

TEST RESULT SUMMARY

FCC PART 15 SUBPART C Section 15.237

MANUFACTURER'S NAME

Telex Communications Inc

NAME OF EQUIPMENT

Auditory Assistance Device

MODEL NUMBER

TX-40

MANUFACTURER'S ADDRESS

9600 Aldrich Avenue S
Bloomington MN 55420

TEST REPORT NUMBER

W9324

TEST DATE

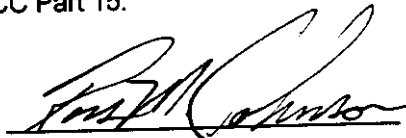
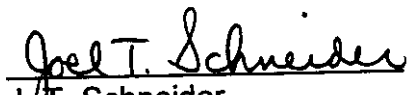
02 July 1999

According to testing performed at TÜV Product Service Inc, the above-mentioned unit is in compliance with the electromagnetic compatibility requirements defined in FCC Part 15.

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

TÜV Product Service Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the requirements of FCC Part 15.

Date: 02 July 1999

Location: Taylors Falls MN
USA
R. M. Johnson
Test Technician
J. T. Schneider
Reviewing Engineer

Not Transferable

EMC EMISSION - TEST REPORT

Test Report File No. : **WC1G932401** Date of issue: 02 July 1999

Model / Serial No. : TX-40

Product Type : Auditory Assistance Device

Applicant : Telex Communications Inc

Manufacturer : Telex Communications Inc

License holder : Telex Communications Inc

Address : 9600 Aldrich Avenue S
: Bloomington MN 55420

Test Result : ☒ **Positive** ☐ **Negative**

Test Project Number : W9324

Reference(s)

Total pages including Appendices : 29

TÜV Product Service Inc is a subcontractor to TÜV Product Service, GmbH according to the principles outlined in ISO/IEC Guide 25 and EN 45001.

TÜV Product Service Inc reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. TÜV Product Service Inc shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV Product Service Inc issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. This report shall not be used by the client to claim product endorsement by NVLAP or any agency of the US government.

TÜV Product Service Inc and its professional staff hold government and professional organization certifications and are members of AAMI, ACIL, AEA, ANSI, IEEE, NVLAP, and VCCI

DIRECTORY - EMISSIONS

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EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to following regulations:

- | | | |
|--|---|---|
| ☐ - EN 50081-1 / 1991 | ☐ - Group 1 | ☐ - Group 2 |
| ☐ - EN 55011 / 1991 | ☐ - Class A | ☐ - Class B |
| ☐ - EN 55013 / 1990 | ☐ - Household appliances and similar | |
| ☐ - EN 55014 / 1987 | ☐ - Portable tools | |
| | ☐ - Semiconductor devices | |
| ☐ - EN 55014 / A2:1990 | ☐ - Household appliances and similar | |
| ☐ - EN 55014 / 1993 | ☐ - Portable tools | |
| | ☐ - Semiconductor devices | |
| ☐ - EN 55015 / 1987 | | |
| ☐ - EN 55015 / A1:1990 | | |
| ☐ - EN 55015 / 1993 | | |
| ☐ - EN 55022 / 1987 | ☐ - Class A | ☐ - Class B |
| ☐ - EN 55022 / 1994 | ☐ - Class A | ☐ - Class B |
| ☐ - BS | | |
| ☐ - VCCI | ☐ - Class A | ☐ - Class B |
| ☒ - FCC Part 15 Subpart C Section 15.237 | | |
| ☒ - FCC Part 15 Subpart B | ☐ - Class A | ☒ - Class B |
| ☐ - CISPR 11 (1990) | ☐ - Group 1 | ☐ - Group 2 |
| | ☐ - Class A | ☐ - Class B |
| ☐ - CISPR 22 (1993) | ☐ - Class A | ☐ - Class B |

Environmental conditions in the lab:

	<u>Actual</u>
Temperature	: 23 °C
Relative Humidity	: 61 %
Atmospheric pressure	: 98.5 kPa
Power supply system	: 3 VDC (2 AA batteries)

Sign Explanations:

- ☐ - not applicable
- ☒ - applicable

Emissions Test Conditions: CONDUCTED EMISSIONS (Interference Voltage)

The *CONDUCTED EMISSIONS (INTERFERENCE VOLTAGE)* measurements were performed at the following test location:

☒ - Test not applicable

- ☐ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)
- ☐ - Wild River Lab Screen Room
- ☐ - New Brighton Lab Shielded Room

Test equipment used :

Model Number	Manufacturer	Description	Serial Number	Cal Date
--------------	--------------	-------------	---------------	----------

Use of the calibrated equipment on this list ensures traceability to national and international standards.

