin response.

Table 1. Time Reference

| Field Name                | Offset | Length | Type/(Value) | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------|--------|--------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Length</b>             | 0      | 1      | Binary       | <b>Length</b> of this message including this field.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Message Type</b>       | 1      | 1      | 0xB1         | <b>Time Reference</b> Message                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Midnight Reference</b> | 2      | 4      | Binary       | Midnight Eastern Time reference time for subsequent <b>Time</b> messages, expressed as number of whole seconds since the Epoch (Midnight January 1, 1970 UTC).                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Time</b>               | 6      | 4      | Binary       | Number of whole seconds elapsed since the start of the current Eastern Time calendar day, derived by converting the current Eastern wall clock time (HH:MM:SS) to seconds.<br><br>On Daylight Saving Time transition days, <b>Time</b> reflects wall clock seconds and does not adjust for the UTC offset change. On a DST spring-forward day, the maximum value will be 82,799 (23 hours). On a DST fall-back day, values between 3,600 and 7,199 will appear twice. Recipients requiring unambiguous absolute timestamps should use <b>Epoch Time</b> (where available) or <b>Midnight Reference</b> in the <b>Time Reference</b> message. |
| <b>Time Offset</b>        | 10     | 4      | Time Offset  | Nanosecond offset from last unit timestamp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Trade Date</b>         | 14     | 4      | Binary Date  | Current Trade Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Total Length=18 bytes     |        |        |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

### Time

A **Time** message is immediately generated and sent when there is a PITCH event for a given clock second. If there is no PITCH event for a given clock second, then no **Time** message is sent for that second. 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. The **Time** field is the number of seconds relative to midnight Eastern Time, which is provided in the **Time Reference** message. On **C1 only**, the **Time** message will also include the **Epoch Time** field, which is the current time represented as the number of whole seconds since the Epoch (midnight January 1, 1970).

Table 1. Time

| Field Name          | Offset | Length | Type/(Value) | Description                                        |
|---------------------|--------|--------|--------------|----------------------------------------------------|
| <b>Length</b>       | 0      | 1      | Binary       | <b>Length</b> of this message including this field |
| <b>Message Type</b> | 1      | 1      | 0x20         | <b>Time</b> Message                                |

| Field Name                                                 | Offset | Length | Type/(Value) | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------|--------|--------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Time</b>                                                | 2      | 4      | Binary       | Number of whole seconds elapsed since the start of the current Eastern Time calendar day, derived by converting the current Eastern wall clock time (HH:MM:SS) to seconds.<br><br>On Daylight Saving Time transition days, <b>Time</b> reflects wall clock seconds and does not adjust for the UTC offset change. On a DST spring-forward day, the maximum value will be 82,799 (23 hours). On a DST fall-back day, values between 3,600 and 7,199 will appear twice. Recipients requiring unambiguous absolute timestamps should use <b>Epoch Time</b> (where available) or <b>Midnight Reference</b> in the <b>Time Reference</b> message. |
| <b>Epoch Time</b>                                          | 6      | 4      | Binary       | <b>C1 Options Only</b><br>Number of whole seconds since the Epoch (midnight January 1, 1970 UTC).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Total Length = 6 bytes, 10 bytes on <b>C1 Options Only</b> |        |        |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## Complex Instrument Definition Expanded

A **Complex Instrument Definition Expanded** message represents a complex instrument that is available to place orders. This message is unsequenced (sequence = 0) and is sent just prior to every **Auction Notification** message. **Complex Instrument Definition Expanded** messages will also be sent in a continuous loop through the day at variable rates as bandwidth allows. The **Time offset** field should be ignored on **Complex Instrument Definition Expanded** messages .

The **Complex Instrument Definition Expanded** message will contain two or more repeating groups of leg definitions. There is a limit of 16 leg definitions.

**Table 1. Complex Instrument Definition Expanded**

| Field Name                                                                                                   | Offset              | Length | Type/(Value)    | Description                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------|---------------------|--------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Length</b>                                                                                                | 0                   | 1      | Binary          | <b>Length</b> of this message including this field.                                                                                                                               |
| <b>Message Type</b>                                                                                          | 1                   | 1      | 0x9A            | <b>Complex Instrument Definition Expanded</b> Message                                                                                                                             |
| <b>Time Offset</b>                                                                                           | 2                   | 4      | Time Offset     | Nanosecond offset from last unit timestamp.                                                                                                                                       |
| <b>Complex Instrument Id</b>                                                                                 | 6                   | 6      | Printable ASCII | Complex Instrument Id right padded with spaces.                                                                                                                                   |
| <b>Complex Instrument Underlying</b>                                                                         | 12                  | 8      | Printable ASCII | Complex Instrument Underlying right padded with spaces.                                                                                                                           |
| <b>Complex Instrument Type</b>                                                                               | 20                  | 4      | Alphanumeric    | 4 character field; each field describes a characteristic.<br>Character 1: Complex Option Type<br>O=All legs are options<br>E=One leg is an equity leg<br>Characters 2-4: Reserved |
| <b>Leg Count</b>                                                                                             | 24                  | 1      | Binary          | The number of legs in the complex instrument. The maximum number of legs is 16.                                                                                                   |
| The following fields repeat <b>Leg Count</b> times for multi-leg strategies. <b>Leg Index</b> is zero-based. |                     |        |                 |                                                                                                                                                                                   |
| <b>Leg Symbol</b>                                                                                            | 25 + Leg Index * 13 | 8      | Printable ASCII | Option or Equity Symbol of leg, right padded with spaces.                                                                                                                         |

| Field Name                               | Offset              | Length | Type/(Value)  | Description                                                                                                                                        |
|------------------------------------------|---------------------|--------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Leg Ratio</b>                         | 33 + Leg Index * 13 | 4      | Signed Binary | Leg ratio (positive for buy-side, negative for sell-side). For options this is the number of contracts, for equities this is the number of shares. |
| <b>Leg Security Type</b>                 | 37 + Leg Index * 13 | 1      | Alphanumeric  | O=Leg is an Option instrument<br>E=Leg is an Equity instrument                                                                                     |
| Total Length=25 + (Leg Count * 13) bytes |                     |        |               |                                                                                                                                                    |

## Symbol Mapping

A **Symbol Mapping** message is used to map the 6 character simple instrument multicast feed symbol field to an OSI symbol and Underlying. These messages are not sequenced (sequence = 0) and are sent continuously through the day at variable rates as bandwidth allows.

**Table 1. Symbol Mapping**

| Field Name              | Offset | Length | Type/(Value)    | Description                                                                                          |
|-------------------------|--------|--------|-----------------|------------------------------------------------------------------------------------------------------|
| <b>Length</b>           | 0      | 1      | Binary          | <b>Length</b> of this message including this field                                                   |
| <b>Message Type</b>     | 1      | 1      | 0x2E            | <b>Symbol Mapping</b> Message                                                                        |
| <b>Feed Symbol</b>      | 2      | 6      | Printable ASCII | <b>Symbol</b> right padded with spaces.                                                              |
| <b>OSI Symbol</b>       | 8      | 21     | Printable ASCII | OSI Symbol                                                                                           |
| <b>Symbol Condition</b> | 29     | 1      | Alphanumeric    | N = Normal<br>C = Closing Only                                                                       |
| <b>Underlying</b>       | 30     | 8      | Alphanumeric    | Symbol of underlying equity right padded with spaces. All spaces if not available or not applicable. |
| Total Length = 38 bytes |        |        |                 |                                                                                                      |

## Auction Notification

**Auction Notification** messages are used to disseminate order details of a complex auction. Auctions will be available for a defined period of time known as the exposure period.

