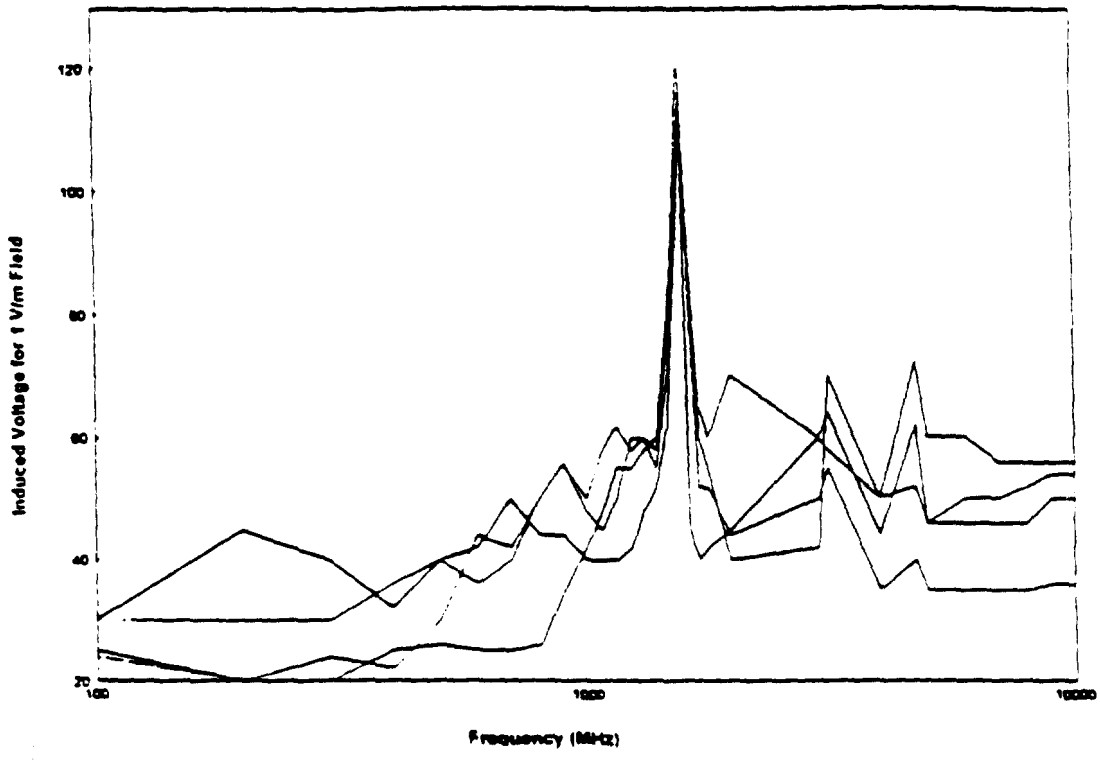

Figure J-1. Frequency Response of Four Commercial GPS Antennas [J-1]

©RTCA, Inc. 1997

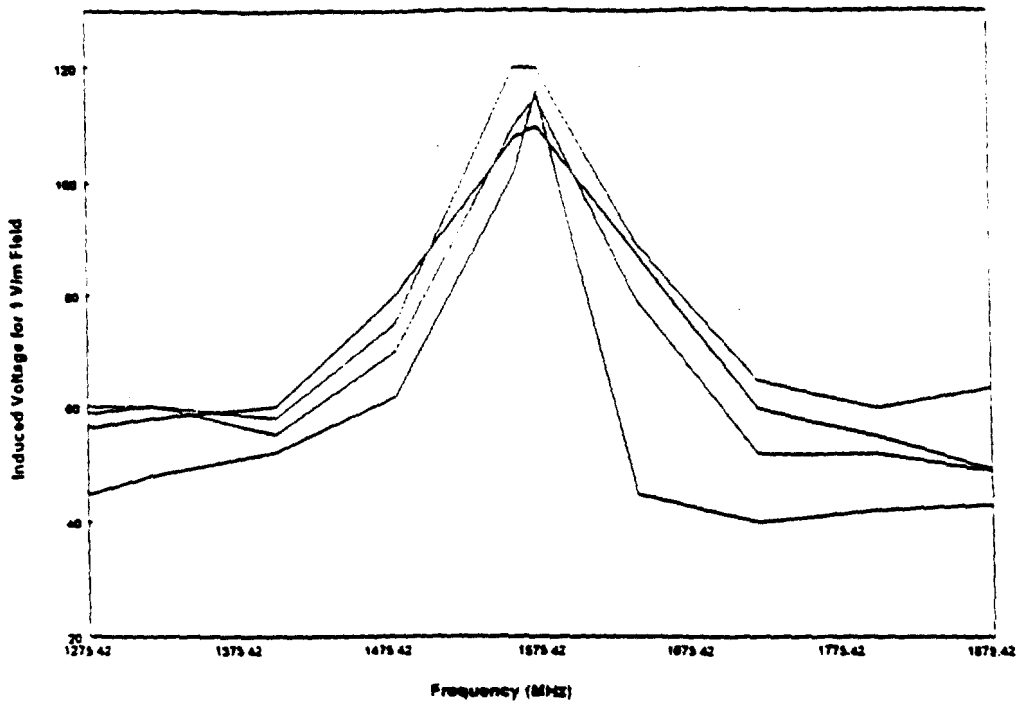

Figure J-2. Frequency Response of Four Commercial GPS Antennas (Expanded) [J-1]

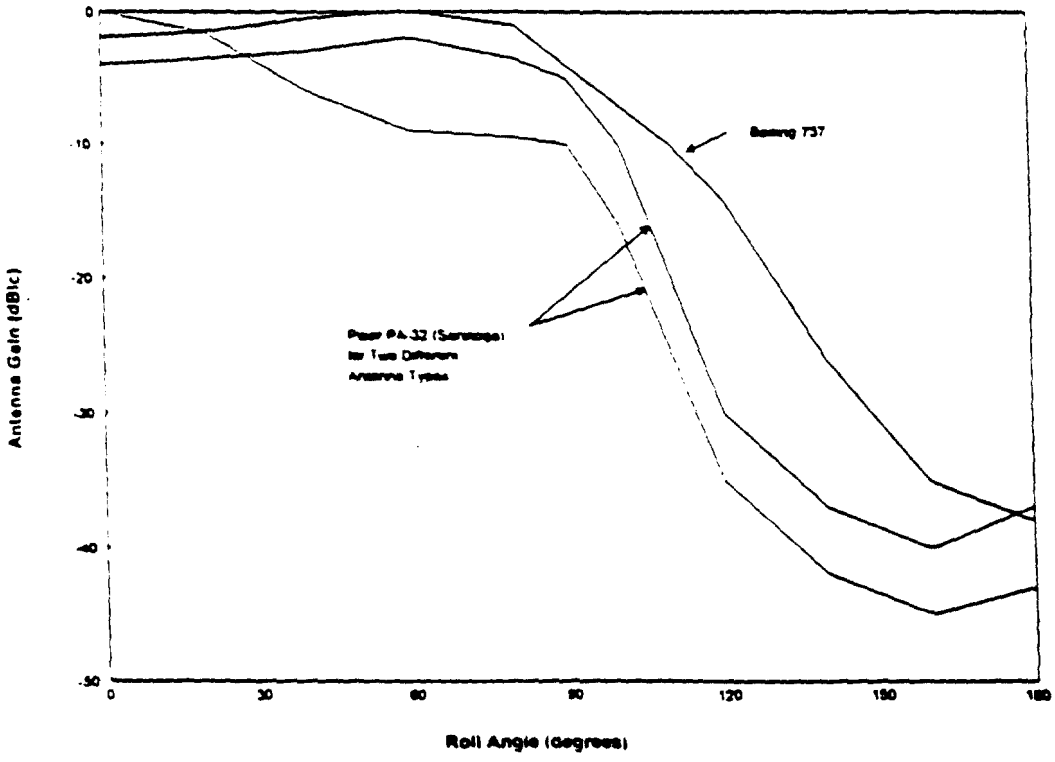

Figure J-3. Modelled Gain Patterns of Three Installed Antennas Along Roll Axis [J-4]

