Elliott

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May 12, 2000

Chief, Equipment Authorization Branch,
Authorization and Evaluation Division,
Office of Engineering and Technology
FEDERAL COMMUNICATIONS COMMISSION
P.O. Box 358315
Pittsburgh, PA 15251-5315

Gentlemen:

The enclosed documents constitute a formal submittal and application for a Grant of Equipment Authorization pursuant to Part 74 of FCC Rules (CFR 47) regarding low power auxiliary stations. Data within this report demonstrates that the equipment tested complies with the FCC technical requirements per section 74.861 of the rules.

Elliott Laboratories, as duly authorized agent prepared this submittal. A copy of the letter of our appointment as agent is enclosed.

If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

Sincerely,

David W. Bare
Principal Engineer

DWB/dmg
Enclosures: Agent Authorization Letter
Emissions Test Report with Exhibits

File: R37514

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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C Specifications for an Intentional Radiator on the TOA Corporation Model: WM-4210 and WM-4220

FCC ID:	DLAWM-4210-4220
GRANTEE:	TOA Corporation 2-1 Takamatsu-cho, Takarazuka-shi Hyogo-ken 665 Japan
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	May 12, 2000
FINAL TEST DATE:	March 4 and March 5, 2000
AUTHORIZED SIGNATORY:	David W. Bare Principal Engineer

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SCOPE

An electromagnetic emissions test has been performed on the TOA Corporation models WM-4210 and WM-4220 pursuant to Subpart H of Part 74 of FCC Rules for low power auxiliary stations. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The wireless microphone above has been 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.

The test results recorded herein are based on a single type test of the TOA Corporation models WM-4210 and WM-4220 and therefore apply only to the tested samples. The samples were selected and prepared by Hisayuki Okuoka of TOA Electronics, Inc.

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart H of Part 74 of FCC Rules for the radiated and conducted emissions of low power auxiliary stations. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization 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 that are subsequently manufactured.

STATEMENT OF COMPLIANCE

The tested samples of TOA Corporation models WM-4210 and WM-4220 complied with the requirements of Subpart H of Part 74 of the FCC Rules low power auxiliary stations.

Maintenance of FCC 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

The following emissions tests were performed on the TOA Corporation models WM-4210 and WM-4220. The actual test results are contained in an exhibit of this report.

LIMITS OF POWER, MODULATION, AND BANDWIDTH

The EUT tested complied with the limits detailed in FCC Rules Part 74 Section 74.861(e)(1) (3) and (5).

The maximum power output was 10.7 dBm on the highest channel. The maximum bandwidth was 125 kilohertz with the modulation set at 16 dB above 50% deviation at the point of maximum baseband frequency response. This maximum frequency deviation of 41.6 kilohertz occurred at 18 kHz . This level was applied at a frequency of 19.5 kilohertz, which is the limit of the response of the microphone. The actual test data and any correction factors are contained in an exhibit of this report.

LIMITS OF RADIATED SPURIOUS EMISSIONS

The EUT tested complied with the limits detailed in FCC Rules Part 74 Section 74.861 (e)(6).

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude equivalent radiated power relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

Frequency	Level	Pol	FCC 74.681		Detector	Comments
MHz	dBm	v/h	Limit	Margin	Pk/QP/Avg	
2418.000	-31.6	h	-23.7	-7.9	Pk	

LIMITS OF FREQUENCY TOLERANCE

The EUT tested complied with the limits detailed in FCC Rules Part 74 Section 74.861 (e)(4).

The frequency of the transmitter varied by less than 0.0023 % over the temperature range of –30 to +50 degrees Celsius. The frequency varied by less than 0.0002 % over the battery voltage range of 9V to 6V, which was the battery end point specified by TOA Electronics. The actual test data and any correction factors are contained in an exhibit of this report.

