Russell Investments

RussellTick™

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1.0 Introduction

Please note items within this document that have been grayed out, although supported technologically, will not be populated on this service at this time.

1.1 Background Information

NASDAQ OMX® and Russell Investments announced that NASDAQ OMX has been selected as the primary source of real-time index values for the Russell Family of Indexes. Developed by NASDAQ OMX Information, LLC, **RussellTick**™ is a premier data feed that consolidates the distribution of the Russell Family of Indexes. As a leader in manager research, Russell created its family of Indexes to better track investment manager performance. Russell's transparent and objective methodology creates benchmarks that reflect a true representation of actual market activity.

In order to more broadly distribute this comprehensive, rules-based index information, NASDAQ OMX has been chosen as the primary source for distribution of all Russell Indexes via a new third-party index data feed service, RussellTick. Modeled after NASDAQ OMX's premier Global Index Data Service℠ (GIDS℠), RussellTick is designed to facilitate excellence in trading performance and portfolio valuation due to its frequent dissemination of index data. The feed supports the diverse array of Russell-branded Indexes, covering both U.S. and Global equities.

About Russell Investments
Founded in 1936, Russell Investments is a global financial services firm that serves institutional investors, financial advisers and individuals in more than 40 countries. Over the course of its history, Russell's innovations have come to define many of the practices that are standard in the investment world today, and have earned the company a reputation for excellence and leadership.

Through a unique combination of wide-ranging and inter-linked businesses, Russell delivers financial products, services and advice. A pioneer, Russell began its strategic pension fund consulting business in 1969 and today is trusted by many well-known worldwide institutions for investment advice. The firm has $176 billion in assets under management (as of 12/31/09) in its mutual funds, retirement products, and institutional funds, and is well recognized for its depth of research and quality of manager selection. Russell offers a comprehensive range of implementation services that helps institutional clients maximize their assets. For more details, please visit www.russell.com/Indexes/.

1.2 Technology Implementation

Russell Investments has selected a primary distribution channel to provide Russell clients with an easy, **single point of access** for both Russell U.S. and Global real-time indexes. This single point of access will offer clients one–stop-shopping for the entire family of real-time Russell Indexes, whether their data need pertains to futures, options, ETF tracking, or simply to the interest in the movement of the global markets. Russell has chosen NASDAQ OMX due to their existing global reach and their superior distribution technology.

1.2.1 RussellTick Overview

Effective **Tuesday, June 1, 2010**, RussellTick began broadcasting over unique IP Multicast channels via the NASDAQ OMX network.

Benefits of RussellTick:

- Offers investors and traders worldwide real-time access to Russell Index values, including the industry-leading U.S. small-cap Russell 2000® Index and U.S. broad-market Russell 3000 Index.
- Consolidates Russell's real-time information for the first time into one data source.
- Supports real-time values for Russell Index-based derivative products enabling investors and traders to easily track portfolio investments based on Russell Indexes
- Empowers investors to better gauge market performance and more easily track portfolio investments.
- Encourages widespread distribution of real-time index data to the public via the Internet and other electronic media throughout the world.

1.2.2 RussellTick Operational Hours

In order to provide coverage for global dissemination of Russell index values, RussellTick will be operational 23 hours a day, beginning June 1, 2010 at 12:05:00 a.m., Eastern Time (ET) and ending at 11:00:00 p.m., ET.

Please note: The operational hours for RussellTick are based on U.S. ET and do not reflect the differing transitions between markets based on daylight savings time. Clients should be prepared to receive data at varying times throughout the calendar year as the markets transition between standard time and daylight savings time, if applicable.

1.3 Connectivity Options

NASDAQ OMX offers a variety of connectivity options for market participant firms and direct data feed subscribers. Please refer to the approved NASDAQ Connectivity Providers list on the NASDAQ Trader website for more information on how to access data products offered by NASDAQ OMX at the U.S. data centers.

1.4 Data Entitlement

For information on data entitlement levels and fees, please contact the NASDAQ OMX Global Data Sales team, visit Russell Investments website or contact Russell client services team +1 866 551 0617.

Distributors receiving the RussellTick data feed are required to submit documentation to NASDAQ OMX indicating how the Information is utilized. Each system utilizing a data feed must be approved by NASDAQ OMX Global Data Products prior to implementation. Any use of the Information in a system that is not approved by NASDAQ OMX will be considered unauthorized. **NASDAQ OMX reserves the right to terminate a firm's data feed access if it is found to have unauthorized systems.** For information on how to obtain approval for any system utilizing a NASDAQ OMX data feed, please refer to the Data Agreements page on the NASDAQ Trader website.

1.5 Document Scope

This data feed interface specifications document defines the communications interface and message format requirements for the direct connect subscribers to this data feed product. All time references in this data feed interface specification are stated in Eastern Standard/Daylight Time.

This document was updated on **October 1, 2010**. Please refer to Appendix E of this document for version control information. NASDAQ OMX reserves the right to add, delete, or modify any of the message formats outlined in this document as needed. All direct data feed subscribers will be required to code their systems to handle data feed format changes as dictated by NASDAQ OMX.

In advance of each product change, NASDAQ OMX will post a Financial Product News or Data Technical News item on the NASDAQ OMX Trader web site detailing the data feed format change and release schedule. Direct Data feed subscribers may request to receive automatic email notifications by filling out the email subscription form on the of NASDAQ OMX Trader website.

2.0 Transmission Characteristics

2.1 Bandwidth Allocations

As noted below, NASDAQ OMX broadcasts two (a primary and a back-up) multicast groups for its data feeds. NASDAQ OMX disseminates data via one logical channel for each multicast group on the extranets. The current bandwidth allocation for the IP multicast channel is as follows:

Data Feed Channel	Bandwidth Allocation (per multicast group)
RussellTick	2.0 Mb

Please note that NASDAQ OMX reserves the right to modify the bandwidth allocation as system capacity dictates. Extranet customers are required to maintain sufficient network capacity to handle the NASDAQ OMX data feed products ordered.

2.2 Transmission Protocol

2.2.1 Protocol Overview

Regardless of network option, NASDAQ OMX data feed transmissions will be transmitted in a non-interactive simplex mode using Internet Protocol (IP) multicast. A broadcast transmission with no answer back will be employed. A version of Cisco's Protocol Independent Multicast (PIM) routing protocol will be used to route multicast packets through the network. All transmissions will be in standard ASCII code with 7 data bits (8th bit is zero).

