

**INSTRUCTION MANUAL**  
**For**  
**Comb Generators**

**Models CGO-51000**  
**1 to 40 GHz, 1 GHz**



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## **1.0 Introduction**

This manual includes product specifications, safety precautions, product maintenance and warranty information.

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## 2.0 Product Specifications

<b>Model:</b>	<b>CGO-51000</b>
<b>Electrical</b>	
Frequency Range:	1 GHz to 40 GHz
Frequency Step Size	1 GHz
Frequency Stability	25 ppm
Antenna	Built in
External Indicators	Power on and Battery low
Battery Type:	Rechargeable 6 V, NiMH
Charging adapter output	6 VDC, 500mA (Unregulated)
Charging adapter input	115 /230 VAC, 60/50 Hz
Charging time	8-10 hours
Operating time	Approximately 18 hours
Operating Temperature	15° C to 40° C / 59° F to 104° F
<b>Mechanical</b>	
Dimensions W x H	7 x 1 inch / 17.8 x 2.54 cm
Weight:	2.5 lbs / 1.1 kg

*This equipment is designed for indoor and outdoor use.*

### 2.1 Other related Com-Power Equipment that can be used with the Comb Generators.

- Passive Horn antenna model AH-840, 18-40 GHz
- Active Horn antenna model AHA-840, 18-40 GHz
- Preamplifier model – PAM-840A, 18-40 GHz, 40 dB Gain

## 3.0 Important Precautions

### Battery care and instructions:

#### To avoid any risk of explosion

- Replace batteries with the size and type specified in this manual.
- Do not dispose of batteries in a fire or trash incinerator, or leave batteries under direct sunlight.
- Do not immerse batteries in water or otherwise get them wet.
- Do not charge batteries, that appear to be leaking, discolored, rusty, deformed; emit an odor
- Use only battery charger adapter supplied with the Comb Generator to charge the batteries.

The only user replaceable part in the Comb Generator is the battery pack. It can be accessed from the bottom of the unit. There are no other user serviceable parts inside the unit. If the Comb Generator needs repair please contact authorized Com-Power service center.

## 4.0 Warranty

Com-Power warrants to its Customers that the products it manufactures will be free from defects in materials and workmanship for a **period of 3 years**. This warranty shall not apply to:

- Transport damages during shipment from your plant.
- Damages due to poor packaging.
- Products operated outside their specifications.
- Products Improperly maintained or modified.
- Consumable items such as fuses, power cords, cables, etc.
- Normal wear
- Calibration
- Products shipped outside the United States without the prior knowledge of Com-Power.

In addition, Com-Power shall not be obliged to provide service under this warranty to repair damage resulting from attempts to install, repair, service or modify the instrument by personnel other than Com-Power service representatives.

Under no circumstances does Com-Power recognize or assume liability for any loss, damage or expense arising, either directly or indirectly, from the use or handling of this product, or any inability to use this product separately or in combination with any other equipment.

When requesting warranty, calibration or repair services, it is recommended that the original packaging material be used for shipping. Damage due to improper packaging will void warranty.

In the case of repair or complaint, a label should be attached to the housing of the instrument which describes briefly the faults observed. Please include the name, telephone number and email address of the contact person. Please visit our website [www.com-power.com](http://www.com-power.com) and obtain an RMA number by selecting service and completing the online form.

## 4.1 Maintenance

This product contains no user replaceable parts other than the battery. If the unit does not operate or needs calibration, please contact Com-Power Corporation. Do not remove the instrument cover. The batteries can be accessed from the the bottom of the unit if needs replacement. Any modifications or repairs performed on the unit by anyone other than an authorized factory trained technician will void warranty.

The exterior surface may be cleaned with mild detergent and then be wiped with a dry, clean, lint-free cloth. Use care to avoid any liquids or foreign objects entering the chassis.

## **5.0 Application and product operation**

### **5.1 Application**

Com-Power CGO-51000 Comb Generator is designed specifically for EMI Site verification testing up to 40 GHz. The CGO-51000 has higher frequency stability of 25 ppm enhancing the accuracy of frequency output.

A Comb Generator provides the fundamental and harmonics of the step frequency. The CGO-51000 Comb Generator generates frequencies in 1 GHz steps. The fundamental frequency of 1 GHz and all harmonics up to 40 GHz are present at the output as soon as the power switch is turned on. For example, if viewed with a spectrum analyzer or EMI receiver, the output harmonics 1, 2, 3 GHz etc. can be seen. It has a circular chassis for improved omni-directional signal radiation.

EMC test laboratories use Open Area Test Sites or Anechoic chambers for EMI radiated emissions testing. These test sites are constructed with specific requirements and are calibrated in a precise manner to optimize the reliability of the measured emissions. The time and expense incurred is considered essential to increase the repeatability of the data taken on these sites.

The data taken on these calibrated sites are generally reliable. However, in some instances, discrepancies do occur, and the reliability of data is questionable. Such discrepancies could be discovered when either (a) data from two test sites for the same equipment do not match, or (b) the data from two different occasions for the same equipment at the same sites are not consistent.

