TELECOMMUNICATIONS ENGINEERING

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OCCUPIED BANDWIDTH AND SPURIOUS EMISSIONS MEASUREMENTS
KQMB – FM, MIDVALE, UTAH

5 November 2002

ENGINEERING REPORT

On the evening of 31 October 2002, I made the equipment performance measurements contemplated in 47 CFR § 73.1590 (a & b) and described in 47 CFR § 73.317 (b-d), for radio station KQMB(FM), Midvale, Utah. These measurements were made as a condition of Construction Permit BMPH-20020125ABB.

KQMB is one of 13 stations sharing a master antenna system at the Farnsworth Peak transmitter site in the Oquirrh Mountains, west of Salt Lake City, Utah. The outputs of the 13 transmitters are combined using a constant impedance balanced bandpass filter combining system designed and fabricated by Jampro Antennas of Sacramento, California. The subject construction permit provided for the replacement of the antenna system. As part of this project, the combining system was modified to allow for the addition of three more stations.

Measurements were made while the station was broadcasting programming material typical of its daily operation. KQMB operates stereophonically with no subsidiary communications services. All 13 stations were operating into the combined antenna system at full licensed/permitted power during the measurements.

The combining system consists of two combining chains, one of six stations, the other of seven. The outputs of the two combining chains are combined using a 90° hybrid, the output lines of which feed the antenna. Stations with 800 kHz frequency spacing are assigned to opposite combining chains, taking advantage of the 30-35 dB transhybrid loss to improve isolation. Sample loops are provided in the output transmission lines of both combining chains. The measurement sample was taken from the loop located in the chain which KQMB feeds.

47 CFR § 73.317 (b) & (c) requires that all signals between 120 and 240 kHz removed from the carrier be attenuated below the level of the carrier by at least 25 dB; that all

signals between 240 kHz and 600 kHz removed from the carrier be attenuated by at least 35 dB below the level of the carrier; and that all signals greater than 600 kHz removed from the carrier be attenuated by at least 80 dB below the level of the carrier.

Three sets of measurements were made to assure compliance with these requirements. The first measurement looked at the spectrum between –600 kHz and +600 kHz, relative to the carrier frequency, in order to assess the station's occupied bandwidth under modulation. The second measurement looked at the spectrum from –1 Mhz to –600 kHz and +600 kHz to +1 MHz, relative to the carrier frequency, to look for near-in intermodulation products. The third measurement scanned the spectrum from 9 KHz to 1 GHz in order to detect any out-of-band intermodulation products or harmonics.

All measurements were taken with a Rohde & Schwarz Model FSP3 Spectrum Analyzer, Serial Number 835151/011, within current calibration.

To measure the occupied bandwidth, the spectrum analyzer was set to 102.7 MHz center frequency, 200 kHz/div span, 3 kHz resolution bandwidth, and 10 kHz video filtering. This results in a measurement noise floor of approximately –72 dBC. An unmodulated carrier was used to establish the reference point at the top of the screen, the analyzer placed in the peak hold mode and modulation applied. After ten minutes of data collection, the resultant spectrum was saved and a plot made of it for analysis.

A copy of this plot is included as Figure 1, below. The emission limits of 47 CFR § 73.317 (b-d) are shown on the plot as red lines. It can be clearly seen from this plot that the occupied bandwidth of KQMB lies well within the prescribed limits between –600 kHz and +600 kHz, relative to the carrier frequency.

