Products
and Services

IDC DOCUMENTATION

# Formats and Protocols for Messages

## IMS1.0

Revision 1

**Notice**

Every effort was made to ensure that the information in this document was accurate at the time of printing. However, the information is subject to change.

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**Trademarks**



**Ordering Information**

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# Formats and Protocols for Messages–IMS1.0

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## TABLES

# About this Document

This chapter describes the organization and content of the document and includes the following topics:

# About this Document

## PURPOSE

This document describes the International Monitoring System 1.0 (IMS1.0) version of the formats and protocols used for discrete message exchange, including requests for subscriptions and data messages.

This document is Revision 1 of *Formats and Protocols for Messages*, published May 1998 [IDC3.4.1]. The following changes have been made for this publication:

- General

  The document title has been changed to *Formats and Protocols for Messages–IMS1.0*. The term "S/H/I" is used to refer to the Seismic, Hydroacoustic, and Infrasonic technologies.

- About this Document

  This chapter provides a more detailed description of the document's organization and an expanded terminology table (see Table II). The paragraphs describing ASCII formats also have been revised.

- Message Protocol

  This chapter now emphasizes the differences between S/H/I message formats and protocols and those of radionuclide messages. Additional examples and cross-references have been included. Also, a section describing the protocol for authenticating messages has been added (see "Message Authentication" on page 27).

- Request Messages

  This chapter now includes a description of how radionuclide data may be requested using the *AutoDRM* system. Environments for specifying event characterization thresholds also have been added. These environments are available only for request messages and therefore do not appear in the Subscription Messages chapter. A synonym for the Arrival data request, SLSD (Standard List of Event Detections), has been included in the Arrival data request type (page 62).

- Subscription Messages

  This chapter now includes a description of subscriptions to radionuclide data and products using the *AutoDRM* system. Capabilities (including the environments AUX_LIST, COMM_LIST, GROUP_BULL_LIST, TIME_STAMP, and NET_LIST) that are not currently supported by the *Subscription Subsystem* have been removed.

- S/H/I Data Messages

  This chapter has been re-organized to reflect the different categories of data messages, including "Station Information" on page 121), "Waveform Data" on page 125, "Processing Products" on page 146, "Status Information" on page 166, and "Logs" on page 180. The Bulletin format in this chapter has been changed; the Bulletin Title Block now accommodates 136 characters (page 155), and the Event Screening Block replaces the old Event Characterization Block (page 161).

- Radionuclide Data Messages

  The wording of this chapter has been changed to include noble gas sampling as an equal to particulate sampling. ALERT messages (page 202) are now a type of data message, and the new data types ARR (Automated Radionuclide Report, page 204) and LAR (Laboratory Analysis Results, page 214) have also been included. Formats for the ARMR (Atmospheric Radionuclide Measurement Report, page 213) and FPEB (Fission Product Event Bulletin, page 214) have been updated, and the section on Pulse Height Data (PHD, page 186) includes additional footnotes, descriptions, and examples.

- Station AutoDRM Basics

  Minor changes have been made to this chapter.

- The Problem Message chapter was omitted from this publication.

- Appendix A: Data Message Examples

  This appendix replaces the original "Appendix." Examples of the new radionuclide data types have been added, and formats for the other examples have been updated as needed. The examples are shown in a smaller font to accommodate most wide data messages, however, a few examples still wrap to the next line.

- "Appendix B: Authentication Example" has been added.
- The Glossary includes additional terms.
- The document now includes an Index.

## SCOPE

This document describes the formats and protocols to use for all messages that are not part of the *Continuous Data Subsystem* [IDC3.4.2Rev1]. It does not describe software for receiving or generating messages or the formats and protocols for continuous data exchange. These topics are described in sources cited in "Related Information" on page iv.

## AUDIENCE

This document is intended for users, software developers, and engineers of the *Message* and *Subscription Subsystems*.

## RELATED INFORMATION

The following documents complement this document:

- *Formats and Protocols for Continuous Data* [IDC3.4.2Rev1]
- *Message Subsystem Software* [IDC7.4.2]
- *Subscription Subsystem Software* [IDC7.4.4]

See "References" on page 225 for a listing of all the sources of information consulted in preparing this document.

## USING THIS DOCUMENT

This document is part of the overall documentation architecture for the International Data Centre (IDC) as charted on the Roadmap located on the pages preceding the Table of Contents. As part of the Products and Services document category, this document provides descriptions of IDC products and their formats. The highlighted box on the Roadmap represents this document.

This document is organized as follows:

- Message Protocol

  This chapter provides a high-level description of the protocol used to exchange messages.

- Request Messages

  This chapter describes the formats for messages that are used to make requests for data and data products.

- Subscription Messages

  This chapter describes the formats for messages that are used to establish and manipulate subscriptions.

- S/H/I Data Messages

  This chapter describes the formats for messages that contain seismic, hydroacoustic, and infrasonic (S/H/I) data and data products.

- Radionuclide Data Messages

  This chapter describes the formats for messages that contain radionuclide data and data products, including messages used for reporting problems encountered within the Radionuclide Monitoring System (RMS).

- Station AutoDRM Basics

  This chapter describes the formats that must be supported by auxiliary seismic stations of the International Monitoring System (IMS).

- References

  This section lists the sources cited in this document.

- Appendix A: Data Message Examples

  This appendix contains examples of formatted data messages.

- Appendix B: Authentication Example

  This appendix contains an example of an authenticated request message.

- Glossary

  This section defines the terms, abbreviations, and acronyms used in this document.

- Index

  This section lists topics and features provided in the document along with page numbers for reference.

## Conventions

This document uses a variety of conventions, which are described in the following tables. Table I shows the typographical conventions.

**TABLE I: TYPOGRAPHICAL CONVENTIONS**

| Element | Font | Example |
|---|---|---|
| required environments | **bold** | **time** |
| attributes of database tables when written separately | *italics* | *status* |
| processes and software units | | *ParseSubs* |
| user-defined arguments | | `delete-remarks` *object* |
| computer code and output | `courier` | `>(list 'a 'b 'c)` |
| filenames, directories, and websites | | `ars.scm` |
| text that should be typed in exactly as shown | | `edit-filter-dialog` |
| key words of control lines, environment lines, request lines, data lines, and specific data message types when used in text. | CAPITALS | E-MAIL, TIME, ARR, BULLETIN, LOG |

Table II explains certain technical terms that are not part of the standard Glossary, which is located at the end of this document.

### TABLE II: TERMINOLOGY

<table>
<tr><th>Term</th><th>Description</th></tr>
<tr><td>*</td><td>(asterisks) symbol indicating that any ASCII character(s) may be substituted</td></tr>
<tr><td>[]</td><td>(square brackets) symbols delineating optional parameters in a syntax description</td></tr>
<tr><td>…</td><td>(ellipsis) symbol indicating that lines of an example have been intentionally omitted</td></tr>
<tr><td>|</td><td>(vertical bar) symbol indicating “or” in a syntax or environment description</td></tr>
<tr><td>block</td><td>group of lines in a data message that constitutes a cohesive unit of information</td></tr>
<tr><td>compressed data</td><td>data that have been reduced significantly in size to make transmission more efficient</td></tr>
<tr><td>control lines</td><td>request or subscription message lines that specify how and/or when the response to the request or subscription will be sent</td></tr>
<tr><td>data message</td><td>AutoDRM message that contains data; usually sent in response to a request message or a subscription</td></tr>
<tr><td>data products</td><td>reports, bulletins, and other products that contain the results of processing</td></tr>
<tr><td>environment lines</td><td>request or subscription message lines that establish an environment within which requests or subscriptions are made</td></tr>
<tr><td>identification lines</td><td>AutoDRM message lines that identify the AutoDRM version, message type, and reference numbers</td></tr>
</table>

TABLE II: TERMINOLOGY (CONTINUED)

| Term | Description |
|---|---|
| logical line | *AutoDRM* instruction or data line that is a complete unit as defined in this document. A logical line may consist of one or more physical lines. |
| physical line | line terminated by a Line Feed, or by a Line Feed followed by a Carraige Return |
| request lines | request or subscription message lines that specify the data or data product being requested |
| request message | *AutoDRM* message that requests data or data products |
| subscription message | *AutoDRM* message that establishes or alters regular delivery of data or data products |

Formats in this document represent either American Standard Code for Information Interchange (ASCII) characters or binary fields, depending on the type of data being described. The conventions for ASCII formats include the following format types:

- "a" alphanumeric character strings
- "i" integers
- "f" floating point numbers
- "e" exponential numbers

Depending on the format type indicator (a, i, f, e), each is followed by either an integer or a decimal number. For alphanumeric character strings and integer numbers, the number following the format type is an integer that describes the maximum number of characters or digits allowed in a field. For example, the format "a5" indicates that the field is represented by five alphanumeric characters (for example, `SE001`); and the format "i4" indicates an integer number with four positions (for example, `4321`). For floating point and exponential numbers, the type indicator is followed by two numbers separated by a period as in "n.m". In both formats, "n" describes the maximum number of characters that may be used to represent the number, including decimal points, exponential indicators, plus or minus signs, and so on. For floating point numbers, "m" is the recommended number of digits that follow the decimal point. The number of digits after the decimal point is allowed to "float" to accommodate anomalous data. For example, "f5.2" accommodates numbers from `.0001` to `9999.`, but the preferred representation is two digits after the decimal point. For exponential number formats, "m" is the exact number of digits to the right of the decimal. For example, "e11.4" accommodates numbers like `–1.2345+E03`.

Some fixed formats allow combinations of the format types. Time and date formats combine the a, f, and i format types. A typical format for a date (such as `1998/04/15`) is i4,a1,i2,a1,i2.

Where binary data are part of a format description, the numbers and characters are expressed as the number of bytes that are used to store them along with the convention that is used for ordering the bytes. The Institute for Electrical and Electronic Engineers (IEEE) byte order convention is used throughout this document.

# Message Protocol

This chapter describes the message protocol and includes the following topics:

- Introduction
- Protocols
- Message Conventions
- Message Structure
- Message Authentication

# Message Protocol

## INTRODUCTION

The protocol for exchanging noncontinuous IMS data, IDC products, and other messages is based upon *AutoDRM*, an automatic data request management system used for obtaining data automatically through a system of email messages [Kra93]. When request messages are sent via electronic mail (email) to the *AutoDRM*, the system responds with a return email message containing the requested data.

The basic *AutoDRM* formats and protocols established by [Kra93] were extended for the Group of Scientific Experts Third Technical Test (GSETT-3) [GSE95b]. The GSETT-3 formats were adopted for use at the IDC and were expanded from the original seismic application to include hydroacoustic, infrasonic, and radionuclide messages. This version of the formats has been designated IMS1.0.

The three types of messages are described as follows:

- Request

  This message type contains a request for IMS/IDC data or data products.

- Subscription

  This message type establishes (or alters) standing requests for IMS/IDC data and/or data products.

- Data

  This message type contains IMS/IDC data or data products as well as RMS Alert data messages.

These message types are described in subsequent chapters.

## PROTOCOLS

Two standard low-level protocols are used for the exchange of messages: electronic mail (email) and file transfer protocol (FTP). Differences exist, however, in the circumstances under which these protocols are used for transmitting radionuclide and S/H/I data messages.

For S/H/I-related messages, the use of the available message protocols depends on the message length and content. For example, email is used for exchanging shorter S/H/I-related messages containing alphanumeric data. FTP is used for exchanging longer S/H/I-related messages as well as those containing binary data.

In contrast, all radionuclide-related messages are exchanged via email. FTP is used only in extremely limited cases where large radionuclide data files are sent from the IMS/IDC to a National Data Center (NDC).

At the application level, the message protocol requires that request and subscription messages be answered with data messages. Information controlling the format, low-level protocol, and destination for the data message are included in request and subscription messages.

## MESSAGE CONVENTIONS

Basic message conventions are used for both radionuclide- and S/H/I-related messages. However, some differences in conventions exist between the radionuclide- and S/H/I-related messages, including:

- fixed format field justification,
- case sensitivity,
- blank lines,
- missing data,
- station naming, and
- comment conventions.

## Message Size

The size of a message is unlimited. The maximum message size depends on the bandwidth of the connection between the message source and recipient, as well as the space available on computers for storing messages.

Although certain sites may be constrained by system limitations to sending email messages smaller than 400 kilobytes, Transmission Control Protocol/Internet Protocol-based (TCP/IP) email systems are generally reliable up to at least 1 megabyte. To accommodate data messages larger than these limits, a mechanism is provided for a single data message to be split into several parts that can be reconstructed by the recipient (see "Ref_id" on page 23).

Radionuclide-related messages larger than 1 megabyte should be broken into several smaller emails using the methods described in "Ref_id" on page 23. For S/H/I-related messages, the message size determines the protocol that is most appropriate for message transmission. Messages larger than 1 megabyte should be transferred via FTP or should be broken into several smaller emails using the methods described in "Ref_id" on page 23.

## Line Length

Line length conventions apply only to ASCII message lines (as opposed to binary message lines that may be used in some waveform data messages). A line may be up to 1,024 characters long, excluding the special characters Line Feed (`LF`) and Carriage Return (`CR`). An ASCII message line may be terminated by a `LF` or by a `LF` followed by a `CR`.

The format for a message line determines its logical line length. A logical line may be broken into several physical lines. To break a logical line into several physical lines, a backslash (\) is inserted at the desired break point. The logical line is then continued on the next physical line. The backslash may occur in any character position of the line and is counted as one of the physical line characters. The backslash does not hold the place of a blank or any other character. The character preceding the backslash is concatenated with the character in position one of the next physical line. If the logical line length for an ASCII line is longer than 1,024 (such as with ASCII waveform data), then the line break character (\) is not used. Data are simply continued on the next line.

## Free Format Lines

Message lines that are not in fixed format are known as free format lines. A free format line may consist of a keyword followed by an argument list or it may contain unformatted free text. Free format lines are left justified and case insensitive. Free format lines must have one or more blank spaces between fields. All lines in request and subscription messages are free format lines.

## Fixed Format Lines

Fixed format lines differ from free format lines in that they have explicitly defined character fields. Most data message lines are in fixed format (header and data lines are examples).

Although many fixed format lines are case insensitive, some are not. Fixed format lines that are case sensitive include message lines in waveform data messages after compression by the CM6 compression scheme (see "Subformat CM6" on page 141). No fixed format lines in radionuclide data messages are case sensitive.

Field contents in radionuclide data messages that must be parsed into the IMS/IDC database are left justified regardless of field or line formatting. Otherwise, field contents are right or left justified according to the field and line formatting. Alphanumeric character fields in fixed format lines (such as a field with format a12) must be left justified. Numeric fields and numeric/alphanumeric character combination fields (such as f10.4; or i4,a1,i2) must be right justified.

## Blank Lines

Blank lines are not permitted in radionuclide data messages that must be parsed into the IMS/IDC database. The exception to this rule occurs within free format line text. Blank lines are allowed in free text fields such as those found in a `#Comment` block and an ALERT data message (see Table 57 on page 189 and "Alerts" on page 202).

In all other message types, blank lines may be added to improve legibility where they do not cause ambiguity.

## Missing Data

Some fields in a message are required, while others are not. Blank characters can be used for missing data in S/H/I data message but not in Radionuclide data messages. For proper data parsing during automatic input processing, Radionuclide fields that are not required and are missing data must be filled. Missing Radionuclide numerical data (that is, floating point, integer, and exponential numbers) are indicated by a negative sign followed by as many "9s" as the field formatting will allow. For example, if the quantity for a field with format f5.2 is unknown, then the field should contain the number -999. Missing Radionuclide character data with formats such as a50 are designated with a a single zero (0).

## Comments

Comments for S/H/I-related messages are used primarily in LOG, ERROR_LOG, and FTP_LOG data messages. In these messages the comments are free-format lines in which the first character is blank.

Comments in radionuclide-related messages use a free format line structure that begins with a `#Comment` line. The lines following the `#Comment` line contain the comment text. The end of the comment is designated by a `STOP` line or another line beginning with a #. Comments may appear in all radionuclide data messages, however only one `#Comment` block is allowed per message. `#Comment` blocks cannot occur within other data blocks, but instead must precede or follow a data block.

## Date and Time Formats

The standard format for specifying the date and time contains two fields: one for the date and one for the time, with a blank separating the two fields. The date must always be present, but the time field may be omitted. When no time is specified, the field defaults to 00:00:00.000.

The time field may have varying degrees of precision (that is, decimal places in the *seconds* attribute). The time format with the highest precision is shown below.

### Syntax

*yyyy*/*mm*/*dd* *hh*:*mm*:*ss*.*sss*

| | |
|---|---|
| *yyyy* | year |
| *mm* | month number |
| *dd* | day of the month |
| *hh* | hour in universal time coordinates (UTC) |
| *mm* | minute |
| *ss.sss* | seconds |

The range of time over a day is from 00:00:00.000 to 23:59:59.999 (24:00:00.000 is not a valid time). Leading zeros in any of the number fields may be dropped in free format lines, but they must be present in fixed format lines. In addition, some of the values may be dropped from the time field in free format lines. If the seconds, or the minutes and seconds are dropped, then they are assumed to be "0" (for example, `21:03` is interpreted as 21:03:00.000 and `9` is interpreted as 09:00:00.000).

The following date-time formats are acceptable for free format lines:

```
1994/01/01 13:04:12.003
1994/12/23
1995/07/14   01:05
1995/09/10 2:15:3
```

## Radionuclide Site Codes

RMS site codes must contain five characters. The first two characters are the two-letter country code for the country in which the site resides (see Table 1). The next character identifies the site type. Site types include `R` for Regional Lab, `C` for Certified Lab, `N` for NDC, `X` for Experimental, and `0` (zero) for Sampling Station. The last two characters are numbers representing the sequence of that site within the country (`01`, `02`, `03`).

The following examples show possible site codes:

```
ARR01
FIC07
CNX09
RU001
```

**TABLE 1: COUNTRY CODES[1]**

| Country | Three-letter Country Code | Two-letter Country Code |
|---|---|---|
| Afghanistan | AFG | AF |
| Albania | ALB | AL |
| Algeria | DZA | DZ |
| Andorra | AND | AD |
| Angola | AGO | AO |
| Antigua and Baruda | ATG | AG |
| Argentina | ARG | AR |
| Armenia | ARM | AM |
| Australia | AUS | AU |
| Austria | AUT | AT |
| Azerbaijan | AZE | AZ |
| Bahamas | BHS | BS |
| Bahrain | BHR | BH |

### TABLE 1: COUNTRY CODES[1] (CONTINUED)

| Country | Three-letter Country Code | Two-letter Country Code |
|---|---|---|
| Bangladesh | BGD | BD |
| Barbados | BRB | BB |
| Belarus | BLR | BY |
| Belgium | BEL | BE |
| Belize | BLZ | BZ |
| Benin | BEN | BJ |
| Bhutan | BTN | BT |
| Bolivia | BOL | BO |
| Bosnia and Herzegovina | BIH | BA |
| Botswana | BWA | BW |
| Brazil | BRA | BR |
| Brunei Darussalam | BRN | BN |
| Bulgaria | BGR | BG |
| Burkina Faso | BFA | BF |
| Burundi | BDI | BI |
| Cambodia | KHM | KH |
| Cameroon | CMR | CM |
| Canada | CAN | CA |
| Cape Verde | CPV | CV |
| Central African Republic | CAF | CF |
| Chad | TCD | TD |
| Chile | CHL | CL |
| China | CHN | CN |
| Columbia | COL | CO |
| Comoros | COM | KM |

**TABLE 1: COUNTRY CODES[1] (CONTINUED)**

| Country | Three-letter Country Code | Two-letter Country Code |
|---|---|---|
| Congo | COG | CG |
| Congo, The Democratic Republic of the | COD | CD |
| Cook Islands | COK | CK |
| Costa Rica | CRI | CR |
| Cote d'Ivoire | CIV | CI |
| Croatia | HRV | HR |
| Cuba | CUB | CU |
| Cyprus | CYP | CY |
| Czech Republic | CZE | CZ |
| Denmark | DNK | DK |
| Djibouti | DJI | DJ |
| Dominica | DMA | DM |
| Dominican Republic | DOM | DO |
| Ecuador | ECU | EC |
| Egypt | EGY | EG |
| El Salvador | SLV | SV |
| Equatorial Guinea | GNQ | GQ |
| Eritrea | ERI | ER |
| Estonia | EST | EE |
| Ethiopia | ETH | ET |
| Fiji | FJI | FJ |
| Finland | FIN | FI |
| France | FRA | FR |
| Gabon | GAB | GA |
| Gambia | GMB | GM |

### TABLE 1: COUNTRY CODES[1] (CONTINUED)

| Country | Three-letter Country Code | Two-letter Country Code |
|---|---|---|
| Georgia | GEO | GE |
| Germany | DEU | DE |
| Ghana | GHA | GH |
| Greece | GRC | GR |
| Grenada | GRD | GD |
| Guatemala | GTM | GT |
| Guinea | GIN | GN |
| Guinea-Bissau | GNB | GW |
| Guyana | GUY | GY |
| Haiti | HTI | HT |
| Holy See | VAT | VA |
| Honduras | HND | HN |
| Hungary | HUN | HU |
| Iceland | ISL | IS |
| India | IND | IN |
| Indonesia | IDN | ID |
| Iran, Islamic Republic of | IRN | IR |
| Iraq | IRQ | IQ |
| Ireland | IRL | IE |
| Israel | ISR | IL |
| Italy | ITA | IT |
| Jamaica | JAM | JM |
| Japan | JPN | JP |
| Jordan | JOR | JO |
| Kazakhstan | KAZ | KZ |

**TABLE 1: COUNTRY CODES[1] (CONTINUED)**

| Country | Three-letter Country Code | Two-letter Country Code |
|---|---|---|
| Kenya | KEN | KE |
| Kiribati | KIR | KI |
| Korea, Democratic People's Republic of | PRK | KP |
| Korea, Republic of | KOR | KR |
| Kuwait | KWT | KW |
| Kyrgyzstan | KGZ | KG |
| Lao People's Democratic Republic | LAQ | LA |
| Latvia | LVA | LV |
| Lebanon | LBN | LB |
| Lesotho | LSO | LS |
| Liberia | LBR | LR |
| Libyan Arab Jamahiriya | LBY | LY |
| Liechtenstein | LIE | LI |
| Lithuania | LTU | LT |
| Luxembourg | LUX | LU |
| Macedonia, The Former Yugoslav Republic of | MKD | MK |
| Madagascar | MDG | MG |
| Malawi | MWI | MW |
| Malaysia | MYS | MY |
| Maldives | MDV | MV |
| Mali | MLI | ML |
| Malta | MLT | MT |
| Marshall Islands | MHL | MH |
| Mauritania | MRT | MR |
| Mauritius | MUS | MU |

**TABLE 1: COUNTRY CODES[1] (CONTINUED)**

| Country | Three-letter Country Code | Two-letter Country Code |
|---|---|---|
| Mexico | MEX | MX |
| Micronesia, Federated States of | FSM | FM |
| Moldova | MDA | MD |
| Monaco | MCO | MC |
| Mongolia | MNG | MN |
| Morocco | MAR | MA |
| Mozambique | MOZ | MZ |
| Myanmar | MMR | MM |
| Namibia | NAM | NA |
| Nauru | NRU | NR |
| Nepal | NPL | NP |
| Netherlands | NLD | NL |
| New Zealand | NZL | NZ |
| Nicaragua | NIC | NI |
| Niger | NER | NE |
| Nigeria | NGA | NG |
| Niue | NIU | NU |
| Norway | NOR | NO |
| Oman | OMN | OM |
| Pakistan | PAK | PK |
| Palau | PLW | PW |
| Panama | PAN | PA |
| Papua New Guinea | PNG | PG |
| Paraguay | PRY | PY |
| Peru | PER | PE |

TABLE 1: COUNTRY CODES[1] (CONTINUED)

| Country | Three-letter Country Code | Two-letter Country Code |
|---|---|---|
| Philippines | PHL | PH |
| Poland | POL | PL |
| Portugal | PRT | PT |
| Qatar | QAT | QA |
| Romania | ROM | RO |
| Russian Federation | RUS | RU |
| Rwanda | RWA | RW |
| Saint Kitts and Nevis | KNA | KN |
| Saint Lucia | LCA | LC |
| Saint Vincent and the Grenadines | VCT | VC |
| Samoa | WSM | WS |
| San Marino | SMR | SM |
| Sao Tome & Principe | STP | ST |
| Saudi Arabia | SAU | SA |
| Senegal | SEN | SN |
| Seychelles | SYC | SC |
| Sierra Leone | SLE | SL |
| Singapore | SGP | SG |
| Slovakia | SVK | SK |
| Slovenia | SVN | SI |
| Solomon Islands | SLB | SB |
| Somalia | SOM | SO |
| South Africa | ZAF | ZA |
| Spain | ESP | ES |
| Sri Lanka | LKA | LK |

### TABLE 1: COUNTRY CODES[1] (CONTINUED)

| Country | Three-letter Country Code | Two-letter Country Code |
|---|---|---|
| Sudan | SDN | SD |
| Suriname | SUR | SR |
| Swaziland | SWZ | SZ |
| Sweden | SWE | SE |
| Switzerland | CHE | CH |
| Syrian Arab Republic | SYR | SY |
| Tajikistan | TWN | TJ |
| Tanzania, United Republic of | TZA | TZ |
| Thailand | THA | TH |
| Togo | TGO | TG |
| Tonga | TON | TO |
| Trinidad and Tobago | TTO | TT |
| Tunisia | TUN | TN |
| Turkey | TUR | TR |
| Turkmenistan | TKM | TM |
| Tuvalu | TUV | TV |
| Uganda | UGA | UG |
| Ukraine | UKR | UA |
| United Arab Emirates | ARE | AE |
| United Kingdom of Great Britain and Northern Ireland | GBR | GB |
| United States of America | USA | US |
| Uruguay | URY | UY |
| Uzbekistan | UZB | UZ |

TABLE 1: COUNTRY CODES[1] (CONTINUED)

| Country | Three-letter Country Code | Two-letter Country Code |
|---|---|---|
| Vanuatu | VUT | VU |
| Venezuela | VEN | VE |
| Viet Nam | VNM | VN |
| Yemen | YEM | YE |
| Yugoslavia | YUG | YU |
| Zambia | ZMB | ZM |
| Zimbabwe | ZWE | ZW |

1. [ISO 3166]

## Radionuclide Detector Codes

The detector code enables easy identification of a unique detector and its location. RMS detector codes contain nine characters. The first five characters are the site code (see "Radionuclide Site Codes" on page 8). This code is followed by a unique four-character alphanumeric identifier assigned to the detector by its owner(s) or operating staff. Blank spaces and backslash (\) characters are not allowed in the four-character identifier.

The following example shows a possible detector code for an HPGe detector located at station DE002:

```
DE002HPGE
```

The following example shows a possible detector code for an HPGe detector at Health Canada in Ottawa used regularly for counting particulate samples from a remote, manual station:

```
CAR01-0G2
```

The following example shows a possible detector code for a LEGe detector located at station SE001:

```
SE001-XE1
```

The following example shows a possible detector code for an experimental gas monitoring unit in the U.S.:

```
USX03ARSA
```

## S/H/I Network Codes

With the large number of S/H/I stations distributed globally, unique station names cannot be guaranteed. The seismic, hydroacoustic, and infrasonic network naming format supports the concept of duplicate station names and thus requires that stations be affiliated with a network.

The network identifier can be up to nine characters in length and consists of two parts separated by an underscore. The first part is three or four characters in length and is the "domain" of the network. This code is either an internationally recognized affiliation (such as IDC) or a three-letter ISO standard country code, as shown in Table 1. The second part of the network identifier is the network code (1–4 characters) within that domain. An NDC sending data to the IDC may use the network code `NDC`. For example, the three-letter ISO code for the Czech Republic is `CZE`, so the default network code for the NDC of the Czech Republic is `CZE_NDC`.

## S/H/I Station Codes

To guarantee that station names are unique and follow international naming conventions, seismic, hydroacoustic, and infrasonic station codes should be registered with the International Seismic Centre (ISC) in the United Kingdom and/or the National Earthquake Information Center (NEIC) in the United States.

All station codes must be five or fewer characters. Array stations have unique station codes for each element of the array as well as a unique array code that refers to the entire array. The code referencing the array should not be the same as the station code of any of the array elements.

## S/H/I Channel Codes

The format for channel designators of S/H/I stations expands upon the format used by the Federation of Digital Seismic Networks (FDSN). Three characters are used to designate a channel. The first specifies the general sampling rate and the response band of the instrument, as shown in Table 2. The second character specifies the instrument code, as shown in Table 3. The third character specifies the physical configuration of the members of a multiple axis instrument package or other parameters as specified for each instrument, as shown in Table 4.

### TABLE 2: S/H/I CHANNEL BAND CODES

| Band Code | Band Type | Sample rate (Hz) | Corner period (seconds) |
|---|---|---|---|
| E | extremely short period | $\geq$ 80 | < 10 |
| S | short period | $\geq$ 10 to < 80 | < 10 |
| H | high broadband | $\geq$ 80 | $\geq$ 10 |
| B | broadband | $\geq$ 10 to < 80 | $\geq$ 10 |
| M | mid period | > 1 to < 10 | |
| L | long period | = 1 | |
| V | very long period | = 0.1 | |
| U | ultra long period | = 0.01 | |
| R | extremely long period | = 0.001 | |
| W | weather/environmental | | |
| X | experimental | | |

**TABLE 3: S/H/I CHANNEL INSTRUMENT CODES**

| Instrument Code | Description |
|---|---|
| H | high-gain seismometer |
| L | low-gain seismometer |
| G | gravimeter/accelerometer seismometer |
| M | mass position seismometer |
| D | pressure sensor |
| C | composite trace |

**TABLE 4: S/H/I CHANNEL ORIENTATION CODES**

| Orientation Code | Description |
|---|---|
| Z, N, or E | traditional (vertical, north-south, east-west) |
| A, B, or C | tri-axial (along the edges of a cube turned up on a corner) |
| T or R | for transverse and radial rotations |
| 1, 2, or 3 | orthogonal components but nontraditional orientations |
| U, V, or W | optional components |
| H | hydrophone |
| F | infrasonic pressure |
| C | coherent beam |
| I | incoherent beam |
| O | origin beam |

### S/H/I Auxiliary Codes

The auxiliary designator is used to distinguish between different instruments or data streams that have the same station and channel codes. This four-letter designator is used only when a conflict exists. When not needed, this field is left blank.

### Latitude/Longitude Conventions

All latitudes and longitudes are written as floating point numbers. Latitudes in the Southern Hemisphere have negative values. Longitudes in the Western Hemisphere have negative values.

### Energy Units

All energy units are reported in kiloelectron volts (keV).

### Distance Units

Distance units used for S/H/I-related messages are nanometers for ground displacement, degrees for source-receiver distances, and kilometers for all other distance measures (this includes, for example, event depth, emplacement depth, and station elevation). Distance units in radionuclide-related messages are specific to each field as described in "Radionuclide Data Messages" on page 183.

## MESSAGE STRUCTURE

The first three lines of a message are the BEGIN, MSG_TYPE, and MSG_ID lines. These provide information on

- the message format version number,
- the message type, and
- the message identification code.

If the message refers to a previous message (for example, a data message in response to a request message), then the fourth line is the REF_ID line. This line contains the message identification code of the referenced message.

If the message is a data message for a subscription, then the fourth line is a PROD_ID line. This line contains the product identification number and the sequence number for that product.

The BEGIN, MSG_TYPE, MSG_ID, and REF_ID/PROD_ID lines are followed by data specific to the message type. The final line of the message is the STOP line. The basic structure of a message is as follows:

#### Syntax

```
begin ims1.0
msg_type data | request | subscription
msg_id id_string [source]
[ref_id ref_str [ref_src] [part seq_num [of tot_num]]] |
[prod_id product_id delivery_id]
...
stop
```

### Begin

Except in the case of a HELP message, the BEGIN line is the first line of an *AutoDRM* message. The BEGIN line contains the version identifier of the *AutoDRM* command syntax.

#### Syntax

```
begin [ims1.0]
```

The argument in the BEGIN line of a data message indicates the format of the data to follow. In some cases, earlier format versions will be accepted by the IDC.

The argument in the BEGIN line of a request message is the default format of the data that are requested. If a specific format string is given on a request line, that format specification will override the default.

## Msg_type

The MSG_TYPE line is the second line of a message. A message type is required for *AutoDRM* to distinguish between the different types of messages. Only one MSG_TYPE is allowed per message. Combining different message types in the same *AutoDRM* message is prohibited.

### Syntax

```
msg_type request | data | subscription
```

## Msg_id

The MSG_ID line is the third line of a message. A message identification code is required for tracking and identifying messages. The MSG_ID line is comprised of the MSG_ID keyword followed by an *id_string* code and a *source* code, separated by a blank.

The sender is responsible for providing a unique *id_string*, as well as a descriptive *source* code. The *id_string* may contain up to 20 alphanumeric characters. The *source* code is optional and may contain up to 16 alphanumeric characters. Blanks or backslash (\) characters are not allowed in either the *id_string* or the *source* codes.

### Syntax

`msg_id` *id_string* [*source*]

| | |
|---|---|
| *id_string* | unique identification code (up to 20 characters) |
| *source* | message source code (up to 16 characters) |

The *source* of a message can be a station, a laboratory, an NDC, or the IDC. For radionuclide facilities, the radionuclide site code is used as the *source* (see "Radionuclide Site Codes" on page 8). For S/H/I stations and data centers (NDCs and the IDC) the source is the network code (see "S/H/I Network Codes" on page 17).

### Ref_id

The REF_ID line is included in a message in two cases:

- when a message is generated and transmitted to a party in response to a message received from (sent by) the same party, and/or
- when a very large message is split into several separate, smaller messages.

Like the MSG_ID, the REF_ID also serves to track and identify messages. If the REF_ID line function is not required in a message, it is omitted. Otherwise, it occurs as the fourth message line.

The REF_ID line is comprised of the REF_ID command followed by a *ref_str* code and a *ref_src* code, separated by a blank. The *ref_str* and *ref_src* are, respectively, the *id_string* and *source* in the MSG_ID line of the original message received. Like the *source*, the *ref_src* is not a required field.

For multiple messages that must be recombined to form a complete message, the REF_ID line contains additional commands and attributes. Following the *ref_src*, the commands `part` and `of` are added with their respective attributes *seq_num* and *tot_num*. The *tot_num* is the total number of separate messages that comprise the complete message unit. The order in which the messages should be recombined is indicated in the *seq_num*.

#### Syntax

`ref_id` *ref_str* [*ref_src*] [`part` *seq_num* [`of` *tot_num*]]

| | |
|---|---|
| *ref_str* | the *id_string* from the MSG_ID line of the request message |
| *ref_src* | the message source code from the MSG_ID line of the request message |
| *seq_num* | sequence number beginning with 1 |
| *tot_num* | total number of parts for this response |

If a message must be split into smaller messages, the split(s) must occur only at DATA_TYPE boundaries. This method has the following advantages:

- data sections are never broken in the middle; and
- each message split is headed by BEGIN, MSG_TYPE, MSG_ID, and REF_ID lines, and terminated by a STOP line.

Each *id_string* in the MSG_ID lines of the individual split messages must be unique. The REF_ID lines, however, will have identical *ref_str* and *ref_src* codes. The `part` *seq_num* command is needed only when a message is split into parts. The `of` *tot_num* coding is optional for all but the last section of the split message.

### Examples

To illustrate the use of REF_ID, suppose the following request for waveform data is sent from the NDC in country ABC to the IDC:

```
begin ims1.0
msg_type request
msg_id 1999/05/21_0001 ABC_NDC
...
stop
```

The IDC's response to the request will have a REF_ID from the IDC and will use the request message MSG_ID string in the REF_ID line:

```
begin ims1.0
msg_type data
msg_id 00000023 IMS_IDC
ref_id 1999/05/21_0001 ABC_NDC
…
stop
```

The following example shows a data message with four distinct DATA_TYPES:

```
begin ims1.0
msg_type data
msg_id 54965 IMS_IDC
ref_id 0002324 ANY_NDC
data_type type1 ims1.0
…
data_type type2 ims1.0
…
data_type type3 ims1.0
…
data_type type4 ims1.0
…
stop
```

The following example shows how a message can be split. The single message in the previous example is split into two distinct messages using the `part` *seq_num* [`of` *tot_num*] referencing mechanism.

```
begin ims1.0
msg_type data
msg_id 54965 IMS_IDC
ref_id 0002324 ANY_NDC part 1 of 2
data_type type1 ims1.0
...
data_type type2 ims1.0
...
stop

begin ims1.0
msg_type data
msg_id 54966 IMS_IDC
ref_id 0002324 ANY_NDC part 2 of 2
data_type type3 ims1.0
...
data_type type4 ims1.0
...
stop
```

### Prod_id

The PROD_ID line is the fourth line of a data message that is generated for a subscription. The PROD_ID line is comprised of the PROD_ID keyword followed by a *product_id* code and a *delivery_id* code, separated by a blank. These numbers help users receiving the subscription know if a delivery has been omitted.

#### Syntax

`prod_id` *product_id delivery_id*

| | |
|---|---|
| *product_id* | product identification code |
| *delivery_id* | delivery identification |

### Stop

Except in the case of a HELP message, the STOP line is the last line of an *AutoDRM* message. In the case where two or more messages with different MSG_ID *id_strings* are included in one email or file, all lines between the STOP and BEGIN lines are ignored. A message without a STOP line is considered incomplete and is ignored.

## MESSAGE AUTHENTICATION

IMS1.0 messages are sent via email using Multi-purpose Internet Mail Extension (MIME) (see Request for Comments [Fre96a], [Fre96b], [Moo96], [Fre96c], and [Fre96d]). Data and request messages in IMS1.0 format may be authenticated using MIME email signed message formats without altering the IMS1.0 formats. The authentication mechanism encapsulates the message within MIME boundaries consisting of the message body and the signature.

The MIME format is defined in [Gal95] and [Cro95]. Further drafts for these formats have standardized more aspects of the encapsulating procedures. The current industry practices, based on the standard described in [PKCS-7], provide the basis for the internet drafts. Messages delivered using a retrieval mechanism based on FTP would also use the MIME format for authentication.

Email signatures for messages would usually carry the entire senders X.509 signed certificate in the signature block [ITU95]. "Appendix B: Authentication Example" on page B1 provides an example of a signed email request and a breakdown of the signature block.

Standard email readers and senders have the capability to interpret and create these authentication signatures. With an appropriate certificate installed in a mail application, a user could manually create a valid request message. The particular message format does not have to be changed to be authenticated; it will just be encapsulated in a MIME standard signed format.

The originating parties signature may be retained when data or products are forwarded from one site to another. In this case, any subsequent signatures would encapsulate the entire previously signed message into a message body with an additional signature.

# Request Messages

This chapter describes the request message formats and includes the following topics:

# Request Messages

## INTRODUCTION

The request message format provides a framework in which almost all data or data products can be requested from the IMS/IDC. The data and data products available include radionuclide pulse-height data and analysis reports, S/H/I waveforms and bulletin products, and more.

Within a single request message, several types of data may be requested. For example, requests may be made for a bulletin and associated waveforms or for specific event information from several different regions. The order of the requests in the request message is preserved in the response (data) message.

Implementation of the *AutoDRM* formats will vary from site to site and will depend on the type of data and information that is available from the site. The minimum required configuration for a station or NDC *AutoDRM* is outlined in "Station AutoDRM Basics" on page 217.

## HELP LINE

The HELP line is considered a request message because it is used to request an *AutoDRM* Users Guide by email. Only the *AutoDRM* email address is required for this protocol to work properly. No other message lines are required in a HELP line message. The same result may be achieved by sending the *AutoDRM* an empty message with the word "`help`" as the email subject (see "HELP" on page A24).

## REQUEST FORMAT

With the exception of the HELP request, all request messages require the basic message structure described in "Message Structure" on page 20. To inform the *AutoDRM* that the message is a request message, the MSG_TYPE is set to `request`.

The body of a request message contains a series of free-format command lines that provide information about the return message (request control lines), sets the environment for subsequent request lines (request environment lines), and specifies the type of data that are to be returned within the limits of the environment (request lines). Some request lines must be preceded by environment lines that, by constraining the request, limit the size of the response.

The response to a request is contained in a data message. In the response data message, the identification (ID) fields from the MSG_ID line of the request message are placed in the REF_ID line.

## REQUEST CONTROL LINES

Request control lines are commands that specify the protocol of the response data message. The existing options for the response message protocol are email and FTP. These options should be used in accordance with the guidelines described in "Protocols" on page 3 and "Message Size" on page 4.

Only one response message protocol can be specified in each request message. If different protocols are desired for the response data, separate request messages must be submitted to the *AutoDRM*. A request message that does not specify a response message protocol will be answered by email using the return address of the sender.

The syntax for the E-MAIL and FTP request control lines are described in the following sections.

## E-mail

The E-MAIL line indicates to the *AutoDRM* that the response message protocol is email. The argument for the E-MAIL command is the email address to which the response message should be sent.

### Syntax

`e-mail` *address*

*address* email address to send reply

If no E-MAIL line is included in the request message, the reply is sent to the address obtained from the mail header. Because the return address from an email header may not be reliable, it is highly recommended to specify the return email address using an E-MAIL line.

## FTP

The FTP line specifies that the message should be put in a file for transmission using FTP. The argument for the FTP line is the email address to which notification should be sent, indicating that the FTP file is ready for transfer.

### Syntax

`ftp` *address*

*address* email address to send notification

The notification message (an FTP_LOG data message) sent to the requestor contains the name and location of the FTP file(s) with the requested data or data product. (See “FTP_log” on page 180 for more about this data type and “Ftp_log” on page A24 for an example of an FTP_LOG data message.)

## REQUEST ENVIRONMENT LINES

Environment lines identify the variables to which the response to the request line is constrained (for example, TIME or STATION). An environment variable is set by arguments that follow a predetermined keyword and is reset with another environment line including the same keyword. An environment keyword with no arguments resets the constraint on that environmental parameter to the default value.

Environment variables may be specified using either ranges or lists. An environment range constrains the variable within the inclusive limits between two values. Ranges are specified using the word "`to`" surrounded by blank spaces.

#### Syntax

*environment_keyword* [ [ *low_limit* ] `to` [ *high_limit* ] ]

Open-ended ranges are specified by omitting the *low_limit* or the *high_limit*. A blank may also be used in the *low_limit* or the *high_limit* when a TIME environment is being specified.

#### Examples

All times between February 23, 1999 at 00:00:00 and March 10, 1999 at 14:37:02 are specified with the following environment line:

```
time 1999/02/23 to 1999/03/10 14:37:02
```

The following example specifies all magnitudes of 5.0 and above:

```
mag 5.0 to
```

List environment lines contain lists of comma-delimited parameters that specify discrete constraints, such as station names and channels. Some list environments are allowed only one parameter (for example, BULL_TYPE); others may have an unlimited number. Spaces after the commas are optional. The general syntax for a list environment is as follows:

### Syntax

*environment_keyword* [ *arg1*[ , *arg2*[ , *arg3*[ , ... ] ] ] ]

Lists can be long, so a wild card character (*) may be used as a substitute for any string of characters in some list environments.

