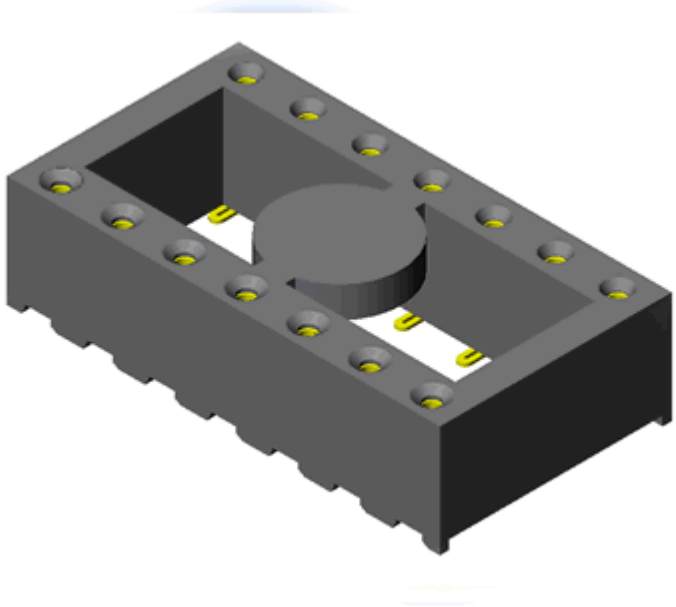
Project Number: N/A	Tracking Code: TC0327-N/A-0227		
Requested by: Phil Eckert	Date: 6/30/2003	Product Rev: N/A	
Part #: ICF-316-T-O	Lot #: N/A	Tech: Troy Cook	Eng: John Tozier
Part description: ICF			Qty to test: 10
Test Start: 07/18/2003	Test Completed: 8/21/2003		



Matte-Tin contact comparison, soldered with and without a Nitrogen blanket

PART DESCRIPTION

ICF-316-T-O
Mated with
TopLine .300/16 IC

Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

CERTIFICATION

All instruments and measuring equipment were calibrated to National Institute for Standards and Technology (NIST) traceable standards according to IS0 10012-l and ANSI/NCSL 2540-1, as applicable.

SCOPE

To evaluate Matte-Tin contact system integrity after exposure to typical Pb-free soldering processes. The evaluation will occur on systems soldered with and without the Nitrogen blanket.

APPLICABLE DOCUMENTS

Standards: EIA Publication 364

TEST SAMPLES AND PREPARATION

The two mating components (if applicable) were soldered using AIM TSC-4 lead free alloy using Sn with 3.8%-4% Ag, and 0.5% - 0.7% Cu solder paste using the oven profile. Along with the Matte-Tin plating, the TopLine IC had lead-free tin finish.

1) All materials were manufactured in accordance with the applicable product specification.
2) All test samples were identified and encoded to maintain traceability throughout the test sequences.
3) After soldering, the parts were cleaned with the Aqueous Inline Cleaning System (Aqueous Millennium Technologies)

Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

FLOWCHART

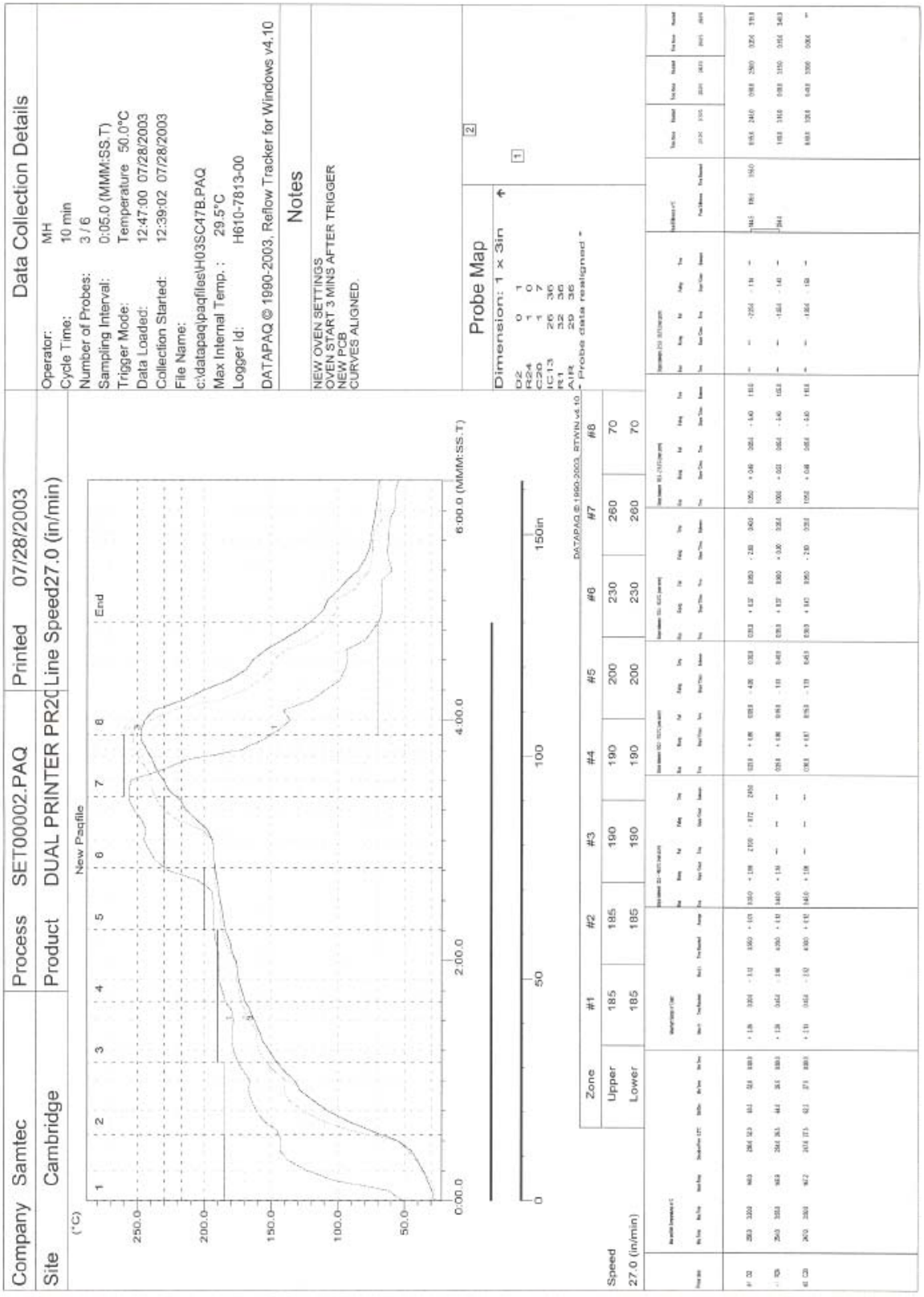
TEST STEP	GROUP A 112 Points 480 hour Test Processed in AIR	GROUP B 112 Points 480 hour Test Processed in Nitrogen
01	LLCR-1	LLCR-1
02	Data Review	Data Review
03	Cyclic Humidity, 240 Hours	Cyclic Humidity, 240 Hours
04	LLCR-2	LLCR-2
05	Data Review	Data Review
06	Cyclic Humidity, 240 Hours	Cyclic Humidity, 240 Hours
07	LLCR-3	LLCR-3

Humidity =EIA-364-31, Test Condition B (240 Hours)
and Method III (+25 ° C to +65 ° C @ 90%RH to 98% RH)
delete steps 7a and 7b

LLCR = EIA-364-23, LLCR
use Keithley 580 in the dry circuit mode, 10 mA Max

Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

OVEN PROFILE



Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

ATTRIBUTE DEFINITION

Following is a brief, simplified description of attributes.

CYCLIC HUMIDITY:

1) Reference document: EIA-364-31, *Humidity Test Procedure for Electrical Connectors.*
   a) Test Condition B, 240 Hours.
   b) Method III, +25° C to + 65° C, 90% to 98% Relative Humidity excluding sub-cycles 7a and 7b.
2) Connectors are mated.
3) Test Condition B run twice for a total of 480 hours.
   a) Intermediate results taken at 240 hours.

LLCR:

1) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets*.
2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
3) The following guidelines are used to categorize the changes in LLCR as a result from stressing
   a) <= +5.0 mOhms: ---------- Stable
   b) +5.1 to +10.0 mOhms:---------- Minor
   c) +10.1 to +15.0 mOhms: ---------- Acceptable
   d) +15.1 to +50.0 mOhms: ---------- Marginal
   e) +50.1 to +2000 mOhms: ---------- Unstable
   f) >+2000 mOhms:---------- Open Failure

Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

RESULTS

LLCR (112 LLCR test points)

- **Initial**
  - **Air Processed ---------- ----------7.6 mOhms Max**
  - **Nitrogen Processed---------- ----------6.7 mOhms Max**
- **Stressed 240 Hours**
  - **<= +5.0 mOhms**
    - **Air Processed----------112 Points ---------- Stable**
    - **Nitrogen Processed----------112 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms**
    - **Air Processed----------0 Points ---------- Minor**
    - **Nitrogen Processed----------0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms**
    - **Air Processed----------0 Points ---------- Acceptable**
    - **Nitrogen Processed----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms**
    - **Air Processed----------0 Points ---------- Marginal**
    - **Nitrogen Processed----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms**
    - **Air Processed----------0 Points ---------- Unstable**
    - **Nitrogen Processed----------0 Points ---------- Unstable**
  - **>+2000 mOhms**
    - **Air Processed----------0 Points ---------- Open Failure**
    - **Nitrogen Processed----------0 Points ---------- Open Failure**
- **Stressed 480 Hours**
  - **<= +5.0 mOhms**
    - **Air Processed----------112 Points ---------- Stable**
    - **Nitrogen Processed----------112 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms**
    - **Air Processed----------0 Points ---------- Minor**
    - **Nitrogen Processed----------0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms**
    - **Air Processed----------0 Points ---------- Acceptable**
    - **Nitrogen Processed----------0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms**
    - **Air Processed----------0 Points ---------- Marginal**
    - **Nitrogen Processed----------0 Points ---------- Marginal**
  - **+50.1 to +2000 mOhms**
    - **Air Processed----------0 Points ---------- Unstable**
    - **Nitrogen Processed----------0 Points ---------- Unstable**
  - **>+2000 mOhms**
    - **Air Processed----------0 Points ---------- Open Failure**
    - **Nitrogen Processed----------0 Points ---------- Open Failure**

After soldering, neither the parts soldered in the 'open air process' or parts soldered in the 'nitrogen blanket process' showed discoloration.

Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES

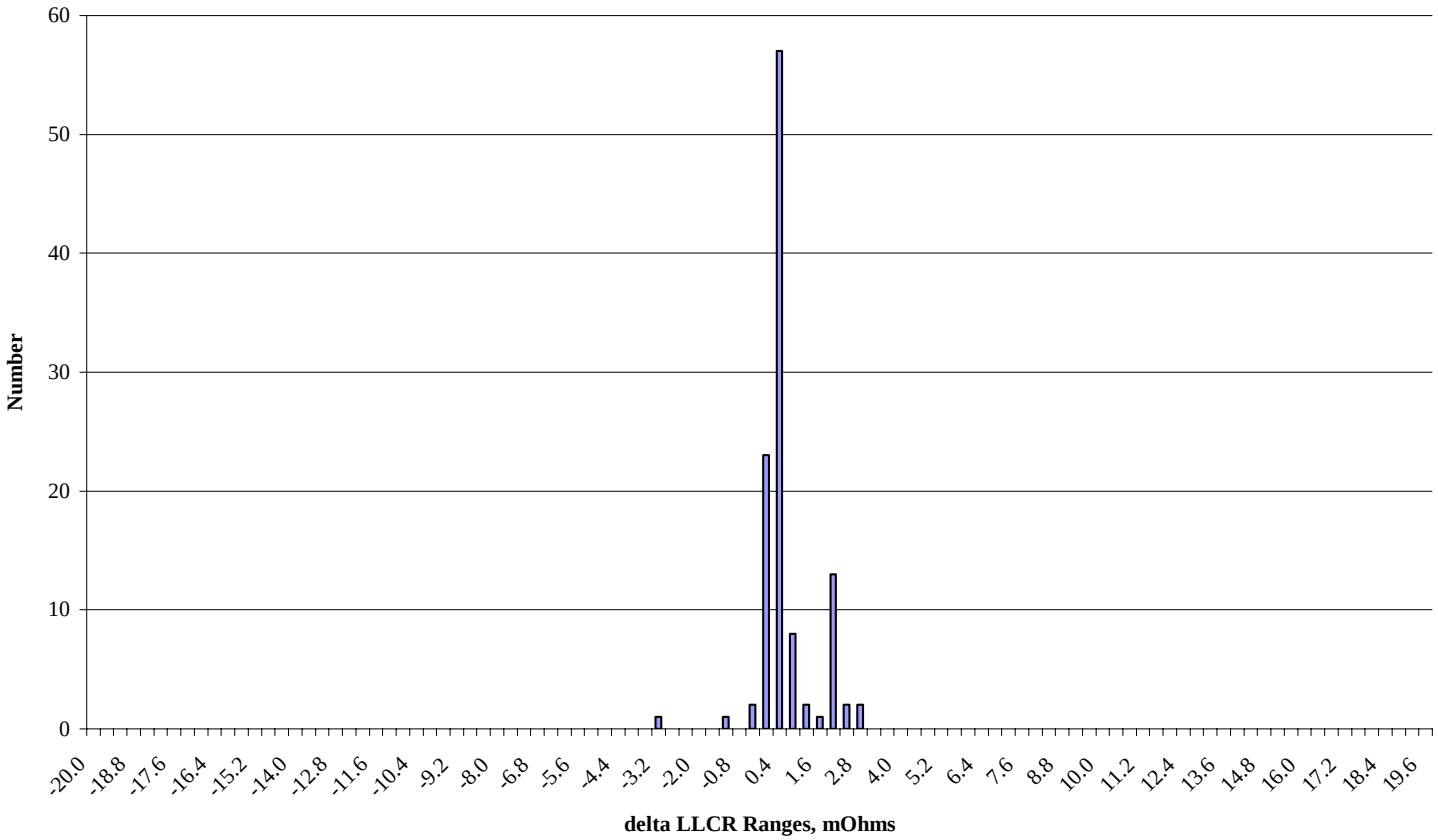
LLCR:

1) A total of 112 points were measured.
2) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
3) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
4) The following guidelines are used to categorize the changes in LLCR as a result from stressing.
   a) <= +5.0 mOhms: ---------- Stable
   b) +5.1 to +10.0 mOhms:---------- Minor
   c) +10.1 to +15.0 mOhms: ---------- Acceptable
   d) +15.1 to +50.0 mOhms: ---------- Marginal
   e) +50.1 to +2000 mOhms ---------- Unstable
   f) >+2000 mOhms:---------- Open Failure

Air Processed

mOhm values	Actual Initial	Delta Humidity- 240 Hours	Delta Humidity- 480 Hours
Average	4.2	0.2	0.3
St. Dev.	1.2	0.5	0.8
Min	2.6	-1.3	-3.6
Max	7.6	2.0	2.5
Count	112	112	112

Air Processed
After 480 Hours



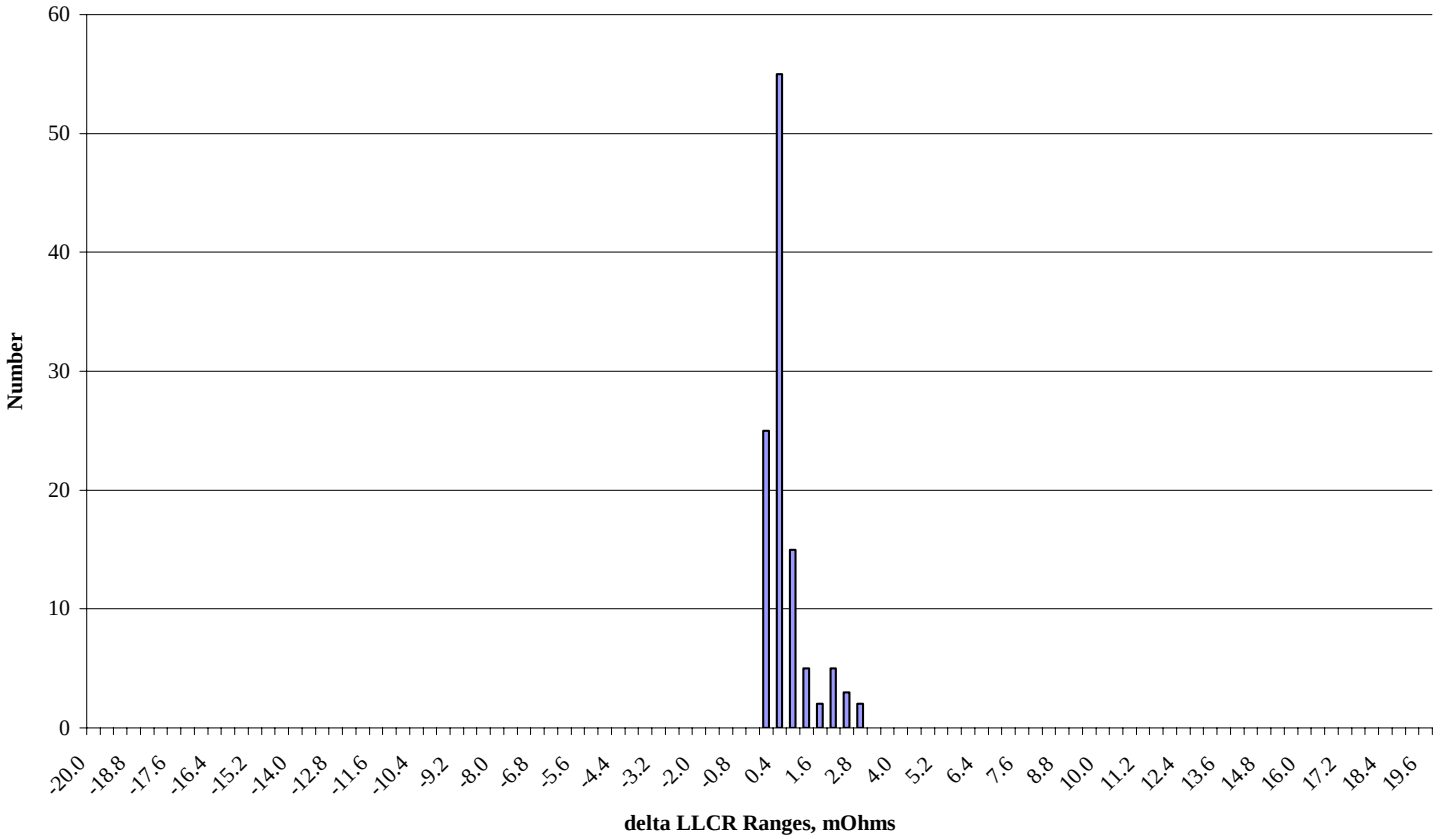
Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES Continued

Nitrogen Processed

mOhm values	Actual Initial	Delta Humidity-240 Hours	Delta Humidity-480 Hours
Average	3.4	0.2	0.4
St. Dev.	1.0	0.5	0.6
Min	2.6	-0.4	-0.3
Max	6.7	2.0	2.6
Count	112	112	112

