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25 March 2008
RPG Build 10.0

INTERFACE CONTROL DOCUMENT
FOR THE
RPG to CLASS 2 USER

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TABLE OF CONTENTS

INDEX OF FIGURES

1 SCOPE

1.1 Identification

This document defines the applications layer interface between the Next Generation Weather Radar (NEXRAD) Radar Product Generation Group (RPG, CI-07, CPCI-03) and a Class 2 User. RPG refers to the RPG equipment, 2830007, Pt 1 and Radar Program Generation Program CPCI 03, 2820003, Pt 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 2 Users

The Class 2 user's system may be located anywhere and they communicate with the RPG via a dial-up phone line. These systems issue one-time product requests to the RPG, receive the products from the RPG, and display the products to the operator.

1.3 Document Overview

This document defines the application layer interface between the RPG and Class 2 external users. This document identifies applicable standards and defines message formats. 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 into 3 sections and one appendix.

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 this application layer interface, operating procedures and message formats.

Appendix A contains a list of abbreviations and acronyms, and selected definitions.

2 REFERENCE DOCUMENTS

2.1 Government Documents

2.1.1 Specifications

Document Number:	**Title**
2810000C	WSR-88D System Specification
2830007A, Pt 1	Prime Item Development Specification for RPG Equipment (B-1, CI-07).
2820003B, Pt 1	Computer Development Specification for Radar Product Generation Program (B5, CPCI-03).
2620001B	Interface Control Document for RPG to Class 1 User
2620040	RPG X.25.Protocol ICD
Source:	WSR-88D Radar Operations Center 1313 Halley Circle Norman, OK 73069 URL: http://www.roc.noaa.gov

3 APPLICATION LAYER

The RPG application interface provides Class 2 users with status messages and meteorological products.

3.1 Operation Procedures

Once the Class 2 communications link is established and logically connected to the RPG, the RPG sets a sign-on timer (default 60 seconds). The Class 2 user is required to identify himself to the NEXRAD system by sending a Sign-on Message Request for Dial-up Users prior to expiration of this timer. If the timer expires, the link will be disconnected. Upon successful verification of the contents of this message by the NEXRAD system, application level message exchange may proceed.

3.1.1 Sign-On Message

Figure 3-3 describes the Sign-on Message format for Dial-in Users to the NEXRAD Network. Once the lower level link has been established, the RPG sets a sign-on timer (60 seconds). If this timer expires before the RPG receives a sign-on message, the link will be disconnected. This sign-on message must be received and validated by the RPG prior to any other (layer 4 and above) message exchange or the RPG will disconnect the link. Once this message has been validated, the Class 2 user will be automatically disconnected after a period of time specified by the Maximum Connect Time halfword in the General Status Message (subsection 3.1.2.1). A privileged Class 2 user may override this feature by setting the Disconnect Override Flag. For details on this procedure, refer to the Maximum Connect Time Disable Request Message in subsection 3.1.4.2**.**

"User Password" is a 6-character ASCII string, left justified (padded with blanks) and containing no special characters. In order for a Class 2 user to successfully request or receive data/status from NEXRAD, this password must agree with the password associated with the Source ID in the site's adaptation data. "Port Password" is a 4-character ASCII string, left justified (padded with blanks) and containing no special characters. "Port Password" identifies the user as having access to the narrowband port. Failure to successfully execute this message will cause an "Invalid Password" message to be sent to the user (figure 3-5) and an immediate disconnect of the link.

3.1.2 Initial Message for Class II Users

3.1.2.1 General Status Message

Once the Class 2 user completes the sign-on message described in section 3.1.1 they will receive the General Status Message describing the NEXRAD system operational status. In addition, this message specifies a Maximum Connect Time for the particular port the Class 2 user is connected. The Maximum Connect Time tells the Class 2 user how long they will remain connected before being automatically disconnected. For details on the disconnect procedure, refer to the Maximum Connect Time Disable Request Message in subsection 3.1.4.2. The format of the General Status Message is shown in Figure 3-6. As the state of the NEXRAD system changes over the duration of the communications session, the Class 2 user will be kept up to date by transmission of a new General Status Message.