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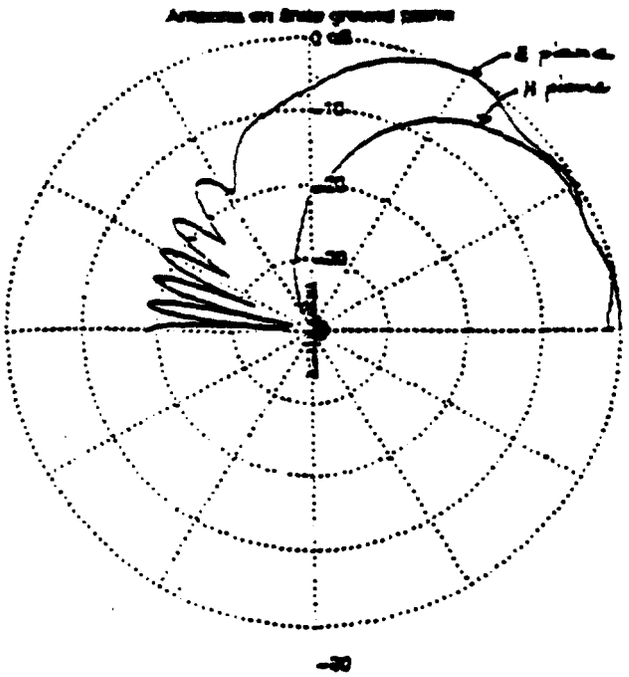

Figure J-4: Antenna on flat, finite ground plane

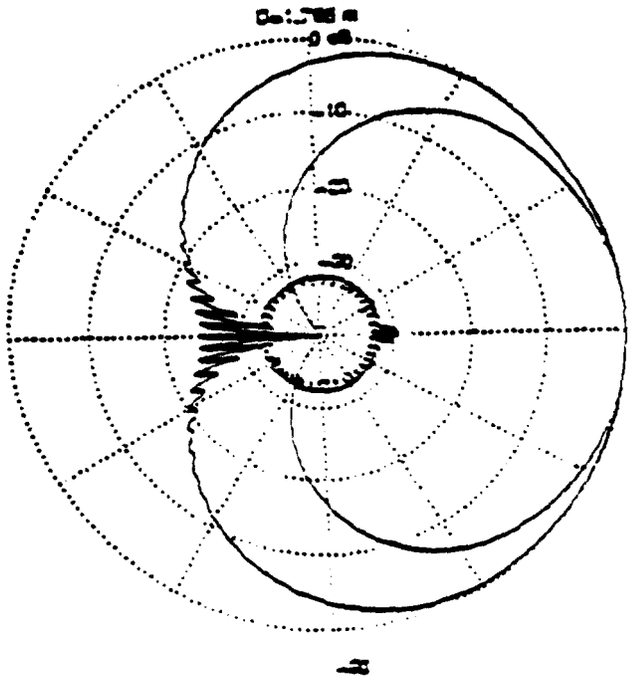

Figure J-5: Beechjet 400A (Groundplane Dia = 1.765m)

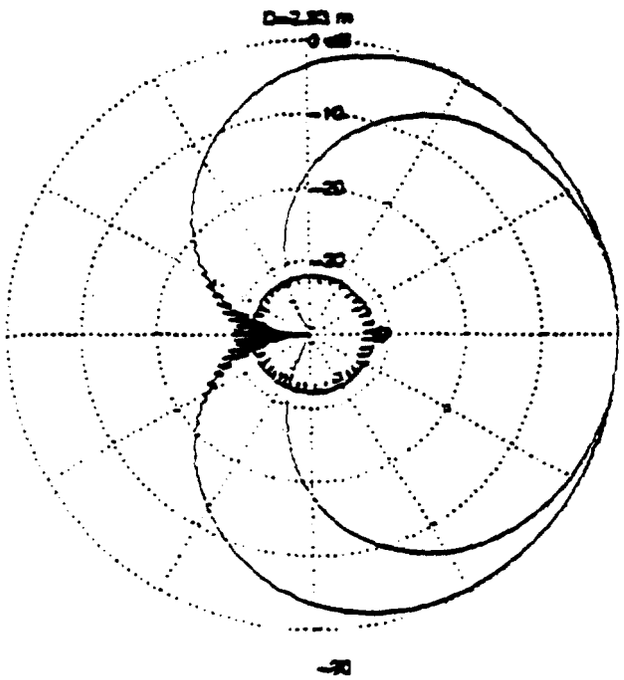

Figure J-6: Challenger 601-3A (Groundplane Dia = 2.83m)

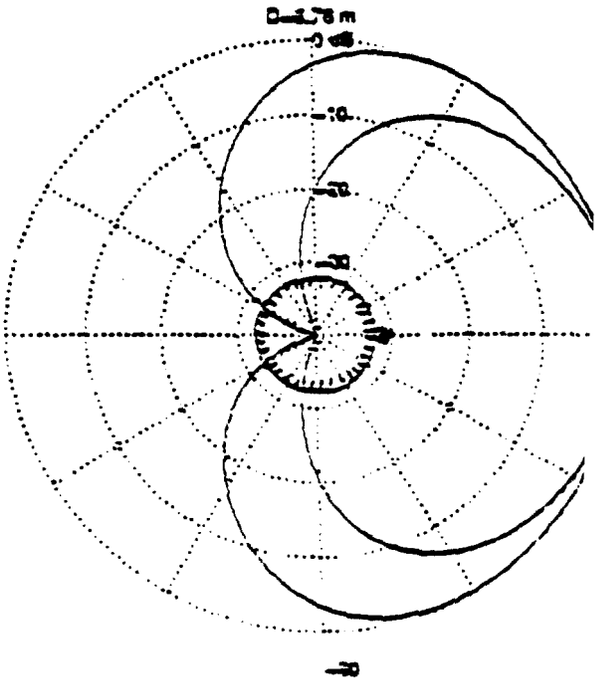

Figure J-7: 737-400 (Groundplane Dia = 6.76m)