### Examples

The following environment line specifies all IMS stations, including seismic, hydroacoustic, and infrasonic stations:

```
sta_list *
```

The following environment line specifies all IMS stations beginning with "A":

```
sta_list a*
```

The following environment line specifies all radionuclide stations operated by the U.S.:

```
sta_list us*
```

The following environment line specifies all IMS channels ending with "Z":

```
chan_list *Z
```

The following sections describe specific environment variables. Default settings and examples are given for each variable. Although many environment variables are listed, only certain ones may be applicable to a particular *AutoDRM* installation. Those variables that have been implemented should be described in the *AutoDRM* Users Guide available through the HELP request line (see "Help Line" on page 30).

The STA_LIST, TIME, and TIME_STAMP environments can be used in requesting either radionuclide or S/H/I data. All other environment variables are used exclusively for requesting S/H/I data.

## Arrival_list

A unique arrival identification code is assigned to each waveform arrival. This arrival identification number appears in the data types for arrivals and bulletins and may be used to obtain arrival information.

### Syntax

arrival_list [ *arid* [ , *arid* [ , … ] ] ]

*arid* arrival identification code

### Default

```
arrival_list *
```

### Example

The following environment line limits the arrivals to those with arids `8971234` or `90814`:

```
arrival_list 8971234,90814
```

## Aux_list

Station and channel are not always adequate to completely describe a specific data stream for some seismic stations. An auxiliary identification is supplied for completeness in handling these special cases. The instances in which the auxiliary identifications are necessary should be rare. The wildcard character (*) is allowed in specifying auxiliary codes.

### Syntax

aux_list [ *aux* [ , *aux* [ , … ] ] ]

*aux* auxiliary code

#### Default

```
aux_list *
```

#### Example

The following environment line limits the auxiliary code to `chi` and `med`:

```
aux_list chi,med
```

### Bull_type

The BULL_TYPE environment provides a means to specify which type of S/H/I bulletin to retrieve. Only one bulletin type may be specified in any BULL_TYPE line. The bulletin types include SEL1 (Standard Event List 1), SEL2 (Standard Event List 2), SEL3 (Standard Event List 3), REB (Reviewed Event Bulletin), SEB (Standard Event Bulletin), SSEB (Standard Screened Event Bulletin), NEB (National Event Bulletin), and NSEB (National Screened Event Bulletin).

#### Syntax

`bull_type` [ *bulletin* ]

| | |
|---|---|
| *bulletin* | bulletin code (`sel1`, `sel2`, `sel3`, `reb`, `seb`, `sseb`, `neb`, `nseb`) |

#### Default

none

#### Example

The following environment line limits the bulletin type to `sel1`:

```
bull_type sel1
```

## Chan_list

The S/H/I channel search list is given in the CHAN_LIST environment. The wildcard character (*) is allowed for specifying channel codes.

### Syntax

`chan_list [`*chan*`[ ,` *chan*`[ , ... ]]]`

| | |
|---|---|
| *chan* | channel code |

### Default

```
chan_list *z
```

### Example

The following environment line limits the channels to three short-period channels:

```
chan_list shz, shn, she
```

The following environment line limits the channels to all short-period channels:

```
chan_list s*
```

## Comm_list

The communications list is a list of communication links to include in S/H/I status reports. Links are defined by the end of the link furthest from the IDC. Thus, for the link between the `USA_NDC` and the IDC, the communications link would be designated as `USA_NDC`. Station codes are used for links from the station to the NDC or from the station to the IDC, and so on.

### Syntax

`comm_list [`*comm*`[ ,` *comm*`[ , ... ]]]`

| | |
|---|---|
| *comm* | communications link code |

#### Default

```
comm_list *
```

#### Example

The following environment line limits the communications links to the ones between the French and Russian NDCs and the IDC:

```
comm_list FRA_NDC,RUS_NDC
```

### Depth

S/H/I events may be constrained by their depth using the DEPTH environment. Depth is given in kilometers from the surface.

#### Syntax

depth [ [ *shallow* ] to [ *deep* ] ]

| | |
|---|---|
| *shallow* | low depth range |
| *deep* | high depth range |

#### Default

no constraint

#### Example

The following environment line limits depths to a range from 0 to 10 km:

```
depth 0.0 to 10.0
```

### Depth_conf

The DEPTH_CONF environment defines the confidence level for the S/H/I depth screening criterion and is given as a number between 0.0 and 1.0.

#### Syntax

depth_conf [ *conf* ]

*conf* confidence level of depth screening criterion

#### Default

depth_conf 0.975

#### Example

The following environment line sets the confidence level for the depth screening criterion at 99 percent:

depth_conf 0.990

### Depth_minus_error

The DEPTH_MINUS_ERROR environment is used to obtain all S/H/I events that have a 90 percent probability of being within a certain depth range. The ranges must be given in kilometers of depth from the surface.

#### Syntax

depth_minus_error [ [ *shallow* ] to [ *deep* ] ]

*shallow* low depth range

*deep* high depth range

#### Default

no constraint

#### Example

The following environment line limits the depth of events to a 90 percent probability of being within 10 km of the surface:

```
depth_minus_error 0.0 to 10.0
```

### Depth_thresh

The depth screening threshold is given in kilometers of depth from the surface. The value of DEPTH_THRESH must be non-negative. S/H/I events with depth confidence intervals deeper than this threshold are screened out.

#### Syntax

`depth_thresh` [ *threshold* ]

*threshold* depth threshold

#### Default

```
depth_thresh 10.0
```

#### Example

The following environment line sets the depth screening threshold at 20.0 km:

```
depth_thresh 20.0
```

### Event_list

A unique event identification code is assigned to each S/H/I event. This number appears in S/H/I bulletins and may be used subsequently to request waveforms or comments associated with a specific event.

#### Syntax

```
event_list [evid[, evid[, ...]]]
```

*evid* event identification code

#### Default

```
event_list *
```

#### Example

The following environment line limits the event number to 87623495 and 87:

```
event_list 87623495, 87
```

### Event_sta_dist

The EVENT_STA_DIST environment is the distance in degrees between the S/H/I event and the S/H/I station. The environment is applied in context to the request. When requesting waveform data associated with specific S/H/I events, EVENT_STA_DIST helps determine the stations from which the data will be retrieved. When requesting bulletin-type information (bulletins, events, origins, or arrivals), EVENT_STA_DIST helps determine the S/H/I events for which the data will be retrieved.

#### Syntax

```
event_sta_dist [[low_dist] to [high_dist]]
```

*low_dist* low-distance range

*high_dist* high-distance range

#### Default

no constraint

### Examples

The following EVENT_STA_DIST environment line limits the request for S/H/I bulletin information to events within 20 degrees of stations `ABC` or `DEF`:

```
sta_list ABC, DEF
event_sta_dist 0 to 20
bull_type REB
bulletin ims1.0
```

The following EVENT_STA_DIST environment line limits the request for waveform data to stations within 20 degrees of an event:

```
event_sta_dist 0 to 20
bull_type REB
relative_to bulletin
waveform ims1.0
```

## Group_bull_list

S/H/I events are often common between bulletins. Sometimes it is desirable to list the various solutions (origins) together. GROUP_BULL_LIST is a list of the bulletins that should be combined with the S/H/I bulletin specified in the BULL_TYPE environment. Origin information from these other bulletins will be included in the combined bulletin that is returned. The arrival information will be for the BULL_TYPE bulletin.

Events in the GROUP_BULL_LIST will be grouped with at most one S/H/I event in the BULL_TYPE bulletin. To be grouped, events must have locations within three degrees and origin times within 60 seconds. If the initial criteria are met for more than one S/H/I event, all events within the range are reported.

### Syntax

`group_bull_list [`*bulletin* `[ ,` *bulletin* `[ ,` … `] ] ]`

*bulletin* bulletin code

### Default

none (no grouping)

#### Example

The following environment lines group SEL3 origins with the SEL1:

```
bull_type SEL1
group_bull_list SEL3
```

### Lat

The LAT environment specifies the range of latitude in degrees. Southern latitudes are negative. The low-range value must be smaller than the high-range value.

In cases where LAT can apply to origins or stations (for example, when requesting a S/H/I bulletin), the constraint will be applied to origins.

#### Syntax

lat [[*low_lat*] to [*high_lat*]]

| | |
|---|---|
| *low_lat* | low-range latitude |
| *high_lat* | high-range latitude |

#### Default

no constraint

#### Example

The following environment line limits latitudes to a range from 12 south to 17 north:

```
lat –12 to 17
```

### Loc_conf

The LOC_CONF environment is used to specify the confidence level for location error ellipses as a number between 0.0 and 1.0. This environment is used to assess whether or not the error ellipse for an S/H/I event was onshore, offshore, or mixed (in other words, partially onshore and offshore).

#### Syntax

`loc_conf [` *conf* `]`

| | |
|---|---|
| *conf* | confidence level for location error ellipses |

#### Default

```
loc_conf 0.90
```

#### Example

The following environment line sets the confidence level for location error ellipses at 99 percent:

```
loc_conf 0.99
```

### Lon

The LON environment specifies the range of longitude in degrees. Western longitudes are negative, and the range is interpreted from west to east. Either both or neither (to return to the default values) of the longitudes must be provided in the LON environment.

In cases where LON can apply to S/H/I origins or stations (for example, when requesting a S/H/I bulletin), the constraint will be applied to origins.

#### Syntax

```
lon [ west_lon to east_lon ]
```

| | |
|---|---|
| *west_lon* | western longitude |
| *east_lon* | eastern longitude |

#### Default

no constraint

#### Examples

The following environment line limits the longitude range to 350 degrees:

```
lon –175 to 175
```

The following environment line limits the longitude range to a 10-degree range spanning the international date line:

```
lon 175 to –175
```

### Mag

The MAG environment specifies the range of magnitudes to include in the search for seismic events. The type of magnitude ($m_b$, $M_s$, and so on) is specified in the MAG_TYPE environment.

#### Syntax

```
mag [ [ low_mag ] to [ high_mag ] ]
```

| | |
|---|---|
| *low_mag* | low-magnitude range |
| *high_mag* | high-magnitude range |

#### Default

no constraint

#### Example

The following environment line limits magnitudes to those with magnitudes above 4.5:

```
mag 4.5 to
```

### Mag_type

The MAG_TYPE list environment specifies the type of magnitude to search when the MAG environment is provided. Standard accepted magnitude codes are `mb` (body wave magnitude), `Ms` (surface wave magnitude), `mbmle` (maximum likelihood body wave magnitude), `msmle` (maximum likelihood surface wave magnitude), and `ML` (local magnitude). Data centers may report other types of magnitudes, provided an explanation is given in the HELP message.

#### Syntax

`mag_type` [ *mag_type* [ , *mag_type* [ , … ] ] ]

*mag_type* `mb` | `mbmle` | `Ms` | `msmle` | `ML`

#### Default

no constraint

#### Example

The following environment line limits the magnitude types to $m_b$ and $M_s$:

```
mag_type mb, Ms
```

## Mb_minus_ms

This difference between $m_b$ and $M_s$ magnitude values specifies the range of magnitude differences to include in the search.

### Syntax

mb_minus_ms [[ *low_mag_diff* ] to [ *high_mag_diff* ]]

*low_mag_diff* low-magnitude difference

*high_mag_diff* high-magnitude difference

### Default

no constraint

### Example

The following environment line limits the difference of magnitudes to the range from 1 to 2:

```
mb_minus_ms 1.0 to 2.0
```

## Mbms_conf

The MBMS_CONF environment defines the confidence level for the $Am_b$-$M_s$ screening criterion, given as a number between 0.0 and 1.0, where *A* is the slope.

### Syntax

mbms_conf [ *conf* ]

*conf* confidence level of the $Am_b$-$M_s$ screening criterion

### Default

```
mbms_conf 0.975
```

#### Example

The following environment line sets the confidence level of the $Am_b$-$M_s$ screening criterion at 99 percent:

```
mbms_conf 0.99
```

### Mbms_slope

The MBMS_SLOPE environment defines the slope (*A*) of the $m_b$-$M_s$ relation. The value should be a positive number (typically between 1.0 and 1.5).

#### Syntax

`mbms_slope` [ *slope* ]

*slope* the slope (*A*) of the $m_b$-$M_s$ relation

#### Default

```
mbms_slope 1.25
```

#### Example

The following environment line sets the slope of the $m_b$-$M_s$ relation at 1.50:

```
mbms_slope 1.50
```

### Mbms_thresh

The $Am_b$-$M_s$ screening threshold is given in magnitude units. S/H/I events with confidence intervals for $Am_b$-$M_s$ less than this threshold are screened out. The value of MBMS_THRESH is not restricted.

### Syntax

```
mbms_thresh [ threshold ]
```

*threshold* threshold of the $Am_b$-$M_s$ screening criterion

### Default

```
mbms_thresh 2.20
```

### Example

The following environment line sets the $Am_b$-$M_s$ screening threshold at 3.5:

```
mbms_thresh 3.50
```

## Min_nsta_ms

MIN_NSTA_MS is the minimum number of S/H/I stations required with $M_s$ measurements for the $Am_b$-$M_s$ screening criterion to be applied. The value of MIN_NSTA_MS must be a positive integer.

### Syntax

```
min_nsta_ms [ integer ]
```

*integer* minimum number of S/H/I stations required with $M_s$ measurements

### Default

```
min_nsta_ms 1
```

#### Example

The following environment line sets the minimum number of S/H/I stations required with $M_s$ measurements at 2:

```
min_nsta_ms 2
```

### Origin_list

A unique origin identification code is assigned to each origin. This origin identification code appears in S/H/I bulletins and may be used subsequently to request waveforms or comments associated with a specific origin.

#### Syntax

origin_list [ *orid* [ , *orid* [ , … ] ] ]

| | |
|---|---|
| *orid* | origin identification code |

#### Default

```
origin_list *
```

#### Example

The following environment line limits the origins to those with orids 132456 or 190672:

```
origin_list 132456,190672
```

## Relative_to

The concept of association provides the ability to tie or associate one S/H/I data type with another. The most common association is between waveforms and events and allows a user to request waveforms associated with a particular set of origins.

RELATIVE_TO has all of the characteristics of a list environment, except that it is active only for the subsequent request line, and the arguments are request keywords.

### Syntax

```
relative_to origin | event | bulletin
```

The data type given in the RELATIVE_TO environment line is not returned in the response. That data type must be explicitly requested on another line, which typically precedes the RELATIVE_TO environment line.

### Example

The following message requests the associated waveforms in CM6 subformat for events found in the bulletin between 1:00 and 1:15 on January 9, 1999:

```
begin ims1.0
msg_type request
msg_id ex001 ANY_NDC
e-mail name@my.computer
time 1999/1/9 1:00 to 1999/1/9 1:15
bull_type reb
relative_to bulletin
waveform ims1.0:cm6
stop
```

To also request the REB bulletin for the time period in the example given above, the line `bulletin ims1.0` must be added:

```
begin ims1.0
msg_type request
msg_id ex002 ANY_NDC
e-mail name@my.computer
time 1999/1/9 1:00 to 1999/1/9 1:15
bull_type reb
bulletin ims1.0
relative_to bulletin
waveform ims1.0:cm6
stop
```

## Sta_list

The STA_LIST environment provides the station search list. This variable may be used for specifying radionuclide and/or S/H/I stations. Radionuclide stations are identified by site codes (see "Radionuclide Site Codes" on page 8). If a S/H/I array station is specified, then all elements of the array are implied. Specific array elements may be referenced individually. The wildcard character (*) is allowed in specifying station codes.

When S/H/I bulletins are requested, STA_LIST can be used to specify the events to be included. If an event in the S/H/I bulletin contains at least one of the stations in the STA_LIST, that event, and all arrivals available for that event, will be included in the bulletin.

### Syntax

`sta_list [` *sta* `[ ,` *sta* `[ , … ] ] ]`

*sta* station or array code

### Default

```
sta_list *
```

#### Example

The following environment line limits the station list to four specific S/H/I stations:

```
sta_list WHY,WOOL,STKA,FCC
```

The following environment line limits the returned data to that from radionuclide station CA004:

```
sta_list CA004
```

The following environment line limits the stations to those beginning with the character "A":

```
sta_list A*
```

### Time

The TIME environment is expressed as a range with date and decimal time entries. The time entries are optional. Unlike most range environments, a space is allowed between the date and time entries of the limits. In addition, this environment variable is translated according to the context of the requested data product. For example, TIME applies to the collection date and time for Fission Product Event Bulletins (FPEBs) and Sample Pulse Height Data (SAMPLEPHD), but applies to acquisition date and time for Blank Pulse Height Data (BLANKPHD), Calibration Pulse Height Data (CALIBPHD), Detector Background Pulse Height Data (DETBKPHD), and Quality Control Pulse Height Data (QCPHD). This convention is used only for request messages.

In requests for S/H/I data, only the date and time fields that are necessary to obtain the resolution must be specified; all other fields are assumed to be 0 or 1 as appropriate (1 for month and day, 0 for hour, minute, and second).

#### Syntax

`time [[`*date1* `[`*time1*`]] to [`*date2* `[`*time2*`]]]`

*date1 time1* low-range date and time

*date2 time2* high-range date and time

#### Default

`time` *(current date and time)* `to` *(current date and time)*

#### Examples

The following environment line limits the time to a range from 1999/02/01 00:00:00.0 to 1999/03/01 00:00:00.0:

```
time 1999/02/01 to 1999/03/01
```

Either of the following environment lines limits the time to a range from 1999/02/01 23:14:19.7 to 1999/03/01 12:00:00.0:

```
time 1999/02/01 23:14:19.7 to 1999/03/01 12
time 1999/2/1 23:14:19.7 to 1999/3/1 12
```

### Time_stamp

The TIME_STAMP environment is used to request that data messages be time stamped. If requested, time stamps will appear at the beginning and end of each data type. Time stamps record the start time and end time that the message entered and exited the processing system.

#### Syntax

```
time_stamp
```

#### Default

none (do not time stamp the returned message)

### Example

The following environment line turns on the time stamp utility:

```
time_stamp
```

## REQUEST LINES

Request lines specify the type of information to be retrieved from the *AutoDRM* installation. All arguments in a request line are optional and include the format for the return message. The format is specified as a generic term, such as `ims1.0`. The arguments *subtype* and *sub_format* are used only in requests for S/H/I data. Radionuclide data are returned in the format specified on the BEGIN line.

### Syntax

*request_keyword* [ **:***subtype* ] [ *format* [ **:***sub_format* ] ]

*request_keyword*
: The *request_keyword* specifies the requested data type.

*subtype*
: The S/H/I *subtype* specifies which subtype to use with this data type. The *subtype* allows a more precise data selection. The *subtype* is used primarily for arrival requests.

*format*
: The *format* specifies the data format to use in the return message (for example, `ims1.0`).

*sub_format*
: The S/H/I *sub_format* further specifies the precise format to use with this data type.

If the format of the S/H/I return data is not specified, the default format in the BEGIN line will be used.

The *subtype* argument is concatenated to the *request_keyword* with a colon (:) (for example, `arrival:automatic`). In addition, *sub_format* is concatenated to the *format* with a colon (for example, `ims1.0:cm6`).

For each request, a subset of the environments described in "Request Environment Lines" on page 33 must be specified (see Table 5 and Table 6). All required environments are enforced for each request. If an environment is not specified explicitly, then the default is used. Because the default values for some environments specify a zero length range (for example, `time`), a request made without explicitly defining these environments will result in no data being returned. Descriptions of the request lines include the applicable environment variables.

The order of the request lines is significant because the environment established prior to the request line is used to constrain the request. The environment can be changed between request lines to allow multiple requests for the same type of information within the same request message.

#### Example

The following message requests S/H/I bulletin information for all events in January 1999 within the areas defined by 10 to 20 degrees north and 120 to 160 degrees east and 55 to 45 degrees south and 25 to 15 degrees west:

```
begin ims1.0
msg_type request
msg_id ex003 any_ndc
e-mail name@my.computer
time 1999/01/01 to 1999/02/01
lat 10.0 to 20.0
lon 120.0 to 160.0
bull_type reb
bulletin ims1.0
lat -55.0 to -45.0
lon -25.0 to -15.0
bulletin ims1.0
stop
```

**TABLE 5: S/H/I DATA REQUEST ENVIRONMENT VARIABLES**

| Environments[1] | Request Lines: arrival or SLSD | bulletin | channel | chan_status | comment | comm_status | event | network | origin | outage | response | station | sta_status | waveform |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **arrival_list** | o | o | | | o | | | | | | | | | |
| **aux_list** | | | o | o | | | | | | o | o | | o | o |
| **bull_type** | r | r | | | | | r | | r | | | | | |
| **chan_list** | o | | o | o | | | | | | o | o | | | o |
| **comm_list** | | | | | | o | | | | | | | | |
| **depth** | | o | | | | | o | | o | | | | | |
| **depth_conf** | | o[2] | | | | | | | | | | | | |
| **depth_minus_error** | | o | | | | | o | | o | | | | | |
| **depth_thresh** | | o[1] | | | | | | | | | | | | |
| **event_list** | | o | | | o | | o | | | | | | | |
| **event_sta_dist** | | o | | | | | o | | o | | | | | |
| **group_bull_list** | | o | | | | | o | | | | | | | |
| **lat** | | o | o | | | | o | | o | | | o | | |
| **loc_conf** | | o[1] | | | | | | | | | | | | |
| **lon** | | o | o | | | | o | | o | | | o | | |
| **mag** | | o | | | | | o | | o | | | | | |
| **mag_type** | | o | | | | | o | | o | | | | | |
| **mb_minus_ms** | | o | | | | | o | | o | | | | | |
| **mbms_conf** | | o[1] | | | | | | | | | | | | |
| **mbms_slope** | | o[1] | | | | | | | | | | | | |

## TABLE 5: S/H/I DATA REQUEST ENVIRONMENT VARIABLES (CONTINUED)

| Environments[1] | Request Lines | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | arrival or SLSD | bulletin | channel | chan_status | comment | comm_status | event | network | origin | outage | response | station | sta_status | waveform |
| **mbms_thresh** | | o[1] | | | | | | | | | | | | |
| **min_nsta_ms** | | o[1] | | | | | | | | | | | | |
| **origin_list** | | o | | | o | | | | o | | | | | |
| **relative_to** | | | | | | | | | | | | | | o |
| **sta_list** | o | o | o | o | o | | o | o | o | o | o | o | o | o |
| **time** | r | r | | r | o | r | r | | r | r | o | | r | r |
| **time_stamp** | o | o | o | o | o | o | o | o | o | o | o | o | o | o |

1. r = required, o = optional
2. may be applied only to NEB and NSEB

## TABLE 6: RADIONUCLIDE DATA REQUEST ENVIRONMENT VARIABLES

| Environments[1] | Request Lines | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | armr | arr | blankphd | calibphd | detbkphd | fpeb | qcphd | sphdf | sphdp |
| **sta_list** | o | o | o | o | o | o | o | o | o |
| **time** | r | r | r | r | r | r | r | r | r |
| **time_stamp** | o | o | o | o | o | o | o | o | o |

1. r = required, o = optional

Descriptions of the possible request lines are given below, and include the applicable environment variables. The variables that must be explicitly specified to obtain a result are in **bold** type.

## ARMR

This data type is one of several radionuclide data products available from the IDC. The ARMR, or Atmospheric Radionuclide Measurement Report, is a revised version of the ARR, or Automated Radionuclide Report, and is generated after manual review of a radionuclide sample is complete. See "ARMR" on page 213 for a complete description and "ARMR" on page A3 for an example.

### Environment

**`time`**,
`sta_list`, `time_stamp`

### Example

The following message requests time-stamped ARMRs from all U.S. radionuclide stations for the month of June 1998:

```
begin ims1.0
msg_type request
msg_id ex004
e-mail name@my.computer
time_stamp
time 1998/06/01 to 1998/07/01
sta_list US*
armr
stop
```

## ARR

This data type is one of several radionuclide data products available from the IDC. The ARR includes results from the automated analysis of a radionuclide sample. See "ARR" on page 204 for a complete description and "ARR" on page A8 for an example.

### Environment

**time**,
sta_list, time_stamp

### Example

The following message requests time-stamped ARRs from radionuclide stations FI001 and RU001 for the month of March 1999:

```
begin ims1.0
msg_type request
msg_id ex005
e-mail name@my.computer
time_stamp
time 1999/03/01 to 1999/04/01
sta_list FI001,RU001
arr
stop
```

## Arrival/SLSD

The ARRIVAL and SLSD (Standard List of Signal Detections) requests are synonymous. An arrival is defined by excess energy that is identified in S/H/I waveform data. The amount of information about an arrival depends on the amount of processing that has been applied to the data. The different stages of processing are expressed using subtypes to the ARRIVAL or SLSD request lines as follows:

- `arrival:automatic` | `slsd:automatic`

  The AUTOMATIC subtype provides the result of the automatic detection process run on waveforms.

- `arrival:reviewed` | `slsd:reviewed`

  The REVIEWED subtype provides the arrivals that have been automatically or manually reviewed to the extent that phase names have been assigned.

- `arrival:grouped` | `slsd:grouped`

  The GROUPED subtype provides the arrivals that have been assigned phase names and that have also been grouped together with the assumption that they belong to the same event.

- `arrival:associated` | `slsd:associated`

  The ASSOCIATED subtype provides the arrivals that have been run through a location program and are associated to an event. ASSOCIATED is the default subtype for ARRIVAL/SLSD.

- `arrival:unassociated` | `slsd:unassociated`

  The UNASSOCIATED subtype provides the arrivals that have been detected but not associated with any event.

A specific bulletin type must be specified through the BULL_TYPE environment for associated and unassociated arrivals.

#### Environment

**bull_type**, **time**,
arrival_list, beam_list, chan_list, sta_list,
time_stamp

#### Example

The following message requests automatically determined arrivals from stations ABC and DEF for the month of March 1999:

```
begin ims1.0
msg_type request
msg_id ex006 any_ndc
e-mail name@my.computer
time 1999/03/01 to 1999/04/01
sta_list ABC,DEF
bull_type SEL1
arrival:automatic ims1.0
stop
```

The following message requests associated arrivals from the REB from stations ABC and DEF for the month of March 1999:

```
begin ims1.0
msg_type request
msg_id ex007 any_ndc
e-mail name@my.computer
time 1999/03/01 to 1999/04/01
sta_list ABC, DEF
bull_type reb
arrival:associated ims1.0
stop
```

## Blankphd

BLANKPHD is one of several pulse height data (PHD) types available for particulate radionuclide samples. It contains the PHD of an unexposed air filter as well as other important information. See "Pulse Height Data" on page 186 for a description of the various PHD types and "Blankphd" on page A15 for an example.

### Environment

**`time`**,
`sta_list`, `time_stamp`

### Example

The following message requests time-stamped BLANKPHDs from all radionuclide stations acquired during the year 1998. Note that the STA_LIST environment is not explicitly specified and therefore defaults to all stations.

```
begin ims1.0
msg_type request
msg_id ex008
e-mail name@my.computer
time_stamp
time 1998/01/01 to 1999/01/01
blankphd
stop
```

## Bulletin

Bulletins are composed of S/H/I origin, event, and associated arrival information. The FPEB cannot be obtained using BULLETIN; it is requested using a FPEB request line.

The IMS1.0 format bulletins, as implemented by the IDC, have two subformats: `ims1.0:short` and `ims1.0:long`. If the subformat is not specified, the `short` subformat is used.

The DEPTH_CONF, DEPTH_THRESH, LOC_CONF, MBMS_CONF, MBMS_SLOPE, MBMS_THRESH, and MIN_NSTA_MS environments are applied only to the NEB and NSEB bulletins specified in the BULL_TYPE environment.

The environment for BULLETIN is also used to constrain waveforms when the RELATIVE_TO environment is used.

#### Environment

**bull_type**, **time**,
arrival_list, depth, depth_conf, depth_minus_error, depth_thresh, event_list, event_sta_dist, group_bull_list, lat, loc_conf, lon, mag, mag_type, mb_minus_ms, mbms_conf, mbms_slope, mbms_thresh, min_nsta_ms, relative_to, sta_list, time_stamp

#### Example

The following message requests the REB for December 25, 1998:

```
begin ims1.0
msg_type request
msg_id ex009 any_ndc
e-mail name@my.computer
time 1998/12/25 to 1998/12/26
bull_type reb
bulletin ims1.0
stop
```

The following message requests the REB and associated SEL2 origins for December 25, 1998:

```
begin ims1.0
msg_type request
msg_id ex009a any_ndc
e-mail name@my.computer
time 1998/12/25 to 1998/12/26
bull_type reb
group_bull_list sel2
bulletin ims1.0
stop
```

The following message requests the REB and associated SEL2 origins whose DEPTH_MINUS_ERROR is less than 10 km in the `long` subformat for December 25, 1998:

```
begin ims1.0
msg_type request
msg_id ex009b any_ndc
e-mail name@my.computer
time 1998/12/25 to 1998/12/26
depth_minus_error to 10
bull_type reb
group_bull_list sel2
bulletin ims1.0:long
stop
```

The following message requests the REB and associated SEL2 origins for December 25, 1998 with DEPTH_MINUS_ERROR less than 10 km and MB_MINUS_MS greater than 0.5:

```
begin ims1.0
msg_type request
msg_id ex009c any_ndc
e-mail name@my.computer
time 1998/12/25 to 1998/12/26
depth_minus_error to 10
mb_minus_ms 0.5 to
bull_type reb
group_bull_list sel2
bulletin ims1.0
stop
```

The following message requests a NSEB for events on June 10, 1998, between magnitudes 4.0 and 6.0, within an area defined by latitude and longitude ranges, and using custom depth and $m_b$ minus $M_s$ screening criteria:

```
begin ims1.0
msg_type request
msg_id ex009d any_ndc
e-mail name@my.computer
time 1998/06/10 to 1998/06/10
bull_type nseb
mag 4.0 to 6.0
lat 60 to 90
lon 45 to 75
depth_thresh 20.0
depth_conf 0.99
mbms_slope 1.5
mbms_thresh 3.5
mbms_conf 0.99
min_nsta_ms 2
bulletin ims1.0
stop
```

## Calibphd

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of a standard calibration source, as well as other important information. See "Pulse Height Data" on page 186 for a description of the various PHD types and "Calibphd" on page A18 for an example.

### Environment

**time**,
sta_list, time_stamp

### Example

The following message requests time-stamped CALIBPHDs from all radionuclide stations acquired during the year 1998. Because the STA_LIST environment is not specified the default (all stations) is used.

```
begin ims1.0
msg_type request
msg_id ex013
e-mail name@my.computer
time_stamp
time 1998/01/01 to 1999/01/01
calibphd
stop
```

## Channel

Channel is a complete set of information about the location, emplacement, and type of seismometers at a station.

### Environment

aux_list, chan_list, lat, lon, sta_list, time_stamp

### Example

The following message requests the short-period channel information for stations in South America using the appropriate LAT and LON environment range. Note that the STA_LIST environment is not explicitly specified; the default for this variable is all stations.

```
begin ims1.0
msg_type request
msg_id ex014 any_ndc
e-mail name@my.computer
lat -60 to 10.0
lon -81 to -34
chan_list s*
channel ims1.0
stop
```

## Chan_status

Channel status is given for the channels in the CHAN_LIST and AUX_LIST environments for the stations in the STA_LIST environment. The TIME environment defines the report period. The minimum report period is one day.

### Environment

**time**,
aux_list, chan_list, sta_list, time_stamp

### Example

The following message requests the channel status reports for the short-period channels over a four-day period for station ARA0:

```
begin ims1.0
msg_type request
msg_id ex015 any_ndc
e-mail name@my.computer
time 1998/11/14 to 1998/11/18
sta_list ara0
chan_list s*
chan_status ims1.0
stop
```

## Comment

Comments may be associated with a S/H/I station, a S/H/I event, an origin, or an arrival. To retrieve comments, the station code or the identifications (IDs) of the arrival, origin, or event can be used. These codes or IDs are listed in the bulletins and are obtained with a request (or subscription to) a bulletin or event list.

#### Environment

**arrival_list** | **event_list** | **origin_list** | **sta_list**,
time, time_stamp

#### Example

The following message requests the comments for events 510 and 512:

```
begin ims1.0
msg_type request
msg_id ex016 any_ndc
e-mail name@my.computer
event_list 510, 512
comment ims1.0
stop
```

### Comm_status

Communications status is given for the communications links listed in the COMM_LIST environment. The TIME environment defines the report period. The minimum report period is one day. The *sub_format* field is used to indicate a verbose communications status report.

#### Syntax

```
comm_status [ ims1.0 [ :verbose ] ]
```

#### Environment

**time**,
comm_list, time_stamp

#### Example

The following message requests the verbose communications status reports for the link from `any_ndc` over a one-week period:

```
begin ims1.0
msg_type request
msg_id ex017 any_ndc
e-mail name@my.computer
time 1998/11/14 to 1998/11/21
comm_list any_ndc
comm_status ims1.0:verbose
stop
```

### Detbkphd

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of an empty detector chamber, as well as other important information. See "Pulse Height Data" on page 186 for a description of the various PHD types and "Detbkphd" on page A21 for an example.

#### Environment

**`time`**,
`sta_list`, `time_stamp`

### Example

The following message requests time-stamped DETBKPHDs acquired during the year 1998 from all operating European radionuclide stations:

```
begin ims1.0
msg_type request
msg_id ex018
e-mail name@my.computer
time_stamp
time 1998/01/01 to 1999/01/01
sta_list DE002,FI001,SE001,UK001
detbkphd
stop
```

## Event

An S/H/I event is the physical occurrence that was detected through the network of S/H/I sensors. S/H/I events can have many estimates of their time and location; and these estimates are known as origins. Only those estimates given in the BULL_TYPE and GROUP_BULL_LIST environments are provided. The origin estimates in BULL_TYPE provide the basis for associating the origins in the GROUP_BULL_LIST.

### Environment

**bull_type**, **time**,
depth, depth_minus_error, event_list, event_sta_dist,
group_bull_list, lat, lon, mag, mag_type, mb_minus_ms,
relative_to, sta_list, time_stamp

#### Example

The following message requests all of the March 1998 REB events within regional distance (20 degrees) of stations ABC and/or DEF. The list is also requested to include the SEL2 events that can be grouped with the REB events.

```
begin ims1.0
msg_type request
msg_id ex019 any_ndc
e-mail name@my.computer
time 1998/03/01 to 1998/04/01
bull_type reb
group_bull_list sel2
sta_list abc,def
event_sta_dist 0.0 to 20.0
event ims1.0
stop
```

### FPEB

This data type is one of several radionuclide data products available from the IDC. The FPEB, or Fission Product Event Bulletin, is generated by the IDC when fission or activation products are detected at a radionuclide station above normal limits. An FPEB contains ARMRs from the stations that detect the fission product(s), information identifying the fission product(s), an estimate of the source location and time, as well as any sample analysis results from Certified Laboratories. See "Fission Product Event Bulletin" on page 214 for a description of the FPEB and "FPEB" on page A23 for an example.

#### Environment

**time**,
sta_list, time_stamp

#### Example

The following message requests all FPEBs generated by the IDC during the first quarter of 1998:

```
begin ims1.0
msg_type request
msg_id ex020
e-mail name@my.computer
time 1998/01/01 to 1998/04/01
fpeb
stop
```

### Origin

Origins are solutions to the location and time of a S/H/I event. Several origins may be determined for any one S/H/I event.

#### Environment

**bull_type**, **time**,
depth, depth_minus_error, event_sta_dist, lat, lon, mag, mag_type, mb_minus_ms, origin_list, relative_to, sta_list, time_stamp

**Example**

The following message requests origin information for the REB origins for August 8, 1998:

```
begin ims1.0
msg_type request
msg_id ex021 any_ndc
e-mail name@my.computer
time 1998/08/08 to 1998/08/09
bull_type reb
origin ims1.0
stop
```

The following message limits the previous request to a specific magnitude and depth range by including more environment lines:

```
begin ims1.0
msg_type request
msg_id ex022 any_ndc
e-mail name@my.computer
time 1998/08/08 to 1998/08/09
mag 4.5 to 5.5
depth 0 to 10
bull_type reb
origin ims1.0
stop
```

## Outage

OUTAGE requests reports on S/H/I data that are not available for the specified time range.

### Environment

**time**,
aux_list, chan_list, sta_list, time_stamp

### Example

The following message requests the outage reports for all S/H/I stations and channels for the month of March 1998. If the station and channels of interest are not explicitly specified, then the default station list (*) and channel list (*z) are used.

```
begin ims1.0
msg_type request
msg_id ex023 any_ndc
e-mail name@my.computer
time 1998/03/01 to 1998/04/01
outage ims1.0
stop
```

## Qcphd

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of a 15 minute sample acquisition as well as other important information. See "Pulse Height Data" on page 186 for a description of the various PHD types and "Qcphd" on page A27 for an example.

**Environment**

**time**,
sta_list, time_stamp

**Example**

The following message requests QCPHDs from KW001 acquired on December 14, 1997:

```
begin ims1.0
msg_type request
msg_id ex024
e-mail name@my.computer
time 1997/12/14 to 1997/12/15
sta_list KW001
qcphd
stop
```

## Response

The response is the instrument response of the specified S/H/I network/station/channel/auxiliary identification code. Responses are valid at any given time and may change through time.

**Environment**

aux_list, chan_list, sta_list, time, time_stamp

#### Example

The following message requests all the instrument responses for the broadband vertical channel of station ABC used in January 1999:

```
begin ims1.0
msg_type request
msg_id ex025 any_ndc
e-mail name@my.computer
time 1999/01/01 to 1999/02/01
sta_list abc
chan_list bhz
response ims1.0
stop
```

### SLSD

SLSD is a synonym for arrival. See "Arrival/SLSD" on page 62.

### Sphdf/p

The Sample Pulse Height Data– Full (SPHDF) and Sample Pulse Height Data–Preliminary (SPHDP) data types are two of several PHD types available for radionuclide samples. The SPHDP contains PHD from a sample acquired for a time shorter than that of the full acquisition time. The SPHDF contains PHD from a sample acquired for the IDC-defined full acquisition time. Like the other PHD types, the SPHDF and SPHDP also include other important information. See "Pulse Height Data" on page 186 for a description of the various PHD types and "Samplephd" on page A30 for an example.

#### Environment

**time**,
sta_list, time_stamp

#### Example

The following message requests SPHDPs and SPHDFs from all Australian radionuclide stations for June 22, 1998:

```
begin ims1.0
msg_type request
msg_id ex026
e-mail name@my.computer
time 1998/06/22 to 1998/06/23
sta_list AU*
sphdp
sphdf
stop
```

### Station

S/H/I station information includes station codes, locations, elevations, station type (array, 3-C), and dates for which waveform or arrival data are available from an *AutoDRM*. Additional station codes may be reported for which neither waveform nor arrival data are available, but this can present problems for users of the *AutoDRM*.

#### Environment

`lat`, `lon`, `sta_list`, `time_stamp`

#### Example

The following message requests station information for all S/H/I stations serviced by this *AutoDRM*:

```
begin ims1.0
msg_type request
msg_id ex027 any_ndc
e-mail name@my.computer
station ims1.0
stop
```

The following message requests station information for S/H/I stations in the southern hemisphere:

```
begin ims1.0
msg_type request
msg_id ex028 any_ndc
e-mail name@my.computer
lat -90 to 0.0
station ims1.0
stop
```

### Sta_status

Station status is given for the S/H/I stations in the STA_LIST environment. The TIME environment defines the report period. The minimum report period is one day.

#### Environment

**time**,
aux_list, sta_list, time_stamp

#### Example

The following message requests the S/H/I station status reports for all stations over a one-week period:

```
begin ims1.0
msg_type request
msg_id ex029 any_ndc
e-mail name@my.computer
time 1998/11/14 to 1998/11/21
sta_status ims1.0
stop
```

### Waveform

Waveforms are digital timeseries data (S/H/I). The WAVEFORM request format will typically accept subformats that specify how the digital data are formatted within the general format of the waveform data type. The subformats include `int`, `cm6`, `cm8`, `aut`, `au6`, and `au8` for IMS1.0 data.

#### Environment

**`time`**,
`aux_list`, `beam_list`, `chan_list`, `sta_list`, `time_stamp`

**Example**

The following message requests data in six-bit compressed subformat from all channels of station ABC from 03:25 to 03:40 on March 1, 1998:

```
begin ims1.0
msg_type request
msg_id ex030 ANY_NDC
e-mail name@my.computer
time 1998/03/01 03:25 to 1998/03/01 03:40
sta_list abc
chan_list *
waveform ims1.0:CM6
stop
```

# Subscription Messages

This chapter describes the formats for subscription messages and includes the following topics:

# Subscription Messages

## INTRODUCTION

Subscription messages can be used as follows:

- to initiate a subscription,
- to change a subscription,
- to request an inventory of personal subscriptions,
- to request that issue(s) of a subscription be resent, or
- to terminate a subscription.

The messages containing the subscription data are sent as data messages.

Subscriptions allow authorized users to have IDC data and data products automatically forwarded to them on a regular basis. The S/H/I products available through subscriptions include the continuous data from primary S/H/I stations in near-real time, bulletins, waveform segments, and arrival information. The radionuclide products available through subscriptions include all those available by request: ARR, ARMR, BLANKPHD, CALIBPHD, DETBKPHD, FPEB, QCPHD, SPHDF, and SPHDP.

Subscriptions may be set up for continuous delivery (in the case of continuous data), immediately upon receipt or generation at the IDC (for example, discrete waveform or radionuclide data and data products), on a daily basis (for example, daily S/H/I bulletins and status reports or radionuclide data and data products), or at a user-specified frequency/time.

## SUBSCRIPTION PROCEDURES

A subscription is made by sending a subscription message to the IDC *AutoDRM*. Upon receipt, the source of a subscription message is first validated for its authenticity. Next the volume of data that will be generated by the request is checked. Subscription messages that are not sent by an authorized user are rejected. After validation, the new subscription is added to the existing subscriptions for that user, and notification of the new subscription is sent to the subscriber in the form of a LOG data message. (See "Log" on page 181 for a description of the LOG message and "Log" on page A24 for an example.) Each subscription is assigned a unique identification number at the IDC.

### Examples

A subscription message is sent to the IDC requesting the daily REB:

```
begin ims1.0
msg_type subscription
msg_id ex031 any_ndc
e-mail name@my.computer
freq daily
bull_type reb
bulletin ims1.0
stop
```

The subscriber receives the following LOG data message as confirmation of the subscription. The subscription ID and product ID numbers are included in the message.

```
begin ims1.0
msg_type data
msg_id ex032 ctbo_idc
ref_id 0088 any_ndc
data_type log ims1.0
 subscription id: 52
 product id: 74
   added at 1997/01/12 19:36:00
   freq daily
   bull_type reb
   bulletin ims1.0:short
   e-mail name@my.computer
stop
```

After the subscription begins, data messages sent to the subscriber include the PROD_ID line that includes the product identification (ID) and a delivery ID number along with the subscription data.

