

Entercom Seattle Cougar Mountain Auxiliary Facility

**Measurement of Cross-Modulation Products
Sept 19, 2001**

INTRODUCTION

Entercom Seattle License, LLC, licensee of KBSG-FM, KISW(FM), KMTT(FM), KNDD(FM) and Entercom Seattle News License, LLC, licensee of KQBZ(FM) have constructed a multiple-transmitter combined auxiliary only facility on Cougar Mountain, near Issaquah, WA. Pacific Lutheran University Inc, Licensee of KPLU-FM is also licensed to use the facility.

Classic Radio Inc, licensee of KING-FM, and Infinity Broadcasting Corporation, dba, KZOK (FM) also hold a construction permit for joint use of the facility for auxiliary only purposes.

Six stations have been granted Auxiliary Antenna licenses to use the facility: KBSG-FM, KISW(FM), KMTT(FM), KNDD(FM), KQBZ(FM) and KPLU-FM. This report details measurements of cross modulation products generated by the addition of the permitted stations, KING(FM) and KZOK(FM).

Measurement of Cross Modulation Products of the six existing facilities, including newly constructed KING(FM) and KZOK(FM), were performed on Sept 19, 2001, by Clay Freinwald, Senior Facilities Engineer, for Entercom Seattle, the owner of the site. Mr Freinwald has been employed as a Broadcast Engineer for a period of 39 years and is experienced with the techniques required to perform the measurements.

An inter-modulation computer program was used to determine all 2nd order products (2A-B) generated by the 8 FM stations. A list of the product frequencies was compiled, and then compared to the fundamental or operating frequencies. See Table 2. The carrier level of each of the broadcast stations was measured and used as a reference for the suppression measurements. See Table 1

For most of the measurements it was necessary to utilize a filter and/or attenuator combination at the combiner systems' output directional coupler (the point of measurement) in order to reject unwanted signals. These un-attenuated or un-filtered signals would either overload the FIM-71 or cause it to generate internal inter-modulation products due to excessive input level. Insertion loss of the filters and attenuators were measured at each measurement frequency.

The six licensed facilities (KBSG-FM, KISW(FM), KMTT(FM) KNDD(FM), KQBZ(FM) and KPLU-FM) were operating at their licensed power during the duration of the tests, while KING(FM) and KZOK(FM) were operating at their permitted power level. In the case where the inter-modulation product to be measured occurred at the operating frequency of one of the six stations, the carrier of that station was turned off to permit measurements. See notes on Table 3.

Equipment used in making the measurements were as follows:

- Potomac Field Strength Meter. Model FIM-71 –
Serial Number 604 – Calibration December 9, 1997
- IFR Systems Service Monitor. Model Com120A
Serial Number 1144 – Calibration December 18, 1999
- 88-108MHz Band-Pass Filter. Wacom Model WP715
- 72 – 88 MHz Band Pass Filter. Telewave 11-28-05
- FM Band Reject Filters. Tru-Spec Model FM88
- 10 db in-line Power Attenuators. Bird Model 8305-100N

MEASUREMENT PROCEDURE

1. The test equipment was configured as described in Figure A.
2. Utilizing the Com120A, the filters were adjusted for minimum loss at the frequencies to be measured. The Com120A was also used to measure the insertion loss of the filters and attenuators.
3. The Com120A was connected to the input of the FIM-71 and/or filters and attenuators and adjusted to generate a signal at the frequency being measured. The FIM-71's frequency was adjusted for a maximum indication.
4. The input of the FIM-71, in series with the appropriate filters or attenuators was then connected to the antenna system's combiner output directional coupler (the point of measurement) as shown in Fig. B.
5. The Carrier Reference or Inter-modulation Product Level was measured with the FIM-71.
6. The level differences between the product frequency and inter-modulation frequency was converted to decibels(db). The results are tabulated in Table 3.

Table 1: Carrier Reference Levels

Carrier Frequency (MHz)	Measured Carrier Level (dB ref 10 Volts)
88.5 KPLU	-4.4
97.3 KBSG	-3.6
98.1 KING	-2.4
99.9 KISW	-3.4
100.7 KQBZ	-2.6
102.5 KZOK	-2.7
103.7 KMTT	-2.3
107.7 KNDD	-2.6

Table 2: Second Order Products

	Carrier Frequency (MHz)							
Interfering Frequency (MHz)	88.5 KPLU	97.3 KBSG	98.1 KING	99.9 KISW	100.7 KQBZ	102.5 KZOK	103.7 KMTT	107.7 KNDD
88.5 KPLU	--	106.1	107.7	111.3	112.9	116.5	118.9	126.9
97.3 KBSG	79.7	--	98.9	102.5	104.1	107.7	110.1	118.1
98.1 KING	78.9	96.5	--	101.7	103.3	106.9	109.3	117.3
99.9 KISW	77.1	94.7	96.3	--	101.5	105.1	107.5	115.5
100.7 KQBZ	76.3	93.9	95.5	99.1	--	104.3	106.7	114.7
102.5 KZOK	74.5	92.1	93.7	97.3	98.9	--	104.9	112.9
103.7 KMTT	73.3	90.9	92.5	96.1	97.7	101.3	--	111.7
107.7 KNDD	69.3	86.9	88.5	92.1	93.7	97.3	99.7	--

