Ewhurst Park
Ramsdell
Basingstoke
Hampshire
England
RG26 5RQ

Switchboard Tel: +44 (0) 1256 851193
Accounts Tel: +44 (0) 1256 855490
Sales Tel: +44 (0) 1256 855400
Fax: +44 (0) 1256 851192
E-mail: sales@rfi.co.uk
Web Site: www.rfi.co.uk

TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Audio Ltd.
DX2020 Wireless Microphone Receiver

To: FCC Part 15: 1996 Subpart B Class B

Test Report Serial No:
RFI/EMCB1/RP34630ETF02A

This Test Report Is Issued Under The Authority Of Brian Watson, Technical Director:	
Tested By:	**Checked By:**
Test Report Copy No: 02	
Issue Date: 30 April 1998	**Test Dates: 03 December 1997 to 15 December 1997**

Test Of: Audio Ltd.
DX2020 Wireless Microphone Receiver
To: FCC Part 15: 1996 Subpart B Class B

Table of Contents

Test Of: Audio Ltd.
DX2020 Wireless Microphone Receiver
To: FCC Part 15: 1996 Subpart B Class B

---

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	Audio Ltd
Model Name or Number	DX2020
Unique Type Identification	DX2020
Serial Number	605423-5
Country Of Manufacture	UK
F.C.C. ID Number	NRK DX2020
Date Of Receipt	1 December 1997

2.2. Description Of EUT

The EUT (DX2020) is a portable wireless receiver specifically for use with the Audio Ltd TX2020 microphone transmitter.

2.3. Modifications Incorporated In EUT

None stated by client.

Test Of: Audio Ltd.
DX2020 Wireless Microphone Receiver
To: FCC Part 15: 1996 Subpart B Class B

3. Test Specification, Methods & Procedures

3.1. Test Specification

Reference:	FCC Part 15: 1996 Class B
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.

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 internal battery supply of 9 V.

5.2. Operating Modes

The EUT was tested in the following operating mode: The EUT (DX2020) was tested in a normal operating mode with a receiving frequency set to 735 MHz. Pre-scans were performed in both a standalone configuration and with a transmitter sending an audio signal, as stated in section 5.3 of this test report.

The reason for choosing this mode was that it was defined by the client as the only mode available and therefore the worst case with regards EMC.

5.3. Configuration And Peripherals

The EUT was tested in the following configuration: The EUT (DX2020) was tested with a headphone test lead of 1 m in length connected to the Headphone port and with two antennas connected. This was then tested in the two configurations stated below:

1- Receiver only, operated as stated in section 5.2 of this test report.
2- Receiver and transmitter together, as stated in section 5.2 of this test report.

Pre-scans were also performed of the transmitter alone to eliminate any emissions due to the transmitter only.

Plots of all operating modes and configurations can be seen in Appendix 4 of this test report.

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

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: Audio Ltd.
DX2020 Wireless Microphone Receiver
To: FCC Part 15: 1996 Subpart B Class B

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 UKAS Document NIS 81 with a confidence level of 95%. Please refer to Section 8 for details of measurement uncertainties.

7.1.3. As the EUT (DX2020) was powered from an internal battery supply, no conducted emissions tests were performed.

7.1.4. As stated in section 5.3 of this test report, initial scans were performed in different operating modes and configurations to determine a worse case mode.
It was found that the worst case emissions were observed when the receiver was tested in a standalone configuration, therefore all radiated final open area test site measurements were performed in this mode and configuration.

Test Of: Audio Ltd.
DX2020 Wireless Microphone Receiver
To: FCC Part 15: 1996 Subpart B Class B

7.2.2. Electric Field Strength Measurements (Frequency Range: 1.0 GHz to 5.0 GHz)

7.2.2.1. Plots of the initial scans can be found in Appendix 4 of this test report

7.2.2.2. The following table lists frequencies at which emissions were measured using an Average detector at a test distance of 3m (result show antenna factors and cable losses):

Frequency (~~MHz~~) GHz	Ant. Pol.	Average Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Actual Average Level (dBuV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1.4433	Vert.	20.1	21.4	0.9	42.4	54.0	11.6	Complied
1.4433	Horiz.	20.0	21.4	0.9	42.3	54.0	11.7	Complied
1.4644	Vert.	19.6	21.4	0.9	41.9	54.0	12.1	Complied
1.4644	Horiz.	19.6	21.4	0.9	41.9	54.0	12.1	Complied
1.6844	Vert.	20.7	21.5	1.0	43.2	54.0	10.8	Complied
1.6844	Horiz.	20.8	21.5	1.0	43.3	54.0	10.7	Complied
2.1622	Vert.	21.0	22.3	1.1	44.4	54.0	9.6	Complied
2.1622	Horiz.	21.0	22.3	1.1	44.4	54.0	9.6	Complied
2.6444	Vert.	20.9	22.5	1.2	44.6	54.0	9.4	Complied
2.6444	Horiz.	20.1	22.5	1.2	43.8	54.0	10.2	Complied
2.8866	Vert.	20.0	22.5	1.3	43.8	54.0	10.2	Complied
2.8866	Horiz.	20.0	22.5	1.3	43.8	54.0	10.2	Complied
3.6066	Vert.	21.0	23.4	1.5	45.9	54.0	8.1	Complied
3.6066	Horiz	20.9	23.4	1.5	45.8	54.0	8.2	Complied
4.0855	Vert.	20.4	24.7	1.6	46.7	54.0	7.3	Complied
4.0855	Horiz.	20.4	24.7	1.6	46.7	54.0	7.3	Complied

Test Of: Audio Ltd.
DX2020 Wireless Microphone Receiver
To: FCC Part 15: 1996 Subpart B Class B

8. Measurement Uncertainty

8.1. Company Policy, as based on the UKAS 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 UKAS NIS 81 (Edition 1, May 1994) as follows:

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Radiated Emissions	30 MHz to 1000 MHz	95%	+/- 4.9 dB
Radiated Emissions	1000 MHz to 5000 MHz	95%	+/- 4.3 dB

8.3. Measurement uncertainties have been applied in accordance with UKAS 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 UKAS 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 2. Measurement Methods

A2.1. Radiated Electric Field Emissions

A2.1.1. Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for a Quasi-Peak detector for measurements below 1000 MHz, and against appropriate Average and Peak limits for measurements above 1000 MHz.

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 a 3m test distance, using a measuring receiver with Quasi-Peak, Average and Peak detectors.

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. For frequencies below 1000MHz on the open area test site, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m.
For frequencies above 1000MHz, a fixed antenna height of 1.5m was used.

Appendix 3. Test Configuration Drawings

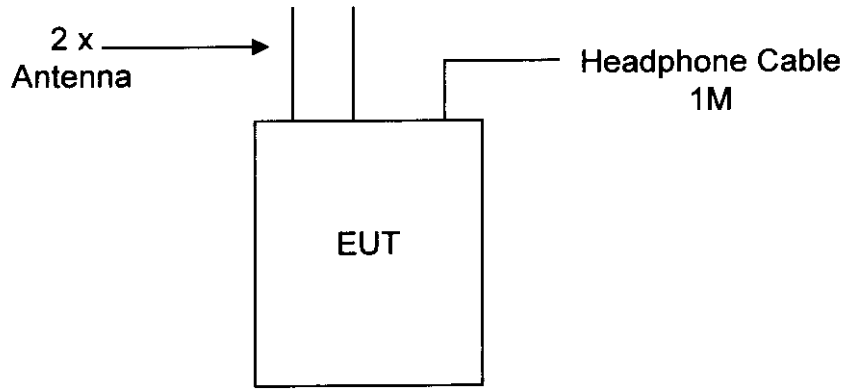
This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\34630ETF02\EMIRAD	Test configuration for measurement of radiated electric field
DRG\34630ETF02\001	Schematic Diagram of the EUT, support equipment and interconnecting cables used for the test

