TEST REPORT
FROM
RADIO FREQUENCY
INVESTIGATION LTD.

Test Of: Basys 418MHz PAT1

To: F.C.C. Part 15
(Intentional Radiators)
Subpart C. Section 15.231

Test Report Serial No:
RFI/EMCA1/RP37143B

This Test Report Is Issued Under The Authority Of Brian Watson Technical Director: 	**Checked By:** 
Tested By: 	**Release Version No:** **PDF01**
Issue Date: 12 August 1998	**Test Date: 20 June 1998**

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1. Client Information

Company Name:	Basys Technology Ltd
Address:	Mumby Road Gosport Hampshire PO12 1AF
Contact Name:	Mr S Grant

2. Equipment Under Test (EUT)

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

2.1. Identification Of Equipment Under Test (EUT)

Brand Name:	Basys
Model Name or Number:	418MHz PAT 1
Unique Type Identification:	63-002026
Serial Number:	Not stated
Country of Manufacture:	UK
FCC ID Number:	Not applicable
Date of Receipt:	20 June 1998

2.2. Description Of EUT

The equipment under test was a radio based short to long range tagging system for the protection and monitoring of assets and the management of personnel movement.

2.3. Modifications Incorporated In EUT

The software was modified so that the EUT would transmit for approx. 3 minutes in "shock" so that measurements could be made. 2 small wire links were added so that the EUT would continuously transmit an unmodulated carrier, in "unmodulated carrier mode" The EUT had wire links connected to the PCB during the Unmodulated carrier mode.test

2.4. Additional Information Related To Testing

Power Supply Requirement:	Internal battery supply of 3 V
Intended Operating Environment:	Commercial premises
Weight:	0.071 Kg
Dimensions:	0.060 x 0.107 x 0.025
Interface Ports:	None

2.5. Support Equipment

No support equipment was used to exercise the EUT during testing.

3. Test Specification, Methods And Procedures

3.1. Test Specification

Reference:	FCC Part 15:1996 Subpart C. Section 15.231 (Intentional Radiators)
Title:	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Digital Devices.
Comments:	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.
Purpose of Test:	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 (1987)
Title: Specification for Radio Interference measuring apparatus and measurement methods.

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.

4. Deviations From The Test Specification

None.

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 an internal battery supply of 3 V.

5.2. Operating Modes

The EUT was tested in the following operating mode: Shock mode, Idle mode, Tamper mode and Continuous unmodulated carrier. These modes were used in order to fully test the equipment .

5.3. Configuration And Peripherals

Throughout testing, the EUT was configured, connected to the relevant support equipment as shown in the diagram in the schematic diagram DRG\37143\001 in Appendix 3. 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.

6. Summary Of Test Results

6.1. Radiated Emissions

Range Of Measurements	Specification Reference	Compliancy Status
Electric Field Strength, 30 MHz to 5.0 GHz	Section 15 of C.F.R. 47: 1996 Clause 15.231	Complied

6.2. Location Of Tests

All the measurements described in this report were performed at the premises of Radio Frequency Investigation Ltd, Dunlop House, Dunlop, Ayrshire, KA3 4BD, Scotland.

7. Measurements, Examinations And Derived Results

7.1. General Comments

7.1.1. Tests for radiated emissions were performed in 4 operating modes as stated in section 5.2 of this test report. 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.

7.2. Test Results For Radiated Emissions

7.2.1. Electric Field Strength Measurements (30 – 1000 MHz): Shock Mode

7.2.1.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 5000 MHz.

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

7.2.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses).

7.2.1.4. Radiated emission limits stated in section 15.231 (4(b)) are as follows: Field strength of fundamental is 3750 uV/m at 260 MHz rising linearly to 12500 uV/m at 470 MHz. The field strength of any spurious emissions shall not exceed a level 20dB below the maximum carrier level allowed. If the frequency of the spurious emission is located in one of the Restricted Bands of Operation stated in section 15.205, then the allowed level of emissions shall not exceed the level given in section 15.209

Shock Mode – Fundamental Emission

Frequency (MHz)	Ant. Pol.	Average Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
417.986	Vert	29.0	80.3	51.3	Complied

Shock Mode – Fundamental Emission

Frequency (MHz)	Ant. Pol.	Peak Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
417.986	Vert	69.0	100.3	31.3	Complied

Shock Mode – Spurious Emissions Highest Average Level

Frequency (MHz)	Ant. Pol.	Average Level (dBmV/m)	Average Limit (dBmV/m)	Margin (dB)	Result
66.123	Vert	0.4	60.3	59.9	Complied
100.100	Vert	10.3	60.3	50.0	Complied
500.000	Vert	10.5	60.3	49.8	Complied
700.000	Vert	14.9	60.3	45.4	Complied

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Shock Mode – Spurious Emissions Highest Peak Level

Frequency (MHz)	Ant. Pol.	Peak Level (dBmV/m)	Peak Limit (dBmV/m)	Margin (dB)	Result
66.123	Vert	13.9	80.3	66.4	Complied
100.100	Vert	20.1	80.3	60.2	Complied
500.000	Vert	22.0	80.3	58.3	Complied
700.000	Vert	26.7	80.3	53.6	Complied

7.3. Test Results For Spurious Radiated Emissions (Above 1000 MHz) Shock Mode

7.3.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 5000 MHz.

7.3.2. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses):

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

Highest Average Levels

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBmV/m)	Average Limit (dBmV/m)	Average Margin (dB)	Result
1.2533	Horiz	2.5	24.8	2.2	29.5	60.3	30.8	Complied
1.2533	Vert	2.0	24.8	2.2	29.0	60.3	31.3	Complied
2.7022	Vert	-4.0	29.5	2.5	28.0	54.0	26.0	Complied
2.7022	Horiz	-3.9	29.5	2.5	28.1	54.0	25.9	Complied
2.5900	Horiz	-3.3	29.2	2.4	28.3	60.3	32.0	Complied
2.5900	Vert	-3.5	29.2	2.4	28.1	60.3	32.2	Complied
3.6400	Vert	10.1	32.2	2.8	45.1	54.0	8.9	Complied
3.6400	Horiz	10.3	32.2	2.8	45.3	54.0	8.7	Complied
4.6200	Horiz	12.1	32.9	2.5	47.5	54.0	6.5	Complied
4.6200	Vert	11.9	32.9	2.5	47.3	54.0	6.7	Complied

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Highest Peak Levels

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBmV/m)	Peak Limit (dBmV/m)	Peak Margin (dB)	Result
1.2533	Horiz	13.1	24.8	2.2	40.1	80.3	40.2	Complied
1.2533	Vert	13.2	24.8	2.2	40.2	80.3	40.1	Complied
2.7022	Vert	7.9	29.5	2.5	39.9	74.0	34.1	Complied
2.7022	Horiz	7.9	29.5	2.5	39.9	74.0	34.1	Complied
2.5900	Horiz	8.4	29.2	2.4	40.0	80.3	40.3	Complied
2.5900	Vert	8.3	29.2	2.4	39.9	80.3	40.4	Complied
3.6400	Vert	21.0	32.2	2.8	56.0	74.0	18.0	Complied
3.6400	Horiz	21.3	32.2	2.8	56.3	74.0	17.7	Complied
4.6200	Horiz	23.5	32.9	2.5	58.9	74.0	15.1	Complied
4.6200	Vert	23.5	32.9	2.5	58.9	74.0	15.1	Complied

7.4. Test Results For Radiated Emissions

7.4.1. Electric Field Strength Measurements (30 – 1000 MHz): Tamper Mode

7.4.1.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 5000 MHz.

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

7.4.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses).

7.4.1.4. Radiated emission limits stated in section 15.231 (4(b)) are as follows: Field strength of fundamental is 3750 uV/m at 260 MHz rising linearly to 12500 uV/m at 470 MHz. The field strength of any spurious emissions shall not exceed a level 20dB below the maximum carrier level allowed. If the frequency of the spurious emission is located in one of the Restricted Bands of operation stated in section 15.205, then the allowed level of emissions shall not exceed the level given in section 15.209

Tamper Mode – Fundamental Emission

Frequency (MHz)	Ant. Pol.	Average Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
417.986	Vert	67.8	80.3	12.5	Complied

Tamper Mode – Fundamental Emission

Frequency (MHz)	Ant. Pol.	Peak Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
417.986	Vert	70.5	100.3	29.8	Complied

Tamper Mode –Spurious Emissions Highest Average Levels

Frequency (MHz)	Ant. Pol.	Average Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
66.123	Vert	0.5	60.3	59.8	Complied
100.100	Vert	10.3	60.3	50.0	Complied
500.000	Vert	10.5	60.3	49.8	Complied

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Tamper Mode –Spurious Emissions Highest Peak Levels

Frequency (MHz)	Ant. Pol.	Peak Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
66.123	Vert	13.9	80.3	66.4	Complied
100.100	Vert	20.1	80.3	60.2	Complied
500.000	Vert	22.1	80.3	58.2	Complied

Tamper Mode –Spurious Emissions in Restricted Band of Operation 240-285 MHz (Quasi-Peak Measurement)

Frequency (MHz)	Ant. Pol.	Q-P Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
250.000	Vert	11.1	46.0	34.9	Complied

7.5. Test Results For Radiated Emissions (Above 1000 MHz) Tamper Mode

7.5.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 5000 MHz.

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

7.5.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses):

Highest Average Levels

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBmV/m)	Average Limit (dBmV/m)	Average Margin (dB)	Result
1.2532	Horiz	2.3	24.8	2.2	29.3	60.3	31.0	Complied
1.2532	Vert	2.0	24.8	2.2	29.0	60.3	31.3	Complied
3.2800	Vert	-4.0	31.2	2.8	30.0	60.3	30.3	Complied
3.2800	Horiz	-4.0	31.2	2.8	30.0	60.3	30.3	Complied
4.1800	Horiz	11.8	33.0	2.5	47.3	54.0	6.7	Complied
4.1800	Vert	11.5	33.0	2.5	47.0	54.0	7.0	Complied

Highest Peak Levels

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBmV/m)	Peak Limit (dBmV/m)	Peak Margin (dB)	Result
1.2532	Horiz	13.5	24.8	2.2	40.5	80.3	39.8	Complied
1.2532	Vert	13.1	24.8	2.2	40.1	80.3	40.2	Complied
3.2800	Vert	5.8	31.2	2.8	39.8	80.3	40.5	Complied
3.2800	Horiz	5.9	31.2	2.8	39.9	80.3	40.4	Complied
4.1800	Horiz	22.6	33.0	2.5	58.1	74.0	15.9	Complied
4.1800	Vert	22.6	33.0	2.5	58.1	74.0	15.9	Complied

7.6. Test Results For Radiated Emissions

7.6.1. Electric Field Strength Measurements (30 – 1000 MHz): Unmodulated Carrier Mode

7.6.1.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 5000 MHz.

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

7.6.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses).

7.6.1.4. Radiated emission limits stated in section 15.231 (4(b)) are as follows: Field strength of fundamental is 3750 uV/m at 260 MHz rising linearly to 12500 uV/m at 470 MHz. The field strength of any spurious emissions shall not exceed a level 20dB below the maximum carrier level allowed. If the frequency of the spurious emission is located in one of the Restricted Bands of operation stated in section 15.205, then the allowed level of emissions shall not exceed the level given in section 15.209

Unmodulated Carrier – Fundamental Emission

Frequency (MHz)	Ant. Pol.	Average Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
417.986	Vert.	29.5	80.3	50.8	Complied

Unmodulated Carrier – Fundamental Emission

Frequency (MHz)	Ant. Pol.	Peak Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
417.986	Vert.	70.0	100.3	30.3	Complied

Unmodulated Carrier –Spurious Emissions Highest Average Levels

Frequency (MHz)	Ant. Pol.	Average Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
700.000	Vert	15.1	60.3	45.1	Complied
835.930	Vert.	36.1	60.3	24.2	Complied

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Unmodulated Carrier –Spurious Emissions Highest Peak Levels

Frequency (MHz)	Ant. Pol.	Peak Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
700.000	Vert	26.7	80.3	53.6	Complied
835.930	Vert.	39.9	80.3	40.4	Complied

Unmodulated Carrier –Spurious Emissions in Restricted Band of Operation 240-285 MHz (Quasi-Peak Measurement)

Frequency (MHz)	Ant. Pol.	Q-P Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
250.000	Vert	11.0	46.0	35.0	Complied

7.7. Test Results For Radiated Emissions (Above 1000 MHz): Unmodulated Carrier Mode

7.7.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 5000 MHz.

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

7.7.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses):

Highest Average Levels

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBmV/m)	Average Limit (dBmV/m)	Average Margin (dB)	Result
1.2533	Horiz	2.9	24.8	2.2	29.9	60.3	30.4	Complied
1.2533	Vert	2.8	24.8	2.2	29.8	60.3	30.5	Complied
1.9800	Vert	-1.9	27.7	2.4	28.2	60.3	32.1	Complied
1.9800	Horiz	-1.8	27.7	2.4	28.3	60.3	32.0	Complied
2.7022	Horiz	-3.5	29.5	2.5	28.5	54.0	25.5	Complied
2.7022	Vert	-3.4	29.5	2.5	28.6	54.0	25.4	Complied
3.9000	Vert	9.9	32.6	2.8	45.3	54.0	8.7	Complied
3.9000	Horiz	9.7	32.6	2.8	45.1	54.0	8.9	Complied
4.9111	Horiz	11.5	33.9	2.4	47.8	54.0	6.2	Complied
4.9111	Vert	11.6	33.9	2.4	47.9	54.0	6.1	Complied

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Highest Peak Levels

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBmV/m)	Peak Limit (dBmV/m)	Peak Margin (dB)	Result
1.2533	Horiz	12.1	24.8	2.2	39.1	80.3	41.2	Complied
1.2533	Vert	12.0	24.8	2.2	39.0	80.3	41.3	Complied
1.9800	Vert	9.8	27.7	2.4	39.9	80.3	40.4	Complied
1.9800	Horiz	9.8	27.7	2.4	39.9	80.3	40.4	Complied
2.7022	Horiz	9.0	29.5	2.5	41.0	74.0	33.0	Complied
2.7022	Vert	8.0	29.5	2.5	40.0	74.0	33.0	Complied
3.9000	Vert	20.6	32.6	2.8	56.0	74.0	18.0	Complied
3.9000	Horiz	20.9	32.6	2.8	56.3	74.0	17.7	Complied
4.9111	Horiz	23.0	33.9	2.4	59.3	74.0	14.7	Complied
4.9111	Vert	22.7	33.9	2.4	59.0	74.0	15.0	Complied

7.8. Electric Field Strength Measurements

7.8.1. Electric Field Strength Measurements (30 – 1000 MHz): Idle Mode

7.8.1.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 5000 MHz.

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

7.8.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses).

7.8.1.4. Radiated emission limits stated in section 15.231 (4(b)) are as follows: Field strength of fundamental is 3750 uV/m at 260 MHz rising linearly to 12500 uV/m at 470 MHz. The field strength of any spurious emissions shall not exceed a level 20dB below the maximum carrier level allowed. If the frequency of the spurious emission is located in one of the Restricted Bands of operation stated in section 15.205, then the allowed level of emissions shall not exceed the level given in section 15.209

Idle Mode – Spurious Emissions Highest Average Level

Frequency (MHz)	Ant. Pol.	Average Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
66.123	Vert	0.4	60.3	59.9	Complied
100.100	Vert	10.2	60.3	50.1	Complied
500.000	Vert	10.5	60.3	49.8	Complied
700.000	Vert	15.0	60.3	45.3	Complied
950.000	Vert	20.8	60.3	39.5	Complied

Idle Mode – Spurious Emissions Highest Peak Level

Frequency (MHz)	Ant. Pol.	Peak Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
66.123	Vert	13.9	80.3	66.4	Complied
100.100	Vert	20.0	80.3	60.3	Complied
500.000	Vert	22.0	80.3	58.3	Complied
700.000	Vert	26.6	80.3	53.7	Complied
950.000	Vert	32.1	80.3	48.2	Complied

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Frequency (MHz)	Ant. Pol.	Q-P Level (dBmV/m)	Limit (dBmV/m)	Margin (dB)	Result
250.000	Vert	11.0	46.0	35.0	Complied

7.8.2. Test Results For Radiated Emissions (Above 1000 MHz) Idle Mode

7.8.2.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 5000 MHz.

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

7.8.2.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses):

Highest Average Levels

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBmV/m)	Average Limit (dBmV/m)	Average Margin (dB)	Result
1.2533	Horiz	2.3	24.8	2.2	29.3	60.3	31.0	Complied
1.2533	Vert	2.0	24.8	2.2	29.0	60.3	31.3	Complied
2.7022	Vert	-4.0	29.5	2.5	28.0	54.0	26.0	Complied
2.7022	Horiz	-3.9	29.5	2.5	28.1	54.0	25.9	Complied
3.2100	Horiz	11.3	31.0	2.8	45.1	60.3	15.2	Complied
3.2100	Vert	11.3	31.0	2.8	45.1	60.3	15.2	Complied
4.9970	Vert	13.4	34.1	2.4	49.9	54.0	4.1	Complied
4.9970	Horiz	13.6	34.1	2.4	50.1	54.0	3.9	Complied

Highest Peak Levels

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBmV/m)	Peak Limit (dBmV/m)	Peak Margin (dB)	Result
1.2533	Horiz	13.0	24.8	2.2	40.0	80.3	40.3	Complied
1.2533	Vert	13.0	24.8	2.2	40.0	80.3	40.3	Complied
2.7022	Vert	7.9	29.5	2.5	39.9	74.0	34.1	Complied
2.7022	Horiz	7.9	29.5	2.5	39.9	74.0	34.1	Complied
3.2100	Horiz	22.2	31.0	2.8	56.0	80.3	24.3	Complied
3.2100	Vert	22.3	31.0	2.8	56.1	80.3	24.2	Complied
4.9970	Vert	28.5	34.1	2.4	65.0	74.0	9.0	Complied
4.9970	Horiz	28.0	34.1	2.4	64.5	74.0	9.5	Complied

7.9. Fundamental Bandwidth Measurement.

7.9.1. Section 15.231 states that a bandwidth measurement is required to be performed`. The bandwidth allowed must not exceed 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. The bandwidth is determined at the points 20dB down from the modulated carrier.

7.9.2. Measurements on the fundamental frequency (418 MHz) were measured with a resolution bandwidth of 120 kHz. The allowable bandwidth for this EUT is 1.045 MHz.

7.9.3. Scans showing the fundamental bandwidth measurements can be seen in Appendix 4 of this test report.

Fundamental Bandwidth – Shock Mode

Frequency of Operation (MHz)	Bandwidth (MHz)
417.986	0.783

Fundamental Bandwidth – Tamper Mode

Frequency of Operation (MHz)	Bandwidth (MHz)
417.986	0.800

Fundamental Bandwidth – Unmodulated Carrier Mode

Frequency of Operation (MHz)	Bandwidth (MHz)
417.986	0.300

7.10. Transmitter Operating Time.

7.10.1. Section15.231 states that a transmitter on/off time measurement is required to be performed. The transmitter used in this device is automatically activated and deactivated within a designated time frame. Therefore, as stated in section 15.231 (a(2)), this transmitter must cease transmission within 5 seconds after activation.

7.10.2. Once the transmitter has automatically activated and deactivated, the EUT returns to the standby condition.

7.10.3. A plot showing compliance with the above can be seen in Appendix 4 of this test report.

Shock Mode "off" time	3.855 seconds

Note- This only applies to the "shock mode", as in tamper mode 15.231 states that the transmitter may operate during the pendancy of the alarm.

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:

Measurement Type	Range	Confidence Level	Calculated Uncertainty
Radiated Emissions	30 MHz to 1000 MHz	95%	+/- 4.1 dB
Radiated Emissions	1 GHz to 5 GHz	95%	+/- 4.3 dB

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).

Appendix 1. Test Equipment Used

Instrument	Manufacturer	Model	RFI No.
Radiated Electric Field			
Biconical Antenna	R & S	HK116	A507
Biconical Antenna	R & S	HK116	A513
Log Spiral	EMCO	3101	A514
Double Ridge Guide Antenna	EMCO	3115	A605
Display Unit	R & S	ESAI-D	M505
RF Unit	R & S	ESBI	M506
Open Area Test Site			
Bi-Log Antenna	Chase	CBL6111A	A546
Double Ridge Guide Antenna	EMCO	3115	A605
Spectrum Monitor	R & S	EZM	M024
Receiver	R & S	ESVP	M044
Display Unit	R & S	ESAI-D	M505
RF Unit	R & S	ESBI	M506
Receiver	R & S	ESCS 30	L515
Display Unit	R & S	ESAI-D	M505
RF Unit	R & S	ESBI	M506
3dB Atennuator	Narda	757C-3	A610

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

Appendix 2. Measurement Methods

A2.1. Radiated Emissions: FCC Part 15

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

A2.1.2. Initial measurements covering the entire measurement band in the form of swept scans in a shielded enclosure were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which the EUT should be re-measured in full on the open area test site. 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.

A2.1.3. The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. Following the initial scans, graphs were 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 on the open area test site, at the appropriate distance, using a measuring receivers with a Quasi-Peak or Average detector (below 1000 MHz) where applicable, for measurements above 1000 MHz average and peak detectors were used.

A2.1.4. For the main (final) measurements the EUT was arranged on a non-conducting table on an open area test site, as detailed in the specification.

A2.1.5. All measurements on the open area test site were performed using broadband antennas.

