



**SUBNANOSECOND  
PULSE GENERATOR MODULE  
PPM0211**

**USER MANUAL**

v.1.0

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# SAFETY MANUAL

## Electrical safety

- PPM0211 pulse generator module is high voltage equipment. Please be very careful and operate by qualified personnel only.
- There is a risk of electric shock, strong electromagnetic interference, damage of the generator, or other electronic equipment in case of improper use.
- It is strongly prohibited to switch on the generator without output coaxial cable. We recommend using at least 50 centimeters length coaxial cable connected between the generator and the load (antenna or first attenuator) to prevent permanent damage to the generator. There is a risk of electrical arcing on the open HV coaxial connector and damage the generator's output circuit.
- When adding or removing the generator to or from the system, ensure that the power supply is unplugged (in OFF state). Please apply power supply only after connecting output and input coaxial cables.
- Please provide sufficient free space and allow free airflow around the generator for good cooling in case of long time operation at a high repetition rate.

## Operation safety

- Please read this manual before installing and using the generator.
- Before using the product, make sure that all the cables are applicable and not damaged. High voltage connectors should be clean and dry, free from dust, dirt, and any obstacles.
- To avoid short circuits, keep metal parts like clips, screws, and staples away from the generator.
- The generator is designed for operation in normal laboratory conditions. Avoid dust, humidity, and temperature extremes. Do not place the generator in any place where it may become wet.
- Place the generator on a stable surface.
- If you encounter any technical problem with the generator, please contact Megaimpulse Ltd. Do not repair the generator by yourself.

## PACKAGE CONTENT

Please check the package for the following items:

- ✓ PPM0211 subnanosecond pulse generator module (hereinafter "generator")
- ✓ PS3001 dual voltage AC/DC switching power converter:  
AC 85V..264V, 47Hz..63Hz / DC +24V, 3.2A, DC +130V, 2.1A, or similar;
- ✓ Semirigid coaxial cable assembly with N-type connector(s) for the output signal feeding and connection to the load;
- ✓ Coaxial cable assembly SMA connector / RG316 cable / SMA connector for the input triggering signal feeding;
- ✓ User manual (printed or electronic version).



Fig.1. General view of PPM0211 subnanosecond pulse generator module.

## DESCRIPTION OF THE OPERATION

PPM0211 generates nanosecond range unipolar high voltage pulses with up to 2kV amplitude and 1MHz max repetition rate. It is made as a compact pulse generator module (head) with an external power supply and external triggering. The typical output pulse waveform is shown in Fig.2.

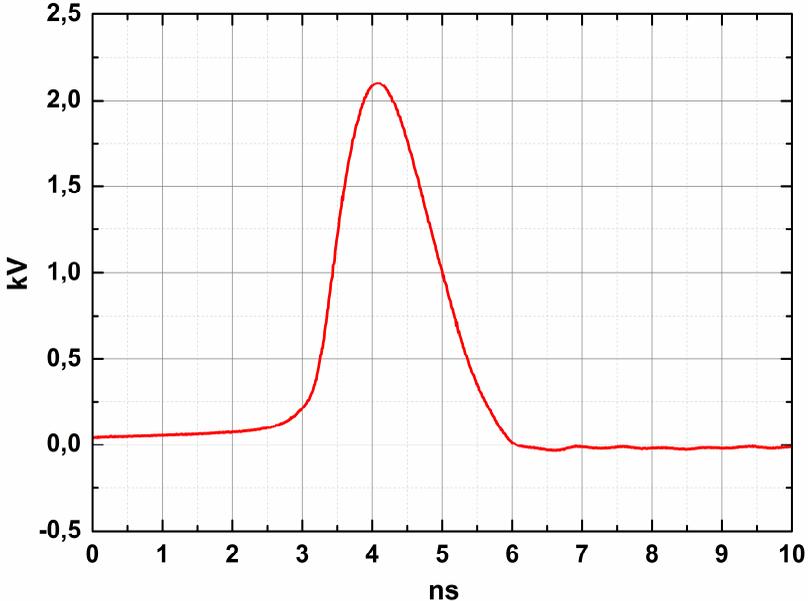


Fig.2. PPM0211 typical output pulse waveform on 50 Ohm matched load.

