Elliott Laboratories Inc.
www.elliottlabs.com
684 West Maude Avenue
Sunnyvale, CA 94086-3518
408-245-7800 Phone
408-245-3499 Fax

Electromagnetic Emissions Test Report In Accordance With FCC Part 74.861 Subpart H and 90.265(B) on the Wireless Microphone Model: WM-3310 and WM-3310H

GRANTEE: TOA Electronics, Inc.
601 Gateway Blvd, Suite 300
S. San Francisco, CA 94080

TEST SITE: Elliott Laboratories, Inc.
684 W. Maude Ave
Sunnyvale, CA 94086

REPORT DATE: May 10, 2001

FINAL TEST DATE: May 9, 2001

AUTHORIZED SIGNATORY: _____
David Bare
Chief Technical Officer

TABLE OF CONTENTS

FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part2, Subpart J, Section 2.1033(C).

2.1033(c)(1) Applicant: TOA Electronics, Inc.
601 Gateway Blvd, Suite 300.
S. San Francisco, CA 94080

2.1033(c)(2) FCC ID: DLAWM-3310

Technical Description

The TOA wireless microphone is of belt-clip body worn transmitter used with a microphone headset or a lavalier microphone. It employs an optimized PLL-synthesizer and a compander noise reduction circuit to minimize the influence of ambient RF noise.

2.1033(c)(3) Instructions/Installation Manual

Please refer to Exhibit 7: User Manual, Theory of Operation

2.1033(c)(4) Type of emissions

FCC 74.861 Subpart H (99% Occupied Bandwidth): **118KF3E**

FCC 90.265 (99% Occupied Bandwidth): **49K7F3E**

2.1033(c)(5) Frequency Range

6 frequencies within 169 - 216 MHz

2.1033(c)(6) Range of Operation Power

Less than 50 mW

2.1033(c)(7) Maximum Power Rating

Section 74.861(E)(1)(i): Limited to 50 mW

Section 90.265(B)(2): Limited to 50 mW

2.1033(c)(8) Applied voltage and currents into the final transistor elements

9Vdc, Current 100 mA

2.1033(c)(9) Tune-up Procedure

The Tune-Up procedure is located in pg. 2-3 User manual. Refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure.

2.1033(c)(10) Schematic Diagram of the Transmitter

Refer to Exhibit 6. The schematic diagram

2.1033(c)(10) Means for Frequency Stabilization

VCO , PLL IC (M7) and LOOP FILTER make up a phase locked loop. The VCO oscillates the transmission frequency directly and divides the output. It then compares the frequency phase by means of the 25 kHz comparison frequency, and outputs a pulse corresponding to the phase difference. The pulse is applied to the VCO as a control voltage after integrated at a loop filter, and then is locked to the set transmission frequency. Both the audio and tone signals are input from the VCO's modulation circuit, and then are frequency-modulated. The modulation method is a reactance modulation system using a variable capacitance diode. And crystal-controlled reference oscillator is 6.0 MHz in frequency,and is oscillated by the PLL IC's internal inverter to operate the PLL as a clock. At the same time, the 6 MHz signal is supplied to the CPU as the CPU reference oscillation frequency. Locations are 9, 10, and 11 (please refer to block diagram).

2.1033(c)(10) Means for Suppression of Spurious radiation

The third Butterworth type low-pass filter is constructed using the transistor Q9 to attenuate the audio signal components of over 15 kHz. Also, the harmonic components of the tone signal to be superimposed in the LPF circuit are attenuated by the-pass filter. Location 5 (Please refer to block diagram).

Low-pass filters are used for the RF section's band limiting filter to suppress the spurious-radiated signals with frequencies much different from the transmission frequency. Location 12 and 16 (please refer to block diagram).

2.1033(c)(10) Means for Limiting Modulation

Please refer to Exhibit 7: User Manual, Theory of Operation, and Tune-up Procedure.

2.1033(c)(10) Means for Limiting Power

By amplifying the VCO's oscillation output with a transistor, these amplifiers not only make up for losses in a pad or RF LPF, but also gain the antenna power. The two-stage construction method is employed for the amplifiers to obtain sufficient buffer effects for the VCO, and a 6 dB pad is installed in the amplifier input. The output is less than 50 mW. Location 13 and 14 (Please refer to block diagram).

2.1033(c)(11) Photographs or Drawing of the Equipment Identification Plate or Label

Refer to Exhibit 4

2.1033(c)(12) Photographs of equipment

Refer to Exhibit 5

2.1033(c)(13) Equipment Employing Digital Modulation

N/A

2.1033(c)(14) Data taken per Section 2.1046 to 2.1057

Refer to Exhibit 2

SCOPE

FCC Part 74.861 Subpart H and 90.265(B) testing was performed for the equipment mentioned in this report. The equipment was tested using Sections 2.1046 to 2.1057. TIA-603 was used as a test procedure guideline to perform the required test.

