Agilent Technologies 8960 Series 10 Wireless Communications Test Set

Manual Operation Guide

Making 3GPP TS 34.121 Tests Manually

W-CDMA/HSDPA Mobile Test Application E1963A Revision A.09
W-CDMA/HSDPA Lab Application E6703C Revision C.04
W-CDMA/HSDPA Lab Application E6703D Revision D.00

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Introduction

The intent of this guide is to help you quickly learn how to use the E1963A and E6703C/D W-CDMA/HSDPA Test and Lab Applications to manually make UE receiver and transmitter tests as specified in the 3GPP TS 34.121 standard.

The Appendix includes additional information to help you perform the 3GPP TS 34.121 tests:

- What 3GPP W-CDMA/HSDPA Conformance Tests Are Supported? table that shows which tests are supported by the test set.

- General procedures that are required to set up the measurements.

- Calibration procedures that must be performed periodically when testing UEs with the test set.

- Amplitude Offset information to help you properly account for losses in your system.

The scope of this guide does not cover the numerous features and capabilities of the test set. For details, refer to the E1963A, E6703C/D/T Online User's Guide which is available at:

- http://wireless.agilent.com/rfcomms/refdocs/wcdma/default.php, or

- User Documentation CD-ROM shipped with your application

1 Making 3GPP TS 34.121 Tests

This chapter demonstrates the step-by-step procedures for making many of the tests specified in the 3GPP TS 34.121 standard. The procedures for each test are based on one set of settings as specified for the test. However, the general setup procedures are the same for other sets of settings. To learn more about which tests are supported by the test set.

Table 1-1. Measurement Procedures

Measurement	General Measurement Procedure	3GPP TS 34.121 Test Procedure
ACLR	How Do I Make an Adjacent Channel Leakage Ratio (ACLR) Measurement?	5.10 5.10A *(lab application or feature-licensed test application only)*
BLER	How Do I Make a Block Error Ratio (BLER) Measurement?	7.2.1 7.3.1: *http://cp.literature.agilent.com/litweb/pdf/1000-1894.pdf*
Change of TFC *(lab application only)*	How Do I Make a Change of TFC (Transport Format Combination) Measurement?	5.6: Measuring 3GPP TS 34.121 5.6 Change Of TFC
Channel Power	How Do I Make a Channel Power Measurement?	5.2A *(lab application or feature-licensed test application only)*: Measuring 3GPP TS 34.121 5.2A Maximum Output Power with HS-DPCCH 5.4.3: Measuring 3GPP TS 34.121 5.2A Maximum Output Power with HS-DPCCH
Code Domain	How Do I Make a Code Domain Measurement?	
Data Throughput Monitor *(lab application only)*	How Do I Use the Data Throughput Monitor?	
Dynamic Power Analysis	How Do I Make a Dynamic Power Analysis Measurement?	5.7A *(lab application or feature-licensed test application only)*: Measuring 3GPP TS 34.121 5.7A HS-DPCCH
HSDPA BLER *(lab application or feature-licensed test application only)*	How Do I Make an HSDPA Block Error Ratio Measurement?	6.3A: Measuring 3GPP TS 34.121 6.3A Maximum Input Level for HS-PDSCH Reception (16QAM)

Table 1-1. Measurement Procedures

Measurement	General Measurement Procedure	3GPP TS 34.121 Test Procedure
Inner Loop Power	How Do I Make an Inner Loop Power Measurement?	5.4.2: Measuring 3GPP TS 34.121 5.4.2 Inner Loop Power Control in the Uplink
IQ Tuning	How Do I Make an IQ Tuning Measurement?	
Loopback BER	How Do I Make a Loopback Bit Error Ratio (BER) Measurement?	6.2 6.3
Occupied Bandwidth	How Do I Make an Occupied Bandwidth (OBW) Measurement?	5.8
Out-of-Synch Handling of Output Power *(lab application only)*	How Do I Make an Out-of-Synch Handling of Output Power Measurement?	5.4.4: Measuring 3GPP TS 34.121 5.4.4 Out-of-Synchronization Handling of Output Power
Phase Discontinuity	How Do I Make a Phase Discontinuity Measurement?	5.13.3
PRACH Preamble Analysis *(lab application only)*	How Do I Make a PRACH Preamble Analysis Measurement?	5.13.4
PRACH Transmit On/Off Power	How Do I Make a PRACH Transmit On/Off Power Measurement?	5.4.1: Measuring 3GPP TS 34.121 5.4.1 Open Loop Power Control in the Uplink 5.5.1: Measuring 3GPP TS 34.121 5.5.1 Transmit OFF Power 5.5.2: Measuring 3GPP TS 34.121 5.5.2 Transmit ON/OFF Time Mask
SEM	How Do I Make a Spectrum Emission Mask Measurement?	5.9 5.9A *(lab application or feature-licensed test application only)*
Spectrum Monitor	How Do I Use the Spectrum Monitor?	
Thermal Power	How Do I Make a Thermal Power Measurement?	5.2: Measuring 3GPP TS 34.121 5.2 Maximum Output Power
TX Dynamic Power	How Do I Make a TX Dynamic Power Measurement?	

Table 1-1. Measurement Procedures

Measurement	General Measurement Procedure	3GPP TS 34.121 Test Procedure
Waveform Quality	How Do I Make a Waveform Quality Measurement?	5.3: Measuring 3GPP TS 34.121 5.3 Frequency Error 5.13.1 5.13.1A (*(lab application or feature-licensed test application only)*: Measuring 3GPP TS 34.121 5.13.1A Error Vector Magnitude (EVM) with HS-DPCCH 5.13.2

How Do I Make an Adjacent Channel Leakage Ratio (ACLR) Measurement?

NOTE	Before performing this measurement, ensure that the test set has been properly calibrated.

Measuring Adjacent Channel Leakage Ratio

1. Establish an `RB Test Mode` connection between the UE and test set.

2. Press the **Measurement selection** key.

3. Select `Adjacent Channel Leakage Ratio`.

4. Select `ACLR Setup` (**F1**):

   - Set the measurement parameters as needed for your measurement situation, such as turning the measurements on or off for the different frequency offsets.

   - Select `Close Menu` (**F6**).

5. If `Trigger Arm` is set to `Single`, you must press the **START SINGLE** key to begin the measurement.

6. Press the `Change View` (**F2**) key to display the measurement results in either graphical or numeric format.

7. If using the graphical display, press `Graph Limits` (**F5**) to enter the pass/fail measurement limit for each of the four frequency offsets (shown in the graphical measurements example below as the thin lines above each measurement).

How Do I Make an Adjacent Channel Leakage Ratio (ACLR) Measurement?

A typical result is shown below.
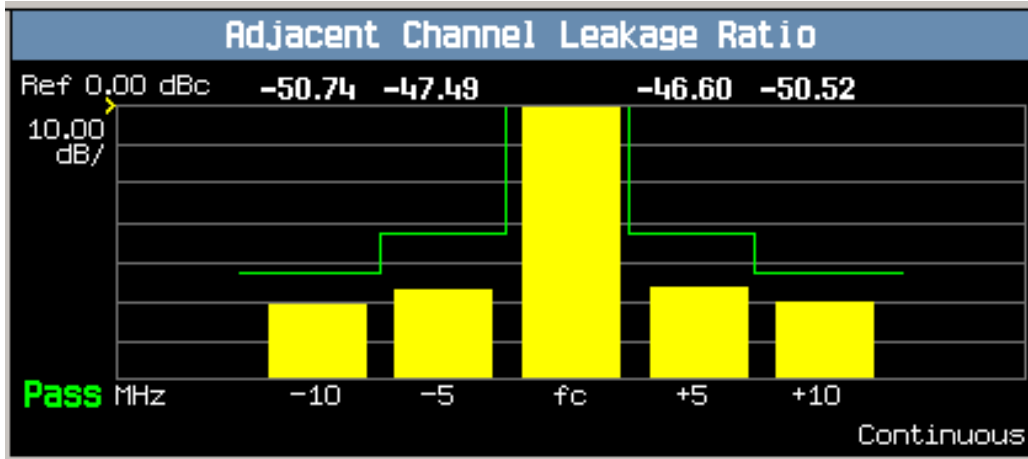
How Do I Make a Block Error Ratio (BLER) Measurement?

Measuring Block Error Ratio

1. Press the **Measurement selection** key.

2. Select the `Block Error Ratio` measurement.

3. Select `Block Error Setup` (**F1**) and set the measurement parameters as needed.

   - For Symmetrical RMCs, you must set Uplink DTCH RMC CRC Presence to `Used for Data` and UE Loopback Type to `Type 2`.

   - Select `Close Menu` (**F6**).

4. Establish an `RB Test Mode` connection between the UE and test set.

5. If `Trigger Arm` is set to `Single`, you must press the **START SINGLE** key to begin the measurement.

NOTE   The time for the measurement to complete increases linearly with the `Number of Blocks to Test`. For example, to test 500 blocks while on a 12.2k RMC takes approximately 10 seconds (500 blocks x 20 ms/block = 10 seconds). A measurement result is not displayed until the `Number of Blocks to Test` has been tested. If you are testing more than 500 blocks, the block counter increments every 500 blocks to indicate measurement progress.

---

6. Adjust `Cell Power` (**F7**), `AWGN Power` (**F4**), `Soft Handoff` (**F3**) and `Cell 2 Power` (**F2**) as desired.

An example measurement result is shown below:
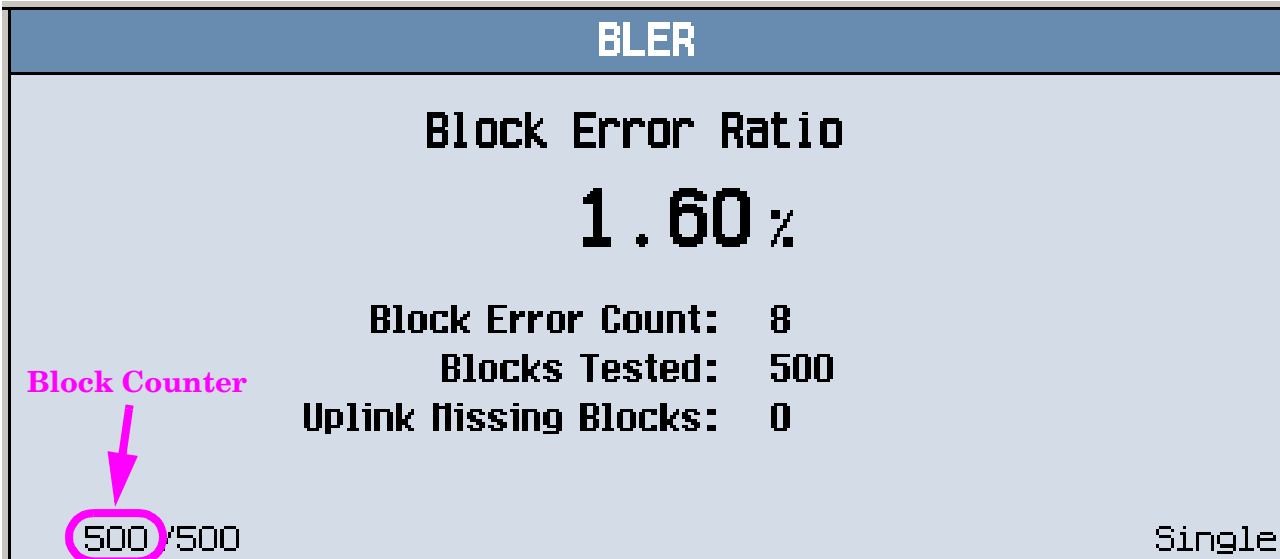
How Do I Make a Block Error Ratio (BLER) Measurement?

For an example of performing BLER measurements while on a faded channel, refer to the:

 E5515C Fading Solution Application Guide

It can be downloaded at *http://cp.literature.agilent.com/litweb/pdf/1000-1894.pdf*.

How Do I Make a Change of TFC (Transport Format Combination) Measurement?

This section is only applicable to the lab application.

Measuring 3GPP TS 34.121 5.6 Change Of TFC

1. Ensure that the test set has been properly calibrated.

2. Set the downlink and uplink channels:

   - Set `Operating Mode` (**F1**) to `Cell Off`.
   - Set `DL Channel` (**F10**) and `Uplink Channel` (**F11**) to the appropriate "mid range" frequencies for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band I, `DL Channel = 10700` and `Uplink Channel = 9750`).
   - Set `Operating Mode` to `Active Cell`.

3. Ensure `Uplink Dummy DCCH Data` is set to its default value of `Off` (select `RB Test Mode Setup`, **F6** on `Call Control 3 of 4`).

4. Ensure `Uplink DPCH Bc/Bd Control` is set to its default value of `Auto` (select `Uplink Parameters`, **F4** on `Call Control 2 of 4`).

5. Ensure `UL CL Power Ctrl Algorithm` is set to its default value of `Two` (select `UL CL Power Ctrl Parameters`, **F8** on `Call Parms 3 of 3`).

6. Establish a `12.2k RMC RB Test Mode` connection between the UE and test set.

7. Ensure that the `Connected DL Channel Levels` are set to their default values, as required by 3GPP TS 34.121 Table E.3.1 (select `Generator Info`, **F3** on `Call Control 2 of 4`).

8. Set `Cell Power` (**F7**) to `-93 dBm`.

9. Set `UE Target Power` (**F7** on `Call Parms 3 of 3`) to `0 dBm`. Ensure that `UL CL Power Ctrl Mode` is set to its default value of `Active Bits` (select `UL CL Power Ctrl Parameters`, **F8** on `Call Parms 3 of 3`).

10. Set `UL CL Power Ctrl Mode` to `Alternating bits`.

11. Press the **Measurement selection** key.

12. Select `Change Of TFC`.

13. Select `Change Of TFC Setup` (**F1**).

   - Set Step Down Size to -7 dB.
   - Set Step Up Size to 7 dB.
   - Set Step Error Limit: Upper to 2 dB.
   - Set Step Error Limit: Lower to - 2 dB.
   - Select `Close Menu` (**F6**).

How Do I Make a Change of TFC (Transport Format Combination) Measurement?

14. Press the **START SINGLE** key to begin the measurement.

15. Verify that the Step Down Error and Step Up Error test results are Pass.

```
          Change Of TFC

   Step Down Relative Power:    -7.38 dB
           Step Down Error:     -0.38 dB Pass
   Step Up Relative Power:       7.37 dB
             Step Up Error:      0.37 dB Pass

                                          Single
```

How Do I Make a Channel Power Measurement?

- Measuring 3GPP TS 34.121 5.2A Maximum Output Power with HS-DPCCH

- Measuring 3GPP TS 34.121 5.4.3 Minimum Output Power

Before performing these procedures, ensure that you have specified the proper Amplitude Offset for your test setup, and that the test set has been properly calibrated.

Measuring 3GPP TS 34.121 5.2A Maximum Output Power with HS-DPCCH

This section is applicable to the lab application or feature-licensed test application only.

3GPP TS 34.121 5.2A measures the UE's maximum output power when the HS-DPCCH is present. For ease of measurement, the test requires you to configure the UE such that the HS-DPCCH is always transmitted, and at a constant level. This is accomplished by setting `DeltaACK`, `DeltaNACK` and `DeltaCQI` to `8`, by setting `CQI Feedback Cycle (k)` to `4 ms` and `CQI Repetition Factor` to `2`, and by setting `Ack-Nack Repetition Factor` to `3` (required because the test is performed using H-Set 1, which has an X00X00 data transmission pattern).

1. Set parameters that can only be set in cell off operating mode (and other parameters that are set from the same menu):

   - Set `Operating Mode` (**F1**) to `Cell Off`.

   - Select `Channel (UARFCN) Parms` (**F12** on `Call Parms 1 of 3`). Set `DL Channel` (**F7**) and `Uplink Channel` (**F8**) to the appropriate "low range" frequencies for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band II, set `DL Channel = 9663` and `Uplink Channel = 9263`).

   - Select `Uplink Parameters` (**F4** on `Call Control 2 of 4`).

     — Set `Uplink DPCH Bc/Bd Control` to `Manual`.

     — Set `Manual Uplink DPCH Bc` to the value corresponding to the first 34.121 v7.0.0 Table C.10.1.4 sub-test you wish to test (for example, for sub-test 3, set `Manual Uplink DPCH Bc` to `15`).

     — Set `Manual Uplink DPCH Bd` to the value corresponding to the first 34.121 v7.0.0 Table C.10.1.4 sub-test you wish to test (for example, for sub-test 3, set `Manual Uplink DPCH Bd` to `8`).

     — Set `Maximum Uplink Transmit Power Level` to `21 dBm`.

     — Note, Qqualmin and Qrxlevmin are fixed to -24 dB and -115 dBm, respectively, in the test set.

   - Set `Operating Mode` to `Active Cell` (pressing the **CALL SETUP** key quickly brings you back to the top level `Call Control` menu).

2. Set `Channel Type` (**F8**) to `12.2k RMC + HSDPA`.

3. Select `HSDPA Parameters` (**F10**).

   - Select `HSDPA RB Test Mode Setup` (**F8**).

     — Set `HS-DSCH Configuration Type` to `FRC` (this is the default value).

     — Set `FRC Type` to `H-Set 1 QPSK` (this is the default value).

How Do I Make a Channel Power Measurement?

— Set `CN Domain` as needed (by default it is set to `PS Domain`). Note, before you can establish a connection in the PS domain, the UE must attach to the test set. To enable this, the `PS Domain Information` parameter (under `Cell Parameters`, **F12** on `Call Control 2 of 4`) must be set to `Present` when the UE registers (attaches) with the test set.

- Select `HSDPA Uplink Parameters` (**F11**).

  — Set `DeltaACK, DeltaNACK` and `DeltaCQI` to 8.

  — Set `Ack-Nack Repetition Factor` to 3.

  — Set `CQI Feedback Cycle (k)` to 4 ms.

  — Set `CQI Repetition Factor` to 2.

4. Select `Cell Parameters` (**F2** on `Call Control 2 of 4`).

   - Set `Default DPCH Offset (DOFF)` to `3 x 512 chips`.

   - Set `PS Domain Information` to `Present` (this is the default value in the lab application only) if you plan to establish the HSDPA connection in the PS domain (i.e. if you've set `CN Domain` to `PS Domain` in step 3 above).

5. Select `Generator Info` (**F3** on `Call Control 2 of 4`), select `Connected DL Channel Levels` (**F4**), then select `HSDPA Conn DL Channel Levels` (**F4**).

   - Set `Cell 1 Connected HSDPA CPICH Level` to `-10 dB` (this is the default value).

   - Set `Cell 1 Connected HSDPA P-CCPCH/SCH Level` to `-12 dB` (this is the default value).

   - Set `Cell 1 Connected HSDPA PICH Level` to `-15 dB` (this is the default value).

   - Set `Cell 1 Connected HSDPA DPCH Level` to `-9 dB`.

   - Set `Cell 1 Sum of Active Conn HS-PDSCH Levels` to `-3 dB` (this is the default value).

