

*D.W. Sargent Broadcast Service, Inc.*

804 RICHARD ROAD, CHERRY HILL, NEW JERSEY 08034-1838

TELEPHONE (856) 667-8573

E-MAIL [dwsbsi@comcast.net](mailto:dwsbsi@comcast.net)

FAX (856) 667-1409

**ATC MASTER FM SYSTEM**

**ST. LOUIS, MO**

**INTERMOD MEASUREMENTS**

**INDEX**

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**November 30, 2006**

**Intermodulation Measurements**  
**On Ten Station FM Transmitting Facility**  
**St. Louis, Missouri**

**INTRODUCTION**

This report covers the results of measurements made on the American Tower master FM transmitting facility located in St. Louis, Mo. The stations transmitting from this site are KSIV (91.5 MHz), KSD (93.7 MHz), KSHE (94.7 MHz), KIHT (96.3 MHz), KYKY (98.1 MHz), KFUE (99.1 MHz), KEZK (102.5 MHz), KLUO (103.3 MHz), WARH (106.5) and KSLZ (107.7 MHz).

Since there are many combinations possible to generate the same IM product, the carrier reference level of the lowest TPO was used in the calculations. All possible third order IM products from 10 MHz to 470 MHz were below the maximum allowable level as required by section 73.317 (b) through (d).

**MEASURING SYSTEM**

A directional coupler is mounted on the output of the combiner for sampling. This coupler is set up to measure any and all products and carriers in the forward direction. The coupling factor increases by 6 dB per octave. This is factored into the calculations.

To prevent an intermod product from being generated in the measuring system, a filter

is connected between the directional coupler output and the input of a spectrum analyzer which measures the level of carriers and intermod products.

For measuring products outside the FM band, a band reject filter, K & L Model 11N53-98/30-N/NP, Serial Number WF032-1, is used to notch out all 10 carriers. This allows measuring the spectrum from 10 MHz to 88 MHz and 108 MHz to 470 MHz. To measure products between 88 MHz to 108 MHz, a two (2) cavity bandpass filter is used. This filter, Sinclair Radio Laboratory Model 1-70-1S7SP, Serial Number (5364)6518-1, is tuned to the product frequency. This allows the intermod product to pass but rejects all other frequencies. The output of this filter is connected to a spectrum analyzer, Hewlett Packard 8562A, Serial Number 2712A00366.

## **MEASUREMENTS**

Before making any measurements all possible intermodulation products from 10 MHz to 470 MHz to the third order were calculated. These are attached as Appendix 1 of this report. Each of the product frequencies were measured. In those cases where a number of combinations fell on a station carrier, the transmitter was shut down and that frequency checked for intermod products.

All ten (10) stations were operating at their normal TPO and with normal programing while measurements were made.

While all frequencies were measured, many were in the noise level of the spectrum analyzer. Due to this and to keep this report to a minimum, only those frequencies that did not meet the requirements of section 73.317 (a) through (d) would be recorded. Appendix 2 is measurements that are typical of all measurements made on the system. No spurious products were found that did

not meet the requirements of section 73.317.

## **COMMENTS**

The ten station multiplexed system consists of a Dielectric Communications bandpass combiner feeding a Dielectric Communications FMV antenna. A drawing of the combiner is attached to this report as Appendix 3.

Respectfully submitted.

*D. W. Sargent Broadcast Service, Inc.*

By,   
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Dean W. Sargent

*D.W. Sargent Broadcast Service, Inc.*

804 RICHARD ROAD, CHERRY HILL, NEW JERSEY 08034-1838

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**APPENDIX 1**

**SPURIOUS EMISSIONS CALCULATIONS**

SPURIOUS EMISSIONS PROGRAM REV 1.2

ST. LOUIS, MO MASTER ANTENNA SYSTEM  
ST. LOUIS MO  
JOB # 289 A 100

Calculated: 2 Dec 1990 11:13:47

SPURIOUS EMISSIONS UP TO ORDER 3

ALL FREQUENCIES ARE IN MHZ

XMIT FREQUENCIES

F 1	91.5000
F 2	93.7000
F 3	94.7000
F 4	96.3000
F 5	98.1000
F 6	99.1000
F 7	102.5000
F 8	103.3000
F 9	106.5000
F10	107.7000