©RTCA, Inc. 1997

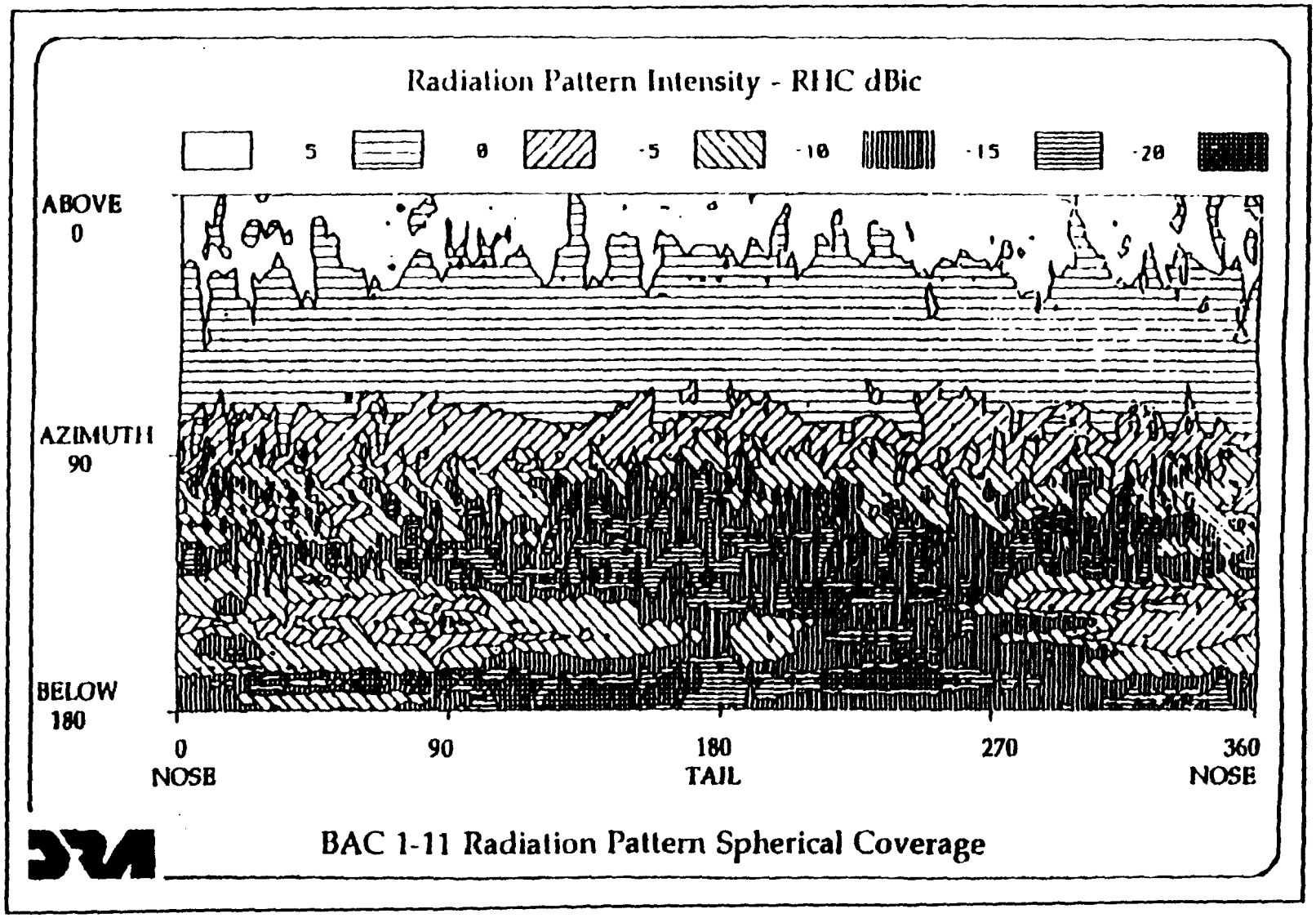

Figure J-8: Measured Gain Pattern for 1/9 Scale BAC-11 Antenna Installation

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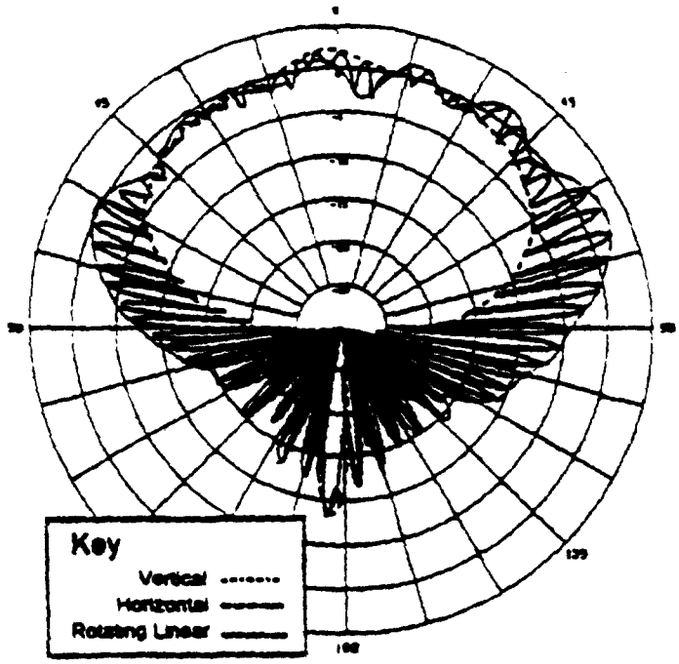

