READINESS TEST ANSWER BOOK

**HKEx Orion Market Data Platform
Securities Market & Index Datafeed Products
(OMD-C)**

Sample

Version 1.0

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1.   Purposes

This Answer Book describes the flow of each test session within the Readiness Test for HKEx Orion Market Data Platform (OMD) Securities and Index Datafeed (OMD-C) and provides the actual data values disseminated by OMD and expected behaviours of clients' feed handler in response to various conditions.

Clients participating in the Readiness Test should follow the instructions in Section 5 of this Answer Book to record their test results accordingly.   To be eligible for joining the Market Rehearsal for OMD Phase 1a rollout, a client must return a signed copy of this Answer Book indicating satisfactory results have been achieved for every test item together with a completed Test Result Declaration form to HKEx.

2.   **Scope of Test**

The Readiness Test covers test cases in the following 5 areas.   The test conditions column makes reference to the test cases spelt out in Section 4.

Test Area	Objectives	Test Conditions
1. Message Decoding & Order Book Building	All data messages specified in the OMD Interface Specification will be transmitted to enable Clients to ensure their correct interpretation of each data field received from the OMD datafeed.	Section 4.1 1 - 2
	Data messages resulting from various trading activities will be transmitted to enable Clients to verify the logic in their application for constructing the market depth info below: Market Depth Information — Applicable to Clients* Aggregate Order Book ● SS ● SP Full Order Book – Board Lot ● SF Full Order Book – Odd Lot O SS O SP O SF Broker Queue ● SS ✧ SP ✧ SF * Notes SS Securities Standard SP Securities Premium SF Securities FullTick ● All Clients of the datafeed specified O Clients planning to receive complimentary Odd Lot Order ✧ Clients planning to receive complimentary Conflated Broker Queue	Section 4.1 2.7
2. Data Recovery (Refresh)	Simulation of various data loss scenarios to enable Clients to verify the ability of their feed handler to recover lost data by Refresh [1].	Section 4.2 3.4
3. Data Recovery (Line Arbitration & Retransmission)	Simulation of various data loss scenarios to enable Clients to verify the ability of their feed handler to recover lost data by the following methods: a. Line Arbitration [2] b. Retransmission [1][3]	Section 4.2 3.1, 3.3 - 3.5 4
4. Performance / Capacity	Transmission of high volume data to enable Clients to ensure the ability of their feed handler to meet the capacity requirements.	Section 4.2 5.1
5. Failover / Disaster Recovery	Simulation of the following exceptional scenarios to enable Clients to verify the built-in processes in their feed handlers for such scenarios: a. Failover of OMD real-time data publisher b. Failover of Refresh service c. Failover of Retransmission service d. Sequence Reset again before market open e. Failover to the Disaster Recovery (DR) site	Section 4.2 6.1 6.2 4.10 6.3 6.4

[1] Certain exception situations on the Clients side that may require refresh or retransmission from OMD such as late connection to OMD, application restart, client network failure, etc. are not expected to be conducted during the Readiness Test, Clients need to simulate the scenarios during the End-to-End Open Test environment.

[2] Line Arbitration is mandatory to all feed providing vendors only.

[3] Clients are required to test their processing of negative logon response and negative retransmission response during the End-to-End Open Test environment which includes i) duplicated logon, ii) logon with invalid username, iii) retransmission request – invalid / unauthorized channel ID, iv) retransmission request – message range exceeding maximum OMD cached messages, v) retransmission request – message range exceeding maximum sequence range, and vi) retransmission request – exceeding daily retransmission request limit.   Various retransmission request limits will be set to a sufficient small value to facilitate the Clients to test their capability in processing negative response from OMD.

3.   **Readiness Test Overview**

The Readiness Test comprises of the following 5 sessions:

Test Session	Objectives
1. Message Decoding and Order Book Building	• To enable clients to verify the ability of their system to correctly interpret each data element received from OMD • To enable clients to verify the logic in their applications to construct market depth or price depth information from OMD data
2. Data Recovery (Refresh Service)	• To enable clients to verify the ability of their systems to capture the latest market states by Refresh under the various scenarios simulated in the test
3. Data Recovery (Line Arbitration and Retransmission)	• To enable clients to verify the logic in their systems for detecting missing data and upon the detection recover the lost data by means of Line Arbitration (optional) and Retransmission
4. Performance / Capacity	• To enable clients to ensure the ability of their systems to handle the high market data rate without adverse effect on performance
5. Failover / Disaster Recovery	• To enable clients to verify the built-in process in their feed handlers for various emergency scenarios, for example, OMD failover to the disaster recovery site

4. Test Conditions

This section lists out the conditions to be covered in both functional and technical aspects. A Client should ensure that its system meets all of the test conditions before participating in the Readiness Test.

4.1 Functional Tests

Test Condition	Details	IS* Reference
1	*Handling of Control Messages*	
1.1	*Heartbeat* messages in all multicast channels in Line A and/or Line B *Expected result:* *Clients should be able to check system/line healthiness by Heartbeat messages*	Control Messages (3.4.1)
1.2	*Sequence Reset* messages in all multicast channels at Start of Day *Expected result:* *All cached data are cleared and Clients should subscribe to the refresh channels for current market state followed by processing (cached) real-time messages upon reception of Sequence Reset messages*	Control Messages (3.4.2)
2	*Handling of Market Data Messages*	
2.1	*Market Definition* messages covering all markets	Reference Data (3.7.1)
2.2	*Security Definition* messages covering (i) all available InstrumentType (ii) 0, 1 & 20 NoUnderlyingSecurities (iii) securities in all markets (iv) securities with non-blank FreeText	Reference Data (3.7.2)
2.3	*Liquidity Provider* messages with at least one with NoLiquidityProviders set to each of 1 & 50	Reference Data (3.7.3)

