

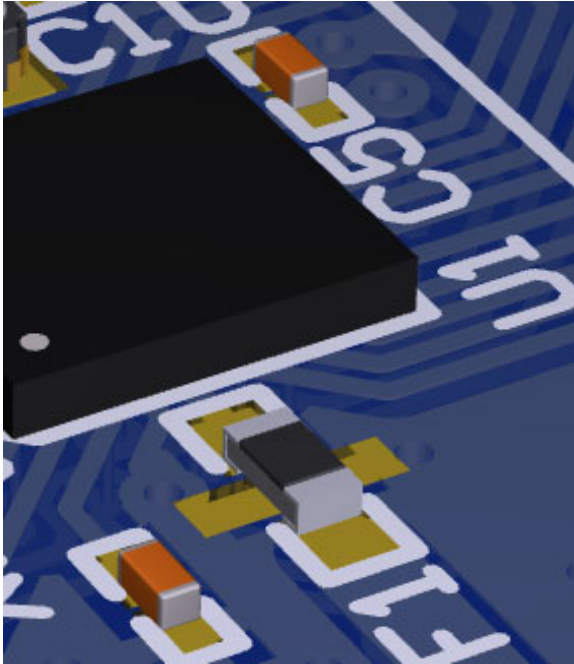
High Frequency Ceramic Solutions

Application Note: AN050

4/24/2023

G.Kuo/M.Carmona

Application Note for Nordic Semiconductor's nRF52832 (QFN and CSP) and nRF52810 (QFN)* Integrated RF Front End Solution Using Johanson's 1.0x0.5mm Impedance Matched Filter



Abstract

The nRF52832 SoC is a powerful, highly flexible ultra-low power multiprotocol SoC ideally suited for Bluetooth® Smart ANT and 2.4GHz ultra low-power wireless applications. The nRF52832 SoC is built around a 32-bit ARM® Cortex™-M4F CPU with 512kB + 64kB RAM. The embedded 2.4GHz transceiver supports Bluetooth Smart, ANT and proprietary 2.4 GHz protocol stack. It is on air compatible with the nRF51 Series, nRF24L and nRF24AP Series products from Nordic Semiconductor.

This application note describes the implementation, measurements, schematics, and design files when pairing Nordic Semiconductor's nRF52832 QFN or CSP package integrated chip with Johanson Technology's impedance matched filter.

Introduction

In partnership with Nordic Semiconductor, Johanson Technology Inc. has developed a miniature 4-pin EIA 0402 (1.0mmx0.5mmx0.38mm) ceramic passive filter that provides the following:

- Consolidates Nordic Semiconductor's reference discrete LC filter into a single, 0402 sized component
- Complex impedance matched specifically to the nRF52 series single ended antenna output

This front-end filter reduces implementation size area by using smaller effective PCB real estate usage. Also, it reduces component count, increases performance consistency (100% RF tested before T&R), and offers excellent temperature stability (4ppm). AEC-Q200 qualification available.

Nordic Semiconductor Chipset	Johanson Technology Impedance-matched Filter	Datasheet
nRF52832-QFAA, -QFAB	2450FM07A0029	PDF
nRF52810-QFAA*, -QCAA*	2450FM07A0029	PDF
nRF52832-CIAA	2450FM07A0035	PDF

*nRF52810 (QFN) and nRF52832 (QFN) are identically matched and therefore both compatible



