



# Universal Protocol Test Platform R&S®CRTU

## Specifications

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# Contents

|                                                                              |           |
|------------------------------------------------------------------------------|-----------|
| <b>SPECIFICATIONS OF RADIO UNIT R&amp;S®CRTU-RU</b> .....                    | <b>3</b>  |
| TIMEBASE OCXO.....                                                           | 3         |
| REFERENCE FREQUENCY INPUTS/OUTPUTS.....                                      | 3         |
| RF GENERATOR (CW SIGNALS) .....                                              | 3         |
| VSWR OF RF INPUT AND OUTPUT CONNECTORS.....                                  | 4         |
| RF RECEIVER.....                                                             | 5         |
| POWER SPLITTER.....                                                          | 5         |
| INTERFACES OF RADIO UNIT R&S®CRTU-RU.....                                    | 5         |
| GENERAL SPECIFICATIONS OF RADIO UNIT R&S®CRTU-RU.....                        | 5         |
| <b>SPECIFICATIONS OF PROTOCOL UNIT R&amp;S®CRTU-PU</b> .....                 | <b>6</b>  |
| INTERFACES OF PROTOCOL UNIT R&S®CRTU-PU.....                                 | 6         |
| GENERAL SPECIFICATIONS OF PROTOCOL UNIT R&S®CRTU-PU.....                     | 6         |
| <b>GENERAL SPECIFICATIONS (OF R&amp;S®CRTU-RU AND R&amp;S®CRTU-PU)</b> ..... | <b>7</b>  |
| <b>GSM SPECIFICATIONS</b> .....                                              | <b>7</b>  |
| <i>RF generator</i> .....                                                    | 7         |
| <i>RF receiver</i> .....                                                     | 8         |
| <i>Audio</i> .....                                                           | 8         |
| <i>Trigger/clock signals</i> .....                                           | 8         |
| <i>Display</i> .....                                                         | 8         |
| <b>WCDMA SPECIFICATIONS</b> .....                                            | <b>9</b>  |
| STANDARD.....                                                                | 9         |
| RF GENERATOR .....                                                           | 9         |
| RF RECEIVER.....                                                             | 10        |
| TRIGGER/CLOCK SIGNALS .....                                                  | 10        |
| <b>OPTION 2-CHANNEL IQ/IF INTERFACE CARD R&amp;S®CRTU-B7</b> .....           | <b>11</b> |
| I/Q INTERFACE .....                                                          | 11        |
| INFLUENCE ON RF INTERFACE .....                                              | 11        |
| IF INTERFACE.....                                                            | 11        |
| <b>ORDERING INFORMATION</b> .....                                            | <b>12</b> |
| GSM .....                                                                    | 12        |
| WCDMA .....                                                                  | 12        |
| COMBINED .....                                                               | 12        |
| RECOMMENDED NUMBER OF REQUIRED ACCESSORIES .....                             | 13        |
| RECOMMENDED ACCESSORIES .....                                                | 13        |

The specifications refer to fully equipped testers with all hardware and software options installed!

Specifications are valid under following conditions:

Data without tolerance limit is not binding.

In compliance with the 3GPP/2GPP2 standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in kbps (thousand bit per second) or ksps (thousand symbol per second).

MCPS, kbps and ksps are not SI units.

**For more general information about R&S®CRTU please refer to the product brochure PD 5213.5574.12, version ≥01.00**

# Specifications of Radio Unit R&S®CRTU-RU

## Timebase OCXO

|                             |                                                                                           |                                                         |
|-----------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------|
| <b>Max. frequency drift</b> | in temperature range +5 °C to +45 °C                                                      | $\pm 5 \times 10^{-9}$ , referred to +25 °C             |
|                             | with instrument orientation                                                               | $\pm 3 \times 10^{-9}$                                  |
|                             | referred to turn-off frequency after 2 h warm-up time following a 24 h off time at +25 °C | $\pm 5 \times 10^{-9}$                                  |
| <b>Max. aging</b>           |                                                                                           | $\pm 3.5 \times 10^{-8}$ /year                          |
|                             |                                                                                           | $\pm 5 \times 10^{-10}$ /day after 30 days of operation |
| <b>Warm-up time</b>         | at +25 °C                                                                                 | approx. 10 min                                          |

## Reference frequency inputs/outputs

|                              |                               |                              |
|------------------------------|-------------------------------|------------------------------|
| <b>Synchronization input</b> |                               | BNC connector REFIN          |
| Frequency                    | sinewave signal               | 1 MHz to 52 MHz, step 1 kHz  |
|                              | squarewave signal (TTL level) | 10 kHz to 52 MHz, step 1 kHz |
| Max. frequency variation     |                               | $\pm 5 \times 10^{-6}$       |
| Input voltage range          | sinewave signal               | 0.5 V to 2 V (rms)           |
| Impedance                    |                               | 50 $\Omega$                  |

|                                 |                            |                                    |
|---------------------------------|----------------------------|------------------------------------|
| <b>Synchronization output 1</b> |                            | BNC connector REFOUT1              |
| Frequency                       | in internal reference mode | 10 MHz from internal reference     |
|                                 | in external reference mode | frequency of synchronization input |
| Output voltage                  |                            | >1.4 V (peak-peak)                 |
| Impedance                       |                            | 50 $\Omega$                        |

