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# MFG-2000 Series

## Multi-Channel Function Generator

## FEATURES

- Maximum Five Output Channels
  - * 2 Equivalent Performance Arbitrary Channels Frequency : 1μHz~10/20/30/60/200MHz
  - * RF Channel Frequency (FG/ARB/MOD) : 160/320MHz
  - * Pulse Generator Frequency : 25MHz
  - * Power Amplifier : Low Frequency, 5Hz~100kHz,20dB/20W(limited by current setting)
- True Point by Point Output Arbitrary Waveform Function: MFG-2220HM Sample Rate: 250MSa/s, Repetition Rate: 125MHz; Other models Sample Rate: 200MSa/s, Repetition Rate: 100MHz, 14-bit Resolution, 16k Points Memory Depth
- Earth Ground Isolation Design Among I/O Terminals and Instrument Chassis (MFG-2220HM Excluded)
- Frequency Counter : 150MHz, 8-bit Frequency Resolution
- AM/FM/PM/ASK/FSK/PSK/SUM/PWM Modulation
- Built-in Medical and Automotive Electronic Waveforms
- USB Host/USB Device/LAN (MFG-22XX only)
- 4.3 Inch TFT Color Display

The MFG-2000 series is a multi-channel function generator, which has up to 5 simultaneous output channels, including CH1 and CH2 equivalent performance dual channel arbitrary function generator with the maximum 200MHz for both channels; RF signal generator, a standard AFG, which produces the maximum 320MHz sine wave and various modulation RF signals; pulse generator, whose frequency reaches 25MHz; power amplifier, which is ideal for audio range. The above-mentioned five different functionality channels are separately or totally allocated on 11 models, which extend from the basic single-channel AFG with pulse generator models to five-channel models so as to satisfy various educational and industrial applications.

The AFG channel of the MFG-2000 series outputs sine, square, and triangle, etc. The series features true point by point output arbitrary aveform characteristics of 200MSa/s sample rate, 100MHz waveform repetition rate, 14-bit resolution, and 16k points memory depth. The MFG-2220HM offers up to 250MSa/s sample rate and 125MHz repetition rate. Some models provide various modulation methods such as AM/FM/PM/FSK /PWM. Sweep, Burst, Trigger, 150MHz Frequency Counter and 25MHz pulse generator are also available for some models. Synchronized dual channel models provide correlated functions, including synchronization, delay, sum, and coupling. RF signal generator, a complete AFG signal source (including ARB), features various modulations, Sweep, and digital modulations such as ASK and PSK and its sine wave frequency is up to 320MHz. A full-function pulse generator with 25 MHz is equipped to all models and its pulse width, rise edge time, fall edge time are adjustable that can be applied as trigger signals. Independent input/output power amplifier with 20W, 20dB, 5Hz~100KHz bandwidth, and distortion less than 0.1% can be applied to the audio application.

The overall design of the MFG-2000 series (MFG-2220HM excluded) is earth ground isolation among output/input terminals and instrument chassis that can only be found in high-level signal sources. The output channels can sustain maximum isolation voltage up to ±42Vpk (DC+ AC peak value) to earth ground that is ideal for floating circuit tests. Multi-unit outputs can be executed without factoring in grounding reference issue. There is no additional isolation requirement for experiments such as “full-wave rectification” and “voltage doubler” which are easy and safe. An external power supply can bring up the DC bias voltage to ±42Vpk to meet the requirements of higher DC bias voltage such as automotive and educational applications.

The AFG of the MFG-2000 series collocating with AWES (Arbitrary Waveform Editing Software) allows users to easily and quickly edit arbitrary waveforms. DWR (Direct Waveform Reconstruction) allows users to collocate with GDS series digital oscilloscopes to retrieve waveforms and upload them to arbitrary generator to achieve direct waveform reconstruction. 102 built-in waveforms allow users to edit arbitrary waveforms and to output the whole segment or divided segments.

With the multi-functionality channels, the MFG-2000 series provides different industrial sectors with special dual channel waveforms, low-frequency vibration simulation, automotive sensors, medical applications(MFG-2220HM excluded), AM/FM broadcast signals, PWM motor or fan control signals, pulse synchronized signals, pulse noise, audio circuit or devices such as speaker tests. The series is ideal for various fields, including scientific research, education, research and development, production and quality control.

**The MFG-2000 series can maximally and simultaneously output five functional channels. The functionalities of each channel are as follows:**

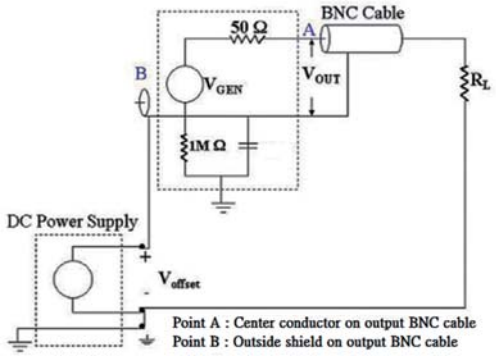
| | | | |
|---|---|---|---|
| Channel 1 | 1uHz-200MHz max. FG With 250MSa/s ARB | AM,FM,PM,FSK,SUM PWM ,Sweep ,Burst , Trigger, Frequency Counter | |
| Channel 2 | | | |
| RF Channel | 1uHz-320MHz max. FG With 200MSa/s ARB | | ASK,PSK |
| Pulse Generator | **25MHz Full Function pulse Generator** (Frequency /Width/duty Cycle /Rise and Fall Edge adjustable) | | |
| Power Amplifier | **20W Power Amplifier** (20W (RL=8Ω)/20dB/5Hz~100kHz/<0.1% (Ampl >1Vpp 20Hz~20kHz) | | |

