Hittite Microwave Corporation continues to expand its synthesized signal generator portfolio by introducing a new and improved next generation synthesized signal generator platform. The HMC-T2220, HMC-T2220B and HMC-T2240 are high power output continuous wave (CW) synthesized signal generators, with key specifications provided in Table 1. These synthesized signal generators are built on a foundation of high quality, market leading Hittite MMICs, and provide the highest output power, lowest harmonic levels, and broadest frequency range compared with signal generators of similar size and cost.

HMC-T2220 Performance Upgrades vs. HMC-T2100
The HMC-T2220 provides a number of performance upgrades compared with the highly successful HMC-T2100, allowing customers to choose the signal generator with the best fit based on their price and performance requirements. The HMC-T2100 is priced at $7,998, while the upgraded HMC-T2220 is priced at only $9,998.

Well received by the industry, the HMC-T2100 delivers signal generation from 10 MHz to 20 GHz, and offers breakthrough price and performance points. The HMC-T2200 builds on the success of the HMC-T2100, providing significant performance enhancements in a number of areas. Table 1 compares the performance of the HMC-T2100, HMC-T2220, HMC-T2220B, and the HMC-T2240.

The HMC-T2220 operates over a broad frequency range from 10 MHz to 20 GHz, covering all of the major communication bands with a frequency resolution of only 1 Hz (vs. 10 KHz for HMC-2100) and fast switching speed of 300 us. Ideal for use in automated test and measurement environments, and research and development laboratories, the HMC-T2220 is a compact, lightweight and portable frequency generator that delivers up to +28 dBm of CW output power in 0.1 dB steps over a 60 dB dynamic range, which represents a 20 dB dynamic range improvement over the HMC-T2100. At 20 GHz, the HMC-T2220 delivers +24 dBm of output power, which is 2 dBm higher than the output power from the HMC-T2100 at the same frequency. The HMC-T2200 is especially suited for CW frequency testing but can be programmed for swept frequency screening.

The HMC-T2200 also features a 30 dB improvement in fractional mode spurious rejection compared with the HMC-T2100 at 10 GHz. The HMC-T2220 exhibits -98 dBc/Hz @ 10 KHz offset at 10 GHz with insignificant deviation over the temperature range of 0º C to +35º C, compared with the HMC-T2100, which provides phase noise performance of -95 dBc/Hz @ 10 KHz offset at 10 GHz.

The HMC-T2200 also adds

Table 1: HMC-T2100, HMC-T2220, HMC-T2220B & HMC-T2240 Key Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>HMC-T2100</th>
<th>HMC-T2220</th>
<th>HMC-T2220B</th>
<th>HMC-T2240</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>0.01 to 20</td>
<td>0.01 to 20</td>
<td>0.01 to 20</td>
<td>0.01 to 40</td>
<td>GHz</td>
</tr>
<tr>
<td>Frequency Resolution</td>
<td>10,000</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Hz</td>
</tr>
<tr>
<td>Output Power</td>
<td>22 @ 20 GHz</td>
<td>24 @ 20 GHz</td>
<td>24 @ 20 GHz</td>
<td>20 @ 40 GHz</td>
<td>dBm</td>
</tr>
<tr>
<td>Power Resolution</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>dB</td>
</tr>
<tr>
<td>Dynamic Range</td>
<td>40</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>dB</td>
</tr>
<tr>
<td>RF OFF Leakage</td>
<td>-60</td>
<td>-80</td>
<td>-80</td>
<td>-70</td>
<td>dBm</td>
</tr>
<tr>
<td>Phase Noise @ 10 kHz Offset @ 10 GHz</td>
<td>-95</td>
<td>-98</td>
<td>-98</td>
<td>-98</td>
<td>dBC/Hz</td>
</tr>
<tr>
<td>Fractional Frequency Spurious Rejection</td>
<td>-70</td>
<td>-70</td>
<td>-70</td>
<td>-70</td>
<td>dBC</td>
</tr>
<tr>
<td>Switching Speed</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>500</td>
<td>μs</td>
</tr>
<tr>
<td>Weight</td>
<td>3.2 (7)</td>
<td>3.2 (7)</td>
<td>5 (11)</td>
<td>3.6 (8)</td>
<td>Kg (lbs)</td>
</tr>
<tr>
<td>Trigger Function</td>
<td>IN</td>
<td>IN and OUT</td>
<td>IN and OUT</td>
<td>IN and OUT</td>
<td>TTL</td>
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<tr>
<td>Battery Operation</td>
<td>N/A</td>
<td>N/A</td>
<td>4</td>
<td>N/A</td>
<td>Hours</td>
</tr>
<tr>
<td>Price/Unit</td>
<td>$7,998</td>
<td>$9,998</td>
<td>$14,998</td>
<td>$19,498</td>
<td>USD</td>
</tr>
</tbody>
</table>

