Integrated Passive Device for Semtech SX1261 / SX1262 / LLCC68

For 863 - 928MHz Operation

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Abstract

This application note serves as a guide on the usage and expected performance of Johanson Technology's impedance-matched filter 0900FM15K0039, designed specifically for the Semtech SX1261, SX1262, and LLCC68 RF transceivers operating at 868 and 915MHz ISM bands – part of their Long-Range Low Power LoRA® and LoRa Smart Home™ product lines.

Introduction

Using Johanson's integrated passive device (IPD) 0900FM15K0039, overall PCB space and component count can be significantly reduced as illustrated in Figure 3. This IPD's performance has shown to meet (and in some cases exceed) the original discrete reference design in terms of fundamental and harmonic power.

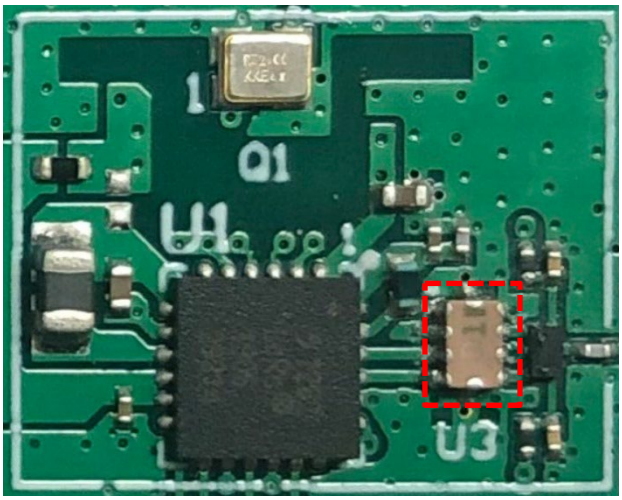

Figure 1. Johanson 0900FM15K0039

With this device, the entire front end RF matching network is reduced to a single EIA 0805 (2.0mm x 1.25mm) component. It is recommended for applications where PCB space is a priority along with consistency of RF performance over production.

For more detailed information regarding this IPD, please see the 0900FM15K0039 datasheet.

Table of Contents

Table of Figures

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Semtech Discrete Reference Design (SX1261/2)

The current L/C discrete reference design consists of 15 capacitors and inductors which make up the impedance matching and harmonic filtering portion of the RF front end. This discrete system accounts for both the transmit and receive networks. Additional pi filter C9, L5, and C10 have also been integrated.

Both SX1261 and SX1262 Mbed shields were used in our IPD qualification.

