Report Of Intermodulation Product Findings

KLTN 102.9 MHz. Missouri City, TX.
KAMA 104.9 MHz. Deer Park, TX.

Project# 22454W

June 30, 2009

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Report of Findings for Intermodulation Product Measurements

Exhibits Accompanying This Report

REPORT OF FINDINGS
KLTN / KAMA
102.9 MHz. / 104.9 MHz.

Introduction: This report of findings is based on data collected at the KLTN and KAMA broadcast facility located in Houston, Texas. The report includes measurements offered as proof that the combined operations of KLTN (102.9 MHz.), and KAMA (104.9) transmitters 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 diplex system are less than the maximum allowable level as required by section 73.317 (b) through (d). Jeff Taylor of Electronics Research, Inc. located in Chandler, Indiana performed the measurements summarized herein on June 30, 2009.

The following exhibits are provided:

Exhibit A:
- A-1 Drawing Depicting Antenna.
- A-2 SHPX-8BC-HW-SP Antenna Specification Sheet.
- A-3 Drawing Depicting Diplexed Scheme.
- A-4 973-8 Constant Impedance Combiner 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 F2 signifies the frequency causing the interference.

The Multiplexed System: These measurements were taken with the both FM stations operating from the combined antenna system. The KLTN and KAMA multiplexed system is fundamentally comprised of antenna, feed line and multiplexer unit. The SHPX-8BC-HW-SP (antenna) and 973-8 combiner units, are products of Electronics Research, Inc. while the 6 1/8" feedline is Dielectric. 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 973-8 Constant Impedance Combiner, filter system was installed. Specifically, the Diplexer utilizes one ERI Model 973-8 module for each frequency (102.9 MHz., and 104.9 MHz.). An interconnecting "U-Link" is required to complete the combiner which is illustrated in the attached Exhibit A-3. The multiplexer, fully assembled, exhibited transmitter port-to-port isolation in excess of -70 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 multiplexer's 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 -30 dB directivity and a forward signal sample of -45 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 Serial # 242 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 Serial # 7512028 signal generator was used. An Anritsu Model S114B Spectrum Analyzer Serial # 2082 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 KLTN and KAMA transmitters were operating at full licensed power. 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
KLTN 102.9	**6**	**-**	**120**	**2.5**	**123.5**	
KAMA 104.9	**6**	**-**	**120**	**13.7**	**112.3**	

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.

Table 2 - Third order Products.

	Carrier Frequencies	
Interfering Frequencies	**102.9**	**104.9**
KLTN 102.9	----	100.9
KAMA 104.9	106.9	----

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-2 for a layout of the measurement equipment.

Table 3 – Intermodulation Measurements

IM Measurements Taken in												
Product Frequency (MHz)	**Transmitter Frequency (MHz)**	**Interfering Frequency (MHz)**	**Pad (dB)**	**Bandpass Filter Loss (dB)**	**Total Loss**	**Full Scale Range (dBµ)**	**Scale Reading (dBµ)**	**Adjusted Level (dBµ)**	**Carrier Reference Level (dBµ)**	**Level Referenced to Carrier (dB)**	**Notes***	
Transmitter Mixes												
	102.9		**6**		**6**	**120**	**2.5**		**123.5**			
	104.9		**6**		**6**	**120**	**13.7**		**112.3**			
100.9	102.9	104.9	6	15	21	20	17.2	23.8	123.5	-99.7		
106.9	104.9	102.9	6	15.2	21.2	20	19.9	21.3	112.3	-91		

The Spectrum Analyzer was used to check the close in spectral attenuation of the carrier to confirm the operation of the transmitter is 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 on June 30, 2009 as summarized in this document, I, Jeff Taylor, find the subject system, specifically the transmitter and filter system for the operation of KLTN and KAMA into the 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 station operating on the installed system. Based on this recorded data, I conclude that KLTN and KAMA 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.

Jeff Taylor, Field Technician

State of Indiana)
) SS:
County of Warrick)

AFFIDAVIT

I, Jeff Taylor, 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 13 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 Univision Radio on behalf of radio Stations KLTN and KAMA in Houston, TX. to prepare this Report Of Findings.