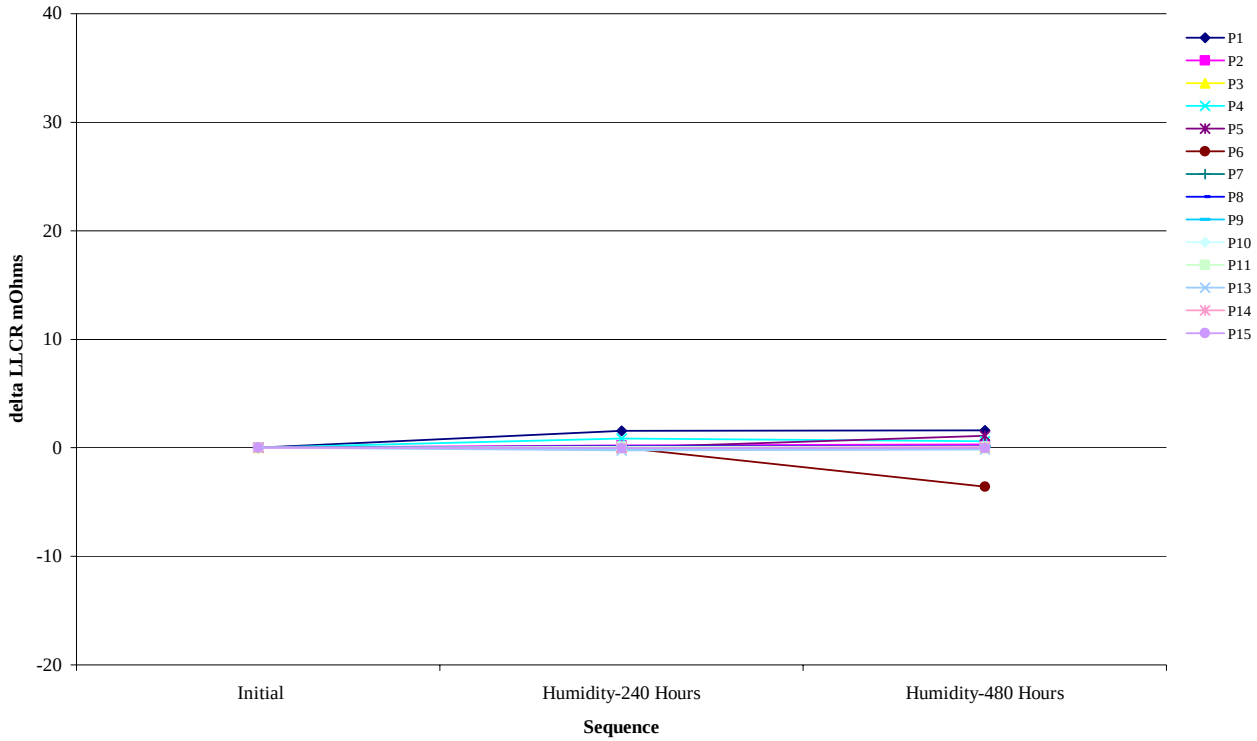
Nitrogen Processed
After 480 Hours



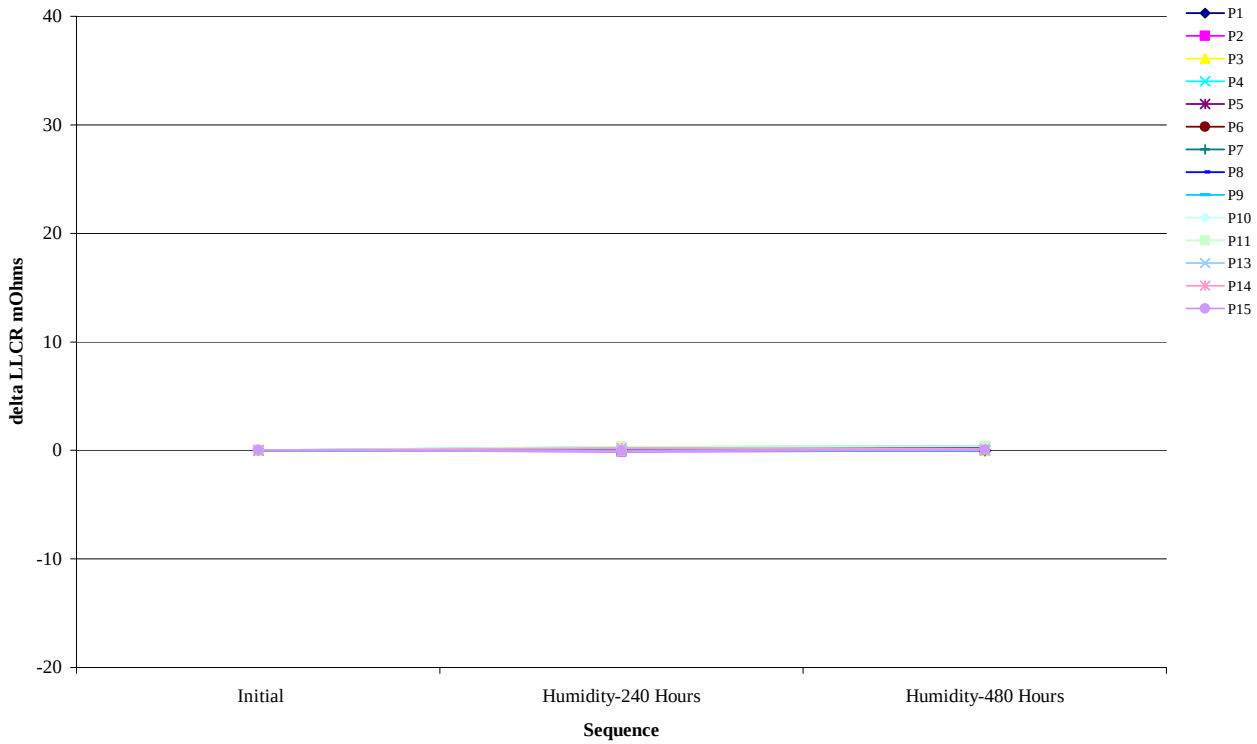
Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES Continued

