



Network

SOLA® Network Connection Specifications for BOX

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Section 1 Introduction

This **Network Connection Specifications** document outlines the specifications and requirements for clients to connect to the Boston Options Exchange (BOX) trading networks. This document was produced by the Technology division of the Montreal Exchange Inc., a member of the TMX Group Inc.

1.1 Intended Audience

This document targets business, programmer, and network analysts who are responsible for determining the technical solutions needed to receive the BOX multicast feeds.

1.2 Scope

This document covers the following topics:

- Connectivity
- HSVF multicast
- Points of Presence (POP) sites
- Routing information

1.3 Related Documents

- HSVF-BX-002E BOX SOLA HSVF Multicast Specifications Guide

1.4 BOX Contact

Market Operation Center Support / Technical Help Desk
Toll Free: 1-866-768- 8845
boxmoc@boxoptions.com

Section 2 Connectivity

Clients can obtain access to the BOX test and production environments through separate production and test networks. Clients (Providers) will need to connect to one or both depending on their needs.

2.1 Applications

Main applications available through the BOX network are summarized in Table 1:

Table 1: Applications Available Through BOX

Service Name	Description
SAIL	The native gateway for order and quote entry on BOX.
FIX	The FIX gateway for order entry on BOX.
BOX-HSVF	BOX High Speed Vendor Feed: The outbound market data feed.
BOX-ATR	BOX Automated Trade Reporting feed, to provide participants with 'drop copies' of all their trades on BOX.
TMS	Trade Management System to manage the post-trading operation.
Reports	Various Participant reports available on BOX ftp server.

2.2 Test Access

The BOX test environment is located on a test network, separate from the production network. Clients will require a separate test connection to access the BOX test system. Access to the BOX test environment can be obtained using the following connectivity options:

- VPN: Access through the Internet is available.
- Third party networks: BT Radianz offers access to the BOX test network. (*Please specify clearly that access to the BOX Test Environment is being requested.*)

Access to the test environment is NOT available from the BOX production network.

2.3 Production Access

To gain access to the BOX production trading services, clients must obtain a connection to the BOX production network. VPN connections to the production network **will not** be accepted. Access to the production network can be obtained by one of the following methods.

2.3.1 Direct Connect

A direct connection can be made to one or more of the BOX Points of Presence sites. A list of the POP sites is available in [Section 4](#).

Network Connectivity

Physical connectivity to the BOX production network is provided by an Ethernet connection (gigabit or 10 gigabit).

Redundancy

BOX can accept multiple connections for redundancy. At each location, BOX has redundant equipment and can therefore provide diverse connections to the BOX production network. For added redundancy, a client may also install redundant links to different POP sites.

2.3.2 Third Party Networks

A 3rd Party Network Provider is a provider who provides a shared access to the BOX production network through a single (redundant) network connection.

For a list of 3rd Party Network Providers offering connectivity to BOX, please visit our website at <http://boxexchange.com/technology/connectivity>.

2.4 Bandwidth Requirements

Bandwidth requirements are determined by the type of traffic the client requires:

Table 2: Bandwidth Requirements

Type of Traffic	Recommended Bandwidth
Simple order routing	128 kbps
Market maker quoting	24 kb/quote/sec
HSVF Market Feed - Best Limit (all classes)	500 mbps
HSVF Market Feed - Five Best Limits (all classes)	1 Gbps

Note: For testing purposes, 64bps is sufficient.

2.5 WAN IP Addressing

The network device peer addresses assigned to the Ethernet links that connect the client equipment to the BOX trading network will be assigned by BOX unless clients supply their own addresses.

2.6 Host IP Addressing

The client must provide the IP addresses of its hosts that will connect to the BOX applications. If possible, the clients should supply public IP addresses assigned to them by the IANA. If public IP addresses are not available to the client, then the client may choose to use private (non-routable) addresses from the reserved IP address ranges as outlined in RFC1597 under the condition that the addresses do not conflict with any addresses currently used on the BOX networks.

2.7 IP Routing

Typically, IP routing will be done using either static routes or Border Gateway Protocol (BGP). Details are to be discussed with our technical network staff.

