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ACCEPTANCE TEST REPORT
ON ANTENNA, AS-3132/I, OF THE
AN/TRN-41 TACAN NAVIGATIONAL SET

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) AN/TRN-41 TACAN NAVIGATIONAL SET		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report gives the results of the acceptance tests on the Antenna AS-3132/T.		



**ACCEPTANCE TEST REPORT
ON ANTENNA, AS-3132/T, OF THE
AN/TRN-41 TACAN NAVIGATIONAL SET**

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This report gives the results of the acceptance tests on the Antenna AS-3132/T.

- 1. Test Identification.** The acceptance tests for Antenna, AS-3132/T, are those tests that will be performed during production of the antenna assuring proper operation of the antenna. These tests have been performed on preproduction antennas to verify compliance with product fabrication specification 404L-701-5032 and prime item development specification 404L-701-5017A Part I of two parts. The acceptance test procedure used to perform these acceptance tests is given in Appendix I of specification number 404L-701-5032, dated 25 October 1976.
- 2. Functional Purpose of Test.** These tests form a part of the AN/TRN-41 qualification tests.
- 3. Test Objectives.** To demonstrate that the Antenna, AS-3132/T, will meet the requirements of specification number 404L-701-5017A, part I of two parts, dated 20 August 1976.
- 4. Description of Test Article.** For this test, four AS-3132/T antennas were used. These antennas were tested at Montek, Salt Lake City and at NACO, Colusa, California during November and December 1976, using the procedures and test configurations shown in Appendix I of specification 404L-701-5032. Due to test results of the shock tests on Antenna S/N 001, a heavier radome was designed and the acceptance tests were repeated on Antenna S/N 003 with the heavier radome.
- 5. Summary of Test Results.** The following table shows the requirement of prime item development specification, 404L-701-5017A, and the test number in the antenna acceptance test procedure, Appendix I of specification number 404L-701-5032. The antennas meet the requirements of 404L-701-5017A as shown in the data sheets of attachments 1 and 2. A comparison of data is given in attachment 3 for Antenna S/N 003 with the light radome and with the heavier radome. Data are also shown in attachment 3 for Antenna S/N 003 that was taken after the shock test (4 foot drop test) was performed with the heavier radome. This last test was not a formal qualification test and the data were taken without Montek Q.A. or DCAS witnessing the tests.

REQUIREMENTS	REQUIREMENT REFERENCE	ACCEPTANCE TEST PROCEDURE
	404L-701-5017 Part I of Two parts	404L-701-5032

Antenna Performance

Operation on channels (64X thru 126X)	3.7.2.1.1.1	10.3.4.3
VSWR	3.7.2.1.1.4	10.3.4.3.2
Antenna Signal Modulation	3.7.2.1.2	10.3.4.3.6
Antenna Signal	3.7.2.1.3	10.3.4.3.3
Antenna Harmonic Content	3.7.2.1.4	10.3.4.3.5



E-SYSTEMS

Montek Division

REQUIREMENTS	REQUIREMENT REFERENCE 404L-701-5017 Part I of Two parts	ACCEPTANCE TEST PROCEDURE 404L-701-5032
Antenna Vertical Coverage	3.7.2.1.5	10.3.4.3.4
Antenna Gain	3.7.2.1.6	10.3.4.3.4
Cross Polarization Effects	3.7.2.1.7	10.3.4.3.7
Antenna Carrier Pattern	3.7.2.1.8	10.3.4.3.4
Azimuth Accuracy	3.7.2.1.9	10.3.4.3.8
Antenna Orientation	3.7.2.1.10	10.3.4.3.9

6. Description of Test Facility and Procedures. The test facilities and procedures are described in Appendix I of specification number 404L-701-5032, dated 25 October 1976.

7. Test Setup Diagrams. The test setup diagrams are provided in Appendix I of specification number 404L-701-5032.

8. List of Test Equipment. Following is a list of test equipment used for the antenna acceptance tests. The list includes manufacturer, model number, and calibration date as applicable.

<u>Name</u>	<u>Manufacturer and P/N</u>	<u>Calibration Date</u>
UHF Signal Generator	HP612A	2/24/77
UHF Signal Generator	HP8614B	12/22/76
Square Wave Modulator	HP8403A	2/24/77
Antenna Positioner	Scientific-Atlanta 5315A-5B-M	N/A
Receiving Horn	Montek P/N 131500-705	N/A
IF AMP	GR1236	3/25/77
UHF Oscillator	GR1326	3/25/77
Wave Analyzer	GR736-A	2/16/77
Oscilloscope	Tektronix 422	12/15/76
Oscilloscope	Tektronix 453	7/14/76
Frequency Meter	HP536A	2/5/77
Azimuth Accuracy Test Set	MM-001B	7/5/77



<u>Name</u>	<u>Manufacturer and P/N</u>	<u>Calibration Date</u>
Pulse to Sine Wave Generator	MM-002A	2/5/77
Sine Wave Phase Shifter	MM-003A	2/5/77
SWR Meter	HP415C	5/30/77
Slotted Line	HP805C	6/13/77
Attenuator	HP8491A	N/A
DC Power Supply	HP6274A	1/16/77
DC Power Supply	HP6215	N/A
Counter	CMC727	4/16/77
Digital Voltmeter	Fluke 8100	4/13/77
Test Interface Box, Antenna	Montek P/N 131500-704	N/A
Antenna Alignment Test Fixture	Montek P/N 006893	N/A
Transit	Path TR-303	N/A
Detector	HP423	N/A
Microwave Amplifier	HP489A	5/20/77

9. Recorded Test Data. Attachment 1 contains copies of the data sheets for antenna serial numbers 001, 002, 003 and 004 in the configuration with the lighter weight radome. Attachment 2 contains the data sheet for antenna serial number 003 with the heavier radome. Attachment 3 is a comparison of test results for Antenna S/N 003 with the light radome, the heavier radome and data taken after shock test with the heavier radome.

10. Test Conditions. All tests were conducted at ambient conditions at the test site.

11. Test Result Analysis. The test results show that the antenna met all requirements of the acceptance test procedure. Modification of the antenna by replacing the original radome with a heavier radome did not result in degradation of the antenna performance. Therefore, further testing of the antennas with the heavier radome will not be performed.

12. Certification. The last page of each data sheet shown in Attachments 1 and 2 have been signed by a Montek Q.A. representative and a DCAS representative, certifying that the test results are authentic, accurate, current and in accordance with the related test procedures.

ATTACHMENT 1
ANTENNA ACCEPTANCE TEST DATA SHEETS

OFFICIAL DATA
COPY.

SAMPLE
ATTACHMENT 2
INSPECTION CERTIFICATION SHEET
FOR
ANTENNA, AS-3132/T

Date: 23 NOV 1976

Serial No. 001

Stamp

1.1 This is to certify that this item has been manufactured in conformance to the critical item product fabrication specification and the workmanship is in accordance with MIL-STD-454 and meets the following criteria:

- a. Free of burrs and sharp edges.
- b. No foreign matter is present.
- c. Finish is as specified in the drawings and MIL-STD-454.
- d. Operating parts work freely and properly.
- e. All hardware is fastened securely.
- f. The general appearance is neat and clean.

1.2 The item has been inspected to ensure compliance with the physical characteristics of the drawing, parts lists and other documents listed on drawing.

Milton B. Grant
Accepted
Contractor QA Representative

23 NOV. 1976
Date

J. J. [Signature]
Accepted
DCAS Representative

11 Dec 1976
Date

SAMPLE

Specification Number 404L-701-5032
25 October 1976 (Draft Copy)

ATTACHMENT 3

PERFORMANCE ACCEPTANCE TEST PROCEDURE DATA SHEET
FOR
ANTENNA, AS-3132/T

Date: 23 NOV 1976

Serial No. 001

Data:

NOTE

Tests marked with an asterisk (*) are periodic production tests which are performed on the first production antenna and on each tenth production antenna. All other tests are performed on each production antenna.

		<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.1	Input Power Rotation and Speed		
c.	Antenna rotates clockwise		<u>✓</u>
d.	15 Hz trigger period low voltage (66.666 ± .133 ms)	<u>66.6685</u>	<u>✓</u>
f.	15 Hz trigger period high voltage (66.666 ± .133 ms)	<u>66.6692</u>	<u>✓</u>
10.3.4.3.2	Voltage Standing Wave Ratio (VSWR)		<u>✓</u>

FREQUENCY	SPECIFICATION	MEASUREMENT
1088 MHz	≤ 2.5 : 1	2.0 : 1
1150 MHz		1.37 : 1
1151 MHz	≤ 1.5 : 1	1.37 : 1
1182 MHz		1.35 : 1
1213 MHz		1.34 : 1

10.3.4.3.3 Reference Triggers

c.



✓

	SPECIFICATION	MEASUREMENTS					
		15 Hz		135 Hz		1350 Hz	
PERIOD		66.666 ± 0.133 ms	<u>66.668</u> ms	7407 μs ± 14.8 μs	<u>7408</u> μs	740 μs ± 1.5 μs	<u>739.6</u> μs
BASE LINE LEVEL	≥ +3.5V		<u>4.8V</u>		<u>4.9V</u>		<u>4.8V</u>
PULSE AMPLITUDE	≥ 3.0V		<u>4.8V</u>		<u>4.9V</u>		<u>4.8V</u>
PULSE RISE TIME	≤ 20 μs		<u>≤ 5 μs</u>		<u>≤ 5 μs</u>		<u>≤ 5 μs</u>

Check if OK

f. Priority of 15 Hz trigger over 135 Hz trigger.

10.3.4.3.4 Antenna Gain and Vertical Coverage

c. Maximum carrier energy location

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
BETWEEN +5° AND +30°	28.0	28.0	29.0

e. Carrier level at different elevations.

