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INTERFACE CONTROL DOCUMENT FOR THE RPG TO CLASS 1 USER

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2620001

DOCUMENT REVISION RECORD FORM

REVISION	**-**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
RELEASED BY	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC	ROC
RELEASE DATE	03/01/96	06/26/98	09/11/01	01/27/02	06/19/02	12/29/02	06/13/03	01/30/04	7/29/04	4/13/05	02/08/06	5/25/07
EFFECTIVITY	03/01/96	06/26/98	09/11/01	01/27/02	06/19/02	12/29/02	06/13/03	01/30/04	7/29/04	4/13/05	02/08/06	5/25/07
AUTHORITY	F0048	F0095	F0103	F0158	F0164	F0174	F0182	F0185	F0186	F0209	F0210	0250
FAST TRACK	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REV HISTORY	BLD 9.0	BLD 10.0	OPEN BLD 1.0	RPG BLD 1.2	RPG BLD 2.0	RPG BLD 3.0	RPG BLD 4.0	RPG BLD 5.0	RPG BLD 6.0	RPG BLD 7.0	RPG BLD 8.0	RPG BLD 9.0
Section 1.0	-	A	B		D					I		
Section 2.0	-	A			D					I		
Section 3.0	-	A		C	D	E	F	G	H	I	J	K
Appendix A	-	A			D							
Appendix B	-	A			D					I		K
Operating Procedures	-	A			D							
Appendix C				C	D	E		G	H	I		
Appendix D					D		F	G				
Appendix E											J	

*Revision table continued on next page.

REVISION	L	M	N	P	R	S	T	U	V	W	X	Y
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EFFECTIVITY	03/25/08	03/03/09	11/04/09	05/24/10	10/08/10		03/07/12	01/03/2014	4/22/2015		01/18/2018	3/3/20
AUTHORITY	0286	0349	0445	0389	0476		420	0599	0686	0726	0747	0813
FAST TRACK	NO	NO	NO	NO	NO		NO	NO	No	NO	NO	NO
REV HISTORY	RPG BLD 10.0	RPG Build 11.0	RPG Build 11.2	RPG Build 12.0	RPG Build 12.1		RPG Build 13.0	RPG Build 14.0	RPG Build 16	RPG Build 17	RPG Build 18.0	RPG Build 19.0
Section 1.0												
Section 2.0												
Section 3.0	L	M	N	P	R	S		U	V	W	X	Y
Appendix A												
Appendix B												
Operating Procedures												
Appendix C	L							U			X	Y
Appendix D										W		
Appendix E				P	R							

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Appendix C	AA
Appendix D	
Appendix E	

REVISION RECORD

Document Originally Released as 1208304 and then converted to ROC Document 2620001

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.
Revision R	Added Build 12.1 products.
Revision S	Not Applicable
Revision T	Added Build 13.0 products. Includes Build 12.1 changes to SuperOb Specific Differential Phase in Table V. Also, Includes Build 12.3 changes to Table II Base Products Message Code and Cross Section Accuracy/Precision, Table III Code 195, Note 1 of Figure 3-6 (Sheet 6), Table V Digital Reflectivity DQA.
Revision U	RPG Build 14.0 includes updates to Section 3 and Appendix C. 01/03/2014; CCR #'s affected NA12-00007, NA12-00008, NA12-00009, NA12-00010, NA12-00358, NA12-00374, NA12-00376
Revision V	RPG Build 16 which includes CCRs NA14-00205, NA14-00212, NA14-00227. Updates to Section 3.
Revision W	RPG Build 17 which includes CCRs NA15-00028, NA15-00030, NA15-00033, NA15-00046, NA15-00049, NA15-00052, NA15-00055, NA15-00058, NA15-00061, NA15-00064
Revision X	RPG Build 18.0 includes CCRs: NA14-00304, NA15-00151, NA15-00152, NA15-00154, NA15-00211, NA16-00064, NA16-00095, NA16-00097, NA16-00099, NA16-00159, NA16-00269, NA16-00279, NA16-00291, NA16-00313, NA16-00314, NA17-00087, NA17-00124, NA18-00056, NA18-00086
Revision Y	RPG Build 19.0 includes CCRs: NA17-00124, NA17-00233, NA17-00294, NA17-00296, NA18-00015, NA18-00018, NA18-00041, NA18-00058, NA18-00128, NA18-00194, NA18-00237, NA18-00239, NA18-00262, NA18-00272, NA18-00291, NA18-00304, NA18-00363, NA18-00366, NA20-00053

Revision AA	RPG Build 21.0 includes CCRs: NA19-00322, NA20-00368, NA21-00016, NA21-00221, NA21-00242, NA21-00246, NA21-00249, NA22-00022

Table of Contents

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 a dedicated 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
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 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 terminated VCP.

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 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 RPGOP_50 and 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 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 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).

3.2.5.3 Command Parameter Message

The Command Parameter Message is sent to authorized, dedicated users upon connection. This message contains information on the commands that are available to the external user. The Command Parameter Message is indicated by a Message Code of 12. The format of the Command Parameter Message is provided in Figure 3-4a.

3.2.5.4 Command Control Message

The Command Control Message is set to the RPG from authorized, dedicated users. The message describes the control commands set to the RPG from external operators. The Command Control Message is indicated by a Message Code of 14. The format of the message is shown in Figure 3-4b.

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
37-38, 97-98	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
172	Digital Storm Total Accumulation	172

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: Storm Structure (product 62), Free Text Message (product 75), PUP Text Message (product 77) 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	HALF WORD	LSB	
MESSAGE	MESSAGE CODE			01
HEADER	DATE OF MESSAGE			02
BLOCK	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	(-1) DIVIDER			10
REQUEST	LENGTH OF BLOCK			11

BLOCK	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)

HALF WORD	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
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	Spare	-
7	Spare	-
8	Product List	3-21
9	Spare	-
10	Spare	-
11	Sign-on Request Message (Dial -up Users)	N/A
12	Command Parameter Message	3-4a
14	Command Control Message	3-4b
15	Bias Table Message	3-25
16-111 112, 114-131	Products (See Table III for individual Product Codes) Reserved for future Products	