**Table 1. Auction Notification**

| Field Name                   | Offset | Length | Type/(Value)    | Description                                                                                                                                                                  |
|------------------------------|--------|--------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Length</b>                | 0      | 1      | Binary          | Length of this message including this field                                                                                                                                  |
| <b>Message Type</b>          | 1      | 1      | 0xAD            | <b>Auction Notification</b> Message                                                                                                                                          |
| <b>Time Offset</b>           | 2      | 4      | Time Offset     | Nanosecond offset from last unit timestamp.                                                                                                                                  |
| <b>Complex Instrument Id</b> | 6      | 6      | Printable ASCII | Complex Instrument Id right padded with spaces.                                                                                                                              |
| <b>Auction ID</b>            | 12     | 8      | Binary          | Day specific identifier assigned to this auction.                                                                                                                            |
| <b>Auction Type</b>          | 20     | 1      | Alphanumeric    | C=Complex Order Auction (COA) (or Stop Complex Order Auction (SCOA) <b>effective TBD</b> )<br>S=Complex Solicitation Auction Mechanism<br>B=Complex AIM<br>O=COA All or None |
| <b>Side</b>                  | 21     | 1      | Alphanumeric    | B=Buy<br>S=Sell                                                                                                                                                              |

| Field Name                | Offset | Length | Type/(Value)             | Description                                                                                                                                                                                                                                                                                                                                   |
|---------------------------|--------|--------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Price</b>              | 22     | 8      | Binary Signed Long Price | Auction price<br>The price field will be populated for all Auctions on EDGX Options, and for Complex SAM Auctions on C1. This field will reflect the auction start price for SPX and SPXW Complex AIMs on C1. For all other Complex AIMs on C1, this field will be set to zero.<br>This field will be set to zero for COA on C1, C2, and BZX. |
| <b>Quantity</b>           | 30     | 4      | Binary                   | Instrument quantity.                                                                                                                                                                                                                                                                                                                          |
| <b>Customer Indicator</b> | 34     | 1      | Alphanumeric             | N=Non-Customer<br>C=Customer                                                                                                                                                                                                                                                                                                                  |
| <b>ParticipantID</b>      | 35     | 4      | Alphanumeric             | Executing Broker (optional) of firm attributed to this quote.                                                                                                                                                                                                                                                                                 |
| <b>Auction End Offset</b> | 39     | 4      | Binary                   | Nanosecond offset from last timestamp.                                                                                                                                                                                                                                                                                                        |
| <b>Client ID</b>          | 43     | 4      | Alphanumeric             | Optional user specified value attributed to this quote.                                                                                                                                                                                                                                                                                       |
| Total Length=47 bytes     |        |        |                          |                                                                                                                                                                                                                                                                                                                                               |

## Auction Cancel

**Auction Cancel** messages are used to disseminate the cancellation of an earlier **Auction Notification** message as a result of a user cancellation of the original complex auction, a user modification request to change the complex auction price or increase the original complex auction quantity, a fading of the NBBO or to cancel any remaining complex auction quantity from the original **Auction Notification** following the complex auction termination.

A user request to modify the complex auction price or to increase the original complex auction quantity will result in a cancellation of the complex auction followed by a new **Auction Notification** message. **Auction Cancel** messages will not be issued for complex auction quantity decrements.

**Table 1. Auction Cancel**

| Field Name            | Offset | Length | Type/(Value) | Description                                      |
|-----------------------|--------|--------|--------------|--------------------------------------------------|
| <b>Length</b>         | 0      | 1      | Binary       | Length of this message including this field      |
| <b>Message Type</b>   | 1      | 1      | 0xAE         | <b>Auction Cancel</b> Message                    |
| <b>Time Offset</b>    | 2      | 4      | Time Offset  | Nanosecond offset from last unit timestamp       |
| <b>Auction ID</b>     | 6      | 8      | Binary       | Day specific identifier assigned to this auction |
| Total Length=14 bytes |        |        |              |                                                  |

## Auction Trade

**Auction Trade** messages are used to disseminate executions resulting from a complex auction.

**Table 1. Auction Trade**

| Field Name          | Offset | Length | Type/(Value) | Description                                        |
|---------------------|--------|--------|--------------|----------------------------------------------------|
| <b>Length</b>       | 0      | 1      | Binary       | Length of this message including this field        |
| <b>Message Type</b> | 1      | 1      | 0xAF         | <b>Auction Trade</b> Message                       |
| <b>Time Offset</b>  | 2      | 4      | Time Offset  | Nanosecond offset from last unit timestamp         |
| <b>Auction ID</b>   | 6      | 8      | Binary       | Day specific identifier assigned to this auction   |
| <b>Execution ID</b> | 14     | 8      | Binary       | Day specific identifier assigned to this execution |

| Field Name            | Offset | Length | Type/(Value)             | Description                |
|-----------------------|--------|--------|--------------------------|----------------------------|
| <b>Price</b>          | 22     | 8      | Binary Signed Long Price | Trade price                |
| <b>Quantity</b>       | 30     | 4      | Binary                   | Instrument quantity traded |
| Total Length=34 bytes |        |        |                          |                            |

## Options Auction Update

**Options Auction Update** messages are used to disseminate price and size information during the Opening and Re-Opening (halt) process for complex instruments. The **Options Auction Update** messages are sent every five seconds during an opening period. See the [Cboe Titanium U.S. Options Complex Book Process](#) for more information.

**Table 1. Options Auction Update**

| Field Name                          | Offset | Length | Type/(Value)             | Description                                                                                                                 |
|-------------------------------------|--------|--------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Length</b>                       | 0      | 1      | Binary                   | <b>Length</b> of this message including this field.                                                                         |
| <b>Message Type</b>                 | 1      | 1      | 0xD1                     | <b>Options Auction Update</b> Message                                                                                       |
| <b>Time Offset</b>                  | 2      | 4      | Time Offset              | Nanosecond offset from last unit timestamp.                                                                                 |
| <b>Complex Instrument ID</b>        | 6      | 8      | Printable ASCII          | <b>Complex Instrument</b> right padded with spaces.                                                                         |
| <b>Auction Type</b>                 | 14     | 1      | Alphanumeric             | G=GTH Opening(C1 Only)<br>O=RTH Opening(C1 Only)<br>H=Halt Re-Opening                                                       |
| <b>Reference Price</b>              | 15     | 8      | Binary Long Price        | <b>Not used for complex series. Will contain zero value.</b>                                                                |
| <b>Buy Contracts</b>                | 23     | 4      | Binary                   | Cumulative Buy interest at the Indicative Price.                                                                            |
| <b>Sell Contracts</b>               | 27     | 4      | Binary                   | Cumulative Sell interest at the Indicative Price.                                                                           |
| <b>Indicative Price</b>             | 31     | 8      | Binary Signed Long Price | SNBBO Collared Volume Maximizing Imbalance Minimizing Price computed on combined Auction-Only and Continuous Book (if any). |
| <b>Auction Only Price</b>           | 39     | 8      | Binary Signed Long Price | <b>Not used for complex series. Will contain zero value.</b>                                                                |
| <b>Opening Condition</b>            | 47     | 1      | Alphanumeric             | <b>Not used for Complex series. Will contain zero value.</b>                                                                |
| <b>Composite Market Bid Price</b>   | 48     | 8      | Binary Signed Long Price | <b>Not used for Complex series. Will contain zero value.</b>                                                                |
| <b>Composite Market Offer Price</b> | 56     | 8      | Binary Signed Long Price | <b>Not used for complex series. Will contain zero value.</b>                                                                |
| Total Length=64 bytes               |        |        |                          |                                                                                                                             |

## Auction Summary

**Auction Summary** messages are used to disseminate the results of the Opening and Re-Opening process of a complex instrument. An Opening or Re-Opening **Auction Summary** message for each complex instrument is sent at the conclusion of the Opening or Re-Opening process and represents the Cboe opening price. See the [Cboe Titanium U.S. Options Complex Book Process](#) for more information.

**Table 1. Auction Summary**

| Field Name    | Offset | Length | Type/(Value) | Description                                  |
|---------------|--------|--------|--------------|----------------------------------------------|
| <b>Length</b> | 0      | 1      | Binary       | Length of this message including this field. |

| Field Name                   | Offset | Length | Type/(Value)             | Description                                                             |
|------------------------------|--------|--------|--------------------------|-------------------------------------------------------------------------|
| <b>Message Type</b>          | 1      | 1      | 0x96                     | <b>Auction Summary</b> Message                                          |
| <b>Time Offset</b>           | 2      | 4      | Time Offset              | Nanosecond offset from last unit timestamp.                             |
| <b>Complex Instrument Id</b> | 6      | 8      | Printable ASCII          | <b>Complex Instrument Id</b> right padded with spaces.                  |
| <b>Auction Type</b>          | 14     | 1      | Alphanumeric             | G=GTH Opening (C1 Only)<br>O=RTH Opening (C1 Only)<br>H=Halt Re-Opening |
| <b>Price</b>                 | 15     | 8      | Binary Signed Long Price | Auction price                                                           |
| <b>Quantity</b>              | 23     | 4      | Binary                   | Cumulative instrument quantity executed during the auction              |
| Total Length=27 bytes        |        |        |                          |                                                                         |

## End of Session

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

**Table 1. End of Session**

| Field Name             | Offset | Length | Type/(Value) | Description                                        |
|------------------------|--------|--------|--------------|----------------------------------------------------|
| <b>Length</b>          | 0      | 1      | Binary       | <b>Length</b> of this message including this field |
| <b>Message Type</b>    | 1      | 1      | 0x2D         | <b>End of Session</b> Message                      |
| <b>Timestamp</b>       | 2      | 4      | Binary       | Nanosecond offset from last unit timestamp         |
| Total Length = 6 bytes |        |        |              |                                                    |

# Message Types

## PITCH 2.X Messages

|      |                                        |
|------|----------------------------------------|
| 0x20 | Time                                   |
| 0xB1 | Time Reference (C1 Only)               |
| 0x9A | Complex Instrument Definition Expanded |
| 0x2E | Symbol Mapping                         |
| 0xAD | Auction Notification                   |
| 0xAE | Auction Cancel                         |
| 0xAF | Auction Trade                          |
| 0xD1 | Auction Update                         |
| 0x96 | Auction Summary                        |
| 0x2D | End of Session                         |

# Example Messages

Each of the following message types must be wrapped by a sequenced or unsequenced unit header as described in [Sequenced Unit Header](#) . Note that in the following examples, each byte is represented by two hexadecimal digits.