Test Condition	Details	IS* Reference
2.4	*Currency Rate* messages covering all currencies currently available in HKEx Securities Market	Reference Data (3.7.4)
2.5	*Trading Session Status* messages covering the full range of values in TradingSessionSubID, TradingSesStatus & TradingSesControlFlag	Status Data (3.8.1)
2.6	*Security Status* messages will be sent with SecurityTradingStatus set to 2 (Trading Halt) & 3 (Resume) at Start of Day and Intraday	Status Data (3.8.2)
2.7	A series of book messages covering all possible book operations for Bid/Offer orders during various trading sessions in a normal trading day *Aggregate Order Book Update* messages covering all possible aggregate book management operations *Broker Queue* messages covering empty broker queue, broker queues with more than 1 spread broker information, broker queues with exactly 40 entries and broker queues with more than 40 entries in the book	Order Book Data (3.9)
2.8	*Trade* messages covering different TrdType	Trade & Price Data (3.10.1)
2.9	*Trade Cancel* message will be sent. This will generate a new trade ticker that should also be processed	Trade & Price Data (3.10.2)
2.10	*Trade Ticker* messages covering different TrdType and at least one of the messages with TrdCancelFlag set on and non-zero AggregateQuantity to set example for partial ticker cancel	Trade & Price Data (3.10.3)
2.11	*Closing Price* messages covering majority non-zero closing price and a few zero closing price (for new securities without order/trade activities)	Trade & Price Data (3.10.4)
2.12	*Nominal Price* messages covering majority non-zero nominal price and a few zero nominal price (for new securities without order/trade activities)	Trade & Price Data (3.10.5)

Test Condition	Details	IS* Reference
2.13	*Indicative Equilibrium Price* messages covering that during Auction Session (majority non-zero and some zero IEP) and after Auction Matching (all zero IEP)	Trade & Price Data (3.10.6)
2.14	*Statistics* messages covering both shortsell and non-shortsell securities and securities with some of the statistics data unavailable, e.g. <u>HighPrice</u>, <u>LowPrice</u>, <u>Turnover</u>, <u>SharesTraded</u>, <u>LastPrice</u> if no order/trades activities for the securities	Value Added Data (3.11.1)
2.15	*Market Turnover* message covering all markets and all available currencies available in HKEx Securities Market	Value Added Data (3.11.2)
2.16	*Yield* messages covering non-zero <u>Yield</u> and zero <u>Yield</u> (i.e. yield is not available) .	Value Added Data (3.11.3)
2.17	*News* messages covering multiple segmented news and news with zero and maximum values for <u>NoSecurityCodes,</u> <u>NoMarketCodes</u> and <u>NoNewsLines</u>	News (3.12.1)
2.18	*Index Definition* messages covering all indexes offered in OMD Index datafeed product	Index Data (3.13.1)

Test Condition	Details	IS* Reference
2.19	*Index Data* messages covering all indexes offered in OMD Index with some of the messages with Null and/or populated values for some of the fields *Expected Result for Test Conditions 2.1 – 2.19:* *Clients are able to extract the market data messages encapsulated in the multicast packets and to decode the messages according to the OMD Interface Specifications for display and/or further processing. The final image of specific securities/indexes/news should match the expected results provided by HKEx in the Answer Book.* *Clients are able to build the correct aggregate order book, full board lot order book, full odd lot order book and conflated broker queue comprising spread and broker information. The final book and broker queue image of specific securities should match perfectly the expected results in the Answer Book.*	Index Data (3.13.2)

4.2   **Technical Tests**

Test Condition	Details	IS* Reference
3	***Data Recovery***	
3.1	A gap will be introduced in Line A and/or Line B for the client to detect *Expected Result:* *Clients are able to detect the gap in Line A and/or Line B.*	Gap Detection (4.1)
3.2	A gap will be introduced in a single line, either Line A or Line B. Client detects missing packets in one line and to process the packet from the other line, in other words, Client arbitrates and merges the duplicated contents received in Line A and Line B for subsequent processing *Expected Result:* *Clients are able to merge the duplicated messages from Line A and Line B for different sets of dual multicast channels for subsequent message decoding and processing and able to detect gaps in the multicast packets received. From there the Clients can arbitrate the two lines to fill in any gaps detected in any one of the two lines.*	Line Arbitration (4.2)
3.3	A large gap will be introduced to both Line A and Line B expecting the Client to request the latest market state images from the refresh service *Expected Result:* *Clients are able to join the refresh channel and recover to the current point whilst processing market data.*	Refresh (3.6.1, 4.4)

Test Condition	Details	IS* Reference
3.4	Client correctly processes the *Refresh Complete* message and applies it to their current cache of market data. *Expected Result:* *The final image of specific securities should match perfectly the expected results in the Answer Book.*	Refresh (3.6.1, 4.4)
4	*Retransmission Service*	
4.1	*Heartbeat* messages in retransmission service	Control Messages (3.4.1)
4.2	Client sends *Logon* message with valid username expecting OMD to respond with a *Logon Response* message with <u>SessionStatus</u> set to 0 (Session Active)	Retransmission (3.5.1, 4.3)
4.3	Client processes *Logon Response* message	Retransmission (3.5.2, 4.3)
4.4	Test the reception of positive *Retransmission Response*: Client sends *Retransmission Request* message with valid channel ID and valid <u>BeginSeqNum</u> / <u>EndSeqNum</u> fields expecting OMD accepts its request with *Retransmission Response* set to 0 (Request accepted) <u>RetransStatus</u> if the messages requested will not exceed any retransmission system limits as stated in the OMD Interface Specifications	Retransmission (3.5.3, 4.3)
4.5	Client processes *Retransmission Response* message.	Retransmission (3.5.4, 4.3)

Test Condition	Details	IS* Reference
4.6	Client processes the requested lost messages in unicast transmission following receipt of a positive *Retransmission Response* message and can fill in the gap detected in real-time multicast channels for the subsequent processing *Expected Result for Test Conditions 4.1 – 4.6:* *Clients are able to detect missing packets, which contain trades or trade tickers, and are able to recover the missing messages from the retransmission server for continuation of real-time market data processing.* *The full trade and/or full trade tickers of specific securities should match perfectly the expected results in the Answer Book.*	Retransmission (3.5.4, 4.3)

