Technical Specifications (continued)

TGR2050 - FREQUENCY

Frequency Range: 150kHz to 2000MHz
Setting Resolution: 10Hz by direct keyboard entry, or in user-set increments of 10Hz to 9999999Hz.
Display Resolution: 10Hz
Frequency Accuracy: See Frequency Reference specifications.
Phase Noise: –116dBc/Hz at 30Hz offset, 500MHz carrier.
Residual FM (FM Offset): Equivalent peak deviation in a 300Hz to 3kHz bandwidth: 12Hz at 500MHz carrier.

TGR2050 - REFERENCE FREQUENCY

Options: Internal or External (via rear panel BNC).
Internal Accuracy: < ± 1 ppm per year; ± 10Hz peak.
Internal Stability: Internal: 400Hz or 1kHz sine, signal also available as an output.
External Ref In: 10MHz from 50Ω, amplitude 2V pk-pk into 50Ω.
External Ref Out: 10MHz into 50Ω, amplitude 2V pk-pk to 5V pk-pk.

TGR2050 - OUTPUT LEVEL

Output Level Range: –127dBm to +7dBm (0.1µV to 50mV into 50Ω), –127dBm to +1dBm in AM mode.
Setting Resolution: 0.1dB (or 0.1%) to 1mV) by direct keyboard entry, or in user-set increments of 0.1dB to 100dB (or 0.1% to 100%)
Accuracy: Better than ±2.0dB.
Harmonics: < 1000MHz - None; 1000MHz - <–50dBc at >1000MHz,
Sub-Harmonics: –60dBc at ±50Hz, –50dBc at ±25Hz.
Carrier Leakage: < 0.5µV generated into a 50Ω load by a 2 cm 2mm loop, at a distance of 25cm from the generator with the output set to –10dBm into a 50Ω sealed load.
External: Type N connector.
Reverse Protection: 50V DC, up to 250V from 50Ω source, LED indication.
Output Switch: RF OUT on-off switch with LED showing ON status.

TGR2050 - MODULATION

Modulation Source: Internal from built-in sine wave generator, or external from front-panel BNC.
Internal: 400Hz or 1kHz sine, signal also available as an output.
External: Calibrated for 1V rms sine, input impedance 600Ω.
Frequency Modulation
Max Peak Deviation: See Table.
Setting Resolution: 0.5kHz.
Deviation Accuracy: < ±(5% setting +1%) for 1kHz Internal
or 1kHz / 1Vrms External Modulation.
External Modulation: 100kHz - 300kHz (±2dB relative to 1kHz).
Distortion: < 2% @ 16kHz modulation, max. deviation (300-3.4kHz bandwidth).
Phase Modulation
Max Peak Deviation: See Table.
Setting Resolution: 0.05 rads for ±10.0% deviation.
0.1 rads for ±10.0% deviation.
Deviation Accuracy: < ±0.05% for 1kHz Internal
or 1kHz / 1Vrms External Modulation.
External Modulation: 100kHz - 150kHz (±2dB relative to 1kHz).
Distortion: < 2% @ 16kHz modulation, max. deviation (300-3.4kHz bandwidth).

Amplitude Modulation
Max Mod. Depth: 100%, usability decreasing to 90% at 2GHz.
Setting Resolution: 0.5%.
Deviation Accuracy: < ±(5% setting +1%) for 1kHz Internal
or 1kHz / 1Vrms External Modulation, < 0.7% depth.
External Modulation: 5kHz - 300MHz (±1dB relative to 1kHz).
Distortion: 150kHz to 1GHz - < ± 5%, > ± 10% @ 2GHz to > ± 25% 1kHz Internal
Distortion: 150kHz to 1GHz - < ± 5% @ 20Hz, > ± 10% @ 70% @ 1kHz modulation, max. deviation (300-3.4kHz bandwidth).

TGR1040/2050 - BUS INTERFACES

Full remote control facilities are available through both RS232 and GPIB interfaces (RS232 included on both units, GPIB included on TGR2050 and optional on TGR1040).

RS232: Variable Baud rate, 19200 Baud maximum, 9-pin D-connector. Fully compatible with TTi ARC (Addressable RS232 Chain) system.