The intentional radiator above was tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with FCC Part 74.861 Subpart H and 90.265(B). Certification of these devices is required as a prerequisite to marketing as defined in Section 2.1033.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to FCC. FCC issues a grant of equipment authorization and a certification number upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product that may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

EMISSION TEST RESULTS

Section 2.1046: RF Power Output

The EUT tested complies with the limits detailed in Section 74.861(E)(1)(i) and Section 90.265(B)(2) with the EUT set to transmit continuously at maximum power. Refer to Setup Photo# 2 in **Exhibit 3** and the test data in **Exhibit 2**: Test Measurement Data for full details.

SECTION 2.1047: MODULATION CHARACTERISTICS

Section 2.1047(a): Voice Modulated Communication Equipment (300 – 3000 Hz)

The constant input test method was used to measure the frequency response from 300 to 3000 Hz. Follow TIA-603 (2.2.6) procedure.

Please refer to Setup Photo# 1 under **Exhibit 3**.
Please, refer to data included under **Exhibit 2**: Test Measurement Data.

Section 2.1047(b): Equipment which employs modulation limiting

No deviation, in access of +/- 75 kHz, was produce at 300, 1000, 2500, and 5000 Hz. Device complies with Section 74.861(E)(3).

No deviation, in access of +/- 25 kHz, was produce at 300, 1000, 2500, and 5000 Hz. Device complies with Section 90.265(B)(1).

Please refer to Setup Photo# 1 under **Exhibit 3**.
Please, refer to data included under **Exhibit 2**: Test Measurement Data.

SECTION 2.1049: OCCUPIED BANDWIDTH

The EUT was tested to show compliance for the emission mask in Section 74.861(E)(6)(i-iii) and Section 90.210(B). The signal was modulated with a 2.5 kHz tone and input voltage adjusted to 16 dB greater than that required to produce 50% deviation.

The Occupied Bandwidth was measured to show compliance to Section 74.861(E)(5) and to Section 90.265(B)(1)

The following Resolution and Video bandwidth was used to show compliance for the above requirement: 300 Hz or 1kHz.

Please refer to Setup Photo# 1 under **Exhibit 3**.
Refer to data included under **Exhibit 2**: Test Measurement Data.

SECTION 2.1051: SPURIOUS EMISSION AT ANTENNA TERMINAL.

The antenna was permanently attached; so radiated emission from 30 MHz to 2 GHz was performed to check for harmonics and spurious emissions. Refer to Section 2.1053: Field Strength Measurements of Spurious emissions.

SECTION 2.1053: FIELD STRENGTH OF SPURIOUS RADIATION.

The following measurements were extracted from the data recorded during the radiated electric field emissions scan and represent the highest amplitude peaks relative to the specification limit. The actual test data is contained in the appendices of this report. The field reading includes the correction factors that were applied on the Test equipment by software means.

Maximized Radiated Unwanted Emissions

Frequency	Level	Pol	90.265, RSS-123		Detector	Azimuth	Height
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters
Signal Substitution							
342.080	-35.0	v	-25.0	-10.0	PK	100	1.1

Frequency	Level	Pol	FCC 74 & RSS-123		Detector	Azimuth	Height
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters
Signal substitution							
392.000	-45.0	v	-25.0	-20.0	PK	130	1.0

Please refer to Setup Photo# 2 under **Exhibit 3**.
Please, refer to data included under **Exhibit 2**: Test Measurement Data.

SECTION 2.1055: FREQUENCY STABILITY

The EUT tested complies with Section 90.265(B)(3) and Section 74.861(E)(4).

Limit:
Per Section 90.265(B)(3): 169 - 174 MHz: +/- 32.5 kHz
Per Section 74.861(E)(4): 174 – 216 MHz: +/- 50 ppm (+/-10.8 kHz drift)

The frequency of the transmitter varied by 2720 Hz over the temperature range of –30 to +50 degrees Celsius.

For voltage stability, the EUT's is battery operated using a +9 Vdc. The battery end point was determined to be at 6**Vdc.** The frequency of the transmitter varied by 0 Hz.

Please, refer to data included under **Exhibit 2**: Test Measurement Data

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on May 9, 2001 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to Section 2.948 of the FCC Rules, construction, calibration, and equipment data has been filed with the Commission.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing are performed in conformance with Section 2 of FCC Rules. Measurements are made with the EUT connected to a spectrum analyzer through an attenuator to prevent overloading the analyzer.

RADIATED EMISSIONS CONSIDERATIONS

Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR 16-1 defined elliptical area.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers are capable of measuring over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the particular detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. If average measurements above 1000MHz are performed, the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz is used.

INSTRUMENT CONTROL COMPUTER

A personal computer is utilized to record the receiver measurements of the field strength at the antenna, which is then compared directly with the appropriate specification limit. The receiver is programmed with appropriate factors to convert the received voltage into filed strength at the antenna. Results are printed in a graphic and/or tabular format, as appropriate.

The test receiver also provides a visual display of the signal being measured.

POWER METER

A power meter and thermister mount may be used for output power measurements from transmitters as they provide a broadband indication of the power output.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or EUT and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transmitters and transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor drive to vary the antenna height.