Test Condition	Details	IS* Reference
5	***Performance / Capacity***	
5.1	Market Data will be disseminated at increasing rates on all OMD datafeed products. Clients are expected to receive market data volume at a rate that will drive to the peak bandwidth requirements for each datafeed product. 1. 50% of maximum 2. 100% of maximum Clients must handle all rates without dropping data. The Answer Book will provide the Sequence Number of the last message. Clients should check their last Sequence Number that they receive against the provided number and make sure that there is no gap in the Sequence Number of messages received. *Expected Result:* *Clients are able to handle full capacity for all of their subscribed OMD datafeed products in the same set of SDNet/2 or HSN circuits without losing multicast data, which is a symptom of an overloaded link in a chain. The last Sequence Number received in each channel should be identical to the Sequence Number provided in this Answer Book. Also the full trade and/or full trade tickers of specific securities should match perfectly the expected results in the Answer Book.*	N/A Performance Testing

Test Condition	Details	IS* Reference
6	*Failover / Disaster Recovery*	
6.1	Failover of real-time Publisher process *Expected Result:* *Clients are able to handle Publisher failover without experiencing any interruption and can continue to receive real-time market data after the failover.* *The final image of specific securities, in particular for SS Clients the aggregate order book and trade tickers of specific securities should match perfectly the expected results in the Answer Book.*	Error Recovery (2.2.4.1)
6.2	Failover of Refresh Service process *Expected Result:* *Clients will receive a Sequence Reset (100) message in each of the refresh channels after Refresh Service process (RFS) failover if they're subscribing to the refresh channels. Clients are expected to handle RFS failover properly without affecting the reception of real-time market data and can capture a full latest market image from RFS for their processing.* *The final image of specific securities should match perfectly the expected results in the Answer Book.*	Error Recovery (2.2.4.1)
6.3	Sending second sets of *Sequence Reset* messages in real-time multicast channels before market open *Expected Result:* *Clients will receive a Sequence Reset (100) message in each of the channels they subscribed before market open. Clients should be able to replace the previously received securities information by the correct one received after the reception of this Sequence Reset (100). The final image of specific securities for the reference data should match perfectly the expected results in the Answer Book.*	Control Message (3.4.2)

Test Condition	Details	IS* Reference
6.4	OMD simulates DR site failover *Expected Result:* *Clients are able to handle DR site failover gracefully including the handling of Sequence Reset messages, recovery from refresh service and merging of refresh image into real-time market data. The final image of specific securities should match perfectly the expected results in the Answer Book.*	Error Recovery (2.2.4.2)
6.5	Primary Retransmission server will be stopped and only the secondary server remains operational. Clients are required to connect to the secondary and make retransmission requests.[1] *Expected Result:* *Clients are able to detect failure of Retransmission Server (RTS) A and auto-switch to reconnect to RTS B for the recovery of missing packets. The final image of specific securities should match perfectly the expected results in the Answer Book.*	Retransmission (3.5.3, 4.3)

[4] HKEx will set the limit on "Maximum Number of Request per Day" to a sufficient small value (i.e. 10 as planned) in the Secondary Retransmission server during this test session to set the test conditions for the Clients to test their capability of processing negative retransmission response for exceeding daily retransmission request limit, Clients are required to make 10+ retransmission requests when connecting to the Secondary Retransmission server to verify that they can process negative response from OMD correctly.

* IS refers to OMD Interface Specifications for Securities Market & Index Datafeed Products – Binary Protocol (version 1.2)

5.   Readiness Test Result Verification

The securities to be configured for each of the 5 test sessions are listed below for the verification by the clients to confirm that they receive the full set of market data for all securities correctly.   Clients should not assume that order and trade market data will be received for ALL securities and for majority of the securities, only static reference data will be received.

List of test securities will be provided in the actual Answer Book.

Session 1: Message Decoding and Order Booking Building   Test Date: _____

Part A – Message Decoding

During this session, OMD disseminates all types of messages under various data scenarios. Correct data values are provided for each of the test cases below.   Clients are required to verify the respective data values in your system and make sure that all are correct.

For each test case below, please put a tick (✓) in the box for each data item where your system records the same value as the expected value.   Bold item(s) is/are key data field(s) of the message.

Test case 1: Interpretation of **Market Definition** (message type: **10**)

OMD Field Name	Expected Value	Result (✓ if correct)
MarketCode	**GEM**	☐
MarketName	Growth Enterprise Market	☐
CurrencyCode	HKD	☐
NumberOfSecurities	123	☐

Test case 2: Interpretation of **Currency Rate** (message type: **14**) – Currency Factor = 1

OMD Field Name	Expected Value	Result (✓ if correct)
CurrencyCode	**USD**	☐
CurrencyFactor	1	☐
CurrencyRate	7.8	☐

Test case 3: Interpretation of **Currency Rate** (message type: **14**)

OMD Field Name	Expected Value	Result (✓ if correct)
CurrencyCode	**JPY**	☐
CurrencyFactor	3	☐
CurrencyRate	11.234	☐

Test case 4: Interpretation of **Trading Session Status** (message type: **20**)

OMD Field Name	Expected Value	Result (✓ if correct)
MarketCode	**GEM**	☐
TradingSession ID	1	☐
TradingSessionSubID	0	☐
TradingSesStatus	100	☐

TradingSesControlFlag	0	☐
StartDateTime	12-11-05T16:01:00	☐
EndDateTime	0	☐

Test case 5: Interpretation of **Security Status** (message type: **21**)

OMD Field Name	Expected Value	Result (✓ if correct)
Security Code	**00001**	☐
SecurityTradingStatus	3	☐

Test case 6: Interpretation of **Securities Definition** (message type: **20**) for Equity

