# R&S®NRQ6
# ACLR 100 MHz (Using FFT Filtering)
# Application Sheet

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# 1  Your Task

This application sheet describes how to perform ACLR measurements on LTE Advanced/5G signals with a bandwidth of 100 MHz.

The R&S NRQ6 frequency selective power sensor has a built-in solution for ACLR measurements, but this function is limited to 20 MHz LTE signals. The limitation is due to the maximum instantaneous bandwidth of 100 MHz total for five channels.

The obvious alternative way would be to replace the ACLR measurement by several separate power measurements at the five frequencies, using the 100 MHz flat filter. Unfortunately, the stopband bandwidth of the 100 MHz flat filter is 140 MHz, due to limited number of FIR coefficients at this high sampling rate. Thus, you would see strong cross-talk of the main channel in the adjacent channels.

This application sheet describes a way to use FFT filtering to realize very steep filters needed for LTE advanced/5G ACLR measurements.

# 2  Possible Solution

The R&S NRQ6 has some built-in features to perform simple spectral analysis of the I/Q samples. The R&S NRQ6-K1 option is not required.

These features are accessible by SCPI using the `SENS:TRAC:IQ:FFT:…` node.

Beside the magnitude spectrum displayed with "Signal Check" of the web user interface, the following command measures the power within a dedicated bandwidth by adding up the power in the frequency domain:

`SENS:TRAC:IQ:FFT:SPEC:ABS:SUM?`

Without additional parameter, this function calculates the power over the whole resolution bandwidth.

Adding a numerical parameter reduces the spectral bandwidth considered.

**Example:**

Resolution bandwidth is set to 100 MHz.

`SENS:TRAC:IQ:FFT:SPEC:ABS:SUM?` -> The power between -50 MHz and +50 MHz around the carrier frequency is measured.

`SENS:TRAC:IQ:FFT:SPEC:ABS:SUM? 0.9` -> The power between -45 MHz and +45 MHz around the carrier frequency is measured.

# 3 How to Configure the R&S NRQ6

**Prerequisites**

There is no R&S NRQ6-K1 option needed. Every R&S NRQ6 can be used.

**Configuration**

```
::
*RST
::
SENS:FUNC "XTIM:VOLT:IQ"       # Select IQ mode
SENS:BAND:RES:TYPE:AUTO OFF    # Manual selection of filter type
SENS:BAND:RES:TYPE FLAT        # Filter type FLAT
SENS:BAND:RES 100.0e6          # 100 MHz RBW filter
SENS:TRAC:IQ:RLEN 120000       # Requesting 120000 I/Q samples (1 ms)
                               #   to be used for FFT calculation
                               #   (biggest radix 2 number below is
                               #    used in fact -> 64k FFT)
```

**Measuring the channel power**

```
SENS:FREQ 2.1e9               # RF = 2.1 GHz (example)
SENS:INP:ATT:AUTO ONCE        # One time setting of the attenuator
INIT                          # Trigger measurement
SENS:TRAC:IQ:FFT:SPEC:ABS:SUM? # Gets the power (linear scale)
                              # use "30.0 + 10.0*log10(linear power)" to
                              # get the logarithmic power / dBm
```

**Measuring the adjacent channel power**

```
SENS:FREQ 2.2e9               # RF = 2.2 GHz for right adjacent channel
INIT                          # Trigger measurement
SENS:TRAC:IQ:FFT:SPEC:ABS:SUM? # Gets the power (linear scale)
                              # use "30.0 + 10.0*log10(linear power)" to
                              # get the logarithmic power / dBm
```

**Calculate ACLR**

ACLR = adjacentPower - channelPower

# 4 Possible Extensions

With the above-mentioned method, all adjacent and alternate channels could be measured resulting in all five power values needed for standard ACLR measurement.

Another extension would be to trigger to an external signal connected to SMA connector denoted as TRG2.

```
::
TRIG:SOUR EXT2                 # Sensor will be triggered by an ext. signal
```

The FFT filtering method delivers very good results with low coding effort. A downside, however, is the long calculation time. It can be reduced by doing several measurements with shorter result length and averaging the readings later in the script.

# 5  Learn More about the R&S NRQ6

For a detailed description of the capabilities of the R&S NRQ6, read its user manual. The user manual also explains all aspects of remote control features in details.

Also, you can always install our basic driver and tools package called R&S NRP Toolkit. Among various tools, this package supplies an optional SDK (Software Development Kit), which contains many sample programs with full commented source code in various programming languages. On an MS Windows PC, you find the SDK after installation under:

```
C:\ProgramData\Rohde-Schwarz\NRP-Toolkit-SDK\
```

The examples especially for the R&S NRQ6 are under:

```
C:\ProgramData\Rohde-Schwarz\NRP-Toolkit-SDK\NRQ\
```

Download the latest version of the R&S NRP Toolkit at:

www.rohde-schwarz.com/software/nrp_s_sn/