MEASUREMENT / TECHNICAL REPORT
for
Certification

Applicant	: TOKO INC. Gomigaya-18, Tsurugashima-shi, Saitama-ken 350-2281 Japan,
Kind of Equipment	: Intentional Radiator 2.4GHz Wireless LAN Card
FCC ID	: NUSTMW885A-2
Model Number	: TMW885A-2
Trade Name	: TOKO
Standard	: 47 CFR Part 15 Subpart C Not authorized pursuant to the transition provisions in Section 15.37
Date Received	: 09/27/2000
Date Tested	: 09/27/2000-10/02/2000
Date Report Issued	: 10/10/2000
Report Number	: EMC00X03

NVLAP LAB CODE:200012-0

The measurements covered by this document have been performed in accordance with NVLAP requirements which include the requirements of ISO/IEC Guide 25:1990 and are traceable to national or international standards of measurement.
This report summarizes the result of a single investigation and test result relate only to tested sample performed on the described test object. This test report must not be used by the client to claim product endorsement by NVLAP or agency of the U.S. Government. The report shall not be reproduced except in full without the written approval of the IPS Corporation. We hereby certify that no party to the applications authorized hereunder is subject to a denial of benefits, including FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 853(a).

Signature on the cover letter.

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<Table of Contents> <Page>

<Table of Contents> <Page>

1 GENERAL INFORMATION

The test report includes the out of scope of the NVLAP and JAB accreditation . The test results and the measurements made in this test report of following section are out of scope of NVLAP and JAB accreditation.

1.1307 (b)(1), 1.1310 Table 1B
15.247 (a)-(2), (b)-(1), (b)-(3), (b)-(3)-(iii), (b)-(4), (c), (d), (e)

1.1 Product Description

The TOKO INC 2.4GHz Wireless LAN Card, Model: TMW885A-2, FCC ID: NUSTMW885A-2 (referred to as the EUT in this report) is operated within the bands 2400 – 2483.5MHz frequency hopping and direct sequence spread spectrum intentional radiators that comply with the section 15.247. It is designed to 2.4GHz Wireless LAN Card and is installed to PCMCIA card slot of the personal computer and it provides 11 channel. The Instruction Manual is referenced to Annex P to this report for the details of the product description. It is manufactured and marketed by TOKO INC. Japan. It is manufactured in accordance with the technical specifications in Part 1, Part 2 and Part 15, Subpart C of the Code of Federal Regulations 47 as a following part.

1.1307 (b)(1)
1.1310 Table 1B
2.1033 (a), (b)
15.201 (b)
15.203
15.205 (a), (b)
15.207 (a) to (d)
15.209 (a) to (f)
15.247 (a)-(2), (b)-(1), (b)-(3), (b)-(3)-(iii), (b)-(4), (c), (d), (e)

1.2 Summary of Test and Inspection Result

Code of Federal Regulation 47 Part 15 Subpart C

Sec.15.203 Antenna Requirement	Pass
Sec.15.205 (a), (b) Spurious Emission	Pass
Sec.15.207 Conducted Limits	Pass
Sec.15.209 Radiated Emission Limits	Pass
Sec.15.247 (a)-(2)	Pass
Sec.15.247 (b)-(1)	Pass
Sec.15.247 (b)-(3)	Pass
Sec.15.247 (b)-(3)-(iii)	Pass
Sec.15.247 (b)-(4)	Pass
1.1307 (b)(1) EIRP	Pass
1.1310 Table 1B MPE	Pass
Sec.15.247 (c)	Pass
Sec.15.247 (d)	Pass
Sec.15.247 (e)	Pass

(Ref. 2.1033(b)(10))

1.3 Related Submittal(s)/Grant(s)

None

1.4 Tested Systems Details

The pre-production sample of the TOKO INC. 2.4GHz Wireless LAN Card Model:TMW885A-2 S/N: 00003 FCC ID: NUSTMW885A-2 was tested as part of a system consisting of the **E**quipment **U**nder **T**est, Note PC with AC Adapter, CRT Display, Printer with AC Adapter, Mouse and Modem with AC Adapter.

EUT, PERIPHERALS, AND CABLES USED

<EUT>	<CABLE>
TOKO 2.4GHz Wireless LAN Card Model : TMW885A-2 S/N : 00003 FCCID : NUSTMW885A-2	Installed to PCMCIA card slat of the Note PC (Think Pad 390X).
<PC>	<CABLE>
1) IBM Note PC (Think Pad390X) Model : TYPE2626 S/N : AA-FN3YM FCC DoC	None.
2) IBM Note PC (Think Pad390) (client PC system) Model : TYPE2626 S/N : AA-DB8FZ FCC DoC	None.
<PERIPHERALS>	<CABLE>
3) IBM AC Adapter for PC (Think Pad390X) Model : 02K6542 S/N : 1Z0RM9487HK FCC ID : N/A	1.8 m unshielded DC cable from AC Adapter to PC; Bundled to 1 m and hanging approximately in the middle between ground plane and table. Provide a ferrite bead on the PC side end of the cable. 0.9 m unshielded AC power cord; Excess cord is shortened to appropriate length.

