



## Dual-Channel Analyzer/Power Supply NGMO2

Precise power supply and measurements under critical test conditions

- ◆ Two channels 15 V/2.5(5) A with 7 A peak
- ◆ Fast load regulation
- ◆ Result memory for fast current and voltage measurements
- ◆ Internal and external triggers
- ◆ Two separate voltage measurement channels
- ◆ Sinking to 2.8 A (static)
- ◆ High-resolution voltage settings
- ◆ Precise measurements in  $\mu\text{A}$  range
- ◆ Minimal ripple and noise
- ◆ Adjustable output impedance for battery emulation
- ◆ OVP/OCF
- ◆ Detection of open sense pins
- ◆ Auxiliary inputs/outputs (output inhibit, relay, complete, trigger)
- ◆ Compact design (2 HU,  $\frac{1}{2}$  19")
- ◆ IEEE488.2, RS-232-C interfaces
- ◆ Fast programming
- ◆ Convenient manual operation



## Dual-Channel Analyzer/Power Supply NGMO2 ...

The Dual-Channel Analyzer/Power Supply NGMO2 from Rohde & Schwarz is more than just a simple power supply for test and measurement applications. This is shown by its advanced features:

- ◆ accurate high-speed voltage source,
- ◆ programmable DC load,
- ◆ precise digital voltmeter,
- ◆ storage oscilloscope,
- ◆ simple squarewave generator delivering high output power,

and two of each of these features are provided. Two independent channels, installed in an enclosure which is 1/2 19" wide and only 2 U high, guarantee a simple and accurate power supply for battery-operated mobile-radio products now and in the future.

Numerous analysis functions extend the functionality of conventional power supplies. And, it is not just development engineers who will value this instrument. In production environments in particular two things are important: speed and reliability. The NGMO2 has both, coupled with high accuracy which is essential if results are to be reproducible.

## Interfaces

The NGM02 can be remote-controlled via the three main, standard interfaces IEC/IEEE bus, RS-232-C and USB. It has a number of additional I/O channels that can be used to good effect when every extra operation performed by a PC or an internal microcontroller could cause an overload or simply lead to unwanted delays. Each channel has a fast output

inhibit to rapidly turn a preset voltage on or off. This may be necessary to test, for example, power semiconductors to prevent destruction by overheating. Not only can the integral, fast current-transient recorder be triggered by internal trigger thresholds for the output current, it also has an external trigger input so that synchronization can be effected using external trigger signals. Although the digital signal processor in the NGM02 is fast

enough to ensure minimal setting and read times for IEC/IEEE-bus programming, the last microsecond delay can be eliminated by directly providing a complete output signal.

... since high tech starts at the source

Relay (Sub-D-15)			
Pin	Function	Pin	Function
1	RELOUT1	8	GND
2	RELOUT2	9	GND
3	RELOUT3	10	INHIBIT_B
4	RELOUT4	11	TRIGGER_B
5	FAULT	12	INHIBIT_A
6	NC	13	TRIGGER_A
7	NC	14	COMPL_B
		15	COMPL_A

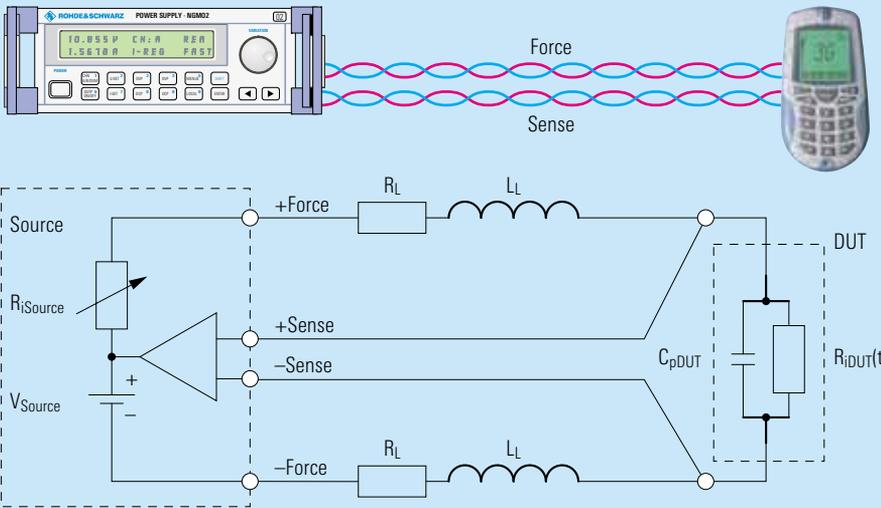
  

Output	
Pin	Function
1	DVM-
2	DVM+
3	FORCE-
4	FORCE-
5	SENSE-
6	SENSE+
7	FORCE+
8	FORCE+

