ELECTRONICS RESEARCH, INC.
7777 Gardner Road, Chandler, Indiana 47610, (812) 925-6000, Fax (812) 925-4030

Report Of Intermodulation Product Findings

SOUTH MOUNTAIN COMBINED BROADCAST FACILITY
PHOENIX / GLENDALE, ARIZONA

KKFR	*92.3*
KKLT	*98.7*

AUXILIARY ANTENNA

June 2004

Electronics Research Inc.
7777 Gardner Road
Chandler, Indiana 47610
Phone (812) 925-6000 Fax (812) 925- 4030

TABLE OF CONTENTS
PHOENIX / GLENDALE, ARIZONA

Report of Findings for Intermodulation Product Measurements

Exhibits Accompanying This Report

REPORT OF FINDINGS
KKFR / KKLT COMBINED AUXILIARY BROADCAST FACILITY
PHOENIX / GLENDALE, ARIZONA

Introduction: This report of findings is based on data collected at the KKFR and KKLT FM auxiliary broadcast facility located in Phoenix, AZ. The report includes measurements offered as proof that the combined operations of KKFR (92.3) MHz. and KKLT (98.7) MHz. transmitters, operating into the auxiliary antenna ,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 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). KOOL-FM (94.5 MHz.), KESZ (99.9 MHz.) and KZON (101.5 MHz.) operate into separate antennas located near the KKFR / KKLT tower. Their effects on the stations operating from the multiplexed system has been considered in this report. Mark Steapleton of Electronics Research, Inc. located in Chandler, Indiana performed the measurements summarized herein on June 27, 2004.

The following exhibits are provided:

Exhibit A:
- A-1 Drawing Depicting Antenna.
- A-2 SHPX-4AC6-SP Antenna Specification Sheet.
- A-3 Drawing Depicting Multiplexing Scheme.
- A-4 963-8 TEE 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 Third 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 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 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 third 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 two FM stations were operating from the combined antenna system. The KKFR, and KKLT multiplexed system is fundamentally comprised of antenna, feed line and multiplexer unit. The SHPX-4AC6-SP antenna and 963-8 TEE multiplexer unit are products of Electronics Research, Inc, whereas the feed line is manufactured by Myat and Andrew Corp., Refer to Exhibit B-1, for an illustration of the Broadcasting Scheme of these stations.

To accomplish the aggregation of two transmitter signals into a common antenna feed and provide transmitter-to-transmitter isolation, a multiplexing scheme consisting of a Tee Combiner module was installed. Specifically, the Multiplexer utilizes four ERI Model 963 Bandpass filters for each transmitter. An interconnecting TEE is required to complete the multiplexer module which is illustrated in the attached Exhibit A-3. The multiplexer, fully assembled, exhibited transmitter port-to-port isolation in excess of - 80 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, when 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-2 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 (dB꞉)	Scale Reading (dB)	**Adjusted Level (dB꞉)**	Notes
KKFR (92.3)	6	---	140	-11.9	**134.1**	
KKLT (98.7)	6	---	140	- 11.5	**134.5**	

Predictable third-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. 1) The reflected port on the directional coupler was used to determine KOOL -FM (94.5 MHz.), KESZ (99.9 MHz.) and KZON (101.5 MHz.) signal was the highest coupled signal of all local signals in the area. The predictable products for these other stations were measured.

Table 2 - Third Order Products.

	Carrier Frequency (MHz)	
Interfering Frequency (MHz)	**KKFR 92.3**	**KKLT 98.7**
KKFR 92.3	**---**	**105.1**
KKLT 98.7	**85.9**	**---**
KOOL-FM 94.5	**90.1**	**102.9**
KESZ 99.9	**84.7**	**97.5**
KZON 101.5	**83.1**	**95.9**

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*
83.1	92.3	101.5	3	11.2	20	< -20.0	14.2	134.1	**119.9**	
84.7	92.3	99.9	3	10.9	20	< -20.0	13.9	134.1	**120.2**	
85.9	92.3	98.7	3	10.8	20	-12.7	21.1	134.1	**113.0**	
90.1	92.3	94.5	3	10.7	40	-8.2	45.5	134.1	**88.6**	1
95.9	98.7	101.5	3	10.5	20	-17.2	16.3	134.5	**118.2**	
97.5	98.7	99.9	3	10.0	20	-10.5	22.5	134.5	**112.0**	
102.9	98.7	94.5	3	9.3	20	- 2.5	29.8	134.5	**104.7**	2
105.1	98.7	92.3	3	9.2	20	-5.4	26.8	134.5	**107.7**	

*** NOTES**

1) Measured signal is a local carrier KFLR-FM transmitting at 90.3 MHz: No discernable signal was measured.