3.1.2.2 Product List Message

The Product List Message provides a list of products that are available to the Class 2 user on a one-time request basis. The format for this message is as described in ICD 2620001. The RPG will

transmit this message automatically, following the General Status Message, at sign-on and whenever product availability changes thereafter.

3.1.3 Requesting Weather Products for Class II Users

Class 2 users request product data in the same manner as Class 1 users described in ICD 2620001 with the exception of Routine Product Lists, which are not applicable to Class 2 users, who only make one-time requests.

3.1.3.1 Product Distribution and Availability

Class 2 users may request any valid NEXRAD product, listed as available on the RPG distribution list, as a one-time product request with the exception of the User Alert message, which is not transmitted to the Class 2 user. All products may not be available to all users due to system degradation, system load shedding, or because of a hardware or software problem.

3.1.3.2 Product Request Message

The Product Request Message is transmitted to the RPG in order to request products on a one-time basis. The format for this message is as described in ICD 2620001.

3.1.3.3 Request Response Message

If the RPG is unable to distribute a product to the Class 2 user, receives an invalid message, receives a request for an invalid product, or receives an invalid request for a communication disconnect override, the Class 2 user will receive a Request Response Message as depicted in Figure 3-5. This message describes the error condition, sequence number (if applicable) of the request message that generated the response, and product or message code of the message in question. All the error conditions of this message nullify the request for the reasons given in the message.

3.1.4 Communications Disconnect

Each RPG Class 2 dial-in port has a maximum connect time assigned in system site adaptation data. This default value, which may vary from port to port, is communicated to the Class 2 user in the General Status Message described in section 3.1.2.1, which the Class 2 user will receive after successful execution of the sign-on procedure in section 3.1.1.1. When the maximum connect time limit is reached, the product currently being transmitted is allowed to complete and the user is notified of a "Commanded Disconnect" and the link is disconnected.

3.1.4.1 Communications Disconnect Override

Privileged Class 2 users may override this feature at sign-on time by setting the "Disconnect Override Flag" to 1 (see Figure 3-3). The maximum allowable connect time for dial-up users is limited by adaptation data even when the disconnect override feature is enabled. Non-privileged users attempting to disable this feature will receive an "Illegal Request" message as described in the "Request Response" message shown in figure 3-5.

3.1.4.2 Maximum Connect Time Disable Request Message

Privileged Class 2 Users may extend the maximum connect time at sign-on by sending the Maximum Connect Time Disable Request Message specified in Figure 3-4. The maximum additional connection time requested is limited by adaptation data. Non-privileged Class 2 users attempting to extend the maximum connect time will receive a Request Response Message indicating an "Illegal Request" back from the RPG.

3.2 Product Data Format Layer

The Product Data Format Layer is defined in the RPG to Class 1 User ICD (2620001), with modifications as described in the following subsections.

3.2.1 Graphic Product Message

Graphic products are transmitted from the RPG to the Class 2 user via the Graphic Product Message in response to one-time product requests. This message is also used to transmit combined products containing both graphic and alphanumeric data. The contents and format of this message are defined in ICD 2620001.

3.2.2 Stand-Alone Tabular Alphanumeric Product Message

Products that are completely alphanumeric are transmitted from the RPG to the Class 2 user via the Stand-Alone Tabular Alphanumeric Product Message. The format for this message, along with the products that use this message are defined in ICD 2620001, with the exception of the User Alert Message, which is not transmitted to the Class 2 user.

