



**GLAST ACD**  
**Gamma-ray Large Area Space Telescope**  
**Anti-Coincidence Detector**  
**Electromagnetic Compatibility (EMC) Test Report**

ManTech Procedure No.

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## ABSTRACT

Electromagnetic compatibility (EMC) tests were performed on the Gamma ray Large Area Telescope (GLAST), Anti Coincidence Detector (ACD) Electronic Chassis at the NASA Goddard Space Flight Center (GSFC) from November 23 – December 9, 2004 in accordance with the requirements in *ACD-PLAN-000215 B*, dated July 2004 and in *MIL-STD-461C* and *MIL-STD-461E*.

### I. Conducted Emissions Results

The test measurements revealed that the Device Under Test (DUT) was in compliance with the CE102 and CECM test limits.

### II. Conducted Susceptibility Results

The DUT revealed no susceptibility when subjected to the CS102, CSCM and CS06 tests.

### III. Radiated Emissions Results

A. The test measurements revealed that the DUT exceeded the RE102 test limits. The worst-case narrowband emission measured 28.0 dB above the limit at 160.62 MHz, while operating in the GSE ON/DUT ON (GASU ON/FREE ON). The worst-case narrowband emission measured 21.8 dB above the limit at 139.91 MHz, while operating in the GSE ON/DUT ON (GASU ON/FREE OFF). The 1 to 18 GHz narrowband measurements revealed no above limit emissions. The corresponding broadband emission data also revealed no above limit emissions.

B. The test measurements revealed that the DUT was in compliance with the RE101 test limits.

### IV. Radiated Susceptibility Results

The DUT revealed no susceptibility when subjected to the RS101 and RS103 tests.

## 1 SCOPE

This document summarizes the results of the electromagnetic compatibility (EMC) tests performed on the Gamma-ray Large Area Space Telescope (GLAST) Anti-Coincidence Detector (ACD) Electronic Chassis at the NASA Goddard Space Flight Center (GSFC). The tests were performed from November 23 through December 9, 2004. Tests were conducted in accordance with the requirements in *ACD-PLAN-000215 B*, dated July 2004 and in *MIL-STD-461C* and *MIL-STD-461E*. Some tests were custom tailored to specific requirements as defined by LAT Environmental Specification, LAT-SS-00778-02 B, dated June 22, 2004

Any performance degradation, malfunction or deviations beyond the specified performance limits experienced by ACD will be discussed in detail herein. The ACD Electronic Chassis will hereafter be called the Device Under Test (DUT).

The following EMC tests were conducted:

- Grounding and Bonding
- CE102 Conducted Emissions, 10 kHz to 10 MHz
- CECM Conducted Emissions, 10 kHz to 150 MHz
- CS102 Conducted Susceptibility, 10 Hz to 10 MHz
- CSCM Conducted Susceptibility, 30 kHz to 100 kHz
- CSCM Conducted Susceptibility, 100 kHz to 150 MHz
- CS06 Conducted Susceptibility, Power Line Transients
- RE102 Electric Field Radiated Emissions, 10 kHz to 18 GHz
- RE101 Magnetic Field Radiated Emissions, 20 Hz to 50 kHz
- RS101 Magnetic Field Radiated Susceptibility, 20 Hz to 50 kHz
- RS103 Electric Field Radiated Susceptibility, 30 MHz to 18 GHz

## 2 TEST FACILITY

Testing was performed at the Small EMC Test Facility in Building 7, Room 8. The facility is designed for EMC testing of NASA's flight hardware, subsystems and small payloads. Also, the facility is designed for the following EMC tests:

- **Emissions** - radiated and conducted electromagnetic interference levels generated by specific flight hardware.
- **Susceptibility** - the inability of specific flight hardware to function properly when subjected to specific levels of radiated and conducted electromagnetic interference.

### 3 APPLICABLE DOCUMENTS

The following documents pertain to this EMC test report to the extent specified herein:

- |     |                       |   |
|-----|-----------------------|---|
| 3.1 | ACD-PLAN-000215       | ACD-PLAN-000215 GLAST ACD<br>Electronic Chassis EMI/EMC Test Plan; July 2004<br>(Appendix B)  |
| 3.2 | MIL-STD-461E          | Requirements for the Control of Electromagnetic<br>Interference Characteristics of Subsystems and<br>Equipment, Aug 20, 1999          |
| 3.3 | MIL-STD-461C          | Electromagnetic Emission and Susceptibility<br>Requirements for the Control of Electromagnetic<br>Interference (Part 3); Aug. 4, 1986 |
| 3.4 | MIL-STD-462, Notice 1 | Electromagnetic Interference Characteristics,<br>Measurement of; Aug. 1, 1968   |
| 3.5 | NASA/GSFC             | Code 549.3 Revised Safety Requirements for<br>Testing in the EMI Shielded Enclosures;<br>April 22, 1998 (Appendix A)                  |
| 3.6 | NASA/GSFC             | Waiver for EMC Testing Under Severe Weather<br>Conditions (see Appendix A)  |
| 3.7 | NASA/GSFC P-303-840   | Electrostatic Discharge (ESD) Control Program,<br>Flight Assurance Procedure, Revision A; October<br>27, 1993                         |

### 4 DESCRIPTION OF DUT

The DUT is the GLAST ACD ELECTRONIC CHASSIS. For this series of EMC tests, the GASU was an integral component of the DUT. Photographs in Appendix A depict the DUT.

### 5 TEST DATA

All data of primary importance are provided in Appendix A. The boldface data in the tables provided in this report indicate the worst-case emissions from the DUT. All other data may be obtained from Mark Branch, Code 549.3, if the need arises.

### 6 TEST ENVIRONMENT

The EMC tests were conducted with the DUT operating under room-ambient atmospheric pressure, temperature and humidity in accordance with the electrostatic discharge ESD protection requirements in Section 3.2 of NASA/GSFC P-442-3441.

## 7 TEST PERSONNEL

The following is a list of personnel who participated in the EMC tests:

- |                                   |                                |
|-----------------------------------|--------------------------------|
| • EMC Supervisor                  | Nicholas Hovaker, ManTech-ATAC |
| • EMC Test Engineer               | Mark Branch, Code 549.3        |
| • EMC Test Engineer               | Nathan Block, ManTech-ATAC     |
| • EMC Test Engineering Technician | Vaughn Nelson, ManTech-ATAC    |
| • EMC Test Engineering Technician | Richard Jones, ManTech-ATAC    |
| • Integration Test Manager        | Raymond Jungo                  |
| • ACD Project Design Lead         | Dave                           |
| • ACD I & T Engineer, Code 568    | George Moore                   |
| • Quality Control, Code 300       | Al Lacks                       |

## 8 DEFINITION OF TERMS

The following terms are provided to ensure consistency between the terminology used in this report and which was used during the EMC tests:

- 8.1 **DUT** - Device Under Test.
- 8.2 **GSE** (Ground Support Equipment) - This is the support equipment used by the project to exercise the DUT through all its operational modes.
- 8.3 **GSE OFF DUT OFF** - This is one of two ambient tests performed before the actual EMC tests. In this mode, the GSE and the DUT have no power applied to them.
- 8.4 **GSE ON DUT OFF** - This is one of two ambient tests performed before the actual EMC tests. In this mode, the GSE is powered on but the DUT has no power supplying it (i.e., the DUT is electrically isolated from the power supply). This measurement helps to characterize those emissions contributed by the GSE.
- 8.5 **GSE ON DUT ON** - In this mode, both the GSE and the DUT have power supplied to them. The DUT is undergoing an actual EMC test, while it is commanded through all of its modes.
- 8.6 **Noisiest Mode** - All of the DUT's subsystems are operating and gathering data. All subsystems are exercised such that they generate the maximum possible emissions. This corresponds to the DUT operating in its flight (max load) mode.

**9 WORK DIRECTIVE (W/D) AND JOB ORDER NUMBER (JON)**

9.1 W/D No: 5593/5847

9.2 Fiscal JON: 556848403369

## 10 TEST NO. 1: GROUNDING AND BONDING

### 10.1 Purpose

The purpose of this test is to measure the DC bond impedance between all metal enclosures, including the DUT, to ensure a low-impedance bond at all frequencies.

### 10.2 Results

The DUT was bonded to the Small EMC Test Facility's reference ground via the copper bench. DC resistance measurements were performed between all metal structures. Table 10-1 summarizes the results of the grounding and bonding measurements performed during the test, which show that the DC bond resistance did not exceed the specification limit of 2.5 milliohms ( $m\Omega$ ).

**Table 10-1. Grounding/Bonding Measurement Results**

Test Number	Measurement Type	$m\Omega$
1	+ Capacitor to Copper Bench	0.09
	- Capacitor to Copper Bench	0.05
	DUT to Copper Bench	0.58

### 10.3 Test Configuration

The DUT was grounded to the facility quiet ground inside the small shield room via the copper bench. The DUT was turned off with no voltage applied to its power input.

## 11 TEST NO. 2: METHOD CE102-CONDUCTED EMISSIONS, 10 kHz TO 10 MHz

### 11.1 Purpose

The purpose of this test is to demonstrate that the levels of narrowband conducted emissions from the DUT's power, power-return and common mode lines do not exceed the specified test limits from 10 kHz to 10 MHz.

### 11.2 Results

The test was performed with the DUT operating as shown in Table 11-1. The test measurements revealed no above limit emissions. Most data was observed to be at least 20 dB below the limit line. Data plots of the narrowband measurements are provided in Appendix A.

**Table 11-1. CE102 Test Result Summary**

Test Number	Test Type	Probe Location	Test Mode	Test Results
6	Narrowband 10 kHz - 10 MHz	+28 VDC (primary)	GSE ON DUT ON (noisiest)	No emissions above the specification limits.
7	Narrowband 10 kHz - 10 MHz	28 VDC Return (primary)	GSE ON DUT ON (noisiest)	No emissions above the specification limits.
8	Narrowband 10 kHz - 10 MHz	+28 VDC (secondary)	GSE ON DUT ON (noisiest)	No emissions above the specification limits.
10	Narrowband 10 kHz - 10 MHz	+28 VDC (secondary)	GSE ON DUT ON (noisiest)	No emissions above the specification limits.

### 11.3 Test Configuration

The test was performed with the DUT operating in the GSE ON DUT ON (noisiest) mode. See Photo 1 in Appendix A for the probe placement on the DUT power lines.

## 12 TEST NO. 3: METHOD CECM-CONDUCTED EMISSIONS, 10 kHz TO 150 MHz

### 12.1 Purpose

The purpose of this test is to measure the time domain noise between the +28 VDC power line and chassis, and the noise between the 28 VDC power-return and chassis.

### 12.2 Results

The test was performed with the DUT operating in noisiest mode and was measured with a 250 MHz bandwidth oscilloscope. As shown in Table 12-1, all observed data was well below the 200 mV<sub>pp</sub> limit. Listed in the table are the highest peak-to-peak values observed. See plots in Appendix B.

**Table 12-1. CECM Test Result Summary**

Test Number	Test Type	Probe Location	Test Mode	Test Results
11	Time Domain Voltage Emissions	28 VDC Return	GSE ON DUT OFF	60 mV <sub>pp</sub>
12	Time Domain Voltage Emission	28 VDC Return	GSE ON DUT OFF	83 mV <sub>pp</sub>
13	Time Domain Voltage Emission	28 VDC Return	GSE ON DUT OFF	110 mV <sub>pp</sub>
14	Time Domain Voltage Emission	+28 VDC	GSE ON DUT OFF	110 mV <sub>pp</sub>
15	Time Domain Voltage Emission	+28 VDC	GSE ON DUT OFF	100 mV <sub>pp</sub>
16	Time Domain Voltage Emission	+28 VDC	GSE ON DUT OFF	126 mV <sub>pp</sub>

Time domain common mode emissions plots are provided in Appendix A.

### 12.3 Test Configuration

The test was performed with the DUT operating in the modes listed in Table 12-1. See Photo 2 in Appendix A for the probe placement on the DUT power lines.

**13 TEST NO. 5: METHOD CS102-CONDUCTED SUSCEPTIBILITY, 10 kHz TO 10 MHz****13.1 Purpose**

The purpose of this test is to determine if the DUT is susceptible to a sinusoidal ripple appearing on the input power lines over the frequency range of 10 kHz to 10 MHz. This test was originally specified as CS102, however, a decision was later made to test to MIL-STD-461C method using CS02.

**13.1 Results**

The DUT revealed no susceptibility when subjected to the following test signal requirements:

**Table 13-1. CS102 Limits**

Frequency Corner Points	Level	Level ( $\mu\text{A}$ )
10 kHz – 100 kHz	86 dB $\mu\text{A}$	20000 $\mu\text{A}$
100 kHz – 350 kHz	52 dB $\mu\text{A}$	400 $\mu\text{A}$
350 kHz – 450 kHz	Increasing to 58 dB $\mu\text{A}$	800 $\mu\text{A}$
450 kHz – 1 MHz	58 dB $\mu\text{A}$	800 $\mu\text{A}$
1 MHz – 1.7 MHz	Decreasing to 54 dB $\mu\text{A}$	500 $\mu\text{A}$
1.7 MHz – 5.5 MHz	Decreasing to 32 dB $\mu\text{A}$	40 $\mu\text{A}$
5.5 MHz – 10 MHz	Decreasing to 26 dB $\mu\text{A}$	20 $\mu\text{A}$

**13.2 Test Configuration**

The test was performed with the DUT power bus operating at a nominal voltage of +28 Volts. See Photo 4 in Appendix A for the test signal injection point.

**14 TEST NO. 6: METHOD CSCM-CONDUCTED SUSCEPTIBILITY, 150 kHz TO 150 MHz**

14.1 Purpose

The purpose of this test is to determine if the DUT is susceptible to low-frequency ripple and a modulated sine wave injected on its input DC power lines from 150 kHz to 150 MHz.

14.2 Results

This CSCM test was eliminated by Project Personnel because of the possibility of damage to the DUT or to the GSE.

## 15 TEST NO. 7: METHOD CS06-CONDUCTED SUSCEPTIBILITY, POWER LINE TRANSIENTS

### 15.1 Purpose

The purpose of this test is to determine if the DUT is susceptible to transient interference on its DC power input lines.

### 15.2 Results

The DUT was subjected to the following test signal requirements:

- The following voltage transient was injected on the DUT's input power lines:
  - **SUSCEPTIBLE** - Spike:  $E = \pm 28$  V,  $t$  (pulse width) = 10  $\mu$ s
  - **NOT SUSCEPTIBLE** - Spike:  $E = \pm 20$  V,  $t$  (pulse width) = 10  $\mu$ s
- The transient was superimposed on the +28 V power line voltage. A pulse repetition rate of 60 pulses-per-second (pps) was applied for five minutes at each polarity.
- The transient was applied differentially between the positive and return power leads.

Table 15-1 summarizes the test results. The oscilloscope data plots of the measured test signals are provided in Appendix A.

**Table 15-1. CS06 Test Result Summary**

Test Number	Pulse Signal	Injection Point	Test Mode	Test Results
17	+28 V	----	----	Positive calibration pulse.
18	-28 V	----	----	Negative calibration pulse.
19	+28 V	+28 VDC to Return	----	Susceptibility noted.
20	-28 V	+28 VDC to Return	----	Susceptibility noted.
21	-28 V	+28 VDC to Return	----	Susceptibility noted.
22	-28 V	+28 VDC to Return	----	Susceptibility noted.

23	-28 V	+28 VDC to Return	----	Susceptibility noted.
24	-28 V	+28 VDC to Return	----	Susceptibility noted.
25	-28 V	+28 VDC to Return	----	Susceptibility noted.
26	-28 V	+28 VDC to Return	----	Susceptibility noted.
27	-28 V	+28 VDC to Return	----	Susceptibility noted.
28	+28 V	+28 VDC to Return	----	Susceptibility noted.
29	+20	----	----	Positive calibration pulse.
30	-20	----	----	Negative calibration pulse.
31	+20	+28 VDC to Return	----	No susceptibility noted.
32	+20	+28 VDC to Return	----	No susceptibility noted.
33	-20	+28 VDC to Return	----	No susceptibility noted.
34	-20	+28 VDC to Return	----	No susceptibility noted.

### 15.3 Test Configuration

The test was performed with the DUT power bus operating at a nominal voltage of + 28 Volts. See Photo 3 in Appendix A for the test signal injection point.

## 16 TEST NO. 8: METHOD RE102-ELECTRIC FIELD RADIATED EMISSIONS, 10 kHz TO 18 GHz

### 16.1 Purpose

The purpose of this test is to demonstrate that the levels of narrowband and broadband radiated electric field emissions from the DUT's equipment or interconnecting cables do not exceed the specified test limits from 10 kHz to 18 GHz. This test excludes antenna port emissions that may contain high-level transmitter spurious emissions and receiver oscillator spurious emissions.

### 16.2 Results

The antenna was placed 1 meter from the body of the DUT and oriented at 45° for measurements to 30 MHz. At frequencies above 30 MHz the antenna was oriented in both the horizontal and vertical positions. The test was performed with the DUT operating as shown in Table 16-1. The worst-case narrowband emission measured 28.0 dB above the limit at 160.62 MHz, while operating in the GSE ON DUT ON (GASU ON FREE ON). In test 42 with the FREE OFF the number and intensity of emissions decreased. See Table 16-1. The 1 to 18 GHz and ambient measurements revealed no above limit emissions.

**Table 16-1. RE102 Test Result Summary**

Test Number	Test Type	Antenna Position	Test Mode	Test Results
41	Narrowband & Broadband 10 kHz - 1 GHz	1 m, 45°	GSE ON DUT ON (noisiest) (GASU ON FREE ON)	25 NB emissions above the limits. The 3 highest: 28.0 dB @ 160.62 MHz, 23.0 dB @ 120.48 MHz & 22.6 dB @ 139.91 MHz.
42	Narrowband & Broadband 10 kHz - 1 GHz	1 m, 45°	GSE ON DUT OFF (noisiest) (GASU ON FREE OFF)	13 NB emissions above the limits. 3 less emissions above the limits compared to test 41: 21.8 dB @ 139.91 MHz, 18.9 dB @ 160.62 MHz, & 8.9 dB @ 20.03 MHz
46	Narrowband & Broadband 10 kHz - 1 GHz	Vertical	GSE ON DUT ON (noisiest)	22 NB emissions above the limits. The 3 highest: 20.9 dB @ 266.42 MHz, 20.1 dB @ 199.85 MHz, & 12.3 dB @ 221.64 MHz
48	Narrowband & Broadband 10 kHz - 1 GHz	Vertical	GSE ON DUT ON (noisiest) (Chassis OFF GASU ON)	24 NB emissions above the limits. The 3 highest: 20.4 dB @ 199.85 MHz, 17.6 dB @ 266.42 MHz, & 12.8 dB @ 219.11 MHz

**Table 16-1. RE102 Test Result Summary (Continued)**

Test Number	Test Type	Antenna Position	Test Mode	Test Results
50	Narrowband & Broadband 10 kHz - 1 GHz	Horizontal	GSE ON DUT ON (noisiest)	3 NB emissions above the limits: 15.6 dB @ 40.4 MHz, 3.9 dB @ 80.56 MHz, & 0.8 dB @ 60.43 MHz
55	Narrowband & Broadband 1.55 - 1.6 GHz	Vertical	GSE ON DUT ON	1 emission above the limit: 7.2 dB @ 1580 MHz
56	Narrowband & Broadband 1.55 - 1.6 GHz	Horizontal	GSE ON DUT ON	2 emissions above the limit: 10.0 dB @ 1580 MHz 0.6 dB @ 1560 MHz

The corresponding broadband emission data also revealed no above limit emissions. Data plots of the narrowband and broadband measurements are provided in Appendix A.

### 16.3 Test Configuration

The test was performed with the DUT operating in the modes listed in Table 16-1. See Photos 5-8 in Appendix A for the antenna placement relative to the DUT.

## 17 TEST NO. 10: METHOD RE101-MAGNETIC FIELD RADIATED EMISSIONS, 30 Hz TO 50 kHz

### 17.1 Purpose

The purpose of this test is to measure narrowband radiated magnetic fields emitted from the DUT from 30 Hz to 50 kHz.

### 17.2 Results

The antenna was placed 1 meter from the body of the DUT and 1 meter from the cable and connector in the X-axis orientation for the magnetic field radiated emissions measurements. The test data revealed no above limit narrowband emissions when compared to the GSE ON/DUT OFF plots. Table 17-1 summarizes the test results. The data plots of the narrowband measured test results are provided in Appendix A.

**Table 17-1. RE101 Test Result Summary**

Test Number	Test Type	Antenna Location	Test Mode	Test Results
65	Narrowband 30 Hz - 50 kHz	1 m, X-axis DUT	GSE ON DUT ON (noisiest)	No emissions above the specification limits.
66	Narrowband 30 Hz - 50 kHz	1 m, X-axis Connector	GSE ON DUT ON (noisiest)	No emissions above the specification limits.

### 17.3 Test Configuration

The test was performed with the DUT in the GSE ON DUT ON (noisiest) mode. See Photos 9-10 in Appendix A for the antenna placement relative to the DUT.

**18 TEST NO. 11: METHOD RS101-MAGNETIC FIELD RADIATED SUSCEPTIBILITY, 30 Hz TO 50 kHz**

**18.1 Purpose**

The purpose of this test is to ensure that the DUT does not exhibit any degradation of performance, malfunctions or undesirable effects when immersed in a magnetic field from 30 Hz to 50 kHz.

**18.2 Results**

The DUT revealed no susceptibility when subjected to the following test signal requirements:

- A 130-dBpT magnetic field was induced on the DUT from 30 Hz and decreasing to 75-dBpT at 50 kHz.
- The magnetic induction coil was located 5 cm from the DUT surface.

The coil locations used are listed in Table 18-1.

**Table 18-1. RS101 Test Result Summary**

<b>Test Number</b>	<b>Frequency Range</b>	<b>Coil Location</b>	<b>Test Mode</b>	<b>Test Results</b>
69	30 Hz - 50 kHz	5 cm		No susceptibility noted.

**18.3 Test Configuration**

The test was performed with the DUT operating in its no load mode. See Photo 11 in Appendix A for the actual coil placement relative to the DUT.

**19 TEST NO. 12: METHOD RS103-ELECTRIC FIELD RADIATED SUSCEPTIBILITY, 14 kHz TO 18 GHz**

19.1 Purpose

The purpose of this test is to ensure that the DUT does not exhibit any degradation of performance, malfunctions or undesirable effects when immersed in an electric field from 14 kHz to 18 GHz.

19.2 Results

The DUT revealed no susceptibility when subjected to the electric field test signal requirements listed in Table 19-1.

**Table 19-1. RS103 Test Requirements**

Frequency Range	Test Level	Polarization	Modulation
30 – 14.9634 GHz	20 V/m	Vert/Horz	AM, 50%, 1-kHz Sine-Wave
14.963 –15.043 GHz	40 V/m	Vert/Horz	AM, 50%, 1-kHz Sine-Wave
15.043 – 18 GHz	20 V/m	Vert/Horz	AM, 50%, 1-kHz Sine-Wave

The antenna was located at one position for the test. Both Vertical and Horizontal polarization was used throughout the 30 MHz to 18 GHz frequency range. Table 19-2 summarizes the test results.

Table 19-2. RS103 Test Result Summary

Test Number	Frequency Range	Test Signal Level	Antenna Location	Test Results
70	30 MHz – 1 GHz	20 V/m	Vertical	No susceptibility noted.
	30 MHz – 1 GHz	20 V/m	Horizontal	No susceptibility noted.
	1 – 14.9634 GHz	20 V/m	Vertical	No susceptibility noted.
	1 – 14.9634 GHz	20 V/m	Horizontal	No susceptibility noted.
71	14.963 – 15.043 GHz	40 V/m	Vertical	No susceptibility noted.
	14.963 – 15.043 GHz	40 V/m	Horizontal	No susceptibility noted.
	15.043 – 18 GHz	20 V/m	Vertical	No susceptibility noted.
	15.043 – 18 GHz	20 V/m	Horizontal	No susceptibility noted.

### 19.3 Test Configuration

The test was performed with the DUT operating in its no load mode. See Photos 12-15 in Appendix A for the actual antenna placement relative to the DUT.

## 20 CONCLUSION

### 20.1 Emissions Results

#### 20.1.1 *Conducted Emissions*

The test measurements revealed that the DUT was in compliance with the CE102 and CECM test requirements.

#### 20.1.2 *Radiated Emissions*

20.1.2.1 The test measurements revealed that the DUT exceeded the RE102 test limits. The worst-case narrowband emission measured 28.0 dB above the limit at 160.62 MHz, while operating in the GSE ON DUT ON (GASU ON FREE ON). The worst-case narrowband emission measured 21.8 dB above the limit at 139.91 MHz, while operating in the GSE ON DUT ON (GASU ON FREE OFF). The 1 to 18 GHz narrowband measurements revealed no above limit emissions. The corresponding broadband emission data also revealed no above limit emissions.

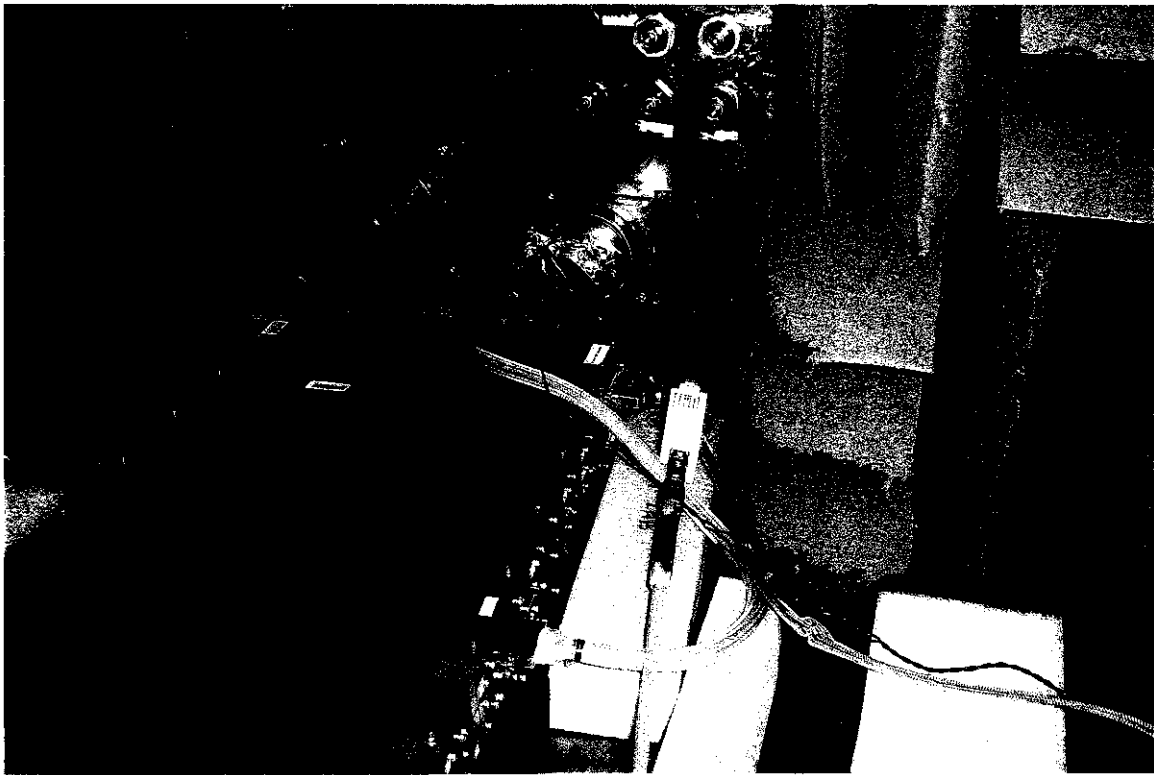
20.1.2.2 The test measurements revealed that the DUT was in compliance with the RE101 test requirements

### 20.2 Susceptibility Results

The DUT revealed no susceptibility when subjected to the CS102, CSCM, CS06, RS101, and RS103 tests.

**Appendix A**

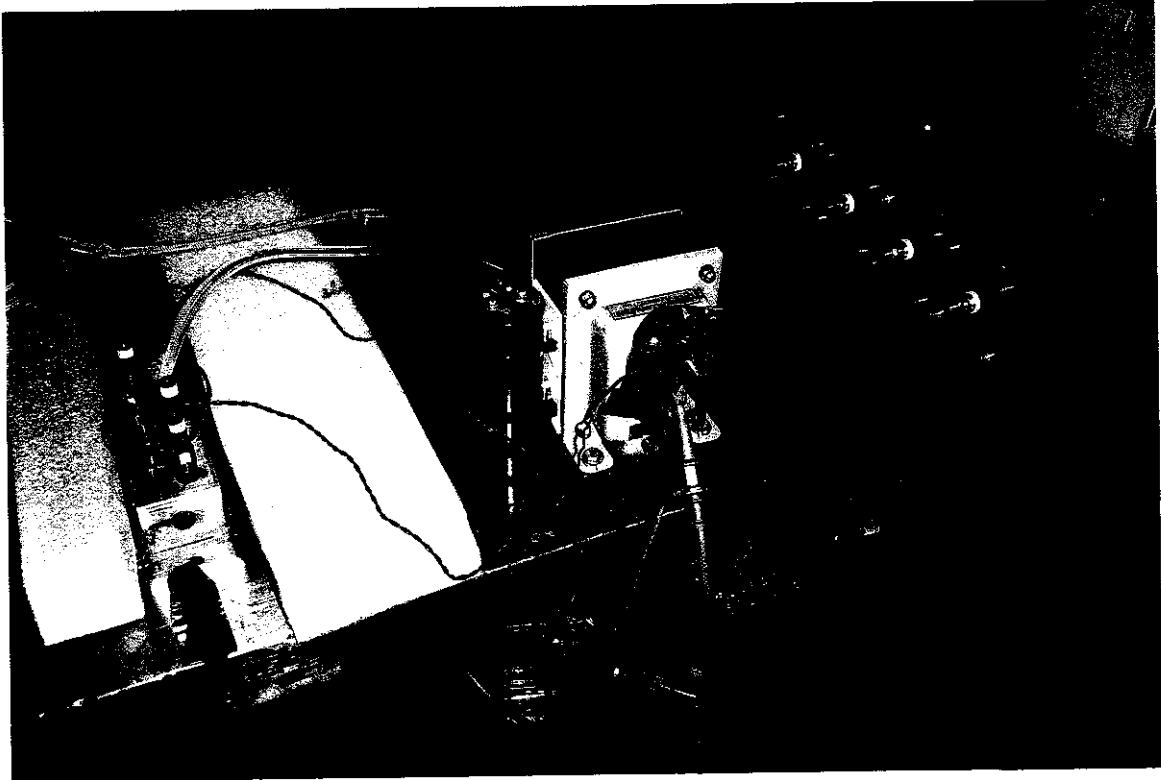
**EMC Test Data & Test Setup Photos**



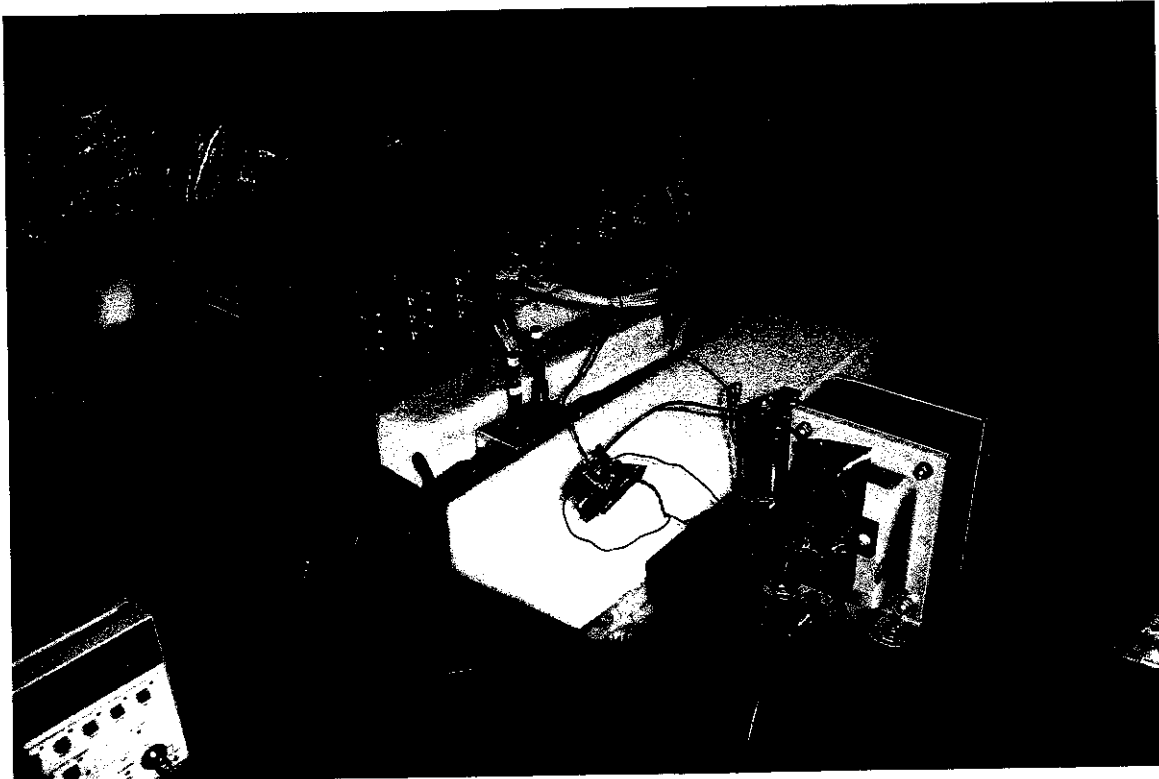
**Photo No.1**  
**November 23, 2004**  
**GLAST / ACD, WD No.5593**  
**CE102, 10 kHz - 10 MHz**  
**Test No.2**



