

FCC PART 15.227
EMI MEASUREMENT AND TEST REPORT


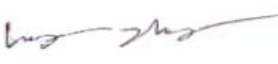
For

Comat Electronic (Shenzhen) Co., Ltd

NO.2 LANE 1,XIN'AN 3RD 28 DISTRICT BAOAN SHENZHEN CHINA

| |
|---------------------------|
| FCC ID: RTX-M-9038 |
|---------------------------|

2004 -02-03

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| This Report Concerns: <input checked="" type="checkbox"/> Original Report | Equipment Type: Transmitter, Wireless Mouse |
|  | |
| Test Engineer: | Jerry Wang/ |
| Report No.: | R0401062(T) |
| Test Date: | 2004-01-15 |
|  | |
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Note: This test report is specially limited to the above client company and product model only.
It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Comat Electronic(Shenzhen) Co., Ltd* 's product, model number: M9038 or the "EUT" as referred to in this report is a Wireless Mouse Transmitter. The EUT is measured approximately 4.75" L x 2.25" W x 1.25" H.

** The test data gathered are from production sample, serial number:0001, provided by the manufacturer.*

Objective

This Type approval report is prepared on behalf of *Comat Electronic(Shenzhen) Co., Ltd* in accordance with Part 2, Subpart J, and Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules, sec 15.203, 15.205, 15.209 and sec 15.227.

Related Submittal(s)/Grant(s)

No Related Submittals.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2001, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

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

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2001.

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

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to ANSI C63.4-2001.

Schematics and Block Diagram

Please refer to Appendix D.

Equipment Modifications

No modifications were made to the EUT.

Test Setup Configuration



Mouse Transmitter

SUMMARY OF TEST RESULTS

Results reported relate only to the product tested, serial number:0001.

| FCC RULES | DESCRIPTION OF TEST | RESULT |
|------------|-------------------------|-----------|
| §15.203 | Antenna requirement | Compliant |
| §15.205 | Restricted Band | Compliant |
| §15.209 | Radiated Emission Limit | Compliant |
| §15.207 | Conducted | Compliant |
| §15.227 | Frequency of Operation | Compliant |
| §15.227(a) | Field Strength | Compliant |
| §15.227(b) | Band Edge | Compliant |

§15.203 - ANTENNA REQUIREMENT

Standard Applicable

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Refer to statement below for compliance.

“The antenna for this device is an integral antenna that the end user cannot access.

§15.205, §15.209, §15.227(b) - RADIATED EMISSIONS TEST

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ± 4.0 dB.

The fundamental data was recorded in average detection mode: set the VBW AVE on, then record the data.

EUT Setup

The radiated emission tests were performed in the open area 10-meter test site, using the setup accordance with the ANSI C63.4-2001. The specification used was the FCC Part 15 Subpart C limits.

Spectrum Analyzer Setup

According to FCC Rules, 47 CFR 15.33, the EUT emissions were investigated from 27 to 1000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

| <i>Frequency Range</i> | <i>RBW</i> | <i>Video B/W</i> |
|-------------------------------|-------------------|-------------------------|
| Below 30MHz | 10kHz | 10kHz |
| 30 – 1000MHz | 100kHz | 100kHz |
| Above 1000MHz | 1MHz | 1MHz |

Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|--------------|-------------------------|--------|---------------|------------|
| HP | Amplifier (0.1-1300MHz) | 8447E | 2944A10187 | 2003-09-23 |
| HP | Spectrum Analyzer | 8565EC | 3946A00131 | 2003-06-30 |
| EMCO | Biconical Antenna | 3110B | 9309-1165 | 2003-10-11 |
| ETS | Logperiodic Antenna | 3148 | 0004-1155 | 2003-10-11 |
| COM-Power | Loop Antenna | AL-130 | 17043 | 2003-04-03 |

* **Statement of Traceability:** BACL Corp. certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

