ELECTRONICS RESEARCH, INC.
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Report Of Intermodulation Product Findings

KJZS, KURK, BROADCAST FACILITY
RENO ~ SPARKS, NEVADA

SEPTEMBER 2004

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REPORT OF FINDINGS
KJZS / KURK COMBINED BROADCAST FACILITY
RENO ~ SPARKS, NEVADA

Introduction: This report of findings is based on data collected at the KJZS and KURK combined FM broadcast facility located in Reno, NV. The report includes measurements offered as proof that the combined operations of KJZS (92.1 MHz.) and KURK (92.9 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 multiplex 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 September 24, 2004.

The following exhibits are provided:

Exhibit A:

A-1 Drawing Depicting Antenna.
A-2 SHPX-8AC-HW-SP Antenna Specification Sheet.
A-3 Drawing Depicting Multiplexing Scheme.
A-4 970-4/973-4 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 Second Order Products.
Table 3. Intermodulation Analysis Measurements.

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

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

The Multiplexed System : These measurements were taken with two FM stations operating from the combined antenna system. The KJZS, and KURK multiplexed system is fundamentally comprised of antenna, feed line and multiplexer unit. The SHPX-8AC-HW-SP antenna, 970 - 973 TEE multiplexer unit, and 3 1/8 rigid feedline are products of Electronics Research, Inc. Refer to Exhibit B-2, 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 was installed. Specifically, the Multiplexer utilizes four ERI Model 970 Bandpass filters with Group Delay Compensation for one transmitter, while the other utilizes four ERI Model 973 Bandpass filters with Group Delay Compensation for the other transmitter. An interconnecting TEE is required to complete the multiplexer which is illustrated in the attached Exhibit A-3. The multiplexer, fully assembled, exhibited transmitter port-to-port isolation in excess of -46 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 40 dB directivity and a forward signal sample of -54 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 IFR Model 2399A Spectrum Analyzer was used to measure the close in spectral attenuation of each carrier and wide band search for any anomalies that may need further investigation. See attached Exhibit B-1 for an illustration of the measurement equipment.

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

Table 1 - Carrier Reference Levels

Carrier Frequency (MHz)	Pad One (dB)	Bandpass Filter Loss (dB)	Full Scale Range (dBμ)	Scale Reading (dB)	Adjusted Level (dBμ)	Notes
KJZS (92.1)	3	---	120	- 7.0	**116.0**	
KURK (92.9)	3	---	140	- 18.5	**124.5**	

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.

Table 2 - Third order Products.

	Carrier Frequency (MHz)	
Interfering Frequency (MHz)	**KJZS 92.1**	**KURK 92.9**
KJZS 92.1	---	**93.7**
KURK 92.9	**91.3**	—
KUUB 94.5	**89.7**	**91.3**
KRNV 102.1	**82.1**	**83.7**

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*
82.1	92.1	102.1	3	9.8	20	<-20.0	<12.8	116.0	**<-116.0**	
83.7	92.9	102.1	3	9.9	20	<-20.0	<12.9	124.5	**<-124.5**	
89.7	92.1	94.5	3	11.5	20	<-20.0	<14.5	116.0	**<-116.0**	
91.3	92.1	92.9	3	12.5	40	- 9.7	45.8	116.0	**-70.2**	1&2
91.3	92.9	94.5	3	12.5	40	- 9.7	45.8	124.5	**-78.7**	1&2
93.7	92.9	92.1	3	10.1	60	- 14.8	58.3	124.5	**-66.2**	2&3

*** NOTES**

1) Measured signal is a local carrier KNIS transmitting at 91.3 MHz. (@ Carson City, NV. No discernable intermodulation product was measured.
2) 92.1 MHz. KJZS transmitter turned off for this measurement. No change in measured level detected.
3) Measured signal is a local carrier KWNS transmitting at 93.7 MHz. (@ Reno, NV. No discernable intermodulation product 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 September 24th, 2004 as summarized in this document, I, Jeff Taylor, find the subject multiplexed system- specifically the transmitters and combiner system for the operation of the KJZS and KURK into the SHPX-8AC-HW-SP ERI 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 KJZS and KURK 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 Jeff Taylor
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 7 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 Nextmedia on behalf of radio Stations KJZS and KURK in Reno,NV. to prepare this Report Of Findings.

