




# TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Wood & Douglas Ltd  
ST500 Transmitter


To: FCC Part 90:1998

**Test Report Serial No:**  
RFI/EMCB2/RP39403B

**This Test Report supersedes RFI Test Report No.:**  
RFI/EMCB1/RP39403B

<b>This Test Report Is Issued Under The Authority Of Brian Watson Technical Director:</b> 	<b>Checked By:</b> 
<b>Tested By:</b> 	<b>Release Version No: PDF01</b>
<b>Issue Date: 2 September 1999</b>	<b>Test Date: 27 July 1999</b>

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**RADIO FREQUENCY INVESTIGATION LTD.**

**TEST REPORT**

**EMC Department**

**S.No: RFI/EMCB2/RP39403B**

**Page 2 of 46**

**Issue Date: 2 September 1999**

**Test Of: Wood & Douglas Ltd ST500 Transmitter**  
**To: FCC Part 90:1998**

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Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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**Table of Contents**

1. Client Information .....	4
2. Equipment Under Test (EUT).....	5
3. Test Specification, Methods And Procedures.....	7
4. Deviations From The Test Specification.....	8
5. Operation Of The EUT During Testing .....	9
6. Summary Of Test Results.....	10
7. Measurements, Examinations And Derived Results.....	11
8. Measurement Uncertainty.....	33
Appendix 1. Test Equipment Used.....	34
Appendix 2. Measurement Methods .....	35
Appendix 3. Test Configuration Drawings .....	39
Appendix 4. Graphical Test Results .....	42
Appendix 5. Photographs of EUT.....	45

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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## 1. Client Information

<b>Company Name:</b>	Wood & Douglas Ltd
<b>Address:</b>	Lattice House Baughurst Basingstoke Hants RG26 5LP
<b>Contact Name:</b>	Mr A Stickland

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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## **2. Equipment Under Test (EUT)**

The following information (with the exception of the Date of Receipt) has been supplied by the client:

### **2.1. Identification Of Equipment Under Test (EUT)**

Brand Name:	Wood & Douglas Ltd
Model Name or Number:	ST500
Unique Type Identification:	ST500 31
Serial Number:	990798023
Country of Manufacture:	UK
FCC ID Number:	Awaiting Certification from the FCC
Date of Receipt:	27 July 1999

### **2.2. Description Of EUT**

The equipment under test is a synthesised 100 mW transmitter with 12.5 kHz channel spacing for telemetry use.

### **2.3. Modifications Incorporated In EUT**

None stated by client.

### **2.4. Additional Information Related To Testing**

Power Supply Requirement:	DC supply of 9 V (customer supplied)
Intended Operating Environment:	Commercial
Weight:	0.03 kg
Dimensions:	60 mm x 40 mm x 20 mm (including pins)
Interface Ports:	10 pin connector for I/O 2 pin connector for power 3 pin connector for RF

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

### 2.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

<b>Description:</b>	ST500 Test Jig
<b>Brand Name:</b>	Wood and Douglas
<b>Model Name or Number:</b>	None stated by client
<b>Serial Number:</b>	WD011
<b>FCC ID Number:</b>	None stated by client
<b>Cable Length And Type:</b>	Not applicable (Direct Connection to the EUT)
<b>Connected to Port:</b>	Not applicable

<b>Description:</b>	Plug Top power supply
<b>Brand Name:</b>	Seung Jin Electronics Co
<b>Model Name or Number:</b>	SJ-1205D
<b>Serial Number:</b>	WD009
<b>FCC ID Number:</b>	None stated by client
<b>Cable Length And Type:</b>	1.5m Twin
<b>Connected to Port:</b>	DC Input Port to Test Jig

Test Of: Wood &amp; Douglas Ltd ST500 Transmitter

To: FCC Part 90:1998

### **3. Test Specification, Methods And Procedures**

#### **3.1. Test Specification**

<b>Reference:</b>	FCC Part 90: 1998
<b>Title:</b>	Code of Federal Regulations, Part 90 (47CFR90) Private Land Mobile Radio Services
<b>Comments:</b>	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
<b>Purpose of Test:</b>	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

#### **3.2. Methods And Procedures**

The methods and procedures used were as detailed in:

ANSI C63.2 (1987)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (1992)

Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1 (1993)

Title: Specification for radio disturbance and immunity measuring apparatus and methods. Part 1. Radio disturbance and immunity measuring apparatus.

#### **3.3. Definition Of Measurement Equipment**

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

RADIO FREQUENCY INVESTIGATION LTD.

TEST REPORT

EMC Department

S.No: RFI/EMCB2/RP39403B

Page 8 of 46

Issue Date: 2 September 1999

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

#### **4. Deviations From The Test Specification**

None.



Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

## **5. Operation Of The EUT During Testing**

### **5.1. Operating Conditions**

The EUT was tested in a normal laboratory environment.

During testing, the EUT was powered by a DC supply of 9 V (customer supplied).

### **5.2. Operating Modes**

The EUT was tested in the following operating modes:

1. Unmodulated Carrier: The EUT was operated with no audio input signal applied.
2. Modulated Carrier: The EUT was operated with an input audio signal from 50 to 20000Hz, using the following steps: 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1200, 1500, 2000, 2500, 3000, 5000, 7500, 10000, 15000, 20000. A maximum audio input level of 750v Pk-Pk was applied at all times.

The EUT was tested in Bottom Channel (430 MHz), Middle Channel (450 MHz) and Top Channel (470 MHz)

The reason for choosing this mode was that it was defined by the client as being likely to be the worst case with regards EMC.

### **5.3. Configuration And Peripherals**

The EUT was tested in the following configuration:

Connected to a test jig to enable correct testing to be performed. Also to provide the correct input signal, an audio generator was connected to the EUT when required.

The reason for choosing this configuration was that it was defined by the client as being likely to be the worst case with regards EMC.

NB Section 2 of this report contains a full list of support equipment used and Appendix 3 contains a schematic diagram of the test configuration.

Test Of: Wood & Douglas Ltd ST500 Transmitter  
 To: FCC Part 90:1998

## **6. Summary Of Test Results**

### **6.1. Conducted Emissions**

<b>Range Of Measurements</b>	<b>Specification Reference</b>	<b>Compliance Status</b>
AC Powerline Conducted Emissions, 450 kHz to 30 MHz	Section 15 of C.F.R. 47: 1998	Complied

### **6.2. Radiated Emissions**

<b>Range Of Measurements</b>	<b>Specification Reference</b>	<b>Compliance Status</b>
Conducted Antenna Port Transmit Power	Section 90.205 of C.F.R. 47: 1998	Complied
Conducted Antenna Port Spurious Emissions (30 to 5000 MHz)	Section 90.210 of C.F.R. 47: 1998	Complied
Modulation Requirements	Section 90.211 of C.F.R. 47: 1998	Complied
Frequency Stability	Section 90.213 of C.F.R. 47: 1998	Complied
Transmit Frequency Behaviour	Section 90.214 of C.F.R. 47: 1998	Complied

### **6.3. Location Of Tests**

All the measurements described in this report were performed at the premises of Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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## **7. Measurements, Examinations And Derived Results**

### **7.1. General Comments**

7.1.1. This section contains test results only. Details of the test methods and procedures can be found in Appendix 2 of this report.

7.1.2. The measurement uncertainties stated were calculated in accordance with the requirements of NAMAS Document NIS 81 with a confidence level of 95%. Please refer to Section 8 for details of measurement uncertainties.

Test Of: Wood & Douglas Ltd ST500 Transmitter  
 To: FCC Part 90:1998

## **7.2. Test Results For AC Mains Conducted Emissions**

### **7.2.1. Quasi-Peak Detector Measurements On Live And Neutral Lines**

7.2.1.1. Plots of the initial scans can be found in Appendix 4.

7.2.1.2. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

#### **Results: Bottom Channel**

<b>Frequency (MHz)</b>	<b>Line</b>	<b>Q-P Level (dBmV)</b>	<b>Q-P Limit (dBmV)</b>	<b>Margin (dB)</b>	<b>Result</b>
0.496	Live	14.1	48.0	33.9	Complied
0.589	Neutral	13.8	48.0	34.2	Complied
0.860	Live	13.0	48.0	35.0	Complied
1.107	Neutral	12.8	48.0	35.2	Complied
2.003	Live	12.3	48.0	35.7	Complied
2.625	Neutral	10.4	48.0	37.6	Complied
3.362	Live	10.1	48.0	37.9	Complied
5.960	Neutral	9.8	48.0	38.2	Complied
7.750	Live	9.5	48.0	38.5	Complied
9.470	Neutral	9.6	48.0	38.4	Complied
16.120	Live	10.2	48.0	37.8	Complied
19.890	Neutral	10.1	48.0	37.9	Complied

Test Of: Wood & Douglas Ltd ST500 Transmitter  
 To: FCC Part 90:1998

**Results: Middle Channel**

Frequency (MHz)	Line	Q-P Level (dBmV)	Q-P Limit (dBmV)	Margin (dB)	Result
0.654	Neutral	13.6	48.0	34.4	Complied
0.675	Live	13.3	48.0	34.7	Complied
1.154	Neutral	12.9	48.0	35.1	Complied
1.303	Live	12.5	48.0	35.5	Complied
2.725	Neutral	10.3	48.0	37.7	Complied
2.855	Live	10.2	48.0	37.8	Complied
4.400	Neutral	9.8	48.0	38.2	Complied
5.430	Live	9.7	48.0	38.3	Complied
8.830	Neutral	9.6	48.0	38.4	Complied
9.510	Live	9.5	48.0	38.5	Complied
16.120	Live	10.3	48.0	37.7	Complied
17.870	Neutral	10.2	48.0	37.8	Complied

**Results: Top Channel**

Frequency (MHz)	Line	Q-P Level (dBmV)	Q-P Limit (dBmV)	Margin (dB)	Result
0.714	Live	13.3	48.0	34.7	Complied
0.780	Neutral	13.3	48.0	34.7	Complied
1.238	Live	12.8	48.0	35.2	Complied
1.669	Neutral	12.2	48.0	35.8	Complied
2.494	Neutral	10.4	48.0	37.6	Complied
2.565	Live	10.3	48.0	37.7	Complied
3.269	Neutral	10.1	48.0	37.9	Complied
6.130	Live	9.8	48.0	38.2	Complied
7.390	Neutral	10.0	48.0	38.0	Complied
10.940	Live	9.9	48.0	38.1	Complied
17.370	Neutral	10.4	48.0	37.6	Complied
22.460	Live	10.1	48.0	37.9	Complied

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

### **7.3. Test for Maximum Transmit Power and Conducted Spurious Emissions**

7.3.1. Tests for maximum transmit power and conducted antenna power was performed to the limits specified in section 90.205 and 90.210.

7.3.2. Measurements for maximum transmit power were performed with the EUT operated without modulation.

7.3.3. Measurements for conducted spurious emissions were performed with the EUT operated with and without modulation.

#### **Results: Bottom Channel**

Frequency (MHz)	Peak Tx Level (dBm)
429.9999	17.86

7.3.4. Conducted spurious emissions scans were performed with the EUT operating with and without a modulated signal.

Frequency (MHz)	Spurious Peak Level (dBm)	Limit (dBm)	Margin	Result
860.000	-43.6	-20.0	23.6	Complied
3431.100	-34.5	-20.0	14.5	Complied

#### **Results: Middle Channel**

Frequency (MHz)	Peak Tx Level (dBm)
449.9998	18.71

7.3.5. Conducted spurious emissions scans were performed with the EUT operating with and without a modulated signal.

Frequency (MHz)	Spurious Peak Level (dBm)	Limit (dBm)	Margin	Result
727.500	-47.5	-20.0	27.5	Complied
3608.800	-30.9	-20.0	10.9	Complied

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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**Results: Top Channel**

Frequency (MHz)	Peak Tx Level (dBm)
470.000	20.22

7.3.6. Conducted spurious emissions scans were performed with the EUT operating with and without a modulated signal.

Frequency (MHz)	Spurious Peak Level (dBm)	Limit (dBm)	Margin	Result
939.900	-53.1	-20.0	33.1	Complied
3755.500	-33.7	-20.0	13.7	Complied

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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#### **7.4. Test for Modulation Requirements**

7.4.1. Conducted antenna port scans were performed around the carrier whilst applying an audio input level to the input of the EUT as specified in section 5.2. Tests were performed on all 3 channels to demonstrate that the modulated carrier complied with the emission mask outlined in section 90.210 of C.F.R. 47: 1998.

7.4.2. All 3 channels complied with the emission limits specified. The scans can be seen in Appendix 4 of this test report.



Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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### **7.5. Test for Frequency Stability**

7.5.1. The EUT was testing in accordance with section 90.213 to demonstrate compliance with the frequency stability requirements.

7.5.2. The ambient temperature was originally set to a level of -30°C and results were recorded for the fundamental frequency on all 3 channels. The temperature was then increased to -20°C and the test repeated. The ambient temperature was increased in 10°C step up to the maximum +50°C.

7.5.3. The limit specified in section 90.213 for a mobile station of 2 Watts or less with a 12.5kHz channel spacing is 2.5ppm.

#### **Results: Bottom Channel**

**Lower Limit: 429.998925 MHz**

**Upper Limit: 430.001075 MHz**

**-30°C**

<b>Time in Minutes from Switch On</b>	<b>Tx Frequency (MHz)</b>
0	429.999869
1	429.99894
2	429.99922
3	429.99941
4	429.99951
5	429.99959
6	429.99965
7	429.99965
8	429.99965
9	429.99965
10	429.99965

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**-20°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	430.00025
1	430.00027
2	430.00048
3	430.00052
4	430.00054
5	430.00056
6	430.00056
7	430.00056
8	430.00056
9	430.00056
10	430.00056

**-10°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	430.00074
1	430.00069
2	430.00072
3	430.00075
4	430.00075
5	430.00075
6	430.00075
7	430.00075
8	430.00075
9	430.00075
10	430.00075

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**0°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	430.00075
1	430.00067
2	430.00063
3	430.00064
4	430.00064
5	430.00064
6	430.00064
7	430.00064
8	430.00064
9	430.00064
10	430.00064

**+10°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	430.00009
1	430.00008
2	430.00006
3	430.00008
4	430.00008
5	430.00008
6	430.00008
7	430.00008
8	430.00008
9	430.00008
10	430.00008

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**+20°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	430.00008
1	430.00000
2	429.99998
3	429.99996
4	429.99996
5	429.99996
6	429.99996
7	429.99996
8	429.99996
9	429.99996
10	429.99996

**+30°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	429.99981
1	429.99975
2	429.99972
3	429.99972
4	429.99972
5	429.99972
6	429.99972
7	429.99972
8	429.99972
9	429.99972
10	429.99972

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**+40°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	429.99965
1	429.99957
2	429.99954
3	429.99954
4	429.99954
5	429.99954
6	429.99954
7	429.99954
8	429.99954
9	429.99954
10	429.99954

**+50°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	429.99957
1	429.99951
2	429.99949
3	429.99949
4	429.99949
5	429.99949
6	429.99949
7	429.99949
8	429.99949
9	429.99949
10	429.99949

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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**Results: Middle Channel**

Lower Limit: 449.998875 MHz

Upper Limit: 450.001125 MHz

**-30°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	449.99861
1	449.99886
2	449.99928
3	449.99943
4	449.99955
5	449.99961
6	449.99961
7	449.99961
8	449.99961
9	449.99961
10	449.99961

**-20°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	450.00024
1	450.00030
2	450.00045
3	450.00053
4	450.00055
5	450.00057
6	450.00058
7	450.00058
8	-450.00058
9	-450.00058
10	-450.00058

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**-10°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	450.00079
1	450.00075
2	450.00075
3	450.00076
4	450.00077
5	450.00077
6	450.00077
7	450.00077
8	450.00077
9	450.00077
10	450.00077

**0°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	450.00071
1	450.00067
2	450.00064
3	450.00063
4	450.00064
5	450.00066
6	450.00066
7	450.00066
8	450.00066
9	450.00066
10	450.00066

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**+10°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	449.99896
1	449.99896
2	449.99921
3	449.99945
4	449.99966
5	449.99977
6	449.99985
7	449.99992
8	449.99996
9	450.00001
10	450.00002

**+20°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	450.00010
1	450.00002
2	449.99998
3	449.99997
4	449.99997
5	449.99997
6	449.99997
7	449.99997
8	449.99997
9	449.99997
10	449.99997



Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**+30°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	449.99986
1	449.99973
2	449.99972
3	449.99971
4	449.99971
5	449.99971
6	449.99971
7	449.99971
8	449.99971
9	449.99971
10	449.99971

**+40°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	449.99965
1	449.99955
2	449.99954
3	449.99953
4	449.99953
5	449.99953
6	449.99953
7	449.99953
8	449.99953
9	449.99953
10	449.99953

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**+50°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	449.99958
1	449.99950
2	449.99950
3	449.99954
4	449.99954
5	449.99954
6	449.99954
7	449.99954
8	449.99954
9	449.99954
10	449.99954

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**Results: Top Channel**

Lower Limit: 469.998825 MHz

Upper Limit: 470.001175 MHz

**-30°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	469.99885
1	469.99917
2	469.99953
3	469.99972
4	469.99981
5	469.99985
6	469.99988
7	469.99988
8	469.99988
9	469.99988
10	469.99988

**-20°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	470.00046
1	470.00049
2	470.00058
3	470.00063
4	470.00065
5	470.00067
6	470.00067
7	470.00067
8	470.00067
9	470.00067
10	470.00067

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**-10°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	470.00056
1	470.00079
2	470.00079
3	470.00079
4	470.00079
5	470.00079
6	470.00079
7	470.00079
8	470.00079
9	470.00079
10	470.00079

**0°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	470.00065
1	470.00061
2	470.00058
3	470.00057
4	470.00055
5	470.00055
6	470.00055
7	470.00055
8	470.00055
9	470.00055
10	470.00055

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**+10°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	470.00054
1	470.00047
2	470.00045
3	470.00044
4	470.00044
5	470.00044
6	470.00044
7	470.00044
8	470.00044
9	470.00044
10	470.00044

**+20°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	470.00012
1	470.00005
2	470.00000
3	470.99998
4	470.99998
5	470.99998
6	470.99998
7	470.99998
8	470.99998
9	470.99998
10	470.99998

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

---

**+30°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	469.99983
1	469.99973
2	469.99970
3	469.99969
4	469.99969
5	469.99969
6	469.99969
7	469.99969
8	469.99969
9	469.99969
10	469.99969

**+40°C**

Time in Minutes from Switch On	Tx Frequency (MHz)
0	469.99963
1	469.99953
2	469.99952
3	469.99952
4	469.99952
5	469.99952
6	469.99952
7	469.99952
8	469.99952
9	469.99952
10	469.99952

**Test Of: Wood & Douglas Ltd ST500 Transmitter**  
**To: FCC Part 90:1998**

---

**+50°C**

<b>Time in Minutes from Switch On</b>	<b>Tx Frequency (MHz)</b>
0	469.99952
1	469.99943
2	469.99945
3	469.99948
4	469.99950
5	469.99952
6	469.99952
7	469.99952
8	469.99952
9	469.99952
10	469.99952

Test Of: Wood & Douglas Ltd ST500 Transmitter  
 To: FCC Part 90:1998

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## **7.6. Test for Transient Behaviour**

7.6.1. Measurements were performed to determine the transient behaviour of the EUT on each channel to the limits specified in section 90.214.

7.6.2. Scans were produced to show the transient behaviour at the point of transmissions and at the point of transmitter turn off.

### **Results: Bottom Channel**

<b>Time Interval</b>	<b>Measured Transmission</b>	<b>Limit</b>	<b>Result</b>
T1 (10ms)	< 12.5 kHz	12.5 kHz	Complied
T2 (25ms)	< No measured value	6.25 kHz	Complied
T3 (10ms)	< 1.5 kHz	12.5 kHz	Complied

### **Results: Middle Channel**

<b>Time Interval</b>	<b>Measured Transmission</b>	<b>Limit</b>	<b>Result</b>
T1 (10ms)	< 12.5 kHz	12.5 kHz	Complied
T2 (25ms)	< No measured value	6.25 kHz	Complied
T3 (10ms)	< 1.5 kHz	12.5 kHz	Complied

### **Results: Top Channel**

<b>Time Interval</b>	<b>Measured Transmission</b>	<b>Limit</b>	<b>Result</b>
T1 (10ms)	< 12.5 kHz	12.5 kHz	Complied
T2 (25ms)	< No measured value	6.25 kHz	Complied
T3 (10ms)	< 1.5 kHz	12.5 kHz	Complied



Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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## **8. Measurement Uncertainty**

8.1. Company Policy, as based on the NAMAS Accreditation Standard, M10, paragraph 12.11 (o), states that Test Reports shall include estimated uncertainty of the calibration or test result (this information need only appear in test reports and test certificates where it is relevant to the validity or application of the test result, where a client's instructions so require or where uncertainty affects compliance to a specification or limit).

8.2. The global uncertainties have been calculated in accordance with NAMAS NIS 81 (Edition 1, May 1994) as follows:

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level</b>	<b>Calculated Uncertainty</b>
Conducted Emissions	0.15 MHz to 30 MHz	95%	+/- 2.2 dB
Conducted Antenna Port Emissions, Transient Behaviour, Modulation Requirements	30 MHz to 5000 MHz	95%	+/- 2.9 dB
Frequency Stability	N/A	95%	+/- 20 Hz

8.3. Measurement uncertainties have been applied in accordance with NAMAS document NIS 81 (edition 1, May 1994), and in the absence of any specification criteria, guidance, or code of practice, compliance has been judged on the basis of shared risk.

8.4. In the case of emissions tests, the measured value of the disturbance from the product sample shall be compared directly with the limits. If the measured value is equal to or less than the limit the product is deemed to pass the test.

8.5. In the case of immunity tests, the equipment is deemed to pass the test if it fulfils the stated performance criteria at the required or a higher severity level. The measurement uncertainty has been taken into account in the calibration procedures stated in the relevant basic standard.

8.6. The methods used to calculate the above uncertainties are in line with those used for calibration laboratories contained in NAMAS document NIS 3003 Edition 8 "The Expression of Uncertainty and Confidence in Measurement" May 1995, which align with international recommendations "Guide to the Expression of Uncertainty in Measurement" ISO/IEC/OIML/BIPM (Prepared by ISO/TAG 4: January 1993).

Test Of: Wood & Douglas Ltd ST500 Transmitter  
 To: FCC Part 90:1998

## Appendix 1. Test Equipment Used

Instrument	Manufacturer	Model	RFI No.
<b>Conducted Emissions:</b>			
Test Receiver	R & S	ESBI	M090
Plotter	H.P.	7440A	P001
Pulse Limiter	R & S	ESH3-Z2	A003
L.I.S.N. (1 ph.)	R & S	ESH3-Z5	A191
<b>Conducted Antenna Port Emissions, Modulation Requirements</b>			
Spectrum Analyser	R & S	FSB	M028
20dB Attenuator	Suhner	6820.17.B	A388
Cable	Rosenberger	UFA210A-1-1182-704704	C461
CMTA Radio Test Set	R & S	CMTA	M015
Plotter	H.P.	7440A	P001
<b>Transient Behaviour, Frequency Stability</b>			
Cable	Rosenberger	UFA210A-1-1182-704704	C461
CMTA Radio Test Set	R & S	CMTA	M015
Signal Generator	R & S	SMHU	G013
Plotter	HP	7440A	P001
Environmental Test Chamber	Design Environmental	BT190-70C	E003
Oscilloscope	Tektronix	2440	M029

**NB** In accordance with NAMAS requirements, all the measurement equipment is on a calibration schedule.

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

## **Appendix 2. Measurement Methods**

### **A2.1. AC Mains Conducted Emissions: FCC Part 15**

A2.1.1. AC mains conducted emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.1.2. The test was performed in a shielded enclosure with the equipment arranged as detailed in the standard on a wooden bench using the floor of the screened enclosure as the ground reference plane and with the EUT powered via a 60 Hz AC mains supply.

A2.1.3. Initial measurements in the form of swept scans covering the entire measurement band were performed in order to identify frequencies on which the EUT was generating interference. In order to minimise the time taken for these swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidths (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

A2.1.4. Following the initial scans, a graph was produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested (at individual frequencies) using the appropriate detector function.

A2.1.5. The test equipment settings for conducted emissions measurements were as follows:

<b>Receiver Function</b>	<b>Initial Scan</b>	<b>Final Measurements</b>
Detector Type:	Peak	Quasi-Peak (CISPR)*
Mode:	Max Hold	Not applicable
Bandwidth:	10 kHz	9 kHz
Amplitude Range:	60 dB	20 dB
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

\* In some instances an Average detector function may also have been used.

