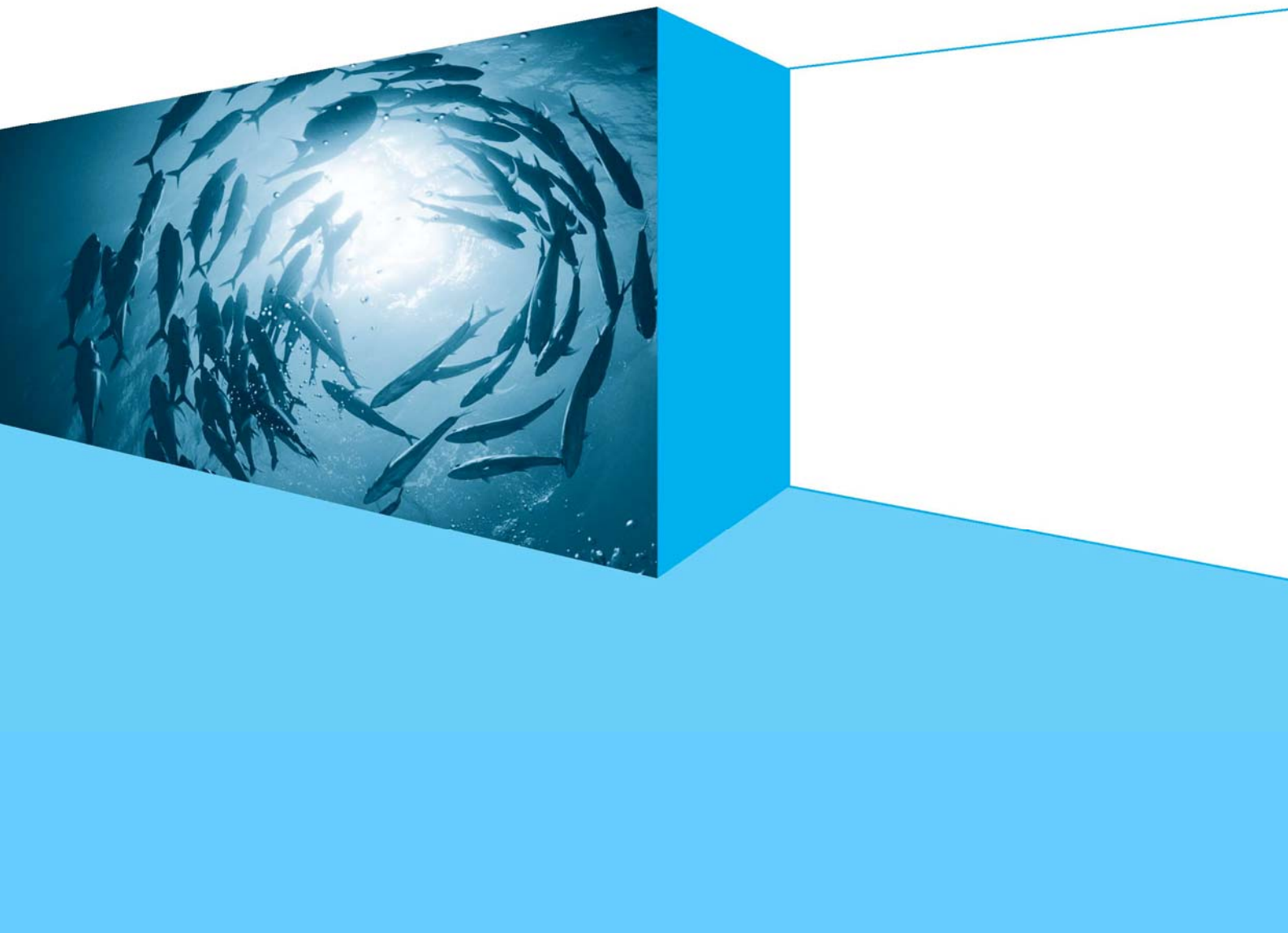




*London*  
**STOCK EXCHANGE**

RECOMMENDED DISPLAY AND DERIVED INFORMATION GUIDELINES - SEPTEMBER 2007

# Infolect





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## 1. About this document

This document provides member firms, software houses and information vendors with recommended display principles and guidelines on calculating derived market data information from data delivered via Infolect.

The purpose of this document is to provide a high level overview of Infolect data content and specific guidance to how this information should be displayed to the end user. The method by which the Exchange calculates derived data is also provided should customers wish to duplicate these calculations independently.

The document is divided into the following sections:

**Market data** - A general description of the market data content supplied by the Exchange.

**Recommended display principles** - General information and recommended display principles for each of our trading services

**Calculating derived data** - Guidelines to the derivation of data from Exchange provided data services.

### 1.1. Related documentation

This document should be read in conjunction with the following documents:

- Service Definition Issue 14
- Data Formats Issue 14
- Guide to TradElect
- Service development documentation is available in the technical library section of the Exchange's website at: [www.londonstockexchange.com](http://www.londonstockexchange.com).

This document has been produced by us to assist member firms and other customers. While it has been prepared using the best information available, the Exchange accepts no liability for decisions taken, or system or other work carried out by any party, based on this document. This document does not form part of the contractual documentation between the Exchange and its customers.

Any queries on these guidelines should be addressed to your Technical Account Manager on **+44 (0)20 7797 3939 (STX: 33939)**. Please contact your Account Manager for more copies of this or other Exchange documents. This document is only available electronically at [www.londonstockexchange.com](http://www.londonstockexchange.com).



## 2. Market Data

### 2.1. Data Categories and Levels

Market data for each of our trading services is disseminated to customers over Infolect and divided into a number of logical information services. Each service is made up of one or more message types and belongs to one of the following categories:

#### UK Data

All Domestic Trading Services:

- SETS
- SETSqx
- SEAQ
- International Retail Service (IRS)

#### International Data

All International Trading Services:

- International Order Book (IOB)
- International Bulletin Board (IBB)
- Also includes European data

#### European Data

All European Trading Services:

- Eurosets
- European Quote Service
- European Reporting Service

Market data messages are grouped into the following four levels of information:

<b>Off Book Data</b>	Off-book trade reports submitted to the Exchange
<b>Level 1</b>	The above plus best prices, reference prices and trades
<b>Level 1 Plus</b>	The above plus an enhanced best price that includes details of volume and other added value data including Time Weighted Average Spread
<b>Level 2</b>	All of the above plus full depth of the order or quote book

With the exception of Off Book Data, a service will only ever contain messages from a single category and level of data. Appendix A specifies the category and level of information associated with each information service.