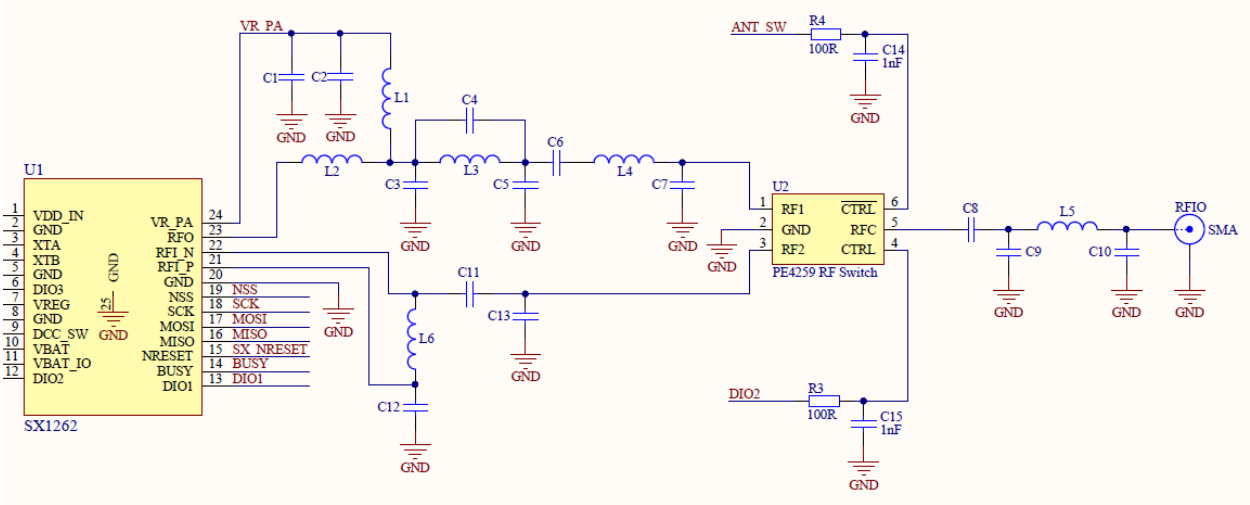

Figure 2. Semtech SX1262 Mbed shield PCB Discrete Reference Design

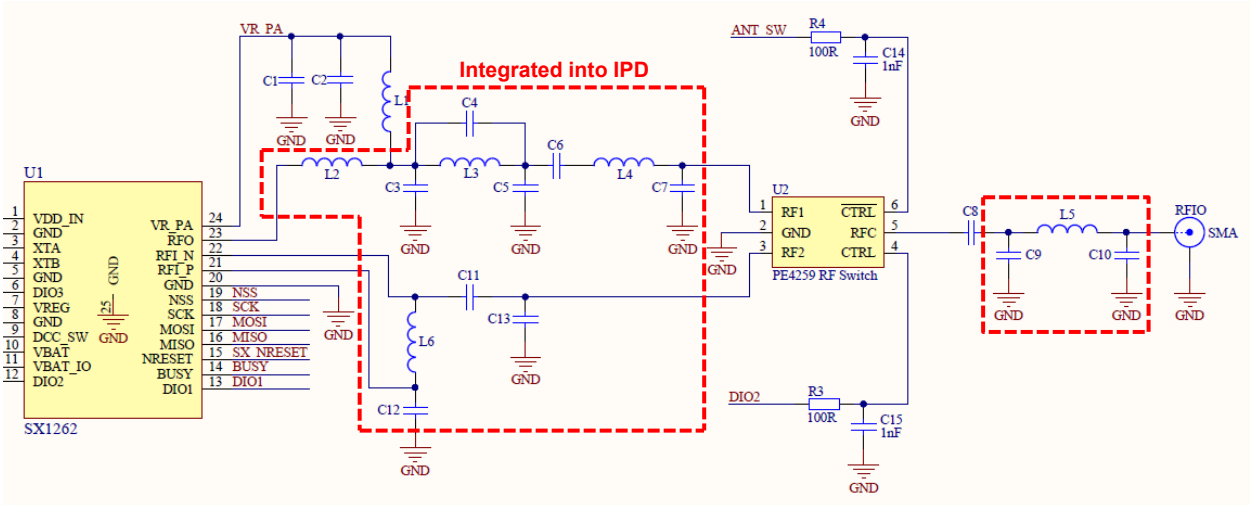

Figure 3. Components replaced by JTI IPD

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Figure 4 shows the RF front end schematic using the Johanson IPD 0900FM15K0039. The RFO and both RFI pins from the chipset feed directly into the integrated device which then feed directly into the SPDT switch of choice. The SPDT single-pole can be fed toward a single-band antenna or dual-band 868/915MHz antenna.

You can find more information regarding Johanson's single and dual-band chip antennas here.

The below RF front end reference design is applicable for Semtech chipsets SX1261, SX1262, and LLCC68.

