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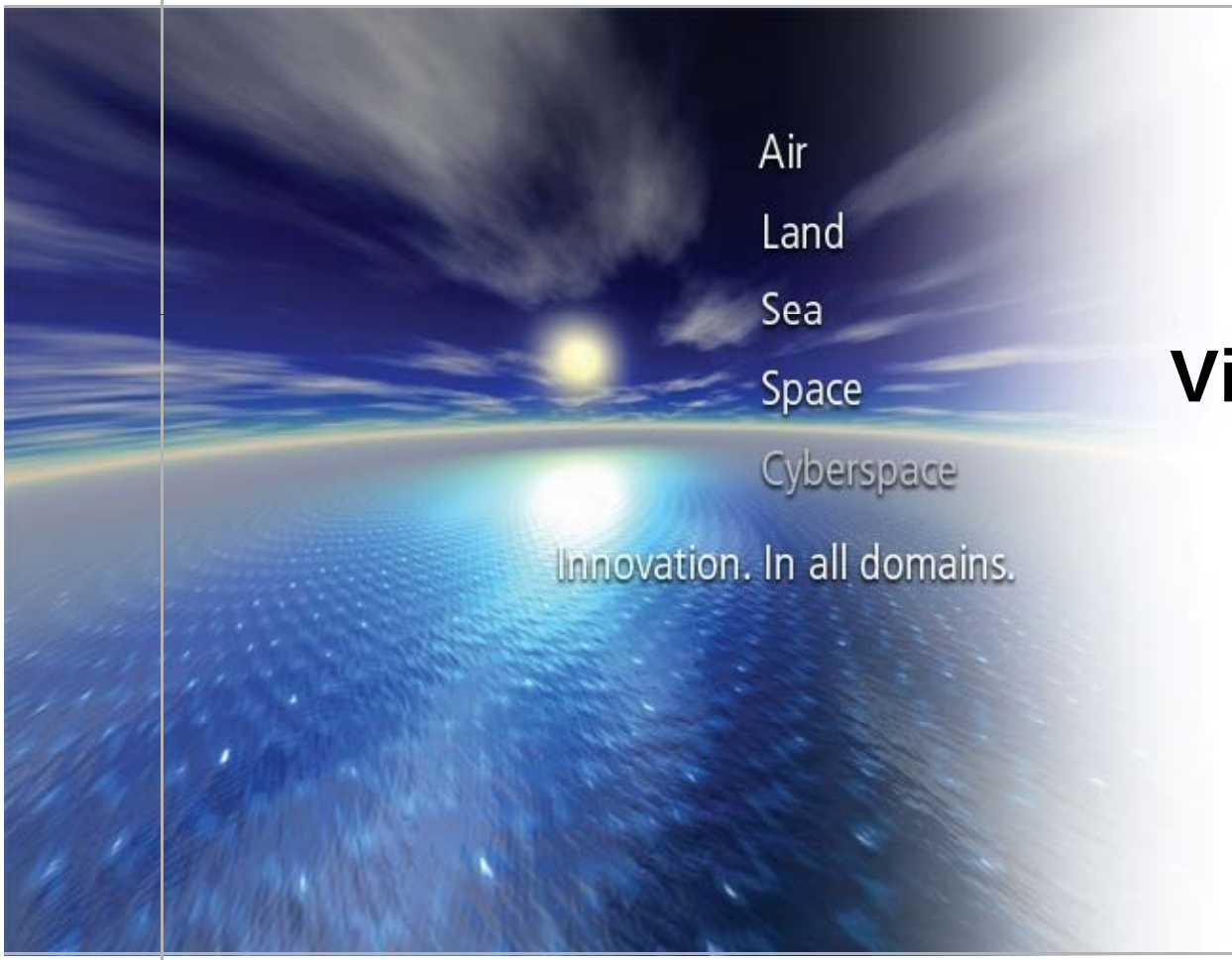

Analysis of Vibration Test Data

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September 1, 2009

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Vibration Analysis

INTRODUCTION

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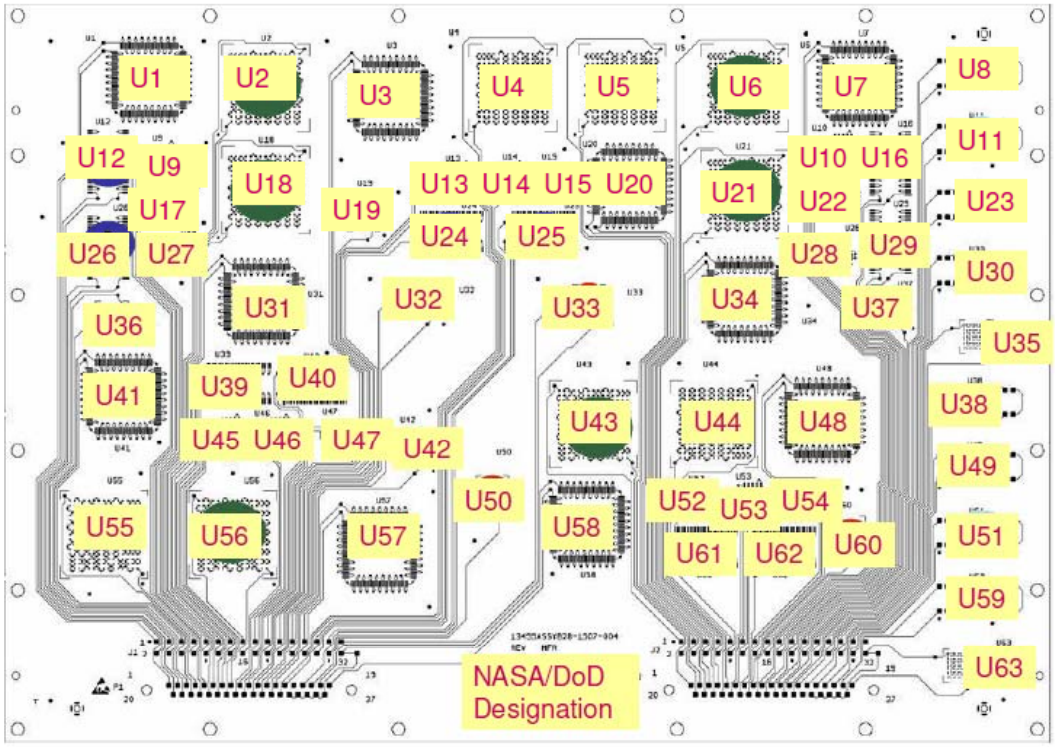
Purpose

- This experiment was performed to assess the relative reliability of reworked as compared to as-received solder joints for a range of common component types
  - using Pb-free solder alloys on high Tg boards reworked with SnPb solder, and
  - when subjected to extended periods of random vibration

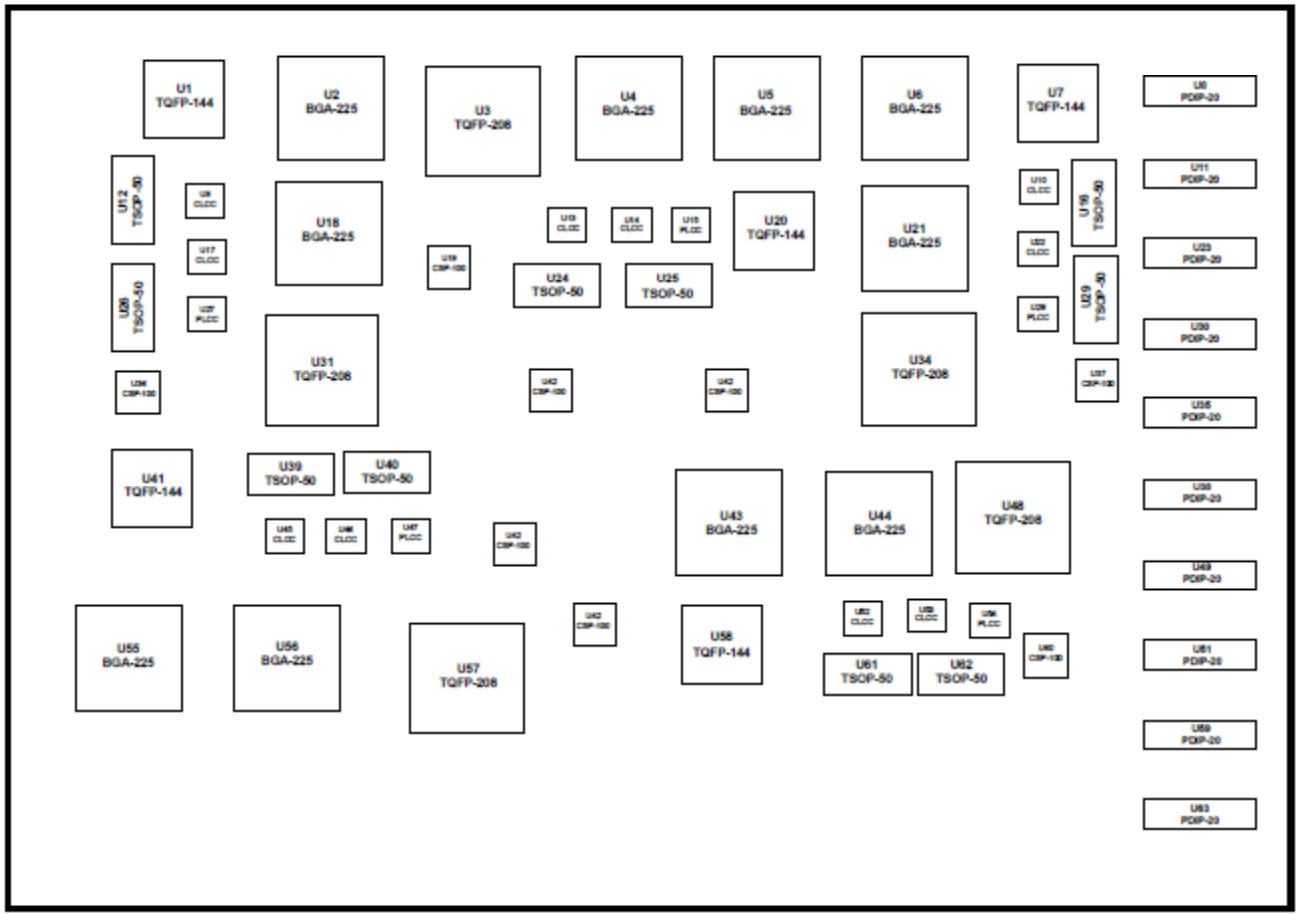
Test vehicle

- The components were mounted to a test board having a layout similar to that used in the JCAA/JG-PP Vibration Test in 2004, the layout is shown below
- The laminate had a glass transition temperature of 170 deg C
- Nine test boards were prepared, and were identified by serial numbers 61 to 68 and 79



Board Schematic

The board layout included locations for the following component types and identified them as shown



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Test Parameters

- The following components were used and monitored in this test:
  - TQFP-144
  - TSOP-50
  - BGA-225 (not reworked)
  - CSP-100 (not reworked)
  - QFN-20
  - PDIP-20
  - CLCC-20
- All vibration boards came from batch F, all parts except PDIPS were attached using SAC305 solder
  - Thru-hole PDIPS were attached with SN100C (SnCuNiGe)
- Two devices had multiple lead finishes
  - PDIP components were supplied with both Sn and AuNiPd finishes
  - TSOPs were supplied with both Sn and SnBi finishes
- Selected devices were removed and were replaced with new Pb-free parts
  - This operation was repeated either one or two times at the Naval Surface Warfare Center at Crane, IN
  - These devices are identified in the analysis as “reworked” and were reattached using SnPb solder

Assigning Components to Board Locations

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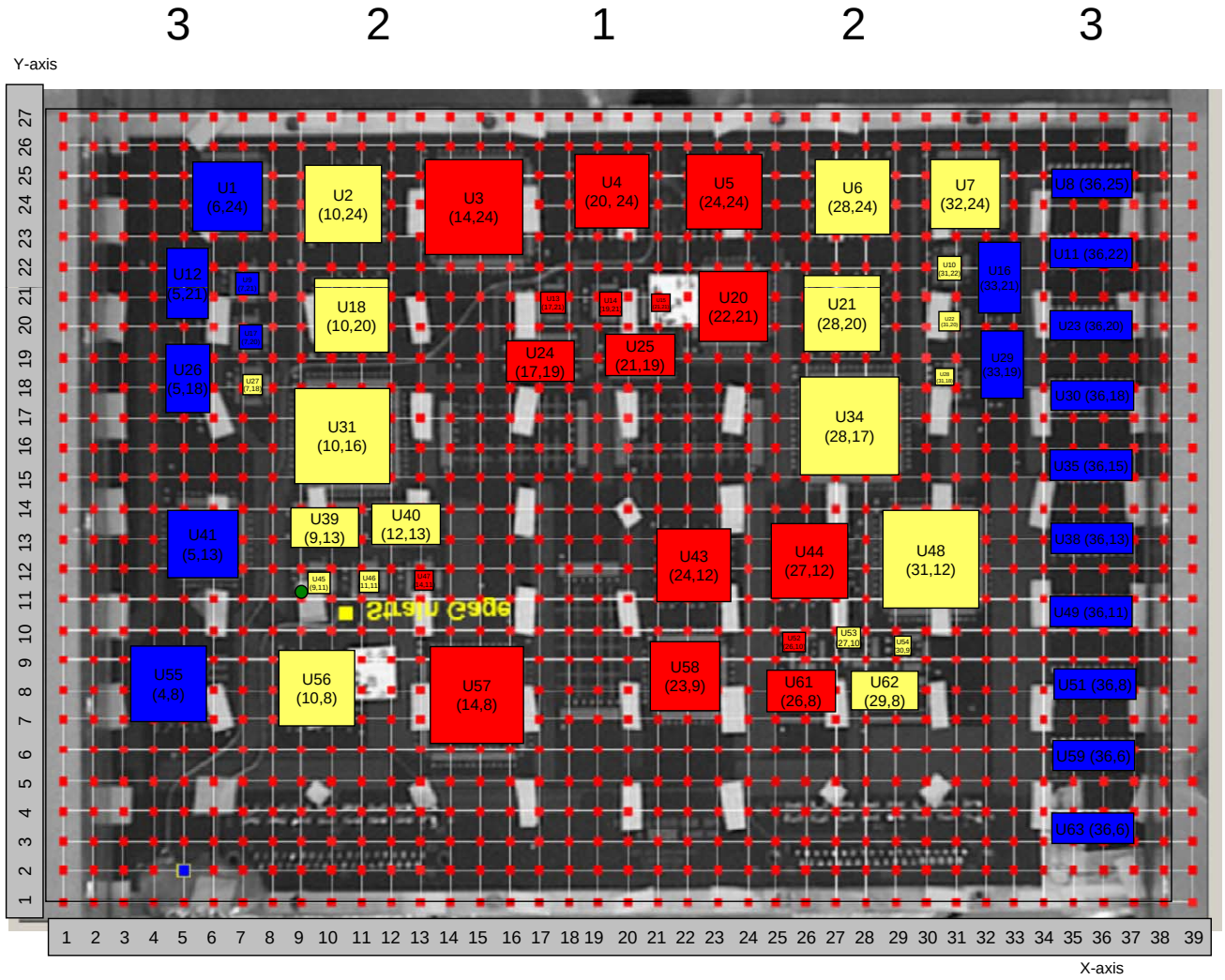
- The components were assigned to one of the following “zones” to identify their relative location on the board for the purpose of later analysis

- The locations were named

	Zone 1 Board center
	Zone 2
	Zone 3 Board edge



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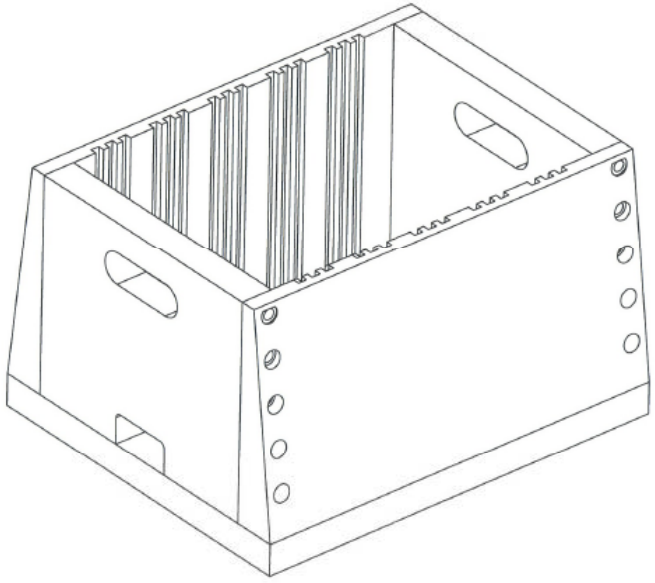
Vibration Conditioning

- All test boards were subjected to random vibration
- The vibration was performed at Celestica, Toronto, Canada
- A step stress methodology was used
  - The test began at a total composite random vibration level of 8 Grms
  - Each level was maintained for one hour
  - The vibration was then increased to the next level
  - Subsequent vibration levels were: 10, 12, 14, 16, 18, 20, and 28 Grms
  - After one hour at 28 Grms, the test was terminated
- During vibration, the boards were mounted in a fixture that secured the edges of the card
- The vibration was performed in the z-axis



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Device Performance Monitoring

- During the test, each device was daisy chained and monitored using an Analysis Tech Event Detector (set to a 300 ohm threshold)

- The results from each device were examined to verify continuity
  - If an open circuit appeared, the test record was examined to determine the exact moment during the vibration cycle when the event occurred
  - If an intermittent was observed, the moment of final disconnection was determined by calculating the percentage of time with continuity vs open circuit
  - All components requiring judgment calls were checked for continuity following the test

- The total elapsed time in vibration was calculated for each device

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Conclusions

- Among the parameters tested, unexplained variation continues to dominate the results
- Batch or Card S/N did not significantly influence the results
- Component package style had a marked influence on both the time to failure (Tf) and on the number of cycles to 10% failure (N10)
- Rework
  - Did influence Time to failure
  - Did not significantly influence N10
- Location on the board
  - Did significantly influence Tf
  - Did not significantly influence N10

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Executive Summary

From these results it appears that a qualified rework facility with a capable process can rework Pb-free boards with SnPb components and create solder joints that have a reliability comparable to as-manufactured assemblies.

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Failure and Root Cause Analysis

- Several of the Weibull plots exhibited anomalies which could bear further examination

- These issues have been grouped in the following way in the next table
  - Oultiers – units which failed much earlier or later that the others and which would have a marked influence on the Weibull model
  - Poor fit – Data sets which deviate markedly from the Weibull model, usually by more than the 90% confidence limits.
  - Low Rho – Weibull models with correlation coefficients less than 90%.

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Weibull fit issues

Part	Zone	Reworks	Page	Outlier	Fit	Low Rho
QFN	2	1	70	X		
TQFP	1	0	77		X	
TSOP	1	1	98		X	
TSOP	3	1	106	X		X
TSOP	2	1	117	X		X
TSOP	3	2	125			X
BGA	1	0	130		X	
BGA	2	0	132		X	
CLCC	1	0	139	X		
CLCC	1	0	139	X		
CLCC	3	2	151			X
CSP	1	0	156		X	
PDIP	3	2	177			X

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Vibration Analysis

SUMMARY STATISTICS

Device count in each batch

Frequency Table for Style by Batch

	1	2	Row Total
BGA-225	40	50	90
	44.44%	55.56%	15.87%
CLCC-20	40	50	90
	44.44%	55.56%	15.87%
CSP-100	40	50	90
	44.44%	55.56%	15.87%
PDIP-20	32	40	72
	44.44%	55.56%	12.70%
QFN-20	20	25	45
	44.44%	55.56%	7.94%
TQFP-144	40	50	90
	44.44%	55.56%	15.87%
TSOP-50	40	50	90
	44.44%	55.56%	15.87%
Column Total	252	315	567
	44.44%	55.56%	100.00%

Cell contents:
Observed frequency
Percentage of row

Frequency of rework for each device type – for both batches combined

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Frequency Table for Style by Reworks

	0	1	2	Row Total
BGA-225	90	0	0	90
	100.00%	0.00%	0.00%	15.87%
CLCC-20	36	36	18	90
	40.00%	40.00%	20.00%	15.87%
CSP-100	90	0	0	90
	100.00%	0.00%	0.00%	15.87%
PDIP-20	20	37	15	72
	27.78%	51.39%	20.83%	12.70%
QFN-20	0	32	13	45
	0.00%	71.11%	28.89%	7.94%
TQFP-144	36	36	18	90
	40.00%	40.00%	20.00%	15.87%
TSOP-50	36	36	18	90
	40.00%	40.00%	20.00%	15.87%
Column Total	308	177	82	567
	54.32%	31.22%	14.46%	100.00%

Frequency of rework for Batch 1

Frequency Table for Style by Reworks

	0	1	2	Row Total
BGA-225	40	0	0	40
	100.00%	0.00%	0.00%	15.87%
CLCC-20	16	16	8	40
	40.00%	40.00%	20.00%	15.87%
CSP-100	40	0	0	40
	100.00%	0.00%	0.00%	15.87%
PDIP-20	13	13	6	32
	40.63%	40.63%	18.75%	12.70%
QFN-20	0	16	4	20
	0.00%	80.00%	20.00%	7.94%
TQFP-144	16	16	8	40
	40.00%	40.00%	20.00%	15.87%
TSOP-50	16	16	8	40
	40.00%	40.00%	20.00%	15.87%
Column Total	141	77	34	252
	55.95%	30.56%	13.49%	100.00%

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Frequency of rework for batch 2

Frequency Table for Style by Reworks

	0	1	2	Row Total
BGA-225	50	0	0	50
	100.00%	0.00%	0.00%	15.87%
CLCC-20	20	20	10	50
	40.00%	40.00%	20.00%	15.87%
CSP-100	50	0	0	50
	100.00%	0.00%	0.00%	15.87%
PDIP-20	7	24	9	40
	17.50%	60.00%	22.50%	12.70%
QFN-20	0	16	9	25
	0.00%	64.00%	36.00%	7.94%
TQFP-144	20	20	10	50
	40.00%	40.00%	20.00%	15.87%
TSOP-50	20	20	10	50
	40.00%	40.00%	20.00%	15.87%
Column Total	167	100	48	315
%	53.02%	31.75%	15.24%	100.00%

Percentage of devices failing the test, overall

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Frequency Table for Style by Fail_Survive

	F	S	Row Total
BGA-225	89	1	90
	98.89%	1.11%	15.87%
CLCC-20	69	21	90
	76.67%	23.33%	15.87%
CSP-100	62	28	90
	68.89%	31.11%	15.87%
PDIP-20	34	38	72
	47.22%	52.78%	12.70%
QFN-20	30	15	45
	66.67%	33.33%	7.94%
TQFP-144	88	2	90
	97.78%	2.22%	15.87%
TSOP-50	87	3	90
	96.67%	3.33%	15.87%
Column Total	459	108	567
	80.95%	19.05%	100.00%

Cell contents:
Observed frequency
Percentage of row

Percentage of as-received devices failing the test

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Frequency Table for Style by Fail_Survive

	Failed	Survived	Row Total
BGA-225	89	1	90
	98.89%	1.11%	29.22%
CLCC-20	31	5	36
	86.11%	13.89%	11.69%
CSP-100	62	28	90
	68.89%	31.11%	29.22%
PDIP-20	10	10	20
	50.00%	50.00%	6.49%
TQFP-144	36	0	36
	100.00%	0.00%	11.69%
TSOP-50	34	2	36
	94.44%	5.56%	11.69%
Column Total	262	46	308
	85.06%	14.94%	100.00%

Percentage of devices reworked devices that failed the test

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Reworked once:

Frequency Table for Style by Fail_Survive

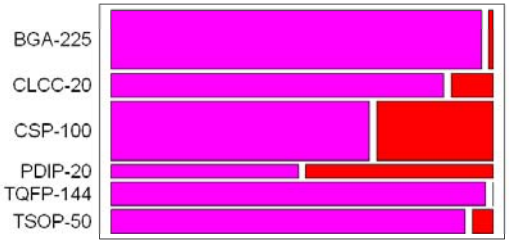
	Failed	Survived	Row Total
CLCC-20	26	10	36
	72.22%	27.78%	20.34%
PDIP-20	17	20	37
	45.95%	54.05%	20.90%
QFN-20	22	10	32
	68.75%	31.25%	18.08%
TQFP-144	34	2	36
	94.44%	5.56%	20.34%
TSOP-50	35	1	36
	97.22%	2.78%	20.34%
Column Total	134	43	177
	75.71%	24.29%	100.00%

Reworked twice:

Frequency Table for Style by Fail_Survive

	Failed	Survived	Row Total
CLCC-20	12	6	18
	66.67%	33.33%	21.95%
PDIP-20	7	8	15
	46.67%	53.33%	18.29%
QFN-20	8	5	13
	61.54%	38.46%	15.85%
TQFP-144	18	0	18
	100.00%	0.00%	21.95%
TSOP-50	18	0	18
	100.00%	0.00%	21.95%
Column Total	63	19	82
	76.83%	23.17%	100.00%

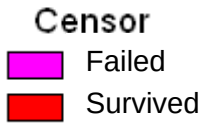
Mosiac Plots of Censored Devices



Zero reworks

One rework

Two reworks



- The height of each bar is proportional to the qty of that device type
- The width of each square is proportional to the qty of that outcome

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Vibration Analysis

ANALYSIS OF TIME TO FAILURE DATA

COMPONENTS OF VARIANCE
ANALYSIS OF VARIANCE

Summary Stats on Time to Failure by package/finish

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Summary Statistics

Code	Count	Average	Median	Standard Deviation
BGA-225	89	90.5771	63.633	81.9713
CLCC-20	69	355.931	422.0	121.458
CSP-100	62	336.542	333.1	57.3507
PDIP/Au-20	10	282.96	306.784	171.049
PDIP/Sn-20	24	175.146	87.0335	166.622
QFN-20	30	314.999	393.5	155.105
TQFP-144	88	297.609	319.767	118.378
TSOP-50/Sn	44	351.852	410.366	120.074
TSOP-50/SnBi	43	342.1	365.0	85.4479
Total	459	275.274	310.0	148.063

(Calculated only on those units which failed the test, excluding censored units.)

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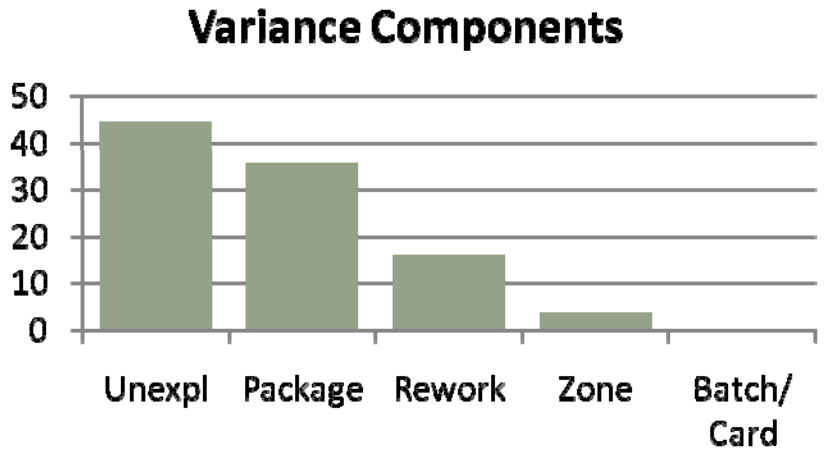
Components of Variance

- The analysis of variance table divides the variance of a parameter, in this case Tf into components, one for each factor
- In this case we will have five levels: Batch, Card, Zone, Package, Rework
- Each factor after the first is nested in the one above
- The goal of such an analysis is usually to estimate the amount of variability contributed by each of the factors, called the variance components.
- On the right side of the table, the contribution of each component is summarized as a percentage of the whole

Components of Variance

Variance Components Analysis

Dependent variable: Tf
Factors:
Batch
Card
Package/Finish
Zone
Reworks

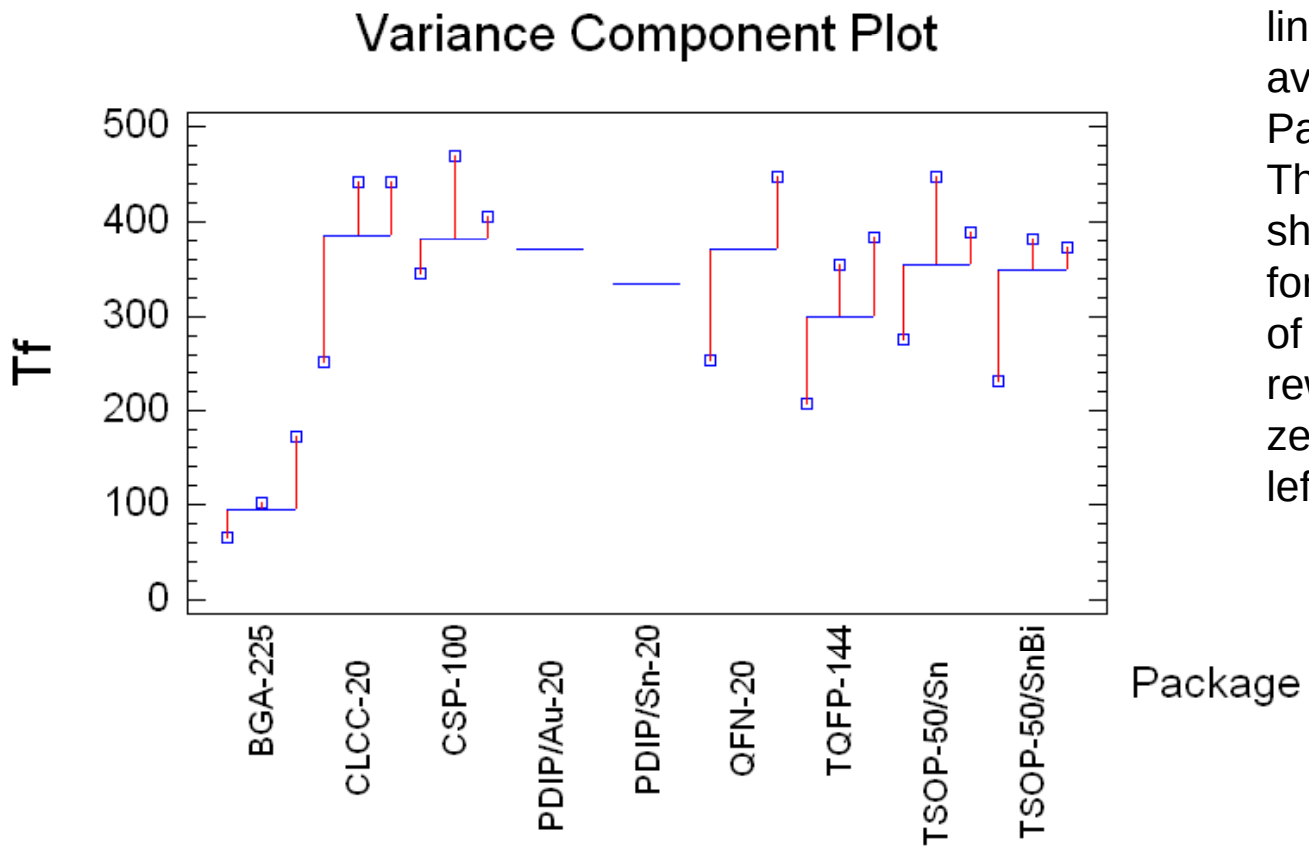


Number of complete cases: 567

Analysis of Variance for Tf

Source	Sum of Squares	Df	Mean Square	Var. Comp.	Percent
TOTAL (CORRECTED)	1.37145E7	566			
Batch	2533.64	1	2533.64	0.0	0.00
Card	163906.0	7	23415.2	0.0	0.00
Package/Finish	6.16591E6	70	88084.4	9120.44	35.77
Zone	2.56761E6	117	21945.4	945.241	3.71
Reworks	1.83988E6	109	16879.6	4079.55	16.00
ERROR	2.97463E6	262	11353.5	11353.5	44.53

Variance Component Plot



The horizontal lines show the average for each Package/Finish. The vertical lines show the average for each number of reworks. The rework levels are zero to two from left to right.

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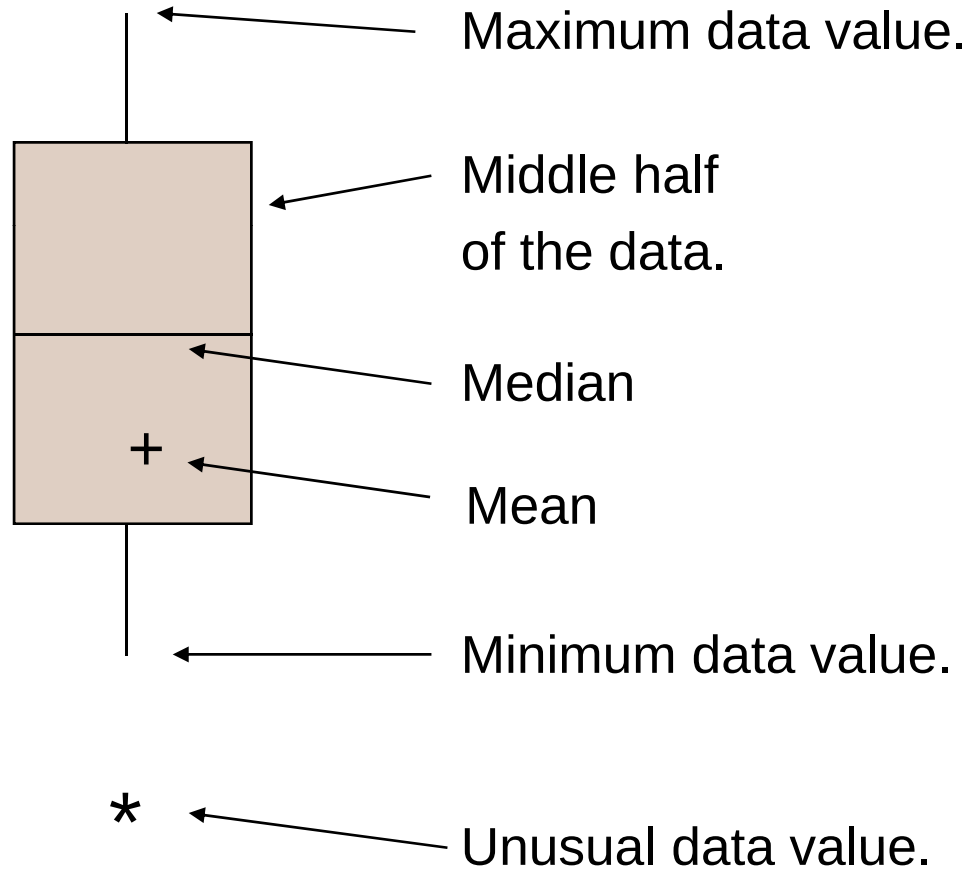
Box and Whisker Plots

Box and whisker plots show both center and variability of the data.



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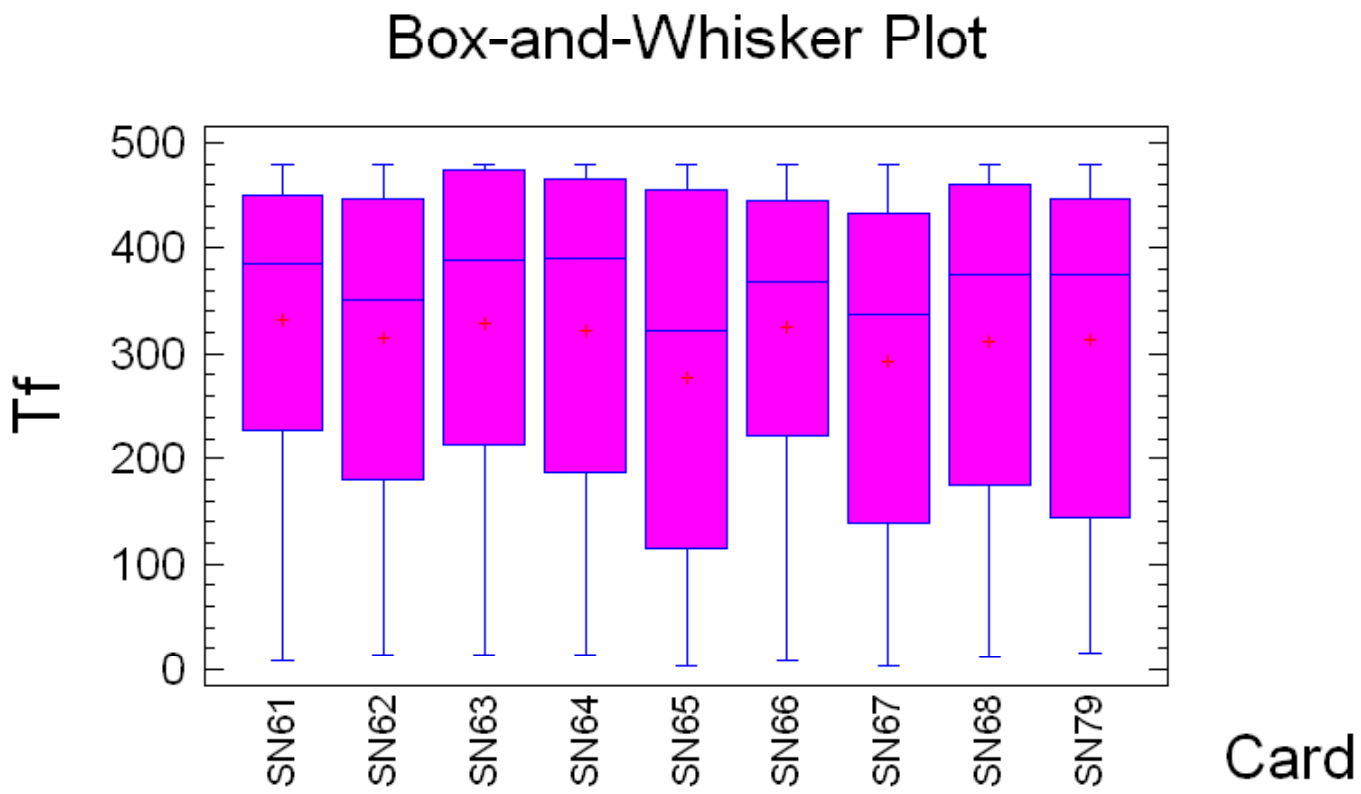
Influence of Card on Time to Failure



ANOVA Test on Card S/N

ANOVA Table for Tf by Card

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	166440.0	8	20805.0	0.86	0.5529
Within groups	1.3548E7	558	24279.6		
Total (Corr.)	1.37145E7	566			

Since the P-value is greater than 0.05, there is no statistically significant difference between the mean Tf from one level of Card SN to another at the 95.0% confidence level.

Influence of Batch Number on the Time to Failure

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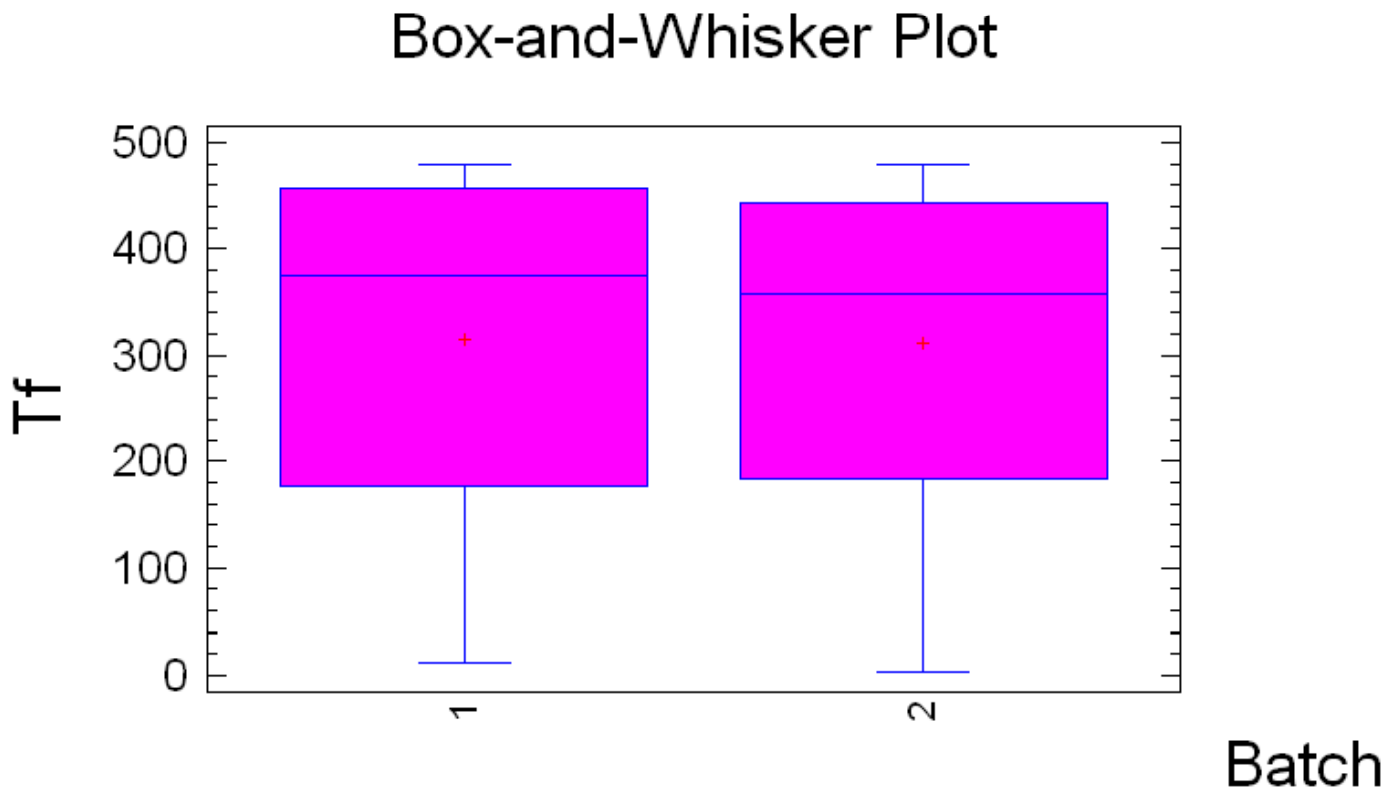

ANOVA Test on Batch Number

ANOVA Table for Tf by Batch

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	2533.64	1	2533.64	0.10	0.7467
Within groups	1.37119E7	565	24268.9		
Total (Corr.)	1.37145E7	566			

Since the P-value is greater than 0.05, there is no statistically significant difference between the mean Tf from one level of Batch to another at the 95.0% confidence level.

Influence of Package on the Time to Failure

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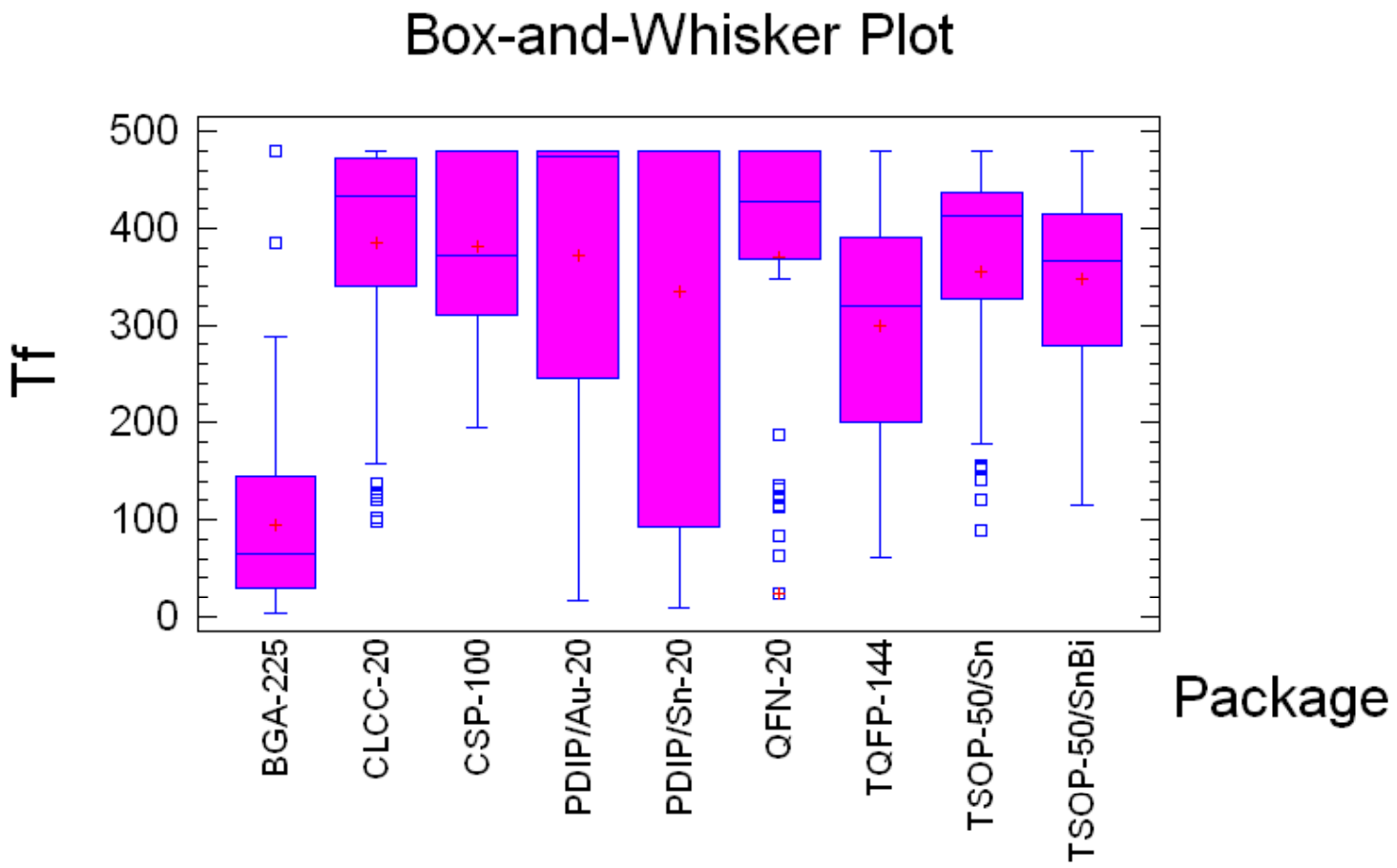

Anova Test for Package/finish

ANOVA Table for Tf by Package

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	5.55695E6	8	694619.0	47.51	0.0000
Within groups	8.15751E6	558	14619.2		
Total (Corr.)	1.37145E7	566			

Since the P-value is less than 0.05, there is a statistically significant difference between the mean Tf from one level of Package to another at the 95.0% confidence level.

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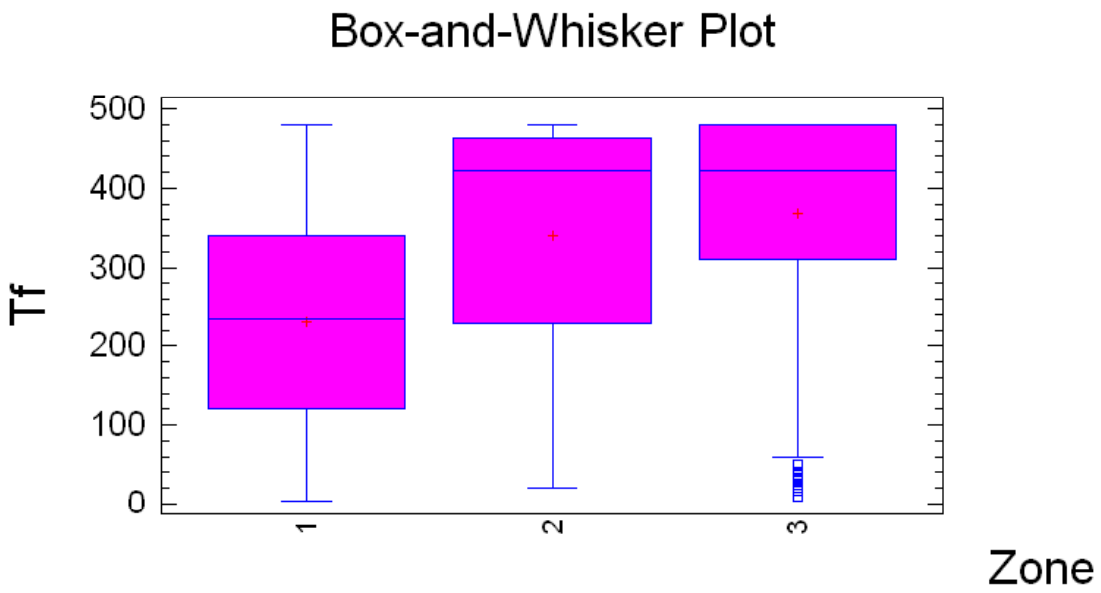
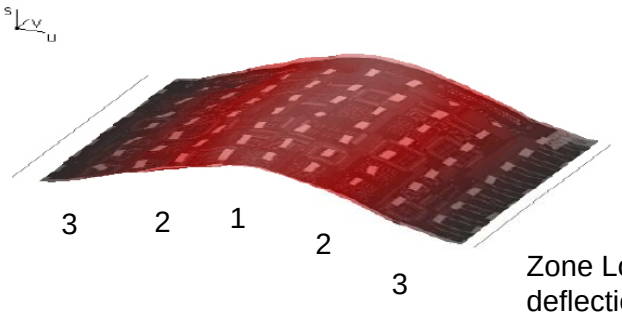
Influence of Zone on the Time to Failure





Zone Locations vs board deflection at 72 Hz

ANOVA Test for the Board Zone

ANOVA Table for Tf by Zone

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	1.99328E6	2	996640.0	47.96	0.0000
Within groups	1.17212E7	564	20782.2		
Total (Corr.)	1.37145E7	566			

Since the P-value is less than 0.05, there is a statistically significant difference between the mean Tf from one level of Zone to another at the 95.0% confidence level.