2.8 Network Security

The BOX trading networks and hosts are protected by the use of packet filtering and firewalls. Security measures in place are meant to protect the BOX trading networks and hosts from intentional or accidental access from client connections. These measures are in no way intended to provide security to the clients themselves. If clients feel they require additional security for their networks, they are encouraged to put in place the security measures deemed appropriate.

Section 3 HSVF Multicast Specifications

3.1 HSVF Multicast Feeds

The multicast version of the BOX HSVF feed is divided into separate multicast lines for each trading slice shown in Table 3: that clients may subscribe to.

Table 3: HSVF Multicast Feeds

Description	Line Designation
Level 1 (best limit)	s1 (s specifies the trading slice)
Level 5 (5 limits)	s5 (s specifies the trading slice)
PIP only	sP (s specifies the trading slice)
Strategy only	sC (s specifies the trading slice)

To ensure resiliency, two instances of the feed are available: “A” and “B” feeds. Both offer identical data and clients can choose to receive either or both.

3.2 Multicast Routing

The BOX multicast network uses PIM sparse mode (PIM-SM) exclusively. PIM dense mode (PIM-DM) or static Internet Group Management Protocol (IGMP) joins are not supported.

PIM-SM requires the use of a Rendezvous Point (RP) towards which client routers forward multicast join requests. Separate RPs are made available in the Secaucus and Chicago locations.

Each feed is sourced from an address range specific to its source location. For optimum multicast routing, clients are expected to support the creation of shortest path trees (SPT). This will ensure the lowest latency, most efficient reception of the feeds as well as allow clients to control the redundant reception of both A and B feeds.

Optimal feed reception ultimately depends on the source tree determined from the client's router point of view. The location from which clients receive a feed will depend on the routes to the source address range contained within the client router's unicast routing table. Clients' unicast routing tables must be accurate in order to ensure they receive the feeds from their intended location.

To aid clients in obtaining the multicast feeds from the desired locations, appropriate routes will be advertised to the client routers via BGP. Clients must configure their network equipment to accept the desired routes from their preferred locations and thus determine the unicast routing table that will be used to create the source tree back to the feed sources. Please refer to [Connection Details](#) for route details.

3.3 Disaster Recovery

If BOX needs to run from its Disaster Recovery (DR) site, the multicast feeds will only be available from the Chicago location.

3.4 Message Recovery (Retransmission)

Two options are available to clients to recover lost messages:

- Feed arbitration
- TCP retransmission

3.4.1 Feed Arbitration

Feed arbitration offers the quickest way to recover lost messages. Clients may read both “A” and “B” instances of the feed simultaneously. Since both feeds disseminate identical data, if a gap is experienced on one feed, the client’s application should be able to retrieve the missing message(s) from the other feed.

3.4.2 TCP Retransmission

Otherwise, clients may connect to recovery servers and request the missing messages. This service is offered over TCP and is available in Secaucus and Chicago locations.

For redundancy, two recovery servers are provided at the location. Either server can be used to retrieve missing messages as the recovery systems are not tied to any particular feed. Since both the A and B feeds are identical, clients can connect to any recovery server to retrieve missing messages.

If a recovery server is not available (due to a technical issue), clients must connect to the alternate server to request message retransmission.

3.5 Test Access

To provide an environment in which participants can test their applications, the BOX multicast services are also available from the BOX test environment, though there are some caveats.

The purpose of the test environment is to perform functional testing. The test environment does not offer any performance testing capabilities.

3.5.1 VPN Limitations

Multicast distribution is not compatible with VPN technology making it impossible to send a multicast feed to clients connected via VPN. Since a majority of BOX clients connect to the test environment via VPN connections, an alternate approach is required.

3.5.2 Test Multicast Feeds

Due to the VPN limitation, BOX test multicast feeds are available directly from the Secaucus POP site. Clients can choose to receive the test multicast feeds over their production connections.

To ensure that test traffic does not impact production traffic, the test feeds are rate limited.

Two separate instances of the multicast feeds are offered:

- Test environment 1 (ISV-1)
- Test environment 2 (ISV-2)

The environment to be used by the client depends on its availability and BOX services being tested. The environment that the client should use will be specified by BOX at the time a client makes arrangements to set up a test session.

3.5.3 Retransmission

There are no issues with using the TCP based retransmission services over a VPN connection. For this reason, test TCP retransmission services will be available from the test environment only.