2) Measured signal is a local carrier KNIX-FM transmitting at 102.5 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 27h. 2004 as summarized in this document, I, Mark Steapleton, find the subject multiplexed system- specifically the transmitters and combiner system for the operation of the KKFR and KKLT into the SHPX-4AC6-SP auxiliary 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 KKFR and KKLT 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

WARRICK COUNTY)
) SS:
STATE OF INDIANA)

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 23 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 Emmis Communications on behalf of radio Stations KKFR in Glendale, AZ. and KKLT in Phoenix, AZ. to prepare this Report Of Findings.

Mark Steapleton

Mark Steapleton; Field Technician

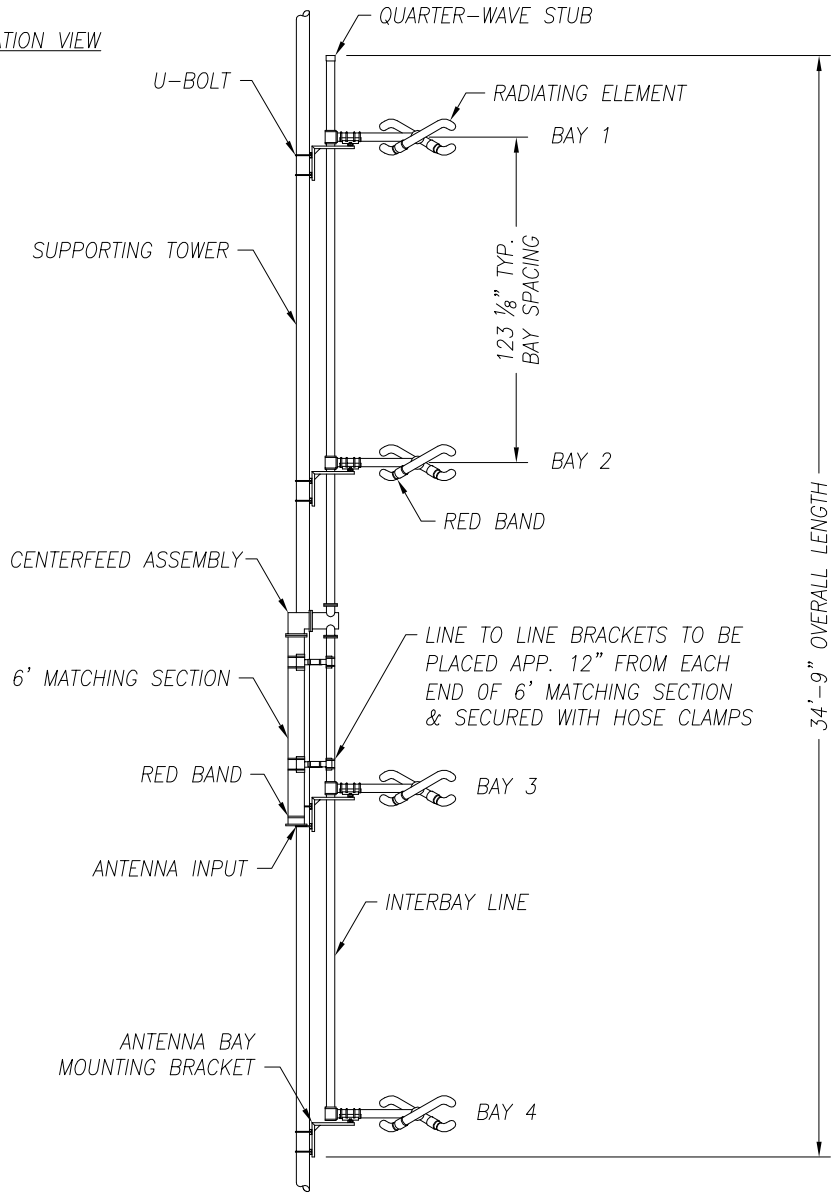
Subscribed and sworn to before me on this 2nd. day of August 2004.

