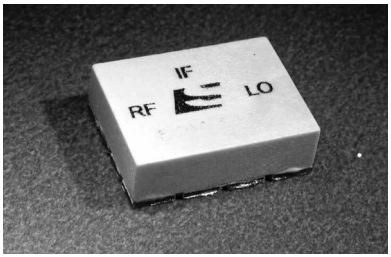
Preliminary Data Sheet

SPM-2045

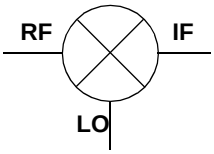
High Linearity Passive FET Mixer



Product Description

The Sirenza SPM-2045 is a passive mixer designed for systems that require high linearity down- or up-conversion. It employs proprietary silicon FETs with proven reliable core-and-wire baluns. It operates efficiently over a wide range of Local Oscillator powers, with input third order intercept remaining approximately 15-18 dB above LO power over this range. This product is packaged in a standard surface mount module for excellent RF performance.

Functional Block Diagram



Product Features

- **Excellent linearity.**
- **Efficient operation over wide LO power range.**
- **Well behaved over variations in frequency, LO power, and port match.**

Applications

- **PCS, DCS, UMTS upconverters and down-converters**

Product Specifications: Down-converter

Test Conditions: FLO = 1.8GHz FIF = 150MHz Frf = 1.95GHZ Plo = 17dBm

Parameters	Test Conditions	Unit	Min.	Typ.	Max.
RF Input Frequency Range		GHz	1.7		2.3
LO Frequency		GHz	1.7		2.3
IF Output Frequency		MHz	50		500
RF Return Loss	Frf = 1.9GHz	dB		14	
LO Return Loss	Flo = 1.7GHz	dB		5	
IF Return Loss	Fif=200MHz	dB		14	
Conversion Loss	2 GHz			7.5	10
SSB Noise Figure				7.5	10
TOI (Input)	Plo=14dBm	dBm		28	
	Plo=17dBm	dBm		31	
	Plo=20dBm	dBm		33	
P1dB (input)	Plo=17dBm	dBm		20	
LO-RF isolation	2 GHz	dB		30	
LO-IF isolation	2 GHz	dB		30	
RF-IF isolation	2 GHz	dB		35	

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Product Specifications: Up-converter

Test Conditions: FLO = 1.8GHz FIF = 150MHz Frf = 1.95GHZ Plo = 17dBm

Parameters	Test Conditions	Unit	Min.	Typ.	Max.
RF Output Frequency Range		GHz	1.7		2.3
LO Frequency		GHz	1.7		2.3
IF Input Frequency		MHz	40		300
RF Return Loss	Frf = 1.9GHz	dB		14	
LO Return Loss	Flo = 1.7GHz	dB		5	
IF Return Loss	Fif=200 MHz	dB		14	
Conversion Loss				8	10
TOI (Input)	Plo=14dBm	dBm		23	
	Plo=17dBm	dBm		27	
	Plo=20dBm	dBm		30	
P1dB (input)	Plo=17dBm	dBm		20	

Absolute Maximum Ratings

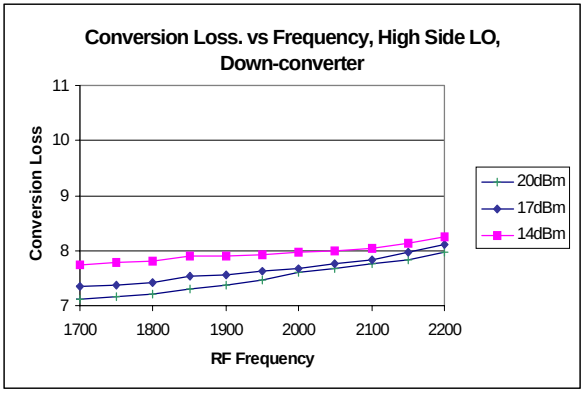
Parameters	Value	Unit
RF Input	+15	dBm
LO Input	+21	dBm
IF Input	+15	dBm
Operating Temperature	-40 to +85	ºC
Storage Temperature	-65 to +150	ºC