1.4 Tested Systems Details (Continued)

<PERIPHERALS>	<CABLE>
4) TOKO Wireless LAN Card PC Model : TMW885A-2 S/N : 00002 FCC ID : NUSTMW885A-2	Installed to PCMCIA card slat of the client Note (Think Pad390).
5) IBM AC Adapter for client PC (Think Pad390) Model : 83H6340 S/N : J14HC6972V6 FCC ID : N/A	1.8 m unshielded DC cable from AC Adapter to PC; Bundled to 1 m and hanging approximately in the middle between ground plane and table. 0.9 m unshielded AC power cord; Excess cord is shortened to appropriate length.
6) MAG CRT Display Model : XJ 500T S/N : U5T001 FCC ID : IAWVST001	1.8 m shielded Video cable from Display to PC; Bundled to 1 m and hanging approximately in the middle between ground plane and table. Provide ferrite bead on the both side end of cable. 1.8 m unshielded AC power cord; Excess cord is shortened to appropriate length.
7) HP Printer Model : C4608A S/N : SG76A1D0VG FCC ID : B94C2164X	2.9 m shielded Printer cable from Printer to PC; Bundled to 1 m and hanging approximately in the middle between ground plane and tabel.
8) HP AC Adapter for Printer Model : C2178A S/N : 030497 FCC ID : N/A	1.8 m unshielded DC cable from AC Adapter to Printer; Excess cable is shortened to appropriate length. 0.9 m unshielded AC power cord; Excess cord is shortened to appropriate length.
9) LOGITECH Mouse Model : M-S28-6MD S/N : LTN52600389 FCC ID : DZL210472	1.8 m shielded Mouse cable from Mouse to PC; Excess cable is shortened to appropriate length.

1.4 Tested Systems Details (Continued)

<PERIPHERALS>	<CABLE>
10) EPSON Modem (LINK 1200) Model : C202A S/N : 010806 FCC ID : BKM552C202A	3.0 m shielded Serial cable from Modem to PC; Bundled to 1 m and hanging approximately in the middle between ground plane and table. Two 2.1 m Modular cables; Bundled to 1 m and hanging approximately in the middle between ground plane and table. One end of the cables were open connected.
11) EPSON AC Adapter for Modem Model : HOOAAJ S/N : N/A FCC ID : N/A	1.8 m unshielded DC cable from AC Adapter to Modem; Excess cable is shortened to appropriate length.

1.5 Test Methodology

Interference measurements were made in accordance 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. Radiate testing in the range of 9 kHz to 30 MHZ was performed at an antenna to EUT distance of 3 meters under the 15.209 (e) and 15.31 (f) (2). Radiate testing in the range of 30 MHz to 1000 MHz was performed at an antenna to EUT distance of 3 meters under the 15.209 (a). And radiate testing in the range of 1 GHz to 25 GHz (10 th harmonic of the highest fundamental frequency, 15.209 (f) and 15.33 (a) (1) for the spectrum investigation was performed at an antenna to EUT distance of 3 meters under the 15.209 (e) and 15.31 (f) (1).

1.6 Test Facility

The Test facility has been certified to Quality System for EMC Testing Service by TUV CERT. Proof has been furnished that the requirements according to DIN EN ISO 9002 / JIS Z 9902 are fulfilled.(Certificate Registration No. 09 100 6813)

Conduced Interference Voltage test was performed on the No.3 10 meter semi-anechoic chamber and Radiated interference Field Strength test was performed on the No.2 3 meter semi-anechoic chamber located at IPS Corp. 1878-1, Harumiya Ono Tatsuno-machi,Kamiina-gun, Nagano-ken, 399-0601, Japan. This Laboratory is Accredited under the National Voluntary Laboratory Accreditation Program (NVLAP)by United States Department of Commerce, National Institute of Standard and Technology (NIST) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. Accreditation awarded for specific services, listed on the Scope of Accreditation for : ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS FCC. (NVLAP LAB CODE : 200012-0). And this laboratory is listed by Federal Communications Commission, Equipment Authorization Division. (Registration Number : 93663)

This Laboratory is accredited by Japan Accreditation Board for Conformity Assessment for satisfactory compliance with JAB RL100 and RL152-1997 of JAB Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of JIS Z 9325 as suppliers of calibration or test results. Accreditation awarded for specific services,listed on the Scope of Accreditation for : ELECTROMAGNETIC COMPATIBILITY TESTING (JAB Accredit No.: RTL0010).

2 PRODUCT LABELING

Figure 2.1 FCC ID Label

See the Annex A.

Figure 2.2 Location of Label on EUT

See the Annex B.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

1. Emission tests were performed with no deviation from the ANSI C63.4-1992.
2. The system was configured for testing a typical fashion. (as a customer would normally use it.) Radiated testing in the range of 1 GHz to 25 GHz was investigated with the spectrum (peak detector function) under the FCC regulation section 15.209 (e) and 15.35 (b). The test performed at an antenna to EUT distance of 3 meter. The level of any unwanted emissions from EUT was not exceed the level of the fundamental emission (Compliance with 15.209 (c)). And test result found to be compliance with FCC regulation section 15.209 (a) Radiated emission limits (500 micro-volts/meter). Data is presented for the “worst case” measurements, that E.U.T was normal operated. The EUT provide a capper electric conducted tape for the inside of the enclosure. These same tape should be used on the mass production unit.
3. The EUT power is supplied from PC via multi voltage input AC Adapter (rated 100 – 240V AC). Therefor test was performed with AC 120V. (as not appropriate section 15.31 (e))
4. All tests were performed with the representative channel operation as follows.
   a. Lowest frequency channel : CH1 2412MHz
   b. Middle frequency channel : CH6 2437MHz
   c. Highest frequency channel : CH11 2462MHz

3.2 EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in manner similar to a typical use. The program sequentially exercise each system component in turn. The sequence used is : (1) an H pattern is printed on the monitor (2) serial port send the data to modem (3) mass storage devices of the PC was exercised, and (4) parallel port send the data at the printer prints an H (5) The data was transmitting and receiving between the EUT and the client PC. The complete cycle takes about 2 seconds and is reported continuously. As the mouse is strictly input devices, no data is transmitted. They are, however, continuously scanned for data input activity.