Jeff Taylor; Field Technician

Jeff Taylor

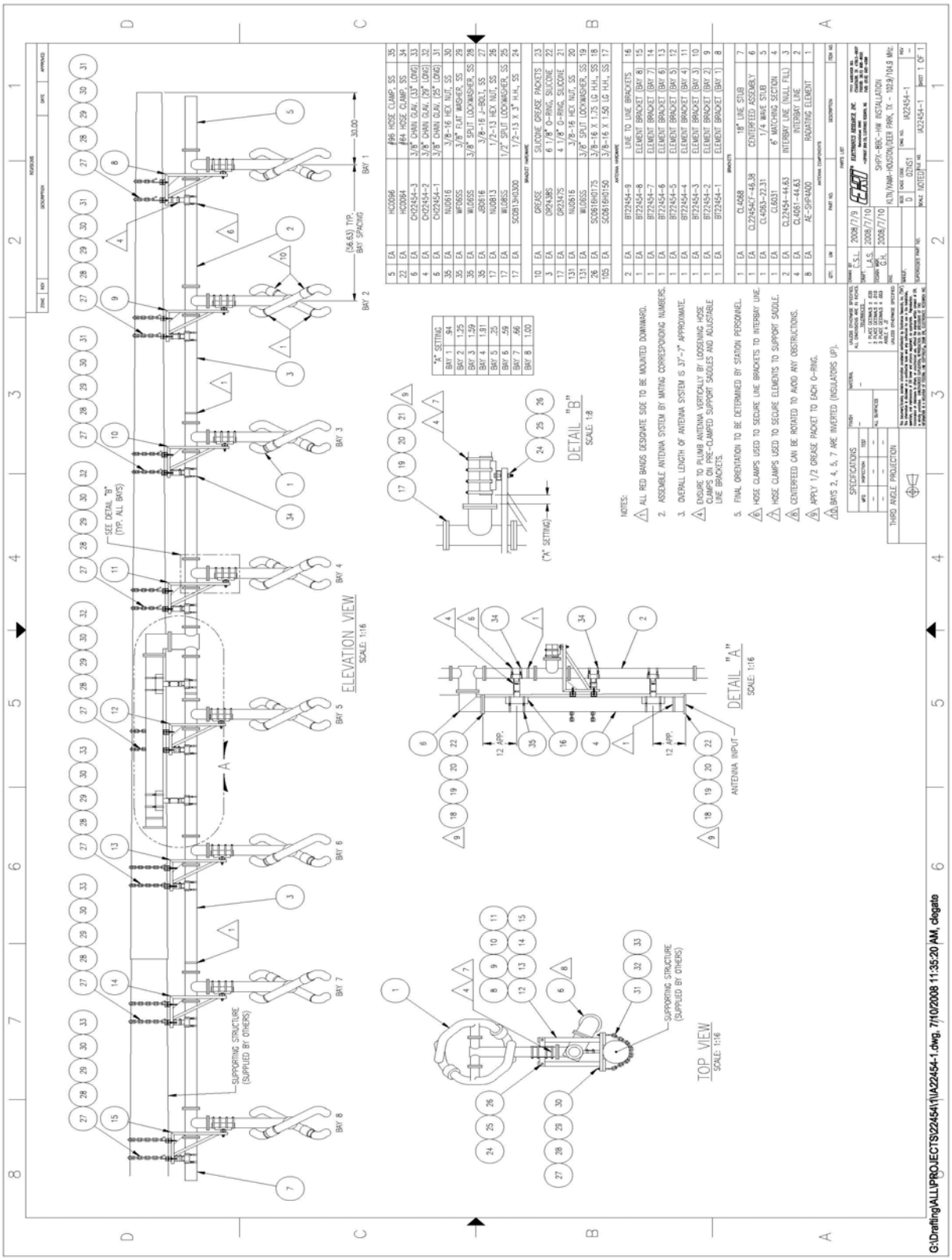
Subscribed and sworn to before me on this 6th, day of July, 2009.

Jacquelyn Kinney; Notary Public
My commission expires July 5, 2015

Jacquelyn S. Kinney

JACQUELYN S. KINNEY
Notary Public, State of Indiana
Vanderburgh County
My Commission Expires
July 05, 2015

EXHIBIT, A-1


ELEVATION VIEW
SCALE: 1:16
TOP VIEW
SCALE: 1:16
DETAIL "A"
SCALE: 1:16
DETAIL "B"
SCALE: 1:8
THIRD ANGLE PROJECTION
SHPX-BSC-HW INSTALLATION
KLN/HAM-HOUSTON/DEER PARK, TX - 1023/1049 MHz
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A-2 ERI Antenna Specification Sheet

Houston, TX.

