ELECTRONICS RESEARCH, INC.
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Report Of Intermodulation Product Findings

KMXR ~ KRYS ~ KSAB
COMBINED BROADCAST FACILITY
CORPUS CHRISTI, TEXAS

June 2002

Electronics Research Inc.
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REPORT OF FINDINGS
KMXR / KRYS / KSAB BROADCAST FACILITY
CORPUS CHRISTI, TEXAS

Introduction : This report of findings is based on data collected at the KMXR, KRYS, and KSAB FM broadcast facility located in Corpus Christi, TX. The report includes measurements offered as proof that the addition of KSAB 99.9 MHz. to the combined operations of KMXR 93.9 MHz., and KRYS 99.1 MHz. are in compliance with the FCC Rules and Regulations as required by the Code of Federal Regulations (CFR) Title 47 section 73.317 paragraph (b) through (d). In brief, the collection of measurements presented in this report shows that all possible second order inter-modulation (IM) products generated by this multiplex system are less than the maximum allowable level as required by section 73.317 (b) through (d). Mark Steapleton of Electronics Research, Inc. located in Chandler, Indiana performed the measurements summarized herein on June 4, 2002.

The following exhibits are provided:

Exhibit A:
- A-1 Drawing Depicting Antenna.
- A-2 SHPX-12AC6-SP Antenna Specification Sheet.
- A-3 Drawing Depicting Multiplexing Scheme.
- A-4 963 Branch Type Multiplexer Specification Sheet.
- A-5 Theoretical Vertical Plane Relative Field Antenna Plots

Exhibit B:
- B-1 Equipment Employed In Intermodulation Product Measurement.
- B-2 Broadcasting Scheme of the Multiplexed Systems.

Table 1. Carrier Reference Levels.
Table 2. Calculated Second Order Products.
Table 3. Intermodulation Analysis Measurements.

Exhibits Accompanying Report: Exhibit A, provides comprehensive information on both antenna and filters used by these radio stations. Exhibit B, illustrates the broadcasting scheme of each station, the layout of the equipment used to isolate and measure potential intermodulation products and forward carrier reference levels. Found within Table 1 are the narrow band carrier frequency measurements that provide relative output signal levels for the IM analysis. Table 2 lists the calculated second order products that can be generated from FM transmitters broadcasting from the multiplexed system. The IM Analysis Measurements, in Table 3, provides detailed information obtained from the product frequency investigation.

The Nature Of Intermodulation Products (IM) : Intermodulation products result from inadequate transmitter-to-transmitter isolation. Intermodulation products are commonly generated from radio stations operating into multiplexed facilities and congested antenna broadcast sites. The mechanics associated with the phenomenon have been well documented. When two or more transmitters are coupled to each other, new spectral components are produced by the mixing of the station frequencies in the active circuits of each transmitter. The common term used to describe this phenomenon is second order product denoted by the mathematical expression $[\ 2(F_1)-(F_2)\ ]$, where F_1 signifies the frequency of the transmitter that is generating the intermodulation product, and F_2 signifies the frequency causing the interference.

The Multiplexed System : At the time of my measurements three FM stations were operating from the combined antenna system. The KMXR, KRYS and KSAB multiplexed system is fundamentally comprised of antenna, feed line and multiplexer unit. The SHPX-12AC6-SP antenna and 963 Branch multiplexer are products of Electronics Research, Inc, whereas the feed line is manufactured by Myat, Refer to Exhibit B-2. for an illustration of the Broadcasting Scheme of these stations.

To accomplish the aggregation of three transmitter signals into a common antenna feed and provide transmitter-to-transmitter isolation, a multiplexing scheme consisting of a Branch Combiner module was installed. Specifically, two of the branches of this combiner utilizes four ERI Model 963 Bandpass filters using nonadjacent coupling for the KMXR and KSAB transmitters. The third branch utilizes three ERI 963 standard Bandpass filters for the KRYS transmitter. An interconnecting TEE's are required to complete the branch multiplexer module which is illustrated in the attached Exhibit A-3. The multiplexer, fully assembled, exhibited transmitter port-to-port isolation in excess of - 56 dB. Other performance measurements, such as match, loss, group-delay, etc, revealed that the multiplexer unit was in proper working condition. Refer to Exhibit A-4 for the Combiner Specification Sheet.

The IM Investigation : Directional Couplers were placed at key locations throughout the combiner to monitor and maintain the multiplexers performance. All couplers furnished with the system are factory calibrated and capable of delivering accurate and repeatable RF measurements. To facilitate the taking of the measurements, the coupler located at the antenna output of the multiplexed system was used. Care was taken in the selection of the measurement location to insure that the measurements would be made far removed from transmitters and any filtering used to reduce broadcast emissions. The coupler selected would normally be used for antenna reflection measurements and thus would provide greater than 33 dB directivity and a forward signal sample of -47 dB.

The forward port of the coupler was used for sampling the outgoing carrier levels and IM products. The IM sampled signal was fed by shielded cable into a Band Pass Filter where all extraneous energy was steeply attenuated. Various attenuation pads were used, as needed, on the band pass filter and/or the FIM71 to ensure an adequate signal level for measurements without overloading the measurement equipment. A Potomac Instruments FIM-71 Field Strength Receiver was employed to record the level of all signals investigated. To facilitate the selective tuning of the Receiver and Band Pass Filter a Wavetek Model 3000 signal generator was used. An Anritsu Model S114B Spectrum Analyzer was used to measure the close in spectral attenuation of each carrier and wide band search for any anomalies that may need further investigation. See attached Exhibit B-1 for an illustration of the measurement equipment.

