



## Brief Guide to Marki Microwave Simulation Models

The following is a brief guide to non-linear simulation models of a selection of Microlithic and MMIC Marki Microwave products. Design kits are available for Keysight's Advanced Design System (ADS) and National Instrument's Microwave Office (MWO). Models are provided primarily for mixer products, as well as several multiplier products; models for legacy products are not supported. Models indicate typical performance only, are provided as-is without technical support, and cannot be considered a guarantee of performance.

### ADS Models: Download and Installation

<https://www.markimicrowave.com/engineering/resources/non-linear-device-models/>

For installation: Go to **DesignKits** (on the main menu) > **Manage Library** > **Add Lib Def File**

The ADS .zip file download includes:

- List of supported parts
- ADS parts library files

In order to use these circuit models, it is required to have a computer with ADS installed, including the Harmonic Balance simulator. These circuit models were developed and tested using ADS license 64-bit version 2017.

### Microwave Office Models: Download and Installation

<https://www.markimicrowave.com/engineering/resources/non-linear-device-models/>

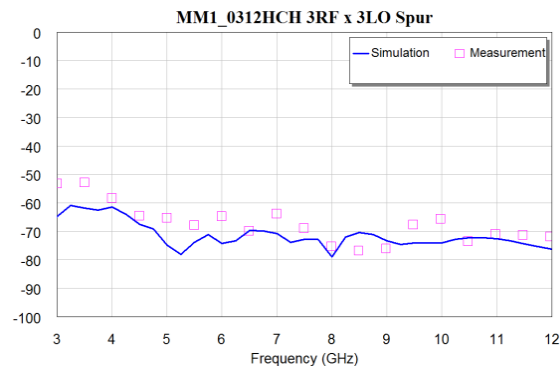
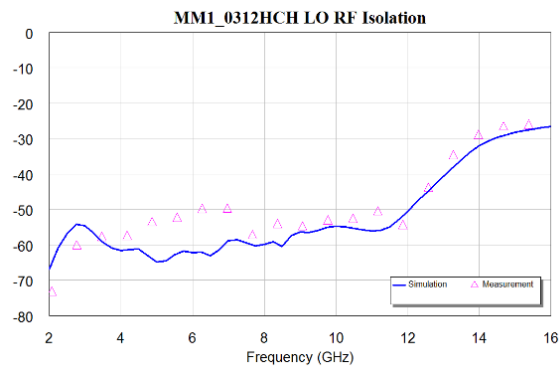
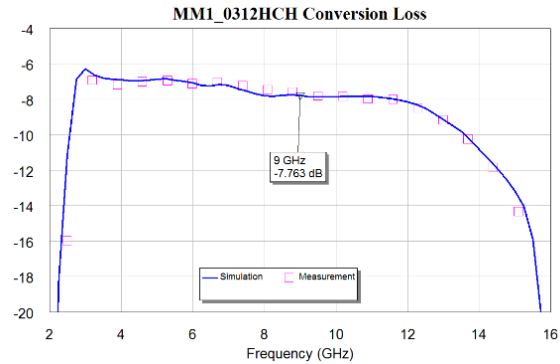
The MWO .zip file download includes:

- List of supported parts
- Marki Microwave Microlithic and MMIC Models for Microwave Office User's Guide
- MWO parts library files

In order to use these circuit models, it is required to have a computer with Microwave Office installed, including the Harmonic Balance simulator. These circuit models were developed and tested using Microwave Office version 12. However, they can also be used with both 32-bit and 64-bit versions of Microwave Office Version 11 as well, provided that the installer is appropriately setup for the available version of Microwave Office.

## Model Accuracy

Complete 3D, non-linear, physics-based models of a selection of Marki mixers and doublers are provided in ADS and MWO. Although these models are presented with no guarantee of accuracy, comparison to measured data has shown them to be remarkably close. For example, measured vs. MWO simulated data is shown for MM1-0312HCH conversion loss, isolation, and the 3x3 spur.



It is recommended to use simulation results in conjunction with bench evaluation under application specific operating conditions. Performance results at high powers tend to be more accurate than results at low powers. For example, a conversion loss result of 7 dB will be accurate to approximately  $\pm 1$  dB, while an isolation result of -40 dB will be accurate to approximately  $\pm 5$  dB. Similarly, results requiring simulation of fewer harmonics also tend to result in higher accuracy, due to fewer compounded errors. For example, a 2x2 spur of -30 dBc will tend to be more accurate than a 5x7 spur of -70 dBc.

