

Converting Oscillator Phase Noise to Time Jitter

by Walt Kester

INTRODUCTION

A low aperture jitter specification of an ADC is critical to achieving high levels of signal-to-noise ratios (SNR). (See References 1, 2, and 3). ADCs are available with aperture jitter specifications as low as 60-fs rms ([AD9445](#) 14-bits @ 125 MSPS and [AD9446](#) 16-bits @ 100 MSPS). Extremely low jitter sampling clocks must therefore be utilized so that the ADC performance is not degraded, because the total jitter is the root-sum-square of the internal converter aperture jitter and the external sampling clock jitter. However, oscillators used for sampling clock generation are more often specified in terms of phase noise rather than time jitter. The purpose of this discussion is to develop a simple method for converting oscillator phase noise into time jitter.

PHASE NOISE DEFINED

First, a few definitions are in order. Figure 1 shows a typical output frequency spectrum of a non-ideal oscillator (i.e., one that has jitter in the time domain, corresponding to phase noise in the frequency domain). The spectrum shows the noise power in a 1-Hz bandwidth as a function of frequency. Phase noise is defined as the ratio of the noise in a 1-Hz bandwidth at a specified frequency offset, f_m , to the oscillator signal amplitude at frequency f_0 .

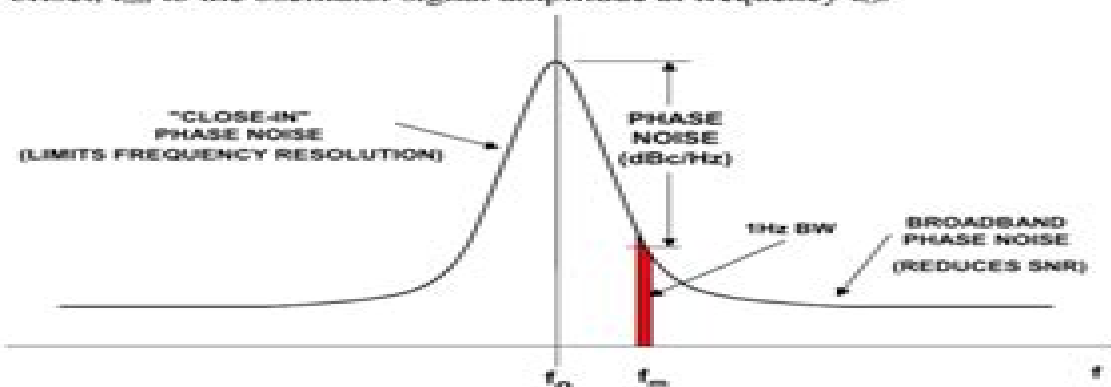


Figure 1: Oscillator Power Spectrum Due to Phase Noise

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A Guide to Noise in Microwave Circuits Peter Heymann, Matthias Rudolph, 2021-12-29 A GUIDE TO NOISE IN MICROWAVE CIRCUITS A fulsome exploration of critical considerations in microwave circuit noise In A Guide to Noise in Microwave Circuits Devices Circuits and Measurement a team of distinguished researchers deliver a comprehensive introduction to noise in microwave circuits with a strong focus on noise characterization of devices and circuits The book describes fluctuations beginning with their physical origin and touches on the general description of noise in linear and non linear circuits Several chapters are devoted to the description of noise measurement techniques and the interpretation of measured data A full chapter is dedicated to noise sources as well including thermal shot plasma and current A Guide to Noise in Microwave Circuits offers examples of measurement problems like low noise block LNB of satellite television and explores equipment and measurement methods like the Y cold source and 7 state method This book also includes A thorough introduction to foundational terms in microwave circuit noise including average values amplitude distribution autocorrelation cross correlation and noise spectra Comprehensive explorations of common noise sources including thermal noise the Nyquist formula and thermal radiation shot noise plasma noise and more Practical discussions of noise and linear networks including narrowband noise In depth examinations of calculation methods for noise quantities including noise voltages currents and spectra the noise correlation matrix and the noise of simple passive networks Perfect for graduate students specializing in microwave and wireless electronics A Guide to Noise in Microwave Circuits Devices Circuits and Measurement will also earn a place in the libraries of professional engineers working in microwave or wireless circuits and system design

Advanced Metric Wave Radar Jianqi Wu, 2019-07-12 This book systematically describes advanced metric wave radar and its practical applications offering a comprehensive introduction to the engineering design methods from the perspectives of system design antenna feed and transmit receive subsystems as well as mechanical structure design Focusing on the height finding method it describes in detail how the super resolution technique can be used to solve the problem of low angle height finding in metric wave radar It also discusses the anti jamming method for the unique jamming environment Further it presents narrowband target recognition methods to overcome the limitations of narrow absolute bandwidth in metric wave radar and to further explore the technique s potential Cooperative detection for metric wave radar netting is also addressed and the main experimental results are included The book offers a valuable resource for professional engineers researchers and teachers as well as graduate students engaged in radar system engineering electronic engineering and signal processing