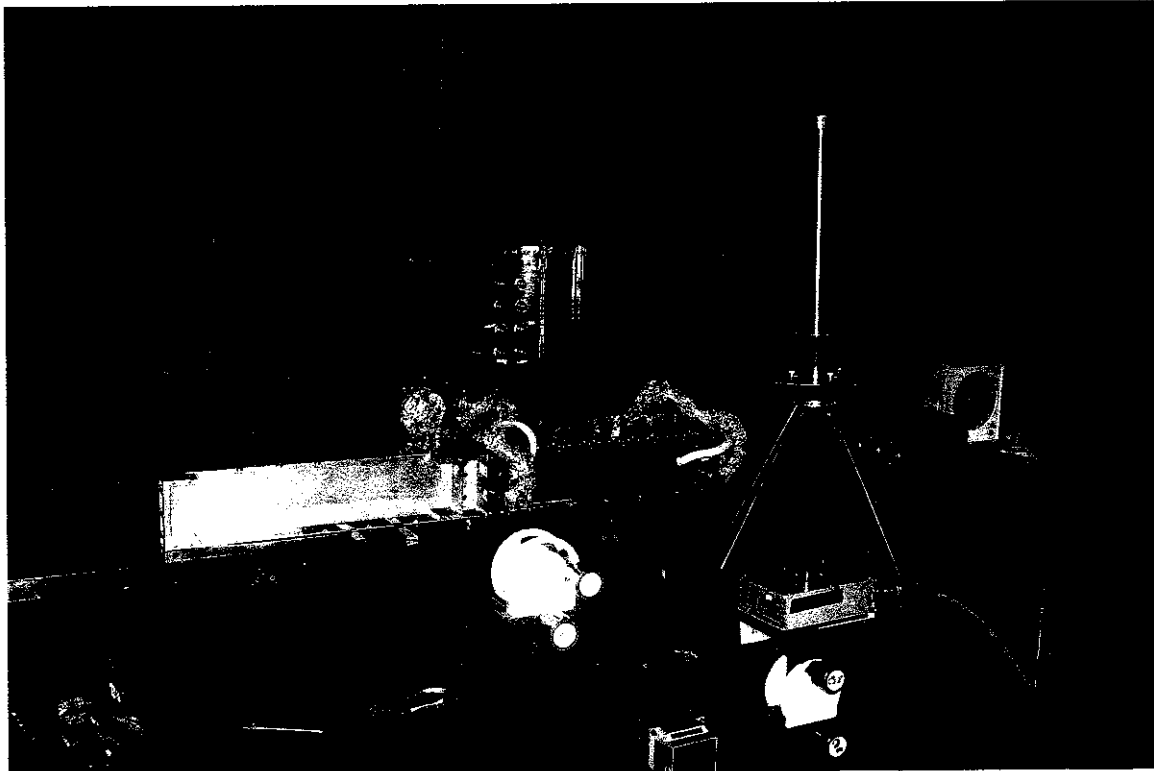
**Photo No.2**  
**November 23, 2004**  
**GLAST / ACD, WD No.5593**  
**CECM, Conducted Emissions Test**  
**Test No.11**



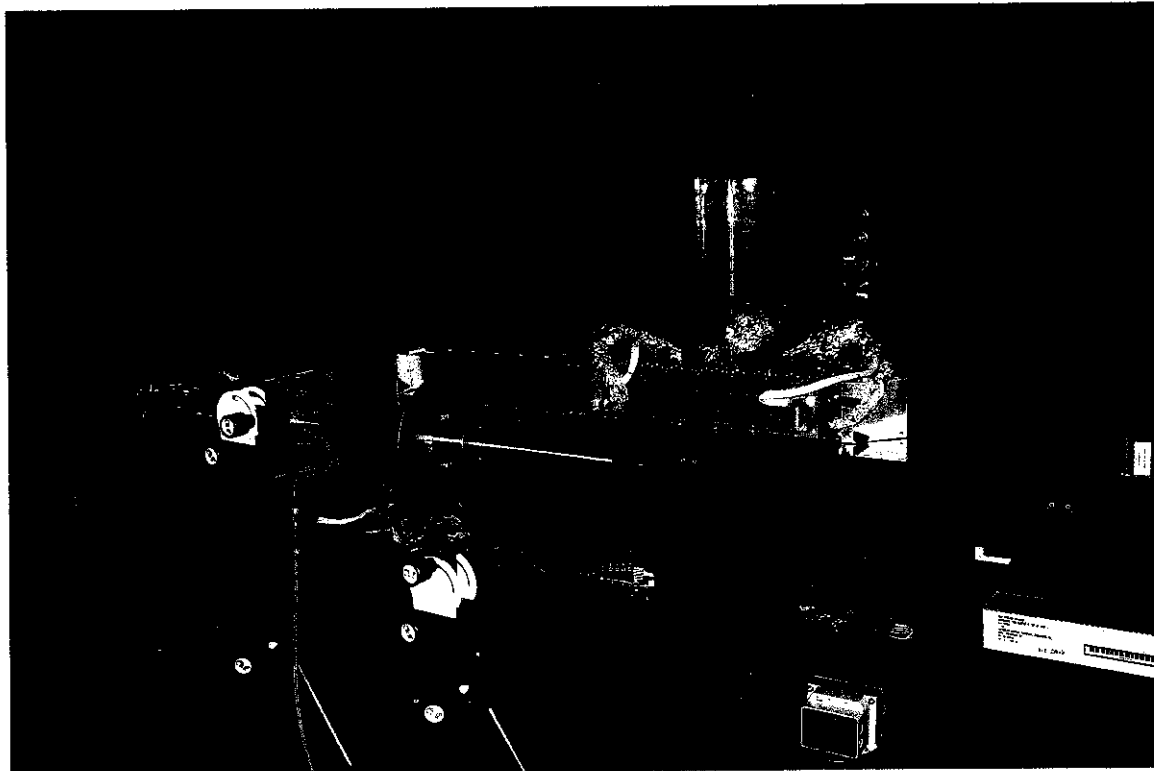
**Photo No.3**  
**November 24, 2004**  
**GLAST / ACD, WD No.5593**  
**CS06, Voltage Transient Test**  
**Test No.17**



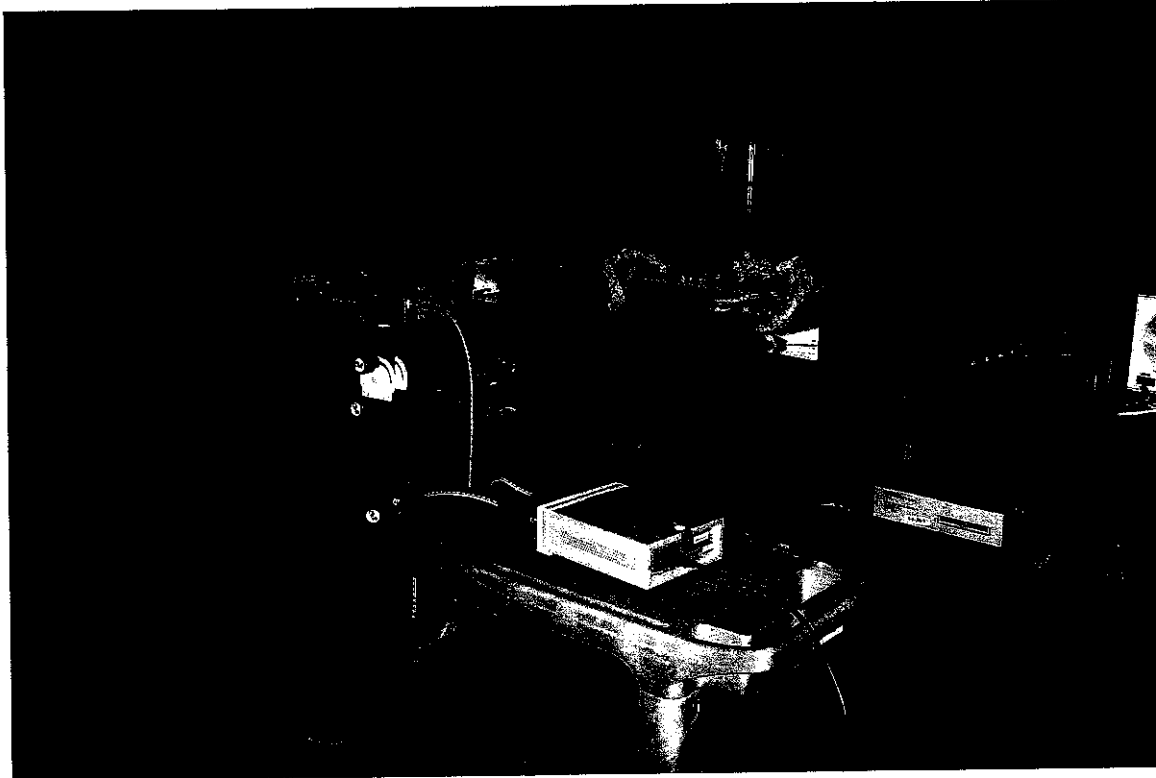
**Photo No.4**  
**November 30, 2004**  
**GLAST / ACD, WD No.5593**  
**CS102, 10 kHz - 10 MHz**  
**Test No.35**



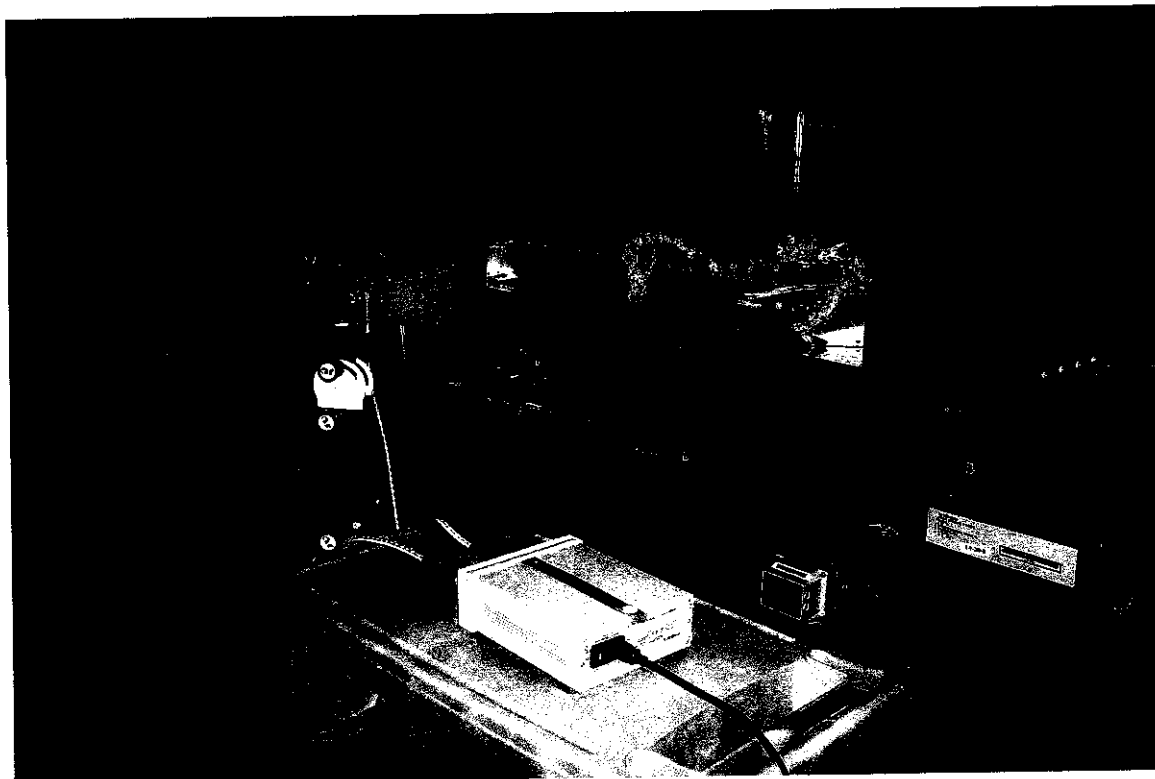
**Photo No.5**  
**December 1, 2004**  
**GLAST / ACD, WD No.5593**  
**RE102, 10 kHz - 1 GHz**  
**1 meter, Vertical**  
**Test No.41**



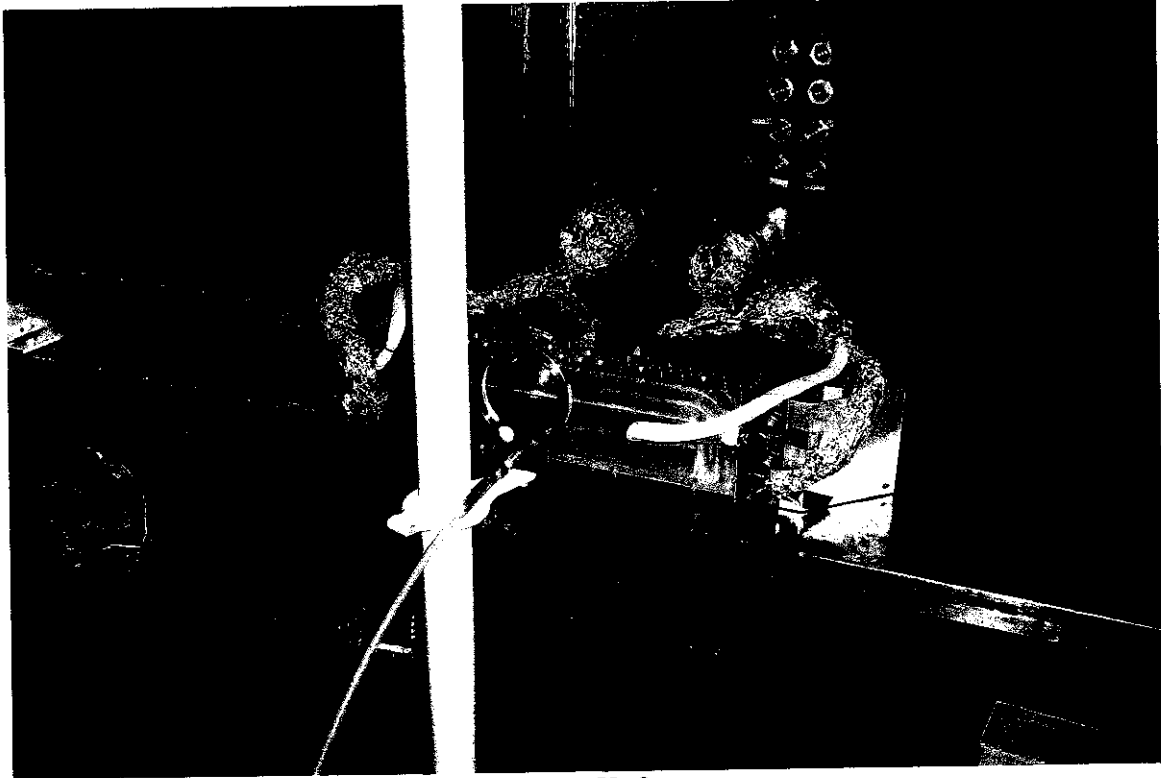
**Photo No.6**  
**December 2, 2004**  
**GLAST / ACD, WD No.5593**  
**RE102, 10 kHz - 1 GHz**  
**1 meter, Horizontal**  
**Test No.49**



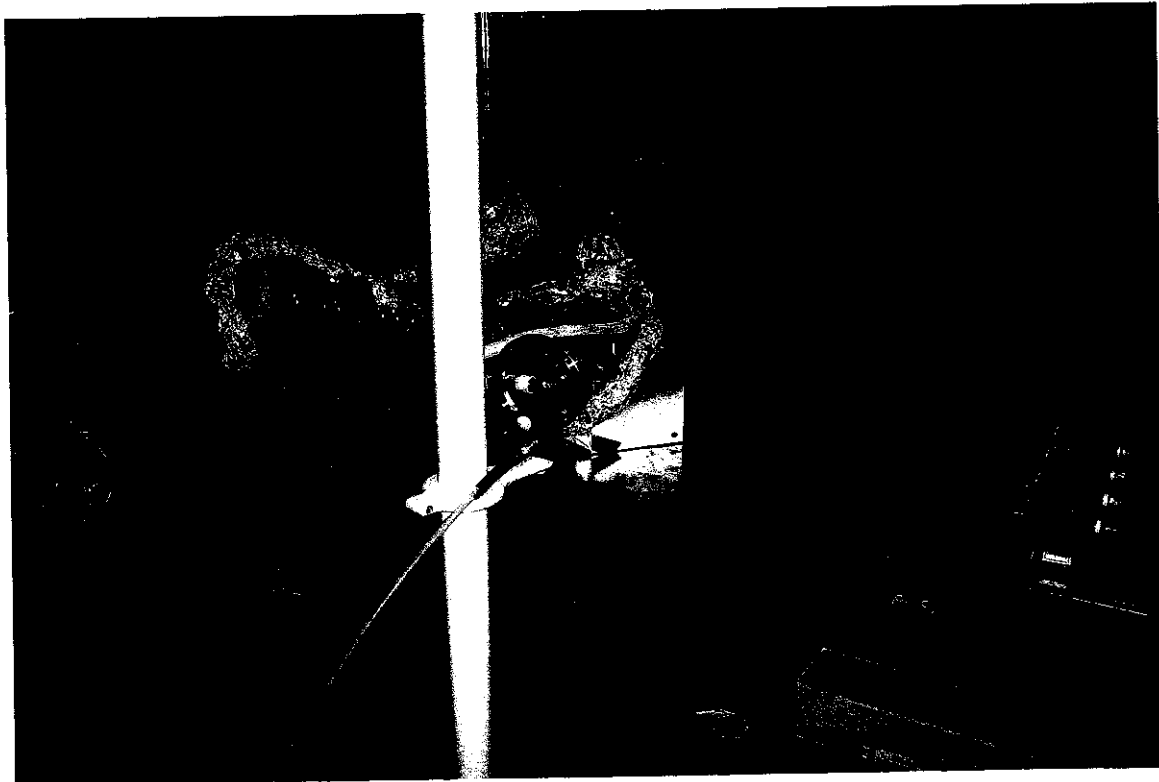
**Photo No.7**  
**December 2, 2004**  
**GLAST / ACD, WD No.5593**  
**RE102, 1 GHz - 18 GHz**  
**1 meter, Horizontal**  
**Test No.53**



**Photo No.8**  
**December 2, 2004**  
**GLAST / ACD, WD No.5593**  
**RE102, 1 GHz - 18 GHz**  
**1 meter, Vertical**  
**Test No.54**



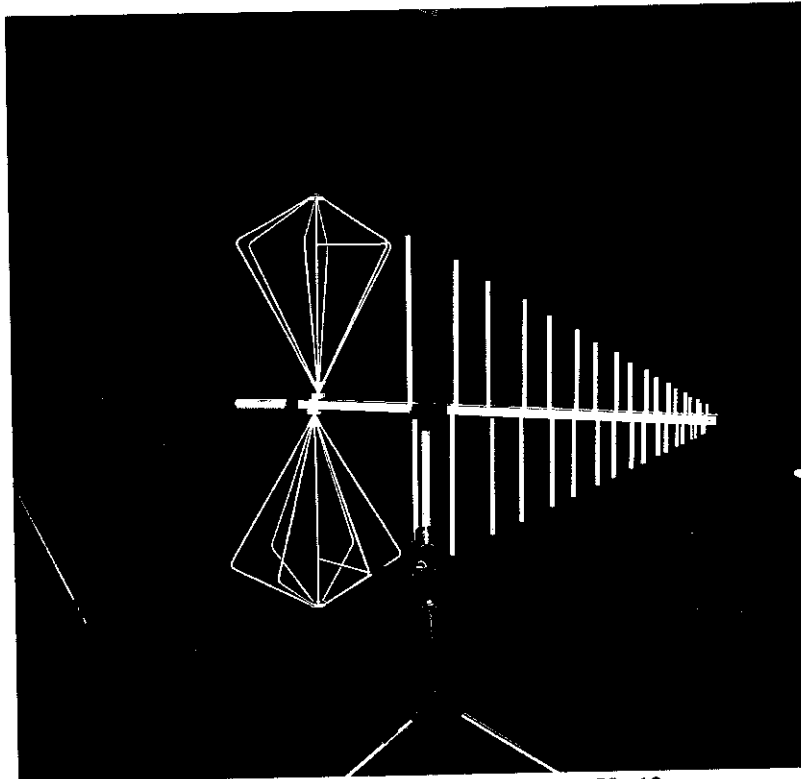
**Photo No.9**  
**December 3, 2004**  
**GLAST / ACD, WD No.5593**  
**RE101, 20 Hz - 50 kHz**  
**7 cm, DUT**  
**Test No.65**



**Photo No.10**  
**December 3, 2004**  
**GLAST / ACD, WD No.5593**  
**RE101, 20 Hz - 50 kHz**  
**7 cm, Connector**  
**Test No.67**

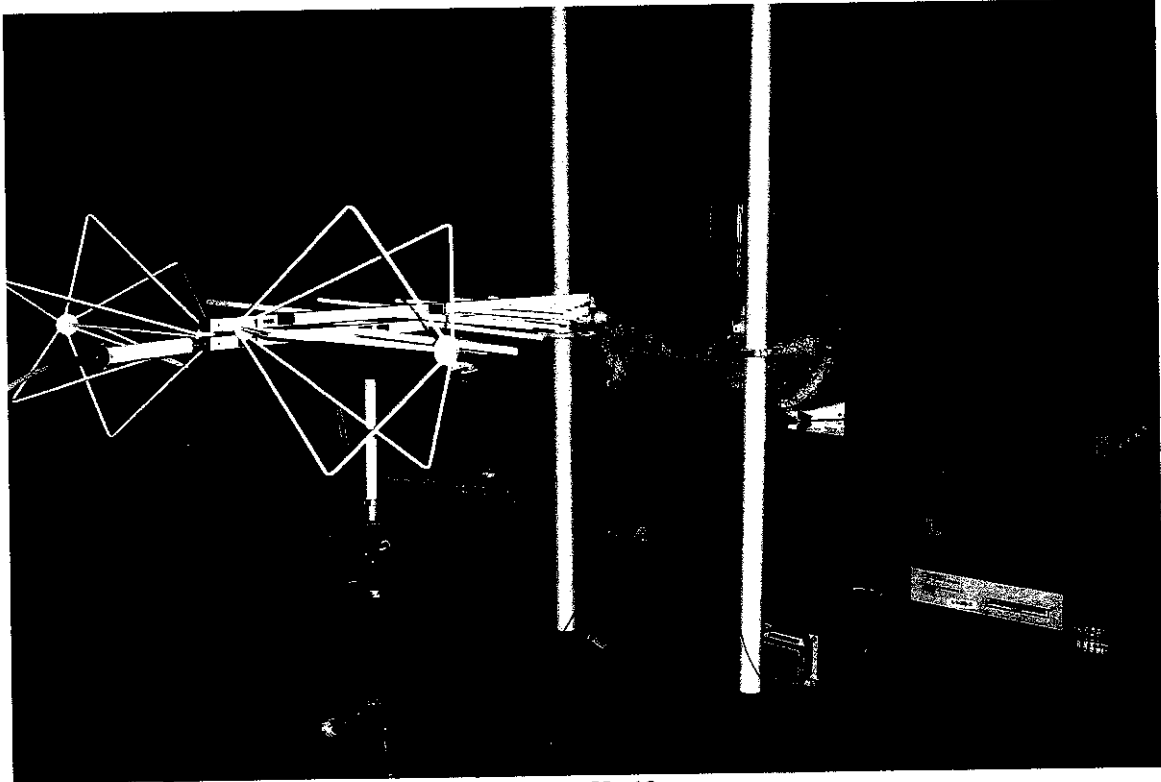


**Photo No.11**  
**December 3, 2004**  
**GLAST / ACD, WD No.5593**  
**RS101, 30 Hz - 50 kHz**  
**5 cm, DUT**  
**Test No.69**

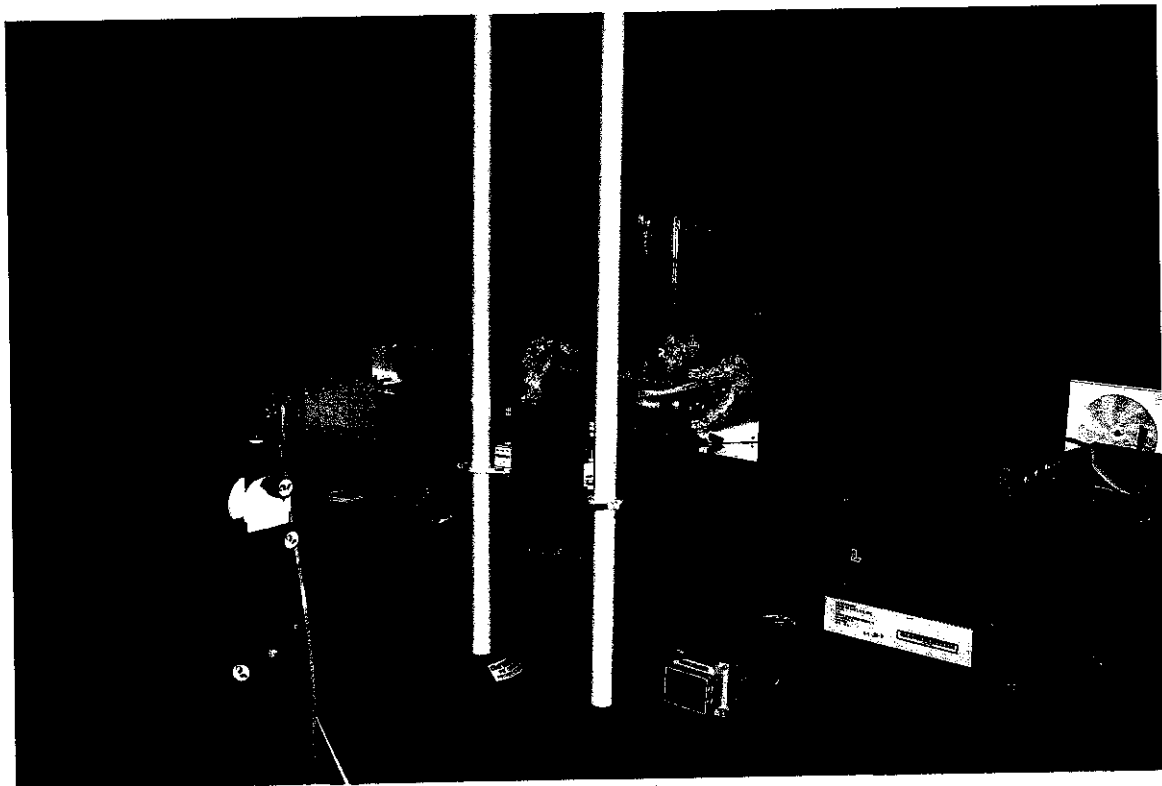


**Photo No.12**  
**December 6, 2004**  
**GLAST / ACD, WD No.5593**  
**RS103, 30 MHz - 1 GHz**  
**1 meter, Vertical**  
**Test No.70**

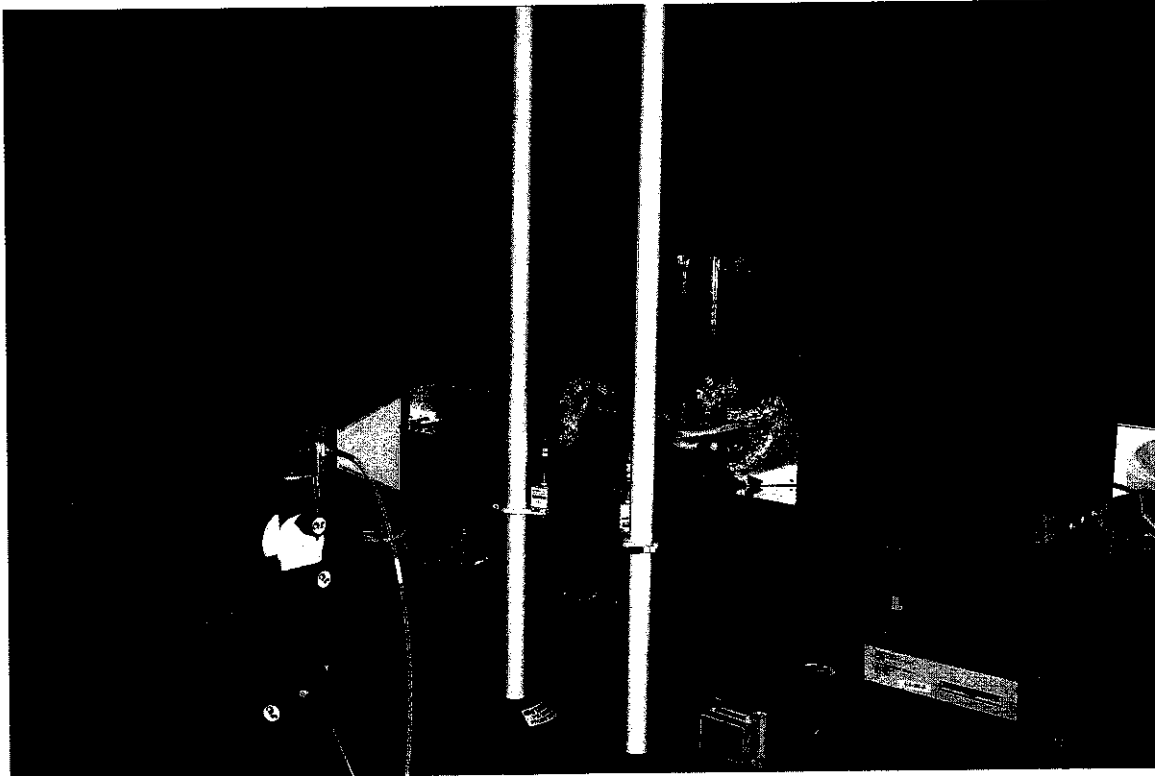




**Photo No.13**  
**December 6, 2004**  
**GLAST / ACD, WD No.5593**  
**RS103, 30 MHz - 1 GHz**  
**1 meter, Horizontal**  
**Test No.70**



**Photo No.14**  
**December 9, 2004**  
**GLAST / ACD, WD No.5593**  
**RS103, 1 GHz - 18 GHz**  
**1 meter, Vertical**  
**Test No.71**



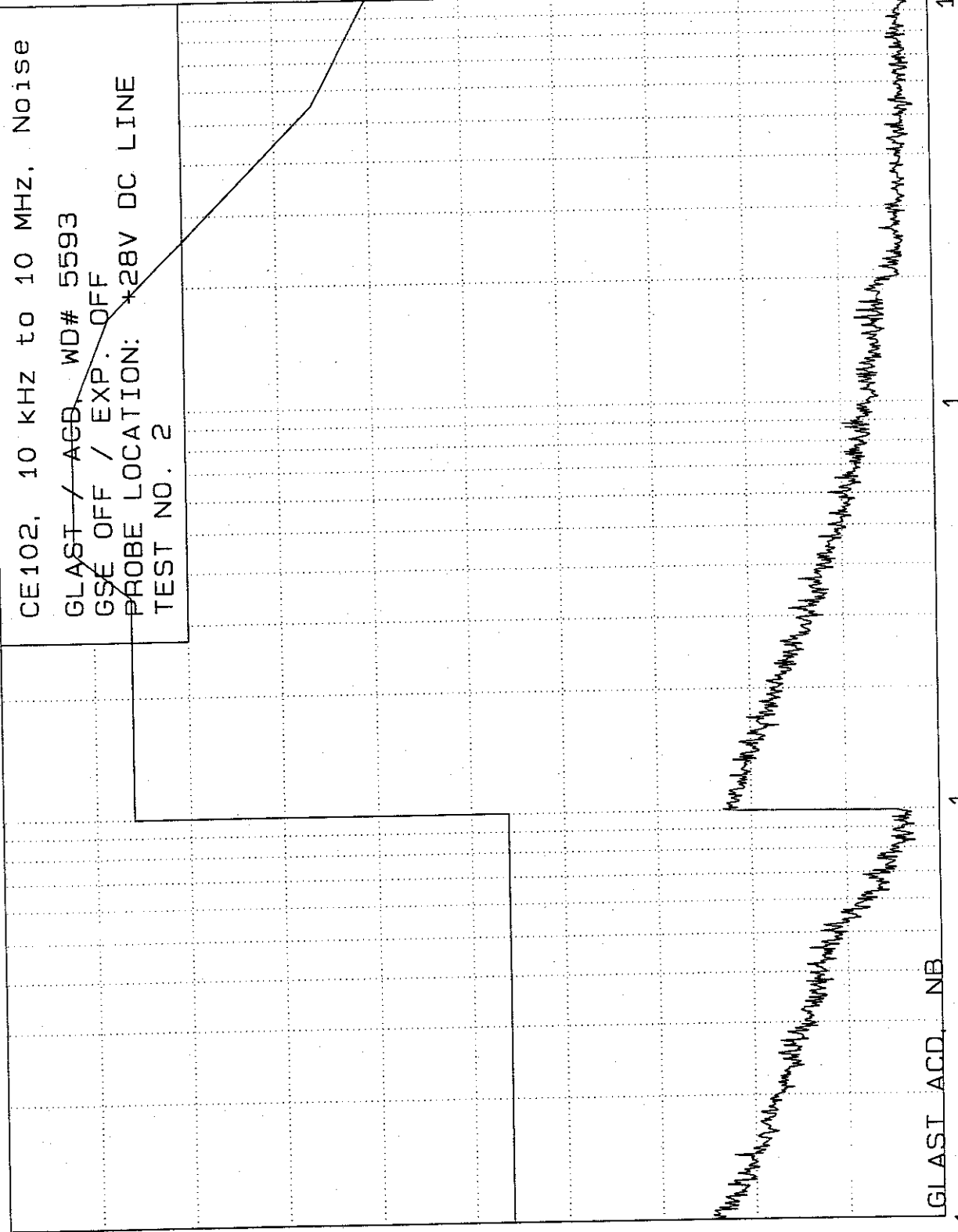
**Photo No.15**  
**December 9, 2004**  
**GLAST / ACD, WD No.5593**  
**RS103, 1 GHz - 18 GHz**  
**1 meter, Horizontal**  
**Test No.71**

EMC Test Laboratory: GSFC NASA  
EMISSION LEVEL [dBuA] PEAK

23 NOV 2004 14:01:24

hp

CE102, 10 KHZ to 10 MHZ, Noise  
GLAST / AGD, WD# 5593  
GSE OFF / EXP. OFF  
PROBE LOCATION: \*28V DC LINE  
TEST NO. 2



GLAST\_ACD\_NB  
0.01 .1 1 10  
FREQUENCY [MHZ]