## Time Reference (C1 Only)

Table 1. Time Reference (C1 Only)

|                    |             |                                                                     |
|--------------------|-------------|---------------------------------------------------------------------|
| Length             | 12          | 18 bytes                                                            |
| Type               | B1          | Time Reference                                                      |
| Midnight Reference | D0 8B 34 60 | 2021-02-23 00:00:00 Eastern<br>(1614056400 seconds since the Epoch) |
| Time               | 00 E1 00 00 | 16:00:00                                                            |
| Time Offset        | 00 00 00 00 | Exactly 16:00:00                                                    |
| Trade Date         | 2F 62 34 01 | 2021-02-23 February 23, 2021                                        |

## Time Message

Table 1. Time Message

|        |             |                                   |
|--------|-------------|-----------------------------------|
| Length | 06          | 6 bytes                           |
| Type   | 20          | Time                              |
| Time   | 98 85 00 00 | 34,200 seconds = 09:30 AM Eastern |

## Time Message

Table 1. Time Message

|                      |             |                                       |
|----------------------|-------------|---------------------------------------|
| Length               | 0A          | 10 bytes                              |
| Type                 | 20          | Time                                  |
| Time                 | 98 85 00 00 | 34,200 seconds =09:30 AM Eastern      |
| Epoch Time (C1 Only) | 68 11 35 60 | 1,614,090,600 seconds since the Epoch |

## Complex Instrument Definition Expanded

Table 1. Complex Instrument Definition Expanded

|                               |                         |                                        |
|-------------------------------|-------------------------|----------------------------------------|
| Length                        | 33                      | 51 bytes                               |
| Type                          | 9A                      | Complex Instrument Definition Expanded |
| Time Offset                   | 18 D2 06 00             | 447,000 ns since last Time Message     |
| CID                           | 43 30 30 30 31 32       | C00012                                 |
| Complex Instrument            | 5A 56 5A 5A 54 20 20 20 | ZVZZT                                  |
| Underlying Complex Instrument | 4F 00 00 00             | O = All Legs are Options               |
| Type Leg Count                | 02                      | 2 Legs                                 |
| Leg Symbol                    | 30 30 30 30 30 31 20 20 | 000001                                 |
| Leg Ratio                     | FF FF FF FF             | -1 = Sell 1                            |
| Leg Security Type             | 4F                      | Option Leg                             |
| Leg Symbol                    | 30 30 30 30 30 32 20 20 | 000002                                 |
| Leg Ratio                     | 01 00 00 00             | 1 = Buy 1                              |

|                   |    |            |
|-------------------|----|------------|
| Leg Security Type | 4F | Option Leg |
|-------------------|----|------------|

## Symbol Mapping Message

**Table 1. Symbol Mapping Message**

|                  |                                                                   |                        |
|------------------|-------------------------------------------------------------------|------------------------|
| Length           | 1E                                                                | 30 bytes               |
| Type             | 2E                                                                | Symbol Mapping Message |
| Feed Symbol      | 30 30 6D 45 56 4F                                                 | 00mEVOO                |
| OSI Symbol       | 4D 53 46 54 20 20 31 39 30 39 32 30 43<br>30 30 31 35 30 30 30 30 | MSFT 190920C00150000   |
| Symbol Condition | 43                                                                | 'C' - Closing Only     |
| Underlying       | 4D 53 46 54 20 20 20 20                                           | MSFT                   |

## Auction Notification Message

**Table 1. Auction Notification Message**

|                    |                         |                                    |
|--------------------|-------------------------|------------------------------------|
| Length             | 2F                      | 47 bytes                           |
| Type               | AD                      | Auction Notification               |
| Time Offset        | 18 D2 06 00             | 447,000 ns since last Time Message |
| CID                | 43 30 30 30 31 32       | C00012                             |
| Auction ID         | 05 40 5B 77 8F 56 1D 0B | 631WC4000005                       |
| Auction Type       | 4F                      | O = COA AON                        |
| Side               | 42                      | B = Buy Side                       |
| Price              | 00 00 00 00 00 00 00 00 | Price not displayed                |
| Quantity           | 64 00 00 00             | 100                                |
| Customer Indicator | 43                      | C = Customer                       |
| ParticipantID      | 45 46 49 44             | EFID                               |
| Auct. End Offset   | 38 73 0E 00             | 947,000 ns since last Time Message |
| Client ID          | 43 4C 49 44             | CLID                               |

## Auction Cancel Message

**Table 1. Auction Cancel Message**

|             |                         |                                    |
|-------------|-------------------------|------------------------------------|
| Length      | E                       | 14 bytes                           |
| Type        | AE                      | Auction Cancel                     |
| Time Offset | 18 D2 06 00             | 447,000 ns since last Time Message |
| Auction ID  | 05 40 5B 77 8F 56 1D 0B | 631WC4000005                       |

## Auction Trade Message

**Table 1. Auction Trade Message**

|             |                         |                                    |
|-------------|-------------------------|------------------------------------|
| Length      | 22                      | 34 bytes                           |
| Type        | AF                      | Auction Trade                      |
| Time Offset | 18 D2 06 00             | 447,000 ns since last Time Message |
| Auction ID  | 05 40 5B 77 8F 56 1D 0B | 631WC4000005                       |

|              |                         |           |
|--------------|-------------------------|-----------|
| Execution Id | 34 2B 46 E0 BB 00 00 00 | 0AAP09VEC |
| Price        | E8 A3 0F 00 00 00 00 00 | \$102.50  |
| Quantity     | 64 00 00 00             | 100       |

## Options Auction Update

**Table 1. Options Auction Update**

|                              |                         |                                    |
|------------------------------|-------------------------|------------------------------------|
| Length                       | 40                      | 64 bytes                           |
| Type                         | D1                      | Options Auction Update             |
| Time Offset                  | 18 D2 06 00             | 447,000 ns since last Time Message |
| CID                          | 43 30 30 30 31 32 20 20 | C00012                             |
| Auction Type                 | 4F                      | Opening Auction                    |
| Reference Price              | 00 00 00 00 00 00 00 00 | always zero                        |
| Buy Contracts                | 64 00 00 00             | 100 Contracts                      |
| Sell Contracts               | C8 00 00 00             | 200 Contracts                      |
| Indicative Price             | E8 A3 0F 00 00 00 00 00 | \$102.50                           |
| Auction Only Price           | 00 00 00 00 00 00 00 00 | always zero                        |
| Opening Condition            | 00                      | always zero                        |
| Composite Market Bid Price   | 00 00 00 00 00 00 00 00 | always zero                        |
| Composite Market Offer Price | 00 00 00 00 00 00 00 00 | always zero                        |

## Auction Summary

**Table 1. Auction Summary**

|              |                         |                                    |
|--------------|-------------------------|------------------------------------|
| Length       | 1B                      | 27 bytes                           |
| Type         | 96                      | Auction Summary                    |
| Time Offset  | 18 D2 06 00             | 447,000 ns since last Time Message |
| CID          | 43 30 30 30 31 32 20 20 | C00012                             |
| Auction Type | 4F                      | O = Opening                        |
| Price        | E8 A3 0F 00 00 00 00 00 | \$102.50                           |
| Quantity     | 4B 00 00 00             | 75                                 |

## End of Session

**Table 1. 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 |

# Multicast Configuration

## Production Environment Configuration

### Limitations/Configurations

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

| Period/Type         | Limit/Setting | Notes                                                                                                                      |
|---------------------|---------------|----------------------------------------------------------------------------------------------------------------------------|
| MTU                 | 1500          | Cboe will send UDP messages up to 1500 bytes. Customers should ensure that their infrastructure is configured accordingly. |
| Gig-Shaped Throttle | 1 Gb/s        | The real-time and gap multicast head ends are configured to shape their output to this level to minimize packet loss.      |

