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TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Audio Limited. TX2020
Wireless Microphone Transmitter

To: FCC Part 74.861

Test Report Serial No:
RFI/EMCB1/RP34630/ETF01B

This Test Report Is Issued Under The Authority Of Brian Watson, Technical Director:	
Tested By:	**Checked By:**
Report Copy No: 02	
Issue Date: 29 April 1998	**Test Dates: 11 March 1998 to 12 April 1998**

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1. Client Information

Company Name:	Audio Limited
Address:	Audio House Progress Road Sands High Wycombe HP12 4JD
Contact Name:	Mr. J. Reeve

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 Limited
Model Name or Number:	TX2020
Unique Type Identification:	TX2020
Serial Number:	605423-6
Country of Manufacture:	UK
FCC ID Number:	NRK TX2020
Date of Receipt:	11 March 1998

2.2. Description Of EUT

The equipment under test is a Wireless Microphone Transmitter.

2.3. Modifications Incorporated In EUT

None stated by client.

2.4. Additional Information Related To Testing

Power Supply Requirement:	Internal Battery Supply of + 9 Volts
Intended Operating Environment:	Any Environment
Weight:	0.175 kg
Dimensions:	90 mm (h) x 60 mm (w) x 20 mm (d)
Interface Ports:	Antenna Microphone
Transmit Frequency	735.0 MHz
Maximum power output	50mW
Frequency generation	Synthesiser
Number of channels	32
Occupied Bandwidth	98kHz
Antenna	External connection (SMA Connection)
Modulation	FM

2.5. Support Equipment

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

Description:	Microphone
Brand Name:	TRAM
Model Name or Number:	TR50
Serial Number:	72276
FCC ID Number:	None Stated by Client
Cable Length And Type:	1m Microphone
Connected to Port:	Microphone

3. Test Specification, Methods And Procedures

3.1. Test Specification

Reference:	FCC Part 74: 1996 Clause 74.861
Title:	Code of Federal Regulations, Part 74 (47CFR80 to end) Experimental Radio, Auxiliary, Special Broadcast and Other Program Distributional Services
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.

The radiated emissions tests were performed in accordance to the methods and procedures of C.F.R. 47 Part 15 Subpart C.

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.

C.F.R. 47 Part 2: 1996
Title: Telecommunication. Frequency allocations and radio treaty matters; general rules and regulations.

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 (TX2020) was powered by an internal battery of + 9 Volts DC..

5.2. Operating Modes

The EUT was tested in the following operating mode: The EUT (TX2020) was operated in transmit mode at full power with an operating frequency of 735.0MHz. When required by the specification a maximum audio input level of –32dBm at 2500Hz was applied to the microphone input port.

5.3. Configuration And Peripherals

The EUT was tested in the following configuration: The EUT (TX2020) was tested with the microphone and antenna attached as for normal operation.

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.

6. Summary Of Test Results

6.1. Radiated Emissions

Range Of Measurements	Specification Reference	Compliancy Status
Electric Field Strength 30 MHz to 8000 MHz	Section 74.861(e(6)) Clause 2.993 & 15.209 of C.F.R. 47: 1996	Complied
Antenna Port 30 MHz to 8000 MHz	Section 74.861(e(6)) Clause 2.991 of C.F.R. 47: 1996	Complied
RF Power Output	Section 74.861(e(1)) Clause 2.985 of C.F.R. 47: 1996	Complied
Occupied Bandwidth	Section 74.861(e(5)) Clause 2.989 of C.F.R. 47: 1996	Complied
Frequency Stability	Section 74.861(e(4)) Clause 2.995 of C.F.R. 47:1996	Complied

6.2. 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.

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.

7.1.3. As the EUT was powered from an internal 9 volt dc supply no conducted emission measurements were performed.

7.2. Test Results For Radiated Emissions. Part 74.861(e(6))

7.2.1. Electric Field Strength Measurements – 30 MHz to 8000 MHz

7.2.1.1. The following radiated electric field strength measurements were performed as in accordance with Part 2 of C.F.R. 47 Section 2.993.

7.2.1.2. The EUT (TX2020) was tested to the limit specified in Part 15 of C.F.R. 47 Section 15.209.

7.2.1.3. The EUT (TX2020) was tested in accordance with the procedure specified in C.F.R. 47 Part 15 Subpart C (Intentional Radiators).

7.2.1.4. The client has stated that the highest clock frequency for the EUT was 735 MHz. Therefore tests were performed up to 8000 MHz.

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

7.2.1.6. The following table lists frequencies at which emissions were measured at a test distance of 3m using a Quasi-Peak detector (results incorporate antenna factors and cable losses):

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
367.497	Horiz	28.5	46.0	17.5	Complied
658.201	Horiz.	32.9	46.0	13.1	Complied
671.000	Vert.	30.7	46.0	15.3	Complied
677.573	Vert.	35.6	46.0	10.4	Complied
683.799	Vert.	28.8	46.0	17.2	Complied
792.450	Horiz.	28.9	46.0	17.1	Complied

7.2.1.7. No radiated field strength measurements were performed in the range of 1000 MHz and 8000 MHz as no emissions were observed during pre-scan tests. Radiated emission pre-scans between this range can be seen in Appendix 4 of this test report.

7.3. Test Results for Conducted Antenna Port. Part 74.861(e(6))

7.3.1. Spurious Emissions at Antenna Terminals – 30 MHz to 8000 MHz

7.3.1.1. The following spurious conducted antenna port measurements were performed as in accordance with Part 2 of C.F.R. 47 Section 2.993.

7.3.1.2. No final spurious antenna terminal emission measurements were performed on the EUT (TX2020) over the range 30 MHz to 8000 MHz because no emissions were observed during the pre-scan tests. Conducted antenna port emission pre-scans can be found in Appendix 4 of this test report.

7.4. RF Power Output. Part 74.861(e(1))

7.4.1. The RF power output of the EUT was measured at the antenna port terminal of the EUT (TX2020) in accordance with Part 74.861(e(1)) and Part 2.985.

7.4.2. The RF output power was measured with an average detector. Measurements were made of the transmitted signal both modulated with a 2500Hz –32dBm audio input and with no modulation present.

7.4.3. RF output power:

Modulated 2500Hz –32dBm:	10.5dBm (10.2mW)	Limit: 250mW	Margin: 239.8
Un-modulated	11.68dBm (10.67mW)	Limit:: 250mW	Margin: 239.33

7.4.4. Scans of the EUT (TX2020) showing the conducted RF output power level can be seen in Appendix 4 (Plots 006, 007 and 008).

7.5. Occupied Bandwidth. Part 74.861(e(5))

7.5.1. The transmitter occupied bandwidth was measured at the antenna port terminal of the EUT (TX2020) with an audio input signal of 2500Hz –32dBm, as specified in Part 2.989(1). The measured bandwidth is determined as being the band between the points where the upper and lower frequency levels of the signal are at 0.5% of the total mean power radiated.

7.5.2. Occupied bandwidth:
98.06 kHz. Using a 10.0 kHz resolution bandwidth. Limit: 200kHz Margin: 101.94

7.5.3. A plot showing the bandwidth measurement and calculation can be found in Appendix 4 (Plot 008).

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7.6. Frequency Stability. Part 74.861(e(4))

7.6.1. The EUT (TX2020) was tested for frequency stability as specified in Part 2.995 of C.F.R. 47.

7.6.2. The client has stated that the minimum battery supply voltage to the EUT is 6 volts and the maximum supply is 9 volts. Frequency stability tests were performed at both supply voltages.

7.6.3. As specified in section 2.995(1) the temperature was varied over the range -30°C to +50°C in steps of 10°C.

Ambient Temperature: -30°C @ 6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.986082	8.8
2.0	734.986459	8.9
3.0	734.986578	9.0
4.0	734.986636	8.9
5.0	734.986839	8.8
6.0	734.987392	8.9
7.0	734.987300	8.8
8.0	734.987852	9.0
9.0	734.988903	9.0
10.0	734.988943	9.0

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Frequency Stability Results (Cont.)

Ambient Temperature: -20°C @ 6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.993645	9.8
2.0	734.993746	9.6
3.0	734.993760	9.7
4.0	734.993807	9.7
5.0	734.993844	9.7
6.0	734.995363	9.7
7.0	734.995722	9.7
8.0	734.995820	9.7
9.0	734.996137	9.7
10.0	734.995997	9.7

Ambient Temperature: -10°C @ 6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.000406	10.4
2.0	735.000196	10.4
3.0	735.000468	10.5
4.0	735.000428	10.4
5.0	735.000443	10.4
6.0	735.000420	10.4
7.0	735.000410	10.4
8.0	735.000386	10.4
9.0	735.000474	10.4
10.0	735.000464	10.4

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Frequency Stability Results (Cont.)

Ambient Temperature: 0°C @ 6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001508	11.2
2.0	735.001575	11.3
3.0	735.001532	11.3
4.0	735.001600	11.3
5.0	735.001664	11.3
6.0	735.001584	11.3
7.0	735.001565	11.3
8.0	735.001554	11.3
9.0	735.001530	11.3
10.0	735.001531	11.3

Ambient Temperature: +10°C @ 6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001242	11.7
2.0	735.001203	11.7
3.0	735.001230	11.7
4.0	735.001224	11.7
5.0	735.001263	11.7
6.0	735.001302	11.7
7.0	735.001257	11.7
8.0	735.001248	11.7
9.0	735.001227	11.7
10.0	735.001233	11.7

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Frequency Stability Results (Cont.)

Ambient Temperature: +20°C @ 6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.000713	11.8
2.0	735.000715	11.9
3.0	735.000705	11.9
4.0	735.000797	11.9
5.0	735.000811	11.9
6.0	735.000735	11.9
7.0	735.000749	11.9
8.0	735.000731	11.9
9.0	735.000761	11.9
10.0	735.000756	11.9

Ambient Temperature: +30°C @ 6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.999387	11.9
2.0	734.999461	11.8
3.0	734.999447	11.9
4.0	734.999463	11.9
5.0	734.999405	11.9
6.0	734.999485	11.9
7.0	734.999471	11.9
8.0	734.999471	11.9
9.0	734.999473	11.9
10.0	734.999470	11.9

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Frequency Stability Results (Cont.)

Ambient Temperature: +40°C @ 6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.998903	11.7
2.0	734.998921	11.7
3.0	734.998929	11.7
4.0	734.998901	11.7
5.0	734.998933	11.7
6.0	734.998898	11.7
7.0	734.998956	11.7
8.0	734.998958	11.7
9.0	734.998934	11.7
10.0	734.998942	11.7

Ambient Temperature: +50°C @ 6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.998528	11.6
2.0	734.998488	11.6
3.0	734.998526	11.6
4.0	734.998537	11.7
5.0	734.998532	11.7
6.0	734.998484	11.7
7.0	734.998517	11.7
8.0	734.998341	11.7
9.0	734.998533	11.7
10.0	734.998512	11.7

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Frequency Stability Results (Cont.)

Ambient Temperature: -30°C @ 9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.992284	10.4
2.0	734.992418	10.5
3.0	734.992462	10.5
4.0	734.992482	10.5
5.0	734.992524	10.5
6.0	734.992788	10.5
7.0	734.993673	10.5
8.0	734.993617	10.5
9.0	734.993213	10.5
10.0	734.993379	10.5

Ambient Temperature: -20°C @ 9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.991741	10.6
2.0	734.991817	10.6
3.0	734.991907	10.6
4.0	734.992013	10.7
5.0	734.992179	10.9
6.0	734.992712	10.9
7.0	734.992783	11.0
8.0	734.992957	11.0
9.0	734.993005	11.0
10.0	734.993288	11.0

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Frequency Stability Results (Cont.)

Ambient Temperature: -10°C @ 9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.000350	11.8
2.0	734.000462	11.8
3.0	734.000474	11.8
4.0	734.000471	11.8
5.0	734.000484	11.8
6.0	734.000418	11.9
7.0	734.000428	11.8
8.0	734.000470	11.8
9.0	734.000479	11.8
10.0	734.000481	11.8

Ambient Temperature: 0°C @ 9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001387	12.5
2.0	735.001384	12.5
3.0	735.001394	12.5
4.0	735.001350	12.5
5.0	735.001355	12.5
6.0	735.001357	12.5
7.0	735.001354	12.5
8.0	735.001348	12.5
9.0	735.001343	12.5
10.0	735.001344	12.5

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Frequency Stability Results (Cont.)

Ambient Temperature: +10°C @ 9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001347	12.8
2.0	735.001343	12.8
3.0	735.001241	12.8
4.0	735.001231	12.8
5.0	735.001235	12.8
6.0	735.001293	12.8
7.0	735.001249	12.8
8.0	735.001241	12.8
9.0	735.001243	12.8
10.0	735.001233	12.8

Ambient Temperature: +20°C @ 9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001815	13.1
2.0	735.001757	13.2
3.0	735.001727	13.2
4.0	735.001851	13.2
5.0	735.002235	13.2
6.0	735.002810	13.2
7.0	735.002900	13.2
8.0	735.002756	13.2
9.0	735.002844	13.2
10.0	735.002858	13.2

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Frequency Stability Results (Cont.)

Ambient Temperature: +30°C @ 9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.999649	13.3
2.0	734.999717	13.3
3.0	734.999629	13.3
4.0	734.999791	13.3
5.0	734.999717	13.3
6.0	734.999839	13.3
7.0	734.999791	13.3
8.0	734.999832	13.3
9.0	734.999831	13.3
10.0	734.999830	13.3

Ambient Temperature: +40°C @ 9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.998854	13.4
2.0	734.998740	13.4
3.0	734.998732	13.4
4.0	734.998810	13.4
5.0	734.998742	13.4
6.0	734.998782	13.4
7.0	734.998752	13.4
8.0	734.998766	13.4
9.0	734.998728	13.4
10.0	734.999315	13.4

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Frequency Stability Results (Cont.)

Ambient Temperature: +50°C @ 9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.998377	13.3
2.0	734.998419	13.4
3.0	734.998353	13.4
4.0	734.998440	13.4
5.0	734.998413	13.4
6.0	734.998425	13.4
7.0	734.998379	13.4
8.0	734.998443	13.4
9.0	734.998431	13.4
10.0	734.998415	13.4

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
Conducted Antenna Port	30 MHz to 8000 MHz	95%	+/- 0.9 dB
Radiated Emissions	30 MHz to 1000 MHz	95%	+/- 4.9 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.
Screened Enclosure: Emissions			
Receiver / Spectrum Analyser System	R & S	ESBI	M088
Plotter	H.P.	7440A	P001
Horn Antenna (1 to 2 GHz)	Eaton	9188-2	A028
Horn Antenna (2 to 4 GHz)	Eaton	91889-2	A031
Biconnical Antenna	EMCO	3104C	A024
Log Spiral Antenna	EMCO	3101	A023
Horn Antenna (4 to 6 GHz)	Flann	12240-20	A253
Horn Antenna (5 - 8.2 GHz)	Flann	12420-20	A254
Cable	Rosenberger	-	C371
30dB Attenuator	Narda	370 BNM	A245
Open Area Test Site			
Receiver	R & S	ESVP	M023
Spectrum Monitor	R & S	EZM	M003
Bilog Antenna	Chase	CBL6111	A259
Turntable Controller	R.H.Electrical Services	RH351	M173
OATS Turntable	British Turntable Ltd	S36069	M174
OATS Antenna Mast	R & S	HCM	A277
Cable	Rosenberger	-	C371
Temperature/Humidity Meter	RS Comp	212-214	M117
Attenuator 3 dB	Narda	370 BNM	A262

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 74.861 (Part 15 Subpart C)

A2.1.1. Radiated emissions measurements were performed in accordance with the methods and procedures stated in C.F.R. 47 Part 15, and ANSI C63.4:1992, 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 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. For emissions 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 emissions above 1000MHz, the antenna height remained fixed at 1.5m.

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

Test Of: Audio Limited. TX2020 Wireless Microphone Transmitter
To: FCC Part 74.861

A2.2. Conducted Antenna Port. FCC Part 74.861

A2.2.1. Spurious measurements at the Antenna port were performed as specified in C.F.R. 47 Part 2.991.

A2.2.2. A measuring receiver was connected to the antenna port of the EUT via a suitable RF Attenuator. The total loss of both the cable and the attenuator were measured prior to testing to allow for their connection.

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 the EUT should be investigated further. 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.

A2.2.4. Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. Any emissions that were within 20dB of the specified limit were measured with an Average and Peak detectors. Emissions found to be greater than 20dB from the specified limit were not investigated further.

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

Test Of: Audio Limited. TX2020 Wireless Microphone Transmitter
To: FCC Part 74.861

A2.3. RF Power Output. FCC Part 74.861

A2.3.1. RF Power Output measurements were performed at the Antenna port as specified in C.F.R. 47 Part 2.985

A2.3.2. The output antenna port of the EUT was connected to a suitable test receiver with an input impedance of 50 ohms via an attenuator. This attenuator was first calibrated to determine the precise loss at the required frequency.

A2.3.3. The EUT was operated at full power with a maximum audio input of –32dBm at 2500Hz continuously applied at the audio input port. A level was also noted with no audio input applied.

A2.3.3. A scan was produced showing the maximum output level achieved.

A2.4. Occupied Bandwidth. FCC Part 74.861

A2.4.1. Measurements were performed to determine the occupied bandwidth level of the EUT as specified in C.F.R. 47 Part 2.989.

A2.4.2. The EUT was operated at full power with a maximum audio input of –32dBm at 2500Hz continuously applied at the audio input port. Scans were produced of the waveform at the receiver input using both single sweep and max hold functions.

A2.4.3. The bandwidth was measured between the points at which the lower frequency level and upper frequency level are equal to 0.5 percent of the total mean power radiated from the device.

A2.5. Frequency Stability. FCC Part 74.861

A2.5.1. Measurements were performed to determine the frequency stability of the EUT as specified in C.F.R. 47 Part 2.995.

A2.5.2. An environmental test chamber was used to perform the resting required.

A2.5.3. To enable the correct voltage level to be applied to the EUT, the battery was removed and a power supply was connected via flexible leads to the battery terminals. The power supply unit was situated outside of the environmental test chamber.