NASDAQ OMX data feeds are designed to adhere to Request for Comment (RFC) 1112 standard from The NIC Group for IP multicast protocol. This RFC states:

> *IP multicasting is the transmission of an IP datagram to a "host group", a set of zero or more hosts identified by a single IP destination address. A multicast datagram is delivered to all members of its destination host group with the same "best-efforts" reliability as regular unicast IP datagrams, i.e., the datagram is not guaranteed to arrive intact at all members of the destination group or in the same order relative to other datagrams.*

To minimize data loss, NASDAQ OMX provides primary and back-up groups for its data feed services. NASDAQ OMX strongly recommends that all direct data feed subscribers program their systems to process both the primary and back-up groups.

The data messages are identical for two groups with the exception of the following UDP message header field values: Source IP Address, Destination IP Address, UDP Source Port Number, and UDP Destination Port Number.

The purpose of two host groups is to provide an extra layer of data redundancy within the extranet and end-user networks. By reading and utilizing both multicast groups into their production environment, IP multicast customers can help to protect themselves against network anomalies which could cause interruptions in data flow. To minimize data loss, NASDAQ OMX strongly recommends that data feed customers process both the primary and back-up groups within their networks.

2.2.2 IP Multicast Addresses

Each NASDAQ OMX IP multicast stream will be assigned a unique Class D host group address for transmission via the extranets. The Class D addresses have been registered by NASDAQ OMX with The NIC Group. For the data feed, the IP multicast addresses and port assignments please visit the UDP/IP Addresses - NASDAQ OMX Data Feeds page on NASDAQ OMX Trader.

2.3 Transmission Block

Messages sent to data feed recipients are blocked to provide more efficient line utilization. Each block contains a maximum of 1000 data characters. Messages may not span blocks. Each message in a block ends in a Unit Separator (US) except the last message, which ends in an End of Text (ETX). With the exception of certain messages (e.g. Control messages), each message sent contains a fixed format header and a text section that has a format and length that varies for each message type.

DATA BLOCK FORMAT

UDP/IP Headers	S O H	Message 1 header and text	U S	Message 2 header and text	U S	Message n header and text	E T X
	1000 Byte Block (Max) from SOH to ETX						

2.4 UDP/IP Headers

Each IP datagram includes the IP and UDP headers as well as the block text data. The datagram fields can be read left to right starting at the top and working your way down through the datagram.

		0		16	32
IP		VERSION 4 bits	HEADER LENGTH 4 bits	TYPE OF SERVICE 8 bits	TOTAL LENGTH (in bytes) 16 bits
		IDENTIFICATION 16 bits		FLAGS 3 bits	FRAGMENT OFFSET 13 bits
		TIME TO LIVE 8 bits	PROTOCOL 8 bits	IP HEADER CHECKSUM 16 bits	
		SOURCE IP ADDRESS 32 bits			
		DESTINATION IP ADDRESS 32 bits			
	UDP	UDP SOURCE PORT NUMBER 16 bits		UDP DESTINATION PORT NUMBER 16 bits	
		UDP LENGTH 16 bits		UDP CHECKSUM 16 bits	
		UDP Data (BLOCK DATA < 1000 BYTES)			

2.5 Field Descriptions

2.5.1 IP Header Fields

The following field descriptions pertain to the IP header:

- **VERSION** – 4 bit field used to define the current version of the IP protocol for transmission. The value will be set to 4.
- **HEADER LENGTH** – 4 bit field to define the number of 32 bit words in the IP header portion of the datagram. For multicast packets being generated by NASDAQ OMX, the value will be set to 5.
- **TYPE OF SERVICE** – 8 bit field with the first 3 bits generally ignored by most network equipment. The next 5 bits are set to zero. Based on this description this field will always have the value of zero (0) for all multicast packets.
- **TOTAL LENGTH** – 16 bit field contains the length in bytes of the entire IP datagram (including UDP header). Since the maximum length of the block text is 1000 bytes, the maximum value for this field is 1028.
- **IDENTIFICATION FIELD** – 16 bit field contains a value that is incremented by one for each packet sent by the system. Not supported for UDP/IP packets.
- **FLAGS AND FRAGMENT OFFSET** – Combined 16 bit field is only used when an IP datagram is fragmented. Not supported for UDP/IP packets.
- **TIME TO LIVE (TTL)** – 8 bit field contains a value that determines the number of routers that a datagram can pass through. Each router that forwards the datagram will decrement this value by one; when it reaches zero, the router throws it away. It is initially set to 32 by the multicast source systems.
- **PROTOCOL** – 8 bit field contains a value representing the next level encapsulated protocol. Since multicast uses UDP, the value is set to 0x17, which is 23 decimals.
- **HEADER CHECKSUM** – 16 bit field contains a checksum made up of the IP header fields only. The calculation is based on the one's complement sum of the header broken into 16 bit words.
- **IP SOURCE ADDRESS** – 32 bit field contains the Registered Class C address of the multicast datagram source system. Address may vary depending on origin (system and location) of NASDAQ OMX data. NASDAQ OMX strongly warns customers against coding their systems for a particular IP source address. **NASDAQ OMX will <u>not</u> notify data feed customers in advance when it changes the origin of data.**
- **IP DESTINATION ADDRESS** – 32 bit field contains the Registered Class D address for each IP Multicast Group. Please see table above for a list of current multicast groups.

2.5.2 UDP Header Fields

The following field descriptions pertain to the UDP header:

- **UDP SOURCE PORT NUMBER** – 16 bit field identifies the $Port_{16}$ address for each IP multicast group. Please see table above for a list of the current source port numbers.
- **UDP DESTINATION PORT NUMBER** – 16 bit field identifies the $Port_{10}$ address for each IP multicast group. Please see table above for a list of the current destination port numbers.
- **UDP LENGTH** – 16 bit field contains the length in bytes of the UDP headers plus the Data Block. The maximum value is 1008.
- **UDP CHECKSUM** – 16 bit field contains a checksum made up of the UDP header plus the Data Block. In addition, it includes the UDP pseudo header, which is made up of selected fields from the IP headers such as Source Address, IP Destination Address, Protocol, and UDP Length. The

calculation is based on the one's complement sum of the datagram broken into 16 bit words.

