RF Exposure

The equipment under test (EUT) is a WIRELESS IP CAMERA. The EUT was powered by AC/DC adapter with input of 100-240Vac, 50/60Hz, 0.5A and output of 5Vdc, 2000mA. For more detail information pls. refer to the user manual.

For WIFI function:
Antenna Type: Integral Antenna

Antenna Gain: 3dBi

Modulation Type: BPSK, QPSK, 16QAM, 64QAM, CCK, DQPSK, DBPSK.

The nominal conducted output power specified: 14dBm +/-3dB.
According to the KDB 447498:

The maximum peak conducted output power of WiFi function is 14.0dBm in the frequency 2462MHz (802.11b) which is within the product variation.

The minimum peak conducted output power of WiFi function is 12.3dBm in the frequency 2422MHz (802.11 n-HT40) which is within the production variation.

According to FCC Part 2.1091, this unlicensed transmitting devices is categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, According to the KDB 447498 and OET 65, the simple calculation as below:

S (power density) = PG/4πR^2

For Maximum Permissible Exposure (MPE) evaluation of the product, the maximum power density at 20 cm from this transmitter shall be less than the General Population / Uncontrolled MPE limit in FCC Part 1.1310.

PG = The maximum conducted output power + Antenna Gain
= 20dBm = 100mW

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna can be calculated according to KDB447498as follow:
= 100mW / 4πR^2 = 0.0199 mW/cm^2

The MPE limit is 1.0 mWcm-2 for general population and uncontrolled exposure in the WiFi frequency range according to FCC Part 1.1310. As the measured power density at 20cm from the transmitter is lower than the MPE limit, the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter's radiating structure and body of the user or nearby persons.

For Bluetooth Function:
Modulation Type: GFSK
Bluetooth Version: 4.0 (Single Mode)
Antenna Type: Integral antenna
Antenna Gain: 2dBi
The nominal radiated output power (e.i.r.p) specified: 1.0 dBm (tolerance: +/- 3 dB)
The nominal conducted output power specified: -1.0 dBm (tolerance: +/- 3dB)

According to the KDB 447498:

The maximum radiated emission of the BT4.0 function is 97.5dBμV/m at 3m in the frequency 2.480GHz
= [(FS*D) ^2 / 30] mW
= 2.27dBm which is within the production variation.
The minimum radiated emission of the BT4.0 function is 96.5dBμV/m at 3m in the frequency 2.442GHz
= [(FS*D) ^2 / 30] mW
= 1.27dBm which is within the production variation.

According to FCC Part 2.1091, this unlicensed transmitting devices is categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use, from the KDB 447498 and OET 65, the simple calculation as below:

S (power density) = PG/4πR^2

For Maximum Permissible Exposure (MPE) evaluation of the product, the maximum power density at 20 cm from this transmitter shall be less than the General Population / Uncontrolled MPE limit in FCC Part 1.1310.

PG = The maximum conducted output power + Antenna Gain
= 4dBm = 2.51mW

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna can be calculated according to KDB447498 as follow:
= 2.51mW / 4πR^2 = 0.0005 mW/cm^2

The MPE limit is 1.0 mWcm-2 for general population and uncontrolled exposure in the WiFi frequency range according to FCC Part 1.1310. As the measured power density at 20cm from the transmitter is lower than the MPE limit, the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter's radiating structure and body of the user or nearby persons.

RF Exposures Evaluation for simultaneous transmission

The EUT including Bluetooth and WIFI transceiver whitch can transmmit simultaneously

The specification of Bluetooth 4.0 and WiFi as below:

Ant1 Gain: 3.0dBi for WIFI; Ant2 Gain: 2.0dBi for Bluetooth
For WIFI nominal conducted output power specified: 14dBm (Tolerance: ±3dBm)
For Bluetooth nominal conducted output power specified: -1dBm (Tolerance: ±3dBm)