A2.5.4. The EUT was situated inside the environmental test chamber and the required temperature (starting from the lowest level) was allowed to settle prior to switching on the EUT.

A2.5.5. Frequency and RF output power measurements were then made at intervals of one minute for a duration of 10 minutes whilst maintaining the required temperature.

A2.5.6. The EUT was then switched off for a minimum of 30 minutes and the environmental chamber was allowed to stabilise at the next temperature. Point A2.5.5. was then repeated.

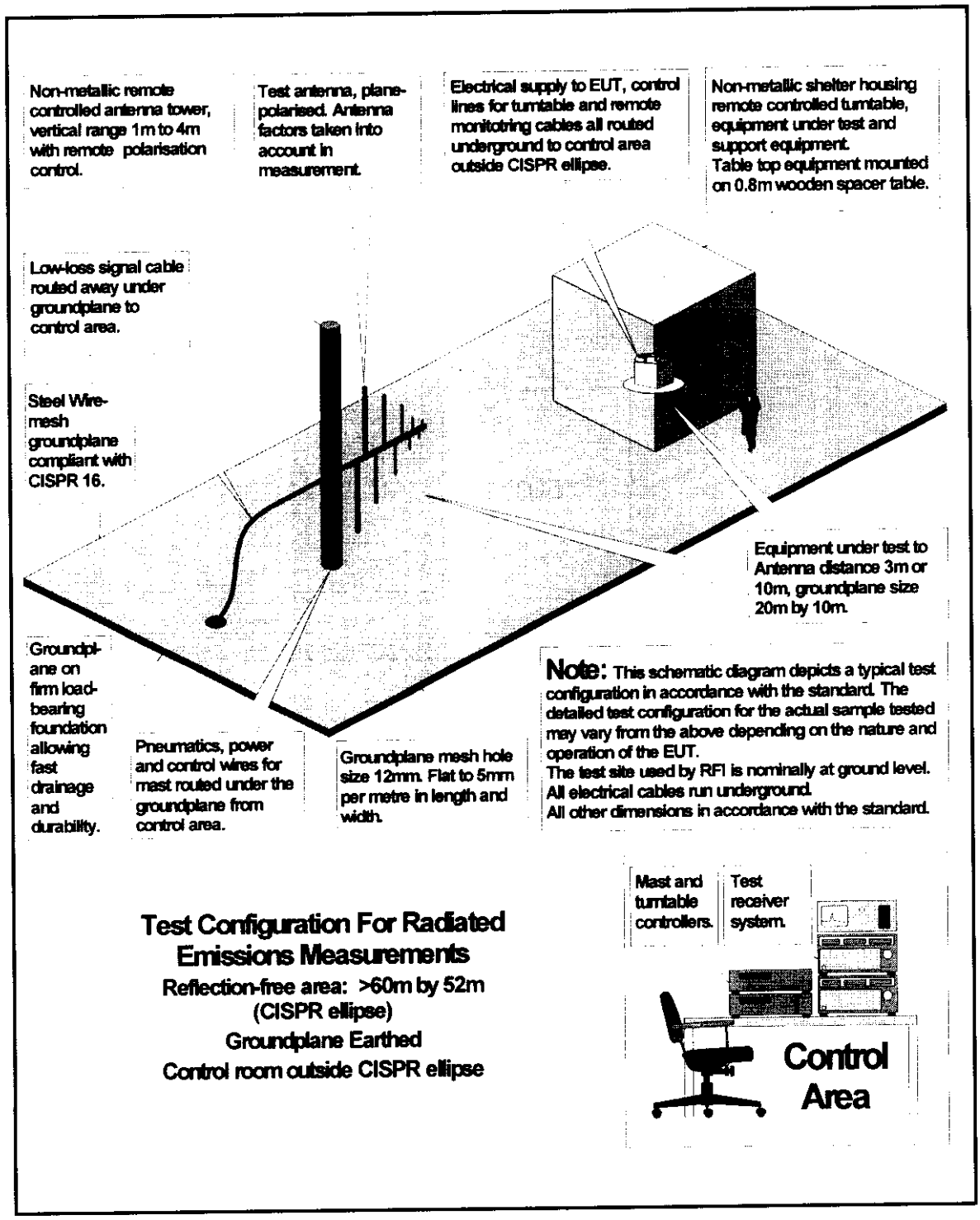
Appendix 3.. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\34630ETF01\EMIRAD	Test configuration for measurement of radiated emissions
DRG\34630ETF01\001	Schematic diagram of the EUT, support equipment and interconnecting cables used for the test
DRG\34630ETF01\002	Schematic Diagram of the EUT for Conducted Antenna Port measurements

Test Of: Audio Limited. TX2020 Wireless Microphone Transmitter
To: FCC Part 74.861

DRG\34630ETF01\EMIRAD



Test Configuration For Radiated Emissions Measurements

Reflection-free area: >60m by 52m (CISPR ellipse)

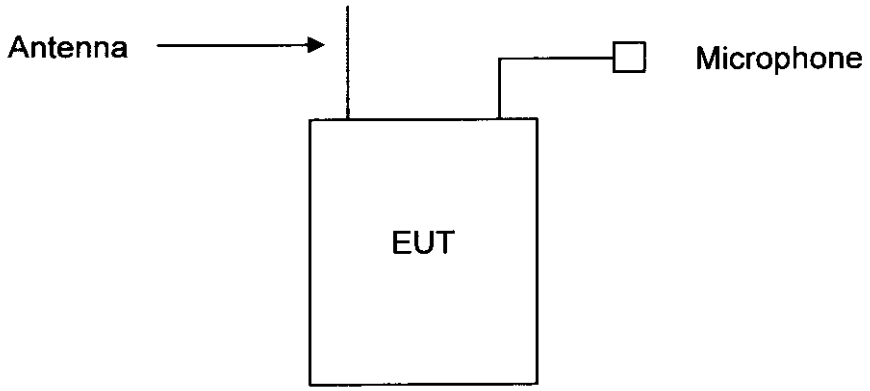
Groundplane Earthed

Control room outside CISPR ellipse

Test Of: Audio Limited. TX2020 Wireless Microphone Transmitter
To: FCC Part 74.861

DRG\34630ETF01\001

Configuration of EUT and Local Support Equipment

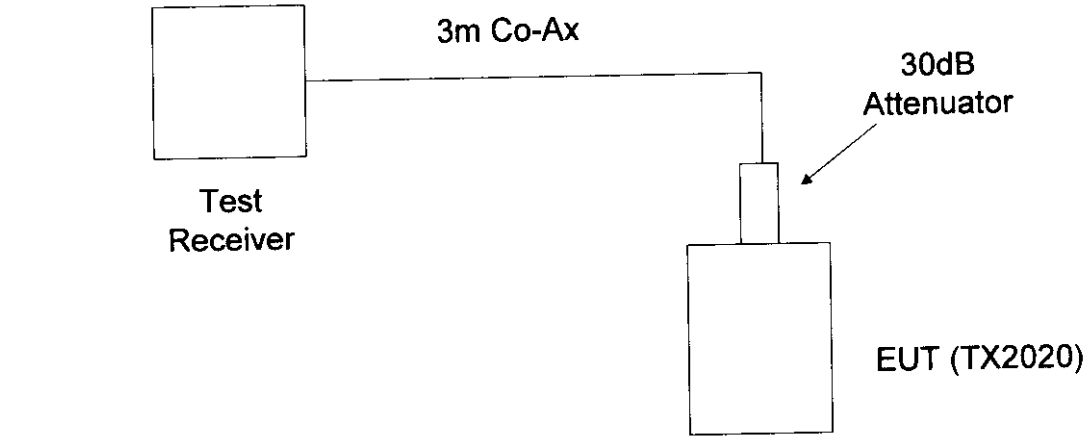


Configuration of Remote Support Equipment

Test Of: Audio Limited. TX2020 Wireless Microphone Transmitter
To: FCC Part 74.861

DRG\34630ETF01\002

Configuration of EUT for Conducted Antenna Port Measurements



Appendix 4. Graphical Test Results

This appendix contains the following graphs:

Graph Reference Number	Title
GPH\34630\JD01\001	Conducted Antenna Port. 30 MHz to 200 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\002	Conducted Antenna Port. 200 MHz to 1000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\003	Conducted Antenna Port. 1000 MHz to 2000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\004	Conducted Antenna Port. 2000 MHz to 4000MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\005	Conducted Antenna Port. 4000 MHz to 5000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\006	Conducted Antenna Port. 5000 MHz to 8000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\007	Conducted Antenna Port. 735 MHz. Bandwidth Measurement at 0.005% Output Power with -32dBm 2500Hz Audio Input. Max Hold Scan
GPH\34630\JD01\008	Conducted Antenna Port. 735 MHz. Bandwidth Measurement at 0.005% Output Power with -32dBm 2500Hz Audio Input. Single Sweep Scan.
GPH\34630\JD01\009	Conducted Antenna Port. 735 MHz. Bandwidth Measurement 3dB Down from Unmodulated Carrier. Max Hold Scan.
GPH\34630\JD01\101	Radiated. 30 MHz to 200 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\102	Radiated. 200 MHz to 720 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\103	Radiated. 750 MHz to 1000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\104	Radiated. 720 MHz to 750 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\105	Radiated. 1000 MHz to 2000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.

Test Of: Audio Limited. TX2020 Wireless Microphone Transmitter
To: FCC Part 74.861

Graphical Test Results continued

GPH\34630\JD01\106	Radiated. 2000 MHz to 4000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\107	Radiated. 4000 MHz to 5000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\108	Radiated. 5000 MHz to 6000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.
GPH\34630\JD01\109	Radiated. 6000 MHz to 8000 MHz. Tx at Full Power with Audio Input of –32dBm 2500Hz.

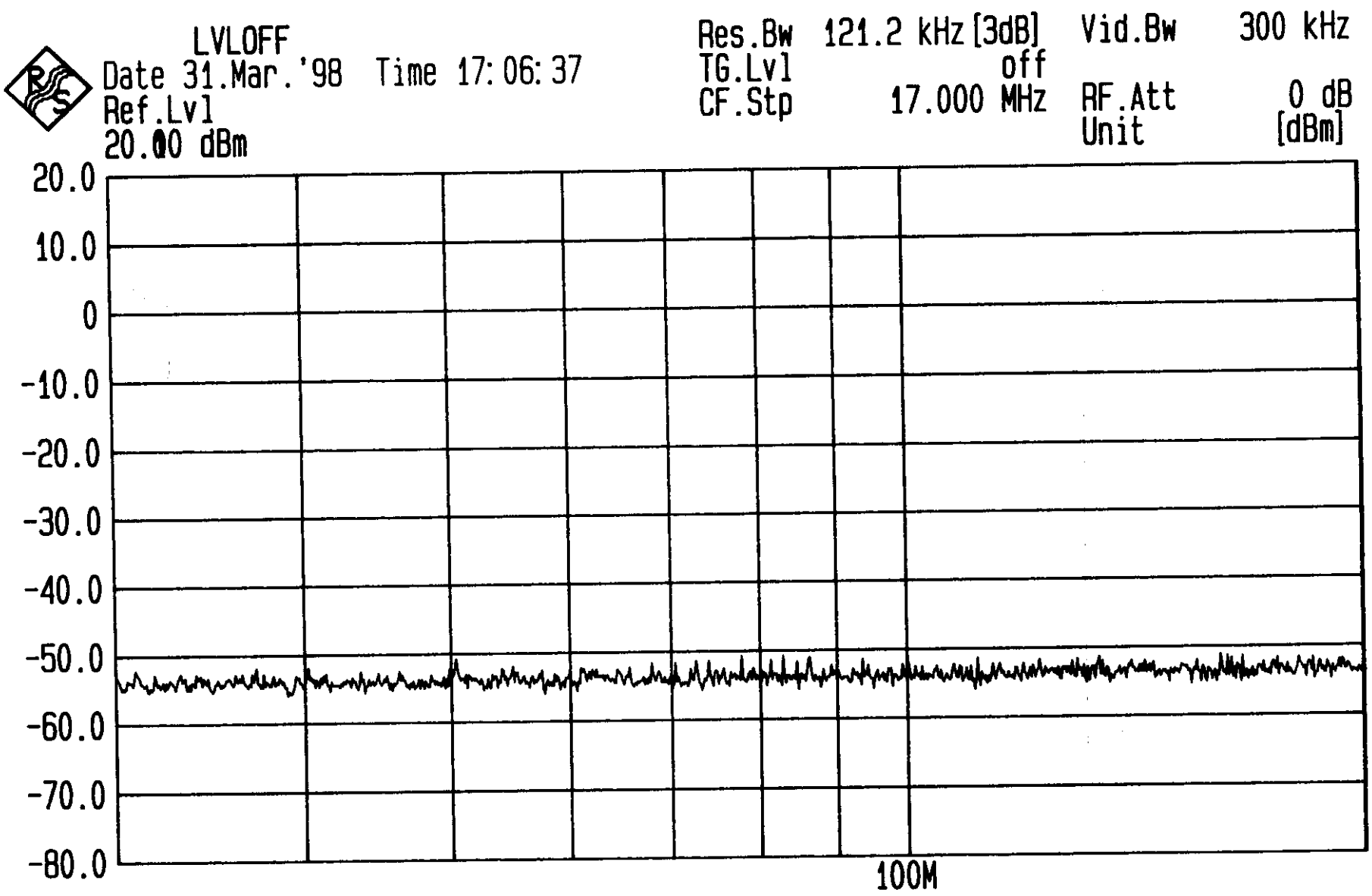
These pages are not included in the total number of pages for this report.

Appendix 5 Photographs of EUT

This appendix contains the following photographs

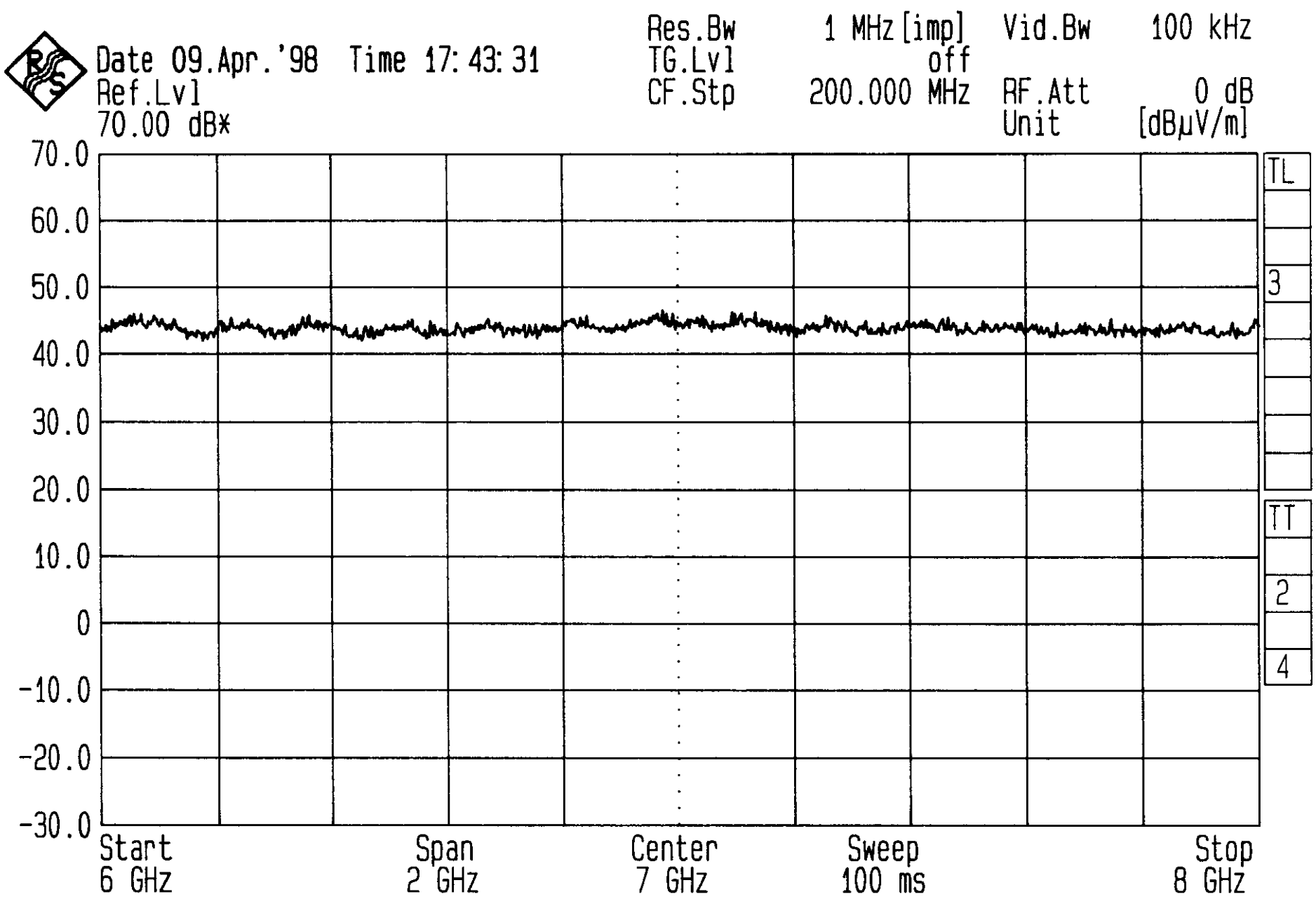
Photo Reference Number	Title
PHT/34630/001	Rear view of EUT
PHT/34630/002	Front view of EUT

