Report Of Intermodulation Product Findings

OKLAHOMA CITY, OKLAHOMA

KOMA – 92.5 MHz.
K243BJ – 96.5 MHz.
K238BW – 104.5 MHz.
KRXO – 107.7 MHz.

Project# 31411

May 21, 2014

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

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REPORT OF FINDINGS
OKLAHOMA CITY, OKLAHOMA
BROADCAST FACILITY

Introduction: This report of findings is based on data collected at the FM broadcast facility located in Oklahoma City, OK. The report includes measurements offered as proof that the combined operations of KOMA (92.5 MHz.), K243BJ (96.5 MHz.), K238BW (104.5 MHz.), and KRXO (107.7 MHz.) 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 multiplexed 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 May 21, 2014.

The following exhibits are provided:

Exhibit A:
- A-1 Drawing Depicting Antenna.
- A-2 SHPXA-8AC-HW-SP Antenna Specification Sheet.
- A-3 Drawing Depicting Multiplexed Scheme.
- A-4 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 F2 signifies the frequency causing the interference.

The Multiplexed System: These measurements were taken with all FM stations operating from the combined antenna system. The KOMA, K243BJ, K238BW, and KRXO multiplexed system is fundamentally comprised of antenna, feed line and multiplexer unit. The SHPXA-8AC-SP (antenna), 955 Constant Impedance combiner units, and feedline, are products of Electronics Research, Inc. Refer to Exhibit B-1, for an illustration of the Broadcasting Scheme of these stations.

To accomplish the aggregation of four transmitter signals into a common antenna feed and provide transmitter-to-transmitter isolation, a multiplexing scheme consisting of (2) 955 Constant Impedance Combiners and (2) 935 Bandpass, filter system was installed. Specifically, the combiner utilizes two ERI Model 955 modules for frequency (92.5 MHz. and 107.7 MHz.) and two ERI Model 935 Bandpass modules for frequency (96.5 MHz. and 104.5 MHz.). Interconnecting "u-links" are 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 -76 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 -54 dB directivity and a forward signal sample of -30 dB.

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 # 686 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 # 5362199 signal generator was used. A Rhode & Schwarz ZVL3 Spectrum Analyzer Serial # 100396 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 A-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 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)	Full Scale Range (dBu)	Scale Reading (dBu)	**Carrier Level (dBu)**	Notes
92.5	**3**	**120**	**9.8**	**113.2**	
96.5	**3**	**120**	**7.1**	**115.9**	
104.5	**3**	**120**	**3.3**	**119.7**	
107.7	**3**	**120**	**5.9**	**117.1**	

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	**92.5**	**96.5**	**104.5**	**107.7**
KWDD 92.5 MHz.	----	100.5	116.5	122.9
KXLR 96.5 MHz.	88.5	----	112.5	118.9
KWLF 104.5 MHz.	80.5	88.5	----	110.9
KTDZ 107.7 MHz.	77.3	85.3	101.3	----

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-2 for a layout of the measurement equipment.

Table 3 – Intermodulation Measurements

IM Measurements Taken in Oklahoma City, OK. System											
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											
	92.5	**Ref.**	**3**		**3**	**120**	**9.8**		**113.2**		
	96.5	**Ref.**	**3**		**3**	**120**	**7.1**		**115.9**		
	104.5	**Ref.**	**3**		**3**	**120**	**3.3**		**119.7**		
	107.7	**Ref.**	**3**		**3**	**120**	**5.9**		**117.1**		
77.3	92.5	107.7	3	10.2	13.2	20	20	13.2	113.2	-100	
80.5	92.5	104.5	3	10.3	13.3	20	20	13.3	113.2	-99.9	
85.3	96.5	107.7	3	10.2	13.2	20	20	13.2	115.9	-102.7	
88.5	92.5	96.5	3	10.2	13.2	20	4.8	28.4	113.2	-84.8	
88.5	96.5	104.5	3	10.2	13.2	40	4.8	48.4	115.9	-67.5	LC 88.5 KZTH
100.5	96.5	92.5	3	9.6	12.6	40	18.3	34.3	115.9	-81.6	LC 100.5 KATT
101.3	104.5	107.7	3	9.8	12.8	20	20	12.8	119.7	-106.9	
110.9	107.7	104.5	3	9.2	12.2	20	20	12.2	117.1	-104.9	
112.5	104.5	96.5	3	9.1	12.1	20	20	12.1	119.7	-107.6	
116.5	104.5	92.5	3	8.9	11.9	20	20	11.9	119.7	-107.8	
118.9	107.7	96.5	3	8.8	11.8	20	20	11.8	117.1	-105.3	
122.9	107.7	92.5	3	8.9	11.9	20	20	11.9	117.1	-105.2	

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 May 21, 2014 as summarized in this document, I, Jeff Taylor, find the subject system, specifically the transmitter and filter system for the operation of KOMA, K243BJ, K238BW, and KRXO 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 KOMA, K243BJ, K238BW, and KRXO 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 18 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.

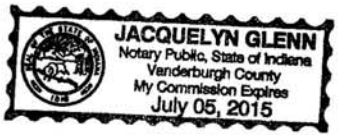
3.) ERI has been requested by Tyler Media on behalf of radio Stations KOMA, K243BJ, K238BW, and KRXO in Oklahoma City, OK. to prepare this Report Of Findings.