Figure J-9: Dual-Band Antenna on Ground Plane

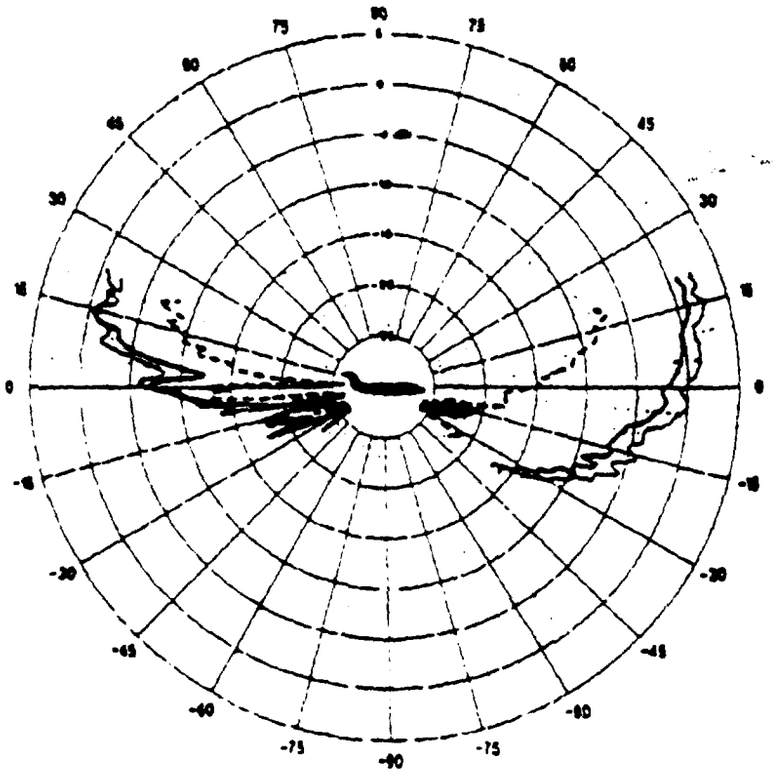

Figure J-10: TCA Antenna Pattern - Porpoise Maneuver

©RTCA, Inc. 1997

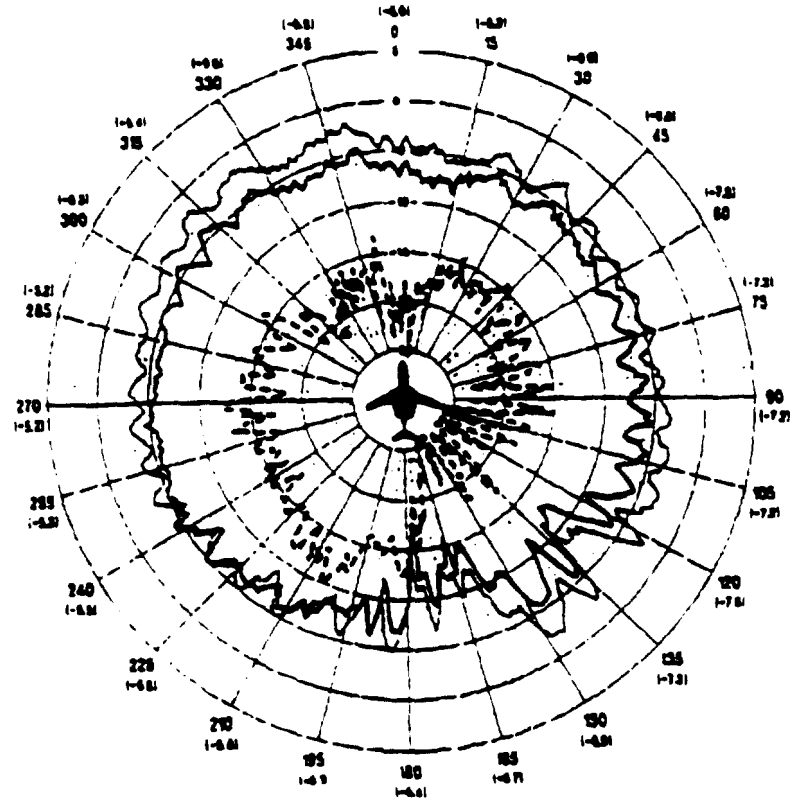

Figure J-11: TCA Antenna Pattern - Flat Turn

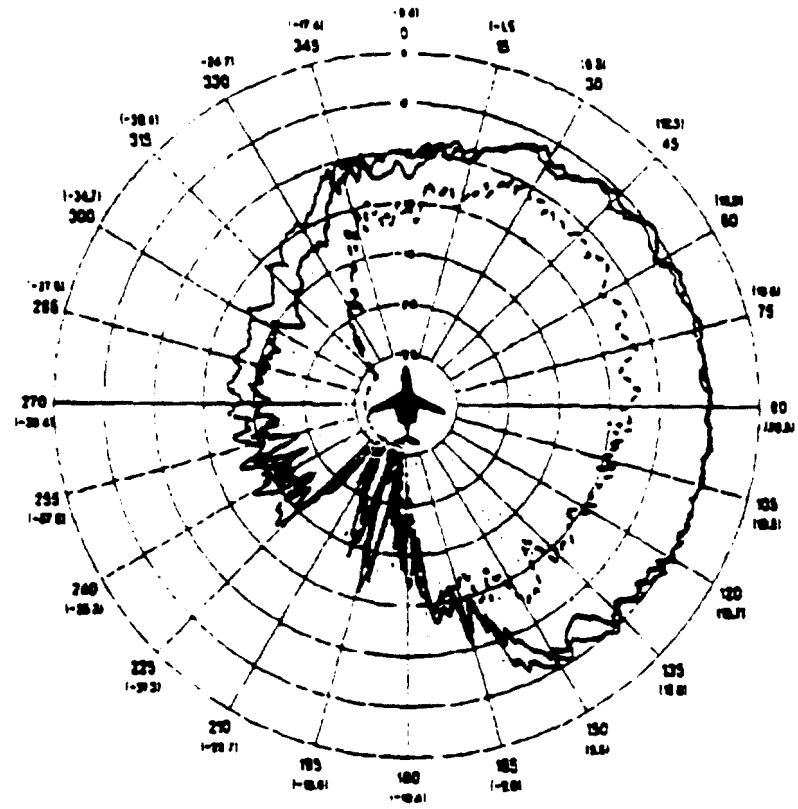

Figure J-12: TCA Antenna Pattern - 28 deg Bank

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Figure J-13: NAWC GPS Antenna Flight vs Owen Model Peak RHCP Gains/Based on Banked Turns

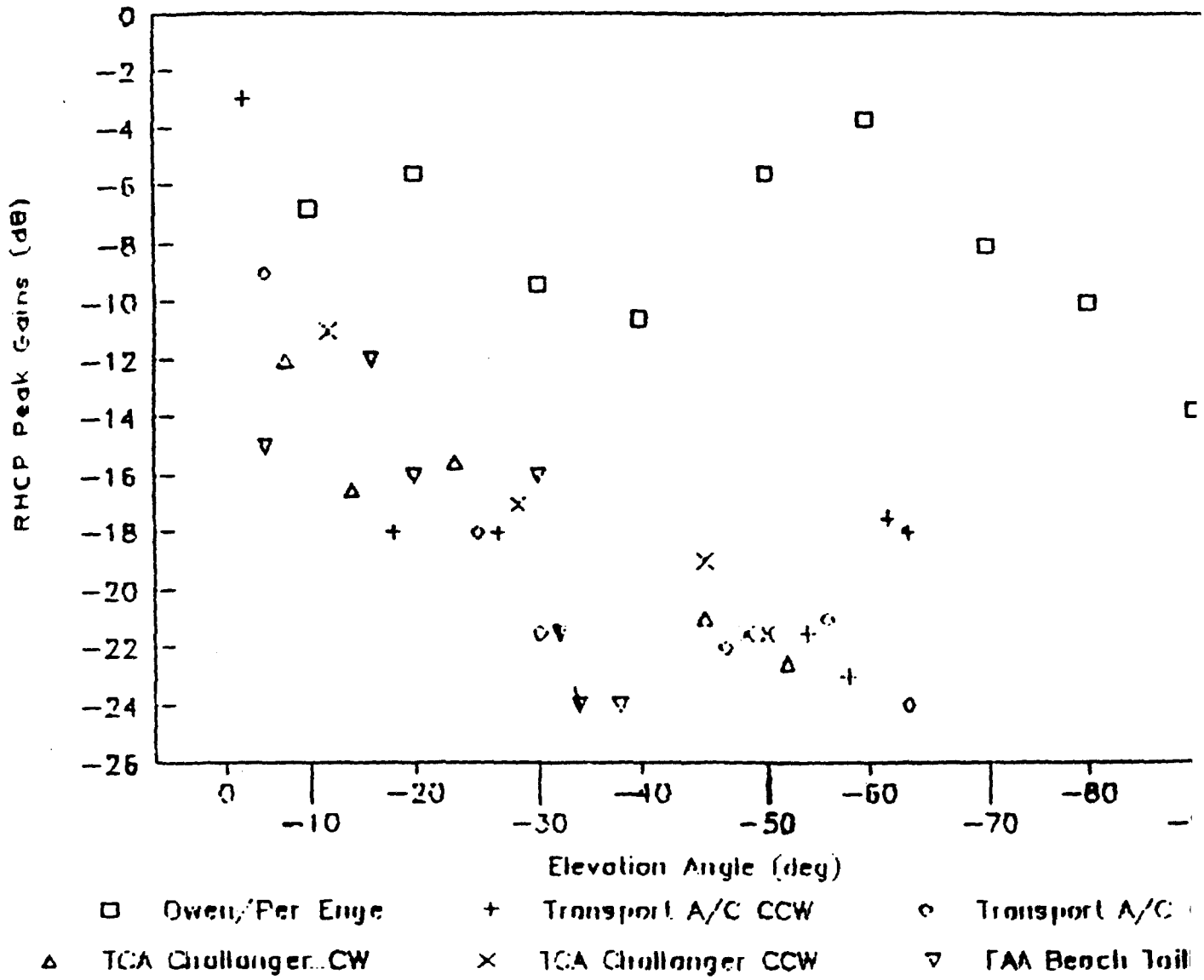

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Figure J-14: NAWC GPS Antenna Flight vs Owen #2
RHCP Peak Gains/Based on Banked Turns