EMC Test Laboratory: GSFC NASA  
EMISSION LEVEL [dBuA] PEAK

23 Nov 2004

14:09:48

hp

120

100

80

60

40

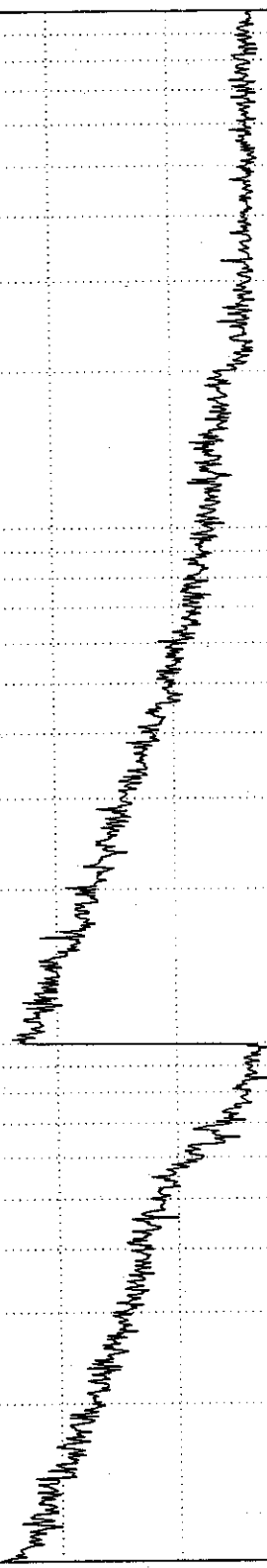
.01

.1

1

10

CE102, 10 KHZ to 10 MHz, Noise  
GLAST / AGB, WD# 5593  
GSE OFF / EXP. OFF  
PROBE LOCATION: 28V DC RTN LINE  
TEST NO. 3



FREQUENCY [MHZ]

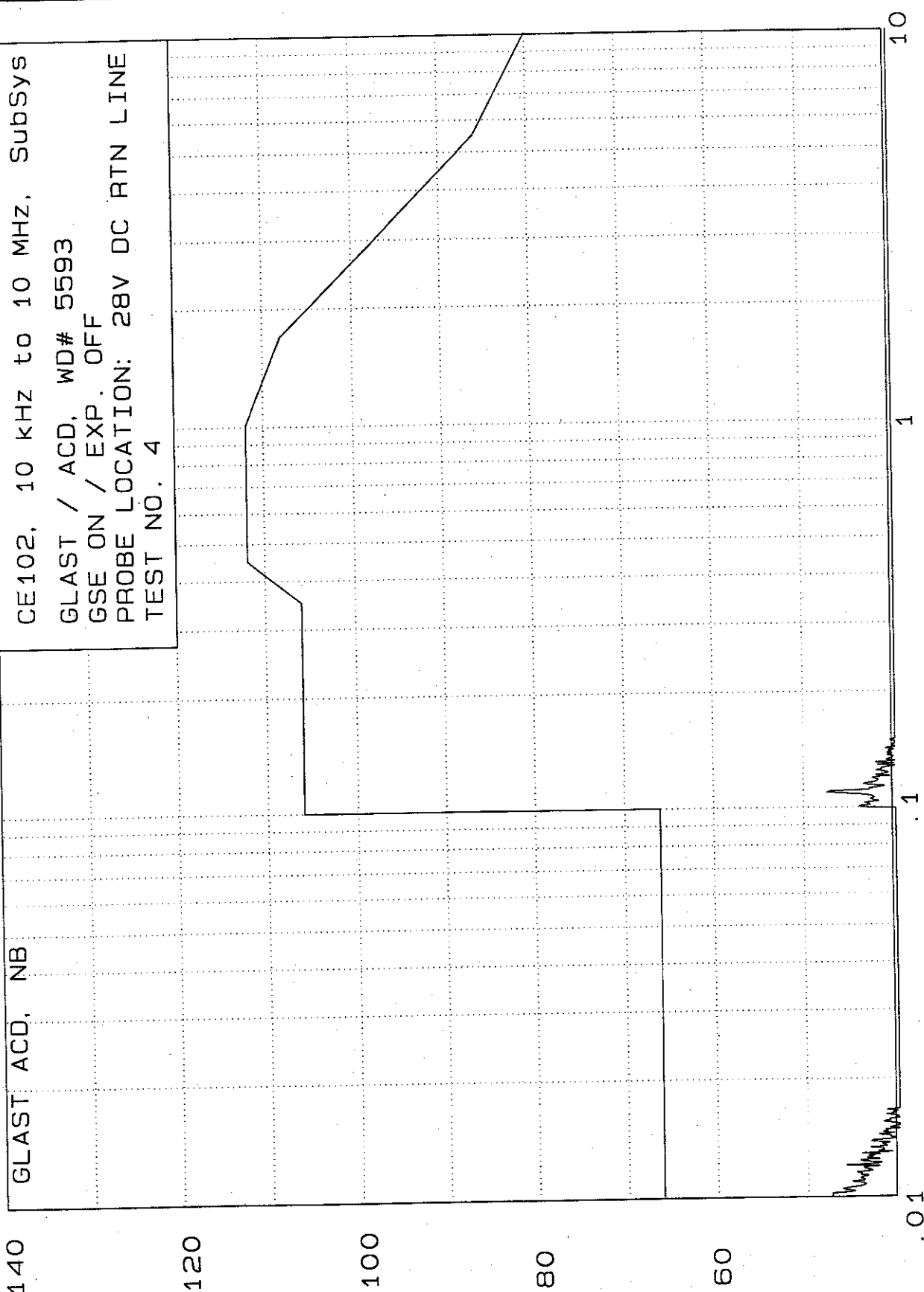
EMC Test Laboratory; GSFC NASA  
EMISSION LEVEL [dBuA] PEAK

23 Nov 2004

14: 18: 20

hp

GLAST ACD, NB  
CE102, 10 KHZ to 10 MHZ, SubSys  
GLAST / ACD, WD# 5593  
GSE ON / EXP. OFF  
PROBE LOCATION: 28V DC RTN LINE  
TEST NO. 4



FREQUENCY [MHZ]

EMC Test Laboratory; GSFC NASA  
EMISSION LEVEL [dBuA] PEAK

23 Nov 2004

14: 32: 10

hp

140

GLAST ACD, NB

CE102, 10 KHZ to 10 MHZ, SubSys  
GLAST / ACD, WD# 5593  
GSE ON / EXP. OFF  
PROBE LOCATION: +28V DC LINE  
TEST NO. 5

120

100

80

60

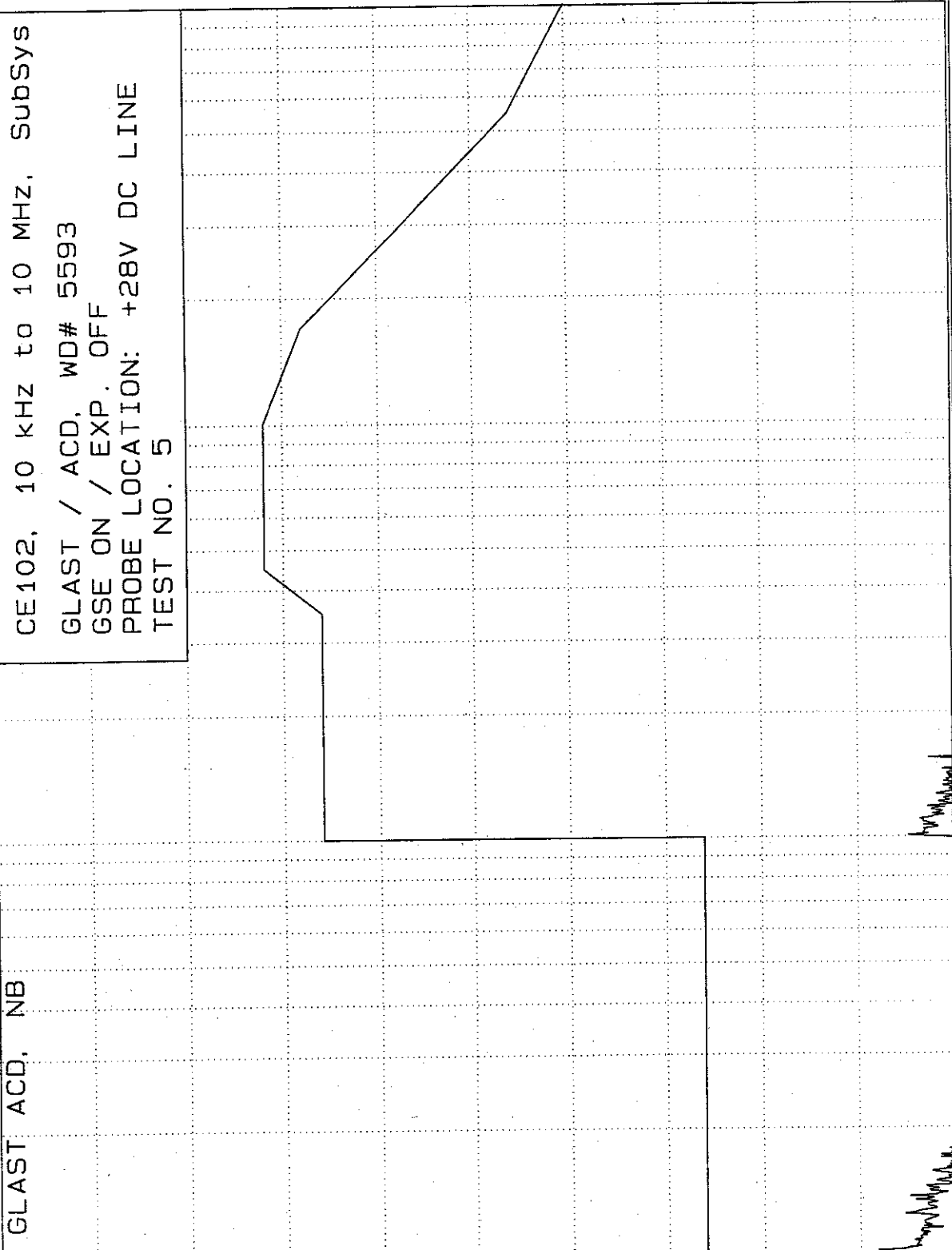
.01

.1

1

10

FREQUENCY [MHZ]



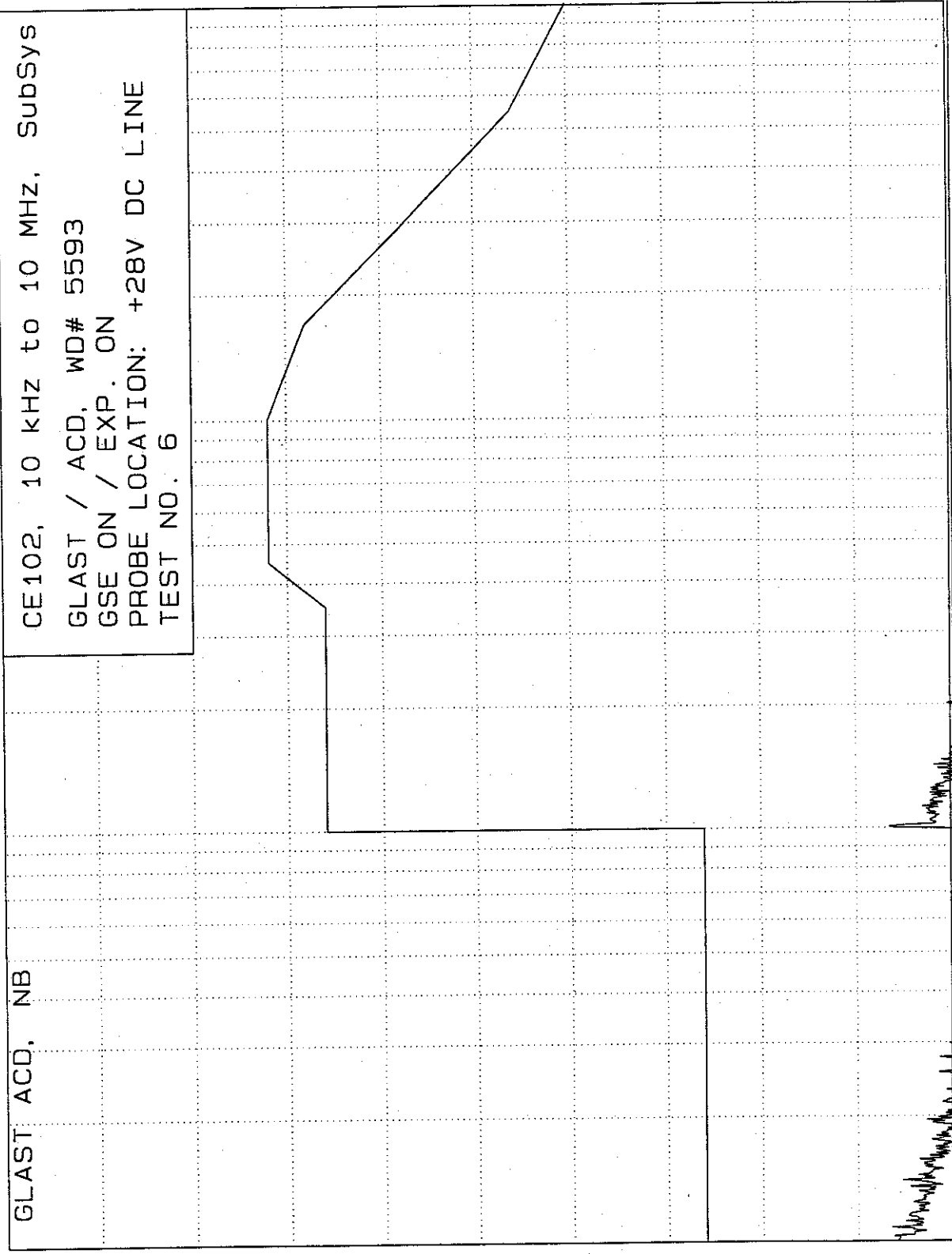
EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuA] PEAK

23 Nov 2004

14: 54: 01

hp

GLAST ACD, NB  
CE102, 10 KHZ to 10 MHZ, SubSys  
GLAST / ACD, WD# 5593  
GSE ON / EXP. ON  
PROBE LOCATION: +28V DC LINE  
TEST NO. 6



.01 .1 1 10  
FREQUENCY [MHZ]

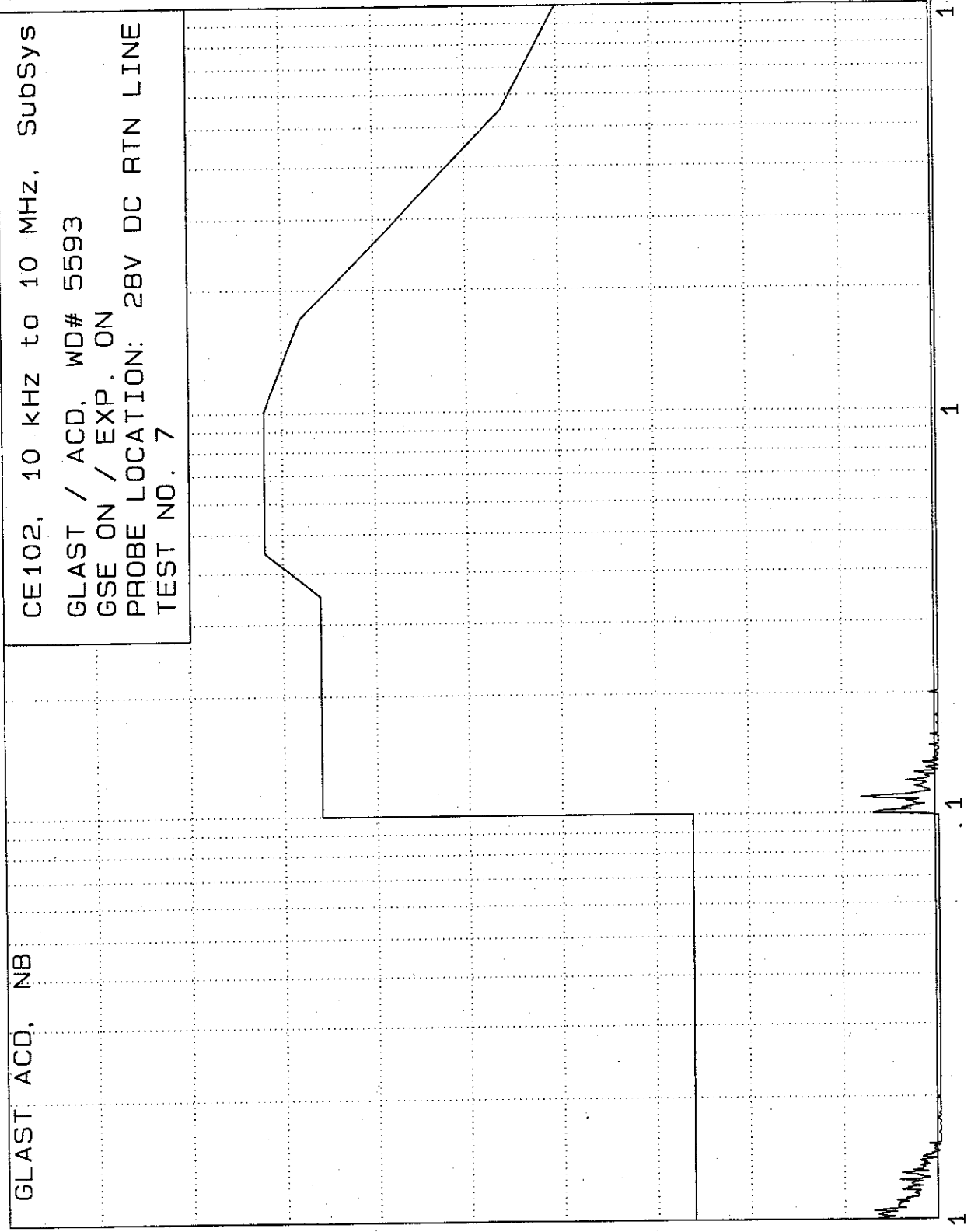
EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuA] PEAK

23 Nov 2004

15: 03: 25

hp

GLAST ACD, NB  
CE102, 10 KHZ to 10 MHZ, SubSys  
GLAST / ACD, WD# 5593  
GSE ON / EXP. ON  
PROBE LOCATION: 28V DC RTN LINE  
TEST NO. 7



FREQUENCY [MHZ]

EMC Test Laboratory; GSFC NASA  
EMISSION LEVEL [dBuA] PEAK

23 Nov 2004

15:33:59

hp

140

GLAST ACD, NB

CE102, 10 KHZ to 10 MHZ, SubSys  
GLAST / ACD, WD# 5593  
GSE ON / EXP. ON, SECONDARY  
PROBE LOCATION: +28V DC LINE  
TEST NO. 8

120

100

80

60

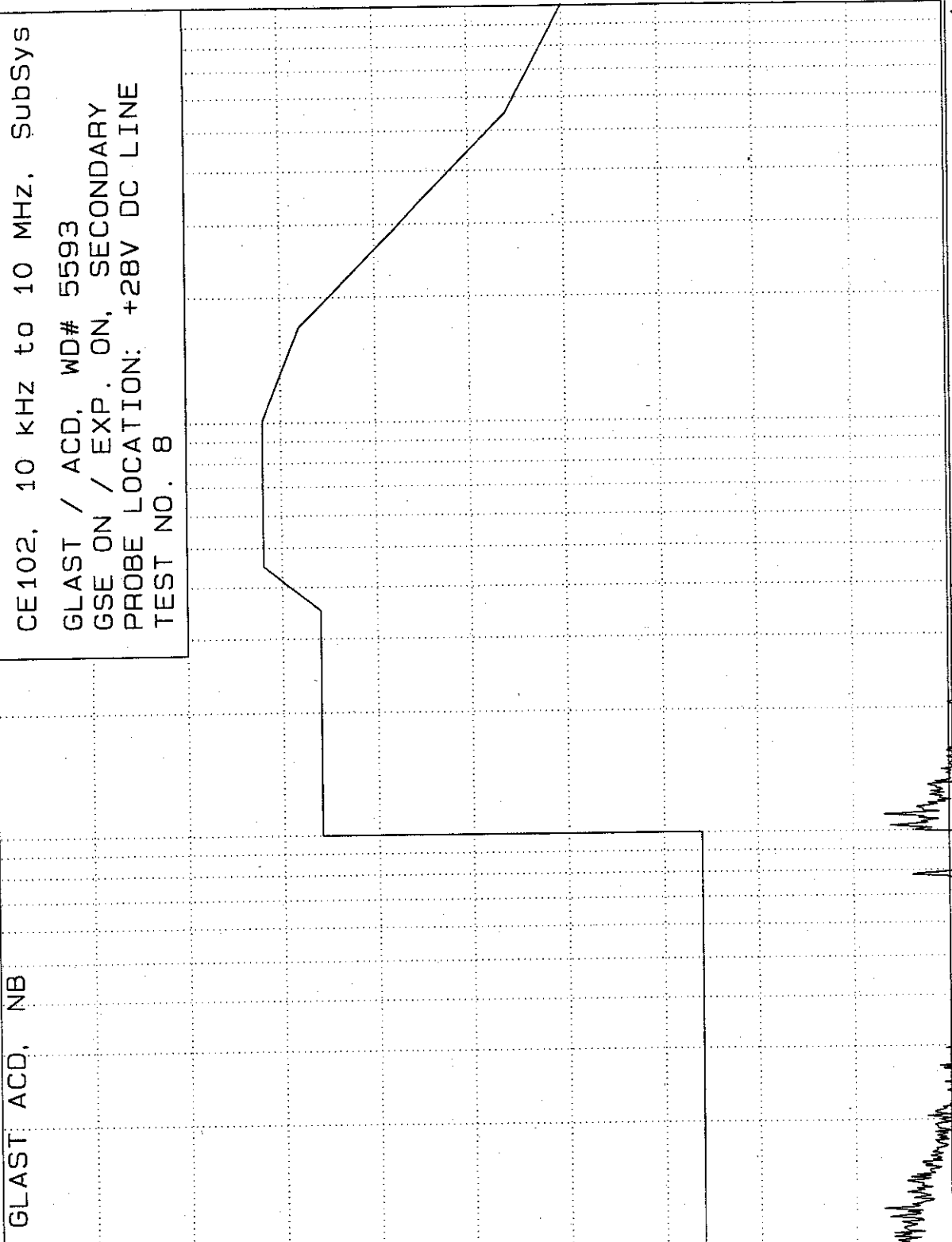
.01

.1

1

10

FREQUENCY [MHZ]



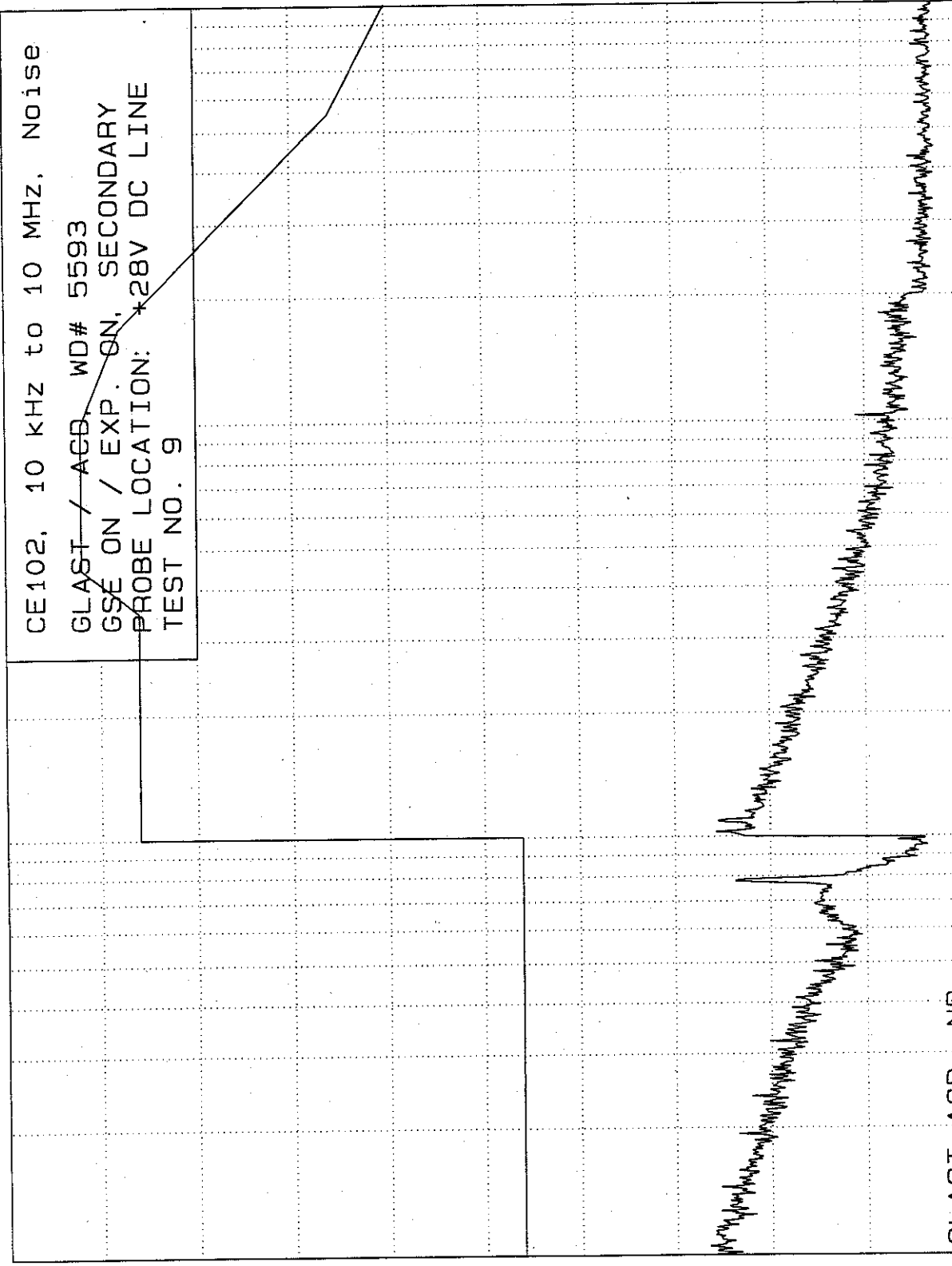
EMC Test Laboratory; GSFC NASA  
EMISSION LEVEL [dBUA] PEAK

23 Nov 2004

15: 43: 01

hp

CE102, 10 KHZ to 10 MHZ, Noise  
GLAST / AGD, WD# 5593  
GSE ON / EXP. ON, SECONDARY  
PROBE LOCATION: \*28V DC LINE  
TEST NO. 9



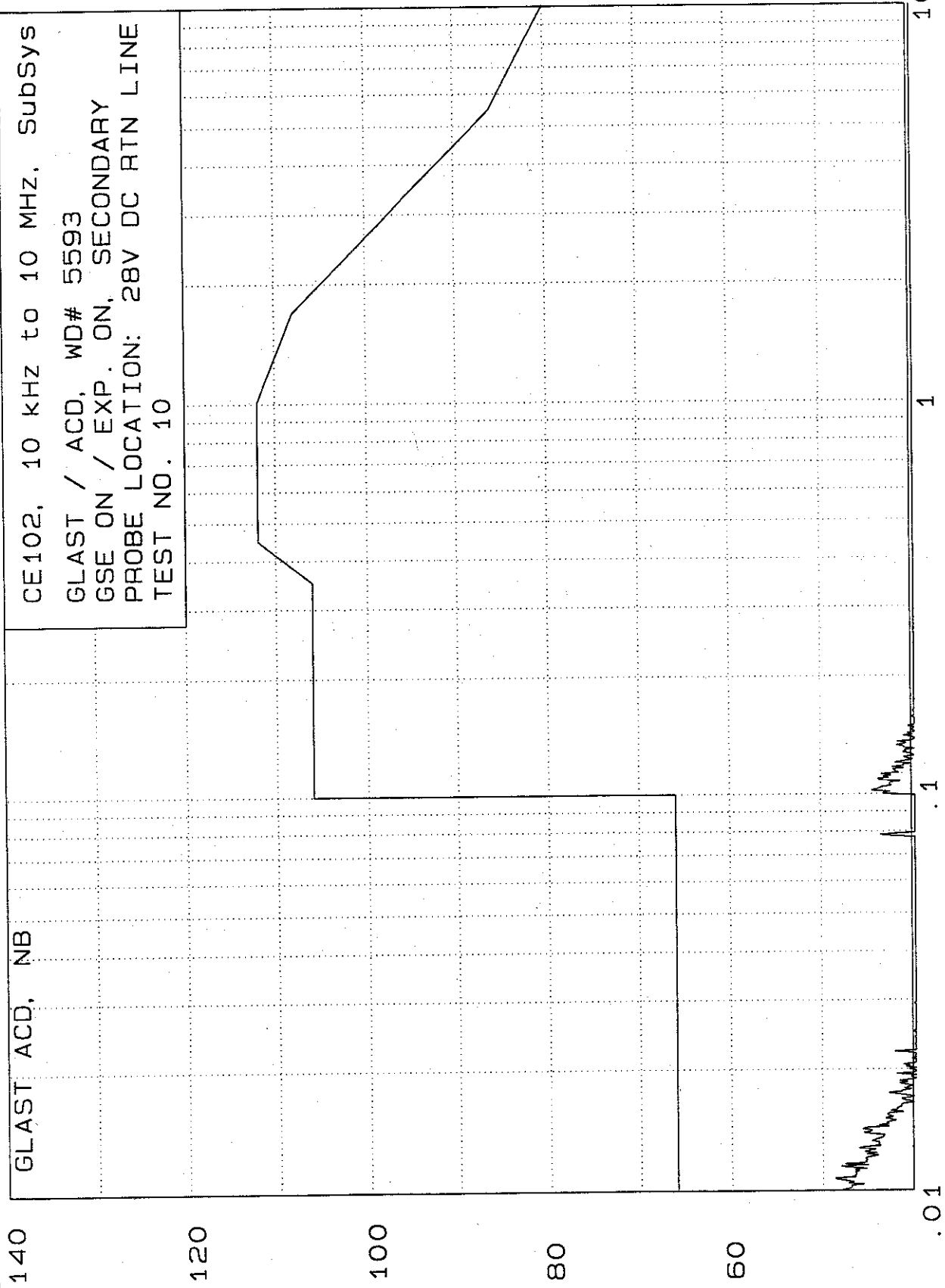
GLAST ACD, NB  
FREQUENCY [MHZ]