Air Processed
Board #1



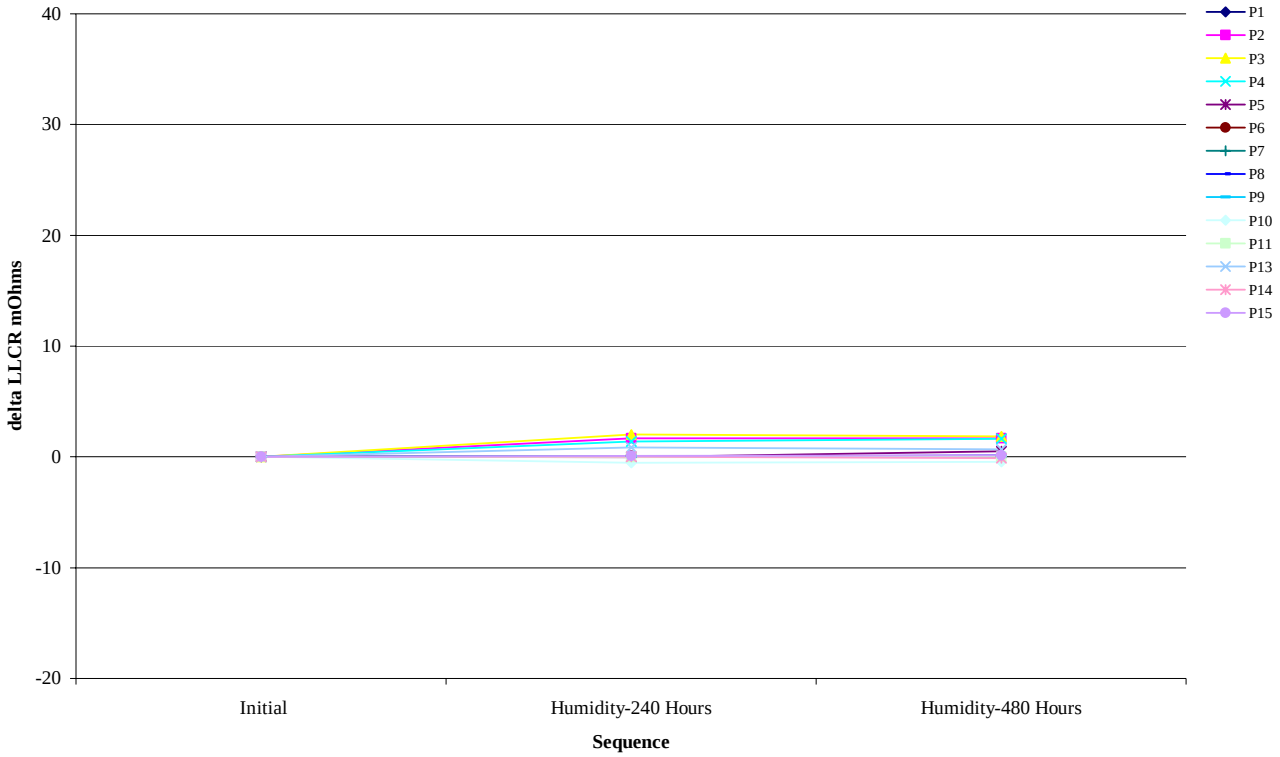
Air Processed
Board #2



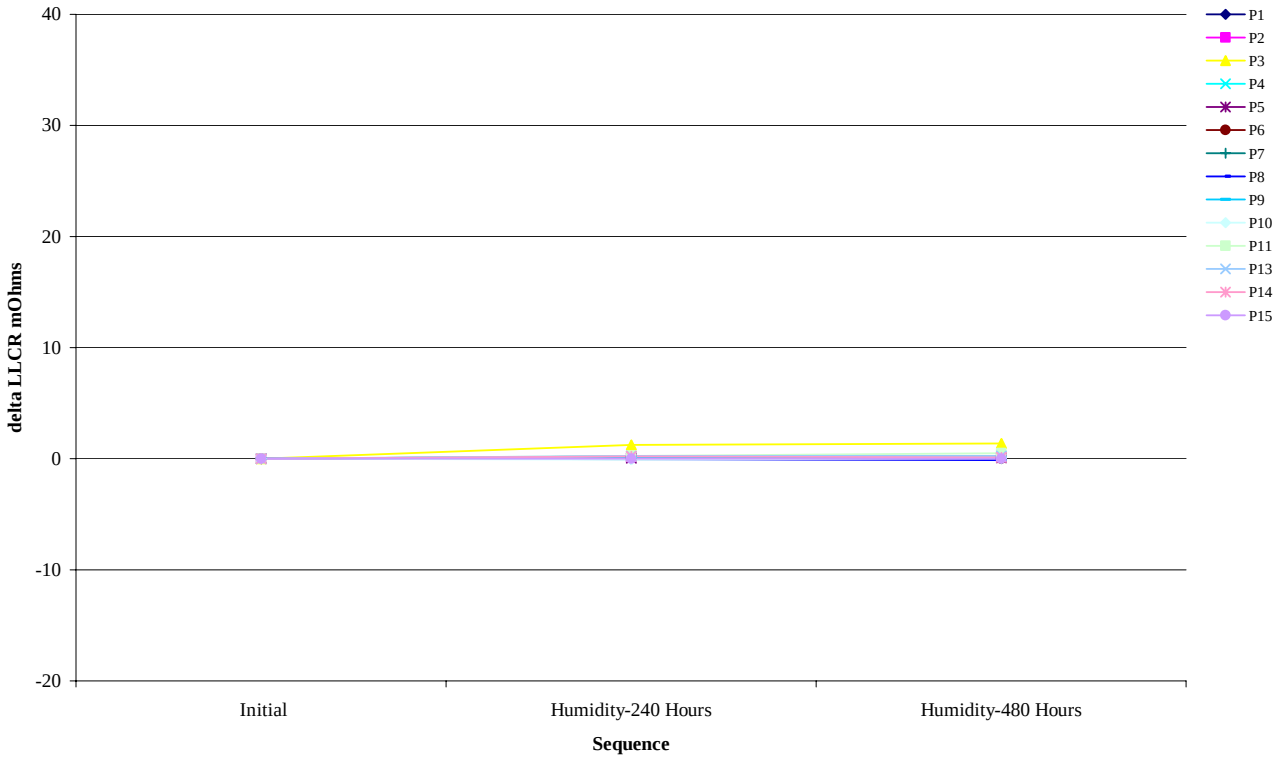
Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES Continued

Air Processed
Board #3



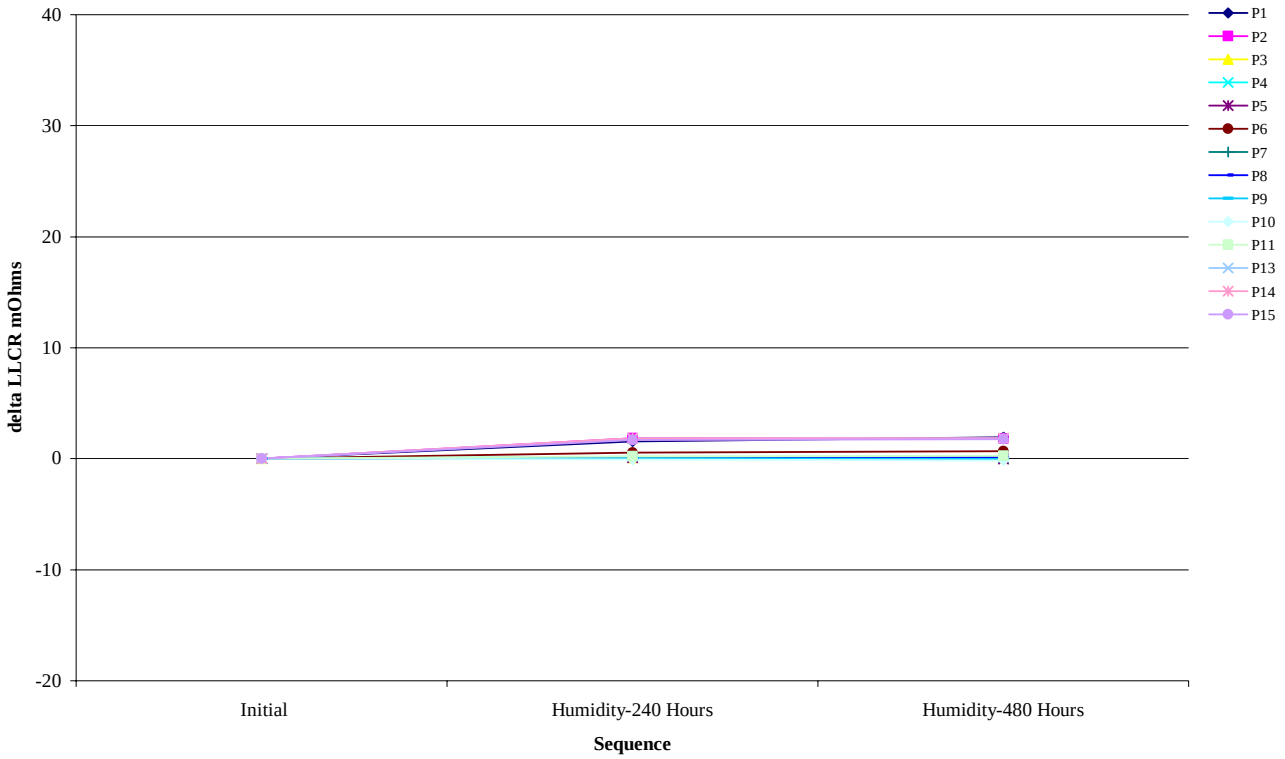
Air Processed
Board #4



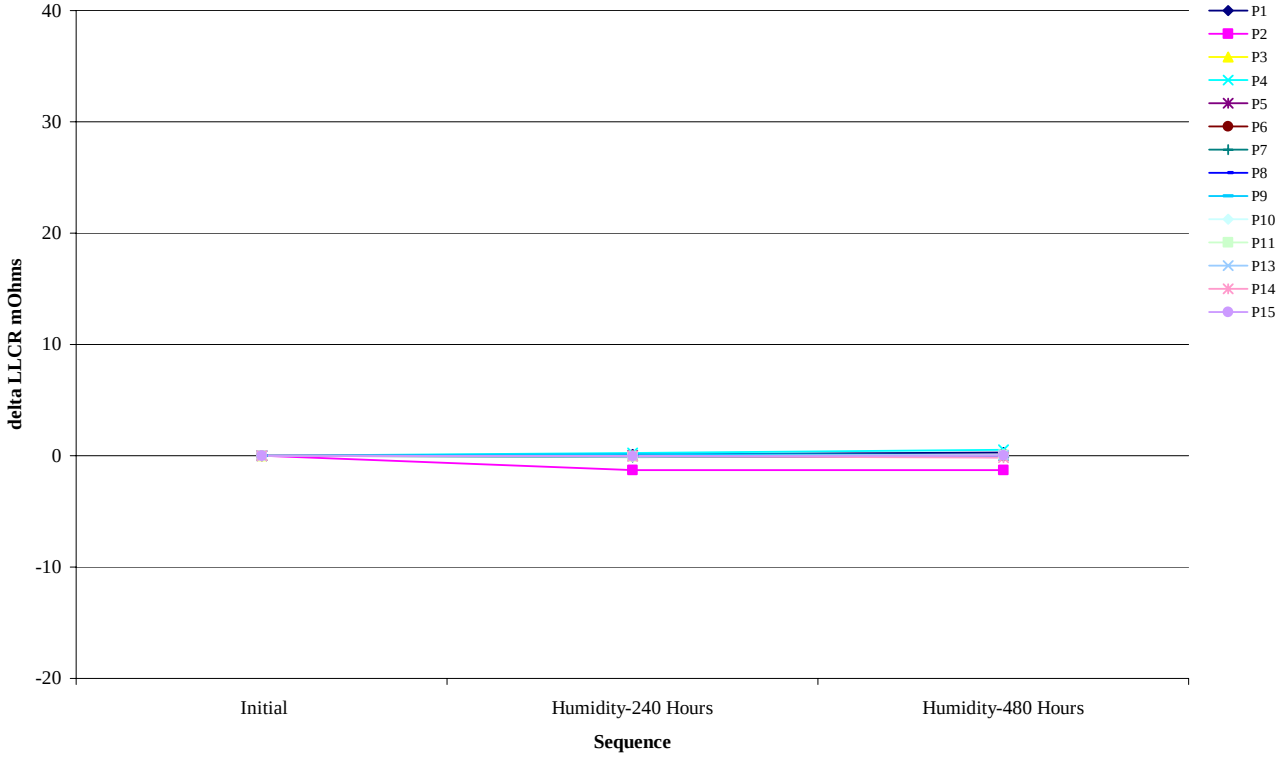
Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES Continued