NGM02 rear view



Connecting a mobile phone to NGMO2 via separate twisted pairs and equivalent circuit diagram (below)



age drops across the terminals of the mobile phone's battery. Compensation has to be performed extremely rapidly to be effective. If not, the undervoltage detector in the mobile will simply turn the phone off. NGMO2 can meet the challenges described above without any hint of output voltage instability.

### Emulation of various battery types and charging states

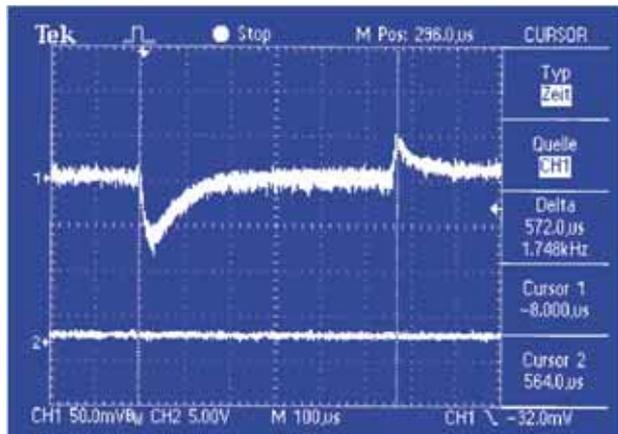
Mobile, electronic communication equipment is usually battery-operated. If power supply units are used to replace batteries during production, highly satisfactory results are obtained with power supplies with optimized regulation. There is, however, one drawback with this approach: as a power supply's internal resistance is usually fixed, it is an ideal case that is being simulated, i.e. that of a fully charged battery. As a battery discharges, its internal resistance continuously increases. This means that the voltage across the DUT drops. To maintain its transmit power, a GSM mobile phone, for example, increases its current drain which in turn produces an even greater voltage drop along the power leads and across the battery's internal resistance which is already very high. This can lead to a vicious circle. The internal supply voltage conditioning of the circuit under

### Critical test environments involving pulsed current drain, e.g. GSM mobile phones

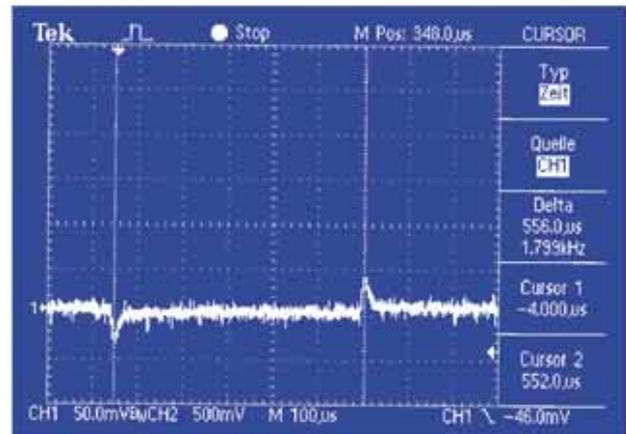
Power-saving transmission technologies have been, and will continue to be, the key to expanding the capabilities of mobile radio. These improvements are a challenge to both test engineers and test equipment. This is particularly true of transmission technologies that make use of time division multiplexing, for example GSM or TDMA, and also applies to the "slotted mode" used for CDMA – in both cases power supplies have to meet special requirements. On production lines, the use of switching matrices, adapters

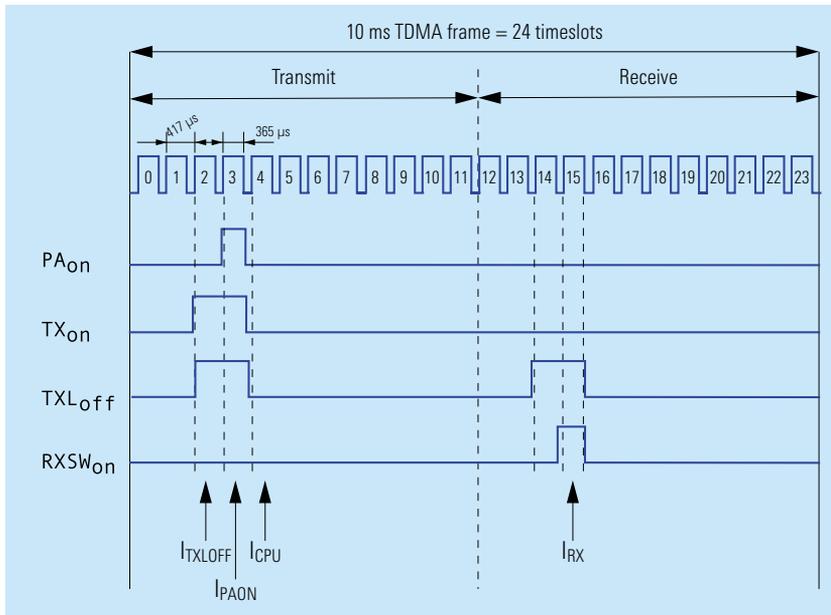
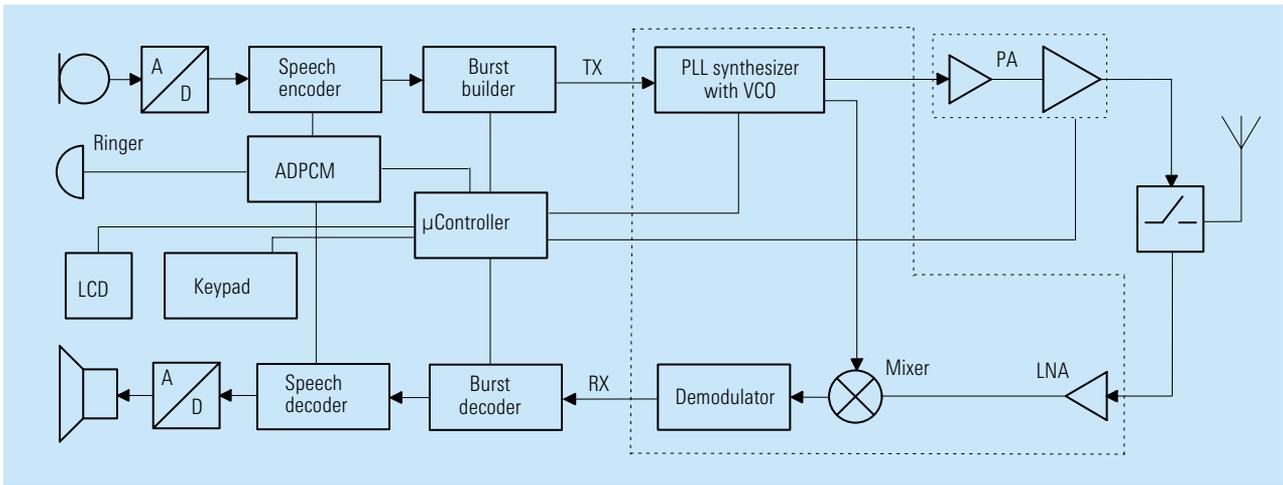
and leads means that cables up to six meters in length can be found between the power supply and the actual DUT. Cable flexibility must be adequate, which means that the force-line cross section cannot be as large as it should be. And then there are the rise and fall times caused by mobile phones taking their power in pulses: these times can be tens of  $\mu\text{s}$ . The inductance of the conductors in the cables causes significant voltage drops. The power supply must, therefore, be capable of compensating for any volt-

Load regulation of non-optimal lab power supply connected to critical GSM mobile phone



Load regulation of NGMO2 connected to critical GSM mobile phone





Current drain of DECT mobile telephone, measured with high time resolution

test must be capable of reliably handling voltage drops of this kind without causing the phone to malfunction. The NGMO2 can be used to emulate this critical case as its output impedance is adjustable. This also means that different types of batteries (NiCd, NiMH, Li-ion, Li-polymer etc) can be emulated to a certain extent. This guarantees that nothing can happen to invalidate tests despite the general trend to lower supply voltages.

### Current/voltage transient analysis

The integral current-transient recorder is a very useful tool for analyzing DUT faults. For example, conclusions can be drawn about whether or not the subassemblies to be tested are functioning properly by forming the differences of the measured current drain of a sequence of signals occurring in rapid succession. For exam-

ple, a DECT mobile telephone: in this case, the current-drain curve over a complete frame can be recorded using a very high time resolution. When the telephone manufacturer knows at which points in time certain subassemblies (complete phone, power amplifier, mixer, receiver, display etc) are activated or deactivated, defective partial clusters can easily be found without using additional, complex test equipment.

The reproducibility of pulse current measurements can be improved even further by not just reading one frame and analyzing it, but instead pin-pointing a specific section of interest and reading it. This measurement is repeated several times in succession and the average taken. The section to be investigated is determined by means of the programmable sampling rate and the number of samples. The trigger point for the transient recorder can be defined with an adjustable current trigger threshold. This means that only relevant information is saved to the sample memory. By limiting the number of samples, it is also possible to optimize the transfer rate when samples are being read. It goes without saying that long-term monitoring (current drain) can also be performed on DUTs by choosing sampling intervals of the appropriate length so that the effect of other operating parameters on current drain can be investigated.

However, power consumption is also becoming more and more critical for sub-assemblies which are not battery-operated. Operating modes such as idle, sleep or power down are being encountered more frequently in electronic equipment because higher clock frequencies coupled with an increasing level of integration are making it impossible to ignore efficient energy management. Using a high-resolution current-transient recorder, like the one already installed in the NGMO2, these modes can be checked using methods similar to those described above.

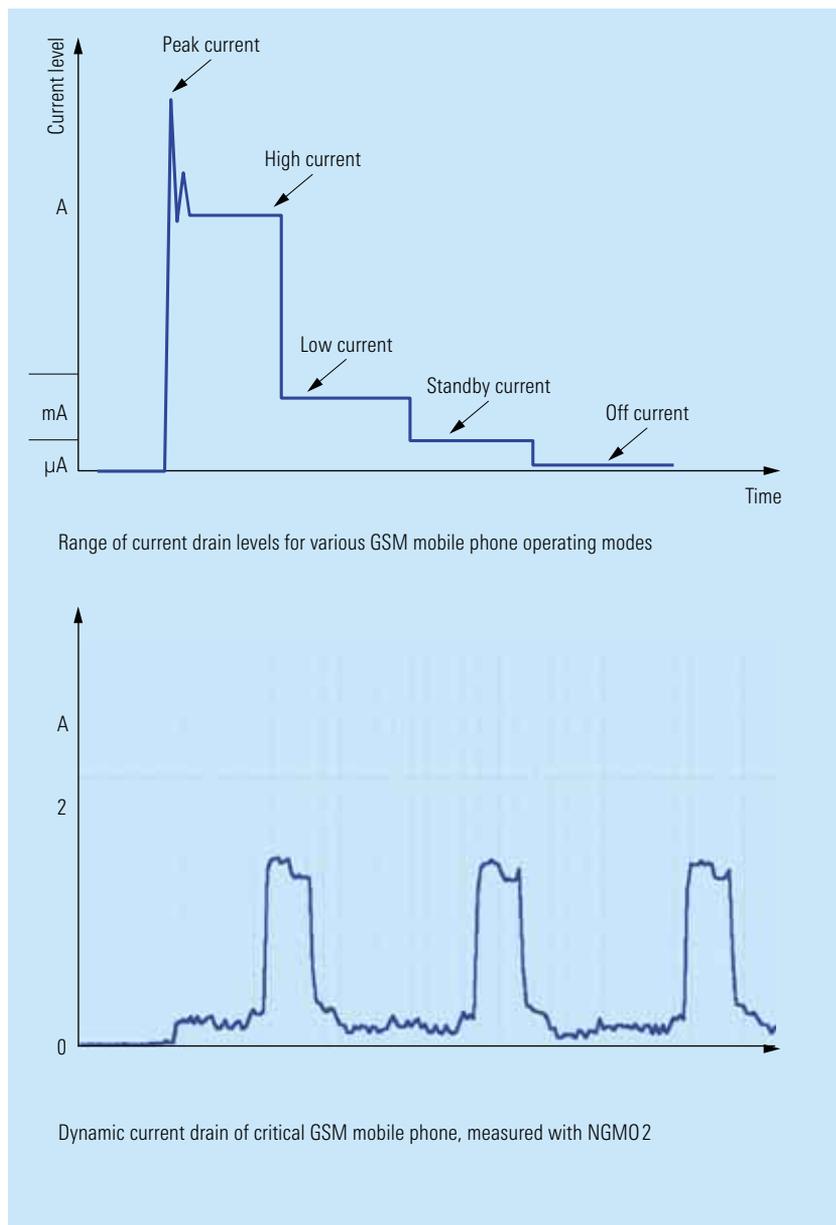
In addition to current transients, the NGMO2 is able to record voltage transients.