The requirements of ANSI C63.4 were used for configuration of the equipment turntable. It specifies that the test height above ground for table-mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An appendix of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

Section 2.1047, 2.1049, and 2.1051: CONDUCTED EMISSIONS AT THE ANTENNA PORT

Modulation characterization, Occupied bandwidth, and frequency stability were performed using an E-field probe, which was connected to a test receiver, to detect the fundamental frequency of the EUT. The E-filed probe was place on the EUT in a way that yield maximum pick-up. The EUT was set at the middle of the frequency band and operating at maximum output power.

Section 2.1046: RF OUTPUT POWER

For removable antennas the EUT is configured to operate in the middle of the EUT frequency range at full power. A spectrum analyzer with resolution and video bandwidths of 30 kHz are used to measure the fundamental output power.

For non-removable antennas radiated measurement was performed. The EUT was set to transmit continuously at maximum power. The frequency was set to the middle of the EUT frequency range.

The EUT was place on the turntable and the search antenna position 3 meters away.

During the test, the receiving antenna was rotated to both vertical and horizontal polarizations to determine maximum field strengths. The table on which the EUT is placed is also rotated through 360° and the antenna height is varied to determine the highest amplitude level received.

The substitution method was used to determine the actual ERP transmitted by the EUT. The EUT was replaced with a dipole antenna and a signal generator. The signal generator was set at the same frequency, previously measured, and the amplitude was varied until the amplitude was the same as previously measured.

Section 2.1047: MODULATION CHARACTERISTICS

Voice Modulated Communication Equipment (300 – 3000 Hz)

TIA/EIA-603 section 2.2.6.2.2 procedure was used for modulation characteristics. The constant input test method was used to measure the frequency response from 300 to 3000 Hz. A test fixture was connected to the Frequency Oscillator, which delivered an adjusted level to the EUT. The deviation was measure with a modulation analyzer meter. The following steps were done.

1. Adjusted the transmitter per the manufacture's procedure for full rated system deviation.
2. Apply a 1000 Hz tone and adjusted the audio frequency generator to produce 20% of the rated system deviation.
3. Set the test receiver to measure rms deviation and record the deviation reading as DEVref.
4. Set the audio frequency generator to the desired test frequency between 300 and 3000 Hz.
5. Recorded the test receiver deviation reading as DEVfreq.

6. Calculated the audio frequency response at the present frequency as:
   Audio Frequency response = 20 * log10 (DEVfreq / DEVref)

7. Repeated steps 4 through 6 for all other test frequencies.

Section 2.1047(b): Equipment which employs modulation limiting

The following procedure was used to test the modulation limiting circuit.

A test fixture was connected to the Frequency Oscillator, which delivered an adjusted level to the EUT. The deviation was measure with a modulation analyzer meter. The audio generator was set to 300, 1000, 2500, 3000, and 5,000 Hz and varied the Frequency Oscillator level for each audio frequency. Recorded the level that will produce 10 to 100% deviation. To further assure the limiting capability of the transmitter the level was increase beyond 100%. No deviation, in access of specified deviation, was produce.

Section 2.1055: FREQUENCY STABILITY

The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The spectrum analyzer is configured to give a 6-digit display for the marker-frequency function. The spectrum analyzer's built-in frequency counter is used to measure the maximum deviation of the fundamental frequency at each temperature.

For battery-powered devices the voltage battery end-point is determined by reducing the dc voltage until the unit ceases to function. For AC operated devices reduce the nominal voltage to 85% and to 115%.

EUT AND CABLE PLACEMENT

The FCC requires that for Radiated Emissions interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst-case orientation is used for final measurements.

Section 2.1053: RADIATED EMISSIONS

The EUT was set to transmit continuously at maximum power. The frequency was set to the middle of the EUT frequency range.

The EUT was set on the turntable and the search antenna position 3 meters away. The EUT was set at the middle of the frequency band and set at maximum output power.

Radiated emissions measurements are performed in two phases. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from the lowest frequency generated in the device up to the frequency required by the regulations. For the Test Receiver a Resolution and Video Bandwidth of 100 kHz was used below 1 GHz and a Resolution and Video Bandwidth of 1 MHz was used above 1 GHz. One or more of these is with the antenna polarized vertically while the one or more of these are with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth that results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions that have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

Substitution Method was performed to determine the actual ERP emission levels of the EUT. The EUT was replace with a dipole antenna and a signal generator. The signal generator was set at the same frequency, previously measured, and the amplitude was varied until the same level was the same as previously measured.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 74.861(e)(6)

The limits for radiated emissions are based on the power of the transmitter at the operating frequency. Data is measured in the logarithmic form of decibels relative to one milliwatt (dBm) or one microvolt/meter (dBuV/m,). The field strength of the emissions from the EUT is measured on a test site with a receiver.

