

TECHNICAL EXHIBIT
APPLICATION FOR LICENSE
RADIO STATION WLUP-FM
CHICAGO, ILLINOIS
CH 250B 4 KW 425 M

Technical Statement

This Technical Statement was prepared on behalf of Radio Station WLUP-FM on Channel 250B assigned to Chicago, Illinois. The station is presently operating on automatic program test authority with the authorized facilities of 4 kilowatts non-directional effective radiated power and an antenna height above average terrain of 425 meters on Channel 250B.¹

Figure 1 is a tabulation of the RF system specifications. Within the Appendix is a report prepared by the antenna manufacturer showing compliance with the spurious emissions special condition contained within the WLUP-FM construction permit.

Charles A. Cooper

June 10, 2003

du Treil, Lundin & Rackley, Inc.
201 Fletcher Avenue
Sarasota, Florida 34237
941.329.6000

¹ See FCC Construction Permit File Number: BPH-20000614ABP.

Figure 1

TECHNICAL EXHIBIT
APPLICATION FOR LICENSE
RADIO STATION WLUP-FM
CHICAGO, ILLINOIS
CH 250B 4 KW 425 M

WLUP-FM RF Transmission System Specifications

Description	System
Transmitter Power Output (5.7 kW):	7.59 dBk
Loss:	1.14 dB
ERI Antenna COG3-20P-2-70-2 (0.91 Power Gain):	-0.43 dB
Effective Radiated Power (4.0 kW):	6.02 dBk

APPENDIX

ANTENNA MANUFACTURER'S SPURIOUS EMISSIONS MEASUREMENT REPORT



ELECTRONICS RESEARCH, INC.

7777 Gardner Road • Chandler, Indiana 47610 • (812) 925-6000 • Fax (812) 925-4030 • www.ERInc.com

**REPORT OF FINDINGS
JOHN HANCOCK CENTER BROADCAST FACILITY
CHICAGO, ILLINOIS**

WOJO (105.1 MHz)

WVAZ (102.7 MHz)

WKQX (101.1 MHz)

WNND (100.3 MHz)

WUSN (99.5 MHz)

WLUP (97.9 MHz)

WNUA (95.5 MHz)

WBEZ (91.5 MHz)

June 9, 2003

REPORT OF FINDINGS

JOHN HANCOCK CENTER BROADCAST FACILITY

CHICAGO, ILLINOIS

Introduction : This report of findings is based on data collected at the John Hancock Center Master FM facility located in Chicago, Illinois. The report includes measurements offered as proof that the multiplexing equipment used to combine the eight (8) FM transmitters into a common transmission system performs 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). The multiplexing system, transmission line, and the master FM antenna is a completely integrated system and is used by the following broadcast stations :

WOJO (105.1 MHz)	WVAZ (102.7 MHz)	WKQX (101.1 MHz)	WNND (100.3 MHz)
WUSN (99.5 MHz)	WLUP (97.9 MHz)	WNUA (95.5 MHz)	WBEZ (91.5 MHz)

Note for brevity the stations listed above will be referred to as *The FM Broadcast Group*.

In brief, the collection of measurements presented in this report shows that all possible third 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). A qualified engineer representing Electronics Research, Inc. located in Chandler, Indiana performed the measurements summarized in this report.

The Following Exhibits Are Provided In Support Of This Report:

Exhibit Group A:

- A-1 Drawing Depicting New Antenna.
- A-2 COG3-20P-2-70-2 Antenna Specification Sheet.
- A-3 Drawing Depicting Multiplexing Scheme And Switching Arrangement .
- A-4 Shively Labs, Multiplexer Specification Sheet.
- A-5 Theoretical Vertical Plane Relative Field Antenna Plots
- A-6 Elevation Drawing Showing Relative Placement Of Antennas
- A-7 Feed System Detail

Exhibit Group B:

- B-1 Equipment Employed In Intermodulation Product Measurement.
- B-2 Calculated Product Chart.
- Table 1. Carrier Reference Levels.
- Table 2. Intermodulation (IM) Analysis Measurements.

Exhibits Accompanying Report: Exhibit Group A, provides information specific to the antenna used by *The FM Broadcast Group* and a illustration showing basic layout of the combining units used to multiplex the eight FM stations. Exhibit Group B, includes a schematic representing the equipment used to isolate and measure potential intermodulation products and tables listing measurement levels.

Found within Table 1 are the carrier frequency measurements that provide relative output signal levels for the IM analysis. Table 2 lists the calculated third 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 generated from FM radio stations operating into multiplexed facilities and from congested antenna broadcast sites. The mechanism that creates these unwanted products is well documented. When two or more transmitters are coupled to each other, new spectral components are produced by the mixing of the station frequencies within the power amplifiers of each transmitter. The most likely IM product and the common term used to describe it is a 3rd order product represented 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. It is common to find 3rd order products in inadequately designed systems and to a much lesser degree find 2nd order $[(F_1) + (F_2)]$ and 5th order $[3(F_1) - 2(F_2)]$ mixing which can occur on rare occasions. The IM investigation will be conducted by pin-pointing likely 3rd order products to determine their levels. Other emissions will be examined if found during the normal sweeping procedures.

The Master FM System : Master FM transmission systems are fundamentally composed of a broad band FM antenna, one or more high power transmission lines, and individual station combiner modules which together make up the combining system. The John Hancock Center master FM system includes two independent antenna systems and a system to switch the FM Broadcast Group's combiner system output from the existing Alford antenna to the new ERI antenna system. The station multiplexing equipment is used in both cases regardless of the antenna selection, however it is important to understand that the FM Broadcast Group's operation from the new antenna system is the focus of this report. It is not intended for the new antenna to replace the existing one, but rather to provide auxiliary antenna capability. The selection of either antenna as primary is also not likely to occur due to the need to switch between antennas while work upon the John Hancock Center roof top continues.

The Alford Master FM System was commissioned in 1970 and it included a combining system and broad band FM antenna capable of accommodating up to 12 FM radio stations. Since its installation, there have been substantial changes to the original system to modernize and improve its performance. In late 1989, a Shively Balanced FM Combiner System replaced the Alford Manufacturing Company multiplexing equipment and in May 2003, a new ERI Cogwheel FM antenna was installed at an elevation of 1394-feet, 6-inches on the building's East mast. The Alford antenna occupies a position at 1174-feet, 6-inches on the building's West mast (both heights are referenced to ground level). As part of the renovation work done in 2002 and 2003 a switching complex was added to allow the selection of either the existing Alford or the new Electronics Research, Inc. (ERI) master FM antenna. The installation of the new antenna also included installing two new transmission lines from the patch panel complex to the ERI FM antenna. The patch panel allows the selection of either the upper, lower, or both halves of new antenna. Normal broadcast operation from the ERI antenna is with both antenna halves operating.

The Electronics Research Inc. (ERI) COG3-20P-2 antenna is a two layer next generation antenna with a separate input to provide for the implementation of IBOC simulcast operation, Drawing A-1 depicts the antenna configuration. The antenna is furnished with dual input ports that feed the upper and lower halves of the antenna separately. This feature allows emergency operation from either antenna half should one or the other half experience a failure. This requires three feed configurations and a hybrid power splitter which is used to feed both halves of the antenna. Both transmission lines are used for normal operation and they are 6-1/8 rigid coaxial transmission lines to allow full power operation using only one of the two transmission lines and a 3dB Hybrid splitter is used to split the combined output of the FM multiplexing system into two halves to feed the top and bottom of the ERI antenna. The digital transmission line is 1-5/8 air dielectric coaxial cable that goes from the antenna to the existing multiplexing equipment. The implementation of IBOC is scheduled after the installation of digital transmitters and other relevant equipment needed to operate this service and FM IBOC service was not operating at the time these IM measurements were made.

Additional information provided with this report includes a drawing titled ***“Feed System Detail”*** labeled Exhibit A-7, includes information detailing the dual Dielectric transmission lines used to feed the new ERI antenna.

The combiner system accomplishes the aggregation of the outputs of the individual FM station's transmitter into a common signal that can be sent through a single transmission line to a broad band FM antenna. The system must provide isolation between closely spaced FM transmitter frequencies but also deliver sufficient passband performance to pass both the analog FM signal and the adjacent digital FM IBOC signal. A multiplexing system consisting of individual constant impedance combiner system is in place at this site and measurements show the system is not able to pass the bandwidth required to implement digital FM IBOC service, but the system is adequate for normal analog FM operation with a bandwidth channel of 150 KHz.

The 10 station Shively constant impedance combiner system, four modules include group delay compensation devices, was installed at the site in 1989. The system uses Shively Labs Type 2540B combiner modules and only eight of the ten modules are presently used by the FM Broadcast Group. The two inactive modules are reserved for auxiliary station use and were not powered at the time of IM product measurements. The multiplexing arrangement is illustrated in Exhibit A-3. The multiplexer, fully assembled, exhibited transmitter port-to-port isolation in excess of -50 dB. Other performance measurements, including impedance match, insertion loss, and group delay confirmed that the Shively combiner system met all its published specifications, included with this report as Exhibit A-4. The specifications are based on information from Shively Lab's Balanced Combiner Specifications dated February 1989.

IM Investigation : In order for the Master FM Antenna to broadcast an IM product it must first be generated within one of the station transmitters then couple into the multiplexing chain. The multiplexing arrangement is a series of individual combiner units therefore it is at the output of this chain that RF signals sampling is required to confirm that the multiplexed site is in FCC compliance.

Directional couplers are placed at key locations throughout the Master FM complex to monitor and maintain system performance. All couplers furnished with the system are factory

calibrated and capable of delivering accurate and repeatable RF samples. To facilitate the taking of the measurements, the ERI coupler located at the multiplexer output of the combined 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 include all filtering used to reduce broadcast emissions. The coupler selected would normally be used for antenna reflection measurements and thus would provide directivity greater than -30 dB forward to reverse signal immunity and a -50dB coupling level.

The forward port of the coupler was used for voltage sampling the outgoing carrier levels and IM products. The sampled signals were fed by a shielded cable into a Band Pass Filter remove extraneous energy. Attenuation pads were used on the Band Pass Filter and the Spectrum Analyzer to ensure an adequate signal level for measurements without overloading the equipment and provide a good impedance match. An IFR 2399A Spectrum Analyzer was employed to record the level of all signals investigated. To facilitate the selective tuning of the Band Pass Filter the Tracking Generator option built into the Spectrum analyzer was used. Also, the 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 Exhibit B-2 for an illustration of the measurement equipment and its configuration.

