



**HEROS**  
technology Ltd  
general electronics



## Frequency Marker/Combo-Pattern Generator

1MHz-100kHz-10kHz composite Combo-Pattern Generator

10MHz-1MHz-100kHz-10kHz-1kHz-100Hz-10Hz-1Hz Marker Generator

**User manual. Rev 01  
(April 2018)**

## Introduction

The Frequency Marker/Combo-Pattern Generator is a non-conventional, cost-effective, high precision signal generator and reference signal level for radio calibration and alignment purposes up to 3 GHz.

The simplest way to obtain many fixed frequencies simultaneously is by adopting the frequency-marker principle. Instead of generating a specific frequency and signal level according to the control settings as conventional generators do, our Frequency Marker/Combo-Pattern Generator generates a composite square wave pulse train of 1MHz, 100kHz and 10kHz signals of precise frequency and amplitude called MARKS.

Those square pulse trains have very sharp edges to generate rich content of harmonics in order to reach the highest possible frequency. For example, marks of 1 MHz can be detected up to the SHF region of the radio spectrum.

As a complement for low and medium frequency measurements, the Frequency Marker/Combo-Pattern Generator incorporates an additional Frequency Marker Generator delivering a range of eight selectable frequencies of 10MHz- 1MHz- 100kHz- 10kHz- 1kHz- 100Hz- 10Hz- 1Hz.

## Architecture

It comprises two separate RF signal generators driven by a common high precision TCXO master oscillator clock source:

### - Combo-Pattern Generator.

A method by which 1MHz-100 kHz and 10 kHz signals are synthesized by creating a formatted pattern sequence of digital pulses.

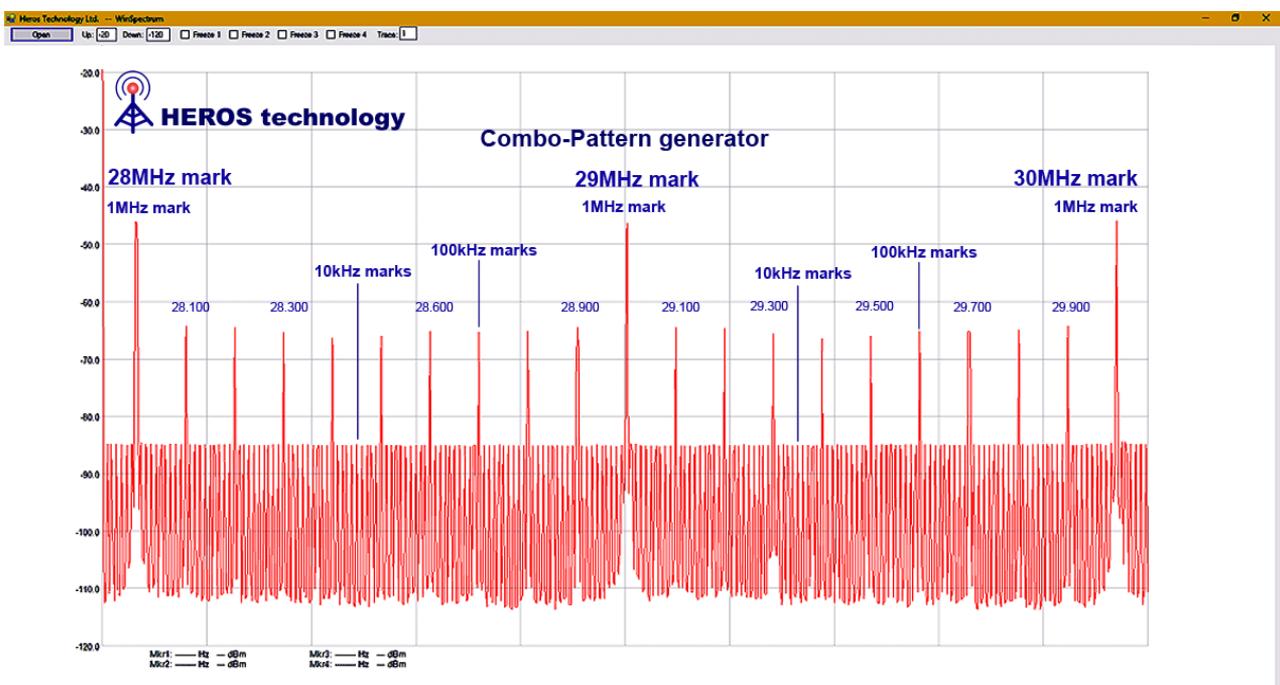
This composite signal pattern is delivered with precise reference level for signal-strength meter (S-Meter) calibration purpose. 1MHz signal mark can be detected up to 3 GHz. 100 kHz and 10 kHz signal marks can be detected up to the top region of the UHF radio spectrum.

