FCC ID: QISWS880

RF Exposures Evaluation for single antenna transmissions

WS880 is 802.11ac Wireless Router equipment with WiFi function. CPU is BCM 4708 chipset, 2.4G wifi PA is BCM4331, 5G wifi PA is BCM4360 and support 3Tx & 3Rx for 2.4G/5G band.. For more detailed features description, please refer to the user's manual.

Antenna information

Antenna No.: 6, 3 antennas (Ant0/1/2) for 2.4G band; 3 antennas (Ant0/1/2) for 5G band.

Antenna Gain: 2.4G band Ant0/1/2: 2dBi, 5G band Ant0/1/2: 2dBi

When product operates on SISO mode 802.11b/g/n-HT20/40 (2.4G band) & 802.11a/n-HT20/40/ac mode (5G band), only one Ant0 (2.4G band Ant0 & 5G band Ant0) is used for transmission. When product operates on MIMO mode (2Tx) can form 3 MIMO mode (2.4G/5G, Ant0+Ant1 or Ant1+Ant2 or Ant0+Ant2) under the 802.11n-HT20/40/ac, If the receiver sensitivity has meet internal limit valve, the antenna of EUT will auto transfer to the another antenna. When product operates on MIMO mode (3Tx) can form 1 MIMO mode (2.4G/5G, Ant0+Ant1+Ant2).

Maximum Peak conducted power

2.4G band SISO

802.11b SISO mode nominal Peak conducted power (Ant0): 18±1dBm;

802.11g SISO mode nominal Peak conducted power (Ant 0): 23±1dBm;

802.11n-HT20 SISO mode nominal Peak conducted power (ANT 0): 22±1dBm;

802.11n-HT40 SISO mode nominal Peak conducted power (ANT 0): 19±1dBm;

2.4G band MIMO 2Tx

802.11n-HT20 nominal Peak conducted power single Antenna (MIMO): 22±1dBm;

802.11n-HT40 nominal Peak conducted power single Antenna (MIMO): 22±1dBm;

2.4G band MIMO 3Tx

802.11n-HT20 nominal Peak conducted power single Antenna (MIMO): 22±1dBm;

802.11n-HT40 nominal Peak conducted power single Antenna (MIMO): 18±2dBm;

5.8G band SISO

802.11a SISO mode nominal Peak conducted power (Ant0): 24±1dBm;

802.11n-HT20 SISO mode nominal Peak conducted power (ANT 0): 24±1dBm;

802.11n-HT40 SISO mode nominal Peak conducted power (ANT 0): 24±1dBm;

802.11ac SISO mode nominal Peak conducted power (ANT 0): 22±1dBm;

5.8G band MIMO 2Tx

802.11n-HT20 nominal Peak conducted power single Antenna (MIMO): 22±2dBm;

802.11n-HT40 nominal Peak conducted power single Antenna (MIMO): 22±1dBm;

802.11ac nominal Peak conducted power single Antenna (MIMO): 21±1dBm;

5.8G band MIMO 3Tx

802.11n-HT20 nominal Peak conducted power single Antenna (MIMO): 22±2dBm;

802.11n-HT40 nominal Peak conducted power single Antenna (MIMO): 22±2dBm;

802.11ac nominal Peak conducted power single Antenna (MIMO): 21±2dBm;

5.2G band SISO

802.11a SISO mode nominal Peak conducted power (Ant0): 9±1dBm;
802.11n-HT20 SISO mode nominal Peak conducted power (ANT 0): 9±1dBm;
802.11n-HT40 SISO mode nominal Peak conducted power (ANT 0): 10±1dBm;
802.11ac SISO mode nominal Peak conducted power (ANT 0): 10±1dBm;