Emissions Test Conditions: RADIATED EMISSIONS (Magnetic Field)

The *RADIATED EMISSIONS (MAGNETIC FIELD)* measurements were performed at the following test location:

- ☐ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)

at a test distance of :

- ☐ - 3 meters
- ☐ - 30 meters

☒ - Test not applicable

Test equipment used :

Model Number	Manufacturer	Description	Serial Number	Cal Date
--------------	--------------	-------------	---------------	----------

Emissions Test Conditions: RADIATED EMISSIONS (Electric Field)

The *RADIATED EMISSIONS (ELECTRIC FIELD)* measurements, in the frequency range of 30 MHz-1000 MHz, were tested in a horizontal and vertical polarization at the following test location :

☐ - Test not applicable

- - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)

at a test distance of :

- - 3 meters
- ☐ - 10 meters
- ☐ - 30 meters

Test equipment used :

Model Number	Manufacturer	Description	Serial Number	Cal Date
■ - 3146	Electro-Mechanics (EMCO)	Log Periodic Antenna	9103-3075	11-98
■ - 3108	Electro-Mechanics (EMCO)	Biconical Antenna	2118	11-98
■ - 8566B	Hewlett-Packard	Spectrum Analyzer	2221A01596	4-99
■ - 85662A	Hewlett-Packard	Analyzer Display	2152A03640	4-99
■ - 85650A	Hewlett-Packard	Quasi-Peak Adapter	2811A01127	4-99
■ - ZHL-1042J	Mini-Circuits	Preamplifier	H072294-11	3-99

Use of the calibrated equipment on this list ensures traceability to national and international standards.

Emissions Test Conditions: INTERFERENCE POWER

The *INTERFERENCE POWER* measurements were performed by using the absorbing clamp on the mains and interface cables in the frequency range 30 MHz - 300 MHz at the following test location :

■ - Test not applicable

- ☐ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)
- ☐ - Wild River Lab Screen Room
- ☐ - New Brighton Lab Shielded Room

Test equipment used :

Model Number	Manufacturer	Description	Serial Number	Cal Date
--------------	--------------	-------------	---------------	----------

Emissions Test Conditions: RADIATED EMISSIONS (Electric Field)

The *EQUIVALENT RADIATED EMISSIONS* measurements in the frequency range 1 GHz - 4.2 GHz were performed in a horizontal and vertical polarization at the following test location :

- ☐ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)
- ☐ - Wild River Lab Screen Room

at a test distance of:

- ☐ - 1 meters
- ☐ - 3 meters
- ☐ - 10 meters

☒ - Test not applicable

Test equipment used :

Model Number	Manufacturer	Description	Serial Number	Cal Date
--------------	--------------	-------------	---------------	----------

Equipment Under Test (EUT) Test Operation Mode - Emission tests :

The device under test was operated under the following conditions during emissions testing:

- ☐ - Standby
- ☐ - Test program (H - Pattern)
- ☐ - Test program (color bar)
- ☐ - Test program (customer specific)
- ☐ - Practice operation
- ☐ - Normal Operating Mode
- ☒ - Transmitter on.

Configuration of the device under test:

- ☐ - See Constructional Data Form in Appendix B - Page B2
- ☒ - See Product Information Form in Appendix B - beginning on Page B3

The following peripheral devices and interface cables were connected during the measurement:

- | | |
|---|----------------|
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - unshielded power cable | |
| ☐ - unshielded cables | |
| ☒ - shielded cables | MPS.No.: _____ |
| ☐ - customer specific cables | |
| ☐ - _____ | |
| ☐ - _____ | |

Emission Test Results:**Conducted emissions 10/150 kHz - 30 MHz**

The requirements are ☐ - MET ☐ - NOT MET

Minimum limit margin _____ dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