|                                 |               |                       |
|---------------------------------|---------------|-----------------------|
| <b>Synchronization output 2</b> |               | BNC connector REFOUT2 |
| Frequency                       | in WCDMA mode | 30.72 MHz             |
|                                 | in GSM mode   | 39 MHz                |
| Impedance                       |               | 50 $\Omega$           |

|                                 |               |                       |
|---------------------------------|---------------|-----------------------|
| <b>Synchronization output 3</b> |               | BNC connector REFOUT3 |
| Frequency                       | in WCDMA mode | 15.36 MHz             |
| Impedance                       |               | 50 $\Omega$           |

## RF generator (CW signals)

|                                |  |                                         |
|--------------------------------|--|-----------------------------------------|
| <b>Frequency range</b>         |  | 100 kHz to 2700 MHz                     |
| <b>Frequency resolution</b>    |  | 0.1 Hz                                  |
| <b>Frequency uncertainty</b>   |  | same as timebase + frequency resolution |
| <b>Frequency settling time</b> |  | <400 $\mu$ s to $\Delta f < 1$ kHz      |

|                                          |                                                        |         |
|------------------------------------------|--------------------------------------------------------|---------|
| <b>Output level uncertainty RF1, RF2</b> |                                                        |         |
| In temperature range +20 °C to +35 °C    | 10 MHz to 450 MHz, level $\geq -106$ dBm               | <0.8 dB |
|                                          | 450 MHz to 2200 MHz                                    |         |
|                                          | level $\geq -106$ dBm                                  | <0.8 dB |
|                                          | level $> -117$ dBm (see note 2)                        | <0.8 dB |
|                                          | level $-130$ dBm to $-117$ dBm (see note 2 and note 3) | <1.7 dB |
|                                          | 2200 MHz to 2700 MHz                                   |         |
|                                          | level $\geq -106$ dBm                                  | <1.0 dB |
|                                          | level $> -117$ dBm (see note 2)                        | <1.0 dB |
|                                          | level $-130$ dBm to $-117$ dBm (see note 2 and note 3) | <1.7 dB |
|                                          |                                                        |         |

|                                      |                                                        |         |
|--------------------------------------|--------------------------------------------------------|---------|
| In temperature range +5 °C to +45 °C | 10 MHz to 450 MHz, level $\geq -106$ dBm               | <1.2 dB |
|                                      | 450 MHz to 2200 MHz                                    |         |
|                                      | level $\geq -106$ dBm                                  | <1.2 dB |
|                                      | level $> -117$ dBm (see note 2)                        | <1.2 dB |
|                                      | level $-130$ dBm to $-117$ dBm (see note 2 and note 3) | <1.7 dB |
|                                      | 2200 MHz to 2700 MHz                                   |         |
|                                      | level $\geq -106$ dBm                                  |         |
|                                      | level $> -117$ dBm (see note 2)                        | <1.7 dB |
|                                      | level $-130$ dBm to $-117$ dBm (see note 2 and note 3) | <1.7 dB |
|                                      | 10 MHz to 450 MHz, level $\geq -106$ dBm               | <1.7 dB |

|                                        |                              |         |
|----------------------------------------|------------------------------|---------|
| <b>Output level uncertainty RF3OUT</b> |                              |         |
| In temperature range +20 °C to +35 °C  | 10 MHz to 450 MHz            |         |
|                                        | level $-80$ dBm to $+10$ dBm | <1.0 dB |
|                                        | 450 MHz to 2200 MHz          |         |
|                                        | level $-90$ dBm to $+10$ dBm | <1.0 dB |
|                                        | 2200 MHz to 2700 MHz         |         |
| In temperature range +5 °C to +45 °C   | level $-90$ dBm to $+5$ dBm  | <1.2 dB |
|                                        | 10 MHz to 450 MHz            |         |
|                                        | level $-80$ dBm to $+10$ dBm | <1.2 dB |
|                                        | 450 MHz to 2200 MHz          |         |
|                                        | level $-90$ dBm to $+10$ dBm | <1.2 dB |
|                                        | 2200 MHz to 2700 MHz         |         |
|                                        | level $-90$ dBm to $+5$ dBm  | <1.7 dB |

|                                         |                                      |            |
|-----------------------------------------|--------------------------------------|------------|
| <b>Output level settling time</b>       |                                      | <4 $\mu$ s |
| <b>Output level resolution</b>          |                                      | 0.1 dB     |
| <b>Generator RF level repeatability</b> | typical values after 1h warm-up time |            |
|                                         | output level $\geq -80$ dBm          | <0.01 dB   |
|                                         | output level $< -80$ dBm             | <0.1 dB    |

Note 2: Not valid at frequencies of netclock harmonics.