2.5.3 UDP Data Fields

The following field descriptions pertain to the Data Block transmission:

- **SOH AND ETX** – The start of a block of data will be indicated by the Start of Header (SOH) control character. The end of the block will be signified by an End of Text (ETX) control character.
- **US** – The Unit Separator (US) character is utilized in message blocks with multiple messages to signify the end of the preceding message but not the end of the block.
- **BLOCK TEXT** – The block text may consist of one or more messages. A message may not span block boundaries. A message shall consist of a Message Header and a Message Text. Each message in a block shall be delimited by a US character except the last message, which will be delimited by an ETX character.
- **DATA FORMAT** – Alphanumeric fields will be left justified and space (hex 20) filled unless otherwise noted. Numeric fields will be right justified and zero (hex 30) filled unless otherwise noted.

2.6 Retransmission Capability

The NASDAQ OMX front-end processor will log messages transmitted to recipients. The message formats are defined in subsequent sections of this document. This log will be accessible as a record of messages sent, and will provide a full retransmission capability. Message types not logged and therefore unavailable for retransmission include:

Type	Value
T	Line Integrity

Retransmission requests may be made by sending an electronic mail message to RETRANQ@NASDAQOMX.com. Retransmission requests will only be honored during the period from the Start of Day (Category C – Type I) message through the End of Retransmission Request (Category C – Type K) message. The recipient can specify by message sequence number which message range the recipient would like retransmitted. Please call to NASDAQ OMX Operations at +1 203 926 3400 should you experience any issues with retransmission requests.

To ensure proper identification of each vendor, a line specific password must be supplied to the operator taking the request. To request a retransmission, the firm must provide the following information to SIP Operations Center:

- Data Feed Subscriber's Firm Name
- Assigned Retransmission Password
- Missing Message Sequence Number(s)
- Contact Name and Telephone Number

Retransmissions will be assigned a low priority in the outgoing message queue in order to prevent any delay or interference with current message delivery. As with original transmissions, retransmissions are broadcast to all direct connect subscribers on both networks. **It is the responsibility of the data feed recipient to ignore retransmitted messages not intended for their firm.** Retransmission messages can be identified by the following attributes:

- **Message Blocking:** Retransmission messages will never be mixed with current messages in the same message block, but current message blocks and retransmission blocks can be interspersed.
- **Message Sequence Number:** The message header will contain the same message sequence number as the original message. Please note that if the Message Sequence Number is reset, no intra-day messages sent prior to the reset control message can be retransmitted.
- **Retransmission Requester:** The message header will contain the unique two-character retransmission requester assigned to the intended recipient. Each firm is given a unique two-character retransmission requester that they should code for in its system. Refer to section 3.4 for more information on the retransmission requester.
- **Date/Time:** The message header will contain the same date and time stamp as the original message.

To obtain the retransmission requester and passwords for your firm, please contact NASDAQ OMX Global Data Products at +1 301 978 5307 or via electronic mail at dataproducts@nasdaqomx.com.

3.0 Message Header

Each message will begin with a message header. The Message Header defines the format of the data message that follows.

3.1 Message Header Format

The Message Header is 32-bytes in length and contains the following data fields:

Message Category	Message Type	Session Identifier	Retransmission Requester	Message Sequence Number
1	1	1	2	8

Originator ID	Time	Date
2	9	8

The field definitions for the message header are outlined in the remainder of this section. Please note that alphabetic and alphanumeric fields are left justified, space filled and numeric fields are right justified, zero filled, unless otherwise specified.

3.2 Field Definitions (Header Only)

3.2.1 Message Category

The Message Category is comprised of one alphabetic byte. This field, along with the Message Type, identifies the message format to follow. The allowable values are as follows:

Code	Description
A	Administrative Messages
C	System Control Messages
P	Real Time Tick Messages

3.2.2 Message Type

The Message Type is comprised of one alphanumeric byte. This field, along with the Message Category, identifies the message format to follow. The allowable values by category are as follows:

Instrument Messages *(Defined in section 4.1)*:

Message Category Code	Message Type Code	Message Format Description
P	A	Tick Details
P	B	Settlement Value
P	C	Instrument Held

Administrative Messages *(Defined in section 4.2)*:

Message Category Code	Message Type Code	Message Format Description
A	A	General Administrative Message (Free-Form Text)
A	B	Index End of Day Summary Message
A	C	NASDAQ OMX / Russell Directory Message
A	D	Symbol Participation Message
A	F	As/Of Summary

Control Messages *(Defined in section 7 of this document)*:

Message Category Code	Message Type Code	Message Format Description
C	I	Start-of-Day Message
C	J	End-of-Day Message
C	K	End of Retransmission Requests
C	L	Message Sequence Number Reset
C	T	Line Integrity
C	Z	End of Transmission

For information on format documentation changes, please refer to Version Control Appendix.

3.2.3 Session Identifier

The Session Identifier is comprised of one alphabetic byte. This field indicates the market session of the message to follow. The allowable values are as follows:

Code	Description
A	All Market Sessions or Session Independent
E	European Market Session
G	Global Market Session
U	U.S. Market Session
P	Asia Market Session

Please Note:

The market session will be used to indicate which underlying trading session will be used in calculating the indexes. It is not intended to dictate the hours an index will be disseminated.

For example an index with a session identifier of "P" will use trading activity that originated from the Asian operational market hours, however, dissemination of RussellTick messaging may continue beyond the operational hours of the session.

Please refer to Appendix-Transmission Schedule for assignment of session values for messaging and anticipated dissemination times.

3.2.4 Retransmission Requester

The Retransmission Requester is a 2 byte, Alphanumeric, space-filled identifier that signifies the intended recipient of the message. Retransmissions will be sent to all recipients, and it is the responsibility of each recipient to discard retransmitted messages not requested by him. The exception is a retransmission with an "R" Retransmission Requester, which denotes a retransmission addressed to all recipients.

All data recipients must code their systems to process the following values:

Code	Description
O (space)	An original transmission to all recipients
R (space)	A retransmission to all recipients
Specific Vendor ID	To be assigned on vendor-by-vendor basis.

In addition to these two codes, NASDAQ OMX has also assigned a special two-character retransmission requester to each direct subscriber of the data feed. Customers should code their system to process the two-character code assigned to their firm as well as the three global values outlined above. To obtain your retransmission requester, please contact NASDAQ OMX Global Data Products at 301.978.5307. For more information on the retransmission capability, please refer to section 2.6 of this document.