Influence of Number of Reworks on Time to Failure

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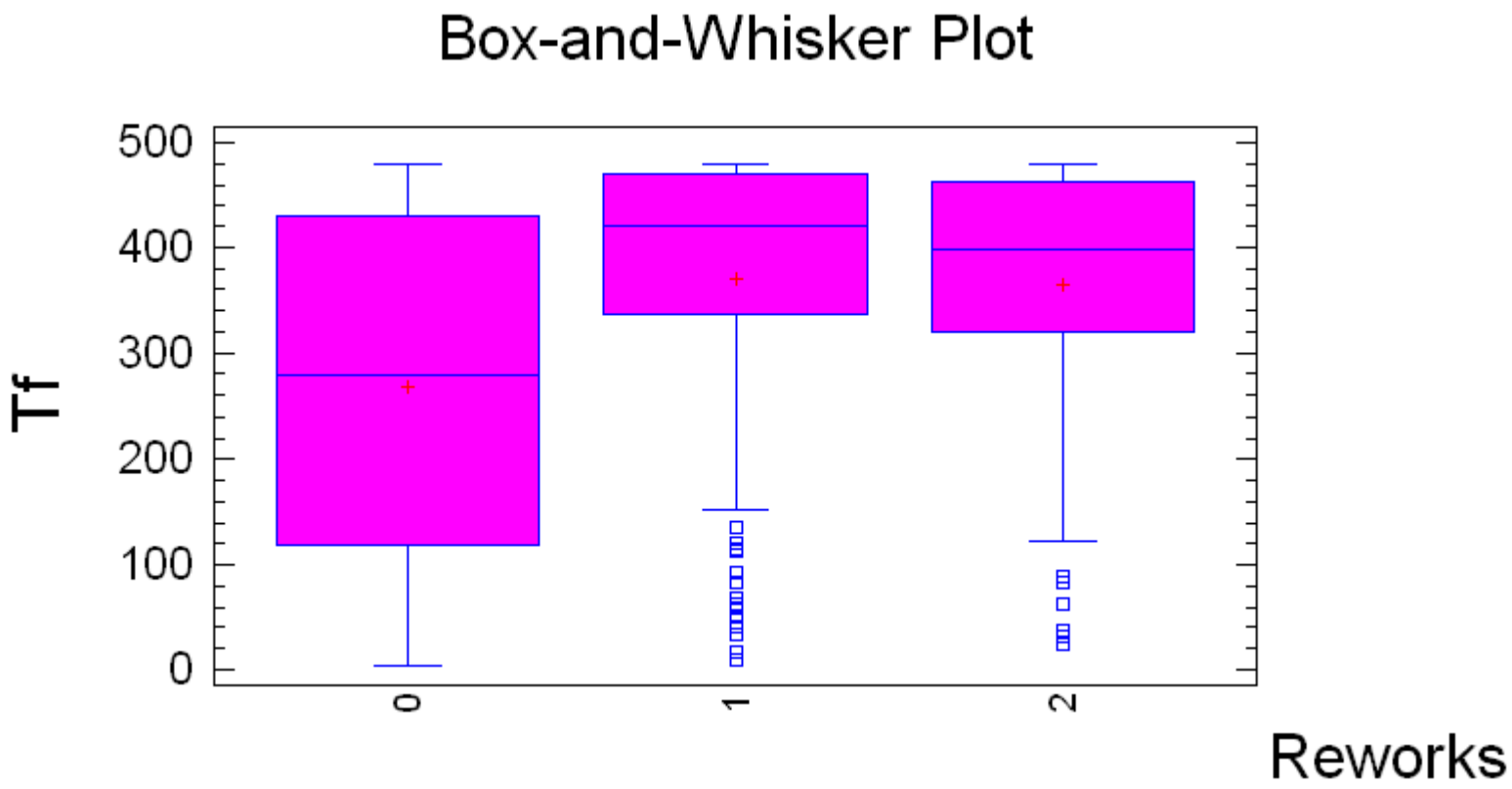

ANOVA Test for Number of Reworks

ANOVA Table for Tf by Reworks

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	1.43004E6	2	715021.0	32.83	0.0000
Within groups	1.22844E7	564	21780.9		
Total (Corr.)	1.37145E7	566			

Since the P-value is less than 0.05, there is a statistically significant difference between the mean Tf from one level of Rework to another at the 95.0% confidence level.

Influence of Rework on CLCC-20

ANOVA Table for Tf by Reworks

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	374925.0	2	187463.0	18.62	0.0000
Within groups	876051.0	87	10069.6		
Total (Corr.)	1.25098E6	89			

Since the P-value is less than 0.05, there is a statistically significant difference between the mean Tf from one level of Rework to another at the 95.0% confidence level.

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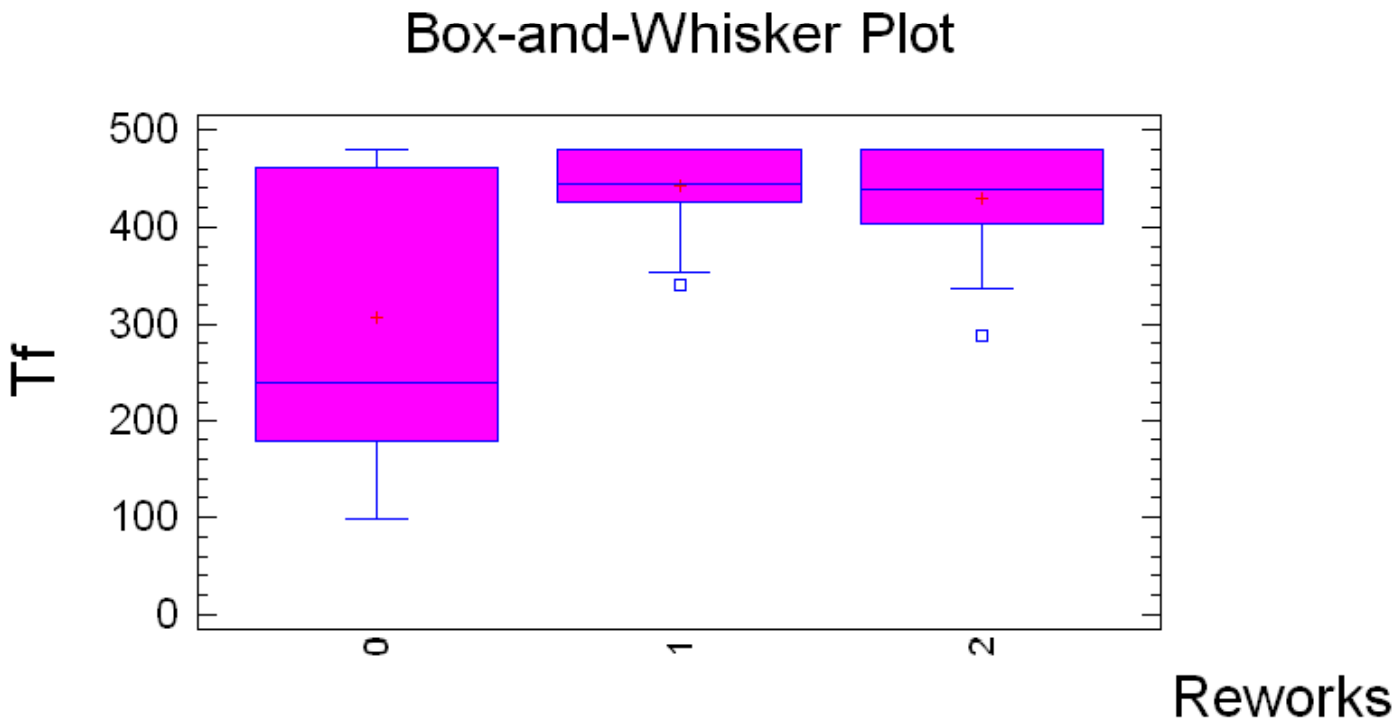
Influence of Rework on CLCC-20



Influence of Rework on PDIP/Au-20

ANOVA Table for Tf by Reworks

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	92935.0	2	46467.5	1.86	0.1833
Within groups	475306.0	19	25016.1		
Total (Corr.)	568241.0	21			

Since the P-value is greater than 0.05, there is no statistically significant difference between the mean Tf from one level of Rework to another at the 95.0% confidence level.

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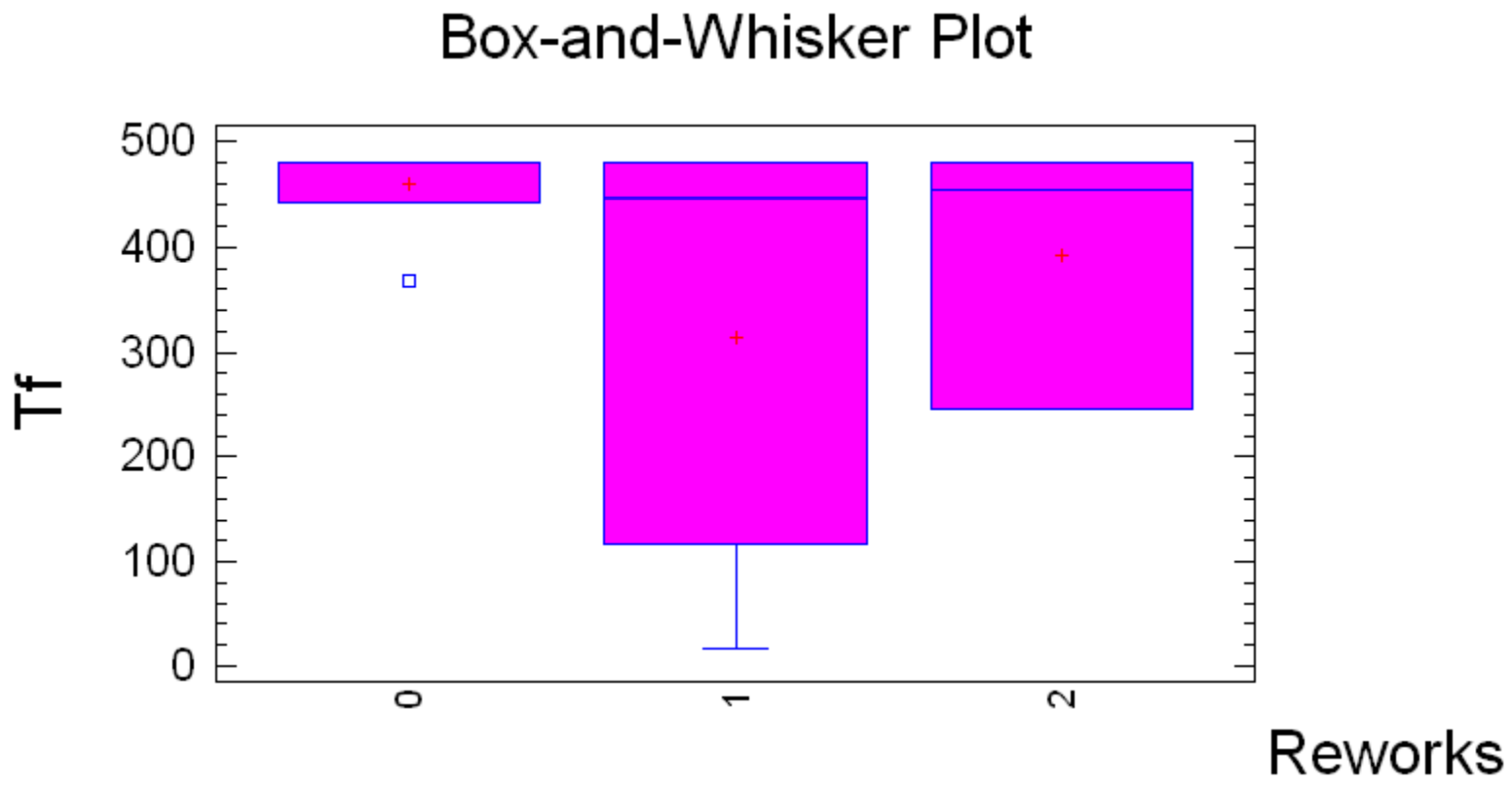
Influence of Rework on PDIP/Au-20



Influence of Rework on PDIP/Sn-20

ANOVA Table for Tf by Reworks

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	66146.8	2	33073.4	0.90	0.4145
Within groups	1.73224E6	47	36856.2		
Total (Corr.)	1.79839E6	49			

Since the P-value is greater than 0.05, there is no statistically significant difference between the mean Tf from one level of Rework to another at the 95.0% confidence level.

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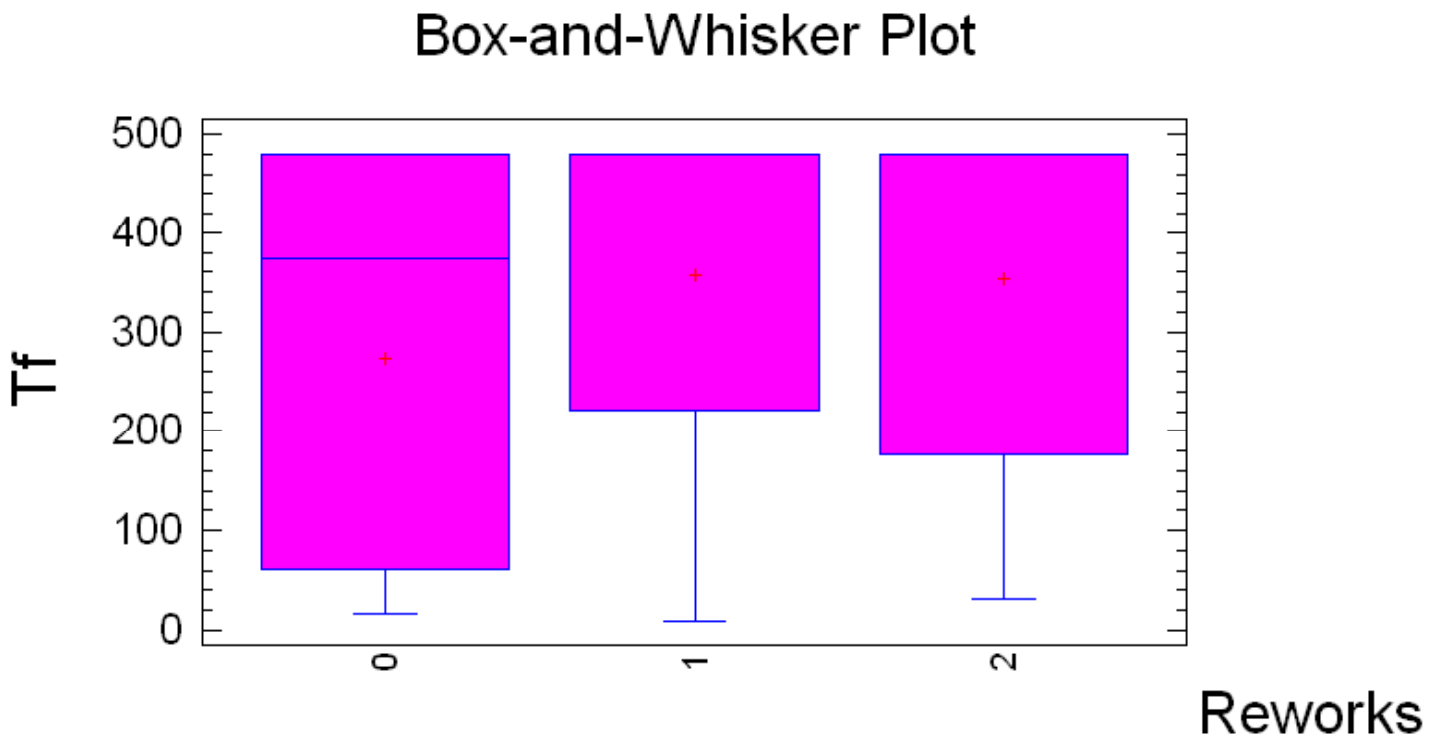
Influence of Rework on PDIP/Sn-20



Influence of Rework on QFN-20

ANOVA Table for Tf by Reworks

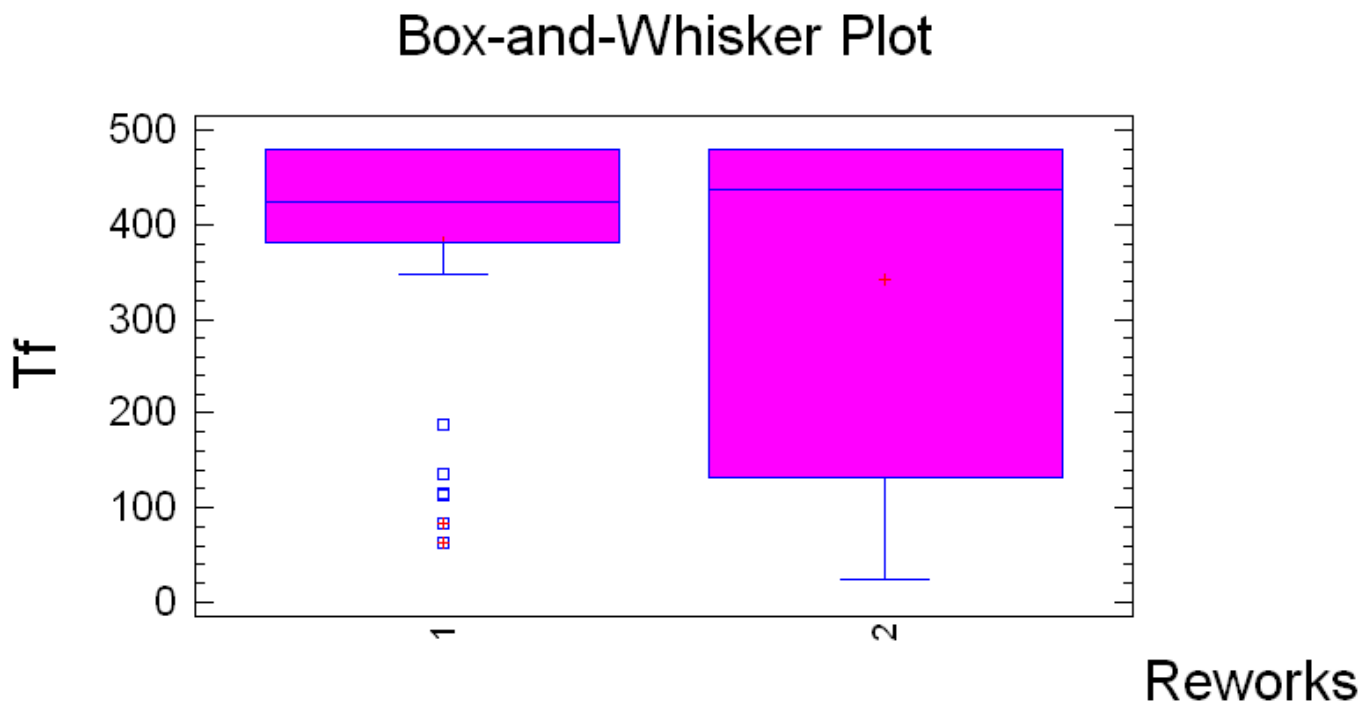
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	14568.9	1	14568.9	0.66	0.4225
Within groups	955354.0	43	22217.5		
Total (Corr.)	969923.0	44			

Since the P-value is greater than 0.05, there is no statistically significant difference between the mean Tf from one level of Rework to another at the 95.0% confidence level.

Raytheon

Influence of Rework on QFN-20



Influence of Rework on TQFP-144

ANOVA Table for Tf by Reworks

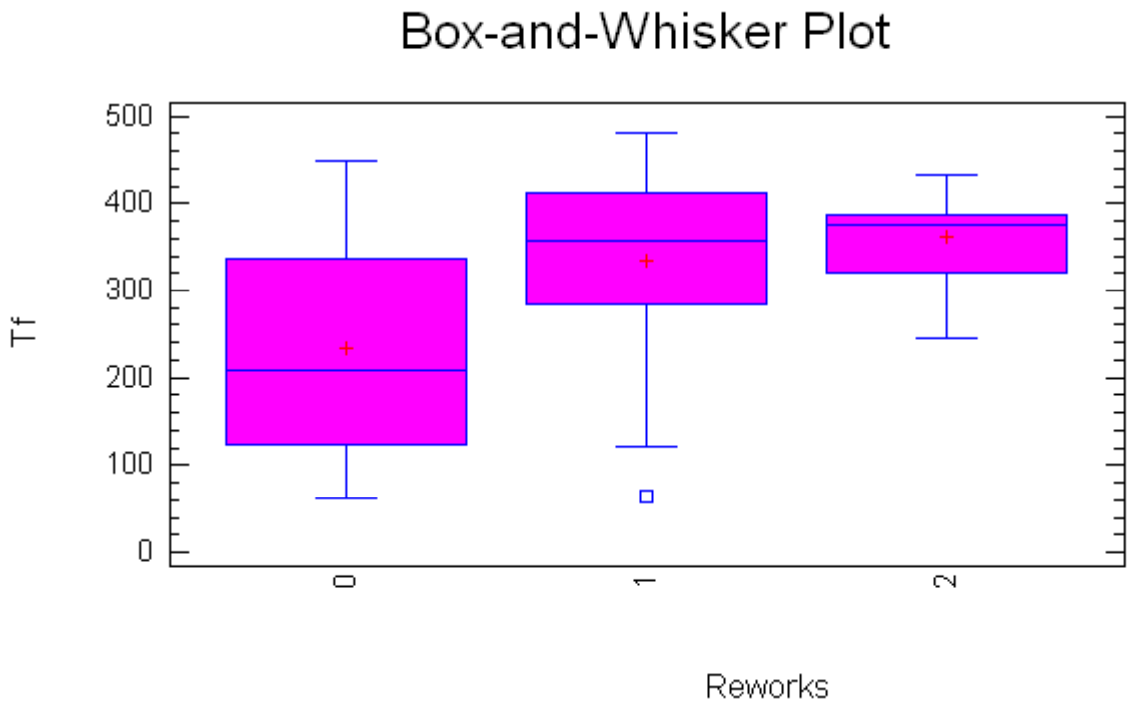
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	262309.0	2	131155.0	11.53	0.0000
Within groups	989780.0	87	11376.8		
Total (Corr.)	1.25209E6	89			

Since the P-value is less than 0.05, there is a statistically significant difference between the mean Tf from one level of Rework to another at the 95.0% confidence level.

Raytheon

Influence of Rework on TQFP-144



Raytheon

Vibration Analysis

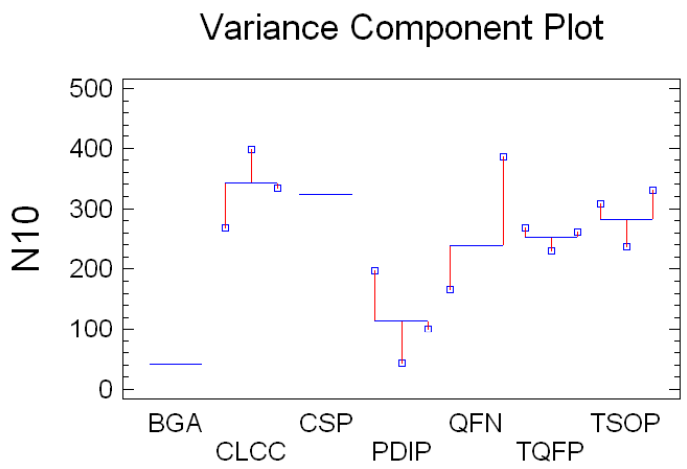
ANALYSIS OF CYCLE TO 10% FAILURE (N10) DATA

COMPONENTS OF VARIANCE
ANALYSIS OF VARIANCE

Summary Stats

Code	Count	Zone	Reworks	Time to Failure			N10	Weibull Model		
				Average	Median	Std Dev		Beta	Eta	Rho
BGA-R0Z1	36	1	0	66.2	17.25	106.84	5	1.0	48.4	0.93
BGA-R0Z2	45	2	0	102.2	82	71.56	31	1.7	116.1	0.95
BGA-R0Z3	9	3	0	172.9	185	60.92	89	2.9	194.7	0.99
CLCC-R0Z1	22	1	0	208.2	186.017	103.31	110	3.3	220.0	0.92
CLCC-R0Z2	14	2	0	459.9	462.834	21.33	426	21.6	473.3	0.99
CLCC-R1Z1	5	1	1	445.5	447.6	18.51	415	25.7	453.9	0.97
CLCC-R1Z2	20	2	1	435.5	438.5	42.48	372	11.0	457.7	0.95
CLCC-R1Z3	11	3	1	451.8	466.533	30.83	409	21.3	455.0	0.85
CLCC-R2Z3	8	3	2	427.9	451	62.62	332	7.9	443.7	0.89
CLCCR2Z2	10	2	2	429.2	438.45	56.97	334	6.7	467.0	0.92
CSP-R0Z1	45	1	0	344.1	335.4	46.45	286	9.7	361.5	0.95
CSP-R0Z2	9	2	0	469.0	480	23.35	424	12.3	509.8	1.00
CSP-R0Z3	36	3	0	405.5	480	99.39	261	4.3	435.8	0.95
PDIP/Au-R0Z3	7	3	0	458.7	480	42.45	373	5.2	574.5	1.00
PDIP/Au-R1Z3	12	3	1	315.0	446.116	198.11	38	0.7	879.7	0.99
PDIP/Au-R2Z3	3	3	2	393.0	453	128.02	160	0.8	555.3	1.00
PDIP/Sn-R0Z3	13	3	0	272.3	374.533	213.03	21	0.8	321.8	0.92
PDIP/Sn-R1Z3	25	3	1	356.0	480	179.29	47	0.7	1052.1	0.99
PDIP/Sn-R2Z3	12	3	2	353.7	480	194.52	42	0.8	801.0	0.89
QFN-R1Z1	18	1	1	253.6	267.65	158.41	56	1.3	294.8	0.97
QFN-R1Z2	18	2	1	444.6	480	85.67	276	2.2	752.2	0.83
QFN-R2Z2	9	2	2	453.6	480	38.39	386	9.4	491.5	0.96
TQFP-R0Z1	28	1	0	182.6	146.3	89.82	84	2.6	202.4	0.97
TQFP-R0Z2	5	2	0	439.5	439.3	5.19	432	94.2	441.8	0.94
TQFP-R0Z3	3	3	0	379.7	358.0	61.44	288	6.6	403.7	0.93
TQFP-R1Z1	9	1	1	283.7	285.7	40.67	223	7.4	301.2	0.97
TQFP-R1Z2	17	2	1	315.8	361.0	124.90	126	2.1	368.4	0.95
TQFP-R1Z3	10	3	1	408.4	406.3	45.34	343	10.5	425.9	0.98
TQFP-R2Z2	14	2	2	372.2	376.7	45.65	306	9.1	387.7	0.97
TQFP-R2Z3	4	3	2	324.5	333.0	73.18	215	4.6	353.1	0.95
TSOP-Bi-R0Z3	4	3	0	362.0	357.0	54.79	276	6.8	385.0	0.98
TSOP/Bi-R0Z1	9	1	0	231.3	236.0	35.13	177	7.0	246.3	0.99
TSOP/Bi-R1Z2	13	2	1	406.7	422.0	96.70	231	3.1	481.0	0.83
TSOP/Bi-R1Z3	10	3	1	372.8	369.8	41.89	309	9.8	390.9	0.98
TSOP/Bi-R2Z2	5	2	2	317.2	326.8	45.64	252	7.6	335.7	0.95
TSOP/Bi-R2Z3	4	3	2	384.8	372.0	33.60	338	14.1	396.9	0.85
TSOP/Sn-R0Z1	5	1	0	445.2	437.6	16.46	420	30.6	452.4	0.92
TSOP/Sn-R0Z2	4	2	0	457.3	461.5	20.50	423	22.8	466.6	0.98
TSOP/Sn-R0Z3	9	3	0	364.3	390.8	74.90	245	4.8	395.2	0.87
TSOP/Sn-R1Z1	9	1	1	237.9	181.0	118.43	112	2.7	261.4	0.89
TSOP/Sn-R1Z2	5	2	1	438.6	436.5	28.77	391	15.8	451.7	1.00
TSOP/Sn-R1Z3	4	3	1	394.3	385.0	70.92	295	6.9	410.1	0.91
TSOP/Sn-R2Z1	4	2	1	144.5	148.5	42.63	79	3.2	161.9	0.98
TSOP/Sn-R2Z3	5	3	2	427.8	429.3	17.35	399	26.7	435.5	0.96
Total	567			313.199	367.033	155.661				

Components of Variance



Variance Components Analysis

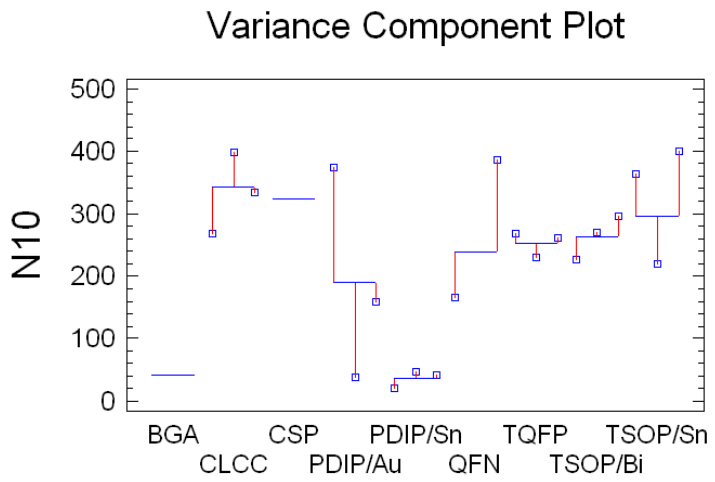
Dependent variable: N10
Factors:
Style
Reworks

Number of complete cases: 44

Analysis of Variance for N10

Source	Sum of Squares	Df	Mean Square	Var. Comp.	Percent
TOTAL (CORRECTED)	819051.0	43			
Style	332311.0	6	55385.1	7031.93	33.88
Reworks	102406.0	9	11378.5	0.0	0.00
ERROR	384334.0	28	13726.2	13726.2	66.12

Components of Variance



Variance Components Analysis

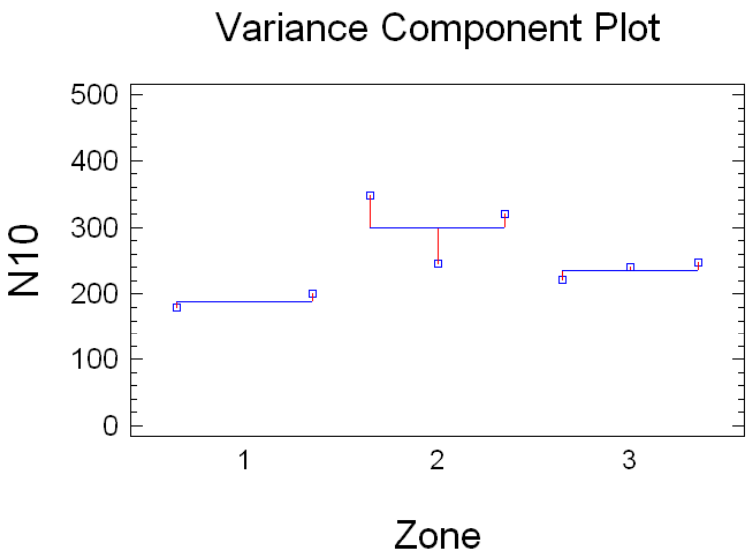
Dependent variable: N10
Factors:
Package/finish
Reworks

Number of complete cases: 44

Analysis of Variance for N10

Source	Sum of Squares	Df	Mean Square	Var. Comp.	Percent
TOTAL (CORRECTED)	819051.0	43			
Package/finish	371218.0	8	46402.2	7040.86	35.42
Reworks	165394.0	13	12722.6	0.0	0.00
ERROR	282439.0	22	12838.1	12838.1	64.58

Components of Variance



Variance Components Analysis

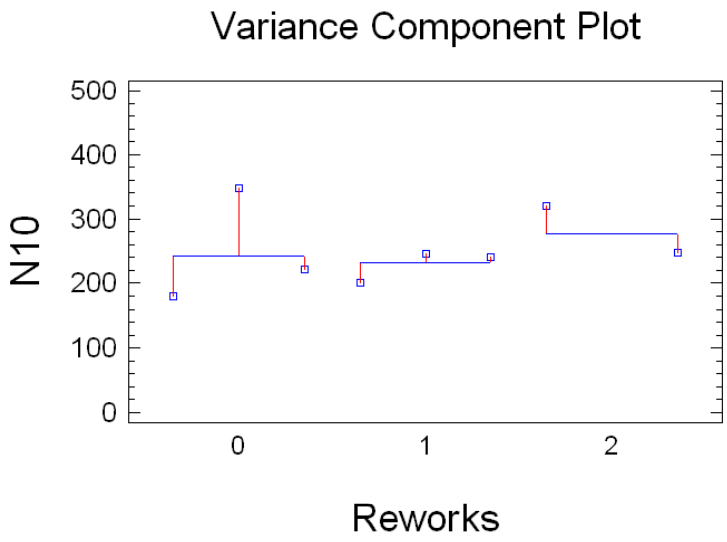
Dependent variable: N10
Factors:
Zone
Reworks

Number of complete cases: 44

Analysis of Variance for N10

Source	Sum of Squares	Df	Mean Square	Var. Comp.	Percent
TOTAL (CORRECTED)	819051.0	43			
Zone	77353.8	2	38676.9	1338.23	6.37
Reworks	33650.9	5	6730.17	0.0	0.00
ERROR	708047.0	36	19668.0	19668.0	93.63

Components of Variance



Variance Components Analysis

Dependent variable: N10
Factors:
Reworks
Zone

Number of complete cases: 44

Analysis of Variance for N10

Source	Sum of Squares	Df	Mean Square	Var. Comp.	Percent
TOTAL (CORRECTED)	819051.0	43			
Reworks	12326.8	2	6163.38	0.0	0.00
Zone	98677.9	5	19735.6	12.4359	0.06
ERROR	708047.0	36	19668.0	19668.0	99.94

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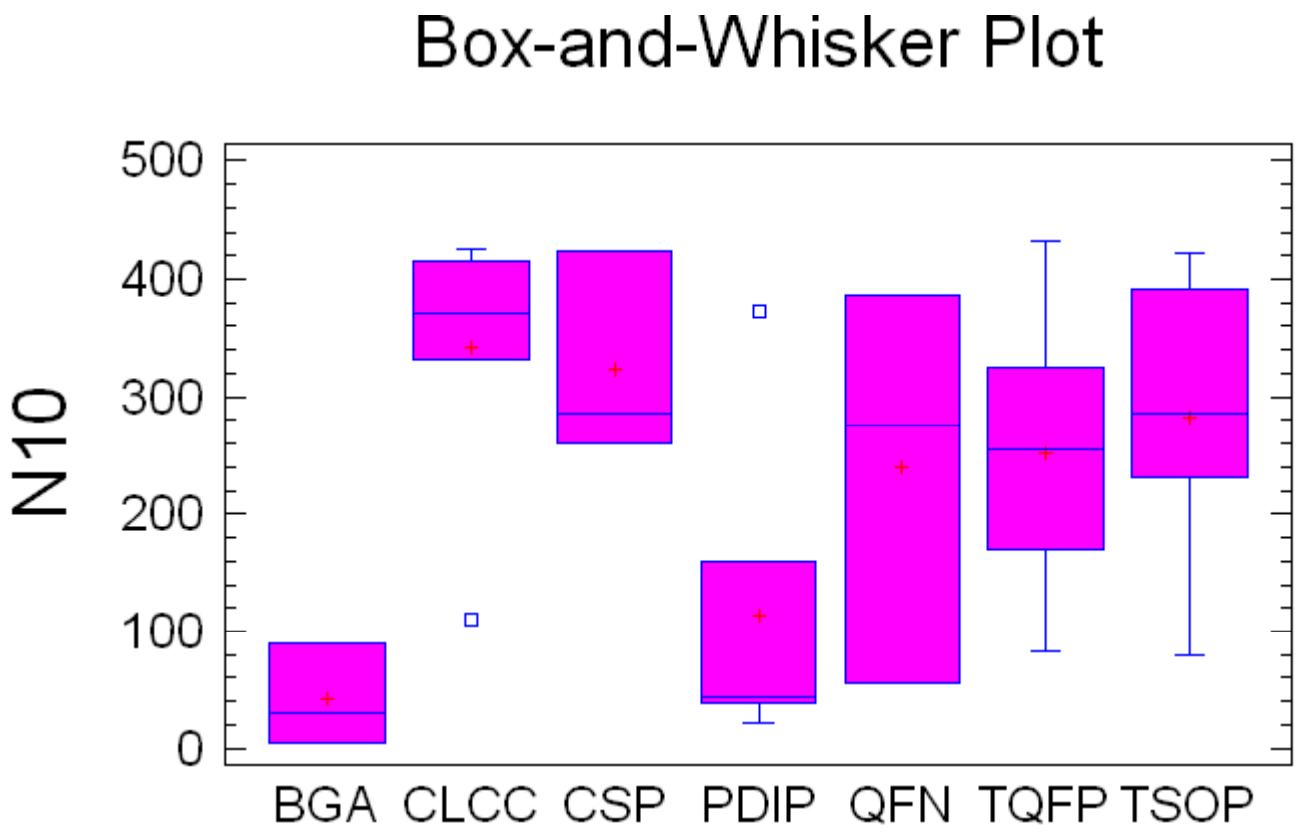
Effect of Style of Package on N10



Effect of Style of Package on N10

ANOVA Table for N10 by Style

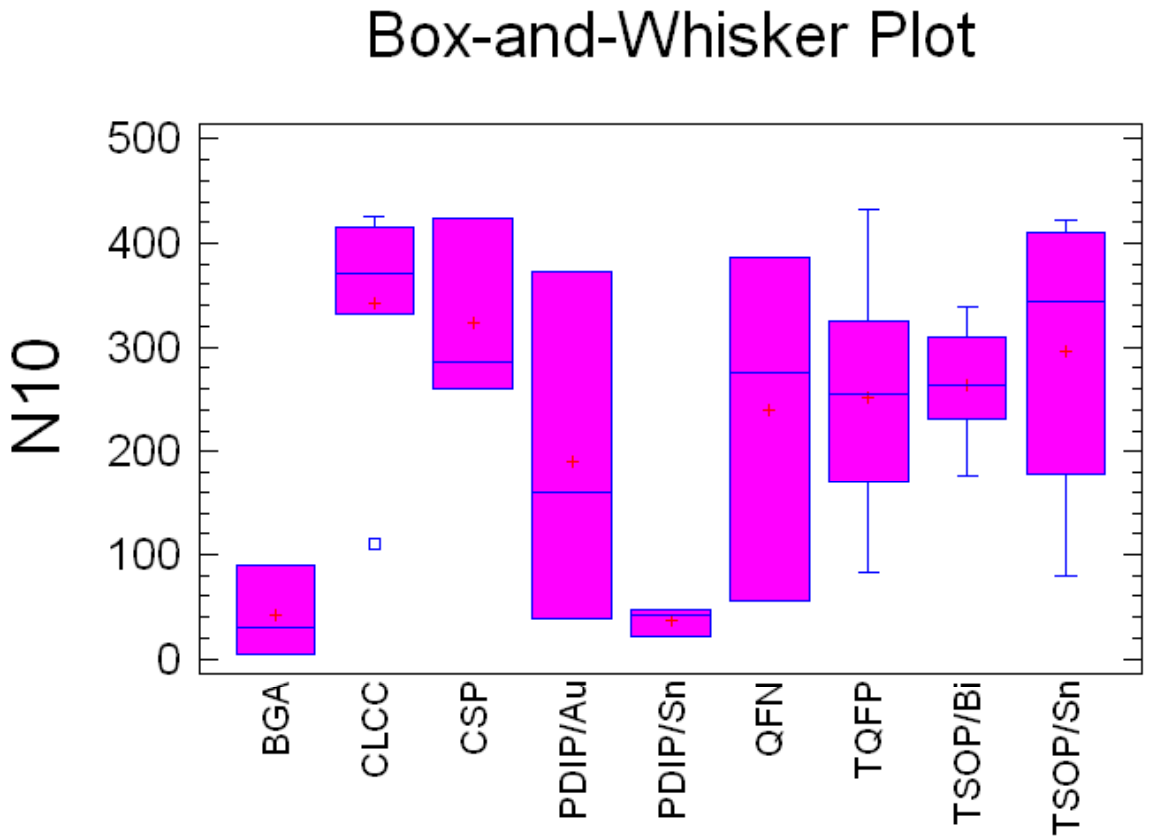
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	332311.0	6	55385.1	4.21	0.0025
Within groups	486741.0	37	13155.2		
Total (Corr.)	819051.0	43			

Since the P-value is less than 0.05, there is a statistically significant difference between the mean N10 from one package and another at the 95.0% confidence level.

Raytheon

Effect of Package/finish on N10



Effect of Package on N10

ANOVA Table for N10 by Package

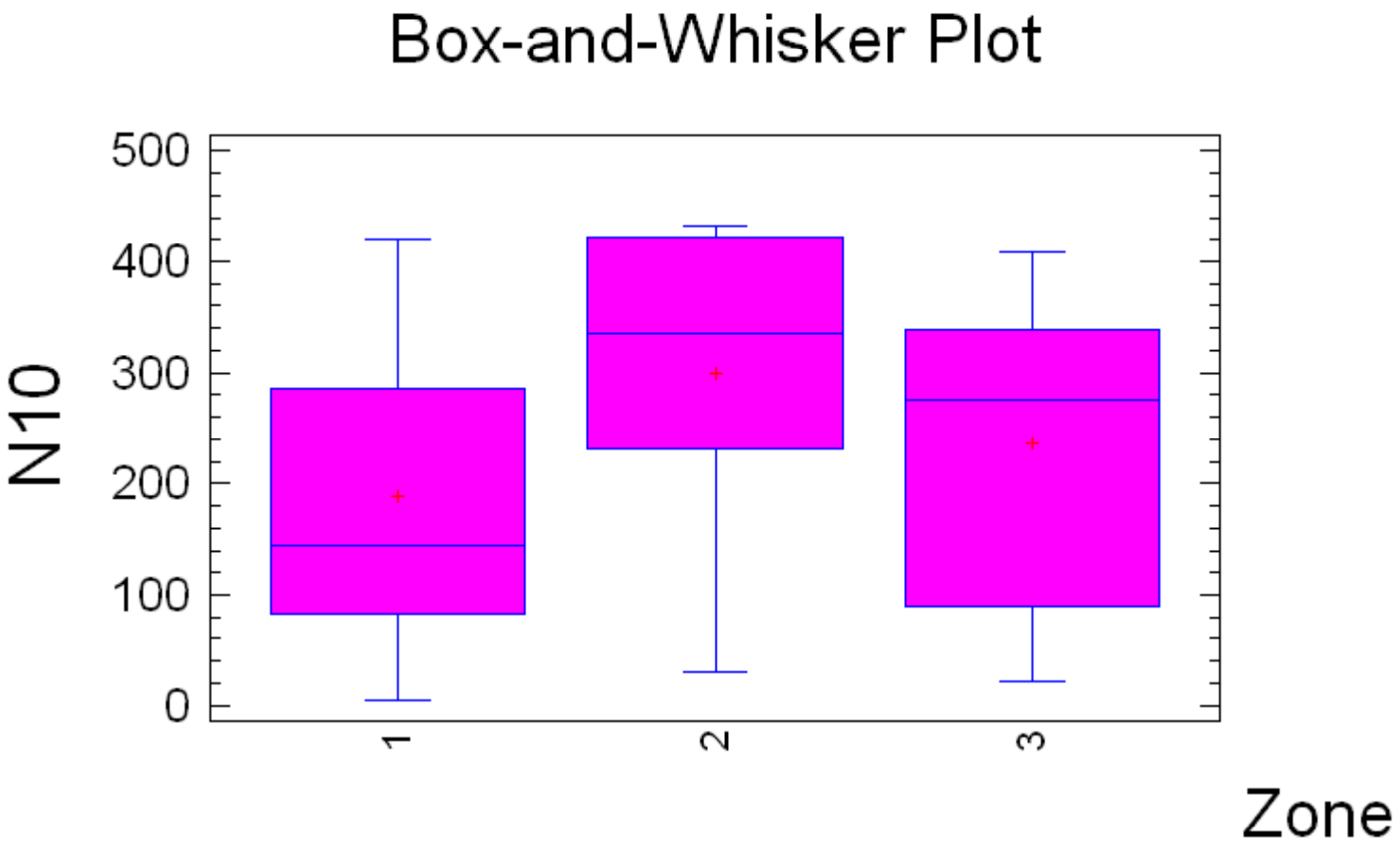
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	371218.0	8	46402.2	3.63	0.0036
Within groups	447834.0	35	12795.2		
Total (Corr.)	819051.0	43			

Since the P-value is less than 0.05, there is a statistically significant difference between the mean N10 from one package/finish and another at the 95.0% confidence level.

Raytheon

Effect of Zone on N10



Anova Test of Zone on N10

ANOVA Table for N10 by Zone

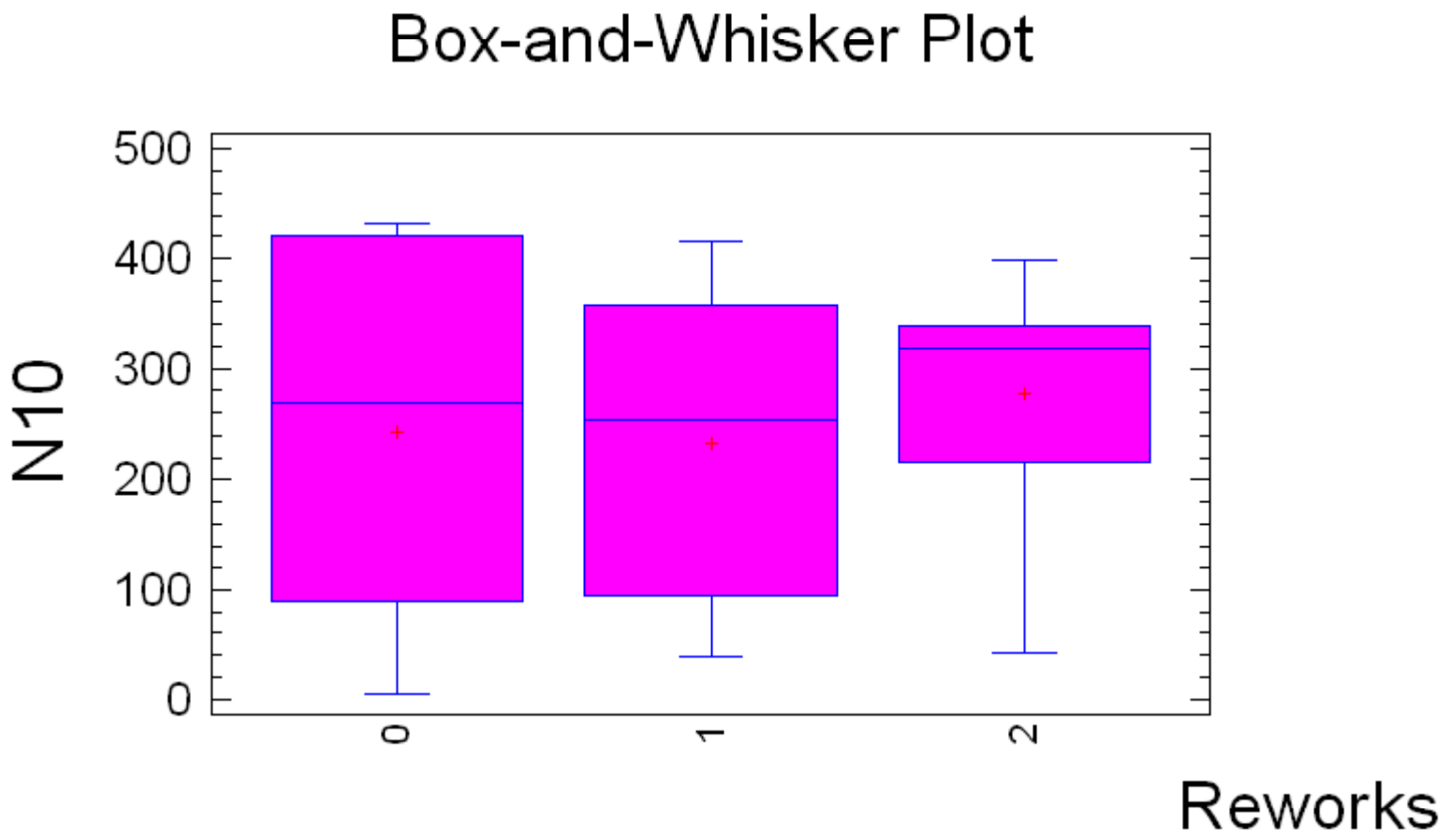
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	77353.8	2	38676.9	2.14	0.1308
Within groups	741698.0	41	18090.2		
Total (Corr.)	819051.0	43			

Since the P-value is greater than 0.05, there is no statistically significant difference between the mean N10 from one zone and another at the 95.0% confidence level.