3.3 Special Accessories

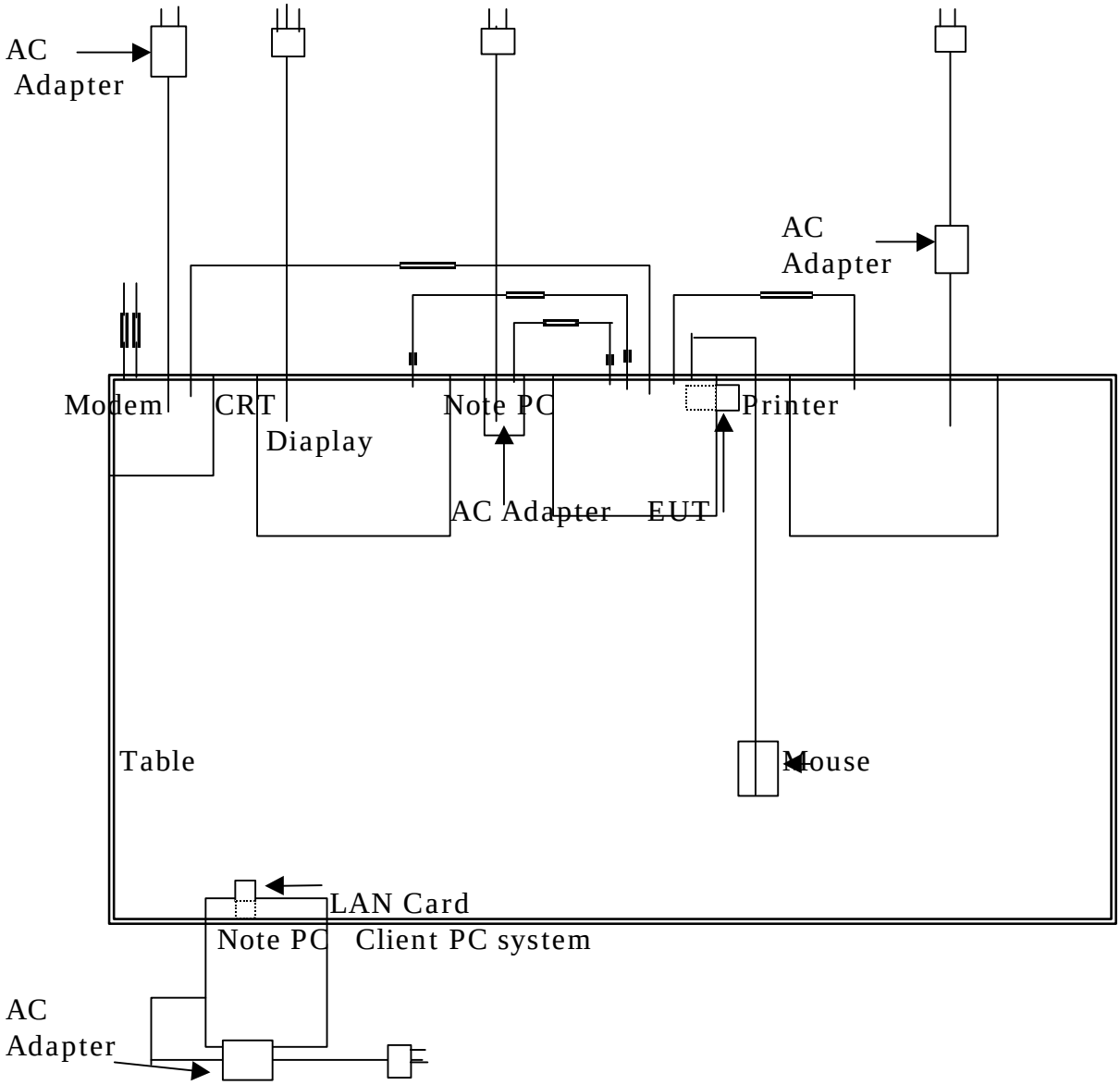
None

3.4 Equipment Modifications

No modification have been carried out.

3.5 Configuration of Tested System

Figure 3.1 Configuration of Tested System



CONDUCTED TEST CONFIGURATION : Figure 6.1
RADIATED TEST CONFIGURATION : Figure 7.1 (9kHz – 30MHz)
: Figure 7.2 (30MHz – 1GHz)
: Figure 7.3 (1GHz – 25G)

4 BLOCK DIAGRAM (S) OF FCC ID: NUSTMW885A-2

4.1 Block Diagram Description

Provided oscillators are described in the Block Diagram.

Figure 4.1 Block Diagram of FCC ID: NUSTMW885A-2

See the Annex C.