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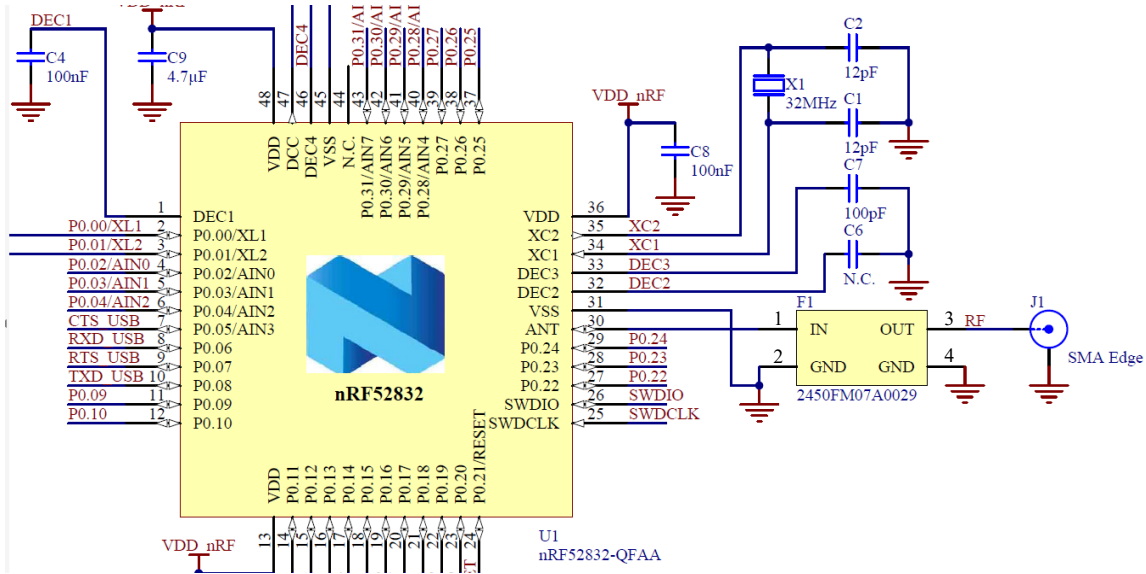
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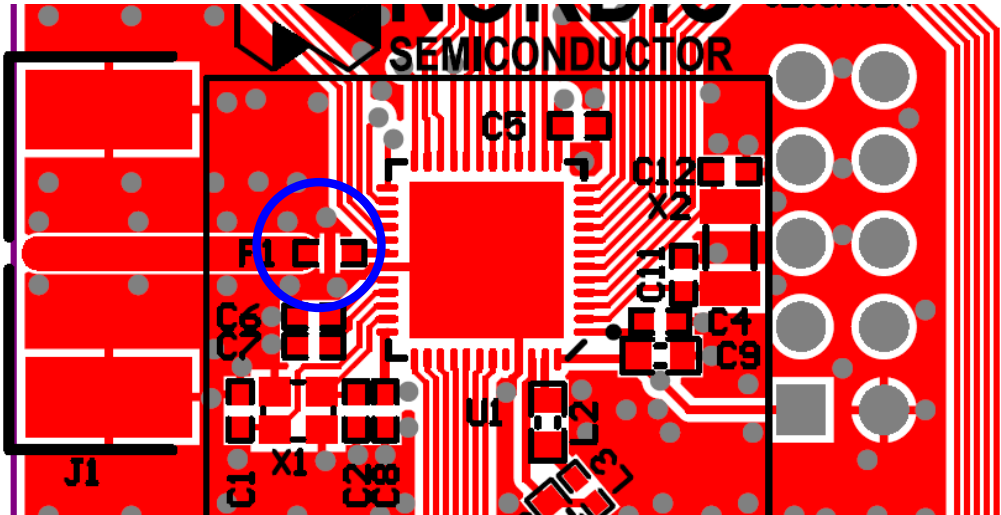
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Application Note for Nordic Semiconductor's nRF52832 (QFN and CSP) and nRF52810 (QFN)* Integrated RF Front End Solution Using Johanson's 1.0x0.5mm Impedance Matched Filter

Schematic nRF52832-QFAA with Impedance-matched Filter 2450FM07A0029



PCB Layout Reference nRF52832-QFAA & Impedance Matched Filter 2450FM07A0029



2450FM07A0029 PCB Footprint

For more schematic examples, download the layout files, BOM, etc. go to: www.johansontechnology.com/nordic