## SUBSCRIPTION FORMAT

A subscription message is formatted much the same way as a request message, but because subscription messages provide data on a scheduled basis rather than as a response to an individual request, they are given a separate message type and have additional capabilities that are not found in request messages.

Like most messages, a subscription request must contain the basic message lines: BEGIN, MSG_TYPE, MSG_ID, and STOP.

### Example

The following example shows the general format of a subscription message:

```
begin ims1.0
msg_type subscription
msg_id ex033 any_ndc
...
stop
```

A subscription message contains information about where to send the subscribed data, how often the subscribed data should be sent, and what data (or data products) to send. Like request messages, subscriptions are defined through environment variables that constrain the data to be sent and request lines that specify which data to send. Separate subscriptions are delimited by separate subscription request lines. In other words, each time a subscription request line is encountered, a corresponding subscription will be initiated for the user.

## SUBSCRIPTION CONTROL LINES

Subscription control lines specify:

- the protocol of the response data message,
- the time duration and frequency of the subscription, and
- whether or not a message should be sent if there are no data to send.

Like request messages, the existing options for the response message protocol are email and FTP. These options should be used in accordance with the guidelines described in "Protocols" on page 3 and "Message Size" on page 4. The formats for E-MAIL and FTP control lines are identical to that in Request messages and can be found in "Request Control Lines" on page 31.

As in request messages, only one response message protocol can be specified in a subscription message. If different protocols are desired for the response data, separate subscription messages must be submitted to the *AutoDRM*. A subscription message that does not specify a response message protocol will be answered by email using the return address of the sender.

Control lines that are unique to subscription messages are described below.

## Send_empty

The SEND_EMPTY control line is a switch that controls whether or not a message is sent if no data match the subscription. This option allows a user to be notified of the absence of data or products.

To prevent the sending of numerous empty messages, this control line is not allowed when the FREQ environment is set to `immediate` (see "Freq" on page 91).

### Syntax

```
send_empty
```

### Default

none (empty messages are not sent)

## Time

In a subscription message, the TIME control line refers to the active time of a subscription. The active time is given as a range. The format of TIME is similar to that in the request environment line (see "Time" on page 54.). In a subscription control line, however, the start time may have the value `now` (the current date and time), and the end time may have the value `forever` (the subscription will run indefinitely). These time limits are not valid for use in request messages.

#### Default

```
time now to forever
```

In the event that a subscription includes a start time before `now`, *AutoDRM* will generate a request message for the data from `time` *start time* `to now`, and the actual subscription will run from `now` to the specified end date.

## SUBSCRIPTION ENVIRONMENT LINES

Subscription environment lines are used to define and limit the response to subscription request lines (see "Subscription Request Lines" on page 96). Many of the request environment variables in "Request Environment Lines" on page 33 are also used as subscription environment variables. These request lines include BULL_TYPE, CHAN_LIST, DEPTH, DEPTH_MINUS_ERROR, EVENT_STA_DIST, LAT, LON, MAG, MAG_TYPE, MB_MINUS_MS, RELATIVE_TO, and STA_LIST.

Some request environment variables are not used in subscription messages. These include the following: ARRIVAL_LIST, BEAM_LIST, EVENT_LIST, ORIGIN_LIST, and TIME. Formats for the environment variables unique to subscriptions are provided in the following sections. These environment variables include FREQ, SUBSCR_LIST, SUBSCR_NAME, PRODID_LIST, and DELIVID_LIST. The environment variables described previously in the chapter on Request Messages are not repeated here. Formats for these environment variables may be found in "Request Environment Lines" on page 33.

### Freq

The FREQ environment specifies how often the data or products should be sent to the subscriber. The FREQ line may appear only once in a subscription message.

Four frequencies are allowed: `continuous`, `immediate`, `daily`, or `custom`. When requesting continuous waveform data, FREQ is set to `continuous`. If it is desired for data or products to be delivered as soon as they become available, FREQ is set to `immediate`. When FREQ is set to `daily`, data and products are delivered once every day. If none of the previous FREQ options satisfies a user's needs, a FREQ of `custom` may be used. This allows a subscriber to specify the frequency/time at which a subscription is to be delivered.

**Syntax**

`freq [ continuous | immediate | daily | custom` *per*/*dow*:*dom*:*hr* ]

| | |
|---|---|
| *per* | number of hours between messages |
| *dow* | day of the week (Sunday is 0) |
| *dom* | day of the month |
| *hr* | hour of the day |

(–1 in any field indicates that the field should be ignored)

**Default**

```
freq daily
```

**Example**

The following environment line limits the delivery of data messages to the third day of every month at 00:00:00.000 UTC (*per* and *dow* have no meaning and are set to –1):

```
freq custom -1/-1:3:0
```

## Prodid_list

The PRODID_LIST environment is a list of product ID numbers. A product ID number is a unique identifier for a certain IDC product and may be shared by multiple subscribers. All of the products identified in the PRODID_LIST will be processed for a subscription when the subscription request line is reached.

#### Syntax

`prodid_list` [ *prod_id* [ , *prod_id* [ , … ] ] ]

*prod_id* identification number of the product

#### Default

The default values for this subscription environment variable depends on the subscription request line. The subscription request lines are as follows:

- none for `unsubscribe` (see "Unsubscribe" on page 115)
- all for `subscr_prod` (see "Subscr_prod" on page 113)
- all for `subscr_log` (see "Subscr_log" on page 111)

### Subscr_list

The SUBSCR_LIST environment lists subscription ID numbers. A subscription ID is a unique identifier for a particular subscription. All of the subscriptions specified in the SUBSCR_LIST will be processed for a subscription when the subscription request line is reached.

#### Syntax

`subscr_list` [ *subscr_id* [ , *subscr_id* [ , … ] ] ]

*subscr_id* identification number of the subscription

#### Default

The default values for this subscription environment variable depends on the subscription request line. The subscription request lines are as follows:

- none for `unsubscribe` (see "Unsubscribe" on page 115)
- all for `subscr_prod` (see "Subscr_prod" on page 113)
- all for `subscr_log` (see "Subscr_log" on page 111)

## Subscr_name

The SUBSCR_NAME environment lists the names of certain IDC data products. All IDC data products specified in the SUBSCR_NAME line will be processed for a subscription when the subscription request line is reached. These names may be used instead of subscription identifiers or product identifiers.

### Syntax

`subscr_name` [ *name* [ , *name* [ , … ] ] ]

*name* name of the subscription

### Default

none

## Delivid_list

The DELIVID_LIST environment is a list of delivery identifiers. The delivery identifier is a number that appears as the third argument in the PROD_ID line for each message sent to a user for a given subscription. The second argument in the PROD_ID line is the product identifier, which denotes a specific product. These numbers are consecutive. This feature allows a user to identify a missing issue to a subscription. This environment is used only with the command SUBSCR_RESEND.

### Syntax

`delivid_list` [ *deliv_id* [ , *deliv_id* [ , … ] ] ]

*deliv_id* delivery identification number

### Default

none

**Example**

The following subscription example demonstrates how delivery identification numbers are provided through the PROD_ID line.

Three consecutive messages received by a subscriber over three days contain sequential delivery identification numbers: 30, 31, and 32.

```
begin ims1.0
msg_type data
msg_id ex034 ctbo_idc
prod_id 74 30
data_type bulletin ims1.0:short
...
(bulletin information)
...
stop

begin ims1.0
msg_type data
msg_id ex035 ctbo_idc
prod_id 74 31
data_type bulletin ims1.0:short
...
(bulletin information)
...
stop

begin ims1.0
msg_type data
msg_id ex036 ctbo_idc
prod_id 74 32
data_type bulletin ims1.0:short
...
(bulletin information)
...
stop
```

## SUBSCRIPTION REQUEST LINES

Subscription message request lines specify the information to send in the return data message. The general formats used for request lines are described in "Request Lines" on page 56.

Some subscription request lines are the same as those used in request messages. Others (NETWORK, STATION, CHANNEL, BEAM, RESPONSE, OUTAGE, and COMMENT) are not used at all in subscriptions. The following request lines are unique to subscriptions: SUBSCRIBE, UNSUBSCRIBE, SUBSCR_PROD, CHANGE, SUBSCR_RESEND, and SUBSCR_LOG. Tables 7 and 8 give the applicable environments for the subscription request lines.

### TABLE 7: S/H/I SUBSCRIPTION REQUEST ENVIRONMENTS

| | Request Lines | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Environments[1]** | **arrival** | **bulletin** | **change** | **chan_status** | **comm_status** | **event** | **origin** | **sta_status** | **subscribe** | **subscr_log** | **subscr_prod** | **subscr_resend** | **unsubscribe** | **waveform** |
| **chan_list** | | | | o | | | | | | | | | | o |
| **delivid_list** | | | | | | | | | | | | r | | |
| **depth** | | o | | | | o | o | | | | | | | |
| **bull_type** | r | r | | | | r | r | | | | | | | |
| **depth_minus_error** | | o | | | | o | o | | | | | | | |
| **event_sta_dist** | | o | | | | o | o | | | | | | | |
| **freq** | o | o | | o | o | o | o | o | | | | | | o |
| **lat** | | o | | | | o | o | | | | | | | |
| **lon** | | o | | | | o | o | | | | | | | |
| **mag** | | o | | | | o | o | | | | | | | |
| **mag_type** | | o | | | | o | o | | | | | | | |
| **mb_minus_ms** | | o | | | | o | o | | | | | | | |

### TABLE 7: S/H/I SUBSCRIPTION REQUEST ENVIRONMENTS (CONTINUED)

| Environments[1] | Request Lines | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | arrival | bulletin | change | chan_status | comm_status | event | origin | sta_status | subscribe | subscr_log | subscr_prod | subscr_resend | unsubscribe | waveform |
| prodid_list | | | * | | | | | | | o | o | * | * | |
| relative_to | | | | | | | | | | | | | | o |
| sta_list | r | o | | o | o | o | o | o | | | | | | o |
| subscr_list | | | * | | | | | | | o | o | * | * | |
| subscr_name | | | * | | | | | | r | o | o | * | * | |

1. r = required, * = one required, o = optional

### TABLE 8: RMS SUBSCRIPTION REQUEST ENVIRONMENTS

| Environments[1] | Request Lines | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | armr | arr | blankphd | calibphd | change | detbkphd | fpeb | qcphd | sphdf | sphdp | subscribe | subscr_log | subscr_prod | subscr_resend | unsubscribe |
| delivid_list | | | | | | | | | | | | | | r | |
| freq | o | o | o | o | | o | o | o | o | o | | | | | |
| prodid_list | | | | | * | | | | | | | o | o | * | * |
| sta_list | o | o | o | o | | o | o | o | o | o | | | | | |
| subscr_list | | | | | * | | | | | | | o | o | * | * |
| subscr_name | | | | | * | | | | | | r | o | o | * | * |

1. r = required, * = one required, o = optional

**Subscription ▼ Messages**

The following sections describe the possible request lines and the applicable environment variables. The environment variables that must be explicitly specified to obtain a result are in **bold** type.

## ARMR

This data type is one of several radionuclide data products available from the IDC. The ARMR, or Atmospheric Radionuclide Measurement Report, is a revised version of the ARR, or Automated Radionuclide Report, and is generated after manual review of a radionuclide sample is complete. See "ARMR" on page 213 for a complete description and "ARMR" on page A3 for an example.

### Environment

`freq`, `sta_list`

### Example

The following subscription message requests daily ARMRs from stations in New Zealand. The frequency is not specifically identified because the default transmittal rate is daily.

```
begin ims1.0
msg_type subscription
msg_id ex037
e-mail name@my.computer
sta_list NZ*
ARMR
stop
```

## ARR

This data type is one of several radionuclide data products available from the IDC. The ARR, or Automated Radionuclide Report, includes results from the automated analysis of a radionuclide sample. See "ARR" on page 204 for a complete description and "ARR" on page A8 for an example.

### Environment

`freq`, `sta_list`

### Example

The following message requests ARRs with no restraints:

```
begin ims1.0
msg_type subscription
msg_id ex038
e-mail name@my.computer
freq immediate
ARR
stop
```

## Arrival

An ARRIVAL line requests arrival information from specific S/H/I stations relative to events in a S/H/I bulletin. The amount of information that is returned depends on the amount of processing that has been applied to the data. The different stages of processing are expressed using subtypes to the arrival request lines as follows: `arrival:automatic`, `arrival:reviewed`, `arrival:associated`, `arrival:grouped`, and `arrival:unassociated` (see "Arrival/SLSD" on page 62 for definitions).

### Environment

**bull_type**, **sta_list**
freq

### Example

The following subscription message requests automatic arrivals from S/H/I stations ABC and DEF from the SEL1 bulletin each day:

```
begin ims1.0
msg_type subscription
msg_id ex039 any_ndc
e-mail name@my.computer
freq daily
sta_list ABC,DEF
bull_type sel1
arrival:automatic ims1.0
stop
```

## Bulletin

S/H/I bulletins are composed of arrival, origin, and event lines. All arrival information associated with the S/H/I event is given in the bulletin. A BULLETIN request line indicates a request for bulletin information for S/H/I events satisfying the environmental conditions.

### Environment

**bull_type**,
depth, depth_minus_error, event_sta_dist, freq, lat, lon, mag, mag_type, mb_minus_ms, sta_list

#### Example

The following subscription message requests the daily REB with no constraints:

```
begin ims1.0
msg_type subscription
msg_id ex040 any_ndc
e-mail name@my.computer
freq daily
bull_type reb
bulletin ims1.0
stop
```

The following subscription message requests the immediate SEL1 and SEL2. Soon after an event has been located (about two hours after real time for the SEL1 and about six hours after real time for the SEL2), the subscription software forwards the results to the user. In the example, messages would be sent to the user as often as once every 20 minutes, because the request has no constraints. This arrangement would be appropriate for an NDC system that processes the data automatically.

```
begin ims1.0
msg_type subscription
msg_id ex041 any_ndc
e-mail name@my.computer
freq immediate
bull_type sel1
bulletin ims1.0
bull_type sel2
bulletin ims1.0
stop
```

The following subscription message requests the daily REB for events with depths less than 30 km, between magnitudes 3.5 and 4.5, and within the two areas defined by the latitude and longitude ranges:

```
begin ims1.0
msg_type subscription
msg_id ex042 any_ndc
e-mail name@my.computer
freq daily
bull_type reb
mag 3.5 to 4.5
depth to 30
lat -30 to -20
lon -180 to -140
bulletin ims1.0
lat 75 to 79
lon 110 to 140
bulletin ims1.0
stop
```

## Calibphd

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of a standard calibration source as well as other information. See "Pulse Height Data" on page 186 for a description of the PHD types and "Calibphd" on page A18 for an example.

### Environment

`freq`, `sta_list`

### Example

The following message requests CALIBPHDs from all RMS stations to be sent monthly:

```
begin ims1.0
msg_type subscription
msg_id ex043
e-mail name@my.computer
freq monthly
calibphd
stop
```

## Change

After a subscription is established, it can be modified through the CHANGE request line. The subscription being changed is specified in the SUBSCR_LIST, PRODID_LIST, or SUBSCR_NAME environment. This line is followed by the CHANGE request line, then a listing of the changed environments and new values, and finally the applicable product. After the change, the subscription identifier will remain the same, but the product identifier and the delivery identifier will change.

### Environment

**prodid_list | subscr_list | subscr_name**

### Example

The following subscription message requests a change to the LAT and LON environments for the BULLETIN subscription number 52:

```
begin ims1.0
msg_type subscription
msg_id ex044 any_ndc
e-mail name@my.computer
subscr_list 52
change
lat 12 to 22
lon 18 to 28
```

```
bulletin ims1.0
stop
```

### Chan_status

CHAN_STATUS requests channel status information for the channels in the CHAN_LIST environment for the S/H/I stations in the STA_LIST environment.

#### Environment

`chan_list`, `freq`, `sta_list`

#### Example

The following subscription message requests the daily channel status reports for the short-period channels at station `ARA0`:

```
begin ims1.0
msg_type subscription
msg_id ex045 any_ndc
e-mail name@my.computer
freq daily
sta_list ARA0
chan_list s*
chan_status ims1.0
stop
```

### Comm_status

COMM_STATUS requests communications status information for the S/H/I communications links. A verbose communications status report listing individual circuit dropouts is obtained by using the `verbose` subformat.

#### Environment

`freq`, `sta_list`

### Example

The following subscription message requests the verbose communications status reports for all links:

```
begin ims1.0
msg_type subscription
msg_id ex046 any_ndc
e-mail name@my.computer
freq daily
comm_status ims1.0:verbose
stop
```

## Detbkphd

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of an empty detector chamber as well as other important information. See "Pulse Height Data" on page 186 for a description of the various PHD types and "Detbkphd" on page A21 for an example.

### Environment

freq, sta_list

### Example

The following message requests DETBKPHDs from all Russian stations to be sent on a monthly basis:

```
begin ims1.0
msg_type subscription
msg_id ex047
e-mail name@my.computer
freq monthly
sta_list RU*
detbkphd
stop
```

## Event

EVENT requests S/H/I event information for preferred origins satisfying the environmental constraints.

### Environment

**bull_type**,
depth, depth_minus_error, event_sta_dist, freq, lat, lon, mag, mag_type, mb_minus_ms, sta_list

### Example

The following subscription message requests all of the REB events within regional distance (20 degrees) of stations ABC and DEF:

```
begin ims1.0
msg_type subscription
msg_id ex048 any_ndc
e-mail name@my.computer
freq daily
bull_type reb
sta_list ABC,DEF
event_sta_dist 0.0 to 20.0
event ims1.0
stop
```

## FPEB

This data type is one of several radionuclide data products available from the IDC. The FPEB, or Fission Product Event Bulletin, is generated by the IDC when fission or activation products are detected at a radionuclide station above normal limits. An FPEB contains ARMRs from the stations that detect the fission product(s), information identifying the fission product(s), an estimate of the source location and time, as well as any sample analysis results from certified laboratories. See "Fission Product Event Bulletin" on page 214 for a description of the FPEB and "FPEB" on page A23 for an example.

#### Environment

`freq`, `sta_list`

#### Example

The following message requests all FPEBs to be sent immediately:

```
begin ims1.0
msg_type subscription
msg_id ex049
e-mail name@my.computer
freq immediate
fpeb
stop
```

### Origin

Origins are solutions to the location and time of a S/H/I source. Several origins may be determined for any one source. The ORIGIN line requests information for those origins that satisfy the environment constraints.

#### Environment

**`bull_type`**,
`depth`, `depth_minus_error`, `event_sta_dist`, `freq`, `lat`, `lon`, `mag`, `mag_type`, `mb_minus_ms`, `sta_list`

#### Example

The following subscription message requests origin information for the daily REB delivered when the REB is ready for distribution:

```
begin ims1.0
msg_type subscription
msg_id ex049 any_ndc
e-mail name@my.computer
freq daily
bull_type reb
origin ims1.0
stop
```

The following subscription message requests origin information for events in the daily REB limited to a specific geographic region:

```
begin ims1.0
msg_type subscription
msg_id ex050 any_ndc
e-mail name@my.computer
freq daily
lat -60 to 10.0
lon -81 to -34
bull_type reb
origin ims1.0
stop
```

### Qcphd

This data type is one of several PHD types available for radionuclide samples. It contains the PHD of a 15 minute sample acquisition as well as other important information. See "Pulse Height Data" on page 186 for a description of the PHD types and "Qcphd" on page A27 for an example.

#### Environment

`freq`, `sta_list`

#### Example

The following message requests QCPHDs from TZP64 to be sent monthly:

```
begin ims1.0
msg_type subscription
msg_id ex051
e-mail name@my.computer
freq monthly
sta_list TZP64
qcphd
stop
```

### Sphdf/p

The Sample Pulse Height Data–Full (SPHDF) and Sample Pulse Height Data–Preliminary (SPHDP) data types are two of several PHD types available for radionuclide samples. The SPHDP contains PHD from a sample acquired for a time shorter than that of the full acquisition time. The SPHDF contains PHD from a sample acquired for the IDC-defined full acquisition time. Like the other PHD types, the SPHDF and SPHDP also include other important information. See "Pulse Height Data" on page 186 for a description of the PHD types and "Samplephd" on page A30 for an example.

#### Environment

`freq`, `sta_list`

**Example**

The following message requests weekly SPHDFs from radionuclide stations located in New Zealand:

```
begin ims1.0
msg_type subscription
msg_id ex052
e-mail name@my.computer
freq weekly
sta_list NZ*
sphdf
stop
```

## Sta_status

STA_STATUS requests the station status for the S/H/I stations in the STA_LIST environment.

**Environment**

freq, sta_list

**Example**

The following subscription message requests the daily station status reports for all S/H/I stations:

```
begin ims1.0
msg_type subscription
msg_id ex053 any_ndc
e-mail name@my.computer
freq daily
sta_list *
sta_status ims1.0
stop
```

## Subscribe

SUBSCRIBE is a request to initiate a new subscription for each standard product given by the SUBSCR_NAME environment.

### Environment

```
subscr_name
```

### Example

The following subscription message requests a subscription to the standard product FPEB:

```
begin ims1.0
msg_type subscription
msg_id ex054 any_ndc
e-mail name@my.computer
subscr_name fpeb
subscribe
stop
```

## Subscr_log

SUBSCR_LOG requests a log of all of the user's changes to the subscriptions. The subscriber's email address determines the subscriptions to which a user is subscribed. Based on the email address, a log of all changes is sent out. The SUBSCR_LOG can be further constrained by use of the environments SUBSCR_LIST, PRODID_LIST, or SUBSCR_NAME.

### Environment

```
subscr_list | prodid_list | subscr_name
```

**Example**

The following subscription message requests a log of subscription 74:

```
begin ims1.0
msg_type subscription
msg_id ex055 any_ndc
subscr_list 74
e-mail name@my.computer
subscr_log
stop
```

The response to the preceding message is as follows:

```
begin ims1.0
msg_type data
msg_id 132430 ctbo_idc
ref_id ex056 any_ndc
data_type log ims1.0
  subscription id: 74
  product id: 52
      was added at 1997/01/09 19:36:00
      freq immediate
      bull_type reb
      bulletin ims1.0
  subscription id: 74
  product id: 94
      was changed at 1997/01/21 15:24:13
      the new product constraints are:
      freq immediate
      lat 12.00 to 22.00
      lon 18.00 to 28.00
      bull_type reb
      bulletin ims1.0
stop
```

### Subscr_prod

SUBSCR_PROD requests a list of the products currently subscribed to by the user. The response to this request includes the subscription identifier, product identifier, subscription name (where applicable), and a listing of the environment and request lines that define the specific product. The response is sent as a LOG data message. If SUBSCR_LIST, PRODID_LIST, or SUBSCR_NAME environments are not specified, then all products currently subscribed to by the user are provided.

#### Environment

```
subscr_list | prodid_list | subscr_name
```

#### Example

The following subscription message requests the current list of subscriptions that are in effect for the user:

```
begin ims1.0
msg_type subscription
msg_id ex057 any_ndc
e-mail name@my.computer
subscr_prod
stop
```

The response to this message is a LOG data message from the IDC:

```
begin ims1.0
msg_type data
msg_id 937418 ctbo_idc
ref_id ex058 any_ndc
data_type log ims1.0
 the following data products are subscribed
 to by name@my.computer:
 subscription id: 52
 product id: 74
   freq daily
   bull_type reb
   bulletin ims1.0
 subscription id: 57
 product id: 78
   freq immediate
   lat 0.0 to 10.0
   lon 120.0 to 140.0
   bull_type sel2
   bulletin ims1.0
stop
```

## Subscr_resend

The SUBSCR_RESEND request causes a subscribed product to be re-delivered. This command gives the subscriber the ability to re-request delivery of a product.

### Environment

**delivid_list**, **prodid_list** | **subscr_list** | **subscr_name**

#### Example

The following subscription message requests that delivery 32 of subscription 52 be resent to the user:

```
begin ims1.0
msg_type subscription
msg_id ex059 any_ndc
e-mail name@my.computer
subscr_list 52
delivid_list 32
subscr_resend
stop
```

### Unsubscribe

The UNSUBSCRIBE request informs the IDC that the user wishes to remove the subscriptions referenced by the SUBSCR_LIST, PRODID_LIST, or SUBSCR_NAME environments. A LOG data message is sent confirming that the subscription has been cancelled.

#### Environment

**subscr_list | prodid_list | subscr_name**

#### Example

The following subscription message requests that subscriptions 52 and 57 be discontinued:

```
begin ims1.0
msg_type subscription
msg_id ex060 any_ndc
e-mail name@my.computer
subscr_list 52, 57
```

```
unsubscribe
stop
```

A confirming LOG data message from the IDC to the subscription user will be sent verifying that the subscription has been terminated:

```
begin ims1.0
msg_type data
msg_id 784321 ctbo_idc
ref_id ex061 any_ndc
data_type log ims1.0
 the following data products have been removed
 by name@my.computer:
 subscription id: 52
 product id: 94
   freq daily
   bull_type reb
   bulletin ims1.0
 subscription id: 57
 product id: 101
   freq immediate
   bull_type sel2
   bulletin ims1.0
stop
```

## Waveform

Waveforms are the digital timeseries data. WAVEFORM requests will typically accept subformats that specify the format of digital data within the general format of the waveform data type. The available formats for waveform data from the IDC subscription service are continuous data format for continuous data and IMS1.0 format for all other waveform data. The available subformats are `int`, `cm6`, `cm8`, `aut`, `au6`, and `au8`.

**Environment**

`chan_list`, `freq`, `sta_list`, `relative_to`

**Examples**

The following subscription message requests continuous data from the short-period, high-gain, vertical channels of the ABAR array and from the central site (CDA0) of the CDAR array:

```
begin ims1.0
msg_type subscription
msg_id ex062 any_ndc
e-mail name@my.computer
freq continuous
sta_list ABAR,CDA0
chan_list shz
waveform ims1.0
stop
```

The following subscription message requests any waveform segments from auxiliary station ABC as soon as they are received by the IDC:

```
begin ims1.0
msg_type subscription
msg_id ex063 any_ndc
e-mail name@my.computer
freq immediate
sta_list ABC
waveform ims1.0
stop
```

# S/H/I Data Messages

This chapter describes the request message formats and includes the following topics:

# S/H/I Data Messages

## INTRODUCTION

*AutoDRM* data formats provide a common format for data and data product exchange. The data formats all contain ASCII options that allow the exchange of information via email (even for waveforms). Waveforms in binary format may also be sent using the *AutoDRM* message format, but the transmission of data messages with binary information must be via FTP.

Each data message contains the required information for all *AutoDRM* messages. All data messages must contain the BEGIN line and be followed by a MSG_TYPE line and a MSG_ID line using the proper formats for the arguments. The MSG_TYPE for data messages is `data`. Because a data message may be a response to a request, a REF_ID line may also appear. If the data message is a response to a subscription, then a PROD_ID line will be included. Sections of data-specific information follow the identification line(s).

Many types of data can be exchanged by using the message formats described in this chapter. These types of data include timeseries, bulletins, station information, and others. The main data format supported by the IDC *AutoDRM* is IMS1.0. Sub-formats may also be available within a specific data type. The type of data that is included in a data section and the format of the data are designated with a DATA_TYPE line.

### Data_type

Data sections must begin with a DATA_TYPE line. The arguments to DATA_TYPE are the type of data that follows (for example, WAVEFORM or BULLETIN) and the format (IMS1.0). The *subtype* and *sub_format* allow more precise selection of the data type and format, respectively.

#### Syntax

data_type *data_type*[:*subtype*] *format*[:*sub_format*]

| | |
|---|---|
| *data_type* | type of data that follows; typical examples are WAVEFORM, BULLETIN, and RESPONSE |
| *subtype* | subtype to use with this data type. *subtype* is used primarily for ARRIVAL data types. |
| *format* | general format of the data (IMS1.0) |
| *sub_format* | internal format to use with this data type. *sub_format* is used primarily for BULLETIN and WAVEFORM data types. |

#### Example

```
data_type waveform IMS1.0:cm6
```

The end of a data section is implied by another DATA_TYPE line, or a STOP line.

The following sections give the formats for data messages. Examples of these data formats are provided in "Appendix A: Data Message Examples" on page A1.

## STATION INFORMATION

Data types for S/H/I stations describe the stations through their locations, instrumentation, channels, and so on.

### Channel

The CHANNEL data type contains information describing the sensors and their emplacement. Table 9 gives the format for the CHANNEL data message and an example is provided in "Channel" on page A19.

### TABLE 9: CHANNEL FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 16-19 | a4 | `Chan` |
| | 21-23 | a3 | `Aux` |
| | 27-34 | a8 | `Latitude` |
| | 36-45 | a9 | `Longitude` |
| | 47-55 | a9 | `Coord Sys` |
| | 63-66 | a4 | `Elev` |
| | 70-74 | a5 | `Depth` |
| | 78-81 | a4 | `Hang` |
| | 84-87 | a4 | `Vang` |
| | 89-99 | a11 | `Sample Rate` |
| | 101-104 | a4 | `Inst` |
| | 111-117 | a7 | `On Date` |
| | 122-128 | a7 | `Off Date` |
| 2-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-19 | a3 | FDSN channel code |
| | 21-24 | a4 | auxiliary code |
| | 26-34 | f9.5 | latitude (degrees, South is negative) |
| | 36-45 | f10.5 | longitude (degrees, West is negative) |
| | 47-58 | a12 | coordinate system (for example, WGS-84) |
| | 60-64 | f5.3 | elevation (km) |
| | 66-70 | f5.3 | emplacement depth (km) |

TABLE 9: CHANNEL FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* | 72-77 | f6.1 | horizontal angle of emplacement (positive degrees clockwise from North, –1.0 if vertical) |
| | 79-83 | f5.1 | vertical angle of emplacement (degrees from vertical, 90.0 if horizontal) |
| | 85-95 | f11.6 | sample rate (samples/sec) |
| | 97-103 | a6 | instrument type |
| | 105-114 | i4,a1,i2,a1,i2 | start date of channel operation (*yyyy/mm/dd*) |
| | 116-125 | i4,a1,i2,a1,i2 | end date of channel operation (*yyyy/mm/dd*) |

## Network

The NETWORK data type provides a descriptive name for each network code. Table 10 shows the format for the NETWORK data message. An example is provided in "Network" on page A25.

TABLE 10: NETWORK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 1-3 | a3 | `Net` |
| | 11-21 | a11 | `Description` |
| 2-*n* (data) | 1-9 | a9 | network code |
| | 11-74 | a64 | descriptive network name |

## Station

The STATION data type describes the site, location, and dates of operation. For arrays, the unique array code that defines a reference point (used for beam) is given along with the information from each element. Table 11 shows the format for the STATION data message. An example is provided in "Station" on page A31.

**TABLE 11: STATION FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 17-20 | a4 | `Type` |
| | 23-30 | a8 | `Latitude` |
| | 33-41 | a9 | `Longitude` |
| | 43-51 | a9 | `Coord Sys` |
| | 57-60 | a4 | `Elev` |
| | 64-70 | a7 | `On Date` |
| | 74-81 | a8 | `Off Date` |
| 2-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-20 | a4 | `1C` = single component<br>`3C` = three component<br>`hfa` = high-frequency array<br>`lpa` = long-period array |
| | 22-30 | f9.5 | latitude (degrees, South is negative) |
| | 32-41 | f10.5 | longitude (degrees, West is negative) |
| | 43-54 | a12 | coordinate system (for example, WGS-84) |
| | 56-60 | f5.3 | elevation (km) |
| | 62-71 | i4,a1,i2,a1,i2 | start of station operation (*yyyy/mm/dd*) |
| | 73-82 | i4,a1,i2,a1,i2 | end of station operation (*yyyy/mm/dd*) |

## WAVEFORM DATA

Data types for waveforms include the response of the instrumentation and the waveform data formats.

### Response

The RESPONSE data type allows the complete response to be given as a series of response groups that can be cascaded. Modern instruments are composed of several different components, each with its own response. This format mimics the actual configuration of the instrumentation.

A complete response description is made up of the `CAL2` block (Table 12) plus one or more of the `PAZ2`, `FAP2`, `GEN2`, `DIG2`, and `FIR2` response blocks in any order (Tables 13–17). The response blocks should be given sequential stage numbers (beginning with 1) in the order that they occur in the system response.

Each response block is comprised of a header line and sufficient occurrences of the values lines to provide all required coefficients. The `DIG2` block may occur only once per response. Comments may be inserted after the `CAL2` block and after any response section as desired, provided that they are enclosed with parenthesis beginning in column 2. Successive channel responses should also be separated by blank lines for readability.

The input of the earth to seismic stations is in nanometers of displacement (all of the responses are displacement responses). For hydroacoustic and infrasonic, the input is units=pressure=(micro-Pascal). Velocity or acceleration responses can be obtained by multiplying the response curve by $i\omega$ or $-\omega^2$, respectively. An example of the RESPONSE data message is provided in “Response” on page A28.

The `CAL2` block gives general information about the response information that follows (see Table 12).

### TABLE 12: CALIBRATION IDENTIFICATION BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | `CAL2` |
| | 6-10 | a5 | station code |
| | 12-14 | a3 | FDSN channel code |
| | 16-19 | a4 | auxiliary identification code |
| | 21-26 | a6 | instrument type |
| | 28-42 | e15.8 | system sensitivity (nm/count) at calibration reference period[1] |
| | 44-50 | f7.3 | calibration reference period (seconds) |
| | 52-62 | f11.5 | system output sample rate (Hz) |
| | 64-73 | i4,a1,i2,a1,i2 | effective start date (*yyyy/mm/dd*) |
| | 75-79 | i2,a1,i2 | effective start time (*hh:mm*) |
| | 81-90 | i4,a1,i2,a1,i2 | effective end date (*yyyy/mm/dd*)[2] |
| | 92-96 | i2,a1,i2 | effective end time (*hh:mm*) |

1. System sensitivity, calibration reference period, and sample rate should be the same as in the `wid2` block.
2. The start/end date/times specify the time period for which the response is valid. If the response is still valid, the end date/time should be left blank.

A poles and zeros block (`PAZ2`) can be used for either an analog filter or an infinite impulse response (IIR) filter. In the data section, poles are always given first followed by zeros (see Table 13).

### TABLE 13: POLES AND ZEROS BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | PAZ2 |
| | 6-7 | i2 | stage sequence number |
| | 9 | a1 | output units code<br>(V = volts, A = amps, C = counts) |
| | 11-25 | e15.8 | scale factor |
| | 27-30 | i4 | decimation (blank if analog) |
| | 32-39 | f8.3 | group correction applied (seconds) |
| | 41-43 | i3 | number of poles |
| | 45-47 | i3 | number of zeros |
| | 49-73 | a25 | description |
| 2-*n* | 2-16 | e15.8 | real part of pole or zero |
| | 18-32 | e15.8 | imaginary part of pole or zero |

Like PAZ2, the frequency, amplitude, phase (FAP2) block can be used to specify the response of analog or digital filters, or some combination of them including a complete system response (see Table 14).

**TABLE 14: FREQUENCY, AMPLITUDE, AND PHASE BLOCK FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | `FAP2` |
| | 6-7 | i2 | stage sequence number |
| | 9 | a1 | output units code<br>(`V` = volts, `A` = amps, `C` = counts) |
| | 11-14 | i4 | decimation (blank if analog) |
| | 16-23 | f8.3 | group correction applied (seconds) |
| | 25-27 | i3 | number of frequency, amplitude, phase triplets |
| | 29-53 | a25 | description |
| 2-*n* (data) | 2-11 | f10.5 | frequency (Hz) |
| | 13-27 | e15.8 | amplitude (input units/output units) |
| | 29-32 | i4 | phase delay (degrees) |

The generic response block (`GEN2`) can specify the response of analog or digital filters, or some combination of them, including a complete system response (see Table 15).

### TABLE 15: GENERIC RESPONSE BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | GEN2 |
| | 6-7 | i2 | stage sequence number |
| | 9 | a1 | output units code<br>(V = volts, A = amps, C = counts) |
| | 11-25 | e15.8 | section sensitivity (input units/output units) |
| | 27-32 | f7.3 | calibration reference period (seconds) |
| | 35-38 | i4 | decimation (blank if analog) |
| | 40-47 | f8.3 | group correction applied (seconds) |
| | 49-51 | i3 | number of corners |
| | 53-77 | a25 | description |
| 2-*n* (data) | 2-12 | f11.5 | corner frequency (Hz) |
| | 14-19 | f6.2 | slope above corner (dB/decade) |

The digitizer block (DIG2) specifies the digitizer sample rate and sensitivity. It also provides a description field to identify the model of digitizer being used (Table 16).

### TABLE 16: DIGITIZER RESPONSE BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | DIG2 |
| | 6-7 | i2 | stage sequence number |
| | 9-23 | e15.8 | sensitivity (counts/input unit) |
| | 25-35 | f11.5 | digitizer sample rate (Hz) |
| | 37-61 | a25 | description |

The finite impulse response block (`FIR2`) is used to describe the response of FIR digital filters (see Table 17).

#### TABLE 17: FINITE IMPULSE RESPONSE BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | `FIR2` |
| | 6-7 | i2 | stage sequence number |
| | 9-18 | e10.2 | filter gain (relative factor, *not* in dB) |
| | 20-23 | i4 | decimation (blank if analog) |
| | 25-32 | f8.3 | group correction applied (seconds) |
| | 34 | a1 | symmetry flag (`A` = asymmetric, `B` = symmetric [odd], `C` = symmetric [even]) |
| | 36-39 | i4 | number of factors |
| | 41-65 | a25 | description |
| | 2-16 | e15.8 | factor(i) |
| | 18-32 | e15.8 | factor(i+1) |
| 2-*n* (data) | 34-48 | e15.8 | factor(i+2) |
| | 50-64 | e15.8 | factor(i+3) |
| | 66-80 | e15.8 | factor(i+4) |

Comments on the response of an instrument are enclosed in parentheses (Table 18).

#### TABLE 18: RESPONSE COMMENT BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 2 | a1 | ( |
| | 3-n | a<n-1> | Comment |
| | n+1 | a1 | ) |

## Waveform

The format for WAVEFORM data messages consists of a waveform identification (`WID2`) block (Table 19), followed by the station (`STA2`) block (Table 20), the waveform data (`DAT2`) block (Table 21), and a checksum (`CHK2`) block (Table 22). Each `DAT2` block should be followed by a `CHK2` block so that the validity (or otherwise) of the data can be verified.

### TABLE 19: WAVEFORM IDENTIFICATION BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | `WID2` |
| | 6-15 | i4,a1,i2,a1,i2 | date of the first sample (*yyyy/mm/dd*) |
| | 17-28 | i2,a1,i2,a1,f6.3 | time of the first sample (*hh:mm:ss.sss*) |
| | 30-34 | a5 | station code |
| | 36-38 | a3 | FDSN channel code |
| | 40-43 | a4 | auxiliary identification code |
| | 45-47 | a3 | `INT`, `CM`*n*, or `AU`*x*<br>`INT` is free-format integers as ASCII characters.<br>`CM` denotes compressed data, and *n* is either `6` (6-bit compression), or `8` (8-bit binary compression)<br>`AU` signifies authentication, and *x* is `T` (uncompressed binary integers), `6` (6-bit compression), or `8` (8-bit binary compression) |
| | 49-56 | i8 | number of samples |
| | 58-68 | f11.6 | data sampling rate (Hz) |
| | 70-79 | e10.2 | system sensitivity (nm/count) at the calibration reference period, the ground motion in nanometers per digital count at calibration period (calper) |

**TABLE 19: WAVEFORM IDENTIFICATION BLOCK FORMAT (CONTINUED)**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 81-87 | f7.3 | calibration reference period; the period in seconds at which the system sensitivity is valid; calper should be near the flat part of the response curve (in most cases, 1 second) |
| | 89-94 | a6 | instrument type (from Table 23) |
| | 96-100 | f5.1 | horizontal orientation of sensor, measured in positive degrees clockwise from North (–1.0 if vertical) |
| | 102-105 | f4.1 | vertical orientation of sensor, measured in degrees from vertical (90.0 if horizontal) |

**TABLE 20: STATION BLOCK FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | `STA2` |
| | 6-14 | a9 | network identifier |
| | 16-24 | f9.5 | latitude (degrees, South is negative) |
| | 26-35 | f10.5 | longitude (degrees, West is negative) |
| | 37-48 | a12 | reference coordinate system (for example, WGS-84) |
| | 50-54 | f5.3 | elevation (km) |
| | 56-60 | f5.3 | emplacement depth (km) |

**TABLE 21: WAVEFORM DATA BLOCK FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | DAT2 |
| 2-*n* | 1-1024 *variable* | i, a, or f | data values |

**TABLE 22: CHECKSUM BLOCK FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | CHK2 |
| | 6-13 | i8 | checksum |

The WID2 block gives the following information:

- date and time of the first data sample
- station, channel, and auxiliary codes
- subformat of the data;
- number of samples and sample rate
- calibration of the instrument represented as the number of nanometers per digital count at the calibration period
- type of instrument (shown in Table 23)
- horizontal and vertical orientation of the instrument.

The auxiliary code will be blank in most cases; the code is only used when two data streams with the same station and channel codes conflict. Instrument response information must be obtained separately using a RESPONSE request.

### TABLE 23: IMS S/H/I INSTRUMENT TYPES

| Instrument Type | Description |
|---|---|
| Akashi | Akashi |
| 20171A | Geotech 20171A |
| 23900 | Geotech 23900 |
| 7505A | Geotech 7505A |
| 8700C | Geotech 8700C |
| BB-13V | Geotech BB-13V |
| CMG-3 | Guralp CMG-3 |
| CMG-3N | Guralp CMG-3NSN |
| CMG-3T | Guralp CMG-3T |
| CMG-3E | Guralp CMG3-ESP |
| FBA-23 | Kinemetrics FBA-23 |
| GS-13 | Geotech GS-13 |
| GS-21 | Geotech GS-21 |
| HM-500 | HM-500 |
| KS3600 | Geotech KS-36000 |
| KS360i | Geotech KS-36000-I |
| KS5400 | Geotech KS-54000 |
| LE-3D | LE-3D |
| Mk II | Willmore Mk II |
| MP-L4C | Mark Products L4C |
| Oki | Oki |
| Parus2 | Parus-2 |
| Podrst | Podrost |
| S-13 | Geotech S-13 |
| S-500 | Geotech S-500 |

**TABLE 23: IMS S/H/I INSTRUMENT TYPES (CONTINUED)**

| Instrument Type | Description |
|---|---|
| S-750 | Geotech S-750 |
| STS-1 | Streckeisen STS-1 |
| STS-2 | Streckeisen STS-2 |
| SDSE-1 | SDSE-1 |
| SOSUS | SOSUS |
| TSJ-1e | TSJ-1e |

Data following the `DAT2` block may be in any of six different subformats recognized in the IMS1.0 waveform format: `int`, `cm6`, `cm8`, `aut`, `au6`, and `au8`. `int` in a simple ASCII subformat; the `cm-` subformats are for compressed data, and the `au-` subformats are for authenticated data. All of the *AutoDRM* formats represent the numbers as integers.