### 2.2. Permissioning

Where a vendor displays different levels of data on a single screen then the screen is deemed to be of the **highest level**. If different screens display different levels or categories of data then vendors must have the appropriate permissioning in place to control access to this information.



## 3. Recommended display principles

### 3.1. Introduction

The Exchange recommends that all vendors who distribute Infolect data adopt the display principles given in this document to ensure conformity and consistency across all products that carry Exchange data.

The recommendations are intended to supplement the Infolect License Agreement (Infolect License) but they do not form part of it and there is no obligation to comply.

### 3.2. General information for all Exchange securities

#### 3.2.1. Identification

Each security should be allocated a unique display identifier that makes it clearly recognisable to the user. Stock Exchange Tradable Instrument Display Mnemonics (TIDMs) codes need not be used, but users should be able to tell the name of the security and the difference between, for example, the ordinary shares and warrants, and A and B shares, issued by the same company.

For each tradable instrument it is recommended that the following information is displayed:

- Unique Display Identifier e.g. TIDM, ISIN, SEDOL
- Market Segment Code e.g. SET1
- Country of Register e.g. GB

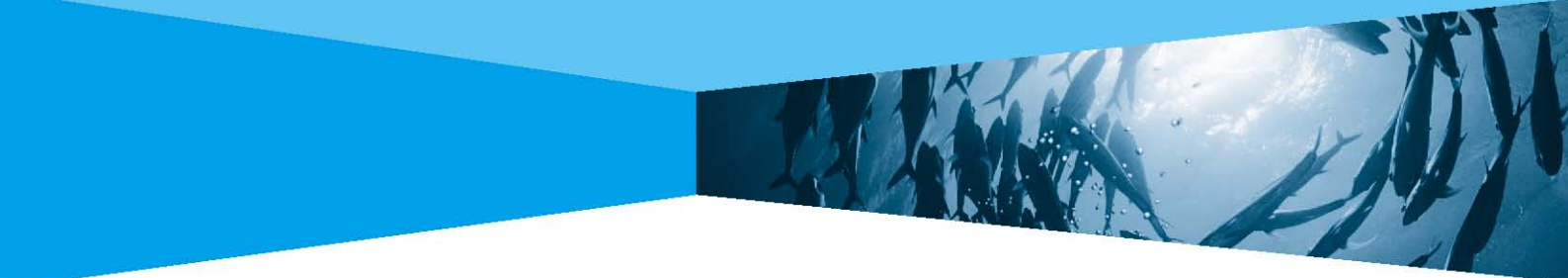
Where an instrument has a dual listing and is being traded on more than one Market Segment, separate Tradable Instruments will be created by the Exchange, each with its own unique TIDM. To prevent confusion the market segment on which an instrument is traded should be clearly distinguished.

#### 3.2.2. Tradable context

To show the context in which the tradable instrument is being traded, vendors should display, where supplied by the Exchange, the following:

- Market e.g. London
- Market Segment Code e.g. SET1
- Market Sector Code e.g. FT10
- Currency Code e.g. GBX
- Current Period e.g. OBT
- Tradable Instrument Action Type (e.g. Suspended)
- Ex-marker code
- Ex-marker start and end date (either implicitly or explicitly)
- Bid status
- News Announcement marker
- Normal Market Size (NMS) value
- Standard Market Size (SMS) value
- Exchange Market Size (EMS) value
- Publication Threshold Size (PTS) value (where applicable)
- Uncrossing Status (where applicable) e.g. Firm / Indicative
- Uncrossing Price (where applicable)

It should be clearly recognisable, either through letter or colour coding, that an instrument is currently closed for trading or is suspended from trading.



In addition, it is recommended that the following information is available for each tradable instrument:

- (previous) Closing Price, as supplied by the Exchange<sup>1</sup>
- Opening Price, as supplied by the Exchange<sup>1</sup>
- Best Bid and Offer, as supplied by the Exchange
- Last five trade prices, together with trade type
- Latest cumulative volume for automatic trades (where applicable), as supplied by the Exchange
- Latest cumulative volume for manual trades (where applicable), as supplied by the Exchange
- Difference between the last automatic trade price and the previous trading days Closing Price for order driven markets
- Difference between the current mid price and the previous trading days Closing Price for quote driven markets
- Trade High / Low and Mid High / Low prices, as supplied by the Exchange
- Tick Size (Price Format code)
- Current VWAP for automatic trades (where applicable) , as supplied by the Exchange
- Current VWAP for all trades, as supplied by the Exchange
- Indicative uncrossing price during auction calls.

For instruments with a Dynamic Tick Size the range of valid Price Format Codes should be displayed. Full information on the Lower and Upper Bands for each code may be displayed on a separate screen.

For those tradable instruments that are subject to continuous auction calls with periodic uncrossings it is recommended that the following information is available for each tradable instrument:

- Time to next uncrossing
- Whether a monitoring extension is in force or not
- Indicative uncrossing price
- Last firm uncrossing price

### **3.2.3. Trade 'tickers'/'time and sales'**

Full details of all trades should be available and displayed with the trade type, trade code, venue, price, size, date, time and bargain condition indicator.

Where possible it is recommended that all trades published during the day are also displayed on 'trade tickers' / 'time and sales' screens with trade time and date, trade time indicators and trade type indicators, immediately on publication.

This will include trades with a trade date prior to the day they are published by the Exchange.

If a vendor service closes before the Exchange has finished publishing trades on that day, this must be shown together with an indication that further trades may be published after the vendor's service has closed.

Where market data from more than one source is shown on the same display then Exchange provided data should be clearly recognisable.

### **3.2.4. Consolidated Market Displays**

Where market venue data from more than one source (market) are shown on the same display then Exchange provided data should be clearly distinguished and attributed.

