Technical White Paper

Enabling Next-Generation Satellite Connectivity for D2D, IoT, and Beyond with TI's AFE8030

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Abstract

The rapid growth of satellite direct-to-device (D2D) and Internet of Things (IoT) connectivity is driving demand for flexible, compact, and power-efficient satellite payload radios. Supporting direct communication with smartphones and low-power IoT devices presents unique RF design challenges, including challenging link budgets, diverse spectrum requirements, and stringent size, weight, power, and reliability constraints with large phased array antennas.

This white paper explores the key RF design considerations for satellite D2D/IoT service links and demonstrates how Texas Instruments' AFE8030, a highly integrated, low-power, octal-channel direct RF-sampling transceiver, addresses these challenges. Key capabilities include simultaneous multi-band operation, fast frequency hopping, flexible JESD204 interfaces, multi-device synchronization, simplified antenna calibration, and dynamic power-saving features. Together, these capabilities enable scalable, software-configurable, and power-efficient radio architectures for next-generation satellite connectivity for D2D, IoT and beyond.

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1 Introduction

Satellite communications are entering a new phase of growth, driven by the convergence of terrestrial cellular networks and non-terrestrial networks (NTN). While traditional satellite services have relied largely on proprietary technologies and dedicated terminals, the emergence of large low earth orbit (LEO) constellations, lower launch costs, software-defined payloads and electronically steerable antennas enable satellite connectivity on an unprecedented scale.

One of the most significant market trends is the rapid emergence of satellite direct-to-device (D2D) and Internet of Things (IoT) connectivity. Since the early demonstrations of direct satellite connectivity to conventional mobile phone in 2020, satellite D2D/IoT technology has rapidly progressed toward commercial deployment, with significant market expansion expected through 2030. 3GPP NTN standardization is bringing satellite communications into the cellular ecosystem, while regulatory frameworks such as supplemental coverage from space (SCS) are enabling satellites to complement terrestrial mobile networks using cellular spectrum. Together with traditional mobile satellite service (MSS) spectrum, these developments create opportunities to extend connectivity directly to smartphones and low-power IoT devices in rural, remote, and underserved areas without requiring specialized satellite terminals.

These market trends are also reshaping satellite radio technology. A satellite communications system typically includes three type of links: service links, feeder links and inter-satellite links, as shown in Figure 1-1. The users receive satellite service (text, voice, or broadband internet) through service links which connect the user terminals (dedicated, cellphone, or IoT devices) to the satellite. The ground station (gateway), serving as the primary aggregation point for all user traffic entering and leaving the satellite network, connects the satellite through the feeder link, and the gateway in turn interfaces with the back-end data network. Serving different purposes, the radio design for service link and feeder link can be different.

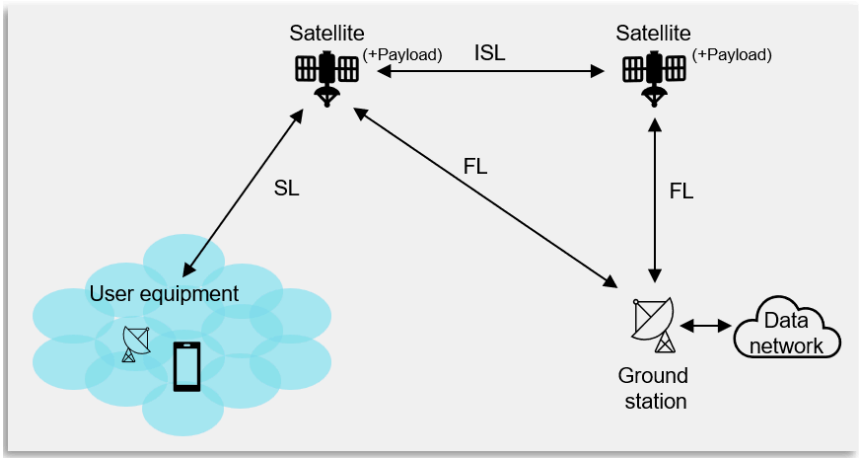


Figure 1-1. Overview of Satellite Communication System

In this white paper, we dive into the challenges faced by D2D/IoT satellite communication payload design and show how the TI AFE8030 enables a low-power, compact, versatile and high-performance Satcom payload radio design for D2D/IoT service link.

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2 Nomenclature

3GPP	3rd generation partnership project
D2D	Direct-to-device
DSA	Digital step attenuator
DDC	Digital-down-converter
DUC	Digital-up-converter
FL	Feeder link
ISL	Inter-satellite link
IoT	Internet of Things
LEO	Low Earth orbit
MSS	Mobile satellite service
NCO	Numerically controlled oscillator
NTN	Non-terrestrial network
SCS	Supplemental coverage from space
SL	Service Link
TT&C	Telemetry, tracking and command

3 Radio Design Challenges for Satellite D2D/IoT Service Link

Satellite D2D and IoT services introduce unique radio design challenges. Unlike traditional satellite services that use dedicated terminals with directional antennas, D2D/IoT systems communicate directly with smartphones or compact, low-power IoT devices. These devices have limited transmit power and small, low-gain antennas, while the satellite can be hundreds or thousands of kilometers away. Closing this challenging link budget while minimizing payload size, weight, and power (SWaP) places significant demands on the satellite RF architecture.