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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## **A2.2. Conducted Antenna Port Emissions: FCC Part 90**

A2.2.1. Conducted Antenna Port Emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.2.2. Prior to testing being performed a suitable RF attenuator and cable were calibrated for the required frequency range. For each measurement range performed, the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the measurement setup.

A2.2.3. Initial measurements covering the entire measurement band in the form of swept scans were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which measurements were performed. In order to minimise the time taken for the swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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### **A2.3. Frequency Stability: FCC Part 90**

A2.3.1. Frequency stability tests were performed to the limits specified in Part 90.213.

A2.3.2. The EUT was placed in an environmental chamber which was capable of producing an ambient temperature of between  $-30$  and  $+50^{\circ}\text{C}$ . The EUT was connected to a suitable measuring instrument to allow accurate frequency measurements to be performed.

A2.3.3. The EUT was set to the first channel to be measured and the power to the EUT was left disconnected.

A2.3.4. The environmental chamber was set to  $-30^{\circ}\text{C}$  and allowed to stabilise for a minimum of 30 minutes. After this time power was applied to the EUT and the frequency generated was recorded. After one minute the frequency was recorded again, and this continued every minute until ten minutes had elapsed.

A2.3.5. The power to the EUT was disconnected and the next channel selected. The procedure in A2.3.4. was repeated. The same procedure was then repeated for the final channel.

A.2.3.5. The chamber was then changed to  $-20^{\circ}\text{C}$ , and A2.3.4. repeated for all channels.

A.2.3.6. Tests were also performed with the ambient temperature set to  $-10$ ,  $0$ ,  $+10$ ,  $+20$ ,  $+30$ ,  $+40$ , and  $+50^{\circ}\text{C}$ .

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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### **A2.4 Modulation Requirements: FCC Part 90**

A2.4.1. Modulation tests were performed to the limits specified in Part 90.211.

A2.4.2. The EUT was connected to a spectrum analyser via a suitable calibrated attenuator and cable. The input of the EUT was connected to a signal generator capable of sweeping from 50 to 20000Hz.

A2.4.3. The EUT was set to the first channel and switch on. The audio generator was set to 50Hz and the maximum AF level for the EUT specified by the manufacturer was set.

A2.4.4. The spectrum analyser was set to scan in a peak max hold configuration, and repetitive scans were performed. The audio generator was changed to the next frequency, whilst the spectrum analyser continued to sweep max hold.

A2.4.5. This was repeated until the audio generator had been adjusted to 20000Hz. The given trace on the spectrum analyser was compared to the limits of the emission mask.

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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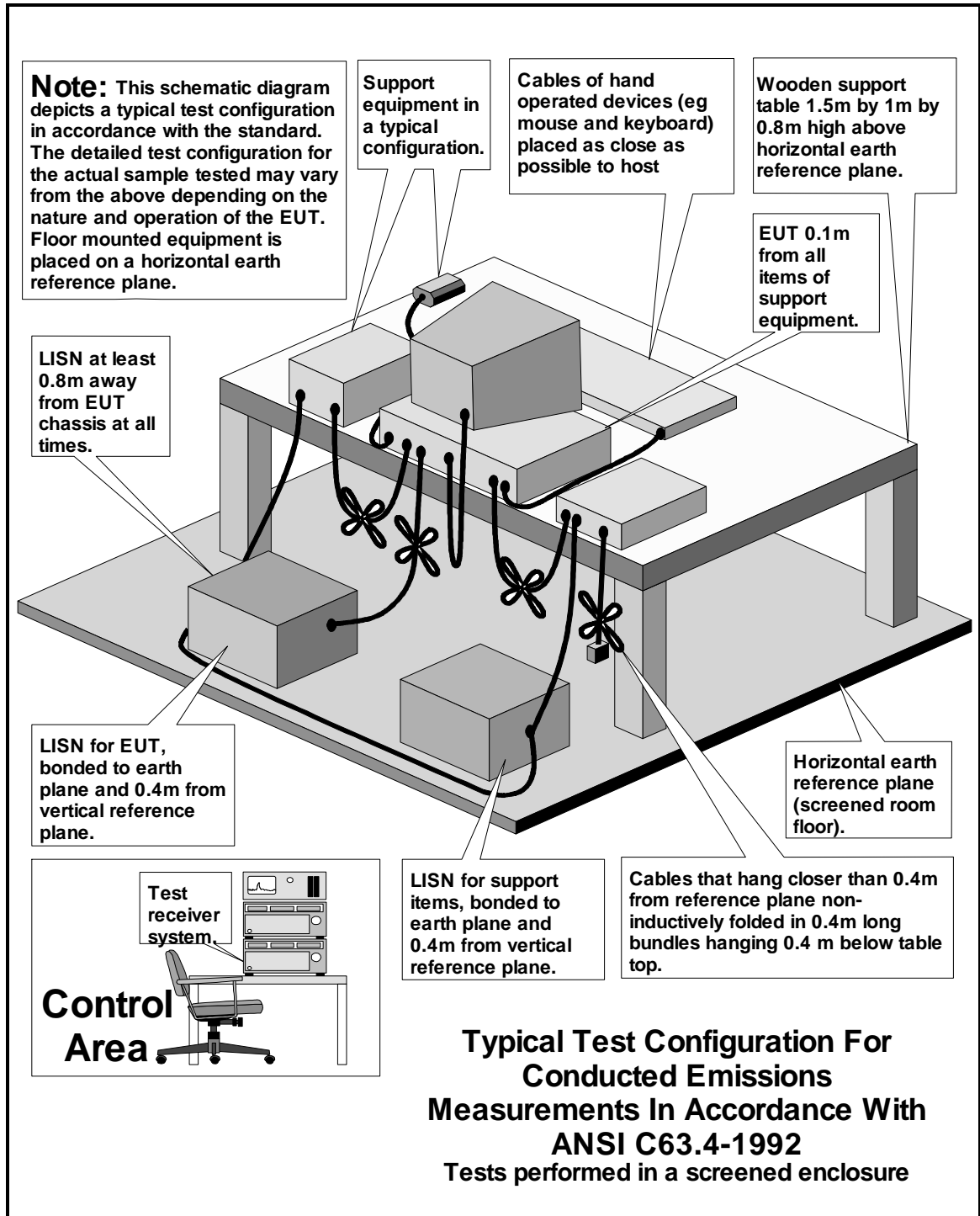
### **Appendix 3. Test Configuration Drawings**

This appendix contains the following drawings:

<b>Drawing Reference Number</b>	<b>Title</b>
DRG\39403ETF01\EMICON	Test configuration for measurement of conducted emissions
DRG\39403ETF01\EMIRAD	Test configuration for measurement of radiated emissions
DRG\39403ETF01\001	Schematic diagram of the EUT, support equipment and interconnecting cables used for the test

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

DRG\39403ETF01\EMICON

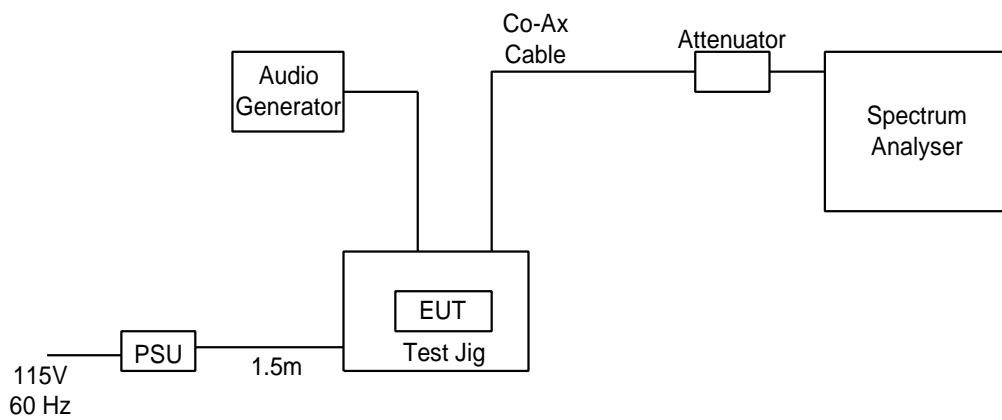




Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

DRG\39403ETF01\001

### Conducted Antenna Port / Frequency Stability Setup



Test Of: Wood & Douglas Ltd ST500 Transmitter  
 To: FCC Part 90:1998

## Appendix 4. Graphical Test Results

This appendix contains the following graphs:

Graph Reference Number	Title
GPH\39403ETF01\001	Conducted Antenna Port. Centre Channel. 449.975 to 450.025 MHz. Unmodulated Tx.
GPH\39403ETF01\002	Conducted Antenna Port. Centre Channel. 445.000 to 450.000 MHz. Unmodulated Tx.
GPH\39403ETF01\003	Conducted Antenna Port. Centre Channel. 450.000 to 455.000 MHz. Unmodulated Tx.
GPH\39403ETF01\004	Conducted Antenna Port. Centre Channel. 30.000 to 445.000 MHz. Unmodulated Tx.
GPH\39403ETF01\005	Conducted Antenna Port. Centre Channel. 455.000 to 1000.000 MHz. Unmodulated Tx.
GPH\39403ETF01\006	Conducted Antenna Port. Centre Channel. 1000.000 to 5000.000 MHz. Unmodulated Tx.
GPH\39403ETF01\007	Conducted Antenna Port. Top Channel. 469.975 to 470.025 MHz. Unmodulated Tx.
GPH\39403ETF01\008	Conducted Antenna Port. Top Channel. 460.000 to 470.000 MHz. Unmodulated Tx.
GPH\39403ETF01\009	Conducted Antenna Port. Top Channel. 470.000 to 480.000 MHz. Unmodulated Tx.
GPH\39403ETF01\010	Conducted Antenna Port. Top Channel. 30.000 to 460.000 MHz. Unmodulated Tx.
GPH\39403ETF01\011	Conducted Antenna Port. Top Channel. 480.000 to 1000.000 MHz. Unmodulated Tx.
GPH\39403ETF01\012	Conducted Antenna Port. Top Channel. 1000.000 to 5000.000 MHz. Unmodulated Tx.
GPH\39403ETF01\013	Conducted Antenna Port. Bottom Channel. 429.975 to 430.025 MHz. Unmodulated Tx.
GPH\39403ETF01\014	Conducted Antenna Port. Bottom Channel. 420.000 to 430.000 MHz. Unmodulated Tx.
GPH\39403ETF01\015	Conducted Antenna Port. Bottom Channel. 430.000 to 440.000 MHz. Unmodulated Tx.
GPH\39403ETF01\016	Conducted Antenna Port. Bottom Channel. 30.000 to 420.000 MHz. Unmodulated Tx.
GPH\39403ETF01\017	Conducted Antenna Port. Bottom Channel. 440.000 to 1000.000 MHz. Unmodulated Tx.
GPH\39403ETF01\018	Conducted Antenna Port. Bottom Channel. 1000.000 to 5000.000 MHz. Unmodulated Tx.
GPH\39403ETF01\019	Conducted Antenna Port. Top Channel. 469.975 to 470.025 MHz. Modulated Tx.

Test Of: Wood & Douglas Ltd ST500 Transmitter  
 To: FCC Part 90:1998

### Graphical Test Results (continued)

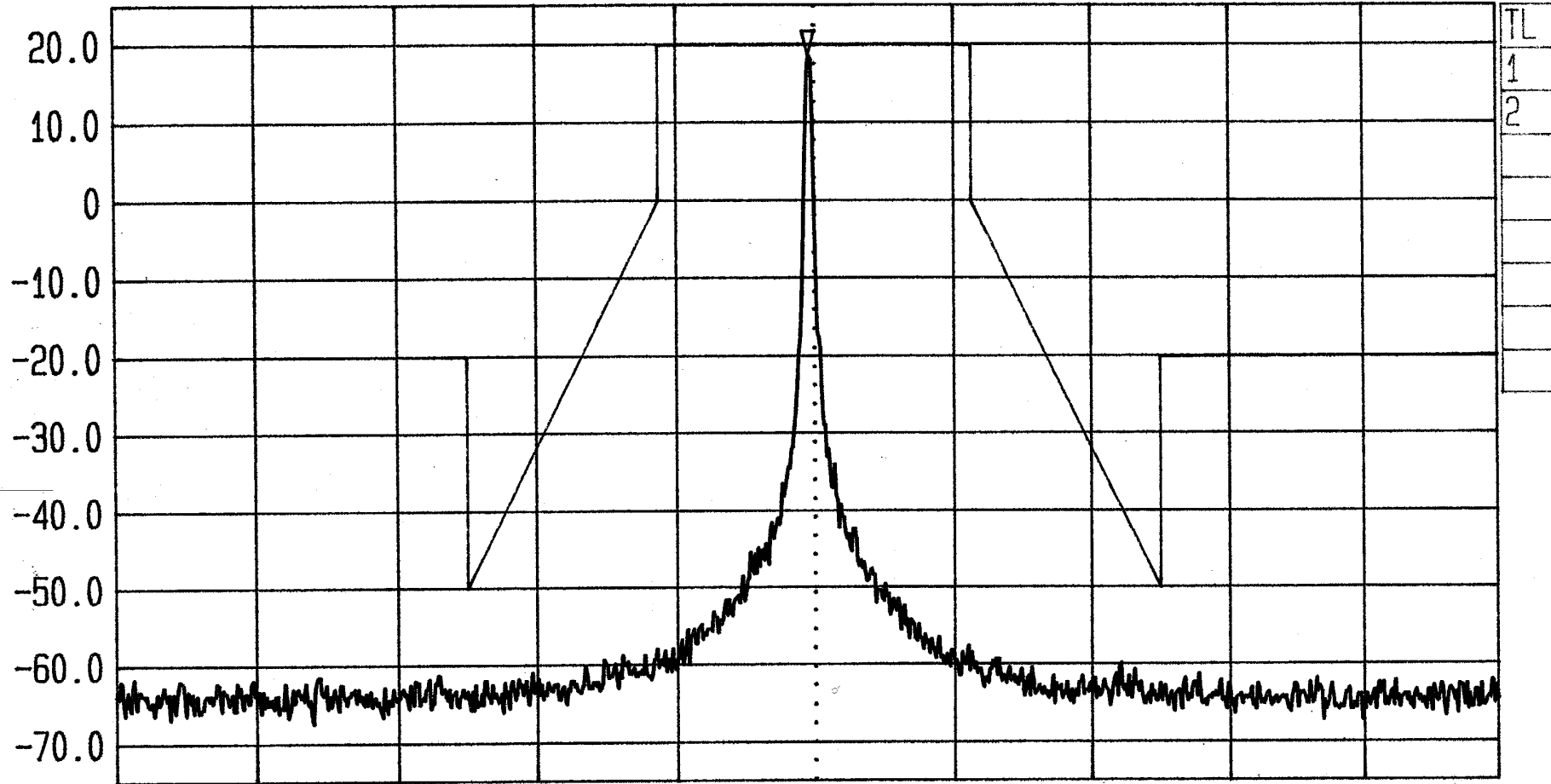
Graph Reference Number	Title
GPH\39403ETF01\020	Conducted Antenna Port. Centre Channel. 449.975 to 450.025 MHz. Modulated Tx.
GPH\39403ETF01\021	Conducted Antenna Port. Bottom Channel. 429.975 to 430.025 MHz. Modulated Tx.
GPH\39403ETF01\022	Transient Response. Bottom Channel. Time: T1
GPH\39403ETF01\023	Transient Response. Bottom Channel. Time: T2
GPH\39403ETF01\024	Transient Response. Bottom Channel. Time: T3
GPH\39403ETF01\025	Transient Response. Middle Channel. Time: T1
GPH\39403ETF01\026	Transient Response. Middle Channel. Time: T2
GPH\39403ETF01\027	Transient Response. Middle Channel. Time: T3
GPH\39403ETF01\028	Transient Response. Top Channel. Time: T1
GPH\39403ETF01\029	Transient Response. Top Channel. Time: T2
GPH\39403ETF01\030	Transient Response. Top Channel. Time: T3
GPH\39403ETF01\101	Conducted Emissions. Bottom Channel. 0.45 to 30 MHz. Live Line.
GPH\39403ETF01\102	Conducted Emissions. Bottom Channel. 0.45 to 30 MHz. Neutral Line.
GPH\39403ETF01\103	Conducted Emissions. Middle Channel. 0.45 to 30 MHz. Live Line.
GPH\39403ETF01\104	Conducted Emissions. Middle Channel. 0.45 to 30 MHz. Neutral Line.
GPH\39403ETF01\105	Conducted Emissions. Top Channel. 0.45 to 30 MHz. Live Line.
GPH\39403ETF01\106	Conducted Emissions. Top Channel. 0.45 to 30 MHz. Neutral Line.

**These pages are not included in the total number of pages for this report.**



LVLOFF  
Date 28.Jul.'99 Time 12:12:25  
Ref.Lvl 25.00 dBm  
Marker 18.71 dBm  
449.99983 MHz

Res.Bw 100.0 Hz [3dB] Vid.Bw 100 Hz  
CF.Stp 5.000 KHz RF.Att 25 dB  
Unit [dBm]



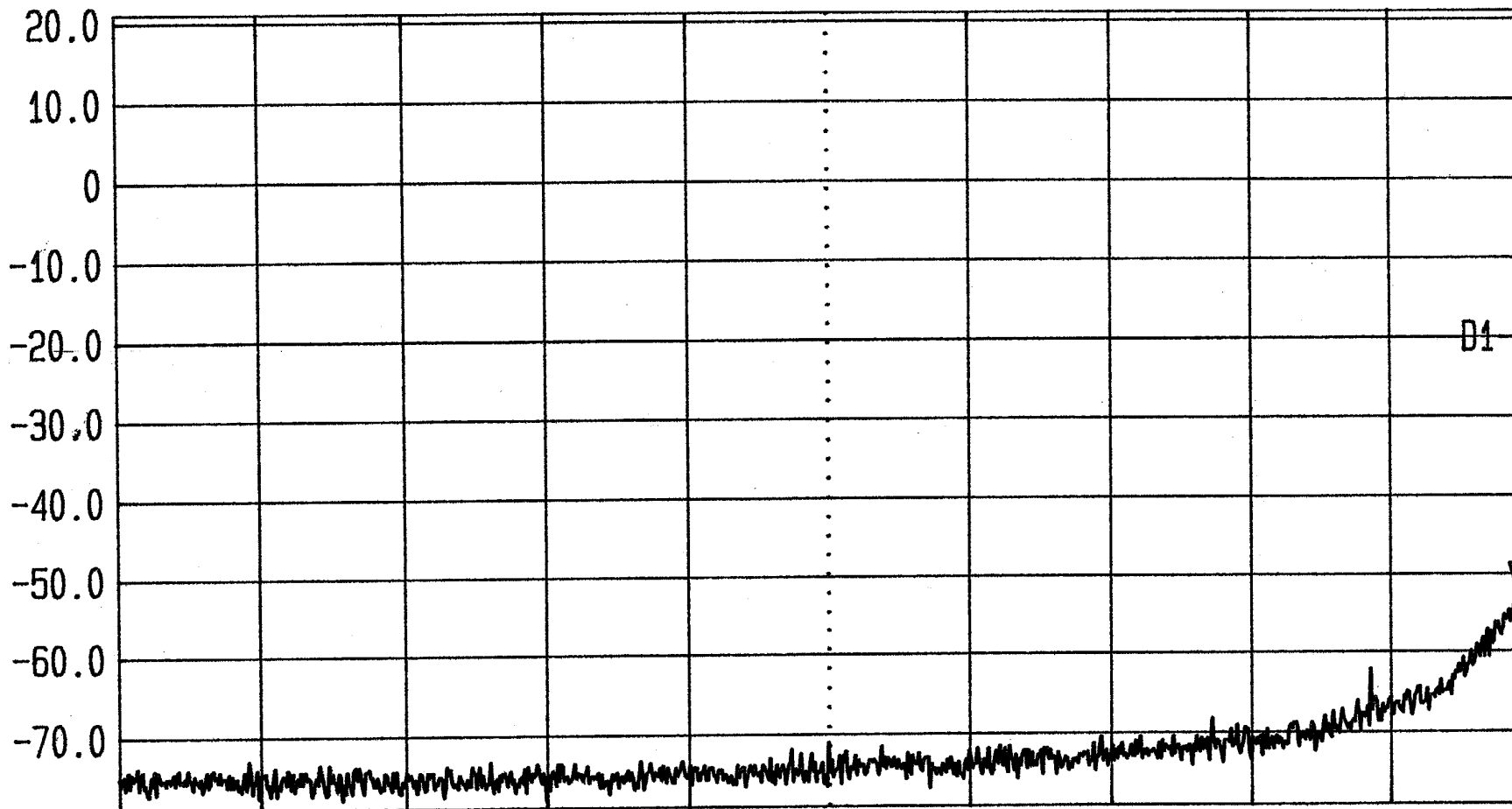
Start 449.975 MHz Span 50 kHz Center 450 MHz Sweep 15.0 s Stop 450.025 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90: 1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Centre Channel. GPH/39403/JD01/001



LVLOFF  
Date 28.Jul.'99 Time 12:22:47  
Ref.Lvl 21.00 dBm  
Marker -51.72 dBm  
449.961 MHz

Res.Bw 1.0 kHz [3dB] Vid.Bw 1 kHz  
CF.Stp 500.000 kHz RF.Att 0 dB  
Unit [dBm]



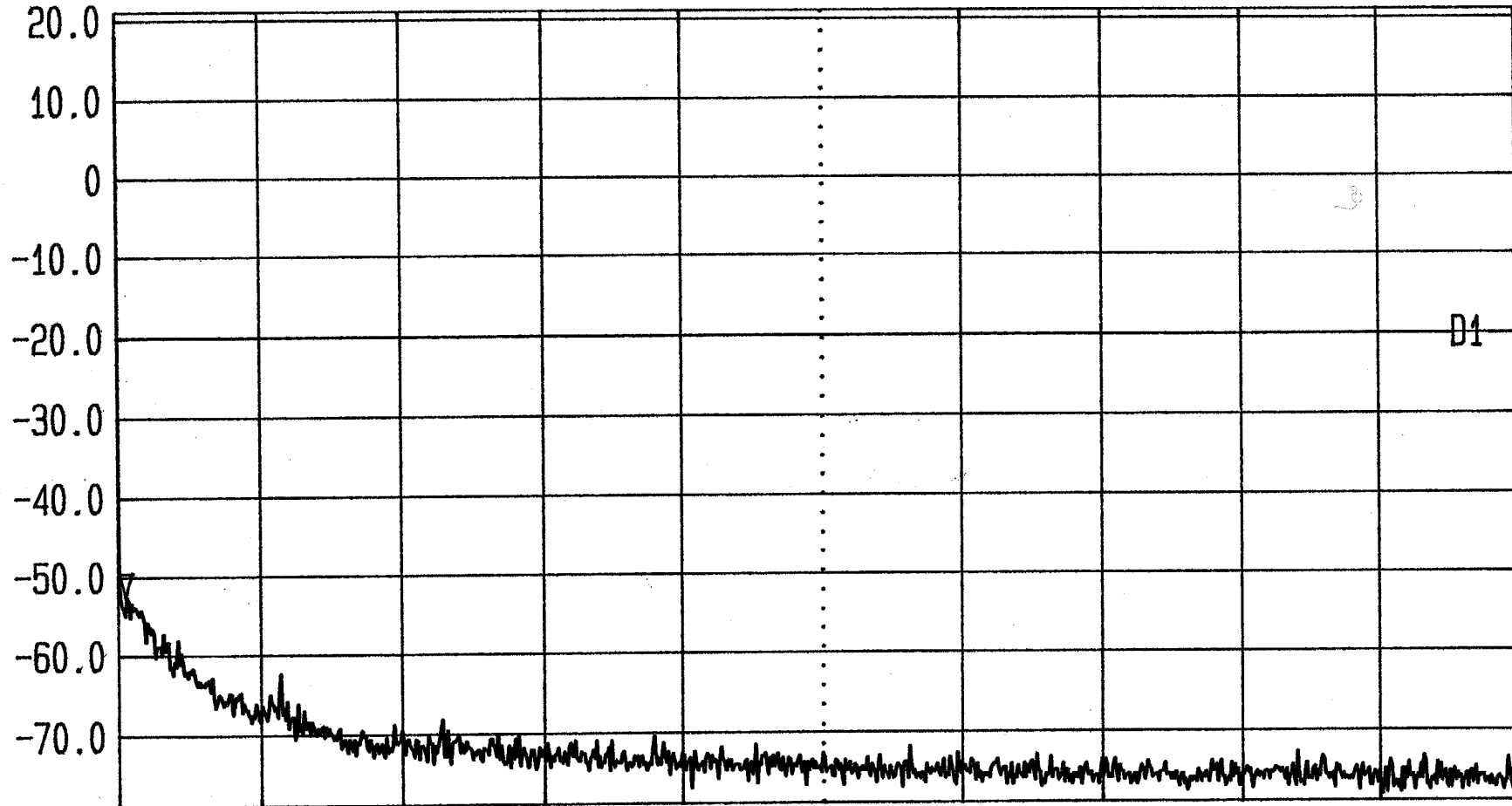
Start 445 MHz Span 5 MHz Center 447.5 MHz Sweep 15.0 s Stop 450 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90:1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Centre Channel. GPH/39403/JD01/002