A checksum must be computed for the waveform data in the IMS1.0 waveform format. The checksum is computed from integer data values prior to converting them to any of the subformats. Figure 1 shows the FORTRAN subroutine for computing `CHK2` checksum, and Figure 2 shows the C function for computing the `CHK2` checksum. To prevent overflow, the checksum is computed modulo 100,000,000 and stored as an eight-digit integer without a sign.

The line length limits for *AutoDRM* messages are enforced for the IMS1.0 data formats; no line may be longer than 1,024 bytes. The line continuation character (\) is not used in waveform data lines.

Examples of the `cm6` and `int` subformats of the WAVEFORM data message are provided in "Waveform (IMS1.0:cm6 format)" on page A32 and "Waveform (IMS1.0:int format)" on page A33.

Using the OUT2 and DLY2 blocks, the WAVEFORM data type can also be used to respond that no data are available for a request or that the response to the request will be delayed. Table 24 shows how the blocks are used (see also Table 25 and Table 26). In addition, the STA2 block contains station information. This block is mandatory and must immediately follow the WID2, OUT2, and DLY2 blocks.

```
 subroutine compute_checksum(signal_int,number_of_samples,checksum)
c*****************************************************************
c  This subroutine computes ims1.0 checksum used in the CHK2 line
c*****************************************************************
c  declarations
c
      implicit none
c
      integer*4 signal_int(*)        ! (input)  seismic signal
                                     !          (counts, integer values)
      integer*4 number_of_samples    ! (input)  number of used samples
      integer*4 checksum             ! (output) computed checksum
      integer*4 i_sample                ! index
      integer*4 sample_value            ! value of one sample after
                                        ! sample overflow check
      integer*4 modulo                  ! overflow protection value
      integer*4 MODULO_VALUE            ! overflow protection value
      parameter (MODULO_VALUE = 100 000 000)
c
c  initialize the checksum
      checksum = 0
c
c  use modulo variable besides MODULO_VALUE parameter to suppress
c  optimizing compilers to bypass local modulo division computation
      modulo = MODULO_VALUE
c
c  loop over all samples (counts, integer values)
c
      do i_sample = 1, number_of_samples
c
c  check on sample value overflow
c
          sample_value = signal_int(i_sample)
          if(abs(sample_value) .ge. modulo)then
              sample_value = sample_value-
     *        (sample_value/modulo)*modulo
          endif
c
c  add the sample value to the checksum
c
          checksum = checksum+sample_value
c
c  apply modulo division to the checksum
c
          if(abs(checksum) .ge. modulo)then
              checksum = checksum-
     *        (checksum/modulo)*modulo
          endif
c
c  end of loop over samples
      enddo
c
c  compute absolute value of the checksum
c
      checksum = abs(checksum)
c
      return
      end
```

**FIGURE 1. FORTRAN SUBROUTINE FOR COMPUTING CHK2 CHECKSUM**

```
#include <stdlib.h>
#include <math.h>

/*
    This function computes the ims1.0 checksum used in the CHK2 line
*/
void
compute_checksum(signal_int, number_of_samples, _checksum)
        int     *signal_int;
        int     number_of_samples;
        int     *_checksum;
{
        int     i_sample;
        int     sample_value;
        int     modulo;
        int     checksum;

        int     MODULO_VALUE = 100000000;

        checksum = 0;

        modulo = MODULO_VALUE;

        for (i_sample=0; i_sample < number_of_samples; i_sample++)
        {
                /* check on sample value overflow */

                sample_value = signal_int[i_sample];

                if (abs(sample_value) >= modulo)
                {
                        sample_value = sample_value -
                                (sample_value/modulo)*modulo;
                }

                /* add the sample value to the checksum */

                checksum += sample_value;

                /* apply modulo division to the checksum */

                if (abs(checksum) >= modulo)
                {
                        checksum = checksum -
                                (checksum/modulo)*modulo;
                }
        }

        /* compute absolute value of the checksum */

        *_checksum = abs(checksum);
}
```

**FIGURE 2. C FUNCTION FOR COMPUTING CHK2 CHECKSUM**

## TABLE 24: APPLICABLE BLOCKS FOR WAVEFORM MESSAGES

| Waveform Message | Block[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | WID2 | OUT2 | DLY2 | STA2 | EID2 | BEA2 | DAT2 | CHK2 |
| waveform data message | r | | | r | o | o | r | r |
| no data message | | r | | r | | | | |
| data delayed message | | | r | r | | | | |

1. r = required, o = optional

## TABLE 25: OUT2 BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | `OUT2` |
| | 6-15 | i4,a1,i2,a1,i2 | date of the first missing sample (*yyyy/mm/dd*) |
| | 17-28 | i2,a1,i2,a1,f6.3 | time of the first missing sample (*hh:mm:ss.sss)* |
| | 30-34 | a5 | station code |
| | 36-38 | a3 | FDSN channel code |
| | 40-43 | a4 | auxiliary identification code |
| | 45-55 | f11.3 | duration that data are unavailable (seconds) |

## TABLE 26: DLY2 BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | `DLY2` |
| | 6-15 | i4,a1,i2,a1,i2 | date of the first delayed sample (*yyyy/mm/dd*) |
| | 17-28 | i2,a1,i2,a1,f6.3 | time of the first delayed sample (*hh:mm:ss.sss*) |
| | 30-34 | a5 | station code |

**TABLE 26: DLY2 BLOCK FORMAT (CONTINUED)**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 36-38 | a3 | FDSN channel code |
| | 40-43 | a4 | auxiliary identification code |
| | 45-55 | f11.3 | estimated duration of queue (seconds) |

The optional `EID2` block specifies to which event(s) a waveform is associated (see Table 27). This block is used when waveforms are requested from a bulletin with the RELATIVE_TO environment. The `EID2` block may be repeated for each event to which a waveform is associated.

**TABLE 27: EID2 BLOCK FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | `EID2` |
| | 6-13 | a8 | event identification of associated event |
| | 15-23 | a9 | bulletin type |

The optional `BEA2` block specifies how a beamed waveform was formed (see Table 28). This block is only used when the waveform is the result of beaming.

**TABLE 28: BEA2 BLOCK FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-4 | a4 | `BEA2` |
| | 6-17 | a12 | beam identification for the waveform |
| | 19-23 | f5.1 | azimuth used to steer the beam (measured in positive degrees clockwise from North) |
| | 25-29 | f5.1 | slowness used to steer the beam (s/degree, –999.0 if vertical beam) |

### Subformat INT

The `INT` waveform subformat represents integer data as blank or newline delimited ASCII characters. The number of blank spaces between samples is unspecified, and an individual sample value may not be continued on the next line.

### Waveform Compression Schemes

Two different compression schemes are recognized in the IMS1.0 waveform format: `CM6` and `CM8`.

For waveform data, the difference between data samples is usually much smaller than the instantaneous magnitudes. The difference of the differences (the second difference) is even smaller. Transmitting the second difference requires fewer significant bits. Reductions in the message length can be achieved if the number of bits to convey the information is reduced when the signal level is small and expanded when the signal level rises. Because samples will take a variable number of bits, an index is required to specify the number of bits in each sample.

Both compression schemes use second differences as a first step in reducing the number of significant bits required to convey the information in the timeseries. A first difference is computed as the difference between successive samples. A second difference is the difference between the differences. The first value in both steps keeps its absolute value (see the following sections).

The following paragraphs describe the compression schemes to reduce the number of bits and/or to make transmission easy.

### Subformat CM6

The `CM6` compression scheme is a six-bit compression of second differences. The advantage of this method is in its conversion of binary integer data to ASCII characters that can be successfully transmitted using email. The compression algorithm converts waveforms into a set of printable ASCII characters carefully avoiding those that have been found to cause problems to either communications circuits or the computers connected to them. The algorithm uses only the 64 characters +, –, 0 - 9, A - Z and a - z.

Initially, all data samples in the packet are represented as 32-bit, 2's complement integers, with a range of $-(2^{31})$ to $+(2^{31}-1)$. Second difference samples are encoded as the difference between the first differences and can be computed for the jth sample using the following formula:

$$D_2(j) = S(j) - 2S(j-1) + S(j-2)$$

where zero and negative indices are ignored. Thus, the second difference data for N samples are as follows:

$$S(1), S(2) - 2S(1), S(3) - 2S(2) + S(1), \ldots, S(N) - 2S(N-1) + S(N-2)$$

To compress the numbers, the second differences are converted from 2's complement to sign and magnitude. These numbers are then fit into a variable number of bytes in which only the six most significant bits (MSB) are used. The most significant usable bit of each byte is used as a flag or control bit, which, if set, signifies that the following byte also contains information relating to the same sample. The second most significant bit is used as a sign bit in the first byte pertaining to a sample and as a data bit in all following bytes of the sample. All other bits are used to represent the value of the second difference of the sample. These numbers are then fit into a variable number of bytes in which only the six most significant bits are used (see Table 29).

**TABLE 29: BIT POSITIONS FOR CM6**

| Most Significant Bit | | | | | | | Least Significant Bit |
|---|---|---|---|---|---|---|---|
| control | sign/data | data | data | data | data | unused | unused |

These six-bit bytes are then used to refer to a lookup table (seeTable 30) from which one of 64 different ASCII characters (+, –, 0-9, A-Z, a-z) is extracted.

**TABLE 30: ASCII REPRESENTATION OF BIT PATTERNS FOR CM6**

| Bit Pattern | Char[1] | Bit Pattern | Char | Bit Pattern | Char | Bit Pattern | Char |
|---|---|---|---|---|---|---|---|
| 000000 | + | 010000 | E | 100000 | U | 110000 | k |
| 000001 | – | 010001 | F | 100001 | V | 110001 | l |
| 000010 | 0 | 010010 | G | 100010 | W | 110010 | m |
| 000011 | 1 | 010011 | H | 100011 | X | 110011 | n |
| 000100 | 2 | 010100 | I | 100100 | Y | 110100 | o |
| 000101 | 3 | 010101 | J | 100101 | Z | 110101 | p |
| 000110 | 4 | 010110 | K | 100110 | a | 110110 | q |
| 000111 | 5 | 010111 | L | 100111 | b | 110111 | r |
| 001000 | 6 | 011000 | M | 101000 | c | 111000 | s |
| 001001 | 7 | 011001 | N | 101001 | d | 111001 | t |
| 001010 | 8 | 011010 | O | 101010 | e | 111010 | u |
| 001011 | 9 | 011011 | P | 101011 | f | 111011 | v |
| 001100 | A | 011100 | Q | 101100 | g | 111100 | w |
| 001101 | B | 011101 | R | 101101 | h | 111101 | x |
| 001110 | C | 011110 | S | 101110 | i | 111110 | y |
| 001111 | D | 011111 | T | 101111 | j | 111111 | z |

1. char = character

### Subformat CM8

The `CM8` subformat is similar to the `CM6` subformat. The same algorithm is used, but the compression is more efficient than the 6-bit subformat because all bits are used. The 8-bit scheme is a binary format that cannot be transmitted using email; FTP must be used.

The second-difference integers are first converted from 2's complement to sign and magnitude. These numbers are then fit into a variable number of bytes in which all eight significant bits are used. The most significant usable bit of each byte is used as a flag or control bit, which, if set, is used to signify that the following byte also contains information relating to the same sample. The second most significant bit is used as a sign bit in the first byte pertaining to a sample and as data in all following bytes. All other bits are used to represent the value of the second difference (Table 31).

**TABLE 31: BIT POSITIONS FOR CM8**

| Most Significant Bit | | | | | | Least Significant Bit | |
|---|---|---|---|---|---|---|---|
| **control** | **sign/data** | **data** | **data** | **data** | **data** | **data** | **data** |

### Subformat AUT

Waveform data that have been signed for authentication must contain more than just waveform samples; they must also contain time and status information. The IMS1.0 authentication subformat includes this information in packets that are individually signed for authentication. The signed data in this subformat include the time-stamp, the number of samples, the status word, and the data. Waveform segments consist of several of these packets concatenated, as shown in Table 32. The data are binary integers.

**TABLE 32: AUTHENTICATION DATA FORMAT**

| Name | Format | Description |
|---|---|---|
| length of packet | 4-byte IEEE integer | length of packet in bytes, not counting this word, for channel data that follows (divisible by 4) |
| authentication | 40-byte string | authentication signature |
| timestamp | 8-byte IEEE float | seconds since 1 January 1970 00:00 for first sample. Must be within one sample of nominal time. |

**TABLE 32: AUTHENTICATION DATA FORMAT (CONTINUED)**

| Name | Format | Description |
|---|---|---|
| samples | 4-byte IEEE integer | number of samples in channel packet |
| status word | 4-byte string | Data status byte (most significant byte):<br>bit 31 1 = dead channel<br>bit 30 1 = zeroed data<br>bit 29 1 = clipped<br>bit 28 1 = calibration signal<br>bits 24-27 undefined<br>Station status byte:<br>bit 23 1 = vault door open<br>bit 22 1 = authentication box opened<br>bit 21 1 = equipment moved<br>bit 20 1 = clock differential too large<br>bits 16-19 undefined<br>Station specific bits:<br>bits 0-15 user defined (for example, station status counter) |
| data | (length of packet minus 56 bytes - based on original 4-byte IEEE integers) | raw four-byte integers or compressed data |

### Subformats AU6 and AU8

Data that have an authentication signature may be compressed for ease in transmission. The same authentication subformat described above is used for compressed authenticated data, with the difference that the data are compressed. The AU6 and AU8 authentication formats are compressed using the 6-bit and 8-bit compression schemes described above. The compression algorithm is applied only to the data, not to the 60 bytes of header information given in Table 32. Before verifying the authenticity of the data, the data must be uncompressed using the appropriate decompression scheme.

# PROCESSING PRODUCTS

Data types for processing products include the results of the various stages of S/H/I processing from arrivals through events.

## Arrival

The ARRIVAL data type is divided into five subtypes (`automatic`, `reviewed`, `grouped`, `associated`, and `unassociated`) to reflect the different processing stages.

### Automatic Arrivals

The `automatic` subtype provides the result of a detection process run on waveforms. The format for the `automatic` data subtype is given in Table 33, and an example is provided in "Arrival:automatic" on page A13.

TABLE 33: AUTOMATIC ARRIVAL FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 17-22 | a6 | `BeamID` |
| | 33-36 | a4 | `Date` |
| | 44-47 | a4 | `Time` |
| | 54-58 | a5 | `Phase` |
| | 64-67 | a4 | `Azim` |
| | 70-73 | a4 | `Slow` |
| | 77-79 | a3 | `SNR` |
| | 87-89 | a3 | `Amp` |
| | 93-95 | a3 | `Per` |
| | 99-101 | a3 | `STA` |

### Table 33: Automatic Arrival Format (continued)

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 105-107 | a3 | `Dur` |
| | 109-114 | a6 | `Author` |
| | 122-126 | a5 | `DetID` |
| 2-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-28 | a12 | beam identifier |
| | 30-39 | i4,a1,i2,a1,i2 | detection date (*yyyy/mm/dd*) |
| | 41-52 | i2,a1,i2,a1,f6.3 | detection time (*hh:mm:ss.sss*) |
| | 54-61 | a8 | preliminary phase code |
| | 63-67 | f5.1 | observed azimuth (degrees) |
| | 69-73 | f5.1 | observed slowness (seconds/degree) |
| | 75-79 | f5.1 | signal-to-noise ratio |
| | 81-89 | f9.1 | amplitude (nanometers) |
| | 91-95 | f5.2 | period (seconds) |
| | 97-101 | f5.1 | short-term average |
| | 103-107 | f5.1 | detection duration (seconds) |
| | 109-117 | a9 | author of the detection |
| | 119-126 | a8 | detection identifier |

#### Reviewed Arrivals

The `reviewed` subtype is used for arrivals that have been reviewed and assigned phase names. Phase names are not expected to have been verified by location. Table 34 gives the format for the `reviewed` data subtype, and an example is provided in "Arrival:reviewed" on page A14.

## TABLE 34: REVIEWED ARRIVAL FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 16-19 | a4 | `Chan` |
| | 22-24 | a3 | `Aux` |
| | 30-33 | a4 | `Date` |
| | 40-43 | a4 | `Time` |
| | 50-54 | a5 | `Phase` |
| | 60-63 | a4 | `Azim` |
| | 66-69 | a4 | `Slow` |
| | 73-75 | a3 | `SNR` |
| | 83-85 | a3 | `Amp` |
| | 89-91 | a3 | `Per` |
| | 93-96 | a4 | `Qual` |
| | 98-103 | a6 | `Author` |
| | 110-114 | a5 | `ArrID` |
| 2-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-19 | a3 | FDSN channel code |
| | 21-24 | a4 | auxiliary identification code |
| | 26-35 | i4,a1,i2,a1,i2 | arrival date (*yyyy/mm/dd*) |
| | 37-48 | i2,a1,i2,a1,f6.3 | arrival time (*hh:mm:ss.sss*) |
| | 50-57 | a8 | phase code |
| | 59-63 | f5.1 | observed azimuth (degrees) |
| | 65-69 | f5.1 | observed slowness (seconds/degree) |

### Table 34: Reviewed Arrival Format (continued)

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* (data) | 71-75 | f5.1 | signal-to-noise ratio |
| | 77-85 | f9.1 | amplitude (nanometers) |
| | 87-91 | f5.2 | period (seconds) |
| | 93 | a1 | type of pick (`a` = automatic, `m` = manual) |
| | 94 | a1 | direction of short period motion (`c` = compression, `d` = dilatation, _ = null) |
| | 95 | a1 | detection character (`i` =impulsive, `e` = emergent, `q` = questionable, _ = null [see Table 9]) |
| | 97-105 | a9 | author of the arrival |
| | 107-114 | a8 | arrival identification |

### Table 35: Detection Character from Uncertainty

| Detection Character | Uncertainty for Local Phases | Uncertainty for Regional/Teleseismic Phases |
|---|---|---|
| i | < 0.05 sec | < 0.2 sec |
| e | < 0.25 sec | < 1.0 sec |
| q | > 0.25 sec | > 1.0 sec |

#### Grouped Arrivals

The `grouped` subtype is used for arrivals that have phase names and have been grouped together, with the implication that they were generated by the same seismic event. Table 36 gives the format for the `grouped` data subtype, and an example is provided in "Arrival:grouped" on page A14.

### TABLE 36: GROUPED ARRIVAL FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 16-19 | a4 | `Chan` |
| | 21-23 | a3 | `Aux` |
| | 29-32 | a4 | `Date` |
| | 39-42 | a4 | `Time` |
| | 50-54 | a5 | `Phase` |
| | 60-63 | a4 | `Azim` |
| | 66-69 | a4 | `Slow` |
| | 73-75 | a3 | `SNR` |
| | 83-85 | a3 | `Amp` |
| | 89-91 | a3 | `Per` |
| | 93-96 | a4 | `Qual` |
| | 100-104 | a5 | `Group` |
| | 106 | a1 | `C` |
| | 108-113 | a6 | `Author` |
| | 121-125 | a5 | `ArrID` |
| 2-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-19 | a3 | FDSN channel code |
| | 21-24 | a4 | auxiliary identification code |
| | 26-35 | i4,a1,i2,a1,i2 | arrival date (*yyyy/mm/dd*) |
| | 37-48 | i2,a1,i2,a1,f6.3 | arrival time (*hh:mm:ss.sss*) |
| | 50-57 | a8 | phase code |

TABLE 36: GROUPED ARRIVAL FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* (data) | 59-63 | f5.1 | observed azimuth (degrees) |
| | 65-69 | f5.1 | observed slowness (seconds/degree) |
| | 71-75 | f5.1 | signal-to-noise ratio |
| | 77-85 | f9.1 | amplitude (nanometers) |
| | 87-91 | f5.2 | period (seconds) |
| | 93 | a1 | type of pick (`a` = automatic, `m` = manual) |
| | 94 | a1 | direction of short period motion (`c` = compression, `d` = dilatation, _ = null) |
| | 95 | a1 | detection quality (`i` = impulsive, `e` = emergent, `q` = questionable, _ = null) |
| | 97-104 | a8 | group identification |
| | 106 | i1 | conflict flag (number of times an arrival belongs to more than one group; leave blank if arrival only belongs to one group) |
| | 108-116 | a9 | author of the arrival |
| | 118-125 | a8 | arrival identification |

### Associated Arrivals

The `associated` subtype is used for arrivals that have been run through a location program and have formed a seismic event. If multiple magnitude measurements have been made on an arrival, the subsequent magnitudes will appear on lines immediately after the arrival. Table 37 gives the format for the `associated` data subtype, and an example is provided in "Arrival:associated" on page A13.

### TABLE 37: ASSOCIATED ARRIVAL FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 19-22 | a4 | `Dist` |
| | 25-28 | a4 | `EvAz` |
| | 30-34 | a5 | `Phase` |
| | 41-44 | a4 | `Date` |
| | 53-56 | a4 | `Time` |
| | 64-67 | a4 | `TRes` |
| | 70-73 | a4 | `Azim` |
| | 75-79 | a5 | `AzRes` |
| | 82-85 | a4 | `Slow` |
| | 88-91 | a4 | `SRes` |
| | 93-95 | a3 | `Def` |
| | 99-101 | a3 | `SNR` |
| | 109-111 | a3 | `Amp` |
| | 115-117 | a3 | `Per` |
| | 119-122 | a4 | `Qual` |
| | 124-132 | a9 | `Magnitude` |
| | 136-141 | a6 | `OrigID` |
| | 143-148 | a6 | `Author` |
| | 156-160 | a5 | `ArrID` |
| 2-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-22 | f6.2 | station to event distance (degrees) |

**TABLE 37: ASSOCIATED ARRIVAL FORMAT (CONTINUED)**

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* (data) | 24-28 | f5.1 | event to station azimuth (degrees) |
| | 30-37 | a8 | phase code |
| | 39-48 | i4,a1,i2,a1,i2 | arrival date (*yyyy/mm/dd*) |
| | 50-61 | i2,a1,i2,a1,f6.3 | arrival time (*hh:mm:ss.sss*) |
| | 63-67 | f5.1 | time residual (seconds) |
| | 69-73 | f5.1 | observed backazimuth (degrees) |
| | 75-79 | f5.1 | azimuth residual (degrees) |
| | 81-85 | f5.1 | observed slowness (seconds/degree) |
| | 87-91 | f5.1 | slowness residual (seconds/degree) |
| | 93 | a1 | time defining flag (`T` or _) |
| | 94 | a1 | azimuth defining flag (`A` or _) |
| | 95 | a1 | slowness defining flag (`S` or _) |
| | 97-101 | f5.1 | signal-to-noise ratio |
| | 103-111 | f9.1 | amplitude (nanometers) |
| | 113-117 | f5.2 | period (seconds) |
| | 119 | a1 | type of pick (`a` = automatic, `m` = manual) |
| | 120 | a1 | direction of short period motion (`c` = compression, `d` = dilatation, _ = null) |
| | 121 | a1 | onset quality (`i` = impulsive, `e` = emergent, `q` = questionable, _ = null) |
| | 123-127 | a5 | magnitude type (`mb`, `Ms`, `ML`, `mbmle`, `msmle`) |
| | 128 | a1 | min max indicator (<, >, or blank) |
| | 129-132 | f4.1 | magnitude value |

TABLE 37: ASSOCIATED ARRIVAL FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* (data) | 134-141 | a8 | origin identification |
| | 143-151 | a9 | author of the arrival |
| | 153-160 | a8 | arrival identification |

### Unassociated Arrivals

The `unassociated` subtype is used for arrivals that have been detected and reviewed, but have not been not associated with a seismic origin. Table 33 gives the format of the `unassociated` subtype line is the same as the format for the `automatic` subtype. An example is provided in "Arrival:unassociated" on page A14.

## Bulletin

Bulletins are composed of origin and arrival information. The information is provided in a series of data blocks as shown in Table 38: bulletin title block (Table 39), event title block (Table 40), origin block (Table 41), phase block (Table 42), phase correction block (under development), event screening block (Table 43), and event characterization arrival block (Table 44). The verbosity of a bulletin can be controlled by specifying the subformat, which can be `short` or `long`. The default is `short`.

The BULL_TYPE environment and the subformat control the blocks of information that appear in a bulletin. Table 38 lists the blocks that are included for each BULL_TYPE and subformat.

A BULLETIN data message contains one bulletin title block and one set of the other block types for each event. The blocks in a BULLETIN data message appear in the order given in Table 38. Examples of the `short` and `long` subformats for bulletins are provided in "Bulletin (IMS1.0:short Format)" on page A16 and "Bulletin (IMS1.0:long Format)" on page A16.

### TABLE 38: BLOCKS USED IN BULLETIN FORMATS

| Block Name | SEL1, SEL2, SEL3, REB subformats | | SEB, SSEB, NEB, NSEB subformats | |
|---|---|---|---|---|
| | short | long | short | long |
| bulletin title block | r | r | r | r |
| event title block | r | r | r | r |
| origin block | r | r | r | r |
| phase block | r | r | r | r |
| phase correction block | | r | | r |
| event screening block | | | r | r |
| event characterization arrival block | | | | r |

### TABLE 39: BULLETIN TITLE BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-136 | a136 | bulletin title |

### TABLE 40: EVENT TITLE BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-5 | a5 | `Event` |
| | 7-14 | a8 | event identification number |
| | 16-80 | a65 | geographic region |

TABLE 41: ORIGIN BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| **Origin Sub-block** | | | |
| 1 (header) | 4-7 | a4 | `Date` |
| | 15-18 | a4 | `Time` |
| | 27-29 | a3 | `Err` |
| | 33-35 | a3 | `RMS` |
| | 37-44 | a8 | `Latitude` |
| | 46-54 | a9 | `Longitude` |
| | 57-60 | a4 | `Smaj` |
| | 63-66 | a4 | `Smin` |
| | 69-70 | a2 | `Az` |
| | 72-76 | a5 | `Depth` |
| | 80-82 | a3 | `Err` |
| | 84-87 | a4 | `Ndef` |
| | 89-92 | a4 | `Nst` |
| | 94-96 | a3 | `Gap` |
| | 99-103 | a5 | `mdist` |
| | 106-110 | a5 | `Mdist` |
| | 112-115 | a4 | `Qual` |
| | 19-124 | a6 | `Author` |
| | 131-136 | a6 | `OrigID` |
| 2-*n* (data) | 1-10 | i4,a1,i2,a1,i2 | epicenter date (*yyyy/mm/dd*) |
| | 12-22 | i2,a1,i2,a1,f5.2 | epicenter time (*hh:mm:ss.ss*) |
| | 23 | a1 | fixed flag (`f` = fixed origin time solution, blank if not a fixed origin time) |

### TABLE 41: ORIGIN BLOCK FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* (data) | 25-29 | f5.2 | origin time error (seconds; blank if fixed origin time) |
| | 31-35 | f5.2 | root mean square of time residuals (seconds) |
| | 37-44 | f8.4 | latitude (negative for South) |
| | 46-54 | f9.4 | longitude (negative for West) |
| | 55 | a1 | fixed flag (`f` = fixed epicenter solution, blank if not a fixed epicenter solution) |
| | 57-60 | f4.1 | semi-major axis of 90% ellipse or its estimate (km, blank if fixed epicenter) |
| | 62-66 | f5.1 | semi-minor axis of 90% ellipse or its estimate (km, blank if fixed epicenter) |
| | 68-70 | i3 | strike (0 <= x <= 360) of error ellipse clock-wise from North (degrees) |
| | 72-76 | f5.1 | depth (km) |
| | 77 | a1 | fixed flag (`f` = fixed depth station, d = depth phases, blank if not a fixed depth) |
| | 79-82 | f4.1 | depth error 90% (km; blank if fixed depth) |
| | 84-87 | i4 | number of defining phases |
| | 89-92 | i4 | number of defining stations |
| | 94-96 | i3 | gap in azimuth coverage (degrees) |
| | 98-103 | f6.2 | distance to closest station (degrees) |
| | 105-110 | f6.2 | distance to furthest station (degrees) |
| | 112 | a1 | analysis type: (`a` = automatic, `m` = manual, `g` = guess) |
| | 114 | a1 | location method: (`i` = inversion, `p` = pattern recognition, `g` = ground truth, `o` = other) |

### TABLE 41: ORIGIN BLOCK FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* (data) | 116-117 | a2 | event type:<br>`uk` = unknown<br>`ke` = known earthquake<br>`se` = suspected earthquake<br>`kr` = known rockburst<br>`sr` = suspected rockburst<br>`ki` = known induced event<br>si = suspected induced event<br>`km` = known mine expl.<br>`sm` = suspected mine expl.<br>`kx` = known experimental expl.<br>`sx` = suspected experimental expl.<br>`kn` = known nuclear expl.<br>`sn` = suspected nuclear explosion<br>`ls` = landslide |
| | 119-127 | a9 | author of the origin |
| | 129-136 | a8 | origin identification |
| **Magnitude Sub-block** | | | |
| 1 (header) | 1-9 | a9 | `Magnitude` |
| | 12-14 | a3 | `Err` |
| | 16-19 | a4 | `Nsta` |
| | 21-26 | a6 | `Author` |
| | 33-38 | a6 | `OrigID` |
| 2-*n* (data) | 1-5 | a5 | magnitude type (`mb`, `Ms`, `ML`, `mbmle`, `msmle`) |
| | 6 | a1 | *min max* indicator (<, >, or blank) |
| | 7-10 | f4.1 | magnitude value |
| | 12-14 | f3.1 | standard magnitude error |
| | 16-19 | i4 | number of stations used to calculate magnitude |

### TABLE 41: ORIGIN BLOCK FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* (data) | 21-29 | a9 | author of the origin |
| | 31-38 | a8 | origin identification |
| **Comment Sub-block** | | | |
| 1 | 2 | a1 | ( |
| | 3-M | a(M-2) | comment |
| | M+1 | a1 | ) |

### TABLE 42: PHASE BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 1-3 | a3 | `Sta` |
| | 9-12 | a4 | `Dist` |
| | 15-18 | a4 | `EvAz` |
| | 20-24 | a5 | `Phase` |
| | 33-36 | a4 | `Time` |
| | 43-46 | a4 | `TRes` |
| | 49-52 | a4 | `Azim` |
| | 54-58 | a5 | `AzRes` |
| | 62-65 | a4 | `Slow` |
| | 69-72 | a4 | `SRes` |
| | 74-76 | a3 | `Def` |
| | 80-82 | a3 | `SNR` |
| | 90-92 | a3 | `Amp` |
| | 96-98 | a3 | `Per` |
| | 100-103 | a4 | `Qual` |

**TABLE 42: PHASE BLOCK FORMAT (CONTINUED)**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (header) | 105-113 | a9 | `Magnitude` |
| | 118-122 | a5 | `ArrID` |
| 2-*n* (data) | 1-5 | a5 | station code |
| | 7-12 | f6.2 | station-to-event distance (degrees) |
| | 14-18 | f5.1 | event-to-station azimuth (degrees) |
| | 20-27 | a8 | phase code |
| | 29-40 | i2,a1,i2,a1,f6.3 | arrival time (*hh:mm:ss.sss*) |
| | 42-46 | f5.1 | time residual (seconds) |
| | 48-52 | f5.1 | observed azimuth (degrees) |
| | 54-58 | f5.1 | azimuth residual (degrees) |
| | 60-65 | f5.1 | observed slowness (seconds/degree) |
| | 67-72 | f5.1 | slowness residual (seconds/degree) |
| | 74 | a1 | time defining flag (`T` or _) |
| | 75 | a1 | azimuth defining flag (`A` or _) |
| | 76 | a1 | slowness defining flag (`S` or _) |
| | 78-82 | f5.1 | signal-to-noise ratio |
| | 84-92 | f9.1 | amplitude (nanometers) |
| | 94-98 | f5.2 | period (seconds) |
| | 100 | a1 | type of pick (`a` = automatic, `m` = manual) |
| | 101 | a1 | direction of short period motion (`c` = compression, `d` = dilatation, _= null) |
| | 102 | a1 | onset quality (`i` = impulsive, `e` = emergent, `q` = questionable, _ = null) |
| | 104-108 | a5 | magnitude type (`mb`, `Ms`, `ML`, `mbmle`, `msmle`) |

### TABLE 42: PHASE BLOCK FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* (data) | 109 | a1 | min max indicator (<, >, or blank) |
| | 110-113 | f4.1 | magnitude value |
| | 115-122 | a8 | arrival identification |

### TABLE 43: EVENT SCREENING BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (title) | 1-15 | a15 | `EVENT SCREENING` |
| 2 (header) | 2-9 | a8 | `OriginID` |
| | 11-17 | a7 | `Smaj_sc` |
| | 19-25 | a7 | `Smin_sc` |
| | 28-32 | a5 | `Depth` |
| | 35-38 | a4 | `Sdep` |
| | 41-44 | a4 | `mbms` |
| | 47-51 | a5 | `Smbms` |
| | 53-61 | a6 | `Foffshore` |
| | 63-68 | a6 | `Dscore` |
| | 70-75 | a6 | `Mscore` |
| | 78-82 | a5 | `Score` |
| | 84-91 | a8 | `Category` |
| 3 (data) | 1-9 | i9 | Origin Identifier |
| | 11-17 | f7.1 | semi-major axis of location confidence ellipse |
| | 19-25 | f7.1 | semi-minor axis of location confidence ellipse |
| | 28-32 | f5.1 | depth estimate (km) |

### TABLE 43: EVENT SCREENING BLOCK FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 3 (data) | 34-38 | f5.1 | depth confidence interval (km) |
| | 40-44 | f5.2 | $m_b$ - $M_s$ |
| | 47-51 | f5.2 | $m_b$ - $M_s$ confidence interval |
| | 58-61 | f4.2 | fraction of location ellipse offshore |
| | 63-68 | f6.2 | depth score |
| | 70-75 | f6.2 | $m_b$:$M_s$ score |
| | 77-82 | f6.2 | total combined screening score |
| | 84-103 | a11,a1,a8 | Category: `NotConsider` \| `InsufftData` \| `NotScreened` \| `ScreenedOut` / `Offshore` \| `Onshore` \| `Mixed` |

### TABLE 44: EVENT CHARACTERIZATION ARRIVAL BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| **Cepstral Peak Analysis Sub-block** | | | |
| 1 (title) | 1-22 | a22 | `cepstral peak analysis` |
| 2 (header) | 1-3 | a3 | `Sta` |
| | 8-14 | a7 | `PeakAmp` |
| | 16-23 | a8 | `PeakQuef` |
| 3-*n* (data) | 1-5 | a5 | station code |
| | 8-14 | f7.5 | peak amplitude |
| | 16-23 | f8.4 | peak quefrency |

**TABLE 44: EVENT CHARACTERIZATION ARRIVAL BLOCK FORMAT (CONTINUED)**

| Record | Position | Format | Description |
|---|---|---|---|
| **Energy Ratio Sub-block** | | | |
| 1 (title) | 1-37 | a37 | `short-period/long-period` energy `ratio` |
| 2 (header) | 1-3 | a3 | `Sta` |
| | 13-17 | a5 | `Ratio` |
| 3-*n* (data) | 1-5 | a5 | station code |
| | 8-17 | f10.8 | short-period/long-period energy ratio |
| **Frequency Dependent Phase Amplitude Sub-block** | | | |
| 1 (title) | 1-47 | a47 | `origin-based frequency-dependent phase amplitude` |
| 2 (header) | 1-3 | a3 | `Sta` |
| | 7-11 | a5 | `Phase` |
| | 19-24 | a6 | `Amp2-4` |
| | 27-32 | a6 | `SNR2-4` |
| | 37-42 | a6 | `Amp4-6` |
| | 45-50 | a6 | `SNR4-6` |
| | 55-60 | a6 | `Amp6-8` |
| | 63-68 | a6 | `SNR6-8` |
| | 72-78 | a7 | `Amp8-10` |
| 3-*n* (data) | 1-5 | a5 | station code |
| | 7-14 | a8 | associated phase |
| | 16-24 | f9.1 | amplitude in 2-4 Hz band |
| | 28-32 | f5.1 | snr in 2-4 Hz band |
| | 34-42 | f9.1 | amplitude in 4-6 Hz band |
| | 46-50 | f5.1 | snr in 4-6 Hz band |
| | 52-60 | f9.1 | amplitude in 6-8 Hz band |

### TABLE 44: EVENT CHARACTERIZATION ARRIVAL BLOCK FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 3-*n* (data) | 64-68 | f5.1 | snr in 6-8 Hz band |
| | 70-78 | f9.1 | amplitude in 8-10 Hz band |
| | 82-86 | f5.1 | snr in 8-10 Hz band |
| **Spectral Variance Sub-block** | | | |
| 1 (title) | 1-47 | a47 | `spectral variance of the detrended log spectrum` |
| 2 (header) | 1-3 | a3 | `Sta` |
| | 7-11 | a5 | `Phase` |
| | 13-19 | a7 | `MinFreq` |
| | 21-27 | a7 | `MaxFreq` |
| | 35-41 | a7 | `SpecVar` |
| 3-*n* (data) | 1-5 | a5 | station code |
| | 7-14 | a8 | associated phase |
| | 16-22 | f7.2 | minimum frequency |
| | 24-30 | f7.2 | maximum frequency |
| | 32-43 | f12.6 | spectral variance of detrended log spectrum |
| **Complexity Sub-block** | | | |
| 1 (title) | 1-10 | a10 | `Complexity` |
| 2 (header) | 1-3 | a3 | `Sta` |
| | 7-11 | a5 | `Phase` |
| | 17-26 | a10 | `Complexity` |
| | 30-32 | a3 | `SNR` |

TABLE 44: EVENT CHARACTERIZATION ARRIVAL BLOCK FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 3-*n* (data) | 1-5 | a5 | station code |
| | 7-14 | a8 | associated phase |
| | 16-26 | f11.4 | complexity |
| | 28-32 | f5.1 | snr of complexity |

## Comment

The first line of the COMMENT data type provides a mechanism for associating the comment to a station, arrival, origin, event, and so on. If no association is needed, then this line may be left blank. The comment is written in free format and can be up to 1,024 characters. Table 45 gives the format for the COMMENT data message, and an example is provided in "Comment" on page A20.

TABLE 45: COMMENT FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-10 | a10 | identification type (`Station`, `Arrival`, `Origin`, `Event`) |
| | 12-19 | a8 | identification string of the identification type |
| 2 | 1-1024 | a1024 | free-format comment |

## Event

Any S/H/I event can have several estimates of the location, origin time, and size (origins). The format for events places these different origins into separate origin blocks. The bulletin title block at the beginning of the data section must include the name of the bulletin used as the basis for associating the separate origin estimates. The events data messages include:

- one bulletin title block (see Table 39)
- *n* origin blocks (see Table 41)

An example of the EVENT data message is provided in "Event" on page A22.

### Origin

The ORIGIN data type consists of a number of origin blocks (Table 41). Multiple magnitudes may be given for the same origin. An example of the ORIGIN data message is provided in "Origin" on page A26.

## STATUS INFORMATION

Several data types provide status information. Status information is available for authentication, stations, channels, communications, and data availability.

### Auth_status

Some data channels contain authentication signatures that are verified at the IDC. The AUTH_STATUS data type provides statistics on the authentication process over the time of the report. The first block (Table 46) of the report gives the number of packets tested (Table 47), the number that passed, and the number that failed by station. The second block contains a list of the failures grouped as intervals for each data channel that failed to verify the authentication signature. An example of the AUTH_STATUS data message is provided in "Auth_status" on page A14.

**TABLE 46: REPORT PERIOD BLOCK FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-18 | a18 | `Report period` |
| | 20-29 | i4,a1,i2,a1,i2 | date (*yyyy/mm/dd*) |
| | 31-40 | i2,a1,i2,a1,f4.1 | time (*hh:mm:ss.s*) |
| | 42-43 | a2 | `to` |

**TABLE 46: REPORT PERIOD BLOCK FORMAT (CONTINUED)**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 45-54 | i4,a1,i2,a1,i2 | date (*yyyy/mm/dd*) |
| | 56-65 | i2,a1,i2,a1,f4.1 | time (*hh:mm:ss.s*) |
| 2 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 16-19 | a4 | `Chan` |
| | 21-23 | a3 | `Aux` |
| | 27-40 | a14 | `Packets_Tested` |
| | 43-56 | a14 | `Packets_Failed` |
| 3-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-19 | a3 | FSDN channel code |
| | 21-24 | a4 | auxiliary identification code |
| | 22-40 | i8 | number of packets tested |
| | 49-56 | i8 | number of packets failing verification |

**TABLE 47: AUTHENTICATION LIST BLOCK FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (title) | 1-23 | a23 | `Failed Packet Intervals` |
| 2 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 16-19 | a4 | `Chan` |
| | 21-23 | a3 | `Aux` |
| | 31-40 | a10 | `Start_Time` |

**TABLE 47: AUTHENTICATION LIST BLOCK FORMAT (CONTINUED)**

| Record | Position | Format | Description |
|---|---|---|---|
| 2 (header) | 55-61 | a8 | `End_Time` |
| | 71-77 | a7 | `Comment` |
| 3-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-19 | a3 | channel code |
| | 21-24 | a4 | auxiliary identification code |
| | 26-35 | i4,a1,i2,a1,i2 | start date of failure interval (*yyyy/mm/dd*) |
| | 37-46 | i2,a1,i2,a1,f4.1 | start time of failure interval (*hh:mm:ss.s)* |
| | 49-58 | i4,a1,i2,a1,i2 | end date of failure interval (*yyyy/mm/dd*) |
| | 60-69 | i2,a1,i2,a1,f4.1 | end time of failure interval (*hh:mm:ss.s*) |
| | 71-132 | a62 | comment |

## Chan_status

The CHAN_STATUS data type gives specific information on the data that have been received at the IDC by station and channel. Detailed statistics on data gaps and timeliness are included. The first block of the report provides the following information (see Table 48):

- reporting period over which the statistics are calculated;
- data availability statistics with the station, channel, and auxiliary codes that identify the reporting data stream;
- amount of data expected for the data stream;
- availability of the data at the IDC as a percentage of the data that were expected over the report period; and
- total number of gaps followed by the median, mean, standard deviation, and minimum and maximum gap size.

The second block of the report provides the following information (see Table 49):

- data timeliness statistics with the station, channel, and auxiliary codes that identify the reporting data stream;
- amount of data expected for the data stream; and
- median, mean, standard deviation, and minimum and maximum delay times for data arriving at the IDC.

For readability, the information is grouped by station with a blank line between stations in each of the sections. An example of the CHAN_STATUS data message is provided in "Chan_status" on page A19.