3.1 Spectrum and RF Flexibility

D2D and IoT service links typically operate at lower frequencies such as L-band and S-band MSS spectrum, and sub-3GHz terrestrial cellular spectrum used for SCS. These lower frequencies provide favorable propagation characteristics for communicating with small, low-gain user devices.

Individual D2D/IoT carriers are typically only a few to tens of megahertz wide. The key RF challenge is therefore not ultra-wide instantaneous bandwidth, but the ability to support multiple frequency bands, operators, and geographic regions. As satellites move across the Earth, a highly configurable RF architecture with wide frequency coverage, fast frequency hopping and spectrum agility becomes increasingly important, with the proliferation of LEO constellations.

Direct RF-sampling architectures are an excellent choice for this requirement. Unlike traditional zero-IF architectures, direct RF sampling architecture provides flexible multi-band operation and fast frequency reconfiguration while eliminating I/Q mismatch, local-oscillator leakage and DC-offset calibration. This flexibility enables a common payload hardware platform to support different frequency bands and operating scenarios through software configuration.

3.2 Large Phased-Array Antennas

The long propagation distance and limited antenna gain of smartphones and IoT devices create a challenging link budget. Large phased-array antennas, along with beamforming technologies, provide the high directivity gain needed to recover link margin while generating multiple steerable spot beams for geographic coverage and spectrum reuse.

Large arrays also require many RF channels. **High-channel-density RF transceivers** can significantly reduce component count, board area, and payload weight. Low power consumption per-channel becomes equally important because even small power savings are multiplied across hundreds or thousands of antenna elements.

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3.3 SWaP and Space Reliability

SWaP optimization is particularly important for satellite payloads because of limited power supply, while payload mass and volume directly affect spacecraft design and launch cost. Higher RF integration and lower device-level power consumption can reduce payload size and power dissipation. System-level techniques such as dynamic power-saving modes can further improve overall efficiency.

Finally, payload electronics must operate reliably throughout the mission without physical maintenance. Depending on mission lifetime and orbit, designs can use different levels of radiation tolerance and system redundancy to achieve the required balance among reliability, power, weight, and cost.

4 TI AFE8030

Together, the above design challenges are driving integrated RF transceivers toward direct RF-sampling with wide frequency coverage and spectrum agility, high channel density, low-power consumption, and space reliability. **The TI AFE8030, an octal-channel, direct RF-sampling-based, low-power, highly configurable RF transceiver, is well positioned to address these design challenges and enable compact, flexible, and power-efficient satellite D2D/IoT payload radios for the service link**. The following sections describe multiple engineering topics in detail while using AFE8030 for D2D/IoT communication payload radio design, including:

- Multi-band support
- Fast frequency hopping and frequency agility
- SerDes and JESD configuration
- Antenna calibration
- Multi-device synchronization
- Power saving
- Software ecosystem

5 Designing D2D/IoT Communication Payload Radio With TI AFE8030

5.1 Multi-Band Support With AFE8030 Dual-DUC and Dual-DDC Chains

LEO satellite payload supporting D2D and IoT can benefit significantly from the ability to operate across multiple frequency bands simultaneously. In traditional discrete RF architectures, multi-band operation can require duplicating significant portions of the signal chain, including mixers, oscillators, and data converters. In contrast, the AFE8030's direct RF-sampling architecture simplifies multi-band implementation by performing frequency conversion and band combination and separation digitally.

The AFE8030 incorporates dual digital up-converter (DUC) and digital down-converter (DDC) chains per transceiver channel, each operating independently with dedicated numerically controlled oscillators (NCOs), as shown in Figure 5-1 and Figure 5-2. A single AFE8030 can therefore simultaneously up-convert two transmit bands and down-convert two receive bands without the overhead of additional mixers and oscillators.

