

## Noise Measurement Amplifier

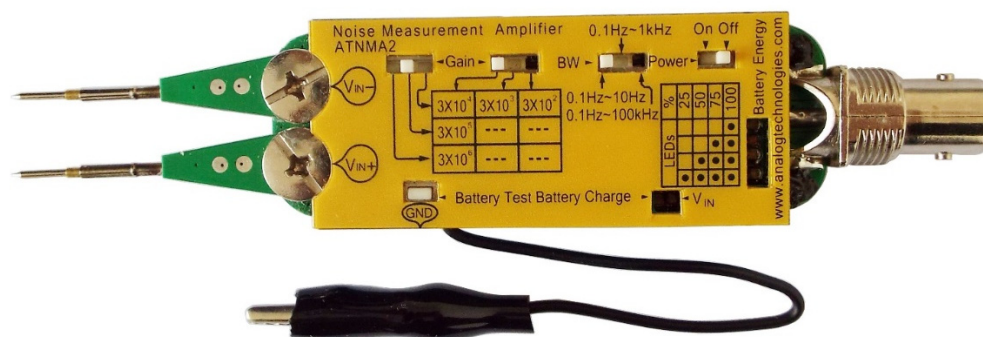


Figure 1. The Physical Photo of ATNMA2

### MAIN FEATURES

Built-in rechargeable battery

Magnifications: 300×, 3,000×, 30,000×, 300,000×, 3,000,000×

Three filter bandwidths: 0.1Hz ~ 10Hz, 0.1Hz ~ 1kHz, 0.1Hz ~ 100kHz

LED low battery indicator function

BNC output terminal

Input probes with adjustable span

100 % Lead (Pb)-free and RoHS Compliant

### INTRODUCTION

This noise measurement amplifier, ATNMA2, is designed to test ultra-low noises, which cannot be measured by an oscilloscope, such as nanovolt or microvolt level noises, for electronic modules. This amplifier measures the noise signals by touching the point that needs testing, then amplifies the detected noise signals, and selects the measured range of frequencies. The rechargeable battery energy is 500mAh, and can be used for more than 20 hours. The rechargeable battery full voltage is 4.2V. The low noise amplifier includes one rechargeable battery, one coaxial cable, and some probes. The maximum input DC voltage is 6.3V. If the voltage is large, partial voltage can be used.

The maximum input peak-to-peak AC (or noise) voltage is 3V/ (gain), e.g. gain= 3000 times, the maximum input noise is 3V/3000=1mV. The maximum output peak-peak is 3V.

Input impedance is 10k and the output impedance is <0.1Ω. The output is DC coupled.

This noise measurement amplifier assembly has 5 portions:

#### 1. Amplification Magnifications

300×:

Measure the noises between 3μV to 30μV, toggle magnification switch S1 to S1-3 and S5 to S5-3.

3000×:

Measure the noises between 0.3μV to 3μV, toggle magnification switch S1 to S1-2 and S5 to S5-3.

30,000×:

Measure the noises between 0.03μV to 0.3μV, toggle magnification switch S1 to S1-1 and S5 to S5-3.

300,000×:

Measure the noises less than 0.1μV, toggle the magnification switch S1 to S1-1 and S5 to S5-2.

3,000,000×:

Measure the noises less than 10nV, toggle the magnification switch S1 to S1-1 and S5 to S5-1.

Please see the switch locations in Figure 2.

#### 2. Noise Measurement Range

Noise measurement ranges include: 0.1Hz ~ 10Hz, 0.1Hz ~ 1 kHz and 0.1 Hz ~ 100 kHz. The specific locations please see Figure 2.

