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INTERFACE CONTROL DOCUMENT FOR THE RPG TO CLASS 1 USER

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INTERFACE CONTROL DOCUMENT
FOR THE RPG TO CLASS 1 USER
2620001

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Supplement 1 23 July 1997	Insert RPGOP information in support of AWIPS program. Draft of section 3 to be released prior to incorporation of all information into next revision of ICD. (Pages are all identified with Supplement followed by section and page number)
Revision B	Divide the document into two documents communication protocol and application layer. The communications protocol will be documented in 2620040, RPG X.25 Protocol ICD. Background maps have been removed since the open RPG does not distribute background maps.
Revision C	Added Build 1.2 products. Added Appendix C on Data Transmission Rates.
Revision D	Added Build 2.0 products. Added Appendix D on bzip2 compression.
Revision E	Added Build 3.0 products.
Revision F	Added Build 4.0 products.
Revision G	Added Build 5.0 products.
Revision H	Added Build 6.0 products.
Revision I	Added Build 7.0 products.
Revision J	Added Build 8.0 products. Added Appendix E on RPG Generic Product Format.
Revision K	Added Build 9.0 products.
Revision L	Added Build 10.0 products. Added VCP 211 to Appendix C.
Revision M	Added reference to CMD Generated Clutter Bypass Map to Table V and to Figure 3-17 (Sheets 1 and 2).
Revision N	Added Build 11.2 products.
Revision P	Added Build 12.0 Dual Polarization products to Section 3.3.1.4, Table II, Table IIa, Table III, Table V, Table VI, Table VIII and Table X.
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1 SCOPE

1.1 Identification

This document defines the interface connection between the Next Generation Weather Radar (NEXRAD) Radar Product Generation Group (RPG) and a Class 1 User or Radar Products Generator Operator's Position (RPGOP). RPG refers to the RPG equipment, 2830007, Pt 1 and Radar Product Generation Program CPCI-03, 2820003, Part 1.

1.2 System Overview

1.2.1 RPG

The RPG system is one component of the WSR-88D system. The WSR-88D system is used to gather weather information to be distributed to the National Weather Service (NWS), the Federal Aviation Administration (FAA), the Department of Defense (DOD), and the general public. The RPG may be located with the RDA system in a shelter at the WSR-88D site, or may be located remotely, and communicate with the RDA through a wideband communication link. It is responsible for Base Data Ingest, Product Generation, Product Storage, Hydrometeorological Processing, Product Distribution, and Base Data Distribution.

1.2.2 Class 1 Users/RPGOP

The Class 1 user's systems may be located anywhere. They communicate with the RPG via dedicated phone lines or LAN connection. These systems issue product requests to the RPG, receive the products from the RPG, and display the products to an operator.

1.3 Document Overview

This document defines the application layer interface between the RPG and Class 1 users/RPGOP. For this interface, this document identifies applicable standards and defines messages, product format and meaning of the packet codes. This ICD is not intended to serve as a document concerning the applicable standards. That is, the reader is assumed to be generally knowledgeable of the contents, terminology, etc., of the standards. Distribution of this document is unrestricted.
This document is organized in 3 sections and five appendices:
Section 1 provides information regarding the identification, scope, purpose and organization of this document.
Section 2 contains information about documentation relevant to this ICD, including applicable, and information documents.
Section 3 provides an overview of the application interface, operating procedures and message formats.
Appendix A contains a list of abbreviations, acronyms, and selected definitions.
Appendix B contains a detailed description of the Radar Coded Message.
Appendix C contains data transmission characteristics.
Appendix D contains product data compression using BZIP2.
Appendix E contains a description of the Generic Product Format.

2 REFERENCE DOCUMENTS

2.1 Government Documents

2.1.1 Specifications

2830007, Pt 1	Prime Item Development Specification for RPG Equipment (B1, CI-07)
2810000H	WSR-88D System Specification
2820003B,Pt1	Computer Program Development Specification for Radar Product Generation Program (SRS, CPCI-03)
2620003B	Product Specification Interface Control Document
2620037	RPG X.25 Protocol Interface Control Document
2620041B	TCP/IP Interface Control Document
Source:	ROC Configuration Management WSR-88D Radar Operations Center 1313 Halley Circle Norman, OK 73069

2.2 Non-Government Documents

2.2.1 Industry Standards

Reference Number	**Title**
IEEE 754-1985	IEEE Standard for Binary Floating-Point Arithmetic
RFC 1832	XDR: External Data Representation Standard

3 APPLICATION LAYER

The RPG application layer interface provides Class 1 users or RPGOPs with status messages and meteorological products.

3.1 RPG Message and Product Segmentation

RPG transport processing segments each application product larger than 10K bytes into 10K byte blocks of user data to be sent to the Network Layer. Therefore, the RPG application Message Header block is always required to correctly reassemble products larger than 10K bytes, regardless of the underlying network. [Note: 1K byte =1024 bytes].

3.2 Operating Procedures

Once the Class 1/RPGOP link is established and logically connected, application level message exchange may proceed. These messages consist of NEXRAD system status messages transmitted to the user, requests for weather product data transmitted from the user to the RPG, and weather product data transmitted from the RPG to the Class 1 user/RPGOP. See RPG X.25 Protocol ICD, 2620037, or RPG TCP/IP, 2620041, for information on establishing the appropriate link.

3.2.1 Initial Messages

3.2.1.1 General Status Message

Upon connection, the first Product Data Level message transmitted by the RPG to a Class 1 user/RPGOP is the General Status Message. The General Status Message describes the state of the Radar Acquisition (RDA) and RPG. This data informs the Class 1 user/RPGOP about operational modes, the scan strategy and equipment status of the RDA and RPG. Figure 3-17 provides a graphic representation of this message. Field identifiers are described (in halfword order) along with their respective units and range in this figure. As the state of the NEXRAD system changes over the life of the communications session, the Class 1 user/RPGOP will be kept up to date by transmission of a new General Status Message. A General Status Message will also be sent at the start of the elevation of a AVSET terninated VCP.

3.2.1.2 Alert Adaptation Parameters Message

The RPG transmits an Alert Adaptation Parameters Message to the Class 1 user/RPGOP after the initial General Status Message. The Class 1 user/RPGOP will also receive this message if any changes are made to the Alert Thresholds or Product Alert Pairing by the RPG. The Alert Adaptation Parameters Message is shown in Figure 3-20.

3.2.2 Requesting Weather Products

Requesting Weather Product Data over a Class 1 user/RPGOP dedicated line is accomplished by the Class 1 user/RPGOP sending a Product Request Message as defined in Figure 3-4. It consists of one Message Header Block, followed by one or more Product Request Blocks. Any available product (except User Alert Message and Free Text Message which may not appear on a routine product list) may be requested either on a one-time or routine basis.

3.2.2.1 Product Distribution and Availability

A Class 1 user/RPGOP may request any valid NEXRAD product. These products may be requested for routine generation or as a one-time product request. All products may not be available to all users due to system degradation, system load shedding, or because of a hardware or software problem.

3.2.2.2 NEXRAD Message Code Definitions

Table II shows the valid message codes for the NEXRAD system. Note that product requests have a message code equal to the product code of the product being transmitted (16 to 299).

3.2.2.3 NEXRAD Weather Product Code Definitions

Table III shows the valid product code for the NEXRAD weather product to be transmitted to the user. Along with the product codes shown, the resolution, range, data level, and type of each product is shown.

3.2.2.4 Product Dependent Header Definitions

Table IIa shows the product dependent halfword definitions for the Product Request message (Figure 3-4). Table V shows the fields that are product dependent for the Product Description Block in Figure 3-6. The products are shown in alphabetical order along with the corresponding message code, content of the product dependent parameter, the halfword location, units, range and accuracy.

3.2.2.5 Requesting One-Time Products

One-time product requests are requested one product per request message. The RPG will transmit the product as it becomes available, based on the parameters specified by the Product Request Block portion of the Product Request Message, and consider the request satisfied.

3.2.2.6 Requesting Routine Products

Routine product requests are requested as a list of products. This is up to a maximum of 31 for a Class 1 user, 65 for an RPGOP_50 and 300 for RPGOP_90. A Class 1 or RPGOP_50 user may be connected via a x.25 or TCP/IP interface. A RPGOP_90 user is connected via a LAN TCP/IP connection. Routine product request lists have one Message Header Block with the "Number of Blocks" field set to the number-of-products-on-the-list + 1. The Message Header Block is then followed by a Product Request Block for each product on the routine product request list. The products on the routine list will then be sent automatically to the user, up to a maximum of once per volume scan, dependent upon the request parameters in the Product Request Block.

3.2.2.7 Request Response Message

If the RPG is unable to distribute a product to the user, or receives an invalid message, or request for an invalid product, the RPG will transmit a Request Response message as shown in Figure 3-18. This message describes the error condition, sequence number (if applicable) of the request that generated the response, and the product or message code of the message in question. All of the error conditions of this message nullify the product request for the reasons given in the message, with the exception of "Available Next Volume Scan" and "One-time Request Generation Process Faulted" errors, which inform the Class 1 user/RPGOP that the product will be sent in the next volume scan.

3.2.3 Alerting

3.2.3.1 Alert Request Message

Alert areas are defined by the Class 1 user/RPGOP and transmitted to the RPG via the Alert Request Message. The format for the message is shown in Figure 3-5. Alert categories and threshold codes are given in Table IV.

3.2.3.2 Alert Message

The Class 1 User/RPGOP is notified when the alert condition is first detected by the RPG, and when the alert condition ends, via the Alert Message. The Alert Message format is shown in Figure 3-19.

3.2.4 External Data Message

External Data Messages are those importing meteorological, hydrometeorological, or other scientific or mathematical information into the RPG from the Class 1 user/RPGOP. In all such messages, the message code will be set to 5 in the Message Header Block (Figure 3-2), though individual messages will vary in content and format. The specific type of external data message will be indicated by the setting of the Block ID in the body of the message block that follows. The format of the message is shown in Figure 3-23.

3.2.4.1 Bias Table Message

This message contains a table of bias adjustment factors and related information determined at the Class 1 user/RPGOP site from rain gage vs. radar-estimated rainfall amounts over various memory timespans. The information is used to perform a mean-field bias adjustment upon precipitation accumulation products in the RPG. The Bias Table Message is indicated by a Message Code of 15. The format of the message is shown in Figure 3-25.

3.2.5 Other Messages

3.2.5.1 Product List Message

The Product List Message defined in Figure 3-21 lists all products commanded for generation by the MSCF operator. A Product List Message is requested by sending a Message Header Block (Figure 3-3) to the RPG and setting the message code to 8. This message was removed in Build 12. Request for message code 8 in Build 12 and later will result in the RPG transmitting General Status Message.

3.2.5.2 Radar Coded Message

The Radar Coded Message (RCM) is produced at the RPG for distribution to users. The format of the RCM is provided in Figure 3-22 and Appendix B. A more complete description of the product can be found in the Product Specification ICD (2620003).

3.3 Message Description

3.3.1 Graphic Product Message

The RPG transmits products to the Class 1 User/RPGOP by using the Graphic Product message shown in Figure 3-6. The message consists of several blocks. Not all products require all blocks; however, the blocks are always transmitted in the order shown in Figure 3-6. One Header block and one Product Description block always precede the product. Products consist of one Product Symbology block (Block ID = 1), and zero or one of each of the Graphic Alphanumeric (Block ID = 2), and Tabular Alphanumeric blocks (Block ID = 3). The number of the last two blocks in each message used is product dependent.

3.3.1.1 Product Description Block

The Product Description block for product data transmission is shown in Figure 3-6 (sheets 2, 6, and 7). Many field identifiers in the Product Description block are product dependent and therefore change depending upon the product being transmitted. Refer to Table V for the definitions of these fields and their corresponding products. The Products are listed by product name, in alphabetical order. As shown in Figure 3-6 (sheet 2), halfwords 55-60 contain offsets from the beginning of the message header (halfword 1) to the (-1) divider of each block indicated. If a product being transmitted does not require a block, or the data is not available, the offset to the block in question is set to zero. The first offset (halfword 55-56) is the offset to the Product Symbology block. The second

offset (halfword 57-58) is the offset to the (-1) divider of the Graphic Alphanumeric block (Block ID = 2). The third offset is the offset to the Tabular Alphanumeric block (Block ID = 3).
Some products, by virtue of their size, require data compression. If a product is compressed, all product data following the Product Description block are compressed. Product dependent parameters defined within the Product Description block specify the compression method and size of the uncompressed product. The length of message in the Message Header block refers to the size of the compressed product. Refer to Table V for Product Description block definitions for compressed products. Appendix D describes the data compression method.

3.3.1.2 Product Symbology Block

The Product Symbology block is block ID number 1 and is shown in Figure 3-6 (sheets 3 and 8). It is always numbered as 1. If it is available in a product, it will always follow the Product Description block. In general, this block contains display data packets that make up the geographic display of the product. These packets contain vectors, text and special character symbols, map data, radial data, raster data, precipitation data, vector arrow data, wind barb data, and special graphic symbols. The packet formats are defined in Figures 3-7 through 3-15c. The Symbology block may, depending upon the product, have multiple "layers" of packets. This is done only in products that have both image type data, mixed with non-image type data. An example of this is a Combined Moment product. It has reflectivity displayed as an image and vector arrow data that is defined with vector arrow packets. The layers are started with the (-1) divider. The product dependent data identified in Table VI is incorporated into the Product Symbology Block.

3.3.1.3 Graphic Alphanumeric Block

The Graphic Alphanumeric block is block ID number 2. It is the block in which display packets are defined to cause the storm related data to be displayed at the top of the geographic screen to amplify the corresponding graphic displayed symbology. The format of this block is shown graphically in Figure 3-6 (sheets 4 and9). The only products for which this block is formatted are the following:

Product Code	Product Name
31	User Selectable Precipitation
35-38, 95-98	Composite Reflectivity, Composite Reflectivity Edited for AP
58	Storm Tracking Information
59	Hail Index
61	Tornado Vortex Signature
141	Mesocyclone Detection
143	Tornado Vortex Signature Rapid Update

The actual data within this block is a series of text packets that format the line data into 5 lines. The number of pages is data dependent. The text packet format used for the attributes is packet number 8 shown in Figure 3-8. Notice that I-start and J-start are defined as 1/4 km from the radar. The Graphic Attributes packets are not geographic, but are actual screen coordinates. Included in the text packet for each page of Attribute data is a series of vector packets to draw the grid lines. The vector packets used are shown in Figure 3-7. The product dependent data identified in Table VII is incorporated into the Graphic Alphanumeric Block.

3.3.1.4 Tabular Alphanumeric Block

The Tabular Alphanumeric block for product data transmission is Block ID number 3. The format of this block is shown graphically in Figure 3-6 (sheets 5 and 10). It is always numbered 3 even though it may not be the third block in the product. The following products have a paired-alphanumeric product that is encoded as Block 3 (Figure 3-6, sheet 7). The paired-alphanumeric product has a

second Header and Product Description block as shown in the figure. The products that have Block ID 3 are as follows:

Product Code	Product Name	Block 3 Message Code
48	VAD Wind Profile	100
58	Storm Tracking Information	101
59	Hail Index	102
61	Tornado Vortex Signature	104
78	Surface Rainfall Accumulation (1 hour)	107
79	Surface Rainfall Accumulation (3 hours)	108
80	Storm Total Rainfall Accumulation	109
132	Clutter Likelihood Reflectivity	110
133	Clutter Likelihood Doppler	111
141	Mesocyclone Detection	141
143	Tornado Vortex Signature Rapid Update	143
171	Storm Total Accumulation	171

The second header of the alphanumeric product is exactly the same as the header at the beginning of the message, except that the Message Code is as defined above. The Data portion of the alphanumeric product is ASCII text formatted into pages of 17 lines of 80-character data. Each page is separated by the (-1) divider. Alphanumeric products containing this block have it as the last block of the product message. The product dependent data identified in Table VIII is incorporated into the Tabular Alphanumeric Block.

3.3.2 Stand-Alone Tabular Alphanumeric Product Message

Figure 3-16 defines the Stand-Alone Tabular Alphanumeric Product Message. This message is used for products that are completely alphanumeric, and are not paired as described in subsection 3.2.1.4. These products do not contain a symbology block. The Stand-Alone Tabular Alphanumeric Products are: User Alert Message (product 73), Storm Structure (product 62), Free Text Message (product 75), and Supplemental Precipitation Data (product 82). The format of the Product Description block is identical to that for the Graphic Product Message, except the first offset is to the (-1) divider shown in Figure 3-16. The product dependent data identified in Table IX is incorporated into the Stand-Alone Tabular Alphanumeric Product Message.

3.3.3 Coordinate System

Three coordinate systems are supported for the expression of weather information:

- Geographic Cartesian
- Polar
- Screen Cartesian

A Geographic Cartesian coordinate system with origin at the radar and positive directions of North (up), and East (right) are supported. The coordinate system has a range of ± 512 kilometers with 1/4-kilometer resolution. Specifically, I (right) and J (up) coordinates range from -2048 to +2048 with negative coordinates in two complement forms. Vectors are represented in this coordinate system.

A Polar coordinate system with origin at the radar and 0-degree radial North (up) is supported. The range coordinate covers from 0 to 460 kilometers with 1/4-kilometer resolution. The azimuth coordinate covers 0 to 360 degrees with 0.1-degree resolution. This resolution is necessary to achieve 0.1-degree resolution used system wide. Positive angles are clockwise. Specifically, theta coordinates range from 0 to 360 degrees. Images are represented in the Polar coordinate system. Each point in the display is represented by a display value.

A Screen Cartesian coordinate system with origin at the upper left corner and positive directions of X to the right and Y down are supported. The X coordinate ranges from 0 to 639 pixels and the Y-coordinate ranges from 0 to 511 pixels. X can be expressed in 10 bits and Y in 9 bits. The screen coordinate system is used to identify the location of text on the screen.

	MSB HALFWORD LSB	
MESSAGE HEADER BLOCK	MESSAGE CODE	01
	DATE OF MESSAGE	02
	TIME OF MESSAGE (MSW)	03
	TIME OF MESSAGE (LSW)	04
	LENGTH OF MESSAGE (MSW)	05
	LENGTH OF MESSAGE (LSW)	06
	SOURCE ID	07
	DESTINATION ID	08
	NUMBER OF BLOCKS	09

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
01	Message Code	INT*2	N/A	-131 to -16, 0 to +211	N/A	NEXRAD Message Code defined in Table II
02	Date of Message	INT*2	Julian Date	1 to 32,767	1	Modified Julian Date at time of transmission (number of days since 1 January 1970, where 1=1 January 1970). To obtain actual Julian Date, add 2,440,586.5 to the modified date
03-04	Time of Message	INT*4	Seconds	0 to 86,399	1	Number of seconds after midnight, Greenwich Mean Time (GMT).
05-06	Length of Message	INT*4	N/A	18 to 1329270	1	Number of bytes in message including header
07	Source ID	INT*2	N/A	0 to 999	1	Source (originators') ID of the sender
08	Destination ID	INT*2	N/A	0 to 999	1	Destination ID (receivers') for message transmission
09	Number Blocks	INT*2	N/A	1 to 51	1	Header Block plus the Product Description Blocks in message

Figure 3-3. Message Header

	MSB HALFWORD LSB	
	MESSAGE HEADER BLOCK (see Figure 3-3)	
PRODUCT REQUEST BLOCK	(-1) DIVIDER	10
	LENGTH OF BLOCK	11
	PRODUCT CODE	12
	FLAG BITS	13
	SEQUENCE NUMBER	14
	NUMBER OF PRODUCTS	15
	REQUEST INTERVAL	16
	VOLUME SCAN DATE	17
	VOL SCAN START TIME (MSW)	18
	VOL SCAN START TIME (LSW)	19
	PRODUCT DEPENDENT	20
	"	21
	"	22
	"	23
	"	24
	"	25

Figure 3-4. Product Request Message (Sheet 1)

HALFWORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
10	Block Divider	INT*2	N/A	-1	N/A	Value of -1 used to delineate the Header from the Product Description Block(s)
11	Length of Block	INT*2	N/A	32	1	Number of bytes in block, including block divider, in the Product Description Block
12	Product Code	INT*2	N/A	16 to 2000	N/A	Internal NEXRAD product code corresponding to a weather product in Table I
13	Flag Bits	INT*2	N/A	0,1/bit	N/A	Bit # Value Meaning 0 1 High Priority 0 0 Low Priority 1 1 Map Requested (Bit 0=MSB)
14	Sequence Number	INT*2	N/A	1 to 32,767	1	Monotonically increase for tracking of request

HALFWORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
15	Number of Products	INT*2	N/A	-1, 1 to 9	1	-1 for continuous (RPS) product transmission. 1 to 9 for one-time requests, when Volume Scan Start Time of Product (halfwords 18, 19) is = -1 (equivalent to PUP Repeat Count). NOTE: For RPS requests, the number of products requested is determined from the Number of Blocks fields of the Message Header.
16	Request Interval	INT*2	N/A	1 to 9	1	If Volume Scan Start Time of Product is >=0 or -2, then Request Interval is 1. If Volume Scan Start Time of Product is = -1, then the range is 1 to 9 and corresponds to the interval of the number of scans to send the product, where: 1 = every volume scan 2 = every other volume scan . . . 9 = every ninth volume scan
17	Volume Scan Date of Product*	INT*2	Julian Date	0 to 32,767	1	Modified Julian date at beginning of volume scan
18-19	Volume Scan Start Time of Product*	INT*4	Seconds	-2 to 86,399	1	Seconds after Midnight (Greenwich Mean Time)** or -1 requests current product -2 requests latest available product**
20-25	Product Dependent	INT*2	N/A	N/A	N/A	See Table II-A

Figure 3-4. Product Request Message (Sheet 2)

*Volume scan date is only applicable for one-time product requests that have a Volume Scan Start Time in the range [0, 86399]. If a volume scan date and time are specified, it corresponds to the volume scan start date and time that is searched for that product.
**For one-time product requests, if specifying the volume scan date and time or latest available and the product has elevation parameters then only the specific angle is allowed in the request. The feature described in Note 9 will result in a Request Response Message indicating Invalid Product Parameters.

Table II. NEXRAD Message Code Definitions

MESSAGE CODE	MESSAGE TYPE	FIGURE
0,13	Product Request, Product Request Cancel	3-4
1	Spare	-
2	General Status	3-17
3	Request Response	3-18
4	Maximum Connection Time Disable Request	N/A
5	External Data Message	3-23
6	Alert Adaptation Parameter Message	3-20
7	Alert Request Message	3-5
8	Product List	3-21
9	Alert Message	3-19
10	Spare	-
11	Sign-on Request Message (Dial -up Users)	N/A
12	Spare	-
14	Spare	-
15	Bias Table Message	3-25
16 to 111 112 to 131 132-141 142	Products (See Table III for individual Product Codes) Reserved for future Products Products (See Table III for Individual Product Codes) Reserved for future Product	
144-151	Products (See Table III for Individual Product Codes)	
152	Archive III Status Product	
153-155	Super Resolution	
156, 157	NTDA Products	
158-179	Dual Polarization Products (See Table III for Individual Product Codes) Codes 167-168 are reserved for future Dual Pol Base, and QPE products, respectively.	
180-193	Reserved for future Products	
194	Base Reflectivity Data Array (DoD Version)	
195	Digital Reflectivity, DQA-Edited Data Array	
196-198	Reserved for future Products	
199	Base Velocity Data Array (DoD Version)	
200-299	Reserved for future Products	
Negative	Annotations have a negative message code equal in magnitude to that of the Product being annotated	

Table IIa. Product Dependent Halfword Definitions for Product Request Message

PRODUCT NAME	MSG CODE(s)	HALFWORD	CONTENT	UNITS	RANGE	ACCURACY/PRECISION
Base Products, ITWS Digital Base Velocity, Clutter Likelihood (Reflectivity and Doppler), NTDA (EDR and EDC)	16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 93, 94, 99, 132, 133, 156, 157, 194, 195, 199	• 22	• Elevation Angle	• Degrees	• -1.0 to 45.0	• .1, Note 1, 9
Cross Section	50, 51, 85, 86	• 20 • 21 • 22 • 23	• Azimuth of Point 1 • Range of Point 1 • Azimuth of Point 2 • Range of Point 2	• Degree • Nmi • Degree • Nmi	• 0 to 359. • 0 to 124.0 • Same as Point 1 • Same as Point 1	• .1, Note 1,10 • .1, Note 1,10 • .1, Note 1,10 • .1, Note 1,10
Storm Relative Mean Radial Velocity Region	55	• 20 • 21 • 22 • 23 • 24	• Azimuth of Window Center • Range of Window Center • Elevation Angle • Storm Speed • Storm Direction	• Degree • Nmi • Degree • Knots • Degrees	• 0 to 359.9 • 0 to 124.0 • -1.0 to 45.0 • 0 to 99.9 • 0 to 359.9	• .1, Note 1 • .1, Note 1 • .1, Note 1,9 • .1, Note 1,2 • .1, Note 1
Storm Relative Mean Radial Velocity Map	56	• 22 • 23 • 24	• Elevation Angle • Storm Speed • Storm Direction	• Degree • Knots • Degrees	• -1.0 to 45.0 • 0 to 99.9 • 0 to 359.9	• .1, Note 1,9 • .1, Note 1,3 • .1, Note 1
VAD	84	• 22	• Altitude	• K Feet	• 0 to 70	• 1
User Selectable Precipitation (Note 5)	31	• 20 • 21	• End Hour • Time Span	• Hours • Hours	• -1 to 23, • 1 to 24	• 1, Note 6 • 1

PRODUCT NAME	MSG CODE(s)	HALFWORD	CONTENT	UNITS	RANGE	ACCURACY/PRECISION
User Selectable Layer Composite Reflectivity	137	• 20 • 21	• Bottom Altitude of Layer • Top Altitude of Layer	• K Feet • K Feet	• 0 to 69 • 1 to 70	• 1 • 1, Note 8
Clutter Filter Control (Note 5)	34	• 20	• Bit Map	• N/A	• 0,1 bit	• N/A, Note 7
Tornado Vortex Signature Rapid Update	143	• 22	• Elevation Angle	• Degrees	• -1.0 to 45.0	• .1, Note 1,9
Digital Mesocyclone Detection	149	• 22	• Elevation Angle	• Degree	• -1.0 to + 45.0	• .1, Note 1,9
User Selectable Snow Accumulations (Note 5)	150, 151	• 20 • 21	• End Hour • Time Span	• Hours • Hours	• -1 to 23 • 1 to 30	• 1, Note 6 • 1
Super Resolution Base Products (R/V/SW)	153, 154, 155	• 22	• Elevation Angle	• Degrees	• -1.0 to 45.0	• .1, Note 1,9
Differential Reflectivity	158, 159	22	Elevation Angle	Degree	-1.0 to + 45.0	.1, Note 1,9
Correlation Coefficient	160, 161	22	Elevation Angle	Degree	-1.0 to + 45.0	.1, Note 1,9
Specific Differential Phase	162, 163	22	Elevation Angle	Degree	-1.0 to + 45.0	.1, Note 1,9
Hydrometeor Classification	164, 165	22	Elevation Angle	Degree	-1.0 to + 45.0	.1, Note 1,9
Melting Layer	166	22	Elevation Angle	Degree	-1.0 to + 45.0	.1, Note 1,9
Digital User-Selectable Accumulation (Note 5)	173	20 21	End Time Time Span	Mins Mins	-1 to 1439 15 to 1440	1, Note 11

Note 1. Scaled Integer.
Note 2. A value of -1 indicates that the storm motion is that of the storm closest to the window center.
Note 3. A value of -1 indicates that the storm motion is that of the vector average of all currently identified storms.
Note 4. Defines up to eight user selected elevation angles available in the current scan strategy. Scan strategy may contain 20 cuts. Each elevation cut selection is represented by a unique bit

setting. Bit 1 of halfword 23 corresponds to elevation cut #l. Bit 4 of halfword 24 corresponds to elevation cut #20. Bit 0 of halfword 23 is the MSB and is not used.
Note 5. One-time requests for this product should use the "latest available" request option. That is, place -2 in the volume scan start time field (halfword 18-19).
Note 6. A value of -1 indicates that the end time will be the time of the most recent hourly update.
Note 7. This halfword defines the clutter map segment number (both Version 0 and Version 1 of the CFC product) and channel type (Version 0 only). For Version 0, bit 15 (bit 0 = MSB) defines the channel type. If bit 15 is 0, then the surveillance channel map is requested. If bit 15 is 1, then the Doppler channel map is requested. For both Version 0 and 1, bits 14 through 10 specify elevation segment numbers 1 through 5, respectively. Set the bit number of the segment being requested. Segment 1 is the lowest clutter filter map elevation segment, segment 5 is the highest clutter filter map elevation segment. For Version 1, bit 15 is ignored for any CFC product request.
Note 8. Minimum layer thickness is 1 K Feet
Note 9. Bits 0-12 (bit 0 is LSB) of halfword represents scaled elevation angle. For elevation angles >= 0, the elevation angle is denoted degrees*10. For elevation angles < 0, the angle is denoted 3600 + degrees*10.

Bits 13-15 have special meaning. If bits 13-15 are not set, bits 0-12 denote elevation angle as described above. Bit 15 is reserved for future use and should never be set. If bit 14 is set (bits 15 and 13 not set) and bits 0-12 not set, then all elevation angles of the volume coverage pattern are requested. If bit 14 is set (bits 15 and 13 not set), bits 0-12 may be used to denote elevation angle as described above. In this case, all elevation angles of the volume coverage pattern matching the specified elevation angle are requested. If bit 13 is set (bits 15 and 14 not set), then all elevation angles at or below the angle specified by bits 0-12 are requested. If bit 13 and 14 are set (bit 15 is not set), then 0-12 specifies an elevation cut number. The first N cuts (where N = cut number) are requested.

If the elevation parameter specifies multiple requests, each request counts against the maximum product count specified for the requestor. This check is only done when the request is first received at the RPG.
Note 10. The minimum cross-section length (Cartesian distance between Point 1 and Point 2) is 2 km. Requests for cross-section of shorter length will be rejected. The user will be notified via a Request/Response Message (see Figure 3-18) with error code set to Illegal Request.
Note 11. A value of -1 indicates that the end time will be the time of the most recent volume scan update.

Table III. Message Codes for Products

CODE	NTR	PRODUCT NAME	RESOLUTION		RANGE	DATA LEVEL	MESSAGE FORMAT
16	1	Base Reflectivity	.54 x 1	Nmi x Deg	124	8	Radial Image
17	1	Base Reflectivity	1.1 x 1	Nmi x Deg	248	8	Radial Image
18	1	Base Reflectivity	2.2 x 1	Nmi x Deg	248	8	Radial Image
19	1	Base Reflectivity	.54 x 1	Nmi x Deg	124	16	Radial Image
20	1	Base Reflectivity	1.1 x 1	Nmi x Deg	248	16	Radial Image
21	1	Base Reflectivity	2.2 x 2	Nmi x Deg	248	16	Radial Image
22	2	Base Velocity	.13 x 1	Nmi x Deg	32	8	Radial Image
23	2	Base Velocity	.27 x 1	Nmi x Deg	62	8	Radial Image
24	2	Base Velocity	.54 x 1	Nmi x Deg	124	8	Radial Image
25	2	Base Velocity	.13 x 1	Nmi x Deg	32	16	Radial Image
26	2	Base Velocity	.27 x 1	Nmi x Deg	62	16	Radial Image
27	2	Base Velocity	.54 x 1	Nmi x Deg	124	16	Radial image

CODE	NTR	PRODUCT NAME	RESOLUTION	RANGE	DATA LEVEL	MESSAGE FORMAT
28	3	Base Spectrum Width	.13 x 1 Nmi x Deg	32	8	Radial Image
29	3	Base Spectrum Width	.27 x 1 Nmi x Deg	62	8	Radial Image
30	3	Base Spectrum Width	.54 x 1 Nmi x Deg	124	8	Radial Image
31	32	User Selectable Storm Total Precipitation	1.1 x 1 Nmi x Deg	124	16	Radial Image/Geographic Alpha
32	33	Digital Hybrid Scan Reflectivity	.54 x 1 Nmi x Deg	124	256	Radial Image
33	33	Hybrid Scan Reflectivity	.54 x 1 Nmi x Deg	124	16	Radial Image
34	34	Clutter Filter Control	1 x 1.4 Km x Deg (Ver. 0) 1 x 1.0 Km x Deg (Ver. 1)	124	8 (Ver. 0) 4 (Ver. 1)	Radial Image
35	6	Composite Reflectivity	.54 x .54 Nmi x Nmi	124	8	Raster Image/Non-geographic Alpha
36	6	Composite Reflectivity	2.2 x 2.2 Nmi x Nmi	248	8	Raster Image/Non-geographic Alpha
37	6	Composite Reflectivity	.54 x .54 Nmi x Nmi	124	16	Raster Image/Non-geographic Alpha
38	6	Composite Reflectivity	2.2 x 2.2 Nmi x Nmi	248	16	Raster Image/Non-geographic Alpha
39		Spare				
40		Spare				
41	8	Echo Tops	2.2 x 2.2 Nmi x Nmi	124	16	Raster Image
42		Spare				
43		Spare				
44		Spare				
45		Spare				
46		Spare				
47		Spare				
48	12	VAD Wind Profile	5 Knots	N/A	5	Non-geographic Alphanumeric
49		Spare			16	Raster Image/Non-geographic Alphanumeric
50	14	Cross Section (Reflectivity)	.54 Horizontal x .27 Vert Nmi x Nmi	124	16	Raster Image (Reflectivity)

CODE	NTR	PRODUCT NAME	RESOLUTION	RANGE	DATA LEVEL	MESSAGE FORMAT
51	14	Cross Section (Velocity)	.54 Horizontal x .27 Vert Nmi x Nmi	124	16	Raster Image (Velocity)
52		Spare				
53		Spare				
54	----------Reserved----------					
55	16	Storm Relative Mean Radial Velocity	.27 x 1 Nmi x Deg	27	16	Radial Image (Region)
56	16	Storm Relative Mean Radial Velocity	.54 x 1 Nmi x Deg	124	16	Radial Image (Map)
57	17	Vertically Integrated Liquid	2.2 x 2.2 Nmi x Nmi	124	16	Raster Image
58	18	Storm Tracking Information	N/A	248	N/A	Geographic and Non-geographic Alpha
59	19	Hail Index	N/A	124	N/A	Geographic and Non-geographic Alpha
60		Spare				Geographic and Non-geographic Alpha
61	21	Tornado Vortex Signature	N/A	124	N/A	Geographic and Non-geographic Alphanumeric
62	22	Storm Structure	N/A	248	N/A	Alphanumeric
63	23	Layer Composite Reflectivity	2.2 x 2.2 Nmi x Nmi	124	8 Avg	Raster Image (Layer 1 Average)
64	23	Layer Composite Reflectivity	2.2 x 2.2 Nmi x Nmi	124	8 Avg	Raster Image (Layer 2 Average)
65	23	Layer Composite Reflectivity	2.2 x 2.2 Nmi x Nmi	124	8 Max	Raster Image (Layer 1 Maximum)
66	23	Layer Composite Reflectivity	2.2 x 2.2 Nmi x Nmi	124	8 Max	Raster Image (Layer 2 Maximum)
67	23	Layer Composite Reflectivity - AP Removed	2.2 x 2.2 Nmi x Nmi	124	8 Max	Raster Image
68		Spare				
69		Spare				
70		Spare				
71		Spare				
72		Spare				
73	25	User Alert Message	N/A	N/A	N/A	Alphanumeric
74	26	Radar Coded Message	1/16 LFM	248	9	Alphanumeric
75	27	Free Text Message	N/A	N/A	N/A	Alphanumeric
76	---- ----------Reserved for internal PUP use ----------					

CODE	NTR	PRODUCT NAME	RESOLUTION	RANGE	DATA LEVEL	MESSAGE FORMAT
78	28	Surface Rainfall Accum. (1 hr)	1.1 x 1 Nmi x Deg	124	16	Radial Image
79	28	Surface Rainfall Accum. (3 hr)	1.1 x 1 Nmi x Deg	124	16	Radial Image
80	29	Storm Total Rainfall Accumulation	1.1 x 1 Nmi x Deg	124	16	Radial Image
81	30	Hourly Digital Precipitation Array	1/40 LFM	124	256/8	Raster Image / Alphanumeric
82	31	Supplemental Precipitation Data	N/A	N/A	N/A	Alphanumeric
83		Spare			9	
84	12	Velocity Azimuth Display	5 Knots	N/A	8	Non-geographic Alphanumeric
85	14	Cross Section Reflectivity	.54 Horizontal x .27 Vert Nmi x Nmi	124	8	Raster Image (Reflectivity)
86	14	Cross Section Velocity	.54 Horizontal x .27 Vert Nmi x Nmi	124	8	Raster Image (Velocity)
87		Spare				
88		Spare				
89	23	Layer Composite Reflectivity	2.2 x 2.2 Nmi x Nmi	124	8 Avg	raster Image - Layer 3 Average
90	23	Layer Composite Reflectivity	2.2 x 2.2 Nmi x Nmi	124	8 Max	Raster Image - Layer 3 Maximum
91-92		Reserved for internal PUP and RPG Use				
93	35	ITWS Digital Base Velocity	.54 x 1 Nmi x Deg	Lesser of 62 Nmi or 18Kft AGL	256	Radial Image
94	1	Base Reflectivity Data Array	.54 x 1 Nmi x Deg	248	256	Radial Image
95	6	Composite Reflectivity Edited for AP	.54x.54 Nmi x Nmi	124	8	Raster Image/Non-geographic Alpha
96	6	Composite Reflectivity Edited for AP	2.2 x 2.2 Nmi x Nmi	248	8	Raster Image/Non-geographic alpha
97	6	Composite Reflectivity Edited for AP	.54 x .54 Nmi x Nmi	124	16	Raster Image/Non-geographic Alpha
98	6	Composite Reflectivity Edited for AP	2.2 x 2.2 Nmi x Nmi	248	16	Raster Image/Non-geographic Alpha
99	2	Base Velocity Data Array	.13 x 1 Nmi x Deg	124	256	Radial Image

CODE	NTR	PRODUCT NAME	RESOLUTION	RANGE	DATA LEVEL	MESSAGE FORMAT
100		Site Adaptable parameters for VAD Wind Profile (Product 48)				
101		Storm Track Alphanumeric Block				
102		Hail Index Alphanumeric Block				
103		Spare				
104		TVS Alphanumeric Block				
105		Site Adaptable Parameters for Combined Shear				
106		Spare				
107		Surface Rainfall (1 hr) Alphanumeric Block				
108		Surface Rainfall (3 hr) Alphanumeric Block				
109		Storm Total Rainfall Accumulation Alphanumeric Block				
110		Clutter Likelihood Reflectivity Alphanumeric Block				
111		Clutter Likelihood Doppler Alphanumeric Block				
112-131		Reserved for Future Products				
132	36	Clutter Likelihood Reflectivity	.54 x 1 Nmi. x Deg	124	11	Radial Image
133	37	Clutter Likelihood Doppler	.54 x 1 Nmi. x Deg	124	12	Radial Image
134	39	High Resolution VIL	.54 x 1 Nmi x Deg	248	256	Radial Image
135	41	Enhanced Echo Tops	.54 x 1 Nmi x Deg	186	199	Radial Image
136	38	SuperOb	Adaptable, default = 5 km x 6 deg	Adaptable, default = 100 km	N/A	Latitude, Longitude (ICD packet code 27)
137	40	User Selectable Layer Composite Reflectivity	0.54 Nmi x1Deg	124 nmi	16	Radial image
138	29	Digital Storm Total Precipitation	1.1Nmi x 1Deg	124	256	Radial Image