Prior to recording measurements, all pertinent broadcasting equipment including Transmitters, Multiplexer, Feed Line and Antenna were adjusted to optimal performance. Also, it was confirmed before taking any measurements that all stations of concern were operating at their full licensed power level. From the equipment setup described above, the relative output signal level of each stations forward carrier was made. The resulting signal levels of these measurements are listed in Table 1, column labeled "Adjusted Level". This level will be used as the reference level for possible IM products of each carrier and was necessary to confirm that no significant levels of spurious energy, referenced to each carrier, were present from any transmitter operating from the multiplexed system.

Table 1 - Carrier Reference Levels

Carrier Frequency (MHz)	Pad One (dB)	Bandpass Filter Loss (dB)	Full Scale Range (dBμ)	Scale Reading (dB)	Adjusted Level (dBμ)	Notes
KMXR (93.9)	3	---	140	-11.9	**131.1**	
KRYS (99.1)	3	---	140	-12.8	**130.2**	
KSAB (99.9)	3	---	140	-11.2	**131.8**	

Predictable second-order products due to system harmonics mixed with all on-site interfering frequencies that could be generated from the multiplexed system are calculated and listed in Table 2.

Table 2 - Second Order Products.

	Carrier Frequency (MHz)		
Interfering Frequency (MHz)	**KMXR 93.9**	**KRYS 99.1**	**KSAB 99.9**
KMXR 93.9	---	104.3	105.9
KRYS 99.1	88.7	---	100.7
KSAB 99.9	87.9	98.3	---

Using the equipment previously described the IM product measurements were recorded and are listed in Table 3. The signal levels referenced to the carriers are calculated and listed in the column labeled "Level Referenced to Carrier". Refer to Exhibit B for a layout of the measurement equipment.

Table 3 Intermodulation Measurements

Product Frequency (MHz)	Carrier Frequency (MHz)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Full Scale Range (dBμ)	Scale reading (dB)	Adjusted Level (dBμ)	Carrier Reference Level (dBμ) (See Table 1)	**Level Referenced to Carrier (dB)**	Notes *
87.9	93.9	99.9	3	7.2	40	-17.4	32.8	131.1	**98.3**	
88.7	93.9	99.1	13	7.2	40	-4.5	55.7	131.1	**75.4**	1
98.3	99.1	99.9	10	7.0	40	-5.2	51.8	130.2	**78.4**	2
100.7	99.9	99.1	20	7.0	20	-6.3	40.7	131.8	**91.1**	
104.3	99.1	93.9	3	7.0	20	-6.6	23.4	130.2	**106.8**	
105.9	99.9	93.9	10	6.9	20	-3.8	33.1	131.8	**98.7**	

*** NOTES**

1) Measured signal is a local carrier KFGG transmitting at 88.7 MHz: No discernable signal was measured.

2) Measured signal is a local carrier KLHB transmitting at 98.3 MHz: No discernable signal was measured.

The Spectrum Analyzer was used to check the close in spectral attenuation of each carrier to confirm the operation of these transmitters are in compliance with Sections (b) and (c) of the FCC Rules and Regulations.

As a final proof of the systems IM Product performance, a wide band search was undertaken using the Spectrum Analyzer. The purpose for this measurement was to look for suspicious anomalies that may warrant further investigation. My search ranged the complete frequency span of the receiver and resulted in no additional investigations.

Conclusion : Based upon my observations and measurements taken June 4th. 2002 as summarized in this document, I, Mark Steapleton, find the subject multiplexed system- specifically the transmitters and combiner system for the operation of the KMXR, KRYS and KSAB into the SHPX-12AC6-SP antenna- to be in proper working order. Furthermore, based on the measured data, it is my opinion that there are no inter-modulation products in excess of 80 dB below carrier levels generated from or within the stations operating on the installed system. Also, based on this recorded data. I conclude that KMXR, KRYS and KSAB are in compliance with the requirements of Section 73.317 paragraph (b) through (d) of the FCC Rules and Regulations.

Respectfully submitted,
Electronics Research, Inc.

By Mark Steapleton
Mark Steapleton Field Technician

AFFIDAVIT

I, Mark Steapleton, hereby declare that the following statements are true and correct to the best of my knowledge and belief :

1.) I am a Field Technician for Electronics Research, Inc ("ERI ") and have been employed by ERI for 21 years. I am familiar with and have assisted in the design, manufacturing and installation of FM Antennas and FM Multiplexers in my long tenure with ERI.

2.) I have either prepared and/or directly supervised the preparation of all technical information contained in this Report Of Findings and to my knowledge to be accurate and true.

3.) ERI has been requested by Clear Channel Communications, on behalf of radio Stations KMXR, KRYS and KSAB in Corpus Christi, TX. to prepare this Report Of Findings.

