



# A Test Lab Techno Corp.

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## MPE Report

Test Report No.	: 1509FS19-01
Applicant	: TP-LINK TECHNOLOGIES CO., LTD.
Manufacturer	: TP-LINK TECHNOLOGIES CO., LTD.
Product Type	: AC1900 Touch Screen Wi-Fi Range Extender
Trade Name	: TP-LINK
Model Number	: RE590T
Date of Received	: Jun. 08, 2015
Test Period	: Jun. 15 ~ Aug. 17, 2015
Date of Issued	: Nov. 05, 2015
Test Specification	: IEEE Std. 1528-2013 47 CFR § 2.1091 47 CFR §1.1310 ANSI / IEEE Std.C95.1-1992
Location of Test Lab.	: Chang-an Lab.

1. The test operations have to be performed with cautious behavior, the test results are as attached.
2. The test results are under chamber environment of A Test Lab Techno Corp. A Test Lab Techno Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples.
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Approved By :

Bill Hu  
(Bill Hu)

Tested By :

Sky Chou  
(Sky Chou)



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## 1. Description of Equipment under Test (EUT)

Applicant	TP-LINK TECHNOLOGIES CO., LTD.																																				
Applicant Address	Building 24 (floors 1,3,4,5) and 28 (floors1-4) Central Science and Technology Park,Shennan Rd, Nanshan, Shenzhen,China																																				
Manufacturer	TP-LINK TECHNOLOGIES CO., LTD.																																				
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Product Type	AC1900 Touch Screen Wi-Fi Range Extender																																				
Trade Name	TP-LINK																																				
Model Number	RE590T																																				
FCC ID	TE7RE590T																																				
Frequency Range	IEEE 802.11b / 802.11g / 802.11n 2.4GHz 20MHz: 2412 ~ 2462 MHz IEEE 802.11n 2.4GHz 40MHz: 2422 ~ 2452 MHz IEEE 802.11a Band I : 5180 ~ 5240 MHz IEEE 802.11a Band III : 5745 ~ 5825 MHz IEEE 802.11n 5GHz 20MHz Band I : 5180 ~ 5240 MHz IEEE 802.11n 5GHz 20MHz Band III : 5745 ~ 5825 MHz IEEE 802.11n 5GHz 40MHz Band I : 5190 ~ 5230 MHz IEEE 802.11n 5GHz 40MHz Band III : 5755 ~ 5795 MHz IEEE 802.11ac 5GHz 20MHz Band I : 5180 ~ 5240 MHz IEEE 802.11ac 5GHz 20MHz Band III : 5745 ~ 5825 MHz IEEE 802.11ac 5GHz 40MHz Band I : 5190 ~ 5230 MHz IEEE 802.11ac 5GHz 40MHz Band III : 5755 ~ 5795 MHz IEEE 802.11ac 80MHz Band I : 5210 MHz IEEE 802.11ac 80MHz Band III : 5775 MHz																																				
Transmit Power (conducted power)	<table> <tr> <td>IEEE 802.11b:</td> <td>0.734 W /</td> <td>28.65 dBm</td> </tr> <tr> <td>IEEE 802.11g:</td> <td>0.653 W /</td> <td>28.15 dBm</td> </tr> <tr> <td>IEEE 802.11n 2.4GHz 20MHz:</td> <td>0.566 W /</td> <td>27.53 dBm</td> </tr> <tr> <td>IEEE 802.11n 2.4GHz 40MHz:</td> <td>0.248 W /</td> <td>23.94 dBm</td> </tr> <tr> <td>IEEE 802.11a Band I :</td> <td>0.454 W /</td> <td>26.57 dBm</td> </tr> <tr> <td>IEEE 802.11a Band III :</td> <td>0.791 W /</td> <td>28.98 dBm</td> </tr> <tr> <td>IEEE 802.11n 5GHz 20MHz Band I :</td> <td>0.479 W /</td> <td>26.81 dBm</td> </tr> <tr> <td>IEEE 802.11n 5GHz 20MHz Band III :</td> <td>0.773 W /</td> <td>28.88 dBm</td> </tr> <tr> <td>IEEE 802.11n 5GHz 40MHz Band I :</td> <td>0.855 W /</td> <td>29.32 dBm</td> </tr> <tr> <td>IEEE 802.11n 5GHz 40MHz Band III :</td> <td>0.734 W /</td> <td>28.66 dBm</td> </tr> <tr> <td>IEEE 802.11ac 80MHz Band I :</td> <td>0.095 W /</td> <td>19.79 dBm</td> </tr> <tr> <td>IEEE 802.11ac 80MHz Band III :</td> <td>0.716 W /</td> <td>28.55 dBm</td> </tr> </table>	IEEE 802.11b:	0.734 W /	28.65 dBm	IEEE 802.11g:	0.653 W /	28.15 dBm	IEEE 802.11n 2.4GHz 20MHz:	0.566 W /	27.53 dBm	IEEE 802.11n 2.4GHz 40MHz:	0.248 W /	23.94 dBm	IEEE 802.11a Band I :	0.454 W /	26.57 dBm	IEEE 802.11a Band III :	0.791 W /	28.98 dBm	IEEE 802.11n 5GHz 20MHz Band I :	0.479 W /	26.81 dBm	IEEE 802.11n 5GHz 20MHz Band III :	0.773 W /	28.88 dBm	IEEE 802.11n 5GHz 40MHz Band I :	0.855 W /	29.32 dBm	IEEE 802.11n 5GHz 40MHz Band III :	0.734 W /	28.66 dBm	IEEE 802.11ac 80MHz Band I :	0.095 W /	19.79 dBm	IEEE 802.11ac 80MHz Band III :	0.716 W /	28.55 dBm
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Transmit Power (conducted power)	Beamforming on		
	IEEE 802.11n 5GHz 20MHz Band I :	0.278 W /	24.44 dBm
IEEE 802.11n 5GHz 20MHz Band III :	0.286 W /	24.56 dBm	
IEEE 802.11n 5GHz 40MHz Band I :	0.485 W /	26.86 dBm	
IEEE 802.11n 5GHz 40MHz Band III :	0.268 W /	24.28 dBm	
IEEE 802.11ac 80MHz Band I :	0.055 W /	17.40 dBm	
IEEE 802.11ac 80MHz Band III :	0.259 W /	24.13 dBm	
Antenna Type	Omni Directional Antenna		
Antenna Max. Gain	2 dBi		
Antenna Delivery	3TX + 3RX		
Temperature Range	0 ~ +40°C		
RF Evaluation	6.89 W/m <sup>2</sup>		