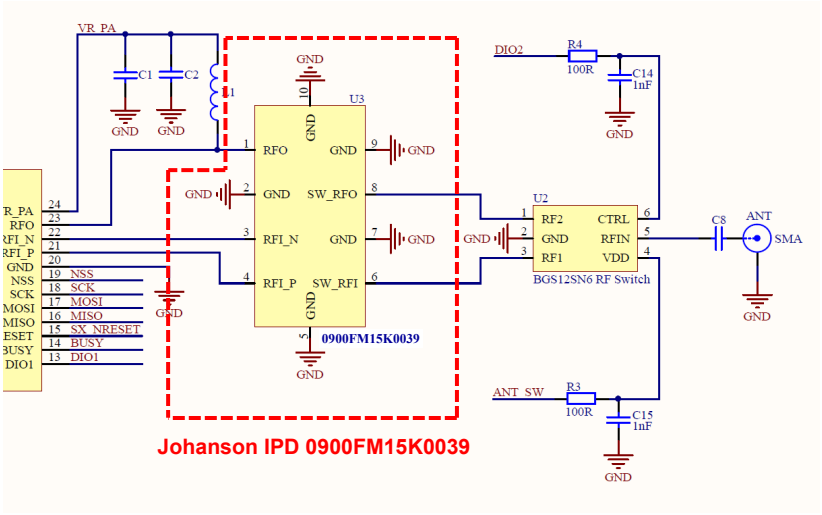

Figure 4. Simplified RF Front End with Johanson IPD

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Semtech SX1261/2 Mbed shield PCB Layout with Johanson 0900FM15K0039

The dimensions for this IPC are 2.00mm x 1.25mm which is equivalent to an EIA 0805 package device. The miniature size of this makes it ideal for compact designs as well as simplicity of layout.

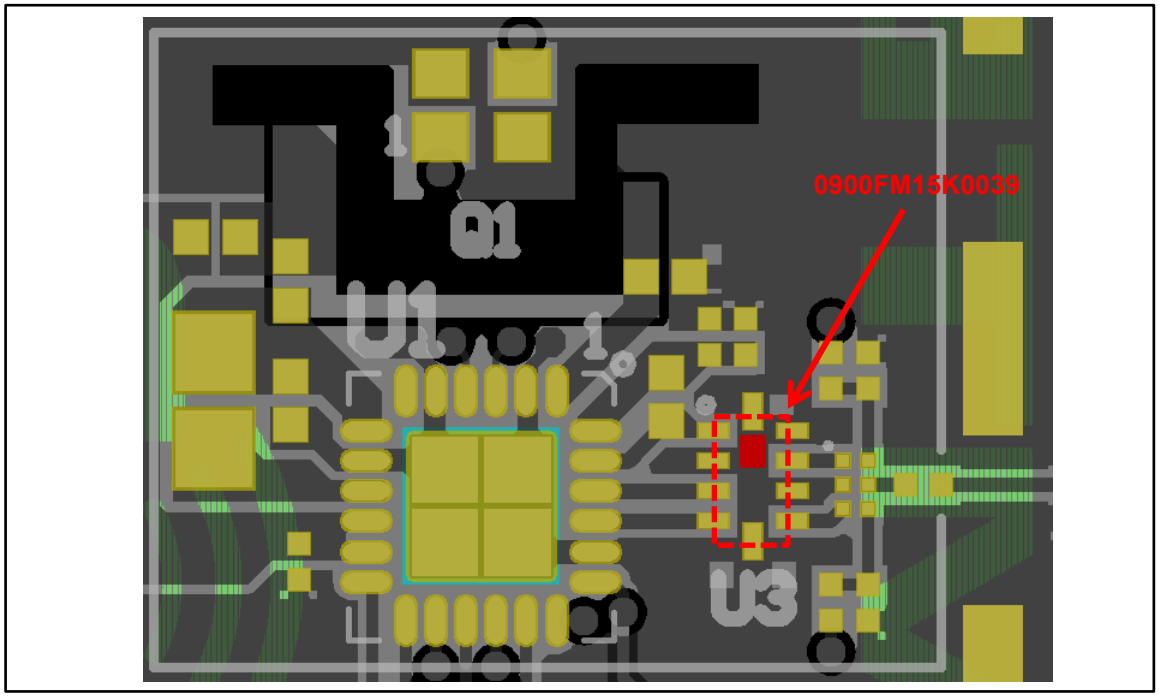

Figure 5. SX1261/2 PCB Layout with Johanson 0900FM15K0039

If you would like to connect with a Johanson Technology RF engineer to go over the layout or suggest an antenna to go with your design, go to our Ask-a-question page.

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Top

SX126xMB2xAS_e588v01a.GTO – Silkscreen Top
SX126xMB2xAS_e588v01a.GTS - Solder_mask Top
SX126xMB2xAS_e588v01a.GTL – Signal_top (35um Copper)
Isolation – FR4 (0.15mm)
SX126xMB2xAS_e588v01a.G1 – Internal signal layer (35um Copper)
Isolation – FR4 (approximately ~0.58mm)
SX126xMB2xAS_e588v01a.G2 – Internal signal layer (35um Copper)
Isolation – FR4 (0.15mm)
SX126xMB2xAS_e588v01a.GBL – Signal Bottom (35um Copper)
SX126xMB2xAS_e588v01a.GBS - Solder_mask Bottom
SX126xMB2xAS_e588v01a.GBO – Silkscreen Bottom

Bottom

Layout files can be requested from us directly.

