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Theory of Operation/Technical Description – FCC ID: YY3-118207

1. RF Circuit Function

The RF circuit in the tablet is meant for both cellular as well as non-cellular functions. The non-cellular functions like WIFI, BT and BLE are performed by WCN3620 transceiver while the GNSS is performed by WTR4905. The WTR4905 also performs cellular RF functions like 2G/3G/4G. For NFC, a PN7120 chip is used.

Non cellular RF functions are -

- Wi-Fi: IEEE 802.11 b/g/n, 2.4GHz
- Bluetooth: Bluetooth 4.0 (Classic BT and BLE)
- GNSS: Receiver only
- NFC

Cellular RF functions are:

- 2G: Voice and Data (G850,G1900)
- 3G: Voice and Data (2,4,5)
- 4G: Data (2,4,5,13,17)

2. RF Signal Flow

Wi-Fi, Bluetooth and BLE

Communication between MSM8916 and WCN3620 for Bluetooth is SSBI signals and for Wi-Fi is IQ signals. Rest of the path is common for both technologies.

MSM8916 ←→ WCN3620 ←→2.45GHz BPF←→RF Test Switch←→ Wi-Fi/BT Antenna PAD

Cellular Networks (2G/3G/4G)

Communication between MSM8916 and WTR4905 is IQ signals and from WTR4905 to antenna is RF signal. The design used multimode PA for the 2G bands 850MHz/1900MHz and 3G/4G bands B2 (with CBW of 5, 10, 15 and 20MHz), B4 (with CBW of 5, 10, 15 and 20MHz), B5 (with CBW of 5 and 10MHz) and 4G only band – Band 13 (10MHz) and Band17 (5MHz and 10MHz). Duplexer associated with each band will determine whether Tx or Rx path is going to operate. ASM IC will select one of the bands to/from the antenna. Diversity path add one more receiver path in order to improve the receiver signal sensitivity.

Primary Path

TX: MSM8916→ WTR4905→Power Amplifiers→Duplexers→ASM→RF Test Switch→Primary Antenna PAD

RX: MSM8916←WTR4905←Duplexers←ASM←RF Test Switch←Primary Antenna PAD

Diversity Path

MSM8916←WTR4905←Rx SAW Filters←ASM←RF Test Switch←RF Connector←Diversity Antenna PAD

GNSS

EUT provides option for position finding mechanism by internal Qualcomm iZat or externally integrated u-blox module. RF switch in the path selects either of this option. SAW filters and the LNAs in the path improve the signal quality for better performance.

Internal iZat Path:

MSM8916←→WTR4905←SAW Filter←RF Switch←GNSS Antenna PAD

External u-blox Path:

MSM8916←→EVA-7M←LNA←SAW Filter←RF Switch←GNSS Antenna PAD

NFC

MSM8916←→NFC Controller (PN7120) ←→Matching Circuits←→NFC Antenna Pogo Pin Contacts

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3. Description of Antenna System

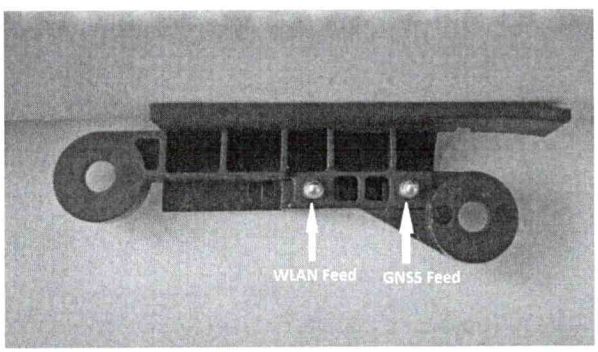
Antennas used in EUT -

- Antenna for Wi-Fi/BT/BLE/GNSS
- Primary Antenna for WWAN (2G/3G/4G)
- Diversity Antenna for 4G
- NFC Antenna

All the antennas in EUT are customized except NFC antenna.

Solder mask open pads are provided for Wi-Fi/BT/BLE/GNSS as well as Primary and diversity WWAN (cellular networks). Pogo pins are provided for NFC.