Prior to recording measurements, all the equipment in the system including FM transmitters, the multiplexer, transmission lines, and the FM antenna were adjusted for optimum performance. Also, it was confirmed before taking emission measurements that any station using the John Hancock site for full time operation was running at their licensed transmitter power output. The normal circumstances under which the master FM system operates includes FM radio stations:

WOJO (105.1 MHz), **WKQX** (101.1 MHz), **WNND** (100.3 MHz), **WUSN** (99.5 MHz) and **WNUA** (95.5 MHz) broadcast at 5.7 Kilowatts ERP and **WLUP** (97.9 MHz), **WVAZ** (102.7 MHz) broadcast at 4.0 Kilowatts and **WBEZ** (91.5 MHz) operates at 5.6 Kilowatts.

Also operating from the immediate roof top vicinity were two auxiliary standby FM antennas belonging to radio stations WFMT and WNIB for the duration of the IM measurements, to insure that those facilities did not cause undesirable interference products when they operate from the Hancock facility.

While operating normally and from the Master FM System described earlier the relative output signal level of each stations 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 is essential in confirming that no significant levels of spurious energy, referenced to each carrier, were present from any transmitter operating from the multiplexed system.

Using the equipment previously described the IM product measurements were recorded and are listed in Table 2. The signal levels referenced to the carriers are calculated and listed in the column labeled " $G^{IM\ Level}$ " for third order product maxing .

To demonstrate compliance with Sections (b) and (c) of the FCC Rules and Regulations,

the emissions from each station's transmitter was observed using the forward RF sampling port from the Output Directional Coupler and the IFR Spectrum Analyzer.

The Spectrum Analyzer was set for a narrow, 600 KiloHertz sweep with averaging and maximum hold features enabled. Because frequency modulation with commercial programming was involved, time was allowed to "build" a composite signature from carrier excursions. With the aid of analyzers threshold limit-line, it could be seen that the spectral shape captured for each station's carrier conformed to the required specifications, within the accuracy of the measurement equipment.

As a final proof of the systems IM Product performance, a wide band search was done using the Spectrum Analyzer. The purpose for this measurement was to look for suspicious anomalies that may warrant further investigation. The search covered a complete frequency span of 50 to 250 MHz. that would include second through fifth order products possibilities. The search was performed without the use of a isolating filter and resulted in no additional investigations.

Conclusion : Based upon my observations and measurements taken June 2th 2003 as summarized in this document, I, Robert Rose, find the subject multiplexed system- specifically the transmitters and combiner system for the operation of the ***FM Broadcast Group*** into the COG3-20P-2 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 ***FM Broadcast Group*** 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 _____

Robert Rose
Vice President of Engineering
June 9, 2003

WARRICK COUNTY)
STATE OF INDIANA) SS:

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

- 1.) That my qualifications are a matter of record with the Federal Communications Commission;
- 2.) I am Vice President of Engineering for Electronics Research, Inc (“ERI”) and have been employed by ERI for 30 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.
- 3.) I have either prepared 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 Keith R. Warner active manager for the Master FM Group John Hancock Center on behalf of FM radio stations WOJO, WKQX, WNND, WUSN, WNUA, WLUP, WVAZ, and WBEZ in Chicago, Illinois to prepare this engineering statement.

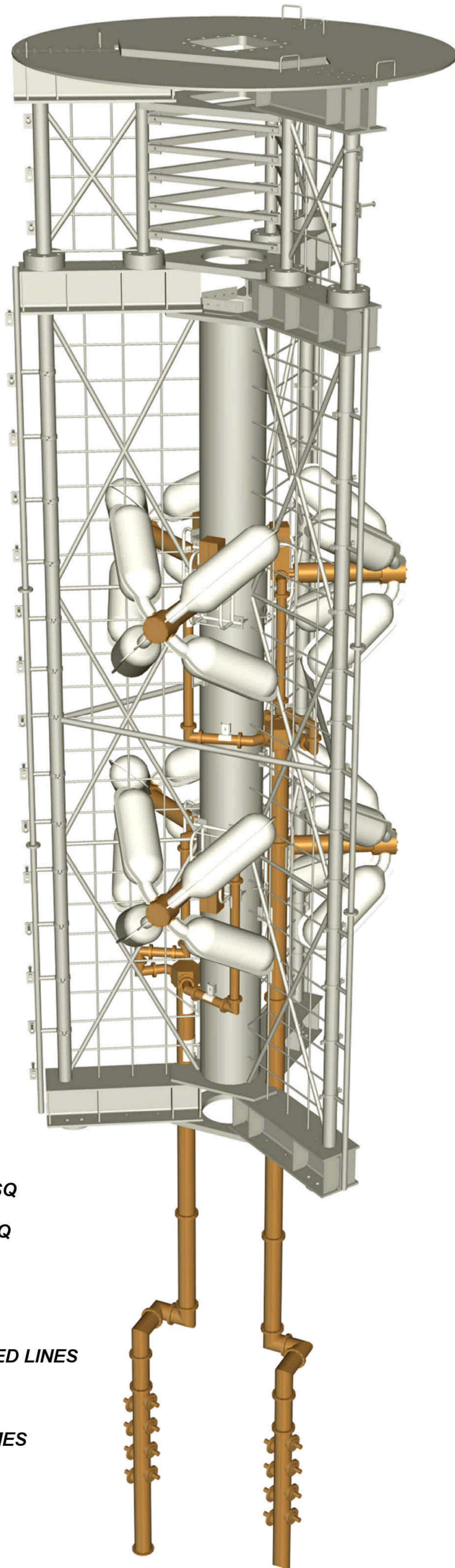
Robert Rose
Vice President of Engineering

Subscribed and sworn to before me on this 9th day of June 2003.

Jacquelyn Kinney; Notary Public
My commission expires July 5, 2007

**MASTER FM ANTENNA
SYSTEM DETAIL**

FOR
CHICAGO, IL
HANCOCK CENTER
PROJECT NO. 08583
EXHIBIT: A-1



**ANTENNA TYPE: HIGH POWER FM-BROADCAST,
SUITABLE FOR STATION MULTIPLEXING**

MODEL NUMBER: COG3-20P-2-70-2

**SUPPORT SPINE: FINISHED AS AN INTEGRAL PART
OF ANTENNA ASSEMBLY**

CALCULATED ANTENNA AREA (EXCLUDING ICE): 207 FT-SQ

CALCULATED ANTENNA AREA (INCLUDING ICE): 282 FT-SQ

WEIGHT (EXCLUDING ICE): 13,916 LBS.

WEIGHT (INCLUDING ICE): 15,850 LBS.

ANTENNA FEED SYSTEM: FED WITH TWO RIGID 6-1/8" FEED LINES

INPUT CONNECTORS: 6-1/8" 50-OHM FLANGED

ELEMENT DE-ICING: ELEMENTS SHROUDED WITH RADOMES

ERI Broadcast Antenna Specification Summary Hancock Center, Chicago, Illinois

General Specifications

Antenna Type..... High Power FM-Broadcast, Suitable for Station Multiplexing
 Model Number..... COG3-20P-2-70-2
 Number of Elements Comprising Design..... Six: Arranged As Follows
 A) Two Bay Levels
 B) Each Bay Uses Three Elements Symmetrically Organized
 Broadcasting Mode..... Right Hand Circular Polarized
 Station Capacity..... Ten FM Broadcast Channels

Electrical Specifications

Antenna Input Power Capability..... 140 Kw Maximum (70 Kw Each Half)⁽¹⁾
 Operating Band-Width..... 88 - 108 Megahertz (FM Band)
 VSWR..... 1.10 : 1 @ Operating Frequencies ⁽²⁾
 Typical Azimuthal Pattern Circularity..... Less Than +/- 1.5 dB From RMS (Free Space)⁽³⁾
 Power Split..... 50/50 (Horizontal & Vertical)
 Axial Ratio..... Less Than 2 dB

Frequency Specific Information:

<u>Station</u>	<u>Frequency</u>	<u>Antenna ERP</u>	<u>Losses</u>	<u>Power Gain</u>	<u>TPO</u>
WEBZ	91.5 MHz	5.6 Kw.	.5846 dB	.870	7.496
WNUA	95.5 MHz	5.7 Kw.	.7136 dB	.893	7.523
WLUP	97.9 MHz	4.0 Kw	1.1405 dB	.906	5.741
WUSN	99.5 MHz	5.7 Kw	1.2955 dB	.913	8.413
WNND	100.3 MHz	5.7 Kw	1.2044 dB	.917	8.203
WKQX	101.1 MHz	5.7 Kw	.7214 dB	.920	7.315
WVAZ	102.7 MHz	4.0 Kw	.7263 dB	.927	5.101
WOJO	105.1 MHz	5.7 Kw	.6782 dB	.935	7.127

Mechanical Specifications

Support Spine..... Furnished As An Integral Part of Antenna Assembly
 Calculated Antenna Area (Excluding Ice)..... 207 Ft-Sq
 Calculated Antenna Area (Including Ice)..... 282 Ft-Sq.
 Weight (Excluding Ice)..... 13,916 Lbs.
 Weight (Including Ice)..... 15,850 Lbs.
 Antenna Feed System..... Fed with two rigid 6-1/8" Feed Lines
 Input Connectors..... 6-1/8" 50 - Ohm Flanged
 Element De-icing..... Elements Shrouded With Radomes
 Overall Length..... 23'-11"
 Center to Center of Elements..... 92"
 Provided Mounting..... Integrated adapter designed to interface to existing customer flange
 Construction Material (Antenna)..... All Non-Corrosive
 Construction Material (Mounting)..... Galvanized plated steel and stainless steel

1) (A) Capability determined assuming concurrent 10 station operation. (B) Calculations made with an Operating VSWR of 1.5:1, (C) Safety factor consideration given to peak voltage & average power, (D) allowance given for simultaneous IBOC Broadcasting.

2) VSWR specification achieved after on-site tuning for user specific frequencies.