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The TOA Corporation models WM-4210 and WM-4220 are wireless microphones that are designed to transmit voice using frequency modulation to a receiver. The samples were received on March 4, 2000 and tested on March 4 and March 5, 2000. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number
TOA Electronics	WM-4210	Wireless microphone	Not serialized
TOA Electronics	WM-4220	Wireless microphone	Not serialized

OTHER EUT DETAILS

The WM-4210 and WM-4220 are identical except for the microphones used.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 4 cm wide by 23.5 cm high.

MODIFICATIONS

The EUTs did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

No support equipment was used during emissions testing.

EXTERNAL I/O CABLING

The EUT did not use cabling, as there are no ports.

EUT OPERATION

The microphone was powered on during testing. Several types of modulation were applied as noted during testing.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on March 4 and March 5, 2000 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure 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 CISPR 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 supporting engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer runs automated data collection programs that control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

FILTERS/ATTENUATORS

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

ANSI C63.4 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 exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that 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.

RADIATED EMISSIONS

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 regulation specified on page 1. 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.

The recorded level is then reproduced using a signal generator and antenna located where the device was on the test table. The power necessary to reproduce the amplitude of the measured emissions from the device was recorded. The effective radiated power (ERP) is then calculated based on the signal generator level and the gain of the substitution antenna relative to a dipole antenna.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

SPECIFICATION LIMITS AND CALCULATIONS

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, or dB milliwatts (dBm). For radiated emissions, the measured data is obtained by the substitution method. The field strength of the emissions from the EUT are measured on a test site with a receiver. A signal generator and antenna are then substituted for the EUT. The output of the signal generator is adjusted to a level such that the same field strength as was measured from the EUT is observed. The power level is corrected by the difference between the gain of the antenna and the gain of a dipole antenna. This level is recorded as the equivalent radiated power (ERP) of the EUT.

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

Frequency Range (MHz)	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 the bandwidth	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

EXHIBIT 1: Test Equipment Calibration Data

Radiated Emissions, 806 - 8060 MHz, 05-Mar-00 02:23 PM

Engineer: david

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	868	12	09/25/1999	09/25/2000
Filtek	High Pass Filter	HP12/1000-5BA	955	12	04/17/1999	04/17/2000
Hewlett Packard	EMC Receiver /Analyzer	8595EM	780	12	01/03/2000	01/03/2001
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	12/02/1999	12/02/2000
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	775	12	06/10/1999	06/10/2000
Hewlett Packard	Sweep Oscillator	8350B	1001	N/A	None	None
Hewlett Packard	RF Plug-in	83595A	1002	N/A	None	None
EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	786	12	01/08/2000	01/08/2001
Hewlett Packard	Power Meter	432A	259, (F304)	12	02/17/2000	02/17/2001
Hewlett Packard	Thermistor Mount	478A	652	12	02/17/2000	02/17/2001

Conducted Emissions on microphone output, 04-Mar-00 06:27 PM

Engineer: david

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Hewlett Packard	EMC Receiver /Analyzer	8595EM	780	12	01/03/2000	01/03/2001
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	775	12	06/10/1999	06/10/2000
Hewlett Packard	Test Oscillator	651B	264	N/A	None	None
Bruel & Kjaer	Precision Sound Level Meter	2230	Rental	12	12/01/1999	12/01/2000

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T 36118 9 Pages

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EMC Test Data

Client:	TOA Electronics	Job Number:	J36175
Model:	WM-4200, WM-4210, and WM-4220	T-Log Number:	T36118
		Proj Eng:	David W. Bare
Contact:	Hisayuki Okuoka		
Emissions Spec:	FCC 74.681, IC RSS-123	Class:	-
Immunity Spec:	N/A	Environment:	Commercial

EMC Test Data

For The

TOA Electronics

Model

WM-4200, WM-4210, and WM-4220

Client:	TOA Electronics	Job Number:	J36175
Model:	WM-4200, WM-4210, and WM-4220	T-Log Number:	T36118
		Proj Eng:	David W. Bare
Contact:	Hisayuki Okuoka		
Emissions Spec:	FCC 74.681, IC RSS-123	Class:	-
Immunity Spec:	N/A	Environment:	Commercial