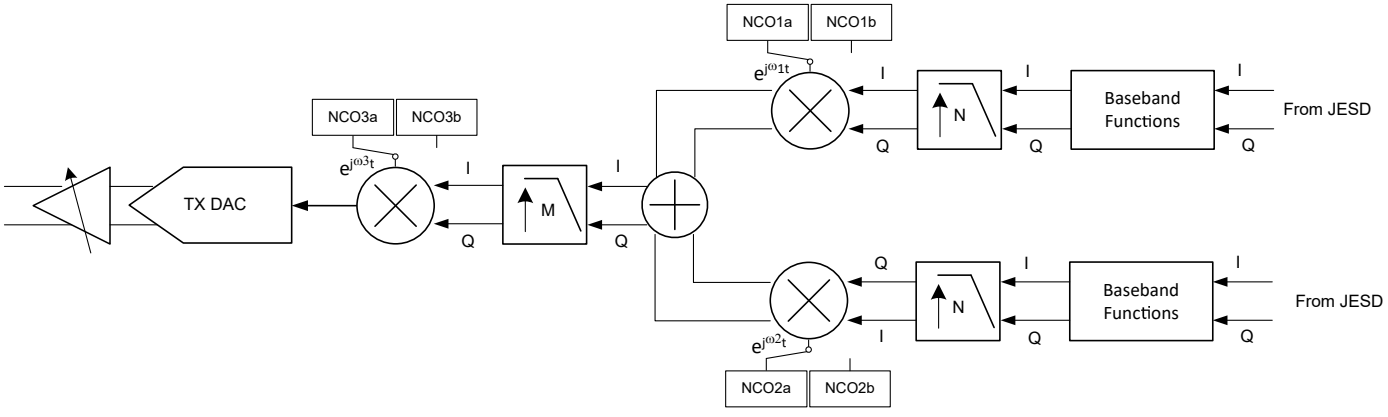


Figure 5-1. AFE8030 Digital Up-Converter (DUC) Block Diagram

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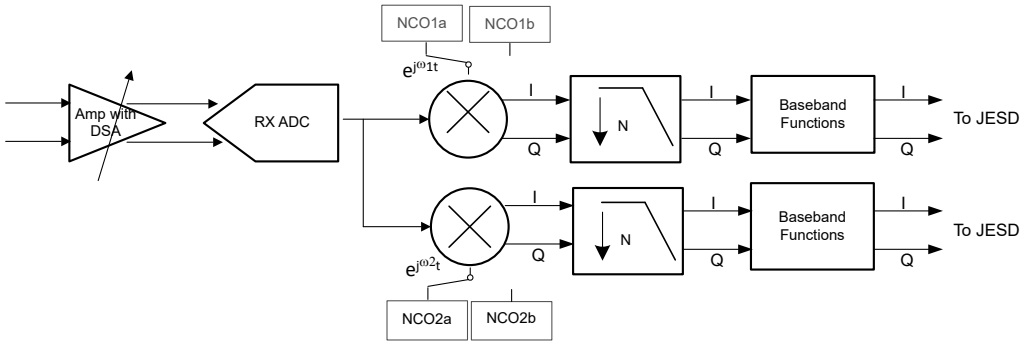


Figure 5-2. AFE8030 Digital Down-Converter (DDC) Block Diagram

Consider simultaneous L- and S-band coverage as a typical example of a satellite D2D application. With a DAC sampling frequency of 6GSPS and a ADC sampling rate of 3GSPS, the AFE8030 can cover the L band and the lower half of the S band within the same Nyquist zone. The AFE8030 can be configured in dual-DUC and dual-DDC modes. With dual-DUC mode, two independent DUC chains can process the respective frequency bands and combine them into a single transmitter output. With dual-DDC mode, the single receiver can digitize both bands through one ADC, and the two independent DDC chains can separate the two frequency bands in the digital domain. Additionally, each of the AFE8030's eight transmitter and eight receiver chains can be configured with independent NCO frequencies, providing additional flexibility for multi-band operation and spectrum allocation.

The relatively narrow bandwidths of D2D and IoT waveforms fit easily within the available bandwidth of each DUC and DDC chain, allowing flexible on the choice of center frequencies through digitally controlled NCO. Additionally, as each DUC and DDC chain have two independent NCOs, the AFE8030 enables fast switching between multiple center frequencies within each band.

Together, the AFE8030 allows simultaneous multi-band coverage using a single RF transceiver, with frequency conversion and band combination/separation maintained in the digital domain of the device. Compared to traditional architecture, this approach significantly reduces component count and hardware complexity. Figure 5-3 shows an example of the transmitter output spectrum, where the single transmitter chain of AFE8030 is sending out both L- and S-band signal simultaneously with the dual-DUC mode.

