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ENGINEERING REPORT:

INTERMODULATION MEASUREMENTS ON COMBINED FM ANTENNA SYSTEM

Citadel and Boise State Combined Antenna System
Deer Point Transmitter Site, Boise, Idaho

August 2001

INTRODUCTION

Spectrum measurements intended to detect unwanted intermodulation products were made on the Citadel and Boise State combined antenna system located at, the Deer Point Transmitter Site, Boise, Idaho. These were made between 9:00 a.m. and 1:00 p.m. on the 30th of August 2001. The measurements were made with all six stations operating into the combined Harris/Dielectric TAC-6FMB-3/18 master antenna. All stations were operating at full power and with normal modulation while measurements were being made. Spectrum measurements were made to confirm that this antenna system and all of the stations comply with “§73.317 *FM Transmission System Requirements*” as required by the Construction Permits (Condition #4), and to assure that the combiner was operating correctly.

STATIONS

The following stations will operate at this site.

Call	Frequency	Power (ERP)
KBSU	90.3 MHz	17.5 kW
KBSX	91.5 MHz	3.7 kW
KIZN	92.3 MHz	48.0 kW
KZMG	93.1 MHz	48.0 kW
KKGL Formerly (KLCL)	96.9 MHz	48.0 kW
KQFC	97.9 MHz	48.0 kW

COMBINED ANTENNA MEASUREMENTS PROCEDURE

The measurements were made using a Hewlett Packard 8591E Spectrum Analyzer from the directional coupler sample port (50 dB) in the combined transmission line. A tunable bandpass cavity (88 MHz to 108 MHz) with 26 dB of attenuation, along with a high pass filter for measurements above 108 MHz, were used to make measurements at levels more than 80 dB

below the FM signals. An additional 30 dB attenuator was used to assure that the Spectrum Analyzer was not producing any internal intermodulation products. A IFR 1200 Signal Generator was connected to a Narda 3020A Bi-Directional Coupler to tune the bandpass cavity to the desired frequency. See enclosed Test Setup Diagram.

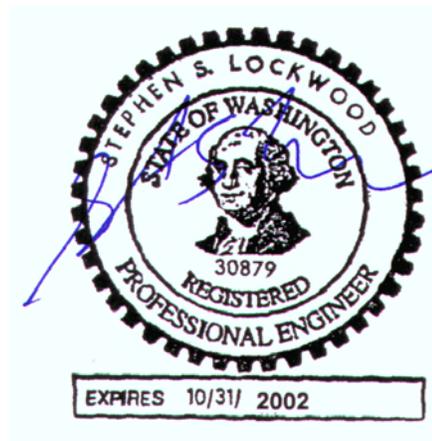
The bandpass cavity was tuned to the frequency of each of the predicted intermodulation products. Measurements were made on each potential intermodulation product frequency from 88 MHz to 108 MHz. Frequencies above 108 MHz were swept for any observable intermodulation products. For products that were close in frequency to operating transmitters, the specific carriers were turned off to observe these intermodulation products. Enclosed are the spectral graphs of the measurements of the occupied bandwidth of each station. There were no harmonics or mix products that exceed the requirements as set forth in §73.317.

STATEMENT OF ENGINEER

This Engineering Report, which is part of applications for license for FM stations operating from the Citadel and Boise State combined antenna system at the Deer Point Transmitter Site, Boise, Idaho, been prepared under my direct supervision. All representations contained herein are true to the best of my knowledge. I am an experienced radio engineer whose qualifications are a matter of record with the Federal Communications Commission. I am a partner in the firm of Hatfield and Dawson Consulting Engineers and am Registered as a Professional Engineer in the States of Washington and Alaska.

30 August 2001

Stephen S. Lockwood, P.E.