EMC Test Laboratory; GSFC NASA  
EMISSION LEVEL [dBuA] PEAK

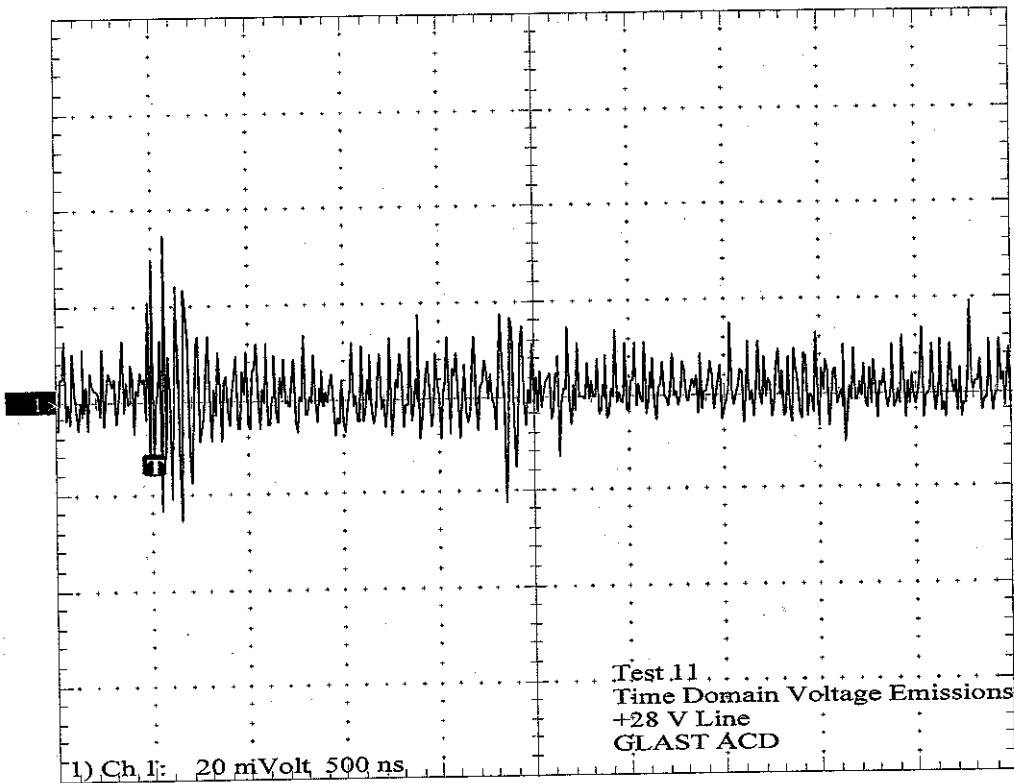
23 Nov 2004 15:52:14

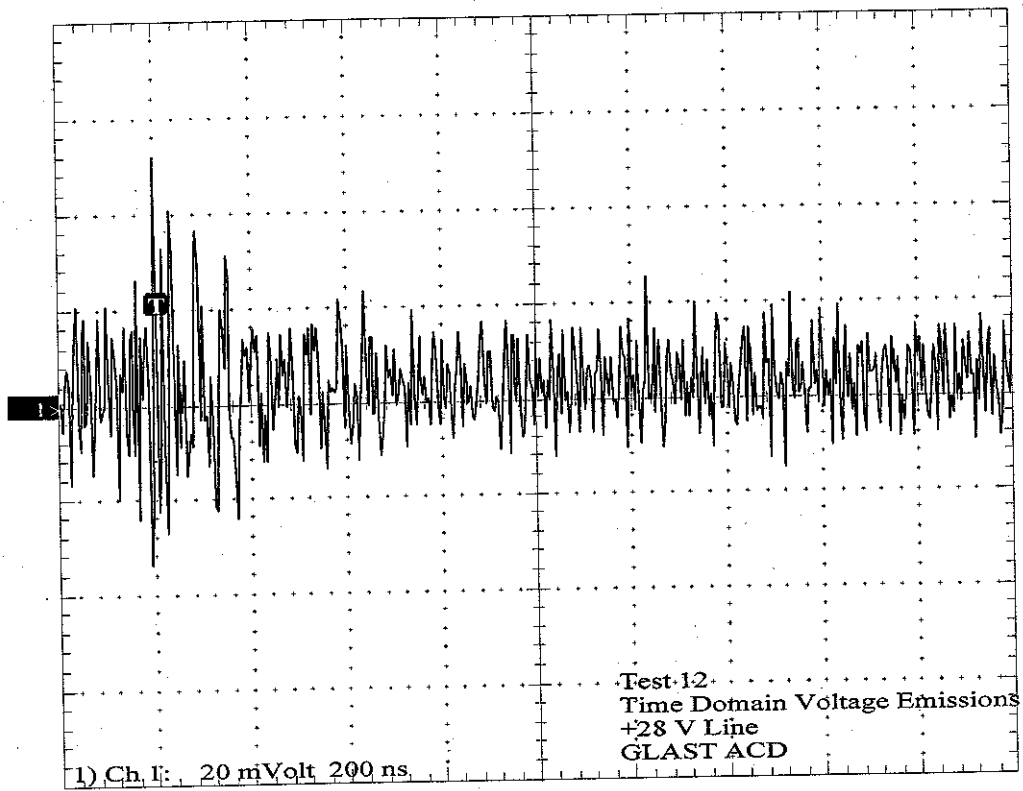
hp

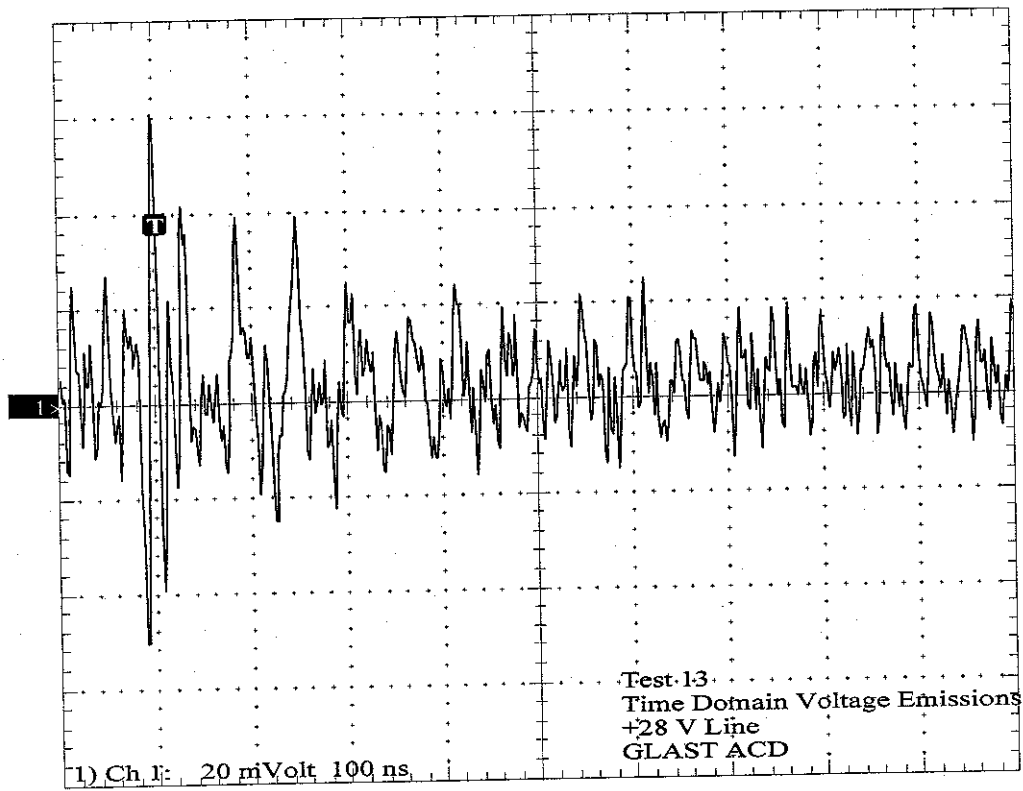
GLAST ACD, NB  
CE102, 10 KHZ to 10 MHz, SubSys  
GLAST / ACD, WD# 5593  
GSE ON / EXP. ON, SECONDARY  
PROBE LOCATION: 28V DC RTN LINE  
TEST NO. 10

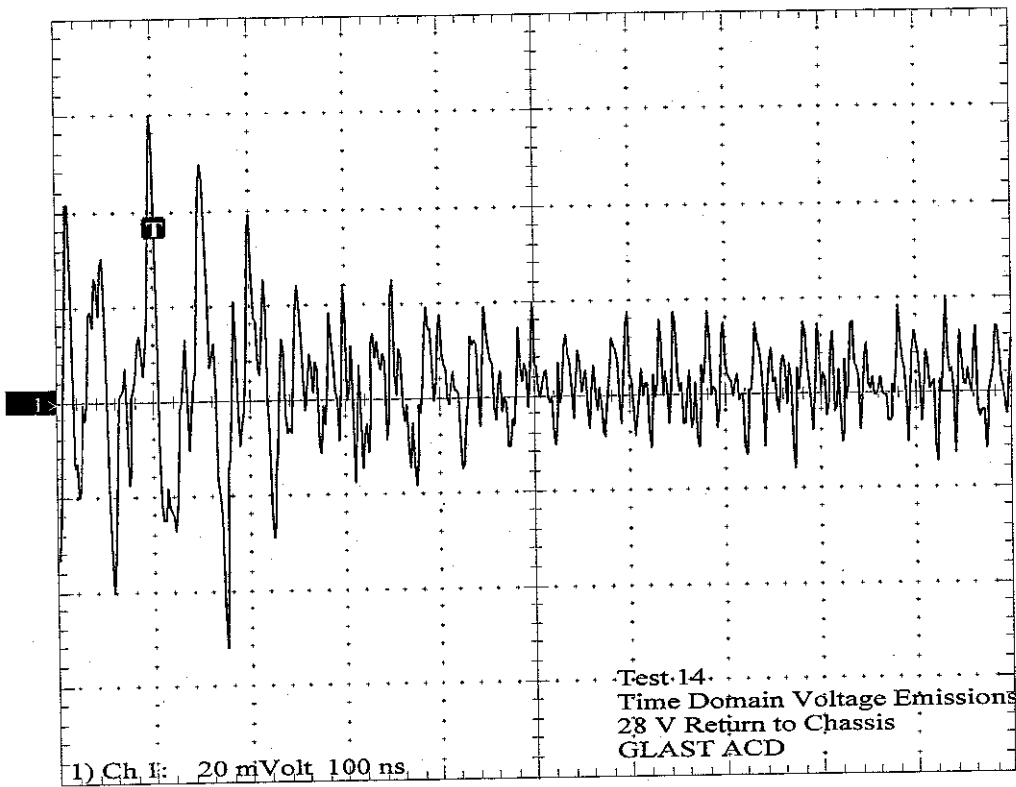


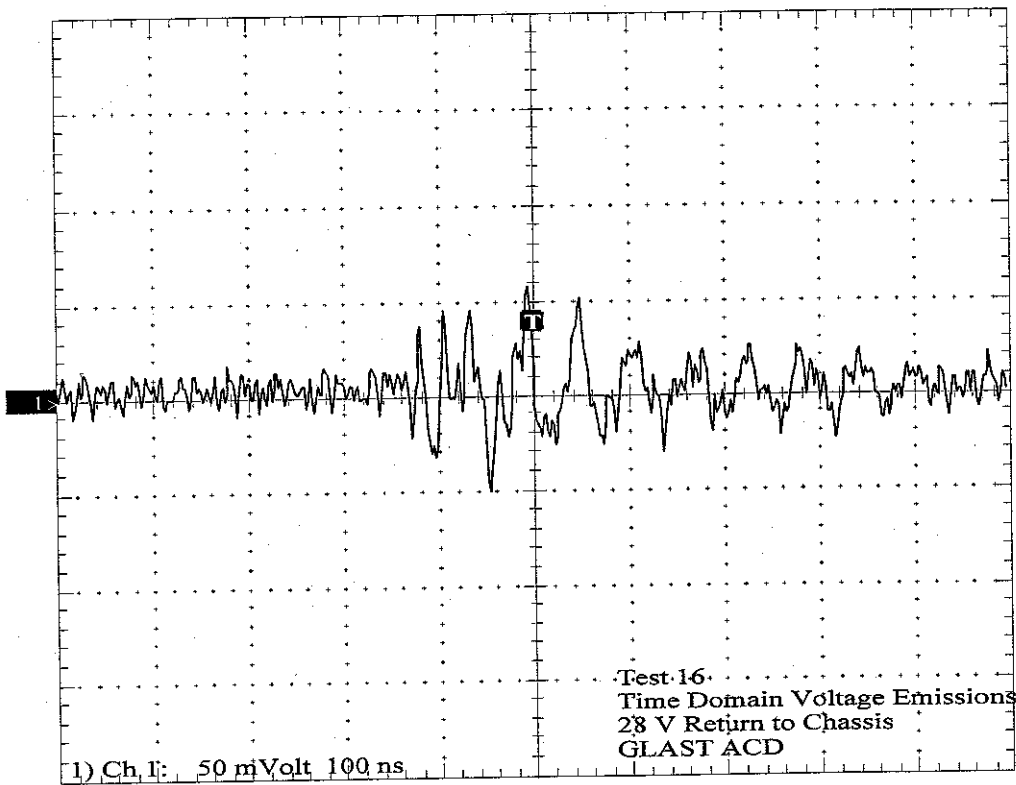
FREQUENCY [MHZ]

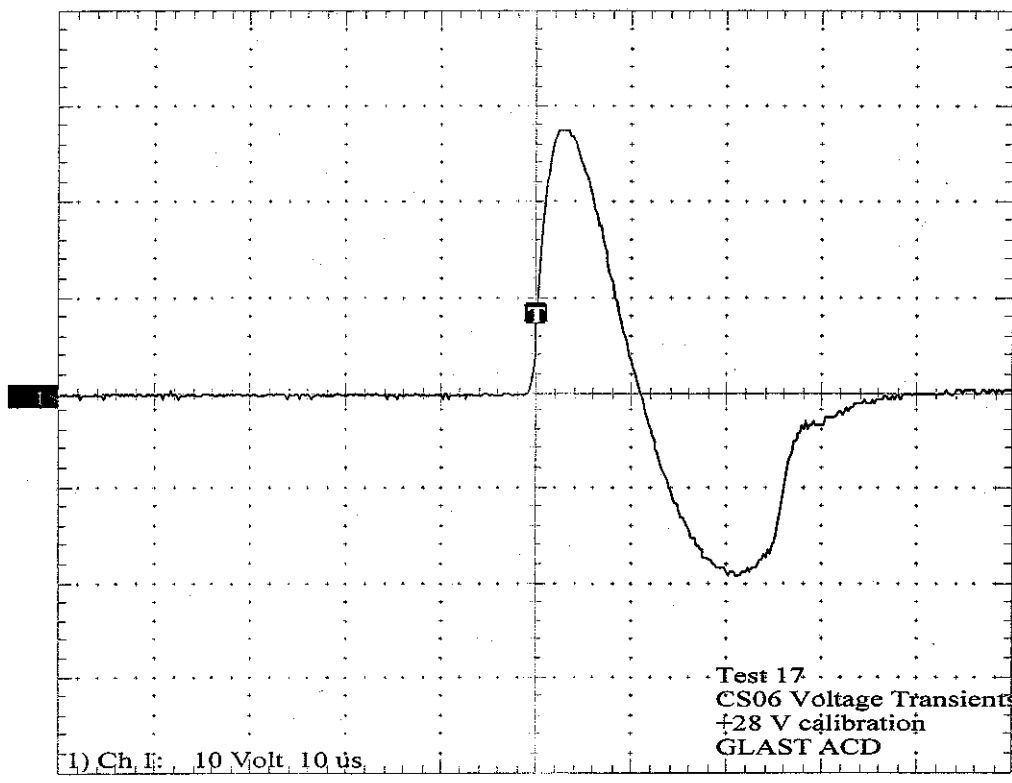


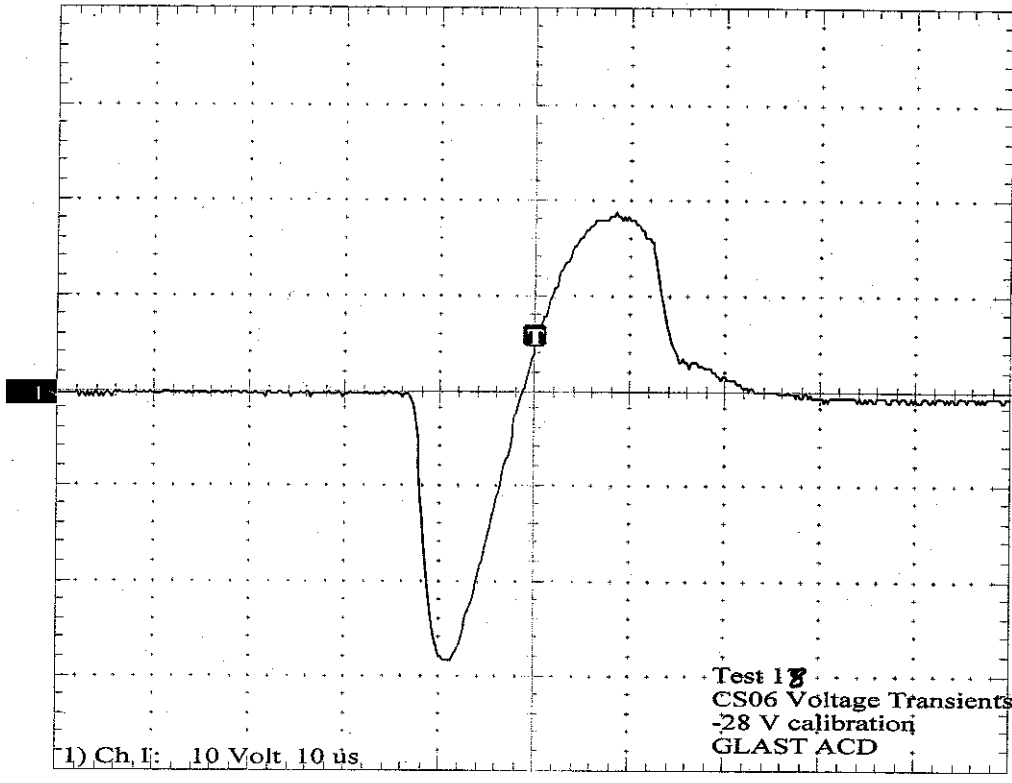


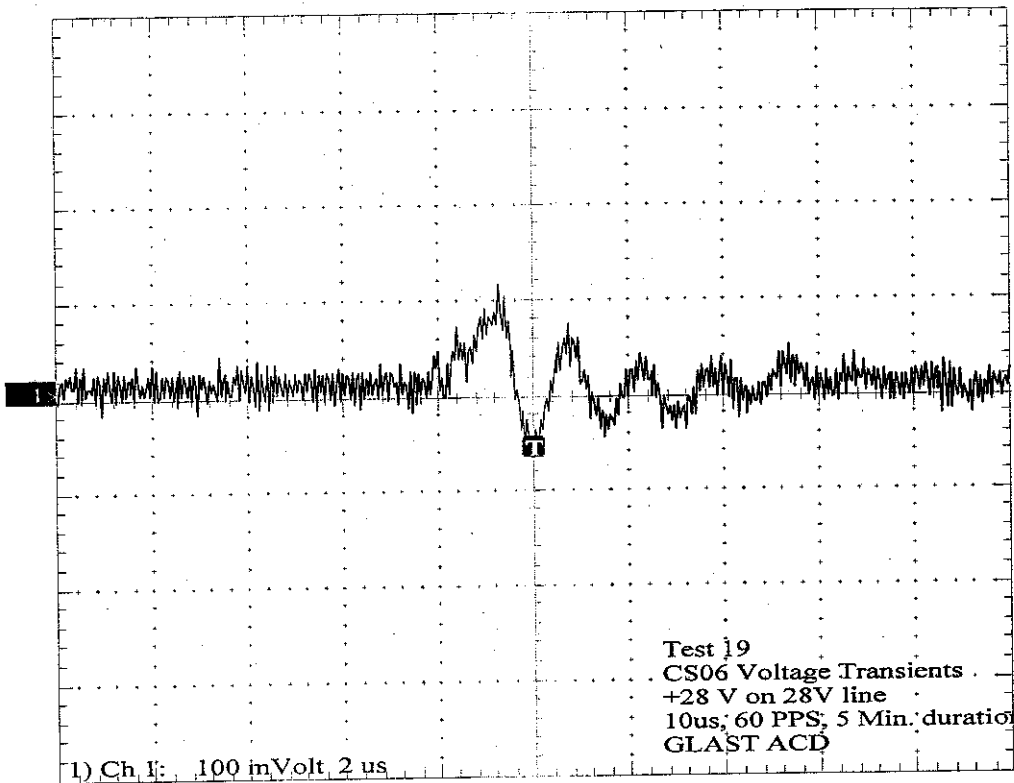


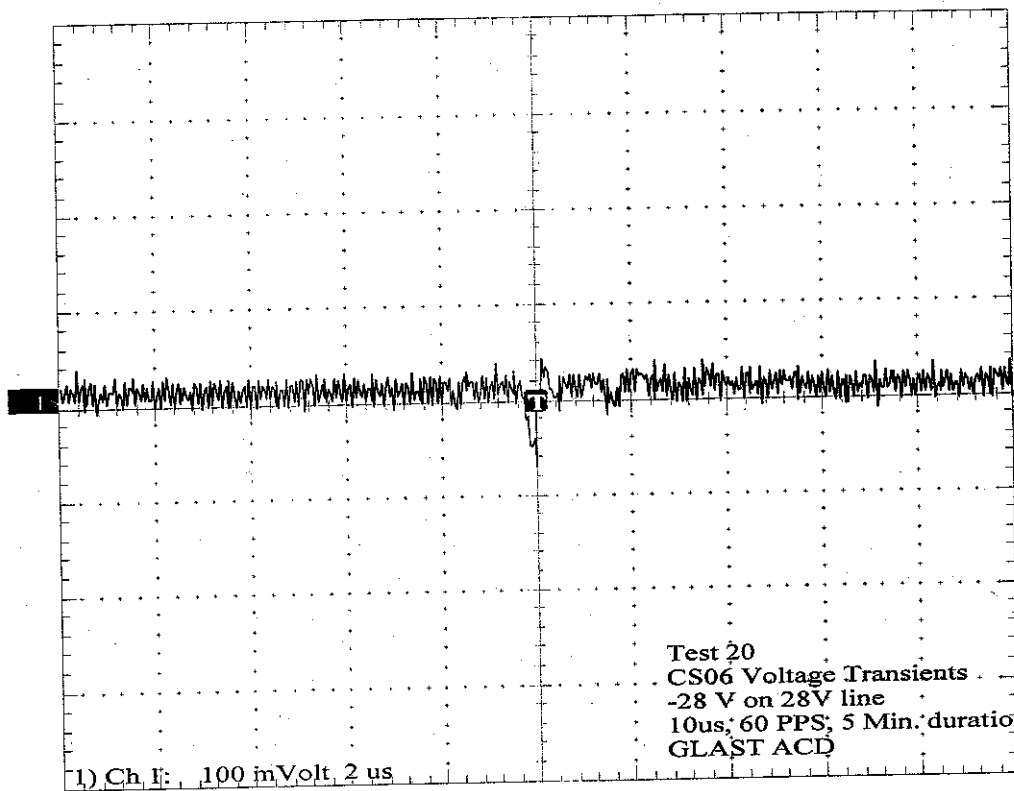


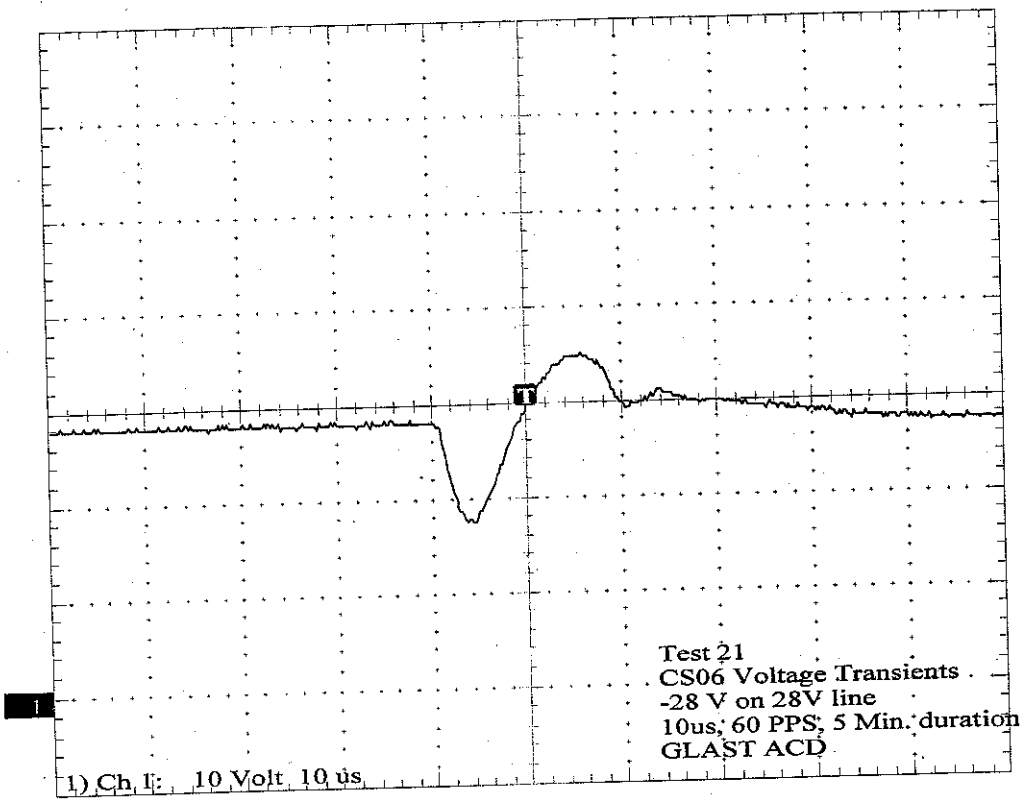


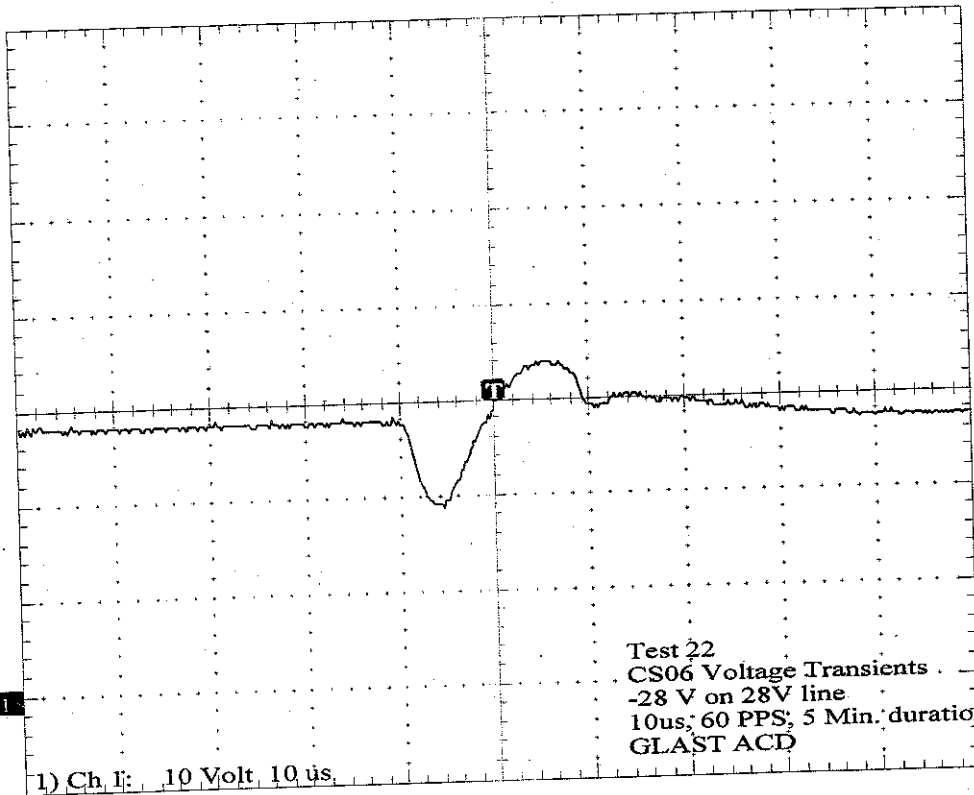




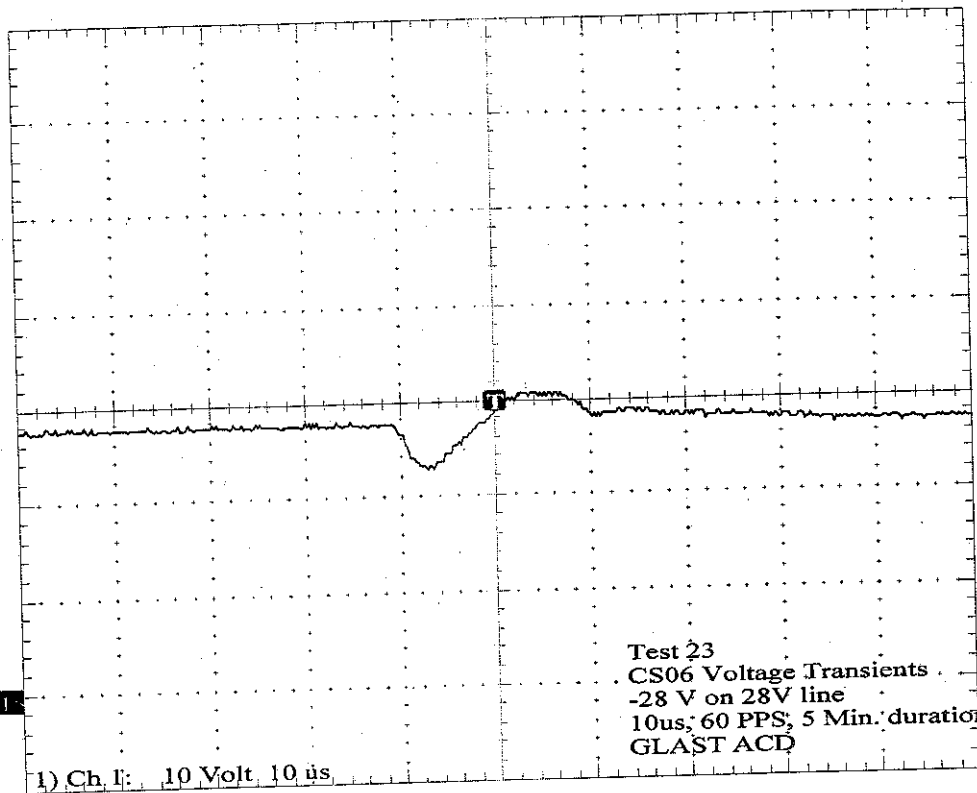


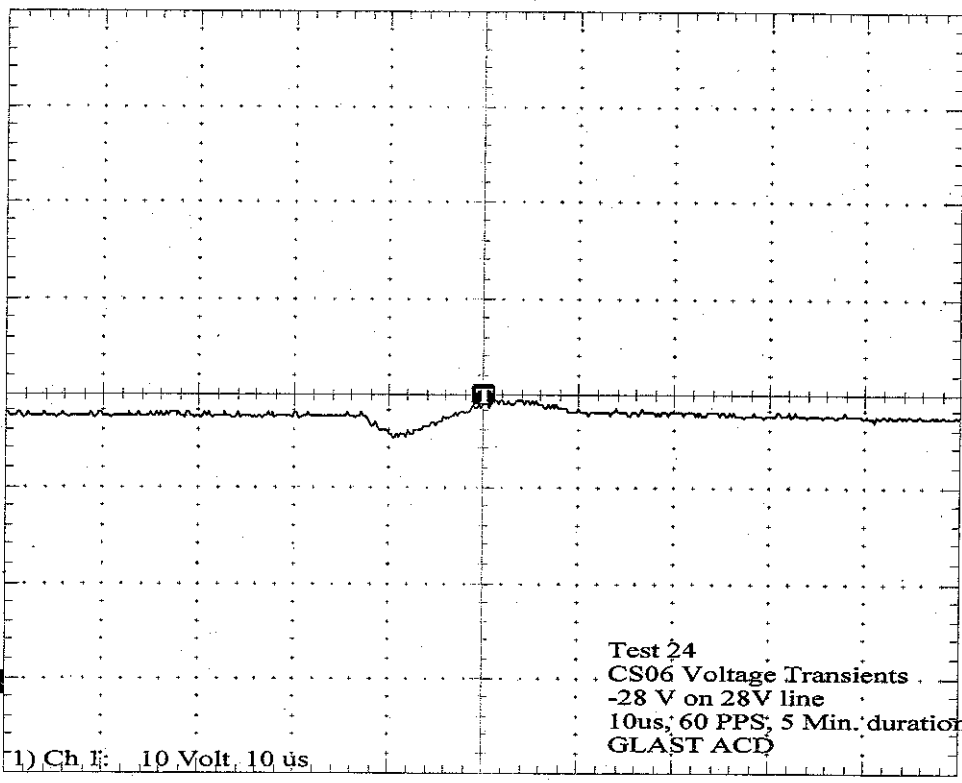






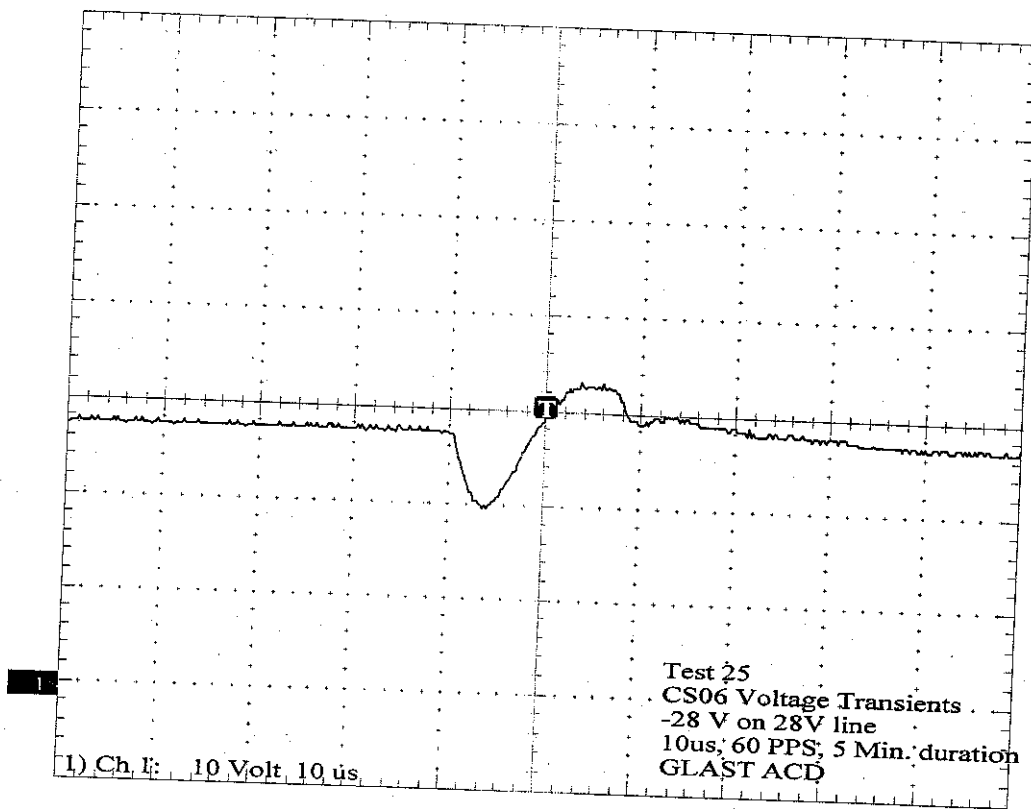
Test 22  
CS06 Voltage Transients  
-28 V on 28V line  
10 $\mu$ s; 60 PPS; 5 Min. duration  
GLAST ACD