3) Typical value is for both Vertical and Horizontal radiation components as based on computer simulation with full scale setup verification.

4) Approximate values based on ANSI/EIA/TIA-222-F standard.

1.4 Specifications of Balanced Combiner

Type Number	2540B-10/10 (5)	
Number of Inputs	10 (expandable)	
Frequency Range	88 - 108 MHz	
Frequency Separation	0.8 MHz min.	
Bandwidth, each channel	150 kHz	
Frequency Response	<u>Design Goal</u>	<u>Typical</u>
Center Frequency ± 100 kHz	0.01 dB	0.015 dB
± 125 kHz	0.015 dB	0.025 dB
± 150 kHz	0.02 dB	0.05 dB
Isolations	<u>Guaranteed</u>	<u>Typical</u>
One channel to other at operating frequency at 800 kHz spacing	50 dB min.	64 dB
At >1 MHz spacing	50 dB min	85 dB
Insertion Loss, from transmitter Input to broadband output	0.45	
Power Input, each port	20 kW cw max. with 3 1/8" hybrid	
Power Output	160 kW max. with 6 1/8" hybrid	
Nominal Impedance, input and output	50 ohms	
VSWR	<u>Guaranteed</u>	<u>Typical</u>
over each channel	1.05 max.	1.03
over ± 150 kHz from center freq.	1.08 max.	1.06
Group Delay Difference	<u>0.8 MHz</u>	<u>Typical</u>
\pm kHz from center freq.	50 nsec	35 nsec
Terminals		
Input	3 1/8"	
Output	Varies from 4 1/16" to 6 1/8"	
Cooling	Natural convection	
Weight of one module	Approx. 1,000 lbs.	
Ambient Temperature	40° C (104° F) max.	
Ambient Humidity	60% R.H.	

Exhibit A-5

Vertical Plane Relative Field Antenna Plots

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FIGURE 1

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

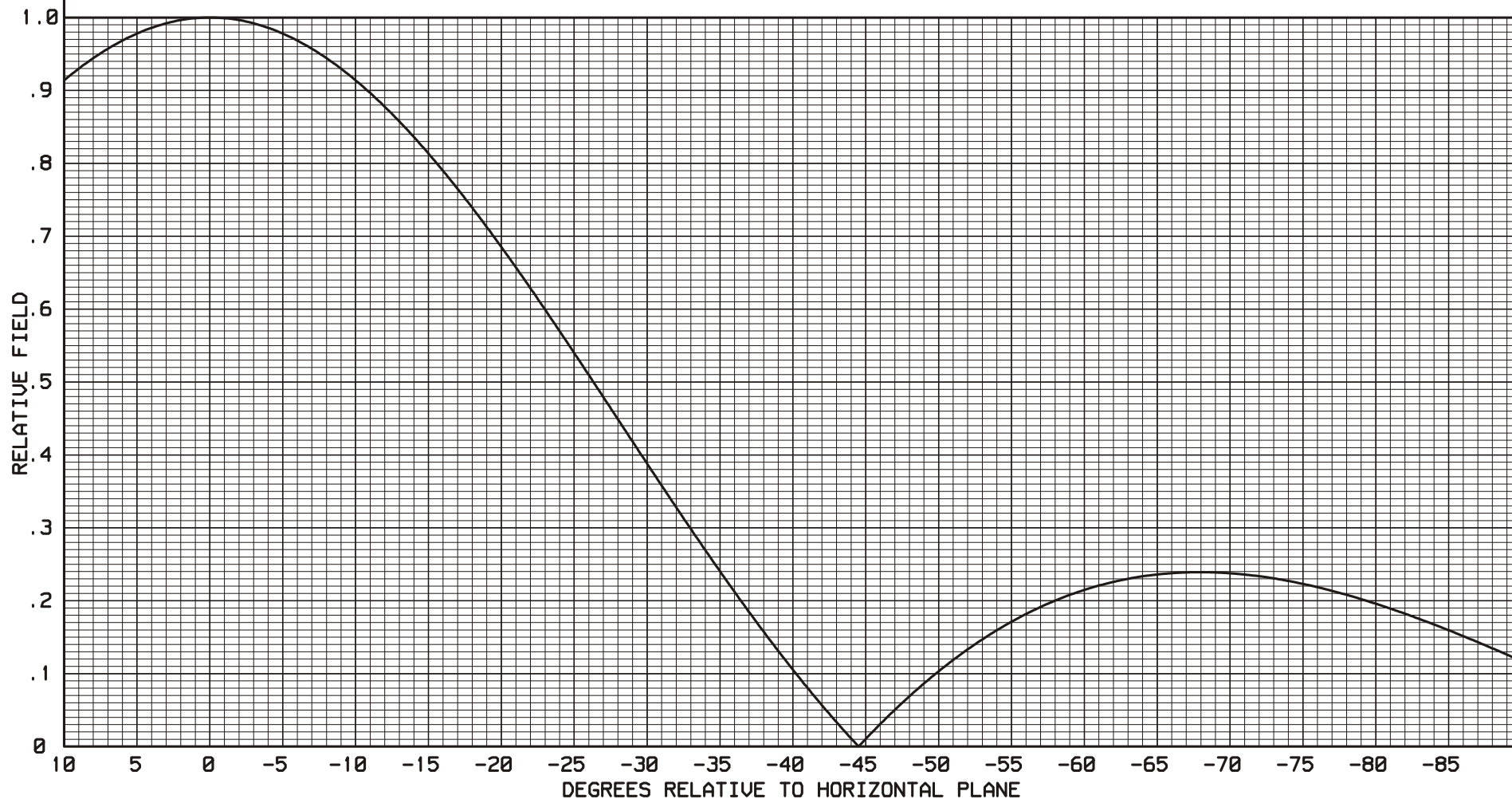
2 LEVELS OF TYPE 1080 ELEMENTS
+0.00 DEGREE(S) BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

POWER GAIN IS .870 IN THE HORIZONTAL PLANE(.870 IN THE MAX.)
[POWER GAINS AT 95% ANTENNA EFFICIENCY]

APRIL 4, 2003

91.5 MHz.

BAY SPACING:
92 INCHES



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CHANDLER, IN. 47610

FIGURE 2

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

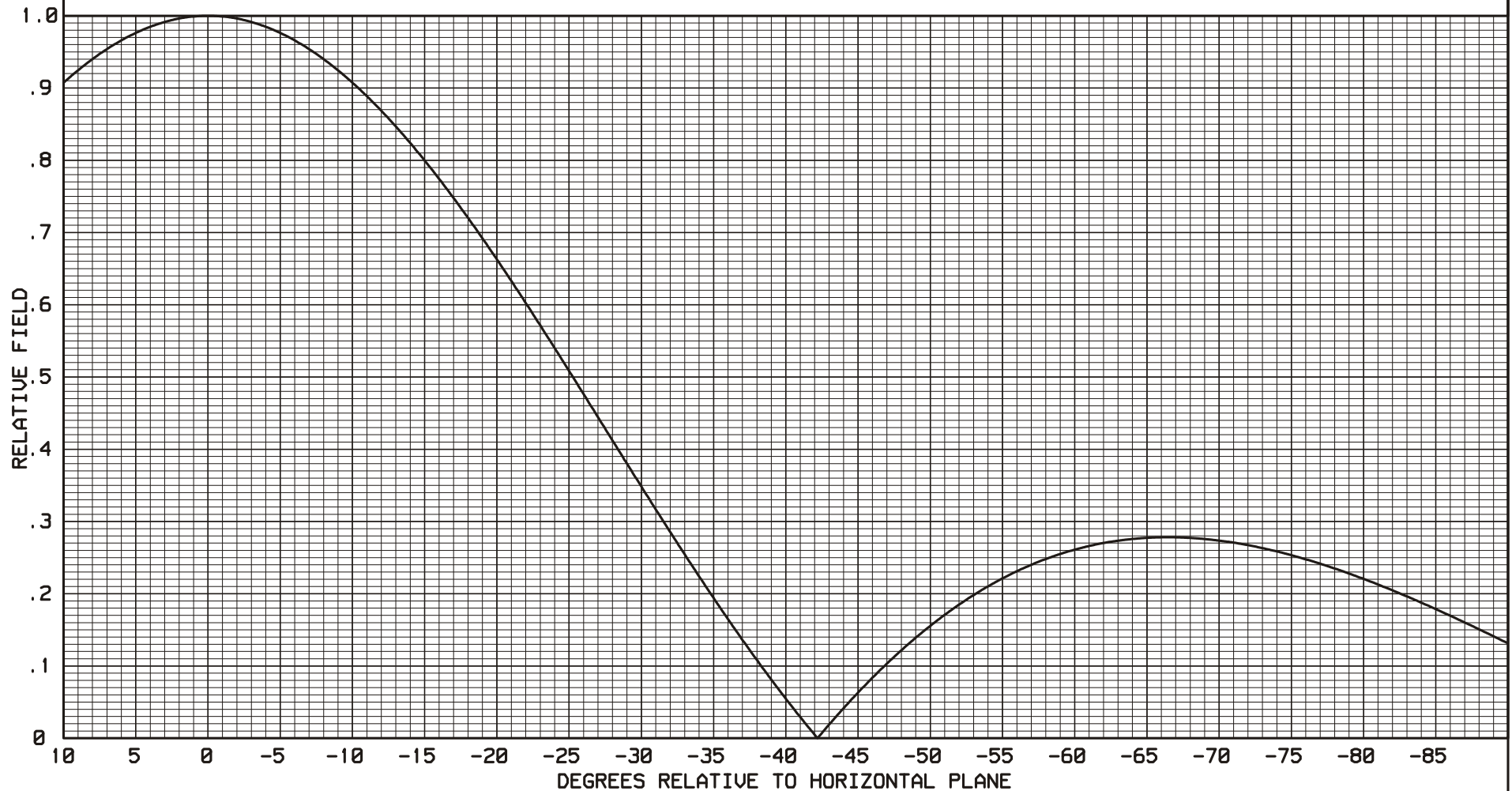
2 LEVELS OF TYPE 1080 ELEMENTS
+0.00 DEGREE(S) BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

POWER GAIN IS .893 IN THE HORIZONTAL PLANE(.893 IN THE MAX.)
[POWER GAINS AT 95% ANTENNA EFFICIENCY]