5 ANTENNA REQUIREMENT

The EUT provide a permanently attached antenna and it found to be compliance with FCC regulation section 15.203.
Figure 5.1 shows construction of the antenna connection.

Figure 5.1
See the Annex D.

6 CONDUCTED EMISSION TEST

6.1 Test Setup

The test setup was made according to ANSI STD C63.4-1992 clause 7 on the No.3 10m semi-anechoic chamber. The rear of non-conductive wooden table top was placed 0.4 m from a vertical metal reference plane that secured to metal floor of the semi-anechoic chamber by screws. Rear of the EUT and the peripherals, shall be all aligned and flush with rear of non-conductive wooden table top. The height of this table was 0.8 m and 2.0 m wide x 1.0 m deep size. Spacing between the each equipment maintain minimum 10 cm. The client PC system was located away from the table. Connection of the AC Adapter of PC (EUT) to the artificial mains network (LISN) is required and the AC Adapter of PC (EUT) is located so that the distance between the boundary of the AC Adapter of PC (EUT) and the closet surface of the artificial mains network is 0.8 m. Connection of the all other equipment to the second artificial mains network (LISN) is required and the equipments are located so that the distance between the boundary of the equipments and the closet surface of the artificial mains network is 0.8 m. The second artificial mains network is terminated with 50 ohm terminator. Where a mains flexible cord is provided by the manufacture this is 2.0 m long and excess cable was folded back and forth as far as possible to 0.8 m so as to from a bundle not exceeding 0.4 m in length. Interconnecting cables of table top equipment that hang closer than 0.4 m to the floor ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table or that excess cable is shortened to appropriate length. The measurement has been conducted with both line and neutral power supply polarization. The measurement has been conducted with both line and neutral power supply polarization. The highest voltage of the EUT has been recorded. By varying the configuration of the test sample and the cable routing it was attempted to maximize the voltage emission. For further description of the configuration refer to the pictures of this report.

6.2 Instrumentation

List of the Instrumentation for the test.

1) Equipment : Test Receiver (For the final Measurement)
Model No : HP8542E
S/N : 3710A00203
Manufacture : Agilent Technologies
Frequency Range : 9 kHz to 2.9 GHz
System Bandwidth : 9 kHz
Detector : Quasi-Peak
Last Calibrate : 1999/08/11
Next Calibrate : 2000/10/31

2) Equipment : LISN for EUT
Model No : KNW-407
S/N : 8-1420-14
Manufacture : Kyoritsu
Frequency Range : 0.15 MHz to 30 MHz
RF Load : 50 50 H
Last Calibrate : 2000/04/17
Next Calibrate : 2001/04/17

3) Equipment : LISN for Peripherals
Model No : D2601
S/N : 62600145
Manufacture : Device
Frequency Range : 0.15 MHz to 30 MHz
RF Load : 50 50 H
Last Calibrate : 2000/04/17
Next Calibrate : 2001/04/17

4) Equipment : 50 ohm Terminator for Second LISN
Model No : CT-05BP
S/N : 5G363
Manufacture : Tamagawa Electronics
Last Calibrate : 2000/01/06
Next Calibrate : 2001/01/06

6.2 Instrumentation (Continued)
List of the Instrumentation for the test

5) Equipment : Transient Limiter
Model No : 11947A
S/N : 3107A02621(3/3)
Manufacture : Ajilent Technologies
Frequency Range : 9 kHz to 30 MHz
calibrated with the cable system

6) Equipment : Switch Box
Model No : MP59B
S/N : M65282(3/7)
Manufacture : Anritsu
Frequency Range : 0.15 MHz to 30 MHz
Calibrated with the cable system

7) Equipment : Step Attenuator
Model No : HP8494B
S/N : 3308A33504(5/7)
Manufacture : Agilent Technologies
Frequency Range : 0.15 MHz to 30 MHz
Calibrated with the cable system

8) Equipment : Cable System
Consists of : 3/3 Transient Limiter and 1/3,2/3 cables
Manufacture : IPS Corporation
Frequency Range : 0.15 MHz to 30 MHz
Last Calibrate : 1999/12/24
Next Calibrate : 2000/12/24

6.3 Measurement Data

1) CH1:2412MHz
File No.: 007 See the Annex E of pages 1 to 4
(Spectrum Chart is presented)

Summary of the measurement result (Worst measurement):
Phase N, 8.163MHz, 39.0dBuV Quasi-Peak Value and it has
9.0dB margin from the Limit (48.0dB V).

2) CH6:2437MHz
File No.: 008 See the Annex E of pages 5 to 8
(Spectrum Chart is presented)

Summary of the measurement result (Worst measurement):
Phase N, 8.165MHz, 39.0dBuV Quasi-Peak Value and it has
9.0dB margin from the Limit (48.0dB V).

3) CH1:2462MHz
File No.: 009 See the Annex E of pages 9 to 12
(Spectrum Chart is presented)

Summary of the measurement result (Worst measurement):
Phase N, 8.164MHz, 38.7dBuV Quasi-Peak Value and it has
9.3dB margin from the Limit (48.0dB V).

Measurement Uncertainties: [measurement Result dB V] +,- 1.5dB

The measurement uncertainties have been determined at a confidence level of approximately 95%(k=2). The uncertainty applies only to the measured values and gives no indication of the long term stability of the Conducted Emission Test Equipments.