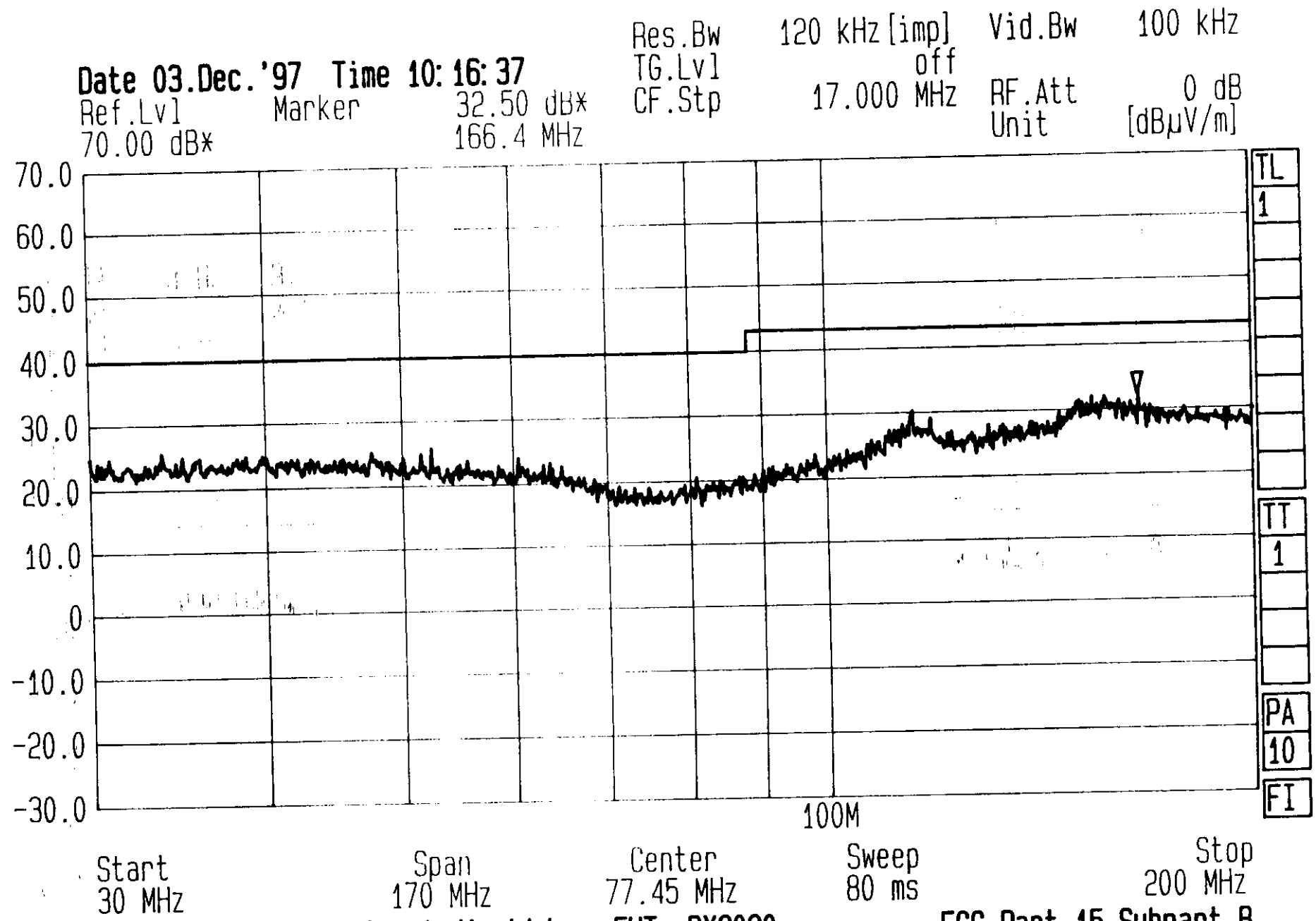
Test Of: Audio Ltd.
DX2020 Wireless Microphone Receiver
To: FCC Part 15: 1996 Subpart B Class B

DRG\34630ETF02\001

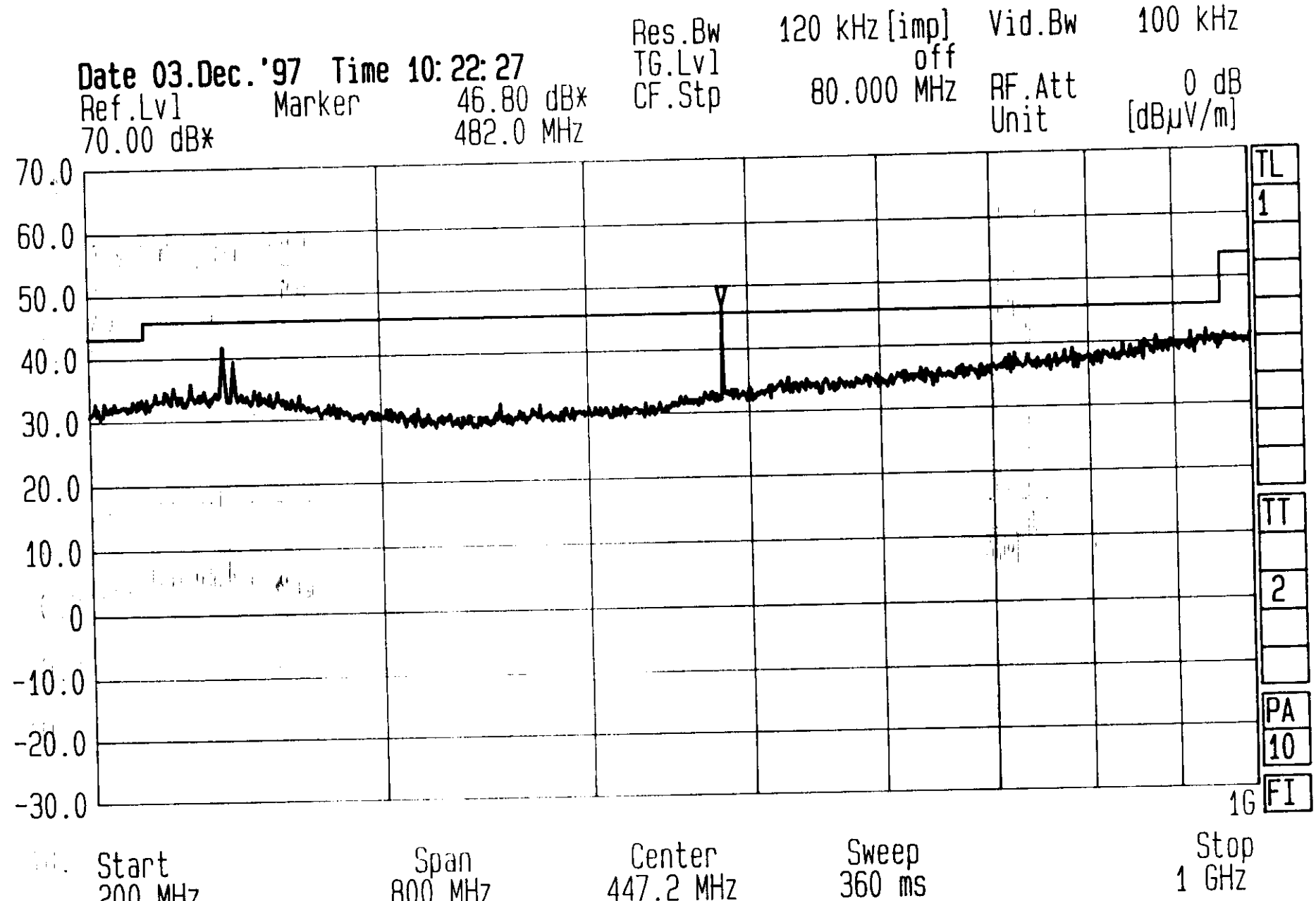
Configuration of EUT and Local Support Equipment