CODE	NTR	PRODUCT NAME	RESOLUTION	RANGE	DATA LEVEL	MESSAGE FORMAT
139		Spare				
140	46	Gust Front MIGFA	N/A	38	N/A	Generic Data Format
141	20	Mesocyclone Detection	N/A	124	N/A	Geographic and Non-geographic Alpha
143	21	Tornado Vortex Signature Rapid Update	N/A	124	N/A	Geographic and Non-geographic Alphanumeric
144	42	One-hour Snow Water Equivalent	0.54 x 1 Nmi x Deg	124	16	Radial Image
145	42	One-hour Snow Depth	0.54 x 1 Nmi x Deg	124	16	Radial Image
146	43	Storm Total Snow Water Equivalent	0.54 x 1 Nmi x Deg	124	16	Radial Image
147	43	Storm Total Snow Depth	0.54 x 1 Nmi x Deg	124	16	Radial Image
149	20	Digital Mesocyclone Detection	N/A	124	N/A	Generic Data Format
150	44	User Selectable Snow Water Equivalent	0.54 x 1 Nmi x Deg	124	16	Radial Image
151	44	User Selectable Snow Depth	0.54 x 1 Nmi x Deg	124	16	Radial Image
152		Archive III Status Product				Generic Data Format
153	1	Super Resolution Reflectivity Data Array	0.13 x 0.5 Nmi x Deg	248	256	Radial Image
154	2	Super Resolution Velocity Data Array	0.13 x 0.5 Nmi x Deg	162	256	Radial Image
155	3	Super Resolution Spectrum Width Data Array	0.13 x 0.5 Nmi x Deg	162	256	Radial Image
156	47	Eddy Dissipation Rate	1.1 x 1 Nmi x Deg	124 nmi	64	Digital Radial Data Array
157	47	Eddy Dissipation Rate Confidence	1.1 x 1 Nmi x Deg	124 nmi	8	Digital Radial Data Array
158	48	Differential Reflectivity	.54 x 1 Nmi x Deg	124	16	Radial Image
159	48	Digital Differential Reflectivity	.13 x 1 Nmi x Deg	162	256	Radial Image
160	49	Correlation Coefficient	.54 x 1 Nmi x Deg	124	16	Radial Image
161	49	Digital Correlation Coefficient	.13 x 1 Nmi x Deg	162	256	Radial Image
162	50	Specific Differential Phase	.54 x 1 Nmi x Deg	124	16	Radial Image

CODE	NTR	PRODUCT NAME	RESOLUTION	RANGE	DATA LEVEL	MESSAGE FORMAT
163	50	Digital Specific Differential Phase	.13 x 1 Nmi x Deg	162	256	Radial Image
164	51	Hydrometeor Classification	.54 x 1 Nmi x Deg	124	16	Radial Image
165	51	Digital Hydrometeor Classification	.13 x 1 Nmi x Deg	162	256	Radial Image
166	52	Melting Layer	.13 x .13 Nmi x Nmi	124	N/A	Linked Contour Vectors/Set Color Level
169	53	One Hour Accumulation	1.1 Nmi X 1 Degree	124	16	Radial Image
170	54	Digital Accumulation Array	0.13 Nmi X 1 Degree	124	256	Radial Image
171	55	Storm Total Accumulation	1.1 Nmi X 1 Degree	124	16	Radial Image
172	56	Digital Storm Total Accumulation	0.13 Nmi X 1 Degree	124	256	Radial Image
173	57	Digital User-Selectable Accumulation	0.13 Nmi X 1 Degree	124	256	Radial Image
174	58	Digital One-Hour Difference Accumulation	0.13 Nmi X 1 Degree	124	256	Radial Image
175	59	Digital Storm Total Difference Accumulation	0.13 Nmi X 1 Degree	124	256	Radial Image
176	60	Digital Instantaneous Precipitation Rate	0.13 Nmi X 1 Degree	124	65536	Generic Radial Product Format
177	51	Hybrid Hydrometeor Classification	250 m (0.13 Nmi) X 1 Degree	124	256	Radial Image
178	62	Icing Hazard Level	0.54 Nmi X 1 Degree	162	71	Generic Radial Product Format
179	63	Hail Hazard Layers	0.54 Nmi X 1 Degree	162	71	Generic Radial Product Format
180-193		Reserved for Future Products				
194	1	Base Reflectivity Data Array (DoD Version)	0.54 x 1 Nmi X Deg	124	256	Radial Image
195	61	Digital Reflectivity, DQA-Edited Data Array	.54 x 1 Nmi x Deg	248	256	Radial Image
196-198		Reserved for Future Products				
199	2	Base Velocity Data Array (DoD Version)	0.27 x 1 Nmi X Deg	124	256	Radial Image

CODE	NTR	PRODUCT NAME	RESOLUTION	RANGE	DATA LEVEL	MESSAGE FORMAT
200-210		Reserved for Future Products				
211-220		Reserved for Future Products				
221-230		Reserved for Future Products				
231-240		Reserved for Future Products				
241-250		Reserved for Future Products				
251-260		Reserved for Future Products				
261-270		Reserved for Future Products				
271-280		Reserved for Future Products				
281-290		Reserved for Future Products				
291-296		Reserved for Internal RPG Use.				
297-299		Reserved for Internal RPG use				

Note: For all message codes for products: Units is N/A, Range is 0 to value shown and Accuracy/Precision is 1.1

	MSB HALFWORD LSB	
MESSAGE HEADER BLOCK	MESSAGE HEADER BLOCK (see Figure 3-3)	
	(-1) BLOCK DIVIDER	
	LENGTH OF BLOCK	
	ALERT AREA NUMBER (1 or 2)	
	NUMBER OF CATEGORIES	
ALERT CATEGORY DEFINITION	ALERT CATEGORY	
	THRESHOLD CODE	
	PRODUCT REQUEST FLAG	
(REPEAT FOR EACH CATEGORY)	..	
	..	
	..	
ALERT GRID	ALERT BOX BITS 0 - 15	ALERT BOX ROW 1
	ALERT BOX BITS 16 - 31	
	ALERT BOX BITS 32 - 47	
	ALERT BOX BITS 48 - 63	
	..	
	..	
	ALERT BOX BITS 0 - 15	ALERT BOX ROW 58
	ALERT BOX BITS 16 - 31	
	ALERT BOX BITS 32 - 47	
	ALERT BOX BITS 48 - 63	

Figure 3-5. Alert Request Message (Sheet 1)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Block Divider	INT*2	N/A	-1	N/A	Integer value of -1 used to delineate the header form the Alert Request Block
Length of Block	INT*2	Bytes	472 - 532	1	Number of bytes from -1 block divider to the end of this message
Alert Area Number	INT*2	N/A	1 to 2	1	A maximum of 2 alert areas may be defined per user
Number of Categories	INT*2	N/A	0 to 10	1	A maximum of 10 alert categories may be defined per message
Alert Category	INT*2	N/A	1 to 41	1	Alert category (refer to Table IV)
Threshold Code	INT*2	N/A	1 to 6	N/A	Parameter dependent threshold code that triggers alert (refer to Table IV)
Product Request Flag	INT*2	N/A	0 to 1	N/A	Determines whether a product is requested for the alert when the threshold is met: 0 = product not requested 1 = product requested
Alert Box Bits: 0 - 15 16 - 31 32 - 47 48 - 63	Integer	N/A	0,1	N/A	Bits 0-57 correspond to the 58 alert boxes contained in each row of Alert Grid. Bits 58 must be set to zero to facilitate checking of empty rows. Each alert Grid contains 58 rows of 16 x 16 Km alert boxes

Figure 3-5. Alert Request Message (Sheet 2)

Table IV. Alert Categories and Threshold Codes

ALERT CATEGORY		THRESHOLD CODES
	GRID GROUP	
1	Velocity	1,2,3,4,5,6
2	Composite Reflectivity	1,2,3,4,5,6
3	Echo Tops	1,2,3,4
4	Spare	
5	Spare	-
6	Vertically Integrated Liquid	1,2,3,4,5,6
	VOLUME GROUP	
7	Velocity Azimuth Display	1,2,3,4,5,6
8	Maximum Size Hail	1,2,3,4,5,6
9	Spare	
10	Tornado Vortex Signature	1,2
11	Maximum Storm Reflectivity	1,2,3,4,5,6
12	Probability of Hail	1,2,3,4,5,6
13	Probability of Severe Hail	1,2,3,4,5,6
14	Storm Top	1,2,3,4,5,6
15	Maximum 1 Hour Rainfall Accumulation	1,2,3,4
16	MDA Strength Rank	1,2,3,4,5,6
17-24	Spare	-
	FORECAST GROUP	
25	Maximum Hail Size	1,2,3,4,5,6
26	Spare	
27	Tornado Vortex Signature	1,2
28	Maximum Storm Reflectivity	1,2,3,4,5,6
29	Probability of Hail	1,2,3,4,5,6
30	Probability of Severe Hail	1,2,3,4,5,6
31	Storm Top	1,2,3,4,5,6
32	MDA Strength Rank	1,2,3,4,5,6
33-41	Spare	-

MSB HALFWORD LSB

MESSAGE HEADER BLOCK (see Figure 3-3)
PRODUCT DESCRIPTION BLOCK (1) (see Sheet 2, 6, 7)
PRODUCT SYMBOLOGY BLOCK (1) (see Sheet 3, 8)
GRAPHIC ALPHANUMERIC BLOCK (1) (see Sheet 4, 9)
TABULAR ALPHANUMERIC BLOCK (1) (see Sheet 5, 10)

Note 1: All blocks need not be used. Any blocks that are used must remain in the order shown above.

Figure 3-6. Graphic Product Message (Sheet 1)

MSB HALFWORD LSB

PRODUCT	10	(-1) BLOCK DIVIDER	
DESCRIPTION	11	LATITUDE OF RADAR (MSW)	
BLOCK	12	LATITUDE OF RADAR (LSW)	
13		LONGITUDE OF RADAR (MSW)	
14		LONGITUDE OF RADAR (LSW)	
15		HEIGHT OF RADAR	
16		PRODUCT CODE	
17		OPERATIONAL MODE	
18		VOLUME COVERAGE PATTERN	
19		SEQUENCE NUMBER	
20		VOLUME SCAN NUMBER	
21		VOLUME SCAN DATE	
22		VOL SCAN START TIME (MSW)	
23		VOL SCAN START TIME (LSW)	
24		PRODUCT GENERATION DATE	
25		PROD GENERATION TIME (MSW)	
26		PROD GENERATION TIME (LSW)	
27		PRODUCT DEPENDENT (P1)	(SEE TABLE V)
28		PRODUCT DEPENDENT (P2)	(SEE TABLE V)
29		ELEVATION NUMBER	
30		PRODUCT DEPENDENT (P3)	(SEE TABLE V)
31		DATA LEVEL 1 THRESHOLD	(SEE NOTE 1)
32		DATA LEVEL 2 THRESHOLD	

33	DATA LEVEL 3 THRESHOLD		
34	DATA LEVEL 4 THRESHOLD		
35	DATA LEVEL 5 THRESHOLD		
36	DATA LEVEL 6 THRESHOLD		
37	DATA LEVEL 7 THRESHOLD		
38	DATA LEVEL 8 THRESHOLD		
39	DATA LEVEL 9 THRESHOLD		
40	DATA LEVEL 10 THRESHOLD		
41	DATA LEVEL 11 THRESHOLD		
42	DATA LEVEL 12 THRESHOLD		
43	DATA LEVEL 13 THRESHOLD		
44	DATA LEVEL 14 THRESHOLD		
45	DATA LEVEL 15 THRESHOLD		
46	DATA LEVEL 16 THRESHOLD		
47	PRODUCT DEPENDENT (P4)		(SEE TABLE V, NOTE 3)
48	PRODUCT DEPENDENT (P5)		
49	PRODUCT DEPENDENT (P6)		
50	PRODUCT DEPENDENT (P7)		
51	PRODUCT DEPENDENT (P8)		
52	PRODUCT DEPENDENT (P9)		
53	PRODUCT DEPENDENT (P10)		
54	VERSION	SPOT BLANK	
55	OFFSET TO SYMBOLOGY (MSW)		
56	OFFSET TO SYMBOLOGY (LSW)		
57	OFFSET TO GRAPHIC (MSW)		
58	OFFSET TO GRAPHIC (LSW)		
59	OFFSET TO TABULAR (MSW)		
60	OFFSET TO TABULAR (LSW)		

Figure 3-6. Graphic Product Message (Sheet 2)

	MSB HALFWORD LSB	
PRODUCT	(-1) BLOCK DIVIDER	
SYMBOLOGY	BLOCK ID (1)	
BLOCK	LENGTH OF BLOCK (MSW)	
	LENGTH OF BLOCK (LSW)	
	NUMBER OF LAYERS	
	(-1) LAYER DIVIDER	
	LENGTH OF DATA LAYER (MSW)	
	LENGTH OF DATA LAYER (LSW)	
	DISPLAY DATA PACKETS	SEE FIGURES 3-7 THRU 3-14
	• . •	
	(-1) LAYER DIVIDER	
	LENGTH OF DATA LAYER (MSW)	
	LENGTH OF DATA LAYER (LSW)	
	DISPLAY DATA PACKETS	SEE FIGURES 3-7 THRU 3-14

Figure 3-6. Graphic Product Message (Sheet 3)

	MSB HALFWORD LSB
GRAPHIC	BLOCK DIVIDER (-1)
ALPHANUMERIC	BLOCK ID (2)
BLOCK	LENGTH OF BLOCK (MSW)
	LENGTH OF BLOCK (LSW)
	NUMBER OF PAGES
REPEAT FOR	PAGE NUMBER
EACH PAGE	LENGTH OF PAGE
	TEXT PACKET 1
	• . .
	TEXT PACKET N

Figure 3-6. Graphic Product Message (Sheet 4)

		MSB HALFWORD LSB	
	TABULAR ALPHANUMERIC BLOCK	BLOCK DIVIDER (-1)	SECOND HEADER AND PRODUCT DESCRIPTION BLOCK DATA FORMATTED AS ALPHANUMERIC PRODUCT MESSAGE
		BLOCK ID (3)	
		LENGTH OF BLOCK (MSW)	
		LENGTH OF BLOCK (LSW)	
		MESSAGE HEADER BLOCK (see Figure 3-3)	
		PRODUCT DESCRIPTION BLOCK (see sheet 2)	
		BLOCK DIVIDER (-1)	
		NUMBER OF PAGES	
REPEAT FOR EACH PAGE	REPEAT FOR EACH LINE	NUMBER OF CHARACTERS	
		CHARACTER DATA	
		END OF PAGE FLAG (-1)	

Figure 3-6. Graphic Product Message (Sheet 5)

HALFWORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
10	Block Divider	INT*2	N/A	-1	N/A	Integer value of -1 used to delineate the header from the Product Description Block
11 - 12	Latitude of Radar	INT*4	Degrees	-90 to +90	0.001	North (+) or South (-) of the Equator
13 - 14	Longitude of Radar	INT*4	Degrees	-180 to +180	0.001	East (+) or West (-) of the Prime Meridian
15	Height of Radar	INT*2	Feet	-100 to +11000	1	Feet above mean sea level
16	Product Code	INT*2	N/A	16 to 299, -16 to -299	N/A	Internal NEXRAD product code of weather product being transmitted (Refer to Table III)
17	Operational Mode	INT*2	N/A	0 to 2	N/A	0 = Maintenance 1 = Clean Air 2 = Precipitation/Severe Weather
18	Volume Coverage Pattern	INT*2	N/A	1 to 767	1	RDA volume coverage pattern for the scan strategy being used
19	Sequence Number	INT*2	N/A	-13, 0 to 32767	1	Sequence number of the request that generated the product (Refer to Figure 3-4). For products generated by an Alert Condition, sequence number = -13
20	Volume Scan Number	INT*2	N/A	1 to 80	1	Counter, recycles to one (1) every 80 volume scans
21	Volume Scan Date	INT*2	Julian Date	1 to 32767	1	Modified Julian Date; integer number of days since 1 Jan 1970
22 - 23	Volume Scan Start Time	INT*4	Seconds GMT	0 to 86399	1	Number of seconds after midnight, Greenwich Mean Time (GMT)

HALFWORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
24	Generation Date of Product	INT*2	Julian Date	1 to 32767	1	Modified Julian Date as above (Note 4)
25 - 26	Generation Time of Product	INT*4	Seconds GMT	0 to 86399	1	Number of seconds after midnight, Greenwich Mean Time (GMT) (Note 4)
27 - 28	----------PRODUCT DEPENDENT PARAMETERS 1 AND 2 (SEE TABLE V)----------|					
29	Elevation Number	INT*2	N/A	0 to 20	1	Elevation number within volume scan for elevation based product 0 for volume-based products.
30	----------PRODUCT DEPENDENT PARAMETER 3 (SEE TABLE V)----------|					
31 - 46	----------PRODUCT DEPENDENT (SEE NOTE 1)----------|					
47 - 53	----------PRODUCT DEPENDENT PARAMETERS 4 THROUGH 10 (SEE TABLE V, NOTE 3)----------|					
54	Version	INT*1	N/A	0 to 255	1	If the message is product data, the upper byte is the version number of the product. The original format of a product will be version 0. (Note 2)
54	Spot Blank	INT*1	N/A	0 to 1	1	If the message is product data, the lower byte is: 1 = Spot Blank ON 0 = Spot Blanking if OFF

HALFWORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
55 - 56	Offset to Symbology	INT*4	Halfwords	0 to 400000	1	Number of halfwords from the top of message (message code field in header) to the -1 divider of each block listed. If the offset is zero (0), the block is not part of the product in question
57 - 58	Offset to Graphic	INT*4	Halfwords	0 to 400000	1	Same as above to Graphic Block (NOTE: For Product 62, this will point to the Cell Trend data)
59 - 60	Offset to Tabular	INT*4	Halfwords	0 to 400000	1	Same as above to Tabular Block

Figure 3-6. Graphic Product Message (Sheet 6)

Note 1. The Data Level threshold values used to define the color table of products, described in Table III, consist of up to 16 Data Levels. The exceptions to this are products 32, 81, 93, 94, 99, 138, 153, 154, 155, 194, 195 and 199 that may have up to a maximum of 255 equally spaced data levels. Additionally, product 134 (High Resolution VIL) can provide 255 data levels not necessarily with equal spacing. Also, product 135 (High Resolution Enhanced Echo Tops) can provide up to 199 data levels due to using the most significant bit as a “topped” flag.
For products 32, 94, 153, 194, and 195, data level codes 0 and 1 correspond to "Below Threshold" and "Missing", respectively. Data level codes 2 through 255 denote data values starting from the minimum data value in even data increments. The threshold level fields are used to describe the 256 levels as follows:

halfword 31 contains the minimum data value in dBZ * 10
halfword 32 contains the increment in dBZ * 10.
halfword 33 contains the number of levels (0 - 255)

For product 81, data level codes 0 will correspond to no accumulation and data level code 255 will represent data outside the coverage area. Data level codes 1 through 254 denote data values starting from the minimum data value in even data increments. The threshold level fields are used to describe the 256 levels for product 81 as follows:

halfword 31 contains the minimum data value in dBA*10
halfword 32 contains the increment in dBA * 1000.
halfword 33 contains the number of levels (0 - 255)

For products 93, 99, 154, 155, and 199 data level codes 0 and 1 correspond to "Below Threshold" and "Range Folded", respectively. For products 93, 99, 154, and 199, data levels 2 through 255 denote data values starting from the minimum data value in even data increments. For product 155, data

levels 129 through 149 denote data values starting from the minimum data value in even data increments. The threshold level fields are used to describe (up to) 256 levels as follows:

halfword 31 contains the minimum data value in m/s*10
halfword 32 contains the increment in m/s*10
halfword 33 contains the number of levels (0 - 255)

For product 134, data level codes 0 and 1 correspond to "Below threshold" and "flagged data", respectively. Data level 255 is reserved for future use. Data levels 2 through 254 relate to VIL in physical units (kg m-2) via either a linear or log relationship. Any value of VIL above 80 kg m-2 is set to a data value of 254. The coefficients used in the equations to relate the data values to VIL are float values. The IEEE standard for 32-bit floating point arithmetic (ANSI/IEEE Standard 754-1985) has been adopted and modified to utilize the 16-bit (2 byte short) half words available here to describe the coefficients. Half words 31, 32, 33, 34, and 35 are used for this purpose as follows:

halfword 31 contains the linear scale encoded hex value of 0x5BB4 (short int 23476)
halfword 32 contains the linear offset encoded hex value of 0xC82A (short int -14294)
halfword 33 contains the digital log start value of 20
halfword 34 contains the log scale encoded hex value of 0x54DC (short int 21724)
halfword 35 contains the log offset encoded hex value of 0x593E (short int 22846)

For Build 9 and beyond, the linear scaling for HRVIL has been modified to provide improved depiction for weak weather signatures. Thus, halfwords 31 and 32 are redefined as follows:

halfword 31 contains the linear scale encoded hex value of 0x59AB (short int 22955)
halfword 32 contains the linear offset encoded hex value of 0x4400 (short int 17408)

The halfword hex values must be decoded to use the equations to convert a digital data value to VIL. For digital values below the value of halfword 33, the linear equation is used:
Digital data value = decoded halfword 31*VIL + decoded halfword 32

For digital data values equal to or greater than the value of halfword 33, the log equation is used:
Digital data value = decoded halfword 34*LN(VIL) + decoded halfword 35

To decode the hex values, a two stage process based on the following methodology is used.
The 32-bit IEEE standard for floating point arithmetic has been modified for a 16 bit short as:

S	E	E	E	E	E	F	F	F	F	F	F	F	F	F	F
0	1				5	6									15

The top row of the above table describes the designation as S for the one sign bit, E for the 5 exponent bits, and F for the ten fraction bits. The middle row notes the bit number starting with the MSB of 0. The bottom row relates 4 bit sequences to half byte sections.

First, convert the halfword hex value to its binary equivalent. Then, using the S, E, and F bit designations in the above table, build the decimal coefficient values using the guide below:

For E = 0, coefficient value = $(-1)^S * 2 * (0 + (F/2^{10}))$, and
for 0 < E < 255; coefficient value = $(-1)^S * 2^{E-16} * (1 + (F/2^{10}))$

For example, a coefficient value of (Hex) 5BB4, (bit sequence 0101 1011 1011 0100) is interpreted as: $(-1)^0 * 2^{22-16} * (1 + (948/2^{10}))$ which resolves to a float value of 123.25.

For product 135, data level codes 0 and 1 correspond to “Below threshold” and “bad data”, respectively. Each echo top byte contains two pieces of information: the echo top in kft and an indication of if it were “topped”. The echo top data, thus, are grouped into two sets: 2-71 and 130-199. The second set is the same echo tops set as the first except that the most significant bit is set to 1 to indicate a “topped” value. Each increment represents an increase of 1 kft. Any value of Echo Tops above 70 kft is set to a data value of 1. Half words 31, 32, 33, and 34 are provided to use for extracting the echo top value and “topped” flag:

halfword 31 contains the DATA_MASK 127 or 0x7f (hex) identifying the data bits
halfword 32 contains the DATA_SCALE 1
halfword 33 contains the DATA_OFFSET 2
halfword 34 contains the TOPPED_MASK 128 or 0x80 (hex)

The following relations are used when HREET data are decoded,

```
Value  : Integer HREET altitude, expressing thousands of feet.
Topped : Boolean describing HREET "topped" condition.
Data   : Packed integer HR-EET value.
==     : Equality evaluation.
!=     : Inequality evaluation.
&      : Binary 'AND' operator.
|      : Binary 'OR' operator.
?      : Conditional expression:
         ( A ? B : C ) returns B if A is true, returns C if A is false.
```

Use the following when decoding HREET data elements from NEXRAD product messages,

```
if ( Data == 0 )

  Value is declared below threshold.
  Topped is declared false.

else if ( Data == 1 )

  Value is declared bad.
  Topped is declared false.

else

  Value  = ( ( Data & DATA_MASK ) / DATA_SCALE ) - DATA_OFFSET
  Topped = ( Data & TOPPED_MASK ) != 0
```

If bit 0 (most significant bit) is zero (0), then the low-order byte (bits 8 - 15) is a numeric value.
Example: A data level value of (Hex) 8401, (bit sequence 1000 0100 0000 0001) is interpreted as: < TH

Except for Products 32, 81, 93, 94, 99, 134, 135, 138, 153, 154, 155, 159 161, 163, 177 and 195 the Data Level Threshold halfwords are coded as follows:
If bit 0 (most significant bit) is set to one (1), then the least significant byte (bits 8-- 15) is interpreted as a code for:

0 = "BLANK"
1 = TH
2 = ND
3 = RF
4 = BI (Biological)
5 = GC (AP/Ground Clutter)
6 = IC (Ice Crystals)
7 = GR (Graupel)
8 = WS (Wet Snow)
9 = DS (Dry Snow)
10 = RA (Light and Moderate Rain)
11 = HR (Heavy Rain)
12 = BD (Big Drops)
13 = HA (Hail and Rain Mixed)
14 = UK (Unknown)

If bits 1, 2, 3, 4, 5, 6 or 7 of the most significant byte are set to 1, then they are interpreted as a code for:
Bit 1 - If set the data field in the least significant byte is scaled by 100, to allow two decimal places of accuracy in some of the Threshold tables.
Bit 2 - If set the data field in the least significant byte is scaled by 20, to allow two decimal places of accuracy in some of the Threshold tables.
Bit 3 - If set the data field in the least significant byte is scaled by 10, to allow for one decimal place of accuracy in some of the threshold tables.

Bit 4 = ">"
Bit 5 = "<"
Bit 6 = "+"
Bit 7 = "-"

For products 159, 161, 163, 170, 172, 173, 174, 175 and 176 data levels that are not used as leading or trailing flag values relate to the data in physical units via a linear relationship.. The Scale and Offset used in the equation (F = (N - OFFSET) / SCALE), where N is the integer data value and F is the resulting floating point value) to relate the integer data values to physical units are ANSI/IEEE Standard 754-1985 floating point values. Halfwords 31 and 32 contain the Scale, and halfwords 33 and 34 contain the Offset. For these products, the physical units and typical values of Scale and Offset are shown in the following table along with the total number of values (including flags) and the number of leading and trailing flags. Leading flags are located at the lowest integer values and trailing flags are located at the highest integer values. The conversion from integer values to meteorological values should always use the Scale and Offset values found in the product header halfwords 31-34, since they could change in future implementations.

Product Name	Code	Physical Units	Scale (hw31, 32)	Offset (hw33,34)	Maximum Data Value (hw36)	Leading Flags (hw37)	Trailing Flags (hw38)
Differential Reflectivity	159	dB	16.0	128.0	255	2; 0 = below threshold 1 = range folded	0
Correlation Coefficient	161	Unitless	300.0	-60.5	255	2; 0 = below threshold 1 = range folded	0
Specific Differential Phase	163	Deg/km	20.0	43.0	243	2; 0 = below threshold 1 = range folded	0
Digital Accum Array	170	0.01 inches	Note A	Note A	255	1; 0 = NO_DATA	0
Digital Storm Total Accum	172	0.01 inches X scaling factor	Note A	Note A	255	1; 0 = NO_DATA	0
Digital User Selectable Accum	173	0.01 inches	Note A	Note A	255	1; 0 = NO_DATA	0
Digital One-Hour Difference Accum	174	0.01 inches	Note A	128.0	255	1; 0 = NO_DATA in either the PPS or QPE	0
Digital Storm Total Difference Accum.	175	0.01 inches	Note A	128.0	255	1; 0 = NO_DATA in either the PPS or QPE	0
Digital Instantaneous Precipitation Rate	176	Inches/ hour	1000.0	0.0	65535	0	0

Note A: Scale and/or Offset values vary for each product, based on the maximum meteorological value reported in the product.

Products 165 and 177 contain enumerated integer values that correspond to hydrometeor classifications as indicated in the following table:

Data Level	Displayed Code	Hydrometeor Classification
0	ND	Below Threshold
10	BI	Biological
20	GC	Anomalous Propagation/Ground Clutter
30	IC	Ice Crystals
40	DS	Dry Snow
50	WS	Wet Snow
60	RA	Light and/or Moderate Rain
70	HR	Heavy Rain
80	BD	Big Drops (rain)
90	GR	Graupel
100	HA	Hail, possibly with rain
140	UK	Unknown Classification
150	RF	Range Folded

For product 138, data level code 0 corresponds to no accumulation and data level codes 1 through 255 denote accumulation values in units of hundredths-of-inches (.01"), in even data increments, with data level code 1 being the first non-zero accumulation value. The threshold level fields are used to describe the 256 levels for product code 138 as follows:

Halfword 31 contains the minimum data value (i.e., 0)
Halfword 32 contains the increment in .01" units
Halfword 33 contains the number of levels (0 - 255)

The Data Level threshold values used to define the color table of products, described in Table III, consist of up to 16 Data Levels. The exceptions to this are products 32, 81, 93, 94, 99, 156 and 157 that may have up to a maximum of 255 equally spaced data levels.

…

For product 156, halfwords 31, 32, 33 and 34 contain parameters for decoding the digital (encoded) EDR, “DEDR”, to EDR via a linear scale as follows:

halfword 31 contains the linear scale factor (increment) in units of $m^{2/3}\ s^{-1}$ * 1000
halfword 32 contains the linear offset in units of $m^{2/3}\ s^{-1}$ * 1000
halfword 33 contains the total number of data levels (currently 64)
halfword 34 contains the number of leading data flags (currently 1)

Thus, DEDR = 0 represents flagged data and EDR = (halfword 31 / 1000) * DEDR + (halfword 32 / 1000) for DEDR values from 1 to 63.

For product 157, halfwords 31, 32, 33 and 34 contain parameters for decoding the digital (encoded) EDC, “DEDC”, to EDC via a linear scale as follows:

halfword 31 contains the linear scale factor (increment)
halfword 32 contains the linear offset

halfword 33 contains the number of data levels (currently 8)
halfword 34 contains the number of leading data flags (currently 0)

Thus, EDC = (halfword 31 / 1000) * DEDC + (halfword 32 / 1000) for DEDC values from 0 to 7.

Note 2. Products with Version Numbers

PRODUCT NAME	PRODUCT CODE	VERSION	REMARKS
Composite Reflectivity	35,36,37,38	1	Version 1 was introduced in Build 9. The only change is to the combined attributes table. The legacy MESO column data was replaced with data from the Mesocyclone Detection Algorithm (MDA). The MDA data in the table is the strength rank of the closest (within 20 km) MDA feature to the SCIT storm cell, or the word "NONE."
Composite Reflectivity Edited for AP	95,96,97,98	1	Version 1 was introduced in Build 9. The only change is to the combined attributes table. The legacy MESO column data was replaced with data from the Mesocyclone Detection Algorithm (MDA). The MDA data in the table is the strength rank of the closest (within 20 km) MDA feature to the SCIT storm cell, or the word "NONE."
STI	58	1	
Hail Index	59	1	
Tornado Vortex Signature	61	1	
Layer Composite Reflectivity - AP removed	67	1	
Radar Coded Message	74	1	
Surface Rainfall Accumulation (1 hr)	78	**1**	
Surface Rainfall Accumulation (3 hr)	79	1	
Storm Total Rainfall Accumulation	80	**1**	
Hourly Digital Precipitation Array	81	2	
Supplemental Precipitation Data	82	1	
Digital Hybrid Scan Reflectivity	32	2	
High Resolution VIL	134	1	
Digital Storm Total	138	2	

PRODUCT NAME	PRODUCT CODE	VERSION	REMARKS
Clutter Filter Control	34	2	Version 1 of the CFC product was introduced in Build 7. The new product was necessary due to changes in the clutter filtering scheme used by the Open RDA system in which the clutter channel information (Doppler vs. Surveillance) was removed.
Digital Mesocyclone Detection	149	1	
Mesocyclone Detection	141	1	

Note 3. For products which are compressed, halfword 51 (P8) denotes the compression method:

halfword 51 contains 0 if no compression is applied
halfword 51 contains 1 if the data are compressed using bzip2 (refer to Appendix D for details)

And halfwords 52 (P9) and 53 (P10) denote the size of the uncompressed product, in bytes, excluding the sizes of the Message Header block and Product Description blocks:

halfword 52 contains size of uncompressed product (MSW), in bytes
halfword 53 contains size of uncompressed product (LSW), in bytes

If the product size less the product header and product description block is less than 1000 bytes, halfword 51 contains 0.

Note 4. For Products 134 and 135, the generation date is replaced by the end of volume date and the generation time is replaced by the end of volume time. The volume end date and time use the same format as specified for generation date and time.

Figure 3-6. Graphic Product Message (Sheet 7)

PRODUCT SYMBOLOGY BLOCK

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Block Divider	INT*2	N/A	-1	N/A	Integer value of -1 used to delineate the Product Description from the Product Symbology Block
Block ID	INT*2	N/A	1	N/A	Constant value of 1 which identifies this block
Length of Block	INT*4	Bytes	1 to 400000	1	Length of block in bytes (includes preceding divider and block id)
Number of Layers	INT*2	N/A	1 to 18	1	Number of data layers contained in this block (see Note 2)
Layer Divider	INT*2	N/A	-1	N/A	Integer value of -1 used to delineate one data layer from another
Length of Data Layer	INT*4	N/A	1 to 400000	1	Length of data layer (in bytes) not including layer divider and length field
Display Data Packets	N/A	N/A	N/A	N/A	See Figures 3-7 through 3-14

Note 2. The various layers are different types of data formats. An example would be the combined moment product. One layer is reflectivity data in radial packets, another layer contains the vector arrow packets that define the velocity and spectrum width data. The length of the layer does not include the divider or the length word.

Figure 3-6. Graphic Product Message (Sheet 8)

GRAPHIC ALPHANUMERIC BLOCK

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Block Divider	INT*2	N/A	-1	N/A	Integer value of -1 used to delineate the Graphic Alphanumeric Block
Block ID	INT*2	N/A	2	N/A	Constant value of 2 which identifies this block
Length of Block	INT*4	Bytes	1 to 65535	1	Length of block in bytes (includes preceding divider and block id) from the divider to the end of message
Number of Pages	INT*2	N/A	1 to 48	1	Total number of pages
Page Number	INT*2	N/A	1 to 48	1	Current page number
Length of Page	INT*2	Bytes	4 to 1360	1	Number of bytes in Text Packet 1 through Text Packet N
Text Packet (N)	N/A	N/A	N/A	N/A	The format of these text packets are Packet Code 8, shown in Figure 3-8b, and Packet Code 10, shown in Figure 3-8

Figure 3-6. Graphic Product Message (Sheet 9)

TABULAR ALPHANUMERIC BLOCK (see Note 3)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Block Divider	INT*2	N/A	-1	N/A	Integer value of -1 used to delineate the Tabular Alphanumeric Block
Block ID	INT*2	N/A	3	N/A	Constant value of 3 which identifies this block
Length of Block	INT*4	Bytes	1 to 65535	1	Length of block in bytes from the divider to the end of message
---------- SECOND MESSAGE HEADER BLOCK ----------					
---------- SECOND PRODUCT DESCRIPTION BLOCK ----------					
Block Divider	INT*2	N/A	-1	N/A	Integer value of -1 used to delineate the data from the Product Description Block
Number of Pages	INT*2	N/A	1 to 48	1	Total number of pages
Number of Characters	INT*2	N/A	0 to 80	1	Number of characters in a line
Character Data	CHAR	8 Bit ASCII	ASCII Character Set	N/A	Characters are ASCII when the MSB is set to zero. When the MSB is set to one, the remaining 7 bits define the special symbol
End of Page Flag	INT*2	N/A	-1	N/A	Integer value of -1 to delineate the end of page

Note 3. Tabular Alphanumeric Block must be the last block in a product message. Maximum lines per page = 17. Alphanumeric Products containing RPG Site Adaptable Parameters must have the Site Adaptable Parameters formatted as the last page(s) of the Product.