Jacquelyn S. Kinney

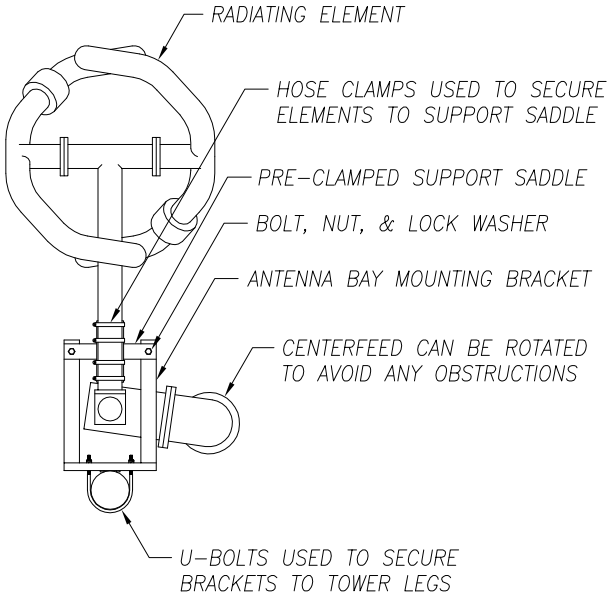
Jacquelyn Kinney; Notary Public
My commission expires July 5, 2007

NOTARY PUBLIC SEAL INDIANA

ELEVATION VIEW



TOP VIEW



NOTE:
1. FINAL ORIENTATION TO BE DETERMINED BY STATION PERSONNEL.

ELECTRONICS RESEARCH, INC.
Established 1943
7777 GARDNER RD.
CHANDLER, IN. 47610–9637
PHONE: (812) 925–6000
FAX: (812) 925–4026

NO	REVISION	APP'D	DATE
6			
5			
4			
3			
2			
1	REVISIONS		0/00 XXX

NAME INSTALLATION DETAIL
STATION: KKFR/KKLT–GLENDALE/PHOENIX, AZ
FREQUENCY: 92.3/98.7 MHz PROJECT NO.: 10529/4
PATH G:\DRAFTING\ALL\PROJECTS\10529\4
FILE IR — 1 DRAWN J.B.F. FACTOR NTS
DATE 8/22/03 APP'D DWG. NO. IR — 1
MODEL SHPX–4AC6–SP

EXHIBIT A-1

A-2 ERI Antenna Specification Sheet

PHOENIX / GLENDALE, ARIZONA

General Specifications

Antenna Type . . . . . High Power FM-Broadcast, Suitable For Diplexing
Model Number SHPX-4AC6-SP
Number Of Bay Levels . . . . . Four
Polarization . . . . . Right Hand Circular

Electrical Specifications

Antenna Input Power Capability (Designed) . . . . . 60 KW.(1)
Operating Frequency Band . . . . . 92.3 and 98.7 Megahertz.
VSWR . . . . . 1.10 : 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:

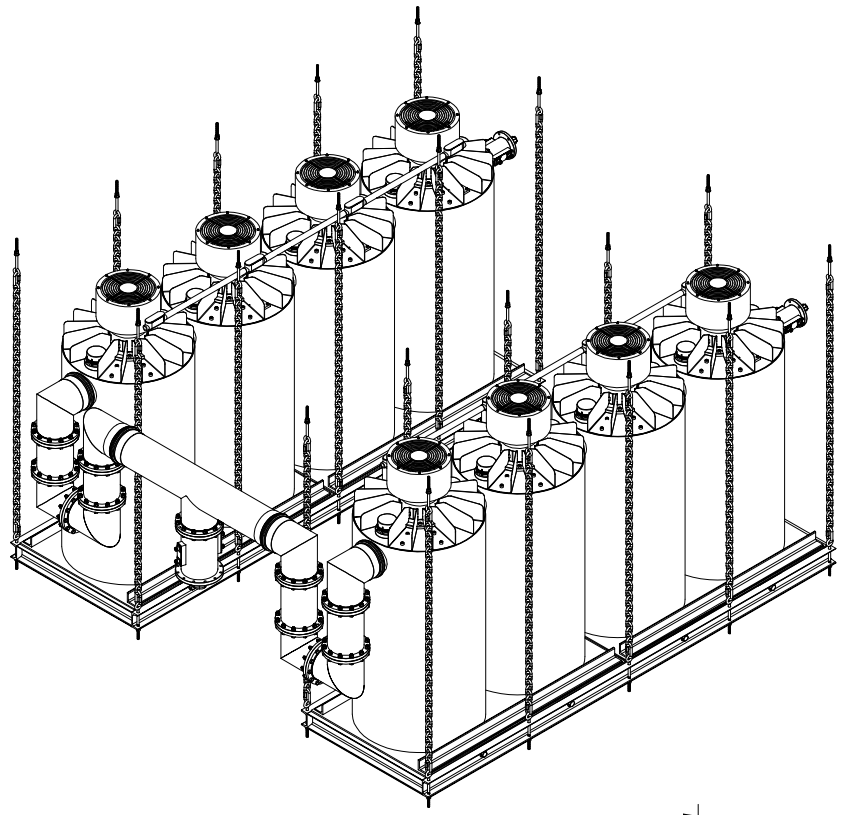
Frequency	Station ERP	Beam Tilt	First Null Fill	Second Null Fill	Power Gain (Maximum)	Line Loss (3)	Filter Loss (4)	Computed TPO
92.3	**50.9 (KW)**	**0.627°**	**8 %**	**1%**	**2.116**	**.292 dB**	**.291 dB**	**27.51 (KW)**
98.7	**51.3 (KW)**	**0.627°**	**8 %**	**1%**	**2.063**	**.299 dB**	**.266 dB**	**28.32 (KW)**