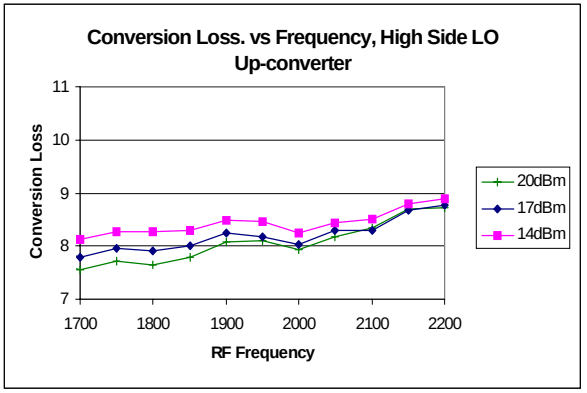
Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation the device voltage and current must not exceed the maximum operating values specified in the table on page one.

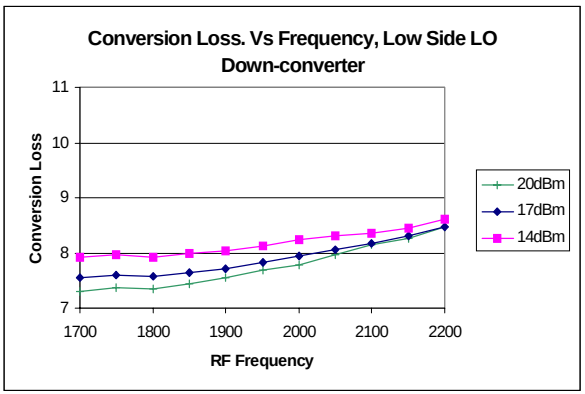
Caution: ESD Sensitive
Appropriate precaution in handling, packaging and testing devices must be observed.

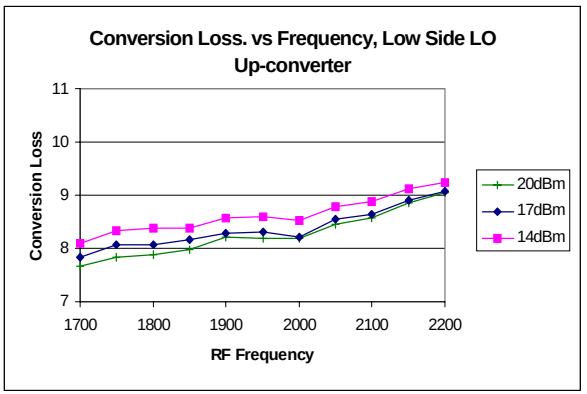
The SPM-2045 mixer is a MOSFET based high performance mixer designed for high linearity frequency conversion in the 2GHz band. This mixer features a wide latitude in LO power requirements. Conversion loss remains quite constant between 10dBm and 20dBm of LO power. Third Order Intercept is approximately proportional to the LO drive. This means that this mixer can be used to replace a wide variety of mixers requiring a variety of LO powers.

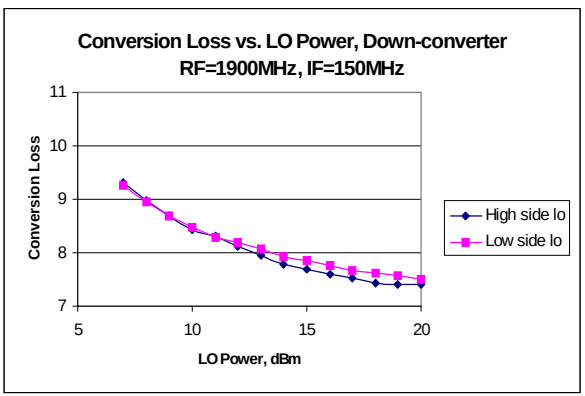
The graphs on the following pages illustrate the performance of the SPM-2045 over a variety of operating conditions. In order to duplicate these performance tests, the following precautions should be observed:
-The mixer should be presented with good return losses at all ports by using isolators or attenuators. This is especially true of the LO port, because of the poor return loss of this port. If ripple is seen in a frequency sweep, it is likely due to reflections caused by poor VSWR in a cable leading up to the device.
-The presence of harmonics in the LO can cause changes in TOI.
-Be aware that signals of many different frequencies exist at the output of the mixer, and any one can potentially cause the spectrum analyzer to generate intermod.
-When measuring TOI, make sure the two generators supplying the RF signal are not interacting, causing intermod themselves.