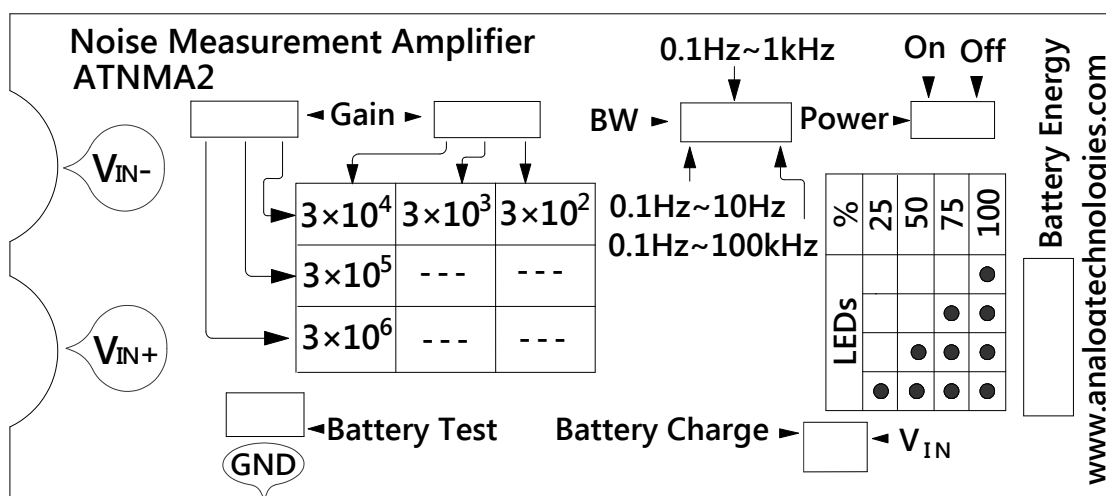


Figure 2. Functions and Locations of ATNMA2

### 3. Battery Capacity Monitoring

Observe battery LEDs when turning on the battery indicator switch. When four power indication LEDs are all lit, it means the battery is full, and the battery voltage is more than 3.8V; three power indication LEDs lit, the battery voltage is more than 3.6V; two power indication LEDs lit, the battery voltage is more than 3.4V; if only one LED is on, the battery voltage is more than 3.2V, and then the circuit does not work well, recharging the battery is necessary, otherwise the battery will be damaged. Please see the capacity monitor demonstration in Figure 3.

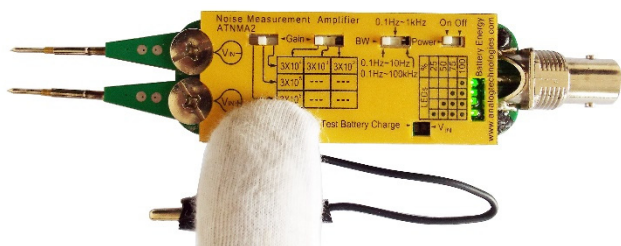


Figure 3. Capacity Monitor of ATNMA2

### 4. Battery Charging Display

The Charging displays, LED 5 and LED 6, will be on when charging well. When the charging voltage exceeds 7.2V or less than the battery voltage, LED 5 turns off. LED 6 is lit when in charging mode. Battery charging display shows in Figure 4.

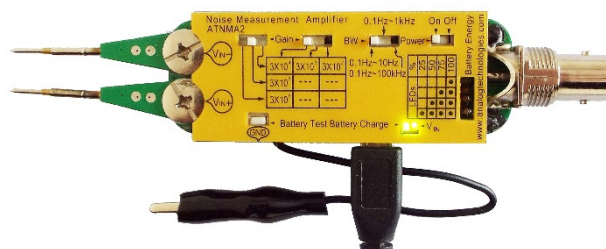


Figure 4. Charging Display of ATNMA2

### 5. Battery Indication

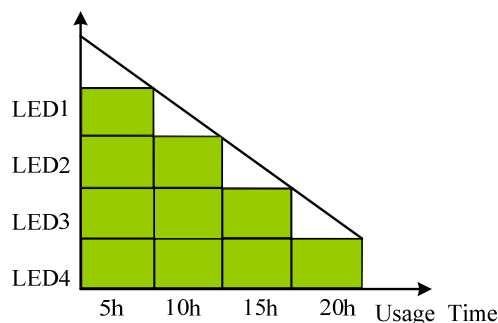


Figure 5. Power Show Time of ATNMA2

### INPUT AND OUTPUT MODLE

#### Rotatable Probe Input:

Adjust the angles of the spring probe to make it contact the point to be tested. Hold the amplifier by hand just like a pen. When two probes are pressed together, they can extend open to an angle of more than 70°.

