

FCC Inquiry document

Date: 2020.09.22

Introduction

Dear FCC KDB reviewer,

We would like to confirm the SAR testing configurations for the power reduction mechanism used for the WLAN in a 2-in-1 convertible PC described in Section I. This device operates at full power in Laptop mode and applies the same level of reduced power to the WLAN antennas in both Tablet and Convertible modes as described in Section II. A magnetic sensor is used to detect and trigger changes in operating modes.

The minimum separation distances applicable to the test positions for all three operating modes are considered in conjunction with KDB 447498 D01 v06 and 616217 D04 v01r02 in Section III for the proposed testing. Since the actual SAR measurement remains straight forward, if the procedures in this KDB inquiry are acceptable and followed for testing, can a PAG waiver for power reduction with magnetic sensor be granted.

Section 1. Device Description

- 1) Applicant: Panasonic Corporation of North America
- 2) Application type: Specific Host Modular Approach (Including Change of FCC ID application)
- 3) FCC ID of WLAN module: ACJ9TGWL20A ('Change of FCC ID' will be performed from Original FCC ID: PD9AX201NG, Grant Date: March 09, 2019)
- 5) Host product description:
 - Model name: CF-33mk2
 - Product type: 2-in-1 convertible PC (Laptop mode/ Tablet mode / Convertible mode)



- WWAN module has been certified as change of ID and C2PC for CF-33 as specific host device

[FCC ID: ACJ9TGWW18A].

6) WLAN module description

- 2.4 GHz & 5 GHz (802.11a/b/g/n/ac/ax)

Section 2. Power control mechanism

The power reduction mechanism in this device covers two operating modes:

1) Switching from Laptop to Tablet mode when the display is detached from the docking connector and magnetic sensor in display not triggered.

2) Switching from Laptop to Convertible mode when magnetic in the keyboard triggers the magnetic sensor in the display.

In Laptop mode, the Max. Output Power is 20dBm. The same amount of power reduction applies to both Tablet and Convertible modes. The exact level of reduced power will be determined during SAR evaluation.

2-1. Switching from Laptop to Table Mode based on docking connector status

In Laptop mode, the display is connected to the keyboard with the docking connector. The display is disconnected from the Keyboard Base with a slide switch for standalone Tablet mode operations (See Figure 2-1). When the display is detached from the Keyboard Base, no other physical keyboard can be supported or connected to the CF-33 Tablet.



Fig.2-1 2-in-1 Convertible PC in Laptop and Tablet Modes

2-2. Convertible Mode detection with magnetic sensor

The docking connector also allows the Tablet to be attached to the Keyboard Base with the display unit (Tablet) facing away from it to support Convertible Mode. When the Tablet/display is closed toward the Keyboard Base in this configuration, the magnetic sensor in the Tablet is triggered by a magnet in the Keyboard Base when they are in close contact in Convertible mode. (See Figure 2-4).



Fig.2-4 Convertible mode

The magnetic sensor is on the bottom side of Tablet and the magnetic is on the upper right of the Keyboard Base. These positions are shown in the Figure 2-5 and Figure 2-6. In the normal Laptop mode, the magnet and sensor are not aligned; therefore, the sensor in the Tablet is not triggered to distinguish between Laptop and Convertible modes.