### U.S. Options Unit/Product Distribution

| Unit | BZX/C1/C2/EDGX Symbol Range | Exceptions                                                           |
|------|-----------------------------|----------------------------------------------------------------------|
| 1    | A - AIPA~                   |                                                                      |
| 2    | AIPB - AO~                  |                                                                      |
| 3    | AP - AVGO~                  |                                                                      |
| 4    | AVGP - BOIL~                |                                                                      |
| 5    | BOIM - CMPR~                | Excludes CBTX, CBTXW                                                 |
| 6    | CMPS - CSIQ~                |                                                                      |
| 7    | CSIR - DJTA~                |                                                                      |
| 8    | DJTB - FARO~                | Excludes DJX, DJXW                                                   |
| 9    | FARP - GLC~                 |                                                                      |
| 10   | GLD - HAYW~                 |                                                                      |
| 11   | HAYX - IYWA~                | Excludes IWM                                                         |
| 12   | IYWB - LMTA~                |                                                                      |
| 13   | LMTB - MES~                 | Excludes MBTX, MBTXW                                                 |
| 14   | MET - MRM~                  | Excludes MGTN, MGTNW                                                 |
| 15   | MRN - MSTR~                 | Excludes MRUT                                                        |
| 16   | MSTS - NKEA~                | Excludes NANOS                                                       |
| 17   | NKEB - PDC~                 | Excludes NVDA, OEX                                                   |
| 18   | PDD - RDDS~                 | Excludes QQQ                                                         |
| 19   | RDDT - SEAA~                | Excludes RLG, RLV, RUI, RUT/RUTW                                     |
| 20   | SEAB - SMHA~                | Excludes SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY |
| 21   | SMHB - TEQ~                 | Excludes SPEQX, SPESG, SPX/SPXW, SPY                                 |
| 22   | TER - TTC~                  | Excludes TSLA                                                        |
| 23   | TTD - VB~                   | Excludes UKXM                                                        |
| 24   | VC - WYNN~                  | Excludes VIX, VIXW                                                   |
| 25   | WYNO - Z~                   | Excludes XEO, XSP, XSPBW                                             |

| Unit | BZX/C1/C2/EDGX Symbol Range | Exceptions |
|------|-----------------------------|------------|
| 26   | NVDA                        |            |
| 27   | TSLA                        |            |
| 28   | QQQ                         |            |
| 29   | IWM                         |            |
| 30   | SPY                         |            |

**Table 1. Units 31-35**

| Unit | BZX/C2 Symbol Range                                                  | C1 Symbol Range                                                                                                                                                             |
|------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31   | DJX (C2 Only), DJXW (C2 Only), RUT (BZX and C2 Only), RUTW (C2 Only) | CBTX, CBTXW, DJX, DJXW, MBTX, MBTXW, MGTN, MGTNW, MRUT, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPEQX, SPESG, UKXM, XEO |
| 32   | N/A                                                                  | NANOS, VIX, VIXW, XSP, XSPBW                                                                                                                                                |
| 33   | N/A                                                                  | SPX                                                                                                                                                                         |
| 34   | N/A                                                                  | SPXW                                                                                                                                                                        |
| 35   | N/A                                                                  | SPX/SPXW, Cross Product Spreads                                                                                                                                             |

Note - Cboe reserves the right to add units and/or change symbol distribution with 48 hours of notice and 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.

## BZX Options Multicast Routing Parameters

| Data Center                  | Rendezvous Point |
|------------------------------|------------------|
| Primary Data Center A feed   | 74.115.128.32    |
| Primary Data Center B feed   | 74.115.128.35    |
| Secondary Data Center E feed | 174.136.181.244  |

## C1 Options Multicast Routing Parameters

| Data Center                  | Rendezvous Point |
|------------------------------|------------------|
| Primary Data Center A feed   | 74.115.128.183   |
| Primary Data Center B feed   | 74.115.128.184   |
| Secondary Data Center E feed | 174.136.181.249  |

## C2 Options Multicast Routing Parameters

| Data Center                  | Rendezvous Point |
|------------------------------|------------------|
| Primary Data Center A feed   | 74.115.128.176   |
| Primary Data Center B feed   | 74.115.128.177   |
| Secondary Data Center E feed | 170.137.16.134   |

## EDGX Options Multicast Routing Parameters

| Data Center                  | Rendezvous Point |
|------------------------------|------------------|
| Primary Data Center A feed   | 74.115.128.162   |
| Primary Data Center B feed   | 74.115.128.163   |
| Secondary Data Center E feed | 174.136.181.240  |

BZX Options Address/Unit Distribution

The following tables describe the unit distribution across the BZX Options Complex Auction Multicast PITCH feeds.

| Primary Datacenter |         | Gig-Shaped [OAB]<br>174.136.164.192/28 | Gig-Shaped [OBB]<br>174.136.164.208/28 |
|--------------------|---------|----------------------------------------|----------------------------------------|
| Unit               | IP Port | Real-time MC                           | Real-time MC                           |
| 1                  | 30851   | 224.0.73.230                           | 233.65.120.22                          |
| 2                  | 30852   |                                        |                                        |
| 3                  | 30853   |                                        |                                        |
| 4                  | 30854   |                                        |                                        |
| 5                  | 30855   |                                        |                                        |
| 6                  | 30856   |                                        |                                        |
| 7                  | 30857   |                                        |                                        |
| 8                  | 30858   |                                        |                                        |
| 9                  | 30859   |                                        |                                        |
| 10                 | 30860   |                                        |                                        |
| 11                 | 30861   |                                        |                                        |
| 12                 | 30862   |                                        |                                        |
| 13                 | 30863   |                                        |                                        |
| 14                 | 30864   |                                        |                                        |
| 15                 | 30865   |                                        |                                        |
| 16                 | 30866   |                                        |                                        |
| 17                 | 30867   | 224.0.73.231                           | 233.65.120.23                          |
| 18                 | 30868   |                                        |                                        |
| 19                 | 30869   |                                        |                                        |
| 20                 | 30870   |                                        |                                        |
| 21                 | 30871   |                                        |                                        |
| 22                 | 30872   |                                        |                                        |
| 23                 | 30873   |                                        |                                        |
| 24                 | 30874   |                                        |                                        |
| 25                 | 30875   |                                        |                                        |
| 26                 | 30876   |                                        |                                        |
| 27                 | 30877   |                                        |                                        |
| 28                 | 30878   |                                        |                                        |
| 29                 | 30879   |                                        |                                        |
| 30                 | 30880   |                                        |                                        |
| 31                 | 30881   |                                        |                                        |

| Primary Datacenter |         | Gig-Shaped [OAB]<br>174.136.164.192/28 | Gig-Shaped [OBB]<br>174.136.164.208/28 |
|--------------------|---------|----------------------------------------|----------------------------------------|
| Unit               | IP Port | Real-time MC                           | Real-time MC                           |
| 32                 | 30882   |                                        |                                        |
| 33                 | 30883   |                                        |                                        |

Note - Cboe 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. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

| Secondary Datacenter |         | Gig-Shaped [OEB]<br>174.136.181.128/28 |
|----------------------|---------|----------------------------------------|
| Unit                 | IP Port | Real-time MC                           |
| 1                    | 31401   | 234.170.137.22                         |
| 2                    | 31402   |                                        |
| 3                    | 31403   |                                        |
| 4                    | 31404   |                                        |
| 5                    | 31405   |                                        |
| 6                    | 31406   |                                        |
| 7                    | 31407   |                                        |
| 8                    | 31408   |                                        |
| 9                    | 31409   |                                        |
| 10                   | 31410   |                                        |
| 11                   | 31411   |                                        |
| 12                   | 31412   |                                        |
| 13                   | 31413   |                                        |
| 14                   | 31414   |                                        |
| 15                   | 31415   |                                        |
| 16                   | 31416   |                                        |
| 17                   | 31417   | 234.170.137.23                         |
| 18                   | 31418   |                                        |
| 19                   | 31419   |                                        |
| 20                   | 31420   |                                        |
| 21                   | 31421   |                                        |
| 22                   | 31422   |                                        |
| 23                   | 31423   |                                        |
| 24                   | 31424   |                                        |
| 25                   | 31425   |                                        |
| 26                   | 31426   |                                        |
| 27                   | 31427   |                                        |
| 28                   | 31428   |                                        |
| 29                   | 31429   |                                        |
| 30                   | 31430   |                                        |
| 31                   | 31431   |                                        |

| Secondary Datacenter |         | Gig-Shaped [OEB]<br>174.136.181.128/28 |
|----------------------|---------|----------------------------------------|
| Unit                 | IP Port | Real-time MC                           |
| 32                   | 31432   |                                        |
| 33                   | 31433   |                                        |

Note - Cboe 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.