Figure 3-6. Graphic Product Message (Sheet 10)

Table V. Product Dependent Halfword Definition for Product Description Block

PRODUCT NAME	MSG CODE	HWORD #	CONTENT	UNITS	RANGE	ACCUR/PREC
Archive III Status Product	152	51	Compression Method	N/A	0 or 1	1
Archive III Status Product	152	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 500000	1
Archive III Status Product	152	53	Uncompressed Product Data Size (LSW)			1
Base Reflectivity	16-21	30	Elevation Angle	Degree	-1.0 to +45.0	.1
Base Reflectivity	16-21	47	Max Reflectivity	dBZ	-32 to +95, (-33)	1, Note 6
Base Reflectivity	16-21	51	Cal. Constant (MSB)			
Base Reflectivity	16-21	52	" " (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Base Reflectivity Data Array	94	30	Elevation Angle	Degree	-1.0 to +45.0	.1
Base Reflectivity Data Array	94	47	Max Reflectivity	dBZ	-32 to +95, (-33)	1, Note 6
Base Reflectivity Data Array	94	51	Compression Method	N/A	0 or 1	1
Base Reflectivity Data Array	94	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 188000	1
Base Reflectivity Data Array	94	53	Uncompressed Product Data Size (LSW)			1
Base Reflectivity Data Array (DoD Version)	194	30	Elevation Angle	Degree	-1.0 to +45.0	.1
Base Reflectivity Data Array (DoD Version)	194	47	Max Reflectivity	dBZ	-32 to +95, (-33)	1, Note 6
Base Reflectivity Data Array (DoD Version)	194	51	Compression Method	N/A	0 or 1	1
Base Reflectivity Data Array (DoD Version)	194	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 188000	1
Base Reflectivity Data Array (DoD Version)	194	53	Uncompressed Product Data Size (LSW)			1
Base Spectrum Width	28-30	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1

PRODUCT NAME	MSG CODE	HWORD #	CONTENT	UNITS	RANGE	ACCUR/PREC
Base Spectrum Width	28-30	47	Max Spectrum Width	Knots	0 to 19	1
Base Velocity	22-27	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Base Velocity	22-27	47	Max Neg. Velocity	Knots	-247 to 0	1
Base Velocity	22-27	48	Max Pos. Velocity	Knots	0 to 245	1
Base Velocity Data Array	99	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Base Velocity Data Array	99	47	Max Neg. Velocity	Knots	-247 to 0	1
Base Velocity Data Array	99	48	Max Pos. Velocity	Knots	0 to 245	1
Base Velocity Data Array	99	51	Compression Method	N/A	0 or 1	1
Base Velocity Data Array	99	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 372000	1
Base Velocity Data Array	99	53	Uncompressed Product Data Size (LSW)			1
Base Velocity Data Array (DoD Version)	199	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Base Velocity Data Array (DoD Version)	199	47	Max Neg. Velocity	Knots	-247 to 0	1
Base Velocity Data Array (DoD Version)	199	48	Max Pos. Velocity	Knots	0 to 245	1
Base Velocity Data Array (DoD Version)	199	51	Compression Method	N/A	0 or 1	1
Base Velocity Data Array (DoD Version)	199	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 372000	1
Base Velocity Data Array (DoD Version)	199	53	Uncompressed Product Data Size (LSW)			1
Clutter Filter Control	34	27	Channel/Segment Bit Map	N/A	0,1 Bit	N/A , Note 8
Clutter Filter Control	34	28	CMD Generated Clutter Bypass Map	N/A	0 or 1	N/A, Note 17
Clutter Filter Control	34	48	Bypass Map Date	Julian Date	1 to 32767	1
Clutter Filter Control	34	49	Bypass Map Time	Minutes	0 to 1439	1
Clutter Filter Control	34	50	Notchwidth Map Date, Note 13	Julian Date	1 to 32767	1

PRODUCT NAME	MSG CODE	HWORD #	CONTENT	UNITS	RANGE	ACCUR/PREC
Clutter Filter Control	34	51	Notchwidth Map Time, Note 13	Minutes	0 to 1439	1
Clutter Likelihood Reflectivity	132	30	Elevation Angle	Degree	-1.0 to +45.0	1
Clutter Likelihood Doppler	133	30	Elevation Angle	Degree	-1.0 to +45.0	1
Composite Reflectivity	35 - 38	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note1
Composite Reflectivity	35 - 38	47	Max Reflectivity	dBZ	-32 to +95, (-33)	1, Note 6
Composite Reflectivity	35 - 38	51	Cal. Constant (MSB)			
Composite Reflectivity	35 - 38	52	Cal Constant (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Composite Reflectivity Edited for AP	95-98	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note 1
Composite Reflectivity Edited for AP	95 - 98	47	Max Reflectivity	dBZ	-32 to 95, (-33)	1, Note 6
Composite Reflectivity Edited for AP	95 - 98	51	Cal Constant (MSB)			
Composite Reflectivity Edited for AP	95 - 98	52	Cal Constant (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A,Note2
Cross Section (Vel)	51 & 86	47	Azimuth point one	Degree	0.0 to 359.9	.1, Note 1
Cross Section (Vel)	51 & 86	48	Range point one	Nmi	0.0 to 124.0	.1, Note 1
Cross Section (Vel)	51 & 86	49	Azimuth point two	Degree	0,0 to 359.9	.1, Note 1
Cross Section (Vel)	51 & 86	50	Range point two	Nmi	0.0 to 124.9	.1, Note 1
Cross Section (Reflect)	50 & 85	47	Azimuth point one	Degree	0.0 to 359.9	.1, Note 1
Cross Section (Reflect)	50 & 85	48	Range point one	Nmi	0.0 to 124.0	.1, Note 1
Cross Section (Reflect)	50 & 85	49	Azimuth point two	Degree	0.0 TO 359.9	.1, Note 1
Cross Section (Reflect)	50 & 85	50	Range point two	Nmi	0.0 to 124.0	.1, Note 1
Cross Section (Reflect)	50 & 85	51	Cal. Constant (MSB)			

PRODUCT NAME	MSG CODE	HWORD #	CONTENT	UNITS	RANGE	ACCUR/PREC
Cross Section (Reflect)	50 & 85	52	" " (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Digital Hybrid Scan Reflect	32	47	Max Reflectivity	dBZ	-32 to +95, (-33)	1, Note 6
Digital Hybrid Scan Reflect	32	48	Date of Scan	Julian Date	1 to 32767	1
Digital Hybrid Scan Reflect	32	49	Avg. Time of Hybrid Scan	Minutes	0 to 1439	1
Digital Hybrid Scan Reflect	32	51	Compression Method	N/A	0 or 1	1
Digital Hybrid Scan Reflect	32	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 86000	1
Digital Hybrid Scan Reflect	32	53	Uncompressed Product Data Size (LSW)			1
Digital Mesocyclone Detection	149	27	Adaptation Data setting for Minimum Reflectivity Threshold	dBZ	-25 to 35	1
Digital Mesocyclone Detection	149	30	Elevation Angle	Degree	-1.0 to + 45.0	.1
Digital Mesocyclone Detection	149	51	Compression Method	N/A	0 or 1	1
Digital Mesocyclone Detection	149	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 300000	1
Digital Mesocyclone Detection	149	53	Uncompressed Product Data Size (LSW)			1
Digital Reflectivity DQA-Edited Data Array	195	30	Elevation Angle	Degree	-1.0 to +45.0	.1
Digital Reflectivity DQA-Edited Data Array	195	47	Max Reflectivity	dBZ	-32 to +95, (-33)	1, Note 6
Digital Reflectivity DQA-Edited Data Array	195	48	Number of artifact edited radials in elevation	unitless	0 to 10000	1

PRODUCT NAME	MSG CODE	HWORD #	CONTENT	UNITS	RANGE	ACCUR/PREC
Digital Reflectivity DQA-Edited Data Array	195	49	AVSET Status	unitless	0, 1, 3	1
Digital Reflectivity DQA-Edited Data Array	195	51	Compression Method	N/A	0 or 1	1
Digital Reflectivity DQA-Edited Data Array	195	52	Uncompressed Product Data Size (MSW)	Bytes	770 - 167910	1
Digital Reflectivity DQA-Edited Data Array	195	53	Uncompressed Product Data Size (LSW)			1
Digital Storm Total Precipitation	138	27	Beg. Date of Rainfall	Julian Date	1 to 32767	1
Digital Storm Total Precipitation	138	28	Beg. Time of Rainfall	Minutes	0 to 1439	1
Digital Storm Total Precipitation	138	30	Mean-field Bias	N/A	0.0 to 99.99	.01, Note 1
Digital Storm Total Precipitation	138	47	Max Rainfall	Inches	0 to 51.00, Note 12	.01 to .20, Note 12
Digital Storm Total Precipitation	138	48	End Date of Rainfall	Julian Date	1 to 32767	1
Digital Storm Total Precipitation	138	49	End Time of Rainfall	Minutes	0 to 1439	1
Digital Storm Total Precipitation	138	50	Sample Size (No. G-R Pairs)	N/A	.00 to 9999.99	.01, Note 1
Digital Storm Total Precipitation	138	51	Compression Method	N/A	0 or 1	1
Digital Storm Total Precipitation	138	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 300000	1
Digital Storm Total Precipitation	138	53	Uncompressed Product Data Size (LSW)			1
Echo Tops Product	41	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to + 45.0	.1, Note 1
Echo Tops Product	41	47	Max Echo	1000 Feet	0 to 70	1, Note 5

Free Text Message	75	47	RPG ID Number	N/A	0 to 999	1
Gust Front MIGFA	140	49	Detection count	N/A	0 - 1000	1
Hail Hazard Layers	179	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note 1
Hail Hazard Layers	179	47	Maximum Hail top altitude in volume	kft	0 to 70	1
Hail Index	59	--	--	--	--	--
High Resolution Enhanced Echo Tops	135	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note 1
High Resolution Enhanced Echo Tops	135	47	Maximum echo top height in volume	kft	0 to 70	1
High Resolution Enhanced Echo Tops	135	48	Number of artifact edited radials in volume	unitless	0 to 10000	1
High Resolution Enhanced Echo Tops	135	49	Echo Tops reflectivity factor threshold	dBZ	-32 to 95	1
High Resolution Enhanced Echo Tops	135	50	Number of spurious points removed	unitless	0 to 10000	1
High Resolution Enhanced Echo Tops	135	51	Compression Method	N/A	0 or 1	1
High Resolution Enhanced Echo Tops	135	52	Uncompressed Product Data Size (MSW)	Bytes	764 - 126870	1
High Resolution Enhanced Echo Tops	135	53	Uncompressed Product Data Size (LSW)			1
High Resolution Vertically Integ. Liq	134	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note 1
High Resolution Vertically Integ. Liq	134	47	Max Digital VIL	unitless	0 to 254	1
High Resolution Vertically Integ. Liq	134	48	Number of artifact edited radials in volume	unitless	0 to 10000	1
High Resolution Vertically Integ. Liq	134	51	Compression Method	N/A	0 or 1	1
High Resolution Vertically Integ. Liq	134	52	Uncompressed Product Data Size (MSW)	Bytes	770 - 167910	1
High Resolution Vertically Integ. Liq	134	53	Uncompressed Product Data Size (LSW)			1
Hourly Dig.Precip Array	81	47	Max Rainfall Accum.	dBA	-6.0 to 25.625	.001, Note 1
Hourly Dig. Precip Array	81	48	Mean-field Bias	N/A	0.01 to 99.99	.01, Note 1
Hourly Dig. Precip Array	81	49	Effective No. G-R Pairs (Sample Size)	N/A	0.00 to 9999.99	.01, Note 1
Hourly Dig. Precip Array	81	50	Rainfall End Date	Julian Date	1 to 32767	1
Hourly Dig. Precip Array	81	51	Rainfall End Time	Minutes	0 to 1439	1

Hybrid Scan Reflectivity	33	47	Max Reflectivity	dBZ	-32 to 95, (-33)	1, Note 6
Hybrid Scan Reflectivity	33	48	Date of Scan	Julian Date	1 to 32767	1
Hybrid Scan Reflectivity	33	49	Avg. Time of Scan	Minutes	0 to 1439	1
Icing Hazard Levels	178	30	AVSET termination elevation angle Otherwise = 0	Degrees	-1.0 to +45.0	.1, Note 1
Icing Hazard Levels	178	47	Maximum icing top altitude in volume	kft	0 to 70	1
ITWS Digital Base Velocity	93	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
ITWS Digital Base Velocity	93	47	Max Neg. Velocity	Knots	-123 to 0	1
ITWS Digital Base Velocity	93	48	Max Pos. Velocity	Knots	0 to 122	1
ITWS Digital Base Velocity	93	50	Velocity Precision Code	N/A	1 or 2	1, Note 11
Lyr 1 Comp.Reflect (avg)	63	47	Max Reflectivity	dBZ	-32 to +95	1
Lyr 1 Comp.Reflect (avg)	63	48	Bottom of layer	1000 Feet	0	Note 5
Lyr 1 Comp.Reflect(avg)	63	49	Top of layer	Feet	6000 to 58000	1
Lyr 1 Comp.Reflect(avg)	63	51	Cal. Constant (MSB)			
Lyr 1 Comp.Reflect(avg)	63	52	" " (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Lyr 1 Comp. Reflect(max)	65	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to 45.0	.1, Note 1
Lyr 1 Comp.Reflect(max)	65	47	Max Reflectivity	dBZ	-32 to +95	1
Lyr 1 Comp.Reflect(max)	65	48	Bottom of layer	1000 Feet	0	Note 5
Lyr 1 Comp.Reflect(max)	65	49	Top of layer	1000 Feet	6 to 58	1
Lyr 1 Comp.Reflect(max)	65	51	Cal. Constant (MSB)			
Lyr 1 Comp.Reflect(max)	65	52	" " (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Lyr 2 Comp.Reflect(avg)	64	47	Max Reflectivity	dBZ	-32 to +95	1
Lyr 2 Comp.Reflect(avg)	64	48	Bottom of layer	1000 Feet	6 to 58	1
Lyr 2 Comp.Reflect(avg)	64	49	Top of layer	1000 Feet	12 to 64	1

Lyr 2 Comp.Reflect(avg)	64	51	Cal. Constant (MSB)			
Lyr 2 Comp.Reflect(avg)	64	52	" " (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Lyr 2 Comp. Reflect(max)	66	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note 1
Lyr 2 Comp.Reflect(max)	66	47	Max Reflectivity	dBZ	-32 to +95	1
Lyr 2 Comp.Reflect(max)	66	48	Bottom of layer	1000 Feet	6 to 58	1
Lyr 2 Comp.Reflect(max)	66	49	Top of layer	1000 Feet	12 to 64	1
Lyr 2 Comp.Reflect(max)	66	51	Cal. Constant (MSB)			
Lyr 2 Comp.Reflect(max)	66	52	" " (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Lyr 1 Comp Ref-AP (max)	67	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note 1
Lyr 1 Comp Ref-AP (max)	67	47	Max Reflectivity	dBZ	-32 to +95	1
Lyr 1 Comp Ref-AP (max)	67	48	Bottom of layer	1000 Feet	0	Note 5
Lyr 1 Comp Ref-AP (max)	67	49	Top of layer	1000 Feet	6 to 58	1
Lyr 1 Comp Ref-AP (max)	67	51	Cal. Constant (MSB)			
Lyr 1 Comp Ref-AP (max)	67	52	Cal. Constant (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Lyr 3 Comp.Reflect (avg)	89	47	Max Reflectivity	dBZ	-32 to +95	1
Lyr 3 Comp.Reflect (avg)	89	48	Bottom of layer	1000 Feet	12 to 64	1
Lyr 3 Comp.Reflect (avg)	89	49	Top of layer	1000 Feet	18 to 70	1
Lyr 3 Comp.Reflect (avg)	89	51	Cal. Constant (MSB)			

Lyr 3 Comp.Reflect (avg)	89	52	" " (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Lyr3 Comp. Reflect (max)	90	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note 1
Lyr 3 Comp.Reflect (max)	90	47	Max Reflectivity	dBZ	-32 to +95	1
Lyr 3 Comp.Reflect (max)	90	48	Bottom of layer	1000 Feet	12 to 64	1
Lyr 3 Comp.Reflect (max)	90	49	Top of layer	1000 Feet	18 to 70	1
Lyr 3 Comp.Reflect (max)	90	51	Cal. Constant (MSB)			
Lyr 3 Comp.Reflect (max)	90	52	Cal. Constant (LSB)	dB (Real*4)	-50.0 to +50.0, Note 14 -198.0 to +198.0, Note 15	N/A, Note 2
Mesocyclone Detection	141	27	Adaptation Data setting for Minimum Reflectivity Threshold	dBZ	-25 to 35	1
Mesocyclone Detection	141	28	Adaptation Data setting for Overlap Display Filter	N/A	0 or 1	0 = overlap filter OFF 1 = overlap filter ON
Mesocyclone Detection	141	30	Adaptation Data setting for Minimum Display Filter Strength Rank	N/A	1 to 5	1
One-hour Snow Water Equivalent	144	27	Length of Missing Periods	Minutes	0 to 32767	1
One-hour Snow Water Equivalent	144	30	Use RCA Flag	N/A	0 or 1	1
One-hour Snow Water Equivalent	144	47	Maximum Value	Inches	0.001 to 32.767	0.001, Note 1
One-hour Snow Water Equivalent	144	48	Starting Date	Julian Date	1 to 32767	1
One-hour Snow Water Equivalent	144	49	Starting Time	Minutes	0 to 1439	1
One-hour Snow Water Equivalent	144	50	Ending Date	Julian Date	1 to 32767	1
One-hour Snow Water Equivalent	144	51	Ending Time	Minutes	0 to 1439	1
One-hour Snow Water Equivalent	144	52	Azimuth of Max.	Degrees	0 to 359	1

One-hour Snow Water Equivalent	144	53	Range to Max.	Nmi	0 to 124	1
One-hour Snow Depth	145	27	Length of Missing Periods	Minutes	0 to 32767	1
One-hour Snow Depth	145	30	Use RCA Flag	N/A	0 or 1	1
One-hour Snow Depth	145	47	Maximum Value	Inches	0.01 to 327.67	0.01, Note 1
One-hour Snow Depth	145	48	Starting Date	Julian Date	1 to 32767	1
One-hour Snow Depth	145	49	Starting Time	Minutes	0 to 1439	1
One-hour Snow Depth	145	50	Ending Date	Julian Date	1 to 32767	1
One-hour Snow Depth	145	51	Ending Time	Minutes	0 to 1439	1
One-hour Snow Depth	145	52	Azimuth of Max	Degrees	0 to 359	1
One-hour Snow Depth	145	53	Range to Max.	Nmi	0 to 124	1

Storm Mean Radial Vel.	55	27	Azimuth of Window	Degree	0.0 to 359.9	.1, Note 1
Storm Mean Radial Vel.	55	28	Range of Window	Nmi	0.0 to 124.0	.1, Note 1
Storm Mean Radial Vel.	55	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Storm Mean Radial Vel.	55	47	Max Neg. Velocity	Knots	-247 to 0	1
Storm Mean Radial Vel.	55	48	Max Pos. Velocity	Knots	0 to +245	1
Storm Mean Radial Vel.	55	49	Motion Source Flag	N/A	-1 = Algorithm	1
Storm Mean Radial Vel.	55	50	Height of Phenomena	1000 Ft AGL	0 to 70	1
Storm Mean Radial Vel.	55	51	Storm Speed	Knots	0.0 to 99.9	.1, Note 1
Storm Mean Radial Vel.	55	52	Storm Direction	Degree	0.0 to 359.9	.1, Note 1
Storm Mean Radial Vel.	55	53	Alert Category	N/A	See Table IV	1, Note 7
Storm Mean Radial Vel.	56	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Storm Mean Radial Vel.	56	47	Max Neg. Velocity	Knots	-247 to 0	1
Storm Mean Radial Vel.	56	48	Max Pos. Velocity	Knots	0 to +245	1
Storm Mean Radial Vel.	56	49	Motion Source Flag	N/A	-1 = Algorithm	1
Storm Mean Radial Vel.	56	51	Avg Speed of Storms	Knots	0.0 to 99.9	.1, Note 1
Storm Mean Radial Vel.	56	52	Avg Dir. of Storms	Degree	0.0 to 359.9	.1, Note 1
Storm Structure	62	--	--	--		

Storm Total Rainfall Accum.	80	47	Max Rainfall	Inches	0.0 to 327.6	.1, Note 1
Storm Total Rainfall Accum.	80	48	Beg. Date Rainfall	Julian Date	1 to 32767	1
Storm Total Rainfall Accum.	80	49	Beg. Time Rainfall	Minutes	0 to 1439	1
Storm Total Rainfall Accum.	80	50	End Date Rainfall	Julian date	1 to 32767	1
Storm Total Rainfall Accum.	80	51	End Time Rainfall	Minutes	0 to 1439	1
Storm Total Rainfall Accum.	80	52	Mean-field Bias	N/A	0.01 to 99.99	.01, Note 1
Storm Total Rainfall Accum.	80	53	Effective No. G-R Pairs (Sample Size)	N/A	0.00 to 9999.99	.01, Note 1
Storm Total Snow Depth	147	27	Length of Missing Periods	Minutes	0 to ??	1
Storm Total Snow Depth	147	30	Use RCA Flag	N/A	0 or 1	1
Storm Total Snow Depth	147	47	Maximum Value	Inches	0.0 to 3276.7	0.1, Note 1
Storm Total Snow Depth	147	48	Starting Date	Julian Date	1 to 32767	1
Storm Total Snow Depth	147	49	Starting Time	Minutes	0 to 1439	1
Storm Total Snow Depth	147	50	Ending Date	Julian Date	1 to 32767	1
Storm Total Snow Depth	147	51	Ending Time	Minutes	0 to 1439	1
Storm Total Snow Depth	147	52	Azimuth of Max.	Degrees	0 to 359	1
Storm Total Snow Depth	147	53	Range to Max.	Nmi	0 to 124	1
Storm Total Snow Water Equivalent	146	27	Length of Missing Periods	Minutes	0 to 32767	1
Storm Total Snow Water Equivalent	146	30	Use RCA Flag	N/A	0 or 1	1
Storm Total Snow Water Equivalent	146	47	Maximum Value	Inches	0.00 to 327.67	0.01, Note 1
Storm Total Snow Water Equivalent	146	48	Starting Date	Julian Date	1 to 32767	1
Storm Total Snow Water Equivalent	146	49	Starting Time	Minutes	0 to 1439	1
Storm Total Snow Water Equivalent	146	50	Ending Date	Julian Date	1 to 32767	1
Storm Total Snow Water Equivalent	146	51	Ending Time	Minutes	0 to 1439	1
Storm Total Snow Water Equivalent	146	52	Azimuth of Max.	Degrees	0 to 359	1
Storm Total Snow Water Equivalent	146	53	Range to Max.	Nmi	0 to 124	1

Storm Track	58	47	Total Number of Storms	N/A	0 to 100	1
SuperOb	136	27	Base Time	Minutes	0 to 1439	1
SuperOb	136	28	Time Radius	Minutes	5 to 90	1
SuperOb	136	30	Offset Minutes	Minutes	0 to 59	1
SuperOb	136	47	SuperOb Cell Range Size	Km	1 to 10	1
SuperOb	136	48	SuperOb Cell Azimuth Size	Degrees	2 to 12	1
SuperOb	136	49	Maximum Range	Km	60 to 230	1
SuperOb	136	50	Minimum Number of Samples	N/A	20 to 200	1
SuperOb	136	51	Compression Method	N/A	0 or 1	1
SuperOb	136	52	Uncompressed Product Data Size (MSW)	Bytes	120 - 1409856	1
SuperOb	136	53	Uncompressed Product Data Size (LSW)			1
Super Resolution Digital Base Reflectivity	153	30	Elevation Angle	Degree	-1.0 to +45.0	.1
Super Resolution Digital Base Reflectivity	153	47	Max Reflectivity	dBZ	-32 to +95, (-33)	1, Note 6
Super Resolution Digital Base Reflectivity	153	51	Compression Method	N/A	0 or 1	1
Super Resolution Digital Base Reflectivity	153	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 1329150	1
Super Resolution Digital Base Reflectivity	153	53	Uncompressed Product Data Size (LSW)			
Super Resolution Digital Base Velocity	154	30	Elevation Angle	Degree	-1.0 to +45.0	.1
Super Resolution Digital Base Velocity	154	47	Max Neg. Velocity	Knots	-247 to 0	1
Super Resolution Digital Base Velocity	154	48	Max Pos. Velocity	Knots	0 to 245	1
Super Resolution Digital Base Velocity	154	51	Compression Method	N/A	0 or 1	1
Super Resolution Digital Base Velocity	154	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 868350	1

Super Resolution Digital Base Velocity	154	53	Uncompressed Product Data Size (LSW)			
Super Resolution Digital Base Spectrum Width	155	30	Elevation Angle	Degree	-1.0 to +45.0	.1
Super Resolution Digital Base Spectrum Width	155	47	Max Spectrum Width	Knots	0 to 19	1
Super Resolution Digital Base Spectrum Width	155	51	Compression Method	N/A	0 or 1	1
Super Resolution Digital Base Spectrum Width	155	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 868350	1
Super Resolution Digital Base Spectrum Width	155	53	Uncompressed Product Data Size (LSW)			
Surface Rainfall Accum	78 & 79	47	Max Rainfall	Inches	0.0 to 189.0	.1, Note 1
Surface Rainfall Accum	78 & 79	48	Mean-field Bias	N/A	0.01 to 99.99	.01, Note 1
Surface Rainfall Accum	78 & 79	49	Effective No. G-R Pairs (Sample Size)	N/A	0.00 to 9999.99	.01, Note 1
Surface Rainfall Accum	78 & 79	50	Rainfall End Date	Julian Date	1 to 32767	1
Surface Rainfall Accum	78 & 79	51	Rainfall End Time	Minutes	0 to 1439	1
TVS	61	47	Total Number of TVS	N/A	-25 to 25	1, Note 5
TVS	61	48	Total Number of ETVS	N/A	-25 to 25	1, Note 5
Tornado Vortex Signature Rapid Update	143	30	Elevation angle	degree	-1.0 to +45.0	.1
Tornado Vortex Signature Rapid Update	143	47	Total Number of TVS	N/A	-25 to 25	1, Note 5
Tornado Vortex Signature Rapid Update	143	48	Total Number of ETVS	N/A	-25 to 25	1, Note 5
Turbulence Detection Algorithm (NTDA)	156, 157	27	Elevation start time in seconds since volume start	Second	0 to 32767	1
Turbulence Detection Algorithm (NTDA)	156, 157	28	Elevation end time in seconds since volume start	Second	0 to 32767	1

Turbulence Detection Algorithm (NTDA)	156, 157	30	Target elevation angle	Degree	-1.0 to +45.0	0.1, Note 1
Turbulence Detection Algorithm (NTDA)	156, 157	47	Minimum elevation angle	Degree	-1.00 to +45.00	0.01, Note 1
Turbulence Detection Algorithm (NTDA)	156, 157	48	Mean elevation angle	Degree	-1.00 to +45.00	0.01, Note 1
Turbulence Detection Algorithm (NTDA)	156, 157	49	Maximum elevation angle	Degree	-1.00 to +45.00	0.01, Note 1
User Alert Message	73	--	--	--		
User Selectable Layer Composite Reflectivity	137	27	Requested Bottom Altitude of Layer	K Feet	0 to 69	1
User Selectable Composite Reflectivity	137	28	Requested Top Altitude of Layer	K Feet	1 to 70	1
User Selectable Layer Composite Reflectivity	137	47	Max Reflectivity	dBZ	-32 to 95	1
User Selectable Composite Reflectivity	137	48	Actual bottom Altitude of Layer (adjusted to correct request errors).	K Feet	0 to 69	1
User Selectable Layer Composite Reflectivity Maximum	137	49	Actual top Altitude of Layer (adjusted to correct request errors).	K Feet	1 to 70	1
User Selectable Precip.	31	27	End Hour	Hours	0 to 23	1
User Selectable Precip.	31	28	Time Span	Hours	1 to 24	1
User Selectable Precip.	31	30	Null Product Flag	N/A	0 to 1	1, Note 9
User Selectable Precip.	31	47	Max Rainfall	Inches	0.0 to 327.6	.1, Note 1

User Selectable Precip.	31	48	Beg. Date Rainfall	Julian Date	1 to 32767	1
User Selectable Precip.	31	49	Beg. Time Rainfall	Minutes	0 to 1439	1
User Selectable Precip.	31	50	End Date Rainfall	Julian Date	1 to 32767	1
User Selectable Precip.	31	51	End Time Rainfall	Minutes	0 to 1439	1
User Selectable Precip.	31	52	Average Mean-field Bias	N/A	0.01 to 99.99	.01, Note 1
User Selectable Precip.	31	53	Average Effective No. G-R Pairs (Sample Size)	N/A	0.00 to 9999.99	.01, Note 1
User Selectable Snow Depth	151	27	End Hour	Hours	0 to 23	1
User Selectable Snow Depth	151	28	Time Span	Hours	1 to 30	1
User Selectable Snow Depth	151	30	Use High Scale Flag/ Use RCA Flag	N/A	0, 1, 256, or 257	1 Note 16
User Selectable Snow Depth	151	47	Maximum Value	Inches	0.00 to 327.67 or 0.0 to 3276.7	0.01 or 0.1, Note 1 and Note 16
User Selectable Snow Depth	151	48	Starting Date	Julian Date	1 to 32767	1
User Selectable Snow Depth	151	49	Starting Hour	Minutes	0 to 1439	1, Note 22
User Selectable Snow Depth	151	50	Ending Date	Julian Date	1 to 32767	1
User Selectable Snow Depth	151	51	Ending Hour	Minutes	0 to 1439	1, Note 22
User Selectable Snow Depth	151	52	Azimuth of Max.	Degrees	0 to 359	1
User Selectable Snow Depth	151	53	Range to Max.	Nmi	0 to 124	1
User Selectable Snow Water Equivalent	150	27	End Hour	Hours	0 to 23	1
User Selectable Snow Water Equivalent	150	28	Time Span	Hours	1 to 30	1
User Selectable Snow Water Equivalent	150	30	Use High Scale Flag/ Use RCA Flag	N/A	0, 1, 256, or 257	1 Note 16
User Selectable Snow Water Equivalent	150	47	Maximum Value	Inches	0.000 to 32.767 or 0.00 to 327.67	0.001 or 0.01, Note 1 and Note 16
User Selectable Snow Water Equivalent	150	48	Starting Date	Julian Date	1 to 32767	1

User Selectable Snow Water Equivalent	150	49	Starting Hour	Minutes	0 to 1439	1, Note 22
User Selectable Snow Water Equivalent	150	50	Ending Date	Julian Date	1 to 32767	1
User Selectable Snow Water Equivalent	150	51	Ending Hour	Minutes	0 to 1439	1, Note 22
User Selectable Snow Water Equivalent	150	52	Azimuth of Max.	Degrees	0 to 359	1
User Selectable Snow Water Equivalent	150	53	Range to Max.	Nmi	0 to 124	1

VAD Wind Profile	48	47	Max Speed (Horiz)	Knots	0 to 350	1, Note 5
VAD Wind Profile	48	48	Direct of Max Speed	Degree	0 to 359	1, Note 1 & 5
VAD Wind Profile	48	49	Alt of Max Speed	Feet/10	00.00 to 70.00	.01, Note 5
Velocity Az. Display	84	47	Wind Speed (Horiz)	Knots	0 to 350	1, Note 5
Velocity Az. Display	84	48	Wind Direct(Horiz)	Degree	0 to 359	1, Note 1 & 5
Velocity Az. Display	84	30	Wind Alt (Horiz)	1000 Feet	0 to 70	1
Velocity Az. Display	84	49	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1 & 5
Velocity Az. Display	84	50	Slant Range	Nmi	0.0 to 124.0	.1, Note 1 & 5
Velocity Az. Display	84	51	RMS Error	Knots	0 to 29	1, Note 5
Vertically Integ. Liq	57	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note 1
Vertically Integ. Liq	57	47	Max VIL	Kg/Sq. meter	0 to 200	1
Differential Reflectivity	158,159	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Differential Reflectivity	158,159	47	Minimum Differential Reflectivity	dB	-7.9 to +7.9	.1
Differential Reflectivity	158,159	48	Maximum Differential Reflectivity	dB	-7.9 to +7.9	.1
Differential Reflectivity	159	51	Compression method	N/A	0 or 1	N/A, Note 23
Differential Reflectivity	159	52	Size of uncompressed product (MSW)	Bytes	120 to 434406	1 byte

Differential Reflectivity	159	53	Size of uncompressed product (LSW)	Bytes		1 byte
Correlation Coefficient	160,161	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Correlation Coefficient	160,161	47	Minimum Correlation Coefficient	N/A	0.2 to 1.05	.00333
Correlation Coefficient	160,161	48	Maximum Correlation Coefficient	N/A	0.2 to 1.05	.00333
Correlation Coefficient	161	51	Compression Method	N/A	0 or 1	N/A, Note 23
Correlation Coefficient	161	52	Size of uncompressed product (LSW)	Bytes	120 to 500000	1 byte
Correlation Coefficient	161	53	Size of uncompressed product (LSW)	Bytes		1 byte
Specific Differential Phase	162,163	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Specific Differential Phase	162,163	47	Minimum Specific Differential Phase	Deg/km	-2.05 to +10.00	.05
Specific Differential Phase	162,163	48	Maximum Specific Differential Phase	Deg/km	-2.05 to +10.00	.05
Specific Differential Phase	163	51	Compression Method	N/A	0 or 1	N/A, Note 23
Specific Differential Phase	163	52	Size of uncompressed product (MSW)	Bytes	120 to 500000	1 byte
Specific Differential Phase	163	53	Size of uncompressed product (LSW)	Bytes		1 byte
Hydrometeor Classification	164,165	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Hydrometeor Classification	164	47	Mode Filter Size	N/A	1 to 15	1
Hydrometer Classification	165	51	Compression Method	N/A	0 or 1	N/A, Note 23
Hydrometeor Classification	165	52	Size of uncompressed product (MSW)	Bytes	120 to 500000	1 byte
Hydrometeor Classification	165	53	Size of uncompressed product (LSW)	Bytes		1 byte
Melting Layer	166	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Melting Layer	166	47	Minimum Melting Layer Height	kft	1 to 70	1
Melting Layer	166	48	Maximum Melting Layer Height	kft	1 to 70	1
One Hour Accum	169	30	Null Product Flag	N/A	0 to 5	1, Note 9, Note 19
One Hour Accum	169	47	Max Accum	Inches	0.0 to 100.0	.1, Note 1
One Hour Accum	169	48	Ending Date of Accumulation	Julian Date	1 to 32767	1
One Hour Accum	169	49	Ending Time of Accumulation	Minutes	0 to 1439	1

One Hour Accum	169	50	Mean-field Bias	N/A	0.01 to 99.99	.01, Note 1, Note 18
One Hour Accum	169	51	Sample Size (Effective No. Gage/Radar Pairs)	N/A	0.00 to 9999.99	.01, Note 1, Note 18
One Hour Accum	169	54	Product Version Number	N/A	1 to 32767	1
Digital Accum Array	170	30	Null Product Flag	N/A	0 to 5	1, Note 9, Note 19
Digital Accum Array	170	47	Max Accum	Inches	0.0 to 100.0	.1, Note 1
Digital Accum Array	170	48	Ending Date of Accumulation	Julian Date	1 to 32767	1
Digital Accum Array	170	49	Ending Time of Accumulation	Minutes	0 to 1439	1
Digital Accum Array	170	50	Mean-field Bias	N/A	0.01 to 99.99	.01, Note 1, Note 18
Digital Accum Array	170	51	Compression Method	N/A	0 or 1	N/A, Note 23
Digital Accum Array	170	52	Size of uncompressed product (MSW)	Bytes	284 to 335096	1 byte
Digital Accum Array	170	53	Size of uncompressed product (LSW)	Bytes		1 byte
Storm Total Accum	171	27	Start Date of Accumulation	Julian Date	1 to 32767	1
Storm Total Accum	171	28	Start Time of Accumulation	Minutes	0 to 1439	1
Storm Total Accum	171	30	Null Product Flag	N/A	0 to 5	1, Note 9, Note 19
Storm Total Accum	171	47	Max Accum	Inches	0.0 to 100.0	.1, Note 1
Storm Total Accum	171	48	Ending Date of Accumulation	Julian Date	1 to 32767	1
Storm Total Accum	171	49	Ending Time of Accumulation	Minutes	0 to 1439	1
Storm Total Accum	171	50	Mean-field Bias	N/A	0.01 to 99.99	.01, Note 1, Note 18
Storm Total Accum	171	51	Sample Size (Effective No. Gage/Radar Pairs)	N/A	0.00 to 9999.99	.01, Note 1, Note 18
Digital Storm Total Accum	172	27	Start Date of Accumulation	Julian Date	1 to 32767	1
Digital Storm Total Accum	172	28	Start Time of Accumulation	Minutes	0 to 1439	1
Digital Storm Total Accum	172	30	Null Product Flag	N/A	0 to 5	1, Note 9, Note 19
Digital Storm Total Accum	172	47	Max Accum	Inches	0 to 100.00	.1 , Note 24
Digital Storm Total Accum	172	48	Ending Date of Accumulation	Julian Date	1 to 32767	1

Digital Storm Total Accum	172	49	Ending Time of Accumulation	Minutes	0 to 1439	1
Digital Storm Total Accum	172	50	Mean-field Bias	N/A	0.0 to 99.99	.01, Note 1, Note 18
Digital Storm Total Accum	172	51	Compression Method	N/A	0 or 1	N/A, Note 23
Digital Storm Total Accum	172	52	Size of uncompressed product (MSW)	Bytes	916 to 355096	1 byte
Digital Storm Total Accum	172	53	Size of uncompressed product (LSW)	Bytes		1 byte
Digital User Selectable Accum	173	27	End Time	Minutes	0 to 1439	1
Digital User Selectable Accum	173	28	Time Span Minutes	Minutes	15 to 1440	1
Digital User Selectable Accum	173	30	Missing Period Flag (high byte) & Null Product Flag (low byte)	N/A	0 or 1 in the high byte; 0, 2 or 3 in the low byte	1, Note 19, Note 21
Digital User Selectable Accum	173	47	Max Accum	Inches	0.0 to 327.6	.1, Note 1
Digital User Selectable Accum	173	48	End Date	Julian Date	1 to 32767	1
Digital User Selectable Accum	173	49	Start Time	Minutes	0 to 1440	1
Digital User Selectable Accum	173	50	Mean-field Bias	N/A	0.01 to 99.99	.01, Note 1, Note 18
Digital User Selectable Accum	173	51	Compression Method	N/A	0 or 1	N/A, Note 23
Digital User Selectable Accum	173	52	Size of uncompressed product (MSW)	Bytes	296 to 335096	1 byte
Digital User Selectable Accum	173	53	Size of uncompressed product (LSW)	Bytes		1 byte
Digital One-Hour Difference	174	47	Max Accum Difference	Inches	-100.0 to 100.0	.1, Note 1
Digital One-Hour Difference	174	48	Ending Date of Accumulation	Julian Date	1 to 32767	1
Digital One-Hour Difference	174	49	Ending Time of Accumulation	Minutes	0 to 1439	1
Digital One-Hour Difference	174	50	Min Accum Difference	Inches	-100.0 to 100.0	.1, Note 1
Digital One-Hour Difference	174	51	Compression Method	N/A	0 or 1	N/A, Note 23
Digital One-Hour Difference	174	52	Size of uncompressed product (MSW)	Bytes	2836 to 335096	1 byte
Digital One_hour Difference	174	53	Size of uncompressed product (LSW)	Byte		1 byte
Digital Storm Total Difference	175	27	Start Date of Accumulation	Julian Date	1 to 32767	1
Digital Storm Total Difference	175	28	Start Time of Accumulation	Minutes	0 to 1439	1

Digital Storm Total Difference	175	30	Null Product Flag	N/A	0 to 5	1, Note 9, Note 19
Digital Storm Total Difference	175	47	Max Accum Difference	Inches	-100.0 to 100.0	.1, Note 1
Digital Storm Total Difference	175	48	Ending Date of Accumulation	Julian date	1 to 32767	1
Digital Storm Total Difference	175	49	Ending Time of Accumulation	Minutes	0 to 1439	1
Digital Storm Total Difference	175	50	Min Accum Difference	Inches	-100.0 to 100.0	.1, Note 1
Digital Storm Total Difference	175	51	Compression Method	N/A	0 or 1	N/A, Note 23
Digital Storm Total Difference	175	52	Size of uncompressed product (MSW)	Bytes	2836 to 335096	1 byte
Digital Storm Total Difference	175	53	Size of uncompressed product (LSW)	Bytes		1 byte
Digital Instantaneous Precipitation Rate	176	27	Hybrid Rate Scan Date	Julian date	1 to 32767	1
Digital Instantaneous Precipitation Rate	176	28	Hybrid Rate Scan Time	Minutes	0 to 1439	1
Digital Instantaneous Precipitation Rate	176	30	Precipitation Detected Flag (high byte) & Gage Bias to be Applied Flag (low byte)	N/A	0 or 1	N/A, Note 18
Digital Instantaneous Precipitation Rate	176	47	Maximum Instantaneous Precipitation Rate	in/hr	0 to 65535	1, Note 1, Note 20
Digital Instantaneous Precipitation Rate	176	48	Hybrid Rate Percent Bins Filled	Percent	0.01 - 100.00	.01%, Note 1
Digital Instantaneous Precipitation Rate	176	49	Highest Elev. Used	Degrees	0.5 - 19.5	0.1°, Note 1
Digital Instantaneous Precipitation Rate	176	50	Mean-field Bias	N/A	0.01 to 99.99	.01, Note 1, Note 18
Digital Instantaneous Precipitation Rate	176	51	Compression Method	N/A	0 or 1	N/A, Note 23
Digital Instantaneous Precipitation Rate	176	52	Size of uncompressed product (MSW)	Bytes	1627 to 662496	1 byte
Digital Instantaneous Precipitation Rate	176	53	Size of uncompressed product (LSW)	Bytes		1 byte

Hybrid Hydrometeor Classification	177	47	Mode Filter Size	N/A	1 to 15	1
Hybrid Hydrometeor Classification	177	48	Hybrid Rate Percent Bins Filled	Percent	0.01 - 100.00	.01%, Note 1
Hybrid Hydrometeor Classification	177	49	Highest Elev. Used	Degrees	0.5 - 19.5	0.1°, Note 1
Hybrid Hydrometeor Classification	177	51	Compression Method	N/A	0 or 1	N/A, Note 23
Hybrid Hydrometeor Classification	177	52	Size of uncompressed product (MSW)	Bytes	120 to 500000	1 byte
Hybrid Hydrometeor Classification	177	53	Size of uncompressed product (LSW)	Bytes		1 byte

Note 1. Scaled Integer, precision column defines scaling.
Note 2. Real*4 represents one fullword (32 bits) of real data, where the values are in IEEE-754-1985 floating point representation.
Note 3. Corresponds to MSB of bit map as defined in Table II- A.
Note 4. Corresponds to LSB of bit map as defined in Table II- A.