Radiated emissions (magnetic field) 10 kHz - 30 MHz

The requirements are ☐ - MET ☐ - NOT MET

Minimum limit margin _____ dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

Radiated emissions (electric field) 30 MHz - 1000 MHz

The requirements are ☒ - MET ☐ - NOT MET

Minimum limit margin for xmtr fundamental _____ 5 dB at _____ 74.6 MHz

Minimum limit margin for xmtr spurious _____ 0.4 dB at _____ 223.8 MHz

Remarks: The fundamental was measured to be 92.4 dBuV/m (41686 uV/m) in peak mode, compared to an average limit of 98 dBuV/m (80000 uV/m). The third harmonic was measured to be 63.1 dBuV/m (1428 uV/m) in average mode, compared to an average limit of 63.5 dBuV/m (1500 uV/m).

Interference Power at the mains and interface cables 30 MHz - 300 MHz

The requirements are ☐ - MET ☐ - NOT MET

Minimum limit margin _____ dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

Equivalent Radiated emissions 1 GHz - 4.2 GHz

The requirements are ☐ - MET ☐ - NOT MET

Minimum limit margin for transmitter _____ dB at _____ MHz

Minimum limit margin for receiver _____ dB at _____ MHz

Remarks: _____

DEVIATIONS FROM STANDARD:

None.

GENERAL REMARKS:

The 26 dB bandwidth of the fundamental must be less than 200 kHz. Page A6 of A6 shows the bandwidth to be less than 50 kHz. The EUT was tested on a wooden tripod 4 feet above the ground plane with its cable hanging vertically, per the setup prescribed in FCC Bulletin OST 19. This produced worst case emissions vs. the ANSI C63.4 setup for intentional radiators.

SUMMARY:

The requirements according to the technical regulations are

☒ - met

☐ - not met.

The device under test does

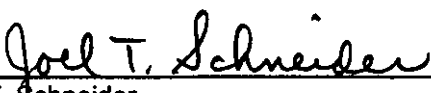
☒ - fulfill the general approval requirements mentioned on page 3.

☐ - not fulfill the general approval requirements mentioned on page 3.

Testing Start Date: 02 July 1999

Testing End Date: 02 July 1999

- TÜV PRODUCT SERVICE INC -


J. T. Schneider
Reviewing Engineer

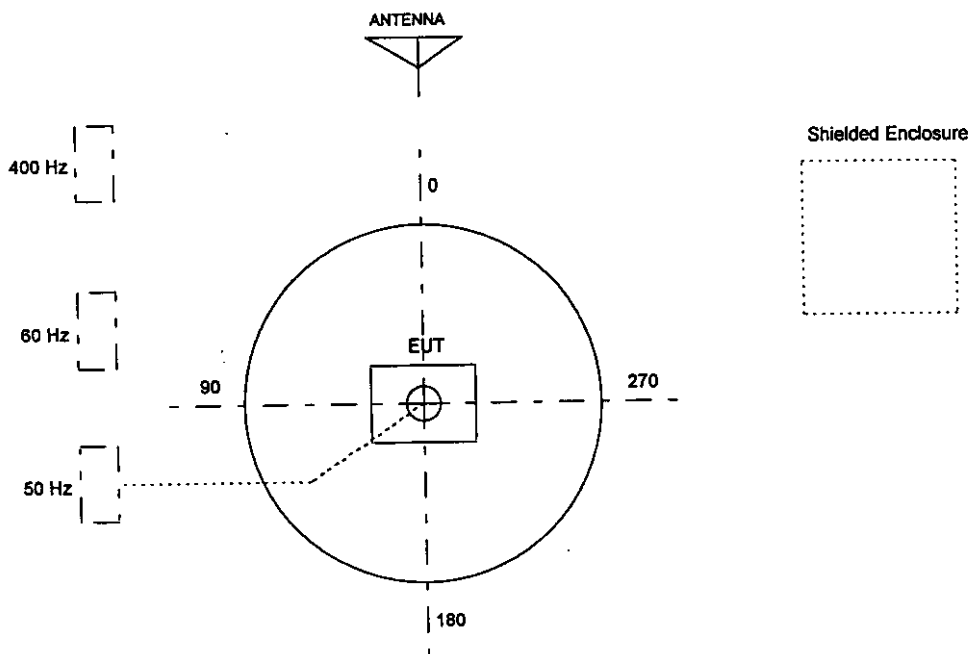

Tested By:
R. M. Johnson

Appendix A

Test Data Sheets
and
Test Setup Drawing(s)