		MSB HALFWORD LSB		
Message	01	Message Code		
Header	02	Date of Message		
Block	03	Time of Message (MSW)		
	04	(LSW)		
	05	Length of Message (MSW)		
	06	(LSW)		
	07	Source ID		
	08	Destination ID		
	09	Number of Blocks		
	10	Block Divider (-1)		
	11	Length of Block		
	12	C1	C2	6 Character ASCII
	13	C3	C4	Dial-in
	14	C5	C6	Password
	15	C1	C2	4 Character ASCII
	16	C3	C4	Port Password
	17	Disconnect Override Flag		
	18	Spare		

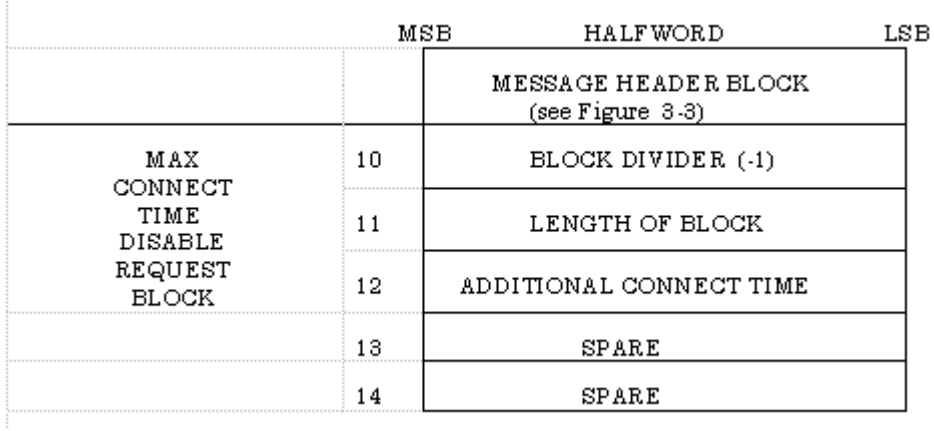
Figure 3-3. Sign-on Message for Dial-up Users (Sheet 1 of 2)

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION / ACCURACY	REMARKS
01	Message Code	INT*2	N/A	Refer to Table II in ICD 2620001	N/A	NEXRAD Message Code 11 for Sign-on message
02	Date of Message	INT*2	Julian Date	1 to 32767	1	Modified Julian date at time of transmission. Integer number of days since 1 January 1970, where 1=1/1/70. To obtain actual Julian date, must add +2449576.5 to the modified value
03-04	Time of Message	INT*4	Seconds GMT	0 to 86399	1	Number of seconds after midnight Greenwich Mean Time (GMT)
05-06	Length of Message	INT*4	N/A	18-409856	1	Number of bytes in message including header (36 for Sign-on message)
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 (receivers') ID for message transmission
09	Number of Blocks	INT*2	N/A	2	1	1 header block plus sign-on message block
10	Block Divider	INT*2	N/A	-1	N/A	Integer value of -1, used to delineate sign-on block from message header block
11	Length of Block	INT*2	N/A	18	1	Number of bytes including divider and length field
12-14	C1 to C6	Char	8-bit ASCII	0 to 9, A to Z	N/A	6 character dial-up password (refer to Note 1)
15-16	C1 to C4	Char	8-bit ASCII	0 to 9, A to Z	N/A	4 character port password (refer to Note 2)

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION / ACCURACY	REMARKS
17	Disconnect Override Flag	INT*2	N/A	0,1	N/A	1 = Yes 0 = No
18	Spare					

Figure 3-3. Sign-on Message for Dial-Up Users (Sheet 2 of 2)

NOTE 1: Dial-up password must be a 6-character ASCII string. For a dial-up user to successfully request data or status from the destination, this password must agree with the password associated with the source id, in the destination adaptation data. Failure to provide a valid password will cause the link to be disconnected at the destination, and reinitialized for the next user.
NOTE 2: Port password must be a 4-character ASCII string identifying the Narrowband User as having access to the port. Each port has a password associated with it and the user must furnish this to establish data transfer above the network layer. If the user designates an invalid Port Password the user will be disconnected and the link reinitialized for the next user.