LVLOFF  
Date 28.Jul.'99 Time 12:27:37  
Ref.Lvl 21.00 dBm Marker -52.59 dBm  
450.033 MHz

Res.Bw 1.0 kHz [3dB] Vid.Bw 1 kHz  
CF.Stp 500.000 kHz RF.Att 0 dB  
Unit [dBm]



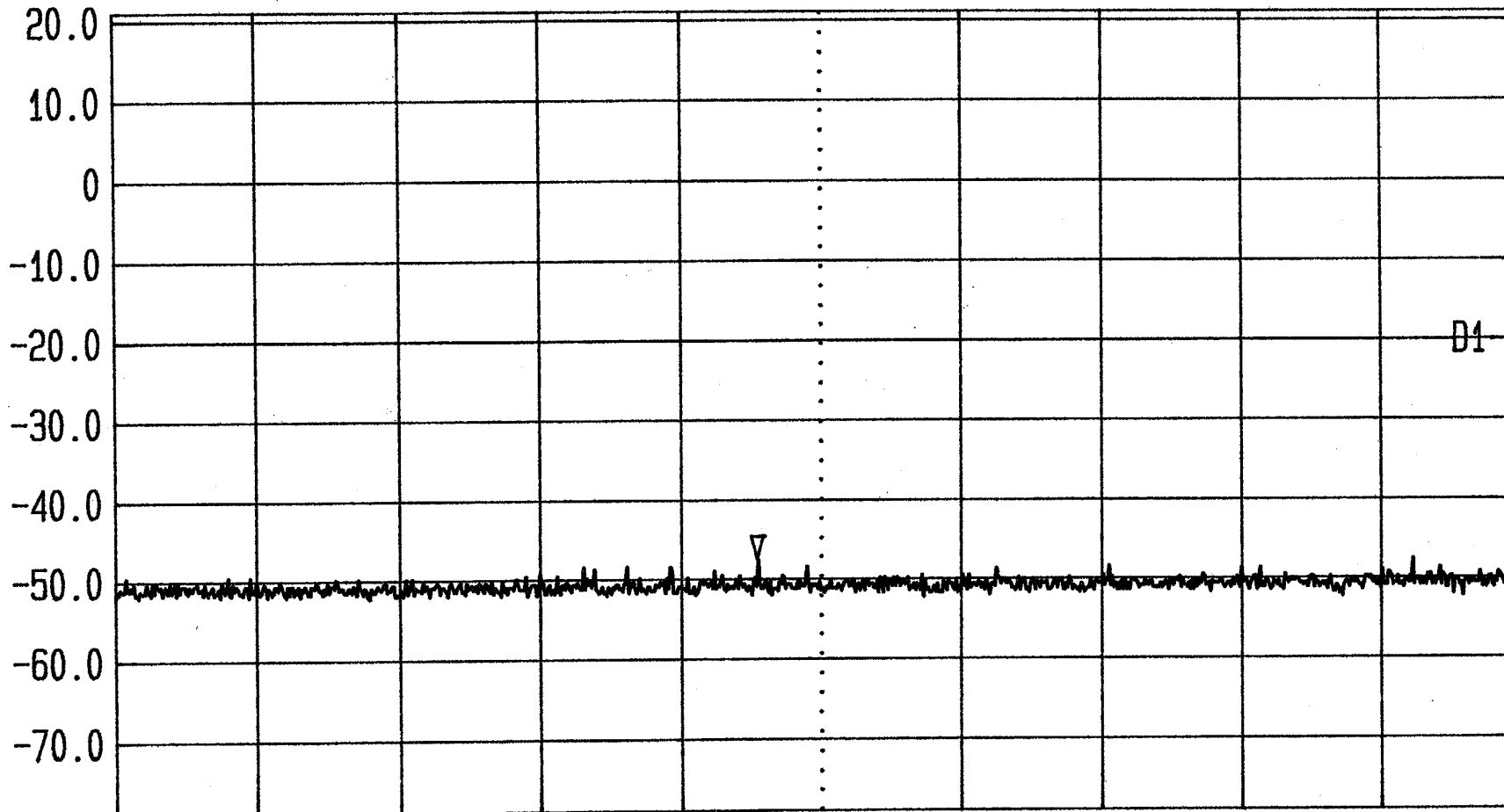
Start 450 MHz Span 5 MHz Center 452.5 MHz Sweep 15.0 s Stop 455 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90:1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Centre Channel. GPH/39403/JD01/003



LVLOFF  
Date 28.Jul.'99 Time 12:32:29  
Ref.Lvl 21.00 dBm  
Marker -47.35 dBm  
218.5 MHz

Res.Bw 80.0 kHz [3dB] Vid.Bw 100 kHz  
CF.Stp 41.500 MHz RF.Att 0 dB  
Unit [dBm]



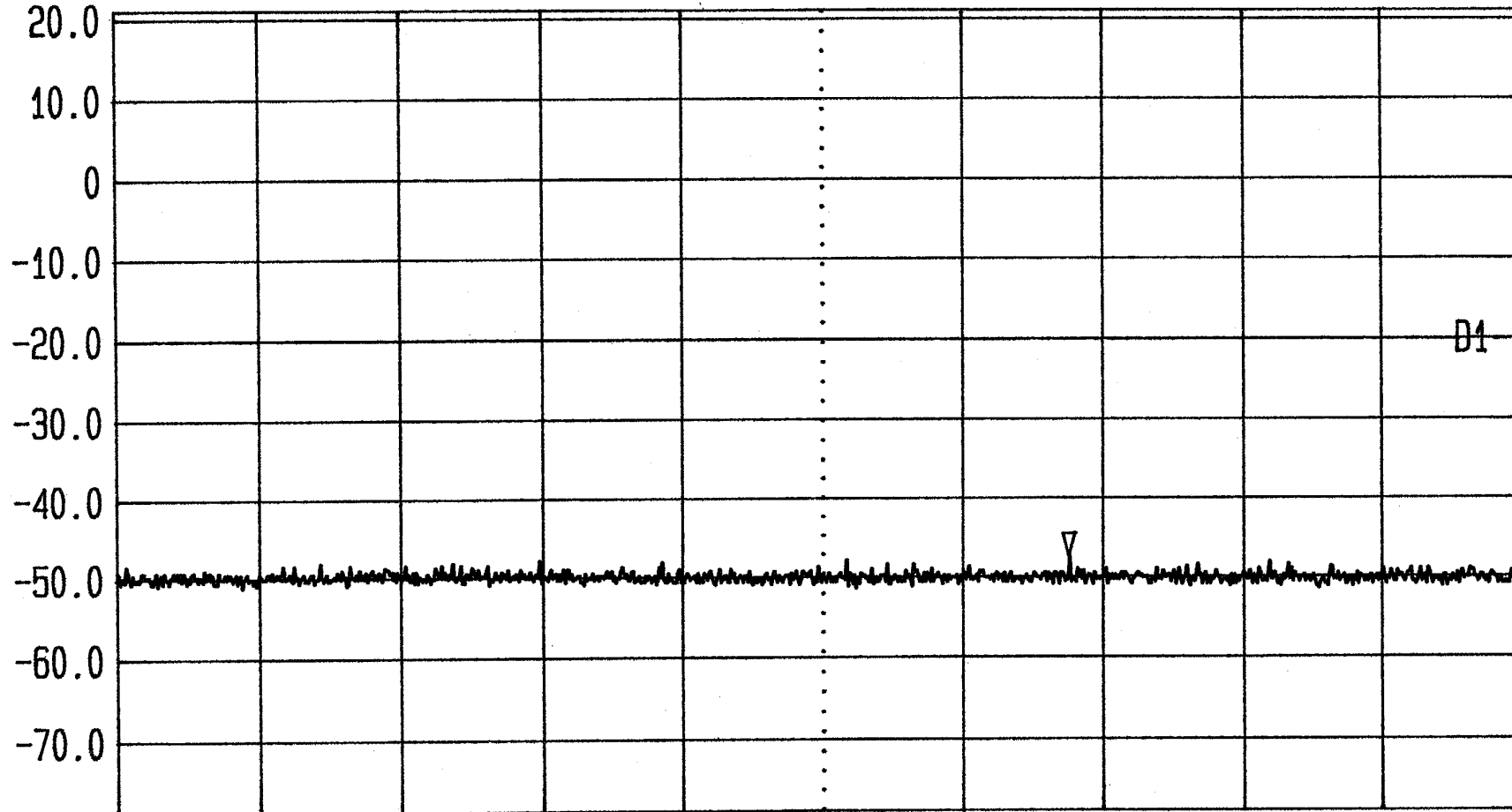
Start 30 MHz Span 415 MHz Center 237.5 MHz Sweep 200 ms Stop 445 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90:1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Centre Channel. GPH/39403/JD01/004



LVLOFF  
Date 28.Jul.'99 Time 12:37:22  
Ref.Lvl 21.00 dBm  
Marker -47.48 dBm  
823.7 MHz

Res.Bw 80.0 kHz [3dB] Vid.Bw 100 kHz  
CF.Stp 54.500 MHz RF.Att 0 dB  
Unit [dBm]



Start 455 MHz Span 545 MHz Center 727.5 MHz Sweep 260 ms Stop 1 GHz

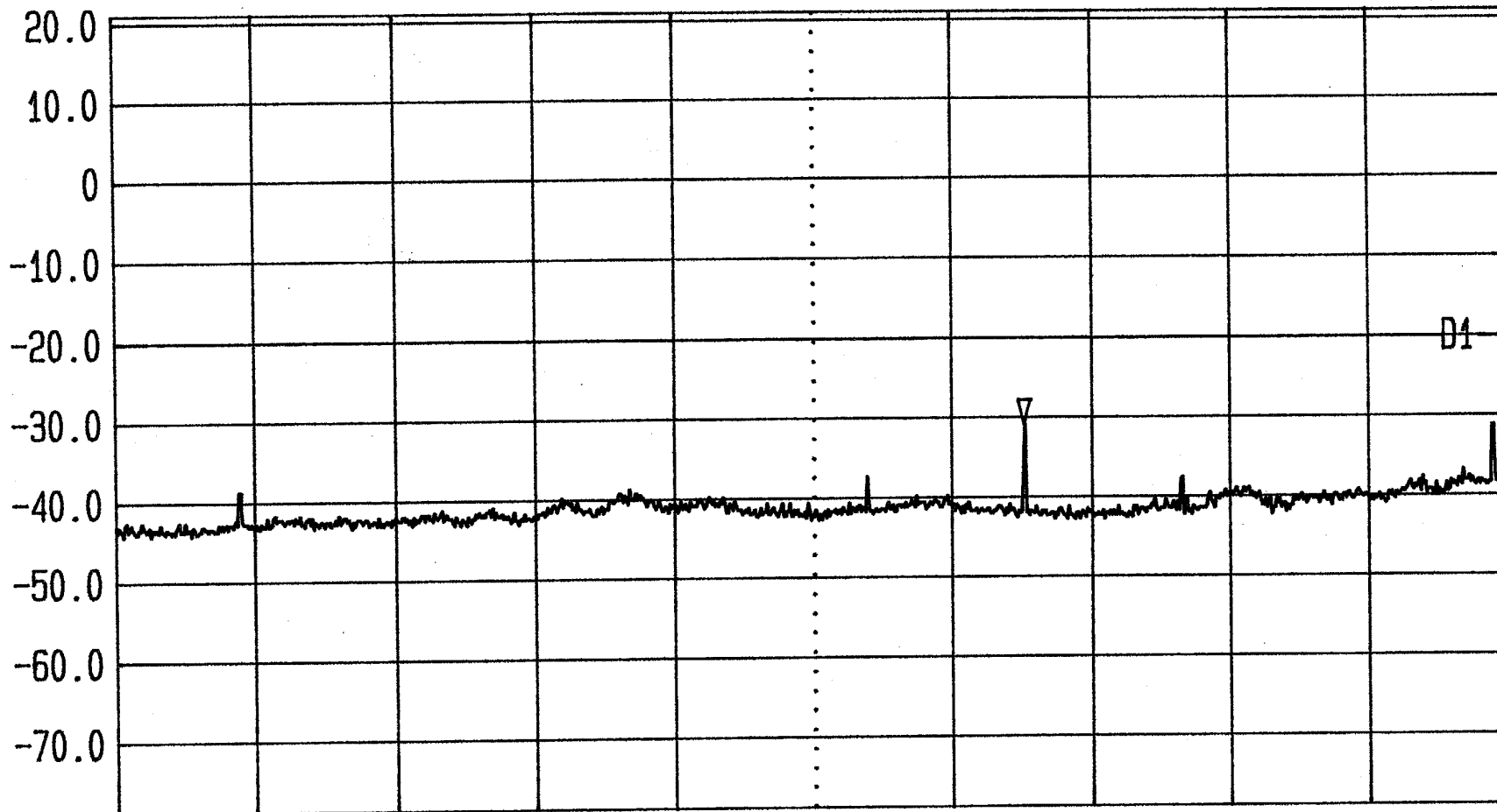
Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90:1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Centre Channel. GPH/39403/JD01/005





LVLOFF  
Date 28 Jul '99 Time 12:56:18  
Ref.Lvl 21.00 dBm  
Marker -30.90 dBm  
3.6088 GHz

Res.Bw 1.0 MHz [3dB] Vid.Bw 1 MHz  
CF.Stp 400.000 MHz RF.Att 0 dB  
Unit [dBm]



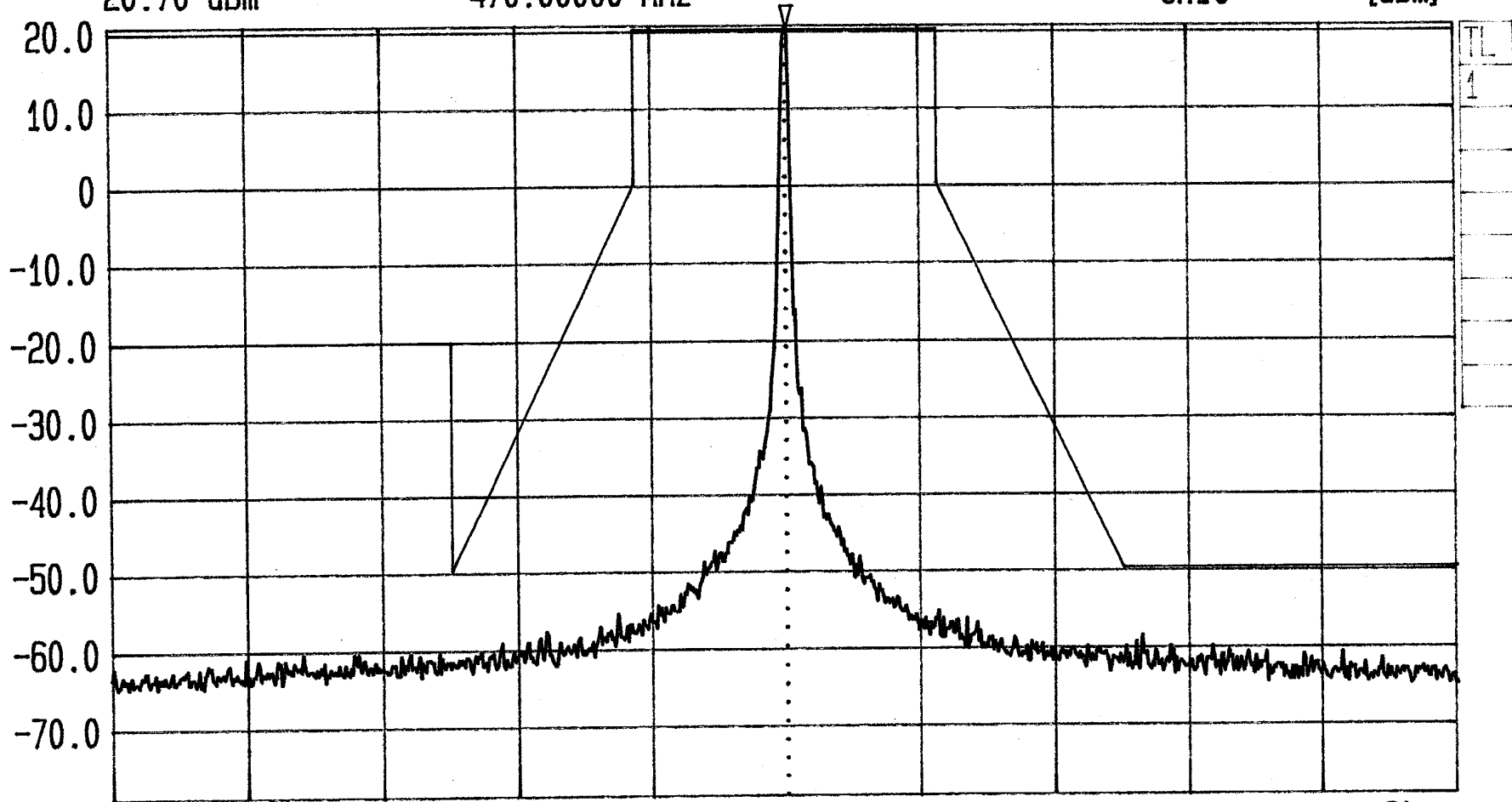
Start 1 GHz Span 4 GHz Center 3 GHz Sweep 20 ms Stop 5 GHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90:1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Centre Channel. GPH/39403/JD01/006



LVLOFF  
Date 26.Jul.'99 Time 14:22:57  
Ref.Lvl 20.70 dBm  
Marker 20.22 dBm  
470.00000 MHz

Res.Bw 100.0 Hz [3dB]  
TG.Lvl off  
CF.Stp 5.000 kHz  
Vid.Bw 100 Hz  
RF.Att 10 dB  
Unit [dBm]



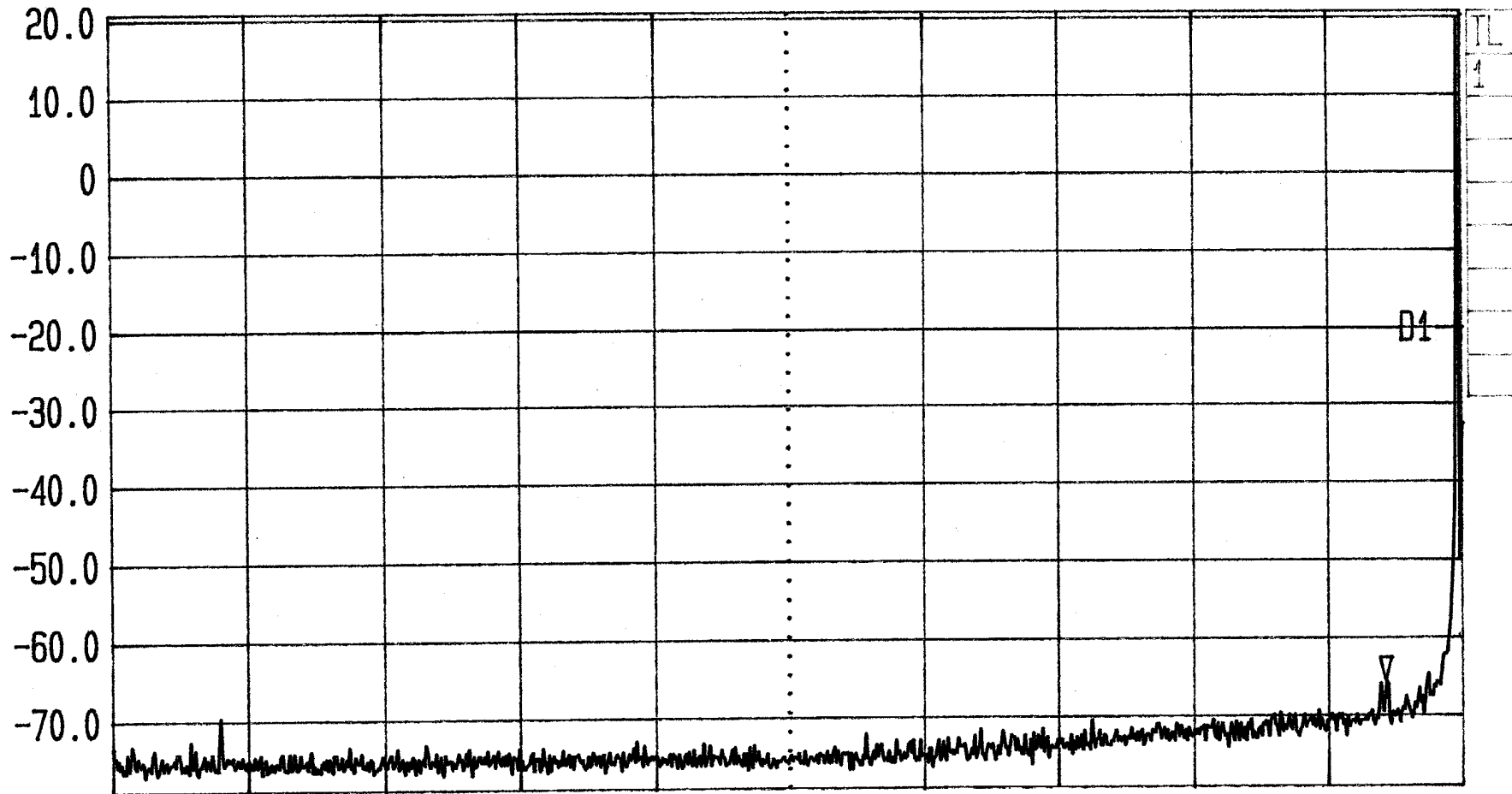
Start 469.975 MHz      Span 50 kHz      Center 470 MHz      Sweep 15.0 s      Stop 470.025 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas.      FCC Part 90: 1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated.      Top Channel.      GPH/39403/JD01/007



LVLOFF  
 Date 26 Jul '99 Time 14:28:11  
 Ref.Lvl 20.70 dBm  
 Marker -65.43 dBm  
 469.43 MHz

Res.Bw 1.0 kHz [3dB]  
 TG.Lvl off  
 CF.Stp 1.000 MHz  
 Vid.Bw 1 kHz  
 RF.Att Unit  
 10 dB [dBm]