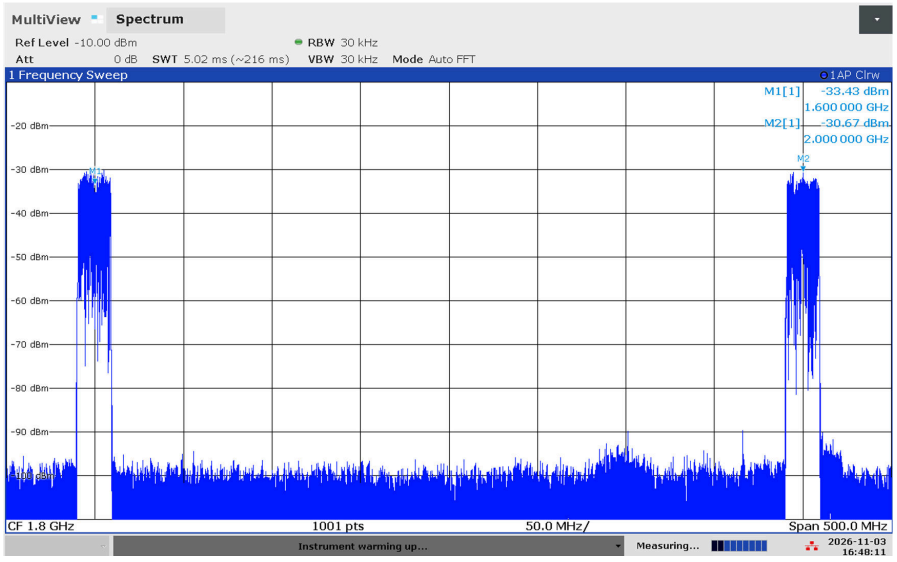


Figure 5-3. Dual-Band (L + S) TX Output Spectrum

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With all the advantages of dual-DUC and dual-DDC modes, simultaneous multi-band operation requires careful RF frequency planning and filtering. In the multi-band configuration, the DACs and ADCs process the combined spectrum spanning multiple bands, designers must do frequency planning wisely to avoid unwanted intermodulation components falling in-band, and design the filter placement carefully to provide sufficient rejection on out-of-band inter-band modulation components. On the receiver side, the digital decimation filters in AFE8030 can provide approximately 85dB or greater out-of-band rejection following digital band separation.

Another important consideration is system power efficiency. Although dual-DUC operation simplifies the transceiver architecture, a broadband power amplifier covering multiple bands can be less efficient than narrowband amplifiers optimized for individual bands. Designers must therefore evaluate the tradeoffs among RF integration, filtering complexity, power amplifier efficiency, and overall system power consumption based on the intended specific use cases.

5.2 Fast Frequency Hopping and Frequency Agility With RF Sampling

Fast frequency hopping and frequency agility are important capabilities for satellite direct-to-device (D2D) communications. Satellites serving multiple geographic regions can need to support different frequency channels or bands. Frequency agility enables satellites to switch frequency bands or channels based on spectrum availability, regulatory restrictions, and interference conditions.

The direct RF-sampling architecture of the AFE8030 is an excellent choice to address these requirements, because frequency conversion in AFE8030 is performed digitally using NCOs, enabling rapid frequency reconfiguration without relying on analog local-oscillator retuning.

In AFE8030, each transmitter/receiver paths support up to two DUC/DDC chains, with two independently configurable NCOs per digital mixer. The device can switch between the two NCOs while maintaining phase-continuous operation, with switching controlled through either SPI commands or dedicated GPIO signals.

NCO-based frequency hopping can achieve settling times on the order of a few hundred nanoseconds. The total hopping time includes the latency associated with the SPI command or GPIO trigger, as well as the digital signal-chain transition required to flush out invalid samples.

As shown in Figure 5-4, the AFE8030 demonstrates a transmitter frequency-hopping time of approximately 215ns when switching between two NCO frequencies using a GPIO trigger.

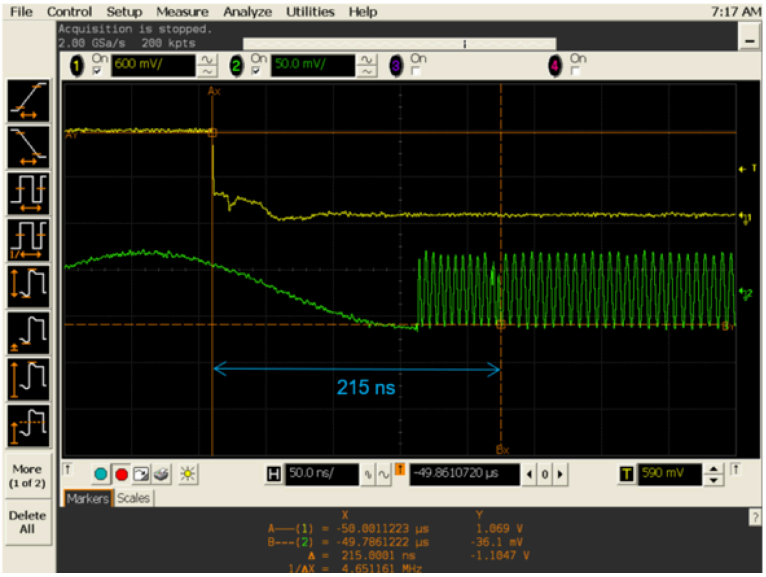


Figure 5-4. Setting Time of Fast Frequency Hopping With AFE8030

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Figure 5-5 demonstrates the phase continuity with the fast frequency hopping, where RX channel B is the reference channel with NCO frequency set as NCO1, the NCO frequency of RX channel A switches from NCO1 to NCO2 and then back to NCO1. The initial phases of both RX channels are aligned, as shown, the RX channel A NCO phase remains aligned with RX channel B following the frequency hopping from NCO1 to NCO2 and back to NCO1.