Test Result : Pass

Disturbance other than those mentioned are small or not detectable.

6.4 CONDUCTED MEASUREMENT PHOTOS

Figure 6.1 Configuration photo of Conducted Measurement

See the Annex F

7 RADIATED EMISSION TEST

7.1 Test Setup

The test setup was made according to ANSI STD C63.4-1992 clause 8 on the No.2 3 meter semi-anechoic chamber, which allows a 3 m distance measurement. Rear of the PC (EUT) and the peripherals shall be all aligned and flush with rear of non-conductive wooden table top. The height of this table was 0.8 m and 2.0 m wide x 1.0 m deep size. Spacing between the each equipment's maintain minimum 10 cm. The client PC system was located away from the table. Connection of the AC Adapter of PC (EUT) to the artificial mains network (LISN) is required and artificial mains network is located under the turn table. Connection of the all other equipment to the second artificial mains network (LISN) is required and artificial mains network is located under the turn table. All artificial mains network are terminated with 50 ohm terminator. The mains flexible cords were dropped to the floor and is routed over to receptacle. Interconnecting cables of table top equipment that hang closer than 0.4 m to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table or that excess cable is shortened to appropriate length. The measurement has been conducted with both horizontal and vertical antenna polarization. The turntable has been fully rotated. The highest radiation of the equipment has been recorded. By varying the configuration of the test sample and the cable routing it was attempted to maximize the voltage emission. For further description of the configuration refer to the pictures of this report.

Distance between equipment and antenna	: 3 m
Height of antenna	: 1 m (9kHz to 30MHz)
	: 1 m to 4 m (30MHz to 25GHz)

7.2 Instrumentation

List of the Instrumentation for the test.

1) Facility : No.2 3 m semi-anechoic chamber
Manufacture : Otsuka Science Co., Ltd.
Frequency Range : 9 kHz to 1000 MHz
Last Calibrate : 2000/02/01
Next Calibrate : 2001/02/01

2) Equipment : Test Receiver (For the final measurement)
Model No. : HP8546A
S/N : 3807A00483
Manufacture : Hewlett Packard
Frequency Range : 9 kHz to 6.5 GHz
System Bandwidth : 120 kHz
Detector : Quasi-Peak
Last Calibrate : 2000/06/15
Next Calibrate : 2001/06/15

3) Equipment : Spectrum Analyzer
Model No. : R3271A
S/N : 55050003
Manufacture : ADVANTEST
Frequency Range : 100 Hz to 26.5 GHz
System Bandwidth : 1000 kHz
Detector : Peak
Last Calibrate : 2000/03/10
Next Calibrate : 2001/03/10

4) Equipment : Bilog Antenna (For the spectrum analysis)
Model No. : CBL6140A
S/N : 1124
Manufacture : Chase
Frequency Range : 30 MHz to 1000 MHz
Last Calibrate : 2000/02/01
Next Calibrate : 2001/02/01

7.2 Instrumentation (Continued)

List of the Instrumentation for the test.

5) Equipment : Tunable Dipole Antenna
(For the final measurement)
Model No. : VHA9103
S/N : 91031513
Manufacture : Schwarzbeck
Frequency Range : 30 MHz to 300 MHz
Last Calibrate : 1999/10/15
Next Calibrate : 2000/10/15

6) Equipment : Tunable Dipole Antenna
(For the final measurement)
Model No. : UHA9105
S/N : 91052125
Manufacture : Schwarzbeck
Frequency Range : 300 MHz to 1000 MHz
Last Calibrate : 2000/05/31
Next Calibrate : 2001/05/31

7) Equipment : Attenuator (Connected to the Antenna)
Model No. : MP721A
S/N : M48971(1/7)
Manufacture : Anritsu
Frequency Range : 30 MHz to 1000 MHz
Calibrated with the Cable system

8) Equipment : Step Attenuator (For the Pre-Amp. Saturation)
Model No. : HP8494B
S/N : 3308A37638(4/7)
Manufacture : Hewlett Packard
Frequency Range : 30 MHz to 1000 MHz
Calibrated with the Cable system

7.2 Instrumentation (Continued)

List of the Instrumentation for the test.

9) Equipment : Pre Amplifier
Model No. : HP8347D
S/N : 3307A01779(6/7)
Manufacture : Hewlett Packard
Frequency Range : 30 MHz to 3000 MHz
Calibrated with the Cable system

10) Equipment : Cable System
Consists of : 1/7 Attenuator, 6/7 Pre-Amplifier
: 2/7,3/7,5/7,7/7 cables
Manufacture : IPS Corporation
Frequency Range : 30 MHz to 1000 MHz
Last Calibrate : 1999/12/24
Next Calibrate : 2000/12/24

11) Equipment : Loop Antenna
Model No. : HLA6120
S/N : 1131
Manufacture : Chase
Frequency Range : 9 kHz to 30 MHz
Last Calibrate : 2000/06/12
Next Calibrate : 2001/06/12

12) Equipment : Double Rigid Guide Antenna
Model No. : 3115
S/N : 9157-4617
Manufacture : EMCO
Frequency Range : 1 GHz to 18 GHz
Last Calibrate : 1999/09/23
Next Calibrate : 2000/10/23

7.2 Instrumentation (Continued)

List of the Instrumentation for the test.

