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DIRECTIONAL ANTENNAS
AM – FM – TV
APPLICATIONS
PROOFS
FIELD MEASUREMENTS
AUDIO AND RF ENGINEERING
EMERGENCY REPAIR

ENGINEERING STATEMENT

Concerning the report of performance for the combined broadcasting facility for KTCL 93.3 MHz, KPTT 95.7 MHz, KCUV 102.3 MHz, KRFX 103.5 MHz, KALC 105.9 MHz, and KBPI 106.7 MHz. In preparation for license filing for KTCL the performance was measured and data collected on the instalation of the above transmitters feeding the common antenna.

At the time this data was gathered KALC 105.9 MHz has no transmitter installed on the site and is not operative from this site. Tests on KALC will be conducted at such a time as transmitting equipment is installed on the premesis. KBPI 106.7 MHz has auxiliary facilities on the site and is only operated when tower service is required on the KBPI main site. KBPI was operated from this site in order to gather data for this showing. KPTT 95.7 MHz, KCUV 102.3 MHz, and KRFX 103.5 MHz were operating continuously on the combined antenna prior to the addition of the transmitter for KTCL 93.3 MHz. The measurements and attached data are submitted as proof that the combined operation of KTCL 93.3 MHz, KPTT 95.7 MHz, KCUV 102.3 MHz, KRFX 103.5 MHz, and KBPI 106.7 MHz are in compliance with CFR Title 47 section 73.317 paragraphs (b) through (d); specifically that the third order intermodulation products are less than the maximum allowable level specified in that section.

NATURE OF THIRD ORDER INTERMODULATION PRODUCTS

Intermodulation products result when signals from one transmitter are injected into the output of another transmitter causing a mixing of the two frequencies in the active components of the amplifiers. The common term to describe this is third order intermodulation and the product is defined by the mathematical expression [2(F1) – (F2)] where F1 signifies the frequency of the transmitter that is generating the intermodulation product and F2 signifies the frequency causing the interference in the transmitter generating F1. When the isolation between transmitters is increased and the interfering signal is below the intermodulation threshhold of the subject transmitter no measureable intermod product occurs. This combining system achieves excellent isolation between the transmitters as installed.

METHODOLOGY

The outgoing signal feed to the antenna was sampled at the forward power coupler at the coaxial feed to the antenna from the combiner. The signal was fed into a Hewlet Packard E7401 analyzer and the signal was calibrated so that the carrier indication was at the top of the graticule then the analyzer was swept across the band of interest in the averaging mode so that random noise cancels out in the display. The levels of the products are clearly visible on the ten division graticule as 10 dB per division so that the bottom would be 100 dB down from peak carrier level. The attached screen shots of the analyzer show the initial condition with KPTT, KCUV, and KRFX operating. Additional screen shots show the addition of KTCL and KAZY to the antenna.