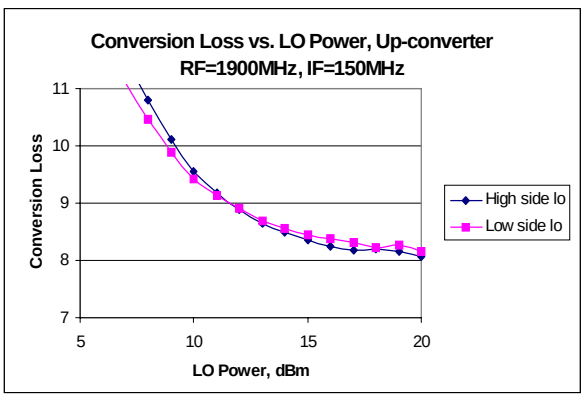




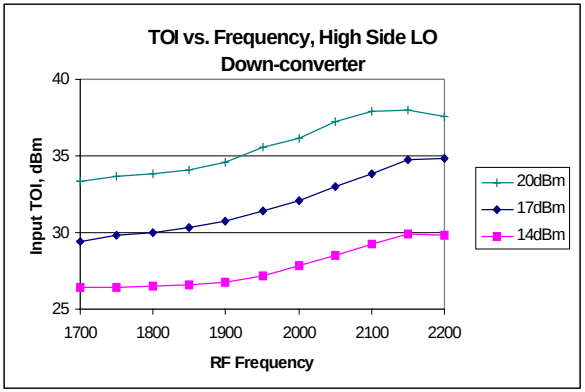


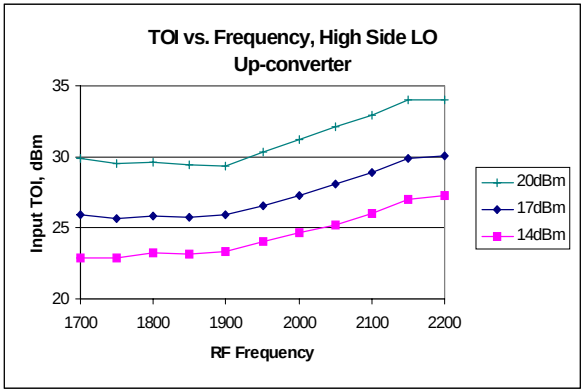


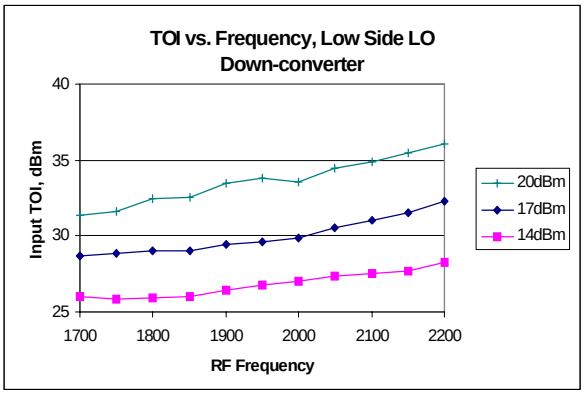


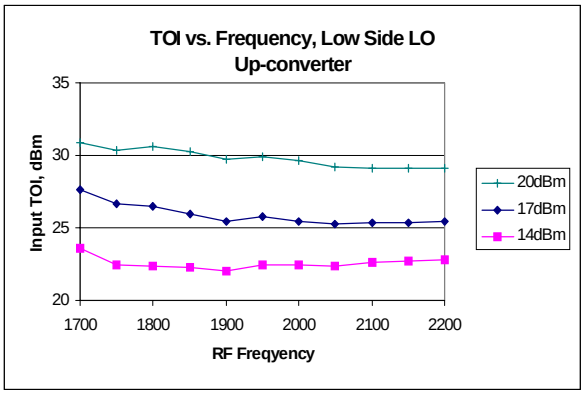


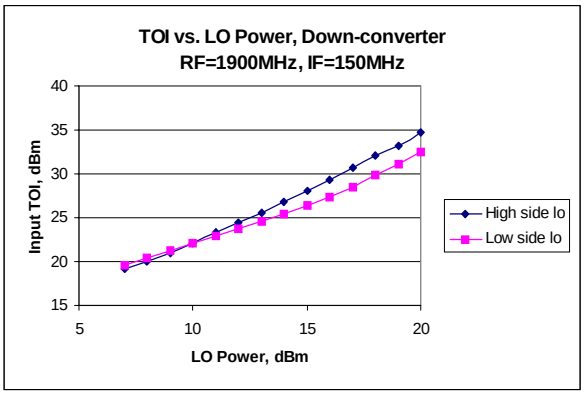
These graphs show mixer conversion loss vs. frequency, with both low-side LO excitation (LO frequency below the RF frequency) and high side excitation (LO frequency above the RF frequency). Operation both as a down-converter and an up-converter is shown, with LO powers of 14, 17, and 20dBm. In all cases, the IF frequency is 150MHz.