* ASK, PSK are standard equipped in MFG-2220HM

## PANEL INTRODUCTION


1. TFT LCD Panel
2. Number Panel
3. Scroll Knob & Selection Key
4. Power switch
5. Output Terminal
6. Main Output Switch
7. Function Keys
8. Operation Keys
9. USB Host
10. Trigger & Modulation Input
11. Sync and Counter Intput
12. Fan
13. Power Amplifier Input & Output
14. LAN (MFG-22XX only)
15. USB Device

## A. CIRCUIT DESIGN FOR GROUND ISOLATION AMONG OUTPUT/INPUT TERMINALS AND INSTRUMENT CHASSIS



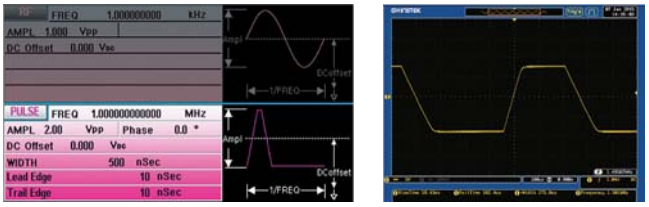

**Connection diagram for MFG connecting with a power supply to increase D.C. bias voltage to ±42Vpk (DC+ AC peak value).**

Output channels, synchronization and modulation input/output connector grounding are isolated from instrument chassis. These connectors can sustain maximum isolation voltage up to ±42Vpk (DC+ AC peak value) to earth ground that is ideal for floating circuit tests. Multi-unit outputs can be executed without factoring in grounding reference issue.

The built-in DC bias voltage of the MFG-2000 series can be applied on various waveforms. The DC bias voltage is ±5V under 50 ohm load. An external power supply can be used to bring up the DC bias voltage to ±42Vpk (DC+ AC peak value) for higher DC bias applications.

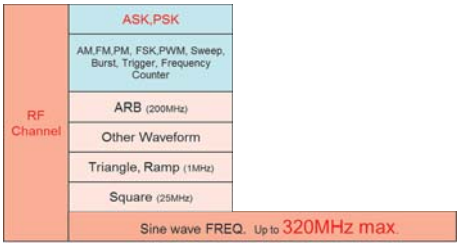
( * MFG-2220HM excluded )

## B. PULSE GENERATOR



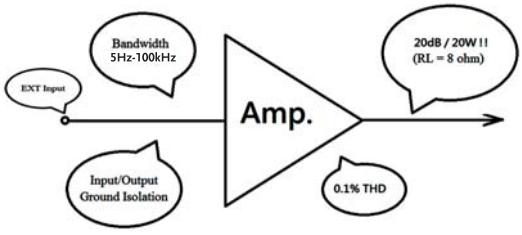

Each model of the series has a built-in pulse generator and its output frequency reaches 25 MHz. Users can set pulse width, duty cycle, rise edge time, and fall edge time to support trigger signal.
The pulse width can be fine-tuned to the minimum of 20ns and the leading/trailing edge times can be set independently to the minimum of 10ns.

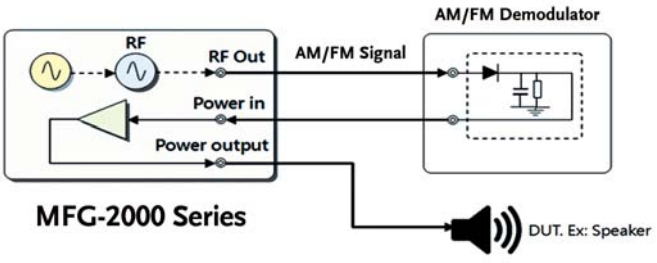
## C. RF SIGNAL GENERATOR




RF signal generator is a full function AFG signal source. Identical to CH1/CH2, it can output sine, square, ramp, pulse, noise, etc. Its sine wave frequency reaches 160MHz or 320MHz. And its true point by point output arbitrary waveform function supports 200 MHz sample rate, 100MHz waveform repetition rate, 14 bit resolution, 16k point memory depth, frequency sweep and various modulation methods such as AM/FM/PM/FSK/PWM/PSK/ASK. RF signal generator can be applied as a high frequency arbitrary waveform generator, simulated signals of analog or digital broadcast stations or carrier signals of local oscillator.

## D. POWER AMPLIFIER

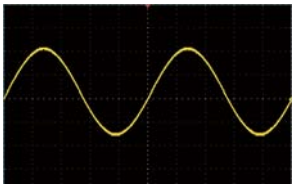


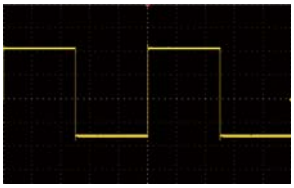

20W/20dB power amplifier, which has a bandwidth of 5Hz~100kHz and less than 0.1% distortion. The low frequency power amplifier can be applied as an audio amplifier or a driver amplifier for piezoelectric components (collocating with an impedance transformer, 20W output) and conducts power component characteristics tests, magnetization characteristics tests(B-H curve) of magnetic materials such as ferrite and amorphous materials (collocating with an impedance transformer, 20W output)

Users can connect a speaker with the low frequency power amplifier of the MFG-2000 series to realize various physics experiments.