OBSERVATIONS

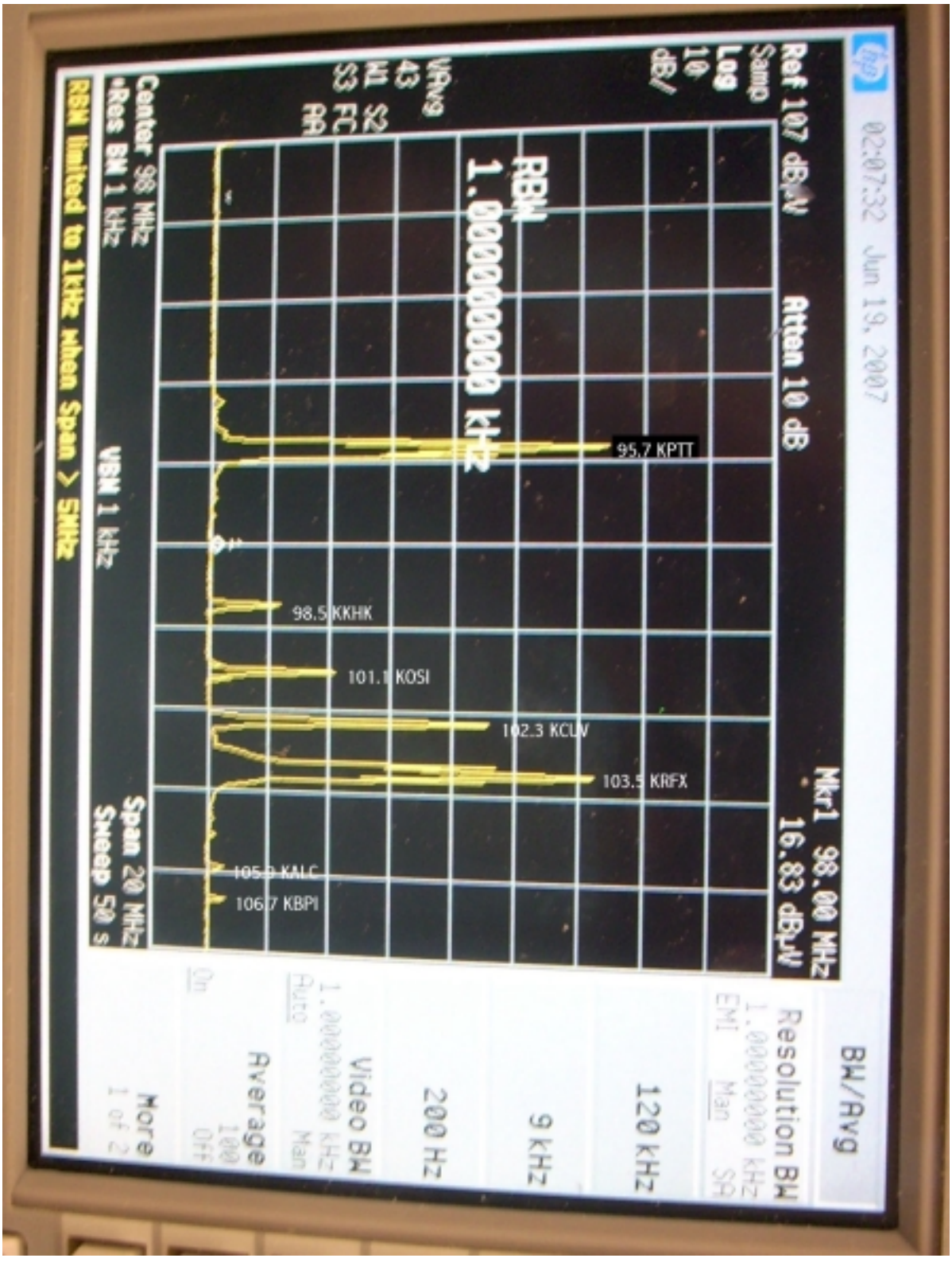
The spectrum observations on 19 June 2007 were limited to the –90 dB noise floor on the site however no indications above –80 dB were found on the third order computed IM frequencies of interest except for local station carriers. For ease of identification the local station carriers at or above the –80dB level were labeled superimposed on the screen shots. Harmonics and spurious were investigated from 150MHz to 1100 MHz and no indications were seen above –80 dB on any frequency observed. Additionally the spectrum analyzer was connected to the sample at the input from each station to the combiner and each was observed while both KAZY and KTCL were turned on and off. No IM product or spur appeared above the noise floor of –90dB on the output of any transmitter when KAZY or KTCL or both were added to the system. The isolation between transmitters was significantly greater than the rated 58 dB on most of the transmitter ports further verifying the excellent isolation achieved in the combiner implementation. The attached IM Measurement summary tabulates the observed compliance levels. The factory description of the combining system is attached as an appendix to this report for reference.