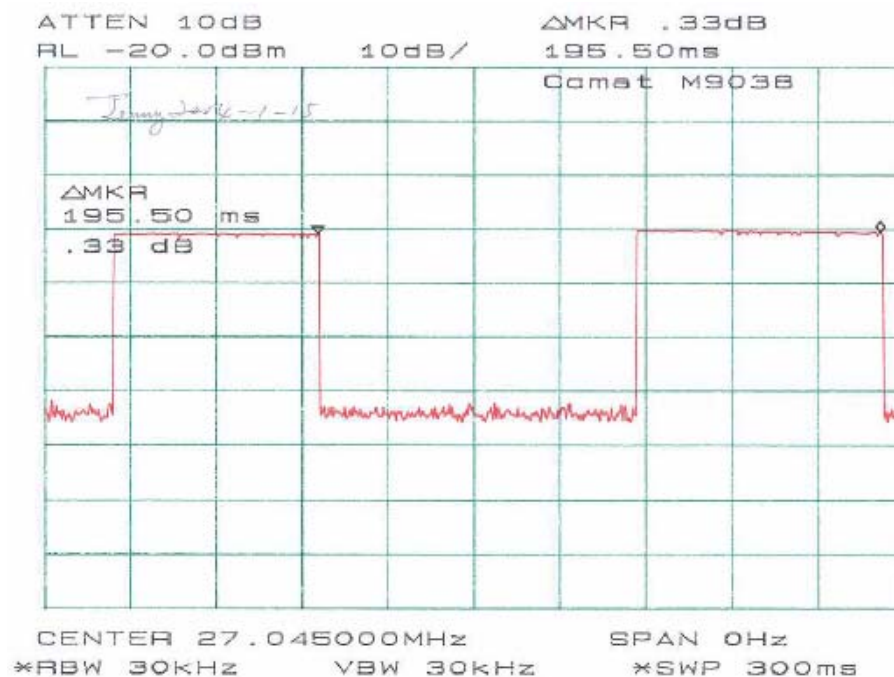
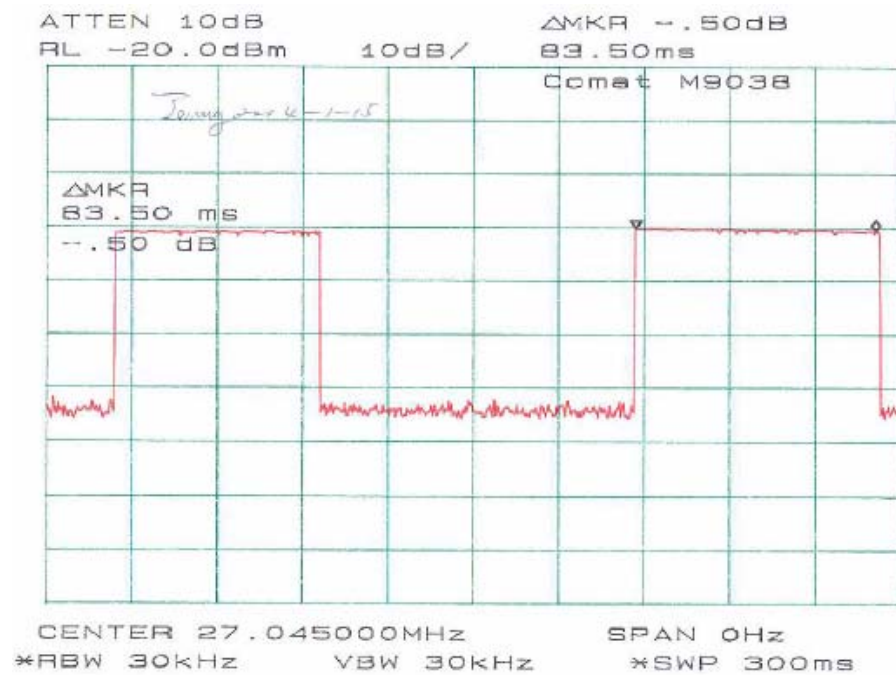
Maximizing procedure was performed on the six (6) highest emissions in the described configurations.