Hatfield & Dawson Consulting Engineers

Predicted Intermodulation Products 88-150 MHz

Deer Point Master Antenna

2 x 91.5	+	2 x 97.9	-	3 x 96.9	=	88.1
2	x	93.1	-	1 x 97.9	=	88.3
1 x 91.5	+	3 x 96.9	-	3 x 97.9	=	88.5
1 x 97.9	+	2 x 92.3	-	2 x 96.9	=	88.7
1 x 92.3	+	2 x 91.5	-	2 x 93.1	=	89.1
2	x	93.1	-	1 x 96.9	=	89.3
1 x 91.5	+	2 x 96.9	-	2 x 97.9	=	89.5
2 x 92.3	+	2 x 97.9	-	3 x 96.9	=	89.7
2	x	91.5	-	1 x 93.1	=	89.9
1 x 93.1	+	3 x 96.9	-	3 x 97.9	=	90.1
1 x 92.3	+	2 x 96.9	-	2 x 97.9	=	90.3
1 x 91.5	+	1 x 96.9	-	1 x 97.9	=	90.5
2	x	91.5	-	1 x 92.3	=	90.7
1 x 93.1	+	2 x 96.9	-	2 x 97.9	=	91.1
1 x 92.3	+	1 x 96.9	-	1 x 97.9	=	91.3
2	x	92.3	-	1 x 93.1	=	91.5
1 x 93.1	+	1 x 96.9	-	1 x 97.9	=	92.1
1 x 91.5	+	1 x 93.1	-	1 x 92.3	=	92.3
1 x 91.5	+	1 x 97.9	-	1 x 96.9	=	92.5
2	x	92.3	-	1 x 91.5	=	93.1
1 x 92.3	+	1 x 97.9	-	1 x 96.9	=	93.3
1 x 91.5	+	2 x 97.9	-	2 x 96.9	=	93.5
1 x 96.9	+	2 x 91.5	-	2 x 93.1	=	93.7
2	x	93.1	-	1 x 92.3	=	93.9
1 x 93.1	+	1 x 97.9	-	1 x 96.9	=	94.1
1 x 92.3	+	2 x 97.9	-	2 x 96.9	=	94.3
1 x 96.9	+	3 x 91.5	-	3 x 92.3	=	94.5

Predicted Intermodulation Products 88-150 MHz

Deer Point Master Antenna

2	x	93.1	-	1	x	91.5	=	94.7				
3	x	96.9	-	2	x	97.9	=	94.9				
1 x		93.1	+	2 x		97.9	-	2 x	96.9	=	95.1	
1 x		91.5	+	1 x		96.9	-	1 x		93.1	=	95.3
1 x		92.3	+	2 x		93.1	-	2 x		91.5	=	95.5
2	x	96.9	-	1	x	97.9	=	95.9				
1 x		92.3	+	1 x		96.9	-	1 x		93.1	=	96.1
1 x		91.5	+	1 x		97.9	-	1 x		93.1	=	96.3
1 x		92.3	+	1 x		97.9	-	1 x		93.1	=	97.1
2 x		91.5	+	2 x		96.9	-	3 x		93.1	=	97.5
1 x		93.1	+	1 x		96.9	-	1 x		92.3	=	97.7
1 x		93.1	+	1 x		96.9	-	1 x		91.5	=	98.5
1 x		93.1	+	1 x		97.9	-	1 x		92.3	=	98.7
2	x	97.9	-	1	x	96.9	=	98.9				
1 x		91.5	+	2 x		96.9	-	2 x		93.1	=	99.1
1 x		96.9	+	3 x		92.3	-	3 x		91.5	=	99.3
1 x		93.1	+	1 x		97.9	-	1 x		91.5	=	99.5
1 x		92.3	+	2 x		96.9	-	2 x		93.1	=	99.9
1 x		96.9	+	2 x		93.1	-	2 x		91.5	=	100.1
1 x		97.9	+	3 x		93.1	-	3 x		92.3	=	100.3
2	x	96.9	-	1	x	93.1	=	100.7				
1 x		91.5	+	2 x		97.9	-	2 x		93.1	=	101.1
2	x	96.9	-	1	x	92.3	=	101.5				
1 x		96.9	+	3 x		93.1	-	3 x		91.5	=	101.7
2 x		91.5	+	2 x		97.9	-	3 x		92.3	=	101.9
2	x	96.9	-	1	x	91.5	=	102.3				
1 x		96.9	+	1 x		97.9	-	1 x		92.3	=	102.5

