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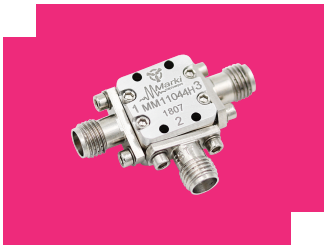
# MM1-1044HS-KKS

## GaAs MMIC Double Balanced Mixer

## DEVICE OVERVIEW

### General Description

MM1-1044H is a GaAs MMIC double balanced mixer that is designed for and operates at the K and Ka band 5G frequencies. MM1-1044H is a high linearity Ka band mixer that works well as both an up and down converter. This mixer offers low conversion loss and high LO to RF isolations over a broadband Ku to Ka band. The sister MM1-1044L is recommended for low power applications. The MM1-1044H is available as both wire bondable die and as connectorized modules.



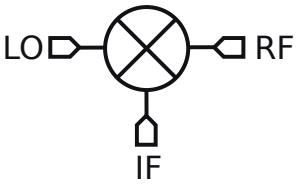
### Features

- Low cost Ka band mixer
- 5G band coverage

### Applications

- Mobile test and measurement equipment
- 5G transceivers

### Functional Block Diagram




### Part Ordering Options

| Part Number | Description | Package | Connectors | Green Status | Product Lifecycle | Export Classification |
|---|---|---|---|---|---|---|
| MM1-1044HS-KKS | GaAs MMIC Double Balanced Mixer | S | Standard | REACH RoHS | Released | EAR99 |
| MM1-1044HS | GaAs MMIC Double Balanced Mixer | S | Standard | REACH RoHS | Released | EAR99 |

## Table Of Contents



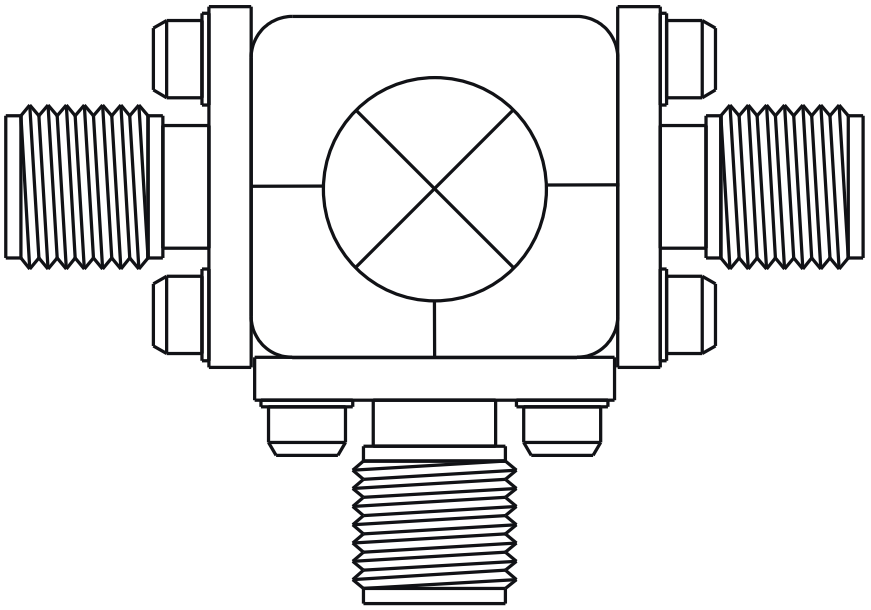
## Revision History

| Revision Code | Revision Date | Comment |
|---|---|---|
| - | 2018-02-01 | Datasheet Initial Release |
| A | 2018-06-01 | Update to CH Package Outline |
| B | 2020-02-01 | Correction to Spur Chart |
| C | 2020-03-01 | Power Handling Updated |

## Port Configuration and Functions

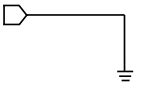
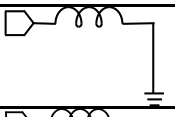
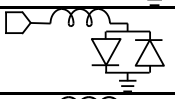
### Port Diagram

The MM1-1044H has the input and output ports given in Port Functions. The MM1-1044H can be used in either an up or down conversion. For configuration A, input the LO into port 1, use port 3 for the RF, and port 2 for the IF. For configuration B, input the LO into port 3, use port 1 for the RF, and port 2 for the IF.

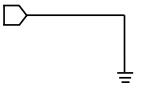
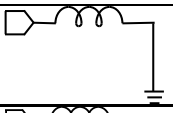
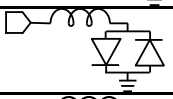
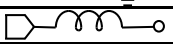


## Port Functions

### Configuration A

| Port | Function | Connector Type | Description | Equivalent Circuit for Package |
|---|---|---|---|---|
| GND | Ground | - | S package ground provided through metal housing and outer coax conductor. |  |
| Port 1 | LO | 2.92F | Port 1 is DC short for the CH and S packages. |  |
| Port 2 | IF | SMAF | Port 2 is diode connected for the CH and S package. |  |
| Port 3 | RF | 2.92F | Port 3 is DC open for the CH and S packages. |  |