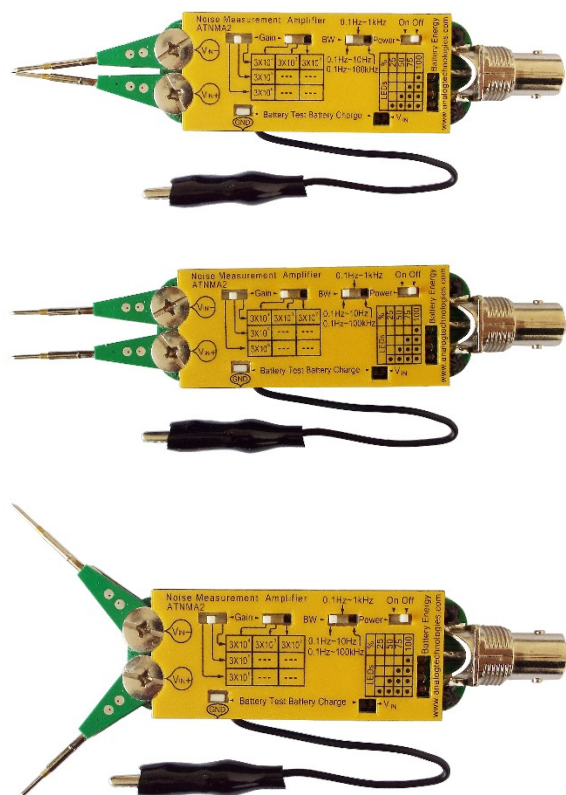


Figure 6. Probe Angle of ATNMA2

**Coaxial cables output:** Use the coaxial cable to connect the BNC and oscilloscope. The type of the coaxial cable line is SYV-50-2-41.

### APPLICATION METHOD

Adjust the angles of the spring probe to contact the point to be tested by two screws, connect the coaxial cable well, and push on the power switch. At this time, press the monitoring battery switch, and the power indication LEDs should be lit. Then select the filter frequency range, toggle two switches at the same time and observe the oscilloscope and adjust suitable magnifications (The oscilloscope waveform is observable but not saturated).

### CALCULATION METHOD

To calculate the ultimate noise value, there are two forms of data that need to be measured. One data is  $V_{O(P-P)}$ , the noise value when there's no power supply module; and the other is

$V_{C(P-P)}$ , the noise value when it's working well. The formula is as follows.

$$V_{IN-TOT-PP} = \frac{V_{OUT-PP}}{G} \quad (1)$$

$$V_{IN-TOT-RMS} = \frac{V_{IN-TOT-PP}}{6.6} \quad (2)$$

$$V_{IN-TOT-RMS} = \sqrt{V_{IN-AMP-RMS}^2 + V_{N-DUT-RMS}^2} \quad (3)$$

$$V_{N-DUT-RMS} = \sqrt{V_{IN-TOT-RMS}^2 - V_{IN-AMP-RMS}^2} \quad (4)$$

$$V_{N-DUT-PP} = V_{N-DUT-RMS} \times 6.6 \quad (5)$$

$V_{OUT-PP}$  is the peak to peak voltage of the tested circuit with power supply from oscilloscope.

G is magnification of the noise measurement amplifier.

$V_{IN-TOT-PP}$  is the total peak to peak voltage of the input terminal.

$V_{IN-TOT-RMS}$  is the total root, meaning it's the square voltage of the input terminal.

$V_{IN-AMP-RMS}$  is the root, meaning it's the square voltage of the noise measurement amplifier;

$V_{N-DUT-RMS}$  is the root, meaning it's the square voltage of device under testing.

$V_{N-DUT-PP}$  is the final peak to peak noise value of the device under testing.

$V_{N-DUT-RMS}$  is the final root, meaning it's the square noise value of the device under testing.

### AMPLIFIER NOISE

Table 1 shows the amplifier's noise itself, at different frequencies.

Table 1.