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Johanson 0900FM15K0039 Reference PCB Layout

Figure 6 depicts some of the more important characteristics to follow to ensure optimal performance when implementing this IPD. Some key points are:

- Ensure that all RF transmission lines are designed to maintain 50Ω impedance.
- Distance between the IPD and transceiver RF pins is important for proper impedance matching.
- GND via placement plays a significant role in the harmonic filtering of this integrated device.

We recommend that designers download the below reference design layout package to find all the necessary information.

Reference design layout package can be requested here.

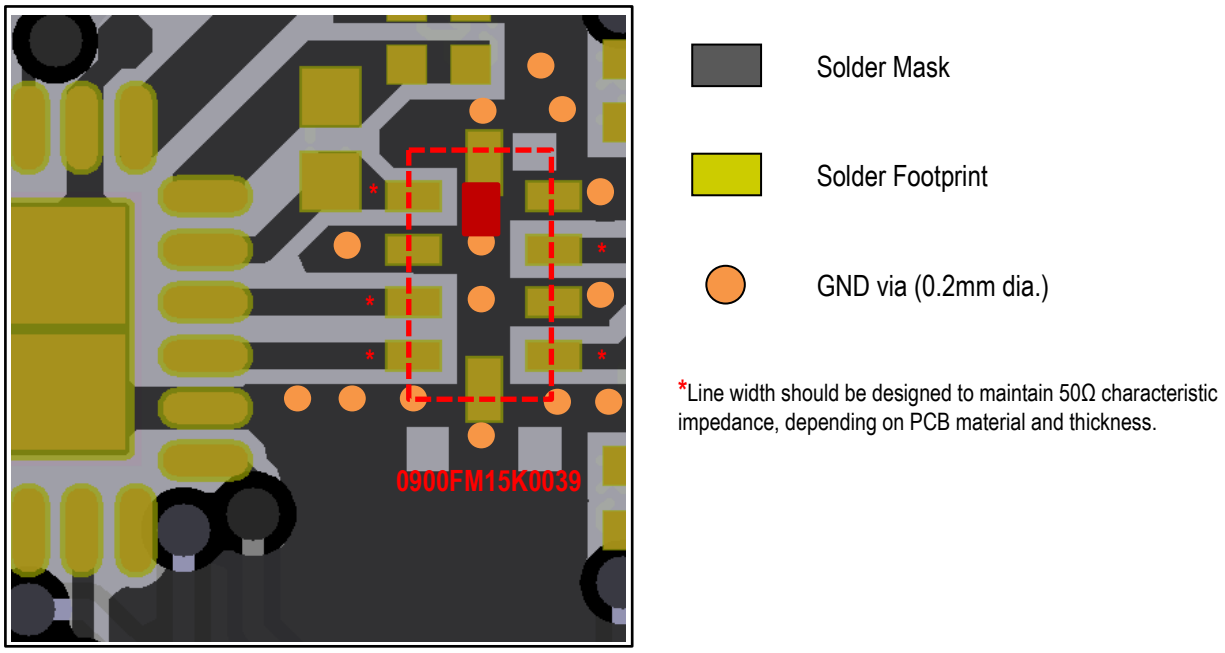

Figure 6. Johanson 0900FM15K0039 Reference Layout

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SX1261/2 and 0900FM15K0039 IPD Active, Power Measurements (Conducted)

The following figures and tables are active measured results of Johanson's 0900FM15K0039 IPD when paired with the Semtech SX1262. These measurements are taken on Semtech's SX126xMB2xAS Mbed shield PCB as seen below.