In order to recognize each signal from the others, they are labelled by its amplitude level following IARU technical recommendations. The 1MHz mark signal level corresponds to a received power of S9+20 or -53dBm (500uV) on a signal-strength meter. The 100kHz mark matches S9 level or -73dBm (50uV) and the 10kHz mark level is S6 or -91dBm (6.3uV).

With the help of an external variable attenuator (not included), intermediate levels on the S-Meter scale can be easily calibrated, knowing that each S-unit change in level corresponds to 6dB.

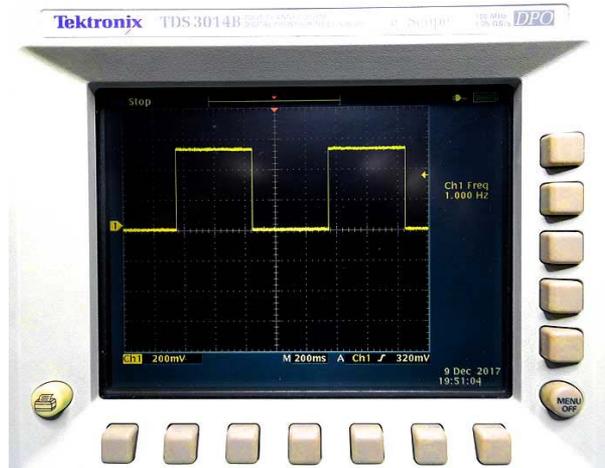
S9 = -73dBm	S7 = -85dBm	S5 = -97dBm	S3 = -109dBm
S8 = -79dBm	S6 = -91dBm	S4 = -103dBm	S2 = -115dBm

It is highly advisable the use of an external variable attenuator (not included) to improve level accuracy over a wide range of frequencies. The attenuator is connected between the generator output port and the device under test (DUT). This way provides isolation between the frequency-correction network and possible capacitive load on the DUT input port.



- Marker Generator

Delivering a range of eight selectable square signal output marks of 10MHz-1MHz-100 kHz-10 kHz-1 kHz-100Hz-10Hz-1Hz over 50 Ω output impedance. The amplitude level of the signal can be varied by the user. Those mark signals can be detected up to VHF region.



- Master oscillator, clock generator

The internal 10MHz high precision low phase noise internal TCXO master oscillator is suitable for most applications. If long term precision is needed an auxiliary input port is available for a 10MHz external reference source such as GPS-locked frequency clock generator that can reach an accuracy of  $1 \times 10^{-12}$  (one picoHz)

Some application examples:

Ham radio devices, scanners, signal level reference, S-Meter calibration for radio receivers, general frequency reference, propagation beacons, testing radiation pattern of antennas, transmitters and receivers reference, reference pulses for testing purposes, instrumentation and laboratory reference, clock reference for video and audio equipment, DAC-ADC clock reference and physics lab applications among much more implementations.



