

## Truly Portable RF Signal Generators for Applications where Size, Performance, and Price matter

AnaPico has recently launched a series of truly portable RF signal generators. The optional internal rechargeable battery makes these generators ideal for applications outside of the lab, without any compromise in RF performance.

The specifications are rivalling high-end laboratory-grade instruments, which are several times the weight, size and price of the new product.

Users benefit from very low phase noise, fast switching speeds, high reliability, and ease of operation in a variety of applications, especially mobile or airborne applications, automated testing and manufacturing, military communications and radar, or wireless systems research and field testing.

Two versions of the APSIN are available, covering respective frequency ranges from 9 kHz to 3.3 GHz (APSIN3000) and 6.4 GHz (APSIN6000) with a 0.001 Hz fine resolution. The wide frequency coverage and the complete function set makes the APSIN also ideally suited for EMC and R&D labs.

The versatile instrument contains all important functions right out of the small box. The APSIN is fully equipped in its standard configuration, supporting analog AM, FM,  $\phi$ M and pulse modulation. An internal low frequency generator provides modulation and pulse signals, which are directly accessible at the rear panel.

The internal rechargeable battery makes the APSIN a truly portable instrument which is particularly attractive for service installation and maintenance applications.

And a powerful PC user interface (Ethernet based) allows very efficient remote access from PC or laptop.

### System Architecture

Fig. 2 shows a block diagram of the signal source core. The APSIN generators use advanced phase-locked loop and direct digital synthesis concepts in combination with intelligent frequency planning thus avoiding bulky microwave components like YIGs or mechanical filters, to deliver key performance without compromise in a compact and power-saving design and at a very attractive price.



Fig 1 APSIN6000 Front View (WxLxH is only 17 x 22 x 10 cm, weight < 2.5 kgs)

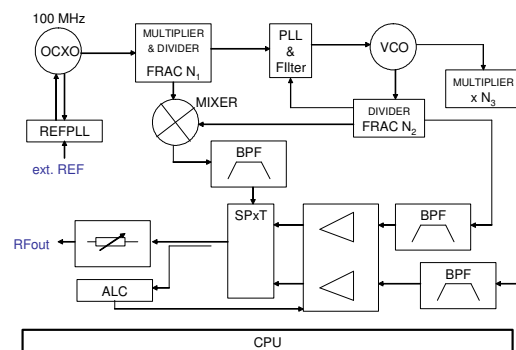


Fig. 2 Block Diagram of the APSIN Signal Generator

The signal generator uses an ultra-stable 100 MHz oven-controlled crystal oscillator (OCXO) as an internal reference. The OCXO has a temperature stability of 100 ppm over

a range of 0 to 85 °C. If required, the OCXO can be phase locked to an external reference between 1 and 100 MHz using the reference phase-locked loop (REFPLL).

Both the reference input and output are at the rear panel.

The 100 MHz OCXO signal is multiplied and divided down (FRAC N1) to derive a variable reference frequency with micro-hertz resolution to the main phase-locked loop (PLL). The PLL along with a second divider (FRAC N2) do phase-lock the voltage-controlled oscillator (VCO) to the variable reference frequency. The VCO output, or the respective multiplied (N3) or divided (N2) version thereof are then filtered by programmable band-pass filters and fed into an amplifier chain. Several RF switches (SPxT) combine the multiple signal paths into a common output.

The internal power sensor of the automatic gain control circuit detects the power level and provides error voltages that are fed back to the variable gain amplifiers to adjust the output power to the desired level. The internal power detector is calibrated individually for each device and has a low temperature drift. Hence, a very accurate and temperature-stable output power level is guaranteed.

An output circuit provides more attenuation and protects against overvoltage and reversed power.

### **Excellent Signal Purity**

A signal with excellent phase noise, low spurious and harmonic content is derived. The measured phase noise of the APSIN is shown in Figure 3. A single-sideband phase noise of less than -130 dBc/Hz at 1 GHz carrier and 20 kHz offset is achieved, making the APSIN attractive for all applications that require spectrally pure signals.

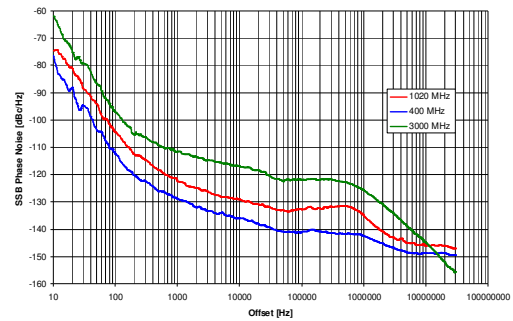


Fig. 3 Measured SSB Phase Noise at 400 MHz, 1 and 3 GHz, respectively.

### **A fast Switching Synthesizer**

Today, most ATE applications require fast switching of power and frequency to maximize throughput in manufacturing and testing. Special care has been given to the design to minimize transients during switching from one to another frequency. As a result, the APSIN offers frequency and power sweeps with very short settling times, typically below 50  $\mu$ s for a 1 GHz step.

The inherent fast-switching of the APSIN yielded in the implementation of fast sweeps with very precise timing. List sweeps can be run with individual dwell time, off time, and power level for each frequency and even long lists can be loaded and executed with high timing accuracy, because transients are taken into account. Short dwell times as low as 200  $\mu$ s are supported. External triggering (via rear panel input or SCPI) allows full synchronization to the test environment.