113, 132-141 142	Products (See Table III for Individual Product Codes) Reserved for future Product	
143-151	Products (See Table III for Individual Product Codes)	
152	Archive III Status Product	
153-155	Super Resolution	
156-157	Spare	
158-179	Dual Polarization Products (See Table III for Individual Product Codes) Codes 158, 160, 162 and 164 are reserved for future Dual Pol Base, and QPE products, respectively.	
180-192	Reserved for future Products	
193	Super Resolution Digital Reflectivity Data-Quality-Edited	
194	Reserved for future Products	
196	Microburst AMDA	
197	Rain Rate Classification	
198-201	Reserved for future Products	
202	Shift Change Checklist	
203-299	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) Power Removed Control Product	30, 93, 94, 99, 113, 132, 133, 193, 195	•22	•Elevation Angle	•Degrees	•-1.0 to 45.0	•.1, Note 1, 9
Cross Section	50, 51	•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 359.9 •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 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

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
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	159	22	Elevation Angle	Degree	-1.0 to + 45.0	.1, Note 1,9
Correlation Coefficient	161	22	Elevation Angle	Degree	-1.0 to + 45.0	.1, Note 1,9
Specific Differential Phase	163	22	Elevation Angle	Degree	-1.0 to + 45.0	.1, Note 1,9
Hydrometeor Classification	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
Super Res Digital Correlation Coefficient	167	22	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1,9
Super Res Digital Phi	168	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 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. In addition, if bit 12 is set, then all elevation angles of the VCP matching the first N cuts 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		Spare				
17		Spare				
18		Spare				
21		Spare				
22		Spare				
23		Spare				
24		Spare				
25		Spare				
26		Spare				
28		Spare				
29		Spare				
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		Spare				
34		Spare				
35		Spare				
36		Spare				
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)
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		Spare				
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		Spare				
64		Spare				
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		Spare				
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 -----------------------------				

77	27	PUP Text Message	N/A	N/A	N/A	Alphanumeric
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		Spare				
86	14	Cross Section Velocity	.54 Horizontal x .27 Vert Nmi x Nmi	124	8	Raster Image (Velocity)
87		Spare				
88		Spare				
89		Spare				
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		Spare				
96		Spare				
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	162	256	Radial Image
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		Reserved for Future Products				
113		Power Removed Control Product	.13 x 0.5 Nmi. x Deg	162 nmi	13	Radial Image
114-131		Reserved for Furture 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		Spare				
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
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
142		Spare				
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
148		Spare				
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		Spare				
157		Spare				
158		Spare				
159	48	Digital Differential Reflectivity	.13 x 1 Nmi x Deg	162	256	Radial Image
160		Spare				
161	49	Digital Correlation Coefficient	.13 x 1 Nmi x Deg	162	256	Radial Image
162		Spare				
163	50	Digital Specific Differential Phase	.13 x 1 Nmi x Deg	162	256	Radial Image
164		Spare				
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
167	53	Super Res Digital Correlation Coefficient	.13x0.5 Nmi x Deg	162	256	Radial Image
168	54	Super Res Digital Phi	.13x0.5 Nmi x Deg	162	256	Radial Image
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
180-192		Reserved for SPG Products				
193	66	Super Resolution Digital Reflectivity Data-Quality-Edited	0.13 Nmi x 1/2 or 1 Deg	248	256	Radial Image
194		Reserved for SPG Products				
195	61	Digital Reflectivity, DQA-Edited Data Array	0.54 Nmi x 1 Deg	248	256	Radial Image
196	64	Microburst AMDA	NA	27	NA	Generic Data Format
197		Rain Rate Classification	250 m (0.13 Nmi) X 1 Degree	124	256	Radial Image
198-199		Reserved for Future Products				
200-201		Reserved for Future Products				
202		Shift Change Checklist				Generic Data Format
203-210		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 (see Figure 3-3)	
Command Parameters Block	(-1) Divider	10
	Version Number	11
	Length of Block	12
	# of Clear Air VCPs	13
	Clear Air VCP 1 (see Note 1)	...
	.....(see Note 1)	...
	Clear Air VCP n	...
	# of Precipitation VCPs	...
	Precipitation VCP 1 (see Note 1)	...
	.....(see Note 1)	...
	Precipitation VCP m	...
	Maximum SAILS Cuts	35
	Maximum SAILS Cuts for VCP 1	36
	.....(see Note 2)	...
	Maximum SAILS Cuts for VCP m	55
	Maximum MRLE Cuts	56
	Maximum MRLE Cuts for VCP 1	57
	… (see Note 2)	...
	Maximum MLRE Cuts for VCP m	76
	Velocity Measurement Increment (VMI) HIGH Resolution value	77
	Velocity Measurement Increment (VMI) LOW Resolution value	78

Figure 3-4a. Command Parameter Message (Sheet 1)

HALF WORD	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 Command Parameter Block
11	Version Number	INT*2	N/A	0-999	N/A	Version Number of the Command Parameter Message. When new command parameters are added or removed, the version number is incremented.
12	Length of Block	INT*2	Bytes	52	1	Number of bytes in block, including block divider.
13	Number of Clear Air VCPs	INT*2	N/A	0-20	N/A	Number of Clear Air VCPs to follow. (see Note 1)
14	Clear Air VCP 1	INT*2	N/A	1-767	N/A	Clear Air Mode VCP number
...						(see Note 1)
...	Number of Precipitation VCPs	INT*2	N/A	0-20	N/A	Number of Precipitation VCPs to follow (see Note 1)
...	Precipitation VCP 1	INT*2	N/A	1-767	N/A	Precipitation Mode VCP Number
...						

35	Maximum SAILS	Code*2	N/A	0-3	N/A	Maximum number of SAILS cuts that can be requested
36	Max SAILS Cuts for VCP 1	Code*2	N/A	0-3	N/A	Maximum number of SAILS cuts that can be requested for VCP 1
55	Max SAILS Cuts for VCP m	Code*2	N/A	0-3	N/A	Maximum number of SAILS cuts that can be requested for VCP m.
56	Max MRLE Cuts	Code*2	N/A	0-4	N/A	Maximum number of MRLE cuts that can be requested.
57	Maximum MRLE cuts for VCP 1	Code*2	N/A	0-4	N/A	Maximum number of MRLE cuts that can be requested for VCP 1.
...						
76	Maximum MLRE cuts for VCP m	Code*2	N/A	0-4	N/A	Maximum number of MRLE cuts that can be requested for VCP m.
77	Velocity Measurement Increment (VMI) HIGH Resolution value	Code*2	N/A	2	N/A	Value to request HIGH VMI
78	Velocity Measurement Increment (VMI) LOW Resolution value	Code*2	N/A	4	N/A	Value to request LOW VMI