A2.1.6. On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

A2.1.7. The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	**Initial Scan**	**Final Measurements Below 1GHz**	**Final Measurements Above 1 GHz**
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak/Average
Mode:	Max Hold	Not applicable	Not applicable
Bandwidth:	100 kHz	120 kHz	1 MHz
Amplitude Range:	60 dB	20 dB	20 dB (typical)
Measurement Time:	Not applicable	> 1 s	> 1 s
Observation Time:	Not applicable	> 15 s	> 15 s
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

Spurious radiated emissions were measured against the limits specified in Section 15.209 of C.F.R. 47 Part 15 Subpart C - Intentional Radiators OR those of Section 15.231 depending upon whichever permitted a higher field strength. Unless otherwise stated, the limits given in this report correspond to those specified in Section 15.209 as these are the most stringent.

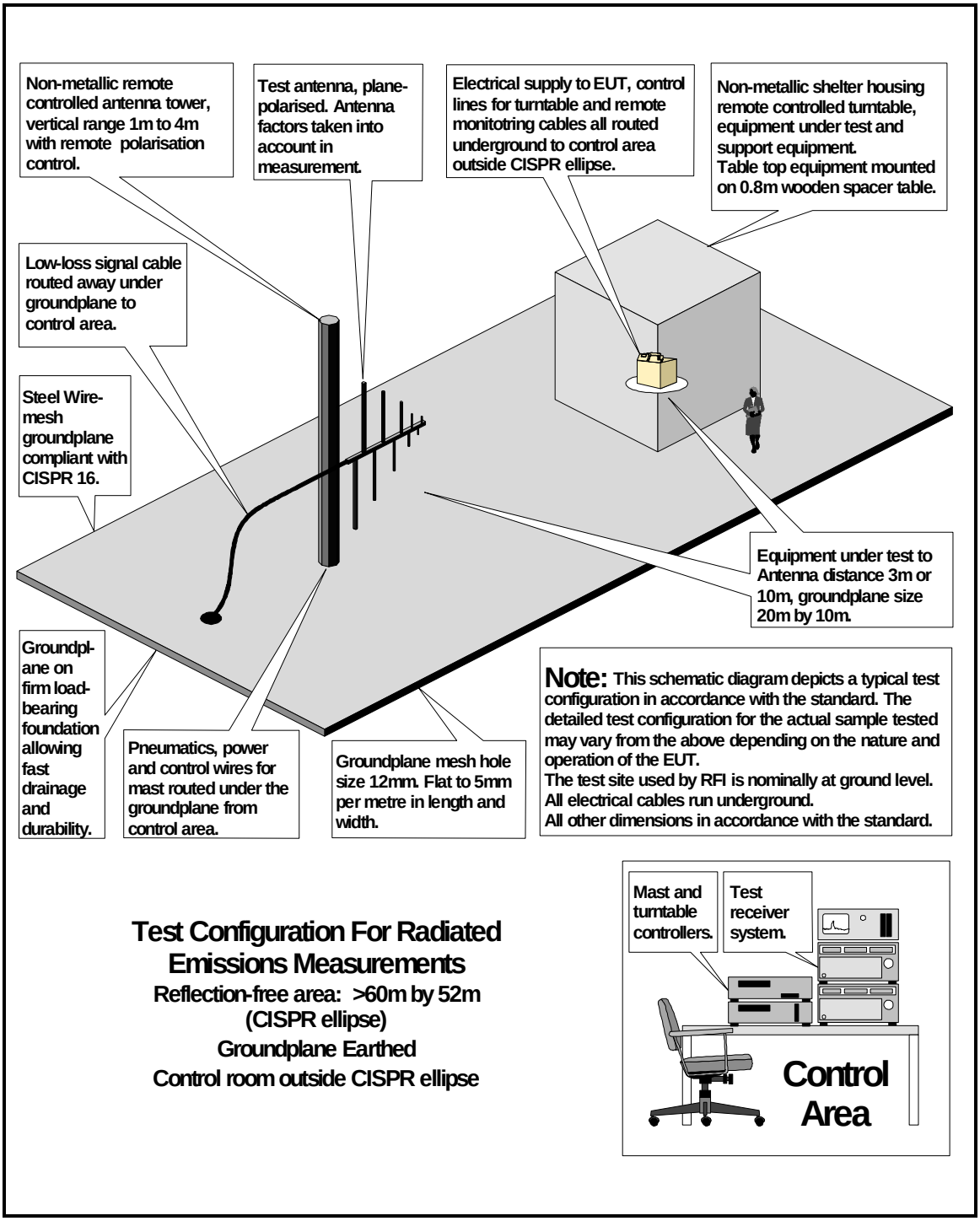
Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\37143JD04\ETF04\EMIRAD	Test configuration for measurement of radiated emissions
DRG\37143JD04\ETF04\001	Schematic diagram of the EUT, support equipment and interconnecting cables used for the test

Test Of: **Basys 418MHz PAT1**
To: **F.C.C. Part 15 Subpart C (Intentional Radiators) Section 15.231**

DRG\37143JD04\ETF04\EMIRAD

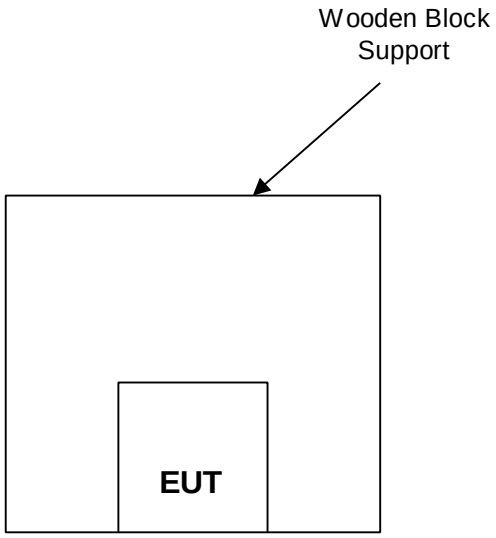


Test Configuration For Radiated Emissions Measurements
Reflection-free area: >60m by 52m (CISPR ellipse)
Groundplane Earthed
Control room outside CISPR ellipse

Test Of: **Basys 418MHz PAT1**
To: **F.C.C. Part 15 Subpart C (Intentional Radiators) Section 15.231**

DRG\37143JD04\ETF04\001

Configuration of EUT and Local Support Equipment



Configuration of Remote Support Equipment

Appendix 4. Graphical Test Results

This appendix contains the following graphs:

Graph Reference Number	Title
GPH\33550\E\01\001	Scan of radiated electric field: both polarisation's (30 to 200 MHz), Idle mode
GPH\33550\E\01\002	Scan of radiated electric field: non-polarised (200 to 1000 MHz), Idle mode
GPH\33550\E\01\003	Scan of radiated electric field: both polarisation's (30 to 200 MHz), Shock mode
GPH\33550\E\01\004	Scan of radiated electric field: non-polarised (200 to 1000 MHz), Shock mode
GPH\33550\E\01\005	Scan of radiated electric field: both polarisation's (30 to 200 MHz), Tamper mode
GPH\33550\E\01\006	Scan of radiated electric field: non-polarised (200 to 1000 MHz), Tamper mode
GPH\33550\E\01\007	Scan of radiated electric field (1 to 3 GHz, RBW 120 kHz), Idle mode
GPH\33550\E\01\008	Scan of radiated electric field (3 to 5 GHz, RBW 120 kHz), Idle mode
GPH\33550\E\01\009	Scan of radiated electric field (1 to 3 GHz, RBW 1 MHz), Idle mode
GPH\33550\E\01\010	Scan of radiated electric field (3 to 5 GHz, RBW 1 MHz), Idle mode
GPH\33550\E\01\011	Scan of radiated electric field (1 to 3 GHz, RBW 120 kHz), Shock mode
GPH\33550\E\01\012	Scan of radiated electric field (3 to 5 GHz, RBW 120 kHz), Shock mode
GPH\33550\E\01\013	Scan of radiated electric field (1 to 3 GHz, RBW 1 MHz), Shock mode
GPH\33550\E\01\014	Scan of radiated electric field (3 to 5 GHz, RBW 1 MHz), Shock mode
GPH\33550\E\01\015	Scan of radiated electric field (415.507 to 420.507 MHz, RBW 120 kHz) Shock Mode Bandwidth
GPH\33550\E\01\016	Scan of radiated electric field (1 to 3 GHz, RBW 120 kHz), Tamper mode
GPH\33550\E\01\017	Scan of radiated electric field (3 to 5 GHz, RBW 120 kHz), Tamper mode
GPH\33550\E\01\018	Scan of radiated electric field (1 to 3 GHz, RBW 1 MHz), Tamper mode

Continued on the following page.

Graphical Test Results continued

GPH\33550\E\01\019	Scan of radiated electric field (3 to 5 GHz, RBW 1 MHz), Tamper mode
GPH\33550\E\01\020	Scan of radiated electric field (415.457 to 420.457 MHz, RBW 120 kHz) Tamper mode bandwidth
GPH\33550\E\01\021	Scan of radiated electric field: (30 to 200 MHz), Unmodulated carrier mode
GPH\33550\E\01\022	Scan of radiated electric field: (200 to 1000 MHz), Unmodulated carrier mode
GPH\33550\E\01\023	Scan of radiated electric field (1 to 3 GHz, RBW 120 kHz), Unmodulated carrier mode .
GPH\33550\E\01\024	Scan of radiated electric field (3 to 5 GHz, RBW 120 kHz), Unmodulated carrier mode
GPH\33550\E\01\025	Scan of radiated electric field (1 to 3 GHz, RBW 1 MHz), Unmodulated carrier mode
GPH\33550\E\01\026	Scan of radiated electric field (3 to 5 GHz, RBW 1 MHz), Unmodulated carrier mode
GPH\33550\E\01\027	Scan of radiated electric field (415.450 to 420.450 MHz) Unmodulated carrier mode bandwidth
GPH\33550\E\01\028	Radiated pre-scans 417.954MHz Shock mode period
GPH\33550\E\01\029	Radiated pre-scans 417.954MHz Shock mode duration
GPH\33550\E\01\030	Radiated pre-scans 417.954MHz Tamper mode period
GPH\33550\E\01\031	Radiated pre-scans 417.954MHz Tamper mode duration
GPH\33550\E\01\032	Scan of radiated electric field (1 to 3 GHz, RBW 120 kHz) EUT “off”, background scan.
GPH\33550\E\01\033	Scan of radiated electric field (3 to 5 GHz, RBW 120 kHz) EUT “off”, background scan.
GPH\33550\E\01\034	Scan of radiated electric field (1 to 3 GHz, RBW 1 MHz) Background scan No EUT.
GPH\33550\E\01\035	Scan of radiated electric field (3 to 5 GHz, RBW 1 MHz) Background scan No EUT.
GPH\33550\E\01\036	Radiated pre-scan 418 MHz Shock mode “OFF” time

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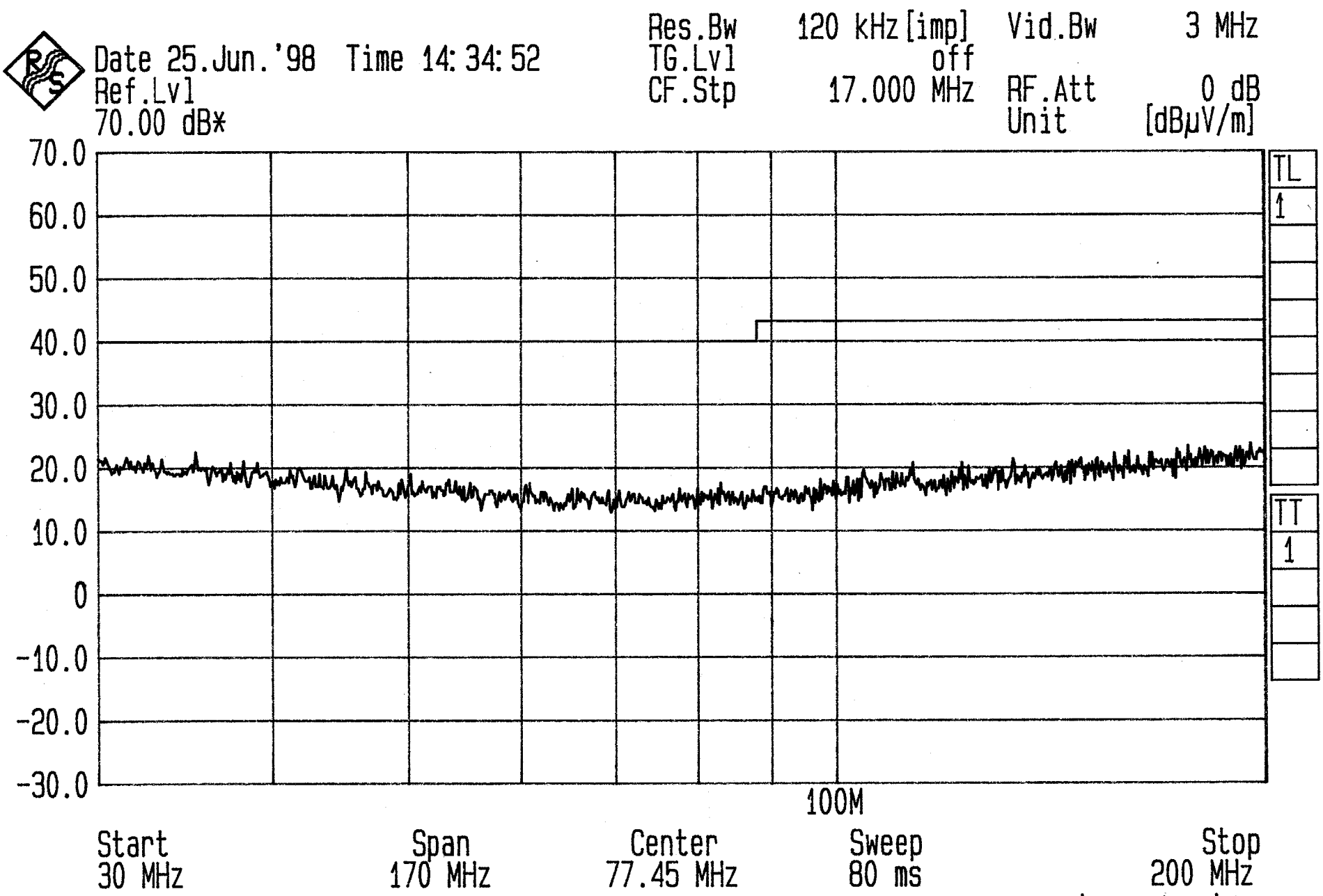

Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37142E04\01
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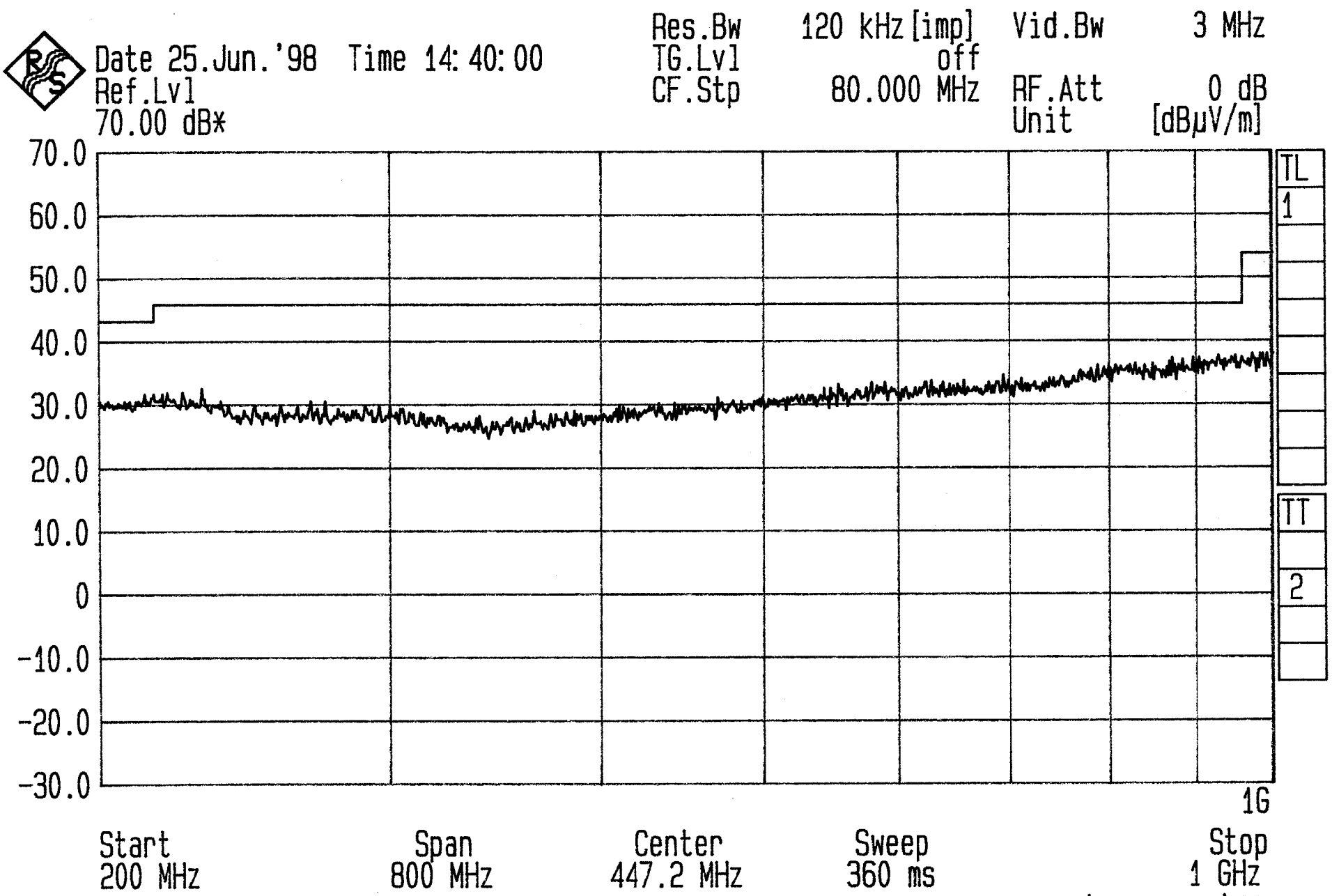

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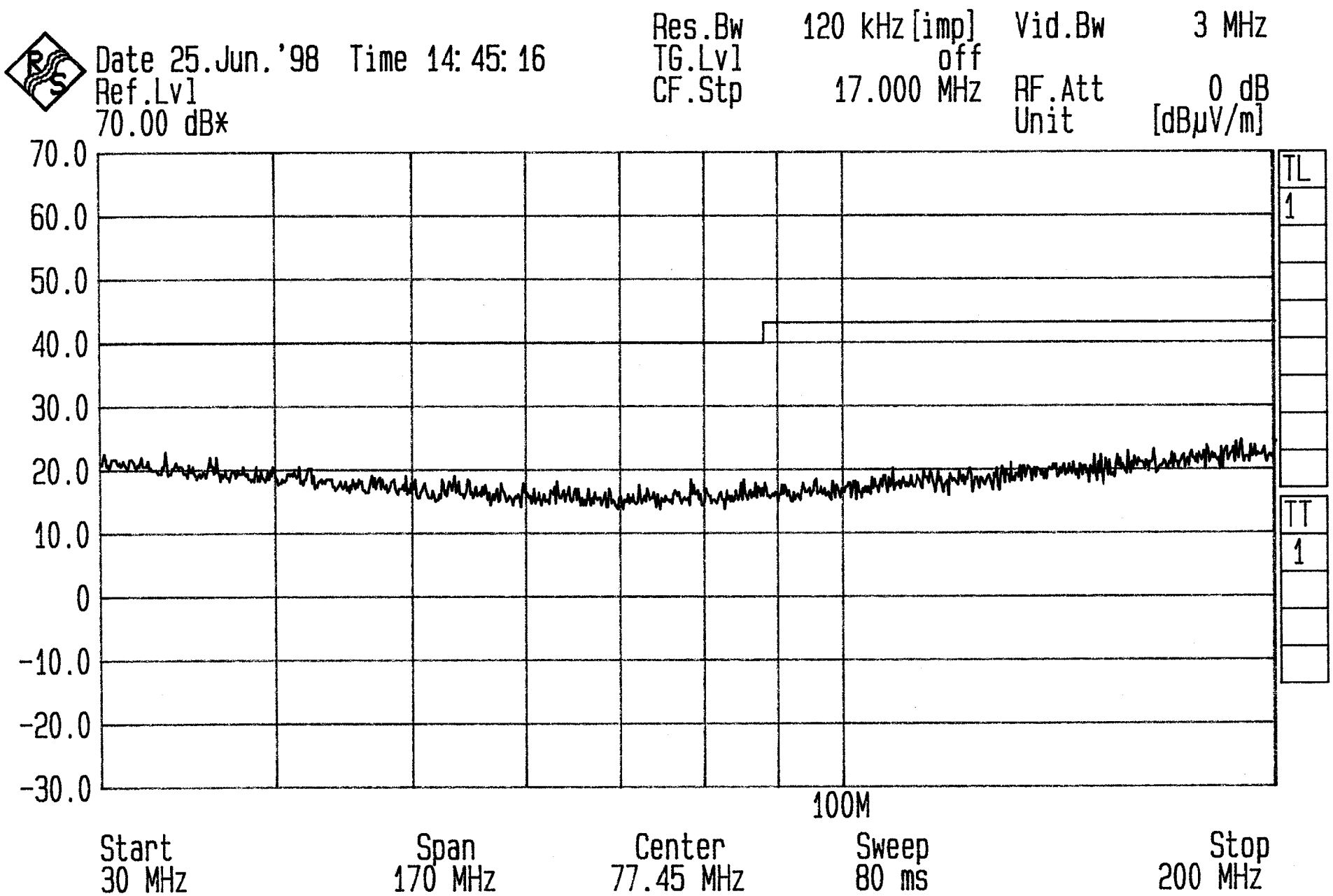