### TABLE 48: CHANNEL STATISTICS BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-18 | a18 | Report period from |
| | 20-29 | i4,a1,i2,a1,i2 | date (*yyyy/mm/dd*) |
| | 31-40 | i2,a1,i2,a1,f4.1 | time (*hh:mm:ss.s*) |
| | 42-43 | a2 | to |
| | 45-54 | i4,a1,i2,a1,i2 | date (*yyyy/mm/dd*) |
| | 56-65 | i2,a1,i2,a1,f4.1 | time (*hh:mm:ss.s*) |
| 2 (title) | 1-28 | a28 | Data Availability Statistics |
| 3 (header) | 1-3 | a3 | Net |
| | 11-13 | a3 | Sta |
| | 17-20 | a4 | Chan |
| | 22-24 | a3 | Aux |
| | 29-40 | a12 | Max_Exp_Time |
| | 46-52 | a6 | %_Avail |
| | 55-58 | a4 | Gaps |
| | 63-68 | a6 | Median |

**TABLE 48: CHANNEL STATISTICS BLOCK FORMAT (CONTINUED)**

| Record | Position | Format | Description |
|---|---|---|---|
| 3 (header) | 75-77 | a3 | `Min` |
| | 86-88 | a3 | `Max` |
| 4-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 18-20 | a3 | FDSN channel code |
| | 22-25 | a4 | auxiliary identification code |
| | 29-40 | i3,a1,i2,a1,i2, a1,f4.1 | maximum data time possible (*ddd hh:mm:ss.s*) |
| | 46-52 | f7.3 | percent of data available at the IDC |
| | 54-58 | i5 | number of data gaps |
| | 61-69 | 13,a1,i2,a1,i2 | median length of data gaps (*hhh:mm:ss*) |
| | 72-80 | 13,a1,i2,a1,i2 | minimum length of data gaps (*hhh:mm:ss*) |
| | 83-91 | 13,a1,i2,a1,i2 | maximum length of data gaps (*hhh:mm:ss*) |

**TABLE 49: DATA TIMELINESS BLOCK FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (title) | 1-26 | a26 | `Data Timeliness Statistics` |
| 2 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 17-20 | a4 | `Chan` |
| | 22-24 | a3 | `Aux` |
| | 28-39 | a12 | `Max_Exp_Time` |
| | 42-50 | a9 | `Delay_Med` |
| | 56-59 | a4 | `Mean` |

### TABLE 49: DATA TIMELINESS BLOCK FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 2 (header) | 65-71 | a7 | `Std_Dev` |
| | 78-80 | a3 | `Min` |
| | 89-91 | a3 | `Max` |
| 3-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 18-20 | a3 | channel code |
| | 22-25 | a4 | auxiliary code |
| | 28-39 | i3,a1,i2,a1,i2, a1,f4.1 | maximum data time possible (*ddd hh:mm:ss.s*) |
| | 42-50 | i3,a1,i2,a1,i2 | median delay time (*hhh:mm:ss*) |
| | 53-61 | i3,a1,i2,a1,i2 | mean delay time (*hhh:mm:ss*) |
| | 64-72 | i3,a1,i2,a1,i2 | standard deviation of delay time (*hhh:mm:ss*) |
| | 75-83 | i3,a1,i2,a1,i2 | minimum delay time (*hhh:mm:ss)* |
| | 86-94 | i3,a1,i2,a1,i2 | maximum delay time (*hhh:mm:ss)* |

## Comm_status

Communications status is given over the time interval specified in the TIME or FREQ environments for *AutoDRM* or subscription requests, respectively. The report is comprised of a communications statistics block giving the report period and a summary section in which each link is described with statistics of link performance for the reporting period (see Table 50). The next block is a list of the link outages for each link (see Table 51). The link outages block is included only in the `long` subformat. An example of the COMM_STATUS data message is provided in "Comm_status" on page A20.

### TABLE 50: COMMUNICATIONS STATISTICS BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-18 | a18 | `Report period from` |
| | 20-29 | i4,a1,i2,a1,i2 | start date (*yyyy/mm/dd*) |
| | 31-40 | i2,a1,i2,a1,f4.1 | start time (*hh:mm:ss.s*) |
| | 42-43 | a2 | `to` |
| | 45-54 | i4,a1,i2,a1,i2 | end date (*yyyy/mm/dd*) |
| | 56-65 | i2,a1,i2,a1,f4.1 | end time (*hh:mm:ss.s*) |
| 2 (header) | 1-4 | a4 | `Link` |
| | 22-29 | a8 | `Nom_kbps` |
| | 32-35 | a4 | `Mode` |
| | 38-41 | a4 | `%_up` |
| | 44-47 | a4 | `From` |
| | 54-57 | a4 | `Util` |
| | 60-63 | a4 | `From` |
| | 70-73 | a4 | `Util` |
| 3-*n* (data) | 1-9 | a9 | link code (farthest from IDC) |
| | 11 | a1 | `-` |
| | 13-21 | a9 | link code (closest to IDC) |
| | 24-29 | f6.1 | nominal speed of link in kbps |
| | 32-35 | a4 | `full` for full-duplex or `half` for half-duplex |
| | 37-41 | f5.1 | percent uptime |
| | 44-52 | a9 | link code (farthest from IDC) |
| | 54-57 | f4.2 | use of link (dat_rate/speed) |
| | 60-68 | a9 | link code (closest to IDC) |
| | 70-73 | f4.2 | use of link (dat_rate/speed) |

### TABLE 51: COMMUNICATIONS OUTAGE BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 (title) | 1-9 | a8 | link code (farthest from IDC) |
| | 11 | a1 | – |
| | 13-21 | a9 | link code (closest to IDC) |
| | 23-34 | a12 | `link outages` |
| 2 (header) | 10-13 | a4 | `From` |
| | 30-36 | a7 | `Through` |
| | 50-57 | a8 | `Duration` |
| 3-*n* (data) | 1-10 | i4,a1,i2,a1,i2 | date of beginning of outage (*yyyy/mm/dd*) |
| | 12-21 | i2,a1,i2,a1,f4.1 | time of beginning of outage (*hh:mm:ss.s*) |
| | 24-33 | i4,a1,i2,a1,i2 | date of end of outage (*yyyy/mm/dd*) |
| | 35-44 | i2,a1,i2,a1,f4.1 | time of end of outage (*hh:mm:ss.s*) |
| | 47-60 | i3,a1,i2,a1,i2, a1,f4.1 | duration of outage (*ddd hh:mm:ss.s*) |

## Outage

The OUTAGE data type provides information on the dates and times of data gaps. Table 52 gives the format for the OUTAGE data message, and an example is provided in "Outage" on page A26.

### TABLE 52: OUTAGE FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-18 | a18 | `Report period from` |
| | 20-29 | i4,a1,i2,a1,i2 | date (*yyyy/mm/dd*) |
| | 31-42 | i2,a1,i2,a1,f6.3 | time (*hh:mm:ss.sss*) |
| | 44-45 | a2 | `to` |

### TABLE 52: OUTAGE FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 47-56 | i4,a1,i2,a1,i2 | date (*yyyy/mm/dd*) |
| | 58-67 | i2,a1,i2,a1,f6.3 | time (*hh:mm:ss.sss*) |
| 2 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 16-19 | a4 | `Chan` |
| | 21-23 | a3 | `Aux` |
| | 30-44 | a15 | `Start Date Time` |
| | 55-67 | a13 | `End Date Time` |
| | 76-83 | a8 | `Duration` |
| | 85-91 | a7 | `Comment` |
| 3-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-19 | a3 | FDSN channel code |
| | 21-24 | a4 | auxiliary identification code |
| | 26-35 | i4,a1,i2,a1,i2 | date of last sample before outage interval or start date of report period[1] |
| | 37-48 | i2,a1,i2,a1,f6.3 | time of last sample before outage interval |
| | 50-59 | i4,a1,i2,a1,i2 | date of first sample after outage interval[2] |
| | 61-72 | i2,a1,i2,a1,f6.3 | time of first sample after outage interval or end time of the report period |
| | 74-83 | f10.3 | duration of interval (seconds) |
| | 85-132 | a48 | comment |

1. Time of last available sample preceding the outage or the start time of the report period.
2. Time of first available sample after the outage or the end time of the report period.

### Sta_status

Station status is given over the time interval specified in the TIME or FREQ environments for *AutoDRM* or subscription requests, respectively. The report is comprised of statistics that can be used to evaluate the overall performance of one or more stations. The first record of the report gives the report period. The status records give the station code and the nominal number of channels for the station. This record is followed by the station capability entries in which station problems are grouped into four categories depending on the impact each failure has on the capability of that station. Station capability is assessed relative to the maximum performance of that particular station based on instrument configuration and site characteristics.

In the context of assessing station status, the station consists of the sensors, digitizers, communications within the site, and data loggers. Station status is assessed at the IDC based on data that are available there, and may therefore include the effects of problems with communications, problems at a NDC, or Data Relay Center. Moreover, because data may arrive late at the IDC, the station status assessment is a snapshot of station capability at a single time.

Station capability is categorized as follows:

- Fully capable

  The system is operating and contributing data to the mission at the level for which it was designed.

- Partially capable

  The system is impaired and contributing significant data to the mission but of degraded quality, reduced quantity, or reduced operational capability.

- Low capability

  The system is severely impaired and is contributing data that do not meet minimum requirements for the designed mission but are still useful for the global monitoring network.

- Not capable

  The system is completely inoperative, or the data being contributed are not useful for the global monitoring network in any way.

For arrays, capability is estimated based on the theoretical array gain for the available channels relative to maximum array gain with all channels operational. The array gain is estimated from the square root of the number of channels; the geometry of the active channels and the relative values of individual array elements are neglected.

Station mission capability may be estimated based on data available at the IDC. Problems not affiliated with stations, such as outages of long-haul or tail communication circuits and problems with forwarding the data from NDCs will be folded into the capability estimates. Problems affecting the quality or timing of seismic waveforms will not be included in the automated station capability estimate, at least in the first instance, and thus capability may be overestimated (see Table 53).

**TABLE 53: STATION CAPABILITY CRITERIA**

| Station Type | Fully Capable | Partial Capability | Low Capability | Non-Capable |
|---|---|---|---|---|
| SP or HF array | array gain ≥ 90% max | 70% ≤ array gain < 90% max | array gain < 70% max, at least one channel operational | no channels operational |
| 3-C BB station | all channels operational | one vertical and one horizontal operational | one channel operational | no channel operational |

**TABLE 53: STATION CAPABILITY CRITERIA (CONTINUED)**

| Station Type | Fully Capable | Partial Capability | Low Capability | Non-Capable |
|---|---|---|---|---|
| **Examples:** | **(operational channels)** | | | |
| 25-element array | 21-25 | 13-20 | 1-12 | 0 |
| 19-element array | 16-19 | 10-15 | 1-9 | 0 |
| 16-element array | 13-16 | 8-12 | 1-7 | 0 |
| 9-element array | 8-9 | 5-7 | 1-4 | 0 |
| 7-element array | 6-7 | 4-5 | 1-3 | 0 |

The maximum data time, which is the cumulative amount of time for which data are expected for this station, follows the station capability entries. For primary stations, this time will be the entire report period; for auxiliary stations, this time will be the sum of the requested data segment time intervals. Availability indicates the percent of data that are available at the IDC relative to that expected. If an array with 10 channels sends 9 channels of data to the IDC for the entire period, then the data availability would be 90.0 percent (even though the data capability may be fully capable 100 percent of the time). The median delay measures the time delay between ground motion and receipt of data at the IDC for primary stations and the delay between request and receipt for auxiliary stations. Finally, the number of successful retrievals of data from the auxiliary stations and the number of retrieval attempts are given. Table 54 gives the station status format and an example is provided in "Sta_status" on page A32.

**TABLE 54: STA_STATUS FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-18 | a18 | `Report period from` |
| | 20-29 | i4,a1,i2,a1,i2 | start date (*yyyy/mm/dd*) |
| | 31-40 | i2,a1,i2,a1,f4.1 | start time (*hh:mm:ss.s*) |
| | 42-43 | a2 | `to` |
| | 45-54 | i4,a1,i2,a1,i2 | end date (*yyyy/mm/dd)* |
| | 56-65 | i2,a1,i2,a1,f4.1 | end time (*hh:mm:ss.s*) |
| 2 (title) | 28-45 | a18 | `Station Capability` |
| 3 (header) | 1-3 | a3 | `Net` |
| | 11-13 | a3 | `Sta` |
| | 17-18 | a2 | `Ch` |
| | 21-24 | a4 | `Full` |
| | 31-34 | a4 | `Part` |
| | 40-42 | a3 | `Low` |
| | 48-50 | a3 | `Non` |
| | 52-63 | a12 | `Max_Exp_Time` |
| | 67-71 | a5 | `Avail` |
| | 75-83 | a9 | `Med_Delay` |
| | 87-89 | a3 | `Att` |
| | 93-95 | a3 | `Suc` |
| | 99-101 | a3 | `Pnd` |
| 4-*n* (data) | 1-9 | a9 | network code |
| | 11-15 | a5 | station code |
| | 17-18 | i2 | nominal number of channels |
| | 20-26 | f7.3 | full station capability (% of report period) |

### TABLE 54: STA_STATUS FORMAT (CONTINUED)

| Record | Position | Format | Description |
|---|---|---|---|
| 4-*n* (data) | 28-34 | f7.3 | partial station capability (% of report period) |
| | 36-42 | f7.3 | low station capability (% of report period) |
| | 44-50 | f7.3 | noncapable station (% of report period) |
| | 52-63 | i3,a1,i2,a1,i2, a1,i2 | maximum data time possible (*ddd hh:mm:ss*) |
| | 65-71 | f7.3 | percent of data available at the IDC |
| | 73-83 | i3,a1,i2,a1,f4.1 | median delay of data from station to IDC (*ddd hh:mm:ss.s*) |
| | 85-87 | i3 | number of IDC attempts to retrieve data |
| | 89-91 | i3 | number of successful attempts to retrieve data from auxiliary station |
| | 93-95 | i3 | number of IDC pending data retrievals |

## LOGS

LOG data types are used primarily as administrative messages.

### Error_log

The ERROR_LOG data type is reserved for responses to request messages that contain errors. Specific formats have not been defined at this time, although the request message can be given with the line or lines causing the error identified. The information is provided in free-format comment lines in which the first character is blank. An example of an ERROR_LOG is provided in "Error_log" on page A21.

### FTP_log

In response to a large data request, data are provided via FTP, and the user receives an email message containing information about the location of the file to be retrieved by the requestor using FTP. The FTP_LOG data type is used to convey this information in a consistent manner so that automated data retrieval programs can easily obtain the data.

Common conventions (for example, `.Z` and `.gz`) exist for expressing that a file is compressed. All files should be compressed.

The FTP_LOG data type consists of a free-format FTP_FILE line followed by comment lines, which have a blank as the first character. This data type must contain the information necessary for retrieving the message file.

### Syntax

`ftp_file` *net_address login_mode directory file*

*net_address* — address of machine where data reside (although names are preferred, the IP number may be used)

*login_mode* — `user` | `guest`; if `user`, then the requestor should log in as a user to FTP the data (an account is required); if `guest`, the requestor should log in as anonymous to FTP the data (an account is not required)

*directory* — directory in which the message file will reside (case sensitive)

*file* — name of the file that contains the message (case sensitive)

An example of the FTP_LOG data message is provided in "Ftp_log" on page A24.

## Log

The LOG data type includes free-format comment lines in which the first character of the line is blank. The exact content of the logs is unspecified. An example of the LOG data message is provided in "Log" on page A24.

# Radionuclide Data Messages

This chapter describes the radionuclide data message formats and includes the following topics:

# Radionuclide Data Messages

## INTRODUCTION

Data messages provide a common format for data and data product exchange. Many different types of RMS data may be exchanged using the message formats described herein.

A data message consists of the basic message structure:

- BEGIN line
- MSG_TYPE line
- MSG_ID line
- message body
- STOP line

Within the message body, several data types may be present. The type of data included in a data section are designated with a DATA_TYPE line. Each data section is comprised of distinct data blocks that contain required and supplemental data.

The data types described in this chapter enable the transmittal and processing of data from High-Purity Germaniium (HPGe) and Low-Energy Germanium (LEGe) detectors only. Additional data types will be added soon to enable the transmittal of data from counting systems employing electron-photon coincidence techniques.

### Data_type

Data sections must begin with a DATA_TYPE line. The argument of the DATA_TYPE command designates the type of data that is included in the message section. The RMS data format version (RMS2.0 or RMS1.0) need not be specified in the DATA_TYPE line. The processing code determines the data format based upon certain characteristics found within the data message. No designated line type is used to end a data section. The end of the section is implied by another DATA_TYPE line or a STOP line.

**Syntax**

`data_type` *data_type*

*data_type* the type of RMS data that follows

Possible data types for radionuclide data messages are as follows:

- ALERT_FLOW
- ALERT_SYS
- ALERT_TEMP
- ALERT_UPS
- ARMR
- ARR
- BLANKPHD
- CALIBPHD
- DETBKPHD
- FLOW
- FPEB
- MET
- QCPHD
- RSR
- SAMPLEPHD

Data types generated by the IDC include the Automatic Radionuclide Report (ARR), Atmospheric Radionuclide Measurement Report (ARMR), Radionuclide Summary Report (RSR), and Fission Product Event Bulletin (FPEB). All others are currently sent to the IDC by RMS stations and regional laboratories. Descriptions and formats for each data type are included in this chapter. Examples of each are located in "Appendix A: Data Message Examples" on page A1.

## PULSE HEIGHT DATA

The following five photon pulse height data (PHD) types contain the results of counts performed on either an HPGe detector or a LEGe detector. PHD types for electron-photon coincidence systems will be added at a later date.

- SAMPLEPHD

  This data message type contains PHD acquired by counting a gas or particulate sample with a detector system. See "Samplephd" on page A30 for an example.

- BLANKPHD

  This data message type contains PHD acquired by counting an unexposed filter paper on an HPGe detector. See "Blankphd" on page A15 for an example. Count times for blanks are long (two to three days or more).

- DETBKPHD

  This data message type contains PHD acquired by performing a background count with a detector system. See "Detbkphd" on page A21 for an example. Background counts are performed with empty detector chambers, closed shields, and long count times (two to three days or more).

- CALIBPHD

  This data message type contains PHD acquired by counting a known standard source with a detector system. See "Calibphd" on page A18 for an example. Calibration sources are counted until at least 10,000 counts have been acquired under each photopeak used for the detector calibration.

- QCPHD

  This data message type contains PHD acquired from a brief count of a known standard source with a detector system. See "Qcphd" on page A27 for an example.

Each PHD type is composed of a number of data blocks. The start of a data block is designated by a line containing the block name. All data block names begin with a pound (#) sign.

Depending on the PHD type, some data blocks are required, and some are optional. Table 55 lists the required and optional data blocks for each photon PHD type. Data sections that do not contain the required data blocks are considered incomplete.

TABLE 55: DATA BLOCKS FOR PULSE HEIGHT DATA

| Data Block[1] | SAMPLEPHD | BLANKPHD | DETBKPHD | CALIBPHD | QCPHD |
|---|---|---|---|---|---|
| #Header | r | r | r | r | r |
| #Comment | o | o | o | o | o |
| #Collection | r | | | | |
| #Sample | o | o | o | o | o |
| #Profile | o | o | o | o | o |
| #Acquisition | r | r | r | r | r |
| #Calibration | o | o | o | r | r |
| #Energy | r | r | r | r | r |
| #Resolution | r | r | r | r | r |
| #Efficiency | r | r | r | r | r |
| #Totaleff | o | o | o | o | o |
| #Spectrum | r | r | r | r | r |
| #Certificate | | | | r | r |

1. r = required, o = optional

PHD blocks contain fixed format lines that comprise separate data block records (see "Fixed Format Lines" on page 5). Data blocks may require several records for completion. For example, at least three records must be present in an #Energy block to be valid. The data blocks in a data section are not required to be in order.

The formats of the data blocks listed in Table 55 are described in Tables 56–68. If a required data block is shown as having an undetermined number of possible records (denoted by, for example, 2-*n*), the minimum number of records is one unless specified otherwise.

In the future, the IDC will provide code for converting Canberra Nuclear Format (CNF) files into IMS/IDC-acceptable PHD messages. The converter program will use the latest acceptable message formats when creating PHD messages to be transmitted to the IDC/IMS.

### TABLE 56: #HEADER BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-7 | a7 | `#Header` |
| 2 | 1-5 | a5 | site code |
| | 7-15 | a9 | detector code |
| | 17 | a1 | system type: `p` for particulate, `g` for gas |
| | 19-35 | a17 | sample geometry |
| | 37-40 | a4 | spectrum qualifier: preliminary (`PREL`) or full (`FULL`) |
| | 42-70 | a29 | sample reference identification |
| | 72-103 | a32 | identification number of the first split |
| | 105-139 | a35 | identification number of the second split |
| 3 | 1-31 | a31 | measurement identification |
| | 33-63 | a31 | background measurement identification |
| 4 | 1-10 | i4,a1,i2,a1,i2 | transmit date (*yyyy/mm/dd*) |
| | 12-21 | i2,a1,i2,a1,f4.1 | transmit time (*hh:mm:ss.s*) |

### TABLE 57: #COMMENT BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-8 | a8 | `#Comment` |
| 2-*n* | 1-80 | a80 | free text |

### TABLE 58: #COLLECTION BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-11 | a11 | `#Collection` |
| 2 | 1-10 | i4,a1,i2,a1,i2 | collection start date (*yyyy/mm/dd*) |
| | 12-21 | i2,a1,i2,a1,f4.1 | collection start time (*hh:mm:ss.s*) |
| | 23-32 | i4,a1,i2,a1,i2 | collection stop date (*yyyy/mm/dd*) |
| | 34-43 | i2,a1,i2,a1,f4.1 | collection stop time (*hh:mm:ss.s*) |
| | 45-54 | f10 | total air volume sampled (scm) |

### TABLE 59: #SAMPLE BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-7 | a7 | `#Sample` |
| 2 | 1-5 | f5.2 | sample mass (g) |
| | 7-11 | f5.2 | sample density ($g/cm^3$) |
| | 13-17 | f5.2 | sample height (mm) |

### TABLE 60: #PROFILE BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-8 | a8 | `#Profile` |
| 2-*n* | 1-7 | f7.2 | average flow rate (scm per hour (scm/h)) |
| | 9-15 | f7.2 | average barometric pressure (hectopascal [hPa]) |
| | 17-23 | f7.2 | average outside temperature (°C) |
| | 25-34 | i4,a1,i2,a1,i2 | data sampling end date (*yyyy/mm/dd*) |
| | 36-45 | i2,a1,i2,a1,f4.1 | data sampling end time (*hh:mm:ss.s*) |

### TABLE 61: #ACQUISITION BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-12 | a12 | `#Acquisition` |
| 2 | 1-10 | i4,a1,i2,a1,i2 | acquisition start date (*yyyy/mm/dd*) |
| | 12-21 | i2,a1,i2,a1,f4.1 | acquisition start time (*hh:mm:ss.s*) |
| | 23-36 | f14 | acquisition real time (seconds (s)) |
| | 38-51 | f14 | acquisition live time (s) |

### TABLE 62: #CALIBRATION BLOCK FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-12 | a12 | `#Calibration` |
| 2 | 1-10 | i4,a1,i2,a1,i2 | date of last detector calibration (*yyyy/mm/dd*) |
| | 12-21 | i2,a1,i2,a1,f4.1 | time of last detector calibration (*hh:mm:ss.s*) |

### TABLE 63: #ENERGY BLOCK FORMAT[1]

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-7 | a7 | `#Energy` |
| 2-*n* | 1-16 | f16 | photon energy (keV) |
| | 18-33 | f16 | photopeak centroid channel |
| | 35-50 | f16 | photopeak centroid uncertainty (channels) |

1. An #Energy block must contain at least three records.

### TABLE 64: #RESOLUTION BLOCK FORMAT[1]

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-11 | a11 | `#Resolution` |
| 2-*n* | 1-16 | f16 | photon energy (keV) |
| | 18-33 | f16 | photopeak FWHM (keV) |
| | 35-50 | f16 | photopeak uncertainty (keV) |

1. A #Resolution block must contain at least three records.

### TABLE 65: #EFFICIENCY BLOCK FORMAT[1]

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-11 | a11 | `#Efficiency` |
| 2-*n* | 1-16 | f16 | photon energy (keV) |
| | 18-33 | f16 | photopeak efficiency (counts/photon) |
| | 35-50 | f16 | photopeak efficiency uncertainty (counts/photon) |

1. An #Efficiency block must contain at least three records.

### TABLE 66: #TOTALEFF BLOCK FORMAT[1]

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-9 | a9 | `#Totaleff` |
| 2-*n* | 1-16 | f16 | photon energy (keV) |
| | 18-33 | f16 | total efficiency (counts/photon) |
| | 35-50 | f16 | total efficiency uncertainty (counts/photon) |

1. A #Totaleff block must contain at least three records.

### TABLE 67: #SPECTRUM BLOCK FORMAT[1]

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-9 | a9 | `#Spectrum` |
| 2 | 1-5 | i5 | total number of channels |
| | 7-10 | i4 | energy span (keV) |
| 3-*n* | 1-5 | i5 | channel |
| | 7-16 | i10 | counts at channel + 0 |
| | 18-27 | i10 | counts at channel + 1 |
| | 29-38 | i10 | counts at channel + 2 |
| | 40-49 | i10 | counts at channel + 3 |
| | 51-60 | i10 | counts at channel + 4 |

1. Counts must be reported for at least 4096 channels in a #Spectrum block.

TABLE 68: #CERTIFICATE BLOCK FORMAT[1]

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-12 | a12 | `#Certificate` |
| 2 | 1-10 | i10 | quantity (grams) |
| | 12-21 | i4,a1,i2,a1,i2 | assay date (*yyyy/mm/dd*) |
| | 23-32 | i2,a1,i2,a1,f4.1 | assay time (*hh:mm:ss.s*) |
| 3-*n* | 1-8 | a8 | radionuclide name |
| | 10-32 | a23 | half-life (hours [H], days [D], years [Y]) |
| | 34-41 | f8.3 | photon energy (keV) |
| | 43-50 | f8.3 | of radionuclide activity at time of assay (Becquerel [Bq]) |
| | 52-58 | f7.3 | radionuclide activity uncertainty at time of assay (%) |
| | 60-66 | f7.3 | photon intensity (%) |

1. A #Certificate block must contain at least two records.

Some of the data fields in Tables 56–68 are described in in the following paragraphs.

## Background Measurement Identification

The background measurement identification (BMID) specifies the measurement identification (MID) of the PHD message containing the results of the relevant background count. The background count is subtracted from the acquisition results reported in the PHD message.

## Certificate

"Certificate" refers to the assay report associated with the standard source of known activity used in the acquisition of calibration, energy, resolution, efficiency, and total efficiency data. The `#Certificate` data block is required only in QCPHD or CALIBPHD data messages.

## Energy Span

The spectrum energy range is rounded to the nearest hundred keV. For particulate samples, the energy span will usually be 2000, 3000, or 4000 keV. For noble gas samples, the energy range will generally be 1000 keV or less.

## Energy/Resolution/Efficiency/ Totaleff

Calibration data transmitted in pulse height data messages should be acquired directly from a calibration-source spectrum, not derived with an interpolating function from a calibration-source spectrum. The calibration equations used in the IDC processing are reported in the ARR and ARMR.

## Identification Number of First Split

A sample might be split for archival purposes or, if it is found to contain multiple relevant fission products, several independent analyses are required for confirmation of the sample contents. As a result, each sample part must be uniquely named. The identification number of the first split and second split facilitates this ability (see "Identification Number of Second Split" on page 195). This field is zero-filled for undivided samples.

The first 29 characters of the field are the SRID. The last three characters are a dash, followed by a unique two-digit identifier (from 01 up to the total number of sample splits).

### Syntax

*code-d-date-time-id1*

| | |
|---|---|
| *code* | radionuclide site code |
| *d* | data type (S for SAMPLEPHD, B for BLANKPHD, C for CALIBPHD, and Q for QCPHD) |
| *date* | date of collection or acquisition start (*yyyy/mm/dd*) |
| *time* | time of collection or acquisition start (*hh:mm:ss.s*) |
| *id1* | unique two-digit identifier (i2) |

### Examples

Analysis of a particulate sample from station `NZ003` has shown the presence of several fission products. The Technical Secretariat has asked the sample to be split into four equal parts with each part being sent to one of four certified laboratories for analysis. The following ID numbers are possible for the first split:

```
NZ003-S-1999/08/15-00:32:55.7-01
NZ003-S-1999/08/15-00:32:55.7-02
NZ003-S-1999/08/15-00:32:55.7-03
NZ003-S-1999/08/15-00:32:55.7-04
```

## Identification Number of Second Split

A sample split might be further partitioned, for example, to quantify the reproducibility of the analysis of a sample split. The format for this field is similar to that of the ID number of the first split, however it includes an additional unique two-digit integer (from 1 up to the total number of secondary sample splits) at the end. This field is zero-filled for undivided samples and splits.

The first 32 characters of the field are the ID number of the first split. The last three characters are a dash, followed by a unique two-digit identifier (from 01 up to the total number of split parts).

### Syntax

*code-d-date-time-id1-id2*

| | |
|---|---|
| *code* | radionuclide site code |
| *d* | data type (S for SAMPLEPHD, B for BLANKPHD, C for CALIBPHD, and Q for QCPHD) |
| *date* | date of collection or acquisition start (*yyyy/mm/dd*) |
| *time* | time of collection or acquisition start (*hh:mm:ss.s*) |
| *id1* | unique two-digit identifier assigned to the first split |
| *id1* | unique two-digit identifier assigned to the second split |

### Examples

Upon receipt of the third sample split from the previous example on page 195, a certified laboratory divides the sample split in two. This split quantifies the reproducibility of the analysis results. ID numbers of the second split for these parts are as follows:

```
NZ003-S-1999/08/15-00:32:55.7-03-01
NZ003-S-1999/08/15-00:32:55.7-03-02
```

## Measurement Identification

The measurement identification (MID) uniquely identifies the results of each detector acquisition. The first nine characters are the detector code (see "Radionuclide Detector Codes" on page 16), the tenth character is a dash, and the remaining characters are the date and time of the acquisition start. This MID enables identification of each PHD set acquired with a detector system throughout the RMS.

### Examples

The following example is a possible MID for a particulate sample acquisition performed using a detector located at station KW001. The sample acquisition start is February 6, 1999 at 8:00 p.m.

```
KW001KWA1-1999/02/06-20:00.0
```

The following example is a possible MID for a calibration count performed on a detector at the National Radiation Laboratory in New Zealand. The acquisition start is November 2, 1999 at 9:37:30.5 a.m.

```
NZC14-1999/11/02-09:37:30.5
```

The following example is a possible detector code for a quality control count performed on a detector at station SE001. The sample collection start is May 23, 1999 at 12:00 p.m.

```
SE001-PGD-1999/05/23-12:00:00.0
```

## Sample Geometry

This field describes the sample geometry used during data acquisition and should not be confused with detector geometry. At present, no choices are preset for this field. Consequently, discretion is given to the data sender in adequately describing the sample geometry in 17 characters or less. No blank spaces or backslashes are allowed.

### Examples

```
bigcoil
1/4-filter
5_mL_petri_dish
compressed_filter
detector_top
filter_pellet
In_holder
```

```
normal/face-up
S7_rack-E
```

## Sample Reference Identification[1]

The Sample Reference Identification (SRID) is a unique alphanumeric string that identifies a unique physical entity for which pulse height information was collected. This unique identifier allows a physical entity to be matched with data that describes it. For detector background counts, this field is zero-filled.

The SRID is comprised of the radionuclide site code (see "Radionuclide Site Codes" on page 8) followed by the data type, a date, and time. For collected particulate and gas samples, the site code is that of the RMS station where the sample was collected, while the date and time are those of the sample collection start. For blank filters and calibration sources, the site code is that of the station or laboratory where the entity was counted, and the date and time are those of the detector acquisition start.

### Syntax

*code-d-date-time*

| | |
|---|---|
| *code* | radionuclide site code |
| *d* | data type (S for SAMPLEPHD, B for BLANKPHD, C for CALIBPHD, and Q for QCPHD) |
| *date* | date of collection or acquisition start (*yyyy/mm/dd*) |
| *time* | time of collection or acquisition start (*hh:mm:ss.s*) |

1. Currently, this field syntax is not enforced. If data are not entered into this field using the specified syntax, a zero must be entered as a place holder. Whether this field is zero-filled or not, the data are still parsed and stored in the RMS database.

#### Example

The following example is an SRID for a sample from station FI001. The collection start date and time is 6:50 a.m. 1 April, 1996.

```
FI001-S-1996/04/01-06:50:00.0
```

The following example is an SRID for a blank filter counted at station `CA002`. The acquisition start date and time is 6:50:30.4 p.m. 23 November, 1998.

```
CA002-B-1998/11/23-18:50:30.4
```

The following example is the SRID for a calibration source counted at the National Radiation Laboratory, in Christchurch, New Zealand. This SRID has an acquisition start date and time of exactly midnight on 7 January, 2000.

```
NZC14-C-2000/01/07-00:00:00.0
```

### Spectral Qualifier

Valid values for the spectral qualifier field are preliminary (`PREL`) and full (`FULL`). The FULL count represents the daily spectrum of record. Preliminary counts are sent to the IDC at specified time intervals during the acquisition of the FULL count, and represent the acquisition results accumulated since the start time of the FULL count.

### Total Efficiency

The "total efficiency" of a monoenergetic photon source is the ratio of the total counts detected to the number of photons emitted. This parameter can be useful for correcting peak areas from losses due to cascade summing.

## FLOW RATE DATA

Data messages of DATA_TYPE FLOW contain data from the blower flow rate meter at an RMS station. The format for the FLOW section is given in Table 69 and an example is provided in "Flow" on page A22. The minimum number of records required for this type of data message is one.

In the future, data from this section will be combined with the `#Profile` PHD block, as well as a record from DATA_TYPE MET (see "Meteorological Data" on page 201), to create a new DATA_TYPE (RMSSOH) for state of health data.

### TABLE 69: FLOW DATA FORMAT

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-5 | a5 | station code |
| | 7-12 | i6 | expected sampling interval (s) |
| | 14-19 | i6 | expected sampling duration (s) |
| 2-*n* | 21-30 | i4,a1,i2.a1.i2 | date of sampling interval commencement (*yyyy/mm/dd*) |
| | 31-40 | i2,a1,i2,a1,f4.1 | time of sampling interval commencement (*hh:mm:ss.s*) |
| | 42-47 | i6 | actual sampling duration(s) |
| | 49-58 | f10.4 | average flow rate ($m^3$/h) |
| | 60-69 | f10.6 | flow rate uncertainty ($m^3$/h) |

Some data fields from Table 69 are described in the following sections.

### Actual Sampling Duration

This field describes the actual total time during which data was sampled and averaged and may be different than that of the expected sampling duration.

### Expected Sampling Duration

This field describes the expected total time during which data was sampled and averaged. Data from several sampling durations may be included in a FLOW data message.

### Expected Sampling Interval

This field describes the expected discrete time interval during which flow data are to be sampled. Data from several sampling intervals are averaged to give the average flow rate for a total time duration.

## METEOROLOGICAL DATA

Data messages of DATA_TYPE MET contain meteorological data recorded at an RMS station. The format for the MET data type is given in Table 70, and an example is provided in "Met" on page A25. The minimum number of records required for this type of data message is one.

**TABLE 70: MET DATA FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-5 | a5 | station code |
| 2-*n* | 1-10 | i4,a1,i2,a1,i2 | met start date (*yyyy/mm/dd*) |
| | 12-21 | i2,a1,i2,a1,f4.1 | met start time (*hh:mm:ss.s*) |
| | 23-32 | i4,a1,i2,a1,i2 | met end date (*yyyy/mm/dd*) |
| | 34-43 | i2,a1,i2,a1,f4.1 | met end time (*hh:mm:ss.s*) |
| | 45-47 | i3 | average inside temperature (°C) |

**TABLE 70: MET DATA FORMAT (CONTINUED)**

| Record | Position | Format | Description |
|---|---|---|---|
| 2-*n* | 49-51 | i3 | average outside temperature (°C) |
| | 53-55 | i3 | average wind-direction (degrees from North) |
| | 57-59 | i3 | average wind-speed (km/h) |
| | 61-67 | f7.2 | average barometric pressure (hPa) |
| | 69-71 | i3 | average relative humidity (% relative humidity) |
| | 73-74 | i2 | rainfall (mm) |

## ALERTS

Once their own message type, ALERTS are now a type of data message. The possible alert data types are as follows:

- ALERT_FLOW

  This type of data message indicates that the sampler flow rate is above or below the maximum or minimum IMS required flow rate.

- ALERT_SYSTEM

  This type of data message indicates that the computer controlling the sampler/acquisition system is being rebooted or that the system is shutting down.

- ALERT_TEMP

  This type of data message indicates that a system temperature is outside the IMS required temperature range for that parameter.

- ALERT_UPS

  This type of data message indicates a problem with the Uninterruptable Power Supply (UPS).

More alert data types and formats will be added in the future.

The general format for the ALERT data types is given in Table 71, and an example of each type of ALERT message is provided in "ALERT_FLOW" on page A2.

**TABLE 71: GENERAL ALERT DATA FORMAT**

| Record | Position | Format | Description |
|---|---|---|---|
| 1 | 1-5 | a5 | station code |
| 2-*n* | 1-80 | a512 | free text describing alert |
| *n*+1[1] | 29-38 | i4,a1,i2,a1,i2 | date (*yyyy/mm/dd*) |
| | 40-49 | i2,a1,i2,a1,f4.1 | time (*hh:mm:ss.s*) |

1. *n*+1 should be 3 or greater.

## REPORTS

The following types of radionuclide reports are generated by the IDC and are made available to subscribers as data products:

- ARR (Automated Radionuclide Report)

  The ARR reports results from the automated analysis of a particulate or gas sample.

- ARMR (Atmospheric Radionuclide Measurement Report)

  The ARMR is a revised version of the ARR and is generated after the manual analysis of a particulate or gas sample is complete.

- RSR (RMS Summary Report)

  The RSR gives a summary of all released samples within a designated collect-stop window.

The DATA_TYPEs of these messages are specified as ARR, ARMR, and RSR.

## ARR

The ARR is comprised of the following sections:

- Sample Information

  This section includes information on the sample collection and data acquisition.

- Measurement Categorization

  This section includes the overall category for a sample. If the category level is greater than one, an explanation of the category assignation is also included.

- Activity Summary

  This section includes the concentrations and relative uncertainties of the radionuclides detected in the sample.

- Minimum Detectable Concentration (MDC) for Key Nuclides

  This section lists the half-lives and MDCs of the radionuclides specified in [WG195].

- Peak Search Results

  This section includes information on the peaks identified during automated spectrum analysis.

- Peak Search Notes

  This section includes notes written during the automated analysis process.

- Processing Parameters

  This section includes the settings used by the *rms_analyze* software unit to identify peaks and quantify peak characteristics. (See [IDC7.1.7] for a description of the *rms_analyze* software unit.)

- Update Parameters

  This section lists the settings used by the *rms_analyze* software unit to update the energy and resolution calibration curves.

- Data Quality Flags

  This section lists values for state of health and data quality parameters, acceptable values for these parameters, and test results (`PASS/FAIL`).

- Event Screening Flags

  This section lists the anthropogenic radionuclides detected, as well as the station-dependent frequency of detection for each nuclide.

- Calibration Equations

  This section includes the energy, resolution, and efficiency calibration equations generated during automated analysis.

- Field of Regard

  This section includes a hypertext link that can be accessed to display atmospheric modeling results for the surrounding region.

An example of an Automated Radionuclide Report is provided in "ARR" on page A8. Some of the data fields are described below. More information on processing parameters, update parameters, data quality flags, event screening flags, and calibration equations can be found in [IDC5.2.2].

### %Eff

This parameter is the detector efficiency relative to a standard 3X3-inch cylindrical NaI(Tl) crystal with a source-to-detector distance of 25 cm. The `%Eff` is given in percent.

### %Uncer

This parameter is the $1\sigma$ uncertainty of the net area, reported in percentage of net area.

### Allow Multiplets

This parameter can have one of two values: `Off` or `On`. When `Allow Multiplets` is `On`, the *rms_analyze* software unit allows multiplets to be used in update matching. When `Allow Multiplets` is `Off`, multiplets are not allowed.

### Avg Flow Rate

This field contains the average blower flow rate in scm/h and is equivalent to the `Sample Quantity` divided by the `Sampling Time`.

### Baseline Channels

This parameter gives the number of channels to the left and right of a Region-of-Interest (ROI) that are used in estimating the background contribution under a peak.

### Baseline Type

This parameter describes the type of equation used for estimating the shape of the background under a peak. The `Baseline Type` can be either `STEP`, indicating a step-function, or `LINEAR`.

### Centroid

Photopeak and ROI centroids are reported in units of channels.

### Collection Station Comments

This field contains any comments made by station personnel.

### Confidence Threshold

This parameter is a confidence factor used in the nuclide identification process. The lower the `Confidence Threshold`, the more likely a possible peak will be accepted.

### Critical-level Test

This parameter can also have one of two values: `Off` or `On`. When `Critical Level Test` is `On`, the *rms_analyze* software unit tests whether the gross peak area exceeds 1.64 times the background standard deviation. Peaks that exceed this limit have less than a 10% probability of originating from a fluctuation in background radiation.

### Detector Type

This field describes the kind of detector used in the acquisition process. Possible detector types include:

- HPGe n

  This detector type describes an n-type HPGe detector, that is, one with a germanium crystal doped with donor atoms at impurity concentration levels.

- HPGe p

  This detector type describes a p-type HPGe detector, that is, one with a germanium crystal doped with acceptor atoms at impurity concentration levels.

- inHPGe

  This detector type describes an intrinsic HPGe detector, that is, one with a germanium crystal of extremely high purity.

- HPGe

  This detector type describes an HPGe detector of unknown carrier type.

- LEGe

  This detector type describes a low-energy germanium detector. This is an acceptable detector type for noble gas monitoring.

Detector types to describe those employing electron-photon coincidence techniques will be added soon.

### Energy Tolerance

The *rms_analyze* software unit will associate a photopeak with a certain nuclide when the peak centroid falls within the `Energy Tolerance` of the photon energy listed in the nuclide library.

### Estimate Peak Widths

This parameter can have one of two values: `Off` or `On`. When `Estimate Peak Widths` is `Off`, the *rms_analyze* software unit calculates peak widths with a peak fitting equation. Otherwise, the *rms_analyze* software unit uses resolution calibration data to determine peak widths.

### Fit Singles

This parameter can have one of two values: `Off` or `On`. When `Fit Singles` is `On`, the *rms_analyze* software unit determines ROI areas using a Gaussian fitting function. When `Fit Singles` is `Off`, the *rms_analyze* software unit determines ROI areas using a simple summation. ROI areas for multiplets are always determined using a Gaussian fit.

### Force Linear

This parameter can have one of two values: `Off` or `On`. When `Force Linear` is `On`, the *rms_analyze* software unit uses a linear fit for the energy vs. channel regression (ECR). When `Force Linear` is `Off`, the *rms_analyze* software unit uses the type of polynomial that best fits the data for the ECR. The maximum polynomial order is three, that is, a cubic polynomial.

### FWHM

This parameter gives the full width at half-max (FWHM) of a photopeak or ROI, that is, the peak width at half the maximum peak height. The FWHM is reported in keV.

