Design. Create. Certify. Connect.
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

SAR Test Exclusion Exhibit For:

Fluke TiX560/TiX520 Thermal Imager

Prepared by:

Khairul Aidi Zainal, Senior EMC Engineer

3/4/2015

LSR
Design. Create. Certify. Connect.
ACCREDITED
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

Contents

Design. Create. Certify. Connect.
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

Product Description:

The thermal Imager is a WLAN and Bluetooth enabled handheld imaging product that can detect infrared radiation (IR). The primary use is for preventive maintenance and diagnosing problems in industrial environments. These products are not intended for sale to consumers. The series has two versions labeled TiX520 and TiX560.

The versions use the same common IR camera body assembly (Fluke part number 4596742). Other than the model numbers, the electronics, mechanical components, layout, bill of materials, assembly procedures, and test processes are the exactly same for the three versions. The versions are configured through software flags in the flash memory at the end of the production line to match the customer's order.

The differences between the versions are the following:

Thermal Sensitivity:

The thermal sensitivity is the minimal temperature difference that the thermal camera can detect. TiX520 can detect down to 0.05 °C temperature difference. TiX560 can detect down to 0.045 °C temperature difference. The native thermal sensitivity of the IR Camera is 0.045 °C. Embedded software within the IR Camera reduces the thermal sensitivity for the Ti200 version.

Temperature Measurement rage:

The TiX520 and TiX560 are Calibrated to -10°C. The TiX520's measurement range is -20 to 850°C and the TiX560's measurement range is -20 to 1200°C

Design. Create. Certify. Connect.
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

Associated Antenna(s):

The antenna associated with the EUT is a Johanson Technology high frequency ceramic chip antenna, part number 2450AT18D0100. The chip antenna has a peak gain of 1.5dBi.

Statement of compliance:

The Fluke TiX560/TiX520 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 for 100MHz to 6000MHz. Evaluation was performed using a distance that is 0.375 inches or 9.525 mm.

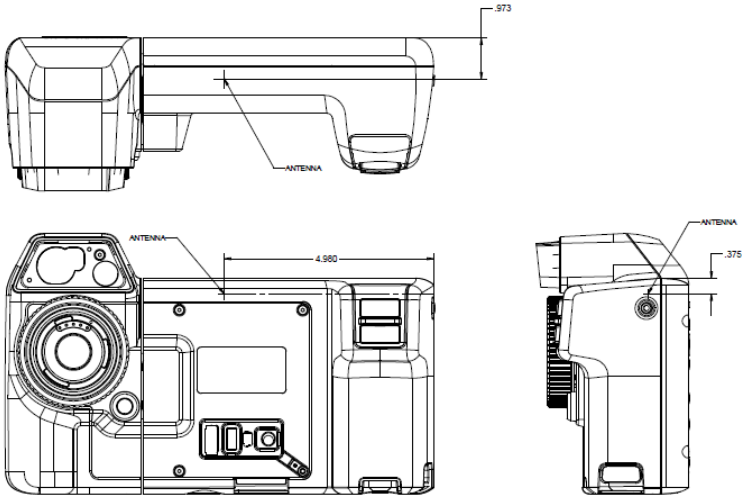
LSR
Design. Create. Certify. Connect.
ACCREDITED
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

Separation Distance:

The TiX560/TiX520 thermal imager is a portable imager that will be handheld and may be used with a neck strap.

The radiating element is on the front of the unit as shown below:

Design. Create. Certify. Connect.
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com



The distance used for calculation is 0.375 inches (9.525mm) as it is shown to be the closest distance to the body when using a neck strap (Refer to assembly drawing above).

SAR Test Exclusion Threshold:

Extremities SAR test exclusion threshold for 100MHz to 6GHz at minimum separation distance of ≤ 50mm.