ELEVATION	1151 MHz			1182 MHz		1213 MHz	
	(A) AREA	(E) VOLTAGE	(E) ² (A) PRODUCT	(E) VOLTAGE	(E) ² (A) PRODUCT	(E) VOLTAGE	(E) ² (A) PRODUCT
-5°	.1736	.61	.0646	.600	.0625	.520	.0469
-15°	.1684	.50	.0421	.470	.0372	.435	.0319
-25°	.1520	.415	.0272	.360	.0205	.340	.0183
-35°	.1428	.315	.0142	.250	.0087	.245	.0086
-45°	.1232	.210	.0054	.170	.0036	.140	.0024
-55°	.1000	.160	.0026	.100	.0010	.100	.0010
-65°	.0737	.100	.0007	.050	.0002	.070	.0004
-75°	.0451	.035	.0001	.070	.0004	.160	.0012
-85°	.0152	.020	.0000	.070	.0001	.100	.0002
TOTAL			.1569 = T ₁	TOTAL	.1344 = T ₁	TOTAL	.1209 = T ₁

+5°	.1736	.775	.1043	.705	.0863	.660	.0756
+15°	.1684	.420	.1425	.860	.1245	.840	.1188
+25°	.1580	.100	.1580	.960	.1456	.960	.1456
+35°	.1428	.905	.1170	.960	.1316	.940	.1262
+45°	.1232	.480	.0587	.740	.0675	.740	.0675
+55°	.1000	.57	.0325	.580	.0306 = 0.0336	.620	.0384
+65°	.0737	.540	.0215	.520	.0199	.620	.0283
+75°	.0451	.400	.0072	.375	.0063	.580	.0113
+85°	.0152	.190	.0005	.140	.0003	.180	.0005
TOTAL			.6422 = T ₂	TOTAL	.6125 = T ₂	TOTAL	.6122 = T ₂

7971

7170 6156

7251

ELEVATION	VOLTAGE (E)		
	1151 MHz	1182 MHz	1213 MHz
-5°	.610	.600	.520
0°	.695	.645	.580
+5°	.775	.705	.660

Check if OK

* f. Maximum carrier level below horizon = E_f

1151 MHz	1182 MHz	1213 MHz
N/A	-25 .090	-25 .160

g. Main lobe peak gain = $10 \log \left(\frac{2}{T_1 + T_2} \right)$ dB
(See step e for T_1 and T_2 .)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≥ 3 dB	3.98 dB	4.26 4.22 dB	4.42 dB

* h. % Energy below horizon = $100 \left(\frac{T_1}{T_1 + T_2} \right)$
(See step e for T_1 and T_2 .)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
$\leq 25\%$	19.6	18 17.9	15.3

i. Slope on horizon = $\frac{E(@+5^\circ)}{E(@0^\circ)} - \frac{E(@-5^\circ)}{E(@0^\circ)}$ V/V/°
(See step e for E values.)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≥ 0.01 V/V/°	.024	.016	.020 .024

j. Gain on horizon = Main lobe peak gain - X dB
(see step g.)

Where $X = 20 \log \frac{1}{E@0^\circ}$
(See step e. for E value.)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≥ -1 dB	.82 dB	.45 .47 dB	-.31 dB

Check if OK

*k. Energy below horizon
 Main lobe gain - Y ≤ -8 dB
 (step g.)
 Where Y = 20 log ($\frac{1}{E_f}$)
 (See step f. for E_f.)



SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≤ -8 dB	N/A	-21dB	-15.9dB

Check if OK

*10.3.4.3.5 Harmonic Content

d.

HARMONIC	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 15 Hz	SQUARE	% OF 15 Hz	SQUARE	% OF 15 Hz	SQUARE	
FUNDAMENTAL	15 Hz	100 %		100 %		100 %		
2nd	30 Hz	12	144.0	5	25.0	3.0	9.0	
3rd	45 Hz	7	49.0	7.4	54.8	3.5	12.25	
4th	60 Hz	5	25.0	4.2	17.6	4.8	23.04	
5th	75 Hz	3	9.0	5.0	25.0	4.1	16.81	
6th	90 Hz	10.7	114.5	2.5	6.25	6.7	44.89	
SUM OF SQUARES 2nd - 6th			294.1		128.65		105.99	
$\sqrt{\Sigma}$			17.1		11.34		10.3	≤ 25%

f.

	1151 MHz *			1182 MHz *			1213 MHz *		
	% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE
105 Hz	2.2	≤ 25%	4.84	9.9	≤ 25%	98.01	6.2	≤ 25%	38.44
120 Hz	10.0		100.0	20.8		432.64	13.5		182.25
150 Hz	0		0.0	4.0		16.00	18.0		324.00
165 Hz	0		0.0	0		0.00	3.8		14.44
SUM OF SQUARES			104.84			546.65			538.13
$\sqrt{\Sigma}$		≤ 25%	10.24		≤ 25%	23.38		≤ 25%	23.65

f.

HARMONIC	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	
FUNDAMENTAL	135 Hz	100 %		100 %		100 %		
2nd	270 Hz	2.2	4.84	2.0		4.0		
3rd	405 Hz	0	0.0	0		0		
4th	540 Hz	0	0.0	0		0		
5th	675 Hz	0	0.0	0		0		
6th	810 Hz	0	0.0	0		0		
SUM OF SQUARES 2nd - 6th			4.84					
$\sqrt{\Sigma}$			2.2		2.0		4.0	≤ 15%

10.3.4.3.6 % Modulation
f., g.*, h.*, and i*.

ANTENNA ELEVATION	% MODULATION 1151 MHz			% MODULATION 1182 MHz			% MODULATION 1213 MHz		
	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM
*-2°	19.9	20.9	X	25.2	29.2	X	24.0	34.0	X
0°	19.4	20.8	40.2	25.3	28.0	53.3	23.5	31.0	54.5
*+5°	18.0	19.0	X	24.6	23.5	X	24.0	25.2	X
*+10°	17.0	17.0	X	22.9	20.1	X	24.1	21.0	X
*+25°	10.8	8.3	X	14.9	10.2	X	17.8	10.6	X
*+30°	6.6	X	X	10.5	X	X	13.1	X	X

SPECIFICATION

Check If OK

15 Hz Mod vs. Vertical Angle

0°	21 ± 9%	<input checked="" type="checkbox"/>
*-2° to +10°	21 ± 9%	<input checked="" type="checkbox"/>
*+10° to +30°	>5%	<input checked="" type="checkbox"/>

135 Hz Mod vs. Vertical Angle

0°	24 ± 12%	<input checked="" type="checkbox"/>
*-2° to +10°	24 ± 12%	<input checked="" type="checkbox"/>
*+10° to +25°	>5%	<input checked="" type="checkbox"/>

Sum of 15 and 135 Hz % Modulation on the horizon.

<55%	<input checked="" type="checkbox"/>
------	-------------------------------------

*Variation in 15 Hz Modulation

-2° to +5°	<8%	<input checked="" type="checkbox"/>
------------	-----	-------------------------------------

*Variation in 135 Hz Modulation

-2° to +5°	<8%	<input checked="" type="checkbox"/> 8.8% *
------------	-----	--

* NOTE: EXCEEDS 8%

m B L 11/24/76



Check if OK

*10.3.4.3.7 Cross Polarization Error

		CROSS POLARIZATION ERROR			
		1151 MHz*	1182 MHz*	1213 MHz*	SPEC
e.	15 Hz @ -30°	+2.0	+1.5	+3.0	< ±3°
f.	15 Hz @ +30°	-1.5	-2.0	-2.0	
h.	135 Hz @ -30°	$\frac{+2.0}{9} = .222$	$\frac{+4.5}{9} = .500$	$\frac{-5.0}{9} = .556$	< ±1°
i.	135 Hz @ +30°	$\frac{-4.0}{9} = .444$	$\frac{+5}{9} = .556$	$\frac{+6.5}{9} = .722$	

Check if OK



10.3.4.3.8 15 Hz Azimuth Accuracy

d. and e.

15 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	* 1151 MHz	* 1182 MHz	* 1213 MHz		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0	0	0	0	0.0	0.0	0.0
20	20.0	22.0	21.0	20	0.0	+2.0	+1.0
40	39.0	41.0	43.5	40	-1.0	+1.0	+3.5
60	58.0	59.5	60.5	60	-2.0	-0.5	+0.
80	77.5	79.0	79.5	80	-2.5	-1.0	+0.5
100	98.0	100.5	100	100	-2.0	+0.5	0.0
120	119.0	121.0	122.0	120	-1.0	+1.0	+2.0
140	138.0	140.0	143.0	140	-2.0	+0.0	+3.0
160	158.0	160.0	165.0	160	-2.0	+0.0	+5.0
180	178.0	181.0	185.0	180	-2.0	+1.0	+5.0
200	196.0	198.0	200.0	200	-4.0	-2.0	0.0
220	214.0	218.0	222.0	220	-6.0	-2.0	+2.0
240	236.0	240.5	243.0	240	-4.0	+0.5	+3.0
260	257.5	260.0	262.0	260	-2.5	+0.0	+2.0
280	278.0	281.0	282.0	280	-2.0	+1.0	+2.0
300	298.0	301.0	302.0	300	-2.0	+1.0	+2.0
320	319.0	320.5	324.0	320	-1.0	+0.5	+4.0
340	339.0	340.5	343.5	340	-1.0	+0.5	+3.5
360	360.0	360.0	360	360	0.0	+0.0	0.0

NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 8°.



Check if OK



10.3.4.3.8 135 Hz Azimuth Accuracy

i. and j.


135 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	1151 MHz	1182 MHz	1213 MHz		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0	0	0	0	0.0	0.0	0.0
20	+5.0	+2.0	+2.5	20	+0.556	+0.222	+0.278
40	+6.0	-1.0	-1.5	40	+0.667	0.111	-0.167
60	+8.0	0.0	+1.0	60	+0.889	0.0	+0.111
80	+6.0	-2.0	-1.0	80	+0.667	-0.222	-0.111
100	+2.0	0.0	0.0	100	+0.222	0.0	0.0
120	+4.0	+1.0	+2.0	120	+0.444	+0.111	+0.222
140	+4.0	+1.0	+3.0	140	+0.444	+0.111	+0.333
160	+8.0	+1.0	+2.0	160	+0.889	+0.111	+0.222
180	+11.0	+3.0	+5.0	180	+1.222	+0.333	+0.556
200	+6.5	+3.0	+3.0	200	+0.722	+0.333	+0.333
220	+7.0	+2.0	+3.0	220	+0.778	+0.222	+0.333
240	+6.0	+2.0	+5.0	240	+0.667	+0.222	+0.556
260	+6.0	+2.5	+4.5	260	+0.667	+0.278	+0.500
280	+5.5	-1.0	0.0	280	+0.611	-0.111	0.0
300	+5.5	+1.0	+2.0	300	+0.611	+0.111	+0.222
320	+3.0	+1.0	+1.5	320	+0.333	+0.111	+0.167
340	+2.5	0.0	+0.5	340	+0.278	0.0	+0.056
360	+2.5	0.0	+1.5	360	+0.278	0.0	+0.167

NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 1.4°.

		<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.9	Antenna Orientation		
h.	Counter time (33,333 ± 185 μs)	<u>33,490 μs</u>	<u>✓</u>
10.3.4.3.10	Antenna Speed Error Alarm		
d.	Antenna speed error alarm condition (3.5 Vdc min)		<u>✓</u>
e.	Antenna speed error normal condition (0.7 Vdc max)		<u>✓</u>

M. B. Grant
 Accepted
 Contractor QA Representative

10 Dec 1976
 Date

Partial Acceptance
A. E. ... 50507A

J. Johnson
 Accepted
 DCAS Representative

23 NOV 76
10 Dec 1976
 Date

OFFICIAL DATA
COPY

SAMPLE
ATTACHMENT 2
INSPECTION CERTIFICATION SHEET
FOR
ANTENNA, AS-3132/T

Date: 3 DEC 1976

Serial No. 002

Stamp

1.1 This is to certify that this item has been manufactured in conformance to the critical item product fabrication specification and the workmanship is in accordance with MIL-STD-454 and meets the following criteria:

- a. Free of burrs and sharp edges.
- b. No foreign matter is present.
- c. Finish is as specified in the drawings and MIL-STD-454.
- d. Operating parts work freely and properly.
- e. All hardware is fastened securely.
- f. The general appearance is neat and clean.