### C1 Options Address/Unit Distribution

The following tables describe the unit distribution across the C1 Complex Options Auction Multicast PITCH feeds.

| Primary Datacenter |         | Gig-Shaped [CAB]<br>170.137.114.80/28 | Gig-Shaped [CBB]<br>170.137.115.80/28 |
|--------------------|---------|---------------------------------------|---------------------------------------|
| Unit               | IP Port | Real-time MC                          | Real-time MC                          |
| 1                  | 30451   | 224.0.74.88                           | 233.182.199.216                       |
| 2                  | 30452   |                                       |                                       |
| 3                  | 30453   |                                       |                                       |
| 4                  | 30454   |                                       |                                       |
| 5                  | 30455   |                                       |                                       |
| 6                  | 30456   |                                       |                                       |
| 7                  | 30457   |                                       |                                       |
| 8                  | 30458   |                                       |                                       |
| 9                  | 30459   |                                       |                                       |
| 10                 | 30460   |                                       |                                       |
| 11                 | 30461   |                                       |                                       |
| 12                 | 30462   |                                       |                                       |
| 13                 | 30463   |                                       |                                       |
| 14                 | 30464   |                                       |                                       |
| 15                 | 30465   |                                       |                                       |
| 16                 | 30466   |                                       |                                       |
| 17                 | 30467   | 224.0.74.89                           | 233.182.199.217                       |
| 18                 | 30468   |                                       |                                       |
| 19                 | 30469   |                                       |                                       |
| 20                 | 30470   |                                       |                                       |
| 21                 | 30471   |                                       |                                       |
| 22                 | 30472   |                                       |                                       |
| 23                 | 30473   |                                       |                                       |
| 24                 | 30474   |                                       |                                       |
| 25                 | 30475   |                                       |                                       |
| 26                 | 30476   |                                       |                                       |
| 27                 | 30477   |                                       |                                       |
| 28                 | 30478   |                                       |                                       |

| Primary Datacenter |         | Gig-Shaped [CAB]<br>170.137.114.80/28 | Gig-Shaped [CBB]<br>170.137.115.80/28 |
|--------------------|---------|---------------------------------------|---------------------------------------|
| Unit               | IP Port | Real-time MC                          | Real-time MC                          |
| 29                 | 30479   |                                       |                                       |
| 30                 | 30480   |                                       |                                       |
| 31                 | 30481   |                                       |                                       |
| 32                 | 30482   |                                       |                                       |
| 33                 | 30483   |                                       |                                       |
| 34                 | 30484   |                                       |                                       |
| 35                 | 30485   |                                       |                                       |

Note - Cboe 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. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

| Secondary Datacenter |         | Gig-Shaped [CEB]<br>170.137.124.224/28 |
|----------------------|---------|----------------------------------------|
| Unit                 | IP Port | Real-time MC                           |
| 1                    | 31451   | 233.19.3.248                           |
| 2                    | 31452   |                                        |
| 3                    | 31453   |                                        |
| 4                    | 31454   |                                        |
| 5                    | 31455   |                                        |
| 6                    | 31456   |                                        |
| 7                    | 31457   |                                        |
| 8                    | 31458   |                                        |
| 9                    | 31459   |                                        |
| 10                   | 31460   |                                        |
| 11                   | 31461   |                                        |
| 12                   | 31462   |                                        |
| 13                   | 31463   |                                        |
| 14                   | 31464   |                                        |
| 15                   | 31465   |                                        |
| 16                   | 31466   |                                        |
| 17                   | 31467   | 233.19.3.249                           |
| 18                   | 31468   |                                        |
| 19                   | 31469   |                                        |
| 20                   | 31470   |                                        |
| 21                   | 31471   |                                        |
| 22                   | 31472   |                                        |
| 23                   | 31473   |                                        |
| 24                   | 31474   |                                        |
| 25                   | 31475   |                                        |
| 26                   | 31476   |                                        |

| Secondary Datacenter |         | Gig-Shaped [CEB]<br>170.137.124.224/28 |
|----------------------|---------|----------------------------------------|
| Unit                 | IP Port | Real-time MC                           |
| 27                   | 31477   |                                        |
| 28                   | 31478   |                                        |
| 29                   | 31479   |                                        |
| 30                   | 31480   |                                        |
| 31                   | 31481   |                                        |
| 32                   | 31482   |                                        |
| 33                   | 31483   |                                        |
| 34                   | 31484   |                                        |
| 35                   | 31485   |                                        |

Note - Cboe 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.

## C2 Options Address/Unit Distribution

The following tables describe the unit distribution across the C2 Complex Options Auction Multicast PITCH feeds.

| Primary Datacenter |         | Gig-Shaped [WAB]<br>174.136.164.64/28 | Gig-Shaped [WBB]<br>174.136.164.80/28 |
|--------------------|---------|---------------------------------------|---------------------------------------|
| Unit               | IP Port | Real-time MC                          | Real-time MC                          |
| 1                  | 30401   | 224.0.131.162                         | 233.130.124.162                       |
| 2                  | 30402   |                                       |                                       |
| 3                  | 30403   |                                       |                                       |
| 4                  | 30404   |                                       |                                       |
| 5                  | 30405   |                                       |                                       |
| 6                  | 30406   |                                       |                                       |
| 7                  | 30407   |                                       |                                       |
| 8                  | 30408   |                                       |                                       |
| 9                  | 30409   |                                       |                                       |
| 10                 | 30410   |                                       |                                       |
| 11                 | 30411   |                                       |                                       |
| 12                 | 30412   |                                       |                                       |
| 13                 | 30413   |                                       |                                       |
| 14                 | 30414   |                                       |                                       |
| 15                 | 30415   |                                       |                                       |
| 16                 | 30416   |                                       |                                       |
| 17                 | 30417   | 224.0.131.163                         | 233.130.124.163                       |
| 18                 | 30418   |                                       |                                       |
| 19                 | 30419   |                                       |                                       |
| 20                 | 30420   |                                       |                                       |
| 21                 | 30421   |                                       |                                       |

| Primary Datacenter |         | Gig-Shaped [WAB]<br>174.136.164.64/28 | Gig-Shaped [WBB]<br>174.136.164.80/28 |
|--------------------|---------|---------------------------------------|---------------------------------------|
| Unit               | IP Port | Real-time MC                          | Real-time MC                          |
| 22                 | 30422   |                                       |                                       |
| 23                 | 30423   |                                       |                                       |
| 24                 | 30424   |                                       |                                       |
| 25                 | 30425   |                                       |                                       |
| 26                 | 30426   |                                       |                                       |
| 27                 | 30427   |                                       |                                       |
| 28                 | 30428   |                                       |                                       |
| 29                 | 30429   |                                       |                                       |
| 30                 | 30430   |                                       |                                       |
| 31                 | 30431   |                                       |                                       |
| 32                 | 30432   |                                       |                                       |
| 33                 | 30433   |                                       |                                       |

Note - Cboe 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. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

| Secondary Datacenter |         | Gig-Shaped [WEB]<br>170.137.17.96/29 |
|----------------------|---------|--------------------------------------|
| Unit                 | IP Port | Real-time MC                         |
| 1                    | 31401   | 233.182.199.112                      |
| 2                    | 31402   |                                      |
| 3                    | 31403   |                                      |
| 4                    | 31404   |                                      |
| 5                    | 31405   |                                      |
| 6                    | 31406   |                                      |
| 7                    | 31407   |                                      |
| 8                    | 31408   |                                      |
| 9                    | 31409   |                                      |
| 10                   | 31410   |                                      |
| 11                   | 31411   |                                      |
| 12                   | 31412   |                                      |
| 13                   | 31413   |                                      |
| 14                   | 31414   |                                      |
| 15                   | 31415   |                                      |
| 16                   | 31416   |                                      |
| 17                   | 31417   | 233.182.199.113                      |
| 18                   | 31418   |                                      |
| 19                   | 31419   |                                      |
| 20                   | 31420   |                                      |
| 21                   | 31421   |                                      |

| Secondary Datacenter |         | Gig-Shaped [WEB]<br>170.137.17.96/29 |
|----------------------|---------|--------------------------------------|
| Unit                 | IP Port | Real-time MC                         |
| 22                   | 31422   |                                      |
| 23                   | 31423   |                                      |
| 24                   | 31424   |                                      |
| 25                   | 31425   |                                      |
| 26                   | 31426   |                                      |
| 27                   | 31427   |                                      |
| 28                   | 31428   |                                      |
| 29                   | 31429   |                                      |
| 30                   | 31430   |                                      |
| 31                   | 31431   |                                      |
| 32                   | 31432   |                                      |
| 33                   | 31433   |                                      |

Note - Cboe 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.