RECEIVE

FREQUENCY	BANDWIDTH
240.0000	460.0000

ORDER	SPUR	COMPONENTS	
2	10.2000	-F4	+F9
2	11.0000	-F1	+F7
2	11.4000	-F4	+F10
2	11.8000	-F1	+F8
2	11.8000	-F3	+F9
2	12.8000	-F2	+F9
2	13.0000	-F3	+F10
2	14.0000	-F2	+F10
2	15.0000	-F1	+F9
2	16.2000	-F1	+F10
2	183.0000	+2F1	
2	185.2000	+F1	+F2
2	186.2000	+F1	+F3
2	187.4000	+2F2	
2	187.8000	+F1	+F4
2	188.4000	+F2	+F3
2	189.4000	+2F3	
2	189.6000	+F1	+F5
2	190.0000	+F2	+F4
2	190.6000	+F1	+F6
2	191.0000	+F3	+F4
2	191.8000	+F2	+F5
2	192.6000	+2F4	
2	192.8000	+F3	+F5
2	192.8000	+F2	+F6
2	193.8000	+F3	+F6
2	194.0000	+F1	+F7
2	194.4000	+F4	+F5
2	194.8000	+F1	+F8
2	195.4000	+F4	+F6
2	196.2000	+2F5	
2	196.2000	+F2	+F7
2	197.0000	+F2	+F8
2	197.2000	+F5	+F6
2	197.2000	+F3	+F7
2	198.0000	+F3	+F8
2	198.0000	+F1	+F9
2	198.2000	+2F6	
2	198.8000	+F4	+F7
2	199.2000	+F1	+F10

2	199.6000	+F4	+F8	
2	200.2000	+F2	+F9	
2	200.6000	+F5	+F7	
2	201.2000	+F3	+F9	
2	201.4000	+F5	+F8	
2	201.4000	+F2	+F10	
2	201.6000	+F6	+F7	
2	202.4000	+F6	+F8	
2	202.4000	+F3	+F10	
2	202.8000	+F4	+F9	
2	204.0000	+F4	+F10	
2	204.6000	+F5	+F9	
2	205.0000	+2F7		
2	205.6000	+F6	+F9	
2	205.8000	+F7	+F8	
2	205.8000	+F5	+F10	
2	206.6000	+2F8		
2	206.8000	+F6	+F10	
2	209.0000	+F7	+F9	
2	209.8000	+F8	+F9	
2	210.2000	+F7	+F10	
2	211.0000	+F8	+F10	
2	213.0000	+2F9		
2	214.2000	+F9	+F10	
2	215.4000	+2F10		
3	75.3000	+2F1	-F10	
3	76.5000	+2F1	-F9	
3	77.5000	+F1	+F2	-F10
3	78.5000	+F1	+F3	-F10
3	78.7000	+F1	+F2	-F9
3	79.7000	+2F2	-F10	
3	79.7000	+2F1	-F8	
3	79.7000	+F1	+F3	-F9
3	80.1000	+F1	+F4	-F10
3	80.5000	+2F1	-F7	
3	80.7000	+F2	+F3	-F10
3	80.9000	+2F2	-F9	
3	81.3000	+F1	+F4	-F9
3	81.7000	+2F3	-F10	
3	81.9000	+F2	+F3	-F9