1.2 The item has been inspected to ensure compliance with the physical characteristics of the drawing, parts lists and other documents listed on drawing.

M. B. Hunt
Accepted
Contractor QA Representative

3 DEC 1976
Date

M. Johnson 
Accepted
DCAS Representative

11 Dec 1976
Date

SAMPLE

Specification Number 404L-701-5032
25 October 1976 (Draft Copy)

ATTACHMENT 3

PERFORMANCE ACCEPTANCE TEST PROCEDURE DATA SHEET
FOR
ANTENNA, AS-3132/T

Date: _____

Serial No. 002

Data:

NOTE

Tests marked with an asterisk (*) are periodic production tests which are performed on the first production antenna and on each tenth production antenna. All other tests are performed on each production antenna.

		<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.1	Input Power Rotation and Speed		
c.	Antenna rotates clockwise		<u>✓</u>
d.	15 Hz trigger period low voltage (66.666 ± .133 ms)	<u>66.67</u>	<u>✓</u>
f.	15 Hz trigger period high voltage (66.666 ± .133 ms)	<u>66.67</u>	<u>✓</u>
10.3.4.3.2	Voltage Standing Wave Ratio (VSWR)		<u>✓</u>

FREQUENCY	SPECIFICATION	MEASUREMENT
1088 MHz	≤ 2.5 : 1	1.68 : 1
1150 MHz		1.3 : 1
1151 MHz	≤ 1.5 : 1	1.3 : 1
1182 MHz		1.48 : 1
1213 MHz		1.43 : 1



10.3.4.3.3 Reference Triggers

c.

✓

	SPECIFICATION	MEASUREMENTS					
		15 Hz		135 Hz		1350 Hz	
PERIOD		66.666 ± 0.133 ms	✓	7407 μs ± 14.8 μs	✓	740 μs ± 1.5 μs	✓
BASE LINE LEVEL	≥ +3.5V	✓		✓		✓	
PULSE AMPLITUDE	≥ 3.0V	✓		✓		✓	
PULSE RISE TIME	≤ 20 μs	✓		✓		✓	

Check if OK

f. Priority of 15 Hz trigger over 135 Hz trigger.

10.3.4.3.4 Antenna Gain and Vertical Coverage

c. Maximum carrier energy location

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
BETWEEN +5° AND +30°	27°	28°	27°

e. Carrier level at different elevations.

1151 MHz				1182 MHz		1213 MHz	
ELEVATION	(A)	(E)	(E) ² (A)	(E)	(E) ² (A)	(E)	(E) ² (A)
	AREA	VOLTAGE	PRODUCT	VOLTAGE	PRODUCT	VOLTAGE	PRODUCT
-5°	.1736	.585	.0540	.630	.0689	.595	.0615
-15°	.1684	.460	.0360	.460	.0356	.460	.0356
-25°	.1580	.360	.0200	.330	.0172	.280	.0124
-35°	.1428	.280	.0110	.240	.0082	.226	.0069
-45°	.1232	.190	.0360	.160	.0032	.180	.0040
-55°	.1000	.160	.0030	.150	.0023	.110	.0012
-65°	.0737	.070	.0004	.100	.0007	.14	.0014
-75°	.0451	.02	.0000	.136	.0008	.26	.0030
-85°	.0152	.02	.0000	.670	.0001	.17	.0004
TOTAL			.1658 = T ₁	TOTAL	.1370 = T ₁	TOTAL	.1254 = T ₁

1151 MHz				1182 MHz		1213 MHz	
ELEVATION	(A)	(E)	(E) ² (A)	(E)	(E) ² (A)	(E)	(E) ² (A)
+5°	.1736	.760	.1003	.760	.1003	.720	.0900
+15°	.1684	.910	.1395	.900	.1366	.880	.1304
+25°	.1580	.990	.1549	.990	.1549	.990	.1549
+35°	.1428	.890	.1131	.960	.1316	.920	.1209
+45°	.1232	.670	.0553	.690	.0587	.620	.0472
+55°	.1000	.510	.0260	.460	.0212	.560	.0314
+65°	.0737	.440	.0143	.460	.0156	.800	.0472
+75°	.0451	.300	.0041	.380	.0065	.740	.0247
+85°	.0152	.140	.0003	.170	.0004	.290	.0013
TOTAL			.6078 = T ₂	TOTAL	.6662 = T ₂	TOTAL	.6482 = T ₂

ELEVATION	VOLTAGE (E)		
	1151 MHz	1182 MHz	1213 MHz
-5°	.585	.630	.595
0°	.680	.700	.660
+5°	.760	.760	.720

Check if OK

*f. Maximum carrier level below horizon = E_f

* 1151 MHz	* 1182 MHz	* 1213 MHz
N/A	.130	.260

g. Main lobe peak gain = $10 \log \left(\frac{2}{T_1 + T_2} \right)$ dB
(See step e for T_1 and T_2 .)

SPECIFICATION	1151 MHz*	1182 MHz	1213 MHz*
≥ 3 dB	4.125 dB	3.962 dB	4.134 dB

*h. % Energy below horizon = $100 \left(\frac{T_1}{T_1 + T_2} \right)$
(See step e for T_1 and T_2 .)

SPECIFICATION	1151 MHz*	1182 MHz*	1213 MHz*
$\leq 25\%$	21.43%	17.06%	16.03%

i. Slope on horizon = $\frac{E(@+5^\circ)}{E(@0^\circ)} - \frac{E(@-5^\circ)}{E(@0^\circ)}$ V/V/°
(See step e for E values.)

SPECIFICATION	1151 MHz*	1182 MHz	1213 MHz*
≥ 0.01 V/V/°	.026	.019	.019

j. Gain on horizon = Main lobe peak gain - X dB
(see step g.)

Where $X = 20 \log \frac{1}{E(@0^\circ)}$
(See step e. for E value.)

SPECIFICATION	1151 MHz*	1182 MHz	1213 MHz*
≥ -1 dB	.775	.864	.525

Check if OK

*k. Energy below horizon

~~Main lobe gain - Y ≤ -8 dB~~ mBZ 12/3/76
 (step g.)

✓

Where $Y = 20 \log \left(\frac{1}{E_f} \right)$

(See step f. for E_f .)

SPECIFICATION	* 1151 MHz	* 1182 MHz	* 1213 MHz
≤ -8 dB	N/A	-17.72 dB	-11.70 dB

Check if OK

*10.3.4.3.5 Harmonic Content

d.

HARMONIC	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 15 Hz	SQUARE	% OF 15 Hz	SQUARE	% OF 15 Hz	SQUARE	
FUNDAMENTAL	15 Hz	100 %	 	100 %	 	100 %	 	
2nd	30 Hz	16.0	256.00	4.5	20.25	5.0	25.00	
3rd	45 Hz	7.0	49.00	3.5	12.25	5.8	33.64	
4th	60 Hz	2.0	4.00	3.0	9.00	8.5	72.25	
5th	75 Hz	4.0	16.00	6.1	37.21	3.0	9.00	
6th	90 Hz	12.9	166.41	5.0	25.00	12.9	166.41	
SUM OF SQUARES 2nd - 6th		 	491.41	 	103.71	 	306.30	
$\sqrt{\Sigma}$		 	22.168	 	10.184	 	17.501	≤ 25%

f.

	FREQ.	1151 MHz *			1182 MHz *			1213 MHz *		
		% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE
	105 Hz	6.4	≤ 25%	40.96	7.0	≤ 25%	49.00	10.8	≤ 25%	116.64
	120 Hz	14.0		196.00	19.0		361.00	11.6		134.56
	150 Hz	0.0		0.0	5.2		27.04	17.8		316.84
	165 Hz	0.0		0.0	0.0		0.0	2.5		6.25
SUM OF SQUARES		 	 	236.96	 	 	437.04	 	 	574.29
$\sqrt{\Sigma}$		 	≤ 25%	15.394	 	≤ 25%	20.906	 	≤ 25%	23.964

f.

	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	
FUNDAMENTAL	135 Hz	100 %	 	100 %	 	100 %	 	
2nd	270 Hz	0.0		0.0		3.0	9.0	
3rd	405 Hz	0.0		0.0		0.0		
4th	540 Hz	0.0		0.0		0.0		
5th	675 Hz	0.0		0.0		0.0		
6th	810 Hz	0.0		0.0		0.0		
SUM OF SQUARES 2nd - 6th		 		 		 	9.0	
$\sqrt{\Sigma}$		 	0.0	 	0.0	 	3.0	≤ 15%

10.3.4.3.6 % Modulation
f., g.*, h.*, and i*.

ANTENNA ELEVATION	% MODULATION 1151 MHz			% MODULATION 1182 MHz			% MODULATION 1213 MHz		
	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM
*-2°	16.0	20.8	X	21.6	26.8	X	21.6	29.5	X
0°	15.3	20.2	35.5	21.3	25.2	46.5	22.0	28.0	50.0
*+5°	14.3	17.8	X	20.4	21.5	X	24.0	25.4	X
*+10°	15.8	13.5	X	19.0	18.2	X	23.2	20.7	X
*+25°	8.2	7.8	X	13.0	9.2	X	18.0	11.2	X
*+30°	6.0	5.9	X	9.3	6.5	X	12.9	X	X

SPECIFICATION

Check If OK

15 Hz Mod vs. Vertical Angle

0°	21 ± 9%	<u>✓</u>
*-2° to +10°	21 ± 9%	<u>✓</u>
*+10° to +30°	>5%	<u>✓</u>

135 Hz Mod vs. Vertical Angle

0°	24 ± 12%	<u>✓</u>
*-2° to +10°	24 ± 12%	<u>✓</u>
*+10° to +25°	>5%	<u>✓</u>

Sum of 15 and 135 Hz % Modulation on the horizon.

< 55%	<u>✓</u>
-------	----------

* Variation in 15 Hz Modulation

-2° to +5°	< 8%	<u>✓</u>
------------	------	----------

* Variation in 135 Hz Modulation

-2° to +5°	< 8%	<u>✓</u>
------------	------	----------

Check if OK

*10.3.4.3.7 Cross Polarization Error

		CROSS POLARIZATION ERROR			
		1151 MHz	1182 MHz	1213 MHz	SPEC
e.	15 Hz @ -30°	+1.0	-0.5	+0.5	< ±3°
f.	15 Hz @ +30°	-1.5	-0.5	+0.5	
h.	135 Hz @ -30°	$\frac{-0.5}{9} = -.056$	$\frac{-3.0}{9} = -.333$	$\frac{-2}{9} = -.222$	< ±1°
i.	135 Hz @ +30°	$\frac{-1.5}{9} = -.167$	$\frac{+4.0}{9} = +.444$	$\frac{+3}{9} = +.333$	

Check if OK

10.3.4.3.8 15 Hz Azimuth Accuracy

d. and e.