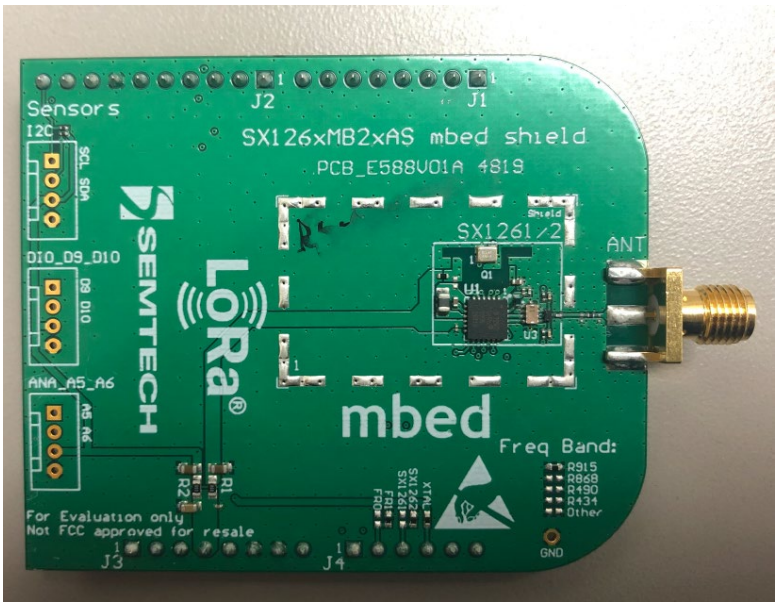

Figure 7. Semtech SX6xMB2AS Mbed shield PCB

Please note that all measurements include Semtech's on-board pi filter for direct comparison to the discrete L/C reference design.

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Transmit Power and Current Consumption

Fundamental Transmit Power and Current Consumption, 868MHz, +14dBm (SX1261 + 0900FM15K0039)