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

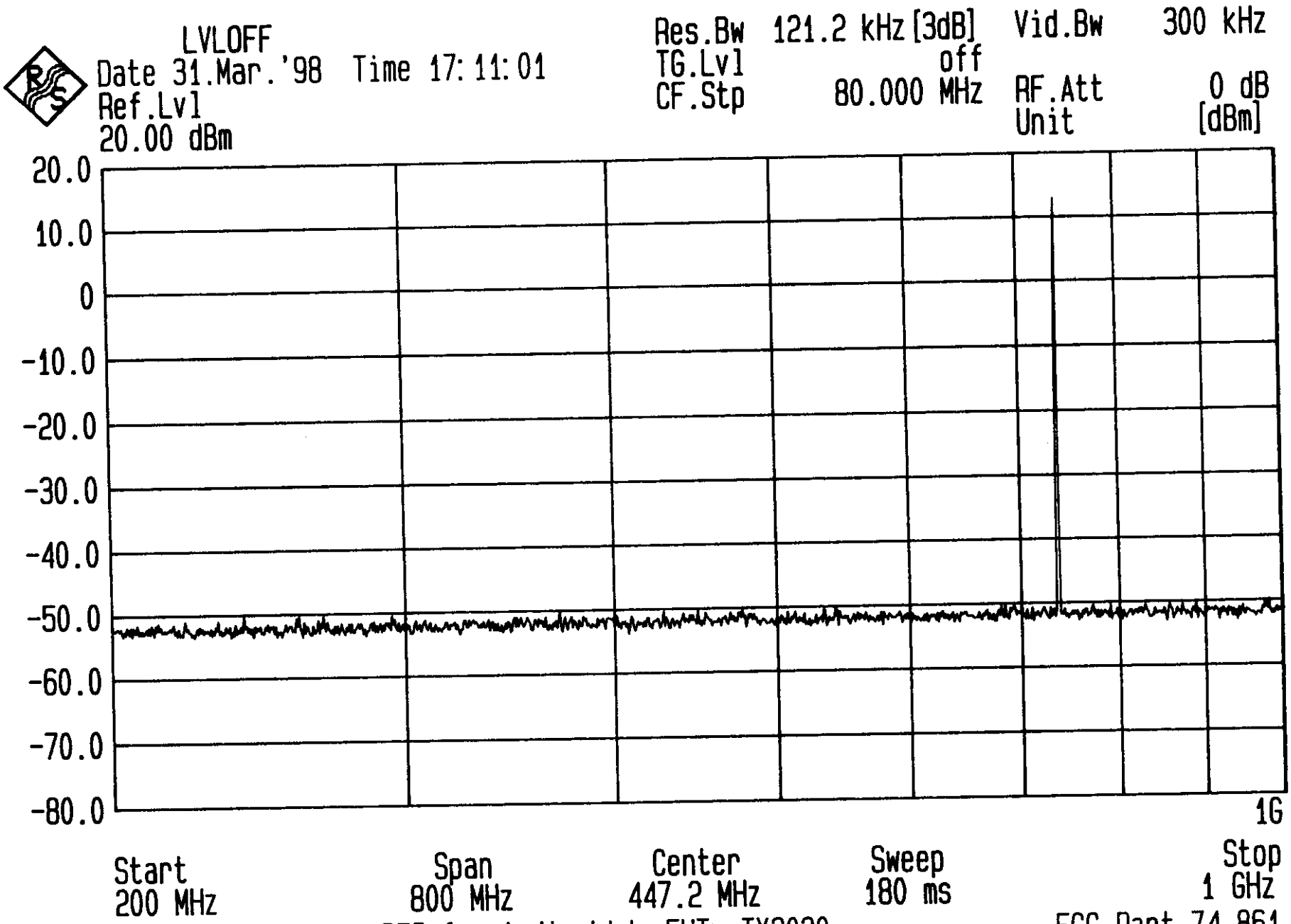


Antenna Port. Tested by RFI for Audio Ltd. EUT: TX2020.
Tx at Full Power with 2500Hz Tone.

FCC Part 74.861
GPH/34630/JD01/001

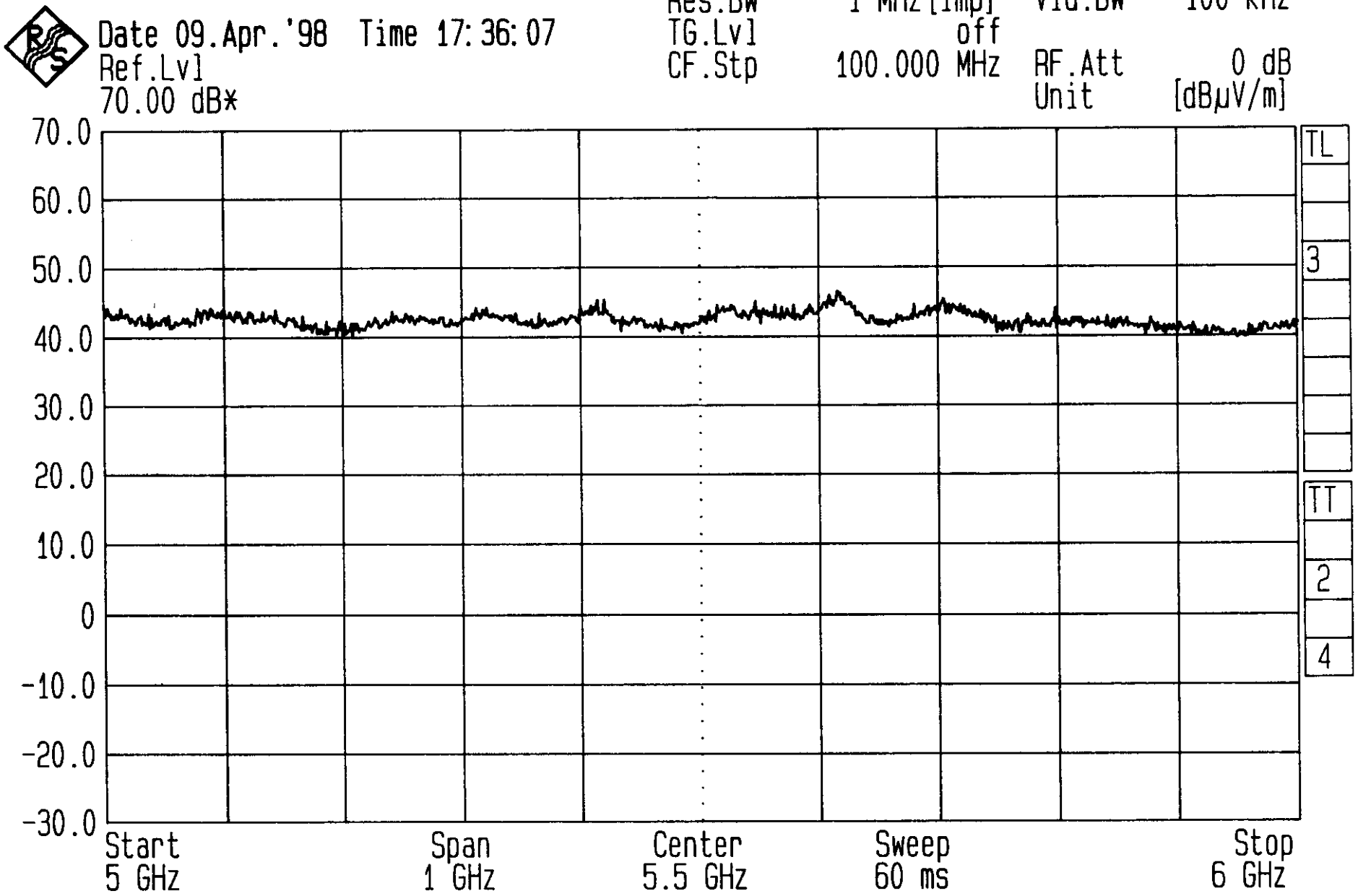


Radiated. Tested by RFI for Audio Ltd. EUT: TX2020. FCC Part 74.861
3m Screened Room Scan. Max Input Signal of -32dBm @ 2500Hz. GPH/34630/JD01/109

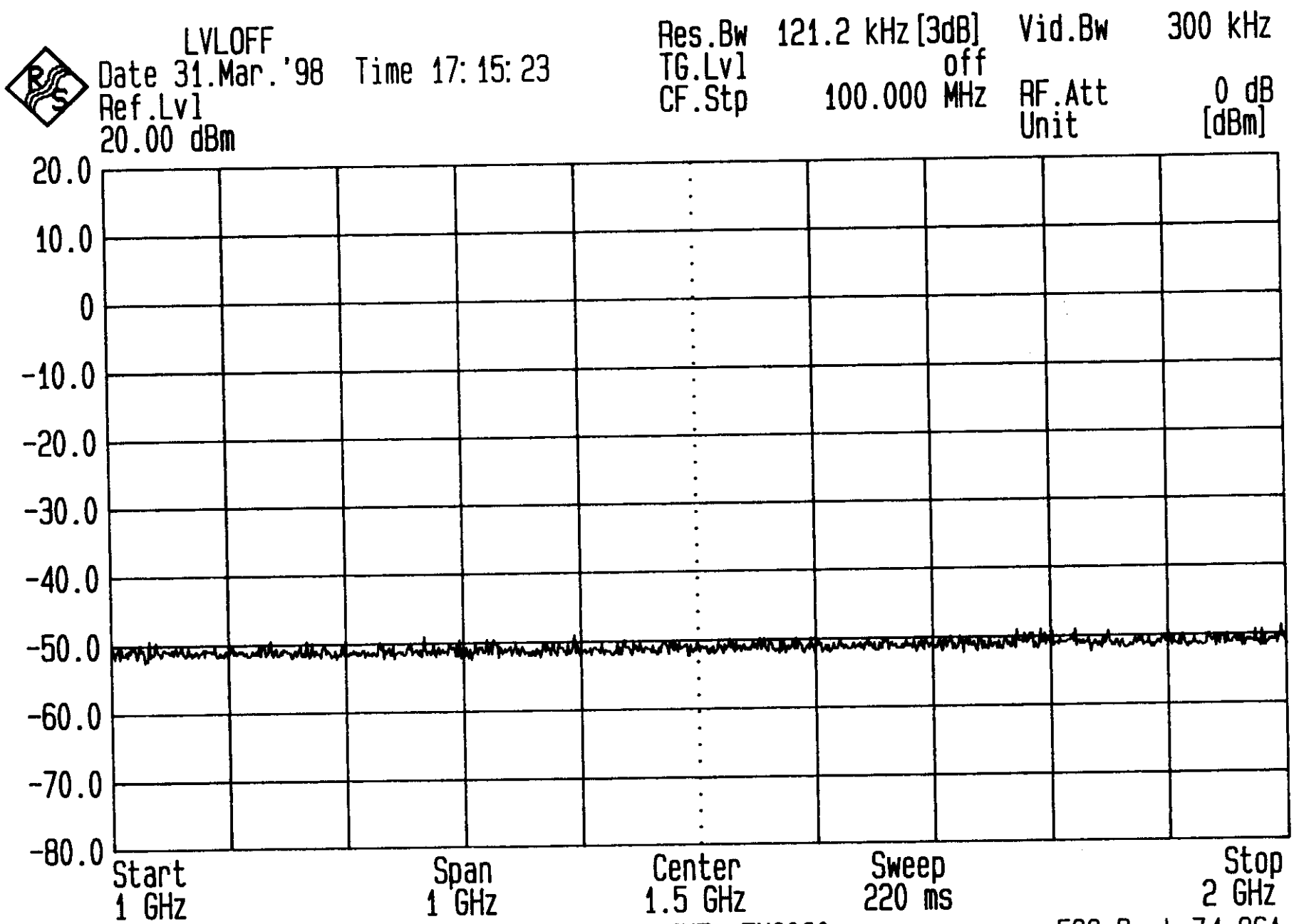


Antenna Port. Tested by RFI for Audio Ltd. EUT: TX2020.
Tx at Full Power with 2500Hz Tone.

FCC Part 74.861
GPH/34630/JD01/002

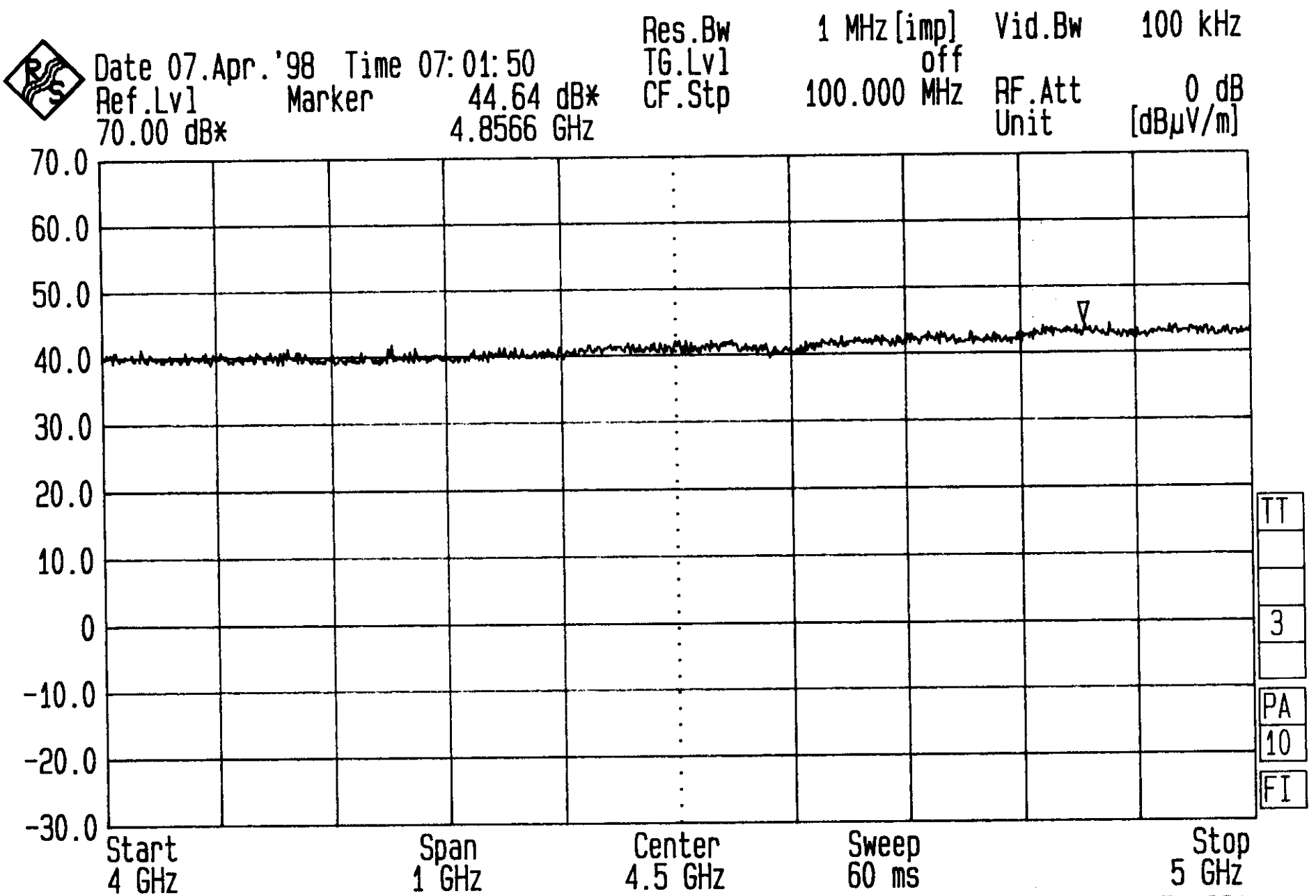


Radiated. Tested by RFI for Audio Ltd. EUT: TX2020. FCC Part 74.861
3m Screened Room Scan. Max Input Signal of -32dBm @ 2500Hz. GPH/34630/JD01/108



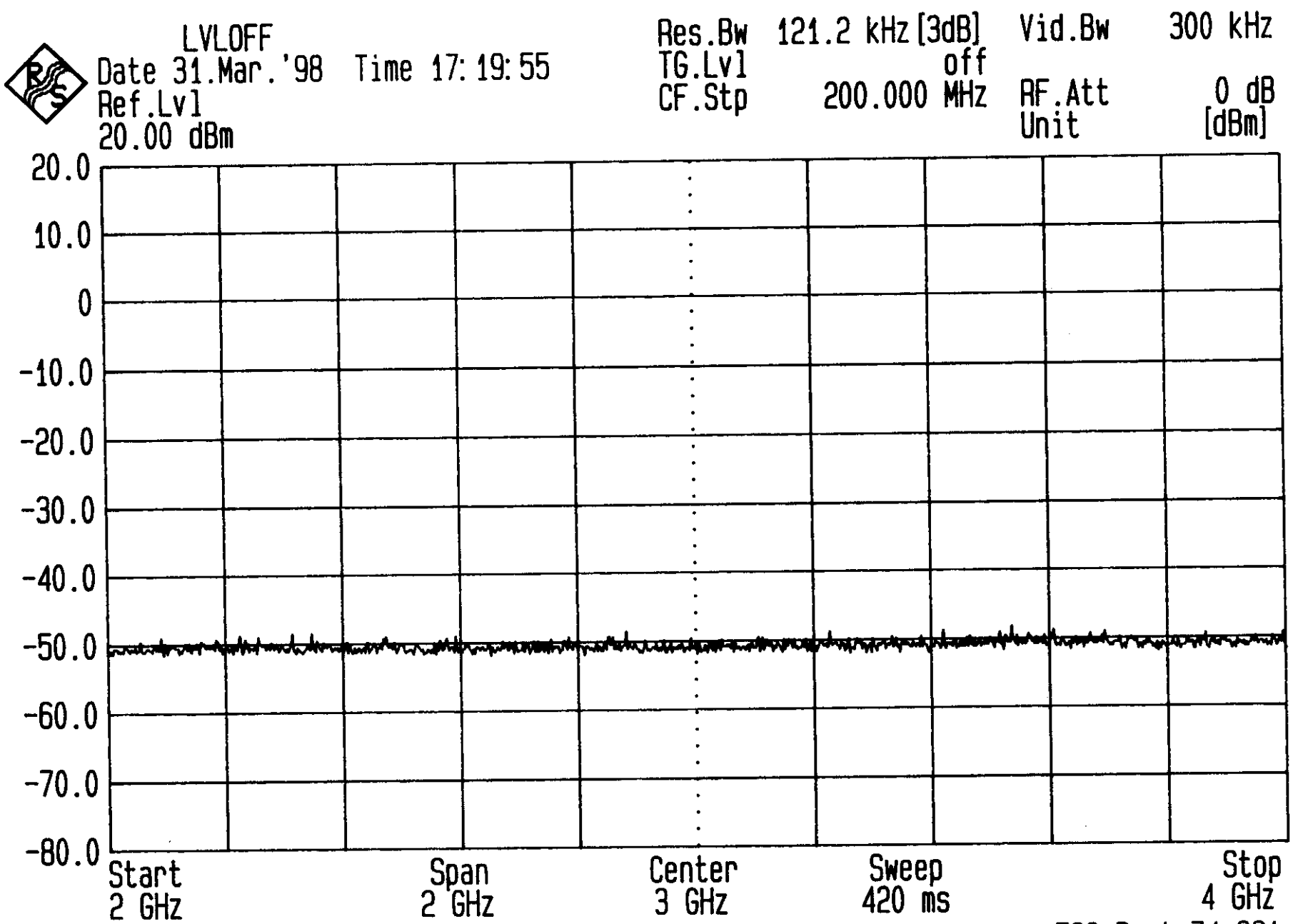
Antenna Port. Tested by RFI for Audio Ltd. EUT: TX2020.
Tx at Full Power with 2500Hz Tone.

