Report of Inter-modulation Product Findings (Summit-Crown Point NE. combined transmitter site)

ASR#1024539

KSD-FM 93.3Mhz iHeartMedia, KEZO-FM 92.3Mhz Summit Communications, KQCH 94.1Mhz Summit Communications

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Daniel J. Mettler SVP
Engineering iHeartMedia

Report of Findings
KFFF/KEZO/KQCH
Omaha, NE.

Introduction: This report of findings is based on data collected for the 3 station FM combined transmitter site located in Omaha NE area (Northwest of Omaha NE) for stations KFFF-FM, KEZO-FM, and KQCH-FM. This site is operating as a main transmitter site for all three stations. This report will show proof of combined operation for transmitters and combiner system for FCC Rules and Regulations by Code of Federal Regulations CFR Title 47 section 73.317 paragraphs (b) thru (d). The collection of measurements presents in this report shows that all third order inter-modulation (IM) products generated by this multi-station system are less than the maximum allowable level required by section 73.317 (b) thru (d).

The Nature of Inter-modulation Products (IM): Inter-modulation products result from inadequate transmitter-to-transmitter isolation. Inter-modulation products are commonly generated from radio stations operating into multiplexed facilities and congested antenna broadcast sites. The mechanics associated with the phenomenon have been well documented. When two or more transmitters are coupled to each other, new spectral components are produced by mixing of the station frequencies in the active circuits of each transmitter. The common term used to describe this phenomenon is third order product denoted by the mathematical expression [2(f1)-(f2)], where f1 signifies the frequency of the transmitter that is generating the inter-modulation product, and f2 signifies the frequency causing the interference.

The Multiplexed system: Measurements were taken with all 3 FM stations operating from the combined antenna system. The KFFF-FM, KEZO-FM and KQCH-FM multiplexed system is fundamentally comprised of an antenna, multiplexer and feedline. The Antenna is a Jampro brand model JBCP-8R 8 bay full wave antenna, To accomplish the aggregation of the multiple transmitter signals into a common antenna feed and provide transmitter-to-transmitter isolation, a multiplexing scheme consisting of a constant impedance combiner also manufactured by Jampro is installed. The Combiner utilizes a Jampro model RCCC-311-FM4EH (KFFF) added to the existing RCCC-421-16H (KEZO/KQCH) series filter modules for each transmitter, the feedline to the antenna is RIGID 6 1/8 inch. Per Jampro manufacturer test data the transmitter port-to-port isolation was greater than –50 db.

IM Measurement method: Due to the absence of an output directional coupler on the combiner system, Measurements were made in the field at 1KM from the tower site utilizing a Potomac Instruments FM FIM-71 strength meter and its associated ANT-71 dipole antenna. The elements for this dipole antenna were adjusted to the length specified in the manufacturer's instruction manual for each frequency which was measured, and an Agilent model 9340A spectrum analyzer, both the FM FIM and the Spectrum Analyzer were connected to the ANT-71 antenna for the specific measurements below.

Prior to measurements all broadcasting equipment was set to optimal operating performance. All transmitters were operating at the licensed or requested power levels. (KFFF-FM 351w, KEZO-FM 28kw, and KQCH-FM 30kw)

KFFF/KEZO/KQCH IM Measurements

IM Measurements: Below listed are the third order frequencies and their measured level from reference per the described methods above. With KFFF operating at 1kw ERP using the rule of the lesser of 80 db or the calculated value of 43 +(10*(log of power in watts) to provide the maximum measured signal is (Base 10 log of 1000 watts is 3.0 That times 10 is 30 Plus 43 = -73db).

Frequency A	92.3					
Frequency B	93.3					
Frequency C	94.1					
DESCRIPTION	**FREQ.**	**ATTENUATION**	**DESCRIPTION**	**FREQ.**	**ATTENUATION**	
	MHZ	**DB**		**MHZ**	**DB**	
A + B	185.6	-82	(2 X A) + (3 X C)	466.9	-82.8	
A - B	-1	-81.5	(2 X C) + (3 X A)	465.1	-84.1	
A + (2 X B)	278.9	-82.5	(3 X A) - C	182.8	-84	
B + (2 X A)	277.9	-81	3 X C	282.3	-81.2	
A + (3 X B)	372.2	-82	(3 X C) - A	190	-85.5	
B + (3 X A)	370.2	-81.7	(3 X A) - (2 X C)	88.7	-78.7	
2 X A	184.6	-82.5	(3 X C) - (2 X A)	97.7	FM Carrier	
(2 X A) - B	91.3	-76	(3 X A) - (3 X C)	-5.4	-82.5	
2 X B	186.6	-78.5	B + C	187.4	-84.9	
(2 X B) - A	94.3	HD Carrier Upper	B - C	-0.8	-78.5	
(2 X A) + (2 X B)	371.2	-83.3	B + (2 X C)	281.5	-84.8	
(2 X A) - (2 X B)	-2	-81.1	C + (2 X B)	280.7	-86.9	
(2 X A) + (3 X B)	464.5	-81.8	B + (3 X C)	375.6	-84.7	
(2 X B) + (3 X A)	463.5	-85.7	C + (3 X B)	374	-81	
3 X A	276.9	-82	(2 X B) - C	92.5	HD Carrier Upper	
(3 X A) - B	183.6	-83.9	(2 X C) - B	94.9	-61	IHM FM (K235CD Translator)
3 X B	279.9	-81.9	(2 X B) + (2 X C)	374.8	-81.8	
(3 X B) - A	187.6	-83.7	(2 X B) - (2 X C)	-1.6	-81.7	
(3 X A) - (2 X B)	90.3	-78	(2 X B) + (3 X C)	468.9	-86.2	
(3 X B) - (2 X A)	95.3	-77.6	(2 X C) + (3 X B)	468.1	-87.1	

KFFF/KEZO/KQCH IM Measurements

(3 X A) - (3 X B)	-3	-81.5	(3 X B) - C	185.8	-85.9	
A + C	186.4	-80.9	(3 X C) - B	189	-85.4	
A - C	-1.8	-82.7	(3 X B) - (2 X C)	91.7	-76.3	
A + (2 X C)	280.5	-85	(3 X C) - (2 X B)	95.7	FM Carrier	
C + (2 X A)	278.7	-81.1	(3 X B) - (3 X C)	-2.4	-84.1	
A + (3 X C)	374.6	-84.5	4 X A	369.2	-86.8	
C + (3 X A)	371	-83.7	4 X B	373.2	-87.5	
(2 X A) - C	90.5	HD Carrier Lower	4 X C	376.4	-84	
2 X C	188.2	-80	5 X A	461.5	-85.4	
(2 X C) - A	95.9	HD Carrier Lower	5 X B	466.5	-88.2	
(2 X A) + (2 X C)	372.8	-80.7	5 X C	470.5	-87.7	
(2 X A) - (2 X C)	-3.6	-81.6				

Conclusion: Based upon my observations and measurements taken July 14,2022 as summarized in this document, I Daniel J. Mettler find the combiner system for operation of radio stations KFFF-FM, KEZO- FM and KQCH-FM into the common antenna to be in proper working order. Based on the measured data above, it is my opinion that there are no inter-modulation (IM) products in excess of -73 db below the referenced carrier levels generated from or with in the stations operating on the install multiplexed system. Based on the data, I conclude that KFFF-FM, is in compliance with the requirements of Section 73.317 paragraph's (b) thru (d) of the RF Rules and Regulations.

Respectfully Submitted

Daniel J. Mettler
SVP Engineering
iHeartmedia
Central Region