Supported Marki Microwave products in ADS and MWO

<b>Supported in ADS</b>	<b>Supported in MWO</b>
<i>Version: 2.0</i>	<i>Version: 4.0</i>
<i>Last Updated: 12/11/18</i>	<i>Last Updated: 06/26/2019</i>
<b>MLD product family</b>	
MLD-0416LSM	MLD-0416LSM
MLD-0632LCH	MLD-0632LCH
MLD-1640LCH	MLD-1640LCH
<b>MMD product family</b>	
MMD-1030HCH	MMD-1030HCH
MMD-1648HCH	MMD-1648HCH
MMD-1648LCH	MMD-1648LCH
MMD-2060HCH	MMD-2060HCH
MMD-2060LCH	MMD-2060LCH
MMD-3580HCH	MMD-3580HCH
MMD-3580LCH	MMD-3580LCH
<b>MLIQ product family</b>	
MLIQ-0218ICH	MLIQ-0218ICH
MLIQ-0218LCH	MLIQ-0218LCH
MLIQ-0416ICH	MLIQ-0416ICH
MLIQ-0416LCH	MLIQ-0416LCH
MLIQ-1845ICH	MLIQ-1845ICH
MLIQ-1845LCH	MLIQ-1845LCH
<b>MM1 product family</b>	
MM1-0212HCH	MM1-0212HCH
MM1-0212SCH	MM1-0212SCH
MM1-0212LCH	MM1-0212LCH
MM1-0220HCH (unverified)	MM1-0220HCH (unverified)
MM1-0220LCH (unverified)	MM1-0220LCH (unverified)
MM1-0312HCH	MM1-0312HCH
MM1-0312SCH	MM1-0312SCH
MM1-0320HCH	MM1-0320HCH
MM1-0320LCH	MM1-0320LCH
MM1-0424SCH	MM1-0424SCH
MM1-0626HCH	MM1-0626HCH
MM1-0626SCH	MM1-0626SCH
MM1-0726HSM	MM1-0726HSM
MM1-0832HCH	MM1-0832HCH
MM1-0832LCH	MM1-0832LCH
MM1-1140HCH	MM1-1140HCH
MM1-1044HCH	MM1-1044HCH
MM1-1044LCH	MM1-1044LCH
MM1-1850HCH	MM1-1850HCH
MM1-1850SCH	MM1-1850SCH

MM1-1857HCH	MM1-1857HCH
MM1-1857LCH	MM1-1857LCH
MM1-1460HCH	MM1-1460HCH
MM1-1460LCH	MM1-1460LCH
MM1-2567LCH	MM1-2567LCH
MM1-40110HCH	MM1-40110HCH
MM1-40110LCH	MM1-40110LCH
<b>MM2 product family</b>	
MM2-0530HCH	MM2-0530HCH
MM2-0530LCH	MM2-0530LCH
<b>MM4 product family</b>	
MM4-2070HCH	MM4-2070HCH
MM4-2070LCH	MM4-2070LCH
<b>MT3 product family</b>	
MT3H-0113HCH	MT3H-0113HCH
MT3H-0113LCH	MT3H-0113LCH
MT3L-0113HCH	MT3L-0113HCH
MT3L-0113LCH	MT3L-0113LCH
<b>MMST product family</b>	
MMST-1040AHCH	MMST-1040AHCH
MMST-1040ALCH	MMST-1040ALCH
MMST-1040BHCH	MMST-1040BHCH
MMST-1040BLCH	MMST-1040BLCH
MMST-1040CHCH	MMST-1040CHCH
MMST-1040CLCH	MMST-1040CLCH
<b>MMIQ product family</b>	
MMIQ-0218HCH	MMIQ-0218HCH
MMIQ-0218LCH	MMIQ-0218LCH
MMIQ-0412HCH	MMIQ-0412HCH
MMIQ-0412LCH	MMIQ-0412LCH
MMIQ-0520HCH	MMIQ-0520HCH
MMIQ-0520LCH	MMIQ-0520LCH
MMIQ-1037HCH	MMIQ-1037HCH
MMIQ-1037SCH	MMIQ-1037SCH
MMIQ-1040LCH	MMIQ-1040LCH
MMIQ-1860HCH	MMIQ-1860HCH
MMIQ-1860LCH	MMIQ-1860LCH
MMIQ-1860SCH	MMIQ-1860SCH
MMIQ-40110HCH	MMIQ-40110HCH
MMIQ-40110LCH	MMIQ-40110LCH
<b>NLTL product family</b>	
NLTL-6273CH	NLTL-6273CH
NLTL-6275CH	NLTL-6275CH
<b>MQH product family</b>	
MQH-0517	
MQH-2R58R5	

Supported in ADS (cont'd.)	Supported in MWO (cont'd.)
<b>ML1 product family</b>	
ML1-0110HSM	ML1-0110HSM
ML1-0110LSM	ML1-0110LSM
ML1-0113ICH	ML1-0113ICH
ML1-0113LCH	ML1-0113LCH
ML1-0218ISM	ML1-0218ISM
ML1-0218LSM	ML1-0218LSM
ML1-0220ICH	ML1-0220ICH
ML1-0220LCH	ML1-0220LCH
ML1-0536ICH	
ML1-0536LCH	
ML1-0638ICH	
ML1-0638LCH	
ML1-0732ICH	ML1-0732ICH
ML1-0732LCH	ML1-0732LCH
ML1-0832ISM	ML1-0832ISM
ML1-0832LSM	ML1-0832LSM
ML1-0936ICH	ML1-0936ICH
ML1-0936LCH	ML1-0936LCH
ML1-1040ICH	ML1-1040ICH
ML1-1040LCH	ML1-1040LCH
ML1-1050ICH	ML1-1050ICH
ML1-1050LCH	ML1-1050LCH
ML1-1644ICH	ML1-1644ICH
ML1-1644LCH	ML1-1644LCH
ML1-1850ICH	ML1-1850ICH
ML1-1850LCH	ML1-1850LCH

#### Revision History

Revision Code	Revision Date	Comment
-	December 2017	Datasheet Initial Release
A	December 2018	ADS product update to v2.0
B	July 2019	MWO PDK updated to v4