**Front panel:**

- 1- Power switch.
- 2- Combo-Pattern SHF output port. 50Ω
- 3- Combo-Pattern HF-VHF output port. 50Ω
- 4- Power-On LED pilot indicator.
- 5- Internal-External Master oscillator LED pilot indicator.
- 6- 10kHz Combo-patern On-Off LED pilot indicator..
- 7- 10kHz Combo-patern On-Off switch.
- 8- Marker output frequency selection.
- 9- Marker output signal level adjust.
- 10- Marker output port. 50Ω



**Rear panel:**

- 11- Power port. DC 12V-13.5V/150mA
- 12- Chassis earth.
- 13- Internal-External Master oscillator toggle selector.
- 14- 10MHz external reference source port. 5VPP max,50Ω



## Specifications

### Combo-Pattern Generator:

- Frequency Range: 10kHz - 3GHz
- Frequency Step Size 1 MHz, 100kHz, 10kHz
- Internal/External master reference clock selector switch.

### TCXO internal master oscillator:

- Clock frequency: 10MHz
- Frequency stability  $\pm 1.5$ PPM
- Time stability  $\pm 1.0$  PPM per year

### External reference master oscillator:

- Frequency: 10MHz.
- Input Ref. signal level: 1V rms; 2.5V rms max; 50 Ohms

If GPS external reference is used: Frequency stability:  
 $1 \times 10^{-12}$ . One picoHz.

### Two Combo-Pattern output ports:

- HF port range: 10kHz-500MHz
- 10kHz to 60 MHz calibrated level. 100kHz marks @ -73dBm (S9)  $\pm 1$ dBm
- SHF port range: 10kHz-3 GHz.

- Amplitude Stability:  $\pm 1$ dB

### Marker Generator:

- Frequency range selection: 10MHz- 1MHz- 100kHz- 10kHz- 1kHz- 100Hz- 10Hz- 1Hz.
- Output signal: Square wave. 50% duty cycle. (odd harmonics stronger than even ones)
- Output level: Variable 1Vrms max. 50 Ohms.

### Input/output port connectors:

- Shielded BNC.

### Operating controls:

Power On/Off - Combo 10kHz mark On/Off - Marker Freq. selector - Marker output level - Internal/external master oscillator selector

### LED indicators:

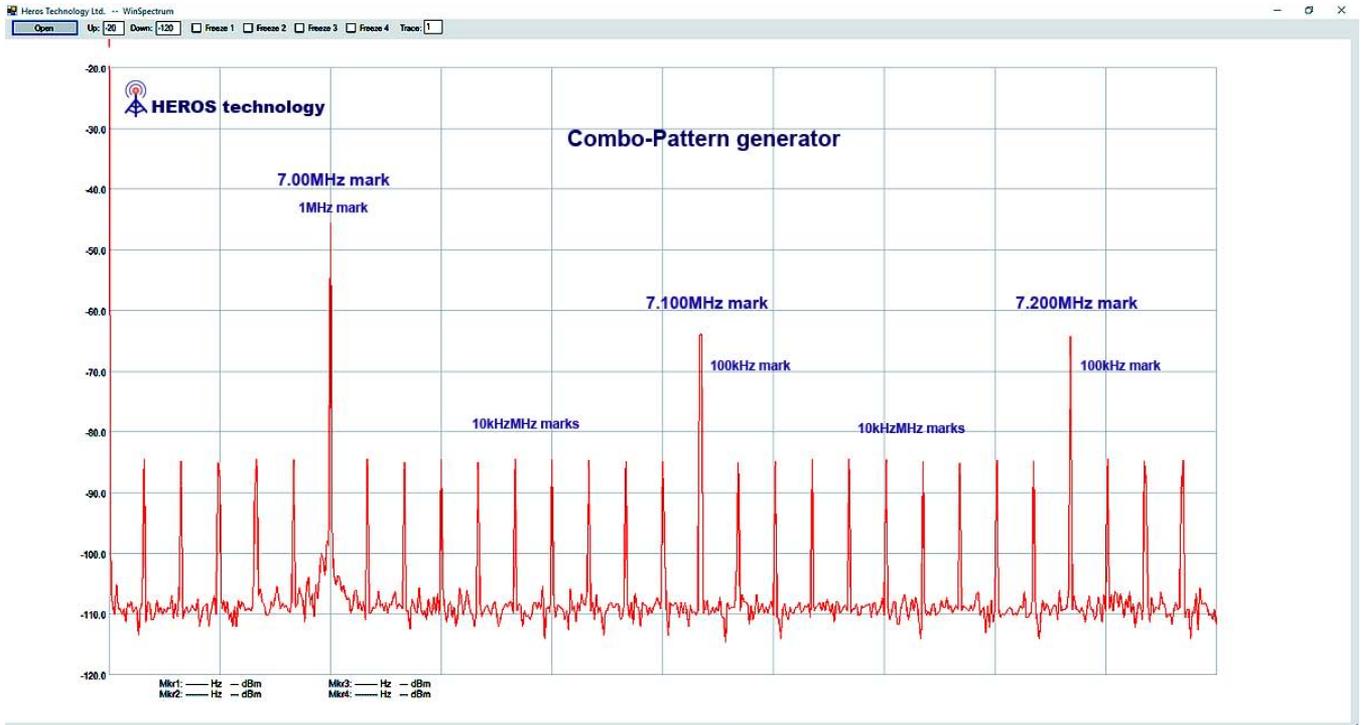
Power On; 10kHz mark On, Internal ref. On; External ref. On