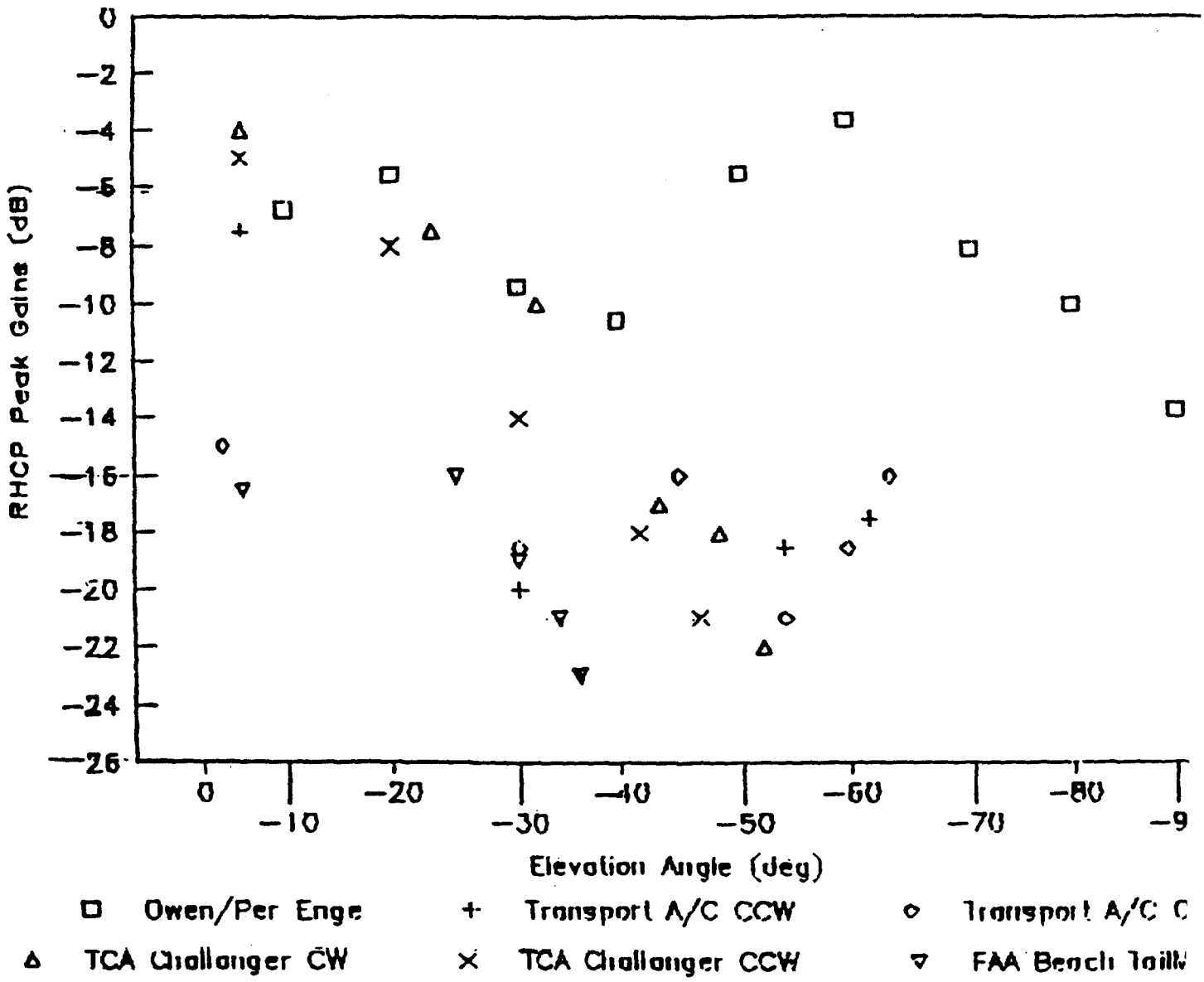

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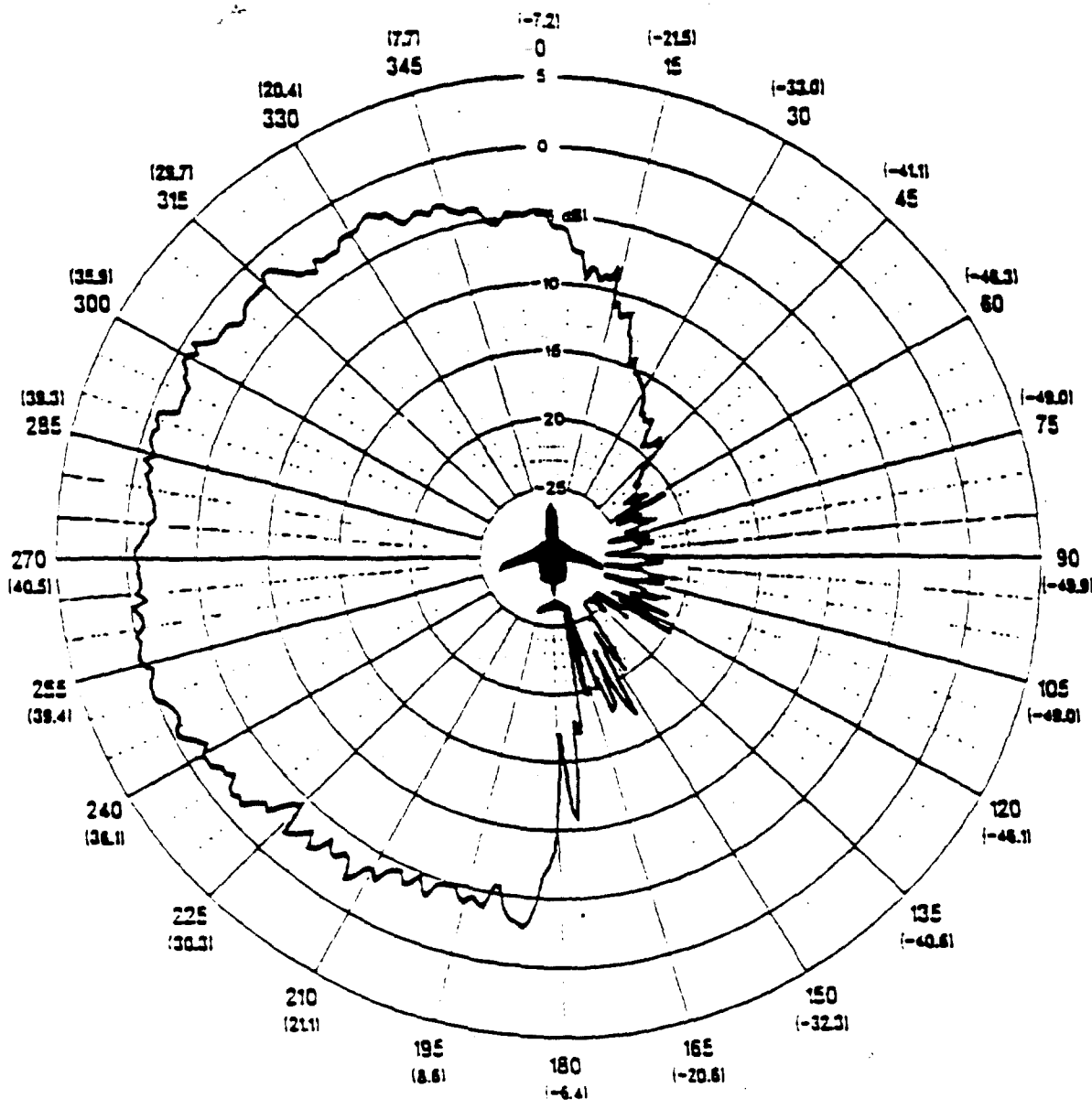
Figure J-15: TCA Antenna Radiation Pattern
Canadair Challenger No. 872

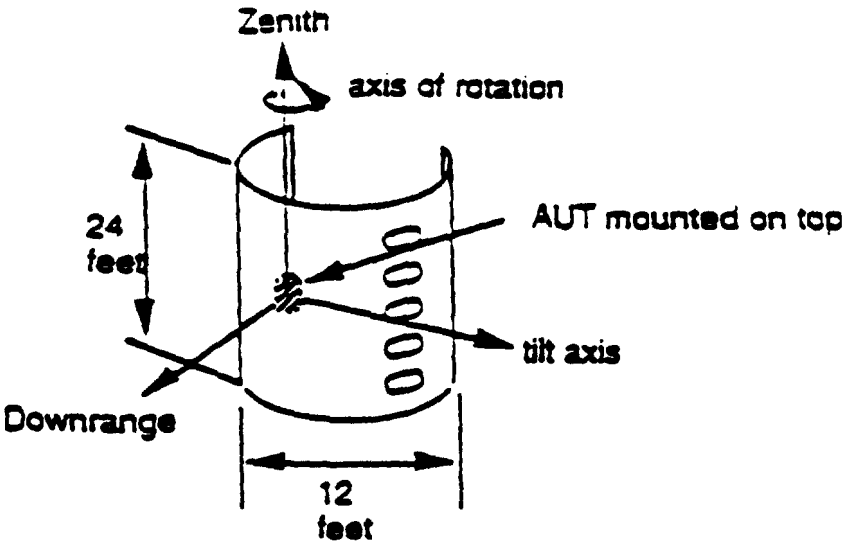


ANTENNA TYPE: SENSOR SYSTEMS S67-1575-14
ANTENNA LOCATION: TOP FUSELAGE,
STA 302.43, 3.275 L
FREQUENCY: 1575.4 MHz
POLARIZATION: RIGHT-HAND CIRCULAR
TYPE OF RUN: 45 DEG CCW BANK TURN

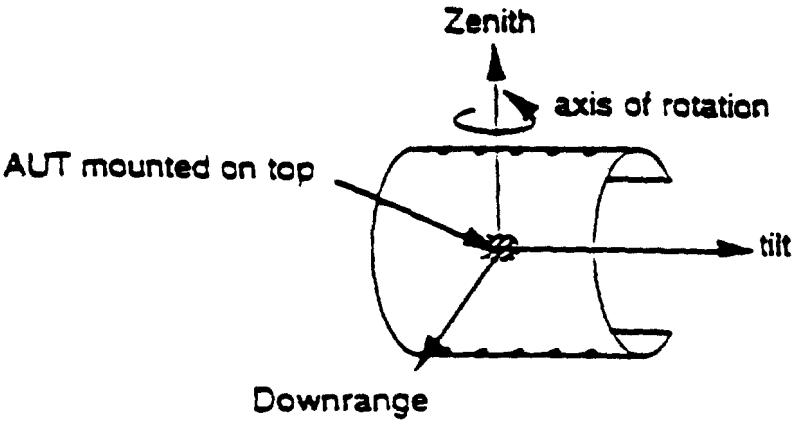
SCALE: ANTENNA GAIN PLOTTED IN dBIC
VERSUS AZIMUTH ANGLE
DEPRESSION ANGLE GIVEN IN PARENTHESES
WHERE: (+) IS ABOVE AIRCRAFT HORIZON
(-) IS BELOW AIRCRAFT HORIZON