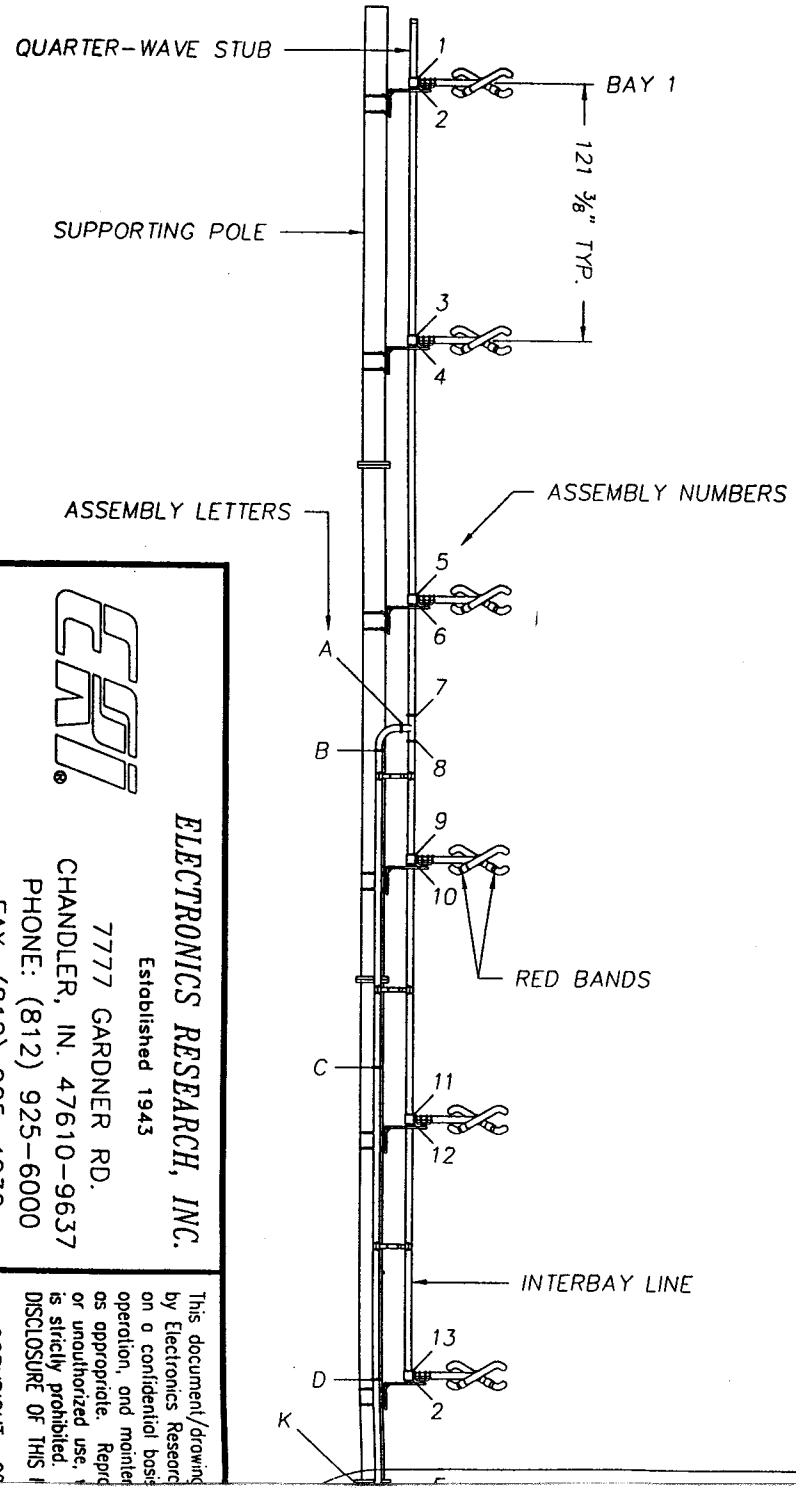
Mark Steapleton

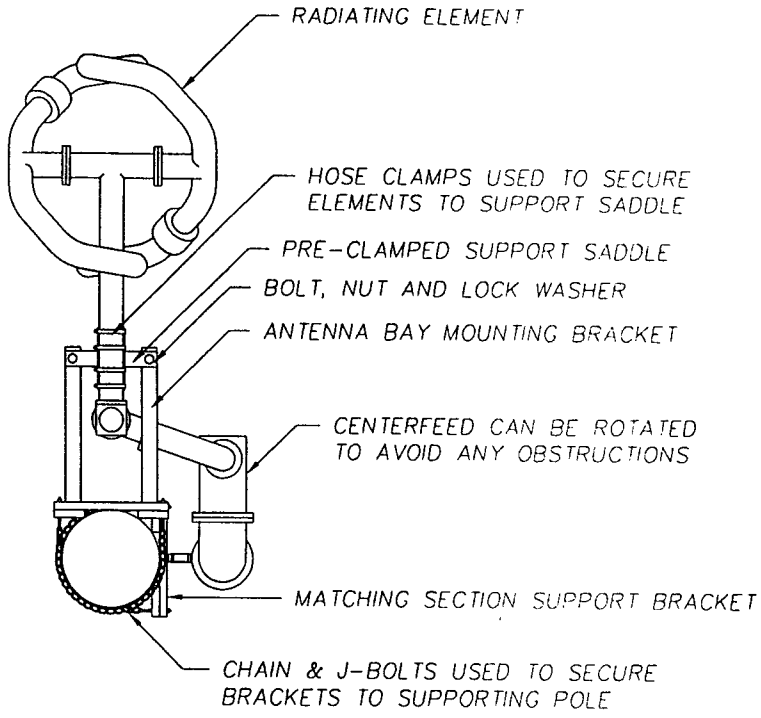
Mark Steapleton; Field Technician

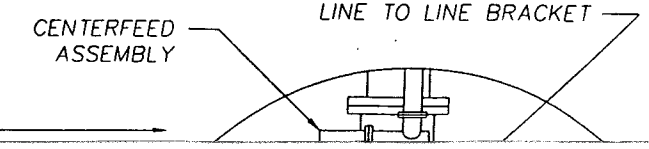
Subscribed and sworn to before me on this 21st. day of June 2002.