According to FCC rules 15.33 (c) and ANSI C63.4-2001 Annex I.4, when average detector function limits are specified for a pulse-modulated transmitter, the average level of emission may be found by measuring the peak level of the emissions and correcting them with the duty cycle as follows:

- 1) Turn on the transmitter, and set it to transmit the pulse train continuously.
- 2) Tune a spectrum analyzer to the transmitter, carrier frequency, and set the spectrum analyzer resolution bandwidth wide enough to encompass all significant spectral components. The video bandwidth should be at least as wide as the resolution bandwidth.
- 3) Set the spectrum analyzer vertical scale (amplitude) to the linear mode and the analyzer frequency scan to 0Hz.
- 4) Calculate the duty cycle = Tx on / (Tx on + Tx off) = 83.5 / 195.5 = 42.7%
- 5) Multiply the peak-detector field strength (expressed in uV/m) of an emission from a transmitter using pulsed modulation by the duty cycle just measured to determine the average detector field strength of that emission for comparison to the average detector limit.

Please refer to the plots in next page for duty cycle.

Other data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBμV of specification limits), and are distinguished with a "Qp" in the data table.



Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

Summary of Test Results

According to the final data in following table, the EUT complied with the FCC 15.227 and FCC 15.209 standards, and had the worst margin of:

-85.21 μV/m at 54.09 MHz in the Horizontal polarization

Environmental Conditions

| | |
|--------------------|-----------|
| Temperature: | 16° C |
| Relative Humidity: | 53% |
| ATM Pressure: | 1035 mbar |

Radiated Emissions Test Result Data

| INDICATED | | TABLE | ANTENNA | | CORRECTION FACTOR | | | CORRECTED AMPLITUDE | | FCC | |
|-----------|---|--------|---------|-------|-------------------|-------|------|---------------------|--------|--------|---------------------|
| Freq. | Ampl. | Angle | Height | Polar | Antenna | Cable | Amp. | Corr. Ampl. | | Limit | Margin |
| MHz | dBμV/m | Degree | Meter | H/ V | dBμV/m | dB | dB | dBμV/m | μV/m | μV/m | μV/m |
| 54.09 | 38.2 | 60 | 1.8 | H | 10.5 | 2.0 | 27.3 | 23.4 | 14.79 | 100 | -85.21 Peak |
| 54.09 | 37.9 | 270 | 1.4 | V | 10.5 | 2.0 | 27.3 | 23.1 | 14.29 | 100 | -85.71 Peak |
| 81.135 | 37.4 | 330 | 1.3 | V | 9.6 | 2.7 | 27.5 | 22.2 | 12.88 | 100 | -87.12 Peak |
| 81.135 | 36.6 | 90 | 1.2 | H | 9.6 | 2.7 | 27.5 | 21.4 | 11.75 | 100 | -88.25 Peak |
| 189.32 | 35.4 | 0 | 1.6 | H | 13.8 | 4.0 | 27.1 | 26.1 | 20.18 | 150 | -129.82 Peak |
| 189.31 | 33.9 | 180 | 1.5 | H | 13.8 | 4.0 | 27.1 | 24.6 | 16.98 | 150 | -133.02 Peak |
| 108.18 | 34.2 | 45 | 1.4 | V | 11.4 | 3.2 | 27.7 | 21.1 | 11.35 | 150 | -138.65 Peak |
| 108.18 | 32.3 | 30 | 1.2 | H | 11.4 | 3.2 | 27.7 | 19.2 | 9.12 | 150 | -140.88 Peak |
| 27.045(V) | Ave = Peak * Duty Cycle = 291.74*0.427=124.57 | | | | | | | | 124.57 | 10000 | -9875.43 |
| 27.045(H) | Ave = Peak * Duty Cycle = 281.84*0.427=120.35 | | | | | | | | 120.35 | 10000 | -9879.65 |
| 27.045 | 58.2 | 0 | 1.2 | V | 15.3 | 0.8 | 25 | 49.3 | 291.74 | 100000 | -99708.26 Fund/Peak |
| 27.045 | 57.9 | 30 | 1.6 | H | 15.3 | 0.8 | 25 | 49.0 | 281.84 | 100000 | -99718.16 Fund/Peak |

NOTES:

FUND: =Fundamental.

The mouse transmitter was placed in continuous transmit mode for all tests.

The EUT was tested in all 3 orthogonal planes.

§15.227(b) - Out of Band Emission

The result has been complied with the 15.227(b), see the following plot:

