ELECTRONICS RESEARCH, INC.
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Report Of Intermodulation Product Findings

RICHLAND TOWER COMBINED BROADCAST FACILITY
KANSAS CITY , MISSOURI

KCMO	***94.9***
KRBZ	***96.5***
KUDL	***98.1***
KQRC	***98.9***
KCFX	***101.1***

March 2003

Electronics Research Inc.
7777 Gardner Road
Chandler, Indiana 47610
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REPORT OF FINDINGS
KCMO / KRBZ / KUDL / KQRC / KCFX / BROADCAST FACILITY
KANSAS CITY , MISSOURI

Introduction : This report of findings is based on data collected at the Richland Towers combined FM broadcast facility located in Kansas City, MO. The report includes measurements offered as proof that the combined operations of **KCMO** (94.9 MHz.), **KRBZ** (96.5 MHz.), **KUDL** (98.1 MHz.), **KQRC** (98.9 MHz.) and **KCFX** (101.1 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). Robert Rose and Bart Wenderoth of Electronics Research, Inc. located in Chandler, Indiana performed the measurements summarized herein on March 23, 2003.

The following exhibits are provided:

- Exhibit A:
  - A-1 Drawing Depicting Antenna.
  - A-2 COG-1083-10CP Antenna Specification Sheet.
  - A-3 Drawing Depicting Multiplexing Scheme.
  - A-4 Constant Impedance Multiplexer Specification Sheet.
  - A-5 Theoretical Vertical Plane Relative Field Antenna Plots (Set Of Six)
  - A-6 Feed System Detail
- Exhibit B:
  - B-1 Equipment Employed In Intermodulation Product Measurement.
  - B-2 Combiner Room.
  - B-3 Calculated Product Chart.
- Table 1. Carrier Reference Levels.
- Table 2. Intermodulation (IM) 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 six FM stations were operating from the combined antenna system. The KCMO, KRBZ, KUDL, KQRC and KCFX multiplexed system is fundamentally comprised of antenna, feed line and multiplexer unit. The COG-1083-10CP antenna and Constant Impedance multiplexer units are products of Electronics Research, Inc, whereas the feed line is manufactured by Myat. Refer to Exhibit B-1, for an illustration of the Broadcasting Scheme of these stations.
A drawing titled ***"Feed System Detail"*** Exhibit A-6, included with this report gives information pertaining to the dual transmission run installed to feed the antenna.

To accomplish the aggregation of five transmitter signals into a common antenna feed and provide transmitter-to-transmitter isolation, a multiplexing scheme consisting of Combiner Modules were used. Specifically, five ERI 963-8 with Group Delay Compensation and one ERI 963-6 Constant Impedance combiner modules were installed. The multiplex is illustrated in the attached Exhibit A-3. The multiplexer, fully assembled, exhibited transmitter port-to-port isolation in excess of -55 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 30 dB directivity and a forward signal sample of -50 dB.

The forward port of the coupler was used for sampling the outgoing carrier levels and IM products. The sampled signals 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 the Spectrum Analyzer to ensure an adequate signal level for measurements without overloading the measurement equipment. 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 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. KRBZ, KUDL, KCFX, KCMO and KQRC were operating at their full licensed power levels for the duration of all IM measurements. 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.

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 " $\mathbf{G}^{IM\ Level}$ ".The equipment employed to measure IM products and the equipment setup arraignment is illustrated in Exhibit B-1.

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 March 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 KCMO, KRBZ, KUDL, KQRC and KCFX into the COG-1083-10CP 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 KCMO, KRBZ, KUDL, KQRC and KCFX 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 (VP Of Antenna Engineering)**

Exhibit B-3

Calculated Product Chart
Richland Tower Master Antenna Kansas City, Missouri

The Product Chart Provides An In-Depth Listing Of Third Order Products And Their Associated Relationship To The Stations Operating From The Richland Tower Master Antenna Site.

How To Use The Product Chart:

Vertical “Column A” and top horizontal “Row 1" list frequencies either operating from or in close proximity to the ERI Master FM Antenna. The (2A-B) product is shown at the juncture of a primary frequency on the left, and a secondary frequency across the top.

Example: Locate 103.3 on the left under Column “A” (A3). Locate 99.7 across the top (E1). The horizontal and vertical intersection (E3) is the 106.9 product.
Calculation: [(2 x 103.3) - 99.7] = [206.6 - 99.7] = 106.9

	A	B	C	D	E	F	G	H	I	J	K
1)		105.1	103.3	101.1	99.7	98.9	98.1	96.5	94.9	94.1	93.3
2) KFME	105.1		106.9	109.1	110.5	111.3	112.1	113.7	115.3	116.1	116.9
3) KPRS	103.3	101.5		105.5	106.9	107.7	108.5	101.1	111.7	112.5	113.3
4) KCFX	101.1	97.1	98.9		102.5	103.3	104.1	105.7	107.3	108.1	108.9
5) KYYS	99.7	94.3	96.1	104.3		100.5	101.3	102.9	104.5	105.3	106.1
6) KQRC	98.9	92.7	94.5	96.7	98.1		99.7	101.3	102.9	103.7	104.5
7) KUDL	98.1	91.1	92.9	95.1	96.5	97.3		99.6	101.3	102.1	102.9
8) KRBZ	96.5	87.9	89.7	91.9	93.3	94.1	94.9		98.1	98.9	99.7
9) KCMO	94.9	84.7	86.5	88.7	90.1	90.9	91.7	93.3		95.7	96.5
10) KFKF	94.1	83.1	84.9	87.1	88.5	89.3	90.1	91.7	93.3		94.9
11) KMXV	93.3	81.5	83.3	85.5	86.9	87.7	88.5	90.1	91.7	92.5	

Below is a listing of product possibilities that may manifest due to transmitter coupling. The list was taken from the above table and is in frequency order.