Jeff Taylor; Field Technician

Jeff Taylor

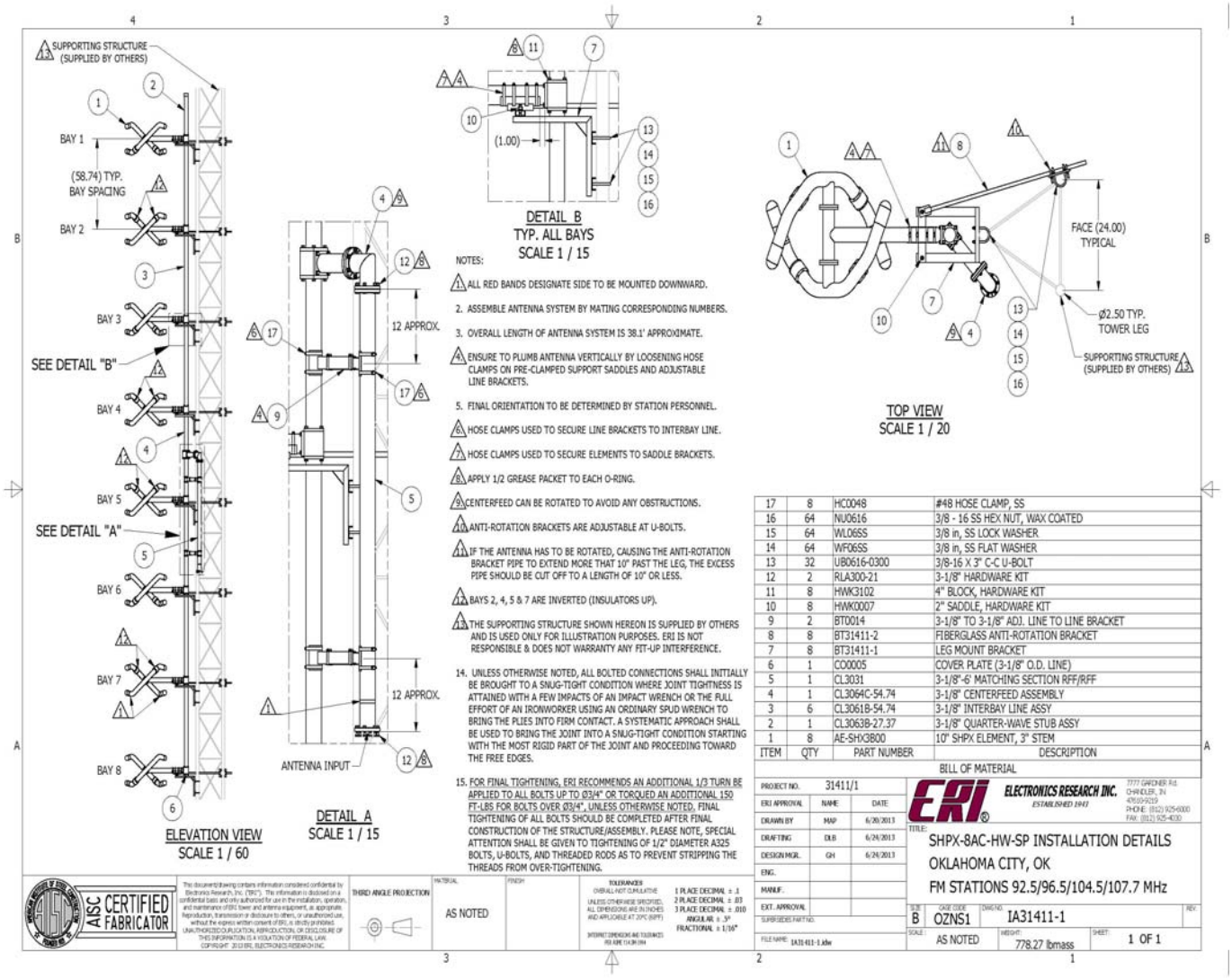
Subscribed and sworn to before me on this 30th, day of May, 2014.

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



Jacquelyn S. Glenn

EXHIBIT, A-1



NOTES:

1. ALL RED BANDS DESIGNATE SIDE TO BE MOUNTED DOWNWARD.
2. ASSEMBLE ANTENNA SYSTEM BY MATING CORRESPONDING NUMBERS.
3. OVERALL LENGTH OF ANTENNA SYSTEM IS 38.1' APPROXIMATE.
4. ENSURE TO PLUMB ANTENNA VERTICALLY BY LOOSENING HOSE CLAMPS ON PRE-CLAMPED SUPPORT SADDLES AND ADJUSTABLE LINE BRACKETS.
5. FINAL ORIENTATION TO BE DETERMINED BY STATION PERSONNEL.
6. HOSE CLAMPS USED TO SECURE LINE BRACKETS TO INTERBAY LINE.
7. HOSE CLAMPS USED TO SECURE ELEMENTS TO SADDLE BRACKETS.
8. APPLY 1/2 GREASE PACKET TO EACH O-RING.
9. CENTERFEED CAN BE ROTATED TO AVOID ANY OBSTRUCTIONS.
10. ANTI-ROTATION BRACKETS ARE ADJUSTABLE AT U-BOLTS.
11. IF THE ANTENNA HAS TO BE ROTATED, CAUSING THE ANTI-ROTATION BRACKET PIPE TO EXTEND MORE THAT 10" PAST THE LEG, THE EXCESS PIPE SHOULD BE CUT OFF TO A LENGTH OF 10" OR LESS.
12. BAYS 2, 4, 5 & 7 ARE INVERTED (INSULATORS UP).
13. THE SUPPORTING STRUCTURE SHOWN HEREON IS SUPPLIED BY OTHERS AND IS USED ONLY FOR ILLUSTRATION PURPOSES. ERI IS NOT RESPONSIBLE & DOES NOT WARRANTY ANY FIT-UP INTERFERENCE.
14. UNLESS OTHERWISE NOTED, ALL BOLTED CONNECTIONS SHALL INITIALLY BE BROUGHT TO A SNUG-TIGHT CONDITION WHERE JOINT TIGHTNESS IS ATTAINED WITH A FEW IMPACTS OF AN IMPACT WRENCH OR THE FULL EFFORT OF AN IRONWORKER USING AN ORDINARY SPUD WRENCH TO BRING THE PLIES INTO FIRM CONTACT. A SYSTEMATIC APPROACH SHALL BE USED TO BRING THE JOINT INTO A SNUG-TIGHT CONDITION STARTING WITH THE MOST RIGID PART OF THE JOINT AND PROCEEDING TOWARD THE FREE EDGES.
15. FOR FINAL TIGHTENING, ERI RECOMMENDS AN ADDITIONAL 1/3 TURN BE APPLIED TO ALL BOLTS UP TO Ø3/4" OR TORQUED AN ADDITIONAL 150 FT-LBS FOR BOLTS OVER Ø3/4", UNLESS OTHERWISE NOTED. FINAL TIGHTENING OF ALL BOLTS SHOULD BE COMPLETED AFTER FINAL CONSTRUCTION OF THE STRUCTURE/ASSEMBLY. PLEASE NOTE, SPECIAL ATTENTION SHALL BE GIVEN TO TIGHTENING OF 1/2" DIAMETER A325 BOLTS, U-BOLTS, AND THREADED RODS AS TO PREVENT STRIPPING THE THREADS FROM OVER-TIGHTENING.

