RF Exposure Exhibit

EUT Name: eero 6 and eero 6 Extender

Model No.: N010001 and Q010001

CFR Part 1.1310 and RSS 102

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1 Test Methodology

In this document, we evaluate the RF Exposure to human body due the intentional transmission from the transmitter (EUT). The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

1.1 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
0.3-1.34	614	1.63	*(100)	6
1.34-30	1842/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
30-1500	…	…	F/300	6
1500-100000	…	…	1.0	6
(B)Limits For General Population / Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
30-1500	…	…	F(MHz)/1500MHz	30
1500-100000	…	…	1.0	30

F = Frequency in MHz

*=Plane wave equivalent density

According to RSS-102 Issue 5: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation

RF FIELD STRENGTH LIMITS FOR DEVICES USED BY THE GENERAL PUBLIC (UNCONTROLLED ENVIRONMENT)

Frequency Range (MHz)	**Electric Field (V/m rms)**	**Magnetic Field (A/m rms)**	**Power Density (W/m^2)**	**Reference Period (minutes)**
$0.003\text{-}10^{21}$	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

1.2 EUT Operating Condition

The Model N010001 and Q010001, is a 2x2 home Wi-Fi router. It is intended to operate as a dual band (2.4GHz and 5GHz) wireless router over 20 MHz, 40 MHz and 80 MHz channels.

1.3 MPE calculation

1.3.1 Antenna Gain

1. Wifi 5.25-5.35 GHz Flex PCB Antenna peak gain: +2.37 dBi or 1.73 (numeric). Total directional gain: 4.06 dBi
2. Wifi 5.470-5.725 GHz Flex PCB Antenna peak gain: +3.57 dBi or (numeric). Total directional gain: 6.29 dBi

1.3.2 Conducted Output Power

1. Wifi 5.27 GHz, TUV Test Report 32062992.001, max power for FCC: 20.86 dBm (121.90 mW) and for beamforming: 23.61 dBm (229.61 mW)
2. Wifi 5.28 GHz, TUV Test Report 32062992.001, max power for RSS: 20.46 dBm (111.17 mW) and for beamforming: 17.90 dBm (61.66 mW) at 5320 MHz
3. Wifi 5.59 GHz, TUV Test Report 32062992.001, max power: 21.87 dBm (153.82 mW) and for beamforming: 23.75 dBm (236.93 mW)

1.3.3 Output Power into Antenna & RF Exposure value (Non-Beamforming Mode)

Calculations for this report are based on highest power measurement and its antenna gain, in the band UNII-2A and UNII-2C. Result below is Non-Beamforming Mode.

FCC (UNII-2A):

Corrected (including cal factors) Measurment:	20.86	dBm	
The Gain of the antenna:	2.37	dBi	
Type of Measurment:	Conducted		Direct measurement at Antenna Port
Impedance:	50.00	Ω	
Measuring Distance:	0.00	m	
Time weighted Duty Cycle:	100.00	%	

The Power Out would be:	0.121898960	Watts
or:	121.89896	mW
or:	121898.96	µW
or:	20.86	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	5.27	GHz

Power output with DC and antenna Gain (EiRP):

Power (dBm):	23.23
Power (mW):	210.378
Power (W):	0.210378

R = distance in	20	cm

FCC:		
Controlled Exposures - Limit =	5	mW/cm^2
Uncontrolled Exposures - Limit =	1	mW/cm^2
Pd =	0.0418533	mW/cm^2
Controlled Margin to Limit =	4.9581	mW/cm^2
Uncontrolled Margin to Limit =	0.9581	mW/cm^2

ISED (UNII-2A):

Corrected (including cal factors) Measurment:	20.46	dBm
The Gain of the antenna:	2.37	dBi
Type of Measurment:	Conducted	Direct measurement at Antenna Port
Impedance:	50.00	Ω
Measuring Distance:	0.00	m
Time weighted Duty Cycle:	100.00	%

The Power Out would be:	0.111173173	Watts
or:	111.17317	mW
or:	111173.17	µW
or:	20.46	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	5.28	GHz

Power output with DC and antenna Gain (EiRP):

Power (dBm):	22.83
Power (mW):	191.867
Power (W):	0.191867

R = distance in	20	cm

IC:

Controlled Exposures to Limit =	46.90435929	W/m^2
Uncontrolled Exposures Limit =	9.166077419	W/m^2
Pd =	0.381707	W/m^2
Controlled Margin to Limit =	46.5227	W/m^2
Uncontrolled Margin to Limit =	8.7844	W/m^2

FCC (UNII-2C):

Corrected (including cal factors) Measurment:	21.87	dBm
The Gain of the antenna:	3.57	dBi
Type of Measurment:	Conducted	Direct measurement at Antenna Port
Impedance:	50.00	Ω
Measuring Distance:	0.00	m
Time weighted Duty Cycle:	100.00	%

The Power Out would be:	0.153815464	Watts
or:	153.81546	mW
or:	153815.46	µW
or:	21.87	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	5.59	GHz

Power output with DC and antenna Gain (EiRP):

Power (dBm):	25.44
Power (mW):	349.945
Power (W):	0.349945

R = distance in	20	cm

FCC:		
Controlled Exposures - Limit =	5	mW/cm^2
Uncontrolled Exposures - Limit =	1	mW/cm^2
Pd =	0.0696194	mW/cm^2
Controlled Margin to Limit =	4.9304	mW/cm^2
Uncontrolled Margin to Limit =	0.9304	mW/cm^2

