PXI

LTE FDD and LTE TDD Measurement Suites

Measurement functions to characterize LTE FDD or LTE TDD signals using methods asdefined in ETSI TS 36.521-1.

- Transmit power
- PRACH time mask
- Transmit signal quality:
  - Frequency error
  - Error Vector Magnitude (EVM)
  - Spectrum flatness
  - Carrier leakage (IQ origin offset)
  - In-band emissions for non allocated RB
  - IQ skew/gain imbalance
  - Symbol clock error
- Output RF spectrum emissions:
  - Occupied bandwidth
  - Spectrum Emission Mask (SEM)
  - Adjacent Channel Leakage power Ratio (ACLR)
- CCDF
- Fast Sequence Tuning (FST)[1]

LTE FDD and LTE TDD are available as separate 303x digitizer options. In each case analysis is supported for uplink (SC-FDMA) transmissions for all bandwidths, 1.4 MHz, to 20 MHz and modulation types QPSK, QAM16 and QAM64. Measurement results are provided with statistical analysis and various display traces.

To simplify operation an "Auto Detect" feature configures settings for format, modulation type, RB allocation and the demodulated reference signal (DMRS).

EVM analysis for uplink PUSCH, PUCCH and SRS is supported with user control of equalizer settings for pilot time, phase and amplitude tracking.

Analysis can be carried out over contiguous slots or active slots only. This is particularly important when analyzing LTE TDD.

Spectral Emissions can be verified against prescribed or user defined mask limits.

