

## RF Exposures Evaluation for single antenna transmissions

The Equipment Under Test (EUT) is a 300Mbps Wireless ADSL2+Router, Model: HG531 V1 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, 0.5A). The EUT including 2 antennas, the RF IC support 2Tx & 2Rx mode, in 802.11b/g/n-HT20/n-HT40 SISO mode Ant2 transceiver only and in MIMO mode Ant1+Ant2 transceiver. For more detailed features description, please refer to the user's manual.

Antenna Type: Integral antenna.

Ant1 Gain: 2dBi; Ant2 Gain: 2dBi

The nominal conducted output power specified: 18dBm +/-4dB.

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

The maximum conducted output power for the EUT is 20.72dBm in the frequency 2.412GHz 802.11g 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= 18+4+2=24dBm=251.19mW

The source-based time averaged maximum radiated power = 251.19 x Duty Cycle = 251.19mW

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:

$$= 251.19 / 4\pi R^2$$

$$= 0.05 \text{ mW/cm}^2$$

The MPE limit is 1.0 mWcm<sup>-2</sup> for general population and uncontrolled exposure in the Bluetooth 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 both antenna transmissions**

The EUT including 2 antennas, the RF IC support 2Tx & 2Rx MIMO mode (Ant1+Ant2) under the 802.11n-HT20 & 802.11n-HT40. For more detailed features description, please refer to the user's manual.

Antenna Type: Integral antenna.

Ant1 Gain: 2dBi; Ant2 Gain: 2dBi

The MIMO mode single antenna nominal conducted output power specified: 17dBm (-4/+3dB).

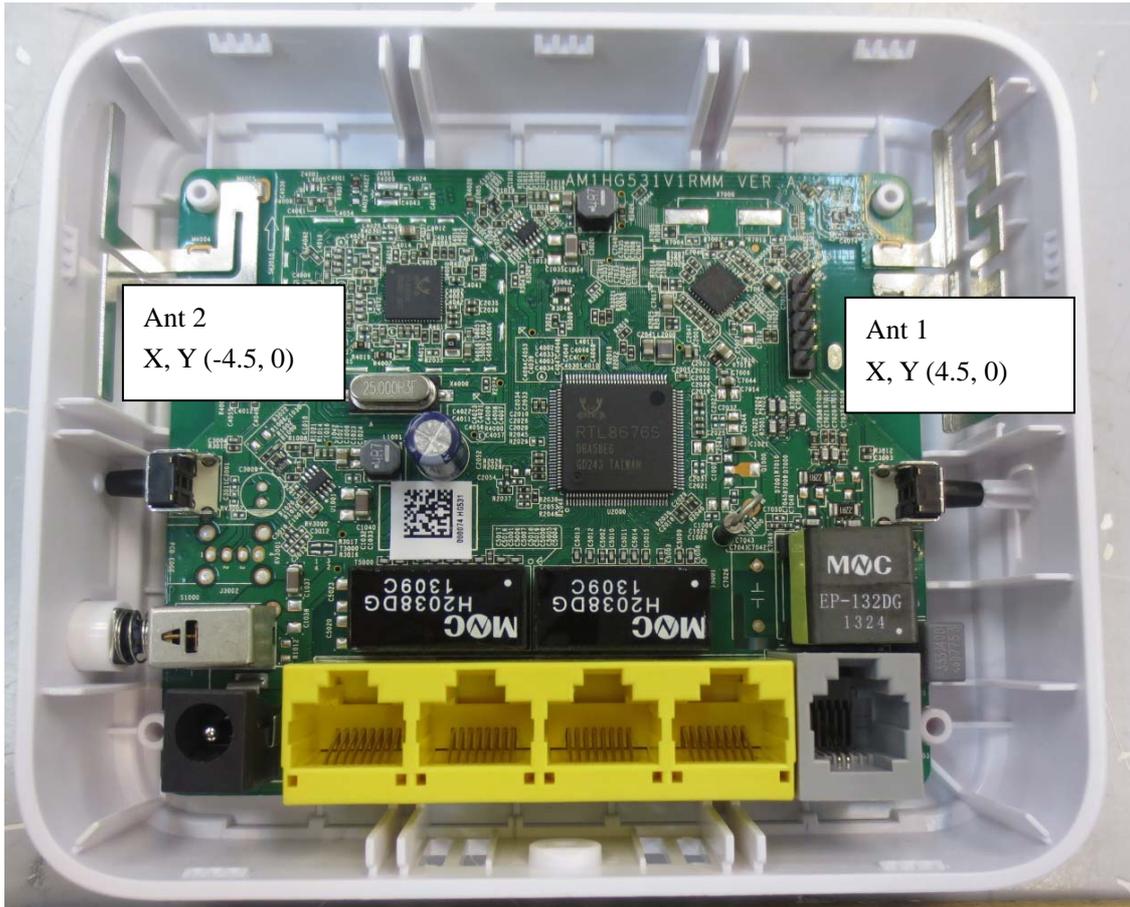
Modulation Type: DBPSK, DQPSK, BPSK, QPSK, 16QAM, 64QAM.

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 cm<sup>2</sup> 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.



Ant 2  
X, Y (-4.5, 0)

Ant 1  
X, Y (4.5, 0)

## Ant1+Ant2

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 <sup>2</sup>		1.00	1.00	0.00	0.00	0.00	0.00
Max % MPE	%	6.0	3.2	3.2	0.0	0.0	0.0	0.0
Power	(W)	0.200	0.100	0.100	0.000	0.000	0.000	0.000
Antenna Gain	dBi		2.00	2.00	3.00	1.50	0.50	1.00
EIRP	(W)	0.32	0.158	0.158	0.000	0.000	0.000	0.000
X	(cm)		-4.5	4.5	12.0	4.0	-8.0	8.0
Y	(cm)		0.0	0.0	0.0	0.0	0.0	0.0
Sector			FALS E	FALS E	FALS E	FALS E	FALS E	FALS E
Arc			FALS E	FALS E	FALS E	FALS E	FALS E	FALS E
$\theta_1$	degs	input	-120	-120	-120	-120	-120	-120
$\theta_2$			60	60	60	60	60	60
$\theta_1$		actual	-120	-120	-120	-120	-120	-120
$\theta_2$			60	60	60	60	60	60