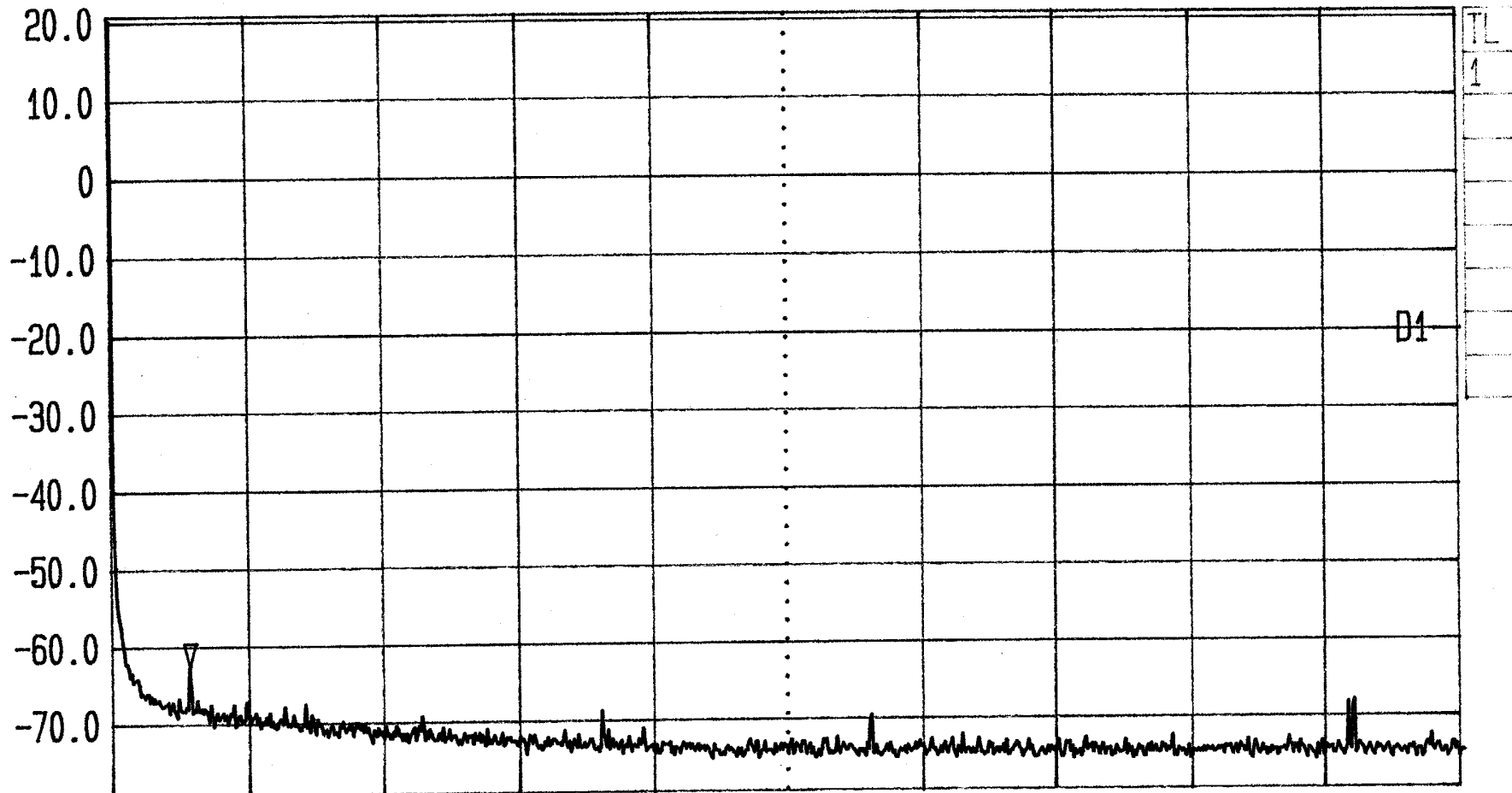
Start 460 MHz      Span 10 MHz      Center 465 MHz      Sweep 30 s      Stop 470 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas.      FCC Part 90: 1998  
 EUT: ST500. Part 90.210 (d). Tx Un-Modulated.      Top Channel.      GPH/39403/JD01/008



LVLOFF  
Date 26.Jul.'99 Time 14:43:00  
Ref.Lvl 20.70 dBm  
Marker -62.43 dBm  
470.56 MHz

Res.Bw 1.0 kHz [3dB]  
TG.Lvl off  
CF.Stp 1.000 MHz  
Vid.Bw 1 kHz  
RF.Att Unit  
10 dB [dBm]



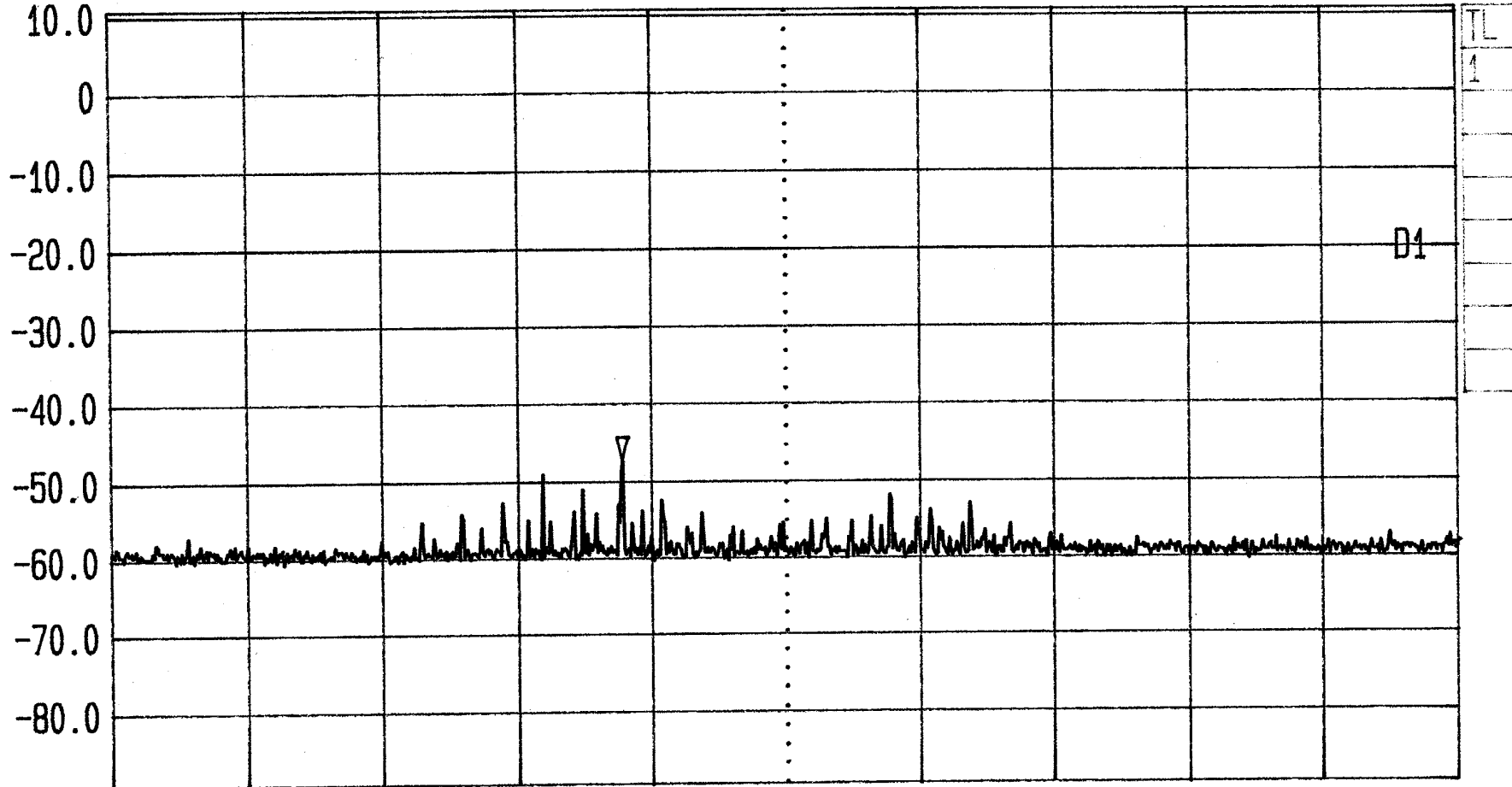
Start 470 MHz Span 10 MHz Center 475 MHz Sweep 30 s Stop 480 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90:1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Top Channel. GPH/39403/JD01/009



LVLOFF  
Date 26.Jul.'99 Time 14:49:36  
Ref.Lvl 10.70 dBm  
Marker -47.19 dBm  
192.4 MHz

Res.Bw 80.0 kHz [3dB]  
TG.Lvl off  
CF.Stp 43.000 MHz  
Vid.Bw 100 kHz  
RF.Att Unit  
0 dB [dBm]



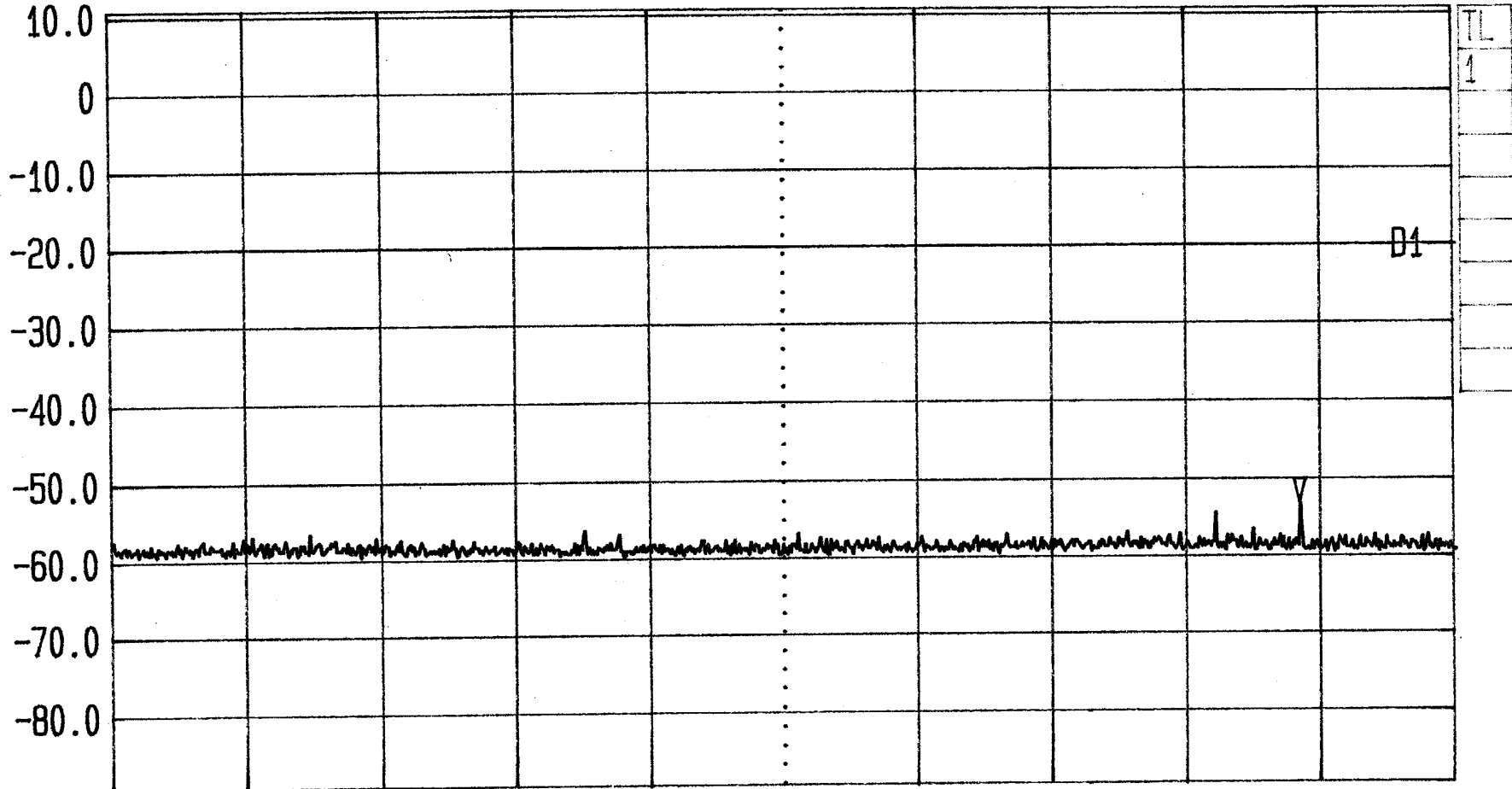
Start 30 MHz      Span 430 MHz      Center 245 MHz      Sweep 220 ms      Stop 460 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90: 1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Top Channel. GPH/39403/JD01/010



LVLOFF  
Date 26.Jul.'99 Time 15:01:38  
Ref.Lvl 10.70 dBm  
Marker -53.08 dBm  
939.9 MHz

Res.Bw 80.0 kHz [3dB]  
TG.Lvl off  
CF.Stp 52.000 MHz  
Vid.Bw 100 kHz  
RF.Att Unit 0 dB [dBm]



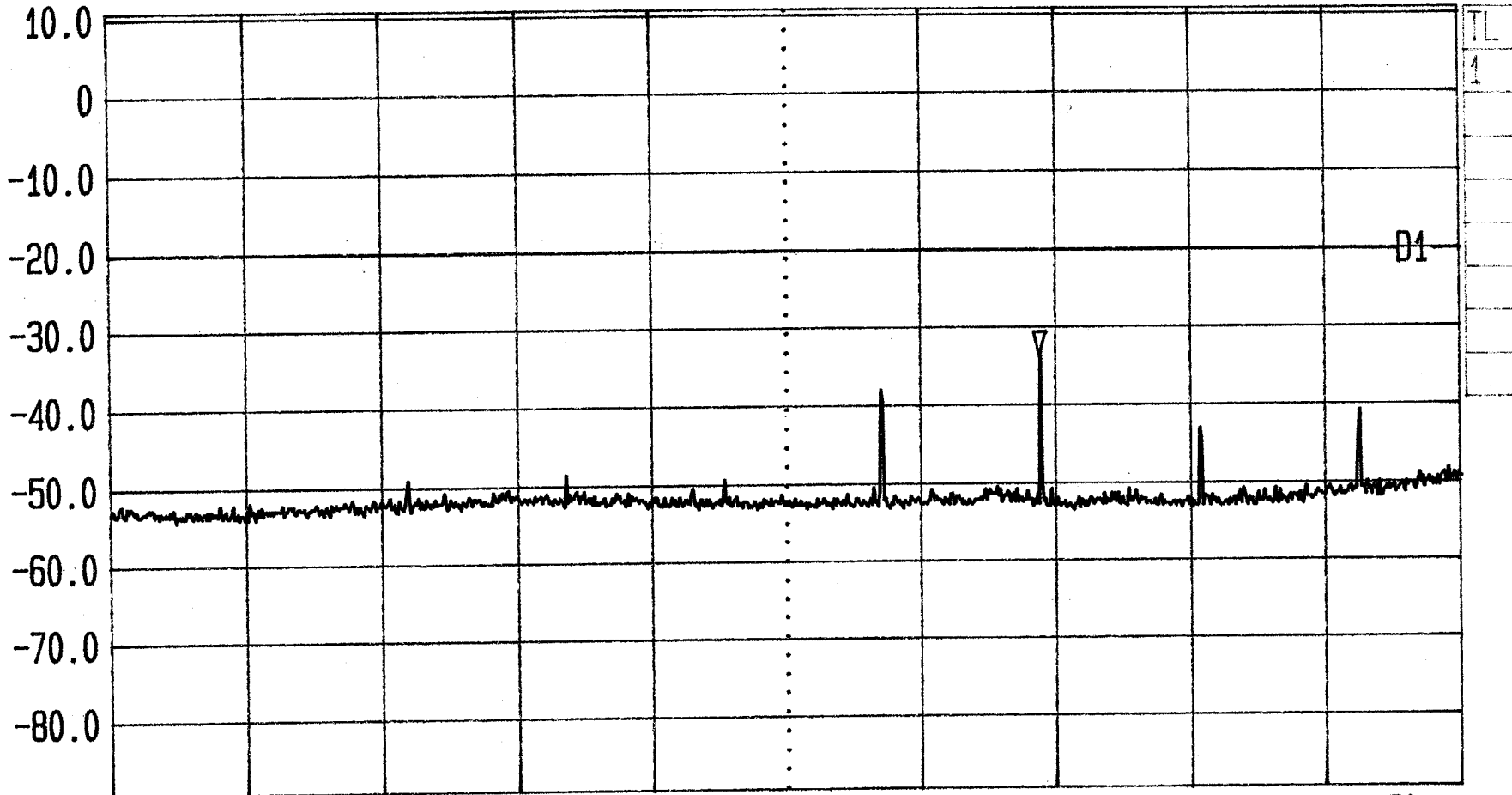
Start 480 MHz      Span 520 MHz      Center 740 MHz      Sweep 260 ms      Stop 1 GHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas.      FCC Part 90: 1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated.      Top Channel.      GPH/39403/JD01/011



LVLOFF  
 Date 26.Jul.'99 Time 15:06:59  
 Ref.Lvl 10.70 dBm  
 Marker -33.68 dBm  
 3.7555 GHz

Res.Bw 1.0 MHz [3dB]  
 TG.Lvl off  
 CF.Stp 400.000 MHz  
 Vid.Bw 1 MHz  
 RF.Att 0 dB  
 Unit [dBm]



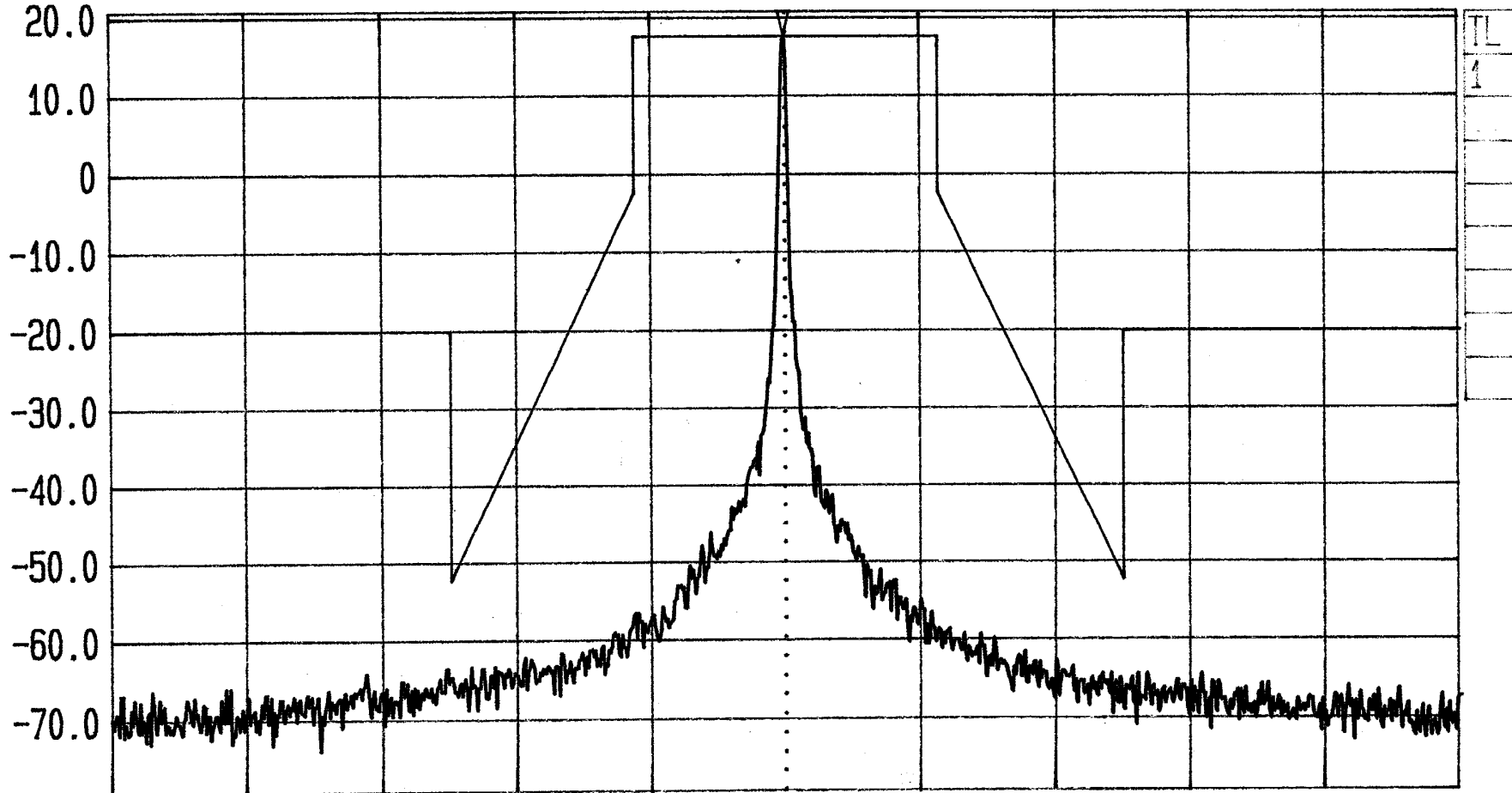
Start 1 GHz      Span 4 GHz      Center 3 GHz      Sweep 20 ms      Stop 5 GHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas.      FCC Part 90: 1998  
 EUT: ST500. Part 90.210 (d). Tx Un-Modulated.      Top Channel.      GPH/39403/JD01/012



LVLOFF  
Date 26.Jul.'99 Time 15:53:36  
Ref.Lvl 20.70 dBm  
Marker 17.86 dBm  
429.99994 MHz

Res.Bw 100.0 Hz [3dB]  
TG.Lvl off  
CF.Stp 5.000 kHz  
Vid.Bw 100 Hz  
RF.Att Unit 0 dB [dBm]



Start 429.975 MHz      Span 50 kHz      Center 430 MHz      Sweep 15.0 s      Stop 430.025 MHz

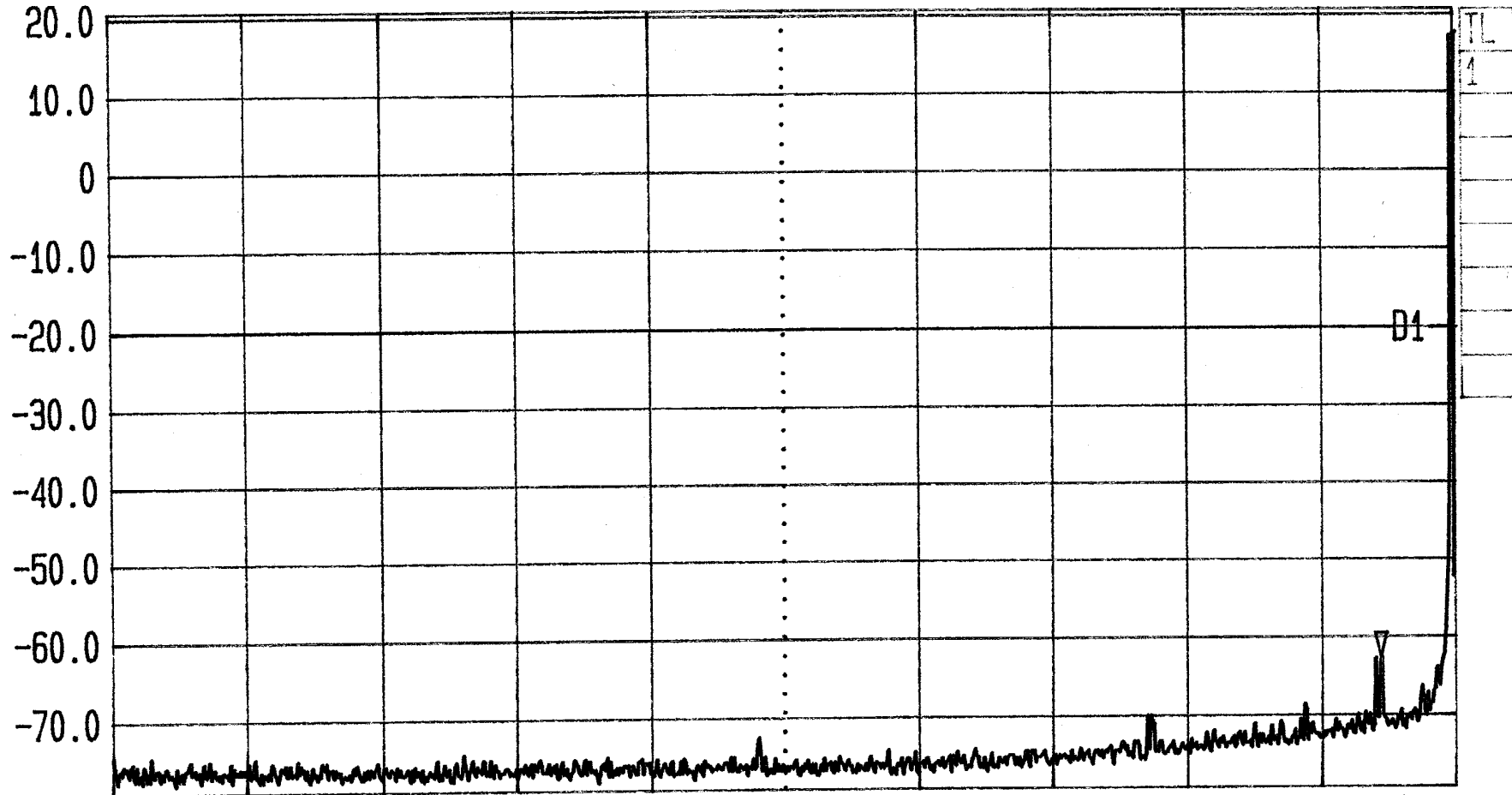
Conducted Antenna Port. Tested by RFI for Wood and Douglas.      FCC Part 90: 1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Bottom Channel.      GPH/39403/JD01/013





LVLOFF  
Date 26.Jul.'99 Time 15:58:51  
Ref.Lvl 20.70 dBm  
Marker -62.38 dBm  
429.44 MHz