Power supply: 9V - 13.5Volts DC/ 0.160 Amp ; 2.1mm / 2.5mm plug power connector.

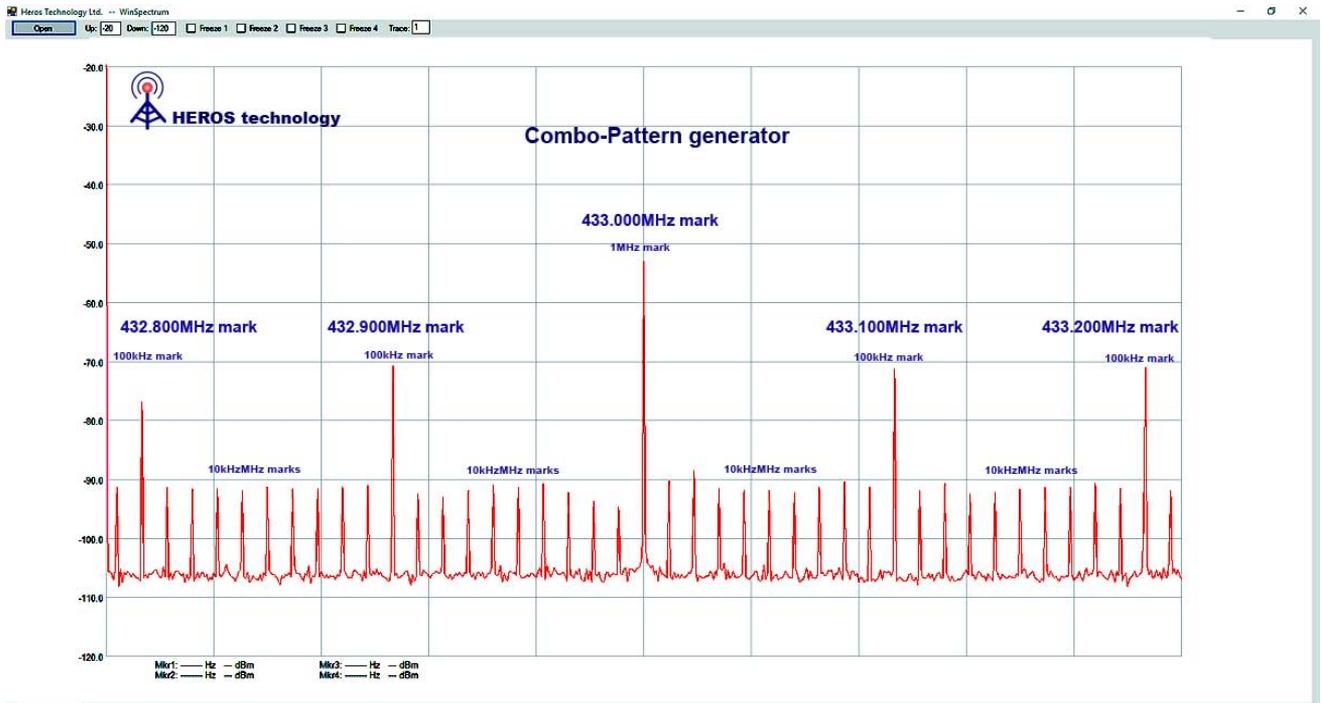