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<sup>1</sup> This information is not available for the European Quoting Service



For Level 2 displays, orders or quotes from separate markets should not be aggregated. Where prices from separate markets are shown in aggregated Level 1, Level 1 Plus or Level 2 displays then the source of the best buy price and best sell price at each level should be clearly displayed.

### 3.3. SETS and Covered Warrants recommended display principles

#### 3.3.1. Level 2 Display criteria

For Level 2 displays the full depth of the order book should be displayed in accordance with the following criteria:

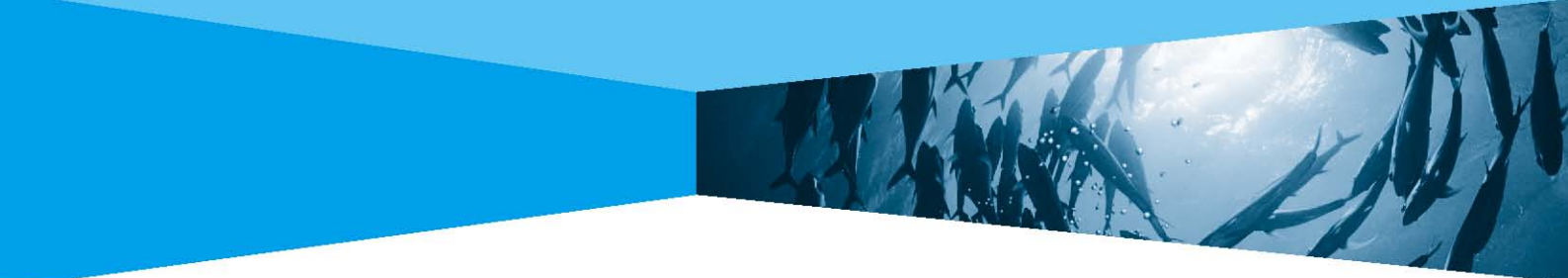
- Orders should be displayed in price / time priority. Time priority should be determined by the sequence number attached to each order message by the Exchange. Market Orders will always have priority over Limit Orders.
- When an order is displayed it should be clear whether it is a buy or a sell order.
- Market Orders and Limit Orders should be clearly differentiated.
- All buy orders and all sell orders should be displayed together.
- Vendors should not display orders for more than one tradable instrument in any block.
- Where each order is displayed separately, the time/date, price, size, and order code should be displayed.
- Where orders at the same price are aggregated, the total volume at that price, together with the total number of separate orders at that price should be displayed.
- Enhanced Quotes should always be shown separately with the participant's mnemonic clearly displayed alongside the order. Enhanced Quotes should never be aggregated.
- Where Limit Orders exist with Enhanced Quotes the orders should be ranked in price and time priority.
- Where a price level contains both Enhanced Quotes and Limit Orders, only Limit Orders can be aggregated. The aggregated Limit Order should be separated into individually aggregated Limit Orders and presented in time priority:

An aggregated order containing orders of an earlier time than the Enhanced Quote

One or more Enhanced Quotes

An aggregated order containing orders of a later time than the Enhanced Quote.

- While orders can be aggregated, as described above, the top 10 price levels on each side of the book should be displayed as a minimum
- In the event that two or more Enhanced Quotes from Market Makers are identical in terms of prices, the best order will be the order which was first disseminated by the Exchange. Time priority should be determined by the sequence number attached to each order message.
- For those Level 2 displays showing the best price then Market Makers mnemonics should also been shown along with the best priced buy and sell orders. If more than one Market



Maker is making the best price then they should be displayed in time order from the centre outwards e.g. with the Market Maker with the highest priority closest to the buy / sell price.

### 3.3.2. Level 1 Displays

For Level 1 displays the aggregated order book should be displayed in accordance with the following criteria:

- The best buy price and best sell price should be clearly displayed with buy and sell side clearly distinguished
- Any Level 1 display should not show the identity of any Market Makers making the best price.

### 3.3.3. Level 1 Plus Displays

Where Level 1 Plus data is displayed alongside Level 1 or Level 2 data then the following information should also be included as part of the order book display.

- The total number and volume of orders at best on the buy and sell sides of the order book
- order volumes on each side of the order book expressed as percentages for each security
- Money flow data: cumulative value of trades executed and the value of orders on each side of the order book for each security
- Any Level 1 Plus display should not show the identity of any Market Makers making the best price.

The following Level 1 Plus data may be displayed on linked screens if preferred:

- Identity of the top 5 member firms in each security in terms of the value of business transacted on the Exchange sorted in alphabetical order.
- Risk and Performance Measures:
  - Price/earnings ratios and market capitalisation message
  - Return measures
  - Alphas/Betas
  - Average/Cumulative traded volumes

## 3.4. SETSqx recommended display principles

### 3.4.1. Level 2 display criteria

For Level 2 products the full depth of the quote / order book should be displayed in accordance with the following criteria:

- Orders should be displayed in price / time priority. Time priority should be determined by the sequence number attached to each order message by the Exchange. Market Orders will always have priority over Limit Orders.
- When an order is displayed it should be clear whether it is a buy or a sell order.

- All buy orders and all sell orders should be displayed together
- Named Orders should always be shown separately with the participant's mnemonic clearly displayed alongside the order. Participants are allowed to submit more than one Named Order for each side of the book.
- Where orders at the same price are aggregated, the total volume at that price, together with the total number of separate orders at that price should be displayed
- Where a price level contains both Named and Limit Orders, only Limit Orders can be aggregated. The aggregated Limit Order should be separated into individually aggregated Limit Orders and presented in time priority:

An aggregated order containing orders of an earlier time than the Named Order;

One or more Named Orders;

An aggregated order containing orders of a later time than the Named Order.

- While orders can be aggregated, as described above, the top 10 price levels on each side of the book should be displayed as a minimum
- In the event that two or more Named Orders from participants are identical in terms of prices, the best order will be the order which was first disseminated by the Exchange. Time priority should be determined by the sequence number attached to each order message.
- Where Market Maker quotes are supported alongside the order book then these should be displayed separately on the same screen.
- Both quotes and orders for a single security should be shown on a single page.
- Each two way quote should be clearly shown separately with the participant's mnemonic, in time priority order. Time priority should be determined by the sequence number attached to each quote message by the Exchange.
- Each two way quote should be shown together with the quote sizes expressed as "n x n" where n is the quote size divided by 1000.
- The period that the instrument is in should be clearly displayed.