FCC Part 74.861
GPH/34630/JD01/003



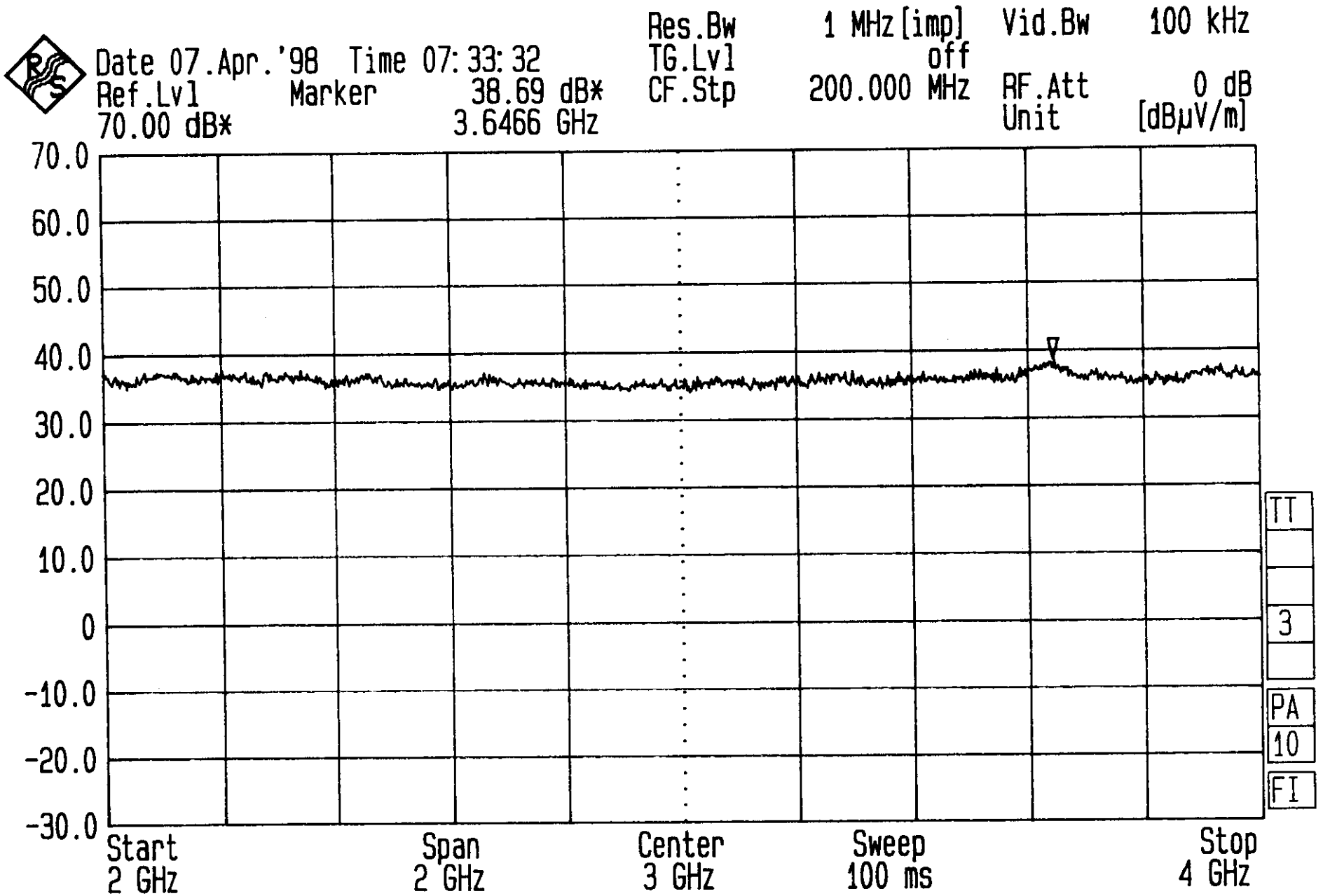
Radiated. Tested by RFI for Audio Ltd. EUT: TX2020.
3m Screened Room Scan. Max Input Signal of -32dBm @ 2500Hz.

FCC Part 74.861
GPH/34630/JD01/107



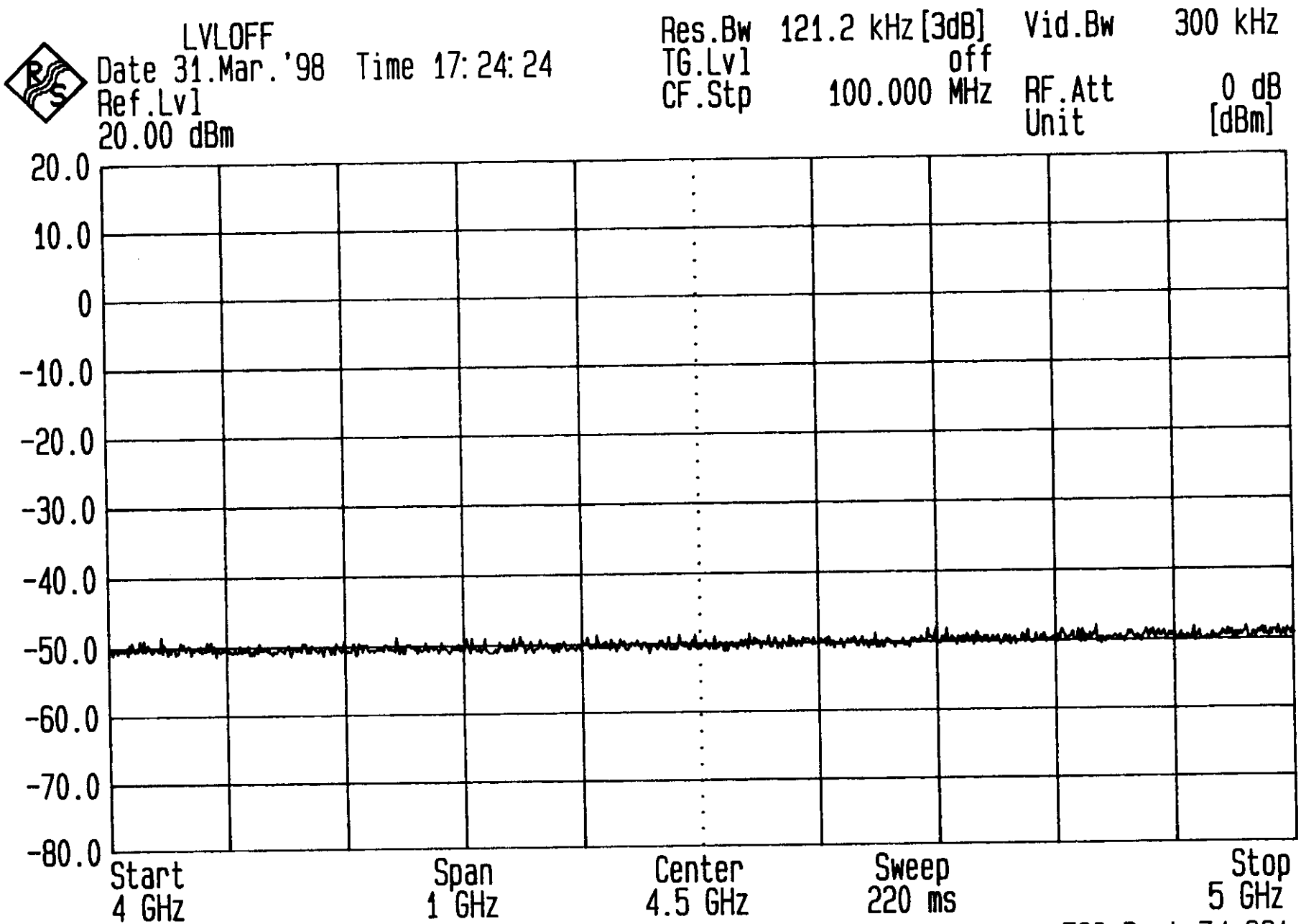
Antenna Port. Tested by RFI for Audio Ltd. EUT: TX2020.
Tx at Full Power with 2500Hz Tone.

FCC Part 74.861
GPH/34630/JD01/004



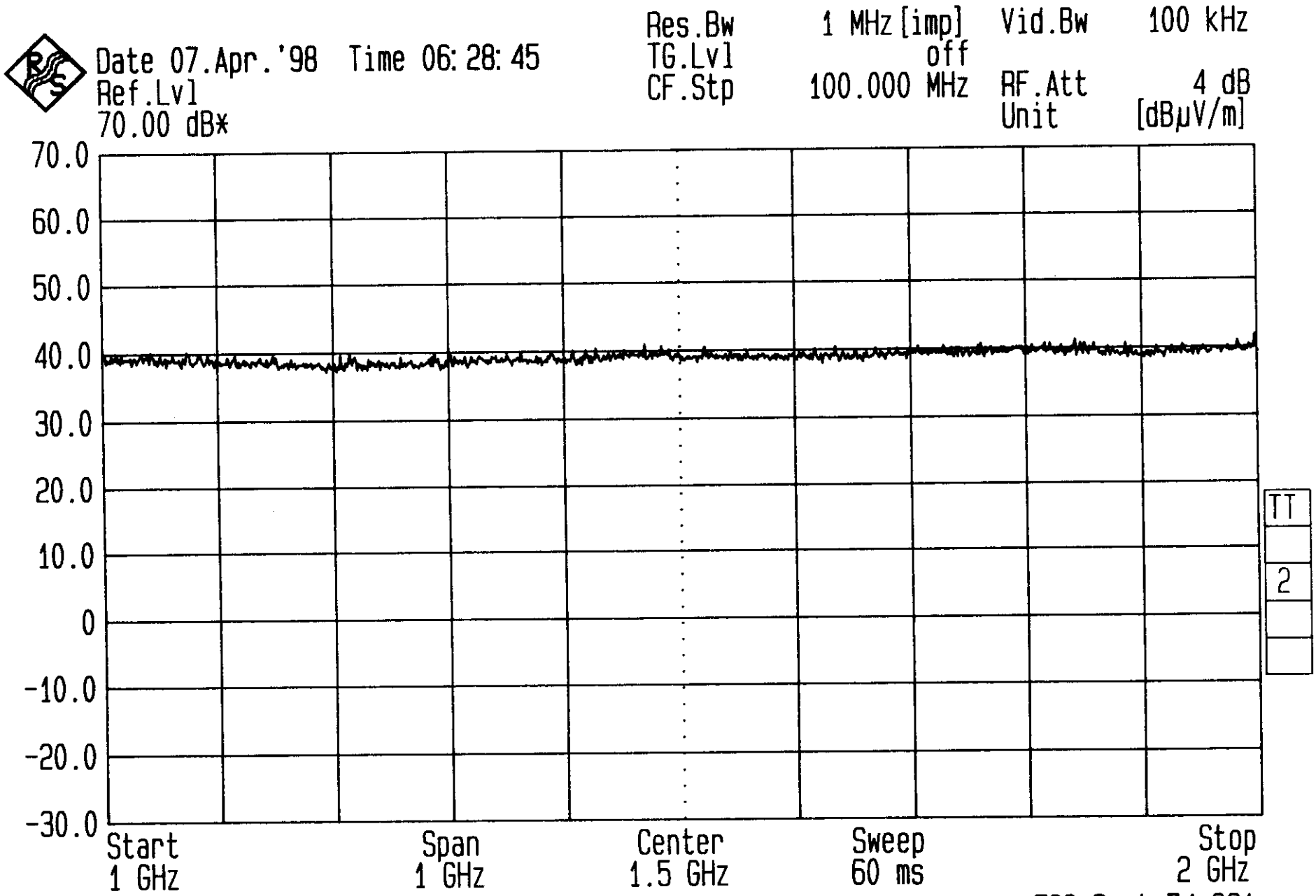
Radiated. Tested by RFI for Audio Ltd. EUT: TX2020.
3m Screened Room Scan. Max Input Signal of -32dBm @ 2500Hz.

FCC Part 74.861
GPH/34630/JD01/106

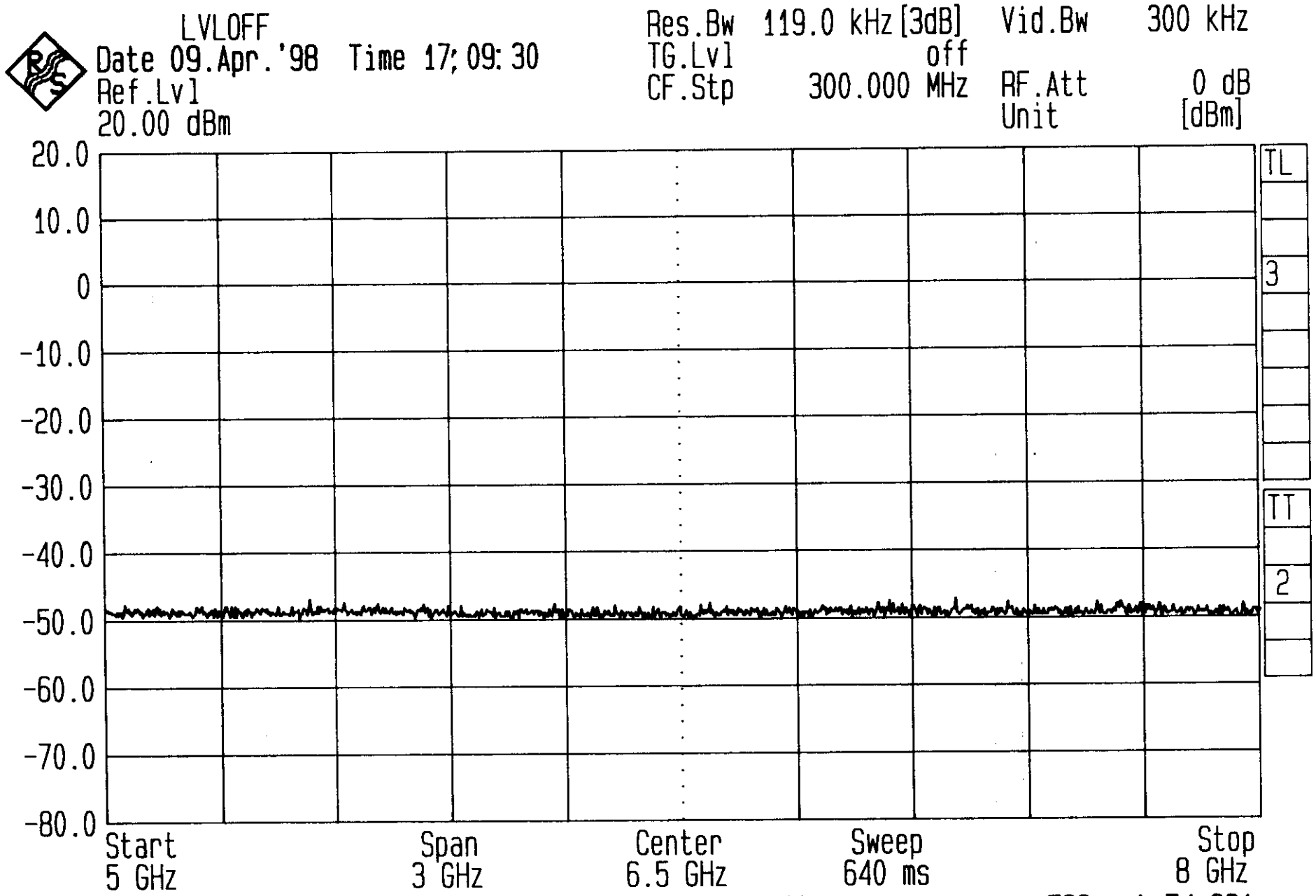


Antenna Port. Tested by RFI for Audio Ltd. EUT: TX2020.
Tx at Full Power with 2500Hz Tone.