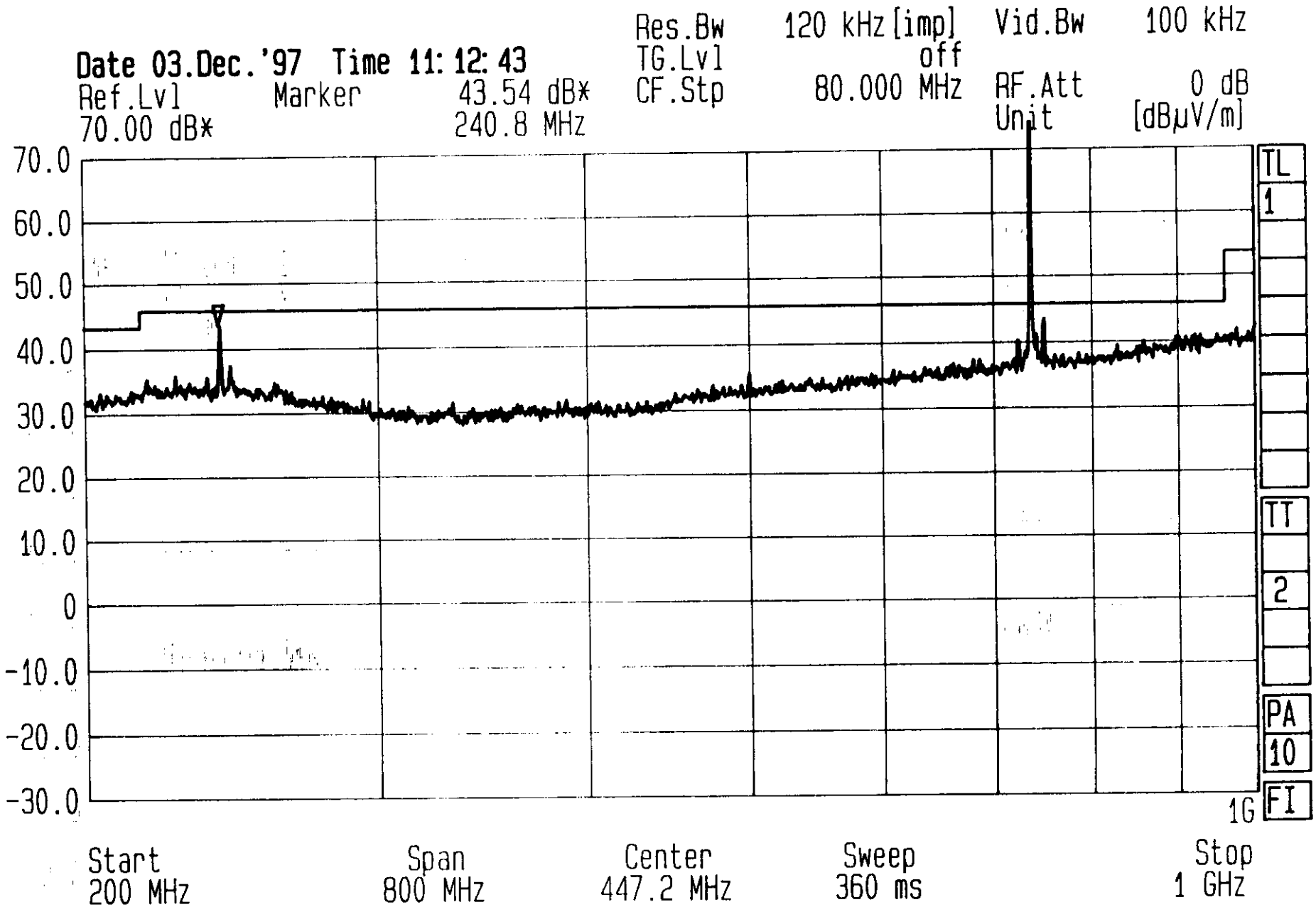
Configuration of Remote Support Equipment



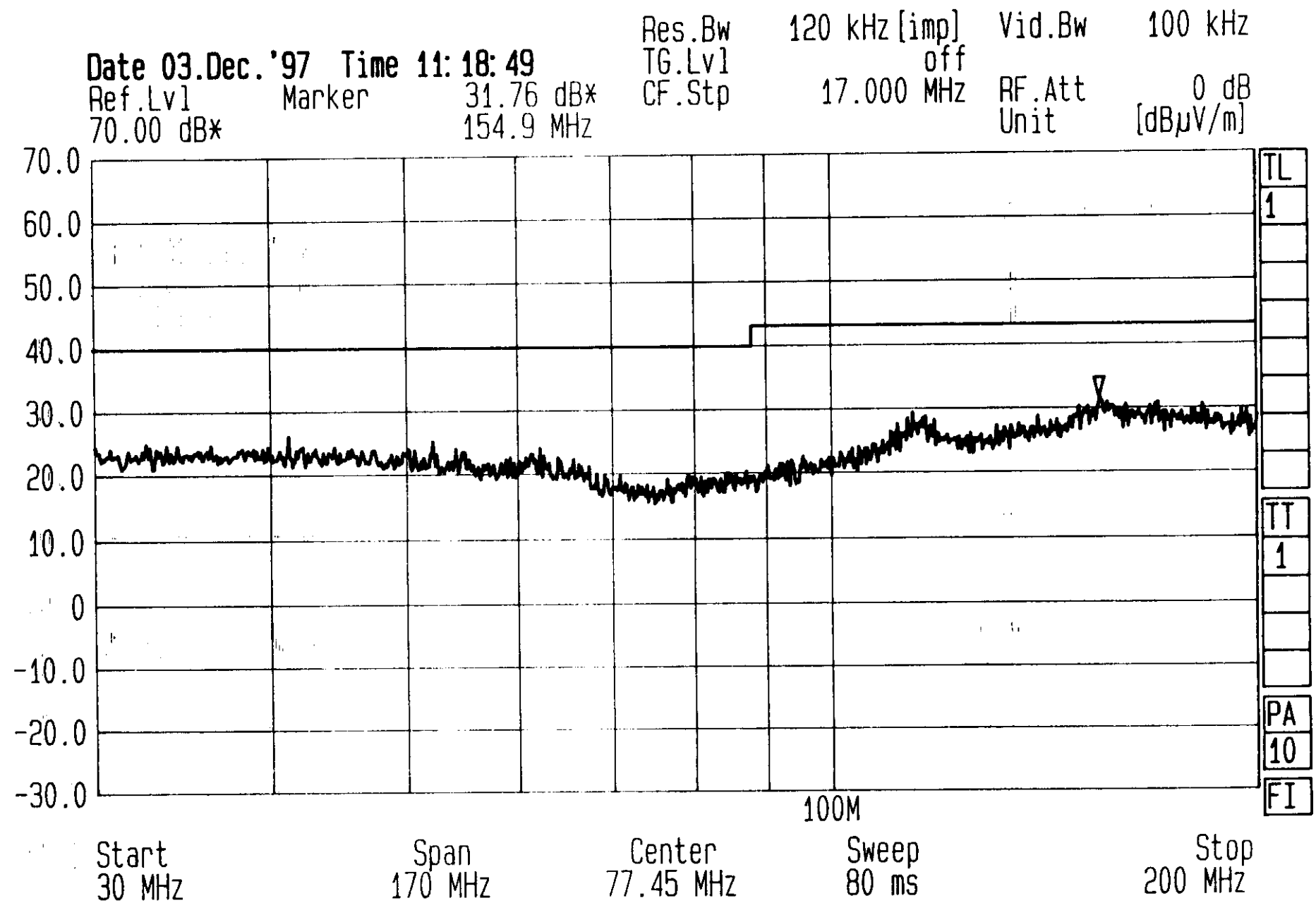
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. QP. 3m Scan. No Transmitter Present. GPH/34630/JD01/ETF02/001