Note 3: Valid for RF1 only.

|                             |                                                   |                              |
|-----------------------------|---------------------------------------------------|------------------------------|
| <b>Spectral purity</b>      | CW signals                                        |                              |
| Attenuation of harmonics    | $f_0 = 10$ MHz to 2200 MHz, measured up to 7 GHz  |                              |
|                             | RF1, RF2                                          | >30 dB                       |
|                             | RF3OUT (level $\leq +10$ dBm)                     | >20 dB                       |
| Attenuation of nonharmonics | 10 MHz to 2000 MHz at $> 5$ kHz from carrier      | >40 dB                       |
| Phase noise                 | single sideband, $f < 2.2$ GHz                    |                              |
|                             | carrier offset 20 kHz to 250 kHz                  | $< -100$ dBc (1 Hz)          |
|                             | carrier offset $\leq 250$ kHz                     | $< -110$ dBc (1 Hz)          |
| Residual FM                 | 30 Hz to 15 kHz                                   | <50 Hz (rms), <200 Hz (peak) |
| Residual AM                 | ITU-T (formerly CCITT)                            | <5 Hz                        |
| I/Q modulation              | ITU-T (formerly CCITT)                            | <0.02% (rms)                 |
|                             | for frequency offset range 0 kHz to $\pm 135$ kHz |                              |
|                             | carrier suppression                               | >40 dB                       |

## VSWR of RF input and output connectors

|                |                      |      |
|----------------|----------------------|------|
| VSWR of RF1    | 10 MHz to 2000 MHz   | <1.2 |
|                | 2000 MHz to 2200 MHz | <1.3 |
|                | 2200 MHz to 2700 MHz | <1.6 |
| VSWR of RF2    | 10 MHz to 2200 MHz   | <1.2 |
|                | 2200 MHz to 2700 MHz | <1.6 |
| VSWR of RF3OUT | 10 MHz to 2200 MHz   | <1.5 |
|                | 2200 MHz to 2700 MHz | <1.7 |
| VSWR of RF4IN  | 10 MHz to 2200 MHz   | <1.5 |
|                | 2200 MHz to 2700 MHz | <1.6 |

## RF receiver

|                        |                                   |                                    |
|------------------------|-----------------------------------|------------------------------------|
| <b>Spectral purity</b> |                                   |                                    |
| Phase noise            | single sideband, $f < 2.2$ GHz    |                                    |
|                        | carrier offset 20 kHz to 250 kHz  | $< -100$ dBc (1 Hz)                |
|                        | carrier offset 250 kHz to 400 kHz | $< -110$ dBc (1 Hz)                |
|                        | carrier offset $\geq 400$ kHz     | $< -118$ dBc (1 Hz)                |
| Residual FM            | 30 Hz to 15 kHz                   | $< 50$ Hz (rms), $< 200$ Hz (peak) |
|                        | ITU-T (formerly CCITT)            | $< 5$ Hz (rms)                     |
| Residual AM            | ITU-T (formerly CCITT)            | $< 0.02$ % (rms)                   |

## Power splitter

|                                 |                      |           |
|---------------------------------|----------------------|-----------|
| Insertion loss (SC/S1 or SC/S2) | 400 MHz to 2200 MHz  | $< 7$ dB  |
|                                 | 2200 MHz to 2700 MHz | $< 8$ dB  |
| VSWR (SC)                       | 400 MHz to 2200 MHz  | $< 1.3$   |
|                                 | 2200 MHz to 2700 MHz | $< 1.6$   |
| VSWR (S1, S2)                   | 400 MHz to 2700 MHz  | $< 1.5$   |
| Isolation (S1/S2)               | 400 MHz to 2200 MHz  | $> 17$ dB |
|                                 | 2200 MHz to 2700 MHz | $> 10$ dB |
| Max. continuous power           | SC                   | 4 W       |
|                                 | S1, S2               | 21 dBm    |

## Interfaces of Radio Unit R&S®CRTU-RU

|                                                                  |  |                                          |
|------------------------------------------------------------------|--|------------------------------------------|
| USB                                                              |  | double connector on rear and front panel |
| Ethernet 1                                                       |  | RJ-45                                    |
| Connector for external monitor (VGA)                             |  | 15-pin D-Sub                             |
| Serial interface COM1, COM2                                      |  | RS-232-C, 9-pin D-Sub                    |
| Printer interface LPT                                            |  | parallel (centronics-compatible), 25-pin |
| Control A (for connection to PU or for R&S®CRTU interconnection) |  | 68-pin high-density connector            |
| Control B (for connection to PU or for R&S®CRTU interconnection) |  | 68-pin high-density connector            |
| IF (RX and TX, CH1 and CH2)<br>(four connections to PU)          |  | BNC                                      |
| Clock (for connection to PU)                                     |  | BNC                                      |
| IEC/IEEE bus remote control interface<br>(for connection to PU)  |  | 24-pin Amphenol                          |

## General specifications of Radio Unit R&S®CRTU-RU

|                     |                           |                                                                              |
|---------------------|---------------------------|------------------------------------------------------------------------------|
| <b>Power supply</b> |                           | power factor correction,<br>in line with EN 61000-3-2                        |
| Input               |                           | 100 V to 240 V $\pm 10$ % (AC), 500 VA,<br>50 Hz to 400 Hz $-5$ % to $+10$ % |
| Power consumption   | without GSM configuration | approx. 160 W                                                                |
|                     | with GSM configuration    | approx. 200 W                                                                |

|                                   |                 |                                                        |
|-----------------------------------|-----------------|--------------------------------------------------------|
| <b>Radio Unit R&amp;S®CRTU-RU</b> |                 |                                                        |
| Dimensions                        | W × H × D       | 465.1 mm × 196.5 mm × 517.0 mm<br>(19" 1/1, 4 HU, 450) |
| Weight                            | without options | approx. 18 kg/ 39.6 lb                                 |