©RTCA, Inc. 1997

Figure J-16: Antenna/test fixture orientations



•Orientation for roll cut



•Orientation for pitch cut

©RTCA, Inc. 1997

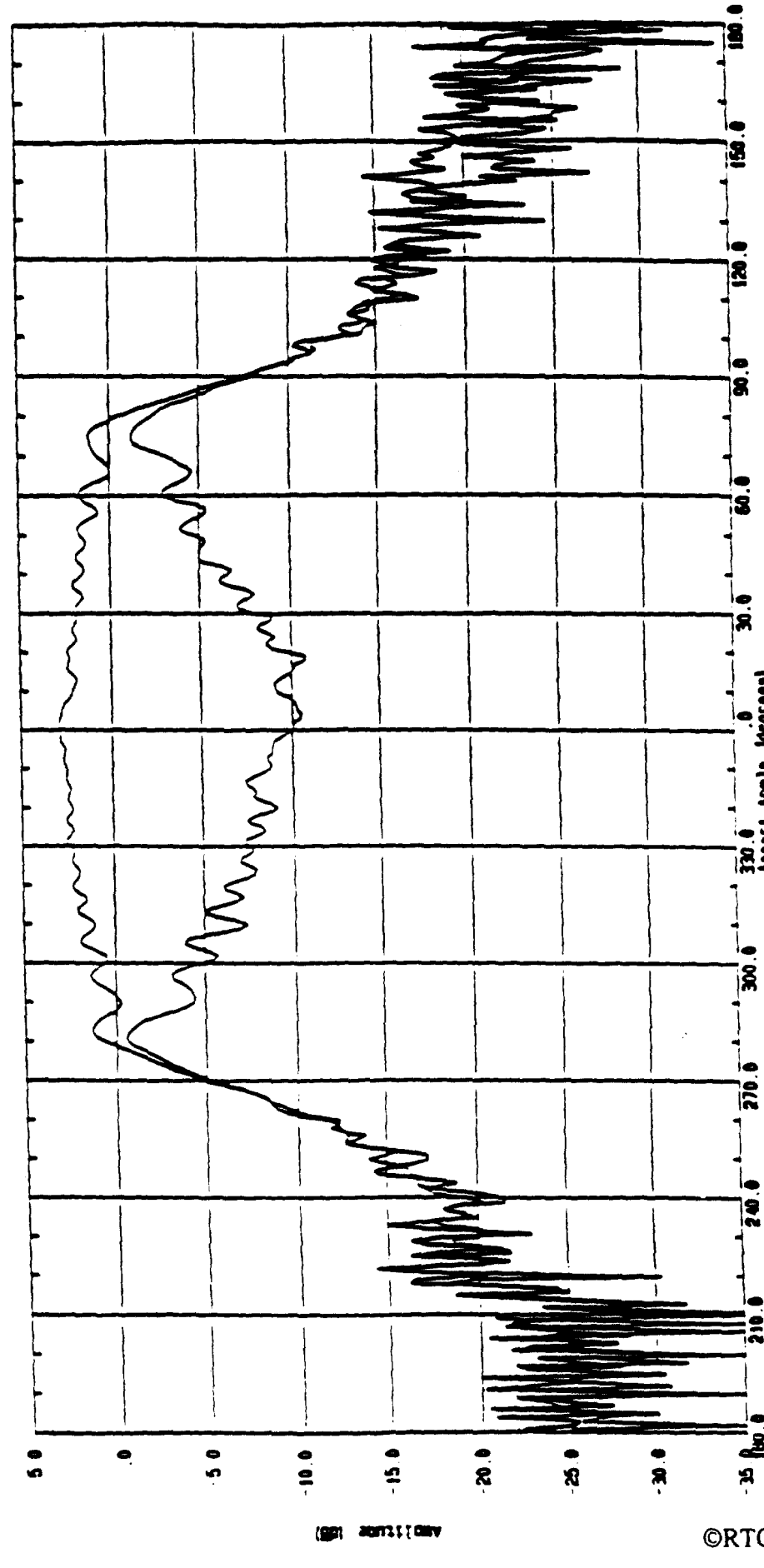


Figure J-17: RHCP and LHCP data for Ball GPS Antenna, Fuselage Section, Horizontal Mount, Elevation cut.

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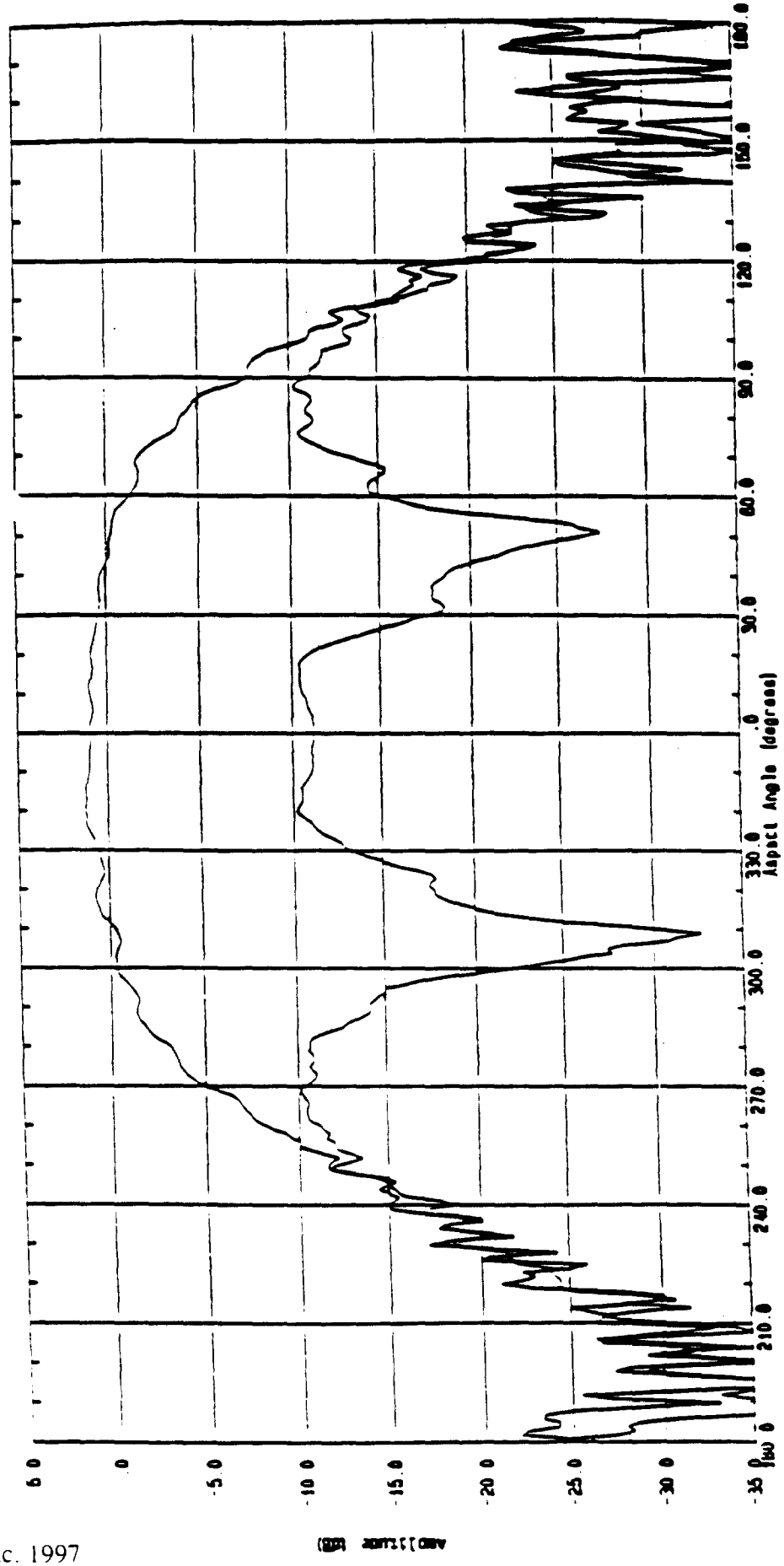