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	**00005**	☐
SecurityTradingStatus	3	☐
MarketCode	MAIN	☐
ISINCode	123456789012	☐
InstrumentType	EQTY	☐
SpreadTableCode	01	☐
SecurityShortName	HSBC HOLDINGS	☐
CurrencyCode	HKD	☐
SecurityNameGCCS	匯豐控股	☐
SecurityNameGB	汇丰控股	☐
LotSize	400	☐
PreviousClosingPrice	74.900	☐
ShortSellFlag	N	☐
CCASSFlag	Y	☐
DummySecurityFlag	N	☐
TestSecurityFlag	N	☐
StampDuty	Y	☐
ListingDate	19000101	☐
DelistingDate	0	☐
FreeText	*NEXT DAY EX-DIV* REFER TO ENT	☐
EFNFlag	N/A	☐
AccruedInterest	N/A	☐
CouponRate	N/A	☐
ConversionRatio	N/A	☐
StrikePrice	N/A	☐
MaturityDate	N/A	☐

OMD Field Name	Expected Value	Result (✓ if correct)
CallPutFlag	N/A	☐
Style	N/A	☐
NoUnderlyingSecurities	N/A	☐
UnderlyingSecurityCode	Not exist	☐
UnderlyingSecurityWeight	Not exist	☐

Test case 7: Interpretation of **Securities Definition** (message type: **20**) for Bond

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	. . .	☐
SecurityTradingStatus	. . .	☐
MarketCode	. . .	☐
ISINCode	. . .	☐
InstrumentType	. . .	☐
SpreadTableCode	. . .	☐
SecurityShortName	. . .	☐
CurrencyCode	. . .	☐
SecurityNameGCCS	. . .	☐
SecurityNameGB	. . .	☐
LotSize	. . .	☐
PreviousClosingPrice	. . .	☐
ShortSellFlag	. . .	☐
CCASSFlag	. . .	☐
DummySecurityFlag	. . .	☐
TestSecurityFlag	. . .	☐
StampDuty	. . .	☐
ListingDate	. . .	☐
DelistingDate	. . .	☐
FreeText	. . .	☐
EFNFlag	Y	☐
AccruedInterest	23.225	☐
CouponRate	0.035	☐
ConversionRatio	N/A	☐
StrikePrice	N/A	☐
MaturityDate	N/A	☐
CallPutFlag	N/A	☐
Style	N/A	☐
NoUnderlyingSecurities	N/A	☐

UnderlyingSecurityCode	Not exist	☐
UnderlyingSecurityWeight	Not exist	☐

Test case 8: Interpretation of **Securities Definition** (message type: **20**) for Warrant

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	. . .	☐
SecurityTradingStatus	. . .	☐
MarketCode	. . .	☐
ISINCode	. . .	☐
InstrumentType	. . .	☐
SpreadTableCode	. . .	☐
SecurityShortName	. . .	☐
CurrencyCode	. . .	☐
SecurityNameGCCS	. . .	☐
SecurityNameGB	. . .	☐
LotSize	. . .	☐
PreviousClosingPrice	. . .	☐
ShortSellFlag	. . .	☐
CCASSFlag	. . .	☐
DummySecurityFlag	. . .	☐
TestSecurityFlag	. . .	☐
StampDuty	. . .	☐
ListingDate	. . .	☐
DelistingDate	. . .	☐
FreeText	. . .	☐
EFNFlag	N/A	☐
AccruedInterest	N/A	☐
CouponRate	N/A	☐
ConversionRatio	0.1	☐
StrikePrice	75.000	☐
MaturityDate	20130228	☐
CallPutFlag	C	☐
Style	E	☐
NoUnderlyingSecurities	1	☐
UnderlyingSecurityCode	00005	☐
UnderlyingSecurityWeight	1	☐

Test case 9: Interpretation of **Securities Definition** (message type: **20**) for Basket Warrant

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	. . .	☐
SecurityTradingStatus	. . .	☐
MarketCode	. . .	☐
ISINCode	. . .	☐
InstrumentType	. . .	☐
SpreadTableCode	. . .	☐
SecurityShortName	. . .	☐
CurrencyCode	. . .	☐
SecurityNameGCCS	. . .	☐
SecurityNameGB	. . .	☐
LotSize	. . .	☐
PreviousClosingPrice	. . .	☐
ShortSellFlag	. . .	☐
CCASSFlag	. . .	☐
DummySecurityFlag	. . .	☐
TestSecurityFlag	. . .	☐
StampDuty	. . .	☐
ListingDate	. . .	☐
DelistingDate	. . .	☐
FreeText	. . .	☐
EFNFlag	N/A	☐
AccruedInterest	N/A	☐
CouponRate	N/A	☐
ConversionRatio	0.1	☐
StrikePrice	75.000	☐
MaturityDate	20130228	☐
CallPutFlag	C	☐
Style	E	☐
NoUnderlyingSecurities	20	☐
UnderlyingSecurityCode (1)	00001	☐
UnderlyingSecurityCode (2)	00002	☐
UnderlyingSecurityCode (3)	. . .	☐
UnderlyingSecurityCode (4)	. . .	☐
UnderlyingSecurityCode (5)	. . .	☐
UnderlyingSecurityCode (6)	. . .	☐

UnderlyingSecurityCode (7)	. . .	☐
UnderlyingSecurityCode (8)	. . .	☐
UnderlyingSecurityCode (9)	. . .	☐
UnderlyingSecurityCode (10)	. . .	☐
UnderlyingSecurityCode (11)	. . .	☐
UnderlyingSecurityCode (12)	. . .	☐
UnderlyingSecurityCode (13)	. . .	☐
UnderlyingSecurityCode (14)	. . .	☐
UnderlyingSecurityCode (15)	. . .	☐
UnderlyingSecurityCode (16)	. . .	☐
UnderlyingSecurityCode (17)	. . .	☐
UnderlyingSecurityCode (18)	. . .	☐
UnderlyingSecurityCode (19)	. . .	☐
UnderlyingSecurityCode (20)	. . .	☐
UnderlyingSecurityWeight (1)	0.05	☐
UnderlyingSecurityWeight (2)	0.15	☐
UnderlyingSecurityWeight (3)	. . .	☐
UnderlyingSecurityWeight (4)	. . .	☐
UnderlyingSecurityWeight (5)	. . .	☐
UnderlyingSecurityWeight (6)	. . .	☐
UnderlyingSecurityWeight (7)	. . .	☐
UnderlyingSecurityWeight (8)	. . .	☐
UnderlyingSecurityWeight (9)	. . .	☐
UnderlyingSecurityWeight (10)	. . .	☐
UnderlyingSecurityWeight (11)	. . .	☐
UnderlyingSecurityWeight (12)	. . .	☐
UnderlyingSecurityWeight (13)	. . .	☐
UnderlyingSecurityWeight (14)	. . .	☐
UnderlyingSecurityWeight (15)	. . .	☐
UnderlyingSecurityWeight (16)	. . .	☐
UnderlyingSecurityWeight (17)	. . .	☐
UnderlyingSecurityWeight (18)	. . .	☐
UnderlyingSecurityWeight (19)	. . .	☐
UnderlyingSecurityWeight (20)	. . .	☐