   - Set `Cell 1 Connected HS-SCCH 1 Level` to `-8 dB`.

6. Set any other parameters needed to establish a connection with your UE, then power on the UE and wait for it to register (attach).

7. Select `Originate Call` (**F3** on `Call Control 1 of 4`).

8. Set `Cell Power` (**F7** on `Call Parms 1 of 3`) to `-86 dBm/3.84 MHz`.

9. Select `UL CL Power Ctrl Parameters` (**F8** on `Call Parms 3 of 3`).

   - Set `UL CL Power Ctrl Mode` to `Active bits` (this is the default value).

   - Set `UL CL Power Ctrl Algorithm` to `Two` (this is the default value). 34.121 specifies algorithm 1 in Annex I, but due to the fact that the test is performed with all up bits, either algorithm produces the same result.

10. Set `UE Target Power` (**F7** on `Call Parms 3 of 3`) to a high value, such as `24 dBm`. The test set drives the UE to the specified level (or simply continues to send all up bits if the UE does not reach that level), while also appropriately ranging the test set's measurement receiver.

11. Select `UL CL Power Ctrl Parameters` (**F8**). Set `UL CL Power Ctrl Mode` to `All Up bits`.

12. Press the **Measurement selection** key.

13. Select `Channel Power`.

14. Set up the measurement:

- Select `Channel Power Setup` (**F1**).

- Set `RRC Filter` to `Off` (this is the default value), in order to measure "mean power".

- Set `Trigger Arm` to `Single`, if desired.

- Set `Trigger Source` to `HS-DPCCH`.

- Set `Measurement Interval` to `666.7 us` (one timeslot). This is the default value.

- Select `Close Menu` (**F6**).

15. If you set `Trigger Arm` to `Single`, press the **START SINGLE** key to begin the measurement.

16. Verify that the measured output power falls within the range specified by 34.121 Table 5.2A.2. For example, for sub-test 3 and a power class 3 UE, the output power must be 23 dBm +2.7/-3.7 dB.
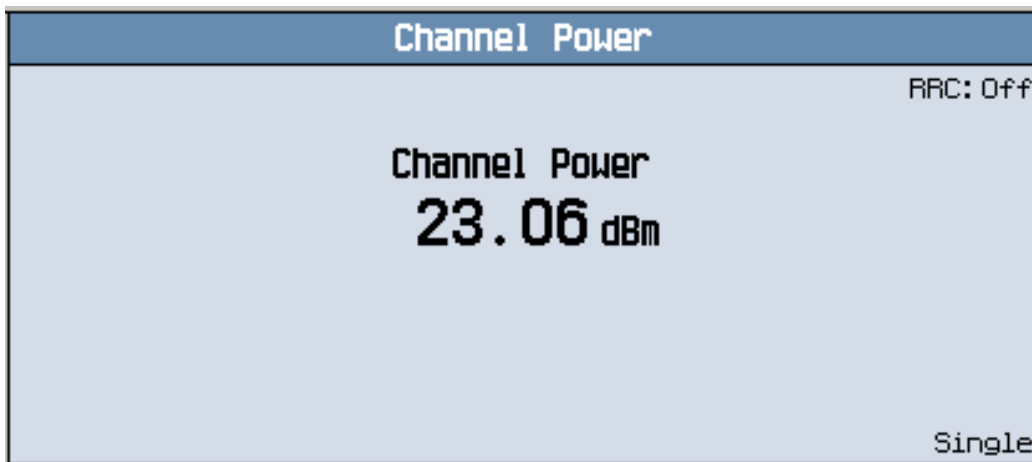
17. Repeat the test for "mid range" and "high range" frequencies (perform a Physical Channel Reconfiguration (Inter-frequency Hard Handoff)Physical Channel Reconfiguration (Inter-frequency Hard Handoff), then repeat steps 14 and 15).

18. Perform a Transport Channel Reconfiguration to change Beta$_c$ and Beta$_d$ to the values for any other 34.121 v7.0.0 Table C.10.1.4 sub-tests you wish to test (using the `TCR Manual Uplink DPCH Bc` and `TCR Manual Uplink DPCH Bd` settings), then repeat steps 14-16.
Note, it is important that you properly configure all of the Transport Channel Reconfiguration parameters before executing the handoff. For example, to maintain the proper settings for 5.2A, either set `TCR Timing Indication (CFN Handling)` to `Maintain` and `TCR Relative DPCH Frame Offset` to `0 chips` or set `TCR Default DPCH Offset (DOFF)` to `3 x 512 chips`. You must also set `TCR DeltaACK`, `TCR DeltaNACK` and `TCR DeltaCQI` to `8`, set `TCR Ack-Nack Repetition Factor` to `3`, set `TCR CQI Feedback Cycle (k)` to `4ms`, and set `TCR CQI Repetition Factor` to `2`.

Measuring 3GPP TS 34.121 5.4.3 Minimum Output Power

1. Ensure that you have specified the proper Amplitude Offset for your test setup.

2. Set the downlink and uplink channels:

- Set `Operating Mode` (**F1**) to `Cell Off`.

- Set `DL Channel` (**F10**) and `Uplink Channel` (**F11**) to the appropriate "low range" frequencies for

   your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band I, `DL Channel = 10563` and `Uplink Channel = 9613`).

   - Set `Operating Mode` to `Active Cell`.

3. Establish an `RB Test Mode` connection between the UE and test set.

4. Ensure that the `Connected DL Channel Levels` are set to their default values, as required by 3GPP TS 34.121 Table E.3.1 (select `Generator Info`, **F3** on `Call Control 2 of 4`).

5. Set `Cell Power` (**F7**) to `-93` dBm.

6. Set `Call Drop Timer` (**F11** on `Call Parms 2 of 3`) to `Off`.

7. Set `UE Target Power`:

   - Ensure that `UL CL Power Ctrl Mode` is set to its default value of `Active Bits` (select `UL CL Power Ctrl Parameters`, **F8** on the `Call Parms 3 of 3` menu).

   - Set `UE Target Power` (**F7**) to -55 dBm.

   The test set then drives the UE to the specified level, while also appropriately ranging its measurement receiver.

8. Return to the `UL CL Power Ctrl Parameters` menu (**F8**) and set `UL CL Power Ctrl Mode` to `All Down bits` and ensure that `UL CL Power Ctrl Algorithm` is set to `Two`. The test set then drives the UE to transmit at the lowest level possible.

9. Press the **Measurement selection** key.

10. Select `Channel Power`.

11. Set up the measurement:

   - Select `Channel Power Setup` (**F1**).

   - Ensure that `RRC Filter` is set to its default value of `Off` (to measure "mean power").

   - Set `Trigger Arm` to `Single`.

   - Ensure that `Measurement Interval` is set to its default value of `666.7 us` (one timeslot).

   - Select `Close Menu` (**F6**).

12. Press the **START SINGLE** key to begin the measurement.

13. Verify that the measured output power is less than -49 dBm.

```
┌─────────────────────────────────────────┐
│          Channel Power                    │
│                                RRC: Off   │
│                                           │
│          Channel Power                    │
│          -57.46 dBm                       │
│                                           │
│                                           │
│                                Single     │
└─────────────────────────────────────────┘
```
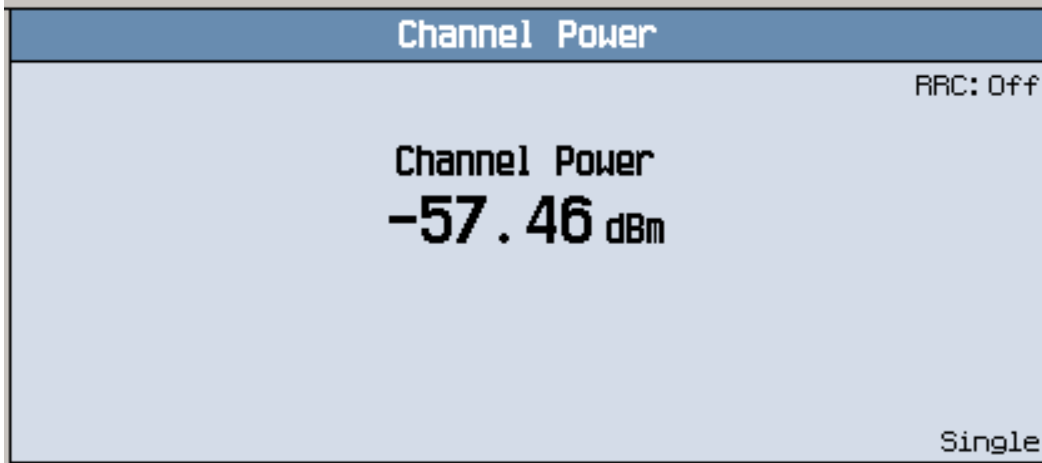
14. Repeat the test for "mid range" and "high range" frequencies (perform a Physical Channel Reconfiguration (Inter-frequency Hard Handoff), then repeat steps 11 and 12).

How Do I Make an HSDPA Block Error Ratio Measurement?

This section is only applicable to the lab application or a test application with the required feature license.

Measuring 3GPP TS 34.121 6.3A Maximum Input Level for HS-PDSCH Reception (16QAM)

This example is for `FDD Test Operating Mode`. The measurement is also available in `Active Cell Operating Mode`.

1. Set `Operating Mode` (**F1**) to `FDD Test`.

2. Set `Cell Power` (**F7**) to `-25.7 dB`.

3. Set `Channel Type` (**F8**) to `12.2k RMC + HSDPA`

4. Set `HSDPA Parameters` (**F10**):

   - Set `FRC Type` (**F8**) to `H-Set 1 16QAM`.
   - Set `FDD Test Number of Transmissions` (under `MAC-hs Parameters`) to `1`.
   - Set `FDD Test RV Sequence` (under `MAC-hs Parameters`) to `6,0,0,0,0,0,0,0` (simply enter `6` and then press the knob, the remaining values are automatically filled with zeros).
   - Set `FDD Test Primary H-RNTI (Hex)` (under `H-RNTI Parameters`) as needed.

5. Set `Channel (UARFCN) Parms` (**F12**): set `DL Channel` and `Uplink Channel` to the proper mid range frequencies for your UE's operating band.

6. Set `UE Target Power` (**F7**) to `20` or `18 dBm`, depending upon the class of your UE.

7. Set `FDD Test UL CL Power Ctrl Mode` to `Alternating bits` and `FDD Test UL CL Power Ctrl Algorithm` to `Two` (under `UL CL Power Ctrl Parameters` (**F8**)) (these are the default values).

8. Set `HSDPA DL Channel Levels` (**F4** under `Downlink Channel Levels`):

   - Set `HSDPA FDD Test CPICH Level` to `-10 dB` (this is the default value).
   - Set `HSDPA FDD Test P-CCPCH/SCH Level` to `-12 dB` (this is the default value).
   - Set `HSDPA FDD Test PICH Level` to `-15 dB` (this is the default value).
   - Set `HSDPA FDD Test DPCH Level` to `-13 dB`.
   - Set `Sum of Active FDD Test HS-PDSCH Levels` to `-3 dB` (this is the default value).
   - Set `FDD Test HS-SCCH 1 Level` to `-13 dB`.

9. Establish an `RB Test Mode` connection between the UE and test set. (In `FDD Test` operating mode the test set does not provide radio bearer setup control of the UE. You must configure the UE to synchronize to the test set, demodulate the downlink HS-SCCH and HS-PDSCH channels and generate the appropriate uplink HS-DPCCH.

10. Press the **Measurement selection** key.

11. Select `HSDPA Block Error Ratio`.

12. Select `HSDPA Blk Error Ratio Setup` (**F1**)

- Set `Number of blocks to test` to 500.
- Set `Trigger Arm` to `Single`.
- Select `Close Menu` (**F6**).

13. Press the **START SINGLE** key to begin the measurement. Wait approximately 3 seconds for the measurement to complete. Determine if the throughput exceeds 700 kbps, as required by 3GPP TS 34.121.

The following example shows results for an `FRC Type` of `H-Set 5 QPSK`:

```
        HSDPA Block Error Ratio

  Block Error Ratio      Information Bit Throughput

       0.00 %                  800.50 kbps

      ACKs:  500              Blocks Tested: 500
     NACKs:  0
   statDTXs: 0                Median CQI:  17


  500 /500                                   Single
```

How Do I Make an Inner Loop Power Measurement?

Measuring 3GPP TS 34.121 5.4.2 Inner Loop Power Control in the Uplink

1. Ensure that you have specified the proper Amplitude Offset for your test setup.

2. Ensure that the test set has been properly calibrated.

3. Set the downlink and uplink channels:

   - Set `Operating Mode` (**F1**) to `Cell Off`.
   - Set `DL Channel` (**F10**) and `Uplink Channel` (**F11**) to the appropriate "mid range" frequencies for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band I, `DL Channel = 10700` and `Uplink Channel = 9750`).
   - Set `Operating Mode` to `Active Cell`.

4. Establish an `RB Test Mode` connection between the UE and test set.

5. Ensure that the `Connected DL Channel Levels` are set to their default values, as required by 3GPP TS 34.121 Table E.3.1 (select `Generator Info`, **F3** on `Call Control 2 of 4`).

6. Set `Cell Power` (**F7**) to `-93 dBm`.

7. Press the **Measurement selection** key.

8. Select `Inner Loop Power`.

9. Select `Inner Loop Power Setup` (**F1**).

   - Set `Test Segment` to A.
   - Set `Number of Slots` as desired.
   - Select `Close Menu` (**F6**).

10. Press the **START SINGLE** key.

11. Verify that the overall test segment result is `Pass`.
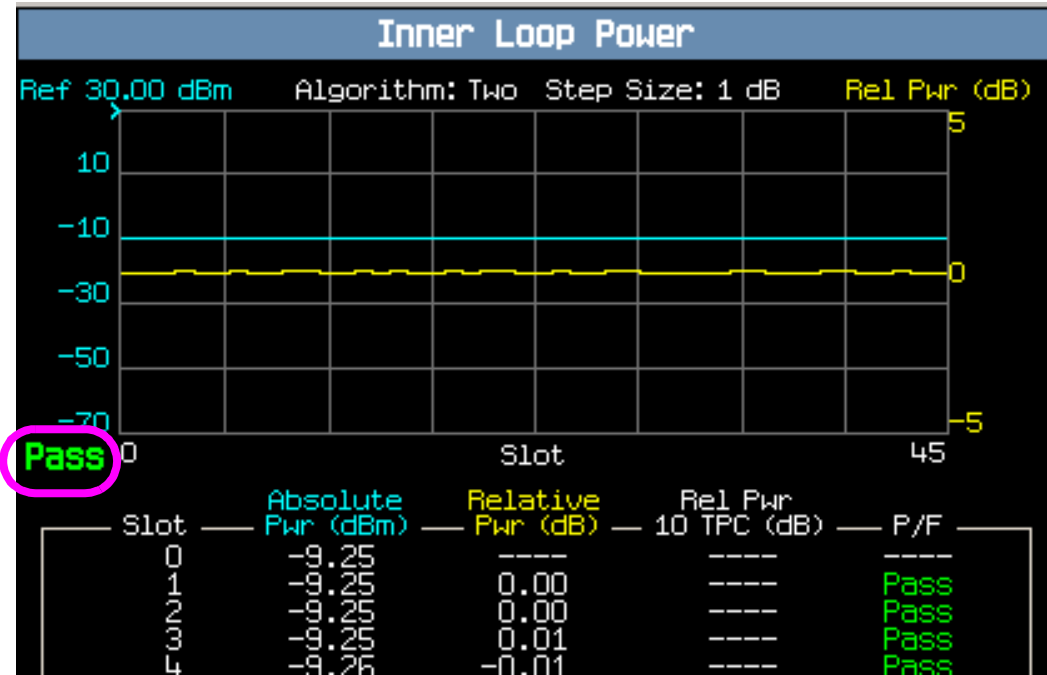
12. If desired, select `Axis Control` (**F2**).

- Set `Start`, `Span`, `Reference` and `dB/div` as needed to properly display the (blue) absolute power trace.

- Press the **More** key to move to `Axis Control 2 of 2`. Set `Relative Power` (**F1**) as needed to properly display the (yellow) relative power trace.

- Select `Return` (**F6**).

13. If desired, select `Marker` (**F3**) to turn on the marker on the graphical display and move the highlighted bar

in the numerical results display area.
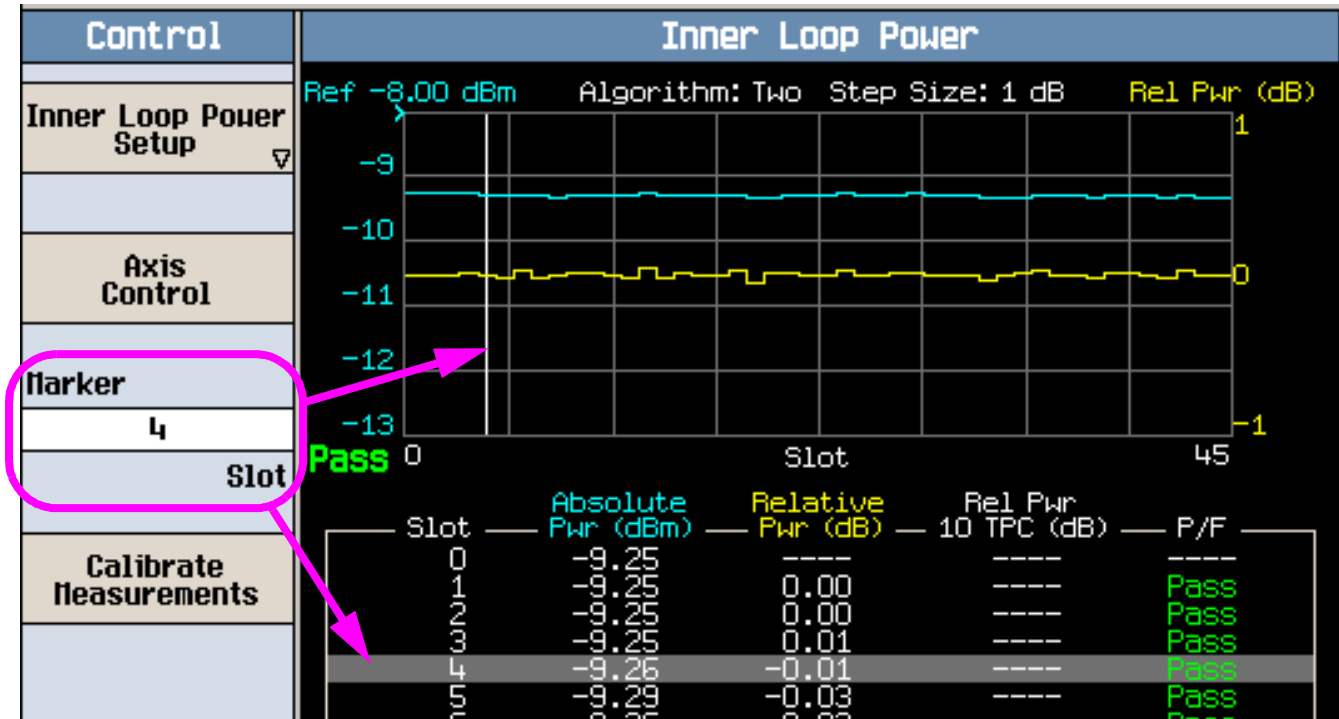
14. Select `Inner Loop Power Setup` (**F1**).

