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Testing Flexi EDGE BTS

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Elevated voltages are inevitably present at specific points in this electrical equipment. Some of the parts may also have elevated operating temperatures.

Non-observance of these conditions and the safety instructions can result in personal injury or in property damage.

Therefore, only trained and qualified personnel may install and maintain the system.

The system complies with the standard EN 60950 / IEC 60950. All equipment connected has to comply with the applicable safety standards.

The same text in German:

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In elektrischen Anlagen stehen zwangsläufig bestimmte Teile der Geräte unter Spannung. Einige Teile können auch eine hohe Betriebstemperatur aufweisen.

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Deshalb wird vorausgesetzt, dass nur geschultes und qualifiziertes Personal die Anlagen installiert und wartet.

Das System entspricht den Anforderungen der EN 60950 / IEC 60950. Angeschlossene Geräte müssen die zutreffenden Sicherheitsbestimmungen erfüllen.

Table of Contents

This document has 60 pages.

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List of Tables

1 Summary of changes

Changes between issues 6-1 and 6-0

Updated Sections:

- *Running a TRX Test* was updated.
- *Measuring BTS Sensitivity* in Appendix A was updated.

New Section:

- Section *Flexi EDGE BTS Output power measurement* was added in Appendix A

Changes between issues 6-0 and 5-0

Updated sections:

- *Running a loop test* updated with a note on ST-IRC feature.

Changes between issues 5-0 and 4-0

Updated sections:

- *Running a TRX test* updated with a description for reported TX Power after TRX Test.

Changes between issues 4-0 and 3-0

The limitations list for running the TRX test has been updated in the following sections:

- *Running a TRX test*
- *Running a loop test*

2 Powering on the BTS at a new site

Before you start

Ensure that all BTS modules are properly installed and that the mains power and BTS power supplies are switched off.

Steps

1 **Switch the mains breaker on.**

2 **Switch the BTS power supply on.**

This applies to 24 VDC and 230 VAC cases only. With the 48 VDC supply the BTS starts as soon as the supply voltage is connected to the System Module.

3 **Check the BTS modules for power.**

Observe the LED lights of the BTS modules and ensure that power is supplied. If the LED lights are off, troubleshoot the applicable modules.

3 Running BTS tests

3.1 Overview of testing

Purpose

The purpose of the tests presented in this document are to verify that the hardware or BTS System is functioning properly and that the test reports can be generated in addition to identifying any maintenance needs.

In general, these tests are performed during normal operation (to verify that the system is functioning properly), troubleshooting situations and when new HW has been installed.

During commissioning the tests are performed automatically. However, if Abis is not available during commissioning the tests can be run manually.

Note the following on the availability of the tests:

- BCCH Transmission test can only be run in Local Mode
- TRX Continuous Transmission test does not work in Local Mode since it requires the target TRX to be in Supervisory operational state
- EAC input and output tests are not available until the BTS is commissioned
- All other tests are available when the BTS is uncommissioned, or when the BTS is commissioned and connected to the BSC, or when the BTS is in Local Mode (Commissioned but not connected to the BSC).

Before you start

For information on connecting to the BTS with PC and BTS Manager as well as the commissioning procedure see the *Flexi EDGE BTS Commissioning* document.

For more information on radio network testing see the *Radio Network Testing* document in BSC3119 BSC/TCSM, Rel. S12, Product Documentation.

Check the alarms and correct the faults before starting the tests. For more information on the alarms see the *Trouble Management of Flexi EDGE BTS* document.

The terms 'Local mode', 'Network mode' and 'Configuring state' appear in the text. Their definitions are:

Local mode: In local mode the BTS does not have an Abis connection to BSC. After a start-up the BTS first reaches 'Waiting for LAPD Establishment' operational state when the user can by using the command "Use Current SW" cause the BTS to use its active SW and therefore BCF to go into the Supervisory and TRX(s) into the Configuring states. The BTS will remain in the resulting Local Mode until the BTS is reset or power cycled.

Network mode: The BTS is connected to the BSC and the BCF is in Supervisory state.

In Configuring state the BTS_CONF_DATA reception step is skipped and the BTS issues default configuration to TRX objects. After power or BCF reset (from local BTS Manager), BTS tries to again connect to BSC.

Summary

You can execute tests or run diagnostic tools on the BTS by choosing appropriate command in Tests menu. Choosing any command from the **Tests** menu or clicking the Tests button in the **View Bar** opens the Tests view. The TRX Test tab sheet is shown

as default. See the figure below for the location of the **Tests** menu and the **Tests** button in the **View Bar**.

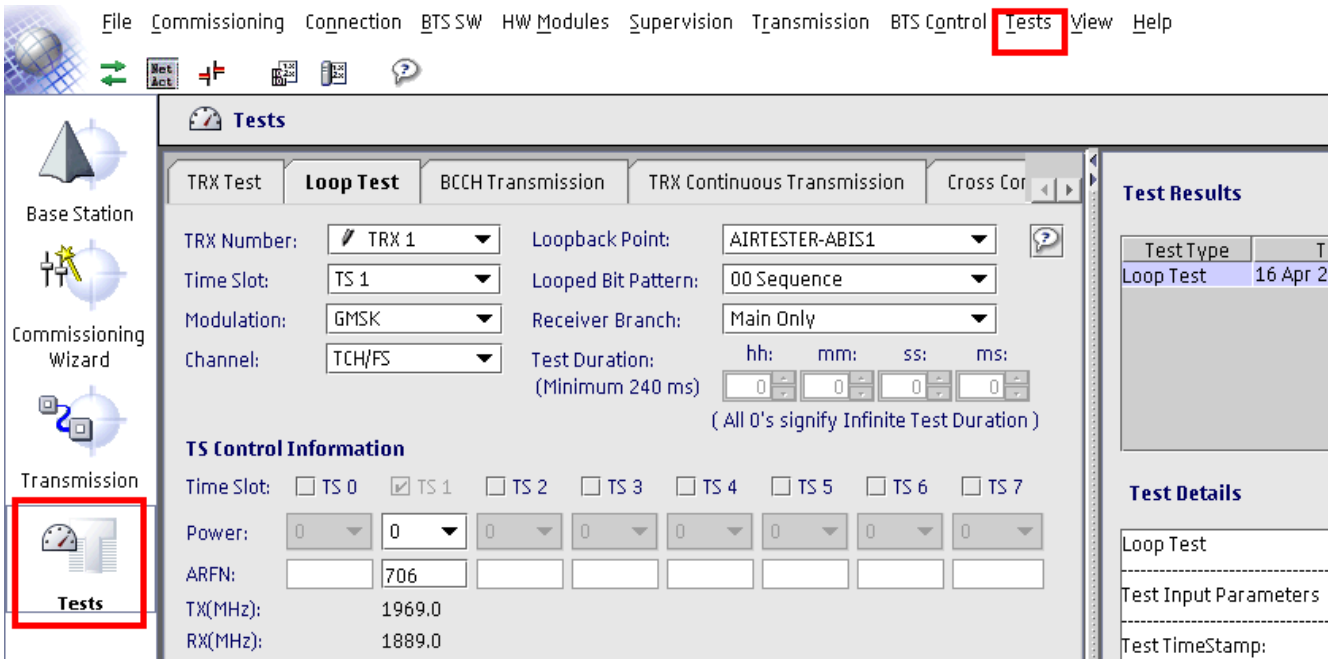

Figure 1 Tests menu and View Bar locations

The Test View screen consists two parts; The tabbed pane on the left and the Report Area on the right.

Tabbed Pane:

The tabbed pane displays the following tab sheets:

- TRX Test (shown as default)
- Loop Test
- BCCH (Broadcast Control Channel) Transmission
- EAC (External Alarm Control) Input
- EAC Output
- TRX Continuous Transmission with BCCH Power level
- Cross Connection Validity Check
- Traffic Trace

The test specific functions and information are displayed below the tabs.

Report Area:

This area is common for all the individual test tab sheets displaying two areas; Test Results and Test Details.

Test Results:

- Test Type column specifies the Test or TRX Continuous Transmission test executed
- Time column specifies the date and time stamp of the Tests executed
- Status column specifies the status of the Test or TRX Continuous Transmission test executed

Values for tests:

- Start Requested - implies the start request for Test has been sent to BTS.

- Ongoing - implies the requested Test has been started at BTS and BTS Manager has received its acknowledgement.
- Stop Request - implies the stop request for Test has been sent to BTS.
- Passed / Partially Passed / Failed - are the status of the executed Test.
- Completed- the requested Test has been stopped at BTS and BTS Manager has received its acknowledgement.

Values for TRX Continuous Transmission test

- Start Requested - implies the start request for TRX Continuous Transmission test has been sent to BTS.
- Ongoing - implies the requested TRX Continuous Transmission test has been started at BTS and BTS Manager has received its acknowledgement.
- Stop Request - implies the stop request for TRX Continuous Transmission test has been sent to BTS.
- Completed - implies the stop request has been acknowledged by BTS.

If you want to save or print the test reports use the buttons on the upper right hand corners of the Test Details and Test Results areas. The rightmost button on the Test Result area clears the test results.

Test Details:

This area displays the report of the test selected in the Test Results table. The test details can either be saved in xml format or printed.

Steps

1	**Launch the BTS Manager.**
2	**Click the Tests button on the View bar.**
3	**Choose the test you wish to run.**

3.2 Running a TRX test

Summary

The purpose of the TRX Test is to verify the TRX object's functionality. During TRX test session the BTS executes various loops to gather the required measurement results. The test is carrier based and can be run from TRX to TRX. However, fromthe BTS Manager the TRX test can be run only for one TRX object at a given time.

TRX must be commissioned and the RF cabling information must be known by the BTS to be able to run the TRX Test. Usually, the BTS gets the RF cabling information during commissioning via RF Cable Autodetection (RFCAD) which requires a BSC connection. If the TRX Test is run in BTS local mode (that is, with no Abis connection) and the RF cabling information is not known by the BTS (for example, if the BTS is not commissioned previously with Abis connected), the BTS must be commissioned in a Standalone mode and RF cabling information should be entered manually.

The TRX Test cannot be performed in the following cases:

- If the selected TRX is not in Configuring or Supervisory state.
- If the selected TRX is in the Shutdown or Power Save state.
- If the selected TRX is an Extended/Super Extended TRX (The extension radius is not zero).
- In case of BB or Antenna Hopping
- If a Loop Test is currently running on any other timeslot on the same TRX.

When TRX Test is started, the TRX object in the EXxx DTRX module starts to transmit a TX test signal, which the TRX loop module in the ERxx Dual Duplexer or ECxx Remote Tune Combiner Module down-converts to a corresponding RX frequency (see Figure 2 TRX test block diagram). The TRX loop switch then connects the signal back to the TRX's RX ports. The Bit Error Rate (BER) and signal level of the looped back test signals are then measured by the DSP in the BB parts of the DTRX module. The TX power is estimated from the received RX signal levels. This is the so-called DSP-ABIS1-AIR3 loop (see Figure 3 TRX Test loop back points).

TX test signal transmission is then stopped and the noise and interference level on the idle radio channel (at RX frequency) are measured by the RX modules. This level plus a fixed channel detection margin is reported as RX Result. This is so-called DSP-Abis1-Air4 (open) loop (see Figure 3 TRX Test loop back points).

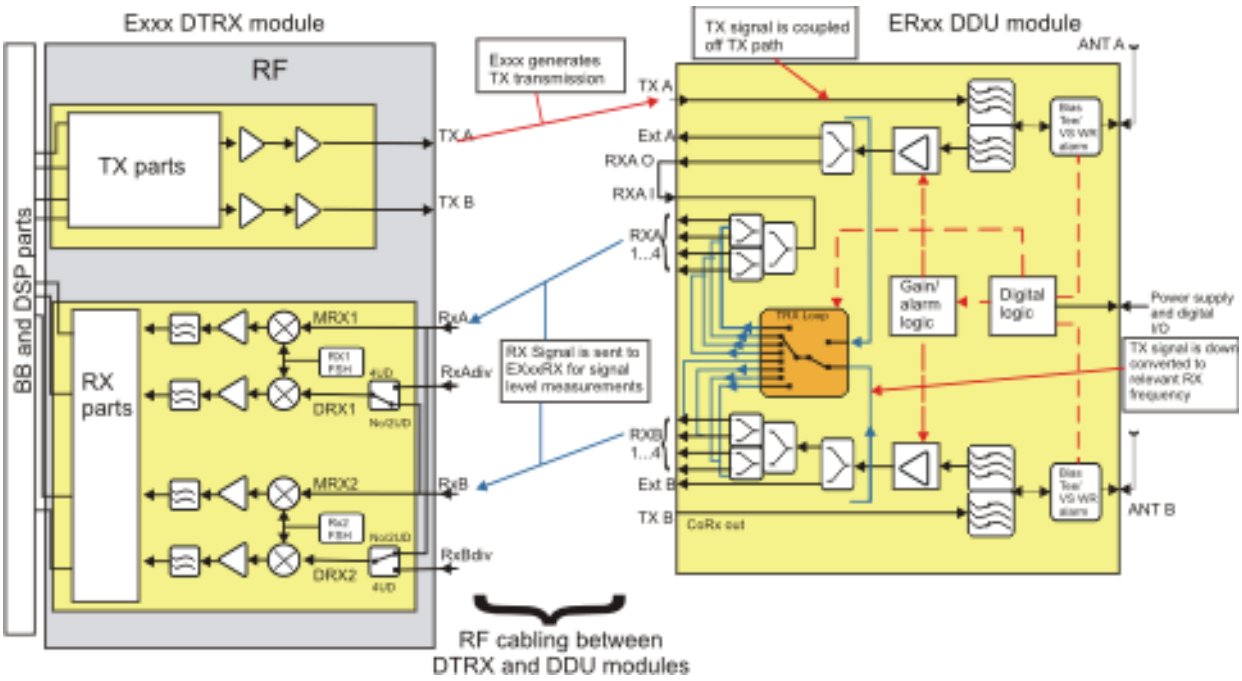

Figure 2 TRX test block diagram

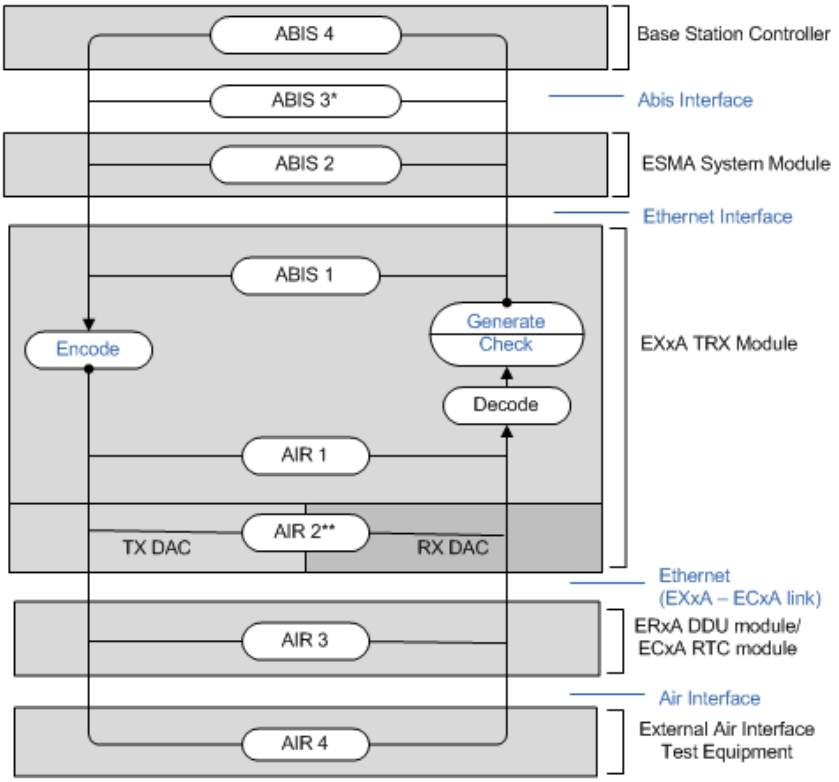

Figure 3 TRX Test loop back points

Steps

1 **Choose the Test | TRX Test command or click the Tests button in the View Bar to open the Tests view (TRX Test Tab Sheet is then viewed as default):**

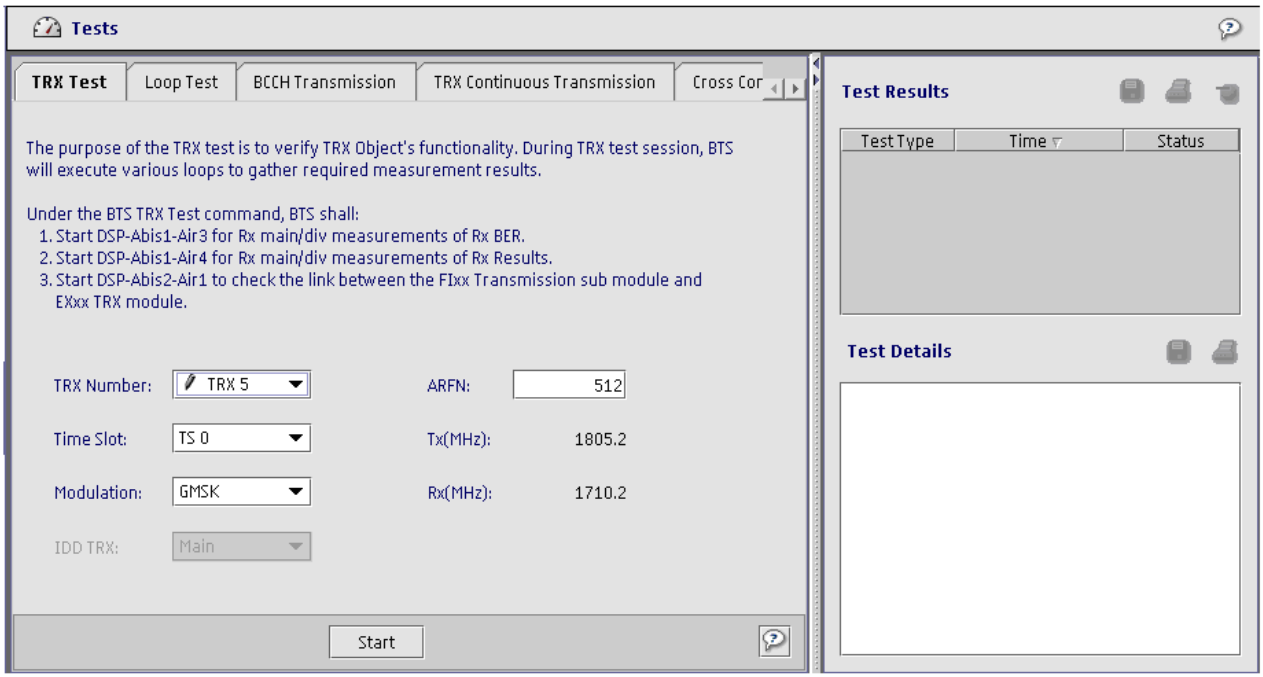

Figure 4 TRX test

2 **Select the TRX Number on which to execute the TRX test.**

The drop-down list shows the available TRX objects with a state icon.

