FCC PART 15 Subpart C

EMI MEASUREMENT AND TEST REPORT

For

TECOM CO., LTD.

No. 23, R & D Rd. 2, Science-Based Industrial Park, Hsin-Chu, Taiwan, R. O. C.

FCC ID: D6X-T7406

May 15, 2001

| This Report Concerns: | | Equipment Type: | |
|-----------------------|-------------------|------------------------------|--|
| 🖾 Original Report | | Multiple -Handset Cordless | |
| | | Phone – Household Appliances | |
| | / | | |
| Test Engineer: | Victor Liu / Hien | Pham | |
| | | | |
| | | | |
| Test Date: | March 30, 2001 | | |
| | | | |
| Deviewed Dry | | | |
| Kevieweu by: | | | |
| | John Y. Chan – E | ngineering Manager | |
| | | | |
| Prepared By: | Bay Area Complia | ance Laboratory Corporation | |
| | 230 Commercial | Street, Suite 2 | |
| | Sunnyvale, CA 94 | 4085 | |
| | Tel: (408) 732-91 | 62 | |
| | Fax: (408) 732 91 | 64 | |

Note: This report may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

TABLE OF CONTENTS

| 1 - GENERAL INFORMATION | 4 |
|--|---------|
| 1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) | 4 |
| 1.2 OBJECTIVE | 4 |
| 1.3 RELATED SUBMITTAL(S)/GRANT(S) | |
| 1.4 TEST METHODOLOGY | |
| 1.5 TEST FACILITY | 44 ح |
| 1.7 SUPPORT EQUIPMENT LIST AND DETAILS | |
| 1.8 External I/O Cabling List and Details | 5 |
| 2 - SYSTEM TEST CONFIGURATION | 6 |
| 2.1 DESCRIPTION OF TEST CONFIGURATION | |
| 2.2 CONFIGURATION OF TEST SYSTEM | 7 |
| 2.3 TEST SETUP BLOCK DIAGRAM | |
| 2.4 Equipment Modifications | 7 |
| 3 - SUMMARY OF TEST RESULTS | 8 |
| 4 - CONDUCTED OUTPUT POWER MEASUREMENT | |
| 4.1 STANDARD APPLICABLE | |
| 4.2 Measurement Procedure | |
| 4.3 MEASUREMENT RESULT | 10 |
| 5 - CHANNEL BANDWIDTH | |
| 5.1 Standard Applicable | 14 |
| 5.2 Measurement Procedure | |
| 5.3 MEASUREMENT RESULT | 14 |
| 6 - NUMBER OF HOPPING FREQUENCY USED | |
| 6.1 STANDARD APPLICABLE | |
| 6.2 Measurement Procedure | |
| 6.3 MEASUREMENT RESULT | |
| 7 - HOPPING CHANNEL SEPARATION | |
| 7.1 STANDARD APPLICABLE | |
| 7.2 Measurement Procedure | |
| 7.3 TEST KESULTS | |
| 8 - 100 KHZ BANDWIDTH OF BAND EDGES MEASUREMENT | |
| 8.1 STANDARD APPLICABLE | |
| 8.2 MEASUREMENT PROCEDURE | |
| 8.3 MEASUREMENT RESULTS | |
| 9 - DWELL TIME ON EACH CHANNEL | |
| 9.1 STANDARD APPLICABLE | |
| 9.2 MEASUREMENT PROCEDURE | |
| 9.3 MEASUREMENT RESULTS | |
| 10 - ANTENNA REQUIREMENT | |
| 10.1 STANDARD APPLICABLE | |
| 10.2 ANTENNA CONNECTED CONSTRUCTION | |
| 11 - RF SAFETY REQUIREMENTS TO 2.1091 | |
| 12 – SPURIOUS RADIATED EMISSION DATA | |
| 12.1 Measurement Uncertainty | |
| 12.2 EUT SETUP | |
| 12.3 SPECTRUM ANALYZER SETUP | |
| 12.4 TEST FRUCEDURE | |

