Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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Reliability, measurement speed and cost effectiveness are the characteristics a test equipment must have to succeed in the field of the widely used DECT communication devices.

In a radiocommunication network such as DECT (Digital European Cordless Telephone) numerous cordless telephones and fixed stations have to share the scarce resources of frequency, time and space. This can only be done by observing stringent rules and specifications.

On the other hand, the DECT system in particular and associated phones are expected to be low-cost units whose complexity and precision are limited. Given these conflicting requirements, it is measurement engineering which has to ensure that the specifications for smoothly working communication are met in spite of less sophisticated technology (compared with other digital cellular systems). The great experience gained with preceding DECT measurement instruments such as signal generators, analyzers, communication testers and DECT type-approval systems as well as cooperative development work with several key end users have contributed towards creating a well-balanced tester for production and service according to all aspects.

Benefits at a glance

Production
- The CMD 60 can be remote controlled via the RS-232 or IEC/IEEE-bus interface using SCPI-compatible commands. In the remote-control mode CMD 60 is designed for fast speed to yield high throughputs in production
- High production output at low investment for test equipment
- Comprehensive test capabilities implemented in one single unit

Development
- Comprehensive in-depth measurements under a convenient user interface
- A lot of complex test setups with conventional equipment become redundant with the use of this special DECT tester
- Automatic regression and stress tests
- The tester supplies a great number of DECT-specific signals such as bit clock, TX/RX enable, to control the module under test

Servicing
- Relaxed manual operation due to a large bright LCD in conjunction with an extremely simple user interface (requires no DECT-specific knowledge) strictly separated from the...
expert user interface for configurations
• Integrated tools such as a scope display for power and FM demodulation versus time ease troubleshooting

Main features
• For production, service and development
• RF measurements to CTR06
• Comprehensive audio tests
• Extremely fast measurements for high production throughput
• Ergonomic user interface for service applications
• Self-contained, lightweight, compact tester
• Can be retrofitted for GSM, GSM 1800 and GSM 1900 measurements

Menu structure
The power ramp measurement permits in-depth analysis of the burst power transmitted by the FP or PP. The measurement is synchronized to bit P0, thus giving precise information not only about the power transmitted but also about timing parameters.

The RF modulation measurement menu presents the demodulated signal in a scope display for easy and quick recognition of typical data forms, and accurate measurement results as numbers and bargraphs for further analysis.

Timing parameters such as the absolute timing accuracy as well as the jitter between two bursts are measured and displayed in an easy-to-read format.

User-defined tolerances for parameters like BER, modulation, timing, power and power ramp (burst) as are shown here can easily be entered via the configuration menu. If any of the set limits are exceeded, the measurement will be shown in inverse video for easy identification.

The module test offers RF signal generator and RF burst analyzer features for testing DECT modules without signalling, i.e. when troubleshooting or adjustments are required.

Interface description

CMD 60 transmitter part
In a very busy DECT environment most DECT frequencies may be in use for communication and therefore influence the measurement in production and development. Besides the channels 0 to 9 the CMD 60 enables the use of an extended frequency range for testing. Channels -3, -2, -1 and 10, 11, 12 are outside the normal DECT specification and therefore free for testing.

The DECT standard requires two levels: -83 and -73 dBm. The CMD 60 provides an extra level range of up to 30 dB to overcome external coupler and cable attenuation.

The CMD 60 provides 1 up to 12 consecutive TDMA slots for rapid BER measurements for PP tests (2 slots for FP test). The measuring time in production can be considerably cut down if more than one timeslot is used for BER measurements.

Modulation is GFSK with $B \times T = 0.5$ according to DECT specifications. In addition, constant envelope, signals with or without modulation or DECT bursts with various bit patterns for module test are possible.

These bit patterns can easily be recognized while testing receiver and demodulator modules.

CMD 60 receiver part
It is similar to the transmitter part above: there are 10 DECT frequency channels N o. 0 to 9. Additionally, 6 extended DECT frequency channels N o. -3, -2, -1 and 10, 11, 12 in DECT channel spacing are provided.