Figure 3-4a. Command Parameter Message (Sheet 2)
Note 1: The number of Clear Air VCPs and the number of Precipitation VCPs can be variable. Halfword 13 will always contain the number of Clear Air VCPs. This number could be 0. Following the number of Clear Air VCPs will be a list of available Clear Air VCPs. If there are no Clear Air VCPs, the next halfword (Halfword 14) will contain the number of Precip VCPs. Otherwise the number of Precipitation VCPs will immediately follow after the last Clear Air VCP in the list. Immediately following the number of Precipitation VCPs is the list of available Precipitation VCPs. The number of Precip VCPs can be 0. Any unused/undefined halfword after the last Precipitation VCP will be set to 0.
The total number of VCPs, Clear Air and Precipitation, will not exceed 20.
The sum of the number of Clear Air VCPs and the number of Precipitation VCPs will always be 1 or greater.
Note 2: The VCPs are listed in the same order as the Clear Air VCPs followed by the Precipitation Mode VCPs. The total number of VCPs listed will not exceed 20.
Note 3: The version number is 1.

	MSB HALFWORD LSB	
	Measure Header Block (see Figure 3-3)	
Command Control Block	(-1) Divider	10
	Version Number	11
	Length of Block	12
	Select VCP for Next Volume Scan	13
	AVSET Control Value	14
	SAILS Control Value	15
	MRLE Control Value	16
	Velocity Measurement Increment (VMI) value	17

Figure 3-4b. Command Control Message (Sheet 1)

HALF WORD	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 Command Parameter Block.
11	Version Number	INT*2	N/A	1-999	N/A	Version Number of the Command Control Message. When new command parameters are added or removed, the version number is incremented.
12	Length of Block	INT*2	Bytes	12	1	Number of bytes in block, including block divider.
13	Select VCP	INT*2	N/A	See Note 2.	N/A	VCP to execute next volume scan with optional volume scan restart.
14	AVSET Control	INT*2	N/A	As Listed: 0: No Change 2: Enable 4: Disable	N/A	AVSET state to take effect next volume scan.
15	SAILS Control	Code*2	N/A	As Listed: -1: No Change 0: Disable 1-3: SAILS Cuts	N/A	Number of SAILS cuts requested for next SAILS enabled VCP executed. (See Note 1.)
16	MRLE Control	Code*2	N/A	As Listed: -1: No Change 0: Disable 2-4: MRLE Cuts	N/A	Number of MRLE cuts requested for next MRLE enabled VCP executed. (See Note 2.)
17	Velocity Measurement Increment (VMI)	Code*2	N/A	As Listed: -1 No Change 2: HIGH VMI 4: Low VMI	N/A	Velocity Measurement Increment value

Figure 3-4b. Command Control Message (Sheet 2)

Note 1: The number of SAILS cuts requested should be limited to the maximum number of SAILS cuts (Halfword 35 of the Command Parameter Message). If SAILS is enabled, then the number of MRLE cuts should be 0.

Note 2: Halfword 13 has the value 0 to denote No Change. Bits 0-12 (Bit 0 LSB) specify the VCP to select, with the VCP number in the range of 1-767. The VCP value should be one of the VCPs (either Clear Air or Precip Mode) specified in Message 12.

Bit 13 is reserved and has special meaning. Bit 13 denotes volume scan restart. If Bit 13 is set, the volume scan is restarted after the VCP is downloaded to the RDA from the RPG. The default behavior should be to not restart the VCP.

Bits 14 and 15 are currently undefined and will be set to 0.

Note 3: The number of MRLE cuts requested should be limited to the maximum number of MRLE cuts (Halfword 56 of the Command Parameter Message). If the number of MRLE cuts is enabled, then the number of SAILS cuts should be 0.

TABLE IV. DELETED

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	BLOCK DIVIDER (-1)	
	ALPHANUMERIC	BLOCK ID (3)	
	BLOCK	LENGTH OF BLOCK (MSW)	
		LENGTH OF BLOCK (LSW)	
			SECOND

			MESSAGE HEADER BLOCK (see Figure 3-3)	HEADER AND
			PRODUCT DESCRIPTION BLOCK (see sheet 2)	PRODUCT DESCRIPTION BLOCK
			BLOCK DIVIDER (-1)	DATA FORMATTED
			NUMBER OF PAGES	AS ALPHANUMERIC
REPEAT	REPEAT		NUMBER OF CHARACTERS	PRODUCT MESSAGE
FOR EACH PAGE	FOR EACH LINE		CHARACTER DATA	
			END OF PAGE FLAG (-1)	

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

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 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 (Note 5)
22 - 23	Volume Scan Start Time	INT*4	Seconds GMT	0 to 86399	1	Number of seconds after midnight, Greenwich Mean Time (GMT) (Note 5)
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
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, 167, 168, 193, and 195 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, 193, 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 except data level 2 for product 193 corresponds to "edit/remove" and data level 254 for product 193 corresponds to “chaff detection”. 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, and 155 data level codes 0 and 1 correspond to "Below Threshold" and "Range Folded", respectively. For products 93, 99, and 154 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 152 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, 193, 195 and 197 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)
15 = LH (Large Hail)
16 = GH (Giant Hail)

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, 167, 168. 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
Super Res Digital Correlation Coefficient	167	Unitless	300.0	-60.5	255	2; 0=below threshold 1=range folded	0
Super Res Digital Phi	168	Unitless	0.702777	2.0	255	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 165, version 1, the HA classification is sub-classified into LH (large hail, 110) and GH (giant hail, 120).

Product 197 contains enumerated integer values that correspond to rainfall rate classifications as indicated in the following table:

Color Levels				
Level Code	**Display**	**Meaning**	**Code**	**Color**
0	NP	No Precip (Biota or NoEcho)	(00 00 00)	black
10	UF	Unfilled	(66 66 66)	gray

20	CZ	Convective R(Z,ZDR)	(66 CC 66)	light green
30	TZ	Tropical R(Z,ZDR)	(C9 70 70)	medium green
40	SA	Specific Attenuation	(00 BB 00)	dark green
50	KL	R(KDP) 25 coeff.	(FF FF 70)	yellow
60	KH	R(KDP) 44 coeff.	(DA 00 00)	red
70	Z1	R(Z)	(00 00 FF)	dark blue
80	Z6	R(Z) * 0.6	(CC 99 FF)	lavender
90	Z8	R(Z) * 0.8	(33 99 FF)	medium blue
100	SI	R(Z) * multiplier	(99 CC FF)	light blue

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.