   - Set `Test Segment` to B.
   - Select `Close Menu` (**F6**).

15. Press the **START SINGLE** key.

16. Verify that the overall test segment result is `Pass`.

17. Repeat steps 14-16 for test segments C, E, F, G and H. Note: step D in 3GPP TS 34.121 5.4.2 is automatically performed as part of `Test Segment E`. For test segments E through H, ensure that `Maximum Power Threshold for Test Control` is set to `Auto`, `Maximum Output Power Test Tolerance` is set to `0.70 dB`, `Minimum Power Threshold for Test Control` is set to `Manual`, and `Minimum Power Threshold for Test Manual` is set to `-49 dBm` (these are the default values), as required by 3GPP TS 34.121

How Do I Make a Loopback Bit Error Ratio (BER) Measurement?

Measuring Loopback Bit Error Ratio

1. Press the **Measurement selection** key.

2. Select the `Loopback Bit Error Ratio` measurement.

3. Select `Bit Error Setup` (**F1**).

   - Set `Number of Bits to Test` to `10000`.
   - Set `Trigger Arm` to `Single`.
   - Set `Confidence Level` to `99.80%` (press the **ON** key).
   - Set `BER Requirement` to `0.10%`.
   - Set Uplink DTCH RMC CRC Presence to `Present` and UE Loopback Type to `Type 1`.

   Select `Close Menu` (**F6**).

4. Establish an `RB Test Mode` connection between the UE and test set.

5. Set UE Target Power to +21 dBm (for a Power Class 4 UE).

6. Set `Cell Power` (**F7**) to `-106 dBm` (for Operating Band I).

7. Press the **START SINGLE** key to begin the measurement.

8. If the `Confidence Test Result` is `Max Bits Tested`, start the measurement again. You may need to increase the `Number of Bits to Test` to enable a `Pass` or `Fail` result.

9. Adjust `Cell Power` (**F7**), `AWGN Power` (**F4**), `Soft Handoff` (**F3**) and `Cell 2 Power` (**F2**) as desired.

An example measurement result is shown below:

```
                      Loopback BER

  Bit Error Ratio           Confidence Test Result
       0.00 %                        Pass

 Bit Error Count:    0      Confidence Level: 99.80 %
 Missing Blocks:     0      BER Requirement:   0.10 %
 CRC Errors:         0      Bad DUT Factor:    1.50
 Loopback Delay:     6 frames

   6344        Bits Tested
 / 10000                                     Single
```

How Do I Make an Occupied Bandwidth (OBW) Measurement?

NOTE   Before performing this measurement, ensure that the test set has been properly calibrated.

Measuring Occupied Bandwidth

1. Establish an `RB Test Mode` connection between the UE and test set.

2. Press the **Measurement selection** key.

3. Select `Occupied Bandwidth`.

4. Select `Occupied BW Setup` (**F1**) and set the measurement parameters as needed. Select `Close Menu` (**F6**).

5. If `Trigger Arm` is set to `Single`, you must press the **START SINGLE** key to begin the measurement.

A typical result is shown below.
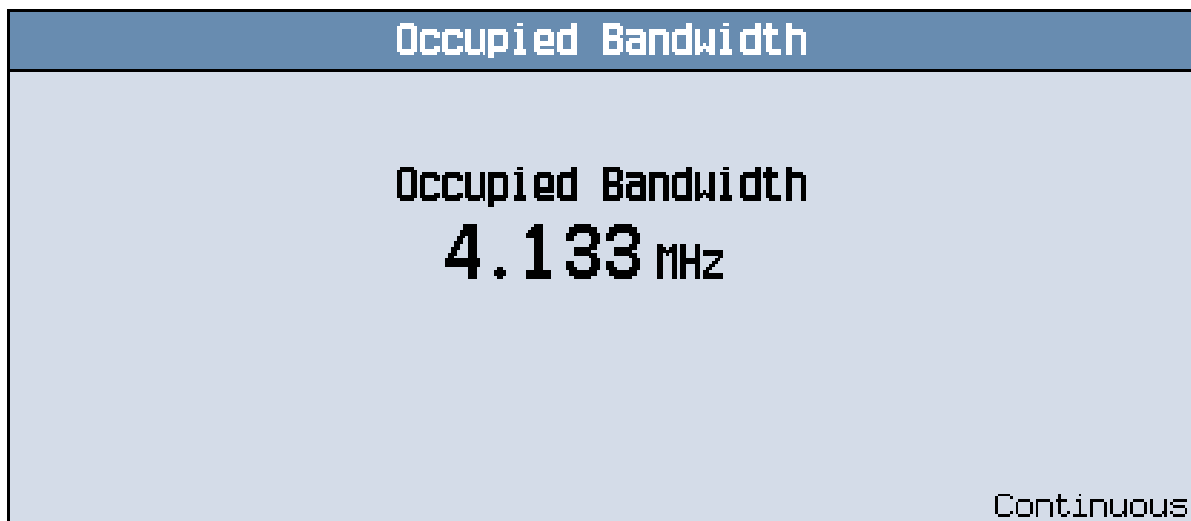
How Do I Make an Out-of-Synch Handling of Output Power Measurement?

This section is only applicable to the lab application.

Measuring 3GPP TS 34.121 5.4.4 Out-of-Synchronization Handling of Output Power

Connect the Test Set, Spectrum Analyzer and UE

1. Connect the UE to the test set's **RF IN/OUT** port and to the spectrum analyzer's **RF INPUT** port via an RF splitter.

2. Connect the test set's rear panel **TRIG OUT** port to the spectrum analyzer's **TRIGGER IN** port.

Configure the Spectrum Analyzer

This example uses an Agilent E4443A PSA Series Spectrum Analyzer.

1. Press the **MODE** key. Select `Spectrum Analysis`.

2. Press the **FREQUENCY** key. Set `Center Freq` to the appropriate "mid range" frequency for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band I, `1950.0 MHz`).

3. Press the **Amplitude** key.

   - Select `More` to move to the `2 of 3` menu. Set `REF Lvl OFFst` to `9 dB` to account for the loss due to the RF splitter (or to the appropriate value for your test setup).

   - Select `More` to move to the `1 of 3` menu. Set `Ref Level` to `-30 dBm` (or to the appropriate level for your test setup to allow accurate measurement of the UE's off power).

4. Press the **SPAN** key and select `Zero Span`.

5. Press the **Det/Demod** key. Set `Detector` to `Man` and choose `Average (Log/RMS/V)` (this also sets **BW/Avg**: `Avg/VBW Type` to `Pwr Avg (RMS)`).

6. Press the **BW/Avg** key. Set `Res BW` to `5 MHz`.

7. Press the **Sweep** key.

   - Set `Sweep Time` to `20 s`.
   - Set `Points` to `8001`. Select `Enter`.

8. Press the **Trig** key and select `Ext Rear` or `Ext Front`.

Configure the Test Set

1. Set the `RF IN/OUT Amplitude Offset` to `-9 dB` (or to the appropriate value for your test setup) to account for the loss due to the RF splitter (press the **SYSTEM CONFIG** key, then select `RF IN/OUT Amptd Offset` (**F5**)).

2. Set the downlink channel:

   - Set `Operating Mode` (**F1**) to `Cell Off`.

How Do I Make an Out-of-Synch Handling of Output Power Measurement?

- Set `DL Channel` (**F10**) to the appropriate "mid range" frequency for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band I, `DL Channel = 10700`).

- Set `Operating Mode` to `Active Cell`.

3. Select `Cell Parameters` (**F2**) from the `Call Control 2 of 4` menu.

   - Set UE Target Power to `S200`.

   - Set T313 UE Link Reestablishment Timer to `15 s`.

   - Set N315 UE In-Sync Counter to `S1`.

   Select `Close Menu` (**F6**).

4. Select `Generator Info` (**F3**). Select `Connected DL Channel Levels` (**F4**).

   - Set `Cell 1 Connected CPICH Level` to `-10.00 dB`.

   - Set `Cell 1 Connected P-CCPCH/SCH Level` to `-12.00 dB`.

   - Set `Cell 1 Connected S-CCPCH Level` to `Off`.

   - Set `Cell 1 Connected PICH Level` to `-15.00 dB`.

   - Set `Cell 1 Connected DPCH Level` to `-16.60 dB`.

   Select `Close Menu` (**F6**) and `Return` (**F6**).

5. Set Trigger Output Setup (**F6**) to `Measurement Generated`.

6. Establish a 12.2k `RB Test Mode` connection between the UE and test set.

7. Set UE Target Power (**F7** on the `Call Parms 3 of 3` menu) to `28 dBm`.

8. Select `UL CL Power Ctrl Parameters` (**F8**). Set UL CL Power Control Mode to `All Up bits`.

9. Set Cell Power (**F7** on the `Call Parms 1 of 3` menu) to `-61 dBm`.

10. Select `Generator Info` (**F3** on the `Call Control 2 of 4` menu) and set AWGN Power (**F5**) to `-60` dBm.

Initiate the Measurement from the Test Set

1. Press the **Measurement selection** key and choose `Out-of-Synch Handling of Output Power`.

2. Select `Out-of-Sync Power Setup` and set the parameters as needed. The default values are those specified by 3GPP TS 34.121 5.4.4. Select `Close Menu` (**F6**).

3. Press the **START SINGLE** key.

View the Measurement Results on the Spectrum Analyzer

A typical result is shown below.
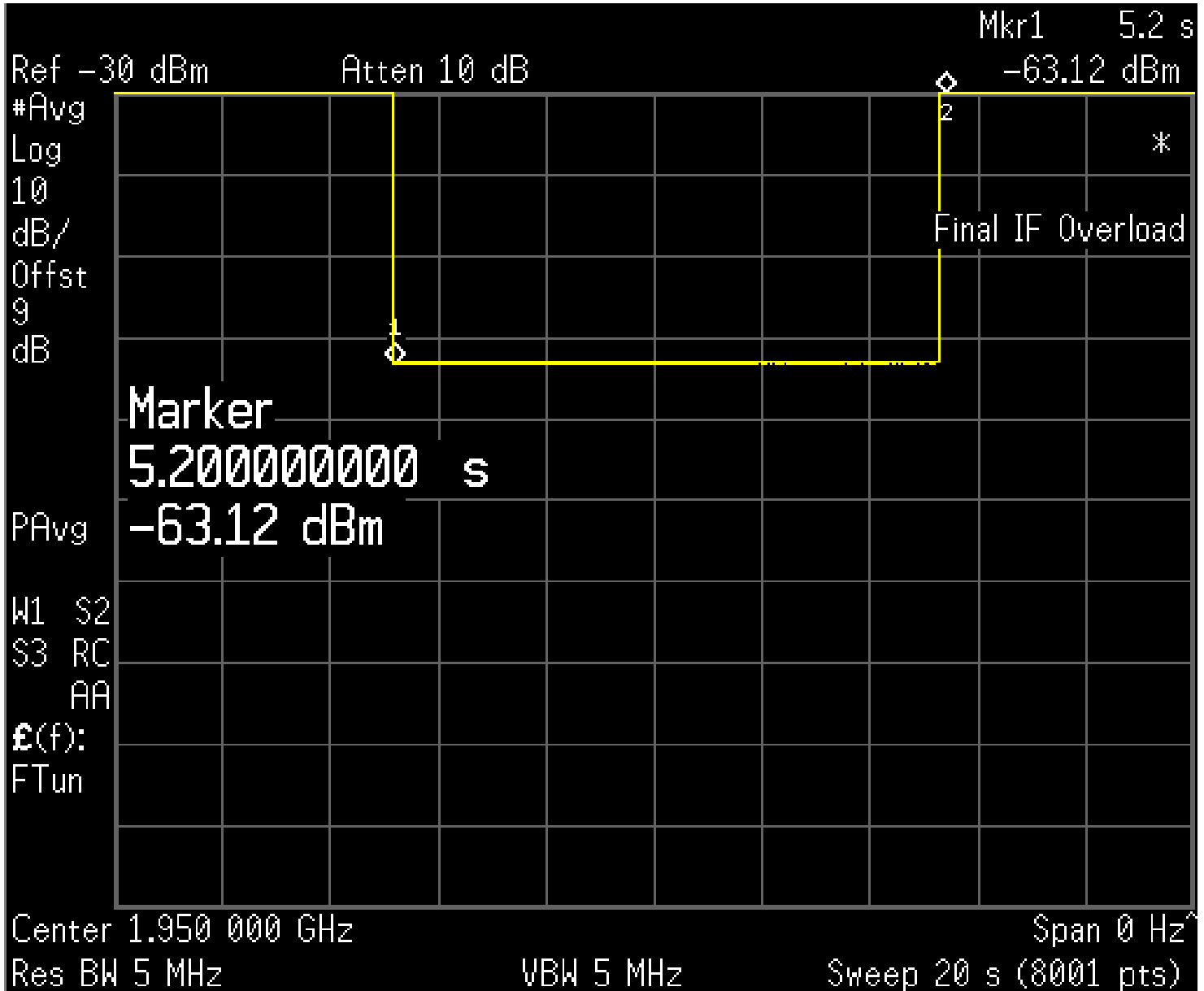
1. Press the **Marker** key.

   - Enter `5.2 s` for `Marker 1`. Ensure that the UE's output power is off (less than -55 dBm) at this marker position.

   - Select `Marker 2`. Select `Normal`. Enter `15.4 s`. Ensure that the UE's output power is on (greater than -49 dBm) at this marker position.

How Do I Make an Out-of-Synch Handling of Output Power Measurement?

Return Test Set Settings to Their Pre-Measurement Values

If desired, when you have completed the measurement, select `End Call` (**F3**) and return the following settings to their pre-measurement values:

- Select `Cell Parameters` (**F2**) from the `Call Control 2 of 4` menu.

  — Set `N313 UE Out-Of-Sync Counter` to `S2`.

  — Set `T313 UE Link Reestablishment Timer` to `3`.

  — Set `N315 UE In-Sync Counter` to `S50`.

  Select `Close Menu` (**F6**).

- Select `Generator Info` (**F3**). Select `Connected DL Channel Levels` (**F4**).

  — Set `Cell 1 Connected CPICH Level` to `-3.30 dB`.

  — Set `Cell 1 Connected P-CCPCH/SCH Level` to `-5.35 dB`.

  — Set `Cell 1 Connected S-CCPCH Level` to `Off`.

  — Set `Cell 1 Connected PICH Level` to `-8.33 dB`.

  — Set `Cell 1 Connected DPCH Level` to `-10.30 dB`.

  Select `Close Menu` (**F6**) and `Return` (**F6**).

- Set `Trig Output Setup` (**F6**) to `Sys Frame Clock`.

- Select `UL CL Power Ctrl Parameters` (**F8**). Set `UL CL Power Ctrl Mode` to `Active bits`.

- Set `UE Target Power` (**F7** on the `Call Parms 3 of 3` menu) as desired.

- Set `Cell Power` (**F7** on the `Call Parms 1 of 3` menu) as desired.

- Select `Generator Info` (**F3** on the `Call Control 2 of 4` menu) and set `AWGN Power` (**F5**) as desired.

# How Do I Make a Phase Discontinuity Measurement?

NOTE   Before performing a phase discontinuity measurement, ensure that the measurement has been
properly calibrated.

Measuring Phase Discontinuity

1. Establish an `RB Test Mode` connection between the UE and test set.

2. Set UL CL Power Control Mode to `Active Bits` (this is the default setting).

3. Set UE Target Power to the UE's maximum output power (for example, `21 dBm`).

4. Press the **Measurement selection** key.

5. Select the `Phase Discontinuity` measurement.

6. Select `Phase Discont. Setup` (**F1**)

   • Set `Power Control Pattern` to `5DOWN/4UP`.

   • Set `Number of Pattern Repetitions` to `10`.

   • Select `Close Menu` (**F6**).

7. Press the **START SINGLE** key to begin the measurement.

8. Select `Graph Control` (**F2**).

9. Select `Axis Control` (**F1**) to set the axis control parameters as needed:

   • `Start` (**F1**) determines the first slot result displayed.

   • `Span` (**F2**) determines the number of timeslots for which results are displayed.

   • `Phase Reference` (**F3** on `Axis Control 1 of 2`).

   • `Phase Range` (**F4** on `Axis Control 1 of 2`).

   • `Power Ref` (**F3** on `Axis Control 2 of 2`).

   • `Power Range` (**F4** on `Axis Control 2 of 2`).

   Select `Return` (**F6**).

10. Select `Trace Show/Hide` (**F4**) to choose which of the 3 available traces to display (`Phase
Discontinuity`, `Phase` and `Power`). Select `Close Menu` (**F6**).

11. Select `Marker` (**F2**) to turn on the marker on the graphical display and move the highlighted bar in the
numerical results display area. Scroll through the numerical data and locate the orange values indicating
worst case phase discontinuity and worst case EVM to determine whether the UE has met specifications for
this portion of the test.

12. Select `Table` (**F3**) to scroll through the 9 columns of numerical results available, as needed.

How Do I Make a Phase Discontinuity Measurement?

