Application Note

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Live Testing with the 6413

This application note describes how to use the Aeroflex 6413 to perform Live Testing on a Node B. The 6413 LIVE option must be enabled to perform such tests.

Introduction

This document provides a quick overview of the Aeroflex 6413 Live Test – Cabled option. This document complements the existing 6413 manual. For further information not described in this user guide, please refer to the complete 6413 user manual

References

Further information can be found in the following documents:

6413 User Manual

3GPP specification TS 25.141

Glossary

For the purpose of this document, the following terms and definition apply:

16-QAM	16 points Quadrature Amplitude Modulation
ACLR	Adjacent Channel Leakage Ratio
CPICH	Common Pilot Channel
EVM	Error Vector Magnitude
HSDPA	High Speed Downlink Packet Access
Iub	Interface between an RNC and a Node B
MOP	Maximum Output Power
OB	Occupied Bandwidth
PCDE	Peak Code Domain Error
QPSK	Quadrature Phase Shift Keying
RACH	Random Access Channel
RNC	Radio Network Controller
UARFCN	UTRA Absolute Radio Frequency Channel Number
UMTS	Universal Mobile Telephony System
UTRA	UMTS Terrestrial Radio Access

INTRODUCTION TO LIVE TEST

The 6413, in its default configuration, allows a user to run bottransmitter and receiver tests using the manufacturer's specific Iub control.

However, disconnecting the Node B to be tested from a live network may not always be feasible. The Node B may be situated in a high traffic area and switching it off the Node B could interrupt many mobile users.

With the Live Test – Cabled option, the 6413 can perform both transmitter and receiver tests on a Node B without detaching the Node B from the network

HSDPA and Live Test

With the Live Test – Cabled option, the 6413 can perform all transmitter tests on an HSDPA capable Node B. They are:

- Maximum Output Power
- Error Vector Magnitude
- Peak Code Domain Error
- Frequency Error
- Adjacent Channel Leakage Ratio
- Absolute CPICH Power
- Occupied Bandwidth
- Spectrum Emission Mask

Both 16-QAM and QPSK modulation schemes are supported

REQUIREMENTS

3.1 Node B

The monitor port of the cell under test should be available. The isolation between the antenna port and the monitor port should also be known. If the monitor port is not available the user may consider connecting a directional coupler to the duplex port of the Node B before it goes live.

The diversity receiver antenna port of the cell under test should also be available.

3.2 6413

The 6413-LIVE option should be enabled.

3.3 Cabling

To perform a live test, the user needs two cables. One to connect the monitor port of the Node B to the duplex port of the 6413, and another one to connect the receiver diversity antenna port of the Node B to the RF Out port of the 6413. The general specifications for both cables are listed on the next page.

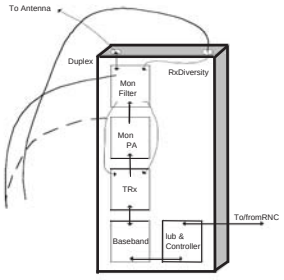
3.3.1 Connection between the Node B's monitor port and the 6413's duplex port

Connectors	N-type male Mating half of the monitor port's connector, typically SMA male
Impedance	50

3.3.2 Connection between the Node B's Diversity Receiver port and the 6413's RF Out port

Connectors	TNC, male 7/16, male
Impedance	50

3.3.3 Setup



The diagram above shows how to set up the 6413 to perform. Live Testing with a theoretical Node B; with only the cell under test is shown. The RF Out port of the 6413 should be connected to the Receiver Diversity port of the cell under test. This theoretical Node B has two monitor ports (Mon), one on the Power Amplifier module (PA) and the other one on the Filter module. In reality, only one port may be available. The duplex port of the 6413 should be connected to one of the monitor ports. If no monitor port is available, a coupler, also known as a sniffer port, is needed to connect to the main antenna port. In the diagram above, the 6413 is connected to the monitor port on the Filter module, an alternative connection is indicated by a dotted line.

On the 6413 Global Parameters menu, the user should first select Live Test–Cabled under Manufacturer and then select the Operating Band to be used. All irrelevant fields and tests will then become greyed out, for example, Line Type and Number of IMA links. The user should then set the Uplink External Loss equal to the cable loss between the RF out port of the 6413 and receiver diversity antenna port of the Node B. The Downlink External Loss should be set to the sum of the cable loss between the duplex port of the 6413 and the monitor port of the Node B and the isolation between the antenna port and the monitor port.

TEST DESCRIPTION

4.1 General

In the default configuration, the 6413 sets up a test model defined by the user for transmitter measurements. In Live Test – Cabled mode, the 6413 does not set up any test models, but dynamically searches for active downlink channels set up by the Node B. Therefore, any tests that require power control from the 6413 will not be available in Live Test – Cabled mode.

4.2 Setup

A Minimal amount of set up is required. The user should ensure that the RF Connection Mode, in the Options menu, is set to RF Out. By switching to RF Out mode, the 6413 is enabled to transmit uplink signal and receive downlink signals on a separate port. The user may wish to check the Downlink UARFCN/Frequency is at the desired value. Once the Downlink UARFCN/Frequency is entered, the value for the uplink will be automatically calculated. The user may also wish to change the Test Mode to Continuous or Continuous with Log if he intends to run the test for some period.

4.3 Transmitter Tests

4.3.1 Maximum Output Power (MOP)

This test measures the power level at the monitor port. If the Downlink External Loss is set to compensate for the isolation between the antenna port and the monitor port, the reading of this test could be used to represent the power at the antenna port.

4.3.2 Error Vector Magnitude (EVM)

This test measures the Error Vector Magnitude at the monitor port, similar to the Iub controlled mode test.

