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SAR Test Exclusion Exhibit For:

Fluke Thermal Imager TiS10-TiS65

Prepared by:

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Product Description:

The Fluke, TiS10, TiS20, TiS40, TiS45, TiS50, TiS55, TiS60, and TiS65 Thermal Imagers (the Product or Imager) are handheld, infrared imaging cameras for use in many applications. These applications include equipment troubleshooting, preventive and predictive maintenance, building diagnostics, and research and development. All Imagers display thermal images on a high-visibility, industrial-quality (320X240) LCD touch screen and can save images to a removable memory card. Saved images and data can be transferred through the memory card to a PC, a direct USB connection to the PC, or by wireless transfer to a PC or mobile device. The TiS family has two mechanical versions: The TiS10, TiS20, TiS40, TiS50, and TiS60 use a fixed focus IR lens. The TiS45, TiS55, and TiS65 use a manual focus lens, which includes an external focus ring.

Note: Bluetooth and WLAN radios do not transmit at the same time. Please refer to Appendix A for BT and WLAN Coexistence information.



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Associated Antenna(s):

The antenna associated with the EUT is a Johanson Technology high frequency ceramic chip antenna, part number 2450AT18B100. The chip antenna has a peak gain of 0.5dBi.

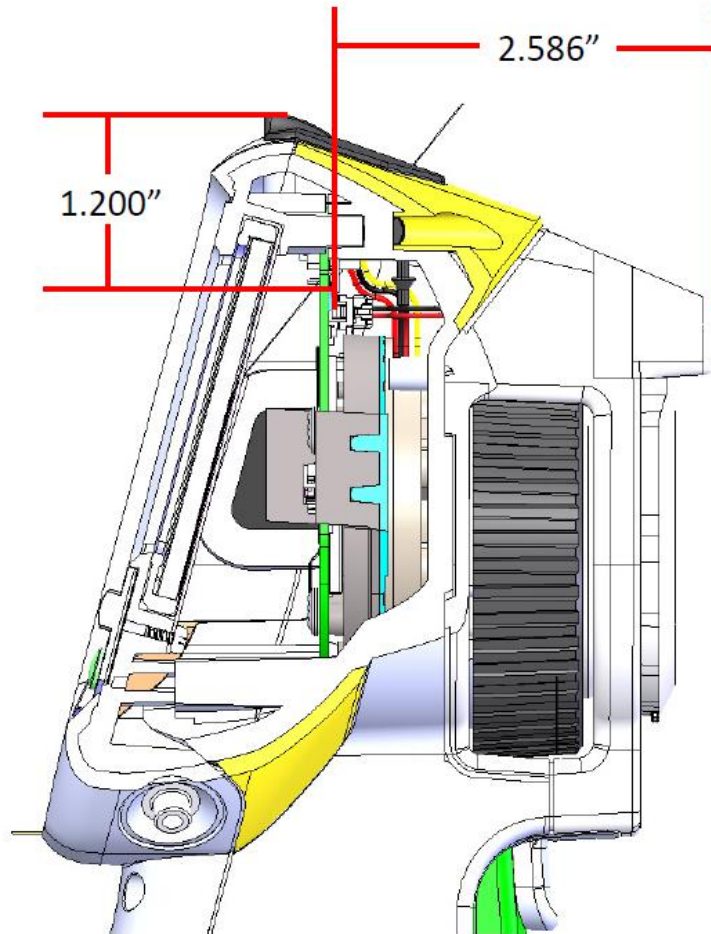
Statement of compliance:

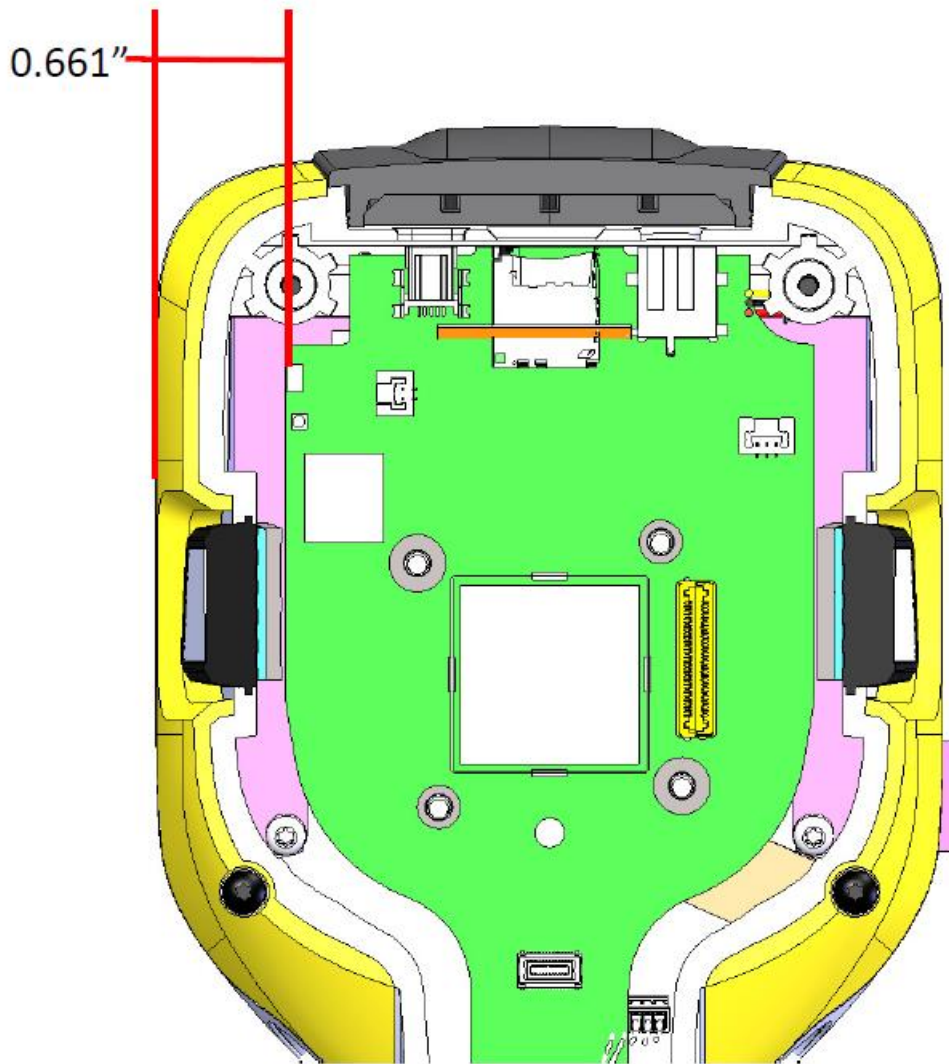
The Fluke USB1 FC WIFI-ADAPTER was evaluated against the SAR test exclusion threshold listed in KDB 447498 D01 General RF Exposure Guidance v05r02 for 10-g extremity at a distance of 5mm as well as RSS-102 Issue 5 for limb-worn at a distance of 15mm.

Separation Distance:

The EUT antenna separation distance to the extremity is greater than 15mm (refer to figure below), hence is excluded from SAR.

ANTENNA LOCATION 1 – All Models





Note: Bluetooth and WLAN radios do not transmit at the same time. Please refer to Appendix A for BT and WLAN Coexistence information.



A. DTS

The EUT was evaluated against the SAR test exclusion threshold listed in KDB 447498 D01 General RF Exposure Guidance v05r02, section 4.3 (1). The EUT was found to be compliant with the SAR exclusion threshold, 10-g extremity, for 100MHz to 6000MHz.

Frequency = 2.462GHz
ERP (dBm) = 11.7dBm
ERP (mW)= 14.9milliwatt
Minimum separation distance = 5mm

$$[14.9\text{mw}/5\text{mm}] * [\sqrt{2.48\text{GHz}}] = 4.7 = \leq 7.5$$

When evaluated against RSS 102 issue 5 section 2.5, table 1:

Frequency = 2.462GHz
EIRP (dBm) = 11.7dBm 0.5dBi = 12.2dBm
ERP (mW)= 16.6milliwatt < 37.5 mW limit