1-g SAR test exclusion threshold equation:

[(maximum power of channel including tune-up tolerance) / (minimum separation distance)] * [$\sqrt{f_{(GHz)}}$] ≤ 3.0

LSR
Design. Create. Certify. Connect.
ACCREDITED
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

Data and calculation:

Maximum Conducted Output Power:

A. DTS

802.11 Standard	Data Rate (MBPS)	Channel	Maximum Conducted (average) Power (dBm)	Duty Cycle correction for average measurement (dB)	Corrected Maximum Conducted Power (dBm)	Power Limit (dBm)	Power margin (dB)
b	1 (DBPSK)	1	11.0	0.0	11.0	30.0	19.0
		6	10.7	0.0	10.7	30.0	19.3
		11	10.7	0.0	10.7	30.0	19.3
g	6 (BPSK)	1	11.9	0.1	12.0	30.0	18.0
		6	11.3	0.1	11.4	30.0	18.6
		11	11.6	0.1	11.7	30.0	18.3
n	MCS0 (BPSK)	1	11.8	0.1	11.9	30.0	18.1
		6	11.3	0.1	11.4	30.0	18.6
		11	11.5	0.1	11.6	30.0	18.4
b	11 (8QPSK)	1	11.5	0.1	11.6	30.0	18.4
		6	10.9	0.1	11.0	30.0	19.0
		11	11.1	0.1	11.2	30.0	18.8
g	54 (64QAM)	1	11.9	0.7	12.6	30.0	17.4
		6	11.9	0.7	12.6	30.0	17.4
		11	12.1	0.7	12.8	30.0	17.2
n	MCS7 (64QAM)	1	8.7	0.7	9.4	30.0	20.6
		6	8.7	0.7	9.4	30.0	20.6
		11	8.9	0.7	9.6	30.0	20.4

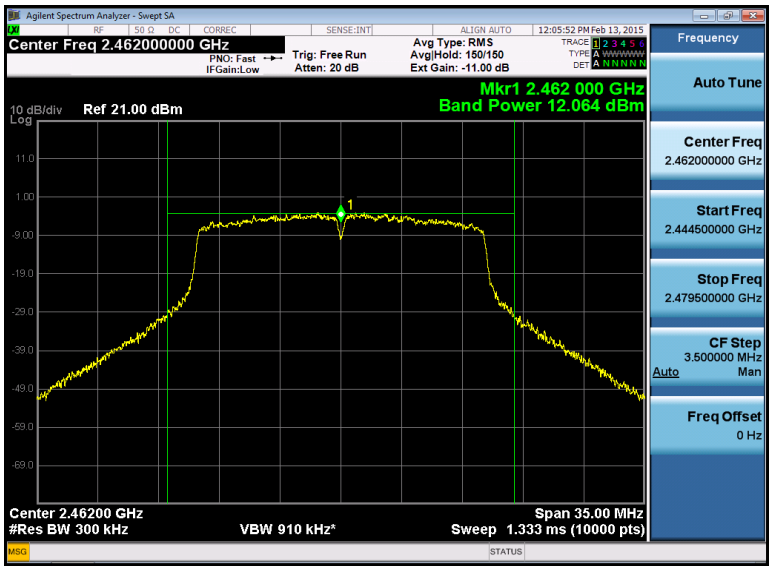
Frequency (MHz)	Conducted Output Power (dBm)	Conducted Power Limit (dBm)	Conducted Power Margin (dB)
2402	1.4	30.0	28.6
2440	0.9	30.0	29.1
2480	-0.3	30.0	30.3

B. FHSS

Packet Type	Channel	Frequency (MHz)	Output Power (dBm)	Output power limit (dBm)	Margin (dB)
GFSK	1	2402	1.3	21.0	19.7
	39	2440	0.6	21.0	20.4
	79	2480	0.6	21.0	20.4
EDR2	1	2402	4.0	21.0	17.0
	39	2440	3.7	21.0	17.3
	79	2480	3.6	21.0	17.4
EDR3	1	2402	4.6	21.0	16.4
	39	2440	4.4	21.0	16.6
	79	2480	4.4	21.0	16.6

Design. Create. Certify. Connect.
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

Screen Capture of maximum output power



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.

