

November 2016
KALC(FM) Channel 290C
Denver, Colorado
Auxiliary Antenna Engineering

Facilities Proposed

The instant application proposes a power increase for the licensed KALC auxiliary facility BXLH-20101020AAI. The proposed auxiliary antenna operation will be on Channel 290C (105.9 MHz) with a maximum lobe effective radiated power of 100 kilowatts. Operation is proposed with the existing 8-element circularly-polarized directional antenna which is 0.83-wavelength at the KALC frequency. This broadband panel antenna system is shared with a number of other stations.

The antenna is side-mounted on a tower with FCC Antenna Structure Registration Number 1033691, which is located at the Lookout Mountain transmitter site near Golden, Colorado. This site hosts a number of FM and TV broadcast stations.

RF Exposure Calculations

The power density calculations shown below were made using the techniques outlined in OET Bulletin No. 65. "Ground level" calculations in this report have been made at a reference height of 2 meters above ground to provide a worst-case estimate of exposure for persons standing on the ground in the vicinity of the tower. The equation shown below was used to calculate the ground level power density figures from the antenna.

$$S(\mu W / cm^2) = \frac{33.40981 \times AdjERP(Watts)}{D^2}$$

Where: *AdjERP(Watts)* is the maximum lobe effective radiated power times the element pattern factor times the array pattern factor.

D is the distance in meters from the center of radiation to the calculation point.

Ground level power densities have been calculated for locations extending from the base of the tower to a distance of 500 meters. Values past this point are increasingly negligible.

Since the OET's FMModel software does not include an element pattern for the ERI 1082 panel antenna (or indeed for any panel antenna model) calculations of the power density produced by the proposed KALC auxiliary antenna system have been made assuming a Type 1 element pattern,

which is the “worst case” element pattern for a “ring stub” antenna. Under this worst-case assumption, the highest calculated ground level power density occurs at a distance of 8 meters from the base of the antenna support structure. At this point the power density is calculated to be $98.3 \mu\text{W}/\text{cm}^2$.

Since this facility in fact uses a panel antenna, which produces an elevation pattern with more suppression at steep vertical angles than that of a “ring stub” antenna, the real-world ground level power density produced by the KALC auxiliary antenna system alone is expected to fall below 5% of the FCC standard for uncontrolled environments. Indeed, measurements performed at the Lookout Mountain site in 2009 while KALC was operating with this same antenna system at 25 kW ERP (see BXLH-20101020AAI) – and while the other broadcast users of this site were also operating – found that the location of the highest spatially-averaged field was only 22.6% of the FCC General Population/Uncontrolled Environment MPE. That location was inside the fence surrounding the adjacent KWGN tower site, a controlled access area inside a fence with a locked gate. The location of the highest spatially-averaged field found in accessible areas was just 17% of the FCC General Population/Uncontrolled Environment MPE. At no point were spatially-averaged fields found which exceeded the FCC General Population/Uncontrolled Environment MPE.

