



ENGINEERING TEST REPORT

FOR

A10102ET1

MODEL NO.: A102, A101, A103

Label ID: US:SANDDNANA10102ET1

IN ACCORDANCE WITH

TIA-968-A




TECHNICAL REQUIREMENTS FOR
CONNECTION OF TERMINAL EQUIPMENT
TO THE TELEPHONE NETWORK

UltraTech FILE NO.: SNG18-ACTA

TESTED FOR:

Sangoma Technologies Inc.
50 McIntosh drive, Suite 120
Markham, Ontario
Canada, L3R 9T3

ISSUE DATE: April 16, 2004

<p>Project Leader: </p> <p>_____ Mike Tom, Manager Telecom Department</p>	<p>Test Technician: </p> <p>_____ Santhosh Fernandez, Test Specialist Telecom Department</p>
<p><i>In the opinion of the qualifying engineer and as allowed by Engineering analysis and examination of the test data, the test results contained herein this report is to the best of my knowledge, true and correct and is hereby issued under the authority of:</i></p> <p>_____ VICTOR H. KEE, P.ENG.</p>	<p></p> <p>_____ Victor H. Kee, P.Eng., Vice President – Engineering</p> <p>Date: April 16, 2004</p>

- The test results contained in this test report only applies to the randomly selected test sample(s) as described in Section 1.3 of this report.
- This report cannot be reproduced in full or in part without the prior written consent of UltraTech Group of Labs Inc.

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Phone: (905) 829-1570 Fax: (905) 829-8050

TABLE OF CONTENTS

EXHIBIT 1. GENERAL	1
1.1. APPLICANT INFORMATION.....	1
1.2. TEST SAMPLE INFORMATION.....	1
1.2.1. <i>FUNCTIONAL DESCRIPTION</i>	2
1.3. TEST PROCEDURES.....	2
1.4. RADIO FREQUENCY GENERATING CIRCUITRY	2
1.5. TEST PLAN.....	2
1.6. MODIFICATIONS.....	2
1.7. SUMMARY OF TECHNICAL REQUIREMENTS - INTERFACE TESTS.....	3
1.8. OPERATIONAL CHECK.....	3
EXHIBIT 2. MEASUREMENT DATA	4
2.1. ENVIRONMENTAL SIMULATION - (68.302)	4
2.1.1. <i>68.302(A) – MECHANICAL SHOCK</i>	4
2.1.2. <i>TELEPHONE LINE SURGE</i>	5
2.1.3. <i>68.302(D)(1) - POWER LINE SURGE</i>	7
2.2. LEAKAGE CURRENT LIMITATIONS - (68.304)	8
2.3. HAZARDOUS VOLTAGE LIMITATIONS - (68.306).....	9
2.3.1. <i>68.306(A) - GENERAL (NETWORK CONNECTIONS)</i>	9
2.3.2. <i>68.306(E)(2) – INTENTIONAL PROTECTIVE PATHS TO GROUND</i>	9
2.4. SIGNAL POWER - (68.308).....	10
2.4.1. <i>68.308(B)(5)(I)(A)-(G) – THROUGH TRANSMISSION AMPLIFICATION</i>	10
2.5. TRANSVERSE BALANCE LIMITATIONS- (68.310)	11
2.6. 1.544 Mb/s DIGITAL SERVICES	12
2.6.1. <i>68.308(H)(2)(I) – 1.544 Mb/s PULSE REPETITION RATE</i>	12
2.6.2. <i>68.308(H)(2)(II) - 1.544 Mb/s PULSE TEMPLATE</i>	12
2.6.3. <i>68.308(H)(2)(IV) - 1.544 Mb/s OUTPUT POWER</i>	12
EXHIBIT 3. PULSE TEMPLATES	13
3.1. OPTION A.....	13
3.1.1. <i>BEFORE STRESS</i>	13
3.1.2. <i>AFTER STRESS</i>	14
3.2. OPTION B.....	15
3.2.1. <i>BEFORE STRESS</i>	15
3.2.2. <i>AFTER STRESS</i>	16
3.3. OPTION C.....	17
3.3.1. <i>BEFORE STRESS</i>	17
3.3.2. <i>AFTER STRESS</i>	18

EXHIBIT 1. GENERAL

1.1. APPLICANT INFORMATION

APPLICANT	
Company	Sangoma Technologies Inc.
Address	50 McIntosh drive, Suite 120 Markham, Ontario Canada, L3R 9T3
Contact: Phone: Email:	Mr. David Mandelstam 905-474-1990 dm@sangoma.com

U.S. Agent for Service	
Company	JBM Electronics
Address	4645 LaGuardia St. Louis MO, 63134-906
Contact: Phone:	Tech. Support 1-314-426-7781

1.2. TEST SAMPLE INFORMATION

Trade Name/Product:	A10102ET1
Models:	A102, A101, A103
Serial #:	Pre-production
Equipment Type:	Digital Terminal Equipment
Interface Type	Digital 1.544 MBps
Power Source:	Power is derieved from host PC

ENGINEERING
PROTOTYPE _____

PRODUCTION
PROTOTYPE _____

PRODUCTION
UNIT X

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050

File #: SNG18-ACTA
April 16, 2004

1.2.1. FUNCTIONAL DESCRIPTION

The TE under test is a WAN card for PC with T1/E1 DSU/CSU.