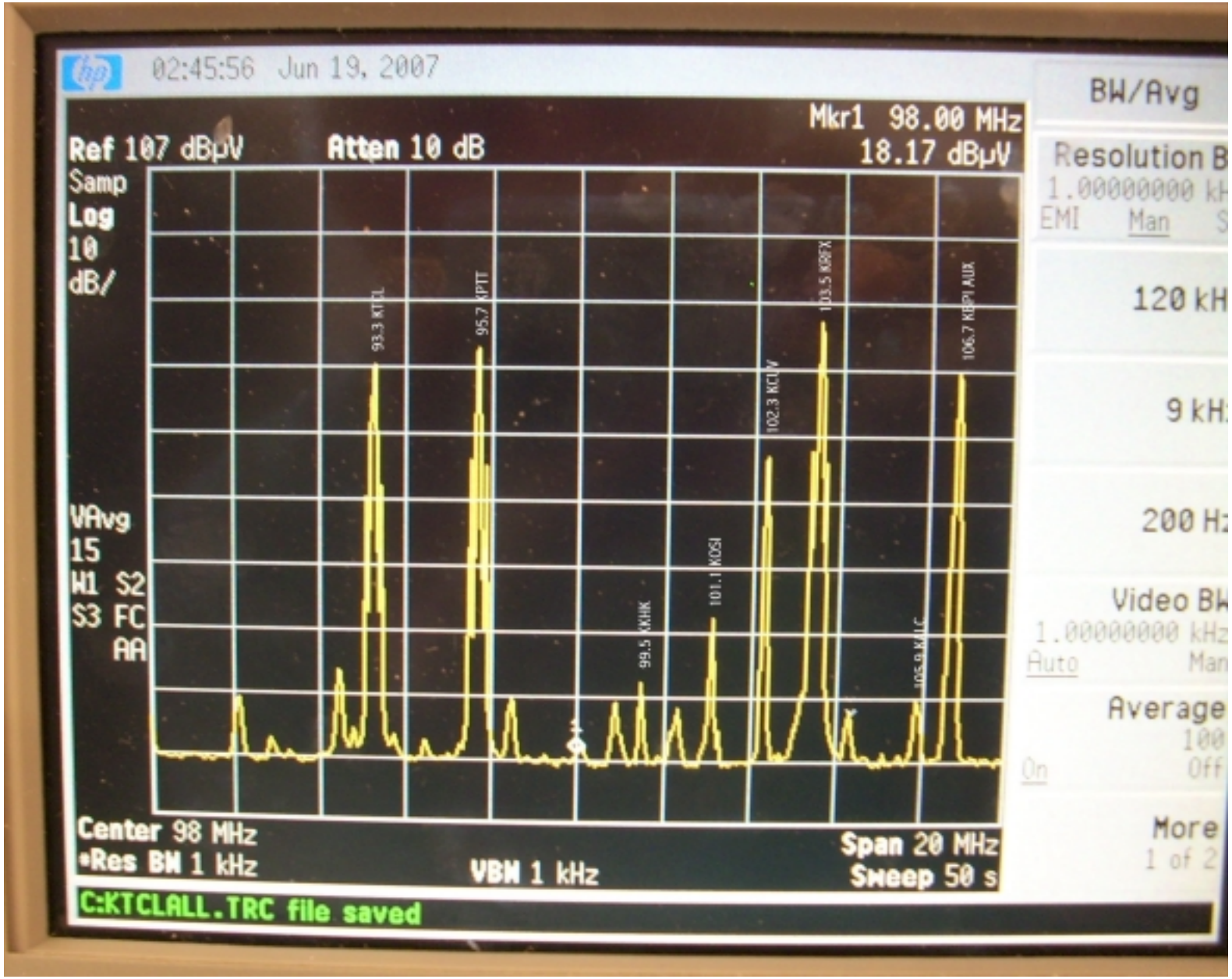
SUMMARY

The KTCL, KPTT, KCUV, KRFX, KBPI operation into the combined antenna system meets FCC standards for operation stated in CFR Title 47 section 73.317 paragraphs (b) through (d); specifically the third order intermodulation products are less than the maximum allowable level specified in that section. The KTCL operation is ready for program test and license.

Respectfully,

Timothy C. Cutforth P.E.
20 June 2007


02:07:32 Jun 19, 2007
Ref 107 dBµV
Atten 10 dB
Mkr1 98.00 MHz
16.83 dBµV
RBW
1.0000000000 kHz
95.7 KPTT
98.5 KKHK
101.1 KOSI
102.3 KCLV
103.5 KRFX
105.3 KALC
106.7 KBPI
Center 98 MHz
#Res BW 1 kHz
VBW 1 kHz
Span 20 MHz
Sweep 50 s
RBW limited to 1kHz when Span > 5MHz
BW/Avg
Resolution BW
1.0000000 kHz
EMI Man
120 kHz
9 kHz
200 Hz
Video BW
Average
More