### 3.4.2. Level 2 Best Price display criteria

#### Securities with Market Maker support

- Where Market Maker quotes are supported then these form the best price for that security. Orders are not eligible for inclusion as best bid and offer prices. The best bid price and best offer quote should be clearly displayed with buy and sell side clearly distinguished.
- The indicative uncrossing price for the order book should also be shown separate to the best prices and is the only indicator of order book best price that should be displayed.

#### Securities with no Market Maker support

- Where Market Maker quotes are not supported then orders will form the best bid and offer price for that security. The best priced buy and best price sell order should be clearly displayed with the buy and sell side clearly distinguished. Those participant mnemonics (if Named Orders make up the 'best' price) should also be shown along the best priced buy and sell orders. If more than one participant is making the best price then they should be displayed in time order, with the participant with the highest priority closest to the buy / sell price.
- The indicative uncrossing price for the order book should also be shown separate to the best prices.

### 3.4.3. Level 1 and Level 1 Plus display criteria

For Level 1 and Level 1 Plus products the SETS recommended display principles should be followed with the following differences:

- For all securities, any Level 1 or Level 1 Plus displays should not show the identity of any participants making the best price.
- For securities with Market Maker support, the best bid / offer quote should be clearly displayed with buy and sell side clearly distinguished.

## 3.5. International Order Book recommended display principles

The SETS recommended display principles should be followed with the following differences:

- Named Orders should always be shown separately with the participant's mnemonic clearly displayed alongside the order. Participants are allowed to submit more than one Named Order for each side of the book.
- Where Limit Orders exist with Named Orders the orders should be ranked in price and time priority.
- Where a price level contains both Named and Limit Orders, only Limit Orders can be aggregated. The aggregated Limit Order should be separated into individually aggregated Limit Orders and presented in time priority:

An aggregated order containing orders of an earlier time than the Named Order

One or more Named Orders

An aggregated order containing orders of a later time than the Named Order.

- While orders can be aggregated, as described above, the top 10 price levels on each side of the book should be displayed as a minimum
- In the event that two or more Named Orders from participants are identical in terms of prices, the best order will be the order which was first disseminated by the Exchange. Time priority should be determined by the sequence number attached to each order message.
- For those Level 2 displays showing the best price then participant mnemonics should also be shown along the best priced buy and sell orders. If more than one participant is making the best price then they should be displayed in time order, with the participant with the highest priority closest to the buy / sell price.
- Any Level 1 or Level 1 Plus displays should not show the identity of any participants making the best price.

### 3.6. International Bulletin Board recommended display principles

The SETS recommended display principles should be followed with the following differences:

- Enhanced Quotes should always be shown separately with the participant's mnemonic clearly displayed alongside the order
- Where Limit Orders exist with Enhanced Quotes the orders should be ranked in price and time priority.
- Where aggregated Enhanced Quotes contain orders with time priorities both earlier and later than the Committed Principal order, the aggregated Limit Order should be separated into individually aggregated Limit Orders and presented in time priority:

An aggregated order containing orders of an earlier time than the Committed Principal order

One or more Unaggregated Enhanced Quotes

An aggregated order containing orders of a later time than the Executable Quote.

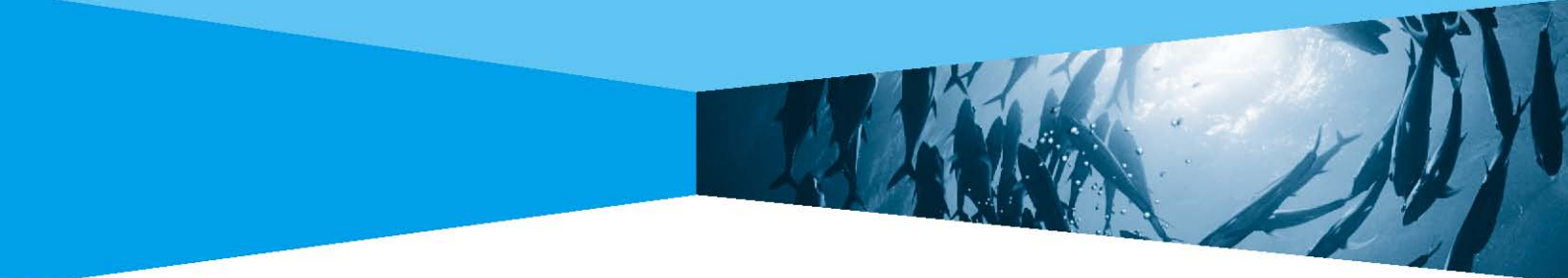
- While orders can be aggregated, as described above, the top 10 price levels on each side of the book should be displayed as a minimum
- In the event that two or more Enhanced Quotes from Market Makers are identical in terms of prices, the best order will be the order which was first disseminated by the Exchange. Time priority should be determined by the sequence number attached to each order message.
- For those Level 2 displays showing the best price then Market Maker mnemonics should also be shown along the best priced buy and sell orders. If more than one Market Maker is making the best price then they should be displayed in time order, with the Market Maker with the highest priority closest to the buy / sell price.
- Any Level 1 or Level 1 Plus displays should not show the identity of any Market Makers making the best price.

### 3.7. EQS, SEAQ and IRS recommended display principles

#### 3.7.1. Level 2 display criteria

For Level 2 products the full depth of the quote book should be displayed in accordance with the following criteria:

- Each two way quote should be clearly shown separately with the participant's mnemonic, in time priority order. Time priority should be determined by the sequence number attached to each quote message by the Exchange.
- Each two way quote should be shown together with the quote sizes expressed as "n x n" where n is the quote size divided by 1000.
- Ideally all quotes for a single security should be displayed on a single page. Where two or more pages are required to display all Market Makers' quotes, it is recommended that each page contains approximately the same number of quotes, and that each page bears a reference to indicate that it is part of a series.