TGR1040/2050 - GENERAL SPECIFICATIONS

General
Display: 20 character x 4 row backlit alphanumeric LCD
Data Entry: Keyboard selection of frequency, amplitude, etc.; value entry direct by numeric keys or by rotary control.
Stored Settings: Up to 9 complete instrument set-ups may be stored and recalled from battery-backed memory.
Mechanical
Size: 130mm (3U) H; 212mm (half-rack) W; 330mm D.
Weight: 4·6 kg. (10 lb)
Power Requirements
100V or 110V - 120V or 220V - 240V, all ±10% 50/60Hz,
Adjustable Internally: 30VA max. Installation Category II.
Temperature & Environmental
Operating Range: +5°C to 40°C, 20-80% RH.
Storage Range: –20°C to + 60°C.
Environmental: Indoor use at altitudes up to 2000m, Pollutant Degree 2.
Safety & EMC
Safety: Complies with EN61010-1.
EMC: Complies with EN61326.

MODEL RANGE

Models Available:
TGR1040 (includes RS-232 interface).
TGR1040GP (includes RS-232 and GPIB interfaces).
TGR2050 (includes RS-232 and GPIB interfaces).

Options:
19 inch rack mounting kit.

Specifications apply after 30 minute warm-up, ambient 5°C to 40°C.
TGR Series low-cost synthesised RF generators

TGR2050 - 150kHz to 2000MHz

TGR1040 - 10MHz to 1000MHz

Lower cost through innovative design

The TGR series sets a new price standard for high performance RF generators. Advanced design techniques utilising the latest component technologies have made this possible. The low cost makes it possible for every engineer involved in RF design, manufacture or testing to have a generator of their own.

High Precision and Stability

The TGR series uses a fully synthesised source locked to a temperature compensated crystal oscillator. This provides excellent signal frequency stability against temperature and ageing. The TGR2050 adds the further capability of locking to an external 10MHz source. The frequency can be set to a resolution of 10Hz across the whole frequency range (1kHz resolution on TGR1040).

Frequency steps can be set to any value and stepping can be done with up/down keys or the rotary encoder. The frequency stepping system makes operations such as precise amplitude response characterisation particularly easy.

Wide Amplitude Range & Low Leakage

The TGR series provides an amplitude range of -127dBm to +7dBm (0.1µV to 500mV into 50Ω). Setting resolution is 0.1dBm or 0.01µV.

Output level steps can be set anywhere between 0.1dBm and 100dBm (or 0.01µV to 100mV depending on the entry mode). Stepping the level is useful for quick assessment of circuit linearity and dynamic range for instance.

The advanced attenuator design provide excellent flatness over the whole frequency range. Meticulous internal screening provides very low output leakage enabling accurate low level measurements in sensitive circuits such as receivers.

Ease of use

The TGR series incorporates a simple and straightforward user interface. The back-lit four line display shows all the major signal parameters simultaneously. Data can be entered numerically using 0-9 keys or can be incremented/decremented using up/down keys or the rotary encoder. Both frequency and output level can be adjusted in steps of user programmed size.

Full remote control

The TGR series provides full remote control facilities for all its functions using both RS-232 and GPIB (IEEE-488.2) interfaces. (GPIB is an option for the TGR1040).

Overview

The TGR series are low cost, synthesised RF signal generators that incorporate the essential features required for most development, test and service work; namely high frequency accuracy and stability, wide dynamic range, low phase noise and leakage, and flexible modulation capabilities.

The TGR2050 covers from 150kHz up to 2GHz and incorporates FM modulation only (internal and external). The wide frequency range and comprehensive modulation capabilities make it suitable for most tasks within the 2GHz spectrum.

The TGR1040 has a more restricted frequency range of 10MHz to 1GHz and incorporates AM, FM and Phase modulation (internal and external). The frequency stepping system makes operations such as precise amplitude response characterisation particularly easy.