EUT INFORMATION

General Description

The EUT is a wireless microphone which is designed to transmit voice using frequency modulation to a receiver. Normally, the EUT would be handheld during operation. The EUT was either placed on a bench or in a chamber during testing. The electrical rating of the EUT is 9V DC supplied from a battery.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
TOA Electronics	WM-4200	Wireless microphone	Not serialized	
TOA Electronics	WM-4210	Wireless microphone	Not serialized	
TOA Electronics	WM-4220	Wireless microphone	Not serialized	

Other EUT Details

The WM-4200, WM-4210, and WM4220 are mostly identical. The WM-4200 is different from other two models in that it has a 4-bank switch, allowing selection of 4x16 frequencies. Additionally, the WM-4200 has an external 1/4 wavelength antenna in contrast to the internal antennas used in WM-4210 and WM-4220.

EUT Enclosure

The EUT enclosure is primarily constructed of plastic. It measures approximately 4 cm wide by 23.5 cm high.

Modification History

Mod. #	Test	Date	Modificaiton
1	N/A	-	-

EMC Test Data

Client:	TOA Electronics	Job Number:	J36175
Model:	WM-4200, WM-4210, and WM-4220	T-Log Number:	T36118
		Proj Eng:	David W. Bare
Contact:	Hisayuki Okuoka		
Emissions Spec:	FCC 74.681, IC RSS-123	Class:	-
Immunity Spec:	N/A	Environment:	Commercial

Test Configuration Information (1)

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None	-	-	-	-

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)
There are no ports on the EUT	-	-	-	-

EUT Operation During Emissions

The microphone was powered on during testing. Several types of modulation were applied as noted during testing.

Client:	TOA Electronics	Job Number:	J36175
Model:	WM-4200, WM-4210, and WM-4220	T-Log Number:	T36118
		Proj Eng:	David W. Bare
Contact:	Hisayuki Okuoka		
Emissions Spec:	FCC 74.681, IC RSS-123	Class:	-
Immunity Spec:	N/A	Environment:	Commercial

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT relative to the specification(s) defined above.

Date of Test: 03/05/2000
Test Engineer: David W. Bare
Test Location: SVOAT #2

Config. Used: WM-4220
Config Change: N/A
EUT Voltage: 9 V DC

General Test Configuration

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

For radiated emissions testing the measurement antenna was located at 3 meters distance from the EUT, unless otherwise noted.

Ambient Conditions

Temp (C): 14°C
Rel. Humidity: 71%

Summary of Results

Run #1: Radiated Emissions, 806-8060 MHz for FCC 74.861

Freq.	Level	Pol	FCC 74.861		Detector	Angle	Hgt	Note
MHz	dBm ERP	v/h	Limit	Margin	Pk/QP/Ave	Deg	m	#
2418.000	-31.6	h	-23.7	-7.9	Pk	250	1.2	

Run #2: Radiated Emissions, 1612-4030 MHz for RSS-123

Measurements made at 3m per FCC requirements

Freq.	Level	Pol	RSS-123		Detector	Angle	Hgt	Note
MHz	dBm ERP	v/h	Limit	Margin	Pk/QP/Ave	Deg	m	#
2418.000	-30.9	h	-35.7	4.8	Pk	250	1.2	

Modifications Made During Testing: None

Elliott

EMC Test Data

Client:	TOA Electronics	Job Number:	J36175
Model:	WM-4200, WM-4210, and WM-4220	T-Log Number:	T36118
		Proj Eng:	David W. Bare
Contact:	Hisayuki Okuoka		
Emissions Spec:	FCC 74.681, IC RSS-123	Class:	-
Immunity Spec:	N/A	Environment:	Commercial