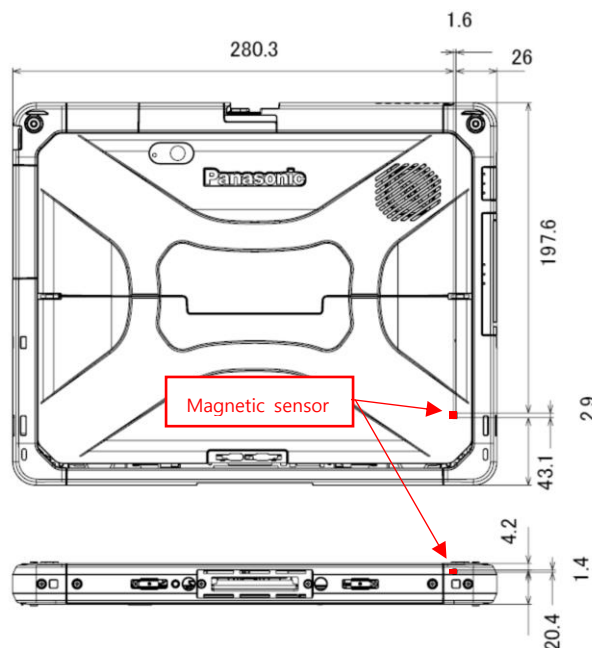


Fig.2-5 Position of Magnetic Sensor (view of rear side of Tablet)

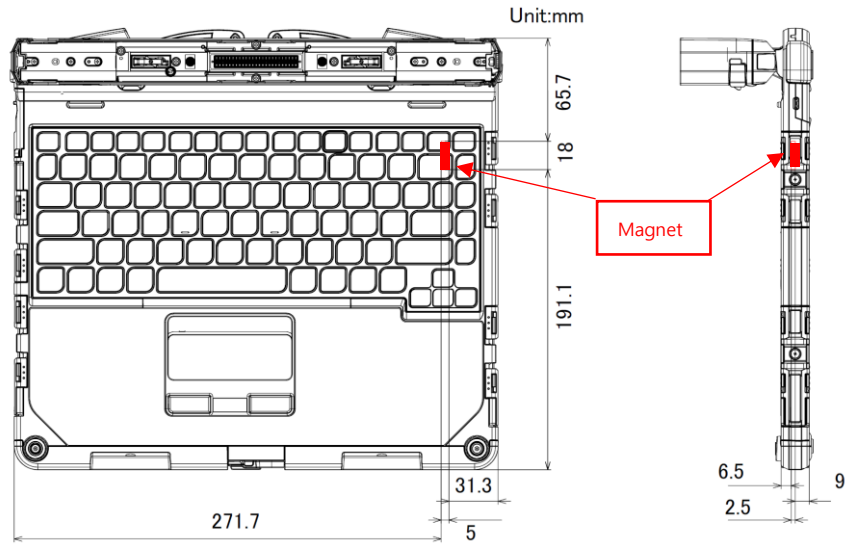


Fig.2-6 Position of Magnet (Keyboard Base)

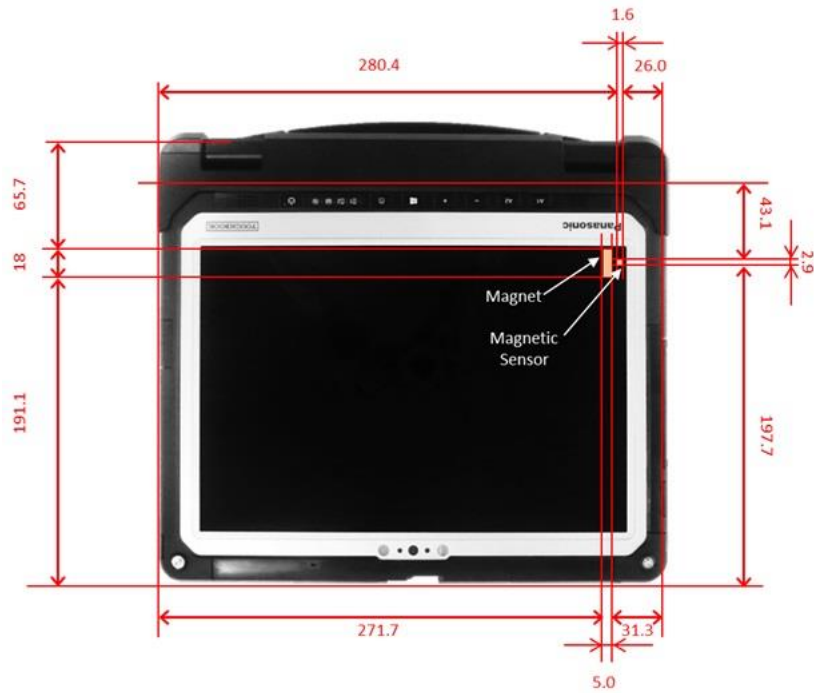


Fig.2-7 Dimension of position of Magnet and Magnetic Sensor (View of front side of Tablet)