Note 2. Products with Version Numbers

PRODUCT NAME	**PRODUCT CODE**	**VERSION**	**REMARKS**
Command Parameter Message	12	2	Version 1 adds support for MRLE and provides the maximum allowed SAILS and MRLE cuts for each VCP. Version 2 adds support for changing the Velocity Measurement Increment (VMI).
Command Control Message	14	2	Version 1 adds support for requesting MRLE. Version 2 adds support for changing the Velocity Measurement Increment IVMI).
Composite Reflectivity	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	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	
Digital Mesocyclone Detection	149	1	
Mesocyclone Detection	141	1	
Hydrometeor Classification	164, 165	1	Version 1, added in Build 17, has the additional classifications of large (LH) and giant (GH) hail.
Digital Storm Total Accumulation	172	2	Version 1 deleted some obsolete parameters and added new ones to the Supplemental Data portion. Version 2 added one new parameter to the Supplemental Data for the KDP Multiplier for Rain/Hail and three new parameters for the Specific Attenuation Rain Rate This version (for Build 19) also added tabular alphanumeric data.

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.
Note 5. For elevation-based products generated on Supplemental Adaptive Intra-volume Low-elevation Scans (SAILS), the volume start date/time is replaced with the elevation start date/time of the Surveillance cuts of the split cut. For algorithm-based products that use multiple elevations such as DMD and TRU, the volume start date/time is replaced with the elevation start time of the lowest elevation Surveillance cut contributing to the product. For Product 75 (Free Text Message), the volume start date/time is replaced by the product generation date/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 6)
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 6. 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/P REC
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
Shift Change Checklist	202	51	Compression Method	N/A	0 or 1	1
Shift Change Checklist	202	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 500000	1
Shift Change Checklist	202	53	Uncompressed Product Data Size (LSW)			1
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	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15 (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
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 Spectrum Width	30	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Base Spectrum Width	30	47	Max Spectrum Width	Knots	0 to 19	1
Base Spectrum Width	30	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
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	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4:	1, Note 24

					0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	
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
Clutter Likelihood Reflectivity	132	30	Elevation Angle	Degree	-1.0 to +45.0	1
Clutter Likelihood Reflectivity	132	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
Clutter Likelihood Doppler	133	30	Elevation Angle	Degree	-1.0 to +45.0	1
Clutter Likelihood Doppler	133	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
Power Removed Control	113	27	RPG Cut Number	N/A	1 to 27	1
Power Removed Control	113	28	CMD Generated Flag	N/A	0 or 1	1
Power Removed Control	113	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Power Removed Control	113	47	Clutter Filter Map Time	Minutes	0 to 1439	1
Power Removed Control	113	48	Clutter Filter Map Date	Julian Date	1 to 32767	1
Power Removed Control	113	51	Compression Method	N/A	0 or 1	1
Power Removed Control	113	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 500000	1
Power Removed Control	113	53	Uncompressed Product Data Size (LSW)			1
Composite Reflectivity	37 - 38	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note1
Composite Reflectivity	37 - 38	47	Max Reflectivity	dBZ	-32 to +95, (-33)	1, Note 6
Composite Reflectivity	37 - 38	51	Cal. Constant (MSB)			

Composite Reflectivity	37 - 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	97-98	30	AVSET termination elevation angle Otherwise = 0	Degree	-1.0 to +45.0	.1, Note 1
Composite Reflectivity Edited for AP	97 - 98	47	Max Reflectivity	dBZ	-32 to 95, (-33)	1, Note 6
Composite Reflectivity Edited for AP	97 - 98	51	Cal Constant (MSB)			
Composite Reflectivity Edited for AP	97 - 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	47	Azimuth point one	Degree	0.0 to 359.9	.1, Note 1
Cross Section (Vel)	51	48	Range point one	Nmi	0.0 to 124.0	.1, Note 1
Cross Section (Vel)	51	49	Azimuth point two	Degree	0,0 to 359.9	.1, Note 1
Cross Section (Vel)	51	50	Range point two	Nmi	0.0 to 124.0	.1, Note 1
Cross Section (Reflect)	50	47	Azimuth point one	Degree	0.0 to 359.9	.1, Note 1
Cross Section (Reflect)	50	48	Range point one	Nmi	0.0 to 124.0	.1, Note 1
Cross Section (Reflect)	50	49	Azimuth point two	Degree	0.0 TO 359.9	.1, Note 1
Cross Section (Reflect)	50	50	Range point two	Nmi	0.0 to 124.0	.1, Note 1
Cross Section (Reflect)	50	51	Cal. Constant (MSB)			
Cross Section (Reflect)	50	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	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan	1, Note 24

					2 – MRLE Scan	
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
Super Resolution Digital Reflectivity Data-Quality-Edited Array	193	30	Elevation Angle	Degree	-1.0 to +45.0	.1
Super Resolution Digital Reflectivity Data-Quality-Edited Array	193	47	Max Reflectivity	dBZ	-31.5 to +95, (33)	1, Note 6
Super Resolution Digital Reflectivity Data-Quality-Edited Array	193	48	Number of artifact edited radials in elevation	unitless	0 to 10000	1
Super Resolution Digital Reflectivity Data-Quality-Edited Array	193	49	AVSET Status	unitless	0, 1, 3	1
Super Resolution Digital Reflectivity Data-Quality-Edited Array	193	50	Chaff Detection Status	unitless	0, 1	1
Super Resolution Digital Reflectivity Data-Quality-Edited Array	193	51	Compression Method	N/A	0 or 1	1
Super Resolution Digital Reflectivity Data-Quality-Edited Array	193	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 1329150	1
Super Resolution Digital Reflectivity Data-Quality-Edited Array	193	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
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
Microburst AMDA	196	27	Half Degree Scan Count Within Volume	N/A	0-1000	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 99.99	.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 Hazard Layers	179	48	HSDA status	N/A	0 or 1	1
Hail Hazard Layers	179	51	Compression Method	N/A	0 or 1	1
Hail Hazard	179	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 1329150	1
Hail Hazard	179	53	Uncompressed Product Data Size (LSW)			
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 99.99	.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
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
Icing Hazard Levels	178	51	Compression Method	N/A	0 or 1	1
Icing Hazard Levels	178	52	Uncompressed Product Data Size (MSW)	Bytes	120 to 1329150	1
Icing Hazard Levels	178	53	Uncompressed Product Data Size (LSW)			
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(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(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
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
Microburst AMDA	196	49	Detection Count	NA	0-1000	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.	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, Note 5
Storm Mean Radial Vel.	56	48	Max Pos. Velocity	Knots	0 to +245	1, Note 5
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 99.99	.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
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	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan	1, Note 24