(1) 81.5 MHz (1)
(2) 83.1 MHz (1)
(3) 83.3 MHz (1)
(4) 84.7 MHz (2)
(5) 84.9 MHz (1)

(6) 85.5 MHz (1)
(7) 86.5 MHz (2)
(8) 86.9 MHz (1)
(9) 87.1 MHz (1)
(10) 87.7 MHz (1)

(11) 87.9 MHz (2)
(12) 88.5 MHz (1)
(13) 88.7 MHz (2)
(14) 89.3 MHz (1)
(15) 89.7 MHz (2)

(16) 90.1 MHz (1)
(17) 90.9 MHz (2)
(18) 91.1 MHz (2)
(19) 91.7 MHz (1)
(20) ***91.9 MHz*** (3)

(21) 2.5 MHz (1)
(22) 92.7 MHz (2)
(23) 92.9 MHz (2)
(24) 93.3 MHz (2)
(25) ***94.1 MHz*** (3)

(26) 94.3 MHz (1)
(27) ***94.5 MHz*** (3)
(28) ***94.9 MHz*** (4)
(29) ***95.1 MHz*** (3)
(30) ***95.7 MHz*** (3)

(31) 96.1 MHz (1)
(32) ***96.5 MHz*** (4)
(33) ***96.7 MHz*** (3)
(34) 97.1 MHz (2)
(35) ***97.3 MHz*** (3)

(36) ***98.1 MHz*** (4)
(37) ***98.3 MHz*** (1)
(38) ***98.9 MHz*** (4)
(39) ***99.6 MHz*** (3)
(40) ***99.7 MHz*** ***(3)***

(41) 100.5 MHz (1)
(42) ***101.1 MHz*** (4)
(43) 101.3 MHz (2)
(44) 101.5 MHz (1)
(45) 102.1 MHz (2)

(46) 102.5 MHz (2)
(47) 102.9 MHz (2)
(48) ***103.3 MHz*** (3)
(49) 103.7 MHz (2)
(50) 104.1 MHz (2)

(51) 104.5 MHz (2)
(52) 105.3 MHz (1)
(53) 105.5 MHz (1)
(54) 105.7 MHz (2)
(55) 106.1 MHz (1)

(56) 106.9 MHz (1)
(57) 107.3 MHz (2)
(58) 107.7 MHz (1)
(59) 108.1 MHz (2)
(60) 108.5 MHz (1)

(61) 108.9 MHz (2)
(62) 109.1 MHz (1)
(63) 101.1 MHz (1)
(64) 110.5 MHz (1)
(65) 111.3 MHz (1)

(66) 111.7 MHz (1)
(67) 112.1 MHz (1)
(68) 112.5 MHz (1)
(69) 113.3 MHz (1)
(70) 113.7 MHz (1)

(71) 115.3 MHz (1)
(72) 116.1 MHz (1)
(73) 116.9 MHz (1)

Table 1

Carrier Reference Levels

Station Call Letters	Frequency	Spectrum Analyzer Measured Level	Measurement Loss Pad + Band-pass Filter	Adjusted Level (Losses Removed)
1) KCFX	101.1 MHz	6.86 dBm	-10.28 dB	17.14 dBm
2) KQRC	98.9 MHz	6.86 dBm	-10.28 dB	17.14 dBm
3) KUDL	98.1 MHz	6.86 dBm	-10.43 dB	17.29 dBm
4) KRBZ	96.5 MHz	6.86 dBm	-10.59 dB	17.45 dBm
5) KCMO	94.9 MHz	6.52 dBm	-10.78 dB	17.30 dBm

The table above lists the five (5) current users of the Richland Tower FM Master 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 their transmitter at 100% of 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 bandpass filters and signal padding. The use of external pads maintains a good impedance match between test measurement equipment. Employing a tuned bandpass filter prevents the Spectrum Analyzer from saturation and prevents potential damage from the presence of strong multistation signals. The adjusted levels are computed with measurement losses removed. These figures serve as reference levels in this report.

Table 2

Intermodulation (IM) Analysis Measurements
Richland Tower Master Antenna, Kansas City, Missouri