**Configuration B**

| Port | Function | Connector Type | Description | Equivalent Circuit for Package |
|---|---|---|---|---|
| GND | Ground | - | S package ground provided through metal housing and outer coax conductor. |  |
| Port 1 | RF | 2.92F | Port 1 is DC short for the CH and S packages. |  |
| Port 2 | IF | SMAF | Port 2 is diode connected for the CH and S package. |  |
| Port 3 | LO | 2.92F | Port 3 is DC open for the CH and S packages. |  |

## Specifications

### Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may be inoperable or have a reduced lifetime.

| Parameter | Maximum Rating | Unit |
|---|---|---|
| Maximum Operating Temperature | 100 | °C |
| Maximum Storage Temperature | 125 | °C |
| Minimum Operating Temperature | -55 | °C |
| Minimum Storage Temperature | -65 | °C |
| Power Handling, at any Port | 30 | dBm |

### Package Information

| Parameter | Details | Rating |
|---|---|---|
| Weight | Package name: S | 12g |
| Dimensions | - | 14.22 x 13.21 mm |

### Recommended Operating Conditions

The Recommended Operating Conditions indicate the limits, inside which the device should be operated, to guarantee the performance given in Electrical Specifications Operating outside these limits may not necessarily cause damage to the device, but the performance may degrade outside the limits of the electrical specifications. For limits, above which damage may occur, see Absolute Maximum Ratings.

| Parameter | Min | Nominal | Max | Unit |
|---|---|---|---|---|
| Ambient Temperature | -55 | 25 | 100 | °C |
| LO Input Power | 11 | - | 20 | dBm |

## Sequencing Requirements

There is no requirement to apply power to the ports in a specific order. However, it is recommended to provide a 50Ω termination to each port before applying power. This is a passive diode mixer that requires no DC bias.

## Electrical Specifications

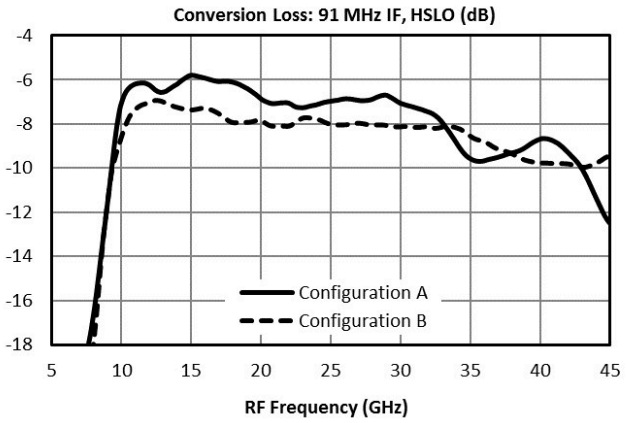
The electrical specifications apply at TA=+25°C in a 50Ω system. Typical data shown is for the connectorized S package mixer used in the forward direction with a +15 dBm sine wave input. Min and Max limits apply only to our connectorized units and are guaranteed at TA=+25°C. All bare die are 100% DC tested and visually inspected. RF testing of our die is performed on a sample basis to verify conformance to datasheet guaranteed specifications.

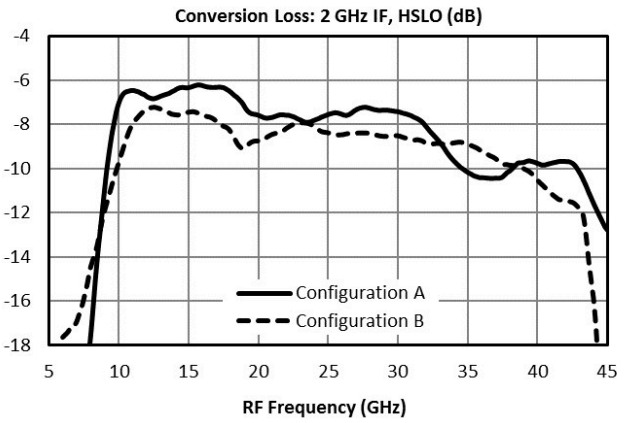
| Parameter | Port Configuration | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Conversion Loss [1] | A | RF/LO = 9 - 44 GHz<br>I = 4 - 14 GHz | - | 9.5 | - | dB |
| Conversion Loss [2] | A | RF/LO = 9 - 44 GHz<br>I = DC - 4 GHz | - | 7.6 | 13.5 | dB |
| Input 1 dB Gain Compression Point (P1dB) | A | - | - | 11 | - | dBm |
| Input IP3 | A | RF/LO = 9 - 44 GHz<br>I = DC - 0.2 GHz | - | 21.6 | - | dBm |
| Conversion Loss [3] | B | RF/LO = 9 - 44 GHz<br>I = 4 - 14 GHz | - | 10 | - | dB |
| Conversion Loss [4] | B | RF/LO = 9 - 44 GHz<br>I = DC - 4 GHz | - | 8.6 | 14.5 | dB |
| Input 1 dB Gain Compression Point (P1dB) | B | - | - | 10 | - | dBm |
| Input IP3 | B | RF/LO = 9 - 44 GHz<br>I = DC - 0.2 GHz | - | 21.8 | - | dBm |
| IF Frequency Range | - | - | 0 | - | 14 | GHz |
| Isolation, LO to IF | - | IF/LO = 9 - 44 GHz | - | 49 | - | dB |
| Isolation, LO to RF | - | RF/LO = 9 - 44 GHz | - | 47 | - | dB |
| Isolation, RF to IF | - | RF/IF = 9 - 44 GHz | - | 39 | - | dB |
| LO Frequency Range | - | - | 10 | - | 44 | GHz |
| Noise Figure [5] | - | RF/LO = 9 - 44 GHz<br>I = DC - 0.2 GHz | - | 7.6 | - | dB |
| RF Frequency Range | - | - | 10 | - | 44 | GHz |

