Session 1: Logon & Password Handling

During this session (available on Monday & Thursday only), the client is required to verify the capability of the feed handler to MMDH logon, password and heartbeat handling.

From 9:00am to 12:30pm, the client should connect to MMDH server to conduct the cases with reference to Test Condition 1 - 3 for Logon and Password Handling in Certification Test Procedures.

Filling in the Answer Sheet

● The client is required to fill in Section 1 to 3 of the Answer Sheet based on the timestamp of Logon Response (1102) and/or Logout (1103) messages received.

Test Condition	Test Cases	Worksheet in MMDH Certification Test Answer Sheet
1.1	**Simulation of Normal Logon** Please state the header time of Logon Response (1102) with Session Status Value of 0 (Session Active) received	Test Condition 1.1
2.1	**Simulation of Invalid Username or Password** Please state the header time of Logon Response (1102) with Session Status Value of 5 (Invalid username or password) received	Test Condition 2.1
2.2	**Simulation of Account Locked** Please state the header time of Logon Response (1102) with Session Status Value of 6 (Account locked) received	Test Condition 2.2
2.3	**Simulation of Session password due to expire** Please state the header time of Logon Response (1102) with Session Status Value of 2 (Session password due to expire) received	Test Condition 2.3
2.4	**Simulation of Password expired** Please state the header time of Logon Response (1102) with Session Status Value of 8 (Password expired) received	Test Condition 2.4
2.5	**Simulation of Duplicated Logon** ● In the first connection, please state the header time of Logon Response (1102) with Session Status Value of 0 (Session Active) received.	Test Condition 2.5 (a)

	• In the first connection, please state the header time of Logout (1103) with Session Status Value of 102 (Logon from second connection)	Test Condition 2.5 (b)
	• In the second connection, please state the header time of Logon Response (1102) with Session Status Value of 104 (Already Connected) received	Test Condition 2.5 (c)
3.1	**Simulation of Change Password does not comply with password policy** Please state the header time of Logon Response (1102) with Session Status Value of 3 (New session password does not comply with policy) received	Test Condition 3.1
3.2	**Simulation of Change Password** Please state the header time of Logon Response (1102) with Session Status Value of 1 (Session password changed) received	Test Condition 3.2
3.3	**Simulation of Change Password within 24 hours** Please state the header time of Logon Response (1102) with Session Status Value of 100 (Password not changed (within 24 hours)) received	Test Condition 3.3

From 12:30 to 1:30pm, no market data will be disseminated. MMDH server sends heartbeat messages regularly in every few seconds as stated in the field "HeartBInterval" in Logon Response (1102) message. The client should conduct the case in Test Condition 4.1 for Handling of Control Messages by:

- Sending the Heartbeat messages continuously to keep connected to MMDH server without disconnection during the whole period.

- Receiving the Heartbeat messages continuously from MMDH server without disconnection during the whole period.

Session 2: Message Decoding & Order Book Building

During this session (available on Tuesday & Friday only), MMDH disseminates all types of messages under various data scenarios. The client is required to state the correct data values for each of the test cases in Test Condition 5 in Answer Sheet.

For Order Book Building, MMDH disseminates Order Book messages (i.e. Aggregate Order Book Update, Broker Queue and Add/Delete Odd Lot Order (for Odd Lot Order subscribers only)) with various order activities. The client is required to check the aggregate order book for the top 10 best bids and offers (i.e. 10BBO) of selected securities as at the end of this session and state the final image of 10BBO & Broker Queue in the answer sheet correspondingly.

<u>Filling in the Answer Sheet</u>

- The client fills in Section 5 of the Answer Sheet based on the latest image in their system as per the instructions below

Test Condition	Test Cases	Worksheet in MMDH Certification Test Answer Sheet
5.1	**<u>Interpretation of Market Definition (10)</u>** Please state the Market Definition (10) messages for the Markets specified in the Answer Sheet – worksheet Test Condition 5.1	Test Condition 5.1
5.2	**<u>Interpretation of Security Definition (11)</u>** Please state the Security Definition (11) messages for the Securities specified in the Answer Sheet– worksheet Test Condition 5.2	Test Condition 5.2
5.3	**<u>Interpretation of Liquidity Provider (13)</u>** Please state the Liquidity Provider (13) messages for the Securities specified in the Answer Sheet– work sheet Test Condition 5.3.	Test Condition 5.3
5.4	**<u>Interpretation of Currency Rate (14)</u>** Please state the Currency Rate (14) messages for the Currencies specified in the Answer Sheet– worksheet –Test Condition 5.4	Test Condition 5.4