Raytheon

Effect of Rework on N10



ANOVA Test of Rework on N10

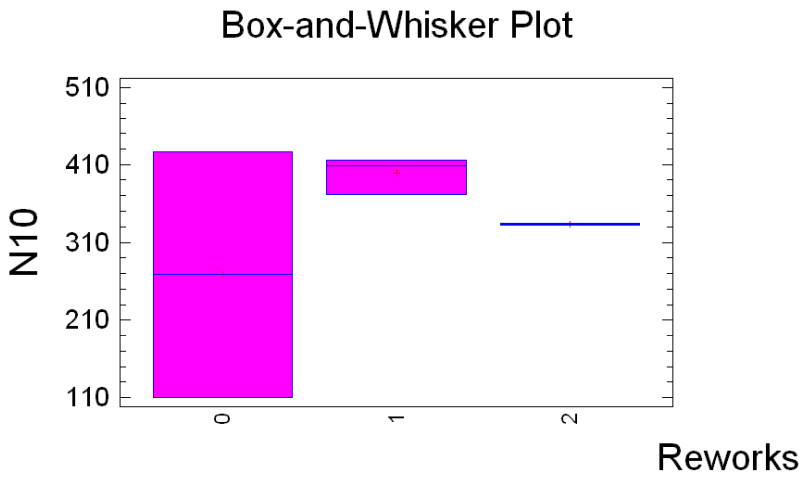
ANOVA Table for N10 by Reworks

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	12326.8	2	6163.38	0.31	0.7328
Within groups	806725.0	41	19676.2		
Total (Corr.)	819051.0	43			

Since the P-value is greater than 0.05, there is no statistically significant difference between the mean N10 from one level of rework and another at the 95.0% confidence level.

Effect of Rework on CLCC-20



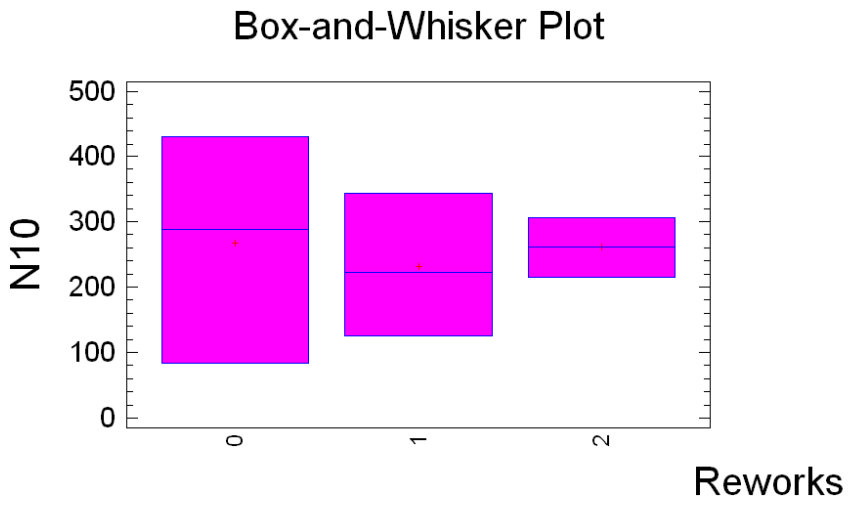
Since the P-value is greater than 0.05, there is no statistically significant difference between the mean N10 from one level of rework and another at the 95.0% confidence level.

ANOVA Table for N10 by Reworks

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	20569.8	2	10284.9	0.81	0.5081
Within groups	51049.1	4	12762.3		
Total (Corr.)	71618.8	6			

Effect of Rework on TQFP-144



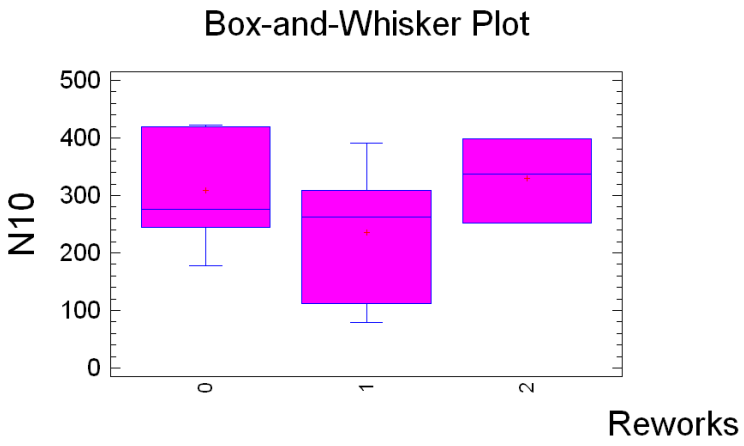
Since the P-value is greater than 0.05, there is no statistically significant difference between the mean N10 from one level of rework and another at the 95.0% confidence level.

ANOVA Table for N10 by Reworks

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	2262.7	2	1131.35	0.06	0.9392
Within groups	89084.4	5	17816.9		
Total (Corr.)	91347.1	7			

Effect of Rework on TSOP-50



Since the P-value is greater than 0.05, there is no statistically significant difference between the mean N10 from one level of rework and another at the 95.0% confidence level.

ANOVA Table for N10 by Reworks

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Between groups	22857.9	2	11428.9	0.95	0.4147
Within groups	131713.0	11	11973.9		
Total (Corr.)	154570.0	13			

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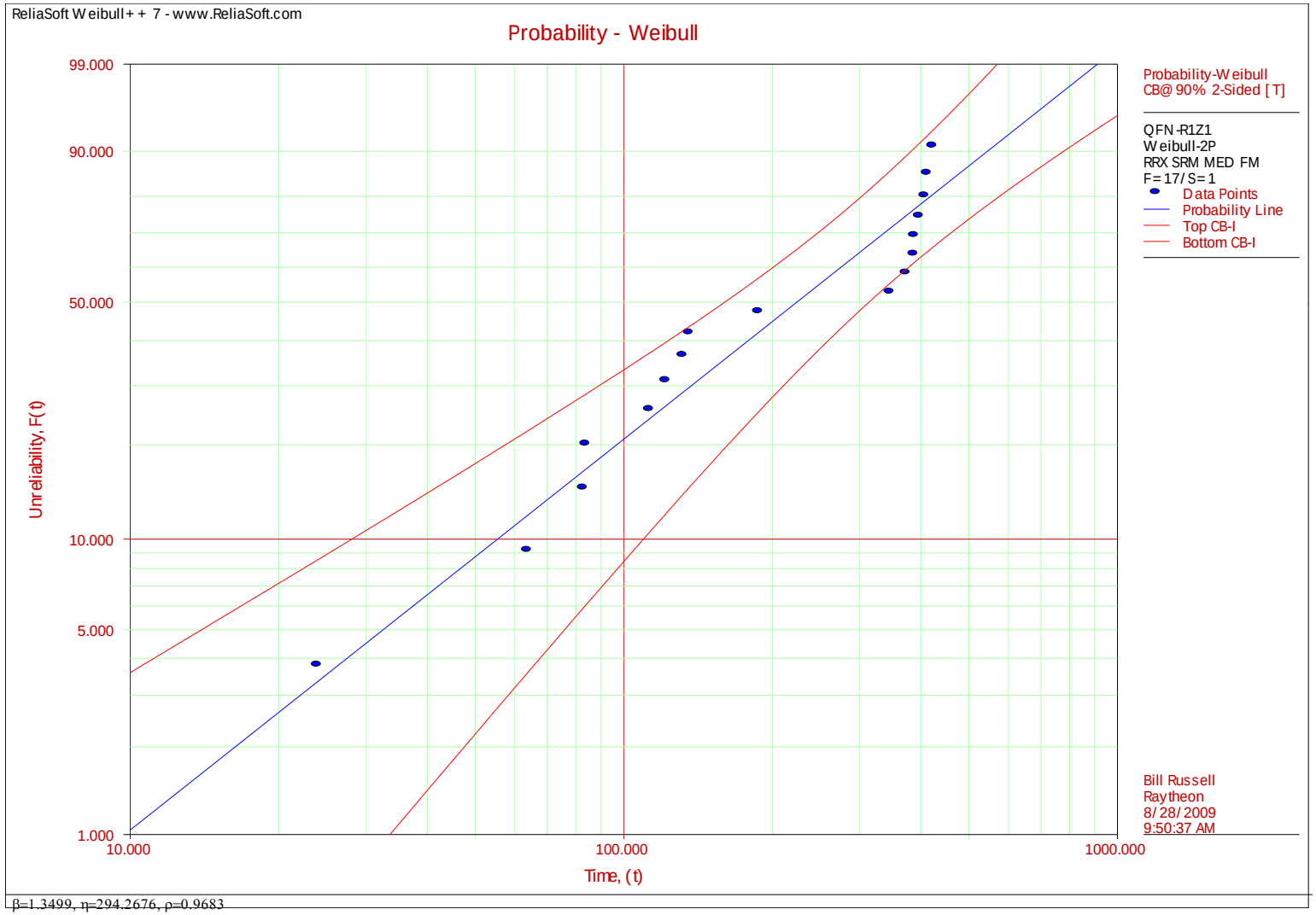
Vibration Analysis

QFN WEIBULL PLOTS

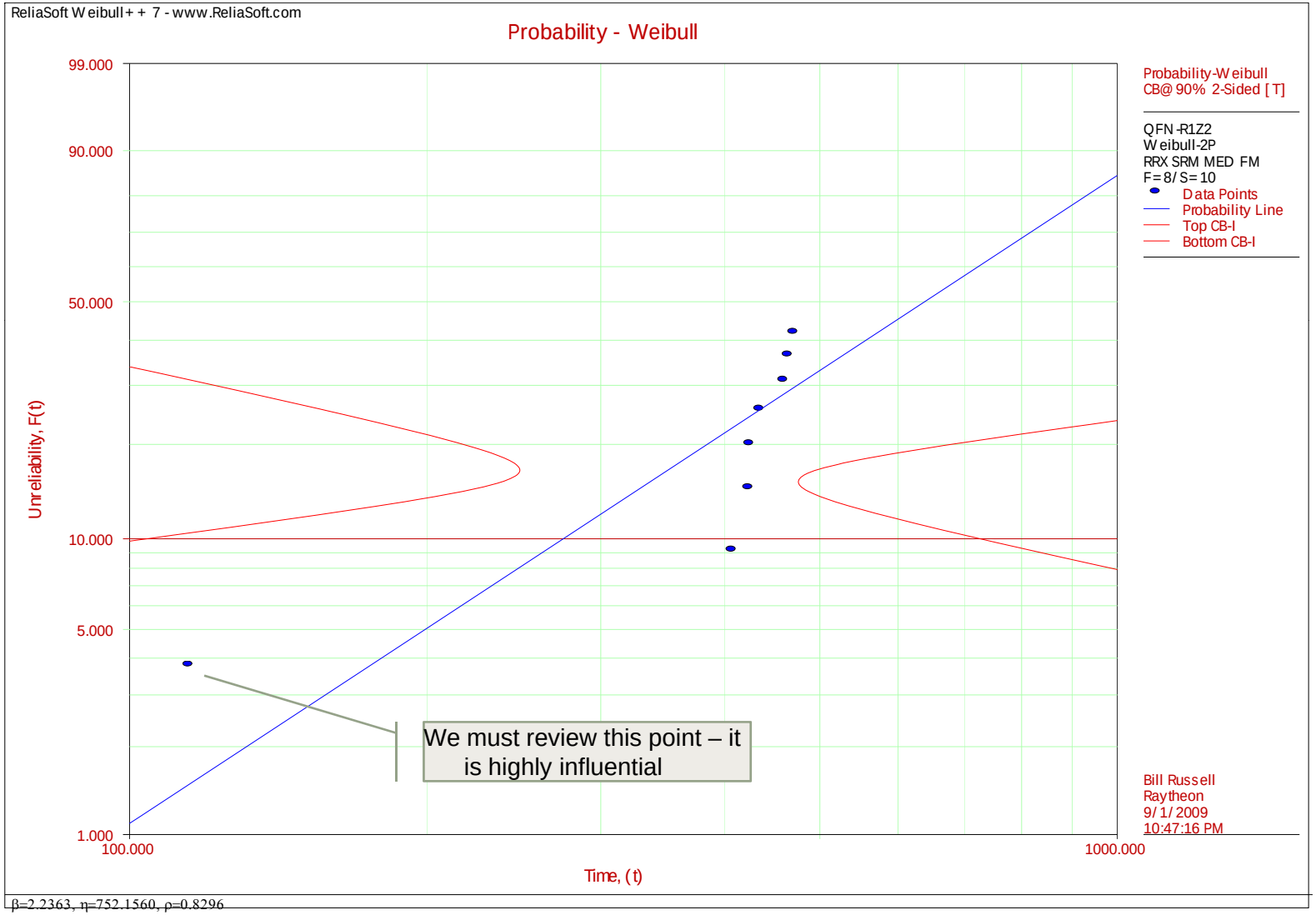
QFN-20 – Zone 1, 1 Rework



QFN-20 – Zone 1, 1 Rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	8	U15	1	QFN-20	QFN-20	Sn	SAC305	2	24	F		QFN-R1Z1
1	SN79	10	U15	1	QFN-20	QFN-20	Sn	SAC305	1	64	F		QFN-R1Z1
2	SN67	10	U15	1	QFN-20	QFN-20	Sn	SAC305	2	83	F		QFN-R1Z1
1	SN62	10	U15	1	QFN-20	QFN-20	Sn	SAC305	1	84	F		QFN-R1Z1
1	SN68	10	U15	1	QFN-20	QFN-20	Sn	SAC305	1	113	F		QFN-R1Z1
2	SN63	12	U15	1	QFN-20	QFN-20	Sn	SAC305	2	122	F		QFN-R1Z1
2	SN61	12	U15	1	QFN-20	QFN-20	Sn	SAC305	2	132	F		QFN-R1Z1
1	SN64	12	U15	1	QFN-20	QFN-20	Sn	SAC305	1	136	F		QFN-R1Z1
2	SN66	14	U15	1	QFN-20	QFN-20	Sn	SAC305	1	188	F		QFN-R1Z1
1	SN68	18	U47	1	QFN-20	QFN-20	Sn	SAC305	1	347	F		QFN-R1Z1
2	SN63	20	U47	1	QFN-20	QFN-20	Sn	SAC305	1	374	F	X1	QFN-R1Z1
1	SN64	20	U47	1	QFN-20	QFN-20	Sn	SAC305	1	388	F		QFN-R1Z1
2	SN66	20	U47	1	QFN-20	QFN-20	Sn	SAC305	1	389	F	X1	QFN-R1Z1
2	SN67	20	U47	1	QFN-20	QFN-20	Sn	SAC305	1	398	F		QFN-R1Z1
1	SN79	20	U47	1	QFN-20	QFN-20	Sn	SAC305	1	408	F		QFN-R1Z1
1	SN62	20	U47	1	QFN-20	QFN-20	Sn	SAC305	1	413	F		QFN-R1Z1
2	SN61	28	U47	1	QFN-20	QFN-20	Sn	SAC305	1	424	F	X1	QFN-R1Z1
2	SN65	28	U47	1	QFN-20	QFN-20	Sn	SAC305	1	480	S	X1	QFN-R1Z1

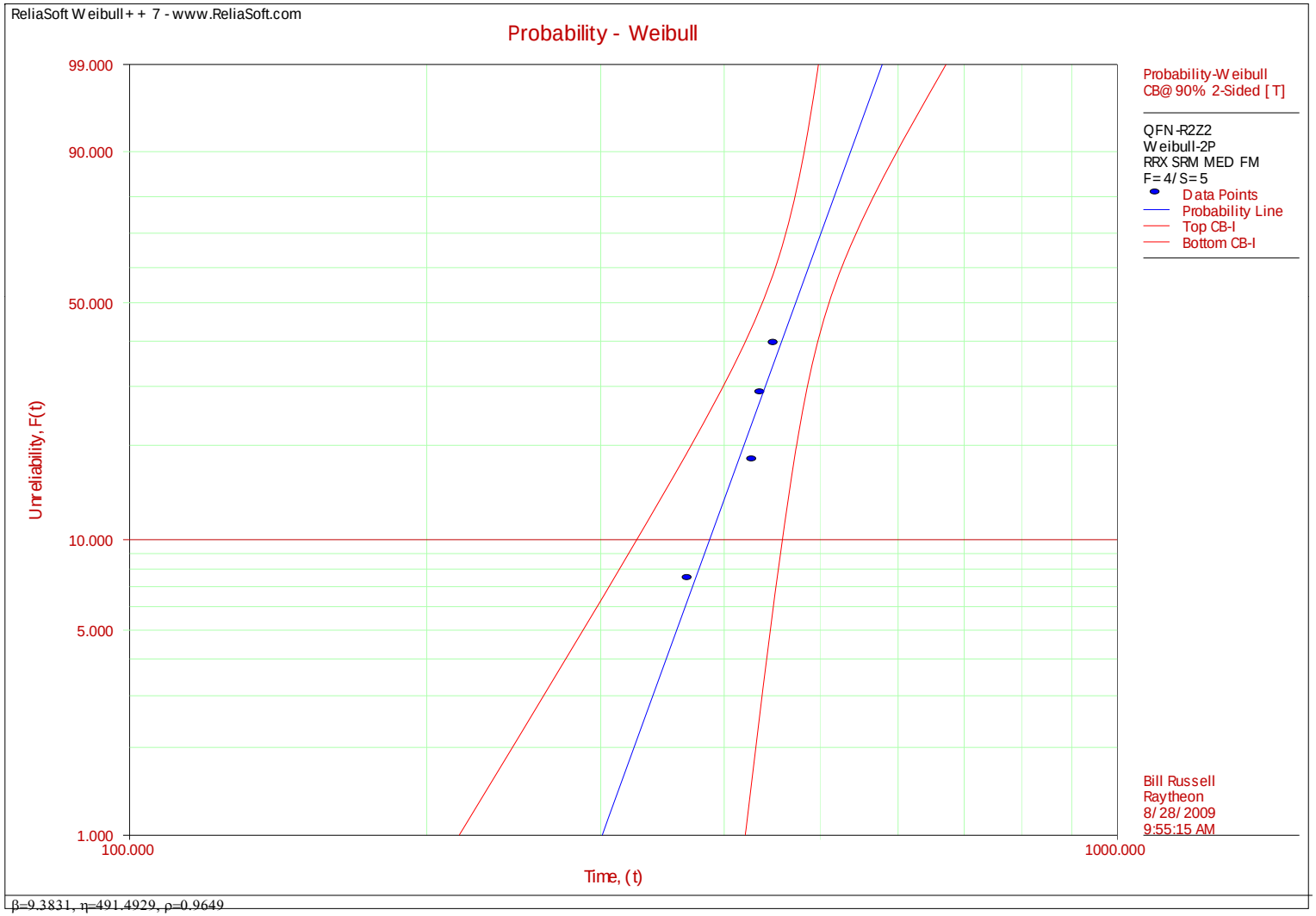
QFN-20 – Zone 2, 1 Rework



QFN-20 – Zone 2, 1 Rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	10	U54	2	QFN-20	QFN-20	Sn	SAC305	1	115	F		QFN-R1Z2
1	SN68	20	U28	2	QFN-20	QFN-20	Sn	SAC305	1	408	F		QFN-R1Z2
2	SN63	28	U54	2	QFN-20	QFN-20	Sn	SAC305	1	424	F		QFN-R1Z2
1	SN62	28	U28	2	QFN-20	QFN-20	Sn	SAC305	1	425	F		QFN-R1Z2
1	SN79	28	U28	2	QFN-20	QFN-20	Sn	SAC305	1	435	F		QFN-R1Z2
2	SN61	28	U54	2	QFN-20	QFN-20	Sn	SAC305	1	460	F		QFN-R1Z2
2	SN67	28	U54	2	QFN-20	QFN-20	Sn	SAC305	1	465	F		QFN-R1Z2
2	SN65	28	U27	2	QFN-20	QFN-20	Sn	SAC305	1	471	F		QFN-R1Z2
1	SN64	28	U28	2	QFN-20	QFN-20	Sn	SAC305	1	480	S		QFN-R1Z2
1	SN62	28	U54	2	QFN-20	QFN-20	Sn	SAC305	1	480	S		QFN-R1Z2
1	SN64	28	U54	2	QFN-20	QFN-20	Sn	SAC305	1	480	S		QFN-R1Z2
1	SN68	28	U54	2	QFN-20	QFN-20	Sn	SAC305	1	480	S		QFN-R1Z2
1	SN79	28	U54	2	QFN-20	QFN-20	Sn	SAC305	1	480	S		QFN-R1Z2
2	SN61	28	U27	2	QFN-20	QFN-20	Sn	SAC305	1	480	S		QFN-R1Z2
2	SN63	28	U27	2	QFN-20	QFN-20	Sn	SAC305	1	480	S		QFN-R1Z2
2	SN67	28	U27	2	QFN-20	QFN-20	Sn	SAC305	1	480	S		QFN-R1Z2
2	SN66	28	U28	2	QFN-20	QFN-20	Sn	SAC305	1	480	S		QFN-R1Z2
2	SN66	28	U54	2	QFN-20	QFN-20	Sn	SAC305	1	480	S	X1	QFN-R1Z2

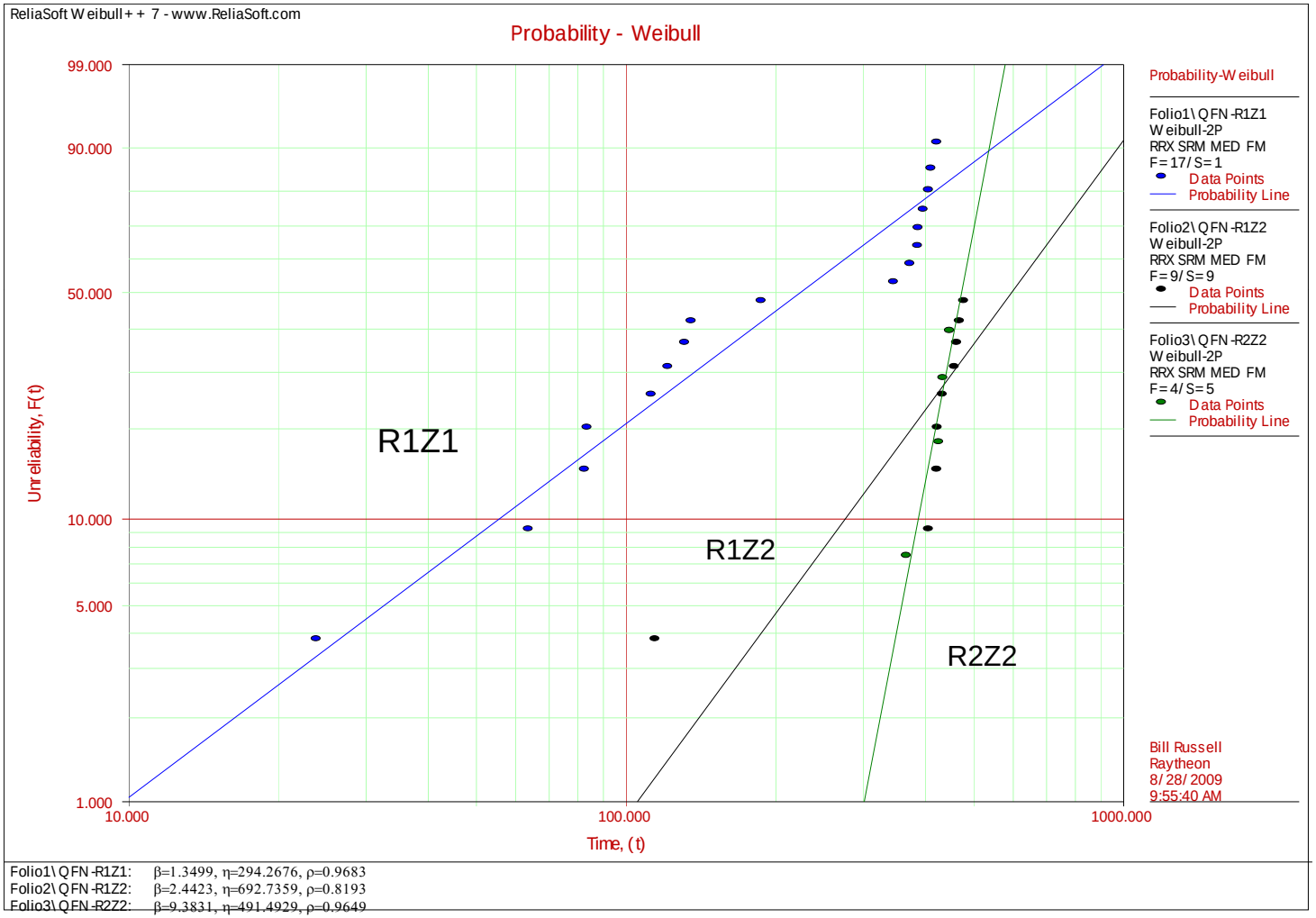
QFN-20 –Zone 2, 2 Rework



QFN-20 –Zone 2, 2 Rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	20	U28	2	QFN-20	QFN-20	Sn	SAC305	2	368	F		QFN-R2Z2
2	SN63	28	U28	2	QFN-20	QFN-20	Sn	SAC305	2	428	F		QFN-R2Z2
2	SN67	28	U28	2	QFN-20	QFN-20	Sn	SAC305	2	436	F		QFN-R2Z2
2	SN61	28	U28	2	QFN-20	QFN-20	Sn	SAC305	2	450	F		QFN-R2Z2
1	SN62	28	U27	2	QFN-20	QFN-20	Sn	SAC305	2	480	S		QFN-R2Z2
1	SN64	28	U27	2	QFN-20	QFN-20	Sn	SAC305	2	480	S		QFN-R2Z2
1	SN68	28	U27	2	QFN-20	QFN-20	Sn	SAC305	2	480	S		QFN-R2Z2
1	SN79	28	U27	2	QFN-20	QFN-20	Sn	SAC305	2	480	S		QFN-R2Z2
2	SN66	28	U27	2	QFN-20	QFN-20	Sn	SAC305	2	480	S		QFN-R2Z2

QFN-20 Multiplot



Note that the Weibull plots for 1 and 2 reworks in Zone 2 would exactly match , if the one outlier was removed

Weibull Test of Comparison

1 QFN-R1Z1	NA		
2 QFN-R1Z2	2>1 85%	NA	
3 QFN-R2Z2	3>1 84%	2>3 68%	NA

This table compares the Weibull models, two at a time. The number shown is a probability than a unit from one group will last longer that a unit from the other group.

For example

2>1

80%

Says the group 2 will last longer than group 1 with a probability of 80%.

Color coding:

Prob > 90% — Weibull curves are significantly different.

89% < Prob < 50% — One group is marginally better than another

Prob = 50% — Samples could be from the same population same

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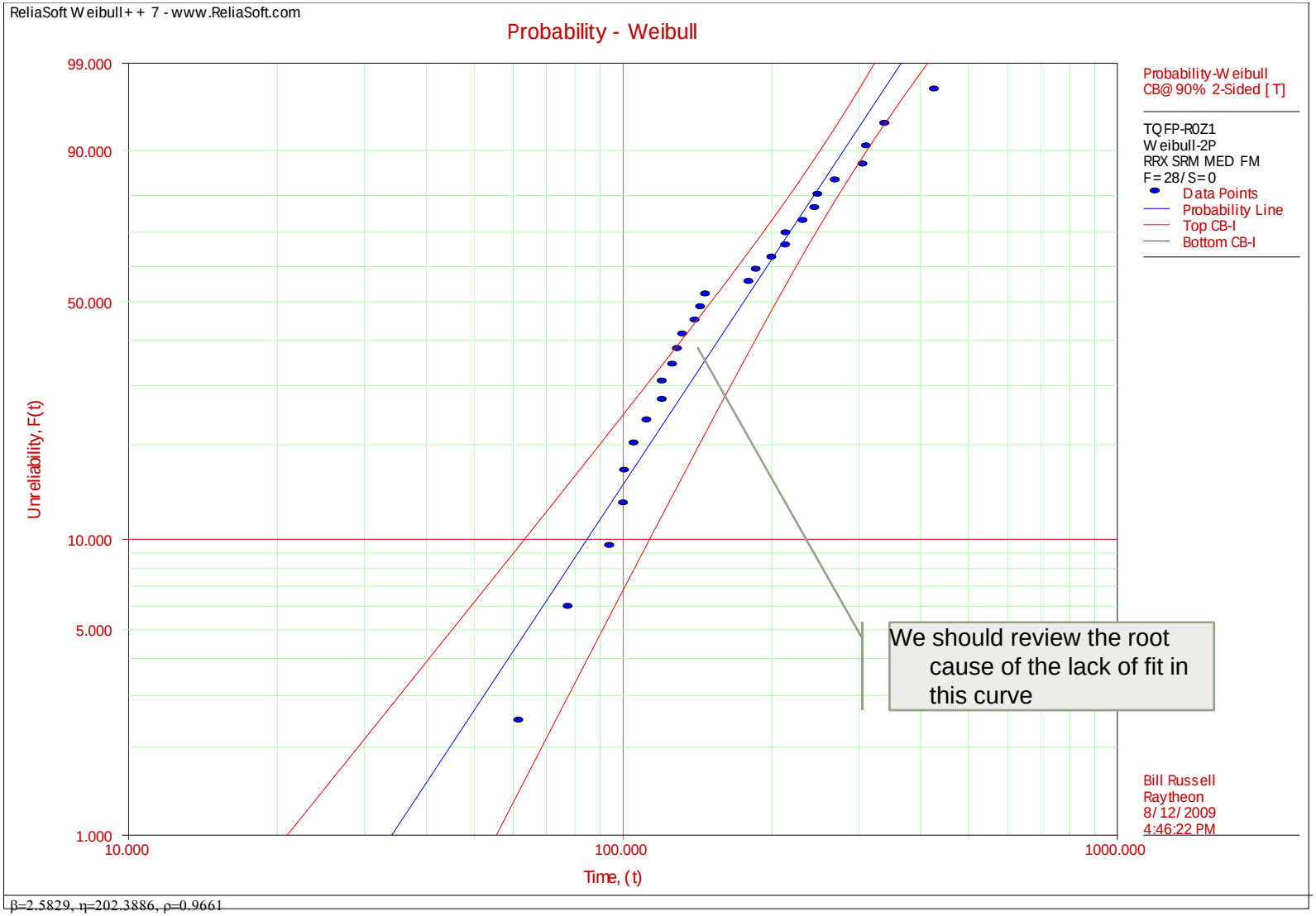
Vibration Analysis

TQFP WEIBULL PLOTS

TQFP-144 – Zone 1, 0 reworks



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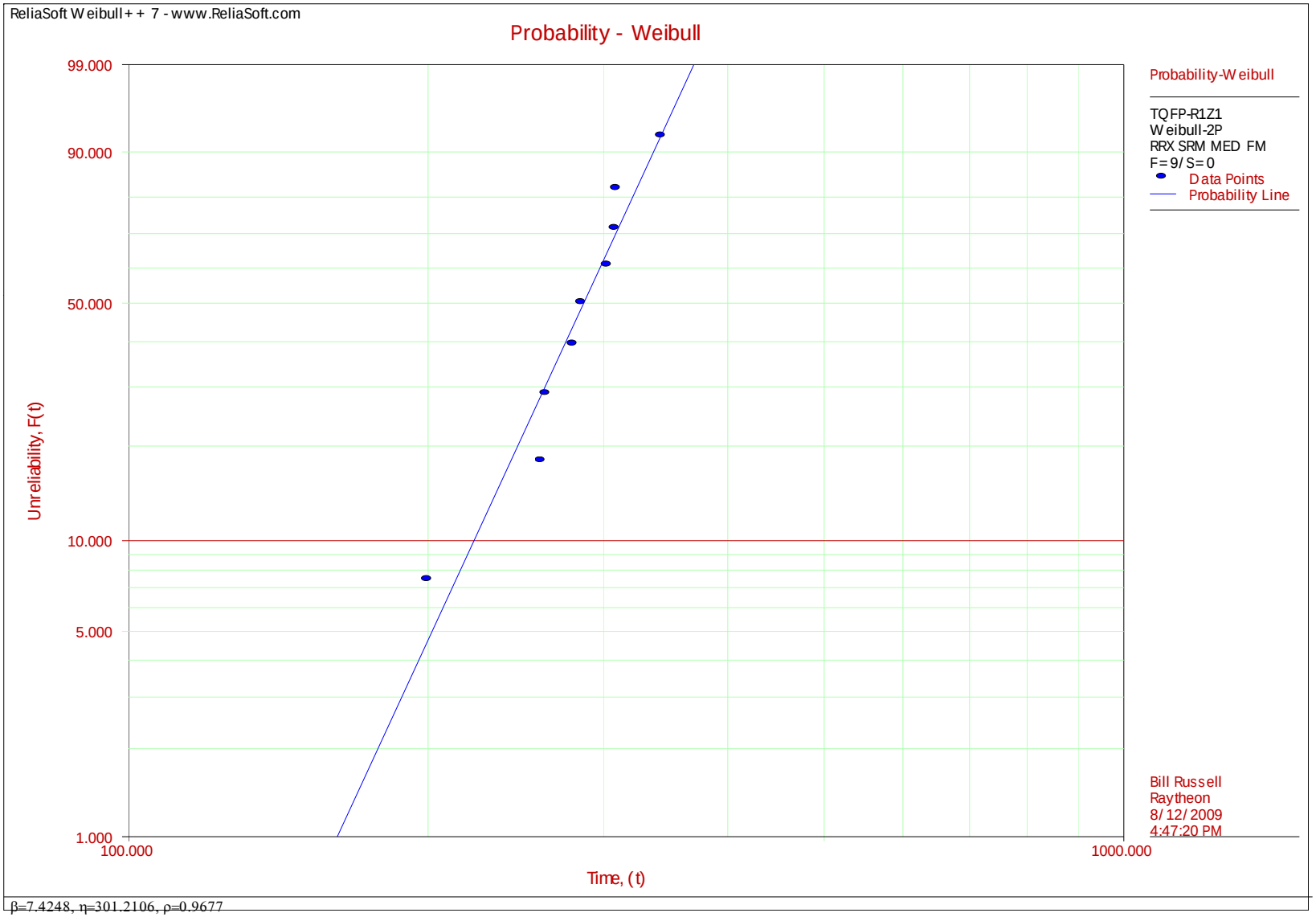
TQFP-144 – Zone 1, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	10	U20	1	TQFP-144	TQFP-144	Sn	SAC305	0	62	F		TQFP-R0Z1
2	SN67	10	U3	1	TQFP-144	TQFP-144	Sn	SAC305	0	78	F		TQFP-R0Z1
1	SN62	10	U3	1	TQFP-144	TQFP-144	Sn	SAC305	0	95	F		TQFP-R0Z1
2	SN65	10	U3	1	TQFP-144	TQFP-144	Sn	SAC305	0	101	F		TQFP-R0Z1
1	SN68	10	U3	1	TQFP-144	TQFP-144	Sn	SAC305	0	101	F		TQFP-R0Z1
2	SN61	10	U3	1	TQFP-144	TQFP-144	Sn	SAC305	0	106	F		TQFP-R0Z1
1	SN79	10	U3	1	TQFP-144	TQFP-144	Sn	SAC305	0	113	F		TQFP-R0Z1
2	SN63	12	U20	1	TQFP-144	TQFP-144	Sn	SAC305	0	121	F		TQFP-R0Z1
2	SN63	12	U57	1	TQFP-144	TQFP-144	Sn	SAC305	0	121	F		TQFP-R0Z1
2	SN66	12	U3	1	TQFP-144	TQFP-144	Sn	SAC305	0	127	F		TQFP-R0Z1
1	SN79	12	U58	1	TQFP-144	TQFP-144	Sn	SAC305	0	130	F		TQFP-R0Z1
2	SN63	12	U3	1	TQFP-144	TQFP-144	Sn	SAC305	0	133	F		TQFP-R0Z1
1	SN64	12	U3	1	TQFP-144	TQFP-144	Sn	SAC305	0	141	F		TQFP-R0Z1
1	SN79	12	U20	1	TQFP-144	TQFP-144	Sn	SAC305	0	145	F		TQFP-R0Z1
2	SN67	12	U20	1	TQFP-144	TQFP-144	Sn	SAC305	0	148	F		TQFP-R0Z1
2	SN66	14	U20	1	TQFP-144	TQFP-144	Sn	SAC305	0	181	F		TQFP-R0Z1
1	SN62	14	U20	1	TQFP-144	TQFP-144	Sn	SAC305	0	187	F		TQFP-R0Z1
1	SN68	14	U20	1	TQFP-144	TQFP-144	Sn	SAC305	0	201	F		TQFP-R0Z1
1	SN64	14	U20	1	TQFP-144	TQFP-144	Sn	SAC305	0	215	F		TQFP-R0Z1
1	SN68	14	U58	1	TQFP-144	TQFP-144	Sn	SAC305	0	215	F		TQFP-R0Z1
2	SN66	14	U58	1	TQFP-144	TQFP-144	Sn	SAC305	0	233	F		TQFP-R0Z1
2	SN61	16	U20	1	TQFP-144	TQFP-144	Sn	SAC305	0	246	F		TQFP-R0Z1
1	SN62	16	U58	1	TQFP-144	TQFP-144	Sn	SAC305	0	250	F		TQFP-R0Z1
1	SN64	16	U58	1	TQFP-144	TQFP-144	Sn	SAC305	0	271	F		TQFP-R0Z1
2	SN67	18	U57	1	TQFP-144	TQFP-144	Sn	SAC305	0	308	F		TQFP-R0Z1
2	SN61	18	U57	1	TQFP-144	TQFP-144	Sn	SAC305	0	313	F		TQFP-R0Z1
2	SN65	18	U57	1	TQFP-144	TQFP-144	Sn	SAC305	0	341	F		TQFP-R0Z1
2	SN61	28	U41	1	TQFP-144	TQFP-144	Sn	SAC305	0	430	F		TQFP-R0Z1

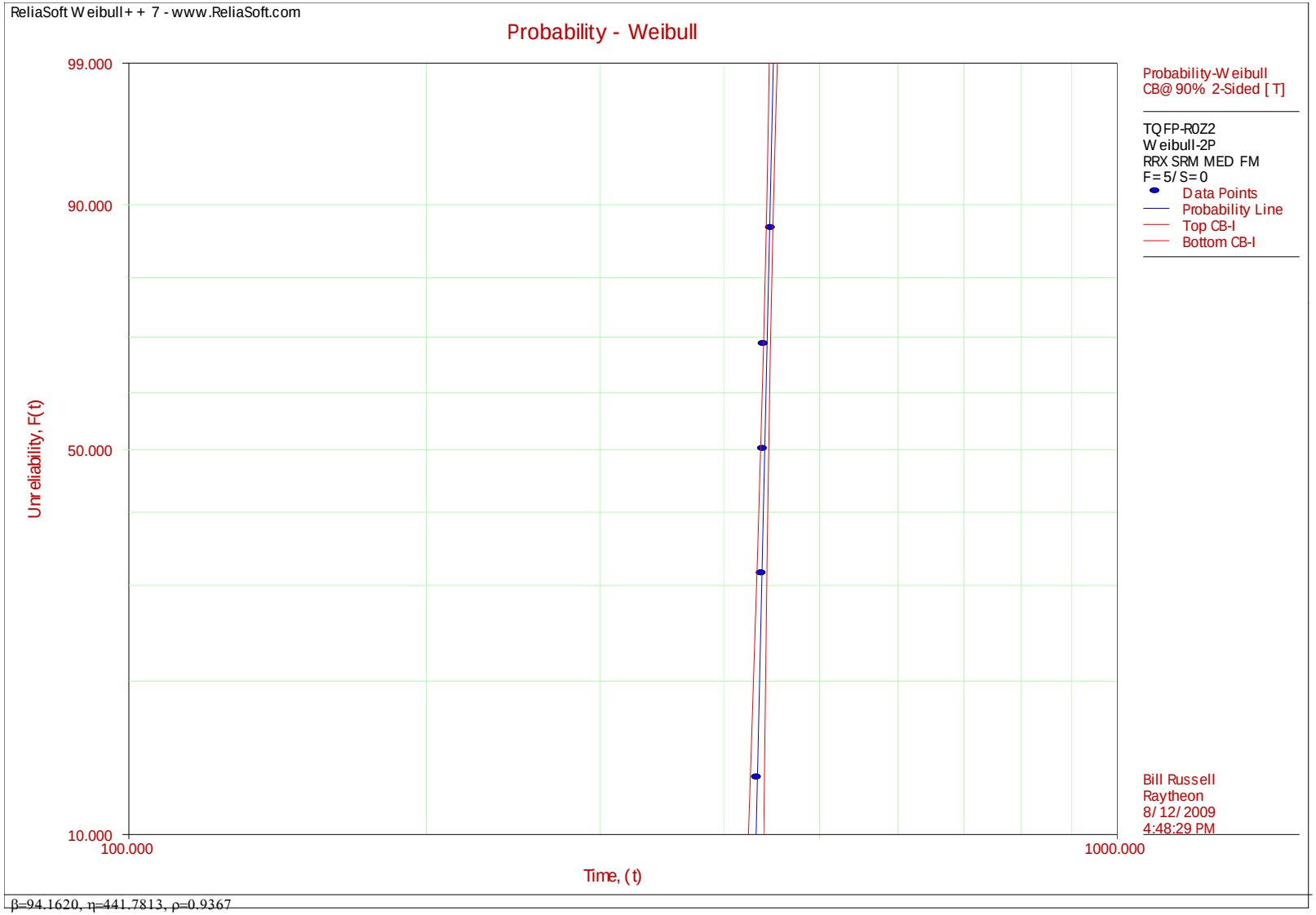
TQFP-144 – Zone 1, 1 rework



TQFP-144 – Zone 1, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN67	14	U58	1	TQFP-144	TQFP-144	Sn	SAC305	1	200	F		TQFP-R1Z1
2	SN65	16	U58	1	TQFP-144	TQFP-144	Sn	SAC305	1	260	F		TQFP-R1Z1
2	SN61	16	U58	1	TQFP-144	TQFP-144	Sn	SAC305	1	263	F		TQFP-R1Z1
2	SN63	16	U58	1	TQFP-144	TQFP-144	Sn	SAC305	1	280	F		TQFP-R1Z1
1	SN62	16	U57	1	TQFP-144	TQFP-144	Sn	SAC305	1	286	F		TQFP-R1Z1
2	SN66	18	U57	1	TQFP-144	TQFP-144	Sn	SAC305	1	303	F		TQFP-R1Z1
1	SN64	18	U57	1	TQFP-144	TQFP-144	Sn	SAC305	1	309	F		TQFP-R1Z1
1	SN68	18	U57	1	TQFP-144	TQFP-144	Sn	SAC305	1	309	F		TQFP-R1Z1
1	SN79	18	U57	1	TQFP-144	TQFP-144	Sn	SAC305	1	343	F		TQFP-R1Z1

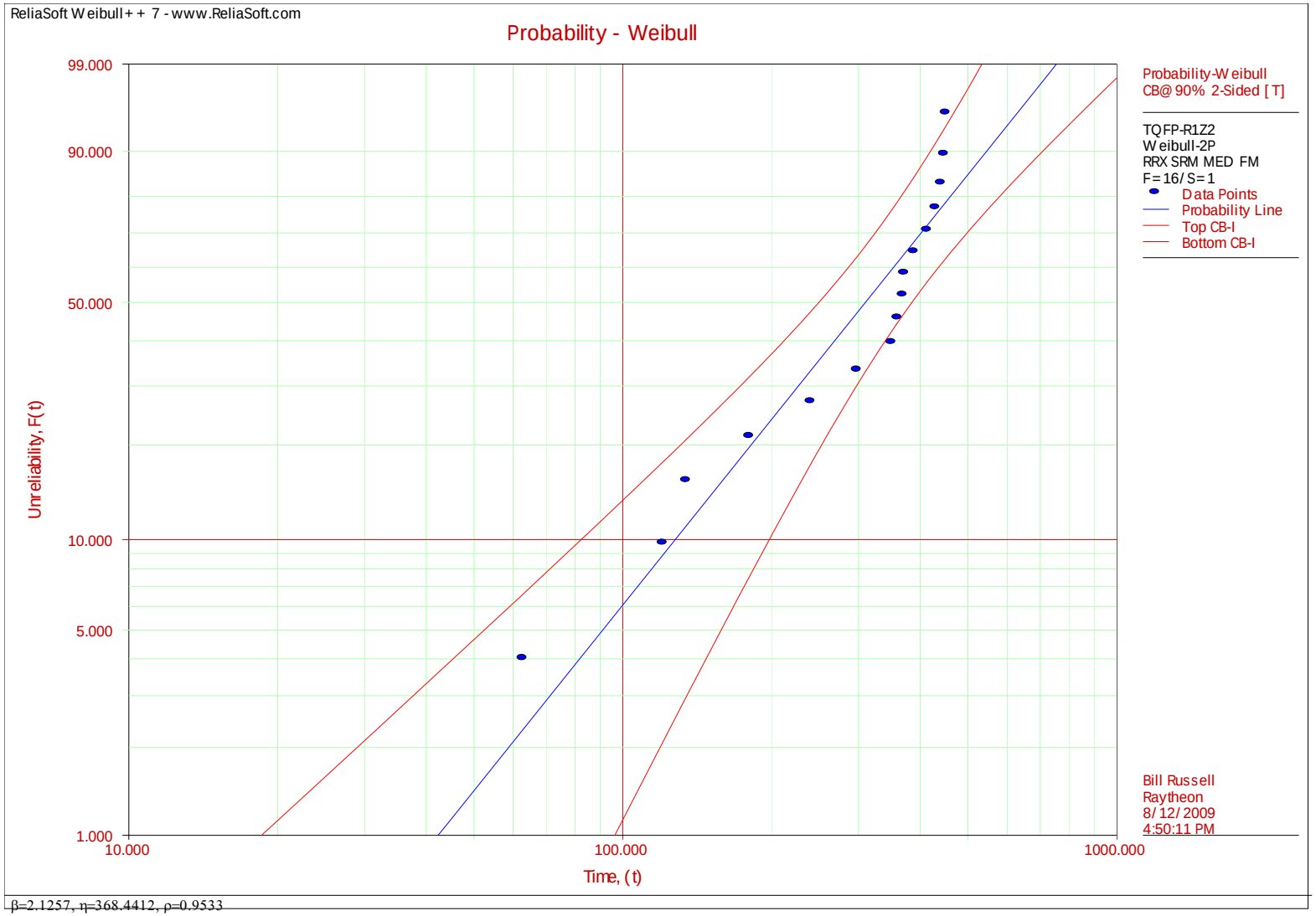
TQFP-144 – Zone 2, 0 rework



TQFP-144 – Zone 2, 0 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN66	28	U48	2	TQFP-144	TQFP-144	Sn	SAC305	0	433	F		TQFP-R0Z2
1	SN68	28	U48	2	TQFP-144	TQFP-144	Sn	SAC305	0	438	F		TQFP-R0Z2
1	SN79	28	U48	2	TQFP-144	TQFP-144	Sn	SAC305	0	439	F		TQFP-R0Z2
1	SN64	28	U48	2	TQFP-144	TQFP-144	Sn	SAC305	0	440	F		TQFP-R0Z2
1	SN62	28	U48	2	TQFP-144	TQFP-144	Sn	SAC305	0	447	F		TQFP-R0Z2