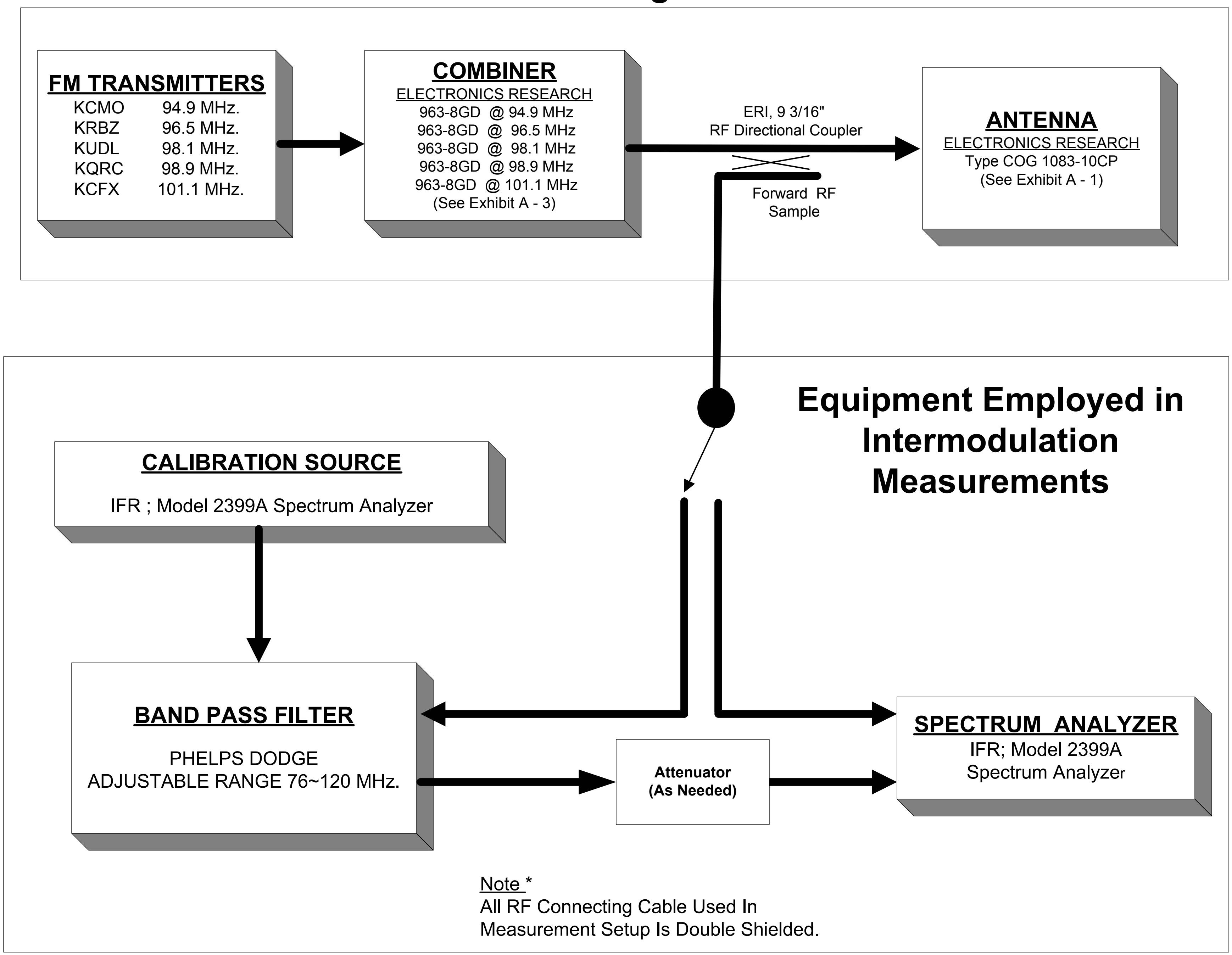
A Frequency Of Product Possibility	B Spectrum Analyzer Measured Level	C Measurement Loss Pad + Band-pass Filter	D Level Adjusted For Measurement Losses	E Associated Station Frequency	F Normalized Reference Level	G IM Level (Deference Between D And F)
(1) 84.7 MHz	-94.30 dBm	-12.51 dBm	-81.73 dBm	94.9 MHz	17.30 dBm	99.03 dBm
(2) 86.5 MHz [1]	-94.90 dBm	-12.07 dBm	-82.83 dBm	94.9 MHz	17.30 dBm	100.13 dBm
(3) 87.9 MHz	-95.10 dBm	-11.72 dBm	-83.38 dBm	96.5 MHz	17.45 dBm	100.83 dBm
(4) 88.7 MHz	-94.70 dBm	-11.63 dBm	-83.07 dBm	94.9 MHz	17.30 dBm	100.37 dBm
(5) 89.7 MHz [1]	-94.90 dBm	-11.68 dBm	-83.22 dBm	96.5 MHz	17.45 dBm	100.67 dBm
(6) 90.1 MHz	-93.50 dBm	-11.56 dBm	-81.94 dBm	94.9 MHz	17.30 dBm	99.24 dBm
(7) 90.9 MHz	-94.60 dBm	-11.60 dBm	-83.00 dBm	94.9 MHz	17.30 dBm	100.30 dBm
(8) 91.1 MHz	-94.60 dBm	-11.60 dBm	-83.00 dBm	98.1 MHz	17.29 dBm	100.29 dBm
(9) 91.7 MHz	-94.30 dBm	-11.96 dBm	-82.34 dBm	94.9 MHz	17.30 dBm	99.64 dBm
(10) 91.9 MHz	-94.20 dBm	-11.49 dBm	-82.71 dBm	96.5 MHz	17.45 dBm	100.16 dBm
(11) 92.7 MHz	-94.50 dBm	-11.45 dBm	-83.05 dBm	98.9 MHz	17.14 dBm	100.19 dBm
(12) 92.9 MHz [1]	-94.50 dBm	-11.44 dBm	-83.06 dBm	98.1 MHz	17.29 dBm	100.35 dBm
(13) 93.3 MHz [3]	See Note, 3	-11.44 dBm	See Note, 3	96.5 MHz & 94.9 MHz	17.45 dBm /17.30 dBm	See Note, 3
(14) 94.1 MHz [3]	See Note, 3	-11.39 dBm	See Note, 3	96.5 MHz	17.45 dBm	See Note, 3
(15) 94.5 MHz [1]	-92.70 dBm	-11.30 dBm	-81.40 dBm	98.9 MHz	17.14 dBm	98.54 dBm
(16) 94.9 MHz [2]	-87.70 dBm	-11.30 dBm	-76.4 dBm	96.5 MHz	17.45 dBm	93.85 dBm
(17) 95.1 MHz	-83.00 dBm	-11.36 dBm	-71.64 dBm	98.1 MHz	17.29 dBm	88.93 dBm
(18) 95.7 MHz [1]	-84.20 dBm	-11.22 dBm	-72.98 dBm	94.9 MHz	17.30 dBm	90.28 dBm
(19) 96.5 MHz [2]	-98.20 dBm	-11.36 dBm	-86.84 dBm	98.1 MHz & 94.9 MHz	17.29 dBm /17.30 dBm	104.13 dBm /104.14 dBm
(20) 96.7 MHz [2]	-89.30 dBm	-10.88 dBm	-78.42 dBm	98.9 MHz	17.14 dBm	95.56 dBm
(21) 97.1 MHz	-90.70 dBm	-10.78 dBm	-79.92 dBm	101.1 MHz	17.14 dBm	97.06 dBm
(22) 97.3 MHz	-84.70 dBm	-10.77 dBm	-73.93 dBm	98.1 MHz	17.29 dBm	91.22 dBm
(23) 98.1 MHz [2]	-99.70 dBm	-10.73 dBm	-88.97 dBm	98.9 MHz & 96.5 MHz	17.14 dBm /17.45 dBm	106.11 dBm /106.42 dBm
(24) 98.9 MHz [1,2]	-92.30 dBm	-10.74 dBm	-81.56 dBm	101.1 MHz & 96.5 MHz	17.14 dBm /17.45 dBm	98.70 dBm / 99.01 dBm
(25) 99.6 MHz	-90.10 dBm	-10.57 dBm	-79.53 dBm	98.1 MHz	17.29 dBm	96.82 dBm
(26) 99.7 MHz [1,3]	See Note, 3	-10.34 dBm	See Note, 3	98.9 MHz & 96.5 MHz	17.14 dBm /17.45 dBm	See Note, 3
(27) 101.3 MHz [2]	-99.80 dBm	-10.26 dBm	-89.54 dBm	98.9 MHz & 98.1 MHz	17.14 dBm /17.29 dBm	106.68 dBm /106.83 dBm
(28) 102.1 MHz [1]	-93.20 dBm	-10.20 dBm	-83.00 dBm	98.1 MHz	17.29 dBm	100.29 dBm
(29) 102.5 MHz	-94.30 dBm	-10.14 dBm	-84.16 dBm	101.1 MHz	17.14 dBm	101.30 dBm
(30) 102.9 MHz [1]	-94.30 dBm	-10.07 dBm	-84.23 dBm	98.9 MHz & 98.1 MHz	17.14 dBm / 7.29 dBm	101.37 dBm /101.52 dBm
(31) 103.3 MHz [3]	See Note, 3	-10.05 dBm	See Note, 3	101.1 MHz	17.14 dBm	See Note, 3
(32) 103.7 MHz [1]	-94.30 dBm	-10.05 dBm	-84.25 dBm	98.9 MHz	17.14 dBm	101.39 dBm
(33) 104.1 MHz	-94.40 dBm	-10.08 dBm	-84.32 dBm	101.1 MHz	17.14 dBm	101.46 dBm
(34) 104.5 MHz [1]	-94.40 dBm	-9.98 dBm	-84.42 dBm	98.9 MHz	17.14 dBm	101.56 dBm
(35) 105.7 MHz	-94.20 dBm	-9.88 dBm	-84.52 dBm	101.1 MHz	17.14 dBm	101.66 dBm
(36) 107.3 MHz	-94.20 dBm	-9.73 dBm	-84.47 dBm	101.1 MHz	17.14 dBm	101.61 dBm
(37) 108.1 MHz [1]	-94.40 dBm	-9.66 dBm	-84.74 dBm	101.1 MHz	17.14 dBm	101.88 dBm
(38) 108.9 MHz [1]	-94.30 dBm	-9.63 dBm	-84.67 dBm	101.1 MHz	17.14 dBm	101.81 dBm