15 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	* 1151 MHz	* 1182 MHz	* 1213 MHz		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0	0	0	0	0.0	0.0	0.0
20	20	18.5	19.0	20	0.0	-1.5	-1.0
40	39	38.5	39.0	40	-1.0	-1.5	-1.0
60	58.5	58.5	59.5	60	-1.5	-1.5	-0.5
80	78.5	78.0	78.5	80	-1.5	-2.0	-1.5
100	98.5	98.5	99.0	100	-1.5	-1.5	-1.0
120	119.0	118.5	119.5	120	-1.0	-1.5	-0.5
140	139.0	138.0	139.0	140	-1.0	-2.0	-1.0
160	158.5	157.0	157.5	160	-1.5	-3.0	-2.5
180	177.0	177.0	178.5	180	-3.0	-3.0	-1.5
200	196.0	196.5	197.5	200	-4.0	-3.5	-2.5
220	215.0	214.0	215.5	220	-5.0	-6.0	-4.5
240	237.0	234.0	235.5	240	-3.0	-6.6	-4.5
260	257.5	256.0	256.0	260	-2.5	-4.0	-4.0
280	279.0	277.0	277.0	280	-1.0	-3.0	-3.0
300	299.0	298.0	300.0	300	-1.0	-2.0	0.0
320	320.0	318.5	320.5	320	0.0	-1.5	+0.5
340	340.5	339.5	340.5	340	+0.5	-0.5	+0.5
360	360.5	360.0	360.0	360	+0.5	0.0	0.0

NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 8°.

Check if OK



10.3.4.3.8 135 Hz Azimuth Accuracy

i. and j.

135 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	1151 MHz	1182 MHz	1213 MHz		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0	0	0	0	0.0	0.0	0.0
20	+2.0	+1.0	+1.5	20	+0.222	+0.111	+0.167
40	+2.0	+2.0	+2.0	40	+0.222	+0.222	+0.222
60	+1.0	+1.5	+0.5	60	+0.111	+0.167	+0.056
80	0.0	0.0	-0.5	80	0.0	0.0	-0.056
100	-1.5	-1.0	-2.0	100	-0.167	-0.111	-0.222
120	+1.0	0.0	-1.5	120	+0.111	0.0	-0.167
140	0.0	0.0	-1.0	140	0.0	0.0	-0.111
160	-1.0	-1.0	-0.5	160	-0.111	-0.111	-0.056
180	-1.0	-1.0	-2.0	180	-0.111	-0.111	-0.222
200	-0.5	-0.5	-1.0	200	-0.056	-0.056	-0.111
220	-0.5	-0.5	-3.0	220	-0.056	-0.056	-0.333
240	-0.0	-0.5	-2.5	240	0.0	-0.056	-0.278
260	+0.5	+1.0	-1.0	260	+0.056	+0.111	-0.111
280	+1.0	-0.5	-2.0	280	+0.111	-0.056	-0.222
300	-0.5	-1.0	-3.0	300	-0.056	-0.111	-0.333
320	+1.5	+0.5	-0.5	320	+0.167	+0.056	-0.056
340	+1.0	+1.0	-0.5	340	+0.111	+0.111	-0.056
360	+1.0	+1.0	+1.0	360	+0.111	+0.111	+0.111


NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 1.4°.

		<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.9	Antenna Orientation		
h.	Counter time (33,333 ± 185 μs)	<u>33,352</u>	<u>✓</u>
10.3.4.3.10	Antenna Speed Error Alarm		
d.	Antenna speed error alarm condition (3.5 Vdc min)		<u>✓</u>
e.	Antenna speed error normal condition (0.7 Vdc max)		<u>✓</u>

M. B. [Signature]
 Accepted
 Contractor QA Representative

3 DEC 1976
 Date

Partial Acceptance
 A. Fulcher [Signature]
 Accepted
 DCAS Representative



3 DEC 76
11 Dec 1976
 Date

OFFICIAL DATA
COPY

SAMPLE
ATTACHMENT 2
INSPECTION CERTIFICATION SHEET
FOR
ANTENNA, AS-3132/T

Date: 1 DEC 1976

Serial No. 003

Stamp

1.1 This is to certify that this item has been manufactured in conformance to the critical item product fabrication specification and the workmanship is in accordance with MIL-STD-454 and meets the following criteria:

- a. Free of burrs and sharp edges.
- b. No foreign matter is present.
- c. Finish is as specified in the drawings and MIL-STD-454.
- d. Operating parts work freely and properly.
- e. All hardware is fastened securely.
- f. The general appearance is neat and clean.

1.2 The item has been inspected to ensure compliance with the physical characteristics of the drawing, parts lists and other documents listed on drawing.

mc B. P. [Signature]
Accepted
Contractor QA Representative

1 DEC 1976
Date

[Signature]
Accepted
DCAS Representative

11 Dec 1976
Date

SAMPLE
ATTACHMENT 3
PERFORMANCE ACCEPTANCE TEST PROCEDURE DATA SHEET
FOR
ANTENNA, AS-3132/T

Specification Number 404L-701-5032
25 October 1976 (Draft Copy)
OFFICIAL DATA COPY

Date: 1 DEC 1976

Serial No. 003

Data:

NOTE

Tests marked with an asterisk (*) are periodic production tests which are performed on the first production antenna and on each tenth production antenna. All other tests are performed on each production antenna.

	<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.1 Input Power Rotation and Speed		
c. Antenna rotates clockwise		<input checked="" type="checkbox"/>
d. 15 Hz trigger period low voltage (66.666 ± .133 ms)	<u>66.667</u>	<input checked="" type="checkbox"/>
f. 15 Hz trigger period high voltage (66.666 ± .133 ms)	<u>66.667</u>	<input checked="" type="checkbox"/>
10.3.4.3.2 Voltage Standing Wave Ratio (VSWR)		<input type="checkbox"/>

FREQUENCY	SPECIFICATION	MEASUREMENT
1088 MHz	≤ 2.5 : 1	1.8 : 1
1150 MHz		1.4 : 1
1151 MHz	≤ 1.5 : 1	1.4 : 1
1182 MHz		1.5 : 1
1213 MHz		1.2 : 1

10.3.4.3.3 Reference Triggers

c.



	SPECIFICATION	MEASUREMENTS					
		15 Hz		135 Hz		1350 Hz	
PERIOD		66.666 ±0.133 ms	<input checked="" type="checkbox"/>	7407 μs ±14.8 μs	<input checked="" type="checkbox"/>	740 μs ±1.5 μs	<input checked="" type="checkbox"/>
BASE LINE LEVEL	≥ +3.5V	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
PULSE AMPLITUDE	≥ 3.0V	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
PULSE RISE TIME	≤ 20 μs	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	

Check if OK

f. Priority of 15 Hz trigger over 135 Hz trigger.

10.3.4.3.4 Antenna Gain and Vertical Coverage

c. Maximum carrier energy location

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
BETWEEN +5° AND +30°	27°	28°	30°

e. Carrier level at different elevations.

ELEVATION	1151 MHz			1182 MHz		1213 MHz	
	(A)	(E)	(E) ² (A)	(E)	(E) ² (A)	(E)	(E) ² (A)
-5°	.1736	.570	.0564	.610	.0646	.555	.0535
-15°	.1684	.435	.0319	.440	.0326	.420	.0297
-25°	.1580	.365	.0210	.325	.0167	.255	.0103
-35°	.1428	.270	.0104	.230	.0076	.185	.0049
-45°	.1232	.200	.0049	.160	.0032	.095	.0011
-55°	.1000	.135	.0018	.130	.0017	.080	.0006
-65°	.0737	.050	.0002	.080	.0005	.150	.0017
-75°	.0451	.020	.00002	.140	.0009	.280	.0035
-85°	.0152	.030	.00001	.110	.0002	.160	.0004
TOTAL			.12663 = T ₁		.1280 = T ₁		.1057 = T ₁

ELEVATION	1151 MHz			1182 MHz		1213 MHz	
	(A)	(E)	(E) ² (A)	(E)	(E) ² (A)	(E)	(E) ² (A)
+5°	.1736	.740	.0951	.750	.0977	.680	.0803
+15°	.1684	.895	.1349	.915	.1410	.870	.1275
+25°	.1580	.995	.1564	.990	.1549	.975	.1502
+35°	.1428	.935	.1248	.965	.1330	.985	.1385
+45°	.1232	.760	.0712	.780	.0750	.835	.0859
+55°	.1000	.600	.0360	.560	.0314	.660	.0436
+65°	.0737	.500	.0184	.470	.0163	.620	.0293
+75°	.0451	.350	.0055	.352	.0056	.530	.0127
+85°	.0152	.140	.0003	.125	.0002	.158	.0004
TOTAL			.6426 = T ₂		.6551 = T ₂		

ELEVATION	VOLTAGE (E)		
	1151 MHz	1182 MHz	1213 MHz
-5°	.570	.610	.555
0°	.660	.680	.625
+5°	.740	.750	.680

Check if OK

* f. Maximum carrier level below horizon = E_f

* 1151 MHz	* 1182 MHz	* 1213 MHz
N/A	.140	.280

g. Main lobe peak gain = $10 \log \left(\frac{2}{T_1 + T_2} \right)$ dB
(See step e for T_1 and T_2 .)

SPECIFICATION	* 1151 MHz	* 1182 MHz	* 1213 MHz
≥ 3 dB	4.21 db	4.07 db	4.12 db

* h. % Energy below horizon = $100 \left(\frac{T_1}{T_1 + T_2} \right)$
(See step e for T_1 and T_2 .)

SPECIFICATION	* 1151 MHz	* 1182 MHz	* 1213 MHz
$\leq 25\%$	16.7%	16.4%	13.7%

i. Slope on horizon = $\frac{E(@+5^\circ)}{E(@0^\circ)} - \frac{E(@-5^\circ)}{E(@0^\circ)}$ V/V/°
(See step e for E values.) 10

SPECIFICATION	* 1151 MHz	* 1182 MHz	* 1213 MHz
≥ 0.01 V/V/°	.026	.021	.020

j. Gain on horizon = Main lobe peak gain - X dB
(see step g.)

$$\text{Where } X = 20 \log \frac{1}{E@0^\circ}$$

(See step e. for E value.)

SPECIFICATION	* 1151 MHz	* 1182 MHz	* 1213 MHz
≥ -1 dB	.60 db	.72 db	.04 db

Check if OK

*k. Energy below horizon

~~Main lobe gain - Y~~ ≤ -8 dB
 (step g.)

✓

Where $Y = 20 \log \left(\frac{1}{E_f} \right)$

(See step f. for E_f .)

SPECIFICATION	* 1151 MHz	* 1182 MHz	* 1213 MHz
≤ -8 dB	N/A	-17db	-11.1db

Check if OK

*10.3.4.3.5 Harmonic Content

d.

HARMONIC	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 15 Hz	SQUARE	% OF 15 Hz	SQUARE	% OF 15 Hz	SQUARE	
FUNDAMENTAL	15 Hz	100 %	X	100 %	X	100 %	X	X
2nd	30 Hz	8.2	67.24	10.0	100.00	18.2	331.24	
3rd	45 Hz	9.6	92.16	6.5	42.25	9.6	92.16	
4th	60 Hz	2.7	7.29	2.0	4.00	6.5	42.25	
5th	75 Hz	2.0	4.00	5.8	33.64	4.8	23.04	
6th	90 Hz	14.0	196.00	9.2	84.64	9.7	94.09	
SUM OF SQUARES 2nd - 6th		X	366.69	X	244.53	X	582.78	
$\sqrt{\Sigma}$		X	19.149	X	16.264	X	24.14	≤ 25%

f.