Res.Bw 1.0 kHz [3dB]  
TG.Lvl off  
CF.Stp 1.000 MHz  
Vid.Bw 1 kHz  
RF.Att Unit  
0 dB [dBm]



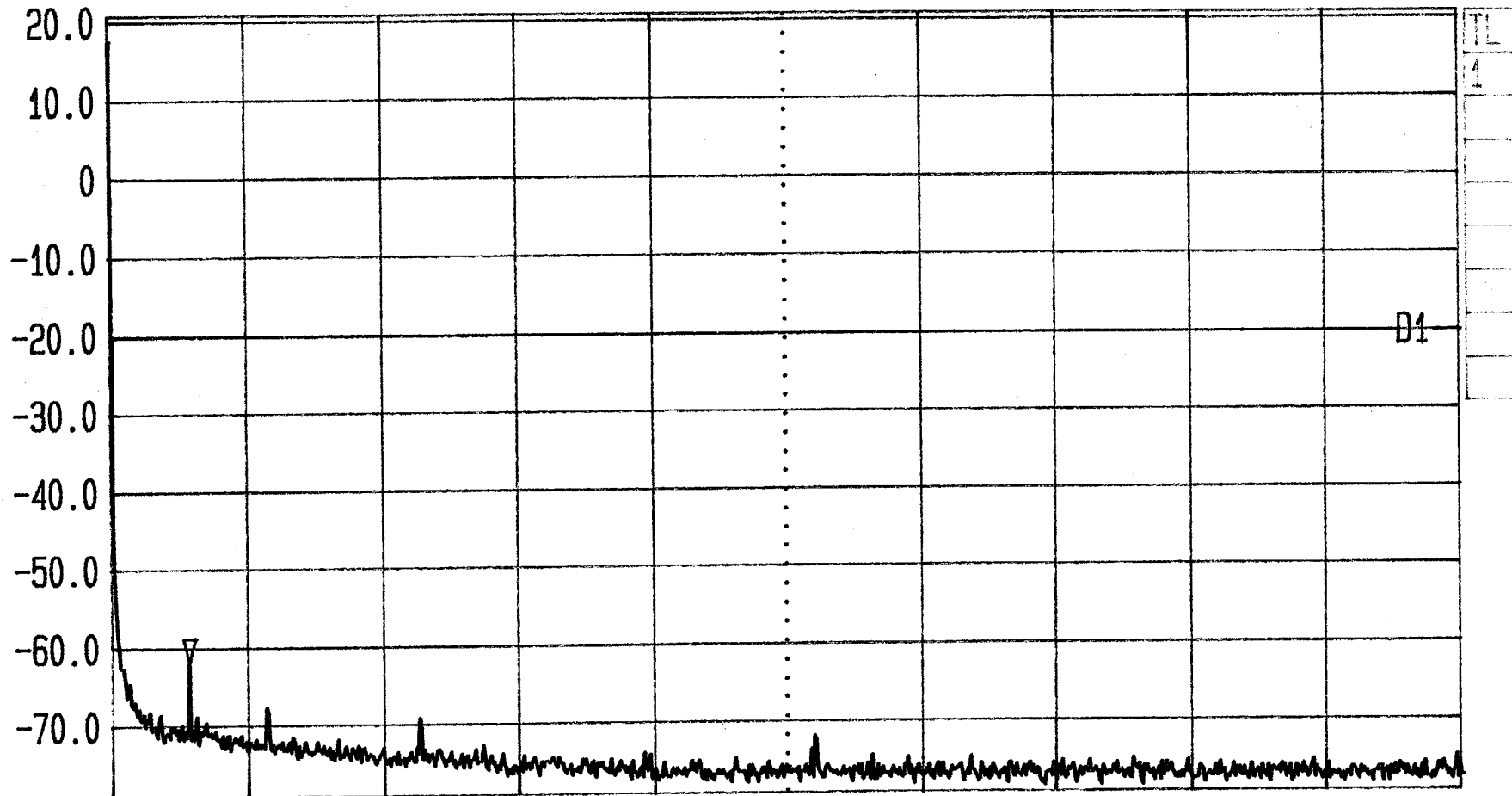
Start 420 MHz Span 10 MHz Center 425 MHz Sweep 30 s Stop 430 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90:1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Bottom Channel. GPH/39403/JD01/014



LVLOFF  
Date 26.Jul.'99 Time 16:04:25  
Ref.Lvl 20.70 dBm  
Marker -61.70 dBm  
430.56 MHz

Res.Bw 1.0 kHz [3dB]  
TG.Lvl off  
CF.Stp 1.000 MHz  
Vid.Bw 1 kHz  
RF.Att 0 dB  
Unit [dBm]



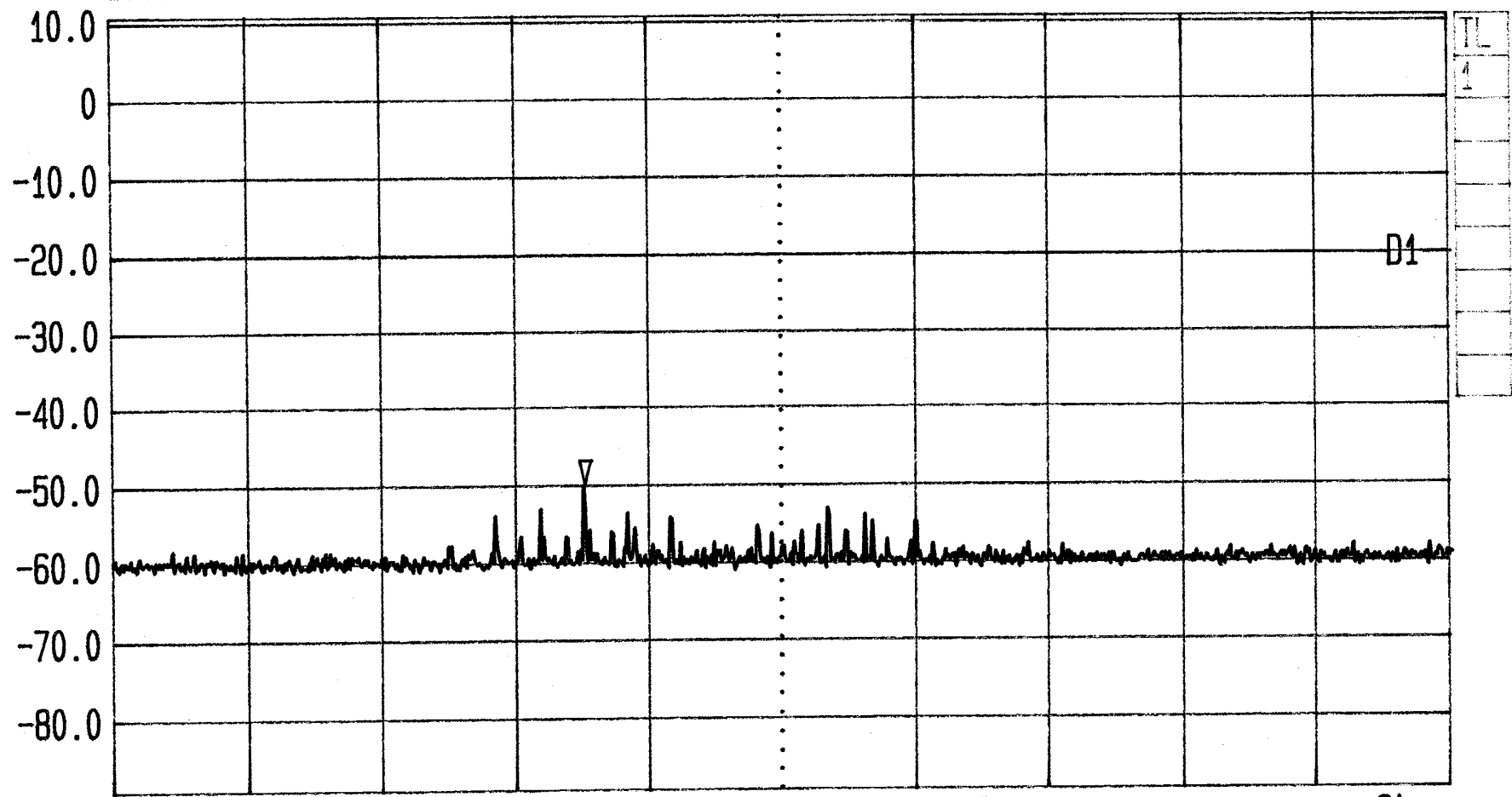
Start 430 MHz Span 10 MHz Center 435 MHz Sweep 30 s Stop 440 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90: 1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Bottom Channel. GPH/39403/JD01/015



LVLOFF  
Date 26.Jul.'99 Time 16:09:47  
Ref.Lvl 10.70 dBm  
Marker -49.68 dBm  
166.5 MHz

Res.Bw 80.0 kHz [3dB]  
TG.Lvl off  
CF.Stp 39.000 MHz  
Vid.Bw 100 kHz  
RF.Att 0 dB  
Unit [dBm]



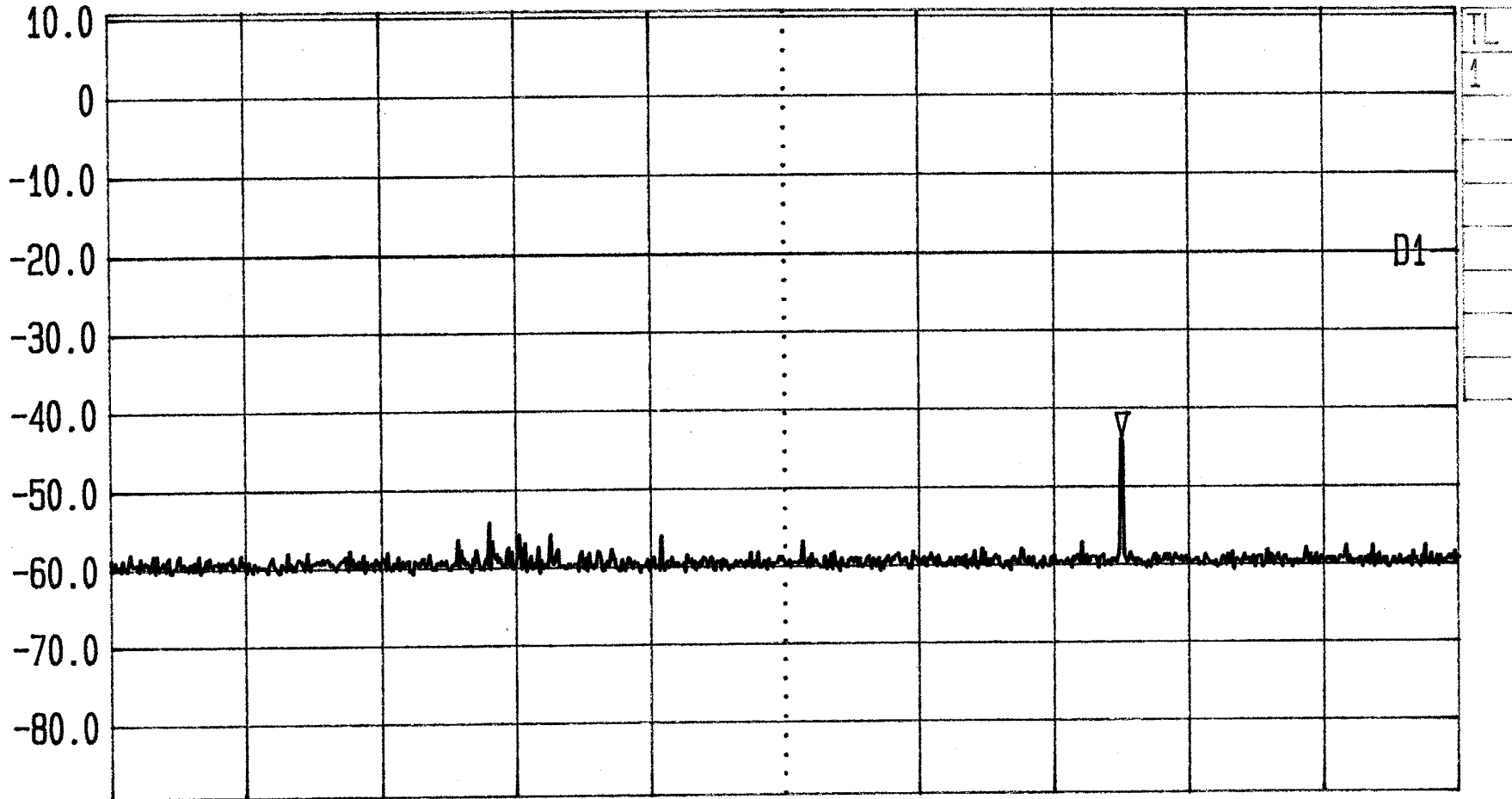
Start 30 MHz      Span 390 MHz      Center 225 MHz      Sweep 200 ms      Stop 420 MHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90: 1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Bottom Channel. GPH/39403/JD01/016



LVLOFF  
Date 26.Jul.'99 Time 16:15:05  
Ref.Lvl 10.70 dBm  
Marker -43.64 dBm  
860.0 MHz

Res.Bw 80.0 kHz [3dB]  
TG.Lvl off  
CF.Stp 56.000 MHz  
Vid.Bw 100 kHz  
RF.Att Unit  
0 dB [dBm]



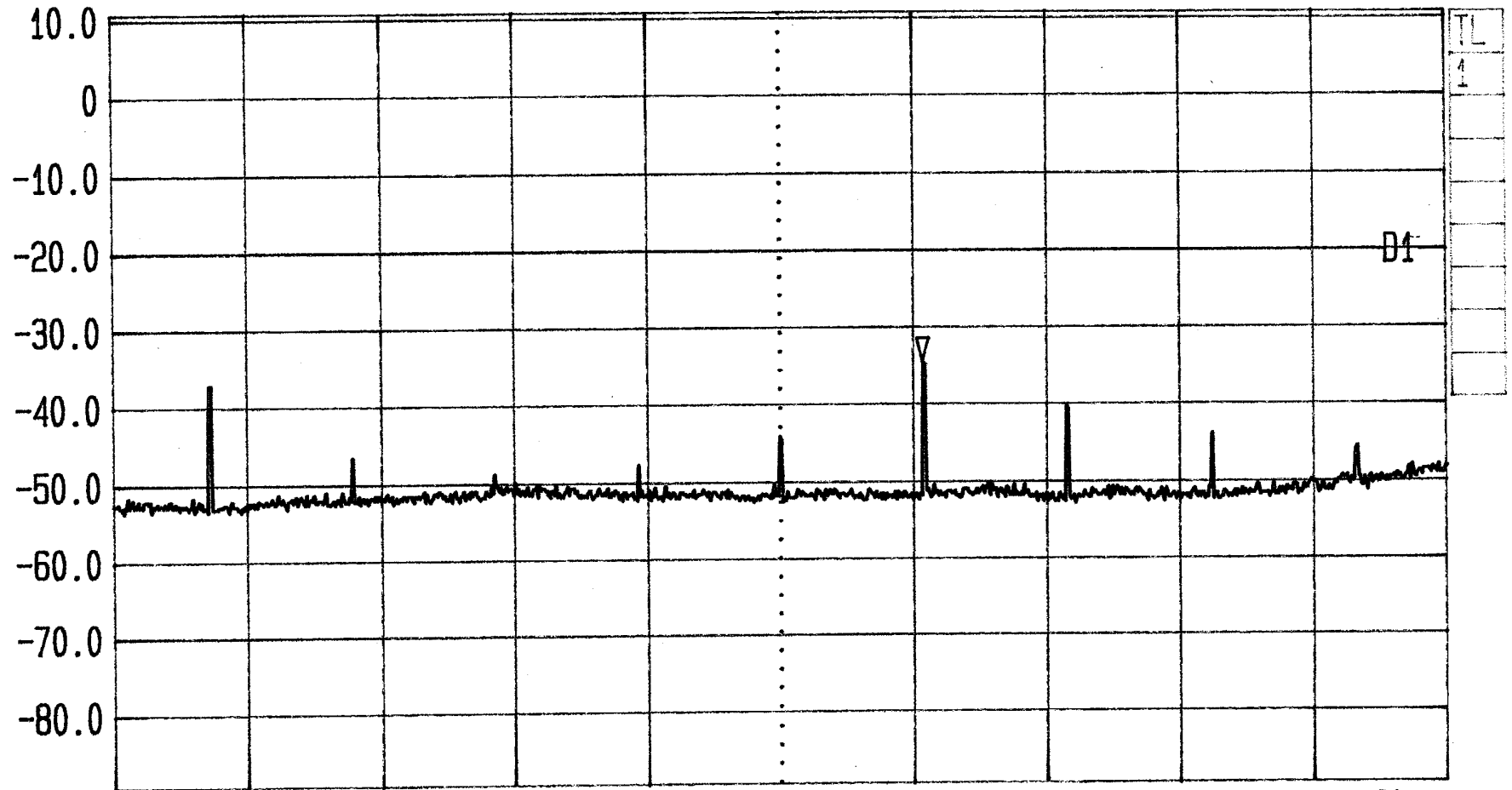
Start 440 MHz Span 560 MHz Center 720 MHz Sweep 280 ms Stop 1 GHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90:1998  
EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Bottom Channel. GPH/39403/JD01/017



LVLOFF  
 Date 26.Jul.'99 Time 16:30:20  
 Ref.Lvl 10.70 dBm  
 Marker -34.50 dBm  
 3.4311 GHz

Res.Bw 1.0 MHz [3dB]  
 TG.Lvl off  
 CF.Stp 400.000 MHz  
 Vid.Bw 1 MHz  
 RF.Att 0 dB  
 Unit [dBm]



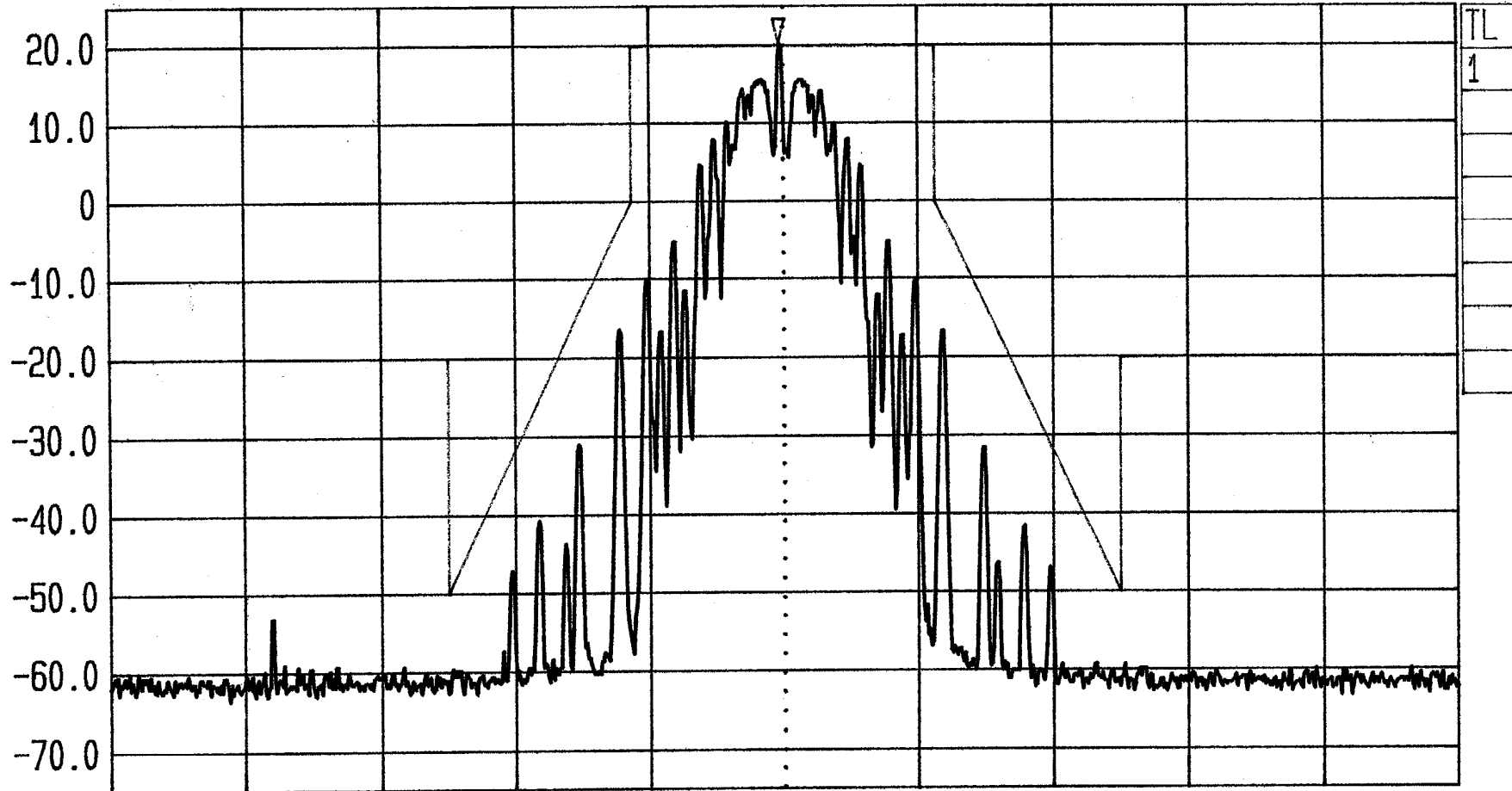
Start 1 GHz      Span 4 GHz      Center 3 GHz      Sweep 20 ms      Stop 5 GHz

Conducted Antenna Port. Tested by RFI for Wood and Douglas.      FCC Part 90:1998  
 EUT: ST500. Part 90.210 (d). Tx Un-Modulated. Bottom Channel.      GPH/39403/JD01/018



LVLOFF  
Date 28.Jul.'99 Time 11:21:34  
Ref.Lvl 25.00 dBm  
Marker 20.33 dBm  
469.99988 MHz

Res.Bw 100.0 Hz [3dB] Vid.Bw 100 Hz  
CF.Stp 5.000 kHz RF.Att 25 dB  
Unit [dBm]



TL
1

Start 469.975 MHz Span 50 kHz Center 470 MHz Sweep 15.0 s Stop 470.025 MHz

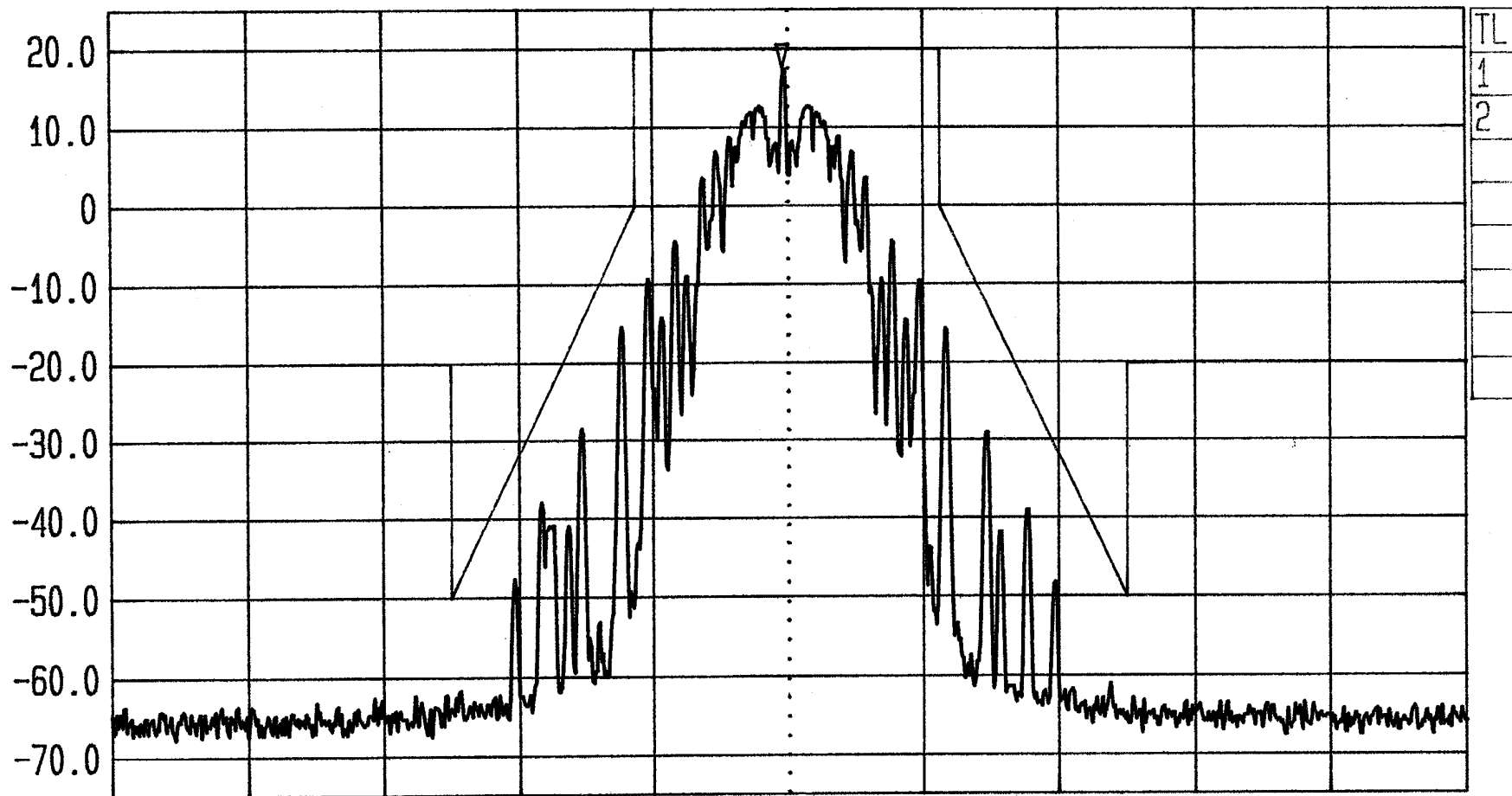
Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90:1998  
EUT: ST500. Part 90.211(a). Tx Modulated. Top Channel. GPH/39403/JD01/019