Similarly to the test multicast feeds, two instances are offered:

- Test environment 1 (ISV-1)
- Test environment 2 (ISV-2)

The environment to be used by the client will be determined by BOX at the time the testing occurs.

Clients need to certify against the retransmission services prior to obtaining access to production retransmission services.

3.6 Multicast Bandwidth

The bandwidth figures shown in Table 2: provide throughput (per second) estimates. Multicast feeds may experience microbursts of activity at rates that surpass the bandwidth recommendations. Depending on participant bandwidth, feed data being received, and network device buffers, some participants may experience message loss when microbursts occur. Table 4: guides participants in identifying circumstances more likely to result in message loss.

Table 4: Message Loss per Feed and Bandwidth Limits

Feed Received	Participant Connection Type	
	1 Gigabit (per second)	10 Gigabit (per second)
Best Limit (s1)	Unlikely	Unlikely
5 Limits (s5)	Possible	Unlikely
PIP only (sP)	Unlikely	Unlikely
Strategy only (sC)	Unlikely	Unlikely

Section 4 Point of Presence Sites

There are two (2) sites available to connect to the BOX production network. No test connections will be accepted to these sites.

4.1 Secaucus Site (Equinix NY4)

The Secaucus site is located at:

Boston Options Exchange
C/o Equinix
755 Secaucus Road
Secaucus, NJ, 07094
NPA-NXX: 201-864
Support 1 gigabit and 10 gigabit connections
Site Contact: Pam Ilardo at (571) 449-5151

4.2 Chicago Site (Equinix CH1)

The Chicago site is located at:

Boston Options Exchange
C/o Equinix
350 East Cermak Road, 6th Floor Ste 650
Chicago, IL, 60616
NPA-NXX: 312-225
Support 1 gigabit and 10 gigabit connections

Appendix A Connection Details

This appendix describes the connection details for both the test and production networks.

A.1 VPN Connections

VPN access is available to the BOX test environment only. Typically, VPN connections are setup in tunnel mode between the client's VPN device and the BOX VPN routers. Over the VPN connection, traffic will be routed between the client's internal hosts and the BOX test hosts. To initiate a VPN connection, the client must have a fixed Internet reachable IP address to be able to pass through BOX's firewalls. For VPN connections, the ISAKMP policies listed in Table 5: are accepted.

Table 5: VPN Connections Policies

Policy 1	
Encryption:	Advanced Encryption Standard (AES) [128 / 192 / 256 bits]
Hash:	SHA [256 / 384 / 512]
Authentication:	Pre-shared key
Diffie-Hellman group:	Group 14 and above (minimum 2048 bit)
Lifetime:	7200 seconds
Policy 2	
Encryption:	Advanced Encryption Standard (AES) [128 / 192 / 256 bits]
Hash:	SHA [256 / 384 / 512]
Authentication:	Pre-shared key
Diffie-Hellman group:	Group 14 and above (minimum 2048 bit)
Lifetime:	7200 seconds

A.2 Production Connections

For production connections, the client is responsible for ordering the appropriate telecommunications lines and/or cross connects and terminating equipment (typically routers). If required, 4RU of cabinet space will be provided in the BOX data cabinets for the client equipment. Equipment needs to be rack mountable in a standard 19" cabinet.

A.3 Setting-up Connections to Secaucus Site (Equinix NY4)

Clients already present at Equinix NY4 can order a cross connect to BOX:

- BOX cage # 08765 for Equinix NY4
- Deliver to next available patch panel port

When Equinix completes their cross connects, they will provide the client with cross connect details (cable ID, patch panel port, etc). BOX needs this information in order to complete the connection at BOX end. There are several choices for cross connects:

- Single mode fiber
- Multi-mode fiber. For multi-mode, the fiber size is important (50 micron or 62.5 micron)

BOX supports both models but needs to know which one in order to match the patch cord.

Clients who are not at Equinix NY4 and wish to connect to BOX at the NY4 location, must order telecommunications lines.

Clients need to provide BOX with the details for their lines once installed; the provider name, cage, patch panel, port, and type of connection (fiber, coax, etc). The information can be found on the DLR from their provider. Based on that information, BOX can order cross connects for their circuit to BOX cage.