FCC Part 74.861
GPH/34630/JD01/005

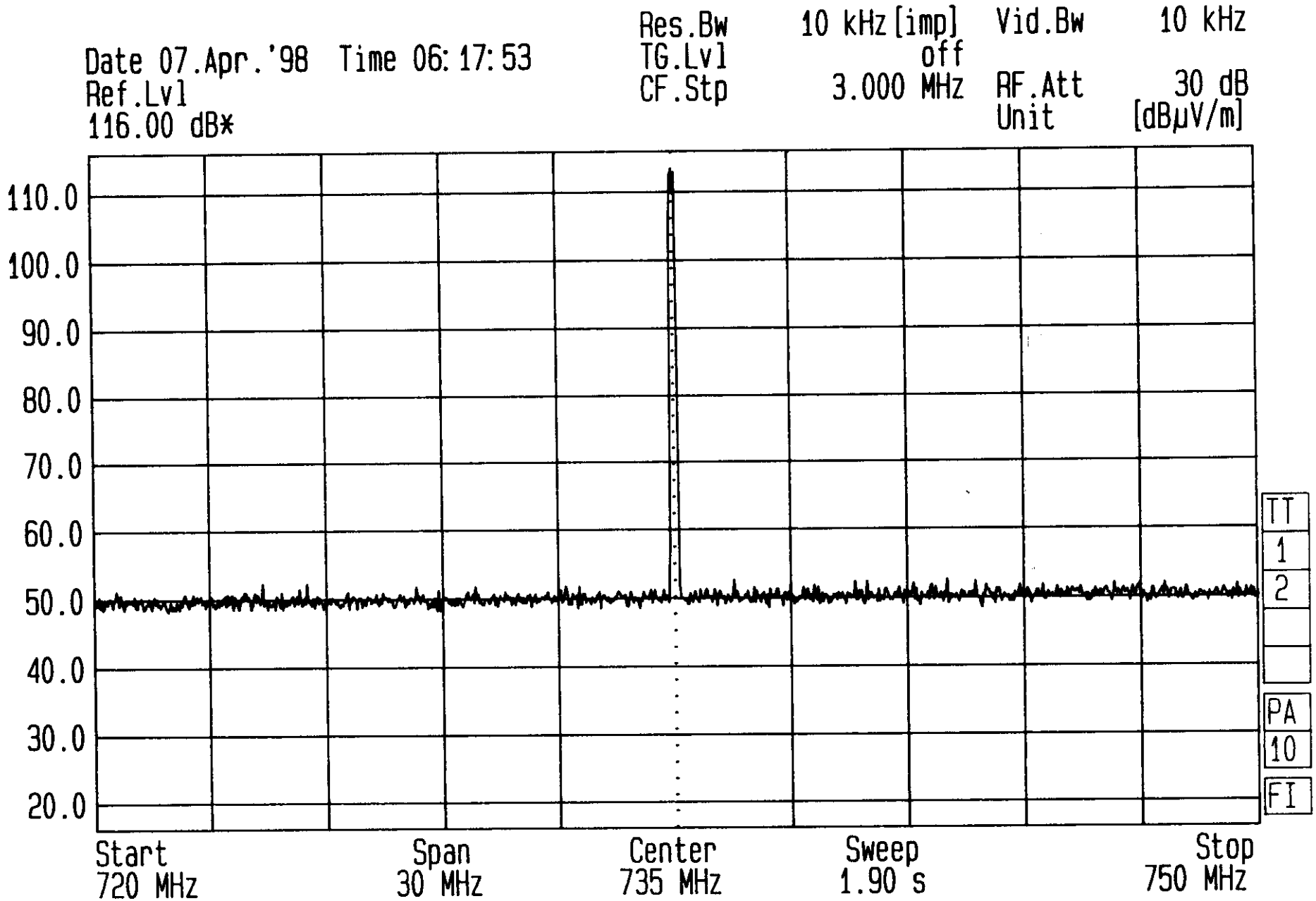


Radiated. Tested by RFI for Audio Ltd. EUT: TX2020. FCC Part 74.861
3m Screened Room Scan. Max Input Signal of -32dBm @ 2500Hz. GPH/34630/JD01/105

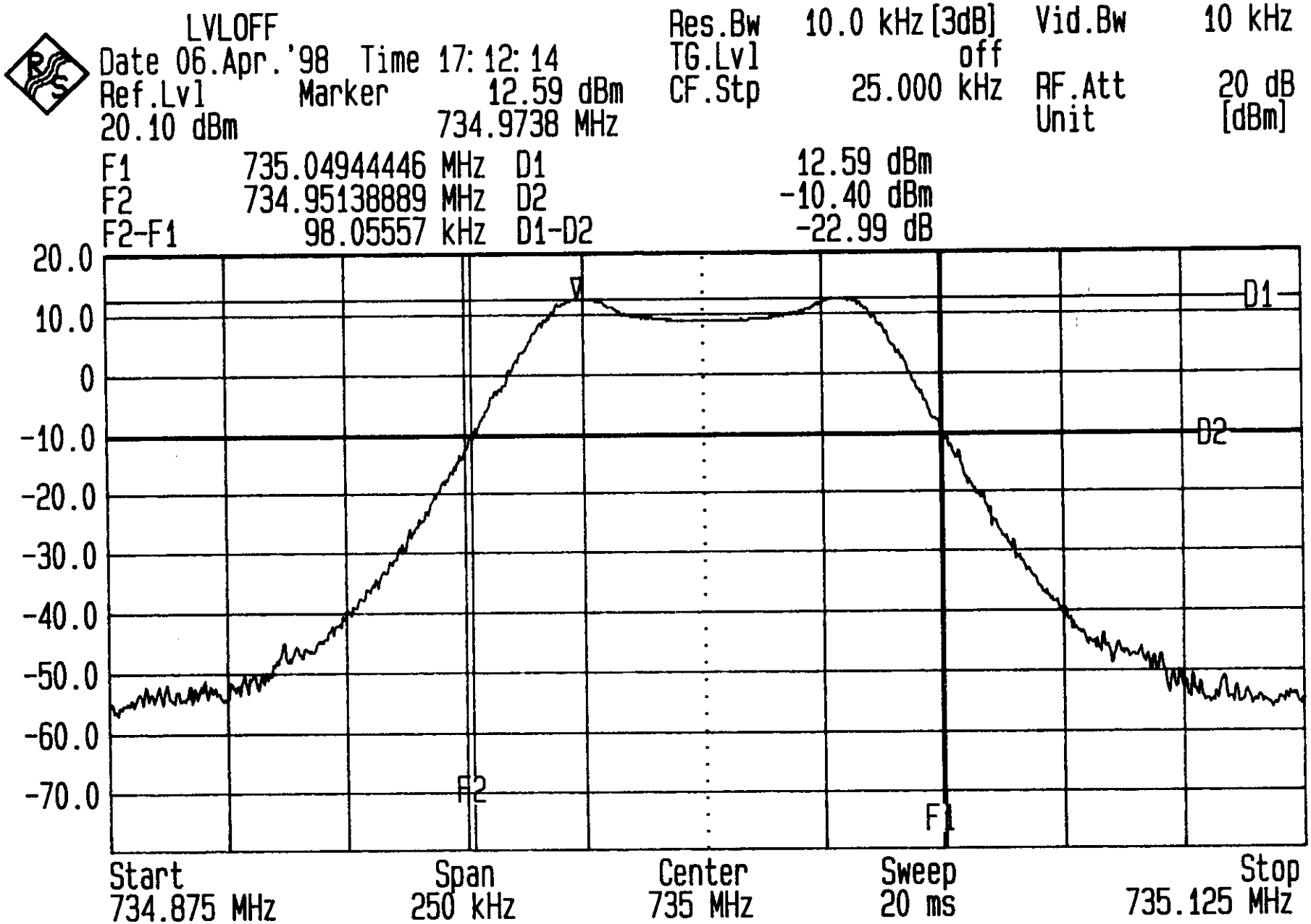


Antenna Port. Tested by RFI for Audio Ltd. EUT: TX2020.
Tx at Full Power with 2500Hz Tone.

FCC art 74.861
GPH/34630/JD01/006

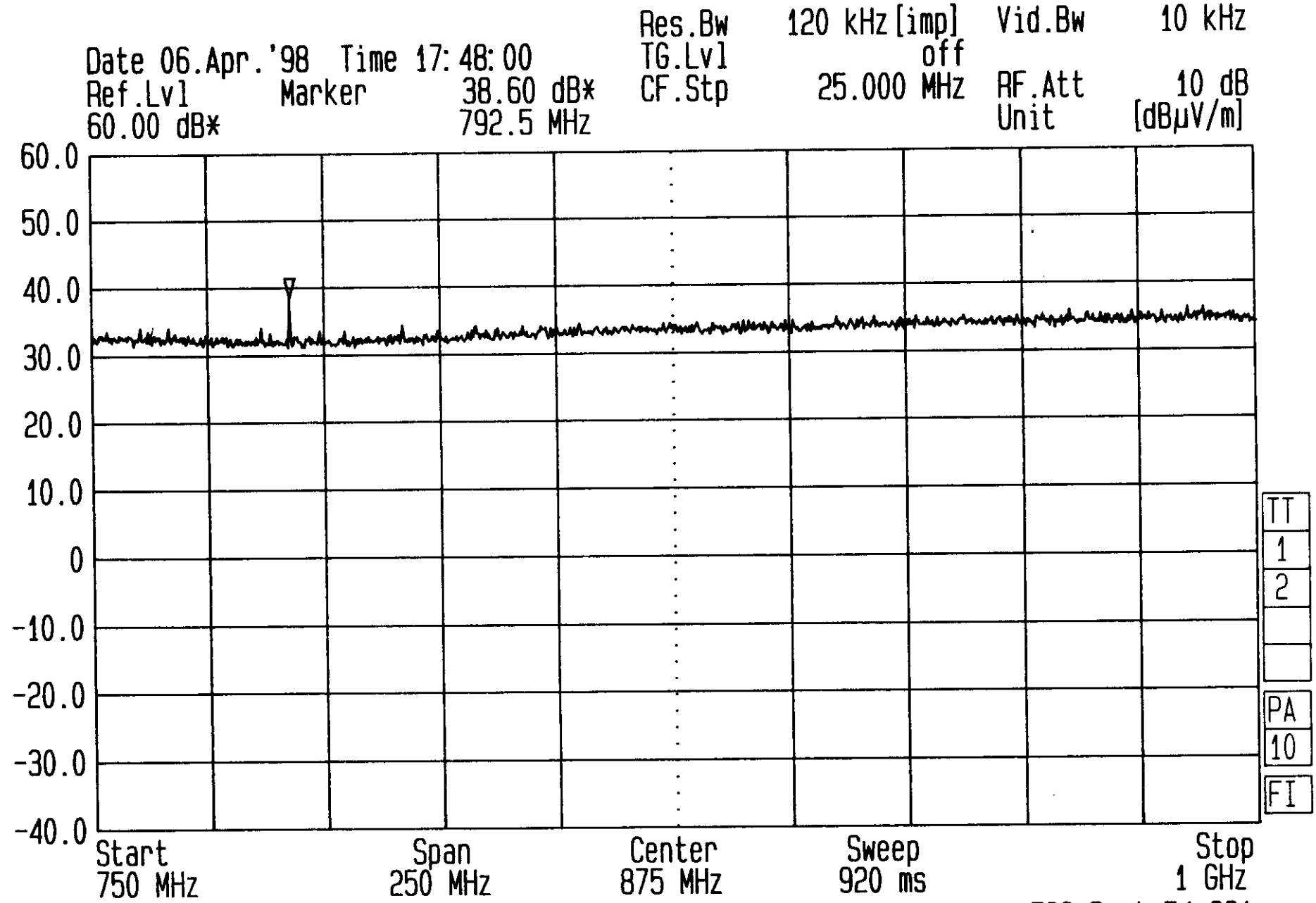


Radiated. Tested by RFI for Audio Ltd. EUT: TX2020. FCC Part 74.861
3m Screened Room Scan. Max Input Signal of -32dBm @ 2500Hz. GPH/34630/JD01/104



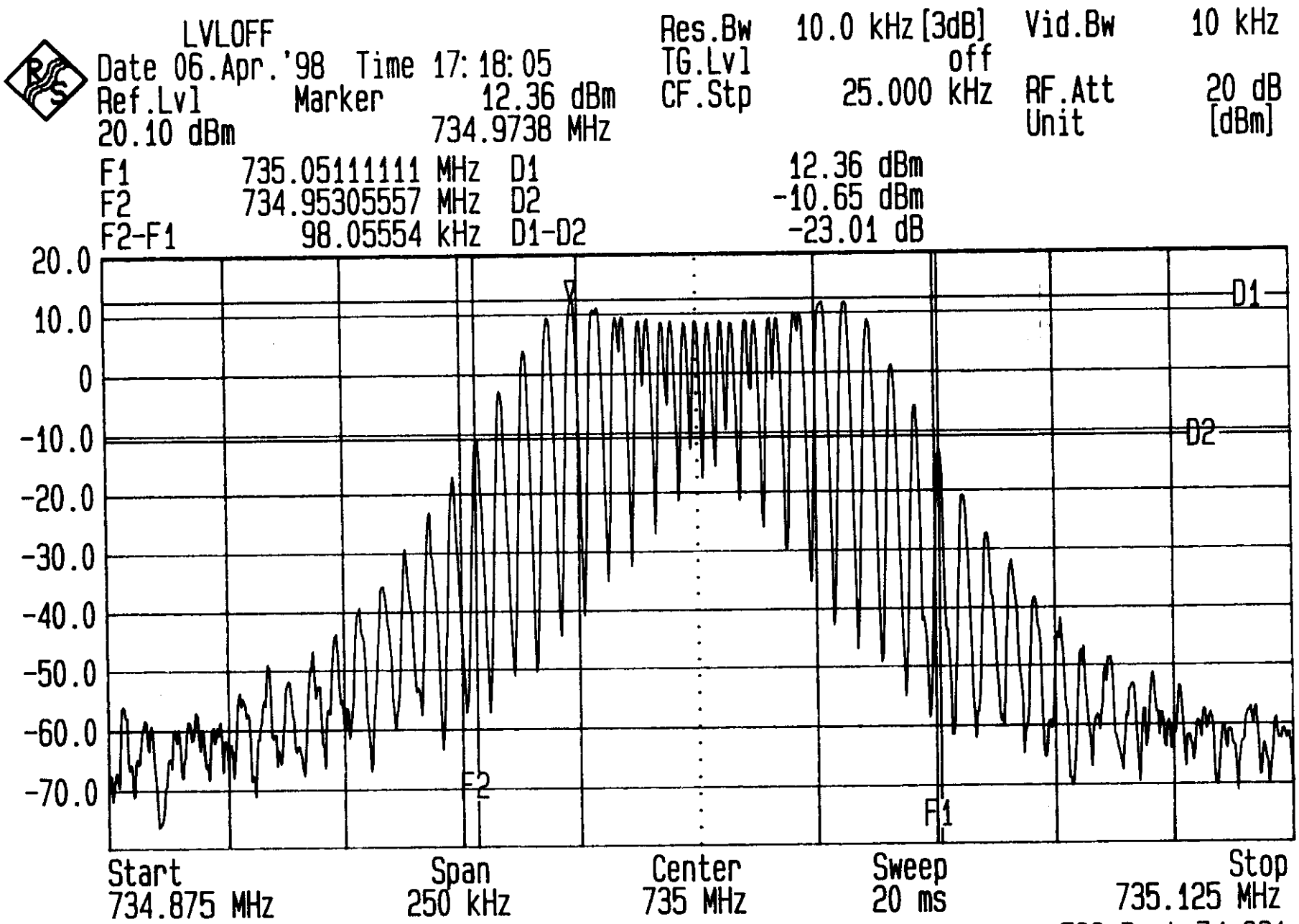
Antenna Port. Tested by RFI for Audio Ltd. EUT: TX2020.
Tx at Full Power with Max Input Signal of -32dBm @ 2500Hz.

FCC Part 74.861
GPH/34630/JD01/007



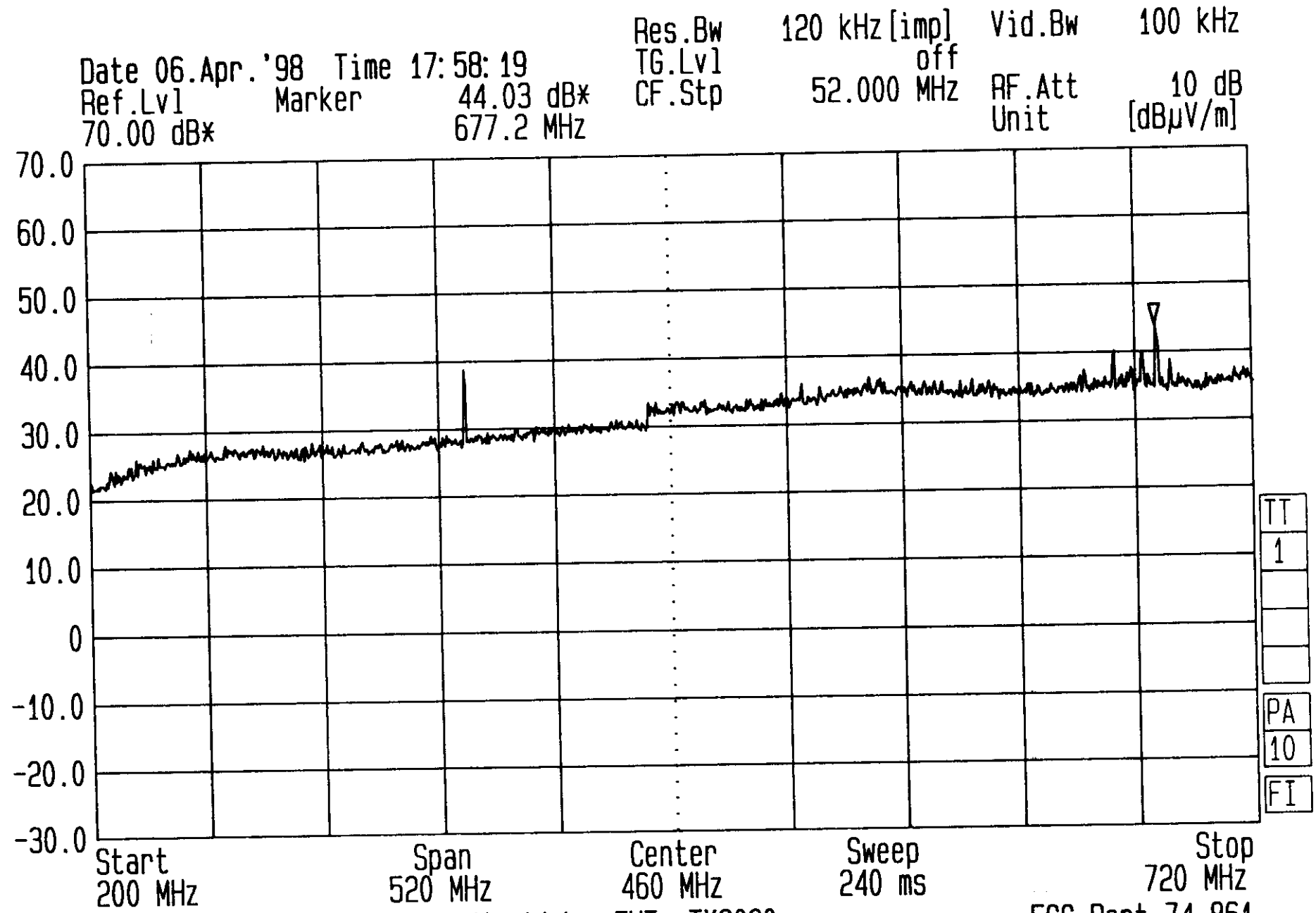
Radiated. Tested by RFI for Audio Ltd. EUT: TX2020.
3m Screened Room Scan. Max Input Signal of -32dBm @ 2500Hz.