Predicted Intermodulation Products 88-150 MHz

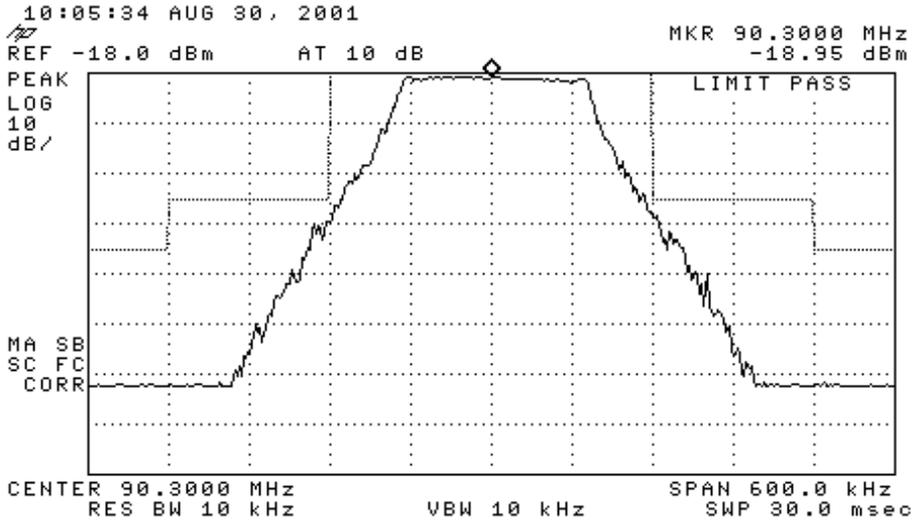
Deer Point Master Antenna

2	x	97.9	-	1	x	93.1	=	102.7				
1 x		91.5	+	3 x		96.9	-	3 x		93.1	=	102.9
1 x		92.3	+	2 x		96.9	-	2 x		91.5	=	103.1
1 x		96.9	+	1 x		97.9	-	1 x		91.5	=	103.3
2	x	97.9	-	1	x	92.3	=	103.5				
1 x		92.3	+	3 x		96.9	-	3 x		93.1	=	103.7
1 x		93.1	+	2 x		96.9	-	2 x		91.5	=	103.9
2	x	97.9	-	1	x	91.5	=	104.3				
3	x	96.9	-	2	x	93.1	=	104.5				
1 x		92.3	+	2 x		97.9	-	2 x		91.5	=	105.1
1 x		91.5	+	3 x		96.9	-	3 x		92.3	=	105.3
1 x		97.9	+	2 x		96.9	-	2 x		93.1	=	105.5
1 x		93.1	+	2 x		97.9	-	2 x		91.5	=	105.9
3	x	96.9	-	2	x	92.3	=	106.1				
1 x		96.9	+	2 x		97.9	-	2 x		93.1	=	106.5
1 x		92.3	+	3 x		97.9	-	3 x		93.1	=	106.7
1 x		93.1	+	3 x		96.9	-	3 x		92.3	=	106.9
1 x		97.9	+	2 x		96.9	-	2 x		92.3	=	107.1
3	x	97.9	-	2	x	93.1	=	107.5				
3	x	96.9	-	2	x	91.5	=	107.7				
1 x		96.9	+	2 x		97.9	-	2 x		92.3	=	108.1
1 x		91.5	+	3 x		97.9	-	3 x		92.3	=	108.3
1 x		92.3	+	3 x		96.9	-	3 x		91.5	=	108.5
1 x		97.9	+	2 x		96.9	-	2 x		91.5	=	108.7
3	x	97.9	-	2	x	92.3	=	109.1				
1 x		93.1	+	3 x		96.9	-	3 x		91.5	=	109.3
1 x		96.9	+	2 x		97.9	-	2 x		91.5	=	109.7