1) Possible Product From Mixing With An Off Site Station.

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

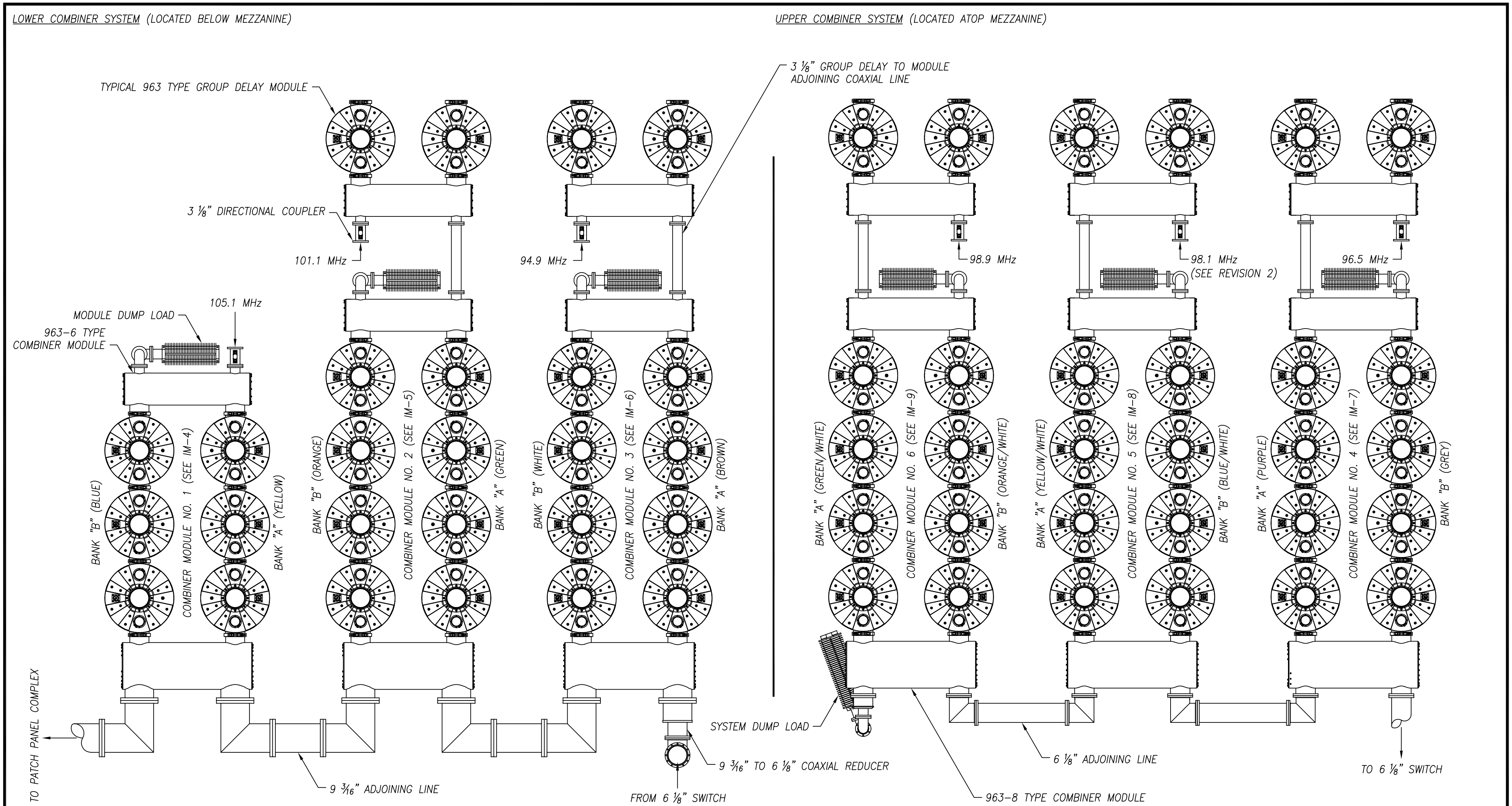
3) Unable To Obtain Measurement Due To Interference From One Of The Following (Off Site) Stations : KPRS (103.3 MHz) ~ KYYS (99.7 MHz) ~ KFKF (94.1 MHz) ~ KMXV (93.3 MHz.)