A typical result is pictured below:
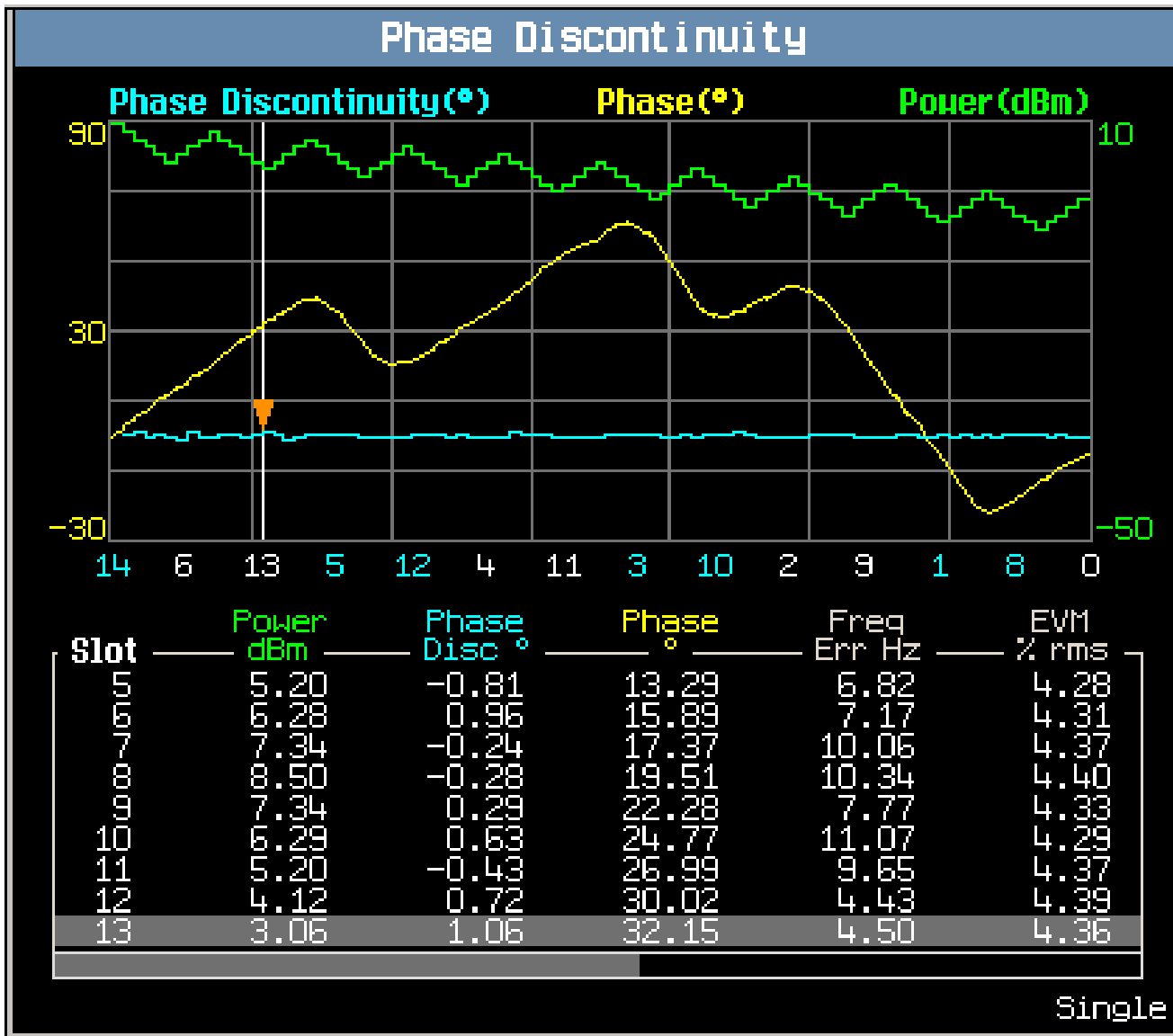
13. Select `Return` (**F6**).

14. Repeat steps 7-12 until the UE reaches its minimum output power (for example, -49 dBm). You can easily determine the UE's output power level by noting the UE Target Power level (**F7** on the `Call Parms 3 of 3` menu), because at the completion of the measurement, the test set sets `MS Target Power` to the UE's output power in the final measured slot).

You may choose to overlap the test subsequences by starting at an `MS Target Power` that is offset from the ending power level.

15. Select `Phase Discont. Setup` (**F1**)

- Set `Power Control Pattern` to `5UP/4DOWN`.
- Set `Number of Pattern Repetitions` to `10`.
- Select `Close Menu` (**F6**).

16. Repeat steps 7-12 until the UE reaches its maximum output power.

How Do I Make a PRACH Preamble Analysis Measurement?

This section is only applicable to the lab application.

NOTE   Before performing a PRACH preamble analysis measurement, ensure that the measurement has been properly calibrated.

Measuring PRACH Preamble Analysis

1. Power the UE on and wait for it to camp to the test set, but DO NOT establish a connection between the UE and test set.

2. Press the right **More** key until you reach the `Call Parms 2 of 3` menu. Ensure that `Call Limit State` (**F2**) is set to `Off`.

3. Press the left **More** key until you reach the `Call Control 2 of 4` menu. Select `Uplink Parameters` (**F4**).

4. Set the PRACH Signature parameters as needed.

5. Set PRACH Preambles to at least 3.

6. Set Available Subchannels (Bit Mask) to specify only one available subchannel. Select `Close Menu` (**F6**).

7. Press the **Measurement selection** key.

8. Select the `PRACH Preamble Analysis` measurement.

9. Select `PRACH Preamble Setup` (**F1**) and set the measurement parameters as needed. Select `Close Menu` (**F6**).

10. Set `Cell Power` (**F7**) as needed.

11. Press the **START SINGLE** key to begin the measurement.

12. Select `Graph Control` (**F2**).

13. Select `Axis Control` (**F1**). Set the axis control parameters as needed. Select `Return` (**F6**).

14.Select `Marker` (**F2**) to turn on the marker on the graphical displays.

PRACH Preamble Analysis

Relative Power dB	-2.620		EVM %	6.670

Phase Error °	0.450		IQ	

EVM (rms)	11.93 %	Magnitude Error	8.40 %
EVM (peak)	20.75 %	Timing Error	0.11 chip
Frequency Error	-26.69 Hz	IQ Gain Imbal	0.186 dB
Origin Offset	-19.5 dB	IQ Phase Imbal	2.272 °
Phase Error (rms)	4.8 °	Signature	0

Single
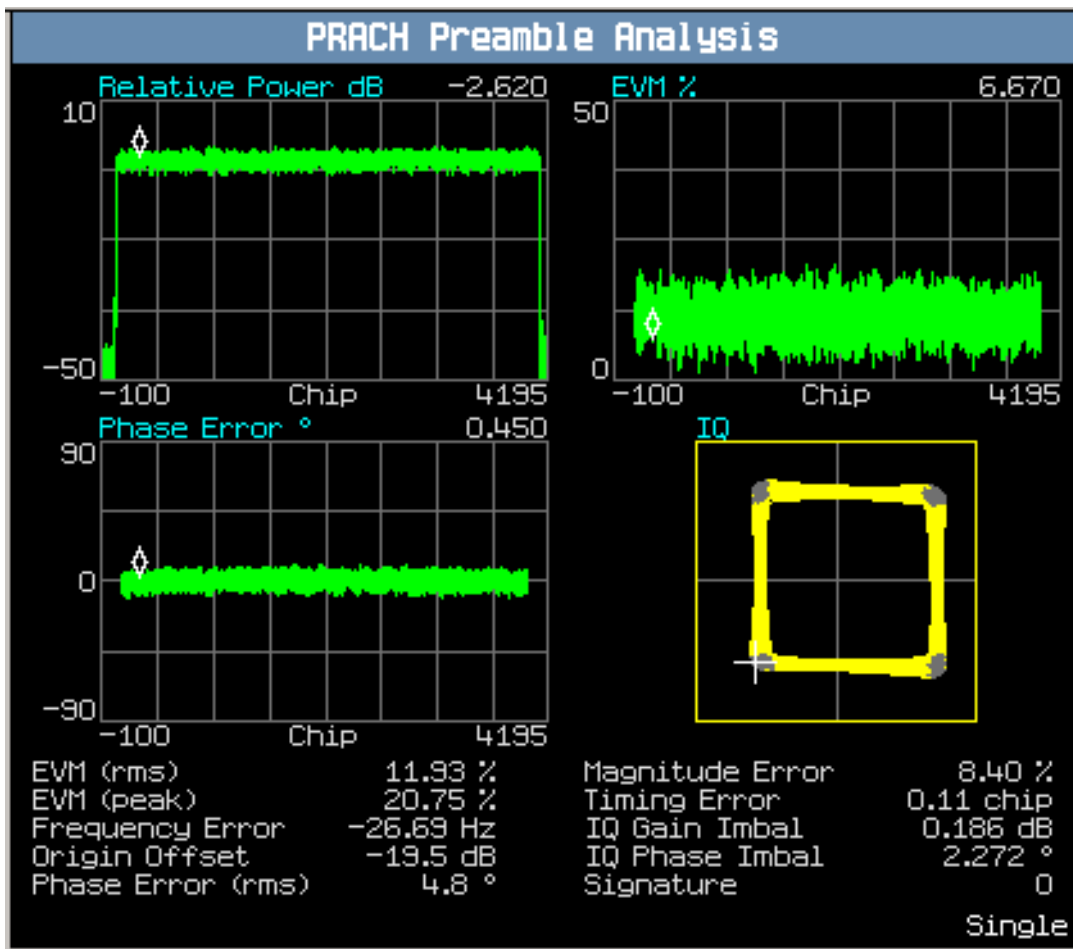
How Do I Make a PRACH Preamble Analysis Measurement?

15. Select `View Select` (**F3**) and then `Zoom View` (**F4**) to zoom on one of the graphical display results.
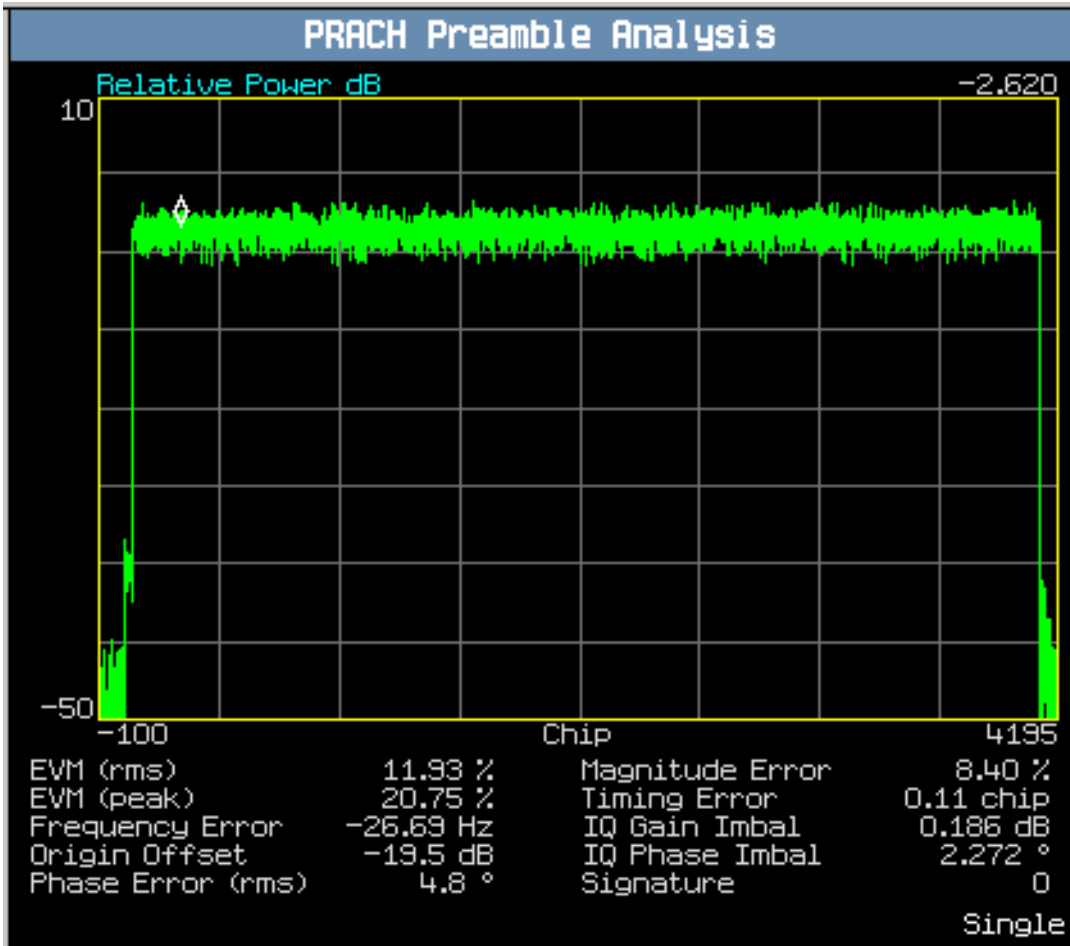
How Do I Make a PRACH Transmit On/Off Power Measurement?

Before performing any of these procedures, ensure that you have specified the proper Amplitude Offset for your test setup, and that the test set has been properly calibrated.

- Measuring 3GPP TS 34.121 5.4.1 Open Loop Power Control in the Uplink

- Measuring 3GPP TS 34.121 5.5.1 Transmit OFF Power

- Measuring 3GPP TS 34.121 5.5.2 Transmit ON/OFF Time Mask

Measuring 3GPP TS 34.121 5.4.1 Open Loop Power Control in the Uplink

1. Set the downlink and uplink channels, and downlink channel levels:

   - Set `Operating Mode` (**F1**) to `Cell Off`.

   - Set `DL Channel` (**F10**) and `Uplink Channel` (**F11**) to the appropriate "low range" frequencies for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band I, `DL Channel = 10563` and `Uplink Channel = 9613`).

   - Ensure that the `Downlink Channel Levels` are set to their default values, as required by 3GPP TS 34.121 Table E.2.2 (select `Generator Info`, **F3** on `Call Control 2 of 4`).

   - Set `Operating Mode` to `Active Cell`.

2. Set uplink parameters:

   - Select `Uplink Parameters` (**F4** from the `Call Control 2 of 4` menu).

   - Set `PRACH Preambles` to 4.

   - Set `PRACH Ramping Cycles (MMAX)` to 1

   - Set `Available Subchannels (Bit Mask)` to only allow one available subchannel (for example, the default value of 000000000001).

   - Set `Maximum Uplink Transmit Power Level` to the specified maximum output power of your UE (for example, 21 dBm for power class 4).

     Note: Qqualmin and Qrxlevmin are fixed to -24 dB and -115 dBm in the test set, as required by 3GPP TS 34.121 Table 5.4.1.1a.
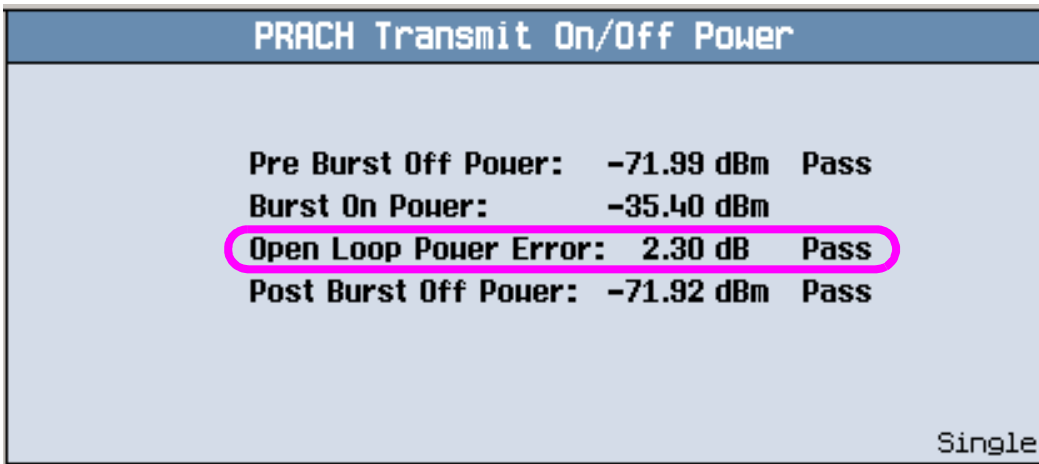
   - Select `Close Menu` (**F6**).

3. Set cell parameters:

   - Select `Cell Parameters` (**F2** from the `Call Control 2 of 4` menu).

   - Ensure that `Primary CPICH TX Power` is set to its default value of `19 dBm`.

   - Set `Uplink Interference` to `-75 dBm`.

   - Ensure that `Constant Value` is set to its default value of `-10 dB`.

   - Select `Close Menu` (**F6**).

How Do I Make a PRACH Transmit On/Off Power Measurement?

4. Connect the UE to the test set, power it on and wait for it to camp to the test set's signal, but do not originate a call between the test set and UE.

5. Set `Cell Power` (**F7** on `Call Parms 1 of 3`) to –25 dBm.

6. Ensure that `Call Limit State` (**F10** on `Call Parms 2 of 3`) is set to its default value of `Off`.

7. Press the **Measurement selection** key.

8. Select `PRACH Transmit On/Off Power`.

9. Select `PRACH TX On/Off Pwr Setup` (**F1**).

   - Ensure that `Open Loop Power Error Upper Limit` is set to its default value of `9 dB`.

   - Ensure that `Open Loop Power Error Lower Limit` is set to its default value of `-9 dB`.

   - Select `Close Menu` (**F6**).

10. Press the **START SINGLE** key to begin the measurement.

11. Verify that the `Open Loop Power Error` test result is `Pass`.

12. To test "RX-middle" or "RX-Sensitivity level" cases:

   - Set cell parameters:

     — Press the **CALL SETUP** key.

     — Select `Cell Parameters` (**F2** from the `Call Control 2 of 4` menu).

     — Set `BCCH Update Page` to `Auto` so the test set will notify the UE when you change the next two cell parameters.

     — Set `Primary CPICH TX Power` to `28 dBm` or `19 dBm`.

     — Set `Uplink Interference` to `-101 dBm` or `-110 dBm`.

     — Ensure that `Constant Value` is still set to `-10 dB`.

     — Select `Close Menu` (**F6**).

   - Set `Cell Power` (**F7**) to `-65.7 dBm` or `-106.7 dBm`.

   - Press the **MEASUREMENT** key to move to the `Measurement/Instrument` screen.

   - Press the **START SINGLE** key to begin the measurement.

- Verify that the `Open Loop Power Error` test result is `Pass`.

13. Repeat the test for "mid range" and "high range" frequencies. Note, if your UE does not camp to the test set at the new frequency, you may need to cycle the UE's power.

Measuring 3GPP TS 34.121 5.5.1 Transmit OFF Power

See Measuring 3GPP TS 34.121 5.5.2 Transmit ON/OFF Time Mask.

Measuring 3GPP TS 34.121 5.5.2 Transmit ON/OFF Time Mask

1. Set the downlink and uplink channels, and downlink channel levels:

   - Set `Operating Mode` (**F1**) to `Cell Off`.
   - Set `DL Channel` (**F10**) and `Uplink Channel` (**F11**) to the appropriate "low range" frequencies for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band I, `DL Channel = 10563` and `Uplink Channel = 9613`).
   - Ensure that the `Downlink Channel Levels` are set to their default values as required by 3GPP TS 34.121 Table E.2.2. (select `Generator Info`, **F3** on `Call Control 2 of 4`).
   - Set `Operating Mode` to `Active Cell`.

2. Set uplink parameters:

   - Select `Uplink Parameters` (**F4** from the `Call Control 2 of 4` menu).
   - Set `PRACH Preambles` to `4`.
   - Set `PRACH Ramping Cycles (MMAX)` to `1`.
   - Set `Available Subchannels (Bit Mask)` to only allow one available subchannel (for example, the default value of 000000000001).
   - Set `Maximum Uplink Transmit Power Level` to the specified maximum output power of your UE (for example, 21 dBm for power class 4).

     Note: Qqualmin and Qrxlevmin are fixed to -24 dB and -115 dBm in the test set, as required by 3GPP TS 34.121 Table 5.4.1.1a.

   - Select `Close Menu` (**F6**).