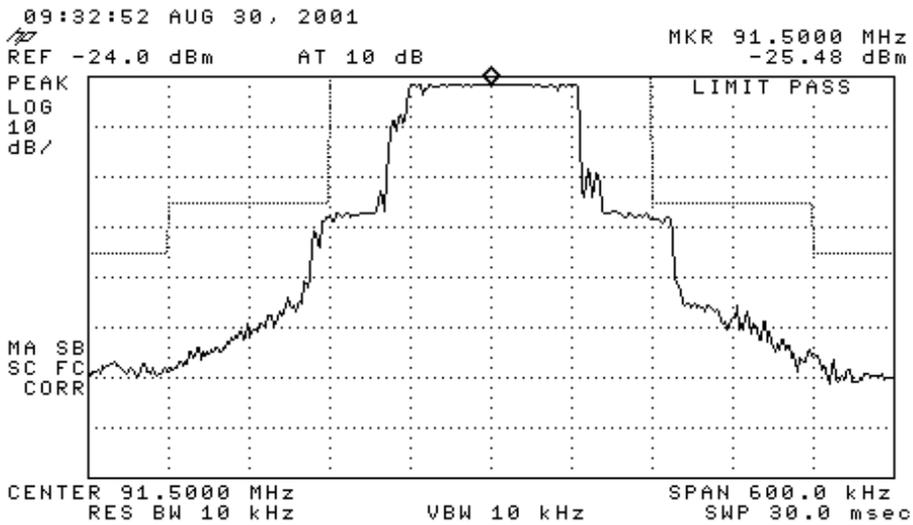
Predicted Intermodulation Products 88-150 MHz

Deer Point Master Antenna

1 x 93.1	+	3 x 97.9	-	3 x 92.3	=	109.9
2 x 96.9	+	2 x 97.9	-	3 x 93.1	=	110.3
3 x		97.9	-	2 x		91.5
1 x 96.9	+	3 x 97.9	-	3 x 93.1	=	111.3
1 x 92.3	+	3 x 97.9	-	3 x 91.5	=	111.5
1 x 97.9	+	3 x 96.9	-	3 x 92.3	=	111.7
1 x 93.1	+	3 x 97.9	-	3 x 91.5	=	112.3
2 x 96.9	+	2 x 97.9	-	3 x 92.3	=	112.7
1 x 96.9	+	3 x 97.9	-	3 x 92.3	=	113.7
1 x 97.9	+	3 x 96.9	-	3 x 91.5	=	114.1
2 x 96.9	+	2 x 97.9	-	3 x 91.5	=	115.1
1 x 96.9	+	3 x 97.9	-	3 x 91.5	=	116.1



