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SAR Test Exclusion Exhibit For:

Fluke USB1 FC WIFI-BLE ADAPTER

Prepared by:

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Contents

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Product Description:

The USB1 FC is a Wi Fi and Bluetooth low energy wireless to USB adapter to be used in test and measurement instruments such as the 1735 Energy Logger to communicate readings wirelessly: http://en-us.fluke.com/products/power-and-energy-loggers/fluke-1735-power-quality.html

The Adapter is placed inside the instrument as shown in the photo and the instrument is left to record voltage and current over a period of time.

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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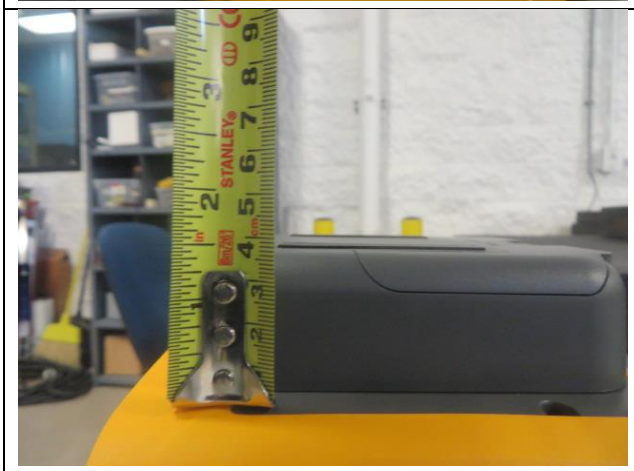
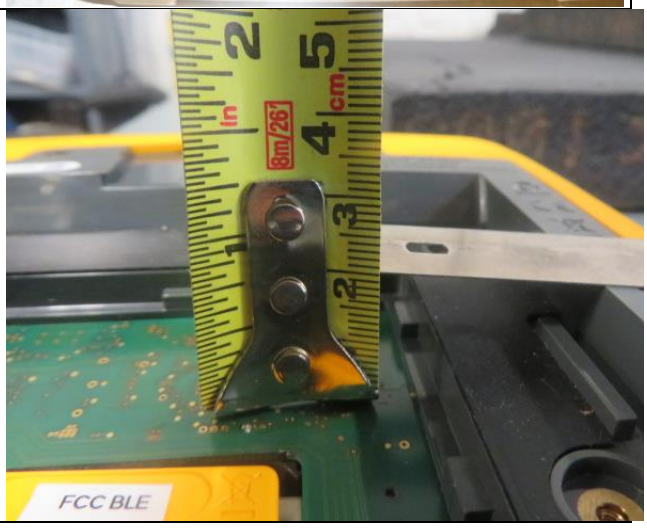
Typical application for the EUT





Associated Antenna(s):

The antenna used by the EUT is a TDK multilayer chip antenna, ANT016008LCD2442MA1 with a peak gain of 2.27 dBi.

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 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.

Note that the measured output power of the EUT is equivalent to the target output level.

Frequency = 2.412GHz
ERP (dBm) = 11.5dBm + 2.0 dBm (manufacturing tolerance) = 13.5dBm
ERP (mW)= 22.4 milliwatt
Minimum separation distance = 5mm