BOX only accepts Ethernet connections directly on BOX equipment. For any other type of circuit, the client needs to provide a router to terminate their line. Clients must ship the equipment (see [section 4.1](#)) and BOX will arrange to have it installed in the appropriate BOX cabinet. Clients must provide BOX with installation instructions (which cables go in which interfaces, etc). All equipment needs to be rack mountable.

When shipping equipment to BOX, clients need to advise BOX so that a ticket with Equinix can be opened. Otherwise, Equinix may refuse the shipment. The following information must be included in the ticket:

- Sender
- Number of boxes
- Delivery company
- Tracking number

A.4 Setting-up Connections to Chicago Site (Equinix CH1)

Clients already present at Equinix CH1 can order a cross connect to BOX:

- BOX cage # 950 for Equinix CH1
- Deliver to next available patch panel port

When Equinix completes their cross connects, they will provide the client with cross connect details (cable ID, patch panel port, etc). BOX needs this information in order to complete the connection at BOX end. There are several choices for cross connects:

- Single mode fiber
- Multi-mode fiber. For multi-mode, the fiber size is important (50 micron or 62.5 micron)

BOX supports both models but needs to know which one in order to match the patch cord.

Clients who are not at Equinix CH1 and wish to connect to BOX at the CH1 location, must order telecommunications lines.

Clients need to provide BOX with the details for their lines once installed; the provider name, cage, patch panel, port, and type of connection (fiber, coax, etc). The information can be found on the DLR from their provider. Based on that information, BOX can order cross connects for their circuit to BOX cage.

BOX only accepts Ethernet connections directly on BOX equipment. For any other type of circuit, the client needs to provide a router to terminate their line. Clients must ship the equipment (see [section 4.2](#)) and BOX will arrange to have it installed in the appropriate BOX cabinet. Clients must provide BOX with installation instructions (which cables go in which interfaces, etc). All equipment needs to be rack mountable.

When shipping equipment to BOX, clients need to advise BOX so that a ticket with Equinix can be opened. Otherwise, Equinix may refuse the shipment. The following information must be included in the ticket:

- Sender
- Number of boxes
- Delivery company
- Tracking number

Appendix B Multicast Feed Details

B.1 Secaucus Production

Rendezvous Point

Table 6: Rendezvous Point – Secaucus

Description	Address
Secaucus production RP	198.235.27.223

Multicast Sources

Table 7: Multicast Sources – Secaucus

Feed	Source Address Range
Secaucus “A” feeds	198.235.27.40/29
Secaucus “B” feeds	198.235.27.48/29

IP Routing

Table 8: details the IP routing information that BOX will advertise to clients. Clients can then adjust their routing in order to determine the connection over which to receive the desired feed.

Table 8: IP Routing – Secaucus

Description	Advertised Route
Default BOX services route	198.235.27.0/24
Secaucus production RP	198.235.27.223/32
Secaucus production “A” feeds	198.235.27.40/29
Secaucus production “B” feeds	198.235.27.48/29

Multicast Lines

Table 9: provides details to the multicast lines that will be available from the Secaucus location.

Table 9: Multicast Lines – Secaucus

Secaucus POP					
Line	Description	“A” Feed Multicast Group Addresses	UDP Port	“B” Feed Multicast Group Addresses	UDP Port
11	Best Limit	224.0.124.1	21401	224.0.124.49	21404
21	Best Limit	224.0.124.2	22401	224.0.124.50	22404
31	Best Limit	224.0.124.3	23401	224.0.124.51	23404
41	Best Limit	224.0.124.4	24401	224.0.124.52	24404
51	Best Limit	224.0.124.5	25401	224.0.124.53	25404
61	Best Limit	224.0.124.6	26401	224.0.124.54	26404
71	Best Limit	224.0.124.7	27401	224.0.124.55	27404
81	Best Limit	224.0.124.8	28401	224.0.124.56	28404
15	5 Limits	224.0.124.9	21402	224.0.124.57	21405
25	5 Limits	224.0.124.10	22402	224.0.124.58	22405
35	5 Limits	224.0.124.11	23402	224.0.124.59	23405
45	5 Limits	224.0.124.12	24402	224.0.124.60	24405
55	5 Limits	224.0.124.13	25402	224.0.124.61	25405
65	5 Limits	224.0.124.14	26402	224.0.124.62	26405
75	5 Limits	224.0.124.15	27402	224.0.124.63	27405
85	5 Limits	224.0.124.16	28402	224.0.124.64	28405
1P	PIP only	224.0.124.17	21403	224.0.124.65	21406
2P	PIP only	224.0.124.18	22403	224.0.124.66	22406
3P	PIP only	224.0.124.19	23403	224.0.124.67	23406