Cindy D. Tomes

Cindy D. Tomes; Notary Public
My commission expires November 6, 2006







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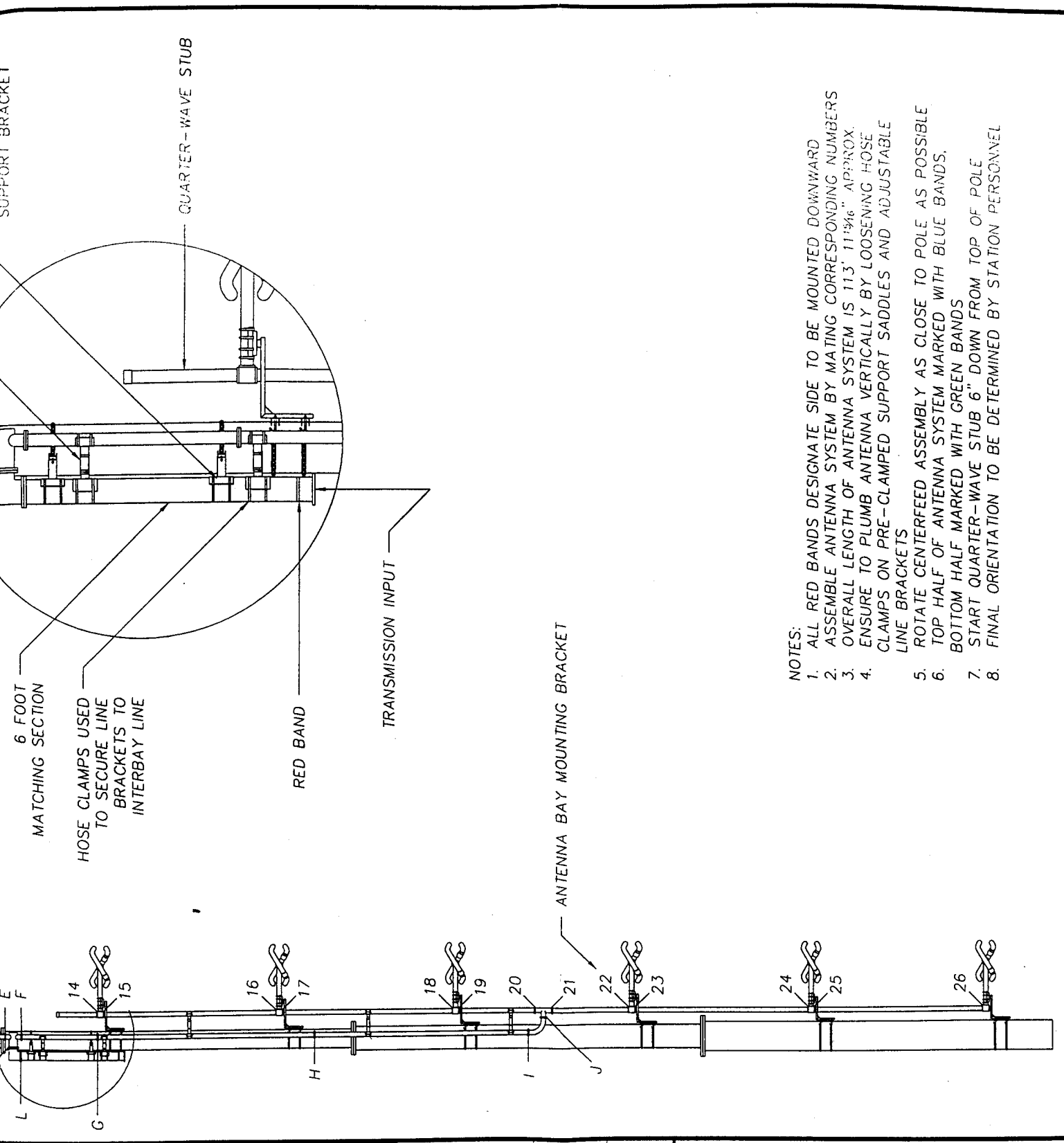


NO	REVISION	APP'D	DATE
6			
5			
4			
3			
2			
1			

NAME INSTALLATION DRAWING

FOR CORPUS CHRISTI, TX

CALL/FREQ. 93.9/99.1/99.9 MHz | PROJ. NO. 07575

DRAWN B. FATHERA | APP'D | FACTOR NTS

TYPE SHPX-12AC-SP | DATE 04/18/00 | DWG. NO. 07575

PATH G:\DRAFTING\B\A\I

A-4 ERI Antenna Specification Sheet

Corpus Christi, Texas

General Specifications

Antenna Type ..... High Power FM-Broadcast, Suitable For Diplexing
Model Number SHPX-12AC-SP
Number Of Bay Levels ..... Twelve
Polarization ..... Right Hand Circular