Operating Temp. Range max: -30°C +85°C

Dimensions: 145x105x65mm (5.70x4.13x2.55in)

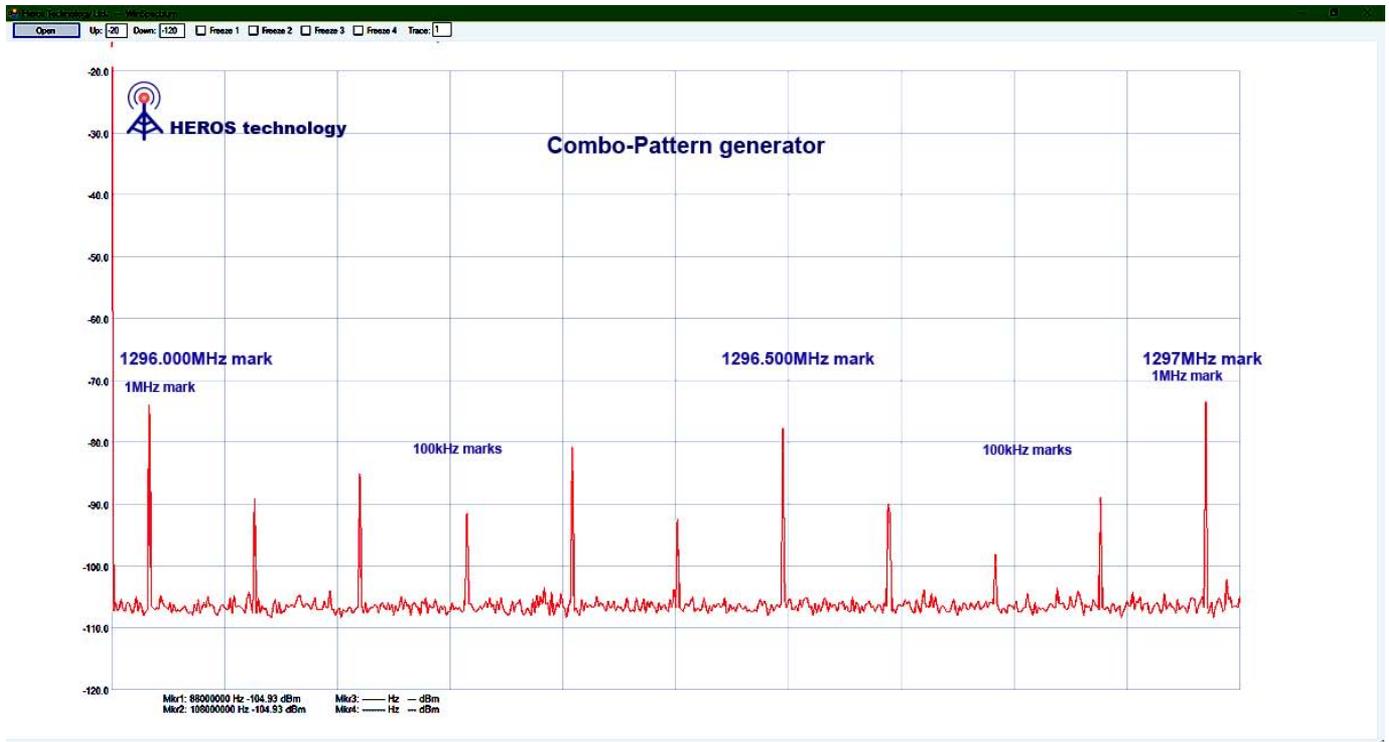
Weight: 0.5Kg (1.10lbs)