ORDER	SPUR	COMPONENTS			PAGE	4
3	81.9000	+F1	+F5	-F10		
3	81.9000	+F1	+F2	-F8		
3	82.3000	+F2	+F4	-F10		
3	82.7000	+F1	+F2	-F7		
3	82.9000	+2F3	-F9			
3	82.9000	+F1	+F6	-F10		
3	82.9000	+F1	+F3	-F8		
3	83.1000	+F1	+F5	-F9		
3	83.3000	+F3	+F4	-F10		
3	83.5000	+F2	+F4	-F9		
3	83.7000	+F1	+F3	-F7		
3	83.9000	+2F1	-F6			
3	84.1000	+F2	+F5	-F10		
3	84.1000	+2F2	-F8			
3	84.1000	+F1	+F6	-F9		
3	84.5000	+F3	+F4	-F9		
3	84.5000	+F1	+F4	-F8		
3	84.9000	+2F4	-F10			
3	84.9000	+2F2	-F7			
3	84.9000	+2F1	-F5			
3	85.1000	+F3	+F5	-F10		
3	85.1000	+F2	+F6	-F10		
3	85.1000	+F2	+F3	-F8		
3	85.3000	+F2	+F5	-F9		
3	85.3000	+F1	+F4	-F7		
3	85.9000	+F2	+F3	-F7		
3	86.1000	+2F4	-F9			
3	86.1000	+F3	+F6	-F10		
3	86.1000	+2F3	-F8			
3	86.1000	+F1	+F2	-F6		
3	86.3000	+F3	+F5	-F9		
3	86.3000	+F2	+F6	-F9		
3	86.3000	+F1	+F7	-F10		
3	86.3000	+F1	+F5	-F8		
3	86.7000	+F4	+F5	-F10		
3	86.7000	+F2	+F4	-F8		
3	86.7000	+2F1	-F4			
3	86.9000	+2F3	-F7			
3	87.1000	+F1	+F8	-F10		
3	87.1000	+F1	+F5	-F7		

ORDER SPUR COMPONENTS

PAGE 5

3	87.1000	+F1	+F3	-F6
3	87.1000	+F1	+F2	-F5
3	87.3000	+F3	+F6	-F9
3	87.3000	+F1	+F6	-F8
3	87.5000	+F2	+F4	-F7
3	87.5000	+F1	+F7	-F9
3	87.7000	+F4	+F6	-F10
3	87.7000	+F3	+F4	-F8
3	87.9000	+F4	+F5	-F9
3	88.1000	+F1	+F6	-F7
3	88.1000	+F1	+F3	-F5
3	88.3000	+2F2	-F6	
3	88.3000	+F1	+F8	-F9
3	88.3000	+2F1	-F3	
3	88.5000	+2F5	-F10	
3	88.5000	+F3	+F4	-F7
3	88.5000	+F2	+F7	-F10
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3	88.7000	+F1	+F4	-F6
3	88.9000	+F4	+F6	-F9
3	88.9000	+F1	+F2	-F4
3	89.3000	+2F4	-F8	
3	89.3000	+F2	+F8	-F10
3	89.3000	+F2	+F5	-F7
3	89.3000	+F2	+F3	-F6
3	89.3000	+2F2	-F5	
3	89.3000	+2F1	-F2	
3	89.5000	+F5	+F6	-F10
3	89.5000	+F3	+F7	-F10
3	89.5000	+F3	+F5	-F8
3	89.5000	+F2	+F6	-F8
3	89.7000	+2F5	-F9	
3	89.7000	+F2	+F7	-F9
3	89.7000	+F1	+F4	-F5
3	89.9000	+F1	+F3	-F4
3	90.1000	+2F4	-F7	
3	90.3000	+F3	+F8	-F10
3	90.3000	+F3	+F5	-F7
3	90.3000	+2F3	-F6	
3	90.3000	+F2	+F6	-F7

ORDER	SPUR	COMPONENTS			PAGE	6
3	90.3000	+F2	+F3	-F5		
3	90.3000	+F1	+F9	-F10		
3	90.5000	+2F6	-F10			
3	90.5000	+F3	+F6	-F8		
3	90.5000	+F2	+F8	-F9		
3	90.5000	+F1	+F5	-F6		
3	90.5000	+F1	+F2	-F3		
3	90.7000	+F5	+F6	-F9		
3	90.7000	+F3	+F7	-F9		
3	90.7000	+F1	+F7	-F8		
3	90.9000	+F2	+F4	-F6		
3	91.1000	+F4	+F7	-F10		
3	91.1000	+F4	+F5	-F8		
3	91.1000	+2F2	-F4			
3	91.3000	+F3	+F6	-F7		
3	91.3000	+2F3	-F5			
3	91.5000	+F3	+F8	-F9		
3	91.7000	+2F6	-F9			
3	91.9000	+F4	+F8	-F10		
3	91.9000	+F4	+F5	-F7		
3	91.9000	+F3	+F4	-F6		
3	91.9000	+F2	+F4	-F5		
3	92.1000	+F4	+F6	-F8		
3	92.1000	+F2	+F3	-F4		
3	92.3000	+F4	+F7	-F9		
3	92.3000	+F1	-F7	+F8		
3	92.5000	+F2	+F9	-F10		
3	92.5000	+F1	-F2	+F3		
3	92.5000	+F1	-F5	+F6		
3	92.7000	+F2	+F5	-F6		
3	92.7000	+2F2	-F3			
3	92.7000	+F1	-F9	+F10		
3	92.9000	+F5	+F7	-F10		
3	92.9000	+2F5	-F8			
3	92.9000	+F4	+F6	-F7		
3	92.9000	+F3	+F4	-F5		
3	92.9000	+F2	+F7	-F8		
3	93.1000	+F4	+F8	-F9		
3	93.1000	+2F3	-F4			
3	93.1000	+F1	-F3	+F4		