### EDGX Options Address/Unit Distribution

The following tables describe the unit distribution across the EDGX Complex Options Auction Multicast PITCH feeds.

| Primary Datacenter |         | Gig-Shaped [EAB]<br>174.136.164.32/28 | Gig-Shaped [EBB]<br>174.136.164.48/28 |
|--------------------|---------|---------------------------------------|---------------------------------------|
| Unit               | IP Port | Real-time MC                          | Real-time MC                          |
| 1                  | 30651   | 224.0.131.160                         | 233.130.124.160                       |
| 2                  | 30652   |                                       |                                       |
| 3                  | 30653   |                                       |                                       |
| 4                  | 30654   |                                       |                                       |
| 5                  | 30655   |                                       |                                       |
| 6                  | 30656   |                                       |                                       |
| 7                  | 30657   |                                       |                                       |
| 8                  | 30658   |                                       |                                       |
| 9                  | 30659   |                                       |                                       |
| 10                 | 30660   |                                       |                                       |
| 11                 | 30661   |                                       |                                       |
| 12                 | 30662   |                                       |                                       |
| 13                 | 30663   |                                       |                                       |
| 14                 | 30664   |                                       |                                       |
| 15                 | 30665   |                                       |                                       |
| 16                 | 30666   |                                       |                                       |
| 17                 | 30667   | 224.0.131.161                         | 233.130.124.161                       |
| 18                 | 30668   |                                       |                                       |

| Primary Datacenter |         | Gig-Shaped [EAB]<br>174.136.164.32/28 | Gig-Shaped [EBB]<br>174.136.164.48/28 |
|--------------------|---------|---------------------------------------|---------------------------------------|
| Unit               | IP Port | Real-time MC                          | Real-time MC                          |
| 19                 | 30669   |                                       |                                       |
| 20                 | 30670   |                                       |                                       |
| 21                 | 30671   |                                       |                                       |
| 22                 | 30672   |                                       |                                       |
| 23                 | 30673   |                                       |                                       |
| 24                 | 30674   |                                       |                                       |
| 25                 | 30675   |                                       |                                       |
| 26                 | 30676   |                                       |                                       |
| 27                 | 30677   |                                       |                                       |
| 28                 | 30678   |                                       |                                       |
| 29                 | 30679   |                                       |                                       |
| 30                 | 30680   |                                       |                                       |
| 31                 | 30681   |                                       |                                       |
| 32                 | 30682   |                                       |                                       |
| 33                 | 30683   |                                       |                                       |

Note - Cboe 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. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

| Secondary Datacenter |         | Gig-Shaped [EEB]<br>174.136.176.144/28 |
|----------------------|---------|----------------------------------------|
| Unit                 | IP Port | Real-time MC                           |
| 1                    | 31651   | 233.19.3.144                           |
| 2                    | 31652   |                                        |
| 3                    | 31653   |                                        |
| 4                    | 31654   |                                        |
| 5                    | 31655   |                                        |
| 6                    | 31656   |                                        |
| 7                    | 31657   |                                        |
| 8                    | 31658   |                                        |
| 9                    | 31659   |                                        |
| 10                   | 31660   |                                        |
| 11                   | 31661   |                                        |
| 12                   | 31662   |                                        |
| 13                   | 31663   |                                        |
| 14                   | 31664   |                                        |
| 15                   | 31665   |                                        |
| 16                   | 31666   |                                        |
| 17                   | 31667   | 233.19.3.145                           |
| 18                   | 31668   |                                        |

| Secondary Datacenter |         | Gig-Shaped [EEB]<br>174.136.176.144/28 |
|----------------------|---------|----------------------------------------|
| Unit                 | IP Port | Real-time MC                           |
| 19                   | 31669   |                                        |
| 20                   | 31670   |                                        |
| 21                   | 31671   |                                        |
| 22                   | 31672   |                                        |
| 23                   | 31673   |                                        |
| 24                   | 31674   |                                        |
| 25                   | 31675   |                                        |
| 26                   | 31676   |                                        |
| 27                   | 31677   |                                        |
| 28                   | 31678   |                                        |
| 29                   | 31679   |                                        |
| 30                   | 31680   |                                        |
| 31                   | 31681   |                                        |
| 32                   | 31682   |                                        |
| 33                   | 31683   |                                        |

Note - Cboe 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.

## Certification Environment Configuration

### U.S. Options Unit/Product Distribution

| Unit | BZX/C1/C2/EDGX Symbol Range | Exceptions           |
|------|-----------------------------|----------------------|
| 1    | A - AIPA~                   |                      |
| 2    | AIPB - AO~                  |                      |
| 3    | AP - AVGO~                  |                      |
| 4    | AVGP - BOIL~                |                      |
| 5    | BOIM - CMPR~                | Excludes CBTX, CBTXW |
| 6    | CMPS - CSIQ~                |                      |
| 7    | CSIR - DJTA~                |                      |
| 8    | DJTB - FARO~                | Excludes DJX, DJXW   |
| 9    | FARP - GLC~                 |                      |
| 10   | GLD - HAYW~                 |                      |
| 11   | HAYX - IYWA~                | Excludes IWM         |
| 12   | IYWB - LMTA~                |                      |
| 13   | LMTB - MES~                 | Excludes MBTX, MBTXW |
| 14   | MET - MRM~                  | Excludes MGTN, MGTNW |
| 15   | MRN - MSTR~                 | Excludes MRUT        |
| 16   | MSTS - NKEA~                | Excludes NANOS       |
| 17   | NKEB - PDC~                 | Excludes NVDA, OEX   |

| Unit | BZX/C1/C2/EDGX Symbol Range | Exceptions                                                           |
|------|-----------------------------|----------------------------------------------------------------------|
| 18   | PDD - RDDS~                 | Excludes QQQ                                                         |
| 19   | RDDT - SEAA~                | Excludes RLG, RLV, RUI, RUT/RUTW                                     |
| 20   | SEAB - SMHA~                | Excludes SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY |
| 21   | SMHB - TEQ~                 | Excludes SPEQX, SPESG, SPX/SPXW, SPY                                 |
| 22   | TER - TTC~                  | Excludes TSLA                                                        |
| 23   | TTD - VB~                   | Excludes UKXM                                                        |
| 24   | VC - WYNN~                  | Excludes VIX, VIXW                                                   |
| 25   | WYNO - Z~                   | Excludes XEO, XSP, XSPBW                                             |
| 26   | NVDA                        |                                                                      |
| 27   | TSLA                        |                                                                      |
| 28   | QQQ                         |                                                                      |
| 29   | IWM                         |                                                                      |
| 30   | SPY                         |                                                                      |

**Table 1. Units 31-35**

| Unit | BZX/C2 Symbol Range                                                  | C1 Symbol Range                                                                                                                                                             |
|------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31   | DJX (C2 Only), DJXW (C2 Only), RUT (BZX and C2 Only), RUTW (C2 Only) | CBTX, CBTXW, DJX, DJXW, MBTX, MBTXW, MGTN, MGTNW, MRUT, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPEQX, SPESG, UKXM, XEO |
| 32   | N/A                                                                  | NANOS, VIX, VIXW, XSP, XSPBW                                                                                                                                                |
| 33   | N/A                                                                  | SPX                                                                                                                                                                         |
| 34   | N/A                                                                  | SPXW                                                                                                                                                                        |
| 35   | N/A                                                                  | SPX/SPXW, Cross Product Spreads                                                                                                                                             |

Note - Cboe reserves the right to add units and/or change symbol distribution with 48 hours of notice and 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.

## Multicast Routing Parameters

| Primary Certification Data Center | Rendezvous Point |
|-----------------------------------|------------------|
| C1                                | 74.115.128.131   |
| C2, EDGX, and BZX                 | 74.115.128.129   |

## BZX Options Address/Unit Distribution

The following table describes the unit distribution across certification BZX Options Complex Auction Multicast PITCH feeds out of the Primary datacenter.

| Primary Datacenter |         | Certification<br>174.136.164.224/28 |
|--------------------|---------|-------------------------------------|
| Unit               | IP Port | Real-time MC                        |
| 1                  | 32651   | 224.0.62.230                        |
| 2                  | 32652   |                                     |

| Primary Datacenter |         | Certification<br>174.136.164.224/28 |
|--------------------|---------|-------------------------------------|
| Unit               | IP Port | Real-time MC                        |
| 3                  | 32653   |                                     |
| 4                  | 32654   |                                     |
| 5                  | 32655   |                                     |
| 6                  | 32656   |                                     |
| 7                  | 32657   |                                     |
| 8                  | 32658   |                                     |
| 9                  | 32659   |                                     |
| 10                 | 32660   |                                     |
| 11                 | 32661   |                                     |
| 12                 | 32662   |                                     |
| 13                 | 32663   |                                     |
| 14                 | 32664   |                                     |
| 15                 | 32665   |                                     |
| 16                 | 32666   |                                     |
| 17                 | 32667   | 224.0.62.231                        |
| 18                 | 32668   |                                     |
| 19                 | 32669   |                                     |
| 20                 | 32670   |                                     |
| 21                 | 32671   |                                     |
| 22                 | 32672   |                                     |
| 23                 | 32673   |                                     |
| 24                 | 32674   |                                     |
| 25                 | 32675   |                                     |
| 26                 | 32676   |                                     |
| 27                 | 32677   |                                     |
| 28                 | 32678   |                                     |
| 29                 | 32679   |                                     |
| 30                 | 32680   |                                     |
| 31                 | 32681   |                                     |
| 32                 | 32682   |                                     |
| 33                 | 32683   |                                     |

Note - Cboe 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.