ITEM	QTY	PART NUMBER	DESCRIPTION
17	8	HC0048	#48 HOSE CLAMP, SS
16	64	NU0616	3/8 - 16 SS HEX NUT, WAX COATED
15	64	WL06SS	3/8 in, SS LOCK WASHER
14	64	WF06SS	3/8 in, SS FLAT WASHER
13	32	UB0616-0300	3/8-16 X 3" C-C U-BOLT
12	2	RLA300-21	3-1/8" HARDWARE KIT
11	8	HWK3102	4" BLOCK, HARDWARE KIT
10	8	HWK0007	2" SADDLE, HARDWARE KIT
9	2	BT0014	3-1/8" TO 3-1/8" ADJ. LINE TO LINE BRACKET
8	8	BT31411-2	FIBERGLASS ANTI-ROTATION BRACKET
7	8	BT31411-1	LEG MOUNT BRACKET
6	1	CO0005	COVER PLATE (3-1/8" O.D. LINE)
5	1	CL3031	3-1/8"-6' MATCHING SECTION RFF/RFF
4	1	CL3064C-54.74	3-1/8" CENTERFEED ASSEMBLY
3	6	CL3061B-54.74	3-1/8" INTERBAY LINE ASSY
2	1	CL3063B-27.37	3-1/8" QUARTER-WAVE STUB ASSY
1	8	AE-SHX3B00	10' SHPX ELEMENT, 3" STEM

BILL OF MATERIAL

PROJECT NO.	31411/1	
ERI APPROVAL	NAME	DATE
DRAWN BY	MAP	6/20/2013
DRAFTING	DLB	6/24/2013
DESIGN MGR.	GH	6/24/2013
ENG.		
MANUF.		
EXT. APPROVAL		
SUPERSEDES PART NO.		
FILE NAME: IA31411-1.idw		

ELECTRONICS RESEARCH INC. ESTABLISHED 1941
2777 GARDNER Rd. CHANDLER, IN 47610-9229 PHONE: (812) 925-6000 FAX: (812) 925-4030

TITLE:
SHPX-8AC-HW-SP INSTALLATION DETAILS
OKLAHOMA CITY, OK
FM STATIONS 92.5/96.5/104.5/107.7 MHz

SIZE	CAGE CODE	DWG NO.	REV
B	OZNS1	IA31411-1	

SCALE: AS NOTED | WEIGHT: 778.27 lbmass | SHEET: 1 OF 1

AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION | MATERIAL: AS NOTED | FINISH

TOLERANCES (OVERALL AND NOT CUMULATIVE) UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES AND APPLICABLE AT 20°C (68°F)
INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994
1 PLACE DECIMAL ± .1
2 PLACE DECIMAL ± .03
3 PLACE DECIMAL ± .010
ANGULAR ± .5°
FRACTIONAL ± 1/16"

A-2 ERI Antenna Specification Sheet

TRANSMISSION SITE
OKLAHOMA CITY, OKLAHOMA

General Specifications

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

Electrical Specifications

Antenna Input Power Capability . . . . . 16 kW Max (1)
Operating Frequency Band ..... 92.5 ~ 107.7 Megahertz.
VSWR. . . . . <1.02:1 @ Operating Frequencies(2)
Azimuthal Pattern Circularity ..... Better Then +/- 2dB 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
92.5	**7.83 KW**	**0°**	**18 %**	**1 %**	**2.195**	**-1.1402 dB**	**-0.328 dB**	**5.000 kW**
96.5	**0.12 KW**	**0°**	**9 %**	**0 %**	**2.400**	**-1.1613 dB**	**-0.452 dB**	**0.072 kW**
104.5	**0.25 KW**	**0°**	**11 %**	**0 %**	**2.564**	**-1.2129 dB**	**-0.582 dB**	**0.147 kW**
107.7	**17.53 KW**	**0°**	**19 %**	**1 %**	**2.521**	**-1.2328 dB**	**-0.346 dB**	**10.00 kW**