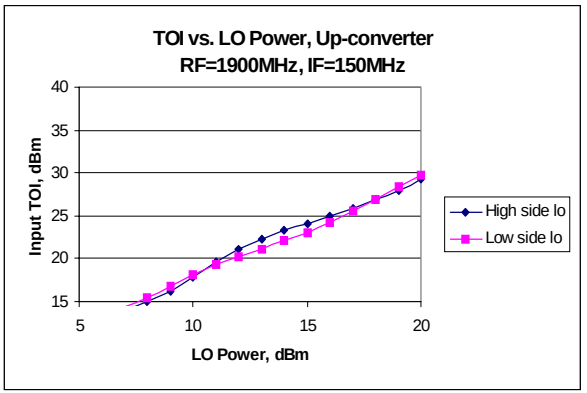




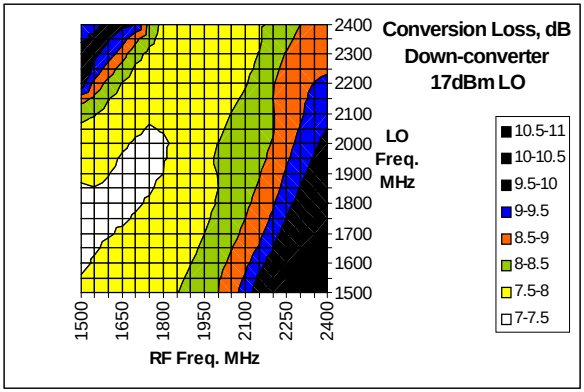


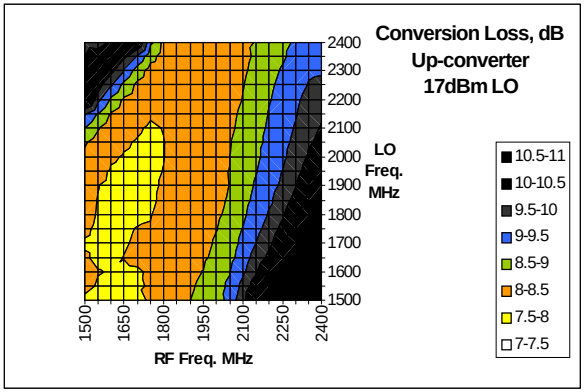


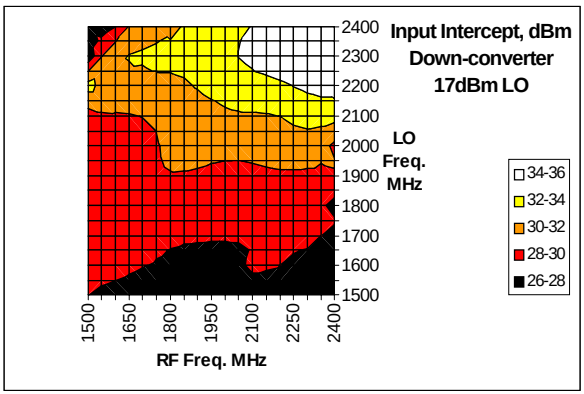


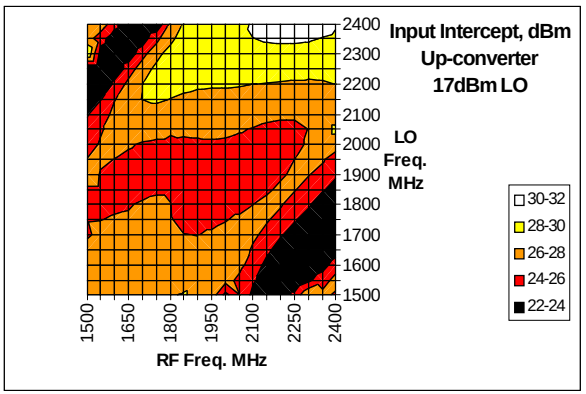


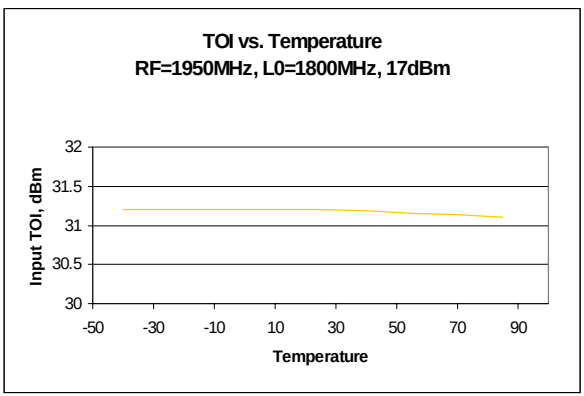
These graphs show mixer Third Order Intercept (TOI) vs. frequency referenced to the input of the mixer (that is, referenced to the RF port in the case off a down-converter, or the IF port in the case of an up-converter), with both low-side LO excitation (LO frequency below the RF frequency) and high side excitation (LO frequency above the RF frequency). Operation both as a down-converter and an up-converter is shown, with LO powers of 14, 17, and 20dBm. In all cases, the IF frequency is 150MHz. The RF power used in measuring third order intercept is +4dBm. Note that third order products closely follow the expected 3:1 slope.