- 
- Bid quotes and offer quotes may be displayed on separate pages.
  - Where quotes are displayed to show at the best bid and best offer quotations they should be selected in accordance with the display criteria set out below. Subsequent quotations should be ranked in descending order according to the display criteria. Vendors should not display in any one block of quotations more than one security quoted in more than one currency.
  - Firm and Enhanced Quotes should be clearly differentiated, ideally through colour coding.
  - In the event that quotations by two or more Market Makers are identical in terms of prices, the best quote will be the quote which was first disseminated by the Exchange. Time priority should be determined by the sequence number attached to each quote message.
  - For those Level 2 displays showing the best price then Market Makers mnemonics should also be shown along the best priced buy and sell quotes. If more than one Market Maker is making the best price then they should be displayed in time priority order from the centre outwards e.g. with the Market Maker with the highest time priority closest to the buy/sell price.

### **3.7.2. Level 1 and Level 1 Plus display criteria**

For Level 1 and Level 1 Plus products the SETS recommended display principles should be followed with the following differences:

- The best bid price and best offer quote should be clearly displayed with buy and sell side clearly distinguished
- Any Level 1 or Level 1 Plus displays should not show the identity of any Market Makers making the best price

## 4. Calculating derived information

### 4.1. General information for all Exchange securities

Derived data is defined as the end result of any calculation that uses any component of Exchange Infolect data as its basis.

Where possible, 'official' derived data provided by the Exchange should be used but if vendors intend to calculate any derived data themselves the following guidelines should be followed.

- Where data is derived, if a mixture of firm and indicative prices are used in whole or part for any calculation then it should be deemed indicative.
- The method of calculation must be clearly visible to the user. If the method of calculation differs to that made by the Exchange then this should also be indicated.
- Where reference is made to best bid, best offer and mid prices, these should be taken to mean those prices disseminated by the Exchange.

### 4.2. Opening Price

The Exchange disseminates an official Opening Price for all Exchange traded securities.

Depending on Market Segment, the Opening Price is based on either the first Automatic Trade, or the Mid price of the best bid and offer at the start of the trading day. Where an execution price, i.e. the first Automatic Trade, is used in this calculation there will be no Opening Price disseminated until execution has occurred.

The following table specifies how the Opening Price is derived for each Exchange trading service.

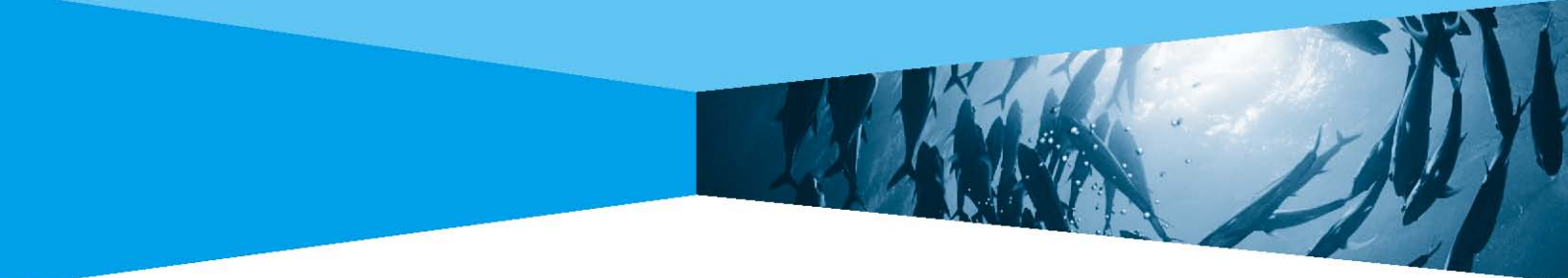
Exchange trading service	Method of calculation
SETS	First UT or AT
SETSqx (with Market Makers)	Mid price of BBO
SETSqx (with no Market Makers)	First UT
Covered Warrants	Mid price of BBO
SEAQ	Mid price of BBO
European Quoting Service	Mid Price of BBO
IOB	First UT or AT
IBB	First UT or AT
IRS	Mid price of BBO

The following guidelines should be used if customers wish to derive the Opening Price themselves.

#### 4.2.1. Automatic Trade based Opening Price

The first valid Automatic Trade (including Uncrossing Trades following auction uncrossing) generated for a Tradable Instrument will be used to define the Opening Price for an instrument.

If the first Automatic Trade is subsequently Contra'd, then the Opening Price should be corrected and



the next Automatic Trade used as the new Opening Price.

Where no Automatic Trade takes place in a trading day then trading in that instrument is not deemed to have 'opened' and no Opening Price should be displayed.

Until the first Automatic Trade takes place then the previous Closing Price can be used for display purposes. However this price should NOT be shown as the Opening Price.

#### 4.2.2. Best based Opening Price

The Mid Price of the Best Bid and Offer at the start of a designated period (generally the start of the mandatory quote period) is used to define the Opening Price for an instrument.

If no Mid Price can be derived then the Opening Price will not be set until the first best price is set in the designated period.

Where no best price is set during the trading day then trading in that instrument is not deemed to have 'opened' and no Opening Price should be displayed.

Until the first best price is set then the previous Closing Price can be used for display purposes. However this price should NOT be shown as the Opening Price.

### 4.3. Closing Price

The Exchange disseminates an official Closing Price for all Exchange traded securities at the end of trading. The following table specifies how the Closing Price is derived for each Exchange trading service.

Exchange trading service	Method of calculation	Note
SETS	Uncrossing price of closing auction	If no uncrossing then the mid of the BBO at the end of the closing auction
Covered Warrants SEAQ	Mid price of BBO Mid price of BBO	Both Firm Exposure orders and Quotes contribute
SETSqx	Uncrossing price of closing auction	If no uncrossing then the mid of the BBO at the end of the closing auction. Where there is no Market Maker support, then the last AT will be used in case of no uncrossing.●
IOB	Uncrossing price of closing auction	If no uncrossing then the VWAP of the last 30 minutes of trading, if no VWAP then last AT or UT



IBB	Uncrossing price of closing auction	If no uncrossing then the VWAP of the last 30 minutes of trading, if no VWAP then last AT or UT
IRS	Mid price of BBO	

The Exchange will not calculate a Closing Price for the European Quote Service.