Run #1: Radiated Emissions, 806-8060 MHz, WM-4200 at highest power frequency

Substitution values

Freq.	Level	Pol	ERP		FCC 74.861	Detector	Angle	Hgt	Note
MHz	dBuV/m	v/h	dBm	Limit	Margin (dB)	Pk/QP/Ave	(Deg)	(m)	#
806.000	103.2	v	10.7	24.0	-13.3	Pk	280	1.3	1
806.000	96.3	h	-0.5	24.0	-24.5	Pk	280	2.4	1
1612.000	61.1	v	-35.7	-23.7	-12.0	Pk	180	1.2	1
8060.000	60.8	v	-36.0	-23.7	-12.3	Pk	-	-	2
7254.000	57.8	v	-39.0	-23.7	-15.3	Pk	-	-	2
6448.000	54.9	v	-41.9	-23.7	-18.2	Pk	-	-	2
5642.000	56.3	v	-40.5	-23.7	-16.8	Pk	130	1.2	1
4836.000	52.1	v	-44.7	-23.7	-21.0	Pk	-	-	2
4030.000	56.2	v	-40.6	-23.7	-16.9	Pk	210	1.2	1
3224.000	55.7	v	-41.1	-23.7	-17.4	Pk	180	1.2	1
2418.000	60.7	v	-36.1	-23.7	-12.4	Pk	60	1.4	1
2418.000	65.2	h	-31.6	-23.7	-7.9	Pk	250	1.2	1
1612.000	52.9	h	-43.9	-23.7	-20.2	Pk	240	1.3	1
3224.000	62.0	h	-34.8	-23.7	-11.1	Pk	225	1.3	1
4030.000	55.7	h	-41.1	-23.7	-17.4	Pk	225	1.3	1
4836.000	57.2	h	-39.6	-23.7	-15.9	Pk	190	1.2	1
5642.000	59.0	h	-37.8	-23.7	-14.1	Pk	210	1.1	1

Note 1:	Microphone standing on table
Note 2:	Noise level of measurement system

Run #2: Radiated Emissions, 1612-4030 MHz, WM-4200 at highest power frequency, using 30 kHz for RSS-123

Freq.	Level	Pol	EIRP		RSS-123	Detector	Angle	Hgt	Note
MHz	dBuV/m	v/h	dBm	Limit	Margin (dB)	Pk/QP/Ave	Deg	m	#
1612.000	60.7	v	-34.6	-35.7	1.1	Pk	180	1.2	1
4030.000	52.6	v	-42.7	-35.7	-7.0	Pk	210	1.2	1
3224.000	52.6	v	-42.7	-35.7	-7.0	Pk	180	1.2	1
2418.000	59.5	v	-35.8	-35.7	-0.1	Pk	60	1.4	1
2418.000	64.4	h	-30.9	-35.7	4.8	Pk	250	1.2	1
1612.000	52.1	h	-43.2	-35.7	-7.5	Pk	240	1.3	1
3224.000	59.8	h	-35.5	-35.7	0.2	Pk	225	1.3	1
4030.000	51.0	h	-44.3	-35.7	-8.6	Pk	225	1.3	1

Note 1:	Microphone standing on table

Client:	TOA Electronics	Job Number:	J36175
Model:	WM-4200, WM-4210, and WM-4220	T-Log Number:	T36118
		Proj Eng:	David W. Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC 74.681, IC RSS-123	Class:	-

Conducted Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing the EUT relative to the specification(s) defined above.

Date of Test: 03/04/2000 Config. Used: 1
Test Engineer: David W. Bare Config Change: N/A
Test Location: SVOATS #2 EUT Voltage: 9V DC

General Test Configuration

The output of the transmitter was connected to the modulation analyzer. A speaker connected to an audio oscillator was positioned next to the microphone and used to modulate the microphone. A sound pressure level meter was located next to the microphone of the EUT to set the SPL.