General Specifications

Antenna Type . . . . . .High Power FM-Broadcast, Suitable For Multiplexing
Model Number SHPX-8BC-HW-SP
Number of Bay Levels ..... Eight
Polarization ..... Right Hand Circular

Electrical Specifications

Antenna Input Power Capability . . . . . 57 kW Max (1)
Operating Frequency Band ..... 102.9 ~ 104.9 Megahertz.
VSWR. . . . . <1.15:1 @ Operating Frequencies(2)
Azimuthal Pattern Circularity ..... Better Then +/- 1dB From RMS (Free Space)
Power Split ..... 50/50 (Horizontal & Vertical)
Frequency Specific Information:

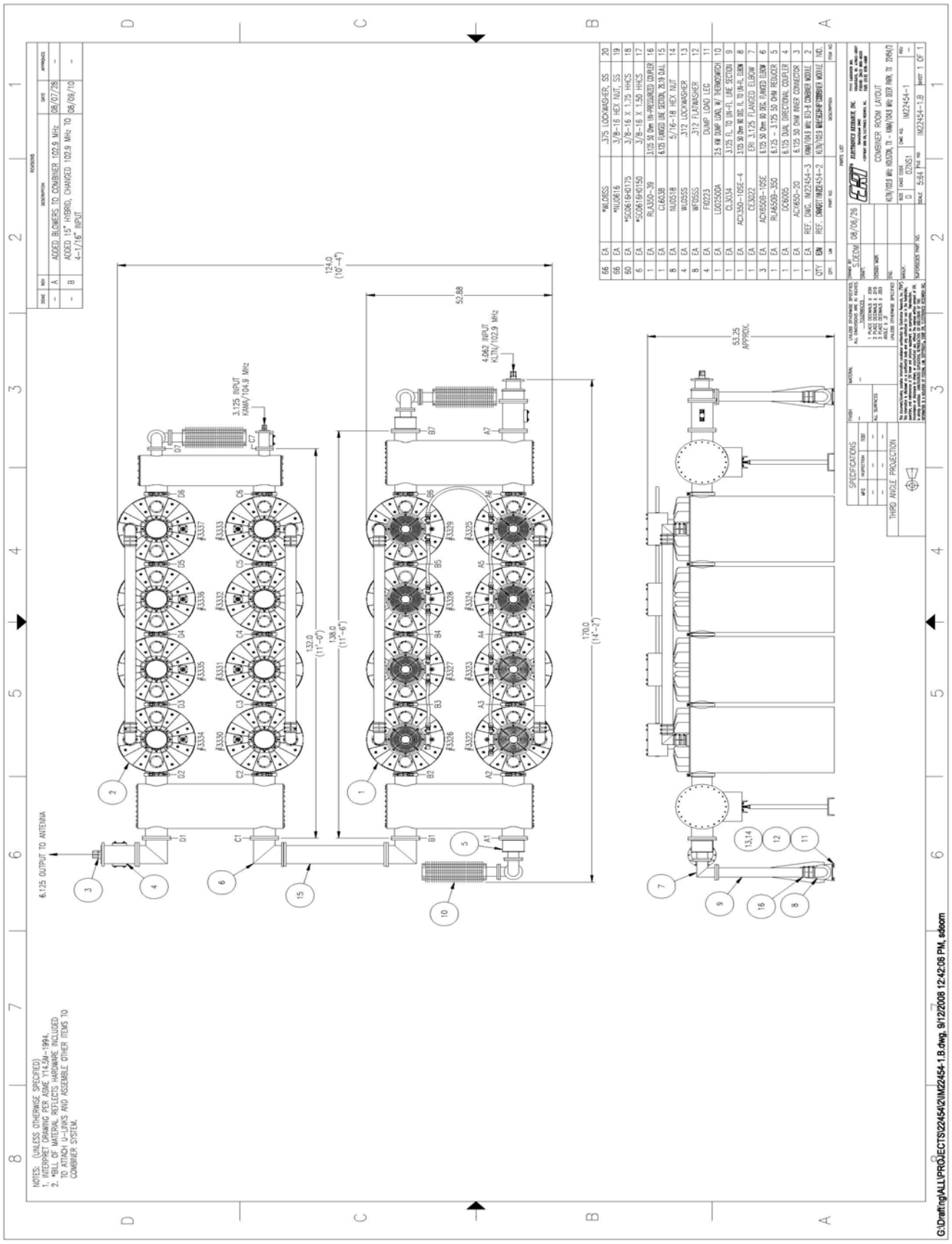
Frequency	Station ERP	Beam Tilt	First Null Fill	Second Null Fill	Power Gain	Line Loss (3)	Filter Loss (4)	Computed TPO
102.9	**100 KW**	**-.33°**	**10 %**	**5 %**	**2.430**	**-0.704 dB**	**.312 dB**	**52 kW**
104.9	**8.7 KW**	**-.33°**	**10 %**	**5 %**	**2.474**	**-0.584 dB**	**.286 dB**	**4.8 kW**