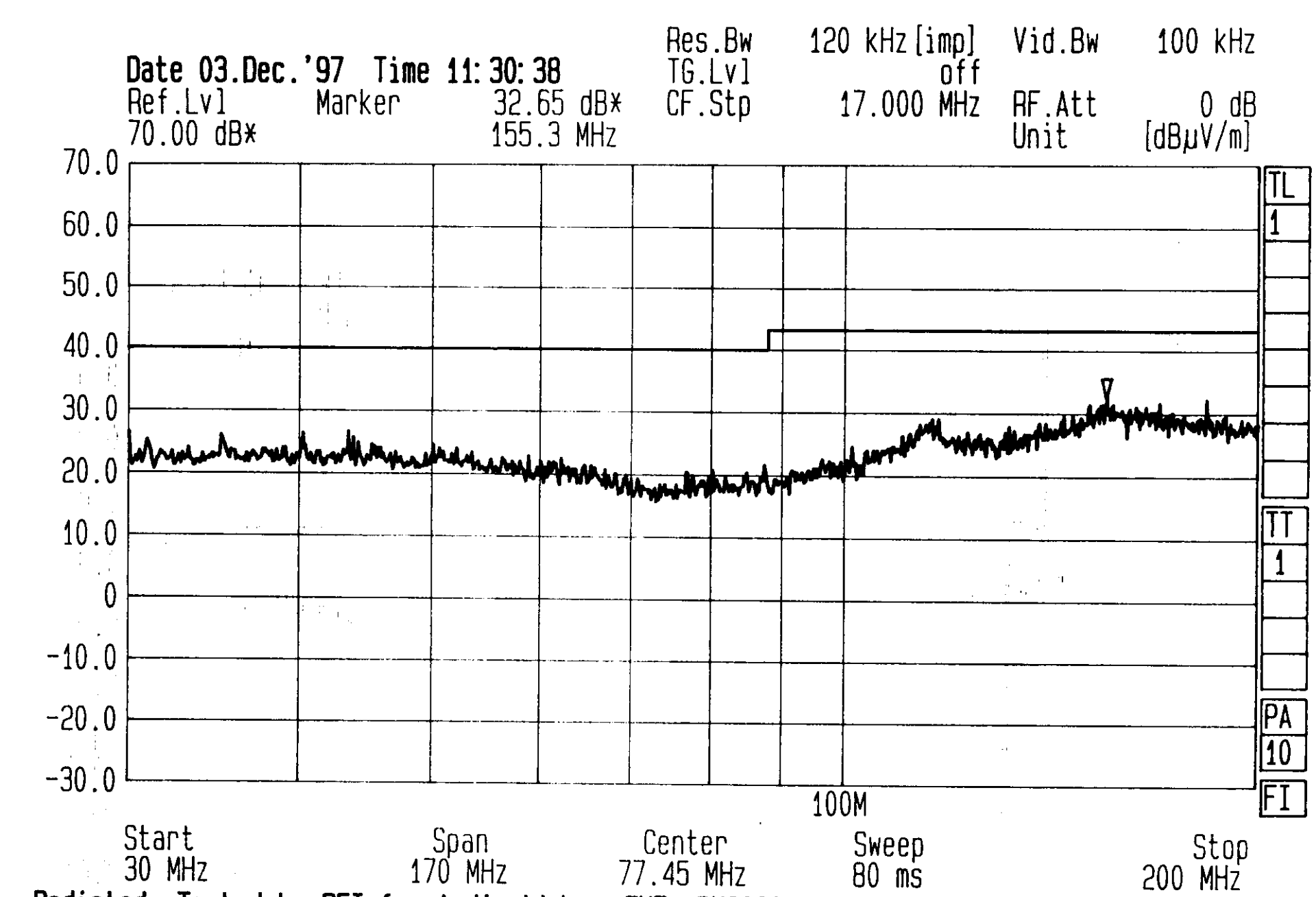
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. QP. 3m Scan. No Transmitter Present. GPH/34630/JD01/ETF02/002



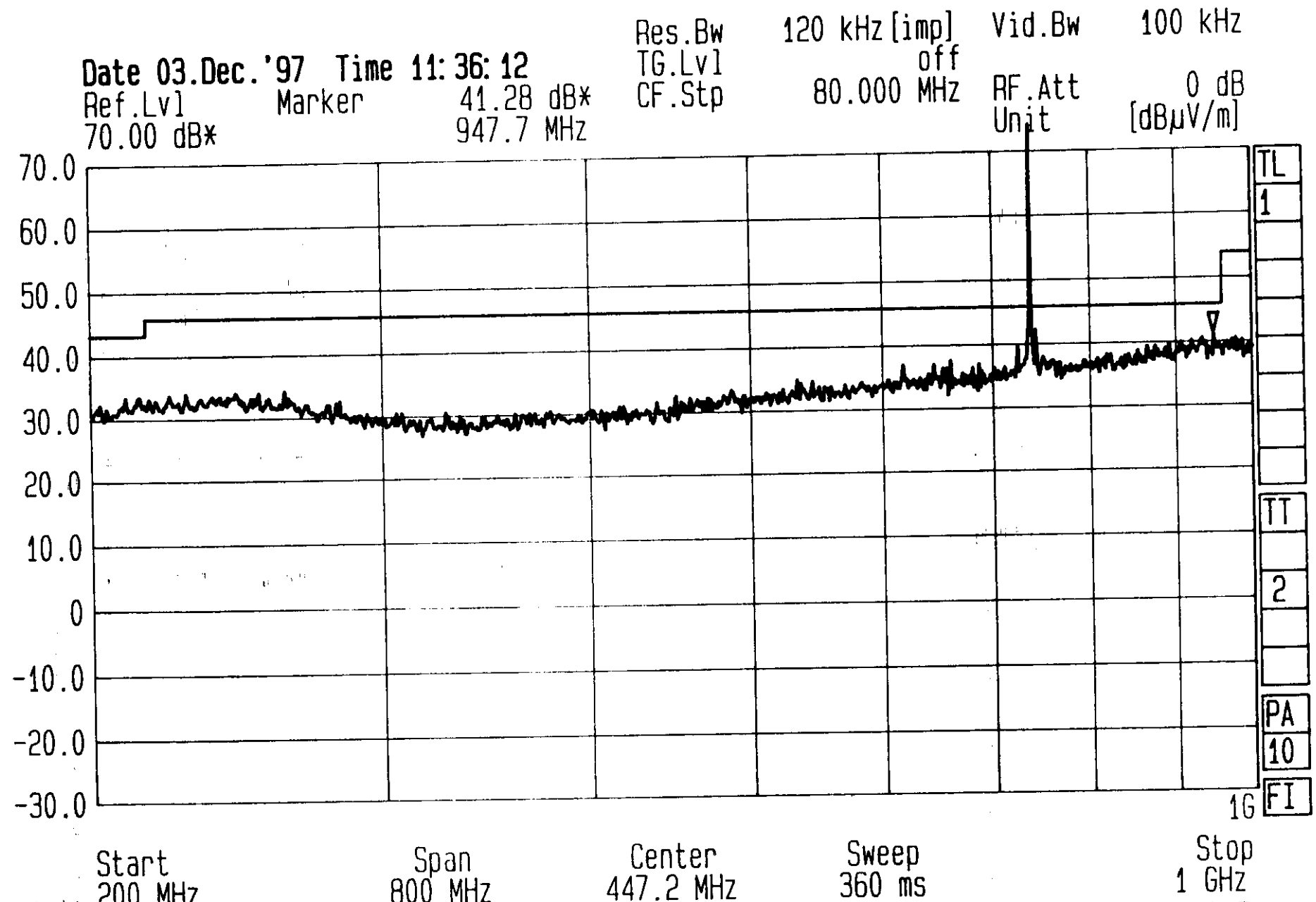
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. QP. 3m Scan. With Transmitter Operating. GPH/34630/JD01/ETF02/003



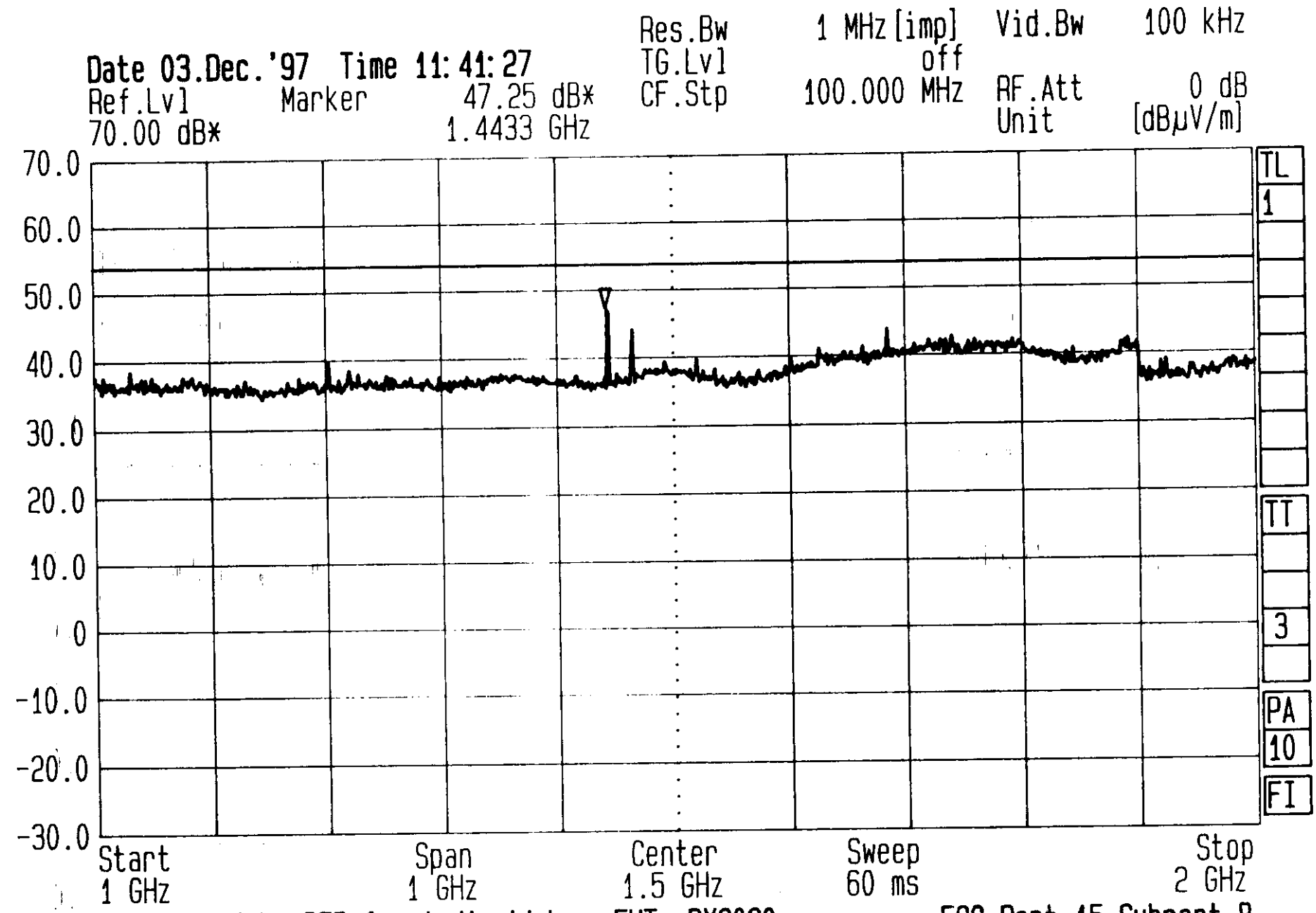
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. QP. 3m Scan. With Transmitter Operating. GPH/34630/JD01/ETF02/004