1.3. TEST PROCEDURES

Test methods and procedures were performed in accordance with *EIA/TIA TSB31-B – Part 68 Rationale and Measurement Guidelines, February 1998*.

The implementation of these test procedures are those specified in ACTA's Adopted Technical Criteria, *TIA-968-A – Telephone Terminal Equipment Technical Requirements for Connection of Terminal Equipment to the Telephone Network, October 2002*. Aspects of the procedure unique to this unit are described in the test plan below.

1.4. RADIO FREQUENCY GENERATING CIRCUITRY

The Terminal equipment has been tested and found to comply with the Class B digital device requirements as set forth in CFR 47, Part 15, Subpart B.

1.5. TEST PLAN

A discussion of the tests selection is attached overleaf followed by the test data. All after stress measurements where applicable are made after the Type B surges. Type A surges and Power Line surge are performed after stress.

1.6. MODIFICATIONS

No modifications were required.

1.7. SUMMARY OF TECHNICAL REQUIREMENTS - Interface Tests

Interface Type: Digital 1.544 MBps Interface Code: N

FCC Paragraph	Test Description	Compliance (Y/N)	
		Before	After
ENVIROMENTAL SIMULATION- 68.302			
68.302 (a)	Mechanical Shock	YES	YES
68.302 (b)(1)	Metallic Voltage Surge – Type A	YES	YES
68.302 (c)(1)	Metallic Voltage Surge – Type B	YES	YES
68.302 (b)2)	Longitudinal Voltage Surge –Type A	YES	YES
68.302(c)(2)	Longitudinal Voltage Surge –Type B	YES	YES
68.302 (d)(1)	Power Line Surge	N/A	N/A
LEAKAGE CURRENT - 68.304			
68.304	Leakage Current Limitations	YES	YES
HAZARDOUS VOLTAGE LIMITATIONS 68.306			
68.306	General – Network Connections	YES	YES
68.306 (e)(2)	Intentional Operating Paths to Ground	YES	YES
SIGNAL POWER LIMITATIONS - 68.308			
68.308 (b)(5)(i)(A)-(G)	Through Transmission Amplification	N/A	N/A
68.308 (b)(5)(i)(H)	Through Transmission - SF Cutoff	N/A	N/A
68.308 (b)(5)(ii)	Through Transmission - SF/Guard Bands	N/A	N/A
TRANSVERSE BALANCE LIMITATIONS - 68.310			
68.310	Digital EUT	YES	YES
DIGITAL TERMINAL EQUIPMENT			
68.308(h)(2)(i)	1.544 Mb/s Pulse Repetition Rate	YES	YES
68.308(h)(2)(ii)	1.544 Mb/s Pulse Template	YES	YES
68.308(h)(2)(iv)	1.544 Mb/s Output Power	YES	YES
68.308(h)(2)(v)	1.544 Mb/s Encoded Analog Content	N/A	N/A
68.314(d)(2)	1.544 Mb/s Signaling Interference	N/A	N/A
68.314(e)	1.544 Mb/s On-Hook Level	N/A	N/A
68.314(f)	1.544 Mb/s Signaling Duration	N/A	N/A
68.314(f)	1.544 Mb/s Direct Inward Dialing	N/A	N/A

* N/A – Not Applicable

1.8. OPERATIONAL CHECK

Feature Tested	Remarks	
	Before Stress	After Stress
Internal Signals	N/A	N/A
Transmit Levels	(1)	(1)
Pulse Shape	(1)	(1)
Line Build-out features	(1)	(1)

- NOTES:** (1) Fully operational.
(2) Partly operational.
Inoperable feature(s): None
(3) Fully inoperable, Fuse F1 opened after surge.