# Specifications of Protocol Unit R&S®CRTU-PU

## Interfaces of Protocol Unit R&S®CRTU-PU

|                                                                 |  |                                              |
|-----------------------------------------------------------------|--|----------------------------------------------|
| USB                                                             |  | double connector on rear and front panel     |
| Ethernet 1, 2, 3                                                |  | RJ-45                                        |
| Ethernet HUB                                                    |  | 5 ports, 10/100 Mbps (auto detection), RJ-45 |
| Connector for external monitor (VGA)                            |  | 15-pin D-Sub                                 |
| Connector for external monitor (DVI)                            |  | 24-pin + 4-pin                               |
| Serial interface COM1                                           |  | RS-232-C, 9-pin D-Sub                        |
| Printer interface LPT                                           |  | parallel (centronics-compatible), 25-pin     |
| Control A (for connection to RU)                                |  | 68-pin high-density connector                |
| Control B (for connection to RU)                                |  | 68-pin high-density connector                |
| Chain IN<br>(for R&S®CRTU interconnection)                      |  | 68-pin high-density connector                |
| Chain OUT<br>(for R&S®CRTU interconnection)                     |  | 68-pin high-density connector                |
| IF (RX and TX, CH1 and CH2)<br>(four connections to RU)         |  | BNC                                          |
| Clock (for connection to RU)                                    |  | BNC                                          |
| IEC/IEEE bus remote control interface<br>(for connection to RU) |  | 24-pin Amphenol                              |

## General specifications of Protocol Unit R&S®CRTU-PU

|                     |  |                                                                                                                  |
|---------------------|--|------------------------------------------------------------------------------------------------------------------|
| <b>Power supply</b> |  | power factor correction,<br>in line with EN 61000-3-2                                                            |
| Input               |  | 100 V to 120 V $\pm 10$ % (AC) or<br>220 V to 240 V $\pm 10$ % (AC), 600 VA,<br>50 Hz to 60 Hz $-5$ % to $+10$ % |
| Power consumption   |  | approx. 180 W                                                                                                    |

|                                      |           |                                                         |
|--------------------------------------|-----------|---------------------------------------------------------|
| <b>Protocol Unit R&amp;S®CRTU-PU</b> |           |                                                         |
| Dimensions                           | W × H × D | 465.1 mm × 241.0 mm × 595.0 mm,<br>(19" 1/1, 5 HU, 550) |
| Weight                               |           | approx. 21 kg/ 46.3 lb                                  |

# General specifications (of R&S®CRTU-RU and R&S®CRTU-PU)

|                               |                        |                                                                                                                                     |
|-------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Operating temperature range   |                        | +5 °C to +45 °C,<br>in line with EN 60068-2-1 or -2                                                                                 |
| Storage temperature range     |                        | –25 °C to +60 °C,<br>in line with EN 60068-2-1 or -2                                                                                |
| Humidity                      | +40 °C, non-condensing | 80 % relative humidity,<br>in line with EN 60068-2-30                                                                               |
| Electromagnetic compatibility |                        | in line with EMC Directive 89/336/EEC,<br>applied standard: EN 61326<br>(immunity for industrial environment;<br>class B emissions) |
| Electrical safety             |                        | IEC 61010-1, EN 61010-1, UL3111-1,<br>CAN/CSA-C22.2 No. 1010.1                                                                      |

|                              |                    |                                                                                                                                         |
|------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Mechanical resistance</b> | non-operating mode |                                                                                                                                         |
| Vibration                    | sinusoidal         | in line with EN 60068-2-6, EN 61010-1,<br>MIL-T-28800 D class 5, 5 Hz to 150 Hz,<br>max. 2 g at 55 Hz, 55 Hz to 150 Hz, 0.5 g<br>const. |
| Vibration                    | random             | in line with EN 60068-2-64,<br>10 Hz to 300 Hz, acceleration 1.2 g rms                                                                  |
| Shock                        |                    | in line with EN 60068-2-27, MIL-STD-810D<br>40 g shock spectrum                                                                         |