| TECOM CO., LTD. | FCC ID: D6X-T7406 |
|---|-------------------|
| 12.5 CORRECTED AMPLITUDE & MARGIN CALCULATION 12.6 Summary of Test Results | |
| 13 - CONDUCTED EMISSIONS TEST DATA | |
| 13.1 Measurement Uncertainty | |
| 13.2 EUT SETUP | |
| 13.3 Spectrum Analyzer Setup | |
| 13.4 Test Procedure | |
| 13.5 Summary of Test Results | |
| 13.6 Conducted Emissions Test Data | |
| 13.7 PLOT OF CONDUCTED EMISSIONS TEST DATA | 44 |

1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

TECOM CO., LTD.'s product, FCC ID: *D6X-T7406* or the "EUT" as referred to in this report is a 900MHz Cordless Telephone. The EUT was composed of two parts, one is the base which measures approximately 15.5cm L x 15cm W x 2.5cm H, and the other is the handset which measures 22cm L x 5.5 cm W x 3.5cm H.

The EUT was tested with Cheng Uei Precision Industry Co., Ltd. AC/DC power adapter, M/N: DBT120950D, Serial #: M/N-105.

1.2 Objective

This type approval report is prepared on behalf of *TECOM CO., LTD.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for Output Power, Antenna Requirement, Hopping Channel Separation, Number of Hopping Frequency Used, 20 dB Bandwidth, Dwell Time on Each Channel, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Spurious Radiated Emission.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals.

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4–1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Suite 2, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 22: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

1.6 Test Equipment List

| Manufacturer | Description | Model | Serial Number | Cal. Due Date |
|-------------------|-----------------------------|------------------|------------------|------------------|
| HP | Spectrum Analyzer | 8564E | 08303 | 12/6/01 |
| HP | Spectrum Analyzer | 8593B | 2919A00242 | 12/20/01 |
| HP | Amplifier | 8349B | 2644A02662 | 12/20/01 |
| HP | Quasi-Peak Adapter | 85650A | 917059 | 12/6/01 |
| HP | Amplifier | 8447E | 1937A01046 | 12/6/01 |
| A.H. System | Horn Antenna | SAS0200/571 | 261 | 12/27/01 |
| Com-Power | Log Periodic Antenna | AL-100 | 16005 | 11/2/02 |
| Com-Power | Biconical Antenna | AB-100 | 14012 | 11/2/02 |
| Solar Electronics | LISN | 8012-50-R-24-BNC | 968447 | 12/28/01 |
| Com-Power | LISN | LI-200 | 12208 | 12/20/01 |
| Com-Power | LISN | LI-200 | 12005 | 12/20/01 |
| BACL | Data Entry Software | DES1 | 0001 | 12/20/01 |
| Rohde & Schwarz | Signal Generator | SMIQ03B | 1125.5555.03 | 7/10/02 |
| Rohde & Schwarz | I/Q Modulation Generator | AMIQ | 1110.2003.02 | 8/10/02 |

1.7 Support Equipment List and Details

| Manufacturer | Description | Model | Serial Number | FCC ID |
|----------------|---------------|--------|---------------|-------------------|
| Nortel Norstar | Power Adapter | NT7B56 | P0882883-01 | AB6CAN-23740-PF-E |

1.8 External I/O Cabling List and Details

| Cable Description | Length (M) | Port/From | То |
|---------------------------|------------|----------------------|------------|
| Unshielded RJ11 Cable x 1 | 30 | RJ11 Input Port/Base | Phone Line |

2 - SYSTEM TEST CONFIGURATION

2.1 Description of Test Configuration

The EUT was configured for testing in a typical fashion (as normally used by a typical user).