Frequency	*Limit*
Operating frequency	24.0 dBm
Operating frequency ± 50% of the bandwidth	25 dB below the amplitude at the operating frequency
Operating frequency ± 100% of thebandwidth	35 dB below the amplitude at the operating frequency
Operating frequency ± 250% of the bandwidth	$43+10*\log_{10}$ (mean output power in watts) dB below the amplitude at the operating frequency

CALCULATION – FIELD STRENGHT FOR SPURIOUS EMISSIONS LIMIT

$$E(V/m) = \frac{\sqrt{30 * P * G}}{d}$$

E= Field Strength in V/m
P= Power in Watts
G= Gain of antenna in numeric gain (Assume 1.64 for ERP)
d= distance in meters

$$E(V/m) = \frac{\sqrt{30 * .05\ W * 1.64\ dB}}{3\ meters}$$

20 * log (.50228 V/m * 1,000,000) = 114.37 dBuV/m @ 3 meters

Section 22.917(e): Request an attenuation of 55 + 10 log (.05) or 42.0 dB for all emissions outside the assigned block, the limit for spurious and harmonic emissions is:

114.37 dBuV/m – 42 dB = 72.37 dBuV/m @ 3 meter.

EXHIBIT 1: Test Equipment Calibration Data

Radiated Emissions, 30 - 1000 MHz, 03-May-01 01:31 AM
Engineer: Rafael

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	DM-105-T1	382	12	8/10/2000	8/10/2001
EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	802	12	2/15/2001	2/15/2002
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	775	12	6/16/2000	6/16/2001
Hewlett Packard	Signal Generator	8656A	295	N/A		
Elliott Laboratories	Dipole antenna	Balum #3	322		1/9/2001	1/9/2002

Radiated (Modulation Characteristics and Occupied Bandwidth), 04-May-01 4:05 PM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	Spectrum Analyzer 9KHz - 26GHz	8563E	284	12	2/22/2001	2/22/2002
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	775	12	6/16/2000	6/16/2001
Hewlett Packard	Test Oscillator	651B	264	N/A		

Temperature and Voltage Stability, 09-May-01 04:18 PM
Engineer: jmartinez

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz)	84125C	1149	12	2/5/2001	2/5/2002
Thermotron	Environmental Chamber	SM-32C	804	Not Required	Not Required	

EXHIBIT 2: Test Measurement Data

The following data includes conducted and radiated emission measurements of the TOA Corporation, model WM 3300 & WM 3310.

T43245 18 Pages

Elliott

EMC Test Data

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Emissions Spec:	FCC & Canada	Class:	n/a
Immunity Spec:		Environment:	

EMC Test Data

For The

TOA

Model

WM-3310

Elliott

EMC Test Data

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Emissions Spec:	FCC & Canada	Class:	n/a
Immunity Spec:	Enter immunity spec on cover	Environment:	

EUT INFORMATION

General Description

The EUT is a wireless transmitter which is designed to tune to a wireless receiving system Normally, the EUT would be placed on the belt or the waist area of a person during operation. The EUT was placed in a table top position during emissions testing to simulate the end user environment. The electrical rating of the EUT is

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
TOA	WM-3310	Transmitter		DLAWM-3310

Other EUT Details

The EUT was tested w/ microphone

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated plastic. It measures approximately 6 cm wide by 2 cm deep by 10 cm high.

Modification History

Mod. #	Test	Date	Modificaiton
1			
2			
3			

Elliott

EMC Test Data

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Emissions Spec:	FCC & Canada	Class:	n/a
Immunity Spec:	Enter immunity spec on cover	Environment:	

Test Configuration Information (1)

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
TOA		microphone		

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

EUT Interface Ports

		Cable(s)		
EUT Port	Connected To	Description	Shielded or Unshielded	Length(m)
Antenna	Wire Antenna			
Microphone	Microphone			0.8

EUT Operation During Emissions

The EUT was transmitting during testing at the channel selected. The EUT was tested for 2 channels, one at a time.

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A

Section 2.1046: Power Output

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/2/2001
Test Engineer: Rafael
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 9V dc

General Test Configuration

The EUT was located on the turntable for radiated emissions testing. Substitution was done for the measured radiated e-field strength to determine the actual output power from the device.

On the OATS, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz. Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measuremen

Ambient Conditions:

Temperature: 18.3°C
Rel. Humidity: 25%

Summary of Results

Run #	Test Performed	Limit	Result	Comment
1	Power Output (WM-3310)	FCC 74, 90, & RSS-124	Pass	Maximum Power = 9 dBm

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A

Run #1: Power Output (Substitution Method)
Channel #2

Frequency	Level	Pol	FCC 74, 90 and RSS-123		Detector	Azimuth	Height	Comments
MHz	dBm	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Signal Substitution								
171.040	-4.0	v	17.0	N/A	PK	340	1.0	
171.040	9.0	h	17.0	N/A	PK	95	1.6	

Client:	TOA Corporation	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC 74, 90.265, & RSS-124	Class:	N/A

Section 2.1049: Modulation Characteristics

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/4/2001
Test Engineer: jmartinez
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 9V dc

General Test Configuration

Used test oscillator to simulate voice frequencies, the voltage level was injected to the EUT through a test fixture. Used an e-field probe to measure the deviation produce by the microphone (EUT). The probe was connected to a test modulation receiver.