Ambient Conditions:

Temp (°C): 20
Rel. Humidity: 71%

Summary of Results

Run #1: Frequency response measurements, WM-4200
The point of maximum response was 10000 Hz and the 3dB down point was 11 kHz

Run #2: 26 dB Bandwidth measurement at 11 kHz, WM-4200
The bandwidth was measured as 119 kHz using 11kHz modulation at an input level 16 dB above the 50% modulation level at 11000 Hz

Run #3: Frequency response measurements, WM-4210
The point of maximum response was 5000 Hz and the 3dB down point was 18.5 kHz

Run #4: 26 dB Bandwidth measurement at 18.5 kHz, WM-4210
The bandwidth was measured as 115 kHz using 18.5kHz modulation at an input level 16 dB above the 50% modulation level at 5000 Hz

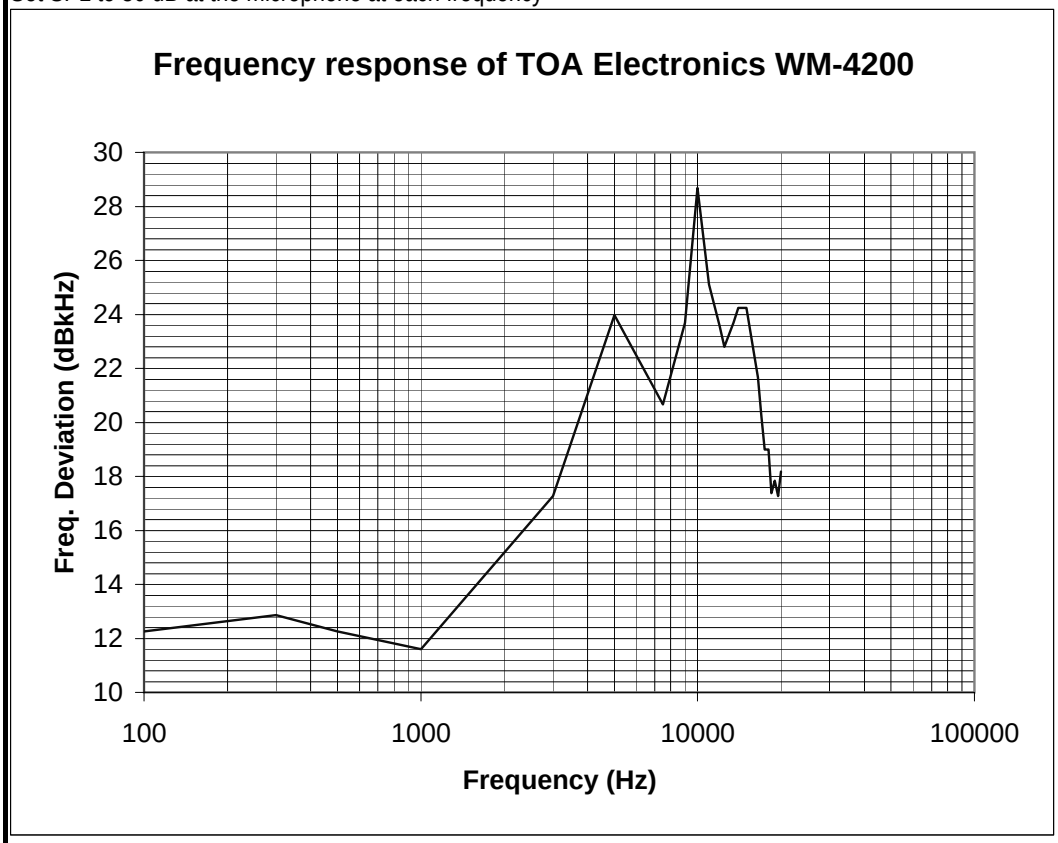
Run #5: Frequency response measurements, WM-4220
The point of maximum response was 18000 Hz and the 3dB down point was 19.5 kHz

Run #6: 26 dB Bandwidth measurement at 19.5 kHz, WM-4220
The bandwidth was measured as 125 kHz using 19.5kHz modulation at an input level 16 dB above the 50% modulation level at 18000 Hz

Modifications Made During Testing: None

Client:	TOA Electronics	Job Number:	J36175
Model:	WM-4200, WM-4210, and WM-4220	T-Log Number:	T36118
		Proj Eng:	David W. Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC 74.681, IC RSS-123	Class:	-

Run #1: Frequency response measurements, WM-4200
Set SPL to 80 dB at the microphone at each frequency



Peak is at 10000 Hz. Maximum deviation at this frequency is 41.8 kHz
50% is 20.9 kHz deviation. 16 dB additional drive is added and the modulation applied at 11000 Hz