### High-resolution current measurements and voltage settings

As the Fig. on the right shows, there are extremely wide variations in the current taken by mobile telephone operating modes. Current peaks of up to 2 A taken at maximum transmit power contrast with currents of a few  $\mu\text{A}$  in the OFF state. In between is the normal mode where currents are the order of a few 100 mA. It is essential to have enough resolution to detect deviations from the normal mobile mode whenever they might occur. The NGMO2, therefore, has different current measurement ranges for both static and dynamic current measurements. The NGMO2 also has the necessary voltage setting resolution of 1 mV to calibrate and adjust DUTs and to provide reproducible voltage levels. This aspect will gain in significance as the trend is towards lower supply voltages.

### Recording characteristics of semiconductor components

The NGMO2 has two completely identical supply and measurement channels. This



means that this small power supply unit can be used to form the basis of an independent parameter test setup for semiconductor components. The NGMO2 can also handle up to four relays and respond to remote control commands. As each channel has an inhibit input, if required, a pulsed supply voltage can be fed to the components to prevent overheating during tests or to simulate a standard pulsed operating mode (e.g. TDMA power amplifier).

## Specifications

### Constant voltage source

	<b>Channels 1 + 2 (both channels with identical specs)</b>
Voltage setting	0 to 15 V
Resolution	1 mV
Deviation	0.05% + 5 mV
at ±10% AC supply fluctuation	0.5 mV
at 10 to 90% nom. current	2.5 mV
Settling time on load steps (0.1 A to 1.6 A) at ≤20 mV	
Deviation	
at large bandwidth directly connected	<35 μs
on "long" lines, with sense lead	<50 μs
at small bandwidth directly connected	<80 μs
on "long" lines, with sense lead	<100 μs
Temporary voltage drop after load step (0.1 A to 1.6 A)	
at large bandwidth on "long" lines, with sense lead	<60 mV
Ripple (rms)	<1 mV
Output impedance	0 to 1 Ω, adjustable in 10 mΩ steps
Voltage compensation	up to 1 V (4 V) per line

### Constant current source

Peak current (1 ms)	7 A
Current setting	
from 1.8 V to 5 V	0 to 5 A
outside 1.8 V to 5 V	0 to 2.5 A
Resolution	1 mA
Deviation	10 mA
at ±10% AC supply fluctuation	1 mA
at 10% to 90% nom. current	2.5 mA
Sinking	2.8 A (0 to 5 V), dropping to 1 A at 15 V

### Voltage measurement

Range	-5 V to +25 V
Resolution	1 mV
Deviation	0.03% + 3 mV
Measurement rate	2 ms to 200 ms, adjustable
Averaging of	1 to 10 values

### Current measurement

Ranges	7 A / 0.5 A / 5 mA
Resolution	200 μA / 10 μA / 0.1 μA
Deviation from upper range value	15 mA / 1 mA / 10 μA
Measurement rate	2 ms to 200 ms, adjustable
Averaging of	1 to 10 values

### Transient measurement

Sample memory	1 to 5000 samples
Sampling interval (adjustable)	10 μs to 1 s in 10 μs steps
Averaging of	1 to 100 values
Measurement system trigger	
Current transients	
Measurement ranges	7 A / 0.5 A
Adjustable trigger thresholds	
Range 7 A	0 mA to 7 A in 200 μA steps
Range 0.5 A	0 mA to 0.5 A in 10 μA steps
Voltage transients	-5 V to +25 V in 1 mV steps
Pre-/posttrigger	-5000 to +50000 samples
Measurement functions	Peak Min, Peak Max, Hi, Low, RMS

### Protection functions

OVP	1.5 V to 22 V, adjustable
OCF	on/off
Detection of sense line interruptions	

### General data

Programming	IEEE488.2, RS-232-C
Inputs	2 x measurement system trigger, 2 x output inhibit
Outputs	2 x complete, 4 x relay, fault
AC supply	120/230 V, 47 Hz to 63 Hz
Dimensions (W x H x D)	210.8 mm x 87.6 mm x 420 mm, without feet
Weight	7.5 kg

## Ordering information

Dual-Channel Analyzer/Power Supply	NGM02	192.1500.24
Front-Panel Output Connectors	NGM02-B0	192.1500.00
19" Adapter for 1 unit	NGM02-B1	192.1500.01
19" Adapter for 2 units	NGM02-B2	192.1500.02





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