13) Equipment : Double Rigid Guide Antenna
Model No. : 3116
S/N : 9512-2277
Manufacture : EMCO
Frequency Range : 18 GHz to 40 GHz
Last Calibrate : 1999/09/23
Next Calibrate : 2000/10/23

14) Equipment : Pre Amplifier
Model No. : 83051A
S/N : 3332A00375
Manufacture : Hewlett Packard
Frequency Range : 50 MHz to 40 GHz
Calibrated with the Cable system

15) Equipment : 4 m Junflon Cable System (For 1 GHz to 40 GHz)
Consists of : Pre-Amplifier and Cable.
Manufacture : IPS Corporation
Frequency Range : 1 GHz to 40 GHz
Last Calibrate : 2000/02/07
Next Calibrate : 2001/02/07

16) Equipment : LISN for EUT & Peripherals
Model No. : A
S/N : 003 / 004
Manufacture : IPS
Frequency Range : 0.15 MHz to 30 MHz
RF Load : 50 50 H
: 50 terminated
Located under the turn table.
Non calibration equipment.

7.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

c.f.= AF + CF - AG

FS = RA + c.f.

Where c.f. = Correction Factor
FS = Field Strength (Emission Level - Result)
RA = Receiver Amplitude (Reading Level)
AF = Antenna Factor
CF = Cable Attenuation Loss
AG = Amplifier Gain

Assume a receiver reading of 52.5 dB V is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The Amplifier Gain of 29.0 dB is subtracted, giving a field strength of 32.0 dB V/m. The 32.0 dB V/m value was mathematically converted to its corresponding level in V/m.

FS = 52.5 + 7.4 + 1.1 - 29.0 = 32.0 dB V/m

Level in V/m = Common Antilogarithm [(32.0 dB V/m)/20] = 39.8 V/m

7.4 Measurement Data

1) Frequency Range 9kHz to 30MHz

CH1:2412MHz

File No.: 024 See the Annex G of pages 1 to 3
Summary of the measurement result (Worst measurement):
0.491MHz, 61.4dB(V/m) Quasi-Peak Value and it has 12.4dB margin from the Limit (73.8dB(V/m)).
Summary of the measurement result (Worst measurement):
0.491MHz, 60.1dB(V/m) Average Value and it has 13.7dB margin from the Limit (73.8dB(V/m)).

CH6:2437MHz

File No.: 025 See the Annex G of pages 4 to 6
Summary of the measurement result (Worst measurement):
0.492MHz, 61.1dB(V/m) Quasi-Peak Value and it has 12.7dB margin from the Limit (73.8dB(V/m)).
Summary of the measurement result (Worst measurement):
0.492MHz, 60.0dB(V/m) Average Value and it has 13.8dB margin from the Limit (73.8dB(V/m)).

CH11:2462MHz

File No.: 026 See the Annex G of pages 7 to 9
Summary of the measurement result (Worst measurement):
0.491MHz, 30.6dB(V/m) Quasi-Peak Value and it has 13.2dB margin from the Limit (73.8dB(V/m)).
Summary of the measurement result (Worst measurement):
0.491MHz, 60.0dB(V/m) Average Value and it has 13.8dB margin from the Limit (73.8dB(V/m)).

7.4 Measurement Data (Continued)

2) Frequency Range 30MHz to 1GHz

CH1:2412MHz

File No.: 018 See the Annex G of pages 10 to 13
Summary of the measurement result (Worst measurement):
Horizontal Polarization 897.610MHz, 42.2dB(V/m) Quasi-Peak Value and it has 3.8dB margin from the Limit (46.0dB(V/m)).

CH6:2437MHz

File No.: 019 See the Annex G of pages 14 to 17
Summary of the measurement result (Worst measurement):
Vertical Polarization 55.846MHz, 35.3dB(V/m) Quasi-Peak Value and it has 4.7dB margin from the Limit (40.0dB(V/m)).

CH11:2462MHz

File No.: 020 See the Annex G of pages 18 to 21
Summary of the measurement result (Worst measurement):
Vertical Polarization 55.841MHz, 37.6dB(V/m) Quasi-Peak Value and it has 2.4dB margin from the Limit (40.0dB(V/m)).

Measurement Uncertainties:

30MHz - 300MHz	
Horizontal Polarized	- [Measurement Result dBuV/m] +,- 3.5dB
Vertical Polarized	- [Measurement Result dBuV/m] +,- 3.9dB
300MHz - 1000MHz	
Horizontal Polarized	- [Measurement Result dBuV/m] +,- 3.8dB
Vertical Polarized	- [Measurement Result dBuV/m] +,- 3.8dB

The measurement uncertainties have been determined at a confidence level of approximately 95 % (k=2). The uncertainty applies only to the measured values and gives no indication of the long term stability of the Radiated Interference Field Strength Test Equipments.

7.4 Measurement Data (Continued)

3) Frequency Range 1GHz to 25GHz

CH1:2412MHz

See the Annex G of Spectrum Chart of Pages 22 to 33

Summary of the measurement result (Worst measurement):

The frequency range from 1GHz to 25GHz test performed at an antenna to EUT distance of 3 meter. The level of any unwanted emissions from EUT was not exceed the level of the fundamental emission (Compliance with 15.209 (c)). And test result found to be compliance with FCC regulation section 15.209 (a) Radiated emission limits (500 micro-volts/meter).