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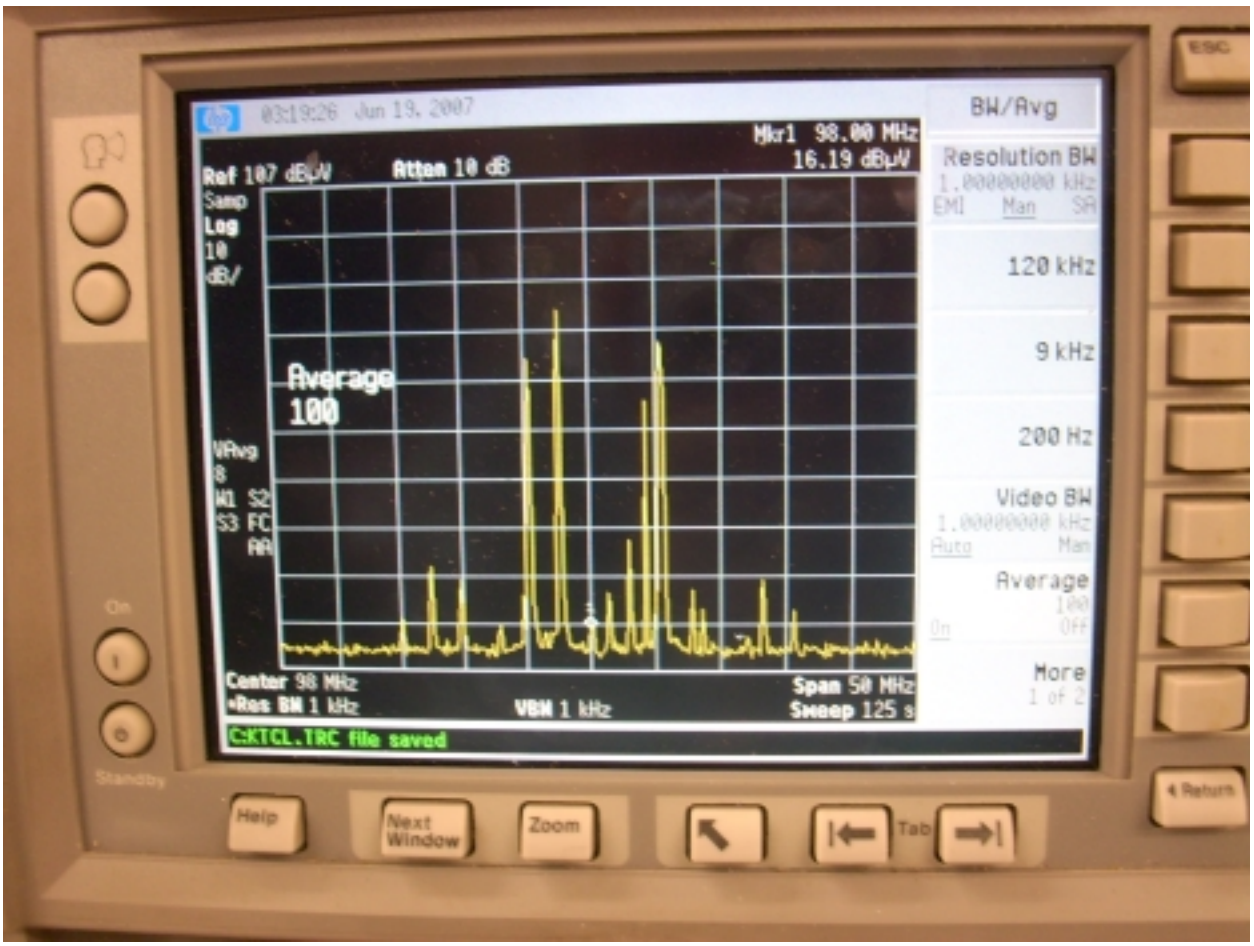
03:19:26 Jun 19, 2007
Mkr1 98.00 MHz
16.19 dBµV
Ref 107 dBµV
Atten 10 dB
Samp
Log
10
dB/
Average
100
VAvg
8
W1 S2
S3 FC
AA
Center 98 MHz
#Res BW 1 kHz
VBW 1 kHz
Span 50 MHz
Sweep 125 s
C:\TCL.TRC file saved
BW/Avg
Resolution BW
1.00000000 kHz
EMI Man SA
120 kHz
9 kHz
200 Hz
Video BW
1.00000000 kHz
Auto Man
Average
100
On Off
More
1 of 2
ESC
On
Standby
Help
Next Window
Zoom
Tab
Return