RT

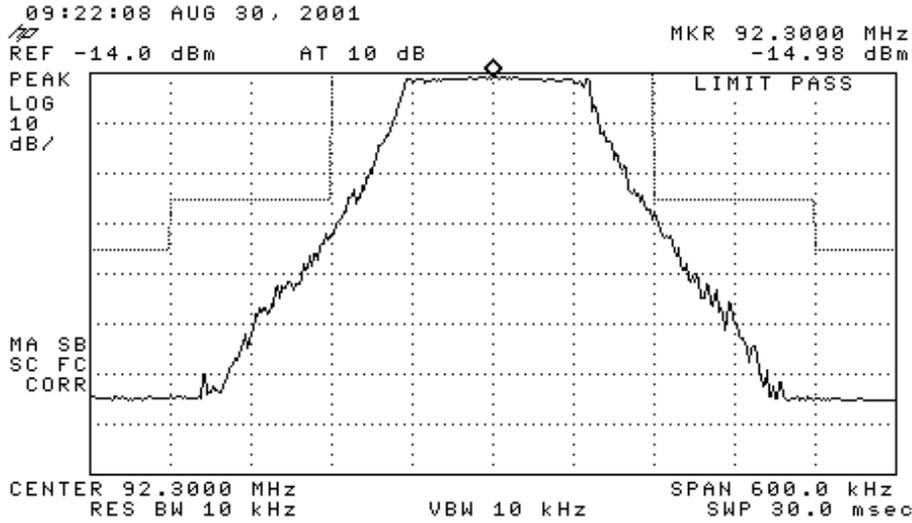


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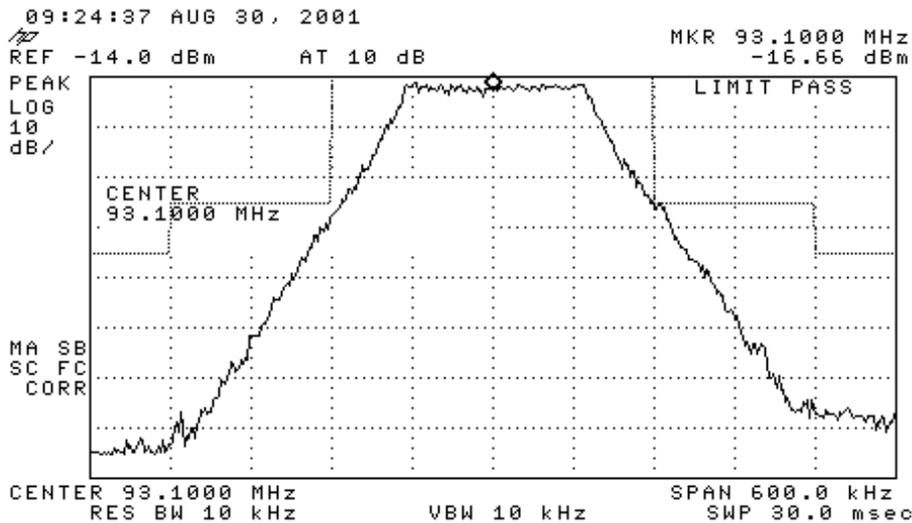
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CONSULTING ENGINEERS**

**KBSU AND KBSX
REFERENCE STATION SIGNALS**
Deer Point, Idaho

August 2001



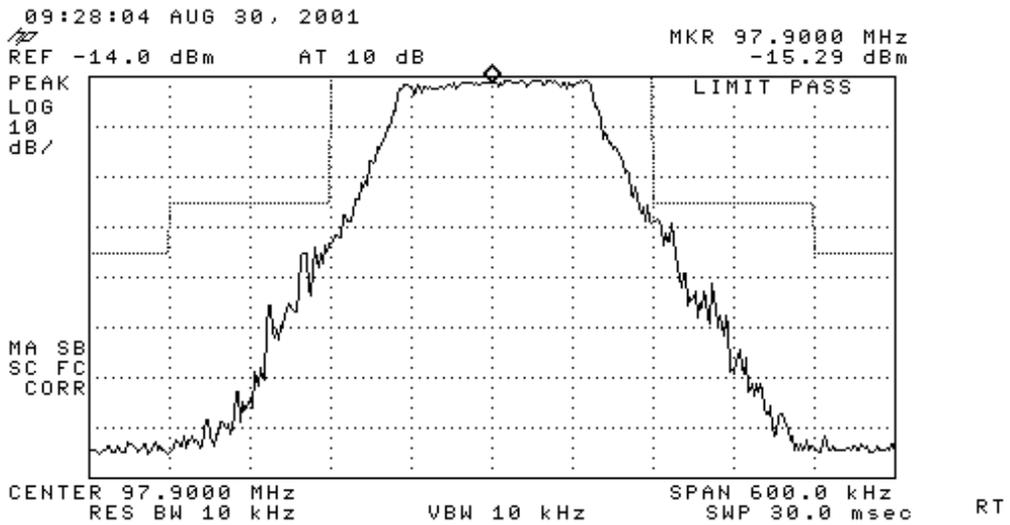
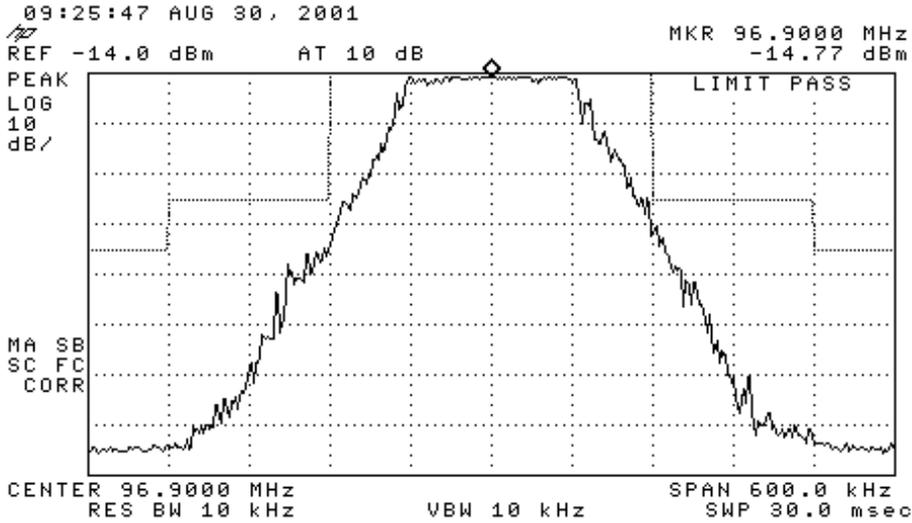
RT