The angle between the Tablet and Keyboard Base for detecting Convertible Mode is set to 10 degrees for closing/engaging and 13 degrees for opening/disengaging, as shown in Figure 2-8. These detection angles should fully address any possible hysteresis concerns between the opening and closing operations to ensure power reduction is maintained unless the angle is more than 10 degrees. Please refer to the attached test results for the range of triggering angles, [File name: KDB Inquiry_Test Results for the Range of triggering angle.](#)

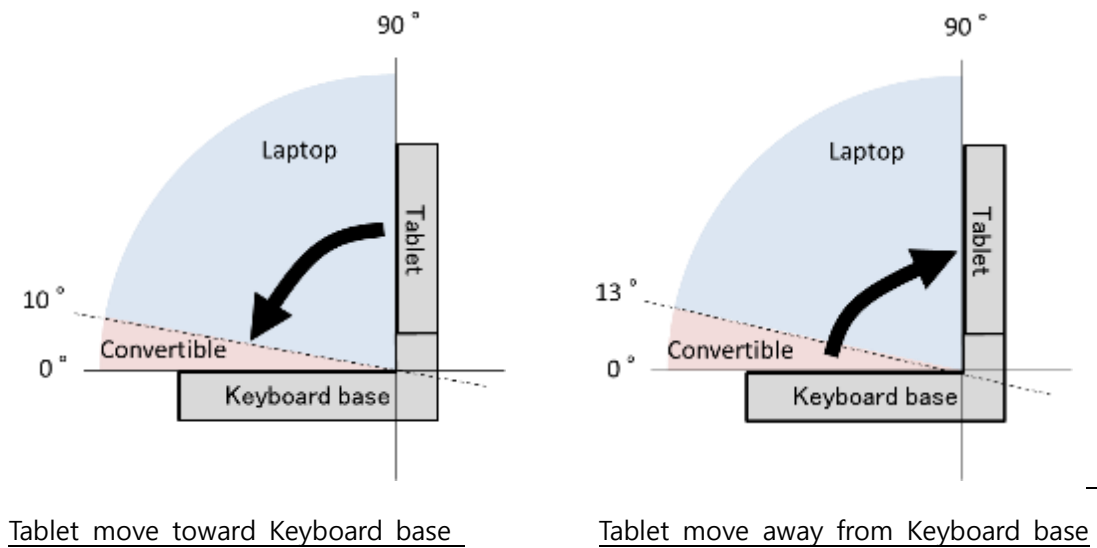


Figure 2-8: Convertible mode detection angles

2-3 Power reduction mechanism

The block diagram of the power reduction mechanism is shown below. (Figure 2-9)

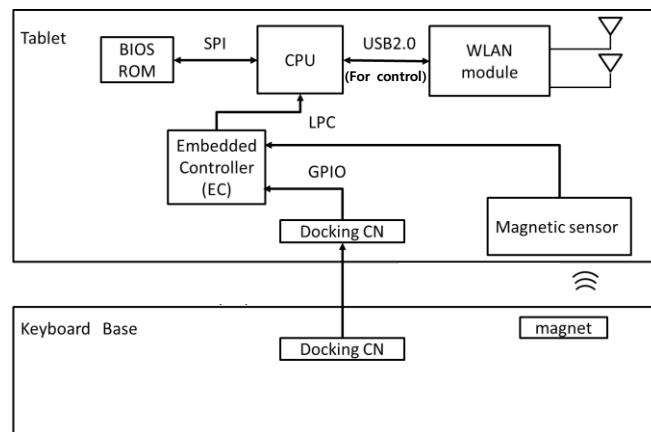


Figure 2-9: Implementation Block Diagram

Signals from the docking connector (CN) and the magnetic sensor are sent to the Embedded Controller (EC) in the Tablet to determine the operating mode according to Table 2-1.

