AN-60-041

LTE Base Station MMIC Amplifier

Mini-Circuits PHA-1+ Ultra High Dynamic Range MMIC Amplifier is designed specifically for applications which require extremely linear performance, particularly wideband, advanced digital communications systems such as LTE which require excellent ACLR suppression and low EVM.

The E-PHEMT based PHA-1+ provides typically +42 dB OIP3 which translates to extremely linear performance in multi-carrier and complex signal environments such as LTE supporting ACLR_1 Measurements of better than -60 dBc at +10 dBm output and -26 dbc at 100mW (near the 1 dB compression point).

The PHA-1+ is characterized using a high peak-to-average ratio OFDM signal used for next generation LTE within the AWS-1 Downlink Band.

Figure 1 (PHA-1+ Test Board)

DUT Configuration:

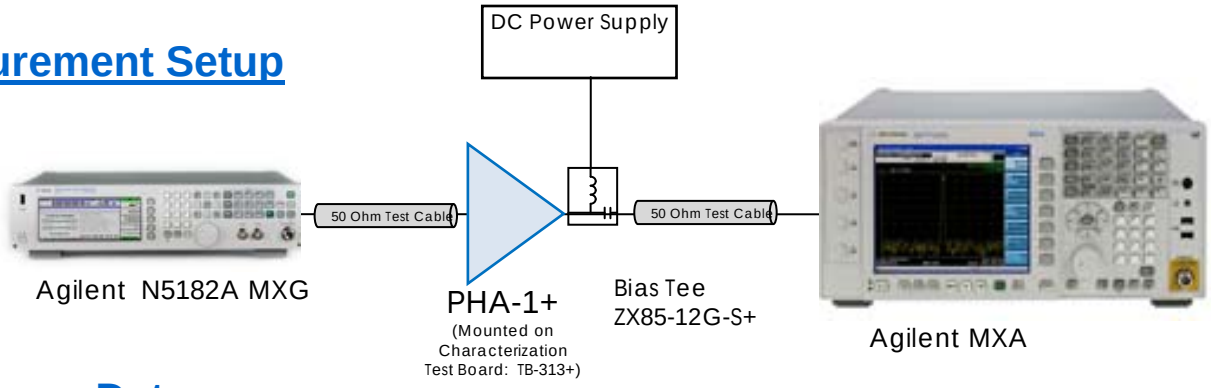
Device: PHA-1+ Test board
Supply Voltage: 5.0V, 150 mA
Temperature: 25° C
Note: All data is referenced to the PCB connectors

Test Signal:
AWS_1 Downlink
Fc = 2130 MHz
OFDM, 10 MHz Channel width

CCDF

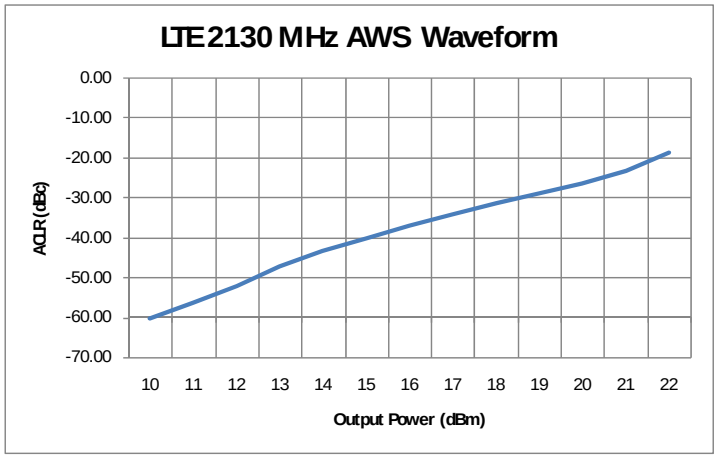
10%	4.05 dB
1.0%	7.27 dB
0.1%	9.12 dB
0.01%	10.32 dB
0.001%	11.40 dB
0.0001%	11.98 dB