Test case 10: Interpretation of **Nominal Price** (message type: **40**)

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	**00005**	☐
NominalPrice	75.000	☐

. . .

(More test cases will be provided in the actual Answer Book)

. . .

Test case <no> : Interpretation of **Closing Price** (message type: **62**)

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	**00005**	☐
ClosingPrice	75.100	☐
Number of Trades	15 (for SP), 0 (for SS)	☐

Test case <no>: Interpretation of **Indicative Equilibrium Price** (message type: **41**)

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	**00005**	☐
Price	74.750	☐
AggregateQuantity	34890800	☐

Test case <no>: Interpretation of **Statistics** (message type: **60**)

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	**00005**	☐
SharesTraded	12345600	☐
Turnover	1234567890.000	☐
HighPrice	75.500	☐
LowPrice	74.500	☐
LastPrice	75.000	☐
VWAP	74.900	☐
ShortSellSharesTraded	12345	☐
ShortSellTurnover	1234500.000	☐

Test case <no>: Interpretation of **Market Turnover** (message type: **61**)

OMD Field Name	Expected Value	Result (✓ if correct)
MarketCode	**MAIN**	☐
Currency Code	HKD	☐
Turnover	1234567890.000	☐

Test case <no>: Interpretation of **Yield** (message type: **44**) for Yield = N/A

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	. . .	☐
Yield	0	☐

Test case <no>: Interpretation of **Yield** (message type: **44**) for Yield with value

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	. . .	☐
Yield	3.585	☐

Test case <no>: Interpretation of **Liquidity Provider** (message type: **13**) – One liquidity provider

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	. . .	☐
NoLiquidityProviders	1	☐
LPBrokerNumber	3898	☐

Test case <no>: Interpretation of **Liquidity Provider** (message type: **13**) – 50 liquidity providers

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	. . .	☐
NoLiquidityProviders	50	☐
LPBrokerNumber (1)	3898	☐
LPBrokerNumber (2)	. . .	☐
LPBrokerNumber (3)	. . .	☐
LPBrokerNumber (4)	. . .	☐
LPBrokerNumber (5)	. . .	☐
LPBrokerNumber (6)	. . .	☐
LPBrokerNumber (7)	. . .	☐
LPBrokerNumber (8)	. . .	☐
LPBrokerNumber (9)	. . .	☐

LPBrokerNumber (10)	. . .	☐
LPBrokerNumber (11)	. . .	☐
LPBrokerNumber (12)	. . .	☐
LPBrokerNumber (13)	. . .	☐
LPBrokerNumber (14)	. . .	☐
LPBrokerNumber (15)	. . .	☐
LPBrokerNumber (16)	. . .	☐
LPBrokerNumber (17)	. . .	☐
LPBrokerNumber (18)	. . .	☐
LPBrokerNumber (19)	. . .	☐
LPBrokerNumber (20)	. . .	☐
LPBrokerNumber (21)	. . .	☐
LPBrokerNumber (22)	. . .	☐
LPBrokerNumber (23)	. . .	☐
LPBrokerNumber (24)	. . .	☐
LPBrokerNumber (25)	. . .	☐
LPBrokerNumber (26)	. . .	☐
LPBrokerNumber (27)	. . .	☐
LPBrokerNumber (28)	. . .	☐
LPBrokerNumber (29)	. . .	☐
LPBrokerNumber (30)	. . .	☐
LPBrokerNumber (31)	. . .	☐
LPBrokerNumber (32)	. . .	☐
LPBrokerNumber (33)	. . .	☐
LPBrokerNumber (34)	. . .	☐
LPBrokerNumber (35)	. . .	☐
LPBrokerNumber (36)	. . .	☐
LPBrokerNumber (37)	. . .	☐
LPBrokerNumber (38)	. . .	☐
LPBrokerNumber (39)	. . .	☐
LPBrokerNumber (40)	. . .	☐
LPBrokerNumber (41)	. . .	☐
LPBrokerNumber (42)	. . .	☐
LPBrokerNumber (43)	. . .	☐
LPBrokerNumber (44)	. . .	☐
LPBrokerNumber (45)	. . .	☐
LPBrokerNumber (46)	. . .	☐
LPBrokerNumber (47)	. . .	☐
LPBrokerNumber (48)	. . .	☐
LPBrokerNumber (49)	. . .	☐
LPBrokerNumber (50)	. . .	☐

Test case <no>: Interpretation of **News** (message type: **22**)

OMD Field Name	Expected Value	Result (✓ if correct)
NewID	1	☐
NewType	EXN	☐
HeadLine	THIS IS A TESTING NEWS	☐
CancelFlag	N	☐
LastFragment	Y	☐
ReleaseTime	YY-MM-DDTHH:MM:SS	☐
NoMarketCode	1	☐
MarketCode	MAIN	☐
NoSecurityCodes	0	☐
SecurityCode	N/A	☐
NoNewsLines	2	☐
NewsLine	TEST LINE 1	☐
NewsLine	TEST LINE 2	☐

Test case <no>: Interpretation of **News** (message type: **22**) for NoMarketCode and NoSecurity Codes = 0 (Applies to all market)