### FWHM Limits

The `Left FWHM limit`, the `Right FWHM limit`, and the `Multiplet FWHM limit` confine the width of a ROI. These parameters are given in units of FWHMs.

### Gain Shift

This parameter is the shift in gain used by *rms_analyze* in the iterative process of locating reference (ref) lines during update processing. The `Gain Shift` is given in percent and is used with the `Zero Shift` below in determining the energy step interval used in finding the ref lines from an original estimated energy value.

### K40_LocationDifference

This parameter is the distance between a sample's K-40 photopeak centroid and that of the MRP, which is reported in units of channels. If `Use MRP` is `OFF`, then this data quality test is not performed.

### Lookup Tol Floor

This parameter is the minimum energy tolerance for matching peaks with nuclides during the update processing.

### Minimum Area

Ref lines with net peak areas less than the `Minimum Area` are not used in the update process.

### Most Recent Prior Sample

This parameter is the sample ID (SID) of the most recent prior (MRP).

#### Net Area

The Net Area is the total number of counts in a ROI that is not associated with background radiation levels.

#### NormalizedGainDifference

The gain is determined by dividing the difference in peak energies for the highest and lowest ref lines by the difference in centroid channels for the highest and lowest ref lines. The normalized gain is determined by dividing the gain by the total spectrum gain, that is, the result from dividing the difference in the highest and lowest spectrum energies by the total spectrum channels. The NormalizedGainDifference is then the difference between a sample's normalized gain and the normalized gain of the MRP. A small value for the NormalizedGainDifference is indicative of a very stable detector system – especially stable electronics.

#### Nts

This parameter is a number assigned to an explanatory footnote that is located at the end of the Peak Search Results section.

#### Perform Subtraction

This parameter can have one of two values: Off or On. When Perform Subtraction is On, the *rms_analyze* software unit performs a ROI-by-ROI blank subtraction.

#### Sample ID

This is a unique number assigned to a PHD message by the IDC. This number is referenced in all data products resulting from the PHD set with that SID.

#### Sample Quantity

This field describes the total atmospheric air volume sampled (in scm).

### Sampling Time

This field is the sample collection duration and is equal to the difference in the `Collection Stop` and `Collection Start` times.

### Station Type

This field contains a descriptor of the monitoring station. Some possible station types include:

- ISAR

  International Surveillance of Atmospheric Radionuclides station developed and produced by Pacific-Sierra Research Corp., Arlington, VA, U.S.A. in conjunction with the Defense Research Establishment (FOA), Stockholm, Sweden.

- RASA

  Radionuclide Aerosol Sampler/Analyzer unit developed by Pacific Northwest National Laboratory, Richland, WA, U.S.A. and produced by DME Corp., Orlando, FL, U.S.A.

- XPU

  Xenon Processing Unit developed and produced by FOA, Stockholm, Sweden

- ARSA

  Automated Radioxenon Sampler/Analyzer unit developed by Pacific Northwest National Laboratory, Richland, WA, U.S.A. and produced by DME Corp., Orlando, FL, U.S.A..

More station types will be added in the future.

#### Threshold

When the width of a possible photopeak is greater than the `Threshold` multiplied by the peak centroid's standard deviation, the possible peak is accepted and analyzed as a true spectrum line. The `Threshold` can have any value between zero and three, including three.

#### UNKNAT

Certain photopeaks are frequently observed in spectra, but the radionuclides or processes responsible for these peaks have yet to be explicitly defined. Such peaks are denoted by the series, UNKNAT01, UNKNAT02, UNKNAT03. The energies of these lines are listed in Table 72.

**TABLE 72: ENERGIES OF UNKNAT LINES**

| Name | Energy (keV) |
|---|---|
| UNKNAT01 | 803.1 |
| UNKNAT02 | 558.5 |
| UNKNAT03 | 962.1 |

#### Use MRP

This parameter can have one of two values: `Yes` or `No`. When `Use MRP` is `Yes`, the *rms_analyze* software unit uses the energy and resolution data from the MRP sample in the update process. The MRP is the sample counted most recently on the detector, originating from the same station as the sample of interest. When `Use MRP` is `No`, the *rms_analyze* software unit uses the energy and resolution pair data of the present sample.

#### Use Weights

This parameter can have one of two values: `Off` or `On`. When `Use Weights` is `On`, the *rms_analyze* software unit determines calibration regression lines by weighting peaks according to their size and area uncertainty. When `Use Weights` is `Off`, all peaks are weighted equally.

#### Width

This field contains the total number of channels in which the photopeak or ROI of interest is observed.

#### Zero Shift

This parameter is the channel shift in the zero energy point used by *rms_analyze* in the iterative process of locating ref lines during update processing. The `Zero Shift` is given in channels and is used with the `Gain Shift` above in determining the energy step interval used in finding the ref lines from an original estimated energy value.

### ARMR

All sections in the ARR are also found in the ARMR, including one additional section: Spectral-Region-of-Interest Editing. The ARMR is a product of the manual review of the automated results by an IDC analyst. The Spectral-Region-of-Interest Editing section summarizes the number of peaks added, deleted, and modified by the analyst.

An example of an ARMR is provided in "ARMR" on page A3.

### RMS Summary Report

The RMS Summary Report is comprised of the following sections:

- Measurement Categorization Summary

  This section lists samples with category 2, 3, 4, and 5 for the summary period. See [IDC7.1.7] for more details on categorization and category numbering.

- Man-made Radionuclide Summary

  This section lists the collection times and locations of all man-made radionuclides detected during the summary period.

- Data Receipt Summary

  This section lists the PHD messages received at the IDC during the summary period.

- Minimum Detectable Concentration (MDC) Summary

  This section lists the ratios of median station MDCs (calculated for the time period desired) to maximum station MDCs for the station/nuclide combinations given in CD-WP224.

An example of an RSR is provided in "RSR" on page A28.

## LABORATORY ANALYSIS RESULTS

(To be added at a later date)

## FISSION PRODUCT EVENT BULLETIN

The Fission Product Event Bulletin (FPEB) is designated as DATA_TYPE FPEB. The FPEB is comprised of the following sections:

- Event Window

  This section summarizes information about the event.

- Regional Source Location

  This section includes a description and map of the event location.

- Event Detection Summary

  This section summarizes the sample characteristics that resulted in the creation of the FPEB.

- Isotopic Ratios

  This section includes any isotopic ratios (for example, $^{134}Cs/^{137}Cs$) resulting from sample analysis.

- Certified Laboratory Results

  This section includes any sample analysis results performed at a certified radionuclide laboratory.

An example of an FPEB is provided in "FPEB" on page A23.

# Station AutoDRM Basics

This chapter describes the basic *AutoDRM* capabilities that are needed for auxiliary seismic stations and includes the following topics:

# Station AutoDRM Basics

## INTRODUCTION

Stations and NDCs providing station data must have a minimum capability to provide data to the IDC through the message system. Clearly, all of the functionality of the request and data messages cannot be supported by these stations to the full extent, and a minimal *AutoDRM* capability is all that is necessary. This chapter describes the minimal *AutoDRM* configuration necessary to fulfill the duties of an auxiliary station supplying data in IMS1.0 format.

## BASIC MESSAGE SUPPORT

A station/NDC providing segmented data must adhere to all of the basic message conventions on size, line length, date-time formats, station and channel naming, and use of units. The following sections describe the basic message formats that must be supported.

### Begin Line

All messages must contain the BEGIN line and must support IMS1.0 format.

### Msg_type

The `request` message type must be supported for receiving requests; the `data` message type must be supported for sending data messages.

### Msg_id

The message identification string and optional source in the MSG_ID line must be recognized in request messages, and a unique message identification string must be generated for data messages.

### Ref_id

The message identification of the request message must be used as the reference identifier of the returned data message.

### E-mail Line

Email must be supported as a data return mechanism. FTP is not required.

## ENVIRONMENT LINES

Many of the environment lines described in the chapter on Request Messages are not applicable to a limited station capability for *AutoDRM*s. The only variable that must be explicitly specified is TIME. If STA_LIST and CHAN_LIST are not explicitly specified, the default values of all stations and all channels are assumed. The AUX_LIST environment is required only if necessary to distinguish between two different data streams. Using these environments, simple requests can be made that obtain data from a particular station and channel within a specified time interval.

## REQUEST LINES

The request lines specify the data that can be obtained from the *AutoDRM*. A simple station *AutoDRM* should be able to provide WAVEFORM, STATION, CHANNEL, RESPONSE, and OUTAGE data.

Request lines may have one or more arguments that specify subtype, formats, and subformats. A simple *AutoDRM* must support the IMS1.0 format as the main format for all requests, as well as one of the ASCII subformats (INT, CM6, or AU6) for waveforms.

## DATA TYPES

Data messages are sent in response to requests sent to the *AutoDRM*. Thus, WAVEFORM, STATION, CHANNEL, RESPONSE, and radionuclide data types must be supported by a simple *AutoDRM* in the IMS1.0 format.

## AUTODRM IMPLEMENTATION SAFEGUARDS

Responding to requests in an automatic system requires safeguards against repeated requests, excessive numbers of requests, excessively large requests, and failures of the email system (for example, returned mail). Although each installation of the *AutoDRM* will be different, some general guidelines are suggested to avoid major problems.

### Message Size

Messages returned by email will have a maximum size of 1 megabyte. Each *AutoDRM* site may set their own limit for the maximum size of an FTP message, and may give priority to trusted users as they see fit.

### Request Echo

The original request message should be echoed in the returned data message as a LOG data type.

### Repeat Requests

Repeated requests for the same data by the same requestor within 10 minutes of the original request may be ignored by an *AutoDRM*.

### Returned Messages

An error in the address for a data message sent out by an *AutoDRM* will result in an email returned to the *AutoDRM* by the email system. The sender's name (before the @ character in the mail address) for such an email will be either mailer-daemon or postmaster (with any combination of upper- and lowercase letters). The *AutoDRM* will forward these messages to the local *AutoDRM*-operator; no other action is taken and no response is sent. The *AutoDRM* may also recognize returned messages by the MSG_TYPE, which will be `data`, or by the presence of a REF_ID line, which is not used in request messages.

### Syntax Errors

In case any syntax error is detected while processing a request message, a ERROR_LOG data message is returned. Also, if a request is made with a keyword that has not been implemented, a ERROR_LOG data message is sent.

A serious syntax error anywhere in a message should abort the entire message, but local policy can override this suggestion.

### AutoDRM Internal Problem Logging

Any problem other than a syntax error revealed during processing of a request message should be reported to the *AutoDRM* operator who should take appropriate action. All request messages must be answered; ERROR_LOG data message is sent as response for these types of errors.

### AutoDRM Operation Logs

All local *AutoDRM* installations should keep logs of incoming and outgoing messages, parameters of MSG_ID lines, volume of data transferred, and Universal Coordinated Times (UTC) of message receipt and dispatch.

## HELP RECOMMENDATIONS

The HELP mechanism can be used to convey a wide variety of information. The following topics can be included in an *AutoDRM* HELP message. At a minimum, every HELP message contains the items shown in **bold**.

Introduction

- information about the local data center
- **email address of local contact** (in case of problems)
- recently added features
- date that the HELP message was last updated

Description of message formats and protocols

- basic message format
- sending and receiving email through *AutoDRM*

Description of commands understood by this *AutoDRM*

- **supported environments**
- **supported data types**
  - **supported subtypes, default subtype**
  - **supported subformats, default subformats**
- local extensions

Local limits

- maximum size of email message
- maximum size of FTP message
- types of requests that will be rejected (for example, sent by root or mailer-daemon)
- repeated identical requests from the same user over a short interval

Local data

- description of what data types are available from what stations/channels

- description of local data archives
  - segmented versus continuous
  - delay in data collection (how soon after real time is data available)
  - time period during which data are available

# References

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[IDC7.1.7] Pacific-Sierra Research Corporation, *Radionuclide Detection Processing*, PSR-98/TN1123, 1998.

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[Moo96] Moore, K., *Request for Comment 2047: MIME (Multipurpose Internet Mail Extensions) Part Three: Message Header Extensions for Non-ASCII Text*, November 1996.
(online) `http://www.cis.ohio-state.edu/htbin/rfc/rfc2047.html`

[PKCS-7] PKCS #7: Cryptographic Message Syntax, Internet Draft draft-hoffman-pkcs-crypt-msg.

[WG195] Working Group 1, *Radionuclide Monitoring*, Ad Hoc Committee on a Nuclear Test Ban, WG1/NTB/224, 1995.

# Appendix A: Data Message Examples

This appendix contains examples of formatted data messages. Some of the examples wrap onto the next line and appear as they would on a computer screen.

# Appendix A: Data Message Examples

## ALERT_FLOW

```
DATA_TYPE ALERT_FLOW
RU001
DEBRIS IS STUCK IN THE INTAKE PIPE! Stopping blower for cleanup!
1999-09-29 14:51:19.1
```

## ALERT_SYSTEM

```
DATA_TYPE ALERT_SYSTEM
AU003
THE SYSTEM IS BEING SHUTDOWN!
1999-04-09 08:23:55.4
```

## ALERT_TEMP

```
DATA_TYPE ALERT_SYSTEM
CA004
Detector crystal temp. is too high! Shutting system down!
1999-10-13 22:30:04.9
```

## ALERT_UPS

```
DATA_TYPE ALERT_UPS
US001
UPS AC line power failure time exceeded! System stopping!
1999-02-22 10:45:55.5
```

## ARMR

```
DATA_TYPE ARMR

                         PIDC GENERATED REPORT
             ATMOSPHERIC RADIONUCLIDE MEASUREMENT REPORT
                          Particulate Version

SAMPLE INFORMATION ======================================================


Station ID:         CA002               Detector ID:        CA002CAA2
Station Type:       ISAR2               Detector Type:      HPGe p


Station Location: Vancouver, Canada
Detector Description: Detector A in Vancouver, Canada


Sample ID:             0023593          Sample Geometry:    DISK
Sample Quantity:      22710.00 m3       Sample Type:        Particulate



Collection Start:   1998/10/27 01:31    Sampling Time:        23.65 hours
Collection Stop:    1998/10/28 01:10    Decay Time:           24.79 hours
Acquisition Start:  1998/10/29 01:58    Acquisition Time:     23.31 hours
Acquisition Stop:   1998/10/30 01:16    Avg Flow Rate:       960.25 m3/hr


Collection Station Comments:
ermias - ubc928 Detector 1 Ranger (29-OCT-1998)


IDC Analysis General Comments:
Analysis 1998/10/29 20:19:15




MEASUREMENT CATEGORIZATION ==============================================


Categorization Legend
---------------------
Level 1  =  Typical Background Rad. Meas.
Level 2  =  Anomalous Background Rad. Meas.
Level 3  =  Typical Anthropogenic Rad. Meas.
Level 4  =  Anomalous Anthropogenic Rad. Meas.
Level 5  =  Mult. Abnormal Anthropogenic Rad. Meas.


Spectrum Category (4) -- Anomalous Anthropogenic Rad. Meas.


Categorization Summary:


Name       Category   Categorization Comment
----       --------   ----------------------
TE-123M       2        Not Regularly Measured
EU-155        4        Not Regularly Measured

ACTIVITY SUMMARY ========================================================
```

```
NATURAL RADIOACTIVITY:

Nuclides Identified and not Quantified:

AC-228, BI-212, BI-214, K-40, PB-214, TL-208, UNKNAT01, UNKNAT03

Nuclides Quantified:

Nuclide            Half-Life           Conc(uBq/m3)        %RelErr        Notes

BE-7               53.3 D                 1.9E+03          3.20
PB-212             10.64 H                8.1E+03          8.10

ACTIVATION-PRODUCT RADIOACTIVITY:

I-123              13.13 H                7.7E+02          3.61
TE-123M            119.7 D                     68          3.61

FISSION-PRODUCT RADIOACTIVITY:

EU-155             4.76 Y                       2        122.87

MINIMUM DETECTABLE CONCENTRATION FOR KEY NUCLIDES ======================

Nuclide            Half-Life              MDC(uBq/m3)

BA-140             12.75 D                   8.64
CE-143             1.4 D                    12.61
CS-134             2.06135 Y                 2.74
CS-136             13.16 D                   2.61
CS-137             30.0197 Y                 2.61
I-131              8.04 D                    2.82
I-133              20.8 H                   10.74
MO-99              65.94 H                  30.58
NB-95              35.15 D                   2.57
RU-103             39.26 D                   2.21
TE-132             78.2 H                    3.15
ZR-95              64.02 D                   4.49
ZR-97              17 H                     16.06

PEAK SEARCH RESULTS =====================================================

      33 peaks found in spectrum by automated peak search.
      33 peaks associated with nuclides by automated processing.
       0 peaks not associated with nuclides by automated processing.
     100 percent of peaks were associated with nuclides.

Note: "*" indicates that a peak was a component of a multiplet.
```

```
 Energy   Centroid   Width  FWHM    %Eff    Net Area     %RelErr   Nuclide   Nts


  44.83     92.24        8  1.55    5.76      668.08     18.73      EU-155
  53.60    110.17       10  1.44    7.71      266.89     32.49      PB-214
  74.80    153.51 *     15  1.32   10.59     7836.51      1.65      PB-212
  74.80    153.51 *     15  1.32   10.59     7836.51      1.65      PB-214
  74.80    153.51 *     15  1.32   10.59     7836.51      1.65      TL-208
  77.08    158.17 *     15  1.32   10.76    12106.68      1.40      BI-214
  77.08    158.17 *     15  1.32   10.76    12106.68      1.40      PB-212
  77.08    158.17 *     15  1.32   10.76    12106.68      1.40      PB-214
  87.15    178.76 *     16  1.40   11.31     4565.86      2.78      EU-155
  87.15    178.76 *     16  1.40   11.31     4565.86      2.78      PB-212
  87.15    178.76 *     16  1.40   11.31     4565.86      2.78      PB-214
  89.88    184.34 *     16  1.40   11.40     1316.21      4.88      AC-228
  89.88    184.34 *     16  1.40   11.40     1316.21      4.88      BI-214
  89.88    184.34 *     16  1.40   11.40     1316.21      4.88      PB-212
 115.16    236.05       10  1.03   11.55      373.32     19.30      PB-212
 158.98    325.66       11  1.31   10.49    11332.32      1.59      I-123
 158.98    325.66       11  1.31   10.49    11332.32      1.59      TE-123M
 238.63    488.59       12  1.36    8.23    28748.37      0.91      PB-212
 277.36    567.84       12  1.44    7.34     1086.72      7.19      TL-208
 295.23    604.40 *     23  1.50    6.99      294.65     12.38      PB-214
 300.11    614.40 *     23  1.51    6.89     1697.73      5.08      PB-212
 338.52    693.00       12  0.91    6.23      132.89     30.78      AC-228
 351.97    720.52       10  1.14    6.03      337.60     15.15      PB-214
 477.60    977.73       14  1.54    4.59    16395.45      1.18      AC-228
 477.60    977.73       14  1.54    4.59    16395.45      1.18      BE-7
 510.81   1045.72       14  1.93    4.31     3685.18      2.85      TL-208
 583.21   1194.00       14  1.63    3.81     8711.32      1.66      AC-228
 583.21   1194.00       14  1.63    3.81     8711.32      1.66      TL-208
 609.38   1247.61       15  1.62    3.65      340.86     13.18      BI-214
 727.32   1489.22       15  1.79    3.09     1850.16      3.93      AC-228
 727.32   1489.22       15  1.79    3.09     1850.16      3.93      BI-212
 763.26   1562.85       13  1.66    2.95      159.71     20.07      TL-208
 785.49   1608.41       15  1.90    2.87      252.13     14.68      BI-212
 785.49   1608.41       15  1.90    2.87      252.13     14.68      BI-214
 785.49   1608.41       15  1.90    2.87      252.13     14.68      PB-214
 802.84   1643.97       11  0.89    2.82       48.40     39.86      UNKNAT01
 860.54   1762.20       16  1.86    2.64     1103.41      5.37      TL-208
 893.02   1828.76       10  1.49    2.55       55.02     45.91      BI-212
 911.21   1866.05       16  2.12    2.50      184.92     18.00      AC-228
 962.26   1970.67 *     24  1.74    2.38      106.39     22.26      UNKNAT03
 968.89   1984.25 *     24  1.75    2.37       73.68     26.35      AC-228
1078.76   2209.46       13  1.66    2.15      119.44     22.62      BI-212
1093.84   2240.36       17  1.42    2.12       90.49     28.29      TL-208
1460.81   2992.53       19  2.23    1.65     3117.45      2.77      K-40
1512.22   3097.90       16  2.69    1.61       87.10     27.20      BI-212
1592.28   3261.96       16  2.29    1.55      225.23     13.55      TL-208
1620.66   3320.10       15  1.97    1.52      211.80     14.25      BI-212


SPECTRAL-REGION-OF-INTEREST (SROI) EDITING =============================


PEAKS ADDED: none


PEAKS DELETED: none


SROIs MODIFIED: none


Nuclide ID Changes:
```

```
   Average Concentration Differences: none
   Nuclides Entering: none
   Nuclides Leaving: none

PROCESSING PARAMETERS ==================================================

Threshold:                3
Peak Start (keV):         42
Peak End (keV):           1990
Left FWHM limit:          2
Right FWHM limit:         2
Multiplet FWHM limit:     4
Fit Singlets:             On
Critical-level Test:      On
Estimate Peak Widths:     On
Baseline Type:            STEP
Baseline Channels:        3
Perform Subtraction:      Off
Energy Tolerance          0.75
Confidence Threshold      0.25

UPDATE PARAMETERS ======================================================

Use MRP:                  Yes
Most Recent Prior sample: Used
Gain Shift (%):           0.1
Zero Shift (Channels):    0.5
Minumum Area:             100
Use Weights:              On
Allow Multiplets:         On
Force Linear:             Off
Lookup Tol Floor (keV):   0.2
Default RER Intercept:    0.8
Default RER Slope:        0.03
Default ECR Slope:        0.488281

DATA QUALITY FLAGS =====================================================

Name                           Pass/Fail  Value           Test

FlowRate                       PASS       960.242         >500
Ba140_MDC                      PASS       8.63981         <30
Be7_FWHM                       PASS       1.54202         <1.7
K40_LocationDifference         PASS       0.0625          <3*std deviation
NormalizedGainDifference       FAIL       0.000155754     <0.0001

EVENT SCREENING FLAGS ==================================================

Activation Products present in this spectrum             Yes
     Number of days since last activation product        59.8716

One fission product in spectrum                          Yes
     Number of days since last fission product           0.0120602

2 or more fission products in spectrum                   No
     Number of days since 2 or more fission products     Never Seen
```

```
Cs-137 present in spectrum                                 No
     Number of times seen in last 30 days                  Never Seen

CALIBRATION EQUATIONS ==================================================


Energy vs. Channel


    E(c) = -0.2963 + 0.4893*c - 5.808E-07*c^2 + 7.949E-11*c^3


       E = energy (keV)
       c = channel number



Resolution vs. Energy


    FWHM(E) = 0.79 + 0.03582*SQRT(E)


       FWHM = Full Width Half Max (keV)
       E = energy (keV)



Efficiency vs. Energy


    L(E) = ln(962.1/E)


    e(E) = exp { -3.738 + 0.9178*L + 0.07541*L^2
     - 0.07795*L^3 + 0.01588*L^4 - 0.006628*L^5 }


       e = efficiency (counts/gamma)
       E = energy (keV)

FIELD OF REGARD ======================================================


http://www.pidc.org//for/US001/1998/300
```

## ARR

```
DATA_TYPE ARR

                              PIDC GENERATED REPORT
                          AUTOMATED RADIONUCLIDE REPORT
                               Particulate Version

SAMPLE INFORMATION ======================================================

Station ID:         CA002               Detector ID:        CA002CAA2
Station Type:       ISAR2               Detector Type:      HPGe p

Station Location: Vancouver, Canada
Detector Description: Detector A in Vancouver, Canada

Sample ID:             0023593          Sample Geometry:    DISK
Sample Quantity:      22710.00 m3       Sample Type:        Particulate

Collection Start:   1998/10/27 01:31    Sampling Time:        23.65 hours
Collection Stop:    1998/10/28 01:10    Decay Time:           24.79 hours
Acquisition Start:  1998/10/29 01:58    Acquisition Time:     23.31 hours
Acquisition Stop:   1998/10/30 01:16    Avg Flow Rate:       960.25 m3/hr

Collection Station Comments:
ermias - ubc928 Detector 1 Ranger (29-OCT-1998)

IDC Analysis General Comments:
Analysis 1998/10/29 20:19:15

MEASUREMENT CATEGORIZATION ==============================================

Categorization Legend
---------------------
Level 1  =  Typical Background Rad. Meas.
Level 2  =  Anomalous Background Rad. Meas.
Level 3  =  Typical Anthropogenic Rad. Meas.
Level 4  =  Anomalous Anthropogenic Rad. Meas.
Level 5  =  Mult. Abnormal Anthropogenic Rad. Meas.

Spectrum Category (4) -- Anomalous Anthropogenic Rad. Meas.

Categorization Summary:

Name       Category   Categorization Comment
----       --------   ----------------------
TE-123M       2        Not Regularly Measured
EU-155        4        Not Regularly Measured

ACTIVITY SUMMARY ========================================================

NATURAL RADIOACTIVITY:
```

```
Nuclides Identified and not Quantified:

AC-228, BI-212, BI-214, K-40, PB-214, TL-208, UNKNAT01, UNKNAT03

Nuclides Quantified:

Nuclide            Half-Life           Conc(uBq/m3)        %RelErr        Notes


BE-7               53.3 D                 1.9E+03          3.20
PB-212             10.64 H                8.1E+03          8.10

ACTIVATION-PRODUCT RADIOACTIVITY:


I-123              13.13 H                7.7E+02          3.61
TE-123M            119.7 D                     68          3.61

FISSION-PRODUCT RADIOACTIVITY:


EU-155             4.76 Y                       2        122.87

MINIMUM DETECTABLE CONCENTRATION FOR KEY NUCLIDES =======================


Nuclide            Half-Life              MDC(uBq/m3)


BA-140             12.75 D                     8.64
CE-143             1.4 D                      12.61
CS-134             2.06135 Y                   2.74
CS-136             13.16 D                     2.61
CS-137             30.0197 Y                   2.61
I-131              8.04 D                      2.82
I-133              20.8 H                     10.74
MO-99              65.94 H                    30.58
NB-95              35.15 D                     2.57
RU-103             39.26 D                     2.21
TE-132             78.2 H                      3.15
ZR-95              64.02 D                     4.49
ZR-97              17 H                       16.06

PEAK SEARCH RESULTS =====================================================


      33 peaks found in spectrum by automated peak search.
      33 peaks associated with nuclides by automated processing.
       0 peaks not associated with nuclides by automated processing.
     100 percent of peaks were associated with nuclides.

Note: "*" indicates that a peak was a component of a multiplet.

Energy   Centroid   Width  FWHM    %Eff    Net Area     %RelErr   Nuclide   Nts


  44.83    92.24        8   1.55    5.76       668.08     18.73     EU-155
```

```
   53.60   110.17        10   1.44    7.71      266.89     32.49     PB-214
   74.80   153.51 *      15   1.32   10.59     7836.51      1.65     PB-212
   74.80   153.51 *      15   1.32   10.59     7836.51      1.65     PB-214
   74.80   153.51 *      15   1.32   10.59     7836.51      1.65     TL-208
   77.08   158.17 *      15   1.32   10.76    12106.68      1.40     BI-214
   77.08   158.17 *      15   1.32   10.76    12106.68      1.40     PB-212
   77.08   158.17 *      15   1.32   10.76    12106.68      1.40     PB-214
   87.15   178.76 *      16   1.40   11.31     4565.86      2.78     EU-155
   87.15   178.76 *      16   1.40   11.31     4565.86      2.78     PB-212
   87.15   178.76 *      16   1.40   11.31     4565.86      2.78     PB-214
   89.88   184.34 *      16   1.40   11.40     1316.21      4.88     AC-228
   89.88   184.34 *      16   1.40   11.40     1316.21      4.88     BI-214
   89.88   184.34 *      16   1.40   11.40     1316.21      4.88     PB-212
  115.16   236.05        10   1.03   11.55      373.32     19.30     PB-212
  158.98   325.66        11   1.31   10.49    11332.32      1.59     I-123
  158.98   325.66        11   1.31   10.49    11332.32      1.59     TE-123M
  238.63   488.59        12   1.36    8.23    28748.37      0.91     PB-212
  277.36   567.84        12   1.44    7.34     1086.72      7.19     TL-208
  295.23   604.40 *      23   1.50    6.99      294.65     12.38     PB-214
  300.11   614.40 *      23   1.51    6.89     1697.73      5.08     PB-212
  338.52   693.00        12   0.91    6.23      132.89     30.78     AC-228
  351.97   720.52        10   1.14    6.03      337.60     15.15     PB-214
  477.60   977.73        14   1.54    4.59    16395.45      1.18     AC-228
  477.60   977.73        14   1.54    4.59    16395.45      1.18     BE-7
  510.81  1045.72        14   1.93    4.31     3685.18      2.85     TL-208
  583.21  1194.00        14   1.63    3.81     8711.32      1.66     AC-228
  583.21  1194.00        14   1.63    3.81     8711.32      1.66     TL-208
  609.38  1247.61        15   1.62    3.65      340.86     13.18     BI-214
  727.32  1489.22        15   1.79    3.09     1850.16      3.93     AC-228
  727.32  1489.22        15   1.79    3.09     1850.16      3.93     BI-212
  763.26  1562.85        13   1.66    2.95      159.71     20.07     TL-208
  785.49  1608.41        15   1.90    2.87      252.13     14.68     BI-212
  785.49  1608.41        15   1.90    2.87      252.13     14.68     BI-214
  785.49  1608.41        15   1.90    2.87      252.13     14.68     PB-214
  802.84  1643.97        11   0.89    2.82       48.40     39.86     UNKNAT01
  860.54  1762.20        16   1.86    2.64     1103.41      5.37     TL-208
  893.02  1828.76        10   1.49    2.55       55.02     45.91     BI-212
  911.21  1866.05        16   2.12    2.50      184.92     18.00     AC-228
  962.26  1970.67 *      24   1.74    2.38      106.39     22.26     UNKNAT03
  968.89  1984.25 *      24   1.75    2.37       73.68     26.35     AC-228
 1078.76  2209.46        13   1.66    2.15      119.44     22.62     BI-212
 1093.84  2240.36        17   1.42    2.12       90.49     28.29     TL-208
 1460.81  2992.53        19   2.23    1.65     3117.45      2.77     K-40
 1512.22  3097.90        16   2.69    1.61       87.10     27.20     BI-212
 1592.28  3261.96        16   2.29    1.55      225.23     13.55     TL-208
 1620.66  3320.10        15   1.97    1.52      211.80     14.25     BI-212

PROCESSING PARAMETERS ==================================================

Threshold:                3
Peak Start (keV):         42
Peak End (keV):           1990
Left FWHM limit:          2
Right FWHM limit:         2
Multiplet FWHM limit:     4
Fit Singlets:             On
Critical-level Test:      On
Estimate Peak Widths:     On
Baseline Type:            STEP
Baseline Channels:        3
Perform Subtraction:      Off
Energy Tolerance          0.75
Confidence Threshold      0.25
```

```
UPDATE PARAMETERS ======================================================

Use MRP:                   Yes
Most Recent Prior sample: Used
Gain Shift (%):            0.1
Zero Shift (Channels):     0.5
Minumum Area:              100
Use Weights:               On
Allow Multiplets:          On
Force Linear:              Off
Lookup Tol Floor (keV):    0.2
Default RER Intercept:     0.8
Default RER Slope:         0.03
Default ECR Slope:         0.488281

DATA QUALITY FLAGS =====================================================

Name                         Pass/Fail  Value           Test

FlowRate                     PASS       960.242         >500
Ba140_MDC                    PASS       8.63981         <30
Be7_FWHM                     PASS       1.54202         <1.7
K40_LocationDifference       PASS       0.0625          <3*std deviation
NormalizedGainDifference     FAIL       0.000155754     <0.0001

EVENT SCREENING FLAGS ==================================================

Activation Products present in this spectrum                Yes
     Number of days since last activation product           59.8716

One fission product in spectrum                             Yes
     Number of days since last fission product              0.0120602

2 or more fission products in spectrum                      No
     Number of days since 2 or more fission products        Never Seen

Cs-137 present in spectrum                                  No
     Number of times seen in last 30 days                   Never Seen

CALIBRATION EQUATIONS ==================================================

Energy vs. Channel
    E(c) = -0.2963 + 0.4893*c - 5.808E-07*c^2 + 7.949E-11*c^3

       E = energy (keV)
       c = channel number

Resolution vs. Energy

    FWHM(E) = 0.79 + 0.03582*SQRT(E)

       FWHM = Full Width Half Max (keV)
```

```
       E = energy (keV)

Efficiency vs. Energy

    L(E) = ln(962.1/E)

    e(E) = exp { -3.738 + 0.9178*L + 0.07541*L^2
     - 0.07795*L^3 + 0.01588*L^4 - 0.006628*L^5 }

       e = efficiency (counts/gamma)
       E = energy (keV)

FIELD OF REGARD ======================================================

http://www.pidc.org/web-gards/for/CA002/1998/300
```

## ARRIVAL:ASSOCIATED

```
DATA_TYPE ARRIVAL:ASSOCIATED IMS1.0
Net       Sta      Dist  EvAz Phase       Date       Time       TRes  Azim AzRes   Slow   SRes Def   SNR       Amp   Per Qual Magni
tude   OrigID Author       ArrID
IDC_SEIS  BBB      1.61  57.1 Pg       1996/08/16 03:41:40.523  -1.1 256.3  17.5  16.2   -2.4 T__  13.4     228.6  0.33 a__ ML
 4.1   769476 IDC_REB   11618399
IDC_SEIS  BBB      1.61  57.1 Lg       1996/08/16 03:42:04.531   1.1 334.7  95.9  18.6 -12.5 T__   8.2     338.6  0.33 a__
       769476 IDC_REB   11618393
IDC_SEIS  DLBC     7.12   1.2 Pn       1996/08/16 03:42:58.584   0.5 166.7 -14.8  16.5    2.8 T__  16.5       1.5  0.33 a__ ML
 4.2   769476 IDC_REB   11618396
IDC_SEIS  DLBC     7.12   1.2 Lg       1996/08/16 03:44:59.808   1.1                         T__                        a__
       769476 IDC_REB   11621022
IDC_SEIS  NEW      9.07 104.6 Pn       1996/08/16 03:43:23.394  -1.3 308.2  13.5   6.6   -7.2 T__   4.2       0.3  0.33 a__ ML
 3.5   769476 IDC_REB   11614783
IDC_SEIS  NEW      9.07 104.6 Lg       1996/08/16 03:46:03.321   2.8 337.6  42.9  12.2 -19.6 ___   4.1       0.2  0.33 a__
       769476 IDC_REB   11614787
IDC_SEIS  YKA     14.05  31.2 Pn       1996/08/16 03:44:30.887  -1.7 222.6  -1.8  12.4   -1.2 T__  11.9       0.5  0.33 a__ ML
 4.5   769476 IDC_REB   11614280
IDC_SEIS  WAKE    58.41 261.4 T        1996/08/16 04:52:31.503 -94.3                         ___   3.1                   m__
       769476 IDC_REB   11614764
IDC_SEIS  HFS     65.16  18.9 P        1996/08/16 03:51:55.581   0.9 343.9   7.9   3.5   -3.0 T__   5.0       1.2  0.55 a__ mb
 4.1   769476 IDC_REB   11614380
                                                                                                                              mbmle
 4.4   769476 IDC_REB   11614380
```

## ARRIVAL:AUTOMATIC

```
DATA TYPE ARRIVAL:AUTOMATIC IMS1.0
Net       Sta   BeamID         Date       Time       Phase     Azim  Slow   SNR       Amp   Per   STA   Dur Author      DetID
IDC_SEIS  BBB   BP0.5_4.0    1996/08/16 03:41:40.523 P        256.3  16.2  13.4     228.6  0.33   4.5   0.2 IDC_REB  11618391
IDC_SEIS  BBB   BP0.2_1.0    1996/08/16 03:42:04.531 S        334.7  18.6   8.2     338.6  0.33   9.1   1.2 IDC_REB  11618393
IDC_SEIS  DLBC  BP0.2_2.0    1996/08/16 03:42:58.584 P        166.7  16.5  16.5       1.5  0.33   2.0   0.4 IDC_REB  11618396
IDC_SEIS  DLBC  BP0.4_6.0    1996/08/16 03:44:59.808                                                        IDC_REB  11621022
```

## ARRIVAL:GROUPED

```
DATA_TYPE ARRIVAL:GROUPED IMS1.0
Net       Sta  Chan Aux     Date       Time        Phase     Azim   Slow   SNR       Amp   Per Qual   Group C Author       ArrID
IDC_SEIS  BBB   bhz      1996/08/16 03:41:40.523 P        256.3  16.2  13.4     228.6  0.33 a__     5636   IDC_REB   11618395
IDC_SEIS  BBB   bhz      1996/08/16 03:42:04.531 S        334.7  18.6   8.2     338.6  0.33 a__     5636   IDC_REB   11618393
IDC_SEIS  DLBC  bhz      1996/08/16 03:42:58.584 P        166.7  16.5  16.5       1.5  0.33 a__     5636   IDC_REB   11618396
IDC_SEIS  DLBC  bhz      1996/08/16 03:44:59.808 S                                          m__     5636   IDC_REB   11621022
IDC_SEIS  NEW   bhz      1996/08/16 03:43:23.394 P        308.2   6.6   4.2       0.3  0.33 a__     5636   IDC_REB   11614783
IDC_SEIS  NEW   bhz      1996/08/16 03:46:03.321 S        337.6  12.2   4.1       0.2  0.33 a__     5636   IDC_REB   11614787
```

## ARRIVAL:REVIEWED

```
DATA_TYPE ARRIVAL:REVIEWED IMS1.0
Net       Sta  Chan  Aux     Date       Time       Phase     Azim  Slow   SNR       Amp   Per Qual Author      ArrID
IDC_SEIS  BBB   bhz   _  1996/08/16 03:41:40.523 P        256.3  16.2  13.4     228.6  0.33 a__ IDC_REB   11618391
IDC_SEIS  BBB   bhz      1996/08/16 03:42:04.531 S        334.7  18.6   8.2     338.6  0.33 a__ IDC_REB   11618393
IDC_SEIS  DLBC  bhz      1996/08/16 03:42:58.584 P        166.7  16.5  16.5       1.5  0.33 a__ IDC_REB   11618396
IDC_SEIS  DLBC  bhz      1996/08/16 03:44:59.808 S                                          m__ IDC_REB   11621022
IDC_SEIS  NEW   bhz      1996/08/16 03:43:23.394 P        308.2   6.6   4.2       0.3  0.33 a__ IDC_REB   11614783
IDC_SEIS  NEW   bhz      1996/08/16 03:46:03.321 S        337.6  12.2   4.1       0.2  0.33 a__ IDC_REB   11614787
```

## ARRIVAL:UNASSOCIATED

```
DATA TYPE ARRIVAL:UNASSOCIATED IMS1.0
Net       Sta   BeamID         Date       Time       Phase     Azim  Slow   SNR       Amp   Per    STA   Dur Author     DetID
IDC_SEIS  BBB   BP0.5_4.0    1996/08/16 03:41:40.523 P        256.3  16.2  13.4     228.6  0.33    4.5   0.2 IDC_REB   11618391
IDC_SEIS  BBB   BP0.2_1.0    1996/08/16 03:42:04.531 S        334.7  18.6   8.2     338.6  0.33    9.1   1.2 IDC_REB   11618393
IDC_SEIS  DLBC  BP0.2_2.0    1996/08/16 03:42:58.584 P        166.7  16.5  16.5       1.5  0.33    2.0   0.4 IDC_REB   11618396
IDC_SEIS  DLBC  BP0.4_6.0    1996/08/16 03:44:59.808                                                       IDC_REB   11621022
```

## AUTH_STATUS

```
DATA_TYPE AUTH_STATUS IMS1.0
Report period from 1994/12/03 00:00:00.0 to 1994/12/04 00:00:00.0
Net       Sta  Chan Aux   Packets_Tested  Packets_Failed
IDC_SEIS  ABC   shz                 8640               3
IDC_SEIS  DEF   bhz                 8640               0
 Failed Packet Intervals
Net       Sta  Chan Aux      Start_Time           End_Time         Comment
IDC_SEIS  ABC   shz      1994/12/03 14:28:40  1994/12/03 14:29:10  Unknown cause
```

## BLANKPHD

```
DATA_TYPE BLANKPHD
#Header
US001 US001USA1 P DISK FULL 0  0  0
0   0
1997/09/28 19:17:59.0
#Comment
3 day, for subtraction - Blank FOA Filter
Detector 1 Test Filter (25-SEP-1997)
#Acquisition
1997/09/25 19:15:38.0 259223.6         259200.0
#Energy
88.000000        179.626129       0.000000
...
1836.099976      3764.159180      0.000000
#Resolution
88.000000        1.368276         0.000000
...
1836.099976      2.340262         0.000000
#Efficiency
88.000000        0.068337         0.002864
...
1836.099976      0.010264         0.000262
#Spectrum
4096  0
0     0           0          0          0          0
...
```

## BULLETIN (IMS1.0:SHORT FORMAT)

```
DATA_TYPE BULLETIN IMS1.0:short
Reviewed Event Bulletin (REB) of the CTBO_IDC for August 16, 1996
EVENT 768958  QUEEN CHARLOTTE ISLANDS REGION
    Date       Time       Err   RMS Latitude Longitude  Smaj  Smin  Az  Depth   Err Ndef Nsta Gap  mdist  Mdist Qual   Author
  OrigID
1996/08/16 03:41:12.45   0.88  0.92  51.3300 -130.3100  16.6   7.7  63   0.0f        23   18 192   1.61  77.98 m i uk IDC_REB
  769476

Magnitude  Err Nsta  Author    OrigID
ML     3.8 0.5    7  IDC_REB   769476
mb     4.0 0.2    6  IDC_REB   769476

Sta     Dist  EvAz Phase        Time      TRes  Azim AzRes   Slow   SRes Def   SNR       Amp   Per Qual Magnitude    ArrID
BBB     1.61  57.1 Pg       03:41:40.523  -1.1 256.3  17.5   16.2   -2.4 T__  13.4     228.6  0.33 a__ ML     4.1 11618391
NEW     9.07 104.6 Pn       03:43:23.394  -1.3 308.2  13.5    6.6   -7.2 T__   4.2       0.3  0.33 a__ ML     3.5 11614783
YKA    14.05  31.2 Pn       03:44:30.887  -1.7 222.6  -1.8   12.4   -1.2 T__  11.9       0.5  0.33 a__ ML     4.5 11614280
WAKE   58.41 261.4 T        04:52:31.503 -94.3                           ___   3.1                  m__            11614764
HFS    65.16  18.9 P        03:51:55.581   0.9 343.9   7.9    3.5   -3.0 T__   5.0       1.2  0.55 a__ mb     4.1 11614380
                                                                                                    mbmle  4.4 11614380
```