ORDER	SPUR	COMPONENTS			PAGE	7
3	93.3000	+F1	-F4	+F5		
3	93.5000	+2F4	-F6			
3	93.5000	+F3	+F9	-F10		
3	93.7000	+F5	+F8	-F10		
3	93.7000	+2F5	-F7			
3	93.7000	+F3	+F5	-F6		
3	93.9000	+F6	+F7	-F10		
3	93.9000	+F5	+F6	-F8		
3	93.9000	+F3	+F7	-F8		
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3	94.1000	+F1	-F2	+F4		
3	94.3000	+F1	-F4	+F6		
3	94.5000	+2F4	-F5			
3	94.5000	+F2	-F7	+F8		
3	94.7000	+F6	+F8	-F10		
3	94.7000	+F5	+F6	-F7		
3	94.7000	+F2	-F5	+F6		
3	94.7000	+F1	-F8	+F9		
3	94.9000	+2F6	-F8			
3	94.9000	+F5	+F8	-F9		
3	94.9000	+F2	-F9	+F10		
3	94.9000	+F1	-F3	+F5		
3	94.9000	+F1	-F6	+F7		
3	95.1000	+F6	+F7	-F9		
3	95.1000	+F4	+F9	-F10		
3	95.3000	+F4	+F5	-F6		
3	95.3000	+F2	-F3	+F4		
3	95.5000	+F4	+F7	-F8		
3	95.5000	+F3	-F7	+F8		
3	95.5000	+F2	-F4	+F5		
3	95.5000	+F1	-F7	+F9		
3	95.7000	+2F6	-F7			
3	95.7000	-F2	+2F3			
3	95.7000	+F3	-F5	+F6		
3	95.7000	+F1	-F6	+F8		
3	95.9000	+F6	+F8	-F9		
3	95.9000	-F1	+2F2			
3	95.9000	+F3	-F9	+F10		
3	95.9000	+F1	-F2	+F5		
3	95.9000	+F1	-F3	+F6		

ORDER	SPUR	COMPONENTS			PAGE	8
3	95.9000	+F1	-F5	+F7		
3	95.9000	+F1	-F8	+F10		
3	96.5000	+F3	-F4	+F5		
3	96.5000	+F2	-F4	+F6		
3	96.7000	+F1	-F5	+F8		
3	96.7000	+F1	-F7	+F10		
3	96.9000	+F5	+F9	-F10		
3	96.9000	-F1	+F2	+F3		
3	96.9000	+F2	-F8	+F9		
3	96.9000	+F1	-F2	+F6		
3	97.1000	+2F5	-F6			
3	97.1000	+F4	-F7	+F8		
3	97.1000	+F2	-F3	+F5		
3	97.1000	+F2	-F6	+F7		
3	97.3000	+2F7	-F10			
3	97.3000	+F5	+F7	-F8		
3	97.3000	+F4	-F5	+F6		
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3	97.5000	+F4	-F9	+F10		
3	97.5000	+F3	-F4	+F6		
3	97.7000	+F2	-F7	+F9		
3	97.7000	+F1	-F4	+F7		
3	97.9000	+F6	+F9	-F10		
3	97.9000	-F1	+2F3			
3	97.9000	-F3	+2F4			
3	97.9000	+F3	-F8	+F9		
3	97.9000	+F2	-F6	+F8		
3	98.1000	+F7	+F8	-F10		
3	98.1000	+F3	-F6	+F7		
3	98.1000	+F2	-F3	+F6		
3	98.1000	+F2	-F5	+F7		
3	98.1000	+F2	-F8	+F10		
3	98.3000	+F6	+F7	-F8		
3	98.5000	+2F7	-F9			
3	98.5000	-F1	+F2	+F4		
3	98.5000	+F1	-F4	+F8		
3	98.7000	+F3	-F7	+F9		
3	98.9000	+2F8	-F10			
3	98.9000	+F5	-F7	+F8		
3	98.9000	-F2	+2F4			

