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ENGINEERING REPORT:

INTERMODULATION MEASUREMENTS ON COMBINED JAMPRO FM ANTENNA SYSTEM

Prepared for
KNRS-FM 105.9 MHz

Farnsworth Peak, Salt Lake City, Utah

Citicasters Licenses, Inc.

October 2015

INTRODUCTION

Spectrum measurements intended to detect unwanted intermodulation products (spurious emissions) were made on the combined FM Jampro antenna system located on the Bonneville International Corporation Site on Farnsworth Peak, Salt Lake City, Utah. These were made between midnight and 5:30 am on 7 October 2015. The measurements were made with all thirteen stations operating into the combined Jampro antenna system. All stations were operating with licensed power with normal modulation while measurements were being made. Spectrum measurements were made to confirm that all operating stations comply with “§73.317 FM Transmission System Requirements” as required by the Construction Permit and to ensure that the combiner was operating correctly.

STATIONS

The following stations will operate at this site.

Callsign	Frequency	Power (ERP)
KRCL	90.9 MHz	25.0 kW
KUBL	93.3 MHz	25.0 kW
KXRK	96.3 MHz	25.0 kW
KZHT	97.1 MHz	25.0 kW
KBZN	97.9 MHz	25.0 kW
KSFI	100.3 MHz	25.0 kW
KBER	101.1 MHz	25.0 kW
KENZ	101.9 MHz	25.0 kW
KSL	102.7 MHz	25.0 kW
KRSP	103.5 MHz	25.0 kW
KSOP	104.3 MHz	25.0 kW
KNRS	105.9 MHz	25.0 kW
KAAZ	106.7 MHz	25.0 kW

COMBINED ANTENNA MEASUREMENTS PROCEDURE

The measurements were made using a Rohde & Schwarz FSH3 Spectrum Analyzer from the directional coupler sample port (63 dB) in the combined transmission line. A tunable bandpass cavity with 25 dB of attenuation was used to make measurements at levels more than 80 dB below the FM signals. An additional filters and attenuators were used to ensure that the Spectrum Analyzer was not producing any internal intermodulation products. A Signal Generator with an RF switch was used to tune the bandpass cavity to the desired frequency. See Figure 1.

A Telewave TWPC1005-1 bandpass cavity was tuned to the frequency of each of the predicted intermodulation products to ensure that no intermodulation products were being produced in the spectrum analyzer. Measurements were made on each potential intermodulation product frequency from 85 MHz to 130 MHz ($2A \pm B$, $3A \pm B$ and $3A \pm 2B$). Additionally, several highpass filters were used for the measurements above the broadcast band. Frequencies from 130 MHz to 600 MHz were swept for any observable intermodulation or harmonic products. For products that were close in frequency to operating transmitters, the specific carriers were turned off to observe these intermodulation products. Measurements were made with full FM modulation under normal programming. Enclosed are example 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.

CONCLUSION

All of the stations at this facility comply with requirements set forth in §73.317.

STATEMENT OF ENGINEER

This Engineering Report, Intermodulation Measurements On Combined FM Antenna System at Farnsworth Peak, Salt Lake City, Utah, has been prepared by me or 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, Alaska and Wyoming.

7 October 2015

Stephen S. Lockwood, P.E.