Electrical Specifications

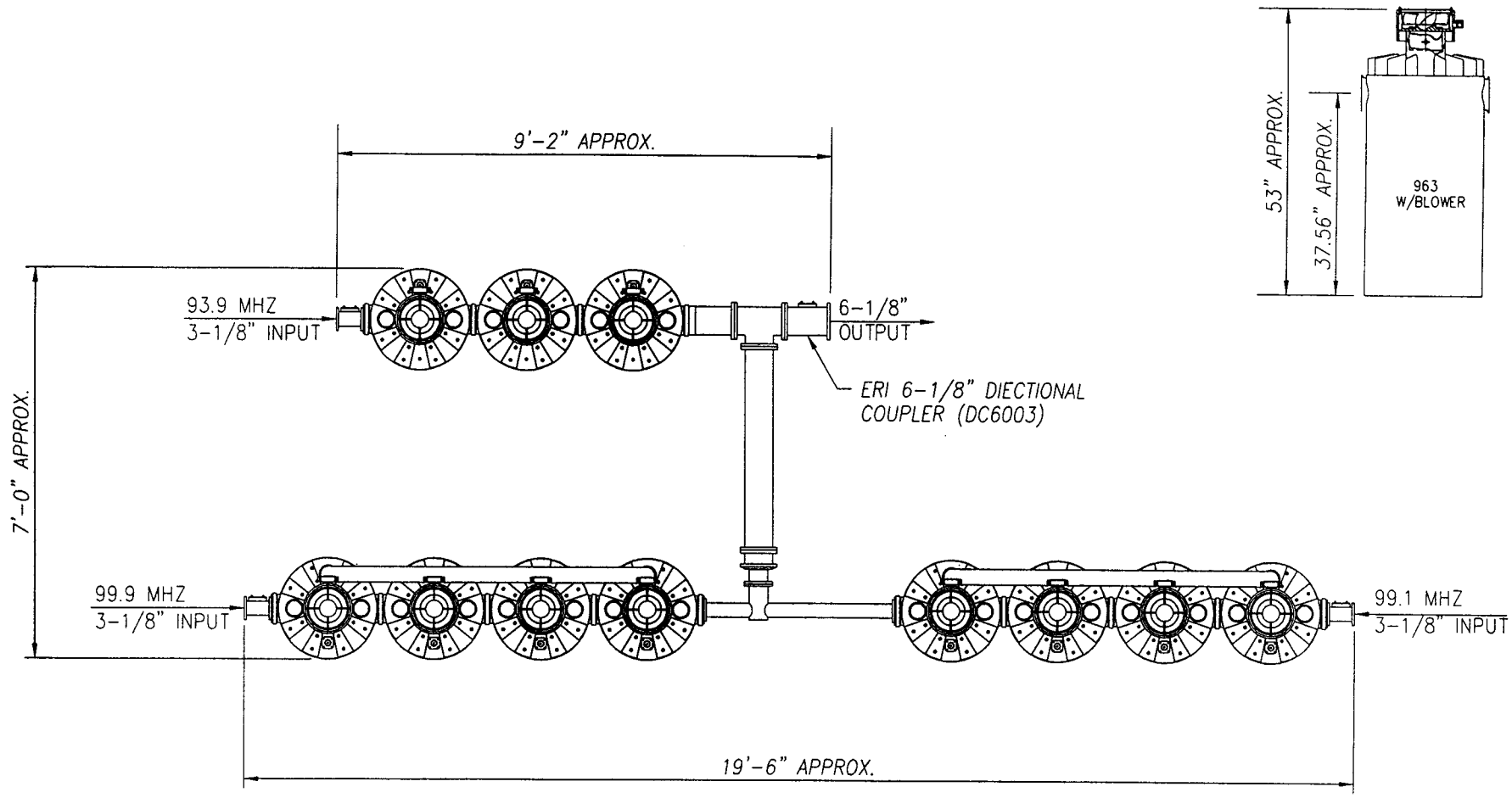
Antenna Input Power Capability ..... 64 KW. Maximum (1)
Operating Frequency Band ..... 93.9, 99.1 and 99.9 Megahertz.
VSWR ..... 1.1 : 1 @ Operating Frequencies.(2)
Azimuthal Pattern Circularity ..... +/- 2dB From RMS (Free Space)
Power Split ..... 50/50 (Horizontal & Vertical)
Quarter Wave Shorting Stub ..... Yes
Frequency Specific Information:

Frequency	Station ERP	Beam Tilt	First Null Fill	Second Null Fill	Power Gain	Line Loss (3)	Filter Loss (4)	Computed TPO
93.9	100 (KW)	0.0°	0 %	11%	6.670	.700 dB	.207 dB	18.47 (KW)
99.1	100 (KW)	0.0°	0 %	8%	6.628	.719 dB	.294 dB	19.05 (KW)
99.9	100 (KW)	0.0°	0 %	11%	6.467	.722 dB	.314 dB	19.63 (KW)

Mechanical Specifications

Antenna Feed System ..... Fed With Single Feed Line
Input Connector ..... 6-1/8" 50- Ohm EIA Flanged
Element Deicing ..... Not Ordered
Interbay Spacing ..... 121.375 Inch Center to Center
Array Length ..... 114 Feet
Construction Material (Antenna) ..... All Noncorrosive
Construction Material (Mounting) ..... Stainless Steel
Mounting ..... Pole
Weight (Antenna Only No Ice) ..... 1,550 Lbs.
Wind Load (Antenna Effective Area [CaAa]) ..... 83 Sq. Ft.