TQFP-144 – Zone 2, 1 rework



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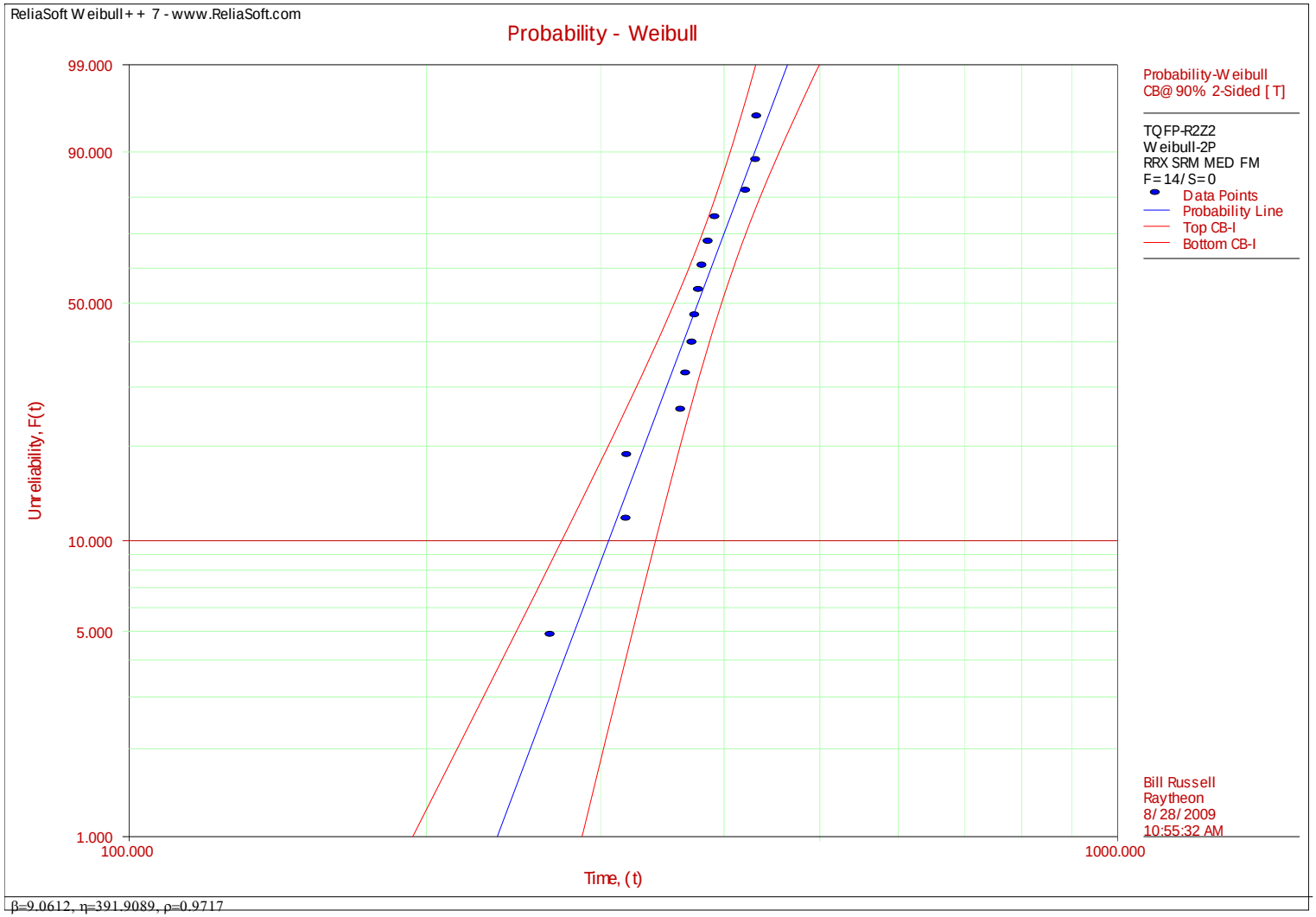
TQFP-144 – Zone 2, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	10	U34	2	TQFP-144	TQFP-144	Sn	SAC305	1	63	F		TQFP-R1Z2
2	SN63	12	U34	2	TQFP-144	TQFP-144	Sn	SAC305	1	121	F		TQFP-R1Z2
2	SN67	12	U7	2	TQFP-144	TQFP-144	Sn	SAC305	1	135	F		TQFP-R1Z2
2	SN65	14	U48	2	TQFP-144	TQFP-144	Sn	SAC305	1	181	F		TQFP-R1Z2
2	SN65	16	U7	2	TQFP-144	TQFP-144	Sn	SAC305	1	241	F		TQFP-R1Z2
2	SN61	16	U7	2	TQFP-144	TQFP-144	Sn	SAC305	1	293	F		TQFP-R1Z2
2	SN67	16	U34	2	TQFP-144	TQFP-144	Sn	SAC305	1	299	F		TQFP-R1Z2
1	SN62	18	U31	2	TQFP-144	TQFP-144	Sn	SAC305	1	351	F		TQFP-R1Z2
2	SN63	20	U7	2	TQFP-144	TQFP-144	Sn	SAC305	1	361	F		TQFP-R1Z2
2	SN61	20	U34	2	TQFP-144	TQFP-144	Sn	SAC305	1	370	F		TQFP-R1Z2
2	SN67	20	U48	2	TQFP-144	TQFP-144	Sn	SAC305	1	373	F		TQFP-R1Z2
2	SN61	20	U48	2	TQFP-144	TQFP-144	Sn	SAC305	1	390	F		TQFP-R1Z2
2	SN66	20	U31	2	TQFP-144	TQFP-144	Sn	SAC305	1	415	F		TQFP-R1Z2
2	SN63	28	U48	2	TQFP-144	TQFP-144	Sn	SAC305	1	431	F		TQFP-R1Z2
1	SN79	28	U31	2	TQFP-144	TQFP-144	Sn	SAC305	1	442	F		TQFP-R1Z2
1	SN64	28	U31	2	TQFP-144	TQFP-144	Sn	SAC305	1	449	F		TQFP-R1Z2
1	SN68	28	U31	2	TQFP-144	TQFP-144	Sn	SAC305	1	452	F		TQFP-R1Z2

TQFP-144 – Zone 2, 2 reworks



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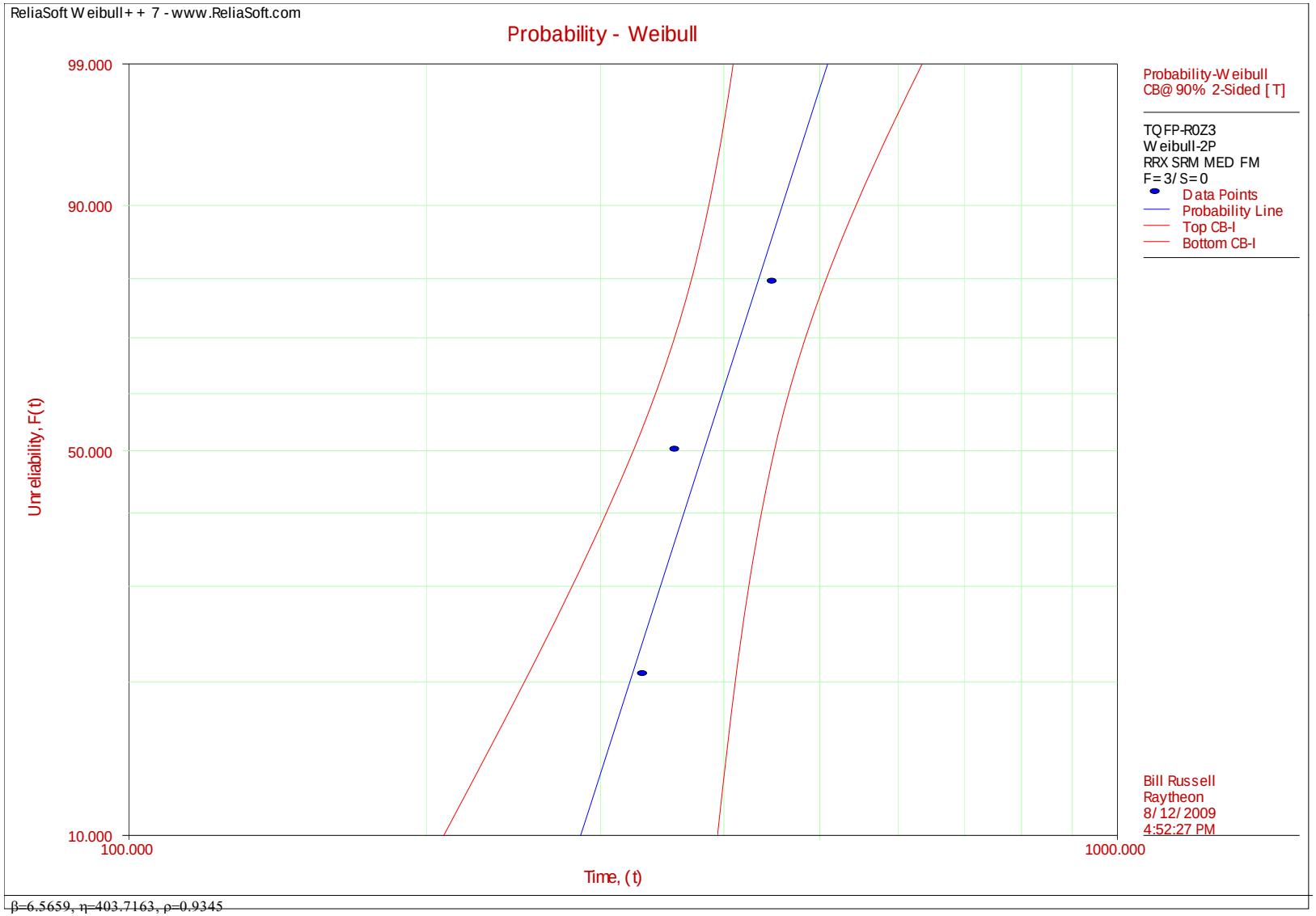
TQFP-144 – Zone 2, 2 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN79	16	U7	2	TQFP-144	TQFP-144	Sn	SAC305	2	268	F		TQFP-R2Z2
1	SN62	18	U7	2	TQFP-144	TQFP-144	Sn	SAC305	2	320	F		TQFP-R2Z2
2	SN66	18	U7	2	TQFP-144	TQFP-144	Sn	SAC305	2	320	F		TQFP-R2Z2
1	SN64	20	U7	2	TQFP-144	TQFP-144	Sn	SAC305	2	363	F		TQFP-R2Z2
1	SN79	20	U34	2	TQFP-144	TQFP-144	Sn	SAC305	2	367	F		TQFP-R2Z2
1	SN64	20	U34	2	TQFP-144	TQFP-144	Sn	SAC305	2	373	F		TQFP-R2Z2
2	SN67	20	U31	2	TQFP-144	TQFP-144	Sn	SAC305	2	375	F		TQFP-R2Z2
1	SN68	20	U34	2	TQFP-144	TQFP-144	Sn	SAC305	2	378	F		TQFP-R2Z2
1	SN68	20	U7	2	TQFP-144	TQFP-144	Sn	SAC305	2	381	F		TQFP-R2Z2
1	SN62	20	U34	2	TQFP-144	TQFP-144	Sn	SAC305	2	387	F		TQFP-R2Z2
2	SN66	20	U34	2	TQFP-144	TQFP-144	Sn	SAC305	2	393	F		TQFP-R2Z2
2	SN61	28	U31	2	TQFP-144	TQFP-144	Sn	SAC305	2	422	F		TQFP-R2Z2
2	SN65	28	U31	2	TQFP-144	TQFP-144	Sn	SAC305	2	432	F		TQFP-R2Z2
2	SN63	28	U31	2	TQFP-144	TQFP-144	Sn	SAC305	2	433	F		TQFP-R2Z2

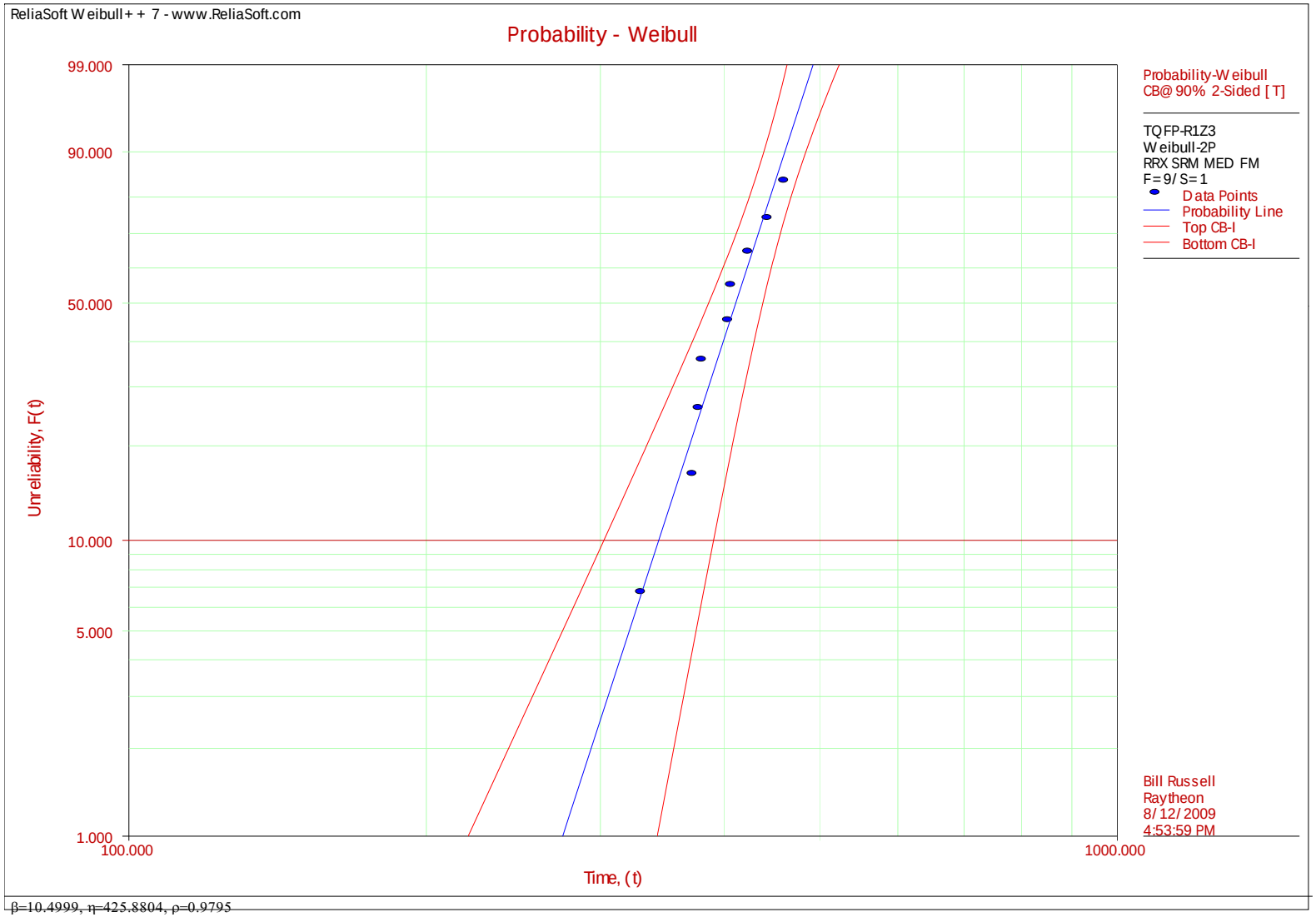
TQFP-144 – Zone 3, 0 reworks



TQFP-144 – Zone 3, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	18	U41	3	TQFP-144	TQFP-144	Sn	SAC305	0	332	F		TQFP-R0Z3
2	SN67	18	U41	3	TQFP-144	TQFP-144	Sn	SAC305	0	358	F		TQFP-R0Z3
2	SN63	28	U41	3	TQFP-144	TQFP-144	Sn	SAC305	0	449	F		TQFP-R0Z3

TQFP-144 – Zone 3, 1 rework



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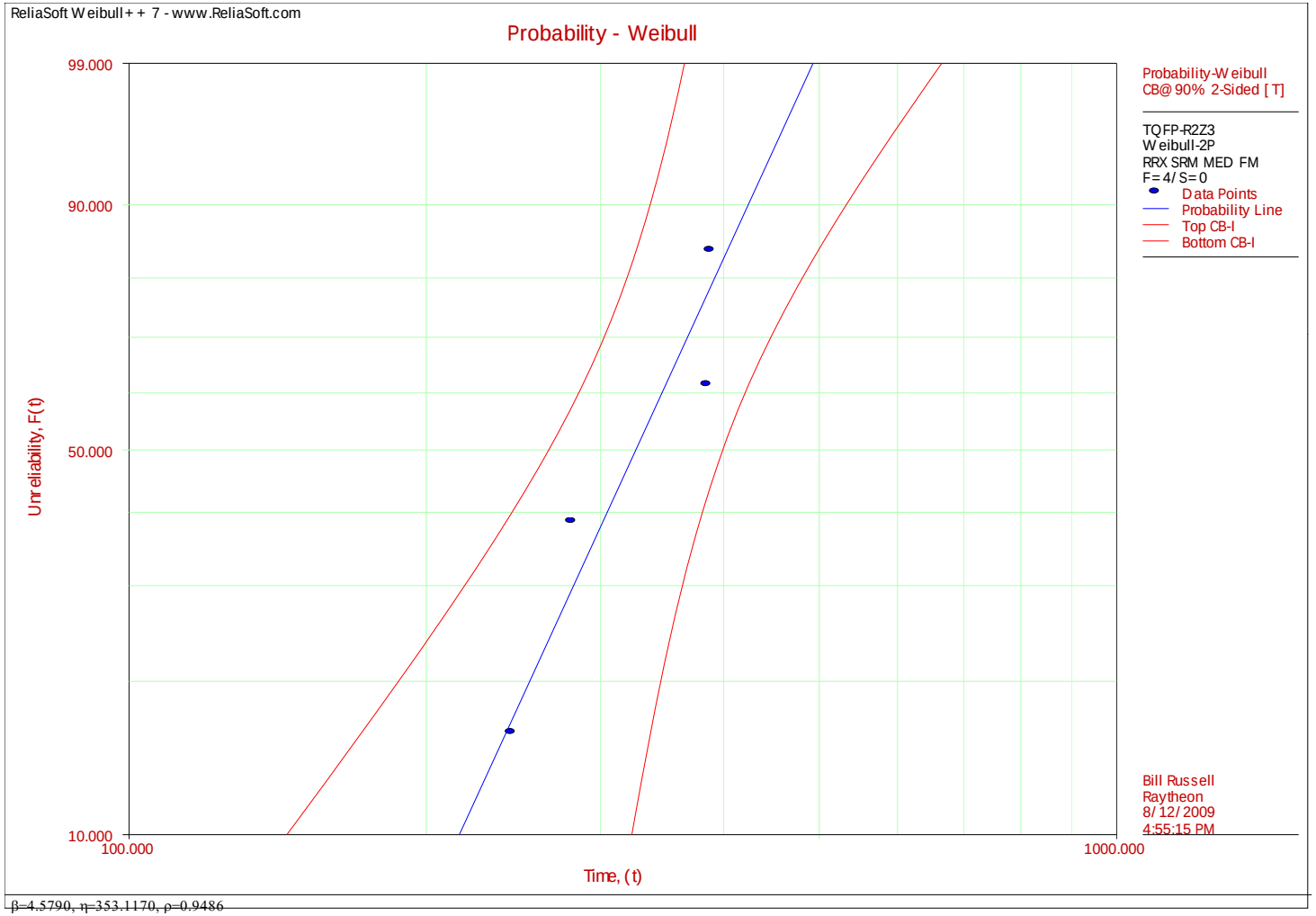
TQFP-144 – Zone 3, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN62	18	U1	3	TQFP-144	TQFP-144	Sn	SAC305	1	331	F		TQFP-R1Z3
1	SN68	20	U1	3	TQFP-144	TQFP-144	Sn	SAC305	1	373	F		TQFP-R1Z3
1	SN79	20	U1	3	TQFP-144	TQFP-144	Sn	SAC305	1	378	F		TQFP-R1Z3
2	SN66	20	U1	3	TQFP-144	TQFP-144	Sn	SAC305	1	381	F		TQFP-R1Z3
1	SN64	20	U41	3	TQFP-144	TQFP-144	Sn	SAC305	1	405	F		TQFP-R1Z3
1	SN68	20	U41	3	TQFP-144	TQFP-144	Sn	SAC305	1	408	F		TQFP-R1Z3
1	SN64	28	U1	3	TQFP-144	TQFP-144	Sn	SAC305	1	424	F		TQFP-R1Z3
2	SN66	28	U41	3	TQFP-144	TQFP-144	Sn	SAC305	1	444	F		TQFP-R1Z3
1	SN62	28	U41	3	TQFP-144	TQFP-144	Sn	SAC305	1	461	F		TQFP-R1Z3
1	SN79	28	U41	3	TQFP-144	TQFP-144	Sn	SAC305	1	480	S		TQFP-R1Z3

TQFP-144 – Zone 3, 2 rework



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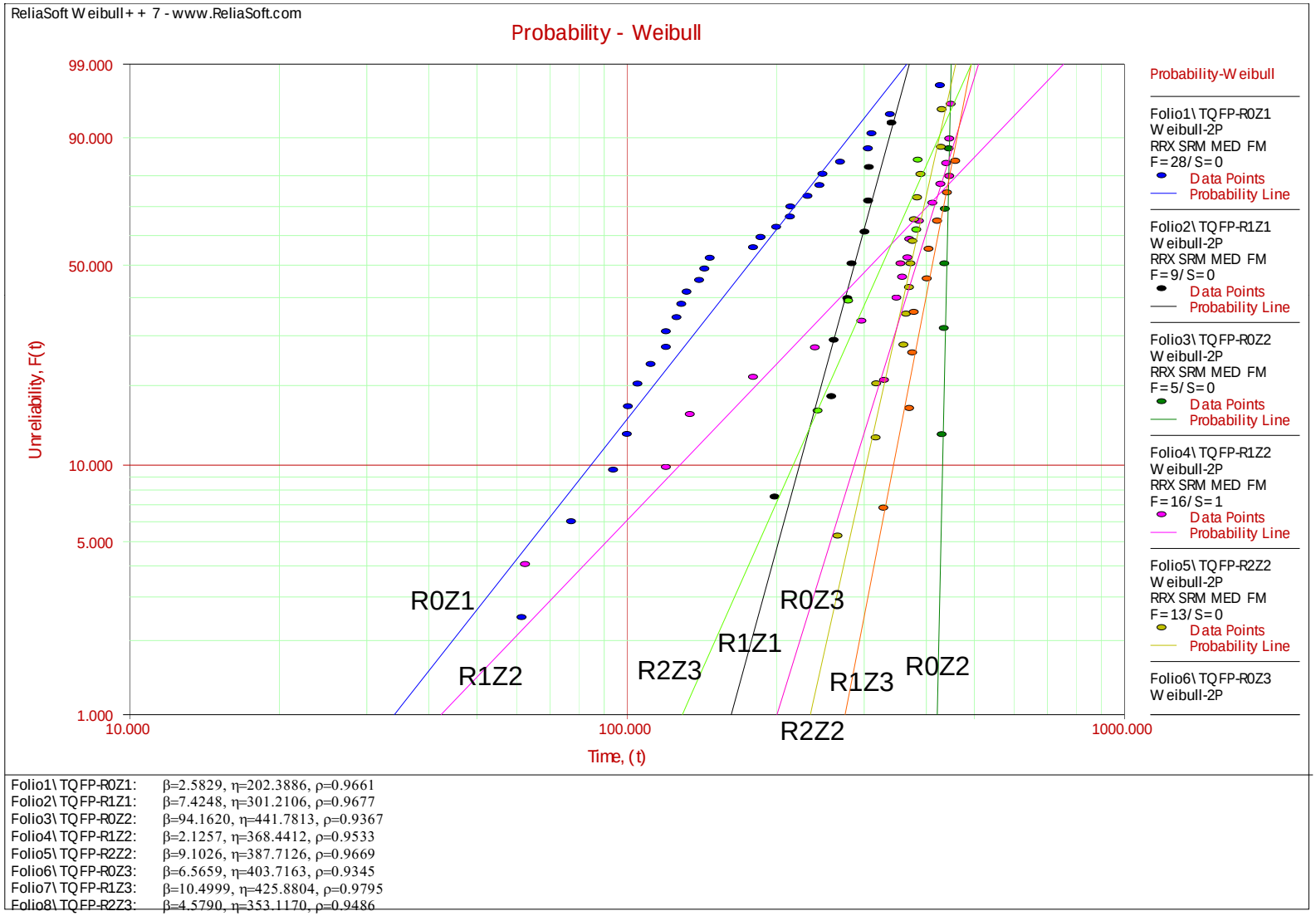
TQFP-144 – Zone 3, 2 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN67	16	U1	3	TQFP-144	TQFP-144	Sn	SAC305	2	244	F		TQFP-R2Z3
2	SN65	16	U1	3	TQFP-144	TQFP-144	Sn	SAC305	2	281	F		TQFP-R2Z3
2	SN61	20	U1	3	TQFP-144	TQFP-144	Sn	SAC305	2	385	F		TQFP-R2Z3
2	SN63	20	U1	3	TQFP-144	TQFP-144	Sn	SAC305	2	388	F		TQFP-R2Z3

TQFP-144 - Multiplot



Folio1\TQFP-R0Z1: β=2.5829, η=202.3886, ρ=0.9661
Folio2\TQFP-R1Z1: β=7.4248, η=301.2106, ρ=0.9677
Folio3\TQFP-R0Z2: β=94.1620, η=441.7813, ρ=0.9367
Folio4\TQFP-R1Z2: β=2.1257, η=368.4412, ρ=0.9533
Folio5\TQFP-R2Z2: β=9.1026, η=387.7126, ρ=0.9669
Folio6\TQFP-R0Z3: β=6.5659, η=403.7163, ρ=0.9345
Folio7\TQFP-R1Z3: β=10.4999, η=425.8804, ρ=0.9795
Folio8\TQFP-R2Z3: β=4.5790, η=353.1170, ρ=0.9486

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Weibull Test of Comparison

1 TQFP-R0Z1	NA						
2 TQFP-R1Z1	2>1 88%	NA					
3 TQFP-R0Z2	3>1 100%	3>2 100%	NA				
4 TQFP-R1Z2	4>1 79%	same	4>3 77%	NA			
5 TQFP-R2Z2	5>1 98%	5>2 91%	3>5 94%	5>4 63%	NA		
6 TQFP-R0Z3	6>1 97%	6>2 80%	3>6 82%	6>4 64%	same	NA	
7 TQFP-R1Z3	7>1 99%	7>2 98%	3>7 75%	7>4 70%	7>5 70%	7>6 64%	NA
8 TQFP-R2Z3	8>1 90%	8>2 67%	3>8 93%	same	5>8 69%	8>6 70%	8>7 82%

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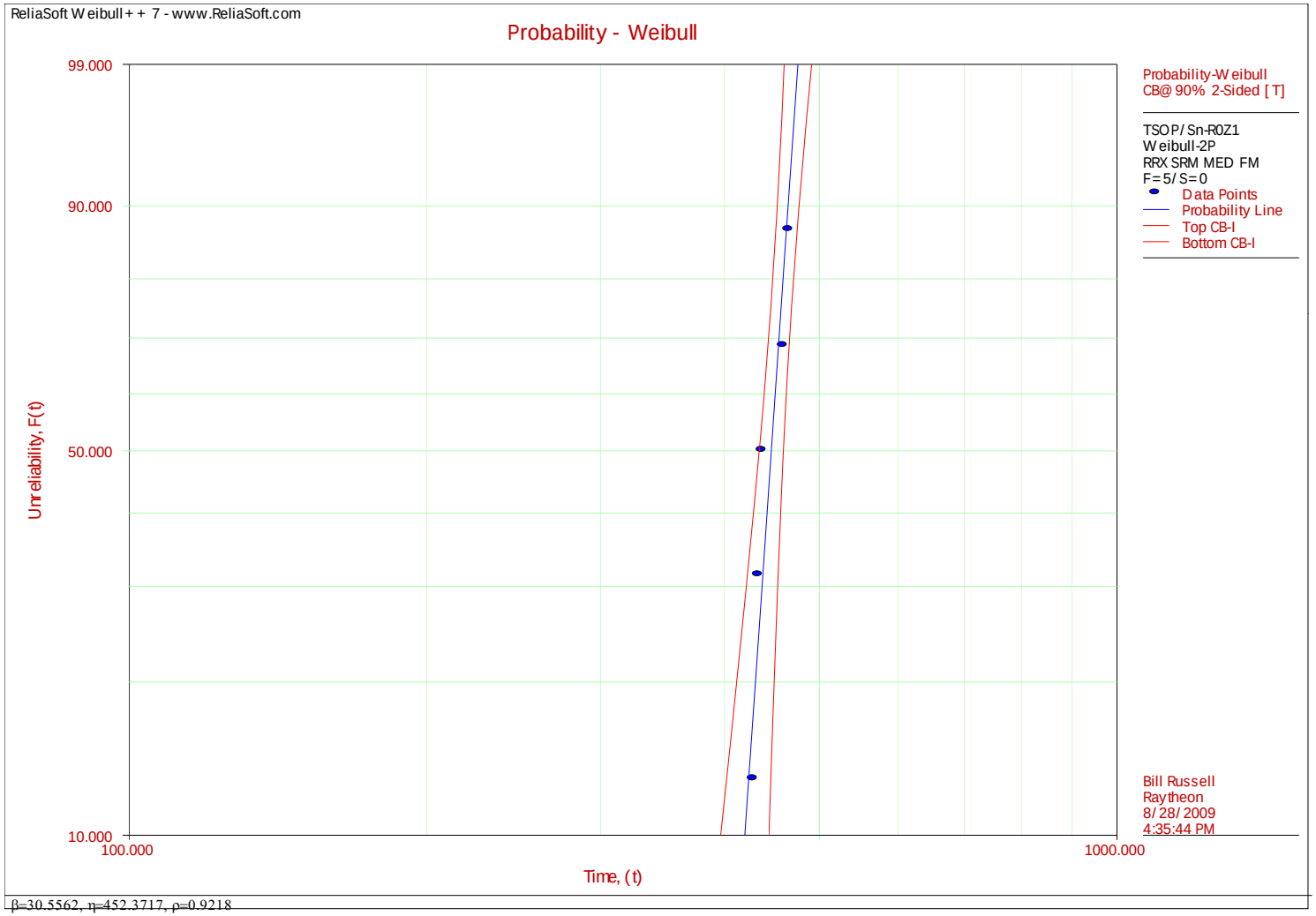
Vibration Analysis

TSOP-50 WITH SN SOLDER WEIBULL PLOTS

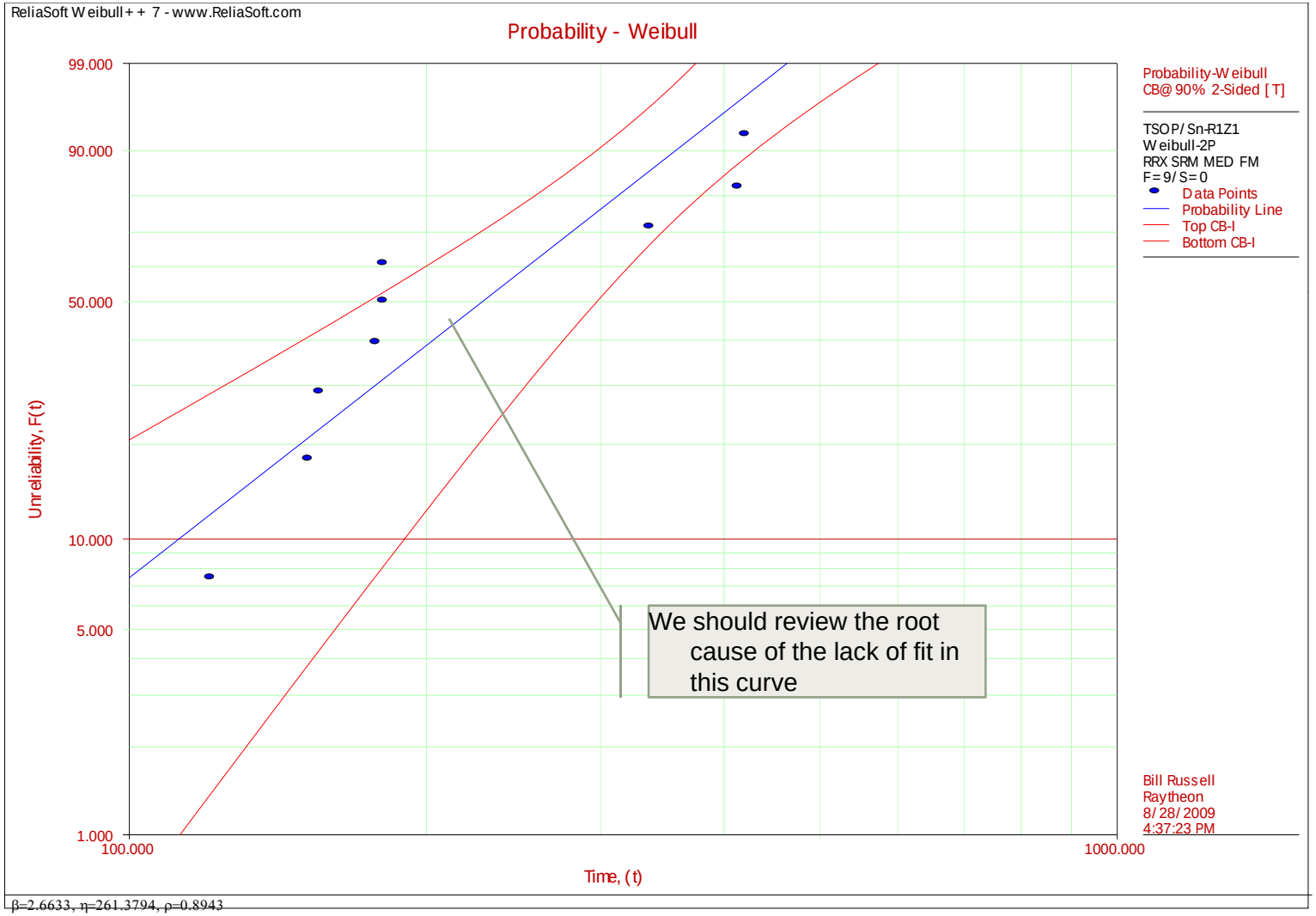
TSOP-50/Sn – Zone 1, 0 reworks



TSOP-50/Sn – Zone 1, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN66	28	U61	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	429	F		TSOP/Sn-R0Z1
1	SN68	28	U61	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	434	F		TSOP/Sn-R0Z1
1	SN64	28	U61	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	438	F		TSOP/Sn-R0Z1
1	SN79	28	U61	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	460	F		TSOP/Sn-R0Z1
1	SN62	28	U61	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	466	F		TSOP/Sn-R0Z1

TSOP-50/Sn – Zone 1, 1 rework



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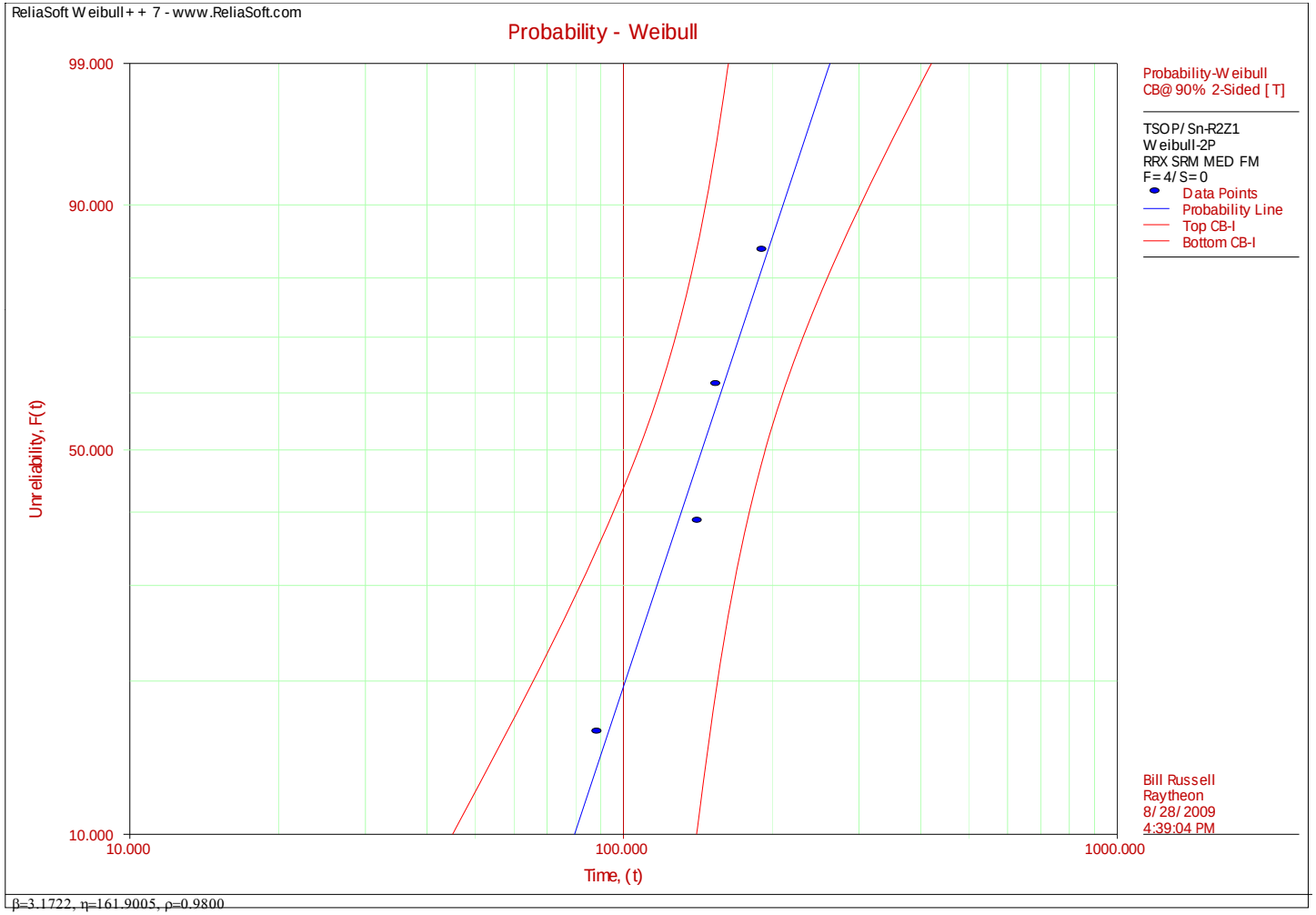
TSOP-50/Sn – Zone 1, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	12	U61	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	121	F		TSOP/Sn-R1Z1
1	SN68	12	U25	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	152	F		TSOP/Sn-R1Z1
1	SN79	12	U25	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	156	F		TSOP/Sn-R1Z1
1	SN64	12	U25	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	178	F		TSOP/Sn-R1Z1
2	SN66	14	U25	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	181	F		TSOP/Sn-R1Z1
1	SN62	14	U25	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	181	F		TSOP/Sn-R1Z1
2	SN67	18	U61	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	337	F		TSOP/Sn-R1Z1
2	SN61	20	U61	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	414	F		TSOP/Sn-R1Z1
2	SN63	28	U61	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	421	F		TSOP/Sn-R1Z1

TSOP-50/Sn – Zone 1, 2 reworks



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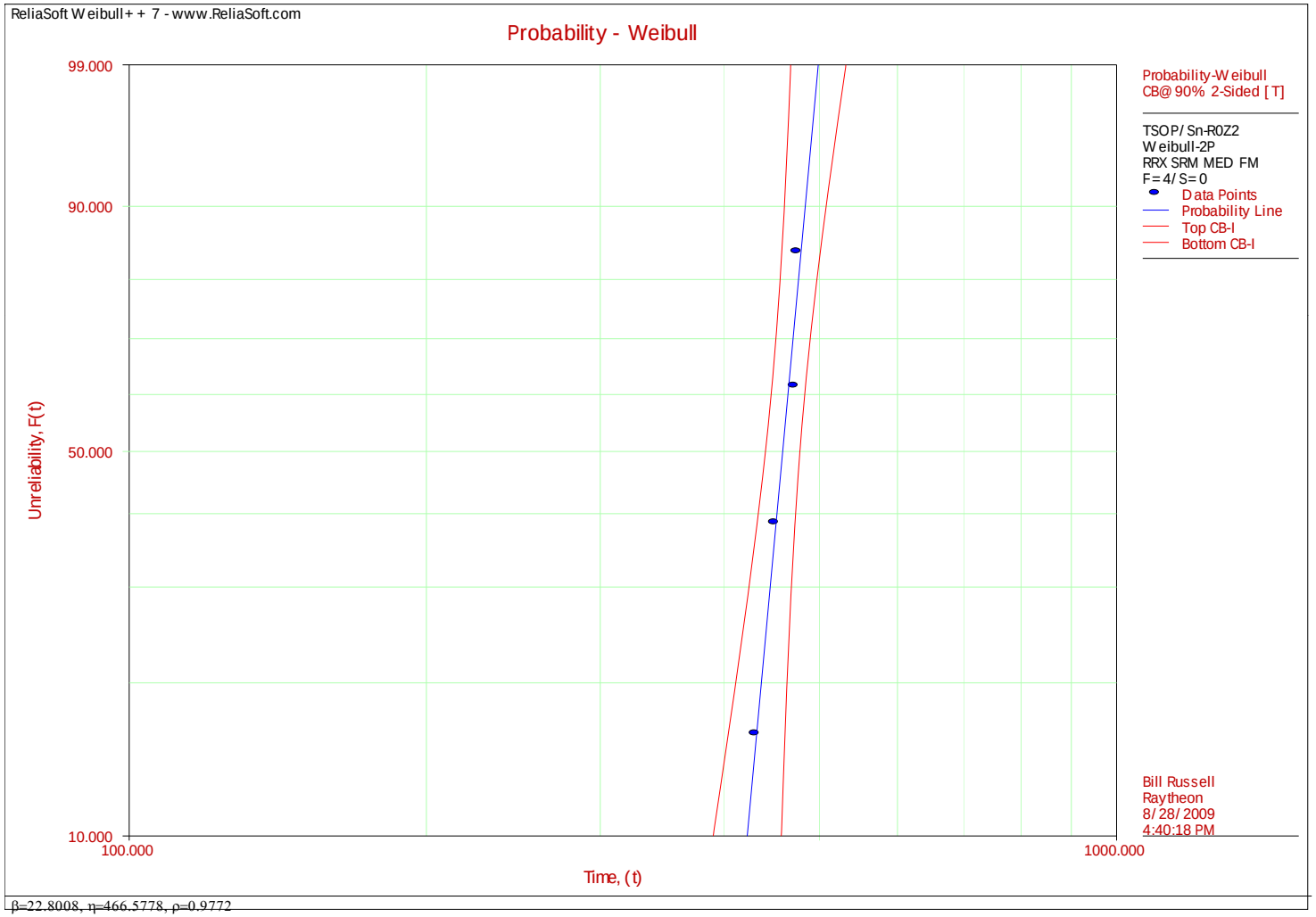
TSOP-50/Sn – Zone 1, 2 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN67	10	U25	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	2	89	F		TSOP/Sn-R2Z1
2	SN63	12	U25	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	2	142	F		TSOP/Sn-R2Z1
2	SN65	12	U25	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	2	155	F		TSOP/Sn-R2Z1
2	SN61	14	U25	1	TSOP-50	TSOP-50/Sn	Sn	SAC305	2	192	F		TSOP/Sn-R2Z1

TSOP-50/Sn – Zone 2, 0 rework



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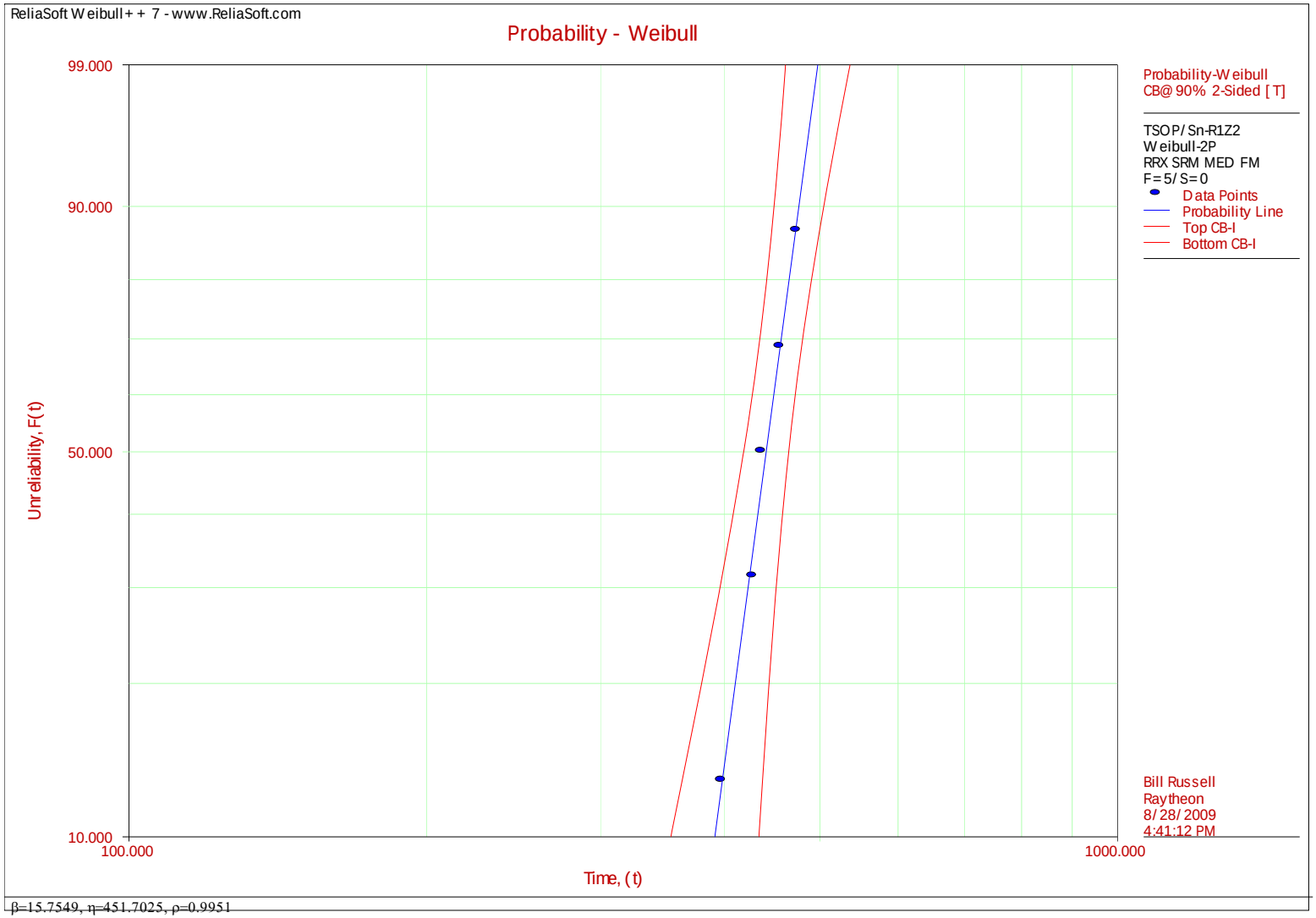
TSOP-50/Sn – Zone 2, 0 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN61	28	U39	2	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	431	F		TSOP/Sn-R0Z2
2	SN67	28	U39	2	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	451	F		TSOP/Sn-R0Z2
2	SN65	28	U39	2	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	472	F		TSOP/Sn-R0Z2
2	SN63	28	U39	2	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	475	F		TSOP/Sn-R0Z2