Note 5.	Msg Code	Halfword	Description
Echo Tops Product	41	47	Value of zero altitude indicates "No Echos Detected
Layer Products	63-67, 89-90	48	Value of zero layer bottom indicates "Surface"
VAD Wind Profile	48	49	Altitude value of -9999 indicates ("Wind Barbs") non-valid altitude, speed and direction which are displayed as blanks
Velocity Azimuth	84	47	Wind speed value of -9999 Display indicates non-valid speed and direction. Speed and direction are displayed as blanks
		50	Slant range value of -9999 indicates non-valid slant range and elevation angle. Values of slant range and elevation angle are displayed as blanks
		51	RMS value of -9999 indicates non-valid RMS. Value of RMS is displayed as blanks.
TVS	61	47	A negative value indicates that the Total Number of TVSs identified by the algorithm exceeded the Maximum number of TVSs in adaptation data. Those with the higher Low-level Delta Velocity were retained.
TVS	61	48	A negative value indicates that the Total Number of ETVSs identified by the algorithm exceeded the Maximum number of ETVSs in adaptation data. Those with the higher Low-level Delta Velocity were retained.
Storm Mean Radial Velocity	55-56	47	A maximum negative velocity of -999 indicates a non-valid maximum negative velocity. Values are displayed as asterisks.
		48	A maximum positive velocity of -777 indicates a non-valid maximum positive velocity. Values are displayed as asterisks.

Note 6. Value enclosed in parentheses of range column is a code to indicate data is unavailable.
Note 7. Applicable only to products generated as a result of an Alert.
Note 8. This halfword defines the clutter map channel type (Version 0 only) and segment number (Version 0 and Version 1). For Version 0, bit 15 (LSB) defines the channel type. If bit 15 is 0, then it is a clutter filter control product for the surveillance channel. If bit 15 is 1, then it is the Doppler channel clutter filter control product. For both Version 0 and Version 1, bits 14 through 10 specify elevation segment numbers 1 through 5, respectively. Segment 1 is the lowest elevation clutter filter map, segment 5 is the upper elevation clutter filter map.
Note 9. If flag is set, the product is null i.e., rainfall data to build product was unavailable.
Note 11. Velocity Precision Code indicates the quantization of the base velocity data used to create this product. A value of 1 denotes 0.5 m/s and 2 denotes 1.0 m/s. Regardless of the value of this code, product 93 is formatted as if the precision is always 0.5 m/s.
Note 12. The value entered for the upper limit of the Digital Storm Total (DSP) Max Rainfall value is a theoretical limit; the actual upper limit has no bound, as the DSP data values are adjusted (scaled) to fit within the range (0 - 255), based upon the Max Rainfall value. The Accuracy/Precision increases according to the scaling (i.e., .01, .02, etc.) and also has no, actual upper limit.
Note 13: The Legacy RDA system created the "Notchwidth Map". The Open RDA system uses a different clutter filtering scheme that makes the "Notchwidth" terminology obsolete. The Open RDA system calls this map the "Clutter Filter Map".

Note 14. Applies to Legacy RDA systems only.
Note 15. Applies to Open RDA systems only.
Note 16. Two flags are stored in this halfword. The high byte contains the High Scale Flag; the low byte contains the Use RCA flag. Counting bit 0 as the most significant bit, the High Scale Flag is in bit 7 and the Use RCA flag is in bit 15. If the High Scale Flag is set, the maximum value in halfword 47 for the User Selectable Snow Water Equivalent (msg code 150) must be divided by 100 and User Selectable Snow Depth (msg code 151) must be divided by 10. If the High Scale Flag is not set, the maximum value in halfword 47 is divided by 1000 and 100 for the User Selectable Water Equivalent and the User Selectable Snow Depth, respectively.
Note 17. A value of 0 indicates the Clutter Bypass Map used for the product was generated by the Radar System Test off-line software. A value of 1 indicates the Clutter Bypass Map used for the product was generated by the Clutter Mitigation Decision (CMD) algorithm.
Note 18. Gage bias is not being implemented for dual-polarization QPE products at this time. However, gage bias and its associated adaptable parameters will be implemented in the future. These parameters are used as placeholders.
Note 19. If the null product flag is zero (FALSE), this means there is accumulation present in the product. If the null product flag is non-zero, this means there are no accumulations present in the product for the reasons given below. This will also be indicated textually in the Product Symbology Block.

1: "No accumulation available. Threshold: 'Elapsed Time to Restart' [TIMRS] xx minutes exceeded."

2: "No precipitation detected during the specified time span."

3: "No accumulation data available for the specified time span."

4: "No precipitation detected since hh:mmZ. Threshold: 'Time Without Precipitation for Resetting Storm Totals' [RAINT] is xx minutes" or "No precipitation detected since RPG startup."

5: "No precipitation detected since hh:mmZ" or "No precipitation detected since RPG startup."

Note 20. Halfword 47 of Digital Instantaneous Precipitation Rate contains the Maximum Rainfall Rate in thousandths of an inch, with values ranging from 0 to 65535, and should be treated like an **unsigned** short integer data type.
Note 21. In the Digital User Selectable Accum product only, the Null Product Flag is stored in the least significant byte of the halfword. The Missing Period Flag will be stored in the most significant byte of the halfword.
Note 22. Until enough hours have elapsed to generate the User Selectable Snow Water Equivalent and Snow Depth products, the minutes will be rounded to the nearest starting and ending hours requested by the user. After the products can be generated, the starting and ending hours will reflect the actual times used to generate the products. These times may deviate from the whole hour by as much as half the volume scan interval.
Note 24. The maximum value inside the DSA product will not necessarily be the maximum encoded value. The maximum encoded value is selected by the user from the HCI (i.e. two times the 16th data level for the STP, STA). A value of two times the STA 16th data level is intended to allow the display of all realistic accumulations and prevent unrealistic accumulations from being displayed. However, one might not see the maximum value within a given DSA product.
Note 24. The maximum value inside the DSA product will not necessarily be the maximum encoded value. The maximum encoded value is selected by the user from the HCI. This implies that one might not see the maximum value within a given DSA product.
Note 23. For products which are compressed, halfword 51 (P8) denotes the compression method:

- halfword 51 contains 0 if no compression is applied
- halfword 51 contains 1 if the data are compressed using bzip2

Table VI. Product Dependent Definition for Product Symbology Block

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY / PRECISION	REMARKS
VAD WIND PROFILE	Altitude	Kft	1 to 70	1	
	Volume Scan Start Time	N/A	Hours: 00 to 23 Minutes: 00 to 59	1	
VELOCITY AZIMUTH DISPLAY	Velocity	Kts	+/-200, +/-100, +/-80, +/-60, +/-40	1	
	Azimuth	Degrees	1 to 360	1	
	Best Fit Function in the form A_1+ VSIN(AZ + δ) Where: A = Harmonic Coefficient (Fourier #1) V = SQRT[CF2²+CF3²} with CF2 and CF3 corresponding to Harmonic Coefficient (Fourier #2 & #3) & = - Horizontal Wind Direction - 90°	Kts Kts Degrees	-39 to 39 0 to +247 0 to 359	1 1 1	
REFLECTIVITY CROSS SECTION	Azimuth	Degrees	0 to 359	1	
	Range	nmi	0 to 124	1	
	Max Reflectivity	dBZ	-32 to 95(-999)*	1	() *Value Indicates Data Not Available
	Height of Max Reflectivity	Kft	0 to 70 (71)*	1	() *Value Indicates Data Not Available
	Max Reflectivity Position: · Azimuth · Range	• Degrees • nmi	• 0 to 359 • 0 to 124	• 1 • 1	

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY / PRECISION	REMARKS
VELOCITY CROSS SECTION	Azimuth	Degrees	0 to 359	1	
	Range	nmi	0 to 124	1	
	Max Velocity	Kts	0 to 245	1	
	Height of Max Velocity	Kft	0 to 70 (71)*	1	( ) * Value Indicates data not available
	Max Velocity Position: · Azimuth · Range	 • Degrees • nmi	 • 0 to 359 • 0 to 124	 • 1 • 1	
	Min Velocity	Kts	-247 to 0	1	
	Height of Min Velocity	Kft	0 to 70 (71)*		() *Value Indicates Data Not Available
	Min Velocity Position: • Azimuth • Range	 • Degrees • nmi	 • 0 to 359 • 0 to 124	 • 1 • 1	
USER SELECTABLE PRECIPITATION	Status	Alphanumeric	- Product Not Generated: Unable To Read Data from Database - Product Not Generated: Illegal Times in Product Request - Product Not Generated: Insufficient Accumulation Date In Hourly Database - Hours Available for Request	N/A	Status messages will be sent only if error conditions occur

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY / PRECISION	REMARKS
ONE-HOUR SNOW WATER EQUIVALENT AND ONE-HOUR SNOW DEPTH	Status	Alphanumeric	- Data not available because: No buffer space for product - Data not available because: Product too big for existing buffer - Data not available because: Insufficient data for hourly accumulations	N/A	Status messages will be sent only if error conditions occur
STORM TOTAL SNOW WATER EQUIVALENT AND STORM TOTAL SNOW DEPTH	Status	Alphanumeric	- Data not available because: First volume of accumulations - Data not available because: No buffer space for product - Data not available because: Product too big for existing buffer - Data not available because: First volume scan of accumulations	N/A	Status messages will be sent only if error conditions occur
USER SELECTABLE SNOW WATER EQUIVALENT AND USER SELECTABLE SNOW DEPTH	Status	Alphanumeric	- Data not available because: No buffer space for product - Data not available because: Product too big for existing buffer - Data not available because: Insufficient number of hourly accumulations - Data not available because: Current hour is not the requested end hour	N/A	Status messages will be sent only if error conditions occur

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY / PRECISION	REMARKS
Digital User - Selectable Accumulation	Status	Alphanumeric	- No precipitation detected during the specified time span - No accumulation data available for the specified time span	N/A	Status messages will be sent only if error conditions occur
Storm-Total Accumulation	Status	Alphanumeric	- No precipitation detected since dd/mm/yy hh:mm Z. Threshold: 'Time Without Precipitation for Resetting Storm Totals'" [RAINT] is mm minutes - No precipitation detected since RPG startup. Threshold: 'Time Without Precipitation for Resetting Storm Totals'" [RAINT] is mm minutes	N/A	Status messages will be sent only if error conditions occur

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY / PRECISION	REMARKS
Digital Storm-Total Accumulation	Status	Alphanumeric	- No precipitation detected since dd/mm/yy hh:mm Z. Threshold: 'Time Without Precipitation for Resetting Storm Totals'" [RAINT] is mm minutes - No precipitation detected since RPG startup. Threshold: 'Time Without Precipitation for Resetting Storm Totals'" [RAINT] is mm minutes	N/A	Status messages will be sent only if error conditions occur
Digital Storm-Total Difference	Status	Alphanumeric	- No precipitation detected since dd/mm/yy hh:mm Z. Threshold: 'Time Without Precipitation for Resetting Storm Totals'" [RAINT] is mm minutes - No precipitation detected since RPG startup. Threshold: 'Time Without Precipitation for Resetting Storm Totals'" [RAINT] is mm minutes	N/A	Status messages will be sent only if error conditions occur
One-Hour Accumulation	Status	Alphanumeric	- No precipitation detected since dd/mm/yy hh:mm Z. - No precipitation detected since RPG startup.	N/A	Status messages will be sent only if error conditions occur

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY / PRECISION	REMARKS
Digital Accumulation Array	Status	Alphanumeric	- No precipitation detected since dd/mm/yy hh:mm Z. - No precipitation detected since RPG startup.	N/A	Status messages will be sent only if error conditions occur
All Dual-Polarization Accumulation Products	Status	Alphanumeric	- No accumulation available. Threshold: 'Elapsed Time to Restart' [TIMRS] (mm minutes) exceeded	N/A	Status messages will be sent only if error conditions occur
All Dual-Polarization Accumulation Products	Status	Alphanumeric	- Product unavailable - unknown reason nn	N/A	"Default" status messages will be sent only if error conditions occur and if error condition is unknown

Table VII. Product Dependent Definition for Graphic Alphanumeric Block

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
COMPOSITE REFLECTIVITY OR COMPOSITE REFLECTIVITY EDITED FOR AP	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2...Z9.	N/A	The sequence is recycled following Note 1
	Storm Position: · Azimuth · Range	 • Degrees • nmi	 • 0 to 360 • 0 to 248	 • 1 • 1	Note 1
	Maximum Reflectivity	dBZ	0 to 95	1	Note 1
	Height of Maximum Reflectivity	Kft	0.0 to 70.0	0.1	Note 1
	Cell-Based VIL	kg/m^2	0 to 120	1	Note 1
	Storm Top	Kft	0.00 to 70.00	0.1	If the storm top was identified at the highest elevation, the value is qualified with ">", Note 1
	Forecast Movement · Storm Direction · Storm Speed	Alphanumeric or • Degrees • Kts	New or • 0 to 360 • 0 to 999	 • 1 • 1	Newly identified storm cells are labeled "NEW". Note 1
	MDA Strength Rank	Alphanumeric	NONE, 1 to 25	1	
	TVS Feature Type	Alphanumeric	NONE, TVS or ETVS	N/A	If both a TVS and ETVS are associated with the same storm cell, then "TVS" will be displayed. Note 1

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Hail Characteristics · Probability of Hail (POH) · Probability of Severe Hail (POSH) · Maximum Expected Hail Size	Alphanumeric or • Percent • Percent • Inches	UNKNOWN or • 0 to 100 • 0 to 100 • 0.00 and 0.50 to 4.00	• 10 • 10 • 0.25	If the maximum expected hail size exceeds 4.0 inches, the hail size is labeled ">4.00". If the Probability of Hail and the Probability of Severe Hail are greater the 0% and the maximum expected hail size is less than 0.50 inches, the hail size is labeled "<0.50". If the Hail Characteristics cannot be determined, the Hail Characteristics are labeled "UNKNOWN". Note 1
ECHO TOPS	Status	Alphanumeric	No Echoes Detected	N/A	This status message will be sent only if the Echo Tops Grid is all zeroes.
HAIL INDEX	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2...Z9	N/A	The sequence is recycled following Z9, (See Note 1)
	Storm Position • Azimuth • Range	• Degrees • Nmi	• 0 to 360 • 0 to 248	• 1 • 1	Note 1

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Hail Characteristics: -Probability of Hail (POH)	Alphanumeric or Percent	UNKNOWN or 0 to 100	10	If maximum expected hail size exceeds 4.0 inches, the hail size is labeled ">4.00".
	-Probability of Severe Hail (POSH)	Percent	0 to 100	10	If the Probability of Severe hail is greater than 0% and the maximum expected hail size is less than 0.50 inches, the hail size is labeled "<0.50".
	-Maximum Expected Hail Size	Inches	0.00 and 0.50 to 4.00	0.25	If the Hail Characteristics cannot be determined, the Hail Characteristics are labeled "UNKNOWN" Note 1
	Hail Temperature Altitudes (MSL) • 0 Degree Celsius	Kft	0.0 to 70.0	.1	Note 1
	• -20 Degree Celsius	Kft	0.0 to 70.0	.1	
	Time of last change to Hail Temperature Altitude	N/A	Hours: 00 to 23 Minutes: 00 to 59	N/A	Note 1
	Date of last change to Hail Temperature Altitudes	N/A	Months: 01 to 12 Days: 01 to 31 Years: 00 to 99	N/A	Note 1

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
STORM TRACKING INFORMATION	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2....Z9	N/A	The sequence is recycled following Z9. Note 1
	Storm Position · Azimuth · Range	 Degrees nmi	 0 to 360 0 to 248	 1 1	Note 1
	Forecast Movement · Direction · Speed	Alphanumeric or Degrees Kts	NEW or 0 to 360 0.0 to 999	 1 0.1	Newly identified storm cells are labeled "NEW" Note 1
	Forecast Error · Error · Mean	 nmi nmi	 0.0 to 99.9 0.0 to 99.9	 0.1 0.1	Note 1
	Maximum Reflectivity	dBZ	0 to 95	1	Note 1
	Height of Maximum Reflectivity	Kft	0.0 to 70.0	0.1	Note 1
MESOCYCLONE DETECTION	Circulation ID	N/A	0 through 999	N/A	The sequence is recycled following 999. Note 2
	Associated SCIT Storm ID	N/A	A0 through Z0, then A1 through Z1, then A2...Z9	N/A	Closest SCIT identified storm cell ID.
	Strength Rank	N/A	1 to 25	1	If the strength rank was computed by the Low-Top or Shallow method, an L or S will also be displayed.
	Low Level (base) Rotational Velocity	Kts	0 to 129	1	
	Position: • Azimuth • Range	 • Degrees • nmi	 • 0 to 360 • 0 to 124	1	Base 2D feature component

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Height of Maximum Rotational Velocity (ARL)	Kft	0 to 33	1	
	Maximum Rotational Velocity	Kts	0 to 129	1	
	Base Height (ARL)	Kft	0 to 33	1	If the Base is on the lowest elevation scan or below 1km, then the height is preceded by a "<" in the display.
	Depth	Kft	0 to 33	1	If the Base is on the lowest elevation scan or below 1km, then the Depth is preceded by a ">" in the display.
TORNADO VORTEX SIGNATURE (TVS)	Feature Type	Alphanumeric	TVS or ETVS	N/A	
	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1. then A2...Z9. "??" is displayed if the TVS feature is not associated with a storm cell.	N/A	The sequence is recycled following Z9
	TVS Feature Position: · Azimuth · Range	• Degrees • nmi	• 0 to 359 • 0 to 124	• 1 • 1	
	Average Delta Velocity	kts	0 to 494	1	

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Low-level Delta Velocity	kts	0 to 494	1	
	Maximum Delta Velocity	kts	0 to 494	1	
	Base	kft	0.0 to 70.0	0.01	If the Base is on the lowest elevation scan, then it is preceded by a "<" in the display.
	Depth	kft	0 to 70	1	If the base or top is on the lowest or highest elevation scan, then the Depth is preceded by a "<" or ">" in the display, respectively
TORNADO VORTEX SIGNATURE RAPID UPDATE	Feature Type	Alphanumeric	TVS or ETVS	N/A	See Note 1
	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2,…, Z9, or ?? is displayed if the TVS feature is not associated with a storm cell.	N/A	The sequence is recycled following Z9 Note 1

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Feature Status	Alphanumeric	New (NEW), Extrapolated (EXT), Persistent (PER), Increasing (INC)	N/A	NEW: Feature is new in this volume scan; EXT: Feature from previous volume scan with extrapolated position; PER: Feature found in both previous and current volume scan; INC: Like PER but with increasing in either LLDV, feature type, or depth.
	Feature Position: • Azimuth • Range	• Degree • nmi	• 0 to 360 • 0 to 124	• 1 • 1	See Note 1
	Average Delta Velocity	kts	0 to 494	1	See Note 1
	Low Level (base) Delta Velocity	kts	0 to 494	1	See Note 1
	Maximum Delta Velocity	kts	0 to 494	1	See Note 1
	Base Height	kft	0.0 to 70.0	0.01	If the Base is on the lowest elevation scan, then it is preceded by a "<" in the display. See Note 1

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Depth	kft	0 to 70	1	If the base or top is on the lowest or highest elevation scan, then the Depth is preceded by a "<" or ">" in the display, respectively. See Note 1

USER SELECTABLE PRECIPITATION	Gage Bias Flag	N/A	Applied/Not Applied	N/A	
	Number of Hours in Product	N/A	1 to 24	0/1	
	End Times	Hours	00 to 23	0/1	
	Bias Estimate	N/A	0.00 to 99.99	0.01	
	Hour Included Flag	N/A	Yes or No	N/A	

Note 1: "^" displayed when the attribute(s) is (are) updated to the current detection
Note 2: When no mesocyclones are detected this negative condition will be indicated by the absence of this data block from the product.

Table VIII. Product Dependent Definition for Tabular Alphanumeric Block

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
VAD WIND PROFILE	Site Adaptable Parameters	See Remarks	See Remarks	See Remarks	2820003 Pt1, Table A-16 VAD
	ALT	100ft	0 to 700	1	
	U	m/s	-127.0 to 126.0	0.1	
	V	m/s	-127.0 to 126.0	0.1	
	W	cm/s	-999.9 to 9999.9	0.1	
	DIR	degrees	0 to 360	1	
	SPD	knots	0 to 999	1	
	RMS	knots	0 to 30.0	0.1	
	DIV	10/s	-99.9999 to 999.9999	0.0001	
	SRNG	nm	0.0 to 124.00	0.01	
	ELEV	degrees	-1.0 to 45.0	0.1	
STORM TRACKING INFORMATION	Radar ID	N/A	0 to 999	1	
	Volume Scan Start Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Volume Scan Start Time	N/A	Hours: 0 to 23 Minutes: 0 to 59 Seconds: 0 to 59	N/A	
	Number of Storm Cells	N/A	0 to 100	1	
	Average Storm Cell Motion · Speed	kts	0 to 99	1	Only on first page of Alphanumeric Product
	• Direction	degrees	0 to 360	1	
	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2....Z9	N/A	The sequence is recycled following Z9 Note 1
	Current Position: · Azimuth	Degrees	0 to 360	1	Note 1
	· Range	nmi	0 to 24	1	
	Forecast Movement · Direction	Alphanumeric or Degrees	0 to 359	1	Note 1
	• Speed	Kts	0 to 999	1	
	Forecast Error	nmi	0.0 to 99.0	0.1	Note 1
	Mean Forecast Error	nmi	0.0 to 99.0	0.1	Note 1

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	The Azimuth and Range Position for each forecast interval up to four forecast intervals	Alphanumeric or Degree Nmi	NO DATA or 0 to 360 0 to 248	1	Note 1
	Site Store Cell Tracking/Forecast Position Adaptable Parameters	See Remarks	See Remarks	See Remarks	2820003, Pt1, Table A-6 Storm Cell Tracking
TORNADO VORTEX SIGNATURE (TVS)	Radar ID	N/A	0 to 999	1	
	Volume Scan Start Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Volume Scan Start Time	N/A	Hours: 0 to 23 Minutes: 0 to 59 Seconds: 0 to 59	N/A	
	Number of TVSs	N/A	0 to 25	1	If the TDA identified more than the (adaptable) maximum number of TVSs, then the number will be preceded by a ">"
	Number of ETVSs	N/A	0 to 25	1	If the TDA identified more than the (adaptable) maximum number of ETVSs, then the number will be preceded by a ">"
	Feature Type	Alphanumeric	TVS or ETVS	N/A	
	Feature ID	N/A	01 through 25	0/1	TVSs and ETVSs are numbered independently

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2....Z9, or ??	N/A	The sequence is recycled following Z9. "??" is displayed if the TVS or ETVS is not associated with a storm cell
	Position: -Azimuth	Degrees	0 to 359	1	
	-Range	Nmi	0 to 124	1	
	Average Delta Velocity	kts	0 to 494	1	
	Low-level Delta Velocity	kts	0 to 494	1	
	Maximum Delta Velocity	kts	0 to 494	1	
	Height of the Maximum Delta Velocity	kft	0.0 to 70.0	0.1	
	Depth	kft	0.0 to 70.0	0.1	If the base or top is on the lowest or highest elevation scan, respectively then the Depth is preceded by a ">" in the display
	Base	kft	0 to 70	1	If the base is on the lowest elevation scan, then it is preceded by a "<" in the display
	Top	kft	0.0 to 70.0	.1	
	Maximum Shear	m/s/km (or E-3/sec)	0 to 999	1	
	Height of the Maximum Shear	kft	0.0 to 70.0	0.1	
	Site Adaptable Parameters	See Remarks	See Remarks	See Remarks	2820003, Pt1, Table A-18 TDA
HAIL INDEX	Radar ID	N/A	0 to 999	1	
	Volume Scan Start Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Volume Scan Start Time	N/A	Hours: 0 to 23 Minutes: 0 to 59 Seconds: 0 to 59	N/A	

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Number of Storm Cells	N/A	0 to 100	1	
	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2...Z9	N/A	The sequence is recycled following Z9 Note 1
	Hail Characteristics · Probability of Hail (POH) · Probability of Severe Hail (POSH) · Maximum Expected Hail Size	Alphanumeric Percent Percent Inches	UNKNOWN or 0 to 100 0 to 100 0.00 and 0.50 to 4.00	N/A	If the maximum expected hail size exceeds 4.00 inches, the hail size is labeled ">4.00". If the Probability of Hail and the Probability of Severe Hail are greater than 0% and the maximum expected hail size is less than 0.50 inches, the hail is labeled "<50.0". If the Hail Characteristics cannot be determined, the Hail Characteristics are labeled "UNKNOWN". Note 1
	Site Adaptable Parameters	See Remarks	See Remarks	See Remarks	2820003, Pt1, Table A-8 Hail
SURFACE RAINFALL ACCUMULATION - ONE HOUR	Mean-field Bias Estimate	N/A	0.01 to 99.99	0.01	
	Effective No. G-R Pairs (Sample Size)	N/A	0.00 to 9999.99	0.01	
	Memory Span used in Bias Estimate	Hours	0.001 to 10**7	0.001	
	Most Recent Bias Source	N/A	N/A	N/A	AWIPS Site ID of location providing bias (WFO or RFC)

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Site Adaptable Parameters	See Remarks	See Remarks	See Remarks	TBD Information is only provided if the product is not labeled 'BAD SCAN'.
SURFACE RAINFALL ACCUMULATION - THREE HOUR	The following information is provided for up to three hourly intervals is:				
	Interval Ending Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Interval Ending Time	N/A	Hours: 0 to 23 Minutes: 0 to 59	N/A	
	Adjusted	N/A	Y/N	N/A	
	Mean-field Bias Estimates	N/A	0.01 to 99.99	0.01	Note 2
	Effective No. G-R Pairs (Sample Sizes)	N/A	0.00 to 9999.99	0.01	Note 2
	Memory Spans used in Bias Estimates	Hours	0.001 to 10**7	0.001	Note 2
	Most Recent Bias Source	N/A	N/A	N/A	AWIPS Site ID of location providing bias (WFO or RFC)
	Scan Type	N/A	1 = Ends at Clock Hour 2 = Ends at Gage Time 3 = Both	N/A	Note 2
STORM TOTAL RAINFALL ACCUMULATION	Mean of Bias Estimates Computed During Accumulation Period	N/A	0.01 to 99.99	0.01	
	Mean of G-R Pair Sample Sizes used in Bias Estimates During Accumulation Period	N/A	0.00 to 9999.99	0.01	

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Mean of Memory Spans used in Bias Estimates During Accumulation Period	Hours	0.001 to 10**7	0.001	
	Most Recent Bias Source	N/A	N/A	N/A	AWIPS Site ID of location providing bias (WFO or RFC)
	Site Adaptable Parameters	See Remarks	See Remarks	See Remarks	TBD Information is only provided if the product is not labeled 'BAD SCAN'.
CLUTTER LIKELIHOOD REFLECTIVITY	Site Adaptable Parameters	See Remarks	See Remarks	See Remarks	TBD
CLUTTER LIKELIHOOD DOPPLER	Site Adaptable Parameters	See Remarks	See Remarks	See Remarks	TBD
MESOCYCLONE DETECTION	Radar ID	N/A	0 to 999	1	Note 5.
	Volume Scan Start Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Volume Scan Start Time	N/A	Hours: 0 to 23 Minutes: 0 to 59 Seconds: 0 to 59	N/A	
	Average Motion: • Direction • Speed	 • Degrees • Kts	 • 0 to 360 • 0 to 129	 1 1	Average of all MDA detected circulations regardless of whether they meet minimum display thresholds.
	Circulation ID	N/A	0 through 999	N/A	The sequence is recycled following 999
	Position: • Azimuth • Range	 • Degrees • nmi	 • 0 to 360 • 0 to 124	 1 1	Base 2D feature component

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Strength Rank	N/A	1 to 25	1	If the strength rank was computed by the Low-Top or Shallow method, an L or S will also be displayed.
	Associated SCIT Storm ID	N/A	A0 through Z0, then A1 through Z1, then A2...Z9	N/A	Closest SCIT identified storm cell ID.
	Low Level (base) Rotational Velocity	Kts	0 to 129	1	
	Low Level (base) Gate-to-Gate Velocity Difference	Kts	0 to 129	1	
	Base Height (ARL)	Kft	0 to 33	1	If the Base is on the lowest elevation scan or below 1km, then the height is preceded by a "<" in the display.
	Depth	Kft	0 to 33	1	If the Base is on the lowest elevation scan or below 1km, then the Depth is preceded by a ">" in the display.
	Storm Relative Depth Percentage	Percent	0 to 100	1	Based on the average depth of the ten SCIT identified storm cells having the highest cell based VIL.
	Maximum Rotational Velocity	Kts	0 to 129	1	
	Height of Maximum Rotational Velocity (ARL)	Kft	0 to 33	1	
	TVS	N/A	Y or N	N/A	Y if a TVS is detected within 2 km of Position

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Motion	deg/kts	0 to 360 deg 0 to 99 kts	1 deg 1 kt	Motion of this MDA detection or blanks if detection not tracked.
	Mesocyclone Strength Index	N/A	0 to 99999	1	See MDA AEL.
TORNADO VORTEX SIGNATURE RAPID UPDATE (TRU)	Radar ID	N/A	0 to 999	1	
	Volume Scan Start Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Volume Scan Start Time	N/A	Hours: 0 to 23 Minutes: 0 to 59 Seconds: 0 to 59	N/A	
	Number of TVSs	N/A	0 to 25	1	If the TRU identifies more than the (adaptable) maximum number of TVSs, then the number will be preceded by a ">"
	Number of ETVSs	N/A	0 to 25	1	If the TRU identifies more than the (adaptable) maximum number of ETVSs, then the number will be preceded by a ">"
	Elevation	degree	-1.0 to 45.0	0.1	

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Feature Status	Alphanumeric	New (NEW), Extrapolated (EXT), Persistent (PER), Increasing (INC)	N/A	NEW: Feature is new in this volume scan; EXT: Feature from previous volume scan with extrapolated position; PER: Feature found in both previous and current volume scan; INC: Like PER but with increasing in either LLDV, feature type, or depth.
	Feature Type	Alphanumeric	TVS or ETVS	N/A	See Note 3
	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2....Z9, or ??	N/A	The sequence is recycled following Z9. "??" is displayed if the TVS or ETVS is not associated with a storm cell
	Position: • Azimuth • Range	 • Degrees • Nmi	 • 0 to 359 • 0 to 124	 • 1 • 1	See Note 3
	Average Delta Velocity	kts	0 to 494	1	See Note 3
	Low-level (base) Delta Velocity	kts	0 to 494	1	See Note 3
	Maximum Delta Velocity	kts	0 to 494	1	See Note 3
	Height of the Maximum Delta Velocity	kft	0.0 to 70.0	0.1	See Note 3
	Depth	kft	0.0 to 70.0	0.1	If the base or top is on the lowest or highest elevation scan, respectively then the Depth is preceded by a ">" in the display. See Note 3

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Base Height	kft	0 to 70	1	If the base is on the lowest elevation scan, then it is preceded by a "<" in the display. See Note 3
	Top Height	kft	0.0 to 70.0	.1	See Note 3
	Maximum Shear	m/s/km (or E-3/sec)	0 to 999	1	See Note 3
	Height of the Maximum Shear	kft	0.0 to 70.0	0.1	See Note 3
One-hour Snow Water Equivalent and One-hour Snow Depth	RPG Name	N/A	N/A	N/A	
	Date	Month/Day /Year	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Time	Hours and Minutes UTC	Hours: 0 to 23 Minutes 0 to 59	N/A	
	Starting Date	Month/Day /Year	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Starting Time	Hours and Minutes UTC	Hours: 0 to 23 Minutes 0 to 59	N/A	
	Ending Date	Month/Day /Year	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Ending Time	Hours and Minutes UTC	Hours: 0 to 23 Minutes 0 to 59	N/A	
	Maximum Snow Accumulation	Inches	0 to 10**7	0.001 for Snow Water Equivalent and 0.01 for Snow Depth	
	Azimuth of Maximum Value	Degrees	0 to 359	1	
	Range to Maximum Value	Nmi	0 to 124	1	
	Range/height Correction Applied	N/A	“Static” or “Used RCA”		
	Missing Time	Minutes	0 to 60	1	

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Site Adaptable Parameters and Configuration Parameters	N/A	N/A	N/A	Page 2
Storm Total Snow Water Equivalent and Storm Total Snow Depth	RPG Name	N/A	N/A	N/A	
	Date	Month/Day/ Year	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Time	Hours and Minutes UTC	Hours: 0 to 23 Minutes 0 to 59	N/A	
	Starting Date	Month/Day/ Year	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Starting Time	Hours and Minutes UTC	Hours: 0 to 23 Minutes 0 to 59	N/A	
	Ending Date	Month/Day/ Year	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Ending Time	Hours and Minutes UTC	Hours: 0 to 23 Minutes 0 to 59	N/A	
	Maximum Snow Accumulation	Inches	0 to 10**7	0.01 for Snow Water Equivalent and 0.1 for Snow Depth	
	Azimuth of Maximum Value	Degrees	0 to 359	1	
	Range to Maximum Value	Nmi	0 to 124	1	
	Range/height Correction Applied	N/A	“Static” or “Used RCA”		
	Missing Time	Minutes	0 to 32767	1	
	Site Adaptable Parameters and Configuration Parameters	N/A	N/A	N/A	Page 2
User Selectable Snow Water Equivalent and User Selectable Snow Depth	RPG Name	N/A	N/A	N/A	

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Date	Month/Day/ Year	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Time	Hours and Minutes UTC	Hours: 0 to 23 Minutes 0 to 59	N/A	
	Starting Date	Month/Day/ Year	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Starting Time	Hours and Minutes UTC	Hours: 0 to 23 Minutes 0 to 59	N/A	
	Ending Date	Month/Day/ Year	Months: 1 to 12 Days: 1 to 31 Years: 00 to 99	N/A	
	Ending Time	Hours and Minutes UTC	Hours: 0 to 23 Minutes 0 to 59	N/A	
	Maximum Snow Accumulation	Inches	0 to 10**7	0.01 for Snow Water Equivalent and 0.1 for Snow Depth	
	Azimuth of Maximum Value	Degrees	0 to 359	1	
	Range to Maximum Value	Nmi	0 to 124	1	
	Range/height Correction Applied	N/A	“Static” or “Used RCA”		
	Site Adaptable Parameters and Configuration Parameters	N/A	N/A	N/A	Page 2
STORM TOTAL ACCUMULATION	Radar ID	N/A	4-digit alpha	N/A	Radar ICAO
	Volume Scan Date	N/A	Months:1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Volume Scan Time	N/A	Hours: 0 to 23 Minutes: 0 to 59	N/A	
	Volume Coverage Pattern	N/A	1 to 1000	1	
	Operational (Weather) Mode	N/A	A, B, or M	N/A	
	Gage Bias Applied	N/A	Yes or No	N/A	Note 4

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Mean of Bias Estimates Computed During Accumulation Period	N/A	0.01 to 99.99	0.01	Note 4
	Mean of G-R Pair Sample Sizes used in Bias Estimates During Accumulation Period	N/A	0.00 to 9999.99	0.01	Note 4
	Mean of Memory Spans used in Bias Estimates During Accumulation Period	Hours	0.001 to 10**7	0.001	Note 4
	Date/Time Last Bias Update	N/A	Months:1 to 12 Days: 1 to 31 Years: 0 to 99 Hours: 0 to 23 Minutes: 0 to 59	N/A	Note 4
	Hybrid Rate Percent Bins Filled	Percentage	0.00 - 100.00	0.01	
	Highest Elev. Used	Degrees	0.5 - 19.5	0.1	
	Total Rain Area (Km**2)	km^2	0.0 - 169,190.0	0.1	
	Site Adaptable Parameters	See Remarks	See Remarks	See Remarks	Information is always provided.

Note 1: Tabular Alphanumeric Block will display an adaptable number of storm cells.
Note 2: This will be repeated each hour in the product.
Note 3: "^" displayed when the attribute(s) is (are) updated to the current detection.
Note 4. Gage bias is not being implemented for dual-polarization QPE products at this time. However, gage bias and its associated adaptable parameters will be implemented in the future. These parameters are used as placeholders.
Note 5: When no mesocyclones are detected this negative condition will be indicated by the absence of this data block from the product.