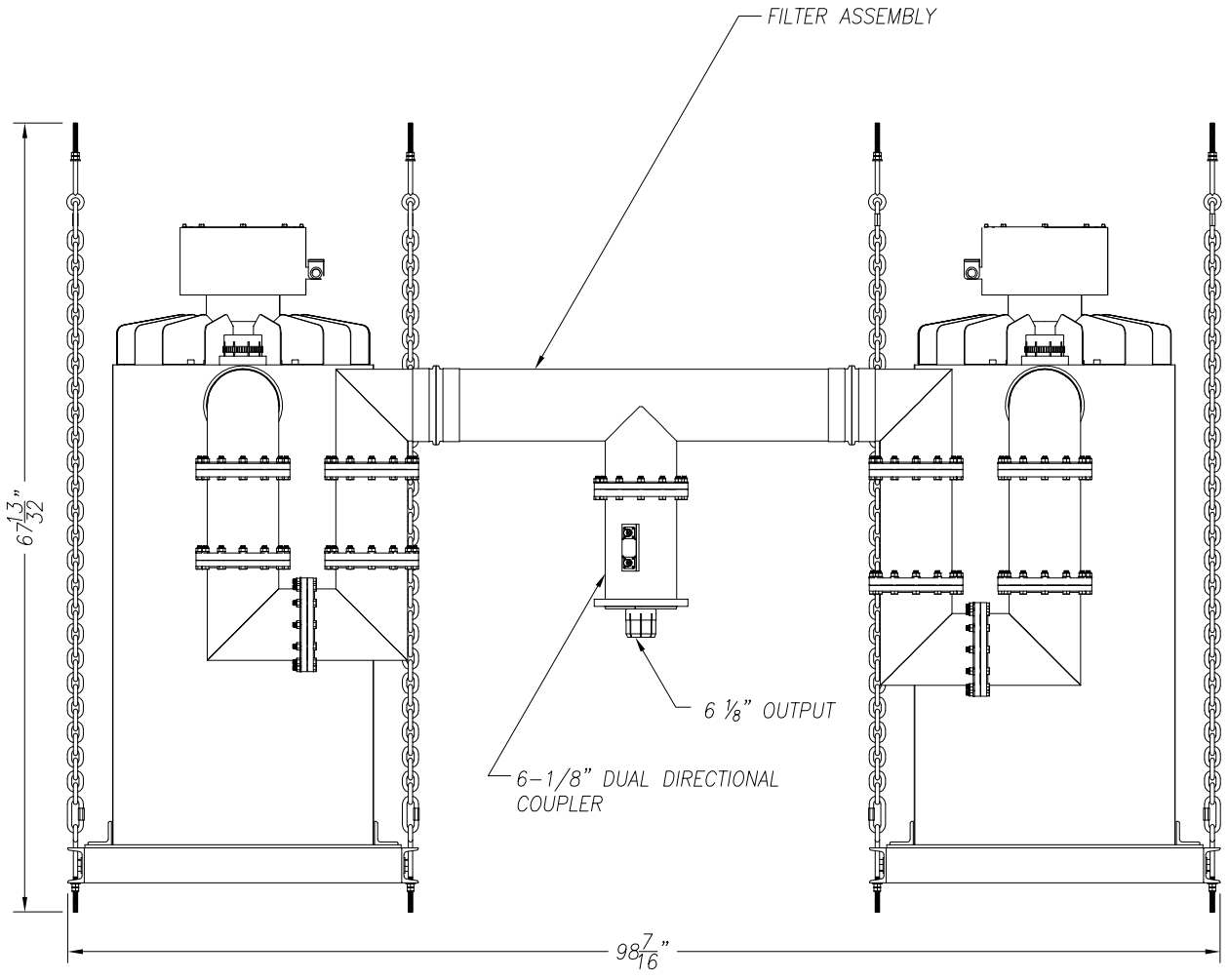
Mechanical Specifications

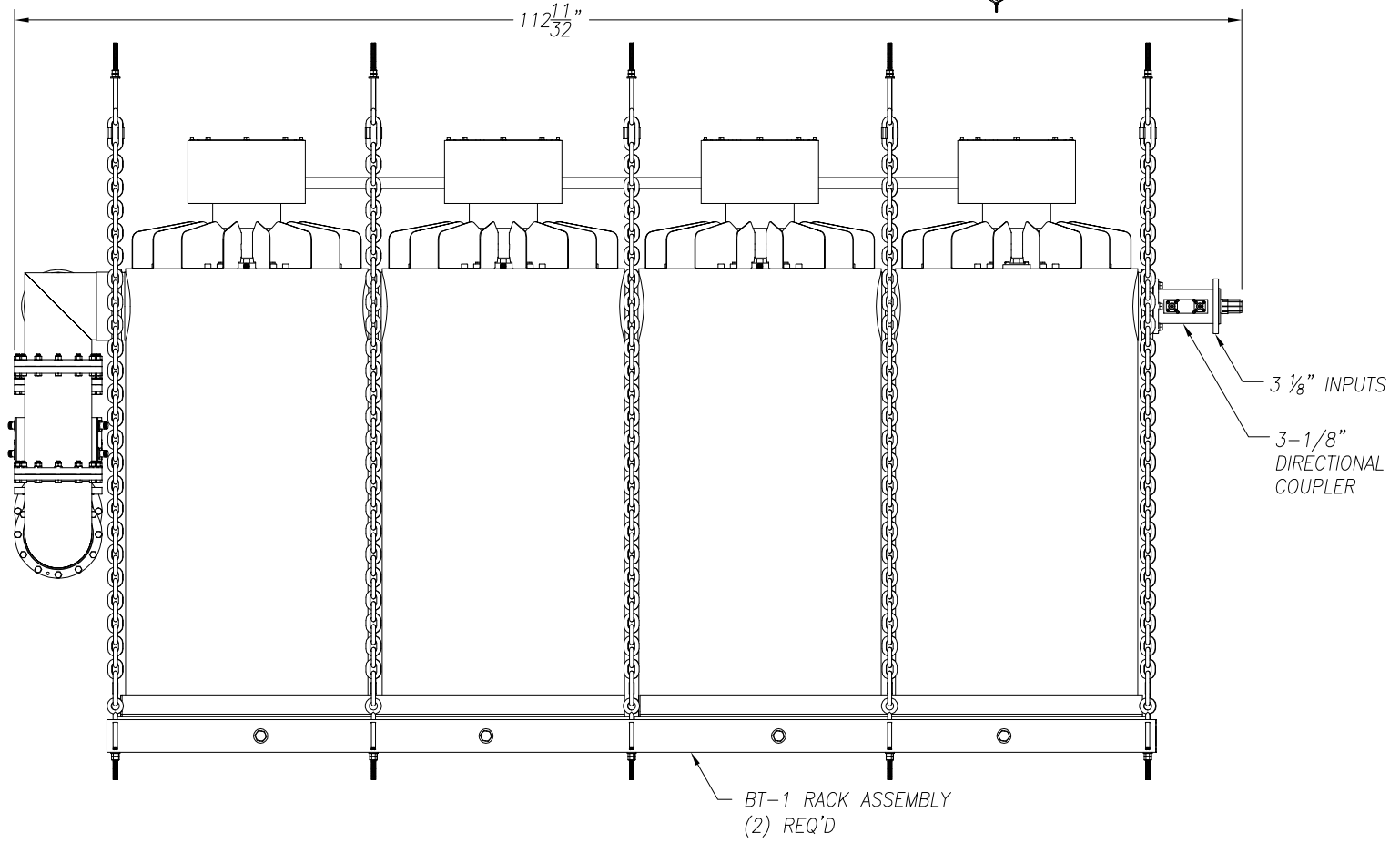
Antenna Feed System . . . . . Fed With Single Feed Line
Input Connector . . . . . 6 1/8" 50- Ohm EIA Flanged
Element Deicing . . . . . Not Ordered
Interbay Spacing . . . . . 123.125 Inch Center to Center
Array Length . . . . . 34' Feet 9" Inches
Construction Material (Antenna) . . . . . All Noncorrosive
Construction Material (Mounting) . . . . . All Stainless Steel