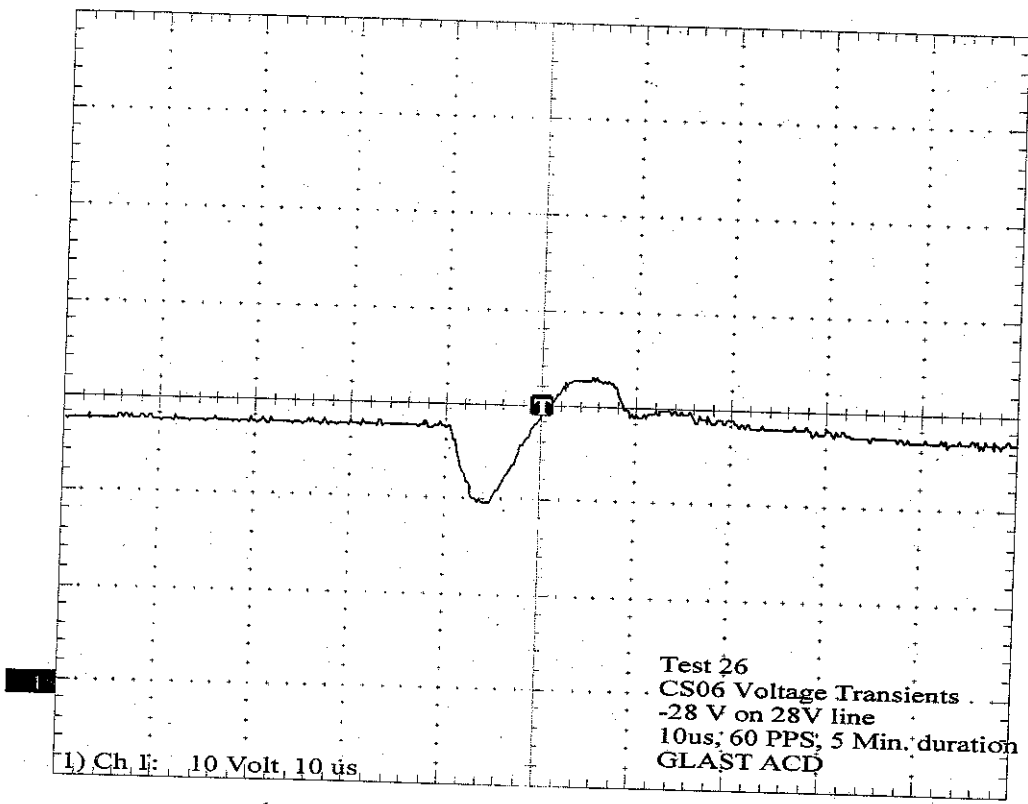


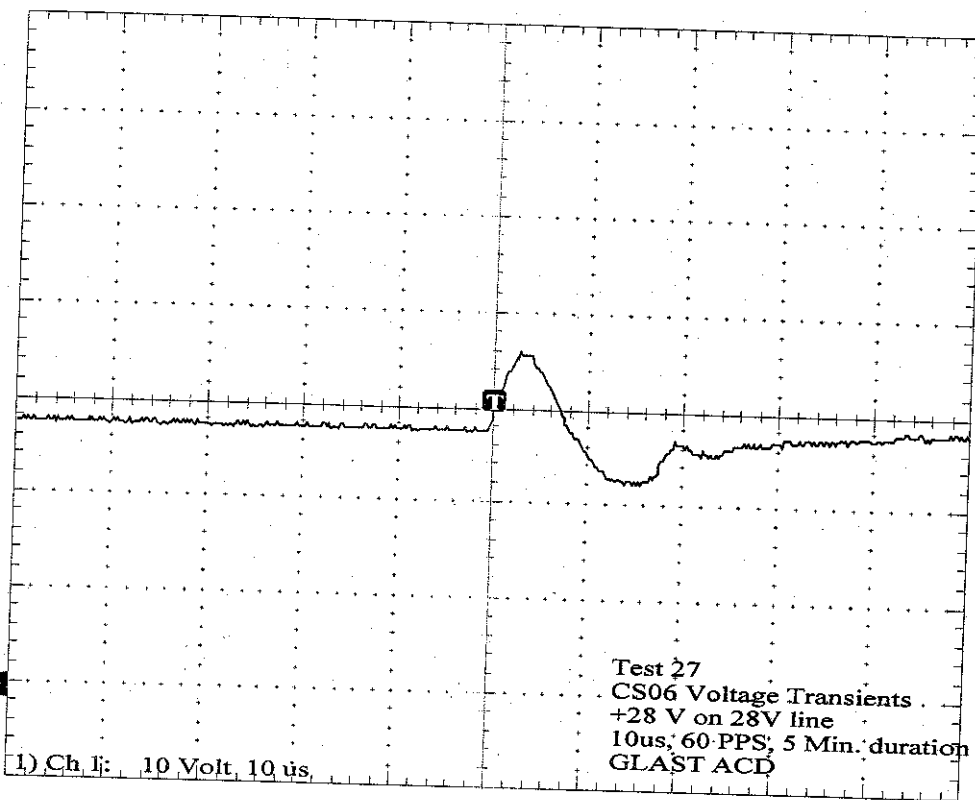


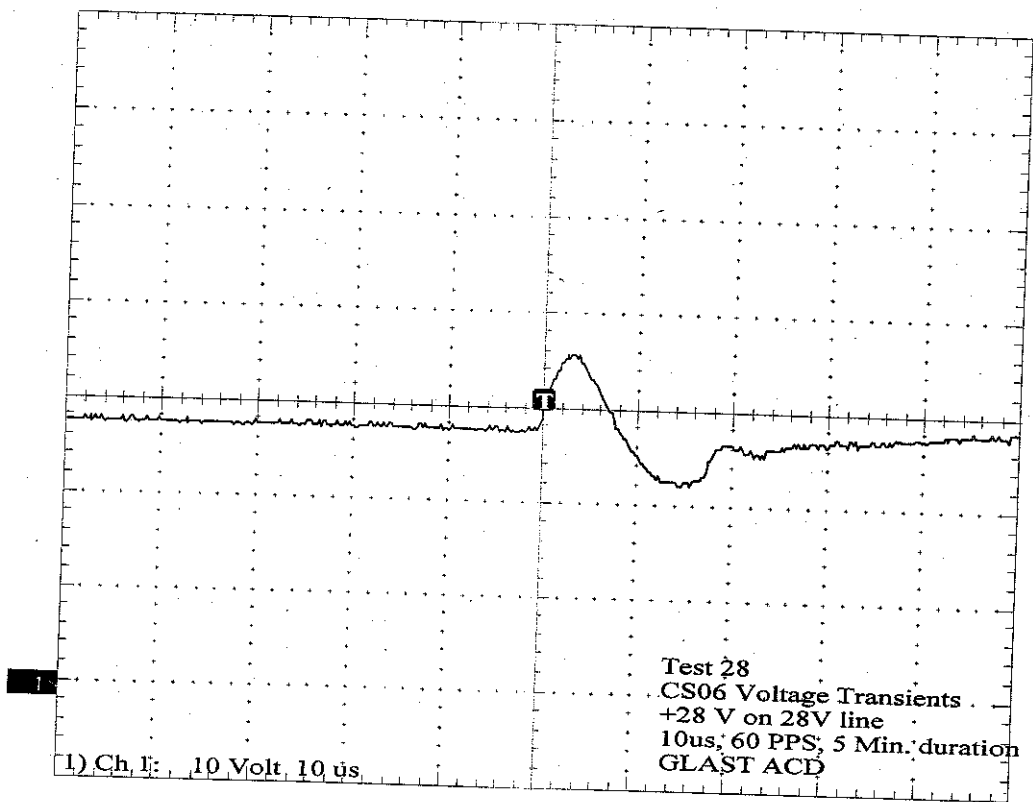
Test 24  
CS06 Voltage Transients  
-28 V on 28V line  
10us; 60 PPS; 5 Min. duration  
GLAST ACD

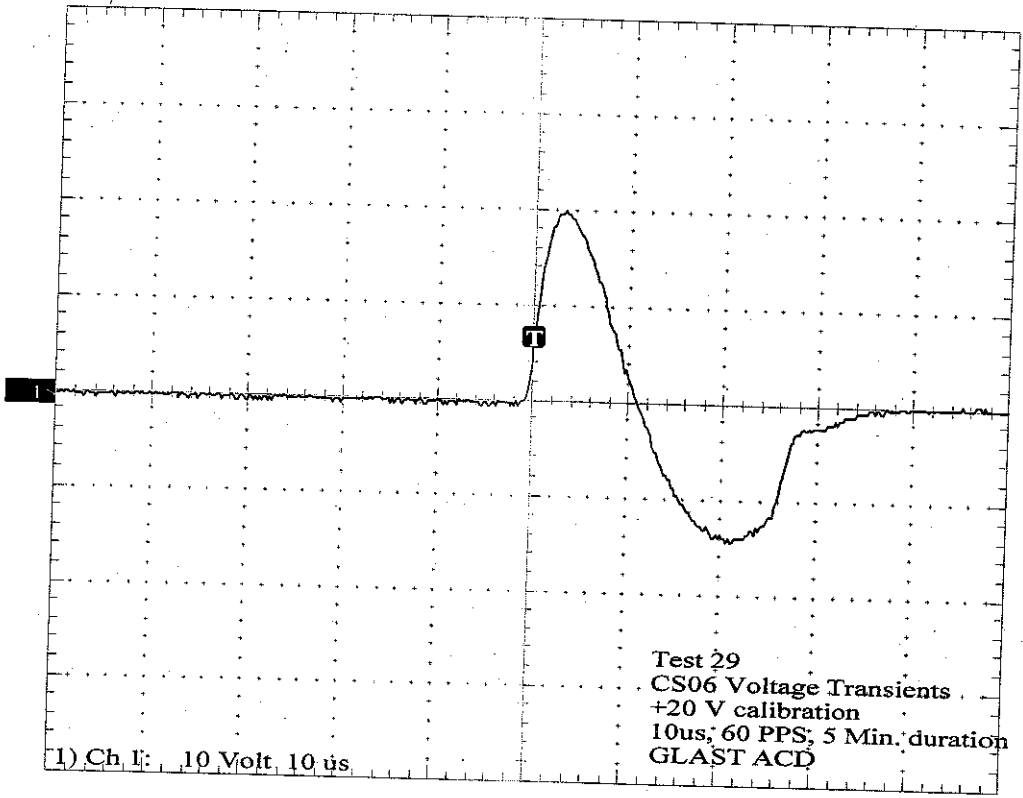
1) Ch. I: 10 Volt, 10 us

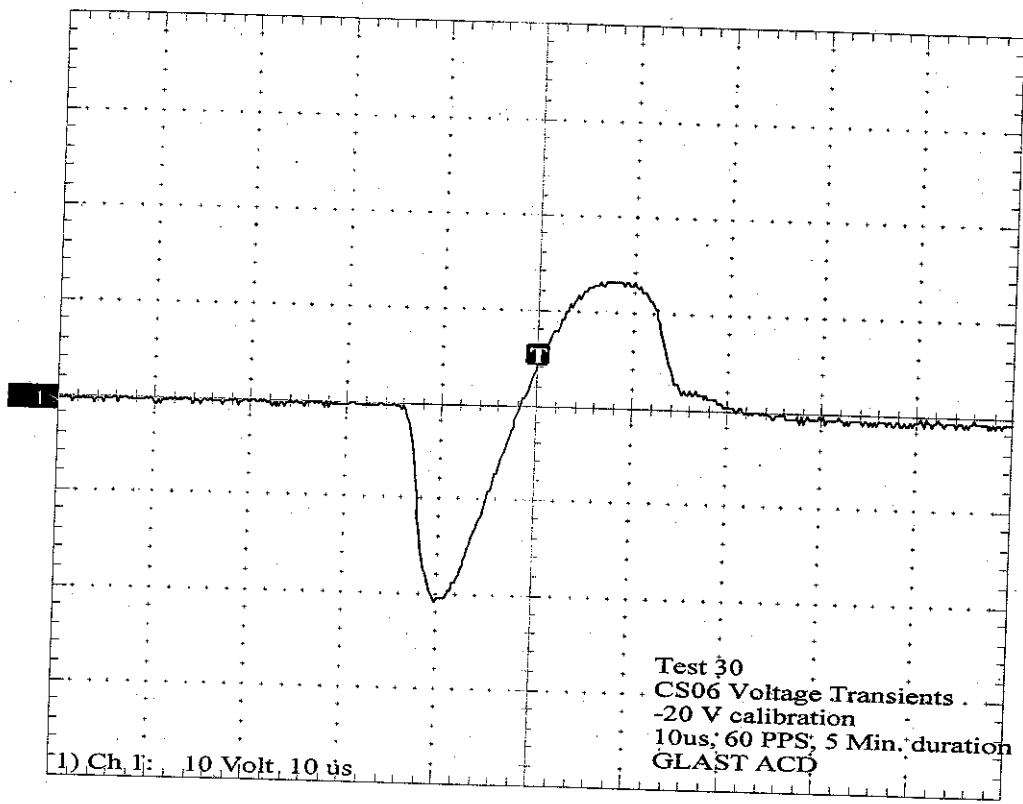


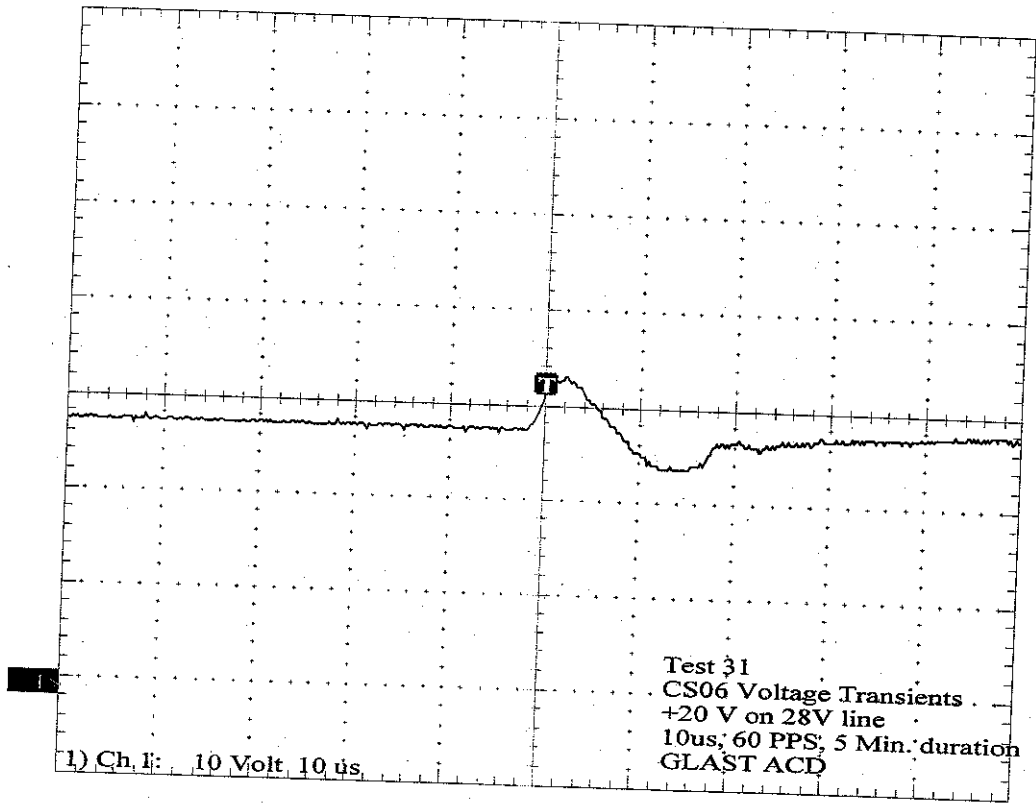


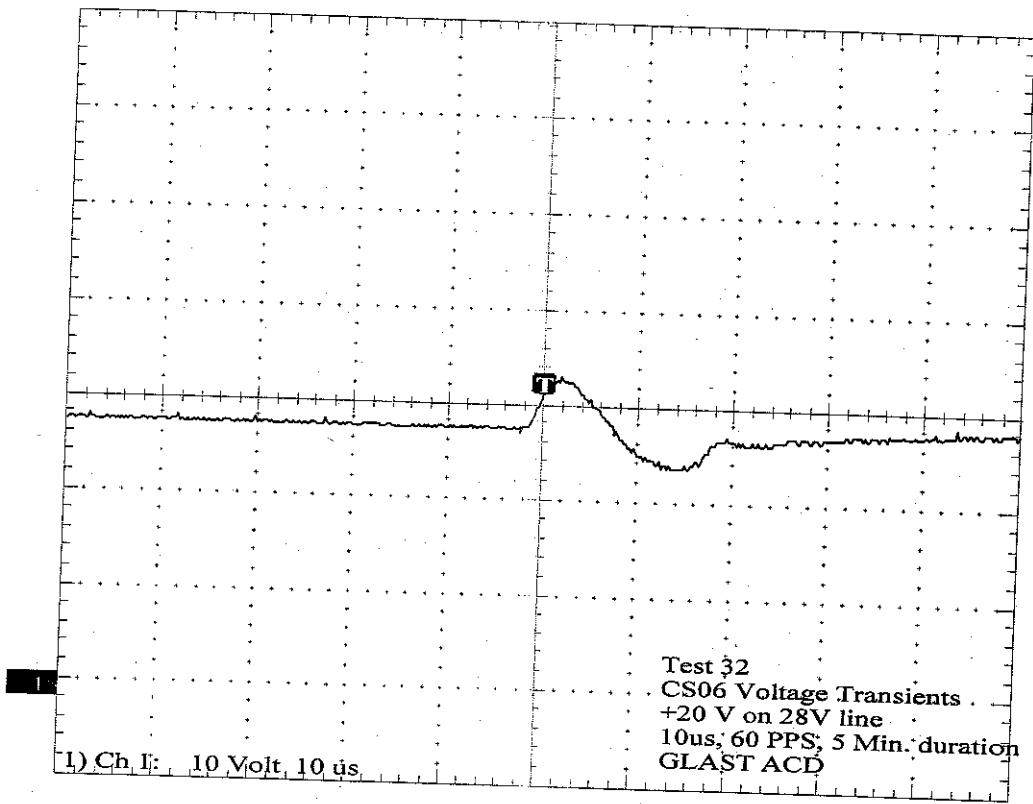


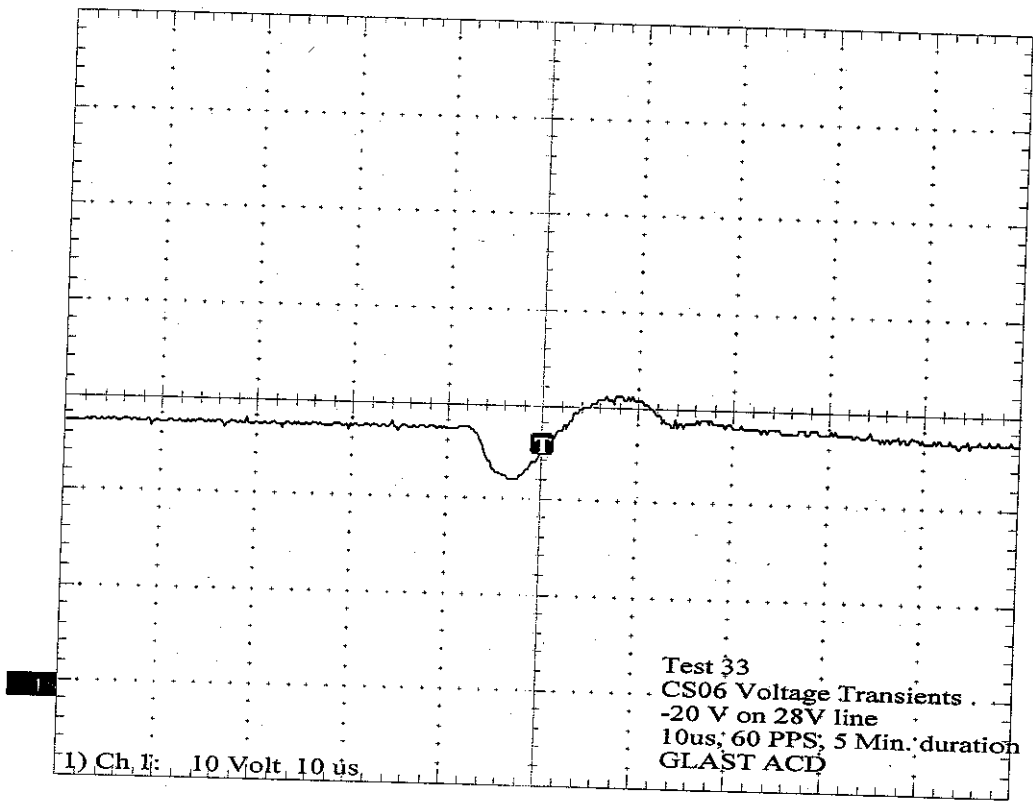


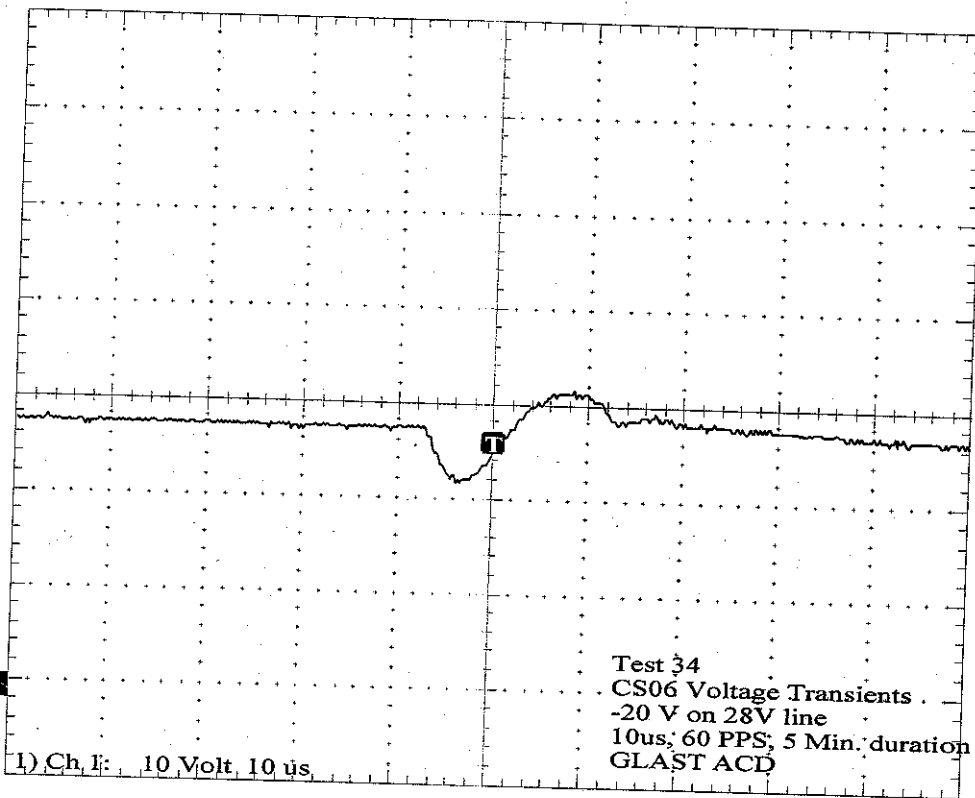








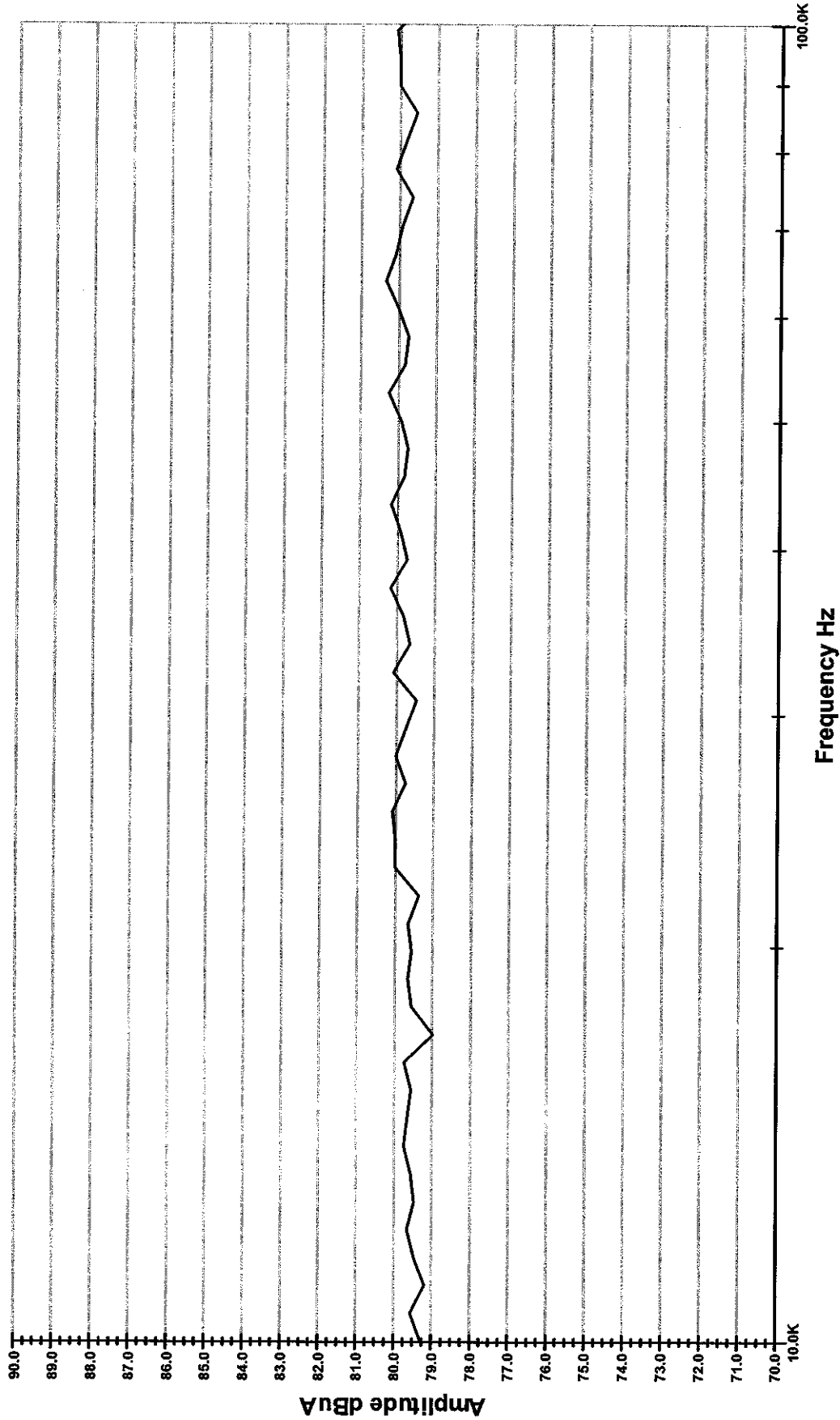




# EMC Test Laboratory, GFSC NASA

## CS102 10 kHz to 100 kHz

### ACD-PLAN-00215



Operator: Vaughn Nelson

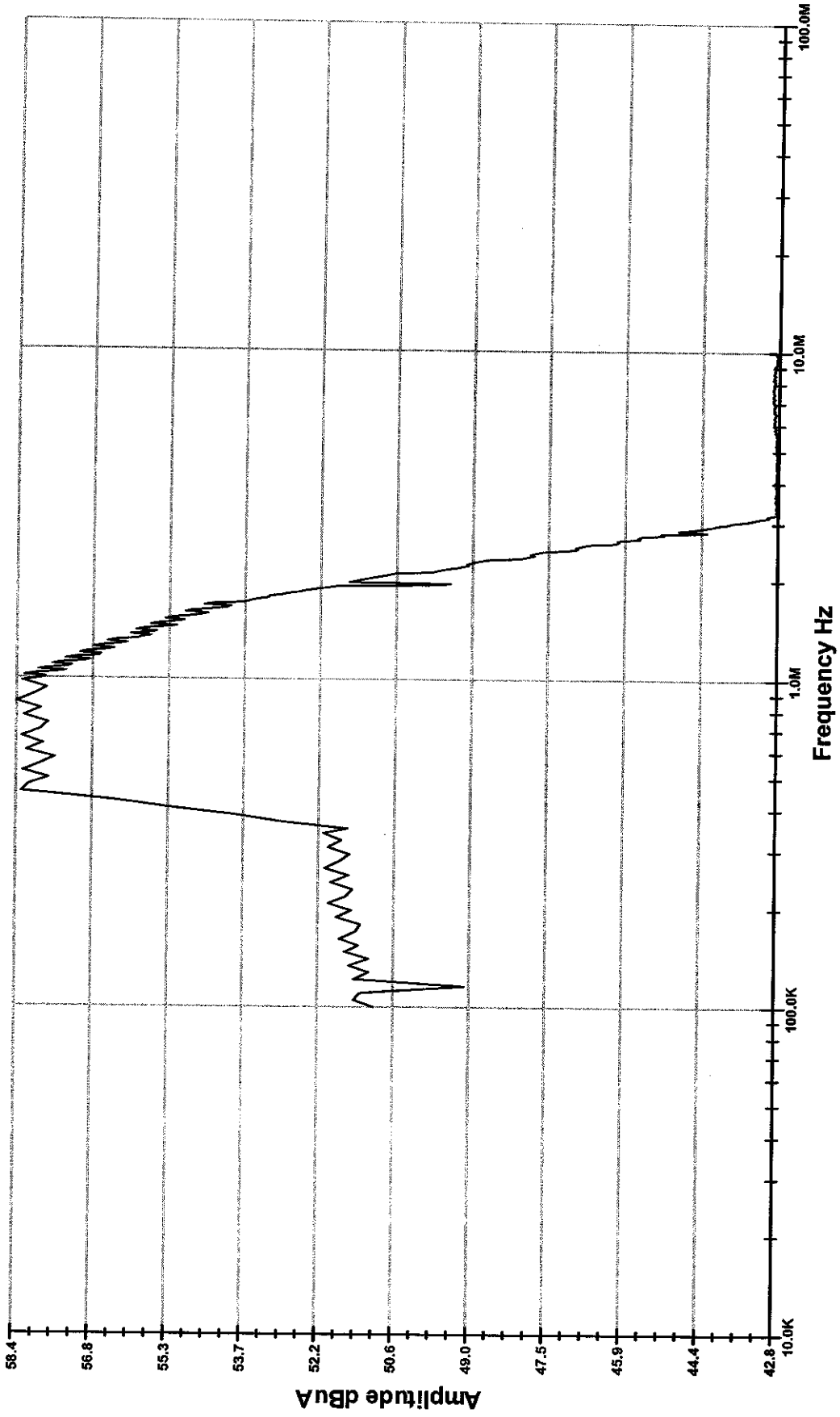
10:43:35 AM, Tuesday, November 30, 2004

EUT: GLAST / ACD Test No.35

EMC Test Laboratory, GSFC NASA

CS102 100 kHz to 10 MHz

ACD-PLAN-00215

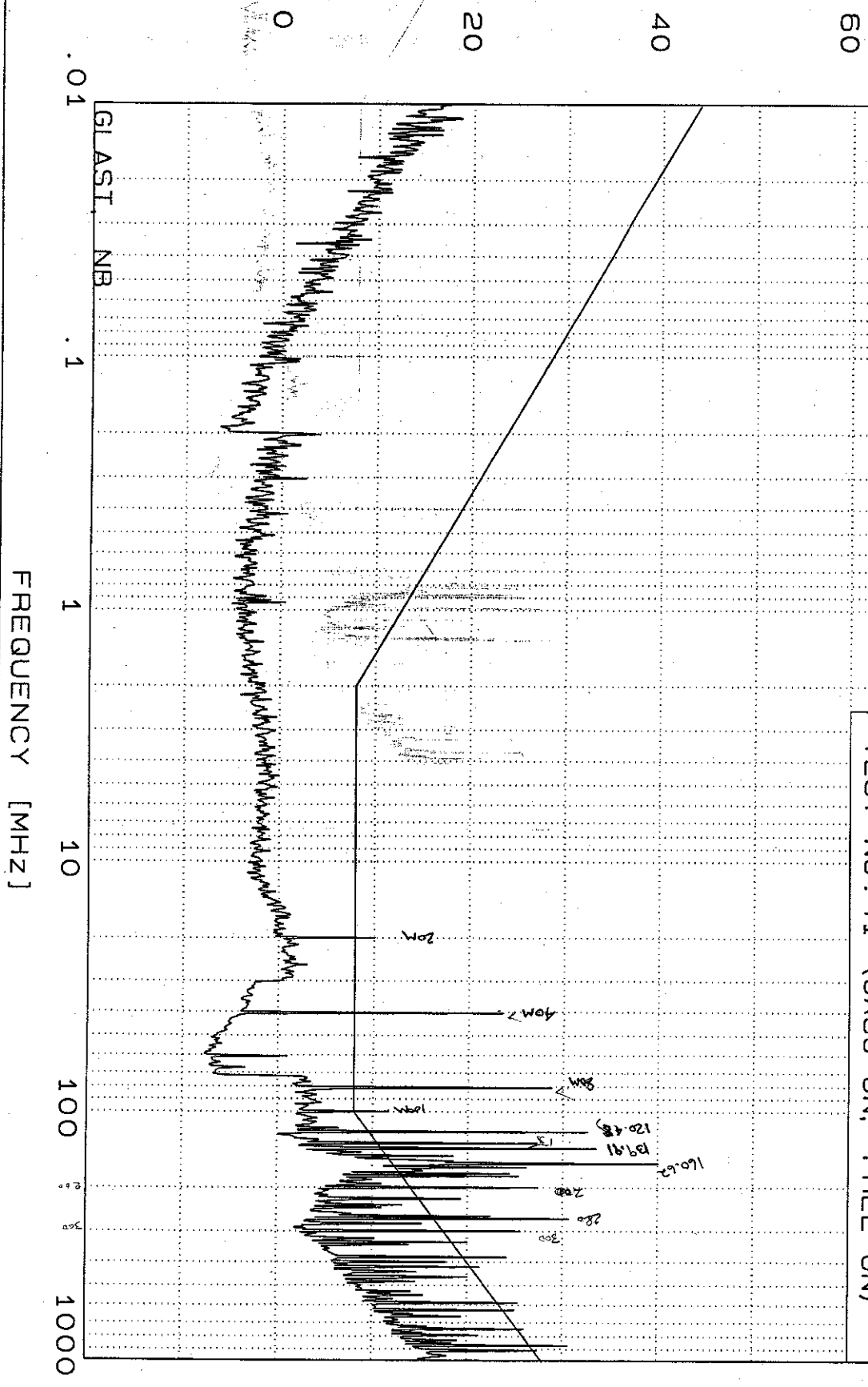


Operator: Vaughn Nelson

11:23:58 AM, Tuesday, November 30, 2004

EUT: GLAST / ACD Test No.36

RE102, 10 KHZ to 1 GHZ, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT ON, Noisy Mode  
ANTENNA POSITION: 45 Deg.  
TEST No. 41 (GASU ON, FREE ON)