					2 – MRLE Scan	
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	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
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	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24

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 99.99	.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
Tornado Vortex Signature Rapid Update	143	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
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 99.99	.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	159	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Differential Reflectivity	159	47	Minimum Differential Reflectivity	dB	-7.9 to +7.9	.1
Differential Reflectivity	159	48	Maximum Differential Reflectivity	dB	-7.9 to +7.9	.1

Differential Reflectivity	159	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
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	161	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Correlation Coefficient	161	47	Minimum Correlation Coefficient	N/A	0.2 to 1.05	.00333
Correlation Coefficient	161	48	Maximum Correlation Coefficient	N/A	0.2 to 1.05	.00333
Correlation Coefficient	161	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
Correlation Coefficient	161	51	Compression Method	N/A	0 or 1	N/A, Note 23
Correlation Coefficient	161	52	Size of uncompressed product (MSW)	Bytes	120 to 500000	1 byte
Correlation Coefficient	161	53	Size of uncompressed product (LSW)	Bytes		1 byte
Specific Differential Phase	163	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Specific Differential Phase	163	47	Minimum Specific Differential Phase	Deg/km	-2.05 to +10.00	.05
Specific Differential Phase	163	48	Maximum Specific Differential Phase	Deg/km	-2.05 to +10.00	.05
Specific Differential Phase	163	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
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	165	30	Elevation Angle	Degree	-1.0 to +45.0	.1, Note 1
Hydrometeor Classification	165	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
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
Melting Layer	166	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
Super Res Digital Correlation Coefficient	167	30	Elevation Angle	Degrees	-1.0 to + 45.0	-1.0 to + 45.0
Super Res Digital Correlation Coefficient	167	47	Min Correlation Coefficient	N/A	0.2 to 1.05	00333
Super Res Digital Correlation Coefficient	167	48	Max Correlation Coefficient	N/A	0.2 to 1.05	00333
Super Res Digital Correlation Coefficient	167	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
Super Res Digital Correlation Coefficient	167	51	Compression Method	N/A	0 or 1	N/A

Super Res Digital Correlation Coefficient	167	52	Size of uncompressed product (MSW)	Bytes	120 to 500000	1 byte
Super Res Digital Correlation Coefficient	167	53	Size of uncompressed product (LSW)	Bytes		1 byte
Super Res Digital Phi	168	30	Elevation Angle	Degrees	-1.0 to + 45.0	1 Note 1.
Super Res Digital Phi	168	47	Min Differential Phase	Degrees	0 to 360	
Super Res Digital Phi	168	48	Max Differential Phase	Degrees	0 to 360	
Super Res Digital Phi	168	50	Delta Time / Supplemental Scan	Seconds / N/A	Bits 5-15: (0-800) Bits 0-4: 0 – Non Supplemental Scan 1 – SAILS Scan 2 – MRLE Scan	1, Note 24
Super Res Digital Phi	168	51	Compression Method	N/A	0 or 1	N/A
Super Res Digital Phi	168	52	Size of uncompressed product (MSW)	Bytes	120 to 500000120 to 500000	1 byte
Super Res Digital Phi	168	53	Size of uncompressed product (LSW)	Bytes		1 byte
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 99.99	.01, Note 1, Note 18
Digital Accum Array	170	27	Threshold Min. Time in Hourly Period	Minutes	0 to 60	1
Digital Accum Array	170	28	Total Time in Hourly Period	Minutes	0 to 60	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
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 1439	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	0.001, 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	0.00 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
Rain Rate Classification	197	47	Mode Filter Size	N/A	1 to 15	1
Rain Rate Classification	197	48	Rain Rate Percent Bins Filled	Percent	0.01 100.00	.01%, Note 1
Rain Rate Classification	197	49	Highest Elev. Used	Degrees	0.5 - 19.5	.01%, Note 1
Rain Rate Classification	197	50	Multiplier for Dry Snow above the ML	N/A	1.0 to 2.8	0.1
Rain Rate Classification	197	51	Compression Method	N/A	0or 1	N/A, Note 23
Rain Rate Classification	197	52	Size of uncompressed product (MSW)	Bytes	120 to 500000	1 byte
Rain Rate Classification	197	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	65-67, 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, TVS Rapid Update	61, 143	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, TVS Rapid Update	61, 143	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	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 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 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 and are set to a value of 0 by default.
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."

6. "No Top_of_Hour accumulation - Some problem encountered with the SQL query resulted in an error."

7. "No Top_of_Hour accumulation because of excessive missing time encountered."

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 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

Note 24. Bits 5-15 contains the delta time, in seconds, between the last radial in the elevation scan used to create the product and the start of the volume scan.

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 + □) Where: A = Harmonic Coefficient (Fourier #1) V = SQRT[CF2^2+CF3^2} 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	
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	N/A	Status messages will be sent only if error conditions occur

			- Hours Available for Request		
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

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
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	N/A	Status messages will be sent only if error conditions occur

			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		
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
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	Storm Cell ID	Alphanumeric	A0 through Z0,	N/A	The sequence is

REFLECTIVITY OR COMPOSITE REFLECTIVITY EDITED FOR AP			then A1 through Z1, then A2...Z9.		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/m²	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
	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
	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
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

	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	
	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
	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

	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
	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
	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	
	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)	Alphanumeric Percent	UNKNOWN or 0 to 100	N/A	If the maximum expected hail size exceeds 4.00 inches, the hail size is labeled ">4.00".