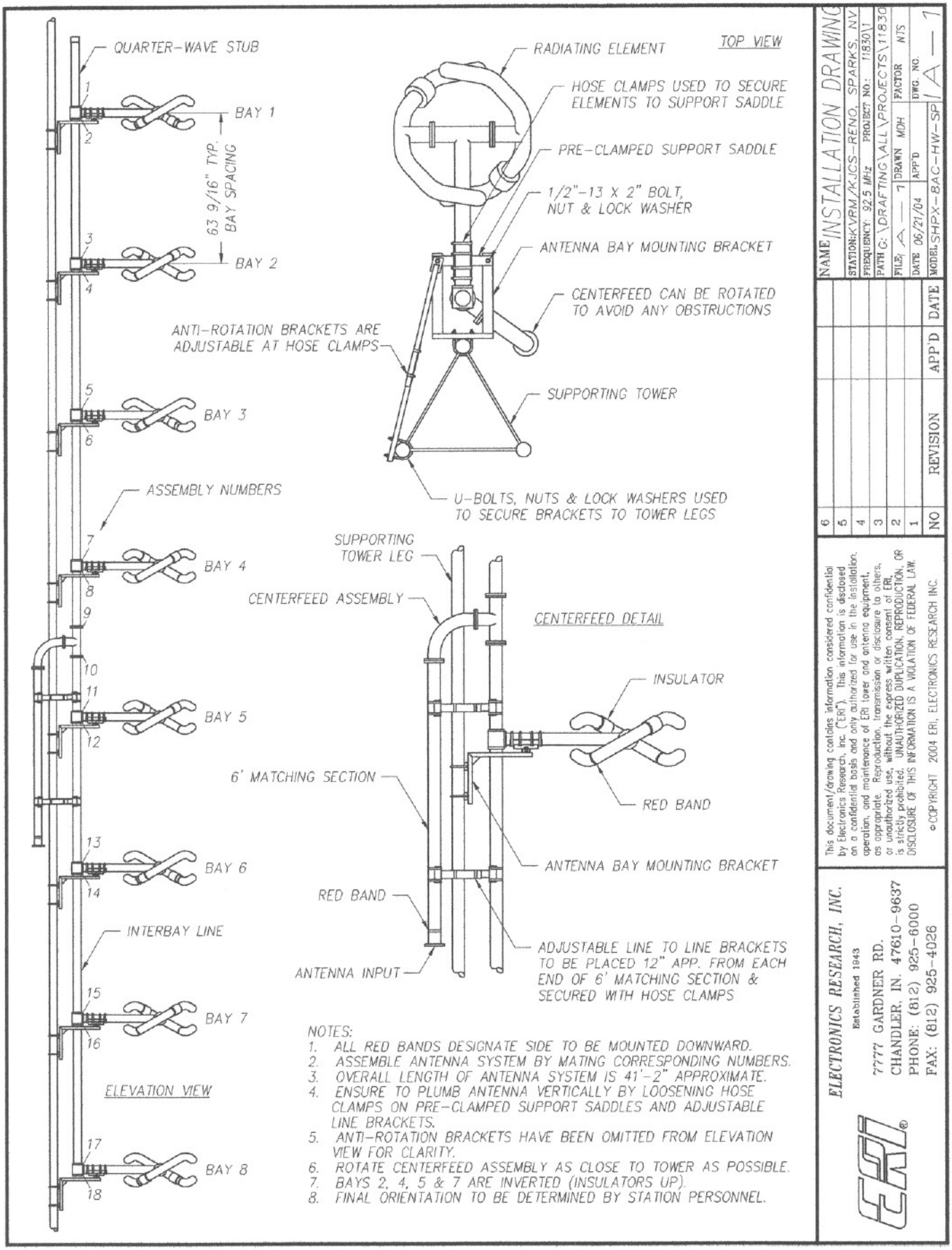
Jeff Taylor; Field Technician

Subscribed and sworn to before me on this 28th, day of September 2004.

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

NOTARY PUBLIC SEAL INDIANA

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 41'-2" APPROXIMATE.
4. ENSURE TO PLUMB ANTENNA VERTICALLY BY LOOSENING HOSE CLAMPS ON PRE-CLAMPED SUPPORT SADDLES AND ADJUSTABLE LINE BRACKETS.
5. ANTI-ROTATION BRACKETS HAVE BEEN OMITTED FROM ELEVATION VIEW FOR CLARITY.
6. ROTATE CENTERFEED ASSEMBLY AS CLOSE TO TOWER AS POSSIBLE.
7. BAYS 2, 4, 5 & 7 ARE INVERTED (INSULATORS UP).
8. FINAL ORIENTATION TO BE DETERMINED BY STATION PERSONNEL.