Bandwidth	Amplifier Noise
0.1Hz~10Hz	150nV
0.1Hz~1kHz	600nV
0.1Hz~100kHz	800nV

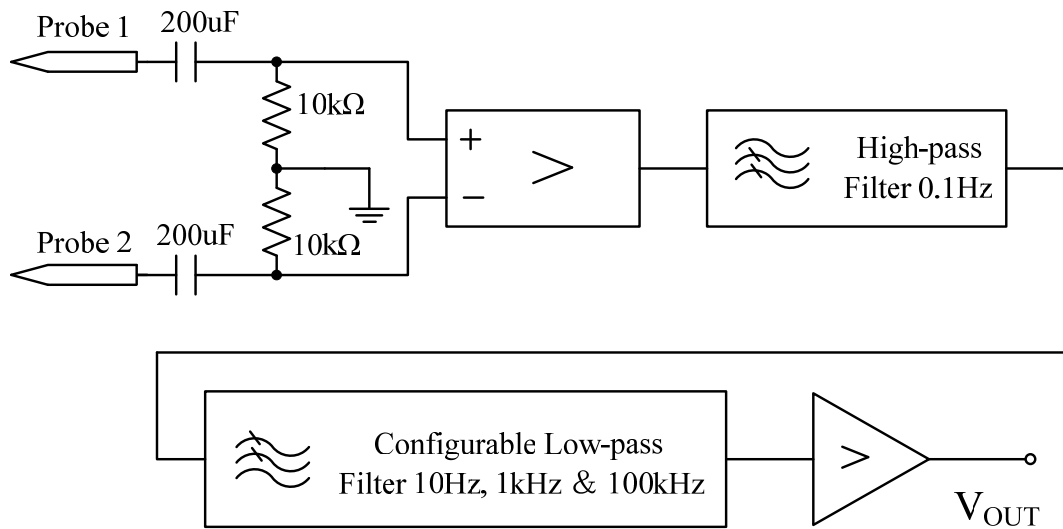


Figure 7. Equivalent Circuit of ATNMA2

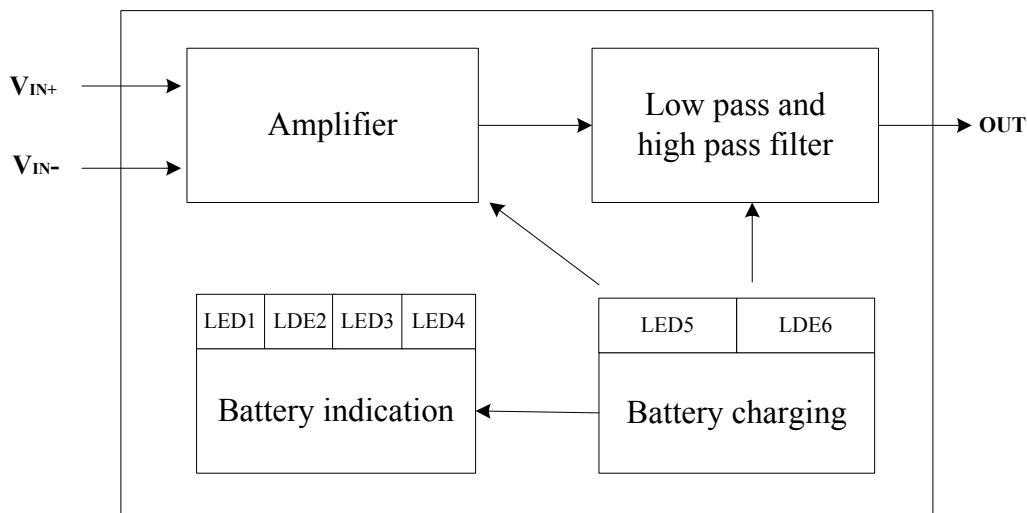


Figure 8. Internal Block Diagram of ATNMA2

