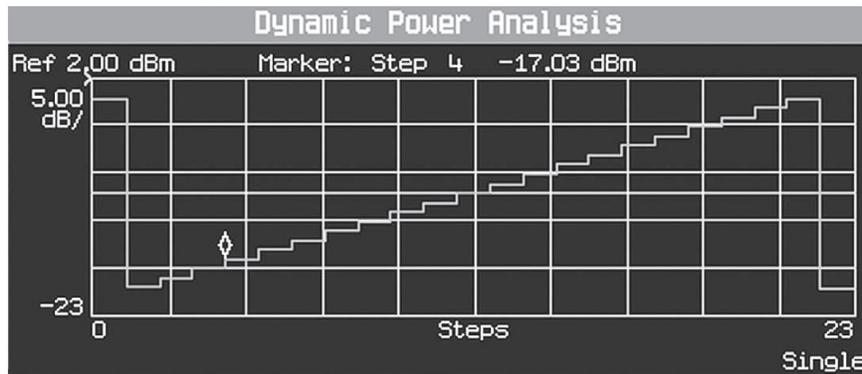


Keysight Technologies

W-CDMA Dynamic Power Analysis Using the 8960 Wireless Communications Test Set

Application Note



This paper illustrates how to use the dynamic power analysis measurement in the Keysight Technologies, Inc. 8960 test set to measure user equipment (UE) power sequences quickly and accurately.

Dynamic Power Analysis Measurement Overview

The dynamic power analysis measurement is a flexible tool that allows the measurement of UE output power sequences that step up and/or down with varying or fixed power step sizes. The power step length, which must be fixed for the sequence, can be between 100 μ s and 10 ms. A total of 58.26 ms of power sequence can be analyzed. For example, up to 87 steps can be measured when **Step Length** is set to one timeslot (666.7 μ s). The test set can measure power between -61 and +28 dBm, and a total change in power of up to 25 dB.

To use the measurement, **Measurement Frequency** must be set to the expected UE transmitter frequency, and **Manual Power** must be set to the maximum expected power for the sequence. Next, specify the length and number of steps in the sequence (including trigger pulses), then configure the RF rise trigger, initiate the measurement, and order the UE to send its sequence continuously.

The measurement executes most efficiently if the UE transmits its power sequence continuously until the measurement has completed. The measurement can be triggered externally or by an RF rise in the power sequence. Once triggered, the measurement captures the first power sequence, auto-ranges to the maximum power of the sequence, then triggers on and measures the next available power sequence. The time for the auto-ranging to complete varies depending upon the power sequence. It is important that the UE continuously transmit its power sequence so that a power sequence is available for the test set to measure as soon as it has completed its auto-ranging.

The **Measurement Interval** and its placement within each step can be varied (using the **Trigger Delay** setting) and the **RRC Filter** can be inserted or removed. The measurement can analyze CW signals and uplink DPCH signals. Note: when measuring CW signals, the **RF Rise Trigger Threshold** setting must be adjusted accordingly and the **Frequency Offset** setting used to indicate the signal's offset from the **Measurement Frequency** setting.

Triggering the Dynamic Power Analysis Measurement

The dynamic power analysis measurement is triggered using an RF rise within the power sequence by setting **Trigger Source** to **RF Rise** and specifying the appropriate **RF Rise Trigger Threshold**. If the power sequence starts with an abrupt rise in power, no separate trigger pulse is needed. However, for the most robust triggering, it is recommended that a trigger pulse be included in every power sequence. The trigger pulse should rise in power by at least 20 dB, reach the maximum power of the sequence, then fall in power by at least 20 dB. Before initiating the measurement, **Power Control** must be set to **Manual** and **Manual Power** must be set to the highest power expected in the sequence. It is recommended that the **RF Rise Trigger Threshold** be set to approximately 10 dB below the expected maximum power.

It is recommended that the trigger qualification also be used, which allows the measurement trigger to be further defined. Instead of the measurement triggering when the UE's signal simply rises above the **RF Rise Trigger Threshold** value, the signal must meet some additional criteria before the measurement is triggered. To use trigger qualification, set **Trigger Qualification State** to **On** and set **Trigger Qualification Type** to **RF Rise**, **RF Fall**, or **RF Rise and Fall** as appropriate for the power sequence. Then, set the **Trigger Qualification Rise Threshold** and/or the **Trigger Qualification Fall Threshold** accordingly. It is recommended that these rise/fall criteria be at least 10 dB (see Figure 1.)