3 **Select Time Slot: Values: TS 0 -TS 7, default TS 0.**

Note that two free timeslots (the selected timeslot and the one three timeslots prior to the tested one) are required for this test. Both timeslots must be free TCH timeslots (test can not be run on timeslots like BCCH or SDCCH).

4 **Select Modulation: Values: GMSK/8PSK, default GMSK.**

5 **Select IDD TRX: Select either Main or Aux TRX.**

- This selection is available only if TRX is configured as an IDD TRX.
- This selection is only possible for IDD Main TRX.

6 **Select the ARFN.**

- Note that this option is only available when BTS is in local mode (that is, with no Abis connection). Otherwise the ARFN received from the BSC is shown here and used for the test.
- BTS TX and RX frequencies corresponding to ARFN are shown automatically.

7 Click Start to execute test with selected parameters.

- The Start button is disabled while execution of the TRX test, until the report arrives or negative acknowledgement is received.
- When the test is running, 7615 - RTS IN TEST USE alarm is activate on both timeslots.

For the duration of the test execution, there is a loss of Sync PS TCH state (if TS is in this state). If there are any User packet data transfers at this time, they are interrupted.

It may be difficult to run a TRX Test with high traffic load when the timeslots are regularly occupied. However, it is possible to run the TRX Test when the TRX object is either locked from BSC or blocked from the BTS Manager.

When the TRX gets blocked, the BSC hands over the ongoing calls to other TRXs, if there are free timeslots available.

1 Block the TRX from BTS Mgr (either via local or remote connection).

2 Wait until the TRX Object State on BTS Manager changes to Blocked.

3 Run the TRX Test via BTS Manager.

4 After the test, unblock the TRX.

If BCCH-TRX is blocked, the BSC performs BCCH reconfiguration and the ongoing calls on the associated TRXs are dropped. On BTS Manager, you can see the current BCCH-TRX via Tests I Traffic Trace.

TRX object block is not possible in BB or Antenna hopping sectors.

The Test report parameters are displayed on the Test Details pane:

Property	Explanation
Test Result 1)	Indicates if the test has passed or failed
Failure Reason 2)	If a test has failed the reason for failure is shown here
Timeslot	Timeslot on which the TRX or Loop test is started
Tx Power3)	Measured TX power level (dBm)
Main Rx BER4)	Measured Bit Error Ratio for Main receive branch (%)
Main Rx Result 5)	Rx Result TRX Test for Main receive branch (dBm)
Diversity Rx BER 4)	Measured diversity Bit Error Ratio for Diversity receive branch (%)
Diversity1 Rx Result 5)	Rx Result TRX Test for Diversity receive branch (dBm)
Diversity2 Rx Result 6)	Rx Result TRX Test for Diversity recieive branch (dBm)
Diversity3 Rx Result 6)	Rx Result TRX Test for Diversity recieive branch (dBm)

Table 1 Test report parameters

1) Test result is either Pass of Fail. BTS SW reports a failure if any of the following conditions is valid:

- Measured Tx Power level is outside ±8 dB of the expected value.

1. Expected value is +47 dBm – PMAX parameter value on BSC. For example, the expected value with PMAX=4 is +47 dBm – 4 dB = +43 dBm.
2. When DPTRX feature is used, the expected values is +2.5 dB higher.

- Rx BER is greater than 2% for RF part or greater than 0% for BB part.
- Rx Result is greater than -100 dBm.
- Difference between the Tx power measured via RX Main and RX diversity branches is greater than 6 dB.

2) Failure Reason is shown if the test failed. For possible Failure Reasons and their detailed troubleshooting instructions, see the Troubleshooting TRX test and TRX loop test failures with BTS Manager section in the Trouble Management of Flexi EDGE BTS document.

3) TX power indicates the TX power at the EXxA (DTRX) module's TX output (that is, either on its TxA or TxB connector). As shown on Figure 1, it is estimated by measuring the signal level of the looped back TX test signal which is converted to the RX frequency in the TRX Loop module and then looped back to the RX modules (to Main and Diversity separately). The TRX loop module is located in ERxA (DDU) and ECxA (RTC) modules and their conversion loss and estimated TX combining loss (of optional EWxx modules) are taken into account.

Measured TX power is calculated as follows:

TX Power = RSSI - Conversion Loss + Combining Loss + Rx Cable Loss (fixed 0.1 dB)

Where:

- RSSI (Received Signal Strength Indication) of the test signal is measured by the RX modules.
- Conversion Loss is a calibrated value and stored in every ERxA (DDU) and ECxA (RTC) antenna filter module in production testing.
  1. There are individual values for each Rx output ports (e.g. separate values for RxA1...4 and RxB1...4 ports in DDU).
  2. In DDU modules, the value range is: 85.6 $\pm$ 2.5 dB.
  3. In RTC modules, the value range is: 95.9 $\pm$ 3.25 dB.
- Combining Loss is an estimated value:
  1. 3.5 dB for 2-way and 7.2 dB for 4-way combining (value is used only in DDU configurations when optional EWxx modules are used).

Reported TX Power result is indicative only and a certain tolerance (up to $\pm$ 6 dB) compared to the actual value) can be expected. If the exact TX output power needs to be known, it must always be measured with external and calibrated test equipment. For details, see *Appendix A: Measuring BTS RF Performance with external test equipment*.

4) BER shows % of the errors seen in the received data.

5) The Rx Result is based on the noise and interference levels measured by the RX modules at the end of the TRX Test session when the TX test signal is not active anymore. The result estimates the Rx Level needed by a single receiver for good quality decode of Full Rate speech.

The Rx Result in TRX Test is calculated from Measurement of Noise & Interference Rx Level on an Idle radio channel Plus detection margins. The Rx Level reported includes masthead Amplifier (MHA) gain and cable loss allowances, depending on MHA type and configuration. Typical values are -85 dBm to -118 dBm in a normal operating environment.

As the Rx Result is NOT based on BER, it does not measure the absolute sensitivity of the TRX. If the exact sensitivity needs to be known, it must always be measured with external and calibrated test equipment. For details, see *Appendix A: Measuring BTS RF performance with external est equipment*.

Diversity Rx BER and Diversity Rx Result are only shown if the BTS HW configuration supports RX diversity and the diversity is enabled on BSC (RDIV parameter set to Y).

6) These values are only measured when 4UD feature is used.

When performing TRX test with 4UD configuration please note the following:

- The RX paths are mapped to the DTRX ports as follows:

DTRX port	Path
RxA Main	Main
RxA Div	Diversity 2
RxB Main	Diversity 1
RxB Div	Diversity 3

Table 2 RX paths mapping to DTRX ports in 4UD configuration

- In 4UD configuration, the DSP-ABIS1-AIR3 (executed as part of TRX test) is not performed on Diversity 2 and Diversity 3 paths. As a result, RX cabling cannot be verified for Div2 and Div3 paths using TRX test. However, RX Results are still measured based on DSP-ABIS1-AIR4 loops, which is executed on all RX paths Main, Diversity1, Diversity2 and Diversity3.

3.3 Running a Loop test

Summary

The purpose of the Loop Test is to verify the operation of the signal path from the Base Station Controller (BSC) and the Air interface, and back.

In TRX Loop Test, two different loopback points can be selected:

- DSP-Abis1-Air3
- AirTester-Abis1

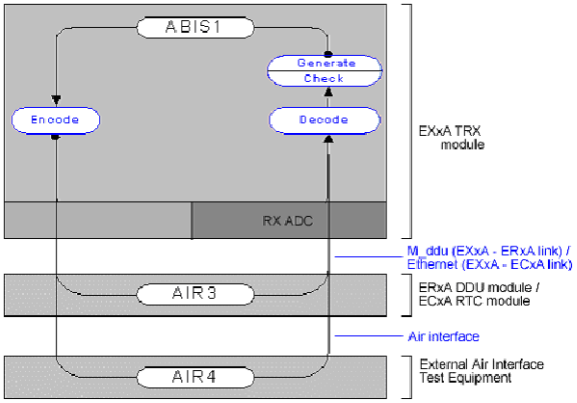

Figure 5 TRX loopback point

You can execute a Loop Test to test internal connections of the BTS. The choice of loopback determines the extent of the loop test. Loops are categorised according to the loopback points.

- Abis1: Loop back in Baseband DSP (the channel decode output is looped to the channel encode input).
- Air3: Loop back in the RF parts of the Dual Duplexer Module (ERxx) or the Remote Tune Combiner Module (ECxx) (TX is down converted to RX).
- If Abis4 loop is required there must be loop module served either by the BSC or a TRAU/PCU Emulator.
- If Abis3 loop is required there must be a wired loop in the E1/T1 set up.
- If Air2 loop is required there must be a wired loop at Tx DAC and a Rx ADC set up.
- If Air4 loop is required there must be an Air Tester set up as loop mode, the Air Tester must give 3 time-slots delay on uplink burst.

Following selections are available from the **Loop Test** tab:

- **TRX Number**: Enables the user to select the TRX on which to execute the loop test.
- **Time Slot**: Enables the user to select the time slot on which to execute the loop test.
- **Modulation**: Enables user to select the modulation scheme.
- **Channel**: Enables user to select the channel. This field contains a variable list that depends on the modulation chosen in the above drop down list
- **Loopback Point**: Enables user to select the loop to execute.
- **Looped Bit Pattern**: Enables user to select the looped bit pattern.
- **Receiver Branch**: Enables user to select the RX diversity.
- **Test Duration**: Enables user to set the duration of loop test in hours, minutes and seconds. Default: 320 ms, min: 240 ms.

TS Control Information is only editable when TRX is in Configuring State. Following fields are still visible in all cases:

- **Timeslot**: User can select time slot for executing Test Pattern transmission when Site is not under BSC Control and TRX is in Configuring State. User needs to provide Power, ARFN, AGC main & AGC Div values for the selected timeslots. The timeslot, on which Loop Test is requested, is selected by default and cannot be deselected. In case TRX is in Supervisory state, Test Pattern Transmission cannot be executed.
- **Power**: Enables user to specify the power of selected time slot. Power is not changeable if the site is under BSC Control.
- **ARFN**: Enables user to specify the ARFN of selected time slot. ARFN value has to be specified for selected timeslot in order to execute the loop test. ARFN is not editable if the site is under BSC Control. Values: In case the site is under BSC Control, the ARFN received from the site is displayed. In case the TRX is RF-Hopping, text “Hopping" is displayed. In the case when site is not under BSC Control, the lowest of the range of ARFNs depending upon the band of the TRX is displayed as default.
- **Tx (MHz)**: Displays the Transmit frequency of the ARFN displayed/selected in the above ARFN edit fields. Value: This value is calculated on the basis of the ARFN value.
- **Rx (MHz)**: Displays the Receive frequency of the ARFN displayed/selected in the above ARFN edit fields. Value: This value is calculated on the basis of the ARFN value.
- **AGC Main**: Enables user to select AGC Main.
- **AGC Div**: Enables user to select AGC Div.

Note that

- For the duration of test execution there is a loss of Sync PS TCH state (if TS is in this state). If there are any User packet data transfers at this time, this is interrupted.
- Loop Test may be terminated before the actual test duration due to the changes in BSC configuration or interruptions received by the BTS from the BSC.

The **Start** button is disabled and the Loop Test cannot be performed in the following cases:

- If the selected TRX is not in configuring/supervisory state.
- If the selected TRX is in Locked Administrative state by the BSC (this limitation has been removed from EP2 CD1.0 onwards).
- If the selected TRX is in the Shutdown state.

Also note that the TRX Loop test cannot be run during BB hopping.

Steps

1 **Choose the Loop Test command on the Tests menu or the Loop Test tab sheet in the Tests view.**

2 **Select the TRX Number on which test to be performed.**

See the Loop test figure below.

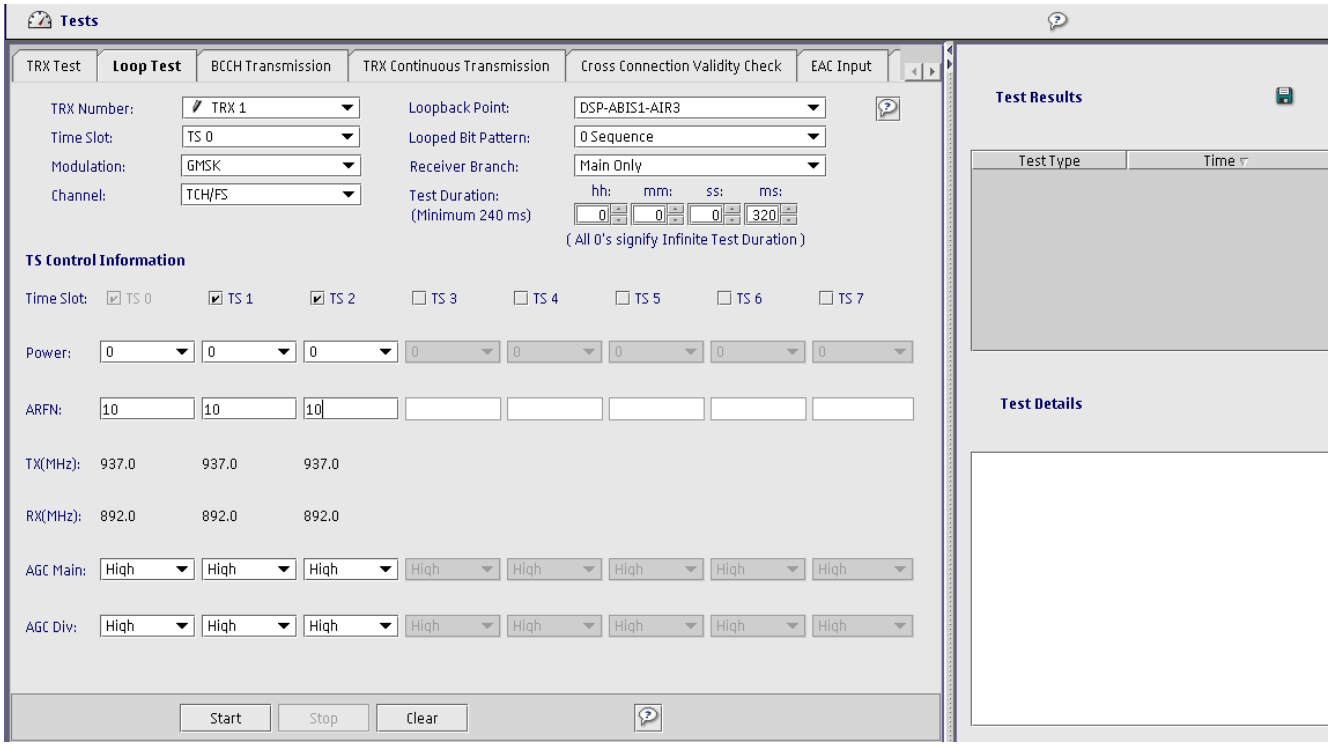

Figure 6 Loop test

3 **Select Time Slot of the selected TRX.**

4 **Select the Modulation.**

5 **Select the Channel.**

6 **Select the Loopback Point.**

7 **Select the Looped Bit Pattern.**

8 **Select the Receiver Branch.**

9 **Select the time the test will be executed.**

10 **If the TRX is in Configuring State, select the values for TS Control Information.**

11 **Click Start to execute test with selected parameters.**

Figures below show the loops on the RTC and Dual Duplexer units.