Handbook of Radar Signal Analysis Bassem R. Mahafza, Scott C. Winton, Atef Z. Elsherbeni, 2021-08-16 This new handbook on radar signal analysis adopts a deliberate and systematic approach It uses a clear and consistent level of delivery while maintaining strong and easy to follow mathematical details The emphasis of this book is on radar signal types and their relevant signal processing and not on radar systems hardware or components This

handbook serves as a valuable reference to a wide range of audience More specifically college level students practicing radar engineers as well as casual readers of the subject are the intended target audience of the first few chapters of this book As the book chapters progress these grow in complexity and specificity Accordingly later chapters are intended for practicing engineers graduate college students and advanced readers Finally the last few chapters contain several special topics on radar systems that are both educational and scientifically entertaining to all readers The presentation of topics in this handbook takes the reader on a scientific journey whose major landmarks comprise the different radar subsystems and components In this context the chapters follow the radar signal along this journey from its birth to the end of its life Along the way the different relevant radar subsystems are analyzed and discussed in great detail The chapter contributors of this new handbook comprise experienced academia members and practicing radar engineers Their combined years of academic and real world experiences are in excess of 175 Together they bring a unique easy to follow mix of mathematical and practical presentations of the topics discussed in this book See the Chapter Contributors section to learn more about these individuals

Wireless Transceiver Design Ariel Luzzatto,Motti Haridim,2016-09-08 Building upon the success of the first edition 2007 *Wireless Transceiver Design* 2nd Edition is an accessible textbook that explains the concepts of wireless transceiver design in detail The architectures and the detailed design of both traditional and advanced all digital wireless transceivers are discussed in a thorough and systematic manner while carefully watching out for clarity and simplicity Many practical examples and solved problems at the end of each chapter allow students to thoroughly understand the mechanisms involved to build confidence and enable them to readily make correct and practical use of the applicable results and formulas From the instructors perspective the book will enable the reader to build courses at different levels of depth starting from the basic understanding whilst allowing them to focus on particular elements of study In addition to numerous fully solved exercises the authors include actual exemplary examination papers for instructors to use as a reference format for student evaluation The new edition has been adapted with instructors lecturers graduate undergraduate students and RF engineers in mind Non RF engineers looking to acquire a basic understanding of the main related RF subjects will also find the book invaluable

Intelligent System and Computing Yang Yi,2020-04-29 The book *Intelligent System and Computing* reports the theory mathematical models algorithms design methods and applications of intelligent systems and computing It covers various disciplines including computer and information science electrical and computer engineering natural sciences economics and neuroscience The broad ranging discussion covers the key disciplines in computational science and artificial intelligence as well as advances in neuromorphic computing deep learning the Internet of Things computer vision and many others This volume provides both academics and professionals with a comprehensive overview of the field and presents areas for future research

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Table of Contents Convert Phase Noise To Jitter Mt 008

1. Understanding the eBook Convert Phase Noise To Jitter Mt 008
 - The Rise of Digital Reading Convert Phase Noise To Jitter Mt 008
 - Advantages of eBooks Over Traditional Books
2. Identifying Convert Phase Noise To Jitter Mt 008
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Convert Phase Noise To Jitter Mt 008
 - User-Friendly Interface
4. Exploring eBook Recommendations from Convert Phase Noise To Jitter Mt 008
 - Personalized Recommendations
 - Convert Phase Noise To Jitter Mt 008 User Reviews and Ratings
 - Convert Phase Noise To Jitter Mt 008 and Bestseller Lists
5. Accessing Convert Phase Noise To Jitter Mt 008 Free and Paid eBooks
 - Convert Phase Noise To Jitter Mt 008 Public Domain eBooks

- Convert Phase Noise To Jitter Mt 008 eBook Subscription Services
- Convert Phase Noise To Jitter Mt 008 Budget-Friendly Options
- 6. Navigating Convert Phase Noise To Jitter Mt 008 eBook Formats
 - ePub, PDF, MOBI, and More
 - Convert Phase Noise To Jitter Mt 008 Compatibility with Devices
 - Convert Phase Noise To Jitter Mt 008 Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Convert Phase Noise To Jitter Mt 008
 - Highlighting and Note-Taking Convert Phase Noise To Jitter Mt 008
 - Interactive Elements Convert Phase Noise To Jitter Mt 008
- 8. Staying Engaged with Convert Phase Noise To Jitter Mt 008
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Convert Phase Noise To Jitter Mt 008
- 9. Balancing eBooks and Physical Books Convert Phase Noise To Jitter Mt 008
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Convert Phase Noise To Jitter Mt 008
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Convert Phase Noise To Jitter Mt 008
 - Setting Reading Goals Convert Phase Noise To Jitter Mt 008
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Convert Phase Noise To Jitter Mt 008
 - Fact-Checking eBook Content of Convert Phase Noise To Jitter Mt 008
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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