The generator is designed to operate with 50 Ohm matched load only, i.e. 50 Ohm resistive load or matched impedance antenna connected by 50 Ohm impedance coaxial cable. Operation with unmatched load inevitably results in reflection part of the energy back to the generator and possible overheating.

- ➔ **It is strongly prohibited to switch on the generator without the load (with an open connector). We recommend using 50 centimeters length coaxial cable between the generator and the load (antenna or first attenuator) to prevent damage to the generator in case of load breakdown or disconnection.**

PPM0211 has overheating protection. If the temperature exceeds 55 °C, then red LED "OVERHEAT" lights on and the triggering is blocked. Please cool down the generator and reduce the repetition rate if required.

- ➔ **Please provide free airflow around the generator in case of long-time operation at high frequency, especially in case of an unmatched load.**

The standard package includes an external AC/DC converter which provides two fixed power supply voltages: DC +24V (low voltage) and DC +130V (high voltage). The output pulse amplitude is proportional to the level of high voltage DC supply. It is fixed in case of using a standard AC/DC converter but can be smoothly adjusted using the laboratory DC voltage power supply, please see Fig.3. Do not exceed DC +130V level for high voltage supply. There is a risk of damage to the generator. The low voltage should always be DC +24V.

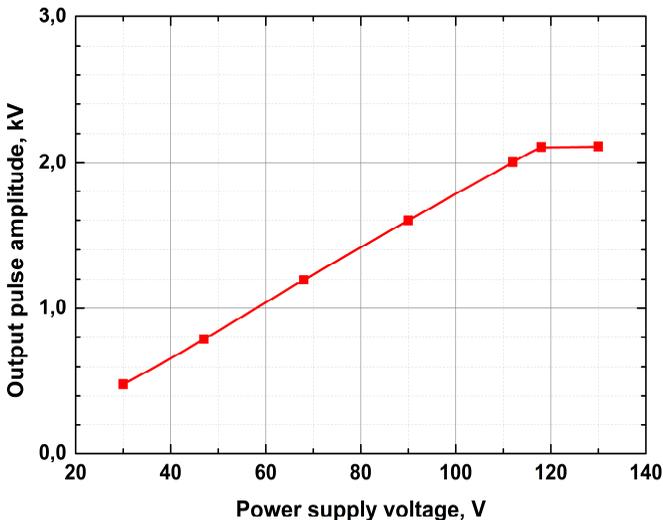


Fig.3. PPM0211 output pulse amplitude VS high voltage power supply.

The optional four wires DC power supply cable may be included in the package.

- ➔ **The ground wires of the optional power supply cable are marked in black color. Low voltage and high voltage supply wires are marked by the labels 24 and 130 correspondingly.**

The contact pins of the power supply connector are the following:

- Pin 1 – GND (ground return DC +24V)
- Pin 2 – DC +24V low voltage supply
- Pin 3 – GND (ground return DC +130V)
- Pin 4 – DC +130V high voltage supply

The generator is triggered by the leading edge of the external triggering pulse. There is no internal triggering mode. Acceptable triggering pulse amplitude is +3.5V ... +5V at 50 Ohm; low triggering pulse amplitude leads to unstable triggering and increases the output pulse jitter. The recommended triggering pulse width is 100ns, the range within 10 ns ... 200 ns are acceptable. Triggering pulse rise time should be no more than 1 ns. Longer rise time may result in increasing the output pulse jitter. Orange LED "SYNC IN" lights on in case of successful triggering.

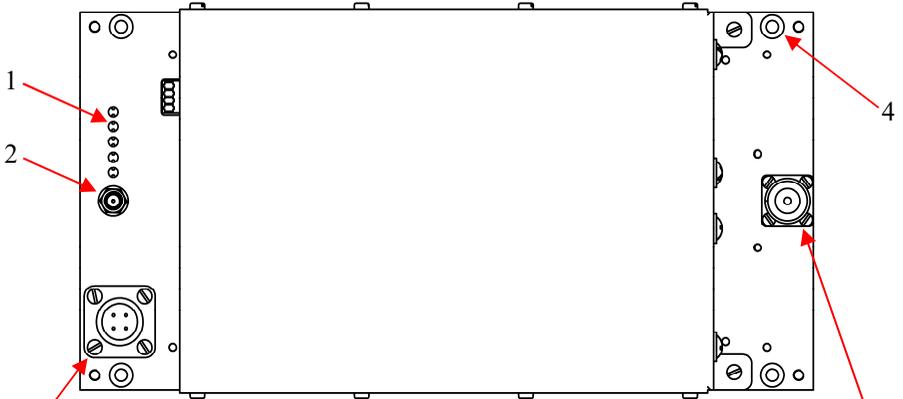
The generator has internal over-frequency protection. If the frequency of the triggering pulses is more than 1 MHz, then the generator blocks the triggering and red LED "OVERLOAD" lights on. The same occurs in the case of a very long triggering pulse. Please reduce the frequency of the triggering pulses and/or triggering pulse width.