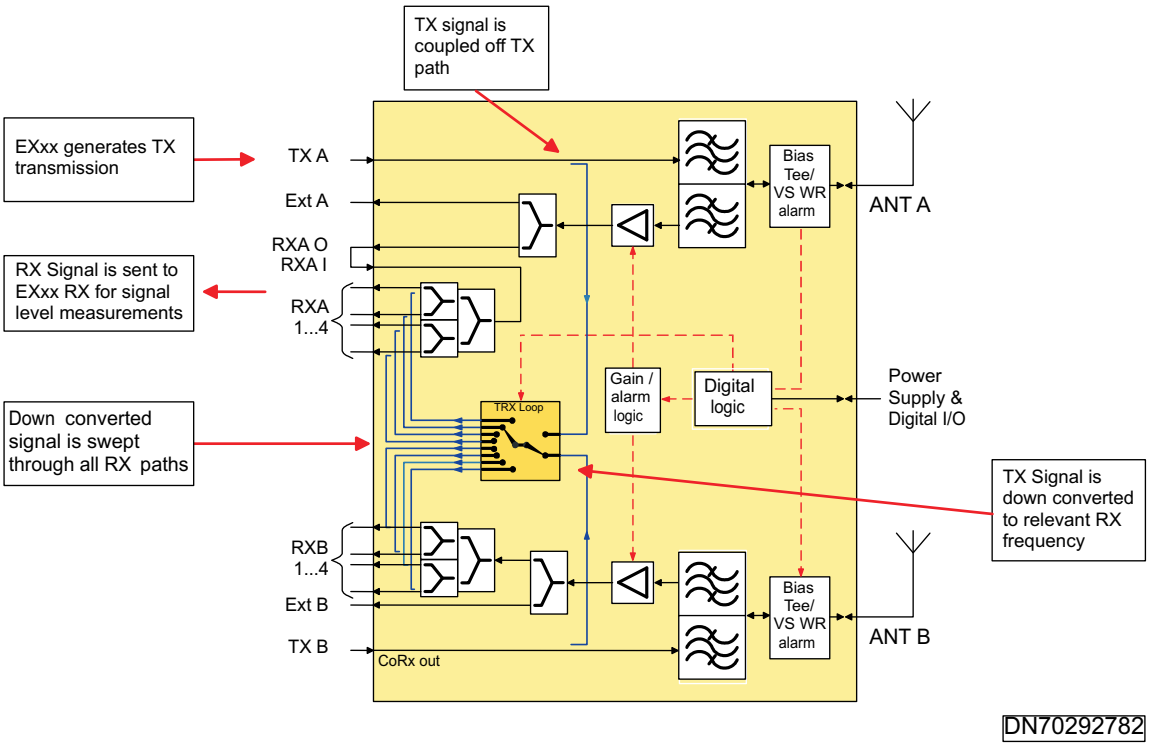

Figure 7 TRX Loop (ERxA, DDU module)

The TX to RX Loop switching is arbitrated on timeslot (577 microseconds) basis to guarantee that other TSs' traffic is not cut during the loop.

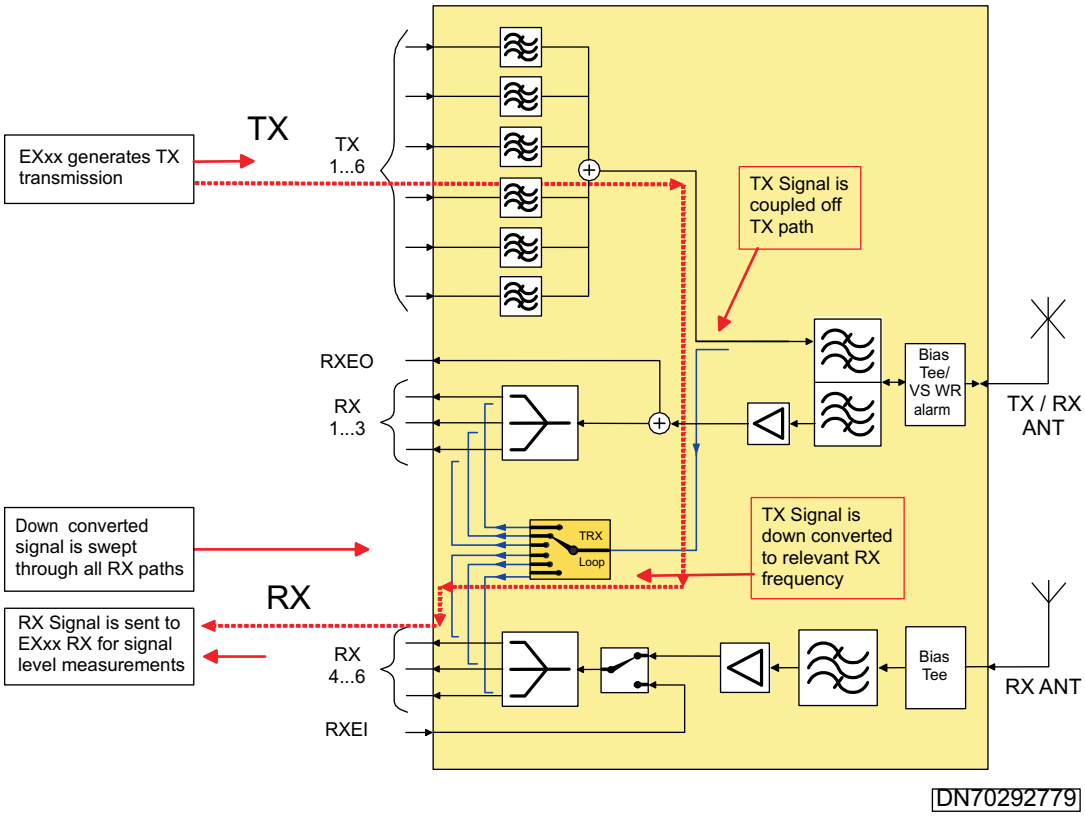

Figure 8 TRX Loop (ECxA, RTC module)

The Test report parameters are displayed on the Test Details pane:

Property	Explanation
Test Result	Indicates if the test has passed or failed
Failure Reason	If a test has failed the reason for failure is shown here
Actual Test Duration	Actual duration of the test.
S/N Ratio	Level of the received signal compared to background noise
RX Quality	Quality of received signal in terms of bit error propability
Main RX Level	Main RX Level in dBm
Div RX Level	Div RX level in dBm
FER (BLER)	Frame (block) error rate, amount of failures with frame (block) decoding
BER	Bit error rate, amount of bit errors in decoded frames
RBER1b	Residual BER in class 1b speech bits
RBER2	Residual BER in class 2 speech bits

Table 3 Test report parameters

The Test Results are displayed on the Test Results pane.

If the test fails look for troubleshooting instructions in the *Troubleshooting TRX test and TRX loop test failures with BTS Manager* section in the *Trouble Management of Flexi EDGE BTS* document.

ST-IRC (BSS20494: Space Time – Interference Rejection Combining) is a licensed feature that gives a link performance benefit by improving the interference (Co-channel & Adjacent channel) rejection capability of the BTS receiver.

In BTS Manager TRX Loop Test the user will be able to select a Combined (STIRC) option for a TRX configured with two way uplink diversity (2UD). This requires both EP3 MP1.0 BTS SW and BTS Manager.

3.4 Running a BCCH Transmission Test

Summary

The purpose of this test is to have all timeslots transmit on the power level specified for the test.

BCCH (Broadcast Control Channel) Transmission is a diagnostic tool. The user interface has a drop-down list that has a listing of all the TRXs present in the BTS and any of these TRXs can be chosen for a test.

Following selections are available:

- **TRX Number**: Enables the user to select the TRX on which to execute the BCCH Transmission.
- **Power**: Enables the user to specify the power of the selected time slot. Power in not changeable if the site is under BSC Control.
- **Network Color Code**: Enables the user to specify the Network Color Code of the BTS.
- **Base Station Color Code**: Enables the user to specify the Base Station Color Code.
- Enables user to specify the ARFN of selected time slot, at least one ARFN value has to be specified in order to execute the loop test. ARFN is not editable if the site is under BSC Control. In case the site is under BSC Control, the ARFN received from the site is displayed. In case the TRX is RF-Hopping, text “Hopping" is displayed. In the case when site is not under BSC Control, the lowest of the range of ARFNs depending upon the band of the TRX is displayed as default.

Note that if the selected TRX is not in configuring state the BCCH test cannot be performed. If the BTS is under Local Mode the command is not available because then the BSC has control on the BCCH.

Steps

1 **Choose the BCCH Transmission command on the Tests menu or choose the BCCH Transmission tab sheet in the Tests view.**

2 **Select the TRX Number on which diagnosis to be performed.**

See the BCCH Transmission Test figure below.

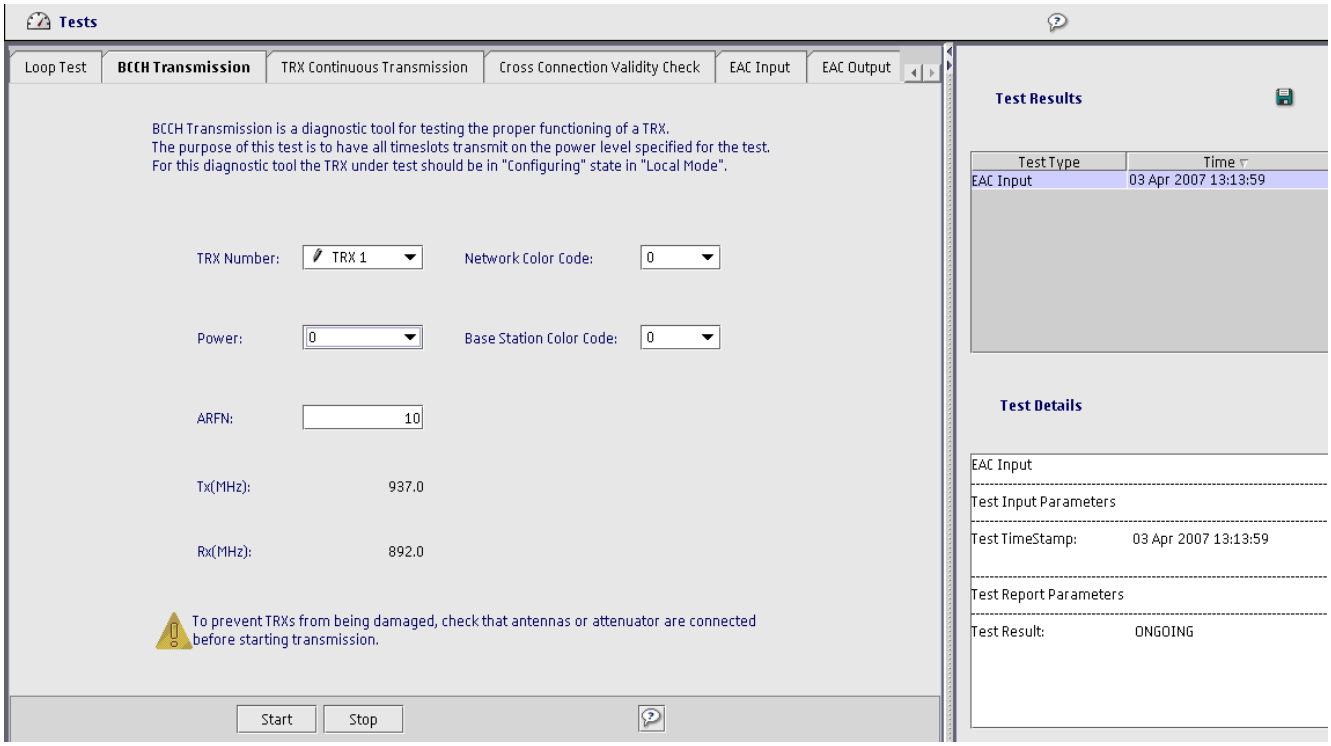

Figure 9 BCCH Transmission test

To prevent transceivers (TRX) from being damaged, check that antennas and attenuators are connected before starting transmission.

3 Select Power control range of the selected TRX.

The default value is 15.

4 Select Network Color Code.

5 Select Base Station Color Code.

6 Select the ARFN.

Note that the ARFN (Absolute Radio Frequency Number) value selection is only available in local mode. In network mode it is given by the BSC.

7 Click Start to execute diagnosis with selected parameters.

The Test Details are displayed on the Test Details pane.

The Test Results are displayed on the Test Results pane. If an error occurs as a test result see the table below for more details.

Test result	Explanation
TRX is not in Configuring State	The selected TRX is not in Configuring state. Check the TRX State and run the test again.
Selected TRX is in Shutdown state	The selected TRX is in Shutdown state. Check the TRX State and run the test again.

Table 4 Test result errors

3.5 Running an EAC Input test

Summary

EAC inputs are connected to the EAC connector of the BTS and the user can freely decide which inputs to connect and where. The states of these inputs can be viewed on the EAC Inputs page.

Note that the EAC Input test runs autonomously for 2 hours. If the test is run manually during BTS commissioning the process can be accelerated by stopping the test when the autonomous timer of 2 hours has run up to 2 hours in the background.

Steps

1 Choose the EAC Input command on the Tests menu or choose the EAC Input tab sheet in the Tests view.

EAC input line states will be shown. See the figure below.

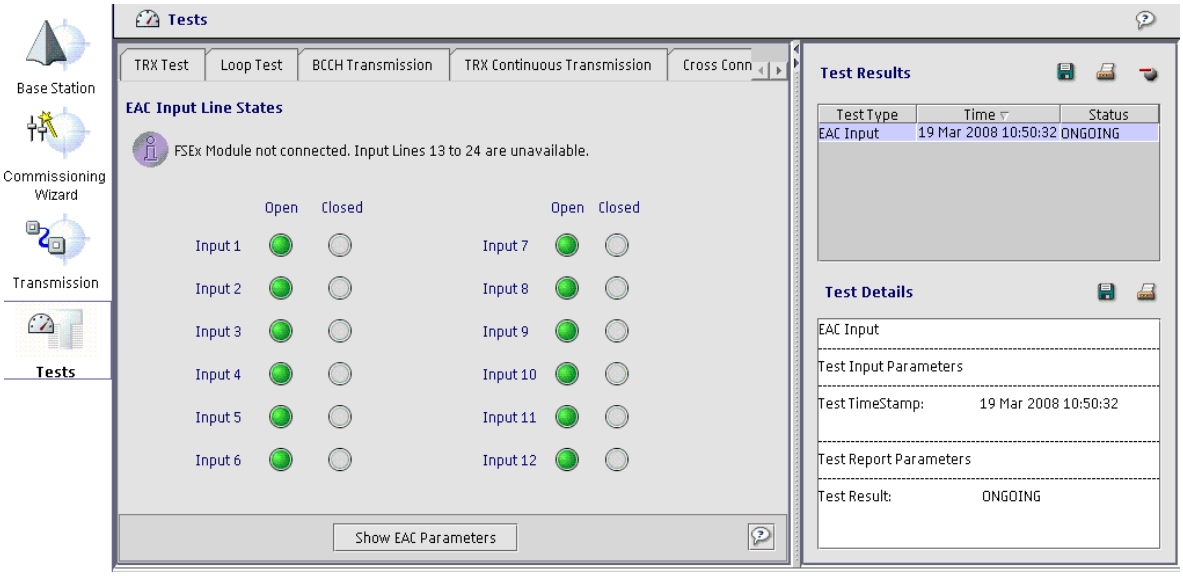

Figure 10 EAC input line states Alarm 1-12 (FSEB not connected)

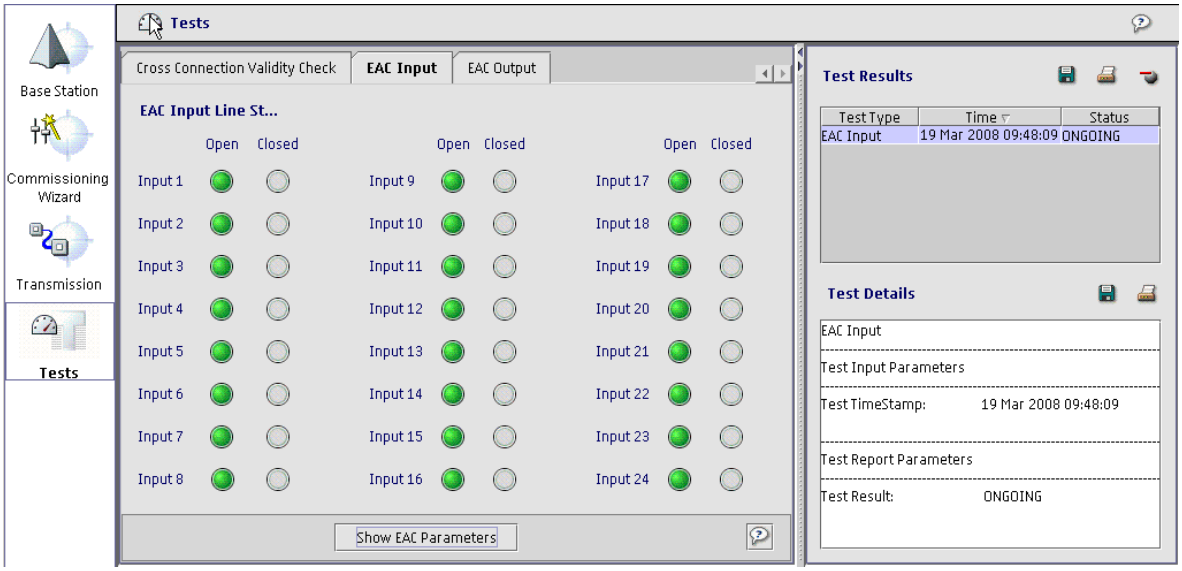

Figure 11 EAC input line states Alarm 1-24 (FSEB connected)

2 **If you wish to see the EAC parameters click the Show EAC parameters button.**

EAC parameters show the following input line states and configurations:

- **Show Input Lines 1 to 12/ Show Input Lines 13 to 24**: Enables you to switch the view to display the lines 1-12 or 13-24 when FSEB is connected.
- **Line State**: Displays the current state of each input line: Open, Close or Unknown.
- **Polarity**: Displays the polarity of the EAC input lines: Active When Open, Active When Closed or Unknown.
- **Alarm**: Displays the state of the alarm.
- If only ESMA is used, EAC input lines 1-12 are at ESMA EAC connector (MDR36)
- If FSEB is connected to ESMA, EAC input lines 1-24 are at FSEB (Screw connectors and Sub D-37 connector).
  Note that the FPA connector can only be used for optional power (BBU) related alarms after the user has defined the BBU type in the BTS Manager during commissioning (the FPA connector can not be configured nor used for other kind of EAC alarms).