	· Probability of Severe Hail (POSH) · Maximum Expected Hail Size	Percent Inches	0 to 100 0.00 and 0.50 to 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)
	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	
	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	N/A	

			Days: 1 to 31 Years: 0 to 99		
	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
	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
	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	
	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
	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	
	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/	Months: 1 to 12	N/A	

		Year	Days: 1 to 31 Years: 00 to 99		
	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	
	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
	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 and are set to a string value of "N/A" until gage bias is implanted.
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 No Value	LSB	
	PACKET CODE (=6)			
	LENGTH OF DATA BLOCK (BYTES)			
	I STARTING POINT			1/4 Km or
	J STARTING POINT			Screen Coordinates
DATA	END I VECTOR NUMBER 1			
BLOCK	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			
	I STARTING POINT			1/4 Km
	J STARTING POINT			Screen Coordinates
DATA	END I VECTOR NUMBER 1			
BLOCK	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 No Value	LSB	
	PACKET CODE (=7)			
	LENGTH OF DATA BLOCK (BYTES)			
DATA	BEGINNING I	VECTOR 1		1/4 KM
BLOCK	BEGINNING J	VECTOR 1		OR
	END I	VECTOR 1		SCREEN COORDINATES
	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			
DATA	BEGINNING I	VECTOR 1		1/4 KM
BLOCK	BEGINNING J	VECTOR 1		OR
	END I	VECTOR 1		SCREEN COORDINATES
	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)
<u>No Value</u>

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		MSB	HALFWORD Set Color Levels		LSB	
0	E	0	3	Packet Codes /OP Flags	0	8	0	2	Packet Codes
8	0	0	0	Initial Point Indicator	0	0	0	2	Color Value Indicator
I					VALUE (LEVEL) OF CONTOUR				
J									
LENGTH =# VECTORS x 4									
I1									
J1									
I2									
J2									

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)

<u>Set Color Levels:</u>

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

<u>Linked Contour Vectors:</u>

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	I STARTING POINT	1/4 KM
BLOCK	J STARTING POINT	Screen Coordinates
	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	VALUE OF TEXT STRING			
BLOCK	I START			1/4 KM
	J START			Screen Coordinates
	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	I STARTING POINT			1/4 KM
BLOCK	J STARTING POINT			Screen Coordinates
	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				
	NUMBER OF RLE HALFWORDS IN RADIAL				
REPEAT FOR	RADIAL START ANGLE				
EACH RADIAL	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
	8	0	0	0	/ OP FLAGS
	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				
	NUMBER OF BYTES IN THIS ROW				
REPEAT FOR	RUN (0)	COLOR CODE (0)	RUN (1)	COLOR CODE (1)	

EACH ROW	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	NUMBER OF BYTES IN ROW		
EACH 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	NUMBER OF BYTES IN ROW			
EACH 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		
	NUMBER OF BYTES IN RADIAL		
	RADIAL START ANGLE		
REPEAT	RADIAL DELTA ANGLE		
FOR	LEVEL (0)		LEVEL (1)
EACH	LEVEL (2)		LEVEL (3)
RADIAL	•		•

	•	•
	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
		PACKET CODE (=5)		
		LENGTH OF DATA BLOCK (BYTES)		
DATA	REPEAT	I COORDINATE		
BLOCK	FOR	J COORDINATE		
	EACH	DIRECTION OF ARROW		
	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
		PACKET CODE (=4)		
		LENGTH OF DATA BLOCK (BYTES)		
DATA	REPEAT	VALUE		
BLOCK	FOR	X COORDINATE		
	EACH	Y COORDINATE		
	BARB	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	I POSITION		
EACH SYMBOL	J POSITION		
	RADIUS OF MESOCYCLONE		

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

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

	MSB	HALFWORD	LSB
	PACKET CODE (=14)		
HAIL PROBABLE	LENGTH OF BLOCK (BYTES)		
REPEAT FOR	I POSITION		
EACH SYMBOL	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	I POSITION		
EACH SYMBOL	J POSITION		
	CHARACTER 1		CHARACTER 2

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

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

	MSB	HALFWORD	LSB
	PACKET CODE (=25)		
STI CIRCLE	LENGTH OF BLOCK (6 BYTES)		
REPEAT FOR	I POSITION		
EACH CIRCLE	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	I POSITION		
EACH SYMBOL	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		TREND CODE	
EACH TREND	# VOLUMES		LATEST VOL PTR
CODE		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

Figure 3-15b. Deleted (Sheet 1)
Figure 3-15b. Deleted (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	REPEAT FOR	NUMBER OF CHARACTERS		
EACH PAGE	EACH LINE	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.
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	

	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)		
10 GENERAL 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	SUPPLEMENTAL CUT MAP (HALFWORD 1)		
60	SUPPLEMENTAL CUT MAP (HALFWORD 2)		
•			
100	SPARE		

Figure 3-17. General Status 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	178	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 9-0	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	Backup Comms
					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
					Bit 12 = 1	Radial by Radial Noise (RxRN) Enabled
					Bit 11 = 1	Coherency Based Theresholding (CBT) Enabled
					Bit 10 = 1	VCP Sequence in use
					Bit 9 = 1	SPRT VCP in use
					Bit 8 = 1	MRLE Enabled VCP in use
					Bit 7 = 1	Base Tilt Enabled VCP in use
					Bit 6 = 1	MPDA VCP in use
					Bit 5 = 0	HIGH Resolution VMI

					Bit 5 = 1	LOW Resolution VMI
59	Supplemental Cut Map	Integer	N/A	0.1/Bit Note 3	Bit 15 = LSB	Where:
					Bit 15 = 1	Elevation Cut 1 of VCP is a supplemental cut
					Bit 0 = 1	Elevation Cut 16 of VCP is a supplemental cut
60	Supplemental Cut Map	Integer	N/A	0.1/Bit Note 3	Bits 0-6	Number of supplemental cuts in VCP
					Bit 15 = 1	Elevation Cut 17 of VCP is a supplemental cut
					Bit 7 = 1	Elevation Cut 25 of VCP is a supplemental cut
61-100	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.
Note 3: A supplemental cut can either be a SAILS cut or a MRLE cut. Refer to Halfword 58 to determine the supplemental cut type. If Bit 14 of Halfword 58 is set, the supplemental cuts are SAILS cuts. If Bit 8 of Halfword 58 is set, the supplemental cuts are MRLE cuts.

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

	MSB	HALFWORD	LSB
	MESSAGE HEADER BLOCK (see Figure 3-3)		
10 REQUEST RESPONSE BLOCK	BLOCK DIVIDER (-1)		
11	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)

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	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)
					Bit 19	Command Not Authorized (Note 4)
					Bit 20	Command Rejected (Note 5)
					Bits 21-31	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.
Note 4: Bit 19 will be set if the Source ID in the Message 14 header and the Line Index of the user do not match the authorized user list maintained at the RPG.

