A look at the tolerance stackup of the Avaya resistive method of discovery

In this case, V2 is exactly equal to (V1*(1 +/- src_tol)) / 2)*(1 +/- src_rel_tol)

The given Inputs:

res_tol := 1% src_tol := 1% src_rel_tol := 1%

R1 := 75000 V1 := 24 Rsigmax := 26500 Rsigmin := 19000

The calculations, Vomin and Vomax are the required detector windows to acquire the desired range of signature resistor

$$\text{Vomax}(a,b,c) := \left[\text{Rsigmax} \cdot \frac{(V1)\cdot(1 + a\cdot\text{src\_tol}) - \left[\frac{V1\cdot(1 + a\cdot\text{src\_tol})}{2}\right]\cdot(1 + c\cdot\text{src\_rel\_tol})}{R1\cdot(1 + b\cdot\text{res\_tol}) + \text{Rsigmax}} \right]$$

$$\text{Vomin}(a,b,c) := \left[\text{Rsigmin} \cdot \frac{(V1)\cdot(1 + a\cdot\text{src\_tol}) - \left[\frac{V1\cdot(1 + a\cdot\text{src\_tol})}{2}\right]\cdot(1 + c\cdot\text{src\_rel\_tol})}{R1\cdot(1 + b\cdot\text{res\_tol}) + \text{Rsigmin}} \right]$$

all the possible cases of tolerance stackup:

Vomax(–1, –1, –1) = 3.156	Vomin(–1, –1, –1) = 2.445
Vomax(–1, –1, 1) = 3.094	Vomin(–1, –1, 1) = 2.396
Vomax(–1, 1, –1) = 3.11	Vomin(–1, 1, –1) = 2.406
Vomax(–1, 1, 1) = 3.048	Vomin(–1, 1, 1) = 2.358
Vomax(1, –1, –1) = 3.22	Vomin(1, –1, –1) = 2.494
Vomax(1, –1, 1) = 3.156	Vomin(1, –1, 1) = 2.445
Vomax(1, 1, –1) = 3.173	Vomin(1, 1, –1) = 2.455
Vomax(1, 1, 1) = 3.11	Vomin(1, 1, 1) = 2.406

VMAX := max(Vomax(–1, –1, –1), Vomax(–1, –1, 1), Vomax(–1, 1, –1), Vomax(–1, 1, 1), Vomax(1, –1, –1), Vom

VMIN := min(Vomin(–1, –1, –1), Vomin(–1, –1, 1), Vomin(–1, 1, –1), Vomin(–1, 1, 1), Vomin(1, –1, –1), Vomin(

Here are the extreme maximum and minimum Detector Voltages

the highest	the lowest
VMAX = 3.22	VMIN = 2.358

Now add in a little margin to obtain the equiv worst case detector thresholds

ref_marg := 0.001%

Vrejmax := VMAX·(1 + ref_marg)	Vrejmin := VMIN·(1 − ref_marg)
Vrejmax = 3.22	Vrejmin = 2.358

Now, let's calculate the resistance range that is guaranteed to be rejected

$$\text{Rrejmax}(a,b,c) := \frac{\text{Vrejmax}\cdot R1\cdot(1 + b\cdot\text{res\_tol})}{(V1)\cdot(1 + a\cdot\text{src\_tol}) - \left[\frac{V1\cdot(1 + a\cdot\text{src\_tol})}{2}\right]\cdot(1 + c\cdot\text{src\_rel\_tol}) - \text{Vrejmax}}$$

$$\text{Rrejmin}(a,b,c) := \frac{\text{Vrejmin}\cdot R1\cdot(1 + b\cdot\text{res\_tol})}{(V1)\cdot(1 + a\cdot\text{src\_tol}) - \left[\frac{V1\cdot(1 + a\cdot\text{src\_tol})}{2}\right]\cdot(1 + c\cdot\text{src\_rel\_tol}) - \text{Vrejmin}}$$

Rrejmax(−1, −1, −1) = 27232.07	Rrejmin(−1, −1, −1) = 18164.53
Rrejmax(−1, −1, 1) = 27989.597	Rrejmin(−1, −1, 1) = 18623.529
Rrejmax(−1, 1, −1) = 27782.213	Rrejmin(−1, 1, −1) = 18531.488
Rrejmax(−1, 1, 1) = 28555.044	Rrejmin(−1, 1, 1) = 18999.762
Rrejmax(1, −1, −1) = 26500.36	Rrejmin(1, −1, −1) = 17719
Rrejmax(1, −1, 1) = 27232.07	Rrejmin(1, −1, 1) = 18164.528
Rrejmax(1, 1, −1) = 27035.72	Rrejmin(1, 1, −1) = 18076.956
Rrejmax(1, 1, 1) = 27782.213	Rrejmin(1, 1, 1) = 18531.488

RMIN := min(Rrejmin(−1, −1, −1), Rrejmin(−1, −1, 1), Rrejmin(−1, 1, −1), Rrejmin(−1, 1, 1), Rrejmin(1, −1, −1), R

RMAX := max(Rrejmax(−1, −1, −1), Rrejmax(−1, −1, 1), Rrejmax(−1, 1, −1), Rrejmax(−1, 1, 1), Rrejmax(1, −1, −1

Summary:
If the minimum and maximum Signature Resistor Values are given as:

Rsigmin = 19000 Rsigmax = 26500

And if the 75K resistor tolerance (res_tol), and the source voltage tolerances (src_tol) are:

res_tol = 1 % src_tol = 1 % src_rel_tol = 1 %

Then

Any signature resistor above this value will be rejected:

RMAX = 28555.044

Any signature resistor below this value will be rejected:

RMIN = 17718.997