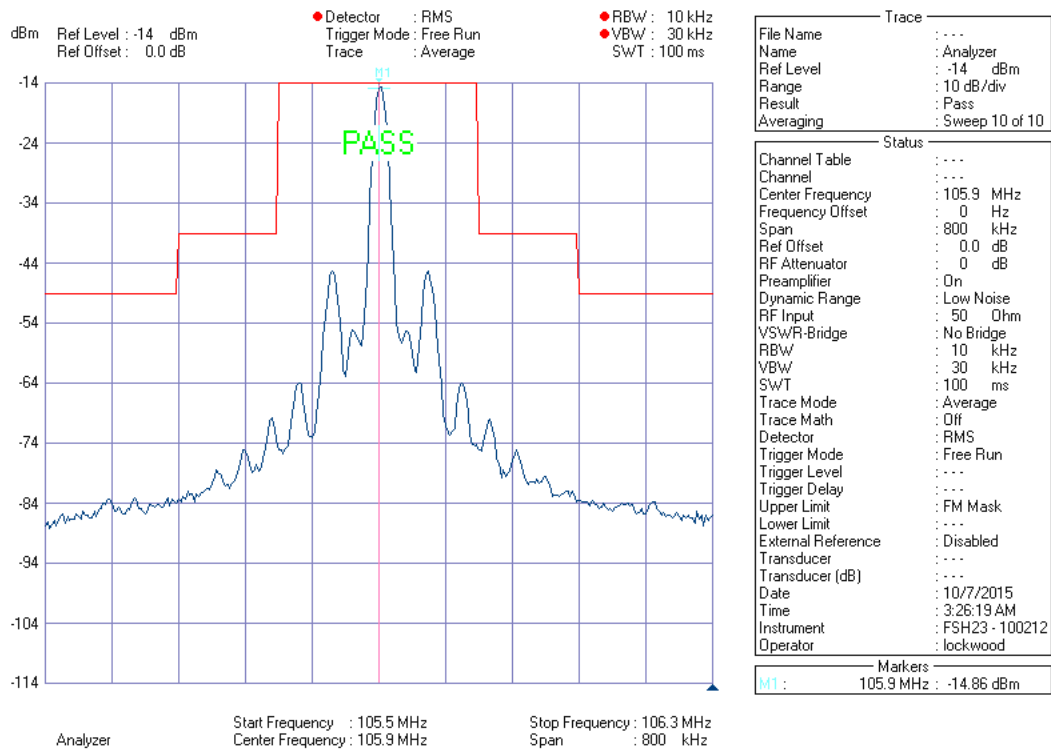


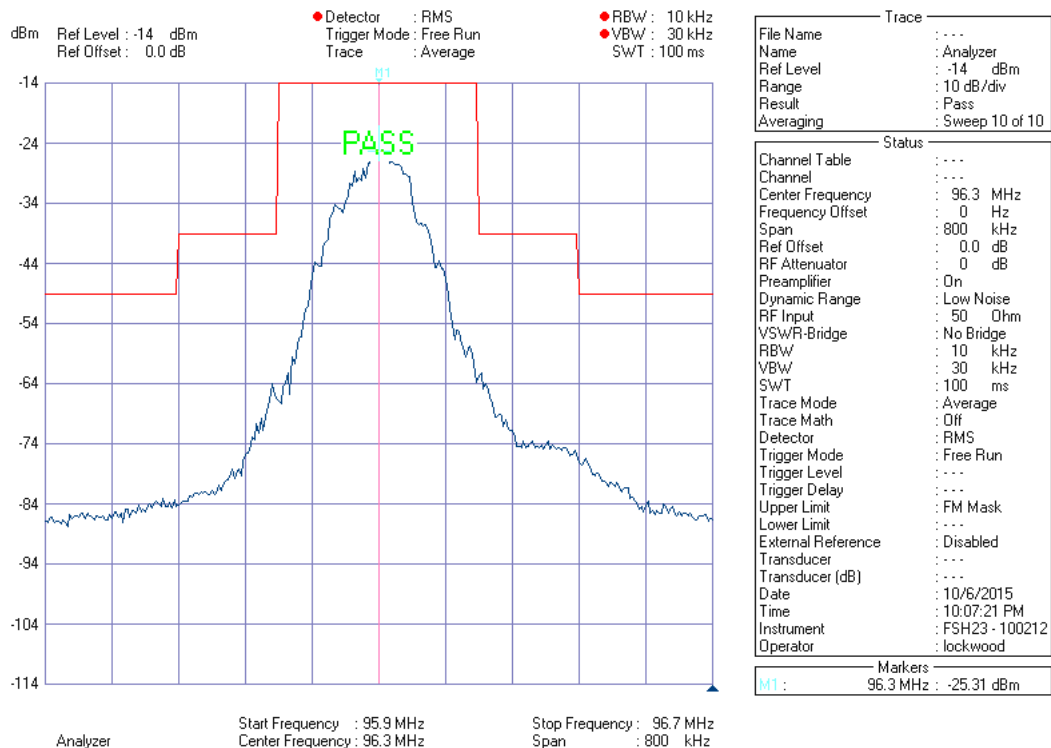
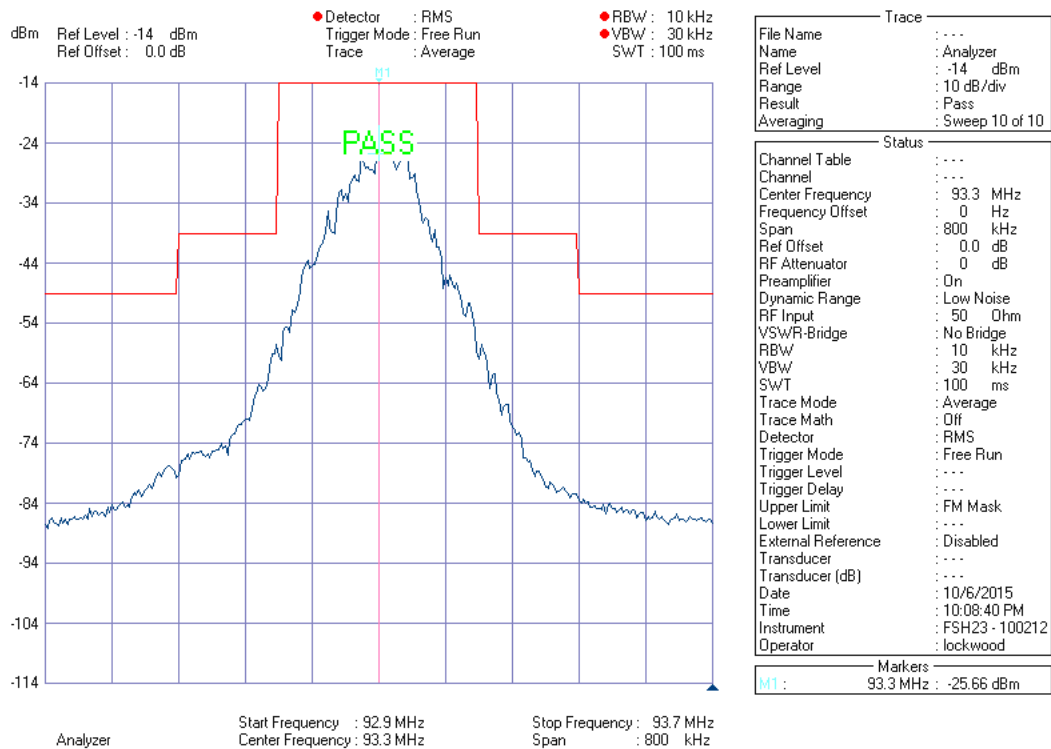
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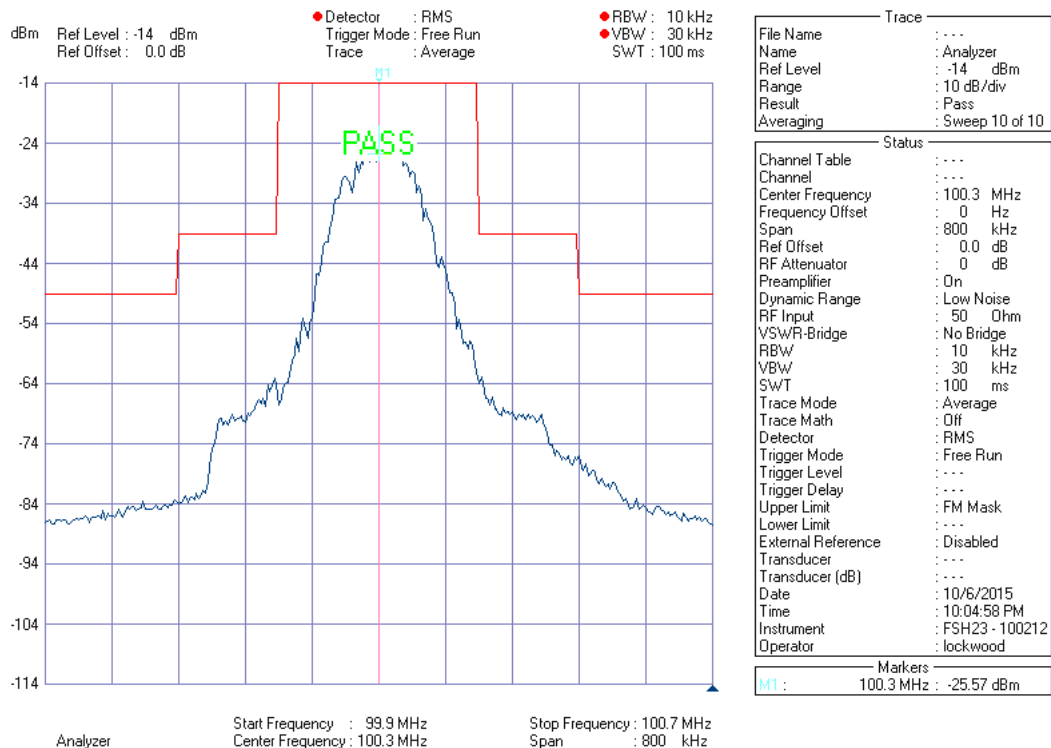
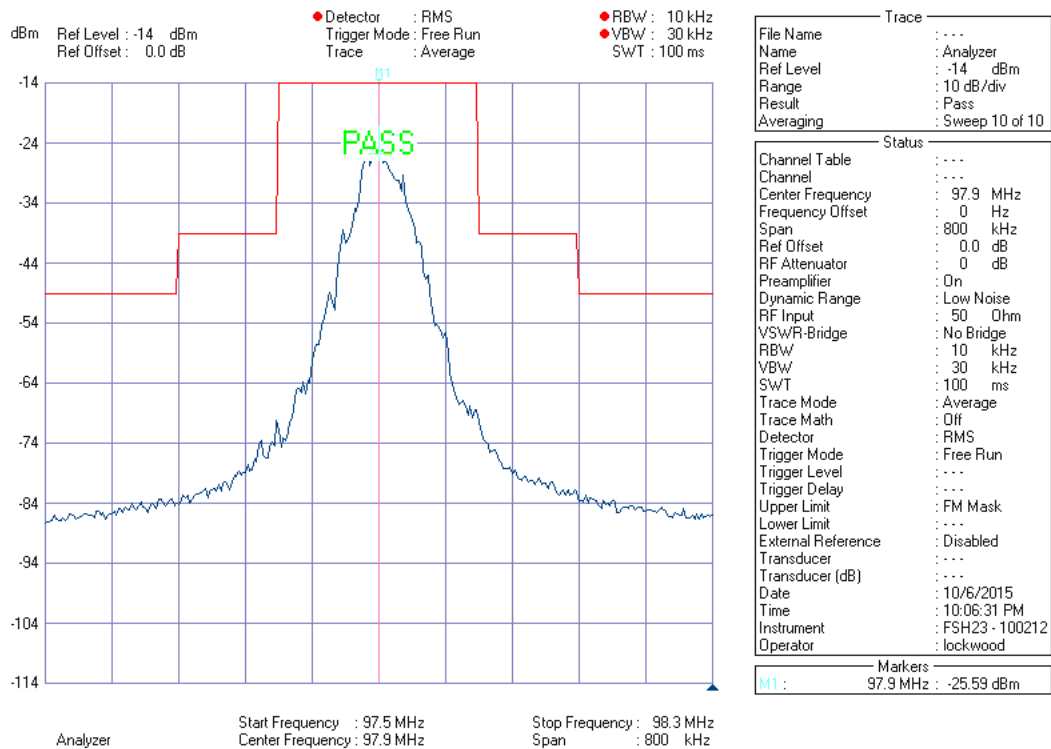
Call Status	City State	FCC File No.	Channel Freq.	ERP(kW) HAAT(m)	Latitude Longitude	Bearing deg-True	Distance kilometers
K209CJ LIC	TOOELE UT	BLFT50420AAC	209D 89.7	0.010 0.0	40-39-12 112-12-06	182.0	0.68
KUER-FM LIC	SALT LAKE CITY UT	BLED21009ADB	211C 90.1	21.000 1244.0	40-39-35 112-12-05	322.4	0.04
KRCL LIC	SALT LAKE CITY UT	BLED30310AOH	215C 90.9	25.000 1140.0	40-39-34 112-12-05	0.0	0.00
KUUUaux LIC	TOOELE UT	BXMLH30709ABL	221C3 92.1	0.035 1188.0	40-39-35 112-12-06	322.4	0.04
KUUU LIC	SOUTH JORDAN UT	BLH80819AAM	223C2 92.5	0.500 1198.0	40-39-35 112-12-04	36.8	0.04
KUUUaux LIC	SOUTH JORDAN UT	BMLH50126AHC	223C2 92.5	0.400 1188.0	40-39-35 112-12-06	322.4	0.04
KUBL-FM LIC	SALT LAKE CITY UT	BLH21203ACG	227C 93.3	25.000 1140.0	40-39-34 112-12-05	0.0	0.00
K229CJ CP	TOOELE UT	BNPFT30805AAY	229D 93.7	0.001 DA 1099.0	40-39-09 112-12-05	181.8	0.77
KODJ LIC	SALT LAKE CITY UT	BLH61005ADE	231C 94.1	21.500 1219.0	40-39-35 112-12-05	322.4	0.04
KODJaux LIC	SALT LAKE CITY UT	BXLH61027ACG	231C 94.1	0.470 1168.0	40-39-35 112-12-05	322.4	0.04
KXRK LIC	PROVO UT	BLH21113AAN	242C 96.3	25.000 1140.0	40-39-34 112-12-05	0.0	0.00
K244DH LIC	FORT DOUGLAS, ETC. UT	BLFT41018AAD	244D 96.7	0.036 DA 1097.0	40-39-12 112-12-06	182.0	0.68