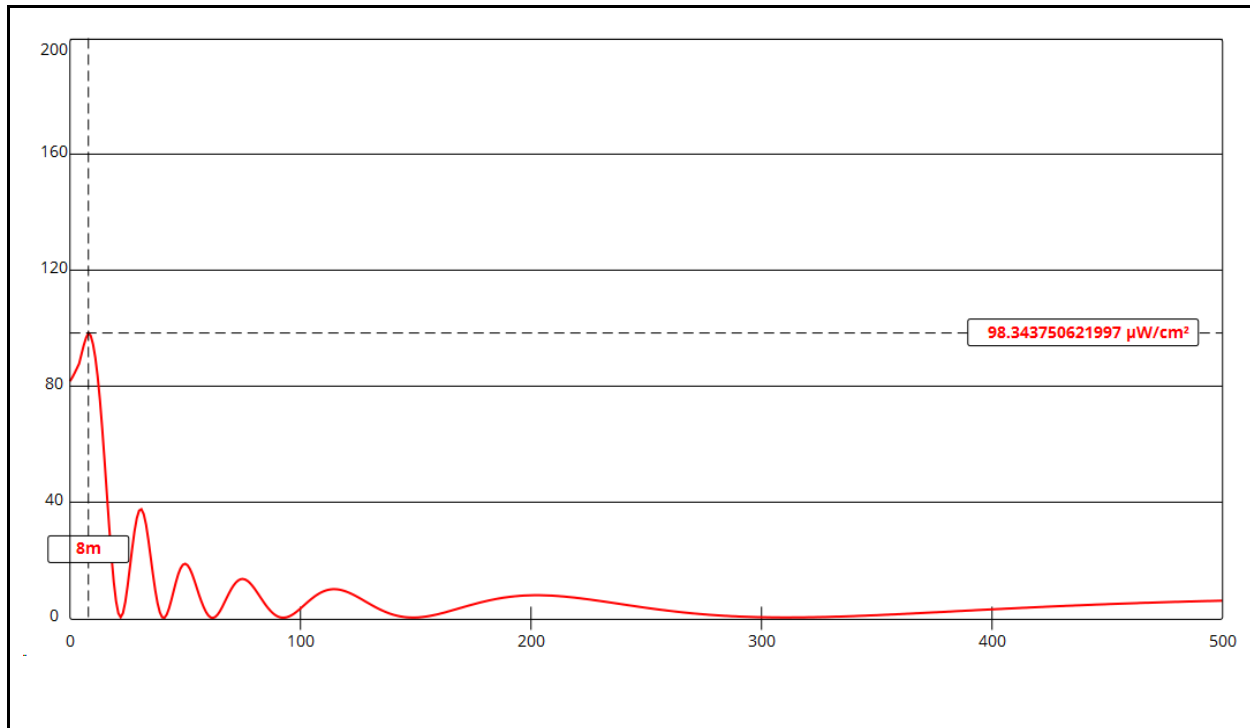
The only known additions to this site since the 2009 measurements have been comparatively low-powered (i.e. FM translators and a 1 kW FM station). Given the number of high-powered facilities at this site, the proposed power increase for the KALC auxiliary facility would not be expected to increase the measured 17% of the Uncontrolled Area MPE (in accessible areas) to over 100%. Indeed, even if a quadrupling of the KALC auxiliary ERP were to equate to a quadrupling of the 2009 measurement, the result would still be only 68% of the Uncontrolled Area MPE.

Public access to the tower is restricted by a fence with a locked gate. Pursuant to OET Bulletin No. 65, all station personnel and contractors are required to follow appropriate safety procedures before any work is commenced on the antenna tower, including reduction in power or discontinuance of operation before any maintenance work is undertaken.

The permittee/licensee in coordination with other users of the site must reduce power or cease operation as necessary to protect persons having access to the site, tower or antenna from radiofrequency radiation in excess of FCC guidelines.

Erik C. Swanson, P.E.

Registered in Washington and Colorado



Ground-Level RF Exposure

OET FMModel

KALC Auxiliary Antenna

Antenna Type: ERI 1082-8CP-DA panel antenna (Type 1 assumed for this study)