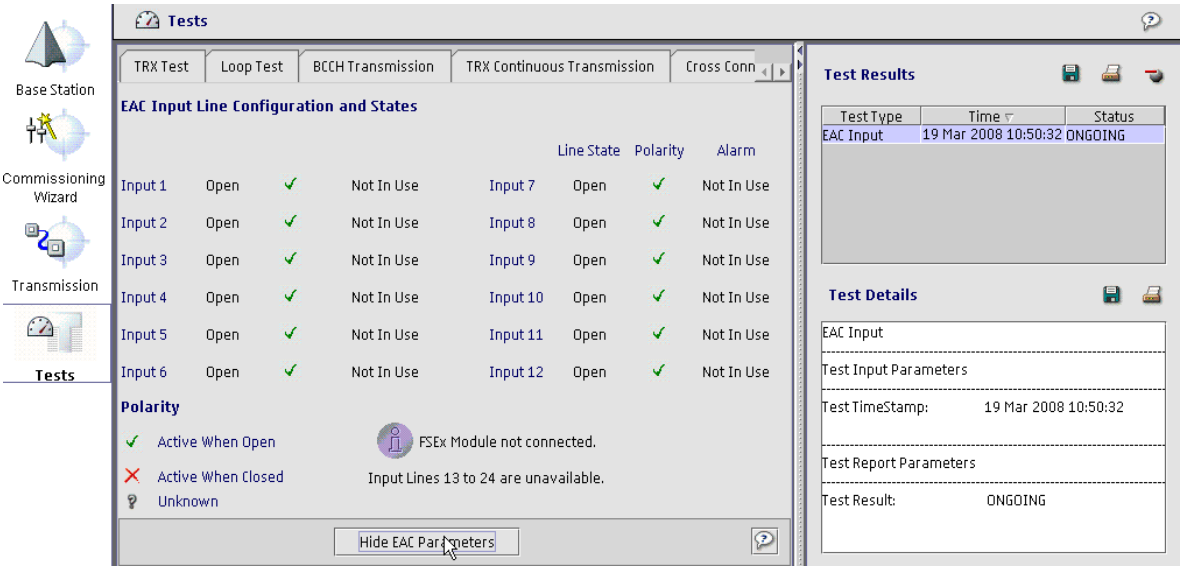

Figure 12 EAC Parameter Alarm 1-12 (FSEB not connected)

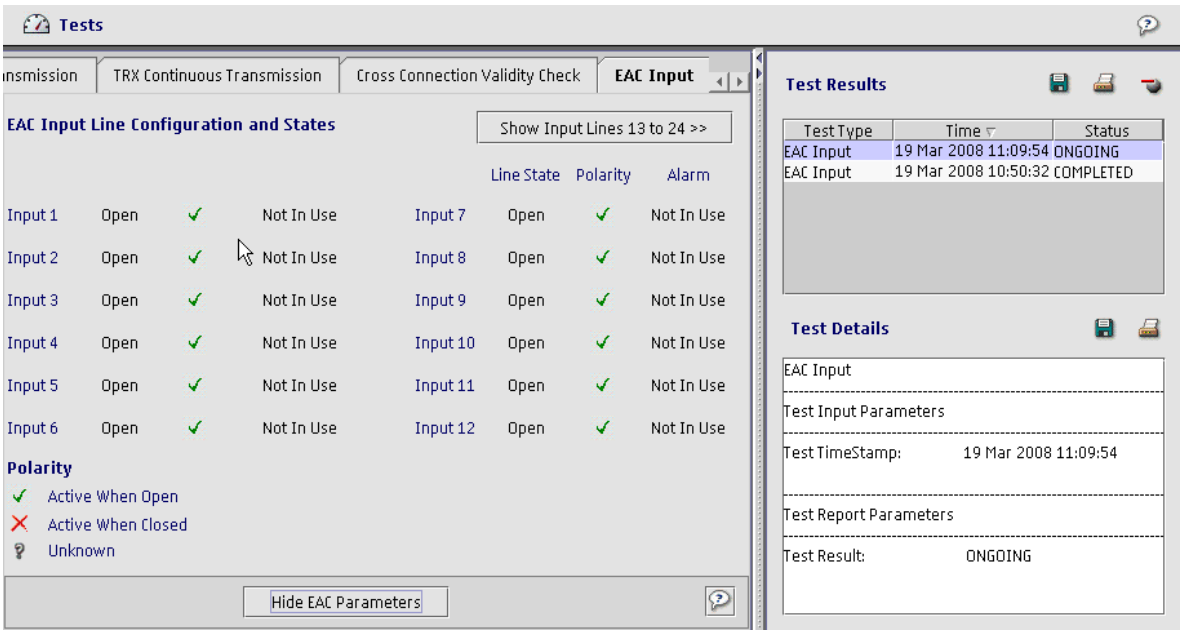

Figure 13 EAC Parameter Alarm 1-24 (FSEB connected)

The Test Details are displayed on the Test Details pane.

The Test Results are displayed on the Test Results pane. If an error occurs as a test result see the table below for more details.

Test result	Explanation
EAC Input Test could not be started	BCF (Base Station Control Function) is not in supervisory state. Check the BCF state and run the test again.

Table 5 Test result errors

3 **Click the Hide EAC Parameters button to return to the EAC Input Line States screen.**

3.6 Running an EAC Output test

Summary

The EAC output screen is used to either set the EAC output lines or to show the actual EAC output line status present at the BTS.

Following selections are available:

- **Current Output Line States**: Displays the current status of the EAC Output lines.
- **EAC Output Test Parameter**: Enables the user to select the output line states for performing the EAC Output test: ON or OFF.
- **Set**: Sets the selected EAC output line states.
- **Revert**: Reverts the EAC output lines states back to the default values (current BSC output line states). Enabled after you have changed the states once by clicking the Set button.

Steps

1 **Choose the EAC Output command on the Tests menu or choose the EAC Output tab sheet in the Tests view.**

Current EAC output line states will be shown. See the figure below.

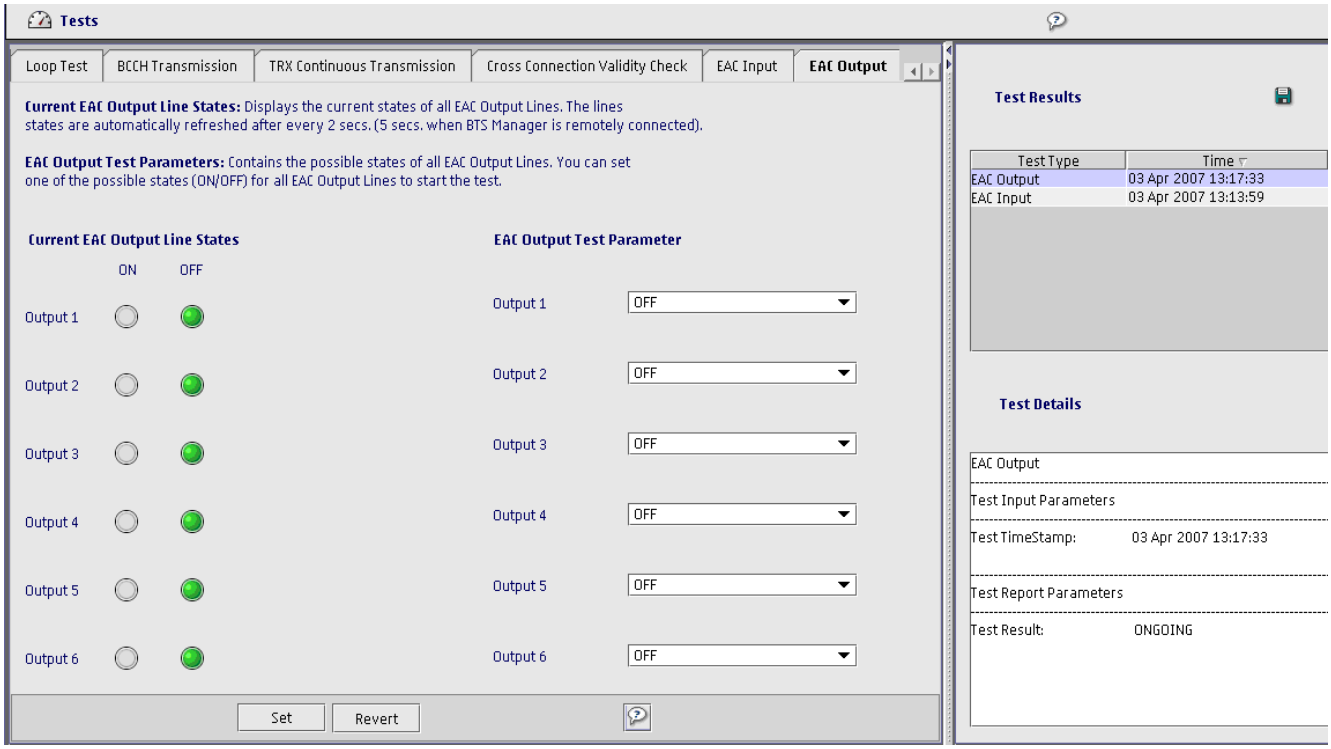

Figure 14 EAC output test

2 **Set the EAC Output Test Parameter values.**

Values are ON and OFF.

3 **Click the Set button to execute the test with the selected parameters.**

The Test Details are displayed on the Test Details pane.

The Test Results are displayed on the Test Results pane. If an error occurs as a test result see the table below for more details.

Test result	Explanation
Invalid Response Received. You may again set the EAC Output line states.	EAC Output line states have not been set. Select the EAC Output line states (ON/OFF)
Invalid Response Received. You may again revert the EAC Output line states.	EAC Output line states have not been reverted. Revert the EAC Output line states by clicking the **Revert** button.

Table 6 Test result errors

4 **Click the Revert button to stop the test.**

The **Revert** button reverts the EAC output lines states back to the default values (current BSC output line states).

3.7 Running a Cross Connection Validity Check test

Summary

The purpose of the cross connection validity check is to verify that:

- OMUSIG is configured
- at least one TRXSIG is configured
- Traffic channels for at least one TRX are configured

If one of the above is missing the test result is shown as FAIL with the description. Note that the cross connection validity check does not change any settings.

Steps

1 **Choose the Cross Connection Validity Check command on the Tests menu or choose the Cross Connection Validity Check tab sheet in the Tests view.**

See the figure below.

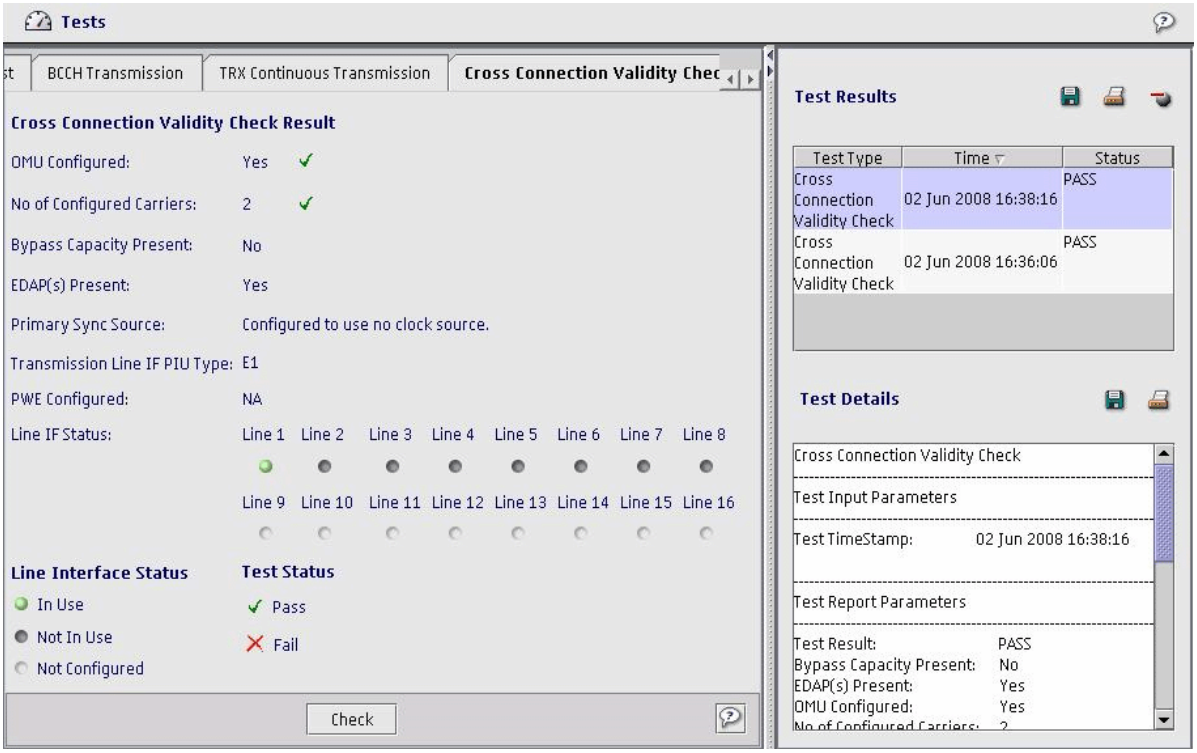

Figure 15 Cross Connection Validity Check

2 **Click the Check button to execute the test.**

The following results are displayed:

- **OMU Configured**: Displays whether the OMU is configured or not.
- **No of Configured Carriers**: Displays the number of the configured carriers.
- **Bypass Capacity Present**: Displays whether the bypass capacity is present or not.
- **EDAP(s) Present**: Displays whether the EDAP is present or not.
- **Primary Sync Source**: Displays the primary synchronisation timing source.

- **Transmission Line IF PIU Type:**
  - **PIU Type**: Displays the interface mode.
  - **PWE configured**: Displays whether the BTS runs in PWE mode or not.
  - **Line IF Status**: Displays whether the line is in use (green bullet), not in use (dark grey bullet) or not configured (light grey bullet)
    Note that all items have the same (leftmost) indentation depth.
- **Test Status**: Displays whether the check is passed or failed.

The Test Details are displayed on the Test Details pane.

The Test Results are displayed on the Test Results pane. If an error occurs as a test result see the table below for more details.

Test result	Explanation
Invalid Response Received. You may recheck the Cross Connection Validity.	Test results can not be displayed. Check the parameters and run the test again.
Test Result: FAIL	The test has failed due to one of the following: • OMUSIG capacity does not exist. Configure the OMU (Operation and Maintenance Unit). • TRXSIG capacity and Fixed traffic channels do not exist. Check the availability of configured carriers. • 7606 alarm 'No capacity for TRX object'. See the *Trouble Management of Flexi EDGE BTS* document for instructions.

Table 7 Test result errors

3.8 Running a TRX Continuous Transmission with BCCH Power Level test

Summary

TRX Test Pattern Transmission is a diagnostic tool. The user interface has a drop-down list that has a listing of all the TRXs present in the BTS and any of these TRXs can be chosen for a test.

TRX Continuous Transmission test will set all timeslots in the TRX to transmit at the same power level as the BCCH TRX. As an example, a spectrum analyser can be connected to the output of the TRX (using a splitter on the antenna so that traffic can continue) and the output power of the TRX can be verified to be within specification. The advantage of using this test method is that the BTS is connected to the BSC and the TRX is in supervisory state carrying traffic - the BTS site is On Air. Traffic is not disturbed and can remain ongoing in a TRX where the TRX Continuous Transmission test has been activated.

Steps

1 Choose the TRX Continuous Transmission command on the Tests menu or choose the TRX Continuous Transmission tab sheet in the Tests view.

2 Select the TRX Number on which test to be performed.

See the TRX Continuous Transmission with BCCH Power Level test figure below.

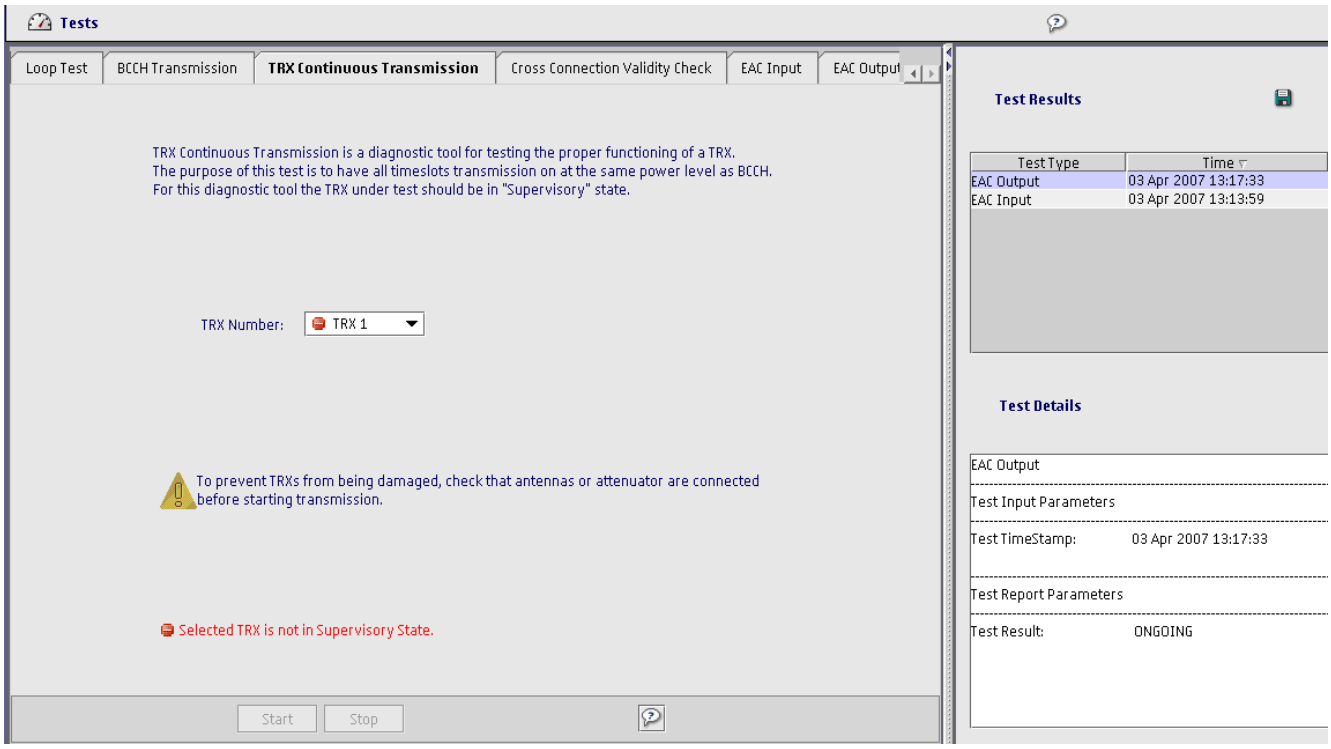

Figure 16 TRX Continuous Transmission with BCCH Power Level test

To prevent transceivers (TRX) from being damaged, check that antennas and attenuators are connected before starting transmission.