Measurement Setup

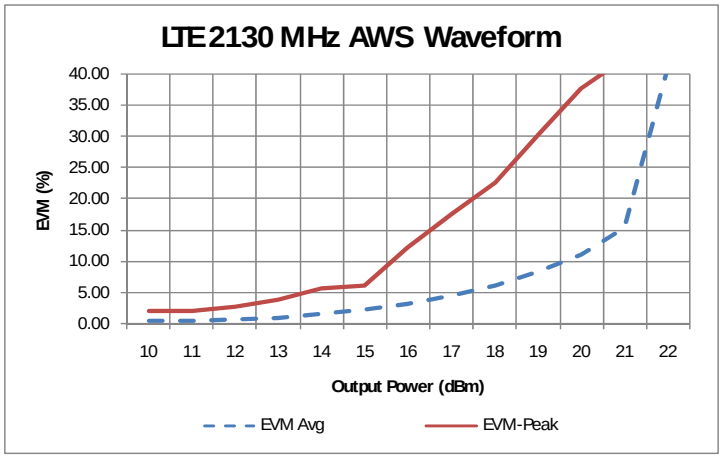


Summary Data

ACLR 1 vs. Output Power

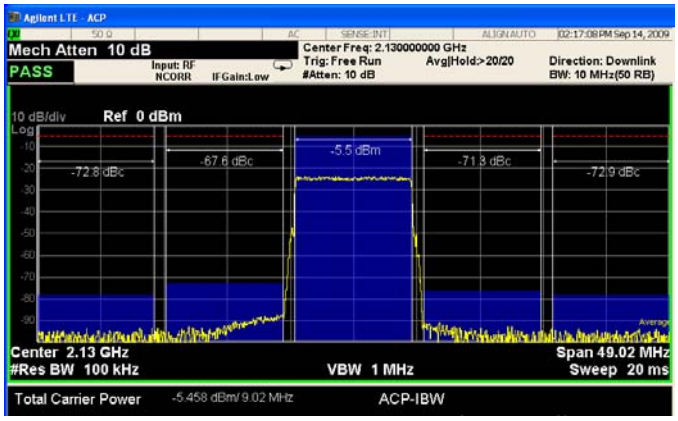


EVM vs. Output Power



ACLR_1 Plots vs. Output power

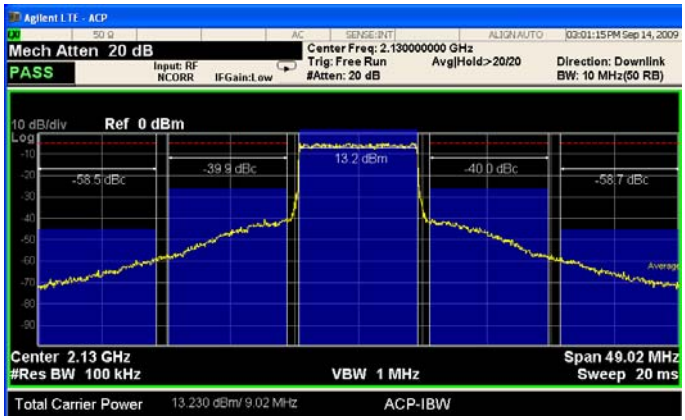
System Reference **Upper: -67.6 dBc**
Lower -71.28 dBc