## BULLETIN (IMS1.0:LONG FORMAT)

```
DATA_TYPE BULLETIN IMS1.0:LONG
Standard Event Bulletin of the PIDC from 1999/01/01 00:00:00 to 1999/01/02 00:00:00,  generated 1999/01/21 18:02:23
EVENT 20276917 VANCOUVER ISLAND REGION
   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az Depth    Err Ndef Nsta Gap  mdist  Mdist Qual   Author
OrigID
1999/01/01 11:01:05.04   2.57  0.74  48.8408 -128.7391  54.3  21.6  58   0.0f     10    9 196   3.37  68.22 m i uk IDC_SEB
20282397

Magnitude  Err Nsta Author      OrigID
mbmle            16 IDC_SEB   20282397
mb     3.6 0.0    2 IDC_SEB   20282397
Ms     3.4 0.2    4 IDC_SEB   20282397
ML     2.9 0.2    5 IDC_SEB   20282397
msmle  3.1 0.1   15 IDC_SEB   20282397

Sta     Dist  EvAz Phase        Time      TRes  Azim AzRes   Slow   SRes Def   SNR       Amp   Per Qual Magnitude    ArrID
BBB     3.37   6.6 Pn       11:02:00.100   1.2 194.6   7.5   11.4   -2.3 T__ 139.5      20.4  0.33 a__             23580875
BBB     3.37   6.6 Sn       11:02:41.057   0.4  87.7 -99.3   22.0   -2.7 T__   2.9       3.6  0.33 m__             23625256
ELK    12.53 125.2 Pn       11:04:06.274   1.5 322.1   7.4    9.2   -4.5 T__   4.0       0.2  0.33 m__ ML     3.5 23625254
MNV    12.91 139.8 Pn       11:04:10.326   0.5 326.3  -0.8    7.2   -6.5 T__   9.8      0.06  0.33 a__ ML     3.1 23579738
MNV    12.91 139.8 LR       11:09:09.898  25.7 234.0 -93.1   37.6    2.0 ___            59.6 21.31 a__ Ms     2.9 23625273
PDAR   14.68 107.3 Pn       11:04:34.116   0.1 356.7  47.1   13.9    2.0 T__   5.5                  m__            23608178
PDAR   14.68 107.3 LR       11:10:26.438  34.6 345.6  44.6   38.3    2.4 ___           202.9 20.69 a__ Ms     3.5 23625274
```

▼ **Appendix A: Data Message Examples**

```
YKA    15.78  24.6 Pn       11:04:48.562   0.2 212.6  -3.8   12.4   -0.5 T__   7.7      0.03  0.33 a__ ML     3.2 23579691
YKA    15.78  24.6 LR       11:11:30.039  45.0  85.0 -131.   39.6    2.9 ___            97.5 20.18 a__ Ms     3.2 23625275
ILAR   18.68 335.4 P        11:05:24.993   0.6 120.9 -19.1    2.1   -9.3 T__   3.8     0.004  0.33 m__ ML     2.1 23608180
INK    19.67 354.7 P        11:05:35.424   0.2 326.5 155.9   11.7    0.8 T__   2.0     0.009  0.33 m__ ML     2.6 23625253
ULM    21.28  73.7 P        11:05:52.200  -0.6  10.7  91.8    9.0   -1.8 T__   3.7       1.7  0.55 a__ mb     3.6 23579678
WK31   59.49 262.4 T        12:15:34.290  -1.3                           ___  10.0                  a__             23580272
WK30   59.50 264.9 T        12:15:36.263  -0.2                           ___   8.0                  a__             23580277
PDY    60.91 329.3 LR       11:39:48.313  27.7 299.4 -102.   38.1    0.5 ___            66.0 18.50 a__ Ms     3.8 23625272
FINES  68.22  12.7 P        11:12:06.123  -0.7   1.7  21.8    7.7    0.8 T__   2.5       0.5  0.72 m__ mb     3.6 23608179
ESDC   79.25  40.2 P        11:13:07.949  -4.2   6.4  40.0   28.6   23.1 ___   2.7       0.6  0.90 m__            23625255
ESDC   79.25  40.2 PcP      11:13:19.399  -0.7 315.7  -0.1    4.8    0.4 ___   6.3       0.7  0.67 a__            23579788

EVENT SCREENING
 OriginID  Smaj_sc Smin_sc Depth   Sdep  mbms   Smbms Foffshore Dscore Mscore  Score Category
 20282397     54.3    21.6   0.0         0.64   0.60      1.00           1.62   1.62 ScreenedOut/Offshore

CEPSTRAL PEAK ANALYSIS
Sta    PeakAmp PeakQuef
BBB    0.06527   0.2000
MNV    0.09767   0.0750
MNV    0.09767   0.0750

SHORT-PERIOD/LONG-PERIOD ENERGY RATIO
Sta         Ratio
MNV    0.00009819
MNV    0.00009819

ORIGIN-BASED FREQUENCY-DEPENDENT PHASE AMPLITUDE
Sta   Phase   Amp2-4  SNR2-4    Amp4-6  SNR4-6    Amp6-8  SNR6-8  Amp8-10 SNR8-10
BBB   Pn        40.6    89.0       6.6    80.9       4.6   163.4      2.3   121.8
BBB   Sn        13.5     0.8       6.1     1.7       1.8     1.7      0.6     1.0
ELK   Pn         0.5     1.0       0.3     1.0       0.2     1.0      0.1     1.1
MNV   Pn         0.3     1.4       0.1     1.7       0.1     1.3      0.0     0.9
MNV   LR         2.0     0.6       0.4     0.7       0.2     1.1      0.1     1.3
PDAR  Pn         0.5     0.9       0.5     0.7       0.7     0.7
PDAR  LR         0.1     1.1       0.1     1.2       0.1     0.9
YKA   Pn         0.1     1.5       0.0     1.2       0.0     1.3
YKA   LR         0.0     1.0       0.0     1.0       0.0     1.3
ILAR  P          0.1     1.2       0.0     1.6       0.0     1.0
INK   P          0.1     1.2       0.0     0.9       0.0     1.0      0.0     1.1
```

## CALIBPHD

```
DATA_TYPE CALIBPHD
#Header
CA002 CA002CAA2 P DISK FULL 0  0  0
0   0
1997/08/05 01:44:15.0
#Comment
- Standard
ISAR2 CALIBRATION SOURCE IPL 560-73
#Acquisition
1997/08/05 01:26:09.6 906.7            900.0
#Energy
88.099998        180.260513       0.000000
...
1836.099976      3759.928711      0.000000
#Resolution
88.099998        1.161428         0.000000
...
1836.099976      2.283365         0.000000
#Efficiency
88.099998        0.106188         0.004743
...
1836.099976      0.012928         0.000351
#Certificate
1.000000 1997/08/01 19:00:00
Cd-109   1.27083 Y               88.100   80.000   4.000   3.600
Co-57    271.79 D                122.100  74.000   3.000   85.600
Te-123m  119.7 D                 159.000  93.000   2.400   84.000
Cr-51    27.71 D                 320.100  232.000  2.400   9.900
Sn-113   115.09 D                391.700  254.000  2.600   64.900
Sr-85    64.84 D                 514.000  541.000  2.500   98.400
Cs-137   30.1198 Y               661.600  318.000  3.400   85.100
Y-88     106.63 D                898.000  784.000  2.500   94.000
Co-60    5.27347 Y               1173.200 452.000  3.400   99.900
Co-60    5.27347 Y               1332.500 452.000  3.400   100.000
Y-88     106.63 D                1836.100 829.000  2.500   99.400
#Spectrum
4096  0
0     0          0          0          0          0
...
```

## CHANNEL

```
DATA_TYPE CHANNEL IMS1.0
Net       Sta  Chan Aux   Latitude  Longitude Coord Sys     Elev Depth   Hang  Vang Sample Rate Inst      On Date    Off Date
IDC_SEIS  ARA0  she       69.53490   25.50580 WGS-84       0.403 0.010   90.0  90.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA0  shn       69.53490   25.50580 WGS-84       0.403 0.011    0.0  90.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA0  shz       69.53490   25.50580 WGS-84       0.403 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA1  shz       69.53630   25.50710 WGS-84       0.411 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA2  shz       69.53380   25.50780 WGS-84       0.392 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARA3  shz       69.53460   25.50190 WGS-84       0.402 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB1  shz       69.53790   25.50790 WGS-84       0.414 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB2  shz       69.53570   25.51340 WGS-84       0.397 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB3  shz       69.53240   25.51060 WGS-84       0.376 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB4  shz       69.53280   25.49980 WGS-84       0.378 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
IDC_SEIS  ARB5  shz       69.53630   25.49850 WGS-84       0.405 0.010   -1.0   0.0   40.000000 GS-13   1987/09/30
```

## CHAN_STATUS

```
DATA_TYPE CHAN_STATUS IMS1.0
Report period from 1994/12/03 00:00:00.0 to 1994/12/04 00:00:00.0
Data Availability Statistics
Net       Sta   Chan Aux    Max_Exp_Time     %_Avail  Gaps    Median      Min        Max
IDC_SEIS  OBN    bhz         000 00:05:00     100.000     0  000:00:00  000:00:00  000:00:00
IDC_SEIS  OBN    bhn         000 00:05:00      99.034     6  000:00:10  000:00:00  000:00:24
IDC_SEIS  OBN    bhe         000 00:05:00     100.000     0  000:00:00  000:00:00  000:00:00
IDC_SEIS  ARU    bhz         000 01:23:14      99.843     8  000:00:07  000:00:00  000:00:12
IDC_SEIS  ARU    bhn         000 01:23:14      99.843    12  000:00:10  000:00:00  000:00:12
IDC_SEIS  ARU    bhe         000 01:23:14      99.843    12  000:00:10  000:00:00  000:00:12

Data Timeliness Statistics
Net       Sta   Chan Aux   Max_Exp_Time  Delay_Med     Mean     Std_Dev      Min        Max
IDC_SEIS  OBN    bhz        000 00:05:00  000:00:00  000:00:00  000:00:00  000:00:00  000:00:00
IDC_SEIS  OBN    bhn        000 00:05:00  000:00:00  000:00:00  000:00:00  000:00:00  000:00:00
IDC_SEIS  OBN    bhe        000 00:05:00  000:00:00  000:00:00  000:00:00  000:00:00  000:00:00

IDC_SEIS  ARU    bhz        000 01:23:14  000:46:22  000:50:17  000:25:50  000:44:14  000:58:01
IDC_SEIS  ARU    bhn        000 01:23:14  000:46:27  000:50:21  000:25:55  000:44:16  000:58:05
IDC_SEIS  ARU    bhe        000 01:23:14  000:45:53  000:49:39  000:26:28  000:43:45  000:57:39
```

## COMMENT

```
DATA_TYPE COMMENT IMS1.0

  Almost anything may be typed into the space between the
  DATA_TYPE line and the STOP line.  No association was
  desired for this comment, so the association line was
  left blank.  Note that this comment is indented so that
  the DATA_TYPE in the second line of this paragraph is
  not interpreted as a command line.
DATA_TYPE COMMENT IMS1.0
Event      7687234
  The referenced event was felt over a wide area (300 square
  kilometers) near the epicenter.
```

## COMM_STATUS

```
DATA_TYPE COMM_STATUS IMS1.0
Report period from 1994/12/03 00:00:00.0 to 1994/12/04 00:00:00.0
Link               Nom_kbps  Mode  %_Up   From    Util   From    Util
AUS_NDC  - CTBO_IDC     56.0  full  88.4  AUS_NDC  0.50  CTBO_IDC  0.08
NOR_NDC  - CTBO_IDC    128.0  full  99.2  NOR_NDC  0.77  CTBO_IDC  0.10
USA_NDC  - CTBO_IDC   1000.0  full 100.0  USA_NDC  0.25  CTBO_IDC  0.25

AUS_NDC  - CTBO_IDC  link outages
         From                Through             Duration
1994/12/02 20:23:14.0  1994/12/03 00:48:28.0  000 00:25:14.0
1994/12/03 02:34:31.0  1994/12/03 02:49:39.0  000 00:15:08.0
1994/12/03 19:02:27.0  1994/12/03 19:12:29.0  000 00:10:02.0

NOR_NDC  - CTBO_IDC  link outages
         From                Through             Duration
1994/12/03 04:34:31.0  1994/12/03 06:35:39.0  000 00:45:13.0
```

## DETBKPHD

```
DATA_TYPE DETBKPHD
#Header
US001 US001USA1 P DISK FULL 0  0  0
0   0
1997/06/25 21:07:39.0
#Comment
M. Cook - Background
Detector 1 Background (25-JUN-1997)
#Acquisition
1997/06/25 16:42:36.5 15720.8          15719.6
#Energy
88.000000        119.365860       0.000000
...
1836.099976      2507.416504      0.000000
#Resolution
88.000000        1.550320         0.000000
...
1836.099976      2.757118         0.000000
#Efficiency
88.000000        0.089655         0.001912
...
1836.099976      0.012618         0.000324
#Spectrum
4096  0
0     0          0          0          0          0
...
```

## ERROR_LOG

The following example shows how the `error log` section is used to identify that the request message line in a request failed.

```
data_type error_log IMS1.0
 An error was detected in the
 following request  message:
   begin IMS1.0
   msg_type request
   msg_id 1040 any_ndc
   time 94/03/01 to 94/03/02
   *** unrecognized time format ***
   sta_list ARA0
   waveform
   stop
```

## EVENT

```
DATA_TYPE EVENT IMS1.0:short
Reviewed Event Bulletin (REB) of the CTBO_IDC for August 16, 1996
Event 768958   QUEEN CHARLOTTE ISLANDS REGION
   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az  Depth  Err Ndef Nsta Gap  mdist  Mdist Qual   Author
  OrigID
1996/08/16 03:41:12.45   0.88  0.92  51.3310 -130.3125  16.6   7.7  63   0.0f        23   18 192   1.61  77.98 m i uk IDC_REB
  769476
1996/08/16 03:41:17.63   1.20  4.26  51.4100 -129.7300  18.9  12.4  70   0.0f        18   17 160   1.27  77.69 m i uk IDC_SEL1
  768958

Magnitude  Err Nsta Author      OrigID
ML     3.8 0.5    7 IDC_REB     769476
mb     4.0 0.2    6 IDC_REB     769476
ML     3.9 0.2    6 IDC_SEL1    768958
mb     4.1 0.4   10 IDC_SEL1    768958
```

## FLOW

```
DATA_TYPE FLOW
KW001 30 900
1997/11/13 20:17:00 900 0.17 0.01
1997/11/13 20:32:00 900 0.17 0.01
1997/11/13 20:47:00 900 0.17 0.01
1997/11/13 21:02:00 900 0.17 0.01
1997/11/13 21:17:00 900 0.17 0.01
1997/11/13 21:32:00 900 0.17 0.01
1997/11/13 21:47:00 900 0.17 0.01
1997/11/13 22:02:00 900 0.17 0.01
1997/11/13 22:17:00 900 0.17 0.01
1997/11/13 22:32:00 900 0.16 0.01
1997/11/13 22:47:00 900 0.17 0.01
1997/11/13 23:02:00 900 0.17 0.01
1997/11/13 23:17:00 900 0.16 0.01
1997/11/13 23:32:00 900 0.16 0.01
1997/11/13 23:47:00 900 0.16 0.01
```

## FPEB

```
DATA_TYPE FPEB
                              PIDC GENERATED REPORT
                            FISSION PRODUCT EVENT BULLETIN

                 Fission Product ID:    59     Revision Number:  1

EVENT WINDOW ==================================================================

This section is currently under development.


REGIONAL SOURCE LOCATION ======================================================

This section is currently under development.


EVENT DETECTION SUMMARY =======================================================

Station    Collect Stop         Sample ID  Name       Categorization Comment
-------    ------------         ---------  ----       ----------------------
NZ004      1998/08/29 21:15:00  22583      I-123      Not Regularly Measured
NZ004      1998/08/29 21:15:00  22583      RU-106     Not Regularly Measured
NZ004      1998/08/29 21:15:00  22583      TE-123M    Not Regularly Measured


Activation Products present in this spectrum                  Yes
     Number of days since last activation product             78.4354

One fission product in spectrum                               Yes
     Number of days since last fission product                7.0104282

2 or more fission products in spectrum                        Yes
     Number of days since 2 or more fission products          10.0768056

Cs-137 present in spectrum                                    Yes
     Number of times seen in last 30 days                     Never Seen


ISOTOPIC RATIOS ==============================================================
This section is currently under development.

CERTIFIED LABORATORY RESULTS =================================================
This section is currently under development.
```

## FTP_LOG

The following example is a data message sent to a requestor of data. It indicates that the data are on machine `pidc.org` in directory `/pub/data` in file `1994001.gz`. The requestor must log into `pidc.org` as a user to obtain the data.

```
data_type ftp_log IMS1.0
ftp_file pidc.org user /pub/data any_ndc 1994001.gz
 The original request could not be satisfied using
 email due to the size of the requested
 information; ftp was used instead. Please
 log into your user account to retrieve the
 data. Data will be removed by 1996/10/23.
```

## HELP

The following examples use the correct protocols for requesting an *AutoDRM User's Guide* from the message subsystem.

```
to: [AutoDRM email address]
from: [your email address]
subject: [any subject]
cc:
bcc:
Attached:
[Text as follows: help]
```

```
to: [AutoDRM email address]
from: [your email address]
subject: help
cc:
bcc:
Attached:
```

## LOG

The following example is a section of a message that is sent to a data requestor or subscriber after *AutoDRM* processes a subscription or request message. The log section precedes the message data section and is used to state that the request command was processed.

```
data_type log IMS1.0
 command waveform processed.
data_type waveform IMS1.0:cm6
...
```

## MET

```
DATA_TYPE MET
KW001
1997/11/09 09:46:00 1997/11/09 10:01:00 21 28 330 0 1021.87 3 0
1997/11/09 10:01:00 1997/11/09 10:16:00 21 28 330 0 1022.80 3 0
1997/11/09 10:16:00 1997/11/09 10:31:00 21 28 330 0 1023.27 3 0
1997/11/09 10:31:00 1997/11/09 10:46:00 21 27 330 0 1023.97 3 0
1997/11/09 10:46:00 1997/11/09 11:01:00 21 27 315 0 1025.37 3 0
1997/11/09 11:01:00 1997/11/09 11:16:00 20 27 310 0 1025.43 3 0
1997/11/09 11:16:00 1997/11/09 11:31:00 20 27 310 0 1024.37 3 0
1997/11/09 11:31:00 1997/11/09 11:46:00 20 26 310 0 1024.27 3 0
1997/11/09 11:46:00 1997/11/09 12:01:00 20 26 310 0 1024.07 3 0
```

## NETWORK

```
data_type network IMS1.0
Net       Description
IDC_SEIS  International Data Center Seismic Network
IDC_HYDR  International Data Center Hydroacoustic Network
```

## ORIGIN

```
DATA_TYPE ORIGIN IMS1.0

   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az  Depth  Err Ndef Nsta Gap  mdist  Mdist Qual   Author
  OrigID
1996/08/16 03:41:12.45   0.88  0.92  51.3300 -130.3100  16.6   7.7  63   0.0f        23   18 192   1.61  77.98 m i uk IDC_REB
  769476

Magnitude  Err Nsta Author      OrigID
ML     3.8 0.5    7 IDC_REB     769476
mb     4.0 0.2    6 IDC_REB     769476


   Date       Time        Err   RMS Latitude Longitude  Smaj  Smin  Az  Depth  Err Ndef Nsta Gap  mdist  Mdist Qual   Author
  OrigID
1996/08/16 04:35:17.66   2.72  0.29   2.1300  127.8800  55.1  44.2  71   0.0f         9    9 150  22.84  92.33 m i uk IDC_REB
  769435

Magnitude  Err Nsta Author      OrigID
mb     4.1 0.4    7 IDC_REB     769435
```

## OUTAGE

```
DATA_TYPE OUTAGE IMS1.0
Report period from 1994/12/24 00:00:00.000 to 1994/12/25 12:00:00.000
NET       Sta  Chan Aux      Start Date Time          End Date Time        Duration Comment
IDC_SEIS  APL  shz       1994/12/24 08:13:05.000 1994/12/24 08:14:10.000     65.000
IDC_SEIS  APL  shn       1994/12/25 10:00:00.000 1994/12/25 10:00:00.030      0.030
```

## QCPHD

```
DATA_TYPE QCPHD
#Header
CA002 CA002CAA2 P DISK FULL 0  0  0
0   0
1997/10/06 05:02:08.0
#Comment
goshka - Standard
ISAR2 CALIBRATION SOURCE IPL 560-73
#Acquisition
1997/10/06 04:43:52.8 904.8            900.0
#Energy
88.099998        180.234055       0.000000
...
1836.099976      3759.182129      0.000000
#Resolution
88.099998        1.188847         0.000000
...
1836.099976      2.365590         0.000000
#Efficiency
88.099998        0.103601         0.004296
...
1836.099976      0.012451         0.000325
#Certificate
1.000000 1997/08/01 19:00:00
Cd-109   1.27083 Y              88.100   80.000   4.000   3.600
Co-57    271.79 D               122.100  74.000   3.000   85.600
Te-123m  119.7 D                159.000  93.000   2.400   84.000
Cr-51    27.71 D                320.100  232.000  2.400   9.900
Sn-113   115.09 D               391.700  254.000  2.600   64.900
Sr-85    64.84 D                514.000  541.000  2.500   98.400
Cs-137   30.1198 Y              661.600  318.000  3.400   85.100
Y-88     106.63 D               898.000  784.000  2.500   94.000
Co-60    5.27347 Y              1173.200 452.000  3.400   99.900
Co-60    5.27347 Y              1332.500 452.000  3.400   100.000
Y-88     106.63 D               1836.100 829.000  2.500   99.400
#Spectrum
4096  0
0     0          0          0          0          0
...
```

**Appendix A: Data Message Examples**

## RESPONSE

```
DATA_TYPE RESPONSE
CAL2 MIAR  BHZ      CMG-3N  4.11000000E+00  16.000   40.00000 1992/09/23 20:00
 (USNSN station at Mount Ida, Arkansas, USA)
PAZ2  1 V  7.29000000E+04   1.000         4   2       CMG-3 (NSN) Acc-Vel (Std)
 -3.14000000E-02  3.14000000E-04
 -1.97000000E-01  1.97000000E-03
 -2.01000000E+02  2.01000000E+00
 -6.97000000E+02  6.97000000E+00
  0.00000000E+00  0.00000000E+00
  0.00000000E+00  0.00000000E+00
 (Theoretical response provided by Guralp Systems, Ltd.)
DIG2  2  4.18000000E+05  5120.00000                  Quanterra QX80
FIR2  3   1.00E+00    16    0.006 C   30          QDP380/900616 stage 1
 -1.11328112e-03 -1.00800209e-03 -1.35286082e-03 -1.73045369e-03 -2.08418001e-03
 -2.38537718e-03 -2.60955630e-03 -2.73352256e-03 -2.73316190e-03 -2.58472445e-03
 -2.26411712e-03 -1.74846814e-03 -1.01403310e-03 -3.51681737e-05  1.23782025e-03
  3.15983174e-03  6.99944980e-03  9.09959897e-03  1.25423642e-02  1.63123012e-02
  2.02632397e-02  2.43172608e-02  2.84051094e-02  3.24604138e-02  3.64142842e-02
  4.01987396e-02  4.37450483e-02  4.69873249e-02  4.98572923e-02  5.22795729e-02
FIR2  4   1.00E+00    2    0.379 C   22          QDP380/900616 stage 2,3,4
  2.88049545e-04  1.55313976e-03  2.98230513e-03  2.51714466e-03 -5.02926821e-04
 -2.81205843e-03 -8.08708369e-04  3.21542984e-03  2.71266000e-03 -2.91550322e-03
 -5.09429071e-03  1.33933034e-03  7.40034366e-03  1.82796526e-03 -8.81958286e-03
 -6.56719319e-03  8.38608573e-03  1.24268681e-02 -5.12978853e-03 -1.84868593e-02
 -1.79236766e-03  2.33604181e-02
(Theoretical response provided by Quanterra, Inc.)
```

## RSR

```
DATA_TYPE RSR
Radionuclide Summary Report
RSR Collect-Stop Window: 1997/10/12 00:00:00 - 1997/10/19 23:59:59

MEASUREMENT CATEGORIZATION SUMMARY:
----------------------------------

Categorization Legend
---------------------
Level 1  =  Normal Natural Rad. Meas.
Level 2  =  Abnormal Natural Rad. Meas.
Level 3  =  Normal Anthropogenic Rad. Meas.
Level 4  =  Abnormal Anthropogenic Rad. Meas.
Level 5  =  Mult. Abnormal Anthropogenic Rad. Meas.

Categories Itemized: 2 4

Collect Stop Station    SID       Name    Level     Statistical Range Status
------------ -------    ---       ----    -----     ------------------------
1997/10/15   AR001      29467     BE-7      2       Below Statistical Range
1997/10/16   SE001      29522     BE-7      2       Below Statistical Range

Level Distribution Over All Categorized & Reviewed Spectra

Total Categorized & Reviewed Spectra: 28

Level 1        Level 2        Level 3        Level 4
-------        -------        -------        -------
21 (75.00%)    2 (7.14%)      5 (17.86%)     0 (0.00%)

MAN-MADE RADIONUCLIDE SUMMARY:
-----------------------------
```

```
Legend:
------
Conc -> Concentration of Nuclide measured in uBq/m3
CP   -> Collection Period measured in days

Col Stop     Station  Station Location          Nuclide  Conc     Error    CP
--------     -------  ----------------          -------  ----     -----    --
1997/10/13   FI001    Helsinki, Finland         CS-137   1.42     5.78     7.0
1997/10/13   SE001    Stockholm, Sweden         CS-137   3.02     16.81    3.0
1997/10/13   SE001    Stockholm, Sweden         XE-133   5681.95  10.06    3.0
1997/10/14   SE001    Stockholm, Sweden         CS-137   1.72     50.36    1.0
1997/10/15   SE001    Stockholm, Sweden         XE-133   1617.03  27.02    2.0
1997/10/16   SE001    Stockholm, Sweden         CS-137   0.98     45.12    1.0


DATA RECEIPT SUMMARY:
--------------------

Station  Station Location          Full Spectra    Other Spectra
-------  ----------------          ------------    -------------
AR001    Argentina                      3               0
AU001    Melbourne, Australia           10              10
CA002    Vancouver, Canada              14              16
FI001    Helsinki, Finland              1               1
KW001    Kuwait City, Kuwait            10              10
SE001    Stockholm, Sweden              6               0
US001    Charlottesville, VA, USA       6               6

MINIMUM DETECTABLE CONCENTRATION SUMMARY:
----------------------------------------

Each cell in this table expresses the ratio of the actual MDC of the
station/nuclide combination (calculated by taking the median of the
MDCs over the time period desired) to the maximum MDC for that
station/nuclide combination as expressed in CD-WP224.

        BA-140   CE-143   CS-134   CS-136   CS-137   I-131    I-133
 AR001  0.71     0.56     0.48     0.50     0.55     1.36     0.83
 AU001  1.92     0.91     1.27     1.25     1.56     3.43     1.18
 AU002  1.60     17.10    0.90     1.55     0.91     3.24     135.78
 AU003  1.58     19.61    0.79     1.50     0.83     3.09     188.91
 AU004  0.87     12.47    0.55     0.88     0.60     2.41     57.92
 CA002  0.28     0.26     0.26     0.25     0.26     0.53     0.29
 DE002  0.04     0.73     0.02     0.03     0.01     0.11     1.54
 FI001  0.04     0.66     0.02     0.03     0.02     0.11     2.90
 KW001  0.98     1.21     0.69     0.70     0.77     2.08     1.37
 NZ001  0.19     0.24     0.10     0.02     0.11     0.11     22.90
 NZ002  0.36     2.20     0.17     0.05     0.19     0.34     305.41
 NZ003  0.21     0.08     0.14     0.02     0.15     0.13     2.62
 SE001  0.42     0.41     0.34     0.41     0.26     0.74     0.72
 US001  1.06     0.80     0.68     0.75     0.80     2.01     1.26


        MO-99    NB-95    RU-103   TE-132   ZR-95    ZR-97    XE-131M
 AR001  1.06     0.38     0.48     0.50     0.89     0.55     0.00
 AU001  2.08     1.02     1.44     1.22     2.27     0.57     0.00
 AU002  10.55    0.81     0.85     2.50     1.79     286.44   0.00
 AU003  10.03    0.67     0.82     2.52     1.81     379.18   0.00
 AU004  5.69     0.41     0.55     1.97     1.02     112.10   0.00
 CA002  0.47     0.16     0.19     0.19     0.40     0.24     0.00
 DE002  0.22     0.02     0.02     0.13     0.04     2.25     0.00
 FI001  0.23     0.02     0.02     0.10     0.04     4.33     0.00
 KW001  1.47     0.50     0.72     0.87     1.32     0.79     0.00
 NZ001  1.46     0.09     0.10     0.10     0.20     46.07    0.00
 NZ002  4.52     0.15     0.18     0.44     0.35     1073.10  0.00
```

```
NZ003  0.86     0.11     0.13     0.08     0.26     3.18     0.00
SE001  0.98     0.25     0.28     0.31     0.63     0.51     4.91
US001  1.47     0.56     0.78     0.84     1.27     0.76     0.00

       XE-133   XE-133M  XE-135
AR001  0.00     0.00     ****
AU001  0.00     0.00     ****
AU002  0.00     0.00     ****
AU003  0.00     0.00     ****
AU004  0.00     0.00     ****
CA002  0.00     0.00     ****
DE002  0.00     0.00     ****
FI001  0.00     0.00     ****
KW001  0.00     0.00     ****
NZ001  0.00     0.00     ****
NZ002  0.00     0.00     ****
NZ003  0.00     0.00     ****
SE001  2.15     17.75    ****
US001  0.00     0.00     ****
```

## SAMPLEPHD

```
DATA_TYPE SAMPLEPHD
#Header
FI001 FI001-F09  P W  FULL FI001-S-1997/09/15-06:46:00.0 0 0
FI001-F09-1997/09/26-13:37:00.0 FI001-F09-1996/11/05-12:59:00.0
1997/09/29 09:25:41.0
#Collection
1997/09/15 06:46:00.0 1997/09/22 06:43:00.0      99043
#Sample
15.60  1.02 11.00
#Acquisition
1997/09/26 13:37:00.0         229200         229200
#Energy
       2.449E+00        3.000E+00        3.000E-01
       ...
       2.706E+03        8.129E+03        3.000E-01
#Resolution
       2.449E+00        7.695E-01        5.000E-02
       ...
       2.706E+03        2.465E+00        5.000E-02
#Efficiency
       3.000E+01        2.160E-03        1.000E-01
       ...
       3.600E+03        2.108E-02        6.312E-04
#Totaleff
       3.000E+01        7.202E-03        1.000E-01
       ...
       3.600E+03        1.109E-01        3.323E-03
#Spectrum
 8192 2700
    0          7          10         11           8          9
....
```

## STATION

```
DATA_TYPE STATION IMS1.0
Net       Sta    Type  Latitude  Longitude Coord Sys     Elev   On Date   Off Date
IDC_SEIS  ARCES hfa   69.53490  25.50580 WGS-84       0.403 1987/09/30
IDC_SEIS  ARA0  3C    69.53490  25.50580 WGS-84       0.403 1987/09/30
IDC_SEIS  ARA1  1C    69.53630  25.50710 WGS-84       0.411 1987/09/30
IDC_SEIS  ARA2  1C    69.53380  25.50780 WGS-84       0.392 1987/09/30
IDC_SEIS  ARA3  1C    69.53460  25.50190 WGS-84       0.402 1987/09/30
IDC_SEIS  ARB1  1C    69.53790  25.50790 WGS-84       0.414 1987/09/30
IDC_SEIS  ARB2  1C    69.53570  25.51340 WGS-84       0.397 1987/09/30
IDC_SEIS  ARB3  1C    69.53240  25.51060 WGS-84       0.376 1987/09/30
IDC_SEIS  ARB4  1C    69.53280  25.49980 WGS-84       0.378 1987/09/30
IDC_SEIS  ARB5  1C    69.53630  25.49850 WGS-84       0.400 1987/09/30
IDC_SEIS  ARC1  1C    69.54110  25.50790 WGS-84       0.381 1987/09/30
IDC_SEIS  ARC2  3C    69.53830  25.52290 WGS-84       0.395 1987/09/30
IDC_SEIS  ARC3  1C    69.53290  25.52310 WGS-84       0.376 1987/09/30
IDC_SEIS  ARC4  3C    69.52930  25.51170 WGS-84       0.377 1987/09/30
IDC_SEIS  ARC5  1C    69.53000  25.49820 WGS-84       0.374 1987/09/30
IDC_SEIS  ARC6  1C    69.53410  25.48820 WGS-84       0.395 1987/09/30
IDC_SEIS  ARC7  3C    69.53960  25.49360 WGS-84       0.362 1987/09/30
IDC_SEIS  ARD1  1C    69.54830  25.50930 WGS-84       0.395 1987/09/30
IDC_SEIS  ARD2  1C    69.54520  25.53080 WGS-84       0.366 1987/09/30
```

## STA_STATUS

```
DATA_TYPE STA_STATUS IMS1.0
Report period from 1994/12/03 00:00:00.0 to 1994/12/04 00:00:00.0
                           Station Capability
Net       Sta   Ch  Full      Part     Low     Non Max_Exp_Time   Avail   Med_Delay   Att   Suc   Pnd
IDC_SEIS  ARCES 33 100.000   0.000   0.000   0.000 000 24:00:00  98.587 000 00:42.9
IDC_SEIS  ABC    3  90.056   5.944   0.000   4.000 000 00:23:35  90.089 000 00:55.7     3     3     0
IDC_SEIS  DEF    3  80.154  19.846   0.000   0.000 000 24:00:00  83.080 000 05:23.6
```

## WAVEFORM (IMS1.0:CM6 FORMAT)

The following waveform has the channel code `scc`, which indicates that it is a short-period coherent beam. The `eid2` line shows that this waveform is associated with the IDC_REB event `54903285`. The `bea2` line reveals that the beam was formed with an azimuth of 127.6 degrees and slowness of 0.125 degrees/second. The *BeamID* `FICB.Pa` may be used to get more detailed beam information from the `beam` data type.

```
DATA_TYPE WAVEFORM IMS1.0:CM6
WID2 1996/10/15 09:54:00.000 ARCES  scc      CM6     1200   20.000000   2.70e-01  1.0000 S-13   -1.0  0.0
STA2 IDC_SEIS    69.53489   25.50580 WGS-84       0.402 0.009
EID2 54903285 IDC_REB
BEA2 FICB.Pa      127.6  0.125
DAT2
AFkFCUHTkHUHCkRMUK-F4N+2-M1UHkGT6UHkGRUG6kQDDkEPUI7kO0UKLMUFLP6-F2R+AKkFC3OGA+kG65kEABQR
8DQIAFS+BR5UFTkFUG5SFCNH70LF7HP5BkG-AMkG6U
...
CHK2 8439546
```

The following message would be sent if data were not available from station KAF, channel shz from 1996 October 15 9:56:00.000 through 1996 October 15 9:57:00.000.

```
DATA_TYPE WAVEFORM IMS1.0:CM6
WID2 1996/10/15 09:54:00.000 KAF   shz      CM6     2400   20.000000   2.70e-01  1.0000 S-13    -1.0  0.0
STA2 IDC_SEIS    62.11270   26.30621 WGS-84       0.195 0.014
DAT2
AFkFCUHTkHUHCkRMUK-F4N+2-M1UHkGT6UHkGRUG6kQDDkEPUI7kO0UKLMUFLP6-F2R+AKkFC3OGA+kG65kEABQR
8DQIAFS+BR5UFTkFUG5SFCNH70LF7HP5BkG-AMkG6U
...
CHK2 1439544
OUT2 1996/10/15 09:56:00.000 KAF   shz           60.000
STA2 IDC_SEIS    62.11270   26.30621 WGS-84       0.195 0.014
WID2 1996/10/15 09:57:00.000 KAF   shz      CM6     1200   20.000000   2.70e-01  1.0000 S-13    -1.0  0.0
STA2 IDC_SEIS    62.11270   26.30621 WGS-84       0.195 0.014
DAT2
AFkFCUHTkHUHCkRMUK-F4N+2-M1UHkGT6UHkGRUG6kQDDkEPUI7kO0UKLMUFLP6-FH62R+AKkFC3OGA+kG65kEABQR
8DQIAFS+BR5UFTkFUG5SFCNH70LF7HP5BkG-AMkG6U
...
CHK2 8648264
STOP
```

## WAVEFORM (IMS1.0:INT FORMAT)

```
WID2 1994/03/10 12:13:14.800 BLA   shz      INT    32490   40.000000   1.30e-02   2.000 GS-13   -1.0  0.0
STA2 IDC_SEIS    37.21130  -80.42050 WGS-84       0.491 0.009
DAT2
1873 1734 1690 1200 873 340 -290 -478 -1300 -209 -1972 -24 13 25 64 81 102 76 53 23 -10 -80 -132
...
12 15 36 75 53 80 27 6 -17 -32 -95 -73 -43 -4 3 29 46 59 100 125 103 76 52 10 -30
CHK2  4968214
```

# Appendix B: Authentication Example

This appendix contains an example of an authenticated request message.

# Appendix B: Authentication Example

## AUTHENTICATED REQUEST MESSAGE

The following example shows a message requesting data from the Standard Event List 1 (SEL1). The message would be authenticated between the 'BEGIN' and 'STOP' lines. The digital signature is in the section labeled 'Cryptographic Signature'.

```
Received: from oedipus.CSS.GOV (oedipus.CSS.GOV [140.162.3.93])
        by zydeco.CSS.GOV (8.8.8/8.8.8) with ESMTP id KAA10451;
        Fri, 2 Oct 1998 10:37:32 -0400 (EDT)
Received: from cmr.gov (localhost [127.0.0.1])
        by oedipus.CSS.GOV (8.8.8/8.8.8) with ESMTP id KAA20612;
        Fri, 2 Oct 1998 10:37:30 -0400 (EDT)
Sender: pmoore@cmr.gov
Message-ID: <3614E521.707893E2@cmr.gov>
Date: Fri, 02 Oct 1998 10:37:21 -0400
From: "Patrick G. Moore" <pmoore@cmr.gov>
Organization: Center for Monitoring Research
X-Mailer: Mozilla 4.05 [en] (X11; I; SunOS 5.6 sun4m)
MIME-Version: 1.0
To: salzberg@css.gov
Subject: signed request message
Content-Type: multipart/signed; protocol="application/x-pkcs7-signature";
micalg=sha1; boundary="------------msDC7ECA315AB748BC62A6C224"
Content-Length: 3772
X-Mozilla-Status: 8001

This is a cryptographically signed message in MIME format.

--------------msDC7ECA315AB748BC62A6C224
Content-Type: text/plain; charset=us-ascii
```

```
Content-Transfer-Encoding: 7bit

BEGIN IMS1.0
MSG_TYPE REQUEST
MSG_ID Auth_ex GSI_IDC
TIME 1998/01/01 to 1998/01/02
BULL_TYPE SEL1
BULLETIN IMS1.0
STOP
--------------msDC7ECA315AB748BC62A6C224
Content-Type: application/x-pkcs7-signature; name="smime.p7s"
Content-Transfer-Encoding: base64
Content-Disposition: attachment; filename="smime.p7s"
Content-Description: S/MIME Cryptographic Signature
```


```
MIIJMAYJKoZIhvcNAQcCoIIJITCCCR0CAQExCzAJBgUrDgMCGgUAMAsGCSqGSIb3DQEHAaCC
B6wwggQ3MIIDoKADAgECAgQ0YloEMA0GCSqGSIb3DQEBBAUAMGAxCzAJBgNVBAYTAkNBMR4w
HAYDVQQKExVObyBMaWFiaWxpdHkgQWNjZXB0ZWQxMTAvBgNVBAsTKEVudHJ1c3QgRGVtbyBX
ZWIgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkwHhcNOTgxMDAxMTgyMzA2WhcNOTkwNDAxMTgy
MzA2WjCBijELMAkGA1UEBhMCVVMxJzAlBgNVBAoTHkNlbnRlciBmb3IgTW9uaXRvcmluZyBS
ZXNlYXJjaDEdMBsGA1UECxMUU29mdHdhcmUgRGV2ZWxvcG1lbnQxMzAUBgNVBAMTDVBhdHJp
Y2sgTW9vcmUwGwYJKoZIhvcNAQkBFg5wbW9vcmVAY21yLmdvdjBcMA0GCSqGSIb3DQEBAQUA
A0sAMEgCQQDTgv4+uPOreqmgeL2T0VUbbsKqU6X7sJx2IRm68GI35c1+97f68DgWsS+T6IlZ
K4e1Ut7OQJ9JeDzbqhmpQq3NAgMBAAGjggIVMIICETA9BglghkgBhvhCAQMEMBYuY2dpLWNs
aS93ZWJjbGkuZXhlP3R5cGU9cmV2Y2hlY2s/Q1JMPTY/c2VyaWFsPTARBglghkgBhvhCAQEE
BAMCBSAwJQYJYIZIAYb4QgECBBgWFmh0dHA6Ly8yMDQuMTAxLjEyOC41MC8wIAYJYIZIAYb4
QgEHBBMWEWRvY2NsaS9pbmRleC5odG1sMCEGCWCGSAGG+EIBCAQUFhJkb2NjbGkvcG9saWN5
Lmh0bWwwNwYJYIZIAYb4QgENBCoWKFRoaXMgaXMgYSBTL01JTUUtT25seSBjbGllbnQgY2Vy
dGlmaWNhdGUwHwYDVR0jBBgwFoAUkxYpvqwKH9VS8o3Yym0flfhL9EcwHQYDVR0OBBYEFPYj
DVfe+8OlpNxYtK9daBITznPTMAsGA1UdDwQEAwIFoDAaBgNVHRAEEzARgQ8xOTk5MDIwNjAz
MjMwNlowCQYDVR0TBAIwADCBggYDVR0fBHsweTB3oHWgc6RxMG8xCzAJBgNVBAYTAkNBMR4w
HAYDVQQKExVObyBMaWFiaWxpdHkgQWNjZXB0ZWQxMTAvBgNVBAsTKEVudHJ1c3QgRGVtbyBX
ZWIgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkxDTALBgNVBAMTBENSTDYwHwYJKoZIhvZ9B0EA
BBIwEBsKV0VCQ0EgMS4wMQMCBsAwDQYJKoZIhvcNAQEEBQADgYEASgO6n8As0qlp4v7u99ia
A8JUNm9k2Fxp/mmcVaK91G2qNPFkP1dXqj0jJ1BkLQW2eWEcogzgF80odblVLqxoDUeOr4ek
QngYwC2LPtGopcA1c1+Faqtx39RjWd2rAZNpL4pdKeTQ+MrHY1WBAAtT8L6JJvFkDmiX8j55
Lu1DlkYwggNtMIIC1qADAgECAgQ0Yjf/MA0GCSqGSIb3DQEBBAUAMGAxCzAJBgNVBAYTAkNB
MR4wHAYDVQQKExVObyBMaWFiaWxpdHkgQWNjZXB0ZWQxMTAvBgNVBAsTKEVudHJ1c3QgRGVt
byBXZWIgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkwHhcNOTcxMTA2MjEzNDU0WhcNMDIxMTA2
MjEzNDU0WjBgMQswCQYDVQQGEwJDQTEeMBwGA1UEChMVTm8gTGlhYmlsaXR5IEFjY2VwdGVk
```

```
MTEwLwYDVQQLEyhFbnRydXN0IERlbW8gV2ViIENlcnRpZmljYXRpb24gQXV0aG9yaXR5MIGd
MA0GCSqGSIb3DQEBAQUAA4GLADCBhwKBgQCt0ateoxBrX9dRs59Layn0VVN/qDtqYOADZexB
qm514GkOV1wYj6chu74AjjvNHMMcikhR3cOLBw6edRlzo0FZOIGFtABXPfqcBwjLeMCx6VeI
TMTrVhUvh04M+P/RFkD6eR+T3aKfFH0pNem1aVd1zoywHQ7R0JA5rihShB/u9QIBA6OCATQw
ggEwMB8GA1UdIwQYMBaAFJMWKb6sCh/VUvKN2MptH5X4S/RHMB0GA1UdDgQWBBSTFim+rAof
1VLyjdjKbR+V+Ev0RzALBgNVHQ8EBAMCAQYwGgYDVR0QBBMwEYEPMjAwMjExMDYyMTM0NTRa
MAwGA1UdEwQFMAMBAf8wgYIGA1UdHwR7MHkwd6B1oHOkcTBvMQswCQYDVQQGEwJDQTEeMBwG
A1UEChMVTm8gTGlhYmlsaXR5IEFjY2VwdGVkMTEwLwYDVQQLEyhFbnRydXN0IERlbW8gV2Vi
IENlcnRpZmljYXRpb24gQXV0aG9yaXR5MQ0wCwYDVQQDEwRDUkwxMB8GCSqGSIb2fQdBAAQS
MBAbCldFQkNBIDEuMDEDAgbAMBEGCWCGSAGG+EIBAQQEAwIABzANBgkqhkiG9w0BAQQFAAOB
gQAJHffNpg4CAhG/61jQBkZGoxJRMPYj6jhkncbLztl/EcU96YtZ38FP/SO4V0jtYK21PRi1
LKw/MfOVH+IiehXg58NMKPqXHKO0YY1j4Jy4TTLncFaRh101tPXtegaykQp+FLxkDc9638d+
aG4fm0V3BRe8G1+pLx4mN9eobeexzjGCAUwwggFIAgEBMGgwYDELMAkGA1UEBhMCQ0ExHjAc
BgNVBAoTFU5vIExpYWJpbGl0eSBBY2NlcHRlZDExMC8GA1UECxMoRW50cnVzdCBEZW1vIFdl
YiBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eQIENGJaBDAJBgUrDgMCGgUAoH0wGAYJKoZIhvcN
AQkDMQsGCSqGSIb3DQEHATAcBgkqhkiG9w0BCQUxDxcNOTgxMDAyMTQzNzIxWjAeBgkqhkiG
9w0BCQ8xETAPMA0GCCqGSIb3DQMCAgEoMCMGCSqGSIb3DQEJBDEWBBT+v88ZXyzZ6HBAABDd
0z7ITN3LkjANBgkqhkiG9w0BAQEFAARAJWfm571r5R24d9jWsmZ8e/qB4yVC39zPHLvhkwoV
Nju0AxQw6eNt8Mp7GpO22vI7Vz/sIAlptsE2unNH1T5wwA==
--------------msDC7ECA315AB748BC62A6C224--
```

## DECODED SIGNATURE BLOCK

This section shows the decoded contents of the signature block for the previous example. The signature block was first converted from its base 64 encoding to the ASN.1 binary representation. Next, the binary representation was parsed with a custom program to identify each ASN.1 field that is contained in the signature block. The X.509 specification determines the ASN.1 fields and their ordering within the certificates and signatures [ITU95].