TEST SETUP FOR EMISSIONS TESTINGWILD RIVER LAB
Large Test Site**Notes:**

1. Items shown in dotted lines are located on the floor below the test area. It is 5 meters vertically from the ground floor to the test area.
2. 50 Hz, 60 Hz, and 400 Hz are power panels for alternating current.
3. The antenna may be positioned horizontally 3, 10 or 30 meters from the center of the turntable.
4. The circle is a 6.7 meter diameter turntable.
5. A ground plane is in the plane of this sheet.
6. The test sample is shown in the azimuthal position representing zero degrees.



T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

Large Test Site
 3 Meter Antenna Distance
 Equipment Under Test:
 TELEX COMMUNICATIONS
 TX-40
 Notes: TRANSMITTER

Report W9324 Run 1
 Date 07/02/99 Page 1
 Engineer _____
 Tech: RMJ _____
 Requester _____

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar\ Height	Delta	Delta
72.022	74.75	8.2	.7	83.7	--	V --		
72.022 MAXED AT 83 DEGREES HORIZONTAL 2.32 METERS HIGH.								
72.022	76.35	8.2	.7	85.3	--	H --		
72.022 MAXED AT 96 DEGREES HORIZONTAL 2.5 METERS HIGH.								
72.025	77.05	8.2	.7	86	--	H --		
MAXED AT 350 DEGREES HORIZONTAL 1.48 METERS HIGH.								
72.025	72.65	8.2	.7	81.6	--	H --		
MAXED AT 218 DEGREES VERTICAL 1 METER HIGH.								
72.025	82.5	8.2	.7	91.4	--	V --		
144.05	45.95	12.2	1.1	59.2	--	V --		
THE FIRST 3 READINGS WERE AT 80 CM HIGH.								
THE REST OF THE READINGS ARE W/EUT AT 4 FEET HIGH CABLE HANGING STRAIGHT DOWN								
READINGS TAKEN IN PEAK WITH 100KHZ RBW. NO PREAMP FOR FUNDAMENTAL.								
74.626	83.6	8	.7	92.4	--	V --		
CHECKED ALL OTHER CHANNELS AND FOUND POWER LEVEL TO BE THE SAME.								
149.25	48.15	12.2	1.1	61.4	--	V --		
223.80	52.25	11.8	1.3	65.4	--	V --		
REMEASURED 223.8 WITH RECEIVER IN AVERAGE MODE / LEVEL WAS 63.1dBuV/M.								
298.50	37.85	14.9	1.6	54.3	--	V --		
373.12	35.65	15.6	1.8	53	--	V --		
447.75	37.95	17.4	2	57.3	--	V --		
522.37	27.75	19.1	2.2	49.1	--	V --		
597.00	30.2	19.6	2.3	52.1	--	V --		

T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

Large Test Site
 3 Meter Antenna Distance
 Equipment Under Test:
 TELEX COMMUNICATIONS
 TX-40
 Notes: TRANSMITTER

Report W9324 Run 1
 Date 07/02/99 Page 2
 Engineer _____
 Tech: RMJ _____
 Requester _____

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar\ Height	Delta	Delta
671.63	34.35	20.8	2.5	57.6	--	V --		
746.25	34.35	21.7	2.7	58.7	--	V --		
820.87	34.4	22.6	2.8	59.8	--	V --		
895.51	24.4	23.6	3	51	--	H --		
970.14	20.75	24.8	3.1	48.6	--	H --		

NO SPURIOUS SIGNALS DETECTED.

END OF SCAN.