Table 3: Intermodulation Measurements

Product Frequency (MHz)	Carrier Frequency (MHz)	Interfering Frequency (MHz)	Filter + Pad Loss (dB)	Measured Value (dB ref 10v)	Carrier Reference (dB ref 10v)	Level Referenced To Carrier (dB)note 1	Notes: See Below
69.3	88.5	107.7	-7	-20	-4.4	-128.6	2
73.3	88.5	103.7	-7	-20	-4.4	-128.6	2
74.5	88.5	102.5	-6.8	-20	-4.4	-128.8	2
76.3	88.5	100.7	-6.5	-17	-4.4	-126.1	2
77.1	88.5	99.9	-6.3	-5.9	-4.4	-115.2	2
78.9	88.5	98.1	-6.1	-13	-4.4	-122.5	2
79.7	88.5	97.3	-6.1	-17	-4.4	-126.5	2
86.9	97.3	107.7	-5.2	-8	-3.6	-119.2	2
88.5	98.1	107.7	-6.4	-17	-2.4	-128.2	3
90.9	97.3	103.7	-6.3	-20	-3.6	-110.1	
92.1	97.3	102.5	-6.2	-2.8	-3.6	-113	
92.1	99.9	107.7	-6.2	-2.8	-3.4	-113.2	
92.5	98.1	103.7	-6.2	-2.8	-2.4	-114.2	
93.7	100.7	107.7	-6.2	-13	-2.6	-104.2	
93.7	98.1	102.5	-6.2	-13	-2.4	-104.4	
93.9	97.3	100.7	-6.2	-10.5	-3.6	-100.7	
94.7	97.3	99.9	-10.2	-15.2	-3.6	-101.4	
95.5	98.1	100.7					4
96.1	99.9	103.7	-10.1	-8	-3.4	-94.5	
96.3	98.1	99.9					5
96.5	97.3	98.1					5
97.3	102.5	107.7	-10.1	-11	-2.7	-98.2	7
97.3	99.9	102.5	-10.1	-11	-3.4	-97.5	7
97.7	100.7	103.7	-30.1				8, 7
98.9	100.7	102.5	-30	-12.5	-2.6	-86.4	
98.9	98.1	97.3	-30	-12.5	-2.4	-86.6	
99.1	99.9	100.7	-30	-17.5	-3.4	-84.1	
99.7	103.7	107.7	-30	-20	-2.3	-87.7	9
101.3	102.5	103.7					10
101.5	99.9	100.7					10
101.7	99.9	98.1					10
102.5	99.9	97.3	-29.8	-20	-3.4	-86.8	6
103.3	100.7	98.1	-29.8	-6.5	-2.6	-94.1	11
104.1	100.7	97.3	-29.7	-4	-2.6	-91.7	
104.3	102.5	100.7	-29.7	-20	-2.7	-87.6	
104.9	103.7	102.5	-29.7	-20	-2.3	-88	
105.1	102.5	99.9					12
106.1	97.3	88.5	-29.6	-10	-3.6	-96.8	
106.7	103.7	100.7					13
106.9	102.5	98.1					13
107.5	103.7	99.9	-29.5	-14	-2.3	-102.2	14
107.7	102.5	97.3	-29.4	-13	-2.7	-100.9	14
107.7	98.1	88.5	-29.4	-13	-2.4	-101.2	14
109.3	103.7	98.1					8, 15
110.1	103.7	97.3	-35	-20	-2.3	-82.7	15
111.3	99.9	88.5	-28.9	-20	-3.4	-87.7	15
111.7	107.7	103.7	-27	-3	-2.6	-93.4	15
112.9	100.7	88.5	-21.9	-7	-2.6	-102.5	15