Handset being tested: The Cordless Phone – Handset, Model T7406 (EUT) was placed on the wooden table and tested in three orthogonal axis. The handset was connected to the headset via its headset port. The Low, middle, and high channels were tested. The handset was transmitting to and receiving from the Base unit. The EUT was investigated for emissions while off hook. The radiated data was taken in this mode of operation. All initial and final investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the 2.5.

Base being tested: The Cordless Phone – Base, Model T7406 (EUT) was placed on the wooden table. The Low, middle, and high channels were tested. The base was connected to the line simulator and an AC adapter via its Tel Line and power ports, respectively. The base was transmitting and receiving from the 900 MHz Handset unit. The conducted as well as radiated data was taken in this mode of operation. All initial and final investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the 2.3.

2.2 Configuration of Test System For Base Unit For Handset Unit EUT: FCCID. D6XT7406 EUT: FCCID. D6XT7406 Handset Uhit Base Unit 30.0 Meter Unshielded RJ11 Cable -2.0 Meter ≻ Unshielded Cabel Telephone Line Adapter 2.3 Test Setup Block Diagram For Base Unit For Handset Unit Power Cord LISN1 I/OCables Draped and LISN1 I/OCables Draped and Bundled if Necessary Bundled if Necessary LISN2 LISN2 ЫL £Л Handset Uhit Base Uhit 1.0 1.0 Meter Meter Non-Conducting Table Non-Conducting Table -1.5 Meter + ≻ 4 ≻ 1.5 Meter

2.4 Equipment Modifications

No modification(s) was made by BACL Corp. to ensure the EUT complies with the applicable limits and standards.

3 - SUMMARY OF TEST RESULTS

| FCC Rules | REQUIREMENTS | RESULT |
|---|--|--|
| CFR 15.203 | An intentional radiator shall be designed to ensure that no antenna other than that furnished by responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may designed the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213. §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded. | Complied |
| CFR15.207 (a) | For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequency within the band 450 kHz to 30 MHz shall not exceed 250 microvolts. | Complied |
| CFR 15.247 (a) | Frequency hopping systems operating in the 902–928 MHz: i bandwidth of the hopping channel is 250kHz or greater, the sy at least 25 hopping frequencies. The maximum allowed 20 dB the hopping channel is 500 kHz. The average time of occupan frequency shall not be greater than 0.4 seconds within a 20 seconds within a 20 seconds. | f the 20dB ystem shall use bandwidth of cy on any cond period. |
| Carrier Frequency Separation | 604kHz | Complied |
| Number of Hopping Frequencies | 25 Channels | Complied |
| Time of Occupancy | 10.6mS | Complied |
| 20 dB Bandwidth | 474kHz | Complied |
| Pseudo-random Frequency Hopping Sequence | See Technical Manual | Provided |

| FCC Rules | REQUIREMENTS | RESULT | |
|--|--|--|--|
| Equal Hopping Frequency Use | See Technical Manual | Provided | |
| System Receiver Input Bandwidth | See Technical Manual | Provided | |
| System Receiver Hopping Capacity | See Technical Manual | Provided | |
| CFR 15.247 (b) (2) | For frequency hopping system operating in the 902 – 928 MHz, band: 0.25 Watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a) (1) of this section. | | |
| Peak Output Power | 21.03dBm for Base Unit; 12.39dBm for Handset Unit | Complied | |
| CFR 15.247 (b) (4) | Systems operating under the provisions of this section shall be o manner that ensures that the public is not exposed to radio frequ levels in excess of the Commission's guidelines. Session 1.1307 chapter | perated in a ency energy (b) (1) of this | |
| RF Exposure Compliance Requirements | See User Manual | Complied | |
| CFR 15.247 (c) | In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100kHz bandwidth within the band contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209 (a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205 (a), must also comply with the radiated emission limits specified in § 15.209 (a) (see § 15.205 (c)). | Complied | |
| Conducted RF Band Edge | See Test Report Page 28, 29 | Complied | |
| Spurious Radiated Emissions | This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT | Complied | |
| Section 15.247 (g) | Describe how the EUT complies with the requirement that it be designed to capable of operating as a true frequency hopping system | Complied | |
| Section 15.247 (h) | Describe how the EUT complies with the requirement that it not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters. | Complied | |

4 - CONDUCTED OUTPUT POWER MEASUREMENT

4.1 Standard Applicable

For frequency hopping, according to §15.247(b) (2), the maximum peak output power of the transmitter shall not exceed 1 Watt.