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

NAME: INSTALLATION DRAWING
STATION: KVRM/KJCS-RENO, SPARKS, NV
FREQUENCY: 92.5 MHz PROJECT NO: 11830\1
PATH G:\DRAFTING\ALL\PROJECTS\11830
FILE: A — 1 DRAWN MDH FACTOR N/S
DATE 06/21/04 APP'D DWG. NO. A — 1
MODEL: SHPX-8AC-HW-SP

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A-2 ERI Antenna Specification Sheet

Reno, Nevada

General Specifications

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

Electrical Specifications

Antenna Input Power Capability (Single Feed) . . . . . 26.4 KW Max (1)
Operating Frequency Band . . . . . 92.1 And 92.9 Megahertz.
VSWR. . . . . 1.15:1 @ Operating Frequencies(2)
Azimuthal Pattern Circularity . . . . . Less Than +/- 1.5 dB From RMS (Free Space)
Power Split . . . . . 50/50 (Horizontal & Vertical)
Quarter Wave Shorting Stub . . . . . Yes
Frequency Specific Information:

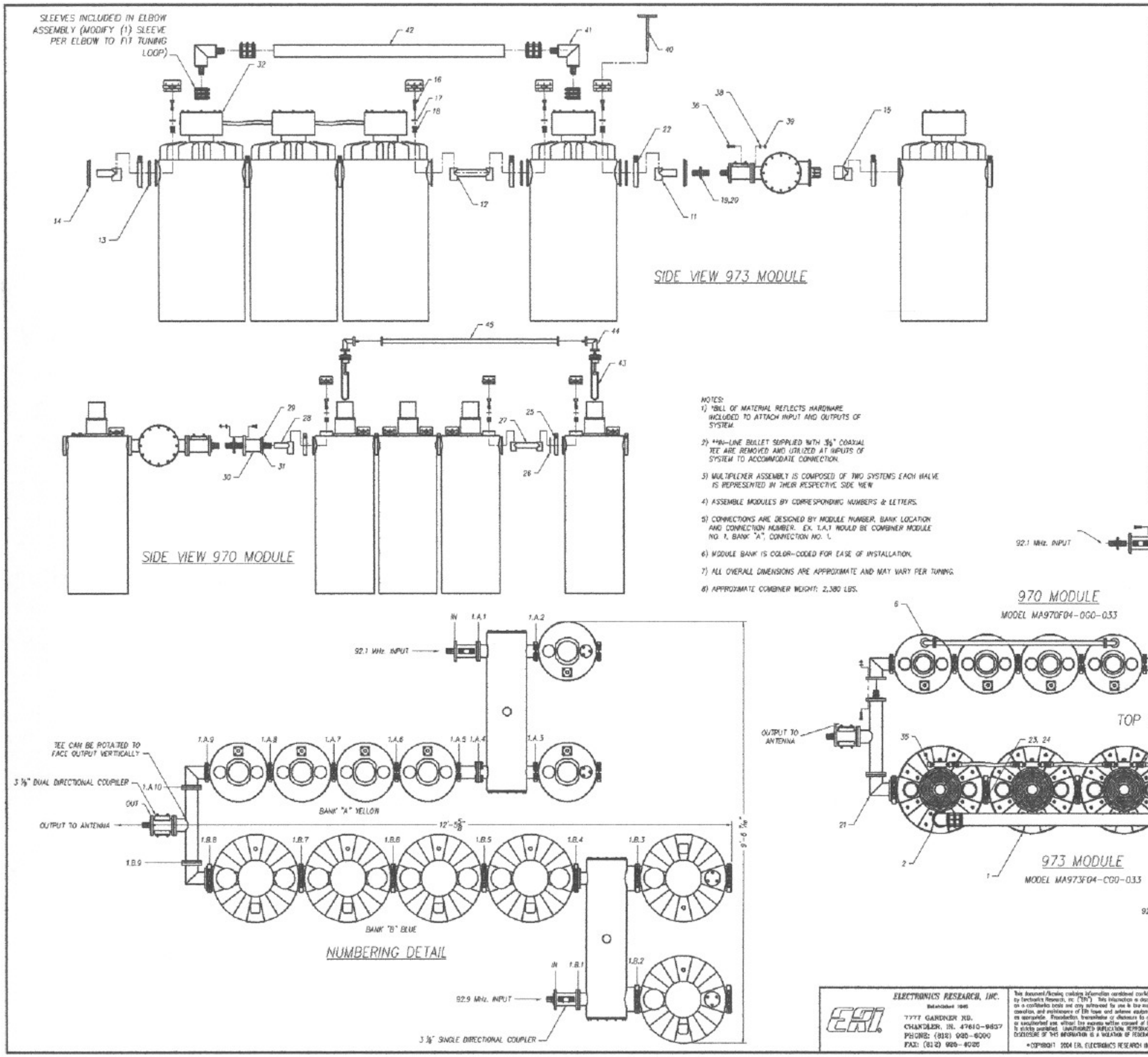
Frequency	Station ERP	Beam Tilt	First Null Fill	Second Null Fill	Power Gain	Line Loss (3)	Filter Loss (4)	Computed TPO
92.1	8.9 (KW)	0.0°	1 %	0%	2.508	.165 dB	.757 dB	4.3 (KW)
92.9	48 (KW)	0.0°	1 %	0%	2.528	.166 dB	.463 dB	21.9 (KW)