Note 5: Bit 20 will be set when the command is authorized but cannot be processed such as when the RDA is not connected or the RDA is connected but the RDA is in local (RDA) control.

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

Figure 3-19. Deleted (Sheet 1)
Figure 3-19. Deleted (Sheet 2)
Figure 3-20. Deleted (Sheet 1)
Figure 3-20. Deleted (Sheet 2)

	MSB HALFWORD LSB	
	MESSAGE HEADER BLOCK (see Figure 3-3)	
10 PRODUCT LIST MESSAGE BLOCK	(-1) BLOCK DIVIDER	
11	LENGTH OF BLOCK	
12	NUMBER OF PRODUCTS	
13	RESERVED	
14 REPEAT FOR	PRODUCT CODE	
15 EACH PRODUCT	ELEVATION	
16	PARAMETER 1	PRODUCT
17	PARAMETER 2	DEPENDENT
18	PARAMETER 3	(SEE TABLE X)
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 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)
REPEAT	Bias Table Row n: Memory Span (MSW)
FOR	Bias Table Row n: Memory Span (LSW)
EACH	Bias Table Row n: No. G-R Pairs (MSW)
ROW	Bias Table Row n: No. G-R Pairs (LSW)
	Bias Table Row n: Avg. Gage (MSW)
	Bias Table Row n: Avg. Gage (LSW)

	Bias Table Row n: Avg. Radar (MSW)
	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 (LSW)	Scaled Integer	N/A	.001 - 1. x 10**5	.001	Effective sample size (No. Gage-Radar Pairs)

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)

4 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	Celsius
Cal	Calibration
CALIB	Calibration
Char	Character
CKT	Circuit
CLIN	Contract Line Item Number
CM	Cubic Meters
Comp	Composite
Const	Constant
CPC	Computer Program Component
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.
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
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
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
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
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
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
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
UCP	Unit Control Position
VAD	Velocity Azimuth Display
Var	Variation
Vel	Velocity
VIL	Vertically Integrated Liquid
VMI	Velocity Measurement Increment
Wd	Width

5 APPENDIX B. RADAR CODED MESSAGE

RADAR CODED MESSAGE CODE

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.

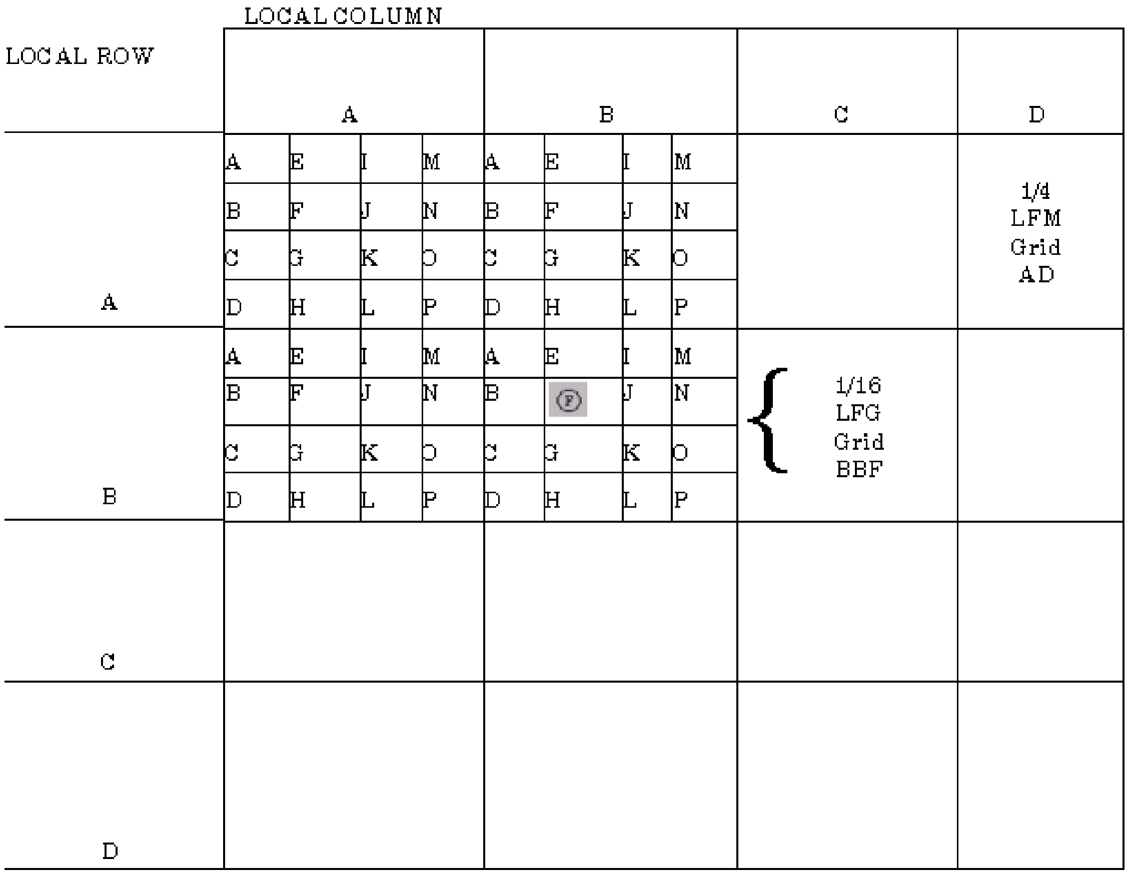

Figure B-1. 1/16 Limited Fine Mesh Model Grid

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

<u>Part B: VAD Winds</u>
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

6 APPENDIX C. DATA TRANSMISSION CHARACTERISTICS

6.1 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
8	Prod. List	.026 + (.014 x # of prod on list)
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).		

6.2 Table XII. Deleted

6.3 Table XIII. VCP 12 Product Size

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
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
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
60	M		3400	5450	4342	4205
61	TVS		2112	2928	2384	2112
62	SS		5758	9850	8355	8302
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
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
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
113	PRC		7483	29357	17479	19237
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
137	ULR		17190	21468	20033	20220
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					

6.4 Table XIV. VCP 121 Product Size (Deleted)

6.5 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
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.