Run #2: 26 dB Bandwidth measurement at 11kHz with modluation from run 1

Channel	Bandwidth kHz	Graph
806 MHz	119	T36118 GPH001

Client:	TOA Electronics	Job Number:	J36175
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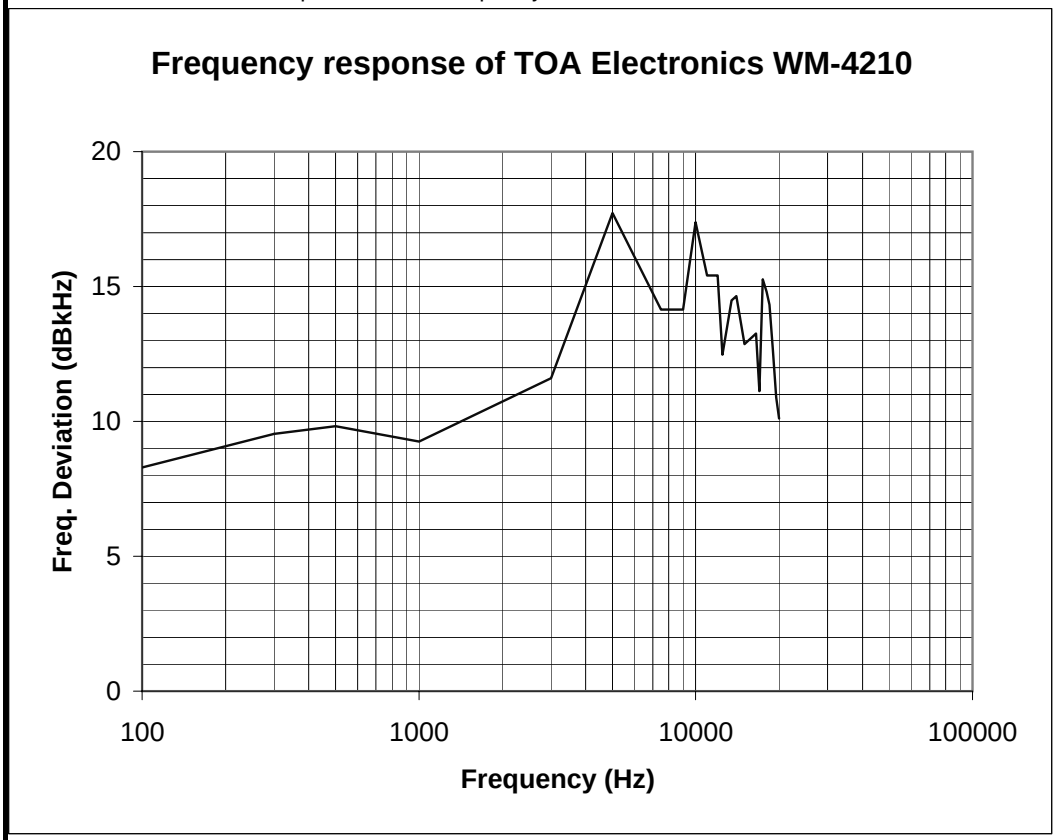
Contact:	Hisayuki Okuoka		
Spec:	FCC 74.681, IC RSS-123	Class:	-

Run #3: Frequency response measurements, WM-4210
Set SPL to 90 dB at the microphone at each frequency



Peak is at 5000 Hz. Maximum deviation at this frequency is 42.6 kHz
50% is 21.3 kHz deviation. 16 dB additional drive is added and the modulation applied at 18500 Hz