3.2.5 Message Sequence Number

The Message Sequence Number is comprised of eight, numeric bytes. At the beginning of each operational cycle, this number will be set to 00000000 (for the Start of Day) of each data channel. Throughout the day, the message sequence number for each original transmission will be incremented by one with the exception of the following control messages:

- The Start of Day (Category C – Type I) message is sent three times to ensure receipt. All three messages in this series will contain a message sequence number of zero.
- The Line Integrity (Category C – Type T) message is sent at one-minute intervals. The message sequence number for these control messages will not be incremented. The message sequence number will contain the same value as the prior original transmission message.
- The Sequence Number Reset (Category C – Type L) message will contain the number to which the Message Sequence Number counter is to be reset. This number is either zero or a number greater than the highest number previously transmitted.
- The End of Day (Category C – Type J) message is sent three times to ensure receipt. Only the first message in this sequence will be incremented.
- The End of Retransmission Requests (Category C – Type K) message is sent three times to ensure receipt. Only the first message in this sequence will be incremented.
- The End of Transmissions (Category C – Type Z) message is sent three times to ensure receipt. Only the first message in this sequence will be incremented.
- The End of Trade Reporting (Category C – Type X) message is sent three times to ensure receipt. Only the first message in this sequence will be incremented.

For more information on these control messages, please refer to Processing Guidelines section of this document.

3.2.6 Originator ID

The Originator Identifier (ID) is comprised of two, alphabetic bytes. This field will be used to identify the system that originated the message or category of Russell Indexes. The allowable values are as follows:

Code	Description
E (space)	Feed Handler
X (space)	NASDAQ OMX PHLX Family
Q (space)	NASDAQ OMX NDAQ Family
Y (space)	NASDAQ OMX Nordic Family
Z (space)	NASDAQ OMX Baltic Family
RU	RussellTick Real-Time Values U.S. Indexes
RG	RussellTick Global Indexes
RN	Russell/Nomura Japanese Indexes
RE	RussellTick European Indexes
RA	RussellTick Asia Indexes
<space filled>	None provided

3.2.7 Time

The Time Stamp field is a 9 byte, numeric field stated in U.S. Eastern Time (ET). Since the system only disseminates the current day's data, the data feed header shows a Time only field. The Time Stamp field denotes the military time (to the nearest millisecond) that the record was created by the system. The time format is HHMMSSCCC.

3.2.8 Date

The Date field is an 8 byte, numeric field. The Date field will reflect the date for which the information should be applied. The date format is YYYYMMDD.

Please Note: The RussellTick service has modified the message header slightly from the current GIDS message header. This was necessary in order to facilitate the distribution of data across market day resulting in the global market coverage. The date time information will represent the date for which the message should be applied.

4.0 Data Formats

In this section, NASDAQ OMX illustrates the field layout for each message format. The data definition for each field is outlined in section 6 of this document.

4.1 Detail Messages

The following message formats are used to disseminate intra-day tick values for NASDAQ OMX index, spot and settlement values as well as intra-day portfolio values for NASDAQ-listed exchange traded funds (ETFs) to the public. For processing guidelines, please refer to Section 9.0 of this specification.

4.1.1 Tick Details

The following message format will be sent for an instrument at a specific time interval. The interval is a parameter driven interval set by NASDAQ OMX and can vary. For message processing guidelines, please refer to Section 8.0 of this specification.

Category P – Type A

Type	Instrument Identifier	Tick Value	Net Change Direction
1	18	12	1

4.1.2 Settlement Value

The settlement value message format will be used to notify the market data industry of the official settlement price and settlement session used to settle cash derivatives on financial products when they expire.

Category P - Type B

Settlement Identifier	Settlement Session	Settlement Value	Time of calc
18	1	12	9

Please note: the time of calc will be stated in U.S. Eastern Time (ET)

4.1.3 Instrument Held

The Instrument Held message format will be used to notify the market data industry that a financial product is being held from public distribution.

Category P - Type C

Type	Instrument Identifier
1	18

4.2 Administrative Messages

NASDAQ OMX supports a limited number of administrative messages on the data feed.

4.2.1 General Administrative (Free-Form Text) Message

NASDAQ OMX supports a variable length, free-form text message format to be used on an as-needed basis. Since the General Administrative Message is a flexible format message, it is up to the individual data feed subscriber to decide how to process these messages. Firms may wish to code their systems to generate a systems alert for data operations as manual processing of the General Administrative message may be required.

Category A - Type A

Text 1 to 300

VARIABLE NUMBER OF BYTES

4.2.2 NASDAQ OMX Directory Message

This Directory message is used to relay index identifier, index name, divisor, and market value for every NASDAQ OMX and Russell index including subordinate index products, settlement instruments or total return versions.

Category A - Type C

Instrument Identifier 18	Instrument Name 50	Divisor 53	Number of Active Issues in Index 4	Currency 3	Start of Day Market Value 53	Dissemination Frequency 1

4.2.3 Index End of Day Summary Message

The End of Day summary message format will be used to relay the summary activity for all indexes for the current trading day. If there is no activity for the trading day for an index, a summary message will not be sent.

Category A - Type B

Instrument Identifier 18	Open Value 12	High Value 12	Low Value 12	Closing Value 12

Net Change Value 12	Net Change Direction 1	Settlement Identifier 18	Settlement Session 1	Settlement Value 12	Closing Market Value 53

Please note: The Settlement information within this message will **only** be populated for instruments that support a settlement value.

4.2.4 Index As/Of Summary Message

The As/Of Summary message format will be used to report or correct summary data for an index. The As/Of Summary includes explicit As/Of Action and Effective Date fields to ensure that the data can be properly applied to the historical databases on the downstream recipient's end.

Category A - Type F

Instrument Identifier	Currency	Open Value	High Value	Low Value	Closing Value
18	3	12	12	12	12

Net Change Value	Net Change Direction	Closing Market Value	As/Of Action	Effective Date
12	1	53	1	8

4.2.5 Issue Symbol Participation Message

This Issue Symbol Participation data format is used to relay membership and weighting data for all component securities, irrespective of the listing market, in a NASDAQ OMX product.