Ambient Conditions:

Temperature: 18° C
Rel. Humidity: 35%

Summary of Results

Run #	Test Performed	Limit	Result	Comment
1 and 2	Modulation Limiting	FCC 74, 90, & 123	Pass	
3	Frequency Response	FCC 74, 90, & 124	Pass	Refer to graph# 1

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	TOA Corporation	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC 74, 90.265, & RSS-124	Class:	N/A

Run #1: Modulation Limiting (WM-3310)
Frequency: 171.045 MHz

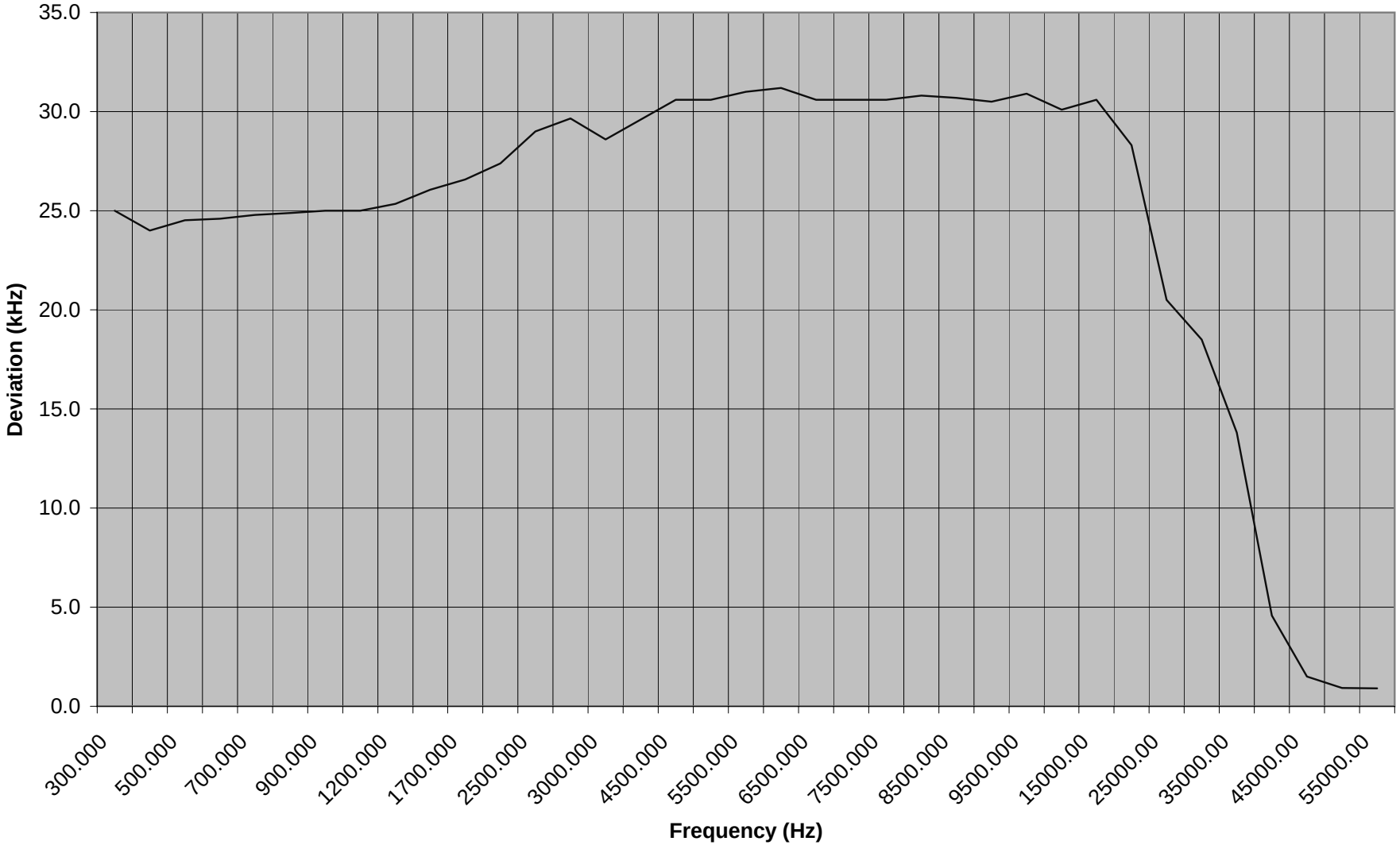
	300 Hz	1kHz	2.5 kHz	5 kHz
	(dBmV)	(dBmV)	(dBmV)	(dBmV)
10%	-65.5	-80.8	-80.9	-40.2
20%	-52.1	-55.4	-58.4	-30.2
30%	-42.2	-46.0	-48.6	-
40%	-	-40.0	-42.6	-
50%	-	-39.4	-39.8	-
60%	-	-33.8	-39.3	-
70%	-	-30.3	-33.8	-
80%	-	-	-30.3	-
90%	-	-	-27.8	-
100%	-	-	-26.0	-
110%	-	-	-	-
120%	-	-	-	-

Run #2: Modulation Limiting (WM-3310)
Frequency: 196.040Hz

	300 Hz	1kHz	2.5 kHz	5 kHz
10%	-50.2	-66.0	-68.0	-38.7
20%	-42.1	-51.7	-54.0	-25.2
30%	-25.8	-44.2	-46.6	-
40%	-	-39.8	-41.5	-
50%	-	-39.3	-39.7	-
60%	-	-33.7	-39.3	-
70%	-	-30.3	-33.7	-
80%	-	-26.4	-30.3	-
90%	-	-	-27.9	-
100%	-	-	-26.0	-
110%	-	-	-	-
120%	-	-	-	-

Input levels are in dBm units.
Note: Although input levels are not stated, the input voltage was increase, but no deviation was produce beyond limiting point.

