

1. Introduction

The core chipset is from Qualcomm, part number QCA9377.

2. Hardware Architecture:

Item	Vendor	Part Number
IEEE802.11 a.b.g.n.ac mac/baseband/radio Bluetooth 4.1 + HS	Qualcomm	QCA9377

The major internal and external block diagram of NFA455 is illustrated in Figure 1-1.

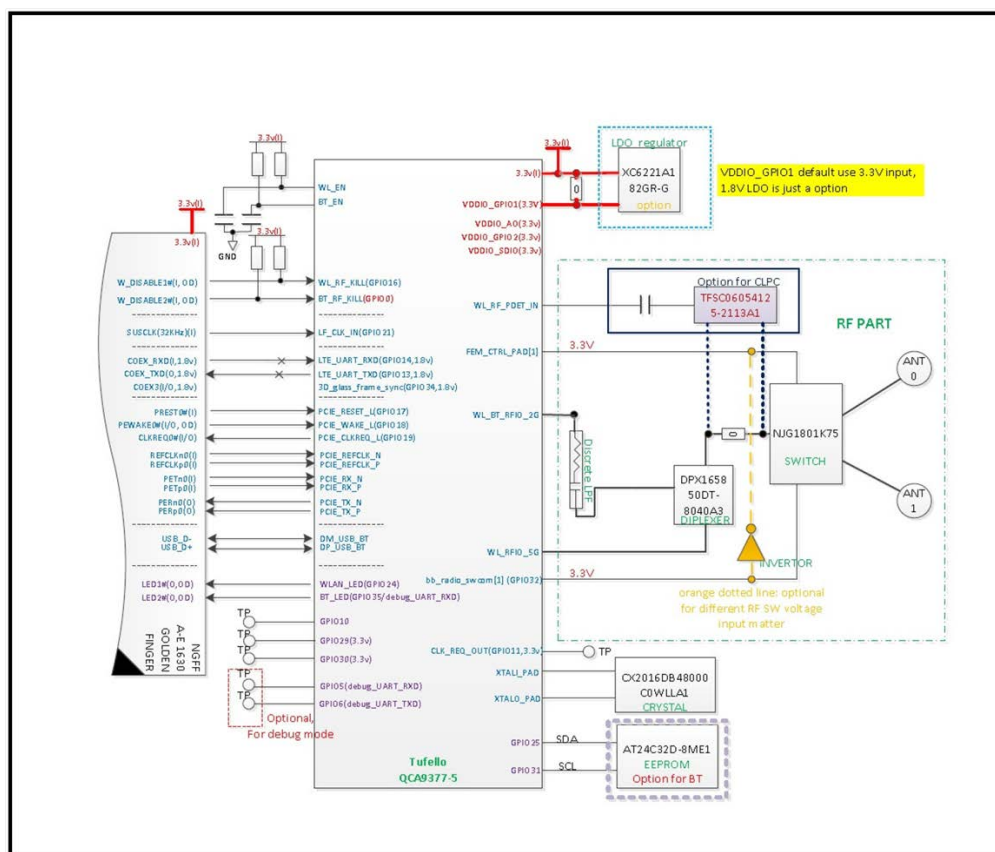


Figure 1-1 NFA455 block diagram and System Interface

- Main (ANT0): WLAN 2.4G(2412~2462MHz), 5G(5180~5825MHz)
- Aux (ANT1): Bluetooth (2402~2480MHz)
- OSC: 48MHz

3. Operational Description

NFA455 is the 802.11a/b/g/n /ac and Bluetooth 4.1 COMBO Module that acts as a communication controller for users of a wireless device to connect to PC

- Features

- >IEEE 802.11ac Draft compliant.
- >Dual-band 2.4GHz /5 GHz
- >Supports 20 MHz/40 MHz at 2.4 GHz and supports 20 MHz, 40 MHz, or 80 MHz at 5 GHz
- >On-chip power amplifiers and low –noise amplifiers for both bands
- >Complies with Bluetooth Core Specification Version 4.1 + HS
- >Supports BT for class 1 and class 2 power-level transmissions without requiring an external PA

- Time base of the RF frequency

For RF frequency, 48MHz crystal is a clock reference.