ISED (UNII-2C):

Corrected (including cal factors) Measurment:	21.87	dBm
The Gain of the antenna:	3.57	dBi
Type of Measurment:	Conducted	Direct measurement at Antenna Port
Impedance:	50.00	Ω
Measuring Distance:	0.00	m
Time weighted Duty Cycle:	100.00	%

The Power Out would be:	0.153815464	Watts
or:	153.81546	mW
or:	153815.46	µW
or:	21.87	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	5.59	GHz

Power output with DC and antenna Gain (EiRP):

Power (dBm):	25.44
Power (mW):	349.945
Power (W):	0.349945

R = distance in	20	cm

IC:

Controlled Exposures to Limit =	48.26164831	W/m^2
Uncontrolled Exposures Limit =	9.530522872	W/m^2
Pd =	0.696194	W/m^2
Controlled Margin to Limit =	47.5655	W/m^2
Uncontrolled Margin to Limit =	8.8343	W/m^2

1.3.4 Output Power into Antenna & RF Exposure value (Beamforming Mode)

Calculations for this report are based on highest power measurement (summed 2 chains) and its antenna gain, in the band UNII-2A and UNII-2C. Result below is Beamforming Mode.

FCC (UNII-2A):

Corrected (including cal factors) Measurment:	23.61	dBm	
The Gain of the antenna:	4.06	dBi	
Type of Measurment:	Conducted		Direct measurement at Antenna Port
Impedance:	50.00	Ω	
Measuring Distance:	0.00	m	
Time weighted Duty Cycle:	100.00	%	

The Power Out would be:	0.229614865	Watts
or:	229.61486	mW
or:	229614.86	µW
or:	23.61	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	5.27	GHz

Power output with DC and antenna Gain (EiRP):

Power (dBm):	27.67
Power (mW):	584.790
Power (W):	0.584790

R = distance in	20	cm

FCC:		
Controlled Exposures - Limit =	5	mW/cm^2
Uncontrolled Exposures - Limit =	1	mW/cm^2
Pd =	0.1163403	mW/cm^2
Controlled Margin to Limit =	4.8837	mW/cm^2
Uncontrolled Margin to Limit =	0.8837	mW/cm^2

ISED (UNII-2A):

Corrected (including cal factors) Measurment:	17.90	dBm
The Gain of the antenna:	4.06	dBi
Type of Measurment:	Conducted	Direct measurement at Antenna Port
Impedance:	50.00	Ω
Measuring Distance:	0.00	m
Time weighted Duty Cycle:	100.00	%

The Power Out would be:	0.061659500	Watts
or:	61.65950	mW
or:	61659.50	µW
or:	17.90	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	5.32	GHz

Power output with DC and antenna Gain (EiRP):

Power (dBm):	21.96
Power (mW):	157.036
Power (W):	0.157036

R = distance in	20	cm

IC:

Controlled Exposures to Limit =	47.08169209	W/m^2
Uncontrolled Exposures Limit =	9.21347598	W/m^2
Pd =	0.312414	W/m^2
Controlled Margin to Limit =	46.7693	W/m^2
Uncontrolled Margin to Limit =	8.9011	W/m^2

FCC (UNII-2C):

Corrected (including cal factors) Measurment:	23.75	dBm
The Gain of the antenna:	6.29	dBi
Type of Measurment:	Conducted	Direct measurement at Antenna Port
Impedance:	50.00	Ω
Measuring Distance:	0.00	m
Time weighted Duty Cycle:	100.00	%

The Power Out would be:	0.237137371	Watts
or:	237.13737	mW
or:	237137.37	µW
or:	23.75	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	5.59	GHz

Power output with DC and antenna Gain (EiRP):

Power (dBm):	30.04
Power (mW):	1009.253
Power (W):	1.009253

R = distance in	20	cm

FCC:		
Controlled Exposures - Limit =	5	mW/cm^2
Uncontrolled Exposures - Limit =	1	mW/cm^2
Pd =	0.2007845	mW/cm^2
Controlled Margin to Limit =	4.7992	mW/cm^2
Uncontrolled Margin to Limit =	0.7992	mW/cm^2

ISED (UNII-2C):

Corrected (including cal factors) Measurment:	23.75	dBm
The Gain of the antenna:	6.29	dBi
Type of Measurment:	Conducted	Direct measurement at Antenna Port
Impedance:	50.00	Ω
Measuring Distance:	0.00	m
Time weighted Duty Cycle:	100.00	%

The Power Out would be:	0.237137371	Watts
or:	237.13737	mW
or:	237137.37	µW
or:	23.75	dBm

Frequency range from 10 MHz to 40 GHz:

Frequency:	5.59	GHz

Power output with DC and antenna Gain (EiRP):

Power (dBm):	30.04
Power (mW):	1009.253
Power (W):	1.009253

R = distance in	20	cm

IC:

Controlled Exposures to Limit =	48.26164831	W/m^2
Uncontrolled Exposures Limit =	9.530522872	W/m^2
Pd =	2.007845	W/m^2
Controlled Margin to Limit =	46.2538	W/m^2
Uncontrolled Margin to Limit =	7.5227	W/m^2

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

FCC and ISED: Result were calculated at a distance from the user is 20 cm.

1.3.5 Sample Calculation

The Friss transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
$\pi \approx 3.1416$
R = distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).