Performance values shown are typical.
a trigger output interface function, and provides a 20 dBm improvement in RF OFF leakage compared with the HMC-T2100, which is highly beneficial for radar system testing applications.

The HMC-T2200 has also been improved from a mechanical/environmental standpoint compared with the HMC-T2100. The fan noise has been reduced by 10 dBa, a new customer-removable ruggedized carry handle has been added, and the front panel control knob functionality has been improved for easier LCD display scrolling.

**High Performance HMC-T2220B, Same Price Point!**

The HMC-T2220B is a higher performance, highly portable, improved battery powered synthesized signal generator which replaces the existing HMC-T2100B at the same price point of $14,998. The HMC-T2220B and the HMC-T2220 provide identical electrical performance.

The HMC-T2220B is ideal for use in field testing, maintenance applications, and remote locations where prime power is unreliable or unavailable. The HMC-T2220B’s small footprint is advantageous in automated test and measurement environments, or research and development laboratories. Key applications include power amplifier testing, use as a local oscillator (LO) source, and the test of communications uplink transmitters or downlink receivers.

The HMC-T2220B contains two removable batteries and an internal battery charger that automatically recharges the batteries when the synthesizer is powered from an AC source. The HMC-T2220B is ideal for use in locations where an AC source is not available and continuously operates for two hours on a single battery, or four hours with two batteries. The recharge time for either one or two batteries is 6.5 hours, during which the unit can be continuously operated.

An installation disk that accompanies each unit includes all the drivers required to remotely control the device as well as a user friendly GUI interface compatible with a Windows XP® or Windows Vista® or Windows 7® operating system (Figure 2). User control is facilitated via pull down menus that allow programming of single or swept modes in frequency and/or power. All necessary files for C/C++ development and Labview drivers are included with user software to allow for a wide range of custom automation remote control.

Furthermore, to facilitate integration into existing HMC-T2100 applications, the HMC-T2220 has a HMC-T2100 compatibility mode. In this mode, the HMC-T2220 identifies itself as a HMC-T2100 so that the HMC-T2220 USB drivers will work for a HMC-T2200, and pro-
grams will recognize a HMC-T2220 as a HMC-T2100. The HMC-T2220 frequency resolution, maximum and minimum power values, and minimum sweep dwell time also change to match the HMC-T2100.

An internal 50 MHz crystal provides the reference signal to the PLL circuit and is locked to an internal TCXO. An externally provided 10 MHz reference signal can be used. The external reference signal is automatically selected when present. In addition, a 10 MHz output reference signal is provided to allow multiple units to be phase locked together. Several methods of automation connectivity are provided on the rear panel, with GPIB, Ethernet, and USB available for connection to a remote computer. An RS-232 interface is provided for in-field programming of software upgrades.