5.5	**Interpretation of Trading Session Status (20)** Please state the Trading Session Status (20) messages with the corresponding InternalSeqNum for the Markets specified in the Answer Sheet– worksheet Test Condition 5.5.	Test Condition 5.5
5.6	**Interpretation of Security Status (21)** Please state the Security Status (21) messages for the Securities specified in the Answer Sheet– worksheet Test Condition 5.6.	Test Condition 5.6
5.7	**Order Book Building** ● Please state the final image of 10BBO & Broker Queue for the Securities specified in the Answer Sheet– worksheet Test Condition 5.7. ● Please state the final image of Odd Lot Order Book for the Securities specified in the Answer Sheet– worksheet Test Condition 5.7. *(For Odd Lot Order Subscriber only)*	Test Condition 5.7
5.8	**Interpretation of Order Imbalance (56)** Please state the Order Imbalance (56) messages with the corresponding InternalSeqNum for the Securities specified in the Answer Sheet– worksheet Test Condition 5.8.	Test Condition 5.8
5.9	**Interpretation of Trade Ticker (52)** Please state the Trade Ticker (52) messages for the Securities specified in the Answer Sheet– worksheet Test Condition 5.9.	Test Condition 5.9
5.10	**Interpretation of Closing Price (62)** Please state the Closing Price (62) messages for the Securities specified in the Answer Sheet– worksheet Test Condition 5.10	Test Condition 5.10
5.11	**Interpretation of Interpretation of Nominal Price (40)** Please state the Nominal Price (40) messages for the Securities specified in the Answer Sheet– worksheet Test Condition 5.11	Test Condition 5.11
5.12	**Interpretation of Indicative Equilibrium Price (41)** Please state the Indicative Equilibrium Price (41) messages with the corresponding InternalSeqNum for the Securities specified in the Answer Sheet– worksheet Test Condition 5.12	Test Condition 5.12
5.13	**Interpretation of Reference Price (43)** Please state the Reference Price (43) messages for the Securities specified in the Answer Sheet– worksheet Test Condition 5.13	Test Condition 5.13

5.14	**Interpretation of VCM Trigger (23)** Please state the VCM Trigger (23) messages for the Securities specified in the Answer Sheet– worksheet Test Condition 5.14	Test Condition 5.14
5.15	**Interpretation of Statistics (60)** Please state the Statistics (60) messages for the Securities specified in the Answer Sheet– worksheet Test Condition 5.15	Test Condition 5.15
5.16	**Interpretation of Market Turnover (61)** Please state the Market Turnover (61) messages for the Markets specified in the Answer Sheet– worksheet Test Condition 5.16	Test Condition 5.16
5.17	**Interpretation of Yield (44)** Please state the Yield (44) messages for the Securities specified in the Answer Sheet– worksheet Test Condition 5.17	Test Condition 5.17
5.18	**Interpretation of News (22)** Please state the News (22) messages for the News specified in the Answer Sheet– worksheet Test Condition 5.18	Test Condition 5.18
5.19	**Interpretation of Index Definition (70)** *(For Index Feed Subscribers only]* Please state the Index Definition (70) messages for the Indices specified in the Answer Sheet– worksheet Test Condition 5.19	Test Condition 5.19
5.20	**Interpretation of Index Data (71)** *(For Index Feed Subscribers only]* Please state the final image of Index Data (71) for the Indices specified in the Answer Sheet– worksheet Test Condition 5.20	Test Condition 5.20

Session 3: Data Recovery – Restart/Refresh

During this session (available on Monday & Thursday only), the client is required to disconnect from and the reconnect to MMDH server so as to trigger the data recovery mechanism of their application **according to the event sequence set out below**:

Test Condition 6.1 - Simulation of data recovery by Refresh

- When the session begins, the client connects to MMDH server to receive market data
- The client then disconnects from the MMDH server and reconnects **after 5 minutes**
- When reconnecting, the client's application is expected to send a Logon (1101) message by stating the field "InternalSeqNum" with last InternalSeqNum received just before the disconnection
- However, since the data of 5 minutes ago should not be available at the time the Logon message is sent, MMDH should return a Logon Response (1102) message with session status of 101 (Session Active – refresh required)
- Upon receipt of the said Logon Response message, the client's application should then send a Refresh Request (1201) message to MMDH server to trigger the refresh recovery.

Test Condition 6.2 - Simulation of data recovery by Restart

- Similar to Test Condition 6.1, the client disconnects from the MMDH server and reconnects to MMDH server, but this time **within 1 minute** instead of after 5 minutes
- Similarly, when reconnecting the client's application is expected to send a Logon (1101) message by stating the field "InternalSeqNum" with last InternalSeqNum received just before the disconnection
- This time, the data of 1 minute ago should be available and therefore MMDH should return a Logon Response (1102) message with session status of 0 (Session Active) followed by messages starting from the sequence number with InternalSeqNum +1.
- The client's application should keep connected to the server until the end of the session.
- The client should not send any Refresh Request (1201) message after this point.