+ 10 dBm **Upper: -60.1 dBc**
Lower: -60.3 dBc

+ 12 dBm **Upper: -51.8 dBc**
Lower: -52.0 dBc

+ 15 dBm **Upper: -39.9 dBc**
Lower: -40.0 dBc

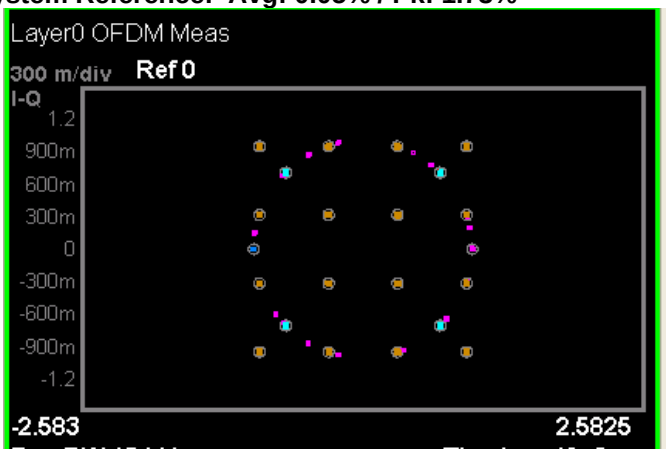


+ 18 dBm **Upper: -31.0 dBc**
Lower: -31.2 dBc

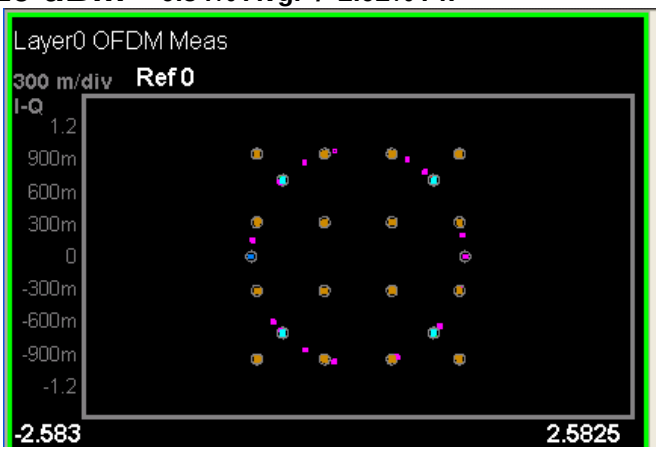
+ 20 dBm **Upper: -26.1 dBc**
Lower: -26.3 dBc

EVM Constellation Plots vs. Output power

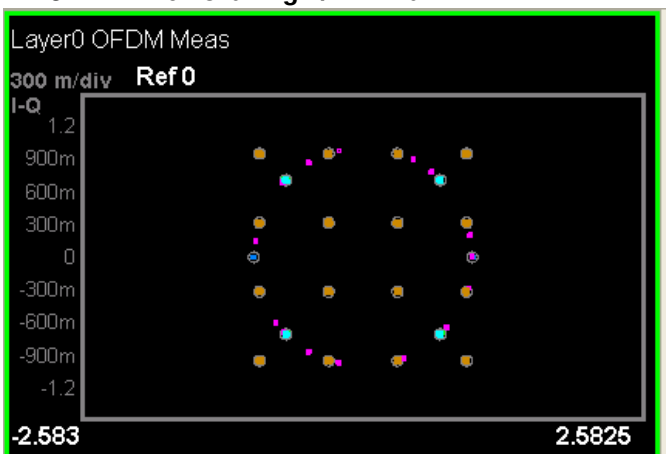
System Reference: Avg: 0.05% / Pk: 1.73%



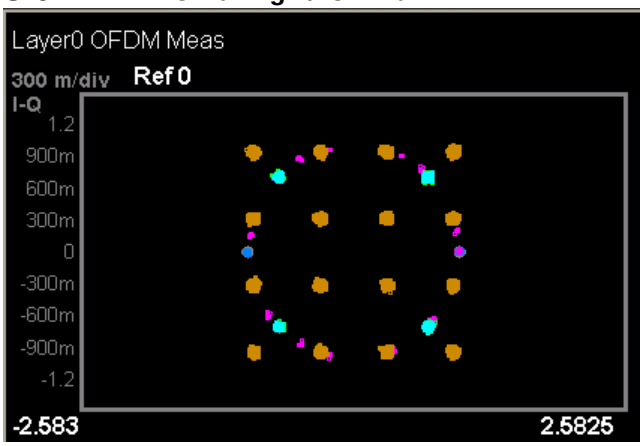
+10 dBm 0.54% Avg. / 2.02% Pk



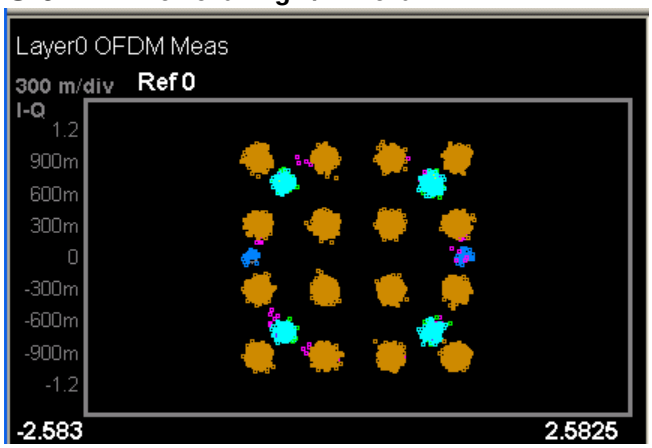
+12 dBm 0.75% Avg. / 2.72% Pk



+15 dBm 2.31% Avg. / 8.12% Pk



+18 dBm 6.19% Avg. / 22.6% Pk



+20 dBm 11.2% Avg. / 37.7% Pk