Mechanical Specifications

Antenna Feed System . . . . . Fed With Single Line
Input Connector . . . . . 3 1/8" 50- Ohm EIA Flanged
Element Deicing . . . . . None Ordered
Interbay Spacing . . . . . 63.5625" Center to Center
Array Length . . . . . Approximately 37' 1"
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 168.3 Feet, 3 1/8" ERI MacXline (Rigid).
4) Losses Taken From Actual Multiplexer Measurements.

EXHIBIT, A - 3



BILL OF MATERIAL

NO.	STOCK NO.	DESCRIPTION	QTY.
1	FI0073B	963 TYPE BAND PASS FILTER W/ DOUBLE LOOP	2
2	FI0075B	963 TYPE BAND PASS FILTER W/ DBL & TPL LOOP	2
3	FI0076	963 BAND PASS W/1 TRPL LOOP	2
4	HY0041	10" HYBRID	1
5	HY0040	10" HYBRID	1
6	FI0074	960 TYPE BAND PASS FILTER W/ 2 DOUBLE LOOPS	4
7	FI0224	960 TYPE BAND PASS FILTER W/ 1 DOUBLE LOOP	2
8	**CT3023	3-1/8" COAXIAL TEE	1
9	DC3005	3-1/8" DUAL DIRECTIONAL COUPLER	1
10	DC3003	3-1/8" SINGLE DIRECTIONAL COUPLER	2
11	FI0145	3" INNER PORT CONNECTOR	2
12	FI0147	INNER CONNECTING ASSEMBLY	3
13	FI0001	6" CONTACT RING	5
14	CF0029	6" MARMAN TO 3-1/8" EIA PORT ADAPTER	2
15	FI0148	6" INNER PORT CONNECTOR	2
16	FI0220	1/2"-13 X 2" LONG STEPPED BOLT	20
17	WF08SSA	1/2" FLATWASHER	20
18	SG0001	SPRING	20
19	*CC0021	3-1/8" IN-LINE BULLET	4
20	*IN0028	3" "S" SPLIT WAFER INSULATOR	3
21	CE3022M	3-1/8" EIA TO 3" MARMAN, 90° MITERED ELBOW	2
22	CM0036	6" MARMAN CLAMP	9
23	SC0518T0450	5/16"-18 X 4-1/2" LONG "T" BOLT	18
24	NU0518BZ	5/16"-18 BRONZE HEX NUT	18
25	CM0037	3" MARMAN CLAMP	9
26	FI0003	3" CONTACT RING	3
27	FI0132	INNER CONNECTING ASSEMBLY	3
28	FI0131	3" INNER PORT CONNECTOR	4
29	FI0006	3" CONTACT RING	1
30	CL3004	3-1/8" LINE SECTION MARMAN TO EIA	1
31	IN0073	INSULATOR W/ CONTACT RING GROOVE	1
32	FI0100	FILTER COOLING UNIT ASSEMBLY	6
33	EF0036	1/2" FLEXIBLE CONDUIT ADAPTER	11
34	ED0050F-PVC	1/2" FLEX CONDUIT (3) 18" LONG, (2) 36" LONG	126
35	C00111	1/2" PVC CAP	1
36	*SC0616H0150	3/8"-16 X 1-1/2" LONG HEXHEAD BOLT	42
37	SC0616H0100	3/8"-16 X 1" LONG HEXHEAD BOLT	12
38	*WL06SS	3/8" LOCKWASHER, SPLIT TYPE	54
39	*NU0616	3/8"-16 HEX NUT	42
40	FI0004	"T" HANDLE TOOL 1/2" SOCKET HEAD	1
41	CE3020	3 1/8" UNFLANGED TO UNFLANGED ELBOW	4
42	CL3180-50A	3 1/8" LINE SECTION UNFLGED (63 3/16")	2
43	TL-1	SPECIAL TUNING LOOP	2
44	N/A	7/8" MYAT ELBOW	2
45	N/A	7/8" LINE SECTION	1

NOTES:

1) *BILL OF MATERIAL REFLECTS HARDWARE INCLUDED TO ATTACH INPUT AND OUTPUTS OF SYSTEM.
2) **IN-LINE BULLET SUPPLIED WITH 3 1/8" COAXIAL TEE ARE REMOVED AND UTILIZED AT INPUTS OF SYSTEM TO ACCOMMODATE CONNECTION.
3) MULTIPLEXER ASSEMBLY IS COMPOSED OF TWO SYSTEMS EACH HALVE IS REPRESENTED IN THEIR RESPECTIVE SIDE VIEW
4) ASSEMBLE MODULES BY CORRESPONDING NUMBERS & LETTERS.
5) CONNECTIONS ARE DESIGNED BY MODULE NUMBER, BANK LOCATION AND CONNECTION NUMBER. EX. 1.A.1 WOULD BE COMBINER MODULE NO. 1, BANK "A", CONNECTION NO. 1.
6) MODULE BANK IS COLOR-CODED FOR EASE OF INSTALLATION.
7) ALL OVERALL DIMENSIONS ARE APPROXIMATE AND MAY VARY PER TUNING.
8) APPROXIMATE COMBINER WEIGHT: 2,380 LBS.

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

NAME: COMBINER INSTALLATION DRAWING
CUSTOMER: VRM\KJCS – RENO, SPARKS, NV.
FREQUENCY: 92.1, 92.9 MHz. PROJECT NO. 11830.2
PATH: C:\DRAFTING\ALL\PROJECTS\11830\2
FILE: M — 1 DRAWN: BAM SCALE: 1/16
DATE: 6/15/04 APP'D: DWG. NO.
MODEL: AS LISTED ABOVE M — 1

A-2 ERI Combiner Specification Sheet

RENO ~ SPARKS, NEVADA

General Specifications:

Multiplexer Type ..... TB73-4/70-4/3 TEE Combiner with Group Delays
Number Of Combining Units ..... Two
Injected Port to Injected Port Isolation ..... - 46 dB
Output Connector ..... 3 1/8 " 50 Ohm EIA (Flanged)
Output Power (Designed) ..... 26.3 KW(1)
Combiner Units, Size and Weight :

Type 970-4 Tuned To 92.1 MHz. ..... 49" ht. X 9' 6 7/16" wd. X 12' 5 5/8" lg. & 636 Lbs.
Type 973-4 Tuned To 92.9 MHz. .... 54" ht. X 9' 6 7/16" wd. X 12' 5 5/8" lg. & 1110 Lbs.

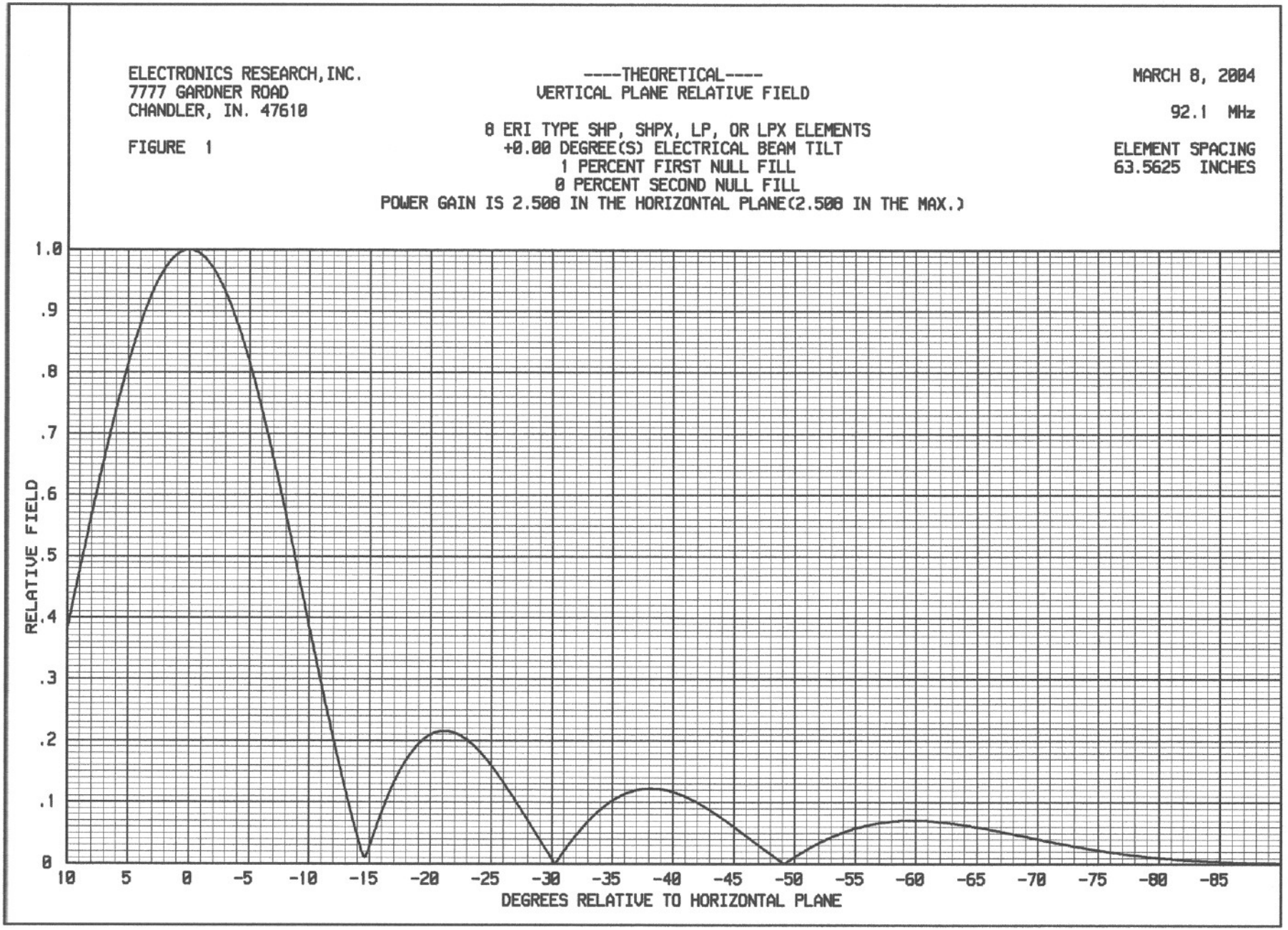
Heat Removal (On 970-4 Module Only) ..... Natural Convection
Heat Removal (On 973-4 Module Only) ..... Forced Air Cooling
Physical Arrangement ..... All Components Free Standing