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 block from the max connect time disable block
11	Length of Block	INT*2	N/A	10	1	Number of bytes including divider and length field
12	Additional Connect Time	INT*2	Minutes	0 to 1440	1	Integer number of minutes (refer to Note 1)
13-14	Spare					

Figure 3-4 Maximum Connect Time Disable Request Message

NOTE 1: Integer number of minutes. Each RPG dial-in port has a maximum connect time assigned in system adaptation. This value is communicated to the Non-associated PUP in the General Status Message (Figure 3-6). Privileged users may request additional time by sending the above request (message code = 4) and setting the "Additional Connect Time" field to:

Integer Value	Description
N > 0	number of additional minutes
N = 0	disable disconnect (continuous)

		MSB HALFWORD LSB	
		MESSAGE HEADER BLOCK (see Figure 3-3)	MESSAGE CODE = 3
	10	BLOCK DIVIDER (-1)	
REQUEST RESPONSE BLOCK	11	LENGTH OF BLOCK	
	12	ERROR CODE (MSW)	
	13	" (LSW)	
	14	SEQUENCE NUMBER	
	15	PRODUCT/MESSAGE CODE	
	16	ELEVATION ANGLE	
	17-24	SPARE	

Figure 3-5 Request Response Message (Sheet 1 of 2)

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 • Bit 0=1 • Bit 1=1 • Bit 2=1 • Bit 3=1 • Bit 4=1 • Bit 5=1 • Bit 6=1 • Bit 7=1 • Bit 8=1 • Bit 9=1 • Bit 10=1 • Bit 11=1 • Bit 12=1 • Bit 13 • Bit 14 • Bit 15 • Bit 16 • Bit 17 • Bit 18 • Bit 19 to 31	Where: • No Such Message Code • No Such Product Code • Product Not Generated (Not Available in Data Base) • One-Time Request Generation Process Faulted • Narrowband Loadshed • Illegal Request • RPG Memory Loadshed • RPG CPU Loadshed (Note 1) • Unavailability of Slots (Real-Time, Replay or Customized) • Failure (task failed) • Unavailable (task not loaded upon startup) • Available Next Volume Scan • Moment Disabled • Invalid Password • Spare • Aborted Volume Scan (Note 2) • Invalid Product Parameters • Product Not Generated (Data Sequence Error) (Note 3) • Task Failure (Self-Terminated) • Spares
14	Sequence Number	INT*2	N/A	-13, 0 to 32767	1	Sequence number of request that caused response

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
15	Product/ Message Code	INT*2	N/A	-16 to -299, 16 to 299	1	Product/Message code as defined in Table II of ICD 2620001, 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					

Figure 3-5. Request Response Message (Sheet 2 of 2)

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.

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	N/A	82	1	Number of bytes to follow
12	Mode of Operation	INT*2	N/A	0 to 2	N/A	Where:
					0 = Maintenance Mode 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=1 • Bit 14=1 • Bit 13=1 • Bit 12=1 • Bit 11=1 • Bit 10=1 • Bit 9 • Bit 8=1 • Bits 7-0 • Bits 15-10, 8=0	• Automatic Calibration Disabled • Online • Maintenance Action Required • Maintenance Action Mandatory • Commanded Shutdown • Inoperable • Spare • Wideband Disconnect • Spare • 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 20	1	Maximum Elevation Cuts = 20
16	Elevation 1	Scaled Integer	Degrees	-1.0 to +45.0	.1	Elevation angle for elevation 1
*						
*						
*						
35	Elevation 20	Scaled Integer	Degrees	-1.0 to +45.0	.1	Elevation angle for elevation 20. NOTE: If the number of elevation cuts N, is less than 20, then elevations N+1 through 20 are zeros.

