

Measurement functions to characterize 3GPP release 8 UMTS mobile transceiver performance in accordance with the methods specified in 3GPP TS 34.121-1 V8.10.0.

- Tx output power Max and Min with drive to level
- ILPC (Inner loop power control)
- Frequency stability
- Out of band Spectral emissions (ACLR/SEM)
- Occupied bandwidth
- CCDF
- Phase discontinuity
- EVM
- Phase and amplitude errors
- IQ skew and gain imbalance
- Origin offset
- Tx slot timing error
- Code domain power/code domain error
- Demodulated symbol data for active channels
- Enhanced physical channels and HS-DPCCH
- Receive sensitivity (BER/BLER) using loopback
- Per-channel code domain error and relative code domain error measurements
- Release 8 support
  - Release 8 spectrum mask support
  - Ability to analyze 4-PAM E-DPDCH
  - DPCCH slot format 4 support
- Fast Sequence Tuning (FST)<sup>(1)</sup>

The UMTS uplink measurement suite supports analysis of 3GPP W-CDMA UE transmit and receive parameters including receiver BER/BLER measurements (using test loop mode 2 per 3GPP 34.109).

The UMTS uplink PXI Studio plug-in provides manual user interface to perform measurements with a variety of trace displays including constellation diagram, code domain power and, spectral mask.

Setting up UMTS uplink measurements requires only user entry of DPCCH slot format and scrambling code. Active channel detection can be set automatically or defined by the user. Measurements can then be made for any user specified or a random timeslot 0 to 14.

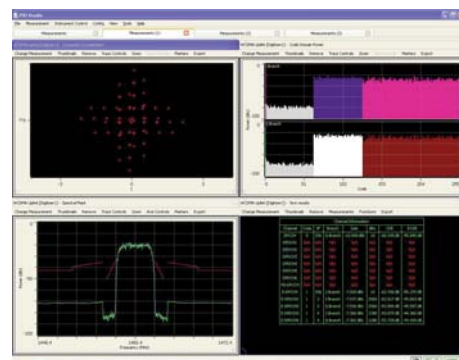


Figure 1. UMTS plug-in typical screenshot

(1) Not exposed in PXI Studio

## UMTS UPLINK

All specifications are defined when used in conjunction with a 3030 Series PXI RF digitizer with option 101 operating in 3GPP FDD frequency bands.

Specifications are defined with the input signal at the RF Digitizer tuned frequency and at the reference level unless otherwise stated.

Measurements performed are in accordance with 3GPP TS 34.121 section 5 and 6 as applicable.

ILPC, Max Power, Min Power, Drive to level and BER measurements additionally require a 3020 series RF signal generator to be assigned.

Note: Additional functions may be provided in the programming interface, see help files for details.

### CONFIGURATIONS

#### Frequency

Uplink (Hz)

User defined frequency or preset UARFCN bands, as shown in the table below

#### UARFCN Bands and Frequencies Table

Band	UARFCN	MHz
I	9612-9888	1922.4-1977.4
II	12-287 step	1852.5-1907.5 1852.4-1907.6
III	9262-9538	1712.4-1782.6
IV	1312-1862	1712.4-1752.5
V	3487-3587	826.4-846.6
VII	2012-2687	2502.4-2567.5
VIII	2712-2863	882.4-912.6
IX	8762-8912	1752.4-1782.4
X	2887-3462	1712.4-1767.5
XI*	3487-3587	1430.4-1450.4

\* No spectrum mask type selection offered for band XI

#### Level

Uplink (DUT output level) (dBm)

#### Path Loss Correction

Uplink (dB)

#### Power Control Mode

Drive to level, Drive to max / min or Disabled

#### Headroom

Specify the headroom (dB) required to ensure ADC is not overloaded by the signal peak level

### MEASUREMENT SET-UP

#### Channel Detection Mode

Case 1, 2, 3 and user defined

	DPDCH	HS-DPCCH	E-DPDCH	E-DPCCH
Case 1	6	1	0	0
Case 2	1	1	2	1
Case 3	0	1	4	1

#### Scrambling Code

0 to  $2^{24}-1$

#### DPCCH Slot Format

0 to 4

#### Pilot Search Length

Symbols

#### Ref Data Pattern Type

All ones, all zeros, PRBS PN9 or PN15

#### Searching Length

ms

#### Analysis Mode

Random or specific slot; 0 to 14

#### Analysis Region

Full slot, First Half slot, Second Half slot

#### Exclude Modulation Accuracy Transient Period

Enable or disable

#### Remove IQ Origin Offset

Enable or disable

#### Slot Power Transient Period

0-333.2  $\mu$ s

#### Channel Detection Threshold

dB

#### CDE Spreading Factor

2-256

#### Spectrum Analysis Mode

Synchronized or Unsynchronized

#### Spectral Mask

Auto, or spectral mask type (Band I to Band XXI)

#### ILPC

Test Segment: Step ABC, EF or GH.