The following guidelines should be used if customers wish to derive the Closing Price themselves.

#### **Uncrossing based Closing Price**

The uncrossing price is determined by an algorithm that takes into account the following:

- Maximum executable volume
- Minimum order surplus
- Market pressure

The final uncrossing price will be used as the Closing Price if the price falls within configurable price tolerance levels or the executable volume is of a large enough size to deem the price to be representative.

If these criteria are not met then the mid of the BBO at the end of the closing auction will be used.

Until the Closing Price is disseminated then the indicative uncrossing price can be used for display purposes. However this price should NOT be shown as the Closing Price.

#### **Best based Closing Price**

The Mid Price of the Best Bid and Offer at the end of a designated period (generally the end of the mandatory quote period) is used to define the Closing Price for an instrument.

### **4.4. Trade High and Trade Low prices**

The Exchange derives official trade highs and trade lows for configured tradable instruments in real time taking into account both automatic and manual trades. Changes to the trade high and low are broadcast in real time, and take into account both contras and cancellations.

Those trade types that contribute to the official Trade High/Low are given in Appendix B.

The Exchange will validate the price of incoming trade reports so that any outlying 'incorrect' trades are ignored when setting the trade high or trade low. Trade reports sent to the Exchange by participants will not be validated, and continued to be broadcast to the market irrespective of price.

For those customers who wish to implement the same approach, validation operates as follows:

#### **Where the trade high/low has already been set for the day**

A trade will only be allowed set a new high or low if it falls within a configurable percentage tolerance around the current trade high or low:

### **Trade high**

The trade price will set the trade high if the price is greater than the current trade high, but less than the current trade high + x%

### **Trade low**

The trade price will set the trade low if the price is less than the current trade low, but greater than the current trade low - x%

Where x is the trade high/low tolerance specified by the Exchange.

### **Where the trade high/low has not been set for the day**

When no previous trade high or low exists e.g. at the start of the trading day then validation will be based on the previous Closing Price, the trade high/low tolerance and a configurable value to compensate for overnight movement of the price:

#### **Trade high/low**

The trade price will set the trade high / low if the trade price is greater than the previous Closing Price - y times x% and less than the previous Closing Price + y times x%

Where x is the trade high / low tolerance and y is a configurable tolerance specified by the Exchange.

### **Where no previous Closing Price exists**

Where no previous closing exists then no validation is performed and the first trade of the day will set the trade high/low

Trade high/low tolerances will be specified for each Market Segment that is configured for trade high/low calculations. These are given in Appendix C.

The overnight price movement tolerance will be set to 2.

## **4.5. Mid High and Mid Low prices**

The Exchange derives official mid highs and trade lows for configured tradable instruments in real time based on the current best price.

Mid High/Lows are calculated for specified Market Segments. These are given in Appendix D.

## **4.6. Buy/Sell Percentages**

The Exchange will calculate buy/sell percentages for each configured tradable instrument, based on the total order volume currently on the order book.

The buy percentage is calculated as follows:

$$\text{Volume of buy orders} / \text{Total volume of buy and sell orders} \times 100$$

The sell percentage is calculated as follows:

$$\text{Volume of sell orders} / \text{Total volume of buy and sell orders} \times 100$$

Buy/Sell percentages are calculated for specified Market Segments. These are given in Appendix D.

## 4.7. Money Flow

The Exchange calculates the cumulative value of on and off order book trades executed and the value of orders for each configured tradable instrument during the trading day as follows:

On-book Money Flow Value Executed is equal to the total value of automatic trades for the day. Off-book Money Flow Value Executed is equal to the total value of manual trades for the day. In both cases:

Money Flow Executed Value = Sum of Trade Size X Trade Price

Money Flow Not Executed Value = Sum of Order Size X Order Price (for each side individually)

Money Flow is calculated for specified Market Segments. These are given in Appendix D.

## 4.8. All Trades VWAP (Volume Weighted Average Price)

The Exchange calculates a cumulative Volume Weighted Average Price for all published trades during the current day as follows:

$$VWAP = \frac{\sum_{i=1}^n (P_i V_i)}{\sum_{i=1}^n (V_i)}$$

where P is the Trade Price, V is the Volume of the Trade, and n is all of the Trades that have taken place for the TI during a trading day up to and including the time of calculation.

Trade types that contribute to the All Trades VWAP figure are specified in Appendix E.

## 4.9. Automatic Trade VWAP

The Exchange calculates a cumulative Volume Weighted Average Price for automatic trades during the current day as follows:

$$VWAP = \frac{\sum_{i=1}^n (P_i V_i)}{\sum_{i=1}^n (V_i)}$$

Where P is the trade price, V is the trade volume and n is all automatic trades that have taken place on that day up to and including the time of calculation.



The VWAP from trades is adjusted to take account of contra trades.

#### 4.10. Cumulative Volumes

The Exchange calculates cumulative volumes throughout the trading day for both automatic and manual trades.

Those trade types that contribute to the cumulative volume figure are specified in Appendix F.

Only those trades where the trade date equals the published date should be included in the cumulative volume figure for the current trading day. This will exclude any late trades, or any trade that occurred before midnight reported that day.

#### 4.11. Time Weighted Average Spread (TWAS)

The Exchange calculates the Time Weighted Average Spread for configured tradable instruments during the trading day as follows:

$$TWAS = \frac{\sum S \times T}{P}$$

Where S is the difference between the offer and bid, T is the time over which that spread applied and P is the period over which the TWAS is calculated.

TWAS will be calculated for positive, choice (zero) and negative spreads.

TWAS is calculated for specified Market Segments. These are given in Appendix D.

#### 4.12. Risk and Performance Measures

The Exchange calculates the following risk and performance measures for configured tradable instruments:

- Price/Earnings Ratio and Market Capitalisation
- Return Measures
- Alphas/Betas
- Average/Cumulative Volumes

Details of how the Exchange calculates these measures are given in the following sections. The following definitions are used:

$P_t$  is the Closing Price of the asset at time  $t$ .

$V_t$  is the total traded volume for an asset at time  $t$ .