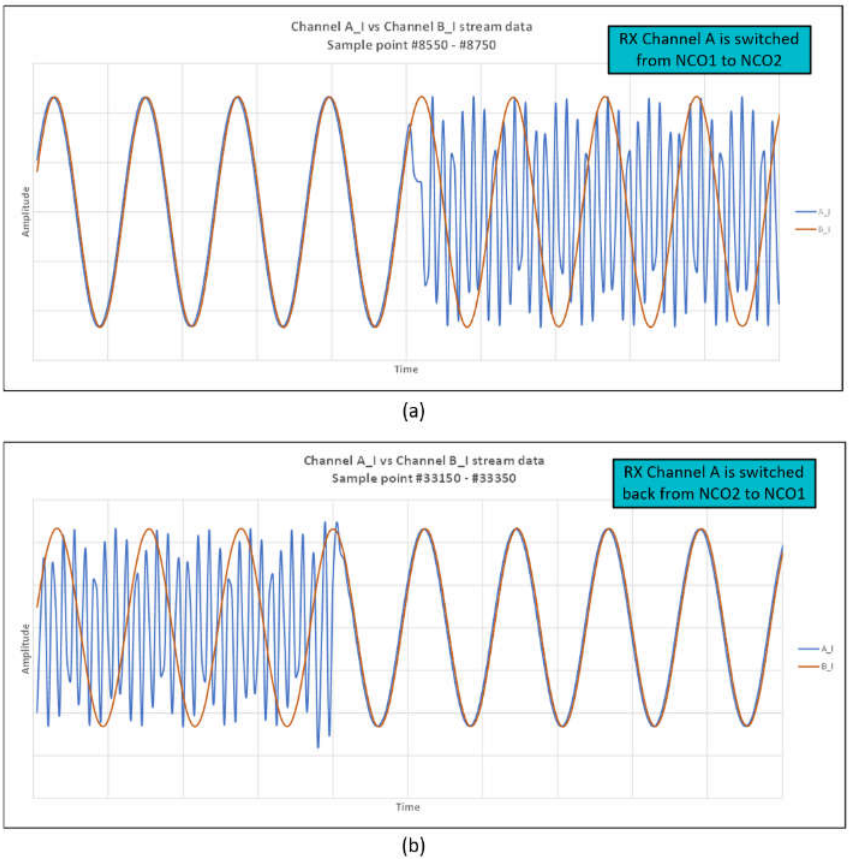


Figure 5-5. Phase Continuity With AFE8030 Fast Frequency Hopping

In addition to the fast frequency hopping feature, in AFE8030, the frequency and phase of each NCO can be programmed independently, which can also be utilized to compensate the frequency offset due to Doppler shifts, or provide the digital phase control of the digital beams.

By combining fast frequency switching, independent NCO configuration, and digitally controlled frequency and phase adjustment, the AFE8030 enables frequency-agile radio architecture capable of adapting to the dynamic operating conditions of satellite D2D/IoT networks.

5.3 Flexible SerDes and JESD Configuration

The AFE8030 provides highly configurable high-speed JESD interfaces, enabling payload designers to optimize digital throughput, power consumption, and board-level connectivity according to mission requirements.

The AFE8030 integrates two independent SerDes macros. Each macro includes four transmit and four receive lanes, providing a total of eight high-speed serial transceivers. Each lane supports three configurable rate modes:

- Full-rate mode: 19Gbps to 32.5Gbps
- Half-rate mode: 9.5Gbps to 16.25Gbps
- Quarter-rate mode: 4.75Gbps to 8.12Gbps

These configurable operating modes allow designers to balance aggregate data throughput against SerDes power consumption based on the number of active RF channels and the required signal bandwidth.

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A built-in SerDes multiplexer decouples the physical lane assignment from the logical JESD data streams, allowing flexible mapping between converter JESD data stream and SerDes lanes. This flexibility is particularly valuable in satellite payloads, where board-level routing constraints, system partitioning, and redundancy requirements can demand unconventional lane-to-converter mappings without redesigning the digital subsystem. The SerDes transmitter incorporates a multi-tap feed-forward equalizer (FFE) with fully programmable coefficients to compensate for frequency-dependent trace loss on densely packed payload PCBs, while the receiver combines a continuous-time linear equalizer (CTLE) with a decision feedback equalizer (DFE) to handle challenging channel responses,enabling reliable link operation over backplane or board-to-board interconnects common in satellite payload architectures.

The AFE8030 supports both JESD204B and JESD204C standards, with 8b/10b encoding for JESD204B and the more efficient 64b/66b encoding for JESD204C. The data packing is highly configurable. For example:

- The number of active JESD lanes L can be set to 1, 2, 4, or 8
- The converter count M can be set from 1 to 16
- The number of octets per frame F can be set across different values from 1 to 32
- The JESD sample resolution N’ can be set to 12 or 16 bits

This flexibility allows the same AFE8030 hardware platform to interface with a wide range of digital processing back-ends, from space-grade FPGAs operating a narrow high-rate link to multi-device DSP clusters using a larger number of lower-rate lanes. Subclass 1 multi-device synchronization via SYSREF is fully supported, enabling deterministic latency and phase-coherent alignment across multiple AFE8030 devices in a clustered payload arrangement, a fundamental requirement for phased-array beamforming and multi-beam satellite payloads where inter-channel timing must be controlled to sub-nanosecond accuracy.

5.3.1 An Example of JESD Configuration for D2D Uplink

Satellite D2D/IoT applications often use relatively narrowband waveforms, allowing the digital interface to be optimized for lower baseband data rates and reduced power consumption. Typically, a baseband data rate of 61.44MSPS is sufficient to receive 50MHz signal bandwidth for one band.