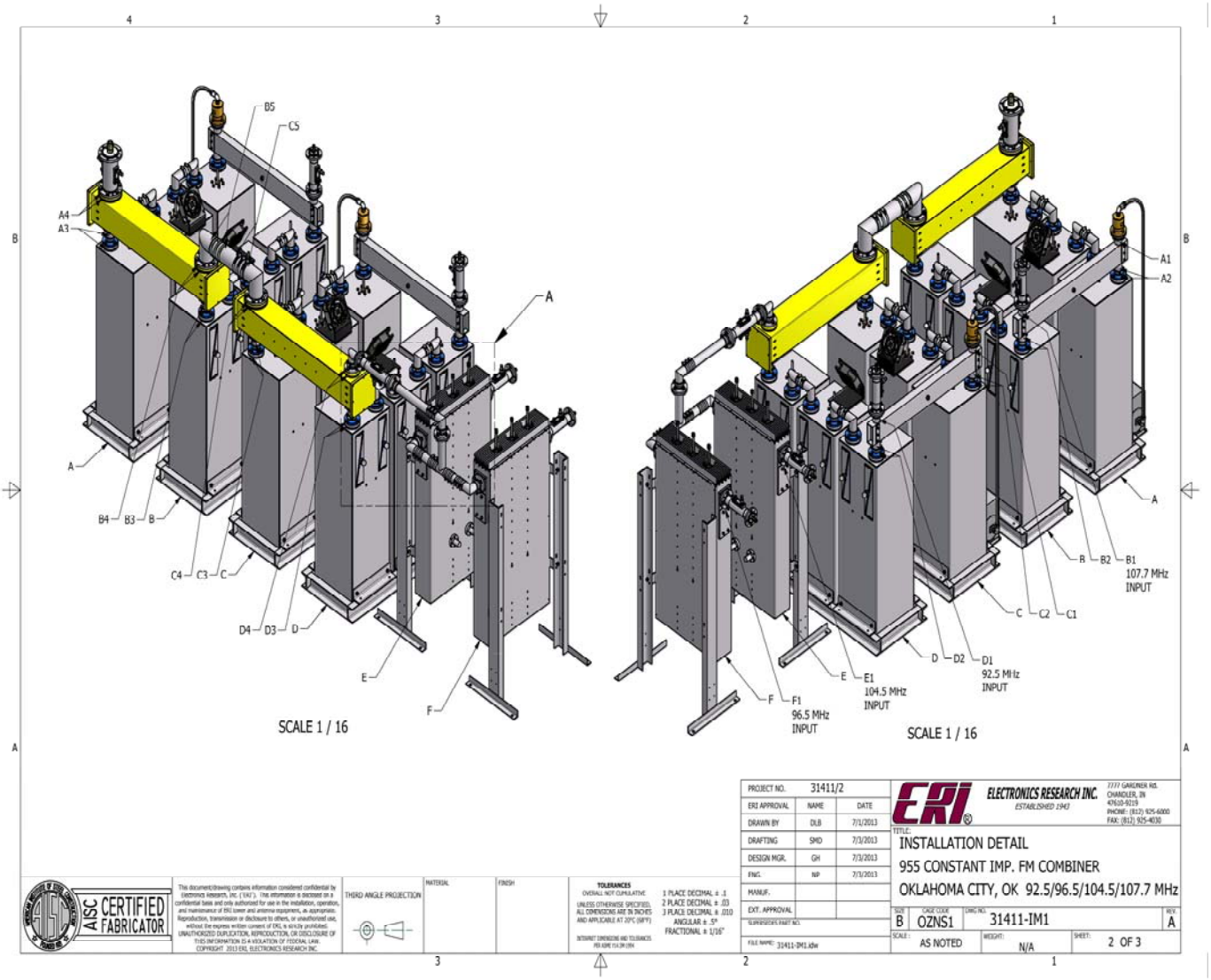
Mechanical Specifications

Antenna Feed System .....Single Input
Input Connector …… . 3 1/8”-50 Ohm EIA Flanged
Element Deicing.....None
Interbay Spacing ..... 58.75” Center to Center
Array Length..... 36.7 Feet
Construction Material (Antenna) ..... Galvanized Plated Steel and Stainless Steel
Construction Material (Mounting)..... Leg

.

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 111 Feet of MACXLine-350 3 1/8” Rigid and 941 Feet of Andrew HJ11-50 4” Heliax.
4) Losses Taken From Actual Combiner.

EXHIBIT A-3



PROJECT NO.	31411/2	
ERI APPROVAL	NAME	DATE
DRAWN BY	DLB	7/1/2013
DRAFTING	SMD	7/3/2013
DESIGN MGR.	GH	7/3/2013
ENG.	NP	7/3/2013
MANUF.		
EXT. APPROVAL		

ELECTRONICS RESEARCH INC.
ESTABLISHED 1941
7777 GARDNER RD.
CHANDLER, IN
47610-9219
PHONE: (812) 925-6000
FAX: (812) 925-4030

TITLE:
INSTALLATION DETAIL
955 CONSTANT IMP. FM COMBINER
OKLAHOMA CITY, OK 92.5/96.5/104.5/107.7 MHz

SIZE	CAGE CODE	DWG NO.	REV
B	OZNS1	31411-IM1	A

SCALE: AS NOTED | WEIGHT: N/A | SHEET: 2 OF 3

FILE NAME: 31411-IM1.idw

AISC CERTIFIED FABRICATOR

THIRD ANGLE PROJECTION

MATERIAL

FINISH

TOLERANCES
OVERALL NOT CUMULATIVE.
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES AND APPLICABLE AT 20°C (68°F)
1 PLACE DECIMAL ± .1
2 PLACE DECIMAL ± .03
3 PLACE DECIMAL ± .010
ANGULAR ± .5°
FRACTIONAL ± 1/16"