If set to Step ABC, Initial Power Tolerance (dB) can be specified

#### Acquisition Trigger Source

Immediate (free run), Burst (video), Ext (PXI trigger bus [0-7], local bus, star trigger, LVDS [AUX/MKR 0-4], TTL)

### MEASUREMENTS

#### POWER

Power measurement can be performed either with or without power control enabled.

For measurements with power control a 3020 Series signal generator is required to be assigned in which case Tx Max power, Tx Min power and drive to level measurements are supported.

#### Measurement Range

Per 3030 Series RF Digitizer maximum input

#### Indication

Average Power (Fast, unsynchronised – all IQ), dBm

Slot Power and slot number (random or specified), dBm

## Accuracy

See 3030 Series module level accuracy spec

## OCCUPIED BANDWIDTH (supported in programming API only)

Bandwidth containing 99% of the total power of the transmitted spectrum

## Indication

Hz

## Accuracy

<100 kHz

## SPECTRUM EMISSION MASK

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The spectral density of the transmitted signal is measured relative to the relevant 3GPP defined spectral mask.

## Measurement Range

±12.5 MHz

## Indication

Global Pass / Fail

The worst case failure or closest proximity to failure relative to the mask dBr level and its corresponding frequency.

In addition, for each mask region the worse case failure or closest proximity to failure is expressed as dBc actual and dBr to mask with the associated absolute frequency.

## Traces

FFT power spectrum and selected mask

## Accuracy

<±0.05 dB error per 10 dBc<sup>(2)</sup>

## SPECTRUM EMISSION MASK OFFSET

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This measurement displays the spectral mask failure points for each of the spectral mask offset regions, which are defined in the specification 3GPP TS 34.121 Section 5.9 Spectrum Emission Mask.

## Indication

Global Pass/Fail

## Accuracy

<±0.05 dB error per 10 dBc<sup>(2)</sup>

## PHASE DISCONTINUITY

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Phase difference between measured slot/half-slot and the preceding slot/half-slot

## Indication

Degrees, slot number

## ADJACENT CHANNEL LEAKAGE RATIO (ACLR)

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The ratio of the channel power to the power measured in the upper and lower adjacent and alternate channels.

## Filter

3.84 MHz RRC filter with alpha 0.22

## Dynamic Range

3030C/3035C typically -65 dBc

3030A/3035 typically -68 dBc

## Indication

Reference channel power (dBm)

1st upper and lower adjacent channel power (dBc or dBm)

2nd upper and lower adjacent channel power (dBc or dBm)

## Accuracy

Absolute measurements; 3030 RF Digitizer level accuracy + scale error 0.05 dB / 10 dBc<sup>(2)</sup>

Relative measurements <± 0.05 dB / 10 dBc<sup>(2)</sup>

## SLOT BY SLOT POWER

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This measurement displays the results of the power measurement made on a slot-by-slot basis.

## Indication

dBm on each slot

## SLOT BY SLOT EVM (PEAK AND RMS)

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This measurement displays the results of the EVM Peak and RMS measurement made on a slot-by-slot basis.

## Indication

% on each slot

## MODULATION ACCURACY

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Composite EVM results are provided for either a specific or random slot number.

Additional functions in the programming API also support QPSK demodulation.

## Indication

EVM peak/rms (%)

Magnitude error peak/rms (%)

Phase error peak / rms (degrees)

Frequency Error (Hz)

Carrier Leak (dB)

IQ gain imbalance (dB)

IQ skew (degrees)

Slot Timing (ms)

HS-DPCCH Timing Offset (ms)

Slot number

## Residual EVM error

<±1%

## Traces

Measured and reference constellation

## PEAK CODE DOMAIN ERROR

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This is computed over user specified spreading factor. The peak code domain errors are defined as the maximum values for the computed code domain errors. The measurements interval is 1 slot (2560 chips).

## CDE Spreading Factor

2, 4, 8, 16, 32, 64, 128, 256

## Trace

Code Domain Power (dBc) vs. code and Code Domain Errors for I and Q channels (dBc)

## Results

Peak code domain error for I and Q channels (dB)

## CCDF (Complimentary cumulative distribution function)

## Trace

Peak to average power (dB) vs. probability (%)

## CHANNEL INFORMATION

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This measurement displays the status and detected settings of all channels within the analyzed WCDMA signal.