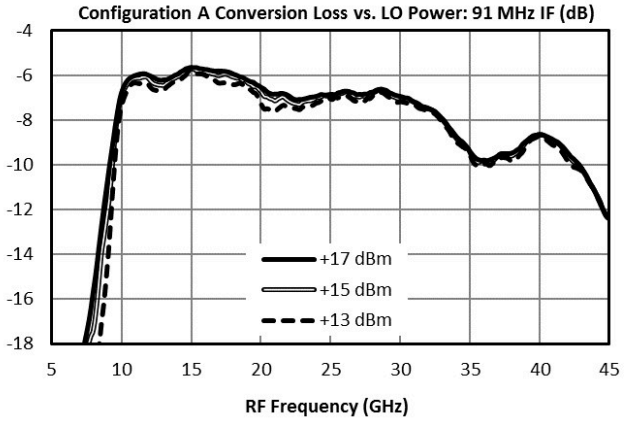
[1][2][3][4] Measured as a down converter to a fixed 91MHz IF.

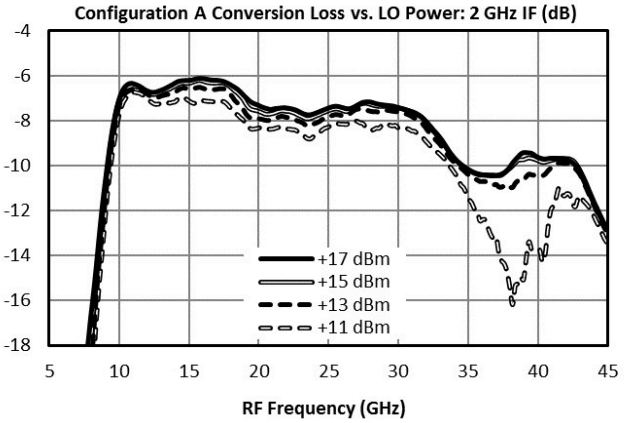
[5] Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.