3 Click Start to execute test with selected parameters.

The Test Details are displayed on the Test Details pane.

The Test Results are displayed on the Test Results pane. If an error occurs as a test result see the table below for more details.

Test result	Explanation
Selected TRX is not in Supervisory State	The selected TRX is not in Supervisory state. Check the TRX State and run the test again.
Selected TRX is Locked by the BSC.	The selected TRX is locked by the BSC. Check the TRX State and run the test again.
Selected TRX is in Shutdown state	The selected TRX is in Shutdown state. Check the TRX State and run the test again.

Table 8 Test result errors

4 Click Stop to stop the test.

3.9 Running a Traffic Trace test

Summary

Choosing the **Tests | Traffic Trace...** command opens the **Traffic Trace** dialog box. This dialog box displays the visualisation of the active/idle time slots in a TRX at given time.

BTS Manager provides traffic trace details for following logical objects of a BTS:

- Any single TRX
- All TRX under a Sector
- All TRX under the BCF object, organized by all Sectors

The BTS Manager displays the following object information for each TRX logical object visible:

- The TRX logical object ID
- The ARFN (this will indicate RF Hopping active, when RF Hopping is active)

The BTS Manager displays also the following types of activity information for each TRX object visible:

- Inactive CS traffic timeslot (indication colour: Empty)
- Active CS traffic timeslot (indication colour: Yellow)
- PCU Synchronized PS timeslot (indication of whether PS traffic is being carried will not be displayed) (indication colour: Blue)
- Common and dedicated control channel (indication colour: Green)
- Reserved for testing (indication colour: Red)
- Unknown (indication of information not available - due to NACK response from BTS) (indication colour: Grey)

When you select the BCF logical object from the tree view, all the tabs within the tabbed pane will be enabled and you can view the traffic trace of all the TRXs under the BCF. If you select Sector, the traffic trace of all the TRXs under that Sector will be displayed. For a TRX selection, the traffic trace of that TRX will be displayed.

If the **Automatic Update** check box is selected, the traffic trace information will be updated at a regular interval. If the check box is not selected, the **Update** button will be enabled and clicking it updates the information.

Steps

1 **Choose the Traffic Trace command on the Tests menu or choose the Traffic Trace tab sheet in the Tests view.**

The Traffic Trace dialog box is shown. See the figure below.

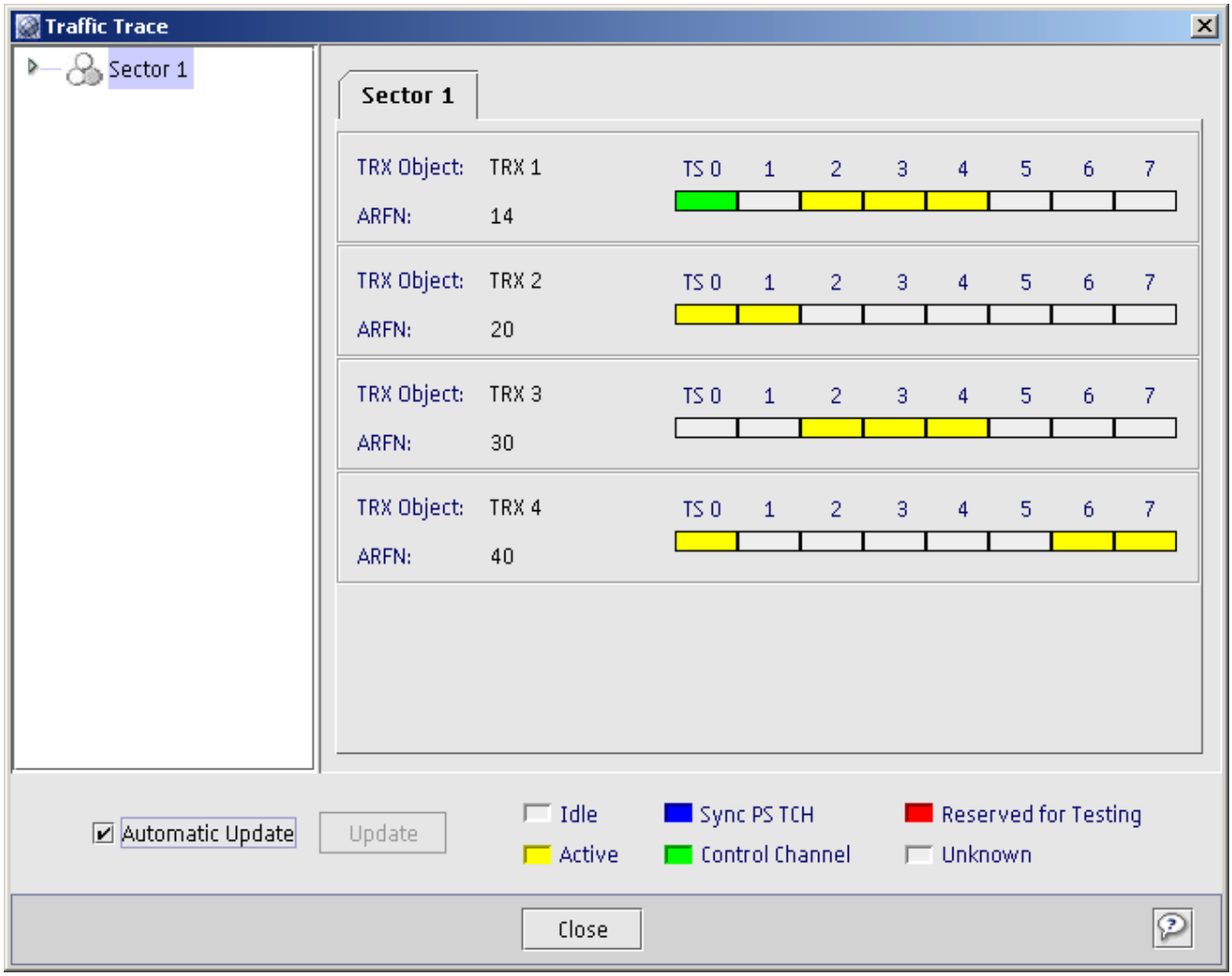

Figure 17 Traffic Trace

4 Appendix A: Measuring BTS RF Performance with external test equipment

4.1 Measuring BTS Sensitivity

Before you start

The BTS should be configured in the normal way with Flexi EDGE BTS Manager. BTS SW should be loaded onto the ESMA System module and the site should be in a fully configured state. Detailed Instructions can be found from the Flexi EDGE BTS Commissioning document. Instructions are incomplete so CMU 300 user manual and some previous knowledge is required to operate measurement equipment and build measurement setup for accurate measurements. It is recommended that measurements are made only by qualified persons.

Following options for CMU 300 is required:

- K31 (GSM 900 MHz)
- K32 (GSM 1800 MHz)
- K33 (GSM 1900 MHz)
- K34 (GSM 850 MHz)
- K41 is required for EDGE (8psk) measurements.
- B12 (high stability OXCO) is recommended for BTS applications.

Summary

Follow these instructions to measure Flexi EDGE BTS RX Sensitivity with Rohde & Schwartz CMU 300 (Universal Radio Communication Tester).

Proposing measurement setup for Sensitivity measurement

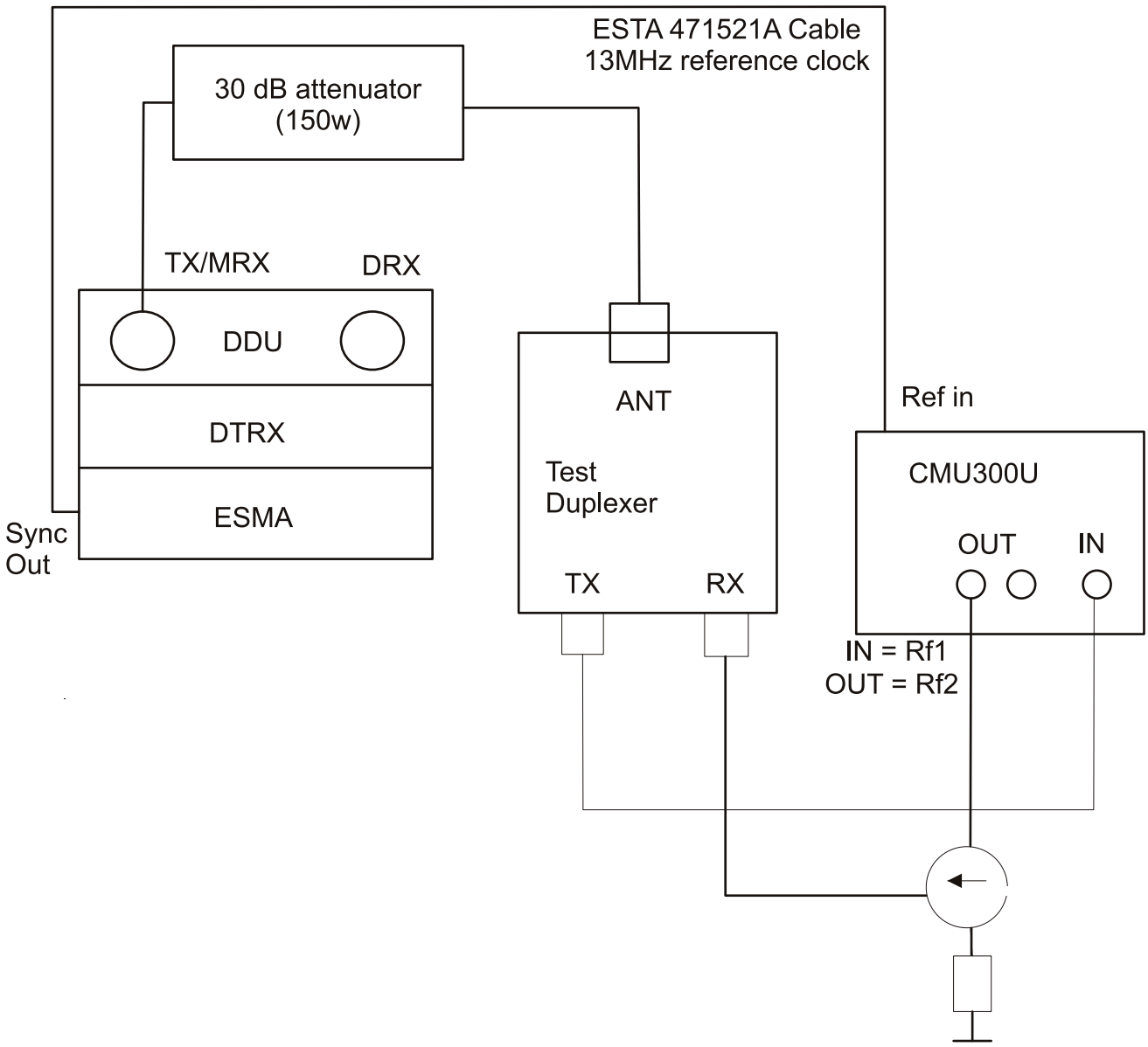

Figure 18 Setup for Single RX branch measurement (Main Only)

Measurement is as accurate as the calibration of the setup.

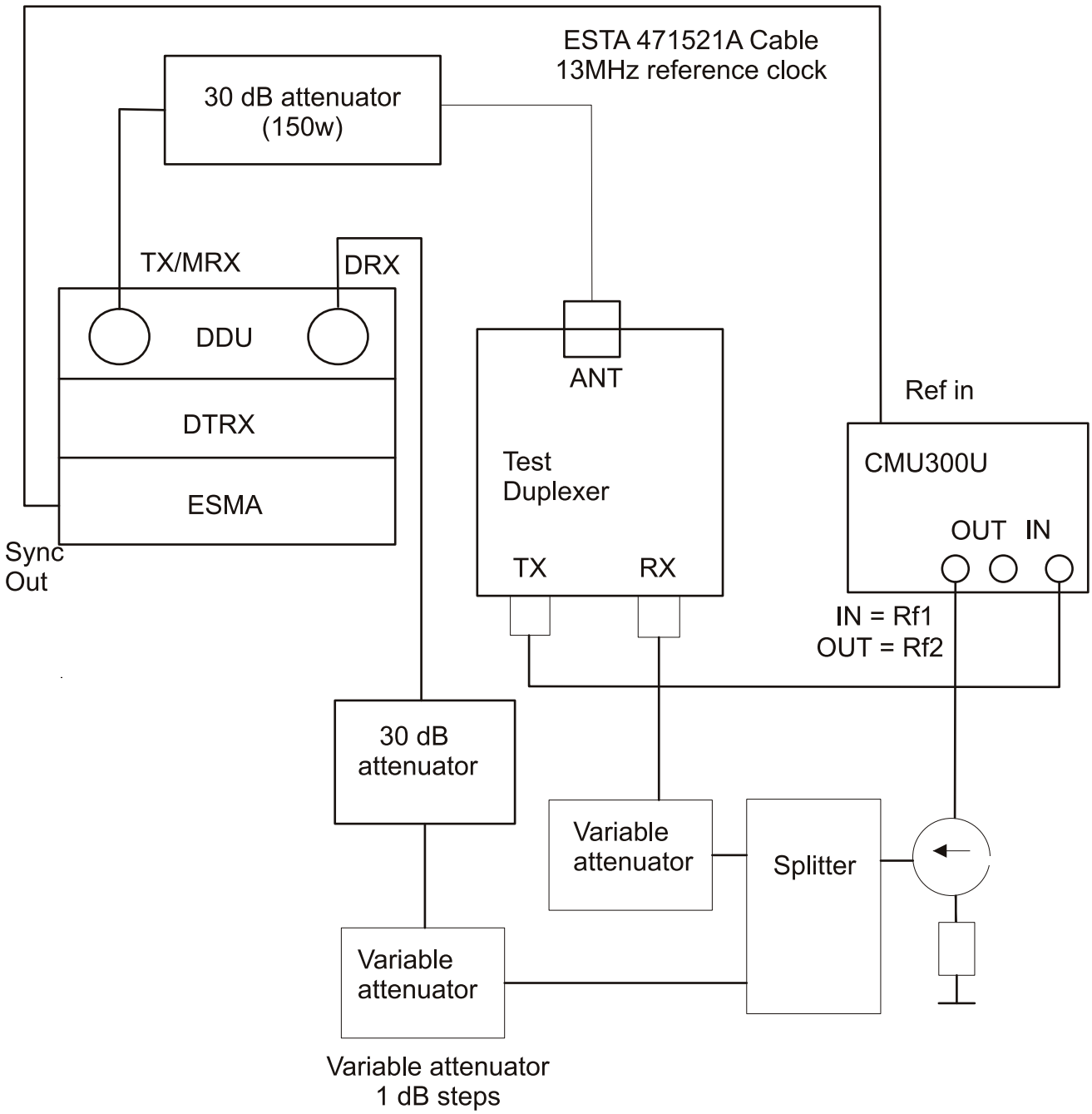

Figure 19 Setup for combined RX branch measurement (Main or DIV or Combined)

Measurement is as accurate as the calibration of the setup. Adjust main and Div branch RX signals to same level at the DDU antenna connector. Use variable attenuators for this adjustment. Main and Div signals must not differ more than 0.5db from each other. It is recommended to use example Network analyzer for measurement setup calibration.

Do not use smaller than 30db attenuators between BTS and CMU to prevent measurement equipment damage in any situation (as shown in Figure 18 Setup for Single RX branch measurement (Main Only) and Figure 19 Setup for combined RX branch measurement (Main or DIV or Combined).

It is recommended to disconnect unused TX connector from DDU. For example, if you are using antenna A for transmitting remove TX cable for DDU TXB connector to prevent measurement equipment damages in case of wrong cabling.

Sensitivity measurement procedure

1 **Disable Abis.**

The Abis may be either physically disconnected or by selecting **BTS Control** and **Disable Abis** from the BTS Manager menu.

If the Abis is physically disconnected, the following alarms will be raised in BTS Manager: Loss of incoming 2M signal and Loss of synchronisation signal(s). With the Abis disabled BCF should now be reset.

2 **Select Use Current from the BTS SW menu.**

Use Current can be selected from the **BTS SW** menu when the TRXs have reached a SW loading state.

After the command is given the TRXs should reach a configuring state with yellow LEDs flashing.

3 **Connect the CMU 300 to the BTS.**

Connect the CMU 300 to the Flexi EDGE BTS by connecting the clock test cable (ESTA 471521A) to Ref In on the CMU 300 and Sync Out connector on the System Module. Connect also the RF cable from the test setup to CMU 300 input port(s) as shown on Figure X and Y. Figure TX connector on the DDU to the RF connector on the CMU.

On CMU select external reference under *connect control* and *Sync* menu set it for external 13 MHz.