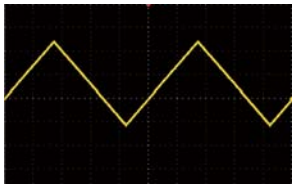
## E. VERSATILE OUTPUT WAVEFORM SELECTIONS



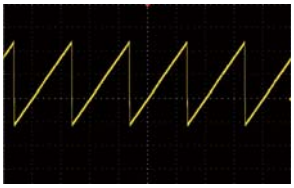
Sine



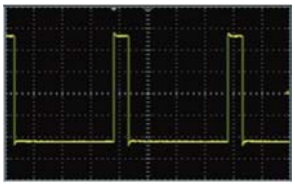
Square



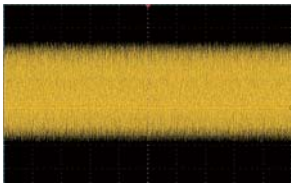
Triangle



Ramp

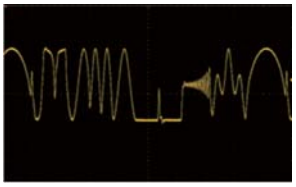


Pulse



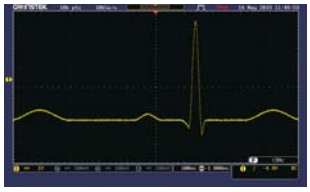
Noise

DC Voltage

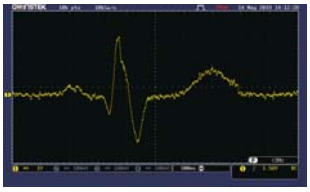


Arbitrary Waveform

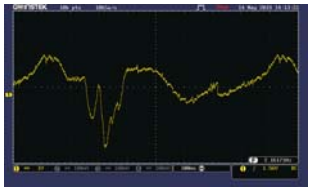
### MEDICAL APPLICATION WAVEFORMS (MFG-2220HM excluded)



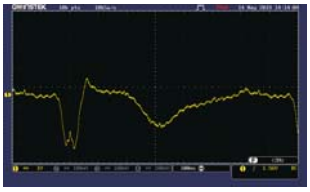
Cardiac



ECG1



ECG2

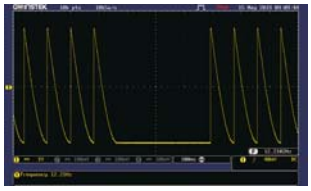


ECG3

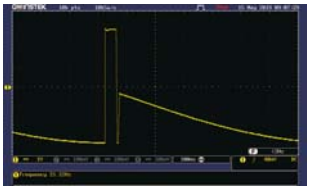
### AUTOMOTIVE ELECTRONIC WAVEFORMS (MFG-2220HM excluded)

Ignition

ISO7637-2 TP3A



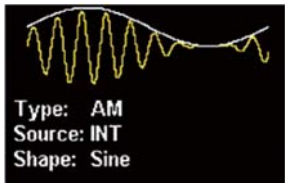
ISO7637-2 TP3B



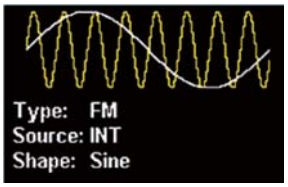
ISO7637-2 TP2B

There are standard waveforms for the series such as sine, square, triangle, ramp, pulse, noise, DC voltage. In addition, 102 built-in waveforms, including medical application waveforms and commonly used automotive electronic waveforms allow users to easily select desired waveforms.

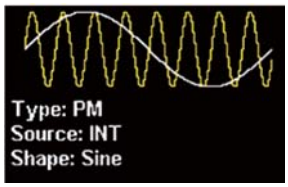
## F. VARIOUS MODULATION FUNCTION



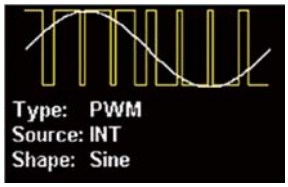

Amplitude Modulation



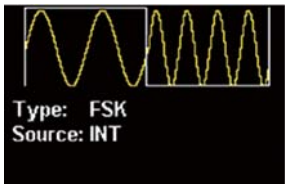

Frequency Modulation



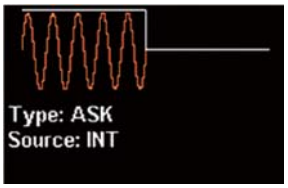

Phase Modulation



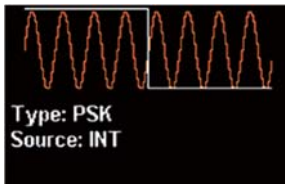

Pulse Width Modulation



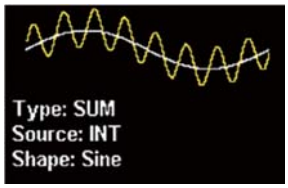

Frequency-shift Keying Modulation




Amplitude-shift Keying Modulation



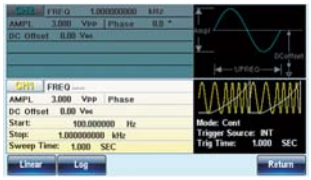

Phase- Shift Keying Modulation

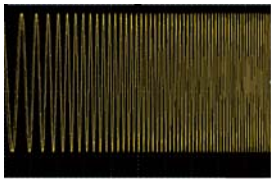



Sum Modulation

The series supports AM, FM, PM, FSK, PWM and SUM modulation. RF channel not only has the above-mentioned modulation capabilities but also supports advanced modulations such as ASK and PSK Modulation. The most modulation sources can be internal or external. Applications include communications systems' base band, motor control and light adjustment.