2.1.2. TELEPHONE LINE SURGE

2.1.2.1. 68.302(b)(1) – (c)(1) - TYPE A & TYPE B METALLIC

PROCEDURE: - TIA-968-A, Section 4.2.2 and 4.2.3

TYPE A:

One 800 Volt surge (10µs max. x 560µs min.) of each polarity was applied across the lead pairs indicated below:

Operation	Equipment Port	Tx Pair		Rx Pair	
		Normal	Reverse	Normal	Reverse
Idle	Port 1	(1)	(1)	(1)	(1)
Transmitting	Port 1	(1)	(1)	(1)	(1)

TYPE B:

One 1000 Volt surge (9µs max. x 720µs min.) of each polarity was applied across the lead pairs indicated below:

Operation	Equipment Port	Tx Pair		Rx Pair	
		Normal	Reverse	Normal	Reverse
Normal	Port 1	(1)	(1)	(1)	(1)
Transmitting	Port 1	(1)	(1)	(1)	(1)

NOTES:

- (1) No effect
- (2) Coil failed (open), leaving the unit permanently on-hook.
- (3) Fuses blew (open) leaving the unit permanently on-hook. When fuses were replaced, unit functioned normally.
- (4) Fuses blew (open) leaving the unit permanently on-hook. When fuses were replaced, unit could not go off-hook.
- (5) The resistors in series with the tip/ring line failed (open), leaving the unit permanently on-hook.
- (6) _____

RESULTS & ANALYSIS: The unit complies with the above requirements.

2.1.2.2. 68.302(b)(2) – (c)(2) - TYPE A & TYPE B LONGITUDINAL

PROCEDURE: - TIA-968-A, Section 4.2.2 and 4.2.3

TYPE A:

One 1500 Volt surge (10µs max. x 160µs min.) of each polarity was applied between the lead pairs listed below:

Operation	Equipment Port	Tx Pair		Rx Pair	
		Normal	Reverse	Normal	Reverse
Normal	Port 1	(1)	(1)	(1)	(1)
Transmitting	Port 1	(1)	(1)	(1)	(1)

TYPE B:

One 1500 Volt surge (9µs max. x 720µs min.) of each polarity was applied between the lead pairs listed below:

Operation	Equipment Port	Tx Pair		Rx Pair	
		Normal	Reverse	Normal	Reverse
Normal	Port 1	(1)	(1)	(1)	(1)
Transmitting	Port 1	(1)	(1)	(1)	(1)

NOTES:

- (1) No effect
- (2) Coil failed (open), leaving the unit permanently on-hook.
- (3) Fuses blew (open) leaving the unit permanently on-hook. When fuses were replaced, unit functioned normally.
- (4) Fuses blew (open) leaving the unit permanently on-hook. When fuses were replaced, unit could not go off-hook.
- (5) The resistors in series with the tip/ring line failed (open), leaving the unit permanently on-hook.

RESULTS & ANALYSIS: The unit complies with the above requirements.

2.1.3. 68.302(d)(1) - POWER LINE SURGE

PROCEDURE: - TIA-968-A, Section 4.2.4

TEST:

Three 2500 Volt surges ($2\mu\text{s}$ max. $\times 10\mu\text{s}$ min.) of each polarity were applied between the phase and neutral terminals of the input AC power line in the equipment states listed below:

Equipment State	Voltage Level +2500			Voltage Level -2500		
	1	2	3	1	2	3

Observations:

RESULTS & ANALYSIS: THIS TEST IS NOT APPLICABLE.

2.2. LEAKAGE CURRENT LIMITATIONS - (68.304)

PROCEDURE: - TIA-968-A, Section 4.3

The unit was subjected to leakage current tests. Listed below are lead pairs selected and the current measured. The highest of on-hook and off-hook readings are shown.

LEAD CATEGORIES:

- (a) All telephone connections.
- (b) All power connections.
- (c) All possible combination of exposed conductive surfaces on the exterior of such equipment excluding terminals for connection to other equipment.
- (d) All terminals for connection to non-registered equipment.
- (e) Points having conducting path to the secondaries of any power supply.
- (f) All auxiliary lead terminals.
- (g) All E & M lead terminals.
- (h) All PR, PC, CY1 and CY2 leads.

MEASUREMENT:

Test Points	Voltage Level (Vac)	Operating Condition	Measured Leakage (mA)	
			Before Stress	After Stress
(a) - (c)	1000	Idle	0.52	0.52
(a) - (c)	1000	Transmitting	0.52	0.52

Note: Maximum Leakage current allowed is 10 mA for all points of connection.

RESULTS & ANALYSIS: The unit complies with the above requirements.

2.3. HAZARDOUS VOLTAGE LIMITATIONS - (68.306)

2.3.1. 68.306(a) - GENERAL (NETWORK CONNECTIONS)

CRITERIA: - Under no condition of failure of registered terminal equipment or registered protective circuitry, or of equipment connected thereto, which can be conceived to occur in the handling, operation or repair of such equipment or circuitry, shall the open circuit voltage on telephone connections exceed 70 volts peak for more than one second, except for voltages for network control signaling and supervision.