[1] not supported in PXI Studio plug-in user interface

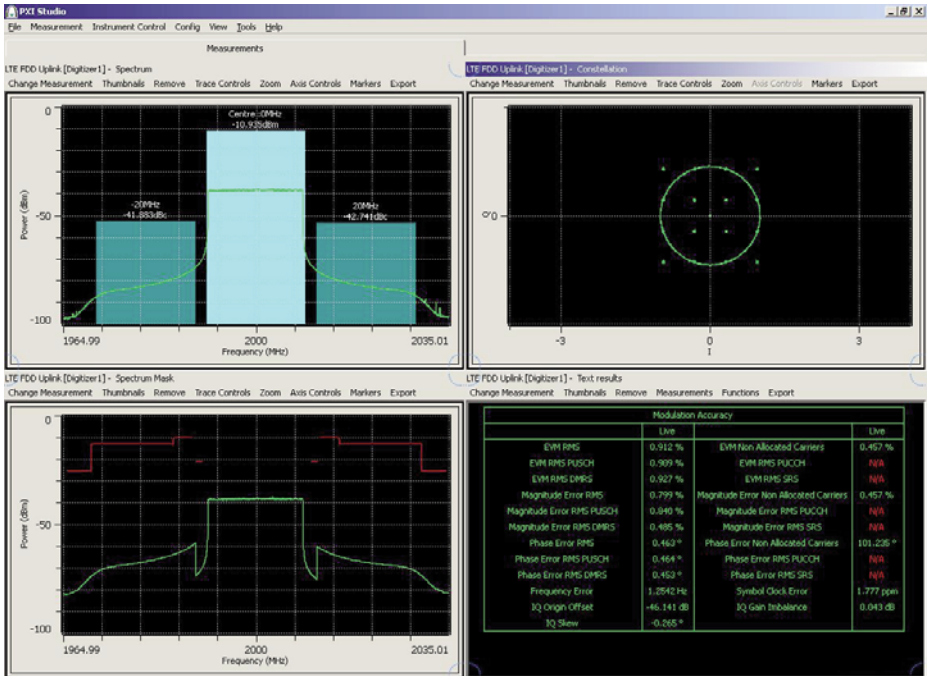

Figure 1. LTE FDD screenshot

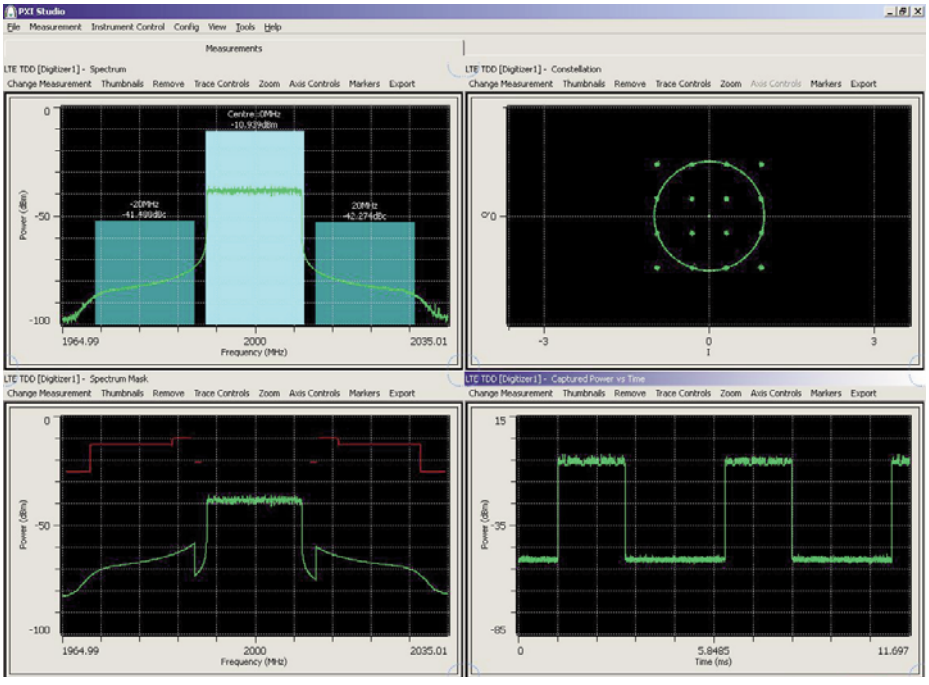

Figure 2. LTE TDD screenshot

LTE FDD AND TDD

All specifications are defined when used in conjunction with the 3030 Series PXI RF digitizer with option 107 (FDD) and option 108 (TDD) operating in all E-UTRA FDD and TDD bands.

Measurements performed are in accordance with 3GPP 36.521-1 section 6.

LTE FDD and LTE TDD measurement suites are supplied separately.

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

CONFIGURATION

Frequency

Uplink (Hz)

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

E-UARFCN Bands and Frequencies Table

Band	E-UARFCN	MHz
1	1800-18599	1920-1979.9
2	18600-19199	1850-1890.9
3	19200-19949	1710-1784.9
4	19950-20399	1710-1754.9
5	20400-20649	824-848.9
6	20650-20749	830-839.9
7	30750-21499	2500-2569.9
8	21450-21799	880-914.9
9	21800-22149	1749.9-1784.8
10	22150-22749	1710-1769.9
11	22750-22999	1427.9-1452.8
12	23000-23179	698-715.9
13	23180-23379	777-786.9
14	23280-23379	788-797.9
17	23730-23849	704-715.9
18	23850-23999	815-829.9
19	24000-24149	830-844.9

Level

Uplink (DUT output level) (dBm)

Path Loss Correction

Uplink (dB)

Physical Channel

Normal, PRACH

Nominal Bandwidth

1.4, 3, 5, 10, 15 and 20 MHz

Sub-frames (link direction)

Uplink

BURST SET UP

Burst Type

Uplink PUSCH: Normal data

MEASUREMENT SET-UP

Cell ID

0 to 503

Cyclic Prefix Type

Normal or Extended

EVM Window Position

Low, middle or high

Analysis Mode

Random slot or Specific slot

Spectrum Analysis Mode(3)

Measure all IQ data or specified number of slots

Number of Slots to Analyze

Dependent on measurement interval

Measurements can be performed for slots which are active and also for slots which are active and contiguous.

1 to 360

EVM Enable Conformance Mode

On / Off

Signal Composition(2)

Uplink & Downlink or Uplink only

Uplink Cyclic Prefix Type(2)

Normal or Extended

Downlink Cyclic Prefix Type(2)

Normal or Extended

Uplink-Downlink Configuration(2)

1 to 6 as defined in table 4.2-2 of 3GPP TS36.211 v8.6.0 (2009-03)

Special Sub-frame Configuration(2)

1 to 8 as defined in table 4.2-1 of 3GPP TS36.211 v8.6.0 (2009-03)

Synchronization Slot (for specific slot analysis only)

0 to 19

Half Subcarrier Shift

On / Off

DTX Present(3)

On / Off

PILOT TRACKING

Phase Tracking

On / Off

Amplitude Tracking

On / Off

Symbol Time Tracking

On / Off

PRACH ANALYSIS SETUP

High Speed Flag

On / Off

NCS Configuration

0 to 15

Logical Root Sequence Number

0 to 837 as defined in section 5.7.2 of 3GPP TS 36.211 v8.9.0 (2009-12)

MEASUREMENTS

Start position (in µs)

Preamble ID

Preamble format

On power (dBm)

Leading off power (dBm)

Trailing off power (dBm)

Trailing gap off power (dBm)