Auto-ranging in the Dynamic Power Analysis Measurement

To ensure successful auto-ranging, the **Steps** setting must be set equal or greater than the number of steps in the power sequence (including trigger pulses). When the measurement is triggered, the test set captures data for the time period specified by the **Steps** and **Step Length** setting to determine the power range of the sequence. It then ranges its receivers to accommodate the highest power in the sequence. The time for this auto-ranging to complete varies depending on the number of steps in the sequence; a typical duration is approximately 500 ms. (Note that this is much greater than the duration of one power sequence.) Once it has completed this autoranging, the test set re-arms and then is triggered by the next available power sequence. It then analyzes and reports the power of each step in that power sequence.

To ensure that the measurement executes as quickly as possible, the UE should transmit its power sequence continuously until the measurement completes. This ensures that as soon as the measurement is done auto-ranging, another power sequence is immediately available for measurement (see Figure 2.)

Note: if the power range of the subsequent power sequence does not closely match that of the power sequence used to auto-range, instead of reporting measurement results, the measurement attempts to auto-range again. This could occur if the **Steps** setting is less than the number of **steps** in the sequence, the UE's signal was noisy, or if a false trigger occurred.

The measurement is most accurate over a 25 dB range. If the UE's power sequence spans more than 25 dB, the test set will measure and report the power of the entire sequence, but accuracy is degraded for steps that are more than the 25 dB below the highest power in the sequence.

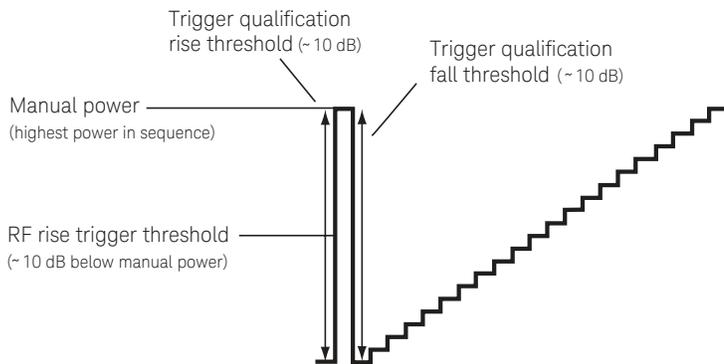


Figure 1. Trigger recommendations

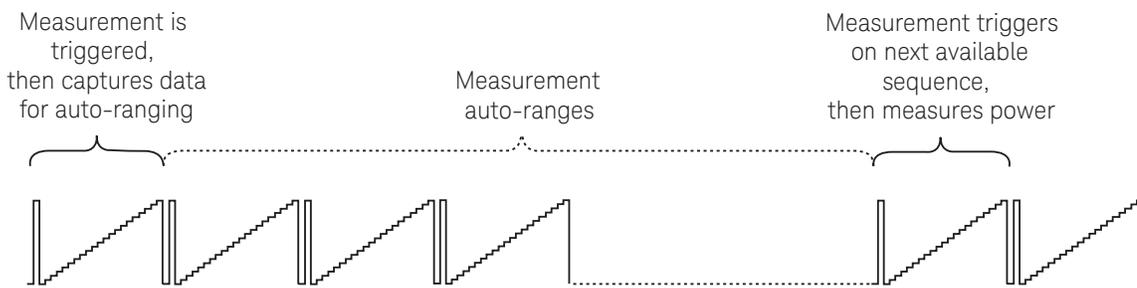


Figure 2. Measurement auto-ranging

Dynamic Power Analysis Measurement Example

This section illustrates how to configure the dynamic power analysis measurement to measure the example power sequence pictured in Figure 3. The test set settings shown in bold are critical for successful measurement triggering and auto-ranging.