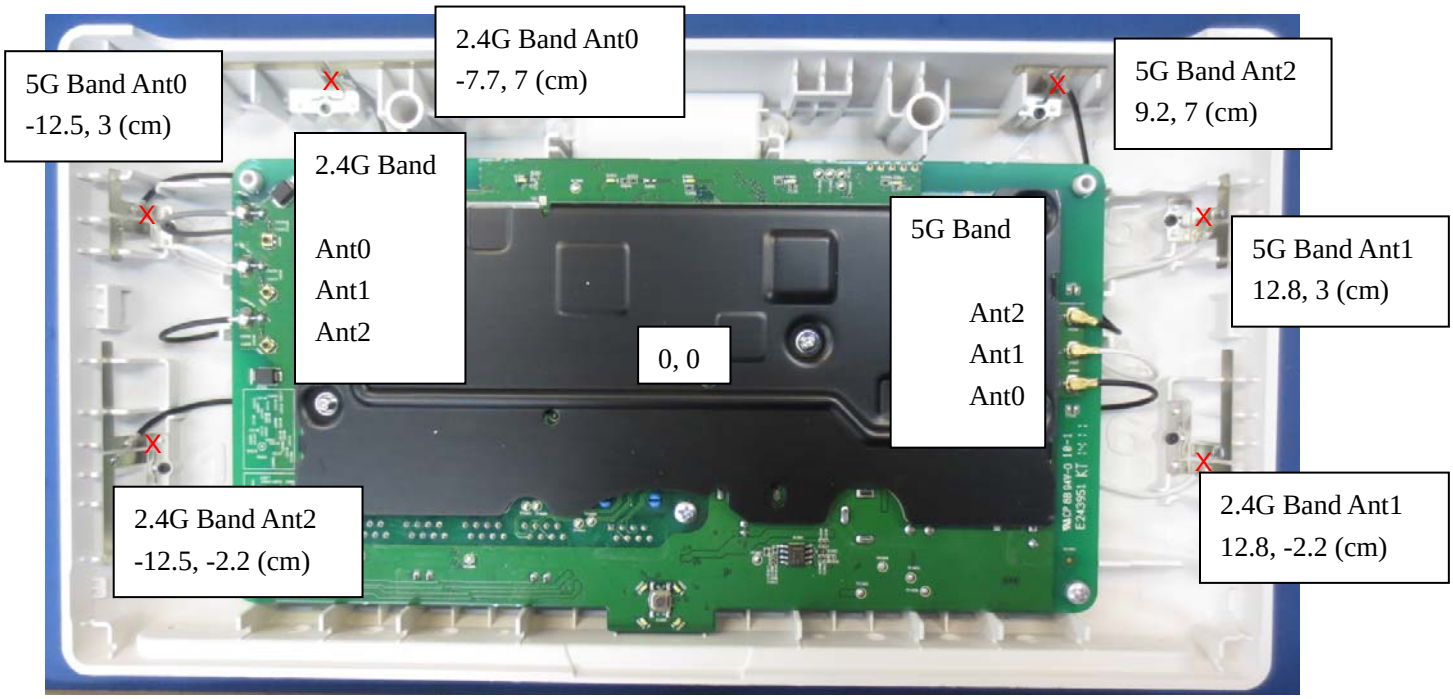
5.2G band MIMO 2Tx

802.11n-HT20 nominal Peak conducted power single Antenna (MIMO): 8±3dBm;
802.11n-HT40 nominal Peak conducted power single Antenna (MIMO): 8±3dBm;
802.11ac nominal Peak conducted power single Antenna (MIMO): 8±3dBm;

5.2G band MIMO 3Tx

802.11n-HT20 nominal Peak conducted power single Antenna (MIMO): 8±3dBm;
802.11n-HT40 nominal Peak conducted power single Antenna (MIMO): 8±3dBm;
802.11ac nominal Peak conducted power single Antenna (MIMO): 8±3dBm;

Antenna photo



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

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:

SISO Mode MPE Evaluation:
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.

The maximum EIRP= 24+1+2=27dBm=501.2mW

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 OET Bulletin 65 as follow:
= EIRP / 4πR^2
= 501.2 / 4πR^2
= 0.0998 mW/cm^2

The MPE limit is 1.0 mWcm-2 for general population and uncontrolled exposure in the range of 1.5GHz~100GHz 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.

Transmitter Duty Cycle Calculation
The EUT transmit continuously during the test, the duty cycle is 1.

The following RF exposure statement or similar sentence is proposed to be included in the user manual:

“FCC RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons.”

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RF Exposures Evaluation for Multi antenna transmissions

The KDB 447498: A Mobile Multi-transmitter MPE Estimation MPE spreadsheet is used for estimating MPE limits for these 6 antennas (2.4G band 3 Antennas/5G band 3 Antennas) simultaneous transmission.

The information of operating frequency (MHz), power (W), antenna gain (dBi), location (X and Y coordinates showed on page 2) for each antenna are entered in the MPE spreadsheet.

The power densities of up to 6 antennas located within a 90 cm^2 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.

Antenna No.		Total	1	2	3	4	5	6
Tx Status			On	On	On	On	On	On
Frequency	MHz		2450	2450	2450	5800	5800	5800
MPE Limit	mW/cm^2		1.00	1.00	1.00	1.00	1.00	1.00
Max % MPE	%	31.0	6.3	6.3	6.3	7.9	7.9	7.9
Power	(W)	1.353	0.200	0.200	0.200	0.251	0.251	0.251
Antenna Gain	dBi		2.00	2.00	2.00	2.00	2.00	2.00
EIRP	(W)	2.14	0.316	0.317	0.317	0.398	0.398	0.398
X	(cm)		-7.7	12.8	-12.5	-12.5	12.8	9.2
Y	(cm)		7.0	-2.2	-2.2	3.0	3.0	7.0
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