Two fans are used for the cooling of the generator. If the temperature is low, then the fans are stopped. The rotation speed of the fans increases with increasing the temperature of the heatsink. Therefore, the cooling system stabilizes the temperature of the generator; this improves the stability of the output pulse waveform and reduces temperature drift.

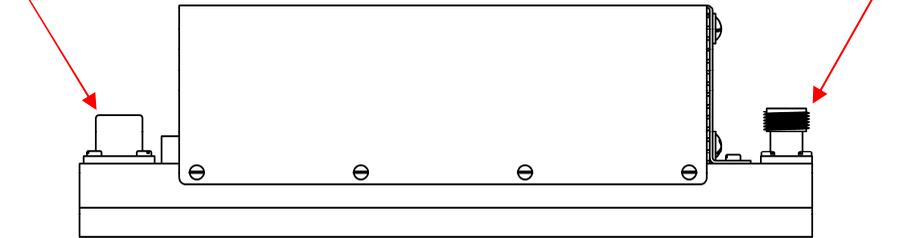
**TECHNICAL SPECIFICATION  
OF PPM0211 SUBNANOSECOND PULSE GENERATOR MODULE**

|  |   |
|--|---|
| Output pulse amplitude   | 2 kV  |
| Pulse polarity and waveform  | Positive, bell-like   |
| Output connector and impedance   | N-type, 50 Ohm impedance  |
| Pulse rise time (fast part)  | 600 ps  |
| Pulse width (FWHM)   | 1.5 ns  |
| Max repetition rate  | 1 MHz   |
| Jitter (RMS)   | < 20 ps   |
| Jitter (peak-to-peak)  | < 100 ps  |
| Internal delay (from leading edge of the triggering pulse to output pulse) | ~ 100 ns  |
| Triggering   | External only   |
| Input triggering pulse connector   | SMA   |
| Triggering pulse parameters  | +5V amplitude at 50 Ohm,<br>10 ns ... 200 ns width, 1ns rise time |
| Power supply (standard AC/DC converter)                                    | +24V, 3.2A; +130V, 2.1A   |
| Size   | 250 x 130 x 80 mm <sup>3</sup>                                    |
| Operation temperature  | 0 °C.. +50°C  |

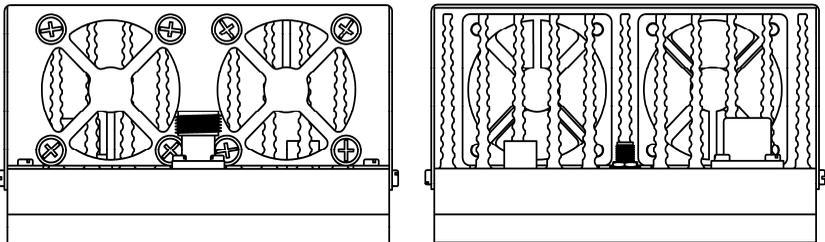
### TOP VIEW



### SIDE VIEW



### LEFT AND RIGHT VIEW



- 1 – control LED (from top to bottom)
  - +24V DC (green) – low voltage +24V DC power supply is applied
  - +HV DC (green) – high voltage +130V DC power supply is applied
  - SYNC IN (orange) – triggering of the generator
  - OVERHEAT (red) – too high temperature
  - OVERLOAD (red) – too high repetition rate
- 2 – Input triggering SMA connector
- 3 – Power supply connector
- 4 – 4x mounting holes 4mm dia, 222x118mm footprint
- 5 – Output HV N-type connector

## PUTTING THE GENERATOR INTO OPERATION

- ➔ **Please follow strictly the following steps. It helps to prevent damage to the generator and other equipment.**

### Step 1.

Unpack and check the presence into the package of the following items:

- PPM0211 pulse generator;
- Dual voltage AC/DC converter with power supply cable;
- Semirigid coaxial cable assembly with N-type connector(s) for the output pulses feeding;
- Coaxial cable assembly SMA/RG316\_cable/SMA for the input triggering pulses feeding.