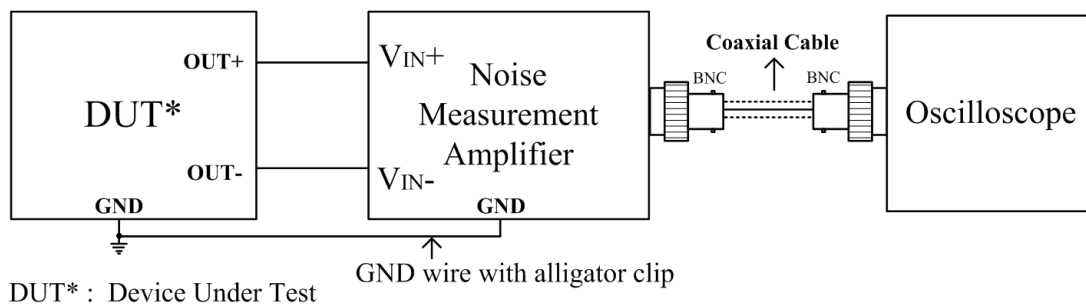


Figure 9. Application Drawing of ATNMA2

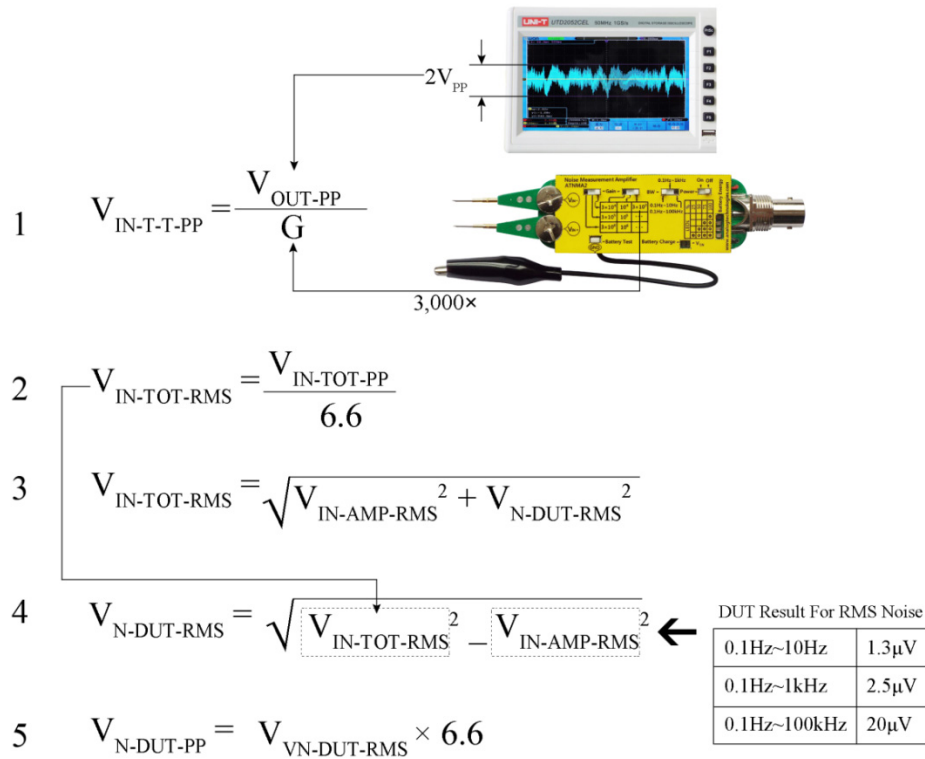


Figure 10. Calculation Formula Diagram of ATNMA2

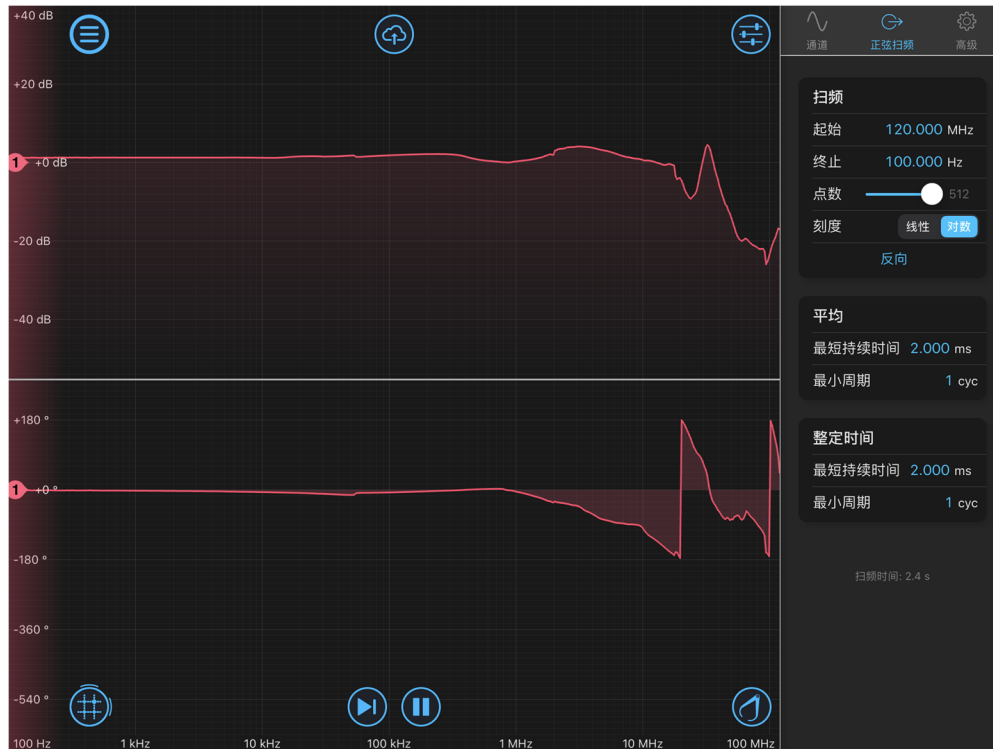


Figure 11.  $V_{IN+}$ ,  $V_{IN-}$  &  $V_{OUT}$  Frequency Response Waveform