Category A - Type D

Market Of Origin	Trading Symbol	Instrument Name	Instrument Identifier	Calculation Method	Index Shares for Instrument
4	18	50	18	1	53

4.3 Control Messages

Control messages consist of a message header only. For processing information, please refer to section 7 of this document.

5.0 Field Occurrence Matrix

This table provides the Message Category and Message Type for each message field. Please note that the following abbreviations will be used to identify message attachments.

Field Name	Message Category	Message Type
A		
As/Of Action	A	F
C		
Calculation Method	A	D
Closing Market Value	A	B
Closing Value	A	B
Currency	A	C
D		
Dissemination Frequency	A	C
Divisor	A	C
E		
Effective Date	A	F
H		
High Value	A	B
I		
Index Shares for Instrument	A	D
Instrument Identifier	P A	A,C B,C,D
Instrument Name	A	C,D
L		
Low Value	A	B
M		
Market Of Origin	A	D
N		
Net Change Direction	P A	A B
Net Change Value	A	B
Number of Active Issues in Index	A	C
Number of ETF Value Attachments	P	D
O		
Open Value	A	B
S		
Settlement Identifier	P A	B B
Settlement Session	P A	B B
Settlement Value	P	B
Start of Day Market Value	A	C
T		
Text	A	A
Tick Value	P	A
Time of calc	P	B
Trading Symbol	A	D
Type	P	A,C

6.0 Field Definitions

***Note:** All alphabetic and alphanumeric fields are left justified and space filled unless otherwise stated. All numeric fields are right justified and zero filled unless otherwise stated.*

As-Of Action
Category A – Type F

1 byte, Alphanumeric. The field denotes if the transaction being reported is an As-Of summary addition or an As-Of summary correction from a prior business day. The associated values are as follows:

Code	Value
A	As-Of Summary Addition
C	As-Of Summary Correction

Calculation Method
Category A – Type D

1 byte, Alphanumeric. Indicates the type of calculation method used for the instrument. Allowable values are as follows:

Code	Value
T	Index Calculation based on TSO (True market value weighted)
D	Index Calculation based on DRM (Modified market value weighted)
E	Index Calculation based on equal weighting
F	Index Calculation based on float weighting
P	Index Calculation based on price weighting
<space>	None provided

Closing Market Value
Category A – Type B

53 bytes, Numeric. This field reflects the closing Market Value at the end of day trade reporting for the instrument identified in the message. This value may be space filled.

Please note: For subordinate indexes such as Total Return versions, settlement values this value may be populated as zero.

Closing Value
Category A – Type B

12 bytes, Numeric (including decimal point). This field reflects the final calculated and disseminated tick value for an instrument during the business day.

Please note: For subordinate indexes such as Total Return versions, settlement values this value may be populated as zero.

Currency
Category A – Type C

3 bytes, Alphanumeric. This field defines the currency of an issue in ISO Currency codes. NASDAQ OMX will support the ISO 4217 standard, ISO 4217 is the international standard describing three-letter codes (also known as the currency code) to define the names of currencies established by the International Organization for Standardization (ISO).

Dissemination Frequency
Category A – Type C

1 byte, Alphanumeric. This field denotes the frequency that an instrument will be disseminated on the data feed. Allowable values are as follows:

Code	Value
1	1-second updates
2	15-second updates
3	1-minute updates
4	Once a day updates
5	Once Weekly
6	Once monthly
7	Once quarterly
8	5-second updates
<space>	None provided

Divisor
Category A – Type C

53 Bytes. Numeric (including decimal point). The Divisor is a number that is adjusted periodically (due to component changes and corporate actions) to ensure continuity of an index. This value is used in the index calculations. The calculation is as follows:

Index Value = (Aggregate Market Value / Divisor)

Please note: For subordinate indexes such as Total Return versions, settlement values this value may be populated as zero.

Effective Date
Category A – Type F

8 Bytes. Numeric. The Effective Date field is a 8 byte, numeric field. The Effective Date field will reflect the date for which the As-Of Summary information should be applied. The effective date format is YYYYMMDD.

High Value
Category A – Type B

12 bytes, Numeric (including decimal point). This field reflects the highest calculated and disseminated tick value for an instrument during the business day.

Please note: For subordinate indexes such as Total Return versions, settlement values this value may be populated as zero.

Index Shares for Issue
Category A – Type D

53 bytes, Numeric (including decimal point). This field represents the number of shares for an issue within a given index and is based on the specific index's Calculation Method. This value is used to calculate the issue's market value. The market value for each issue is summed to get the Aggregate Market Value used in the index calculation below:

Index Value = (Aggregate Market Value / Divisor)

Instrument Identifier
Category P – Type A, Type C

Category A – Type B, Type C, Type D

18 bytes, Alphanumeric (including special characters). The Instrument Identifier denotes the NASDAQ OMX instrument (index; ETF; spot value; settlement value; etc) associated with the value in the message.

Instrument Name
Category A – Type C, Type D

50 bytes, Alphanumeric (including special characters). Instrument name as defined by the Market of Origin. Due to dependencies on Market of Origin naming protocols and field size limit, instrument name may be abbreviated.

Low Value
Category A – Type B

12 bytes, Numeric (including decimal point). This field reflects the lowest calculated and disseminated tick value for an instrument during the business day.

Please note: For subordinate indexes such as Total Return versions, settlement values this value may be populated as zero.

Market of Origin
Category A - Type D

4 bytes, Alphanumeric. This field indicates the market place on which the issue within the message is primarily listed. NASDAQ OMX will support the ISO 10383 standard, an ISO standard for "Codes for exchanges and market identification" (MIC): it defines codes for stock markets. This standard is updated frequently and the latest published standard is available at the maintenance organization of ISO 10383

Please note: NASDAQ OMX may continue to support the following values for US based exchange ID's in place of the MIC value:

Code	Value
A	Amex
N	NYSE LLC
P	NYSE Arca Group
Q	NASDAQ Listed Market
X	NASDAQ OMX PHLX

Net Change Direction
Category P – Type A; Category A – Type B

1 byte, Alphanumeric (including special characters). This field indicates the direction of net change related to the prior day's closing value for a given instrument. The associated values are as follows:

Code	Value
+	Positive or zero net change or (Net Gain)
-	Negative net change or (Net Loss)
Space	No net change calculated

Net Change Value
Category A – Type B

12 bytes, Numeric (including decimal point). This field reflects the difference between the current tick value and the prior day's closing tick value for a given instrument.