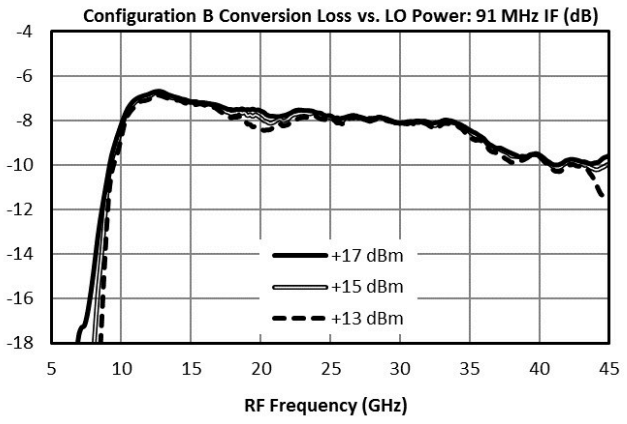
## Typical Performance Plots

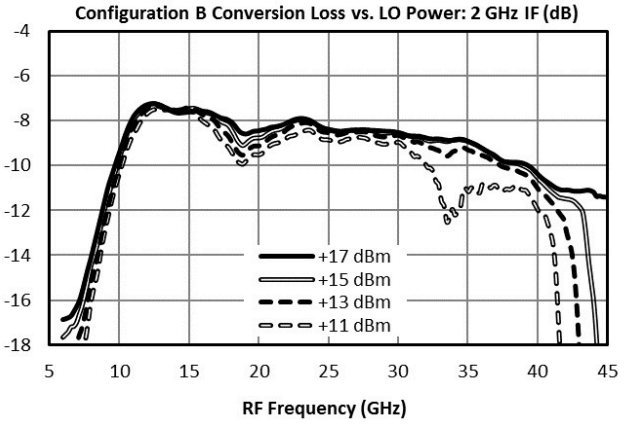


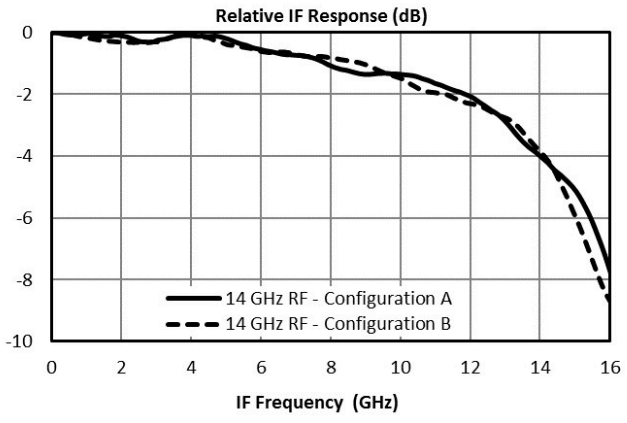



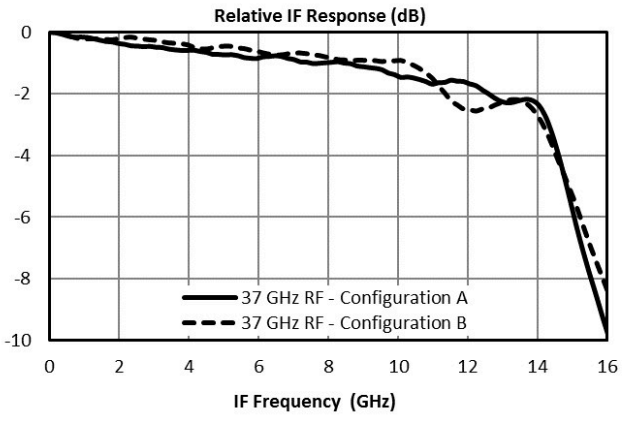



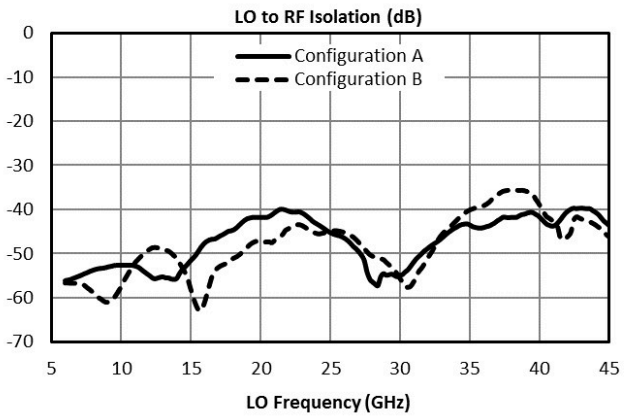



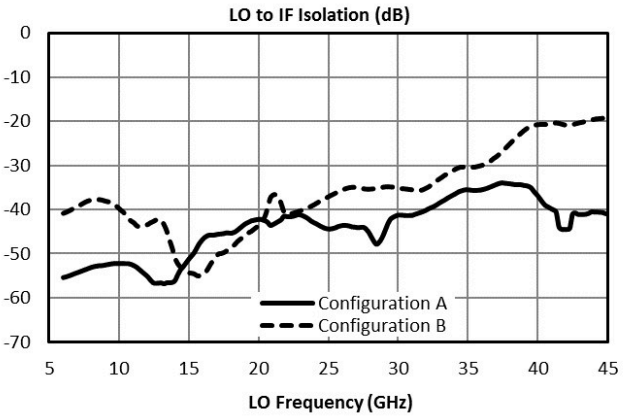



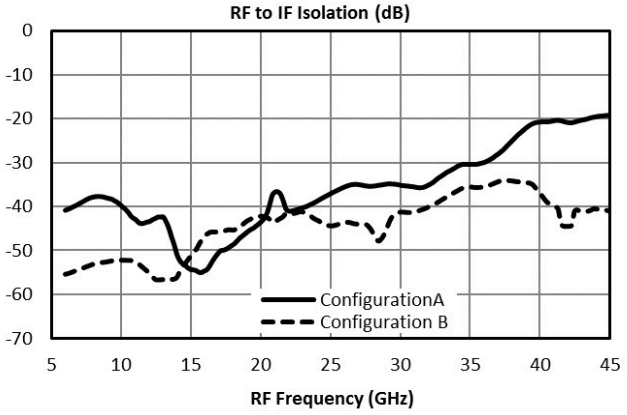



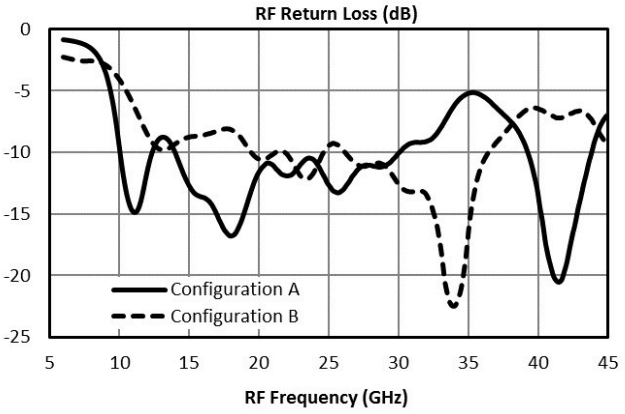



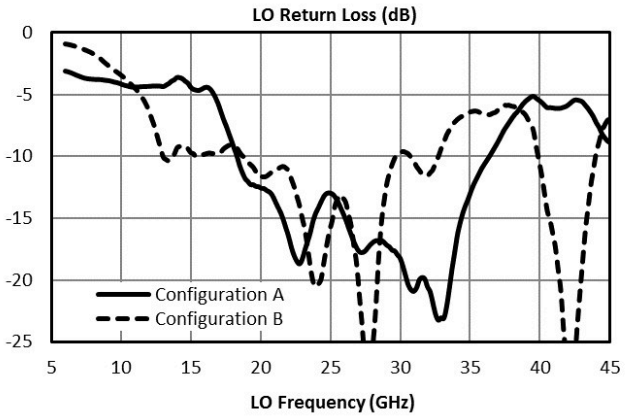



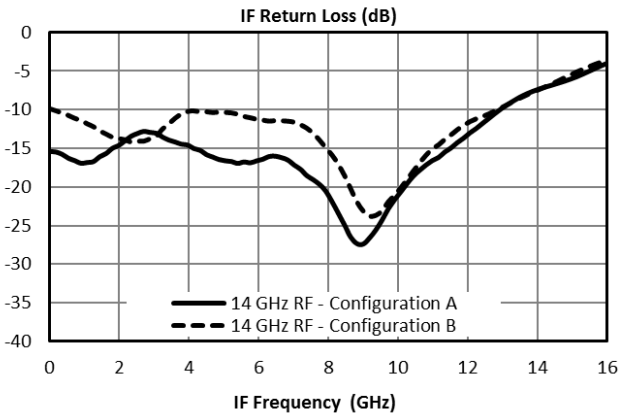


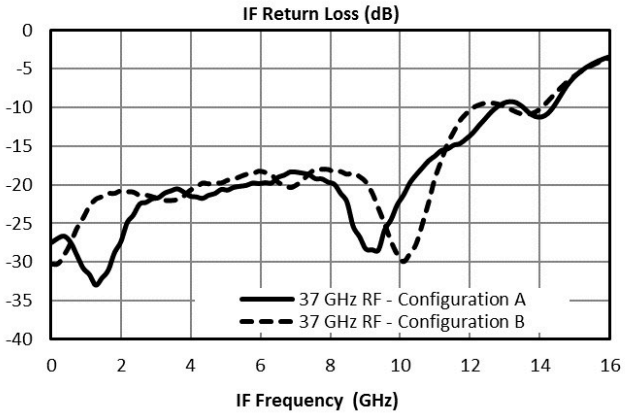



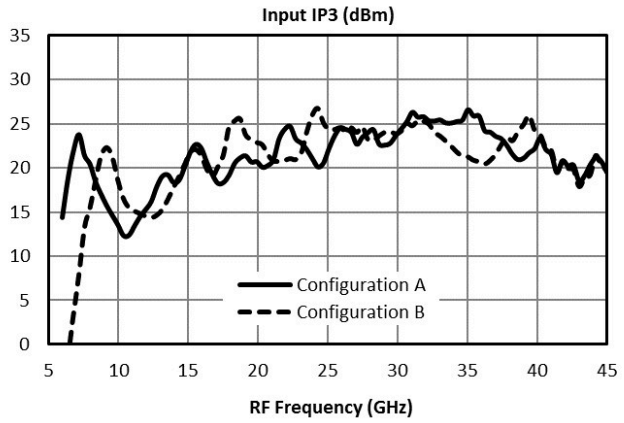



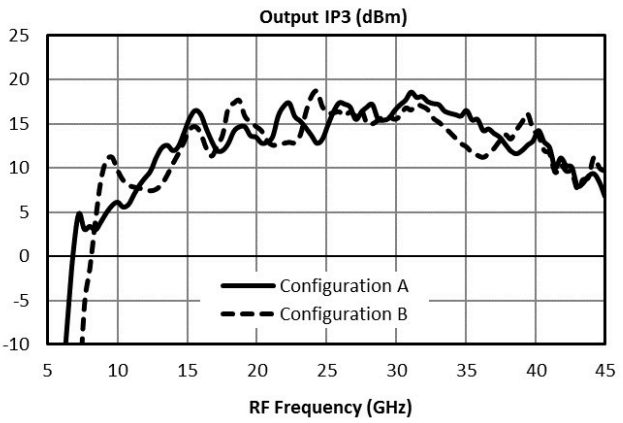



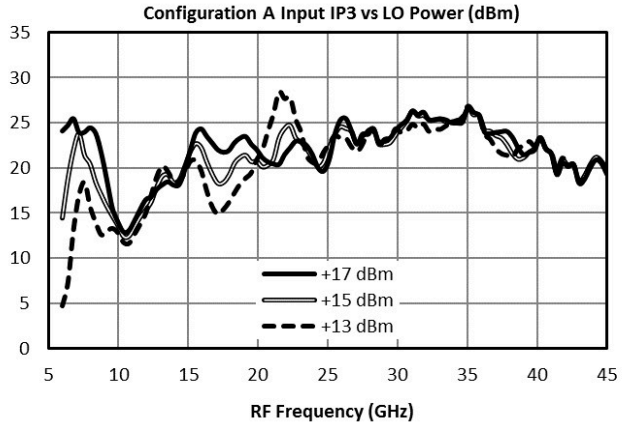



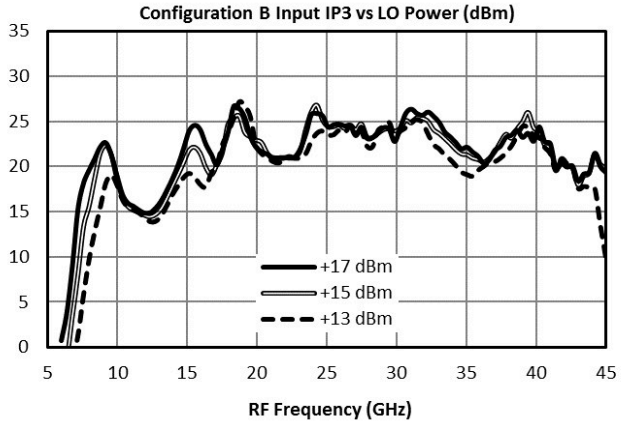



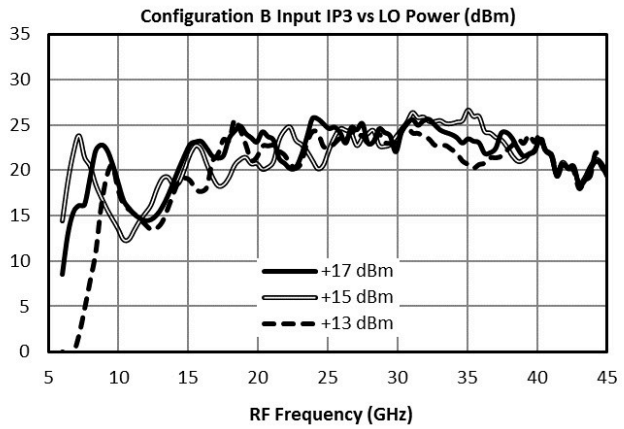