RB offset

Trace

PRACH Power vs. Time

Power vs. Frequency

PUSCH SETUP

PUSCH Present

On / Off

DMRS Dss

0 to 29

n(2)DMRS

0,2,3,4,6,8,9,10

PUCCH SETUP

PUCCH Present

On / Off

Delta Shift Dss

1 to 3

Cyclic Shift

0 to 7

Resource Index 2

0 to 1175

Number of Reserved Resource Blocks

1 to 98

SRS SETUP

SRS Present

On / Off

Cyclic Shift

0 to 7

Transmission Combination

0 to 1

Slot Configuration

RB Auto Detect

On / Off

Channel Type

OFF, PUSCH, PUCCH

Number of RBs

1 to max number of RBs for selected Bandwidth

RB Offset

0 to max-1

Modulation Type

QPSK, 16QAM, 64QAM

n(2)DMRS

0,2,3,4,6,8,9,10

(2) Available in LTE TDD only

(3) Available in LTE FDD only

MEASUREMENTS

POWER

Average power

Indication

dBm

Measurement Range

Per 3030 Series RF Digitizer maximum input

Trace

Captured power vs. time

Power vs. slot

Power vs. resource block

Accuracy

See 3030 Series module level accuracy spec

FREQUENCY ERROR

Carrier frequency error over one sub-frame excluding the guard period (Cyclic prefix)

Indication

Hz

Accuracy

<±10 Hz + (Freq Standard Error x Transmitter Freq (MHz))

EVM

The difference between the reference waveform and the measured waveform corrected by the sample timing offset and RF frequency offset with origin offset removed.

Indication

% / dB

Exclude Exclusion Period

On / Off

Traces

EVM (rms) vs. sub-carrier

EVM (rms) vs. symbol

EVM (rms) excluding non allocated carriers

Constellation (with /without non allocated carriers)

Measurement Results

EVM (rms)

EVM PUCCH (rms)

EVM PUSCH (rms)

EVM DMRS (rms)

EVM SRS (rms)

EVM Non Allocated Carriers

Indication

dB

Accuracy

<±1%

IQ COMPONENT

IQ Origin Offset (carrier leak) (dB)

IQ gain imbalance (dB)

IQ skew (degrees)

Symbol Clock Error

ppm

SPECTRUM FLATNESS

Mask Type

Normal conditions

Extreme conditions

User defined

Indication

For each slot analyzed:-

Mask Pass / Fail

Mask Upper Pass / Fail

Mask Lower Pass / Fail

Traces

dBr values for each sub-carrier

SYMBOL CLOCK TOLERANCE

Indication

ppm

Accuracy

As per reference frequency

OCCUPIED BANDWIDTH

Bandwidth containing 99% of the total integrated mean power of the transmitted spectrum on the assigned channel.

Indication

Hz

SPECTRAL EMISSION MASK

The spectral density of the transmitted signal should lie within the spectral mask.

The mask is frequency aligned to the maximum spectrum density.

Mask Type

General, NS_03, NS_04, NS_06, or User defined

Measurement BW

As determined by Mask Type selected.

Indication

Global Pass/Fail

The worst case dBc level value and its corresponding frequency relative to the mask are reported.

Traces

FFT power spectrum and mask values

Accuracy

<±0.05 dB error per 10 dBc[4]

IN-BAND EMISSIONS

In-band emissions computed for non-allocated resources blocks.

Measurement Results

In-band emission measurement (General, IQ Image and Carrier leakage):

Overall Pass/Fail

Trace

In-band emission measurement and limits

MAGNITUDE/PHASE ERRORS

Measurement Results

Magnitude (%) and Phase Error RMS (degrees)

Magnitude (%) and Phase Error RMS PUSCH (degrees)

Magnitude (%) and Phase Error RMS PUCCH (degrees)

Magnitude (%) and Phase Error RMS DMRS (degrees)

Magnitude (%) and Phase Error RMS SRS (degrees)

Magnitude (%) and Phase Error Non Allocated Carriers (degrees)

Trace

Magnitude and Phase error vs. Symbol

Magnitude and Phase error vs. Carrier

Magnitude and Phase error vs. Carrier (excluding non allocated carriers)

Sub Carrier Allocation Trace

Provide subcarrier allocation information including modulation and channel types.

Adjacent Channel Leakage Ration (ACLR)

Number Channels

1 to 5

Indication

Reference channel power (dBm)

1st upper and lower adjacent channel power (dBc)

2nd upper and lower adjacent channel power (dBc)

Accuracy

<±0.05 dB error / 10 dBc[4]

CCDF (Complimentary Cumulative Distribution Function)

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

[4] 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.

LTE (FDD)

When purchased with a 303x order as:	3030 option 107
When purchased as an upgrade, then order as:	RTROPT107/3030

LTE (TDD)

When purchased with a 303x order as:	3030 option 108
When purchased as an upgrade, then order as:	RTROPT108/3030

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AEROFLEX
A passion for performance.

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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

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