T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

Large Test Site
 3 Meter Antenna Distance
 Equipment Under Test:
 TELEX COMMUNICATIONS
 TX-40
 Notes: TRANSMITTER

Figure _____

Report W9324 Run 1
 Date 07/02/99 Page 3
 Engineer _____
 Tech: RMJ _____
 Requester _____

Measurement Summary

Frequency MHz	----- Final dBuV/m	----- uV/m	Azimuth deg	Polar\ Height	Delta	Delta
72.025	91.4	37153.	--	V --		
74.626	92.4	41686.	--	V --		
144.05	59.2	912.01	--	V --		
149.25	61.4	1174.8	--	V --		
223.80	63.1	1428.0	--	V --		
298.50	54.3	518.8	--	V --		
373.12	53	446.68	--	V --		
447.75	57.3	732.82	--	V --		
522.37	49.1	285.10	--	V --		
597.00	52.1	402.71	--	V --		
671.63	57.6	758.57	--	V --		
746.25	58.7	860.99	--	V --		
820.87	59.8	977.23	--	V --		
895.51	51	354.81	--	H --		
970.14	48.6	269.15	--	H --		

File W9324 Run 1

MR Δ 41 KHz
0.20 dB

ATTEN 10 dB

REF 77.0 dBμV

h_p

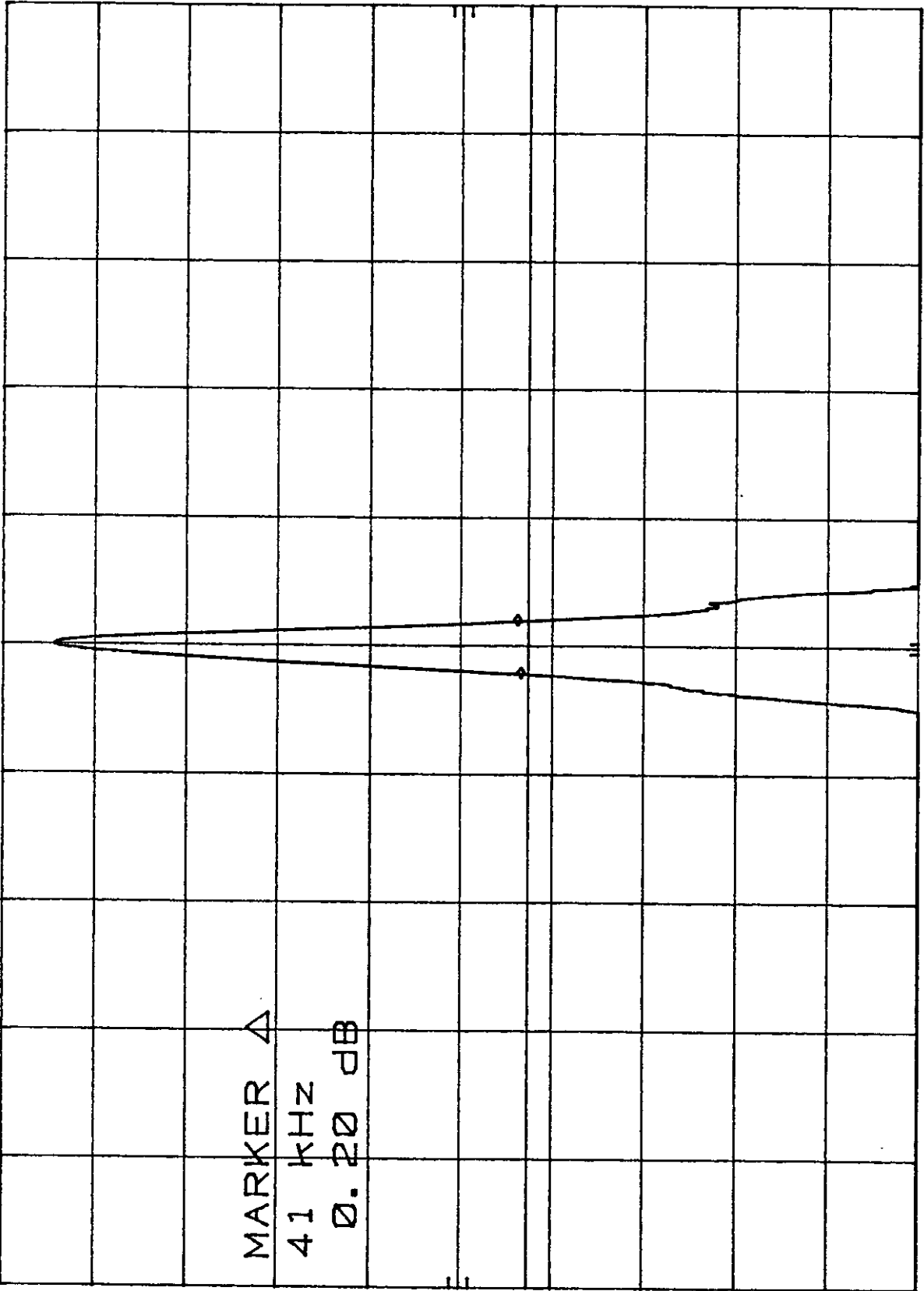
5 dB/

POS PK

MARKER Δ
41 KHz
0.20 dB

DL
48.3
dBμV

CORR'D



SPAN 1.00 MHz
SWP 30.0 msec

VBW 300 KHz

CENTER 74.62 MHz
RES BW 10 KHz

Appendix B

Constructional Data Form

and

Product Information Form(s)

A completed form helps ensure that product testing will go smoothly. Add attachments as necessary for additional documentation. For additional help, please contact your TÜV Product Service Representative.

Applicant — Enter company information pertaining to the location where the product is manufactured and for the manufacturer's contact soliciting the testing.

Company: Telex Communications, Inc.
Address: 9600 Aldrich Ave. South
Bloomington, MN 55420
Phone: 612-887-5566 Fax: 612-887-9180
Contact: Tom Scheller Position: Chief Engineer,
Hearing Instruments Group

General Equipment Description — Indicate which attachments you are providing with this document. It is recommended that you provide those listed.

Type of Auditory Assistance
Equipment: Device Model No.: TX-40

Serial No.: Prototype FCC ID No.: CEYTX40
Auditory assistance transmitter, 40 channel synthesized, 72-76MHz.

General description: _____

Product Variant/Options: Omnidirectional, directional and boom mics

Attachments: (only required for certification)

☐ External Photographs ☐ Product Literature ☐ High Level Bill of Materials

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: _____ Signature of Applicant: _____