Table 2-1 Signal and modes

Docking CN	Magnetic Sensor	Power reduction mode	WLAN power
Disconnect	Detection (only if Tablet is manually placed on Keyboard Base with magnet and sensor aligned; therefore, unlikely)	Tablet/Convertible mode	Reduction
Disconnect	Non-detection	Tablet mode	Reduction
Connect	Detection	Convertible mode	Reduction
Connect	Non-detection	Laptop mode	Max. (20dBm)

Unless a "Connect" signal is received from the Docking connection, a default "Disconnect" condition is assumed by the EC and reduced power is applied. When the magnetic sensor is broken, EC receives "Detection" from Magnetic sensor. Therefore, when such abnormality occurs, the EC determines that it is in Tablet mode and does not output the maximum power.

The operating mode is sent by EC to the Wi-Fi Driver, which reads the applicable power levels from the power table in the BIOS ROM for the WLAN module to establish transmit power.

Section 3. SAR Test consideration

3-1. Antenna location and dimension

The antennas of WLAN module are located on the left and right side of the Tablet, Edge 2 and Edge 4, as shown in Figure 3-1.

All antennas are located in edge of the tablet. The antenna position and overall dimension of the device are shown in Figure 3-2.

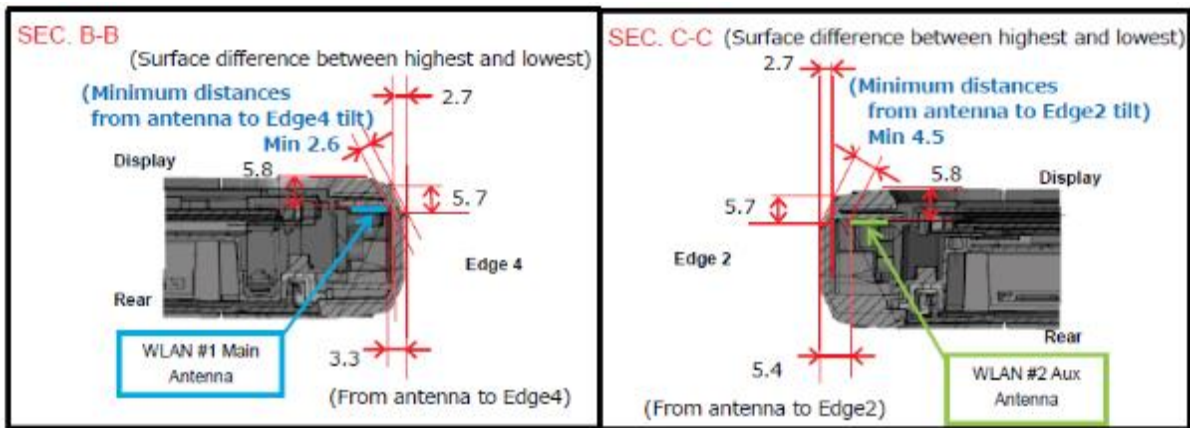
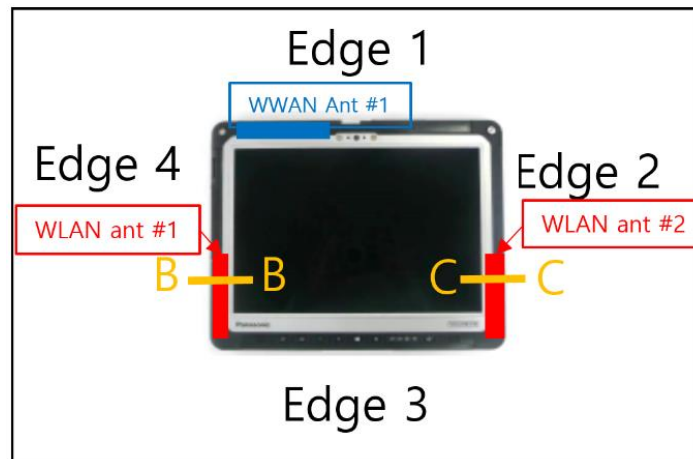