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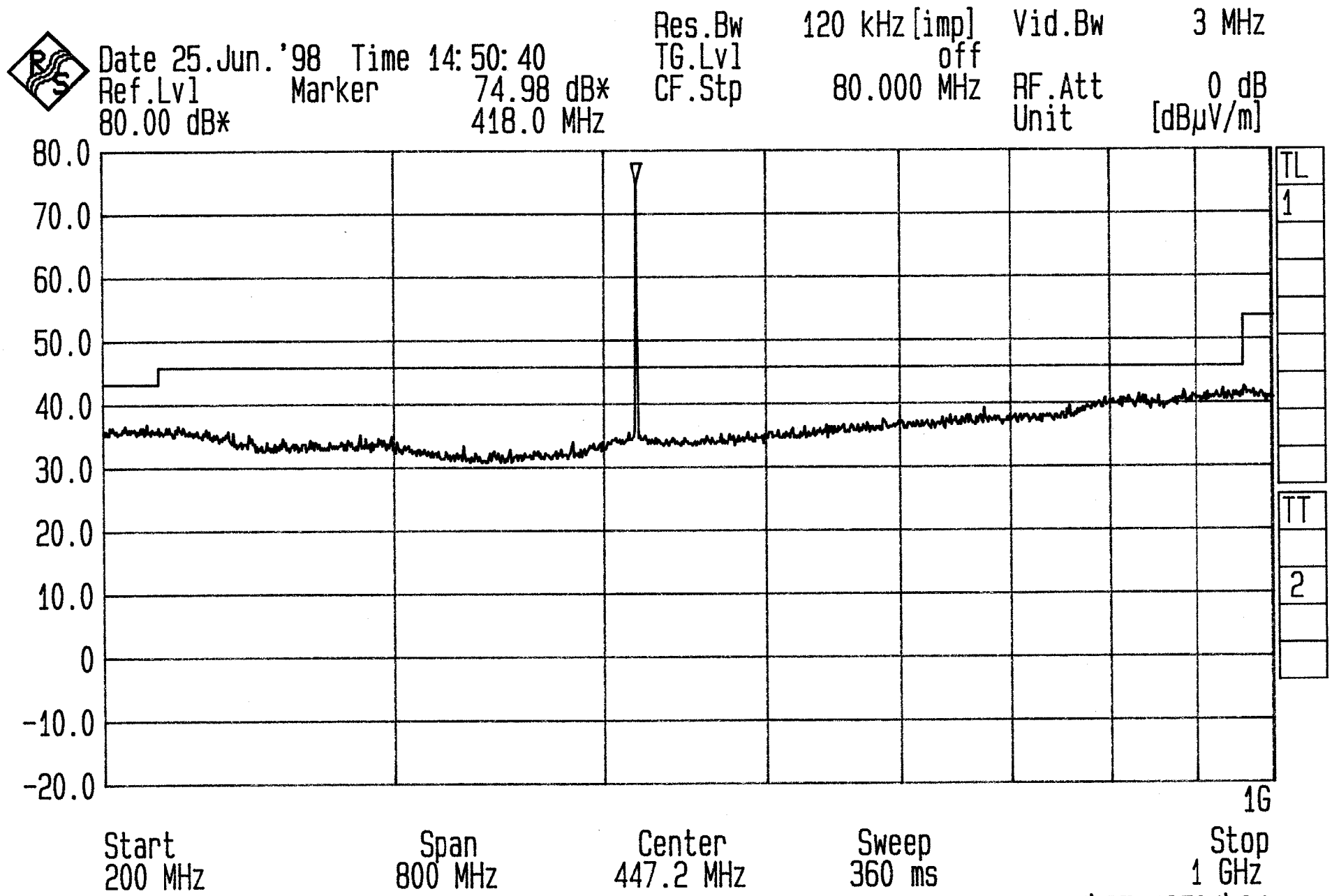

Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\04
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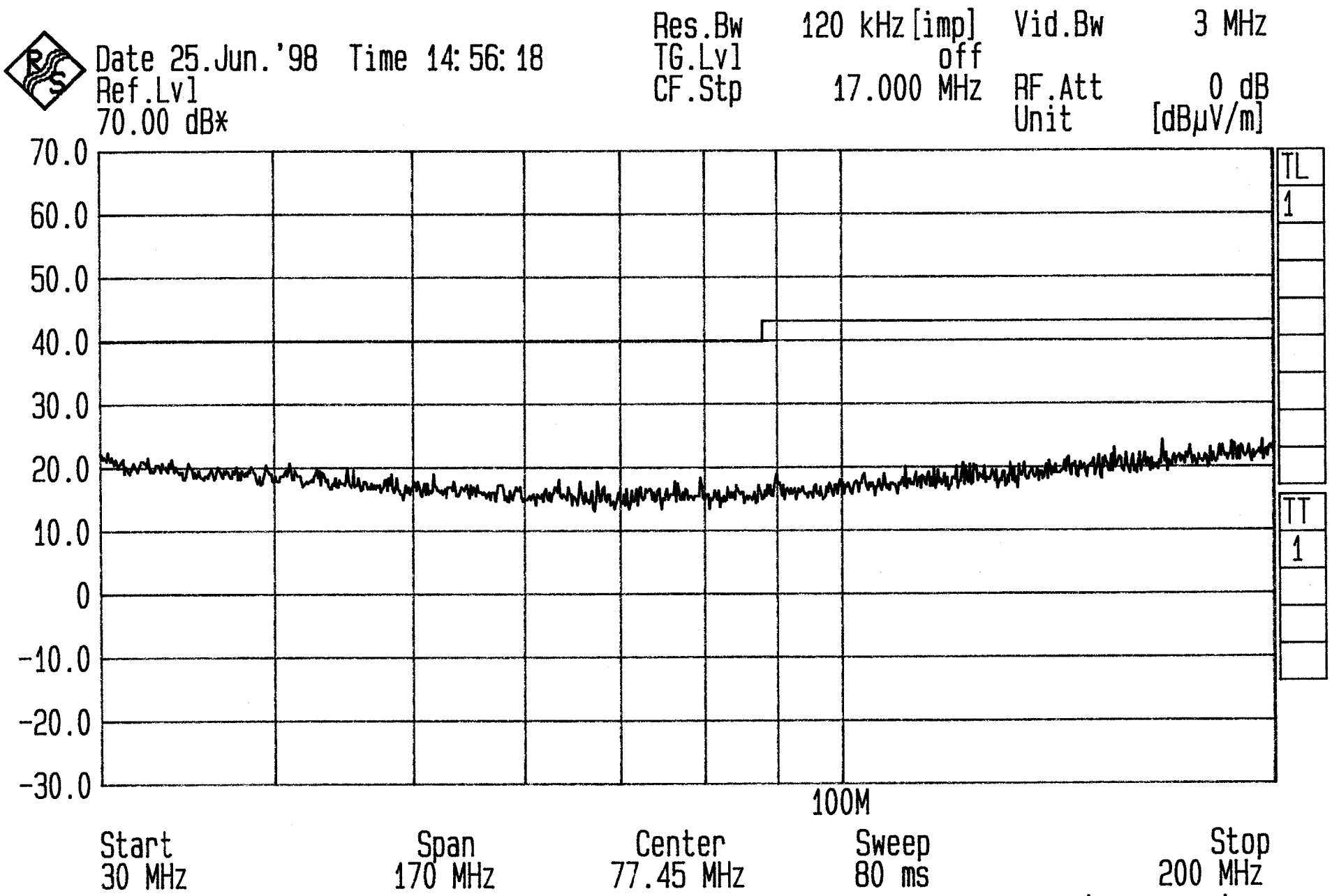

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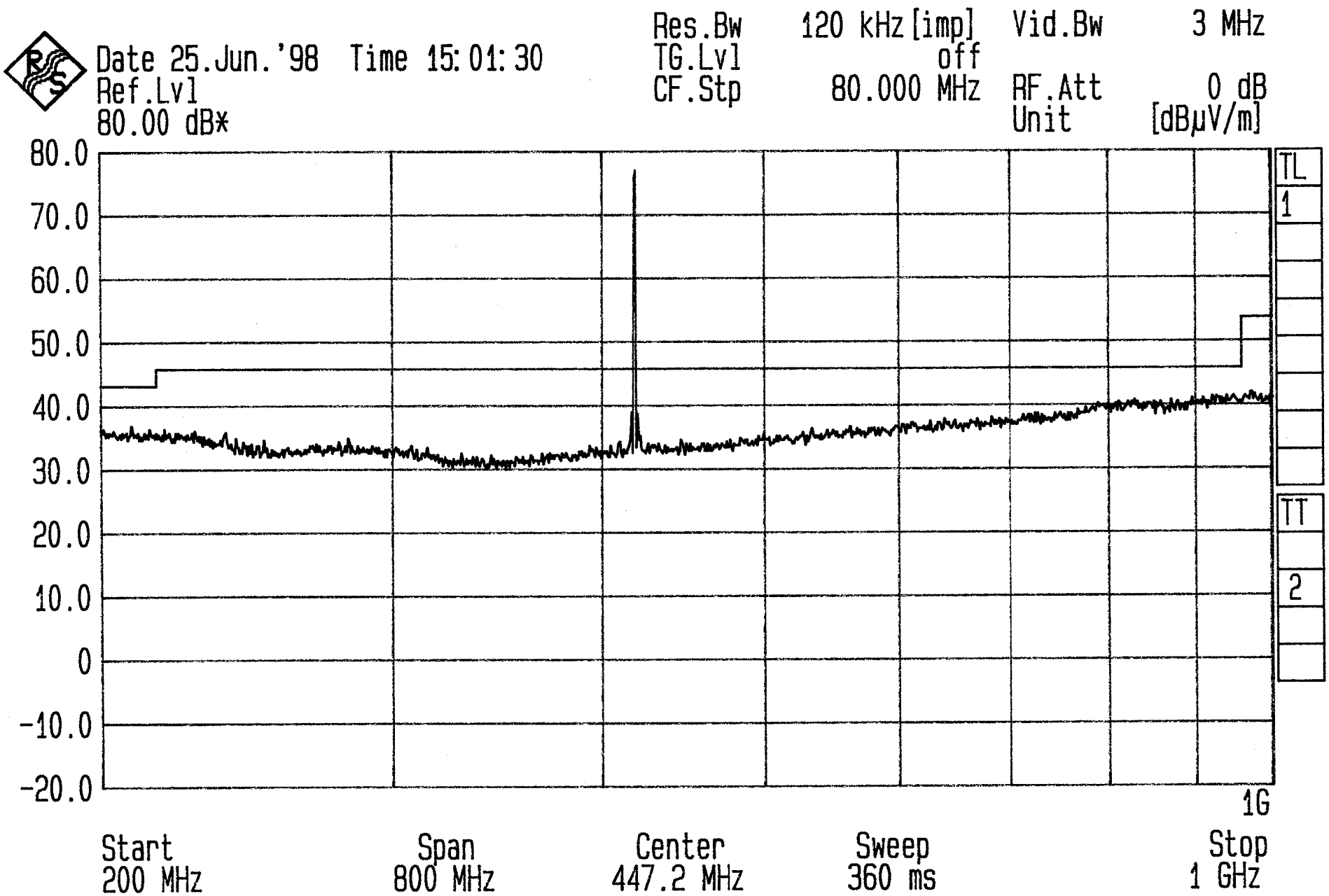

Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\06
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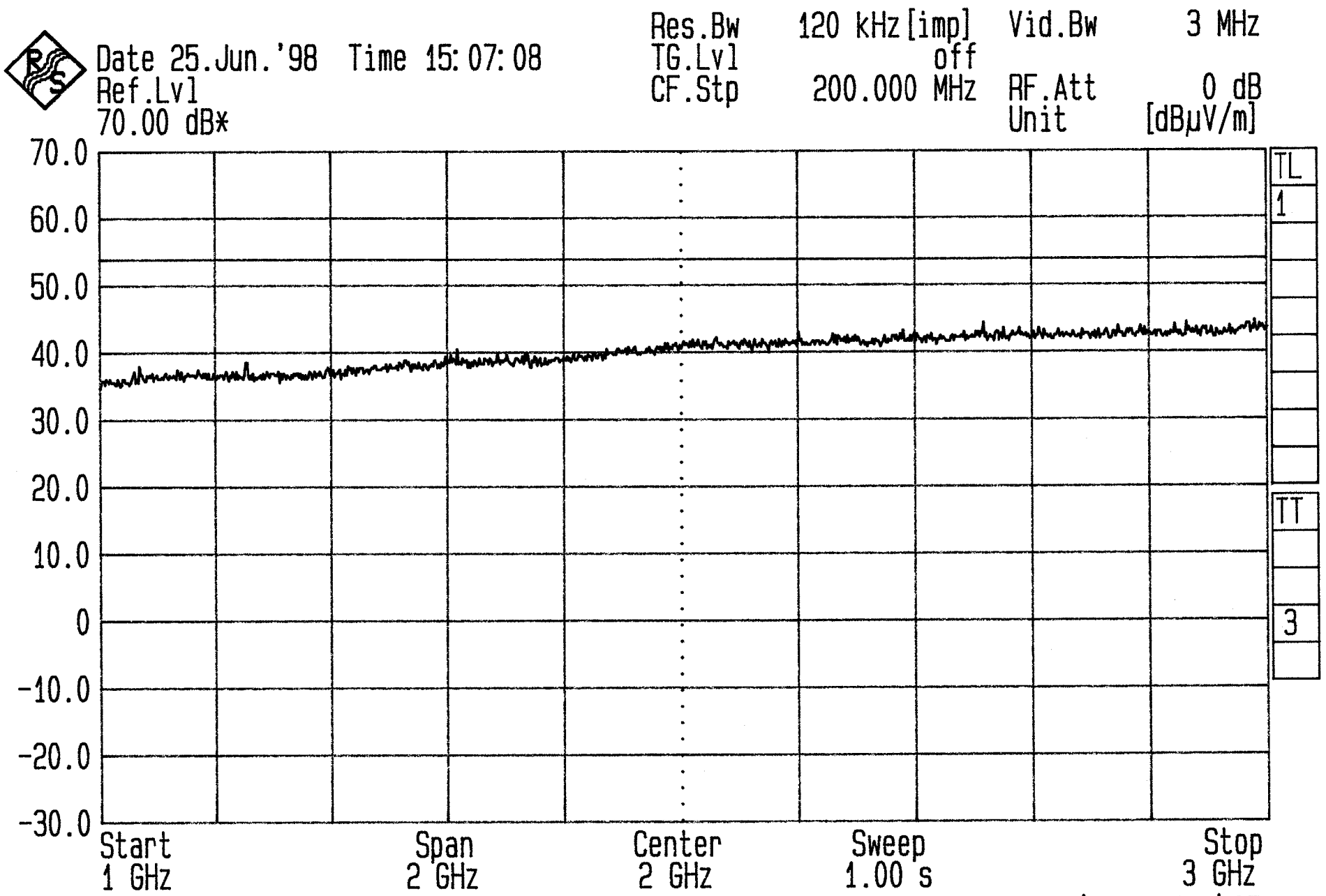

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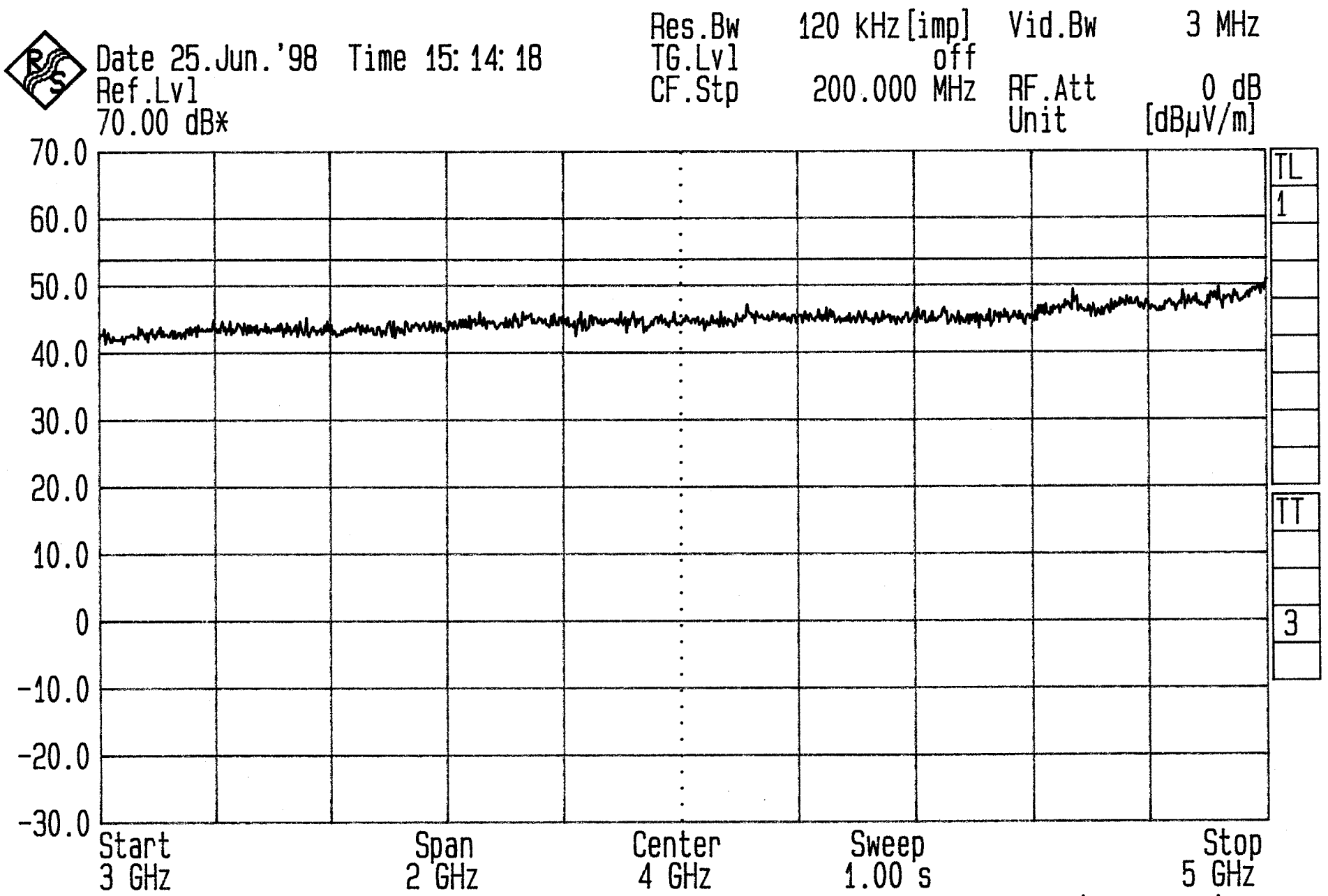

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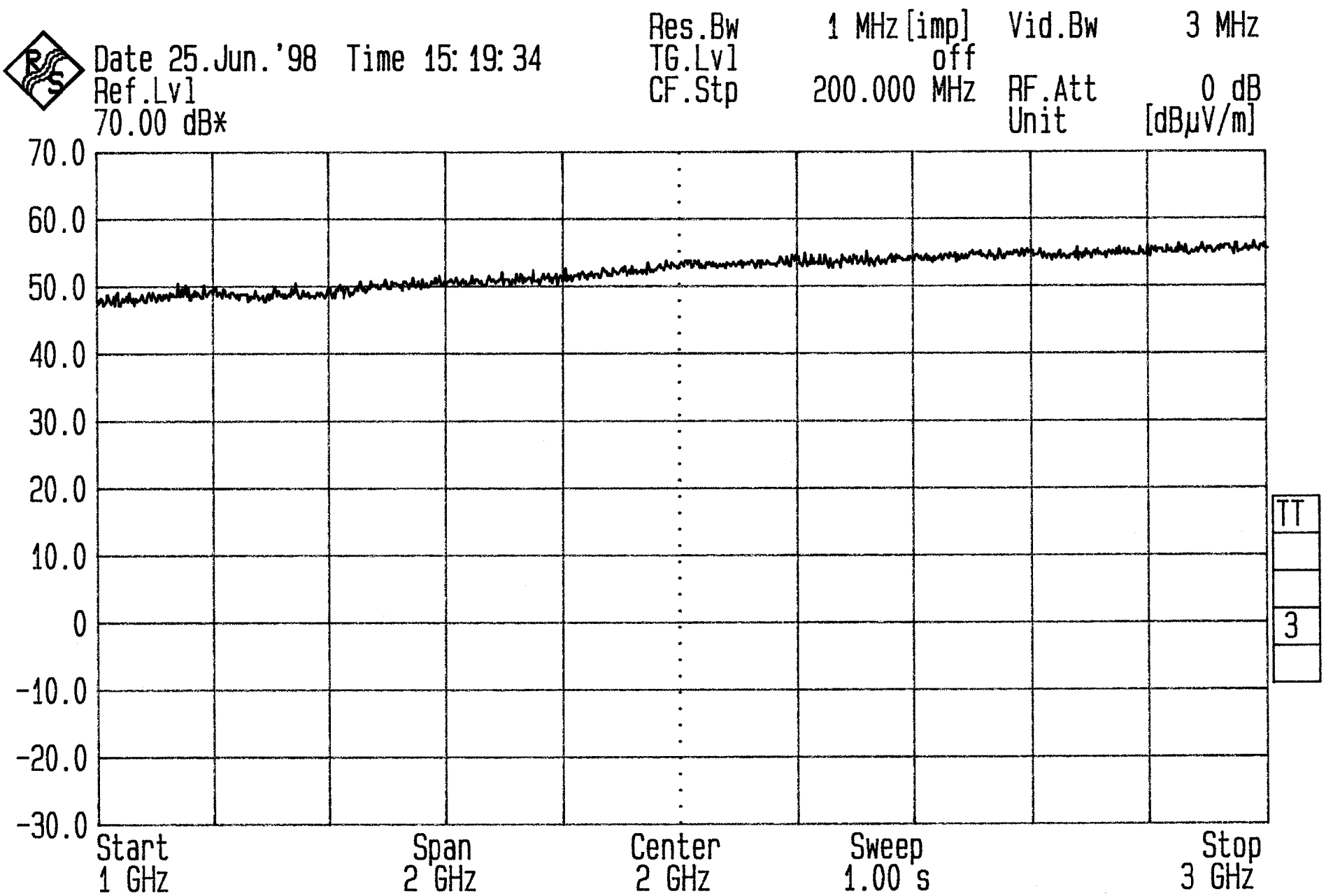