## Typical Performance Plots: IP3

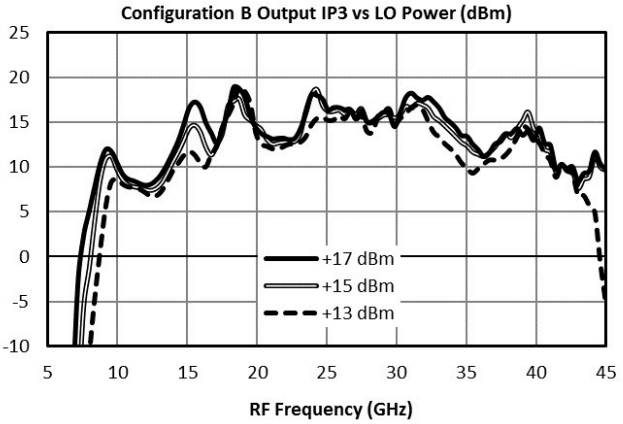


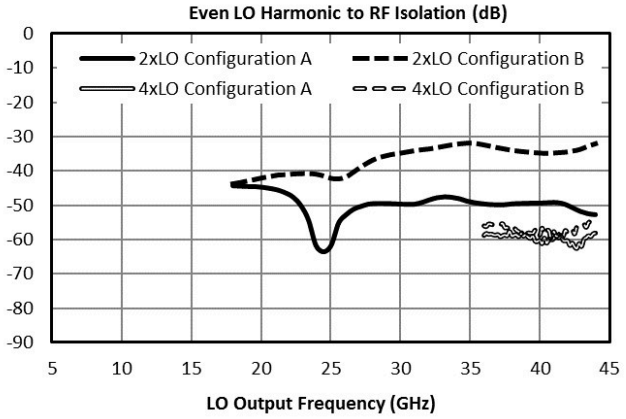



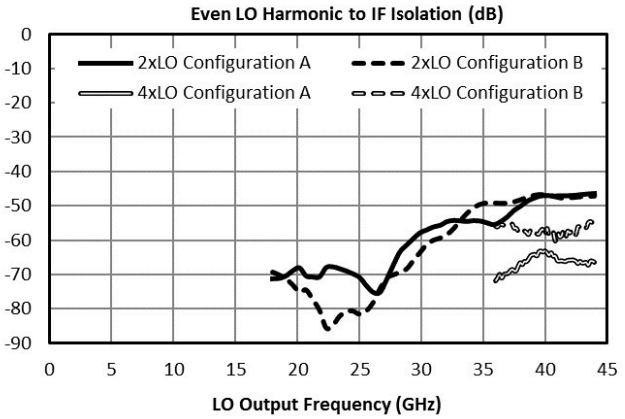



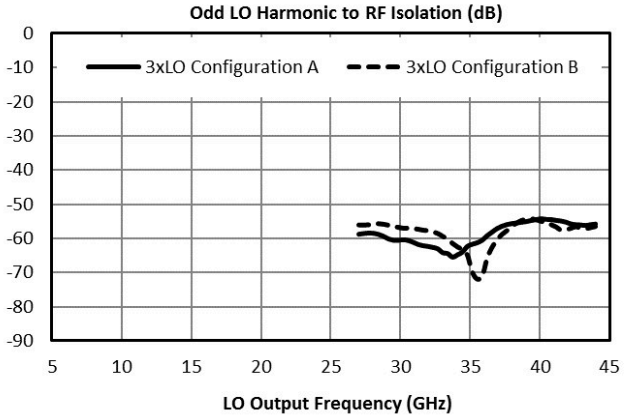



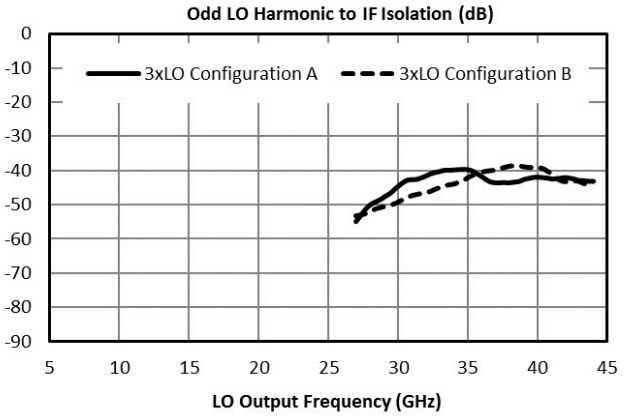



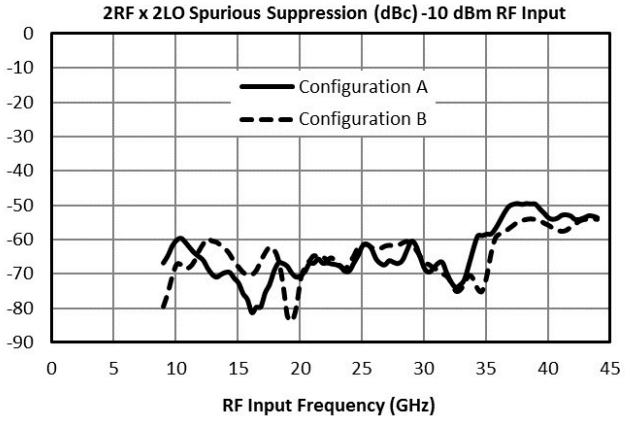
## Typical Performance Plots: LO Harmonic Isolation

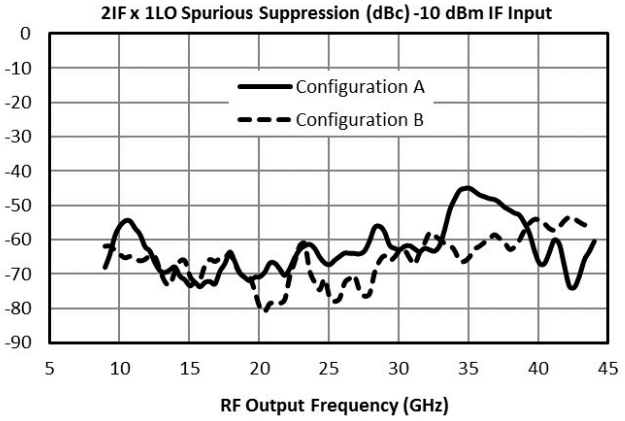


## Spur Table

## Typical Spurious Performance: Down-Conversion

Typical spurious data is provided by selecting RF and LO frequencies (± m*LO ± n*RF) within the RF/LO bands, to create a spurious output within the IF band. The mixer is swept across the full spurious band and the mean is calculated. The numbers shown in the table below