PROCEDURE: - TIA-968-A, Section 4.4

MEASUREMENT:

Operating State	Measured Maximum Peak AC Voltage (V)								
	Less Than 70V			Greater than 70V					
	T-R	T-Gnd	R-Gnd	T-R	Time	T-Gnd	Time	R-Gnd	Time
IDLE	< 0.1	< 0.1	< 0.1	--	--	--	--	--	--

*Time refers to duration of ac voltage present

RESULTS & ANALYSIS: The unit complies with the above requirements.

2.3.2. 68.306(e)(2) – INTENTIONAL PROTECTIVE PATHS TO GROUND

CRITERIA: - Registered terminal equipment and protective circuitry having an intentional dc conducting path to earth ground for protection purposes at the leakage current test voltage that was removed during the leakage current test of 68.304 shall, upon its replacement, have a 50 or 60 Hz voltage source applied between simplex telephone connections and earth ground.

PROCEDURE: - TIA-968-A, Section 4.4

MEASUREMENT:

Component Re-Installed	Measured Leakage Current (µA)				Maximum Leakage
	Before Stress		After Stress		
	Tip/Ring-Gnd	Tip1/Ring1-Gnd	Tip/Ring-Gnd	Tip1/Ring1-Gnd	10 mA
Sidactors S1, S3, S4 & S6	0.018	1.85	0.018	1.85	

RESULTS & ANALYSIS: The unit complies with the above requirements.

2.4. SIGNAL POWER - (68.308)

2.4.1. 68.308(b)(5)(i)(A)-(G) – THROUGH TRANSMISSION AMPLIFICATION

CRITERIA: - Where through-transmission equipment provides a dc electrical signal to equipment connected therewith (e.g. for powering of electro-acoustic transducers), dc conditions shall be provided which fall within the range of conditions provided by a loop simulator circuit.

PROCEDURE: - TIA-968-A, Section 4.5.2.3

MEASUREMENT:

SOURCE: Recorded cassette test tape. **LEVEL:** -11dBV

Frequency Band	Measured Level (dBV)						Allowable Net Amplification
	Before Stress			After Stress			
	Input (a)	Output (b)	Net Gain (a)-(b)	Input (a)	Output (b)	Net Gain (a)-(b)	
Below 3995 Hz							
600 to 3995 Hz (A)							
4 kHz (B)							
Net Gain (A-B)							3 dB
800 to 2450 Hz (C)							
2450 to 2750 Hz (D)							
Net Gain (C-D)							1 dB

RESULTS & ANALYSIS: THIS TEST IS NOT APPLICABLE.

2.5. TRANSVERSE BALANCE LIMITATIONS- (68.310)

CRITERIA: - The minimum balance requirements specified in 68.310(a), shown below shall be equaled or exceeded under all reasonable conditions of the application of earth ground to the equipment or protective circuit under test.

PROCEDURE: - TIA-968-A, Section 4.6

MEASUREMENT:

**Balance shown is the lesser of the tip/ring, ring/tip measurements.*

Frequency (kHz)	Transmit Pair		Receive Pair		Specified Limit (dB)	RL Value (Ω)
	Before Stress	After Stress	Before Stress	After Stress		
12	54.6	54.6	54.4	54.4	35	90
40	70.4	70.4	70.0	70.0	35	90
75	68.5	68.5	68.5	68.5	35	90
100	67.1	67.1	67.6	67.6	35	90
150	65.5	65.5	66.3	66.3	35	90
192	64.1	64.1	64.7	64.7	35	90
250	61.6	61.6	62.8	62.8	35	90
400	57.7	57.7	58.9	58.9	35	90
700	53.1	53.1	54.3	54.3	35	90
1000	50.3	50.3	51.2	51.2	35	90
1544	46.1	46.1	47.6	47.6	35	90

RESULTS & ANALYSIS: The unit complies with the above requirements.

2.6. 1.544 Mb/s DIGITAL SERVICES

2.6.1. 68.308(h)(2)(i) – 1.544 Mb/s PULSE REPETITION RATE

CRITERIA: - The pulse repetition rate shall be within ± 50 pulses per second of 1.544×10^6 pulses per second.

PROCEDURE: - TSB31B, Sec. 13.7

MEASUREMENT:

Signal Type	Measured Pulse Rate ($\times 10^6$)	
	Before Stress	After Stress
All Ones Signal	1.5439	1.5439

RESULTS & ANALYSIS: The unit complies with the above requirements.

2.6.2. 68.308(h)(2)(ii) - 1.544 Mb/s PULSE TEMPLATE

CRITERIA: - The registered terminal equipment shall be capable of optionally delivering three sizes of output pulses. The output pulse option shall be selectable at the time of installation.