Please note: For subordinate indexes such as Total Return versions, settlement values this value may be populated as zero.

Number of Active Issues in an Index
Category A – Type C

4 bytes, Numeric. Indicates the total number of active issues included in the index calculation at the beginning of trading day.

Please note: For subordinate indexes such as Total Return versions, settlement values this value may be populated as zero.

Open Value
Category A – Type B

12 bytes, Numeric (including decimal point). This field reflects the first calculated and disseminated tick value for an instrument during the business day.

Please note: For subordinate indexes such as Total Return versions, settlement values this value may be populated as zero.

Settlement Identifier
Category P – Type B; Category A – Type B

18 bytes, Alphanumeric (including special characters). The Settlement Identifier denotes the NASDAQ OMX instrument (index; ETF; spot value; settlement value; etc) associated with the value in the message.

Settlement Session
Category P – Type B; Category A – Type B

1 byte, Alphanumeric (including special characters). This field reflects the settlement session for which a derivative is based on. The allowable values are as follows:

Code	Value
O	Instruments settles at the open
C	Instruments settles at the close
M	Instruments settles mid day
<space>	None provided

Settlement Value
Category P – Type B; Category A – Type B

12 bytes, Numeric (including decimal point). This field reflects the value to be used to settle derivatives when they expire. The method used to calculate and timing of dissemination of the value will vary based on the instrument.

Start of Day Market Value
Category A – Type C

53 bytes, Numeric. This field reflects the Instrument Market Value at the start of the day. This value is based on the start of day market value of the underlying components provided by the instrument sponsor.

Please note: For subordinate indexes such as Total Return versions, settlement values this value may be populated as zero.

Text
Category A – Type A

Variable length up to 300 bytes. Alphanumeric. Free-form text is used to notify data feed subscribers of corporate actions or special trading situations.

Tick Value
Category P – Type A

12 bytes, Numeric (including decimal point). This field reflects the calculated value for a given instrument.

For Indexes: The Tick Value represents the current net asset value for a proprietary index or instrument.

Time of Calc
Category P – Type B

9 byte, Numeric, This field denotes the military time (to the nearest second) that the settlement value was originally calculated. The time format is HHMMSSCCC.

Trading Symbol
Category A – Type D

18 bytes, Alphanumeric (including special characters). This field identifies the trading symbol of an instrument as assigned by the Market of Origin and matches the Symbology used for outbound dissemination on the market of origin native dissemination protocols.

Note: To download the NASDAQ symbol directory, please visit the NASDAQ Trader web site at https://www.nasdaqtrader.com/Trader.aspx?id=symbollookup

NASDAQ publishes a list of security additions, deletions, or changes for NASDAQ-listed issues. For information, please refer to the on the NASDAQ Daily List product description on the NASDAQ OMX Trader website.

Type
Category P – Type A; Category P – Type C

1 byte, Alphanumeric. This field indicates what type of instrument (index value; settlement value; etc) is being reported in the message. The allowable values are as follows:

Code	Value
I	Index Value
E	Exchange Traded Fund (ETF)
S	Settlement Value – **not currently supported**
P	Spot Value – **not currently supported**
L	Subordinated product value – **not currently supported**
<space>	None provided

7.0 Control Messages

7.1 Overview

A Control message is a fixed format message that performs a specific system function. All Control Messages consist of a standard Message Header only. As outlined in section 3, the Message Header is comprised of the following fields:

Message Category	Message Type	Session Identifier	Retransmission Requester	Message Sequence Number
1	1	1	2	8

Originator ID	Time	Date
2	9	8

Control messages are used to notify subscribers of certain system events. NASDAQ OMX supports the following control messages on the data feed:

Category	Type	Usage
C	I	Start of Day
C	J	End of Day
C	K	End of Retransmission Requests
C	Z	End of Transmissions
C	L	Sequence Number Reset

7.2 Control Message Description

7.2.1 Start Of Day

Category C - Type I

The Start of Day control message signifies the beginning of each operational cycle for processing. Each day, the Start of Day control message will be sent to inform subscribers that all subsequent data transmitted will be real-time updates and should be treated accordingly. The message will be sent three times, at 10-second intervals, with the same Message Sequence Number (00000000) on each message.

7.2.2 End Of Day

Category C - Type J

The End of Day control message signals the end of active message dissemination for the operational cycle. The system shall generate and disseminate the End of Day control message upon receipt of the appropriate inbound control messages from all inbound sources. The End of Day message will be sent three times, at 10-second intervals. The first End of Day control message will contain a Message Sequence Number one greater than the highest Message Sequence Number previously transmitted. The Message Sequence Numbers of the subsequent two control messages, however, will not be incremented.

7.2.3 End Of Retransmission Requests

Category C - Type K

This message signals that no further retransmission requests will be honored. The End of Retransmission Requests message will be sent three times, at 10-second intervals. The first End of Retransmission Requests control message will contain a Message Sequence Number one greater than the highest Message Sequence Number previously transmitted. The Message Sequence Numbers of the subsequent two control messages, however, will not be incremented. The Message Sequence Number will not be incremented when the message is sent three times in the normal message transmission sequence. Although NASDAQ OMX operations may no longer accept retransmission requests after this control message is disseminated, it will disseminate retransmissions in queue.

7.2.4 End Of Transmissions

Category C - Type Z

The End of Transmissions Message signals that there will be no further transmissions of data sent through the line. This message will be transmitted at the end of the day, and will be the last message of the day. The End of Transmissions message will be sent three times, at 10-second intervals. The End of Transmissions control message will contain a Message Sequence Number one greater than the highest Message Sequence Number previously transmitted. The Message Sequence Numbers in the subsequent two control messages, however, will not be incremented.

7.2.5 Line Integrity

Category C - Type T

The Line Integrity Control Message will be transmitted at approximately one-minute intervals to verify the operational integrity of the message transmission, and will be intermixed with other messages. The Message Sequence Number will not be incremented for the Line Integrity Message. The Message Sequence Number will be equal to the message sequence number of the last message sent. Line Integrity Messages will not be retransmitted.