A-4 ERI Combiner Specification Sheet

TRANSMISSION SITE
OKLAHOMA CITY, OKLAHOMA

General Specifications:

Multiplexer Type ..... Band Pass and Constant Impedance
Number of Combining Units ..... Four
Injected Port to Injected Port Isolation ..... < - 76 dB
Output Connector ..... 3 1/8 "50 Ohm EIA (Flanged)
Output Power (Designed) ..... 16 kW(1)

Heat Removal .....Forced Air cooling
Physical Arrangement ..... All Components Floor Standing

Injected Port Specifications:

Frequency Assignment ..... 92.5 ~ 96.5 ~ 104.1, and 107.7 MHz.
Power Rating, Each Injected Port (Designed)..... 4.000 kW
Input Connector .....1-5/8" 50 Ohm EIA (Flanged).
VSWR.....< 1.06:1 @ +/-150 KHz.(2)
Group Delay .....Less than 90 ns Overall Variation, Carrier @ +/- 150 KHz.
Insertion Loss (Measured):

94.3 MHz. ..... - 0.328 dB
95.9 MHz. ..... - 0.452 dB
98.1 MHz. ..... - 0.582 dB
103.9 MHz. ..... - 0.346 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

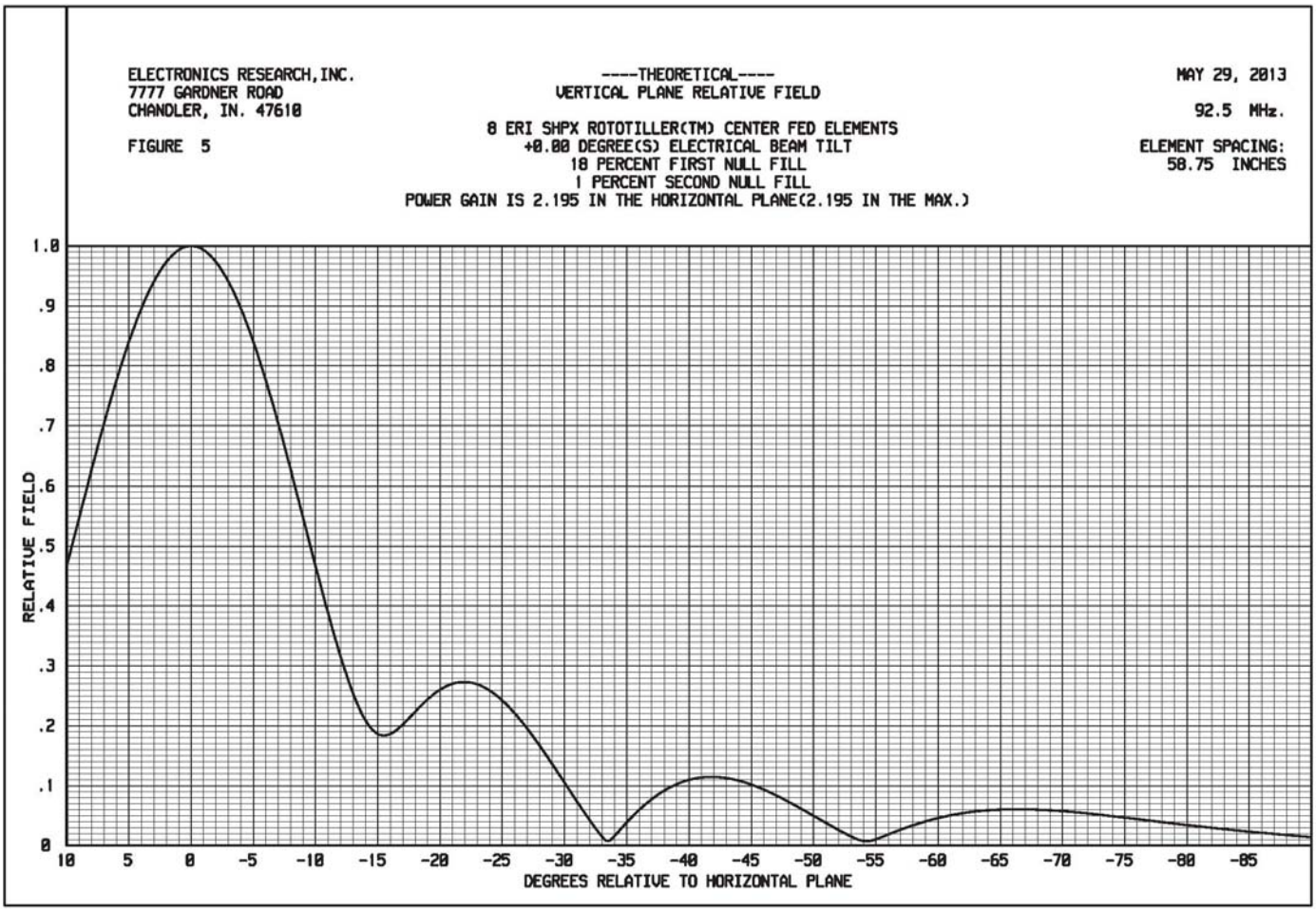

ELECTRONICS RESEARCH,INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610
FIGURE 5
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD
8 ERI SHPX ROTOTILLER(TM) CENTER FED ELEMENTS
+0.00 DEGREE(S) ELECTRICAL BEAM TILT
10 PERCENT FIRST NULL FILL
1 PERCENT SECOND NULL FILL
POWER GAIN IS 2.195 IN THE HORIZONTAL PLANE(2.195 IN THE MAX.)
MAY 29, 2013
92.5 MHz.
ELEMENT SPACING:
58.75 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