LVLOFF  
 Date 28.Jul.'99 Time 12:05:18  
 Ref.Lvl 25.00 dBm  
 Marker 17.64 dBm  
 429.99983 MHz

Res.Bw 100.0 Hz [3dB] Vid.Bw 100 Hz  
 CF.Stp 5.000 kHz RF.Att Unit 25 dB [dBm]



Start 429.975 MHz Span 50 kHz Center 430 MHz Sweep 15.0 s Stop 430.025 MHz

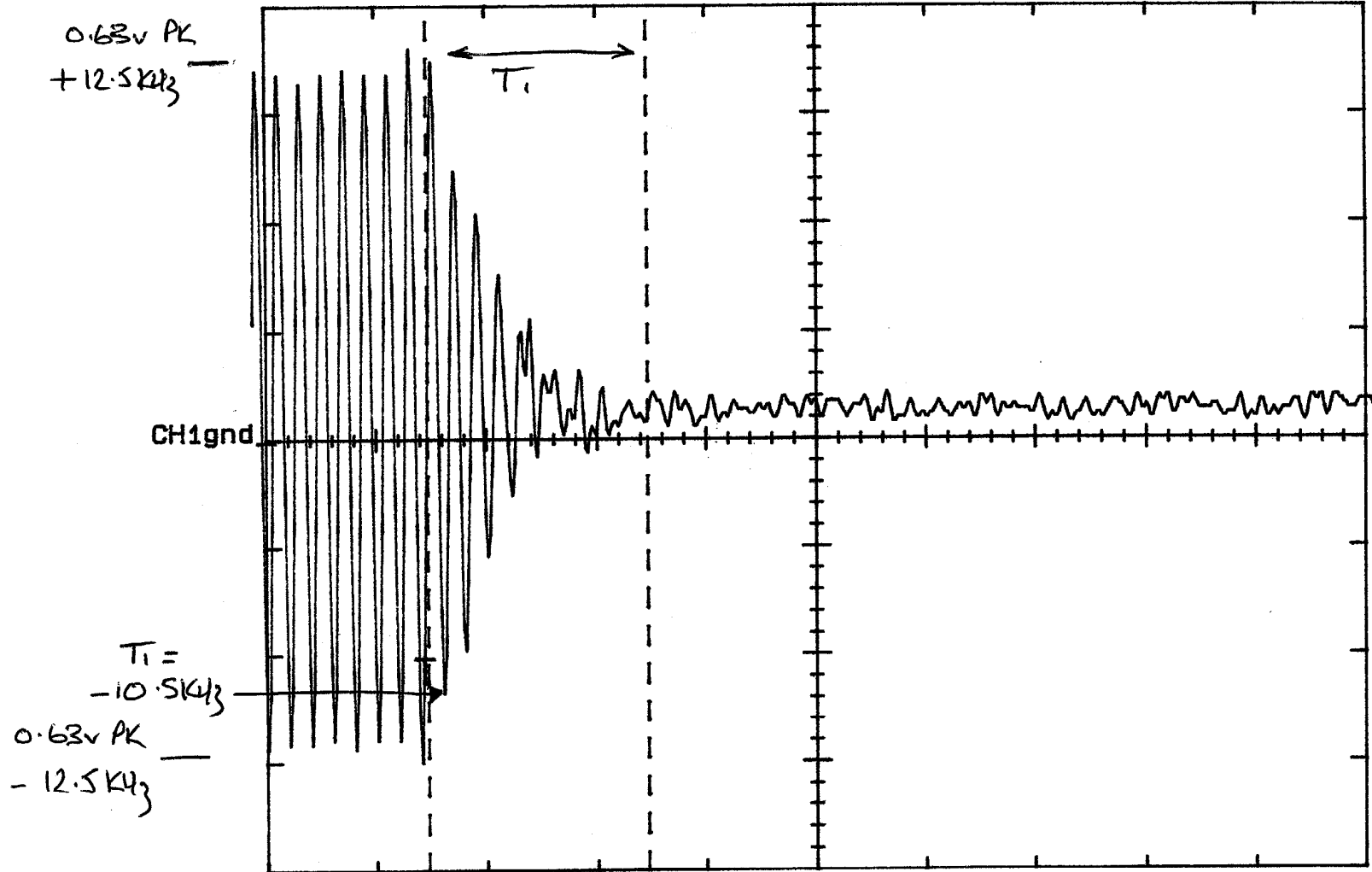
Conducted Antenna Port. Tested by RFI for Wood and Douglas. FCC Part 90: 1998  
 EUT: ST500. Part 90.211(a). Tx Modulated. Bottom Channel. GPH/39403/JD01/021



CH1 200mV

A 5ms -628mV VERT

10.000ms



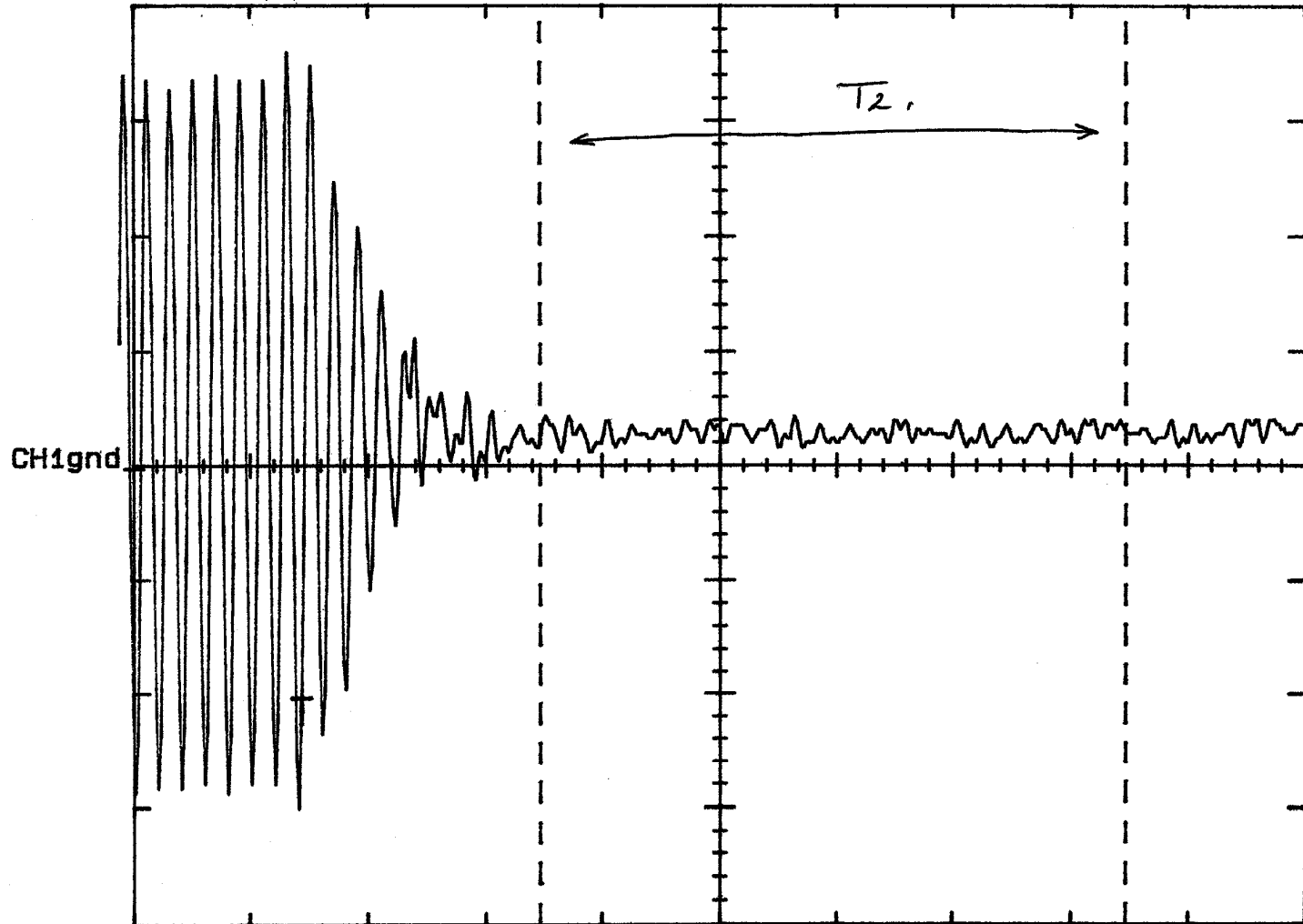
BOTTOM CHANNEL 430 MHz.