	MSB HALFWORD LSB No Value	
	PACKET CODE (=6)	
	LENGTH OF DATA BLOCK (BYTES)	
DATA BLOCK	I STARTING POINT	1/4 Km or Screen Coordinates
	J STARTING POINT	
	END I VECTOR NUMBER 1	
	END J VECTOR NUMBER 1	
	END I VECTOR NUMBER 2	
	END J VECTOR NUMBER 2	
	•	
	•	

Figure 3-7 Linked Vector Packet - Packet Code 6 (Sheet 1)

	MSB Uniform Value LSB	
	PACKET CODE (=9)	
	LENGTH OF DATA BLOCK (BYTES)	
	VALUE (LEVEL) OF VECTOR	
DATA BLOCK	I STARTING POINT	1/4 Km Screen Coordinates
	J STARTING POINT	
	END I VECTOR NUMBER 1	
	END J VECTOR NUMBER 1	
	END I VECTOR NUMBER 2	
	END J VECTOR NUMBER 2	
	•	
	•	

Figure 3-7 Linked Vector Packet - Packet Code 9 (Sheet 2)

No Value

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	6	N/A	Packet Type 6
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
I Starting Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector starting point
J Starting Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector starting point
End I Vector Number 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 1
End J Vector Number 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 1
End I Vector Number 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 2
End J Vector Number 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 2

Uniform Value

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	9	N/A	Packet Type 9
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
Value (Level) of Vector	INT*2	N/A	0 to 15	1	Color Level of Vector
I Starting Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector starting point
J Starting Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector starting point
End I Vector Number 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 1
End J Vector Number 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 1
End I Vector Number 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 2
End J Vector Number 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 2

Figure 3-7. Linked Vector Packet - Packet Code 9 (Sheet 3)

	MSB HALFWORD LSB No Value		
	PACKET CODE (=7)		
	LENGTH OF DATA BLOCK (BYTES)		
	BEGINNING I	VECTOR 1	1/4 KM
	BEGINNING J	VECTOR 1	OR
DATA	END I	VECTOR 1	SCREEN COORDINATES
BLOCK	END J	VECTOR 1	
	BEGINNING I	VECTOR 2	
	BEGINNING J	VECTOR 2	
	END I	VECTOR 2	
	END J	VECTOR 2	
	•	•	

Figure 3-8. Unlinked Vector Packet - Packet Code 7 (Sheet 1)

	MSB Uniform Value	LSB	
	PACKET CODE (=10)		
	LENGTH OF DATA BLOCK (BYTES)		
	VALUE (LEVEL) OF VECTORS		
	BEGINNING I	VECTOR 1	1/4 KM
	BEGINNING J	VECTOR 1	OR
DATA	END I	VECTOR 1	SCREEN COORDINATES
BLOCK	END J	VECTOR 1	
	BEGINNING I	VECTOR 2	
	BEGINNING J	VECTOR 2	
	END I	VECTOR 2	
	END J	VECTOR 2	
	•	•	

Figure 3-8. Unlinked Vector Packet - Packet Code 10 (Sheet 2)

No Value

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	7	N/A	Packet Type 7
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
Begin I Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector starting point 1
Begin J Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector starting point 1
End 1 Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 1
End J Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 1
Begin I Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector starting point 2
Begin J Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector starting point 2
End I Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 2
End J Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 2

Figure 3-8. Unlinked Vector Packet - Packet Code 7 (Sheet 3)

Uniform Value

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	10	N/A	Packet Type 10
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
Value (Level) of Vector	INT*2	N/A	0 to 15	1	Color Level of Vector
Begin I Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector starting point 1
Begin J Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector starting point 1
End 1 Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 1
End J Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 1
Begin I Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector starting point 2
Begin J Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector starting point 2
End I Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 2
End J Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 2

Figure 3-8. Unlinked Vector Packet - Packet Code 10 (Sheet 4)

MSB	HALFWORD Linked Vectors		LSB	
0	E	0	3	Packet Codes /OP Flags
8	0	0	0	Initial Point Indicator
I				
J				
LENGTH =# VECTORS x 4				
I1				
J1				
I2				
J2				

MSB	HALFWORD Set Color Levels		LSB	
0	8	0	2	Packet Codes
0	0	0	2	Color Value Indicator
VALUE (LEVEL) OF CONTOUR				

MSB	HALFWORD Linked Vectors		LSB	
3	5	0	1	Packet Codes /OP Flags
LENGTH =# VECTORS x 8				
I				
J				
I1				
J1				
I				
J				
I2				
J2				

Figure 3-8a Contour Vector Packet - Packet Codes 0E03, 0802 and 3501 (Sheet 1)

Set Color Levels:

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	0802 (Hex)	N/A	Packet Type X'0802'
Color Value Indicator	INT*2	N/A	0002 (Hex)	N/A	Indicates that color value is present in this packet
Value (Level) of Contour	INT*2	N/A	0 to 15	1	Color Level of Contour

Linked Contour Vectors:

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	0E03 (Hex)	N/A	Packet Type X'0E03'
Initial Point Indicator	INT*2	N/A	8000 (Hex)	N/A	Indicates that initial point is present in this packet
I Starting point	INT*2	Km/4	-2048 to +2047	1	I coordinate for vector starting point
J Starting Point	INT*2	Km/4	-2048 to +2047	1	J coordinate for vector starting point
Length of vectors	INT*2	Bytes	4 to 32764	Multiples of 4	Length to follow in bytes (where length = # of vectors X4)
End I Vector Number 1	INT*2	Km/4	-2048 to +2047	1	I coordinate for vector end point 1
End J Vector Number 1	INT*2	Km/4	-2048 to +2047	1	J coordinate for vector end point 1
End I Vector Number 2	INT*2	Km/4	-2048 to +2047	1	I coordinate for vector end point 2
End J Vector Number 2	INT*2	Km/4	-2048 to +2047	1	J coordinate for vector end point 2
. . .					
. . .					

Figure 3-8a Contour Vector Packet - Packet Codes 0802 and 0E03 (Sheet 2)

Unlinked Contour Vectors:

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	3501 (Hex)	N/A	Packet Type X'3501'
Length of Vectors	INT*2	Bytes	8 to 32760	Multiples of 8	Length to follow in bytes (where length = # of vectors X 8)
Begin I Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector starting point 1
Begin J Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector starting point 1
End 1 Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 1
End J Vector 1	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 1
Begin I Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector starting point 2
Begin J Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector starting point 2
End I Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for vector end point 2
End J Vector 2	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for vector end point 2

Figure 3-8a Contour Vector Packet - Packet Code 3501 (Sheet 3)

	MSB HALFWORD Write Text (No Value) LSB		
	PACKET CODE (=1)		
	LENGTH OF DATA BLOCK (BYTES)		
DATA BLOCK	I STARTING POINT		1/4 KM Screen Coordinates
	J STARTING POINT		
	CHARACTER 1	CHARACTER 2	
	CHARACTER 3	CHARACTER 4	
	•	•	
	•	•	
	CHARACTER N-1	CHARACTER N	

Figure 3-8b. Text and Special Symbol Packets - Packet Code 1 (Sheet 1)

	MSB HALFWORD Write Text (Uniform Value) LSB		
	PACKET CODE (=8)		
	LENGTH OF DATA BLOCK (BYTES)		
DATA BLOCK	VALUE OF TEXT STRING		1/4 KM Screen Coordinates
	I START		
	J START		
	CHARACTER 1	CHARACTER 2	
	CHARACTER 3	CHARACTER 4	
	•	•	
	•	•	
	CHARACTER N-1	CHARACTER N	

Figure 3-8b. Text and Special Symbol Packets - Packet Code 8 (Sheet 2)

	MSB HALFWORD Write Special Symbols (No Value)	LSB	
	PACKET CODE (=2)		
	LENGTH OF DATA BLOCK (BYTES)		
DATA BLOCK	I STARTING POINT		1/4 KM Screen Coordinates
	J STARTING POINT		
	CHARACTER 1	CHARACTER 2	
	CHARACTER 3	CHARACTER 4	
	•	•	
	•	•	
	CHARACTER N-1	CHARACTER N	

Figure 3-8b. Text and Special Symbol Packets - Packet Code 2 (Sheet 3)

Write Text (No Value)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	1	N/A	Packet Type 1
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
I Starting Point	INT*2	Km/4 or Pixels	-2408 to +2047	1	I coordinate for text starting point
J Starting Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for text starting point
Character 1 to N	Char	8 bit ASCII	ASCII Character Set	N/A	Characters are ASCII

Write Text (Uniform Value)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	8	N/A	Packet Type 8
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
Value (Level) of Text	INT*2	N/A	0 to 15	1	Color Level of text
I Starting Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for text starting point
J Starting Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for text starting point
Character 1 to N	Char	8 bit ASCII	ASCII Character Set	N/A	Characters are ASCII

Figure 3-8b. Text and Special Symbol Packets - Packet Code 1 (Sheet 4)

Write Special Symbols (No Value)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	2	N/A	Packet Type 2
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
I Starting Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	I coordinate for special symbol starting point (Note 1)
J Starting Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	J coordinate for special symbol starting point (Note 1)
Character 1 to N	Char	8 bit ASCII	ASCII Character Set	N/A	Characters are ASCII

Note 1: I, J for special symbols are at the center of the symbol and at the upper left corner of the symbol for text.

Note 2: The special symbol characters in use are: !(21), “(22), #(23), $(24), %(25) to report past storm cell position, current storm cell position, forecast storm cell position, past MDA position, and forecast MDA position, respectively. Where, the number in parenthesis is the 8-bit hexadecimal value for the ASCII character. The appearance of the special symbols (e.g., filled circles, plus marks, X within a circle) is described in the Product Specification ICD (2620003), sections 18.3.2 and 20.3.2.

Figure 3-8b. Text and Special Symbol Packets - Packet Code 2 (Sheet 5)

	MSB	HALFWORD	LSB		
	9	MESSAGE HEADER BLOCK (See Figure 3-3)			
	60	PRODUCT DESCRIPTION BLOCK (See sheets 2-4 of Figure 3-6)			
	61	BLOCK DIVIDER (-1)			
	62	MAP ID			
	63	DATA FORMAT (=1)			
	64	NUMBER OF DATA PIECES (=1 OR 17)			
	65	TOTAL BYTE COUNT OF DATA PIECES	MSB		
	66		LSW		
	67	MAP PIECE 1 LOCATION		MAP FILE SECTOR#	
	68	BYTE LENGTH OF MAP PIECE 1			
	69				
	70	MAP PIECE 2 LOCATION			ONLY WHEN THE HIGH RESOLUTION MAP IS INCLUDED
	71	BYTE LENGTH OF MAP PIECE 2	(MSW)		
	72		(LSW)		
		• •			
	115	MAP PIECE 17 LOCATION			
	116	BYTE LENGTH OF MAP PIECE 17	(MSW)		
	117		(LSW)		
		ALIGNMENT FILLER		ZERO FILL TO HALFWORD 128 FROM FIRST BYTE OF MESSAGE	
MAP DATA	129	MAP DATA PIECE 1			
		MAP DATA PIECE 2		LOW RESOLUTION	
		• •		HIGH RESOLUTION IF INCLUDED	
		MAP DATA PIECE 17			

Figure 3-9. Map Message Packet Sheet (Sheet 1 of 3)

MSB	HALFWORD Linked Vectors		LSB
0	E	2	3
8	0	0	0
I			
J			
LENGTH = # VECTORS X 4			
I1			
J1			
I2			
J2			

MSB	HALFWORD Text		LSB
4	E	0	0
0	C	2	3
8	0	0	0
X			
Y			
LENGTH OF C's			
C1		C2	
C3		C4	

MSB	Unlinked Vectors		LSB
3	5	2	1
LENGTH # X 8			
I			
J			
I1			
J1			
I			
J			
I2			
J2			

MSB	Special Symbols		LSB
4	E	0	1
0	C	2	3
8	0	0	0
X			
Y			
LENGTH OF C's			
C1		C2	
C3		C4	

Figure 3-9. Map Message Packet - Packet Codes 0E23, 4E00, 3521 and 4E01 (Sheet 2)

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
61	Block Divider	INT*2	N/A	-1	N/A	Integer -1, Block Divider
62	Map ID	INT*2	N/A	132 to 198	1	Message code for appropriate map from Table II
63	Data Format	INT*2	N/A	1	N/A	Integer 1 for RAMTEK format
64	Number of Data Pieces	INT*2	N/A	1, 17	1	Integer number of map segments; 1 = low resolution, 17 = high and low resolution
65-66	Total Byte Count	INT*4	Bytes	1 to 409600	1	Number of bytes in data pieces
67	Map Piece 1 Location	INT*2	N/A	1 to 32767	1	Map file sector number on RPG disk; offset from the beginning of map file to first piece of data on the disk
68-69	Byte Length of Map Piece 1	INT*4	Bytes	1 to 81920	1	The length of piece 1 in bytes
70-117	Note 1	Note 1	Note 1	Note 1	Note 1	Comparable to halfwords 67-69 for map piece 2 to 17; only when the high resolution map is included
118-127	Alignment Filler	INT*2	N/A	0	N/A	Zero filled to halfword 128 from first byte of the message
129	Map Data Piece 1	Note 1	Note 1	Note 1	Note 1	Low resolution - contain packets shown in Sheet 1 of this figure
	Map Data Piece 2	Note 1	Note 1	Note 1	Note 1	High resolution if included, contains packet shown in Sheet 1 of this figure
	•					
	•					
	•					
	Map Data Piece 17					

Note 1. Data pieces will be in the formats shown for: Linked Vectors (No Value), Unlinked Vectors (No Value),
Write Text (No Value), and Write Special Symbols (No Value). The first 8 bytes will be replaced by the code shown in sheet 1 of this figure. The upper left corner of area of coverage is 0,0 and the resolution is 1/8 Km.

Figure 3-9. Map Message Packet - Packet Codes 0E23, 4E00, 3521 and 4E01 (Sheet 3)

	MSB HALFWORD			LSB	
	A	F	1	F	PACKET CODE
	INDEX OF FIRST RANGE BIN				
	NUMBER OF RANGE BINS				
	I CENTER OF SWEEP				
	J CENTER OF SWEEP				
	SCALE FACTOR (230 / # OF RANGE BINS)				
	NUMBER OF RADIALS				
REPEAT FOR EACH RADIAL	NUMBER OF RLE HALFWORDS IN RADIAL				
	RADIAL START ANGLE				
	RADIAL ANGLE DELTA				
	RUN (0)	COLOR CODE (0)	RUN (1)	COLOR CODE (1)	
	RUN (2)	COLOR CODE (2)	RUN (3)	COLOR CODE (3)	
	• ··				
	• ··				
	RUN (N)	COLOR CODE (N)	0000	0000	

Figure 3-10. Radial Data Packet (16 Data Levels) - Packet Code AF1F (Sheet 1)

Sectors or "Windows" Products will use this format with sufficient data to fill the requested area.

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	AF1F (Hex)	N/A	Packet Type X'AF1F'
Index of First Range Bin	INT*2	N/A	0 to 460	1	Location of first range bin
Number of Range Bins	INT*2	N/A	1 to 460	1	Number of range bins comprising a radial
I Center of Sweep	INT*2	Km/4	-2048 to +2047	1	I coordinate of center of sweep
J Center of Sweep	INT*2	Km/4	-2048 to +2047	1	J coordinate of center of sweep
Scale Factor	Scaled Integer	Pixels	.001 to 8.000	.001	Number of pixels per range bin
Number of Radials	INT*2	N/A	1 to 400	1	Total number of radials in products
Number of RLE Halfwords in Radial	INT*2	Halfword	1 to 230	1	Number of RLE (Run Length Encoded) 16-bit halfwords per radial
Radial Start Angle	Scaled Integer	Degrees	0.0 to 359.9	.1	Starting angle at which radial data was collected; Scan is always in Clockwise direction
Radial Angle Delta	Scaled Integer	Degrees	0.0 to 2.0	.1	Radial angle data
Run(0)	4 Bit INT	N/A	0 to 15	1	4-bit run code
Color Code(0)	4 Bit INT	N/A	0 to 15	1	4-bit color level

Figure 3-10. Radial Data Packet (16 Data Levels) - Packet Code AF1F (Sheet 2)

	MSB HALFWORD			LSB	
	B	A	0	F or 7	PACKET CODE / OP FLAGS
	8	0	0	0	
	0	0	C	0	
	I COORDINATE START				
	J COORDINATE START				
	X SCALE INT				
	X SCALE FRACTIONAL				
	Y SCALE INT				
	Y SCALE FRACTIONAL				
	NUMBER OF ROWS				
	PACKING DESCRIPTOR				
REPEAT FOR EACH ROW	NUMBER OF BYTES IN THIS ROW				
	RUN (0)	COLOR CODE (0)	RUN (1)	COLOR CODE (1)	
	RUN (2)	COLOR CODE (2)	RUN (3)	COLOR CODE (3)	
	• ··				
	• ··				
	RUN (N)	COLOR CODE (N)	0000	0000	

Figure 3-11. Raster Data Packet - Packet Codes BA0F and BA07 (Sheet 1)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	BA0F (Hex) or BA07 (Hex)	N/A	Packet Type X 'BA0F' or X'BA07'
Packet Code	INT*2	N/A	8000 (Hex)	N/A	Packet Type X'8000'
Packet Code	INT*2	N/A	00C0 (Hex)	N/A	Packet Type X'00C0'
I Coordinate Start	INT*2	Km/4	-2048 to +2047	1	Starting location of data
J Coordinate Start	INT*2	Km/4	-2048 to +2047	1	Starting location of data
X Scale INT	INT*2	N/A	1 to 67	1	Scaling factor for grid
X Scale Fractional	N/A	N/A	N/A	N/A	Reserved for internal PUP use
Y Scale INT	INT*2	N/A	1 to 67	1	Scaling factor for grid
Y Scale Fractional	N/A	N/A	N/A	N/A	Reserved for internal PUP use
Number of Rows	INT*2	N/A	1 to 464	1	Number of rows in layer
Packing Descriptor	INT*2	N/A	2	N/A	Defines packing format 2
Number of Bytes in this Row	INT*2	Bytes	2 to 920	1	Number of bytes in this row not including self
Run(0)	4 Bit INT	N/A	0 to 15	1	4-bit run code
Color Code(0)	4 Bit INT	N/A	0 to 15	1	4-bit color level

Figure 3-11. Raster Data Packet - Packet Codes BA0F and BA07 (Sheet 2)

	MSB HALFWORD LSB	
	PACKET CODE (=17)	
	SPARE	
	SPARE	
	NUMBER OF LFM BOXES IN ROW	
	NUMBER OF ROWS	
REPEAT FOR EACH ROW	NUMBER OF BYTES IN ROW	
	RUN (0)	LEVEL (01)
	RUN (1)	LEVEL (1)
	• • •	• • •
	RUN (N)	LEVEL (N)

Figure 3-11a. Digital Precipitation Data Array Packet - Packet Code 17 (Sheet 1)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	17	N/A	Packet Type 17
Spares	N/A	N/A	N/A	N/A	
Number of LFM Boxes in Row	INT*2	N/A	131	1	Number of boxes in each row
Number of Rows	INT*2	N/A	131	1	Total number of rows
Number of Bytes in Row	INT*2	N/A	2 to 262	1	Number of bytes in this row
Run(0)	1 Byte	N/A	0 to 255	1	8-bit run code
Level(0)	1 Byte	N/A	0 to 255	1	8-bit data level code. See Note 1 of Figure 3-6

Figure 3-11a. Digital Precipitation Data Array Packet - Packet Code 17 (Sheet 2)

	MSB HALFWORD			LSB
	PACKET CODE (=18)			
	SPARE			
	SPARE			
	NUMBER OF LFM BOXES IN ROW			
	NUMBER OF ROWS			
REPEAT FOR EACH ROW	NUMBER OF BYTES IN ROW			
	RUN (0)	LEVEL (0)	RUN (1)	LEVEL (1)
	RUN (2)	LEVEL (2)	RUN (3)	LEVEL (3)
	•••			
	•••			
	RUN (N)	LEVEL (N)	0000	0000

Figure 3-11b. Precipitation Rate Data Array Packet - Packet Code 18 (Sheet 1)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	18	N/A	Packet Type 18
Spares	N/A	N/A	N/A	N/A	
Number of LFM Boxes in Row	INT*2	N/A	13	1	Number of boxes in each row
Number of Rows	INT*2	N/A	13	1	Total number of rows
Number of Byes in Row	INT*2	N/A	2 to 14	1	Number of bytes in this row
Run(0)	4-Bit INT	N/A	0 to 15	1	4-bit run code
Level(0)	4-Bit INT	N/A	0 to 15	1	4-bit data level code

Figure 3-11b. Precipitation Rate Data Array Packet - Packet Code 18 (Sheet 2)

	MSB HALFWORD	LSB
	PACKET CODE (=16)	
	INDEX OF FIRST RANGE BIN	
	NUMBER OF RANGE BINS	
	I CENTER OF SWEEP	
	J CENTER OF SWEEP	
	RANGE SCALE FACTOR	
	NUMBER OF RADIALS	
REPEAT FOR EACH RADIAL	NUMBER OF BYTES IN RADIAL	
	RADIAL START ANGLE	
	RADIAL DELTA ANGLE	
	LEVEL (0)	LEVEL (1)
	LEVEL (2)	LEVEL (3)
	•	•
	•	•
	LEVEL (N-1)	LEVEL (N)

Figure 3-11c. Digital Radial Data Array Packet - Packet Code 16 (Sheet 1)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	16	N/A	Packet Type 16
Index of First Range Bin	INT*2	N/A	0 to 230	1	Location of first range bin
Number of Range Bins	INT*2	N/A	0 to 1840	1	Number of range bins comprising a radial
I Center of Sweep	INT*2	Km/4	-2048 to +2047	1	I coordinate of center of sweep
J Center of Sweep	INT*2	Km/4	-2048 to +2047	1	J coordinate of center of sweep
Range Scale Factor	Scaled Integer	N/A	.001 to 1.000	.001	Cosine of elevation angle for elevation based products. For volume based products the value 1.00.
Number of Radials	INT*2	N/A	1 to 720	1	Total number of radials in product (Note 1)
Number of Bytes in Radial	INT*2	N/A	1 to 1840	1	Number of bytes of 8-bit data level values per radial
Radial Start Angle	Scaled Integer	Degrees	0.0 to 359.9	.1	Starting angle at which radial data was collected; Scan is always clockwise
Radial Delta Angle	Scaled Integer	Degrees	0.0 to 2.0	.1	Delta angle from previous radial
Level (0)	1 Byte	N/A	0 to 255	1	8-bit data level code. (See Note 1 of Figure 3-6)

Note 1: The RPG clips radials to 70 kft. This could result in an odd number of bins in a radial. However, the radial will always be on a halfword boundary, so the number of bytes in a radial may be number of bins in a radial + 1.

Figure 3-11c. Digital Radial Data Array Packet - Packet Code 16 (Sheet 2)

		MSB HALFWORD LSB
DATA BLOCK	REPEAT FOR EACH ARROW	PACKET CODE (=5)
		LENGTH OF DATA BLOCK (BYTES)
		I COORDINATE
		J COORDINATE
		DIRECTION OF ARROW
		ARROW LENGTH
		ARROW HEAD LENGTH
		• • •

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	5	N/A	Packet Type 5
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
I Coordinate Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	Coordinate where the arrow and/or value is to be centered
J Coordinate Point	INT*2	Km/4 or Pixels	-2048 to +2047	1	Coordinate where the arrow and/or value is to be centered
Direction of Arrow	INT*2	Degrees	0 to 359	1	Arrow direction in 1-degree steps: points with wind field
Arrow Length	INT*2	Pixels	1 to 512	1	Number of pixels in arrow
Arrow Head Length	INT*2	Pixels	1 to 512	1	Number of pixels in arrow head

Figure 3-12. Vector Arrow Data Packet - Packet Code 5

		MSB HALFWORD LSB
DATA BLOCK	REPEAT FOR EACH BARB	PACKET CODE (=4)
		LENGTH OF DATA BLOCK (BYTES)
		VALUE
		X COORDINATE
		Y COORDINATE
		DIRECTION OF WIND
		WIND SPEED
		• • •

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	4	N/A	Packet Type 4
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
Value	INT*2	N/A	1 to 5	1	Color level of wind barb (reflects the RMS value associated with the computed velocity)
X Coordinate	INT*2	Km/4 or Pixels	-2048 to +2047	1	Coordinate where the value starts
Y Coordinate	INT*2	Km/4 or Pixels	-2048 to +2047	1	Coordinate where the value starts
Direction of Wind	INT*2	Degrees	0 to 359	1	Points into wind
Wind Speed	INT*2	Knots	0 to 195	1	Magnitude of wind

Figure 3-13. Wind Barb Data Packet - Packet Code 4

	MSB HALFWORD LSB
	PACKET CODE (=3 or 11)
MESOCYCLONE	LENGTH OF BLOCK (BYTES)
REPEAT FOR EACH SYMBOL	I POSITION
	J POSITION
	RADIUS OF MESOCYCLONE

	MSB HALFWORD LSB
	PACKET CODE (=12 or 26)
TVS or ETVS	LENGTH OF BLOCK (BYTES)
REPEAT FOR EACH SYMBOL	I POSITION
	J POSITION

	MSB HALFWORD LSB
	PACKET CODE (=13)
HAIL POSITIVE (FILLED)	LENGTH OF BLOCK (BYTES)
REPEAT FOR EACH SYMBOL	I POSITION
	J POSITION

	MSB HALFWORD LSB
	PACKET CODE (=14)
HAIL PROBABLE	LENGTH OF BLOCK (BYTES)
REPEAT FOR EACH SYMBOL	I POSITION
	J POSITION

Figure 3-14. Special Graphic Symbol Packet - Packet Code 3 or 11, 12 or 26, 13 and 14 (Sheet 1)

	MSB HALFWORD LSB	
	PACKET CODE (=15)	
STORM ID	LENGTH OF BLOCK (BYTES)	
REPEAT FOR EACH SYMBOL	I POSITION	
	J POSITION	
	CHARACTER 1	CHARACTER 2

	MSB HALFWORD LSB
	PACKET CODE (=19)
HDA HAIL	LENGTH OF BLOCK (BYTES)
REPEAT FOR EACH SYMBOL	I POSITION
	J POSITION
	PROB. OF HAIL
	PROB. OF SEVERE HAIL
	MAX HAIL SIZE

	MSB HALFWORD LSB
SCIT PAST/ FORECAST DATA	PACKET CODE (=23 or 24)
	LENGTH OF BLOCK (BYTES)
	DISPLAY DATA PACKETS
	• •

	MSB HALFWORD LSB
	PACKET CODE (=25)
STI CIRCLE	LENGTH OF BLOCK (6 BYTES)
	I POSITION
	J POSITION
	RADIUS OF CIRCLE

Figure 3-14. Special Graphic Symbol Packet - Packet Codes 15, 19, 23, 24 and 25 (Sheet 2)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	3, 11 to 15, 19, 23 to 26	N/A	Packet Type (Note 1)
Length of Block	INT*2	Bytes	1 to 32767	1	Number of bytes in block not including self or packet code
I Position	INT*2	Km/4	-2048 to +2047	1	I starting coordinate
J Position	INT*2	Km/4	-2048 to +2047	1	J starting coordinate
Radius of Mesocyclone	INT*2	Km/4	-2048 to +2047	1	A radius of 0 indicates that no mesocyclone is present and I, J coordinates are set to 0,0.
Character 1	Char	8-bit ASCII	A to Z	N/A	First character of Storm ID
Character 2	Char	8-bit ASCII	0 to 9	N/A	Second character of Storm ID
Probability of Hail	INT*2	N/A	0 to 100, -999	10	Probability in Percent (Note 2)
Probability of Severe Hail	INT*2	N/A	0 to 100, -999	10	Probability in Percent (Note 2)
Max Hail Size	INT*2	Inches	0 to 4	1	Maximum expected hail size
Display Data Packet	INT*2	N/A	N/A	N/A	Past or forecast position data for a Single storm cell. Consists of packet code 2, (Figure 3-8b), packet code 6*(Figure 3-7) or packet code 25 (Figure 3-14)
Radius of STI Circle	INT*2	Pixels	1 to 512	1	Radius of circle

Note 1.A packet code of 11 indicates 3-D correlated shear. Packet code 23 for past position data, packet code 24 for forecast position data, and packet code 25 for current position. Packet code 12 is for TVS position data and packet code 261 is for ETVS position data.
Note 2.A value of -999 indicates that these cells are beyond the maximum range for algorithm processing.

Figure 3-14. Special Graphic Symbol Packet - Packet Codes 3, 11, 12, 13, 14, 15, 19, 23, 24, 25 and 26 (Sheet 3)

	MSB HALFWORD LSB
	PACKET CODE (=20)
	LENGTH OF BLOCK (BYTES)
REPEAT FOR EACH SYMBOL	I POSITION
	J POSITION
	POINT FEATURE TYPE
	POINT FEATURE ATTRIBUTE

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	20	N/A	Packet Type (Note 1)
Length of Block	INT*2	Bytes	8 to 32760	1	Number of bytes in block not including self or packet code
I Position	INT*2	Km/4	-2048 to +2047	1	I starting coordinate
J Position	INT*2	Km/4	-2048 to +2047	1	J starting coordinate
Point Feature Type	INT*2	N/A	1 to 4, 5 to 8, 9-11	1	1 = mesocyclone (extrapolated) 3 = mesocyclone (persistent, new, or increasing) 5 = TVS (extrapolated) 6 = ETVS (extrapolated) 7 = TVS (persistent, new, or increasing) 8 = ETVS (persistent, new, or increasing) 9 = MDA Circulation with Strength Rank >= 5 AND with a Base Height <= 1 km ARL or with its Base on the lowest elevation angle. 10 = MDA Circulation with Strength Rank >= 5 AND with a Base Height > 1 km ARL AND that Base is not on the lowest elevation angle. 11 = MDA Circulation with Strength Rank < 5
Point Feature Attribute	INT*2	Type dependent, see remarks.	Type dependent, see remarks.	Type dependent, see remarks.	For feature types 1-4, 9, 10, 11, radius in km/4

Figure 3-14. Special Graphic Symbol Packet - Packet Code 20 (Sheet 4)

	MSB HALFWORD	LSB
	PACKET CODE (=21)	
	LENGTH OF BLOCK (BYTES)	
	CELL ID C1	CELL ID C2
	I POSITION	
	J POSITION	
REPEAT FOR EACH TREND CODE	TREND CODE	
	# VOLUMES	LATEST VOL PTR
	VOL. 1 TREND DATA	
	• •	
	VOL N TREND DATA	

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	21	N/A	Packet Type 21
Length of Block	INT*2	Bytes	12 to 198	1	Number of bytes to follow in this packet
Cell ID C1	8 bit ASCII	N/A	A to Z	N/A	First character of cell ID
Cell ID C2	8 bit ASCII	N/A	0 to 9	N/A	Second character of cell ID
I Position	INT*2	Km/8	-4096 to +4095	1	Cell I coordinate at latest Volume Scan
J Position	INT*2	Km/8	-4096 to +4095	1	Cell J coordinate at latest Volume Scan
Trend Code	INT*2	N/A	1 to 8	1	Indicates trend data type to follow: 1 = cell top 2 = cell base 3 = max. ref. hgt. 4 = prob. hail 5 = prob. svr. hail 6 = cell based VIL 7 = max. ref. 8 = centroid hgt.

Figure 3-15. Cell Trend Data Packet - Packet Code 21 (Sheet 1)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
# Volumes	INT*1	N/A	1 to 10	1	Number of volume scans of trend data for this trend code in the circular list
Latest Vol PTR	INT*1	N/A	1 to 10	1	Pointer to the latest volume scan in the circular list
Vol 1 Trend Data	INT*2	Note 1	Note 1	Note 1	Trend data for each scan in the circular list
•					
•					
•					
Vol N Trend Data					

TREND CODE	UNITS	SCALE FACTOR	SCALED RANGE	PRECISION	REMARKS
1	Feet	/100	0 to 1700	100 Feet	Note 2
2	Feet	/100	0 to 1700	100 Feet	Note 2
3	Feet	/100	0 to 700	100 Feet	
4	Percent	1	0 to 100	10 Percent	Note 3
5	Percent	1	0 to 100	10 Percent	Note 3
6	kg/m**2	1	0 to 100	1 kg/m**2	
7	dBZ	1	0 to 75	1 dBZ	
8	Feet	/100	0 to 700	100 Feet	

Note 1: The following defines the units, scale factor, range and precision for each trend code:
Note 2: If the value is over 700, then 1000 has been added to denote that the CELL TOP (BASE) was detected on the highest (lowest) elevation scan.
Note 3:Flag values of -999 denote that an UNKNOWN value (i.e. the cell is outside the maximum hail processing range).

Figure 3-15. Cell Trend Data Packet - Packet Code 21 (Sheet 2)

	PACKET CODE (=22)	
CELL TREND	LENGTH OF BLOCK (BYTES)	
VOLUME SCAN	# VOLUMES	LATEST VOL PTR
TIMES	VOL TIME 1	
	• •	
	VOL TIME N	

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	22	N/A	Packet Type 22
Length of Block	INT*2	Bytes	4 to 22	1	Number of bytes to follow in this packet
# Volumes	INT*2	N/A	1 to 10	1	Number of cell trend volume scan times in the circular list
Latest Vol PTR	INT*2	N/A	1 to 10	1	pointer to the latest cell trend volume scan time in the circular list
Vol Time 1	INT*2	Minutes	0 to 1439	1	Circular list of cell trend volume scan times in minutes after midnight (seconds are truncated)
• • Vol Time N					

Figure 3-15a. Cell Trend Volume Scan Times - Packet Code 22

	MSW HALFWORD LSB
	PACKET CODE (=27)
	LENGTH OF PACKET (MSW)
	LENGTH OF PACKET (LSW)
	ELEVATION ANGLE
REPEAT FOR EACH SUPEROB CELL WITH AN AVERAGE RADIAL VELOCITY	LATITUDE (MSW)
	LATITUDE (LSW)
	LONGITUDE (MSW)
	LONGITUDE (LSW)
	HEIGHT
	AVERAGE RADIAL VELOCITY
	STD OF THE AVERAGE RADIAL VELOCITY
	TIME DEVIATION
	AVERAGE AZIMUTH

Figure 3-15b. SuperOb Wind Data Packet - Packet Code 27 (Sheet 1)

Packet 27 would be used in the Product Symbology Block. Each packet would represent a complete elevation scan. Multiple packets would be contained in a single data layer. If there is no data in the elevation scan, the packet "Length of Block" would be set to 2 bytes. There could be more packets than elevation angles in the VCPs since a mixture of VCPs result in reporting all the elevation angles which are separated by 0.35 degrees.

Maximum packet size is based on full data coverage extending out to 100 km range and with spatial parameters of 2 degrees by 1 km is 324002 bytes. However, default adaptable parameters (5 km by 6 degrees) result in a maximum packet size of 21602 bytes.
A SuperOb-cell is defined as a region bounded by adaptable range and azimuth limits (default 6 degrees by 10 km). The geographic center-point of cells are positioned at an azimuth and range at a multiples of ½ of the cell dimensions (e.g., 0 deg/5km, 0 deg/15km, … 6deg/5 km,… 354deg/95km). However, the position of the average radial velocity (i.e., latitude, longitude, height, and azimuth) is the average of the radar bin positions used in the average radial velocity computation.
The product is generated once an hour (default) at 30 minutes past the hour regardless of the position of the antenna with the VCP.
What if the radar data stops before the end of the time period, complete product at the scheduled time?
If the radar is down for the full hour, don't need to generate a product.

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Packet Code	INT*2	N/A	27	N/A	Packet Code 27
Packet Length (MSW)	INT*4	Bytes	2 to 324002	1	Number of bytes to follow in this packet
Elevation Angle	INT*2	Degrees	-1.0 to +45.0	0.1	Angle of the Elevation Scan
Latitude (MSW) ---------- Latitude (LSW)	INT*4	Degrees	-90 to +90	0.001	North (+) or South (-) of the Equator of the cell
Longitude (MSW) ---------- Longitude (LSW)	INT*4	Degrees	-180 to +180	0.001	East (+) or West (-) of the Prime Meridian of the cell
Height	INT*2	Meters	-100 to 21336	1	Height above sea level of the cell
AVG Radial Velocity	INT*2	Meters/ Second	-127 to +126	0.01	Mean radial velocity for the cell
Standard Dev. of Ave. Radial Velocity	INT*2	Meters/ Second	0 to 255	1	Standard deviation of mean velocity
Time Deviation	INT*2	Seconds	-5400 to +5400	1	Deviation from Base Time of the average time of all velocity samples in the SuperOb cell
Azimuth Average	INT*2 (Note 1)	Degrees	0 to 359	0.01	Average azimuth angle of all velocity samples in the SuperOb cell.

Note 1: The Azimuth Average is an unsigned 16-bit value.

Figure 3-15b. SuperOb Wind Data Packet -- Packet Code 27 (Sheet 2)

	PACKET CODE (=28, 29)
	RESERVED (=0)
GENERIC	LENGTH OF DATA (BYTES) (MSHW)
DATA	LENGTH OF DATA (BYTES) (LSHW)
PACKET	START OF SERIALIZED DATA
	SERIALIZED DATA HALFWORD 1
	• •
	SERIALIZED DATA HALFWORD N

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Packet Code	INT*2	N/A	28 or 29	N/A	Packet Type 28 or Packet Type 29
Reserved	INT*2	N/A	0	N/A	See Note 1
Length of Serialized Data (MSHW)	INT*2	Bytes	0 to maximum 2-byte integer value	1	Number of bytes to follow in this packet (most significant halfword).
Length of Serialized Data (LSHW)	INT*2	Bytes	0 to maximum 2-byte integer value	1	Number of bytes to follow in this packet (least significant halfword).
Serialized Data	N/A	N/A	N/A	N/A	Serialized data returned from Generic Data Packet serializing function. See Note 2.

Note 1: Reserved for future use. Should be set to 0.
Note 2: The serialized data is encoded using External Data Representation (XDR). The XDR Standard is defined in Request For Comments (RFC) 1832. The deserialized data format is defined by Generic Product Format described in Appendix E.