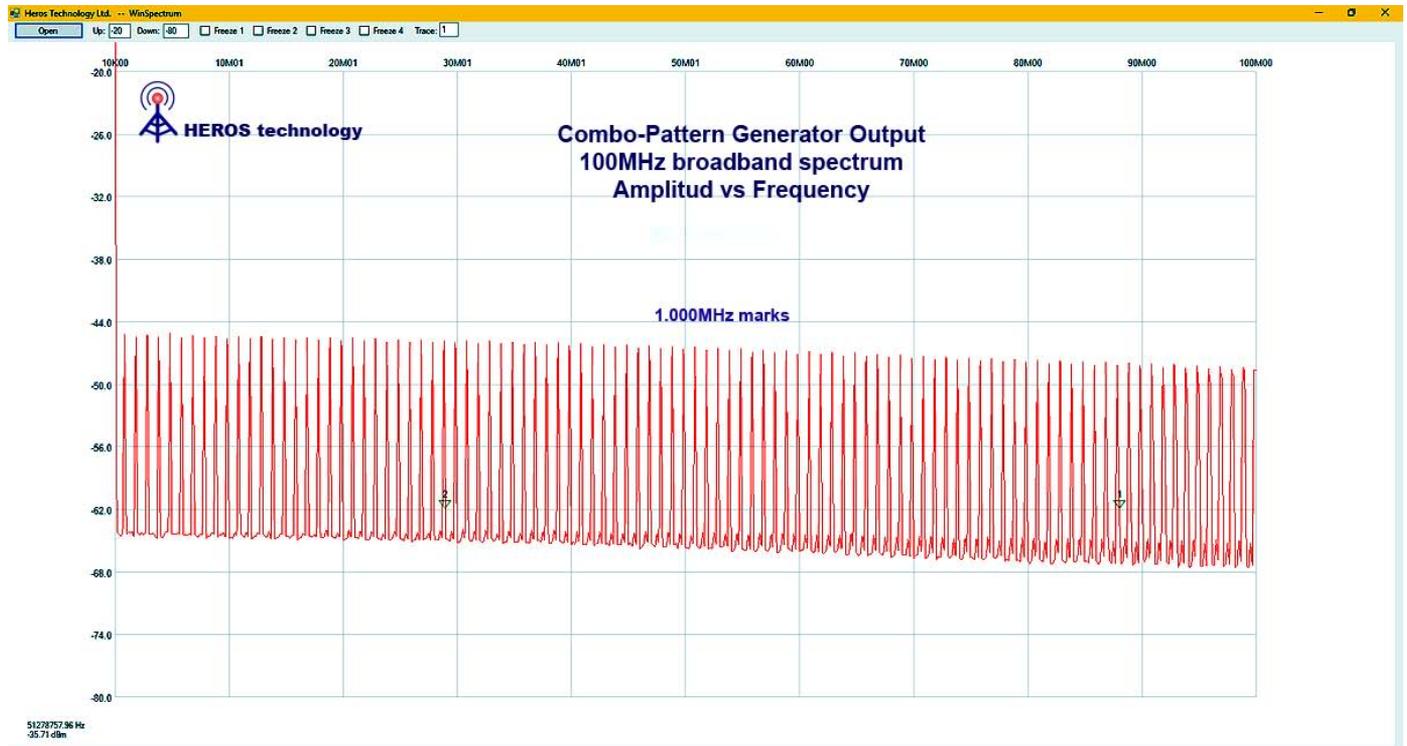
HF 7 MHz Combo-Pattern output signal



UHF 433 MHz Combo-Pattern output signal



SHF 1296MHz Combo-Pattern output signal



Broadband 10kHz-100MHz Combo-Pattern output signal



**NOTES:**

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