Secaucus POP					
Line	Description	“A” Feed Multicast Group Addresses	UDP Port	“B” Feed Multicast Group Addresses	UDP Port
4P	PIP only	224.0.124.20	24403	224.0.124.68	24406
5P	PIP only	224.0.124.21	25403	224.0.124.69	25406
6P	PIP only	224.0.124.22	26403	224.0.124.70	26406
7P	PIP only	224.0.124.23	27403	224.0.124.71	27406
8P	PIP only	224.0.124.24	28403	224.0.124.72	28406
1C	Strategy only	224.0.124.25	21407	224.0.124.73	21408
2C	Strategy only	224.0.124.26	22407	224.0.124.74	22408
3C	Strategy only	224.0.124.27	23407	224.0.124.75	23408
4C	Strategy only	224.0.124.28	24407	224.0.124.76	24408
5C	Strategy only	224.0.124.29	25407	224.0.124.77	25408
6C	Strategy only	224.0.124.30	26407	224.0.124.78	26408
7C	Strategy only	224.0.124.31	27407	224.0.124.79	27408
8C	Strategy only	224.0.124.32	28407	224.0.124.80	28408

Retransmission

Table 10: Retransmission Feeds – Secaucus

Feeds	Secaucus Retransmission Server 1	Secaucus Retransmission Server 2	TCP Port
Trading slice 1 (11, 15, 1P, 1C)	198.235.27.47	198.235.27.55	21410
Trading slice 2 (21, 25, 2P, 2C)	198.235.27.47	198.235.27.55	22410
Trading slice 3 (31, 35, 3P, 3C)	198.235.27.47	198.235.27.55	23410

Feeds	Secaucus Retransmission Server 1	Secaucus Retransmission Server 2	TCP Port
Trading slice 4 (41, 45, 4P, 4C)	198.235.27.47	198.235.27.55	24410
Trading slice 5 (51, 55, 5P, 5C)	198.235.27.47	198.235.27.55	25410
Trading slice 6 (61, 65, 6P, 6C)	198.235.27.47	198.235.27.55	26410
Trading slice 7 (71, 75, 7P, 7C)	198.235.27.47	198.235.27.55	27410
Trading slice 8 (81, 85, 8P, 8C)	198.235.27.47	198.235.27.55	28410

B.2 Chicago Production

This information applies to the Chicago site.

Rendezvous Point

Table 11: Rendezvous Point – Chicago

Description	Address
Chicago production RP	198.235.27.222

Multicast Sources

Table 12: Multicast Sources – Chicago

Feed	Source Address Range
Chicago "A" feeds	198.235.27.232/29
Chicago "B" feeds	198.235.27.240/29

IP Routing

Table 13: details the IP routing information that BOX will advertise to clients. Clients can then adjust their routing in order to determine over which of their connections they will receive the desired feed.

Table 13: IP Routing – Chicago

Description	Advertised Route
Default BOX services route	198.235.27.0/24
Chicago production RP	198.235.27.222/32
Chicago production “A” feeds	198.235.27.232/29
Chicago production “B” feeds	198.235.27.240/29

Multicast Lines

Table 14: lists the multicast groups that will be available from the Chicago location.