Figure 3-15c Generic Data Packet - Packet Codes 28 and 29 (Sheet 1)

		MSB HALFWORD LSB
		MESSAGE HEADER BLOCK (see Figure 3-3)
		PRODUCT DESCRIPTION BLOCK (see sheets 2, 6, & 7 of Figure 3-6)
		BLOCK DIVIDER (-1)
		NUMBER OF PAGES
REPEAT FOR EACH PAGE	REPEAT FOR EACH LINE	NUMBER OF CHARACTERS
		CHARACTER DATA
		END OF PAGE FLAG (-1)

FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Block Divider	INT*2	N/A	-1	N/A	Integer value of -1, used to delineate this block from the header
Number of Pages	INT*2	N/A	1 to 48	1	Total number of page
Number of Characters	INT*2	N/A	0 to 80	1	Number of characters in line
Character Data to N	Char	8 bit ASCII	ASCII Character Set	N/A	Characters are ASCII
End of Page Flag	INT*2	N/A	-1	N/A	Integer value of -1, to delineate end of page

Figure 3-16. Stand-Alone Tabular Alphanumeric Product Message

Table IX. Product Dependent Definition for Stand-Alone Tabular Alphanumeric Block

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
STORM STRUCTURE	Radar ID	N/A	0 to 999	N/A	
	Volume Scan Start Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Volume Scan Start Time	N/A	Hours: 0 to 23 Minutes: 0 to 59 Seconds: 0 to 59	N/A	
	Number of Storms Cells	N/A	0 to 100	1	
	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2 ...Z9	N/A	The sequence is recycled following Z9 Note 1
	Storm Positions: · Azimuth · Range	• Degrees • nmi	• 0 to 360 • 0 to 248	• 1 • 1	Note 1
	Storm Base	Kft	0.0 to 70.0	0.1	If the storm base was identified at the lowest elevation, the value is qualified with "<". Note 1
	Storm Top	Kft	0.0 to 70.0	0.1	If the storm top was identified at the highest elevation, the value is qualified with ">". Note 1
	Cell Based VIL	kg/m^2	0 to 120	1	Note 1
	Maximum Reflectivity	dBZ	0 to 95	1	Note 1
	Height of Maximum Reflectivity	Kft	0.0 to 70.0	0.1	Note 1
	Site Adaptable Parameters	See Remarks	See Remarks	See Remarks	See Table LXVIII, Site Adaptation Data in Radar Product Generation Program, 2820003, Pt1.
USER ALERT MESSAGE	Radar ID	N/A	0 to 999	N/A	

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Volume Scan Start Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Volume Scan Start Time	N/A	Hours: 0 to 23 Minutes: 0 to 59 Seconds: 0 to 59	N/A	
	Alert Area	N/A	1 or 2	1	
	Position: · Azimuth · Range	 Degrees nmi	 0.0 to 359.9 0.0 to 250.0	 0.1 0.1	Position is the alert grid box center for grid based alerts, feature base center for mesocyclone and TVS alerts, not applicable for VAD and 1 HR rainfall alerts, and Storm cell centroid for all other alerts.
	Alert Category	N/A	See Table IV	1	
	Alert Threshold	See Remarks	See Remarks	See Remarks	See Table LXVIII, Site Adaptation Data in Radar Product Generation Program, 2820003, Pt1
	Exceeding Value	See Remarks	See Remarks	See Remarks	See Table LXVIII, Site Adaptation Data in Radar Product Generation Program, 2820003, Pt1
	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2....Z9	N/A	Storm ID sequence is recycled following Z9

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	Forecast Movement · Direction · Speed	 Degrees Kts	" " or 0 to 360 0 to 999	 1 1	" " indicates that the information is unavailable since alert is not related to a storm ID.
FREE TEXT MESSAGE	Message Text	ASCII	All ASCII Characters	N/A	
SUPPLEMENTAL PRECIPITATION DATA	Radar ID	N/A	0 to 999	N/A	
	Average Scan Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Average Scan Time	N/A	Hours: 0 to 23 Minutes: 0 to 59	N/A	
	No. Blockage Bins Rejected	N/A	0 to 99999	1	
	No. Clutter Bins Rejected	N/A	0 to 99999	1	
	No. Bins Smoothed	N/A	0 to 99999	1	
	Percent Hybrid Scan Filled	%	90.00 to 100.00	0.01	
	Highest Elev. Angle used in Hybrid Scan	Deg	0.50 to 19.50	0.01	
	Hybrid Scan Rain Area	Km**2	0.0 to 999999.9	0.1	
	Mean-field Bias Estimate	N/A	.01 to 99.99	.01	
	Effective # Gage-Radar Pairs (Sample Size)	N/A	0.00 to 9999.99	.01	
	Memory Span used in Bias Estimate	Hours	.001 to 10**7	.001	
	Bias Applied Flag	Alphanumeric	Yes or No	N/A	
	Begin Missing Period Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Begin Missing Period Time	N/A	Hours: 0 to 23 Minutes: 0 to 59	N/A	
	End Missing Period Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
	End Missing Period Time	N/A	Hours: 0 to 23 Minutes: 0 to 59	N/A	
	Volume Coverage Pattern	N/A	1 to 1000		
	Operational (Weather) Mode	N/A	A, B or M	N/A	
	Average Scan Date (Last Bias Update)	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Average Scan Time (Last Bias Update)	N/A	Hours: 0 to 23 Minutes: 0 to 59	N/A	
	Memory Span, per evaluation timespan	Hours	0.001 to 10**7	.001	
	Effective # Gage-Radar Pairs, per evaluation timespan	N/A	0.000 to 9999.999	.001	
	Average Gage Value, per evaluation timespan	mm	0.000 to 99.999	.001	
	Average Radar Value, per evaluation timespan	mm	0.000 to 99.999	.001	
	Mean-field Bias Estimate, per evaluation timespan	N/A	0.001 to 99.999	.001	

	MSB HALFWORD LSB
	MESSAGE HEADER BLOCK (see Figure 3-3)
GENERAL 10 STATUS BLOCK	(-1) BLOCK DIVIDER
11	LENGTH OF BLOCK
12	MODE OF OPERATION
13	RDA OPERABILITY STATUS
14	VOLUME COVERAGE PATTERN
15	NUMBER OF ELEVATION CUTS
16 17 . • 35	ELEVATION 1 ELEVATION 2 . • ELEVATION 20

36	RDA STATUS
37	RDA ALARMS
38	DATA TRANSMISSION ENABLE
39	RPG OPERABILITY STATUS
40	RPG ALARMS
41	RPG STATUS
42	RPG NARROWBAND STATUS
43	REFLECT. CALIB. CORR.
44	PRODUCT AVAILABILITY
45	SUPER RESOLUTION CUTS
46	CLUTTER MITIGATION DECISION STATUS
47	VERTICAL CHANNEL REFLECTIVITY CALIBRATION CORRECTION
48	RDA BUILD NUMBER
49	RDA CHANNEL NUMBER
50	RESERVED
51	RESERVED
52	BUILD VERSION
53	ELEVATION 21
•	
•	
57	ELEVATION 25
58	VCP SUPPLEMENTAL DATA
59	SPARE
•	
•	
100	SPARE

Figure 3-17. General Status Message (Sheet 1)

HALFWORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
10	Block Divider	INT*2	N/A	-1	N/A	Integer -1, block divider
11	Length of Block	INT*2	Bytes	82	1	Number of bytes to follow
12	Mode of Operation	INT*2	N/A	0 to 2	N/A	Where: 1 = Clear Air Mode 2 = Precipitation/Severe Weather Mode
13	RDA Operability Status	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					Bit 15	Spare
					Bit 14=1	Online
					Bit 13=1	Maintenance Action Required
					Bit 12=1	Maintenance Action Mandatory
					Bit 11=1	Commanded Shutdown
					Bit 10=1	Inoperable
					Bit 9	Spare
					Bit 8=1	Wideband Disconnect
					Bits 7-0	Spare
					Bits 15-10, 8=0	Indeterminate: if all bits are zero, then the RPG determines the status
14	Volume Coverage Pattern	INT*2	N/A	1 to 767	1	RDA Volume Coverage Pattern for the scan strategy being used
15	Number of Elevation Cuts	INT*2	N/A	1 to 25	1	Maximum elevation cuts = 25

16 . . .	Elevation 1	Scaled Integer	Degrees	-1.0 to +45.0	.1	Elevation angle elevation 1
35	Elevation 20	Scaled Integer	Degrees	-1.0 +45.0	.1	Elevation angle for elevation 20.
36	RDA Status	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					Bit 15	Spare
					Bit 14=1	Startup
					Bit 13=1	Standby
					Bit 12=1	Restart
					Bit 11=1	Operate
					Bit 10=1	Spare
					Bit 9=1	Off-line Operate
					Bit 8-0	Spares
					Bits 14-9=0	Indeterminate; if all bits are zero, then the RPG cannot determine the status
37	RDA Alarms	Integer	N/A	0,1/Bit, Note 1	Bit 15=LSB	Where:
					Bit 15=1	Indeterminate; the RPG cannot determine the alarms present
					Bit 14=1	Tower/Utilities
					Bit 13=1	Pedestal
					Bit 12=1	Transmitter
					Bit 11=1	Receiver
					Bit 10=1	RDA Control
					Bit 9=1	RDA Communications
					Bit 8=1	Signal Processor
					Bits 7-0	Spares
					Bits 15-7=0	No Alarms; if all bits are zero, then there are no alarms present
38	Data Transmission Enabled	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					Bit 15=1	Spare
					Bit 14=1	None
					Bit 13=1	Reflectivity

					Bit 12=1	Velocity
					Bit 11=1	Spectrum Width
					Bit 10=1	Dual Pol Data Expected
					Bits 9-0	Spares
39	RPG Operability Status	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					Bit 15=1	Loadshed
					Bit 14=1	On-line
					Bit 13=1	Maintenance Action Required
					Bit 12=1	Maintenance Action Mandatory
					Bit 11=1	Commanded Shutdown
					Bits 10 to 0	Spares
40	RPG Alarms	Integer		N/A	Bit 15=LSB	Where:
					Bit 15=1	No Alarms
					Bit 14=1	Node Connectivity
					Bit 13=1	Wideband Failure
					Bit 12=1	RPG Control Task Failure
					Bit 11=1	Data Base Failure
					Bit 10=1	Spare
					Bit 9=1	RPG Input Buffer Loadshed (Wideband)
					Bit 8=1	Spare
					Bit 7=1	Product Storage Loadshed
					Bit 6=1	Spare
					Bit 5=1	Spare
					Bit 4=1	Spare
					Bit 3=1	RPG/RPG Intercomputer Link Failure
					Bit 2=1	Redundant Channel Error
					Bit 1=1	Task Failure
					Bit 0=1	Media Failure
41	RPG Status	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					Bit 15=1	Restart
					Bit 14=1	Operate
					Bit 13=1	Standby
					Bit 12=1	Spare

					Bit 11	Spares
42	RPG Narrowband Status	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					Bit 15=1	Commanded Disconnect
					Bit 14=1	Narrowband Loadshed
					Bit 13-0	Spares
43	Horizontal Channel Reflectivity Calibration Correction	Fixed Point, Scaled Integer	dB/4	-792 to +792 (-198 dB to +198 dB)	.25/ 1	Reflectivity Calibration Correction (difference from adaptation data)
44	Product Availability	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					Bit 15=1	Product Availability
					Bit 14=1	Degraded Availability
					Bit 13=1	Not Available
45	Super Resolution Elevation Cuts	Integer	N/A	0,1/Bit	Bit 15 = LSB Bit 15 = Elev 1	Bit field indicating which elevation cuts have super resolution enabled.
46	Clutter Mitigation Decision Status	Integer	N/A	0,1/Bit	Bit 15 = LSB	Where:
					Bit 15 = 0	Disabled
					Bit 15 = 1	Enabled
					Bits 14-10	Bit field indicating which elevation segments have Clutter Mitigation Decision enabled.
47	Vertical Channel Reflectivity Calibration Correction	Fixed Point, Scaled Integer	dB/4	-792 to + 792 (-198 dB to + 198 dB)	.25/1	Reflectivity Calibration Correction (difference from adaptation data)

48	RDA Build Number	Fixed Point, Scaled Integer	N/A	0 to 999, Note 2	N/A	RDA major and minor build version information
49	RDA Channel Number	Integer	N/A	0,1,2	N/A	0 = NWS single thread 1 = RDA 1 2 = RDA 2 for NWS redundant or FAA redundant
50-51	Reserved					Halfword 50 & 51 are applicable to dial-up (Class II, Class IV, and Class V [RFC]) user only
52	Build Version	Scaled Integer	N/A	10 to 32767		RPG Build Version
53	Elevation 21	Scaled Integer	Degrees	-1.0 to +45.0	.1	Elevation angle for elevation 21.
57	Elevation 25					Elevation angle for elevation 25. NOTE: If number of elevation cuts N is less than 25, then elevations N+1 through 25 are zeros
58	VCP Supplemental Data	Integer	N/A	0,1/Bit	Bit 15 = LSB	Where:
					Bit 15 = 1	AVSET Enabled
					Bit 14=1	SAILS Enabled VCP in use
					Bit 13 =1	Site-Specific VCP in use
59-100	Spare	N/A	N/A	N/A	N/A	N/A

Note 1: RDA Alarms reflect the controlling channel.
Note 2: For Legacy RDA systems, this value will be 0. For Open RDA systems, the Build Version format is XX.Y where XX indicates the major build version and Y indicates the minor build version. This information is stored in scaled integer format. For example, Build 7.0 equals a value of 70. Build 99.9 equals a value of 999.

Figure 3-17. General Status Message (Sheet 2)

	MSB HALFWORD LSB
	MESSAGE HEADER BLOCK (see Figure 3-3)
10	BLOCK DIVIDER (-1)
REQUEST 11 RESPONSE BLOCK	LENGTH OF BLOCK
12	ERROR CODE (MSW)
13	(LSW)
14	SEQUENCE NUMBER
15	PRODUCT/MESSAGE CODE
16	ELEVATION ANGLE
17	VOLUME SCAN DATE
18-19	VOLUME SCAN START TIME
20-24	SPARES (7 HALFWORDS)

Figure 3-18. Request Response Message (Sheet 1)

HALFWORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
10	Block Divider	INT*2	N/A	-1	N/A	Integer -1, Block Divider
11	Length of Block	INT*2	Bytes	26	1	Number of bytes to follow
12-13	Error Code	Integer	N/A	0,1/Bit	Bit 31=LSB	Where:
					Bit 0=1	No Such Message Code
					Bit 1=1	No Such Product Code
					Bit 2=1	Product Not Generated (Not Available in Data Base)
					Bit 3=1	One-Time Request Generation Process Faulted
					Bit 4=1	Narrowband Loadshed
					Bit 5=1	Illegal Request
					Bit 6=1	RPG Memory Loadshed
					Bit 7=1	RPG CPU Loadshed (Note 1)
					Bit 8=1	Unavailability of Slots (Real-Time, Replay or Customized)

					Bit 9=1	Failure (Task Failed)
					Bit 10=1	Unavailable (Task Not Loaded Upon Startup)
					Bit 11=1	Available Next Volume Scan
					Bit 12=1	Moment Disabled
					Bit 13	Bit 13 is Reserved and Not Applicable to Associated PUPS
					Bit 14	Spare
					Bit 15	Aborted Volume Scan (Note 2)
					Bit 16	Invalid Product Parameters
					Bit 17	Product Not Generated (Data Sequence Error) Note 3
					Bit 18	Task Failure (Self-Terminated)
					Bits 19-31	Spares
14	Sequence Number	INT*2	N/A	-13, 0 to 32767	1	Sequence number of request that caused response
15	Product/Message Code	INT*2	N/A	-16 to -299, 16 to 299	N/A	Product/Message code as defined in Table II, that caused response
16	Elevation Angle	Scaled Integer	Degrees	-1.0 to +45.0	.1	Elevation angle of radar for requested product
17	Volume Scan Date	INT*2	Julian Date	1 to 32767	1	Modified Julian Date; integer number of days since Jan. 1, 1970
18-19	Volume Scan Start Time	INT*4	Seconds GMT	0 to 86399	1	Number of seconds after midnight, Greenwich Mean Time (GMT)
20-24	Spares					

Note 1: The RPG has not implemented the CPU Loadshed functionality that will generate an alarm.
Note 2: The following conditions will cause ABORTED VOLUME SCAN: Commanded VCP Restart (either via operator command or Mode Deselection) or Unexpected Start of Volume Scan.
Note 3: Product Not Generated (Data Sequence Error) is caused when VCP number changes unexpectedly, Azimuth Tolerance Exceeded in the initial elevation cut of volume, RDA Elevation Number Changes Unexpectedly, or Start of Elevation Y Expected, But Start Of Elevation received.

In addition, any sequence error encountered during task processing …e.g. the task is not processing radial messages fast enough and its input buffers are lost at the expense of new input buffers.

Figure 3-18. Request Response Message (Sheet 2)

	MSB HALFWORD LSB	
	MESSAGE HEADER BLOCK (see Figure 3-3)	
10	BLOCK DIVIDER (-1)	
11	ALERT STATUS	
12	ALERT AREA NUMBER	
13	ALERT CATEGORY	
14	THRESHOLD CODE	
15	THRESHOLD VALUE (MSW)	
16	THRESHOLD VALUE (LSW)	
17	EXCEEDING VALUE (MSW)	
18	EXCEEDING VALUE (LSW)	
19	GRID BOX AZIMUTH	
20	GRID BOX RANGE	
21	STORM CELL ID C1	STORM CELL ID C2
22	VOLUME SCAN NUMBER	
23	VOLUME SCAN DATE	
24	VOLUME SCAN START TIME (MSW)	
25	VOLUME SCAN START TIME (LSW)	

Figure 3-19. Alert Message (Sheet 1)

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
10	Block Divider	INT*2	N/A	-1	N/A	Integer value of -1, used to delineate the header from the Alert Message Block
11	Alert Status	INT*2	N/A	1 to 2	N/A	1 = First Time Alert 2 = Alert Ended
12	Alert Area Number	INT*2	N/A	1 to 2	N/A	Area number of alert as defined per user
13	Alert Category	INT*2	N/A	1 to 41	N/A	Alert category number as defined by Table IV
14	Threshold Code	INT*2	N/A	1 to 6	N/A	Parameter dependent threshold code that triggers alert (Refer to Table IV)
15-16	Threshold Value	INT*4	-	-	-	Parameter dependent data value corresponding to the user defined threshold code (Refer to Table LXVIII in 2820003, Pt1)

17-18	Exceeding Value	INT*4	-	-	-	Parameter dependent data value (maximum detected) which triggered the alert (Refer to Table LXVIII in 2820003, Pt1)
19	Grid Box Azimuth	Scaled Integer	Degrees	0.0 to 359.9	.1	Identifies the location of the grid box that triggered the alert. This halfword has no meaning for a cancelled alert.
20	Grid Box Range	Scaled Integer	Nmi	0.0 to 186.0	.1	Identifies the location of the grid box that triggered the alert. This halfword has no meaning for a canceled alert.
21	Storm ID C1	Char	8-bit ASCII	A to Z, blank	N/A	First character of Storm Cell ID associated with alert, when applicable (A-Z)
21	Storm ID C2	Char	8-bit ASCII	0 to 9, blank	N/A	Second character of Storm Cell ID
22	Volume Scan Number	INT*2	N/A	1 to 80	1	Identifies the volume scan when alert was triggered
23	Volume Scan Date	INT*2	Julian Date	1 to 32767	1	Identifies the volume scan date when the alert was triggered or canceled. (Modified Julian Date: integer number of days since Jan 1970.)
24-25	Volume Scan Time	INT*4	Seconds GMT	0 to 86399	1	Identifies the volume scan when the alert was time triggered or canceled. (Number of seconds after midnight, Greenwich Mean Time (GMT).)

Figure 3-19. Alert Message (Sheet 2)

MSB	HALFWORD LSB
	MESSAGE HEADER BLOCK (see Figure 3-3)
10	BLOCK DIVIDER (-1)
11	LENGTH OF BLOCK
REPEAT FOR 12	ALERT GROUP
EACH ALERT 13	ALERT CATEGORY
CATEGORY 14	NUMBER OF ALLOWABLE THRESHOLDS
(MAX = 41) 15	THRESHOLD 1
.	.
•	•
•	•
20	THRESHOLD 6
21	PRODUCT ID

Figure 3-20. Alert Adaptation Parameters Message (Sheet 1)

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION / ACCURACY	REMARKS
10	Block Divider	INT*2	N/A	-1	N/A	Integer value of -1, used to delineate the header from the Alert Adaptation Data Parameters
11	Length of Block	INT*2	Bytes	820	1	Number of bytes to follow from -1 divider to end of block
12	Alert Group	INT*2	N/A	0 to 3	1	1 = Grid Group 2 = Volume Group 3 = Forecast Group
13	Alert Category	INT*2	N/A	0 to 41	1	Alert category number as defined by Table IV
14	Number of Allowable Thresholds	INT*2	N/A	0 to 6	1	Parameter dependent threshold code that triggers alert (refer to Table IV)
15-20	Threshold Value	INT*2	-	-	-	Parameter dependent data value corresponding to the user defined threshold code (refer to Table LVIII in 2820003, Pt1)
21	Product Code	INT*2	N/A	0, 16 to 299	1	Product Code as defined in Table III for product alert pairing, with the following exceptions: Product Code of 91 corresponds to SWR(43), SWV(44), SWW(45), and SWS(46); Product code of 92 corresponds to SWR(43), SRR(55), SWW(45), and SWS(46).

NOTE: The RPG transmits the Alert Adaptation Parameters Message upon Narrowband link connection, or if any changes are mad to either Product Alert Pairing or Alert Thresholds. Zero in range denotes spares.

Figure 3-20. Alert Adaptation Parameters Message (Sheet 2)

MSB	HALFWORD LSB	
	MESSAGE HEADER BLOCK (see Figure 3-3)	
PRODUCT LIST MESSAGE BLOCK 10	(-1) BLOCK DIVIDER	
11	LENGTH OF BLOCK	
12	NUMBER OF PRODUCTS	
13	RESERVED	
REPEAT FOR EACH PRODUCT 14	PRODUCT CODE	
15	ELEVATION	PRODUCT DEPENDENT (SEE TABLE X)
16	PARAMETER 1	
17	PARAMETER 2	
18	PARAMETER 3	
19	PARAMETER 4	
20	DISTRIBUTION CLASS	

Figure 3-21. Product List Message (Sheet 1)

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION / ACCURACY	REMARKS
10	Block Divider	INT*2	N/A	-1	N/A	Integer -1, block divider
11	Length of Block	INT*2	Bytes	4 to 8408	1	Number of bytes in block from -1 divider to end of the block.
12	Number of Products	INT*2	N/A	0 to 600	1	Number of Products on list
13	Reserved	-	-	-	-	Reserved for dial-up users
14	Product Code	INT*2	N/A	16 to 299	1	Internal NEXRAD product code from Table III
15	Elevation	Scaled Integer	Degrees	-1.0 to +45.0	.1	Elevation of product
16	Parameter 1	-	-	-	-	Product dependent (Refer to Table X)
17	Parameter 2	-	-	-	-	Product dependent (Refer to Table X)
18	Parameter 3	-	-	-	-	Product dependent (Refer to Table X)
19	Parameter 4	-	-	-	-	Product dependent (Refer to Table X)
20	Distribution Class	INT*2	N/A	0 to 20	1	Distribution class for individual products: 0 = Available for one-time product request 1 = Repeat every volume scan 2 = Repeat every other volume scan 9 9 20 = Repeat every 20th volume scan

Figure 3-21. Product List Message (Sheet 2)

Table X. Product List Message Parameter Definition

Product Name (see Note 1)	Message Code	Slice	Parameter 1 (see Note 2)	Parameter 2 (see Note 2)	Parameter 3 (see Note 2)	Parameter 4 (see Note 2)
Base Products	16-30	Elevation	N/A	N/A	N/A	N/A
User Selectable Layer Reflectivity	137	N/A	Bottom Altitude of Layer	Top Altitude of Layer	N/A	N/A
Cross Section	50, 51, 85, 86	N/A	Azimuth of Point 1	Range of Point 1	Azimuth of Point 2	Range of Point 2
Storm Relative Mean Radial Velocity Region	55	Elevation	Azimuth of Window Center	Range of Window Center	Storm Speed	Storm Direction
Storm Relative Mean Radial Velocity Map	56	Elevation	N/A	N/A	Storm Speed	Storm Direction
Velocity Azimuth Display	84	Altitude	N/A	N/A	N/A	N/A
Tornado Vortex Signature Rapid Update (TRU)	143	Elevation	N/A	N/A	N/A	N/A
User Selectable Snow Water Equivalent and User Selectable Snow Depth	150, 151	N/A	End Hour	Time Span	N/A	N/A
Differential Reflectivity	158-159	Elevation	N/A	N/A	N/A	N/A
Correlation Coefficient	160-161	Elevation	N/A	N/A	N/A	N/A
Specific Differential Phase	162-163	Elevation	N/A	N/A	N/A	N/A
Hydrometeor Classification	164-165	Elevation	N/A	N/A	N/A	N/A
Melting Layer	166	Elevation	N/A	N/A	N/A	N/A
Digital User Selectable Accumulation	173	N/A	End Time	Time Span	N/A	N/A

Note l: The units, range and accuracy/precision for the above parameters are identical to the parameters listed in Table II- -A.
Products that are completely defined by (message) product code (Slice and Parameters 1- -4 are N/A) are as follows: 32-- 41, 47, 48, 57- -75, 78-- 83 and 87-- 90.
Note 2: For Parameters 1-4, if parameter is N/A, the value is undefined.

THE RADAR CODED MESSAGE

MSB HALFWORD LSB	
MESSAGE HEADER BLOCK (see Figure 3-3)	MESSAGE CODE = 74
PRODUCT DESCRIPTION BLOCK (Figure 3-6, Sheets 2, 6, & 7)	
RADAR CODED MESSAGE HEADER (see Appendix B)	BLOCK 3,TABULAR ALPHANUMERIC BLOCK
RADAR ENCODED MESSAGE DATA BLOCK	

Figure 3-22. Radar Coded Message

MSB HALFWORD LSB	
Message Header Block (See Figure 3-3)	
Block Divider (-1)	
Block ID	
Spare	
Compression Type	
Decompressed Size (MSW)	
Decompressed Size (LSW)	
Data Packets	See Figures 3-7 through 3-15c

Field Name	Type	Units	Range	Accuracy/Precision	Remarks
Block Divider	INT*2	N/A	-1	N/A	Integer value of -1 used to delineate this block from the Message Header block
Block ID	INT*2	N/A	4	N/A	Value of 4 indicates Environmental Data from 40-km RUC Model. See Note 1.
Spare	INT*2	N/A	N/A	N/A	Spare
Compression Type	INT*2	N/A	0 to 2	1	0 = No compression, 1 = bzip2, 2 = zlib
Decompressed Size	INT*4	Bytes	0 to 2147483647	1/1	Size of decompressed data packets.

Note 1. For messages containing data from a source external to RPG (as indicated by Message Code 5 in Message Header), Block ID indicates specific type of External Data.

Figure 3-23. External Data Message

	MSB HALFWORD LSB
	Message Header Block (See Figure 3-3)
	Block Divider (-1)
	Block ID (1)
	Version Number
	Block Length
	AWIPS Site ID (MSW)
	AWIPS Site ID (LSW)
	Radar ID (MSW)
	Radar ID (LSW)
	Observation Time: Year
	Observation Time: Month
	Observation Time: Day
	Observation Time: Hour
	Observation Time: Minute
	Observation Time: Second
	Generation Time: Year
	Generation Time: Month
	Generation Time: Day
	Generation Time: Hour
	Generation Time: Minute
	Generation Time: Second
	No. Rows (in Bias Table)
	Bias Table Row n: Memory Span (MSW)
REPEAT	Bias Table Row n: Memory Span (LSW)
	Bias Table Row n: No. G-R Pairs (MSW)
FOR	Bias Table Row n: No. G-R Pairs (LSW)
	Bias Table Row n: Avg. Gage (MSW)
EACH	Bias Table Row n: Avg. Gage (LSW)
	Bias Table Row n: Avg. Radar (MSW)
ROW	Bias Table Row n: Avg. Radar (LSW)
	Bias Table Row n: Mean Field Bias (MSW)
(MEMORY SPAN)	Bias Table Row n: Mean Field Bias (LSW)

Figure 3-25. Bias Table Message (Sheet 1)

Field Name	Type	Units	Range	Acc/Prec	Remarks
Block Divider	INT*2	N/A	-1	N/A	Integer value of -1 used to delineate this block from the Message Header block
Block ID	INT*2	N/A	1	N/A	Value of 1 indicates "Bias Table" type of Environmental Data[1]
Version Number	INT*2	N/A	0 to 99	1	Initial=0, then 1, 2...
Block Length	INT*2	N/A	70 to 270	1	Length of block in bytes (from -1 divider to end of block)
AWIPS Site ID (MSW)/ AWIPS Site ID (LSW)	CHAR*4	N/A	N/A	N/A	ID of AWIPS site (RFC or WFO) which originally computed the mean field bias (leading blank +3 chars)
Radar ID (MSW) / Radar ID (LSW)	CHAR*4	N/A	N/A	N/A	ID of destination radar (leading blank +3 chars)
Observation Time: Year	INT*2	N/A	1970-2099	1	Ending date/time of Gage-Radar accum. period in Bias Table
Observation Time: Month	INT*2	N/A	1-12	1	"
Observation Time: Day	INT*2	N/A	1-31	1	"
Observation Time: Hour	INT*2	N/A	0-23	1	"
Observation Time: Minute	INT*2	N/A	0-59	1	"
Observation Time: Second	INT*2	N/A	0-59	1	"
Generation Time: Year	INT*2	N/A	1970-2099	1	Date/time of generation of Bias Table (will be later than Obs.time)
Generation Time: Month	INT*2	N/A	1-12	1	"
Generation Time: Day	INT*2	N/A	1-31	1	"
Generation Time: Hour	INT*2	N/A	0-23	1	"
Generation Time: Minute	INT*2	N/A	0-59	1	"
Generation Time: Second	INT*2	N/A	0-59	1	"
No. Rows (in Table)	INT*2	N/A	2-12	1	No. Memory Spans evaluated (default: 10)
Memory Span (MSW) / Memory Span (LSW)	Log, then Scaled Int[2]	Hours	.001 - 1. x 10**7	.001	Period of Gage-Radar Analysis
No. G-R Pairs (MSW) / No. G-R Pairs	Scaled Integer	N/A	.001 - 1. x 10**5	.001	Effective sample size (No. Gage-Radar Pairs)

(LSW)					
Avg. Gage (MSW) / Avg. Gage (LSW)	Scaled Integer	mm	0.00-254.00	.001	Avg. Hourly Gage Accum.
Avg. Radar (MSW) / Avg. Radar (LSW)	Scaled Integer	mm	0.00-254.00	.001	Avg. Hourly Radar Accum.
Bias (MSW) / Bias (LSW)	Scaled Integer	N/A	.01-100.00	.001	Mean-field Bias (Avg. Gage/Avg. Radar ratio)

1 For messages containing Environmental Data from external source to RPG (as indicated by Message Code 15 in Message Header), Message Block ID indicates specific type of Environmental Data.

2 First take (natural) logarithm, then scale by 1000.

Figure 3-25. Bias Table Message (Sheet 2)

APPENDIX A. GLOSSARY

Acronym/ Abbreviation	Description
A	Address Sequence
ABM	Asynchronous Balanced Mode
ACCUM	Accumulation
ADAPT	Adaptation
ADM	Asynchronous Disconnect Mode
ALT	Altitude
ANSI	American National Standards Institute
ARO	Asynchronous Respond Opportunity
ASCII	American Standard Code for Information Interchange
AZ	Azimuth
BA	Balanced, Asynchronous Balanced Mode (Same as ABM)
Beg	Beginning
Bit	Binary Digit
Block	A related set of bytes containing control information or data. A block is a component of a message.
bps	Bits per second
C	Control Sequence
Cal	Calibration
CALIB	Calibration
CCITT	Consultative Committee International Telephone and Telegraph
Char	Character
CKT	Circuit
CLIN	Contract Line Item Number
CM	Cubic Meters
Comp	Composite
Const	Constant
CPC	Calcomp Pen Command
CPCI	Computer Program Configuration Item
CPU	Central Processor Unit
CRC	Cyclical Redundancy Checking
dBZ	Reflectivity, in decibels
DCE	Data Circuit-Terminating Equipment
deg	Degree
Dig	Digital
Dir	Direction
DISC	Disconnect
DM	Disconnected Mode
DTE	Data Terminal Equipment
EIA	Electronic Industries Association
Err	Error
Ext	External
F or Flag	Flag Sequence
FCS	Frame Check Sequence

Flg	Flag
Frame	A segment of a bit stream bounded by a uniquely recognizable bit sequence and containing a specified number of bits or bytes of data.
FRMR	Frame Reject
GFS	General Format Specifier
GMT	Greenwich Mean Time
Halfword	Two bytes (16 bits)
Header	A set of bits or bytes contained in a bounded segment of information which provides a label or control information to the remaining contents of the segment.
Hgt	Height
Hword	Halfword (16 bits)
I	Information
I-field	Information field
I-frame	Information frame
ICD	Interface Control Document
ID	Identification
IEB	Industrial Electronics Bulletin
INT*2	One halfword of integer data in standard 2' s compliment format
INT*4	One fullword (32 bits) of integer data in standard 2's compliment format
Int	Integer
Integ	Integrated
Integer	Bit stream of 1s and 0s, represented as an integer number, not formatted in 2's compliment format (i.e., 32,768 integer code would represent setting the MSB of a halfword).
ISO	International Organization for Standardization
ITS	Information Transfer State
kg	Kilogram
km	Kilometer
kfs	Kilofeet
kts	Knots
LAPB	Link Access Procedure, Balanced
LCG	Logical Channel Group
LDS	Logically Disconnected State
LFM	Limited Fine Mesh
Liq	Liquid
LSB	Least Significant Bit
LSW	Least Significant Word
MAX	Maximum
Message	The complete set of information transported from the source to the destination. A message may be a product, product request, data, data request, or NEXRAD control information.
MSB	Most Significant Bit
Msg	Message

MSL	Mean Sea Level
MSW	Most Significant Word
N(r)	Receive sequence variable
N(s)	Send sequence variable
NMI	Nautical Mile
N/A	Not Applicable
NAVAIDS	Navigational Aids
Neg	Negative
NEXRAD	Next Generation Weather Radar
Num	Number
NTR	NEXRAD Technical Requirements
OP	Operation
OS	Operating System
OSI	Open Systems Interconnection
PDB	Product Description Block
Pos	Positive
Prec	Precipitation
Prob	Probability
Product	A collection of information that is self-contained and provides a complete representation of a graphical image or an alphanumeric message.
PUP	Principal User Processor Group
PVC	Permanent Virtual Circuit
RAD	Radial
RCM	Radar Coded Message
RDA	Radar Data Acquisition Group
Real*4	One fullword (32 bits) of real data, where the MSB is the Sign-bit, followed by a 7 bit Exponent and a 24 bit Mantissa
Reflect	Reflectivity
Reflect.Calib.Corr.	Reflectivity Calibration Correction
REJ	Reject
RES	Resolution
RFC	River Forecast Center
RGDAC	Rain Gage Data Acquisition Computer
RLE	Run Length Encoded
RMS	Root Mean Square
RNR	Receiver Not Ready
RPG	Radar Product Generation Group
RPGOP	Radar Product Generator Operational Position
RR	Receiver Ready
SABM	Set Asynchronous Balanced Mode
Scaled Integer	Integer values with an assumed decimal point whose position is defined by the precision of the item
SCN	Specification Change Notice
Sec	Second
SD	Snow Depth
sq	Square

Spd	Speed
SPR	Software Problem Report
SR	Signaling Rate Selector
SW	Spectrum Width
SWE	Snow Water Equivalent
SWP	Severe Weather Probability
TAB	Tabular
TM	Test Mode
Turb	Turbulence
TWA	Two-Way Alternate Transmission
TWS	Two-Way Simultaneous Transmission
UA	Unnumbered Acknowledgment
UCP	Unit Control Position
UI	Unnumbered Frame
VAD	Velocity Azimuth Display
Var	Variation
Vel	Velocity
VIL	Vertically Integrated Liquid
VME	Versa Module Eurocard
VMECS	Versa Module Eurocard Communication Subsystem
Wd	Width
ZBID	Zero-Bit Insertion and Deletion

APPENDIX B. RADAR CODED MESSAGE

The Radar Coded Message, as described in Item 26, Appendix E of the NTR, NEXRAD Products, will be composed of the following three parts, preceded by a communications header: Part A (Reflectivity), Part B (VAD Winds) and Part C (Remarks). In the groups below, capital letters represent the fixed part of the group, and small letters represent variables. The message will be encoded as follows:

Header

The header is encoded as follows:

cccc	Value is 1234. It is no longer the communications node (PUP site identifier).
ROBUU	The product category for unedited radar coded message.
sidd	Four-letter RDA site identifier.

Part A: Reflectivity

Part A of the Radar Coded Message (RCM) contains a tabular listing of alphanumerics. Data in the Radar Coded Message are located with respect to a polar stereographic grid. The local grid at each antenna site is designed to be a subset of the National Radar Grid so that data may be readily composited.

The National Radar Grid has a resolution of LFM (Limited Fine Mesh model) which is 47.625 km at 60 degrees north latitude. The vertical axis of the grid is parallel to the 105 degrees west longitude meridian.

At each site, a local grid is chosen having 25 rows and 25 columns, with the antenna site located within the central box. The 25 rows and columns of the grid are assigned letters A through Y, so that the box containing the antenna site is always box NM. Box AA is at the upper left. As shown in Figure D-1, each box is further subdivided to form an overall 1/16-LFM grid.

The RCM is based on the 256-level, .54 nmi x 1 degree Composite or Hybrid Scan Reflectivity product but contains only nine data level categories; six for data within 124 nmi and one for missing or below threshold data and two for data beyond 124 nmi. Hybrid Scan Reflectivity data is used for the region within 124 nmi of the radar and Composite Reflectivity data is used for the region outside of 124 nmi. For data beyond 124 nmi, a separate threshold is provided for which: (a) all data above that threshold are labeled as level eight, and (b) all data below that threshold are labeled as level nine.