RL

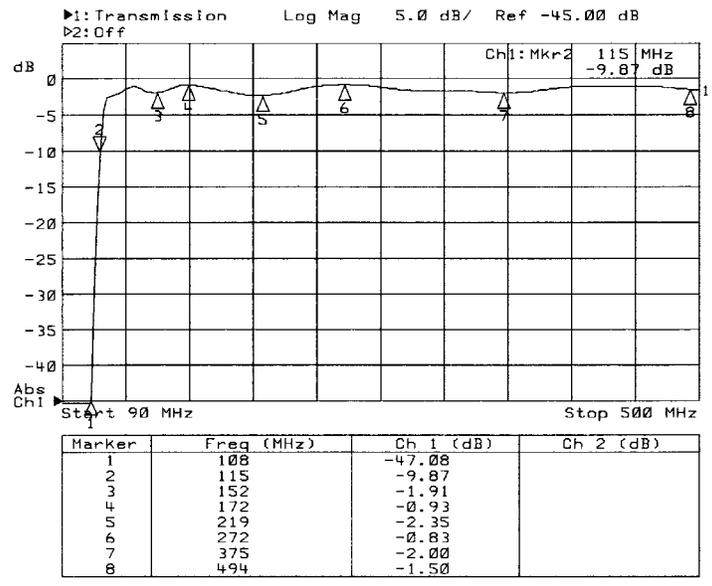
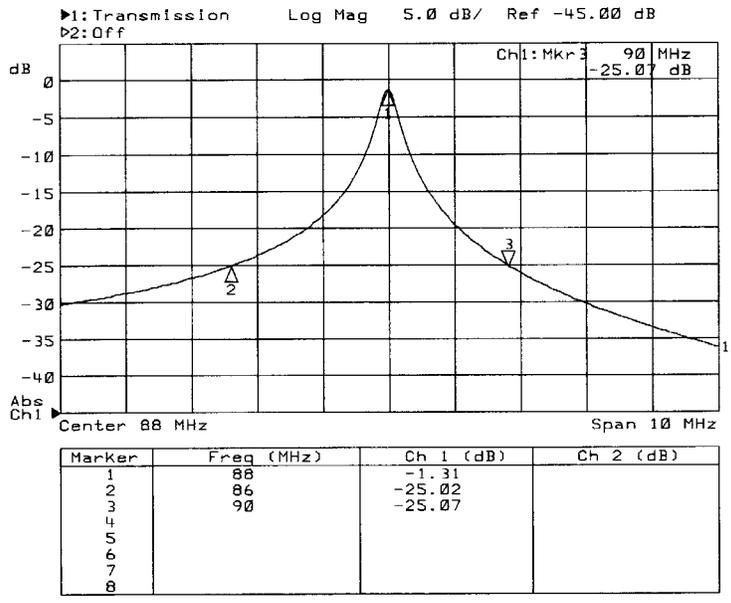
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CONSULTING ENGINEERS**