[22.4mw/5mm]*[√2.412GHz] = 4.48*1.55 =6.9 **≤ 7.5**

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

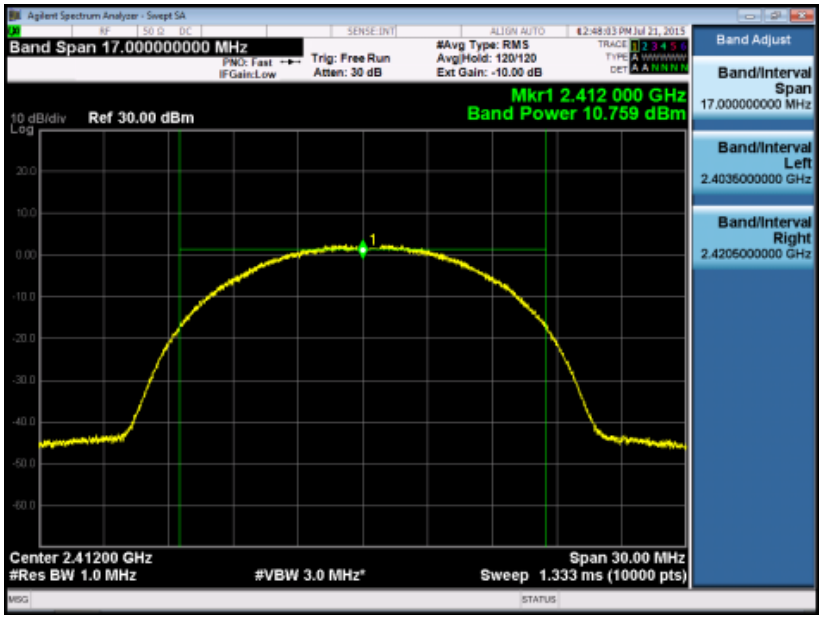
Frequency = 2.412GHz
EIRP (dBm) = 11.5dBm + 2.3dBi + 2.0 dBm (manufacturing tolerance) = 15.8dBm
ERP (mW)= 38.0 milliwatt

Interpolating between 1900 and 2450 MHz for 2412 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 = 15.2 *2.5 = **38 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 2412 MHz; 11 MBPS

Note: A duty cycle correction (0.7dB) was added to the output power shown in the plot above to account for the signal having less than 97% duty cycle.

MPE Calculation:

The following MPE calculations are based on a measured conducted RF power of +11.5 dBm as presented to the antenna. The peak gain of this antenna, based on the data sheet is 2.27 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:	11.50	(dBm)
Maximum peak output power at antenna input terminal:	14.125	(mW)
Antenna gain(typical):	2.27	(dBi)
Maximum antenna gain:	1.687	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.004739	(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.

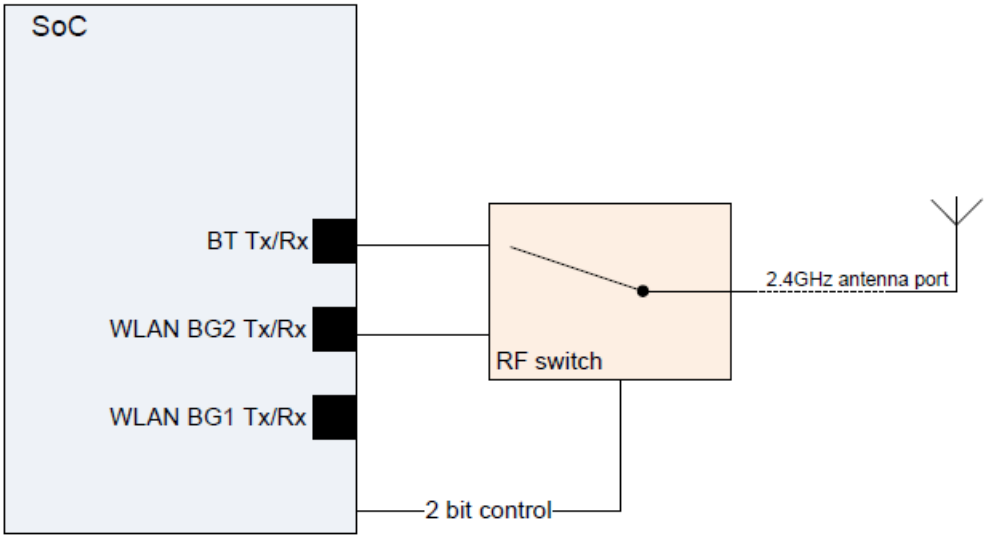


Figure 4. Wi-Fi – BT/BLE Coexistence – Shared Antenna