Air Processed
Board #5



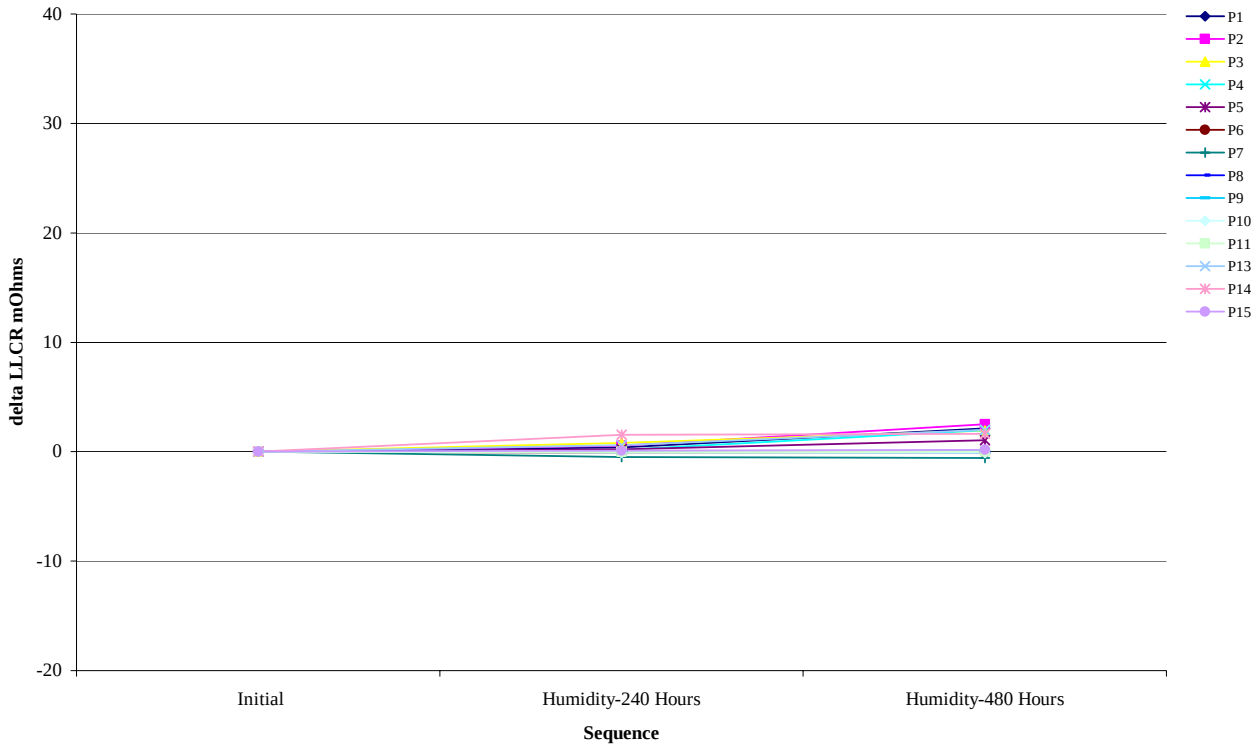
Air Processed
Board #6



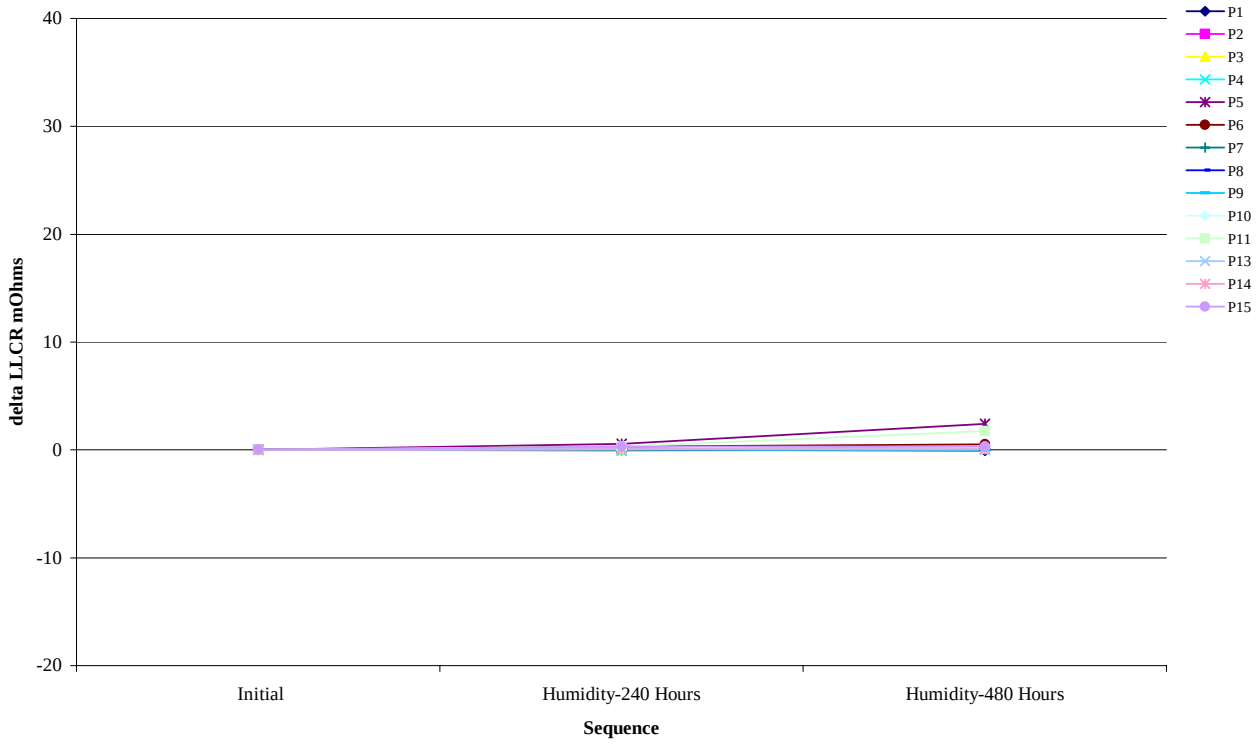
Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES Continued

Air Processed
Board #7



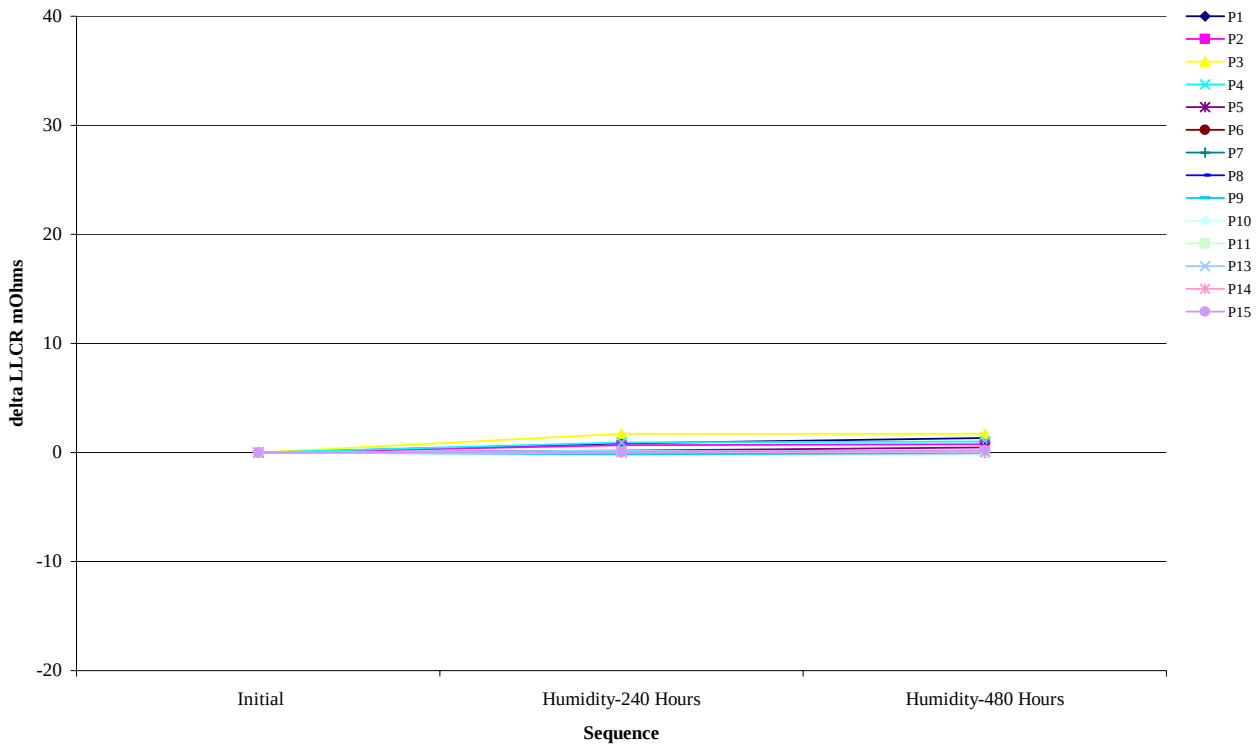
Air Processed
Board #8



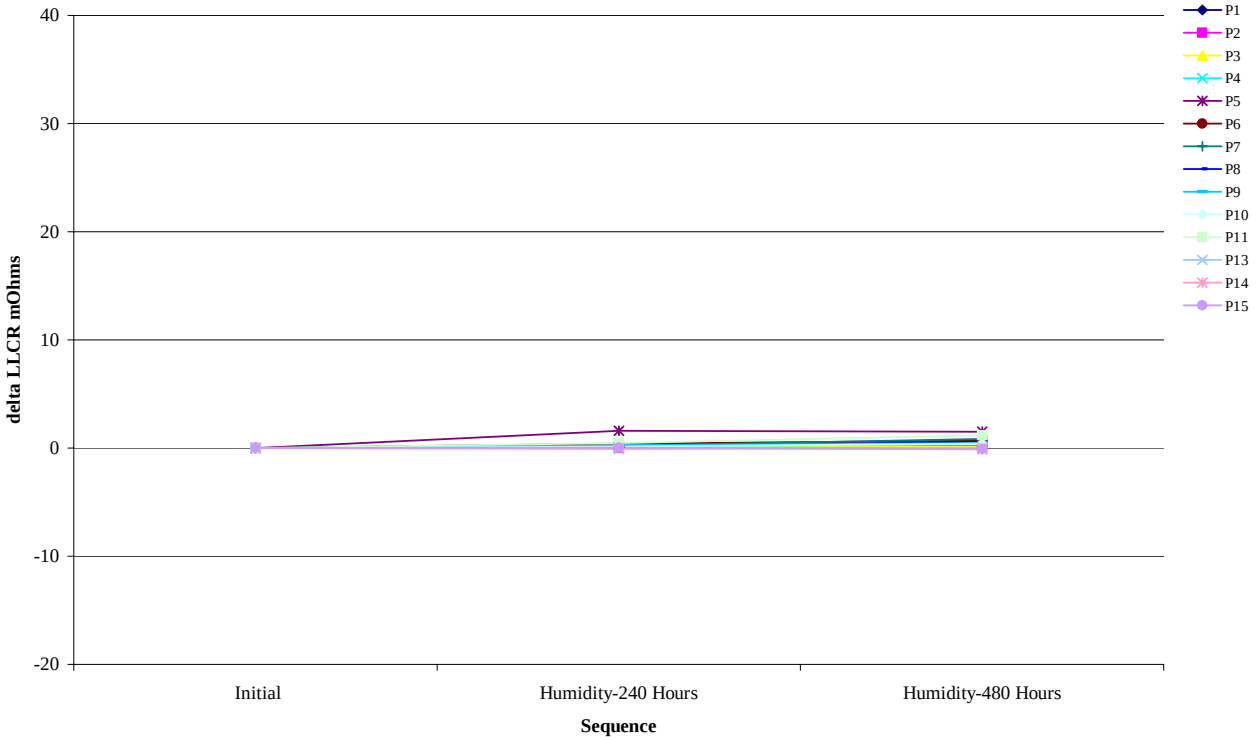
Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES Continued