KIZN AND KZMG
REFERENCE STATION SIGNALS
Deer Point, Idaho August 2001



**HATFIELD & DAWSON
CONSULTING ENGINEERS**

**KKGL AND KQFC
REFERENCE STATION SIGNALS**
Deer Point, Idaho August 2001

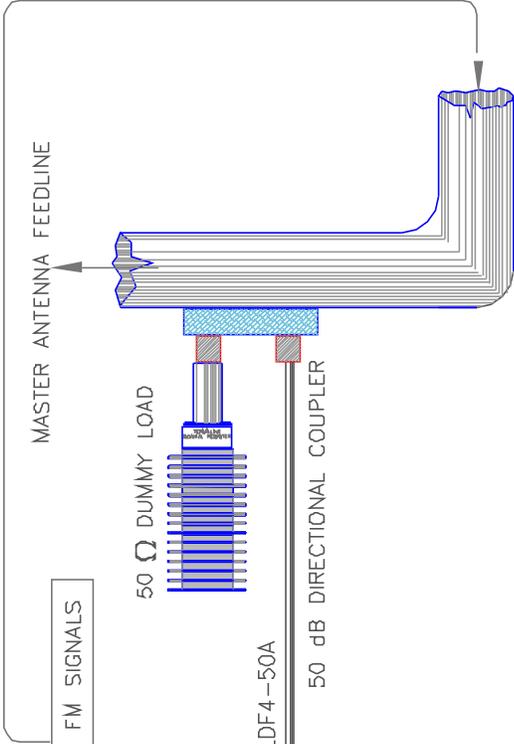


**HATFIELD & DAWSON
 CONSULTING ENGINEERS**

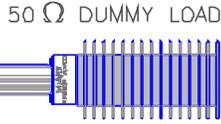
Bandpass and Highpass Filters
 REFERENCE STATION SIGNALS
 Deer Point, Idaho August 2001

KBSU	90.3MHz	17.5kW
KBSX	91.5MHz	3.8kW
KIZN	92.3MHz	48.0kW
KZMG	93.1MHz	48.0kW
KLCI	96.9MHz	48.0kW
KQFC	97.9MHz	48.0kW

COMBINED FM SIGNALS

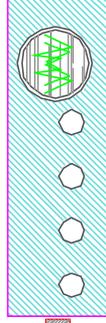


NARDA 3020A BI-DIRECTIONAL COUPLER



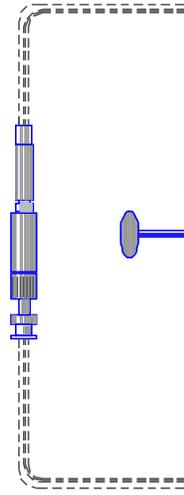
3ft LDF1-50

RAMSEY RSG-1000 SIGNAL GENERATOR



3ft LDF1-50

MICROWAVE FILTER CORPORATION
55KHP-120 FASTTRAP (108 MHz - 1 GHz)

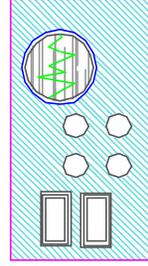


3ft LDF1-50

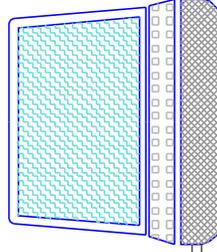
TELEWAVE
TWPC 1005-1
BAND PASS CAVITY
(88 MHz - 108 MHz)

FLUKE 20 dB ATTENUATOR

HP 8591E SPECTRUM ANALYZER



LAPTOP COMPUTER



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SCHEMATIC DIAGRAM
HARRIS - DIELECTRIC MASTER ANTENNA SYSTEM TEST SETUP
CITADEL/BSU DEER POINT, ID 8/2001