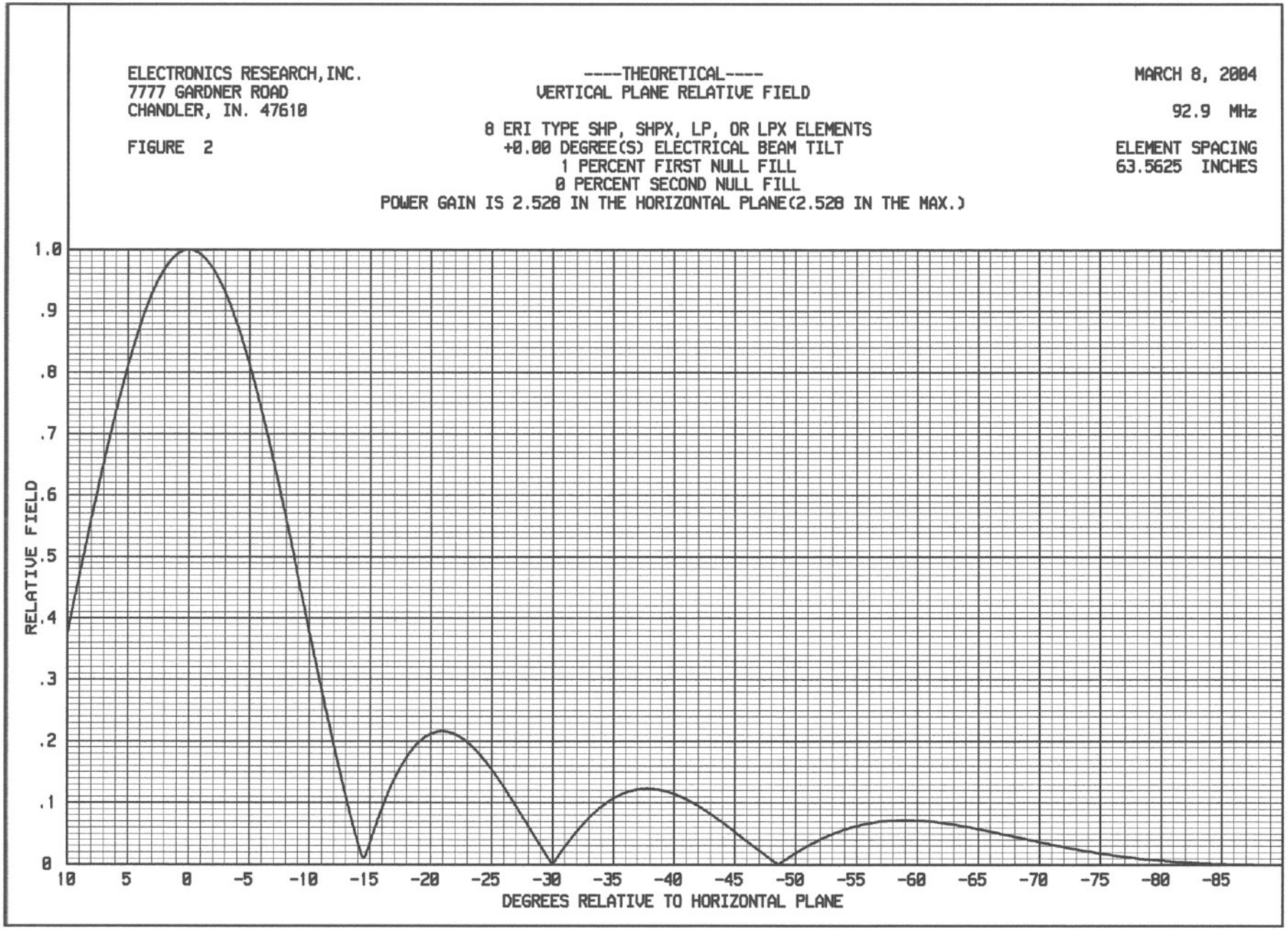
Injected Port Specifications:

Frequency Assignment ..... 92.1 MHz. and 92.9 MHz.
Power Rating, Each Injected Port (Designed) ..... 4.4 KW for 92.1 MHz & 22 KW for 92.9 MHz.
Input Connector ..... 3-1/8" 50 Ohm EIA (Flanged)
VSWR ..... Less than 1.07:1 @ +/-200 KHz(2)
Group Delay ..... Less than 50 ns Overall Variation, Carrier @ +/- 150 KHz
Insertion Loss (Measured):

92.1 MHz. ..... - 0.757 dB
92.9 MHz. ..... - 0.463 dB

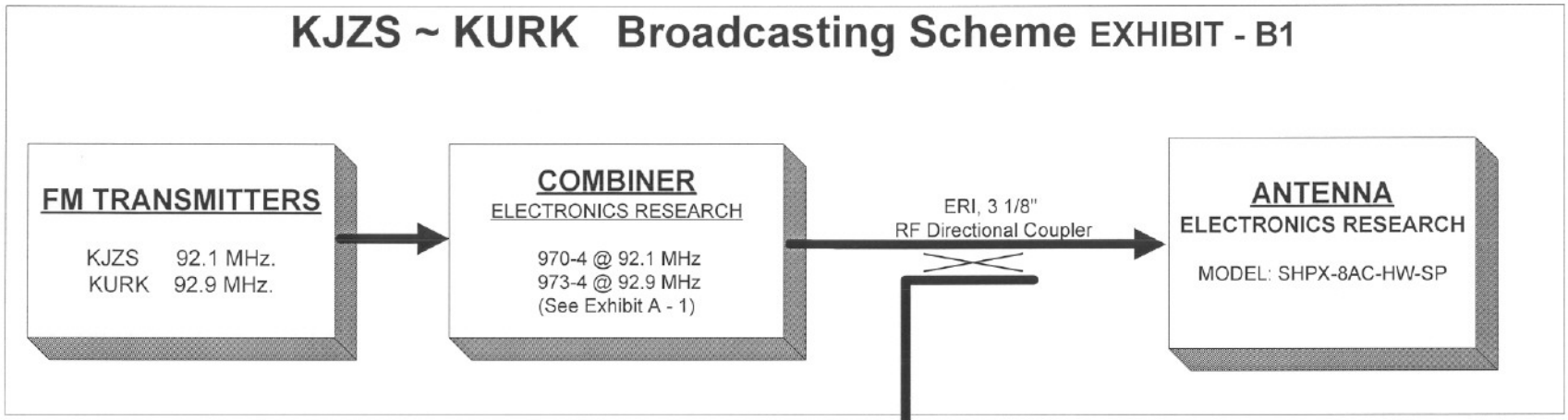
1) Power Rating Listed is as Designed Only. Actual Power Capabilities May Vary.
2) When Terminated in 50 Ohm Resistive Load.