It is important to find the cause for such inconsistency. However, this is generally very time consuming and difficult because the reason could be one of four complex factors. That includes the equipment under test (EUT), site, test instrumentation and test personnel. Each of these factors may have many possible causes. The EUT, for example, may have changed due to component variation, temperature, operating mode, wear and tear, design etc. The test site may be a cause due to a reflective object near the site, variation of ground saturation or ambient signal presence. It also could be due to malfunctioning test instrumentation. The burden of finding and avoiding such a situation always falls on the test personnel.

It is essential to know if and when a problem occurs, as well as the exact reason causing the problem. The Comb Generator can help in the process to determine the causes of the problems.

### **5.1.1 Operating Procedures**

Measure the emissions from the Comb Generator at a few standard frequencies and record the levels in a daily log prior to starting a radiated emissions test.

- Set up the Comb Generator at the test site with the appropriate antenna. There may be some variation at higher frequency so consistently using the same direction minimizes the variation due to direction. For convenience, the Comb Generator has angle markings on the top.
- Take measurement at discrete frequencies such as 1 GHz, 2 GHz, 5 GHz, 10 GHz, 12 GHz, 15 GHz, 18 GHz, 40GHz etc. Record this in the daily log.
- Compare this data with the daily log of prior readings to make sure that the pattern does not have abrupt changes from the established daily log at any frequency.

This daily log is used to detect any test equipment or test site related problem as described below.

### **5.1.2 Problems Related to Test Equipment**

Variation on the daily log of the Comb Generator output data is dependent on the test equipment as well as test site. The Comb Generator replaces the EUT. The Comb Generator not only generates the output simultaneously at all the harmonics, and has very high output amplitude stability. This is achieved by utilizing a stabilized signal circuit as well as geometry of the radiator.

With the variations due to the EUT practically eliminated, only variations remaining are due to other factors, mainly the test instrumentation and the test site. The variation due to test instrumentation is limited to the sum total of the tolerance on all test equipment used (spectrum analyzer, antenna, Comb Generator, cables). A few days of data will establish the range of variation to be expected at a site. Variation of less than  $\pm 3$  dB is usually considered normal. Any variation in the readings above normal indicates a potential problem.

Log established over a period of time can be used to detect potential problems with measurements, so that it can be promptly investigated.

### **5.1.3 Problems Related to test site**

The above procedure cannot distinguish the problems related to a test site. The Comb Generator can be used in two ways to detect any problem with a test site. One method is to start the daily log immediately after the TEST SITE is calibrated. This way, one is certain about the validity of the TEST SITE. The second method is to calibrate the Comb Generator radiated output as absolute emission level. Such calibration is provided as an option with the Comb Generators.

In addition, when difficulty arises with any EUT data taken at two different sites, the Comb Generator can be used to determine if both sites give reliable results, just by comparing the data at the two sites with the Comb Generator. In this case, if the two sites do not produce comparable results, the site with data matching closest to the Comb Generator's absolute emission level can be considered more reliable.

### **5.1.4 Problems Related to Test Personnel**

The Comb Generator cannot directly help to eliminate the test personnel related problems. However, by increasing the confidence level and establishing definite procedures for eliminating test site and equipment related problems it helps tremendously in reducing the problems related to EMI measurements.

## **5.2 Items included with the Comb Generator**

The following accessories and documents are supplied with the Model CGO-51000 Comb Generator:

- Battery Charger / Power Adapter
- Instruction Manual
- Radiated test data (Optional)
- Rechargeable battery (pre-installed)

#### **Optional items**

- Spare battery pack



## 5.4 Battery Replacement

The replaceable battery pack can be accessed from the bottom of the Comb Generator. Six screws secure the cover to the battery compartment. Please charge the new batteries before first use to maximize operating time of the Comb Generator.

## 5.5 Troubleshooting Common problems

**Problem: No Output.**

**A: Make sure the power switch is on and the green LED is lit.**

- Make sure the battery low indicator is not on. Check all the interconnecting cables, adapters and connectors from the receiving antenna to the receiver. Check the operation of the receiver and preamplifier.
- Reduce resolution bandwidth and measurement span of the receiver to see if you can see the signal above the noise floor of your receiver.

**Problem: Battery low indicator remains lit even after charging for more than 5/6 hours.**

**A:** The battery may need to be replaced. However, before you replace the battery perform the following steps

- Make sure the battery terminals are properly connected to the battery socket in the Comb Generator. Make sure you are charging Comb Generator only with supplied adapter.
- Check the charging adapter to make sure it is supplying the proper voltage. The unloaded (without connecting it to the Comb Generator) voltage measured at the charger output jack should be at least 7.5Vdc to properly charge the Comb Generator batteries. If the charging adapter is not producing the proper voltage replace the adapter, otherwise replace battery and try charging it again.

## 6.0 Typical Radiated Output of the Comb Generator