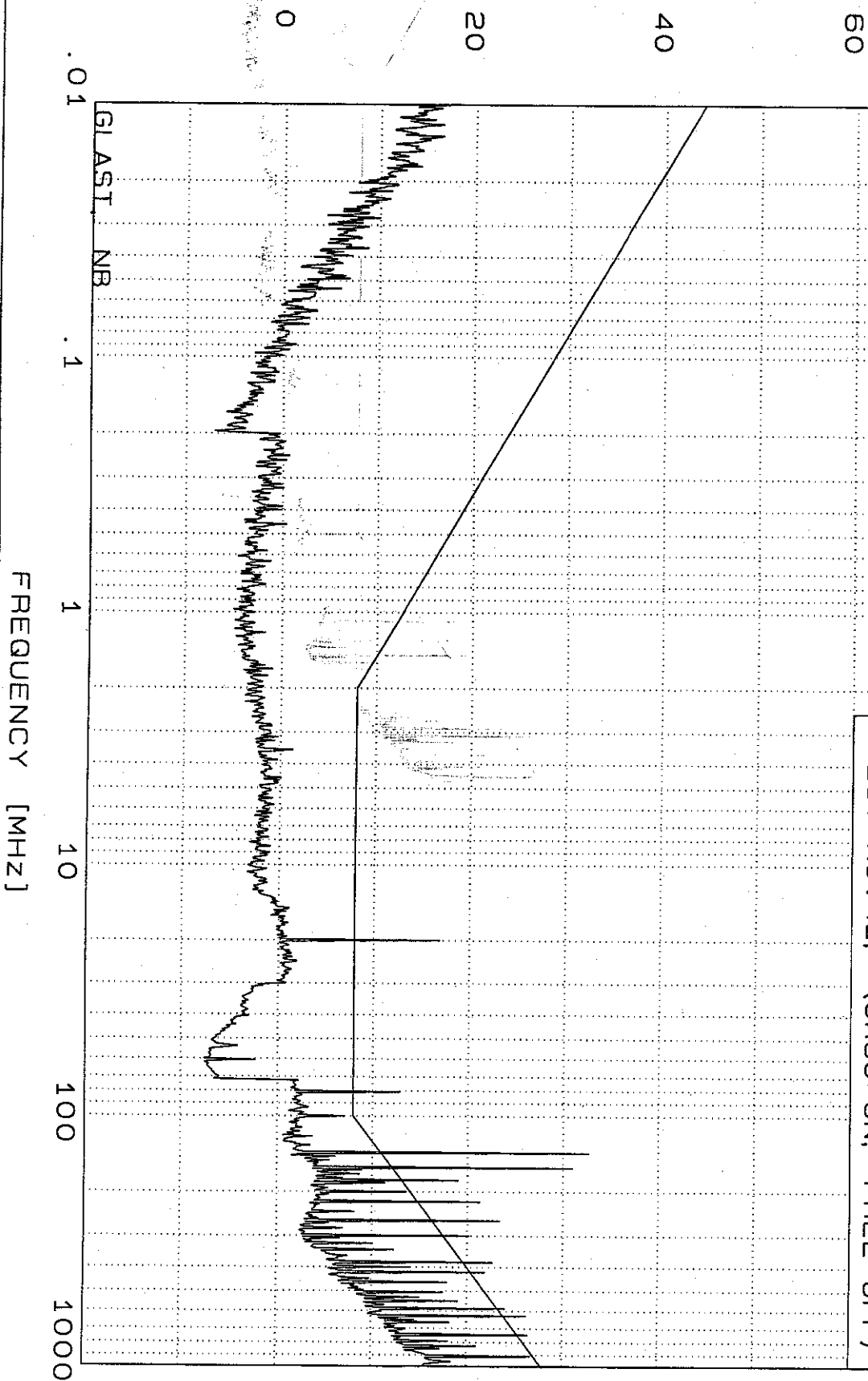
41

2. Radiated Emissions Test Setup  
2.1 RE102, 10 kHz to 1 GHz, Subsys

31 highest Peaks above 0 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/M)	DELTA
1	160.62	40.1	28.0
2	120.48	32.6	23.0
3	139.91	33.5	22.6
4	80.56	28.8	20.8
5	133.62	27.3	16.8
6	40.4	23.7	15.7
7	266.42	30.7	14.3
8	166.26	26.2	13.8
9	199.85	27.4	13.5
10	180.2	25.4	12.3
11	176.1	24.4	11.5
12	298.9	25.6	8.2
13	149.91	18.5	7.0
14	260.37	22.5	6.3
15	380.56	24.2	4.7
16	221.64	19.3	4.5
17	861.12	30.6	4.0
18	100.23	11.7	3.7
19	20.03	10.1	2.1
20	582.42	25.3	2.1
21	331.5	20	1.7
22	624.03	25	1.2
23	417.23	21.3	1.0
24	741.53	26	.7
25	901.66	27.4	.4

RE102, 10 KHZ to 1 GHZ, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT OFF  
ANTENNA POSITION: 45 Deg.  
TEST No. 42, (GASU ON, FREE OFF)



42

=====  
EMC Test Laboratory, GSFC NASA 1 Dec 2004 16:08:46  
=====

2. Radiated Emissions Test Setup  
2.1 RE102, 10 kHz to 1 GHz, Subsys

=====  
31 highest Peaks above 0 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/M)	DELTA
1	139.91 ✓	32.7	21.8
2	160.62 ✓	31	18.9 USE 166.26
3	20.03 ✓	16.9	8.9
4	260.37 ✓	23.4	7.2
5	219.11 ✓	21.3	6.6 USE 221.64
6	180.2 ✓	19	5.9
7	80.56 ✓	12.9	4.9
8	380.56 ✓	22.7	3.2
9	298.9 ✓	20.2	2.8
10	624.03 ✓	26.2	2.4
11	417.23 } NOT USED	21.9	1.6
12	741.53 ✓	26.4	1.1
13	582.42 ✓	24	.8

(dBuV/M)	DELTA
32.7	21.8
31	18.9
16.9	8.9
23.4	7.2
21.3	6.6
19	5.9
12.9	4.9
22.7	3.2
20.2	2.8
26.2	2.4
21.9	1.6
26.4	1.1
24	.8

47

=====  
EMC Test Laboratory, GSFC NASA 2 Dec 2004 10:54:44  
=====

2. Radiated Emissions Test Setup  
2.1 RE102, 10 kHz to 1 GHz, Subsys  
=====

31 highest Peaks above 0 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/M)	DELTA
1	266.42	37.3	20.9
2	199.85	34	20.1
3	221.64	27.1	12.3
4	100.23	20.2	12.2
5	80.56	18.9	10.9
6	180.2	23.9	10.8
7	139.91	21.3	10.4
8	120.48	19.8	10.2
9	176.1	22.7	9.8
10	40.4	16.6	8.6
11	133.62	17	6.5
12	160.62	18.5	6.4
13	380.56	23.8	4.3
14	398.47	23.8	3.9
15	109.89	12.4	3.6
16	457.45	24.5	3.4
17	260.37	19.4	3.2
18	367.65	22.1	2.9
19	422.06	22.9	2.5
20	129.09	11	.8
21	339.21	19.2	.7
22	240.23	16	.5

=====
EMC Test Laboratory, GSFC NASA 2 Dec 2004 13:13:05
=====

2. Radiated Emissions Test Setup
2.1 RE102, 10 kHz to 1 GHz, Subsys

=====
31 highest Peaks above 0 dB of Limit Line #1
peak criteria = 6 dB

Table with 4 columns: PEAK#, FREQ (MHz), (dBuV/M), DELTA. Contains 16 rows of peak data with checkmarks and a handwritten note 'USE 380.6' pointing to peak 6.

2 Dec 2004 13:13:05

51

=====
EMC Test Laboratory, GSFC NASA 2 Dec 2004 13:40:37
=====

2. Radiated Emissions Test Setup
2.1 RE102, 10 kHz to 1 GHz, Subsys

=====
31 highest Peaks above 0 dB of Limit Line #1
peak criteria = 6 dB

Table with 4 columns: PEAK#, FREQ (MHz), (dBUV/M), DELTA. Contains 5 rows of peak data with checkmarks next to the frequency values.

2. Radiated Emissions Test Setup
2.1 RE102, 10 kHz to 1 GHz, Subsys

Faded table with 4 columns: PEAK#, FREQ (MHz), (dBUV/M), DELTA. Contains 5 rows of peak data.

49

=====

EMC Test Laboratory, GSFC NASA 2 Dec 2004 11:50:03

=====

2. Radiated Emissions Test Setup  
2.1 RE102, 10 kHz to 1 GHz, Subsys

=====

31 highest Peaks above 0 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/M)	DELTA
1	266.42✓	38.6	22.2
2	199.85✓	32.9	19.0
3	260.37✓	28.3	12.1
4	221.64✓	25.6	10.8
5	380.56✓	27.3	7.8
6	160.62✓	19.7	7.6
7	133.62✓	13.3	2.8
8	100.23✓	9.6	1.6
9	176.1✓	13.6	.7
10	462.74✓	21.9	.7

2 DEC 2004

limit line #1

44.4

19.0

7.8

7.6

2.8

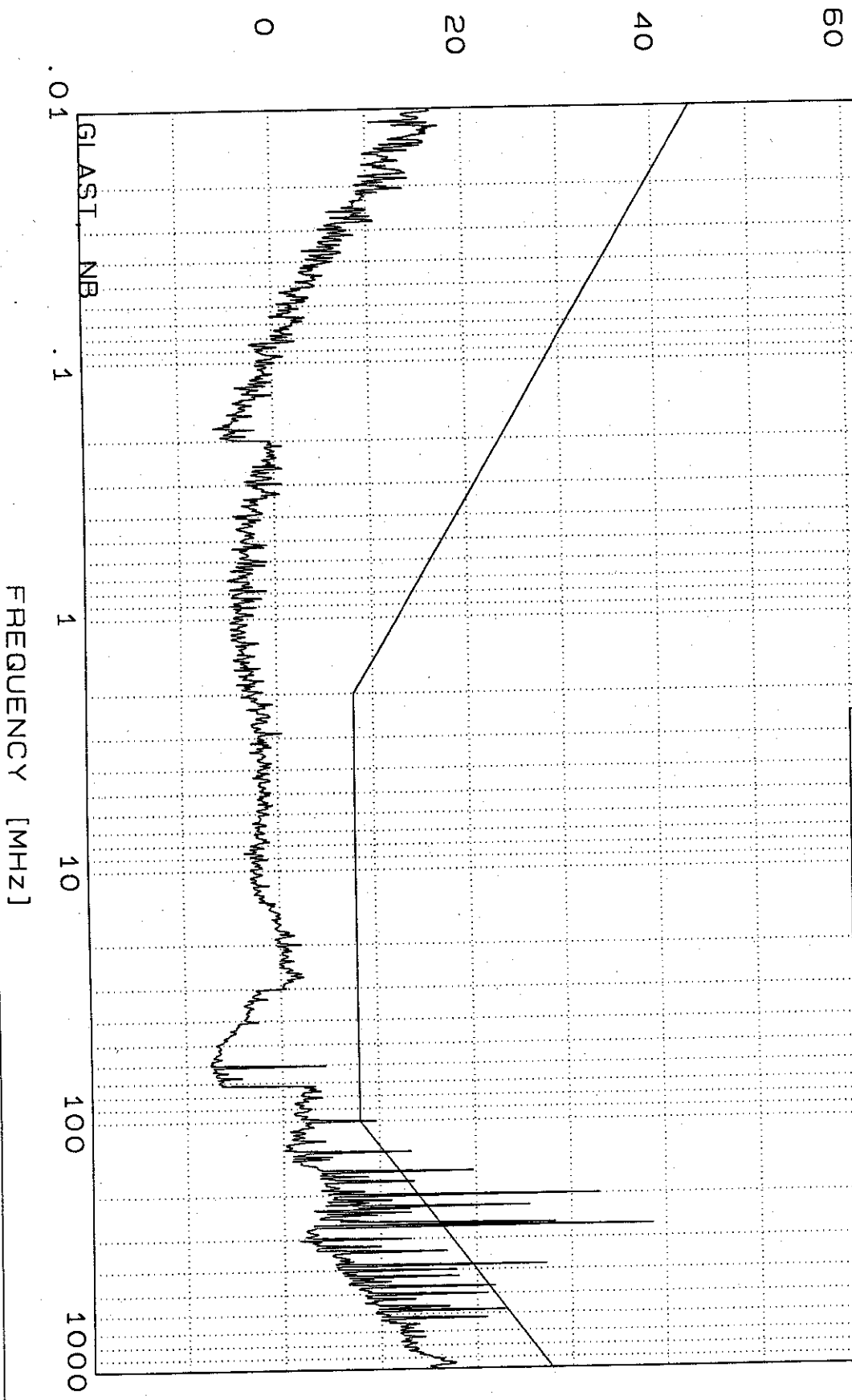
1.6

hp 80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 11:50:03

RE102, 10 KHZ to 1 GHZ, Subsys  
Glast/ ACD, WD No. 5593  
GSE ON / DUT OFF  
ANTENNA POSITION: 1M, HORZ.  
TEST NO. 49



GLAST NB

FREQUENCY [MHz]

hp

80

EMC Test Laboratory: GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 13:13:05

RE102. 10 KHZ to 1 GHZ. Subsys  
Glast/ ACCD, WD No. 5593  
GSE ON / DUT ON, NOISY MODE  
ANTENNA POSITION: 1M, HORZ.  
TEST No. 50

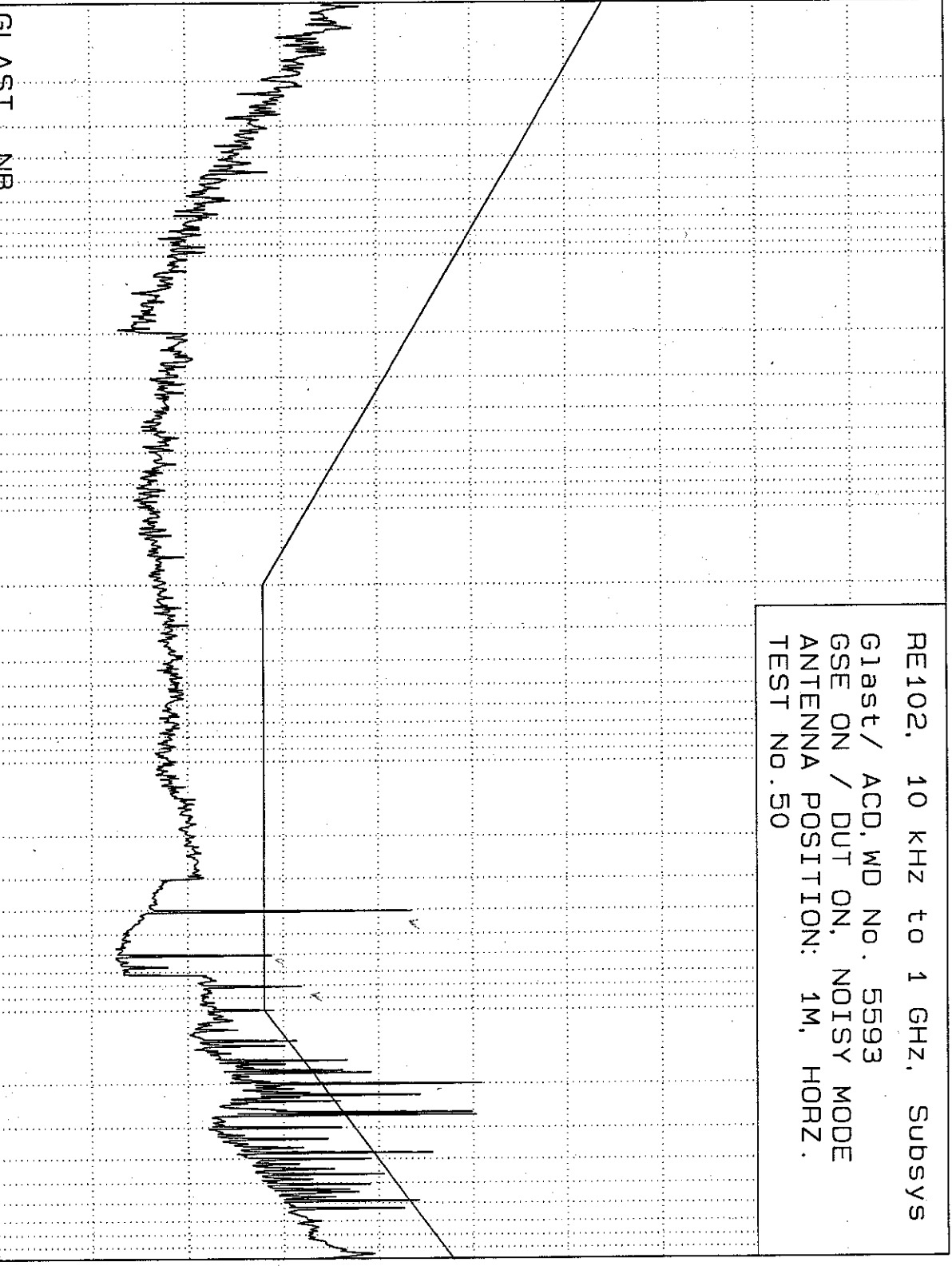
60

40

20

0

.01 .1 1 10 100 1000  
GLAST, NB  
FREQUENCY [MHZ]



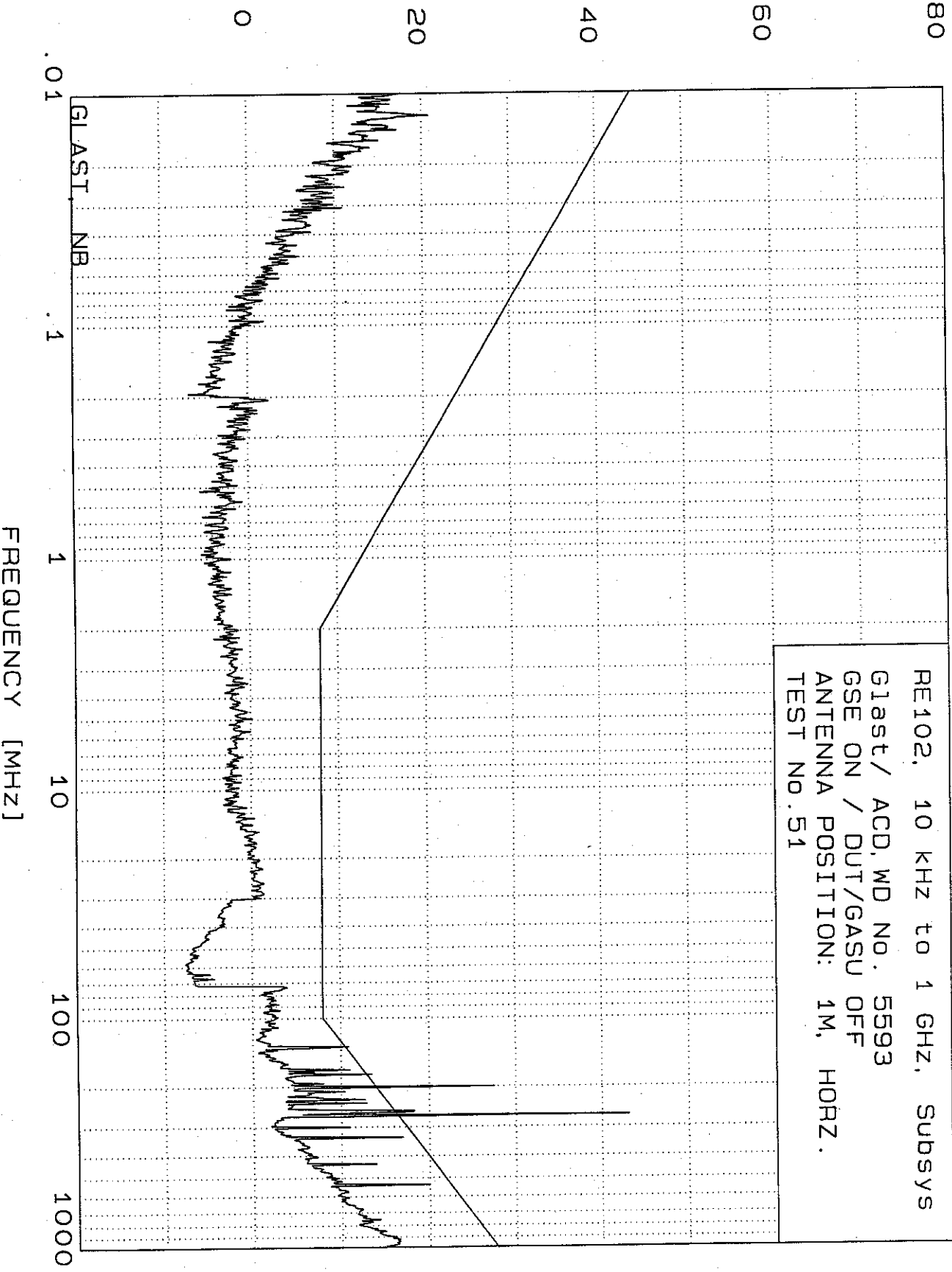
hp

80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/m] PEAK

2 Dec 2004 13:40:37

RE102. 10 KHZ to 1 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT/GASU OFF  
ANTENNA POSITION: 1M, HORIZ.  
TEST No. 51



FREQUENCY [MHz]

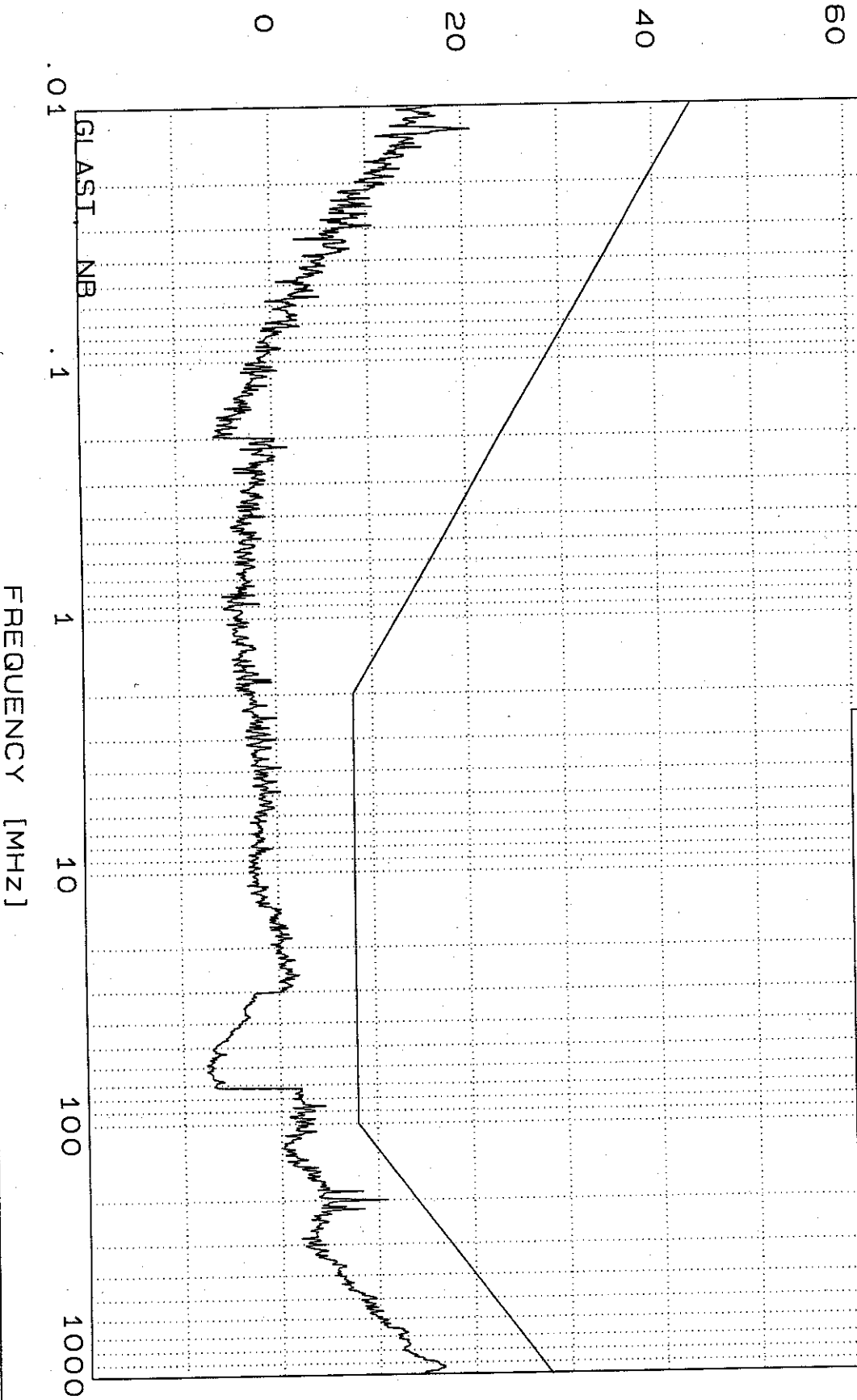
hp

80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 14:03:44

RE102, 10 KHZ to 1 GHZ, Subsys  
Glast/ ACD, WD No. 5593  
DUT/GASU/VME CRATE OFF  
ANTENNA POSITION: 1M, HORIZ.  
TEST NO.52

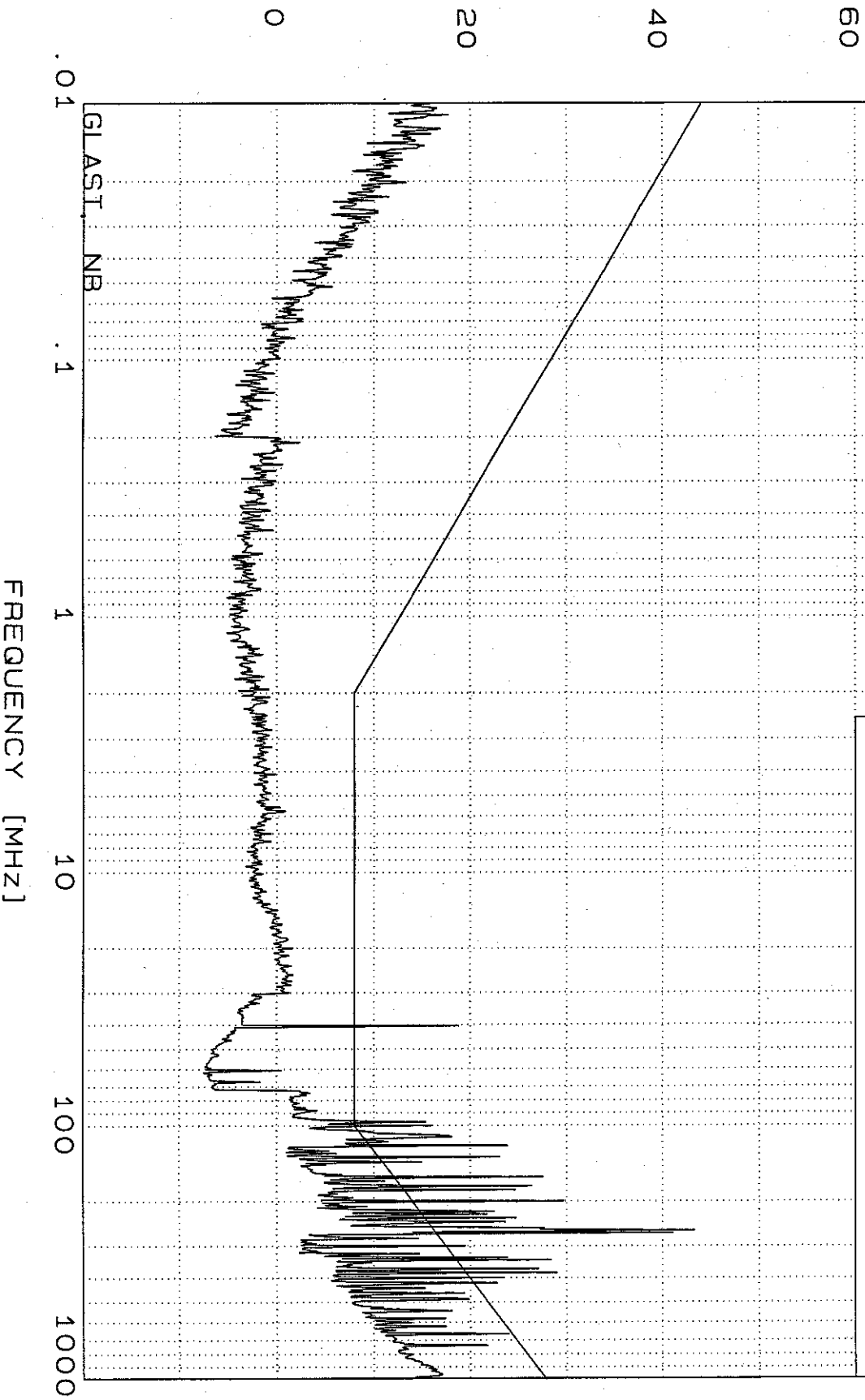




EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 10:13:08

RE102, 10 KHZ to 1 GHZ, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT ON, NOISY MODE  
ANTENNA POSITION: 1M, VERT.  
TEST NO. 46



46

EMC Test Laboratory, GSFC NASA 2 Dec 2004 10:13:08

2. Radiated Emissions Test Setup  
2.1 RE102, 10 kHz to 1 GHz, Subsys

31 highest Peaks above 0 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/M)	DELTA
1	260.37 ✓	43.3	27.1
2	266.42 ✓	41.1	24.7
3	199.85 ✓	29.7	15.8 USE 199.65
4	160.62 ✓	27.6	15.5
5	120.48 ✓	23.9	14.3
6	174.08 ✓	26.4	13.6 USE 176.80
7	133.62 ✓	23.1	12.6
8	180.2 ✓	24.7	11.6
9	40.4 ✓	18.8	10.8
10	339.21 ✓	28.4	9.9
11	232.08	24.8	9.6
12	380.56	29	9.5
13	111.16	18.1	9.2
14	240.23	23.7	8.2
15	100.23	16.1	8.1
16	367.65	27.1	7.9
17	219.11	22.5	7.8
18	96.83	15.4	7.4
19	224.21	21.8	6.9
20	331.5	23.9	5.6
21	139.91	15	4.1
22	398.47	23.5	3.6
23	417.23	22.8	2.5
24	298.9	19.5	2.1

14.3  
13.6  
15.5  
14.3  
12.6  
11.6  
10.8  
9.9  
9.6  
9.5  
9.2  
8.2  
8.1  
7.9  
7.8  
7.4  
6.9  
6.9  
5.6  
5.6  
4.1  
3.6  
2.5  
2.5  
2.1  
2.1

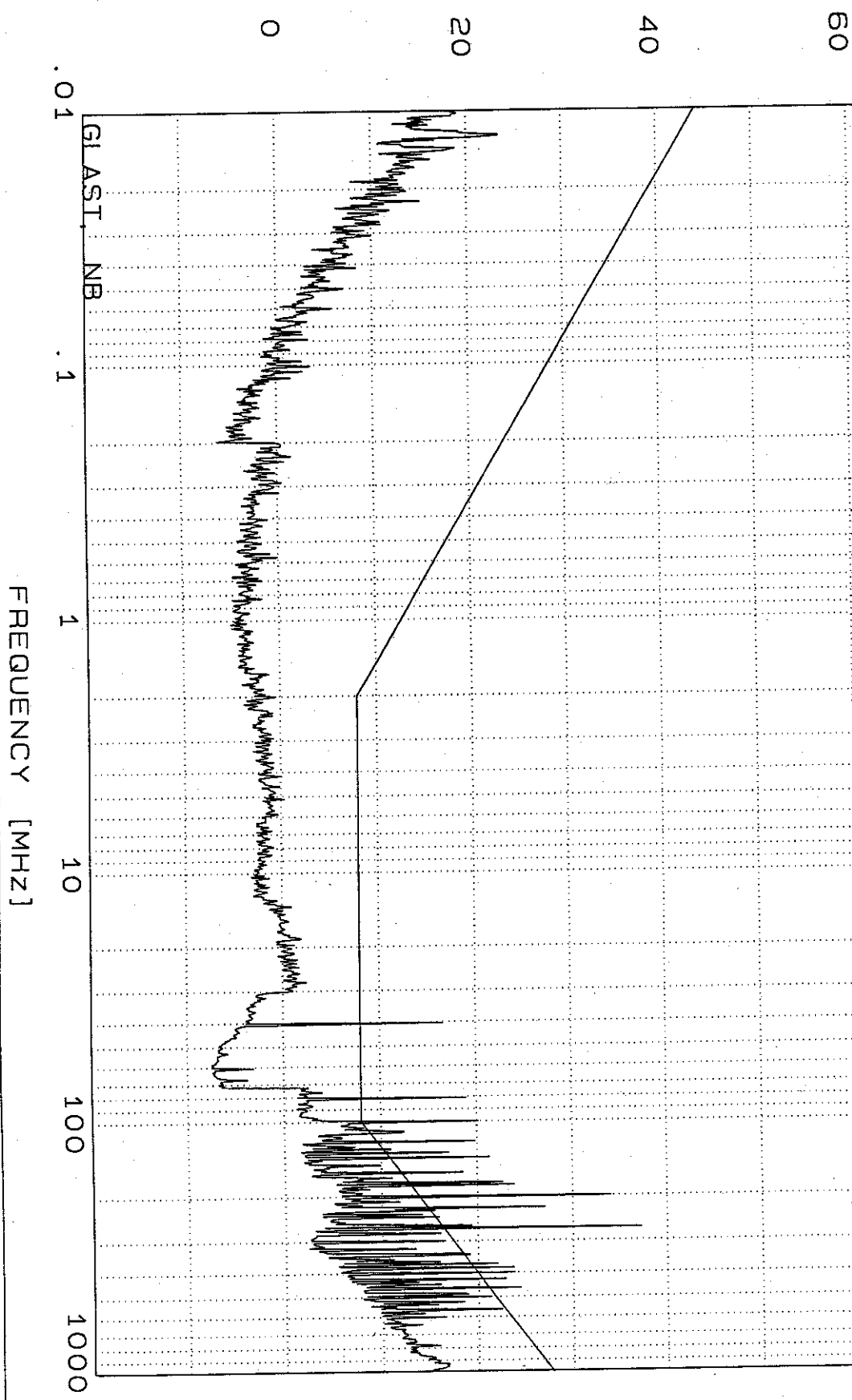
hp

80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 10:54:44

RE102, 10 KHZ to 1 GHZ, Subsys  
Glast/ ACD, WD No. 5593  
GSE ON / DUT ON, NOISY MODE  
ANTENNA POSITION: 1M, VERT.  
TEST NO. 47, REPEAT OF TEST 46