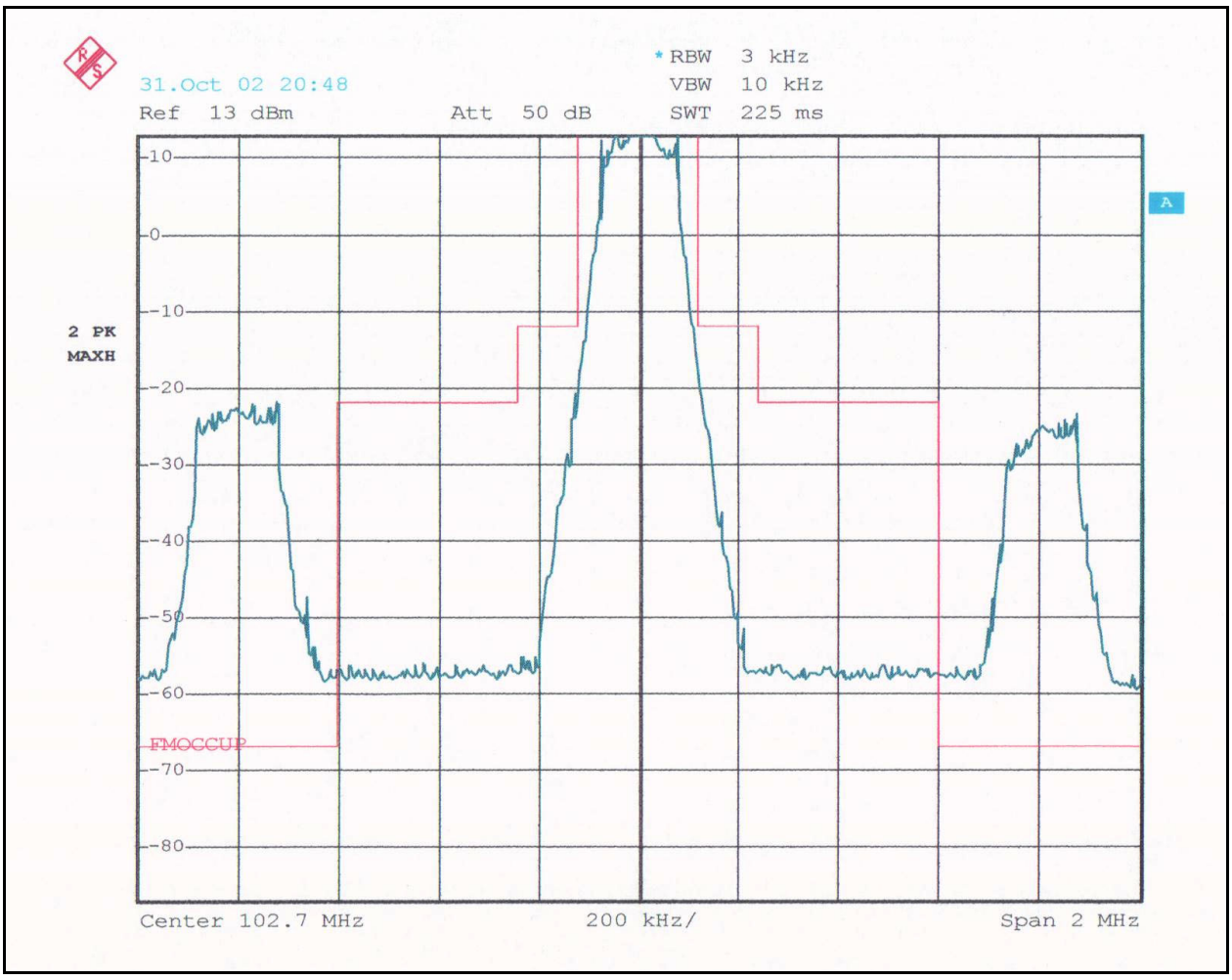
31.Oct 02 20:48
* RBW 3 kHz
VBW 10 kHz
Ref 13 dBm
Att 50 dB
SWT 225 ms
2 PK
MAXH
A
10
0
-10
-20
-30
-40
-50
-60
FMOCCUP
-70
-80
Center 102.7 MHz
200 kHz/
Span 2 MHz

FIGURE 1

To make the second set of measurements a set of six notch filters, connected in series, was inserted between the measurement port and the input of the spectrum analyzer. The notch filters were tuned using a Hewlett-Packard 8712B Network Analyzer to place a notch at the center frequency of each of the stations on the combiner chain shared with KQMB. The insertion loss of the notch filters was typically –20 dB at the center frequency and less than –0.5 dB at ±600 kHz. The purpose of the notch filters was to increase the dynamic range of the spectrum analyzer by reducing internally generated harmonics and intermodulation products.

The reference level of the spectrum analyzer was reduced by 15 dB, making the top of the screen equal to –15 dBC. No other changes were made to the instrument settings. This configuration reduced the instrument noise floor to approximately –93 dBC. The instrument was again placed in the peak hold mode, data collected for ten minutes, and a plot of the resulting spectrum made.

A copy of this plot is included as Figure 2, below. The emission limits between –1 MHz and –600 kHz, and +600 kHz and +1 Mhz are shown as red lines on the plot. The signal that appears 800 kHz below the KQMB carrier was identified as KKAT Ogden, Utah. The signal that appears 800 kHz above the KQMB carrier was identified as KRSP Salt Lake City, Utah. Both of these stations are part of the Farnsworth Peak combined antenna system. Other than these signals there are no signals above the prescribed emissions limit.