TSOP-50/Sn – Zone 2, 1 rework



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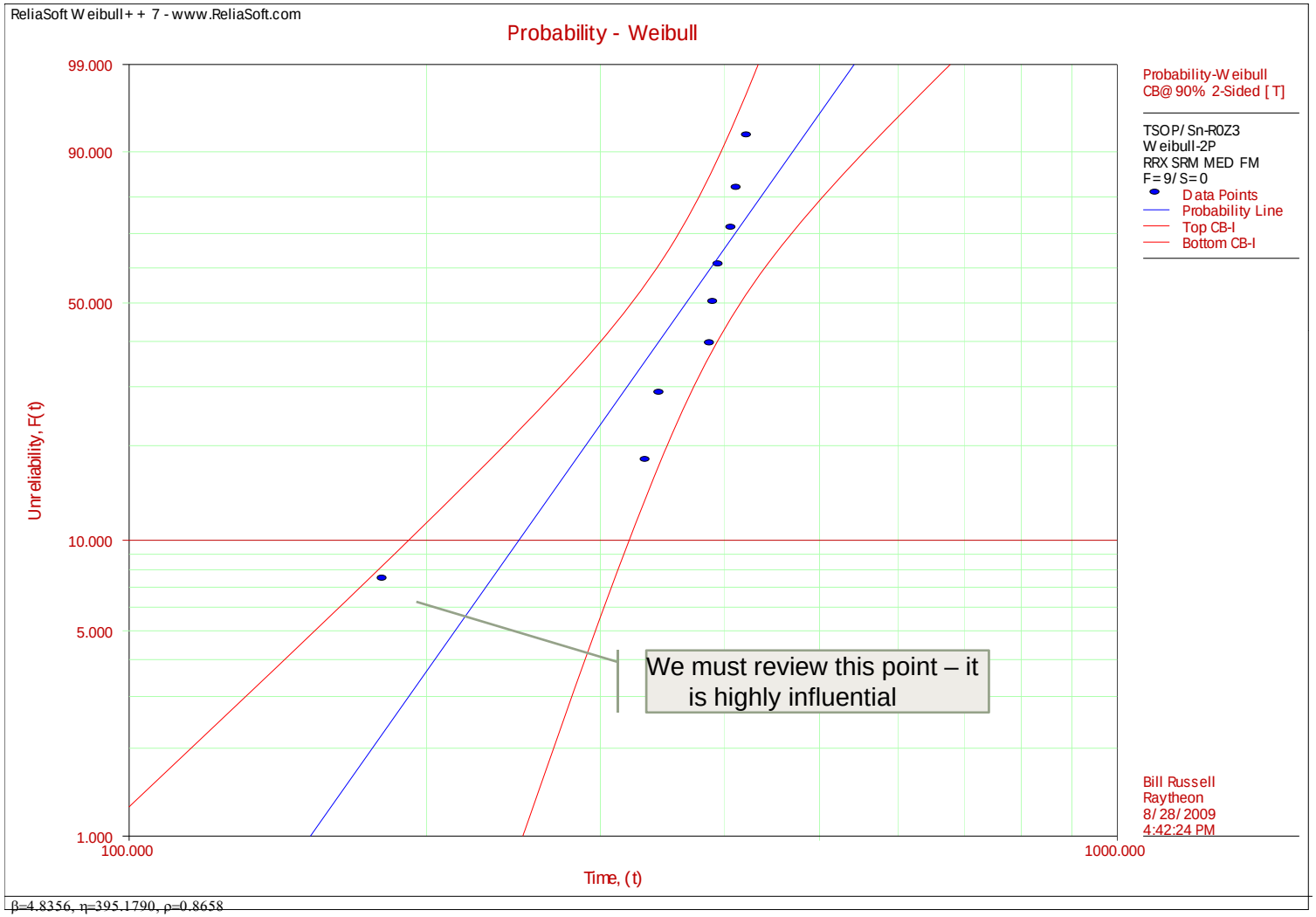
TSOP-50/Sn – Zone 2, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN66	20	U39	2	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	398	F		TSOP/Sn-R1Z2
1	SN79	28	U39	2	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	428	F		TSOP/Sn-R1Z2
1	SN62	28	U39	2	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	437	F		TSOP/Sn-R1Z2
1	SN68	28	U39	2	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	456	F		TSOP/Sn-R1Z2
1	SN64	28	U39	2	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	474	F		TSOP/Sn-R1Z2

TSOP-50/Sn – Zone 3, 0 rework



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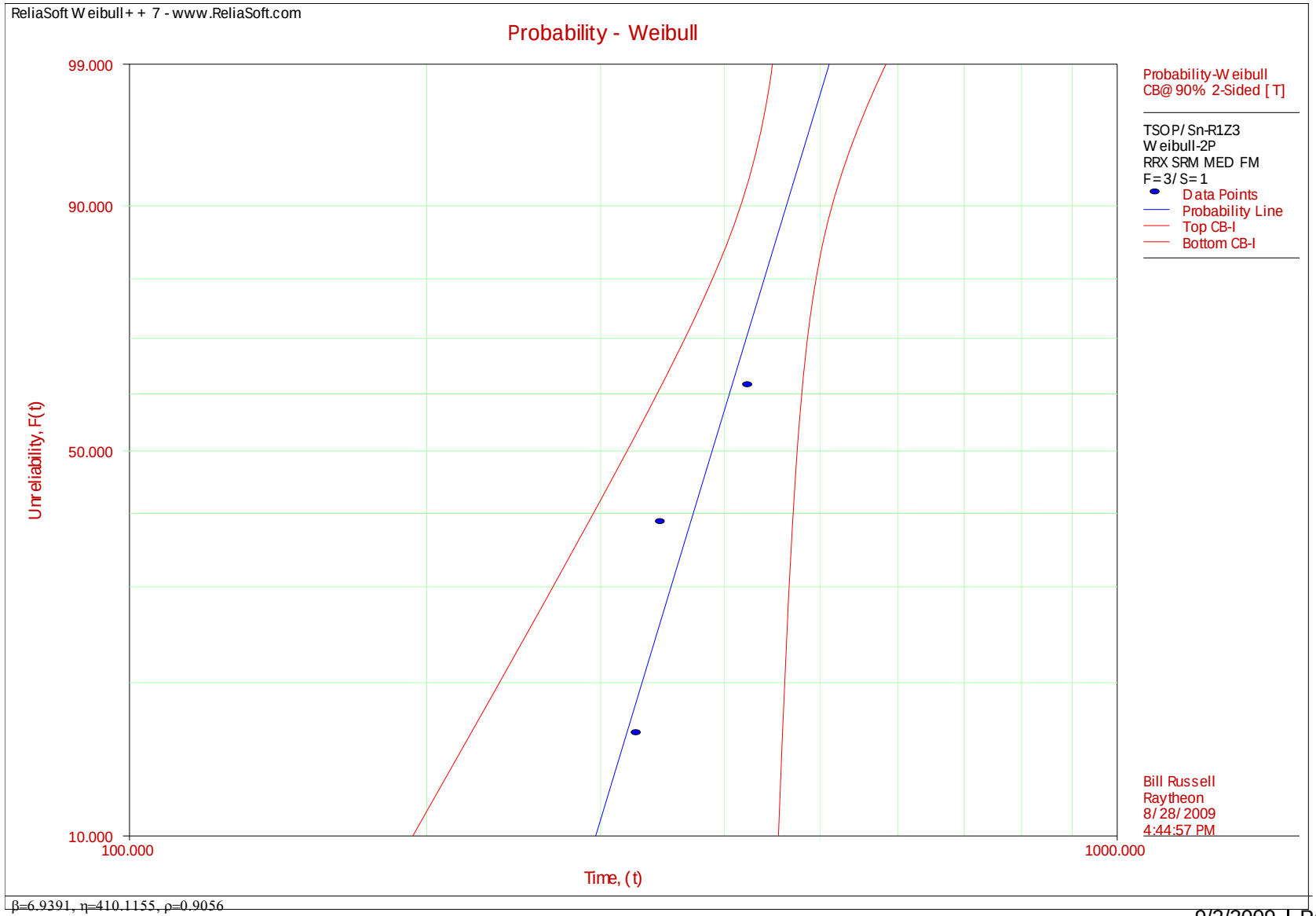
TSOP-50/Sn – Zone 3, 0 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN67	14	U12	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	181	F		TSOP/Sn-R0Z3
2	SN65	18	U12	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	334	F		TSOP/Sn-R0Z3
2	SN66	18	U12	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	345	F		TSOP/Sn-R0Z3
1	SN68	20	U12	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	388	F		TSOP/Sn-R0Z3
1	SN64	20	U12	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	391	F		TSOP/Sn-R0Z3
2	SN61	20	U12	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	396	F		TSOP/Sn-R0Z3
2	SN63	20	U12	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	408	F		TSOP/Sn-R0Z3
1	SN62	20	U12	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	413	F		TSOP/Sn-R0Z3
1	SN79	28	U12	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	0	423	F		TSOP/Sn-R0Z3

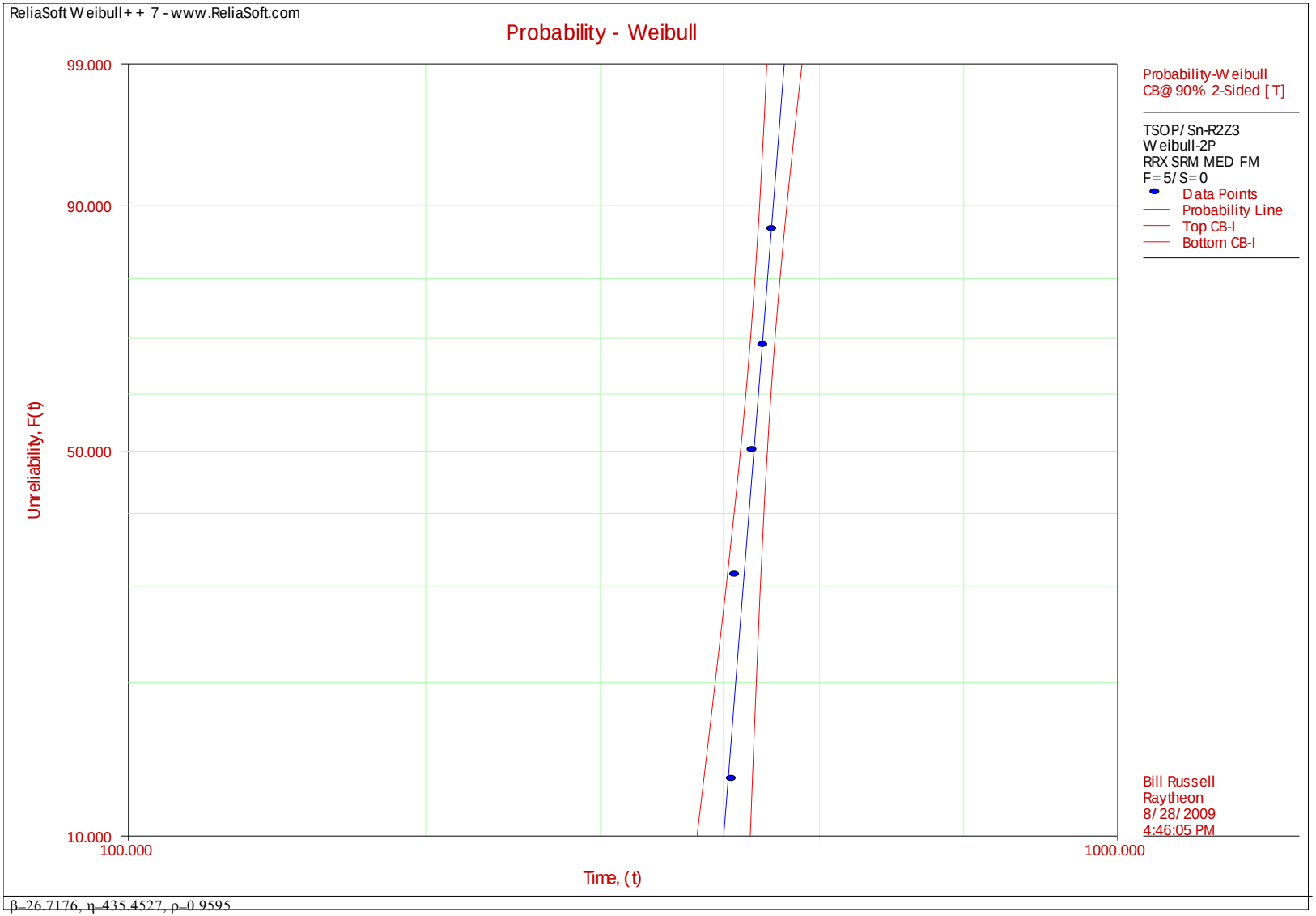
TSOP-50/Sn – Zone 3, 1 rework



TSOP-50/Sn – Zone 3, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	18	U29	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	327	F		TSOP/Sn-R1Z3
2	SN67	18	U29	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	346	F		TSOP/Sn-R1Z3
2	SN61	28	U29	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	424	F		TSOP/Sn-R1Z3
2	SN63	28	U29	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	1	480	S		TSOP/Sn-R1Z3

TSOP-50/Sn – Zone 3, 2 reworks



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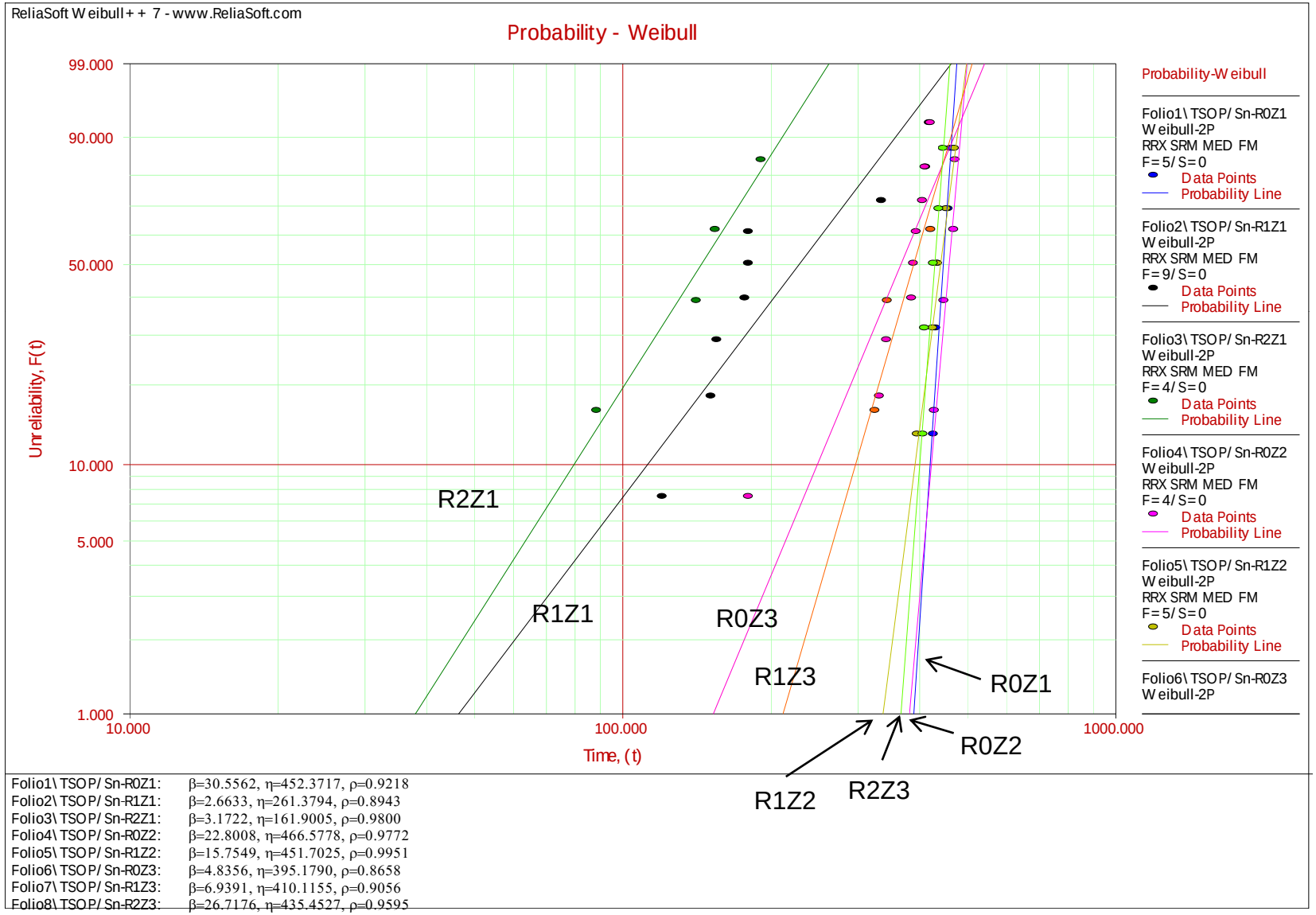
TSOP-50/Sn – Zone 3, 2 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN79	20	U29	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	2	409	F		TSOP/Sn-R2Z3
1	SN62	28	U29	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	2	429	F		TSOP/Sn-R2Z3
1	SN64	28	U29	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	2	440	F		TSOP/Sn-R2Z3
1	SN68	28	U29	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	2	449	F		TSOP/Sn-R2Z3
2	SN66	20	U29	3	TSOP-50	TSOP-50/Sn	Sn	SAC305	2	412	F		TSOP/Sn-R2Z3

TSOP-50/Sn - Multiplot



Folio1\ TSOP/ Sn-R0Z1: β=30.5562, η=452.3717, ρ=0.9218
Folio2\ TSOP/ Sn-R1Z1: β=2.6633, η=261.3794, ρ=0.8943
Folio3\ TSOP/ Sn-R2Z1: β=3.1722, η=161.9005, ρ=0.9800
Folio4\ TSOP/ Sn-R0Z2: β=22.8008, η=466.5778, ρ=0.9772
Folio5\ TSOP/ Sn-R1Z2: β=15.7549, η=451.7025, ρ=0.9951
Folio6\ TSOP/ Sn-R0Z3: β=4.8356, η=395.1790, ρ=0.8658
Folio7\ TSOP/ Sn-R1Z3: β=6.9391, η=410.1155, ρ=0.9056
Folio8\ TSOP/ Sn-R2Z3: β=26.7176, η=435.4527, ρ=0.9595

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Weibull Test of Comparison

1 TSOP/Sn-R0Z1	NA						
2 TSOP/Sn-R1Z1	1>2 98%	NA					
3 TSOP/Sn-R2Z1	1>3 100%	2>3 79%	NA				
4 TSOP/Sn-R0Z2	4>1 67%	4>2 99%	4>3 100%	NA			
5 TSOP/Sn-R1Z2	same	5>2 97%	5>3 100%	4>5 67%	NA		
6 TSOP/Sn-R0Z3	1>6 82%	6>2 84%	6>3 98%	4>6 85%	5>6 67%	NA	
7 TSOP/Sn-R1Z3	1>7 82%	7>2 90%	7>3 100%	4>7 86%	5>7 76%	same	NA
8 TSOP/Sn-R2Z3	1>8 76%	8>2 97%	8>3 100%	4>8 83%	5>8 63%	8>6 76%	8>7 73%

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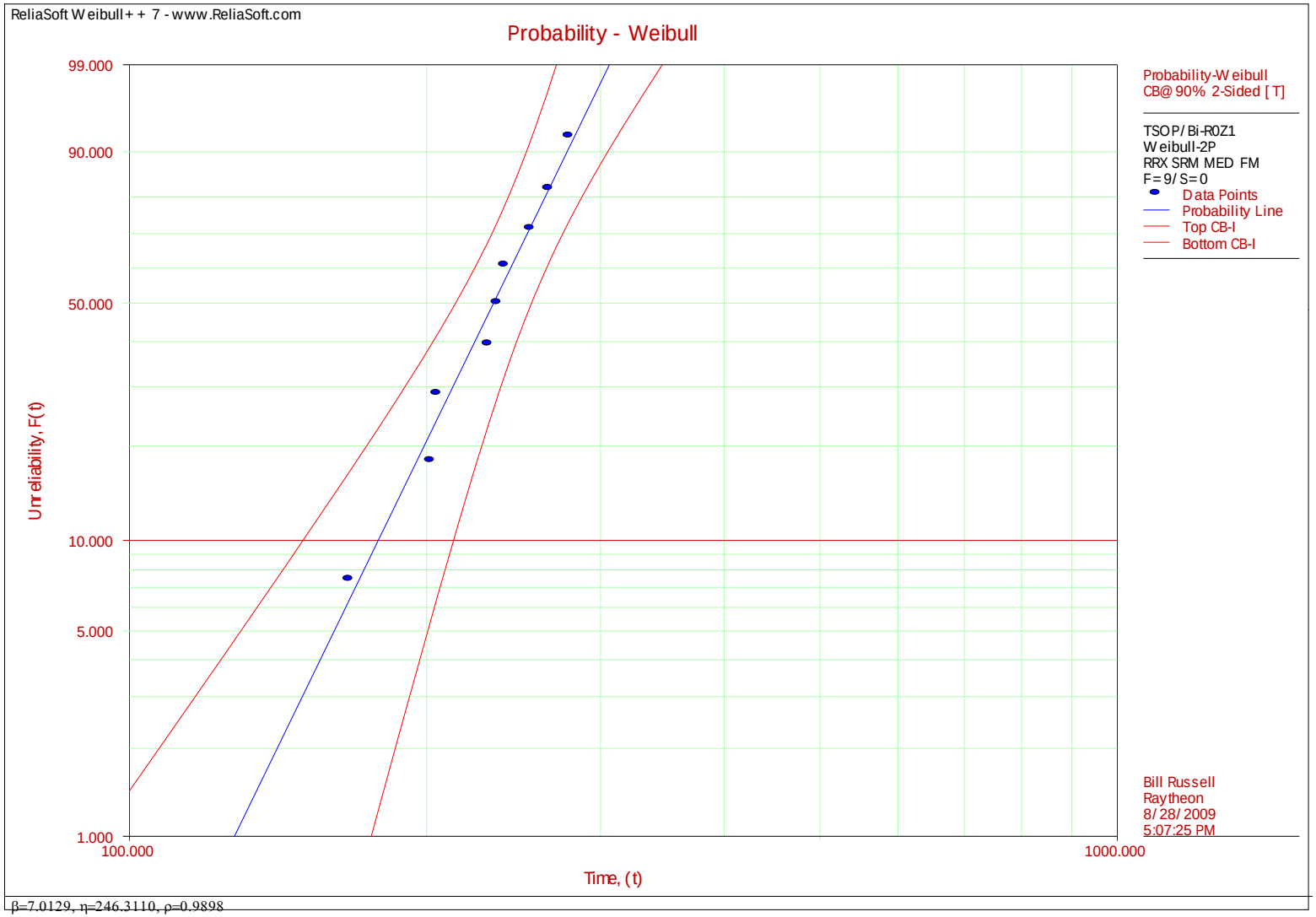
Vibration Analysis

TSOP-50 WITH TIN BISMUTH SOLDER WEIBULL PLOTS

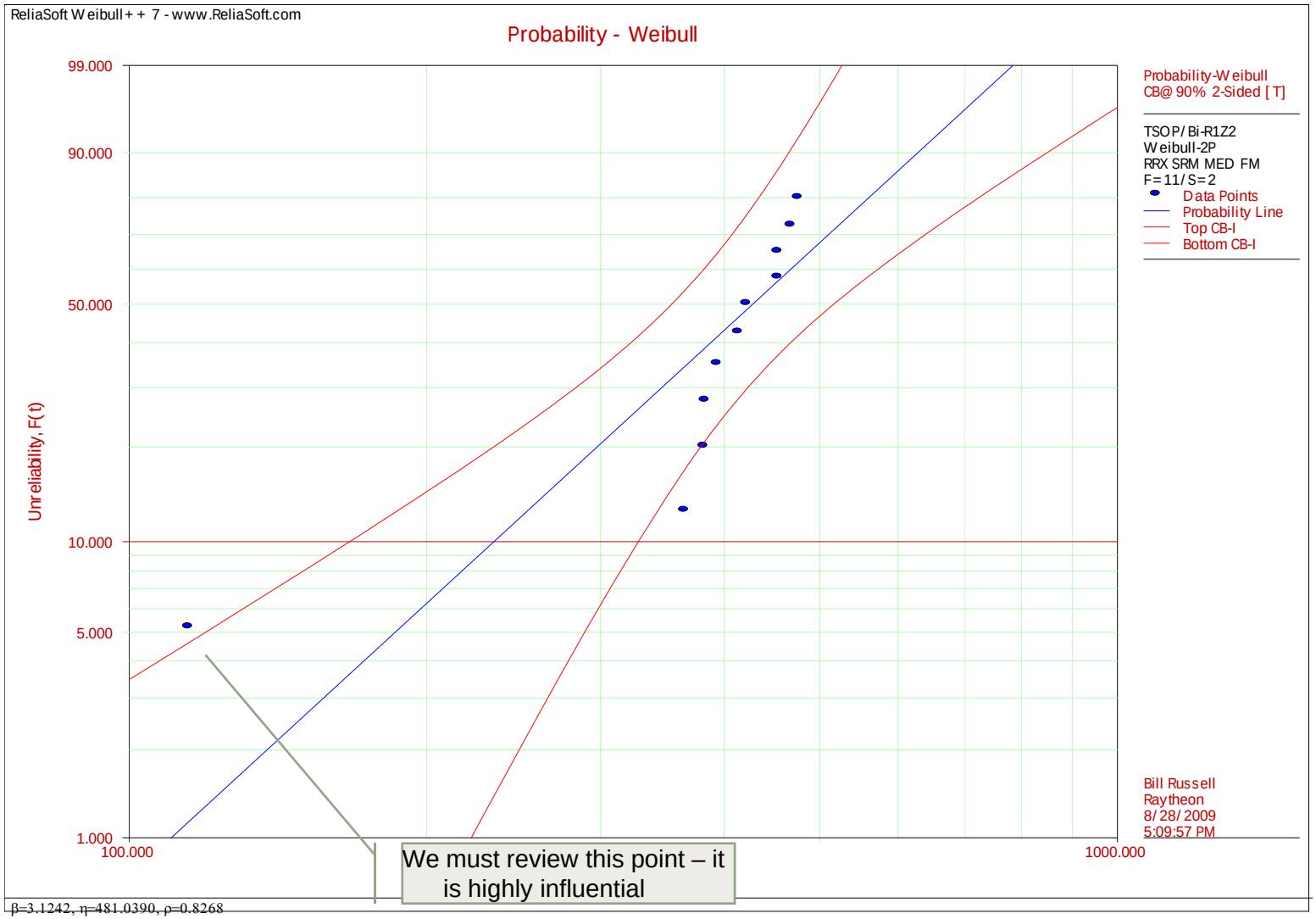
TSOP-50/SnBi – Zone 1, 0 reworks



TSOP-50/SnBi – Zone 1, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN62	12	U24	1	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	167	F		TSOP/Bi-R0Z1
2	SN67	14	U24	1	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	202	F		TSOP/Bi-R0Z1
2	SN61	14	U24	1	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	205	F		TSOP/Bi-R0Z1
2	SN65	14	U24	1	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	231	F		TSOP/Bi-R0Z1
2	SN66	14	U24	1	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	236	F		TSOP/Bi-R0Z1
1	SN79	14	U24	1	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	240	F		TSOP/Bi-R0Z1
1	SN68	16	U24	1	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	255	F		TSOP/Bi-R0Z1
1	SN64	16	U24	1	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	266	F		TSOP/Bi-R0Z1
2	SN63	16	U24	1	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	279	F		TSOP/Bi-R0Z1

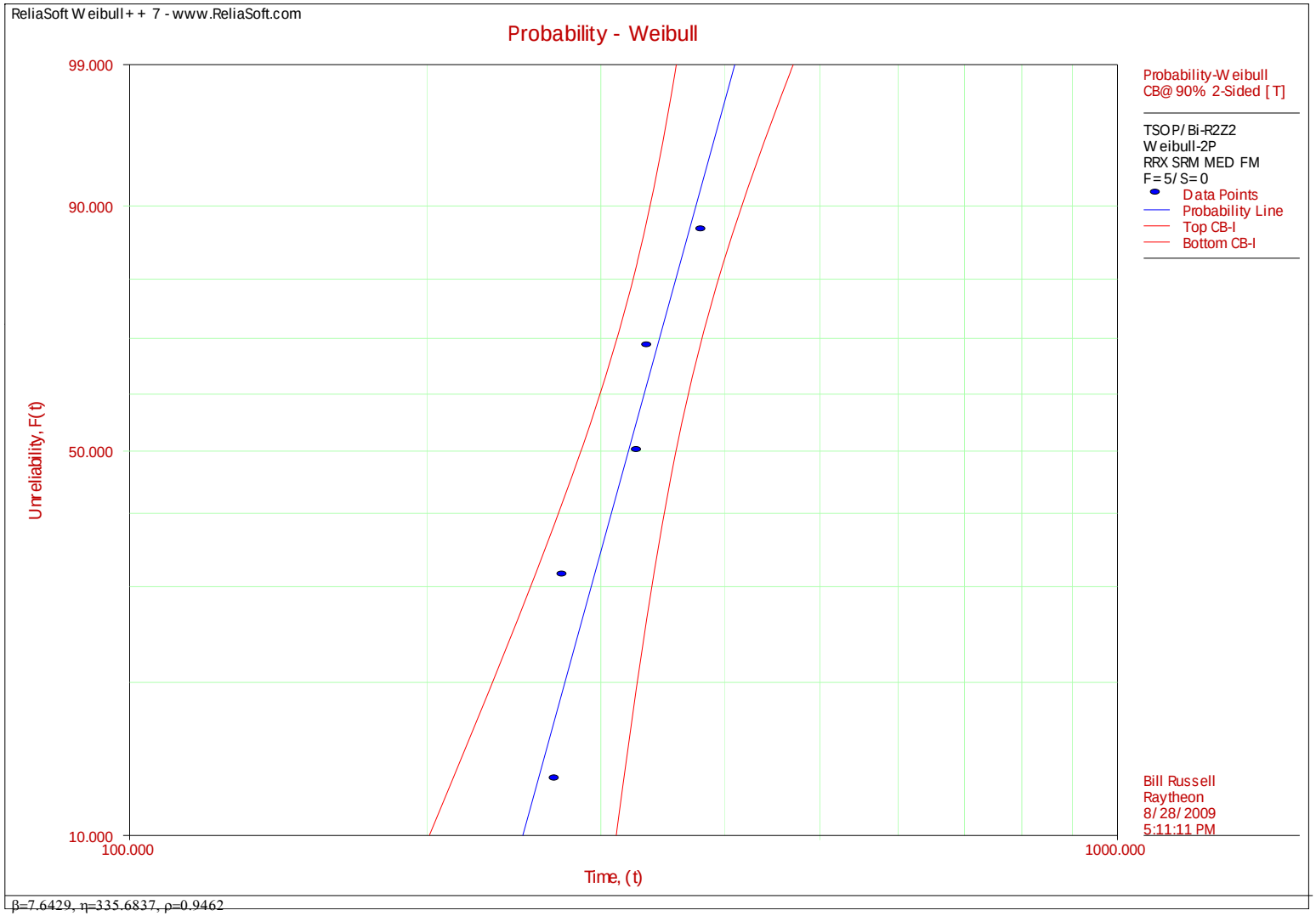
TSOP-50/SnBi – Zone 2, 1 rework



TSOP-50/SnBi – Zone 2, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	10	U62	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	115	F		TSOP/Bi-R1Z2
2	SN61	20	U40	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	365	F		TSOP/Bi-R1Z2
2	SN67	20	U40	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	382	F		TSOP/Bi-R1Z2
2	SN65	20	U40	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	383	F		TSOP/Bi-R1Z2
2	SN63	20	U40	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	394	F		TSOP/Bi-R1Z2
2	SN67	20	U62	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	414	F		TSOP/Bi-R1Z2
2	SN63	28	U62	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	422	F		TSOP/Bi-R1Z2
2	SN66	28	U62	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	454	F		TSOP/Bi-R1Z2
2	SN61	28	U62	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	454	F		TSOP/Bi-R1Z2
1	SN79	28	U62	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	468	F		TSOP/Bi-R1Z2
1	SN64	28	U62	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	476	F		TSOP/Bi-R1Z2
1	SN62	28	U62	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	480	S		TSOP/Bi-R1Z2
1	SN68	28	U62	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	480	S		TSOP/Bi-R1Z2

TSOP-50/SnBi – Zone 2, 2 reworks



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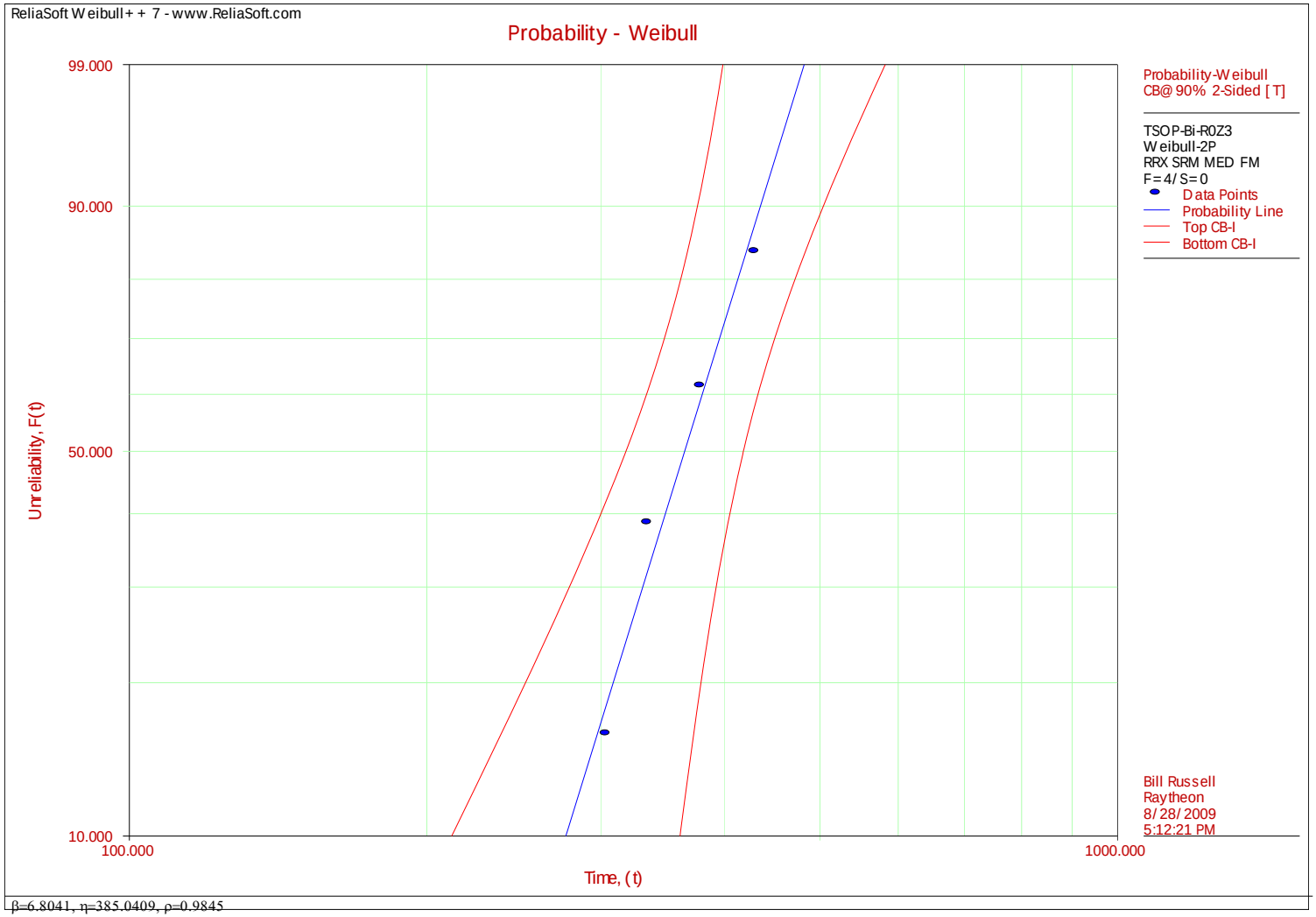
TSOP-50/SnBi – Zone 2, 2 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN66	16	U40	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	2	270	F		TSOP/Bi-R2Z2
1	SN62	16	U40	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	2	275	F		TSOP/Bi-R2Z2
1	SN79	18	U40	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	2	327	F		TSOP/Bi-R2Z2
1	SN64	18	U40	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	2	335	F		TSOP/Bi-R2Z2
1	SN68	20	U40	2	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	2	380	F		TSOP/Bi-R2Z2

TSOP-50/SnBi – Zone 3, 0 reworks



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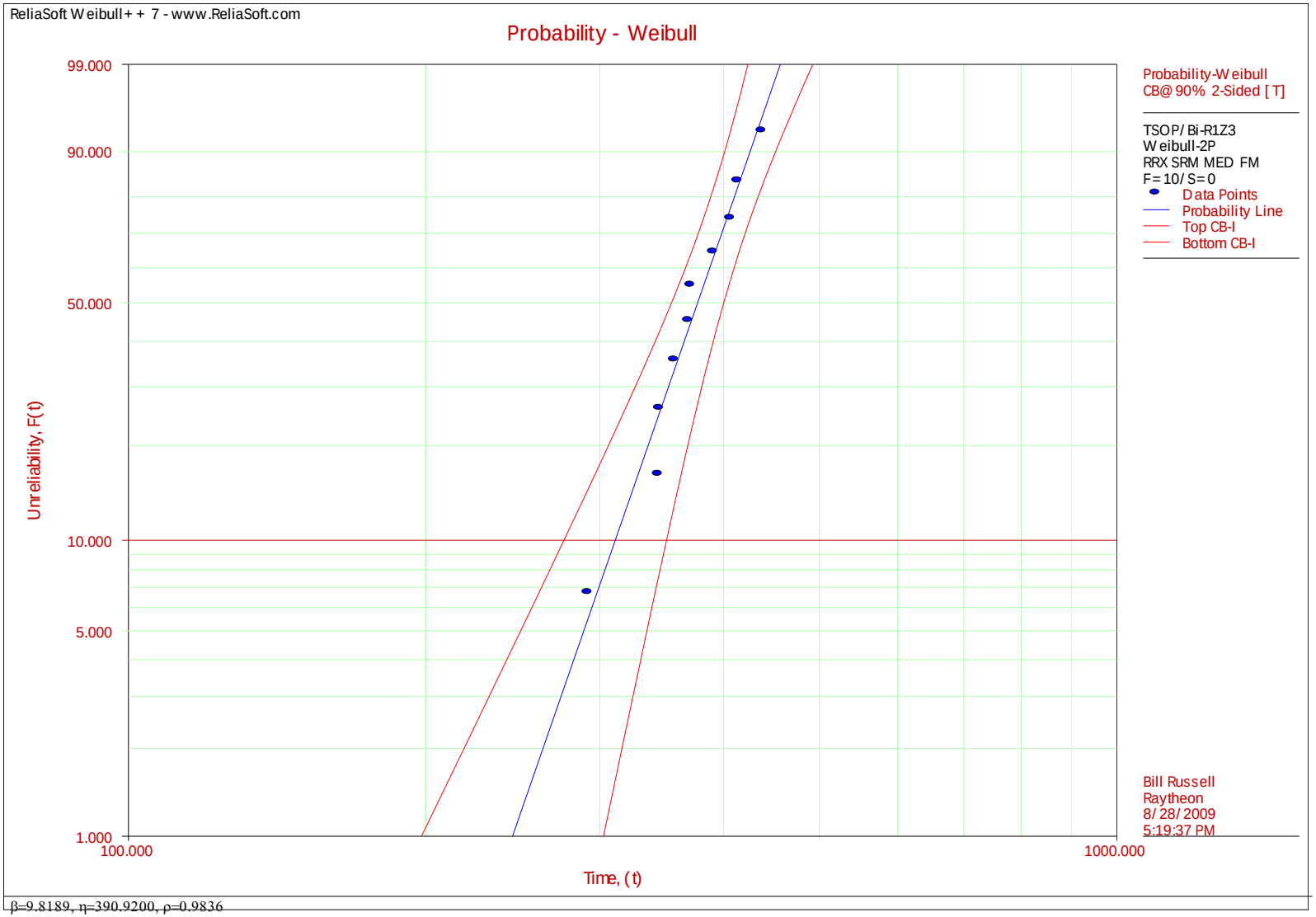
TSOP-50/SnBi – Zone 3, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN67	18	U26	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	304	F		TSOP-Bi-R0Z3
2	SN65	18	U26	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	335	F		TSOP-Bi-R0Z3
2	SN63	20	U26	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	379	F		TSOP-Bi-R0Z3
2	SN61	28	U26	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	0	430	F		TSOP-Bi-R0Z3

TSOP-50/SnBi – Zone 3, 1 rework



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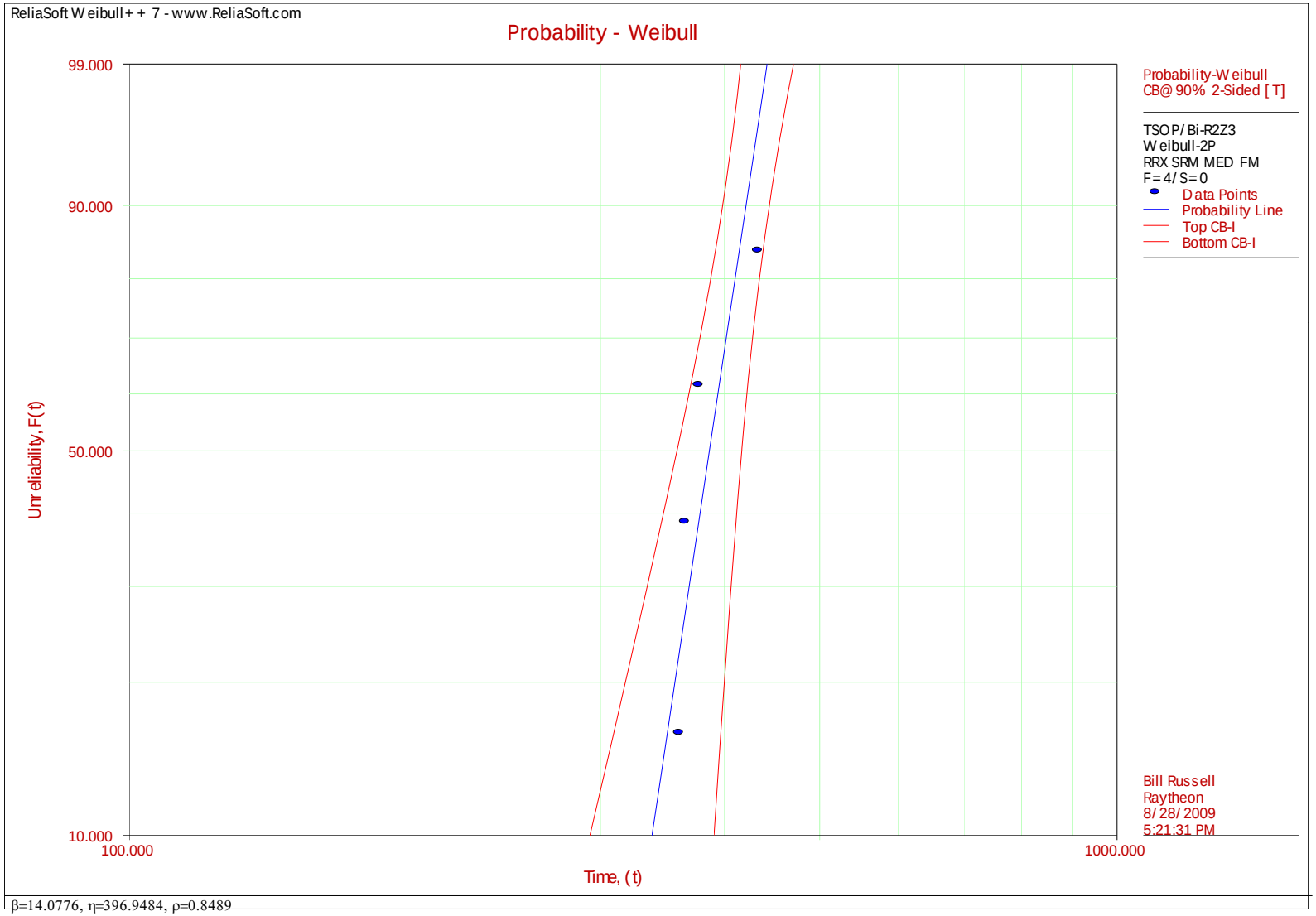
TSOP-50/SnBi – Zone 3, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN68	16	U26	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	292	F		TSOP/Bi-R1Z3
1	SN62	18	U26	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	344	F		TSOP/Bi-R1Z3
1	SN79	18	U16	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	345	F		TSOP/Bi-R1Z3
2	SN66	18	U26	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	357	F		TSOP/Bi-R1Z3
1	SN64	20	U26	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	369	F		TSOP/Bi-R1Z3
1	SN62	20	U16	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	371	F		TSOP/Bi-R1Z3
1	SN64	20	U16	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	391	F		TSOP/Bi-R1Z3
2	SN66	20	U16	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	407	F		TSOP/Bi-R1Z3
1	SN68	20	U16	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	414	F		TSOP/Bi-R1Z3
1	SN79	28	U26	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	1	438	F		TSOP/Bi-R1Z3

TSOP-50/SnBi – Zone 3, 2 reworks



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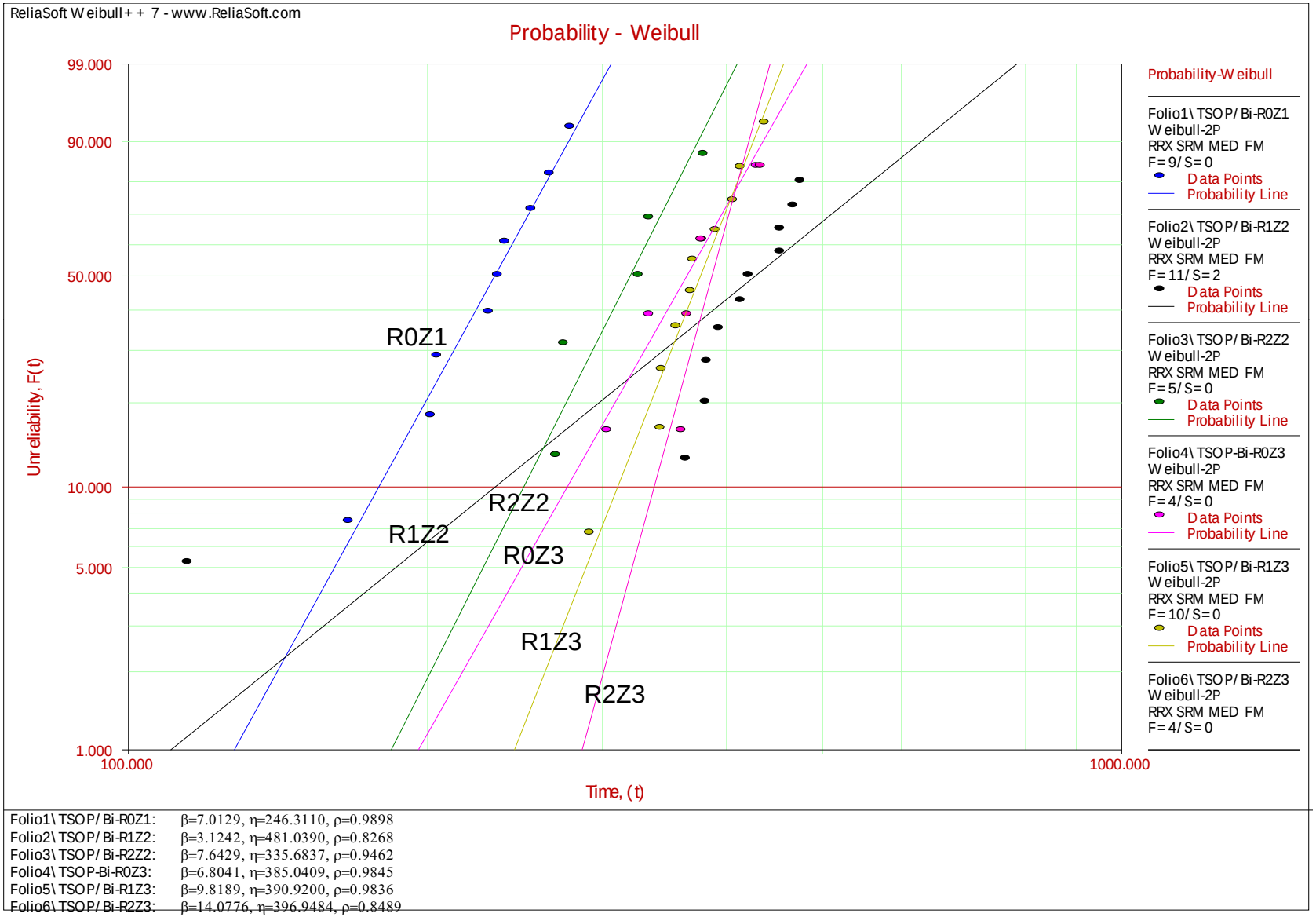
TSOP-50/SnBi – Zone 3, 2 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN61	20	U16	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	2	361	F		TSOP/Bi-R2Z3
2	SN67	20	U16	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	2	366	F		TSOP/Bi-R2Z3
2	SN65	20	U16	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	2	378	F		TSOP/Bi-R2Z3
2	SN63	28	U16	3	TSOP-50	TSOP-50/SnBi	SnBi	SAC305	2	434	F		TSOP/Bi-R2Z3