APRIL 4, 2003

95.5 MHz.

BAY SPACING:
92 INCHES



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FIGURE 4

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

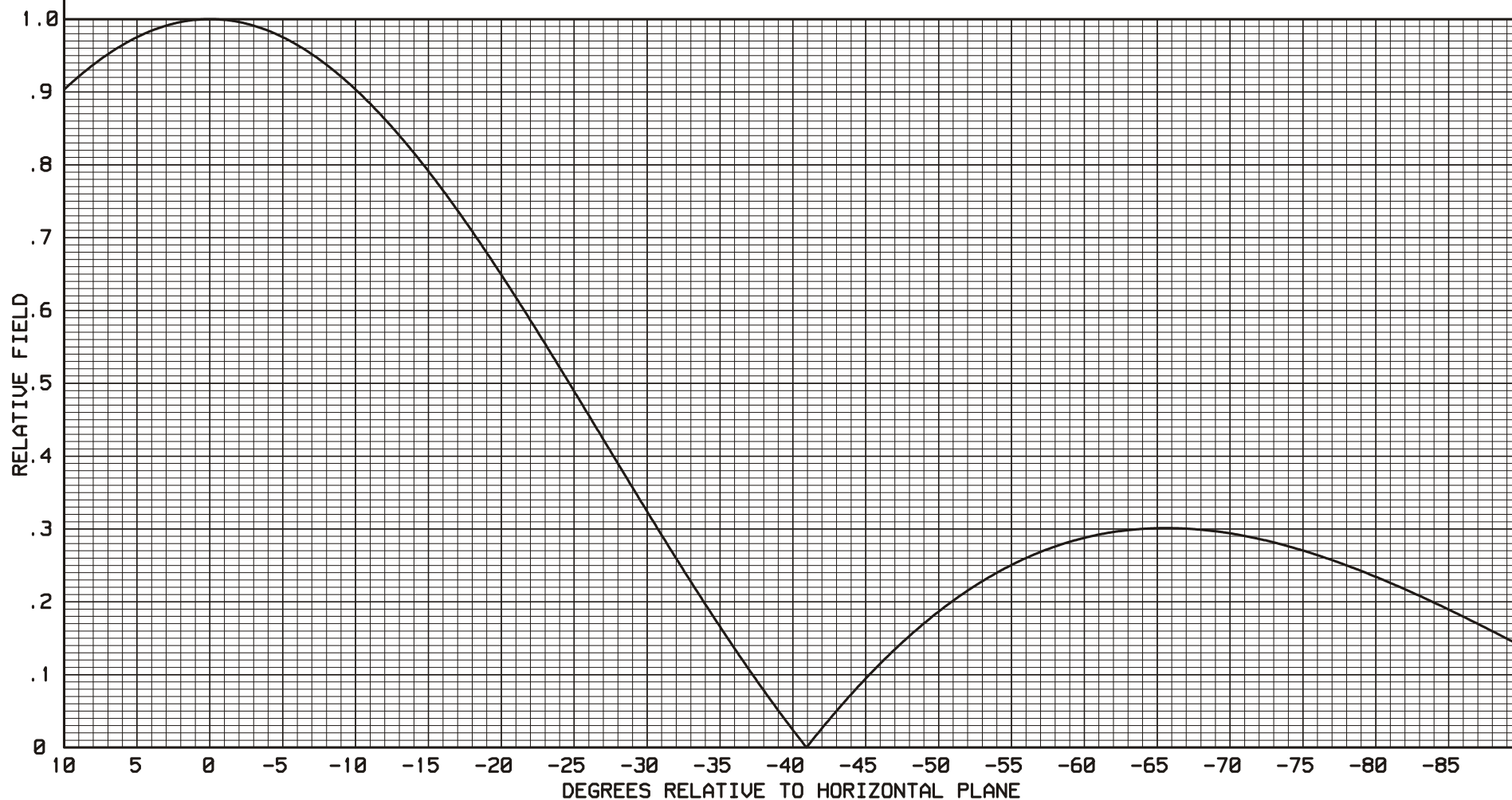
2 LEVELS OF TYPE 1080 ELEMENTS
+0.00 DEGREE(S) BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

POWER GAIN IS .906 IN THE HORIZONTAL PLANE(.906 IN THE MAX.)
[POWER GAINS AT 95% ANTENNA EFFICIENCY]

APRIL 4, 2003

97.9 MHz.

BAY SPACING:
92 INCHES



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FIGURE 6

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

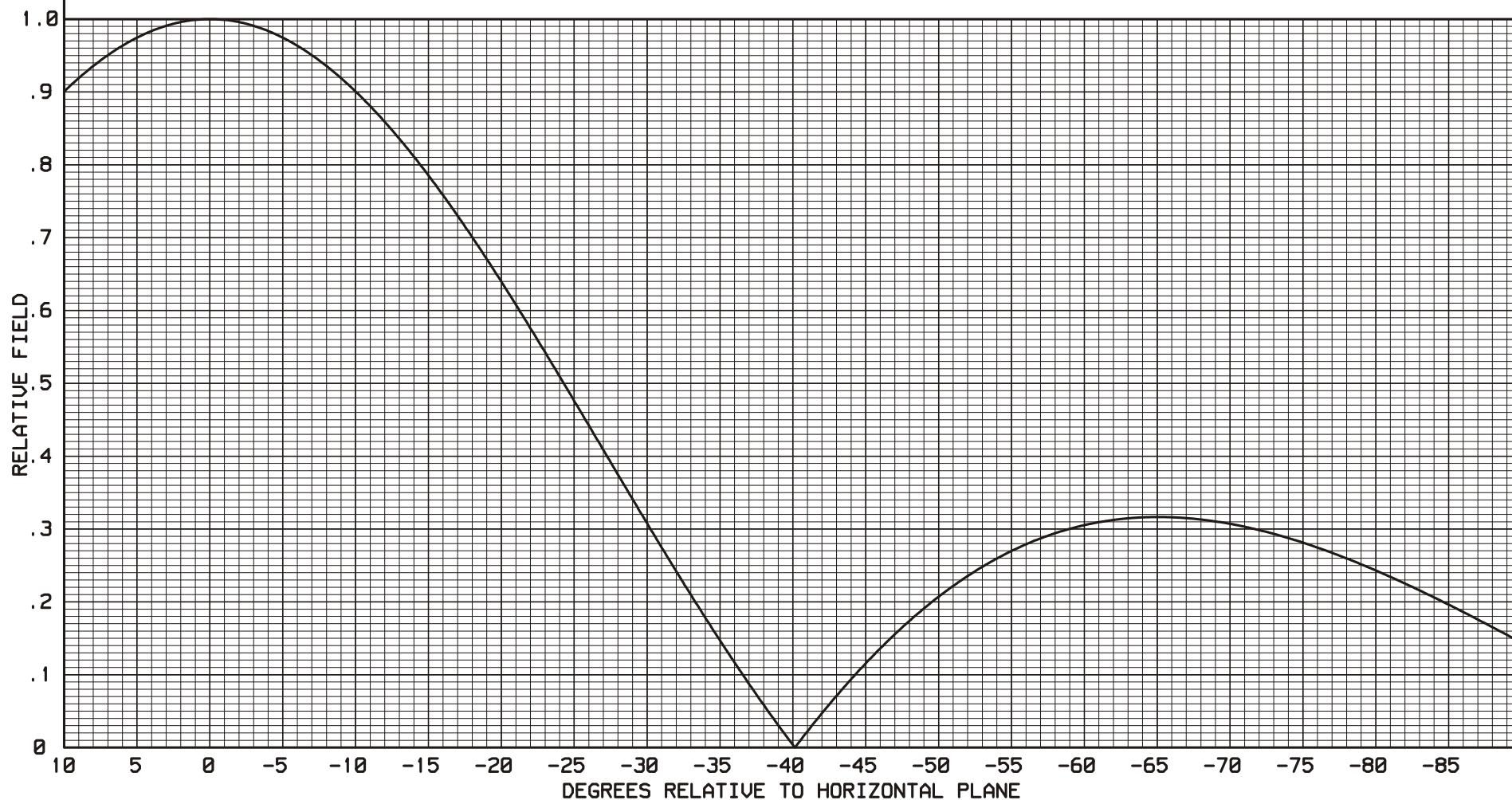
2 LEVELS OF TYPE 1080 ELEMENTS
+0.00 DEGREE(S) BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

POWER GAIN IS .913 IN THE HORIZONTAL PLANE(.913 IN THE MAX.)
[POWER GAINS AT 95% ANTENNA EFFICIENCY]

