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APPENDIX A

DOPPLER WEATHER RADAR INTERFACE TO THE NEXRAD METEOROLOGICAL PROCESSOR

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A1.0 SCOPE

This appendix describes the data format requirements for the Doppler weather radar interface to the NEXRAD Meteorological Processor. Included are the required data items and formats. These data items and formats have been excerpted from the Interface Control Document for the RDA to ORPG, June 29, 1999, and the Doppler Weather Radar to NEXRAD Meteorological Processor Interface Control Document, May 25, 2000; both documents are available for reference purposes (see section A2.0).

A2.0 Applicable Documents

This section lists all the applicable documents referenced elsewhere in this specification. The current issue of the following documents, together with their first tier references, form a part of this specification. Unless specifically stated otherwise, the version of the document that applies is the version in effect on the date of issue of the solicitation.

The following documents are available from the sources shown.

a. Department of Commerce

Interface Control Document for the RDA/ORPG (Draft) Document Number 2620002C
Code Identification 0WY55
WSR-88D OSF
June 26, 1999

Source: WSR-88D Operational Support Facility
3200 Marshall Avenue
Norman, OK 73072
Attn: Systems Support Branch
405-366-6549 x3231

Doppler Weather Radar To NEXRAD Meteorological Processor Interface Control Document (ICD) (1st Draft)
(May 25, 2000)

Source: WSR-88D Operational Support Facility
3200 Marshall Avenue
Norman, OK 73072
Attn: Engineering Branch
405-366-6520

A3.0 Data Format Requirements

A3.1 Message Description

The message header data format shall be as described in
Table 3A-1. The maximum number of halfwords to be transferred at one time shall be 1208 halfwords (2416) bytes, including the message header. Messages with a length greater than 1208 halfwords shall be divided into segments of 1208 halfwords or less. The Message Header of each segment shall contain both the total number of segments in the entire message and the individual segment number. For messages with length of 1208 halfwords or less, the number of message segments shall be one, and the individual segment number is not applicable.

Table A3-1 Message Header Data Format

NAME	DESCRIPTION	FORMAT	UNITS	RANGE	ACCURACY/ PRECISION	BYTE
Message Size	Message size in halfwords (1)	Integer	Halfwords	10 to 1028	1	0-1
Spare						2
Message Type	Message Type = 1	Integer	N/A	N/A	N/A	3
I.D. Sequence Number	Message Sequence Number	Integer	ID Number	0 to 32,767 then roll over to 0	1	4-5
Julian Date	JD - 2440586.5 (2)	Integer	Days	1 to 65,535	1	6-7
Milli-seconds of day	Number of milliseconds from Midnight, GMT	Integer	Milli-seconds	(3)	±2000/±1	8-11
Number of Message Segments	Messages larger than 1208 halfwords are segmented and transmitted separately	Integer	Segments	1 to 32,767	1	12-13
Message Segment Number	Segment number of this message	Integer	Segment ID Number	1 to 32,767	1	14-15

Notes: (1) This is the message size for this message segment, not the total of all segments in the message.
(2) 1 January 1970 00.00 Greenwich Mean Time = 1 Modified Julian Date
(3) 0 to 86,399,999

N/A: Not Applicable

A3.2 Digital Radar Data Format

Digital radar data format requirements shall be as described in Table A3-2.

Table A3-2 Digital Radar Data Format

NAME	DESCRIPTION	FORMAT	UNITS	RANGE	ACCURACY/ PRECISION	BYTE
Time	Zulu reference time at which radial was collected	Integer 4 bytes	Milli-seconds	0 to 86,399,999	± 2000/± 1	0-3
Modified Julian Date	Current Julian Date (1) -2440586.5	Integer 2 bytes	Day	1 to 65,535	1	4-5
Unamb Range	Unambiguous Range Interval Size	Integer 2 Bytes (2)	Km	115 to 511	± 0.1/± 0.1	6-7
Azimuth Angle (3)	Azimuth at which radial data was collected	Integer 2 bytes	Deg	0 to 359.956055	(4)	8-9
Azimuth Number (3)	Radial number within elevation cut	Integer 2 bytes	Count	1 to 400	1	10-11
Radial Status	Radial Status (e.g., last)	Integer 2 bytes (5)	N/A	N/A	N/A	12-13
Elevation Angle (6)	Elevation angle at which radial data was collected	Integer 2 bytes (4)	Deg	353 to 70	(4)	14-15
Elevation Number (6)	Elevation number within volume scan	Integer 2 bytes	Count	1 to 25	1	16-17

Notes: (1) 1 January 1970 00.00 GMT = 1 Modified Julian Date
(2) Fixed Point Scaled
(3) For vertical raster scan, these denote “Elevation Angle” and “Elevation Number” along with associated units, range, and accuracy
(4) Precision of 0.1Deg +/- 0.01 Deg
(5) Format Defined in Table A3-4
(6) For vertical raster scan, these denote “Azimuth Angle” and “Azimuth Number”, along with associated units, range and accuracy

N/A: Not Applicable

Table A3-2 Digital Radar Data Format (cont.)