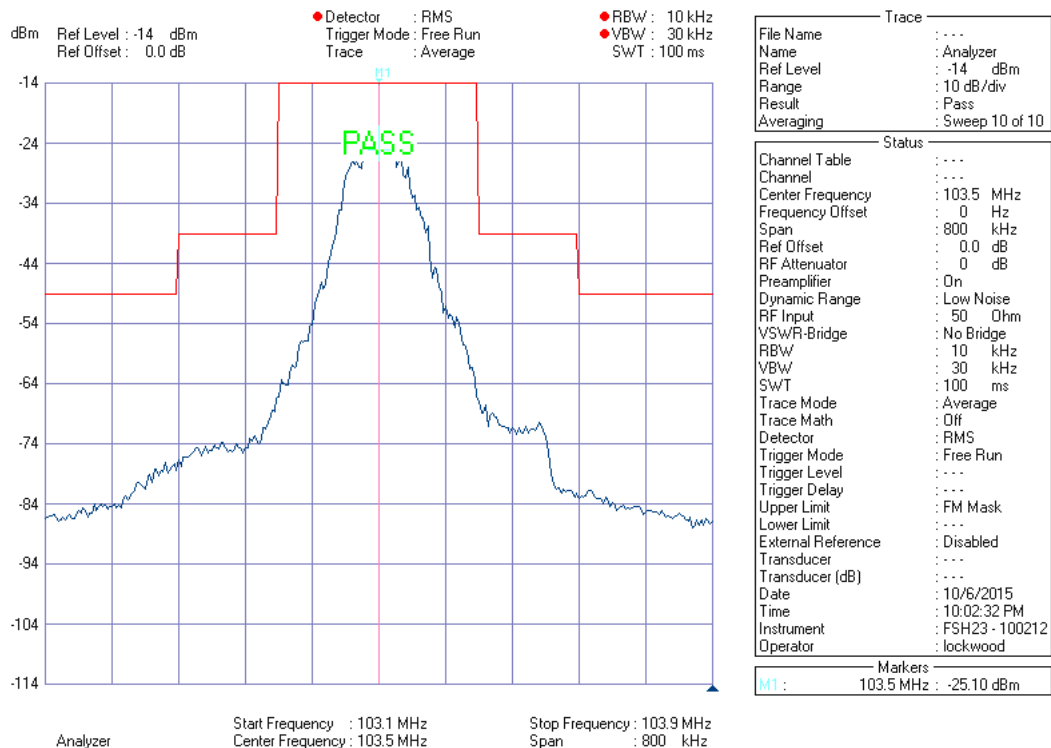
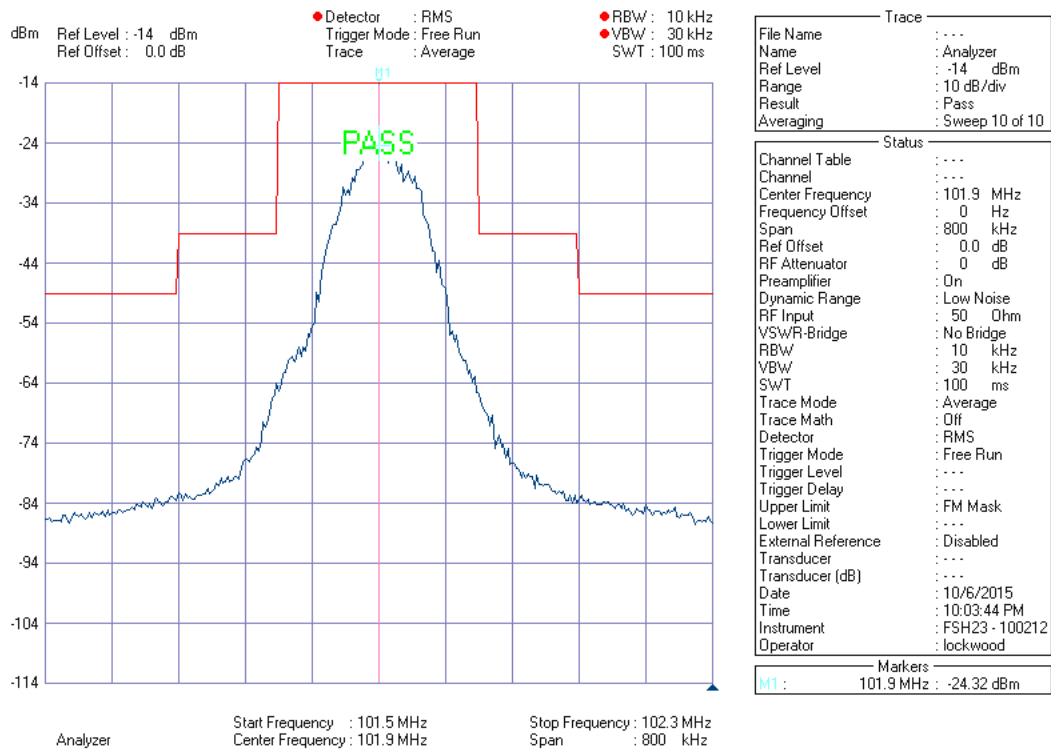
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KZHT	SALT LAKE CITY		246C	25.000	40-39-34	0.0	0.00
LIC	UT	BLH30507ACH	97.1	1140.0	112-12-05		
KZHTaux	SALT LAKE CITY		246C	7.200	40-39-35	322.4	0.04
LIC	UT	BXMLH60607ACY	97.1	1113.0	112-12-05		
KBZN	OGDEN		250C	26.000	40-39-35	322.4	0.04
LIC	UT	BLH781208AG	97.9	1149.0	112-12-05		
KSFI	SALT LAKE CITY		262C	25.000	40-39-34	0.0	0.00
LIC	UT	BMLH21113AAK	100.3	1140.0	112-12-05		
KSFIaux	SALT LAKE CITY		262C	13.500	40-39-35	322.4	0.04
LIC	UT	BLH800728AC	100.3	1113.0	112-12-05		
KBER	OGDEN		266C	25.000	40-39-34	0.0	0.00
LIC	UT	BMLH21203ACC	101.1	1140.0	112-12-05		
KENZ	OGDEN		270C	25.000	40-39-34	0.0	0.00
LIC	UT	BLH30508AAI	101.9	1140.0	112-12-05		