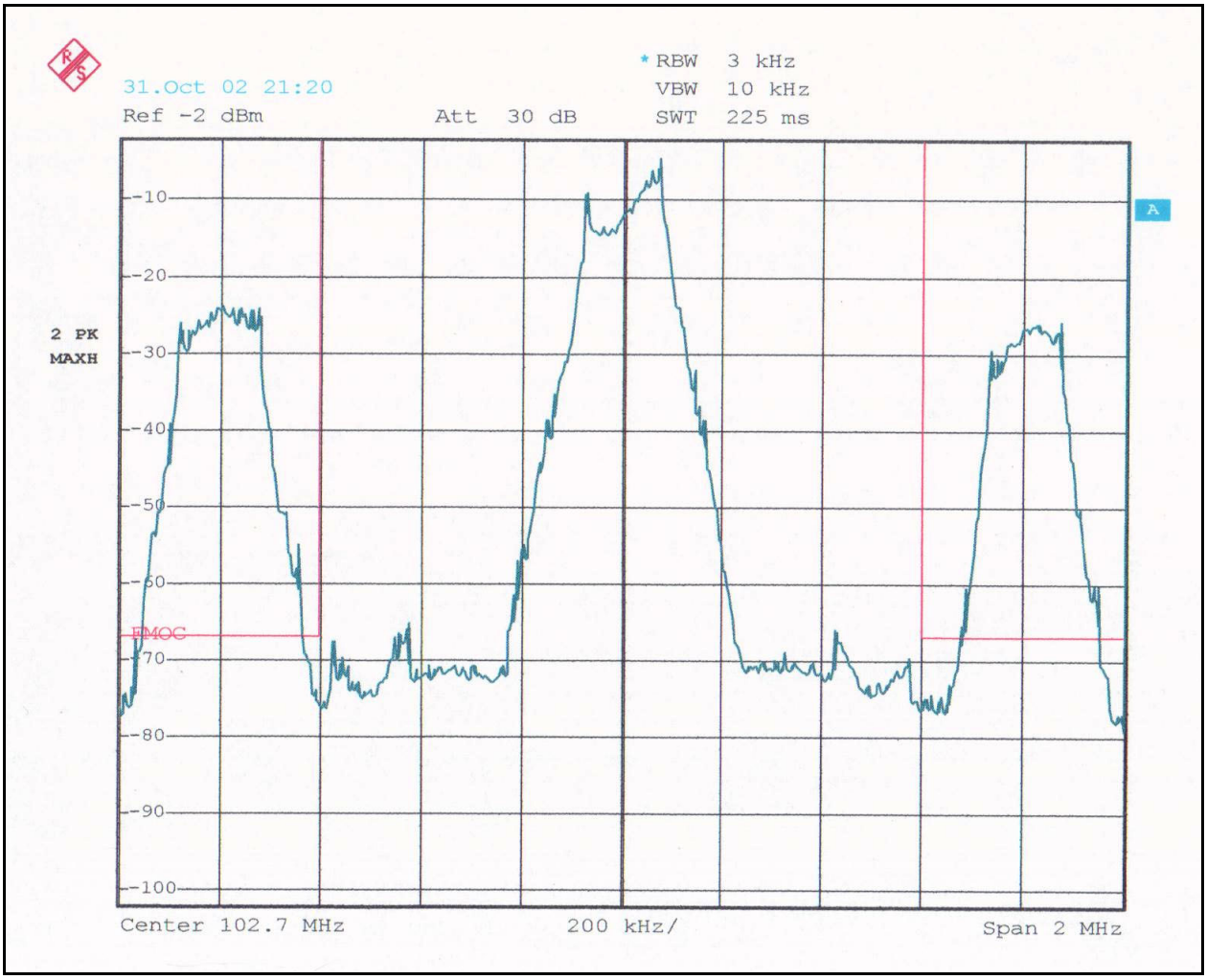
31.Oct 02 21:20
Ref -2 dBm
Att 30 dB
* RBW 3 kHz
VBW 10 kHz
SWT 225 ms
2 PK
MAXH
-10
-20
-30
-40
-50
-60
FMOC
-70
-80
-90
-100
A
Center 102.7 MHz
200 kHz/
Span 2 MHz

FIGURE 2

To measure spurious signals and harmonics, the spectrum analyzer was set to 2 MHz/div span, 10 kHz resolution bandwidth, and 30 kHz video filtering. The notch filters remained in the sample line. The analyzer was initially set at 10 MHz center frequency and then incremented successively by 20 MHz to scan the spectrum from 9 kHz to 1 GHz. Any signals that were greater –80 dBC were noted. Upon completion of the scan, each of these signals was compared to a list of known transmitters in the area and the analyzer was used to demodulate the signal. All of the signals noted were identified as being either signals from other stations in the combined system or ingress from other known transmitters. No intermodulation products, spurious signals or harmonics were found that could be attributed to the operation of KQMB.

In light of the above measurements I believe that KQMB is in full compliance with the requirements of 47 CFR § 73.317 (a) through (d).

ENGINEER'S STATEMENT

I hereby affirm that:

I have been retained by KQMB to ascertain their compliance with 47 CFR § 73.1590 (a) & (b) and 47 CFR § 73.317 (b-d) and to prepare this report;

This report and associated exhibits were prepared by me, and are based on measurements made by me;

To the best of my knowledge all statements made herein are true and reflect the actual facts of the matter;

I am a Broadcast Engineer of 36 years experience and;

My qualifications are a matter of record with the Commission.

Respectfully submitted this 5th day of November, 2002,

Gray Frierson Haertig

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