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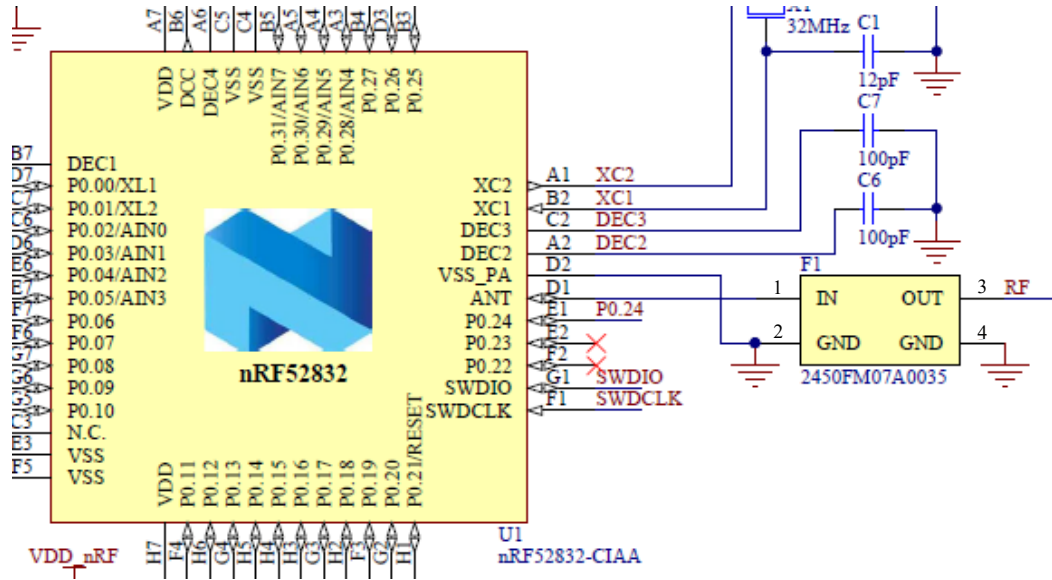
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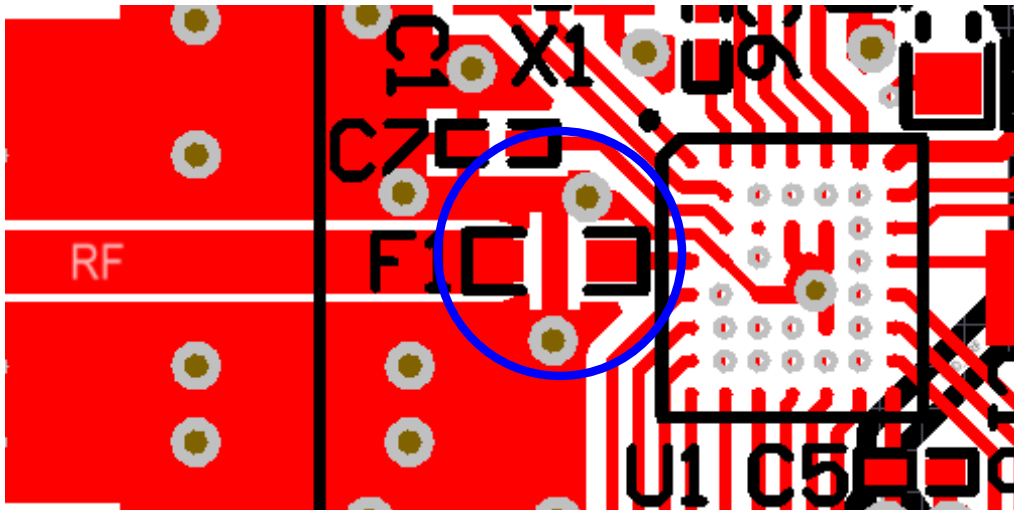
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Application Note for Nordic Semiconductor's nRF52832 (QFN and CSP) and nRF52810 (QFN)* Integrated RF Front End Solution Using Johanson's 1.0x0.5mm Impedance Matched Filter

Schematic nRF52832-CIAA with Impedance-matched Filter 2450FM07A0035



PCB Layout Reference nRF52832-CIAA & Impedance-matched Filter 2450FM07A0035



2450FM07A0035 PCB Footprint

For more schematic examples, download the layout files, BOM, etc. go to: www.johansontechnology.com/nordic