TSOP-50/SnBi - Multiplot



Raytheon

Weibull Test of Comparison

1 TSOP/Bi-R0Z1	NA					
2 TSOP/Bi-R1Z2	2>1 90%	NA				
3 TSOP/Bi-R2Z2	3>1 91%	2>3 90%	NA			
4 TSOP/Bi-R0Z3	4>1 95%	2>4 66%	4>3 72%	NA		
5 TSOP/Bi-R1Z3	5>1 99%	2>5 63%	5>3 81%	same	NA	
6 TSOP/Bi-R2Z3	6>1 100%	2>6 61%	6>3 88%	6>5 61%	same	NA

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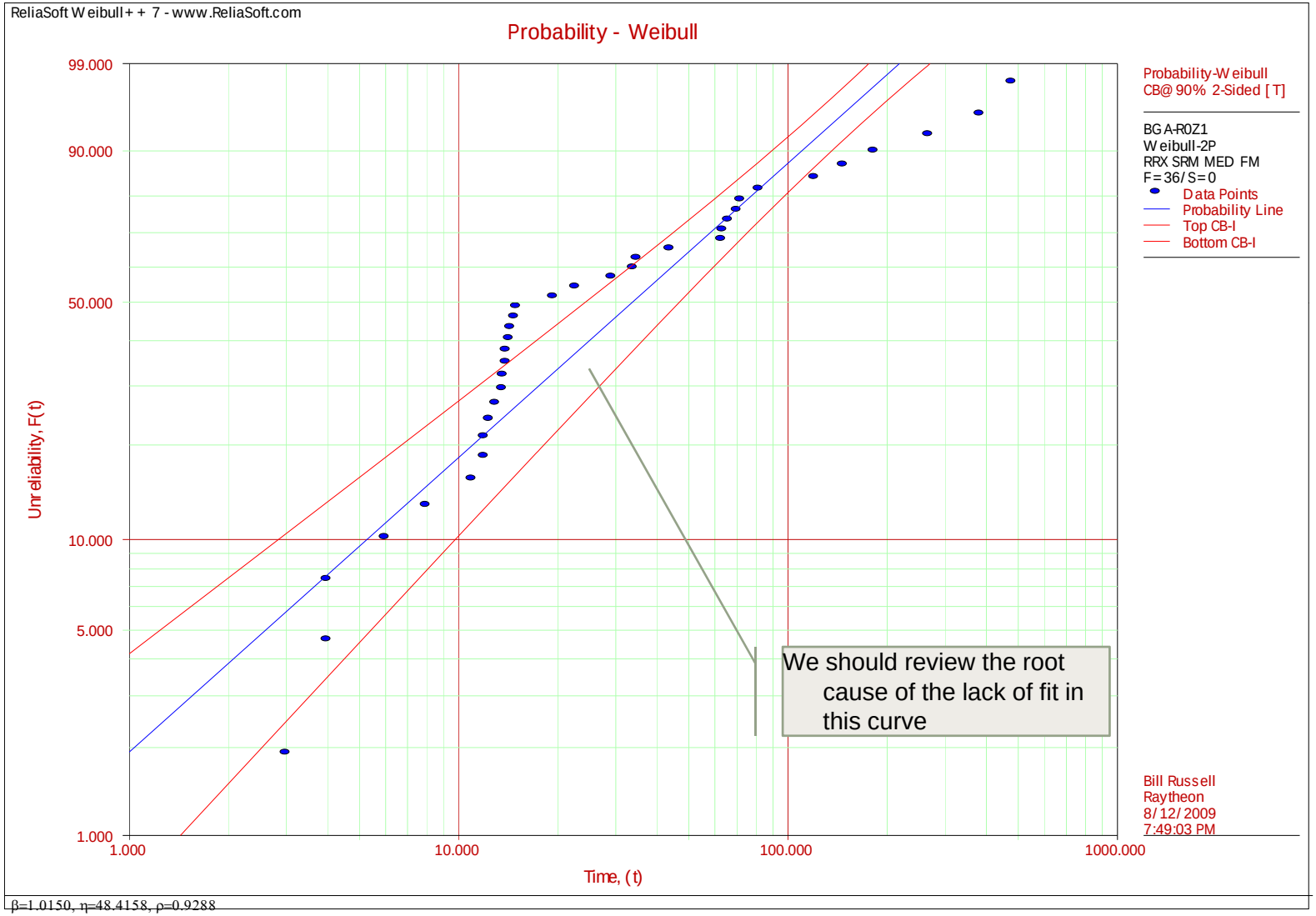
Vibration Analysis

BGA WEIBULL PLOTS

BGA-225 – Zone 1, 0 reworks



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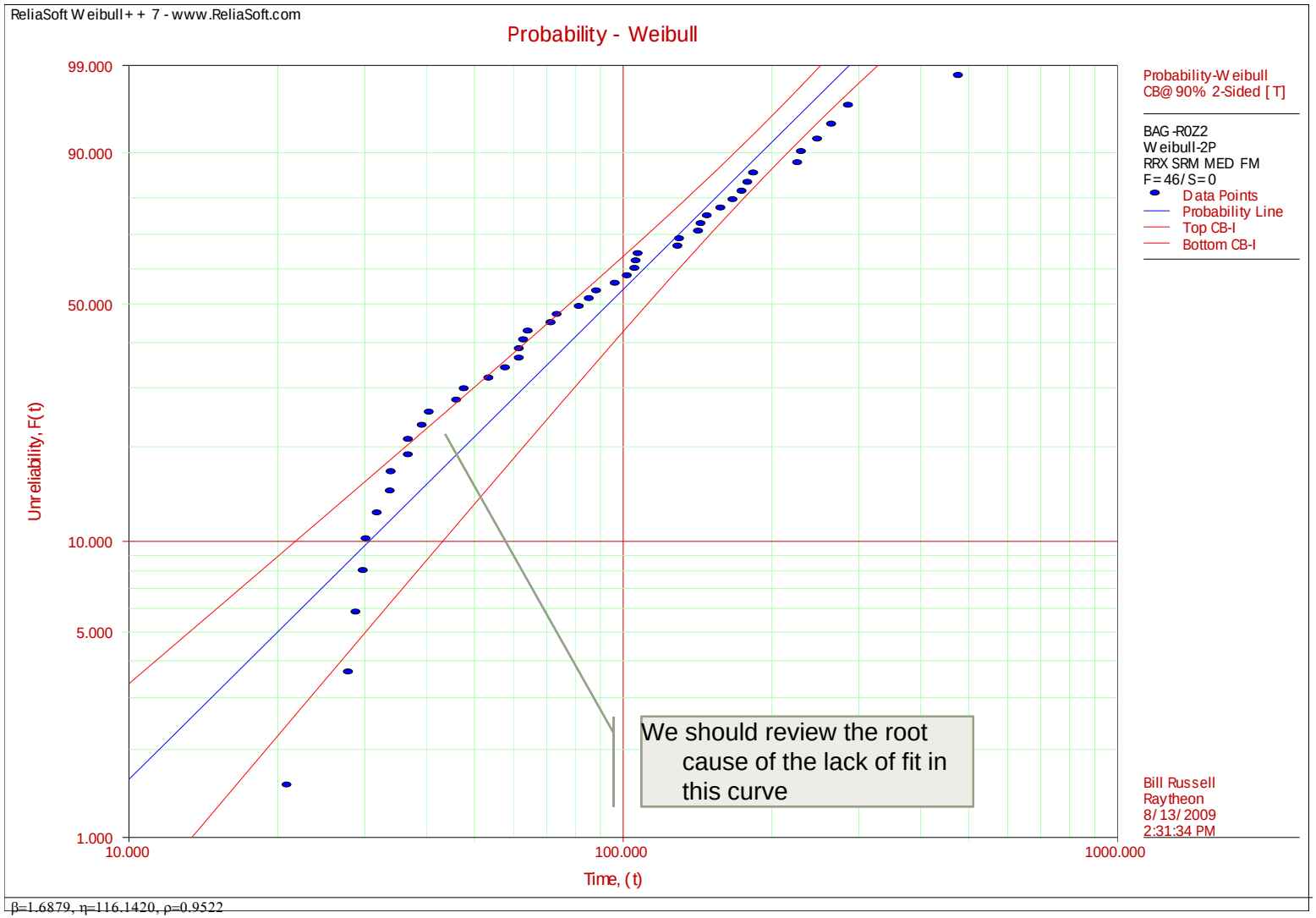
BGA-225 – Zone 1, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	8	U4	1	BGA-225	BGA-225	SAC405	SAC305	0	3	F		BGA-R0Z1
2	SN67	8	U4	1	BGA-225	BGA-225	SAC405	SAC305	0	4	F		BGA-R0Z1
2	SN67	8	U5	1	BGA-225	BGA-225	SAC405	SAC305	0	4	F		BGA-R0Z1
2	SN65	8	U5	1	BGA-225	BGA-225	SAC405	SAC305	0	6	F		BGA-R0Z1
2	SN66	8	U4	1	BGA-225	BGA-225	SAC405	SAC305	0	8	F		BGA-R0Z1
2	SN66	8	U5	1	BGA-225	BGA-225	SAC405	SAC305	0	11	F		BGA-R0Z1
2	SN61	8	U4	1	BGA-225	BGA-225	SAC405	SAC305	0	12	F		BGA-R0Z1
2	SN61	8	U5	1	BGA-225	BGA-225	SAC405	SAC305	0	12	F		BGA-R0Z1
1	SN68	8	U4	1	BGA-225	BGA-225	SAC405	SAC305	0	12	F		BGA-R0Z1
2	SN67	8	U43	1	BGA-225	BGA-225	SAC405	SAC305	0	13	F		BGA-R0Z1
1	SN64	8	U4	1	BGA-225	BGA-225	SAC405	SAC305	0	14	F		BGA-R0Z1
1	SN64	8	U5	1	BGA-225	BGA-225	SAC405	SAC305	0	14	F		BGA-R0Z1
2	SN63	8	U43	1	BGA-225	BGA-225	SAC405	SAC305	0	14	F		BGA-R0Z1
2	SN65	8	U43	1	BGA-225	BGA-225	SAC405	SAC305	0	14	F		BGA-R0Z1
1	SN68	8	U5	1	BGA-225	BGA-225	SAC405	SAC305	0	14	F		BGA-R0Z1
1	SN62	8	U4	1	BGA-225	BGA-225	SAC405	SAC305	0	14	F		BGA-R0Z1
1	SN79	8	U4	1	BGA-225	BGA-225	SAC405	SAC305	0	15	F		BGA-R0Z1
1	SN79	8	U5	1	BGA-225	BGA-225	SAC405	SAC305	0	15	F		BGA-R0Z1
1	SN62	8	U5	1	BGA-225	BGA-225	SAC405	SAC305	0	19	F		BGA-R0Z1
1	SN79	8	U43	1	BGA-225	BGA-225	SAC405	SAC305	0	23	F		BGA-R0Z1
1	SN68	8	U43	1	BGA-225	BGA-225	SAC405	SAC305	0	29	F		BGA-R0Z1
2	SN66	8	U43	1	BGA-225	BGA-225	SAC405	SAC305	0	34	F		BGA-R0Z1
1	SN64	8	U43	1	BGA-225	BGA-225	SAC405	SAC305	0	35	F		BGA-R0Z1
1	SN79	8	U44	1	BGA-225	BGA-225	SAC405	SAC305	0	44	F		BGA-R0Z1
2	SN65	10	U44	1	BGA-225	BGA-225	SAC405	SAC305	0	63	F		BGA-R0Z1
1	SN64	10	U44	1	BGA-225	BGA-225	SAC405	SAC305	0	64	F		BGA-R0Z1
1	SN62	10	U43	1	BGA-225	BGA-225	SAC405	SAC305	0	66	F		BGA-R0Z1
1	SN68	10	U44	1	BGA-225	BGA-225	SAC405	SAC305	0	70	F		BGA-R0Z1
2	SN61	10	U43	1	BGA-225	BGA-225	SAC405	SAC305	0	72	F		BGA-R0Z1
2	SN67	10	U44	1	BGA-225	BGA-225	SAC405	SAC305	0	82	F		BGA-R0Z1
2	SN63	12	U44	1	BGA-225	BGA-225	SAC405	SAC305	0	121	F		BGA-R0Z1
1	SN62	12	U44	1	BGA-225	BGA-225	SAC405	SAC305	0	148	F		BGA-R0Z1
2	SN66	14	U44	1	BGA-225	BGA-225	SAC405	SAC305	0	183	F		BGA-R0Z1
2	SN61	16	U44	1	BGA-225	BGA-225	SAC405	SAC305	0	268	F		BGA-R0Z1
2	SN63	20	U4	1	BGA-225	BGA-225	SAC405	SAC305	0	384	F		BGA-R0Z1
2	SN63	28	U5	1	BGA-225	BGA-225	SAC405	SAC305	0	480	S		BGA-R0Z1

BGA-225, Zone 2, 0 reworks



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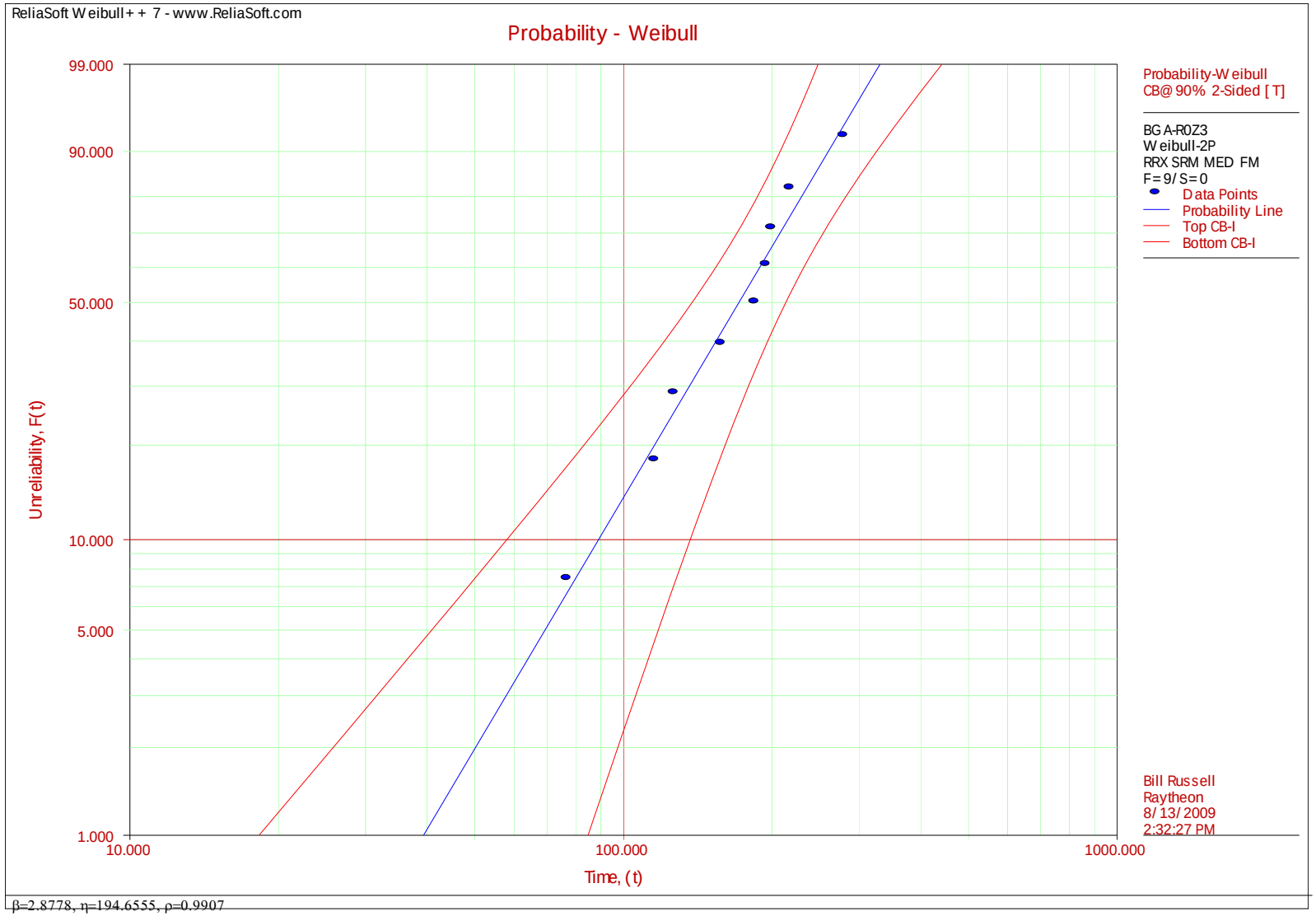
BGA-225, Zone 2, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN64	8	U2	2	BGA-225	BGA-225	SAC405	SAC305	0	21	F		BGA-R0Z2
2	SN65	8	U6	2	BGA-225	BGA-225	SAC405	SAC305	0	28	F		BGA-R0Z2
2	SN67	8	U6	2	BGA-225	BGA-225	SAC405	SAC305	0	29	F		BGA-R0Z2
2	SN61	8	U2	2	BGA-225	BGA-225	SAC405	SAC305	0	30	F		BGA-R0Z2
1	SN68	8	U6	2	BGA-225	BGA-225	SAC405	SAC305	0	30	F		BGA-R0Z2
2	SN66	8	U6	2	BGA-225	BGA-225	SAC405	SAC305	0	32	F		BGA-R0Z2
2	SN67	8	U2	2	BGA-225	BGA-225	SAC405	SAC305	0	34	F		BGA-R0Z2
1	SN64	8	U21	2	BGA-225	BGA-225	SAC405	SAC305	0	34	F		BGA-R0Z2
2	SN65	8	U21	2	BGA-225	BGA-225	SAC405	SAC305	0	37	F		BGA-R0Z2
2	SN67	8	U21	2	BGA-225	BGA-225	SAC405	SAC305	0	37	F		BGA-R0Z2
1	SN64	8	U6	2	BGA-225	BGA-225	SAC405	SAC305	0	39	F		BGA-R0Z2
1	SN79	8	U6	2	BGA-225	BGA-225	SAC405	SAC305	0	41	F		BGA-R0Z2
1	SN68	8	U21	2	BGA-225	BGA-225	SAC405	SAC305	0	46	F		BGA-R0Z2
2	SN65	8	U2	2	BGA-225	BGA-225	SAC405	SAC305	0	48	F		BGA-R0Z2
1	SN62	8	U6	2	BGA-225	BGA-225	SAC405	SAC305	0	54	F		BGA-R0Z2
1	SN62	8	U2	2	BGA-225	BGA-225	SAC405	SAC305	0	58	F		BGA-R0Z2
1	SN79	10	U21	2	BGA-225	BGA-225	SAC405	SAC305	0	62	F		BGA-R0Z2
1	SN68	10	U2	2	BGA-225	BGA-225	SAC405	SAC305	0	62	F		BGA-R0Z2
1	SN64	10	U18	2	BGA-225	BGA-225	SAC405	SAC305	0	63	F		BGA-R0Z2
1	SN79	10	U2	2	BGA-225	BGA-225	SAC405	SAC305	0	65	F		BGA-R0Z2
2	SN63	10	U6	2	BGA-225	BGA-225	SAC405	SAC305	0	72	F		BGA-R0Z2
2	SN63	10	U2	2	BGA-225	BGA-225	SAC405	SAC305	0	74	F		BGA-R0Z2
2	SN61	10	U6	2	BGA-225	BGA-225	SAC405	SAC305	0	82	F		BGA-R0Z2
2	SN66	10	U21	2	BGA-225	BGA-225	SAC405	SAC305	0	86	F		BGA-R0Z2
2	SN61	10	U18	2	BGA-225	BGA-225	SAC405	SAC305	0	89	F		BGA-R0Z2
2	SN67	10	U18	2	BGA-225	BGA-225	SAC405	SAC305	0	97	F		BGA-R0Z2
1	SN62	10	U21	2	BGA-225	BGA-225	SAC405	SAC305	0	103	F		BGA-R0Z2
1	SN79	10	U18	2	BGA-225	BGA-225	SAC405	SAC305	0	106	F		BGA-R0Z2
2	SN63	10	U21	2	BGA-225	BGA-225	SAC405	SAC305	0	107	F		BGA-R0Z2
2	SN65	10	U18	2	BGA-225	BGA-225	SAC405	SAC305	0	108	F		BGA-R0Z2
2	SN66	12	U2	2	BGA-225	BGA-225	SAC405	SAC305	0	130	F		BGA-R0Z2
1	SN68	12	U18	2	BGA-225	BGA-225	SAC405	SAC305	0	131	F		BGA-R0Z2
1	SN79	12	U56	2	BGA-225	BGA-225	SAC405	SAC305	0	143	F		BGA-R0Z2
1	SN62	12	U18	2	BGA-225	BGA-225	SAC405	SAC305	0	145	F		BGA-R0Z2
2	SN66	12	U18	2	BGA-225	BGA-225	SAC405	SAC305	0	149	F		BGA-R0Z2
1	SN64	12	U56	2	BGA-225	BGA-225	SAC405	SAC305	0	159	F		BGA-R0Z2
2	SN61	12	U21	2	BGA-225	BGA-225	SAC405	SAC305	0	168	F		BGA-R0Z2
1	SN68	12	U56	2	BGA-225	BGA-225	SAC405	SAC305	0	175	F		BGA-R0Z2
2	SN65	12	U56	2	BGA-225	BGA-225	SAC405	SAC305	0	180	F		BGA-R0Z2
2	SN67	14	U56	2	BGA-225	BGA-225	SAC405	SAC305	0	185	F		BGA-R0Z2
2	SN61	14	U56	2	BGA-225	BGA-225	SAC405	SAC305	0	227	F		BGA-R0Z2
2	SN63	14	U18	2	BGA-225	BGA-225	SAC405	SAC305	0	231	F		BGA-R0Z2
2	SN66	16	U56	2	BGA-225	BGA-225	SAC405	SAC305	0	249	F		BGA-R0Z2
2	SN63	16	U56	2	BGA-225	BGA-225	SAC405	SAC305	0	266	F		BGA-R0Z2
1	SN62	16	U56	2	BGA-225	BGA-225	SAC405	SAC305	0	288	F		BGA-R0Z2

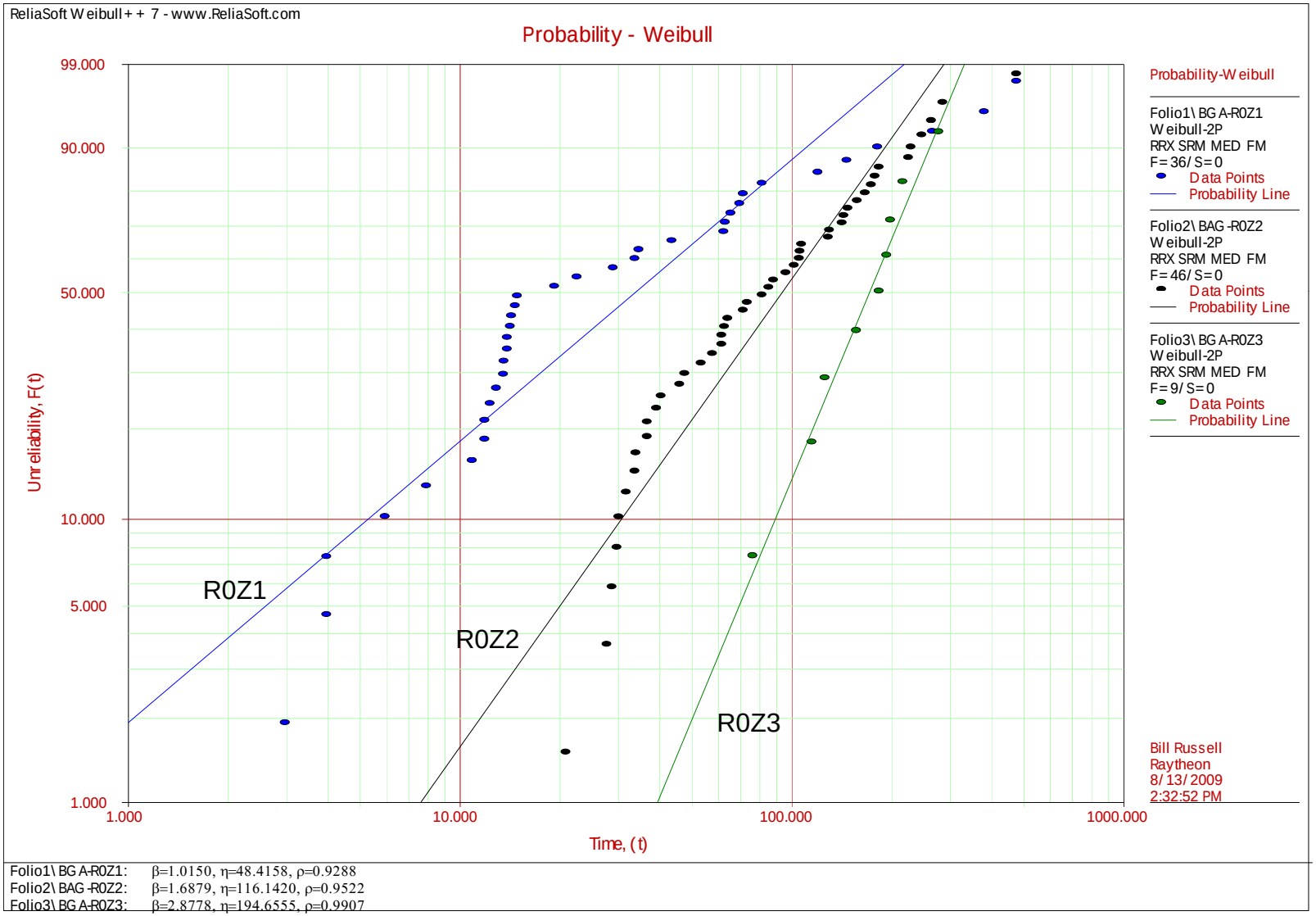
BGA-225 – Zone 3, 0 Reworks



BGA-225 – Zone 3, 0 Reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN67	10	U55	3	BGA-225	BGA-225	SAC405	SAC305	0	77	F		BGA-R0Z3
1	SN79	10	U55	3	BGA-225	BGA-225	SAC405	SAC305	0	116	F		BGA-R0Z3
2	SN65	12	U55	3	BGA-225	BGA-225	SAC405	SAC305	0	127	F		BGA-R0Z3
1	SN62	12	U55	3	BGA-225	BGA-225	SAC405	SAC305	0	158	F		BGA-R0Z3
1	SN68	14	U55	3	BGA-225	BGA-225	SAC405	SAC305	0	185	F		BGA-R0Z3
2	SN61	14	U55	3	BGA-225	BGA-225	SAC405	SAC305	0	195	F		BGA-R0Z3
2	SN63	14	U55	3	BGA-225	BGA-225	SAC405	SAC305	0	200	F		BGA-R0Z3
1	SN64	14	U55	3	BGA-225	BGA-225	SAC405	SAC305	0	218	F		BGA-R0Z3
2	SN66	16	U55	3	BGA-225	BGA-225	SAC405	SAC305	0	280	F		BGA-R0Z3

BGA-225 - Multiplot



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Weibull Test of Comparison

1 BGA-R0Z1	NA		
2 BAG-R0Z2	2>1 79%	NA	
3 BGA-R0Z3	3>1 94%	3>2 78%	NA

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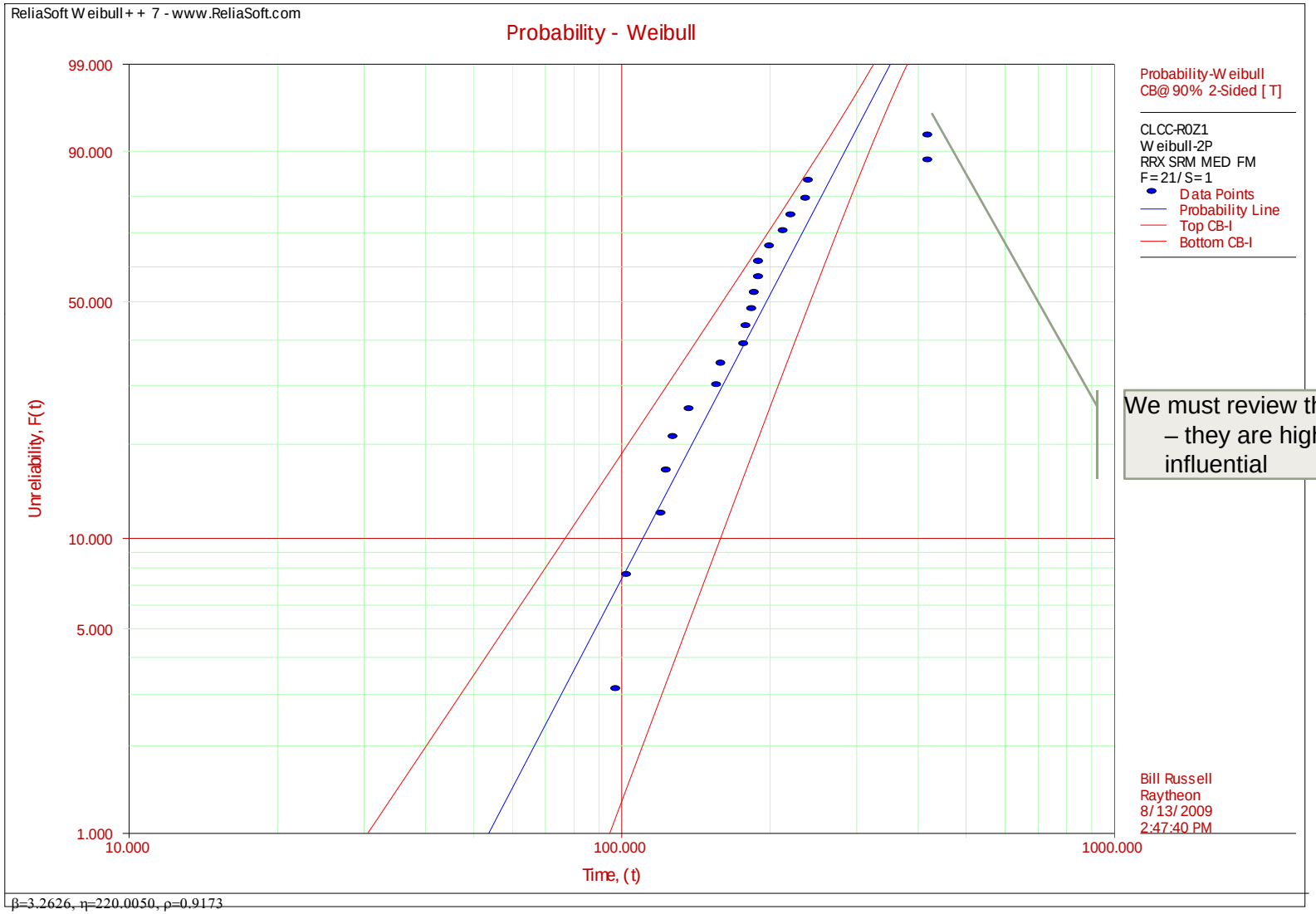
Vibration Analysis

CLCC WEIBULL PLOTS

CLCC – Zone 1, 0 reworks



We must review these points – they are highly influential

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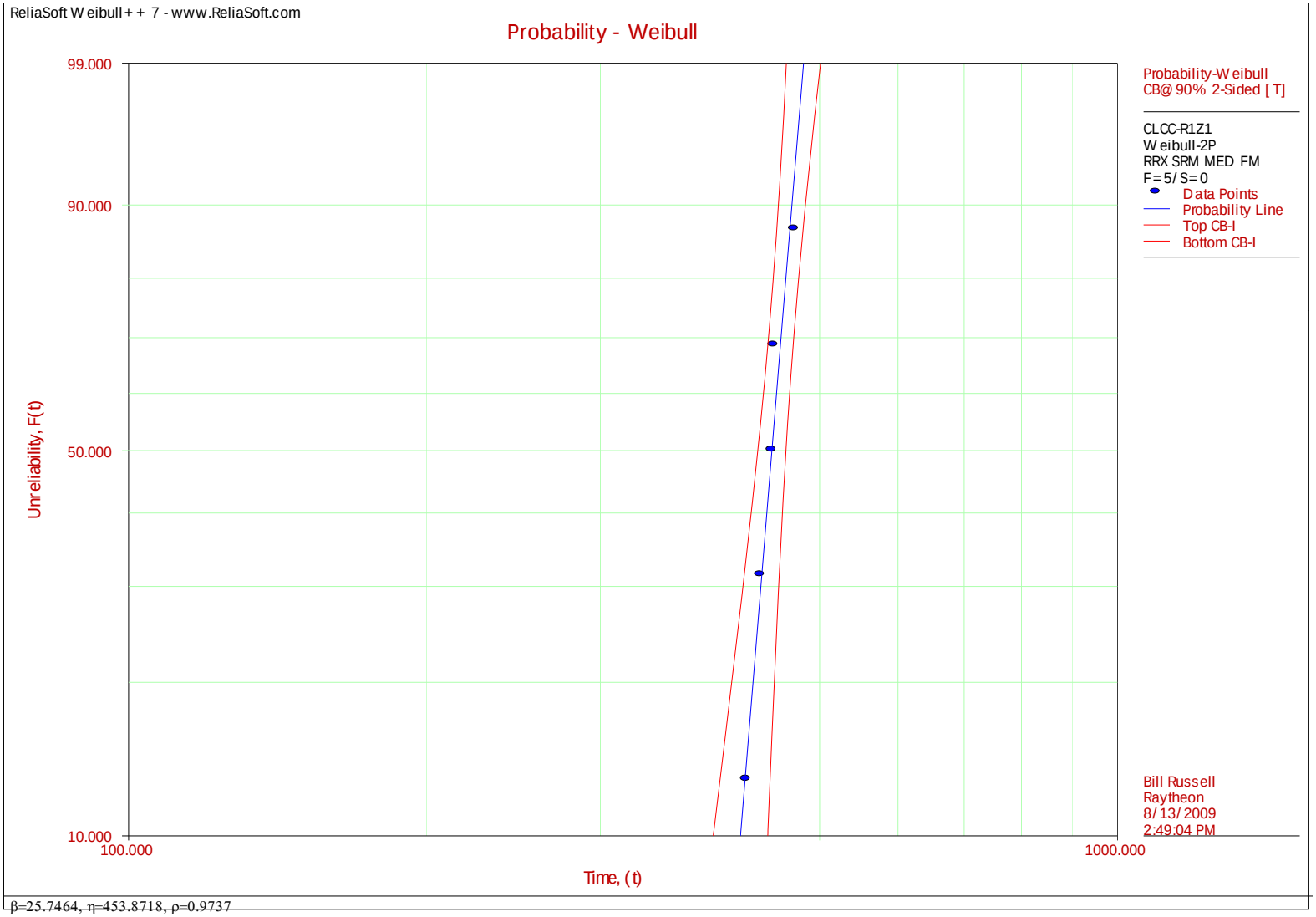
CLCC – Zone 1, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	10	U14	1	CLCC-20	CLCC-20	SAC305	SAC305	0	98	F		CLCC-R0Z1
2	SN67	10	U14	1	CLCC-20	CLCC-20	SAC305	SAC305	0	103	F		CLCC-R0Z1
2	SN65	12	U52	1	CLCC-20	CLCC-20	SAC305	SAC305	0	121	F		CLCC-R0Z1
1	SN79	12	U14	1	CLCC-20	CLCC-20	SAC305	SAC305	0	124	F		CLCC-R0Z1
1	SN79	12	U13	1	CLCC-20	CLCC-20	SAC305	SAC305	0	128	F		CLCC-R0Z1
2	SN67	12	U13	1	CLCC-20	CLCC-20	SAC305	SAC305	0	138	F		CLCC-R0Z1
1	SN68	12	U13	1	CLCC-20	CLCC-20	SAC305	SAC305	0	157	F		CLCC-R0Z1
2	SN65	12	U13	1	CLCC-20	CLCC-20	SAC305	SAC305	0	160	F		CLCC-R0Z1
1	SN68	12	U14	1	CLCC-20	CLCC-20	SAC305	SAC305	0	178	F		CLCC-R0Z1
1	SN62	12	U14	1	CLCC-20	CLCC-20	SAC305	SAC305	0	180	F		CLCC-R0Z1
2	SN61	14	U13	1	CLCC-20	CLCC-20	SAC305	SAC305	0	185	F		CLCC-R0Z1
1	SN64	14	U13	1	CLCC-20	CLCC-20	SAC305	SAC305	0	187	F		CLCC-R0Z1
1	SN62	14	U13	1	CLCC-20	CLCC-20	SAC305	SAC305	0	191	F		CLCC-R0Z1
1	SN64	14	U14	1	CLCC-20	CLCC-20	SAC305	SAC305	0	191	F		CLCC-R0Z1
2	SN61	14	U14	1	CLCC-20	CLCC-20	SAC305	SAC305	0	201	F		CLCC-R0Z1
2	SN63	14	U13	1	CLCC-20	CLCC-20	SAC305	SAC305	0	214	F		CLCC-R0Z1
2	SN66	14	U13	1	CLCC-20	CLCC-20	SAC305	SAC305	0	222	F		CLCC-R0Z1
2	SN63	14	U14	1	CLCC-20	CLCC-20	SAC305	SAC305	0	238	F		CLCC-R0Z1
2	SN66	16	U14	1	CLCC-20	CLCC-20	SAC305	SAC305	0	241	F		CLCC-R0Z1
2	SN63	28	U52	1	CLCC-20	CLCC-20	SAC305	SAC305	0	421	F		CLCC-R0Z1
2	SN67	28	U52	1	CLCC-20	CLCC-20	SAC305	SAC305	0	421	F		CLCC-R0Z1
2	SN61	28	U52	1	CLCC-20	CLCC-20	SAC305	SAC305	0	480	S		CLCC-R0Z1

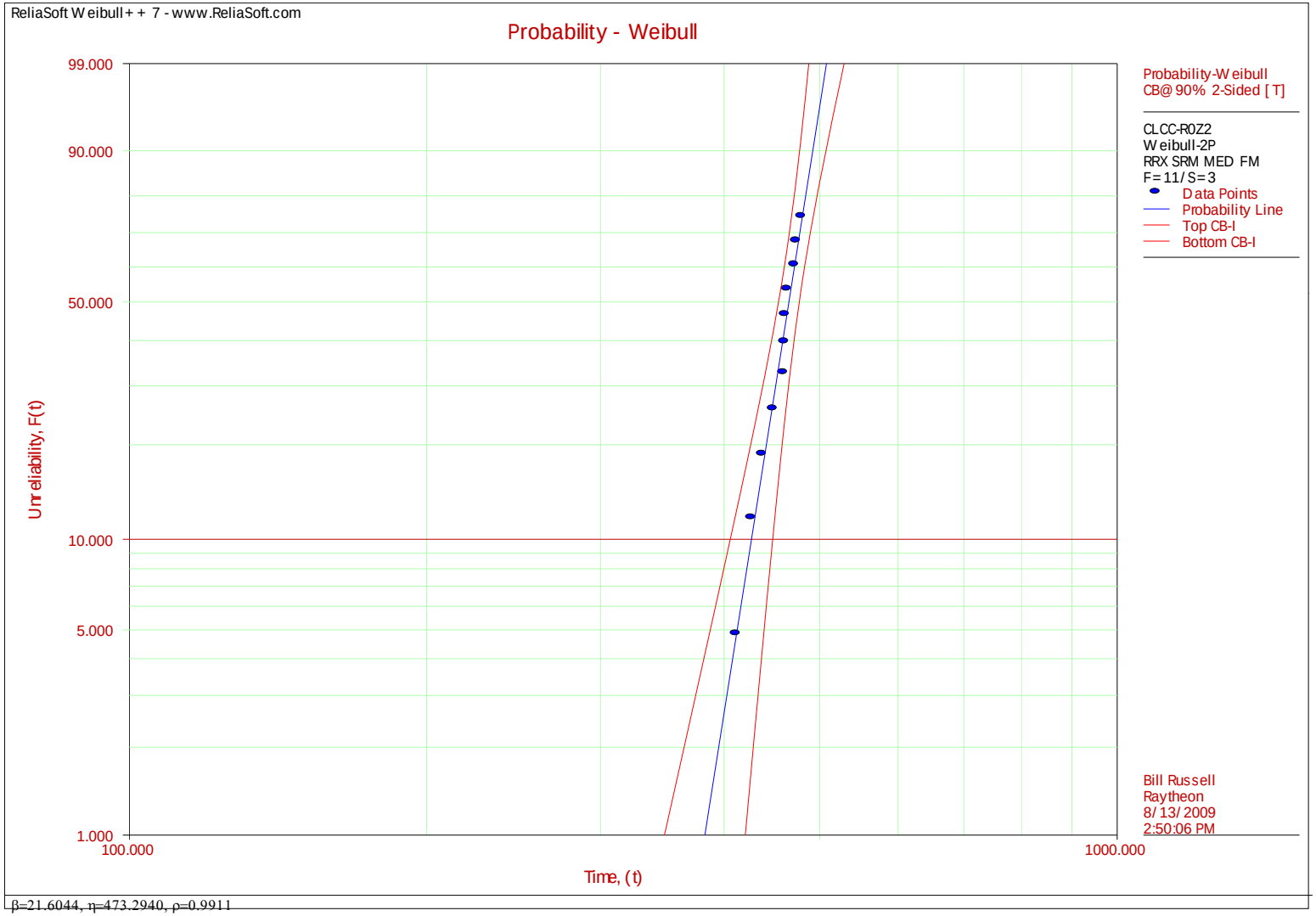
CLCC – Zone 1, 1 rework



CLCC – Zone 1, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN68	28	U52	1	CLCC-20	CLCC-20	SAC305	SAC305	1	422	F		CLCC-R1Z1
1	SN62	28	U52	1	CLCC-20	CLCC-20	SAC305	SAC305	1	436	F		CLCC-R1Z1
1	SN79	28	U52	1	CLCC-20	CLCC-20	SAC305	SAC305	1	448	F		CLCC-R1Z1
1	SN64	28	U52	1	CLCC-20	CLCC-20	SAC305	SAC305	1	450	F		CLCC-R1Z1
2	SN66	28	U52	1	CLCC-20	CLCC-20	SAC305	SAC305	1	472	F		CLCC-R1Z1

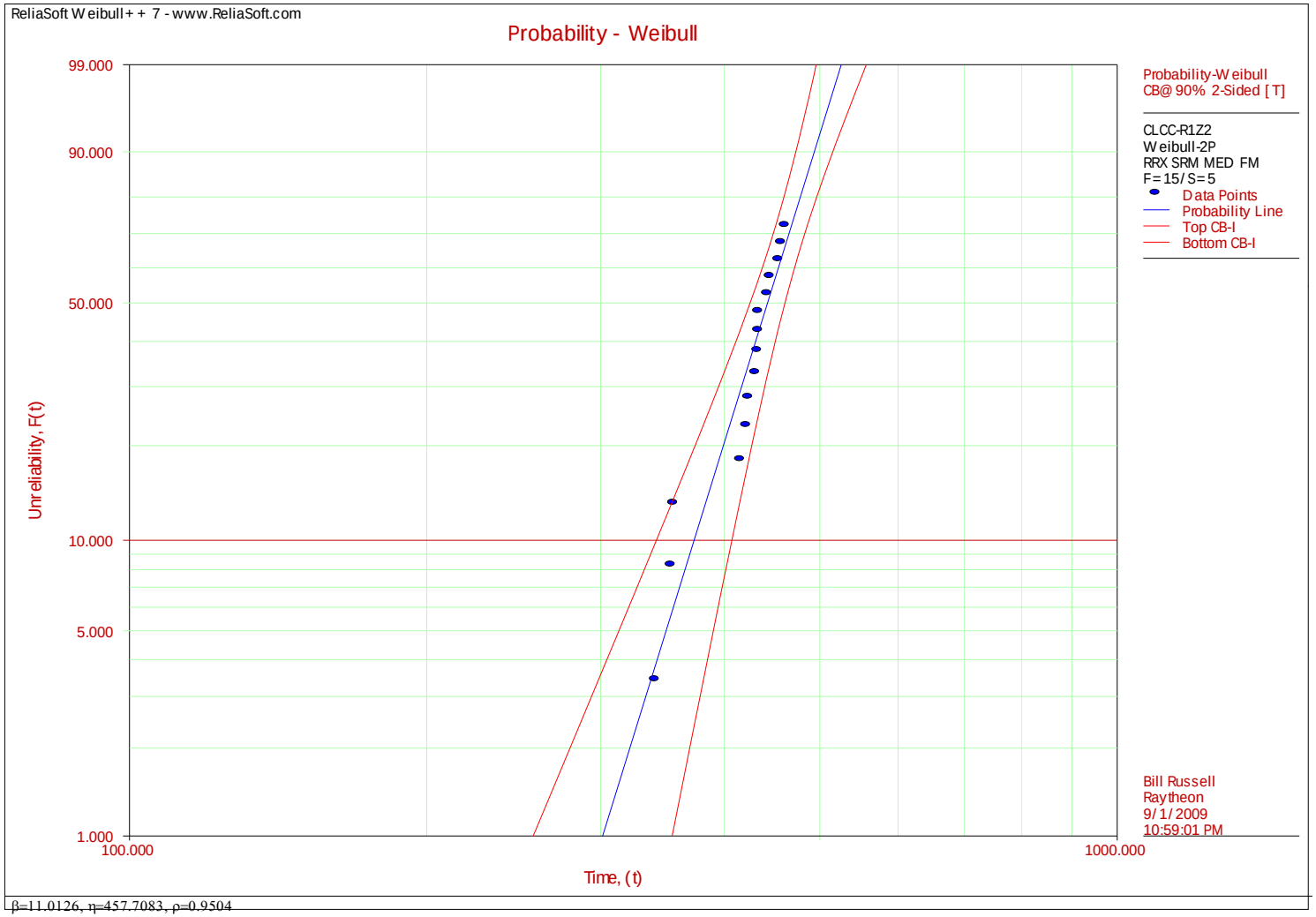
CLCC – Zone 2, 0 reworks



CLCC – Zone 2, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN79	20	U46	2	CLCC-20	CLCC-20	SAC305	SAC305	0	412	F		CLCC-R0Z2
2	SN67	28	U45	2	CLCC-20	CLCC-20	SAC305	SAC305	0	427	F		CLCC-R0Z2
2	SN66	28	U46	2	CLCC-20	CLCC-20	SAC305	SAC305	0	438	F		CLCC-R0Z2
2	SN66	28	U53	2	CLCC-20	CLCC-20	SAC305	SAC305	0	449	F		CLCC-R0Z2
1	SN64	28	U53	2	CLCC-20	CLCC-20	SAC305	SAC305	0	460	F		CLCC-R0Z2
1	SN68	28	U46	2	CLCC-20	CLCC-20	SAC305	SAC305	0	461	F		CLCC-R0Z2
1	SN68	28	U53	2	CLCC-20	CLCC-20	SAC305	SAC305	0	462	F		CLCC-R0Z2
1	SN62	28	U46	2	CLCC-20	CLCC-20	SAC305	SAC305	0	464	F		CLCC-R0Z2
2	SN65	28	U45	2	CLCC-20	CLCC-20	SAC305	SAC305	0	472	F		CLCC-R0Z2
1	SN79	28	U53	2	CLCC-20	CLCC-20	SAC305	SAC305	0	474	F		CLCC-R0Z2
1	SN64	28	U46	2	CLCC-20	CLCC-20	SAC305	SAC305	0	480	S		CLCC-R0Z2
1	SN62	28	U53	2	CLCC-20	CLCC-20	SAC305	SAC305	0	480	S		CLCC-R0Z2
2	SN61	28	U45	2	CLCC-20	CLCC-20	SAC305	SAC305	0	480	S		CLCC-R0Z2
2	SN63	28	U45	2	CLCC-20	CLCC-20	SAC305	SAC305	0	480	S		CLCC-R0Z2

