Morse Micro
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BCF Overview and Impact on System Performance

Application Note

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1 What is a BCF and why is it needed?

A **Board Configuration File (BCF)** is a specialized configuration file used by the Morse Micro firmware to define and control hardware behavior and system parameters. Its primary role is to provide a layer of abstraction between the hardware and firmware, allowing system configuration to be customized without requiring firmware changes.

A BCF file contains detailed settings that define how the hardware components should operate. These include control mappings for GPIO (General Purpose Input/Output) pins, transmit power levels across MCS rates, and state transitions of the Front-End Module (FEM) during transmit and receive modes. By externalizing hardware configuration, BCFs enable customization for different hardware variants, regional compliance requirements, and performance optimization. This centralized approach simplifies development, deployment, and updates while maintaining compatibility and traceability, significantly reducing the complexity and cost of managing Wi-Fi HaLow systems.

2 Key Functions of a BCF

A BCF is loaded by the Morse Micro firmware at runtime, allowing the firmware to precisely configure system parameters to ensure optimal performance of the Morse Micro chip. A correctly calibrated and configured BCF provides significant benefits in terms of performance, compliance, and operational reliability. The following outlines the key functions covered by BCF configurations:

Front-End Module (FEM) Control

A BCF governs the seamless transitions of the Front-End Module (FEM) between states such as transmit, receive, and sleep modes. Properly defined GPIO mappings facilitate features like Low Noise Amplifier (LNA) bypass in Rx mode, enabling precise signal handling and gain management

Output Power Optimization

A BCF defines MCS-specific power backoffs and frequency-specific power offsets, optimizing the power amplifier's operation across Modulation and Coding Schemes (MCS) and bandwidths. This ensures effective power output control while maintaining signal integrity.

Flattened Power Output Across Frequency

By applying frequency-specific power offsets, a BCF flattens the power output curve across the frequency range. This function maintains consistent transmit power, aligning with both performance standards and regulatory requirements.

Compliance of Regulatory Standards

A BCF ensures the device operates within regulatory constraints by managing power levels, particularly for band-edge channels, to adhere to spectral emission limits.

A correctly configured and calibrated BCF is critical for achieving optimal performance, ensuring regulatory compliance, and maintaining reliable operation. Proper validation and implementation of the BCF unlock the full potential of Morse Micro systems while minimizing risks and operational challenges.

2.1 Impact of a Misconfigured BCF

The use of an incorrect or poorly configured BCF can lead to several negative outcomes, including:

- **Reduced Output Power**: Suboptimal power settings result in diminished signal strength.
- **Limited Connection Range**: Improperly configured FEM receive states degrade the device's ability to detect and process incoming signals.
- **Decreased Throughput**: Inefficient MCS rate power configurations hinder data transmission performance.
- **Regulatory Non-Compliance**: Improper settings can cause spectral emission mask (SEM) violations, leading to non-compliance with regulatory standards.

3 Where Can I Access the Correct BCF File for My Device?

The correct BCF required for your device depends on the source of the hardware being used. Sources of BCF files may include:

- **Morse Micro Evaluation Kits:** If you have purchased an evaluation kit directly from a stocking distributor (e.g. Mouser), the appropriate BCF file is provided alongside the kit or available for download from the Morse Micro support portal.

- **Morse Micro Module Vendors:** For devices incorporating a Morse Micro chip through third-party module vendors, the vendor provides a customized BCF tailored to their specific hardware configuration. Using this vendor-supplied BCF is essential for ensuring proper operation.

- **OEM Products with Morse Micro Chips:** If the device is part of an OEM product, the BCF file will be preloaded on the device by the OEM. In this instance, there is no need for the customer or user to have any interaction with the BCF.

When using a third-party vendor module, it is essential to use the vendor-provided BCF. Module vendors carefully optimize their BCFs to ensure the best performance for their specific hardware. Relying on a generic or incorrect BCF can negate these optimizations, potentially causing non-compliance, degraded performance, or system instability.

4 BCF and Firmware Dependencies

BCF files are closely linked to the system's firmware (FW) version, with compatibility governed by a structured versioning system. BCFs are versioned using a **major.minor.patch** format. A change in the **major** version indicates incompatibility with previous FW versions, requiring users to update both the firmware and BCF to the newer compatible versions. Minor and patch updates maintain compatibility but may introduce parameter or feature changes. When transitioning to a new FW version, it is critical to ensure that the corresponding BCF version is also updated to maintain optimal system performance and compatibility.

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About Morse Micro
Morse Micro is a leading Wi-Fi HaLow fabless semiconductor company based in Sydney, with global offices. As the world's premier Wi-Fi HaLow company, we pioneer next-gen IoT wireless connectivity solutions. Morse Micro is now sampling its Wi-Fi CERTIFIED HaLow MM6108 production silicon: the fastest, smallest, lowest power and longest-range Wi-Fi HaLow chip available in the market.