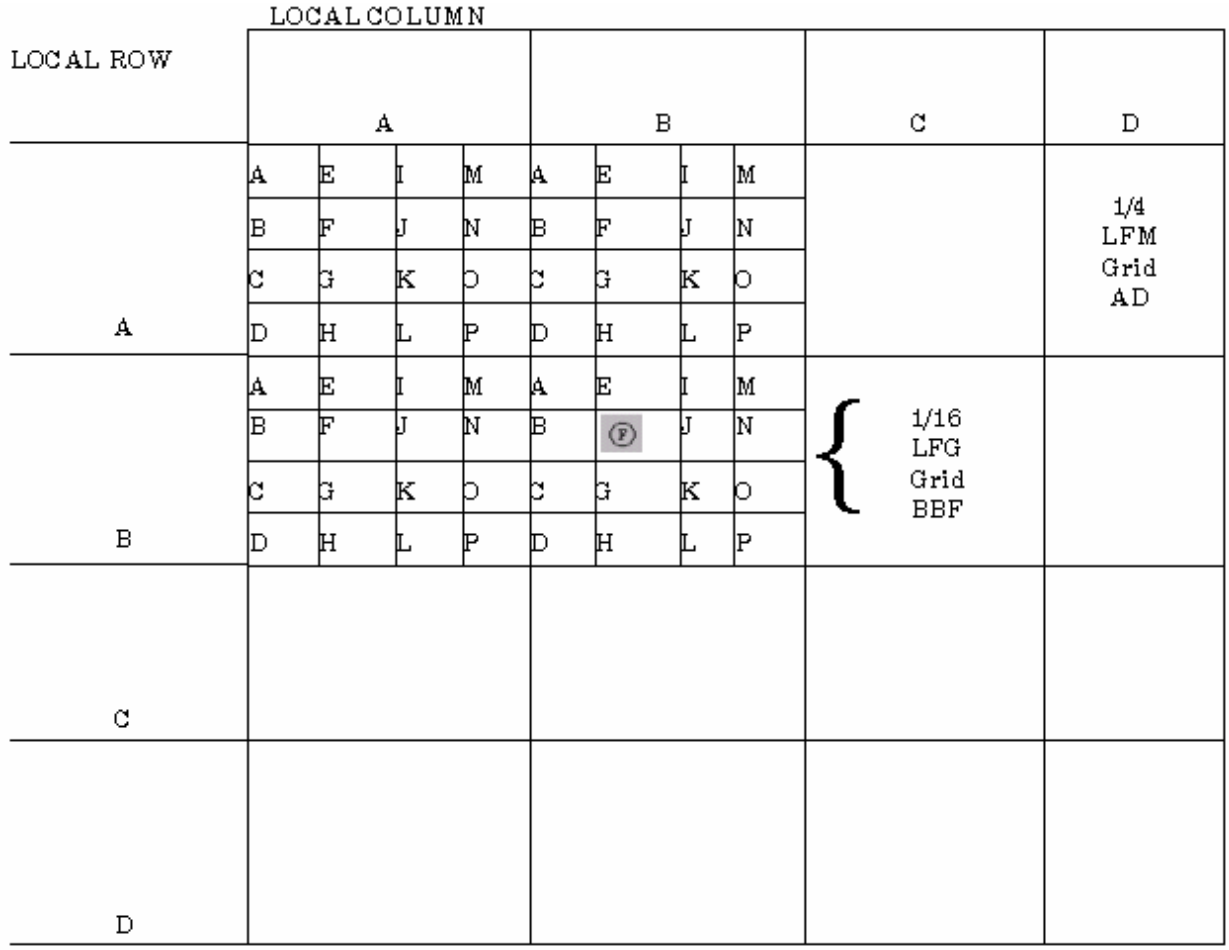

Figure B-1. 1/16 Limited Fine Mesh Model Grid

Within the tabular listing, data are provided for the maximum echo top. The height, and the position where provided, are derived from the Echo Tops product. The listing also shows the locations of the largest centroids within 124 nmi of the radar using the 1/16-LFM grid and provides the forecast centroid speed and direction, as available from the Storm Position Forecast algorithm. Part A of the message is encoded as follows:

/NEXRAA	Part A indicator.
sidd	Four letter RDA site identifier.
ddmmyytttt	The day (dd) of the month (mm), the year (yy) and the time (tttt) to the nearest minute in Greenwich Mean Time (GMT).
UNEDITED	Status of message. The "edited" version no longer exists.
RADNE	A group to encode no reportable reflectivity intensity values shall be provided; i.e., field NInnnn is zero.
RADOM	A group to encode radar down for maintenance shall be provided.
/MDnnnn	A group of six characters to encode operational mode shall be provided. See Appendix I of the NTR. Choices are PCPN and CLAR. (Example: /MDPCPN)
/SCnnnn	A group of six characters to encode scan strategy shall be provided. Refer to Appendix I of NTR. Choices are 1405 (14 scans in 5 minutes), 0906, 0510,

	1404, 0907, etc. (Example: /SC1405)
/NInnnn:	The total number (nnnn) of intensities (NI) reported in the following field (gggi) shall be encoded. (Example: /NI0144:)
gggi	Reflectivity intensity shall be mapped onto the 1/16 LFM grid. Encode locations and intensities by a series of groups made up of three letters (1/16 LFM followed by the maximum intensity of the designated grid box). The three letters (in order) shall be row, column, and sub-grid. The numbers following represent intensities in succeeding sub-grid boxes in that row; that is, encode each 1/16 LFM grid box from west to east, starting with the northern-most row with data, followed by the next southern row, etc. In the interest of compacting the message, successive intensities of different or similar values may be listed after a single location as long as the intensities are continuous. When succeeding sub-grid boxes contain the same intensity value, the number of succeeding boxes with the same value may be designated by a letter of the alphabet; that is, if four succeeding 1/16 LFM grid boxes (a total of five boxes) are at level 2, they could be coded as GGG2D. The "2D" may also be followed by different intensity values. Location/intensity groups shall be separated by a comma. (Example: ABF112D33l, BCA1211)
/MThhh:ggg	The location and height (MSL) of the maximum echo top (MT) within 230 km radius of the radar shall be encoded using the three-letter grid designator (ggg) and assigning the height coinciding with echo top product in hundreds of feet (hhh). (Example: /MT320:NLB)
/NCENnn:	The total number (nn) of centroids (NCEN) reported in this portion of the message shall be encoded. This number shall correspond to the corrected centroids below. (Example: /NCEN04:)
Cnnggg dddfff	The centroid (C) number (nn), location (grid box) (ggg), direction from which it is moving (in 1-degree increments) (ddd), and its speed (fff) in knots, shall be encoded. Successive groups shall be separated by commas. If, during editing, data are deleted in a grid box that contains a centroid, this group shall be corrected by deleting this centroid. (Example: C03QMB240012)
/ENDAA(C/R)	A group to indicate the end of Part A.

The following is a summary example of the components of Part A:

/NEXRAA sidd ddmmyytttt UNEDITED
/MDnnnn /SCnnnn /NInnnn:
gggiii. . .i,gggiii...1
/MThhh:ggg
/NCENnn: Cnnggg dddfff, Cnnggg dddfff
/ENDAA

Part B: VAD Winds

Part B of the RCM contains a single profile of the horizontal wind information derived from the output of the VAD algorithm. Part B of the message is encoded as follows:

/NEXRBB	Part B indicator.
sidd	Four letter RDA site identifier.
ddmmyytttt	The day (dd) of the month (mm), the year (yy), and the time (tttt), to the nearest minute, in GMT.
VADNA	The optional entry VADNA shall be encoded for instances when no VAD wind data available for the last 15 minutes, if appropriate.
hhhcdddfff	Coded heights (hhh) in hundreds of feet MSL; confidence 3 level, using RMS for the coded height; wind direction (ddd) and wind speed (fff), in knots,

	shall coincide with those derived from the VAD Winds product. The confidence level shall be encoded as a single letter in accordance with the following:
	A = RMS of 2 kts; B = RMS of 4 kts; C = RMS of 6 kts; D = RMS of 8 kts; E = RMS of 10 kts; F = RMS of 12 kts; G = RMS of greater than or equal to 14 kts.

Wind direction and speed, as output from the VAD Algorithm, shall be reported at up to 19 heights, in feet MSL. Default heights are:

1,000	6,000	12,000	25,000
2,000	7,000	14,000	30,000
3,000	8,000	16,000	35,000
4,000	9,000	18,000	50,000
5,000	10,000	20,000	

(Example: 080C240060)

/ENDBB (C/R) End of Part B indicator.

The following is a summary example of the components of Part B:

/NEXRBB sidd 2812881330 (C/R)
hhhcdddfff ,hhhcdddfff ,hhhcdddfff
/ENDBB (C/R)

Part C: Remarks

Part C of the Radar Coded Message contains remarks in an alphanumeric format. Automatically generated remarks provide information on the locations of tornadic vortex signatures, mesocyclones, centroids, storm tops and hail indices. Part C is encoded as follows:

/NEXRCC	Part C indicator.
sidd	Four letter RDA site identifier.
ddmmyytttt	The day (dd) of the month (mm), the year (yy) and the time (tttt) to the nearest minute in GMT.
/NTVSnn:	The total number (nn) of Tornado Vortex Signatures (NTVS) detected by the TVS algorithm and reported in Part C shall be encoded (Example: /NTVSO3:).
TVSnnggg	The location (ggg) and number identifier (nn) of each Tornado Vortex Signature (TVS) shall be encoded using the three-letter grid box designator (Example: TVS02NLB).
/NMESnn:	The total number (nn) of mesocyclones that meet or exceed the Minimum Display Filter Strength Rank threshold (default = strength rank 5) detected by the Mesocyclone Detection algorithm and reported in Part C shall be encoded (Example: /NMESO02:).
Mrrggg:	The location (ggg) and strength rank (rr) of each mesocyclone that meets or exceeds the Minimum Display Filter Strength Rank threshold (M) shall be encoded using the three-letter grid box designator (Example: M05JLC).
/NCENnn:	The total number (nn) of centroids (NCEN) reported in Part C shall be encoded (Example: /NCENO8:).
Cnnggg ShhhHi	The height (hhh) in hundreds of feet (Above Ground Level - AGL), of the storm top(s), as derived from the Storm Cell Centroids algorithm, for each centroid identified in Part A to include location (ggg) shall be encoded. The centroid identifier number (nn) is the same as given in Part A. The hail (H) index (I), as provided by the Hail algorithm, is also given as one of the four following data levels:

	N - no hail (Probability of Severe Hail(POSH) = <30% P - possible or probable hail (50%>POSH>=30% H - hail (POSH >= 50% U - unknown (Example: C04QQD S440HP).

The following is a summary example of the components of Part C:

/NEXRCC sidd 2812881330 (C/R)
/NTVSnn: TVSnnggg,TVSnnggg,TVSnnggg
/NMESnn: Mnnggg,Mnnggg,Mnnggg
/NCENnn: Cnnggg ShhhHi,Cnnggg ShhhHi,Cnnggg ShhhHi
/UNEDITED:int

APPENDIX C. DATA TRANSMISSION CHARACTERISTICS

Table XI. Application Data Sizes

Typical Maximum Application Data Size Estimates (Note 1)		
Product Code	**Mnemonic**	**Message Size All VCPs**
0	Prod. Req.	For RPS list =.05 x # of prod on list. For OTR = .05
2	GSM	.124
3	Request Resp.	.048
4	Max. Connect	.028
6	Alert Adapt.	.064
7	Alert Req.	.550
8	Prod. List	.026 + (.014 x # of prod on list)
9	Alert	.05
11	Sign On	.036
12	Request PUP Status	.018
13	Prod. Req. Cancel	.05
14	PUP Status	.1
NOTE 1: All product sizes are estimated maximum based on Build 4.0 testing and sizes are given in Kilobytes where (1 Kilobyte = 1024 bytes).		

Table XII. VCP 11 Product Size

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
16	R	0.5	18968	19340	19170	19200
16	R	1.5	17342	18026	17647	17649
16	R	2.4	16528	17084	16819	16897
16	R	3.4	14894	15594	15332	15304
16	R	4.3	13668	14436	14029	14024
17	R	0.5	16170	16510	16358	16400
17	R	1.5	14046	14814	14408	14388
17	R	2.4	12550	13052	12833	12884
17	R	3.4	10882	11486	11241	11266
18	R	0.5	10756	11150	10958	10940
18	R	1.5	9636	10130	9873	9844
18	R	2.4	8504	8988	8765	8810
18	R	3.4	7706	8220	7990	8016
19	R	0.5	29130	29864	29634	29674
19	R	1.5	27240	29048	28066	27862
19	R	2.4	25510	26980	26197	26036
19	R	3.4	22830	24200	23443	23538
19	R	4.3	19546	22420	20802	20416
20	R	0.5	22650	22938	22772	22744
20	R	1.5	19974	21018	20413	20310
20	R	2.4	17486	18278	17880	17842
20	R	3.4	15136	16042	15571	15566
21	R	0.5	14166	14360	14238	14211
21	R	1.5	12828	13196	12987	12977
21	R	2.4	11300	11580	11456	11474
21	R	3.4	10218	10572	10371	10348
22	V	0.5	19348	22158	21053	21173
22	V	1.5	13556	14220	13881	13858
22	V	2.4	12236	12938	12441	12370
22	V	3.4	11672	12302	11970	11948
23	V	0.5	17582	19530	18723	18786
23	V	1.5	13310	13920	13651	13663
23	V	2.4	12524	13038	12720	12684
23	V	3.4	12186	12568	12305	12278
24	V	0.5	16208	17562	17019	17222
24	V	1.5	13210	13660	13438	13448
24	V	2.4	12830	13630	13198	13114
24	V	3.4	12040	12660	12373	12474
24	V	4.3	11440	11700	11601	11612
25	V	0.5	24624	26006	25339	25558
25	V	1.5	17368	19570	18630	18798

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
25	V	2.4	17388	18582	17913	17730
25	V	3.4	16586	17406	16991	16990
25	V	4.3	15680	16696	16186	16146
26	V	0.5	23160	24180	23809	23897
26	V	1.5	17974	20228	19162	19227
26	V	2.4	18670	19896	19292	19328
26	V	3.4	18110	19006	18522	18344
27	V	0.5	20532	21612	21206	21278
27	V	1.5	17980	19294	18483	18420
27	V	2.4	18614	18960	18733	18636
27	V	3.4	17122	17606	17376	17450
27	V	4.3	15862	16240	16011	15946
28	SW	0.5	34794	36780	36112	36486
28	SW	1.5	27902	30820	29331	29444
28	SW	2.4	26578	30824	29083	29582
28	SW	3.4	26538	29228	28146	28614
29	SW	0.5	32464	33820	33199	33173
29	SW	1.5	28452	30564	29706	29690
29	SW	2.4	28704	31362	30148	30408
29	SW	3.4	27994	30068	29170	29482
30	SW	0.5	26132	27070	26640	26764
30	SW	1.5	24322	25108	24749	24892
30	SW	2.4	24882	25422	25186	25146
30	SW	3.4	23496	24122	23784	23832
30	SW	4.3	20960	22640	21958	22024
31	USP		280	280	280	280
32	DHR		40046	43286	41685	41738
33	HSR		27466	28324	28044	28094
35	CR		31862	32846	32288	32285
36	CR		11060	11286	11176	11177
37	CR		43324	44956	43854	43572
38	CR		12542	12792	12648	12664
41	ET		3180	3334	3243	3244
48	VWP		11532	11938	11820	11864
50	RCS		636	1944	1300	1329
51	VCS		1326	2004	1525	1370
55	SRR		1680	2112	1892	1889
56	SRM	0.5	18812	20544	19704	19787
56	SRM	1.5	17138	18590	17925	18060
56	SRM	2.4	16710	19224	18012	18093
56	SRM	3.4	15768	18390	16967	16722
56	SRM	4.3	14690	17126	15910	15708
57	VIL		2392	2504	2443	2444
58	STI		11078	18642	15575	15956
59	HI		11676	12026	11831	11826
60	M		3626	4928	4371	4452

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
61	TVS		3028	3428	3178	3178
62	SS		12696	17176	14948	14914
63	LRA		3000	3192	3086	3090
64	LRA		3052	3288	3165	3152
65	LRM		3234	3424	3305	3281
66	LRM		2932	3002	2955	2948
67	APR		3030	3214	3122	3096
73	UAM		782	5380	2061	1438
74	RCM		2710	2780	2760	2780
78	OHP		5734	12696	11233	11988
79	THP		12278	12278	12278	12278
80	STP		17486	18112	17782	17746
81	DPA		2592	10984	8012	8538
82	SPD		2834	2834	2834	2834
84	VAD		3828	6702	5914	6176
89	LRA		2236	2386	2315	2308
90	LRM		3004	3086	3055	3050
93	DBV	0.5	44558	44558	44558	44558
93	DBV	1.5	44558	44558	44558	44558
93	DBV	2.4	44558	44558	44558	44558
93	DBV	3.4	36650	36650	36650	36650
93	DBV	4.3	29270	29350	29327	29350
94	DR	0.5	45422	49361	47540	47424
94	DR	1.5	41268	45532	43257	43074
94	DR	2.4	34849	38184	36276	36106
94	DR	3.4	29339	34208	31659	31529
94	DR	4.3	24316	30184	27288	27518
95	CRE		24032	28696	27745	28246
96	CRE		6574	11118	10340	10938
97	CRE		31520	36152	34731	35074
98	CRE		7946	12504	11700	12284
99	DV	0.5	84409	94614	87733	87238
99	DV	1.5	79320	86532	81680	80620
99	DV	2.4	77767	87576	81842	81522
99	DV	3.4	74043	85500	78812	78969
99	DV	4.3	64770	79918	72260	73260
132	CLR	0.5	38626	40314	39584	39568
132	CLR	1.5	39252	40008	39594	39596
132	CLR	2.4	33556	34138	33871	33836
132	CLR	3.4	29284	30054	29717	29872
132	CLR	4.3	24890	27272	26082	25944
133	CLD	0.5	31492	32390	31928	32074
133	CLD	1.5	30546	31892	31424	31416
133	CLD	2.4	29900	31218	30582	30604
133	CLD	3.4	29400	30902	30141	30194
133	CLD	4.3	26886	29438	28336	28240

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
134	DVL		46993	47780	47439	47437
135	EET		24167	24855	24543	24523
136	SO		126736	138016	132376	132376
137	ULR		15140	23998	19750	19720
138	DSP		44676	44676	44676	44676
139	MRU	0.5	1320	5030	3559	3786
139	MRU	1.5	2834	5122	3912	4076
139	MRU	2.4	2846	5204	4040	4146
139	MRU	3.4	2916	5214	4221	4228
139	MRU	4.3	2950	5628	4346	4240
139	MRU	5.3	2950	5708	4352	4272
139	MRU	6.2	2950	5708	4430	4782
139	MRU	7.5	2950	5730	4467	4826
139	MRU	8.7	2950	5730	4495	4848
139	MRU	10.0	2950	5730	4500	4848
139	MRU	12.0	2950	5730	4501	4848
139	MRU	14.0	2950	5730	4501	4848
139	MRU	16.7	2950	5730	4501	4848
139	MRU	19.5	2094	4816	3601	3786
141	MD		120	3120	2030	2022
143	TRU	0.5	120	1870	1438	1558
143	TRU	1.5	120	1870	1438	1558
143	TRU	2.4	120	1870	1528	1558
143	TRU	3.4	120	1870	1549	1662
143	TRU	4.3	120	1870	1552	1662
143	TRU	5.3	120	1870	1552	1662
143	TRU	6.2	120	1870	1552	1662
143	TRU	7.5	120	1870	1552	1662
143	TRU	8.7	120	1870	1552	1662
143	TRU	10.0	120	1870	1552	1662
143	TRU	12.0	120	1870	1552	1662
143	TRU	14.0	120	1870	1552	1662
143	TRU	16.7	120	1870	1552	1662
143	TRU	19.5	120	1870	1438	1558
144	OSW		2836	30442	21748	29077
145	OSD		2836	28706	20813	27721
146	SSW		15496	22940	19808	20308
147	SSD		15538	20266	18197	18516
149	DMD	0.5	3103	4417	3659	3607
149	DMD	1.5	3354	4798	4153	4201
149	DMD	2.4	4081	5830	4970	4986
149	DMD	3.4	4338	6524	5439	5426
149	DMD	4.3	4605	6869	5646	5650
149	DMD	5.3	4665	7169	5888	5879
149	DMD	6.2	4674	7450	6076	6190
149	DMD	7.5	4656	7671	6209	6295

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
149	DMD	8.7	4658	7859	6287	6470
149	DMD	10.0	4675	7851	6363	6573
149	DMD	12.0	4918	7997	6417	6690
149	DMD	14.0	4900	7982	6464	6740
149	DMD	16.7	4869	8169	6496	6746
149	DMD	19.5	4935	8155	6478	6622
150	USW		3082	3082	3082	3082
151	USD		3082	3082	3082	3082

Table XIII. VCP 12 Product Size

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
16	R	0.5	14334	17910	16264	16475
16	R	0.9	12086	17910	15164	15242
16	R	1.3	10036	16314	12527	12003
16	R	1.8	9904	11094	10610	10820
17	R	0.5	12746	13846	13257	13302
17	R	0.9	11158	13846	12623	12826
17	R	1.3	9704	13090	11247	11182
17	R	1.8	8776	9960	9409	9490
18	R	0.5	8158	8710	8589	8617
18	R	0.9	7122	8710	8143	8027
18	R	1.3	6534	7896	7398	7516
18	R	1.8	6158	6978	6571	6554
18	R	2.4	5754	6426	6098	6066
19	R	0.5	16950	22954	20172	20489
19	R	0.9	13654	22954	18257	18199
19	R	1.3	11152	18940	14268	13337
19	R	1.8	10978	12204	11746	11844
19	R	2.4	11196	12550	11881	12006
20	R	0.5	14472	17398	15874	15848
20	R	0.9	12400	17398	14774	14779
20	R	1.3	10360	15132	12450	12124
20	R	1.8	9404	10552	10081	10192
20	R	2.4	8934	10070	9551	9758
21	R	0.5	9486	10838	10085	10049
21	R	0.9	8308	10838	9439	9412
21	R	1.3	6890	9338	8164	8151
21	R	1.8	6518	7328	6966	6998
22	V	0.5	28006	35776	29280	28917
22	V	0.9	18934	35776	25629	28025
22	V	1.3	16914	28270	20763	21068
22	V	1.8	17074	20626	19317	19692
23	V	0.5	23410	32676	25994	25384
23	V	0.9	16638	32676	22893	23487

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
23	V	1.3	15430	24450	18582	18384
23	V	1.8	15100	17278	16412	16484
24	V	0.5	17936	22346	19335	18902
24	V	0.9	13856	22346	17552	17936
24	V	1.3	13508	17746	15273	15309
24	V	1.8	13372	14898	14263	14382
25	V	0.5	32152	34528	33610	33762
25	V	0.9	23996	34528	30744	31027
25	V	1.3	21398	29902	26948	28221
25	V	1.8	20028	28042	25449	26298
26	V	0.5	27238	31100	29223	29247
26	V	0.9	20308	31100	26517	26848
26	V	1.3	18754	26458	22823	23413
26	V	1.8	17014	22482	20598	21048
27	V	0.5	20340	22658	21313	21271
27	V	0.9	16258	22658	19749	20340
27	V	1.3	15814	19796	17901	18246
27	V	1.8	14758	18038	16853	17146
28	SW	0.5	41934	45846	43111	42965
28	SW	0.9	33398	45846	39751	41463
28	SW	1.3	27394	40992	34293	34691
28	SW	1.8	26558	35890	30736	31534
29	SW	0.5	33158	42384	36340	36009
29	SW	0.9	26630	42384	32991	33368
29	SW	1.3	23024	34350	27821	27829
29	SW	1.8	21692	27626	24309	24820
30	SW	0.5	23708	27834	25188	25017
30	SW	0.9	19952	27834	23347	23808
30	SW	1.3	18374	24248	20763	20842
30	SW	1.8	17526	20768	19051	19382
31	USP		280	376	283	280
32	DHR		85716	85716	85716	85716
33	HSR		12012	17660	15034	15320
35	CR		25204	28052	26587	26688
36	CR		7570	9584	8863	8891
37	CR		29696	33646	31438	31530
38	CR		8298	10276	9526	9655
41	ET		1866	1998	1936	1936
48	VWP		5578	11200	9097	9436
56	SRM	0.5	19522	22448	20705	20438
56	SRM	0.9	16556	22448	19376	19588
56	SRM	1.3	15882	19588	17656	17626
56	SRM	1.8	14678	17892	16566	16774
57	VIL		1506	1684	1583	1573
58	STI		4550	10940	8981	9309
59	HI		5594	8914	7386	6942

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
60	M		3400	5450	4342	4205
61	TVS		2112	2928	2384	2112
62	SS		5758	9850	8355	8302
63	LRA		1744	1850	1789	1784
64	LRA		1684	1836	1755	1747
65	LRM		2544	2992	2751	2738
66	LRM		1970	2150	2083	2092
67	APR		2196	2506	2338	2343
74	RCM		1800	2010	1919	1940
78	OHP		5734	11064	8020	5734
79	THP		5816	5816	5816	5816
80	STP		8940	10490	9750	9794
81	DPA		2592	8316	5036	2592
82	SPD		2834	2834	2834	2834
84	VAD		6444	7070	6759	6742
89	LRA		1524	1648	1589	1591
90	LRM		1810	1994	1921	1934
93	DBV	0.5	43582	44070	43948	43948
93	DBV	0.9	43582	44070	43950	43948
93	DBV	1.3	42362	44070	43624	43460
93	DBV	1.8	42606	44070	43830	43948
93	DBV	2.4	43704	44314	43840	43826
94	DR	0.5	168376	168376	168376	168376
94	DR	0.9	167910	168376	168367	168376
94	DR	1.3	148238	168376	160095	167910
94	DR	1.8	133782	138390	137637	138006
95	CRE		21324	23260	22464	22470
96	CRE		7176	9248	8437	8426
97	CRE		23576	25416	24651	24709
98	CRE		7696	9786	8944	8933
99	DV	0.5	329806	333510	332584	332584
99	DV	0.9	329806	333510	332601	332584
99	DV	1.3	320546	333510	330126	328880
99	DV	1.8	322398	333510	331695	332584
132	CLR	0.5	27318	32188	29678	29818
132	CLR	0.9	25394	32188	28400	28330
132	CLR	1.3	20480	29256	24734	24823
132	CLR	1.8	19978	22830	21673	21972
133	CLD	0.5	26450	30698	28209	28172
133	CLD	0.9	23532	30698	26660	26490
133	CLD	1.3	21860	27762	24314	24223
133	CLD	1.8	21214	24406	22660	23022
134	DVL		10149	16880	13274	12788
135	EET		11061	12394	11968	12042
136	SO		42247	114620	78433	78433
137	ULR		17190	21468	20033	20220

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
138	DSP		44676	44676	44676	44676
139	MRU	0.5	120	3622	2501	2858
139	MRU	0.9	120	3704	2565	2863
139	MRU	1.3	828	3786	2686	2868
139	MRU	1.8	992	3786	2797	2898
139	MRU	2.4	992	3848	2884	2950
139	MRU	3.1	992	3900	3040	3152
139	MRU	4.0	992	4052	3162	3266
139	MRU	5.1	1982	4086	3326	3522
139	MRU	6.4	1982	4168	3343	3535
139	MRU	8.0	1982	4172	3395	3618
139	MRU	10.0	1982	4172	3396	3618
139	MRU	12.5	1982	4172	3396	3618
139	MRU	15.6	1982	4172	3396	3618
139	MRU	19.5	1816	3970	2834	2908
141	MD		136	1890	1347	1562
143	TRU	0.5	120	1454	564	120
143	TRU	0.9	120	1454	564	120
143	TRU	1.3	120	1454	564	120
143	TRU	1.8	120	1454	581	120
143	TRU	2.4	120	1558	688	120
143	TRU	3.1	120	1558	739	120
143	TRU	4.0	120	1558	764	120
143	TRU	5.1	120	1558	846	1454
143	TRU	6.4	120	1558	846	1454
143	TRU	8.0	120	1558	846	1454
143	TRU	10.0	120	1558	846	1454
143	TRU	12.5	120	1558	846	1454
143	TRU	15.6	120	1558	846	1454
143	TRU	19.5	120	1454	564	120
144	OSW					
145	OSD					
146	SSW					
147	SSD					
150	USW					
151	USD					

Table XIV. VCP 121 Product Size

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
16	R	0.5	19000	21078	20347	20572
16	R	1.5	14868	16966	15787	15794
16	R	2.4	13812	15806	14530	14246
16	R	3.3	12804	14232	13271	13108
16	R	4.3	11138	12576	11524	11286
17	R	0.5	16200	17862	17235	17352
17	R	1.5	12102	13690	12716	12680
17	R	2.4	10562	11946	10983	10782
17	R	3.3	9130	10046	9439	9329
18	R	0.5	10828	11984	11454	11454
18	R	1.5	8068	9328	8568	8452
18	R	2.4	7136	8242	7527	7399
18	R	3.3	6430	7320	6743	6647
19	R	0.5	29606	31364	30437	30389
19	R	1.5	21412	25180	22656	22456
19	R	2.4	19350	22626	20322	20175
19	R	3.3	16830	19332	17704	17587
19	R	4.3	14052	16238	14678	14629
20	R	0.5	22930	24272	23478	23474
20	R	1.5	15986	18486	16671	16483
20	R	2.4	13674	15722	14248	14137
20	R	3.3	11522	13078	12087	12047
21	R	0.5	14824	15526	15137	15084
21	R	1.5	10556	12000	11076	10964
21	R	2.4	9042	10424	9481	9292
21	R	3.3	7944	8986	8345	8257
22	V	0.5	35428	37400	36741	36966
22	V	1.5	37930	43412	41496	42378
22	V	2.4	37478	44076	41640	42316
22	V	3.3	32110	36538	35167	35647
23	V	0.5	33194	36608	35389	35834
23	V	1.5	34302	38874	37267	38014
23	V	2.4	29684	32268	31129	31358
23	V	3.3	26036	27300	26792	26867
24	V	0.5	28486	34022	31882	32096
24	V	1.5	27138	29298	28559	28720
24	V	2.4	23584	25044	24418	24454
24	V	3.3	20454	21392	20844	20786
25	V	0.5	30218	34504	32270	32626
25	V	1.5	33698	37098	35396	35306
25	V	2.4	34930	39890	37855	37850
25	V	3.3	29874	33892	32511	32666
25	V	4.3	22224	24418	23863	24024
26	V	0.5	31330	32690	32244	32338
26	V	1.5	30868	33680	32468	32778

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
26	V	2.4	27166	29544	28513	28664
26	V	3.3	23366	25192	24494	24638
27	V	0.5	26180	28324	27324	27475
27	V	1.5	23322	25192	24500	24458
27	V	2.4	21488	22894	22110	22108
27	V	3.3	18848	19862	19283	19269
27	V	4.3	15842	16316	16062	16045
28	SW	0.5	47334	49068	48380	48566
28	SW	1.5	50052	51760	51040	51091
28	SW	2.4	46296	50662	49232	49494
28	SW	3.3	39916	42890	41781	41834
29	SW	0.5	46510	48272	47474	47544
29	SW	1.5	42784	44180	43440	43484
29	SW	2.4	35054	36218	35478	35366
29	SW	3.3	29676	30994	30313	30309
30	SW	0.5	37188	39302	38642	38798
30	SW	1.5	31842	32788	32388	32395
30	SW	2.4	26792	28284	27515	27404
30	SW	3.3	22624	24240	23223	23060
31	USP		280	10268	2390	424
32	DHR		85716	85716	85716	85716
33	HSR		28506	30548	29206	29218
35	CR		35338	40224	39068	39712
36	CR		8064	12580	12136	12482
37	CR		50212	55822	54019	54448
38	CR		10296	14968	14547	14644
41	ET		2744	3274	2933	2857
42	M		2112	2798	2472	2552
48	VWP		9218	10388	9516	9453
50	RCS		636	1614	1121	1179
51	VCS		1132	1594	1303	1221
55	SRR		2122	2796	2443	2369
56	SRM	0.5	24536	30380	28649	28911
56	SRM	1.5	22184	26874	26167	26348
56	SRM	2.4	20340	23852	23072	23167
56	SRM	3.3	17870	20710	19572	19626
56	SRM	4.3	15208	17222	16324	16343
57	VIL		2128	2608	2278	2208
58	STI		10438	18062	14424	14080
59	HI		10962	11700	11231	11204
61	TVS		2112	2112	2112	2112
62	SS		10840	16580	13560	13416
63	LRA		3228	3476	3329	3334
64	LRA		2574	2786	2671	2678
65	LRM		3924	4564	4191	4107
66	LRM		2684	3154	2926	2930

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
67	APR		3792	4348	4030	3975
73	UAM		782	4066	975	975
74	RCM		2990	3200	3057	3060
78	OHP		5734	13600	12359	12629
79	THP		5816	12278	8476	10122
80	STP		15394	17308	16478	16486
81	DPA		2592	14418	11339	12628
82	SPD		2834	2834	2834	2834
84	VAD		1948	6924	5265	6616
89	LRA		1860	1980	1925	1906
90	LRM		2312	2434	2379	2383
93	DBV	0.5	43338	43338	43338	43338
93	DBV	1.5	43338	43338	43338	43338
93	DBV	2.4	43338	43338	43338	43338
93	DBV	3.3	36462	36462	36462	36462
93	DBV	4.3	28710	28710	28710	28710
94	DR	0.5	166046	166046	166046	166046
94	DR	1.5	146110	146520	146141	146110
94	DR	2.4	120510	120510	120510	120510
94	DR	3.3	101966	101966	101966	101966
94	DR	4.3	85830	85830	85830	85830
95	CRE		29602	34454	33637	33930
96	CRE		7762	12250	11819	12158
97	CRE		38892	44804	43287	43392
98	CRE		9740	14418	13898	14210
99	DV	0.5	327954	327954	327954	327954
99	DV	1.5	327954	327954	327954	327954
99	DV	2.4	327954	327954	327954	327954
99	DV	3.3	329806	329806	329806	329806
99	DV	4.3	330732	330732	330732	330732
132	CLR	0.5	38556	39948	39126	39031
132	CLR	1.5	33508	35584	34302	34254
132	CLR	2.4	28910	31358	29713	29489
132	CLR	3.3	25222	27538	25898	25674
133	CLD	0.5	40872	42364	41705	41718
133	CLD	1.5	36092	37724	36993	37047
133	CLD	2.4	31362	33842	32195	31942
133	CLD	3.3	27052	29594	27671	27296
134	DVL		37074	43265	38816	37963
135	EET		25329	28548	26031	25667
136	SO		30561	67536	53762	63190
137	ULR		14198	27482	19552	18898
138	DSP		44676	44676	44676	44676
139	MRU	0.5	120	1402	980	1156
139	MRU	1.5	120	1402	1014	1156
139	MRU	2.4	120	2224	1227	1279

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
139	MRU	3.3	120	2224	1234	1279
139	MRU	4.3	120	2224	1256	1279
139	MRU	6.0	120	2224	1268	1320
139	MRU	9.9	120	2224	1268	1320
139	MRU	14.6	120	2224	1268	1320
139	MRU	19.5	120	1402	1008	1156
141	MD		136	136	136	136
143	TRU	0.5	120	1454	171	120
143	TRU	1.5	120	1454	171	120
143	TRU	2.4	120	1454	171	120
143	TRU	3.3	120	1454	171	120
143	TRU	4.3	120	1454	171	120
143	TRU	6.0	120	1454	171	120
143	TRU	9.9	120	1454	171	120
143	TRU	14.6	120	1454	171	120
143	TRU	19.5	120	120	120	120
144	OSW					
145	OSD					
146	SSW					
147	SSD					
150	USW					
151	USD					
152	ASP		TBD	TBD	TBD	TBD

Table XV. X-25 Bandwidth Estimation for an Example Class 1 User RPS List (See Note 1)

Product Code	Product Name	Elevation	Estimated Size (bytes)	With X.25 Overhead (Note 2)	Total	With Satcom X.25 Overhead (Note 3)	Satcom Total
2	GSM		124	8	132	8	132
19	R	.5	29250	1832	31082	784	30034
19	R	1.5	29250	1832	31082	784	30034
19	R	2.4	29250	1832	31082	784	30034
19	R	3.4	29250	1832	31082	784	30034
26	V	.5	24250	1520	25770	704	24954
27	V	1.5	21750	1360	23110	664	22414
27	V	3.4	21750	1360	23110	664	22414
27	V	6.2	21750	1360	23110	664	22414
27	V		21750	1360	23110	664	22414
33	HSR		28250	1768	30018	768	29018
37	CR		45250	2832	48082	1352	46602
56	SRM	.5	20750	1304	22054	648	21398
56	SRM	1.5	20750	1304	22054	648	21398
56	SRM	2.4	20750	1304	22054	648	21398
56	SRM	3.4	20750	1304	22054	648	21398
56	SRM	4.3	20750	1304	22054	648	21398
56	SRM	7.5	20750	1304	22054	648	21398
57	VIL		2750	176	2926	48	2798
58	STI		19500	1224	20724	472	19972
59	HI		11750	736	12486	344	12094
60	M		5750	360	6110	96	5846
Total Bytes Transferred per 5 Minute Scan					495872	-	
Total Bits Transferred in 300 Second Scan					3966976	-	
Bandwidth Required in Bits per second (bps)					13223.25	-	
Total Bytes Transferred per 5 Minute Scan							480104
Total Bits Transferred in 300 Second Scan							3840832
Bandwidth Required in Bits per second (bps)							12802.77

Note 1: Assumption is VCP 11, which uses a 5 minute (300 sec) scan strategy. This example calculation would be typical of estimating bandwidth for a Class 1 user. The Class 1 user has a dedicated connection and should send a Routine Product Set (RPS) list request dependent upon VCP or precipitation detection. This example does not account for the initial connection data exchanges, e.g. Product codes 6, 7, and 8 or Class 1 (e.g. PUP) status exchanges. Nor does the example include overhead attributed to protocol acknowledgements.

Note 2: If product size is < 10240 bytes, then data packet overhead is calculated as follows:

Let P = Product Size, X.25/LAPB/Flag Overhead = 8 bytes

[dividend of (P ÷ 128) + 1] x 8 bytes

If product size is > 10240 bytes or multiple of 10240 bytes, then data packet overhead is calculated:

80 x [dividend of (P ÷ 10240)] x [((Remainder of (P ÷10240)) ÷ 128) + 1] x 8 bytes

Note 3: If product size is < 10240 bytes, then data packet overhead is calculated as follows:

Let P = Product Size, X.25/LAPB/Flag Overhead = 8 bytes

[dividend of (P ÷ 512) + 1] x 8 bytes

If product size is > 10240 bytes or multiple of 10240 bytes, then data packet overhead is calculated:

40 x [dividend of (P ÷ 10240)] x [((Remainder of (P ÷ 10240)) ÷ 512) + 1] x 8 bytes

Bandwidth Estimation Example

The estimated transfer rates for an example Class 1 user RPS list are tabulated below. The estimates only include routine products and not additional one time request (OTR). As indicated in Note 1, this example is for the worse case coverage pattern. VCP 11 is a 14 elevation scan strategy completed in 5 minutes (300 seconds). Omitted in estimates is the additional payload of protocol acknowledgements. The estimate does include calculation for both the default NEXRAD X.25 configuration of 128 byte data packets and the communications option packet size of 512 bytes for each data packet. Reference section 7.1 Ten Kilobyte Segmentation of 2620040, ICD for RPG X.25 Protocol for more detail on the 10240 byte product segmentation. The X.25/LAPB overhead consists of: 3 bytes for X.25 + 4 bytes for LAPB + 1 byte for the inter-frame flag.