LSR
Design. Create. Certify. Connect.
ACCREDITED
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

Comparison to SAR threshold:

The output power used in the calculation below is the highest output power available by the device. This output power was determined to be at 2462MHz (channel 11) and when the radio is operating in the 802.11g mode (54MBPS).

Frequency = 2.480 GHz
Output power = 12.8 dBm
Output power = **19.0** milliwatt
Minimum separation distance = 10 mm

[19mw/10mm]*[√2.48GHz] = **3.0**

LSR
Design. Create. Certify. Connect.
ACCREDITED
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

MPE Calculation:

The following MPE calculations are based on a measured conducted RF power of +12.8 dBm as presented to the antenna. The peak gain of this antenna, based on the data sheet is 1.5 dBi.

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:	12.80	(dBm)
Maximum peak output power at antenna input terminal:	19.055	(mW)
Antenna gain(typical):	1.5	(dBi)
Maximum antenna gain:	1.413	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.005355	(mW/cm^2)
Maximum allowable antenna gain:	24.2	(dBi)
Margin of Compliance at 20 cm =	22.7	dB

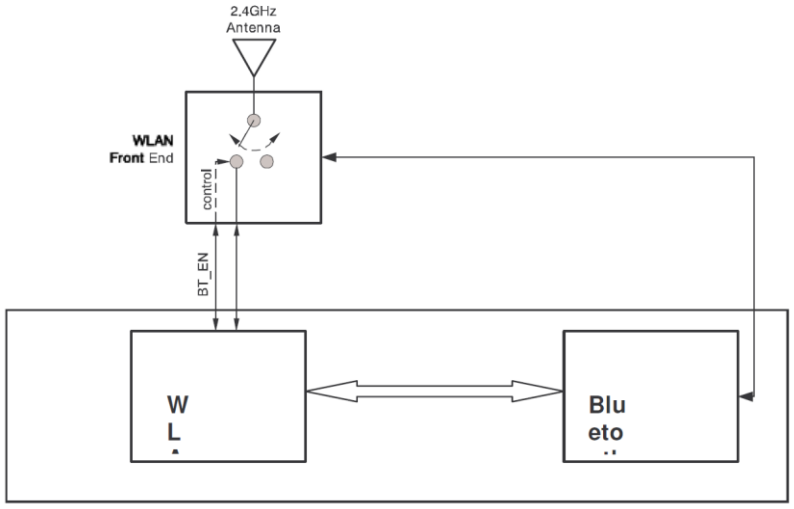
Design. Create. Certify. Connect.
TESTING CERT #1255.01
W66 N220 Commerce Court ● Cedarburg, WI 53012
Phone: 262.375.4400 ● Fax: 262.375.4248
www.lsr.com

Bluetooth and WLAN Coexistence:

(Information presented below was referenced from TI application note: WL1271 WLAN Bluetooth Coexistence Application note. Literature Number: SPRAB96)

The radio chipset implemented is a TI WL1271. On these chipset, the SoftGemini (SG 3.0) algorithm enables WLAN and Bluetooth technology to co-exist in a single product. SoftGemini (SG 3.0) handles cases that involve BT Voice /Data and WLAN voice/Data applications using a single antenna.

In the single antenna configuration, the WLAN subsystem uses and internal radio frequency switch that enables the Bluetooth and WLAN operations to be multiplexed through a single antenna. This function allows either WLAN or Bluetooth to transmit and not both at the same time.



In the single antenna configuration, the following rules apply in the shared antenna configuration:

- Bluetooth TX is not allowed, if the switch is in WLAN state.
- WLAN TX is not allowed, if the switch is in Bluetooth state.
- Simultaneous RX is not possible because of a very high-power input signal
- Switch receive isolation for the BT in the WL1273FE is at least 30dB