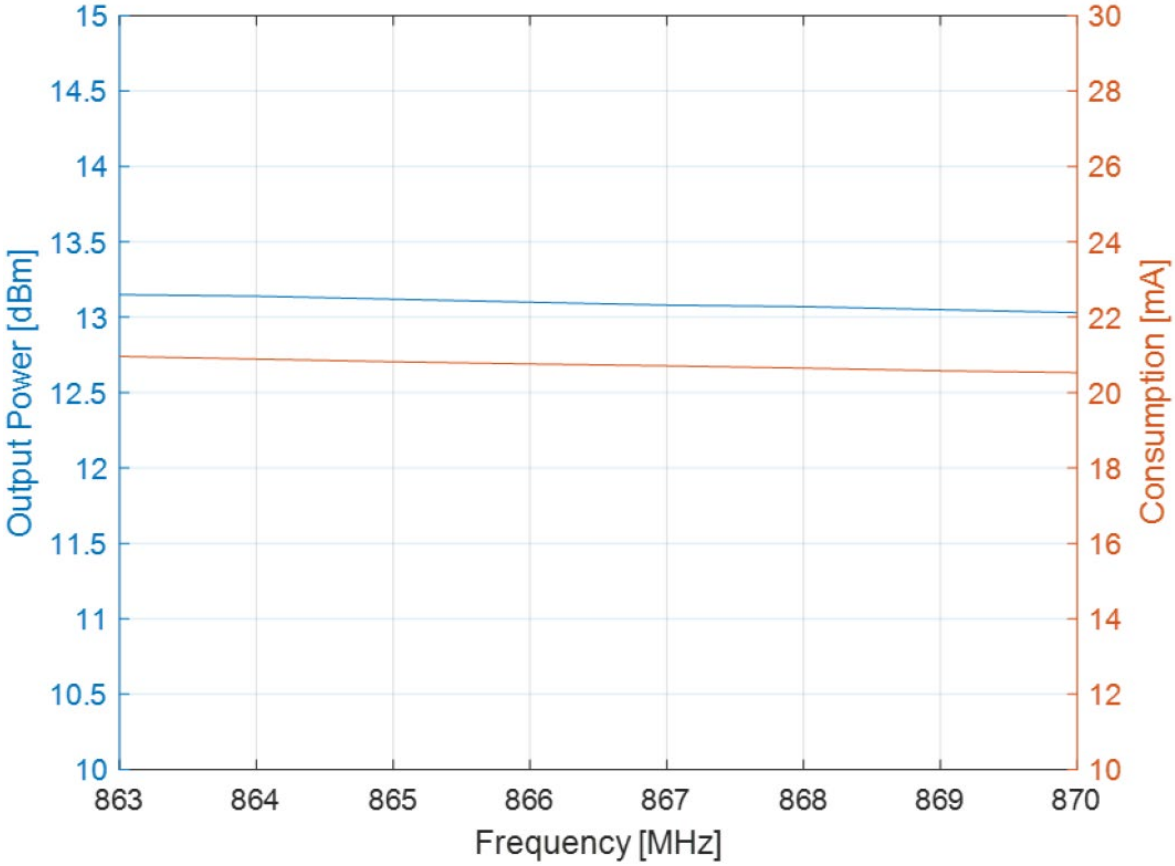

Figure 8. 868MHz Fundamental Power and Current Consumption, +14dBm

For more detailed measurement results, see Semtech Application Note AN1200.70

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Fundamental and Harmonic Transmit Power, 868MHz, +14dBm (SX1261 + 0900FM15K0039)

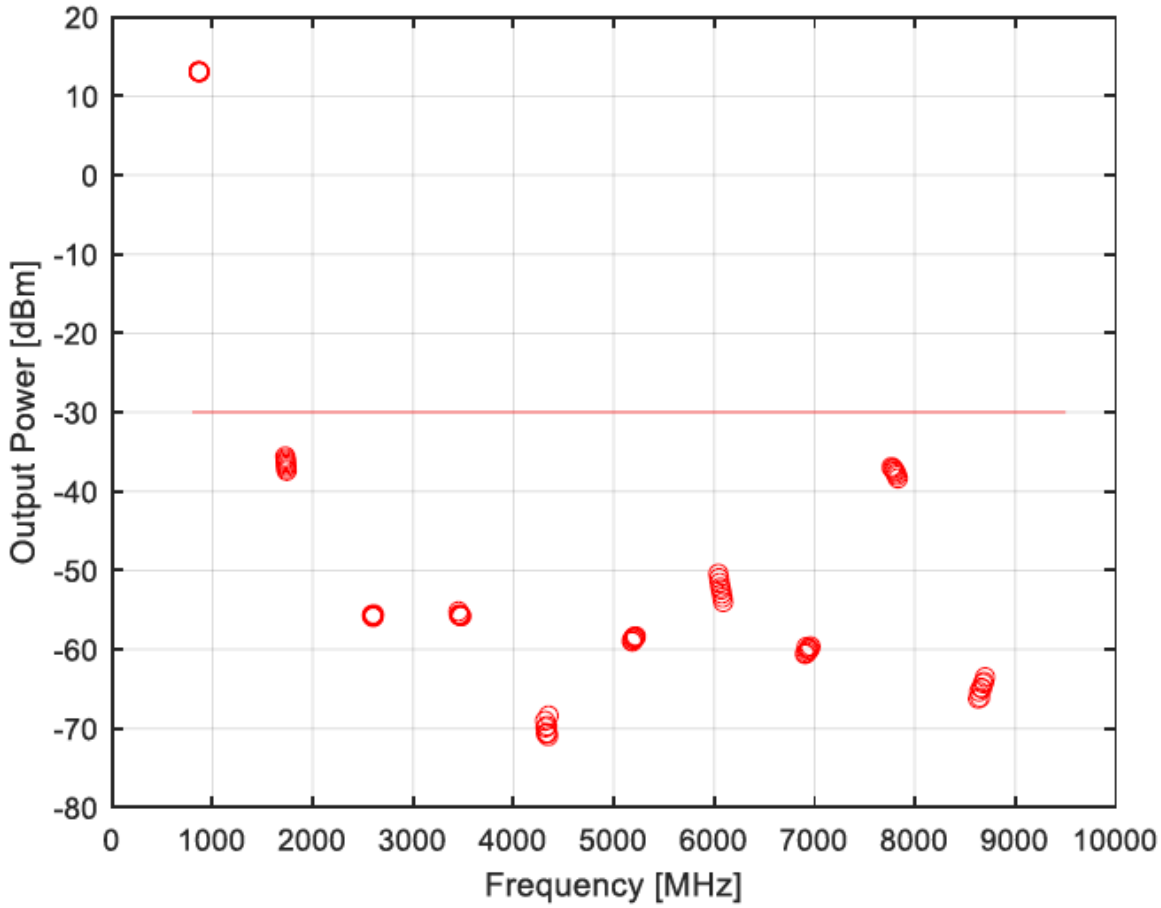

Figure 9. 868MHz Fundamental and Harmonic Power Measurement, +14dBm

For more detailed measurement results, see Semtech Application Note AN1200.70

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Fundamental Transmit Power and Current Consumption, 915MHz, +22dBm (SX1262 + 0900FM15K0039)