Table 14: Multicast Lines – Chicago

Chicago POP					
Line	Description	“A” Feed Multicast Group Addresses	UDP Port	“B” Feed Multicast Group Addresses	UDP Port
11	Best Limit	224.0.124.97	21401	224.0.124.145	21404
21	Best Limit	224.0.124.98	22401	224.0.124.146	22404
31	Best Limit	224.0.124.99	23401	224.0.124.147	23404
41	Best Limit	224.0.124.100	24401	224.0.124.148	24404
51	Best Limit	224.0.124.101	25401	224.0.124.149	25404
61	Best Limit	224.0.124.102	26401	224.0.124.150	26404
71	Best Limit	224.0.124.103	27401	224.0.124.151	27404
81	Best Limit	224.0.124.104	28401	224.0.124.152	28404
15	5 Limits	224.0.124.105	21402	224.0.124.153	21405
25	5 Limits	224.0.124.106	22402	224.0.124.154	22405
35	5 Limits	224.0.124.107	23402	224.0.124.155	23405
45	5 Limits	224.0.124.108	24402	224.0.124.156	24405
55	5 Limits	224.0.124.109	25402	224.0.124.157	25405

Chicago POP					
Line	Description	“A” Feed Multicast Group Addresses	UDP Port	“B” Feed Multicast Group Addresses	UDP Port
65	5 Limits	224.0.124.110	26402	224.0.124.158	26405
75	5 Limits	224.0.124.111	27402	224.0.124.159	27405
85	5 Limits	224.0.124.112	28402	224.0.124.160	28405
1P	PIP only	224.0.124.113	21403	224.0.124.161	21406
2P	PIP only	224.0.124.114	22403	224.0.124.162	22406
3P	PIP only	224.0.124.115	23403	224.0.124.163	23406
4P	PIP only	224.0.124.116	24403	224.0.124.164	24406
5P	PIP only	224.0.124.117	25403	224.0.124.165	25406
6P	PIP only	224.0.124.118	26403	224.0.124.166	26406
7P	PIP only	224.0.124.119	27403	224.0.124.167	27406
8P	PIP only	224.0.124.120	28403	224.0.124.168	28406
1C	Strategy only	224.0.124.121	21407	224.0.124.169	21408
2C	Strategy only	224.0.124.122	22407	224.0.124.170	22408
3C	Strategy only	224.0.124.123	23407	224.0.124.171	23408
4C	Strategy only	224.0.124.124	24407	224.0.124.172	24408
5C	Strategy only	224.0.124.125	25407	224.0.124.173	25408
6C	Strategy only	224.0.124.126	26407	224.0.124.174	26408
7C	Strategy only	224.0.124.127	27407	224.0.124.175	27408
8C	Strategy only	224.0.124.128	28407	224.0.124.176	28408

Retransmission

Table 15: Retransmission Feeds – Chicago

Feeds	Chicago Retransmission Server 1	Chicago Retransmission Server 2	TCP Port
Trading slice 1 (11, 15, 1P, 1C)	198.235.27.239	198.235.27.247	21410
Trading slice 2 (21,25, 2P, 2C)	198.235.27.239	198.235.27.247	22410
Trading slice 3 (31, 35, 3P, 3C)	198.235.27.239	198.235.27.247	23410
Trading slice 4 (41, 45, 4P, 4C)	198.235.27.239	198.235.27.247	24410
Trading slice 5 (51, 55, 5P, 5C)	198.235.27.239	198.235.27.247	25410
Trading slice 6 (61, 65, 6P, 6C)	198.235.27.239	198.235.27.247	26410
Trading slice 7 (71, 75, 7P, 7C)	198.235.27.239	198.235.27.247	27410
Trading slice 8 (81, 85, 8P, 8C)	198.235.27.239	198.235.27.247	28410

B.3 Test Environment

As described in [Section 3](#) of this document, test multicast services will be served from either the Secaucus POP (UDP multicast) or from the Test environment (TCP retransmission).

To avoid confusion, the multicast services offered from the Secaucus POP have been assigned different addresses.

Rendezvous Point

Table 16: Rendezvous Point – Test Environment

Description	Address
Secaucus test RP	198.235.27.221

Multicast Sources

Table 17: Multicast Sources – Test Environment

Feed	Source Address Range
ISV 1 feeds	198.235.27.56/29
ISV 2 feeds	198.235.27.56/29

IP Routing

Table 18: details the IP routing information that BOX will advertise to clients. The routes associated to the test multicast services will be distributed via the Secaucus POP. The routes for the TCP based test services will be distributed via the test environment.