ELECTRONICS RESEARCH, INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610
FIGURE 1
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD
8 ERI TYPE SHP, SHPX, LP, OR LPX ELEMENTS
+0.00 DEGREE(S) ELECTRICAL BEAM TILT
1 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL
POWER GAIN IS 2.508 IN THE HORIZONTAL PLANE(2.508 IN THE MAX.)
MARCH 8, 2004
92.1 MHz
ELEMENT SPACING
63.5625 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


ELECTRONICS RESEARCH, INC.
7777 GARDNER ROAD
CHANDLER, IN. 47610
FIGURE 2
----THEORETICAL----
VERTICAL PLANE RELATIVE FIELD
8 ERI TYPE SHP, SHPX, LP, OR LPX ELEMENTS
+0.00 DEGREE(S) ELECTRICAL BEAM TILT
1 PERCENT FIRST NULL FILL
0 PERCENT SECOND NULL FILL
POWER GAIN IS 2.528 IN THE HORIZONTAL PLANE(2.528 IN THE MAX.)
MARCH 8, 2004
92.9 MHz
ELEMENT SPACING
63.5625 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

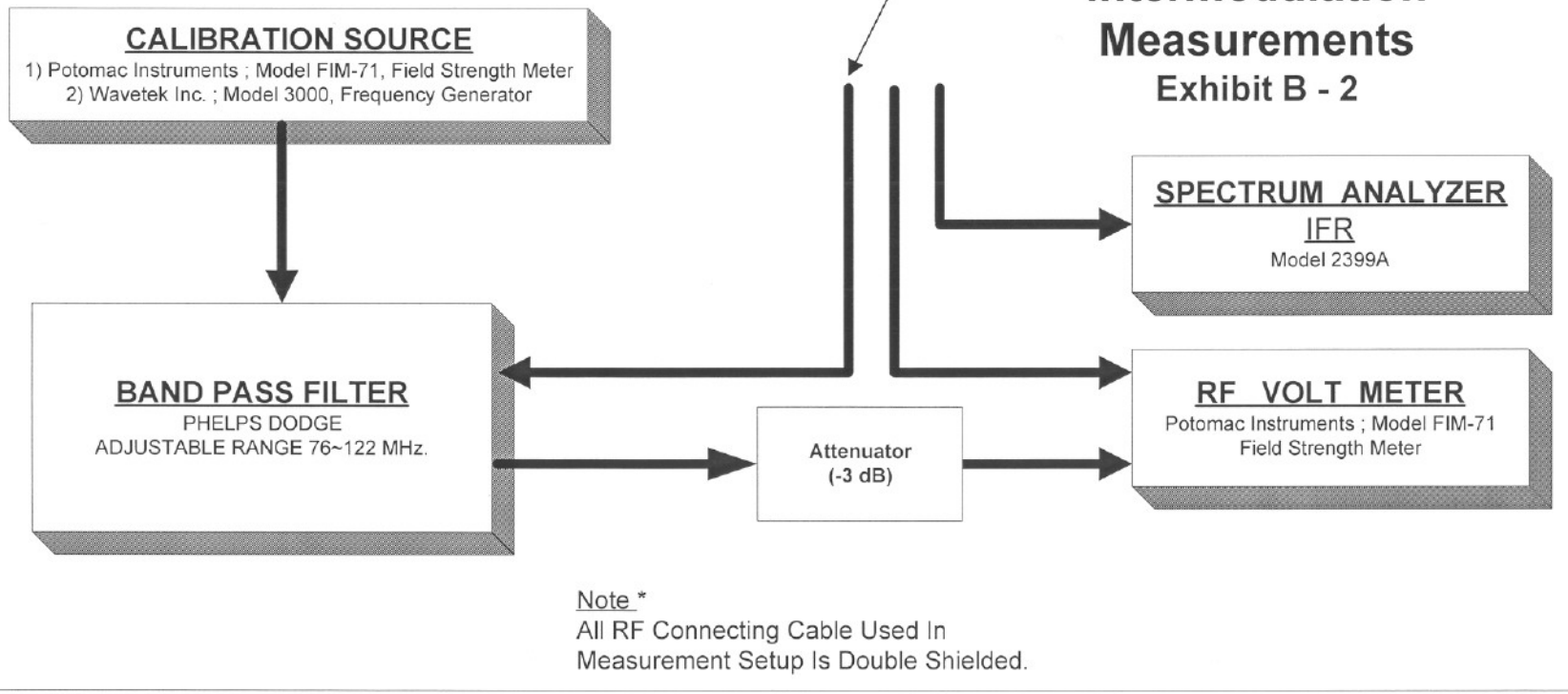
EXHIBIT, A - 5

KJZS ~ KURK Broadcasting Scheme EXHIBIT - B1



Equipment Employed in Intermodulation Measurements

Exhibit B - 2



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

Broadcasting Scheme and Equipment Employed in Intermodulation Measurements

EXHIBIT B