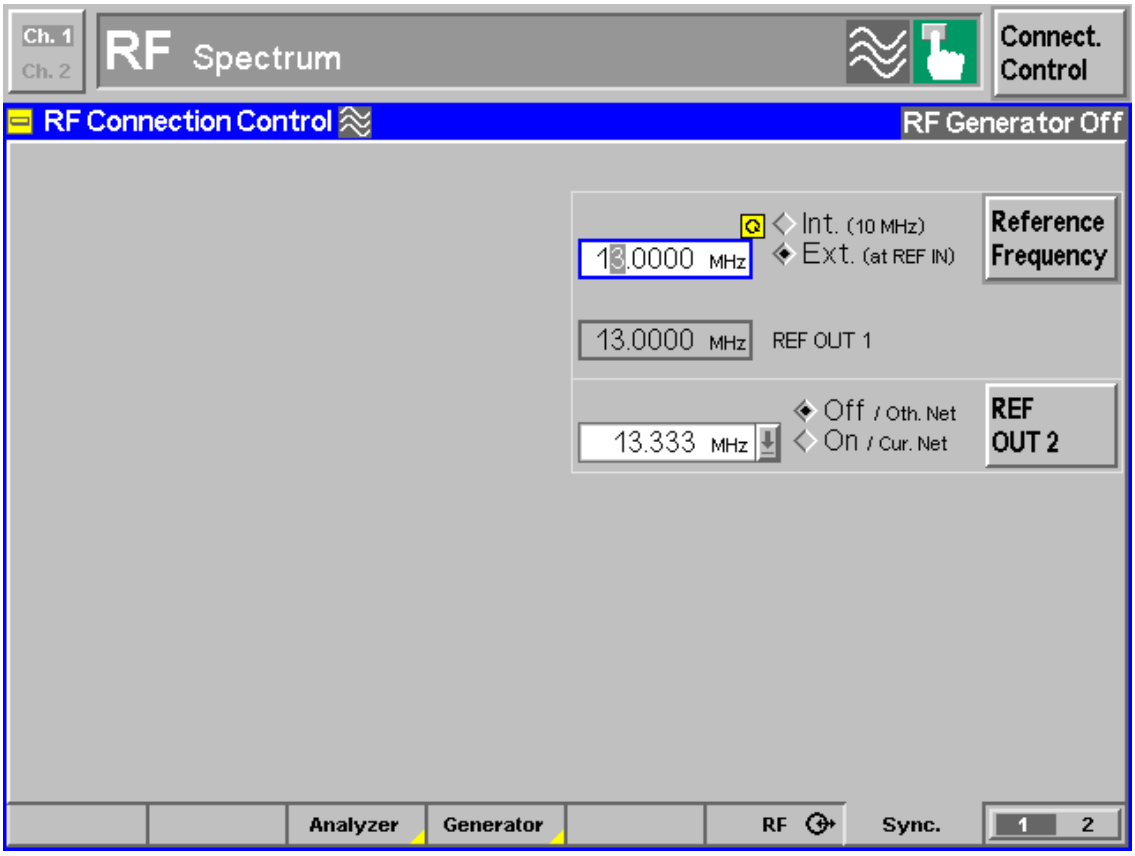

Figure 20 Select external reference under connect control menu and set it for 13 MHz

4 **Select correct input for incoming signal to CMU 300 under *connect control* RF menu**

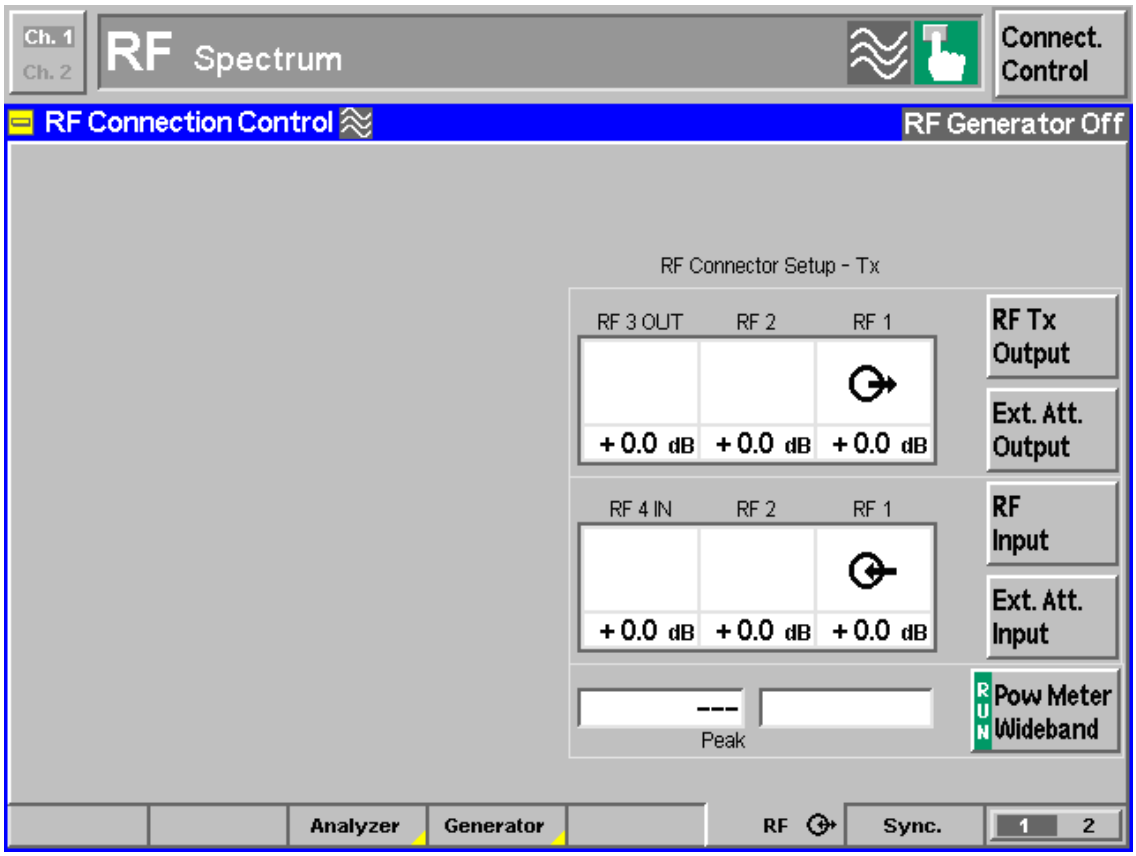

Figure 21 Input port selections for spectrum analyzer measurement

5 **Press *Main* on CMU.**

6 **Select Basic Functions | RF | Spectrum from the CMU main menu.**

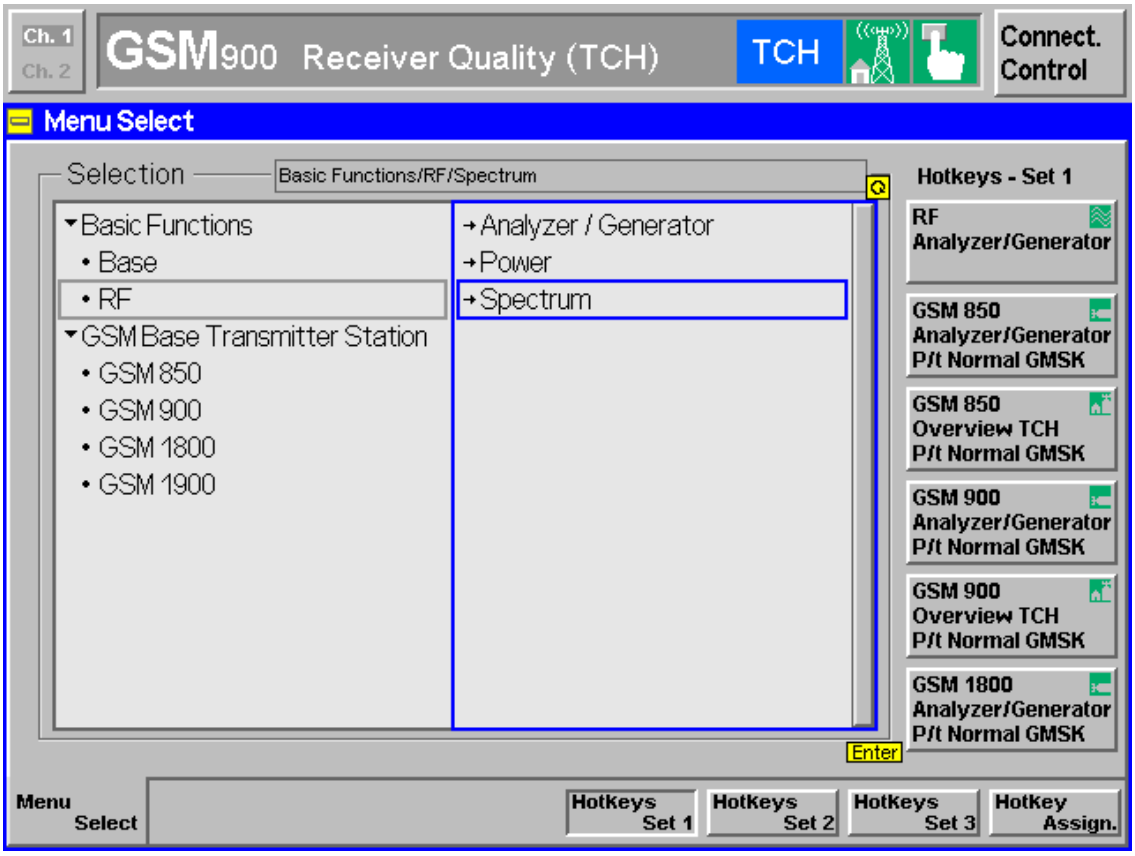

Figure 22 RF spectrum

7 Start the BCCH transmission from the BTS Manager test menu. Start with low power levels (PL7) to see that your setup is build correctly.

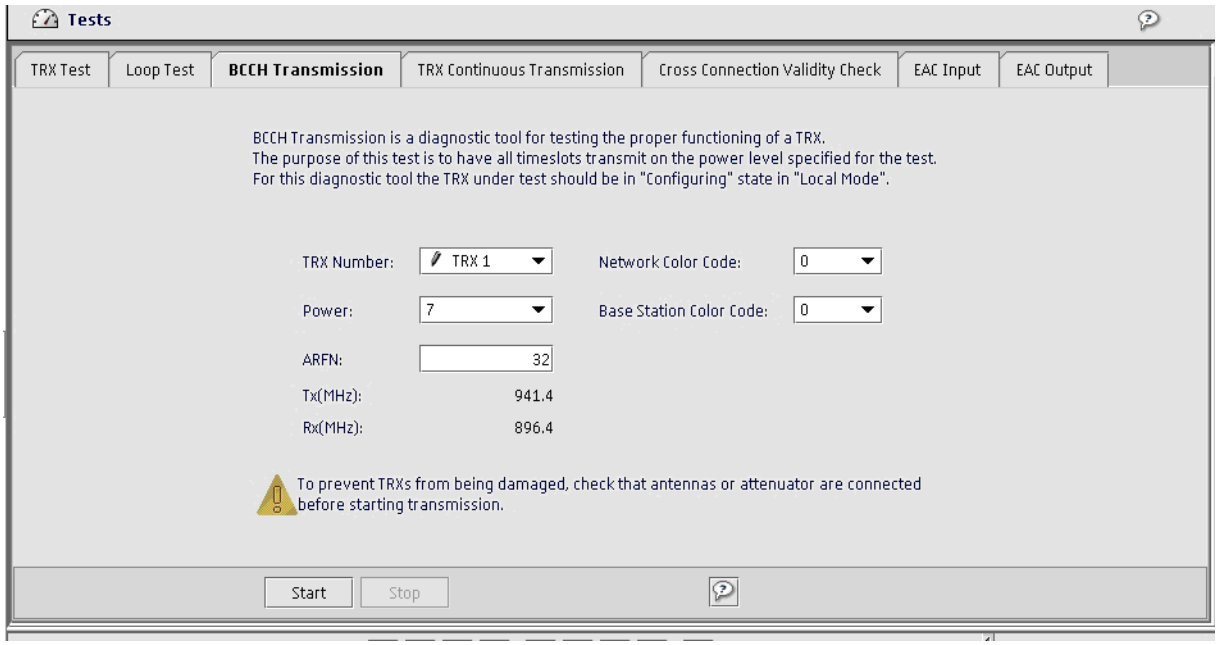

Figure 23 BCCH Transmission settings on BTS Manager

If the centre frequency is correct the following image should appear on the CMU. A scale of 3 MHz/div and a span of 30 MHz should be adequate.

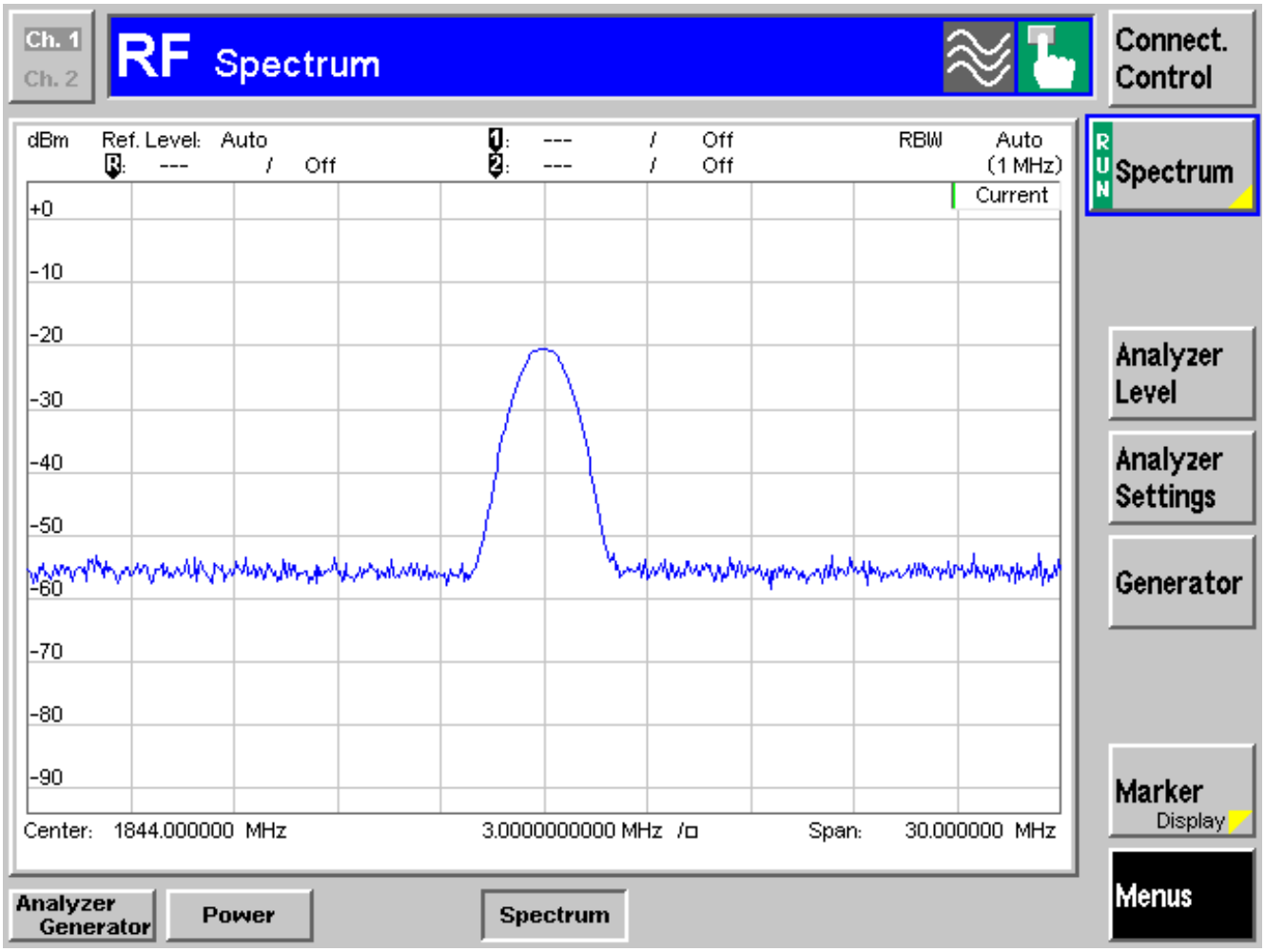

Figure 24 Spectrum analyzer measurement result

Stopping and starting the BCCH carrier should cause the signal to stop and start. If this is not the case then the configuration and frequency should be checked.

Output power does not present accurate output power level, but can be used as indication that setup is cabled correctly and BTS is setup correctly for BCCH transmission.

8 **Select *GSM Base Transmitter Station* | *GSM 1800* | *Signalling* | *Receiver Quality* | *BER CMU Average* from the CMU main menu.**

See the following figure.