3. Set cell parameters:

   - Select `Cell Parameters` (**F2** from the `Call Control 2 of 4` menu).
   - Ensure that `Primary CPICH TX Power` is set to its default value of `19 dBm`.
   - Set `Uplink Interference` to the proper value for your UE's power class as required by 3GPP TS 34.121 Table 5.5.2.3 (for example, `-98 dBm` for power class 4).
   - Ensure that `Constant Value` is set to its default value of `-10 dB`.
   - Select `Close Menu` (**F6**).

4. Connect the UE to the test set, power it on and wait for it to camp to the test set's signal, but do not originate a call between the test set and UE.

5. Set `Cell Power` (**F7**) to `-106.7 dBm`.

How Do I Make a PRACH Transmit On/Off Power Measurement?

6. Ensure that `Call Limit State` (**F10** on `Call Parms 2 of 3`) is set to its default value of `Off`.

7. Press the **Measurement selection** key.

8. Select `PRACH Transmit On/Off Power`.

9. Select `PRACH TX On/Off Pwr Setup` (**F1**).

   - Ensure that `Off Power Limit` is set to its default value of `-55 dBm`.
   - Set `Open Loop Power Error Upper Limit` to `1.7 or 2.7 dB`, depending upon your UE's power class, as required by 3GPP TS 34.121 Table 5.2.2.
   - Ensure that `Open Loop Power Error Lower Limit` is set to its default value of `-9 dB`.
   - Select `Close Menu` (**F6**).

10. Press the **START SINGLE** key to begin the measurement.

11. Verify that the `Pre Burst Off Power`, `Open Loop Power Error` and `Post Burst Off Power` test results are `Pass`.
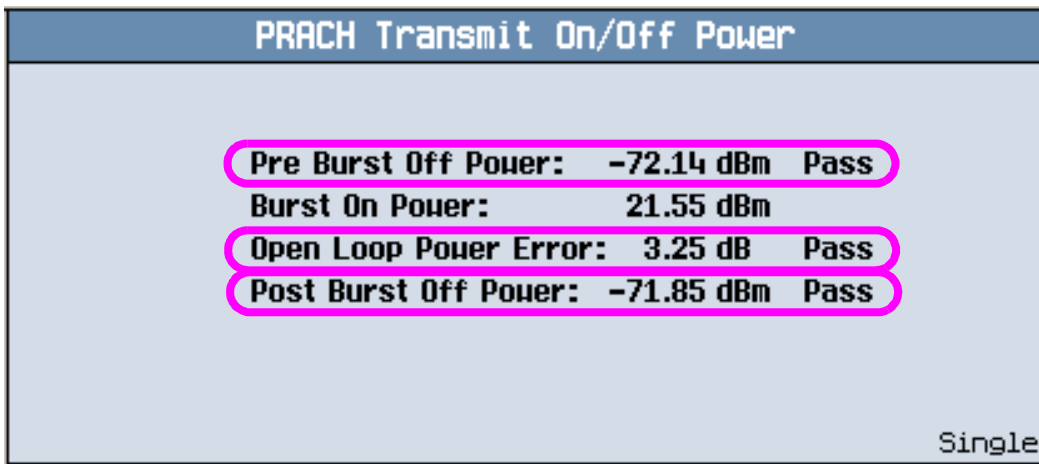
12. Repeat the test for "mid range" and "high range" frequencies. Note, if your UE does not camp to the test set at the new frequency, you may need to cycle the UE's power.

How Do I Make a Spectrum Emission Mask Measurement?

NOTE	Before performing this measurement, ensure that the test set has been properly calibrated.

Measuring Spectrum Emission Mask

1. Establish an `RB Test Mode` connection between the UE and test set.

2. Press the **Measurement selection** key.

3. Select `Spectrum Emission Mask`.

4. Select `SEM Setup` (**F1**) and set the measurement parameters as needed. Select `Close Menu` (**F6**).

5. If `Trigger Arm` is set to `Single`, you must press the **START SINGLE** key to begin the measurement.

6. Press the `Change View` (**F2**) key to display the measurement results in either graphical or numeric format.

How Do I Make a Spectrum Emission Mask Measurement?

A typical result is shown below.

Offset Range (MHz)	2.5 – 3.5	3.5 – 7.5	7.5 – 8.5	8.5 – 12.5
Level (dBc)	−65.80	−59.85	−60.44	−59.92
Freq Offset (MHz)	−3.44	−7.25	−8.50	−8.75
Mask Margin (dB)	16.63	21.10	11.44	10.92
	Pass	Pass	Pass	Pass

In-Channel Power: −27.68 dBm/3.84 MHz

Continuous

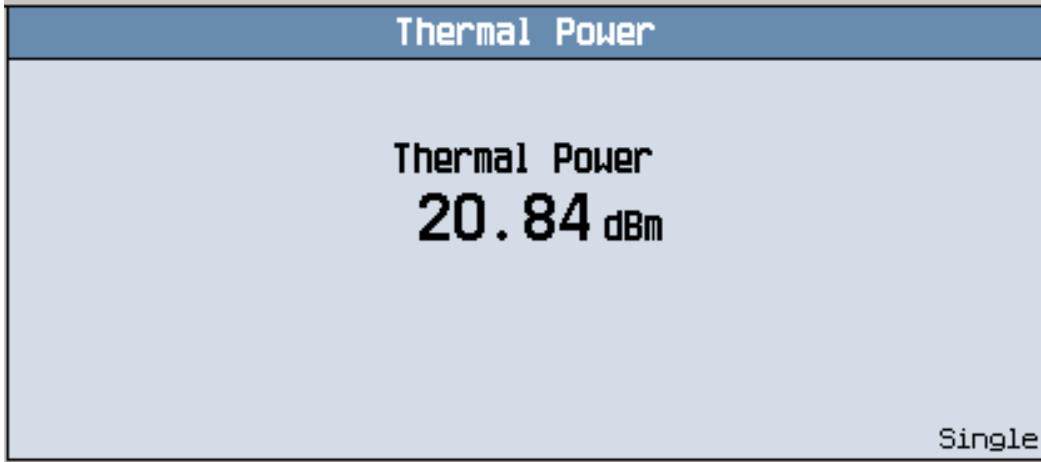# How Do I Make a Thermal Power Measurement?

Measuring 3GPP TS 34.121 5.2 Maximum Output Power

1. Ensure that you have specified the proper Amplitude Offset for your test setup.

2. Set the downlink and uplink channels:

   - Set `Operating Mode` (**F1**) to `Cell Off`.
   - Set `DL Channel` (**F10**) and `Uplink Channel` (**F11**) to the appropriate "low range" frequencies for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band I, `DL Channel = 10563` and `Uplink Channel = 9613`).
   - Set `Operating Mode` to `Active Cell`.

3. Establish an `RB Test Mode` connection between the UE and test set.

4. Ensure that the `Connected DL Channel Levels` are set to their default values, as required by 3GPP TS 34.121 Table E.3.1 (select `Generator Info`, **F3** on `Call Control 2 of 4`).

5. Set `Cell Power` (**F7**) to `-93 dBm`.

6. Set `UE Target Power`:

   - Select `UL CL Power Ctrl Parameters` (**F8** on the `Call Parms 3 of 3` menu) and set `UL CL Power Ctrl Mode` to `Active bits`.
   - Set `UE Target Power` (**F7**) to the specified maximum output power for your UE (for example, 21 dBm for power class 4).

   The test set then drives the UE to the specified level, while also appropriately ranging its measurement receiver.

7. Return to the `UL CL Power Ctrl Parameters` menu (**F8**) and set `UL CL Power Ctrl Mode` to `All Up bits` and set `UL CL Power Ctrl Algorithm` to `Two`. The test set then drives the UE to transmit at the highest level possible.

8. Press the **Measurement selection** key.

9. Select `Thermal Power`.

10. Select `Thermal Power Setup` (**F1**) and set `Trigger Arm` to `Single`. Select `Close Menu` (**F6**).

11. Press the **START SINGLE** key to begin the measurement.

How Do I Make a Thermal Power Measurement?

12. Verify that the measured output power is within the range specified by 3GPP TS 34.121 Table 5.2.2 (for example, 21 dBm +/- 2.7 dB for power class 4).

```
┌────────────────────────────────────────┐
│             Thermal Power              │
├────────────────────────────────────────┤
│                                        │
│            Thermal Power               │
│            20.84 dBm                    │
│                                        │
│                                        │
│                                        │
│                               Single   │
└────────────────────────────────────────┘
```

13. Repeat the test for "mid range" and "high range" frequencies.

How Do I Make a Waveform Quality Measurement?

- Measuring 3GPP TS 34.121 5.3 Frequency Error
- Measuring 3GPP TS 34.121 5.13.1A Error Vector Magnitude (EVM) with HS-DPCCH

Before performing these procedures, ensure that you have specified the proper Amplitude Offset for your test setup, and that the test set has been properly calibrated.

Measuring 3GPP TS 34.121 5.3 Frequency Error

1. Set the downlink and uplink channels:

    - Set `Operating Mode` (**F1**) to `Cell Off`.
    - Set `DL Channel` (**F10**) and `Uplink Channel` (**F11**) to the appropriate "low range" frequencies for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band I, `DL Channel = 10563` and `Uplink Channel = 9613`).
    - Set `Operating Mode` to `Active Cell`.

2. Establish an `RB Test Mode` connection between the UE and test set.

3. Ensure that the `Connected DL Channel Levels` are set to their default values, as required by 3GPP TS 34.121 Tables 5.3 and E.3.1 (select `Generator Info`, **F3** on `Call Control 2 of 4`).

4. Set `Cell Power` (**F7**) to `-106.7 dBm`.

5. Set `UE Target Power`:

    - Ensure that `UL CL Power Ctrl Mode` is set to its default value of `Active Bits` (select `UL CL Power Ctrl Parameters`, **F8** on the `Call Parms 3 of 3` menu).
    - Set `UE Target Power` (**F7**) to the specified maximum output power for your UE (for example, 21 dBm for power class 4).

    The test set then drives the UE to the specified level, while also appropriately ranging its measurement receiver.

6. Return to the `UL CL Power Ctrl Parameters` menu (**F8**) and set `UL CL Power Ctrl Mode` to `All Up bits` and ensure that `UL CL Power Ctrl Algorithm` is set to `Two`. The test set then drives the UE to transmit at the highest level possible.

7. Press the **Measurement selection** key.

8. Select `Waveform Quality`.

9. Select `Waveform Quality Setup` (**F1**) and set `Trigger Arm` to `Single`.

10. Press the **START SINGLE** key to begin the measurement.

11. Verify that the measured `Frequency Error` is less than +/- (0.1 ppm + 10 Hz). For an uplink frequency of 1922.6 MHz, this corresponds to a frequency error requirement of +/- 202.26 Hz.

12.Repeat the test for "mid range" and "high range" frequencies.

Measuring 3GPP TS 34.121 5.13.1A Error Vector Magnitude (EVM) with HS-DPCCH

This section is applicable to the lab application or feature-licensed test application only.

3GPP TS 34.121 5.13.1A measures EVM at two locations on a defined 12 ms UE power pattern: when the HS-DPCCH is off (the minimum power level in the pattern) and when the HS-DPCCH is on (the maximum power level in the pattern). The test is performed such that the 12 ms UE power pattern maximum corresponds to the UE's maximum output power as defined in 34.121 Table 5.2A.1. The test is also performed such that the 12 ms UE power pattern maximum corresponds to -13 dBm.

1. Set parameters that can only be set in cell off operating mode (and other parameters that are set from the same menu):

   - Set `Operating Mode` (**F1**) to `Cell Off`.

   - Select `Channel (UARFCN) Parms` (**F12** on `Call Parms 1 of 3`). Set `DL Channel` (**F7**) and `Uplink Channel` (**F8**) to the appropriate "low range" frequencies for your UE's operating band, as specified by 3GPP TS 34.108 5.1.1 (for example, for operating band II, set `DL Channel = 9663` and `Uplink Channel = 9263`).

   - Select `Uplink Parameters` (**F4** on `Call Control 2 of 4`).

     — Set `Uplink DPCH Bc/Bd Control` to `Manual`.

     — Set `Manual Uplink DPCH Bc` to `15` (for 34.121 v7.0.0 Table C.10.1.4 sub-test 3).

     — Set `Manual Uplink DPCH Bd` to `8` (for 34.121 v7.0.0 Table C.10.1.4 sub-test 3).

     — Set `Maximum Uplink Transmit Power Level` to `21 dBm`.

     — Note, Qqualmin and Qrxlevmin are fixed to -24 dB and -115 dBm, respectively, in the test set.

   - Set `Operating Mode` to `Active Cell` (pressing the **CALL SETUP** key quickly brings you back to the top level `Call Control` menu).

2. Set `Channel Type` (**F8**) to `12.2k RMC + HSDPA`.

3. Select `HSDPA Parameters` (**F10**).

   - Select `HSDPA RB Test Mode Setup` (**F8**).

— Set `HS-DSCH Configuration Type` to `FRC` (this is the default value).

— Set `FRC Type` to `H-Set 1 QPSK` (this is the default value).

— Set `CN Domain` as needed (by default it is set to `PS Domain`). Note, before you can establish a connection in the PS domain, the UE must attach to the test set. To enable this, the `PS Domain Information` parameter (under `Cell Parameters`, **F12** on `Call Control 2 of 4`) must be set to `Present` when the UE registers (attaches) with the test set.

- Select `HSDPA Uplink Parameters` (**F11**).

— Set `DeltaACK`, `DeltaNACK` and `DeltaCQI` to `8`.

— Set `Ack-Nack Repetition Factor` to `1` (this is the default value).

— Set `CQI Feedback Cycle (k)` to `4 ms`.

— Set `CQI Repetition Factor` to `1` (this is the default value).

4. Select `Cell Parameters` (**F2** on `Call Control 2 of 4`).

- Set `Default DPCH Offset (DOFF)` to `3 x 512 chips`.

- Set `PS Domain Information` to `Present` (this is the default value in the lab application) if you plan to establish the HSDPA connection in the PS domain (i.e. if you've set `CN Domain` to `PS Domain` in step 3 above).

5. Select `Generator Info` (**F3** on `Call Control 2 of 4`), select `Connected DL Channel Levels` (**F4**), then select `HSDPA Conn DL Channel Levels` (**F4**).

- Set `Cell 1 Connected HSDPA CPICH Level` to `-10 dB` (this is the default value).

- Set `Cell 1 Connected HSDPA P-CCPCH/SCH Level` to `-12 dB` (this is the default value).

- Set `Cell 1 Connected HSDPA PICH Level` to `-15 dB` (this is the default value).

- Set `Cell 1 Connected HSDPA DPCH Level` to `-9 dB`.

- Set `Cell 1 Sum of Active Conn HS-PDSCH Levels` to `-3 dB` (this is the default value).

- Set `Cell 1 Connected HS-SCCH 1 Level` to `-8 dB`.

6. Set any other parameters needed to establish a connection with your UE, then power on the UE and wait for it to register (attach).

7. Select `Originate Call` (**F3** on `Call Control 1 of 4`).

8. Set `Cell Power` (**F7** on `Call Parms 1 of 3`) to `-86 dBm/3.84 MHz`.

9. Select `UL CL Power Ctrl Parameters` (**F8** on `Call Parms 3 of 3`).

- Set `UL CL Power Ctrl Mode` to `Active bits` (this is the default value).

- Set `UL CL Power Ctrl Algorithm` to `Two` (this is the default value).

How Do I Make a Waveform Quality Measurement?

10. To perform the test such that the 12 ms UE power pattern maximum corresponds to the UE's maximum output power as defined in 34.121 Table 5.2A.1, set `UE Target Power` (**F7** on `Call Parms 3 of 3`) to the appropriate value for your UE's power class.

Table 1. Required UE Target Power Setting to Achieve Table 5.2A.1 Maximum Power

UE Power Class	34.121 v7.0.0 Table C.10.1.4 Sub-Test	UE Target Power setting
3	3	16.9 dBm
4	3	13.9 dBm

For example, for a power class 3 UE, set `UE Target Power` to 16.9 dBm (the test set rounds this value to 17 dBm). The test set drives the UE's DPCCH+DPDCH level to 17 dBm, which places the UE's DPCCH+DPDCH+HS-DPCCH level at 23.1 dBm, while also appropriately ranging the test set's measurement receiver.

11. Select `UL CL Power Ctrl Parameters` (**F8** on `Call Parms 3 of 3`). Set `UL CL Power Ctrl Mode` to `Alternating bits`.