Nitrogen Processed
Board #1



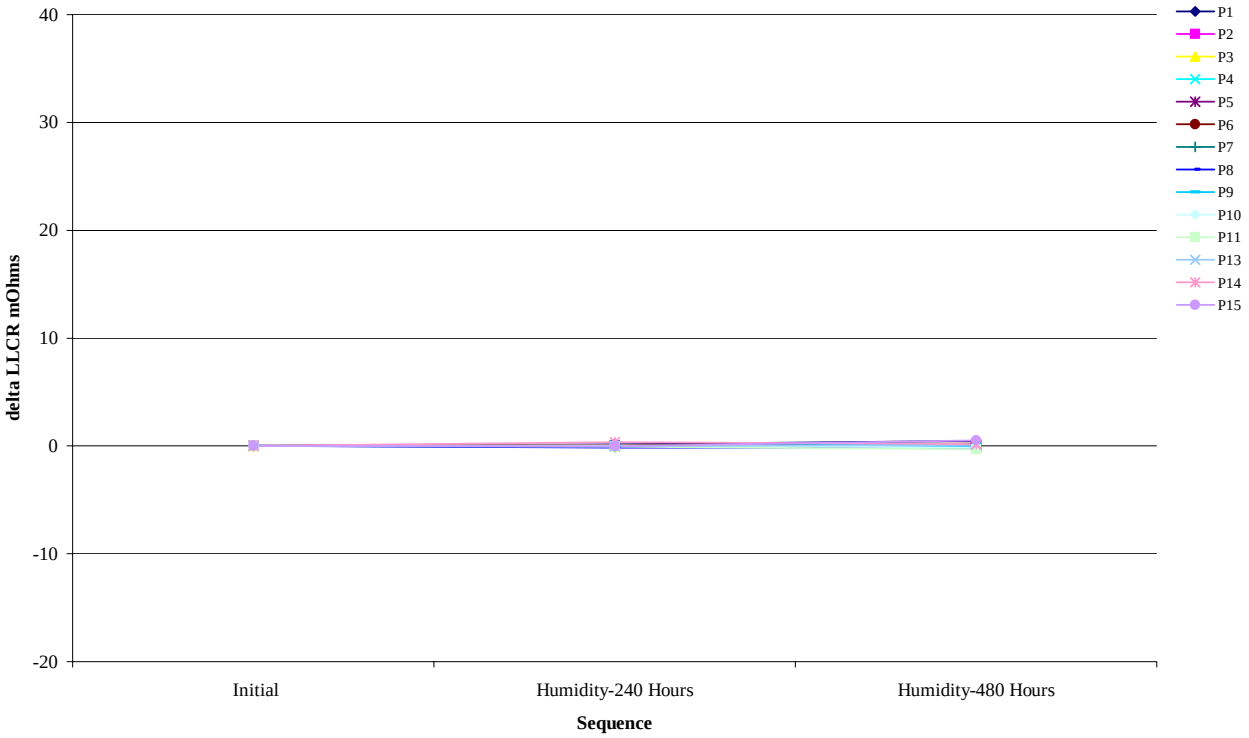
Nitrogen Processed
Board #2



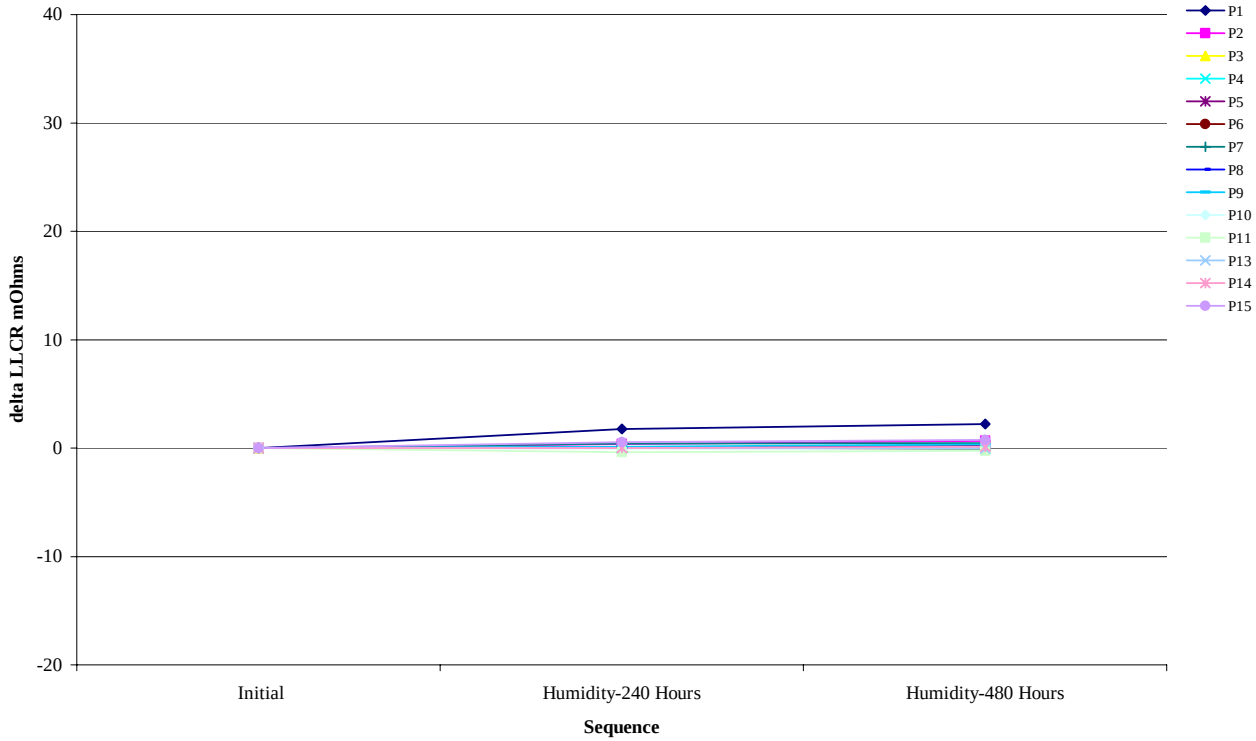
Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES Continued