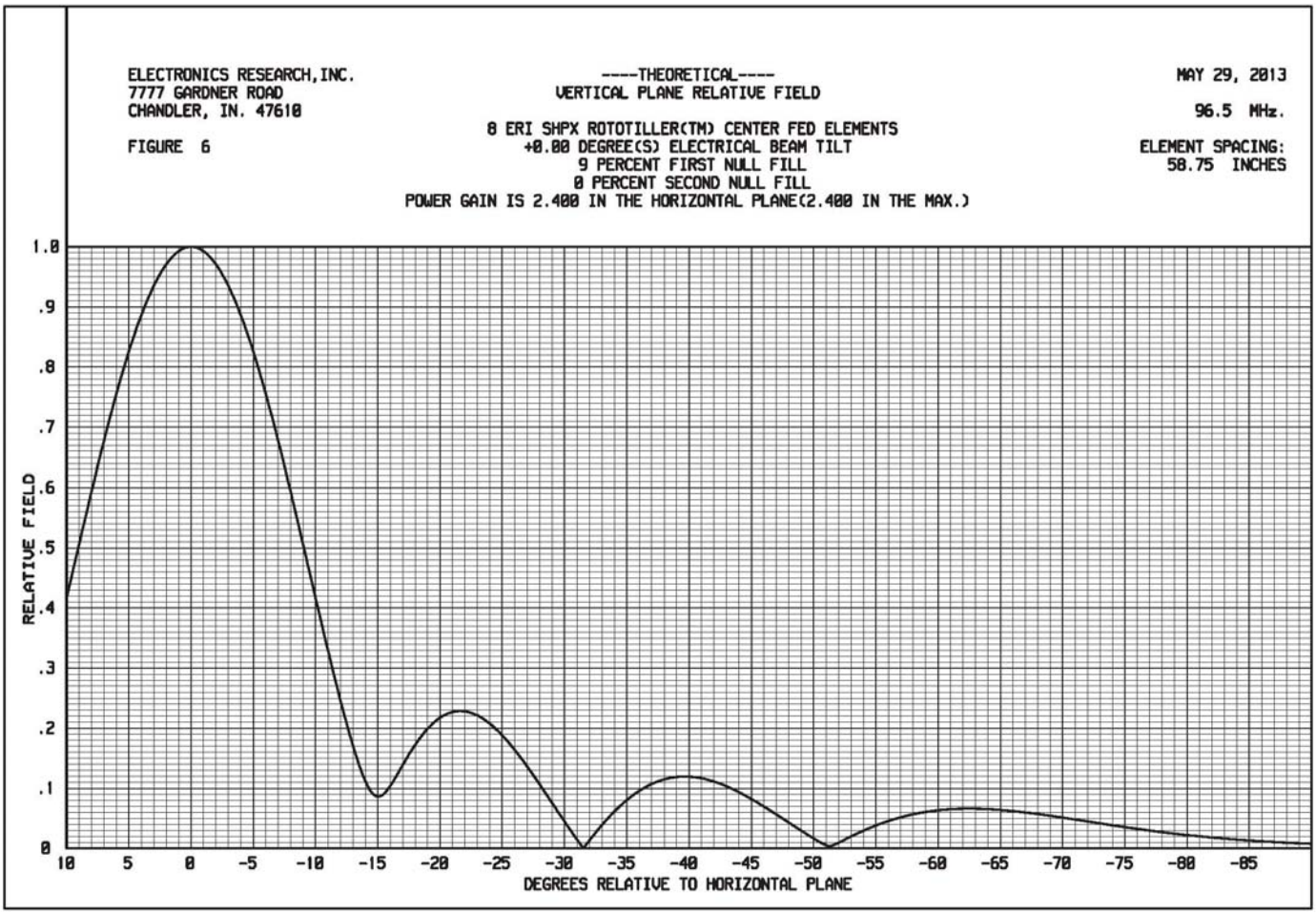

ELECTRONICS RESEARCH,INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610
FIGURE 6
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD
8 ERI SHPX ROTOTILLER(TM) CENTER FED ELEMENTS
+0.00 DEGREE(S) ELECTRICAL BEAM TILT
9 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL
POWER GAIN IS 2.400 IN THE HORIZONTAL PLANE(2.400 IN THE MAX.)
MAY 29, 2013
96.5 MHz.
ELEMENT SPACING:
58.75 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