KCMO ~ KRBZ ~ KUDL ~ KQRC ~ KCFX
Broadcasting Scheme



Broadcasting Scheme and Equipment Employed in Intermodulation Measurements

EXHIBIT B-1



NOTES:

1) MINIMUM MEZZANINE HEIGHT: 6'

2) DIMENSIONS GIVEN ARE APPROXIMATE.

3) DRAWING IS DESIGNED TO CROSS REFERENCE WITH DETAILS IM–4 THRU IM–9 TO CLARIFY SYSTEM CONFIGURATION.

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NO	REVISION	APP'D	DATE
6			
5			
4			
3			
2	99.7 MHz RE-TUNED TO 98.1 MHz		4/03 SMD
1	RENAME FROM TOP-1 TO IM-12, REVISE LAYOUT		12/02 RRH

NAME	TOP VIEW COMBINER SYSTEM
STATION:	KANSAS CITY, MO.
FREQUENCY:	N/A
PROJECT NO.:	09574/3
PATH	G:\DRAFTING\ALL\PROJECTS\09574\3
FILE	IM – 12
DRAWN	BAM
FACTOR	1/30
DATE	9/12/02
APP'D	
DWG. NO.	IM – 12
MODEL	NON–APPLICABLE

A-4 ERI Combiner Specification Sheet
KANSAS CITY , MISSOURI

General Specifications:

Multiplexer Type . . . . 963 Constant Impedance Combiner
Number Of Combining Units . . . . Six
Injected Port to Injected Port Isolation . . . . < - 58 dB
Output Connector . . . . 9 3/16 " 50 Ohm EIA (Flanged)
Output Power . . . . 250 KW
Combiner Units, Size and Weight :

Type 963-8GD Tuned To 94.9 MHz . . . . 58" ht. X 4.5' wd. X 17' lng. & 2,000 Lbs.
Type 963-8GD Tuned To 96.5 MHz . . . . 58" ht. X 4.5' wd. X 17' lng. & 2,000 Lbs.
Type 963-8GD Tuned To 98.1 MHz . . . . 58" ht. X 4.5' wd. X 17' lng. & 2,000 Lbs.
Type 963-8GD Tuned To 98.9 MHz . . . . 58" ht. X 4.5' wd. X 17' lng. & 2,000 Lbs.
Type 963-8GD Tuned To 101.1 MHz . . . . 58" ht. X 4.5' wd. X 17' lng. & 2,000 Lbs.

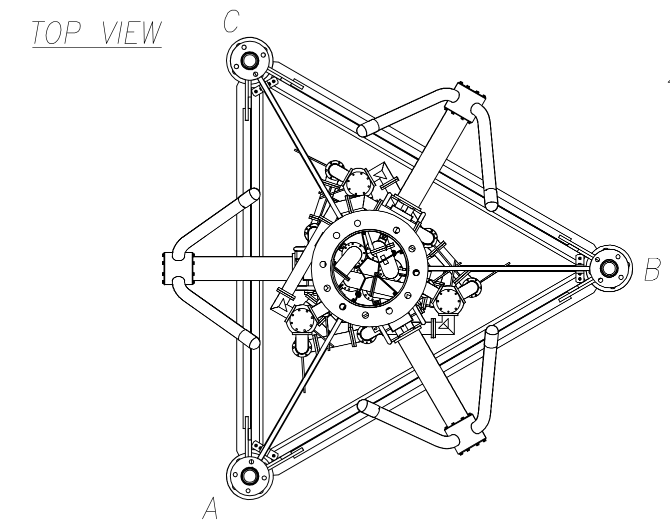
Heat Removal (Multiplexer Module) . . . . Natural Convection
Heat Removal (Group Delay Modules) . . . . Forced Air
Physical Arrangement . . . . All Components Floor and Mezzanine Standing Upright

Injected Port Specifications:

Frequency Assignment (From Antenna Output) . . . . 101.1 / 94.9 / 96.5 / 98.1, And 98.9 MHz.
Power Rating, Each Injected Port (Maximum) . . . . 31 KW
Input Connector . . . . 3-1/8" 50 Ohm EIA (Flanged)
VSWR . . . . Less than 1.08:1 @ +/-150 KHz[1]
Group Delay . . . . Less than 60 ns Overall Variation, Carrier @ +/- 150 KHz
Insertion Loss (Measured):