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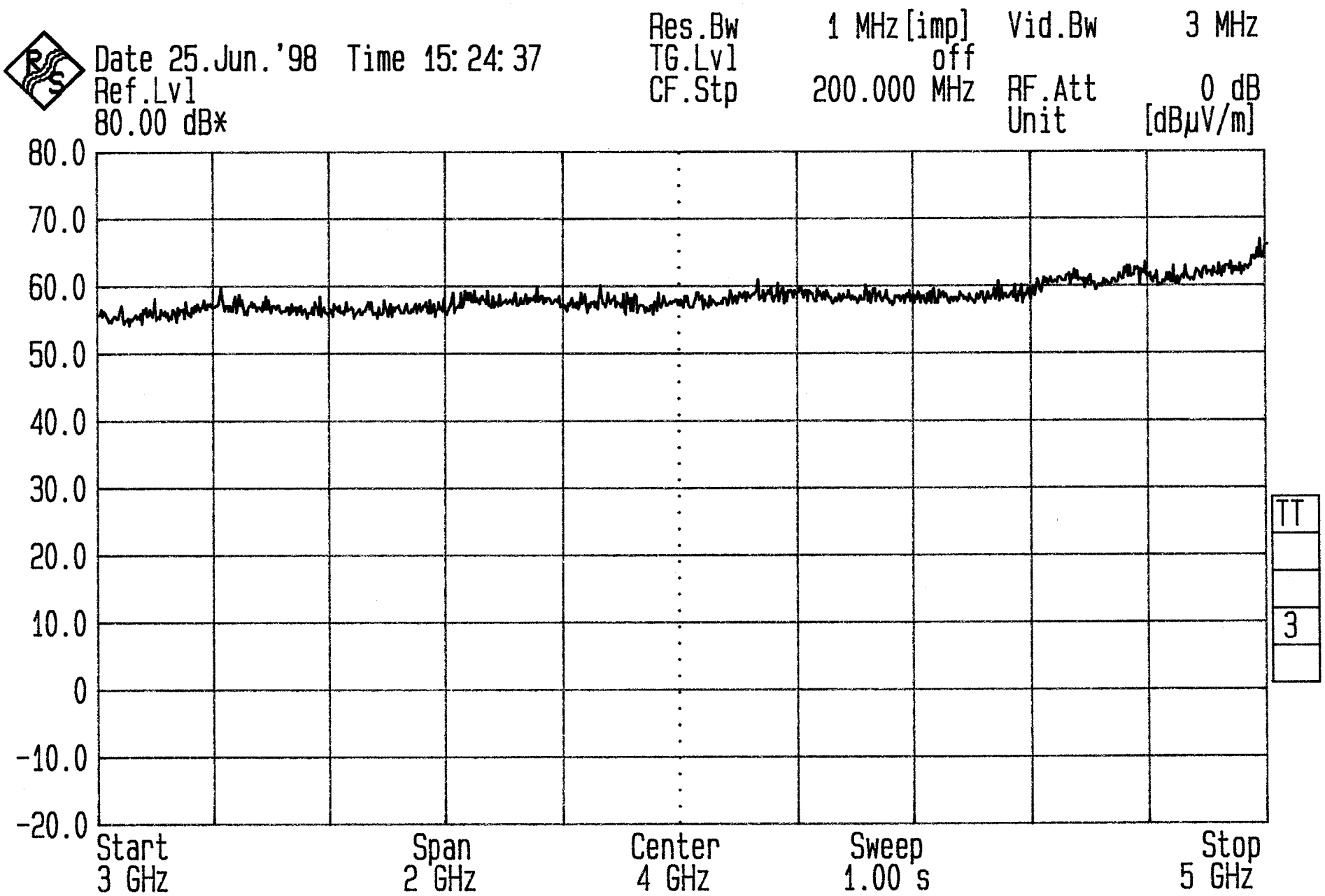

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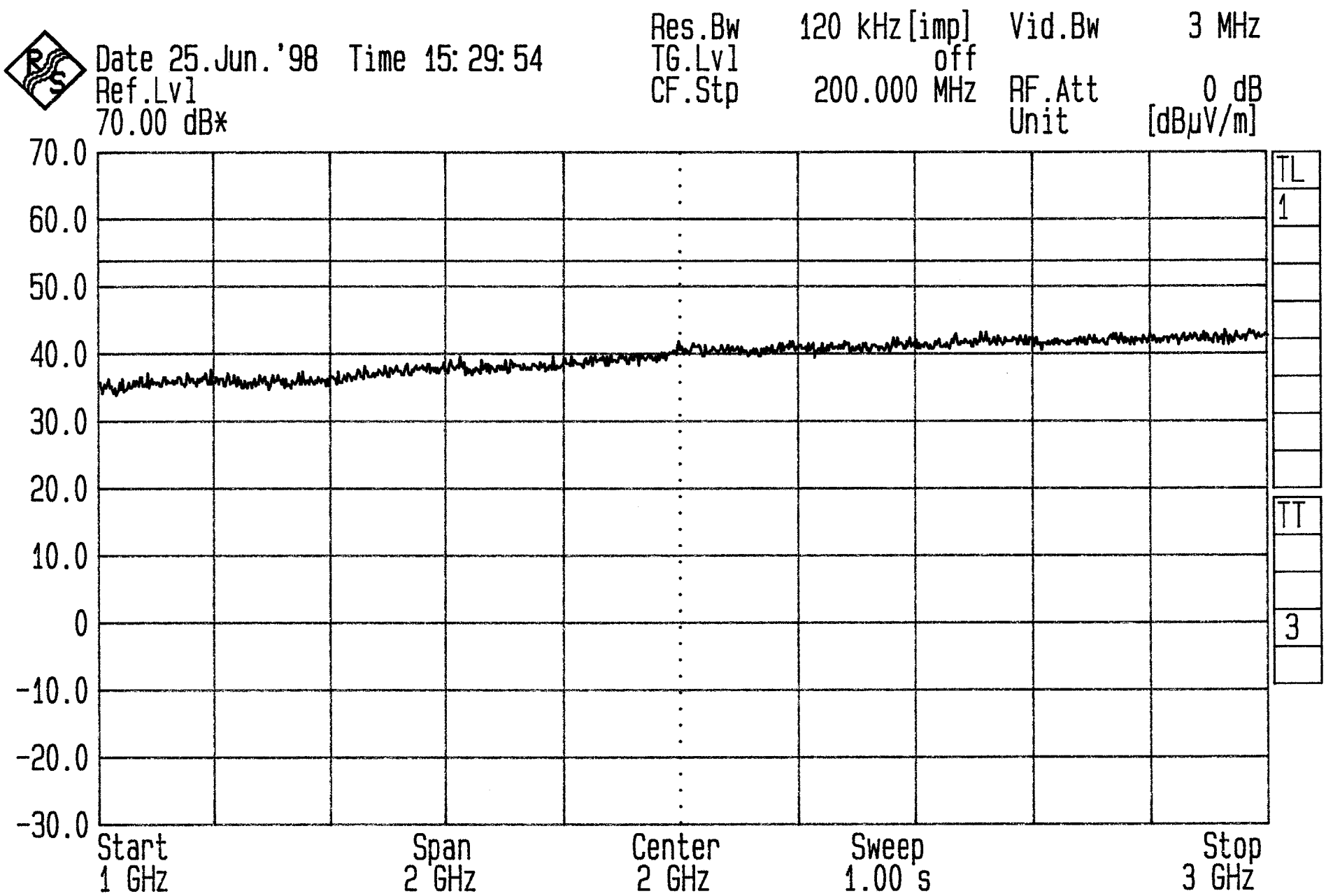

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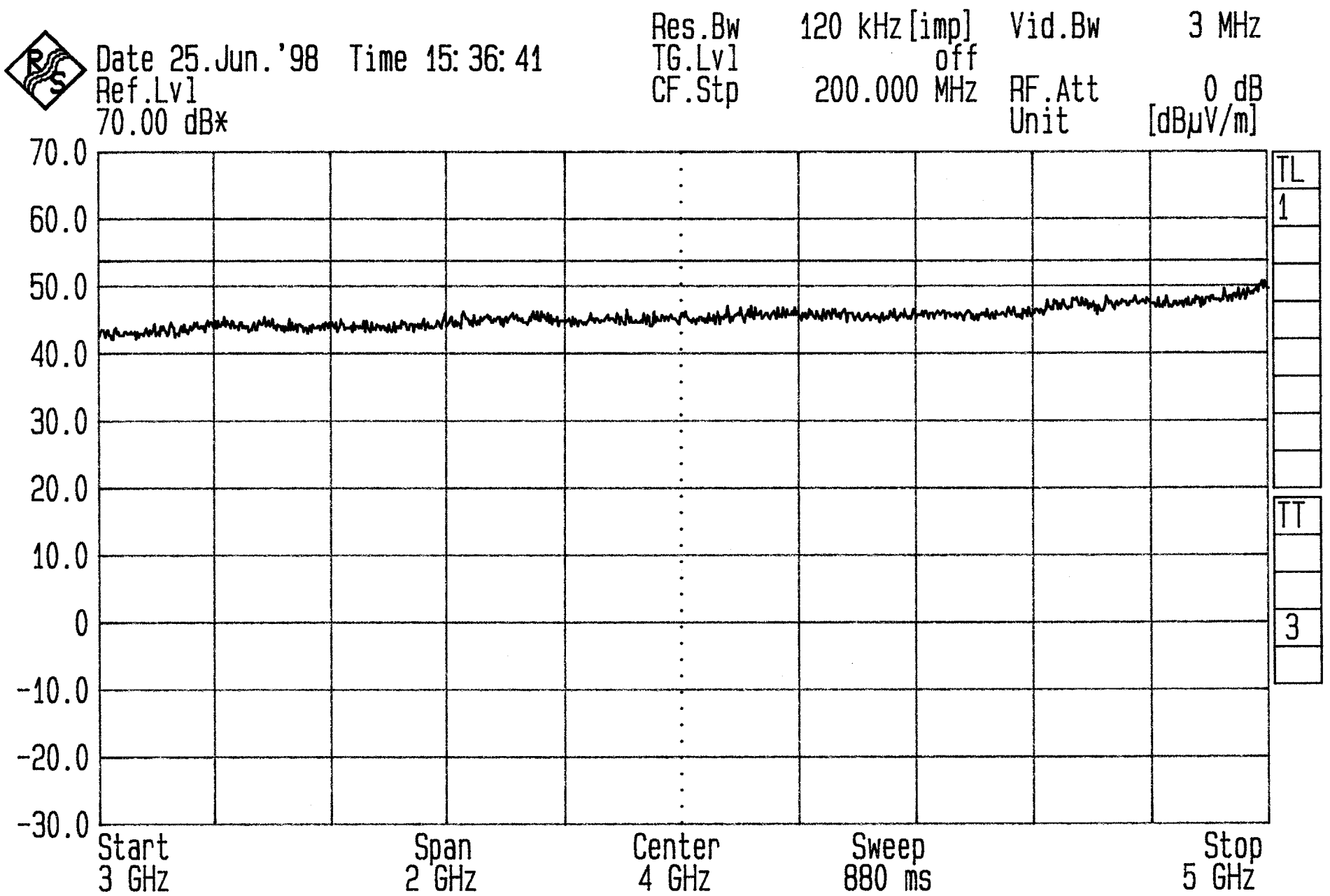

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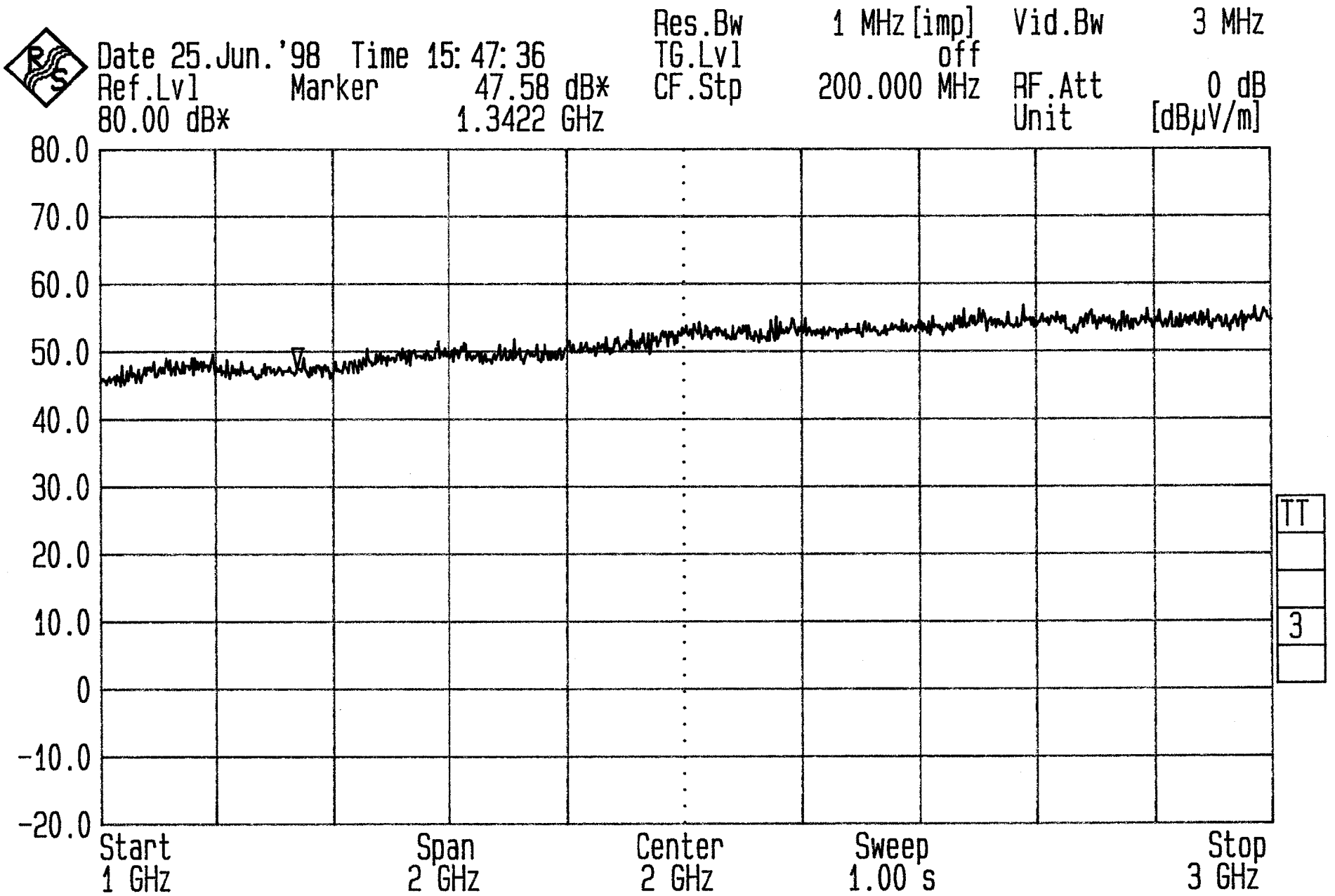

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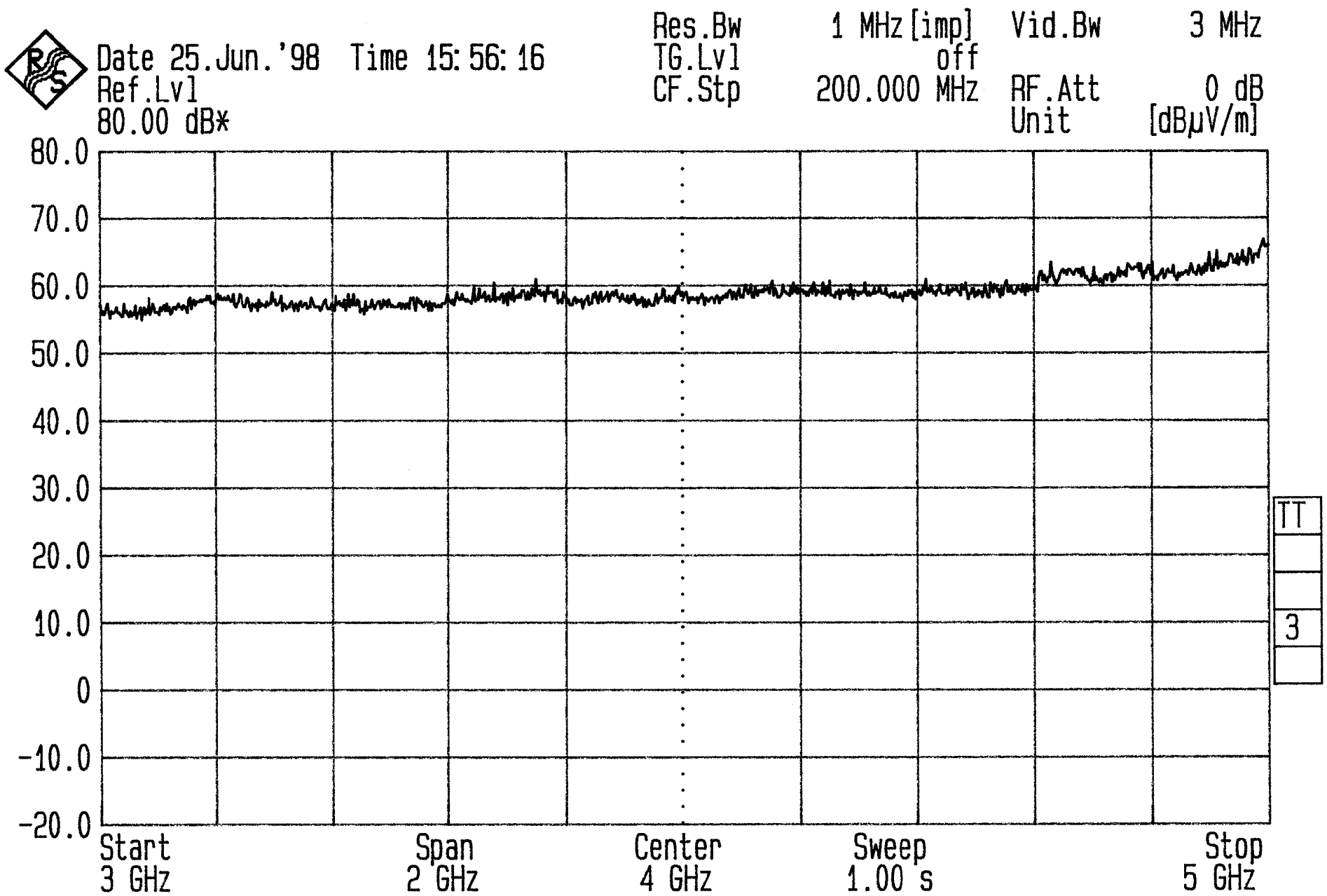