## GSM specifications

### RF generator

|                   |  |                 |
|-------------------|--|-----------------|
| <b>Modulation</b> |  | GMSK, B×T = 0.3 |
|                   |  | 8PSK            |

|                        |              |                                          |
|------------------------|--------------|------------------------------------------|
| <b>Frequency range</b> |              |                                          |
|                        | GSM400 band  | 460 MHz to 468 MHz<br>488 MHz to 496 MHz |
|                        | GSM850 band  | 869 MHz to 894 MHz                       |
|                        | GSM900 band  | 921 MHz to 960 MHz                       |
|                        | GSM1800 band | 1805 MHz to 1880 MHz                     |
|                        | GSM1900 band | 1930 MHz to 1990 MHz                     |

|                                                 |  |        |
|-------------------------------------------------|--|--------|
| <b>Attenuation of inband spurious emissions</b> |  | >50 dB |
|-------------------------------------------------|--|--------|

|                             |      |           |
|-----------------------------|------|-----------|
| <b>Inherent phase error</b> | GMSK | <1°, rms  |
|                             |      | <4°, peak |

|                     |      |           |
|---------------------|------|-----------|
| <b>Inherent EVM</b> | 8PSK | <2 %, rms |
|---------------------|------|-----------|

|                                |                         |         |
|--------------------------------|-------------------------|---------|
| <b>Frequency settling time</b> | to residual phase of 4° | <500 µs |
|--------------------------------|-------------------------|---------|

|                           |      |                     |
|---------------------------|------|---------------------|
| <b>Output level range</b> | GMSK |                     |
| RF1                       |      | –130 dBm to –33 dBm |
| RF2                       |      | –130 dBm to –16 dBm |
| RF3OUT                    |      | –90 dBm to +5 dBm   |

|                           |      |                     |
|---------------------------|------|---------------------|
| <b>Output level range</b> | 8PSK |                     |
| RF1                       |      | –130 dBm to –37 dBm |
| RF2                       |      | –130 dBm to –20 dBm |
| RF3OUT                    |      | –90 dBm to +1 dBm   |

|                                 |                                       |         |
|---------------------------------|---------------------------------------|---------|
| <b>Output level uncertainty</b> | GSM bands                             |         |
| RF1, RF2                        | at >−117 dBm                          |         |
|                                 | in temperature range +20 °C to +35 °C | <0.7 dB |
|                                 | in temperature range +5 °C to +45 °C  | <0.9 dB |
| RF3OUT                          |                                       |         |
|                                 | −90 dBm to +5 dBm for GMSK            |         |
|                                 | −90 dBm to +1 dBm for 8PSK            |         |
|                                 | in temperature range +20 °C to +35 °C | <0.9 dB |
|                                 | in temperature range +5 °C to +45 °C  | <1.1 dB |

## RF receiver

|                        |  |                      |
|------------------------|--|----------------------|
| <b>Frequency range</b> |  |                      |
| GSM400 band            |  | 450 MHz to 458 MHz   |
|                        |  | 478 MHz to 486 MHz   |
| GSM850 band            |  | 824 MHz to 849 MHz   |
| GSM900 band            |  | 876 MHz to 915 MHz   |
| GSM1800 band           |  | 1710 MHz to 1785 MHz |
| GSM1900 band           |  | 1850 MHz to 1910 MHz |

|                             |      |            |
|-----------------------------|------|------------|
| <b>Inherent phase error</b> | GMSK | <0.6°, rms |
|                             |      | <2°, peak  |

|                     |      |             |
|---------------------|------|-------------|
| <b>Inherent EVM</b> | 8PSK | <1.0 %, rms |
|---------------------|------|-------------|

|                                               |                                  |                    |
|-----------------------------------------------|----------------------------------|--------------------|
| <b>Reference level for full dynamic range</b> | GMSK                             |                    |
| RF1                                           | max. continuous input power 50 W | +10 dBm to +53 dBm |
| RF2                                           | max. continuous input power 2 W  | −4 dBm to +39 dBm  |
| RF4IN                                         |                                  | −22 dBm to 0 dBm   |

|                                               |                                  |                   |
|-----------------------------------------------|----------------------------------|-------------------|
| <b>Reference level for full dynamic range</b> | 8PSK                             |                   |
| RF1                                           | max. continuous input power 50 W | +6 dBm to +49 dBm |
| RF2                                           | max. continuous input power 2 W  | −8 dBm to +35 dBm |
| RF4IN                                         |                                  | −26 dBm to −4 dB  |

## Audio

|                                   |                    |               |
|-----------------------------------|--------------------|---------------|
| <b>Input connector AUX1 (BNC)</b> | speech coder input |               |
| Full range input level            | low sensitivity    | 1.40 V (peak) |
|                                   | high sensitivity   | 0.10 V (peak) |
| Input impedance                   |                    | 100 kΩ        |

|                                    |                       |               |
|------------------------------------|-----------------------|---------------|
| <b>Output connector AUX2 (BNC)</b> | speech decoder output |               |
| Full range output level            |                       | 1.00 V (peak) |
| Output impedance                   |                       | <10 Ω         |
| Maximum output current             |                       | 20 mA (peak)  |

## Trigger/clock signals

|                               |                      |      |
|-------------------------------|----------------------|------|
| <b>Input (BNC) connectors</b> | Trig In A, Trig In B |      |
|                               | nominal input level  | TTL  |
|                               | input impedance      | 1 kΩ |

|                                |                                           |      |
|--------------------------------|-------------------------------------------|------|
| <b>Output (BNC) connectors</b> | Trig Out A, Trig Out B, SLOT CLK, BIT CLK |      |
| Nominal output level           |                                           | TTL  |
| Output impedance               |                                           | 50 Ω |