	FREQ.	1151 MHz *			1182 MHz *			1213 MHz *		
		% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE
	105 Hz	1.5	≤ 25%	2.25	1.8	≤ 25%	3.24	10.0	≤ 25%	100.00
	120 Hz	15.5		240.25	15.0		225.00	17.6		289.00
	150 Hz	1.5		2.25	2.1		4.41	18.5		342.25
	165 Hz	0.2		0.40	0		0.0	3.2		10.24
SUM OF SQUARES		X	X	245.15	X	X	232.65	X	X	741.49
$\sqrt{\Sigma}$		X	≤ 25%	15.657	X	≤ 25%	15.253	X	≤ 25%	27.23 *

* NOTE: THE CROSS PRODUCTS FOR 1213 MHz EXCEED 25%

f.

	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	
FUNDAMENTAL	135 Hz	100 %	X	100 %	X	100 %	X	X
2nd	270 Hz	1.0	1.0	0.6	0.36	3.5	12.25	
3rd	405 Hz	0.2	0.4	0.0		2.2	4.84	
4th	540 Hz	0.0		0.0		0.0	0.0	
5th	675 Hz	0.0		0.0		0.0	0.0	
6th	810 Hz	0.0		0.0		0.0	0.0	
SUM OF SQUARES 2nd - 6th		X	1.4	X	0.36	X	17.09	≤ 15%
$\sqrt{\Sigma}$		X	1.183	X	0.6	X	4.134	

10.3.4.3.6 % Modulation

f., g.*, h.*, and i*.

ANTENNA ELEVATION	% MODULATION* 1151 MHz			% MODULATION 1182 MHz			% MODULATION* 1213 MHz		
	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM
*-2°	16.1	23.6	X	23.0	27.7	X	24	33	X
0°	15.6	22.8	38.4	22.5	26.0	48.5	24.0	31.0	55.0
*+5°	14.0	19.0	X	21.2	21.7	X	27.0	28.0	X
*+10°	13.0	16.5	X	19.8	17.3	X	27.2	23.3	X
*+25°	8.1	7.9	X	13.0	8.6	X	21.0	12.0	X
*+30°	5.5	5.5	X	8.8	5.8	X	15.5	8.8	X

SPECIFICATION

Check If OK

15 Hz Mod vs. Vertical Angle

0°	21 ± 9%	<input checked="" type="checkbox"/>
*-2° to +10°	21 ± 9%	<input checked="" type="checkbox"/>
*+10° to +30°	>5%	<input checked="" type="checkbox"/>

135 Hz Mod vs. Vertical Angle

0°	24 ± 12%	<input checked="" type="checkbox"/>
*-2° to +10°	24 ± 12%	<input checked="" type="checkbox"/>
*+10° to +25°	>5%	<input checked="" type="checkbox"/>

Sum of 15 and 135 Hz % Modulation on the horizon.

<55%

*Variation in 15 Hz Modulation

-2° to +5° <8%

*Variation in 135 Hz Modulation

-2° to +5° <8%

Check if OK

*10.3.4.3.7 Cross Polarization Error

		CROSS POLARIZATION ERROR			
		1151 MHz	1182 MHz	1213 MHz	SPEC
e.	15 Hz @ -30°	+1.0	+0.0	+1.0	< ±3°
f.	15 Hz @ +30°	-1.0	-1.0	-0.5	
h.	135 Hz @ -30°	$\frac{-1.0}{9} = -0.111$	$\frac{0}{9} = 0.0$	$\frac{-6.5}{9} = -0.722$	< ±1°
i.	135 Hz @ +30°	$\frac{-0.5}{9} = -0.056$	$\frac{0}{9} = 0.0$	$\frac{+4.5}{9} = +0.500$	

Check if OK



10.3.4.3.8 15 Hz Azimuth Accuracy

d. and e.

15 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	* 1151 MHz	* 1182 MHz	* 1213 MHz		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0.0	0.0	0.0	0	0.0	0.0	0.0
20	18.5	18.5	19.0	20	-1.5	-1.5	-1.0
40	38.5	38.5	38.5	40	-1.5	-1.5	-1.5
60	59.0	58.0	59.0	60	-1.0	-2.0	-1.0
80	79.0	78.5	79.0	80	-1.0	-1.5	-1.0
100	98.5	97.5	98.0	100	-1.5	-1.5	-2.0
120	118.5	118.5	118.0	120	-1.5	-1.5	-2.0
140	137.5	137.5	138.0	140	-2.5	-2.5	-2.0
160	157.0	157.0	157.5	160	-3.0	-3.0	-2.5
180	176.5	176.5	178.0	180	-3.5	-3.5	-2.0
200	195.5	195.5	195.0	200	-4.5	-4.5	-5.0
220	215.5	214.5	213.5	220	-4.5	-5.5	-6.5
240	237.0	236.0	233.5	240	-3.0	-4.0	-6.5
260	257.0	256.5	255.0	260	-3.0	-3.5	-5.0
280	276.0	276.0	277.0	280	-4.0	-3.0	-1.5
300	318.0	319.5	319.5	300	-2.0	-0.5	-0.5
320	340.5	340.0	340.0	320	+0.5	0.0	0.0
340	340.5	340.0	340.0	340	+0.5	0.0	0.0
360	360.0	360.0	360.0	360	0.0	0.0	0.0

NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 8°.

Check if OK



10.3.4.3.8 135 Hz Azimuth Accuracy

i. and j.

135 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	1151 MHz	1182 MHz	1213 MHz		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0.0	0.0	0.0	0	0.0	0.0	0.0
20	+3.0	+1.5	+3.5	20	+ .333	+ .167	+ .389
40	+5.0	+3.0	+5.5	40	+ .556	+ .333	+ .611
60	+5.0	+2.0	+4.0	60	+ .556	+ .222	+ .444
80	+1.0	-0.5	+1.0	80	+ .111	- .056	+ .111
100	+2.0	+1.0	+0.5	100	+ .222	+ .111	+ .056
120	+0.5	0.0	+1.0	120	+ .111	0.0	+ .111
140	+2.5	-0.5	+1.0	140	+ .278	- .056	+ .111
160	+2.0	+0.5	+1.5	160	+ .222	+ .056	+ .167
180	+1.5	-0.5	+2.5	180	+ .167	- .056	+ .278
200	+0.5	0.0	-0.5	200	+ .056	0.0	- .056
220	0.0	0.0	-0.5	220	0.0	0.0	- .056
240	-1.0	-0.5	0.0	240	- .111	- .056	0.0
260	+1.0	-0.5	-1.0	260	+ .111	- .056	- .111
280	-0.5	0.0	0.0	280	- .056	0.0	0.0
300	-0.5	-1.0	-0.5	300	- .056	- .111	- .056
320	-1.5	-1.0	-1.5	320	- .167	- .111	- .167
340	+1.0	-1.0	+2.5	340	+ .111	- .111	+ .278
360	+1.0	-1.0	-1.0	360	+ .111	- .111	- .111

NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 1.4°.

		<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.9	Antenna Orientation		
h.	Counter time (33,333 ± 185 μs)	<u>33260 μs</u>	<u>✓</u>
10.3.4.3.10	Antenna Speed Error Alarm		
d.	Antenna speed error alarm condition (3.5 Vdc min)		<u>✓</u>
e.	Antenna speed error normal condition (0.7 Vdc max)		<u>✓</u>

M. B. Hunt
Accepted
Contractor QA Representative

1 DEC 1976
Date

Partial Acceptance
A. J. Cochran
J. Wilson
Accepted
DCAS Representative

1 DEC 76
11 Dec 1976
Date

OFFICIAL DATA
COPY

SAMPLE
ATTACHMENT 2
INSPECTION CERTIFICATION SHEET
FOR
ANTENNA, AS-3132/T

Date: 24 NOV 1976 Serial No. 004

Stamp

1.1 This is to certify that this item has been manufactured in conformance to the critical item product fabrication specification and the workmanship is in accordance with MIL-STD-454 and meets the following criteria:

- a. Free of burrs and sharp edges.
- b. No foreign matter is present.
- c. Finish is as specified in the drawings and MIL-STD-454.
- d. Operating parts work freely and properly.
- e. All hardware is fastened securely.
- f. The general appearance is neat and clean.

1.2 The item has been inspected to ensure compliance with the physical characteristics of the drawing, parts lists and other documents listed on drawing.

M. B. Piment
Accepted
Contractor QA Representative

24 NOV 1976
Date

J. M. ...
Accepted
DCAS Representative

11 Dec 1976
Date

SAMPLE
ATTACHMENT 3

Specification Number 404L-701-5032
25 October 1976 (Draft Copy)

PERFORMANCE ACCEPTANCE TEST PROCEDURE DATA SHEET
FOR
ANTENNA, AS-3132/T

Date: _____ Serial No. _____

Data: NOTE

Tests marked with an asterisk (*) are periodic production tests which are performed on the first production antenna and on each tenth production antenna. All other tests are performed on each production antenna.

	<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.1 Input Power Rotation and Speed		
c. Antenna rotates clockwise		✓
d. 15 Hz trigger period low voltage		
(66.666 ± .133 ms)	<u>66.667</u>	
f. 15 Hz trigger period high voltage		
(66.666 ± .133 ms)	<u>66.667</u>	
10.3.4.3.2 Voltage Standing Wave Ratio (VSWR)		

FREQUENCY	SPECIFICATION	MEASUREMENT
1088 MHz	≤ 2.5 : 1	1.68 : 1
1150 MHz		1.2 : 1
1151 MHz	≤ 1.5 : 1	1.2 : 1
1182 MHz		1.3 : 1
1213 MHz		1.2 : 1



10.3.4.3.3 Reference Triggers

c.

	SPECIFICATION	MEASUREMENT					
		15 Hz		135 Hz		1350 Hz	
PERIOD		66.666 ± 0.133 ms	✓	7407 μs ± 14.8 μs	✓	740 μs ± 1.5 μs	
BASE LINE LEVEL	≥ +3.5V		✓		✓		✓
PULSE AMPLITUDE	≥ 3.0V		✓		✓		✓
PULSE RISE TIME	≤ 20 μs		✓		✓		✓

Check if OK

f. Priority of 15 Hz trigger over 135 Hz trigger.

10.3.4.3.4 Antenna Gain and Vertical Coverage

c. Maximum carrier energy location

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
BETWEEN +5° AND +30°	26°	28°	26°

e. Carrier level at different elevations.