KSL-FM	MIDVALE		274C	25.000	40-39-34	0.0	0.00
LIC	UT	BLH21113AAL	102.7	1140.0	112-12-05		
KRSP-FM	SALT LAKE CITY		278C	25.000	40-39-34	0.0	0.00
LIC	UT	BLH21113AAM	103.5	1140.0	112-12-05		
KSOPaux	SALT LAKE CITY		282C	19.500	40-39-35	322.4	0.04
LIC	UT	BLH870825KD	104.3	1219.0	112-12-05		
KSOP-FM	SALT LAKE CITY		282C	25.000	40-39-34	0.0	0.00
LIC	UT	BLH40205AAJ	104.3	1140.0	112-12-05		
KAUU	AMERICAN FORK		286C	15.000	40-39-35	322.4	0.04
CP	UT	BPH80325AID	105.1	1243.0	112-12-05		
KNRS-FM	CENTERVILLE		289C	25.000	40-39-34	0.0	0.00
LIC	UT	BLH21125AAS	105.7	1140.0	112-12-05		
KNRSaux	CENTERVILLE		289C	15.000	40-39-35	322.4	0.04
LIC	UT	BXMLH60607ACZ	105.7	1111.0	112-12-05		
	CENTERVILLE		290C	0.000	40-39-34	0.0	0.00
RSV	UT	RM11363	105.9	0.0	112-12-05		