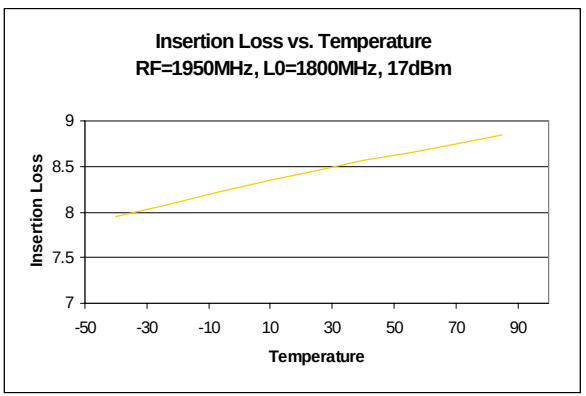




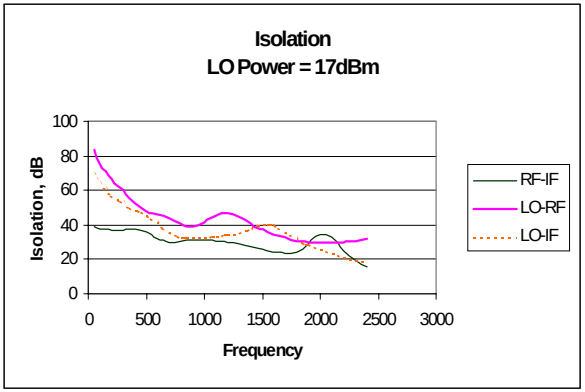


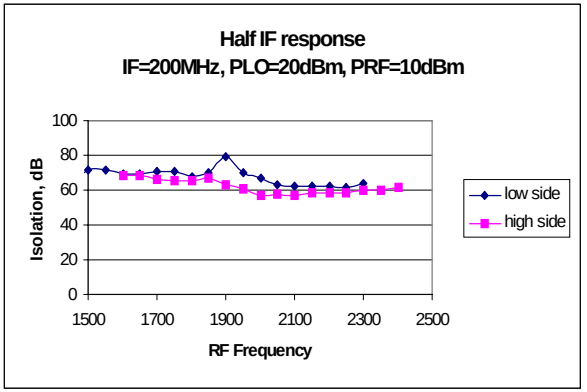


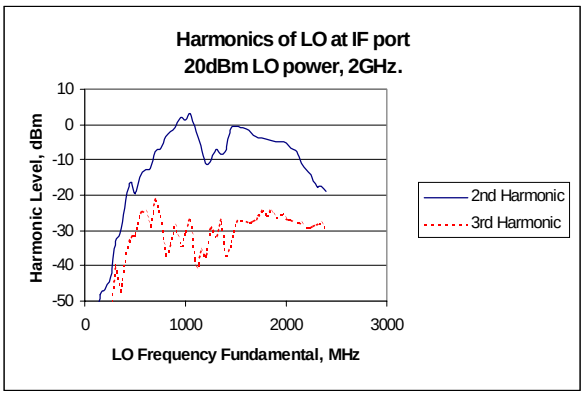


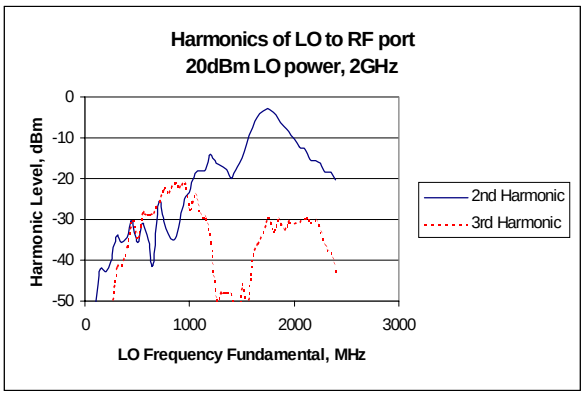


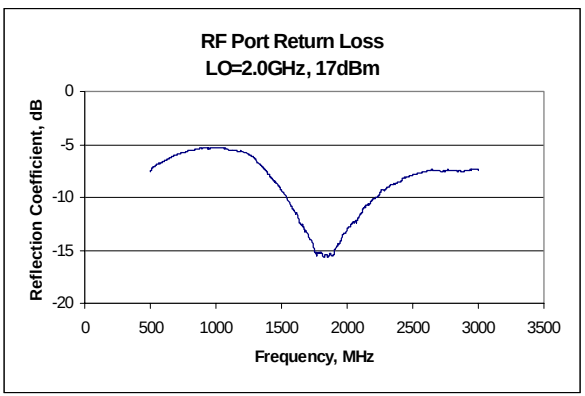
The contour graphs show mixer input TOI and conversion loss over a variety of RF and LO frequencies. These contour graphs can be used to assess the suitability of these mixers over a variety of frequencies of operation. Note that constant IF frequency curves can be overlaid as diagonal lines. Also shown are graphs of TOI and insertion loss vs. temperature. These curves were measured down-converter mode.