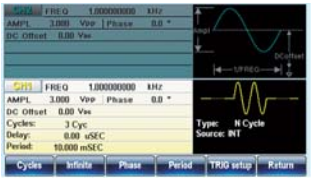
## G. SWEEP FUNCTION

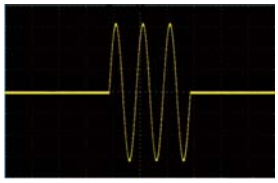




The series supports frequency sweep that can also integrate other functions, including linear/logarithm and INT/EXT/Manual trigger to meet various application requirements. Frequency sweep carries out tests on the frequency response of electronic components such as filter and low frequency amplifier.

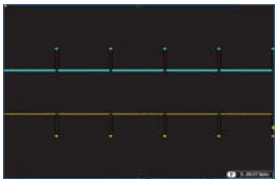
## H. BURST FUNCTION



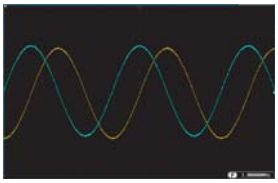


The series supports N-period or gated trigger. Phase angle, duration time, frequency, waveform infinite can be adjusted to meet non-continuous output applications.

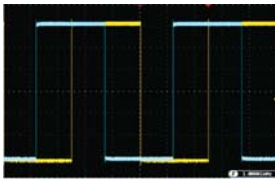
## I. THE OUTPUT CORRELATED FUNCTIONS OF EQUIVALENT PERFORMANCE DUAL CHANNEL



**Differential Signal**



**Sine and Cosine Signal**

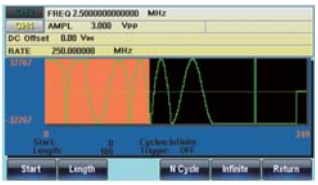


**Square Wave Phase Setting**

The CH1 and CH2 of MFG-2220HM/2230M/2260M/2260MFA/2260MRA can be applied separately. These two channels provide four correlated functions, including sum, coupling, tracking and phase.

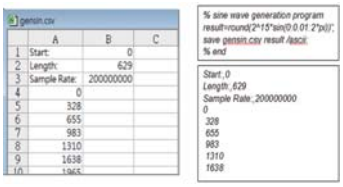
* The coupling function allows users to freely set ratio and offset values for frequency and amplitude of both channels to realize that all parameters are simultaneously effective for both channels. The measurement of the Third-Order Intercept Point for an amplifier and the simulations of two different frequency oscillators outputting signals are two applied examples for coupling function.
* The tracking function can produce 180 degree phase offset differential signals with same frequency and amplitude.
* The phase function allows users to freely set phase parameters for both channels such as sine wave, cosine wave, and square wave signals.
* The sum modulation function can sum up two signals into one and output this signal via one channel. One of the related applications is to sum up sine waveform and noise to execute speaker distortion tests.

## J. FOUR METHODS TO OBTAIN ARBITRARY WAVEFORMS



**Front Panel Operation**

Via single unit's panel, arbitrary waveforms can be selected, edited, stored, recalled, output, triggered from 102 built-in waveforms.

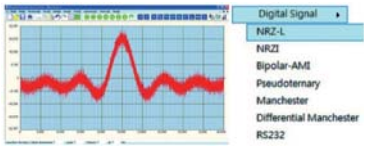


**CSV File Upload**

Support CSV file upload produced by MATLAB and Excel.

**Direct Waveform Reconstruction**

Collocate with GDS series digital oscilloscopes to retrieve waveforms and upload them to arbitrary generator to achieve direct waveform reconstruction.(DSO LINK is only for MFG-22XX Series)




**Arbitrary Waveform Editing PC Software**

Use AWES to edit complex waveforms. The software supports waveform mathematical operation. The waveform series includes Uniform Noise, Gaston Noise, Rayleigh Noise, various digital codes such as non zero code, Manchester and RS-232, etc.

## K. MULTI-CHANNEL SYNCHRONIZED PHASE OPERATION


MFG-2220HM features reference input and reference output interfaces. Users can drive up to four MFG-2220HM units through the reference input and reference output interfaces to achieve eight-channels of phase synchronous outputs.
(*MFG-2220HM only)

## SPECIFICATIONS

| | CH1 (Function With ARB) | CH2 (Function With ARB) | 25MHz Pulse Generator | RF Generator (Function With ARB) | Power Amplifier | Modulation/Sweep/ Burst/Frequency Counter |
|---|---|---|---|---|---|---|
| MFG-2110 | • 10MHz | | • | | | |
| MFG-2120 | • 20MHz | | • | | | |
| MFG-2120MA | • 20MHz | | • | | • | • |
| MFG-2130M | • 30MHz | | • | | | • |
| MFG-2160MF | • 60MHz | | • | • 160MHz | | • |
| MFG-2160MR | • 60MHz | | • | • 320MHz | | • |
| MFG-2230M | • 30MHz | • 30MHz | • | | | • |
| MFG-2260M | • 60MHz | • 60MHz | • | | | • |
| MFG-2260MFA | • 60MHz | • 60MHz | • | • 160MHz | • | • |
| MFG-2260MRA | • 60MHz | • 60MHz | • | • 320MHz | • | • |
| MFG-2220HM | • 200MHz | • 200MHz | • | | | • |