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 67 Feet, Myat Type 401-000 Rigid 4 1/16 " Coax. And A Feed Run Of 254 Feet, 5" Andrew Type HJ9-50 Flex Coax . Each transmitter Incorporates Two (2) Dielectric Type 5000 Motorized Coax Switch with .05dB loss per switch.
4) Losses Taken From Actual On Site Multiplexer Measurements.
5) With Low Q Element Design, Moderate Icing Will Not Cause Appreciable VSWR Rise.

NOTES:
THIS ASSEMBLY IS TO MOUNT FROM THE CEILING. IT WILL BE LOCATED IN TWO ROOMS WITH THE TEE ASSEMBLY GOING THROUGH THE WALL.







ELECTRONICS RESEARCH, INC.
Established 1943
7777 GARDNER RD.
CHANDLER, IN. 47610-9637
PHONE: (812) 925-6000
FAX: (812) 925-4030

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

NAME INSTALLATION DETAIL		
FOR KKFR/KKLT - GLENDALE/PHOENIX, AZ		
PATH G:\DRAFTING\ALL\PROJECTS\10529\2		
FILE [illegible]	DRAWN J.L.B.	FACTOR 1/16
DATE 10/1/03	APP'D	DWG. NO. [illegible]
MAT'L	CUT	

A-4 ERI Combiner Specification Sheet

PHOENIX / GLENDALE, ARIZONA

General Specifications:

Multiplexer Type . . . . . Band Pass TB 63-8/6 TEE Combiner
Number Of Combining Units . . . . . Two
Injected Port to Injected Port Isolation . . . . . < - 80 dB
Output Connector . . . . . 6 1/8 " 50 Ohm EIA (Flanged)
Output Power (Designed) . . . . . 60 KW
Combiner Units, Size and Weight :

Type 963-4 Tuned To 92.3 MHz. . . . . 5' ht. X 2' wd. X 8' lg. & 770 Lbs.
Type 963-4 Tuned To 98.7 MHz. . . . . 5' ht. X 2' wd. X 8' lg. & 770 Lbs.

Heat Removal (All Multiplexer Components) . . . . . Forced Air
Physical Arrangement . . . . . All Components Upright On Racks Suspended From The Ceiling

Injected Port Specifications:

Frequency Assignment . . . . . 92.3 MHz. And 98.7 MHz.
Power Rating, Each Injected Port (Designed) . . . . . 28 KW
Input Connector . . . . . 3-1/8" 50 Ohm EIA (Flanged)
VSWR . . . . . Less than 1.08:1 @ +/-150 KHz(1)
Group Delay . . . . . Less than 80 ns Overall Variation, Carrier @ +/- 150 KHz
Insertion Loss (Measured on site):

92.3 MHz. . . . . - 0.291 dB
98.7 MHz. . . . . - 0.266 dB

1) When Terminated in 50 Ohm Resistive Load.