Frequency Response



Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A

Section 2.1049: Occupied Bandwidth

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/4/2001
Test Engineer: jmartinez
Test Location: SVOATS #2
Config. Used: 1
Config Change: None
EUT Voltage: 9V dc

General Test Configuration

The EUT was measured with an pick up antenna to measure the occupied bandwidth per standard. A test oscillator was used to simulate voice and a modulation test receiver was used to measure the deviation. An HP analyzer was used to plot and measure the Occupied Bandwidth

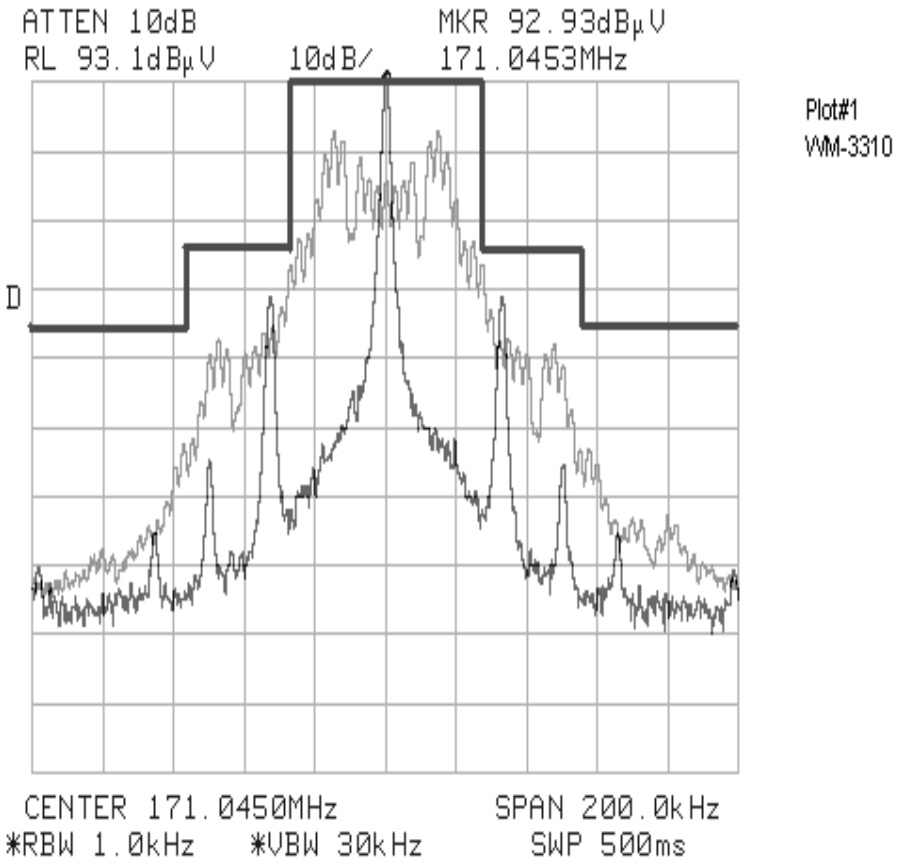
Ambient Conditions:

Temperature: 18°C
Rel. Humidity: 35%

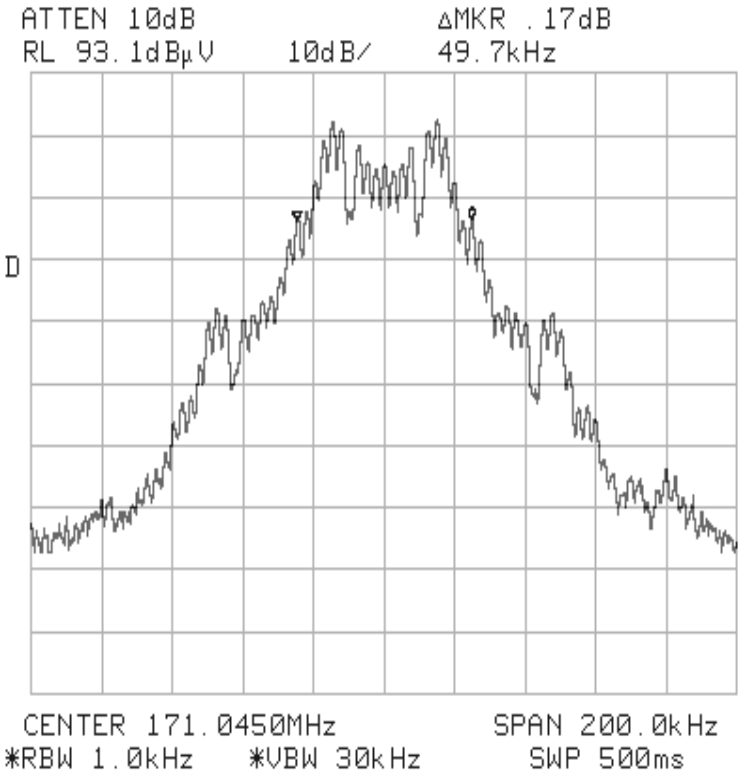
Summary of Results

Plot	Test Performed	Limit	Result	Comment
# 1	Emission Mask	Section 90.265 and RSS-123(6.3.1)	Pass	
# 2	Occupied Bandwidth	Section 74.861 and RSS-123(6.3.3)	Pass	Measured BW = 49.7 kHz
# 3	Emission Mask	Section 90.265 and RSS-123(6.3.1)	Pass	
# 4	Occupied Bandwidth	Section 74.861 and RSS-123(6.3.3)	Pass	Measured BW = 118.3 kHz

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A



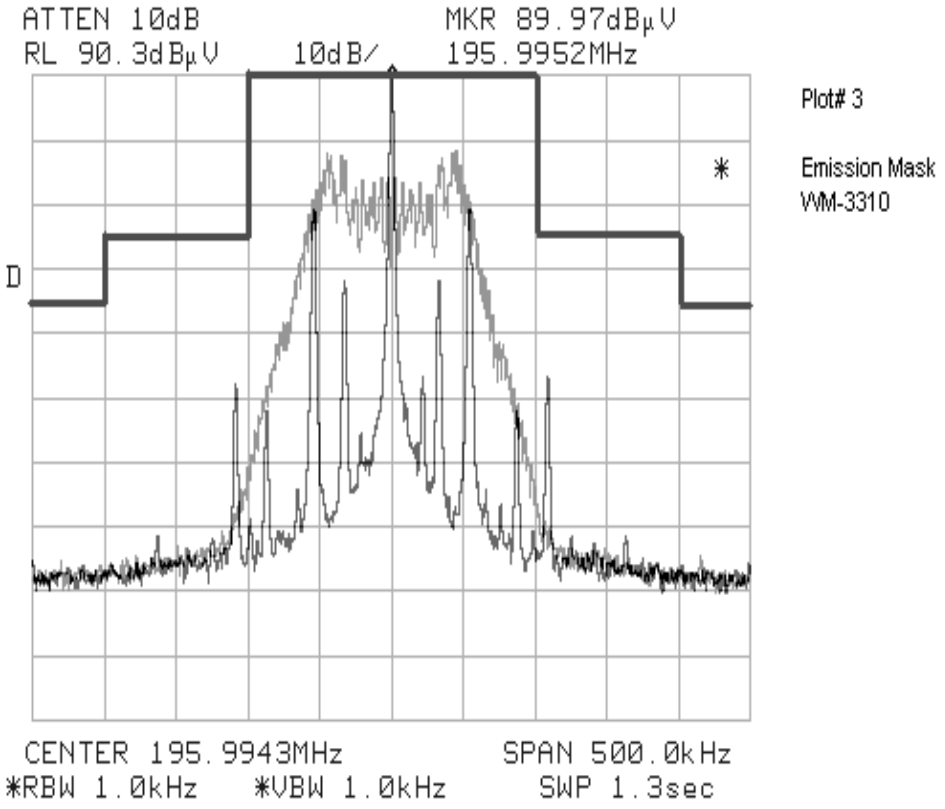
Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A



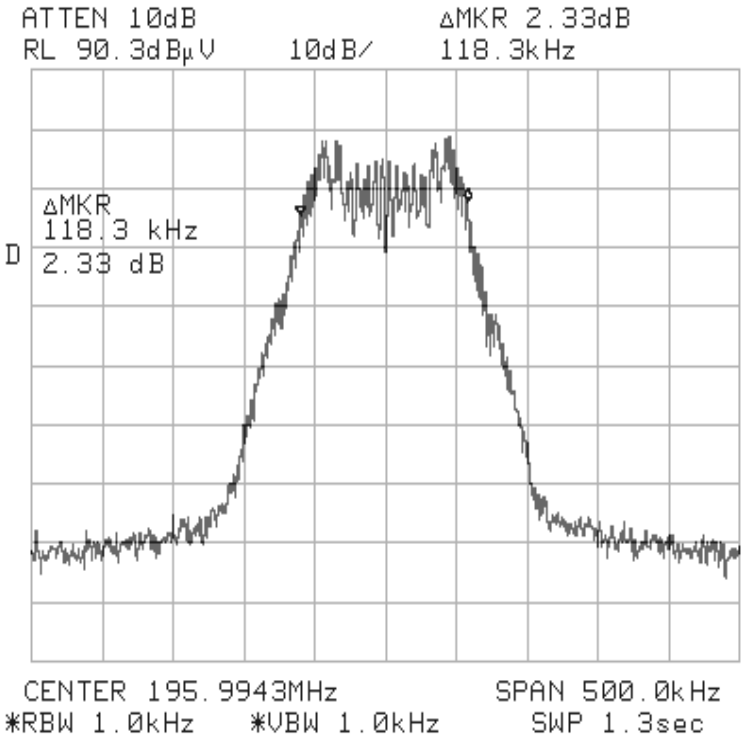
Plot# 2

Occupied Bandwidth
WM-3310

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A



Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A



Plot# 4

Occupied Bandwidth
WM3310

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A

Section 2.1053: Field Strenght of Spurious Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/2/2001
Test Engineer: Rafael
Test Location: SVOATS #2

Config. Used: 1
Config Change:
EUT Voltage: 9Vdc

General Test Configuration

The EUT was located on the turntable for radiated emissions testing.