PROCEDURE: - TSB31B, Sec. 13.2.2

MEASUREMENT:

Please refer to the oscilloscope traces in Exhibit 3 for details of conformance with the defined pulse mask.

RESULTS & ANALYSIS: The unit complies with the above requirements.

2.6.3. 68.308(h)(2)(iv) - 1.544 Mb/s OUTPUT POWER

CRITERIA: - The output power in a 3 kHz band about 772 kHz when an all ones signal sequence is being produced as measured across a 100 Ω terminating resistance shall be within the following limits:

PROCEDURE: - TSB31B, Sec. 13.2.3

MEASUREMENT:

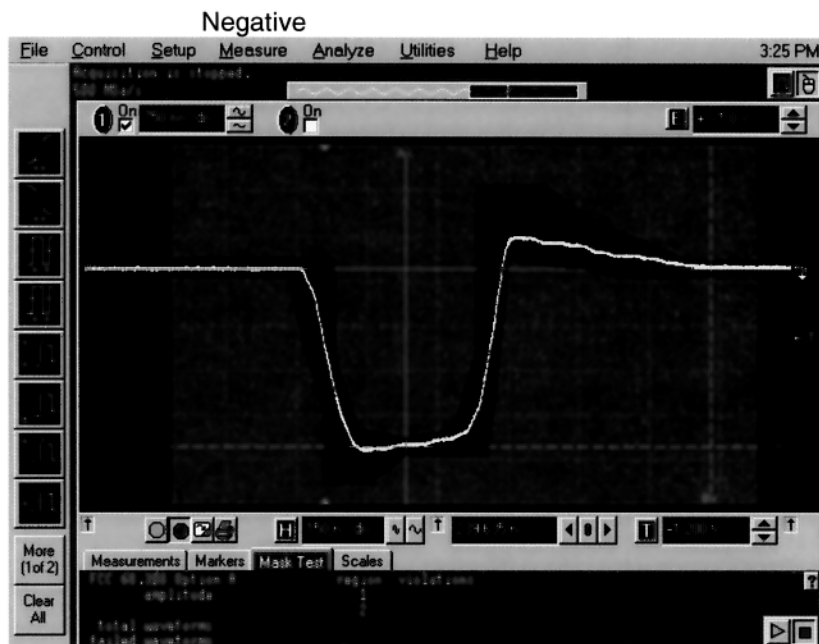
Output Pulse Option	Frequency (kHz)	Measured Signal Power (dBm)		Specified Maximum (dBm)
		Before Stress	After Stress	
A (0 dB)	772	4.85	4.85	+19.0
	1544	-24.1	-24.1	at least 25 dB < @ 772 kHz

RESULTS & ANALYSIS: The unit complies with the above requirements.

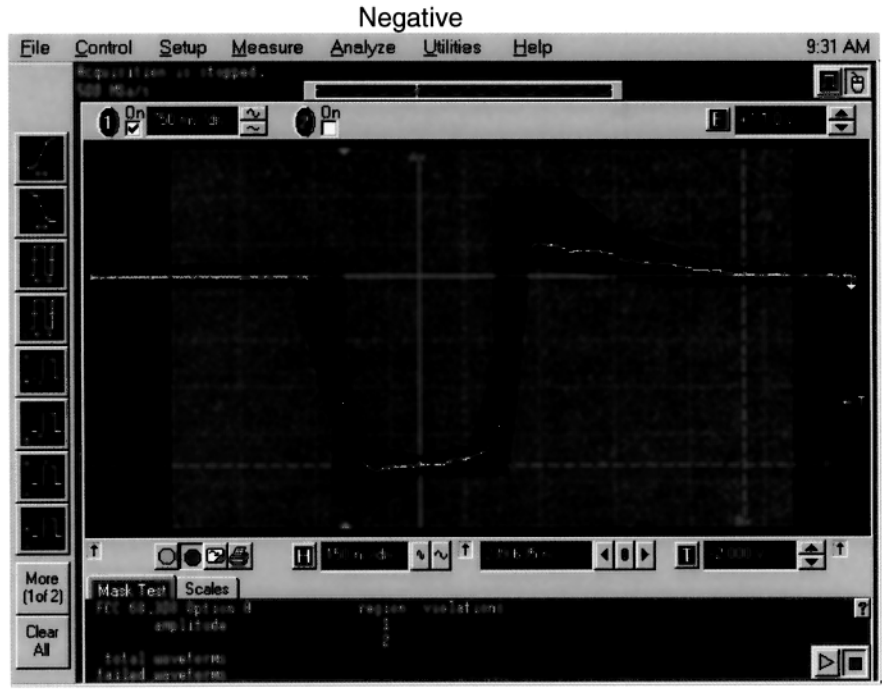
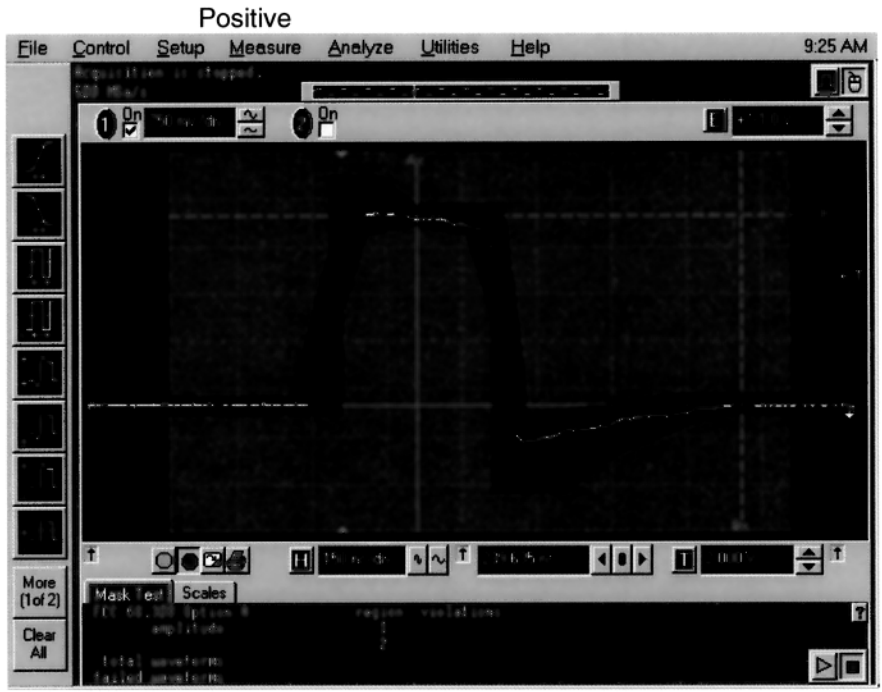
EXHIBIT 3. PULSE TEMPLATES