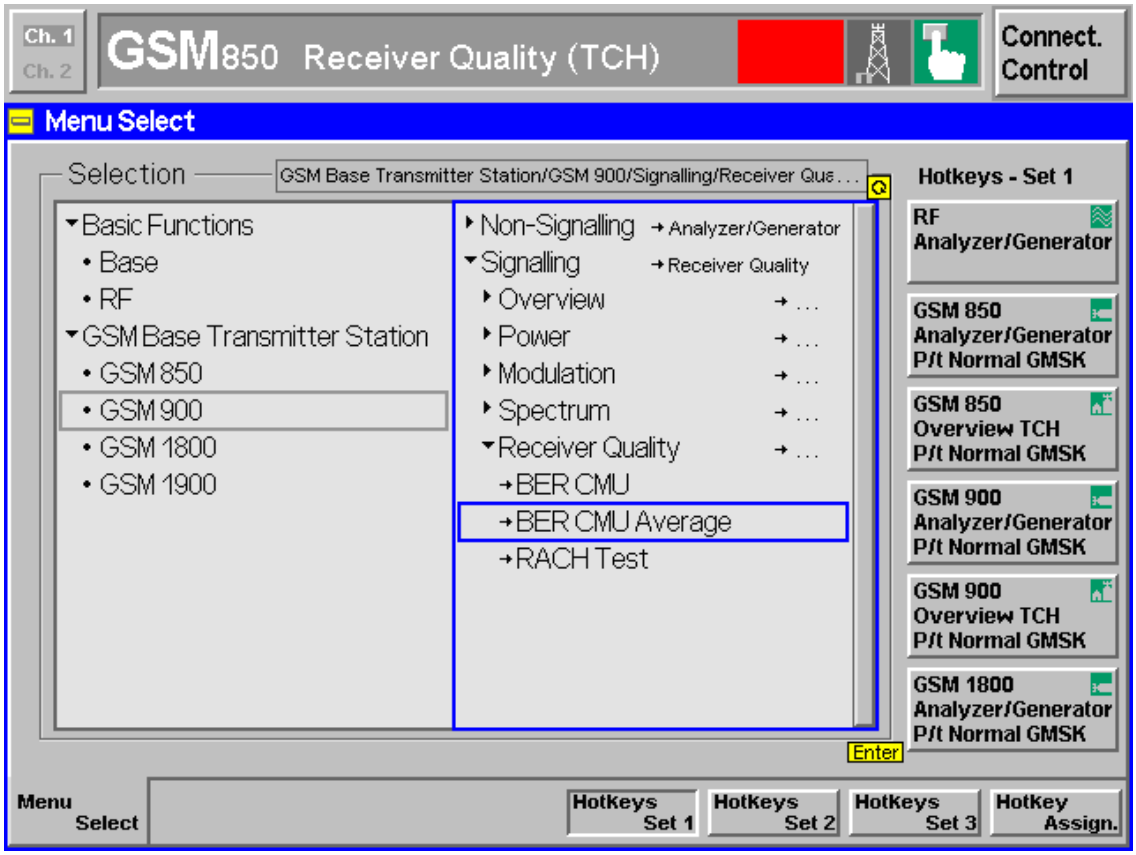

Figure 25 Select BER Average test from CMU, frequency band is depended of the BTS frequency band

9 **Type measurement setup attenuator values to Ext. Att Output and Ext. Att Input. Now levels being displayed by instrument are at BTS Antenna port.**

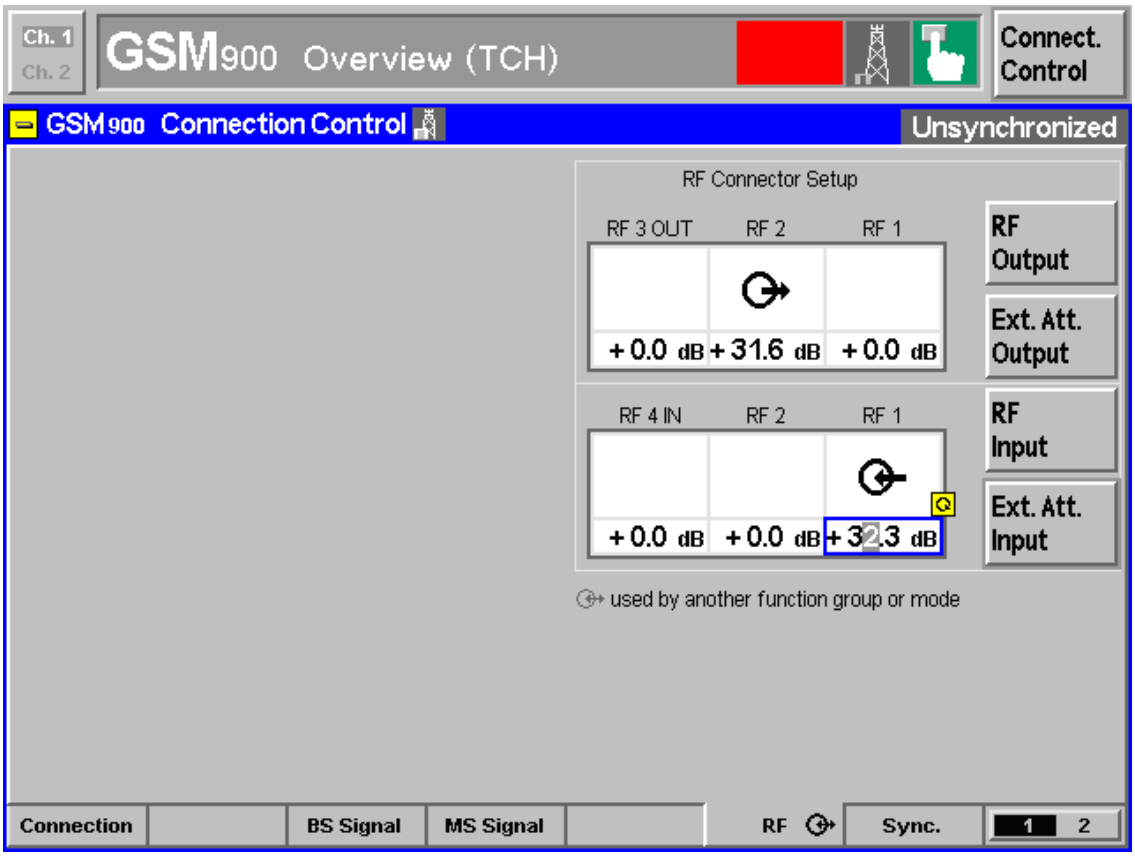

Figure 26 Select correct input and output connectors under connect control and RF

10 **Select the BCCH, TCH channels and TCH timeslots being planned to set on the BTS Manager. Example uses 900 MHz channel 32 and the TCH is set for channel 62 at time slot 3.**

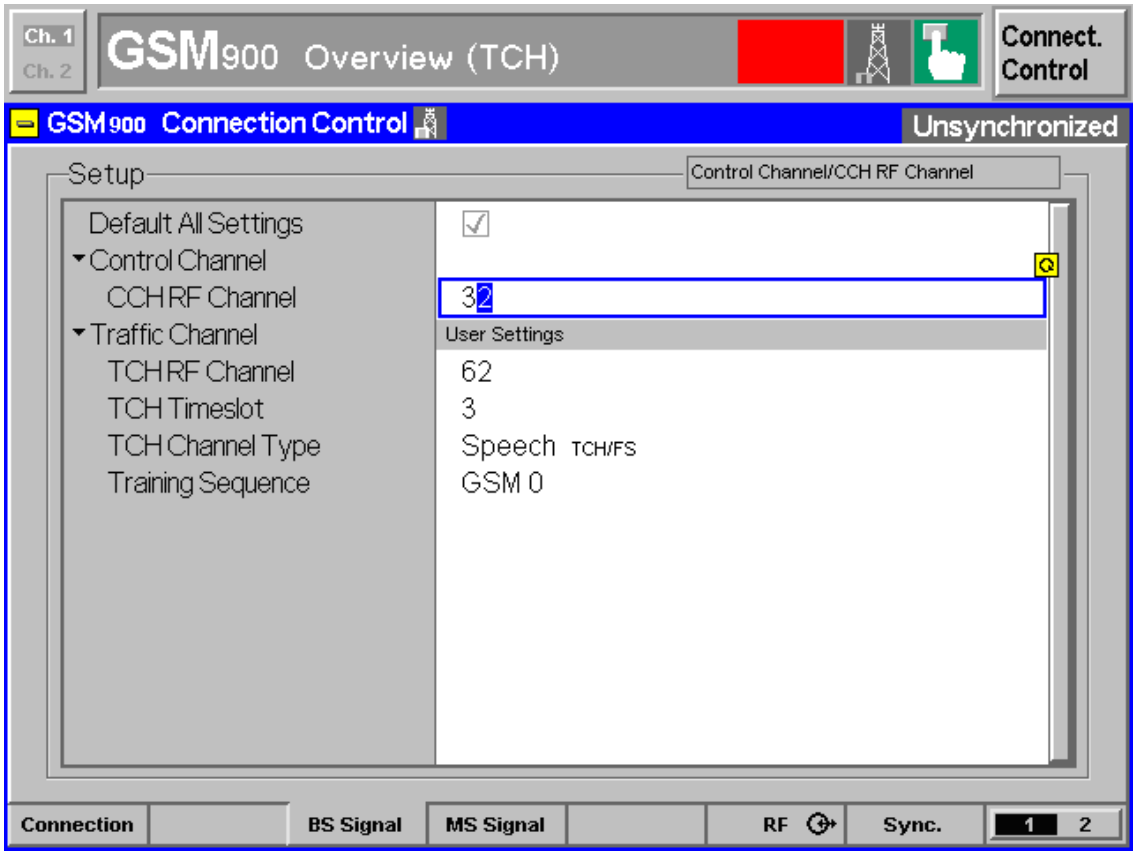

Figure 27 Select correct channel settings from BS signal menu.

11 Select Start Sync on the CMU control panel.

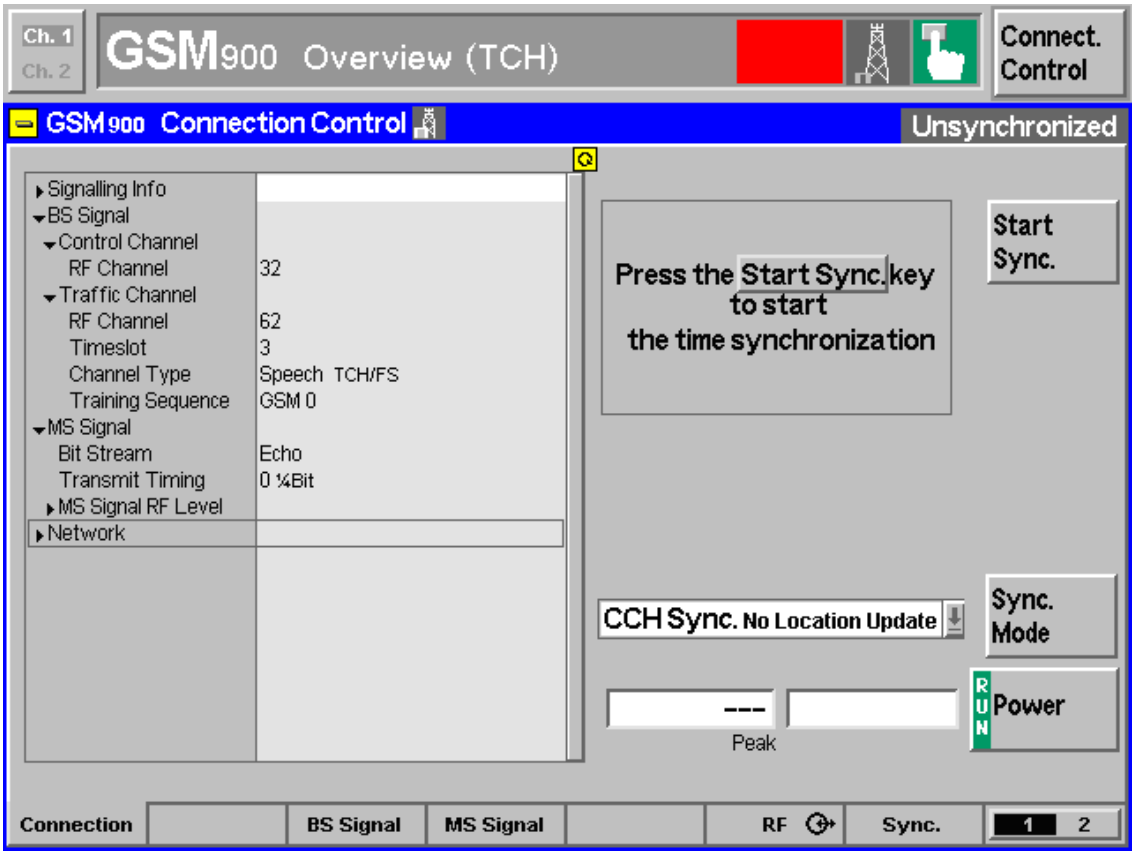

Figure 28 Press start Sync from CMU Menu

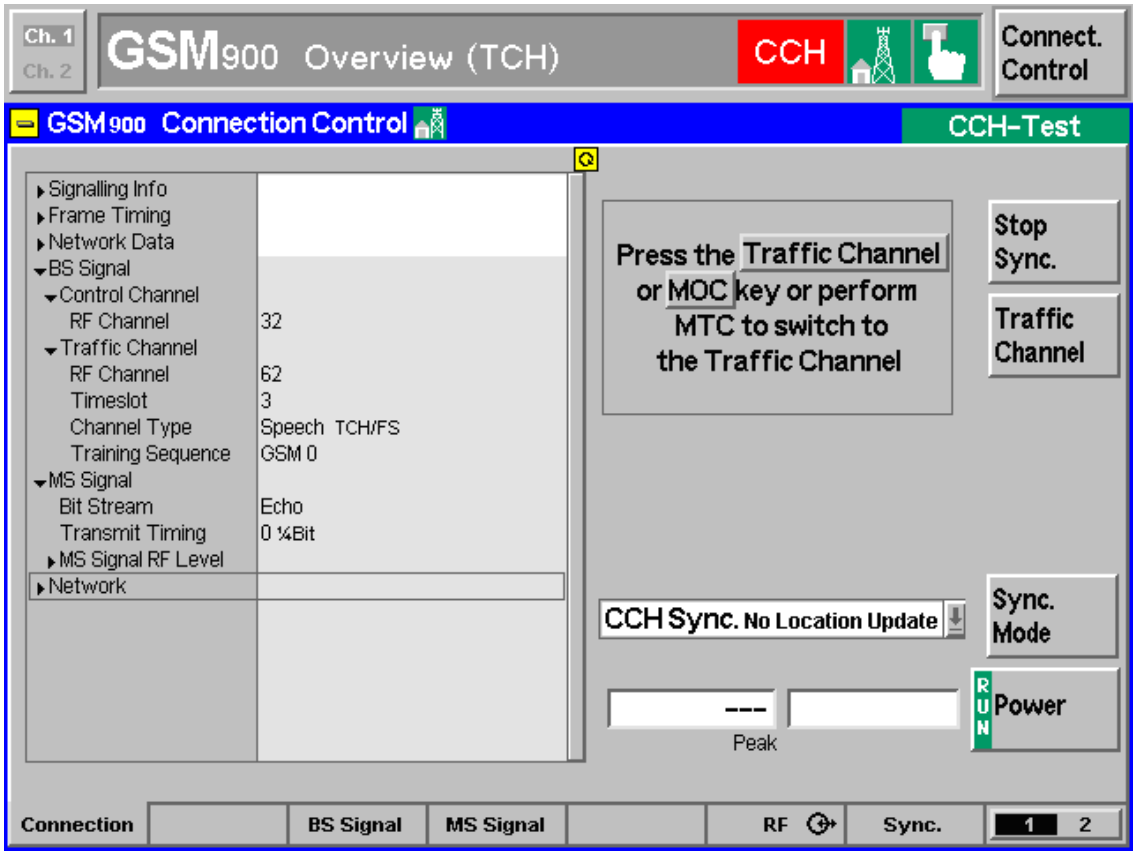

Figure 29 Synchronization is made successfully when radio mast icon is green

12 **Select the *Traffic Channel* to make actual measurements.**

See the figure below.

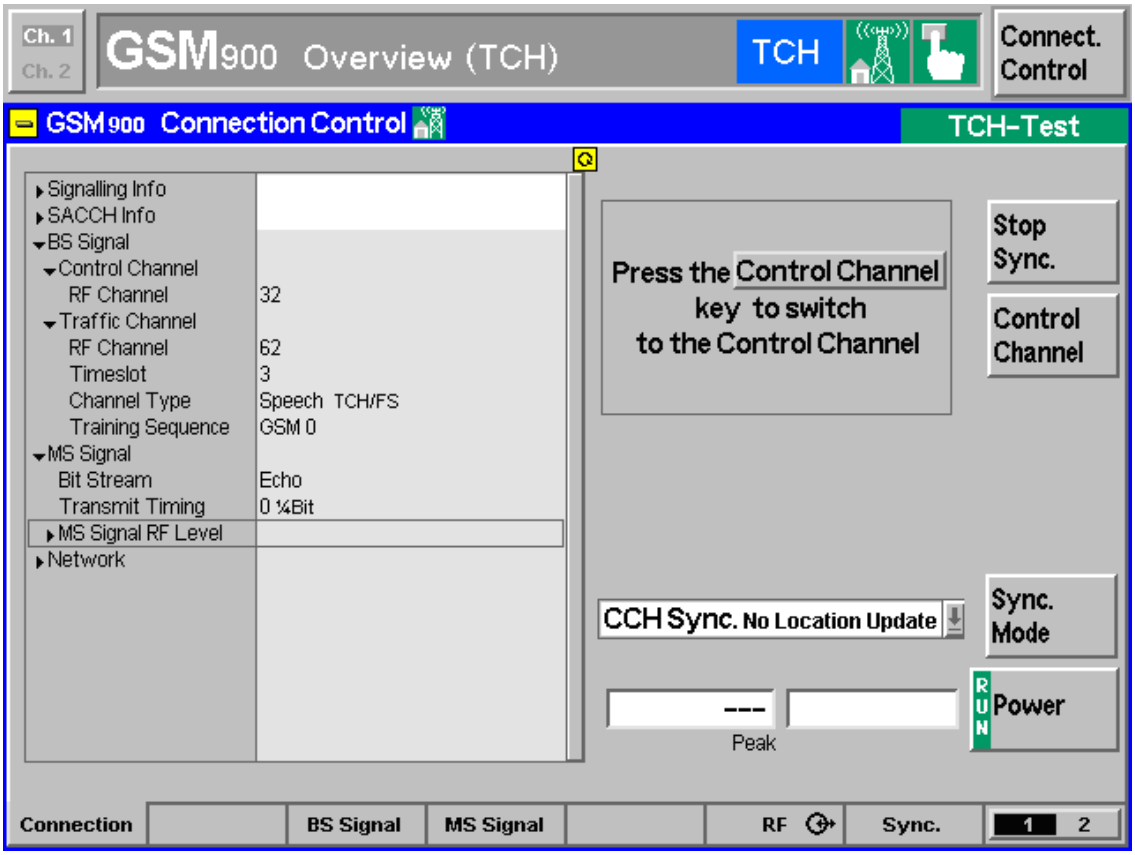

Figure 30 TCH channel need to be activated to make RF measurements. Start Loop test from BTS Manger, you can stop BCCH transmission it is not needed after synchronization.