No. of Elements: 8

Element Spacing: 0.83 wavelength

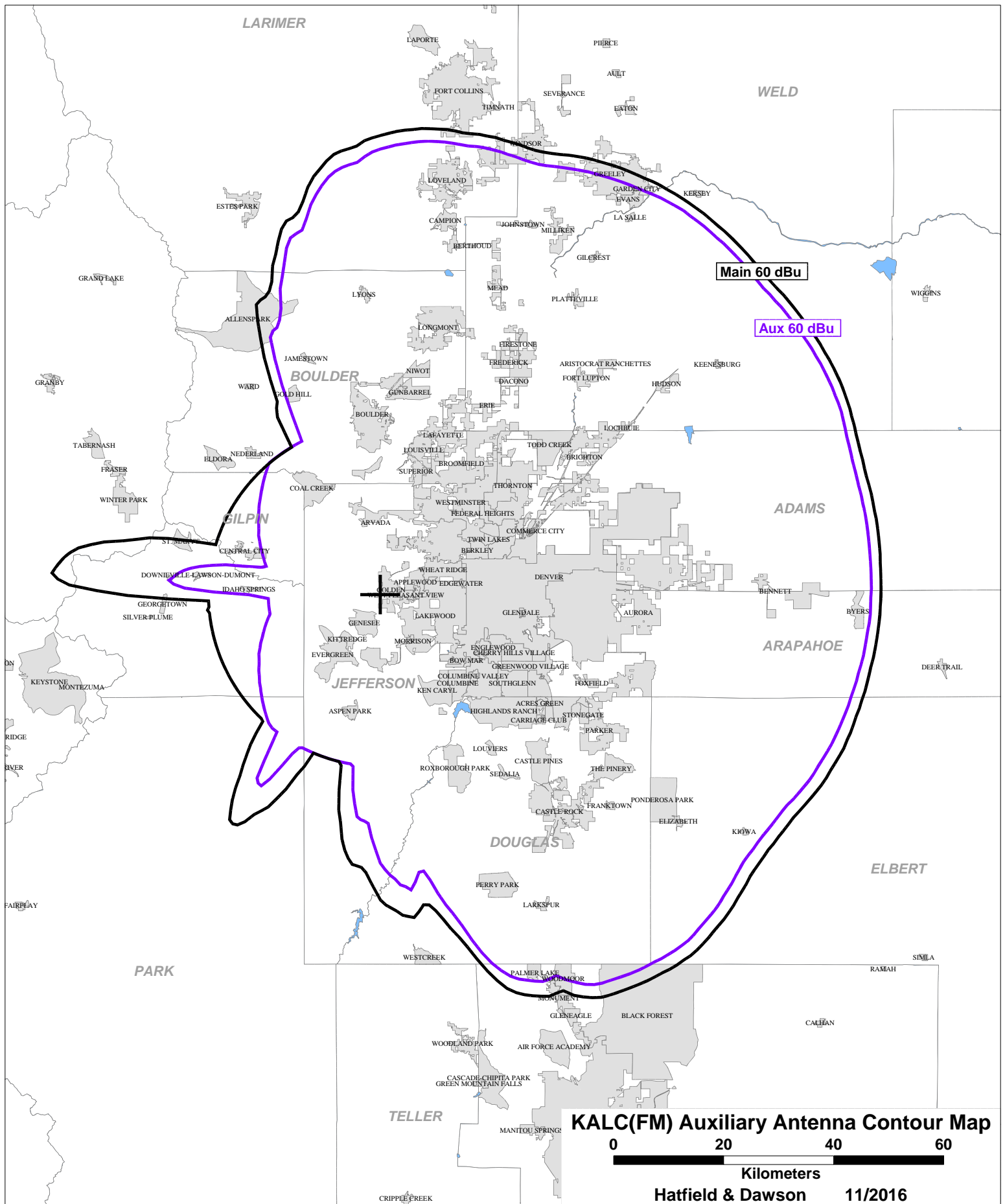
Distance: 500 meters

Horizontal ERP: 100 kW

Vertical ERP: 100 kW

Antenna Height: 49 meters AGL

Maximum Calculated Power Density is 98.3 $\mu\text{W}/\text{cm}^2$ at 8 meters from the antenna structure.



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Protection of Table Mountain Radio Receiving Zone

The requirements of §1.924(b) of the Commission's Rules require that new or changed facilities of FM broadcast stations located in the vicinity of the Table Mountain Radio Receiving Zone of the Research Laboratories of the Department of Commerce located in Boulder County, Colorado, maintain a field strength value of 80 dBu or less, except as noted in the following table.

The propagation path from the proposed KALC auxiliary facility has been evaluated using a variety of propagation models, and the radiation pattern of the existing authorized antenna has been carefully reviewed. From this data, a specific value of effective radiated power can be determined which would overprotect Table Mountain, but there is at least 2 dB of ambiguity in this analysis.

The directional antenna envelope pattern proposed herein shows a reduction below maximum radiation toward Table Mountain. If measurements after construction show that the measured field value at the Table Mountain location exceeds the maximum allowable, the directional antenna feed system has been configured to allow reduction of radiation in the Northeastern row of antenna elements, while at the same time maintaining the radiation within the envelope pattern.

GRANDFATHERED RADIO/TV STATIONS
TABLE MOUNTAIN MAXIMUM PERMISSIBLE MEASURED SIGNAL LEVELS

Call Sign	Frequency	Location	Mean		Maximum*	
			mV/m	dBuV/m	mV/m	dBuV/m
KRCN	1060 kHz	Longmont	61.13	95.73	72.66	97.23
KRKS-FM	94.7 MHz	Boulder	16.30	84.24	18.99	85.57
KOSI-FM	101.1 MHz	Lookout Mtn	16.30	84.24	19.37	85.74
KRFX-FM	103.5 MHz	Lookout Mtn	12.90	82.21	15.33	83.71
KQKS-FM	104.3 MHz	Longmont	37.88	91.57	45.02	93.07
KBPI-FM	106.7 MHz	Lookout Mtn	22.40	87.00	26.62	88.50
KCNC-TV	67.25 MHz **	Lookout Mtn	13.46	82.58	16.00	84.08
KRMA-TV	83.25 MHz **	Lookout Mtn	10.30	80.26	12.24	81.76
KMGH-TV	175.25 MHz	Lookout Mtn	44.07	92.88	52.37	94.38
KUSA-TV	187.25 MHz	Lookout Mtn	43.58	92.79	51.79	94.28

*Maximum is mean times 1.5 dB

**Analog TV operation, discontinued on this channel