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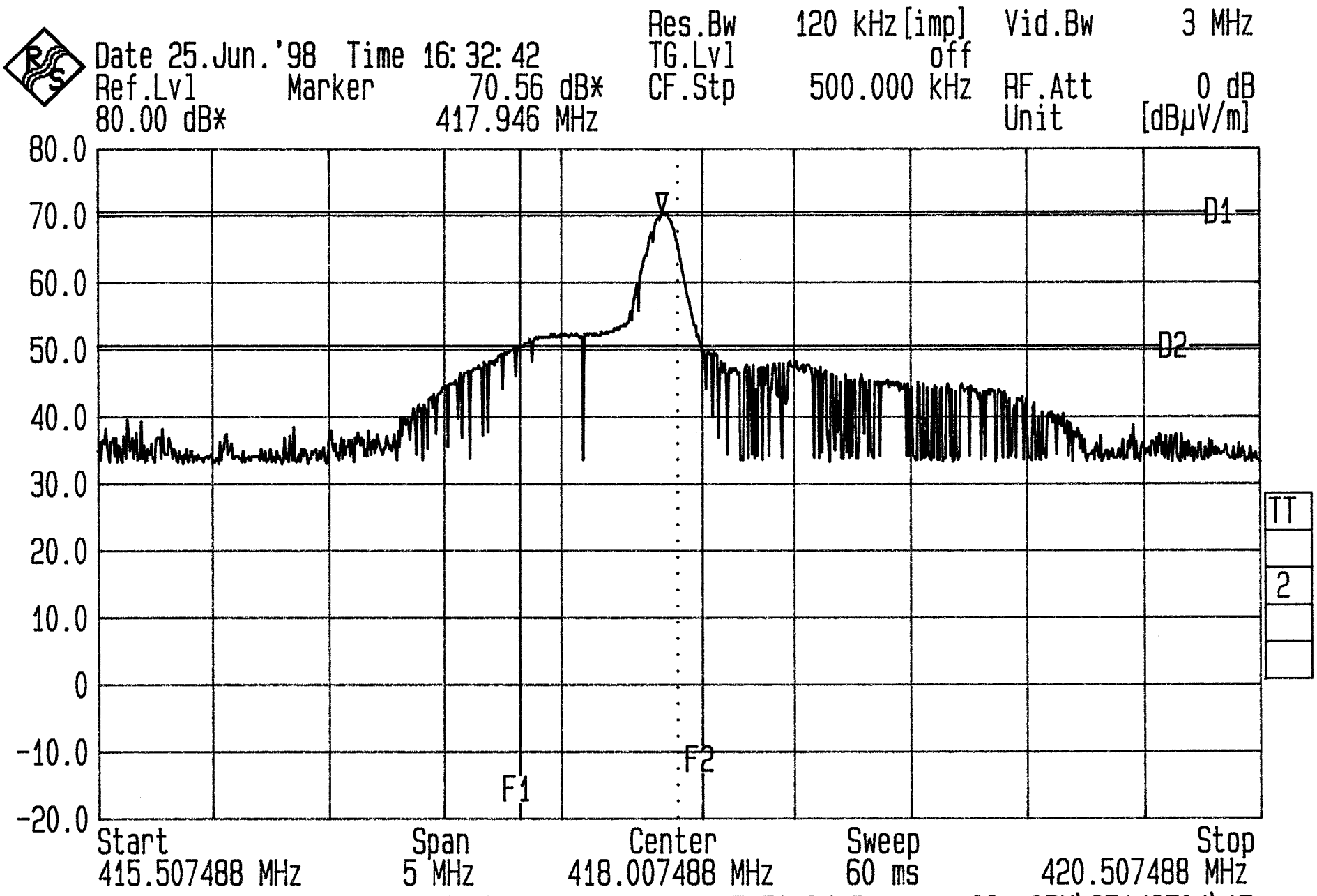

Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\15
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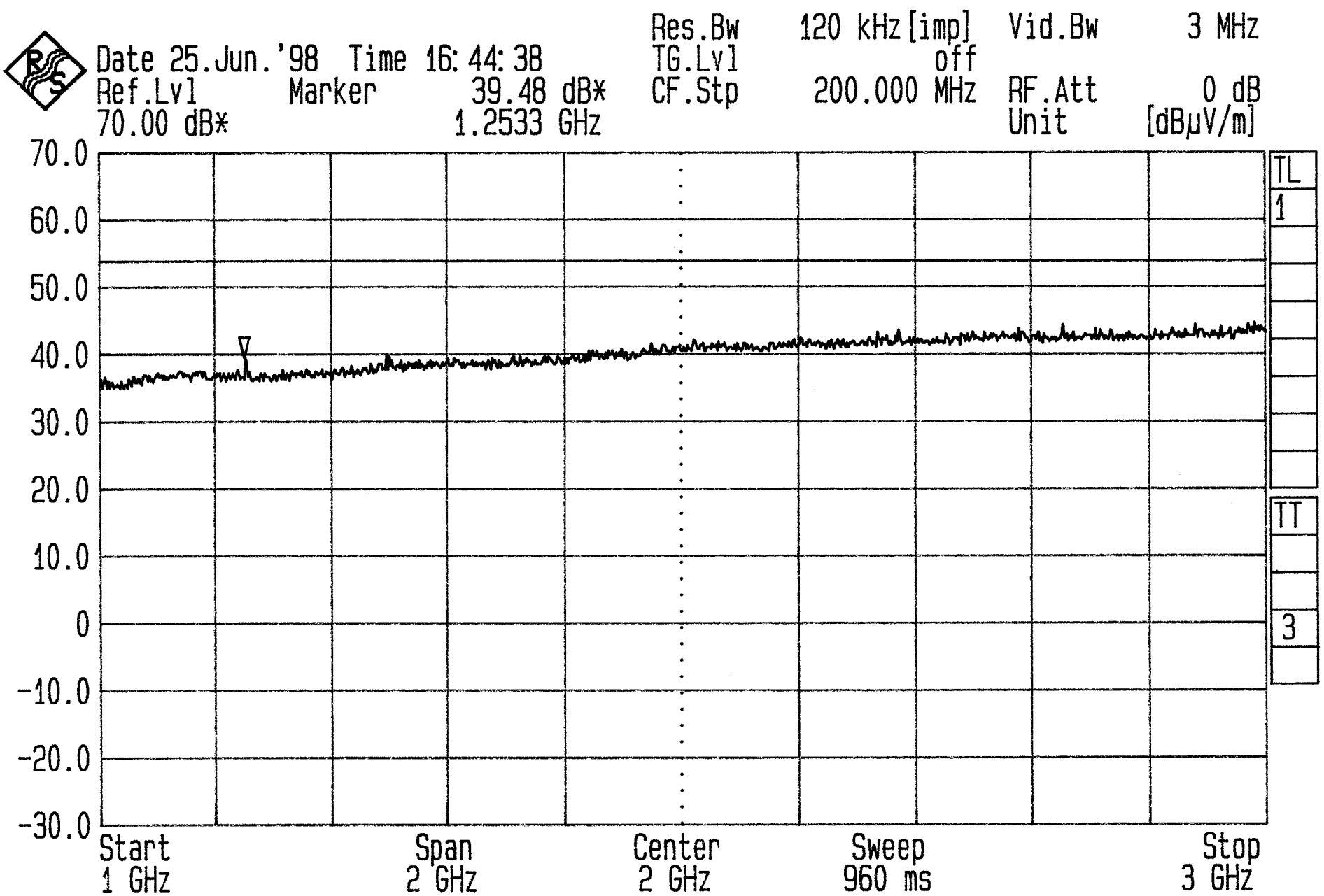
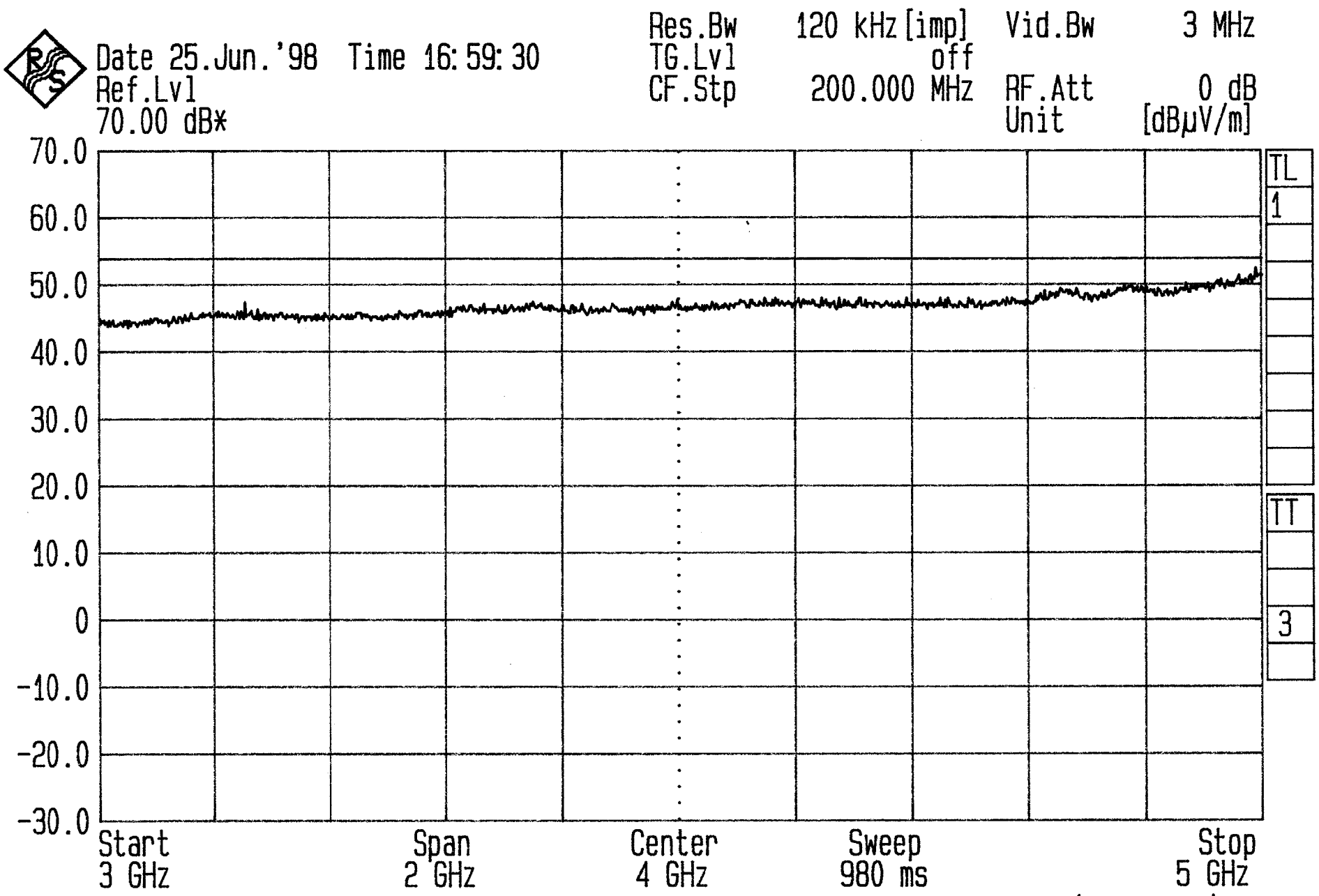
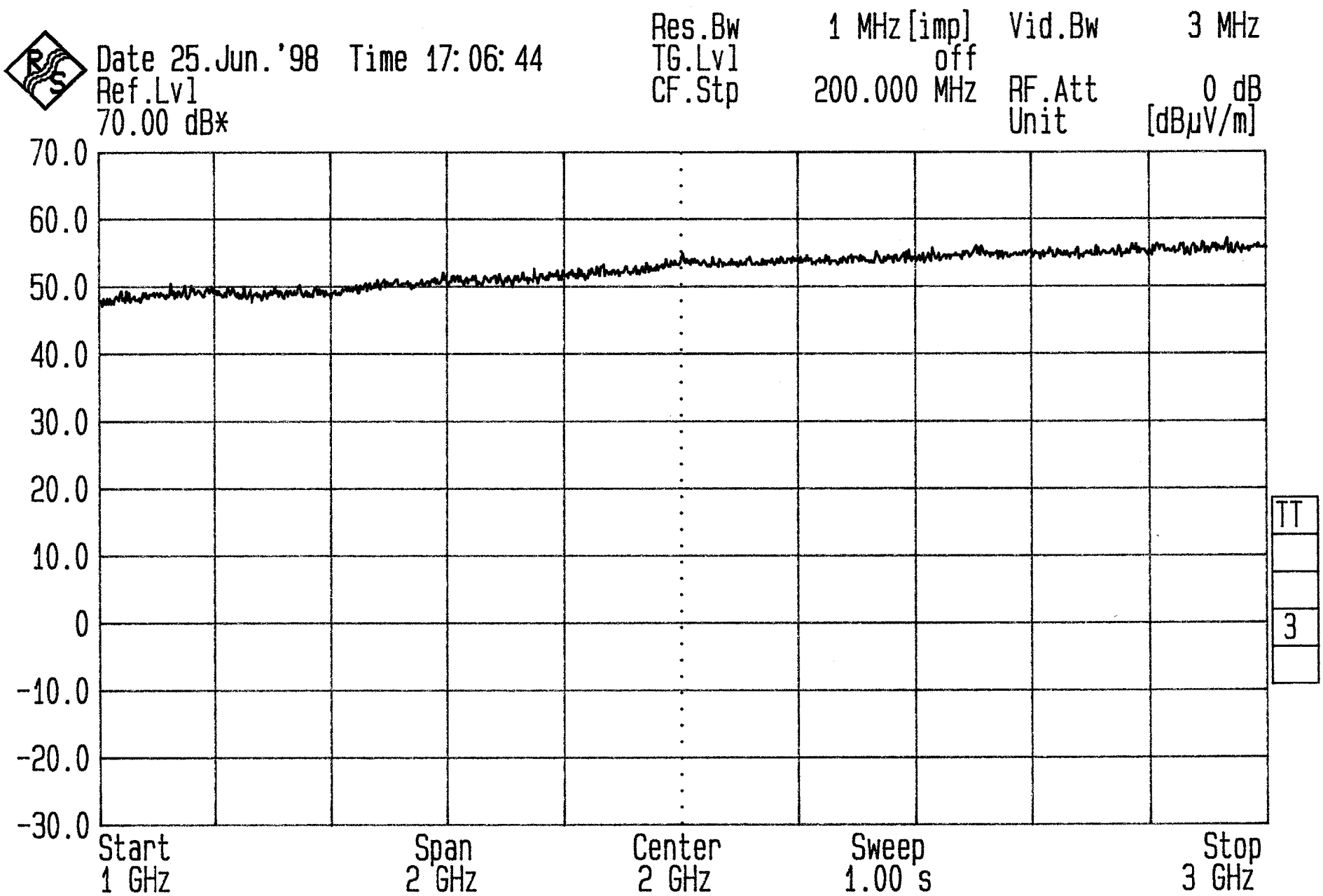


Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\16
EUT: 418MHz PAT /Cust: BASYS /OpCond: TAMPER MODE /Eng: JL/Spec: FCC 47 PT15 C



Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\17
EUT: 418MHz PAT /Cust: BASYS /OpCond: TAMPER MODE /Eng: JL/Spec: FCC 47 PT15 C



Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\18
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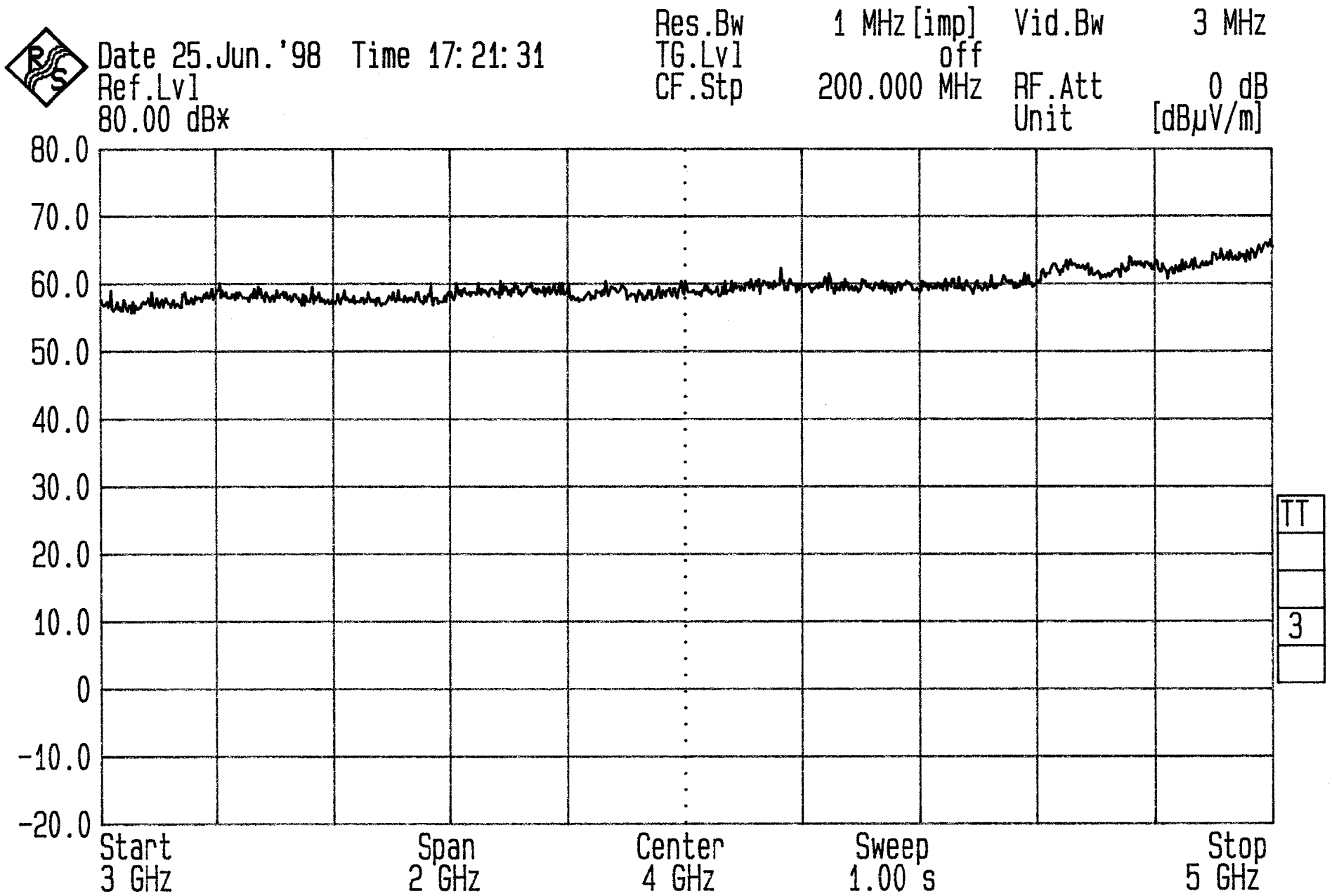
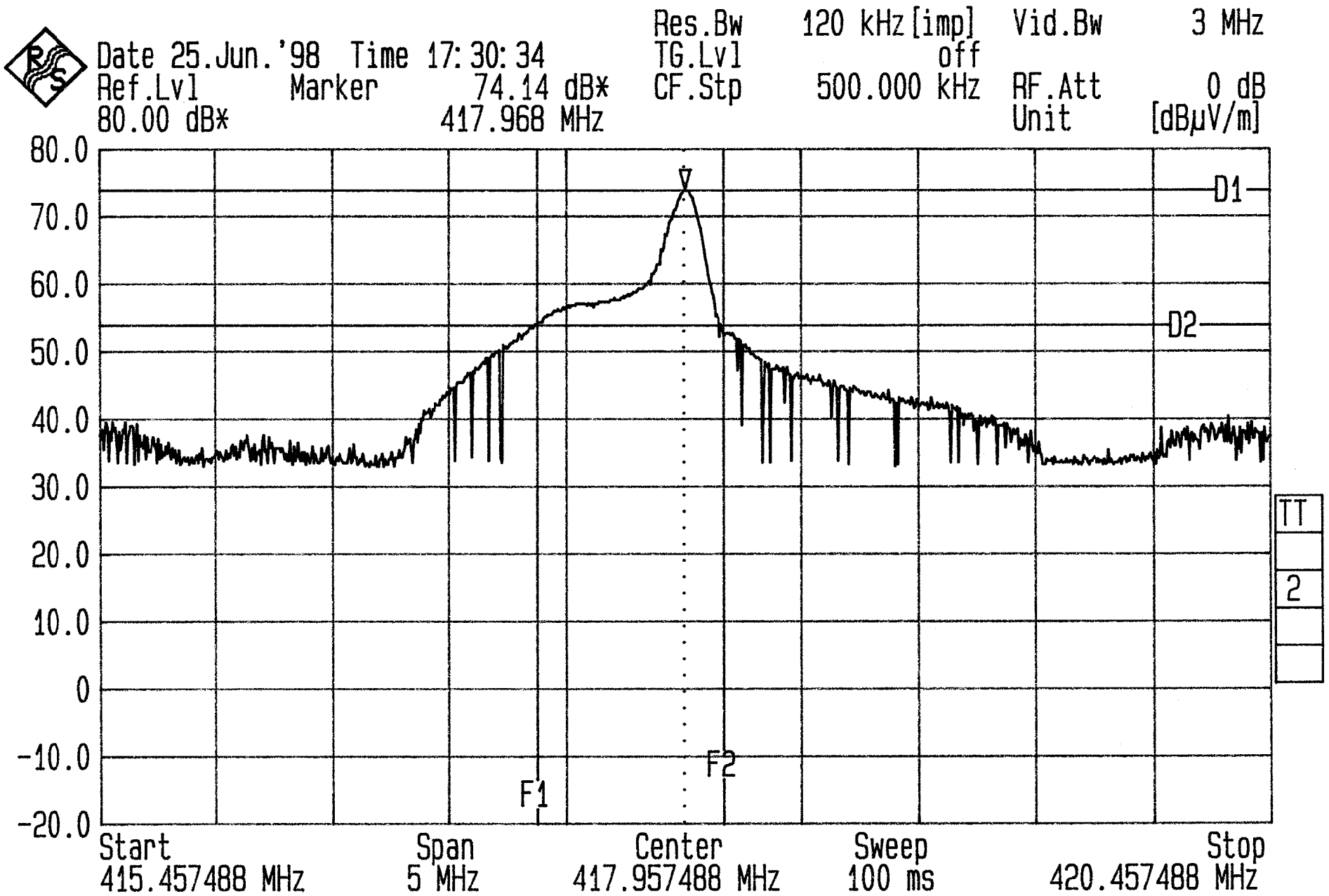
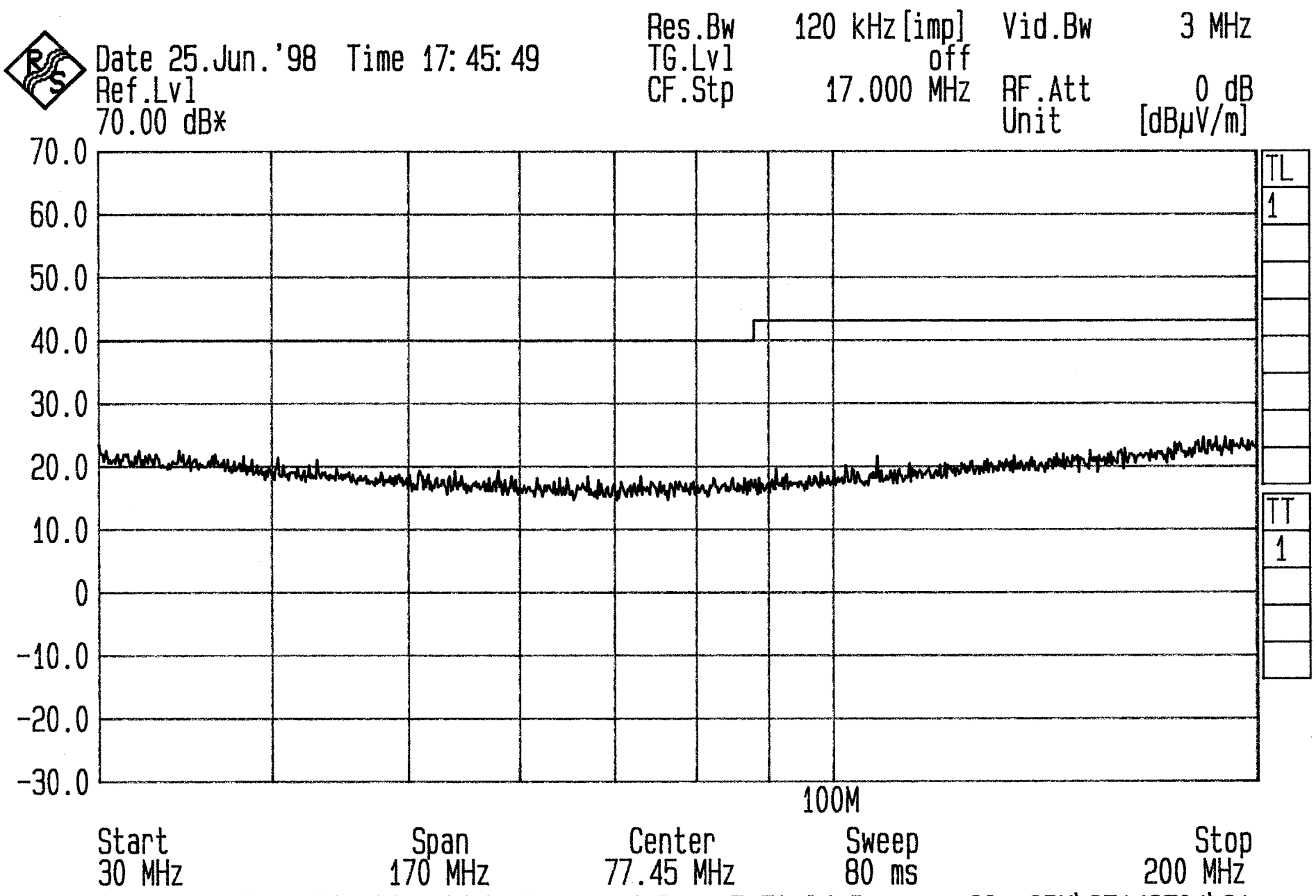


Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\19

EUT: 418MHz PAT /Cust: BASYS /OpCond: TAMPER MODE /Eng: JL/Spec: FCC 47 PT15 C



Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\20
EUT: 418MHz PAT /Cust: BASYS /OpCond: TAMPER MODE BANDWIDTH/ Eng: JL/Spec: FCC 47 PT15 C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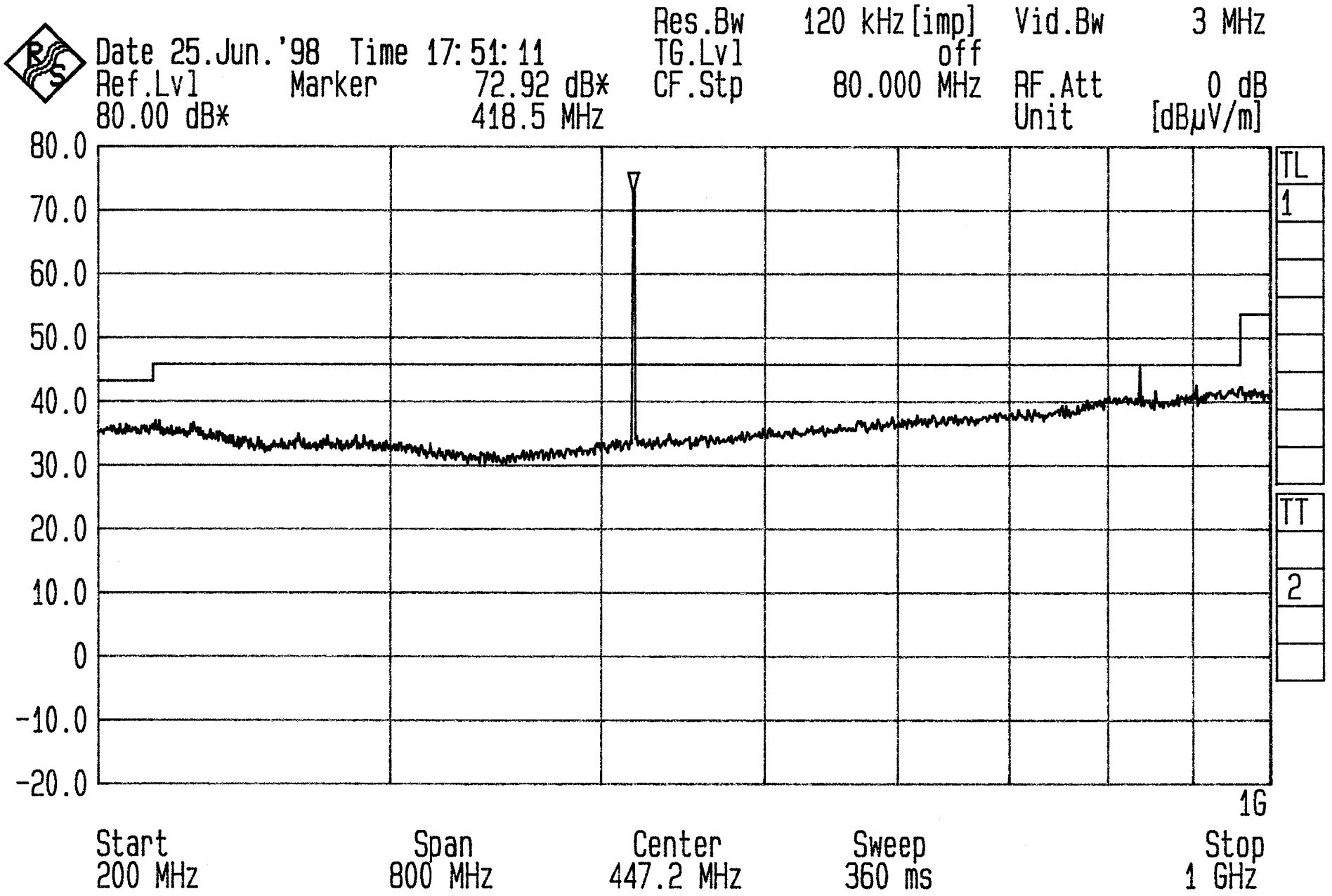
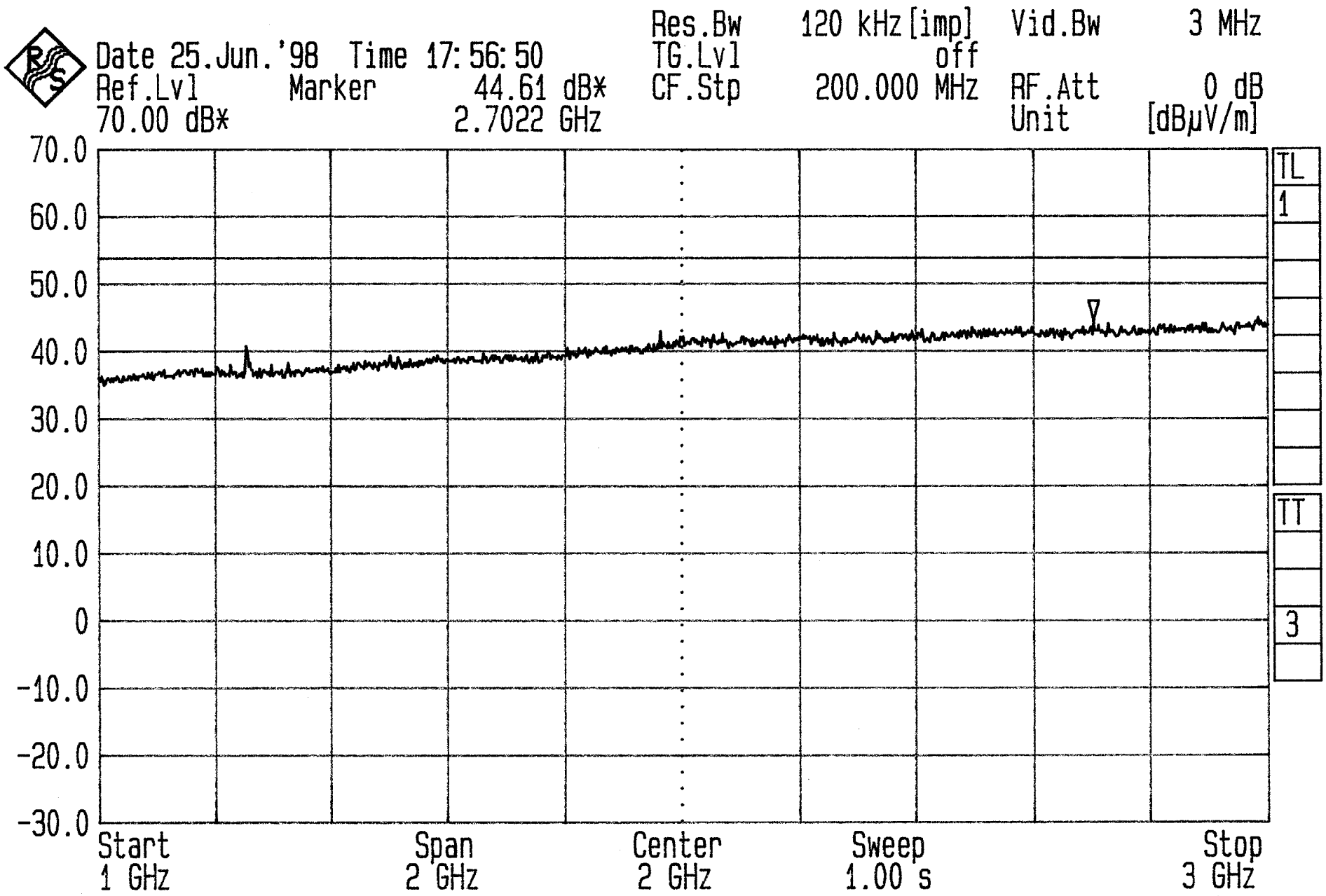
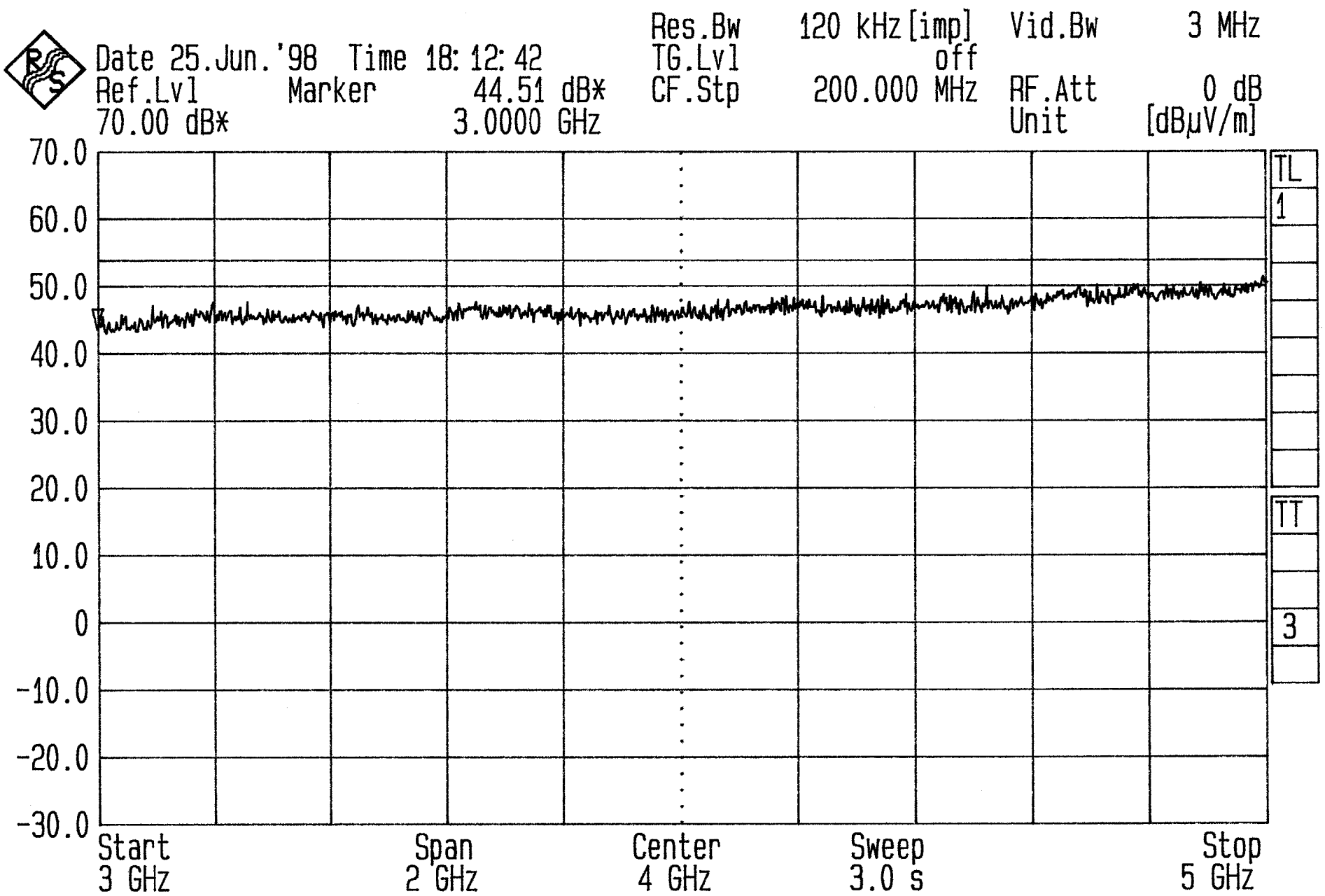
Ref.Lvl
70.00 dB*
Res.Bw 120 kHz[imp]
TG.Lvl off
CF.Stp 17.000 MHz
Vid.Bw 3 MHz
RF.Att 0 dB
Unit [dBµV/m]
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
-20.0
-30.0
100M
TL
1
TT
1
Start 30 MHz
Span 170 MHz
Center 77.45 MHz
Sweep 80 ms
Stop 200 MHz
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\21
EUT: 418MHz PAT /Cust: BASYS /OpCond: UNMOD CARRIER / Eng: JL/Spec: FCC 47 PT15 C



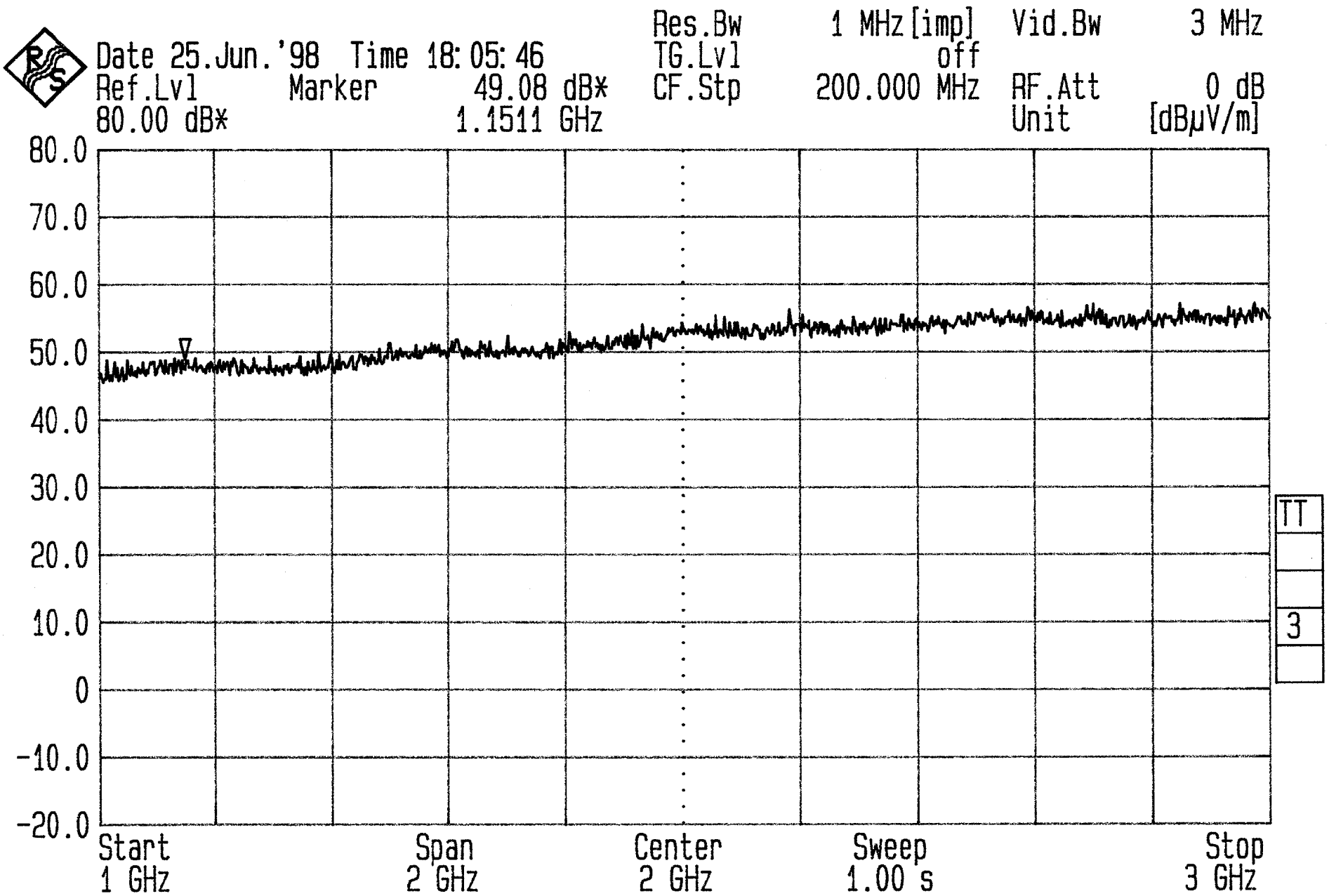
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\22
EUT: 418MHz PAT /Cust: BASYS /OpCond: UNMOD CARRIER / Eng: JL/Spec: FCC 47 PT15 C



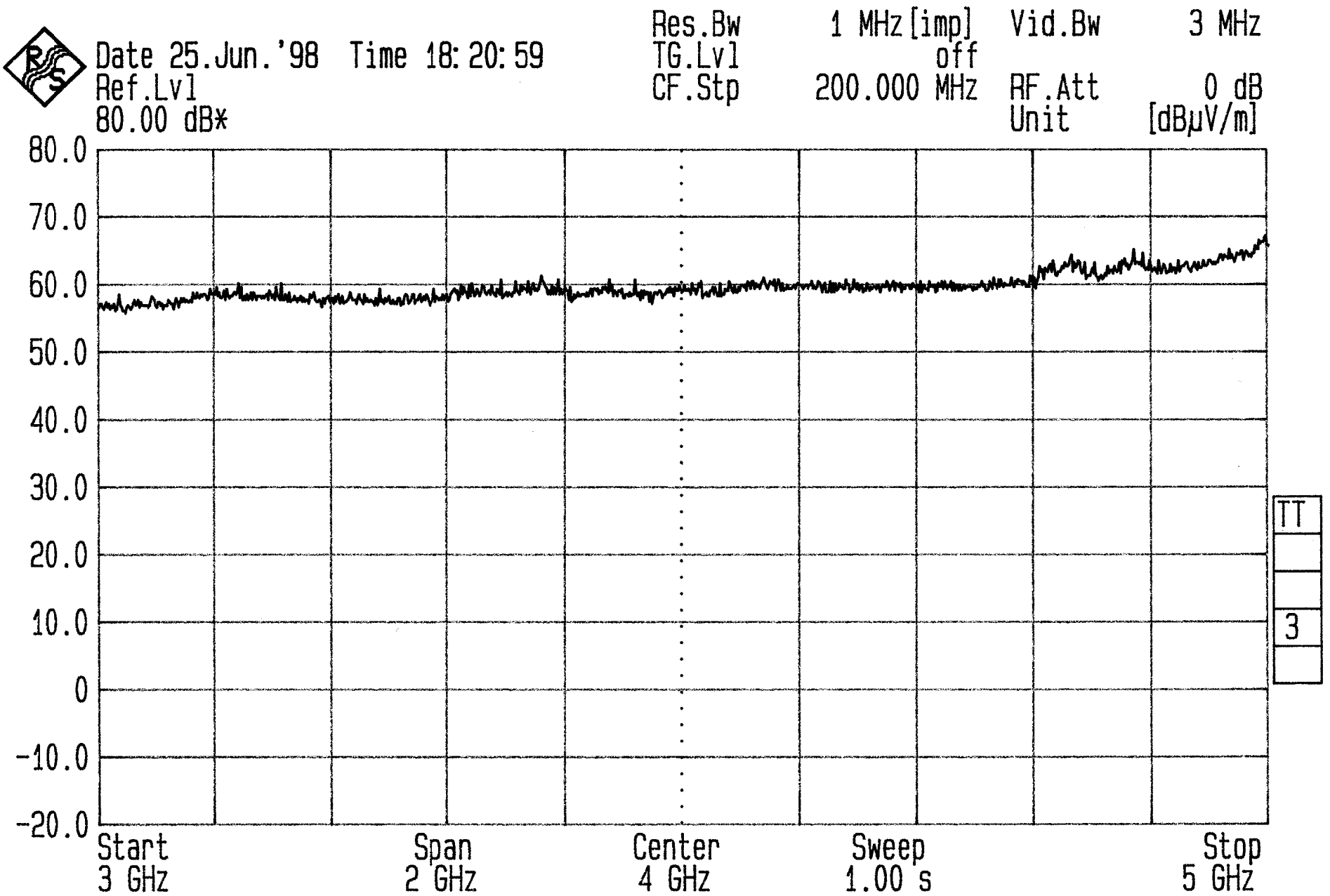
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\23
EUT: 418MHz PAT /Cust: BASYS /OpCond: UNMOD CARRIER / Eng: JL/Spec: FCC 47 PT15 C