**Phase Noise Performance:**
**HMC-T2100, HMC-T2200/B & HMC-T2240**

Phase noise is a key parameter in the operation of a synthesized microwave source for a wide range of applications from radar to communications systems. Normally the phase noise is specified as the amount of noise below the carrier level when normalized to a 1 Hz bandwidth at some offset from the carrier. The test signal source phase noise specifications should be significantly better than that of the device under test (DUT) in order to accurately determine the DUT noise floor.

For LO drive applications, phase noise in the LO signal is translated to the mixer products. If the desired signal is smaller than the two mixed signals, the translated noise due to the LO phase noise may completely mask the smaller signal. This effect is more pronounced in high-selectivity receivers where the smaller desired signal may not be recoverable. Another application for low-phase noise is adjacent channel selectivity, which tests the receiver’s rejection of unwanted signals. A signal generator is set one channel spacing away from the receiver’s IF channel and the signal is increased until it goes through the pass-band and distorts the in-channel by a preset value. The difference between the two signal levels sets the figure of merit for adjacent channel selectivity. In the case of poor phase noise, higher distortion on the desired signal occurs and the measured adjacent channel selectivity is lower than in reality.

The system architecture designed into the HMC-T2100 and the HMC-T2200 series provides for excellent typical phase noise performances of -95 dBc/Hz and -98 dBc/Hz, respectively at 10 kHz offset at 10 GHz, and is shown in Figures 3 and 4. The HMC-T2240 exhibits similar phase noise performance compared with the HMC-T2200 at 10 GHz, but also provides extended operation up to 40 GHz.

This high phase noise performance makes these signal generators ideal for receiver testing and RF sourcing for multiple applications.

**Output Power Performance:**
**HMC-T2100, HMC-T2200/B & HMC-T2240**

In many applications, RF power is a key consideration for DUT operation. In various test instrumentation or lab setups, the output power of the synthesizer is a key differentiator. For example, in setting up a link budget for the test setup, the incremental effect of all of the individual losses of the splitters, switches, and attenuators must be carefully considered to ensure that the DUT high power input requirement is satisfied. Mixers should not be starved of LO drive power, while power amplifiers need high input power to meet the P1dB measurement requirement.

In typical test equipment setups, the common trend is to place one or more power amplifiers before the DUT to increase the input power, but this is problematic since it introduces matching problems as well as calibration complexities. Because of their high output power, the HMC-T2100 and HMC-T2200 series signal generators eliminate these issues, simplify the design of the test setup, and increase customer return on investment by reducing the overall complexity of the calibration process.

The HMC-T2100 and the HMC-T2200 series signal generators deliver best in class output power for portable RF signal generators and are ideal for performing high-quality adjacent channel selectivity measurements. The HMC-T2100 delivers up to +27 dBm of output power, while the HMC-T2220 and HMC-T2240 deliver up to +28 dBm and +30 dBm, respectively. Figures 5, 6 and 7 provide a detailed overview of output power performance vs. frequency for all four signal generators.

**Summary**

The HMC-T2100 and the new HMC-T2200 series CW synthesized signal generators are compact and lightweight, making them well suited for integration within various test environments, while improving overall productivity and equipment utilization. These signal generators are all CSA...
and CE certified, and their size and capability ensure a simpler test configuration coupled with exceptional value compared with competing solutions in the market today. All Hittite synthesized signal generators can be ordered via the company’s e-commerce site or direct purchase order. Contact Hittite today at TE@hittite.com to request your on-site product demonstration. Visit our new instrumentation website at www.tm-hittite.com for more details and ordering information.

In addition to these signal generator products, Hittite Microwave is well known for providing high performance frequency generation and distribution products, including dividers, multipliers, dynamic and static prescalers, VCOs, phase-locked oscillators (PLOs) and complete synthesizers. More than 100 standard products are available from Hittite which can be utilized in signal generation loops from DC to 80 GHz. In addition, Hittite develops custom VCOs to meet demanding application-specific requirements.

Designers can also choose from over 925 products across 31 product lines offered by Hittite. Data sheets and supporting information for all of Hittite’s products are available online at www.hittite.com.

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