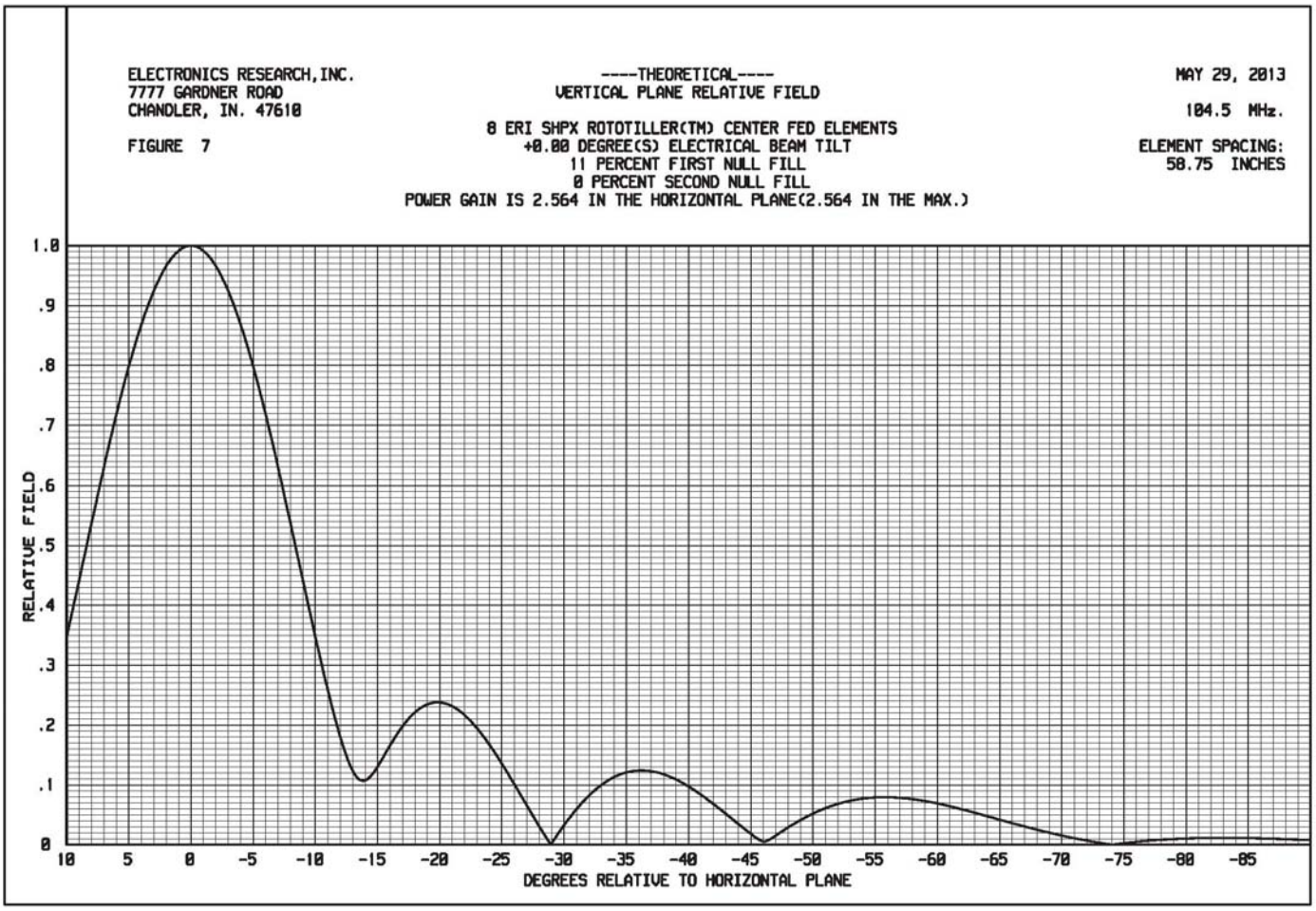
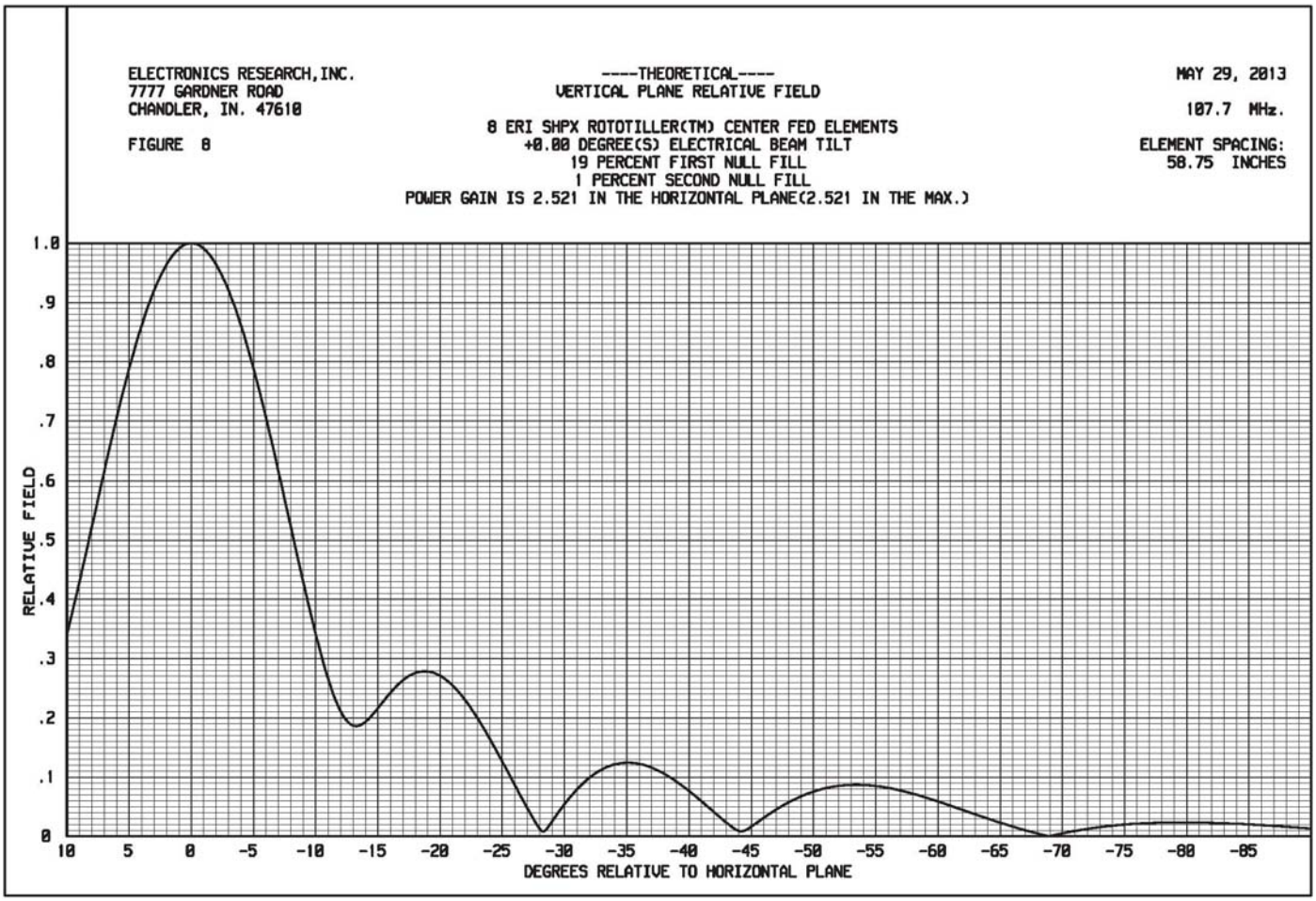
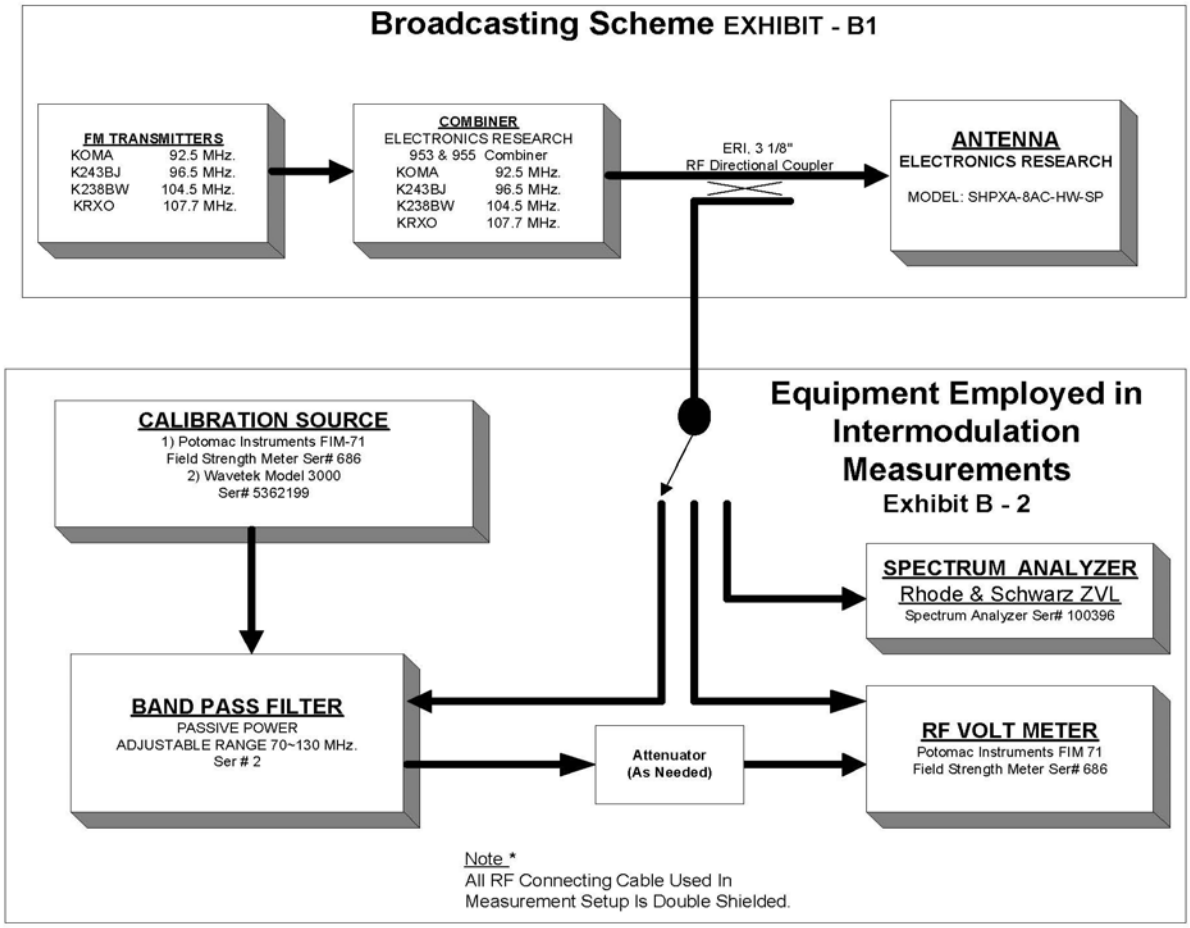

ELECTRONICS RESEARCH, INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610
FIGURE 7
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD
8 ERI SHPX ROTOTILLER(TM) CENTER FED ELEMENTS
+0.00 DEGREE(S) ELECTRICAL BEAM TILT
11 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL
POWER GAIN IS 2.564 IN THE HORIZONTAL PLANE(2.564 IN THE MAX.)
MAY 29, 2013
104.5 MHz.
ELEMENT SPACING:
58.75 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 8
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD
8 ERI SHPX ROTOTILLER(TM) CENTER FED ELEMENTS
+0.00 DEGREE(S) ELECTRICAL BEAM TILT
19 PERCENT FIRST NULL FILL
1 PERCENT SECOND NULL FILL
POWER GAIN IS 2.521 IN THE HORIZONTAL PLANE(2.521 IN THE MAX.)
MAY 29, 2013
187.7 MHz.
ELEMENT SPACING:
58.75 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



Broadcasting Scheme and Equipment Employed in Intermodulation Measurements

EXHIBIT B