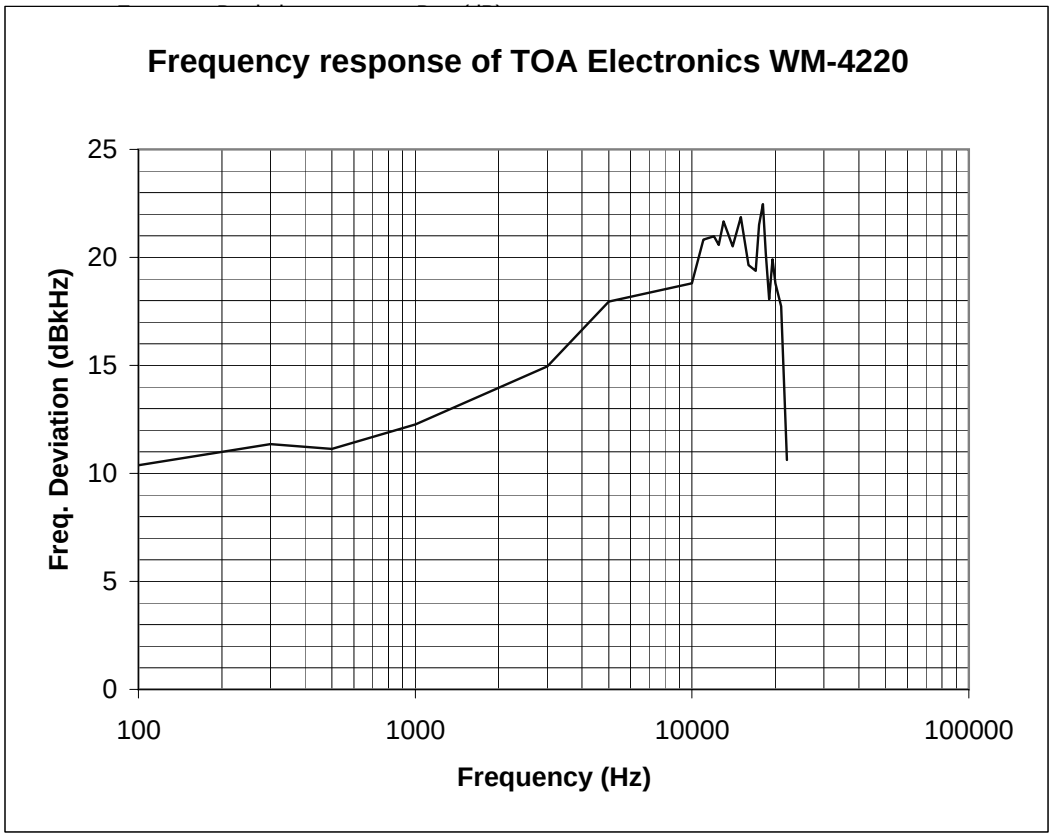
Run #4: 26 dB Bandwidth measurement at 18.5kHz with modluation from run 3

Channel	Bandwidth kHz	Graph
806 MHz	115	T36118 GPH002

Client:	TOA Electronics	Job Number:	J36175
Model:	WM-4200, WM-4210, and WM-4220	T-Log Number:	T36118
		Proj Eng:	David W. Bare
Contact:	Hisayuki Okuoka		
Spec:	FCC 74.681, IC RSS-123	Class:	-

Run #5: Frequency response measurements, WM-4220

Set SPL to 83 dB at the microphone at each frequency



Peak is at 18000 Hz. Maximum deviation at this frequency is 41.6 kHz

50% is 20.8 kHz deviation. 16 dB additional drive is added and the modulation applied at 19500 Hz

Run #6: 26 dB Bandwidth measurement at 19.5kHz with modluation from run 5

Channel	Bandwidth kHz	Graph
806 MHz	125	T36118 GPH003

EXHIBIT 3: Proposed FCC ID Label & Label Location

EXHIBIT 4: Detailed Photographs of TOA Corporation Model WM-4210 and WM-4220 Construction

6 Pages

EXHIBIT 5: Operator's Manual for TOA Corporation Model WM-4210 and WM-4220

4 Pages

EXHIBIT 6: Block Diagram of TOA Corporation Model WM-4210 and WM-4220

2 Pages

EXHIBIT 7: Schematic Diagrams for TOA Corporation Model WM-4210 and WM-4220

4 Pages

EXHIBIT 8: Theory of Operation for TOA Corporation Model WM-4210 and WM-4220

4 Pages