For satellite D2D and IoT payload applications, 12-bit converter sample resolution at 61.44MSPS can provide sufficient performance to meet link budget and dynamic range requirements. Compared with a 16-bit JESD sample configuration commonly used in terrestrial infrastructure, reducing the JESD sample resolution to 12 bits lowers the payload data rate by 25%, potentially enabling lower SerDes operating speeds, reduced interface power consumption and simpler board-level interconnect.

For the single-band use cases, with all eight receive channels active in single-band mode at 61.44MSPS, the JESD204C framing configuration LMFS = 1-16-24-1 and N’ = 12 bits produces a lane rate of approximately 12.165Gbps. This falls within the AFE8030’s half-rate SerDes operating range (9.5Gbps – 16.25Gbps), whereas the equivalent 16-bit configuration requires approximately 16.22Gbps per lane, pushing the SerDes into full-rate mode and its associated higher PLL frequency and core power. Running half-rate SerDes is therefore not merely a convenience, but a deliberate power-reduction strategy well suited to the thermally constrained environment of a satellite payload.

For the dual-band use cases, where the payload demands simultaneous coverage of two frequency bands, the AFE8030’s dual-DDC mode doubles the effective converter count to M = 32 by producing two independent complex IQ streams per receive channel. The corresponding JESD204C configuration LMFS = 1-32-48-1 and N’ = 12 bits with 61.44 MSPS baseband data rate per band yields a lane rate of approximately 24.33Gbps, which sits within the AFE8030’s full-rate SerDes range (19Gbps – 32.5Gbps) and still concentrates the entire dual-band payload across one physical SerDes lane, preserving a compact, low-pin-count digital interface to the downstream FPGA even as the spectral capacity of the payload doubles, an highly efficient interface option to multi-band D2D/IoT applications.

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Table 5-1. AFE8030 JESD204C Configuration Comparison

Parameter	Single-Band 16-bit	Single-Band 12-bit	Dual-Band 12-bit
Baseband data rate	61.44MSPS	61.44MSPS	61.44MSPS
JESD Standard	JESD 204C	JESD 204C	JESD 204C
Encoding	64b/66b	64b/66b	64b/66b
# of bits per word for JESD frame mapping (N')	16	12	12
# of JESD lanes (L)	1	1	1
# of converters (M)	16	16	32
# of octets per frame (F)	32	24	48
# of samples per frame	1	1	1
Lane rate	Approximately 16.22Gbps	Approximately 12.17Gbps	24.33Gbps
SerDes rate mode	Full-rate	Half-rate	Full-rate
Lane rate vs 16-bit baseline	Baseline	25% lower	50% higher but with dual-band (2x baseband complex IQ streams)

5.4 Antenna Calibration

Accurate phased-array antenna calibration is essential for maintaining consistent beamforming performance across transmit and receive channels. Channel-to-channel variations in gain and phase can degrade beamforming accuracy, reduce array gain, and increase sidelobe levels. These effects must be calibrated to maintain desired antenna performance.

Traditional calibration architectures can require dedicated RF switches for individual transmit and receive channels, increasing component count, board area, routing complexity and time, particularly in large antenna arrays. The AFE8030 simplifies calibration through integrated digital features, including TX NCO SWAP, RX NCO SWAP, and TX GAIN SWAP, RX GAIN SWAP. These functions can be controlled through GPIO signals or SPI commands using the C-SDK of the device.

As shown in Figure 5-6, during the RX antenna calibration, one TX channel can be rapidly re-configured to the uplink (RX) NCO frequency using the fast TX NCO SWAP function, and the transmitted signal is observed by all the RX channels simultaneously, based on the captured data, the RX antennal calibration coefficients are calculated and stored in FPGA. During this process, the RX DSA attenuation setting is also quickly switched to a higher value through the RX GAIN SWAP function so that the RX chain does not saturate due to the higher output from the TX Power Amplifier during the calibration mode. A similar process can be followed for TX antenna calibration by using the fast RX NCO SWAP and TX GAIN SWAP functions.

This approach provides a fast and elegant way for antenna calibration without introducing additional circuits on the board. By leveraging these built-in digital features, the AFE8030 enables a streamlined, hardware-efficient calibration architecture to meet the SWaP constraints of satellite payloads.

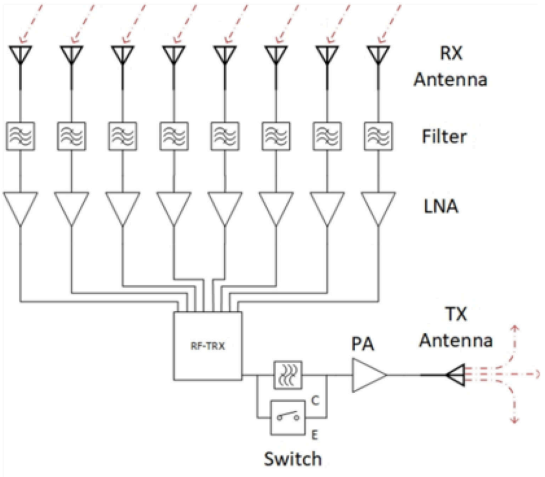


Figure 5-6. Antenna Calibration With AFE8030

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5.5 Multi-Device Synchronization

Multi-device synchronization is essential for satellite D2D/IoT payloads employing large phased-array antennas, where multiple RF transceivers must operate coherently to support accurate beamforming. Any timing or phase mismatch can degrade beamforming performance, reducing link margin and overall system efficiency. Precise timing and phase alignment across multiple devices must remain throughout the entire system life cycle, including initial bring-up, subsequent JESD204B and JESD204C link reinitializations, and power-on resets.