On the OATS, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 18.3°C
Rel. Humidity: 25%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 1000MHz - Maximized Emissions	FCC 90 and RSS 123	Pass	-10dB @ 342.08 MHz
2	RE, 30 - 1000MHz - Maximized Emissions	FCC 74 and RSS 123	Pass	-20dB @ 392 MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Elliott

EMC Test Data

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A

Deviations From The Standard

No deviations were made from the requirements of the standard.

Run #1: Preliminary Radiated Emissions, 30-1000 MHz
Channel #2 (171.04 MHz)

Frequency	Level	Pol	FCC 90 & RSS-123		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Harmonics								
342.080	60.9	v	70.5	-9.6	PK	100	1.1	
342.080	51.1	h	70.5	-19.4	PK	0	2.2	
513.120	46.7	v	70.5	-23.8	PK	200	1.0	
513.120	39.6	h	70.5	-30.9	PK	345	1.0	
684.160	44.5	v	70.5	-26.0	PK	170	1.0	
684.160	43.5	h	70.5	-27.0	PK	330	1.0	
855.210	46.1	v	70.5	-24.4	PK	95	1.0	
855.210	44.1	h	70.5	-26.4	PK	210	1.2	
Frequency	Level	Pol	FCC 90 & RSS-123		Detector	Azimuth	Height	Comments
MHz	dBm	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Signal Substitution								
342.080	-35.0	v	-25.0	-10.0	PK	100	1.1	

Elliott

EMC Test Data

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A

Run #2: Preliminary Radiated Emissions, 30-1000 MHz
Channel #5 (196 MHz)

Frequency	Level	Pol	FCC 74 & RSS-123		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Harmonics								
392.000	52.5	v	70.5	-18.0	PK	130	1.0	
392.000	43.0	h	70.5	-27.5	PK	220	1.0	
588.000	43.9	v	70.5	-26.6	PK	180	1.0	
588.000	34.7	h	70.5	-35.8	PK	140	1.2	
784.000	46.1	v	70.5	-24.4	PK	30	1.0	partial ambient
784.000	45.7	h	70.5	-24.8	PK	275	1.6	partial ambient
980.000	44.7	v	70.5	-25.8	PK	360	1.0	
980.000	44.5	h	70.5	-26.0	PK	345	1.3	
Frequency	Level	Pol	FCC 74 & RSS-123		Detector	Azimuth	Height	Comments
MHz	dBm	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Signal substitution								
392.000	-45.0	v	-25.0	-20.0	PK	130	1.0	

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A

Section 2.1055: Frequency Stability

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/9/2001
Test Engineer: jmartinez
Test Location: Enviromental Chamber

Config. Used: 1
Config Change: None
EUT Voltage: 9Vdc

General Test Configuration

A spectrum analyzer and support equipment were all place on top of a table, located outside the temperature chamber. A pick-up antenna was used to receive the CW carrier. The pick-up probe was connected to a spectrum analyzer, which was used ot measure the EUT frequency drift.

Ambient Conditions:

Temperature: 22°C
Rel. Humidity: 42%

Summary of Results

Run #	Test Performed	Limit	Result	Comments
1	Temperature Vs. Frequency	FCC 90 & RSS-123	Pass	
2	Temperature Vs. Frequency	FCC 74 & RSS-123	Pass	
3	Temperature Vs. Voltage	FCC 74, 90, & RSS-123	Pass	

Modifications Made During Testing: None

Client:	TOA	Job Number:	J41858
Model:	WM-3310	T-Log Number:	T43245
		Proj Eng:	David Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC & Canada	Class:	N/A

Run# 1: Temperature Vs. Frequency
Frequency: 171.04 MHz

Temp(Celsius)	Drift (Hz)	Limit (kHz)
-30	-750	32.5
-20	0	32.5
-10	750	32.5
0	1300	32.5
10	1000	32.5
20	800	32.5
30	800	32.5
40	500	32.5
50	200	32.5

Run# 2: Temperature Vs. Frequency
Frequency: 196 MHz

Temp(Celsius)	Drift (Hz)	Limit (Hz)
-30	-350	9800
-20	200	9800
-10	850	9800
0	1350	9800
10	1200	9800
20	600	9800
30	568	9800
40	425	9800
50	212	9800

Run# 2: Temperature Vs. Voltage

Battery End-point is **6Vdc**. This is stated in the user manual specification. No drift was measure as DC voltage was reduced.

EXHIBIT 3: Photographs of Test Configuration

EXHIBIT 4: FCC ID Label and Location

1 page

EXHIBIT 5: Internal and External Photos

EXHIBIT 6: Schematics and Block Diagram

EXHIBIT 7: User Manual, Theory of Operation, and Tune-Up procedure