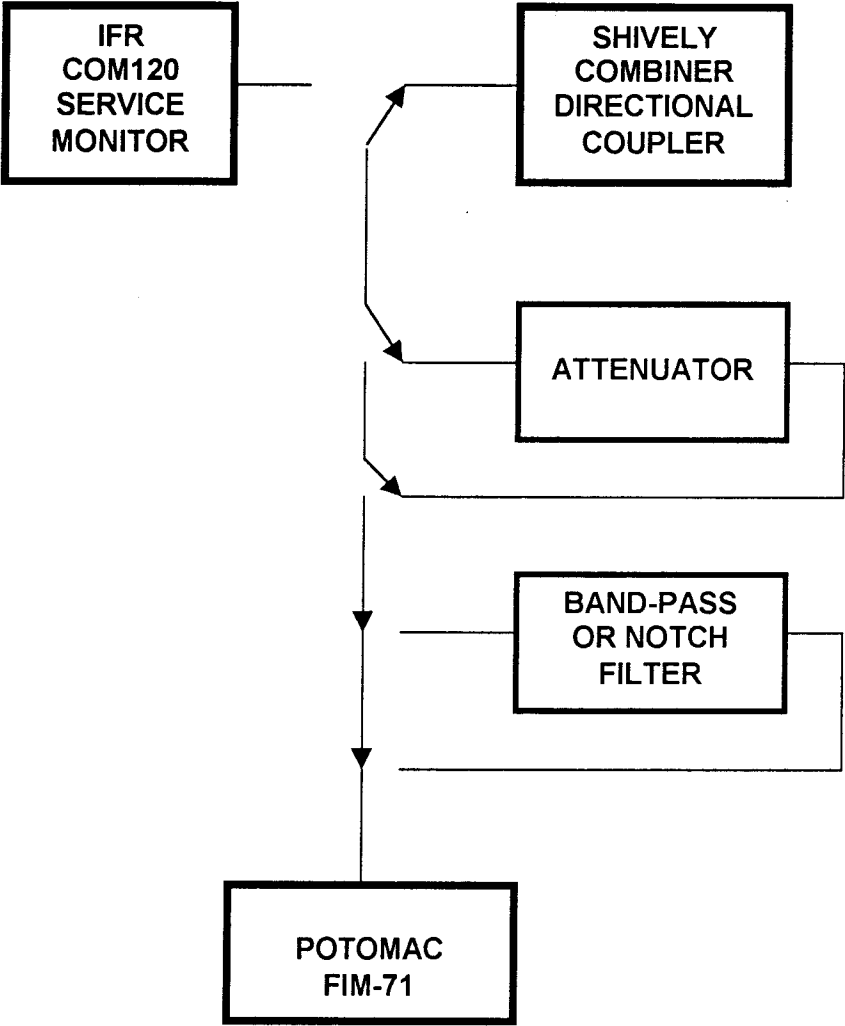
Product Frequency (MHz)	Carrier Frequency (MHz)	Interfering Frequency (MHz)	Filter + Pad Loss (dB)	Measured Value (dB ref 10v)	Carrier Reference (dB ref 10v)	Level Referenced To Carrier (dB) note 1	Notes: See Below
112.9	107.7	102.5	-21.9	-7	-2.6	-102.5	15
114.7	107.7	100.7	-14.2	-5	-2.6	-108.2	15
115.5	107.7	99.9	-11.7	-16.8	-2.6	-122.5	15
116.5	102.5	88.5	-8.2	-1.5	-2.7	-110.6	15
117.3	107.7	98.1	-6	-0.5	-2.6	-111.9	15
118.1	107.7	97.3	-4.5	-11.7	-2.6	-124.6	15
118.9	103.7	88.5	-3.5	-18.5	-2.3	-112.7	15
126.9	107.7	88.5	-4.7	-9	-2.6	-121.7	15

Table 3: Intermodulation Measurements (continued)

Notes:

1. Level Referenced to Carrier = Measured Value – Carrier Reference – Filter Loss
2. Filter used for this measurement was - Telewave Model 22-28-05
3. Carrier of 88.5 KPLU switched off for this measurement.
4. Measure not possible due to ingress by KUBE 93.3, located within 300 meters.
5. Measure not possible due to ingress by KYCW 96.5, located within 300 meters.
6. Carrier of 102.5 KZOK switched off for this measurement.
7. Carrier of 97.3 KBSG switched off for this measurement.
8. Measurement not possible due to phantom products in FIM-71. Verified absence of significant product with an IFR spectrum analyzer which confirmed that products on these frequencies were in excess of 85 db below reference carrier..
9. Carrier of 99.9 KISW switched off for this measurement.
10. Measurement not possible due to ingress by KPLZ 101.5, located within 300 meters.
11. Carrier of 103.7 KMTT switched off for this measurement.
12. Measurement not possible due to ingress by KCMS 105.3, located within 300 meters.
13. Measurement not possible due to ingress by KRWM 106.9, located within 300 meters.
14. Carrier of 107.7 KNDD switched off for this measurement.
15. Filter used for this measurement was Tru-Spec model FM-88.

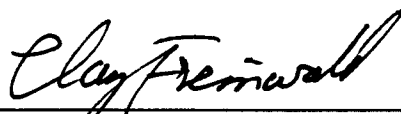
Test Equipment Configuration
Cougar Mountain IMD Measurements
(Figure A)



CONCLUSION

All predicted cross-modulation products of the form 2A-B are lower than the level of 80 db below station carriers. Sufficient measurements were made to establish that the operations authorized for this auxiliary facility, in conjunction with the other stations listed in this report, are in compliance with 47CFR Sections 73.317(b) through 73.317(d)

Clay Freinwald
Senior Facilities Engineer, Entercom



December 7, 2001