3.1. OPTION A

3.1.1. Before stress

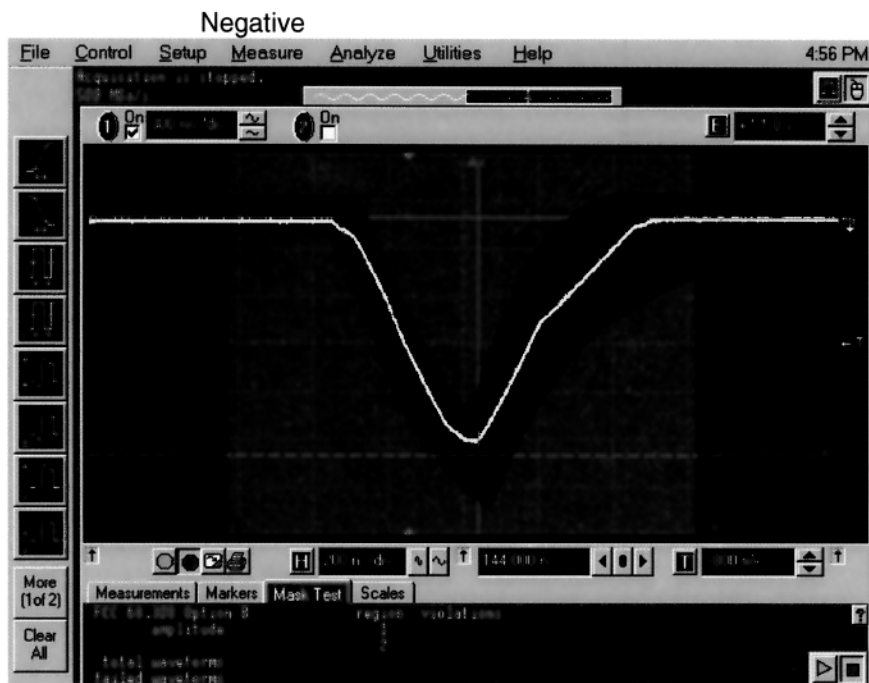
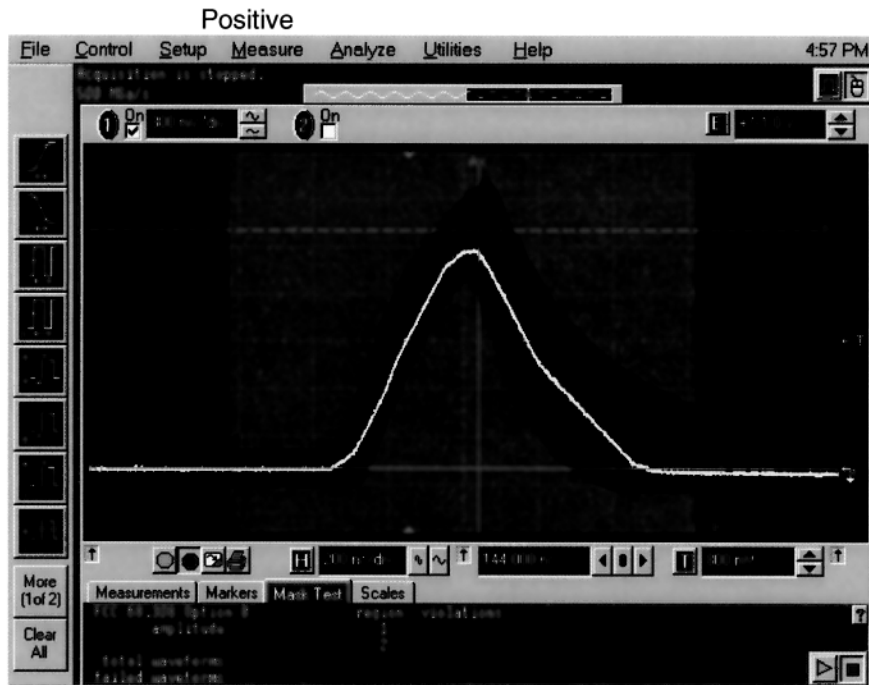