ELECTRONICS RESEARCH,INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610

FIGURE 3

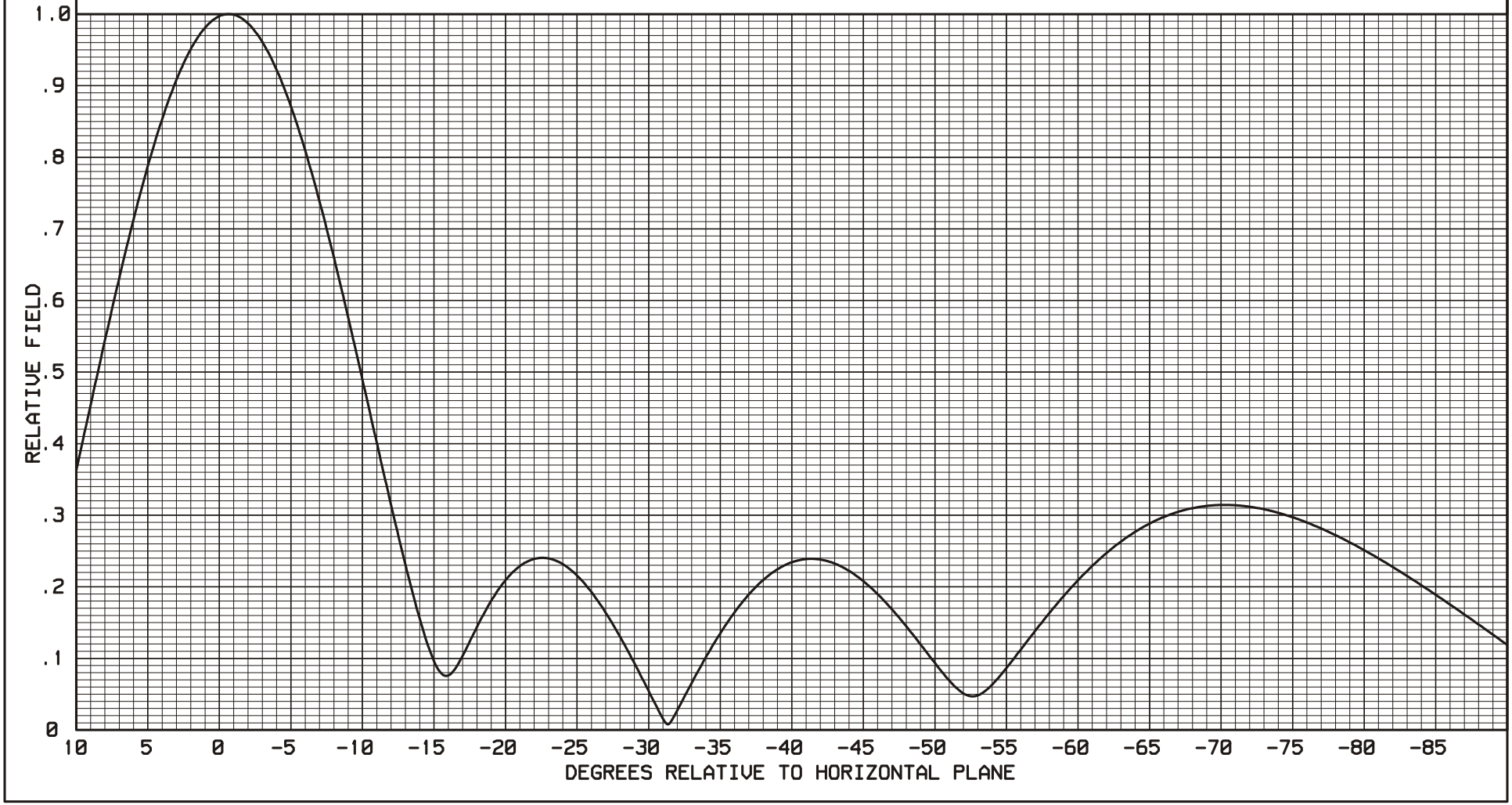
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD

4 ERI TYPE SHP, SHPX, LP, OR LPX ELEMENTS
-.627 DEGREE(S) ELECTRICAL BEAM TILT
8 PERCENT FIRST NULL FILL
1 PERCENT SECOND NULL FILL
POWER GAIN IS 2.104 IN THE HORIZONTAL PLANE(2.116 IN THE MAX.)