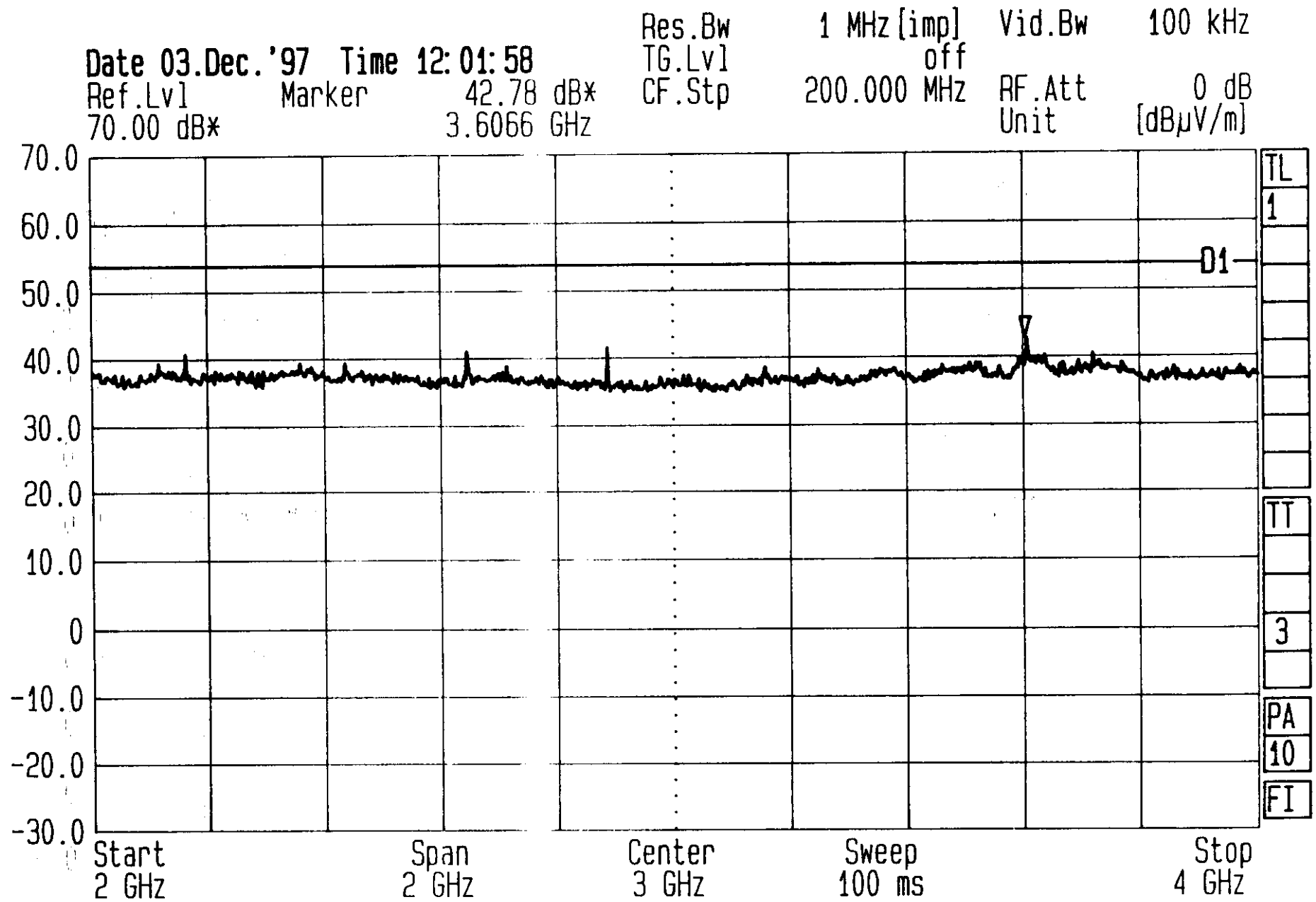
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. QP. 3m Scan. Transmitter Only. GPH/34630/JD01/ETF02/005



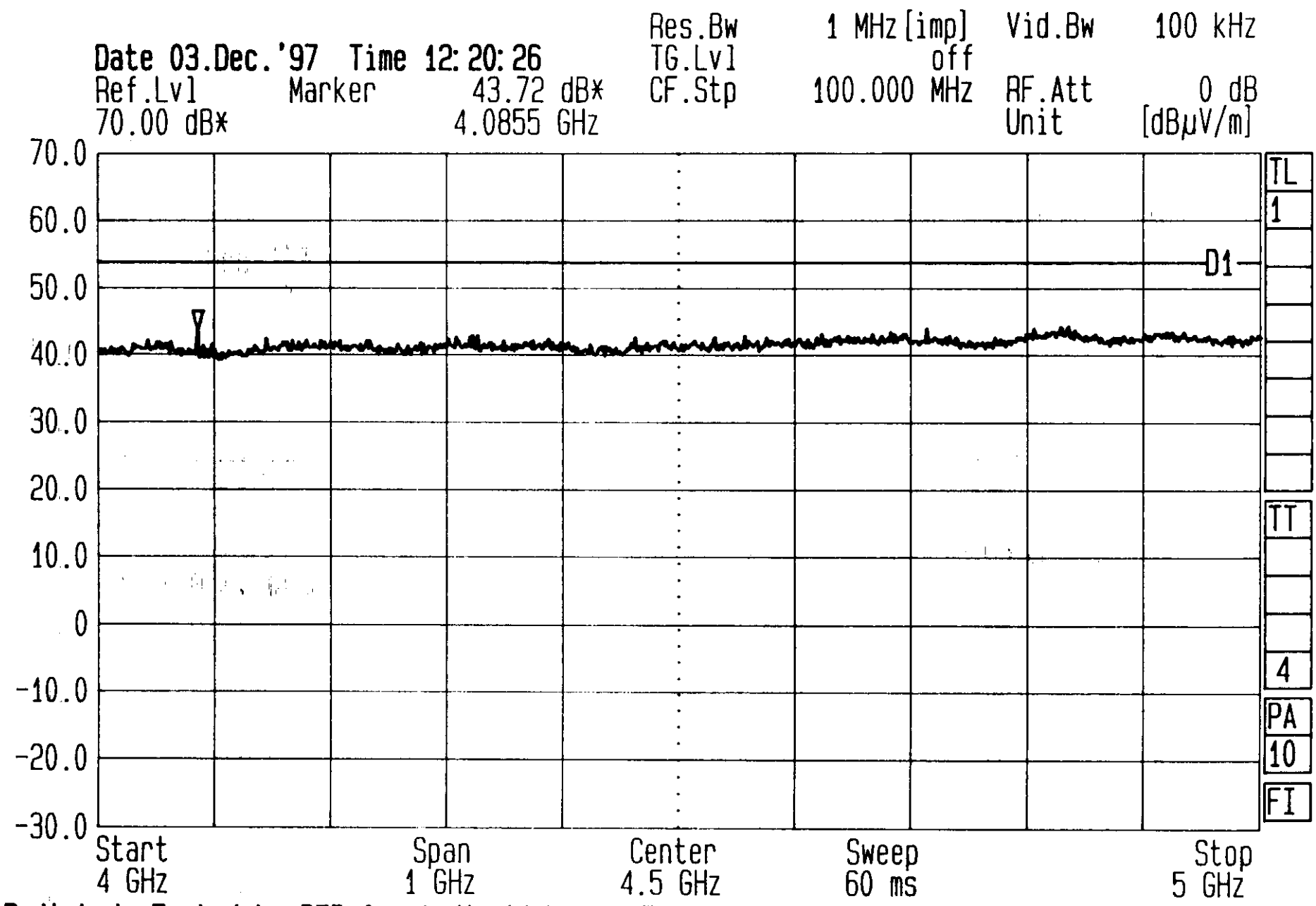
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. QP. 3m Scan. Transmitter Only. GPH/34630/JD01/ETF02/006