GP4 | 39403 ID01 | 022

CH1 200mV

A 5ms -628mV VERT

25.000ms

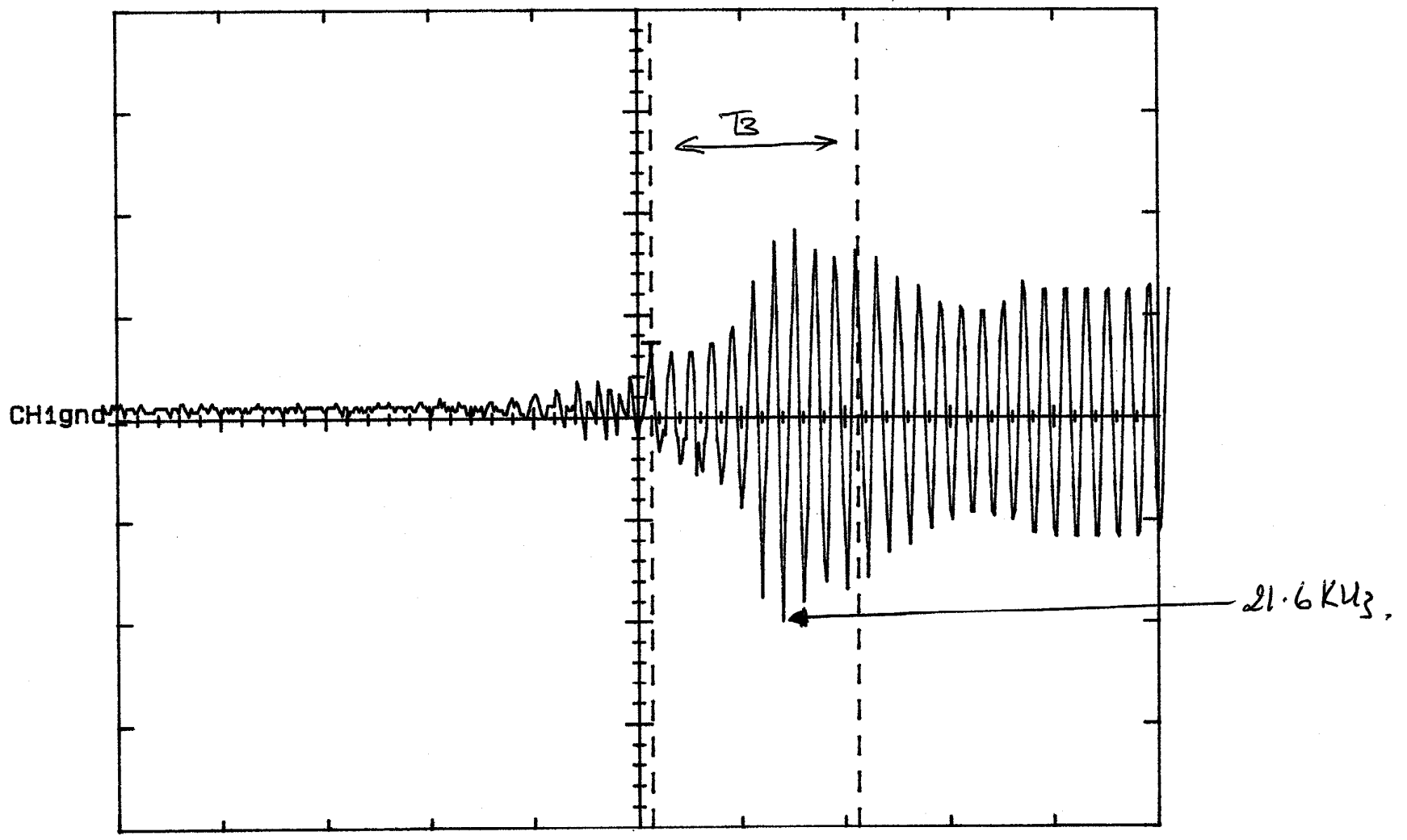


BOTTOM CHANNEL 430 MHz

QPH/39A03J001/023

CH1 500mV A 5ms -621mV VERT

10.000ms



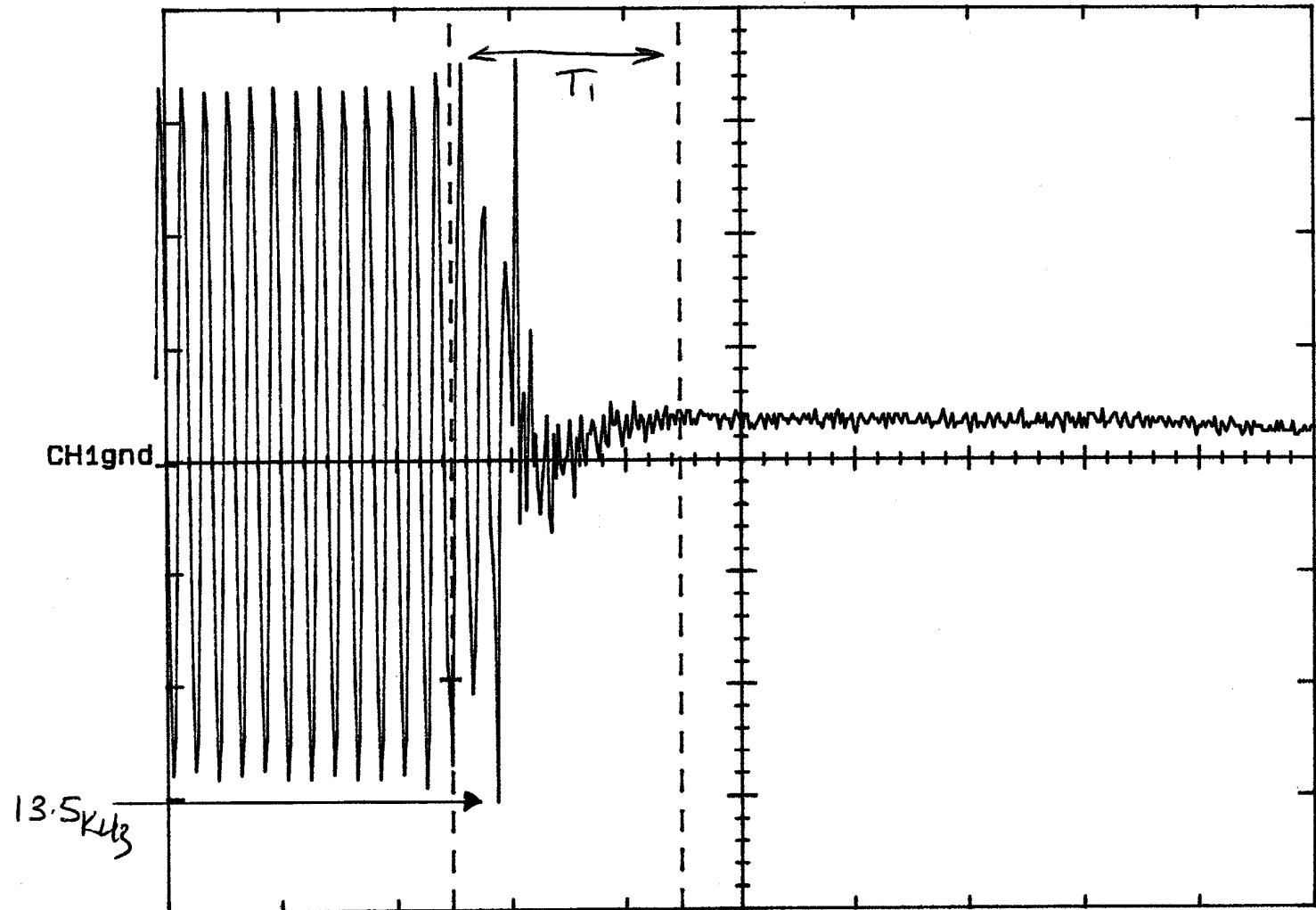
BOTTOM CHANNEL 430 MHz,

GPU (39403 JDO1) 024

CH1 200mV

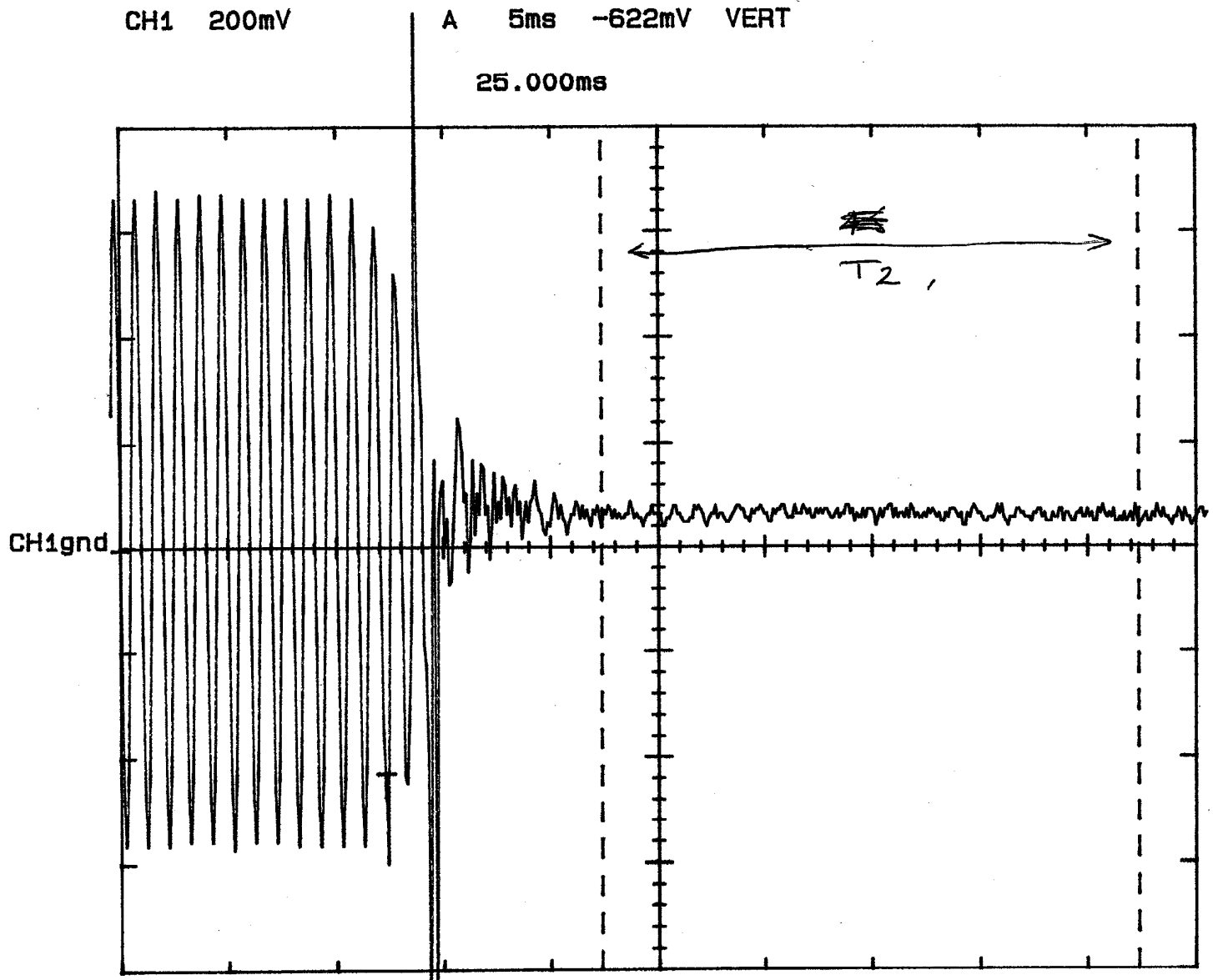
A 5ms -622mV VERT

10.000ms



MIDDLE CHANNEL 450 MHz

QP14 | 39403 001 | 025



MIDDLE CHANNEL

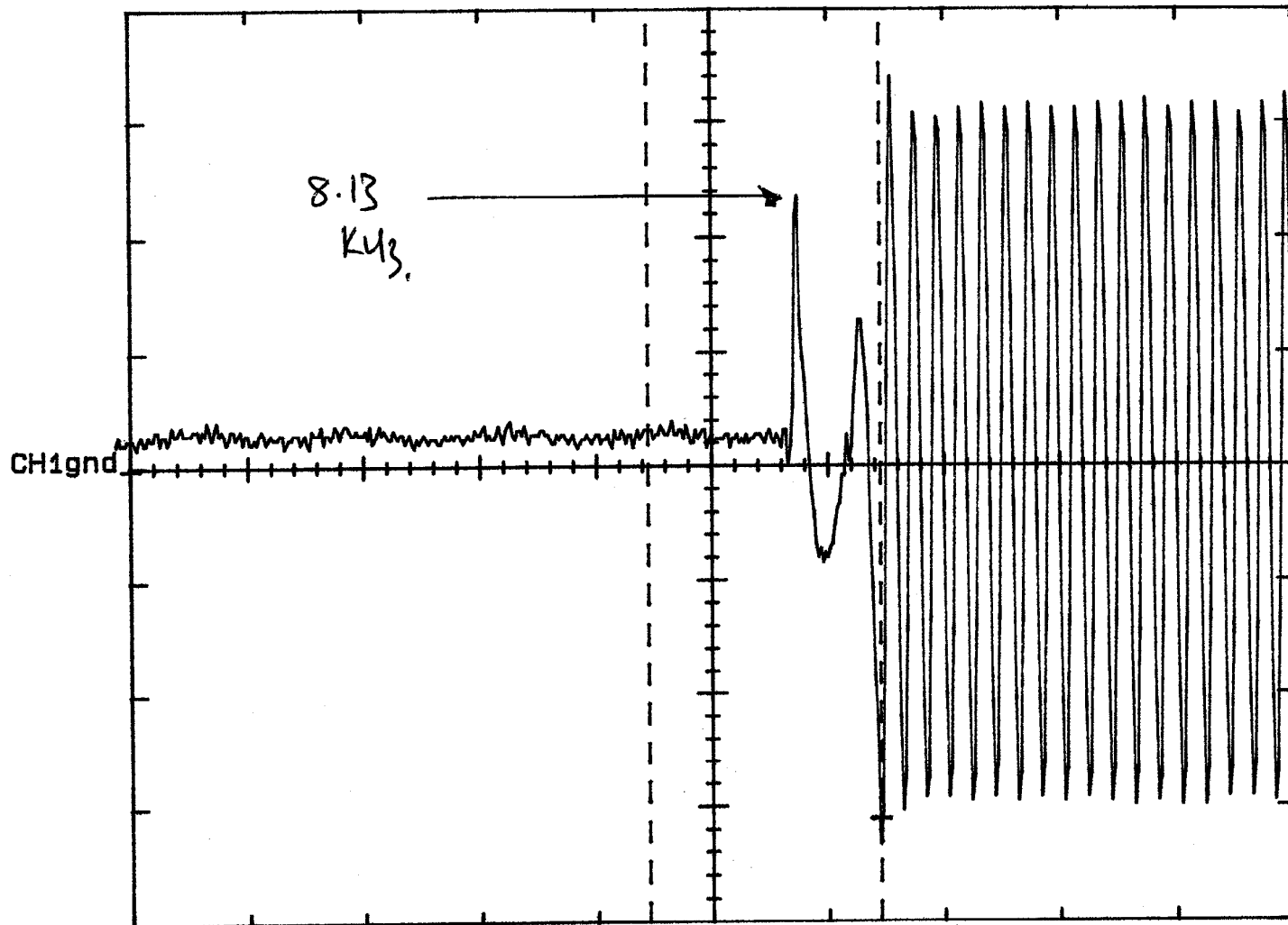
450 MHz

9PH/39403 JDO1/026

CH1 200mV

A 5ms -622mV VERT

10.000ms

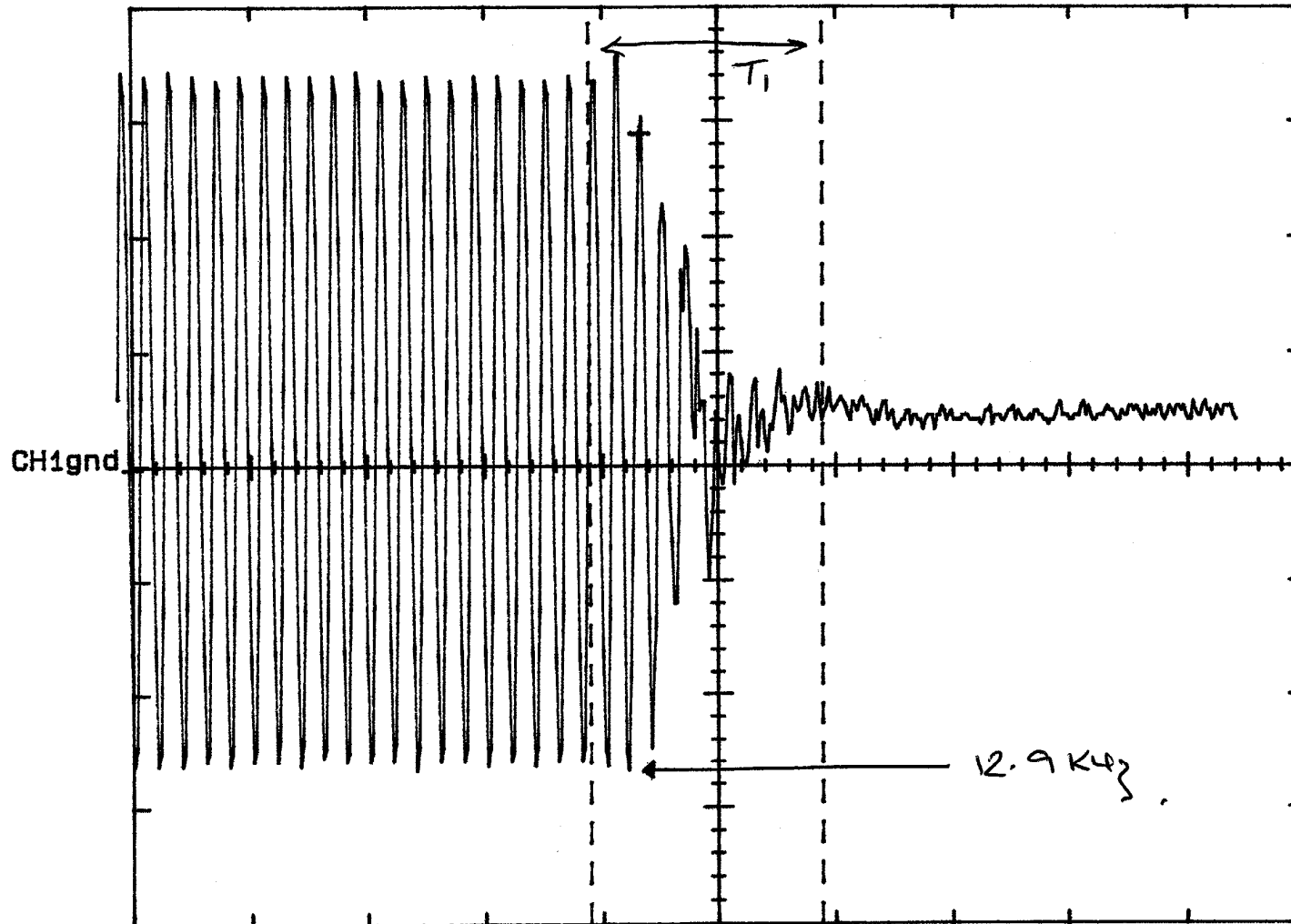


MIDDLE CHANNEL 450 MHz.

GPH/39403J001/027

CH1 200mV A 5ms 744mV VERT

10.000ms



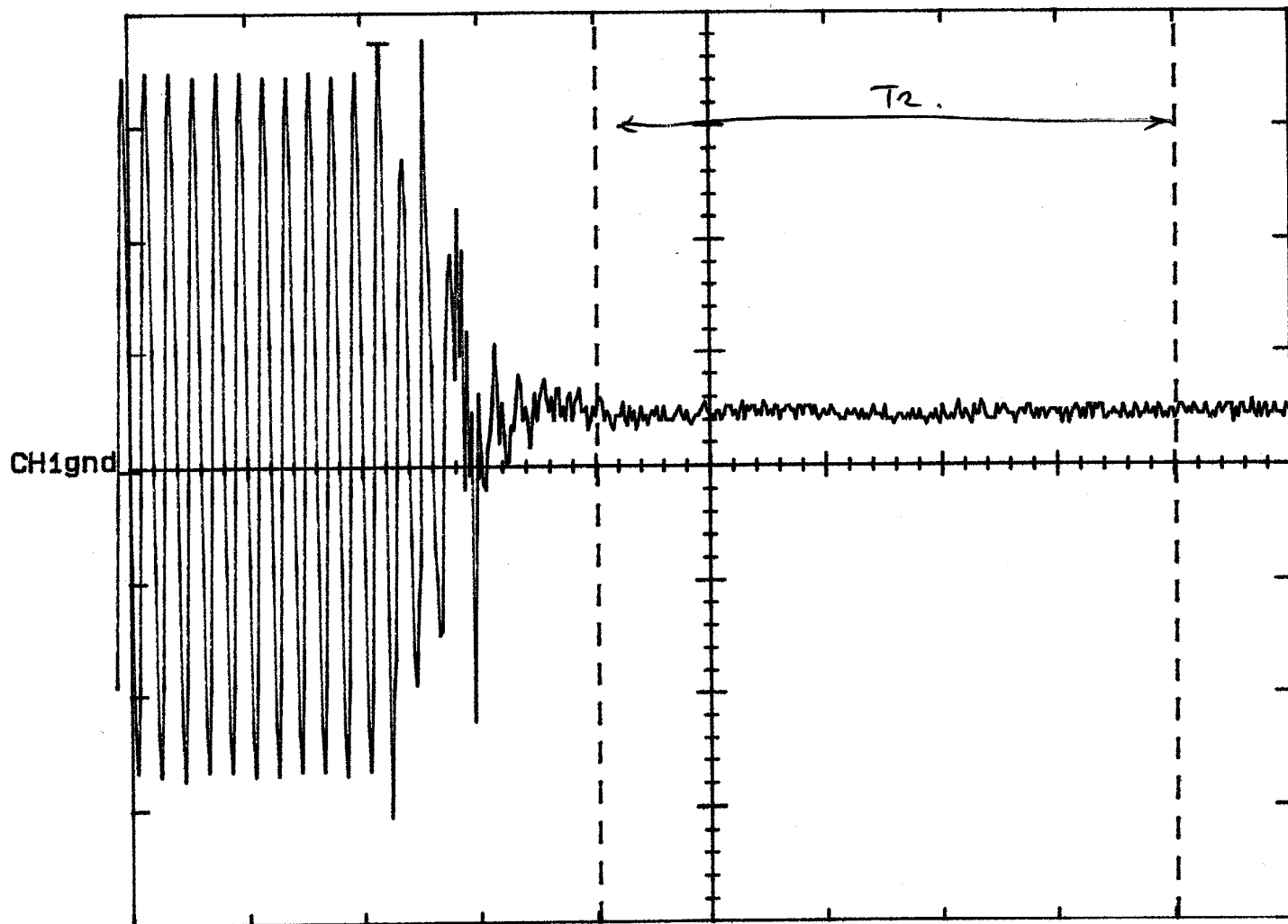
TOP CHANNEL 470 MHz

QPH/39403J001/028

CH1 200mV

A 5ms 744mV VERT

25.000ms



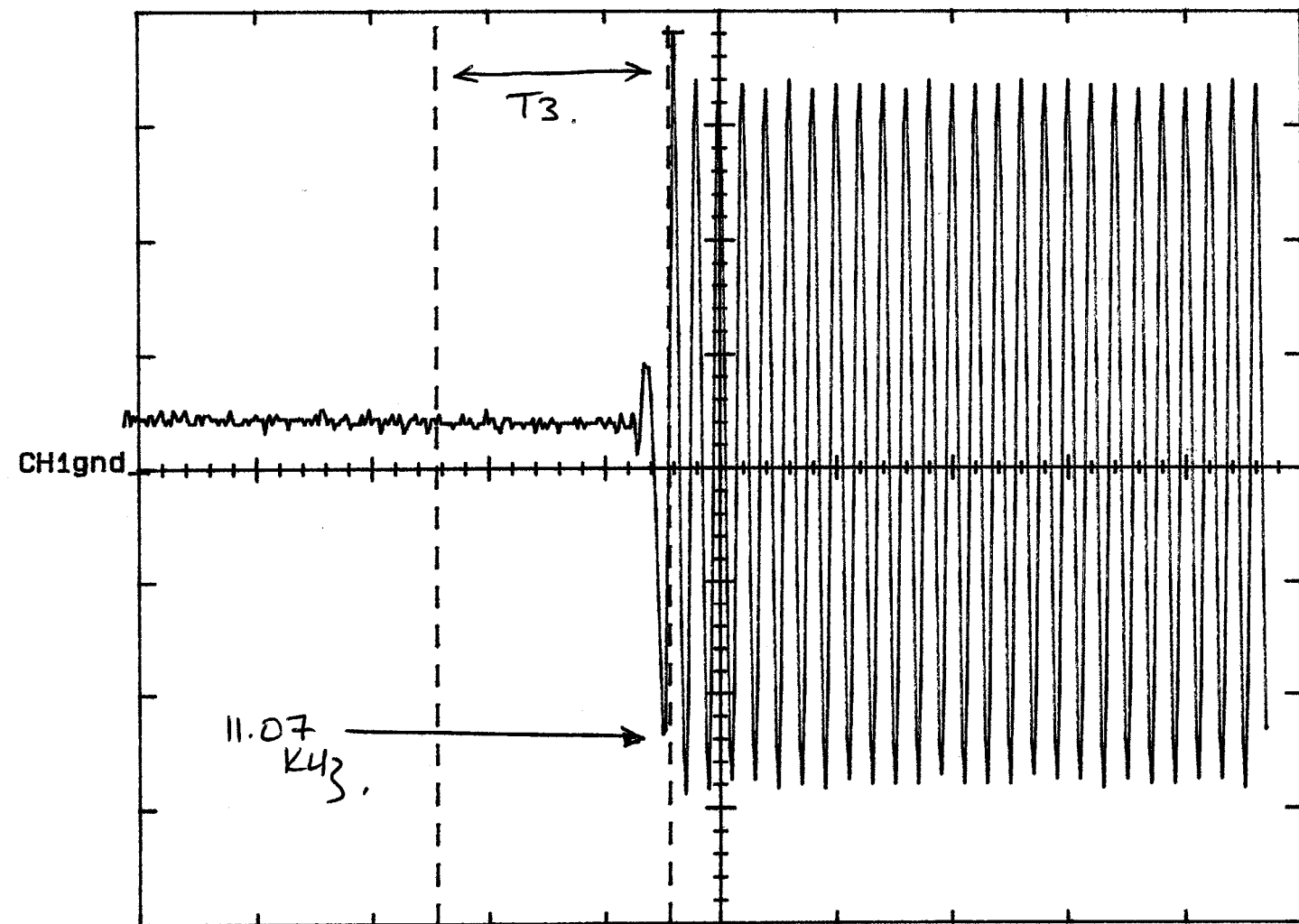
Top Channel 470 MHz

9P4/39403 J001/029



CH1 200mV A 5ms 744mV VERT

10.000ms



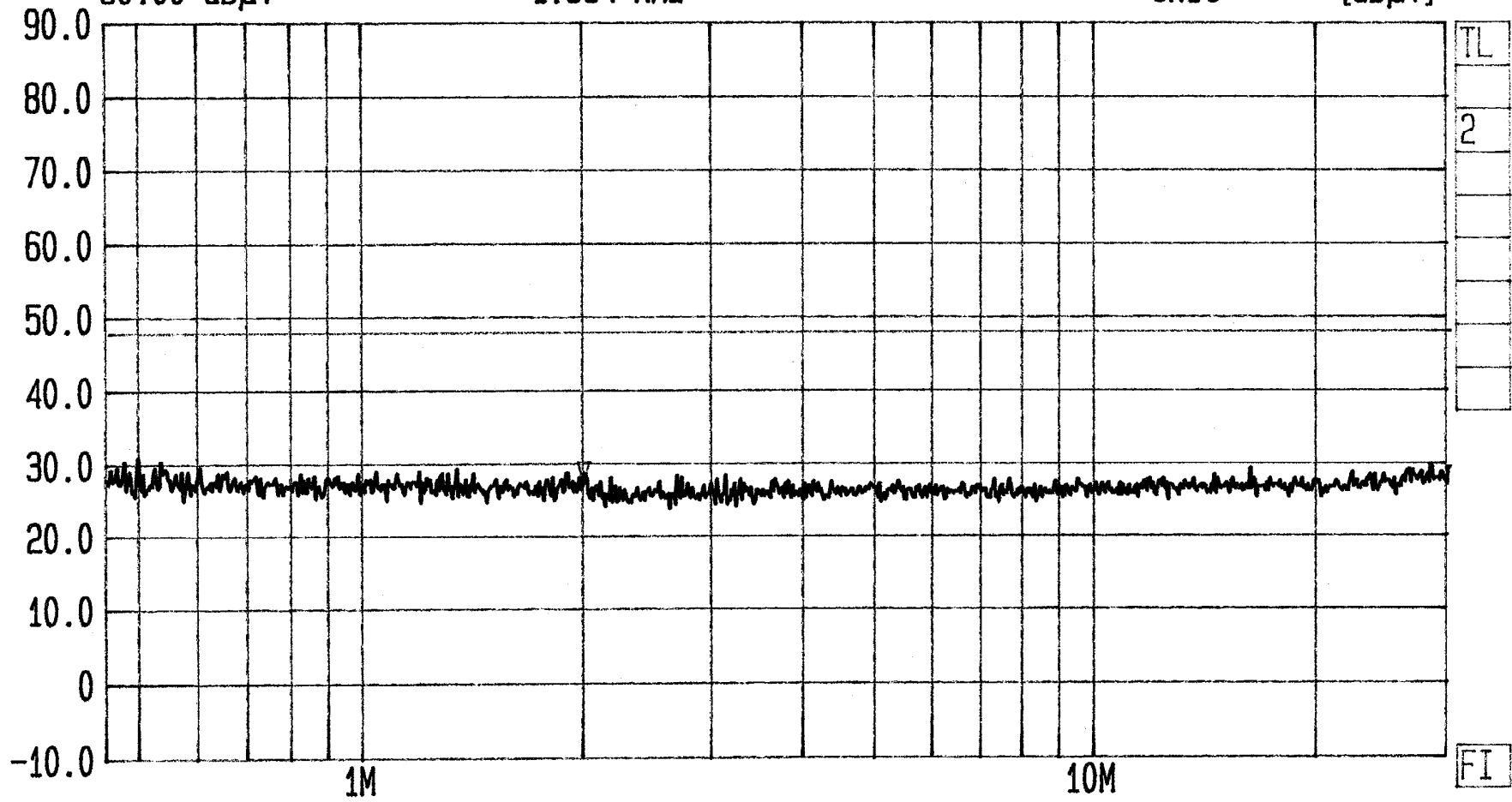
TOP CHANNEL 470 MHz

9PH/89403 J001/030



Date 27.Jul.'99 Time 10:33:24  
 Ref.Lvl 90.00 dBμV  
 Marker 27.18 dBμV  
 1.984 MHz

Res.Bw 9 kHz [imp] Vid.Bw 100 kHz  
 TG.Lvl off  
 CF.Stp 2.955 MHz RF.Att 20 dB  
 Unit [dBμV]



Start 450 kHz Span 29.55 MHz Center 3.67423 MHz Sweep 2.2 s Stop 30 MHz

Conducted Emissions. (Live) Tested by RFI for Wood and Douglas. FCC part 15 Subpart C  
 EUT: ST500. Part 15.207. TX Un-Modulated. Bottom Channel. GPH/39403/JD01/101



Date 27.Jul.'99 Time 11:02:04

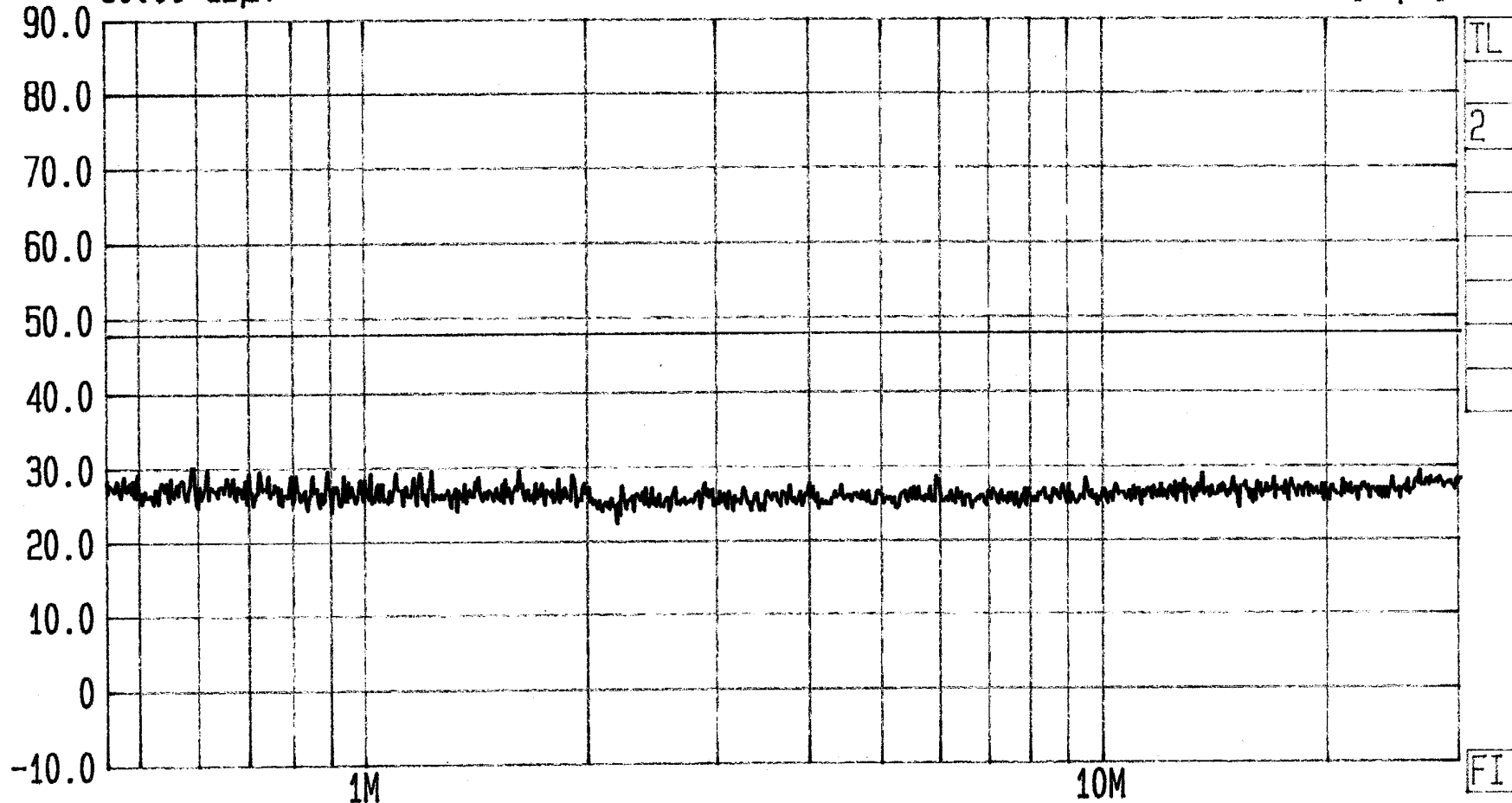
Ref.Lvl  
90.00 dBμV

Res.Bw  
TG.Lvl  
CF.Stp

9 kHz [imp]  
off  
2.955 MHz

Vid.Bw  
RF.Att  
Unit

100 kHz  
20 dB  
[dBμV]



Start  
450 kHz

Span  
29.55 MHz

Center  
3.67423 MHz

Sweep  
2.2 s

Stop  
30 MHz

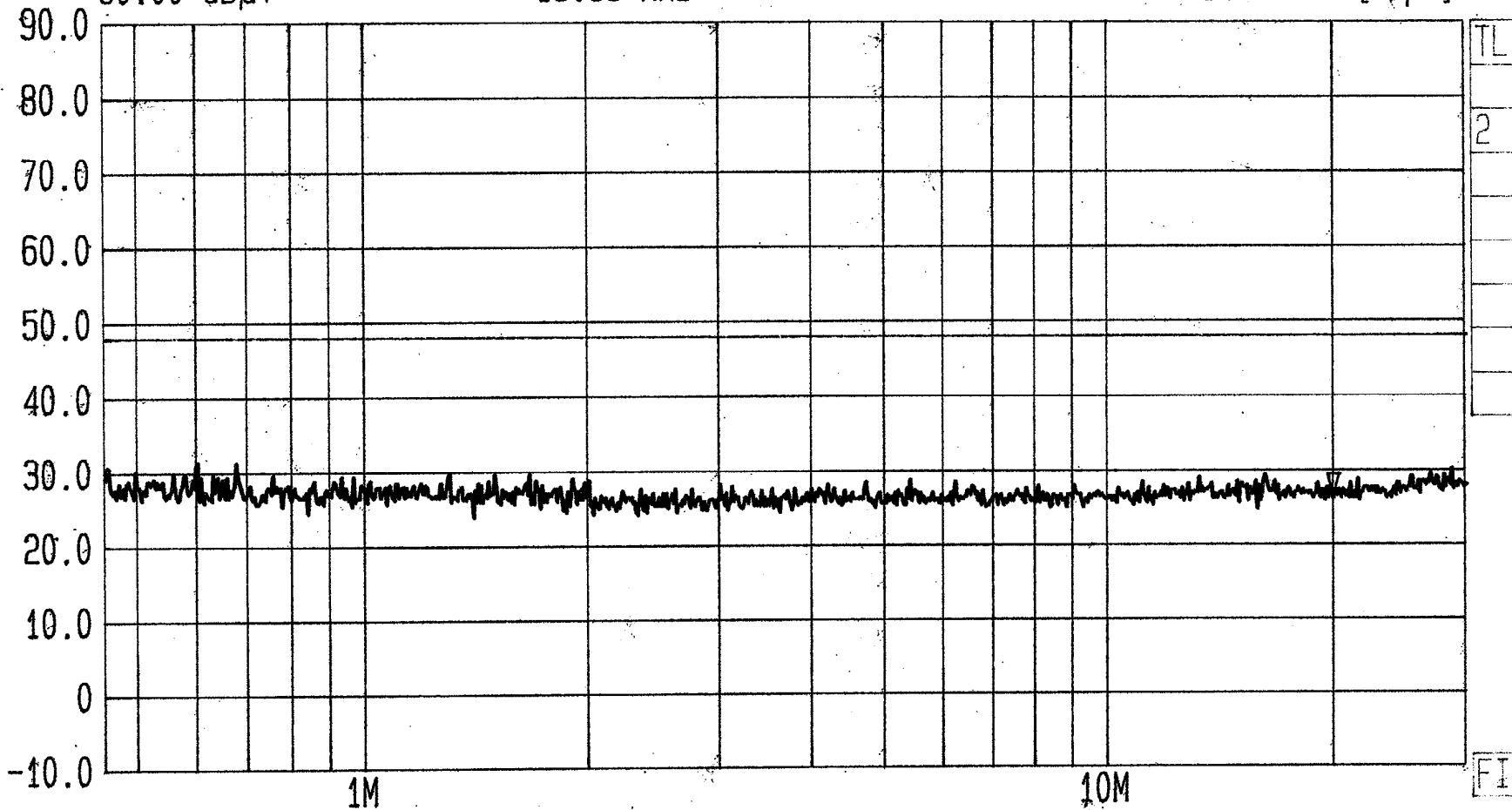
Conducted Emissions (Neutral) Tested by RFI for Wood and Douglas.  
EUT: ST500. Part 15.207. TX Un-Modulated. Bottom Channel.

