FCC RF EXPOSURE REPORT

FCC ID: Q87-RE9000

Project No.	**: 1708107**
Equipment	**: WiFi Tri band repeater**
Model	**: RE9000**
Series Model	**: N/A**
Applicant	**: Linksys LLC**
Address	**: 121 Theory Drive, Irvine, CA, 92617, USA**
According:	**: FCC Guidelines for Human Exposure IEEE C95.1**

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Testing Laboratory
0659

MPE CALCULATION METHOD:

Calculation Method of RF Safety Distance:

$$S = \frac{PG}{4\pi r^2} = \frac{EIRP}{4\pi r^2}$$

where:
S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Table for Filed Antenna
2.4G:

Ant.	Brand	Test Model	Antenna Type	Connector	Gain (dBi)
1	Aristotle	RFA-TR-F90-A-9719	Dipole	iPEX	1.43
2	Aristotle	RFA-TR-F90-B-9719	Dipole	iPEX	1.93

Note:
(1) The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and receivers (2T2R).

(2) For Power Spectral Density (CDD mode)
Directional Gain =
10*log{[10^(G1/20)+10^(G2/20)+…+10^(Gn/20)]^2/NANT} = 4.70 dBi < 6dBi

(3) For Conducted Output Power (CDD mode)
Gain = 1.93 dBi < 6dBi

Operating Mode / TX Mode	2TX
802.11b	V (ANT 1+ANT 2)
802.11g	V (ANT 1+ANT 2)
802.11n(20MHz)	V (ANT 1+ANT 2)
802.11n(40MHz)	V (ANT 1+ANT 2)

Table for Filed Antenna:
5G:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)		Note
					Band 1	Band 4	
1	Aristotle	RFA-TR-F90-A-9719	Dipole	iPEX	1.05	3.5	TX/RX
2	Aristotle	RFA-TR-F90-B-9719	Dipole	iPEX	2.85	3.7	TX/RX
3	Aristotle	RFA-05-F90-C-9719	Dipole	iPEX	4.57	-	TX/RX
4	Aristotle	RFA-05-F90-D-9719	Dipole	iPEX	4.52	-	TX/RX

Note:
(1) The EUT incorporates a MIMO function. Physically, the EUT provides four completed transmitters and receivers (UNII-1: 4T4R, UNII-3: 2T2R), 2.4G and 5G can transmit simultaneously.
(2) All Ant. 1, Ant. 2, Ant. 3 and Ant. 4 can be used as transmitting/receiving antenna. Ant. 1, Ant. 2, Ant. 3 and Ant. 4 could transmit/receive simultaneously.
The Ant. 1+ Ant. 2+ Ant. 3 + Ant. 4 generated the worst case, so it was selected to test and record in the report.
(3) The EUT(N mode & AC mode) with beamforming function,
The UNII-1 beamforming gain is -0.52 dBi, The UNII-3 beamforming gain is -2.08 dBi. then,
For UNII-1:
For power spectral density:
Directional gain =
10*log{[10^(G1/20)+10^(G2/20)+…+10^(Gn/20)]^2/NANT} = 9.38 dBi > 6dBi.
The reduced power spectral density limits (dBm/MHz) = 17 - (9.38-6) = 13.62

For conducted power:
For NANT = 4 < 5,
Direction gain (dBi) = GANT + 0 = 4.57 + 0 = 4.57
The Direction gain is less than 6, so conducted power limits will not be reduced.

For UNII-3:
For power spectral density:
Directional gain =
10*log{[10^(G1/20)+10^(G2/20)+…+10^(Gn/20)]^2/NANT} = 6.61 dBi > 6dBi.
The reduced power spectral density limits (dBm/MHz) = 30 - (6.61-6) = 29.39

For conducted power:
For NANT = 2 < 5,
Direction gain (dBi) = GANT + 0 = 3.7 + 0 = 3.7
The Direction gain is less than 6, so conducted power limits will not be reduced.

Operating Mode / TX Mode	UNII-1 4TX	UNII-3 2TX
802.11a	V (ANT 1 + ANT 2+ ANT 3+ ANT 4)	V (ANT 1 + ANT 2)
802.11n(20MHz)	V (ANT 1 + ANT 2+ ANT 3+ ANT 4)	V (ANT 1 + ANT 2)
802.11n(40MHz)	V (ANT 1 + ANT 2+ ANT 3+ ANT 4)	V (ANT 1 + ANT 2)
802.11ac(20MHz)	V (ANT 1 + ANT 2+ ANT 3+ ANT 4)	V (ANT 1 + ANT 2)
802.11ac(40MHz)	V (ANT 1 + ANT 2+ ANT 3+ ANT 4)	V (ANT 1 + ANT 2)
802.11ac(80MHz)	V (ANT 1 + ANT 2+ ANT 3+ ANT 4)	V (ANT 1 + ANT 2)

CACULATION:

2.4G:

Test Mode :	TX B Mode Total / CH01, CH06, CH11

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
2412	1.93	1.5596	25.39	345.9394	0.10738667	1	Complies
2437	1.93	1.5596	25.61	363.9150	0.11296668	1	Complies
2462	1.93	1.5596	25.19	330.3695	0.10255347	1	Complies

Test Mode :	TX G Mode Total / CH01, CH06, CH11

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
2412	1.93	1.5596	26.98	498.8845	0.15486396	1	Complies
2437	1.93	1.5596	27.16	519.9960	0.16141741	1	Complies
2462	1.93	1.5596	26.65	462.3810	0.14353254	1	Complies

Test Mode :	TX N-20M Mode Total / CH01, CH06, CH11

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
2412	1.93	1.5596	26.26	422.6686	0.13120500	1	Complies
2437	1.93	1.5596	26.24	420.7266	0.13060216	1	Complies
2462	1.93	1.5596	26.18	414.9540	0.12881023	1	Complies

Test Mode :	TX N-40M Mode Total / CH03, CH06, CH09

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
2422	1.93	1.5596	25.01	316.9567	0.09838987	1	Complies
2437	1.93	1.5596	26.21	417.8304	0.12970310	1	Complies
2452	1.93	1.5596	26.35	431.5191	0.13395236	1	Complies

Note: the calculated distance is 20 cm.

5G:

Test Mode :	UNII-1/TX A Mode Total /CH36, CH40, CH48

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5180	4.57	2.8642	22.96	197.6970	0.11270686	1	Complies
5200	4.57	2.8642	23.49	223.3572	0.12733576	1	Complies
5240	4.57	2.8642	23.38	217.7710	0.12415104	1	Complies

Test Mode :	UNII-1/TX N20 Mode Total /CH36, CH40, CH48

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5180	4.57	2.8642	22.78	189.6706	0.10813104	1	Complies
5200	4.57	2.8642	22.9	194.9845	0.11116047	1	Complies
5240	4.57	2.8642	22.78	189.6706	0.10813104	1	Complies

Test Mode :	UNII-1/TX N40 Mode Total / CH38, CH46

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5190	4.57	2.8642	23.29	213.3045	0.12160470	1	Complies
5230	4.57	2.8642	23.36	216.7704	0.12358062	1	Complies

Test Mode :	UNII-1/TX AC20 Mode Total /CH36, CH40, CH48

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5180	4.57	2.8642	22.91	195.4339	0.11141672	1	Complies
5200	4.57	2.8642	22.92	195.8845	0.11167356	1	Complies
5240	4.57	2.8642	22.96	197.6970	0.11270686	1	Complies

Test Mode :	UNII-1/TX AC40 Mode Total / CH38, CH46

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5190	4.57	2.8642	22.35	171.7908	0.09793781	1	Complies
5230	4.57	2.8642	22.45	175.7924	0.10021907	1	Complies

Test Mode :	UNII-1/TX AC80 Mode Total / CH42

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5210	4.57	2.8642	22.6	181.9701	0.10374099	1	Complies

Note: the calculated distance is 20 cm.

Test Mode :	UNII-3/TX A Mode Total / CH149, CH157, CH165

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5745	4.57	2.8642	22.44	175.3881	0.09998857	1	Complies
5785	4.57	2.8642	22.32	170.6082	0.09726361	1	Complies
5825	4.57	2.8642	22.14	163.6817	0.09331477	1	Complies

Test Mode :	UNII-1/TX N20 Mode Total / CH149, CH157, CH165

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5745	4.57	2.8642	21.67	146.8926	0.08374336	1	Complies
5785	4.57	2.8642	21.44	139.3157	0.07942375	1	Complies
5825	4.57	2.8642	21.31	135.2073	0.07708154	1	Complies

Test Mode :	UNII-1/TX N40 Mode Total / CH151, CH159

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5755	4.57	2.8642	20.23	105.4387	0.06011050	1	Complies
5795	4.57	2.8642	20.17	103.9920	0.05928576	1	Complies

Test Mode :	UNII-1/TX AC20 Mode Total / CH149, CH157, CH165

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5745	4.57	2.8642	20.54	113.2400	0.06455804	1	Complies
5785	4.57	2.8642	20.35	108.3927	0.06179458	1	Complies
5825	4.57	2.8642	20.18	104.2317	0.05942242	1	Complies

Test Mode :	UNII-1/TX AC40 Mode Total / CH151, CH159

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5755	4.57	2.8642	19.63	91.8333	0.05235406	1	Complies
5795	4.57	2.8642	19.33	85.7038	0.04885965	1	Complies

Test Mode :	UNII-3/TX AC80 Mode Total / CH155

Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
5210	4.57	2.8642	19.78	95.0605	0.05419390	1	Complies

Note: the calculated distance is 20 cm.

COLLOCATED POWER DENSITY CACULATIONS

So for 2.4G+5G simultaneous transmission:

0.16141741/1+0.12733576/1=0.28875317<1