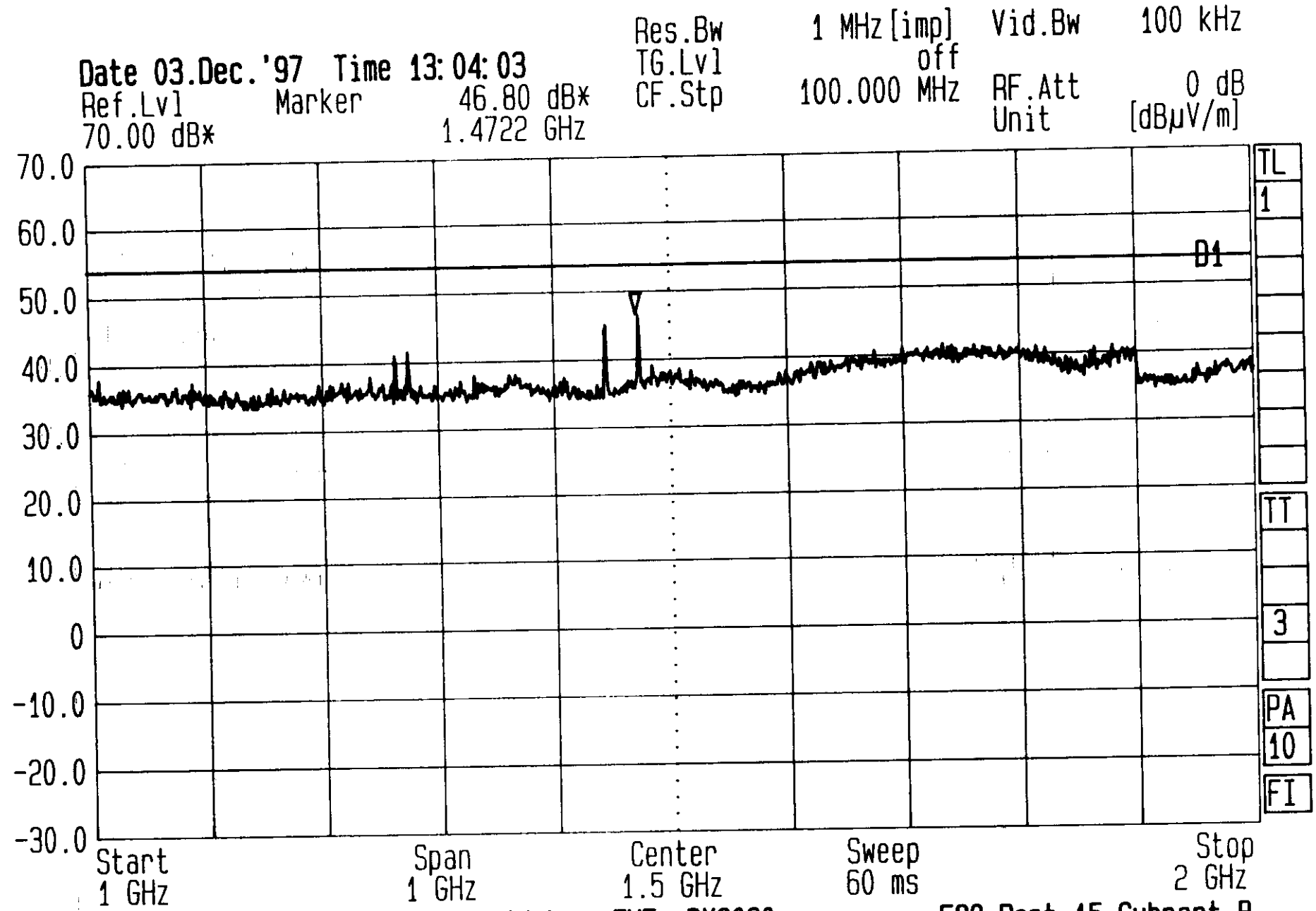
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. Average. 3m Scan. No Transmitter Present. GPH/34630/JD01/ETF02/007



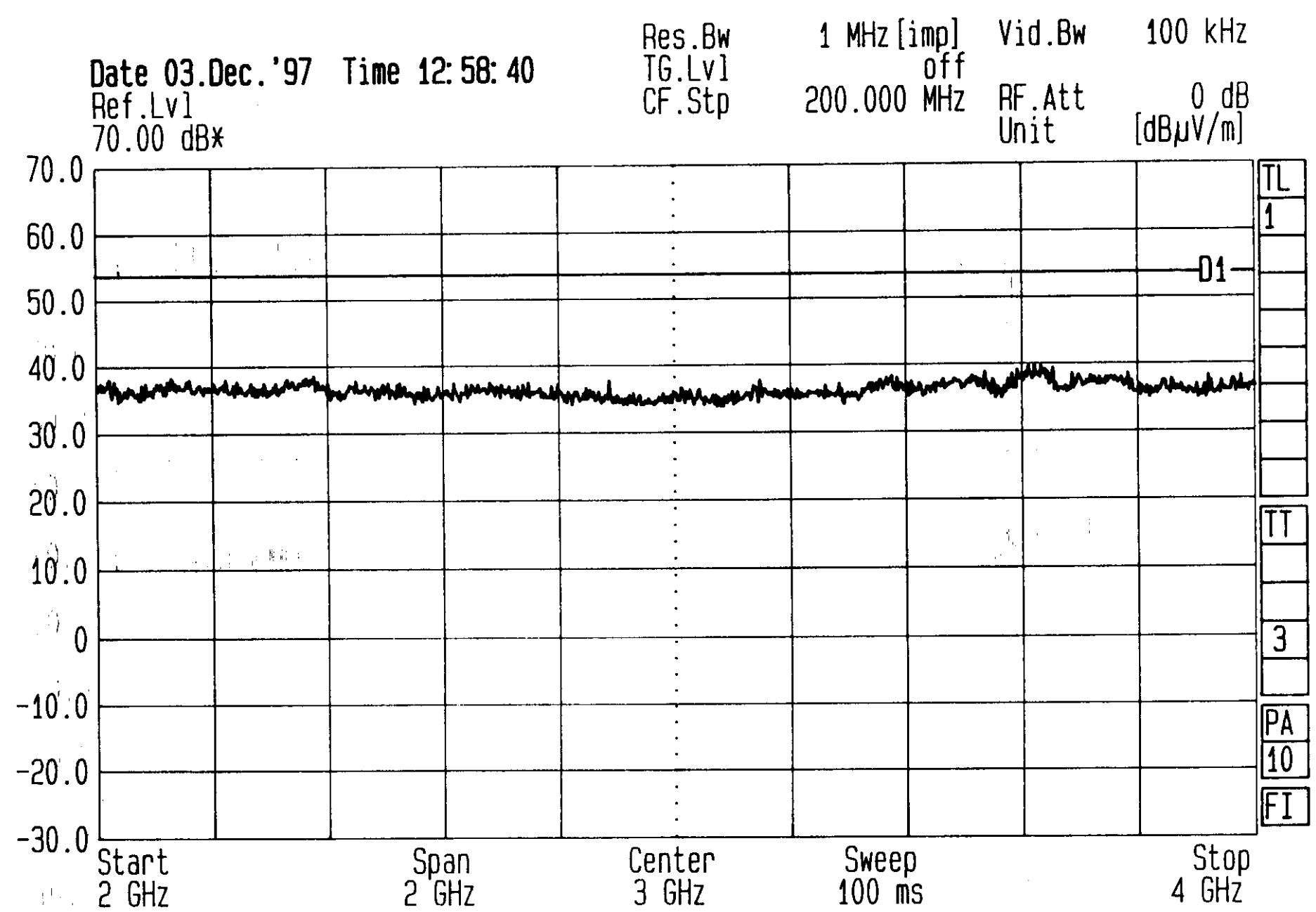
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. Average. 3m Scan. No Transmitter Present. GPH/34630/JD01/ETF02/008