7.2.6 Sequence Number Reset

Category C - Type L

The Sequence Number Reset Message forces the resetting of the Sequence Number. The Sequence Number will either be reset to zero or to a number greater than the last number previously transmitted. Please note that, if the Sequence Number Reset message is sent, the feed handler will not be able to process retransmission requests for messages sent prior to the Sequence Number Reset control message.

8.0 Message Processing Guidelines – Instrument Messages

NASDAQ OMX reserves the right to add or delete instruments and market indicators as needed.

8.1 Overview

As outlined in Section 4.1 of this document, NASDAQ OMX supports the following message types:

- Tick Details (Category P – Types A)
- Settlement Value (Category P – Types B)
- Instrument Held (Category P – Types C)

The Tick Details message is used to broadcast the current value for an instrument. NASDAQ OMX will differentiate between instrument types via the Type field. Please refer to section 6 for the supported type values.

This data service will include foreign component securities. In order to reach the global marketplace, NASDAQ OMX intends to provide intraday updates for these instruments based on the real-time trading activity of all component securities. NASDAQ OMX intends to support dissemination timing for the Tick Details messages to begin as early as 12:00 a.m., ET; ending at approximately 11:00 p.m. ET. via the Tick Details message format.

Please Note: The processing of tick detail messages related to indexes, which are comprised of component securities in the Asia markets, will span two operational days related to RussellTick. As such vendors should be aware that tick details disseminated between 7:00:00 p.m. ET and 11:00:00 p.m. ET for Asia markets, Session Identifier "P", within the messages header, will have a date in the message header representative of the local markets operational day.

8.2 Instrument Held Message

If NASDAQ OMX needs to hold an instrument from public dissemination, it will disseminate an Instrument Held message. **This message will be sent only at the time the dissemination halt is instituted.** NASDAQ OMX will broadcast a new Tick Detail message for the symbol to indicate that the disseminate halt is lifted.

In the event that all instruments are to be held, NASDAQ OMX may disseminate the following universal code in the Instrument Held format for message efficiency:

Instrument Identifier Code	Index Category Held
.ALL	All Russell Index Instruments Held

8.3 Settlement Value

The Settlement Value is used by the derivative markets to settle cash derivatives when they expire. Settlement values are determined by the instrument sponsor and can vary in their calculation methodologies as well as their settlement timing. NASDAQ OMX will only provide settlement information for instruments that support a settlement identifier. For all other indexes the Index Settlement Value and Index Settlement Flag will be populated with zero within the Index Detail Message.

8.3.1 Display Guidelines

NASDAQ OMX strongly recommends that firms use the provided settlement values for their index displays (rather than calculating their own values).

Due to the importance of this value in the settlement of cash derivatives it is highly recommended for those vendors that maintain a time and sale display that you include the Settlement Values as they are disseminated. In addition if possible the settlement value should be populated in summary displays as its own unique value (populated as N/A if not received).

9.0 Message Processing Guidelines – Administrative

9.1 Overview

NASDAQ OMX will use administrative messages to communicate the directory and issue symbol participation information to subscribers. In addition, NASDAQ OMX will support a free-form text message for those items that do not lend themselves easily to a fixed format message format. The field layouts for these messages are outlined in Section 4 of this document.

9.2 General Administrative Messages

(Category A – Type A)

The General Administrative Message (Category A – Type A) is a free form text message used to notify subscribers of market events or special trading situations. The length of the Administrative Message is variable but cannot exceed a maximum of 300 characters. NASDAQ OMX may generate the General Administrative Message format on an as-needed basis.

Since the General Administrative Message is a flexible format message, it is up to the individual data feed subscriber to decide how to process these messages. Firms may wish to code their systems to generate a systems alert for data operations as manual processing of the General Administrative message may be required.

9.3 NASDAQ OMX / Russell Directory Messages

(Category A – Type C)

The directory formats are designed to support a greater range of NASDAQ OMX and Russell indexes. This message provides the index identifier and index name for each NASDAQ OMX and Russell index. This message will be disseminated prior to the opening of each market globally. Please refer to the transmission schedule for approximate times.

9.4 Index End of Day Summary Messages

(Category A – Type B)

Many investors require the end-of-day price summary information. The Index End of Day Summary Directory Messages is intended to provide the summary activity for all Russell indexes, if there was no activity during the trading day a summary message will not be sent.

Index End of Day Summary messages will be disseminated at multiple intervals. Please refer to the Transmission schedule for a list of Summary Spins and approximate timing.

9.5 Index As/Of Summary Message

(Category A – Types F)

Given the importance of Index summary data, NASDAQ OMX supports an **As/Of Summary message (Category A – Type F)** that is used to report closing prices and summary information and corrections of previous day(s) closing prices or summary information for all indexes. The As/Of Summary message will include an explicit as/of action and effective date field in order to facilitate the vendors processing and allow for a new As/Of Summary message to be correctly applied to historical databases.

9.6 Issue Symbol Participation Message

(Category A – Types D)

As a complement to the NASDAQ OMX Directory message, NASDAQ OMX disseminates the Issue Symbol Participation message for all component securities in a NASDAQ OMX product.

This message provides the market of origin, trading symbol, instrument name, calculation method and current index shares for instrument.

A morning spin for **all** component issues will be disseminated at approximately 2:00 a.m, ET. The Issue Symbol Participation message may also be sent intra-day in the event of a change to a security's index shares within an index or when the security has been added to or removed from an index. Intra-day, NASDAQ will retransmit only the message for affected security.

Please note: Inclusion of the component securities via the issue participation message is at the discretion of the index sponsor and may not be supported for all Instruments disseminated via the GIDS data service.

10.0 Format Release and Testing Information

10.1 Release Notification

To keep pace with the changing business environment, NASDAQ OMX may modify its data feed format specifications for direct data feed customers. In advance of each release, NASDAQ OMX will notify direct connect customers of the format change via a Vendor Alert on the NASDAQ OMX web site. In the notice, NASDAQ OMX will outline the scope of the changes as well as the testing and release schedule. Direct connect customers are required to modify and test their code based on NASDAQ OMX notices. If you wish to receive automatic e-mail notification whenever a Vendor Alert is posted to the NASDAQ OMX web site, please send an e-mail request to NASDAQ OMX Global Data Products (mailto:dataproducts@nasdaqomx.com).