Nitrogen Processed
Board #3



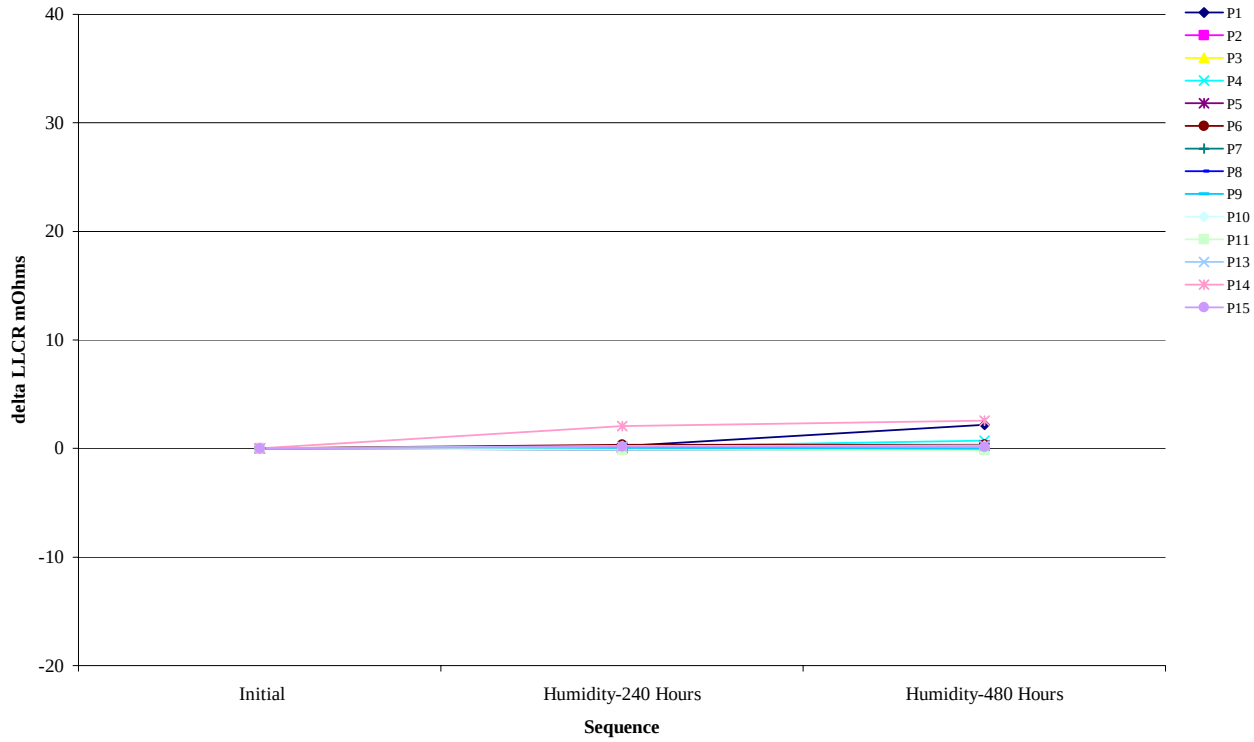
Nitrogen Processed
Board #4



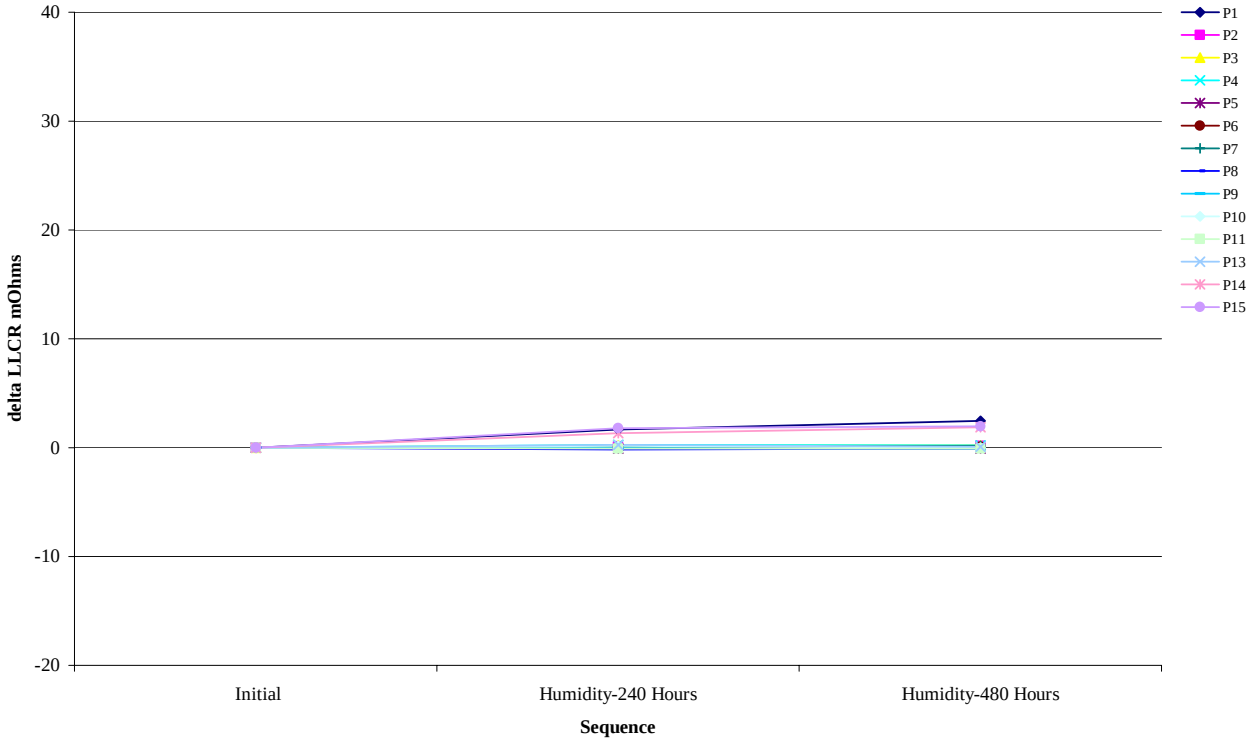
Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES Continued

Nitrogen Processed
Board #5



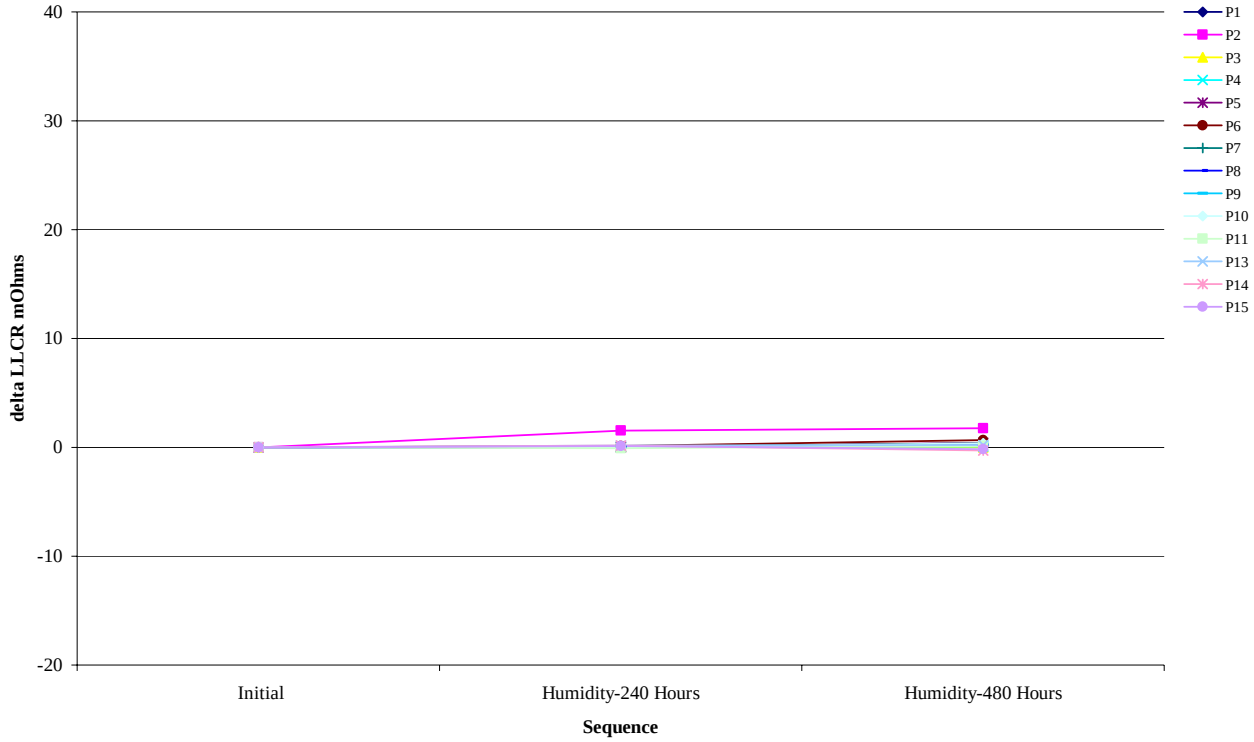
Nitrogen Processed
Board #6



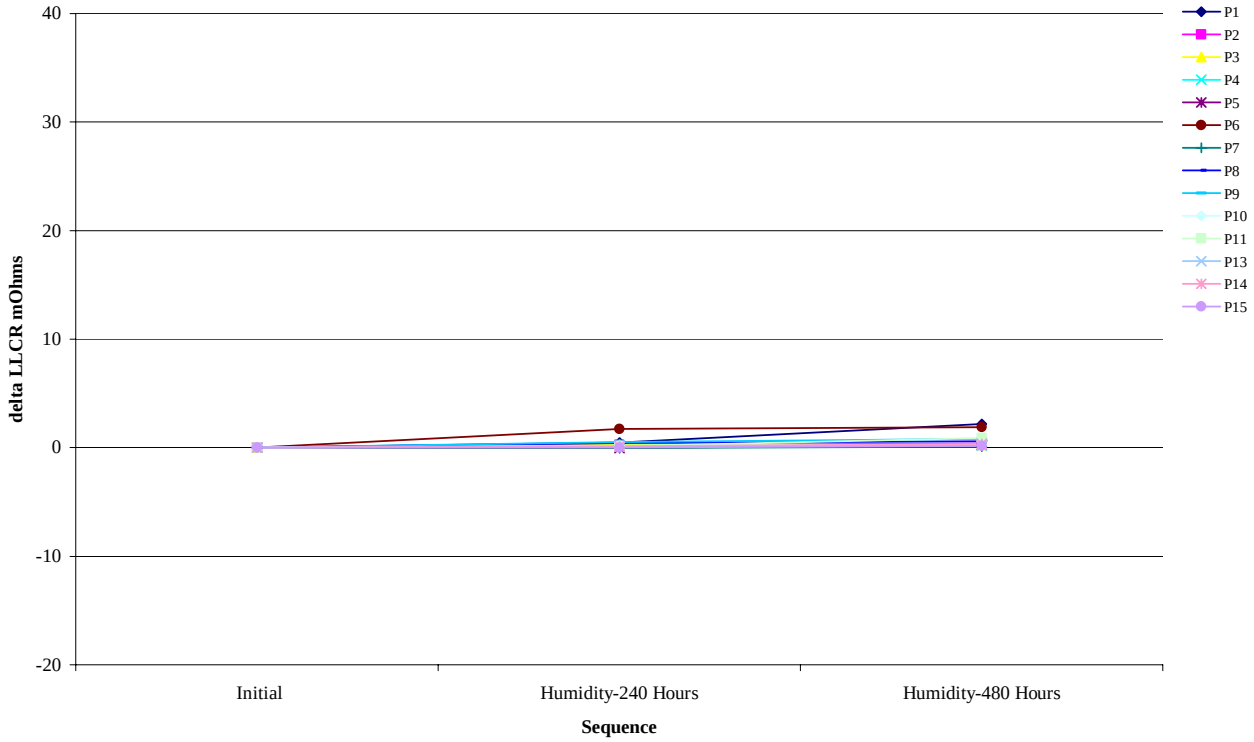
Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA SUMMARIES Continued

Nitrogen Processed
Board #7



Nitrogen Processed
Board #8



Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA

LLCR, Air Processed:

	Jul. 23 2003	Aug. 05 2003	Aug. 20 2003
Date			
Room Temp C	20	21	21
RH	47%	51%	54%
Initials	Troy Cook	Troy Cook	Troy Cook

mOhm values		Actual	Delta	Delta
Board	Position	Initial	Humidity-240 Hours	Humidity-480 Hours
1	P1	4.5	1.6	1.6
1	P2	3.6	0.2	0.3
1	P3	4.1	0.0	0.0
1	P4	5.7	0.8	0.6
1	P5	3.7	0.0	1.1
1	P6	7.6	0.0	-3.6
1	P7	3.3	0.1	0.1
1	P8	3.2	0.1	0.1
1	P9	3.5	-0.1	0.0
1	P10	3.4	-0.1	0.0
1	P11	3.4	0.1	0.1
1	P13	5.2	-0.2	-0.2
1	P14	4.3	0.0	0.0
1	P15	4.4	0.0	0.0
2	P1	6.1	0.0	0.1
2	P2	6.0	-0.1	0.0
2	P3	6.0	0.0	0.0
2	P4	5.9	-0.1	0.0
2	P5	3.5	0.0	0.3
2	P6	3.3	0.0	0.0
2	P7	3.2	0.0	-0.1
2	P8	3.3	0.0	0.0
2	P9	3.0	0.3	0.4
2	P10	3.3	0.0	0.1
2	P11	3.0	0.3	0.4
2	P13	5.9	0.0	0.0
2	P14	5.7	0.2	0.1
2	P15	5.9	0.0	0.0
3	P1	5.9	0.1	0.1
3	P2	4.1	1.7	1.7
3	P3	4.0	2.0	1.9
3	P4	4.7	1.4	1.6
3	P5	3.6	0.0	0.5
3	P6	3.6	0.1	0.0
3	P7	2.7	0.0	0.1
3	P8	3.1	0.0	0.1
3	P9	3.1	0.1	0.0