1151 MHz				1182 MHz		1213 MHz	
ELEVATION	(A)	(E)	(E) ² (A)	(E)	(E) ² (A)	(E)	(E) ² (A)
	AREA	VOLTAGE	PRODUCT	VOLTAGE	PRODUCT	VOLTAGE	PRODUCT
-5°	.1736	.580	.0584	.600	.0625	.585	.0594
-15°	.1684	.470	.0372	.450	.0341	.480	.0388
-25°	.1580	.380	.0228	.320	.0162	.340	.0183
-35°	.1428	.290	.0120	.240	.0082	.270	.0104
-45°	.1232	.210	.0054	.185	.0042	.180	.0040
-55°	.1000	.170	.0029	.165	.0027	.160	.0026
-65°	.0737	.100	.0007	.130	.0012	.140	.0014
-75°	.0451	.040	.0001	.140	.0009	.150	.0010
-85°	.0152	.020	.0000	.075	.0001	.080	.0001
TOTAL			.1395 = T ₁	TOTAL	.1301 = T ₁	TOTAL	.1360 = T ₁
+5°	.1736	.770	.1029	.735	.0938	.730	.0925
+15°	.1684	.900	.1364	.860	.1304	.900	.1364
+25°	.1580	1.000	.1580	.995	.1564	.995	.1564
+35°	.1428	.900	.1157	.955	.1302	.930	.1235
+45°	.1232	.700	.0604	.710	.0621	.640	.0505
+55°	.1000	.550	.0303	.500	.0250	.505	.0255
+65°	.0737	.490	.0177	.485	.0173	.620	.0283
+75°	.0451	.370	.0062	.420	.0080	.560	.0141
+85°	.0152	.160	.0004	.190	.0005	.280	.0007
TOTAL			.6280 = T ₂	TOTAL	.6237 = T ₂	TOTAL	.6279 = T ₂

ELEVATION	VOLTAGE (E)		
	1151 MHz	1182 MHz	1213 MHz
-5°	.580	.600	.585
0°	.680	.670	.655
+5°	.770	.735	.730

Check if OK

*f. Maximum carrier level below horizon = E_f

* 1151 MHz	* 1182 MHz	* 1213 MHz
N.A.	.140	.150

g. Main lobe peak gain = $10 \log \left(\frac{2}{T_1 + T_2} \right)$ dB
(See step e for T_1 and T_2 .)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≥ 3 dB	+4.16 dB	+4.24 dB	+4.18 dB

*h. % Energy below horizon = $100 \left(\frac{T_1}{T_1 + T_2} \right)$
(See step e for T_1 and T_2 .)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
$\leq 25\%$	18.2%	17.3%	17.8%

i. Slope on horizon = $\frac{E(@+5^\circ)}{E(@0^\circ)} - \frac{E(@-5^\circ)}{E(@0^\circ)}$ V/V/°
(See step e for E values.)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≥ 0.01 V/V/°	0.028	0.020	0.022

j. Gain on horizon = Main lobe peak gain - X dB
(see step g.)

$$\text{Where } X = 20 \log \frac{1}{E@0^\circ}$$

(See step e. for E value.)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≥ -1 dB	+0.81 dB	+0.76 dB	+0.50 dB

Check if OK

*k. Energy below horizon

~~Main lobe gain - Y~~ ≤ -8 dB
~~(step g.)~~

✓

Where $Y = 20 \log \left(\frac{1}{E_f} \right)$

(See step f. for E_f .)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≤ -8 dB	N.A.	-17.1 dB	-16.5 dB

Check if OK

*10.3.4.3.5 Harmonic Content

d.

HARMONIC	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 15 Hz	SQUARE	% OF 15 Hz	SQUARE	% OF 15 Hz	SQUARE	
FUNDAMENTAL	15 Hz	100 %		100 %		100 %		
2nd	30 Hz	2.5	6.3	3.9	15.2	19.9	396.0	
3rd	45 Hz	12.3	151.3	8.0	64.0	9.9	98.0	
4th	60 Hz	6.6	43.6	5.2	27.0	6.5	42.3	
5th	75 Hz	4.9	24.0	14.0	196.0	11.1	123.2	
6th	90 Hz	19.2	368.6	7.3	53.3	4.0	16.0	
SUM OF SQUARES 2nd - 6th			593.8		355.5		675.5	
$\sqrt{\Sigma}$			24.4		18.9		26.0	≤ 25%

f.

	FREQ.	1151 MHz *			1182 MHz *			1213 MHz *		
		% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE
	105 Hz	0	≤ 25%	0.0	8.8	≤ 25%	77.44	2.5	≤ 25%	6.25
	120 Hz	17.2		(17.2) ²	18.9		357.21	11.0		121.00
	150 Hz	0			8.7		75.69	21.0		441.00
	165 Hz	0			2.0		4.06	3.8		14.44
SUM OF SQUARES				(17.2) ²			514.34			582.69
$\sqrt{\Sigma}$			≤ 25%	17.2		≤ 25%	22.68		≤ 25%	24.14

f.

	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	
FUNDAMENTAL	135 Hz	100 %		100 %		100 %		
2nd	270 Hz	0		4.2	(4.2) ²	3.2	(3.2) ²	
3rd	405 Hz	0		0		0		
4th	540 Hz	0		0		0		
5th	675 Hz	0		0		0		
6th	810 Hz	0		0		0		
SUM OF SQUARES 2nd - 6th			0		(4.2) ²		(3.2) ²	
$\sqrt{\Sigma}$			0		4.2		3.2	≤ 15%

10.3.4.3.6 % Modulation
f., g.*, h.*, and i*.

ANTENNA ELEVATION	% MODULATION 1151 MHz*			% MODULATION 1182 MHz			% MODULATION 1213 MHz*		
	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM
*-2°	17.0	23.0	X	23.0	25.5	X	16.7	19.9	X
0°	21.7	16.6	38.3	22.5	24.2	46.7	16.2	18.6	34.8
*+5°	15.0	18.9	X	22.2	19.8	X	17.3	16.0	X
*+10°	14.0	16.0	X	21.5	16.5	X	18.0	13.5	X
*+25°	8.3	7.6	X	14.2	8.1	X	13.2	7.3	X
*+30°	5.3	X	X	10.0	X	X	8.9	X	X

SPECIFICATION

Check If OK

15 Hz Mod vs. Vertical Angle

0°	21 ± 9%	<input checked="" type="checkbox"/>
*-2° to +10°	21 ± 9%	<input checked="" type="checkbox"/>
*+10° to +30°	>5%	<input checked="" type="checkbox"/>

135 Hz Mod vs. Vertical Angle

0°	24 ± 12%	<input checked="" type="checkbox"/>
*-2° to +10°	24 ± 12%	<input checked="" type="checkbox"/>
*+10° to +25°	>5%	<input checked="" type="checkbox"/>

Sum of 15 and 135 Hz % Modulation on the horizon.

< 55%	<input checked="" type="checkbox"/>
-------	-------------------------------------

*Variation in 15 Hz Modulation

-2° to +5°	< 8%	<input checked="" type="checkbox"/>
------------	------	-------------------------------------

*Variation in 135 Hz Modulation

-2° to +5°	< 8%	<input checked="" type="checkbox"/>
------------	------	-------------------------------------

Check if OK

*10.3.4.3.7 Cross Polarization Error

		CROSS POLARIZATION ERROR			
		1151 MHz	1182 MHz	1213 MHz	SPEC
e.	15 Hz @ -30°	0	+2.0	+2.5	< ±3°
f.	15 Hz @ +30°	-2.0	0	-3.0	
h.	135 Hz @ -30°	$\frac{-0.5}{9} = -.055$	$\frac{-3}{9} = -.333$	$\frac{-9}{9} = -1.00$	< ±1°
i.	135 Hz @ +30°	$\frac{0}{9} = .000$	$\frac{+7}{9} = +.777$	$\frac{+6}{9} = +.667$	

Check if OK



10.3.4.3.8 15 Hz Azimuth Accuracy

d. and e.

15 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	* 1151 MHz	* 1182 MHz	* 1213 MHz		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0	0	0	0	0	0	0
20	19.0	18.5	18.5	20	-1.0	-1.5	-1.5
40	38.5	36.5	36.0	40	-1.5	-3.5	-4.0
60	59.0	57.5	56.5	60	-1.0	-2.5	-3.5
80	78.0	77.0	77.5	80	-2.0	-3.0	-2.5
100	97.5	97.0	96.0	100	-2.5	-3.0	-4.0
120	117.5	118.5	118.5	120	-2.5	-1.5	-1.5
140	139.0	138.0	138.5	140	-1.0	-2.0	-1.5
160	158.0	156.5	157.0	160	-2.0	-3.5	-3.0
180	176.5	177.5	179.0	180	-3.5	-2.5	-1.0
200	195.0	196.5	198.0	200	-5.0	-3.5	-2.0
220	215.5	215.5	216.0	220	-4.5	-4.5	-4.0
240	235.0	234.0	235.0	240	-5.0	-6.0	-5.0
260	257.0	256.0	255.0	260	-3.0	-4.0	-5.0
280	278.0	276.5	278.5	280	-2.0	-3.5	-1.5
300	297.5	298.0	299.0	300	-2.5	-2.0	-1.0
320	318.5	319.5	319.0	320	-1.5	-0.5	-1.0
340	339.5	340.0	340.5	340	-0.5	0	+0.5
360	0	0	0	360	0	0	0

NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 8°.

Check if OK

10.3.4.3.8 135 Hz Azimuth Accuracy

i. and j.


135 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	1151 MHz	1182 MHz	1213 MHz		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0	0	0	0	0	0	0
20	+3.0	+1.5	+1.0	20	+.333	+.166	+.111
40	+4.5	+2.0	+1.5	40	+.500	+.222	+.166
60	+7.0	+2.5	+2.5	60	+.777	+.277	+.277
80	+5.0	+2.0	+1.5	80	+.555	+.222	+.166
100	+2.0	+2.5	+2.5	100	+.222	+.277	+.277
120	+2.5	+2.5	+1.5	120	+.277	+.277	+.166
140	+2.0	+2.0	+1.5	140	+.222	+.222	+.166
160	+3.5	0	+1.5	160	+.388	+.000	+.166
180	+7.0	+1.5	+1.0 +2.0	180	+.777	+.166	+.111
200	+3.5	0	+0.5	200	+.388	+.000	+.055
220	+4.5	+1.0	+2.0	220	+.500	+.111	+.222
240	+2.5	+1.0	+1.0	240	+.277	+.111	+.111
260	+2.0	+2.0	+1.5	260	+.222	+.222	+.166
280	+3.5	+1.0	+0.5	280	+.388	+.111	+.055
300	+3.5	+0.5	-0.5	300	+.388	+.055	-.055
320	+2.5	+1.0	+0.5	320	+.277	+.111	+.055
340	+4.0	+0.5	+1.0	340	+.444	+.055	+.111
360	+2.0	+2.5	+1.0	360	+.222	+.277	+.111

NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 1.4°.

		<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.9	Antenna Orientation		
h.	Counter time (33,333 ± 185 μs)	<u>33,411</u>	<u>✓</u>
10.3.4.3.10	Antenna Speed Error Alarm		
d.	Antenna speed error alarm condition (3.5 Vdc min)		<u>✓</u>
e.	Antenna speed error normal condition (0.7 Vdc max)		<u>✓</u>

Accepted
 Contractor QA Representative

Date

Final Acceptance
A. F. ...