IM Measurements Taken in

Product Frequency (MHz)	Transmitter Frequency (MHz)	Interfering Frequency (MHz)	Pad (dB)	Bandpass Filter Loss (dB)	Total Loss	Full Scale Range (dBµ)	Scale Reading (dBµ)	Adjusted Level (dBµ)	Carrier Reference Level (dBµ)	Level Referenced to Carrier (dB)	Notes*
	Transmitter Mixes										
	93.3		**6**		**6**	**120**	**8**		**118**		
	95.7		**6**		**6**	**120**	**8.5**		**117.5**		
	102.3		**6**		**6**	**100**	**8.3**		**97.7**		
	103.5		**6**		**6**	**120**	**8.3**		**117.7**		
	105.9		**6**		**6**	**120**			**126**		Not operational from this site.
	106.7		**6**		**6**	**120**	**8.2**		**117.8**		
79.9	93.3	106.7	6	12	18	20	20	18	118	<-80	
80.7	93.3	105.9	6	11.1	17.1	20	20	17.1	118	<-80	
83.1	93.3	103.5	6	11.6	17.6	20	11.5	26.1	118	<-80	
84.3	93.3	102.3	6	11.1	17.1	20	20	17.1	118	<-80	
84.7	95.7	106.7	6	11	17	20	20	17	117.5	<-80	
85.5	93.3	101.1	6	11.1	17.1	20	20	17.1	118	<-80	
85.5	95.7	105.9	6	11.1	17.1	20	20	17.1	117.5	<-80	
87.1	95.7	99.5	6	11.5	17.5	20	20	17.5	117.5	<-80	
87.9	95.7	103.5	6	11.5	17.5	20	20	17.5	117.5	<-80	
89.1	93.3	102.3	6	10.9	16.9	20	20	16.9	118	<-80	
90.3	95.7	101.1	6	11	17	20	19	18	117.5	<-80	
90.9	93.3	95.7	6	11.8	17.8	20	20	17.8	118	<-80	
91.9	93.3	99.5	6	10.8	16.8	20	20	16.8	118	<-80	
96.5	102.3	90.1	6	10.6	16.6	20	17.5	19.1	97.7	<-80	
97.3	95.7	89.3	6	11.9	17.9	40	19	38.9	117.5	<-80	
97.9	102.3	106.7	6	10.9	16.9	20	20	16.9	97.7	<-80	
98.1	103.5	93.3	6	11.8	17.8	20	20	17.8	117.7	<-80	
98.7	102.3	105.9	6	10.7	16.7	20	20	16.7	97.7	<-80	
100.3	103.5	106.7	6	11.4	17.4	20	2	35.4	117.7	<-80	
101.1	95.7	103.5	6	11.3	17.3	60	13.1	64.2	117.5	-68	Local Carrier 101.1 MHz. KOSI
101.1	95.7	105.9	6	11.3	17.3	60	13.1	64.2	117.5	-68	Local Carrier 101.1 MHz. KOSI
101.3	102.3	90.1	6	10.3	16.3	40	16.8	39.5	97.7	<-80	
102.1	103.5	89.3	6	11.3	17.3	20	20	17.3	117.7	<-80	
103.5	102.3	101.1	6	10.1	16.1	100	1.2	114.9	97.7	7	Local Carrier 103.5 MHz. KRFX
104.7	103.5	102.3	6	10.5	16.5	20	20	16.5	117.7	<-80	

105.1	102.3	99.5	6	10.1	16.1	40	18.5	37.6	97.7	<-80	
105.9	103.5	101.1	6	10.3	16.3	40	12.7	43.6	117.7	-80	Local Carrier 105.9 MHz. KALC
107.5	103.5	99.5	6	11.2	17.2	20	1.8	35.4	117.7	<-80	
107.5	106.7	105.9	6	11.2	17.2	20	1.8	35.4	117.8	<-80	
108.9	102.3	95.7	6	10.1	16.1	20	20	16.1	97.7	<-80	
109.9	106.7	103.5	6	10.4	16.4	20	20	16.4	117.8	<-80	
111.1	106.7	102.3	6	10.1	16.1	20	20	16.1	117.8	<-80	
111.3	102.3	93.3	6	10.2	16.2	20	20	16.2	97.7	<-80	
111.3	103.5	95.7	6	11	17	20	20	17	117.7	<-80	
112.3	106.7	101.1	6	11.6	17.6	20	20	17.6	117.8	<-80	
113.7	103.5	93.3	6	10.7	16.7	20	20	16.7	117.7	<-80	
113.9	106.7	99.5	6	10.4	16.4	20	20	16.4	117.8	<-80	
114.5	102.3	90.1	6	10.2	16.2	20	20	16.2	97.7	<-80	
115.3	102.3	89.3	6	10.1	16.1	20	20	16.1	97.7	<-80	
116.9	103.5	90.1	6	10.3	16.3	20	20	16.3	117.7	<-80	
117.7	103.5	89.3	6	10.2	16.2	20	20	16.2	117.7	<-80	
117.7	106.7	95.7	6	10.2	16.2	20	20	16.2	117.8	<-80	
120.1	106.7	93.3	6	10.4	16.4	20	20	16.4	117.8	<-80	
123.3	106.7	90.1	6	10.2	16.2	20	20	16.2	117.8	<-80	
124.1	106.7	89.3	6	10.1	16.1	20	20	16.1	117.8	<-80	