Table XVI. - VCP 211 Product Sizes

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
39	R	1.5	13340	16328	15428	15828
39	R	2.4	13686	16520	15456	15698
39	R	3.3	13236	16942	15373	15596
39	R	4.3	12502	16450	14927	15296
28	R	0.5	14332	15928	15017	15121
28	R	1.5	10690	12322	11658	11885
28	R	2.4	10482	12474	11688	11897
28	R	3.3	10310	12468	11684	11954
29	R	4.3	10194	12096	11424	11650
39	R	0.5	15338	16780	16018	16068
39	R	1.5	11020	12736	12148	12302
39	R	2.4	9924	11486	10920	11024
37	R	3.3	8890	10806	10106	10198
37	R	4.3	7854	9980	9189	9382
28	R	0.5	12716	13950	13391	13477
28	R	1.5	9356	10304	9878	9937
28	R	2.4	8242	9132	8746	8823
28	R	3.3	7332	8354	7961	8077
29	R	4.3	6522	7676	7225	7356
28	R	0.5	9892	10864	10387	10411
28	R	1.5	7508	8326	7969	8034
28	R	2.4	6694	7686	7317	7393
28	R	3.3	6336	7410	6949	7067
29	R	4.3	5638	6860	6395	6504
28	R	0.5	8484	9310	8890	8882
28	R	1.5	6566	7086	6806	6809
28	R	2.4	5812	6424	6153	6212
28	R	3.3	5374	5950	5696	5749
29	R	4.3	4786	5522	5232	5284
39	SW	0.5	39028	47066	41744	40978
37	SW	1.5	22946	33990	28308	28046
37	SW	2.4	14076	21188	17735	17758
37	SW	3.3	12980	18858	15716	15398
37	SW	4.3	13062	17818	14913	14338
28	SW	0.5	35404	42236	38301	38077
28	SW	1.5	18430	25802	21467	21030
28	SW	2.4	13584	19014	15584	15223
29	SW	3.3	13402	17810	15204	14948
29	SW	4.3	13814	17298	15073	14906
39	SW	0.5	25088	29366	26522	25654
39	SW	1.5	15972	20440	18091	18068
39	SW	2.4	12430	15966	14127	13932
39	SW	3.3	12154	14942	13482	13442
37	SW	4.3	11988	13928	12789	12758
39	V	0.5	28664	35648	31199	30642

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
37	V	1.5	19884	25530	22480	22104
37	V	2.4	15996	20588	17998	17944
37	V	3.3	15498	19208	16971	16534
37	V	4.3	13158	18368	16450	16284
28	V	0.5	27228	38210	31015	29361
28	V	1.5	19306	26684	22335	22418
28	V	2.4	15836	19640	17648	17430
29	V	3.3	15914	18104	16764	16618
29	V	4.3	13080	17156	16274	16248
28	V	0.5	26238	31782	28561	28170
28	V	1.5	16748	21198	18317	17895
28	V	2.4	14712	17730	15888	15527
29	V	3.3	15040	17798	16055	15730
29	V	4.3	15082	17272	16155	16188
28	V	0.5	25982	35150	29308	27940
28	V	1.5	17126	22718	19210	18948
28	V	2.4	15032	17658	16228	16137
29	V	3.3	15226	17084	16048	15838
29	V	4.3	15344	17416	16387	16412
39	V	0.5	20354	24284	21727	21184
39	V	1.5	15326	18000	16374	16238
39	V	2.4	13156	15626	14229	14028
39	V	3.3	13258	14982	14003	13824
39	V	4.3	12134	14190	13558	13628
39	V	0.5	20606	26248	22318	21440
37	V	1.5	15358	19172	16750	16692
37	V	2.4	13162	15510	14152	14142
37	V	3.3	13078	14560	13700	13722
37	V	4.3	12088	13876	13349	13336
37	CR		31432	34754	33057	32713
35	CR		24428	26228	25312	25174
38	CR		6732	10084	7184	7041
36	CR		6052	6196	6136	6140
41	ET		2080	2234	2161	2171
59	HI		3560	8916	5617	5607
48	VSP		6742	11546	10897	11458
63	LRA		2142	2364	2293	2310
64	LRA		2046	2230	2118	2114
65	LRM		2744	2960	2876	2883
66	LRM		2236	2454	2345	2351
60	M		2112	2388	2136	2112
67	APR		2698	2922	2829	2839
62	SS		4926	9710	6959	6852
58	STI		3466	11240	6561	6113
31	USP		520	16428	6230	520
32	DHR		29653	32666	30982	30742

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
33	HSR		18122	19608	18609	18490
39	SRM	0.5	19346	24414	21628	21290
39	SRM	1.5	15702	18484	16570	16402
39	SRM	2.4	13250	16438	14595	14346
39	SRM	3.3	13420	15594	14374	14262
39	SRM	4.3	12696	15092	14044	14092
28	SRR	0.5	11214	15692	12913	12374
28	SRR	1.5	8936	12224	9881	9602
28	SRR	2.4	7938	10270	8859	8595
29	SRR	3.3	7602	9696	8497	8296
29	SRR	4.3	6856	9014	8296	8392
61	TVS		2112	2112	2112	2112
51	VCS		1628	1718	1670	1670
50	RCS		1490	1556	1526	1530
57	VIL		1670	1868	1783	1780
28	DBV	0.5	44070	44070	44070	44070
28	DBV	1.5	44070	44070	44070	44070
28	DBV	2.4	44070	44070	44070	44070
29	DBV	3.3	36870	36870	36870	36870
29	DBV	4.3	28950	28950	28950	28950
32	DR	0.5	31931	35059	33479	33728
32	DR	1.5	22152	24610	23090	22967
33	DR	2.4	18843	21128	19944	19815
33	DR	3.3	19446	20637	20139	20095
33	DR	4.3	17449	20041	19212	19442
32	DV	0.5	77061	87291	82648	83138
33	DV	1.5	52250	60582	55679	55362
33	DV	2.4	40554	49827	44335	43866
33	DV	3.3	45061	47971	46152	46113
33	DV	4.3	42894	47465	44823	44634
78	OHP		5734	11070	9075	10414
79	THP		5816	9070	6900	5816
80	STP		8448	11010	10255	10314
81	DPA		2592	9342	6914	8614
82	SPD		2834	2834	2834	2834
84	VAD		5396	6846	6094	6112
85	RCS		1488	1540	1518	1522
86	VCS		1632	1712	1672	1676
89	LRA		1520	1618	1561	1566
90	LRM		1848	2096	2005	2010
97	CRE		30854	32906	31885	31998
95	CRE		24100	25840	24784	24666
98	CRE		6822	8718	7039	6974
96	CRE		5986	7800	6157	6096
74	RCM		1940	2290	2173	2220
39	CLR	0.5	30326	33624	31654	31070

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
37	CLR	1.5	24974	26820	25647	25388
37	CLR	2.4	22610	24240	23366	23210
37	CLR	3.3	22774	23564	23233	23244
37	CLR	4.3	21616	23152	22458	22410
39	CLD	0.5	30764	33752	32226	31798
37	CLD	1.5	24166	26242	25168	25070
37	CLD	2.4	21450	24170	22445	22326
37	CLD	3.3	22402	23534	22820	22772
37	CLD	4.3	21818	23308	22510	22508
134	DVL		23572	26483	25262	25340
135	EET		10162	12049	11223	11422
136	SO		105782	108860	107170	106869
137	ULR		21048	21870	21402	21338
138	DSP		44628	44628	44628	44628
39	MRU	0.5	120	828	174	120
39	MRU	1.5	120	828	192	120
39	MRU	2.4	120	828	192	120
39	MRU	3.3	120	828	192	120
39	MRU	4.3	120	992	233	120
140	GFM		248	2580	993	248
141	MD		120	120	120	120
39	TRU	0.5	120	120	120	120
39	TRU	1.5	120	120	120	120
39	TRU	2.4	120	120	120	120
39	TRU	3.3	120	120	120	120
39	TRU	4.3	120	120	120	120
144	OSW		2836	21556	15304	20462
145	OSD		2836	24756	16519	21854
146	SSW		2836	17304	15065	15710
147	SSD		2836	16850	14692	15236
32	DMD	0.5	736	1841	1000	1052
33	DMD	1.5	748	2291	1144	1064
33	DMD	2.4	760	2454	1344	1403
33	DMD	3.3	772	2427	1381	1427
33	DMD	4.3	780	2430	1377	1428
150	USW		3082	3082	3082	3082
151	USD		3082	3082	3082	3082

Table XVII. VCP 212 Product Size

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
16	R	0.5	9588	20624	15971	16166
17	R	0.5	6412	17004	12226	14926
18	R	0.5	3800	11148	7607	7588
19	R	0.5	10718	31848	23913	24477
20	R	0.5	5078	23814	14955	14926
21	R	0.5	5150	14322	10496	10561
22	V	0.5	12416	38768	19035	17100
23	V	0.5	13250	30796	17517	16139
24	V	0.5	11820	25070	16036	15245
25	V	0.5	15516	35560	23142	22165
26	V	0.5	16034	33420	22539	21925
27	V	0.5	18678	39408	26654	26168
28	SW	0.5	16898	42476	27191	26558
29	SW	0.5	18678	39408	26654	26168
30	SW	0.5	14946	32034	22847	22878
31	USP		280	376	329	376
32	DHR		29139	42536	37747	38074
33	HSR		18274	31418	25684	25998
35	CR		30302	30302	30302	30302
36	CR		6762	6762	6762	6762
37	CR		43786	43786	43786	43786
38	CR		8326	8326	8326	8326
41	ET		2612	3322	2915	2864
48	VWP		7326	11866	10557	11084
50	RCS		1892	2338	2136	2152
51	VCS		1758	2160	1929	1889
55	SRR	0.5	7592	14658	9716	9194
56	SRM	0.5	14122	27312	18476	18023
57	VIL		1936	2352	2133	2134
58	STI					
59	HI					
60	M					
61	TVS					
62	SS					
63	LRA		2208	2710	2398	2339
64	LRA		1996	2220	2139	2166
65	LRM		3046	3600	3272	3200
66	LRM		2498	3002	2713	2678
67	APR		3052	3606	3208	3222
73	UAM					
74	RCM		2220	2220	2220	2220
78	OHP		5734	14434	10426	11952
79	THP		8768	12338	10433	11878
80	STP		8530	13482	12120	12686
81	DPA		2592	16078	11035	14968

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
82	SPD		2834	2834	2834	2834
84	VAD		5530	7064	6626	6790
85	RCS		1682	1900	1800	1706
86	VCS		1600	1862	1692	1659
89	LRA		1446	1664	1518	1497
90	LRM		1978	2314	2148	2157
93	DBV	0.5	31110	44070	41541	44070
94	DR	0.5	14325	27623	24645	26720
95	CRE		30504	30504	30504	30504
96	CRE		6790	6790	6790	6790
97	CRE		43818	43818	43818	43818
98	CRE		8332	8332	8332	8332
99	DV	0.5	36958	135123	92926	91234
132	CLR	0.5	20258	39132	32237	33156
133	CLD	0.5	20476	40002	31790	31563
134	DVL		29836	44427	39254	41247
135	EET		12432	22688	18585	19409
136	SO		113379	124530	119157	119562
137	ULR		25762	30026	28222	28452
138	DSP		992	23224	17768	19212
139	MRU	0.5				
140	GFM		248	7564	2375	2004
141	MD		120	120	120	120
143	TRU	0.5	120	120	120	120
144	OSW		2836	30088	19304	26634
145	OSD		2836	27312	18034	25280
146	SSW		2836	23746	20529	22386
147	SSD		2836	20218	17884	18258
149	DMD	0.5	736	804	770	772
150	USW		3082	3082	3082	3082
151	USD		3082	3082	3082	3082
153	SDR	0.5	200970	335831	301943	310465
154	SDV	0.5	141796	268326	227813	231899
155	SDW	0.5	32080	214440	115390	72308
156	EDR		2716	8817	5797	5946
157	EDC		2155	5657	3884	3858
194	DR7	0.5	6699	34290	25047	26263
199	DV7	0.5	17936	57258	38873	38191

Table XVIII. VCP 21 Product Size (Dual Pol)

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
16	R	0.5	8504	17500	11874	11132
17	R	0.5	5596	13236	9120	8819
18	R	0.5	3880	8282	5861	5536
19	R	0.5	8746	23886	14326	12734
20	R	0.5	5240	16642	9788	8821
21	R	0.5	4182	10288	7086	6625
22	V	0.5	12822	32312	19155	17212
23	V	0.5	11492	30328	17643	15268
24	V	0.5	10466	22650	14417	12899
25	V	0.5	14818	51846	29917	26330
26	V	0.5	13696	47758	25786	23272
27	V	0.5	12520	32050	19176	15268
28	SW	0.5	19070	55864	35616	31157
29	SW	0.5	15854	53782	29662	26956
30	SW	0.5	13238	35160	21007	19424
31	USP		280	376	336	376
32	DHR		24714	33785	30992	21731
33	HSR		16922	23850	21138	21713
34	CFC		8790	8790	8790	8790
35	CR		21866	21866	21866	21866
36	CR		5340	5340	5340	5340
37	CR		27004	27004	27004	27004
38	CR		5952	5952	5952	5952
41	ET		1460	1662	1594	1608
48	VWP		5248	9554	8464	9004
50	RCS		1482	1640	1554	1550
51	VCS		1582	1806	1702	1710
55	SRR	0.5	8032	17878	12676	11896
56	SRM	0.5	12134	30498	18157	16359
57	VIL		1326	1428	1375	1374
63	LRA		1448	1572	1508	1506
64	LRA		1342	1444	1386	1378
65	LRM		1976	2384	2108	2086
66	LRM		1396	1614	1477	1464
67	APR		1966	2366	2118	2112
74	RCM		1520	1520	1520	1520
78	OHP		5734	11626	9471	10523
79	THP		8768	9938	9436	9402
80	STP		8530	11232	10400	10706
81	DPA		2592	6462	5224	6101
82	SPD		2834	2834	2834	2834
84	VAD		5398	7068	6699	6804
85	RCS		1480	1570	1525	1520
86	VCS		1558	1674	1618	1626
89	LRA		1318	1354	1324	1322

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
90	LRM		1334	1432	1378	1378
93	DBV	0.5	28950	44070	39462	22070
94	DR	0.5	10150	12225	10975	10845
95	CRE		22358	22358	22358	22358
96	CRE		5354	5354	5354	5354
97	CRE		27378	27378	27378	27378
98	CRE		5992	5992	5992	5992
99	DV	0.5	22193	124971	59029	48374
132	CLR	0.5	16994	32530	22867	22083
133	CLD	0.5	17078	34130	23349	22372
134	DVL		12128	14679	13498	13285
135	EET		3516	5639	4601	4469
136	SO		48467	52416	49863	48706
137	ULR		9418	11590	10198	9822
138	DSP		914	4809	3145	3321
140	GFM		248	248	248	248
141	MD		120	120	120	120
143	TRU	0.5	120	120	120	120
144	OSW		2836	23036	16303	20862
145	OSD		2636	28164	19252	24382
146	SSW		2836	16758	14154	14133
147	SSD		2636	16982	14508	15028
149	DMD	0.5	736	780	759	760
150	USW		3082	3082	3082	3082
151	USD		3082	3082	3082	3082
153	SDR	*	27341	261972	107417	58473
154	SDV	*	67525	249681	178687	169887
155	SDW	*	20018	201525	75760	41520
156	EDR		767	3439	1989	1996
157	EDC		752	2480	1583	1565
158	ZDR		15204	44822	26947	24567
159	DZD		28706	146518	74380	62945
160	CC		12248	40664	25153	23500
161	DCC		12897	151168	73048	61111
162	KDP		9916	17370	12505	12387
163	DKD		6544	27370	10385	9672
164	HC		9740	13390	11038	10778
165	DHC		7930	29422	14490	13529
166	ML		5960	5960	5960	5960
169	OHA		244	6430	6001	6244
170	DAA		244	12276	7628	8267
171	STA		3252	10318	9412	9624
172	DSA		810	13476	7518	7696
173	DUA		12813	27090	17250	16132
174	DOD		684	11502	7880	8625
175	DSD		244	19220	10672	10482

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
176	DPR		4197	10058	6090	5323
177	HHC		5374	10040	7015	6650
194	DR7	0.5	2873	25632	12022	9407
195	DRQ		9445	32514	18536	17198
199	DV7	0.5				

Table XIX. VCP 212 Product Size (Dual Pol)

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
16	R	0.5	11568	17074	14979	15518
17	R	0.5	7770	15002	11688	12147
18	R	0.5	4184	9796	6998	7244
19	R	0.5	13640	28100	22702	24602
20	R	0.5	5738	21314	14074	14984
21	R	0.5	6294	12938	9994	10384
22	V	0.5	11822	30080	19395	17969
23	V	0.5	11204	26100	18873	18589
24	V	0.5	10776	23348	17028	17051
25	V	0.5	18722	44140	34650	36283
26	V	0.5	15702	39688	29942	31944
27	V	0.5	13780	31688	23958	25019
28	SW	0.5	25970	51768	42866	46444
29	SW	0.5	20678	48310	36587	39279
30	SW	0.5	16622	37164	27766	28937
31	USP		280	376	333	376
32	DHR		38034	39531	38870	38975
33	HSR		26446	28074	27330	27469
41	ET		2648	3210	2918	2920
48	VWP		5330	10672	9469	10289
50	RCS		1570	1942	1788	1772
51	VCS		1716	2030	1883	1880
55	SRR	0.5	9656	16694	13813	13337
56	SRM	0.5	12958	28780	21785	21986
57	VIL		1888	2148	2014	2030
63	LRA		2564	2866	2701	2696
64	LRA		2124	2332	2256	2258
65	LRM		3046	3590	3359	3396
66	LRM		2696	3002	2854	2858
67	APR		3046	3586	3353	3414
78	OHP		5734	11668	9261	11298
79	THP		5816	9938	6543	5816
80	STP		8530	12170	10801	10854
81	DPA		2592	12366	8152	11313
82	SPD		2834	2834	2834	2834
84	VAD		5732	6558	6208	6228

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
85	RCS		1546	1736	1635	1630
86	VCS		1636	1910	1746	1712
89	LRA		1634	2044	1817	1806
90	LRM		2366	2594	2449	2428
93	DBV	0.5	31110	44070	41498	44070
94	DR	0.5	14624	21770	17045	16152
99	DV	0.5	34621	141741	93178	92068
132	CLR	0.5	19090	35772	29844	32137
133	CLD	0.5	18914	33550	27813	28817
134	DVL		32590	36578	34573	34633
135	EET		14211	18981	16204	16202
136	SO		77276	84563	81061	81345
137	ULR		17896	20822	19776	19832
138	DSP		928	11278	7485	7709
140	GFM		248	8300	4244	4244
141	MD		120	120	120	120
143	TRU	0.5	120	120	120	120
144	OSW		2836	26508	16801	244922
145	OSD		2836	27690	17738	26363
146	SSW		2836	19160	15911	16399
147	SSD		2836	19262	15825	15931
149	DMD	0.5	736	804	770	772
150	USW		3082	3082	3082	3082
151	USD		3082	3082	3082	3082
153	SDR	0.5	43444	386313	194946	120 527
154	SDV	0.5	219089	281510	252482	257789
155	SDW	0.5	28796	233180	120356	77401
156	EDR		1950	5517	3486	3117
157	EDC		1498	3866	2544	2314
158	ZDR		19084	52470	36316	24949
159	DZD		47216	198764	121745	106317
160	CC		19254	42772	32337	32453
161	DCC		43916	199430	113583	99540
162	KDP		12470	18448	14976	14449
163	DKD		10125	29765	21595	22675
164	HC		10232	12834	11477	11391
165	DHC		11129	25008	19591	20233
166	ML		5690	5690	5690	5690
169	OHA		6156	7960	7253	7352
170	DAA		18777	47629	39064	42979
171	STA		9122	10684	9831	9744
172	DSA		9140	51954	32464	33050
173	DUA		18777	59991	42634	45661
174	DOD		18104	53059	40706	43965
175	DSD		18104	62296	42362	44032
176	DPR		31700	50111	38576	39007

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
177	HHC		7759	9191	8456	8572
194	DR7	0.5	9858	31871	23371	25698
195	DRQ		13422	46121	31935	22646
199	DV7	0.5	16959	57507	39811	4063

APPENDIX D. PRODUCT DATA COMPRESSION USING BZIP2

In order to decompress products having been compressed using bzip2, the libbzip2 library, version 1.0.1 or higher, is required. The source code can be found at the official home page (URL): **http://sources.redhat.com/bzip2**. This web site contains complete instructions on building the libbzip2 library on a wide range of computer architectures and operating systems. Detailed documentation of the various library functions is also provided.
Within libbzip2, the library function that should be used to decompress the data is:

```
BZ2_bzBuffToBuffDecompress( char *dest,
    unsigned intdestLen,
    char *source,
    unsigned intsourceLen,
    intsmall,
    int verbosity).
```

The destination buffer "dest" holds the decompressed product. The destination buffer size "destLen" must be at least as large as the sum of the Message Header block, Product Description block and the compressed product data size given by the Product Dependent Parameters (see Table V). The source "source" points to the compressed product data immediately following the Product Description block. The source length "sourceLen" is the total product size (defined in the Message Header block), less the size of the Message Header and Product Description blocks. Depending on the architecture, "small" can either be 0 (normal case) or non-zero. By specifying a non-zero value for "small", the library requires less memory utilization at the expense of increased decompression time. The verbosity level can take on any value from 0 to 4 inclusive with higher values denoting greater verbosity.
After the product is decompressed, the products Message Header and Product Description blocks can be prepended to the decompressed product data.

APPENDIX E. GENERIC PRODUCT FORMAT

The Generic Product Format is designed to be a flexible, platform independent data format wherein the information describing the data is contained in the data itself. Information for each product that typically has been included in this interface control document such as the parameter's definition, type, range, precision and scaling, is encoded in the data structures defined in this appendix.

The first item within the deserialized data will be the Product Description data structure (for packet 28 data) or the External Data Description data structure (for packet 29 data). The Product Description data structure is defined in Figure E-1. The External Data Description data structure is defined in Figure E-1b. Additional product data is determined by the values of "Parameter List" and "Component List". The Parameter List is defined in Figure E-2. The possible Component List data structures are defined in Figures E-3 through E-11.

The following conventions will be used for describing data structure element types:

Byte/Char	One byte (8 bits)
INT*2	2 byte, signed integer data
INT*4	4 byte, signed integer data
UINT*4	4 byte, unsigned integer data
REAL*4	4 byte, floating point data adhering to IEEE-754-1985 standard
String	NULL (0) terminated array of ASCII coded characters, each character occupying 1 byte
Pointer	Contains the address of a data item. Size is architecture dependent.

NAME
DESCRIPTION
CODE
TYPE
GENERATION TIME
RADAR NAME
RADAR LATITUDE
RADAR LONGITUDE
RADAR HEIGHT
VOLUME SCAN START TIME
ELEVATION SCAN START TIME
ELEVATION ANGLE
VOLUME SCAN NUMBER
OPERATIONAL MODE
VOLUME COVERAGE PATTERN
ELEVATION NUMBER
SPARE
SPARE
NUMBER OF PARAMETERS
PARAMETER LIST
NUMBER OF COMPONENTS
COMPONENT LIST

Figure E-1. Product Description Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Name	String	N/A	N/A	N/A	Product name
Description	String	N/A	N/A	N/A	Product description (may contain version information)
Code	INT*4	N/A	See Table II	N/A	Product code
Type	INT*4	N/A	1 to 7	1/1	1=Volume, 2=Elevation, 3=Time, 4=On Demand, 5=On Request, 6=Radial, 7=External
Generation Time	UINT*4	Seconds	0 to 4294967295	1/0.5	Product generation time. See Note 1.
Radar Name	String	N/A	N/A	N/A	Null or empty string indicates the radar name is not applicable
Radar Latitude	REAL*4	Degrees	-90.0 to +90.0	N/A	Only applicable if radar name specified.
Radar Longitude	REAL*4	Degrees	-180.0 to +180.0	N/A	Only applicable if radar name specified.
Radar Height	REAL*4	Meters	30 to 3350	N/A	Meters above mean sea level.
Volume Scan Start Time	UINT*4	Seconds	0 to 4294967295	1/0.5	Volume scan start time. See Note 1.
Elevation Scan Start Time	UINT*4	Seconds	0 to 4294967295	1/0.5	Used only if type is equal to 2. See Note 1.
Elevation Angle	REAL*4	Degrees	-1.0 to +45.0	N/A	Angle of elevation scan
Volume Scan Number	INT*4	N/A	1 to 80	N/A	Counter, recycles to 1 after 80 volume scans.

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Operational Mode	INT*2	N/A	1 to 3	N/A	1=Test, 2=Clear Air, 3=Precipitation
Volume Coverage Pattern	INT*2	N/A	0 to 999	N/A	Volume coverage pattern (VCP) number
Elevation Number	INT*2	N/A	1 to 20	N/A	Elevation number within the VCP. Only used if type is equal to 2.
Spare	INT*2	N/A	N/A	N/A	Spare (reserved for future compression type)
Spare	INT*4	N/A	N/A	N/A	Spare (reserved for future decompressed size)
Number of Parameters	INT*4	N/A	0 to 1000	N/A	Number of product specific parameters
Parameter List	Pointer to Structure	N/A	N/A	N/A	See Note 2
Number of Components	INT*4	N/A	0 to 1000	N/A	Number of product specific components
Component List	Pointer to Structure	N/A	N/A	N/A	See Note 3

Figure E-1. Product Description Data Structure (Sheet 2)

Note 1. Specified in number of seconds elapsed since midnight GMT January 1, 1970 (Unix Time).
Note 2. Product Parameter data structure defined in Figure E-2.
Note 3. When the product contains multiple detected events, this is an array of pointers to Event Component data structures (see Figure E-10). A product can have any number of events. If there is only one event, this is an array of pointers, each of which points to one of the following product component structure types: Radial Component (Figure E-3), Grid Component (Figure E-5), Area Component (Figure E-6), Text Component (Figure E-8), or Table Component (Figure E-9). A product can have any number of components of mixed types.

NAME
DESCRIPTION
CODE
TYPE
GENERATION TIME
SPARE (MSW)
SPARE (LSW)
SPARE (MSW)
SPARE (LSW)
SPARE (MSW)
SPARE (LSW)
SPARE (MSW)
SPARE (LSW)
NUMBER OF PARAMETERS
PARAMETER LIST
NUMBER OF COMPONENTS
COMPONENT LIST

Figure E-1b. External Data Description Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Name	String	N/A	N/A	N/A	Product name
Description	String	N/A	N/A	N/A	Product description (may contain version information)
Code	INT*4	N/A	See Table II	N/A	Product code
Type	INT*4	N/A	7	1/1	Product type = External
Generation Time	UINT*4	Seconds	0 to 4294967295	1/0.5	Product generation time. See Note 1.
Spare	INT*4	N/A	N/A	N/A	Spare
Spare	INT*4	N/A	N/A	N/A	Spare
Spare	INT*2	N/A	N/A	N/A	Spare
Spare	INT*2	N/A	N/A	N/A	Spare (reserved for future

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
					compression type)
Spare	INT*4	N/A	N/A	N/A	Spare (reserved for future decompressed size)
Number of Parameters	INT*4	N/A	0 to 1000	N/A	Number of product specific parameters
Parameter List	Pointer to Structure	N/A	N/A	N/A	See Note 2
Number of Components	INT*4	N/A	0 to 1000	N/A	Number of product specific components
Component List	Pointer to Structure	N/A	N/A	N/A	See Note 3

Figure E-1b. External Data Description Data Structure (Sheet 2)

Note 1. Specified in number of seconds elapsed since midnight GMT January 1, 1970 (Unix Time).
Note 2. Product Parameter data structure defined in Figure E-2.
Note 3. When the product contains multiple detected events, this is an array of pointers to Event Component data structures (see Figure E-10). A product can have any number of events. If there is only one event, this is an array of pointers, each of which points to one of the following product component structure types: Radial Component (Figure E-3), Grid Component (Figure E-5), Area Component (Figure E-6), Text Component (Figure E-8), or Table Component (Figure E-9). A product can have any number of components of mixed types.

PARAMETER ID
PARAMETER ATTRIBUTES

Figure E-2. Product Parameter Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Parameter ID	String	N/A	N/A	N/A	Parameter identifier
Parameter Attributes	String	N/A	N/A	N/A	See Notes 1, 2.

Figure E-2. Product Parameter Data Structure (Sheet 2)

Note 1. Format description of the ASCII-text parameter attributes:

1. The attributes are represented by an ASCII string. The string consists of a number of sections terminated by ";", each of which specifies an applicable attribute. ";" after the last section is optional. Each section must be in the form of "attribute name = attribute description" where "attribute name" must be one of the following: "name", "type", "unit", "range", "value", "default", "accuracy", "description", "conversion" and "exception". The attribute name is case-insensitive. That is, for example,

"name", "Name" and "NAME" are all valid and identical. "attribute description" is a character string that describes the value of the attribute as explained in the following.

2. Attribute description:

"name": The name of the parameter. An example is "name = 2D feature altitude".

"type": One of the following type names: "int", "short", "byte" (4-byte, 2-byte and 1-byte integer respectively), "bit" (1-bit data), "float", "double" (4-byte and 8-byte IEEE floating point numbers respectively), "string" (ASCII character string), "unit", "ushort" and "ubyte" (unsigned versions of int, short and byte). An example is "type = int". If type is not specified, "int" is assumed. The type name is case-insensitive.

"unit": The physical unit of the data value. Standard unit names are to be defined. Examples are "unit = meter" and "unit = percent".

"range": The set of all valid values for the parameter. The range can be specified with one of the following three formats:

a. Single interval specification defined by "[min, max]" where "min" and "max" are respectively the minimum and maximum values. "[" and "]" can be replaced by "(" and ")" respectively if the boundary is not inclusive. Unlimited boundary is specified by "-". Examples are "range = [1, 2]", "range = (1, 2]", "range = [1., -)", "range = [A, Z]" (character string type), and "range = (-, -)".

b. A list of valid values: { v1, v2, ...}. Examples are "range = {1, 2, 3}" and "range = {reflectivity, velocity, spectrum width}.

c. A named method that checks the range. The method name is enclosed by "<" and ">". The method must be described elsewhere.

"value" and "default": A value or a list of values separated by ",". Examples are "value = 1", "value = 1.0, 2., 3.0" and "value = Yes, No".

"accuracy": The accuracy of the data. [max_error] is used for the absolute maximum error and (max_error) for the relative maximum error.

"description": A text description of the data.

"conversion": The way to convert binary data stored externally. The conversion can be specified with one of the following formats:

a. Format [scale, offset] is used for scale-offset type of conversion: value = data * scale + offset. An example is "conversion = [2., 64.]".

b. Format {valueMap, data1, value1, data2, value2, ...} for data

mapping conversions. Where "valueMap" is a reserved key word. "data1", "data2" ... are the data and "value1", "value2" ... are the values to convert to. An example is "conversion = {valueMap, 1, -5., 2, 0., 3, 50., 4, 100.}".

c. Format <method> is used for named conversion method. The method must be described elsewhere.
Elements of binary data array are assumed to be stored one after another in the local byte order for types other than "bit" and "string". For type "bit", we assume that the elements are stored in a byte array each of which holds 8 elements. The first bit element is stored in the left-most bit in the bytes. For type "string", elements are null-terminated strings and stored one after another with the null terminator.

"exception": A list of the exceptional data values and their meanings. An example is "exception = 0, below threshold, 1, missing data". Standard vocabulary for describing exceptional values needs to be established in the future.

3. When characters ";", "=" and "," are used for formatting purpose, characters "space", "tab" and "line return" surrounding them are insignificant. That is, for example, "name = short", "name=short" and "name =short" are all identical. Non-formatting use of ";" and "," are allowed if no ambiguity is introduced. In case of ambiguity, "\" can be used in front of characters ";" and "," to indicate that they are not interpreted as formatting characters. The part of "Attribute description" is case-sensitive except otherwise specified.

Note 2.

Component parameters are either definitive or descriptive. Definitive component parameters are required and predefined. Examples are:

The dimension size (number of grid points) for each dimension.

The location of the origin and the coordinate orientation for certain grids.

For equally spaced grid, the step size for each dimension.

The altitude of a geo-area if the altitude is relevant.

The definitive component parameters must be predefined so the user of the product can interpret and display the data product-independently.

Descriptive component parameters, on the other hand, provide additional descriptions of the product component. Examples are the data field name, the intensity of the event, the forecast position and so on.

RADIAL COMPONENT TYPE (=1)
DESCRIPTION
BIN SIZE
RANGE TO FIRST BIN
NUMBER OF COMPONENT PARAMETERS
COMPONENT PARAMETER LIST
NUMBER OF RADIALS
RADIAL DATA

Figure E-3. Radial Component Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Radial Component Type	INT*4	N/A	1	N/A	Radial component type
Description	String	N/A	N/A	N/A	Component Description
Bin Size	REAL*4	Meters	0.0 to 1000.0	N/A	Range extent of each bin
Range to First Bin	REAL*4	Meters	1000.0 to 460000.0	N/A	Range to the center of the first bin
Number of Component Parameters	INT*4	N/A	1 to 1000	N/A	Number of component parameters
Component Parameter List	Pointer to Structure	N/A	N/A	N/A	See Figure E-2
Number of Radials	INT*4	N/A	0 to 800	N/A	Number of radials in a radar elevation sweep
Radial Data	Pointer to Structure	N/A	N/A	N/A	See Figure E-4

Figure E-3. Radial Component Data Structure (Sheet 2)

AZIMUTH
ELEVATION
WIDTH
NUMBER OF BINS
BIN VALUES

Figure E-4. Radial Information Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Azimuth	REAL*4	Degrees	0.0 to 360.0	N/A	Azimuth of the leading edge of the radial
Elevation	REAL*4	Degrees	-1.0 to +45.0	N/A	Elevation angle of the radial
Width	REAL*4	Degrees	0.0 to 2.0	N/A	Radial width or separation
Number of Bins	REAL*4	Degrees	0 to 1840	N/A	Number of data values along a radial
Bin Values	Structure	N/A	N/A	N/A	See Figure E-11

Figure E-4. Radial Information Data Structure (Sheet 2)

GRID COMPONENT TYPE (=2)
NUMBER OF DIMENSIONS
DIMENSIONS
GRID TYPE
NUMBER OF COMPONENT PARAMETERS
COMPONENT PARAMETER LIST
GRID DATA

Figure E-5. Grid Component Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Grid Component Type	INT*4	N/A	2	N/A	Grid component type
Number of Dimensions	INT*4	N/A	1 to 4	N/A	Number of grid dimensions
Dimensions	Pointer to INT*4	N/A	N/A	N/A	Grid dimensions, ordered from fastest changing to slowest.
Grid Type	INT*4	N/A	1 to 4	N/A	1=Array, 2=Equally spaced, 3=Lat/Lon, 4=Polar
Number of Component Parameters	INT*4	N/A	1 to 1000	N/A	Number of component parameters
Component Parameter List	Pointer to Structure	N/A	N/A	N/A	See Figure E-2. See Note 1.
Grid Data	Structure	N/A	N/A	N/A	See Figure E-11.

Figure E-5. Grid Component Data Structure (Sheet 2)

Note 1. Grid origin and dimension sizes are defined by component parameters. For equally spaced dimensions, we use component parameters for specifying the step sizes. For each unequally spaced grid dimension, we use an additional 1-D grid component to specify the grid pointer locations in that dimension.

AREA COMPONENT TYPE (=3)
NUMBER OF COMPONENT PARAMETERS
COMPONENT PARAMETER LIST
AREA TYPE
NUMBER OF POINTS
LIST OF POINTS

Figure E-6. Area Component Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Area Component Type	INT*4	N/A	3	N/A	Area component type
Number of Component Parameters	INT*4	N/A	1 to 1000	N/A	Number of component parameters
Component Parameter List	Pointer to Structure	N/A	N/A	N/A	See Figure E-2
Area Type	INT*4	N/A	1 to 131075	N/A	0x00001=Point (Lat/Lon), 0x00002=Area (Lat/Lon), 0x00003=Polyline (Lat/Lon), 0x10001=Point (X/Y), 0x10002=Area (X/Y), 0x10003=Polyline (X/Y), 0x20001=Point (Az/Ran), 0x20002=Area (Az/Ran), 0x20003=Polyline (Az/Ran)
Number of Points	INT*4	N/A	1 to 10000	N/A	Number of data points
List of Points	Pointer to Structure	N/A	N/A	N/A	See Figure E-7a, E-7b, and E-7c.

Figure E-6. Area Component Data Structure (Sheet 2)

LATITUDE
LONGITUDE

Figure E-7a. Geographic Location Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Latitude	REAL*4	Degrees	-90.0 to +90.0	N/A	Latitude location of data point
Longitude	REAL*4	Degrees	-180.0 to +180.0	N/A	Longitude location of data point

Figure E-7a. Geographic Location Data Structure (Sheet 2)

X COORDINATE
Y COORDINATE

Figure E-7b. X/Y Location Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
X Coordinate	REAL*4	km	N/A	N/A	X-coordinate of data point (See Note 1)
Y Coordinate	REAL*4	km	N/A	N/A	Y-coordinate of data point (See Note 1)

Figure E-7b. X/Y Location Data Structure (Sheet 2)

Note 1. The default unit for the X/Y location structure is kilometers (km). If a different unit is required, it must be specified in the component parameters.

AZIMUTH
RANGE

Figure E-7c. Az/Ran Location Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
Azimuth	REAL*4	Degrees	N/A	N/A	Azimuth of data point
Range	REAL*4	km	N/A	N/A	Range of data point (See Note 1)

Figure E-7c. Az/Ran Location Data Structure (Sheet 2)

Note 1. The default unit for range is kilometers. If a different unit is required, it must be specified in the component parameters.

TEXT COMPONENT TYPE (=4)
NUMBER OF COMPONENT PARAMETERS
COMPONENT PARAMETER LIST
TEXT

Figure E-8. Text Component Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Text Component Type	INT*4	N/A	4	N/A	Text component type
Number of Component Parameters	INT*4	N/A	1 to 1000	N/A	Number of component parameters
Component Parameter List	Pointer to Structure	N/A	N/A	N/A	See Figure E-2
Text	String	N/A	N/A	N/A	ASCII string

Figure E-8. Text Component Data Structure (Sheet 2)

TABLE COMPONENT TYPE (=5)
NUMBER OF COMPONENT PARAMETERS
COMPONENT PARAMETER LIST
TITLE
NUMBER OF COLUMNS
NUMBER OF ROWS
COLUMN LABELS
ROW LABELS
ENTRIES

Figure E-9. Table Component Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Table Component Type	INT*4	N/A	5	N/A	Table component type
Number of Component Parameters	INT*4	N/A	1 to 1000	N/A	Number of component parameters
Component Parameter List	Pointer to Structure	N/A	N/A	N/A	See Figure E-2
Title	String	N/A	N/A	N/A	ASCII string
Number of Columns	INT*2	N/A	1 to 32768	N/A	Number of columns in table
Number of Rows	INT*2	N/A	1 to 32768	N/A	Number of rows in table
Column Labels	Pointer to Structure	N/A	N/A	N/A	See Figure E-12.
Row Labels	Pointer to Structure	N/A	N/A	N/A	See Figure E-12.
Entries	Structure	N/A	N/A	N/A	See Figure E-12.

Figure E-9. Table Component Data Structure (Sheet 2)

EVENT COMPONENT TYPE (=6)
NUMBER OF EVENT PARAMETERS
EVENT PARAMETER LIST
NUMBER OF COMPONENTS
COMPONENT LIST

Figure E-10. Event Component Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Event Component Type	INT*4	N/A	6	N/A	Event component type
Number of Event Parameters	INT*4	N/A	1 to 10000	N/A	Number of event parameters
Event Parameter List	Pointer to Structure	N/A	N/A	N/A	See Figure E-2.
Number of Components	INT*4	N/A	1 to 1000	N/A	Number of components
Component List	Pointer	N/A	N/A	N/A	See Note 1.

Figure E-10. Event Component Data Structure (Sheet 2)

Note 1. An array of pointers each of which points to one of the product component structures. An event can have any number of components of mixed types. Possible types are Radial Component (Figure E-3), Grid Component(Figure E-5), Area Component (Figure E-6), Text Component (Figure E-8), and Table Component (Figure E-9).

ATTRIBUTES
DATA

Figure E-11. Binary Data Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Attributes	String	N/A	N/A	N/A	See Figure E-2 Note 1. Attribute "type" is required.
Data	Pointer	N/A	N/A	N/A	See Note 1.

Figure E-11. Binary Data Data Structure (Sheet 2)

Note 1. The data is fully described by "Attributes". The attributes are used to interpret the data.

For Grid Component data (see Figure E-5), the gridded data are stored as a 1-dimensional array with the index of the first dimension varying the fastest.

For Table Component data, "Entries" is an "Number of Rows" X "Number of Columns" array with the row index varying the fastest.

TEXT STRING

Figure E-12. String Data Structure (Sheet 1)

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARKS
Text String	String	N/A	N/A	N/A	ASCII coded characters terminated with a null character

Figure E-12. String Data Structure (Sheet 2)