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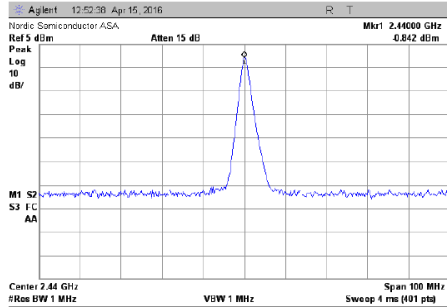
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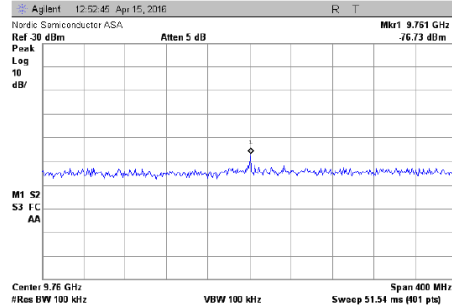
Application Note for Nordic Semiconductor's nRF52832 (QFN and CSP) and nRF52810 (QFN)* Integrated RF Front End Solution Using Johanson's 1.0x0.5mm Impedance Matched Filter

TX Power nRF52832-QFAA + 2450FM07A0029 on Reference Design PCB

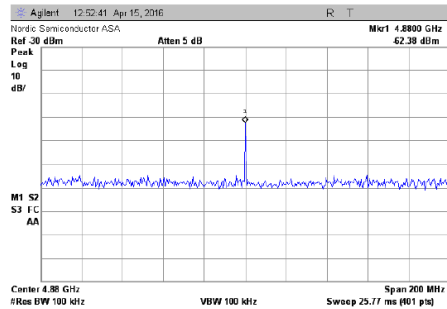
0dBm, 2440MHz (Mid)



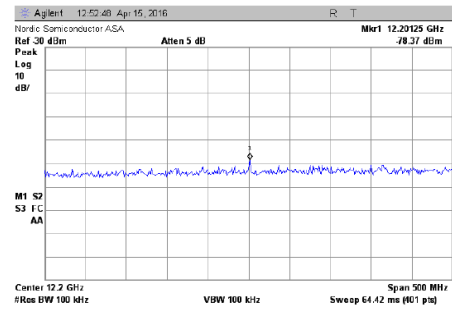
Mid 0dBm Fundamental



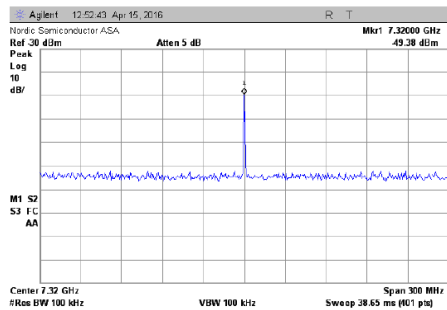
Mid 0dBm 4th harmonic



Mid 0dBm 2nd harmonic



Mid 0dBm 5th harmonic



Mid 0dBm 3rd harmonic

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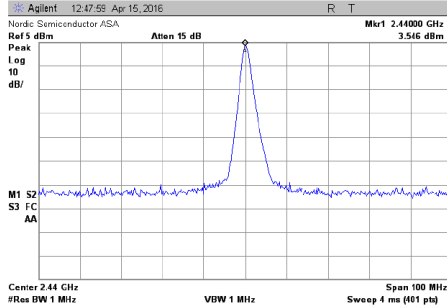
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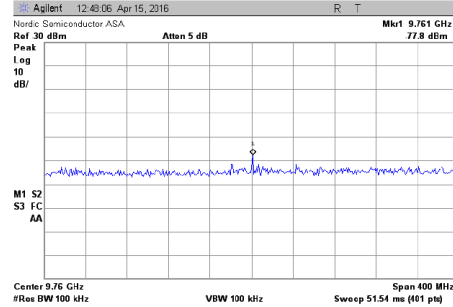
Application Note for Nordic Semiconductor's nRF52832 (QFN and CSP) and nRF52810 (QFN)* Integrated RF Front End Solution Using Johanson's 1.0x0.5mm Impedance Matched Filter