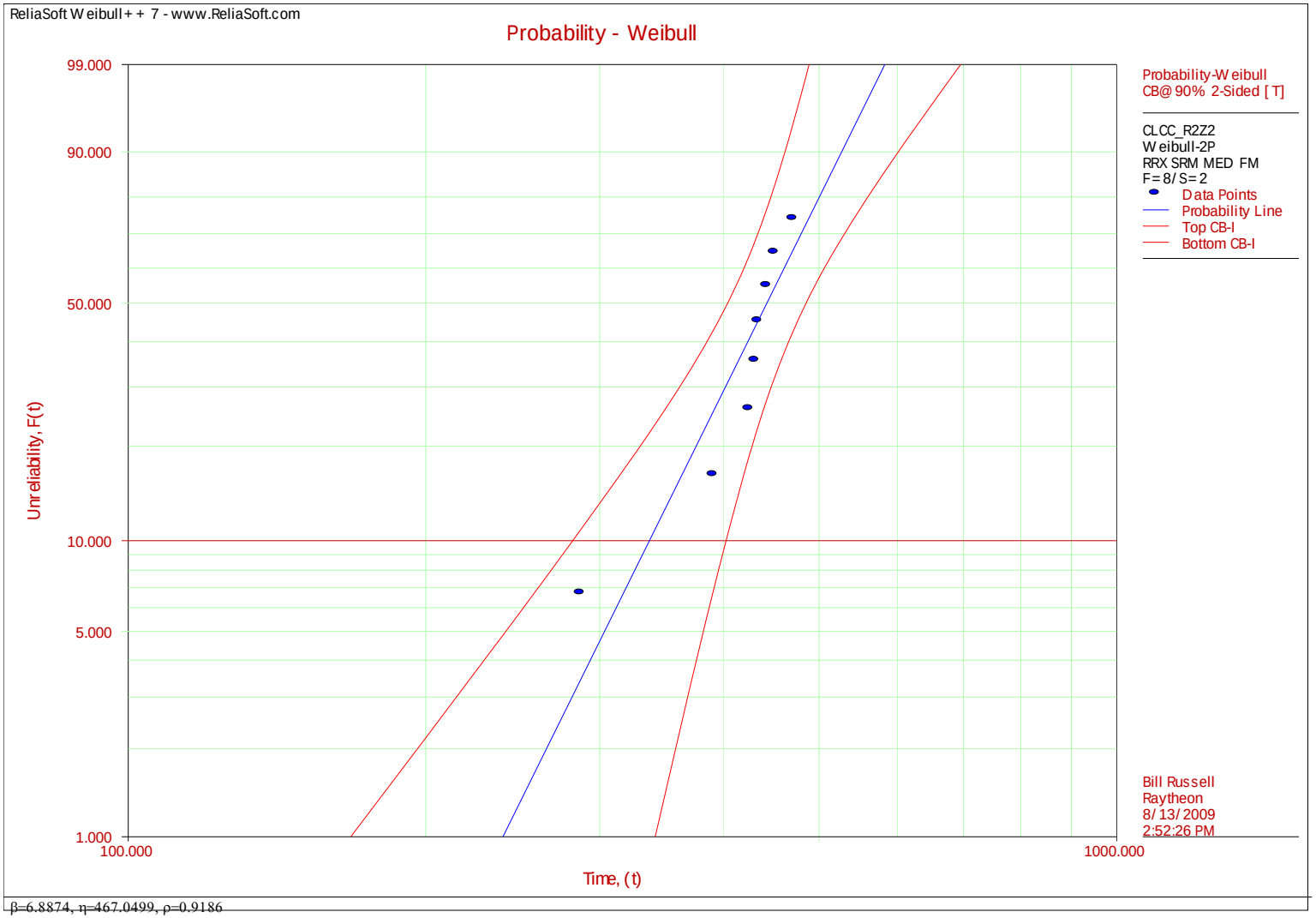
CLCC – Zone 2, 1 rework



CLCC – Zone 2, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN67	18	U10	2	CLCC-20	CLCC-20	SAC305	SAC305	1	341	F		CLCC-R1Z2
2	SN61	18	U46	2	CLCC-20	CLCC-20	SAC305	SAC305	1	354	F		CLCC-R1Z2
2	SN67	18	U22	2	CLCC-20	CLCC-20	SAC305	SAC305	1	356	F		CLCC-R1Z2
1	SN79	20	U45	2	CLCC-20	CLCC-20	SAC305	SAC305	1	416	F		CLCC-R1Z2
2	SN63	28	U53	2	CLCC-20	CLCC-20	SAC305	SAC305	1	422	F		CLCC-R1Z2
2	SN65	28	U10	2	CLCC-20	CLCC-20	SAC305	SAC305	1	424	F		CLCC-R1Z2
2	SN61	28	U10	2	CLCC-20	CLCC-20	SAC305	SAC305	1	431	F		CLCC-R1Z2
2	SN67	28	U46	2	CLCC-20	CLCC-20	SAC305	SAC305	1	433	F		CLCC-R1Z2
2	SN63	28	U22	2	CLCC-20	CLCC-20	SAC305	SAC305	1	434	F		CLCC-R1Z2
2	SN65	28	U22	2	CLCC-20	CLCC-20	SAC305	SAC305	1	434	F		CLCC-R1Z2
2	SN67	28	U53	2	CLCC-20	CLCC-20	SAC305	SAC305	1	443	F		CLCC-R1Z2
2	SN66	28	U45	2	CLCC-20	CLCC-20	SAC305	SAC305	1	446	F		CLCC-R1Z2
2	SN65	28	U46	2	CLCC-20	CLCC-20	SAC305	SAC305	1	455	F		CLCC-R1Z2
2	SN61	28	U22	2	CLCC-20	CLCC-20	SAC305	SAC305	1	458	F		CLCC-R1Z2
1	SN62	28	U45	2	CLCC-20	CLCC-20	SAC305	SAC305	1	462	F		CLCC-R1Z2
1	SN64	28	U45	2	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z2
1	SN68	28	U45	2	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z2
2	SN63	28	U46	2	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z2
2	SN61	28	U53	2	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z2
2	SN65	28	U53	2	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z2

CLCC – Zone 2, 2 reworks



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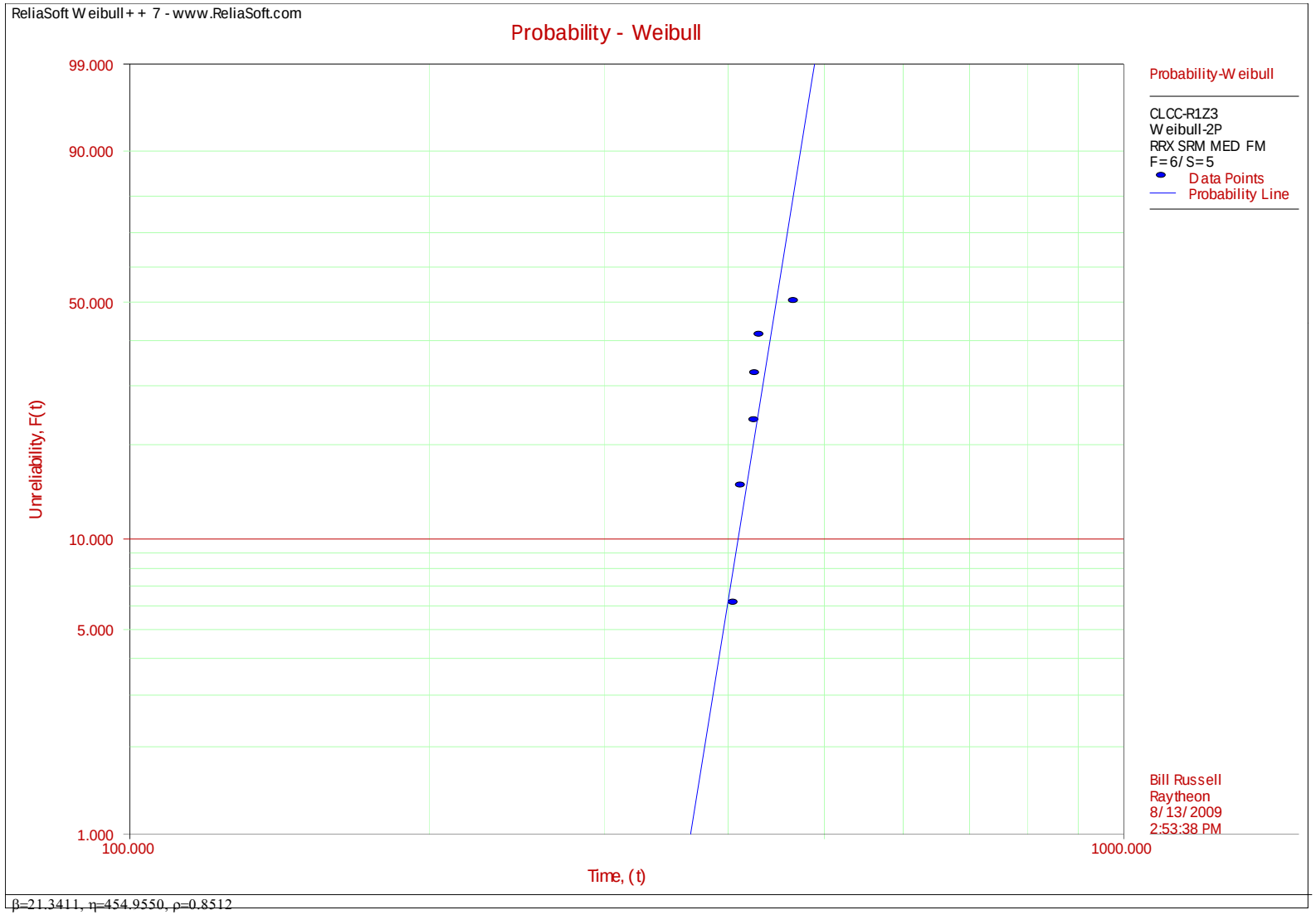
CLCC – Zone 2, 2 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN79	16	U10	2	CLCC-20	CLCC-20	SAC305	SAC305	2	287	F		CLCCR2Z2
1	SN64	20	U22	2	CLCC-20	CLCC-20	SAC305	SAC305	2	391	F		CLCCR2Z2
2	SN66	28	U10	2	CLCC-20	CLCC-20	SAC305	SAC305	2	425	F		CLCCR2Z2
1	SN62	28	U10	2	CLCC-20	CLCC-20	SAC305	SAC305	2	431	F		CLCCR2Z2
1	SN79	28	U22	2	CLCC-20	CLCC-20	SAC305	SAC305	2	434	F		CLCCR2Z2
2	SN66	28	U22	2	CLCC-20	CLCC-20	SAC305	SAC305	2	443	F		CLCCR2Z2
1	SN64	28	U10	2	CLCC-20	CLCC-20	SAC305	SAC305	2	451	F		CLCCR2Z2
1	SN68	28	U10	2	CLCC-20	CLCC-20	SAC305	SAC305	2	471	F		CLCCR2Z2
1	SN62	28	U22	2	CLCC-20	CLCC-20	SAC305	SAC305	2	480	S		CLCCR2Z2
1	SN68	28	U22	2	CLCC-20	CLCC-20	SAC305	SAC305	2	480	S		CLCCR2Z2

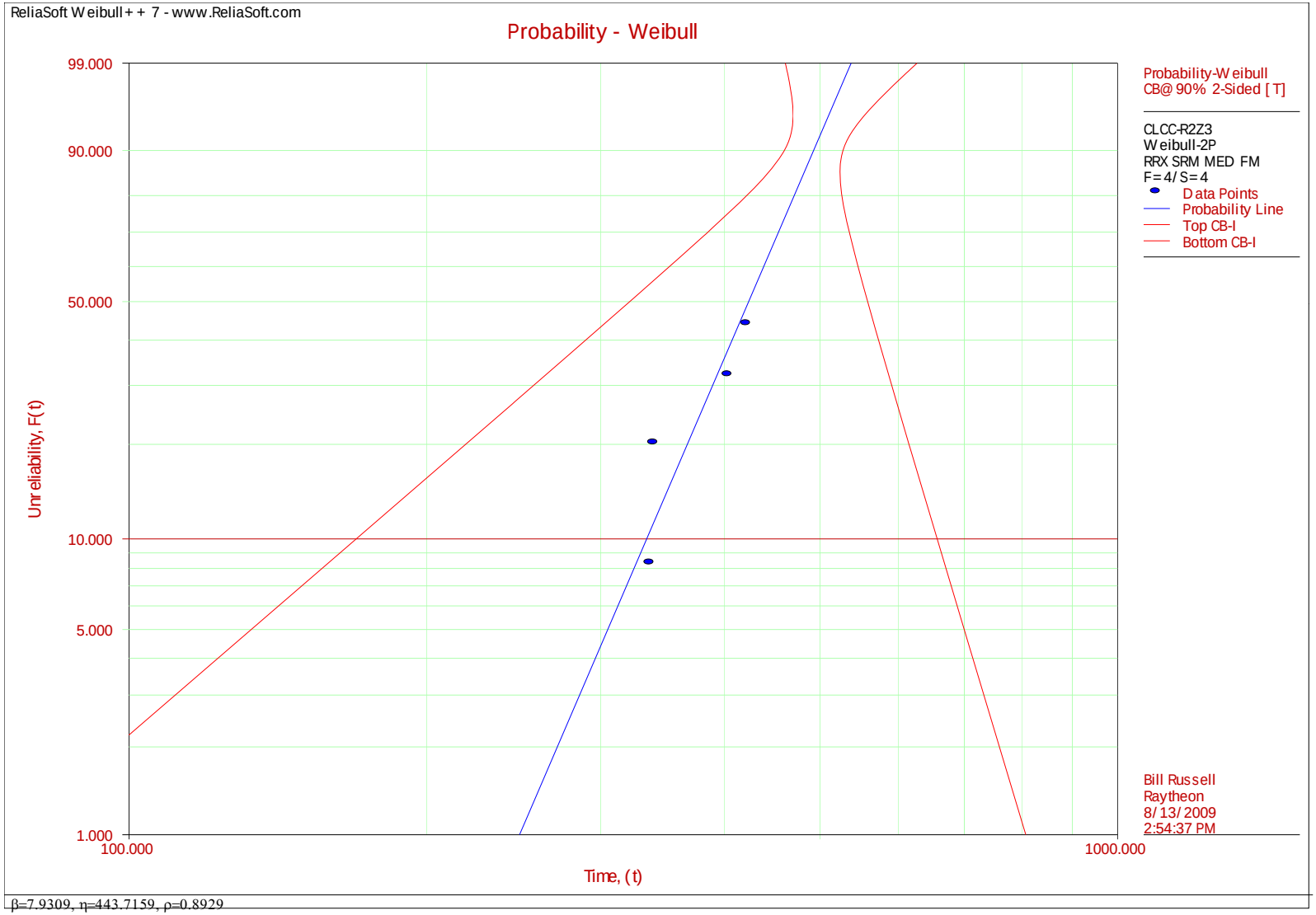
CLCC – Zone 3, 1 rework



CLCC – Zone 3, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN79	20	U9	3	CLCC-20	CLCC-20	SAC305	SAC305	1	406	F		CLCC-R1Z3
2	SN66	20	U9	3	CLCC-20	CLCC-20	SAC305	SAC305	1	413	F		CLCC-R1Z3
1	SN68	28	U9	3	CLCC-20	CLCC-20	SAC305	SAC305	1	426	F		CLCC-R1Z3
1	SN62	28	U9	3	CLCC-20	CLCC-20	SAC305	SAC305	1	427	F		CLCC-R1Z3
2	SN63	28	U10	3	CLCC-20	CLCC-20	SAC305	SAC305	1	431	F		CLCC-R1Z3
1	SN64	28	U9	3	CLCC-20	CLCC-20	SAC305	SAC305	1	467	F		CLCC-R1Z3
1	SN62	28	U17	3	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z3
1	SN64	28	U17	3	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z3
1	SN68	28	U17	3	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z3
1	SN79	28	U17	3	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z3
2	SN66	28	U17	3	CLCC-20	CLCC-20	SAC305	SAC305	1	480	S		CLCC-R1Z3

CLCC – Zone 3, 2 reworks



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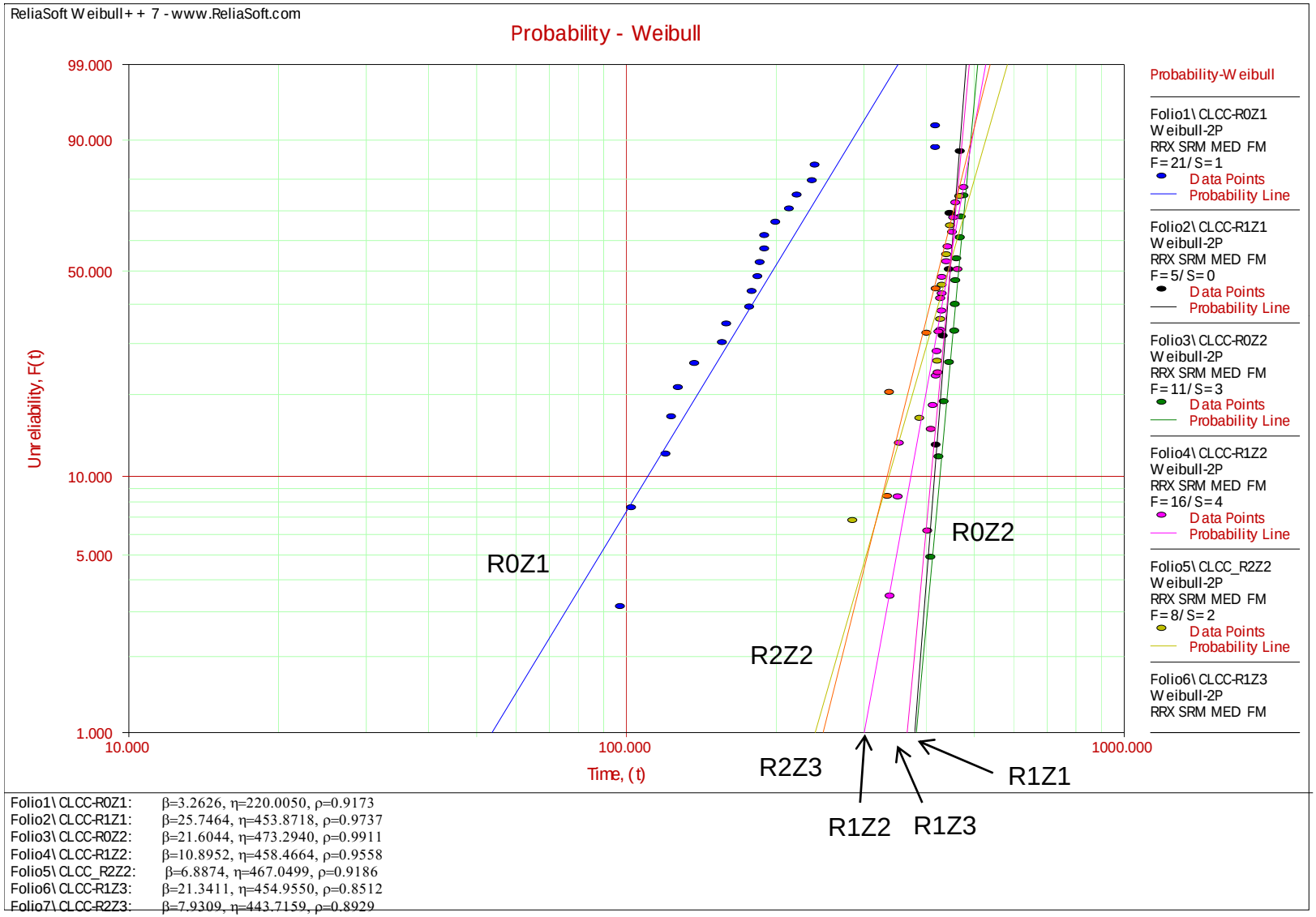
CLCC – Zone 3, 2 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	18	U9	3	CLCC-20	CLCC-20	SAC305	SAC305	2	337	F		CLCC-R2Z3
2	SN67	18	U9	3	CLCC-20	CLCC-20	SAC305	SAC305	2	340	F		CLCC-R2Z3
2	SN61	20	U17	3	CLCC-20	CLCC-20	SAC305	SAC305	2	404	F		CLCC-R2Z3
2	SN61	28	U9	3	CLCC-20	CLCC-20	SAC305	SAC305	2	422	F		CLCC-R2Z3
2	SN63	28	U17	3	CLCC-20	CLCC-20	SAC305	SAC305	2	480	S		CLCC-R2Z3
2	SN65	28	U17	3	CLCC-20	CLCC-20	SAC305	SAC305	2	480	S		CLCC-R2Z3
2	SN67	28	U17	3	CLCC-20	CLCC-20	SAC305	SAC305	2	480	S		CLCC-R2Z3
2	SN63	28	U9	3	CLCC-20	CLCC-20	SAC305	SAC305	2	480	S		CLCC-R2Z3

CLCC - Multiplot



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Weibull Test of Comparison

1 CLCC-R0Z1	NA						
2 CLCC-R1Z1	2>1 100%	NA					
3 CLCC-R0Z2	3>1 100%	3>2 71%	NA				
4 CLCC-R1Z2	4>1 100%	same	3>4 66%	NA			
5 CLCC_R2Z2	5>1 99%	same	3>5 60%	same	NA		
6 CLCC-R1Z3	6>1 100%	same	3>6 70%	same	same	NA	
7 CLCC-R2Z3	7>1 99%	2>7 63%	3>7 73%	same	same	6>7 63%	NA

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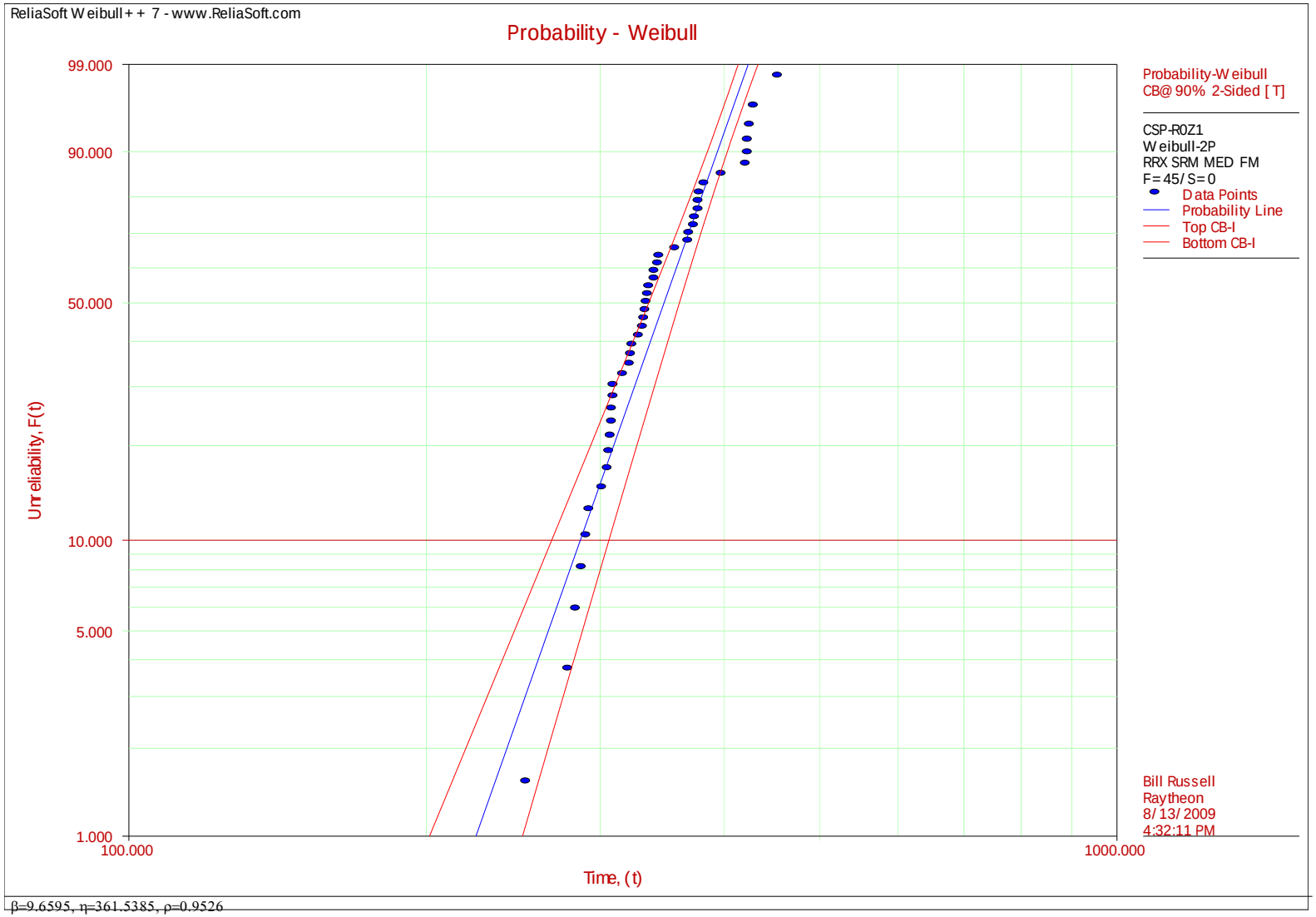
Vibration Analysis

CSP WEIBULL PLOTS

CSP – Zone 1, 0 reworks



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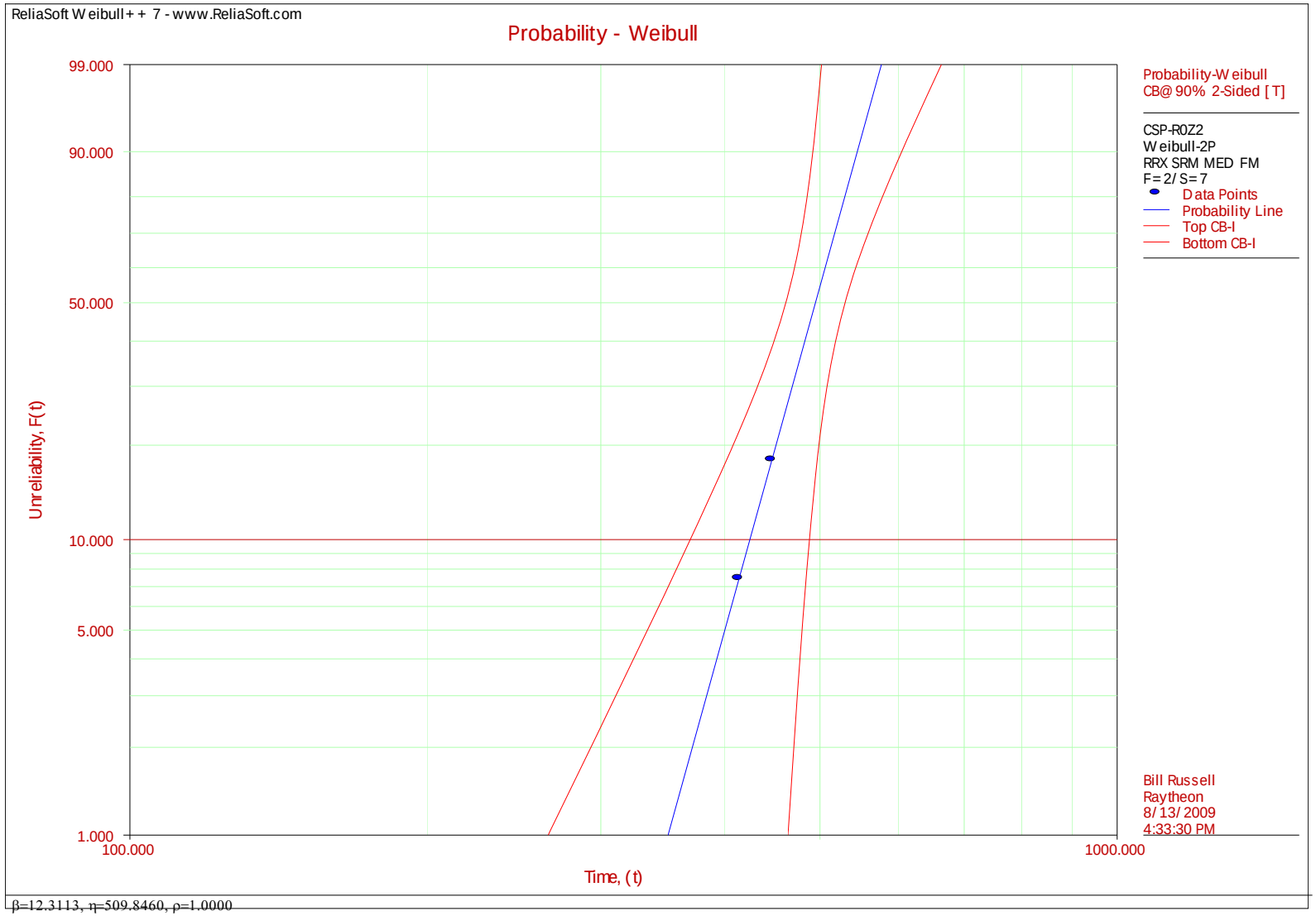
CSP – Zone 1, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN68	16	U50	1	CSP-100	CSP-100	SAC105	SAC305	0	253	F		CSP-R0Z1
2	SN63	16	U50	1	CSP-100	CSP-100	SAC105	SAC305	0	279	F		CSP-R0Z1
2	SN67	16	U19	1	CSP-100	CSP-100	SAC105	SAC305	0	284	F		CSP-R0Z1
1	SN62	16	U19	1	CSP-100	CSP-100	SAC105	SAC305	0	288	F		CSP-R0Z1
1	SN64	16	U33	1	CSP-100	CSP-100	SAC105	SAC305	0	291	F		CSP-R0Z1
2	SN61	16	U50	1	CSP-100	CSP-100	SAC105	SAC305	0	293	F		CSP-R0Z1
1	SN62	18	U32	1	CSP-100	CSP-100	SAC105	SAC305	0	302	F		CSP-R0Z1
2	SN67	18	U32	1	CSP-100	CSP-100	SAC105	SAC305	0	306	F		CSP-R0Z1
1	SN79	18	U50	1	CSP-100	CSP-100	SAC105	SAC305	0	307	F		CSP-R0Z1
2	SN63	18	U33	1	CSP-100	CSP-100	SAC105	SAC305	0	308	F		CSP-R0Z1
2	SN66	18	U50	1	CSP-100	CSP-100	SAC105	SAC305	0	309	F		CSP-R0Z1
2	SN67	18	U50	1	CSP-100	CSP-100	SAC105	SAC305	0	309	F		CSP-R0Z1
1	SN79	18	U19	1	CSP-100	CSP-100	SAC105	SAC305	0	310	F		CSP-R0Z1
2	SN65	18	U33	1	CSP-100	CSP-100	SAC105	SAC305	0	310	F		CSP-R0Z1
2	SN67	18	U33	1	CSP-100	CSP-100	SAC105	SAC305	0	317	F		CSP-R0Z1
2	SN65	18	U32	1	CSP-100	CSP-100	SAC105	SAC305	0	322	F		CSP-R0Z1
2	SN65	18	U50	1	CSP-100	CSP-100	SAC105	SAC305	0	323	F		CSP-R0Z1
1	SN68	18	U33	1	CSP-100	CSP-100	SAC105	SAC305	0	324	F		CSP-R0Z1
2	SN66	18	U19	1	CSP-100	CSP-100	SAC105	SAC305	0	329	F		CSP-R0Z1
2	SN63	18	U32	1	CSP-100	CSP-100	SAC105	SAC305	0	332	F		CSP-R0Z1
2	SN65	18	U19	1	CSP-100	CSP-100	SAC105	SAC305	0	333	F		CSP-R0Z1
1	SN79	18	U32	1	CSP-100	CSP-100	SAC105	SAC305	0	334	F		CSP-R0Z1
1	SN62	18	U50	1	CSP-100	CSP-100	SAC105	SAC305	0	335	F		CSP-R0Z1
1	SN64	18	U50	1	CSP-100	CSP-100	SAC105	SAC305	0	336	F		CSP-R0Z1
1	SN79	18	U33	1	CSP-100	CSP-100	SAC105	SAC305	0	337	F		CSP-R0Z1
2	SN61	18	U19	1	CSP-100	CSP-100	SAC105	SAC305	0	341	F		CSP-R0Z1
2	SN66	18	U32	1	CSP-100	CSP-100	SAC105	SAC305	0	341	F		CSP-R0Z1
1	SN62	18	U33	1	CSP-100	CSP-100	SAC105	SAC305	0	344	F		CSP-R0Z1
2	SN61	18	U32	1	CSP-100	CSP-100	SAC105	SAC305	0	345	F		CSP-R0Z1
2	SN66	18	U33	1	CSP-100	CSP-100	SAC105	SAC305	0	358	F		CSP-R0Z1
2	SN66	20	U42	1	CSP-100	CSP-100	SAC105	SAC305	0	369	F		CSP-R0Z1
2	SN67	20	U42	1	CSP-100	CSP-100	SAC105	SAC305	0	370	F		CSP-R0Z1
1	SN68	20	U19	1	CSP-100	CSP-100	SAC105	SAC305	0	374	F		CSP-R0Z1
1	SN68	20	U32	1	CSP-100	CSP-100	SAC105	SAC305	0	375	F		CSP-R0Z1
2	SN63	20	U19	1	CSP-100	CSP-100	SAC105	SAC305	0	378	F		CSP-R0Z1
2	SN61	20	U33	1	CSP-100	CSP-100	SAC105	SAC305	0	378	F		CSP-R0Z1
2	SN61	20	U42	1	CSP-100	CSP-100	SAC105	SAC305	0	379	F		CSP-R0Z1
1	SN62	20	U42	1	CSP-100	CSP-100	SAC105	SAC305	0	383	F		CSP-R0Z1
1	SN79	20	U42	1	CSP-100	CSP-100	SAC105	SAC305	0	399	F		CSP-R0Z1
2	SN63	28	U42	1	CSP-100	CSP-100	SAC105	SAC305	0	422	F		CSP-R0Z1
1	SN68	28	U42	1	CSP-100	CSP-100	SAC105	SAC305	0	424	F		CSP-R0Z1
1	SN64	28	U19	1	CSP-100	CSP-100	SAC105	SAC305	0	424	F		CSP-R0Z1
1	SN64	28	U32	1	CSP-100	CSP-100	SAC105	SAC305	0	426	F		CSP-R0Z1
2	SN65	28	U42	1	CSP-100	CSP-100	SAC105	SAC305	0	430	F		CSP-R0Z1
1	SN64	28	U42	1	CSP-100	CSP-100	SAC105	SAC305	0	455	F		CSP-R0Z1

CSP – Zone 2, 0 reworks



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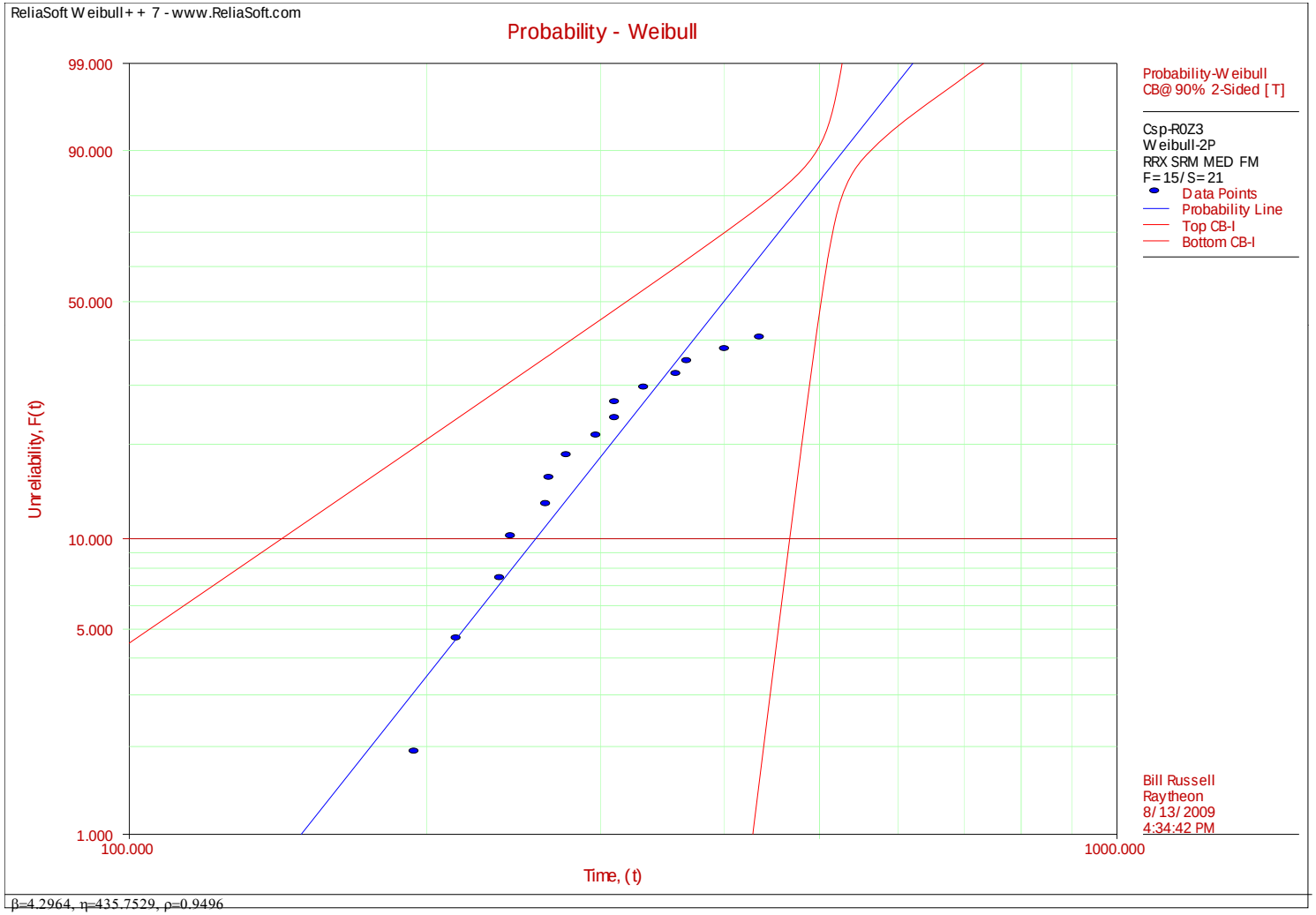
CSP – Zone 2, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN61	20	U60	2	CSP-100	CSP-100	SAC105	SAC305	0	414	F		CSP-R0Z2
1	SN64	28	U60	2	CSP-100	CSP-100	SAC105	SAC305	0	447	F		CSP-R0Z2
1	SN62	28	U60	2	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z2
1	SN68	28	U60	2	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z2
1	SN79	28	U60	2	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z2
2	SN63	28	U60	2	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z2
2	SN65	28	U60	2	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z2
2	SN66	28	U60	2	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z2
2	SN67	28	U60	2	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z2

CSP – Zone 3, 0 reworks (two parameter model)



CSP – Zone 3, 0 reworks (two parameter model)

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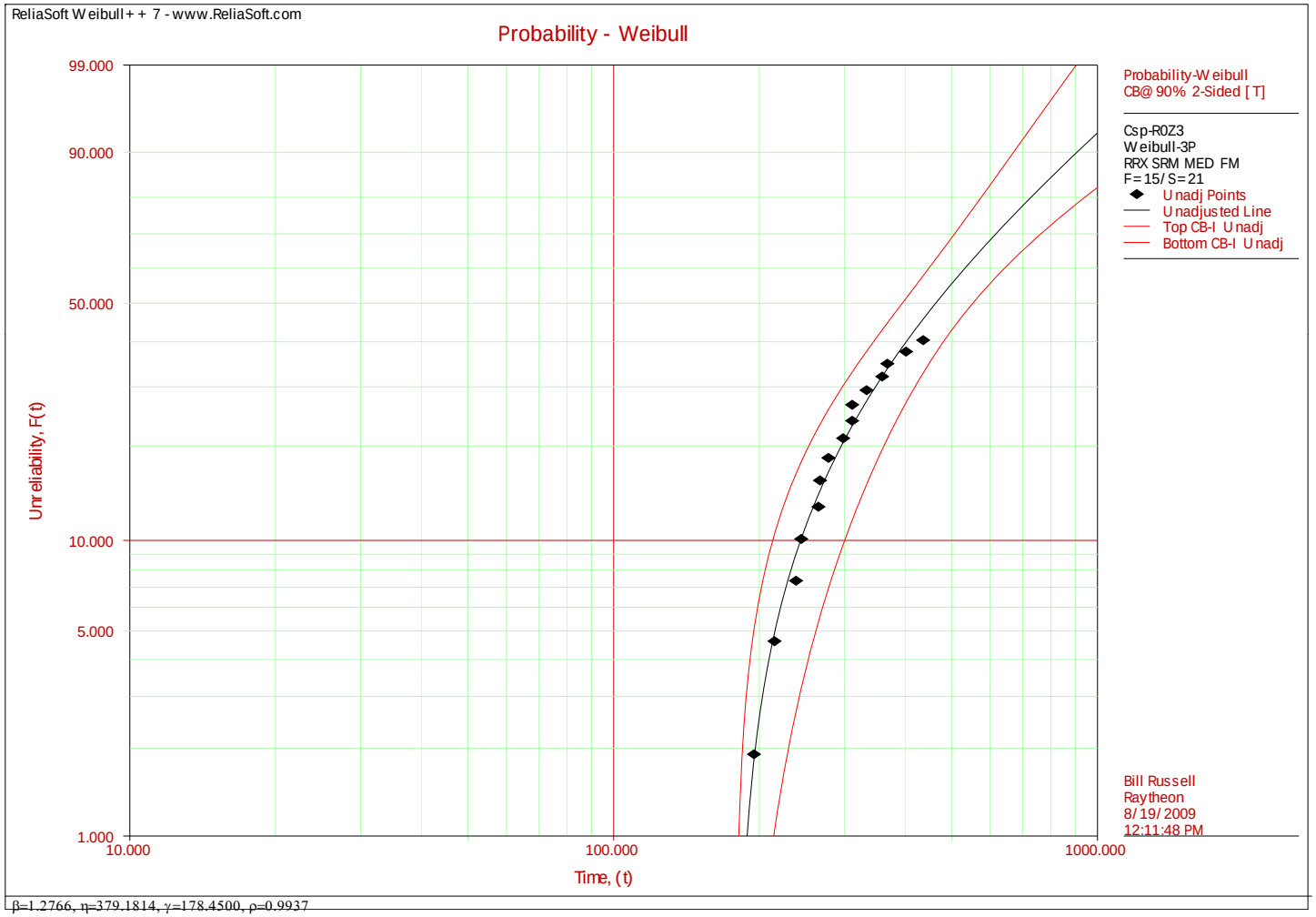
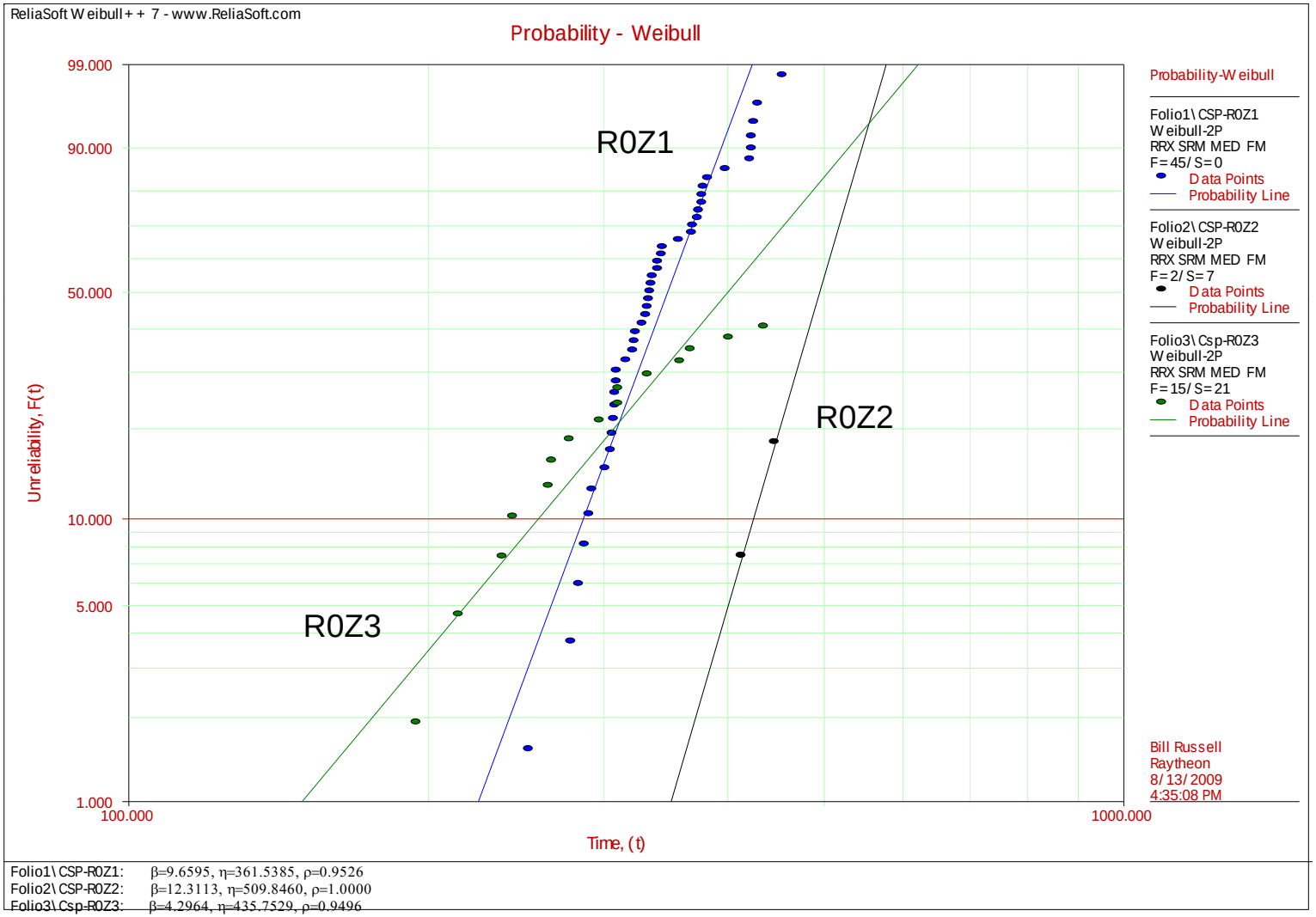
Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN65	14	U35	3	CSP-100	CSP-100	SAC105	SAC305	0	195	F		CSP-R0Z3
1	SN68	14	U35	3	CSP-100	CSP-100	SAC105	SAC305	0	215	F		CSP-R0Z3
2	SN67	14	U35	3	CSP-100	CSP-100	SAC105	SAC305	0	238	F		CSP-R0Z3
2	SN67	16	U36	3	CSP-100	CSP-100	SAC105	SAC305	0	244	F		CSP-R0Z3
1	SN62	16	U35	3	CSP-100	CSP-100	SAC105	SAC305	0	265	F		CSP-R0Z3
1	SN64	16	U35	3	CSP-100	CSP-100	SAC105	SAC305	0	267	F		CSP-R0Z3
2	SN63	16	U35	3	CSP-100	CSP-100	SAC105	SAC305	0	278	F		CSP-R0Z3
2	SN61	16	U35	3	CSP-100	CSP-100	SAC105	SAC305	0	298	F		CSP-R0Z3
2	SN65	18	U36	3	CSP-100	CSP-100	SAC105	SAC305	0	311	F		CSP-R0Z3
1	SN79	18	U35	3	CSP-100	CSP-100	SAC105	SAC305	0	311	F		CSP-R0Z3
1	SN68	18	U36	3	CSP-100	CSP-100	SAC105	SAC305	0	333	F		CSP-R0Z3
2	SN66	18	U35	3	CSP-100	CSP-100	SAC105	SAC305	0	359	F		CSP-R0Z3
2	SN66	20	U36	3	CSP-100	CSP-100	SAC105	SAC305	0	368	F		CSP-R0Z3
2	SN61	20	U36	3	CSP-100	CSP-100	SAC105	SAC305	0	402	F		CSP-R0Z3
1	SN62	28	U36	3	CSP-100	CSP-100	SAC105	SAC305	0	436	F		CSP-R0Z3
1	SN64	28	U36	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
1	SN79	28	U36	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
1	SN62	28	U37	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
1	SN64	28	U37	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
1	SN68	28	U37	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
1	SN79	28	U37	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
1	SN62	28	U63	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
1	SN64	28	U63	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
1	SN68	28	U63	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
1	SN79	28	U63	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN63	28	U36	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN61	28	U37	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN63	28	U37	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN65	28	U37	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN66	28	U37	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN67	28	U37	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN61	28	U63	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN63	28	U63	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN65	28	U63	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN66	28	U63	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3
2	SN67	28	U63	3	CSP-100	CSP-100	SAC105	SAC305	0	480	S		CSP-R0Z3