OMD Field Name	Expected Value	Result (✓ if correct)
NewID	1	☐
NewType	EXN	☐
HeadLine	THIS IS A TESTING NEWS	☐
CancelFlag	N	☐
LastFragment	Y	☐
ReleaseTime	YY-MM-DDTHH:MM:SS	☐
NoMarketCode	0	☐
MarketCode	MAIN	☐
NoSecurityCodes	0	☐
SecurityCode	N/A	☐
NoNewsLines	2	☐
NewsLine	TEST LINE 1	☐
NewsLine	TEST LINE 2	☐

Test case <no>: Interpretation of **Index Definition** (message type: **70**) (For Index Feed Subscribers only)

OMD Field Name	Expected Value	Result (✓ if correct)
IndexCode	**CSI300**	☐
IndexSource	C	☐
CurrencyCode	CNY	☐

Test case <no>: Interpretation of **Index Data** (message type: **71**)) (For Index Feed Subscribers only)

OMD Field Name	Expected Value	Result (✓ if correct)
IndexCode	**CSI300**	☐
IndexStatus		☐
IndexTime	12-11-05 11:25:30	☐
IndexValue	2388.1234	☐
NetChgPrevDay	123.1234	☐
HighValue	2398.1234	☐
LowValue	2378.1234	☐
EASValue	N/A	☐
IndexTurnover	123456.7890	☐
OpeningValue	2387.1234	☐
ClosingValue	1289.1234	☐
PreviousSesClose	2265.1234	☐
IndexVolume	12341234	☐
NetChgPrevDayPct	5.23	☐
Exception		☐

Test case <no>: Interpretation of **Index Data** (message type: **71**) - HSI (For Index Feed Subscribers only)

OMD Field Name	Expected Value	Result (✓ if correct)
IndexCode	**0000100**	☐
IndexStatus	T	☐
IndexTime	12-11-05 09:28:12	☐
IndexValue	18784.56	☐
NetChgPrevDay	264.03	☐
HighValue	18814.39	☐
LowValue	18652.78	☐
EASValue	18794.83	☐
IndexTurnover	4885513569	☐
OpeningValue	18800.03	☐
ClosingValue	18764.14	☐
PreviousSesClose	18520.53	☐
IndexVolume	N/A	☐
NetChgPrevDayPct	8.24	☐

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(More test cases will be provided in the actual Answer Book)

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Part B – Order Book Building

During the same session as Part A, OMD disseminates Order Book messages (i.e. Add/Delete Order (SF only), Add/Delete Odd Lot Order, Aggregate Order Book Update (SS and SP only) and Broker Queue) with various order activities.   The full order book (for SF) and aggregate order book for the top 10 best bid and offers, or "10BBO" (for SS and SP) as at the end of this test session are provided for each of the test cases below.   Clients are required to verify the respective order book recorded in your system and make sure that all are correct.

For each test case below, please put a tick (✓) in the box for each order book entry where your system records the same details as the expected details.

Test case 1: Securities with order input with trades matched – Test Security: 00005

Full Order Book (SF Subscribers only)

Buy			Sell			Test Security: 00005
Order ID	Quantity	Price	Price	Quantity	Order ID	Result (✓ if correct)
00000003	800	73.6				☐
00000001	400	73.5				☐
			73.9	1200	00000002	☐
			74.2	1600	00000004	☐

Full Odd-Lot Order Book (Subscribers of Odd Lot Order Book only)

Buy				Sell				Test Security: 00005
Order ID	Broker ID	Quantity	Price	Price	Quantity	Broker ID	Order ID	Result (✓ if correct)
00000003	3909	800	73.6					☐
00000001	3822	400	73.5					☐
				73.9	1200	2389	00000002	☐
				74.2	1600	3435	00000004	☐

10BBOs   (SS and SP Subscribers only)

Buy				Sell				Test Security: 00005
No. of Orders	Aggregated Quantity	Price	Price Level	Price Level	Price	Aggregated Quantity	No. of Orders	Result (✓ if correct)
1	800	73.6	1					☐
1	400	73.5	2					☐
				1	73.9	1200	1	☐
				2	74.2	1600	1	☐

Broker Queue (SS Subscriber and SP/SF Subscribers receiving Conflated Broker Queue)

Buy	Sell	Test Security: 00005
Broker ID	**Broker ID**	**Result (✓ if correct)**
3909		☐
(-1)		☐
3822		☐
	3435	☐
	(-1)	☐
	2389	☐

Trade (SP and SF Subscribers only)

Trade Time	Trade ID	Trade Type	Price	Quantity	Cancel (Yes or No)	Result (✓ if correct)
12-11-05 11:25:45	12345667	0	75.000	400		☐
12-11-05 11:27:22	12345680	0	75.100	1600	Yes	☐
12-11-05 11:35:38	12345813	0	75.150	2000		☐
12-11-05 11:35:38	12345814	0	75.150	800	Yes	☐

Trade Tickers (SS Subscribers only)

Trade Time	Ticker ID	Trade Type	Price	Aggregated Quantity	Cancel (Yes or No)	Result (✓ if correct)
12-11-05 11:25:45	01234566	0	75.000	400		☐
12-11-05 11:27:22	01234568	0	75.100	1600	Yes	☐
12-11-05 11:35:38	01234581	0	75.150	1200		☐

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(More test cases will be provided in the actual Answer Book)

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Session 2: Data Recovery (Refresh Service)　　　　Test Date: _____

During this session, OMD simulates missing packet scenarios to force the client application to reinstate the latest market states by requesting Refresh service.　The latest market states are provided below.　Clients are required to verify the respective data values in your system and make sure that all are correct.

For each test case below, please put a tick (✓) in the box for each data item where your system records the same value as the expected value.　Bold item(s) is/are key data field(s) of the message.