Antenna for Wi-Fi/BT/BLE/GNSS



Primary Antenna for WWAN

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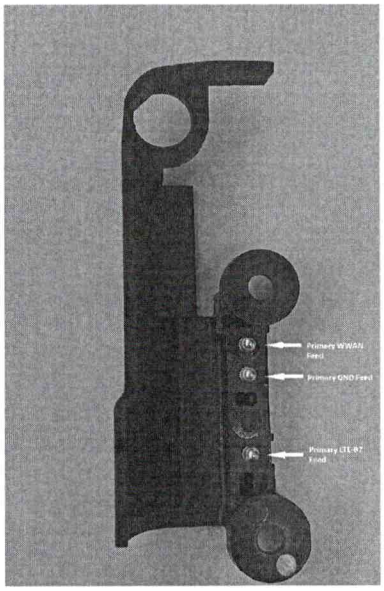
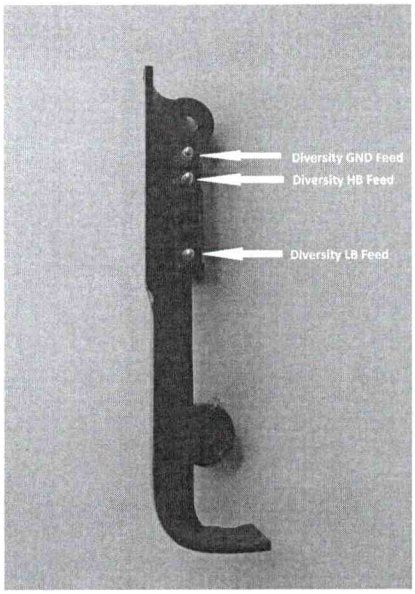


Diversity Antenna for 4G



NFC Antenna

EUT uses the sticker type NFC antenna along with EMI Ferrite Sheet.

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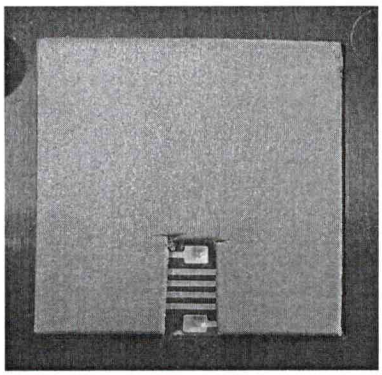

4. Compliance With 15.203 Antenna Requirements

Antennas used in EUT -

- Antenna for Wi-Fi/BT/BLE/GNSS
- Primary Antenna for WWAN (2G/3G/4G)
- Diversity Antenna for 4G (Cellular Networks)
- NFC Antenna

All the antennas in EUT are customized except NFC antenna.

Solder mask open pads are provided for Wi-Fi/BT/BLE/GNSS, WWAN. Pogo pins are provided for NFC.

As per the 15.203 requirements:

1) An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Adherence - In our design we are using customized antenna made of a carrier and conductive part (pogo spring pins) which makes contact with the antenna pads of PCB. This is not the standard type and hence any other antenna cannot be used in place of currently used antenna. This approach is applicable for both cellular as well as non-cellular RF sections. The pictures of the customized antenna are available in the above section.

2) Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

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Adherence – The antenna in our EUT (tablet) cannot to remove by a user as the antenna is fixed inside the unit. Removal of antenna requires the unit to be sent to service Centre where the professionally trained person removes/replaces/reworks the antenna if at all necessary.

5. Description Of All Modulation Schemes Used

Following is the list of modulation schemes supported.

- Wi-Fi 802.11 b/g/n: DBPSK, DQPSK, BPSK, QPSK, 16-QAM, 64-QAM
- BT : GFSK, π/4-DPSK, 8DPSK
- BLE : GFSK
- 2G
  Data: GMSK, 8-PSK
  Voice: GMSK
- 3G
  Data: Dual BPSK, QPSK, 16-QAM and 64 QAM (downlink only)
  Voice: Dual BPSK, QPSK
- 4G
  Data: QPSK, 16-QAM and 64 QAM (downlink only)
- GNSS : BPSK/BOC
-
- NFC: ASK

6. Simultaneous transmission configurations as mentioned below:

- GSM and WIFI – along with NFC, BLE/BT and GPS transmit simultaneously
- 3G with NFC, BLE/BT and GPS transmit simultaneously
- 4G with NFC, BLE/BT and GPS transmit simultaneously

7. Notes -

- LTE operates in data only mode. No VoLTE support.
- WIFI hotspot works in 'g' mode mid channel. If the WIFI hotspot is active during a 2G call, the data connection is cut. This data connection over WIFI hot spot reconnects automatically after the 2G call.

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