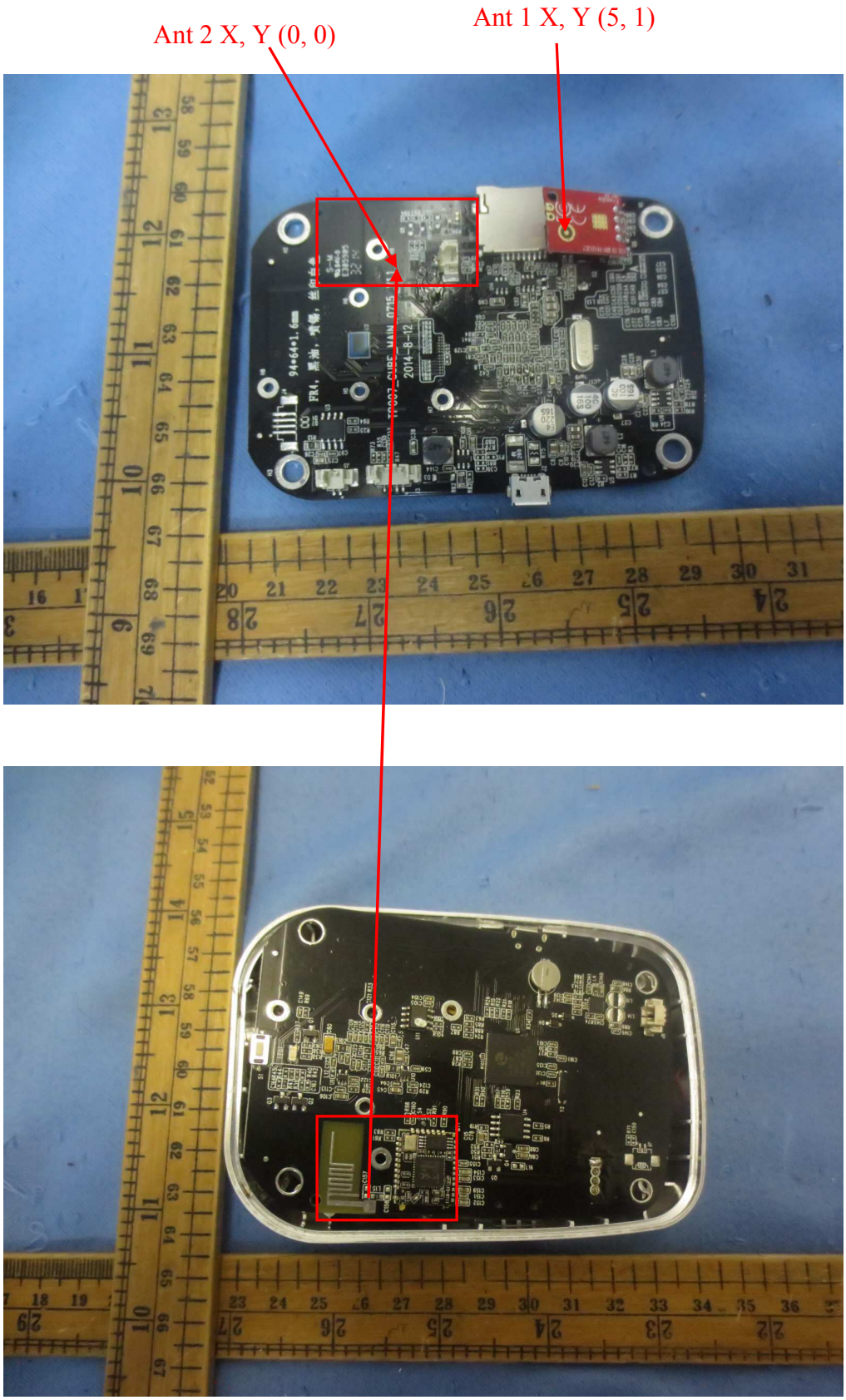
The KDB 447498: A Mobile Multi-transmitter MPE Estimation MPE spreadsheet is used for estimating MPE limits for these 2 transmitter's simultaneous transmission.

The information of operating frequency (MHz), power (W), antenna gain (dBi), location (X and Y coordinates showed on next page) for each antenna are entered in the MPE Spreadsheet.

The power densities of up to 2 antennas located within a 90 cm² region at 1cm intervals are estimated first. Then the power densities computed for each antenna are summed.

The plot “% MPE Contour” displays the result in percentages of the frequency-dependent power density limits. As the measured power density at 20cm from the transmitter is lower than the MPE limit (the compliance boundary for simultaneous transmission), the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter’s radiating structures and body of the user or nearby persons.

RF Radiation Exposure Statement Caution as below should be put in the manual:
To maintain compliance with the FCC’s RF exposure guidelines, place the product at least 20cm from nearby persons.


Ant 2 X, Y (0, 0)
Ant 1 X, Y (5, 1)

Antenna No.		Total	1	2	3	4	5	6
Tx Status			On	On	Off	Off	Off	Off
Frequency	MHz		2450	2450	1900	2450	2450	5800
MPE Limit	mW/cm^2		1.00	1.00	0.00	0.00	0.00	0.00
Max % MPE	%	2.0	2.0	0.1	0.0	0.0	0.0	0.0
Power	(W)	0.052	0.050	0.002	0.000	0.000	0.000	0.000
Antenna Gain	dBi		3.00	2.00	3.00	1.50	0.50	1.00
EIRP	(W)	0.10	0.100	0.003	0.000	0.000	0.000	0.000
X	(cm)		5.0	0.0	12.0	4.0	-8.0	8.0
Y	(cm)		1.0	0.0	0.0	0.0	0.0	0.0
Sector			FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Arc			FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
θ_1	degs	input	-120	-120	-120	-120	-120	-120
θ_2			60	60	60	60	60	60
θ_1		actual	-120	-120	-120	-120	-120	-120
θ_2			60	60	60	60	60	60