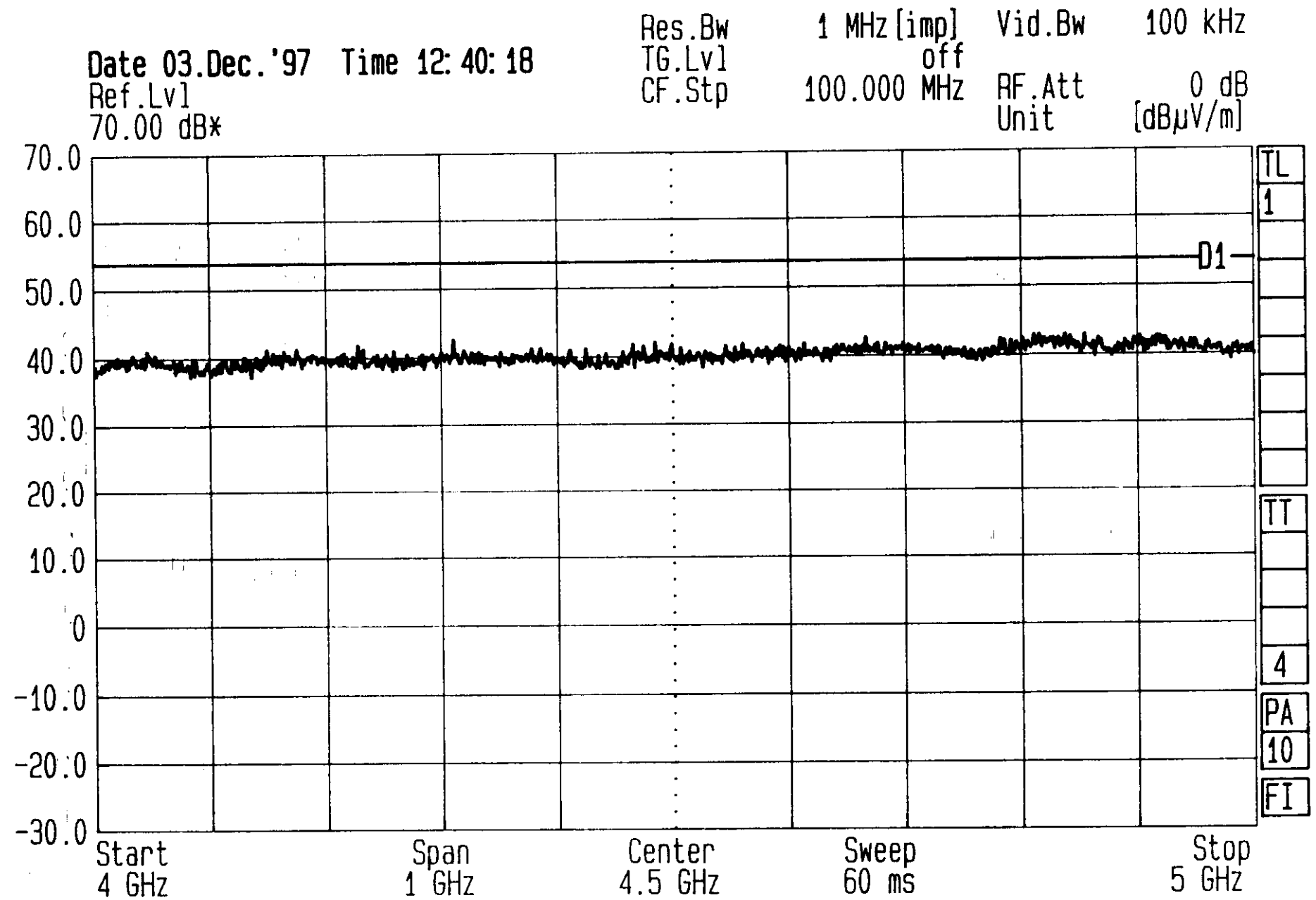
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. Average. 3m Scan. No Transmitter Present. GPH/34630/JD01/ETF02/009



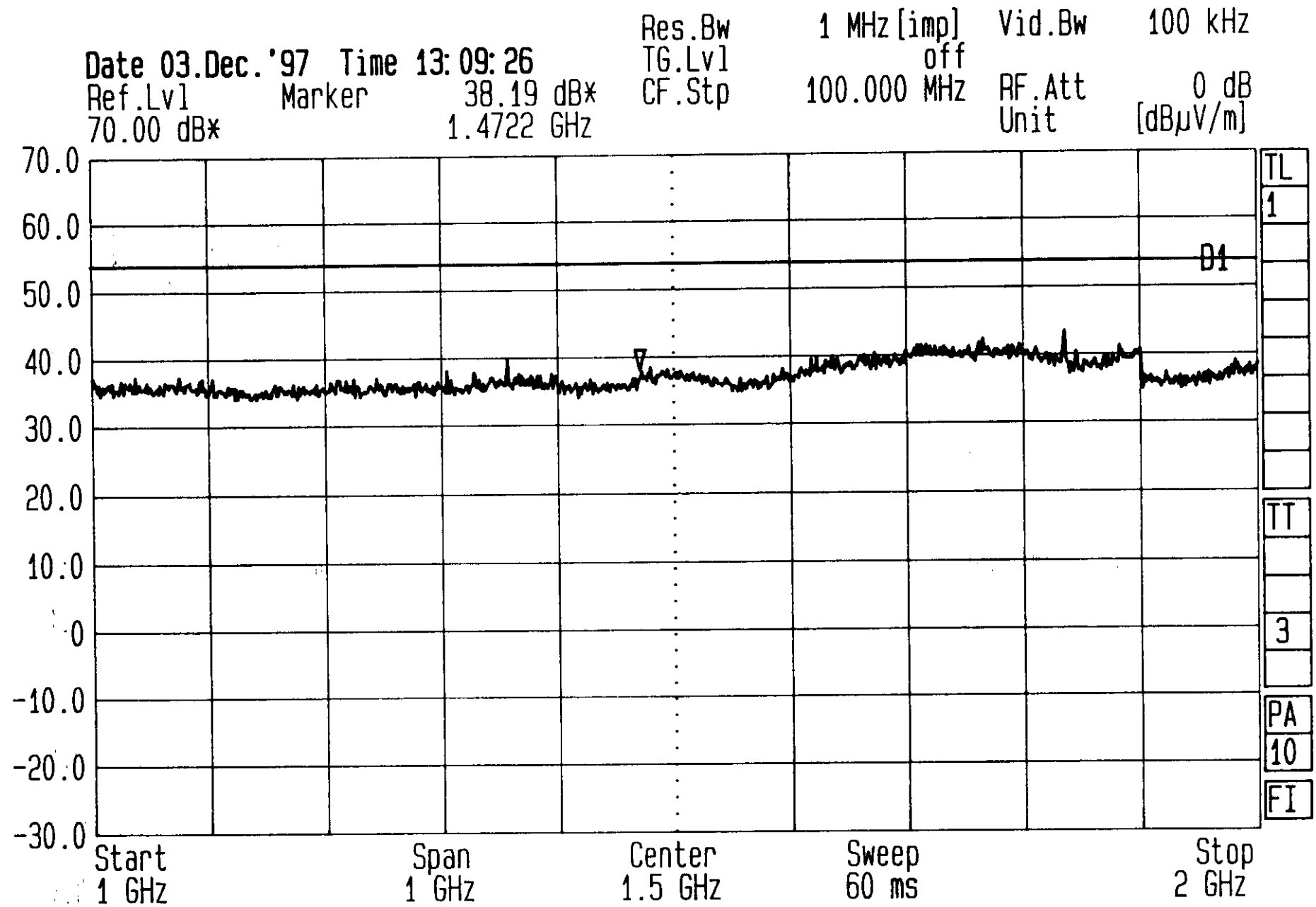
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. Average. 3m Scan. With Transmitter Operating. GPH/34630/JD01/ETF02/010