Figure J-18: RHCP and LHCP data for COMANT GPS Antenna, Fuselage Section, Vertical Mount, Roll Cut

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Figure J-19: RHCP and LHCP data for COMANT GPS Antenna, Fuselage Section, Horizontal Mount, Elevation Cut

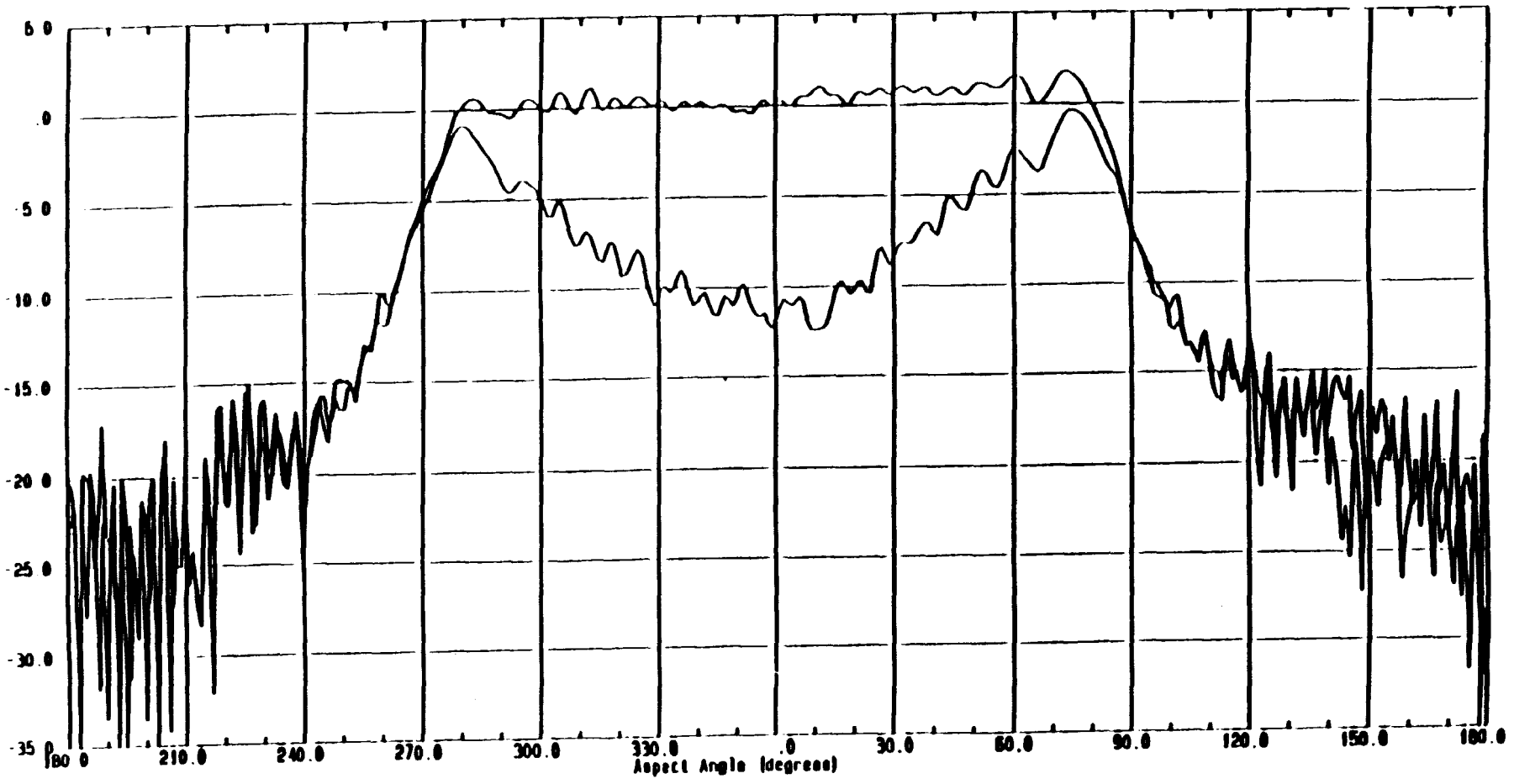

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EXHIBIT B

Out-of-band Emissions from Land-Mobile VHF Radios

The proposed NTIA specification would limit spurious radiation from L-band MSS mobile Earth stations within the 1559-1605 MHz GNSS band to -70 dBW/MHz. Other transmitters operate under requirements that permit higher spurious emissions levels than those proposed for MSS. Specifically, land-mobile very-high frequency (VHF) transmitters used by business and other users and operating under Part 90 are subject to a much weaker standard. The 10th harmonic of transmissions in the 156.5-160.5 MHz band falls within the 1559-1605 MHz range, that is, the GNSS band. Section 90.209(c) sets the limit at -43 dB - 10log(P), where P is the Part 90 transmitter's power in Watts.

Part 90 transmitters must be type accepted. Pursuant to Section 2.997 of the Commission's rules, an application for type acceptance must investigate spectral purity up to at least the 10th harmonic of the carrier frequency. The magnitude of spurious emission which are attenuated more than 20 dB below the permissible level need not be reported. Therefore, spurious components below -63 dBW, 7 dB higher than the proposed maximum level for MSS transmitters are not considered significant.

Analysis of the applications granted for several type-accepted Part 90 transmitters document that those transmitters indeed emit spurious emissions in the 1559-1605 MHz band substantially in excess of the proposed standard for MSS mobile Earth stations. (See Table below). All of the listed transmitters radiate spurious emissions that are within the Part 90 requirements, but exceed the proposed MSS standard by amounts ranging from 4.6 to 11.1 dB.

Model and FCC ID	Transmit Frequency (MHz)	Spurious Frequency (MHz)	Spurious Power (dBW)	Interference Relative to Proposed MSS Standard (dB)
Midland Consumer Radio Transmitter MMA-78-211	156.8	1568	-60.8	9.2
Kenwood USA Corp. Transmitter ALHTK-230-1	156.8	1568	-65.4	4.6
Kenwood USA Corp. Transmitter (Lo Power mode) ALHTK-730HG-1	162.03	1620.3	-58.9	11.1*
Kenwood USA Corp. Transmitter (Hi Power mode) ALHTK-730HG-1	162.03	1619.9*	-60.4	9.6 *
		1458.18*	-59.1	10.9 *

* No data points were available for the Kenwood ALHTK-730-HG-1 in the 1559-1605 MHz GNSS band. However, the data points above and below that band indicate that the spurious emissions in the GNSS band may be similar to those of the other units.

WASHINGTON, D.C. 20554

GRANT OF EQUIPMENT AUTHORIZATION

Type Acceptance

Kenwood USA Corporation
2201 East Dominguez Street
Long Beach, CA 90810

Date of Grant: February 5, 1992

File No.: 31010/EQU 17.9

Application dated: January 15, 1992

Attention: T. Yoshida

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER [redacted]

Name of Grantee

Equipment Class : Non-Broadcast Transmitter

Note(s)	Rule Part(s)	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission
BD	22,74,90	150-174	5	.0005	16K0F3E
BD	22,74,90	150-174	5	.0005	16K0F1D
BD	22,74,90	150-174	5	.0005	15K0F2D
BG	22,74,90	150-174	2	.0005	16K0F3E
BG	22,74,90	150-174	2	.0005	16K0F1D
BG	22,74,90	150-174	2	.0005	15K0F2D

BD: The output power is continuously variable from the value listed in this entry to 10%-15% of the value listed.