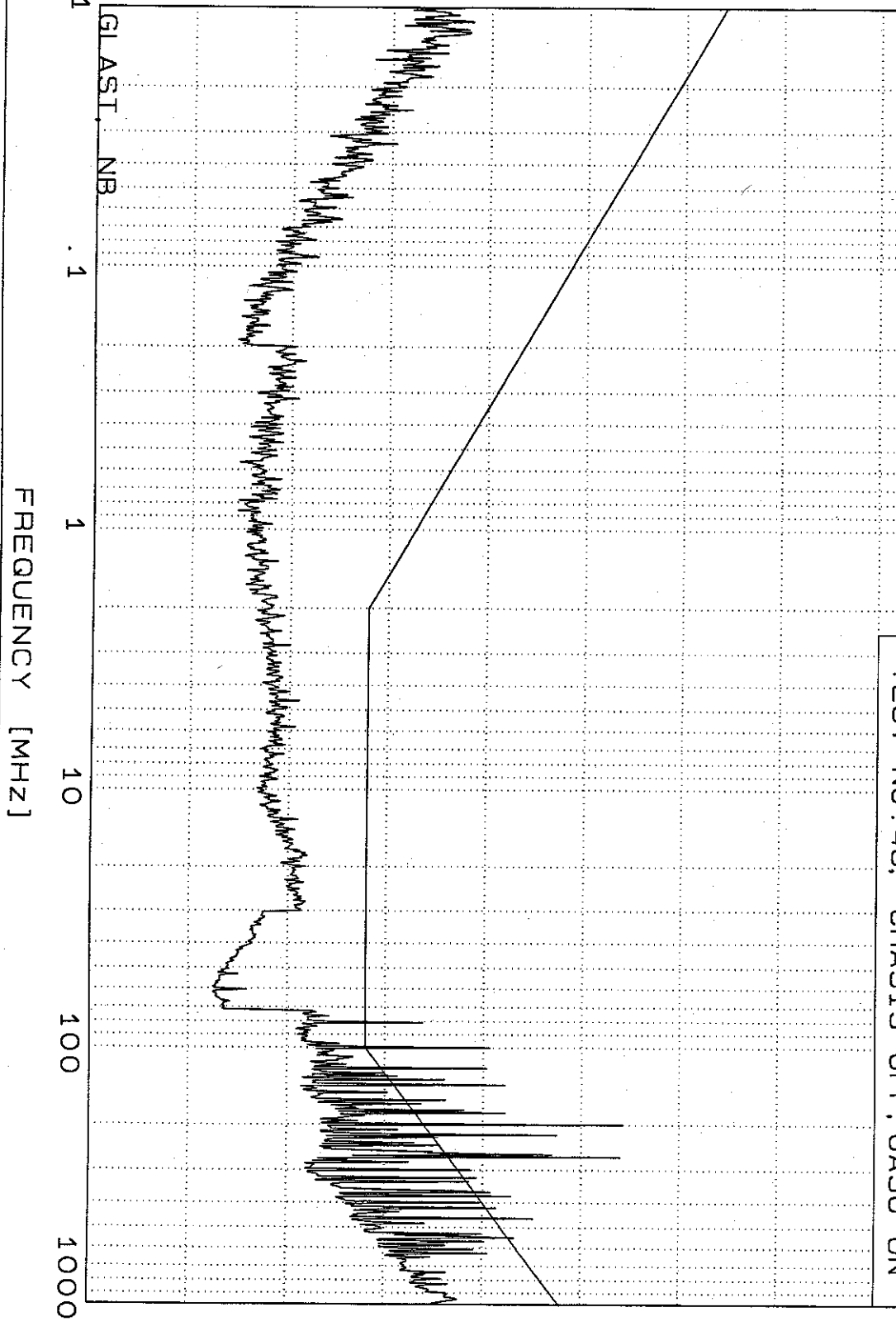
FREQUENCY [MHZ]



EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 11:18:35

RE102, 10 KHZ to 1 GHZ, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT OFF  
ANTENNA POSITION: 1M, VERT.  
TEST No. 48, CHASIS OFF, GASU ON



2. Radiated Emissions Test Setup  
2.1 RE102, 10 kHz to 1 GHz, Subsys

31 highest Peaks above 0 dB of Limit Line #1  
peak criteria = 6 dB

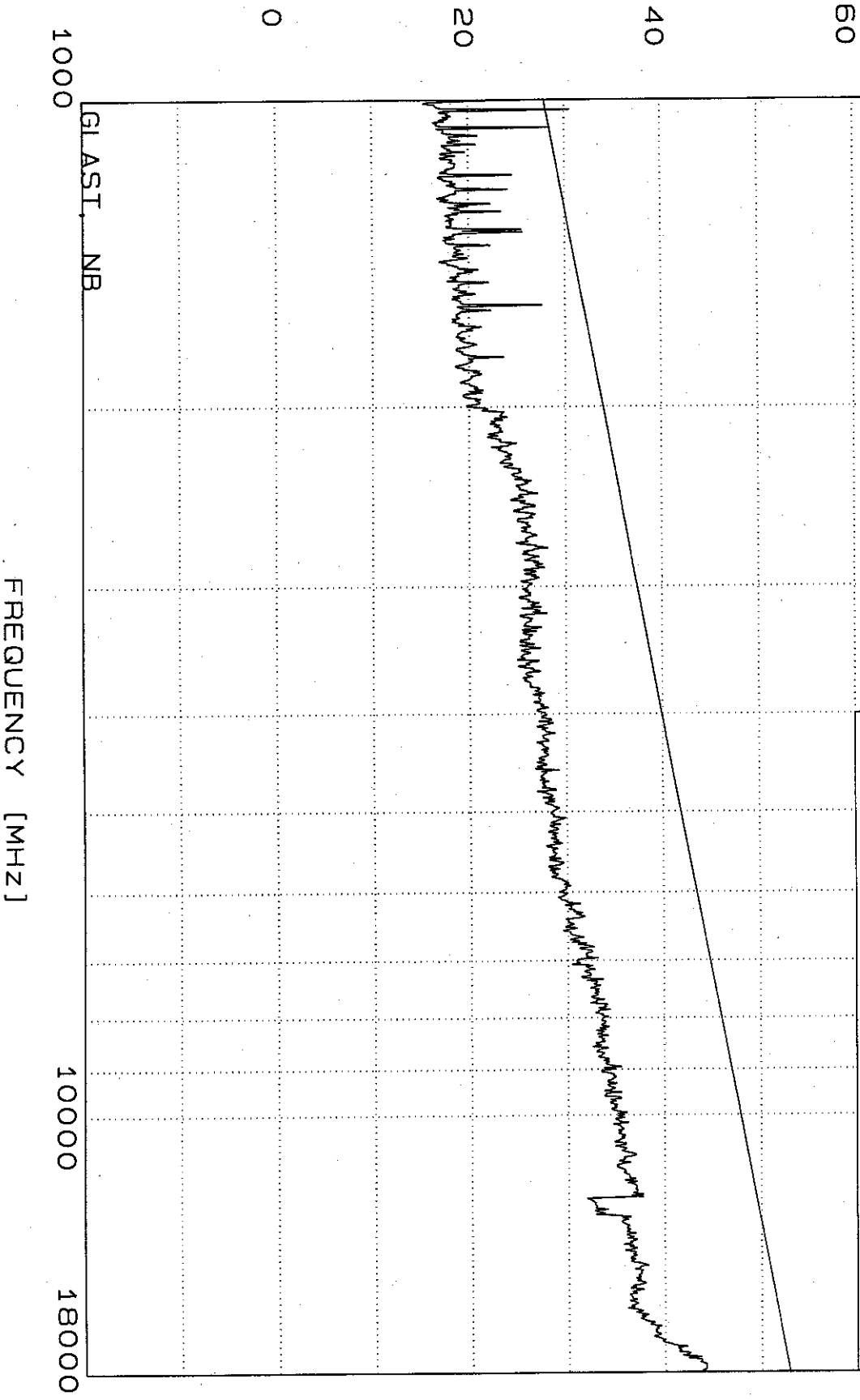
PEAK#	FREQ (MHz)	(dBuV/M)	DELTA
1	199.85	34.3	20.4
2	266.42	34	17.6
3	219.11	27.5	12.8
4	100.23	20.7	12.7
5	139.91	22.3	11.4
6	120.48	20.4	10.8
7	260.37	27	10.8
8	180.2	22.3	9.2
9	80.56	13.9	5.9
10	133.62	16.1	5.6
11	176.1	18.1	5.2
12	160.62	16.2	4.1
13	457.45	25.2	4.1
14	376.21	22.9	3.5
15	363.45	20.8	1.7
16	298.9	18.9	1.5
17	166.26	13.8	1.4
18	320.25	19.4	1.4
19	129.09	11.3	1.1
20	417.23	21.4	1.1
21	543.58	23.3	.7
22	224.21	15.5	.6
23	331.5	18.6	.3
24	240.23	15.7	.2

hp 80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 14:56:09

RE102. 1 GHz to 18 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT ON  
ANTENNA POSITION: 1M, HORIZ.  
TEST No. 53



GLAST, NB

FREQUENCY [MHZ]

hp

80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 15:12:17

RE102, 1 GHz to 18 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT ON  
ANTENNA POSITION: 1M, VERTICAL  
TEST No. 54

60

40

20

0

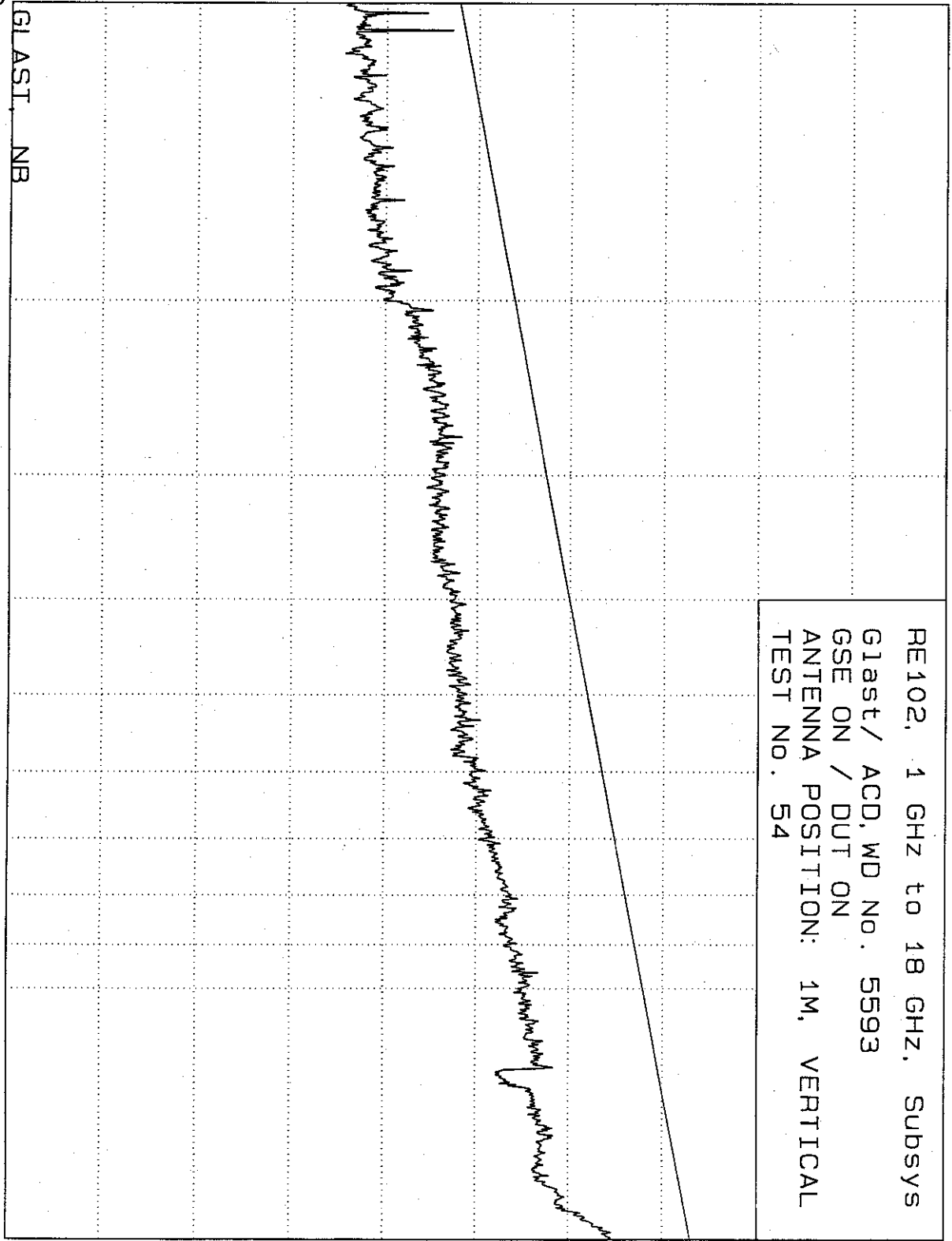
1000

10000

18000

GLAST NB

FREQUENCY [MHZ]



hp

80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 15: 31: 13

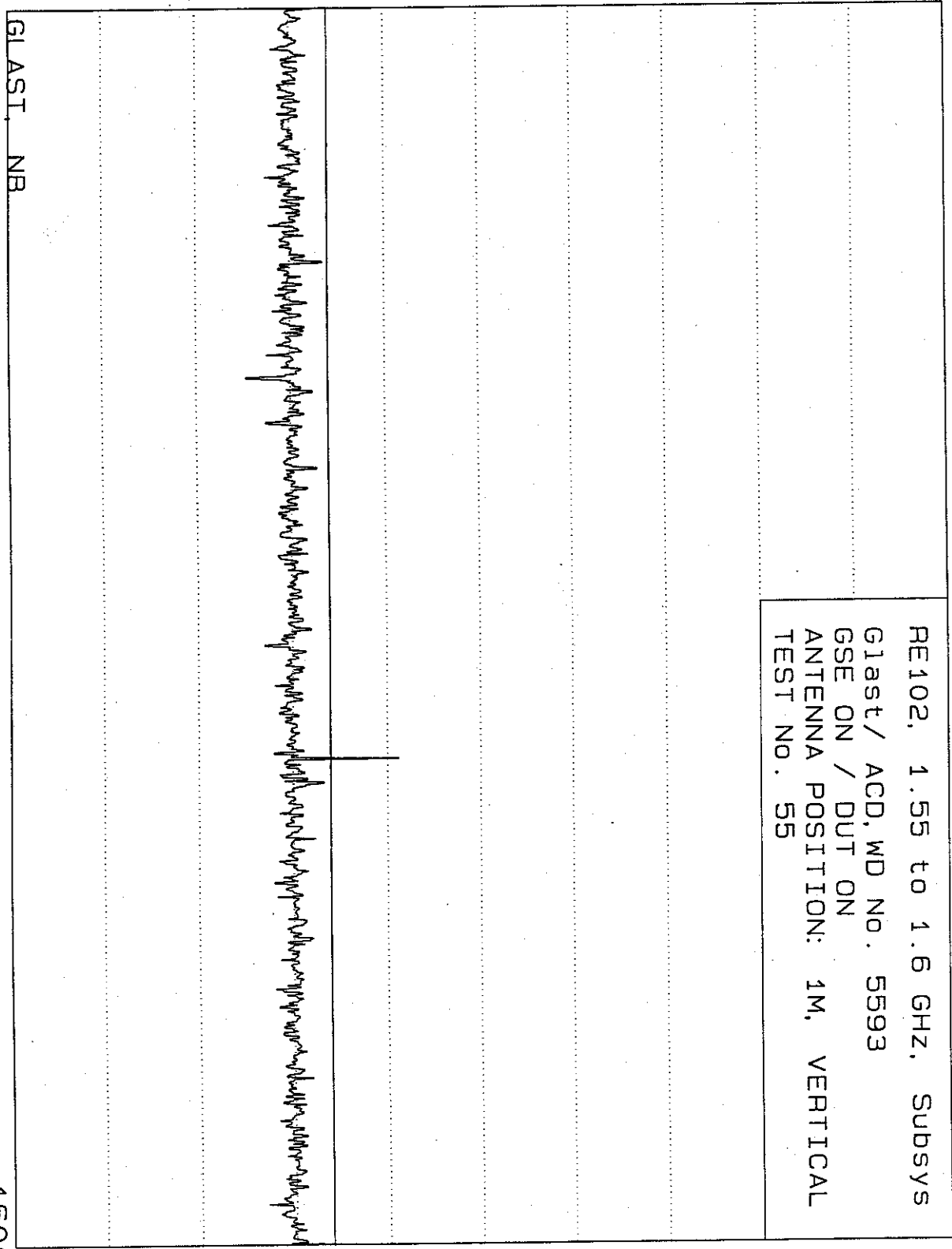
RE102, 1.55 to 1.6 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT ON  
ANTENNA POSITION: 1M, VERTICAL  
TEST No. 55

60

40

20

0



Glast, NB

1550

1600

FREQUENCY [MHZ]

=====
EMC Test Laboratory, GSFC NASA 2 Dec 2004 15:31:13
=====

2. Radiated Emissions Test Setup
2.4 RE102, 1.55 to 1.6 GHz, Subsys

=====
31 highest Peaks above 0 dB of Limit Line #1
peak criteria = 6 dB

Table with 4 columns: PEAK#, FREQ (MHz), (dBuV/M), DELTA. Row 1: 1, 1580, 21.2, 7.2

2 Dec 2004 15:31:13

Subsys

(dBuV/M) DELTA
21.2 7.2



80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 15:35:29

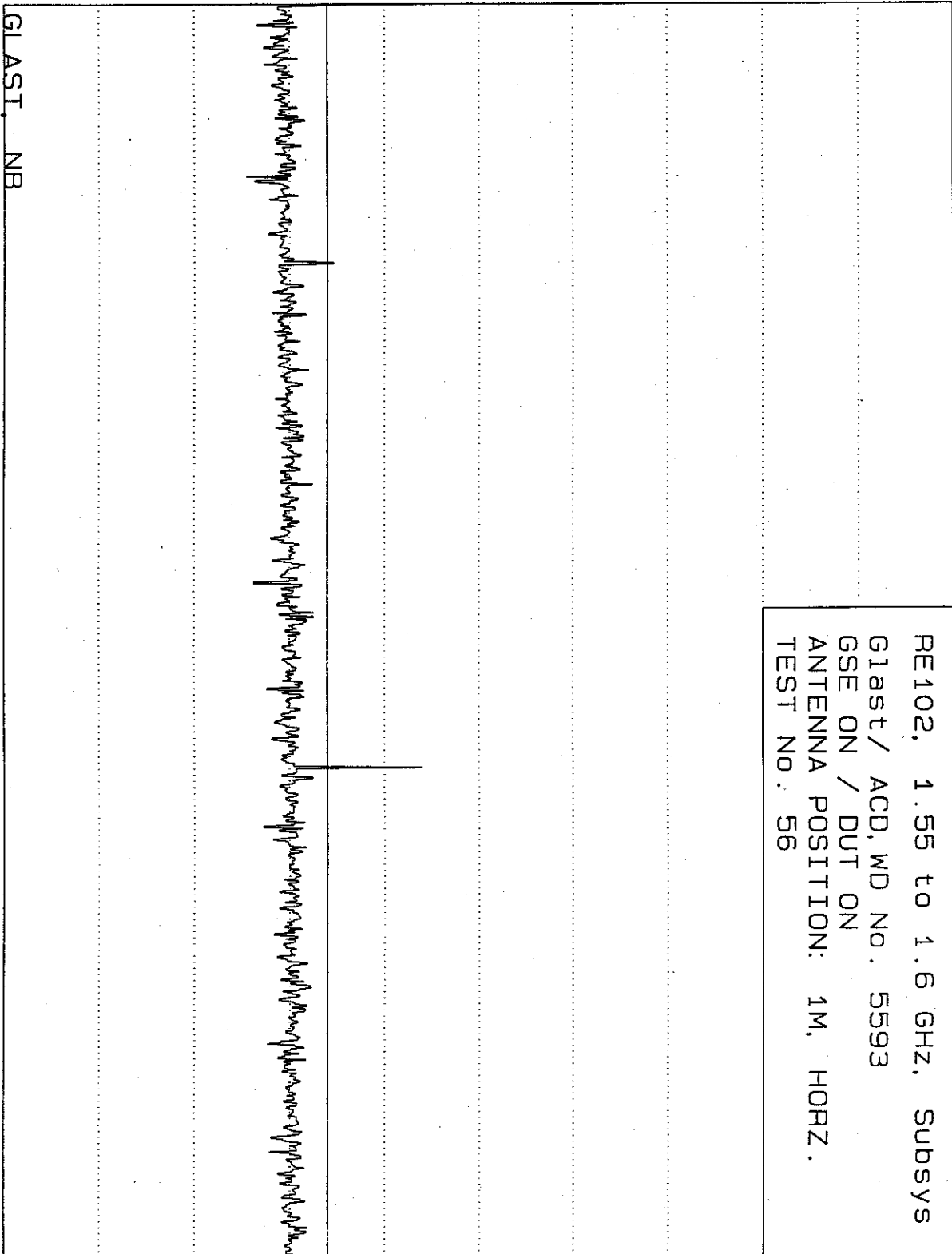
RE102, 1.55 to 1.6 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT ON  
ANTENNA POSITION: 1M, HORIZ.  
TEST No. 56

60

40

20

0



GLAST, NB

1550

1600

FREQUENCY [MHz]

=====

EMC Test Laboratory, GSFC NASA      2 Dec 2004 15:35:29

=====

2. Radiated Emissions Test Setup  
2.4 RE102, 1.55 to 1.6 GHz, Subsys

=====

31 highest Peaks above 0 dB of Limit Line #1  
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV/M)	DELTA
1	1580	24	10.0
2	1560.1	14.6	.6

=====

EMC Test Laboratory, GSFC NASA      2 Dec 2004 15:35:29

=====

24	10.0
14.6	.6

hp

80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 15:39:22

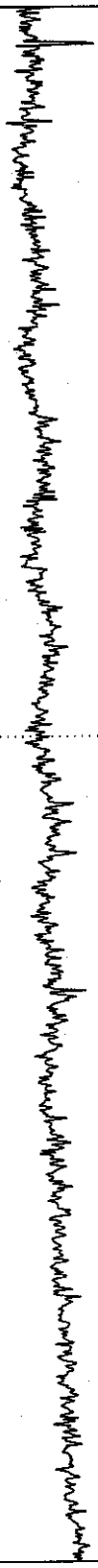
RE102, 1.77 to 2.3 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT ON  
ANTENNA POSITION: 1M, HORZ.  
TEST No. 57

60

40

20

0



GLAST\_NB

1770

2300

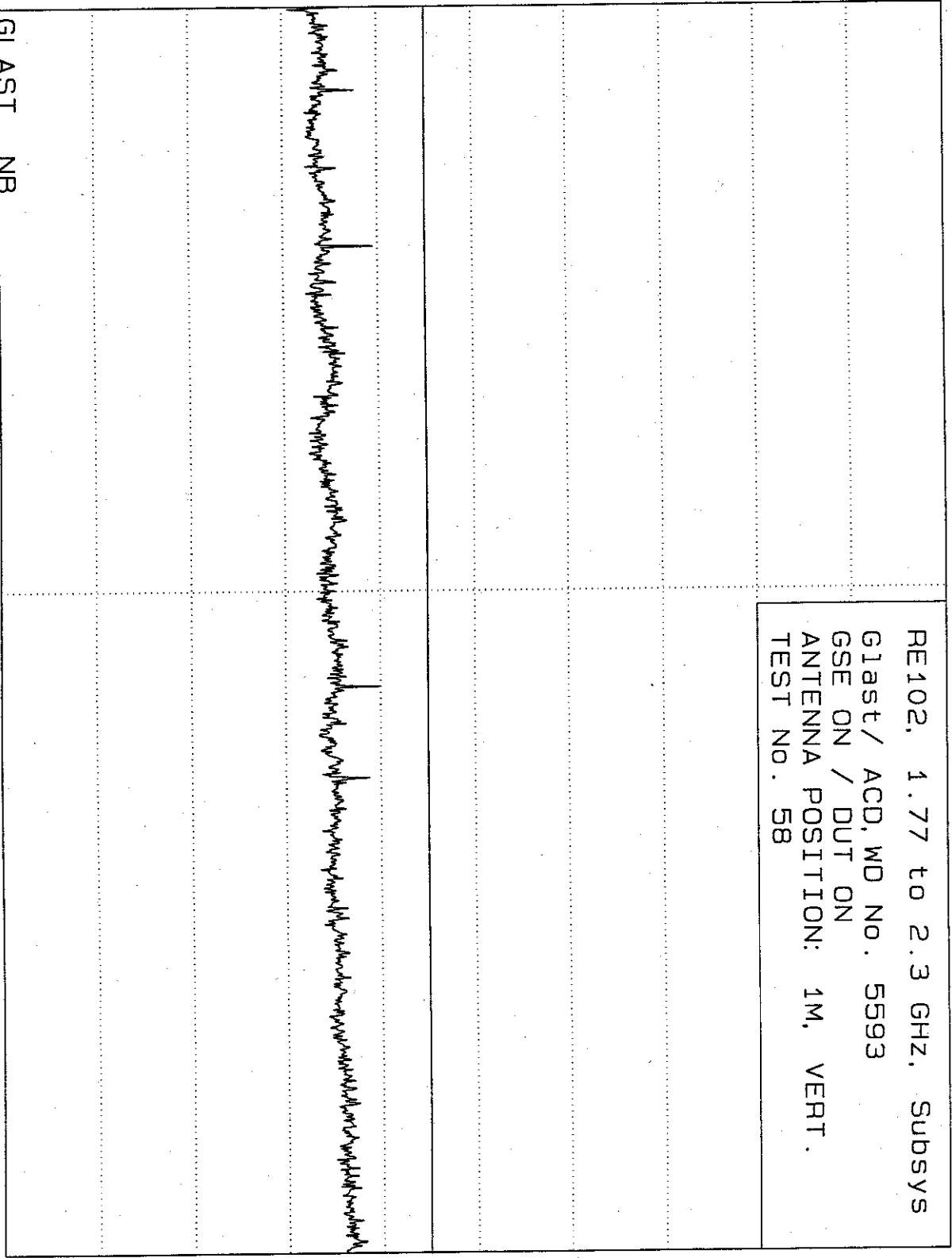
FREQUENCY [MHZ]

hp 80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBV/M] PEAK

2 Dec 2004 15:46:16

RE102, 1.77 to 2.3 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT ON  
ANTENNA POSITION: 1M, VERT.  
TEST No. 58



GLAST, NB

1770

2300

FREQUENCY [MHZ]

hp 80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBUV/M] PEAK

2 Dec 2004 15:56:07

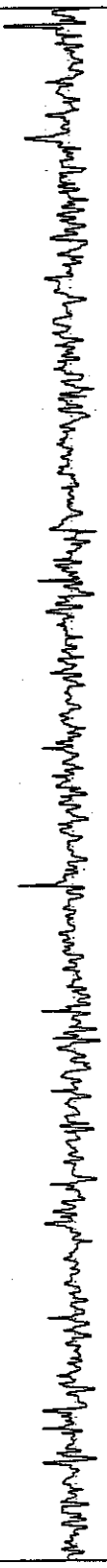
RE102, 1.55 to 1.6 GHz. Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT/GASU OFF  
ANTENNA POSITION: 1M, VERTICAL  
TEST NO. 59

60

40

20

0



Glast, NB

1550

1600

FREQUENCY [MHZ]

hp

80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL (dBuV/M) PEAK

2 Dec 2004 15:59:39

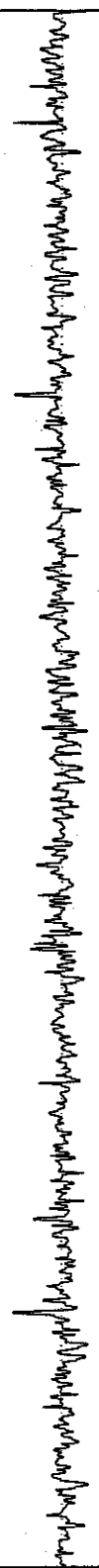
RE102, 1.55 to 1.6 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT/GASU OFF  
ANTENNA POSITION: 1M, HORIZ.  
TEST No. 60

60

40

20

0



GLAST, NB

1550

1600

FREQUENCY [MHZ]

hp

80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 16:05:52

RE102, 1 GHz to 18 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT/GASU OFF  
ANTENNA POSITION: 1M, HORIZ.  
TEST No. 61

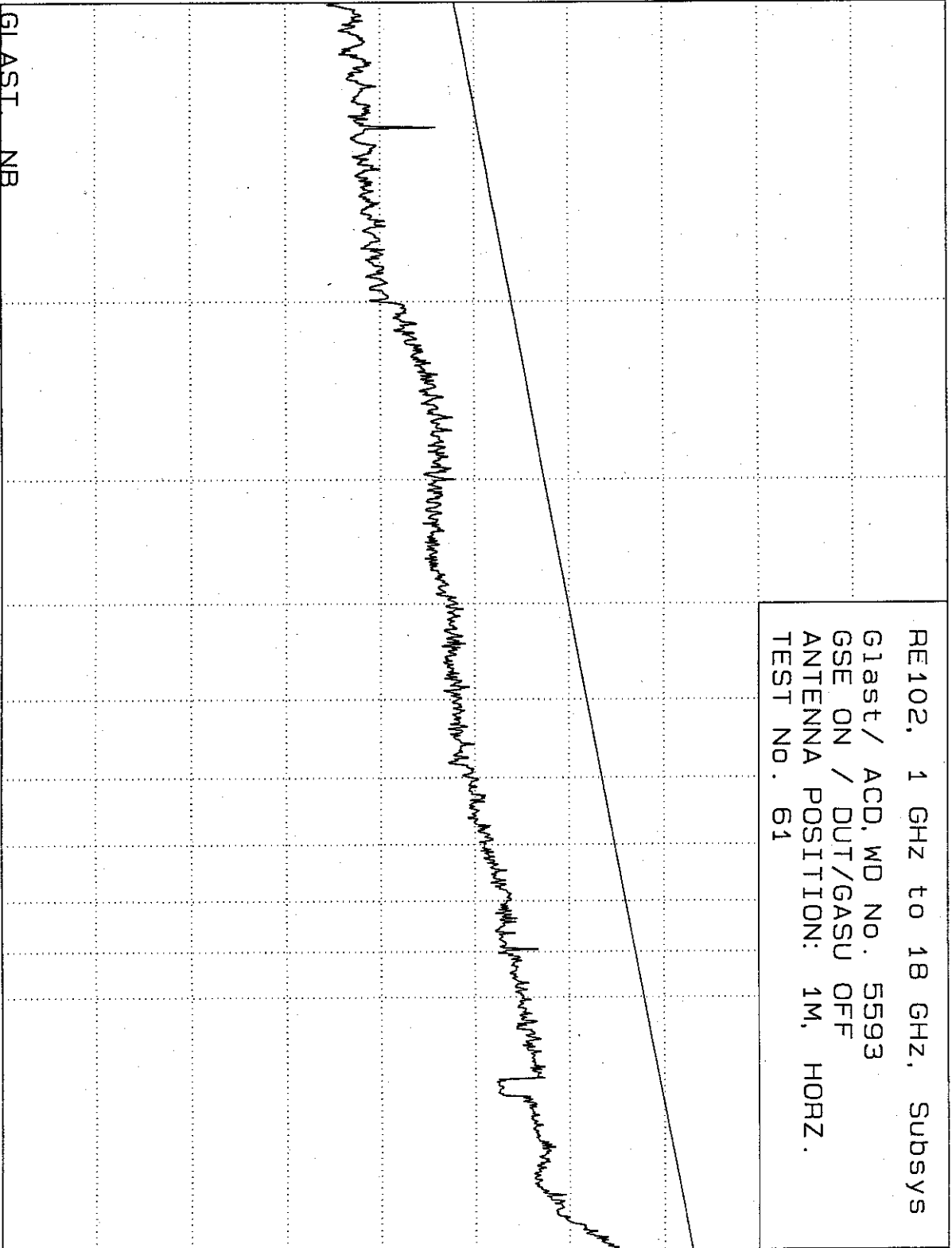
60

40

20

0

1000



Glast NB

FREQUENCY [MHZ]

10000

18000



80

EMC Test Laboratory, GSFC NASA  
EMISSION LEVEL [dBuV/M] PEAK

2 Dec 2004 16:22:23

RE102, 1 GHz to 18 GHz, Subsys  
Glast / ACD, WD No. 5593  
GSE ON / DUT/GASU OFF  
ANTENNA POSITION: 1M, VERT.  
TEST No. 62

60

40

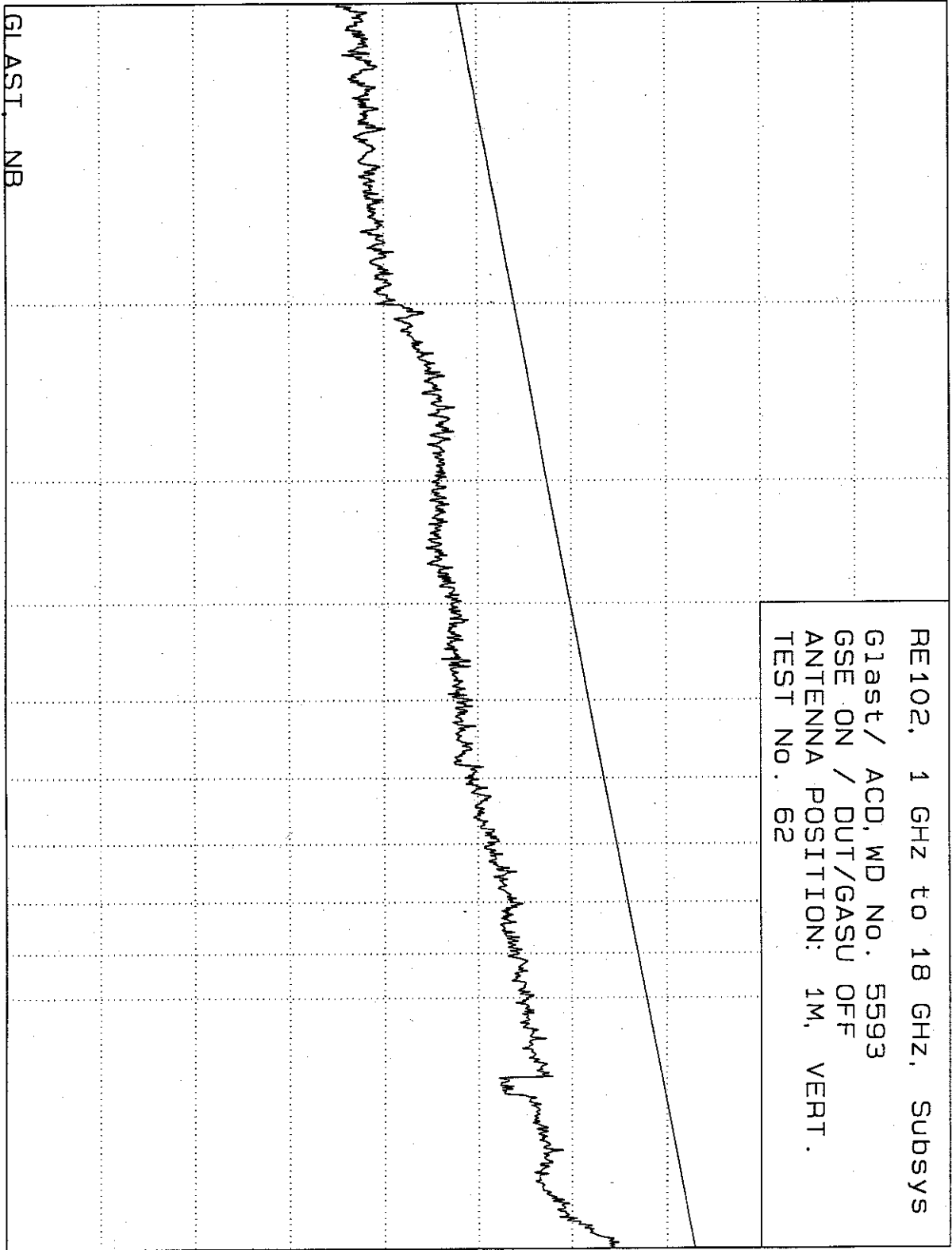
20

0

1000

10000

18000



GLAST, NB

FREQUENCY [MHZ]