## Display

|                    |  |                                   |
|--------------------|--|-----------------------------------|
| Display size       |  | 21 cm TFT colour display (8.4")   |
| Resolution         |  | 640 x 480 pixels (VGA resolution) |
| Pixel failure rate |  | <2 × 10 <sup>−5</sup>             |

# WCDMA specifications

## Standard

|          |  |                                        |
|----------|--|----------------------------------------|
| Standard |  | 3GPP-FDD, 3.84 Mcps, R99, Rel-5, Rel-6 |
|----------|--|----------------------------------------|

## RF Generator

|                        |           |                          |
|------------------------|-----------|--------------------------|
| <b>Modulation</b>      |           | according to standard    |
| <b>Frequency range</b> | band I    | 2110 MHz to 2170 MHz     |
|                        | band II   | 1930 MHz to 1990 MHz     |
|                        | band III  | 1805 MHz to 1880 MHz     |
|                        | band IV   | 2110 MHz to 2155 MHz     |
|                        | band V    | 869 MHz to 894 MHz       |
|                        | band VI   | 875 MHz to 885 MHz       |
|                        | band VII  | 2620 MHz to 2690 MHz     |
|                        | band VIII | 925 MHz to 960 MHz       |
|                        | band IX   | 1844.9 MHz to 1874.9 MHz |

|                                       |                                             |                     |
|---------------------------------------|---------------------------------------------|---------------------|
| <b>Output level range (rms value)</b> | max. value depends on channel configuration |                     |
| RF1                                   |                                             | −120 dBm to −37 dBm |
| RF2                                   |                                             | −120 dBm to −20 dBm |
| RF3OUT                                |                                             | −100 dBm to +0 dBm  |

|                                 |                                       |         |
|---------------------------------|---------------------------------------|---------|
| <b>Output level uncertainty</b> | in temperature range +20 °C to +35 °C |         |
| RF1, RF2                        | output level $\geq$ −120 dBm          |         |
|                                 | f < 2200 MHz                          | <0.8 dB |
|                                 | f $\geq$ 2200 MHz                     | <1.0 dB |
| RF3OUT                          | output level $\geq$ −80 dBm           |         |
|                                 | f < 2200 MHz                          | <1.0 dB |
|                                 | f $\geq$ 2200 MHz                     | <1.2 dB |

|                                 |                                      |         |
|---------------------------------|--------------------------------------|---------|
| <b>Output level uncertainty</b> | in temperature range +5 °C to +45 °C |         |
| RF1, RF2                        | output level $\geq$ −120 dBm         |         |
|                                 | f < 2200 MHz                         | <1.1 dB |
|                                 | f $\geq$ 2200 MHz                    | <1.7 dB |
| RF3OUT                          | output level $\geq$ −80 dBm          |         |
|                                 | f < 2200 MHz                         | <1.2 dB |
|                                 | f $\geq$ 2200 MHz                    | <1.7 dB |

## RF receiver

|                 |           |                          |
|-----------------|-----------|--------------------------|
| Frequency range | band I    | 1920 MHz to 1980 MHz     |
|                 | band II   | 1850 MHz to 1910 MHz     |
|                 | band III  | 1710 MHz to 1785 MHz     |
|                 | band IV   | 1710 MHz to 1755 MHz     |
|                 | band V    | 824 MHz to 849 MHz       |
|                 | band VI   | 830 MHz to 840 MHz       |
|                 | band VII  | 2500 MHz to 2570 MHz     |
|                 | band VIII | 880 MHz to 915 MHz       |
|                 | band IX   | 1749.9 MHz to 1784.9 MHz |

|                                                       |                                        |                    |
|-------------------------------------------------------|----------------------------------------|--------------------|
| Max. level setting range<br>peak envelope power (PEP) |                                        |                    |
| RF1                                                   | max. continuous power +47 dBm (note 1) | –38 dBm to +53 dBm |
| RF2                                                   | max. continuous power +33 dBm          | –52 dBm to +39 dBm |
| RF4IN                                                 | max. continuous power +0 dBm           | –77 dBm to +0 dBm  |

## Trigger/clock signals

|                         |                        |             |
|-------------------------|------------------------|-------------|
| Output (BNC) connectors | Trig Out A, Trig Out B |             |
| Nominal output level    |                        | TTL         |
| Output impedance        |                        | 50 $\Omega$ |

Note 1: 50 W in temperature range +5 °C to +30 °C, linear degradation down to 25 W at +45 °C.

# Option 2-channel IQ/IF Interface Card R&S®CRTU-B7

The R&S®CRTU-B7 is a 2-channel option. Each channel can be setup independent from each other.

Note for I/Q chip connections:

If standard signaling tests or test cases are used, it is required to combine both channels. See application note for details.