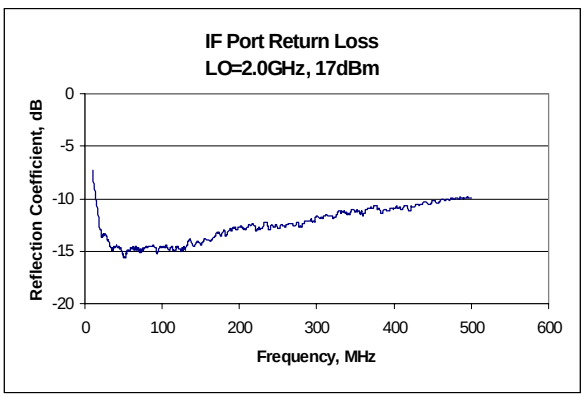




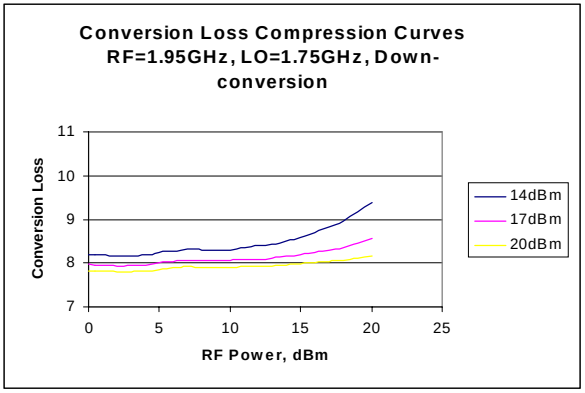


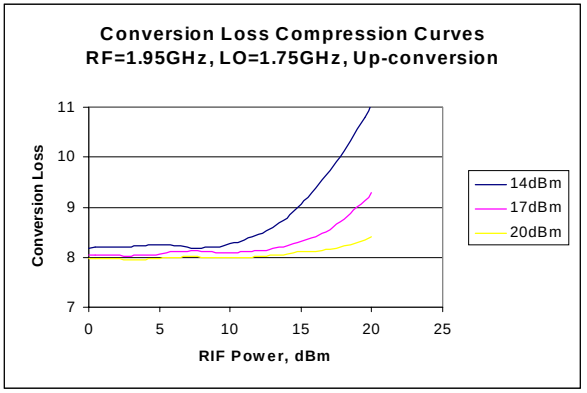


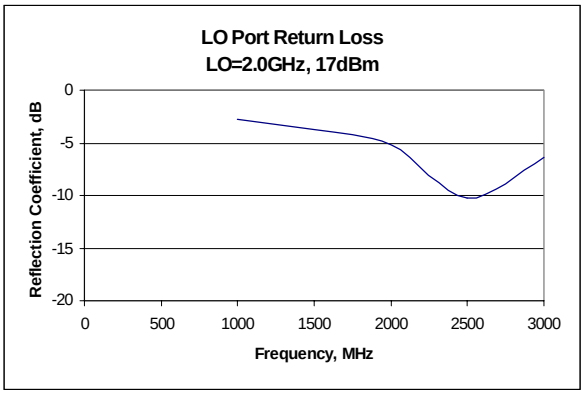




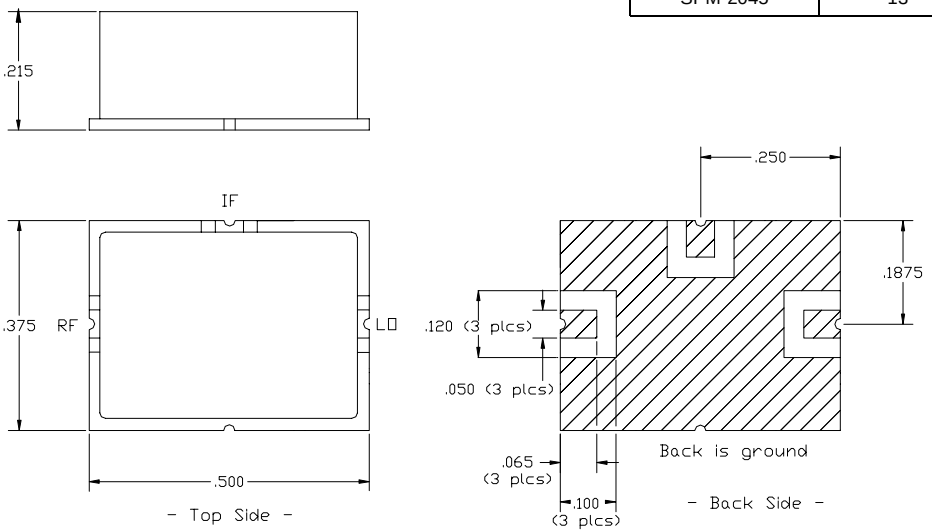
The isolation graph shows port isolation with a 2GHz LO at 17dB.
Half IF response is measured by applying RF signals (10dBm amplitude) 100MHz above or below the LO, and measuring the level of the undesired IF component at 200MHz.