Market Definition (message type: 10)

OMD Field Name	Expected Value	Result (✓ if correct)
MarketCode	**GEM**	☐
MarketName	Growth Enterprise Market	☐
CurrencyCode	HKD	☐
NumberOfSecurities	123	☐

Currency Rate (message type: 14)

OMD Field Name	Expected Value	Result (✓ if correct)
CurrencyCode	**JPY**	☐
CurrencyFactor	3	☐
CurrencyRate	11.234	☐

Trading Session Status (message type: 20)

OMD Field Name	Expected Value	Result (✓ if correct)
MarketCode	**GEM**	☐
TradingSession ID	1	☐
TradingSessionSubID	0	☐
TradingSesStatus	100	☐
TradingSesControlFlag	0	☐
StartDateTime	12-11-05T16:01:00	☐
EndDateTime	0	☐

Statistics (message type: 60)

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	**00005**	☐
SharesTraded	12345600	☐
Turnover	1234567890.000	☐
HighPrice	75.500	☐
LowPrice	74.500	☐
LastPrice	75.000	☐
VWAP	74.900 for SP, N/A for SS	☐
ShortSellSharesTraded	12345	☐
ShortSellTurnover	1234500.000	☐

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(More test cases will be provided in the actual Answer Book)

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Session 3: Data Recovery (Line Arbitration & Retransmission)   Test Date: _____

During this session, OMD simulates missing packet scenarios to force the client application to recover lost data (i) by line arbitration only; (ii) by retransmission only; and (iii) by either line arbitration or by retransmission.   The recovered messages in each of the above scenarios are provided below.   Clients are required to verify the respective data values in your system and make sure that all are correct.

For each test case below, please put a tick (✓) in the box for each data item where your system records the same value as the expected value.   Bold item(s) is/are key data field(s) of the message.

Test case 1 – Message gap in Line A or Line B

SecurityCode = 00005, Trade (SP and SF Subscribers only)

Trade Time	Trade ID	Trade Type	Price	Quantity	Cancel (Yes or No)	Result (✓ if correct)
12-11-05 11:25:45	12345667	0	75.000	400		☐
12-11-05 11:27:22	12345680	0	75.100	1600	Yes	☐
12-11-05 11:35:38	12345813	0	75.150	2000		☐
12-11-05 11:35:38	12345814	0	75.150	800	Yes	☐

SecurityCode = 00005, Trade Tickers (SS Subscribers only)

Trade Time	Ticker ID	Trade Type	Price	Aggregated Quantity	Cancel (Yes or No)	Result (✓ if correct)
12-11-05 11:25:45	01234566	0	75.000	400		☐
12-11-05 11:27:22	01234568	0	75.100	1600	Yes	☐
12-11-05 11:35:38	01234581	0	75.150	1200		☐

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(More test cases will be provided in the actual Answer Book)

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Session 4: Performance / Capacity   Test Date: _____

During this session, OMD disseminates high volume data at increasing rate up to the OMD installed limit.   Clients are required to verify if their application can handle the volume without data loss.

Please put a tick (✓) in the box for each scenario where your system can handle without data loss.

OMD Data Rate Scenario	Expected Result	Result (✓ if correct)
50% of installed maximum	Sequence Number of the last message = 1234	☐
	1234 messages received with Sequence Number from 1 to 1234 consecutively	☐
100% of installed maximum	Sequence Number of the last message = 1234	☐
	1234 messages received with Sequence Number from 1 to 1234 consecutively	☐

Session 5: Failover and Disaster Recovery   Test Date: _____

During this session, OMD simulates various exceptional scenarios according to the pre-set timetable.   Clients are required to go through each scenario in its scheduled time and verify if their application can handle it and resume service after the incident timely.

Please put a tick (✔) in the box for each scenario where your system can handle and be resumed on time.

Test case 1 : Sequence Reset (100) messages sent before market open to provide new set of Securities Definition messages

After the Sequence Reset messages and the Securities Definition messages for market open, OMD sends out another Sequence Reset message in each channel.   Clients are expected to clear the securities information in cache and replace it with data from the new Securities Definition sent after the second round of Sequence Reset messages.

Please put a tick (✔) in the box for a security in the list below if your system records the same image of the security as that specified by the expected data values.

Newly added security in current set of securities Definition.   It's correct if your security database includes the below security.

SecurityCode	SecurityShortName	FreeText	TradingStatus	Result (✔ if correct)
12345	NEW SECURITY		3	☐

Security removed in current set of securities Definition.   It's correct if your security database does not include the below security.

SecurityCode	SecurityShortName	FreeText	TradingStatus	Result (✔ if correct)
54321	DELETED SECURITY		3	☐

Security suspended in previous set of Securities Definition but activated in current set of securities Definition.   It's correct if the TradingStatus in your final security image match the below value.

SecurityCode	SecurityShortName	FreeText	TradingStatus	Result (✔ if correct)
00002	CLP HOLDINGS		3	☐

Security activated in previous set of securities Definition but suspended in current set of securities Definition.   It's correct if the TradingStatus in your final security image match the below value.

SecurityCode	SecurityShortName	FreeText	TradingStatus	Result (✔ if correct)
89999	RMB-DUMMY		2	☐

Security with non-blank FreeText in previous set of securities Definition but blank in current set of securities Definition.   It's correct if the FreeText in your final security image match the below value.

SecurityCode	SecurityShortName	FreeText	TradingStatus	Result (✓ if correct)
00001	CHEUNG KONG		3	☐

Security with blank FreeText in previous set of securities Definition but non-blank in current set of securities Definition.   It's correct if the FreeText in your security final image match the below value.

SecurityCode	SecurityShortName	FreeText	TradingStatus	Result (✓ if correct)
00003	HK & CHINA GAS	AAA-B-CCC	3	☐

Also please also check if the statement below is true and put a tick (✓) in the box provided if yes.

- There is no visible impact of the second round of Sequence Reset messages on   ☐
- our application
-
-

Test case 2 : Failover of OMD real-time data publisher

OMD simulates a real-time data publisher failure that will trigger a failover of the affected component. This interruption should be transparent to clients except SS clients may receive duplicate trade tickers (i.e. trade ticker ID same as one received previously) which they should discard.