## Indication

Active / inactive channels

## Channel Code

Spreading Factor ( $2^N$  where  $N = 1$  to 8)

Branch (I or Q)

Gain (dBc)

Number of bits demodulated

Code Domain Error (CDE) (dB)

Relative CDE (dB)

## DEMODULATED SYMBOLS

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Symbol data is available for each active channel.

## Channel Types

DPCCH

DPDCH1 to 6

HS-DPCCH

E-DPCCH

E-DPDCH1 to 4

ILPC (Inner Loop Power Control)

Requires 3020 Series signal generator assignment.

## SETUP

### Test Segment

A,B,C (Power Control Algorithm 2, 1 dB step size)

E,F (Power Control Algorithm 1, 1 dB step size)

G,H (Power Control Algorithm 1, 2 dB step size)

### Initial Power Tolerance (A,B,C)

1 to 10 dB

### Measurement Results

ILPC Absolute / Relative Power Vs. Slot Table

Slot No

Slot Power (dBm / dBc)

Step (Pass / Fail)

Ten Step (Pass / Fail)

ILPC Overall

Result (Pass / Fail)

Failed sector

ILPC Power

Max Power (dBm)

Min Power (dBm)

### Traces

ILPC Power vs. Slot (absolute / relative)

ILPC Relative Power vs. Slot (10 steps)

### BER (Bit Error Rate) / BLER (Block Error Rate)

Requires assignment of 3020 Series RF signal generator

Assumes the device under test is configured to operate either in symmetric test loop mode 1 or asymmetric test loop mode 2 per 3GPP TS 34.109 V7.3.0 and configured to use TFCS table values 1 or 3 per 3GPP TS 34.121-1 B8.3.0

### Downlink Signal Content

PSCH, SSCH, PCPICH, PCCPCH, PICH, DPCH

### Measurement Results

Bit error rate (%)

Number of bits examined

Number of bits in error

Block error rate (%)

Number of blocks examined

Number of blocks in error

## Setup

Test Loop Mode: Mode 1 (Symmetric) or Mode 2 (Asymmetric)

Number of DTCH blocks: Up to 100

Number of bits to compare: Up to 24,400

Notes

(2) Excluding the effects of noise

## GENERAL

### Operating System

Windows® XP (service pack 2) and 32-bit Vista.

### Required Memory

512 Mbytes minimum, 1024 Mbytes recommended

### Display Resolution

Minimum 1024 x 768

### Other

Aeroflex 3000 Series modules require NI VISA version 3.1 or later (NI Visa 4.2 or later under Windows® Vista).

Aeroflex 3000 Series module drivers version 5.4.0 or later

## ORDERING

PXI Studio is supplied as standard with plug-ins for RF Digitizer, Signal Generator, RF Combiner and Spectrum Analyzer.

Optional measurement plug-ins may be purchased with the 303x at time of order or purchased as an upgrade to the 303x.

Note: To be able to use measurement plug-ins within PXI Studio, associated options must be enabled in the 303x digitizer.

### UMTS Uplink

When purchased with a 303x, order as: 3030 option 101

When purchased as an upgrade, then order as: RTROPT101/3030

#### CHINA Beijing

Tel: [+86] (10) 6539 1166  
Fax: [+86] (10) 6539 1778

#### CHINA Shanghai

Tel: [+86] 21 2028 3588  
Fax: [+86] 21 2028 3558

#### CHINA Shenzhen

Tel: [+86] (755) 3301 9358  
Fax: [+86] (755) 3301 9356

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Fax: [+358] (9) 804 2441

#### FRANCE

Tel: [+33] 1 60 79 96 00  
Fax: [+33] 1 60 77 69 22

#### GERMANY

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Fax: [+49] 89 99641 160

#### HONG KONG

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Fax: [+852] 2834 5364

#### INDIA

Tel: [+91] 80 [4] 115 4501  
Fax: [+91] 80 [4] 115 4502

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Fax: [+81] (3) 3500 5592

#### KOREA

Tel: [+82] (2) 3424 2719  
Fax: [+82] (2) 3424 8620

#### SCANDINAVIA

Tel: [+45] 9614 0045  
Fax: [+45] 9614 0047

#### SINGAPORE

Tel: [+65] 6873 0991  
Fax: [+65] 6873 0992

#### TAIWAN

Tel: [+886] 2 2698 8058  
Fax: [+886] 2 2698 8050

#### UK Stevenage

Tel: [+44] (0) 1438 742200  
Fax: [+44] (0) 1438 727601  
Freephone: 0800 282388

#### USA

Tel: [+1] (316) 522 4981  
Fax: [+1] (316) 522 1360  
Toll Free: 800 835 2352

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[www.aeroflex.com](http://www.aeroflex.com)

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