12. 34.121 5.13.1A specifies that you measure EVM "during the half slot period when the UE is at its maximum power in the 12ms cycle and in the half slot period when the UE is at its minimum power in the cycle." In the 12 ms UE power pattern specified by `DeltaACK = DeltaNACK = DeltaCQI = 8`, `Ack-Nack Repetition Factor = 1`, `CQI Feedback Cycle (k) = 4 ms` and `CQI Repetition Factor = 1`, there are several maximum power and minimum power half slot periods. Also, to date there is great divergence in what power pattern is actually exhibited by UEs of various manufacturer, model, hardware revision and firmware revision, given these six settings. It is thus recommended that you use the `Dynamic Power Analysis` measurement to quickly evaluate the 12 ms power pattern exhibited by your UE (for a given UE model, UE firmware revision and UE hardware revision) and determine the location of a maximum half slot period and a minimum half slot period before proceeding with this test. To do so, press the **Measurement selection** key and select `Dynamic Power Analysis`, then select `Dynamic Power Setup` (**F1**) and set `Steps` to 18, `Step Length` to 666.7 us, `Measurement Interval` to 616.7 us, `Trigger Source` to `HS-DPCCH`, `Trigger Delay` to 25 us, and `HS-DPCCH Trigger Subframe Alignment` to subframe 0. Adjust the `Axis Control` (**F2**) as needed.
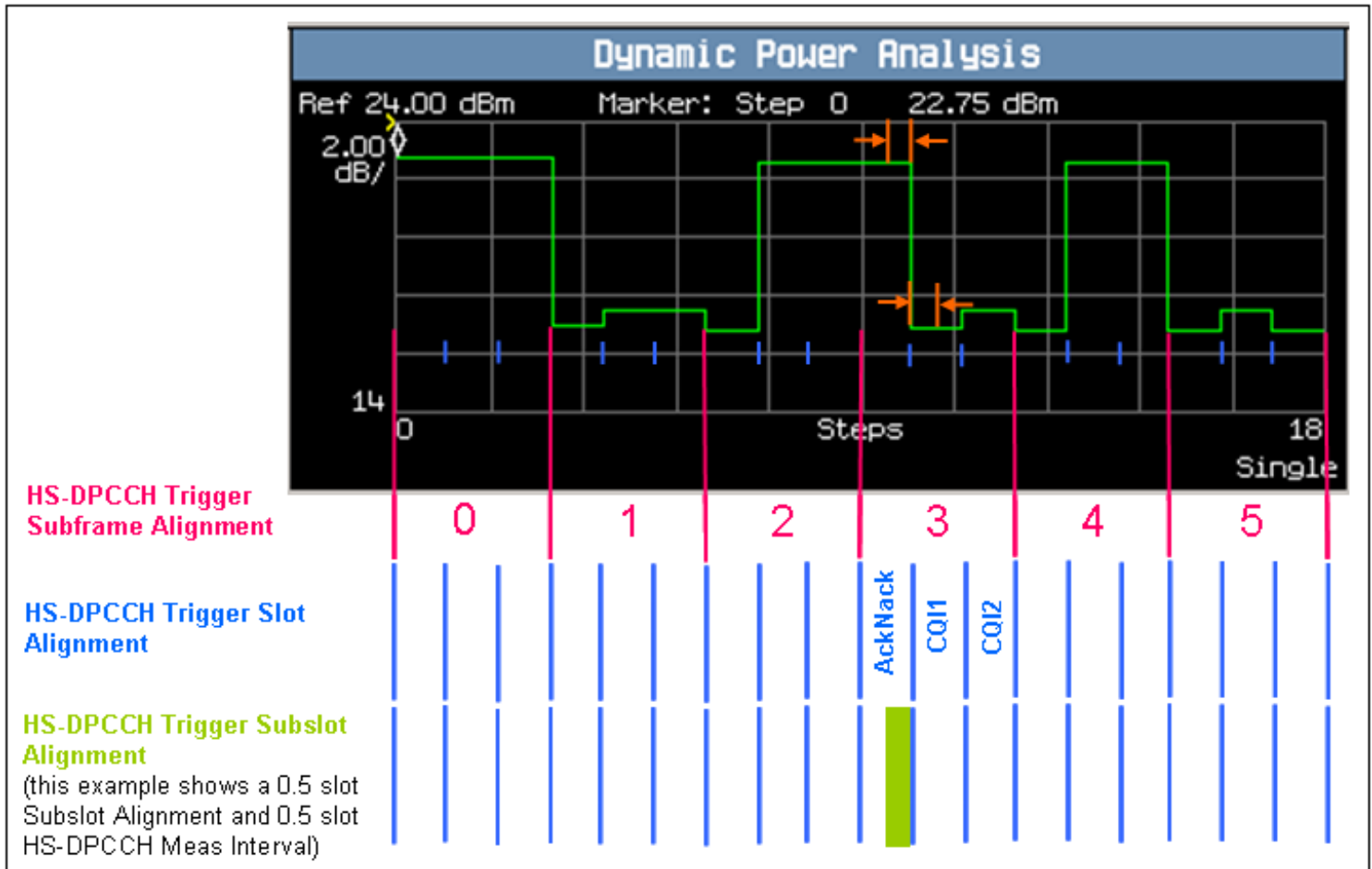
You can then confirm the location of a maximum power half slot period and a minimum power half slot period and set the waveform quality trigger alignment settings accordingly for each. This example procedure measures the half slot periods indicated above in orange (second half of the AckNack slot in subframe 3 and the first half of the CQI1 slot in subframe 3).

13. Press the **Measurement selection** key.

14. Select `Waveform Quality`.

15. Set up the measurement to measure the "half slot period when the UE is at its maximum power in the 12ms cycle". This example procedure measures the second half of the AckNack slot in subframe 3.

- Select `Waveform Quality Setup` (**F1**).

- Set `Trigger Source` to `HS-DPCCH`.

- Set `Transient Period` to `Exclude`.

- Set `HS-DPCCH Trigger Subframe Alignment` to `subframe 3`.

- Set `HS-DPCCH Trigger Slot Alignment` to `AckNack` (this is the default value).

- Set `HS-DPCCH Measurement Interval` to `0.5 slot` (you must do this before setting `HS-DPCCH Trigger Subslot Alignment` to `0.5 slot`).

How Do I Make a Waveform Quality Measurement?

- Set `HS-DPCCH Trigger Subslot Alignment` to `0.5 slot`.
- Set `Trigger Arm` to `Single`, if desired.
- Select `Close Menu` (**F6**).

16. If you set `Trigger Arm` to `Single`, press the **START SINGLE** key to begin the measurement.

17. Verify that the measured EVM is less than 17.5%.

18. Set up the measurement to measure the "half slot period when the UE is at its minimum power in the 12ms cycle". This example procedure measures the first half of the CQI1 slot in subframe 3.

- Select `Waveform Quality Setup` (**F1**).
- Set `HS-DPCCH Trigger Slot Alignment` to `CQI1`.
- Set `HS-DPCCH Trigger Subslot Alignment` to `0.0 slot`.
- Select `Close Menu` (**F6**).

19. If you set `Trigger Arm` to `Single`, press the **START SINGLE** key to begin the measurement.

20. Verify that the measured EVM is less than 17.5%.

21. To perform the test such that the 12 ms UE power pattern maximum corresponds to -13 dBm:

- Select `UL CL Power Ctrl Parameters` (**F8** on `Call Parms 3 of 3`). Set `UL CL Power Ctrl Mode` to `Active bits`.

- Set `UE Target Power` (**F7** on `Call Parms 3 of 3`) to `-19.1 dBm` (for 34.121 v7.0.0 Table C.10.1.4 sub-test 3). The test set drives the UE's DPCCH+DPDCH level to the -19 dBm, which places the UE's DPCCH+DPDCH+HS-DPCCH level at approximately -13 dBm, while also appropriately ranging the test set's measurement receiver.

- Select `UL CL Power Ctrl Parameters` (**F8** on `Call Parms 3 of 3`). Set `UL CL Power Ctrl Mode` to `Alternating bits`.

- Repeat steps 15-20.

22. To perform the test for "mid range" and "high range" frequencies:

- Perform a Physical Channel Reconfiguration (Inter-frequency Hard Handoff) to the appropriate UARFCNs.

- Repeat steps 9-21.

2   Appendix

This Appendix includes some general setup procedures that are required to perform the tests and other helpful information.

The contents are:

- What 3GPP W-CDMA/HSDPA Conformance Tests Are Supported?
- How Do I Set Up a Call and Make a Connection?
- How Do I Perform a Handoff (Handover)?
- Calibrating the Test Set
- Amplitude Offset

What 3GPP W-CDMA/HSDPA Conformance Tests Are Supported?

These tables list the tests specified in 3GPP TS 34.121, whether the tests are supported by the test set, and the recommended measurement to perform the tests.

- 3GPP TS 34.121 Section 5 Transmitter Characteristics
- 3GPP TS 34.121 Section 6 Receiver Characteristics
- 3GPP TS 34.121 Section 7 Performance Requirements
- 3GPP TS 34.121 Section 9 Performance Requirements for HSDPA

Table 2. 3GPP TS 34.121 Section 5 Transmitter Characteristics

3GPP TS 34.121	Test Description	Supported in Test Set?	Measurement Procedure
5.2	Maximum Output Power	Yes	
5.2A	Maximum Output Power with HS-DPCCH	Yes[#]	How Do I Make a Channel Power Measurement?
5.3	Frequency Error	Yes	How Do I Make a Waveform Quality Measurement?
5.4.1	Open Loop Power Control in the Uplink	Yes	How Do I Make a PRACH Transmit On/Off Power Measurement?
5.4.2	Inner Loop Power Control in the Uplink	Partially	How Do I Make an Inner Loop Power Measurement? (does not support 3 dB step size)
5.4.3	Minimum Output Power	Yes	How Do I Make a Channel Power Measurement? (with RRC filter OFF)
5.4.4	Out-of-synchronization handling of output power	Yes[+, **]	How Do I Make an Out-of-Synch Handling of Output Power Measurement? (Establish a connection between the test set and UE, initiate the measurement from the test set, measure the UE's output power using the spectrum analyzer)
5.5.1	Transmit OFF Power	Yes	How Do I Make a PRACH Transmit On/Off Power Measurement?
5.5.2	Transmit ON/OFF Time mask	Yes	How Do I Make a PRACH Transmit On/Off Power Measurement?
5.6	Change of TFC	Yes[+]	How Do I Make a Change of TFC (Transport Format Combination) Measurement?
5.7	Power setting in uplink compressed mode	No	
5.7A	HS-DPCCH	Yes[#]	How Do I Make a Dynamic Power Analysis Measurement?

What 3GPP W-CDMA/HSDPA Conformance Tests Are Supported?

Table 2. 3GPP TS 34.121 Section 5 Transmitter Characteristics

3GPP TS 34.121	Test Description	Supported in Test Set?	Measurement Procedure
5.8	Occupied Bandwidth (OBW)	Yes	How Do I Make an Occupied Bandwidth (OBW) Measurement?
5.9	Spectrum Emission Mask	Yes	How Do I Make a Spectrum Emission Mask Measurement?
5.9A	Spectrum Emission Mask with HS-DPCCH	Yes[#]	How Do I Make a Spectrum Emission Mask Measurement?
5.10	Adjacent Channel Leakage Power Ratio (ACLR)	Yes	How Do I Make an Adjacent Channel Leakage Ratio (ACLR) Measurement?
5.10A	Adjacent Channel Leakage Power Ratio (ACLR) with HS-DPCCH	Yes[#]	How Do I Make an Adjacent Channel Leakage Ratio (ACLR) Measurement?
5.11	Spurious Emissions	Yes[**]	Camp to test set, measure spurious emissions using external spectrum analyzer
5.12	Transmit Intermodulation	Yes[*, **]	Camp to the test set, inject tones using external signal generator, measure transmit intermodulation using external spectrum analyzer
5.13.1	Error Vector Magnitude (EVM)	Yes	How Do I Make a Waveform Quality Measurement?
5.13.1A	Error Vector Magnitude (EVM) with HS-DPCCH	Yes	How Do I Make a Waveform Quality Measurement?
5.13.2	Peak code domain error	Partially	How Do I Make a Waveform Quality Measurement? (only for a single DPCH)
5.13.3	UE Phase Discontinuity	Yes	How Do I Make a Phase Discontinuity Measurement?
5.13.4	PRACH Preamble Quality	Partially[+]	How Do I Make a PRACH Preamble Analysis Measurement? (measurement is not performed on first preamble, AICH transmission timing is fixed to 0, measurement does not determine if correct access slot was used)

Table 3. 3GPP TS 34.121 Section 6 Receiver Characteristics

3GPP TS 34.121	Test Description	Supported in Test Set?	Measurement Procedure
6.2	Reference Sensitivity Level	Yes	How Do I Make a Loopback Bit Error Ratio (BER) Measurement?
6.3	Maximum Input Level	Yes	How Do I Make a Loopback Bit Error Ratio (BER) Measurement?

Table 3. 3GPP TS 34.121 Section 6 Receiver Characteristics

3GPP TS 34.121	Test Description	Supported in Test Set?	Measurement Procedure
6.3A	Maximum Input Level for HS-PDSCH Reception (16QAM)	Yes[#]	How Do I Make an HSDPA Block Error Ratio Measurement?
6.4	Adjacent Channel Selectivity (ACS)	Yes[*]	How Do I Make a Loopback Bit Error Ratio (BER) Measurement? (plus W-CDMA signal from a signal generator)
6.5	Blocking Characteristics	Yes[*]	How Do I Make a Loopback Bit Error Ratio (BER) Measurement? (plus W-CDMA signal from a signal generator)
6.6	Spurious Response	Yes[*]	How Do I Make a Loopback Bit Error Ratio (BER) Measurement? (plus a CW signal from a signal generator)
6.7	Intermodulation Characteristics	Yes[*]	How Do I Make a Loopback Bit Error Ratio (BER) Measurement? (plus 2 CW signals from signal generators)
6.8	Spurious Emissions	No	

Table 4. 3GPP TS 34.121 Section 7 Performance Requirements

3GPP TS 34.121	Test Description	Supported in Test Set?	Measurement Procedure
7.2.1	Demodulation in Static Propagation Conditions: Demodulation of Dedicated Channel (DCH)	Yes	How Do I Make a Block Error Ratio (BLER) Measurement?
7.3.1	Demodulation of DCH in Multi-Path Fading Propagation Conditions: Single Link Performance	Partially[+, ***]	How Do I Make a Block Error Ratio (BLER) Measurement? (plus multi-path fading simulator and external AWGN noise source) (only for tests with phase reference = P-CPICH)
7.4.1	Demodulation of DCH in Moving Propagation Conditions: Single Link Performance	Yes[+, ***]	How Do I Make a Block Error Ratio (BLER) Measurement? (plus multi-path fading simulator and external AWGN noise source)
7.5.1	Demodulation of DCH in Birth-Death Propagation Conditions: Single Link Performance	Yes[+, ***]	How Do I Make a Block Error Ratio (BLER) Measurement? (plus multi-path fading simulator and external AWGN noise source)
7.6.1	Demodulation of DCH in Open-Loop Transmit Diversity Mode	No	
7.6.2	Demodulation of DCH in Closed Loop Transmit Diversity Mode	No	

What 3GPP W-CDMA/HSDPA Conformance Tests Are Supported?

Table 4. 3GPP TS 34.121 Section 7 Performance Requirements

3GPP TS 34.121	Test Description	Supported in Test Set?	Measurement Procedure
7.6.3	Demodulation of DCH in Site Selection Diversity Transmission Power Control Mode	No	
7.7.1	Demodulation of DCH in Inter-Cell Soft Handover	No	
7.7.2	Combining of TPC Commands from Radio Links of Different Radio Link Sets	No	
7.7.3	Combining of Reliable TPC Commands from Radio Links of Different Radio Link Sets	No	
7.8.1	Power Control in the Downlink, Constant BLER Target	No	
7.8.2	Power Control in the Downlink, Initial Convergence	No	
7.8.3	Power Control in the Downlink, Wind Up Effects	No	
7.8.4	Power Control in the Downlink, Different Transport Formats	No	
7.9.1	Downlink Compressed Mode: Single Link Performance	No	
7.10	Blind Transport Format Detection	No	
7.11	Demodulation of Paging Channel (PCH)	No	
7.12	Detection of Acquisition Indicator (AI)	No	

Table 5. 3GPP TS 34.121 Section 9 Performance Requirements for HSDPA

3GPP TS 34.121	Test Description	Supported in the Test Set?	Measurement Procedure
9.2.1A	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance - QPSK/16QAM, FRC H-Set 1/2/3	Partially[+, ***]	How Do I Make an HSDPA Block Error Ratio Measurement? (plus multi-path fading simulator and external AWGN noise source) (16QAM tests are not supported because `CCITT PRBS15` is not at least 4664 * 10 bits long)
9.2.1B	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance - QPSK, FRC H-Set 4/5	Yes[+, ***]	How Do I Make an HSDPA Block Error Ratio Measurement? (plus multi-path fading simulator and external AWGN noise source)

Table 5. 3GPP TS 34.121 Section 9 Performance Requirements for HSDPA

3GPP TS 34.121	Test Description	Supported in the Test Set?	Measurement Procedure
9.2.1C	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance - QPSK/16QAM, FRC H-Set 6/3	No	
9.2.1D	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance - Enhanced Performance Requirements Type 1 - QPSK/16QAM, FRC H-Set 1/2/3	Partially[+, ***]	How Do I Make an HSDPA Block Error Ratio Measurement? (plus multi-path fading simulator and external AWGN noise source) (16QAM tests are not supported because `CCITT PRBS15` is not at least 4664 * 10 bits long)
9.2.1E	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance - Enhanced Performance Requirements Type 1 - QPSK/16QAM, FRC H-Set 6/3	No	
9.2.1F	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance - Enhanced Performance Requirements Type 2 - QPSK/16QAM, FRC H-Set 6/3	No	
9.2.2	Open Loop Diversity Performance	No	
9.2.3	Closed Loop Diversity Performance	No	
9.3.1	Reporting of CQI: Single Link Performance - AWGN Propagation Conditions	No	
9.3.2	Reporting of CQI: Single Link Performance - Fading Propagation Conditions	No	
9.3.3	Reporting of CQI: Open Loop Diversity Performance - AWGN Propagation Conditions	No	
9.3.4	Reporting of CQI: Open Loop Diversity Performance - Fading Propagation Conditions	No	
9.3.5	Reporting of CQI: Closed Loop Diversity Performance - AWGN Propagation Conditions	No	
9.3.6	Reporting of CQI: Closed Loop Diversity Performance - Fading Propagation Conditions	No	

What 3GPP W-CDMA/HSDPA Conformance Tests Are Supported?

Table 5. 3GPP TS 34.121 Section 9 Performance Requirements for HSDPA

3GPP TS 34.121	Test Description	Supported in the Test Set?	Measurement Procedure
9.4.1	HS-SCCH Detection Performance: Single Link Performance	Partially[+, ***]	How Do I Make an HSDPA Block Error Ratio Measurement? (plus multi-path fading simulator and external AWGN noise source) (HS-SCCH 2-4 all use the same `Alternate H-RNTI`)
9.4.1A	HS-SCCH Detection Performance: Single Link Performance - Enhanced Performance Requirements Type 1	Partially[+, ***]	How Do I Make an HSDPA Block Error Ratio Measurement? (plus multi-path fading simulator and external AWGN noise source) (HS-SCCH 2-4 all use the same `Alternate H-RNTI`)
9.4.2	HS-SCCH Detection Performance: Open Loop Diversity Performance	No	
9.4.2A	HS-SCCH Detection Performance: Open Loop Diversity Performance - Enhanced Performance Requirements Type 1	No	

[+] This test is supported in the lab application only.

[#] This test is supported in the lab application or feature-licensed test application only.

[*] Requires also an external signal generator, such as the E4438C ESG Vector Signal Generator.

[**] Requires also an external spectrum analyzer, such as the E4445A PSA Spectrum Analyzer.

[***] Requires also a multi-path fading simulator and external AWGN source, such as the N5115B Fading Solution.

How Do I Set Up a Call and Make a Connection?

- Establishing a Connection
- Establishing an HSDPA Connection (*lab application or feature-licensed test application only*)

Establishing a Connection

Set Cell Parameters

1. Press the **CALL SETUP** key.

2. Press the left **More** key to move to the `Call Control 2 of 4` menu.

3. Select `Cell Parameters` (**F2**).

Cell Parameters	Value
BCCH Update Page	Inhibit
PS Domain Information	Present
MCC (Mobile Country Code)	1
MNC (Mobile Network Code)	1
LAC (Local Area Code)	1
RAC (Routing Area Code)	1
Cell Identity	1
ATT (IMSI Attach) Flag State	Not Set

- Set BCCH Update Page to `Auto`, if desired, so that the UE will be notified of any changes to the BCCH information transmitted by the test set after the call is established.
- Set ATT (IMSI Attach) Flag State to `Set`, if required for your UE to register with the test set.
- Set Repeat Paging to `On`, if desired, to help ensure your UE will respond to the test set's page.
- Set any other cell parameters as needed.
- Select `Close Menu` (**F6**).

NOTE   Some cell parameters can only be set when `Operating Mode` (**F1**) is set to `Cell Off`.

Set Uplink Parameters

1. Press the **CALL SETUP** key.

2. Press the left **More** key to move to the `Call Control 2 of 4` menu.

How Do I Set Up a Call and Make a Connection?