### CH1/CH2

| | | |
|---|---|---|
| WAVEFORMS | Standard | Sine, Square, Triangle, Ramp, Pulse, Noise |
| ARBITRARY FUNCTIONS | Arb Function | Built-in |
| | Sample Rate | 200 MSa/s ; MFG-2220HM:250MSa/s |
| | Repetition Rate | 100MHz ; MFG-2220HM:125MHz |
| | Waveform Length | 16k points |
| | Amplitude Resolution | 14 bits |
| | Non-volatile Memory | 10sets 16k points(1) |
| | User-defined Output Section | From point 2 ~ 16384 |
| FREQUENCY CHARACTERISTICS | Range | MFG-2220HM:Sine:200MHz(Max.);Square:60MHz(Max.);Triangle,Ramp:5MHz;Others:Sine:60MHz(Max.) Square:25MHz(Max.);Triangle,Ramp:1MHz |
| | Resolution | 1 μHz |
| | Accuracy Stability | ±20 ppm |
| | Aging | ±1 ppm, per 1 year |
| | Tolerance | ≤1 μHz |
| OUTPUT CHARACTERISTICS (2) | Amplitude Range | 1mVpp ~ 10 Vpp(into 50Ω) ; 2mVpp ~ 20 Vpp (open-circuit) MFG-2220HM : 1mVpp ~ 10Vpp ≦20MHz ; 1mVpp ~ 5Vpp ≦70MHz ; 1mVpp ~ 2Vpp ≦120MHz ; 1mVpp ~ 1Vpp ≦ 200MHz(into 50Ω) |
| | Accuracy | ±2% of setting ±1 mVpp (at 1 kHz/into 50Ω without DC offset) |
| | Resolution | 0.1mV or 4 digits |
| | Flatness | ± 1% (0.1dB) ≦1MHz ; ± 3% (0.3dB) ≦50 MHz ; ± 16% (1.5dB) ≦60MHz (sinewave relative to 1 kHz/into 50Ω), MFG-2220HM: ± 1% (0.1dB) ≦10MHz; ± 2% (0.2dB) ≦60 MHz ± 4% (0.4dB) ≦100MHz; ± 8% (0.8dB) ≦160MHz; ± 10% (1dB) ≦200MHz; (sinewave relative to 1 kHz/into 50Ω) |
| | Units | Vpp, Vrms, dBm |
| OFFSET | Range | ±5 Vpk AC + DC (into 50Ω); ±10Vpk AC + DC (open circuit) |
| | Accuracy | ±(1% of setting + 5mV + 0.5% of amplitude) |
| WAVEFORM OUTPUT | Impedance | 50Ω typical (fixed); > 10MΩ (output disabled) |
| | Protection | Short-circuit protected; Overload relay automatically disables main output |
| | Ground Isolation | 42Vpk max (MFG-2220HM excluded) |
| SYNC OUTPUT | Range | TTL-compatible into>1kΩ |
| | Impedance | 50Ω standard |
| | Ground Isolation | 42Vpk max (MFG-2220HM excluded) |
| SINE WAVE CHARACTERISTICS (3) | Harmonic Distortion | –60 dBc DC ~ 200kHz, Ampl > 0.1 Vpp –55 dBc 200kHz ~ 1 MHz, Ampl > 0.1 Vpp ; –45 dBc 1MHz ~ 10 MHz, Ampl > 0.1Vpp ; –35 dBc 10MHz ~ 30MHz, Ampl > 0.1Vpp ; –27 dBc 30MHz ~ 60MHz, Ampl > 0.1Vpp MFG-2220HM:<–60 dBc <200kHz ; <–55 dBc 200kHz ~ 1 MHz ; <–45 dBc 1MHz ~ 10 MHz; <–35 dBc 10MHz ~ 30MHz ; <-30 dBc 30MHz ~ 200MHz ; (at 1Vpp/into 50Ω without DC offset) |
| | Total Harmonic Distortion | < 0.1% (Ampl>1Vpp) DC~100 kHz |
| SQUARE WAVE CHARACTERISTICS | Rise/Fall Time | <15ns ; MFG-2220HM:<6ns |
| | Overshoot | <5% |
| | Asymmetry | 1% of period +5 ns |
| | Variable duty Cycle | 0.01% to 99.99% (limited by the current frequency setting) |
| | Jitter | 20ppm +500ps(4) |
| RAMP CHARACTERISTICS | Linearity | < 0.1% of peak output |
| | Variable Symmetry | 0% ~ 100% |
| PULSE CHARACTERISTICS | Frequency | 1uHz ~ 25MHz |
| | Pulse Width | ≧20nS ; MFG-2220HM≧10nS (limited by the current frequency setting) |
| | Variable duty Cycle | 0.01% ~ 99.99% (limited by the current frequency setting) |
| | Overshoot | <5% |
| | Jitter | 20ppm + 500ps(4) |