## I/Q interface

|                             |                                                 |                                                              |
|-----------------------------|-------------------------------------------------|--------------------------------------------------------------|
| <b>Analog I/Q outputs</b>   | IF → I/Q; TX and RX paths, analog I/Q output    | connector I/Q CH1/CH2                                        |
| I/Q bandwidth               |                                                 | 0 Hz to 2.5 MHz                                              |
| Max. output voltage range   | EMF                                             | –1 V to +1 V, peak<br>$\sqrt{I^2 + Q^2} = 1 \text{ V, peak}$ |
| Output impedance            |                                                 | 50 Ω                                                         |
| I and Q amplitude imbalance | for GSM                                         | <2 %                                                         |
|                             | for WCDMA                                       | <2.5 %                                                       |
| Offset voltage              | in temperature range +20 °C to +35 °C for GSM   | <4 mV                                                        |
|                             | in temperature range +20 °C to +35 °C for WCDMA | <5 mV                                                        |
|                             | in temperature range +5 °C to +45 °C            | <8 mV                                                        |

|                          |                                             |                                                                    |
|--------------------------|---------------------------------------------|--------------------------------------------------------------------|
| <b>Analog I/Q inputs</b> | I/Q → IF; TX–path, analog I/Q input         | connector I/Q CH1/CH2                                              |
| I/Q bandwidth            |                                             | 0 Hz to 2.5 MHz                                                    |
| Max. input voltage range |                                             | –0.5 V to +0.5 V, peak<br>$\sqrt{I^2 + Q^2} = 0.5 \text{ V, peak}$ |
| Input impedance          |                                             | 50 Ω                                                               |
| Carrier suppression      | in temperature range +20 °C to +35 °C       | >40 dB                                                             |
|                          | in temperature range +5 °C to +45 °C        | >35 dB                                                             |
| Sideband suppression     | $f_{I/Q} < 1 \text{ MHz}$                   | >45 dB                                                             |
|                          | $1 \text{ MHz} < f_{I/Q} < 2.5 \text{ MHz}$ | >40 dB                                                             |

|                          |                                             |                                                                    |
|--------------------------|---------------------------------------------|--------------------------------------------------------------------|
| <b>Analog I/Q inputs</b> | I/Q → IF; RX path, analog I/Q input         | connector I/Q CH1/CH2                                              |
| I/Q bandwidth            |                                             | 0 Hz to 2.5 MHz                                                    |
| Max. input voltage range |                                             | –0.5 V to +0.5 V, peak<br>$\sqrt{I^2 + Q^2} = 0.5 \text{ V, peak}$ |
| Input impedance          |                                             | 50 Ω                                                               |
| Carrier suppression      |                                             | >35 dB                                                             |
| Sideband suppression     | $f_{I/Q} < 1 \text{ MHz}$                   | >45 dB                                                             |
|                          | $1 \text{ MHz} < f_{I/Q} < 2.5 \text{ MHz}$ | >40 dB                                                             |

## Influence on RF interface

|                             |                                               |                                           |
|-----------------------------|-----------------------------------------------|-------------------------------------------|
| <b>RF level uncertainty</b> | bypass with I/Q IF OUT, I/Q IN/OUT, IF IN/OUT |                                           |
| Output level uncertainty    | at RF 1, RF 2, RF 3 OUT                       | add 0.3 dB to R&S® CRTU-RU specifications |

## IF interface

|                            |           |                             |
|----------------------------|-----------|-----------------------------|
| <b>IF outputs, TX path</b> |           | connector IF TX CH1/CH2 OUT |
| IF level range             |           | up to –5 dBm, PEP           |
| Standard IF frequencies    | for GSM   | 13.85 MHz                   |
|                            | for WCDMA | 15.36 MHz                   |

|                            |           |                             |
|----------------------------|-----------|-----------------------------|
| <b>IF outputs, RX path</b> |           | connector IF RX CH1/CH2 OUT |
| IF level range             |           | up to +6 dBm, PEP           |
| Standard IF frequencies    | for GSM   | 10.7 MHz                    |
|                            | for WCDMA | 7.68 MHz                    |

# Ordering information

## GSM

| Designation                                                                                                                                                              | Type         | Order number |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|
| Protocol Tester for GSM                                                                                                                                                  | R&S®CRTU-G   | 1140.0009K02 |
| Protocol Tester for GSM (extension unit)                                                                                                                                 | R&S®CRTU-S   | 1140.1705K02 |
| 2-channel IQ/IF Interface Card for R&S®CRTU-G                                                                                                                            | R&S®CRTU-B7  | 1139.0009.02 |
| Upgrade R&S®GRTU-G to R&S®CRTU-GW                                                                                                                                        | R&S®CRTU-U01 | 1140.1105.02 |
| Upgrade R&S®GRTU-S to R&S®CRTU-G                                                                                                                                         | R&S®CRTU-U03 | 1140.0209.02 |
| Upgrade R&S®GRTU-G hardisk to 120 Gbyte                                                                                                                                  | R&S®CRTU-U05 | 1139.1105.04 |
| Upgrade of PC module to 933 MHz/512 Mbyte                                                                                                                                | R&S®CRTU-U06 | 1139.1940.02 |
| Upgrade of R&S®CRTU-S to R&S®CRTU-MS                                                                                                                                     | R&S®CRTU-U10 | 1139.2401.02 |
| <b>Equipment supplied with R&amp;S®CRTU-G/CRTU-S</b>                                                                                                                     |              |              |
| Included in the scope of delivery: hardlock, test SIMs R&S®CRT-Z2 and R&S®CRT-Z12 (for US and rest-of-world), all RF-, control- and Ethernet-cables for a multibox setup |              |              |