4.2 Measurement Procedure

- 1. Place the EUT on the turntable and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

4.3 Measurement Result

Refer to the attached plots.

FCC ID: D6X-T7406





5.NOV.2001 08:56:54



Report # R0103214

FCC ID: D6X-T7406





Report # R0103214

FCC ID: D6X-T7406



TECOM T7406 MIDDLE (HANDSET) 3.NOV.2001 07:57:39 Date:



Report # R0103214

Page 13 of 45

5 - CHANNEL BANDWIDTH

5.1 Standard Applicable

According to §15.247(a)(l)(ii), for frequency hopping system operating in the 902-928 MHz, the maximum 20dB bandwidth of the hopping channel is 500 kHz.

5.2 Measurement Procedure

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- 3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- 4. Repeat above procedures until all frequencies measured were complete.

5.3 Measurement Result

Please refer to the hereinafter plots for more details.

FCC ID: D6X-T7406





Report # R0103214

FCC ID: D6X-T7406



Report # R0103214

FCC ID: D6X-T7406





Report # R0103214

6 - NUMBER OF HOPPING FREQUENCY USED

6.1 Standard Applicable

According to §15.247(a)(1)(i), for frequency hopping system operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.

6.2 Measurement Procedure

- 1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- 3. Set the SA on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- 4. Set the SA on View mode and then plot the result on SA screen.
- 5. Repeat above procedures until all frequencies measured were complete.

6.3 Measurement Result

Please see the hereinafter pots for more detail.

FCC ID: D6X-T7406



Report # R0103214

7 - HOPPING CHANNEL SEPARATION

7.1 Standard Applicable

According to \$15.247(a)(1), frequency hopping system shall have, hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

7.2 Measurement Procedure

- 1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT as shown in figure 4 without connection to measurement instrument Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- 3. By using the Max-Hold function record the separation of two adjacent channels.
- 4. Measure the frequency difference of these two adjacent channels by SA MARK function, and then plot the result on SA screen.
- 5. Repeat above procedures until all frequencies measured were complete.

7.3 Test Results

Refer to the attached Plots.



Report # R0103214

Page 21 of 45

FCC ID: D6X-T7406



Ref Lvl Delta 1 [T2] RBW 100 kHz RF Att 50 dB 0.43 dB VBW 100 kHz 20 dBm 616.69138276 kHz SWT 20 ms Unit dBm 20 A. 10 When -10 Haller 2VIEW 2113 1 -20 -30 -40 -50 -60 -7 -80 Center 904 MHz 150 kHz/ Span 1.5 MHz TECOM T7406 ADJ LOW (Handset) 5.NOV.2001 06:58:11 Title: Date:

Report # R0103214

FCC ID: D6X-T7406



8 - 100 kHz BANDWIDTH OF BAND EDGES MEASUREMENT

8.1 Standard Applicable

According to \$15.247(c), if *any* 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in \$15.209(a), whichever results in the lesser attenuation.

8.2 Measurement Procedure

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- 3. Set both RBW and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
- 4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- 5. Repeat above procedures until all measured frequencies were complete.

8.3 Measurement Results

- a) Lower Band Edge: All emissions in this 100kHz bandwidth are attenuated more than 20 dB from the carrier.
- b) Upper Band Edge: All emissions in this 100kHz bandwidth are attenuated more than 20 dB from the carrier.

Please refer to the hereinafter plots.



Report # R0103214

Page 25 of 45

FCC ID: D6X-T7406





Report # R0103214

Page 26 of 45