## C1 Options Address/Unit Distribution

The following table describes the unit distribution across certification C1 Complex Auction Multicast PITCH feeds out of the Primary datacenter.

| Primary Datacenter |         | Certification<br>170.137.126.16/28 |
|--------------------|---------|------------------------------------|
| Unit               | IP Port | Real-time MC                       |
| 1                  | 32451   | 233.103.126.16                     |
| 2                  | 32452   |                                    |
| 3                  | 32453   |                                    |
| 4                  | 32454   |                                    |
| 5                  | 32455   |                                    |
| 6                  | 32456   |                                    |
| 7                  | 32457   |                                    |
| 8                  | 32458   |                                    |
| 9                  | 32459   |                                    |
| 10                 | 32460   |                                    |
| 11                 | 32461   |                                    |
| 12                 | 32462   |                                    |
| 13                 | 32463   |                                    |
| 14                 | 32464   |                                    |
| 15                 | 32465   |                                    |
| 16                 | 32466   |                                    |
| 17                 | 32467   | 233.103.126.17                     |
| 18                 | 32468   |                                    |
| 19                 | 32469   |                                    |
| 20                 | 32470   |                                    |
| 21                 | 32471   |                                    |
| 22                 | 32472   |                                    |
| 23                 | 32473   |                                    |
| 24                 | 32474   |                                    |
| 25                 | 32475   |                                    |
| 26                 | 32476   |                                    |
| 27                 | 32477   |                                    |
| 28                 | 32478   |                                    |
| 29                 | 32479   |                                    |
| 30                 | 32480   |                                    |
| 31                 | 32481   |                                    |
| 32                 | 32482   |                                    |
| 33                 | 32483   |                                    |
| 34                 | 32484   |                                    |
| 35                 | 32485   |                                    |

Note - Cboe 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.

## C2 Options Address/Unit Distribution

The following table describes the unit distribution across certification C2 Complex Auction Multicast PITCH feeds out of the Primary datacenter.

| Primary Datacenter |         | Certification<br>174.136.160.80/28 |
|--------------------|---------|------------------------------------|
| Unit               | IP Port | Real-time MC                       |
| 1                  | 32401   | 224.0.74.158                       |
| 2                  | 32402   |                                    |
| 3                  | 32403   |                                    |
| 4                  | 32404   |                                    |
| 5                  | 32405   |                                    |
| 6                  | 32406   |                                    |
| 7                  | 32407   |                                    |
| 8                  | 32408   |                                    |
| 9                  | 32409   |                                    |
| 10                 | 32410   |                                    |
| 11                 | 32411   |                                    |
| 12                 | 32412   |                                    |
| 13                 | 32413   |                                    |
| 14                 | 32414   |                                    |
| 15                 | 32415   |                                    |
| 16                 | 32416   |                                    |
| 17                 | 32417   | 224.0.74.159                       |
| 18                 | 32418   |                                    |
| 19                 | 32419   |                                    |
| 20                 | 32420   |                                    |
| 21                 | 32421   |                                    |
| 22                 | 32422   |                                    |
| 23                 | 32423   |                                    |
| 24                 | 32424   |                                    |
| 25                 | 32425   |                                    |
| 26                 | 32426   |                                    |
| 27                 | 32427   |                                    |
| 28                 | 32428   |                                    |
| 29                 | 32429   |                                    |
| 30                 | 32430   |                                    |
| 31                 | 32431   |                                    |
| 32                 | 32432   |                                    |
| 33                 | 32433   |                                    |

Note - Cboe 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.

## EDGX Options Address/Unit Distribution

The following table describes the unit distribution across certification EDGX Complex Auction Multicast PITCH feeds out of the Primary datacenter.

| Primary Datacenter |         | Certification<br>174.136.174.176/28 |
|--------------------|---------|-------------------------------------|
| Unit               | IP Port | Real-time MC                        |
| 1                  | 32651   | 224.0.74.188                        |
| 2                  | 32652   |                                     |
| 3                  | 32653   |                                     |
| 4                  | 32654   |                                     |
| 5                  | 32655   |                                     |
| 6                  | 32656   |                                     |
| 7                  | 32657   |                                     |
| 8                  | 32658   |                                     |
| 9                  | 32659   |                                     |
| 10                 | 32660   |                                     |
| 11                 | 32661   |                                     |
| 12                 | 32662   |                                     |
| 13                 | 32663   |                                     |
| 14                 | 32664   |                                     |
| 15                 | 32665   |                                     |
| 16                 | 32666   |                                     |
| 17                 | 32667   | 224.0.74.189                        |
| 18                 | 32668   |                                     |
| 19                 | 32669   |                                     |
| 20                 | 32670   |                                     |
| 21                 | 32671   |                                     |
| 22                 | 32672   |                                     |
| 23                 | 32673   |                                     |
| 24                 | 32674   |                                     |
| 25                 | 32675   |                                     |
| 26                 | 32676   |                                     |
| 27                 | 32677   |                                     |
| 28                 | 32678   |                                     |
| 29                 | 32679   |                                     |
| 30                 | 32680   |                                     |
| 31                 | 32681   |                                     |
| 32                 | 32682   |                                     |
| 33                 | 32683   |                                     |

Note - Cboe 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.

# Connectivity

## Supported Extranet Carriers

Cboe has certified a number of carriers defined in the [Cboe Titanium U.S. Equities/Options Connectivity Manual](#) with respect to redistribution of Cboe Multicast data feeds. For more information on receiving Multicast PITCH through any of these providers, reach out to the vendor contact noted in the Extranet Providers section of the Connectivity Manual.

## Bandwidth Recommendation

The Gig-shaped feeds require 1Gbps of bandwidth. Cboe will use 90% of these respective bandwidths for Multicast PITCH to allow customers to use the same physical connection for FIX order entry if desired.

## Multicast Test Program

The ZIP file [here](#) 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.

## References

For more information on Cboe Symbology, please see the [Cboe Titanium U.S. Symbology Reference](#).

## Support

Please direct questions or comments regarding this specification to [tradedesk@cboe.com](mailto:tradedesk@cboe.com).

## Revision History

| Document Version | Date     | Description                                                                                                                                                                                                                                                                                                                                    |
|------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.0.0            | 05/11/17 | Initial draft in support of Complex orders for EDGX Options Exchange. Based on Bats Multicast PITCH 2.X.                                                                                                                                                                                                                                       |
| 2.0.1            | 05/15/17 | Removed <b>Trading Status</b> message.                                                                                                                                                                                                                                                                                                         |
| 2.0.2            | 05/18/17 | Various minor updates and clarification added.                                                                                                                                                                                                                                                                                                 |
| 2.0.3            | 07/28/17 | Added Multicast Ips/Ports for Certification environment.                                                                                                                                                                                                                                                                                       |
| 2.0.4            | 08/08/17 | Added Multicast Ips/Ports for Production environment.                                                                                                                                                                                                                                                                                          |
| 2.0.5            | 09/01/17 | Added C2 Options references.                                                                                                                                                                                                                                                                                                                   |
| 2.0.6            | 10/17/17 | Cboe branding/logo changes.                                                                                                                                                                                                                                                                                                                    |
| 2.0.7            | 10/25/17 | Incorrect Multicast Feed IDs were fixed in sections 1.1, 6.1.5, and 6.1.6                                                                                                                                                                                                                                                                      |
| 2.0.8            | 11/24/17 | Auction Price is only valid for EDGX and will be set to zero for C2.<br>Added C2 Options Certification IP and Port information.<br>Added RUT, RUTW options (C2 Options Only) to distinct unit (unit 33).                                                                                                                                       |
| 2.0.9            | 02/05/18 | Update C2 Options IP and Port information.                                                                                                                                                                                                                                                                                                     |
| 2.0.10           | 03/08/18 | Updated Unit Distribution ranges.                                                                                                                                                                                                                                                                                                              |
| 2.0.11           | 03/23/18 | Unit Distribution ranges Effective Date updated to 4/14/18.                                                                                                                                                                                                                                                                                    |
| 2.1.0            | 11/16/18 | Added support for C1 Options.                                                                                                                                                                                                                                                                                                                  |
| 2.1.1            | 12/04/18 | Feature Pack 4 Updates.                                                                                                                                                                                                                                                                                                                        |
| 2.1.2            | 02/14/19 | Added certification IP port and unit distribution information.                                                                                                                                                                                                                                                                                 |
| 2.1.3            | 03/05/19 | Added matching engine unit 33 information in support of XSP trading on EDGX Options effective 04/08/19.<br>Added C1 certification primary data center rendezvous point IP address and C1 Certification symbol ranges.                                                                                                                          |
| 2.1.4            | 04/15/19 | Added C1 production IPs and units.<br>Added DJX to C2 ME 33 in Unit/Product Distribution tables (effective 05/08/19).                                                                                                                                                                                                                          |
| 2.1.5            | 05/08/19 | Corrected C1 Production Gig-Shaped [CAB] and [CBB] source network IP addresses.                                                                                                                                                                                                                                                                |
| 2.1.6            | 05/14/19 | Added <b>Composite Market Bid Price</b> and <b>Composite Market Offer Price</b> fields to the <b>Options Auction Update</b> message and updated associated example message.<br>Added additional proprietary products to matching unit 31 in C1.                                                                                                |
| 2.1.7            | 06/12/19 | Corrected cert. and prod. C1 symbol range for units 9 and 20.                                                                                                                                                                                                                                                                                  |
| 2.1.8            | 08/01/19 | Added note indicating <b>Options Auction Update</b> message <b>Opening Condition</b> field value will always be zero. Updated example message.<br>Corrected <b>Leg Count</b> field description in <b>Complex Instrument Definition Expanded</b> message to indicate a total of 12 legs are allowed.                                            |
| 2.1.9            | 09/18/19 | Updated OSI Symbol example values in <b>Symbol Mapping</b> and <b>Constituent Symbol Mapping</b> message type examples.                                                                                                                                                                                                                        |
| 2.1.10           | 08/27/20 | Corrected QQQ and UKXM symbol exclusion entries in Unit Distribution table.<br>Changed instances of Complex Instrument Definition to Complex Instrument Definition Expanded, as the former was deprecated 02/28/19.<br>Clarified description of <b>Time</b> message.<br>Added SPESG to C1 unit 31 Unit Distribution table (effective 9/21/20). |
| 2.1.11           | 10/06/20 | Added SPESG to the Unit Symbol Distribution table Exclusion entries for C1.                                                                                                                                                                                                                                                                    |
| 2.1.12           | 10/20/20 | Removed XSP from the Unit Symbol Distribution tables on EDGX (effective 11/2/20).                                                                                                                                                                                                                                                              |