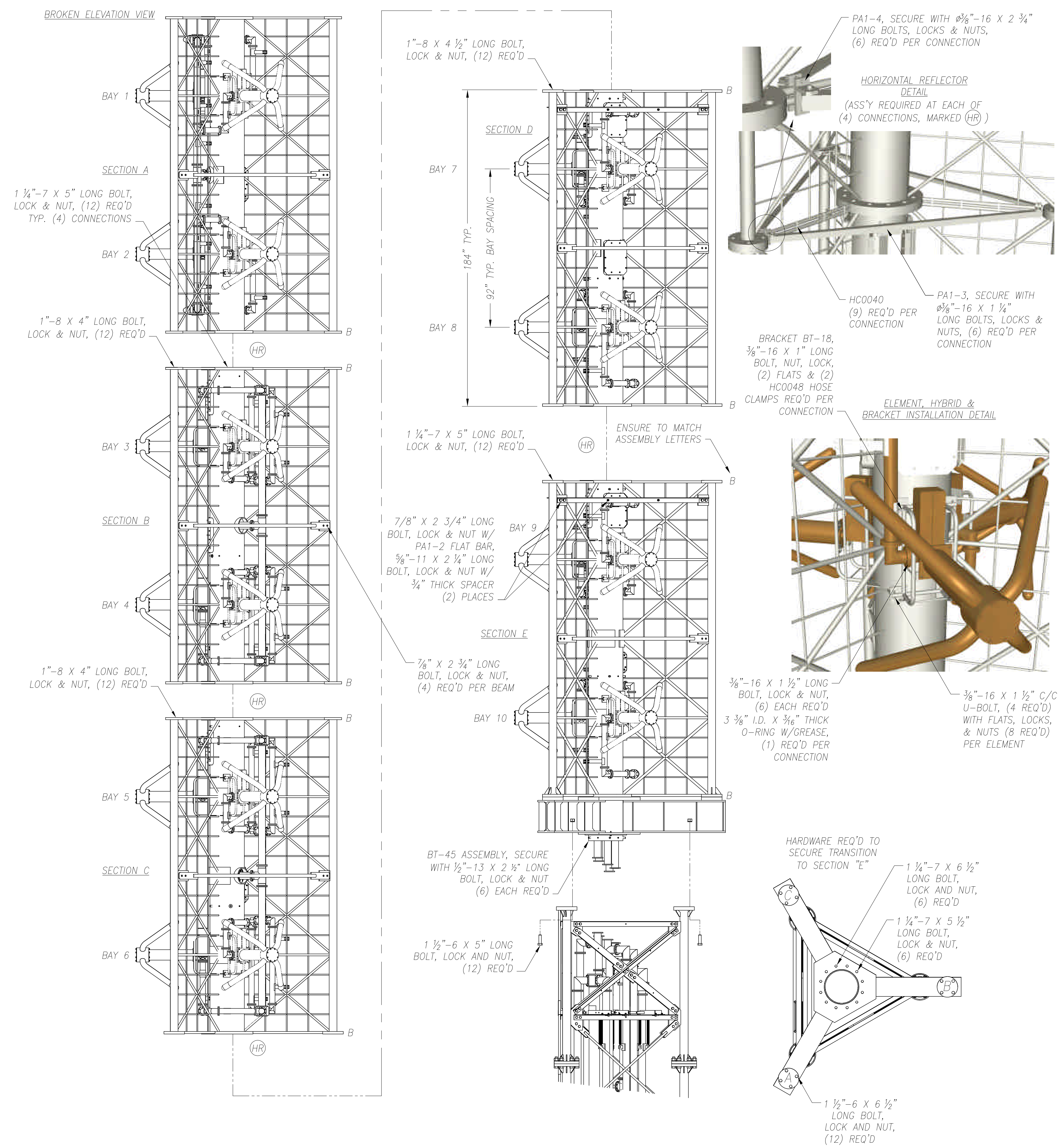
94.9 MHz. . . . . - 0.567 dB
96.5 MHz. . . . . - 0.572 dB
98.1 MHz. . . . . - 0.576 dB
98.9 MHz. . . . . - 0.579 dB
101.1 MHz. . . . . - 0.586 dB

1) When Terminated in 50 Ohm Resistive Load.



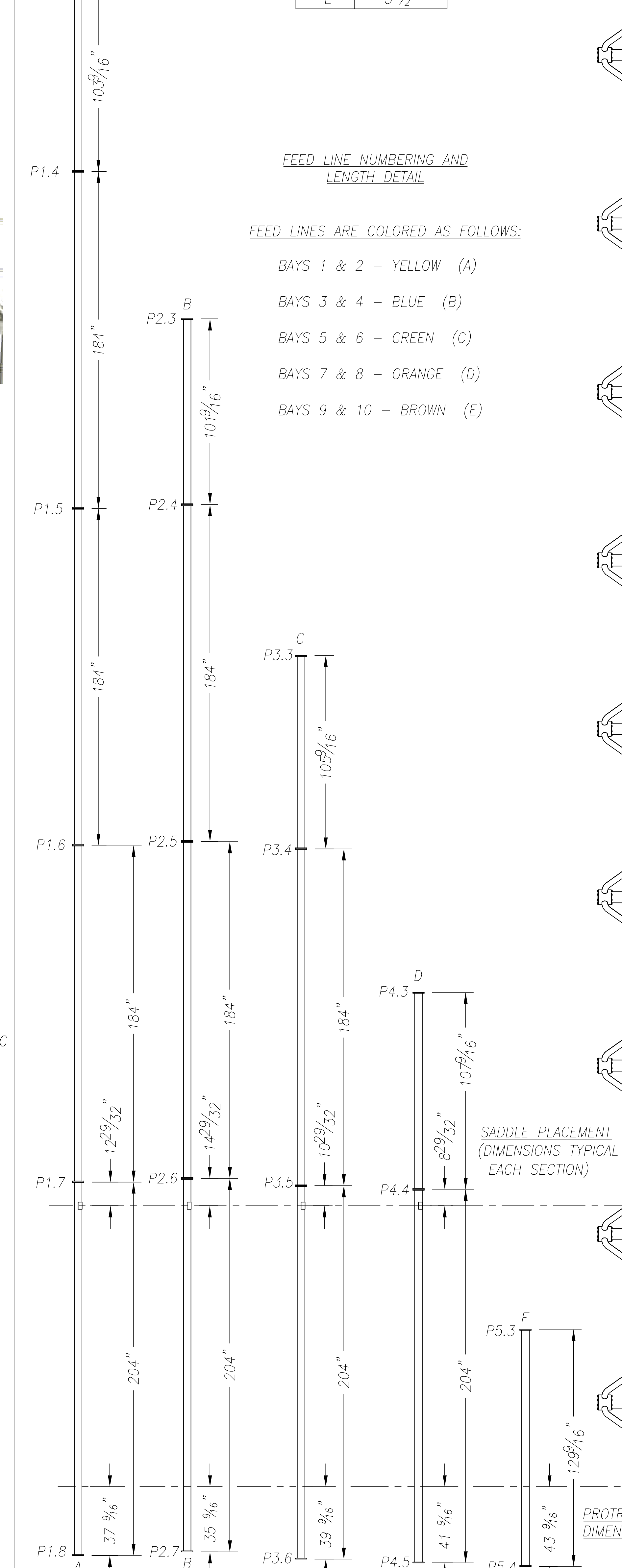
NOTES: 1) THE (10) ELEMENT/HYBRID ASSEMBLIES THAT MUST BE INSTALLED ARE SHOWN WITH PHANTOM LINES BELOW. THE HYBRID FLANGES, AS WELL AS THE FLANGES ON THE ELBOWS IN WHICH THEY CONNECT ARE NUMBERED, EX. 1,A,1, 2,B,1, ETC. MATCH NUMBERS FOR PLACEMENT. (SEE FEED HARNESS DETAIL & NUMBERING SCHEME, IC-2 FOR FULL DETAIL)