 Accepted
 DCAS Representative

24 NOV 76
 11 Dec 1976
 Date

ATTACHMENT 2

**ANTENNA ACCEPTANCE TEST DATA
SHEET WITH HEAVY RADOME**

25 October 1976 (Draft Copy)

ATTACHMENT 3

PERFORMANCE ACCEPTANCE TEST PROCEDURE DATA SHEET
FOR
ANTENNA, AS-3132/T

*New Heavy Radome
tested at NACO as
S/N-003. Video parts
changed at MINTEK bench,
of Durin - New's*

Date: 1-17-77

Serial No. - 003 / S/N-001

Data:

NOTE

Tests marked with an asterisk (*) are periodic production tests which are performed on the first production antenna and on each tenth production antenna. All other tests are performed on each production antenna.

		<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.1	Input Power Rotation and Speed		
c.	Antenna rotates clockwise		<u>✓</u>
d.	15 Hz trigger period low voltage (66.666 ± .133 ms)	<u>66.667ms</u>	<u>✓</u>
f.	15 Hz trigger period high voltage (66.666 ± .133 ms)	<u>66.668ms</u>	<u>✓</u>
10.3.4.3.2	Voltage Standing Wave Ratio (VSWR)		<u> </u>

FREQUENCY	SPECIFICATION	MEASUREMENT
1088 MHz	≤ 2.5 : 1	<u>1.62:1</u>
1150 MHz		<u>1.25:1</u>
1151 MHz	≤ 1.5 : 1	<u>1.28:1</u>
1182 MHz		<u>1.32:1</u>
1213 MHz		<u>1.36:1</u>

10.3.4.3.3 Reference Triggers

c.

✓

	SPECIFICATION	MEASUREMENTS					
		15 Hz		135 Hz		1350 Hz	
PERIOD		66.666 ±0.133 ms	<u>66.667</u>	7407 μs ±14.8 μs	<u>7409</u>	740 μs ±1.5 μs	<u>741</u>
BASE LINE LEVEL	≥ +3.5V		<u>4.2V</u>		<u>4.2V</u>		<u>4.2V</u>
PULSE AMPLITUDE	≥ 3.0V		<u>4.2</u>		<u>4.2V</u>		<u>4.2V</u>
PULSE RISE TIME	≤ 20 μs		<u>1.0 μsec.</u>		<u>1.0 μsec.</u>		<u>1.0 μsec.</u>

Check if OK

f. Priority of 15 Hz trigger over 135 Hz trigger.

10.3.4.3.4 Antenna Gain and Vertical Coverage

c. Maximum carrier energy location

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
BETWEEN +5° AND +30°	27.0°	29.0°	28.0°

e. Carrier level at different elevations.

1151 MHz				1182 MHz		1213 MHz	
ELEVATION	(A)	(E)	(E) ² (A)	(E)	(E) ² (A)	(E)	(E) ² (A)
	AREA	VOLTAGE	PRODUCT	VOLTAGE	PRODUCT	VOLTAGE	PRODUCT
-5°	.1736	.57	.0564	.585	.0594	.525	.0478
-15°	.1684	.46	.0536	.44	.0326	.44	.0326
-25°	.1580	.35	.0194	.32	.0162	.30	.0142
-35°	.1428	.24	.0082	.20	.0057	.18	.0046
-45°	.1232	.19	.0044	.13	.0021	.05	.0003
-55°	.1000	.14	.0022	.08	.0006	.04	.0002
-65°	.0737	.06	.0003	.05	.0002	.13	.0012
-75°	.0451	.03	.0000	.09	.0004	.20	.0018
-85°	.0152	.02	.0001	.07	.0001	.15	.0003
TOTAL			.1263	TOTAL	.1173	TOTAL	.1030

+5°	.1736	.725	.0912	.74	.0951	.70	.0851
+15°	.1684	.89	.1334	.90	.1364	.88	.1384
+25°	.1580	.99	.1549	.98	.1517	.99	.1549
+35°	.1428	.93	.1235	.94	.1262	.96	.1316
+45°	.1232	.74	.0675	.96	.0712	.74	.0675
+55°	.1000	.56	.0314	.54	.0292	.59	.0348
+65°	.0737	.47	.0163	.46	.0156	.59	.0257
+75°	.0451	.33	.0049	.33	.0049	.49	.0108
+85°	.0152	.14	.0003	.13	.0003	.21	.0007
TOTAL		.6234	TOTAL	.6306	TOTAL	.6495	

ELEVATION	VOLTAGE (E)		
	1151 MHz	1182 MHz	1213 MHz
-5°	.57	.585	.525
0°	.64	.66	.60
+5°	.725	.74	.70

Check if OK

*f. Maximum carrier level below horizon = E_f

1151 MHz	1182 MHz	1213 MHz
N/A	0.09V	0.20V

g. Main lobe peak gain = $10 \log \left(\frac{2}{T_1 + T_2} \right)$ dB
(See step e for T_1 and T_2 .)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≥ 3 dB	4.26 db	4.27 db	4.25 db

*h. % Energy below horizon = $100 \left(\frac{T_1}{T_1 + T_2} \right)$
(See step e for T_1 and T_2 .)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
$\leq 25\%$	16.9%	15.7%	13.7%

i. Slope on horizon = $\frac{E(@ +5^\circ)}{E(@ 0^\circ)} - \frac{E(@ -5^\circ)}{E(@ 0^\circ)}$ V/V/°
(See step e for E values.)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≥ 0.01 V/V/°	.024	.024	.019

j. Gain on horizon = Main lobe peak gain - X dB
(see step g.)

$$\text{Where } X = 20 \log \frac{1}{E @ 0^\circ}$$

(See step e. for E value.)

SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
≥ -1 dB	+ .39 dbi	+ .66 dbi	- .18 dbi

Check if OK

*k. Energy below horizon

~~Main lobe gain~~ $\overset{N}{\leftarrow} Y \rightarrow$ 8 dB
 (step g)

Where $Y = 20 \log \left(\frac{1}{E_f} \right)$

(See step f. for E_f .)



SPECIFICATION	1151 MHz	1182 MHz	1213 MHz
$\frac{N}{E_f} = 8 \text{ dB}$	N/A	20.9 db	14.0 db

Check if OK

*10.3.4.3.5 Harmonic Content

d.

HARMONIC	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 15 Hz	SQUARE	% OF .15 Hz	SQUARE	% OF 15 Hz	SQUARE	
FUNDAMENTAL	15 Hz	100 %	X	100 %	X	100 %	X	X
2nd	30 Hz	12.5	156.25	4.4	19.36	14	196	
3rd	45 Hz	11.7	136.9	6.0	36.0	4.5	20.25	
4th	60 Hz	3.3	10.9	1.2	1.44	6.3	39.69	
5th	75 Hz	4.5	20.25	2.7	7.29	.6	.36	
6th	90 Hz	14.9	222.0	9.1	82.8	10.9	118.81	
SUM OF SQUARES 2nd - 6th		X	546.3	X	146.9	X	375.11	
$\sqrt{\Sigma}$		X	23.4	X	12.12	X	19.37	≤ 25%

f.

	FREQ.	1151 MHz *			1182 MHz *			1213 MHz *		
		% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE	% OF 135 Hz	SPECIFICATION	SQUARE
	105 Hz	1.6	≤ 25%	2.56	2.5	≤ 25%	6.25	11.0	≤ 25%	121
	120 Hz	13.4		173.56	16.1		259.21	13.0		169
	150 Hz	0		0	5.2		27.04	16.6		275.56
	165 Hz	0		0	.6		.36	2.6		6.76
SUM OF SQUARES		X	X	182.12	X	X	292.86	X	X	572.22
$\sqrt{\Sigma}$		X	≤ 25%	13.5	X	≤ 25%	17.1	X	≤ 25%	23.9

f.

HARMONIC	FREQ.	1151 MHz *		1182 MHz *		1213 MHz *		SPECIFICATION
		% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	% OF 135 Hz	SQUARE	
FUNDAMENTAL	135 Hz	100 %	X	100 %	X	100 %	X	X
2nd	270 Hz	1.0	1.0	1.4	1.96	4.2	17.64	
3rd	405 Hz	0	0	0	0	.8	.64	
4th	540 Hz	0	0	0	0	0	0	
5th	675 Hz	0	0	0	0	0	0	
6th	810 Hz	0	0	0	0	0	0	
SUM OF SQUARES 2nd - 6th		X	1.0	X	1.96	X	18.28	
$\sqrt{\Sigma}$		X	1.0	X	1.4	X	4.27	≤ 15%

10.3.4.3.6 % Modulation
f., g.*, h.*, and i*.

ANTENNA ELEVATION	% MODULATION 1151 MHz			% MODULATION 1182 MHz			% MODULATION 1213 MHz		
	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM	15 Hz	135 Hz	SUM
*-2°	15.5	20.4	X	19.5	25.1	X	23.3	34.0	X
0°	15.0	20.0	35.0	19.7	24.7	44.4	23.0	32.0	55.0
*+5°	13.3	18.0	X	18.7	21.0	X	23.1	28.5	X
*+10°	12.2	15.0	X	17.2	16.8	X	20.4	23.5	X
*+25°	7.0	7.3	X	11.5	9.0	X	17.3	11.1	X
*+30°	5.1	X	X	8.0	X	X	13.2	X	X

SPECIFICATION

Check If OK

15 Hz Mod vs. Vertical Angle

0°	21 ± 9%	<u>✓</u>
*-2° to +10°	21 ± 9%	<u>✓</u>
*+10° to +30°	>5%	<u>✓</u>

135 Hz Mod vs. Vertical Angle

0°	24 ± 12%	<u>✓</u>
*-2° to +10°	24 ± 12%	<u>✓</u>
*+10° to +25°	>5%	<u>✓</u>

Sum of 15 and 135 Hz % Modulation on the horizon.

<55% ✓

*Variation in 15 Hz Modulation

-2° to +5° <8% ✓

*Variation in 135 Hz Modulation

-2° to +5° <8% ✓

Check if OK



*10.3.4.3.7 Cross Polarization Error

		CROSS POLARIZATION ERROR				SPEC
		1151 MHz	1182 MHz	1213 MHz		
e.	15 Hz @ -30°	1.2°	.5°	.6°		< ±3°
f.	15 Hz @ +30°	-1.5°	-1.0°	-.6°		
h.	135 Hz @ -30°	$\frac{.5}{9} = .055$	$\frac{-1.5}{9} = -.5$	$\frac{-7.0}{9} = -.78$		< ±1°
i.	135 Hz @ +30°	$\frac{-.5}{9} = -.055$	$\frac{5.3}{9} = .58$	$\frac{7.5}{9} = .83$		

10.3.4.3.8 15 Hz Azimuth Accuracy

Check if OK



d. and e.