CSP – Zone 3, 0 reworks (three parameter model)



CSP – Multiplot



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Weibull Test of Comparison

1 CSP-R0Z1	NA		
2 CSP-R0Z2	2>1 98%	NA	
3 Csp-R0Z3	3>1 68%	2>3 79%	NA

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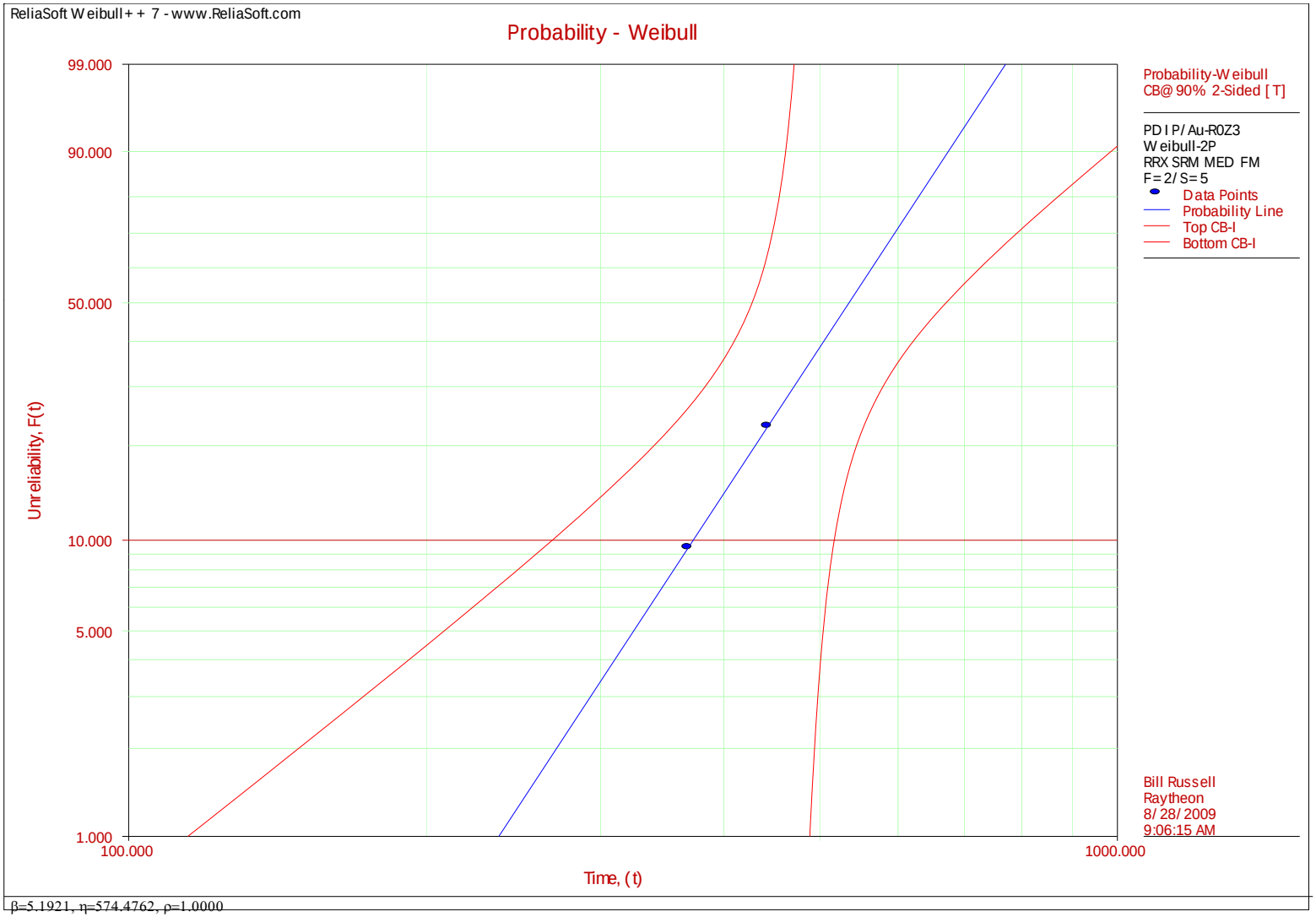
Vibration Analysis

PDIP WEIBULL PLOTS

PDIP/Au – Zone 3, 0 reworks



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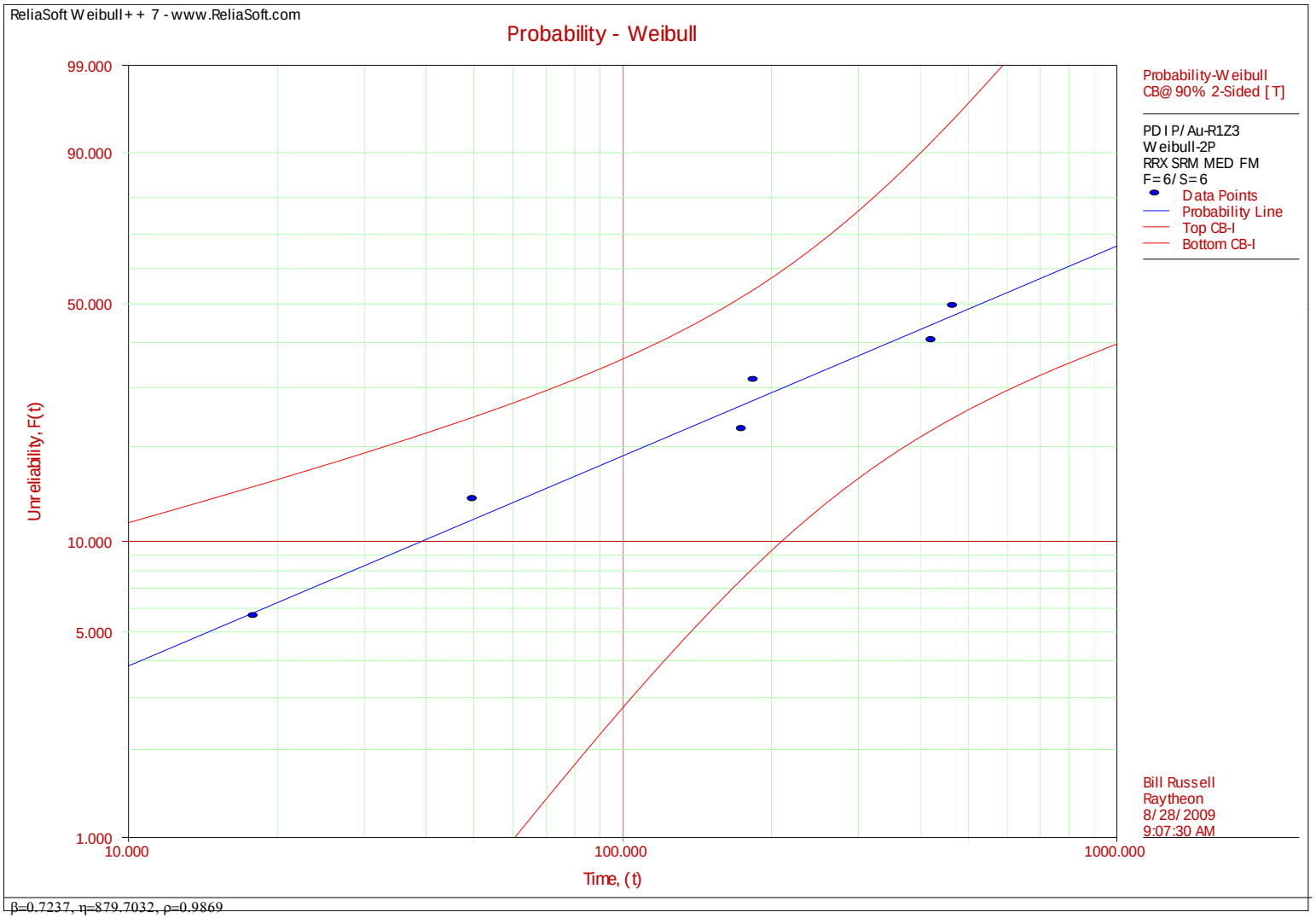
PDIP/Au – Zone 3, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN62	20	U30	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	0	368	F		PDIP/Au-R0Z3
1	SN62	28	U38	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	0	443	F		PDIP/Au-R0Z3
1	SN62	28	U23	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	0	480	S		PDIP/Au-R0Z3
1	SN62	28	U59	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	0	480	S		PDIP/Au-R0Z3
1	SN64	28	U59	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	0	480	S		PDIP/Au-R0Z3
1	SN68	28	U59	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	0	480	S		PDIP/Au-R0Z3
2	SN66	28	U59	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	0	480	S		PDIP/Au-R0Z3

PDIP/Au – Zone 3, 1 rework

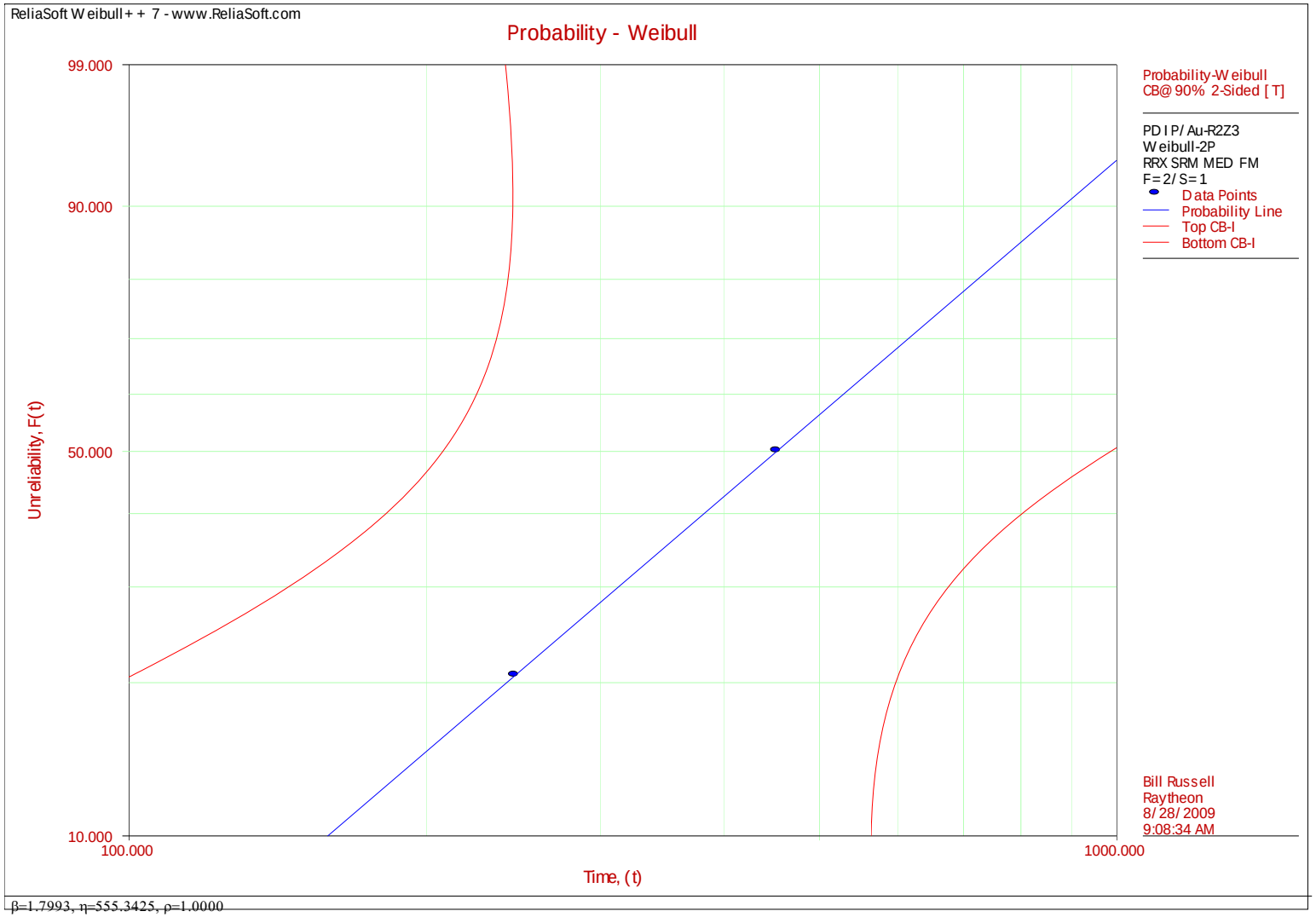


Raytheon

PDIP/Au – Zone 3, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN62	8	U49	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	18	F		PDIP/Au-R1Z3
1	SN62	8	U8	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	50	F		PDIP/Au-R1Z3
1	SN64	8	U51	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	60	S		PDIP/Au-R1Z3
1	SN62	12	U11	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	175	F		PDIP/Au-R1Z3
1	SN68	14	U51	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	185	F		PDIP/Au-R1Z3
1	SN62	28	U51	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	424	F		PDIP/Au-R1Z3
2	SN66	28	U51	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	468	F		PDIP/Au-R1Z3
2	SN67	28	U49	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	480	S		PDIP/Au-R1Z3
2	SN61	28	U59	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	480	S		PDIP/Au-R1Z3
2	SN63	28	U59	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	480	S		PDIP/Au-R1Z3
2	SN65	28	U59	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	480	S		PDIP/Au-R1Z3
2	SN67	28	U59	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	1	480	S		PDIP/Au-R1Z3

PDIP/Au – Zone 3, 2 reworks



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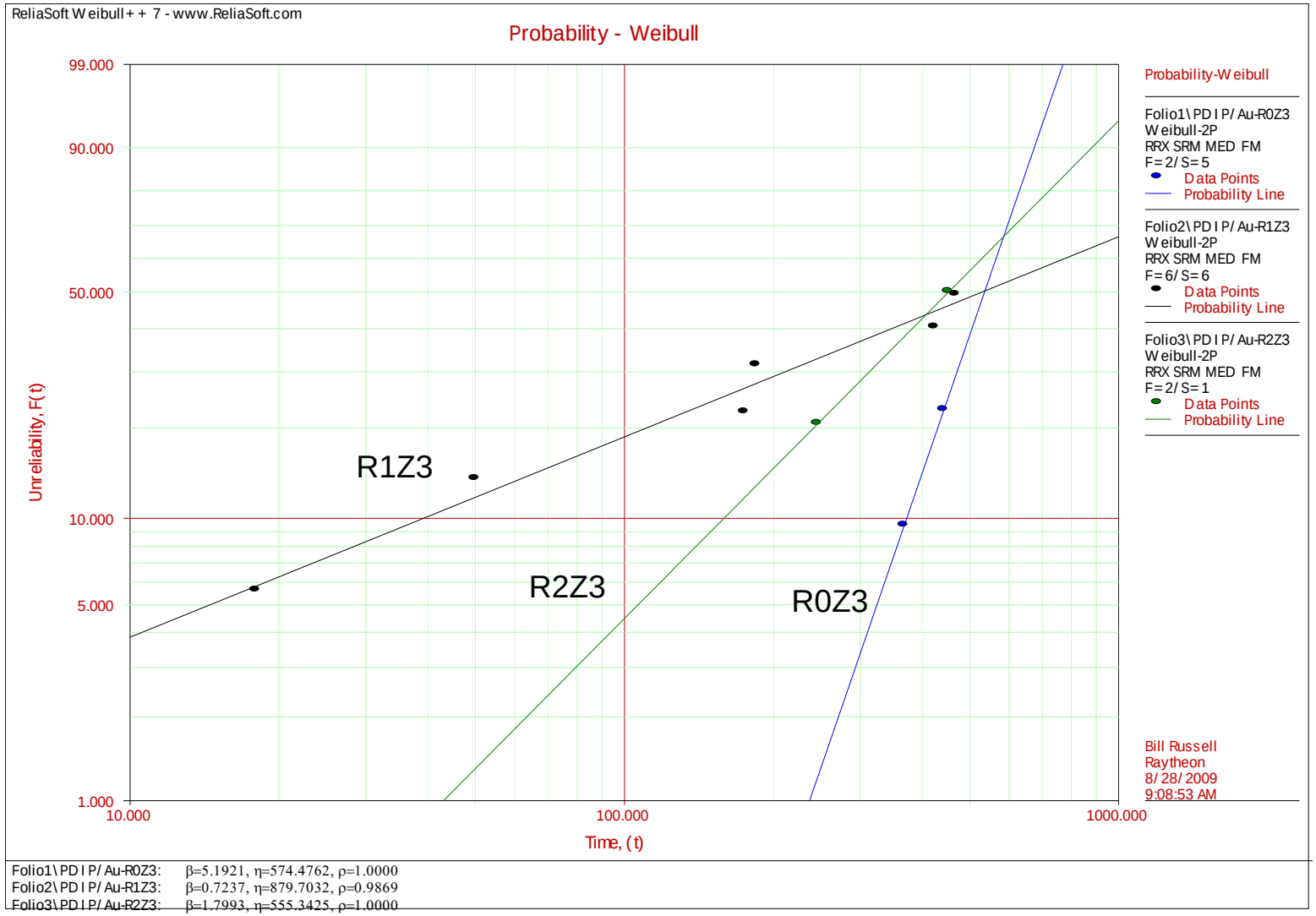
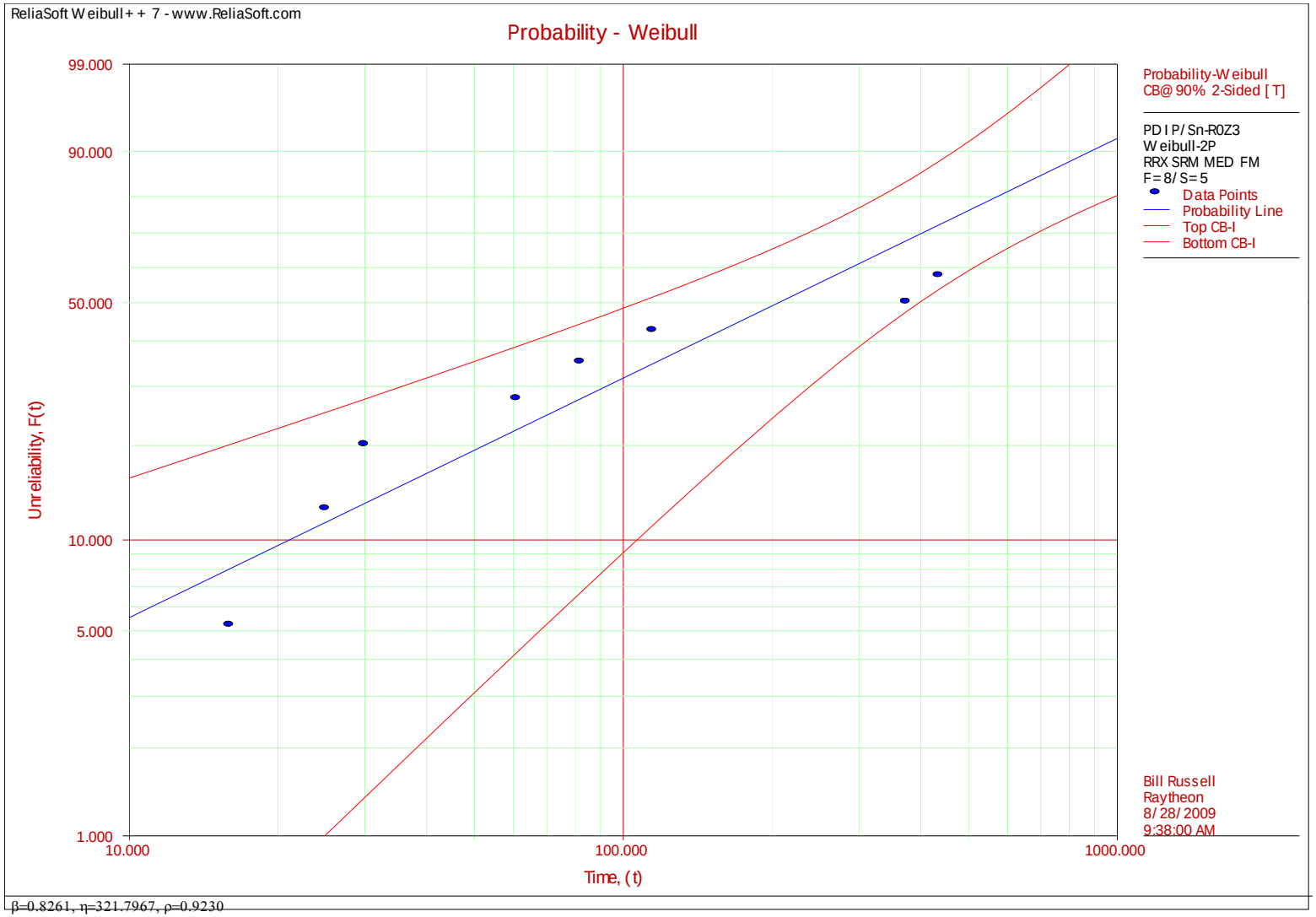
PDIP/Au – Zone 3, 2 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN63	16	U51	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	2	246	F		PDIP/Au-R2Z3
2	SN61	28	U51	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	2	453	F		PDIP/Au-R2Z3
2	SN65	28	U51	3	PDIP-20	PDIP/Au-20	NiPdAu	SN100C	2	480	S		PDIP/Au-R2Z3

PDIP/Au - Multiplot



PDIP/Sn – Zone 3, 0 reworks



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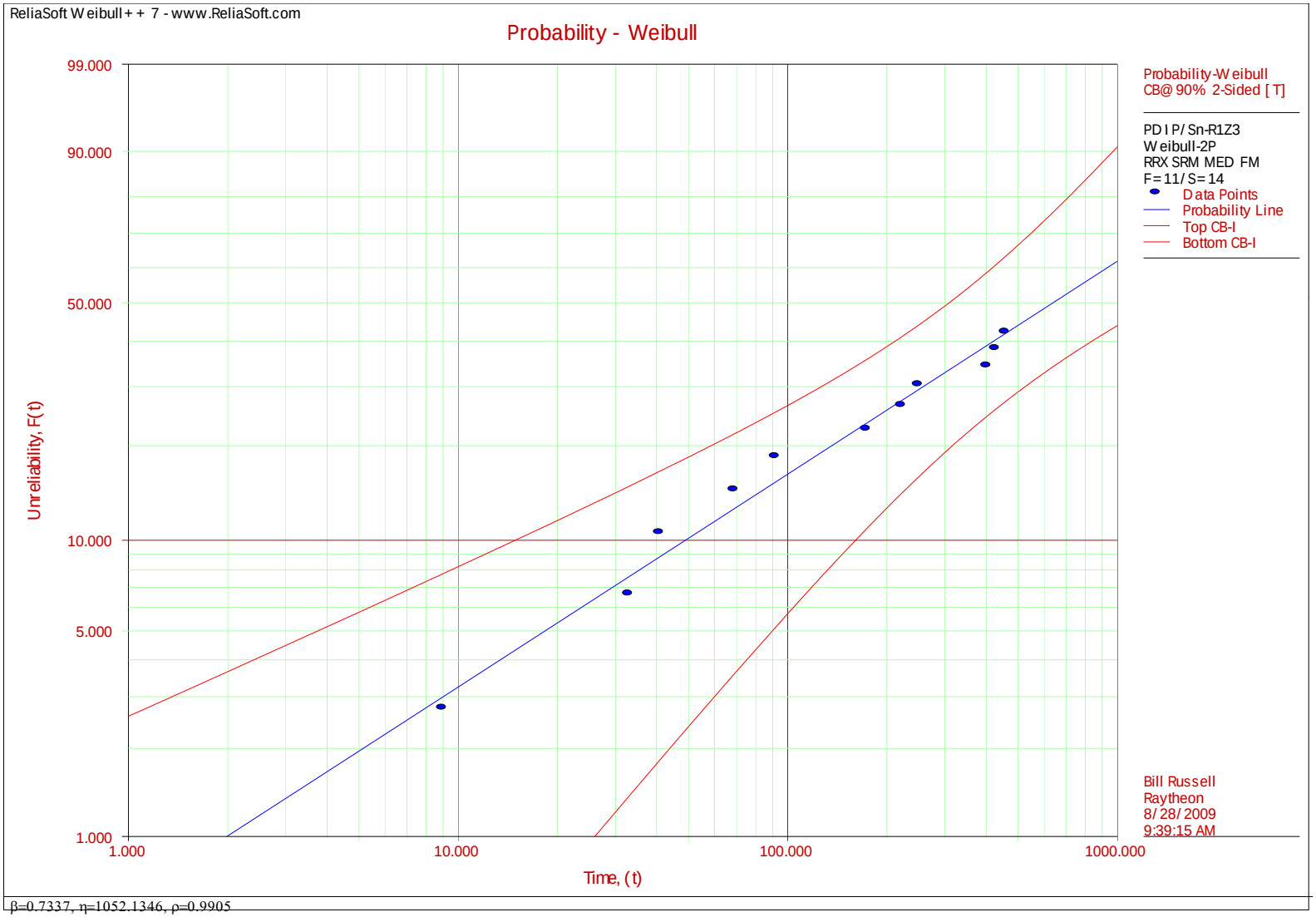
PDIP/Sn – Zone 3, 0 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN63	8	U30	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	16	F		PDIP/Sn-R0Z3
1	SN64	8	U38	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	25	F		PDIP/Sn-R0Z3
2	SN65	8	U30	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	30	F		PDIP/Sn-R0Z3
2	SN66	10	U38	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	61	F		PDIP/Sn-R0Z3
1	SN68	10	U38	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	82	F		PDIP/Sn-R0Z3
2	SN67	10	U30	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	115	F		PDIP/Sn-R0Z3
1	SN79	20	U59	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	375	F		PDIP/Sn-R0Z3
2	SN61	28	U30	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	437	F		PDIP/Sn-R0Z3
1	SN64	28	U23	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	480	S		PDIP/Sn-R0Z3
1	SN68	28	U23	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	480	S		PDIP/Sn-R0Z3
1	SN79	28	U23	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	480	S		PDIP/Sn-R0Z3
1	SN79	28	U38	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	480	S		PDIP/Sn-R0Z3
2	SN66	28	U23	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	0	480	S		PDIP/Sn-R0Z3

PDIP/Sn – Zone 3, 1 rework



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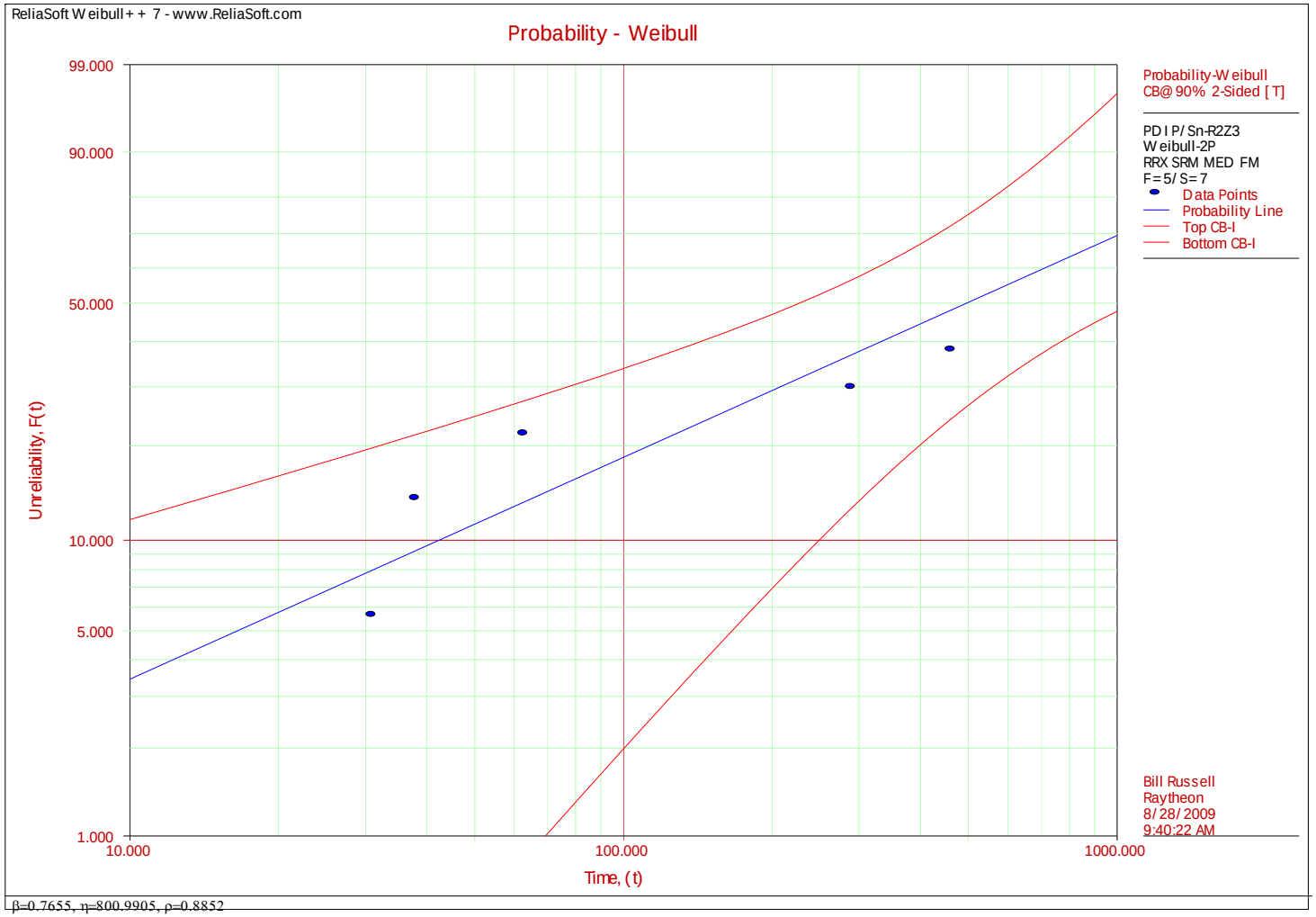
PDIP/Sn – Zone 3, 1 rework

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
2	SN61	8	U49	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	9	F		PDIP/Sn-R1Z3
2	SN63	8	U8	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	33	F		PDIP/Sn-R1Z3
2	SN63	8	U49	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	41	F		PDIP/Sn-R1Z3
1	SN68	10	U30	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	69	F		PDIP/Sn-R1Z3
1	SN64	10	U30	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	92	F		PDIP/Sn-R1Z3
2	SN65	12	U49	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	174	F		PDIP/Sn-R1Z3
2	SN66	14	U30	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	222	F		PDIP/Sn-R1Z3
1	SN79	16	U30	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	250	F		PDIP/Sn-R1Z3
1	SN79	20	U51	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	403	F		PDIP/Sn-R1Z3
2	SN67	28	U38	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	428	F		PDIP/Sn-R1Z3
2	SN61	28	U38	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	458	F		PDIP/Sn-R1Z3
1	SN64	28	U11	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
1	SN68	28	U11	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
1	SN79	28	U11	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN66	28	U11	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN61	28	U23	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN63	28	U23	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN65	28	U23	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN67	28	U23	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN63	28	U38	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN65	28	U38	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN67	28	U51	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN61	28	U8	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN65	28	U8	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3
2	SN67	28	U8	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	1	480	S		PDIP/Sn-R1Z3

PDIP/Sn – Zone 3, 2 reworks



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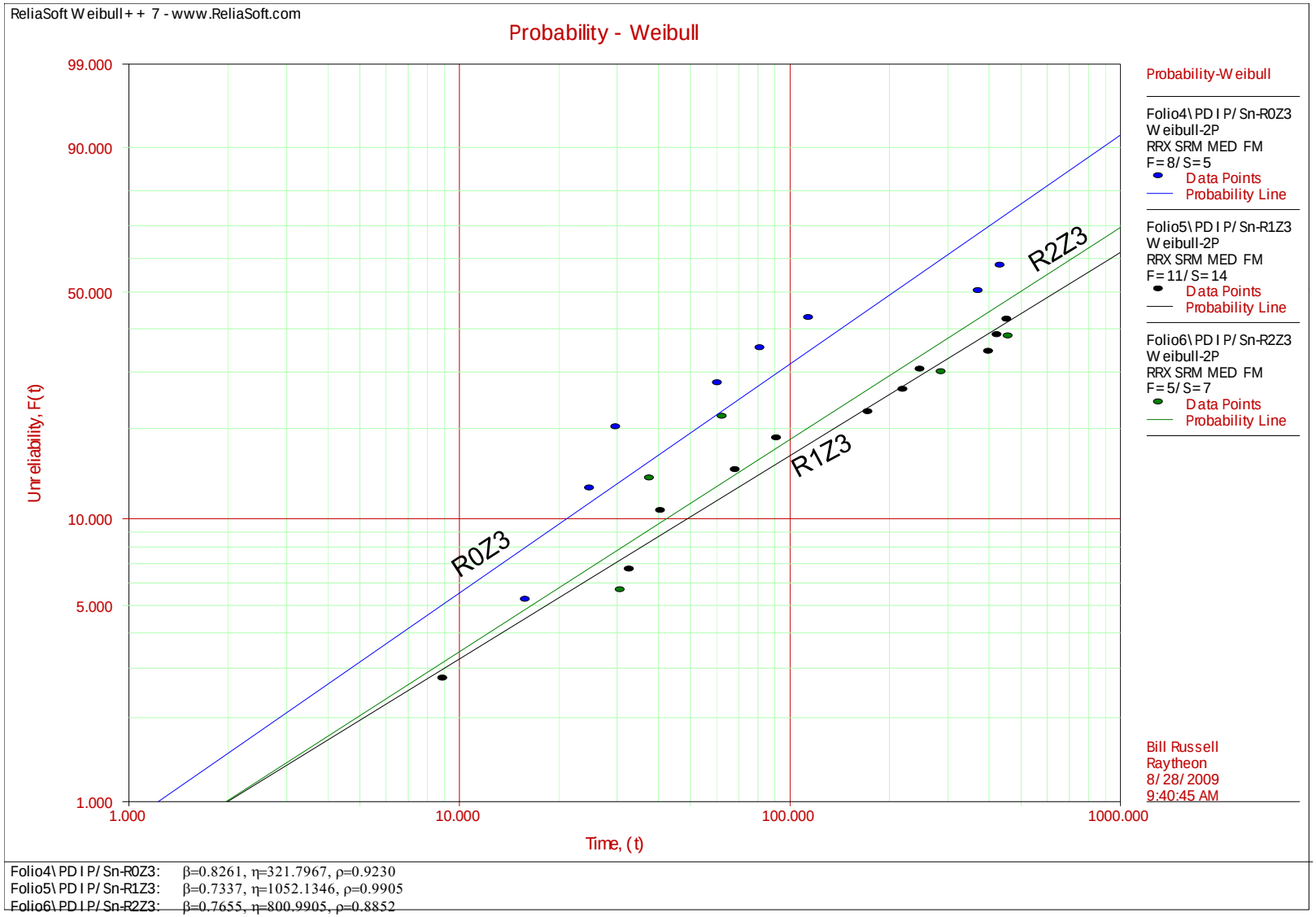
PDIP/Sn – Zone 3, 2 reworks

Batch	Card	Gs	SITE	Zone	Style	Package	Finish	Solder	Reworks	Tf	Fail/ Survive	Stencil	Weibull Group
1	SN79	8	U49	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	31	F		PDIP/Sn-R2Z3
1	SN68	8	U49	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	38	F		PDIP/Sn-R2Z3
2	SN66	10	U49	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	63	F		PDIP/Sn-R2Z3
1	SN64	16	U49	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	290	F		PDIP/Sn-R2Z3
1	SN79	28	U8	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	462	F		PDIP/Sn-R2Z3
1	SN64	28	U8	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	480	S		PDIP/Sn-R2Z3
1	SN68	28	U8	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	480	S		PDIP/Sn-R2Z3
2	SN61	28	U11	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	480	S		PDIP/Sn-R2Z3
2	SN63	28	U11	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	480	S		PDIP/Sn-R2Z3
2	SN65	28	U11	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	480	S		PDIP/Sn-R2Z3
2	SN67	28	U11	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	480	S		PDIP/Sn-R2Z3
2	SN66	28	U8	3	PDIP-20	PDIP/Sn-20	Sn	SN100C	2	480	S		PDIP/Sn-R2Z3

PDIP/Sn - Multiplot



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Weibull Test of Comparison

1 PDIP-R0Z3	NA		
2 PDIP-R1Z3	same	NA	
3 PDIP-R2Z3	same	same	NA

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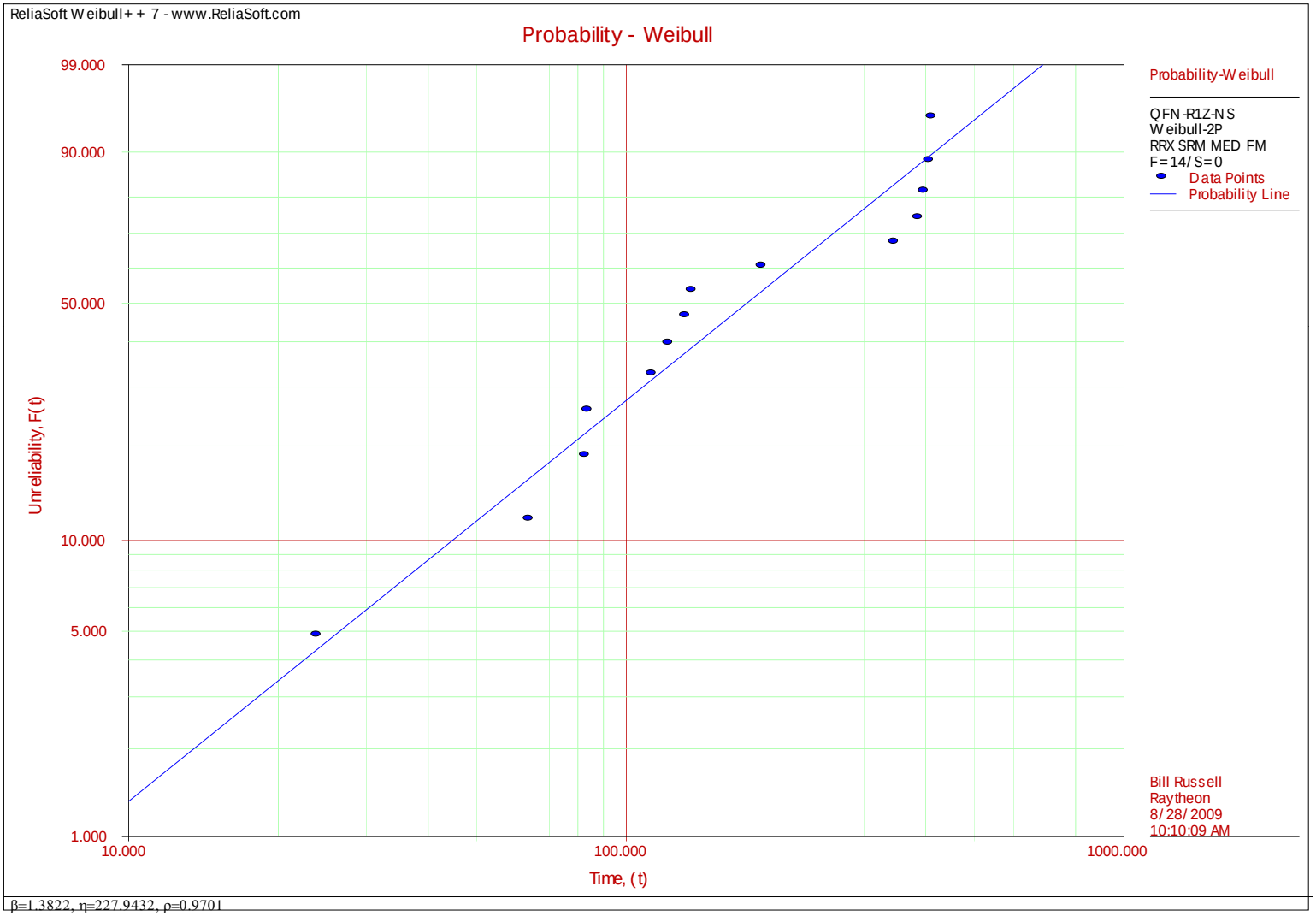
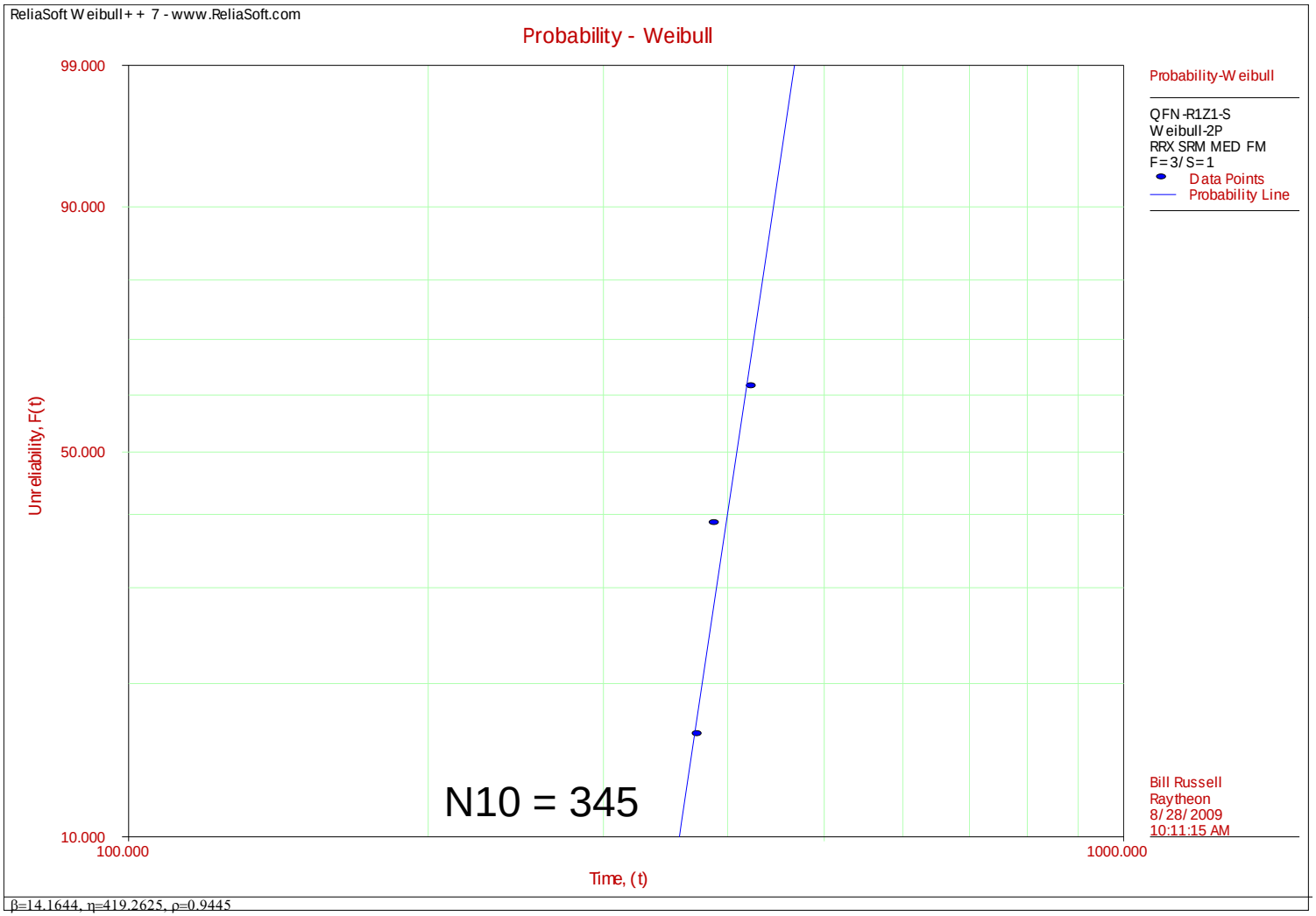
Vibration Analysis

QFN STENCIL TESTS

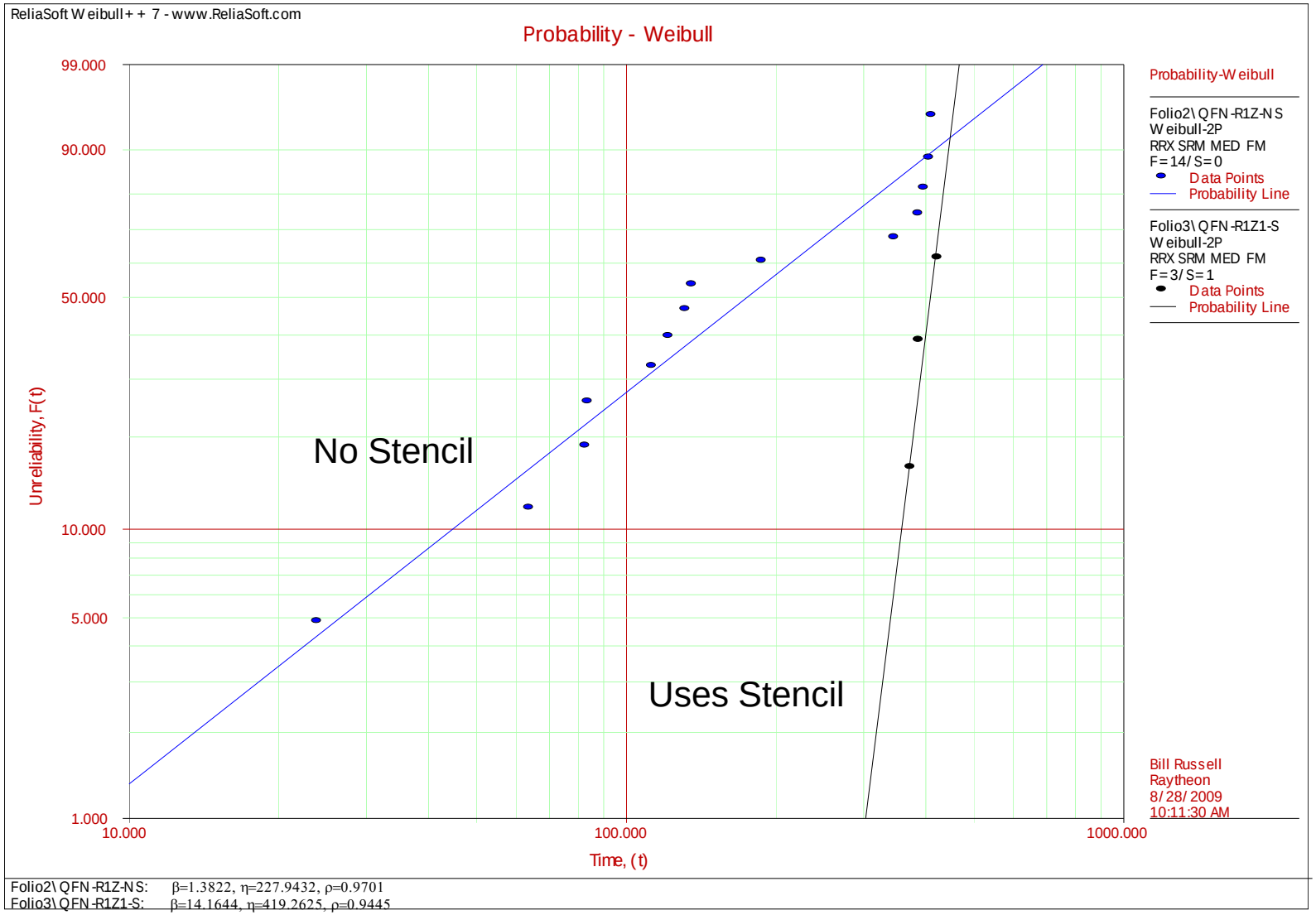
QFN With No Stencil



QFN With Stencil



QFN Stencil Comparison Multiplot



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Weibull Test of Comparison

Folio3/QFN-R1Z1-S will last longer

with probability of 89%

Convergence Delta at Solution is 0.00001970%