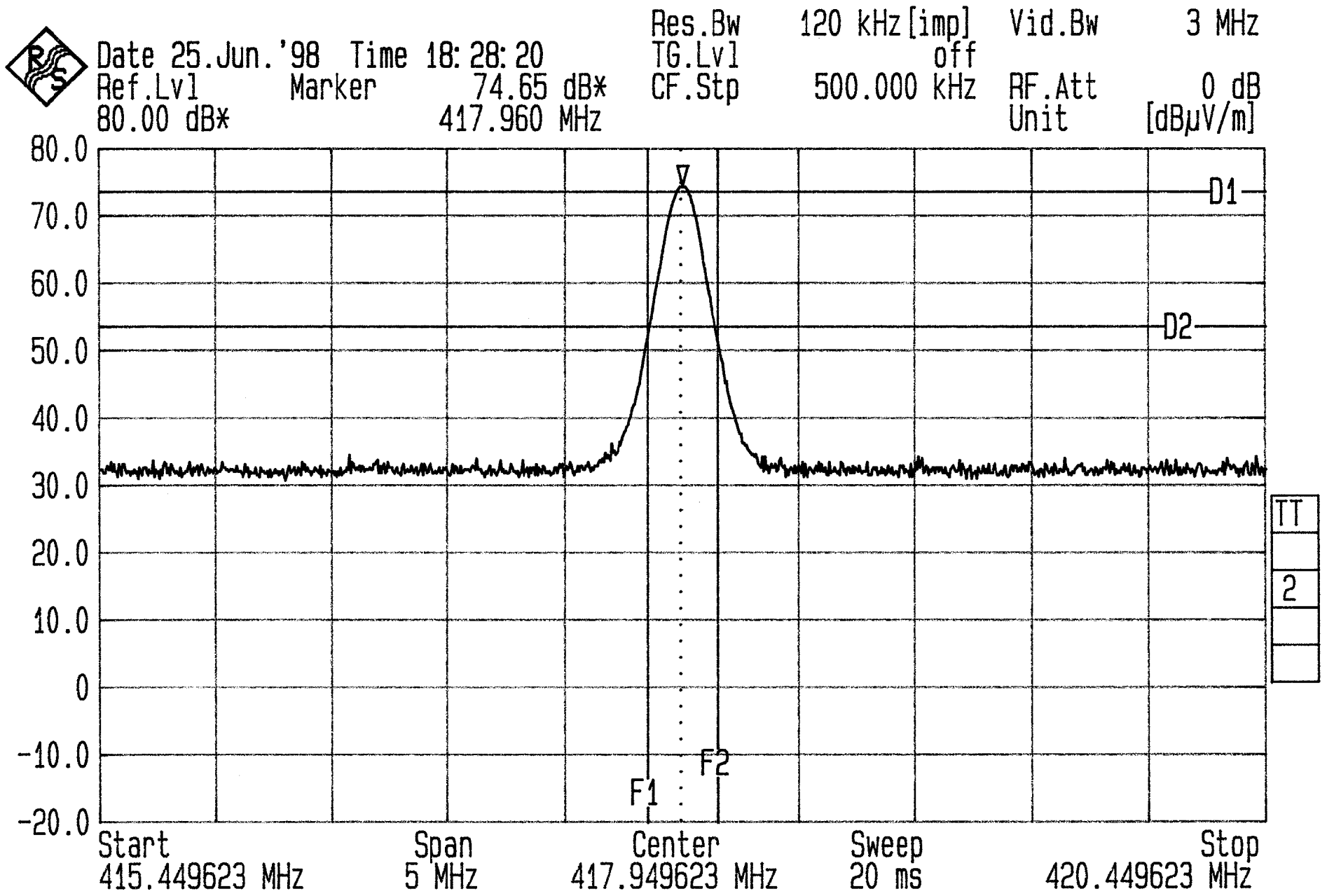
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH/37143E04/24
EUT: 418MHz PAT /Cust: BASYS /OpCond: UNMOD CARRIER / Eng: JL/Spec: FCC 47 PT15 C



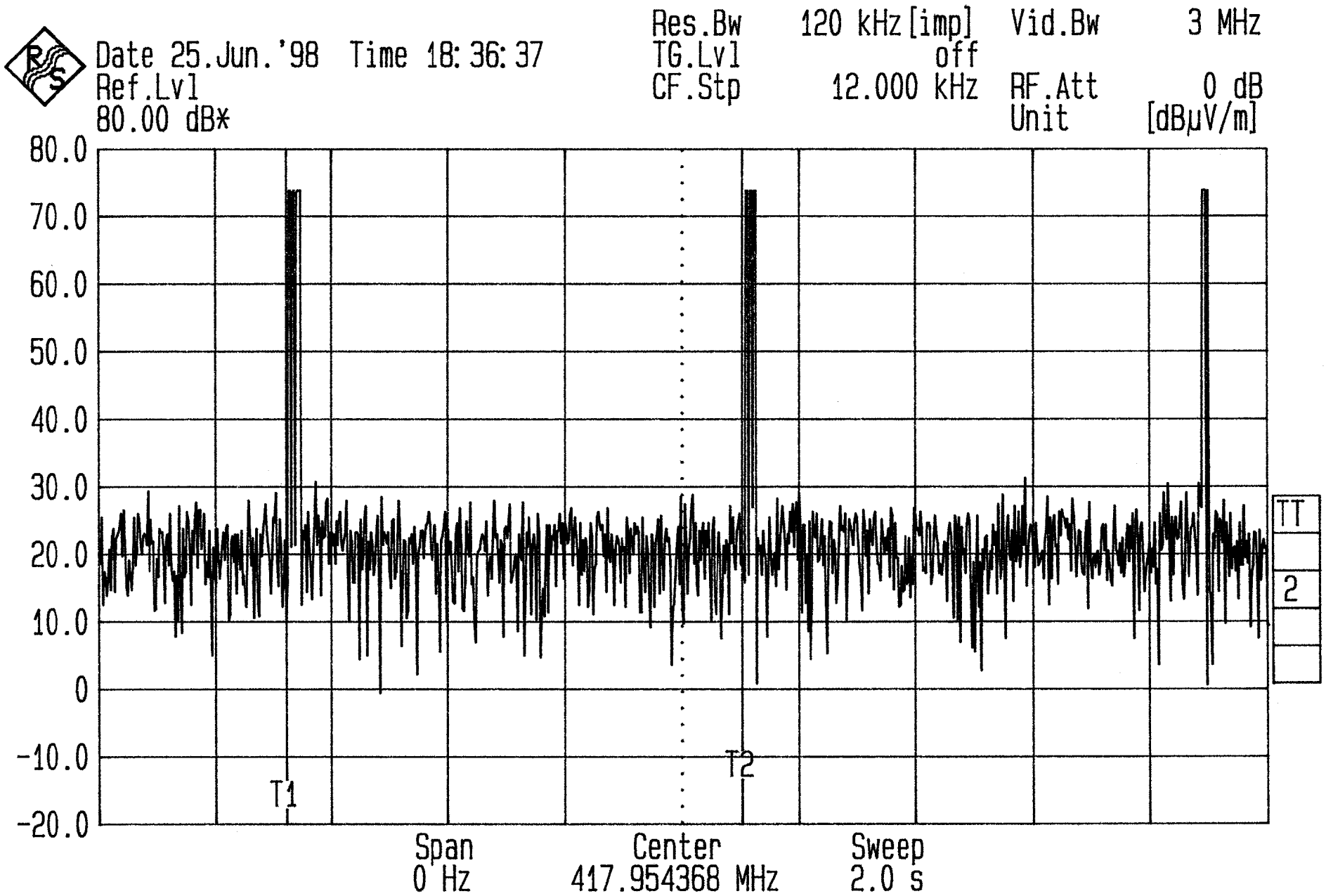
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\25
EUT: 418MHz PAT /Cust: BASYS /OpCond: UNMOD CARRIER / Eng: JL/Spec: FCC 47 PT15 C



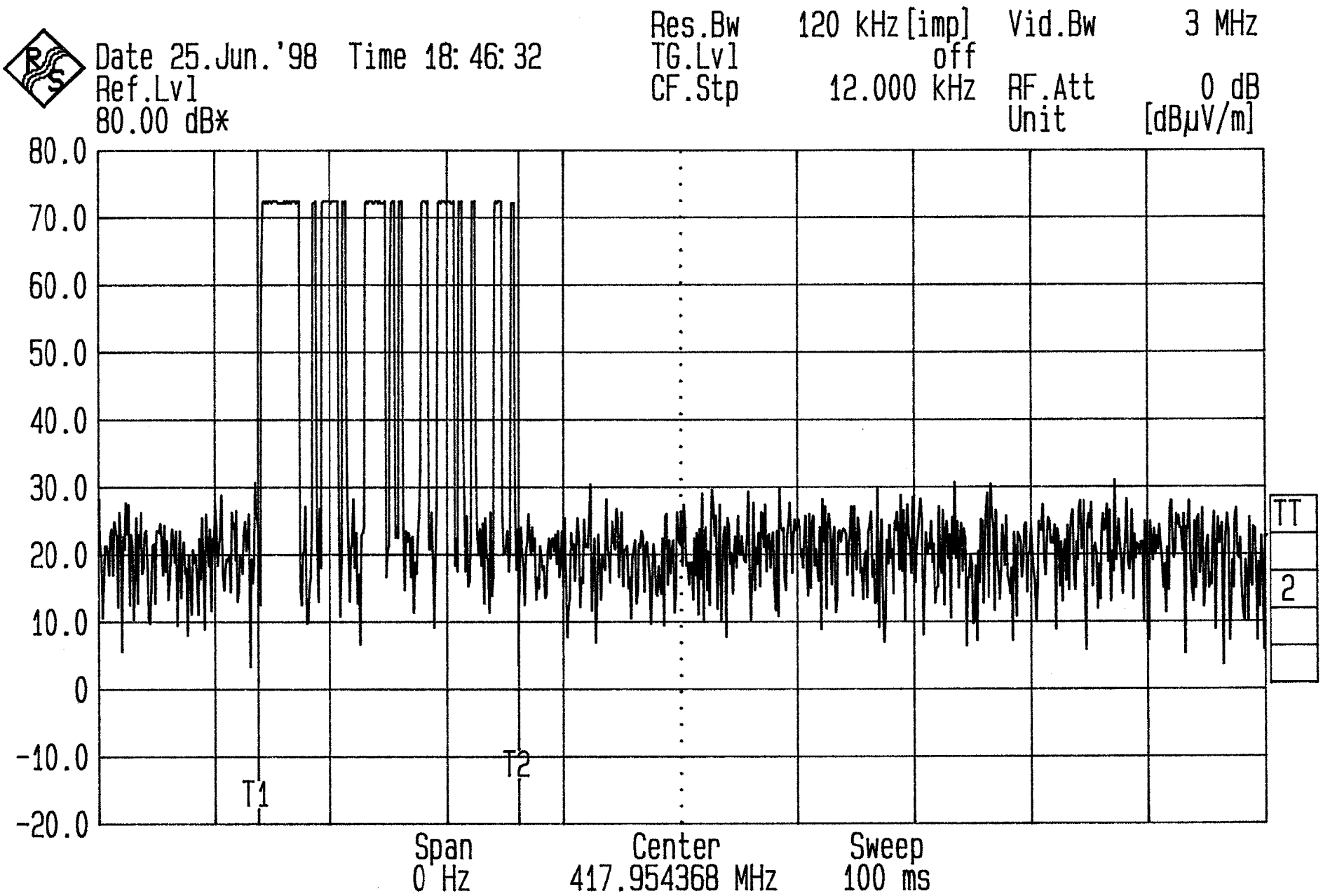
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\26
EUT: 418MHz PAT /Cust: BASYS /OpCond: UNMOD CARRIER / Eng: JL/Spec: FCC 47 PT15 C



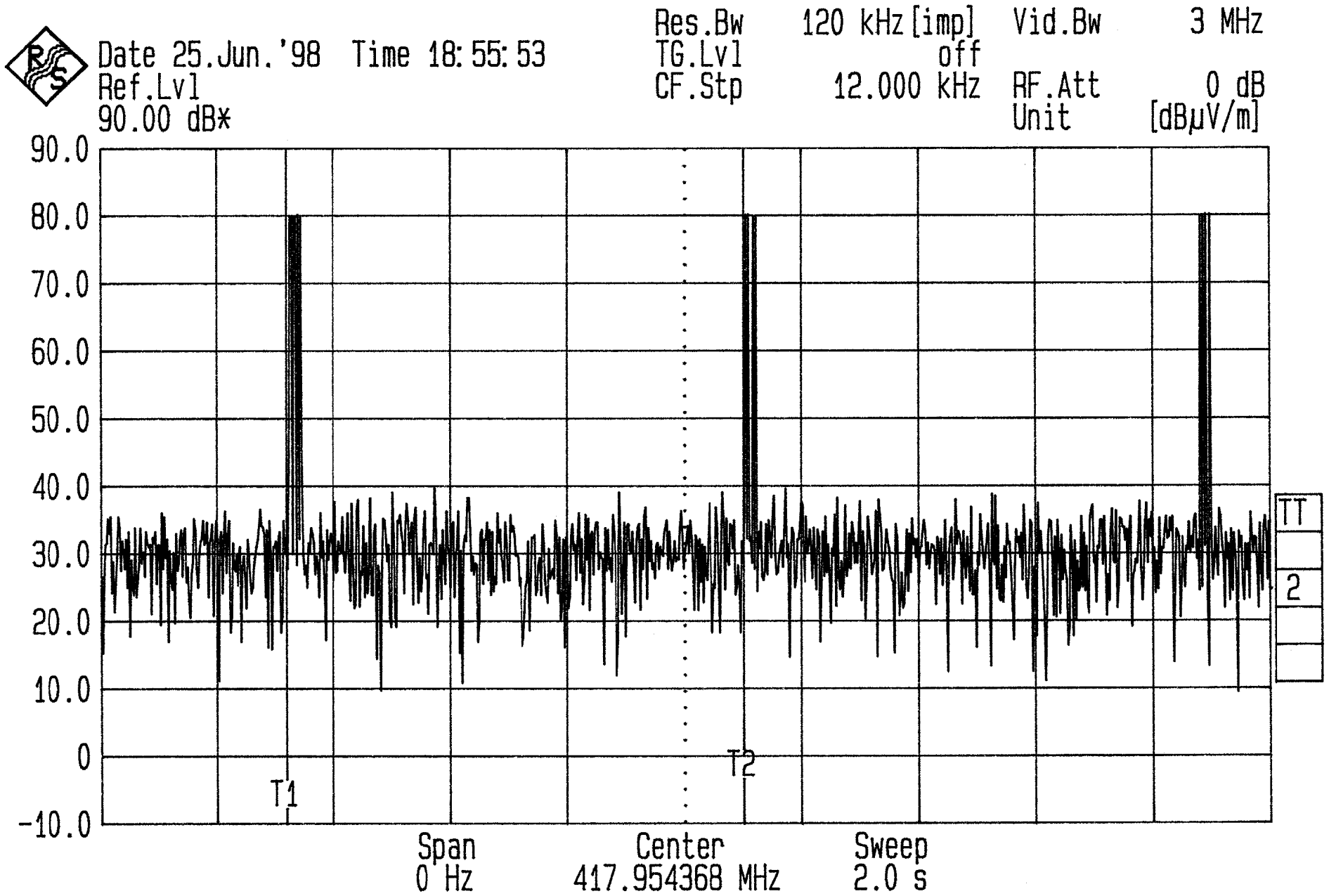
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\27
EUT: 418MHz PAT /Cust: BASYS /OpCond: UNMOD CARRIER Bandwidth / Eng: JL/Spec: FCC 47 PT15 C



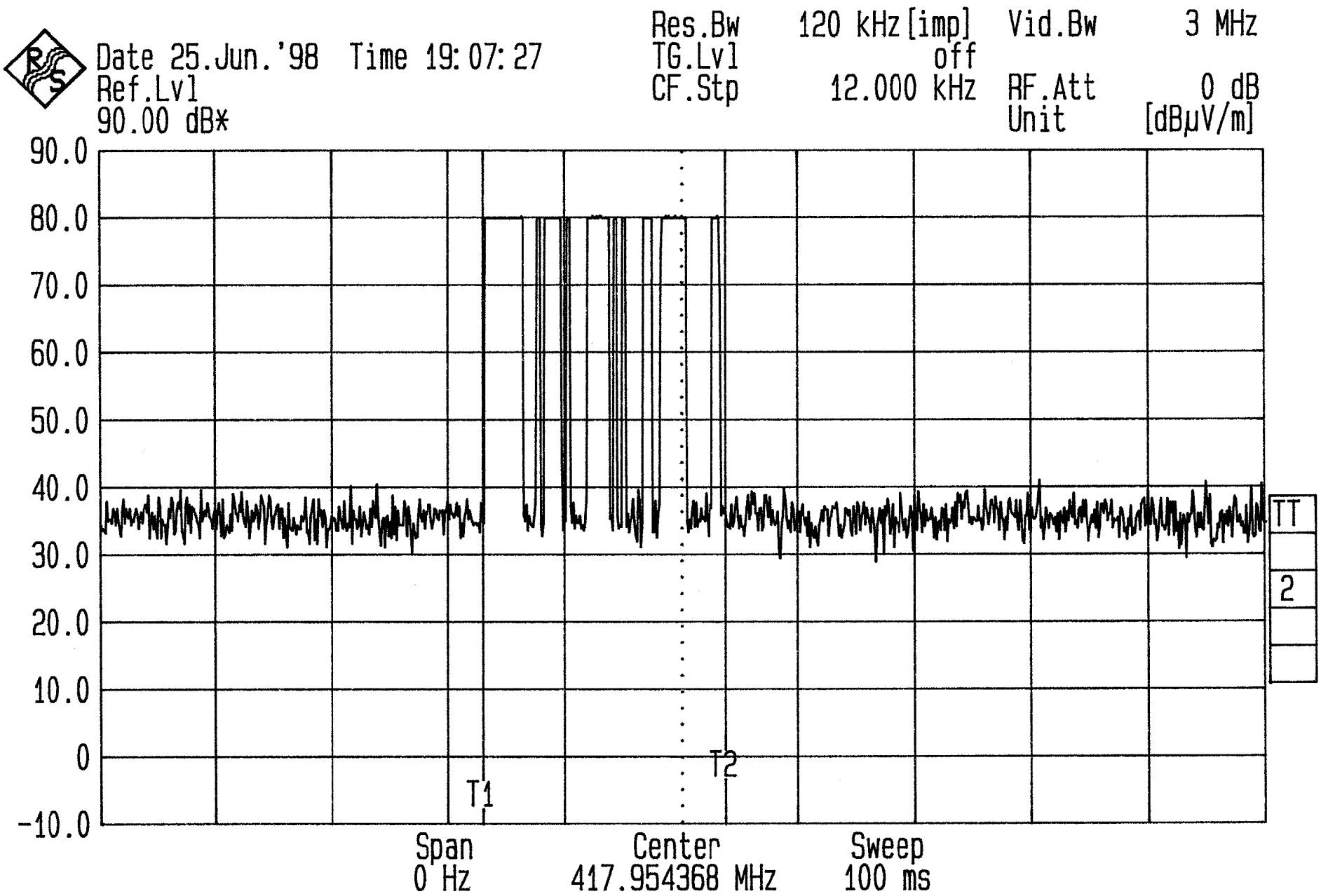
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH/37143E04/28
EUT: 418MHz PAT /Cust: BASYS /OpCond: SHOCK MODE PERIOD / Eng: JL/Spec: FCC 47 PT15 C