1) Power Capability Has Been Rated Assuming An Operating Transmission VSWR Of 1.5:1
2) VSWR Specification Achieved After On Site Tuning For User Specific Frequencies.
3) Line Loss Assumes A Feed Run Of 980 Feet, Myat Type 401-002 Rigid 4 1/16 Coax .
4) Losses Taken From Actual Multiplexer Measurements.



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No.	Revision	By	Date
7			
6			
5			
4			
3			
2			
1	REMOVED NOTCH FILTERS PER ROBERT ROSE		5/26/00 DJR

DRAWING	COMBINER SYSTEM LAYOUT		
FOR	CORPUS CHRISTI, TX		
Call/Freq.	93.9 MHZ / 99.1 MHZ / 99.9 MHZ		PROJ. NO. 07575
Drawn by:	DRUFFIN	App'd	Scale NTS
Name	ASYDTL2	Date 02/17/00	Drawing No.: CM-1
Path	C:\DRAFTING\ALL\PROJECTS\07575		

EXHIBIT A-3

A-2 ERI Combiner Specification Sheet

Corpus Christi, Texas.

General Specifications:

Multiplexer Type ..... 963 Branch Type Combiner
Number Of Combining Units ..... Three
Injected Port to Injected Port Isolation ..... - 56 dB
Output Connector ..... 6 1/8 " 50 Ohm EIA (Flanged)
Output Power ..... 64 KW
Combiner Units, Size and Weight :

Type 963-3 Tuned To 93.9 MHz. ..... 5' ht. X 2' wd. X 6' lg. & 578 Lbs.
Type 963-4 Tuned To 99.1 MHz. **(With Non-Adjacent coupling)** ... 5' ht. X 2' wd. X 8' lg. & 770 Lbs.
Type 963-4 Tuned To 99,9 MHz. **(With Non-Adjacent coupling)** ... 5' ht. X 2' wd. X 8' lg. & 770 Lbs.

Heat Removal (All Multiplexer Components) ..... Forced Air
Physical Arrangement ..... All Components Floor Standing

Injected Port Specifications:

Frequency Assignment ..... 93.9, 99.1 And 99.9 MHz.
Power Rating, Each Injected Port (Maximum) ..... 28 KW
Input Connector ..... 3-1/8" 50 Ohm EIA (Flanged)
VSWR ..... Less than 1.08:1 @ +/-150 KHz(1)
Group Delay ..... Less than 100 ns Overall Variation, Carrier @ +/- 100 KHz
Insertion Loss (Measured):

93.9 MHz. ..... - 0.207 dB
99.1 MHz. ..... - 0.294 dB
99.9 MHz ..... - 0.314 dB

1) When Terminated in 50 Ohm Resistive Load.

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FIGURE 3

----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD

12 ERI TYPE SHP, SHPX, LP, OR LPX ELEMENTS
+0.00 DEGREE(S) ELECTRICAL BEAM TILT
0 PERCENT FIRST NULL FILL
11 PERCENT SECOND NULL FILL
POWER GAIN IS 6.467 IN THE HORIZONTAL PLANE(6.467 IN THE MAX.)