APRIL 4, 2003

99.5 MHz.

BAY SPACING:
92 INCHES



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CHANDLER, IN. 47610

FIGURE 7

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

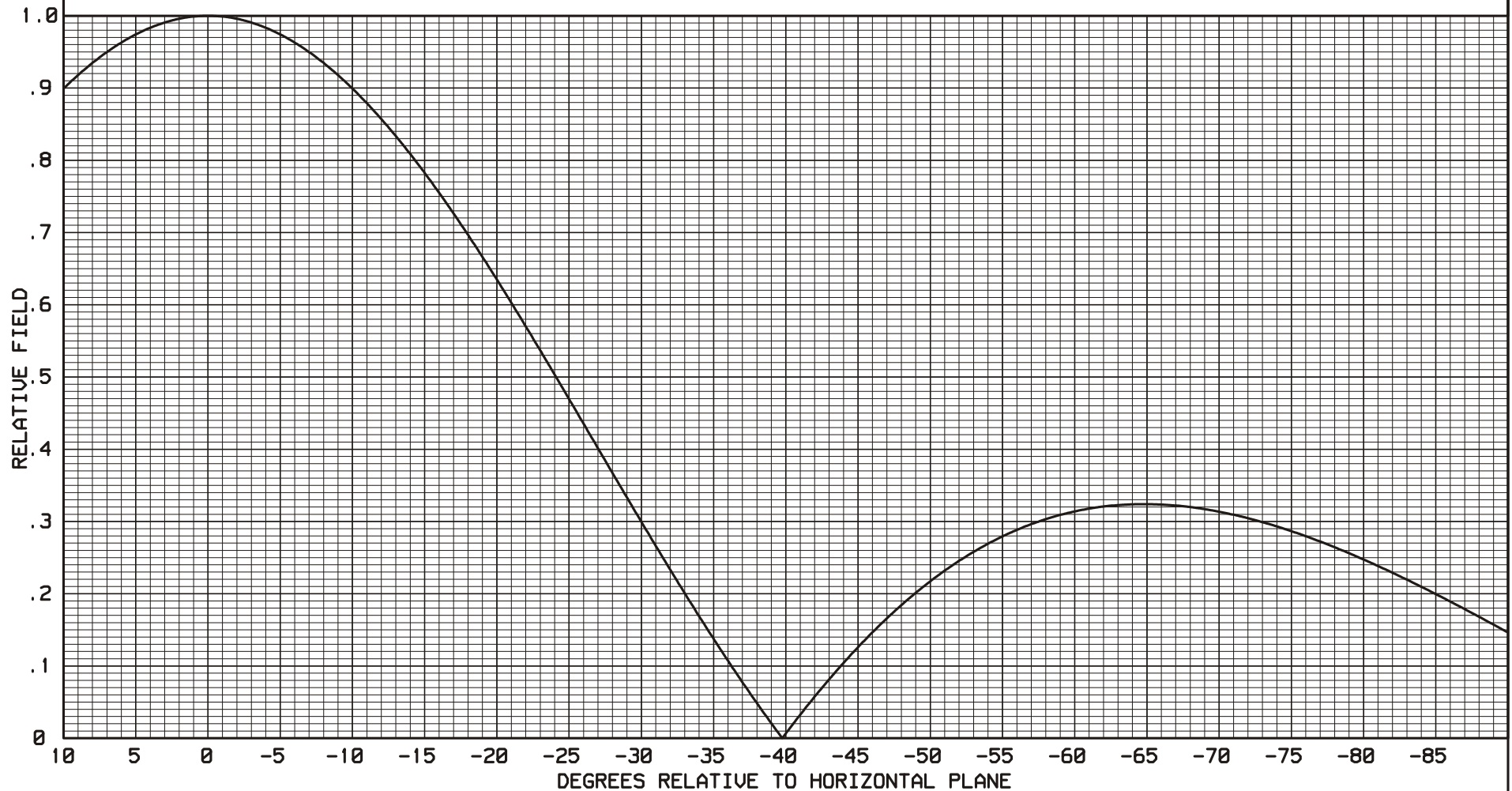
2 LEVELS OF TYPE 1080 ELEMENTS
+0.00 DEGREE(S) BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

POWER GAIN IS .917 IN THE HORIZONTAL PLANE(.917 IN THE MAX.)
[POWER GAINS AT 95% ANTENNA EFFICIENCY]

APRIL 4, 2003

100.3 MHz.

BAY SPACING:
92 INCHES



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CHANDLER, IN. 47610

FIGURE 8

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

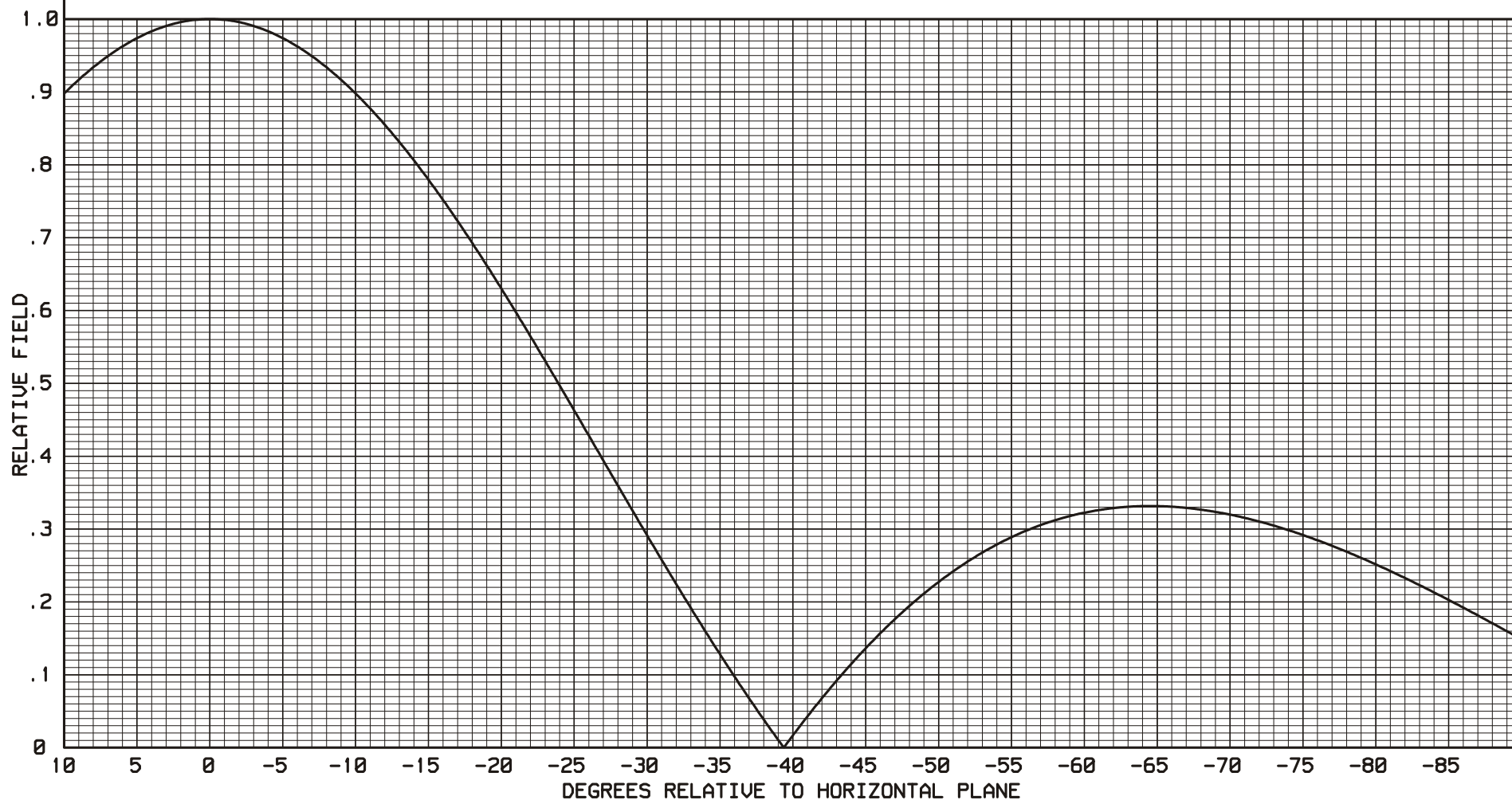
2 LEVELS OF TYPE 1080 ELEMENTS
+0.00 DEGREE(S) BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

POWER GAIN IS .920 IN THE HORIZONTAL PLANE(.920 IN THE MAX.)
[POWER GAINS AT 95% ANTENNA EFFICIENCY]

APRIL 4, 2003

101.1 MHz.

BAY SPACING:
92 INCHES



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FIGURE 9

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

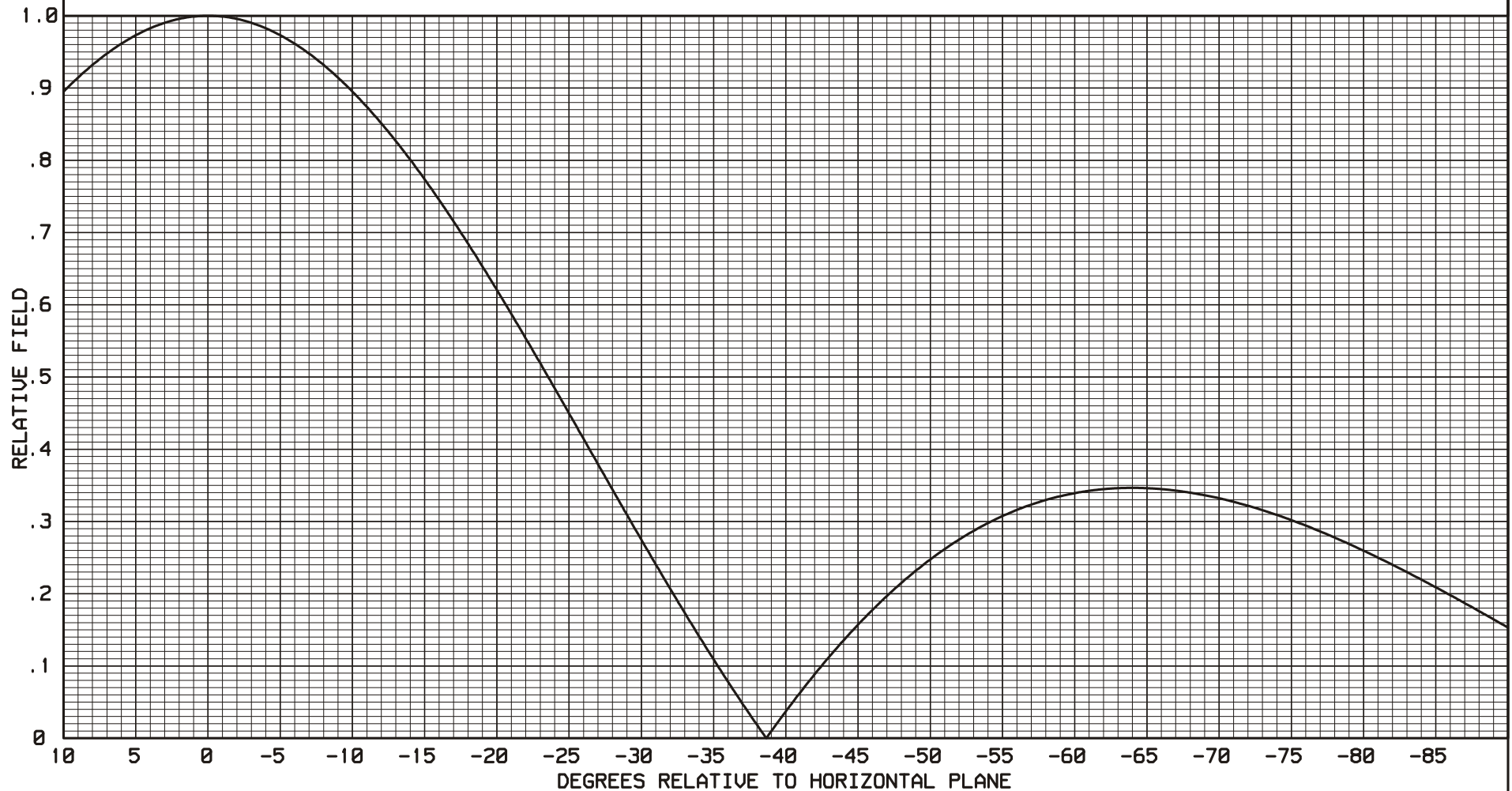
2 LEVELS OF TYPE 1080 ELEMENTS
+0.00 DEGREE(S) BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