Figure 3-1: Antenna location and dimension of Tablet

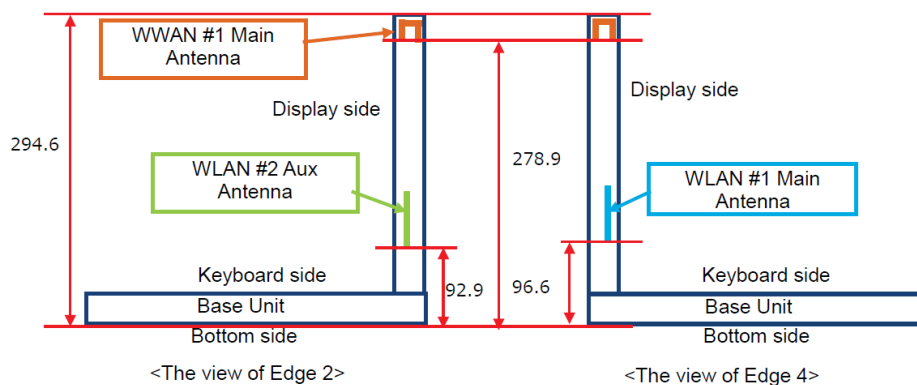


Figure 3-2: Antenna location and dimension of Laptop

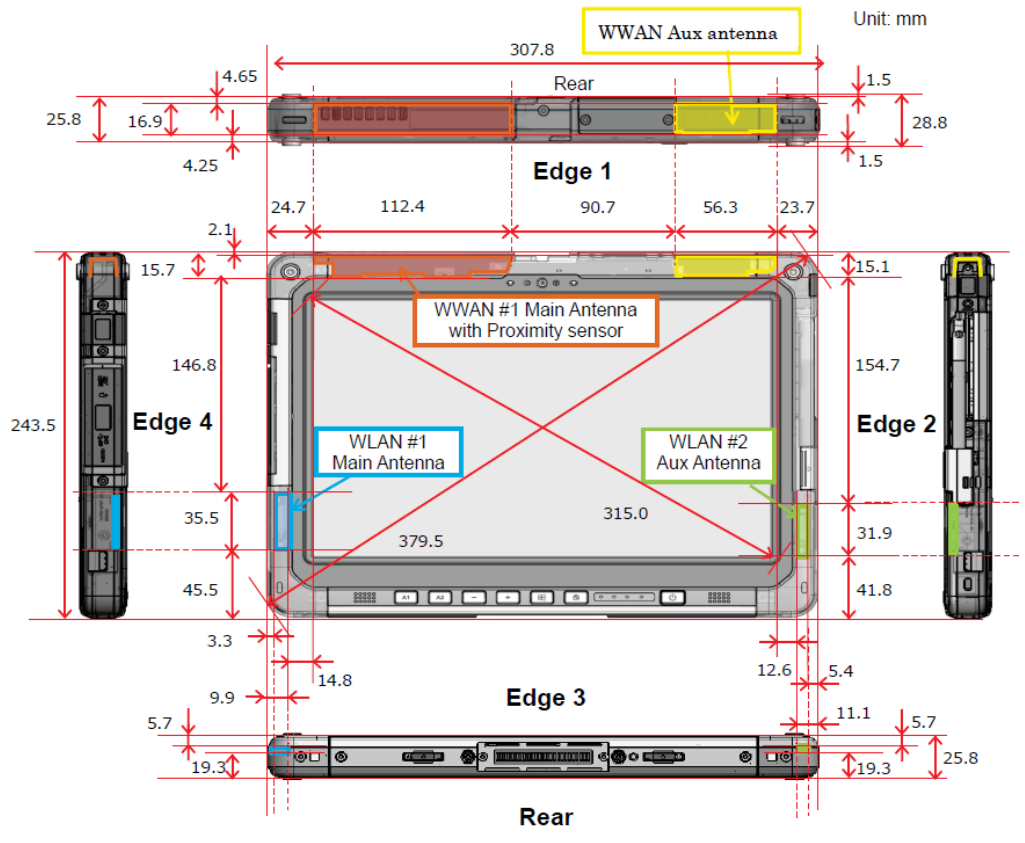


Figure 3-3: Overall dimension of the tablet

3-2. SAR Test Position and minimum test separation distance

1) Tablet mode

According to the tablet procedures in KDB 616217, Edge 2, Edge 4 and the bottom of the Tablet will require SAR testing for the Wi-Fi antennas, with respect to test positions 1, 3 and 5 in Figure 3-3. The antennas are more than 2.5 cm from Edge 3; therefore, according to KDB 616217 and KDB 447498, SAR for this edge is not required for the antennas. Edge 2, Edge 4 and the bottom of the Tablet will be positioned against the phantom at zero distance for SAR measurement. SAR will be measured separately for each antenna for the bottom.

As shown in Figure 3-1, the antennas have a smaller distance to the rounded upper corner of the Tablet than to Edge 2 or Edge 4 and according to KDB Inquiry Tracking No. 351084, each tilt position of Edge 2 and Edge 4 will be tested as zero separation distance.