Remove the protective and packaging materials from the generator and power supply converter.

### Step 2.

In case of using alternative laboratory DC power supply:

Please set the external power supplies according to the recommended low voltage and high voltage levels before connecting to the generator.

### Step 3.

Connect the output semirigid coaxial cable assembly and the load to the generator.

Connect the triggering pulse generator by input coaxial cable assembly.

Connect standard AC/DC converter or alternative laboratory DC power supply by using optional four wires DC power supply cable. The ground wires of the cable are marked in black color. Low voltage and high voltage supply wires are marked by the labels.

- ➔ **Improper connection of DC supply will damage the generator.**

### Step 4.

Switch on the power supply. Both greens LED “+24V DC” and “+HV DC” should light on. Set the external triggering pulses frequency to 1 kHz, amplitude to +5V, pulse width 100 ns. Apply triggering pulses, orange LED “SYNC IN” should light on.

High voltage output pulses should be generated. Please check them. Set the external triggering pulses frequency as required, but below or equal to the maximum repetition rate.

→ **Please pay attention that most of the standard GHz range coaxial attenuators are not suitable for direct registration of output pulses because of extremely high peak power. Even 100W and more power attenuators will be broken inevitably. We recommend using of 142 series Barth Electronics attenuator (for the frequencies below 5 kHz) as the first attenuator connected just to the generator output or use a high voltage directional coupler.**

The generator is designed for long-time operation at a max repetition rate, but it can be overheated in case of unmatched load and high ambient temperature. Please provide free airflow around the generator for good cooling. The temperature of the generator should be below 55 °C. Reduce the repetition rate and/or improve the airflow in case of overheating.

If the frequency of the triggering pulses is too high, then the red LED “OVERLOAD” lights on and the generator stops the operation. Please reduce the frequency of the triggering pulses, LED “OVERLOAD” lights off and the generator continues the operation automatically.

## TRIGGERING OF THE GENERATOR

The recommended triggering pulse waveform is shown in Fig. 4. Nominal triggering pulse amplitude is +5V at 50 Ohm, pulse duration should be within 10 ns ... 200 ns, rise time should be 1 ns or less. Longer rise time may result in increasing the output pulse jitter.

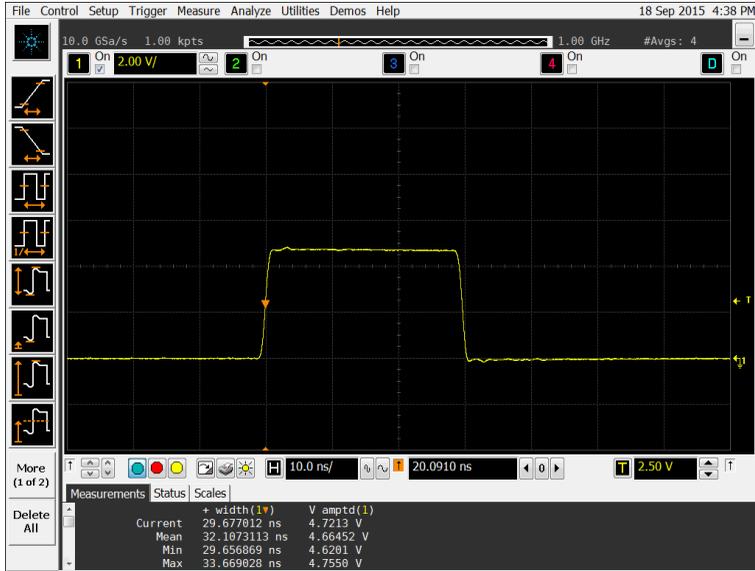


Fig. 4. Recommended triggering pulse waveform.

## **WARRANTY**

Please see your sales agreement to determine the warranty period and warranty terms. The generator has warranty seals.

- ➔ **Removing the warranty seals terminates the warranty.**