140

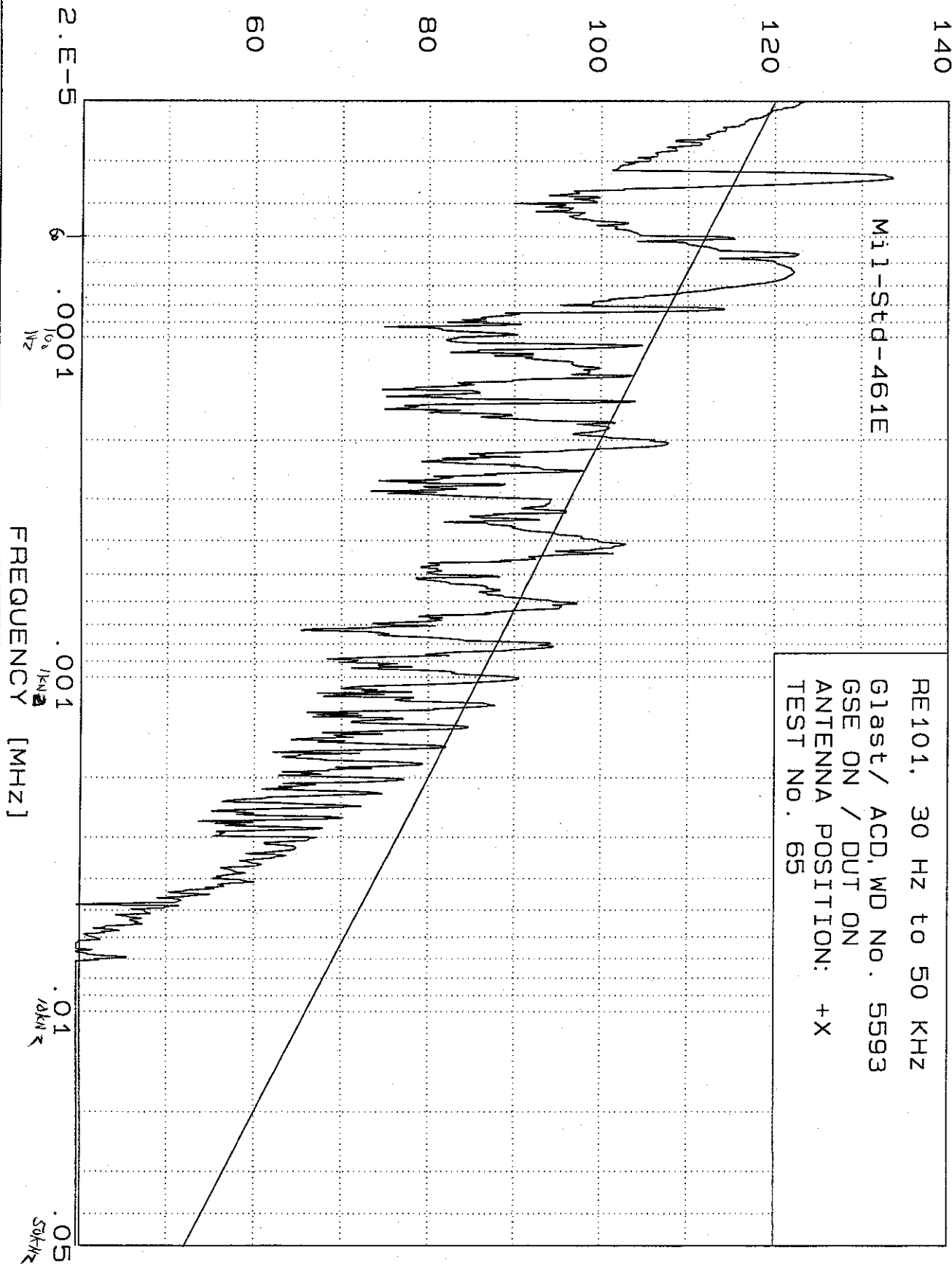
EMC Test Laboratory;  
EMISSION LEVEL [dBPT]

GSFC NASA  
PEAK

3 Dec 2004 10:33:08

RE101, 30 Hz to 50 KHz  
G1ast/ ACD, WD No. 5593  
GSE ON / DUT ON  
ANTENNA POSITION: +X  
TEST No. 65

M11-Std-461E



10<sup>6</sup> Hz

10<sup>3</sup> Hz

10<sup>4</sup> Hz

50 kHz



140

EMC Test Laboratory,  
EMISSION LEVEL [dBPT]

GSFC NASA  
PEAK

3 Dec 2004 10:41:41

M11-Std-461E

RE101, 30 Hz to 50 KHz  
G1ast / ACD, WD No. 5593  
GSE ON / DUT ON  
ANTENNA POSITION: +X CONNECTOR  
TEST No. 66

120

100

80

60

2.E-5

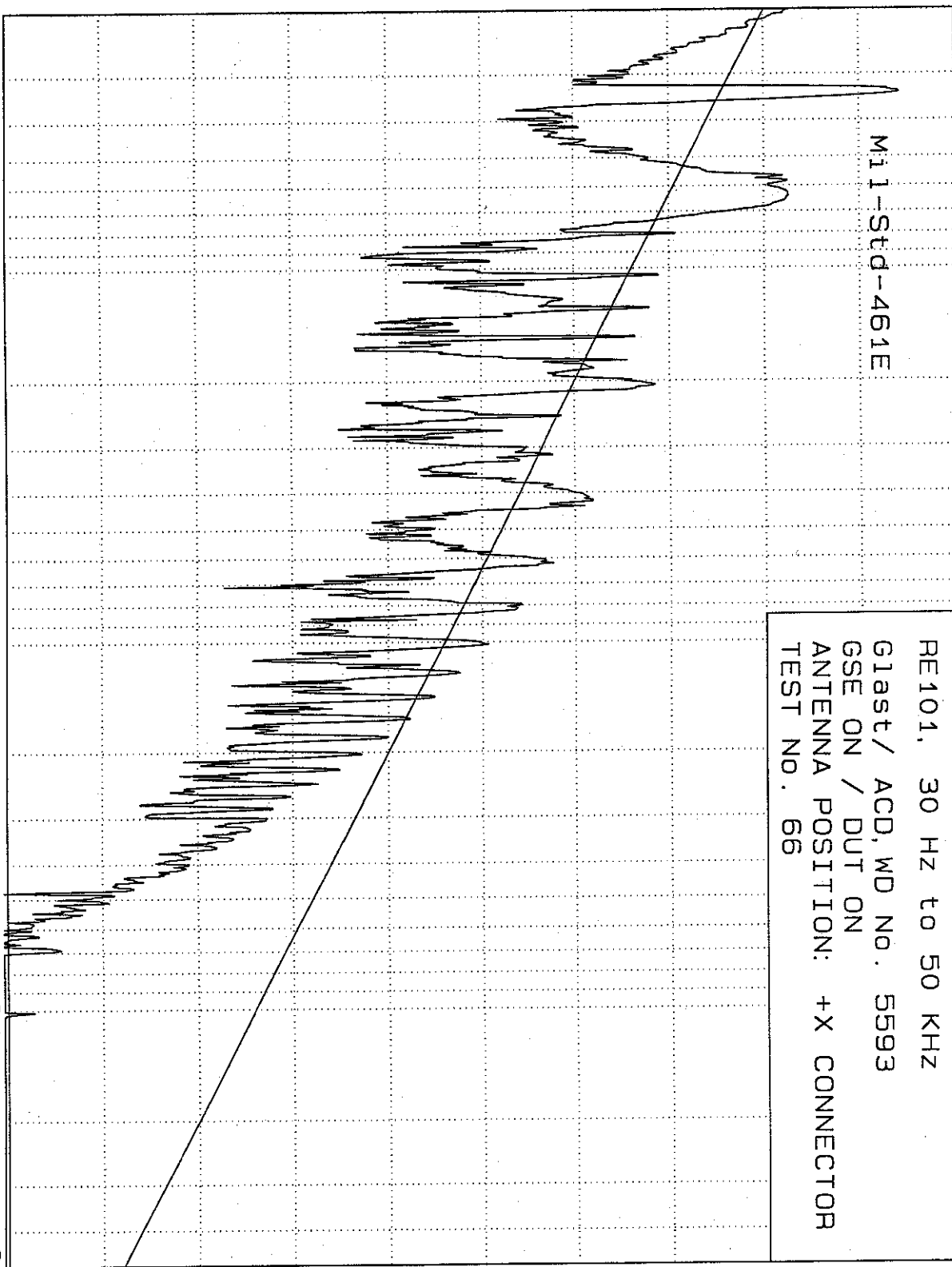
.0001

.001

.01

.05

FREQUENCY [MHZ]





140

EMC Test Laboratory;  
EMISSION LEVEL [dBPT]

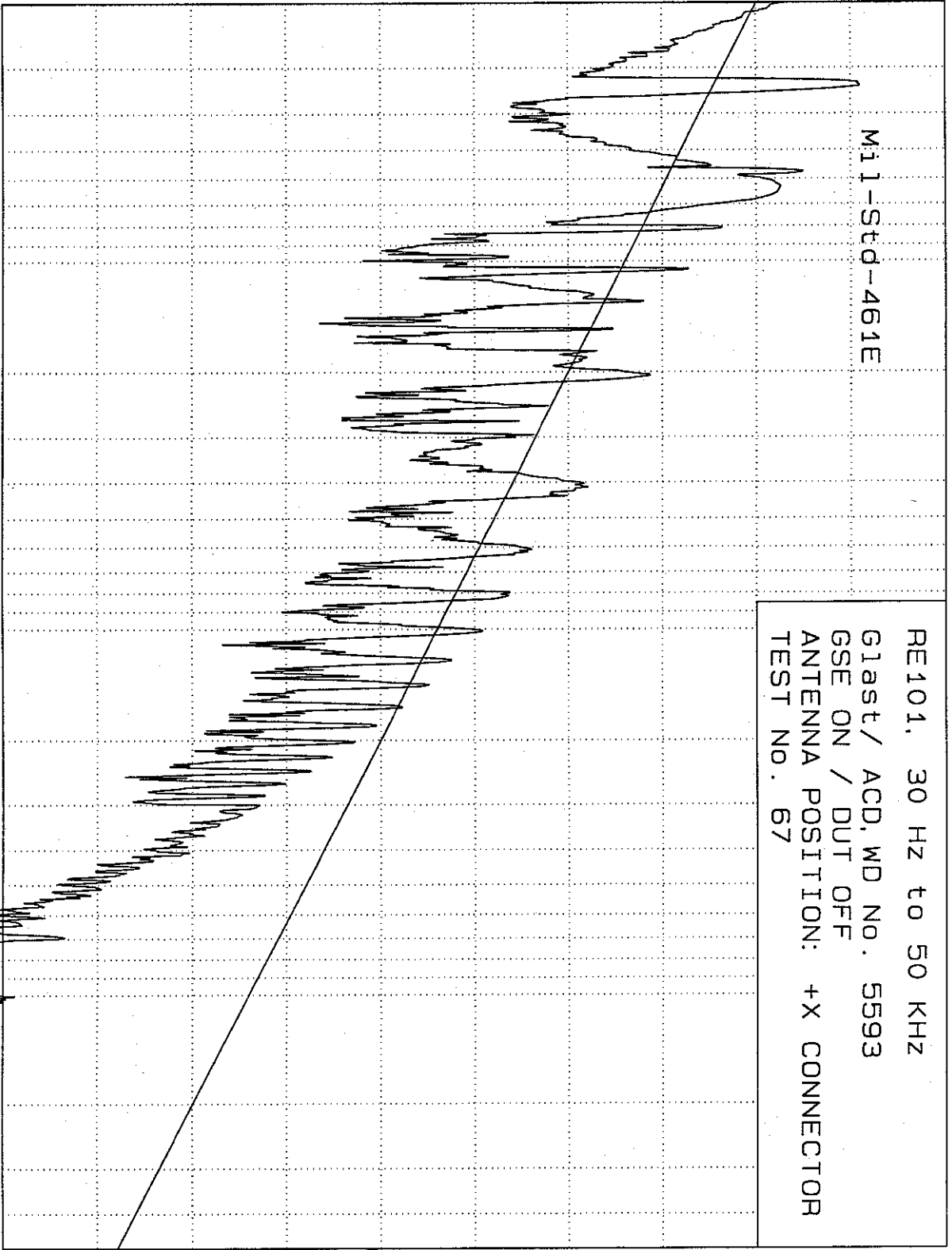
GSFC NASA  
PEAK

3 Dec 2004 10:46:10

Mi1-Std-461E

RE101, 30 Hz to 50 KHz  
G1ast/ ACD, WD No. 5593  
GSE ON / DUT OFF  
ANTENNA POSITION: +X CONNECTOR  
TEST No. 67

120  
100  
80  
60  
2.E-5



FREQUENCY [MHZ]



140

EMC Test Laboratory,  
EMISSION LEVEL [dBPT]

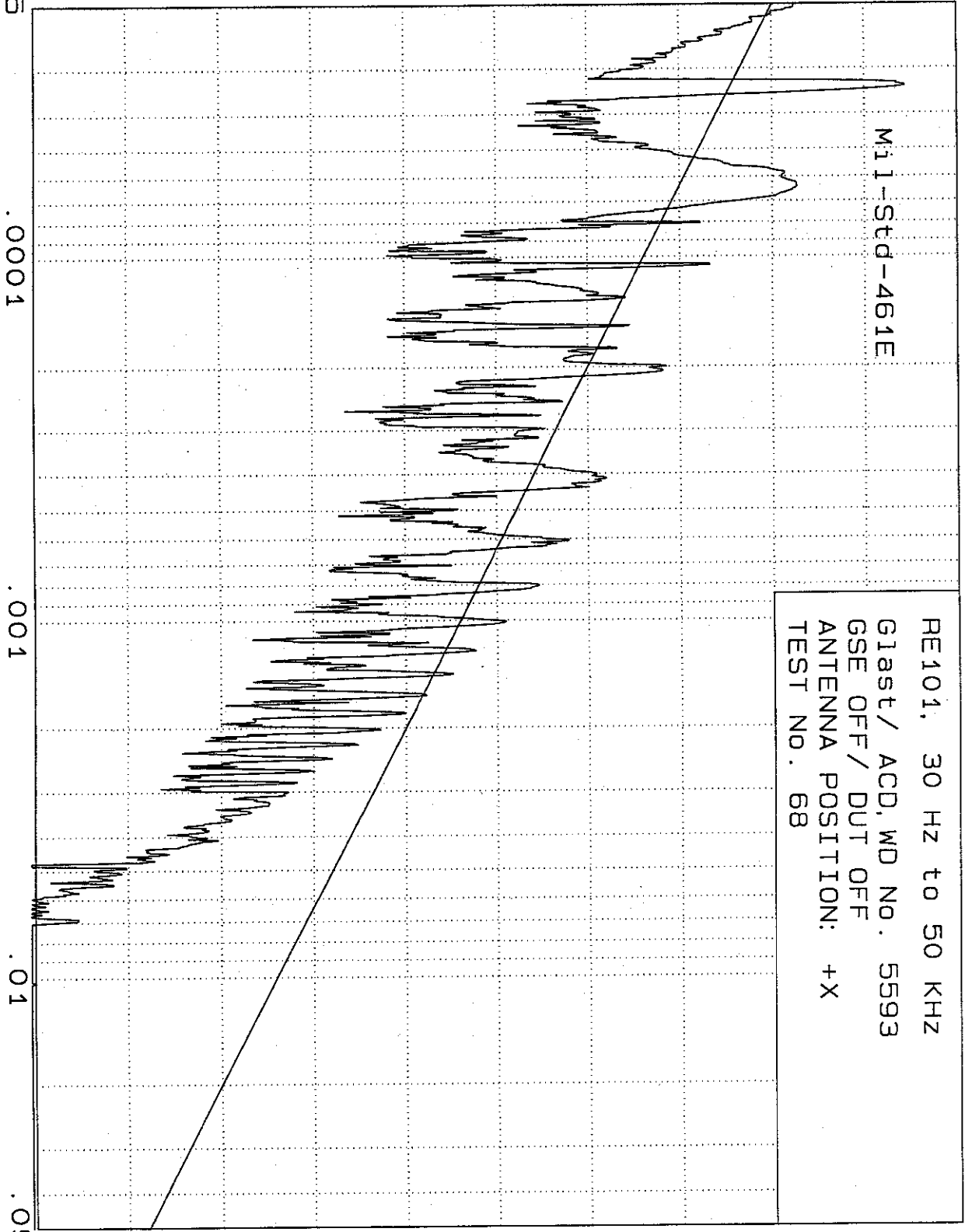
GSFC NASA  
PEAK

3 Dec 2004 10:50:35

M11-Std-461E

RE101, 30 Hz to 50 KHz  
G1ast/ ACD, WD No. 5593  
GSE OFF/ DUT OFF  
ANTENNA POSITION: +X  
TEST No. 68

120  
100  
80  
60  
2.E-5

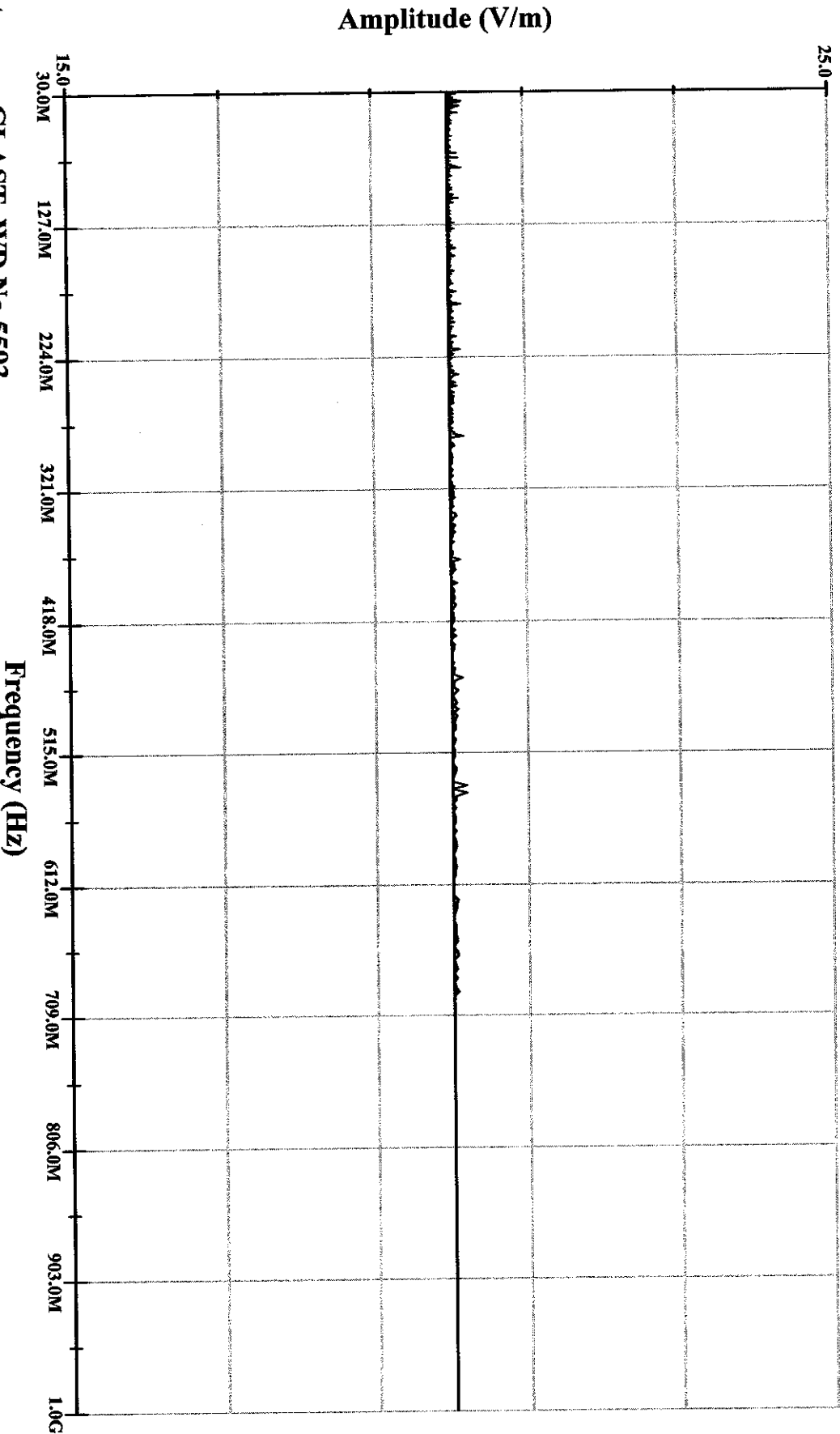


FREQUENCY [MHZ]

EMC Test Laboratory, GSFC NASA

Mil-Std-461E RS103

Vertical Field Level 30 MHz to 1 GHz



Customer - GLAST, WD No.5593

DUT - ACD

Run # - 70

Print # - 1

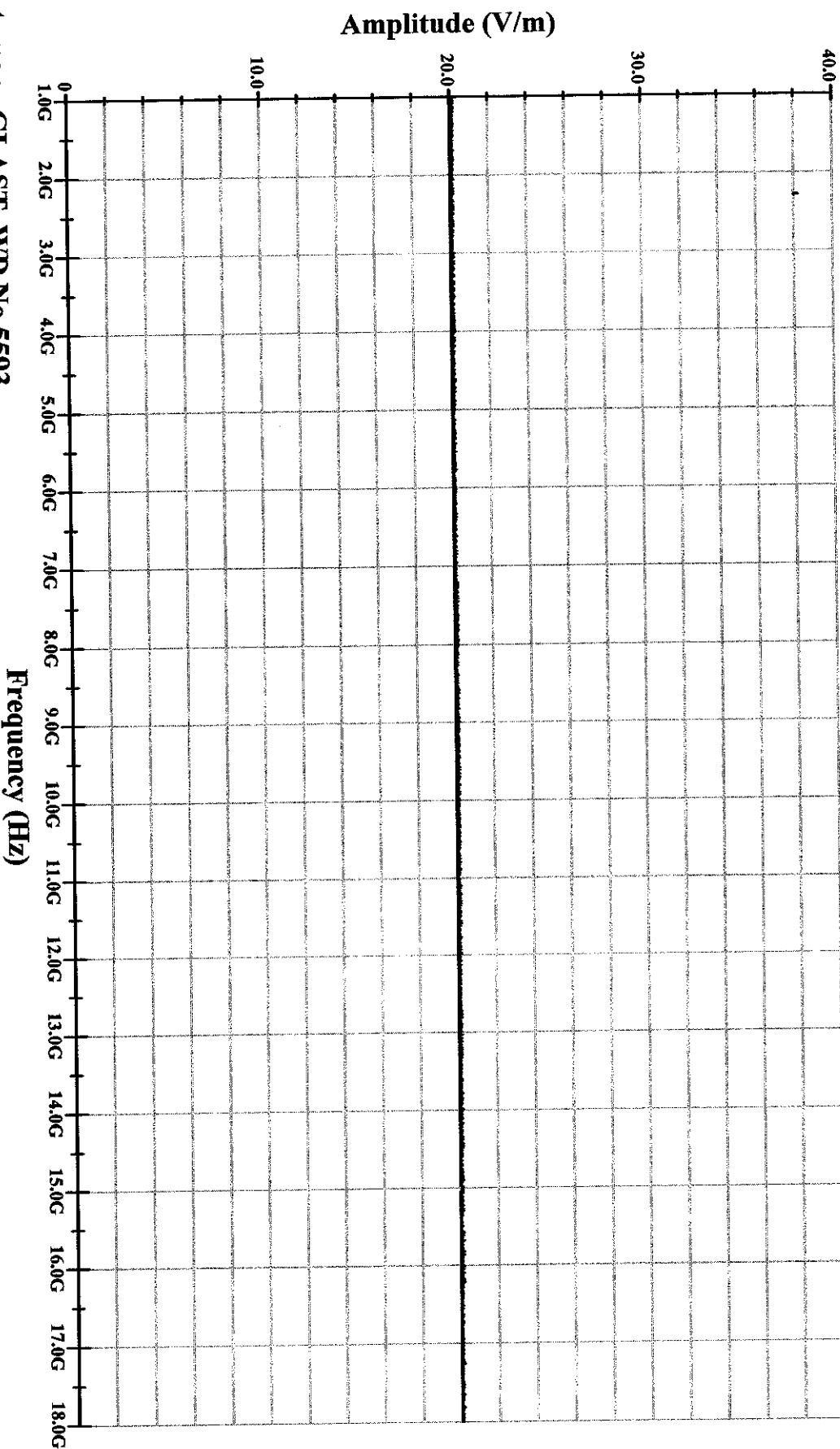
Operator: Vaughn Nelson

03:54:54 PM, Monday, December 06, 2004

# EMC Test Laboratory, GSFC NASA

Mil-Std-461C RS103

Vertical Field Level 1 GHz to 18 GHz



Customer - GLAST, WD No.5593

DUT - ACD

Run # - 71

Print # - 1

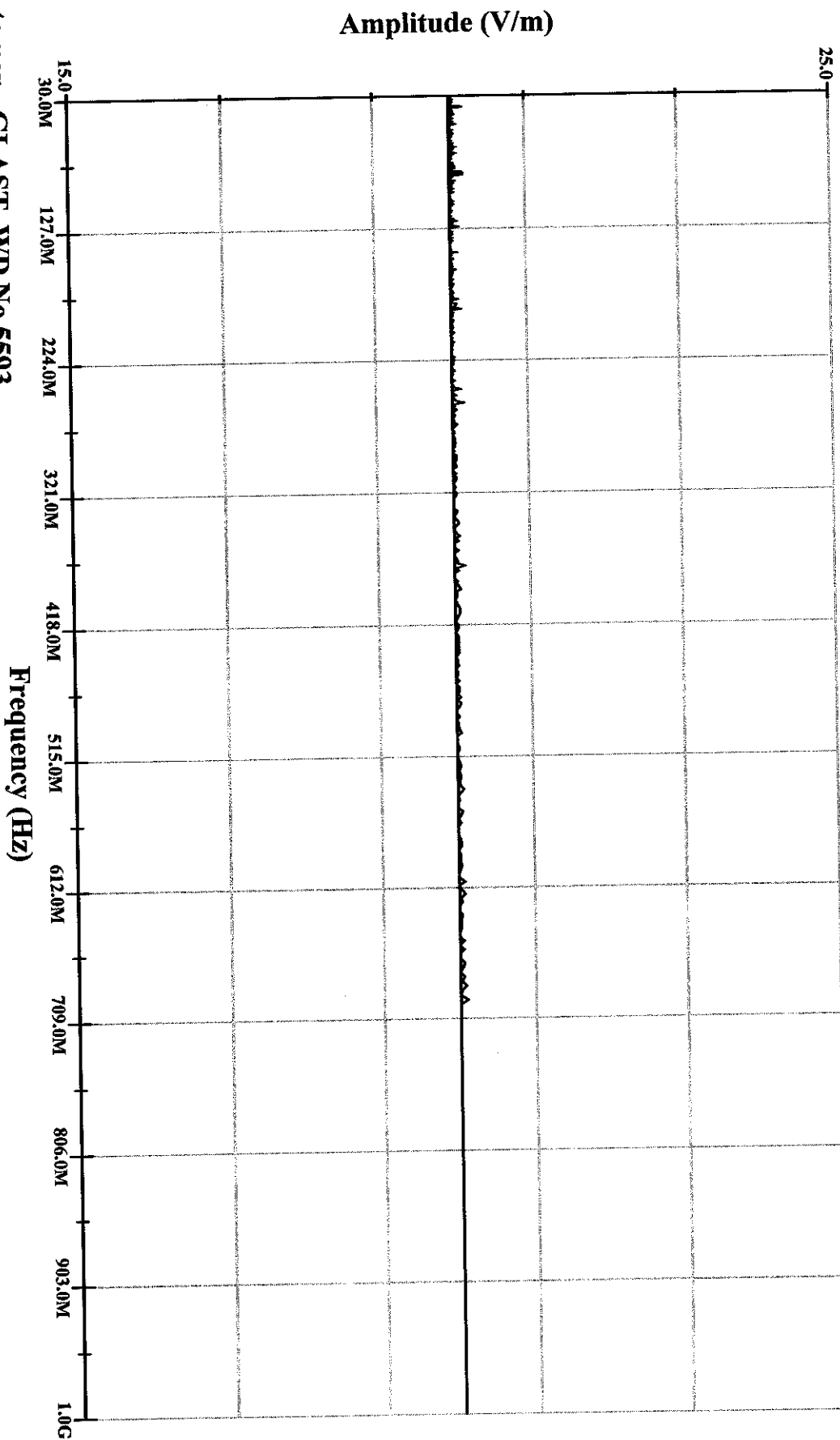
Operator: Vaughn Nelson

11:06:40 AM, Thursday, December 09, 2004

**EMC Test Laboratory, GSFC NASA**

**Mil-Std-461E RS103**

**Horizontal Field Level 30 MHz to 1 GHz**



**Customer - GLAST, WD No.5593**

**DUT - ACD**

**Run # - 70**

**Print # - 1**

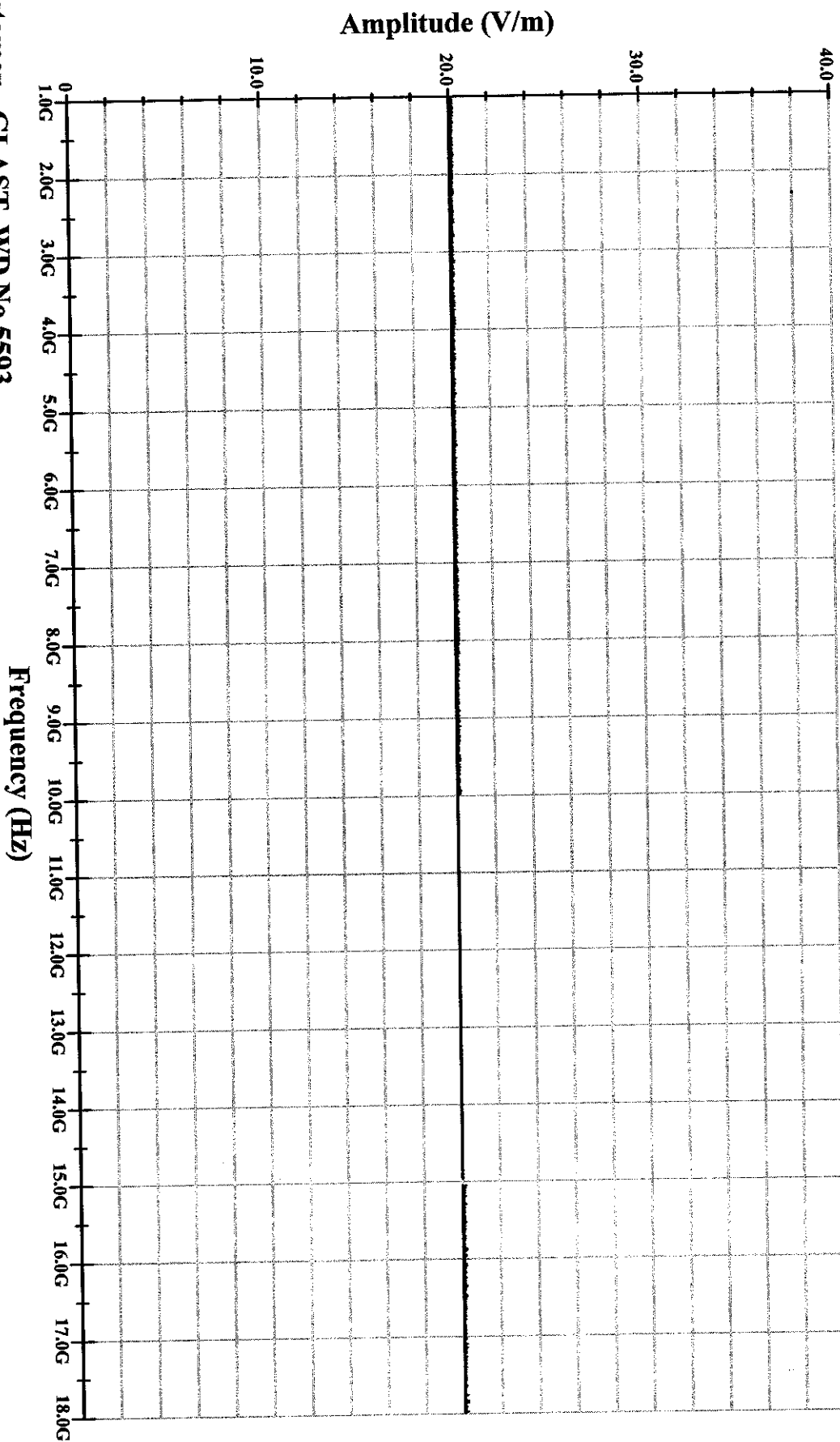
**Operator: Vaughn Nelson**

**03:15:09 PM, Monday, December 06, 2004**

# EMC Test Laboratory, GSFC NASA

MIL-Std-461E RS103

Horizontal Field Level 1 GHz to 18 GHz



Customer - GLAST, WD No.5593

DUT - ACD

Run # - 71

Print # - 1

Operator: Vaughn Nelson

01:29:59 PM, Thursday, December 09, 2004