3. Select `Uplink Parameters` (**F4**).

Uplink Parameters	Value
PRACH Preambles	64
PRACH Ramping Cycles(MMAX)	2
Available Subchannels (Bit Mask)	000000000001
Uplink DPCH Scrambling Code	0
Uplink DPCH Bc/Bd Control	Auto
Manual Uplink DPCH Bc	8
Manual Uplink DPCH Bd	15
Maximum Uplink Transmit Power Level	21 dBm

- Set Maximum Uplink Transmit Power Level to the appropriate value for your UE.
- Set other uplink parameters as needed.
- Select `Close Menu` (**F6**).

Set Call Parameters

1. Press the **CALL SETUP** key.

2. Set `Operating Mode` (**F1**) to `Cell Off`.

3. Select `Channel (UARFCN) Parms` (**F12**) and set the downlink and uplink channels to frequencies supported by your UE. Select `Return` (**F12**).

4. If required by your UE for successful call establishment:

   - Press the right **More** key to move to the `Call Parms 2 of 3` menu.
   - Set `RLC Reestablish` (**F9**) to `Off`.
   - Set `SRB Config` (**F12**) to `2.2k DCCH`.

5. Use the right **More** key to move between the three `Call Parms` menus and set other call parameters as needed.

6. Set `Operating Mode` (**F1**) to `Active Cell`.

Establish the Call

1. Connect the UE to the front panel **RF IN/OUT** port and power it on.

2. After a few seconds the UE should register with the test set. The test set then displays `UE Information` such as `IMSI` and `IMEI` on the `Call Setup` screen and the `MM Status` should change from `None` to `IMSI Attached`.

3. You can then establish the call in one of two ways:

   - Test set originated call -

     — Select `Paging Service` (**F9**) and set as needed.

     — If `Paging Service` is set to `RB Test Mode`, select `Channel Type` (**F8**) and set as needed.

     — Select `Originate Call` (**F3**).

     — For the lab application only, if `Paging Service` is set to `AMR Voice`, and `Calling Party Number Inclusion` is set to `Include`, the `Calling Party Number` is displayed on the UE's screen.

     — Answer the call if necessary, and verify that `Connected` is displayed in the `Active Cell` window.

   - UE initiated call -

     — Dial a number into the UE and press send.

     — Verify that `Connected` is displayed in the `Active Cell` window.

How Do I Set Up a Call and Make a Connection?

— For the lab application only, the Called Party Number is displayed under UE Information.

Establishing an HSDPA Connection

This section is only applicable to the lab application or feature-licensed test application.

Set HSDPA Parameters

1. Press the **CALL SETUP** key.

2. Select HSDPA Parameters (**F10**).

3. Select HSDPA RB Test Mode Setup (**F8**).

   • Set FRC Type to an H-Set supported by your UE.

   • Set CN Domain as needed. Note, before you can establish a connection in the PS domain, the UE must have attached to the test set.

   • Set Uplink 64k DTCH for HSDPA Loopback State as needed for your UE.

   • Set other HSDPA RB Test Mode Setup parameters as needed, then select Close Menu (**F6**).

4. Set `MAC-hs Parameters` (**F10**), `HSDPA Uplink Parameters` (**F11**) and `H-RNTI Parameters` (**F11** on `HSDPA Parms 2 of 2`) as needed, then select `Return` (**F12**).

Establish the HSDPA Connection

1. Connect the UE to the front panel **RF IN/OUT** port and power it on.

2. After a few seconds the UE should register with the test set. If PS Domain Information is set to `Absent`, the UE registers in the CS domain and `MM Status` changes from `None` to `IMSI Attached`. If `PS Domain Information` is set to `Present`, the UE should register in the CS domain and then also will register in the PS domain if it supports PS services (which causes `GMM State` to change from `None` to `Attached`).

Call Processing Status		
RRC State: Idle	Soft Handoff State:	Off
MM Status: IMSI Attached	Compressed Mode State:	Off
GMM State: None		

Call Processing Status		
RRC State: Idle	Soft Handoff State:	Off
MM Status: IMSI Attached	Compressed Mode State:	Off
GMM State: Attached		

Ensure that the `CN Domain` parameter is set to `CS Domain` if the UE did not attach to the GMM.

3. Set `Paging Service` (**F9**) to `RB Test Mode`.

4. Set `Channel Type` (**F8**) to `12.2k RMC + HSDPA`.

5. Select `Originate Call` (**F3**).

6. Verify that `Connected` is displayed in the `Active Cell` window.

Active Cell
Connected

How Do I Perform a Handoff (Handover)?

- Physical Channel Reconfiguration (Inter-frequency Hard Handoff)
- Transport Channel Reconfiguration
- System Handoff

Physical Channel Reconfiguration (Inter-frequency Hard Handoff)

1. Establish a call with the UE and verify that `Connected` is shown in the `Active Cell` field.
2. Press the **CALL SETUP** key.
3. Select `Handoffs` (**F5**).
4. Select `Physical Chann Reconfig` (**F1**).
5. Set Handoff Downlink Channel (UARFCN) and Handoff Uplink Channel (UARFCN) (and Handoff Band Arbitrator if needed).
6. Select `Execute Handoff` (**F5**).
7. Verify that `Connected` is still shown in the `Active Cell` field.

Transport Channel Reconfiguration

```
                        Call Setup Screen
┌─────────────────┬──────────────────────────────────┬─────────────────┐
│ Handoff Setup   │    Active Cell Operating Mode     │   Call Parms    │
│                 │                                    │ Cell Power      │
│                 │         UE Information             │   -75.00        │
│                 │  IMSI:          001012345678901    │ dBm/3.84 MHz    │
│                 │  IMEI:          004400131774490    │                 │
│                 │  Power Class:        4             │ Channel Type    │
│                 │  Detected PRACH Signature:   0     │   12.2k RMC     │
│                 │                                    │                 │
│                 │  UE Expected Open Loop Transmit    │ Paging Service  │
│                 │           Power                    │  RB Test Mode   │
│                 │  Initial PRACH Tx Power: -21.20 dBm│                 │
│                 │  Initial DPCCH Tx Power: -14.17 dBm│                 │
│                 │ Transport Channel Reconfig│ Value  │ DL Channel      │
│                 │     Setup                 │        │   10730         │
│                 │ Handoff RB Test Mode RAB  │12.2k RMC│                │
│ Execute         │ TCR Timing Indication     │Initialise│ Uplink Channel│
│ Handoff         │ (CFN Handling)            │        │   9780          │
│                 │                           │        │                 │
│ Close           │                           │        │                 │
│ Menu            │                           │        │                 │
│                 │   │Active Cell│Sys Type: UTRA FDD   │                 │
│                 │   │Connected  │Logging: No Conn.    │                 │
│ 1 of 4          │   │IntRef│Offset│ L │              │     1 of 3      │
└─────────────────┴──────────────────────────────────┴─────────────────┘
```

1. Establish an RB test mode call with the UE and verify that `Connected` is shown in the `Active Cell` field.

2. Press the **CALL SETUP** key.

3. Select `Handoffs` (**F5**).

4. Select `Transport Chann Reconfig` (**F2**).

5. Set `Handoff RB Test Mode RAB` as needed.

6. Select `Execute Handoff` (**F5**).

7. Verify that `Connected` is still shown in the `Active Cell` field.

System Handoff

```
                          Call Setup Screen
┌──────────────┬──────────────────────────────────────┬──────────────┐
│Handoff Setup │    Active Cell Operating Mode         │  Call Parms  │
│              │ ┌────────────────────────────────────┐│ Cell Power   │
│              │ │          UE Information             ││   -75.00     │
│              │ │ IMSI:              001012345678901  ││ dBm/3.84 MHz │
│              │ │ IMEI:              004400131774490  ││              │
│              │ │ Power Class:       4                ││ Channel Type │
│              │ │ Detected PRACH Signature:   0       ││   12.2k RMC  │
│              │ └────────────────────────────────────┘│              │
│              │ ┌────────────────────────────────────┐│ Paging Service│
│              │ │ UE Expected Open Loop Transmit Power││  RB Test Mode │
│              │ │ Initial PRACH Tx Power:  -21.20 dBm ││              │
│              │ │ Initial DPCCH Tx Power:  -14.17 dBm ││              │
│              │ ├──────────────────────────┬─────────┤│ DL Channel   │
│              │ │ System Handoff Setup     │  Value  ││   10700      │
│              │ │ GSM BCC (Base Station    │    3    ││              │
│              │ │   Colour Code)           │         ││              │
│ Execute      │ │ GSM NCC (Network Colour  │    3    ││ Uplink Channel│
│ Handoff      │ │   Code)                  │         ││   9750       │
│              │ │ GSM Cell Band            │  PGSM   ││              │
│              │ │ GSM Broadcast Chan       │   20    ││              │
│              │ │ GSM Traffic Band         │  PGSM   ││              │
│              │ │ GSM Traffic Channel      │   30    ││              │
│ Close        │ │ GSM TCH Timeslot         │    4    ││              │
│ Menu         │ │ GSM Channel Mode         │FR Speech││              │
│              │ ┌──────┬──────────┬──────────────────┐│              │
│              │ │      │Active Cell│Sys Type: UTRA FDD││              │
│              │ │      │Connected │ Logging: No Conn. ││              │
│  1 of 4      │ │      │IntRef Offset  L             ││   1 of 3     │
└──────────────┴──────────────────────────────────────┴──────────────┘
```

1. Confirm that the GSM/GPRS format is in active cell operating mode (press the **SYSTEM CONFIG** key, select `Format Switch` (**F2**), select `GSM/GPRS`, and set `Operating Mode` (**F1**) to `Active Cell (GSM)`). Return to the W-CDMA format by pressing the **SYSTEM CONFIG** key.

2. Establish an RB test mode or AMR voice call with the UE and verify that `Connected` is shown in the `Active Cell` field.

3. Press the **CALL SETUP** key.

4. Select `Handoffs` (**F5**).

5. Select `System Handoff` (**F3**).

6. Set the GSM system parameters as needed.

7. Select `Execute Handoff` (**F5**).

8. When performing a handoff from W-CDMA RB test mode to a GSM voice call with RB Test Mode to GSM

Handoff Alerting State set to On, the UE will ring. You must answer the ring for the connection to be completed and testing to progress.

9. Verify that `Connected` is still shown in the `Active Cell` field.

Calibrating the Test Set

Description

- Calibration Process Requirements
- Recommended Calibration Intervals
- Calibration Descriptions
    - IQ Calibrations
    - Burst Mod Offset 1 Calibration
    - Digital Average Power Calibration
    - Spectrum Monitor Calibration
    - Calibrate Measurements
    - Channel Power Calibration
    - Thermal Power Null Adjustment

Various calibration routines must be run periodically to ensure measurement accuracy, source accuracy and allow the most robust demodulation of the device-under-test's signal. This document describes the various calibrations available in the test set and when they should be performed.

Calibration Process Requirements

IMPORTANT

- *Ensure that the calibration is necessary* - running calibrations more often than necessary wastes your time and effort, and if the calibration is performed incorrectly, could actually result in degraded test set performance.

- For example, if you are going to be using the test set in a racked test system, then you must calibrate the test set while it is in that test system, and all of the equipment has reached a stable operating temperature.

- *Ensure that no power is present at the front panel RF connectors* - remove any cables or connectors from the RF IN/OUT and RF OUT ONLY connectors. If you are operating in a high RF environment, it is recommended that you also terminate the RF connectors with a 50 Ohm load.

Before performing any calibrations on your test set:

Recommended Calibration Intervals

This section indicates when the test set calibrations should be performed. Procedures are given for test sets that include *Option 003: Flexible Radio Link* and test sets that do not. Refer to Calibration Descriptions for

Calibrating the Test Set

details about the calibrations and how to perform them.

- Once every year you must perform a full calibration by following steps 1-7 of the Calibration Procedure for Test Sets with Option 003 (or steps 1-2 of the Calibration Procedure for Test Sets without Option 003 if your test set does not include option 003).

- You must also perform steps 1-7 of the Calibration Procedure for Test Sets without Option 003 (or steps 1-2 of the Calibration Procedure for Test Sets without Option 003 if your test set does not include option 003) if any of the following events occur:

  — When you receive the test set, before using it for the first time (regardless of whether the test set is new, being returned from service, or on loan from a colleague).

  — After adding a *new* application or format to the test set.
  Note: *Upgrading* firmware already present in the test set does not typically require running the calibration procedures. However, when upgrading firmware, it is advisable to check the release notes for any major feature changes that require re-calibration of the test set.

  — After you perform any kind of repair or service on your test set.

- It is recommended that once every month you perform steps 4-7 of the Calibration Procedure for Test Sets with Option 003 (or step 2 of the Calibration Procedure for Test Sets without Option 003 if your test set does not include option 003).

- You must also perform steps 4-7 of the Calibration Procedure for Test Sets with Option 003 (or step 2 of the Calibration Procedure for Test Sets without Option 003 if your test set does not include option 003) if any of the following events occur:

  — The operating environment for your test set changes significantly (for example, the temperature changes by more than 10 degrees C or the test set is moved from a racked test system to a bench top).

  — A measurement returns integrity indicator `19 (Uncalibrated Due to Temperature)`.

IMPORTANT   Ensure that your test set has warmed up at least 30 minutes and that no power is present at the front panel RF connectors before performing any calibrations.

Calibration Procedure for Test Sets with Option 003

Application or Format	Calibration Interval = 1 year			Calibration Interval = 1 month			
	IQ Calibrations (See Note 1)	Burst Mod Offset 1 Calibration	Digital Average Power Calibration	Thermal Power Null Adjust	Spectrum Monitor Calibration	Channel Power Calibration	Calibrate Measurements
cdma2000/ IS-95/AMPS	Step 1 Perform IQ1 and IQ2 once from one of these applications or formats	Step 2 Perform once from one of these applications or formats	Step 3A Perform once from one of these applications or formats Step 3B Cycle Power	Step 4 Perform once from one of these applications or formats	Step 5 Perform once from one of these applications or formats	Covered by Step 5 (See Note 2)	
1xEV-DO							
W-CDMA					Step 6 Perform once from this application		Covered by Step 6 (See Note 2)
GSM/GPRS/ EGPRS					Step 7 Perform once from one of these applications or formats		
AMPS/136							

Note 1 – Calibrate Second IQ Modulator only applies to instruments with Option 002: RF Source 2.
Note 2 – You do not need to run this calibration if Spectrum Monitor calibration is run first.

Calibration Procedure for Test Sets without Option 003

Application or Format	Calibration Interval = 1 year	Calibration Interval = 1 month
	IQ Calibrations *(See Note 1)*	Spectrum Monitor Calibration
GSM/GPRS/EGPRS	**Step 1** Perform IQ1and IQ2 once from one of these applications or formats	**Step 2** Perform once from one of these applications or formats
AMPS/136		
Note 1 – Calibrate Second IQ Modulator only applies to instruments with Option 002: RF Source 2.		

Calibration Descriptions

If any of the following calibrations fail, ensure that you have followed the Calibration Process Requirements and have performed the calibrations in the order prescribed by Recommended Calibration Intervals. If the calibration still fails, contact your local Agilent Sales Representative for assistance.

IQ Calibrations When performed from a GSM/GPRS/EGPRS or AMPS/136 application or format, the `First IQ Modulator` calibration sends a signal from the Baseband Generator 1 module to the RF Source 1 module to optimize the phase accuracy of RF Source 1 as a function of frequency. The optimization data is then stored in the test set and accessed whenever the RF Source frequency is set. The `Second IQ Modulator` calibration performs a similar procedure for RF Source 2 (RF Source 2 is only present if the test set includes option 002: RF Source 2).

When performed from a W-CDMA/HSDPA, cdma2000/IS-95/AMPS or 1xEV-DO application or format (which require option 003: Flexible Radio Link), the IQ calibrations perform the same phase optimizations explained above. Additionally, a signal is sent from the Flexible Radio Link Subsystem to the RF sources to calibrate phase accuracy for those alternative paths as well. This additional calibration data is written to the same calibration data file as above, but in a different area of the calibration table.

The IQ calibrations ensure that the test set accurately generates IQ-modulated signals. If the test set's IQ modulators have not been properly calibrated, the test set's output power (when producing an IQ-modulated signal) will be inaccurate, which may result in degraded receiver test results.

If you perform the IQ calibrations from a W-CDMA/HSDPA, cdma2000/IS-95/AMPS or 1xEV-DO application or format, you do not need to perform them from any other application or format. However, note that if you perform the IQ calibrations from a GSM/GPRS/EGPRS or AMPS/136 application/format, you must still perform them once from a W-CDMA/HSDPA, cdma2000/IS-95/AMPS or 1xEV-DO application or format.

The IQ calibrations do not need to be run frequently. See Recommended Calibration Intervals.

To initiate the IQ calibrations from the front panel, press **SYSTEM CONFIG**, press the right **More** (1 of 2) key, select `Service` (**F7**), then select `Cal. first IQ Modulator` or `Cal. second IQ Modulator`. To initiate the IQ calibrations from a remote program, use the `CALibration:IQ[1]|2?` queries.

Each IQ calibration takes 5-6 minutes to execute.

Burst Mod Offset 1 Calibration This calibration is only applicable to W-CDMA/HSDPA,

cdma2000/IS-95/AMPS, and 1xEV-DO applications and formats. This calibration is only required when using the test set to generate an `AM` or `DSB-SC` test signal (select (**F9**) `Test Signal` when in `CW Operating Mode`). These test signals are used for calibrating Zero Intermediate Frequency (Zero IF) devices which utilize Qualcomm's radioOne™ architecture.

You do not have to perform the `Burst Mod Offset 1` calibration for each application/format in your test set; performing it from one application/format provides calibration data to all relevant applications and formats.

The `Burst Mod Offset 1` calibration does not need to be run frequently.

The `Burst Mod Offset 1` calibration calibrates the noise and signal level of RF Source 1 (as a function of frequency) to most accurately produce the `AM` and `DSB-SC` test signals required for Zero IF device calibration. The calibration is performed by generating the modulated test signals and adjusting RF Source 1 to optimize gain and minimize the noise floor. The optimization data is then stored in the test set and accessed whenever the RF Source frequency is set.

To initiate the `Burst Mod Offset 1` calibration from the front panel, press **SYSTEM CONFIG**, press the right **More** (1 of 2) key, select `Service` (**F7**), then select `Cal. Burst Mod Offset 1`. To initiate the `Burst Mod Offset 1` calibration from a remote program, use the `CALibration:BMOFfset?` query.

The `Burst Mod Offset 1` calibration takes less than 1 minute to execute.

Digital Average Power Calibration The `Digital Average Power` calibration is only applicable to the cdma2000/IS-95/AMPS and 1xEV-DO applications/formats.

You do not have to perform the `Digital Average Power` calibration for each application/format in your test set; performing it from one application/format provides calibration data to all relevant applications and formats.

The `Digital Average Power` calibration does not need to be run frequently.

IMPORTANT	You *must* cycle the test set's power after the `Digital Average Power` calibration is complete in order to complete the calibration (the calibration data is not available to the test set until it has been restarted).