FCC Part 74.861
GPH/34630/JD01/103



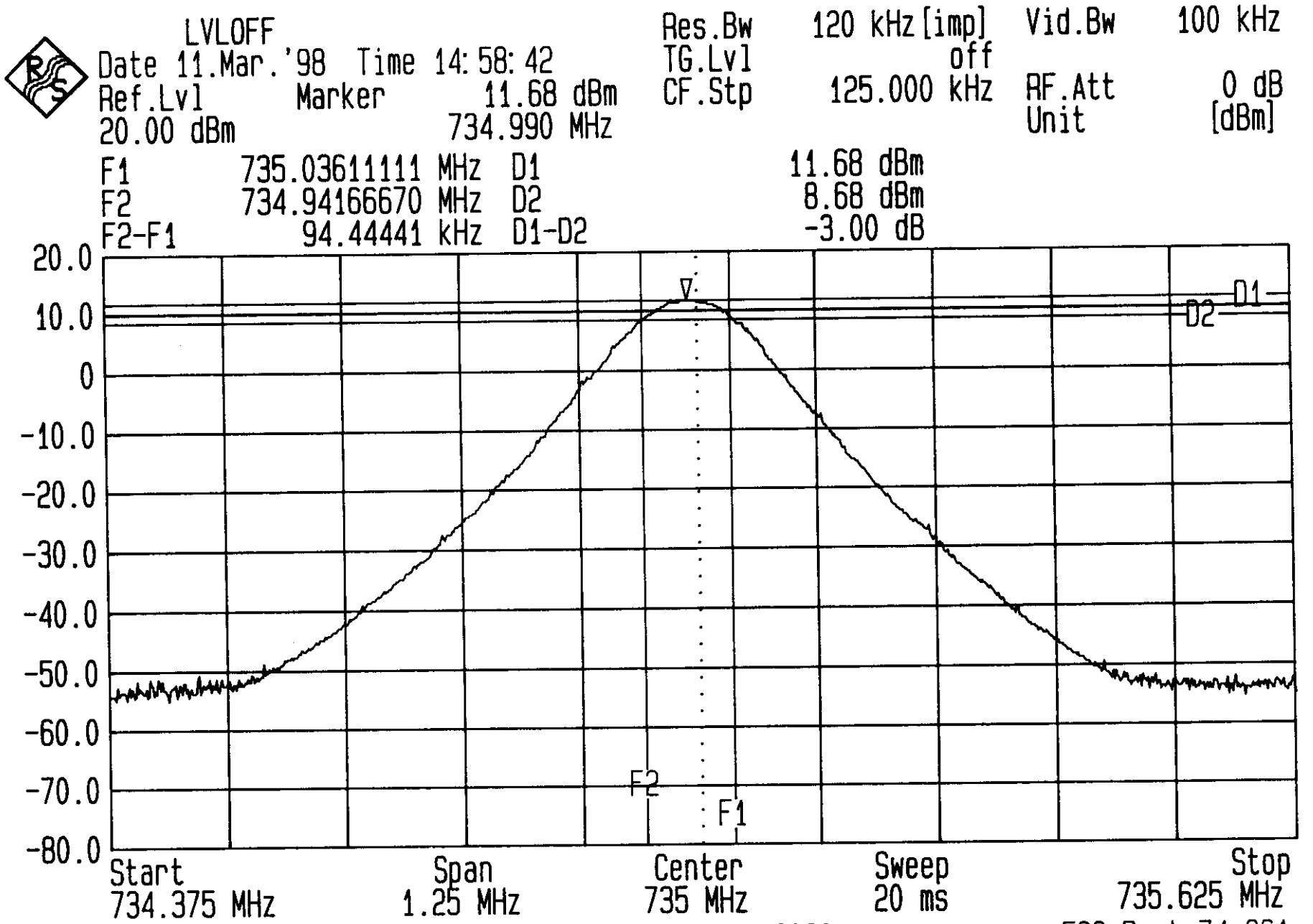
Antenna Port. Tested by RFI for Audio Ltd. EUT: TX2020.
Tx at Full Power with Max Input Signal of -32dBm @ 2500Hz.

FCC Part 74.861
GPH/34630/JD01/008



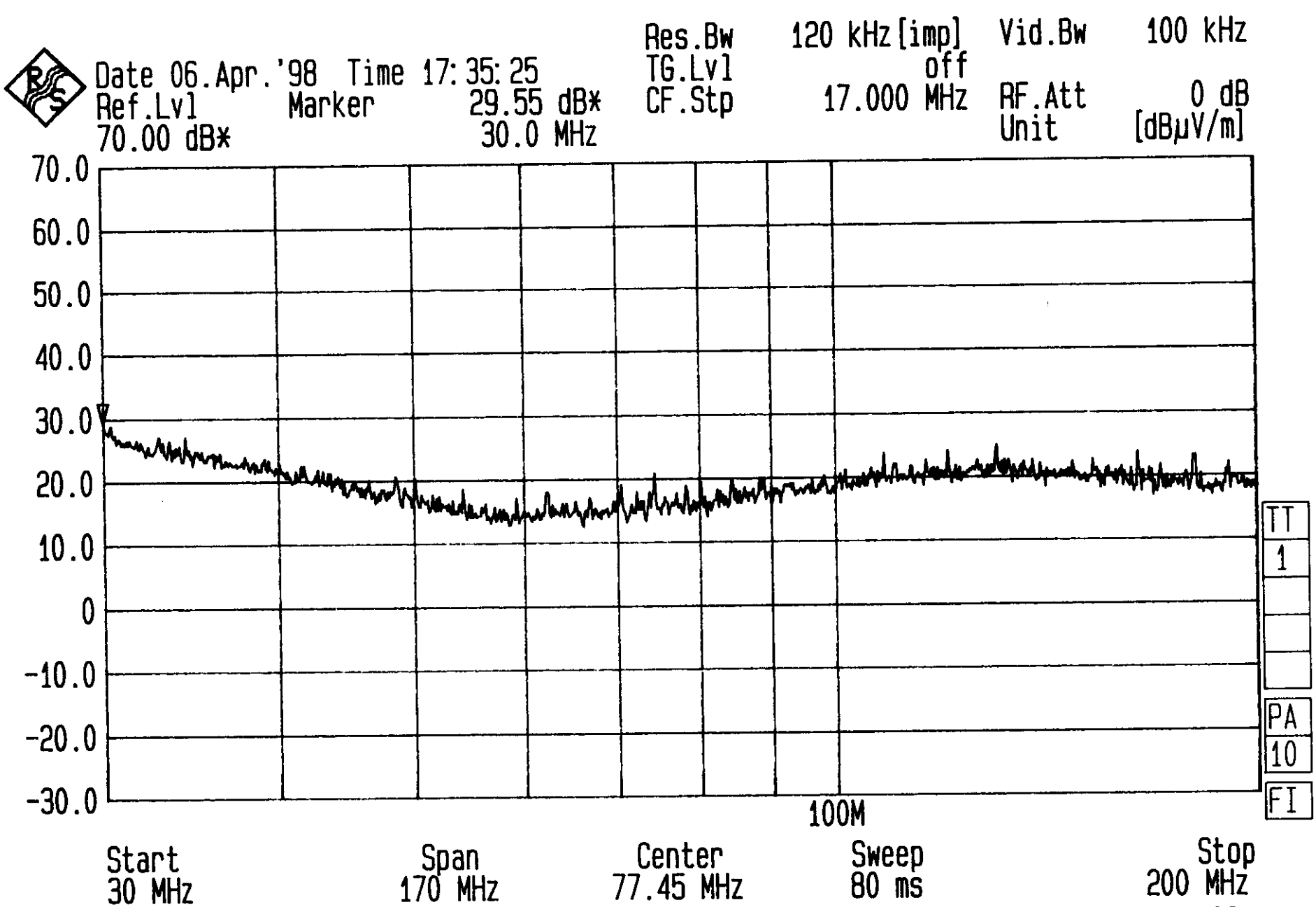
Radiated. Tested by RFI for Audio Ltd. EUT: TX2020.
3m Screened Room Scan. Max Input Signal of -32dBm @ 2500Hz.

FCC Part 74.861
GPH/34630/JD01/102



Antenna Port. Tested by RFI for Audio Ltd. EUT: TX2020.
Tx 735MHz Bandwidth Measurement 3dB Down From Carrier.

FCC Part 74.861
GPH/34630/JD01/~~006~~ 009



Radiated. Tested by RFI for Audio Ltd. EUT: TX2020.
3m Screened Room Scan. Max Input Signal of -32dBm @ 2500Hz.

FCC Part 74.861
GPH/34630/JD01/101

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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 Limited.
TX2020 Wireless
Microphone Transmitter

To: FCC Part 74.861
(Selected Additional Requirements)

Test Report Serial No:
RFI/EMCB1/RP34630/ETF01C

This Test Report Is Issued Under The Authority Of Brian Watson, Technical Director:	
Tested By:	**Checked By:**
Report Copy No: 01	
Issue Date: 27 August 1998	**Test Dates: 11 March 1998 to 12 April 1998 and 5 August to 6 August 1998**

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Test Of: Audio Limited.
TX2020 Wireless
Microphone Transmitter
To: FCC Part 74.861

Table of Contents

Test Of: **Audio Limited.**
TX2020 Wireless
Microphone Transmitter
To: **FCC Part 74.861**

1. Client Information

Company Name:	Audio Limited
Address:	Audio House Progress Road Sands High Wycombe HP12 4JD
Contact Name:	Mr. J. Reeve

Test Of: Audio Limited.
TX2020 Wireless
Microphone Transmitter
To: FCC Part 74.861

---

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 Limited
Model Name or Number:	TX2020
Unique Type Identification:	TX2020
Serial Number:	605423-6
Country of Manufacture:	UK
FCC ID Number:	NRK TX2020
Date of Receipt:	11 March 1998

2.2. Description Of EUT

The equipment under test is a Wireless microphone transmitter.

2.3. Modifications Incorporated In EUT

None stated by client.

2.4. Additional Information Related To Testing

Power Supply Requirement:	Internal Battery Supply of + 9 Volts
Intended Operating Environment:	Any Environment
Weight:	0.175 kg
Dimensions:	90 mm (h) x 60 mm (w) x 20 mm (d)
Interface Ports:	Antenna Microphone
Transmit Frequency	735.0 MHz
Maximum power output	50mW
Frequency generation	Synthesiser
Number of channels	32
Occupied Bandwidth	98kHz
Antenna	External connection (SMA Connection)
Modulation	FM

2.5. Support Equipment

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

Description:	Microphone
Brand Name:	TRAM
Model Name or Number:	TR50
Serial Number:	72276
FCC ID Number:	None Stated by Client
Cable Length And Type:	1m, standard microphone
Connected to Port:	Microphone

3. Test Specification, Methods And Procedures

3.1. Test Specification

Reference:	FCC Part 74: 1996 Clause 74.861
Title:	Code of Federal Regulations, Part 74 (47CFR80 to end) Experimental Radio, Auxiliary, Special Broadcast and Other Program Distributional Services
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.

The radiated emissions tests were performed in accordance to the methods and procedures of C.F.R. 47 Part 15 Subpart C.

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.

C.F.R. 47 Part 2: 1996
Title: Telecommunication. Frequency allocations and radio treaty matters; general rules and regulations.

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 (TX2020) was powered by an internal battery of + 9 Volts DC..

5.2. Operating Modes

The EUT was tested in the following operating mode: The EUT (TX2020) was operated in transmit mode at full power with an operating frequency of 735.0MHz. When required by the specification a maximum audio input level of –32dBm at 2500Hz was applied to the microphone input port.

5.3. Configuration And Peripherals

The EUT was tested in the following configuration: The EUT (TX2020) was tested with the microphone and antenna attached as for normal operation.

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 Limited.
TX2020 Wireless
Microphone Transmitter
To: FCC Part 74.861

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6. Summary Of Test Results

6.1. Radiated Emissions

Range Of Measurements	Specification Reference	Compliancy Status
Audio Frequency Response	Section 74.861 Clause 2.987(a) of C.F.R. 47: 1996	Complied
Audio Limiting	Section 74.861 Clause 2.987(b) of C.F.R. 47: 1996	Complied
Occupied Bandwidth	Section 74.861(e(5)) Clause 2.989 of C.F.R. 47: 1996	Complied
Frequency Stability	Section 74.861(e(4)) Clause 2.995 of C.F.R. 47:1996	Complied

6.2. 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.

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.

7.1.3. As the EUT was powered from an internal 9 volt dc supply no conducted emission measurements were performed.

Test Of: Audio Limited.
TX2020 Wireless
Microphone Transmitter
To: FCC Part 74.861

7.2. Test Results: Audio Frequency Response: Part 74.861. Section 2.987(a)

7.2.1. The audio frequency response of the circuit was measured in accordance with the procedure outlined in ETS 300 162:1998.

7.2.2. The transmitter gain control was set to a medium (50%) setting and was unchanged throughout the test.

7.2.3. A reference frequency of 1kHz was set and the input audio level adjusted to allow for a 3.5kHz deviation. This level corresponds to a 0dB ref.

7.2.4. The modulated frequency was adjusted from 100Hz to 5000Hz and the frequency deviation noted in order to demonstrate the frequency response of the circuit.

7.2.5. A graphical plot from the below tabulated results can be seen in Appendix 4.

Results

Modulation Frequency (Hz)	Measured Deviation (kHz)	dB Relative to 1kHz
100	6.0	4.68
200	5.8	4.39
300	4.6	2.37
400	4.3	1.79
500	4.2	1.58
600	4.0	1.16
700	3.9	0.94
800	3.7	0.48
900	3.6	0.24
1000 (Reference)	3.5	0.00
1200	3.5	0.00
1400	3.3	-0.51
1600	3.3	-0.51
1800	3.1	-1.05
2000	3.1	-1.05
2200	3.1	-1.05
2500	3.0	-1.34
3000	3.0	-1.34
3500	3.0	-1.34
4000	3.1	-1.05
4500	3.1	-1.05
5000	3.4	-0.25

7.3. Test Results: Audio Frequency Response of the LF Filter: Part 74.861. Section 2.987(a)

7.3.1. The audio frequency response of the LF filter circuit was measured in accordance with the procedure outlined in ETS 300 162:1998.

7.3.2. The transmitter gain control was set to a medium (50%) setting and was unchanged throughout the test.

7.3.3. A reference frequency of 1kHz was set and the input audio level adjusted to allow for a 3.5kHz deviation. This level corresponds to a 0dB reference.

7.3.4. The modulated frequency was adjusted from 20Hz to 100Hz with the LF filter switched on and off to demonstrate the response of the LF circuit.

7.3.5. It can be observed from the tables that there is a greater frequency response, and thus, a greater frequency deviation with the LF filter out.

7.3.6. A graphical plot from the below tabulated results can be seen in Appendix 4.

Results: LF Filter In

Modulation Frequency (Hz)	Measured Deviation (kHz)	dB Relative to 1kHz
20	1.0	-10.88
30	1.0	-10.88
40	2.0	-4.86
50	3.6	0.24
60	4.5	2.18
70	5.0	3.10
80	5.3	3.60
90	5.3	3.60
100	5.3	3.60

Please refer to the next page for the continuation of test results.

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TX2020 Wireless
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To: FCC Part 74.861

Test Results: Audio Frequency Response of the LF Filter: Part 74.861. Section 2.987(a) (continued)

Results: LF Filter Out

Modulation Frequency (Hz)	Measured Deviation (kHz)	dB Relative to 1kHz
20	1.0	-10.88
30	1.6	-6.80
40	3.8	0.71
50	5.1	3.27
60	6.2	4.97
70	6.2	4.97
80	6.2	4.97
90	6.2	4.97
100	6.2	4.97

7.4. Test Results: Audio Limiting: Part 74.861. Section 2.987(b)

7.4.1. The audio limiting response of the circuit was measured in accordance with the procedure outlined in ETS 300 162:1998.

7.4.2. The transmitter gain control was set to a gain position 0 (medium), gain position 1, gain position 4 (medium) and gain position 7 (maximum).

7.4.3. The relevant gain was set and the audio input level was increased from a nominal setting to a point exceeding the limiting threshold of the device. The output deviation was then noted and plotted.

7.4.4. The circuit was seen to be limiting within this range.

7.4.5. Limiting can be seen to be occurring in the **bold** portions of the following table.

7.4.6. A graphical plot from the below tabulated results can be seen in Appendix 4.

Test Of: Audio Limited.
TX2020 Wireless
Microphone Transmitter
To: FCC Part 74.861

Results:

Audio Input Level (dBuV)	Frequency Deviation (kHz)			
	Gain Position 0	Gain Position 1	Gain Position 4	Gain Position 7
-40	-	-	11.0	22.0
-38	-	-	13.0	24.0
-36	-	-	14.0	27.1
-34	-	-	16.0	31.5
-32	-	-	18.0	32.8
-30	-	-	19.8	**33.0**
-28	-	-	22.0	**33.0**
-26	-	-	24.5	**33.1**
-24	-	-	27.5	**33.1**
-22	-	-	30.7	**33.2**
-20	12.6	16.0	33.2	-
-18	14.0	18.6	**33.9**	-
-16	15.7	21.0	**33.9**	-
-14	17.5	23.6	**33.9**	-
-12	19.6	26.4	**33.9**	-
-10	22.2	29.2	-	-
-8	24.6	32.7	-	-
-6	27.5	33.9	-	-
-4	31.0	34.8	-	-
-2	35.0	36.8	-	-
0	39.2	40.0	-	-
2	43.0	43.7	-	-
4	46.0	45.2	-	-
6	**48.0**	**47.8**	-	-
8	**49.0**	**48.9**	-	-
10	**49.0**	**49.0**	-	-

7.5. Test Results: Frequency Stability. Part 74.861(e(4))

7.5.1. The EUT (TX2020) was tested for frequency stability as specified in Part 2.995 of C.F.R. 47:1997.

7.5.2. The client has stated that the minimum battery supply voltage to the EUT is + 6 volts and the maximum supply is + 9 volts. Frequency stability tests were performed at both supply voltages.