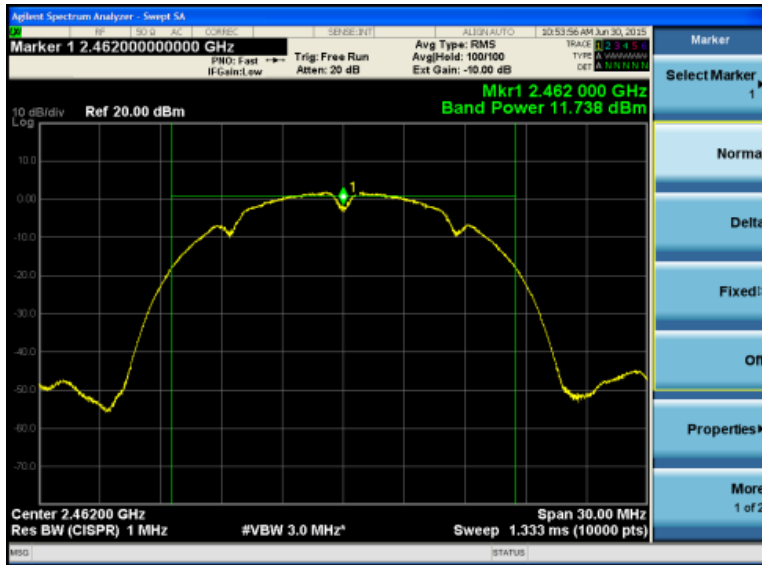
Interpolating between 2450 and 3500 MHz for 2462 MHz at separation distance of 15 mm yields exemption limit of 15.2 mW

Applying the limb-worn 10 gram value multiply by a factor of 2.5 = 15.01 * 2.5 = 37.5 mW

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance^{4,5}

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Screen Capture of maximum output power



Frequency 2462 MHz; 1 MBPS



B. DSSS/FHSS

The EUT was evaluated against the SAR test exclusion threshold listed in KDB 447498 D01 General RF Exposure Guidance v05r02, section 4.3 (1). The EUT was found to be compliant with the SAR exclusion threshold, 10-g extremity, for 100MHz to 6000MHz.

- Frequency = 2.402 GHz
- ERP (dBm) = 4.9 dBm
- ERP (mW)= 3.1 milliwatt
- Minimum separation distance = less than 5 mm

$$[3.1\text{mw}/5\text{mm}] * [\sqrt{2.402\text{GHz}}] = 0.62 * 1.55 = \underline{0.96} \leq 7.5$$

When evaluated against RSS 102 issue 5 section 2.5, table 1:

- Frequency = 2.402 GHz
- EIRP (dBm) = 4.9 + 0.5 dBm
- EIRP (mW)= 3.5 milliwatt

Interpolating between 1900 and 2450 MHz for 2402 MHz at separation distance of 5 mm yields exemption limit of 4.3 mW

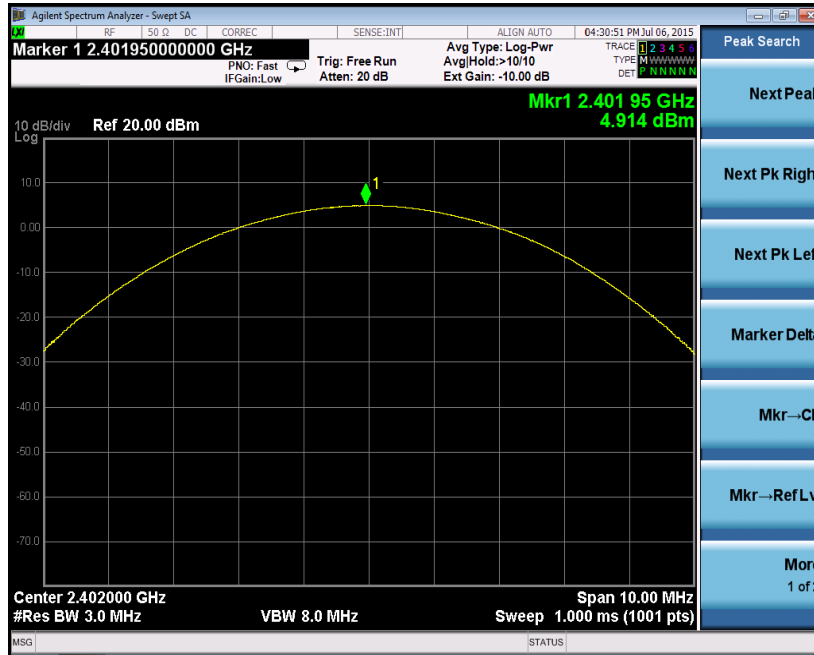
Applying the limb-worn 10 gram value multiply by a factor of 2.5 = 4.3*2.5 = **10.8mW**