Mechanical Specifications

Antenna Feed System .....Fed With One 6 1/8” Line
Input Connector …… . 6 1/8”-50 Ohm EIA Flanged
Element Deicing..... None
Interbay Spacing ..... 56.625” Center to Center
Array Length..... 36 Feet
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 1103 Feet, 6 1/8" Rigid along with transmitter to input of filters. (per station)
4) Losses Taken From Actual Combiner.

EXHIBIT A-3


NOTES: (UNLESS OTHERWISE SPECIFIED)
1. INTERPRET DRAWING PER ASME Y14.5M-1994.
2. *BILL OF MATERIAL REFLECTS HARDWARE INCLUDED TO ATTACH U-LINKS AND ASSEMBLE OTHER ITEMS TO COMBINER SYSTEM.
6.125 OUTPUT TO ANTENNA
3.125 INPUT KAMA/104.9 MHz
4.062 INPUT KLTN/102.9 MHz
124.0 (10'-4")
52.88
132.0 (11'-0")
138.0 (11'-6")
170.0 (14'-2")
53.25 APPROX.
COMBINER ROOM LAYOUT
KLTN/1053 MHz HOUSTON, TX - KAMA/1043 MHz DEER PARK, TX 2004/2
IM22454-1
IM22454-1.B
THIRD ANGLE PROJECTION
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A-4 ERI Combiner Specification Sheet

Houston, TX.

General Specifications:

Diplexer Type .....973-8 Constant Impedance Combiner
Number of Combining Units ..... Two
Injected Port to Injected Port Isolation ..... < - 70 dB
Output Connector ..... 6 1/8 "50 Ohm EIA (Flanged)
Output Power (Designed) ..... 57 kW(1)

Heat Removal for 102.9 MHz. .....Forced Air Cooling
Heat Removal for 104.9 MHz. .....Natural Convection
Physical Arrangement ..... All Components Floor Standing

Injected Port Specifications:

Frequency Assignment .....102.9 and 104.9 MHz.
Power Rating, Each Injected Port (Designed).....52 kW for 102.9 and 4.1 kW for 104.9 MHz.
Input Connector .....6 1/8" for 102.9 MHz. / 3 1/8" for 104.9 MHz.
VSWR.....< 1.07:1 @ +/-200 KHz.(2)
Group Delay .....Less than 75 ns Overall Variation, Carrier @ +/- 150 KHz.
Insertion Loss (Measured):

102.9 MHz. ..... - 0.312 dB
104.9 MHz. ..... - 0.286 dB

1) Power Rating Listed is as Designed Only. Actual Power Capabilities May Vary.
2) When Terminated in 50 Ohm Resistive Load.