$R_t$  is the simple fractional return of an asset at time  $t$ . It is defined:

$$R_t = \frac{P_t}{P_{t-1}}$$

$D_t$  is any dividend paid on the asset at time  $t$ . It will be zero for most days.  
 $I_t$  is the value of the market index (FTSE All Share index) at time  $t$ .

#### 4.12.1. Price/Earnings Ratio and Market Capitalisation

The Exchange calculates the Price / Earnings Ratio as follows:

Earnings per Share = Earnings / Number of Shares in Issue

Price/Earnings Ratio = Price per share / Earnings per Share

The Exchange calculates the Market Capitalisation as follows:

Market Capitalisation = Price per Share \* Number of Shares in Issue

For both calculations the price of a tradable instrument is defined as follows:

- Best (Mid) Price to be used for quote driven instruments
- Last Automatic Trade Price to be used for order driven instruments
- 'Final' values based on Closing Price

Appendix D gives the source of price data for each market segment.

#### 4.12.2. Return Measures (3-month, 6-month, 1-year, 3-year and 5-year)

The Exchange calculates period returns over a range of periods: 3-month, 6-month, 1-year, 3-year and 5-year.

These are simple percentage returns of an instrument over a given period. The period will always be converted into a number of trading days  $N$ . The returns for the current day are based on the previous day's Closing Price and the Closing Price  $N$  trading days in the past.

Once the correct number of trading days has been determined, the simple percentage return is calculated as:

$$R = \left( \frac{P_t}{P_{t-N}} - 1 \right) \times 100$$

For DRIP (Dividend Re-Invested Price) returns that include investment returns related to dividend payments in addition to the simple price change of the asset over the period, the return is calculated by compounding the daily dividend adjusted returns over the period of the calculation:

$$DRIP = \left( \left( \prod_t (1 + R_t^*) \right) - 1 \right) \times 100$$

where  $R_t^*$  is the dividend adjusted daily return:

$$R_t^* = \frac{(P_t + D_t)}{P_{t-1}} - 1$$

For the purposes of these calculations it is assumed that dividend payments are immediately re-invested by buying additional shares in the instrument.

For annualised net yield returns, the return is based on the last 3 years of Closing Prices.

This is calculated as follows:

3 years of daily returns  $R_t$  are determined

Mean value of the log of these returns is calculated:

$$L\bar{R}_t = \frac{\sum \log R_t}{N}$$

Where  $N$  is the number of trading days in the previous 3 years.

The mean log is then multiplied by the number of trading days in a trading year (252) and converted from a log to a percentage return:

$$Y_{ann} = \left( \exp(L\bar{R}_t \times 252) - 1 \right) \times 100$$

#### 4.12.3. Alpha and Beta (3-month, 6-month, 1-year, 3-year and 5-year)

The Exchange calculates alphas and betas over a range of periods: 3-month, 6-month, 1-year, 3-year and 5-year. Both alpha and beta are measured with respect to the FTSE All Share index.

The Exchange calculates alphas and betas by least squares analysis of the daily log returns of the instrument in question versus those of the market. The beta value is the slope of the best-fit line of instrument and market returns and the alpha is the intercept on the y-axis:

$$\beta = \frac{N \left( \sum_t LR_{t,M} \times LR_{t,I} \right) - \left( \sum_t LR_{t,M} \right) \left( \sum_t LR_{t,I} \right)}{N \left( \sum_t LR_{t,M}^2 \right) - \left( \sum_t LR_{t,M} \right)^2}$$

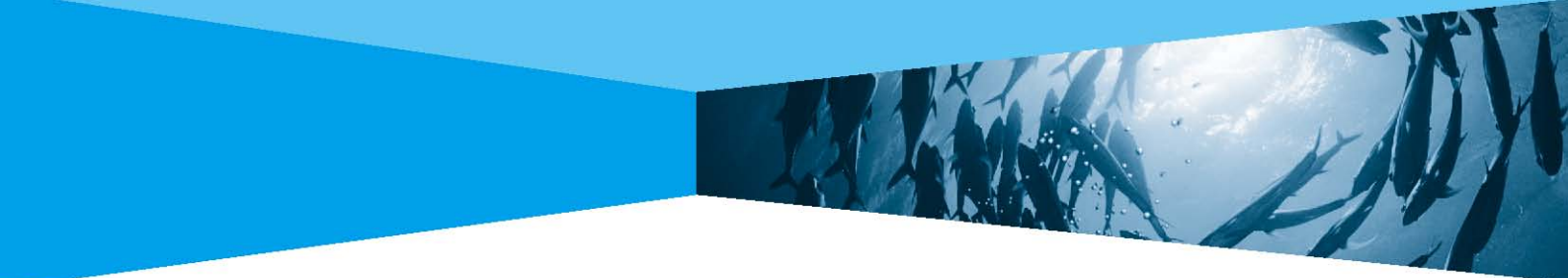
$$\alpha = \left( \exp \left( \frac{\sum_t LR_{t,I} - \beta \sum_t LR_{t,M}}{N} \right) - 1 \right) \times 100$$

where

$LR_{t,M}$  = log return from day t-1 to day t for the market index:

$$LR_{t,M} = \log \frac{I_t}{I_{t-1}}$$

$LR_{t,I}$  = log return from day t-1 to day t for the instrument:


$$LR_{t,l} = \log \frac{P_t}{P_{t-1}}$$

N is the number of trading days for the period of the alphas and betas being calculated.

#### 4.12.4. Average and Cumulative volume (3-month, 6-month, 1-year, 3-year and 5-year)

The Exchange calculates average and cumulative volumes over a range of periods: 3-month, 6-month, 1-year, 3-year and 5-year.

Average volume is calculated as:

$$AV = \frac{\sum V_t}{N}$$

Cumulative volume is calculated as:

$$CV = \sum_t V_t$$

For the purposes of these calculations, both manual and automatic trading volumes are included.