NAME	DESCRIPTION	FORMAT	UNITS	RANGE	ACCURACY/ PRECISION	BYTE
Surv. Range	Range to first surveillance gate (BIN)	Integer 2 bytes (2) (7)	Km	32,768 to +32,768	± 0.05/ ± 0.001	18-19
Doppler Range	Range to center of first Doppler gate	Integer 2 bytes (2) (7)	Km	-32,768 to +32,768	± 0.05/ ± 0.001	20-21
Surv. Range Sample Interval	Size of surveillance sample interval	Integer 2 bytes (2) (7)	Km	0.25 to 4	± 0.05/ ± 0.001	22-23
Doppler Range Sample Interval	Size of Doppler sample interval	Integer 2 bytes (2) (7)	Km	0.25 to 4	± 0.05/ ± 0.001	24-25
Number of surv. Bins	Number of surveillance Bins for current radial	Integer 2 bytes	Count	0 to 460	1	26-27
Number of Doppler Bins	Number of Doppler Bins for current radial	Integer 2 bytes	Count	0 to 920	1	28-29
Surv. Pointer	Pointer to first location of surveillance data in radial	Integer 2 bytes	BYTE	100 (8)	1	36-37*
Velocity Pointer	Pointer to first location of velocity data in radial	Integer 2 bytes	BYTE	100 to 560 (8)	1	38-39
Spectral Width Pointer	Pointer to first location of spectral width data in radial	Integer 2 bytes	BYTE	100 to 1480 (8)	1	40-41

* Bytes 30 - 35 Not Used

Notes: (2) Fixed point scaled
(7) Format defined in Table A3-3
(8) 0 indicates no data

Table A3-2 Digital Radar Data Format (cont.)

NAME	DESCRIPTION	FORMAT	UNITS	RANGE	ACCURACY/ PRECISION	BYTE
Doppler Velocity Resolution	Indicates scaling used for Doppler Velocity	Integer 2= 0.5m/s 4= 1.0m/s	N/A	N/A	N/A	42-43
Volume Coverage Pattern Number	Identifies volume coverage pattern being used	Integer 2 bytes	N/A	1 to 767	1	44-45
Nyquist Velocity	Nyquist velocity	Fixed point scaled integer 2 bytes	m/s	5.0 to 327.67	± .003/ ± .01	60-61**
ATMOS	Atmospheric attenuation factor	Fixed point scaled integer 2 bytes	dB/Km	- .02 to -.002	± .004/ ± .001	62-63
TOVER	Threshold parameter which specifies the minimum difference in echo power between two resolution cells for them not to be labeled “overlaid”	Fixed point scaled integer 2 bytes	dB	0.0 to 20.0	± .1/± .1	64-65
Reflectivity	Weather radar surv. Data (0 to 460 cells)	Fixed point scaled integer (9) (10)	dBz	-32 to +94.5	± -1/± 0.5	100-559

** Bytes 46 - 59 Not Used

Notes: (9) Code of 00 - Signal Below Threshold, Code of 01 - Signal Overlaid
(10) See Table A3-4 for Scaling - Range of Doppler Velocity set in accordance with Doppler Velocity Resolution

N/A: Not Applicable

Table A3-2 Digital Radar Data Format (cont.)

NAME	DESCRIPTION	FORMAT	UNITS	RANGE	ACCURACY/ PRECISION	BYTE
Doppler Velocity	Weather radar velocity data (0 to 920 cells)	Ref Fixed Point Scaled Integer 1 Byte (9) (10)	m/s	-63.5 to +63 -127 to 126	± 1/0.5 ± 1/1	100-1479 (11)
Doppler spectrum Width	Weather radar spectral width data (0 to 920 Cells)	Fixed Point Scaled Integer 1 Byte (9) (10)	m/s	-63.5 to +63	± 1/0.5	100-2399 (12)

Notes: (9) Code of 00 - Signal Below Threshold, Code of 01 - Signal Overlaid
(10) See Table A3-5 for Scaling - Range of Doppler Velocity set in accordance with Doppler Velocity Resolution
(11) Byte Start Location depends on length of Reflectivity Field, Byte Stop Location depends on Length of Velocity Field
(12) Byte Start Location depends on length of Reflectivity Field and Velocity Fields, Byte Stop Location depends on Length of Spectral Width Field

A3.3 Range Data Format

Range data format requirements shall be as described in Table A3-3.

Table A3-3 Range Data Format (Km)

BIT	MEANING
15	Sign
14	16.384
13	8.192
12	4.096
11	2.048
10	1.024
09	0.512
08	0.256
07	0.128
06	0.064
05	0.032
04	0.016
03	0.008
02	0.004
01	0.002
00 (LSB)	0.001

A3.4 Radial Status Data Format

Radial status data format requirements shall be as described in Table A3-4.

Table A3-4 Radial Status Data Format

RADIAL STATUS INDICATOR(HEX)	SETTING(HEX)	BAD DATA(HEX)
Start of new elevation	00	80
Intermediate radial data	01	81
End of Elevation	02	82
Beginning of Volume Scan	03	83
End of Volume Scan	04	84

A3.5 Base Data Scaling

Base data scaling requirements shall be as described in Table A3-5.

Table A3-5 Base Data Scaling

LSB = 0.5	$R = NINT[2.*(R_{num} + 32.)] + 2$
LSB = 0.5	$V = NINT[2.*(V_{num} + 63.5)] + 2$
LSB = 1.0	$V = NINT[V_{num} + 127.] + 2$
LSB = 0.5	$SW = NINT[2.*(SW_{num} + 63.5)] + 2$

Where:

NINT is a rounding function (i.e., NINT[1.5] returns 2). R_{num}, V_{num}, and SW_{num} are values before scaling. The inverse relationships are:

$$R_{num} = \frac{R}{2} - 33.0$$

$$V_{num} = \frac{V}{2} - 64.5 \text{ or } V - 129.0$$

$$SW_{num} = \frac{SW}{2} - 64.5$$