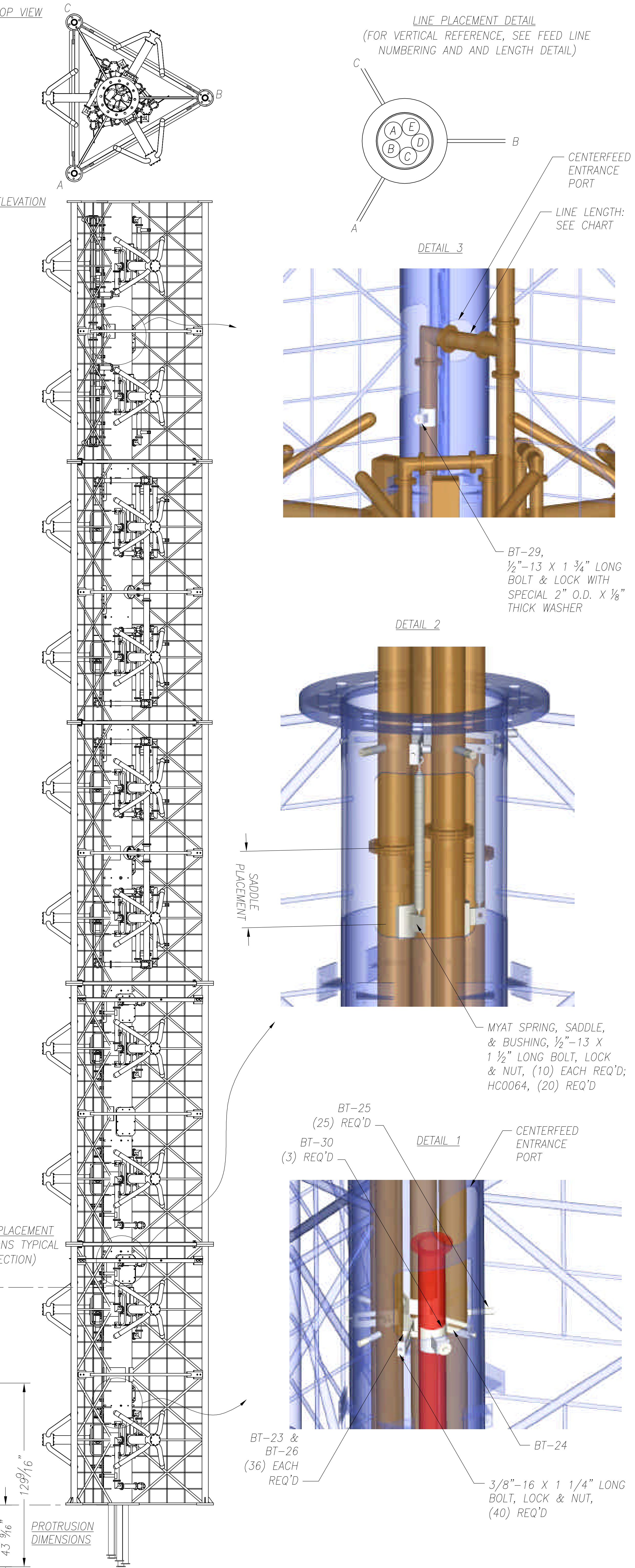
2) SUGGESTED INSTALLMENT PROCEDURE:
1. PREP COGWHEEL FOR INSTALLATION: INSTALL MISSING ELEMENTS (SEE ELEMENT/HYBRID AND BRACKET INSTALLATION DETAIL), REMOVE SHIPPING PACKAGING, ATTACH CENTERFEED ELBOWS AND STUB SECTIONS TO TEE (SEE DETAIL 3 ON RIGHT) AND PLACE SPRING HANGER SADDLES IN CORRECT LOCATION (SEE SADDLE PLACEMENT ON RIGHT).
2. SET TRANSITION ASSEMBLY ON PROVIDED STANDS (ON GROUND). ENSURE THAT (FOR PICKING ORIENTATION PURPOSES) LADDER BRACKET ON TRANSITION IS ON THE SAME FACE AS THE EXISTING LADDER.
3. HOIST SECTIONS "E" & "D" UP AND VERY CAREFULLY BOLT TO TRANSITION. ENSURE THAT LETTERS A,B,&C ON COG SECTION LEGS MATCH THOSE ON THE TRANSITION SECTION.
4. RAISE SECTIONS JUST ABOVE TOWER & ALIGN CORRECTLY.
5. LOWER VERY CAREFULLY ONTO THE TOWER SECTION AND SECURE.
6. INSTALL PIPE W/FLANGE MARKED BT-45, ALONG WITH STAR CONFIGURATION AND TEFLON ALIGNMENT PINS AS SHOWN AT BOTTOM OF SECTION "E".
7. ENSURE THAT LINES ARE ADJUSTED TO PROTRUDE OUT OF THE PIPE AS DIMENSIONED IN DETAIL BELOW BY LOOSENING HOSE CLAMPS ON SPRING HANGERS AND (2) RIGID LINE BRACKETS. LINE SECTIONS ARE ALIGNED WITH TEFLON PINS IN STAR CONFIGURATIONS. (SEE DETAIL 1 ON RIGHT)
8. WHILE ON THE GROUND, ATTACH SECTIONS "B"&"C" TO SECTION "A" AND PREP FOR INSTALLATION (SEE NOTE 1).
9. HOIST SECTIONS "B","C"&"A" JUST ABOVE SECTION "D" AND ENSURE TO ALIGN LETTERS A,B,&C ON COG SECTION LEGS.
10. LOWER VERY CAREFULLY ONTO SECTION "D" AND SECURE.
11. ADJUST LINES TO MATCH WITH THOSE ON SECTION "D" BY LOOSENING HOSE CLAMPS ON SPRING HANGERS AND (3) RIGID LINE BRACKETS. ENSURE THAT LINE TENSION IS HANGING EVENLY FROM SPRINGS, IT IS IMPORTANT TO MAINTAIN PROTRUSION DIMENSIONS ON LINES AS SECTIONS ARE ADDED.
12. ENSURE TO INSTALL MISSING HORIZONTAL TIE BEAMS, STAINLESS HORIZONTALS AND HOSE CLAMPS (SHOWN BELOW), FIBERGLASS ANGLES SECURE ONLY TO THE TOP OF SECTIONS "E"&"D".