### PULSE GENERATOR

| | | |
|---|---|---|
| PULSE GENERATOR | Amplitude | 1mVpp ~ 2.5 Vpp (into 50Ω) ; 2mVpp ~ 5 Vpp (open-circuit) |
| | Offset | ±1 Vpk AC + DC (into 50Ω) ; ±2Vpk AC + DC (Open circuit) |
| | Frequency | 1uHz ~ 25MHz |
| | Pulse Width | 20nS ~ 999.7ks(limited by the current frequency setting) |
| | Variable duty Cycle | 0.1% ~ 99.9%(limited by the current frequency setting) |
| | Leading and Trailing Edge Time(5) | 10nS ~ 20S(1ns resolution)(limited by the current frequency and pulse width settings) |
| | Overshoot | <5% |
| | Jitter | 100ppm + 500ps(4) |

### RF GENERATOR

| | | |
|---|---|---|
| ARBITRARY FUNCTIONS | ARB function | Built-in |
| | Sample Rate | 200 MSa/s |
| | Repetition Rate | 100MHz |
| | Waveform Length | 16k points |
| | Amplitude Resolution | 14 bits |
| | User-defined output section | From point 2~16384 |
| | Jitter | 20ppm +5ns |

## SPECIFICATIONS

| | | |
|---|---|---|
| **FREQUENCY CHARACTERISTICS** | **Range** | Sine: 1uHz~160MHz(DDS)/1uHz~60MHz(ARB) for MFG-2XXXMF ; 1uHz~320MHz(DDS)/ 1uHz~60MHz(ARB) for MFG-2XXXMR<br>Square: 25MHz(max); Triangle, Ramp: 1MHz |
| | **Resolution** | 1μHz |
| | **Accuracy Stability** | ±20 ppm |
| | **Aging** | ±1 ppm, per 1 year |
| | **Tolerance** | ≦1μHz |
| **OUTPUT CHARACTERISTICS(2)** | **Amplitude(into 50Ω)** | 1mVpp to 2 Vpp (MFG-2XXXMF);1mVpp to 1 Vpp (MFG-2XXXMR) |
| | **Accuracy** | ±2% of setting ±1 mVpp(at 1 kHz/into 50Ω without DC offset) |
| | **Resolution** | 1mV or 3 digits |
| | **Flatness** | ±1%(0.1dB)≦1MHz; ±3%(0.3dB)≦50 MHz; ±10%(0.9dB)≦160MHz; ±35%(3.5dB)≦320MHz (sinewave relative to 1 kHz/into 50Ω) |
| **OFFSET** | | ±1 Vpk AC +DC (into 50Ω) ;±2Vpk AC +DC (Open circuit) |
| **WAVEFORM OUTPUT** | **Impedance** | 50Ω typical(fixed) ; >10MΩ(output disabled) |
| **SINE WAVE CHARACTERISTICS(3)** | **Harmonic Distortion** | -60 dBc <200kHz ; -55 dBc 200kHz~1 MHz ; -45 dBc 1MHz~10 MHz; -30 dBc 10MHz~320MHz |
| | **Total Harmonic Distortion** | < 0.1% (Ampl>1Vpp) DC~100 kHz |
| **SQUARE WAVE CHARACTERISTICS** | **Rise/Fall Time** | <15ns |
| | **Overshoot** | <5% |
| | **Asymmetry** | 1% of period +5 ns |
| | **Variable duty Cycle** | 0.01% to 99.99%(limited by the current frequency setting) |
| | **Jitter** | 20ppm+500ps(4) |
| **RAMP CHARACTERISTICS** | **Linearity** | < 0.1% of peak output |
| | **Variable Symmetry** | 0% to 100% |
| **MODULATION/ SWEEP** | **Modulation Type** | AM,FM,PM,FSK,PWM (The detail same as CH1 modulation specification) |
| | **Sweep type** | Frequency |
| | **Source** | INT/EXT (INT only for AM,FM,PM, PWM) |
| | **Modulating Frequency** | Sine-DDS 5us~327.68mS(Resolution:5uS); Sine-ARB 2mHz~20kHz(Resolution:1mHz) |
| **PSK (MFG-2220HM also provided)** | **Carrier Waveforms** | Sine-DDS |
| | **Modulating Waveforms** | 50% duty cycle square |
| | **Internal Frequency** | 2 mHz to 1 MHz |
| | **Phase Range** | 0° ~ 360.0° |
| | **Source** | Internal / External |
| **ASK (MFG-2220HM also provided)** | **Carrier Waveforms** | Sine-DDS |
| | **Modulating Waveforms** | 50% duty cycle square |
| | **Internal Frequency** | 2 mHz to 1 MHz |
| | **Amplitude Range** | 1mVpp to 10Vpp |
| | **Source** | Internal / External |

## POWER AMPLIFIER

| | | |
|---|---|---|
| **POWER AMPLIFIER** | **Input Impedance** | 10KΩ |
| | **Input Voltage** | 1.25Vpmax |
| | **Working Mode** | Constant Voltage |
| | **Gain** | 20dB |
| | **Output Power (RL=8Ω)** | 20W (Square) |
| | **Output Voltage** | 12.5Vpmax |
| | **Output Current** | 1.6Amax |
| | **Rise/Fall Time** | <2.5uS |
| | **Full Power Bandwidth** | 5Hz ~ 100kHz |
| | **Overshoot** | 5% |
| | **Total Harmonic Distortion** | < 0.1% (Ampl >1Vpp); 20Hz ~ 20 kHz |
| | **Ground Isolation** | 42Vpk max |