## WCDMA

| Designation                                                                                                                                                                                                               | Type         | Order number |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|
| Protocol Tester for WCDMA                                                                                                                                                                                                 | R&S®CRTU-W   | 1140.0509K02 |
| Multi-cell Extension (2 WCDMA channels) for CRTU-W                                                                                                                                                                        | R&S®CRTU-M   | 1140.2101K02 |
| Upgrade R&S®CRTU-W to R&S®CRTU-GW                                                                                                                                                                                         | R&S®CRTU-U04 | 1140.0309.02 |
| Upgrade R&S®CRTU-M to R&S®CRTU-W                                                                                                                                                                                          | R&S®CRTU-U07 | 1139.2102.02 |
| Upgrade R&S®CRTU-M to R&S®CRTU-MS                                                                                                                                                                                         | R&S®CRTU-U11 | 1139.3108.03 |
| PPC Upgrade                                                                                                                                                                                                               | R&S®CRTU-U13 | 1139.3008.02 |
| <b>Equipment supplied with R&amp;S®CRTU-W/CRTU-M</b>                                                                                                                                                                      |              |              |
| Included in the scope of delivery: R&S®CRTU-B7, hardlock, test SIM R&S®CRT-Z3, all RF-, control- and Ethernet-cables for a multibox setup, Microsoft VisualStudio .Net 2005 Compiler, spare fuses (two for Protocol Unit) |              |              |

## Combined

| Designation                                                                                                                                                                                                                                     | Type         | Order number |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|
| Protocol Tester for WCDMA and GSM                                                                                                                                                                                                               | R&S®CRTU-GW  | 1140.0709K02 |
| Protocol Tester for WCDMA and GSM (extension unit)                                                                                                                                                                                              | R&S®CRTU-MS  | 1140.2401K02 |
| Upgrade of R&S®CRTU-MS to R&S®CRTU-GW                                                                                                                                                                                                           | R&S®CRTU-U12 | 1139.3208.02 |
| <b>Equipment supplied with R&amp;S®CRTU-GW/CRTU-MS</b>                                                                                                                                                                                          |              |              |
| Included in the scope of delivery: R&S®CRTU-B7, hardlocks, test SIMs CRT-Z2, CRT-Z12 and R&S®CRT-Z3, all RF-, control- and Ethernet-cables for a multibox setup, Microsoft VisualStudio .Net 2005 Compiler, spare fuses (two for Protocol Unit) |              |              |

## Recommended number of required accessories

|             | Mouse    | Keyboard | Monitor | DVD Drive |
|-------------|----------|----------|---------|-----------|
| R&S®CRTU-G  | 1        | 1        | 1       | 1         |
| R&S®CRTU-W  | 1        | 1        | 1       | 0         |
| R&S®CRTU-GW | 1 or 2** | 1 or 2** | 1       | 1         |
| R&S®CRTU-S  | 1        | 1        | 1*      | 1         |
| R&S®CRTU-M  | 1        | 1        | 1       | 0         |
| R&S®CRTU-MS | 1 or 2** | 1 or 2** | 1       | 1         |

Notes:

\* If used in standalone mode, e.g. for data testing.

\*\* With one mouse and keyboard only, user have to change USB connectors between RU and PU when changing operation modes between GSM and WCDMA.

Important information:

Monitor, keyboard, mouse and external DVD drive are absolutely necessary for the proper operation of the protocol testers R&S®CRTU.

We strongly recommend using only the original PC components of Rohde & Schwarz specified below in connection with a Protocol Tester R&S®CRTU. The interaction of all components is continuously tested and adjusted. The proper operation with other commercially available PC components cannot be warranted.

## Recommended accessories

|                         |             |              |
|-------------------------|-------------|--------------|
| USB-Mouse optical mouse | R&S®PSL-Z10 | 1157.7060.03 |
| USB-Keyboard            | R&S®PSL-Z2  | 1157.6870.04 |
| Monitor 17" TFT         | R&S®PMC3    | 1082.6004.12 |
| USB DVD±RW Drive        | R&S®PSP-B6  | 1134.8201.22 |

|                                         |             |              |
|-----------------------------------------|-------------|--------------|
| Antenna Coupler for Handheld Telephones | R&S®CMU-Z10 | 1150.0801.02 |
| Shielded Chamber for R&S®CMU-Z10        | R&S®CMU-Z11 | 1150.1008.02 |
| 19" Rack Adapter (for Radio Unit)       | R&S®ZZA-411 | 1096.3283.00 |
| 19" Rack Adapter (for Protocol Unit)    | R&S®ZZA-511 | 1096.3290.00 |
| <b>Additional test SIMs</b>             |             |              |
| Test SIM GSM 900/1800                   | R&S®CRT-Z2  | 1039.9005.02 |
| Test SIM GSM 850/1900                   | R&S®CRT-Z12 | 1139.1205.02 |
| UICC/USIM Test Card                     | R&S®CRT-Z3  | 1139.1005.02 |



For product brochure, see PD 5213.5574.12  
and [www.rohde-schwarz.com](http://www.rohde-schwarz.com)  
(search term: CRTU)



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