POWER GAIN IS .927 IN THE HORIZONTAL PLANE(.927 IN THE MAX.)
[POWER GAINS AT 95% ANTENNA EFFICIENCY]

APRIL 4, 2003

102.7 MHz.

BAY SPACING:
92 INCHES



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FIGURE 10

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

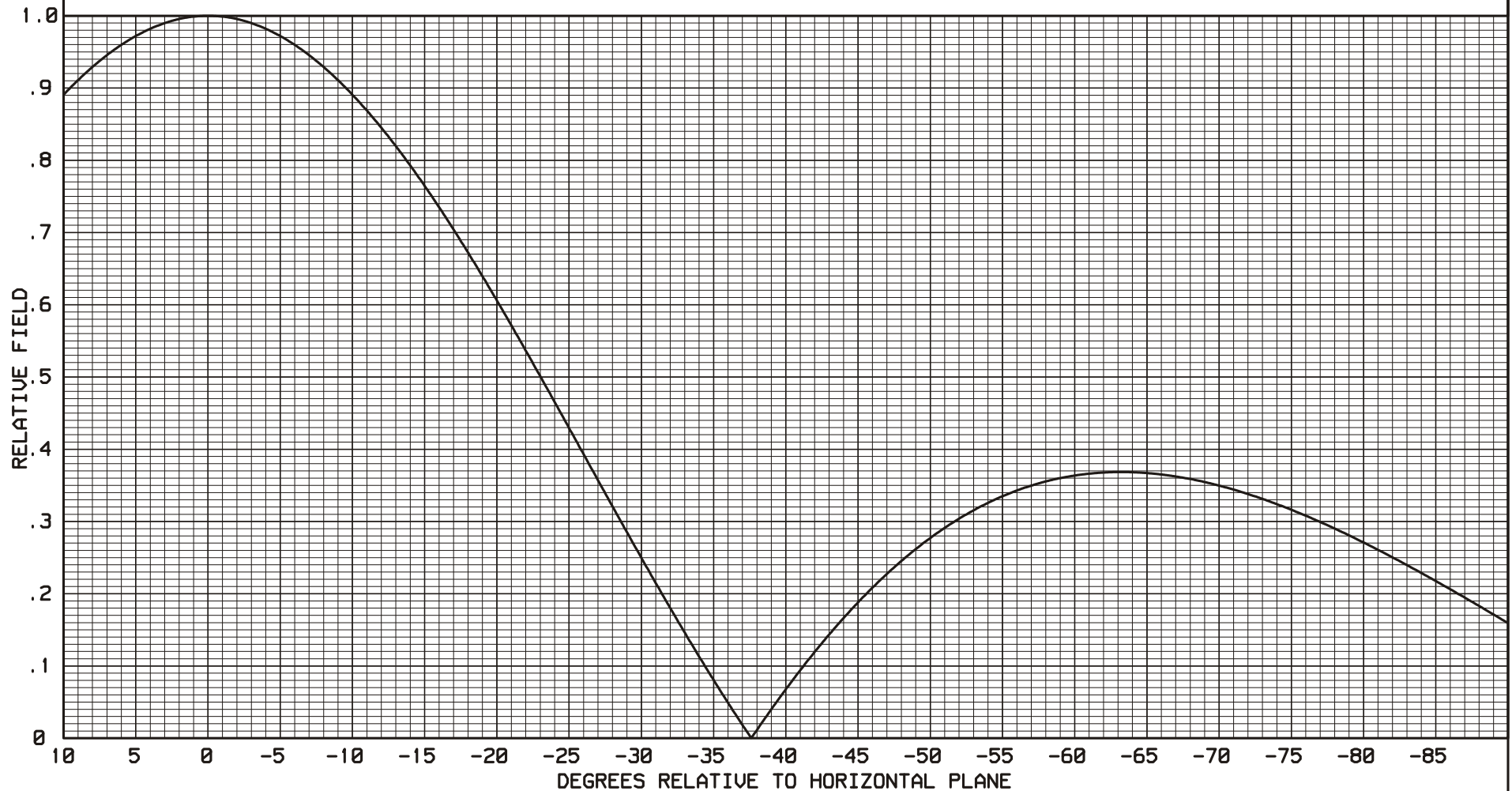
2 LEVELS OF TYPE 1080 ELEMENTS
+0.00 DEGREE(S) BEAM TILT
0 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL

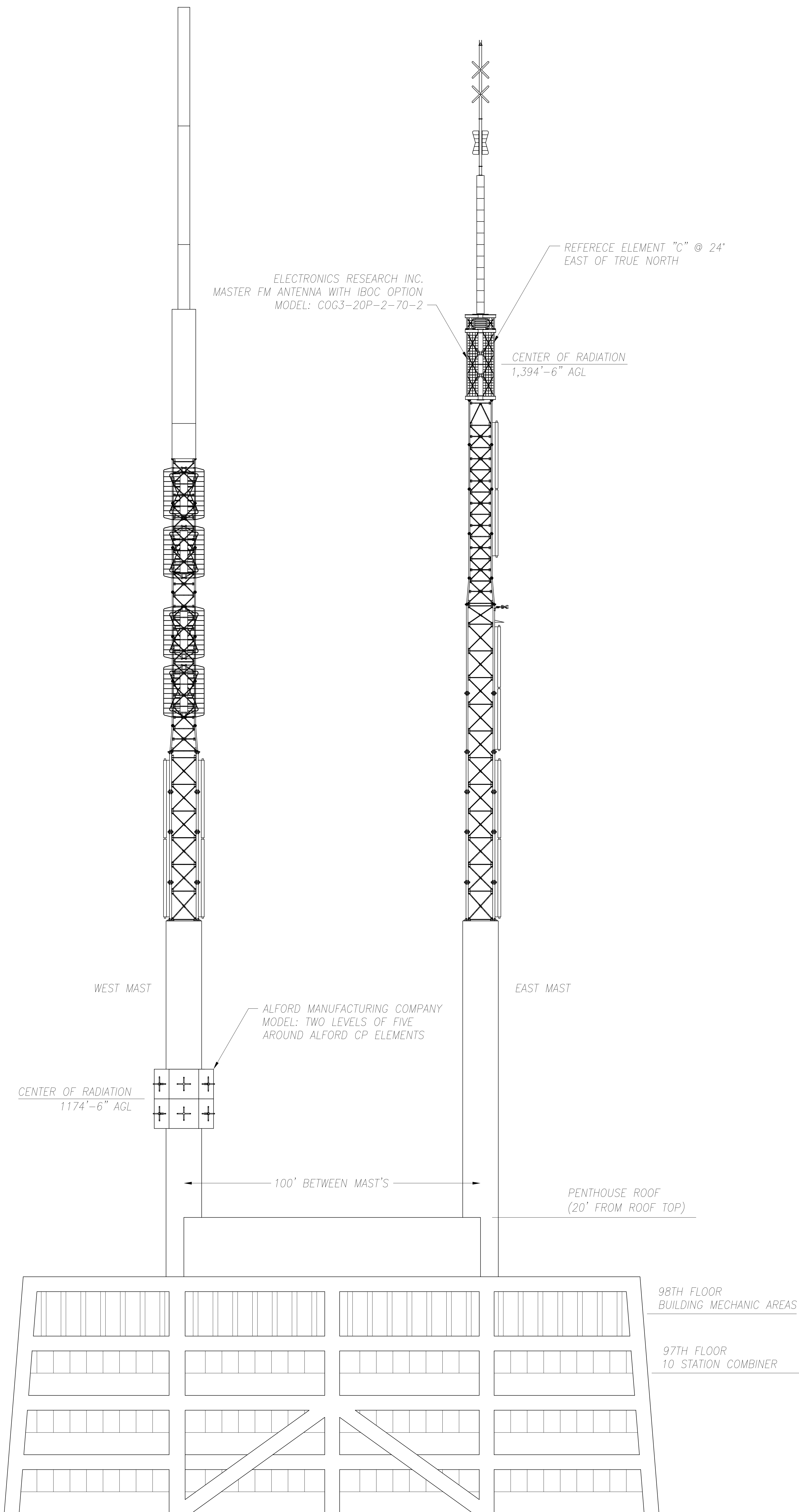
POWER GAIN IS .935 IN THE HORIZONTAL PLANE(.935 IN THE MAX.)
[POWER GAINS AT 95% ANTENNA EFFICIENCY]

APRIL 4, 2003

105.1 MHz.

BAY SPACING:
92 INCHES





ELECTRONICS RESEARCH, INC.