SAR test exclusion requirement is satisfied.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance^{4,5}

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Screen Capture of maximum output power



Frequency 2402 MHz



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MPE Calculation:

The following MPE calculations are based on a measured conducted RF power of +11.7 dBm as presented to the antenna. The peak gain of this antenna, based on the data sheet is 0.5 dBi.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

- where: S = power density
- P = power input to the antenna
- G = power gain of the antenna in the direction of interest relative to an isotropic radiator
- R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	<u>11.70</u> (dBm)
Maximum peak output power at antenna input terminal:	<u>14.791</u> (mW)
Antenna gain(typical):	<u>0.5</u> (dBi)
Maximum antenna gain:	<u>1.122</u> (numeric)
Prediction distance:	<u>20</u> (cm)
Prediction frequency:	<u>2462</u> (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	<u>1</u> (mW/cm ²)
Power density at prediction frequency:	0.003302 (mW/cm ²)

APPENDIX A –Bluetooth and WLAN Coexistence

(Information presented below was referenced from TI WiLink 8 Software specification, document SWRU423 section 2.10)

Both WLAN and BT operate on a 2.4-GHz ISM band. Allowing the two technologies to work simultaneously, especially when located on the same device, is a challenging task that requires special treatment to keep performance quality on both sides. The advantage of having both Wi-Fi and BT/BLE on a single combo device such as WiLink8.0 provides better correlation between the different IPs to ensure good performance. WiLink8.0 uses a shared antenna for Wi-Fi and BT.

This operation is accomplished by managing a time-division multiplexing (TDM) scheme; transmitting and receiving independent signals over the shared antenna in an alternating pattern, using an external controlled switch.

The WLAN both switches the antenna to the BT IP and protects BT traffic from any WLAN traffic by other devices, using a number of different methods.

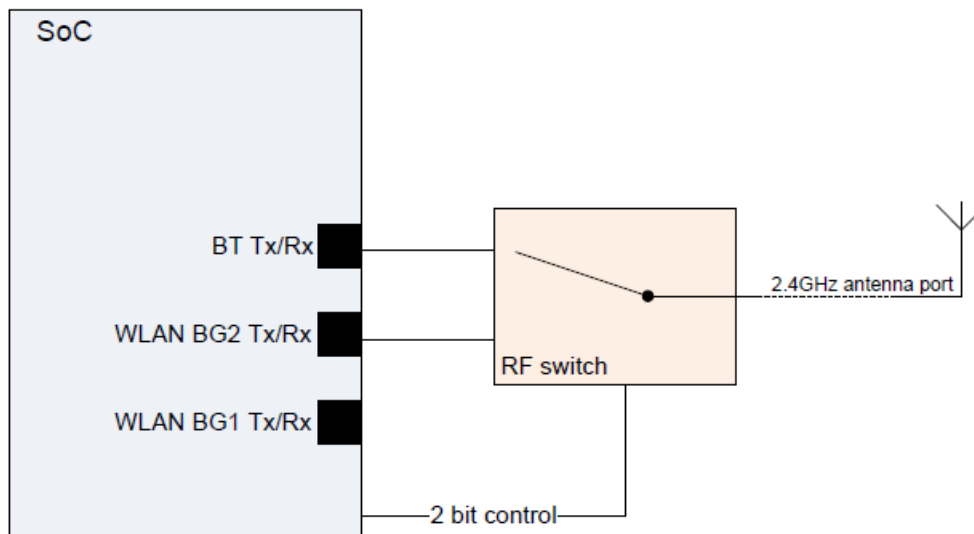


Figure 4. Wi-Fi – BT/BLE Coexistence – Shared Antenna