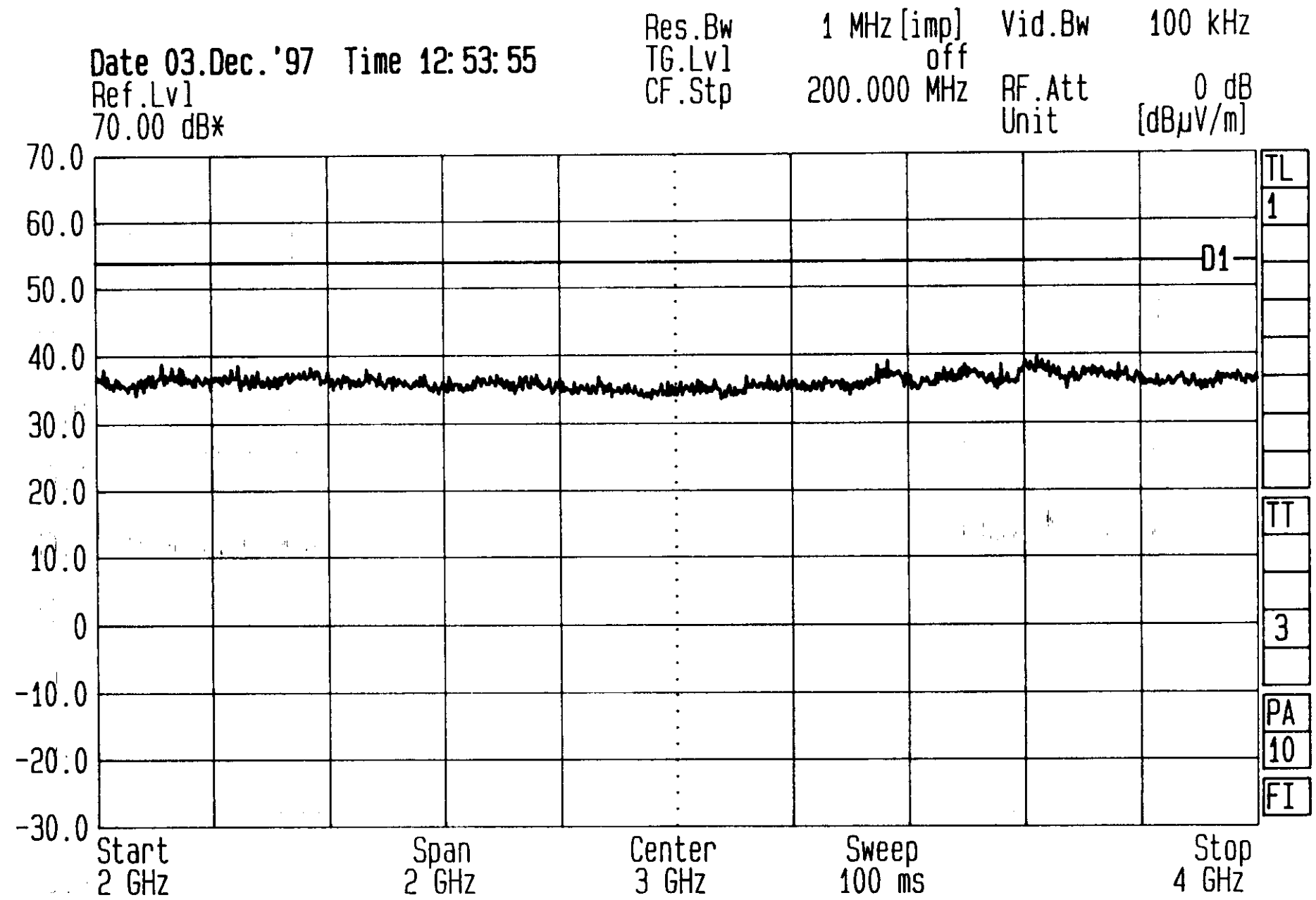
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. Average. 3m Scan. With Transmitter Operating. GPH/34630/JD01/ETF02/011



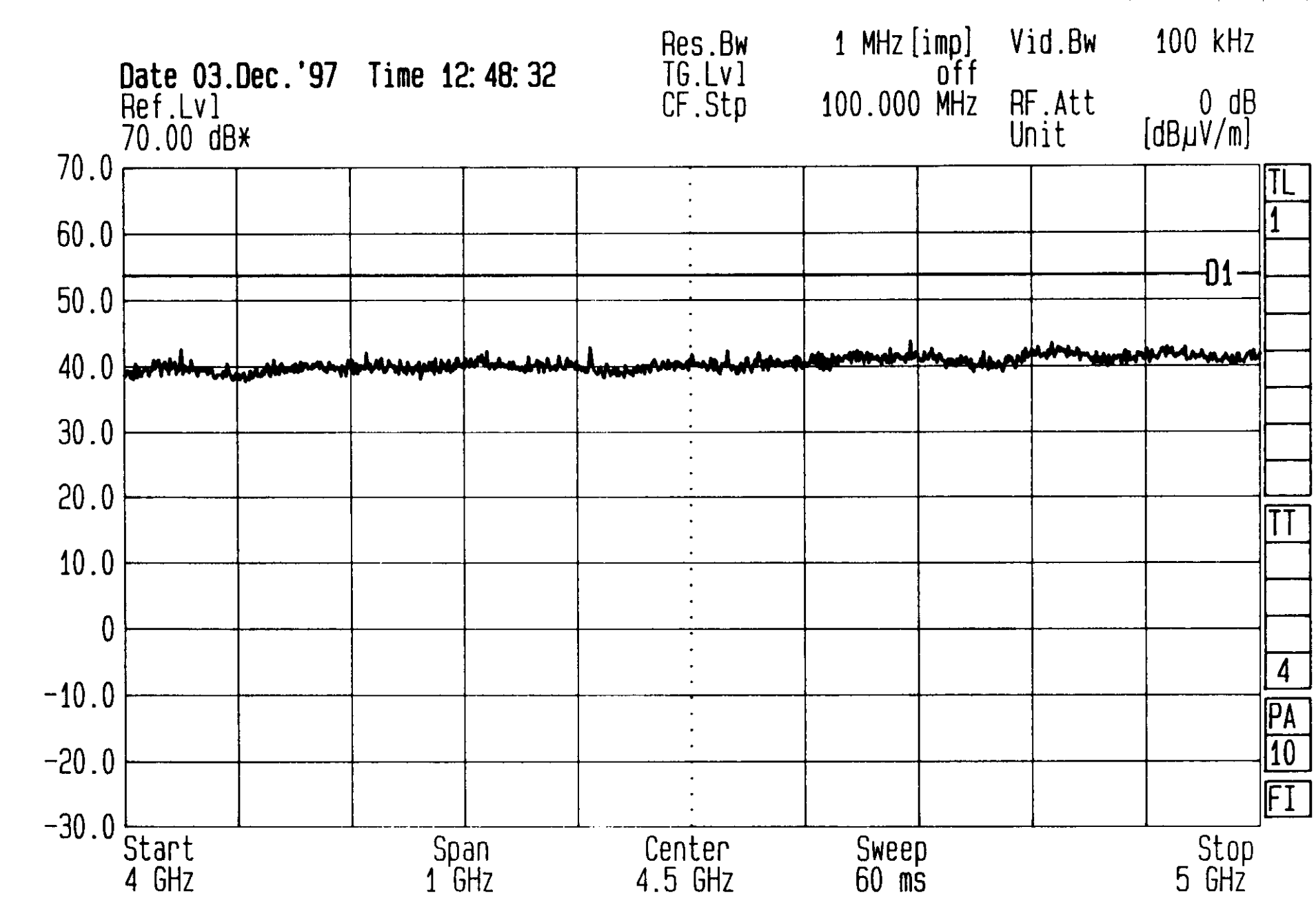
Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. Average. 3m Scan. With Transmitter Operating. GPH/34630/JD01/ETF02/012



Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. Average. 3m Scan. Transmitter Only. GPH/34630/JD01/ETF02/013



Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. Average. 3m Scan. Transmitter Only. GPH/34630/JD01/ETF02/014



Radiated. Tested by RFI for Audio Ltd. EUT: DX2020. FCC Part 15 Subpart B
Limit. Average. 3m Scan. Transmitter Only. GPH/34630/JD01/ETF02/015

Test Of: Audio Ltd.
DX2020 Wireless Microphone Receiver
To: FCC Part 15: 1996 Subpart B Class B

Appendix 5. Photographs of EUT

This appendix contains the following photographs

Photo Reference Number	Title
PHT/34630/001	Rear view of EUT.
PHT/34630/002	Front view of EUT.

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