BG: The output power is continuously variable from the value listed in this entry to 25%-30% of the value listed.

COPY

Mail to:
Morton Flom
M. Flom Associates, Inc.
3356 N. San Marcos Pl., #107
Chandler, AZ 85224

2-7

Grantee : Kenwood USA Corporation
: 2201 East Dominguez Street
: Long Beach, CA 90810

Attention : T. Yoshida

Mail to : Morton Flom
: M. Flom Associates, Inc.
: 3356 N. San Marcos Pl., #107
: Chandler, AZ
: 85224

Fee Serial # : 012192 8315209 003

Equipment Class : (TNB) Non-Broadcast Transmitter

Note(s)	Rule Part(s)	Freq Range MHz	RF Power	Freq Tol	Emiss Desig
BD	22,74,90	150 - 174	5	.0005	16K0F3E a
					16K0F1D b
					15K0F2D c
BG			2		16K0F3E
					16K0F1D
					15K0F2D

Application Date : 011592
Application Receipt Date : 012192

Grant Date : BLANK
Original Grant Date : BLANK
Expiration Date : BLANK

Sample Status : BLANK
Confidentiality Code : BLANK
Related App ID : BLANK

Stat/Way Code and Stat/Way Date:
LI/JG TR/FC
012792 012892

BG/"FC"
2/5/92

Internal remarks: BLANK

Remarks: BLANK

Notes: [redacted]
BD, BG

jg

Subsection
2.991:

SPURIOUS EMISSIONS @ ANTENNA TERMINALS

MEASUREMENT
PROCEDURE: REFERENCE: EIA STANDARD RS 152B, Paragraph 17.

1. The emissions were measured for the worst case as follows:

   (a): within a band of frequencies defined by the carrier frequency plus and minus one channel.

   (b): from the lowest frequency generated in the E.U.T. and to at least the 10th Harmonic of the carrier frequency, or 40 GHz, whichever is lower.

2. The magnitude of spurious emissions which are attenuated more than 20 db below the permissible value need not be specified.

3. TEST RESULTS: ATTACHED

TEST RESULTS

	FREQUENCY OF CARRIER, MHz	150.05, 162.05 173.95
	SPECTRUM SEARCHED, GHz	0 to 2
	FREQUENCY OF MAXIMUM RESPONSE, Hz	2820
LIMIT:	-(43 + 10 LOG W)	-40 dBc (0.5 W) -46 dBc (2.0 W) -50 dBc (5.0 W)

EMISSION, MHz/HARM.	SPURIOUS LEVEL BELOW CARRIER, dbc

PLEASE SEE COMPUTER PRINTOUT

ATTACHED 3 PAGES

ALL OTHER SPURIOUS READINGS WERE 20 db OR MORE BELOW LIMIT

M. Flom P.Eng

SUPERVISED BY:

MORTON FLOM, P. Eng.

PAGE 21. ADDENDUM 2.
TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)
KENWOOD, TK-248
10 JAN 1992, 15:53

POWER: MEDIUM

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	MICRO-WATTS
162.050	324.11	-38.5	-71.5	.1
162.050	485.66	-38.8	-71.8	.1
162.050	649.15	-39.3	-72.3	.1
162.050	810.56	-38.6	-71.6	.1
162.050	973.25	-38.1	-71.1	.2
162.050	1134.35	-36.9	-69.9	.2
162.050	1295.63	-37.5	-70.5	.2
162.050	1458.46	-33.9	-66.9	.4
162.050	1620.85	-35.5	-68.5	.3
162.050	1782.07	-35.5	-68.5	.3
162.050	1943.88	-34.9	-67.9	.3
162.050	2106.15	-34.7	-67.7	.3
162.050	2267.98	-34.5	-67.5	.4
162.050	2430.55	-34.5	-67.5	.4

PAGE 21. ADDENDUM 3.
TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)
KENWOOD, TK-248
10 JAN 1992, 15:48

POWER: HIGH

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	MICRO-WATTS
162.050	324.10	-36.4	-73.5	.2
162.050	485.29	-38.6	-75.7	.1
162.050	648.21	-39.2	-76.3	.1
162.050	810.71	-38.1	-75.2	.1
162.050	973.19	-38.5	-75.6	.1
162.050	1134.92	-38.0	-75.1	.2
162.050	1297.20	-36.7	-73.8	.2
162.050	1458.86	-35.6	-72.7	.3
162.050	1619.94	-36.5	-73.6	.2
162.050	1783.37	-35.5	-72.6	.3
162.050	1944.62	-35.0	-72.1	.3
162.050	2106.25	-35.2	-72.3	.3
162.050	2267.74	-34.5	-71.6	.4
162.050	2431.59	-33.7	-70.8	.4

GRANT OF EQUIPMENT AUTHORIZATION

Type Acceptance

Renwood Communications Corporation
2201 East Dominguez Street
PO Box 22745
Long Beach, CA 90801-5745

Date of Grant: July 29, 1996

File No.: 31010/SGS 17.9

Application dated: June 5, 1996

Attention: N. Naniki, President

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER [redacted]

Name of Grantee

Equipment Class : Non-Broadcast Transmitter

Note(s)	Rule Part(s)	Frequency Range (MHz)	Output Watts	Frequency Tolerance	Emission
BE,CO	22,74,80,90.210	148-174	100	.00025	16K0F3E
BE,CO	90.210	148-174	100	.00025	11K0F3E

Single Channel Mode

BE: The output power is continuously variable from the value listed in this entry to 15%-20% of the value listed.

CO: Transmitter meets technical requirements only for use at coast stations.

COPY

Mail to:
Morton Flom, President
M. Flom Associates Inc
3356 N San Marcos Place, Suite 107
Chandler, AZ 85224-1871

7-30

In correspondence concerning this grant, please refer to the FCC IDENTIFIER, File No., and date of grant.

FCCID: ALHTK-730HG-1 File: 31010/EQU 17.9 Application Type: T Acc

Grantee : Kenwood Communications Corporation
: 2201 East Dominguez Street
: PO Box 22745
: Long Beach, CA 90801-5745

Attention : N. Namiki, President

Mail to : Morton Flom, President
: M. Flom Associates Inc
: 3356 N San Marcos Place, Suite 107
: Chandler, AZ
: 85224-1571

Fee Serial # : 061096 8315393 001

Equipment Class : (TNB) Non-Broadcast Transmitter

Note(s)	Rule Part(s)	Freq Range MHz	RF Power	Freq Tol	Emiss Desig
BE,CO	22,74,80,90,210	148-174	100	.00025	16K0F3E
	90-210				11K0F3E

Application Date : 060596
App Receipt Date : 061096

Grant Date : BLANK
Org Grant Date : BLANK
Expiration Date : BLANK

Sample Status : BLANK
Confidentiality Code : N
Related App ID : BLANK

Stat/Way Code and Stat/Way Date:
LI/LO AR/LO TRFC RTLFE RGLFC
061796 061796 6/18/96 7/11/96 7/25/96

Internal remarks: BLANK

Remarks: Single channel Mode

Notes:

BE
CO

JG

Fax Sent
(See G-1 file)

NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

PARAGRAPH: 47 CFR 2.991

GUIDE: EIA STANDARD RS 152B, Paragraph 17

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. The emissions were measured for the worst case as follows:

   (a): within a band of frequencies defined by the carrier frequency plus and minus one channel.

   (b): from the lowest frequency generated in the EUT and to at least the 10th harmonic of the carrier frequency, or 40 GHz, whichever is lower.

2. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

3. MEASUREMENT RESULTS: ATTACHED FOR WORST CASE

FREQUENCY OF CARRIER, MHz	= 162.03, 150.03, 173.97
SPECTRUM SEARCHED, GHz	= 0 to 10 x F_C
MAXIMUM RESPONSE, Hz	= 2820
ALL OTHER EMISSIONS	= ≥ 20 dB BELOW LIMIT
LIMIT, dBc: $-(43 + 10 \text{ LOG } P_0)$	= −63 (100 Watts) −54.8 (15 Watts)

[signature]