### **High Output Power**

In many applications (such as mixers with high LO drive level), a high RF power is desirable to avoid complicated and costly setups with external power amplifiers. As standard, the APSIN provides high output power with low harmonic content. The APSIN level setting range is -100 dBm to +13 dBm over the

entire frequency range, with typical over-range greater than 18 dBm (Fig. 4).

For applications requiring a level setting range not exceeding 45 dB, a even more favourably priced solution is available without the output attenuator.

The good level accuracy and repeatability of the APSIN (level uncertainty typically <0.5 dB with ALC on) provides users with reliable measurement results.

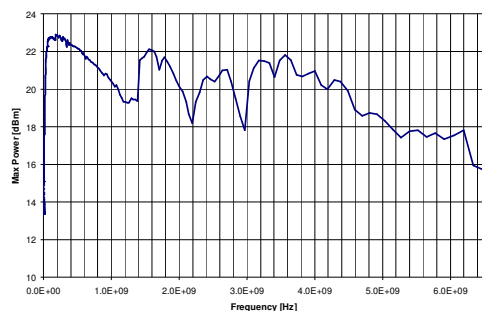


Fig 4 Maximum output power of the APSIN6000

### **Fast Pulse Modulation**

Besides supporting basic AM, FM, and PM modulation, the APSIN supports fast pulse modulation with on/off dynamics of 80 dB. The internal pulse modulator produces pulses as short as 100 ns with programmable duty cycle and rise and fall times of only 5 ns. Bit streams can be loaded into the APSIN to generate arbitrary pulse patterns.

### **Versatile Remote Control via GUI**

The ease of usability helps to ensure that lab users and manufacturers can use AnaPico's APSIN most efficiently. User-friendly features, such as intuitive front panel with an LCD display, a Windows™ based graphical user interface, Ethernet LAN connectivity for effortless automated tests and remote control, and web-browser access allow efficient handling and control of the instrument. Supporting the standard SCPI interface language, the APSIN is more than just

a replacement of older bulky GPIB-controlled equipment.

When test systems include legacy signal generators that are no longer manufactured or can no longer be repaired, switching to other types of generators is usually a costly exercise. It often results in the time consuming task of modifying the remote control software, provided that the source code is still available. On request, the APSIN can be supplied with control emulation modes for a wide variety of signal generators, which allows cost-efficient substitution of legacy signal generators.

### **Handheld Instrument for Field Installation, Test and Maintenance**

The APSIN signal generators features a battery-operated (good for three hours of operation), field-proven design so powerful, yet so small that it fits into anyone's backpack.

Its exceptional performance combined with ease-of-use and broad functionality makes it an ideal solution for field environments and applications that require mobility such as site surveys (see Fig. 5), on-site system test or base-station receive level calibration. Both CW and modulated test signals can be generated over a wide range of frequencies and levels. This provides the user with test signals required to carry out measurements such as intermodulation, gain or sensitivity.

The APSIN's flash memory holds several setups and preloaded list sweeps that can be executed on-site. And the field application staff will appreciate the rugged but light weight design, which make the instrument truly portable.



Fig. 5 The mains-free operation provides advantages in field testing such as in-building and outdoor propagation measurements or testing in shielded rooms.

**Ideal for Automated Tests and Production**

The low-power and fan-less design is ideal for applications in space-limited and thermal-constraint ATE systems. The variety of connectivity options and the APSIN's low profile of 10 H x 17 W (cm) further enhance the signal generator's ATE advantages.

The increased throughput and lower cost of test created by the fast switching speed also make the APSIN excellent for high volume component manufacturing, such as RFIC and MMIC testing.

The 19" rack-mount kit holds two units side-by-side in a 3 HE format (Fig. 6), allowing dense installations in space critical environments.

A front panel with only the status display and the RF on/off button is available for applications that are exclusively using computer remote control. On demand, the RF output can be configured to front or rear panel.



Fig. 6 19" Rackmount holding two APSIN signal generators in 3U height and 30 cm (12") depth

**Conclusion**

The key performance of the APSIN signal generators is summarized in Table 1.

The APSIN provide all functionality and performance that is expected from today's RF signal generators. But the small form factor, light weight and the internal batteries make it a unique portable instrument. Due to its low cost, high reliability, and the complete feature set, the APSIN is the right RF signal source for a broad range of applications.

Table 1 APSIN performance summary

|                      | APSIN3000  | APSIN6000                          |
|----------------------|--|------------------------------------|
| Frequency resolution | 9 kHz to 3400 MHz<br>0.001 Hz  | 9 kHz to 6400 MHz<br>0.001 Hz      |
| Level uncertainty    | -100 to + 13 dBm<br>< 1 dB   | -100 to +13 dBm<br>< 1 dB          |
| Spectral Purity      | -130 dBc/Hz<br>(1 GHz; 20kHz off)  | -115 dBc/Hz<br>(5 GHz; 20 kHz off) |
| Harmonics            | < -35 dBc  | < -35 dBc                          |
| Switching time       | 1 ms   | 1 ms                               |
| Modulation           | AM, FM; PM, pulse modulation   |                                    |
| Remote control       | Ethernet (TCP/IP); SCPI 1999   |                                    |
| Connectors           | RF, pulse, FM/PM in, Trigger in, Func out<br>(Pulse video out, LF generator out, Trigger out), REF in, REF out |                                    |