Filling in the Answer Sheet

- The client fills in Sections 6.1 and 6.2 of the Answer Sheet based on the latest image in their system as per the instructions below

Test Condition	Test Cases	Worksheet in MMDH Certification Test Answer Sheet
6.1	**Simulation of data recovery exceeds Server cache (Refresh):** Please state the header time of Logon Response (1102) with Session Status Value of 101 (Session Active – refresh required) received	Test Condition 6.1 (a)
	Please state the header time of Refresh Response (1202) received	Test Condition 6.1 (b)
	Please state the header time of Refresh Complete (203) received	Test Condition 6.1 (c)
6.2	**Simulation of data recovery within Server cache (Restart):** Please state the header time of Logon Response (1102) with Session Status Value of 0 (Session Active) received	Test Condition 6.2 (a)
	Order Book Building ● Please state the final image of 10BBO & Broker Queue for the Securities specified in the Answer Sheet– worksheet Test Condition 6.2(b)	Test Condition 6.2 (b)

Session 4: Failover to Secondary Server

When the session (available on Monday & Thursday only) begins, the client keeps connected to MMDH server to receive market data. When MMDH simulates a primary node failure, the client should detect no live data received from primary node of MMDH (i.e. missing of 3 consecutive heartbeat messages) and disconnection automatically.

Clients planning to use non-standard configuration, i.e. dual live connection, should execute the test case as per Test Condition 8.1 only whereas clients planning to use standard configuration, i.e. single live connection, should execute the test case per Test Condition 8.2 only.

Test Condition 8.1 – Simulation of MMDH Primary Node Failure
(For Non-Standard Configuration only)

The client attempts to reconnect to MMDH Primary Server until connection can be established and then within 1 minute sends a Logon (1101) message by stating the field "InternalSeqNum" with last InternalSeqNum received just before the disconnection. Upon receipt of the Logon Response (1102), the clients should be able to receive the market data until the end of the session.

Filling in the Answer Sheet
- The client fills in Section 8.1 of the Answer Sheet based on the latest image in their system as per the instructions below

Test Condition	Test Cases	Worksheet in MMDH Certification Test Answer Sheet
8.1	**Simulation of MMDH Primary Node Failure** ● Please state the test date of the failover to secondary server test. **Order Book Building** ● Please state the final image of 10BBO & Broker Queue for the Securities specified in the Answer Sheet – worksheet Test Condition 8.1.	Test Condition 8.1

Test Condition 8.2 – Simulation of MMDH Primary Node Failure
(For Standard Configuration only)

The client attempts to switch to MMDH Secondary Server and sends a Logon (1101) message by stating the field "InternalSeqNum" with last InternalSeqNum received just before the disconnection within 1 minute.   Upon receipt of the Logon Response (1102), the clients should be able to receive the market data until the end of the session.

Filling in the Answer Sheet

- The client fills in Section 8.2 of the Answer Sheet based on the latest image in their system as per the instructions below

Test Condition	Test Cases	Worksheet in MMDH Certification Test Answer Sheet
8.2	**Simulation of MMDH Primary Node Failure** ● Please state the test date of the failover to secondary server test. **Order Book Building** ● Please state the final image of 10BBO & Broker Queue for the Securities specified in the Answer Sheet– worksheet Test Condition 8.2.	Test Condition 8.2

Session 5: Performance and Capacity

During this session (available on Monday & Thursday only), MMDH disseminates high volume data at increasing rates to the installed limit. In order to pass the performance and capacity test, the client's feed handler is required to demonstrate its capability in handling of MMDH data during this session by achieving a mean delay of less than 1 second. The clients should state the test date for verification.   HKEX will check the mean delay figures of the client's feed handler recorded by MMDH server and confirm the result thereafter.

Test Condition	Test Cases	Worksheet in MMDH Certification Test Answer Sheet
7	**<u>Capacity</u>** Please state the test date of the performance and capacity test.	Test Condition 7

Test Session about Handling of messages with Non-consecutive InternalSeqNum

The clients are required to contact HKEX personnel to reserve a test session (either Session 2 or Production Replay) at least 2 days in advance to test the case about handling of messages with non-consecutive InternalSeqNum.

During the session, MMDH disseminates messages with non-consecutive InternalSeqNum. The clients are required to go through this session to verify if the feed handler can handle messages with non-consecutive InternalSeqNum smoothly.

Test Condition	Test Cases	Worksheet in MMDH Certification Test Answer Sheet
/	**Handling of messages with non-consecutive InternalSeqNum** Please state the test date of Production Replay & click the box if the feed handler can handle it smoothly.	Additional Verification

Test Session about Production Replay

During this session (available on Wednesday only), MMDH replays the production historical data. The clients are required to go through this session to verify if their feed handler can handle the historical data smoothly.

Test Condition	Test Cases	Worksheet in MMDH Certification Test Answer Sheet
/	**Production Replay** Please state the test date of Production Replay & click the box if the feed handler can handle it smoothly.	Additional Verification