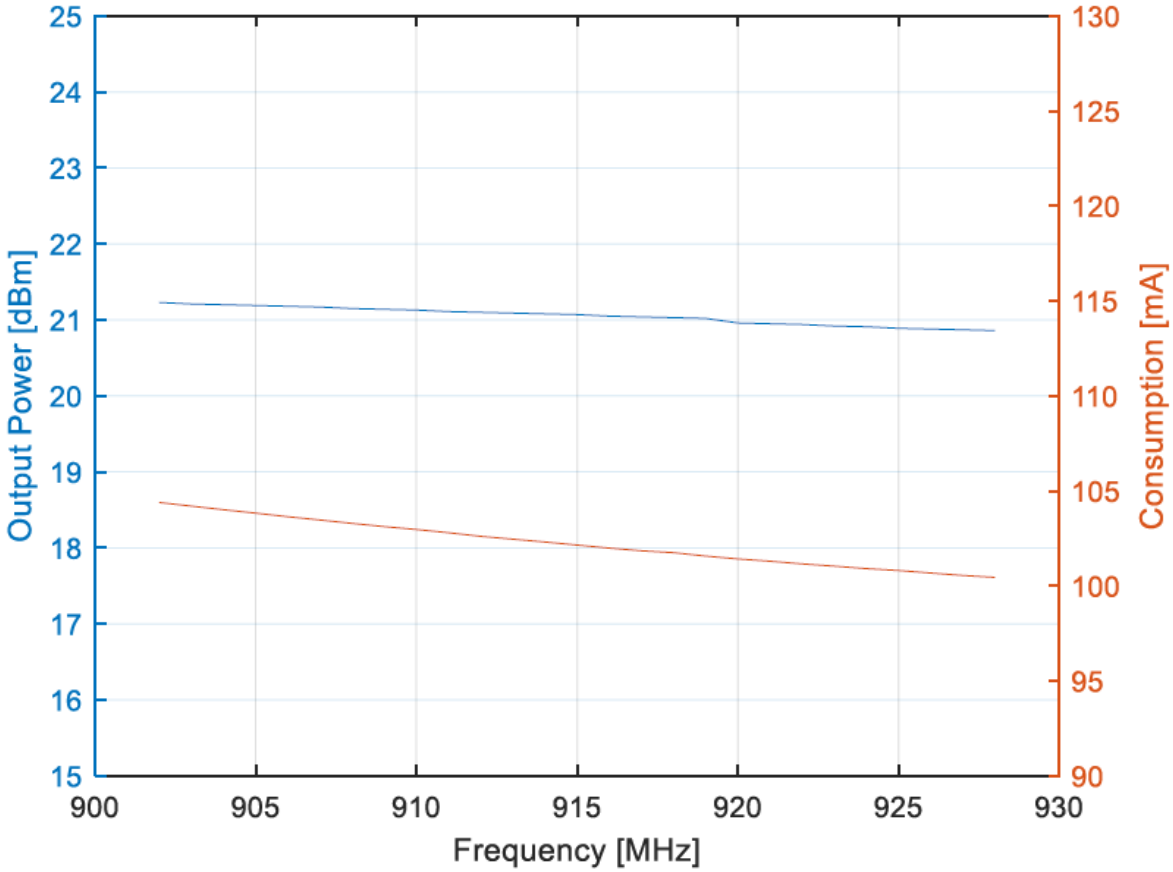

Figure 10. 915MHz Fundamental Power and Current Consumption, +22dBm

For more detailed measurement results, see Semtech Application Note AN1200.70

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Fundamental and Harmonic Transmit Power, 915MHz, +22dBm (SX1262 + 0900FM15K0039)