7.5.3. As specified in section 2.995(1) the temperature was varied over the range -30°C to +50°C in steps of 10°C.

Ambient Temperature: -30°C @ +6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.986082	8.8
2.0	734.986459	8.9
3.0	734.986578	9.0
4.0	734.986636	8.9
5.0	734.986839	8.8
6.0	734.987392	8.9
7.0	734.987300	8.8
8.0	734.987852	9.0
9.0	734.988903	9.0
10.0	734.988943	9.0

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Frequency Stability Results (continued)

Ambient Temperature: -20°C @ +6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.993645	9.8
2.0	734.993746	9.6
3.0	734.993760	9.7
4.0	734.993807	9.7
5.0	734.993844	9.7
6.0	734.995363	9.7
7.0	734.995722	9.7
8.0	734.995820	9.7
9.0	734.996137	9.7
10.0	734.995997	9.7

Ambient Temperature: -10°C @ +6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.000406	10.4
2.0	735.000196	10.4
3.0	735.000468	10.5
4.0	735.000428	10.4
5.0	735.000443	10.4
6.0	735.000420	10.4
7.0	735.000410	10.4
8.0	735.000386	10.4
9.0	735.000474	10.4
10.0	735.000464	10.4

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Frequency Stability Results (continued)

Ambient Temperature: 0°C @ +6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001508	11.2
2.0	735.001575	11.3
3.0	735.001532	11.3
4.0	735.001600	11.3
5.0	735.001664	11.3
6.0	735.001584	11.3
7.0	735.001565	11.3
8.0	735.001554	11.3
9.0	735.001530	11.3
10.0	735.001531	11.3

Ambient Temperature: +10°C @ +6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001242	11.7
2.0	735.001203	11.7
3.0	735.001230	11.7
4.0	735.001224	11.7
5.0	735.001263	11.7
6.0	735.001302	11.7
7.0	735.001257	11.7
8.0	735.001248	11.7
9.0	735.001227	11.7
10.0	735.001233	11.7

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TX2020 Wireless
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Frequency Stability Results (continued)

Ambient Temperature: +20°C @ +6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.000713	11.8
2.0	735.000715	11.9
3.0	735.000705	11.9
4.0	735.000797	11.9
5.0	735.000811	11.9
6.0	735.000735	11.9
7.0	735.000749	11.9
8.0	735.000731	11.9
9.0	735.000761	11.9
10.0	735.000756	11.9

Ambient Temperature: +30°C @ +6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.999387	11.9
2.0	734.999461	11.8
3.0	734.999447	11.9
4.0	734.999463	11.9
5.0	734.999405	11.9
6.0	734.999485	11.9
7.0	734.999471	11.9
8.0	734.999471	11.9
9.0	734.999473	11.9
10.0	734.999470	11.9

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Frequency Stability Results (continued)

Ambient Temperature: +40°C @ +6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.998903	11.7
2.0	734.998921	11.7
3.0	734.998929	11.7
4.0	734.998901	11.7
5.0	734.998933	11.7
6.0	734.998898	11.7
7.0	734.998956	11.7
8.0	734.998958	11.7
9.0	734.998934	11.7
10.0	734.998942	11.7

Ambient Temperature: +50°C @ +6 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.998528	11.6
2.0	734.998488	11.6
3.0	734.998526	11.6
4.0	734.998537	11.7
5.0	734.998532	11.7
6.0	734.998484	11.7
7.0	734.998517	11.7
8.0	734.998341	11.7
9.0	734.998533	11.7
10.0	734.998512	11.7

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Frequency Stability Results (continued)

Ambient Temperature: -30°C @ +9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.992284	10.4
2.0	734.992418	10.5
3.0	734.992462	10.5
4.0	734.992482	10.5
5.0	734.992524	10.5
6.0	734.992788	10.5
7.0	734.993673	10.5
8.0	734.993617	10.5
9.0	734.993213	10.5
10.0	734.993379	10.5

Ambient Temperature: -20°C @ +9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.991741	10.6
2.0	734.991817	10.6
3.0	734.991907	10.6
4.0	734.992013	10.7
5.0	734.992179	10.9
6.0	734.992712	10.9
7.0	734.992783	11.0
8.0	734.992957	11.0
9.0	734.993005	11.0
10.0	734.993288	11.0

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Frequency Stability Results (continued)

Ambient Temperature: -10°C @ +9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.000350	11.8
2.0	735.000462	11.8
3.0	735.000474	11.8
4.0	735.000471	11.8
5.0	735.000484	11.8
6.0	735.000418	11.9
7.0	735.000428	11.8
8.0	735.000470	11.8
9.0	735.000479	11.8
10.0	735.000481	11.8

Ambient Temperature: 0°C @ +9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001387	12.5
2.0	735.001384	12.5
3.0	735.001394	12.5
4.0	735.001350	12.5
5.0	735.001355	12.5
6.0	735.001357	12.5
7.0	735.001354	12.5
8.0	735.001348	12.5
9.0	735.001343	12.5
10.0	735.001344	12.5

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Frequency Stability Results (continued)

Ambient Temperature: +10°C @ +9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001347	12.8
2.0	735.001343	12.8
3.0	735.001241	12.8
4.0	735.001231	12.8
5.0	735.001235	12.8
6.0	735.001293	12.8
7.0	735.001249	12.8
8.0	735.001241	12.8
9.0	735.001243	12.8
10.0	735.001233	12.8

Ambient Temperature: +20°C @ +9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	735.001815	13.1
2.0	735.001757	13.2
3.0	735.001727	13.2
4.0	735.001851	13.2
5.0	735.002235	13.2
6.0	735.002810	13.2
7.0	735.002900	13.2
8.0	735.002756	13.2
9.0	735.002844	13.2
10.0	735.002858	13.2

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Frequency Stability Results (continued)

Ambient Temperature: +30°C @ +9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.999649	13.3
2.0	734.999717	13.3
3.0	734.999629	13.3
4.0	734.999791	13.3
5.0	734.999717	13.3
6.0	734.999839	13.3
7.0	734.999791	13.3
8.0	734.999832	13.3
9.0	734.999831	13.3
10.0	734.999830	13.3

Ambient Temperature: +40°C @ +9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.998854	13.4
2.0	734.998740	13.4
3.0	734.998732	13.4
4.0	734.998810	13.4
5.0	734.998742	13.4
6.0	734.998782	13.4
7.0	734.998752	13.4
8.0	734.998766	13.4
9.0	734.998728	13.4
10.0	734.999315	13.4

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To: FCC Part 74.861

Frequency Stability Results (continued)

Ambient Temperature: +50°C @ +9 volts

Time after power applied (seconds).	Measured Frequency (MHz)	Measured Power (dBm)
1.0	734.998377	13.3
2.0	734.998419	13.4
3.0	734.998353	13.4
4.0	734.998440	13.4
5.0	734.998413	13.4
6.0	734.998425	13.4
7.0	734.998379	13.4
8.0	734.998443	13.4
9.0	734.998431	13.4
10.0	734.998415	13.4

7.6. Test Results: Occupied Bandwidth: Part 74.861.

7.6.1. Plots to determine the occupied bandwidth of the transmitted signal were produced. These can be found in Appendix 4 of this test report.

7.6.2. The transmitter gain control was set to a medium (50%) setting and was unchanged throughout the test.

7.6.3. A reference frequency of 1kHz was set and the input audio level adjusted to allow for a 3.5kHz deviation.

7.6.4. The modulated frequency was adjusted from 20Hz to 15000Hz and the frequency at which maximum frequency bandwidth was present was set, and a plot was produced.

Appendix 1. Test Equipment Used

Instrument	Manufacturer	Model	RFI No.
Screened Enclosure: Emissions			
Spectrum Analyser System	R & S	FSM	L506
Plotter	H.P.	7440A	P001
Cable	Rosenberger	-	C371
30dB Attenuator	Narda	370 BNM	A245
Radiocommunications Analyser	R & S	CMTA	M027
Power Supply Unit	R & S	NGPE 40/40	S006

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

Appendix 2. Measurement Methods

A2.1. Occupied Bandwidth. FCC Part 74.861

A2.1.1. Measurements were performed to determine the occupied bandwidth level of the EUT as specified in C.F.R. 47 Part 2.989.

A2.1.2. The EUT was operated at full power with a maximum audio input of –32dBm. The input audio was swept from 20Hz to 15000Hz and the bandwidth was monitored on a spectrum analyser with a max hold facility to show a full profile of the signal.. Where the worst bandwidth measurement was found, a plot was produced.

A2.2. Frequency Stability. FCC Part 74.861

A2.2.1. Measurements were performed to determine the frequency stability of the EUT as specified in C.F.R. 47 Part 2.995.

A2.2.2. An environmental test chamber was used to perform the required testing parameters.

A2.2.3. To enable the correct voltage level to be applied to the EUT, the battery was removed and a power supply was connected via flexible leads to the battery terminals. The power supply unit was situated outside of the environmental test chamber.

A2.2.4. The EUT was situated inside the environmental test chamber and the required temperature (starting from the lowest level) was allowed to settle prior to switching on the EUT.

A2.2.5. Frequency and RF output power measurements were then made at intervals of one minute for a duration of 10 minutes whilst maintaining the required temperature.

A2.2.6. The EUT was then switched off for a minimum of 30 minutes and the environmental chamber was allowed to stabilise at the next temperature. Point A2.5.5. was then repeated.

A2.3. Audio Frequency Response. FCC Part 74.861

A2.3.1. The audio frequency response of the circuit was measured in accordance with the procedure outlined in ETS 300 162:1998.

A2.3.2. The transmitter gain control was set to a medium (50%) setting and was unchanged throughout the test.

A2.3.3. A reference frequency of 1kHz was set and the input audio level adjusted to allow for a 3.5kHz deviation. This level corresponds to a 0dB ref.

A2.3.4. The modulated frequency was adjusted from 100Hz to 5000Hz and the frequency deviation noted in order to demonstrate the frequency response of the circuit.

A2.4. Audio Frequency Response of the LF Filter. FCC Part 74.861

A2.4.1. The audio frequency response of the LF filter circuit was measured in accordance with the procedure outlined in ETS 300 162:1998.

A2.4.2. The transmitter gain control was set to a medium (50%) setting and was unchanged throughout the test.

A2.4.3. A reference frequency of 1kHz was set and the input audio level adjusted to allow for a 3.5kHz deviation. This level corresponds to a 0dB reference.

A2.4.4. The modulated frequency was adjusted from 20Hz to 100Hz with the LF filter switched on and off to demonstrate the response of the LF circuit.

A2.4.5. It can be observed from the tables that there is a greater frequency response, and thus, a greater frequency deviation with the LF filter out.

A2.5. Audio Limiting: Part 74.861

A2.5.1. The audio limiting response of the circuit was measured in accordance with the procedure outlined in ETS 300 162:1998.

A2.5.2. The transmitter gain control was set to a gain position 0 (medium), gain position 1, gain position 4 (medium) and gain position 7 (maximum).

A2.5.3. The relevant gain was set and the audio input level was increased from a nominal setting to a point exceeding the limiting threshold of the device. The output deviation was then noted and plotted.

A2.5.4. The circuit was seen to be limiting within this range.

A2.5.5. Limiting can be seen to be occurring in the **bold** portions of the following table.

Appendix 3.. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\34630ETF01\001	Schematic diagram of the EUT, support equipment and interconnecting cables used for the test

Test Of: Audio Limited.
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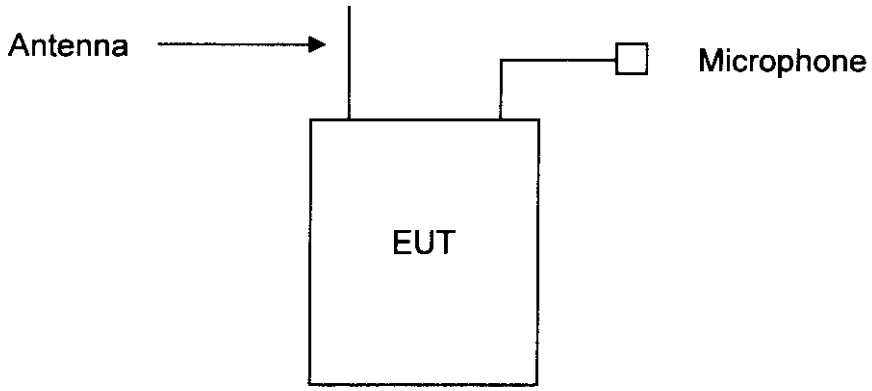
DRG\34630ETF01\001

Configuration of EUT and Local Support Equipment



Configuration of Remote Support Equipment

Test Of: Audio Limited.
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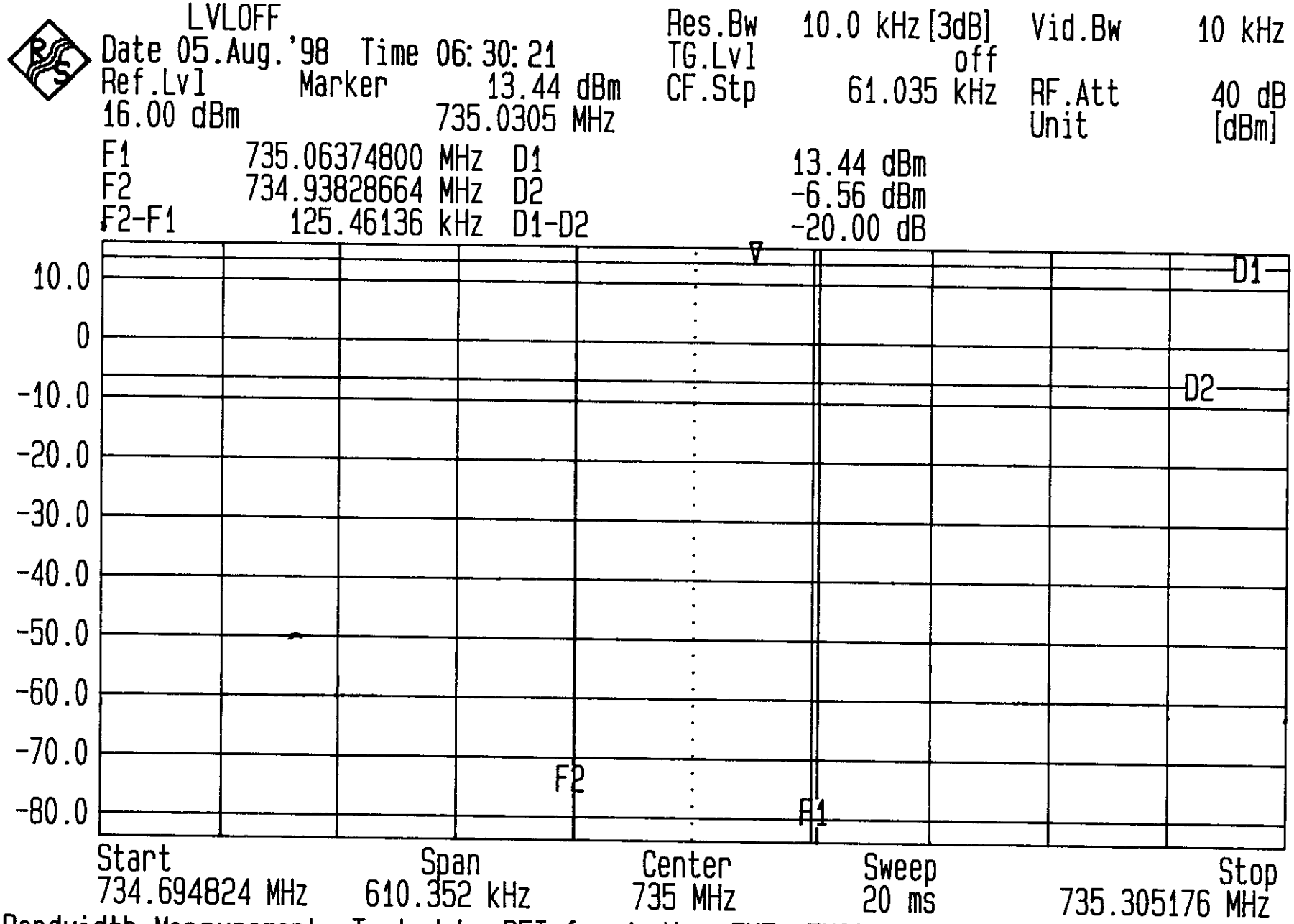
Appendix 4. Graphical Test Results

This appendix contains the following graphs:

Graph Reference Number	Title
GPH\34630\JD01\100	Graphical plot of Occupied Bandwidth Plot @ 735MHz. 10kHz Resolution Bandwidth. 20dB Down from Carrier
GPH\34630\JD01\101	Graphical plot of Occupied Bandwidth Plot @ 735MHz. 10kHz Resolution Bandwidth. 3dB Down from Carrier
GPH\34630\JD01\102	Graphical plot of Occupied Bandwidth Plot @ 735MHz. 100kHz Resolution Bandwidth. 3dB Down from Carrier
GPH\34630\JD01\004	Graphical plot of LF Audio Response given in (dB) and (kHz)
GPH\34630\JD01\005	Graphical plot of Audio Frequency Response given in (dB) and (kHz)
GPH\34630\JD01\006	Graphical plot of Audio Limiting