AUGUST 19, 2003

92.3 MHz.

ELEMENT SPACING
123.125 INCHES



ELECTRONICS RESEARCH,INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610

FIGURE 4

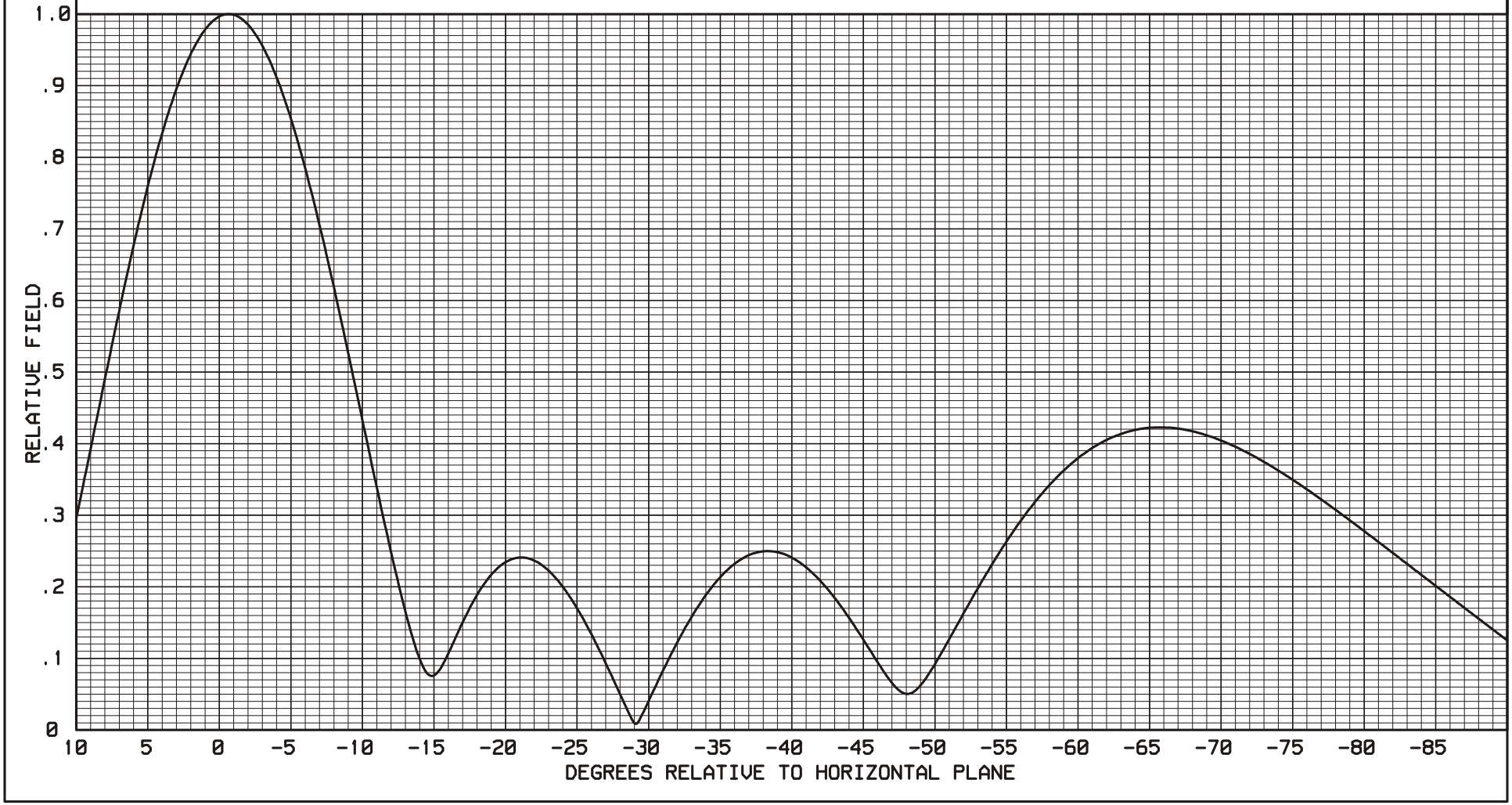
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD

4 ERI TYPE SHP, SHPX, LP, OR LPX ELEMENTS
-.627 DEGREE(S) ELECTRICAL BEAM TILT
8 PERCENT FIRST NULL FILL
1 PERCENT SECOND NULL FILL
POWER GAIN IS 2.049 IN THE HORIZONTAL PLANE(2.063 IN THE MAX.)

AUGUST 19, 2003

98.7 MHz.

ELEMENT SPACING
123.125 INCHES



KKFR ~ KKLT Broadcasting Scheme EXHIBIT - B1

FM TRANSMITTERS

KKFR 92.3 MHz.
KKLT 98.7 MHz.

COMBINER
ELECTRONICS RESEARCH

963-4 @ 92.3 MHz.
963-4 @ 98.7 MHz
(See Exhibit A - 3)

ERI, 6 1/8"
RF Directional Coupler

Forward RF
Sample

AUX. ANTENNA
ELECTRONICS RESEARCH

MODEL SHPX-4AC6-SP
(See Exhibit A - 1)

Equipment Employed in Intermodulation Measurements
Exhibit B - 2

CALIBRATION SOURCE
1) Potomac Instruments ; Model FIM-71, Field Strength Meter
2) Wavetek Inc. ; Model 3000, Frequency Generator

SPECTRUM ANALYZER
Anritsu; Model S114B
Spectrum Analyzer

BAND PASS FILTER
PHELPS DODGE
ADJUSTABLE RANGE 76~120 MHz.

Attenuator
(If used)

RF VOLT METER
Potomac Instruments ; Model FIM-71
Field Strength Meter

Note *
All RF Connecting Cable Used In
Measurement Setup Is Double Shielded.

Broadcasting Scheme and Equipment Employed in Intermodulation Measurements

EXHIBIT B