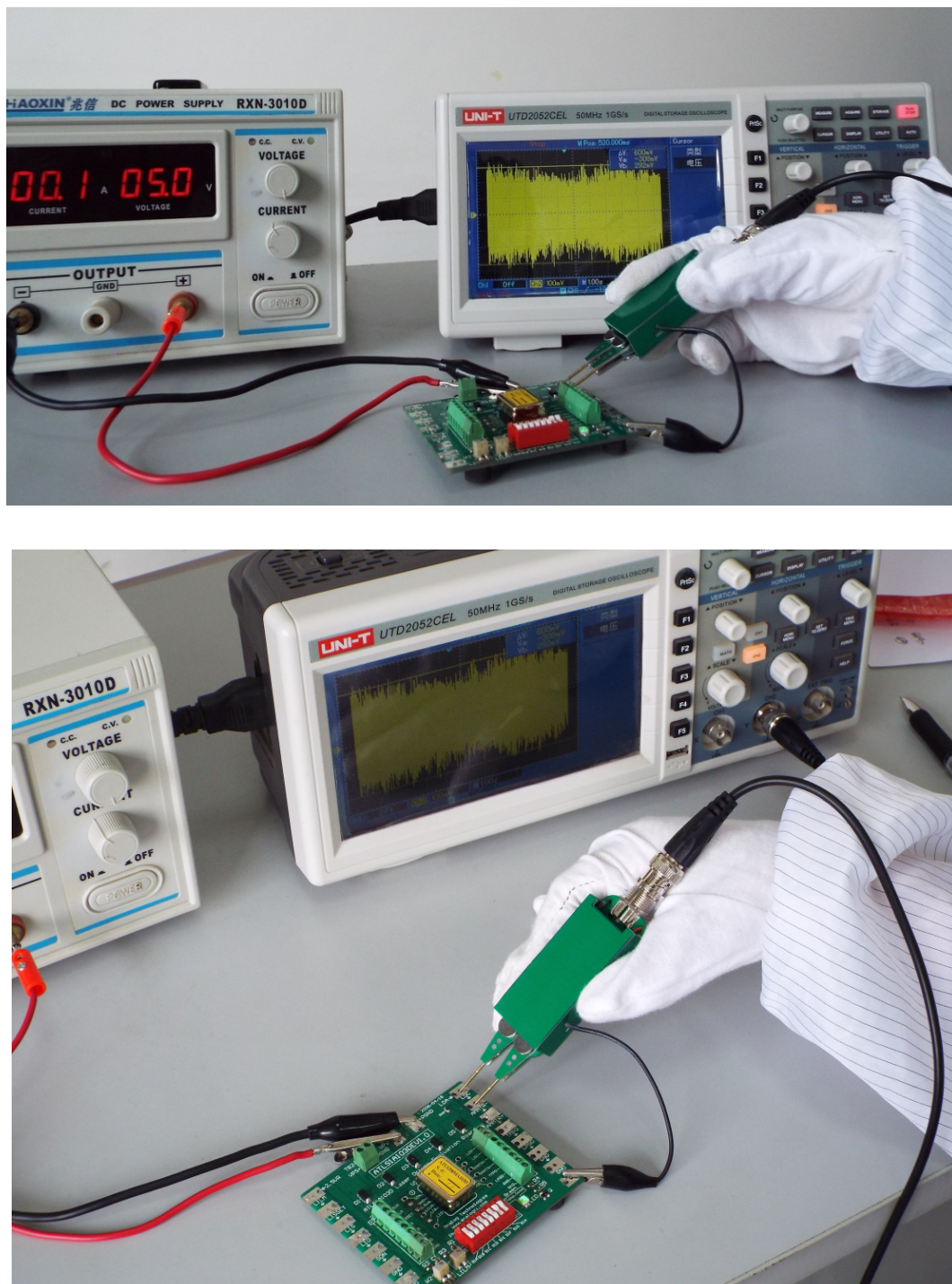


Figure 12. Application Presentation Photo of ATNMA2



Figure 13. Side View of ATNMA2

## ACCESSORIES



Figure 14. BNC-BNC Connector 1.5m Coaxial Cable



Figure 15. Charger and USB cable of ATNMA2