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



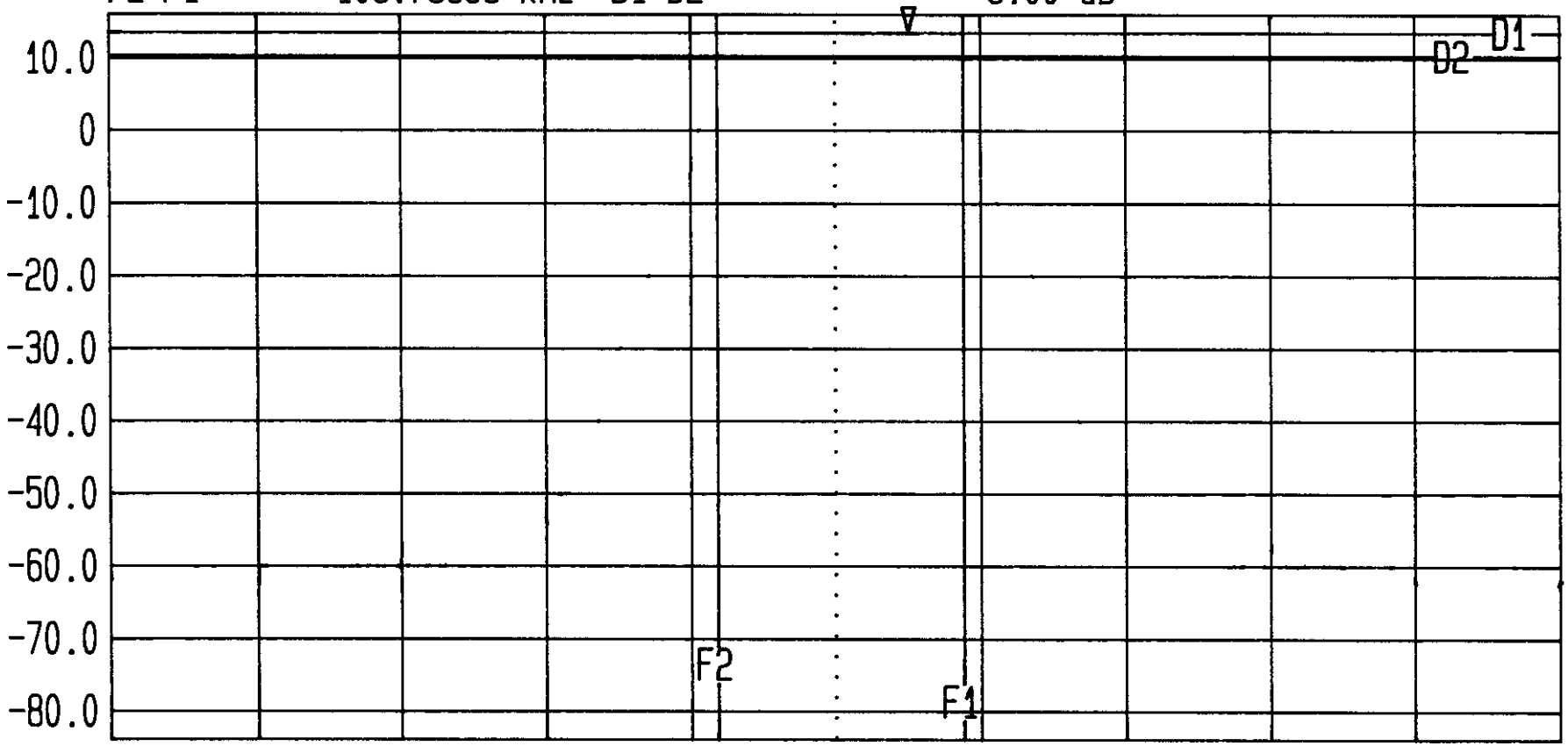
Bandwidth Measurement. Tested by RFI for Audio. EUT: TX2020. FCC Part 74.861(e(5))
Bandwidth 20dB Down from Carrier. Max Response @ 15kHz. FCC ID: NRKTX2020

GPH/34630/100

LVLOFF
Date 05.Aug.'98 Time 06:24:13
Ref.Lvl Marker 13.44 dBm
16.00 dBm 735.0305 MHz

Res.Bw	10.0 kHz [3dB]	Vid.Bw	10 kHz		
TG.Lvl	off				
CF.Stp	61.035 kHz	RF.Att	40 dB		
		Unit	[dBm]		

F1	735.05357546 MHz	D1	13.44 dBm
F2	734.94981553 MHz	D2	10.44 dBm
F2-F1	103.75993 kHz	D1-D2	-3.00 dB



Start	Span	Center	Sweep	Stop
734.694824 MHz	610.352 kHz	735 MHz	20 ms	735.305176 MHz

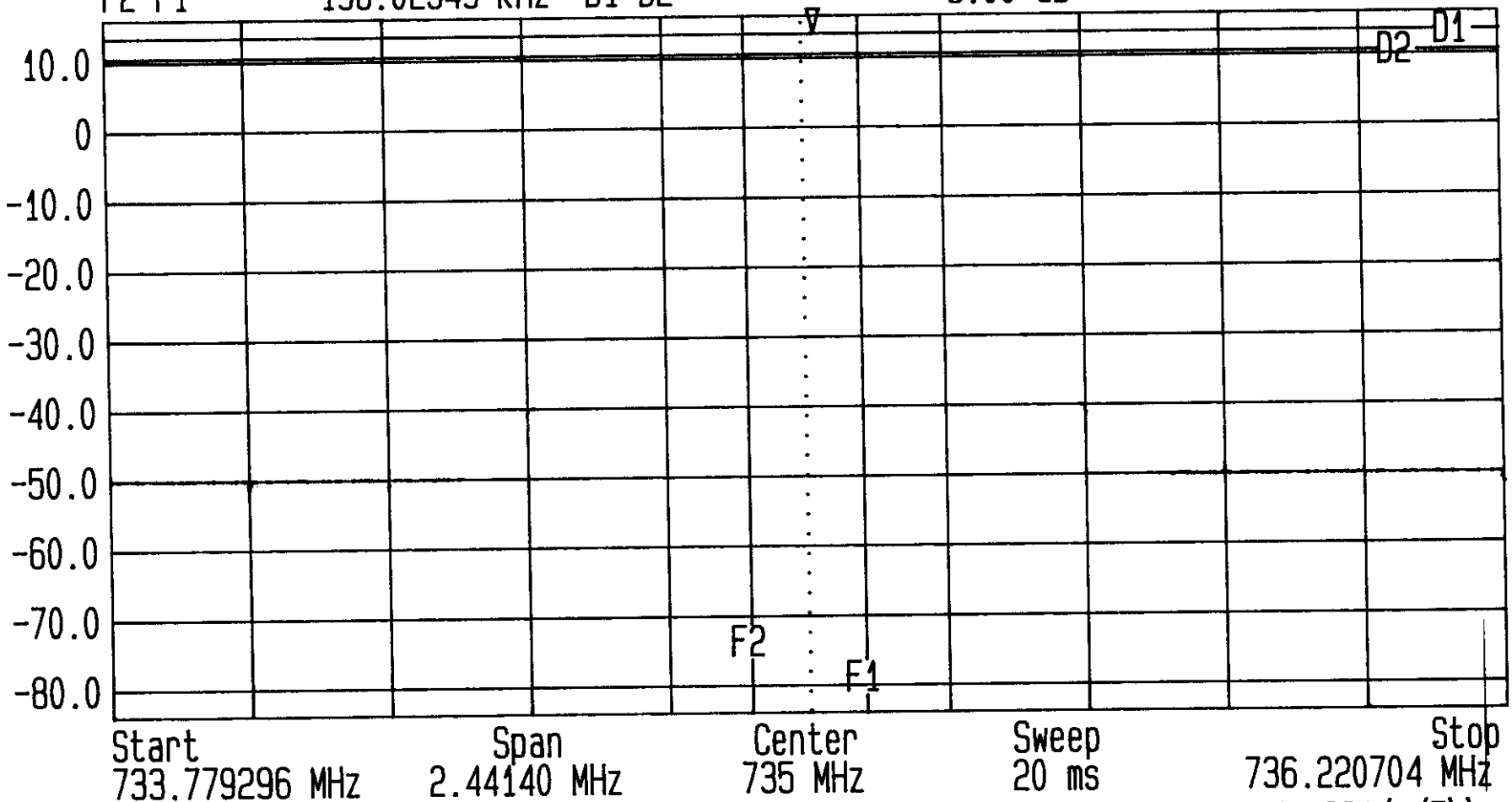
Bandwidth Measurement. Tested by RFI for Audio. EUT: TX2020. FCC Part 74.861(e(5))
Bandwidth 3dB Down from Carrier. Max Response @ 15kHz. FCC ID: NRKTX2020

GPH/34630/101

LVLOFF
Date 05.Aug.'98 Time 06:18:10
Ref.Lvl Marker 13.67 dBm
16.00 dBm 735.021 MHz

Res.Bw 100.0 kHz [3dB] Vid.Bw 100 kHz
TG.Lvl off
CF.Stp 244.140 kHz RF.Att 40 dB
Unit [dBm]

F1 735.09765644 MHz D1 13.67 dBm
F2 734.89963095 MHz D2 10.67 dBm
F2-F1 198.02549 kHz D1-D2 -3.00 dB



Start 733.779296 MHz
Span 2.44140 MHz
Center 735 MHz
Sweep 20 ms
Stop 736.220704 MHz

Bandwidth Measurement. Tested by RFI for Audio. EUT: TX2020. FCC Part 74.861(e)(5))
Bandwidth 3dB Down from Carrier. Max Response @ 15kHz. FCC ID: NRKTX2020

GPH|34630|102

Test Of: Audio Limited.
TX2020 Wireless
Microphone Transmitter
To: FCC Part 74.861

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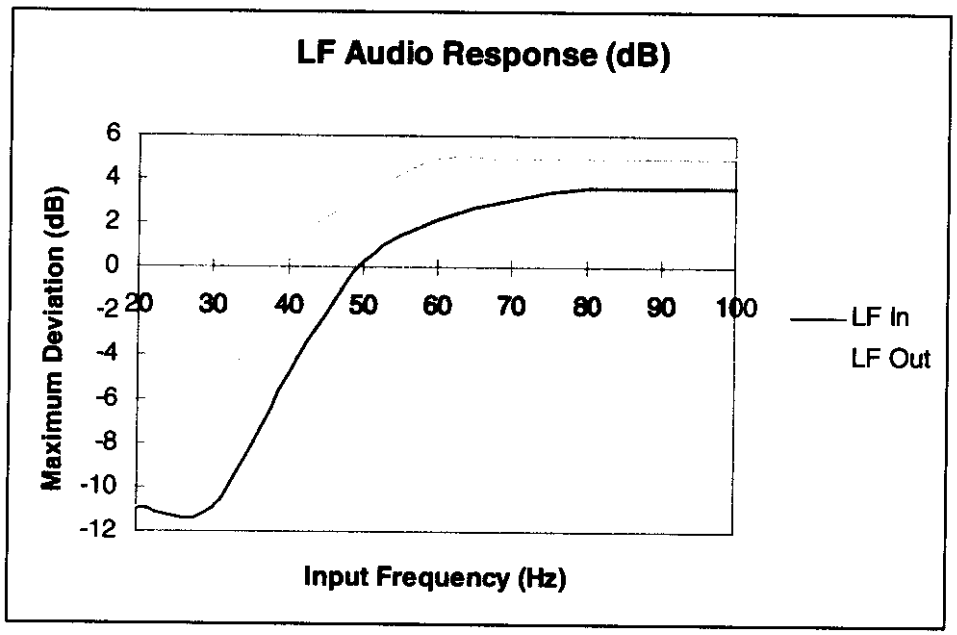

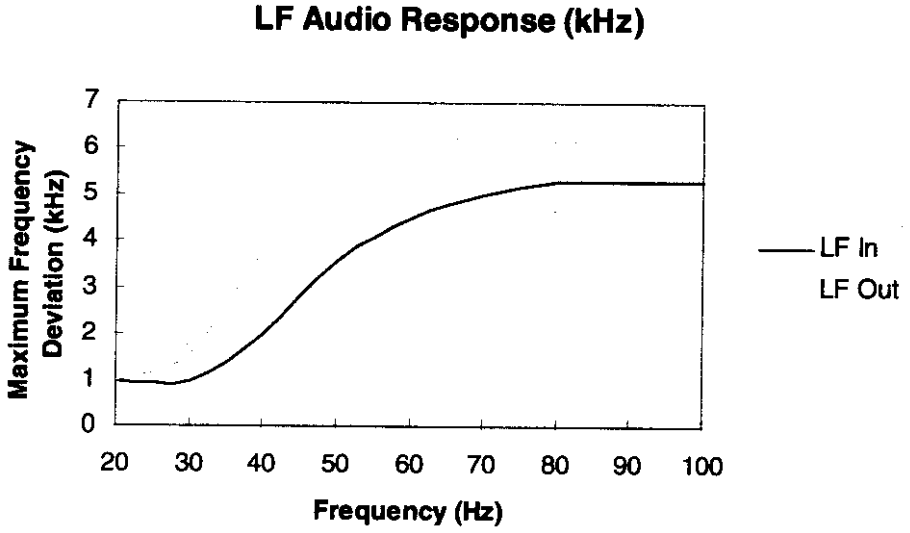

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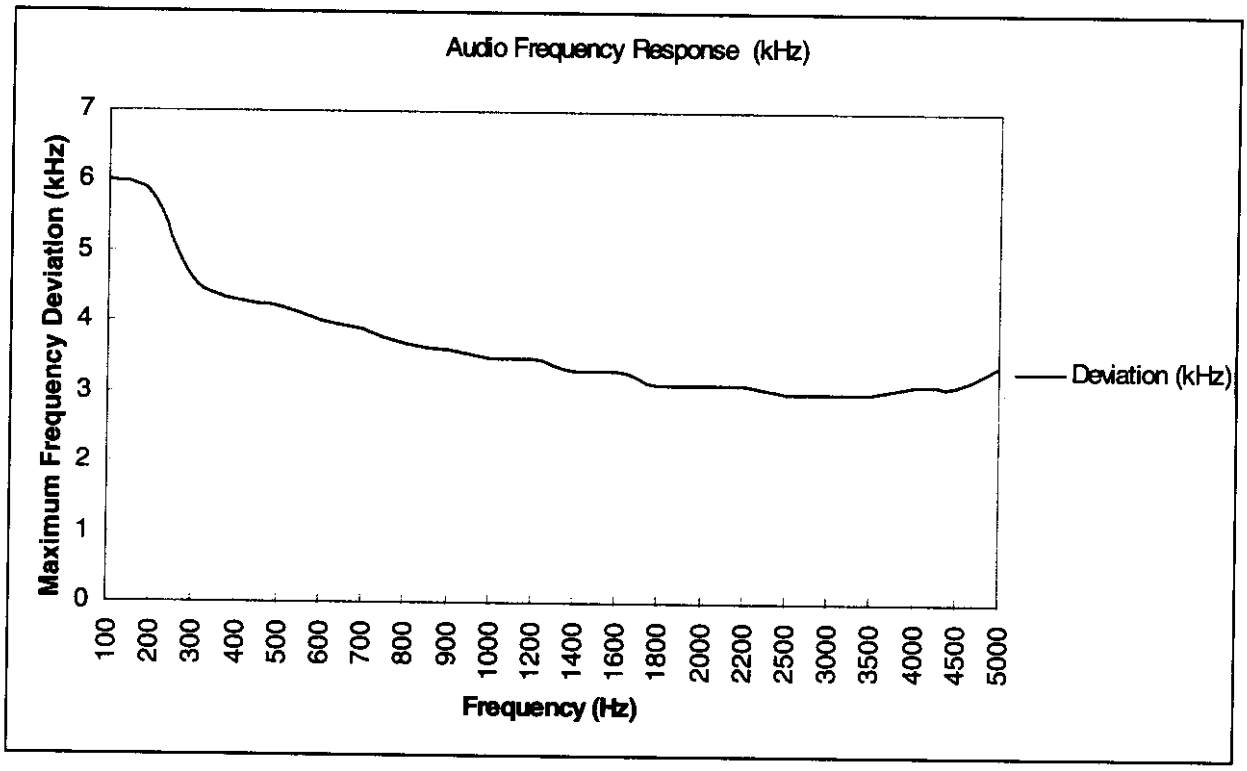

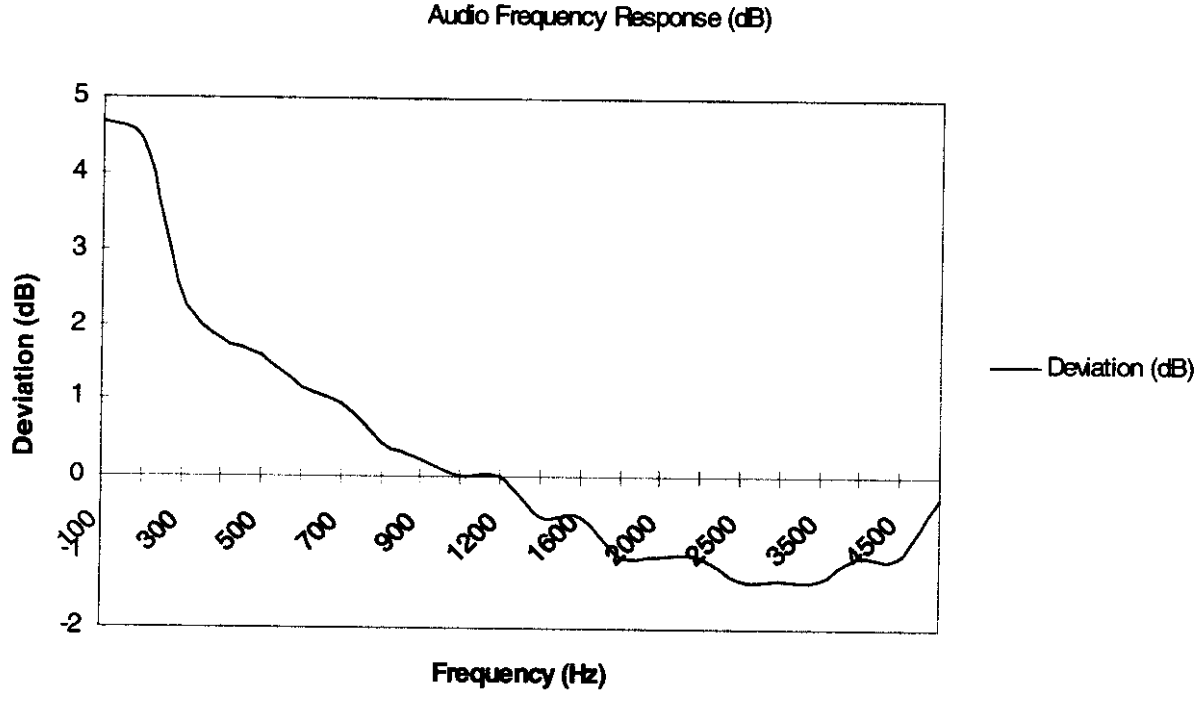

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