NOTES:
1) PARTS ARE STAMPED FOR ASSEMBLY PURPOSES.
2) RIGID LINE BRACKETS (BT-29 & BT-30) ARE USED DIRECTLY AND EXCLUSIVELY ON LINES THAT ROUTE THROUGH CENTERFEED ENTRANCE PORTS AS SHOWN IN DETAIL 3 AND IN RED ON DETAIL (1).
3) POLE WALL THICKNESS CHANGES FROM ½" ON THE LOWER (3) SECTIONS TO ⅜" ON THE TOP (2) SECTIONS, ENSURE TO USE BRACKET BT-30 ON THE LOWER (3) SECTIONS AND BRACKET BT-29 ON THE UPPER (2) SECTIONS.
IN ADDITION, THERE ARE (2) SIZES OF STAR CONFIGURATIONS. USE BT-24 BRACKETS ON LOWER (3) SECTIONS AND BT-27 BRACKETS ON THE UPPER (2) SECTIONS.
4) SPRING HANGERS ARE PLACED ONLY AT THE TOP OF EACH SECTION AS SHOWN IN DETAIL 2.

SECTION	LINE LENGTH
A	9 ¾"
B	13 ¾"
C	7 ½"
D	11 ¾"
E	5 ½"





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

NAME	SECTION INSTALLATION/LINE DETAILS
STATION	09574-KANSAS CITY,MO
FREQUENCY	N/A
PROJECT NO.	09574
PATH	G:\DRAFTING\ALL\PROJECTS\09574
FILE	IC-4
DRAWN	B.L.V.
FACTOR	NTS
DATE	12/3/02
APP'D	
DWG. NO.	IC-4
MODEL	COG3-20P-10-140-2

A-2 ERI Antenna Specification Sheet
KANSAS CITY , MISSOURI

General Specifications

Antenna Type . . . . High Power FM-Broadcast, Suitable For Multiplexing
Model Number COG-1083-10CP
Number Of Bay Levels . . . . Ten
Polarization . . . . Right Hand Circular

Electrical Specifications

Antenna Input Power Capability (Designed) . . . . 250 KW. Maximum (1)
Operating Frequency Band . . . . All FM Frequencies
VSWR . . . . 1.15 : 1 (2)
Azimuthal Pattern Circularity . . . . +/- 2dB From RMS (Free Space)
Power Split . . . . 50/50 (Horizontal & Vertical)
Quarter Wave Shorting Stub . . . . NA
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 (5)
94.9	**100 (KW)**	**-0.75°**	**10 %**	**5%**	**4.223**	**.567 dB**	**.563 dB**	**30.72 (KW)**
96.5	**100 (KW)**	**-0.75°**	**10 %**	**5%**	**4.286**	**.572 dB**	**.483 dB**	**29.75 (KW)**
98.1	**100 (KW)**	**-0.75°**	**10 %**	**5%**	**4.350**	**.576 dB**	**.537 dB**	**29.70 (KW)**
98.9	**100 (KW)**	**-0.76°**	**10 %**	**5%**	**4.381**	**.579 dB**	**.559 dB**	**29.66 (KW)**
101.1	**100 (KW)**	**-0.76°**	**10 %**	**5%**	**4.467**	**.586 dB**	**.552 dB**	**29.09(KW)**

Mechanical Specifications

Antenna Feed System . . . . Fed With Dual Feed Lines
Input Connectors . . . . 6-1/8" 50- Ohm EIA Flanged
Element Deicing . . . . Not Ordered (6)
Interbay Spacing . . . . 92.00 Inch Center to Center
Array Length . . . . 119.6 Feet
Construction Material (Antenna) . . . . All Noncorrosive
Construction Material (Mounting) . . . . Galvanized Plated Steal and All Stainless Steel
Mounting . . . . Integral Arrangement (Antenna Preassembled To Mast)

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 1202 Feet, Myat Type 601 Rigid 6 1/8" Coax.
4) Losses Taken From Actual Multiplexer Measurements.
5) TPO Calculations Are Figured As Combiner Input Power.
6) With Low Q Element Design, Moderate Icing Will Not Cause Appreciable VSWR Rise.