

Calculate R4, such that the design minimum IKA is provided to operate the TL431:

$R4 = (V_{bat\ Min} / I_{KA}) - Z_{KA}$		
<b>Design Goals:</b>		<b>Actual Values:</b>
$I_{KA}$	3 mA	2.8
<b>Datasheet Values:</b>		
$Z_{KA}$	0.2 Ohms	0.2
<b>Assumptions:</b>		
$V_{batt\ Min}$	6.1 V	6.1
$V_{batt\ Max}$	8.4 V	8.4
<b>Calculated Values:</b>		
$R_4$	2033 Ohms	2200
$I_{KA\ at\ V_{batt\ Max}}$	4.1 mA	3.8

Calculating the voltage divider for setting a TL431 adjustable shunt.

$V_{ref} = V_{nom} + (I_{ka} - I_{nom}) \times Z_{ka} + (V_{ka} - V_{nom}) \times -1.4mV/V$ : For Cathode V <= 10V	
$V_{ref} = V_{nom} + (I_{ka} - I_{nom}) \times Z_{ka} + (V_{ka} - 10) \times -1mV/V - 10.5mV$ : For Cathode V > 10V	
$R1 = (V_{ka} - V_{ref}) / I_{fb}$	
$R2 = V_{ref} / (I_{fb} - I_{ref})$	
<b>Design Goals:</b>	
$V_{KA}$	6.1 V
$I_{FB}$	0.2 mA
$I_{KA}$	2.8 mA
<b>Datasheet Values:</b>	
$I_{ref}$	2 uA
$I_{nom}$	10 mA
$V_{nom}$	2.495 V
$dV_{ref} / dV_{KA}$	-1.4 mV
$Z_{KA}$	0.2 Ohms
<b>Calculated Values:</b>	
$V_{ref}$	2.489 V
$R_1$	18057 Ohms
$R_2$	12568 Ohms