TX Power nRF52832-QFAA + 2450FM07A0029 on Reference Design PCB

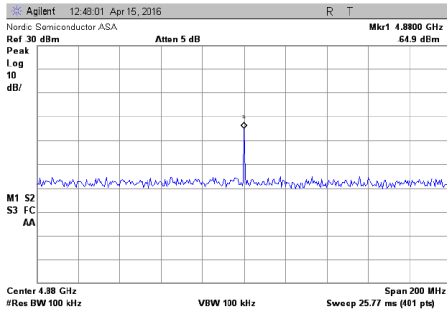
+4dBm, 2440MHz (Mid)



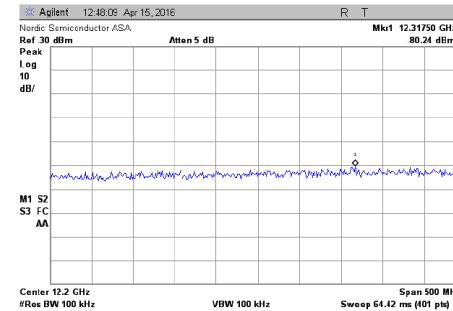
Mid +4dBm Fundamental



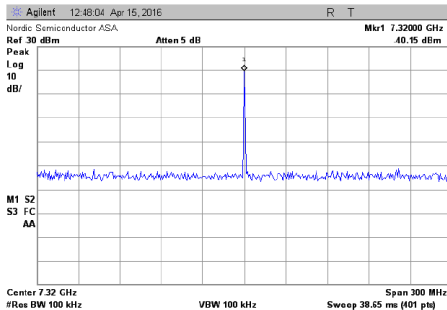
Mid +4dBm 4th harmonic



Mid +4dBm 2nd harmonic



Mid +4dBm 5th harmonic



Mid +4dBm 3rd harmonic

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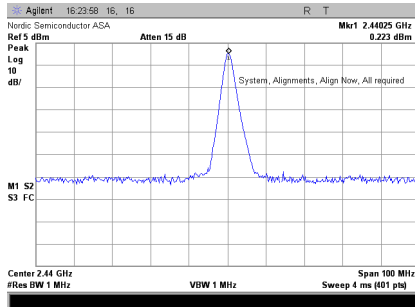
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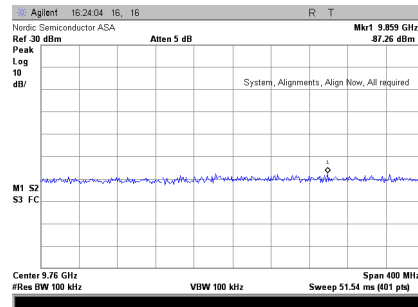
Application Note for Nordic Semiconductor's nRF52832 (QFN and CSP) and nRF52810 (QFN)* Integrated RF Front End Solution Using Johanson's 1.0x0.5mm Impedance Matched Filter

TX Power nRF52832-CIAA + 2450FM07A0035 on Reference Design PCB

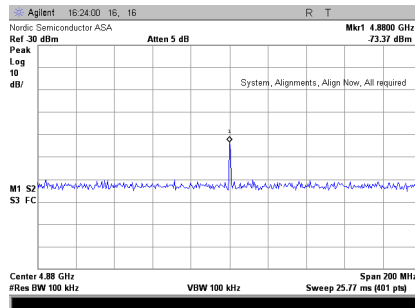
0dBm, 2440MHz (Mid)