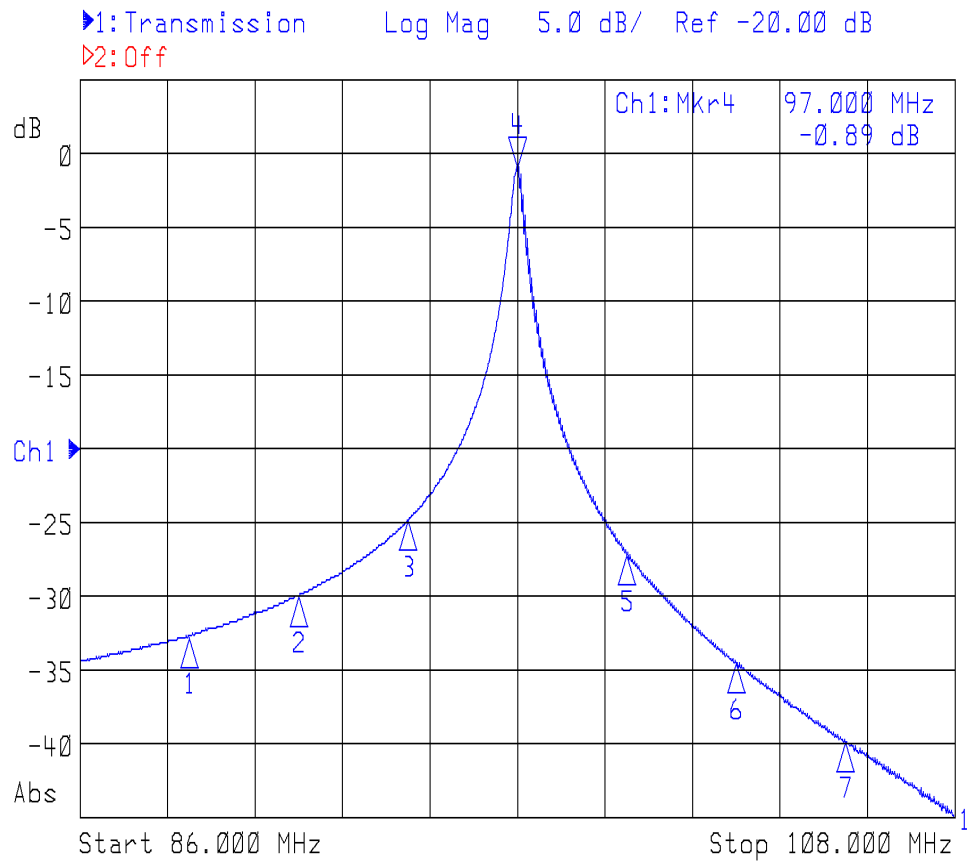
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CP	UT BPH50421AAY	105.9	1140.0	112-12-05		
KAAZ-FM	SPANISH FORK	293C	25.000	40-39-34	0.0	0.00
LIC	UT BLH21125AAT	106.5	1140.0	112-12-05		
KAAZaux	SPANISH FORK	293C	0.410	40-39-35	322.4	0.04
LIC	UT BXLH80409AAV	106.5	1020.0	112-12-05		
KAAZ-FM	SPANISH FORK	294C	25.000	40-39-34	0.0	0.00
CP	UT BPH50421AAU	106.7	1140.0	112-12-05		
KKLV	KAYSVILLE	298C	22.000	40-39-35	322.4	0.04
LIC	UT BLED40122AAI	107.5	1243.0	112-12-05		