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
36	RDA Status	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					• Bit 15 • Bit 14=1 • Bit 13=1 • Bit 12=1 • Bit 11=1 • Bit 10=1 • Bit 9=1 • Bit 8-0 • Bits 14-9=0	• Spare • Startup • Standby • Restart • Operate • Spare • Off-line Operate • Spares • 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 • Bit 14=1 • Bit 13=1 • Bit 12=1 • Bit 11=1 • Bit 10=1 • Bit 9=1 • Bit 8=1 • Bit 7=1 • Bits 6-0 • Bits 15-7=0	• Indeterminate; the RPG cannot determine the alarms present • Tower/Utilities • Pedestal • Transmitter • Receiver/Signal Processor • RDA Control • RDA Communications • Spare • Spare • Spares • 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 • Bit 14=1 • Bit 13=1 • Bit 12=1 • Bit 11=1 • Bits 10 to 0	• Spare • None • Reflectivity • Velocity • Spectrum Width • Spares

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
39	RPG Operability Status	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					• Bit 15=1 • Bit 14=1 • Bit 13=1 • Bit 12=1 • Bit 11=1 • Bits 10 to 0	• Loadshed • On-line • Maintenance Action Required • Maintenance Action Mandatory • Commanded Shutdown • Spares
40	RPG Alarms	Integer	N/A		Bit 15=LSB	Where:
					• Bit 15=1 • Bit 14=1 • Bit 13=1 • Bit 12=1 • Bit 11=1 • Bit 10=1 • Bit 9=1 • Bit 8=1 • Bit 7=1 • Bit 6=1 • Bit 5=1 • Bit 4=1 • Bit 3=1 • Bit 2=1 • Bit 1=1 • Bit 0=1	• No Alarms • Node Connectivity • Spare • RPG Control Failure • Base Data Failure • Spare • RPG Input Buffer Loadshed (Wideband) • Spare • Product Storage Loadshed • Spare • Spare • Spare • RPG/RPG Intercomputer Link Failure • Redundant Channel Error • Task Failure • Media Failure
41	RPG Status	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					• Bit 15=1 • Bit 14=1 • Bit 13=1 • Bit 12=1 • Bit 11=1 • Bit 10-0	• Restart • Operate • Standby • Spare • Test Mode • Spares

HALF WORD	FIELDNAME	TYPE	UNITS	RANGE	PRECISION/ ACCURACY	REMARKS
42	RPG Narrowband Status	Integer	N/A	0,1/Bit	Bit 15=LSB	Where:
					•Bit 15=1 •Bit 14=1 •Bit 13-0	•Commanded Disconnect •Narrowband Loadshed •Spares
43	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 • Bit 15=1 • Bit 14=1 • Bit 13=1	Where: • Product Availability • Degraded Availability • 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	Spare					
47	Spare					
48	RDA Build Number	Fixed Point, Scaled Integer	N/A	0 to 999, Note 2	N/A	Major and minor RDA Build Version
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

Figure 3-6. General Status Message

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.

APPENDIX A. GLOSSARY

Acronym/ Abbreviation	Description
ASCII	American Standard Code for Information Interchange
Bit	Binary Digit
Block	A related set of bytes containing control information or data. A block is a component of a message.
C	Control Sequence
CLIN	Contract Line Item Number
CPCI	Computer Program Configuration Item
CPU	Central Processor Unit
dBZ	Reflectivity, in Decibels
DISC	Disconnect
GFS	General Format Specifier
GMT	Greenwich Mean Time
Halfword	16 contiguous 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.
ICD	Interface Control Document
ID	Identification
INFO	Information
ISO	International Organization for Standardization
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
MSW	Most Significant Word
N/A	Not Applicable
NEXRAD	Next Generation Weather Radar
NWS	National Weather Service
OSI	Open Systems Interconnection
Product	A collection of information that is self-contained and provides a complete representation of a graphical image or an alphanumeric message.
RDA	Radar Data Acquisition Group
Reflect Calib. Corr.	Reflectivity Calibration Correction
RLE	Run Length Encoded
RPG	Radar Product Generation Group
SCN	Specification Change Notice
SR	Signaling Rate Selector
ZBID	Zero-Bit Insertion/Deletion