FEBRUARY 3, 2000

99.9 MHz

ELEMENT SPACING
121.362 INCHES

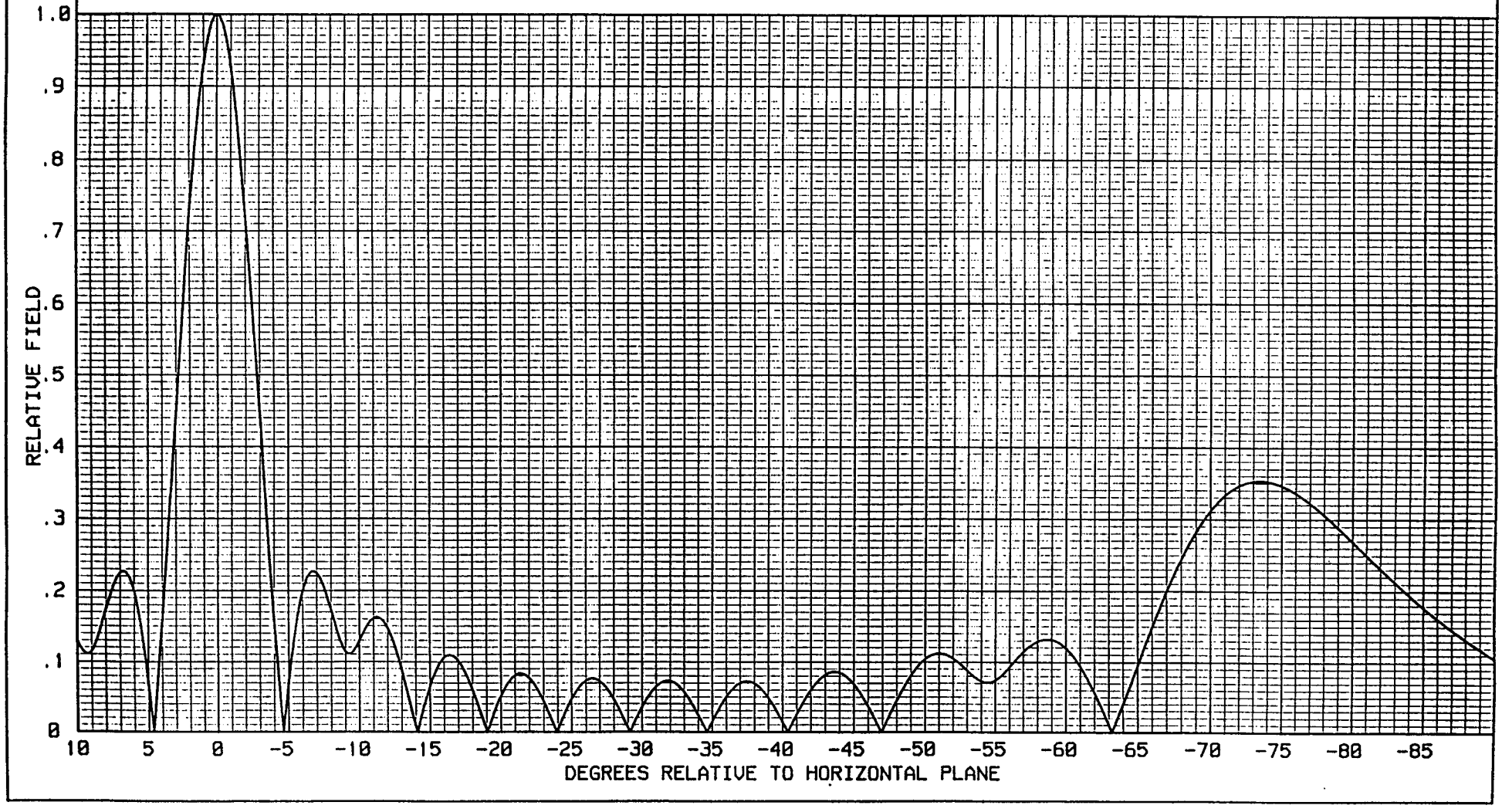

EXHIBIT A-5

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FIGURE 2

----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD

12 ERI TYPE SHP, SHPX, LP, OR LPX ELEMENTS
+0.00 DEGREE(S) ELECTRICAL BEAM TILT
0 PERCENT FIRST NULL FILL
8 PERCENT SECOND NULL FILL
POWER GAIN IS 6.628 IN THE HORIZONTAL PLANE(6.628 IN THE MAX.)