6.6 Table XVI. - VCP 211 Product Sizes

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
30	SW	0.5	25088	29366	26522	25654
30	SW	1.5	15972	20440	18091	18068
30	SW	2.4	12430	15966	14127	13932
30	SW	3.3	12154	14942	13482	13442
30	SW	4.3	11988	13928	12789	12758
37	CR		31432	34754	33057	32713
38	CR		6732	10084	7184	7041
41	ET		2080	2234	2161	2171
59	HI		3560	8916	5617	5607
48	VWP		6742	11546	10897	11458
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
56	SRM	0.5	19346	24414	21628	21290
56	SRM	1.5	15702	18484	16570	16402
56	SRM	2.4	13250	16438	14595	14346
56	SRM	3.3	13420	15594	14374	14262
56	SRM	4.3	12696	15092	14044	14092
55	SRR	0.5	11214	15692	12913	12374
55	SRR	1.5	8936	12224	9881	9602
55	SRR	2.4	7938	10270	8859	8595
55	SRR	3.3	7602	9696	8497	8296
55	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
93	DBV	0.5	44070	44070	44070	44070
93	DBV	1.5	44070	44070	44070	44070
93	DBV	2.4	44070	44070	44070	44070
93	DBV	3.3	36870	36870	36870	36870
93	DBV	4.3	28950	28950	28950	28950
94	DR	0.5	31931	35059	33479	33728
94	DR	1.5	22152	24610	23090	22967
94	DR	2.4	18843	21128	19944	19815
94	DR	3.3	19446	20637	20139	20095
94	DR	4.3	17449	20041	19212	19442
99	DV	0.5	77061	87291	82648	83138
99	DV	1.5	52250	60582	55679	55362
99	DV	2.4	40554	49827	44335	43866

99	DV	3.3	45061	47971	46152	46113
99	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
90	LRM		1848	2096	2005	2010
97	CRE		30854	32906	31885	31998
98	CRE		6822	8718	7039	6974
74	RCM		1940	2290	2173	2220
132	CLR	0.5	30326	33624	31654	31070
132	CLR	1.5	24974	26820	25647	25388
132	CLR	2.4	22610	24240	23366	23210
132	CLR	3.3	22774	23564	23233	23244
132	CLR	4.3	21616	23152	22458	22410
133	CLD	0.5	30764	33752	32226	31798
133	CLD	1.5	24166	26242	25168	25070
133	CLD	2.4	21450	24170	22445	22326
133	CLD	3.3	22402	23534	22820	22772
133	CLD	4.3	21818	23308	22510	22508
134	DVL		23572	26483	25262	25340
135	EET		10162	12049	11223	11422
137	ULR		21048	21870	21402	21338
138	DSP		44628	44628	44628	44628
139	MRU	0.5	120	828	174	120
139	MRU	1.5	120	828	192	120
139	MRU	2.4	120	828	192	120
139	MRU	3.3	120	828	192	120
139	MRU	4.3	120	992	233	120
140	GFM		248	2580	993	248
141	MD		120	120	120	120
143	TRU	0.5	120	120	120	120
143	TRU	1.5	120	120	120	120
143	TRU	2.4	120	120	120	120
143	TRU	3.3	120	120	120	120
149	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
149	DMD	0.5	736	1841	1000	1052
149	DMD	1.5	748	2291	1144	1064
149	DMD	2.4	760	2454	1344	1403
149	DMD	3.3	772	2427	1381	1427
149	DMD	4.3	780	2430	1377	1428
150	USW		3082	3082	3082	3082
151	USD		3082	3082	3082	3082

15.7 Table XVII. VCP 212 Product Size

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
30	SW	0.5	14946	32034	22847	22878
31	USP		280	376	329	376
32	DHR		29139	42536	37747	38074
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
56	SRM	0.5	14122	27312	18476	18023
57	VIL		1936	2352	2133	2134
58	STI					
59	HI					
60	M					
61	TVS					
62	SS					
65	LRM		3046	3600	3272	3200
66	LRM		2498	3002	2713	2678
67	APR		3052	3606	3208	3222
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
82	SPD		2834	2834	2834	2834
84	VAD		5530	7064	6626	6790
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
113	PRC		7483	29357	17479	19237
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
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

15.8 Table XVIII. Deleted

15.9 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)
30	SW	0.5	16622	37164	27766	28937
31	USP		280	376	333	376
32	DHR		38034	39531	38870	38975
41	ET		2648	3210	2918	2920
48	VWP		5330	10672	9469	10289
50	RCS		1570	1942	1788	1772
51	VCS		1716	2030	1883	1880
56	SRM	0.5	12958	28780	21785	21986
57	VIL		1888	2148	2014	2030
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
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
113	PRC		7483	29357	17479	19237
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
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	120527
154	SDV	0.5	219089	281510	252482	257789
155	SDW	0.5	28796	233180	120356	77401
159	DZD		47216	198764	121745	106317
161	DCC		43916	199430	113583	99540
163	DKD		10125	29765	21595	22675
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
177	HHC		7759	9191	8456	8572
195	DRQ		13422	46121	31935	22646
197	RRC		7759	9191	8456	8572

Table XX. VCP 112 Product Size (Dual Pol)

PRODUCT CODE	PRODUCT MNEMONIC	ELEVATION	MIN SIZE (Bytes)	MAX SIZE (Bytes)	AVERAGE SIZE (Bytes)	MEDIAN SIZE (Bytes)
30	SW	0.5	16622	37164	27766	28937
31	USP		280	376	333	376
32	DHR		38034	39531	38870	38975
41	ET		2648	3210	2918	2920
48	VWP		5330	10672	9469	10289
50	RCS		1570	1942	1788	1772
51	VCS		1716	2030	1883	1880
56	SRM	0.5	12958	28780	21785	21986
57	VIL		1888	2148	2014	2030
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

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
113	PRC		7483	29357	17479	19237
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
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	UDS		3082	3082	3082	3082
153	SDR	0.5	43444	386913	194946	120527
154	SDV	0.5	219089	281510	252482	257789
155	SDW	0.5	28796	233180	120356	77401
159	DZD		47216	198764	121745	106317
161	DCC		43916	199430	113583	99540
163	DKD		10125	29765	21595	22675
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
177	HHC		7759	9191	8456	8572
195	DRQ		13422	46121	31935	22646
197	RRC		7759	9191	8456	8572

7 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.

8 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.
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 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)