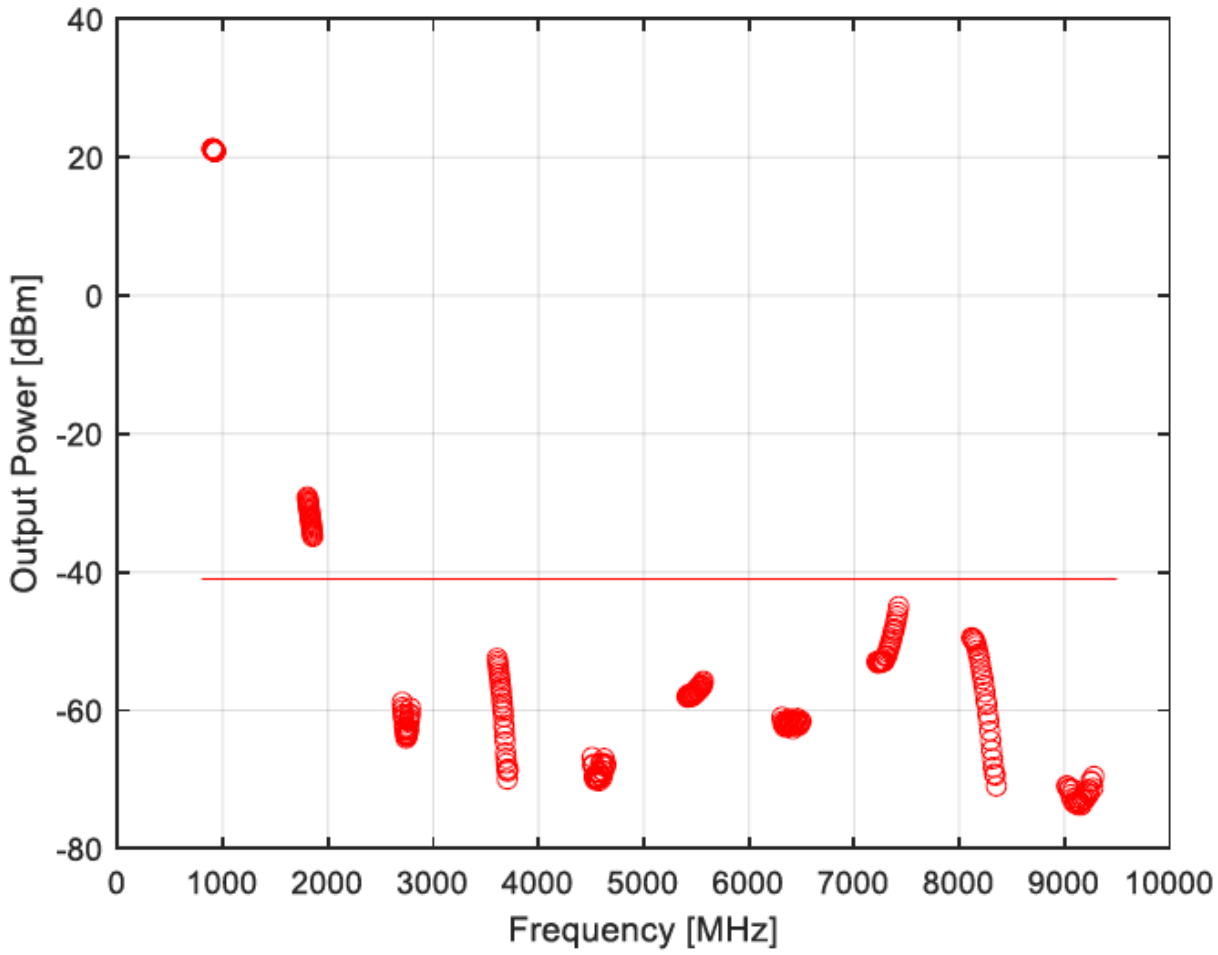

Figure 11. 915MHz Fundamental and Harmonic Transmit Power, +22dBm

For more detailed measurement results, see Semtech Application Note AN1200.70

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Important Links

0900FM15K0039 Datasheet

0900FM15K0039 Landing page for Samples, Quotes, Layout Requests, etc.

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Changelog	
1.1	Initial Release

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