| Document Version | Date     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.1.13           | 01/22/21 | Updated <b>Price</b> field description on <b>Auction Notification</b> message to indicate that for SPX and SPXW AIM on C1, this field will reflect the auction start price <b>(C1 Only)</b> (effective 02/22/21).                                                                                                                                                                                                                                                                                                                       |
| 2.1.14           | 02/01/21 | Added MRUT to Unit/Symbol Distribution tables for C1 unit 31 (effective 03/01/21).<br>Added new updated Unit/Symbol Distribution tables with harmonized symbol ranges (effective 03/22/21).                                                                                                                                                                                                                                                                                                                                             |
| 2.1.15           | 03/25/21 | Updated the Unit Symbols Distribution Exceptions entries (effective 3/22/21).<br>Added Binary Date field type to Section 2.2 - Data Types (effective 10/10/21 TBD 09/27/21 Q3 2021).<br>Added new <b>Time Reference</b> message (effective 10/10/21 TBD 09/27/21 Q3 2021).<br>Added <b>EpochTime</b> field to <b>Time</b> message (effective 10/10/21 TBD 09/27/21 Q3 2021).<br>Updated description of <b>Auction Type</b> field on <b>Options Auction Update</b> and <b>Auction Summary</b> messages (effective TBD 09/27/21 Q3 2021). |
| 2.1.16           | 05/13/21 | Updated Curb session effective date to 02/07/22 TBD 09/27/21.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2.1.17           | 06/08/21 | Noted in <b>Complex Instrument Definition Expanded</b> message that a total of 16 legs are allowed (effective 08/25/21 08/09/21).                                                                                                                                                                                                                                                                                                                                                                                                       |
| 2.1.18           | 08/02/21 | Updated the effective date in the <b>Complex Instrument Definition Expanded</b> message that a total of 16 legs are allowed (effective 08/25/21).                                                                                                                                                                                                                                                                                                                                                                                       |
| 2.1.19           | 08/27/21 | Updated Curb session effective date to TBD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 2.1.20           | 09/09/21 | Updated description of <b>Auction Type</b> field on <b>Options Auction Update</b> and <b>Auction Summary</b> messages (effective TBD).                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2.1.21           | 09/30/21 | Updated effective date for new <b>Time Reference</b> message <b>(C1 Only)</b> , <b>EpochTime</b> field to <b>Time</b> message <b>(C1 Options Only)</b> , and Binary Date field type to Section 2.2 - Data Types to 10/10/21.<br>Added new section 1.2 - '24x5 Feed Hours and System Restart <b>(C1 Only)</b> (effective 10/10/21).                                                                                                                                                                                                      |
| 2.1.22           | 11/4/21  | Corrected example <b>Time</b> message values.<br>Removed note indicating <b>Auction Type</b> value O will be sent prior to Curb session. This value will only be sent for the RTH Opening.                                                                                                                                                                                                                                                                                                                                              |
| 2.1.23           | 02/02/22 | Added NANOS to the C1 unit 32 Unit/Product Distribution tables (effective 03/14/22).                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 2.1.24           | 03/01/22 | Removed XSP from the BZX unit 31 Unit/Product Distribution tables.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 2.1.25           | 11/07/22 | Moved XSP to the C1 unit 32 Unit/Production Distribution tables (effective 12/04/22).                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2.1.26           | 03/30/23 | Clarified RUT is on BZX and C2 Unit 31.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 2.1.27           | 01/29/24 | Added MXACW, MXUSA, and MXWLD to unit 31 Unit/Product Distribution tables (effective 03/18/24).                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2.1.28           | 11/22/24 | Added CBTX, CBTXW, MBTX, and MBTXW to unit 31 Unit/Product Distribution tables (effective 12/02/24).                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 2.2.29           | 12/13/24 | Added new Unit/Product Distribution for Units 1-30 (effective 03/31/25).                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 2.2.30           | 01/15/25 | Updated with Cboe Titanium branding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 2.2.31           | 03/25/25 | Added SPEQX to C1 unit 31 <a href="#">unit/product distribution</a> (effective 04/14/25).                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 2.2.32           | 07/08/25 | Added Time Offset data type. Effective 09/08/25, Time Offset fields will be populated to nanosecond precision.                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 2.2.33           | 07/24/25 | Specification updated to indicate complex functionality is available for all Cboe Options Exchanges, with BZX Options complex functionality effective on 10/13/25.                                                                                                                                                                                                                                                                                                                                                                      |
| 2.2.34           | 08/13/25 | Updated Secondary Datacenter IP ports in <a href="#">BZX Options Address/Unit Distribution</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| Document Version | Date     | Description                                                                                                                                                                                                                                               |
|------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2.2.35           | 10/14/25 | Updated <a href="#">BZX Options Address/Unit Distribution table</a> headers from Gig-Shaped [CAB], Gig-Shaped [CBB], and Gig-Shaped [CEB], to Gig-Shaped [OAB], Gig-Shaped [OBB], and Gig-Shaped [OEB].                                                   |
| 2.2.36           | 10/20/25 | Added MGTN and MGTNW to unit 31 in <a href="#">US Options Unit/Product Distribution</a> and excluded MGTN and MGTNW from unit 14 (effective 12/08/25 <del>TBD 11/17/25</del> .)                                                                           |
| 2.2.37           | 11/06/25 | Updated MGTN and MGTNW effective date to <del>TBD</del> .                                                                                                                                                                                                 |
| 2.2.38           | 11/18/25 | Updated MGTN and MGTNW effective dates to 12/08/25.                                                                                                                                                                                                       |
| 2.2.39           | 01/12/26 | Updated <a href="#">24x5 Feed Hours and System Restart</a> to document the new time at which persisted orders are added back into the order book (effective 02/02/26).                                                                                    |
| 2.2.40           | 1/13/26  | Added C = SCOA to <b>Auction Type</b> on the Auction Notification Message (effective TBD <del>05/18/26</del> TBD).                                                                                                                                        |
| 2.2.41           | 04/01/26 | Removed references to MXEA, MXEF, MXACW, MXUSA, and MXWLD.<br>Updated <b>Time</b> description in <b>Time</b> and <b>Time Reference</b> messages.<br>Added XSPBW to C1 unit 32 Unit/Product Distribution tables (effective 06/15/26 <del>06/01/26</del> ). |
| 2.2.42           | 04/06/26 | Updated effective date to TBD <del>05/18/26</del> : Added C = SCOA to <b>Auction Type</b> on the Auction Notification Message.                                                                                                                            |
| 2.2.43           | 05/14/26 | Updated effective date to TBD: Added C = SCOA to <b>Auction Type</b> on the Auction Notification Message.<br>Updated XSPBW effective date to 06/15/26.<br>Updated U.S. Options Unit/Product Distribution to include DJXW(effective 05/18/26).             |
| 2.2.44           | 07/21/26 | Removed VIX and VIXW exclusion from unit 23 and added VIX and VIXW exclusion to unit 24 U.S. Options Unit/Product Distribution tables.                                                                                                                    |