EXHIBIT A – 5

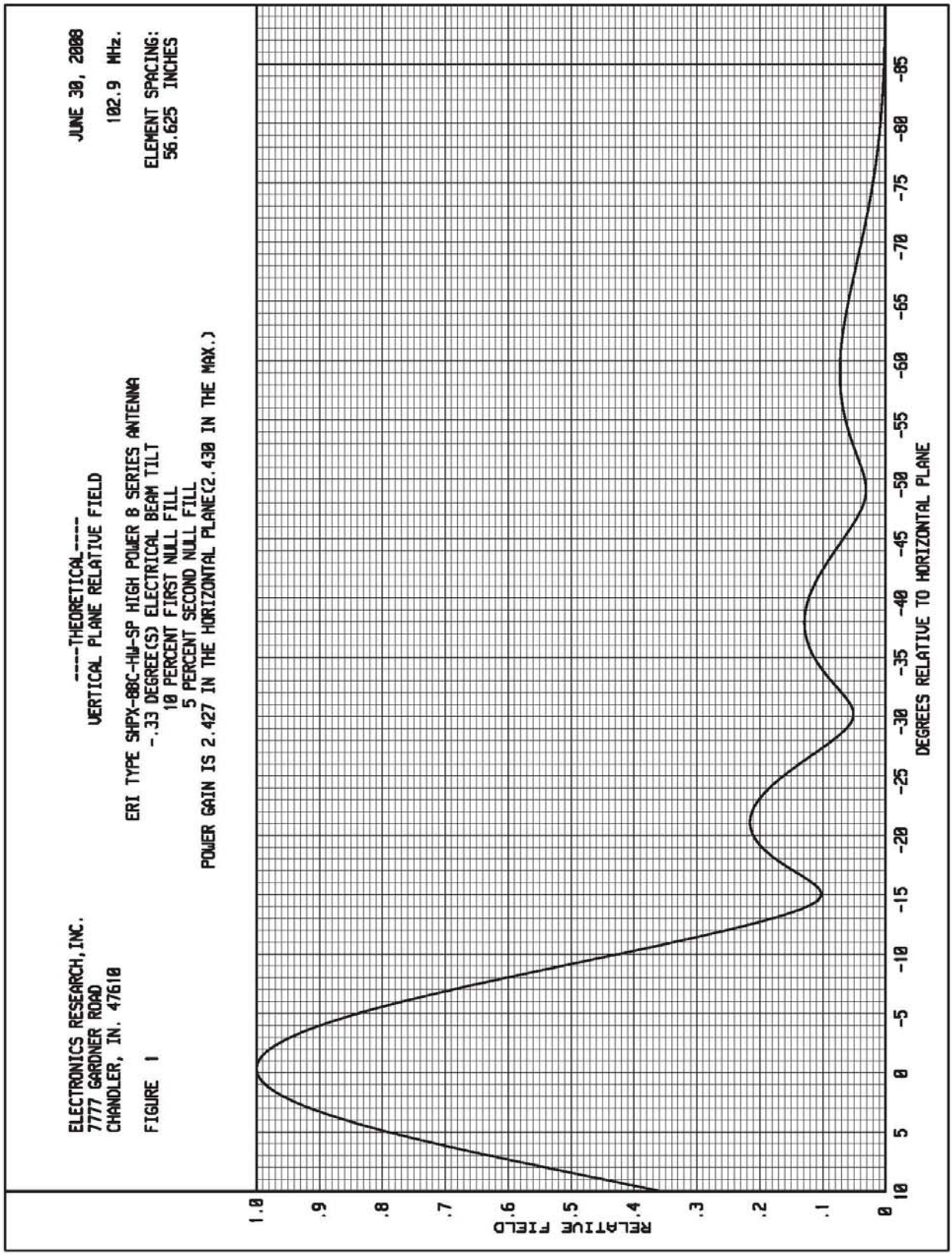
ELECTRONICS RESEARCH, INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610
FIGURE 1
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD
ERI TYPE SHPX-88C-HW-SP HIGH POWER B SERIES ANTENNA
-.33 DEGREE(S) ELECTRICAL BEAM TILT
10 PERCENT FIRST NULL FILL
5 PERCENT SECOND NULL FILL
POWER GAIN IS 2.427 IN THE HORIZONTAL PLANE(2.430 IN THE MAX.)
JUNE 30, 2008
102.9 MHz.
ELEMENT SPACING:
56.625 INCHES
RELATIVE FIELD
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85
DEGREES RELATIVE TO HORIZONTAL PLANE

