

RF Exposures Evaluation for SISO Mode

The Equipment Under Test (EUT) is a QISHG255E, Model: HG658 V2 operating at 2412-2462MHz for 802.11b/g/n-HT20, 11 channels with 5MHz channel spacing. EUT operated at 2422-2452MHz for 802.11n-HT40, 7 channels with 5MHz channel spacing. It is powered by AC/DC Adapter (Input: 100-240Vac, 50/60Hz; Output: 12V, 1A). The EUT including 3 antennas, the RF IC support 2*3 and optional diversity with 3 antennas, 802.11b SISO mode work at Ant1 only, 802.11g/n SISO mode and 801.11n-HT20/HT40 MIMO mode work at Ant1\Ant2\Ant3. Ant2 is only for reception, and Ant1\ Ant3 could be used for transmission and reception. For more detailed features description, please refer to the user's manual.

Antenna Type: Integral antenna.

Ant1 Gain: 1dBi; Ant3 Gain: 1dBi; Ant2 (only receive)

802.11b/g/n nominal Peak conducted power (SISO): 22 dBm±4dBm

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

The maximum conducted output power for the EUT is 24.55dBm in the frequency 2.437GHz 802.11n-HT20 SISO which is within the production variation.

The minimum conducted output power for the EUT is 18.51dBm in the frequency 2.437GHz 802.11b 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:

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 OET Bulletin 65.

The maximum E.I.R.P= 22+4+1=27dBm=501.19mW

The source-based time averaged maximum radiated power = 501.19 x Duty Cycle = 501.19mW

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:

$$= 501.19 / 4\pi R^2$$

$$= 0.10 \text{ mW/cm}^2$$

The MPE limit is 1.0 mW/cm² for general population and uncontrolled exposure in the 2.4GHz 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.

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.”

RF Exposures Evaluation for MIMO Mode

The EUT including 3 antennas, the RF IC support 2*3 and optional diversity with 3 antennas, 802.11b SISO mode work at Ant1 only, 802.11g/n SISO mode and 801.11n-HT20/HT40 MIMO mode work at Ant1\Ant2\Ant3. Ant2 is only for reception, and Ant1\Ant3 could be used for transmission and reception. For more detailed features description, please refer to the user's manual.

Antenna Type: Integral antenna.

Ant1 Gain: 1dBi; Ant3 Gain: 1dBi; Ant 2 (only receive)

The MIMO mode single antenna nominal conducted output power specified: 20dBm $\pm$ 3dB.

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

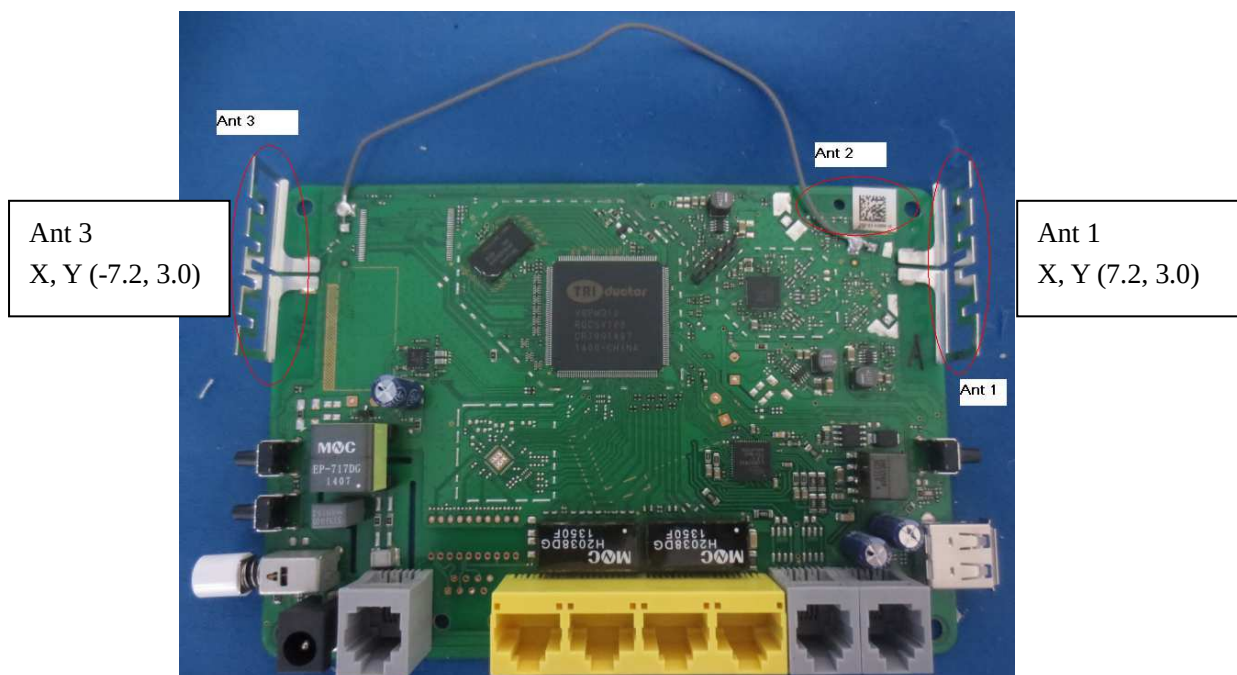
The conducted output power(single antenna) tested are from 18.31dBm to 22.10dBm which are within the production variation

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



Ant1+Ant3

Antenna No.		Total	1	2	3	4	5	6
Tx Status			On	On	Off	Off	Off	Off
Frequency	MHz		2450	2450	2100	2450	2450	5800
MPE Limit	mW/cm ²		1.00	1.00	0.00	0.00	0.00	0.00
Max % MPE	%	9.7	5.0	5.0	0.0	0.0	0.0	0.0
Power	(W)	0.400	0.200	0.200	0.000	0.000	0.000	0.000
Antenna Gain	dBi		1.00	1.00	3.00	1.50	0.50	1.00
EIRP	(W)	0.50	0.252	0.252	0.000	0.000	0.000	0.000
X	(cm)		-7.2	7.2	12.0	4.0	-8.0	8.0
Y	(cm)		3.0	3.0	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

% MPE Contour

Note: The 0% contour surrounding the antennas identifies a 20 cm perimeter surrounding all active antennas