This signature block in the example contains the signature of the body of the message using one PIDC staff member's secret RSA key, along with a public key in a certificate, which has been signed by the Entrust demo Certificate Authority. To verify this signature, the application must have the PIDC staff member's or the Certificate Authority's certificate in its list of trusted certificates. This block would be almost identical had DSA been used rather than RSA signatures.

```
  0 30 2352: SEQUENCE {
  4 06    9:   OBJECT IDENTIFIER signedData (1 2 840 113549 1 7 2)
 15 A0 2337:   [0] {
 19 30 2333:     SEQUENCE {
 23 02    1:       INTEGER 1
 26 31   11:       SET {
 28 30    9:         SEQUENCE {
 30 06    5:           OBJECT IDENTIFIER sha1 (1 3 14 3 2 26)
 37 05    0:           NULL
           :           }
           :         }
 39 30   11:       SEQUENCE {
 41 06    9:         OBJECT IDENTIFIER data (1 2 840 113549 1 7 1)
           :         }
 52 A0 1964:       [0] {
 56 30 1079:         SEQUENCE {
 60 30  928:           SEQUENCE {
 64 A0    3:             [0] {
 66 02    1:               INTEGER 2
           :               }
 69 02    4:             INTEGER 878860804
 75 30   13:             SEQUENCE {
 77 06    9:               OBJECT IDENTIFIER
           :                 md5withRSAEncryption (1 2 840 113549 1 1 4)
 88 05    0:               NULL
           :               }
 90 30   96:             SEQUENCE {
 92 31   11:               SET {
 94 30    9:                 SEQUENCE {
 96 06    3:                   OBJECT IDENTIFIER countryName (2 5 4 6)
101 13    2:                   PrintableString 'CA'
           :                   }
           :                 }
105 31   30:               SET {
107 30   28:                 SEQUENCE {
109 06    3:                   OBJECT IDENTIFIER organizationName (2 5 4 10)
114 13   21:                   PrintableString 'No Liability Accepted'
           :                   }
           :                 }
```

```
 137 31   49:             SET {
 139 30   47:               SEQUENCE {
 141 06    3:                 OBJECT IDENTIFIER
            :                   organizationalUnitName (2 5 4 11)
 146 13   40:                 PrintableString 'Entrust Demo Web Certification
Authority'

            :                 }
            :               }
            :             }
 188 30   30:           SEQUENCE {
 190 17   13:             UTCTime '981001182306Z'
 205 17   13:             UTCTime '990401182306Z'
            :             }
 220 30  138:           SEQUENCE {
 223 31   11:             SET {
 225 30    9:               SEQUENCE {
 227 06    3:                 OBJECT IDENTIFIER countryName (2 5 4 6)
 232 13    2:                 PrintableString 'US'
            :                 }
            :               }
 236 31   39:             SET {
 238 30   37:               SEQUENCE {
 240 06    3:                 OBJECT IDENTIFIER organizationName (2 5 4 10)
 245 13   30:                 PrintableString 'Center for Monitoring Research'
            :                 }
            :               }
 277 31   29:             SET {
 279 30   27:               SEQUENCE {
 281 06    3:                 OBJECT IDENTIFIER
            :                   organizationalUnitName (2 5 4 11)
 286 13   20:                 PrintableString 'Software Development'
            :                 }
            :               }
 308 31   51:             SET {
 310 30   20:               SEQUENCE {
 312 06    3:                 OBJECT IDENTIFIER commonName (2 5 4 3)
 317 13   13:                 PrintableString 'Patrick Moore'
            :                 }
 332 30   27:               SEQUENCE {
 334 06    9:                 OBJECT IDENTIFIER
```

```
           :                 emailAddress (1 2 840 113549 1 9 1)
345 16   14:               IA5String 'pmoore@cmr.gov'
           :               }
           :             }
           :           }
361 30   92:         SEQUENCE {
363 30   13:           SEQUENCE {
365 06    9:             OBJECT IDENTIFIER
           :               rsaEncryption (1 2 840 113549 1 1 1)
376 05    0:             NULL
           :             }
378 03   75:           BIT STRING 0 unused bits
           :             30 48 02 41 00 D3 82 FE 3E B8 F3 AB 7A A9 A0 78
           :             BD 93 D1 55 1B 6E C2 AA 53 A5 FB B0 9C 76 21 19
           :             BA F0 62 37 E5 CD 7E F7 B7 FA F0 38 16 B1 2F 93
           :             E8 89 59 2B 87 B5 52 DE CE 40 9F 49 78 3C DB AA
           :             19 A9 42 AD CD 02 03 01 00 01
           :           }
455 A3  533:         [3] {
459 30  529:           SEQUENCE {
463 30   61:             SEQUENCE {
465 06    9:               OBJECT IDENTIFIER
           :                 revocation-url (2 16 840 1 113730 1 3)
476 04   48:               OCTET STRING
           :               16 2E 63 67 69 2D 63 6C 69 2F 77 65 62 63 6C 69
           :               2E 65 78 65 3F 74 79 70 65 3D 72 65 76 63 68 65
           :               63 6B 3F 43 52 4C 3D 36 3F 73 65 72 69 61 6C 3D
           :               }
526 30   17:             SEQUENCE {
528 06    9:               OBJECT IDENTIFIER
           :                 cert-type (2 16 840 1 113730 1 1)
539 04    4:               OCTET STRING
           :               03 02 05 20
           :               }
545 30   37:             SEQUENCE {
547 06    9:               OBJECT IDENTIFIER
           :                 base-url (2 16 840 1 113730 1 2)
558 04   24:               OCTET STRING
           :               16 16 68 74 74 70 3A 2F 2F 32 30 34 2E 31 30 31
           :               2E 31 32 38 2E 35 30 2F
```

```
          :                  }
584 30   32:               SEQUENCE {
586 06    9:                 OBJECT IDENTIFIER
          :                    renewal-url (2 16 840 1 113730 1 7)
597 04   19:                 OCTET STRING
          :                  16 11 64 6F 63 63 6C 69 2F 69 6E 64 65 78 2E 68
          :                  74 6D 6C
          :                  }
618 30   33:               SEQUENCE {
620 06    9:                 OBJECT IDENTIFIER
          :                    ca-policy-url (2 16 840 1 113730 1 8)
631 04   20:                 OCTET STRING
          :                  16 12 64 6F 63 63 6C 69 2F 70 6F 6C 69 63 79 2E
          :                  68 74 6D 6C
          :                  }
653 30   55:               SEQUENCE {
655 06    9:                 OBJECT IDENTIFIER
          :                    comment (2 16 840 1 113730 1 13)
666 04   42:                 OCTET STRING
          :                  16 28 54 68 69 73 20 69 73 20 61 20 53 2F 4D 49
          :                  4D 45 2D 4F 6E 6C 79 20 63 6C 69 65 6E 74 20 63
          :                  65 72 74 69 66 69 63 61 74 65
          :                  }
710 30   31:               SEQUENCE {
712 06    3:                 OBJECT IDENTIFIER
          :                    authorityKeyIdentifier (2 5 29 35)
717 04   24:                 OCTET STRING
          :                  30 16 80 14 93 16 29 BE AC 0A 1F D5 52 F2 8D D8
          :                  CA 6D 1F 95 F8 4B F4 47
          :                  }
743 30   29:               SEQUENCE {
745 06    3:                 OBJECT IDENTIFIER
          :                    subjectKeyIdentifier (2 5 29 14)
750 04   22:                 OCTET STRING
          :                  04 14 F6 23 0D 57 DE FB C3 A5 A4 DC 58 B4 AF 5D
          :                  68 12 13 CE 73 D3
          :                  }
774 30   11:               SEQUENCE {
776 06    3:                 OBJECT IDENTIFIER keyUsage (2 5 29 15)
781 04    4:                 OCTET STRING
```

```
             :                    03 02 05 A0
             :                    }
  787 30   26:                  SEQUENCE {
  789 06    3:                    OBJECT IDENTIFIER
             :                      privateKeyUsagePeriod (2 5 29 16)
  794 04   19:                    OCTET STRING
             :                    30 11 81 0F 31 39 39 39 30 32 30 36 30 33 32 33
             :                    30 36 5A
             :                    }
  815 30    9:                  SEQUENCE {
  817 06    3:                    OBJECT IDENTIFIER basicConstraints (2 5 29 19)
  822 04    2:                    OCTET STRING
             :                    30 00
             :                    }
  826 30  130:                  SEQUENCE {
  829 06    3:                    OBJECT IDENTIFIER cRLDistPoints (2 5 29 31)
  834 04  123:                    OCTET STRING
             :                    30 79 30 77 A0 75 A0 73 A4 71 30 6F 31 0B 30 09
             :                    06 03 55 04 06 13 02 43 41 31 1E 30 1C 06 03 55
             :                    04 0A 13 15 4E 6F 20 4C 69 61 62 69 6C 69 74 79
             :                    20 41 63 63 65 70 74 65 64 31 31 30 2F 06 03 55
             :                    04 0B 13 28 45 6E 74 72 75 73 74 20 44 65 6D 6F
             :                    20 57 65 62 20 43 65 72 74 69 66 69 63 61 74 69
             :                    6F 6E 20 41 75 74 68 6F 72 69 74 79 31 0D 30 0B
             :                    06 03 55 04 03 13 04 43 52 4C 36
             :                    }
  959 30   31:                  SEQUENCE {
  961 06    9:                    OBJECT IDENTIFIER nsn-ce (1 2 840 113533 7 65)
  972 04   18:                    OCTET STRING
             :                    30 10 1B 0A 57 45 42 43 41 20 31 2E 30 31 03 02
             :                    06 C0
             :                    }
             :                  }
             :                }
             :              }
  992 30   13:            SEQUENCE {
  994 06    9:              OBJECT IDENTIFIER
             :                md5withRSAEncryption (1 2 840 113549 1 1 4)
 1005 05    0:              NULL
             :              }
```

```
1007 03  129:          BIT STRING 0 unused bits
            :            4A 03 BA 9F C0 2C D2 A9 69 E2 FE EE F7 D8 9A 03
            :            C2 54 36 6F 64 D8 5C 69 FE 69 9C 55 A2 BD D4 6D
            :            AA 34 F1 64 3F 57 57 AA 3D 23 27 50 64 2D 05 B6
            :            79 61 1C A2 0C E0 17 CD 28 75 B9 55 2E AC 68 0D
            :            47 8E AF 87 A4 42 78 18 C0 2D 8B 3E D1 A8 A5 C0
            :            35 73 5F 85 6A AB 71 DF D4 63 59 DD AB 01 93 69
            :            2F 8A 5D 29 E4 D0 F8 CA C7 63 55 81 00 0B 53 F0
            :            BE 89 26 F1 64 0E 68 97 F2 3E 79 2E ED 43 96 46
            :          }
1139 30  877:        SEQUENCE {
1143 30  726:          SEQUENCE {
1147 A0    3:            [0] {
1149 02    1:              INTEGER 2
            :              }
1152 02    4:            INTEGER 878852095
1158 30   13:            SEQUENCE {
1160 06    9:              OBJECT IDENTIFIER
            :                md5withRSAEncryption (1 2 840 113549 1 1 4)
1171 05    0:              NULL
            :              }
1173 30   96:            SEQUENCE {
1175 31   11:              SET {
1177 30    9:                SEQUENCE {
1179 06    3:                  OBJECT IDENTIFIER countryName (2 5 4 6)
1184 13    2:                  PrintableString 'CA'
            :                  }
            :                }
1188 31   30:              SET {
1190 30   28:                SEQUENCE {
1192 06    3:                  OBJECT IDENTIFIER organizationName (2 5 4 10)
1197 13   21:                  PrintableString 'No Liability Accepted'
            :                  }
            :                }
1220 31   49:              SET {
1222 30   47:                SEQUENCE {
1224 06    3:                  OBJECT IDENTIFIER
            :                    organizationalUnitName (2 5 4 11)
1229 13   40:                  PrintableString 'Entrust Demo Web Certification
Authority'
```

```
             :                 }
             :               }
             :             }
1271 30   30:            SEQUENCE {
1273 17   13:              UTCTime '971106213454Z'
1288 17   13:              UTCTime '021106213454Z'
             :              }
1303 30   96:            SEQUENCE {
1305 31   11:              SET {
1307 30    9:                SEQUENCE {
1309 06    3:                  OBJECT IDENTIFIER countryName (2 5 4 6)
1314 13    2:                  PrintableString 'CA'
             :                  }
             :                }
1318 31   30:              SET {
1320 30   28:                SEQUENCE {
1322 06    3:                  OBJECT IDENTIFIER organizationName (2 5 4 10)
1327 13   21:                  PrintableString 'No Liability Accepted'
             :                  }
             :                }
1350 31   49:              SET {
1352 30   47:                SEQUENCE {
1354 06    3:                  OBJECT IDENTIFIER
             :                    organizationalUnitName (2 5 4 11)
1359 13   40:                  PrintableString 'Entrust Demo Web Certification
Authority'
             :                  }
             :                }
             :              }
1401 30  157:            SEQUENCE {
1404 30   13:              SEQUENCE {
1406 06    9:                OBJECT IDENTIFIER
             :                  rsaEncryption (1 2 840 113549 1 1 1)
1417 05    0:                NULL
             :                }
1419 03  139:              BIT STRING 0 unused bits
             :                30 81 87 02 81 81 00 AD D1 AB 5E A3 10 6B 5F D7
             :                51 B3 9F 4B 6B 29 F4 55 53 7F A8 3B 6A 60 E0 03
             :                65 EC 41 AA 6E 75 E0 69 0E 57 5C 18 8F A7 21 BB
             :                BE 00 8E 3B CD 1C C3 1C 8A 48 51 DD C3 8B 07 0E
```

```
            :              9E 75 19 73 A3 41 59 38 81 85 B4 00 57 3D FA 9C
            :              07 08 CB 78 C0 B1 E9 57 88 4C C4 EB 56 15 2F 87
            :              4E 0C F8 FF D1 16 40 FA 79 1F 93 DD A2 9F 14 7D
            :              29 35 E9 B5 69 57 75 CE 8C B0 1D 0E D1 D0 90 39
            :                      [ Another 10 bytes skipped ]
            :            }
1561 A3  308:          [3] {
1565 30  304:            SEQUENCE {
1569 30   31:              SEQUENCE {
1571 06    3:                OBJECT IDENTIFIER
            :                  authorityKeyIdentifier (2 5 29 35)
1576 04   24:                OCTET STRING
            :                30 16 80 14 93 16 29 BE AC 0A 1F D5 52 F2 8D D8
            :                CA 6D 1F 95 F8 4B F4 47
            :                }
1602 30   29:              SEQUENCE {
1604 06    3:                OBJECT IDENTIFIER
            :                  subjectKeyIdentifier (2 5 29 14)
1609 04   22:                OCTET STRING
            :                04 14 93 16 29 BE AC 0A 1F D5 52 F2 8D D8 CA 6D
            :                1F 95 F8 4B F4 47
            :                }
1633 30   11:              SEQUENCE {
1635 06    3:                OBJECT IDENTIFIER keyUsage (2 5 29 15)
1640 04    4:                OCTET STRING
            :                03 02 01 06
            :                }
1646 30   26:              SEQUENCE {
1648 06    3:                OBJECT IDENTIFIER
            :                  privateKeyUsagePeriod (2 5 29 16)
1653 04   19:                OCTET STRING
            :                30 11 81 0F 32 30 30 32 31 31 30 36 32 31 33 34
            :                35 34 5A
            :                }
1674 30   12:              SEQUENCE {
1676 06    3:                OBJECT IDENTIFIER basicConstraints (2 5 29 19)
1681 04    5:                OCTET STRING
            :                30 03 01 01 FF
            :                }
1688 30  130:              SEQUENCE {
```

```
1691 06    3:             OBJECT IDENTIFIER cRLDistPoints (2 5 29 31)
1696 04  123:             OCTET STRING
            :             30 79 30 77 A0 75 A0 73 A4 71 30 6F 31 0B 30 09
            :             06 03 55 04 06 13 02 43 41 31 1E 30 1C 06 03 55
            :             04 0A 13 15 4E 6F 20 4C 69 61 62 69 6C 69 74 79
            :             20 41 63 63 65 70 74 65 64 31 31 30 2F 06 03 55
            :             04 0B 13 28 45 6E 74 72 75 73 74 20 44 65 6D 6F
            :             20 57 65 62 20 43 65 72 74 69 66 69 63 61 74 69
            :             6F 6E 20 41 75 74 68 6F 72 69 74 79 31 0D 30 0B
            :             06 03 55 04 03 13 04 43 52 4C 31
            :             }
1821 30   31:           SEQUENCE {
1823 06    9:             OBJECT IDENTIFIER nsn-ce (1 2 840 113533 7 65)
1834 04   18:             OCTET STRING
            :             30 10 1B 0A 57 45 42 43 41 20 31 2E 30 31 03 02
            :             06 C0
            :             }
1854 30   17:           SEQUENCE {
1856 06    9:             OBJECT IDENTIFIER
            :               cert-type (2 16 840 1 113730 1 1)
1867 04    4:             OCTET STRING
            :             03 02 00 07
            :             }
            :           }
            :         }
            :       }
1873 30   13:     SEQUENCE {
1875 06    9:       OBJECT IDENTIFIER
            :         md5withRSAEncryption (1 2 840 113549 1 1 4)
1886 05    0:       NULL
            :       }
1888 03  129:     BIT STRING 0 unused bits
            :       09 1D F7 CD A6 0E 02 02 11 BF EB 58 D0 06 46 46
            :       A3 12 51 30 F6 23 EA 38 64 9D C6 CB CE D9 7F 11
            :       C5 3D E9 8B 59 DF C1 4F FD 23 B8 57 48 ED 60 AD
            :       B5 3D 18 B5 2C AC 3F 31 F3 95 1F E2 22 7A 15 E0
            :       E7 C3 4C 28 FA 97 1C A3 B4 61 8D 63 E0 9C B8 4D
            :       32 E7 70 56 91 87 5D 35 B4 F5 ED 7A 06 B2 91 0A
            :       7E 14 BC 64 0D CF 7A DF C7 7E 68 6E 1F 9B 45 77
            :       05 17 BC 1B 5F A9 2F 1E 26 37 D7 A8 6D E7 B1 CE
```

```
           :           }
           :         }
2020 31  332:       SET {
2024 30  328:         SEQUENCE {
2028 02    1:           INTEGER 1
2031 30  104:           SEQUENCE {
2033 30   96:             SEQUENCE {
2035 31   11:               SET {
2037 30    9:                 SEQUENCE {
2039 06    3:                   OBJECT IDENTIFIER countryName (2 5 4 6)
2044 13    2:                   PrintableString 'CA'
           :                   }
           :                 }
2048 31   30:               SET {
2050 30   28:                 SEQUENCE {
2052 06    3:                   OBJECT IDENTIFIER organizationName (2 5 4 10)
2057 13   21:                   PrintableString 'No Liability Accepted'
           :                   }
           :                 }
2080 31   49:               SET {
2082 30   47:                 SEQUENCE {
2084 06    3:                   OBJECT IDENTIFIER
           :                     organizationalUnitName (2 5 4 11)
2089 13   40:                   PrintableString 'Entrust Demo Web Certification
Authority'

           :                   }
           :                 }
           :               }
2131 02    4:             INTEGER 878860804
           :             }
2137 30    9:           SEQUENCE {
2139 06    5:             OBJECT IDENTIFIER sha1 (1 3 14 3 2 26)
2146 05    0:             NULL
           :             }
2148 A0  125:           [0] {
2150 30   24:             SEQUENCE {
2152 06    9:               OBJECT IDENTIFIER
           :                 contentType (1 2 840 113549 1 9 3)
2163 31   11:               SET {
2165 06    9:                 OBJECT IDENTIFIER data (1 2 840 113549 1 7 1)
```

```
              :              }
              :            }
2176 30   28:            SEQUENCE {
2178 06    9:              OBJECT IDENTIFIER
              :                signingTime (1 2 840 113549 1 9 5)
2189 31   15:              SET {
2191 17   13:                UTCTime '981002143721Z'
              :                }
              :              }
2206 30   30:            SEQUENCE {
2208 06    9:              OBJECT IDENTIFIER
              :                sMIMECapabilities (1 2 840 113549 1 9 15)
2219 31   17:              SET {
2221 30   15:                SEQUENCE {
2223 30   13:                  SEQUENCE {
2225 06    8:                    OBJECT IDENTIFIER rc2CBC (1 2 840 113549 3 2)
2235 02    1:                    INTEGER 40
              :                    }
              :                  }
              :                }
              :              }
2238 30   35:            SEQUENCE {
2240 06    9:              OBJECT IDENTIFIER
              :                messageDigest (1 2 840 113549 1 9 4)
2251 31   22:              SET {
2253 04   20:                OCTET STRING
              :                  FE BF CF 19 5F 2C D9 E8 70 40 00 10 DD D3 3E C8
              :                  4C DD CB 92
              :                }
              :              }
              :            }
2275 30   13:          SEQUENCE {
2277 06    9:            OBJECT IDENTIFIER
              :              rsaEncryption (1 2 840 113549 1 1 1)
2288 05    0:            NULL
              :            }
2290 04   64:          OCTET STRING
              :            25 67 E6 E7 BD 6B E5 1D B8 77 D8 D6 B2 66 7C 7B
              :            FA 81 E3 25 42 DF DC CF 1C BB E1 93 0A 15 36 3B
              :            B4 03 14 30 E9 E3 6D F0 CA 7B 1A 93 B6 DA F2 3B
```

```
:              57 3F EC 20 09 69 B6 C1 36 BA 73 47 D5 3E 70 C0
:            }
:          }
:        }
:      }
:    }

0 warnings, 0 errors.
```

# Glossary

## Symbols

**μBq**

MicroBecquerels.

**A**

**acquisition live time**

Time multichannel analyzer (MCA) electronics is available for processing pulse amplitude signals; equivalent to acquisition real-time less detector dead-time, reported in seconds.

**acquisition real time**

Total elapsed clock time a sample is counted, reported in seconds.

**acquisition start date**

Date of spectrum acquisition commencement, format is *yyyy/mm/dd*.

**acquisition start time**

Time of spectrum acquisition commencement, format is *hh:mm:ss.s*.

**acquisition time interval**

Equivalent to live time, reported in seconds.

**activation products**

Nuclides produced from the absorption of a neutron by a nucleus.

**activity**

Decay rate of a radionuclide; this quantity is usually expressed in Becquerels (disintegrations per second), Bq.

**ARMR**

Atmospheric Radionuclide Measurement Report; electronic file containing a spectrum summary, collection statistics, comments, nuclide results, MDC's peak search results, and calibration equations.

**ARR**

Automatic Radionuclide Report; product of automatic data processing that includes sections describing the sample information, categorization results, sample activity, MDCs for key nuclides, peak search results and notes, processing parameters, update parameters, data quality flags, event screening flags, calibration equations, and field of regard.

**array**

Collection of sensors distributed over a finite area (usually in a cross or concentric pattern) and referred to as a single station.

**ARSA**

Automated Radioxenon Sampler/Analyzer.

**ASCII**

American Standard Code for Information Interchange. Standard, unformatted 256-character set of letters and numbers.

**assay date**

Date of certificate source assay, format is *yyyy/mm/dd*.

**assay time**

Time of certificate source assay, format is *hh*:*mm*:*ss.s*.

**AutoDRM**

Automatic Data Request Manager.

**AUX**

(1) R: Auxiliary Power Supply. (2) S/H/I: Abbreviation for an auxiliary station code.

**avg**

Average.

## B

**background**

Contribution to a spectrum from naturally occurring radionuclides as well as interactions between radiation and materials in the vicinity of the detector.

**background measurement ID**

Unique alphanumeric string identifying the relevant background measurement for a specific sample; includes the detector code and the background acquisition initiation date and time.

**barometric pressure**

Outside air pressure, expressed in hPa.

**baseline**

Contribution to a spectrum from the partial energy deposition of a photon in a detector.

**beam**

Waveform created from array station elements that are sequentially summed in the direction of a specified azimuth and slowness.

**Becquerel**

Unit of activity equal to one disintegration per second; denoted by Bq.

**BLANKPHD**

Blank Pulse Height Data; ASCII data message containing the pulse height data of an unexposed air filter, as well as other information, in an IDC-approved format.

**BMID**

Background Measurement ID.

**Bq**

Becquerel.

## C

**°C**

Degrees Celsius.

**CALIBPHD**

Calibration Pulse Height Data; ASCII data message containing the pulse height data of a certified standard source, as well as other information, in an IDC-approved format. The data in a CALIBPHD is used to perform the ECR, EER, and RER.

**category**

R: Number from 1 to 5 assigned to a radionuclide sample indicating the presence of certain types of nuclides. Category 1 indicates a spectrum with normal natural nuclides while 5 indicates spectra with multiple man made nuclides.

**centroid**

Energy (in keV) or channel number at the center of a fitted peak.

**centroid channel**

Spectrum channel at the center of a photopeak.

**certificate**

Certified standard source of known activity used in the acquisition of radionuclide energy, resolution, and efficiency calibration data.

**certified laboratory**

Radionuclide laboratories listed in Annex 1 of the CTBT and including any laboratories that are certified by the IMS/IDC in the future.

**channel**

(1) R: Energy window (in keV) representing a differential increment of pulse height. Many spectra are divided into 4,096 channels. (2) S/H/I: Component of motion or distinct stream of data.

**cm**

Centimeter.

**CNF**

Canberra Nuclear Format.

**collection start date**

Date of air sample collection commencement, format is *yyyy/mm/dd*.

**collection start time**

Time of air sample collection commencement, format is *hh*:*mm*:*ss.s*.

**collection stop date**

Date of air sample collection termination, format is *yyyy/mm/dd*.

**collection stop time**

Time of air sample collection termination, format is *hh*:*mm*:*ss.s*.

**comments**

Free text field containing comments made by a station operator or IDC analyst.

**count(s)**

(1) R: Number of pulses observed within a spectrum channel. (2) S/H/I: Units of digital waveform data.

**CTBT**

Comprehensive Nuclear Test-Ban Treaty (the Treaty).

**CTBTO**

Comprehensive Nuclear Test-Ban Treaty Organization.

## D

**data block**

Units of information that, when combined with other data blocks, comprise a data message.

**data type**

Kind of data in a data message.

**date of last calibration**

Date of previous detector calibration, format is *yyyy/mm/dd*.

**dB**

Decibel.

**decade**

Factor of ten in frequency (Hz).

**decay time**

Duration of time an exposed filter is allowed to decay before data acquisition begins.

**deg.**

Degrees (as a distance).

**DETBKPHD**

Detector Background Pulse Height Data; ASCII data message containing the pulse height data from a background count, as well as other information, in an IDC-approved format.

**detector code (or ID)**

Includes the radionuclide site code plus four unique characters identifying a specific detector unit.

**detector type**

Data field describing the type of radiation detector used in the data acquisition process.

## E

**E.**

East.

**ECR**

Energy versus Channel Regression; an equation providing the detector-specific relationship between channel number and energy. The equation contains calibration coefficients and is interpolated from a transmitted calibration spectrum and compared to the ECRU for quality control.

**ECRU**

Energy versus Channel Regression Update; an equation providing the detector-specific relationship between channel number and energy. The equation contains calibration coefficients, is interpolated using photopeak identification data from the transmitted spectrum and is compared with the ECR for quality control.

**efficiency**

Ratio of counts detected under a photopeak to the amount of radiation quanta emitted by a sample; depends on detector configuration and geometry.

**email**

Electronic mail.

**energy**

(1) R: Kinetic energy of a photon or particle emitted from a nuclide (in keV). (2) S/H/I: Occurrence that displays characteristics indicative of a possible nuclear weapons test.

**event**

(1) S/H/I: Unique source of seismic, hydroacoustic, or infrasonic wave energy that is limited in both time and space. (2) R: occurrence that displays characteristics indicative of a possible nuclear weapons test.

**Executive Council**

Executive body of the CTBTO responsible for supervising the activities of the Technical Secretariat.

# F

**FDSN**

Federation of Digital Seismic Networks.

**FIR**

Finite Impulse Response.

**fission products**

Radionuclides produced from fission.

**flow rate**

Air volume passing through an air filter per unit time; reported in scm ($m^3$)/hr.

**FPEB**

Fission Product Event Bulletin; bulletin generated by the IDC when fission or activation products are detected at a radionuclide station above normal limits. An FPEB contains information on the possible event, source location, fission products, activation products detected, any isotopic ratios calculated, and any certified laboratory results.

**FTP**

File Transfer Protocol; protocol for transferring files between computers.

**FULL SPHD**

Full Sample Pulse Height Data; ASCII data message containing the pulse height data of a sample acquired for approximately 24 hours, as well as other information, in an IDC-approved format.

**full width at half-maximum**

Metric of detector resolution and equivalent to the width of a photopeak (in keV) taken at the peak height equal to half the maximum peak counts.

**FWHM**

Full Width at Half-Maximum.

# G

**g**

Gram.

**gain**

(1) R: Amplification of a photon's energy deposition signal in a detector crystal. This is achieved through the use of electronic amplifiers. (2) S/H/I: Amplification of waveform energy.

**GSE**

Group of Scientific Experts.

**GSETT-3**

Group of Scientific Experts Third Technical Test.

## H

**h**

Hour.

**HPGe**

High-Purity Germanium Detector.

**Hz**

Hertz.

## I

**IDC**

International Data Centre.

**IEEE**

Institute for Electrical and Electronic Engineers.

**IIR**

Infinite Impulse Response.

**IMS**

International Monitoring System.

**inHPGE**

Intrinsic HPGE detector.

**ISAR**

International Surveillance of Atmospheric Radionuclides.

**ISAR station**

Radionuclide monitoring station set up by the PIDC and that meets CTBT requirements.

**ISC**

International Seismic Centre.

## K

**keV**

Kiloelectron Volts; a metric of energy.

**km**

Kilometer.

## L

**LAR**

Laboratory Analysis Results.

**LEGe**

Low-Energy Germanium; a type of germanium detector that is used for low-energy gamma spectroscopy.

**LSB**

Least significant bit.

## M

**m**

1) Meter. 2) Megabyte. 1,024 kilobytes.

**$m_b$**

Magnitude of a seismic body wave.

**mbmle**

Magnitude of an event based on maximum likelihood estimation using seismic body waves.

**MDC**

Minimum Detectable Concentration. See minimum detectable concentration.

**measurement ID**

Unique alphanumeric string identifying a specific data acquisition; includes the detector code and the acquisition commencement date and time.

**message type**

Kind of message; possible message types include DATA, REQUEST, and SUBSCRIPTION.

**message ID**

Unique 20-character alphanumeric identification given to a message by the sender that facilitates message tracking for the sender.

**met end date**

Date of meteorological data collection termination, format is *yyyy/mm/dd*.

**met end time**

Time of meteorological data collection termination, format is *hh:mm:ss.s*.

**met start date**

Date of meteorological data collection commencement, format is *yyyy/mm/dd*.

**met start time**

Time of meteorological data collection commencement, format is *hh:mm:ss.s*.

**MID**

Measurement ID.

**minimum detectable concentration**

Activity concentration of a given radionuclide that is indistinguishable from zero or the measurement process noise level.

**ML**

Magnitude based on waves measured near the source.

**mm**

Millimeter.

**MRP**

Most Recent Prior; the sample counted most recently on the same detector and originating from the same station as the sample presently being analyzed.

**$M_s$**

Magnitude of seismic surface waves.

**MSB**

Most significant bit.

**msmle**

Magnitude of an event based on maximum likelihood estimation using surface waves.

**multiplet**

Spectral region of interest comprised of more than one photopeak.

**Mw**

Magnitude of an event based on measurements of the moment tensor.

## N

**N.**

North.

**natural radioactivity**

Radioactivity from cosmogenic and primordial nuclides that is always present on earth.

**NDC**

National Data Center.

**NEB**

National Event Bulletin. Bulletin of events that is a national product.

**NEIC**

National Earthquake Information Center.

**net area**

Equal to the integrated photopeak counts minus the baseline and background counts.

**nm**

Nanometer.

**NSEB**

National Screened Event Bulletin. Bulletin of events that is produced using a national event screen.

**nuclide**

One of many combinations of nucleons that may comprise an atomic nucleus. Because all nuclides of interest with respect to CTBT compliance verification are radioactive, this term is often used to refer specifically to radionuclides.

## P

**peak**

R: Statistically significant increase in counts above a spectrum baseline at an energy associated with a gamma line of a particular radionuclide or other phenomenon.

**PHD**

Pulse Height Data; a format for spectral data messages. Possible PHD data message types include SAMPLEPHD, BLANKPHD, DETBKPHD, CALIBPHD, and QCPHD.

**photon energy**

Component of the data pairs comprising a radionuclide detector's energy, resolution, and efficiency calibration data (in KeV).

**PIDC**

Prototype International Data Centre.

**PREL SPHD**

Preliminary Sample Pulse Height Data; ASCII data message containing the pulse height data of a sample acquired for less than the nominal 24 hours, as well as other information.

**Provisional Technical Secretariat**

(PTS) body of the CTBTO that includes the IMS and the IDC; the PTS will assist the Executive Council and the States Parties to implement the Treaty. After entry into force of the Treaty, the PTS will be referred to as the Technical Secretariat.

# Q

**QCPHD**

Quality Control Pulse Height Data; ASCII data message containing the spectrum of a certificate source as well as other information. Information in the QCPHD, along with other data, is used to check a detector's state of health.

**quantity**

Collected air volume in scm; same as sampled air volume.

# R

**radioactivity**

See activity.

**radionuclide**

Nuclide that has an unstable nucleus, that is, a radioactive nuclide.

**RASA**

Radionuclide Aerosol Sampler/Analyzer.

**REB**

Reviewed Event Bulletin; the bulletin formed of all S/H/I events that have passed analyst inspection and quality assurance review.

**reference ID**

See sample reference ID.

**RER**

Resolution (versus) Energy Regression; an equation providing the detector-specific relationship between resolution and energy. This equation contains calibration coefficients and is interpolated from a transmitted calibration spectrum.

**resolution**

R: Metric of a detector's ability to detect photons at discrete energies and is equivalent to the FWHM.

**RMS**

Radionuclide Monitoring System; the part of the IMS that monitors the atmosphere for radionuclides.

**ROI**

Region of Interest; group of radionuclide spectrum channels that include either one or multiple peaks.

**RSR**

Radionuclide Summary Report; report containing lists of category measurements, collection times, and locations of anthropo-genic radionuclides, MDC's, and spectra received by the IDC within a time period.

## S

**S.**

South.

**s**

Second (time).

**sample**

(1) Any physical entity counted on a detector. (2) Solid or gaseous entity collected by a blower at an RMS station that is analyzed for its radioactive contents.

**sample geometry**

Sample configuration, shape, and physical state in a detector chamber.

**sample ID**

Unique identification number assigned to a given spectrum or record by the PIDC operations system.

**sample reference ID**

Unique alphanumeric string identifying a sample; includes station code, data type, and sample collection commencement date and time.

**SAMPLEPHD**

Sample Pulse Height Data; ASCII data message containing pulse height data acquired by counting a gas or particulate sample with a detector system.

**scm**

Standard Cubic Meter.

**SEB**

Standard Event Bulletin; a list of analyst reviewed S/H/I events and event parameters (origin and associated arrival information). The SEB is similar to the REB, but also includes event characterization parameters and event screening results for each event.

**second split**

Fractionation of the first split.

**SEL1**

Standard Event List 1; S/H/I bulletin created by total automatic analysis of continuous timeseries data. Typically, the list runs one hour behind real time.

**SEL2**

Standard Event List 2; S/H/I bulletin created by totally automatic analysis of both continuous data and segments of data specifically down-loaded from stations of the auxiliary seismic network. Typically, the list runs five hours behind real time.

**SEL3**

Standard Event List 3; S/H/I bulletin created by totally automatic analysis of both continuous data and segments of data specifically down-loaded from stations of the auxiliary seismic network. Typically, the list runs 12 hours behind real time.

**S/H/I**

Seismic, hydroacoustic, and infrasonic.

**SID**

R: Sample ID; unique alphanumeric string assigned to a sample during the automated processing for identification and accounting purposes.

**singlet**

Spectrum photopeak consisting of counts from one mono-energetic photon; photopeak containing counts from multiple photons, but fit as if it is comprised of counts from only one because contributions from the individual radiations have yet to be separated.

**site code**

Five character alphanumeric field identifying a particular RMS site: the first two characters are the county code, the third identifies the site type (`R` for Regional Lab, `C` for Certified Lab, `N` for National Data Center, `X` for Experimental, and `0` for Sampling Station), and the last two characters are the country code.

**SLSD**

Standard List of Signal Detections.

**snr**

Signal-to-noise ratio.

**spectral qualifier**

Code in a SAMPLEPHD that indicates whether the spectrum acquisition time is truncated or full; spectral qualifier "FULL" indicates a spectrum was acquired for a full acquisition time interval while "PREL" indicates a spectrum was acquired for an acquisition time LESS than a full acquisition time interval.

**spectrum**

(1) R: a plot of the differential number of pulses (in counts) per differential pulse height (in channels or keV). (2) S/H/I: a plot of the energy contained in waveforms as a function of frequency.

**SPHD**

Sample Pulse Height Data; ASCII data message type containing the pulse height data of a sample, as well as other information. There are two types of SPHDs: full and preliminary. See FULL SPHD and PREL SPHD.

**SPHDF**

Full SPHD.

**SPHDP**

Preliminary SPHD.

**SRID**

Sample reference ID.

**SSEB**

Standard Screened Event Bulletin; similar in content and format to the Standard Event Bulletin (SEB), but does not include events that were screened out by a standard set of event screening criteria.

**standard cubic meter**

Volume occupied by 1 $m^3$ of gas at $0^oC$ and 1013 hpa.

**station code (or ID)**

(1) Code used to identify distinct stations. (2) Site code.

**system type**

Phase of the RMS sample being collected; "P" indicates particulate and "G" gaseous.

## T

**TCP/IP**

Transmission Control Protocol/Internet Protocol.

**Technical Secretariat**

Referred to as the Provisional Technical Secretariat prior to the Treaty's entry-into-force; body of the CTBTO that includes the IMS and the IDC.

**3-C**

Three component.

**time of last calibration**

Time of previous detector calibration, format is *hh:mm:ss.s*.

**total efficiency**

Ratio of gamma-rays interacting with the detector crystal to the total number emitted by a sample.

**transmit date**

Date a message was sent from a transmitter, format is *yyyy/mm/dd*.

**transmit time**

Time a message is sent from a transmitter, format is *hh:mm:ss.s*.

**Treaty**

Comprehensive Nuclear Test-Ban Treaty (CTBT).

## U

**UPS**

Uninterruptable Power Supply.

**UTC**

Universal Coordinated Time.

## V

**V**

Volts; a unit of electrical potential or electromotive force.

## W

**W.**

West.

## X

**XPU**

Xenon Processing Unit.

# Index

## Symbols



## A



## B

## F



## G



## H



## I



## K

## L



## M



## N



## O



## P

## Q



## R



## S