FCC Part 15  
GPH/39403/JD01/102



Date 27.Jul.'99 Time 11:29:09  
 Ref.Lvl 90.00 dB $\mu$ V  
 Marker 26.22 dB $\mu$ V  
 19.89 MHz

Res.Bw 9 kHz [imp] Vid.Bw 100 kHz  
 TG.Lvl off  
 CF.Stp 2.955 MHz RF.Att 20 dB  
 Unit [dB $\mu$ V]



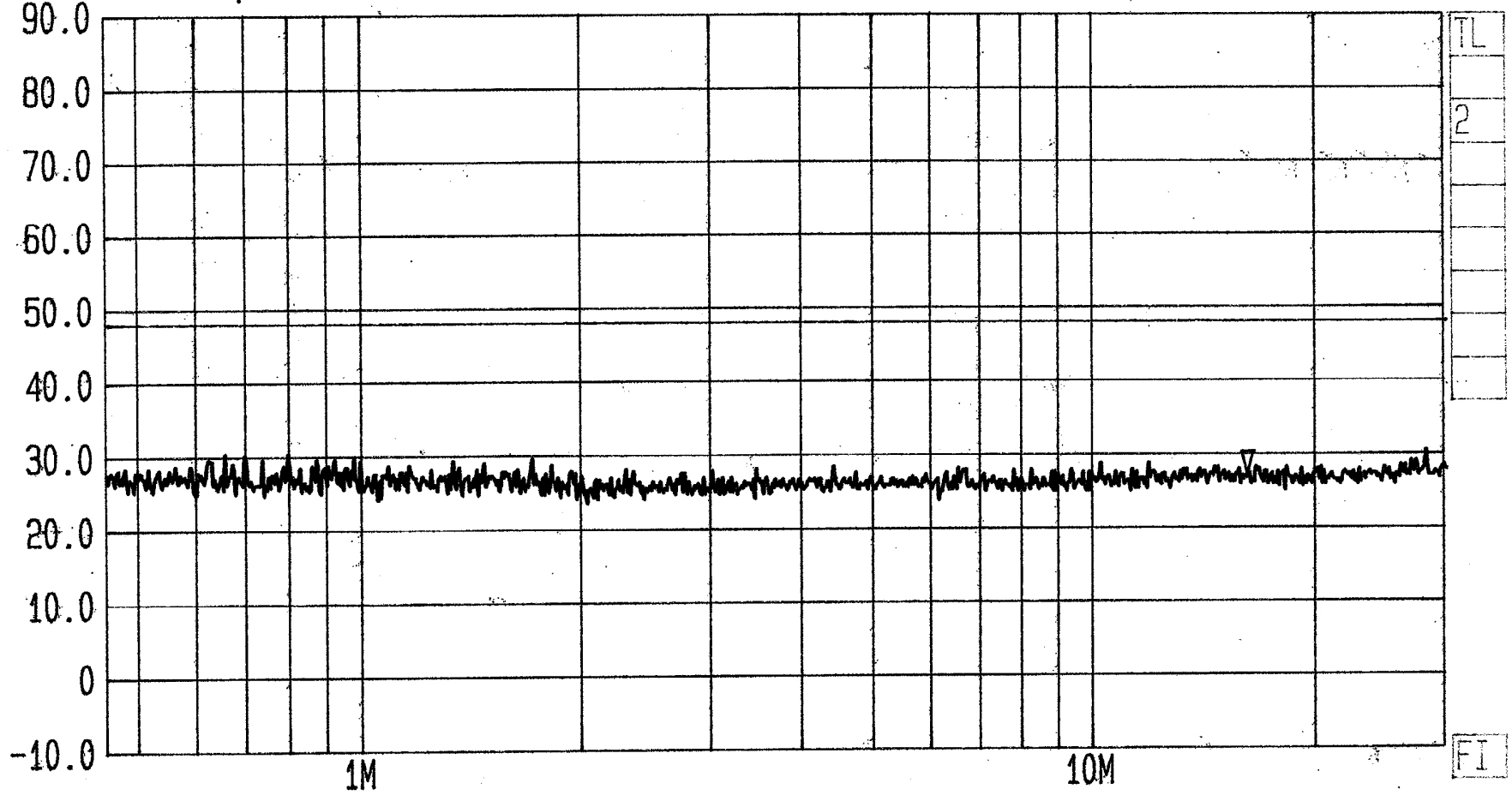
Start 450 kHz Span 29.55 MHz Center 3.67423 MHz Sweep 2.2 s Stop 30 MHz

Conducted Emissions (Live) Tested by RFI for Wood and Douglas. FCC Part 15  
 EUT: ST500. Part 15.207. TX Un-Modulated. Middle Channel. GPH/39403/JD01/103



Date 27.Jul.'99 Time 11:36:52  
 Ref.Lvl 90.00 dBμV  
 Marker 27.16 dBμV  
 16.12 MHz

Res.Bw 9 kHz [imp]  
 T6.Lvl off  
 CF.Stp 2.955 MHz  
 Vid.Bw 100 kHz  
 RF.Att 20 dB  
 Unit [dBμV]



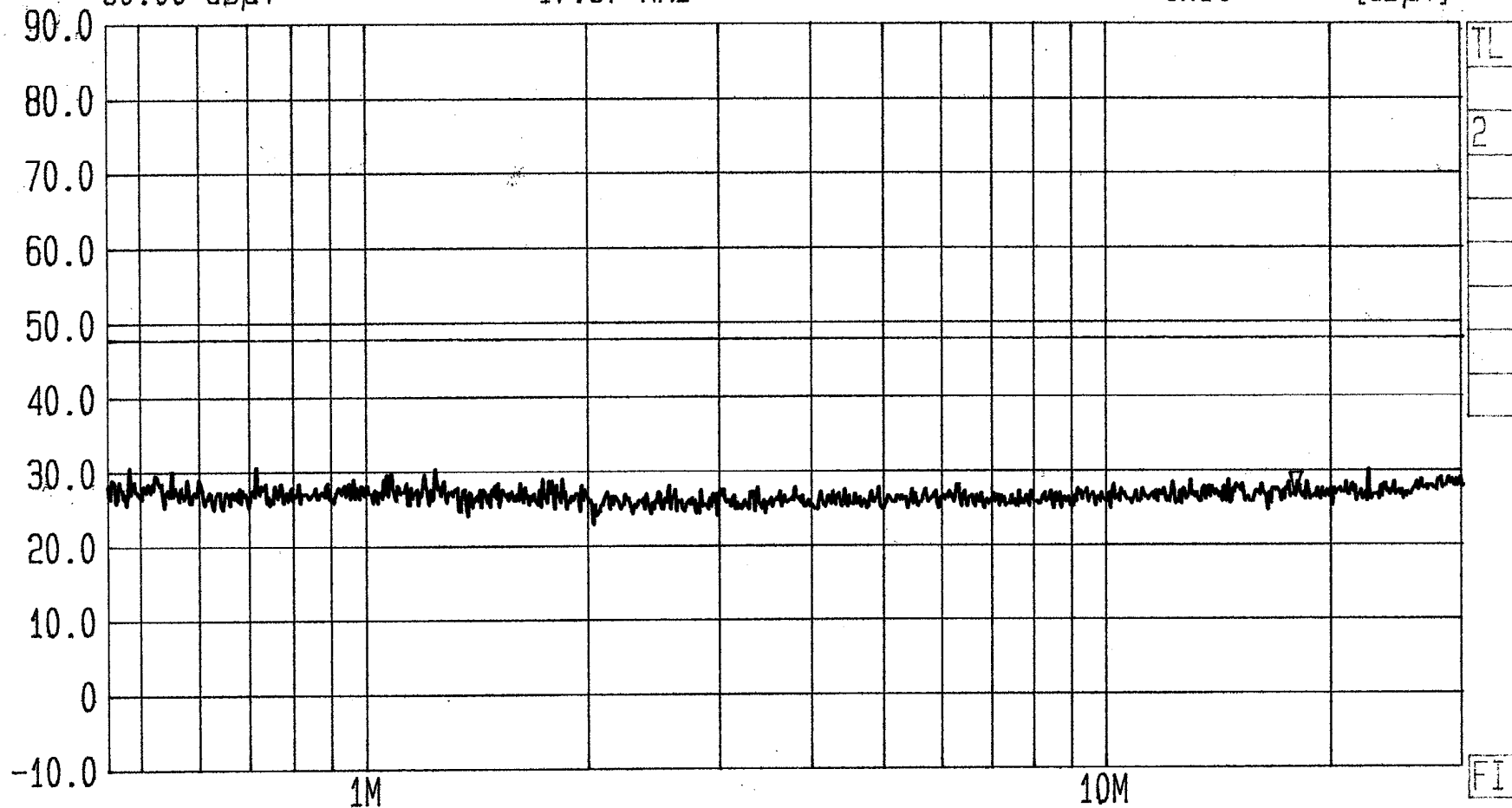
Start 450 kHz      Span 29.55 MHz      Center 3.67423 MHz      Sweep 2.2 s      Stop 30 MHz

Conducted Emissions (Neutral) Tested by RFI for Wood and Douglas. FCC Part 15  
 EUT: ST500. Part 15.207. TX Un-Modulated. Middle Channel. GPH/39403/JD01/104



Date 27.Jul.'99 Time 11:46:51  
 Ref.Lvl 90.00 dB $\mu$ V  
 Marker 26.75 dB $\mu$ V  
 17.87 MHz

Res.Bw 9 kHz [imp] Vid.Bw 100 kHz  
 TG.Lvl off  
 CF.Stp 2.955 MHz RF.Att 20 dB  
 Unit [dB $\mu$ V]



Start 450 kHz Span 29.55 MHz Center 3.67423 MHz Sweep 2.2 s Stop 30 MHz

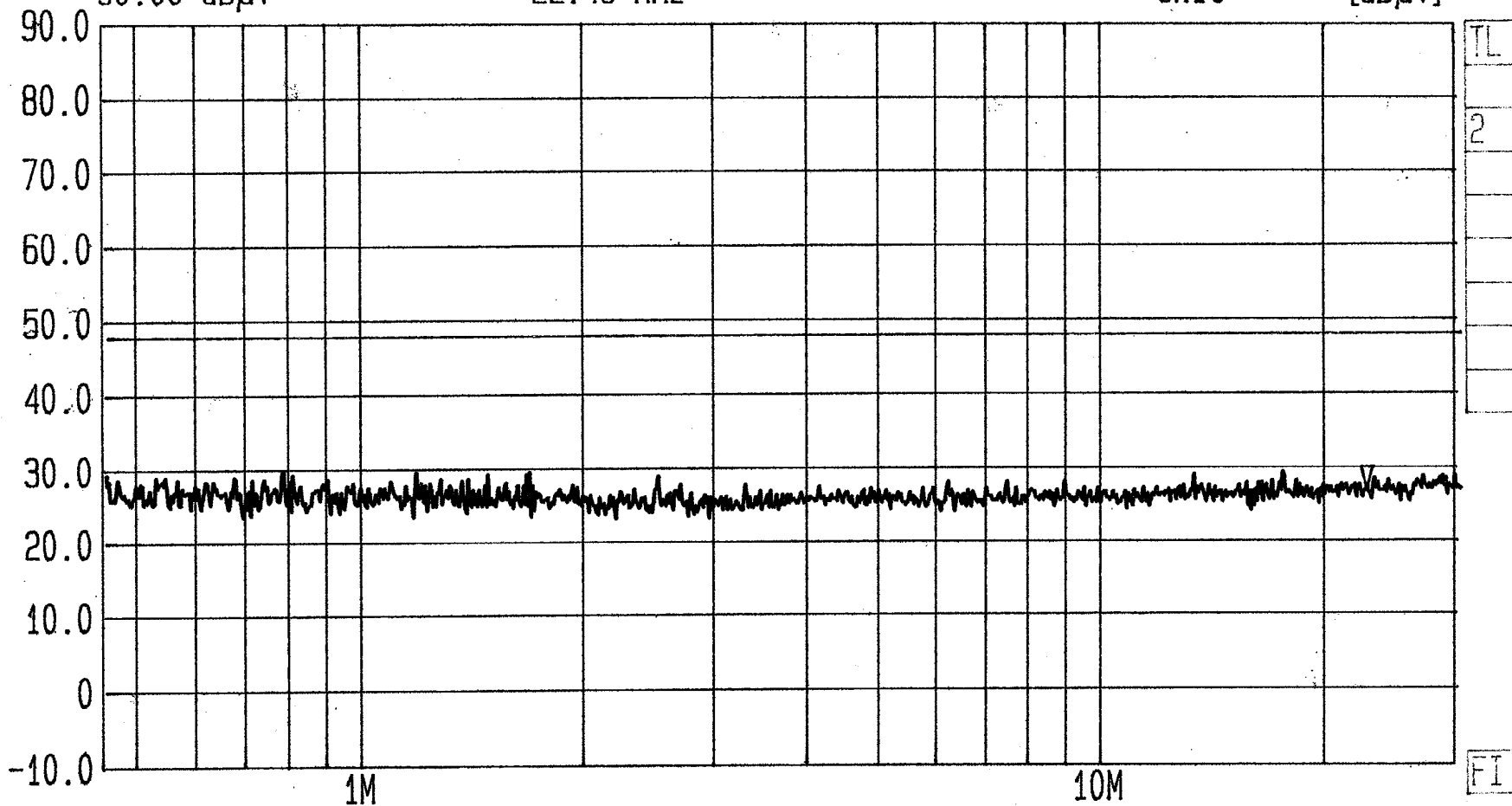
Conducted Emissions (Live) Tested by RFI for Wood and Douglas.  
 EUT: ST500. Part 15.207. TX Un-Modulated. Top Channel.

FCC Part 15  
 GPH/39403/JD01/105



Date 27.Jul.'99 Time 11:54:17  
 Ref.Lvl 90.00 dBμV  
 Marker 26.95 dBμV  
 22.46 MHz

Res.Bw 9 kHz [imp] Vid.Bw 100 kHz  
 TG.Lvl off  
 CF.Stp 2.955 MHz RF.Att 20 dB  
 Unit [dBμV]



Start 450 kHz Span 29.55 MHz Center 3.67423 MHz Sweep 2.2 s Stop 30 MHz

Conducted Emissions (Neutral) Tested by RFI for Wood and Douglas. FCC Part 15  
 EUT: ST500. Part 15.207. TX Un-Modulated. Top Channel. GPH/39403/JD01/106

**RADIO FREQUENCY INVESTIGATION LTD.**

**TEST REPORT**

**EMC Department**

**S.No: RFI/EMCB2/RP39403B**

**Page 44 of 46**

**Issue Date: 2 September 1999**

**Test Of: Wood & Douglas Ltd ST500 Transmitter**  
**To: FCC Part 90:1998**

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Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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## **Appendix 5. Photographs of EUT**

This appendix contains the following photographs:

<b>Photo Reference Number</b>	<b>Title</b>
PHT\39403ETF02\001	Side view of Conducted Emissions
PHT\39403ETF02\002	Front view of Conducted Emissions
PHT\39403ETF02\003	Test Set-up: Conducted Antenna Port Emissions

These pages are not included in the total number of pages for this report.

**RADIO FREQUENCY INVESTIGATION LTD.**

**TEST REPORT**

**EMC Department**

**S.No: RFI/EMCB2/RP39403B**

**Page 46 of 46**

**Issue Date: 2 September 1999**

**Test Of: Wood & Douglas Ltd ST500 Transmitter**  
**To: FCC Part 90:1998**

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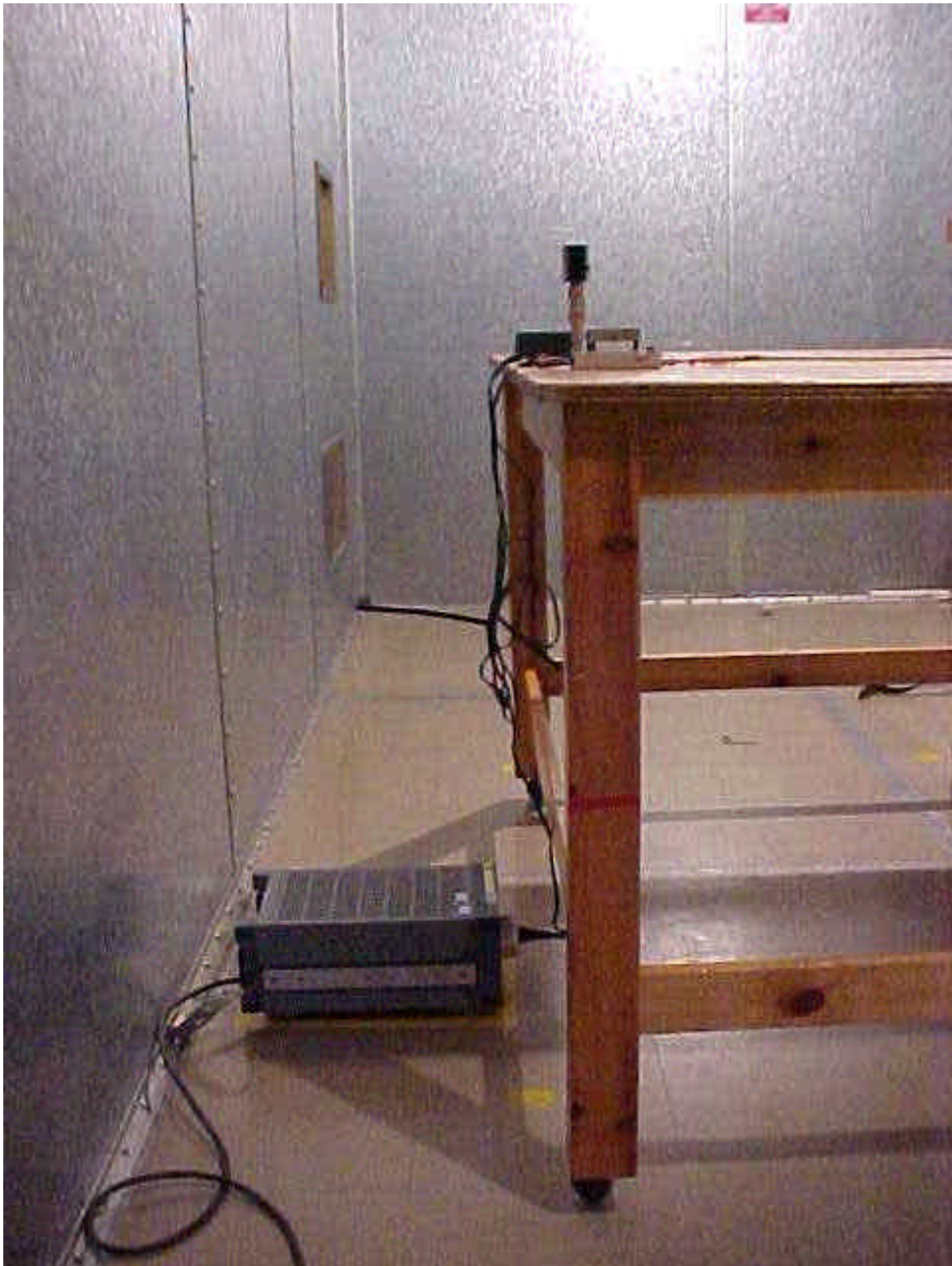
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EMC Department

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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**PHT\39403ETF02\001: Side view of Conducted Emissions**

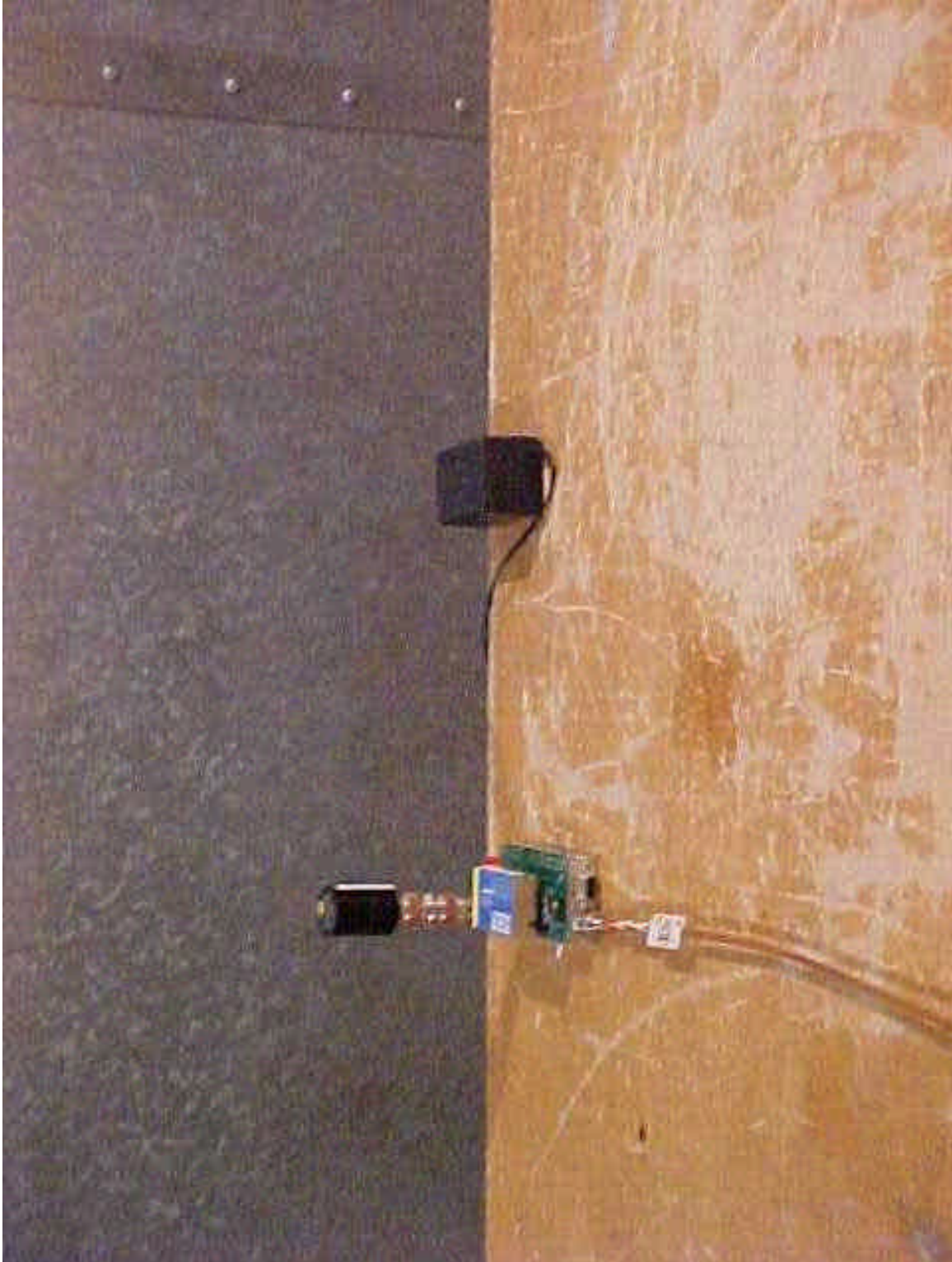


EMC Department

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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**PHT\39403ETF02\002: Front view of Conducted Emissions**



EMC Department

Test Of: Wood & Douglas Ltd ST500 Transmitter  
To: FCC Part 90:1998

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**PHT\39403ETF02\003: Test Set-up: Conducted Antenna Port Emissions**