Established 1943

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FAX: (812) 925-4026

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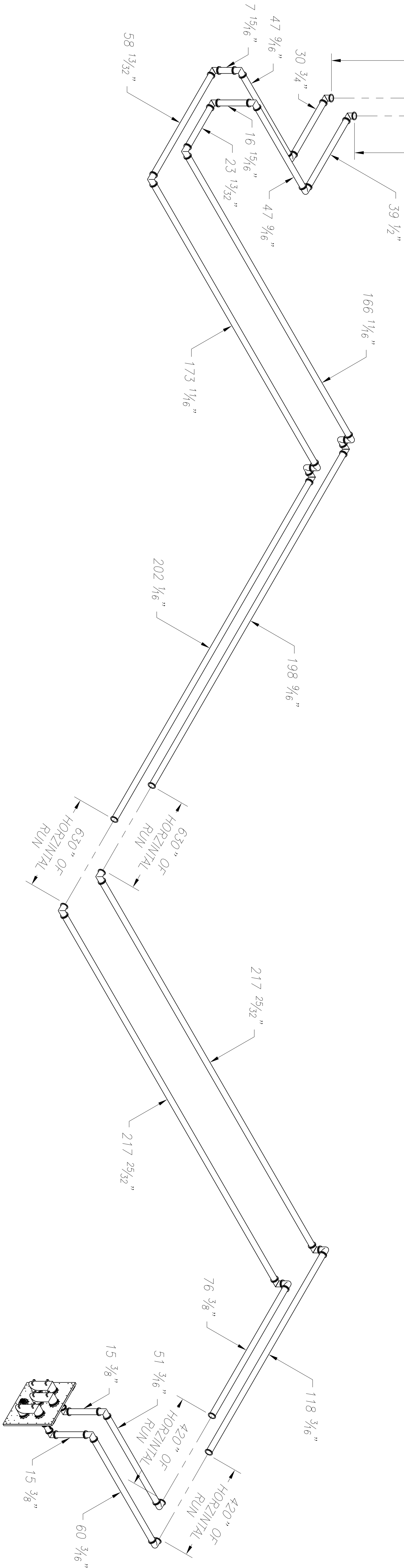
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NAME		ELEVATION		DETAIL	
STATION:	HANCOCK BUILDING \ CHICAGO, IL.	PROJECT NO.:	08583		
FREQUENCY:	N/A				
PATH G:	\DRAFTING\ALL\PROJECTS\08583				
FILE	E --- T	DRAWN	BAM		
DATE	5/9/03	APP'D		DWG. NO.	A-6
NO	REVISION	APP'D	DATE	MODEL	NON-APPLICABLE
1					

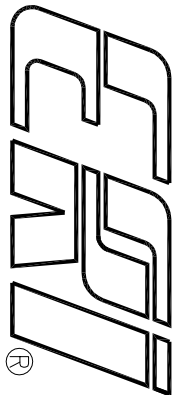
INPUT FINE TUNER

292'-11" APP.

290'-11" APP. VERTICAL RUN



DUAL DIELECTRIC TRANSMISSION LINES
DIELECTRIC INC. MODEL NO: 675-003
EACH RUN LENGTH 460' (APPROX. INCLUDING ELBOWS)
RF LOSS FOR ESTIMATING PURPOSES IS -.024 dB



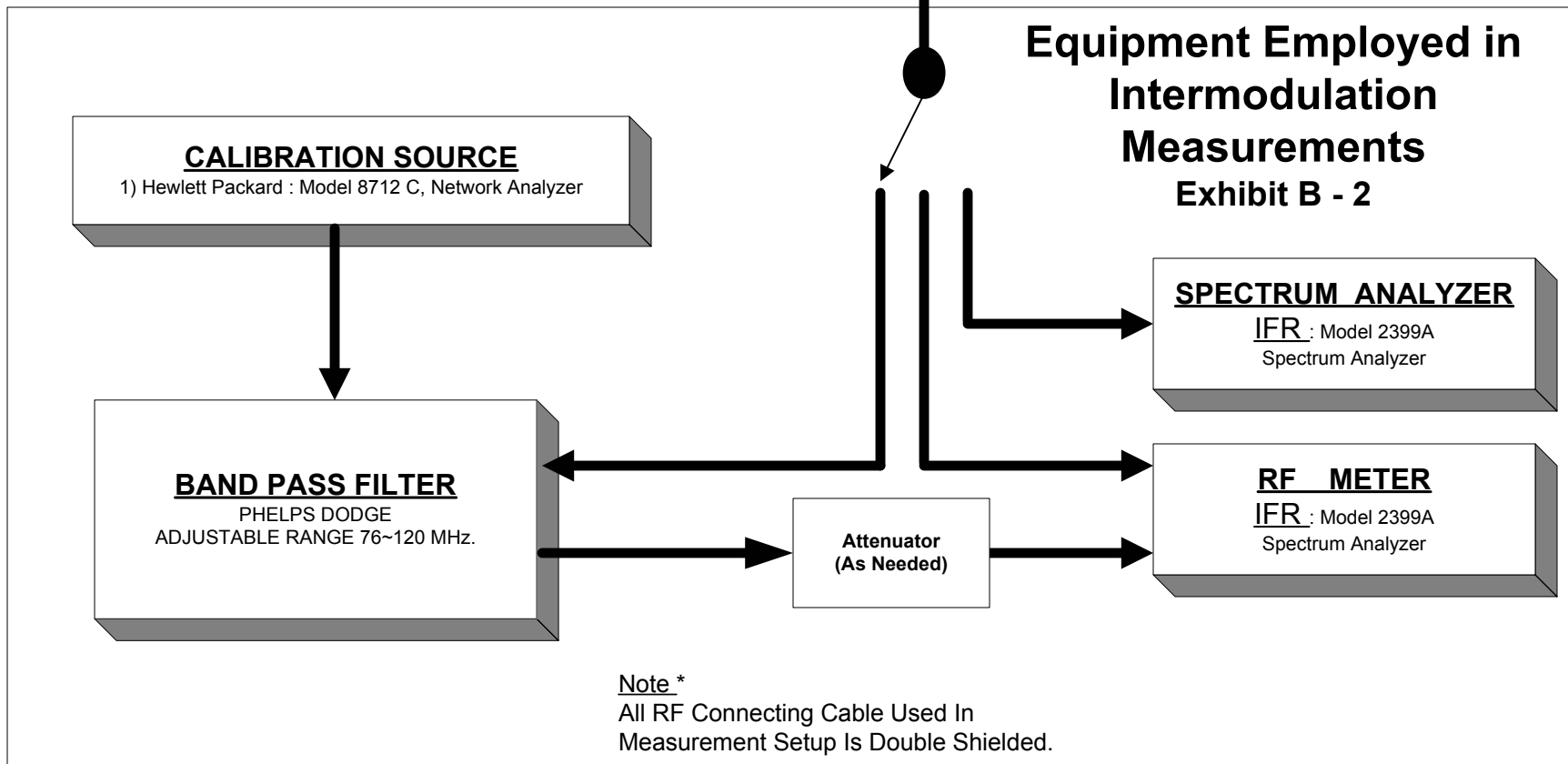
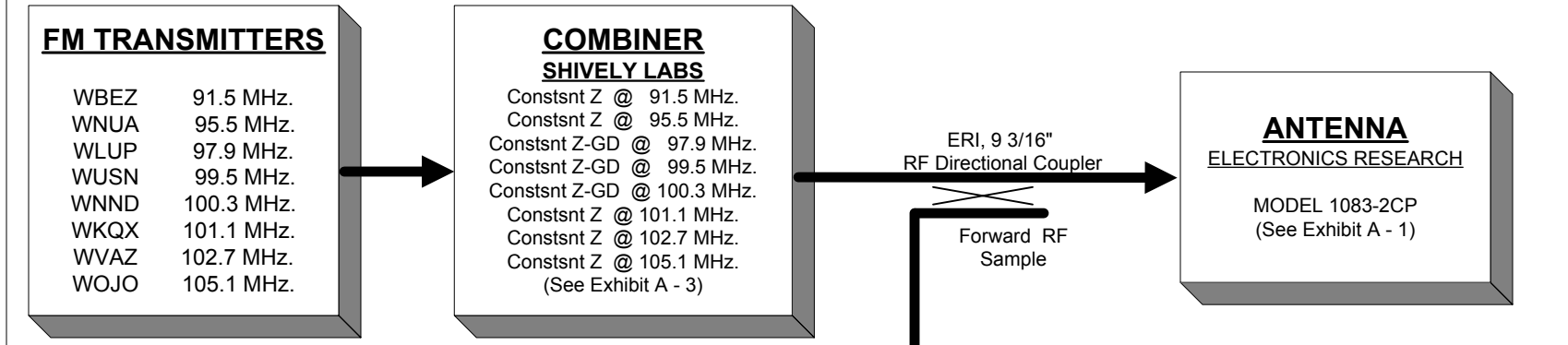
ELECTRONICS RESEARCH, INC.
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7777 GARDNER RD.
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NAME: FEED SYSTEM DETAIL					
6					STATION: HANCOCK BUILDING \ CHICAGO, IL.
5					FREQUENCY: N/A PROJECT NO.: 08583
4					PATH G: \DRAFTING\ALL\PROJECTS\08583
3					FILE / L: 1 DRAWN: BAM FACTOR: NTS
2					DATE: 5/9/03 APP'D: DWG. NO.
1					
NO	REVISION	APP'D	DATE	MODEL: NON-APPLICABLE	
				A	

Hancock Bldg. Broadcasting Scheme EXHIBIT - B1



Broadcasting Scheme and Equipment Employed in Intermodulation Measurements

EXHIBIT B

Table 2.

Intermodulation Products

	91.5	95.5	97.1	97.9	98.7	99.5	100.3	101.1	102.7	105.1
91.5	--	99.5	102.7	104.3	105.9	107.5	109.1	110.7	113.9	118.7
93.1	89.9	97.9	101.1	102.7	104.3	105.9	107.5	109.1	112.3	117.1
93.9	89.1	87.1	100.3	101.9	103.5	105.1	106.7	108.3	111.5	116.3
95.5	87.5	--	98.7	100.3	101.9	103.5	105.1	106.7	109.9	114.7
97.1	85.9	93.9	--	98.7	100.3	101.9	103.5	105.1	108.3	113.1
97.1	85.9	93.9	--	98.7	100.3	101.9	103.5	105.1	108.3	113.1
97.9	85.1	93.1	96.3	--	99.5	101.1	102.7	104.3	107.5	112.3
98.7	84.3	92.3	95.5	97.1	--	100.3	101.9	103.5	106.7	111.5
99.5	83.5	91.5	94.7	96.3	97.9	--	101.1	102.7	105.9	110.7
100.3	82.7	90.7	93.9	95.5	97.1	98.7	--	101.9	105.1	109.9
101.1	81.9	89.9	93.1	94.7	96.3	97.9	99.5	--	104.3	109.1
101.9	81.1	89.1	92.3	93.9	95.5	97.1	98.7	100.3	103.5	108.3
102.7	80.3	88.3	91.5	93.1	94.7	96.3	97.9	99.5	--	107.5
105.1	77.9	85.9	89.1	90.7	92.3	93.9	95.5	97.1	100.3	--

Table 1.**Carrier Reference Levels**

Carrier Frequency (MHz)	Pad One (dB)	Measured Level (dBm)	Adjusted Level (dBm)
WBEZ	3	9	12.0
WNUA	3	9.76	12.76
WLUP	3	8.45	11.45
WUSN	3	9.56	12.56
WNND	3	9.5	12.5
WKQX	3	9.72	12.72
WVAZ	3	8.4	11.4
WOJO	3	9.7	12.7

The table above lists the eight (8) current users of the John Hancock Center, Chicago, IL Antenna System. The data in the table was obtained from the directional coupler located between the antenna patching complex and the multiplexer output. The data was taken with each station operating at their transmitter at 100% of the licensed output power. The directional coupler was configured to provide a forward level sample, the same setup method to measure all IM products.

