Definition of the Specifications

To guarantee the part performance in Doherty architecture, the part is specified in Doherty operation for maximum power condition and low power condition. The following specification definition assumes the extra port extension is already applied to the raw S parameter and the parts is measured with Pin n connected to Port n (where n=1, 2, 3, 4).

Maximum power condition

Under the maximum power condition, the symmetrical Doherty architecture requires main amplifier and peak amplifier to work at full capacity with the optimum termination (50 Ω). The two amplifiers should deliver RF power of equal magnitude and 90 degree phase difference. Doherty combiner functions as a coherent power combiner and supplies the 90 degree phase compensation. The following specification is defined with 50 Ω port impedance at three ports for this condition. The return loss and the insertion loss in max power mode are not affected by the 50 ohm lossless port rotation mentioned in electrical spec table in page 1. The phase imbalance and the amplitude imbalance are not affected either since port rotation are taken off equally from the main and the peak amp port.

Parameter	Definition	Mathematical Representation
Return Loss	The impedance match at the combining port to a 50Ω system.	$20\log\lvert S_{11}\rvert$
Insertion Loss	The combined power divided by the sum of input power under the perfect combining condition.	$10\log(\lvert S_{13}\rvert^2 + \lvert S_{14}\rvert^2)$
Phase Imbalance	The phase difference between Peak-Combined path and Main-Combined path at ω_c = 2140MHz.	$\text{Phase}\,(S_{14}(\omega_c)) - \text{Phase}\,(S_{13}(\omega_c))$
Amplitude Imbalance	The magnitude difference between Peak-Combined path and Main-Combined path.	$\frac{1}{2}(20\log\lvert S_{14}\rvert - 20\log\lvert S_{13}\rvert)$

Low power condition

Under low power condition, the Doherty operation turns off peak amplifier and requires main amplifier to be terminated with double of the optimum impedance (100 Ω). In this configuration, Doherty combiner servers as an impedance transformer transforming 50 Ω at combining port to 100 Ω at main amplifier port. The following specification is defined under the port impedance condition of Port 1 (Combining Port) 50 Ω, Port 4 (Main Amp Port) 100 Ω and Port 3 (Peak Amp Port) open. With the peak amp left off, the extra line length in that port (see figure in page 2) acts as an open stub which shifts the low power mode return loss null and insertion loss. The offset line length needs to be adjusted taking the port rotation number into consideration so that the junction of 50 Ω and 35 Ω transmission line sees high impedance instead of the part edge. The return loss and the insertion loss defined below are after the offset line adjustments specified in the spec table.

Parameter	Definition	Mathematical Representation
Return Loss	The impedance match of the 50 to100 Ω transformer.	$20\log\lvert S_{11}\rvert$
Insertion Loss	The output power divided by input power.	$20\log\lvert S_{41}\rvert$