are for a -10 dBm RF input. Spurious suppression is scaled for different RF power levels by (n-1), where "n" is the RF spur order. For example, the 2RF x 2LO spur is 70 dBc for a -10 dBm input, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) lower, or 80 dBc. Data is shown for the frequency plan in 3.6 Typical Performance.

**Typical Down-conversion spurious suppression (dBc): Config A (B)**

| -10 dBm RF Input | 0xLO | 1xLO | 2xLO | 3xLO | 4xLO | 5xLO |
|---|---|---|---|---|---|---|
| 1xRF | 27 (21) | Reference | 24 (36) | 16 (16) | 44 (39) | 22 (21) |
| 2xRF | 73 (75) | 59 (53) | 70 (72) | 69 (57) | 72 (75) | 66 (57) |
| 3xRF | 97 (100) | 65 (65) | 77 (92) | 75 (74) | 77 (89) | 68 (71) |
| 4xRF | 118 (119) | 114 (99) | 109 (115) | 112 (104) | 115 (118) | 111 (104) |
| 5xRF | N/A | 130 (129) | 116 (133) | 121 (123) | 123 (131) | 121 (123) |

## Typical Spurious Performance: Up-Conversion

Typical spurious data is taken by mixing an input within the IF band, with LO frequencies (± m*LO ± n*IF), to create a spurious output within the RF output band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious suppression is scaled for different IF input power levels by (n-1), where "n" is the IF spur order. For example, the 2IFx1LO spur is typically 68 dBc for a -10 dBm input with a sine-wave LO, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) lower, or 78 dBc. Data is shown for the frequency plan in 3.6 Typical Performance.