ORDER SPUR

COMPONENTS

PAGE 9

3	98.9000	+F3	-F6	+F8
3	98.9000	+F2	-F5	+F8
3	98.9000	+F2	-F7	+F10
3	98.9000	+F1	-F6	+F9
3	99.1000	-F2	+F3	+F5
3	99.1000	+F3	-F5	+F7
3	99.1000	+F3	-F8	+F10
3	99.3000	+F7	+F8	-F9
3	99.3000	+F5	-F9	+F10
3	99.3000	+F1	-F3	+F7
3	99.5000	-F1	+F3	+F4
3	99.5000	+F4	-F8	+F9
3	99.7000	+F4	-F6	+F7
3	99.7000	-F3	+F4	+F5
3	99.9000	+F6	-F7	+F8
3	99.9000	-F4	+2F5	
3	99.9000	+F3	-F5	+F8
3	99.9000	+F3	-F7	+F10
3	99.9000	+F2	-F4	+F7
3	99.9000	+F1	-F5	+F9
3	100.1000	+2F8	-F9	
3	100.1000	-F5	+2F6	
3	100.1000	-F2	+F3	+F6
3	100.1000	+F1	-F3	+F8
3	100.1000	+F1	-F6	+F10
3	100.3000	+F6	-F9	+F10
3	100.3000	-F1	+F2	+F5
3	100.3000	+F4	-F7	+F9
3	100.3000	+F1	-F2	+F7
3	100.5000	+F4	-F6	+F8
3	100.7000	+F4	-F5	+F7
3	100.7000	-F2	+F4	+F5
3	100.7000	+F4	-F8	+F10
3	100.7000	-F3	+F4	+F6
3	100.7000	+F2	-F4	+F8
3	100.9000	-F4	+F5	+F6
3	100.9000	+F3	-F4	+F7
3	101.1000	-F1	+2F4	
3	101.1000	+F2	-F6	+F9
3	101.1000	+F1	-F2	+F8

3	101.1000	+F1	-F5	+F10
3	101.3000	+F7	+F9	-F10
3	101.3000	+F5	-F8	+F9
3	101.3000	-F1	+F3	+F5
3	101.3000	-F1	+F2	+F6
3	101.5000	+F5	-F6	+F7
3	101.5000	+F4	-F5	+F8
3	101.5000	+F4	-F7	+F10
3	101.5000	-F3	+2F5	
3	101.5000	+F2	-F3	+F7
3	101.7000	+2F7	-F8	
3	101.7000	-F2	+F4	+F6
3	101.7000	+F3	-F4	+F8
3	101.7000	+F1	-F4	+F9
3	101.9000	-F4	+2F6	
3	102.1000	+F8	+F9	-F10
3	102.1000	+F5	-F7	+F9
3	102.1000	+F3	-F6	+F9
3	102.1000	+F2	-F5	+F9
3	102.3000	+F6	-F8	+F9
3	102.3000	+F5	-F6	+F8
3	102.3000	-F1	+F3	+F6
3	102.3000	+F2	-F3	+F8
3	102.3000	+F2	-F6	+F10
3	102.5000	+F5	-F8	+F10
3	102.5000	-F2	+2F5	
3	102.5000	-F3	+F5	+F6
3	102.9000	-F1	+F4	+F5
3	102.9000	+F1	-F4	+F10
3	103.1000	+F6	-F7	+F9
3	103.1000	+F3	-F5	+F9
3	103.3000	+F5	-F7	+F10
3	103.3000	+F3	-F6	+F10
3	103.3000	+F2	-F5	+F10
3	103.3000	+F1	-F3	+F9
3	103.5000	+F6	-F8	+F10
3	103.5000	-F2	+F5	+F6
3	103.5000	-F3	+2F6	
3	103.5000	-F5	+F6	+F7
3	103.5000	-F2	+F3	+F7