Should the standard DECT output level of 24 dBm be attenuated due to couplers and cable attenuation, the CMD 60 provides more than 30 dB measurement range.

There are two independent receive paths: For DECT signalling and BER a signalling path is incorporated in the CMD 60. For TX tests the CMD 60 provides a measurement path. The FM and envelope detector are both taken to external connectors and postprocessed for power ramp and modulation measurements. The FM and envelope detector output permits monitoring of the DUT transmit signal.

RF input/output
The CMD 60 transmitter and receiver are connected to a bidirectional N connector (RF in/out). All mentioned specifications are valid for this connector. Moreover, there is a high-level output for the CMD transmitter (level range like N connector + approx. 40 dB) as well as a high-sensitivity input for the CMD receiver on the front panel.
Power ramp measurement

**Demodulator interface**
CMD60 provides a linear, analog FM demodulator output (DC-coupled) and a logarithmic analog RF envelope demodulator output (DC-coupled).

**Wideband input/output**
The second wideband input/output (100 MHz to 2.5 GHz) is on the rear panel. The input signal from the front connector is provided at this connector with an attenuation of 12 dB. It can be monitored with a spectrum analyzer for spurious measurements. Furthermore, this connector can be used to introduce an interferer into the RF connection without reconnecting the test setup for the in-channel tests.

**CMD60 audio part**
In addition to the DECT RF interface on the CMD60 front panel, there is an analog DECT voice interface for a speaker and the appropriate microphone (analog A/DCM interface). Alternatively, it can be connected to the AF Measurement Unit CMD-B41.

**Overview of options**

<table>
<thead>
<tr>
<th>Designation, functions</th>
<th>Option</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AF Measurement Unit with Frequency Counter</strong> (CMD-B41 needed): this option provides an audio measurement unit with AF generator and AF analyzer. The parameters measured are level (peak and rms), frequency, and distortion on selectable frequencies. In addition, the option CMD-B41 incorporates a 60-MHz TTL counter to verify the DUT’s reference frequency</td>
<td>CMD-B41</td>
<td>1051.6902.02</td>
</tr>
<tr>
<td><strong>Multitone Generator and Analyzer</strong> for CMD5x and CMD6x: comprehensive audio tests up to 8460 Hz (CMD-B41 and CMD-B41 required)</td>
<td>CMD-B44</td>
<td>1099.3203.02</td>
</tr>
<tr>
<td><strong>Reference Frequency Input/Output, Frequency Synchronization:</strong> CMD provides a 10 MHz interface as a common frequency reference.</td>
<td>CMD-B3</td>
<td>1051.6202.02</td>
</tr>
<tr>
<td><strong>OCXO Reference Oscillator:</strong> this option improves aging and frequency drift of the internal reference source</td>
<td>CMD-B1</td>
<td>1051.6002.02</td>
</tr>
<tr>
<td><strong>DSP/Adapter for CMD-B4x options:</strong> DSP system carrying out applications for GSM RF and audio tests as well as DECT audio tests. In contrast to GSM, this option is not required for DECT BER measurements</td>
<td>CMD-B4</td>
<td>1051.6654.02</td>
</tr>
<tr>
<td><strong>IEC/IEEE-Bus Interface:</strong> in addition to the standard RS-232-C interface, the CMD can be fitted with this remote-control interface (CMD-B6 required)</td>
<td>CMD-B6</td>
<td>1051.7609.02</td>
</tr>
<tr>
<td><strong>Adapter for CMD-B6x options</strong></td>
<td>CMD-B6</td>
<td>1051.7409.02</td>
</tr>
<tr>
<td><strong>Frequency Extension DECTCH +12 to -22</strong> (option only for new instruments) for Latin America and other countries</td>
<td>CMD-K61</td>
<td>1082.3840.02</td>
</tr>
<tr>
<td><strong>Same as CMD-K61, but upgrade for instruments with HW version &quot;D&quot;</strong></td>
<td>CMD-U61</td>
<td>1099.5258.02</td>
</tr>
<tr>
<td><strong>Extension for GSM900 and GSM1800</strong></td>
<td>CMD-U65</td>
<td>1059.8104.02</td>
</tr>
</tbody>
</table>
Specifications in brief