4.3.3 Peak Code Domain Error (PCDE)

This test measures the Peak Code Domain Error at the monitor port, similar to the Iub controlled mode test.

4.3.4 Frequency Error (FE)

This test measures the Frequency Error at the monitor port, similar to the Iub controlled mode test.

4.3.5 Adjacent Channel Leakage Ratio (ACLR)

This test measures the ACLR at the monitor port, centred on the assigned frequency. If the connected monitor port is coupled to a filter/combiner that is connected to more than one power amplifier, and if one of the extra amplifiers is transmittingat ±5 MHz or ± 10MHz from the frequency assigned, thenthe 6413 will report a high power ratio for that frequency. If theACLR readings are much higher than expected, check that theNode B is commissioned to use multi carriers.

4.3.6 ACPICH Power Accuracy (ACPICH)

This test measures the absolute power of the CPICH channel.If the Downlink External Loss is set to compensate for the isolationbetween the antenna port and the monitor port, the reading could be used to represent the absolute power of the CPICH channel at the antenna port.

4.3.7 Occupied Bandwidth (OB)

This test measures the occupied bandwidth at the monitor port, similar to the Iub controlled mode test.

4.3.8 Spectrum Emission Mask (SEM)

This test measures the emission, both in band and out of band, of the Node B at the monitor port, similar to the Iub controlled mode test.

4.4 Receiver Tests

4.4.1 RACH Reference Sensitivity (RRS)

During this test the 6413 sends RACH preambles to the Node B's diversity receiver port and listens to the acknowledgements being sent by the Node B via the monitor port. Preambles detected by the Node B will be displayed as a fraction of the number of preambles sent by the 6413.

4.4.2 RACH Dynamic Range (RDR)

Similar to the RACH Reference Sensitivity test, RACH preambles will be sent to the Node B via the diversity receiver port, but the preambles will be summed with White Gaussian Noise prior to being sent. The acknowledged indication will be captured by the 6413 via the monitor port and displayed as a fraction of the number of preambles sent.

4.4.3 RACH Absolute Sensitivity (RAS)

Instead of setting the uplink power for the RRS test, the user can use the RACH Absolute Sensitivity test to find the minimum uplink power where the probability of detection is equal to 0.99.

4.5 Special Functions

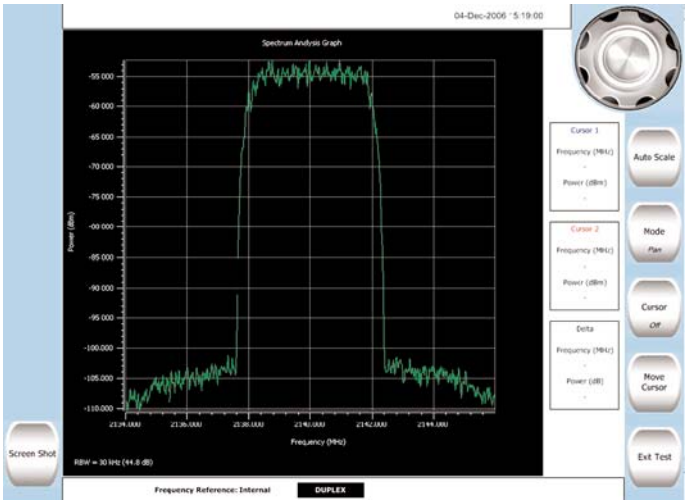
4.5.1 Multimode

Multimode, in Live Test – Cabled mode, allows users to monitor the four transmitter measurements of the Node B under test without disconnecting the Node B from the network. The measurements are Maximum Output Power, Error Vector Magnitude, Peak Code Domain Error, and Frequency Error.

4.5.2 Spectrum Analysis Graph and Code Domain Analyzer

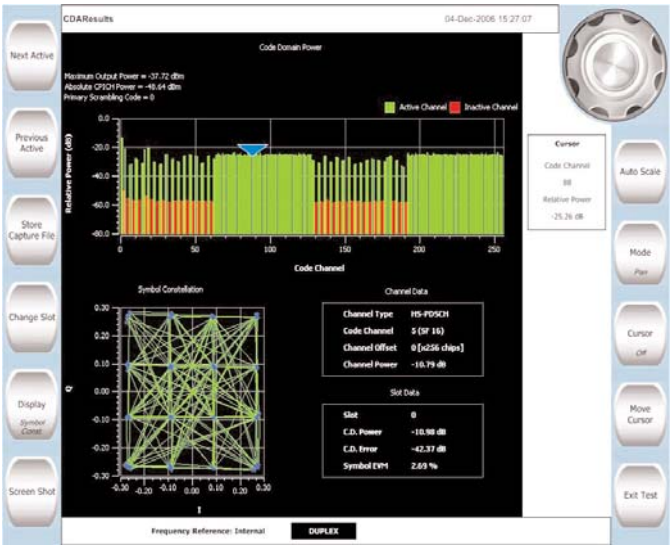
These two tools allow the user to monitor the transmitted spectrum and coded channels.

The Spectrum Analysis Graph behaves like a simple spectrum analyzer. By defaults it will be centred at the selected UARFCN/Frequency. The user can pan or zoom by using the touch screen control. It is also possible to activate markers and display the power, frequency or difference between two markers. Below is a screenshot of Spectrum Analysis Graph



Using the code domain analyzer, the user can monitor the primary scrambling code, maximum output power, and absolute CPICH power directly. If the user selects a channel, the channel type, code channel number, spreading factor, channel offset, and channel power, amongst others parameters, will be displayed. The user can also scroll through the Symbol Constellation diagram, Slot Power diagram and Symbol EVM plot.

Below is a screenshot of the Code Domain Analyzer, with a 16- QAM HS-PDSCH selected



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