System Configuration Block Diagram -- Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

Installation and Environmental Conditions (describe) -- Describe the intended installation. Include details such as power connection and system grounding approaches. Describe the intended operating environment, include details such as humidity, cooling, heating and hazardous environments. Attaching a copy of an Installation manual is recommended for proper documentation of your system. Please indicate.

Product is intended to be worn by the teacher at the waist, with a clip-on lavalier mic.

☐ Installation manual/instructions (attached, only required for certification)

Power Requirements -- Indicate your system power requirements for the equipment to be tested.

Rated Voltage (2) AA batteries, 3V total Rated Input Power 150mA.

Protection Class -- Indicate your product's protection class. Contact your TÜV Product Service representative and is only required for certification.

Type: _____ Class: _____

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: _____ Signature of Applicant: _____

I/O Ports and Cables

Indicate all interface cables which can be attached to the equipment even if they are not sold as part of your system. Describe the port (e.g., Parallel, Serial, SCSI), list its type (e.g., AC, DC, Signal, Control) and number of ports/cables of type. Indicate if the I/O port is to be exercised during testing. List the type of transmission and if the cable is an EUT assembly-to-assembly interconnection cable (PC to printer, to modem). Indicate whether the cable is shielded or not, type of shield (e.g. Braid, Foil) and how terminated (e.g. 360 degree to conductive shell, pigtail) at both ends of the cable. If a cable can have a typical length of ≥ 3.0 meters, then it is required to test with a cable of at least 3.0 meters.

I/O Ports and Cables

Description:	Mic/antenna cable		
Type of Port:	3.2mm phone jack	# of ports/cables of type _____	
Exercised during testing?	☐ Yes	☐ No	
Assembly $\leftrightarrow$ Assembly Interconnect	☐ Yes	☐ No	
Cable shielded:	☒ Yes	☐ No	
Shield Type (describe)	shield is the antenna		
Termination: (describe)			
Transmission Type:	☐ Analog	☐ Digital	
Length of cable:	Maximum:	Tested:	