Technical Specifications

TGR1040 - FREQUENCY

| Frequency Range: | 10MHz to 1000MHz |
| Setting Resolution: | 1kHz by direct keyboard entry, or in user-set increments of 1kHz to 500kHz |
| Display Resolution: | 1kHz |
| Stability: | ± 1ppm/year ageing |
| Phase Noise: | -110dBc/Hz offset, 500MHz carrier |
| Residual FM: | Equivalent peak deviation in a 300Hz to 3kHz bandwidth: 17Hz at 500MHz carrier |

TGR1040 - OUTPUT LEVEL

| Output Level Range: | -127dBm to +7dBm (0.1µV to 500mV into 50Ω) |
| Setting Resolution: | 0.1dB (or 0.01µV to 1mV) by direct keyboard entry, or in user-set increments of 0.1dB to 100dB (or 0.01µV to 100mV) |
| Accuracy: | Better than ±1dBm, except for output levels >70dBm at 500-1000 MHz, ±3dBm |
| Harmonics: | Typically <±5dBc, maximum ~±20dBc, any carrier frequency, output level <5dBm |
| Non-Harmonic Spurii: | <±60dBc at 2kHz offset |
| Carrier Leakage: | <±0.5µV generated into a 50Ω load by a 2 turn 25mm loop, at a distance of 25cm from the generator with the output set to -10dBm into a 50Ω sealed load |
| Output Type: | Type I connector, Reverse protection 50V DC |
| Output Switch: | RF OUT on/off switch with LED showing ON status |

TGR1040 - FM MODULATION

| Peak Deviation: | 0.5kHz at 10kHz |
| Setting Resolution: | 0.5kHz |
| Modulation Frequency: | Internal 1kHz, External 300Hz to 50kHz |
| Deviation Accuracy: | <±10% of setting ±0.5kHz, excluding residual FM, ±2% for 1kHz modulation, ±1% for 1Vrms external |
| External Modulation: | Frequency Response: ±1dB from 300Hz to 50kHz relative to 1kHz |
| Distortion: | <2% total harmonic distortion at 1kHz modulating frequency, 100kHz deviation and 500MHz carrier |
| Input Type: | BNC connector, input impedance 50Ω |

TGR1040 - FURTHER SPECIFICATIONS

Specifications for Bus Interfaces, Power Requirement, Mechanical Details etc. are given on the rear page.
The TGR series sets a new price standard for high performance RF generators. Advanced design techniques utilizing the latest component technologies have made this possible. The low cost makes it possible for every engineer involved in RF design, manufacture or testing to have a generator of their own.

**High Precision and Stability**

The TGR series uses a fully synthesised source locked to a temperature compensated crystal oscillator. This provides excellent signal frequency stability against temperature and ageing. The TGR2050 adds the further capability of locking to an external 10MHz source. The frequency can be set to a resolution of 10Hz across the whole frequency range (1kHz resolution on TGR1040). Frequency steps can be set to any value and stepping can be done with up/down keys or the rotary encoder. The frequency stepping system makes operations such as precise amplitude response characterisation particularly easy.

**Wide Amplitude Range & Low Leakage**

The TGR series provides an amplitude range of –127dBm to +7dBm (0.1µV to 500mV into 50Ω). Setting resolution is 0.1dBm or 0.01µV. Output level steps can be set anywhere between 0 dBm and 100dBm (or 0.01µV to 100mV depending on the entry mode). Stepping the level is useful for quick assessment of circuit linearity and dynamic range for instance. The advanced attenuator design provide excellent flatness over the whole frequency range. Meticulous internal screening provides very low output leakage enabling accurate low level measurements in sensitive circuits such as receivers.

**Ease of use**

The TGR series incorporates a simple and straightforward user interface. The back-lit four line display shows all the major signal parameters simultaneously. Data can be entered numerically using 0 – 9 keys or can be incremented/decremented using up/down keys or the rotary encoder. Both frequency and output level can be adjusted in steps of user programmed size. Output level can be set either in dBm or linear units of µV or mV. A single button press will translate from one to the other. The TGR series can store nine full instrument set-ups in non-volatile memory. This allows repetitive testing procedures to be undertaken quickly and accurately.

**Full remote control**

The TGR series provides full remote control facilities for all its functions using both RS-232 and GPIB (IEEE-488.2) interfaces. (GPIB is an option for the TGR1040).