Achieving this requires three key synchronization capabilities:

1. Phase aligned device clocks for SYSREF to latch;
2. SYSREF-based deterministic data path latency;
3. Synchronized NCO operation to maintain consistent digital frequency and phase relationships across devices

The first capability relies on clock distribution devices and optimized layout to minimize the propagation delay variation across multiple devices. The SYSREF signals must meet the setup and hold time requirements of device clock.

The AFE8030 supports multiple approaches to achieve the SYSREF-based deterministic latency. One approach is to use single-shot SYSREF. In single-shot mode, the SYSREF signal is a single pulse, which is given simultaneously to all the RF transceivers on the board. When all transceivers receive SYSREF at exactly the same instant with respect to the device clocks, they become phase-synchronized. It is also possible to use general-purpose input/output (GPIO)-based control to enable SYSREF latch. In this mode, the SYSREF can operate in continuous sysref mode. All RF transceivers latch to the first device clock rising edge after receiving a GPIO-based latch enable signal. All subsequent pulses are ignored. This approach only requires routing a CMOS GPIO signal to the RF transceivers, which makes this method relatively simpler to implement compared to the single-shot SYSREF method, as it can be challenging to route a differential signal to multiple AFEs on the board with matched lengths. At the same time, this approach requires synchronizing one GPIO per AFE from the host, which can be challenging if the host ASIC or FPGA does not have enough GPIOs.

When it comes to synchronizing NCOs across devices, the simplest way to achieve phase synchronization is to choose transmitter and receiver NCOs that are integer multiples of the SYSREF frequency. This method works well for both single-shot and continuous SYSREF modes, as it does not need any extra mechanism to synchronize the NCOs for transmit and receive across multiple analog front-end devices. It does not matter even if all transceivers latched on different sysref edges. Figure 5-7 shows how in this mode, it does not matter even if all analog front ends latched on different sysref edges.

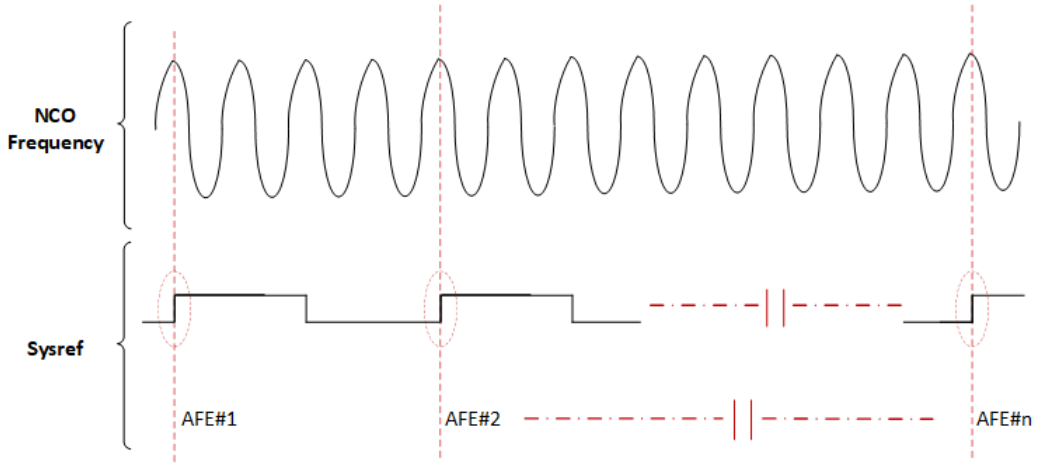


Figure 5-7. Example Illustrating how the NCO Frequency Equals Four Times the Sysref Frequency

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Figure 5-8 shows the histogram of the phase difference between TX outputs of two devices over power cycles, where on the left side, the NCO phases are not synchronized, therefore the phase difference over power cycles is random; on the right side, the NCO phases across multiple devices are synchronized with SYSREF-based latch, therefore the phase difference over power cycles is retained within a tight deviation, approximately 1.5 degrees.