3	P10	3.4	-0.5	-0.5
3	P11	3.1	0.0	0.0
3	P13	5.0	0.9	0.7
3	P14	6.4	0.0	-0.1
3	P15	6.3	0.1	0.1
4	P1	5.3	0.2	0.3
4	P2	5.5	0.1	0.1
4	P3	4.5	1.3	1.4
4	P4	5.8	0.2	0.2
4	P5	3.4	0.0	0.1
4	P6	3.3	0.1	0.0
4	P7	3.4	0.0	0.0
4	P8	3.4	0.0	-0.1
4	P9	2.9	0.1	0.1
4	P10	2.8	-0.1	0.0
4	P11	3.1	0.2	0.5
4	P13	5.7	0.3	0.3
4	P14	5.9	0.2	0.1
4	P15	6.0	0.0	0.0
5	P1	4.0	1.6	1.9
5	P2	4.2	1.8	1.8
5	P3	6.0	0.1	0.1
5	P4	6.2	0.2	0.0
5	P5	3.5	0.1	0.0
5	P6	2.8	0.6	0.7
5	P7	3.1	0.0	0.2
5	P8	3.0	0.0	0.1
5	P9	3.1	0.0	0.0
5	P10	3.2	-0.1	-0.1
5	P11	3.2	0.2	0.3
5	P13	4.4	1.8	1.9
5	P14	4.5	1.9	1.9
5	P15	5.0	1.7	1.8
6	P1	3.4	0.1	0.3
6	P2	4.2	-1.3	-1.3
6	P3	2.8	0.0	0.0
6	P4	3.0	0.3	0.5
6	P5	3.6	0.0	0.0
6	P6	3.0	-0.1	0.0
6	P7	3.1	-0.1	0.0
6	P8	2.9	0.0	-0.1
6	P9	2.9	0.2	0.1
6	P10	2.6	-0.1	0.1
6	P11	3.7	0.0	0.1
6	P13	2.9	0.0	0.0
6	P14	2.9	-0.1	-0.2
6	P15	3.0	0.0	0.0
7	P1	3.5	0.4	2.1
7	P2	3.3	0.6	2.5
7	P3	3.9	0.8	1.9

7	P4	3.8	0.2	2.0
7	P5	3.8	0.2	1.0
7	P6	3.8	-0.1	-0.1
7	P7	3.9	-0.5	-0.6
7	P8	3.5	0.0	-0.1
7	P9	3.5	0.0	0.1
7	P10	3.7	-0.1	-0.1
7	P11	3.7	0.0	0.0
7	P13	3.7	0.6	2.0
7	P14	4.2	1.5	1.6
7	P15	6.1	0.1	0.2
8	P1	6.2	0.0	-0.1
8	P2	5.8	0.1	0.2
8	P3	6.1	0.0	0.1
8	P4	6.4	-0.1	0.0
8	P5	3.3	0.6	2.4
8	P6	3.3	0.3	0.5
8	P7	3.9	0.0	0.1
8	P8	3.5	0.1	0.1
8	P9	3.7	0.0	0.0
8	P10	3.5	0.1	0.2
8	P11	3.5	0.3	1.7
8	P13	6.4	0.1	0.1
8	P14	6.5	0.0	0.0
8	P15	6.6	0.3	0.3

Tracking Code: TC0327-N/A-0227	Part #: ICF-316-T-O
Part description: ICF	

DATA Continued

LLCR, Nitrogen Processed:

	Jul. 23 2003	Aug. 05 2003	Aug. 20 2003
Date			
Room Temp C	22	21	20
RH	52%	47%	49%
Initials	Troy Cook	Troy Cook	Troy Cook

mOhm values		Actual	Delta	Delta
Board	Position	Initial	Humidity-240 Hours	Humidity-480 Hours
1	P1	4.2	0.9	1.3
1	P2	4.9	0.7	0.7
1	P3	3.9	1.7	1.7
1	P4	4.8	0.9	1.0
1	P5	3.4	0.2	0.5
1	P6	3.0	0.0	0.0
1	P7	2.8	0.1	0.1
1	P8	2.8	-0.1	0.0
1	P9	2.7	-0.2	-0.1
1	P10	2.6	0.0	0.1
1	P11	2.8	0.0	0.1
1	P13	5.8	0.1	0.0
1	P14	6.0	0.0	0.1
1	P15	6.1	0.1	0.2
2	P1	2.7	0.1	0.2
2	P2	2.6	0.0	0.0
2	P3	2.6	0.2	0.2
2	P4	2.8	0.1	0.0
2	P5	4.7	1.6	1.5
2	P6	3.1	0.4	0.7
2	P7	3.1	0.2	0.8
2	P8	3.1	0.1	0.6
2	P9	3.0	0.2	0.4
2	P10	3.2	0.1	0.4
2	P11	3.1	0.5	1.2
2	P13	2.9	-0.1	0.0
2	P14	3.0	0.0	-0.1
2	P15	3.1	0.0	-0.1
3	P1	2.9	0.1	0.5
3	P2	2.8	0.1	0.1
3	P3	2.9	0.0	0.1
3	P4	3.0	0.0	-0.1
3	P5	3.1	0.0	0.1
3	P6	3.0	0.1	0.2
3	P7	3.0	-0.1	0.1
3	P8	2.9	-0.2	-0.2

3	P9	2.7	0.0	0.1
3	P10	2.9	0.1	-0.1
3	P11	2.9	-0.1	-0.3
3	P13	2.9	0.0	0.1
3	P14	2.8	0.3	0.2
3	P15	2.9	0.0	0.5
4	P1	3.6	1.7	2.2
4	P2	2.9	0.4	0.7
4	P3	2.8	0.0	0.0
4	P4	2.8	0.1	0.0
4	P5	3.0	0.1	0.2
4	P6	3.3	0.0	0.0
4	P7	3.0	0.4	0.5
4	P8	2.9	0.0	0.0
4	P9	3.0	0.1	0.3
4	P10	2.9	-0.1	0.0
4	P11	3.1	-0.4	-0.3
4	P13	3.2	0.0	0.0
4	P14	3.0	0.0	0.1
4	P15	3.1	0.5	0.7
5	P1	3.3	0.2	2.2
5	P2	3.1	0.0	0.1
5	P3	3.2	0.0	0.1
5	P4	3.3	0.2	0.7
5	P5	3.0	0.1	0.3
5	P6	3.1	0.3	0.3
5	P7	3.2	0.1	0.0
5	P8	3.1	-0.1	-0.1
5	P9	3.1	0.0	0.0
5	P10	3.1	0.2	0.3
5	P11	3.1	-0.1	-0.1
5	P13	3.1	0.2	0.3
5	P14	3.6	2.0	2.6
5	P15	6.1	0.2	0.1
6	P1	2.9	1.7	2.5
6	P2	2.7	0.1	0.2
6	P3	2.6	0.2	0.2
6	P4	2.6	0.3	0.2
6	P5	3.0	-0.1	-0.1
6	P6	2.8	0.1	0.1
6	P7	2.7	0.1	0.2
6	P8	3.0	-0.2	-0.1
6	P9	3.0	0.0	-0.1
6	P10	2.9	0.2	0.0
6	P11	2.9	-0.1	-0.1
6	P13	2.7	0.2	0.1
6	P14	3.0	1.3	1.9
6	P15	4.1	1.8	2.0
7	P1	5.9	0.1	0.2
7	P2	4.6	1.5	1.8

7	P3	6.1	0.0	0.0
7	P4	6.2	0.0	0.1
7	P5	3.1	0.0	0.4
7	P6	3.2	0.1	0.7
7	P7	3.3	0.1	0.4
7	P8	3.3	0.0	0.3
7	P9	3.5	0.1	0.2
7	P10	3.5	0.0	0.4
7	P11	3.5	-0.1	0.1
7	P13	6.3	0.2	0.2
7	P14	6.5	0.2	-0.3
7	P15	6.7	0.1	-0.2
8	P1	3.6	0.5	2.2
8	P2	3.1	0.3	0.4
8	P3	3.0	0.3	0.3
8	P4	3.0	0.2	0.2
8	P5	2.9	0.0	0.3
8	P6	3.4	1.7	1.9
8	P7	2.9	0.0	0.1
8	P8	3.2	0.5	0.6
8	P9	3.1	0.5	0.8
8	P10	2.9	0.2	0.3
8	P11	3.0	0.1	0.9
8	P13	3.1	0.1	0.2
8	P14	3.1	0.1	0.3
8	P15	3.2	0.0	0.2

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: THL-01
Description: Temperature/Humidity Chart Recorder
Manufacturer: Dickson
Model: THDX
Serial #: 9316255
Accuracy: Temp: +/- 1C; Humidity: +/-2% RH (0 - 60%) +/- 3% RH (61 - 95%).
… Last Cal: 7/15/02, Next Cal: 7/15/03

Equipment #: MO-01
Description: Micro-Ohmeter
Manufacturer: Keithley
Model: 580
Serial #: 0772740
Accuracy: See Manual
… Last Cal6/12/03, Next Cal: 6/12/04

Equipment #: MO-03
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0791975
Accuracy: See Manual
… Last Cal: 6/12/03, Next Cal: 6/12/04

Equipment #: THC-01
Description: Temperature/Humidity Chamber
Manufacturer: Thermotron
Model: SM-8-7800
Serial #: 30676
Accuracy: See Manual
… Last Cal: 5/28/2003, Next Cal: 5/28/2004

Equipment #: OV-5
Description: Nitrongen Purge IR Reflow
Manufacturer: Vitronics Soltec
Model: XPM-730
Serial #: XN 70328
Accuracy: +/- 5 deg. C