3.1.2. After stress

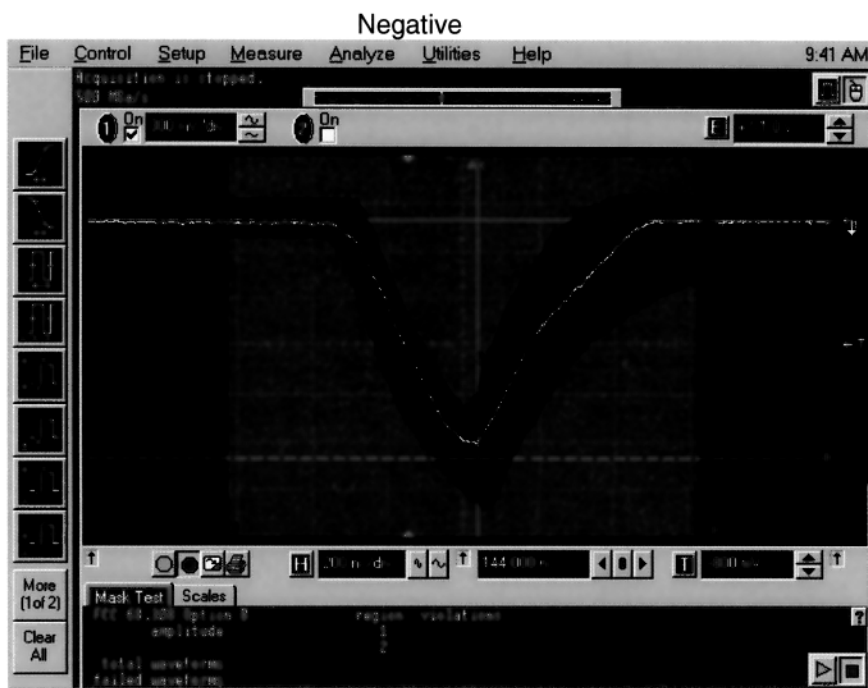
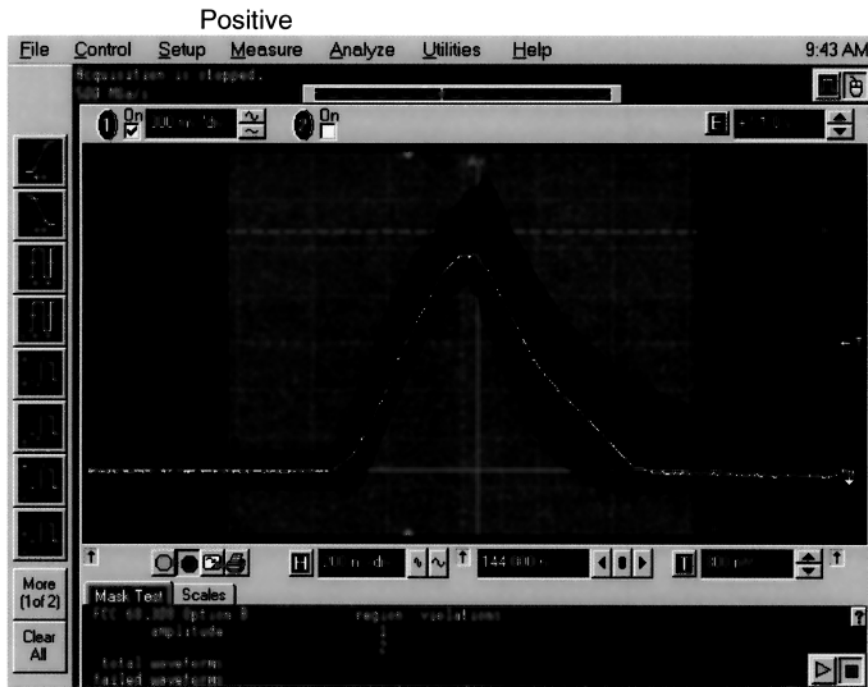