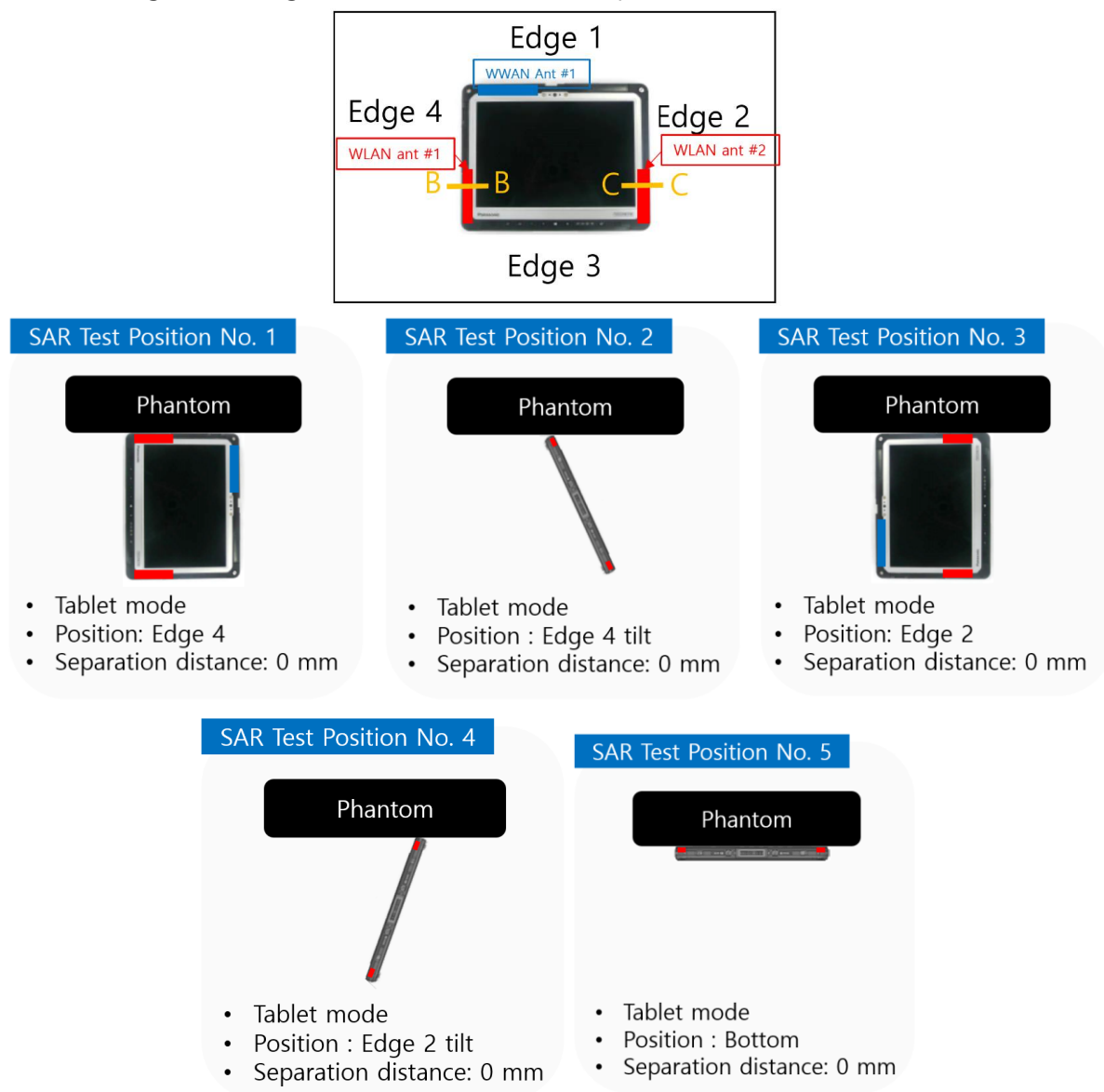


Fig3-4 SAR Test Position in Tablet mode

2) Convertible mode

For Convertible mode, when the display is resting on the Keyboard Base, the antennas are further away from the user. Since the antennas are installed near the top surface of the Tablet and the Keyboard Base is more than 25 mm thick, SAR influence from the Keyboard Based should be insignificant. The SAR for Tablet mode should cover all exposure conditions in Convertible mode. [Please confirm that no further SAR testing is required for Convertible mode.](#)

3) Laptop mode

In Laptop mode, as shown in Figure 3-2 above, the antennas are 92.9 and 96.6 mm from the bottom of the Keyboard Base. The WLAN #2 Aux Antenna is closer to the Bottom than WLAN #1 Main Antenna. At a separation distance of over 9 cm from the phantom, the SAR will become substantially small or not measurable, which should