15 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	1151 MHz*	1182 MHz*	1213 MHz*		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0	0	0	0	0	0	0
20	19.3	18.3	16.5	20	-0.7	-1.7	-3.5
40	37.5	37.5	37.3	40	-2.5	-2.5	-2.7
60	57.8	57.5	57.5	60	-2.2	-2.5	-2.5
80	78.6	78.0	77.0	80	-1.4	-2.0	-3.0
100	98.5	98.5	99.0	100	-1.5	-1.5	-1.0
120	118.5	118.4	120.0	120	-1.5	-1.6	0
140	138.7	138.7	138.5	140	-1.3	-1.3	-1.5
160	158.5	158.5	157.6	160	-1.5	-1.5	-2.4
180	177.5	177.5	179.4	180	-2.5	-2.5	-0.6
200	196.0	196.5	198.8	200	-4.0	-3.5	-1.2
220	215.5	215.3	216.5	220	-4.5	-4.7	-3.5
240	237.0	235.8	235.0	240	-3.0	-4.2	-5.0
260	257.0	256.0	257.5	260	-3.0	-4.0	-2.5
280	278.5	278.3	279.0	280	-1.5	-1.7	-1.0
300	299.0	298.7	299.2	300	-1.0	-1.3	-0.8
320	320.0	320.0	320.0	320	0	0	0
340	341.0	340.8	340.0	340	+1.0	+0.8	0
360	0	0	359.0	360	0	0	-1.0

NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 8°.

Check if OK



10.3.4.3.8 135 Hz Azimuth Accuracy

i. and j.


135 Hz AZIMUTH ACCURACY							
DEGREES	REFERENCE PHASE SHIFTER READING			DEGREES	AZIMUTH ERROR		
	1151 MHz	1182 MHz	1213 MHz		1151 MHz* NOTE 1	1182 MHz* NOTE 1	1213 MHz* NOTE 1
0	0	0	0	0	0	0	0
20	2.5	2.0	2.5	20	.28	.22	.28
40	6.2	4.2	3.3	40	.69	.47	.37
60	7.0	5.5	4.5	60	.78	.61	.5
80	5.4	6.0	5.0	80	.6	.67	.56
100	6.8	4.9	4.0	100	.76	.54	.44
120	6.0	4.4	3.5	120	.67	.49	.39
140	6.3	4.4	4.3	140	.70	.49	.48
160	5.0	3.5	3.0	160	.56	.39	.33
180	6.3	3.5	3.0	180	.70	.38	.33
200	4.3	3.5	3.0	200	.48	.39	.33
220	4.3	3.4	2.3	220	.48	.38	.26
240	3.3	3.4	2.0	240	.33	.38	.22
260	3.0	3.4	2.3	260	.33	.38	.26
280	3.3	3.0	2.0	280	.37	.33	.22
300	3.5	3.0	2.3	300	.39	.33	.26
320	3.0	3.0	1.9	320	.33	.33	.21
340	0	1.9	1.7	340	0	.21	.19
360	1.0	1.0	1.0	360	.11	.11	.11

NOTE 1: Difference between maximum negative and maximum positive values at any frequency must be less than or equal to 1.4°.

		<u>Reading</u>	<u>Check if OK</u>
10.3.4.3.9	Antenna Orientation		
h.	Counter time (33,333 ± 185 μs)	<u>33.347 μsec</u>	<u>✓</u>
10.3.4.3.10	Antenna Speed Error Alarm		
d.	Antenna speed error alarm condition (3.5 Vdc min)		<u>✓</u>
e.	Antenna speed error normal condition (0.7 Vdc max)		<u>✓</u>

H. J. Gardner 
Accepted
Contractor QA Representative

1-25-77
Date

J. H. Johnson TEST REVIEWED 
Accepted
DCAS Representative

1-25-77
Date

ATTACHMENT 3

**COMPARISON OF DATA BETWEEN ORIGINAL
AND HEAVY RADOMES**

AN/TRN-41 ANTENNA SN 003

Parameter	Orig. Design 12/1/76	New Design 1/17/77	After Drop Test 1-30-77
Main Lobe Location at 1151 MHz	27°	27°	26°
Main Lobe Location at 1182 MHz	28°	29°	29°
Main Lobe Location at 1213 MHz	30°	28°	27.5°
Main Lobe Gain at 1151 MHz	4.21 dB/ISO	4.26 dB/ISO	4.4 dB/ISO
Main Lobe Gain at 1182 MHz	4.07 dB/ISO	4.27 dB/ISO	4.37 dB/ISO
Main Lobe Gain at 1213 MHz	4.12 dB/ISO	4.25 dB/ISO	4.35 dB/ISO
% Energy Below Horizon at 1151 MHz	16.7%	16.9%	15.4%
% Energy Below Horizon at 1182 MHz	16.4%	15.7%	13.7%
% Energy Below Horizon at 1213 MHz	13.7%	13.7%	12.1%
Slope on Horizon at 1151 MHz	0.026 v/v/deg.	0.024 v/v/deg.	0.031 v/v/°
Slope on Horizon at 1182 MHz	0.021 v/v/deg.	0.024 v/v/deg.	0.030 v/v/°
Slope on Horizon at 1213 MHz	0.020 v/v/deg.	0.019 v/v/deg.	0.034 v/v/°
Gain on Horizon at 1151 MHz	0.60 dB/ISO	0.39 dB/ISO	+0.25 dB/ISO
Gain on Horizon at 1182 MHz	0.72 dB/ISO	0.66 dB/ISO	+0.49 dB/ISO
Gain on Horizon at 1213 MHz	0.04 dB/ISO	-0.18 dB/ISO	+0.06 dB/ISO
Negative Angle Lobe Energy at 1151 MHz	No Lobe	No Lobe	No Lobe
Negative Angle Lobe Energy at 1182 MHz	-17 dB/Main	-20.9 dB/Main	-20 dB
Negative Angle Lobe Energy at 1213 MHz	-11 dB/Main	-14.0 dB/Main	-12.8 dB
Harmonics: R.S.S 15 to 90 Hz at 1151 MHz	19.1%	23.4%	22.8%
Harmonics: R.S.S 15 to 90 Hz at 1182 MHz	16.3%	12.1%	13.44%
Harmonics: R.S.S 15 to 90 Hz at 1213 MHz	24.1%	19.4%	20.57%
Harmonics: R.S.S 105 to 165 Hz at 1151 MHz	15.7%	13.5%	14.87%
Harmonics: R.S.S 105 to 165 Hz at 1182 MHz	15.3%	17.1%	17.09%
Harmonics: R.S.S 105 to 165 Hz at 1213 MHz	27.2%	23.9%	24.3%

Parameter	Orig. Design 12/1/76	New Design 1/17/77	After Drop Test 1/30/77
Harmonics R.S.S. 135 to 810 Hz at 1151 MHz	1.2%	1.0%	0.8%
Harmonics R.S.S. 135 to 810 Hz at 1182 MHz	0.6%	1.4%	0.9%
Harmonics R.S.S. 135 to 810 Hz at 1213 MHz	4.1%	4.3%	5.8%
15 Hz % Mod: -2° to +10° (Min/Max) at 1151 MHz	13.0%/16.1%	12.2%/15.5%	12.8%/15.2%
15 Hz % Mod: -2° to +10° (Min/Max) at 1182 MHz	19.8%/23.0%	17.2%/19.7%	17.7%/19.5%
15 Hz % Mod: -2° to +10° (Min/Max) at 1213 MHz	24.0%/27.2%	20.4%/23.3%	23.8%/25.8%
15 Hz Mod: +10° to +30° (Min/Max) at 1151 MHz	5.5%/13.0%	5.1%/12.2%	5.0%/12.8%
15 Hz Mod: +10° to +30° (Min/Max) at 1182 MHz	8.8%/19.8%	8.0%/17.2%	7.7%/17.7%
15 Hz Mod: +10° to +30° (Min/Max) at 1213 MHz	15.5%/27.2%	13.2%/20.4%	13.0%/25.8%
135 Hz % Mod: -2° to +10° (Min/Max) at 1151 MHz	16.5%/23.6%	15.0%/20.4%	16.2%/23.3%
135 Hz % Mod: -2° to +10° (Min/Max) at 1182 MHz	17.3%/27.7%	16.8%/25.1%	16.1%/25.0%
135 Hz % Mod: -2° to +10° (Min/Max) at 1213 MHz	23.3%/33.0%	23.5%/34.0%	21.0%/31.0%
135 Hz % Mod: +10° to +25° (Min/Max) at 1151 MHz	7.9%/16.5%	7.3%/15.0%	7.8%/16.2%
135 Hz % Mod: +10° to +25° (Min/Max) at 1182 MHz	8.6%/17.3%	9.0%/16.8%	8.4%/16.1%
135 Hz % Mod: +10° to +25° (Min/Max) at 1213 MHz	12.0%/23.3%	11.1%/23.5%	11.0%/21.0%
Sum of 15 and 135 Hz % Mod on Horizon at 1151 MHz	38.4%	35.0%	37.3%
Sum of 15 and 135 Hz % Mod on Horizon at 1182 MHz	48.5%	44.4%	42.0%
Sum of 15 and 135 Hz % Mod on Horizon at 1213 MHz	55.0%	55.0%	52.8%
Variation in 15 Hz % Mod: -2° to +5° at 1151 MHz	2.1%	2.2%	1.6%
Variation in 15 Hz % Mod: -2° to +5° at 1182 MHz	1.8%	1.0%	1.1%
Variation in 15 Hz % Mod: -2° to +5° at 1213 MHz	3.0%	0.2%	1.2%
Variation in 135 Hz % Mod: -2° to +5° at 1151 MHz	4.6%	2.4%	4.3%
Variation in 135 Hz % Mod: -2° to +5° at 1182 MHz	6.0%	4.1%	6.0%
Variation in 135 Hz % Mod: -2° to +5° at 1213 MHz	5.0%	5.5%	7.2%
15 Hz Cross Polarization Error at 1151 MHz	+1.0°; -1.0°	+1.2°; -1.5°	+1.5°; -1.5°
15 Hz Cross Polarization Error at 1182 MHz	0°; -1.0°	+0.5°; -1.0°	+0.5°; -0.6°
15 Hz Cross Polarization Error at 1213 MHz	+1.0°; -0.5°	+0.6°; -0.6°	+0°; +0°

<u>Parameter</u>	<u>Orig. Design</u> 12/1/76	<u>New Design</u> 1/17/77	<u>After Drbp Test</u> 1/30/77
135 Hz Cross Polarization Error at 1151 MHz	-0.11°; -0.06°	+0.06°; -0.06°	+0, +0
135 Hz Cross Polarization Error at 1182 MHz	0°; 0°	-0.50°; +0.58°	-.53°; +.61°
135 Hz Cross Polarization Error at 1213 MHz	-0.72°; +0.50°	-0.78°; +0.83°	-.61°; +.67°
15 Hz Azimuth Accuracy (Max-Min) at 1151 MHz	5.0°	5.5°	4.0°
15 Hz Azimuth Accuracy (Max-Min) at 1182 MHz	5.5°	5.5°	3.8°
15 Hz Azimuth Accuracy (Max-Min) at 1213 MHz	6.5°	5.0°	4.1°
135 Hz Azimuth Accuracy (Max-Min) at 1151 MHz	0.72°	0.78°	0.68°
135 Hz Azimuth Accuracy (Max-Min) at 1182 MHz	0.44°	0.67°	0.55°
135 Hz Azimuth Accuracy (Max-Min) at 1213 MHz	0.78°	0.56°	0.28°

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