Table 18: IP Routing – Test Environment

Description	Advertised Route
Default BOX services route	198.235.27.0/24
Test RP	198.235.27.221/32
Test "ISV 1" and "ISV 2" feeds	198.235.27.56/29

Table 19: Test Routing Information –Test Environment

Description	Advertised Route
Default BOX Test services route	198.235.30.0/24

Multicast Lines

Table 20: lists the multicast groups for the ISV 1 and ISV 2 test feeds. These feeds will be broadcasted from the Secaucus production POP.

Table 20: Multicast Lines – Test Environment

Line	Description	ISV 1 Multicast Groups	UDP Port	ISV 2 Multicast Groups	UDP Port
11	Best Limit	224.0.115.1	11401	224.0.115.49	11404
21	Best Limit	224.0.115.2	12401	224.0.115.50	12404
31	Best Limit	224.0.115.3	13401	224.0.115.51	13404
41	Best Limit	224.0.115.4	14401	224.0.115.52	14404
51	Best Limit	224.0.115.5	15401	224.0.115.53	15404
61	Best Limit	224.0.115.6	16401	224.0.115.54	16404
71	Best Limit	224.0.115.7	17401	224.0.115.55	17404
81	Best Limit	224.0.115.8	18401	224.0.115.56	18404
15	5 Limits	224.0.115.9	11402	224.0.115.57	11405
25	5 Limits	224.0.115.10	12402	224.0.115.58	12405
35	5 Limits	224.0.115.11	13402	224.0.115.59	13405
45	5 Limits	224.0.115.12	14402	224.0.115.60	14405
55	5 Limits	224.0.115.13	15402	224.0.115.61	15405
65	5 Limits	224.0.115.14	16402	224.0.115.62	16405
75	5 Limits	224.0.115.15	17402	224.0.115.63	17405
85	5 Limits	224.0.115.16	18402	224.0.115.64	18405
1P	PIP only	224.0.115.17	11403	224.0.115.65	11406
2P	PIP only	224.0.115.18	12403	224.0.115.66	12406
3P	PIP only	224.0.115.19	13403	224.0.115.67	13406
4P	PIP only	224.0.115.20	14403	224.0.115.68	14406

Line	Description	ISV 1 Multicast Groups	UDP Port	ISV 2 Multicast Groups	UDP Port
5P	PIP only	224.0.115.21	15403	224.0.115.69	15406
6P	PIP only	224.0.115.22	16403	224.0.115.70	16406
7P	PIP only	224.0.115.23	17403	224.0.115.71	17406
8P	PIP only	224.0.115.24	18403	224.0.115.72	18406
1C	Strategy only	224.0.115.25	11407	224.0.115.73	11408
2C	Strategy only	224.0.115.26	12407	224.0.115.74	12408
3C	Strategy only	224.0.115.27	13407	224.0.115.75	13408
4C	Strategy only	224.0.115.28	14407	224.0.115.76	14408
5C	Strategy only	224.0.115.29	15407	224.0.115.77	15408
6C	Strategy only	224.0.115.30	16407	224.0.115.78	16408
7C	Strategy only	224.0.115.31	17407	224.0.115.79	17408
8C	Strategy only	224.0.115.32	18407	224.0.115.80	18408

Retransmission

Test retransmission services will be offered from the test environment only.

Table 21: Retransmission Feeds – Test Environment

Feeds	ISV 1 Retransmission Server	ISV 1 TCP Port	ISV 2 Retransmission Server	ISV 2 TCP Port
Trading slice 1 (11, 15, 1P, 1C)	198.235.30.19	21410	198.235.30.20	11410
Trading slice 2 (21, 25, 2P, 2C)	198.235.30.19	22410	198.235.30.20	12410
Trading slice 3 (31, 35, 3P, 3C)	198.235.30.19	23410	198.235.30.20	13410
Trading slice 4 (41, 45, 4P, 4C)	198.235.30.19	24410	198.235.30.20	14410
Trading slice 5 (51, 55, 5P, 5C)	198.235.30.19	25410	198.235.30.20	15410
Trading slice 6 (61, 65, 6P, 6C)	198.235.30.19	26410	198.235.30.20	16410
Trading slice 7 (71, 75, 7P, 7C)	198.235.30.19	27410	198.235.30.20	17410
Trading slice 8 (81, 85, 8P, 8C)	198.235.30.19	28410	198.235.30.20	18410



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