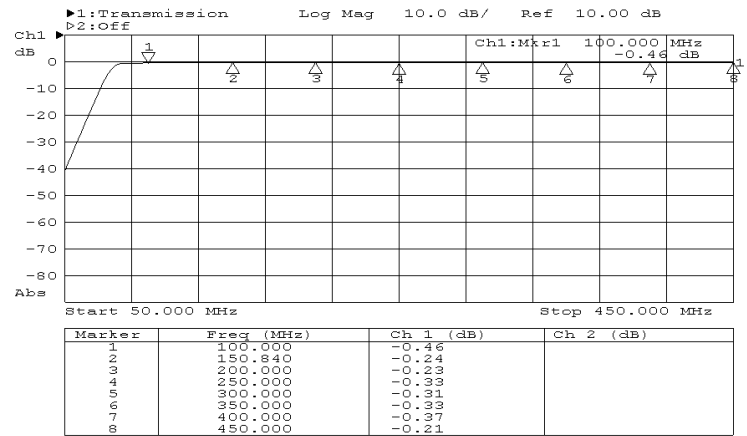




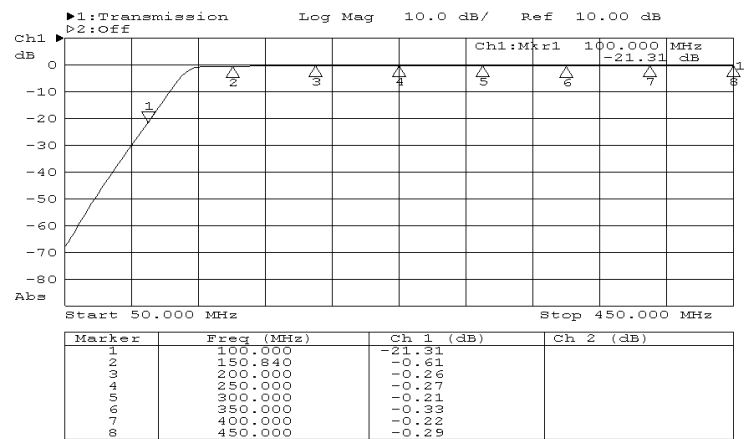




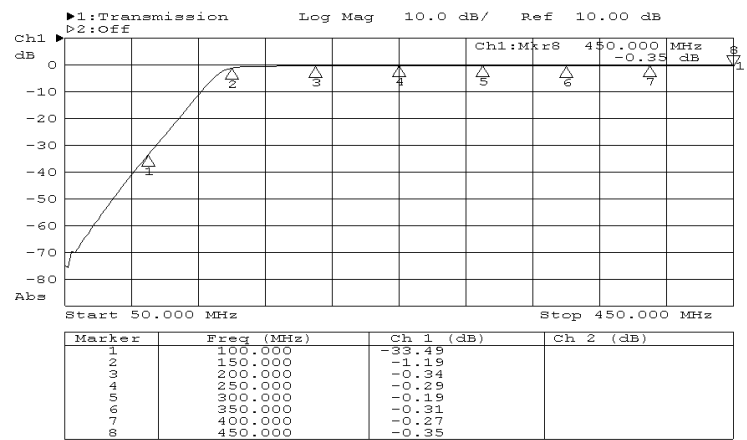
Telewave TWPC1005-1 bandpass cavity filter



Mini-Circuits BHP-100 Highpass Filter



Mini-Circuits BHP-150 Highpass Filter



Mini-Circuits BHP-175 Highpass Filter