The measured levels taken from the Spectrum Analyzer include the attenuation effects of external signal padding. The use of external attenuation pads maintains a good impedance match between test measurement equipment. Employing a tuned band pass filter prevents the Spectrum Analyzer from saturation and prevents potential damage from the presence of strong multi-station signals. The adjusted levels are computed with measurement losses removed. These figures serve as reference levels in this report.

Intermodulation (IM) Analysis Measurements John Hancock Center, Chicago Illinois

Table 2

A	Frequency Of Product Possibility	B Spectrum Analyzer Measured Level	C Measurement Loss 3 dB Pad + Band-Pass Filter	D Level Adjusted For Measurement Losses	E Associated Station Frequency	F Normalized Reference Level	G IM Level (Deference Between D And F)
(1)	77.9 MHz	-95.40 dBm	-13.60 dB	-81.80 dBm	91.5 MHz	12.00 dBm	-83.80 dBm
(2)	80.3 MHz	-96.20 dBm	-13.10 dB	-83.10 dBm	91.5 MHz	12.00 dBm	-95.10 dBm
(3)	81.9 MHz	-95.60 dBm	-12.92 dB	-82.68 dBm	91.5 MHz	12.00 dBm	-94.68 dBm
(4)	82.7 MHz	-96.10 dBm	-12.80 dB	-83.30 dBm	91.5 MHz	12.00 dBm	-95.30 dBm
(5)	83.5 MHz	-95.60 dBm	-12.70 dB	-82.90 dBm	91.5 MHz	12.00 dBm	-94.90 dBm
(6)	84.3 MHz	-96.90 dBm	-12.60 dB	-84.30 dBm	91.5 MHz	12.00 dBm	-96.30 dBm
(7)	85.1 MHz	-95.60 dBm	-12.60 dB	-83.00 dBm	91.5 MHz	12.00 dBm	-95.00 dBm
(8)	85.9 MHz	-95.90 dBm	-12.50 dB	-83.40 dBm	91.5 MHz & 95.5 MHz	12.00 dBm / 12.76 dBm	-95.40 dBm / -96.16 dBm
(9)	87.5 MHz	-96.00 dBm	-12.40 dB	-83.60 dBm	91.5 MHz	12.00 dBm	-95.6 dBm
(10)	88.3 MHz	-96.10 dBm	-12.20 dB	-83.90 dBm	95.5 MHz	12.76 dBm	-96.66 dBm
(11)	89.1 MHz ⁽¹⁾	-95.60 dBm	-12.10 dB	-83.50 dBm	97.1 MHz	Note 1	Note 1
(12)	89.9 MHz	-95.70 dBm	-12.10 dB	-83.60 dBm	95.5 MHz	12.76 dBm	-96.36 dBm
(13)	90.7 MHz	-95.70 dBm	-12.00 dB	-83.70 dBm	95.5 MHz & 97.9 MHz	12.76 dBm / 11.45 dBm	-96.46 dBm / -95.15 dBm
(14)	91.5 MHz ^(1,2)	-88.70 dBm	-12.20 dB	-76.50 dBm	97.1 MHz	Note 1	Note 1
(15)	92.3 MHz ⁽¹⁾	-95.90 dBm	-12.00 dB	-83.90 dBm	95.5 MHz & 98.7 MHz	12.76 dBm / Note 1	-96.66 dBm / Note
(16)	93.1 MHz ^(1,2,3)	-75.60 dBm	-12.00 dB	-63.60 dBm	95.5 MHz & 97.1 MHz	12.76 dBm / Note 1	-76.36 dBm / Note
(17)	93.9 MHz ^(1,2)	-84.00 dBm	-11.90 dB	-72.10 dBm	95.5 MHz & 97.1 MHz	12.76 dBm / Note 1	-84.86 dBm / Note
(18)	94.7 MHz ⁽¹⁾	-94.30 dBm	-11.80 dB	-82.50 dBm	97.1 MHz & 98.7 MHz	Note 1	Note 1
(19)	95.5 MHz ^(1,2)	-92.40 dBm	-11.80 dB	-80.60 dBm	97.1 MHz & 100.3 MHz	Note 1 / 12.50 dBm	Note 1 / -93.10 dBm
(20)	96.3 MHz ⁽¹⁾	-93.10 dBm	-11.80 dB	-81.30 dBm	97.1 MHz & 99.5 MHz	Note 1 / 12.56 dBm	Note 1 / -93.86 dBm
(21)	97.1 MHz ⁽²⁾	-89.70 dBm	-11.70 dB	-78.00 dBm	97.9 MHz & 101.1 MHz	11.45 dBm / 12.72 dBm	-89.45 dBm / -90.72 dBm
(22)	97.9 MHz ^(1,2)	-92.50 dBm	-11.70 dB	-80.80 dBm	98.7 MHz & 100.3 MHz	Note 1 / 12.50 dBm	Note 1 / -103.28 dBm
(23)	98.7 MHz ^(1,2)	-79.50 dBm	-11.70 dB	-67.80 dBm	97.1 MHz & 99.5 MHz	Note 1 / 12.56 dBm	Note 1 / -80.36 dBm
(24)	99.5 MHz ⁽²⁾	-92.30 dBm	-11.60 dB	-80.70 dBm	95.5 MHz & 101.1 MHz	12.76 dBm / 12.72 dBm	- 93.46 dBm / -93.42 dBm
(25)	100.3 MHz ⁽²⁾	-95.10 dBm	-11.60 dB	-83.50 dBm	97.9 MHz & 99.5 MHz	11.45 dBm / 12.56 dBm	-94.95 dBm / -96.06 dBm
(26)	101.1 MHz ^(1,2)	-92.90 dBm	-11.60 dB	-81.30 dBm	99.5 MHz & 100.3 MHz	12.56 dBm / 12.50 dBm	-93.86 dBm / -93.80 dBm
(27)	101.9 MHz ⁽²⁾	-79.10 dBm	-11.60 dB	-67.50 dBm	100.3 MHz & 101.1 MHz	12.50 dBm / 12.72 dBm	-80.00 dBm / -80.22 dBm
(28)	102.7 MHz ^(1,2)	-93.10 dBm	-11.60 dB	-81.50 dBm	97.1 MHz	Note 1	Note 1
(29)	103.5 MHz	-94.90 dBm	-11.60 dB	-83.30 dBm	101.1 MHz	12.72 dBm	-96.02 dBm
(30)	104.3 MHz	-91.40 dBm	-11.60 dB	-79.80 dBm	101.1 MHz	12.72 dBm	-95.52 dBm
(31)	105.1 MHz ⁽²⁾	-89.00 dBm	-11.60 dB	-77.40 dBm	100.3 MHz	12.50 dBm	- 89.90 dBm
(32)	105.9 MHz ⁽¹⁾	-90.90 dBm	-11.60 dB	-79.30 dBm	98.7 MHz	Note 1	Note 1
(33)	106.7 MHz	-95.50 dBm	-11.60 dB	-83.90 dBm	101.1 MHz	12.72 dBm	- 96.62 dBm
(34)	107.5 MHz	-91.00 dBm	-11.50 dB	-79.50 dBm	105.1 MHz	12.70 dBm	- 92.20 dBm
(35)	108.3 MHz	-95.90 dBm	-11.50 dB	-84.40 dBm	102.7 MHz	11.40 dBm	- 95.80 dBm
(36)	109.1 MHz	-95.20 dBm	-11.60 dB	-83.60 dBm	100.3 MHz	12.50 dBm	- 96.10 dBm
(37)	109.9 MHz	-95.90 dBm	-11.50 dB	-84.40 dBm	105.1 MHz	12.70 dBm	- 97.10 dBm
(38)	110.7 MHz	-95.60 dBm	-11.50 dB	-84.10 dBm	101.1 MHz	12.72 dBm	- 96.82 dBm
(39)	111.5 MHz	-95.30 dBm	-11.50 dB	-83.80 dBm	105.1 MHz	12.70 dBm	- 96.50 dBm
(40)	112.3 MHz	-95.20 dBm	-11.50 dB	-83.70 dBm	105.1 MHz	12.70 dBm	- 96.40 dBm
(41)	113.1 MHz	-95.20 dBm	-11.50 dB	-83.70 dBm	105.1 MHz	12.70 dBm	- 96.40 dBm
(42)	113.9 MHz	-95.30 dBm	-11.40 dB	-83.90 dBm	102.7 MHz	11.40 dBm	- 95.30 dBm
(43)	114.7 MHz	-95.20 dBm	-11.40 dB	-83.80 dBm	105.1 MHz	12.70 dBm	- 96.50 dBm
(44)	118.7 MHz	-94.80 dBm	-11.30 dB	-83.50 dBm	105.1 MHz	12.70 dBm	- 96.20 dBm
(45)	116.3 MHz ¹⁾	-94.80 dBm	-11.40 dB	-83.40 dBm	105.1 MHz	12.70 dBm	- 96.10 dBm
(46)	117.1 MHz	-94.00 dBm	-11.30 dB	-82.70 dBm	105.1 MHz	12.70 dBm	- 95.40 dBm

1) This frequency, reference level or measurement is related to other antennas co-located on roof top, therefore certain information is unobtainable.

2) Selective Stations Were Intermittently Turned Off To Verify The Level Of Frequency.

3) Unable To Obtain An Accurate Measurement Due To Interference From An Off Site Station (WXRT)