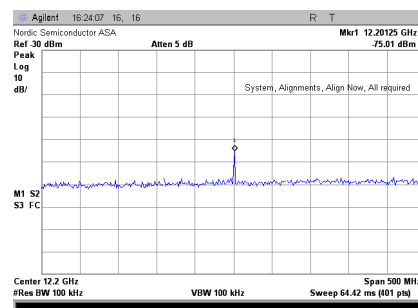
Mid 0dBm Fundamental



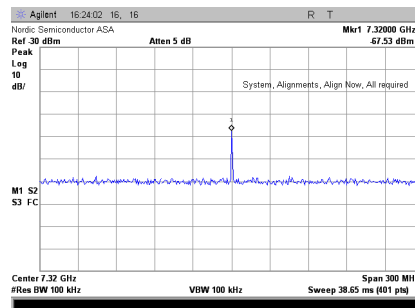
Mid 0dBm 4th harmonic



Mid 0dBm 2nd harmonic



Mid 0dBm 5th harmonic



Mid 0dBm 3rd harmonic

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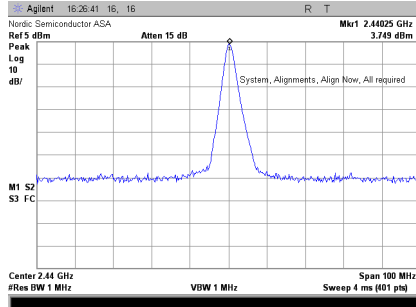
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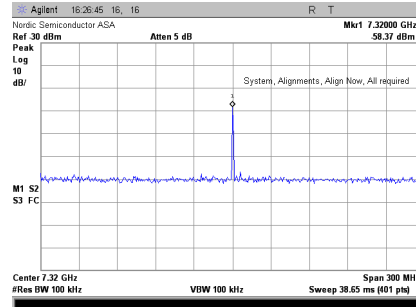
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TX Power nRF52832-CIAA + 2450FM07A0035 on Reference Design PCB

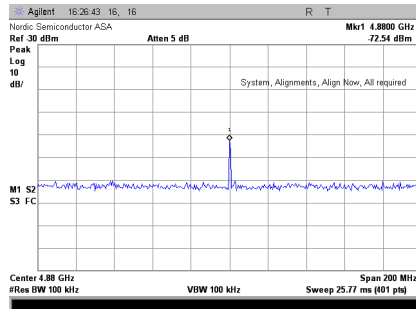
+4dBm, 2440MHz (Mid)



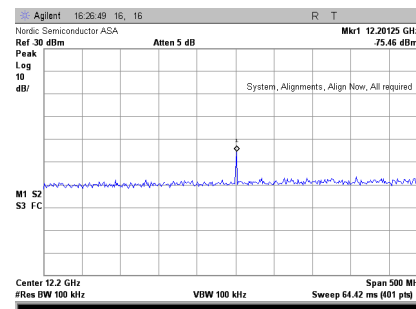
Mid +4dBm Fundamental



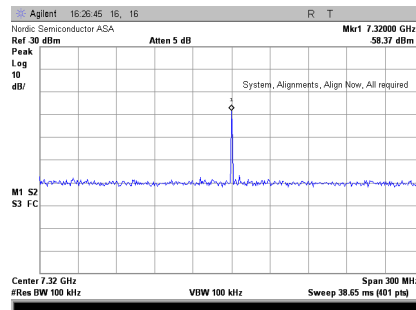
Mid +4dBm 4th harmonic



Mid +4dBm 2nd harmonic



Mid +4dBm 5th harmonic



Mid +4dBm 3rd harmonic

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Complete TX Power nRF52832 with Johanson Impedance-matched Filter

+4 dBm Setting		nRF52832-QFAA	
	Frequency	2450FM07A0029	
Fundamental	2,402.00	3.52	
2nd harmonic	4,804.00	-72.52	
3rd harmonic	7,206.00	-40.84	
4th harmonic	9,608.00	-76.89	
5th harmonic	12,010.00	-80.63	

Fundamental Hi	2,480.00	3.63	
2nd harmonic	4,960.00	-66.14	
3rd harmonic	7,440.00	-41.55	
4th harmonic	9,920.00	-80.79	
5th harmonic	12,400.00	-80.05	

Fundamental Mid	2,440.00	3.55	
2nd harmonic	4,880.00	-64.90	
3rd harmonic	7,320.00	-40.15	
4th harmonic	9,760.00	-77.80	
5th harmonic	12,200.00	-80.24	