## ADVANCED FUNCTIONS

| | | |
|---|---|---|
| **AM MODULATION** | **Carrier Waveforms** | Sine, Square, Triangle, Ramp, Pulse, Arb |
| | **Modulating Waveforms** | Sine, Square, Triangle, Upramp, Dnramp |
| | **Modulating Frequency** | 2mHz ~ 20kHz ; MFG-2220HM : 2mHz ~ 50kHz(Int) ; DC ~ 20kHz ; MFG-2220HM : DC ~ 50kHz (Ext) |
| | **Depth** | 0% ~ 120.0% |
| | **Source** | Internal / External |
| **FM MODULATION** | **Carrier Waveforms** | Sine, Square, Triangle, Ramp |
| | **Modulating Waveforms** | Sine, Square, Triangle, Upramp, Dnramp |
| | **Modulating Frequency** | 2mHz ~ 20kHz ; MFG-2220HM : 2mHz ~ 50kHz(Int) ; DC ~ 20kHz ; MFG-2220HM : DC ~ 50kHz (Ext) |
| | **Peak Deviation** | DC to max frequency ; MFG-2220HM: DC ~ 0.5*max frequency |
| | **Source** | Internal / External |
| **PM** | **Carrier Waveforms** | Sine, Square, Triangle, Ramp |
| | **Modulating Waveforms** | Sine, Square, Triangle, Upramp, Dnramp |
| | **Modulation Frequency** | 2mHz ~ 20kHz ; MFG-2220HM : 2mHz ~ 50kHz(Int) ; DC ~ 20kHz ; MFG-2220HM : DC ~ 50kHz (Ext) |
| | **Phase Deviation** | 0° ~ 360.0° |
| | **Source** | Internal / External |
| **SUM** | **Carrier Waveforms** | Sine, Square, Triangle, Ramp ; MFG-2220HM: Sine, Square, Triangle, Pulse ,Ramp ,Noise |
| | **Modulating Waveforms** | Sine, Square, Triangle, Upramp, Dnramp |
| | **Modulation Frequency** | 2mHz ~ 20kHz ; MFG-2220HM : 2mHz ~ 50kHz(Int) ; DC ~ 20kHz ; MFG-2220HM : DC ~ 50kHz (Ext) |
| | **SUM Depth** | 0% ~ 100.0% |
| | **Source** | Internal / External |
| **PWM** | **Carrier Waveforms** | Square |
| | **Modulating Waveforms** | Sine, Square, Triangle,Upramp, Dnramp |
| | **Modulation Frequency** | 2mHz ~ 20kHz ; MFG-2220HM : 2mHz ~ 50kHz(Int) ; DC ~ 20kHz ; MFG-2220HM : DC ~ 50kHz (Ext) |
| | **Phase Deviation** | 0% ~ 100.0% pulse width |
| | **Source** | Internal / External |
| **FSK** | **Carrier Waveforms** | Sine, Square, Triangle, Ramp, Pulse |
| | **Modulating Waveforms** | 50% duty cycle square |
| | **Internal Frequency** | 2 mHz to 1 MHz |
| | **Frequency Range** | 1μHz to max frequency |
| | **Source** | Internal / External |
| **SWEEP** | **Waveforms** | Sine, Square, Triangle, Ramp |
| | **Type** | Linear or Logarithmic |
| | **Sweep Direction** | Sweep up or sweep down |
| | **Start/Stop Freq** | 1uHz to max frquency |
| | **Sweep Time** | 1ms to 500s |