For each record type below, please put a tick (✓) in the box for each record where your system records the same image as that defined by the expected values.

SecurityCode = 00005, Trade (SP and SF Subscribers only)

Trade Time	Trade ID	Trade Type	Price	Quantity	Cancel (Yes or No)	Result (✓ if correct)
12-11-05 11:25:45	12345667	0	75.000	400		☐
12-11-05 11:27:22	12345680	0	75.100	1600	Yes	☐
12-11-05 11:35:38	12345813	0	75.150	2000		☐
12-11-05 11:35:38	12345814	0	75.150	800	Yes	☐

SecurityCode = 00005, Trade Tickers (SS Subscribers only)

Trade Time	Ticker ID	Trade Type	Price	Aggregated Quantity	Cancel (Yes or No)	Result (✓ if correct)
12-11-05 11:25:45	01234566	0	75.000	400		☐
12-11-05 11:27:22	01234568	0	75.100	1600	Yes	☐
12-11-05 11:35:38	01234581	0	75.150	1200		☐

Also please also check if the statement below is true and put a tick (✓) in the box provided if yes.

● There is no visible impact of the real-time data publisher failover on our   ☐
application

Test case 3 : Failover of OMD Refresh service

OMD simulates a Refresh (RFS) service failure that will trigger a failover as a result a Sequence Reset (100) message will be transmitted in each of the refresh channels.   Clients are expected to handle RFS failover properly without affecting the reception of real-time market data and can capture a full latest market image from RFS.

For each record below, please put a tick (✓) in the box for each data item where your system records the same value as the expected value.   Bold item(s) is/are key data field(s) of the message.

Market Definition (message type: **10**)

OMD Field Name	Expected Value	Result (✓ if correct)
MarketCode	**GEM**	☐
MarketName	Growth Enterprise Market	☐
CurrencyCode	HKD	☐
NumberOfSecurities	123	☐

Currency Rate (message type: **14**)

OMD Field Name	Expected Value	Result (✓ if correct)
CurrencyCode	**JPY**	☐
CurrencyFactor	3	☐
CurrencyRate	11.234	☐

Statistics (message type: 60)

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	**00005**	☐
SharesTraded	12345600	☐
Turnover	1234567890.000	☐
HighPrice	75.500	☐
LowPrice	74.500	☐
LastPrice	75.000	☐
VWAP	74.900 for SP, N/A for SS	☐
ShortSellSharesTraded	12345	☐
ShortSellTurnover	1234500.000	☐

. . .

(More test cases will be provided in the actual Answer Book)

. . .

Also please also check if the statement below is true and put a tick (✓) in the box provided if yes.

- Our application can handle this scenario and receive latest market states from the   ☐
  Refresh service after its failover

Test case 4 : Failover of OMD Retransmission service

OMD simulates a primary Retransmission (RTS) server failure as a result only the secondary RTS server remains operational to provide service.　Clients are expected to detect such failure and auto-switch to the secondary RTS server to make retransmission requests.

For each record type below, please put a tick (✓) in the box for each record where your system records the same image as that defined by the expected values.

SecurityCode = 00005, Trade (SP and SF Subscribers only)

Trade Time	Trade ID	Trade Type	Price	Quantity	Cancel (Yes or No)	Result (✓ if correct)
12-11-05 11:25:45	12345667	0	75.000	400		☐
12-11-05 11:27:22	12345680	0	75.100	1600	Yes	☐
12-11-05 11:35:38	12345813	0	75.150	2000		☐
12-11-05 11:35:38	12345814	0	75.150	800	Yes	☐

SecurityCode = 00005, Trade Tickers (SS Subscribers only)

Trade Time	Ticker ID	Trade Type	Price	Aggregated Quantity	Cancel (Yes or No)	Result (✓ if correct)
12-11-05 11:25:45	01234566	0	75.000	400		☐
12-11-05 11:27:22	01234568	0	75.100	1600	Yes	☐
12-11-05 11:35:38	01234581	0	75.150	1200		☐

Also please also check if the statement below is true and put a tick (✓) in the box provided if yes.

- Our application can handle this scenario and recover missing data from the　　　　☐
  Retransmission service after its failover

Test case 5 : Disaster Recovery (DR) site failover

OMD simulates a primary site failure resulting in failover to the DR site. Upon the takeover of the DR site, OMD will delivers a Sequence Reset (100) messages from each channel. Clients are expected to clear the data in cache upon receipt of the Sequence Reset messages and then obtain the latest market image from the Refresh service and real-time channels at the DR site.

For each record below, please put a tick (✓) in the box for each data item where your system records the same value as the expected value. Bold item(s) is/are key data field(s) of the message.

Market Definition (message type: **10**)

OMD Field Name	Expected Value	Result (✓ if correct)
MarketCode	**GEM**	☐
MarketName	Growth Enterprise Market	☐
CurrencyCode	HKD	☐
NumberOfSecurities	123	☐

Currency Rate (message type: **14**)

OMD Field Name	Expected Value	Result (✓ if correct)
CurrencyCode	**JPY**	☐
CurrencyFactor	3	☐
CurrencyRate	11.234	☐

Statistics (message type: 60)

OMD Field Name	Expected Value	Result (✓ if correct)
SecurityCode	**00005**	☐
SharesTraded	12345600	☐
Turnover	1234567890.000	☐
HighPrice	75.500	☐
LowPrice	74.500	☐
LastPrice	75.000	☐
VWAP	74.900 for SP, N/A for SS	☐
ShortSellSharesTraded	12345	☐
ShortSellTurnover	1234500.000	☐

. . .

(More test cases will be provided in the actual Answer Book)

. . .

Also please also check if the statement below is true and put a tick (✓) in the box provided if yes.

- Our application can reconnect to the DR site in time, handle the Sequence Reset　　　□
  messages received at logon, reinstate the latest market states from the Refresh
  service, and run normally afterwards

＊＊＊　　End of Test　　＊＊＊

I/We declare that we have completed all required test cases with positive result

Name of Client: _____　Signature: _____　Date: _____