FEBRUARY 3, 2000

99.1 MHz

ELEMENT SPACING
121.362 INCHES

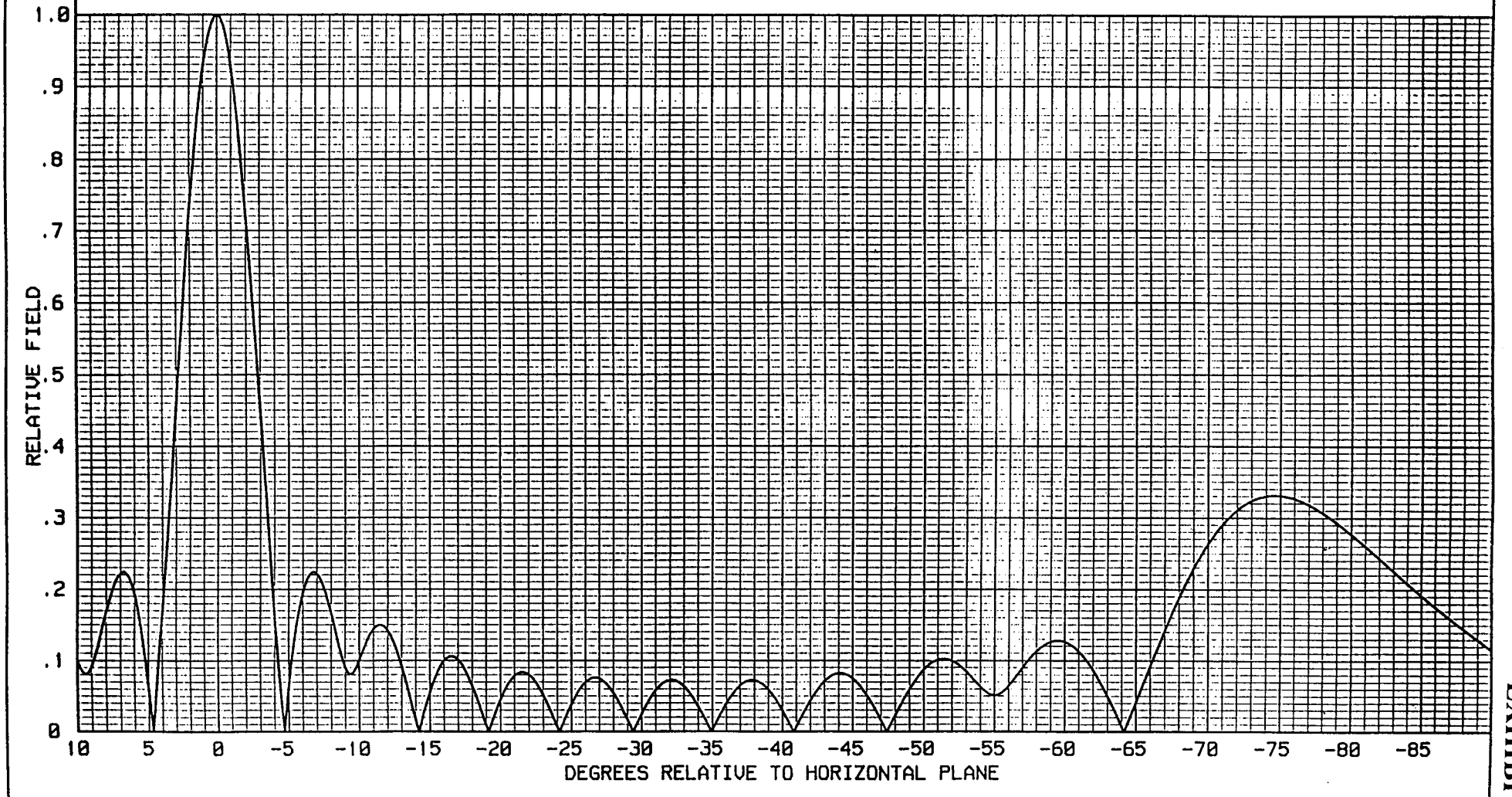

EXHIBIT A-5

ELECTRONICS RESEARCH, INC.
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FIGURE 1

----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD

12 ERI TYPE SHP, SHPX, LP, OR LPX ELEMENTS
+0.00 DEGREE(S) ELECTRICAL BEAM TILT
0 PERCENT FIRST NULL FILL
11 PERCENT SECOND NULL FILL
POWER GAIN IS 6.670 IN THE HORIZONTAL PLANE(6.670 IN THE MAX.)

FEBRUARY 3, 2000

93.9 MHz

ELEMENT SPACING
121.362 INCHES

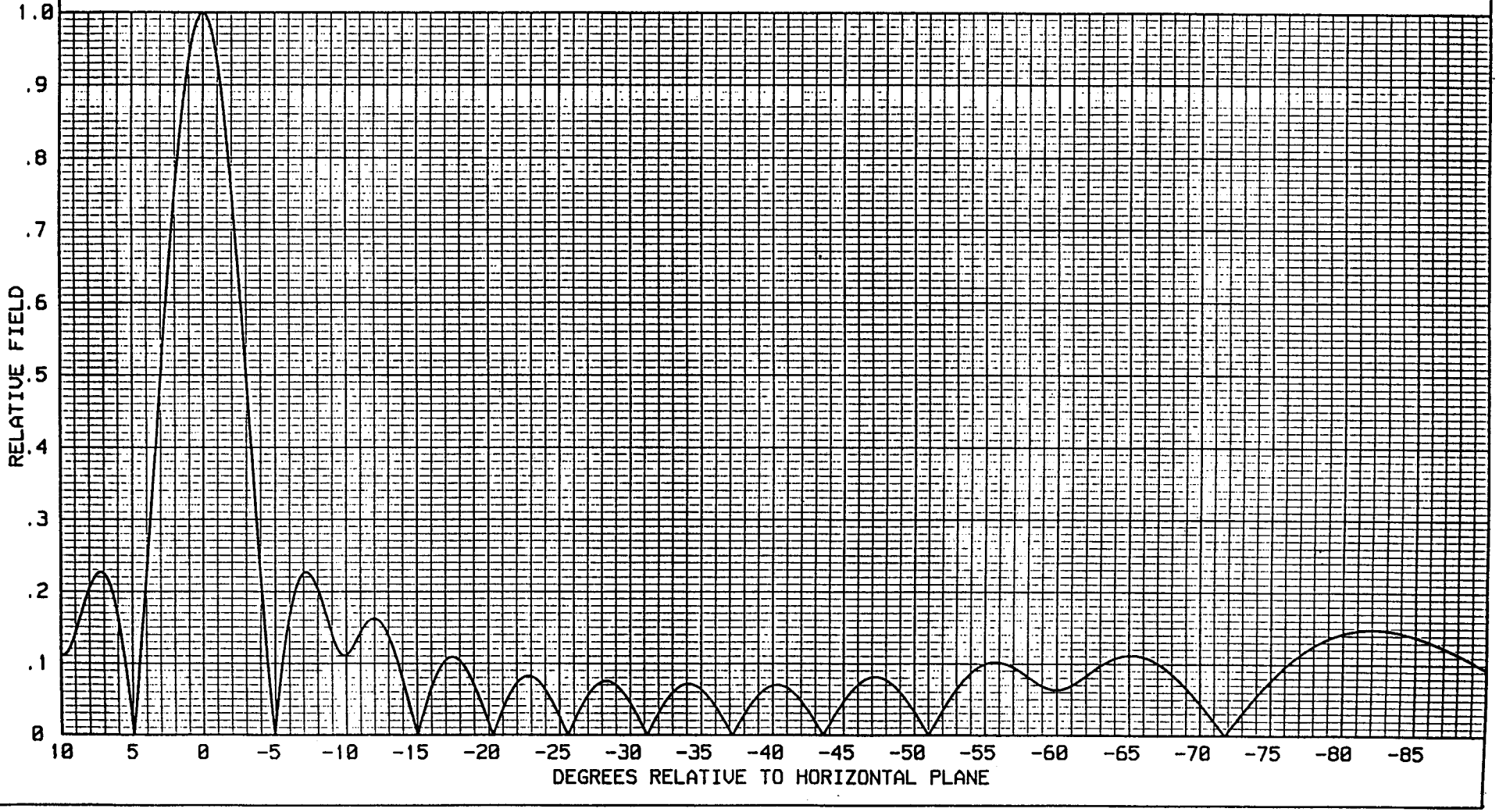

EXHIBIT A - 5

Broadcasting Scheme and Equipment Employed in Intermodulation Measurements