(All unwanted emissions are measured with 10 dB V/m or more (peak detector) below the limit)

CH6:2437MHz

See the Annex G of Spectrum Chart of Pages 34 to 45

Summary of the measurement result (Worst measurement):

The frequency range from 1GHz to 25GHz test performed at an antenna to EUT distance of 3 meter. The level of any unwanted emissions from EUT was not exceed the level of the fundamental emission (Compliance with 15.209 (c)). And test result found to be compliance with FCC regulation section 15.209 (a) Radiated emission limits (500 micro-volts/meter).

(All unwanted emissions are measured with 10 dB V/m or more (peak detector) below the limit)

CH11:2462MHz

See the Annex G of Spectrum Chart of Pages 46 to 57

Summary of the measurement result (Worst measurement):

The frequency range from 1GHz to 25GHz test performed at an antenna to EUT distance of 3 meter. The level of any unwanted emissions from EUT was not exceed the level of the fundamental emission (Compliance with 15.209 (c)). And test result found to be compliance with FCC regulation section 15.209 (a) Radiated emission limits (500 micro-volts/meter).

(All unwanted emissions are measured with 10 dB V/m or more (peak detector) below the limit)

Measurement Uncertainties (1000MHz to 2500MHz):

Measurement Uncertainties was not calculated due to this measurement was only investigation.

Test Result : Pass

Disturbance other than those mentioned are small or not detectable.

7.5 RADIATED MEASUREMENT PHOTOS

Figure 7.1 Configuration photo of Radiated Measurement (9kHz – 30MHz)

See the Annex H.

Figure 7.2 Configuration photo of Radiated Measurement (30MHz – 1GHz)
See the Annex H.

Figure 7.3 Configuration photo of Radiated Measurement (1GHz – 25GHz)
See the Annex H.

8 OPERATION WITHIN THE BANDS 2400-2483.5 (15.247)

8.1 15.247 (a) (2)

See the Annex I.
Summary of the measurement result:
EUT is direct sequence system, the minimum 6 dB bandwidth is at 10.4 10.5 MHz .
(Requirement : The minimum 6 dB bandwidth shall be at least 500 kHz)

8.2 15.247 (b) (1)

Summary of the measurement result:
EUT is direct sequence system, the maximum out put with peak detector is 17mW.
Power Meter : Anritsu ML2437A
Power Sensor : Anritsu MA2472A
(Requirement : The maximum peak output power shall not exceed 1W)

8.3 15.247 (b) (3)

The antenna gain of the EUT is less than 0dBi.
(Requirement : Measurement shall be required for directional gain grater than 6 dBi)

8.4 15.247 (b) (3) (iii)

See the Annex P.

8.5 15.247 (b) (4), 1.1307 (b) (1), 1.1310 Table 1B

See the page 34 to 36
1.1307 (b) (1) Total EIRP = 12.3 dBm (17mW)
1.1310 Table 1B MPE Calculated Distance = 1.163 cm

8.6 15.247 (c)

The EUT found to be compliance with this section with the investigation of the radiated emission measurement. (See the Annex G)
(Requirement : The intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth)

8.7 15.247 (d)

See the Annex J.
Summary of the measurement result:
The transmitted continuously spectrum peak power density at any time interval is
-12.7 dBm to -13.3 dBm in any 3 kHz bandwidth.
(Requirement : The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band)

8.8 15.247 (e)

See the Annex K.

Summary of the measurement result:
AS measurement using the CW jamming margin method
GP= (S/N) o + Mj + Lsys

Requirement : The processing gain shall be at least 10 dB

Measurement Procedure

1. measurement systematic diagram
   See attached material. (Annex K, Graph)
   The application of LanEval manufactured by INTERSIL shall be utilized for packet error rate (PER) measurement.
   Note: Packet error rate (PER) is same as Bit error rate (BER).

2. measurement procedure
   1. The transmitter (TMW885A-2) shall be kept continuously transmitted. STEP ATTN shall be adjusted to –50dBm for measurement value of power meter. This level is the output value of transmitter in measurement.
   2. Signal Generator (SG) for CW Jammer shall be set to CH1 (2412MHz) and non-modulation and output ON, after the transmitter output OFF. SG output level shall be adjusted to –58.4dBm for measurement value of power meter. This level (–58.4dBm) is the reference level of minimum J/S, 10dB process gain.
   3. CW Jammer is switched OFF, transmitter is ON in transmission conditions, and then packet error shall be measured with the receiver. It shall be confirmed that PER is error-free.
   4. CW Jammer is switched ON at reference level and it shall be confirmed that PER is under 8%.

8.8 15.247 (e) (Continued)

   5. CW Jammer shall be adjusted to PER 8% and it shall be confirmed that the J/S is above –8.4dB to record.
   6. 4 and 5 shall be repeated for measurement at 50KHz step in receiver transit range of ±8.5MHz.
   7. Measurement of 1 to 6 shall be performed in CH6 (2437MHz) and CH11 (2463MHz) as like as above.

In case that some points are over PER 8% at step 4, it is acceptable if the number is under 20% of all measurement points. (The data of worst 20% must be excluded from the data of all measurement points to evaluate.)