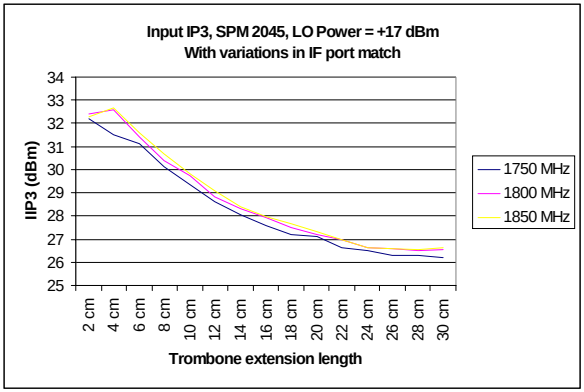


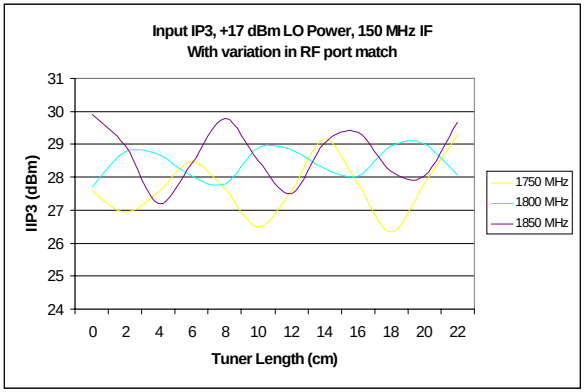
Package Dimensions



Part Number Ordering Information

Part Number	Reel Size	Devices/Reel
SPM-2045	13"	1000





Sensitivity to Port Match

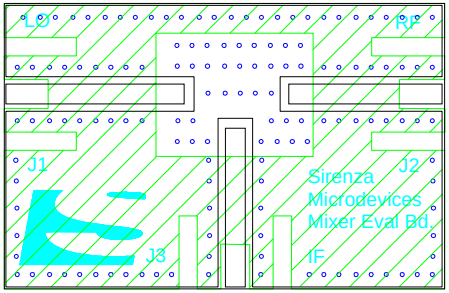
These graphs demonstrate the sensitivity of the linearity of the SPM-2045 to the impedance of the source which drives the RF port, and the load that the IF port sees. In this case, the mixer is operated as a down-converter with LO drive of 17dBm and an IF frequency of 150MHz. Three LO frequencies are shown.

In the left graph, a variable-length 50 ohm transmission line ("trombone") is placed between the IF port of the mixer and a 2 dB, open-circuited attenuator to provide a 4dB return loss to the IF port. The length of the transmission line is changed to vary the phase of the reflection coefficient, thus providing a variable impedance. This graph shows how the input TOI varies with the phase of the reflection coefficient. Notice that significant degradation in TOI can occur with mismatch, depending on the phase of the mismatch.

In the right graph, a double-stub tuner is placed between the RF source and the mixer in order to provide a non-50 ohm impedance to the RF port. The stub separation was adjusted to provide a reflection coefficient of approximately -4 dB. The tuner length was changed to vary the phase of the reflection coefficient, thus providing a variable impedance. This graph shows how the input TOI varies with the phase of the reflection coefficient on the RF port. Note that the TOI is very tolerant of variations in load impedance, showing a change of only 3dB.

Demo Test Board Schematic

SPM Evaluation Board



Recommended connectors:
Johnson 142-0701-851 SMA end-launch connectors (or equivalent)