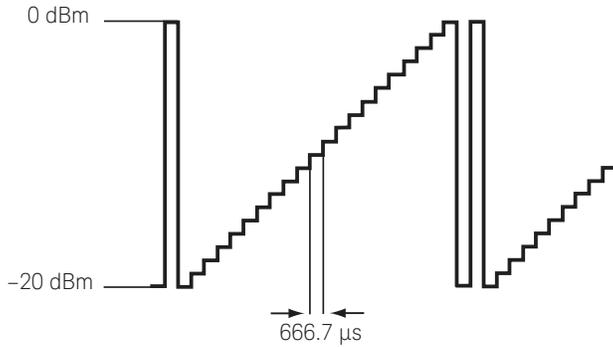


Figure 3. Example ramp-up power sequence

Test set settings:

Measurement frequency = 1950 MHz

Power control = **Manual**

Manual power = **0 dBm**

Steps = **23**

Step length = **666.7 μs**

Measurement interval = 300 μs

RF rise trigger threshold = **-10 dBm**

RRC filter = On

Frequency offset = 0 Hz

Trigger qualification state = **On**

Trigger qualification type = **RF Rise and Fall**

Trigger qualification rise threshold = **10 dB**

Trigger qualification fall threshold = **10 dB**

Trigger arm = Single

Trigger source = **RF Rise**

Trigger delay = 183.3 μs (to place the measurement interval in the center of the timeslot)

Measurement timeout = 10 s

Remote commands:

```

RFANalyzer:MANual:MEASurement 1950 MHZ
RFANalyzer:CONTRol:POWER:AUTO OFF
RFANalyzer:MANual:POWER 0 DBM
SETup:WDPAnalysis:STEPs 23
SETup:WDPAnalysis:LENGth 666.7 US
SETup:WDPAnalysis:INTerval 300 US
SETup:WDPAnalysis:TRIGger:THReshold -10 DBM
SETup:WDPAnalysis:RRCfilter ON
SETup:WDPAnalysis:FOFFset 0 HZ
SETup:WDPAnalysis:TRIGger:QUALify:STATe ON
SETup:WDPAnalysis:TRIGger:QUALify:TYPE RISEFALL
SETup:WDPAnalysis:TRIGger:QUALify:RISE 10 DB
SETup:WDPAnalysis:TRIGger:QUALify:FALL 10 DB
SETup:WDPAnalysis:CONTInuous OFF
SETup:WDPAnalysis:TRIGger:SOURce RISE
SETup:WDPAnalysis:TRIGger:DELay 183.3 US
SETup:WDPAnalysis:TIMEout 10 S
INITiate:WDPAnalysis
"Order UE to transmit its power sequence continuously"
FETCh:WDPAnalysis?

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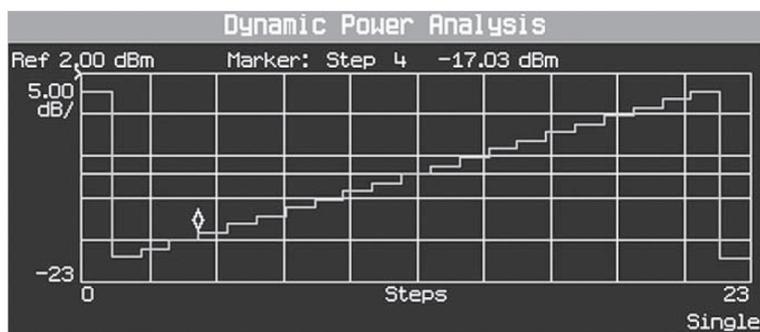


Figure 4: Dynamic power analysis measurement result

Optimizing the Dynamic Power Analysis Measurement

To help ensure the measurement routine executes as fast as possible, consider the following:

- ensure that the UE is continuously repeating its power sequence
- use RF rise triggering, include a trigger pulse in the power sequence, and use trigger qualification to avoid false triggering
- make the trigger pulse equal to the maximum power in the sequence, to best utilize the 25 dB dynamic range of the measurement
- minimize the space between consecutive sequences (one step of space is sufficient)
- note that a noisy UE signal may force the measurement to auto-range repeatedly

Conclusion

The dynamic power analysis measurement in the 8960 is a flexible tool that provides fast and accurate power measurements to aid in the calibration of UE.

For additional information on the dynamic power analysis measurement, visit:

http://wireless.keysight.com/rfcomms/refdocs/wcdma/wcdma_meas_wdpanalysis_desc.php

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