13 **Choose the Loop Test command on the Tests menu or choose the Loop Test tab sheet in the Tests view in the BTS Manager. Make following selections for the loop test window as shown in figure *Loop test settings*.**

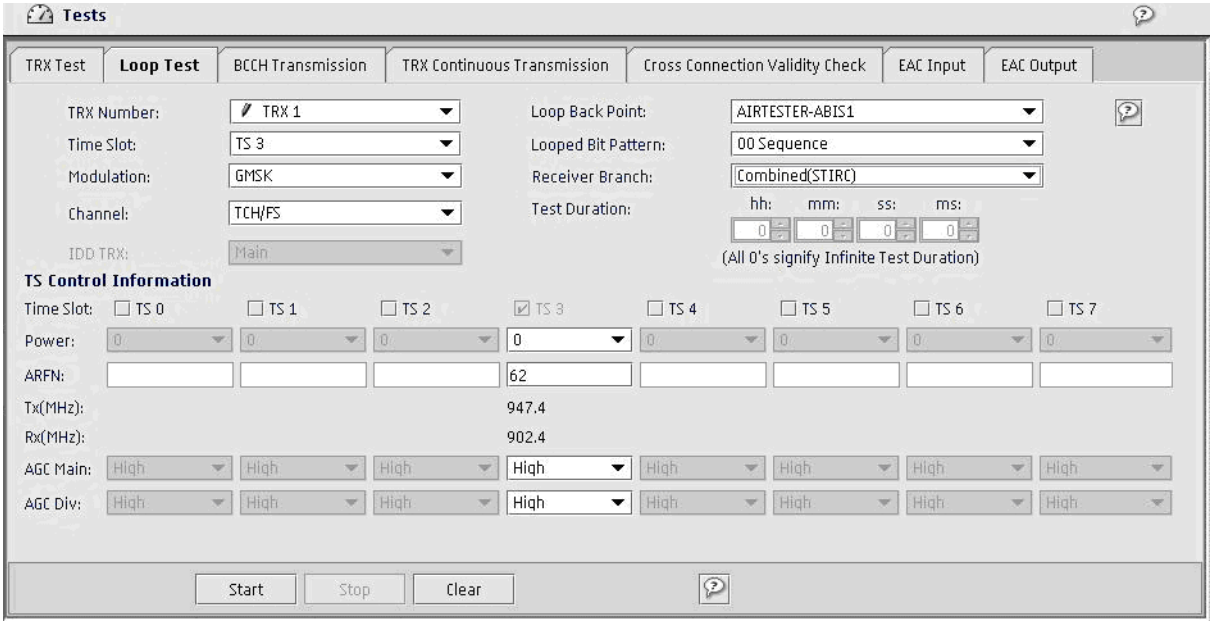

Figure 31 Loop test settings

14 **Click *Start* on BTS Manager to execute test with selected parameters.**

15 **On CMU select CMU average on application menu. This allows you to adjust (MS) level constantly and see how the BER is affected.**

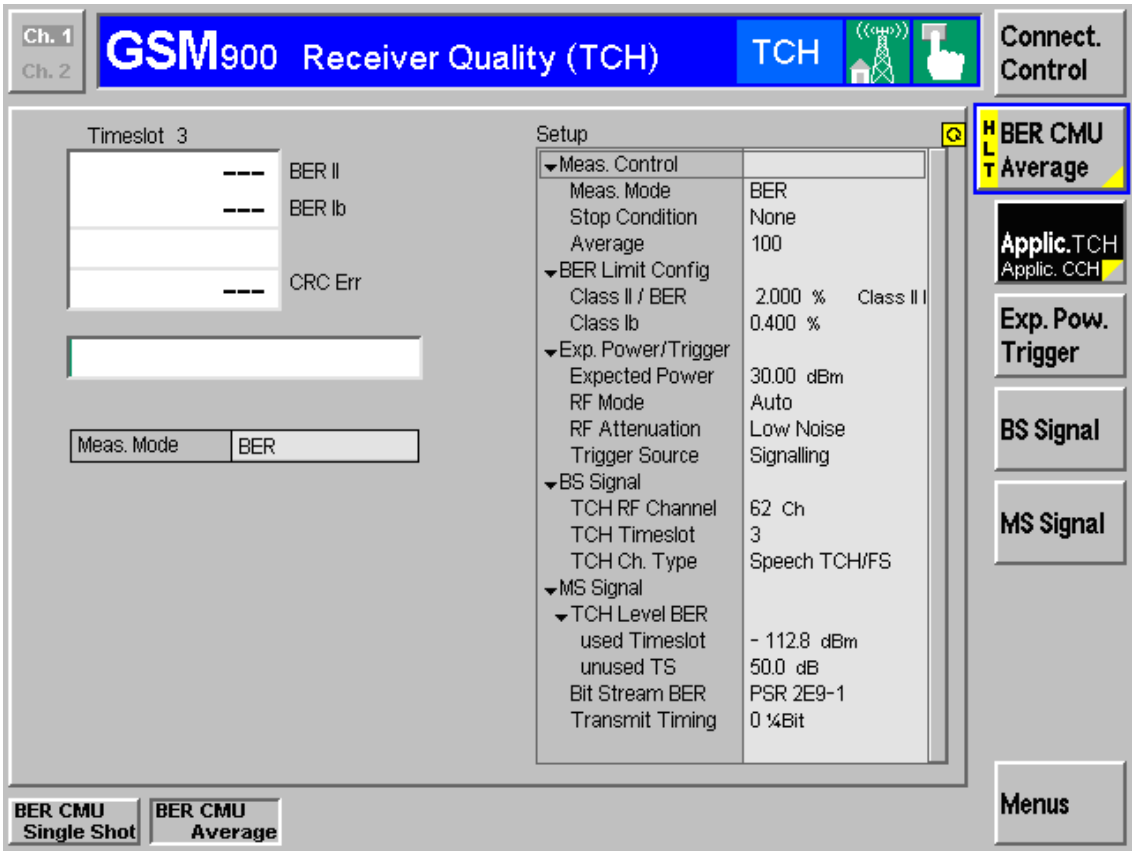

Figure 32 Select BER CMU Average to adjust MS level continuously during measurement is ongoing.

16 **Adjust MS signal level for -60dBm, this is good starting point for sensitivity measurement.**

17 **Start BER CMU Average measurement. Adjust MS level until you reach about 2% BER. CRC errors should be 0 during whole measurement period.**

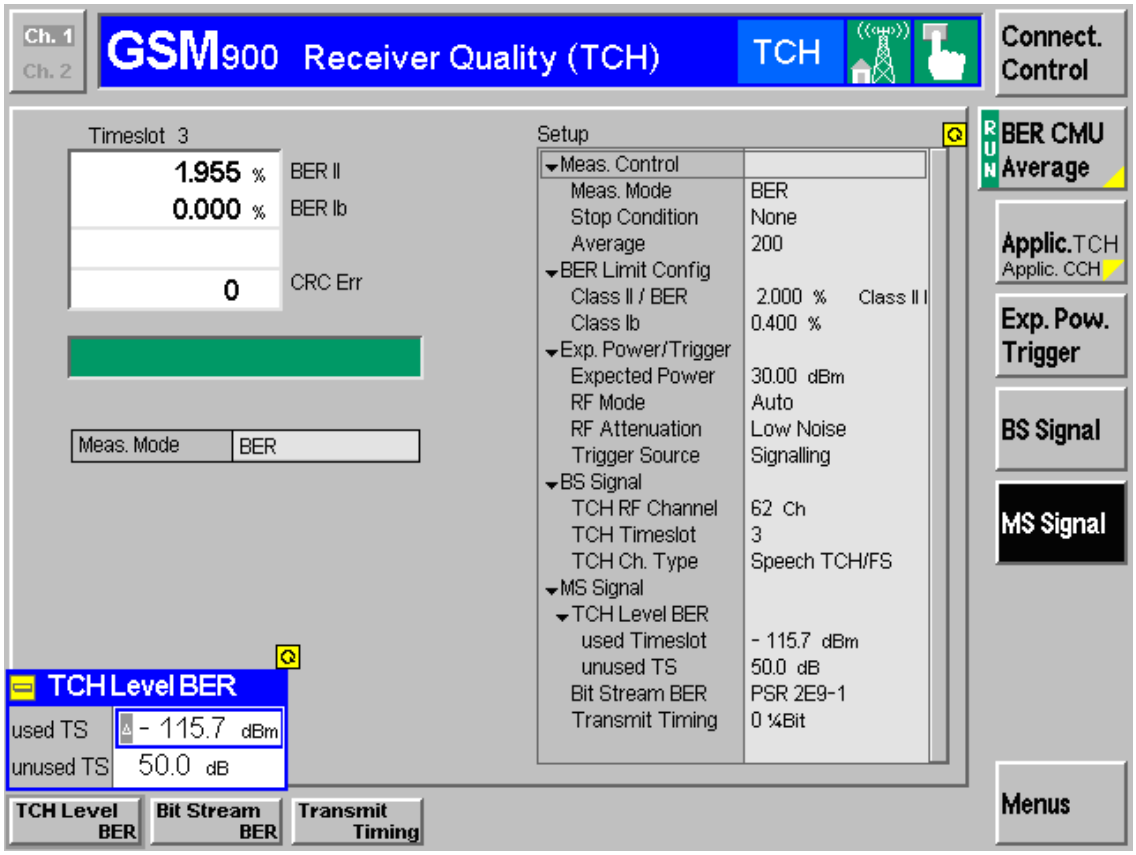

Figure 33 Typical result of the BTS sensitivity measurement with STIRC combining

3GPP specifies TCH/FS sensitivity level at 2% (R) BER II. Per 3GPP the adjacent (unused) timeslot should be 50dBc higher compared to measured timeslot.

Sample count for measurement is specified as follows on 3GPP specification:

Prop. Cond.	Error rate	Sat. sign.	Indep. samples	Station. proc.	Samples	Time (s)
Static	FER=0.10%	30000	4	-	12000	2400.0
Ib	RBER=0.40 %	7500	10	-	75000	11.4
II	RBER=2.0 %	1500	10	-	15000	3.8

Table 9 Sample count for measurement

200 samples can be used for basic BTS sensitivity measurements.

Actual MS level is depending of the measurement setup calibration accuracy.

4.2 Flexi EDGE BTS Output power measurement

Accurate BTS output power measurement can be made only with power meter.

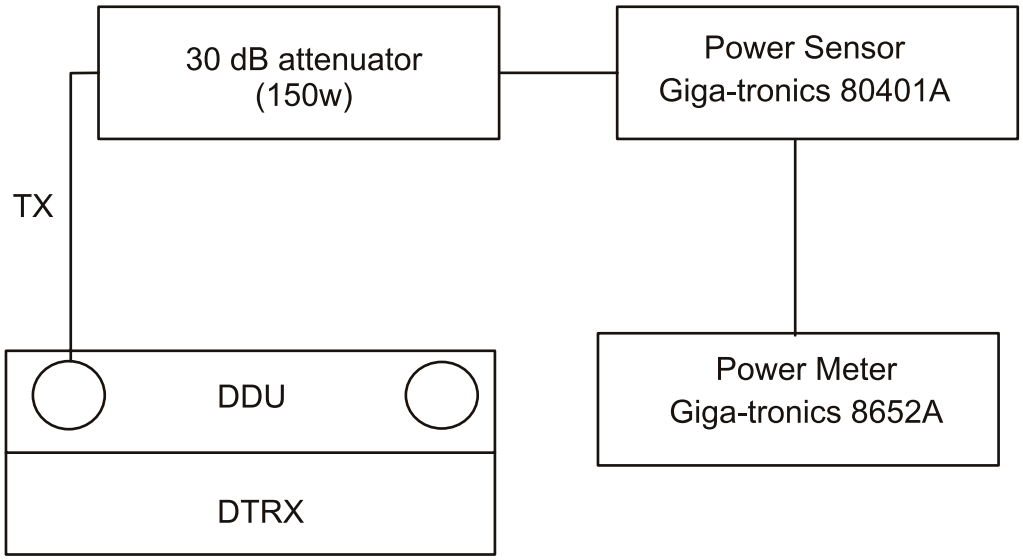

Figure 34 Output power measurement test setup example

Use suitable attenuator for the setup depending of the used power sensor. Do not exceed maximum input power which the power sensor is rated for. Note for measurement accuracy; too small attenuator might put too much power to the power sensor and too big attenuator might not keep the sensor input power on optimal dynamic range. Check the measurement equipment specifications for recommended power levels for measurement sensor.

Measure the insertion loss of the measurement setup (cables, attenuators, adapters between BTS antenna connector and power sensor). Enter the insertion loss as an offset for power meter.

Calibrate (zero) the power meter before it is connected to the test setup.

Connect the power meter to the BTS and start test pattern transmission.

Start with small power levels (PL10) to see that your test setup is build correctly.

Depending of the used measurement equipment you may need to adjust gating time and delay to sample power only during active time slot. ESTA cable provides also frame clock which can be used for the power meter triggering if needed. Measurement should be made with burst average type settings.

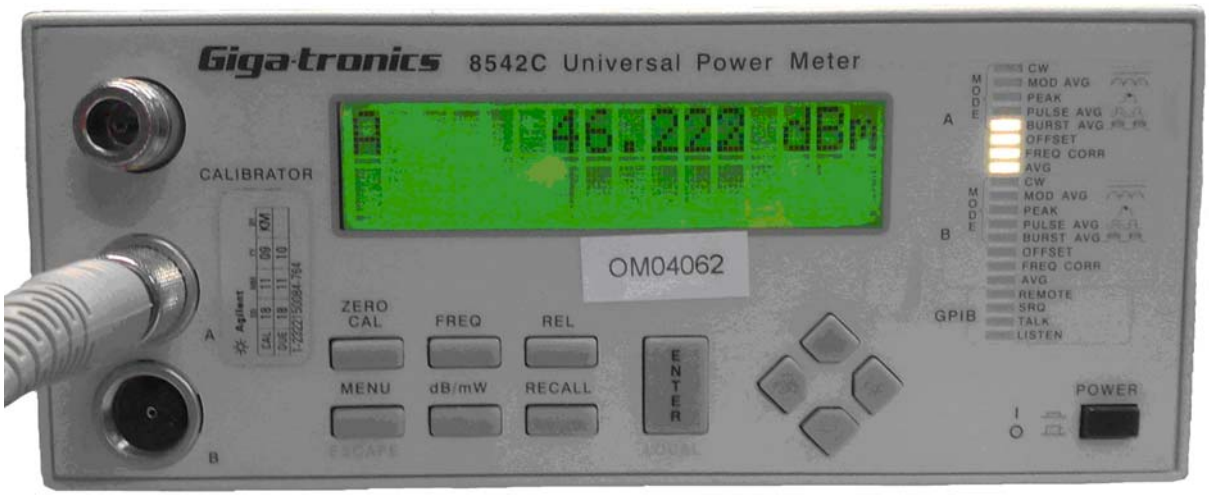

Figure 35 Typical BTS Output power measurement result for By-pass configuration at power level 0 with Giga-tronics 8542C

To check correct measurement settings you might want to start with one time slot transmission and add more active timeslots. Output power reading should stay constant. If output power is changing depending of the used time slots your power meter is not capable to measure power during active timeslot and output power reading is not accurate.

Power measurement accuracy is related to your test setup calibration (offset) accuracy and accuracy of the power meter it self.

4.3 Flexi EDGE BTS Sync Test cable (ESTA)

Flexi EDGE BTS Sync Test cable (ESTA) can be used to gain access to 13 MHz and Frame Clock signals. These signals are needed when measuring the BTS RF performance with external test equipment.

The sync test cable (ESTA) can be ordered separately from Nokia HWS. The code is 471521A.

The description of the cable connectors are as follows:

- MDR14: This is inserted into the SYNC OUT connector on the ESMA System Module
- BNC-1 (TSTCLK): Provides 13 MHz clock signal for external test equipment (reference clock for RF measurements)
- BNC-2 (TSTFCLK_OUT) : Provides Frame Clock signal (approx.. 217 Hz) for external test equipment.

Connector pin assignments are listed in the table below.

Connector	Pin	Signal
MDR14	11 10 13 14	TSTCLK_OUT Ground TSTFCLK_OUT Ground
BNC 1	Center Body	TSTCLK_OUT Ground
BNC 2	Center Body	TSTFCLK_OUT Ground

Table 10 Connector pin assignments

Sync Test cable is presented in the figure below.

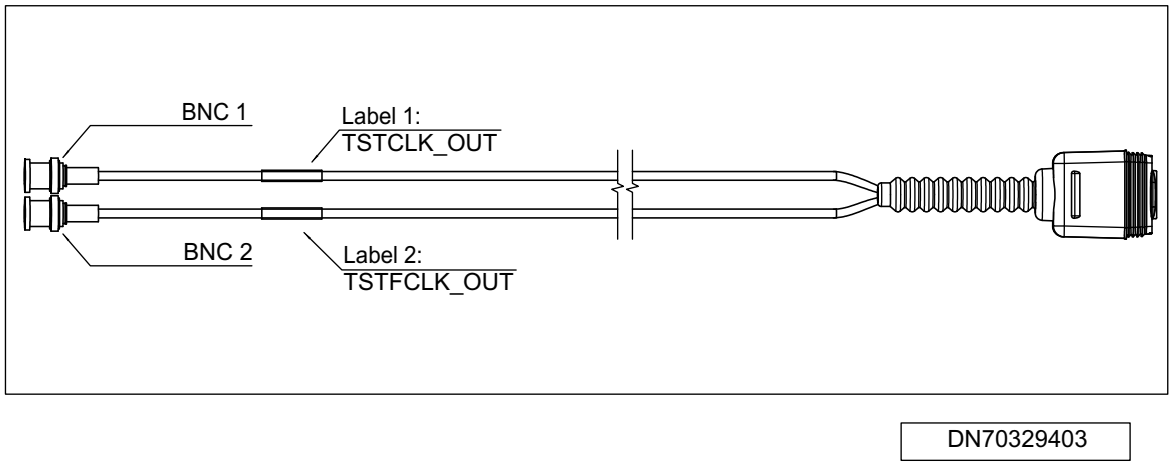

Figure 36 Flexi EDGE BTS Sync Test cable (ESTA)