For CMD60/ CMD65 see also CMD52/ CMD55 on page 26

**Time and frequency reference**
- **TC XO**
  - Nominal frequency: 10 MHz
  - Temperature effect (0 to 35°C): $<1.5 \times 10^{-4}$
  - Aging: $<0.5 \times 10^{-3}$ / year
- **OC XO**
  - Nominal frequency: 10 MHz
  - Temperature effect (0 to 50°C): $<5 \times 10^{-7}$ / day or $<2 \times 10^{-7}$ / year

**DECT signal generator**
- Frequency: 10 DECT channels 0 to 9
- Additional DECT channels: $-3$ to $-1$, 10 to 12 and half channels
- Level range: $-100$ to $-40$ dBm
- Burst switch-off: $>30$ dB
- Modulation: GFSK ($B \times T = 0.5$)

**DECT analyzer**
- Specifications valid for N connector
- Frequency same as signal generator
- Level (setting for external attenuation and expected power shall be matching):
  - $-10$ to $+30$ dBm
  - $-65$ to $+30$ dB (for level meter)
  - $-30$ to $+30$ dB (for broadband FM demodulator and signalling), values shifted by about $-40$ dB for input 2 for TX postprocessing and analog output

**FM demodulator**
- Range: $0$ to $+50$ kHz deviation
- Resolution: $1$ Hz
- Level meter (transient response)
- Range: $-65$ to $+30$ dBm
- Dynamic: $70$ dB

**Analog DECT ADPCM interface**
- Output balanced
- Input $S / N = THD$
  - Range: $1$ V, $380$ Hz to $3$ kHz
  - $50$ dB at full-range level balanced
- Input $S / N = THD$
  - Range: $50$ mV, $300$ Hz to $3$ kHz
  - $50$ dB at full-range level balanced

**DC measurements**
- DC voltmeter: 0 to $\pm 30$ V
- DC ammeter: 0 to $\pm 10$ A

**Ordering information**
- Digital Radiocommunication Tester CMD60 1050.9008.60
- GSM 900, GSM 1800, DECT CMD65 1050.9008.65
- GSM 900 and GSM 1800 Extension CMD-U65 1059.8104.02

**Option CMD-B4 with CMD-B41**
- **AF meter**
  - Frequency range: 50 Hz to 10 kHz
  - Input voltage: 0.1 mV to 30 V
  - Load impedance: 1 MΩ

- **AF distortion meter**
  - Frequency range: 300 Hz to 3 kHz
  - Input voltage: 100 mV to 30 V
  - Load impedance: 1 MΩ

- **AF counter**
  - Frequency range: 20 Hz to 10 kHz
  - Input voltage: $10$ mV to $30$ V
  - Resolution: 1 Hz
  - Load impedance: 1 MΩ

- **60 MHz counter**
  - Frequency range: 10 kHz to 60 MHz
  - Input signal: min.: 100 mV, max.: TTL signal
  - Resolution: 1 Hz
  - Load impedance: 1 MΩ; $|100 \, \text{pF}|

- **AF generator**
  - Frequency range: 50 Hz to 10 kHz
  - Resolution: 0.1 Hz
  - Accuracy: 0.05 Hz
  - Output voltage: $10$ mV to 5 V
  - Max. current: 2 mA
  - Source impedance: $25 \, \Omega$

- **General data**
  - Power supply, AC: $100$ to $120$ V $\pm 10\%$, $200$ to $240$ V $\pm 10\%$
  - Power consumption: approx. 60 VA
  - Dimensions (W x H x D): $435$ mm x $192$ mm x $363$ mm
  - Weight (without options): approx. 12 kg