I/O Ports and Cables

Description:			
Type of Port:		# of ports/cables of type _____	
Exercised during testing?	☐ Yes	☐ No	
Assembly $\leftrightarrow$ Assembly Interconnect	☐ Yes	☐ No	
Cable shielded:	☐ Yes	☐ No	
Shield Type (describe)			
Termination: (describe)			
Transmission Type:	☐ Analog	☐ Digital	
Length of cable:	Maximum:	Tested:	

I/O Ports and Cables

Description:			
Type of Port:		# of ports/cables of type _____	
Exercised during testing?	☐ Yes	☐ No	
Assembly $\leftrightarrow$ Assembly Interconnect	☐ Yes	☐ No	
Cable shielded:	☐ Yes	☐ No	
Shield Type (describe)			
Termination: (describe)			
Transmission Type:	☐ Analog	☐ Digital	
Length of cable:	Maximum:	Tested:	

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

EUT configurations -- Provide a technical description of all possible EUT configurations. Specify if more than one configuration is to be tested.

40 channels (72-76 MHz) selectable with push button switch on front panel.

EUT Software and Operation Modes to be Tested -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. Consult with your TÜV Product Service Representative when typical operating modes are not practical. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. This pattern must be sent to the parallel port device, serial port device, and must be write/read/verified to each storage device. Monitors must display the H pattern, typically in white letters on a black background. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing.

General Description:
(describe)

Software Revision Level:
(list and describe)

Operating modes to be
tested: (list and describe)

☐ Operation manual/instructions (attached)

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

Description	Model #	Serial #	FCC ID #
--------------------	----------------	-----------------	-----------------

Interfacing Equipment and/or Simulators (which are not part of the EUT) – List and Describe all equipment or peripherals that will be connected to the EUT. For FCC testing a minimum configuration is required. If you have questions about this minimum configuration contact your TÜV Product Service representative.

[illegible]

Date: _____ **Signature of Applicant:** _____

EMC System Details — List all frequencies and sub-harmonics which are 10kHz or above for such things as oscillators, horizontal line rate of monitors, and clock rates of incorporated OEM assemblies. List all power supplies. Indicate switching frequencies. List power line filters and indicate the manufacturer, model and location on EUT. Indicate all components used for high frequency noise reduction. (e.g., ceramic capacitor, 0.01 μ F, 1 ea. at C12 - C20).

Oscillator Frequencies

<i>Frequency</i>	<i>Sub-harmonics</i>	<i>EUT Location</i>	<i>Description of Use</i>
10Mhz.			Synthesizer fundamental

Power Supply

<i>Frequency</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Type (list frequency)</i>
150KHz				

Power Line Filters

<i>Manufacturer</i>	<i>Model #</i>	<i>Qty</i>	<i>Location on EUT</i>

Critical EMI Components (Capacitors, ferrites, etc.)

<i>Description</i>	<i>Manufacturer</i>	<i>Part # or Value</i>	<i>Qty</i>	<i>Location on EUT</i>

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

Other EMI Critical Construction Detail — Indicate any other measures taken to reduce high frequency noise, (e.g., grounding the circuit board on the right rear corner with 0.25" braid, 3 inches long to the chassis).

Description of Enclosure — Describe the principle materials of the enclosure (e.g., plastic, plastic with shielding material, metal, metal with specific shielding contact points, metal with paint on all surfaces).

Plastic

Date and sign each page of the CDF. Original signatures must be present on each page.

Date:

Signature of Applicant:

Appendix C

MEASUREMENT PROTOCOL

GENERAL INFORMATION

Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of ± 4.5 dB. The equipment comprising the test systems are calibrated on an annual basis.

Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

CONDUCTED EMISSIONS

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

RADIATED EMISSIONS

The final level, expressed in dB μ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB μ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor & Cable (dB)	=	Final (dB μ V/m)	-	FCC B Limit (dB μ V/m)	=	Delta FCC B (dB)
32.21	13.9	+	16.3	=	30.2	-	40.0	=	-9.8

DETAILS OF TEST PROCEDURES**General Standard Information**

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" and FCC Bulletin OST 19 (1979).

Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 450 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 1000 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak (or peak) detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.

The customer cited FCC Bulletin OST 19 for testing this type of device. Placing the EUT 4 feet above the ground plane with its cable hanging straight down provided higher levels than the above method, and the measurements were made with the OST 19 configuration.