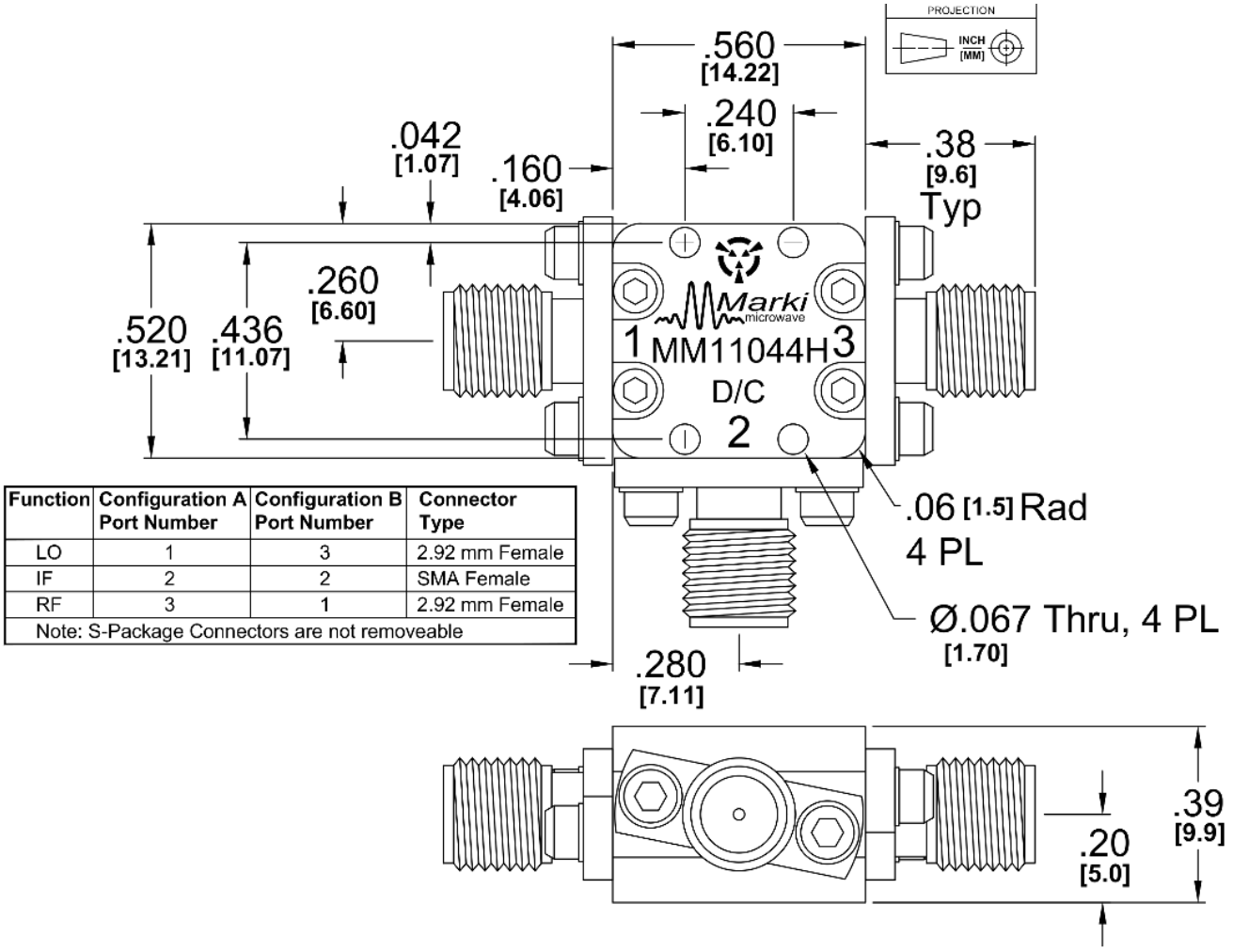
**Typical Up-conversion spurious suppression (dBc): Config A (B)**

| -10 dBm RF Input | 0xLO | 1xLO | 2xLO | 3xLO | 4xLO | 5xLO |
|---|---|---|---|---|---|---|
| 1xIF | 26 (22) | Reference | 26 (36) | 13 (12) | 35 (38) | 25 (24) |
| 2xIF | 65 (63) | 68 (68) | 67 (51) | 74 (69) | 67 (59) | 71 (76) |
| 3xIF | 90 (96) | 67 (67) | 76 (81) | 66 (63) | 67 (74) | 59 (58) |
| 4xIF | 109 (103) | 109 (112) | 108 (96) | 110 (105) | 106 (98) | 108 (110) |
| 5xIF | 124 (124) | 115 (112) | 114 (122) | 106 (103) | 104 (113) | 104 (107) |

## Mechanical Data

### Outline Drawing

Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP




| Function | Configuration A Port Number | Configuration B Port Number | Connector Type |
|---|---|---|---|
| LO | 1 | 3 | 2.92 mm Female |
| IF | 2 | 2 | SMA Female |
| RF | 3 | 1 | 2.92 mm Female |
| Note: S-Package Connectors are not removeable | | | |

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