### TGR Series

- **Setability of 10Hz at up to 2GHz (TGR2050)**
- **Accuracy better than 1 ppm over 15°C to 30°C**
- **Ageing better than 1 ppm over one year**
- **External frequency locking (TGR2050)**
- **Low phase noise and low leakage**
- **Amplitude range of –127dBm to +7dBm**
- **Amplitude entry in dBm or µV / mV**
- **Amplitude setability of 0.1dBm or 0.01µV**
- **FM, Phase and AM modulation (TGR2050)**
- **Direct numeric entry or rotary control with user settable frequency/amplitude increments**
- **Non-volatile storage for 9 generator set-ups**
- **Full remote control via RS-232 or GPIB**
- **Unmatched price/performance ratio**

### Technical Specifications

#### TGR1040 - FREQUENCY

<table>
<thead>
<tr>
<th>Frequency Range:</th>
<th>10MHz to 1000MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting Resolution:</td>
<td>1kHz by direct keyboard entry, or in user-set increments of 1kHz</td>
</tr>
<tr>
<td>Display Resolution:</td>
<td>1kHz</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>&lt; ± 1 ppm over temperature range 15°C to 30°C</td>
</tr>
<tr>
<td>Stability:</td>
<td>&lt; ± 2ppm/year ageing</td>
</tr>
<tr>
<td>Phase Noise:</td>
<td>–110dBc/Hz at 25kHz offset, 500MHz carrier.</td>
</tr>
<tr>
<td>Residual FM:</td>
<td>Equivalent peak deviation in a 300Hz to 3kHz bandwidth, 17Hz at 500MHz carrier.</td>
</tr>
</tbody>
</table>

#### TGR1040 - OUTPUT LEVEL

<table>
<thead>
<tr>
<th>Output Level Range:</th>
<th>–127dBm to +7dBm (0.1µV to 500mV into 50Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting Resolution:</td>
<td>0 dB to 120dB (or 0.1µV to 1mV) by direct keyboard entry, or in user-set increments of 0.1dB to 100dB (or 0.01µV to 100mV).</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>Better than ±0.1dBm, except for output levels between –70dBm and 1000MHz, ±3dBm.</td>
</tr>
<tr>
<td>Harmonics:</td>
<td>Typically &lt;-20dBc, maximum –20dBc, any carrier frequency, output level &lt;0dBm.</td>
</tr>
<tr>
<td>Non-Harmonic Spurious:</td>
<td>–60dBm at ≥6kHz offset.</td>
</tr>
<tr>
<td>Carrier Leakage:</td>
<td>&lt;0.05V (generated into a 50Ω load by a 2 turn 25mm loop, at a distance of 25mm from the generator with the output set to +10dBm into a 50Ω sealed load.</td>
</tr>
<tr>
<td>Output Type:</td>
<td>Output impedance 50Ω, Type N connector, Reverse protection 50V DC.</td>
</tr>
<tr>
<td>Output Switch:</td>
<td>RF OUT on off-switch with LED showing ON status.</td>
</tr>
</tbody>
</table>

#### TGR1040 - FM MODULATION

<table>
<thead>
<tr>
<th>Peak Deviation:</th>
<th>1kHz, External 300Hz to 50kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting Resolution:</td>
<td>0.1kHz</td>
</tr>
<tr>
<td>Modulation Deviation:</td>
<td>&lt;10% of setting ±0.5kHz, excluding residual FM, for 1kHz modulation, internal or 1Vrms external.</td>
</tr>
<tr>
<td>External Modulation:</td>
<td>±1dB from 300Hz to 50kHz relative to 1kHz.</td>
</tr>
<tr>
<td>Input Type:</td>
<td>50Ω, BNC connector, input impedance 100Ω.</td>
</tr>
</tbody>
</table>

### Overview

The TGR series are low cost, synthesised RF signal generators that incorporate the essential features required for most development, test and service work; namely high frequency accuracy and stability, wide dynamic range, low phase noise and leakage, and flexible modulation capabilities. The TGR2050 covers from 150kHz up to 2GHz and incorporates AM, FM and Phase modulation (internal and external). The wide frequency range and comprehensive modulation capabilities make it suitable for most tasks within the 2GHz spectrum.