also qualify for the laptop mode SAR test exclusion conditions (≥ 25 mm) in KDB 616216. Therefore, instead of measuring SAR with the display positioned at 90 degrees to the keyboard or if SAR measurement is necessary, the test configuration in Figure 3-5 is proposed. With the display open to 10 degrees from the Keyboard Base, the minimum vertical separation distance for SAR measurement with the bottom in contact with the phantom is 53.2 mm for WLAN #2 Aux Antenna, which also qualifies for the laptop mode SAR test exclusion conditions of KDB 616217. [Please confirm that SAR testing can be excluded in Laptop mode for antennas that are more than 25 mm from the base of the keyboard, which also includes the 10 degrees configuration in Figure 3-5](#)

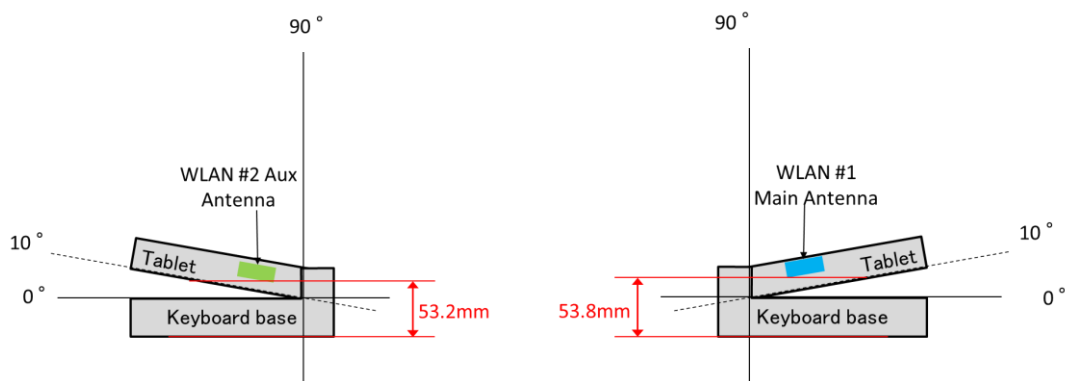


Fig.3-5 Minimum distance from WLAN antenna in Laptop mode

Please confirm if our testing plan is acceptable.