EXHIBIT A – 5

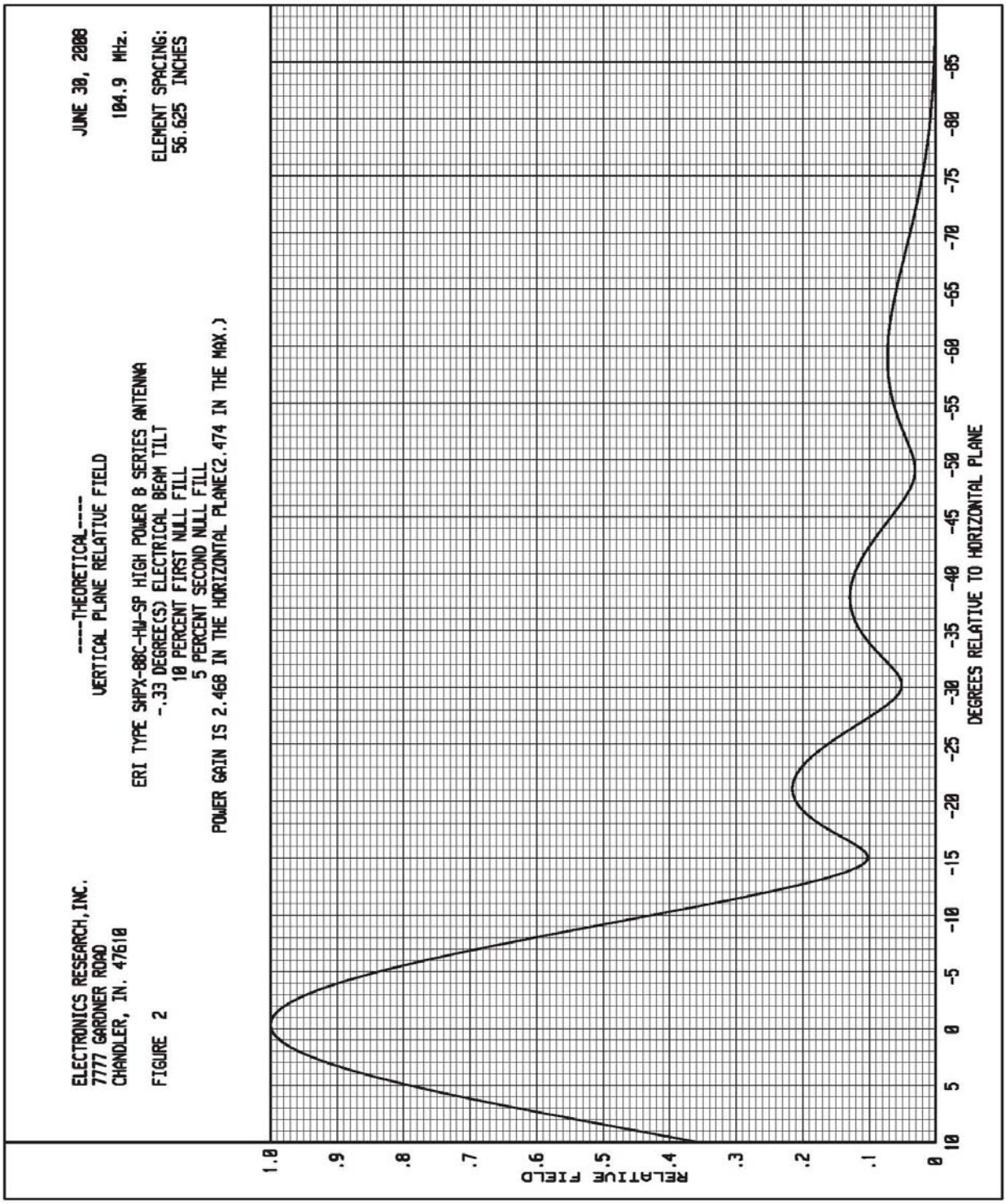
ELECTRONICS RESEARCH,INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610
FIGURE 2
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD
ERI TYPE SHPX-08C-HW-SP HIGH POWER B SERIES ANTENNA
-.33 DEGREE(S) ELECTRICAL BEAM TILT
10 PERCENT FIRST NULL FILL
5 PERCENT SECOND NULL FILL
POWER GAIN IS 2.468 IN THE HORIZONTAL PLANE(2.474 IN THE MAX.)
JUNE 30, 2000
184.9 Mhz.
ELEMENT SPACING:
56.625 INCHES
RELATIVE FIELD
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85
DEGREES RELATIVE TO HORIZONTAL PLANE

EXHIBIT B

Broadcasting Scheme and Equipment Employed in Intermodulation Measurements