The `Digital Average Power` calibration generates calibration data for the Fast Power Detector for use by cdma2000/IS-95/AMPS and 1xEV-DO applications and formats. This calibration improves the accuracy of the Fast Power Detector when used to measure IS-95 and reverse RC-1 and RC-2 signals.

The calibration generates a CW signal at a given power level, measures it using the Fast Power Detector, generates a CDMA-modulated signal at the same power level, measures it using the Fast Power Detector and notes the difference. The calibration then generates a CW signal at a given power level, measures it using the Thermal Power Detector, generates a CDMA-modulated signal at the same power level, measures it using the Thermal Power Detector and notes the difference. Calibration data is then created by comparing these results. This is repeated for several power levels.

The `Digital Average Power` calibration provides calibration data for the following measurements:

- Digital Average Power
- Maximum/Minimum Power

To initiate the `Digital Average Power` calibration from the front panel, press **Measurement selection**, select `Digital Average Power,` then select `Calibrate Digital Avg Pwr` **(F4)**. To initiate the `Digital Average Power` calibration from a remote program, use the `CALibration:DAPower?` query.

The `Digital Average Power` calibration takes approximately 9 minutes to execute.

Spectrum Monitor Calibration Performing the `Spectrum Monitor` calibration from one application/format does not provide calibration data to all relevant applications and formats. The calibration data files are shared as follows:

- cdma2000/IS-95/AMPS and 1xEV-DO share the same `Spectrum Monitor` calibration data file.
- W-CDMA/HSDPA has its own `Spectrum Monitor` calibration data file.
- GSM/GPRS/EGPRS and AMPS/136 share the same `Spectrum Monitor` calibration data file.

Thus, if you perform the `Spectrum Monitor` calibration from a 1xEV-DO application/format, you do not need to perform it from a cdma2000/IS-95/AMPS application/format. However you do still need to perform it from a W-CDMA/HSDPA application/format and then again from either a GSM/GPRS/EGPRS or AMPS/136 application/format.

The `Spectrum Monitor` calibration should be run monthly, or whenever the test set's operating environment changes.

Performing the `Spectrum Monitor` calibration from a cdma2000/IS-95/AMPS or 1xEV-DO application/format executes the same routine as performing the Channel Power Calibration.

Performing the `Spectrum Monitor` calibration from a W-CDMA/HSDPA application/format executes the same routine as performing the Calibrate Measurements routine.

Performing the `Spectrum Monitor` calibration from a GSM/GPRS/EGPRS or AMPS/136 application/format calibrates the IF signal path in the Measurement Downconverter, using a CW signal.

To initiate the `Spectrum Monitor` calibration from the front panel, press **Instrument selection**, select `Spectrum Monitor,` select `Trigger Setup` **(F4)**, then select `Calibrate Measurement` (**F11**). To initiate the `Spectrum Monitor` calibration from a remote program, use the `CALibration:SMONitor?` query.

The `Spectrum Monitor` calibration takes between 45 seconds and 3 minutes to execute, depending upon which application/format it is executed from.

Calibrate Measurements The `Calibrate Measurements` routine is only applicable to W-CDMA/HSDPA applications/formats.

The `Calibrate Measurements` routine should be run monthly, or whenever the test set's operating environment changes.

The `Calibrate Measurements` routine calibrates the signal paths through the Measurement Downconverter and Demod Downconverter using both a CW signal and a modulated signal. The calibration is performed by comparing measured signals through the MDC and DDC to measurements made using the Fast Power Detector (for CW signals) and the Thermal Power Detector (for modulated signals). Both of these detectors are calibrated at the factory and temperature controlled for stability. During the `Calibrate Measurements` calibration, the internal temperature of the test set is measured and stored with the calibration data. If the internal temperature of the test set drifts by more than +/- 10 C since the last calibration, measurements utilizing this calibration will return integrity indicator 19 (`Uncalibrated Due to Temperature`).

The `Calibrate Measurements` routine provides calibration data for the following measurements:

Calibrating the Test Set

- Adjacent Channel Leakage Ratio
- Channel Power
- Change of TFC (*lab application only*)
- Code Domain
- Fast Device Tune (*lab application or feature-licensed test application only*)
- Dynamic Power Analysis
- Inner Loop Power
- IQ Tuning
- Occupied Bandwidth
- Phase Discontinuity
- PRACH Preamble Analysis (*lab application only*)
- PRACH Transmit On/Off Power
- Spectrum Emission Mask
- Spectrum Monitor
- TX Dynamic Power
- Waveform Quality

Performing the `Calibrate Measurements` routine executes the same routine as performing the Spectrum Monitor Calibration from a W-CDMA/HSDPA application/format.

To initiate the `Calibrate Measurements` routine from the front panel, initiate any of the measurements listed above and select `Calibrate Measurements` **(F4)**. To initiate the `Calibrate Measurements` routine from a remote program, use the `CALibration:MEASurements?` query.

The `Calibrate Measurements` routine takes approximately 3 minutes to execute.

Channel Power Calibration The `Channel Power` calibration is applicable to the cdma2000/IS-95/AMPS and 1xEV-DO applications/formats.

You do not have to perform the `Channel Power` calibration for each application/format in your test set; performing it from one application/format provides calibration data to all relevant applications and formats.

The `Channel Power` calibration should be run monthly, or whenever the test set's operating environment changes.

The `Channel Power` calibration calibrates the signal paths through the Measurement Downconverter and Demod Downconverter using both a CW signal and a modulated signal. The calibration is performed by comparing measured signals through the MDC and DDC to measurements made using the Fast Power Detector (which is calibrated at the factory and temperature controlled for stability). During the `Calibrate Measurements` calibration, the internal temperature of the test set is measured and stored with the calibration data. If the internal temperature of the test set drifts by more than +/- 10 C since the last calibration, measurements utilizing this calibration will return integrity indicator 19 (`Uncalibrated Due to Temperature`).

The `Channel Power` calibration provides calibration data for the following measurements:

- Access Probe Power

- Channel Power

- Code Channel Time/Phase Error

- Fast Device Tune (*lab application or feature-licensed test application only*)

- Gated Power

- Graphical Access Probe Power (*lab application only*)

- Handoff Waveform Quality

- Maximum/Minimum Power

- Time Response of Open Loop Power Control

- TX Dynamic Power

- TX Spurious Emissions

- Waveform Quality + Code Domain

- Spectrum Monitor

Performing the `Channel Power` calibration executes the same routine as performing the Spectrum Monitor Calibration from a cdma2000/IS-95/AMPS or 1xEV-DO application/format.

To initiate the `Channel Power` calibration from the front panel, initiate any of the measurements listed above and select `Calibrate Channel Power` **(F4)**. To initiate the `Channel Power` calibration from a remote program, use the `CALibration:CPOWer?` query.

The `Channel Power` calibration takes approximately 2 minutes to execute.

Thermal Power Null Adjustment The `Thermal Power Null Adjustment` is only applicable to the cdma2000/IS-95/AMPS, 1xEV-DO and W-CDMA/HSDPA applications/formats.

The Thermal Power Detector is calibrated at the factory and temperature controlled for stability. However, it is still possible for the auto-null circuit within the detector to drift over time. The `Thermal Power Null Adjustment` should be run monthly to:

- Re-center the auto-null circuit to provide optimum accuracy for the affected measurements.

- Ensure that the auto-null circuit has not drifted such that it is no longer able to null the power detector. If this occurs, the `Thermal Power Null Adjustment` returns a 1 (fail).

You do not have to perform the `Thermal Power Null Adjustment` from each application/format in your test set; performing it from one application/format checks the auto-null circuit and provides re-centering data as needed. However, to achieve the accuracy optimization that results from re-centering, each of your applications must include the `Thermal Power Null Adjustment` feature (because only applications including the `Thermal Power Null Adjustment` feature are able to instruct the Thermal Power Detector to use the re-centering data generated by the `Thermal Power Null Adjustment`).

This adjustment affects the Thermal Power (W-CDMA/HSDPA) measurement, as well as all measurements that are calibrated by the Digital Average Power Calibration (cdma2000/IS-95/AMPS, 1xEV-DO) and Calibrate Measurements (W-CDMA/HSDPA) routine.

Calibrating the Test Set

To initiate the `Thermal Power Null Adjustment` from the front panel, press **SYSTEM CONFIG**, press the right **More** (1 of 2) key, and select `Thermal Power Null Adjust` (**F9**). To initiate the `Thermal Power Null Adjustment` from a remote program, use the `SYSTem:INSTrument:THERmal:POWer:NULL:ADJust?` query.

The `Thermal Power Null Adjustment` takes between 30 seconds and 3 minutes.

Amplitude Offset

Description

Amplitude offsets compensate for loss or gain between the test set's RF IN/OUT front panel connector and the mobile station's RF connector.

To access the amplitude offset feature, press the **SYSTEM CONFIG** key, followed by the `RF IN/OUT Amptd Offset` (**F5**) key.

Amplitude offset settings are preserved during power cycles or instrument preset.

Setting Up Amplitude Offsets and Frequency Points

Up to 20 frequency points can be assigned an amplitude offset. Negative amplitude offset values should be entered when there is a loss through the RF cabling and test fixtures and positive values should be entered when there is a gain.

The RF IN/OUT Amplitude Offset table displays the current (on/off) state of the amplitude offset feature. There are also 20 rows for entering frequencies and 20 rows for entering corresponding offset values. To enter values in the table use the RF IN/OUT Amplitude Offset Setup menu.

To set up amplitude offsets remotely, one comma-separated string is sent to set up frequency points and another comma-separated string assigns the corresponding amplitudes.

GPIB Commands

```
OUTPUT 714;"SYSTEM:CORRECTION:SFREQUENCY 1710.2 MHZ,1805.2 MHZ,1784.8 MHZ,1879.8 MHZ"
!sets the first 4 frequencies in the amplitude offset table.
```

```
OUTPUT 714;"SYSTEM:CORRECTION:SGAIN -2.55,-3.12,-3.68,-4.23"
!sets the first 4 amplitude offsets in the amplitude offset table.
```

Turning amplitude offsets on/off

When the RF IN/OUT Amplitude Offset State is on, all offsets that are not individually turned off are applied and the word "Offset" appears in the Instrument Status Area of the test set's display.

If the RF IN/OUT Amplitude Offset State is off, none of the amplitude offsets are applied.

GPIB Command

```
OUTPUT 714;"SYSTEM:CORRECTION:STATE ON"
!Sets the RF IN/OUT Amplitude Offset State to On
```

NOTE   If the RF IN/OUT Amplitude Offset State is turned off , none of the amplitude offsets are on, even if values are entered for the individual offsets.

Examples of Amplitude Offset Behavior

When the amplitude offset table entries accurately represent the loss in all components (cabling, connectors, and test fixturing) in the signal path between the test set and the mobile station, the test set will make the necessary adjustments in both receiver and transmitter measurements.
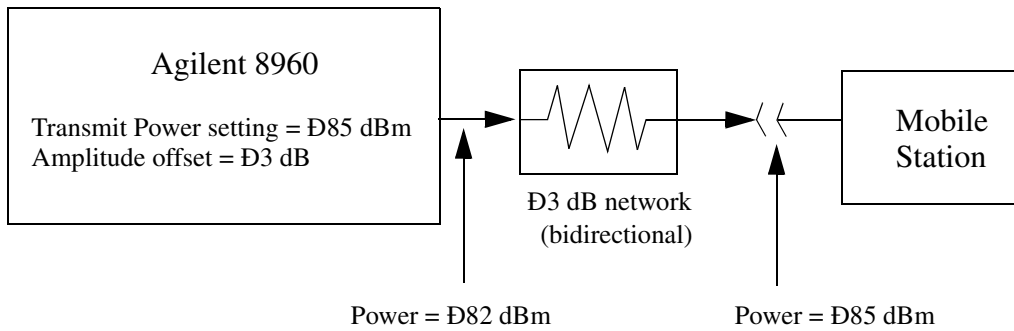
Amplitude Offset

Mobile Station Receiver Example

When you set a transmit power level, the test set uses the amplitude offset value to adjust the power so that the test set's transmit power level refers to the power level received at the mobile station.

As shown in Figure 1. Amplitude Offset Mobile Station Receiver Example, with the test set's transmit power set to -85 dBm and a -3 dB amplitude offset the actual power level transmitted from the test set will be automatically offset to -82 dBm. With a 3 dB loss in the signal path the mobile station will receive -85 dBm, the actual setting.

Figure 1.   Amplitude Offset Mobile Station Receiver Example

Agilent 8960

Transmit Power setting = Ð85 dBm
Amplitude offset = Ð3 dB

Ð3 dB network
(bidirectional)

Mobile
Station

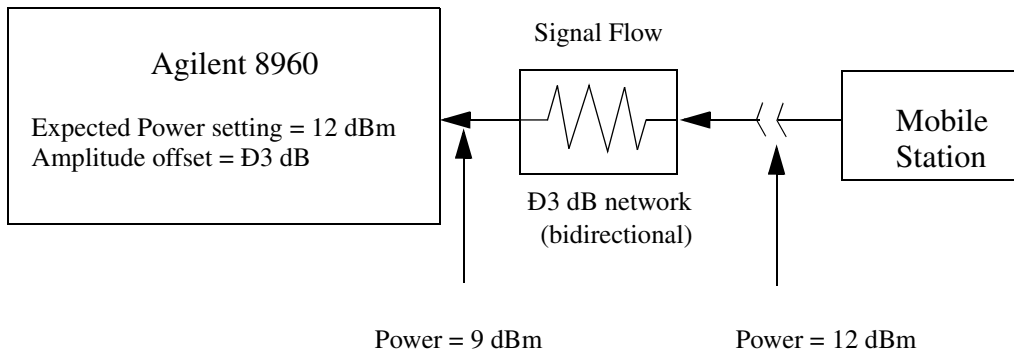Power = Ð82 dBm   Power = Ð85 dBm

Mobile Station Transmitter Example

When you measure power from the mobile station, the displayed and queried values are offset to show the level at the mobile station.

As shown in Figure 2. Amplitude Offset Mobile Station Transmitter Example, with the mobile station transmitting 12 dBm and a -3 dB amplitude offset is entered, the measured power at the test set would be 9 dBm. The displayed power level is automatically adjusted to 12 dBm to show the level at the mobile station.

If the expected power, which can be set manually or automatically is 12 dBm, the test set's internal hardware adjusts itself to receive 9 dBm which is the actual power from the mobile station after 3 dB loss in the network.

Figure 2.   Amplitude Offset Mobile Station Transmitter Example

Signal Flow

Agilent 8960

Expected Power setting = 12 dBm
Amplitude offset = Ð3 dB

Ð3 dB network
(bidirectional)

Mobile
Station

Power = 9 dBm   Power = 12 dBm

Amplitude Offsets Between Frequency Settings

If mobile station testing is performed at frequencies that do not have amplitude offsets assigned to them, the test set will estimate an amplitude offset based on the nearest settings. For example, the following screen shows five amplitude offsets for frequencies ranging from 890.2 MHz to 1710.2 MHz.

Figure 3.   RF IN/OUT Amplitude Offset Setup

System Config Screen			
RF IN/OUT	**RF IN/OUT Amplitude Offset**		**Utilities**

RF IN/OUT Amplitude Offset State: On

Number	Frequency (MHz)	Offset (dB)
1	890.20	−1.00
2	890.60	−2.00
3	891.00	−3.00
4	914.00	−4.00
5	1710.20	−4.50
6	Off	Off
7	Off	Off
8	Off	Off

RF IN/OUT Amplitude Offset Setup	Value
RF In/Out Amplitude Offset State	On
Frequency 1	890.200 MHz
Offset 1	−1.00 dB
Frequency 2	890.600 MHz
Offset 2	−2.00 dB
Frequency 3	891.000 MHz
Offset 3	−3.00 dB
Frequency 4	914.000 MHz

Side menu: RF IN/OUT Amptd Offset Setup ▽; Close Menu

Active Cell: Idle   Sys Type: IS-2000   IntRef Offset   1 of 2

Message Log

For test frequencies between the lowest (890.2 MHz) and highest (1710.2 MHz) frequency points that are not entered in the table, the test set will calculate offsets using piece-wise linear interpolation.

The graph shown in Figure 4. Amplitude Offset Interpolation is a conceptual representation of the test set's amplitude offset configuration using the settings from the RF IN/OUT Amplitude Offset table in Figure 3. RF IN/OUT Amplitude Offset Setup. Each of the five points are shown on a non-scaled frequency versus amplitude offset graph. At a test frequency of 890.4 MHz, which is midway between point number one (-1 dB) and point number two (-2 dB) the test set applies an offset of -1.5 dB. Be aware that since amplitude offsets are in units of dB, this piece-wise linear interpolation does not produce a linear transition from point to point.

Amplitude Offset

Figure 4.   Amplitude Offset Interpolation
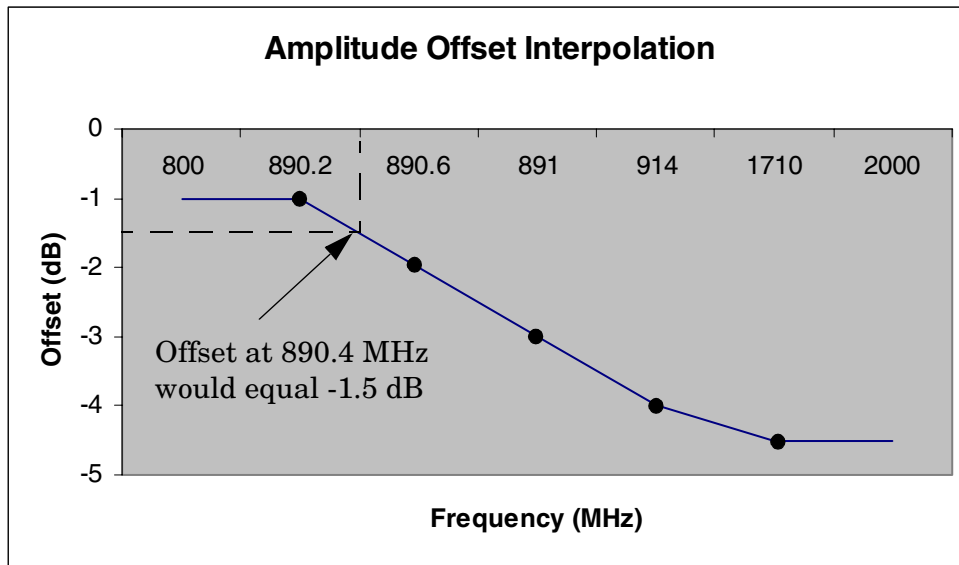
If testing is done outside the range of frequencies bounded by the lowest and highest frequency entries, the test set simply uses the amplitude offset that is paired with the nearest frequency point.

IMPORTANT   It is highly recommended that amplitude offsets are set up for each test frequency. This eliminates inaccuracies due to the mismatch between the test set's linear interpolation and the actual frequency response of the RF path between the test set and mobile station.