10.2 Types of Testing

In advance of each release, NASDAQ OMX will offer test data for its direct data feed customers to be used for quality assurance (QA) purposes. Depending on the scope of the changes, the testing period will range from one day to one month. For its data feed customers. The following types of testing opportunities will be offered for RussellTick:

- **FTP file tests:** Given that the RussellTick service will be operational for 23 hours five days a week, evening format testing will not be supported. In order to provide direct data recipient's sufficient testing opportunities NASDAQ OMX will make available FTP files via a public location. Prior to each UAT, NASDAQ OMX should post a News Alert with file locations.

- ***Weekend production tests:*** In advance of major releases, NASDAQ OMX will conduct user acceptance tests (UATs) on select Saturdays for its market participants. As market participants enter information into its production systems, NASDAQ OMX will broadcast this test data in the new data formats to direct data feed subscribers. Prior to each UAT, NASDAQ OMX should post a Vendor Alert and/or a Head Trader Alert with registration information.

- ***Weekend stress tests:*** For bandwidth upgrades and capacity-related releases, NASDAQ OMX will attempt to simulate projected data rates as part of the production test on Saturdays. At the conclusion of the manual entry period, NASDAQ OMX will start software drivers to stress test its system. Please note that the market close event and any post-closing reports will be disseminated only after the stress test is complete. When a UAT includes a stress test, NASDAQ OMX will denote it in the Vendor Alert.

For a list of upcoming testing and release dates for NASDAQ OMX data feed subscribers, please refer to the "Release Schedule" section of the NASDAQ OMX web site. **NASDAQ OMX strongly recommends that all direct subscribers use these testing opportunities to check their hardware and software applications.** During the testing phase, NASDAQ OMX Global Data Products may ask market data vendors or market participants to provide status updates and/or submit testing verification forms as part of the QA process.

10.3 Identification of test data

During normal operational hours, NASDAQ OMX will identify test data in one of the following two ways:

- ***Test Symbols:*** NASDAQ may also send out intra-day test data using special issue symbols and market participant identifiers on its data feeds. Test securities are identified within the NASDAQ Symbol Directory on the NASDAQ OMX web site.

During non-market hours, NASDAQ OMX will broadcast **unmarked** test data on its direct data feeds. Customers should take necessary precautions to protect their systems against database corruption during evenings, weekends, and market holidays. Please refer to the Appendix A of this document for the current data feed transmission schedule.

Appendix – Transmission Schedule

While the message formats of the new RussellTick service are modeled after the current NASDAQ OMX Global Index Data Service (GIDS), the transmission schedule is different.

Note: *All times referenced are approximate and are stated in US Eastern Time. This transmission schedule is based on a normal trading day and does not reflect the possible timing differential when day light savings time is in effect. NASDAQ OMX reserves the right to alter this schedule as necessary with minimal advance notice.*

Time	Transmission	Message Category	Message Type	Session ID	Originator ID
00:05:00	**Start of Day Control Message**	C	I	A	E
00:05:10	Start of Day Control Message	C	I	A	E
00:05:20	Start of Day Control Message	C	I	A	E
	Line Integrity (Control messages sent at one-minute intervals during operational day)	C	T	A	E
	General Administrative Messages (Free form text messages will be generated on an as-needed basis.)	A	A	A	Various
	Message Sequence Number Reset (Control message will be generated on an as-needed basis)	C	L	A	E
00:05:30 – 23:00:00	**Tick Detail Messages** (Calculation and dissemination of index; spot and ETF Intra-Day Portfolio values)	P	A	Various	Various
00:05:30	**Asia Ticks Restart** (Asia date is now in sync with RussellTick Operational date)	P	A	Various	Various
00:05:30 – 23:00:00	**As/Of Summary**	A	F	Various	Various
02:00:00	**Index Directory Message** (Russell Europe, Global, US)	A	C	Various	Various
02:00:00	**Tick Detail Messages** (Europe, Global Markets)	P	A	Various	Various
05:00:00	**Asia Markets Close** (India Last)				
07:00:00	**America's Markets Open** (Argentina first)				
09:30:00	**U.S. Markets Open**				
14:00:00	**European Markets Close** (Germany Last)				
16:00:00	**US Markets Close**				
17:00:00	**America's Markets Close** (Canada Last)				
19:00:00	**Index End of Day Summary Messages** Russell Asia Markets	A	B	Various	Various
19:00:00	**Asia Markets Open**				
19:00:00	**Index Directory Message** (Asia)	A	C	Various	Various
19:00:00	**Asia Ticks Start** (Asia date is T+1 to RussellTick Operational date)	P	A	Various	Various
19:15:00	**Index End of Day Summary Messages** Russell European Markets	A	B	Various	Various
22:30:00	**Index End of Day Summary Messages** Russell US Markets	A	B	Various	Various
22:50:00	**Index End of Day Summary Messages** Russell Global Markets	A	B	Various	Various

Time	Transmission	Message Category	Message Type	Session ID	Originator ID
23:00:00	**End of Day Control Message**	C	J	A	E
23:00:10	End of Day Control Message	C	J	A	E
23:00:20	End of Day Control Message	C	J	A	E
23:00:30	**End of Retransmission Control Message**	C	K	A	E
23:00:40	End of Retransmission Control Message	C	K	A	E
23:00:50	End of Retransmission Control Message	C	K	A	E
23:01:00	**End of Transmissions Message** (Time is approximate; delayed when retransmissions still active)	C	Z	A	E
23:01:10	End of Transmission Control Message	C	Z	A	E
23:01:20	End of Transmission Control Message	C	Z	A	E

Appendix – Version Control Information

Version	Date	Description of Documentation Change(s)
2010-1.0	03/12/2010	• Feed Implementation
2010-1.1		• Added additional Originator ID (section 3.2.6) values to cover Russell Europe and Russell Asia • Modified the expected spin timing for End of Day Summary messages (transmission schedule appendix).
2010-1.1a	6/4/2010	• Modified the Spin times for End of Day Summary messages
2010-1.1b	10/01/2010	• Minor modifications to the specification document. To address client identified typos. o 3.0 removed byte size inconsistency o 3.2.2 removed reference to ETF message that is not supported • Modified Session Identifier 3.2.3 o Added new Session ID of “G” for Global Market Session o Modified the footnotes to more clearly define intent of this field.
2011-1.2	07/20/2011	• Added additional Dissemination Frequency (section 6.0) value for 5-second tick updates