3.2. OPTION B

3.2.1. Before stress

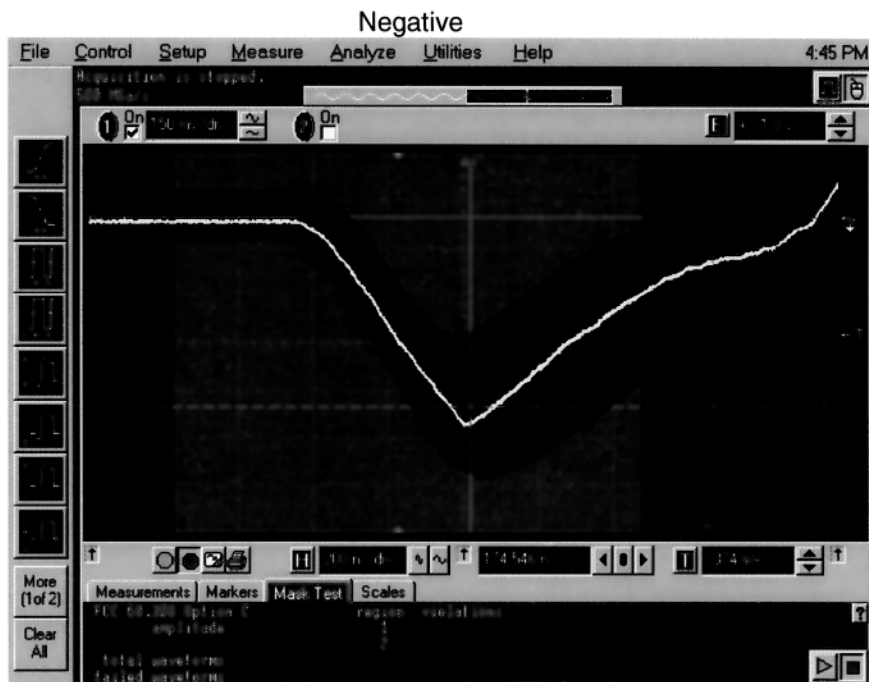
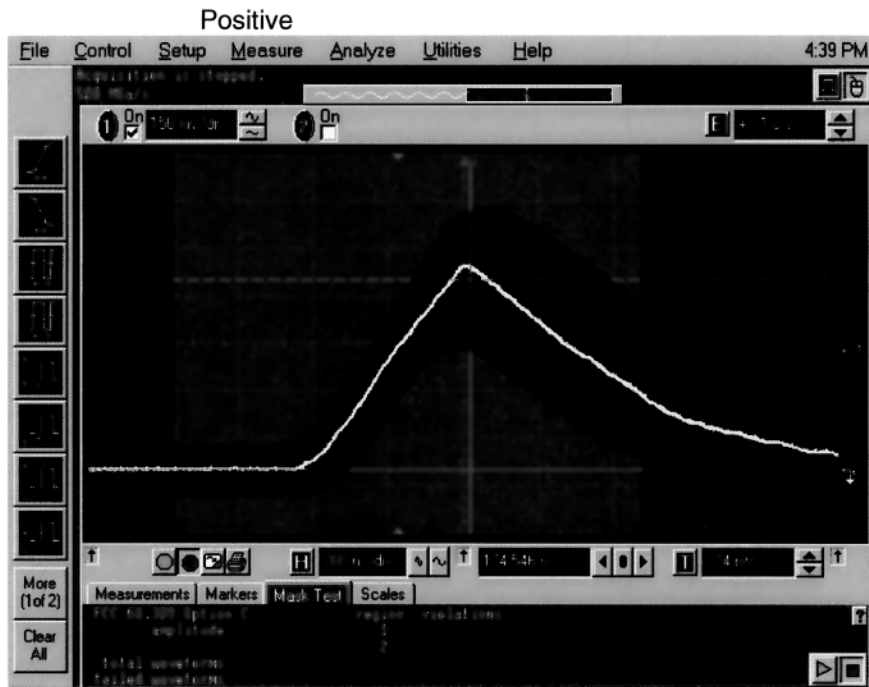


3.2.2. After stress



3.3. OPTION C

3.3.1. Before stress



3.3.2. After stress