#### DIMENSIONS

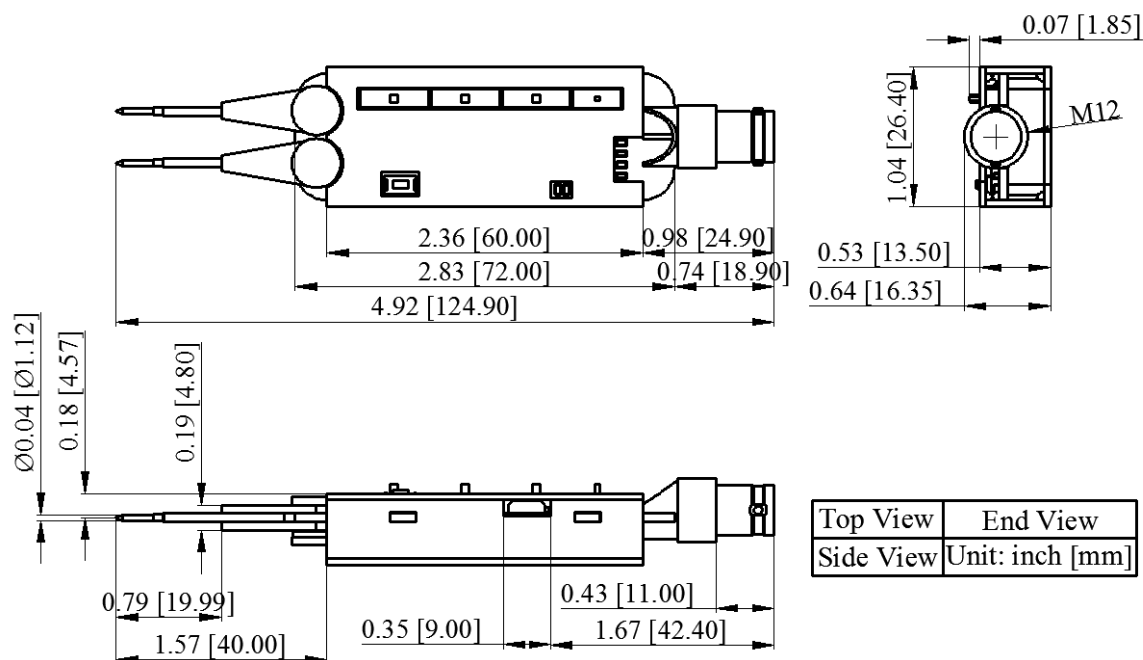


Figure 16. Dimensions of AHVA2KV2X20MA

#### ORDERING INFORMATION

Table 2. Part Number

Part #	Description	Unit Price
ATNMA2	Noise Measurement Amplifier	\$189



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