## Appendix A - Category and Level

S01	UK Level 1
S02	UK Level 1 Plus
S03	UK Level 2
S04	UK Reference Data
S05	International Level 1
S06	International Level 1 Plus
S07	International Level 2
S08	International Reference Data
S09	European Service Level 1
S10	European Service Level 1 Plus
S11	European Service Level 2
S12	European Service Ref Data
S13	Covered Warrants Level 1
S14	Covered Warrants Level 1 Plus
S15	Covered Warrants Level 2
S16	Market Status Indicators
S17	Market Reference Data
S18	RNS News
S19	Daily Official List (Full)
S20	Daily Official List (Changes)
S21	UK and International Off Book Trade Data
S22	European Off Book Trade Data
S23	UK and International Off Book Reference Data
S24	European Off Book Reference Data

## Appendix B – Trade High/Low Trade Types

Automatic Trade Types						
Trade Type	AT	CT <sup>2</sup>	UT			
Manual Trade Types						
Trade Type	O	OK	NT	NK	PC	LC <sup>1</sup>

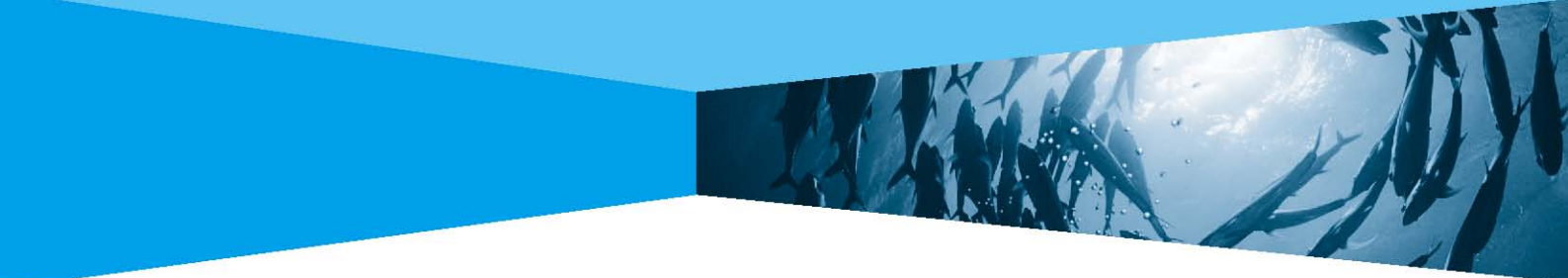
## Appendix C – Trade High/Low Validation Tolerances

Segment	Validation Tolerance	Segment	Validation Tolerance	Segment	Validation Tolerance	Segment	Validation Tolerance
AIM	80%	AIMI	80%	AIM3	80%	AMSM	80%
ASQ1	80%	ASQ2	80%	ASQN	80%	ASX1	80%
ASX2	80%	ASXN	80%	CNVE	80%	LVSD	80%
INSD	80%	EQS	80%	ETC2	80%	ETCS	80%
ETCU	80%	ETF2	80%	ETFS	80%	ETFU	80%
GILT	80%	IOB	80%	IOBU	80%	IRSQ	80%
IRSU	80%	ITBB	80%	ITBU	80%	ITR	80%
NSTS	80%	SEAQ	80%	SEQ1	80%	SEQ2	80%
SET1	50%	SET2	50%	SET3	50%	SFM1	80%
SFM2	80%	SFM3	80%	SFM4	80%	SMKT	80%
STBS	80%	STMM	50%	SSMM	80%	SSMU	80%
SSQ3	80%	SSQ4	80%	SSX3	80%	SSX4	80%

## Appendix D – Added Value Data by Market Segment

Market Segment	Mid High/Low	Trade High/Low	All Trades VWAP	Buy/Sell Percentages	Money Flow	Time Weighted Average Spread	PE Ratio and Market Capitalisation
AIM	✓	✓	✓				✓
AIMI	✓	✓					✓
AIM3	✓	✓	✓				✓
AMSM		✓	✓	✓		✓	✓
ASQ1	✓	✓	✓		✓	✓	✓
ASQ2	✓	✓	✓		✓	✓	✓
ASQN		✓	✓				✓
ASX1	✓	✓	✓		✓	✓	✓

<sup>2</sup> These trade types are reversing trades and therefore may have a negative impact on the calculation



ASX2	✓	✓	✓		✓	✓	✓
ASXN		✓	✓				✓
CNVE	✓	✓					
LVSD	✓	✓			✓		
INSD	✓	✓			✓		
EQS	✓	✓	✓				✓
ETC2		✓	✓	✓		✓	
ETCS		✓	✓	✓		✓	
ETCU		✓	✓	✓		✓	
ETF2		✓	✓	✓		✓	
ETFS		✓	✓	✓		✓	
ETFU		✓	✓	✓		✓	
GILT		✓			✓		
IOB		✓	✓	✓	✓	✓	
IOBU		✓	✓	✓	✓	✓	
IRSQ	✓	✓	✓		✓		
IRSU	✓	✓	✓		✓		
ITBB		✓	✓	✓	✓	✓	
ITBU		✓	✓	✓	✓	✓	
ITR		✓	✓				
NSTS		✓	✓	✓	✓	✓	✓
SEAQ	✓	✓	✓		✓		✓
SEQ1	✓	✓	✓				✓
SEQ2	✓	✓	✓		✓	✓	✓
SET1		✓	✓	✓	✓	✓	✓
SET2		✓	✓	✓	✓	✓	✓
SET3		✓	✓	✓	✓	✓	✓
SFM1		✓	✓	✓	✓	✓	✓
SFM2	✓	✓	✓		✓	✓	✓
SFM3	✓	✓	✓		✓	✓	✓
SFM4		✓	✓				✓
SMKT		✓			✓		✓
STBS	✓	✓			✓		
STMM		✓	✓	✓	✓	✓	✓
SSMM		✓	✓	✓	✓	✓	✓
SSMU		✓	✓	✓	✓	✓	✓
SSQ3	✓	✓	✓		✓	✓	✓
SSQ4		✓	✓				✓



SSX3	✓	✓	✓		✓	✓	✓
SSX4		✓	✓				✓

### Appendix E – All Trades VWAP Trade Types

Trade Type								
AT	CT <sup>1</sup>	LC <sup>1</sup>	NK	NT	O	OK	PC	UT

### Appendix F – Cumulative Volume Trade Types

Automatic Trade Types						
Trade Type	AT	CT <sup>1</sup>	UT			
Manual Trade Types						
Trade Type	O	OK	NT	NK	PC	LC <sup>1</sup>