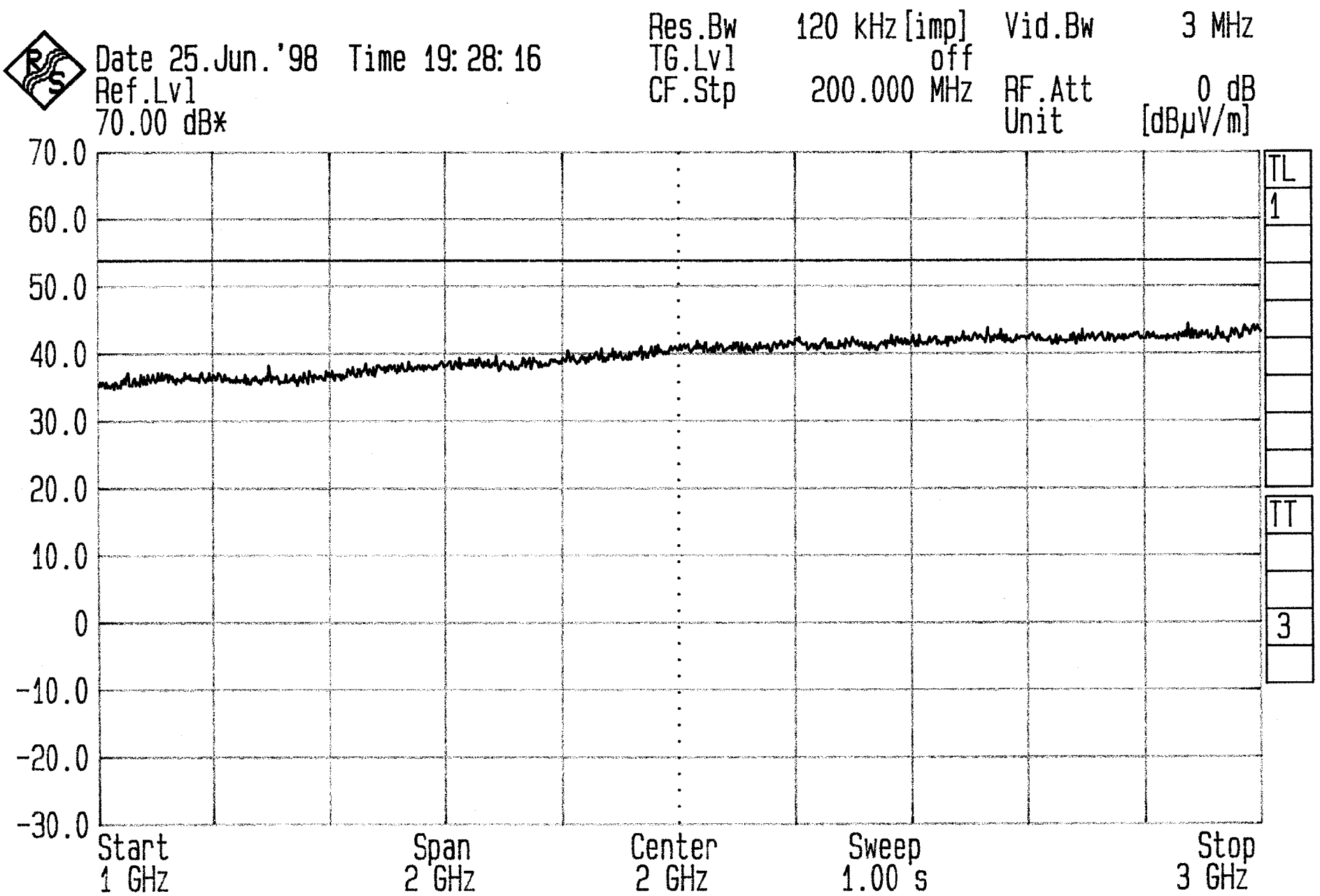
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH/37143E04/29
EUT: 418MHz PAT /Cust: BASYS /OpCond: SHOCK MODE DURATION / Eng: JL/Spec: FCC 47 PT15 C



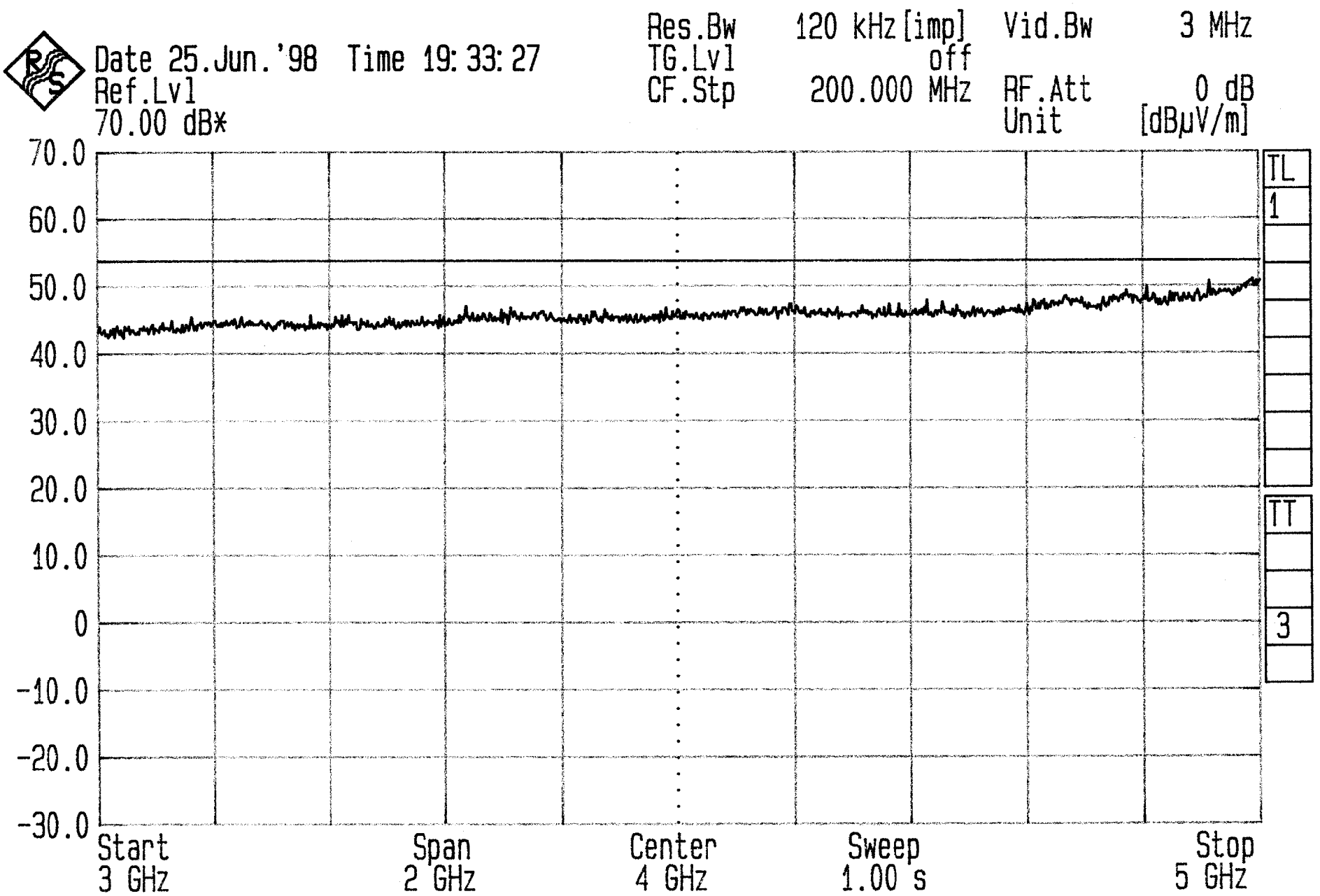
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH/37143E04/30
EUT: 418MHz PAT /Cust: BASYS /OpCond: TAMPER MODE PERIOD / Eng: JL/Spec: FCC 47 PT15 C



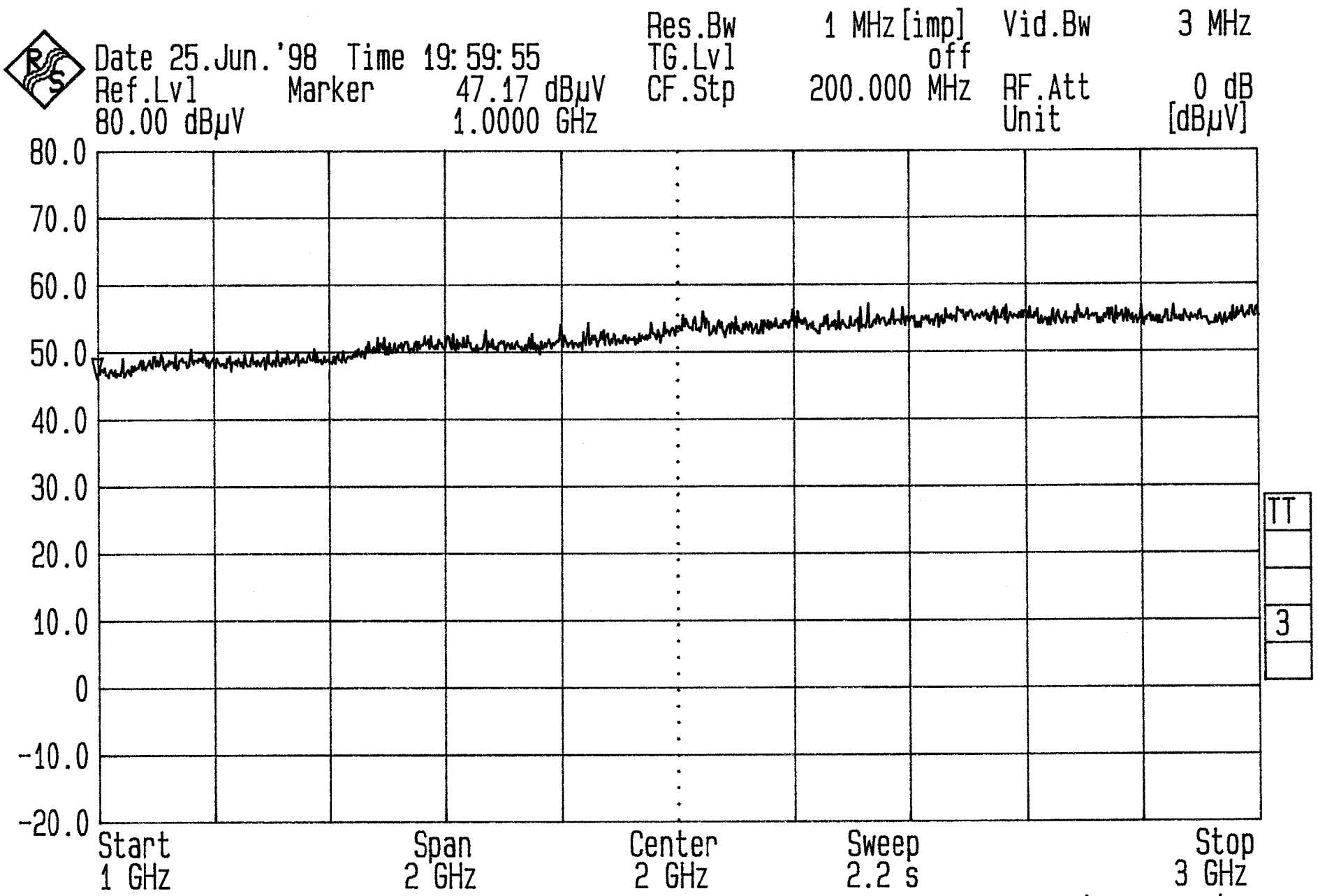
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH/37143E04/31
EUT: 418MHz PAT /Cust: BASYS /OpCond: TAMPER MODE DURATION / Eng: JL/Spec: FCC 47 PT15 C



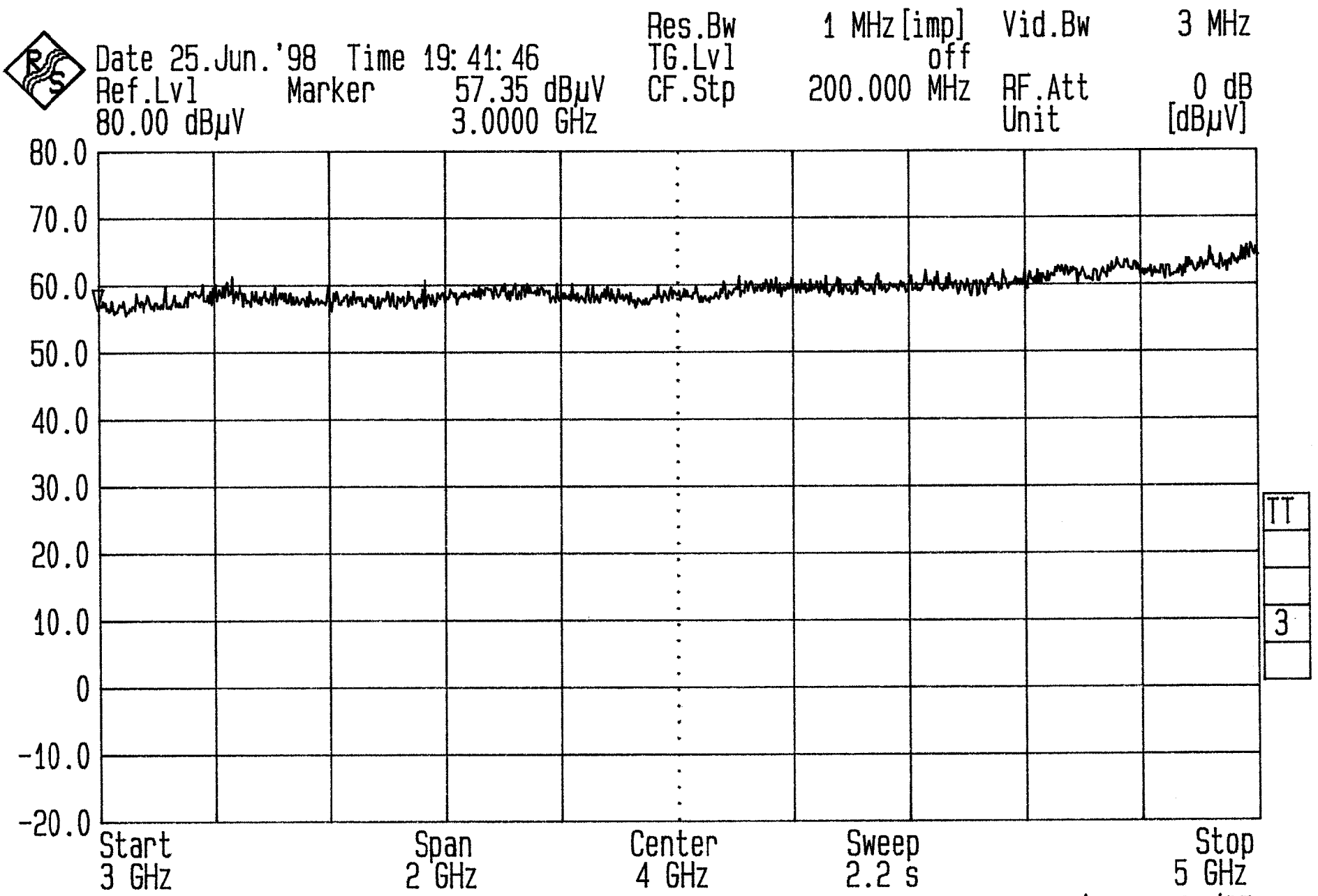
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\32
EUT: 418MHz PAT/Cust: BASYS /OpCond: EUT OFF BACKGRUND SCAN/ Eng: JL/Spec: FCC 47 PT15 C



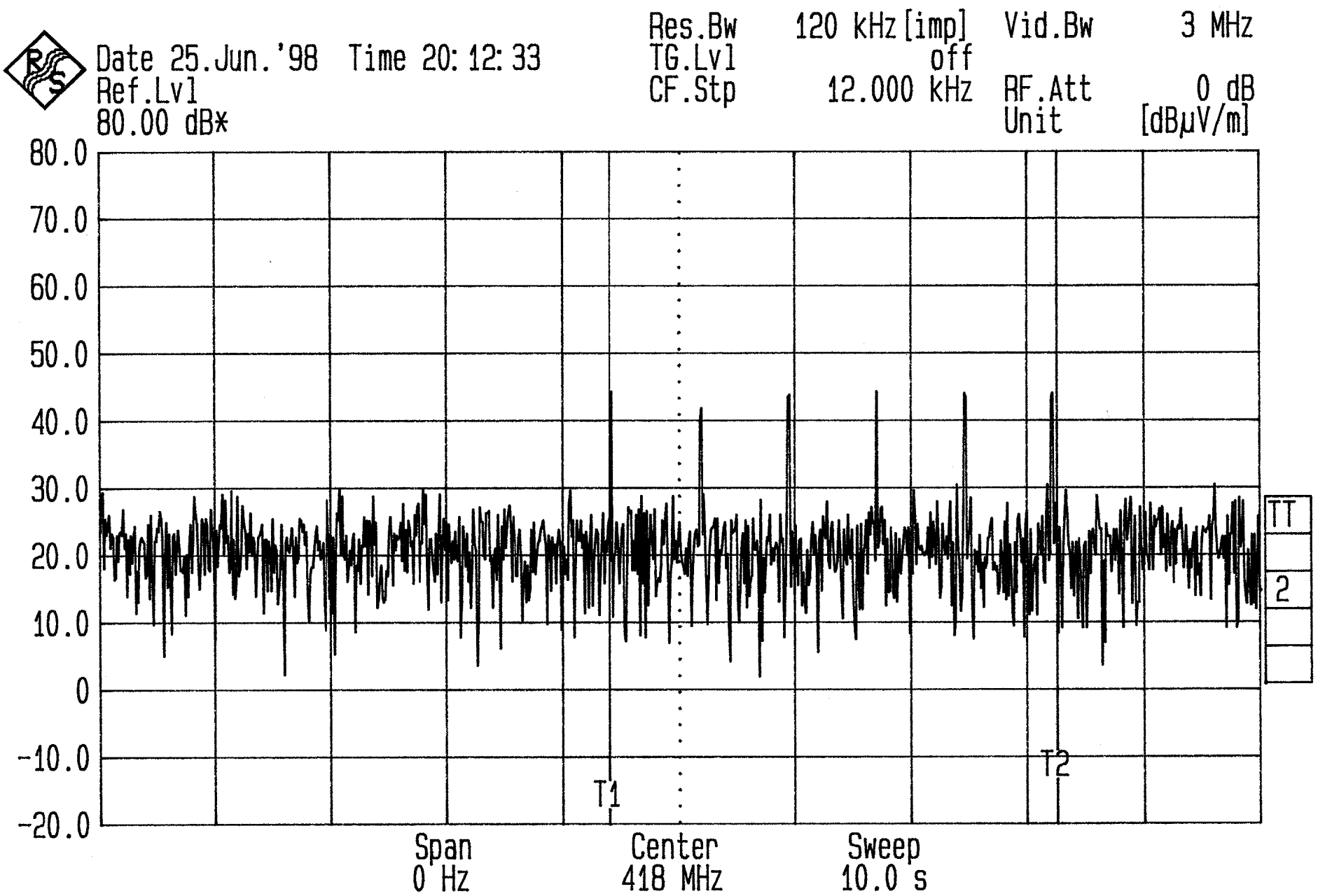
Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH\37143E04\33
EUT: 418MHz PAT/Cust: BASYS /OpCond: EUT OFF BACKGRUND SCAN/ Eng: JL/Spec: FCC 47 PT15 C



Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH/37143E04/34
EUT: 418MHz PAT /Cust: BASYS /OpCond: BACKGROUND SCAN NO EUT Eng: JL/Spec: FCC 47 PT15 C



Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH/37143E04/35
EUT: 418MHz PAT /Cust: BASYS /OpCond: BACKGROUND SCAN NO EUT Eng: JL/Spec: FCC 47 PT15 C



Radio Frequency Investigation Ltd. Screened Room E-Field Prescan @3m GPH/37143E04/36
EUT: 418MHz PAT /Cust: BASYS /OpCond: SHOCK MODE "OFF" TIME Eng: JL/Spec: FCC 47 PT15 C

Appendix 5. Antenna Factors and Cable Factors

This appendix details the factors for each antenna and the cable losses for measurements between 1 –5 GHz.

EMCO Double Guided Ridge Horn Antenna

Frequency (MHz)	Antenna Factor (dB)
1000	24.1
1500	25.5
2000	27.8
2500	28.9
3000	30.4
3500	31.8
4000	33.1
4500	32.9
5000	34.1

Insertion Loss for C563 & C573 Cables

Frequency (GHz)	Loss (dB)
1	2.05
2	2.43
3	2.79
4	2.81
5	2.31

Appendix 6. Measurement Calculation

The following appendix shows a sample measurement calculation. The calculation shows how the final level was achieved when the correct antenna factor and cable loss is applied.

Frequency (MHz)	Polarity (H/V)	Measured Level (dBmV/m)	Antenna Factor (dB)	Cable Loss (dB)	Final Result (dBmV/m)
1253.3	Horiz	2.9	24.8	2.2	29.9

Appendix 7. Photographs of EUT

This appendix contains the following photographs

Photo Reference Number	Title
PHT\37143\001	Front view of EUT
PHT\37143\002	Rear view of EUT
PHT\37143\003	Close up of EUT

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

Test Of: **Basys 418MHz PAT1**
To: **F.C.C. Part 15 Subpart C (Intentional Radiators) Section 15.231**

PHT\37143\001 Front view of EUT

Test Of: **Basys 418MHz PAT1**
To: **F.C.C. Part 15 Subpart C (Intentional Radiators) Section 15.231**

PHT\37143\002 Rear view of EUT

Test Of: **Basys 418MHz PAT1**
To: **F.C.C. Part 15 Subpart C (Intentional Radiators) Section 15.231**

PHT\37143\003 Close up of EUT