## SPECIFICATIONS

| | | |
|---|---|---|
| | **Source** | Internal / External |
| | **Trigger** | Single, External, Internal |
| | **Marker** | Marker signal on falling edge (programmable) |
| | **Source** | Internal / External |
| **BURST** | **Waveforms** | Sine, Square, Triangle, Ramp |
| | **Frequency** | Max Frequency 25MHz (sine, square); 1MHz (triangle, ramp) |
| | **Pulse Count** | 1~1000000 Cycles or intfinite |
| | **Start/Stop Phase** | -360.0°~ +360.0° |
| | **Internal Frequency** | 1 us ~ 500 s |
| | **Gate Source** | External Trigger |
| | **Trigger Source** | Single, External, Internal |
| **TRIGGER DELAY** | **NCycle, Infinite** | 0s ~ 100 s |
| **EXTERNAL TRIGGER INPUT** | **Type** | For FSK, Burst, Sweep |
| | **Input Level** | TTL Compatibility |
| | **Slope** | Rising or Falling(Selectable) |
| | **Pulse Width** | >100ns |
| | **Input Impedance** | 10kΩ, DC coupled |
| **EXTERNAL MODULATION INPUT** | **Type** | For AM, FM, PM, SUM, PWM |
| | **Voltage Range** | ±5V full scale |
| | **Input Impedance** | 10kΩ |
| | **Frequency** | DC ~ 20kHz(MFG-2220HM : DC ~ 50KHz) |
| | **Ground Isolation** | 42Vpk max(MFG-2220HM excluded) |
| **TRIGGER OUTPUT** | **Type** | For ARB, Burst, Sweep |
| | **Level** | TTL Compatible into 50Ω |
| | **Pulse Width** | >450ns ; MFG-2220HM : >100ns |
| | **Maximum Rate** | 1MHz |
| | **Fan-out** | ⩾4 TTL Load |
| | **Impedance** | 50Ω Typical |
| **REFERENCE INPUT (MFG-2220HM only)** | **Input Voltage** | 0.5Vpp to 5Vpp |
| | **Output Impedance** | 1kΩ,unbalanced ,AC coupled |
| | **Input Frequency** | 26.8436MHz±500Hz |
| | **Waveform** | Since or Square (50±5% duty) |
| **REFERENCE OUTPUT (MFG-2220HM only)** | **Output Voltage** | 3.3Vpp square wave |
| | **Output Impedance** | 50Ω ,AC coupled |
| | **Output Frequency** | 26.8436MHz |
| **FREQUENCY COUNTER** | **Range** | 5Hz ~ 150MHz |
| | **Accuracy** | Time Base accuracy±1count |
| | **Time Base** | ±20ppm (23°C ±5°C) |
| | **Resolution** | The maximum resolution is : 100nHz for 1Hz, 0.1Hz for 100MHz |
| | **Input Impedance** | 1kΩ/1pf |
| | **Sensitivity** | 35mVrms ~ 30Vms (5Hz ~ 150MHz) |
| | **Ground Isolation** | 42Vpk max(MFG-2220HM excluded) |
| **Dual Channel Function (CH1/CH2)** | **Phase** | -180◦ ~180◦ Synchronize phase |
| | **Track** | CH2=CH1 |
| | **Coupling** | Frequency (Ratio or Difference); Amplitude & DC Offset |
| | **Dsolink** | ✓ |
| **OTHER** | **Store/Recall** | 10 Groups of Setting Memories |
| | **Interface** | LAN (MFG-22XX Series only), USB |
| | **Display** | 4.3 inch TFT LCD, 480 × 3 (RGB) × 272 |
| **GENERAL SPECIFICATIONS** | **Power Source** | AC 100~240V, 50~60Hz |
| | **Power Amplifier Source** | DIP switch, AC 100~120V/AC 220~240V, 50~60Hz (MFG-2120MA, MFG-2260MFA, MFG-2260MRA only) |
| | **Power Consumption** | 30W or 80W(With power amplifier) |
| | **Operating Environment** | Temperature to satisfy the specification : 18 ~ 28°C ; Operating temperature : 0 ~ 40°C ; Relative humidity: ⩽ 80%, 0 ~ 40°C, ⩽ 70%, 35 ~ 40°C ; Installation category : CAT II |
| | **Operating Altitude** | 2000 Meters |
| | **Pollution Degree** | IEC 61010 degree 2, Indoor use |
| | **Storage Temperature** | -10 ~ 70°C, Humidity : ⩽70% |
| | **Dimensions & Weight** | 266(W) x 107(H) x 293(D) mm ; Approx. 2.5kg |

The specifications apply when the function generator is powered on for at least 30 minutes under +20°C~+30°C

Specifications subject to change without notice. MFG-2000GD2BH

Note : (1). A total of ten waveforms can be stored. (Every waveform can be composed of a maximum of 16k points)
(2). Add 1/10th of output amplitude and offset specification per °C for operation outside of 0°C to 28°C range (1-year specification)
(3). DC offset set to zero
(4). Jitter specification for RF Generator: 20ppm +5ns
(5). Only Pluse channel support

## ORDERING INFORMATION

| | |
|---|---|
| **MFG-2110** | **10MHz Single Channel Arbitrary Function Generator with Pulse Generator** |
| **MFG-2120** | **20MHz Single Channel Arbitrary Function Generator with Pulse Generator** |
| **MFG-2120MA** | **20MHz Single Channel Arbitrary Function Generator with Pulse Generator, Modulation, Power Amplifier** |
| **MFG-2130M** | **30MHz Single Channel Arbitrary Function Generator with Pulse Generator, Modulation** |
| **MFG-2160MF** | **60MHz Single Channel Arbitrary Function Generator with Pulse Generator, Modulation, 160MHz RF Signal Generator** |
| **MFG-2160MR** | **60MHz Single Channel Arbitrary Function Generator with Pulse Generator, Modulation, 320MHz RF Signal Generator** |
| **MFG-2230M** | **30MHz Dual Channel Arbitrary Function Generator with Pulse Generator, Modulation** |
| **MFG-2260M** | **60MHz Dual Channel Arbitrary Function Generator with Pulse Generator, Modulation** |
| **MFG-2260MFA** | **60MHz Dual Channel Arbitrary Function Generator with Pulse Generator, Modulation, 160MHz RF Signal Generator, Power Amplifier** |
| **MFG-2260MRA** | **60MHz Dual Channel Arbitrary Function Generator with Pulse Generator, Modulation, 320MHz RF Signal Generator, Power Amplifier** |
| **MFG-2220HM** | **200MHz Dual Channel Arbitrary Function Generator with Pulse Generator, Modulation** |

## ACCESSORIES

Quick Start Guide x 1, CD-ROM with MFG Software and User Manual x 1

**GTL-101** BNC-Alligator test lead x 1 (MFG-2110/2120/2120MA/2130M/2160MF/2160MR)

**GTL-101** BNC-Alligator test lead x 2 (MFG-2230M/2260M/2260MFA/2260MRA)

**GTL-110** BNC cable x 2 (MFG-2220HM)

## OPTIONAL ASSESSORIES

**GTL-246** USB Type A to Type B cable

## FREE DOWNLOAD

Arbitrary Waveform Editing Software