ORDER SPUR COMPONENTS

PAGE 11

3	103.7000	+F7	-F9	+F10
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ORDER SPUR COMPONENTS

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3	319.5000	+3F9		
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3	323.1000	+3F10		

*D.W. Sargent Broadcast Service, Inc.*

804 RICHARD ROAD, CHERRY HILL, NEW JERSEY 08034-1838

TELEPHONE (856) 667-8573

E-MAIL [dwsbsi@comcast.net](mailto:dwsbsi@comcast.net)

FAX (856) 667-1409

**APPENDIX 2**

**SPURIOUS EMISSIONS MEASUREMENTS**

			Directional		IM Product	Carrier	IM Product Level
IM Product			Coupler	IM Product	Corrected	Reference	Reference To
Frequency	Attenuator	Filter Loss	Correction	Level	Level	Level	Carrier Level
MHz	dB	dB	dB	dBu	dBu	dBu	dB
94.7	10	10	19.5	-83	-82.5	16.5	-99
96.9	10	10	19.8	-71	-70.8	16.5	-87.3
97.3	10	10	19.8	-85	-84.8	16.5	-101.3
98.1	10	10	19.9	-79	-78.9	16.5	-95.4
98.5	10	10	19.9	-92	-91.9	16.5	-108.4
98.7	10	10	19.9	-94	-93.9	16.5	-110.4
99.1	10	10	19.9	-85	-84.9	16.5	-101.4
100.1	10	9.7	20.1	-94	-94.4	16.5	-110.9
102.5	10	9.7	20.1	-79	-79.4	16.5	-95.9
103.3	10	9.5	20.1	-71	-72.3	16.5	-88.8
105.5	10	9.3	20.2	-84	-84.9	16.5	-101.4
105.9	0	9	20.2	-66	-77.2	16.5	-93.7
106.5	0	9	20.2	-84	-95.2	16.5	-111.7
107.7	0	9	20.2	-83	-94.2	16.5	-110.7

*D.W. Sargent Broadcast Service, Inc.*

804 RICHARD ROAD, CHERRY HILL, NEW JERSEY 08034-1838

TELEPHONE (856) 667-8573

E-MAIL [dwsbsi@comcast.net](mailto:dwsbsi@comcast.net)