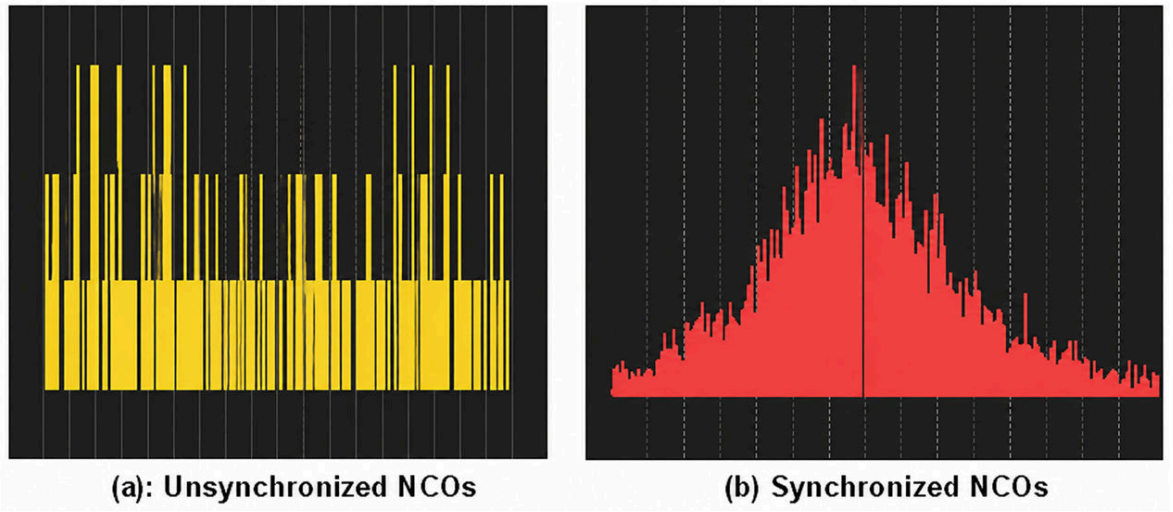


Figure 5-8. Distribution of TX Outputs Phase Difference Between Two AFEs Over Power Cycle

5.6 Software Ecosystem

To accelerate integration and reduce development overhead, TI provides a comprehensive software ecosystem for the AFE8030. A C-SDK (CAPIs) enables straightforward device initialization and post-bringup control of the AFE8030's digital features, including NCO configuration, NCO phase tuning, gain settings, Alarms handling, and calibration routines, allowing software engineers to quickly bring up and fine-tune the device without navigating low-level register maps directly. For system-level integration, TI offers integrated Linux drivers compatible with standard embedded Linux® environments, including PetaLinux, enabling seamless deployment across a range of SoC-based platforms. Additionally, TI also provides JESD204B/C IP cores as part of the ecosystem at no additional licensing cost, eliminating a common barrier in high-speed data converter deployments and reducing time to market for customers.

5.7 Radiation Tolerance

AFE8030 offers package options with SnPb solder balls. In addition, the radiation tolerance of AFE8030 has been validated through a series of standardized tests to maintain reliable performance in the harsh environments. Please contact TI for further information on space-qualified variants.

6 Beyond D2D/IoT: Broader Satellite Communication Applications

While this white paper focuses on satellite D2D and IoT service links, the AFE8030's highly integrated and flexible RF-sampling architecture also supports a broader range of satellite communication applications. With frequency coverage up to 6GHz, and instantaneous signal bandwidth up to 800MHz, the AFE8030 can address diverse requirements spanning telemetry, tracking and command (TT&C), earth observation data downlinks, spectrum sensing, broadband communications, and so on. For applications operating at higher RF frequencies, such as Ku-band and Ka-band satellite communications, the AFE8030 can also serve as an intermediate frequency (IF) stage transceiver in a superheterodyne architecture, interfacing with external frequency-conversion stages to extend system-level frequency coverage. Many of the design techniques discussed in this white paper, including multi-band operation, frequency agility, multi-device synchronization, antenna calibration and power optimization, are equally applicable to these broader satellite applications. Together with its wide bandwidth, high channel density, and flexible digital signal processing capabilities, these features make the TI AFE8030 a versatile building block for next-generation software-defined satellite payload across diverse satellite applications.

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7 Conclusion

Satellite D2D and IoT connectivity is transforming satellite communications by extending cellular and IoT services directly to conventional user devices. Unlike traditional satellite systems relying on dedicated terminals, D2D/IoT payloads must overcome challenging link budgets while supporting diverse spectrum allocations, large phased-array antennas, and stringent size, weight, power, and reliability requirements.

The TI AFE8030 addresses these challenges through a highly integrated, low-power direct RF-sampling architecture. The dual-DUC/DDC configuration of the AFE8030 enables simultaneous multi-band operation, while digitally controlled NCOs provide fast frequency hopping and spectrum agility. High channel density, flexible JESD204B/C configurations, deterministic multi-device synchronization, and streamlined antenna calibration simplify the implementation of scalable phased-array payloads. Furthermore, low active-mode power consumption and configurable power-saving modes help optimize payload power efficiency across different traffic conditions.

By combining RF flexibility, high integration, power-efficient operation, and a comprehensive software ecosystem, the AFE8030 enables compact, scalable, and software-configurable satellite payload radio architectures. These capabilities help satellite system designers reduce hardware complexity, optimize SWaP, and quickly adapt to the evolving demands of next-generation satellite connectivity.

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Last updated 10/2025