CH1 (2412MHz)
Across the Pass Band : 2403.5 2420.5 MHz
(offset Frequency f = ±8500 KHz)
Worst J/S data point = -8.1 at offset Frequency f = -1550 KHz (2410.45 MHz)
Discarding the worst 20% of the J/S data point.

-8.1×0.8 = -6.48
The lowest remaining J/S ratio = -6.4
(S/N)o = 16.4 , Lsys = 2.0
12 (dB) = 16.4 + (-6.4) + 2.0

CH2 (2437MHz)

Across the Pass Band : 2428.5 2445.5 MHz
(offset Frequency f = ±8500 KHz)
Worst J/S data point = -8.1 at offset Frequency f = -1550 KHz (2435.45 MHz)
Discarding the worst 20% of the J/S data point.
-8.1×0.8 = -6.48
The lowest remaining J/S ratio = -6.4
(S/N)o = 16.4 , Lsys = 2.0
12 (dB) = 16.4 + (-6.4) + 2.0

8.8 15.247 (e) (Continued)

CH3 (2462MHz)

Across the Pass Band : 2453.5 2470.5 MHz
(offset Frequency f = ±8500 KHz)
Worst J/S data point = -7.9 at offset Frequency f = -1550 KHz (2460.45 MHz)
Discarding the worst 20% of the J/S data point.
-7.9×0.8 = -6.32
The lowest remaining J/S ratio = -6.3
(S/N)o = 16.4 , Lsys = 2.0
12.1 (dB) = 16.4 + (-6.3) + 2.0

Test & Investigation Result : Pass

15.247 (b) (4), 1.1307 (b) (1)

Calculation for Total EIRP

A	B	C	D	E
Specified Antenna Gain (dBi)	Minimum Cable Losses (dB)	Total Antenna Gain (dBi)	Max. RF Output Power at Antenna Terminal (dBm)	Total EIRP (dBm(mW))
0	0	0	12.3 (17mW)	12.3 (17)

Calculation : C = A + B, E = C + D

Note : Cable losses was very small and it can not measured due to the antenna and the transmitting circuit was connected by printed circuit.

15.247 (b) (4) , 1.1310 Table 1B

RF EXPOSURE CALCULATIONS FOR ANTENNA OF WIRELESS LAN CARD, FCC ID : NUSTMW885A-2

From FCC1.1310 table1B the maximum permissible RF exposure for an uncontrolled environment is 1mW/(cm^2).
The electric field generated for a 1mW/(cm^2) exposure (S) is calculated as follows:

$S = E*E/Z$

Where, S = Power density
E = Electric field
Z = Impedance

$E*E = S \times Z$

1mW/(cm^2) = 10W/(m^2)

Z is 377 ohms of the impedance of free space, where E and H field are perpendicular.
Thus the Electric field to produce a 1mW/(cm^2) exposure is:

$E = \sqrt{(10 \times 377)} = 61.4$ V/m, which is equivalent to 1 mW/(cm^2).

Using the relationship between electric field E, effective radiated power in watts P, and distance in meters D, the corresponding distance D to produce a 1mW/(cm^2) is calculated in the following expression:

$D = \sqrt{(P \times 30) / E} = \sqrt{(17 \times 10 \times 30) / 61.4} = 1.163$cm

Where , P : maximum effective radiated power measured, 17 mW (12.3 dBm).
E : electric field equivalent to 1 mW/(cm^2), 61.4 V/m

The table below identifies the distance where the 1 mW/(cm^2) exposure limits may be exceeded during continuous transmission using the EUT with internal antenna.

15.247 (b) (4) , 1.1310 Table 1B (Continued)

Antenna Type	Peak output Power		Calculated RF Exposure Separation Distance (cm)
	(DBm)	(mW)	
Integral	12.3	17	1.163

CAUTION on the Manual.
“CAUTION : Exposure to Radio Frequency radiation. Antenna shall be mounted in such a manner to minimize the potential for human contact during normal operation. The antenna should not be contacted during operation to avoid the possibility of exceeding the FCC radio frequency exposure limits.”

9 APPLICANT AND MANUFACTURER INFORMATION

9.1 Engineering Statement

TYPE OF APPLICATION	: Certification
APPLICABLE RULES	: 47 CFR Part 15 Subpart C
APPLICANT	: TOKO INC. Gomigaya-18, Tsurugashima-shi, Saitama-ken 350-2281 Japan
TRADE NAME	: TOKO
KIND OF EQUIPMENT	: Intentional Radiator 2.4GHz Wireless LAN Card
FCC ID	: NUSTMW885A-2
MODEL NUMBER	: TMW885A-2
MEASUREMENT PROCEDURE	: ANSI C63.4-1992 47 CFR Part 15 Subpart C Section 15.247
APPLICANT'S REPRESENTATIVE	: Rikiya Kan / Manager

ENGINEERING STATEMENT

I HEREBY STATE THAT: The measurements / test shown in this application were made in accordance with the procedures indicated and the energy emitted and electromagnetic compatibility by this equipment was found to be within the limits applicable.

I FURTHER STATE THAT: On the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the Part 15 of the F.C.C. Rules under normal use and maintenance.

10 PHOTOS OF TESTED EUT

Figure 1 Inner View Component Side of the Main Board.
See the Annex L.

Figure 2 Inner View Foil Side of the Main Board.
See the Annex M.

Figure 3 Front View.
See the Annex N.

Figure 4 Front View.
See the Annex O.