- Synthesizer

Synthesizer and Internal voltage controlled oscillator (VCO) inside Transceiver provides the desired LO-signal based on the phase-locked loop (PLL) with a relatively wide tuning range for this application. Also, generate the desired RF frequency through up-converting or down-converting using frequency direct conversion method

- WIFI Transmission

Baseband data is modulated and upconverted to the 2.4GHz ISM and 5-GHz U-NII bands, respectively. Linear on chip power amplifier are included, which are capable of delivering high output powers while meeting IEEE802.11ac and IEEE802.a/b/g/n specifications without the need for external PAs. When using the internal PAs, closed-loop output power control is completely integrated. Base-band Processing (BBP) IC has DSSS (BPSK/QPSK/CCK) and OFDM (BPSK/QPSK/16QAM/64QAM/25QAM) modulation function, it provides transmission data rate are 1, 2, 5.5, 11Mbps on DSSS and 6, 12, 18, 24, 36, 48, 54 Mbps on OFDM. Digital data signal will be converted to analog (TX IQ) signals through DAC in BBP IC, TX IQ pass through to low pass filter. TX I/Q signal use direct conversion (zero-IF) architecture converter to generate carrier frequency signal. Transceiver IC and internal PA magnify output power.

- WIFI Receiver

The NFA455 has a wide dynamic range, direct conversion receiver that employs high-order on-chip channel filtering to ensure reliable operation in the noisy 2.4GHz ISM band or the entire 5GHz U-NII band. Control signals are available that can support the use of optional LNAs for each band, which can increase the receive sensitivity by several decibels.

Reverse direction isolation of LNA inside Transceiver IC suppresses unwanted radiation. Then RF signal will be directly down to IF signal (RX IQ) and high frequency spurious emissions are suppressed by LPF. At last RX IQ signal will be demodulated digital data.

- Bluetooth Low Energy



The NFA455 support the Bluetooth 4.1 Low Energy operating mode.

- Product Details

> Data Modulation

DSSS: CCK, BPSK, QPSK for 802.11b

OFDM: BPSK, QPSK, 16QAM, 64QAM, 256QAM for 802.11a,g,n,ac

FHSS: GFSK, OQPSK, 8DPSK, $\pi/4$ DPSK for Bluetooth

> Frequency: 2.4GHz/ 5GHz

> Power: +3.3V $\pm 5\%$ (+3.135V ~ +3.465V)



4.OEM Section - to whom wants to install the radio.

FCC Statement

This device complies with Part 15 of FCC Rules, Operation is Subject to following two conditions:

- (1) This device may not cause harmful interference, and*
- (2) This device must accept any interference received including interference that cause undesired operation.*

Caution: *Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void user's authority to operate the equipment.*

This equipment has been tested and found to comply within the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a different circuit from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help.

For product available in the USA/Canada market, only channel 1~11 can be operated and these channel assignments deal with only the 2.4GHz range

This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

This device is going to be operated in 5.15~5.25GHz frequency range, it is restricted in indoor environment only

IMPORTANT NOTE:

FCC Radiation Exposure Statement;

This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter.

A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

USER MANUAL OF THE END PRODUCT:

In the users manual of the end of product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated.

The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

If the size of the end product is smaller than 8x10cm, then additional FCC part15.19statement is required to be available in the users manual; This device complies with Part15 of FCC rules.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: A3LNFA455". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Warning: Attaching any kind of external antenna is not allowed and it needs to additional test and certification.

- The module is limited to OEM installation ONLY.
- OEM integrators are responsible for ensuring that the end-user has no manual instructions to remove or install module.
- Separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.
- Do the labeling on finished products that this product contains Transmitter Module.

Example: “Contains Transmitter Module FCC ID: A3LNFA455”
or “Contains FCC ID: A3LNFA455” etc.

- This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
- Devices operating within the 5.15 - 5.25 GHz Band will be restricted to indoor operations

Warning: Attaching any kind of external antenna is not allowed and it needs to additional test and certification



* Guidance to the host manufacturer

Since this may depend on the details of how the module is integrated with the host, the grantee shall provide guidance to the host manufacturer for compliance with the Part 15B requirement.

To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and is fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the FCC Part 15B unintentional radiator requirements.

* WARNING

- i. We recommend to keep 20 cm distance when installing this module.
- ii. This module should not be installed and operating simultaneously with other radio without additional evaluation or FCC filing.
- iii. The host system should have proper label showing that it "Contains FCC ID : A3LNFA455"

* Comprehensive integration instructions

For proper integration of modules in the final products it is required that detailed and comprehensive instructions must be provided to the integrators so that any subsequent associated party (grantee, host manufacture, original equipment manufacturer (OEM), integrator, or end-user) can clearly understand the conditions and limitations for authorized uses of the modular transmitter. These instructions must be included as one of the Form 731 exhibits,. While modules can provide great flexibility for third parties without requiring additional compliance demonstrations, additional technical requirements may call for separate equipment authorization information for compliance demonstration (e.g. for RF exposure and hearing-aid compatibility, for devices with specific antennas, or specific host/enclosure configurations.) A transmitter module grantee is responsible for including the necessary details for ensuring compliance for RF exposure requirements and the associated usage conditions for portable, mobile and fixed-mount equipment configurations as applicable.