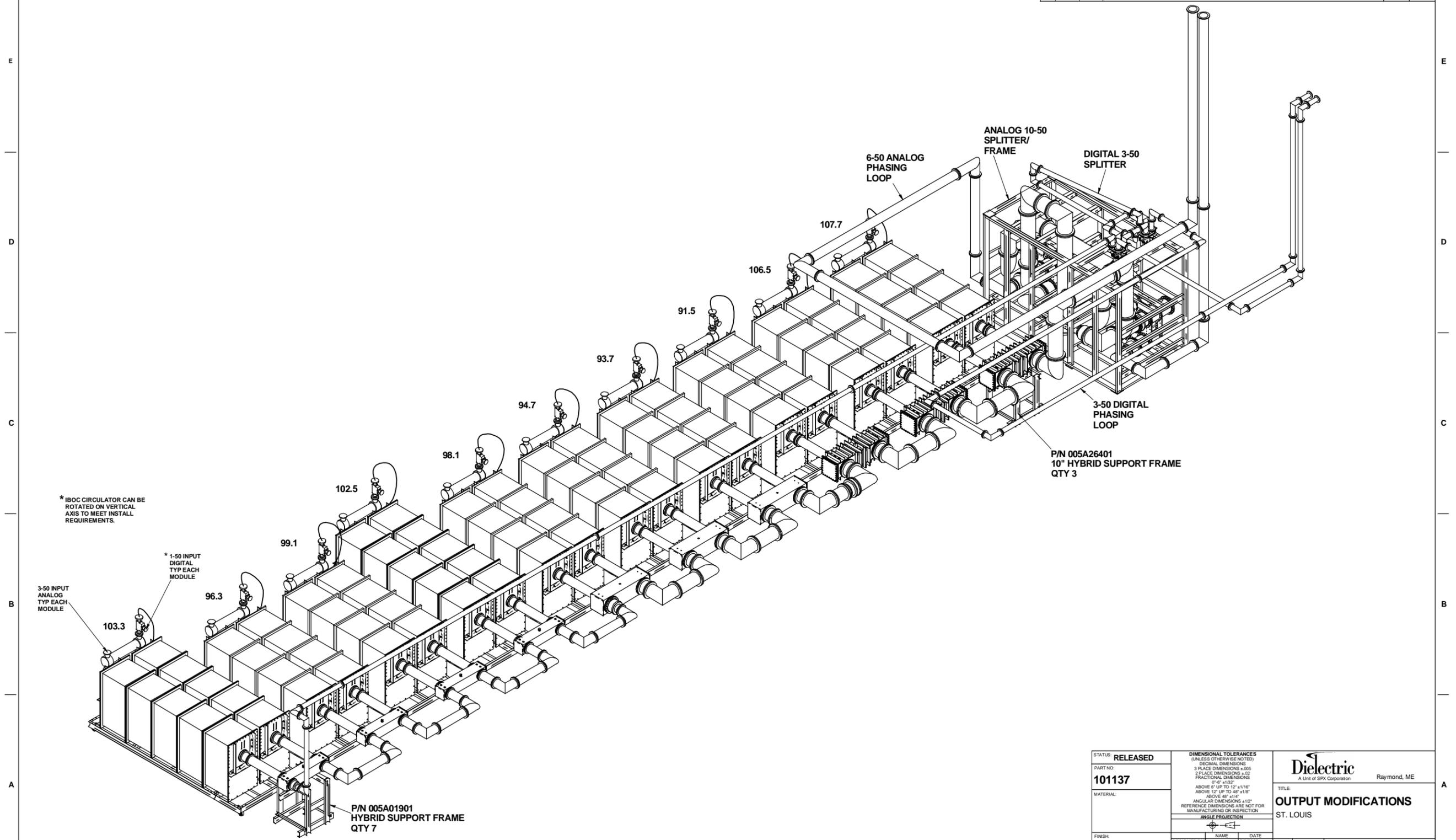
FAX (856) 667-1409

**APPENDIX 3**

**COMBINER DRAWING**

8 7 6 5 8 3 2 1

REV.	SHEET	ZONE	REVISION NOTE	ECO	DATE APPR
C			CAD MAINTAINED. CHANGES SHALL BE INCORPORATED BY THE DESIGN ACTIVITY. PER CUSTOMER REQUEST CHANGED CALL LETTERS FOR 96.3 & 106.5		9/19/2006



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**UNLESS OTHERWISE SPECIFIED**  
MANUFACTURING TOLERANCE AND PROCEDURES MUST BE IN ACCORDANCE WITH D7909P. ALL ALUMINUM, COPPER, AND BRASS WELDING MUST COMPLY WITH ASME BCT. XVII PRODUCTION WELDING PROCEDURES. STRUCTURAL STEEL WELDING MUST COMPLY WITH AWS 1.1 CURRENT REVISION.

STATUS: <b>RELEASED</b>		<b>Dielectric</b> A Unit of SPX Corporation Raymond, ME	
PART NO: <b>101137</b>	DIMENSIONAL TOLERANCES (UNLESS OTHERWISE NOTED) DECIMAL DIMENSIONS 3 PLACE DIMENSIONS ±.005 2 PLACE DIMENSIONS ±.02 FRACTIONAL DIMENSIONS 0/16 ±.02 ABOVE 6" UP TO 12" ±.116" ABOVE 12" UP TO 48" ±.18" ABOVE 48" ±.14" ANGULAR DIMENSIONS ±12° REFERENCE DIMENSIONS ARE NOT FOR MANUFACTURING OR INSPECTION		
MATERIAL:	ANGLE PROJECTION 		
FINISH: CLEAN ONLY	DESIGNED BY: MarciaK 9/9/2006	DATE: 9/9/2006	TITLE: <b>OUTPUT MODIFICATIONS</b> ST. LOUIS
	DETAIL BY: MarciaK 9/9/2006	9/9/2006	
	CHKD BY: Kenal 9/9/2006	9/9/2006	GAGE CODE: <b>D 08441</b> DRAWING NO.: <b>004A79601</b>
	ENGR. 1 APPR: Bill 9/9/2006	9/9/2006	
	ENGR. 2 APPR: N/A 9/9/2006	9/9/2006	SHEET: 1 OF 3
	MANUFACT. (Paw) 9/15/2006	9/15/2006	

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