+4 dBm		nRF52832-CIAA	
	Frequency	2450FM07A0035	
Fundamental	2,402.00	4.24	
2nd harmonic	4,804.00	-69.77	
3rd harmonic	7,206.00	-55.50	
4th harmonic	9,608.00	-86.23	
5th harmonic	12,010.00	-72.39	

Fundamental Hi	2,480.00	4.33	
2nd harmonic	4,960.00	-71.80	
3rd harmonic	7,440.00	-57.29	
4th harmonic	9,920.00	-84.64	
5th harmonic	12,400.00	-74.42	

Fundamental Mid	2,440.00	4.33	
2nd harmonic	4,880.00	-71.67	
3rd harmonic	7,320.00	-57.39	
4th harmonic	9,760.00	-86.05	
5th harmonic	12,200.00	-74.23	

0 dBm Setting		nRF52832-QFAA	
	Frequency	2450FM07A0029	
Fundamental	2,402.00	-0.97	
2nd harmonic	4,804.00	-64.70	
3rd harmonic	7,206.00	-48.85	
4th harmonic	9,608.00	-78.05	
5th harmonic	12,010.00	-80.59	

Fundamental Hi	2,480.00	-0.84	
2nd harmonic	4,960.00	-60.93	
3rd harmonic	7,440.00	-49.71	
4th harmonic	9,920.00	-80.08	
5th harmonic	12,400.00	-80.07	

Fundamental Mid	2,440.00	-0.84	
2nd harmonic	4,880.00	-62.38	
3rd harmonic	7,320.00	-49.38	
4th harmonic	9,760.00	-76.73	
5th harmonic	12,200.00	-78.37	

0 dBm		nRF52832-CIAA	
	Frequency	2450FM07A0035	
Fundamental	2,402.00	0.44	
2nd harmonic	4,804.00	-72.10	
3rd harmonic	7,206.00	-65.06	
4th harmonic	9,608.00	-86.81	
5th harmonic	12,010.00	-75.18	

Fundamental Hi	2,480.00	1.05	
2nd harmonic	4,960.00	-71.05	
3rd harmonic	7,440.00	-66.31	
4th harmonic	9,920.00	-86.68	
5th harmonic	12,400.00	-72.42	

Fundamental Mid	2,440.00	0.81	
2nd harmonic	4,880.00	-72.49	
3rd harmonic	7,320.00	-66.55	
4th harmonic	9,760.00	-86.18	
5th harmonic	12,200.00	-73.78	



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2450FM07A0029 Filter (Impedance-matched to nRF52832-QFAx, nRF52810-QxAA)

<https://www.johansontechnology.com/datasheets/2450FM07A0029/2450FM07A0029.pdf>

2450FM07A0035 Filter (Impedance-matched to nRF52832-CIAA)

<https://www.johansontechnology.com/datasheets/2450FM07A0035/2450FM07A0035.pdf>

Application Notes, Layout Files, and more

<https://www.johansontechnology.com/nordic>

Packaging information

<https://www.johansontechnology.com/tape-reel-packaging>

Soldering Information

<https://www.johansontechnology.com/ipcsoldering-profile>

MSL Info

<https://www.johansontechnology.com/msl-rating>

Recommended Storage Condition and Max Shelf Life

<https://www.johansontechnology.com/recommended-storage-conditions>

RoHS Compliance

<https://www.johansontechnology.com/rohs-compliance>

Antenna layout and tuning techniques

<https://www.johansontechnology.com/tuning>

Antenna layout review, tuning, and characterization services

<https://www.johansontechnology.com/pc-antenna-services>

Johanson uses 6/6 RoHS Green Low-Temperature-Co-fired-Ceramic (LTCC) integrated passive technology in a 4-pin (Sn plated) monolithic structure. This component is 100% RF Tested, making it a more reliable system, impedance controlled environment, consistent-guaranteed RF performance in a very small RF front end-solution compared to the L/C discrete solution.

Johanson Technology, Inc. reserves the right to make design changes without notice.

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