The TGR1040 has a more restricted frequency range of 10MHz to 1GHz and incorporates FM modulation only (internal and external). It retains the high stability and wide amplitude range of the 2050 making it suitable for many task including FM radio receiver sensitivity measurements, system gain measurements, receiver tuning & alignment, oscillator substitutions, EMC/antenna/field strength measurements and as a signal source for many other RF circuit and system development tasks. Both instruments can be operated using either numeric or rotary controls, and can be remotely controlled via either an RS-232 interface or GPIB interface. Nine memories are provided for user set-ups.
Technical Specifications (continued)

TGR2050 - FREQUENCY
- Frequency Range: 150kHz to 2000MHz
- Setting Resolution: 10Hz by direct keyboard entry, or in user-set increments of 10Hz to 999 9999MHz.
- Display Resolution: 10Hz.
- Frequency Accuracy: See Frequency Reference specifications.
- Phase Noise: < -116dBc at 25kHz offset, 500MHz carrier.
- Residual FM (FM Off): Equivalent peak deviation in a 300Hz to 3kHz bandwidth: 12kHz at 500MHz carrier.

TGR2050 - REFERENCE FREQUENCY
- Options: Internal or External (via rear panel BNC).
- Internal Accuracy: < ± 1 ppm per year.
- Internal Stability: < ± 1 ppm per day.
- Internal Ref. Out: 10MHz from 50MOhm, amplitude 2V pk-pk into 50Ohm.
- External Ref In: 10MHz into 50MOhm, amplitude 2V pk-pk to 5V pk-pk.

TGR2050 - OUTPUT LEVEL
- Output Level Range: -127dBm to +7dBm (0.1uV to 500mV into 50Ohm), -127dBm to +1dBm in AM mode.
- Setting Resolution: 0.1uV or (0.1uV to 1mV) by direct keyboard entry, or in user-set increments of 0.1uV to 100uV (or 0.01µV to 100µV).
- Accuracy: Better than ±0.1dB.
- Harmonics: < ±20dBc at ±7dBm.
- Sub-Harmonics: < 100kHz - None; > 100kHz - <25dBc at 1kHz.
- Non-Harmonic Spurii: < ±60dBc at ±0.5MHz, < ±50dBc at ±2.5MHz.
- Carrier Leakage: < ±50µV generated into a 50Ohm load by a 2 turn 25mm loop, at a distance of 25mm from the generator with the output set to ±10dBm into a 50Ohm sealed load.
- Output Type: Output impedance 50Ohm, Type N connector.
- Reverse Protection: 50V DC, up to 25W from 50Ohm source, LED indication.
- Output Switch: RF OUT on-off switch with LED showing ON status.

TGR2050 - MODULATION
- Modulation Source
  - Type: Internal from built-in sine wave generator, or external from front panel BNC.
  - Internal: 400Hz or 1kHz sine, signal also available as an output.
  - External: Calibrated for 1V rms input, input impedance 600Ω.
- Frequency Modulation
  - Max Peak Deviation: See Table.
  - Setting Resolution: 0.5kHz.
  - Deviation Accuracy: < ±10% ±50kHz for 1kHz Internal or 1kHz / 1Vrms External Modulation.
  - External Modulation: 10kHz - 300kHz (±2dB relative to 1kHz).
  - Distortion: < 2% @ 1kHz modulation, max. deviation (300-3.4kHz bandwidth).
- Phase Modulation
  - Max Peak Deviation: See Table.
  - Setting Resolution: 0.05 rads for ±0.05rads deviation, 0.1 rads for ±0.10rads deviation.
  - Deviation Accuracy: < ±0.1% ±0.01rads for 1kHz Internal or 1kHz / 1Vrms External Modulation.
  - External Modulation: 100kHz - 1kHz (±2dB relative to 1kHz).
  - Distortion: < 2% @ 1kHz modulation, max. deviation (300-3.4kHz bandwidth).

Amplitude Modulation
- Max Mod. Depth: 100%, useability decreasing to 90% at 2GHz.
- Setting Resolution: 0.5%.
- Deviation Accuracy: < ±5% setting +1% for 1kHz Internal or 1kHz / 1Vrms External Modulation, < ±0.7% depth.
- External Modulation: 5kHz - 100kHz (±1dB relative to 1kHz).
- Distortion: 150kHz to 1GHz - < ±5%, 250MHz to 1GHz - < ±10%, 1GHz to 2GHz - < ±20%, 1GHz to 100MHz - < ±30%, 1GHz to 2GHz - < ±60% deviation (900-3.4kHz bandwidth).

TGR1040/2050 - BUS INTERFACES
- Full remote control facilities are available through both RS232 and GPIB interfaces (RS232 included on both units, GPIB included on TGR2050 and optional on TGR1040).
- RS232: Variable baud rate, 19200 Baud maximum, 9-pin D-connector. Fully compatible with TTi ARC (Addressable RS232 Channel) system.

TGR1040/2050 - GENERAL SPECIFICATIONS
- Display: 20 character x 4 row backlit alphanumeric LCD
- Data Entry: Keyboard selection of frequency, amplitude, etc.; value entry direct by numeric keys or by rotary control.
- Stored Settings: Up to 9 complete instrument set-ups may be stored and recalled from battery-backed memory.
- Mechanical
  - Size: 130mm (3U) H; 212mm (half-rack) W; 330mm D.
  - Weight: 4.6 kg. (10 lb)
- Power Requirements
  - 100V or 110V - 120V or 220V - 240V, all ±10% 50/60Hz, adjustable internally; 30VA max. Installation Category II.
- Temperature & Environmental
  - Operating Range: +5°C to 40°C, 20-80% RH.
- Environmental: Indoor use at altitudes up to 2000m, Pollution Degree 2.
- Safety & EMC
  - Safety: Complies with EN61010-1.
  - EMC: Complies with EN61326.

MODEL RANGE
- Models Available:
  - TGR1040 (includes RS-232 interface).
  - TGR1040/F (includes RS-232 and GPIB interfaces).
  - TGR2050 (includes RS-232 and GPIB interfaces).
- Options:
  - 19 inch rack mounting kit.

Specifications apply after 30 minute warm-up, ambient 5°C to 40°C
1GHz and 2GHz synthesised RF signal generators
high stability and low phase noise
wide amplitude range and low leakage
flexible signal modulation capabilities

Designed and built in Europe by: Thurlby Thandar Instruments Ltd. Glabe Road, Huntingdon, Cambs. PE29 7DR United Kingdom (UK) Tel: +44 (0)1480 412451 Fax: +44 (0)1480 450409 Email: info@aimtti.com Web: www.aimtti.com

AIM & THURLBY THANDAR INSTRUMENTS

AIM & THURLBY THANDAR INSTRUMENTS

Thurlby Thandar Instruments Ltd. operates a policy of continuous development and reserves the right to alter specifications without prior notice.
Product Summary

Laboratory Power Supplies
Bench and system power supplies from 30 watts up to 1200 watts using linear, mixed-mode and PowerFlex regulation technologies.

Waveform Generators
Analog and digital (DDS) function generators, true arbitrary generators, arbitrary/function generators and pulse generators.

Precision Measurement Instruments
Benchtop DMMs, frequency counters, component measurement instruments (LCR), electronic dc loads, current probes.

RF and EMC Test Equipment
Spectrum analyzers, signal generators, frequency counters, power meters, emc measurement instruments.

Company name and product brands
Thurlby Thandar Instruments Ltd. (TTi) is one of Europe’s leading manufacturers of test and measurement instruments.

Products have been sold under two brand names: TTi and Aim.

In the future, however, the full product range will be branded Aim-TTi.

This changeover will be gradual and many products will continue to carry the TTi or Aim brands for some time to come.

Web Addresses (URLs)
The preferred URL for obtaining information concerning Aim-TTi products is:
www.aimtti.com (international customers)

Customers in the UK should use the URL:
www.aimtti.co.uk

Customers in the USA should use the URL:
www.aimtti.us

Note that previous URLs such as www.tti-test.com will continue to operate for the time being.