The above equipment was tested by A Test Lab Techno Corp. For compliance with the requirements set forth in 47 CFR § 2.1091 & 47 CFR § 1.1310. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties



## 2. Human Exposure Assessment

Due to the design and installation of this product, it is not possible to conduct SAR evaluation. This is because client either manufactures or supplies the antenna(s) that will be used in the installation of this product. Therefore, this product will be evaluated as a mobile device per 47 CFR §1.1310 titled “Radiofrequency radiation exposure limits”, generally referred to as MPE limits.

In 47 CFR § 2.1091, paragraph (b) defines a mobile device as “a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 cm is normally maintained between the transmitter’s radiating structure(s) and the body of the user or nearby persons. ” This product is intended to be installed into a vehicle such that the unit is physically secured at one location. In the installation guide supplied with the product,

Client has made the following statement: “IMPORTANT: To meet the FCC’s RF Exposure Guidelines, the antenna should be installed so there is at least 20 cm of separation between the body of the user and nearby persons and the antenna”. Based on the installation of the transceiver and the antenna, the transmitters radiating structure is more than 20 cm from the user. Thus, this product is a “mobile device” as defined in section § 2.1091 paragraph (b).

Exposure evaluation

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

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.



### 3. RF Output Power

Band	Data Rate	CH	Frequency (MHz)	Average Power (dBm)			
				ANT-0	ANT-1	ANT-2	ANT-0+1+2
IEEE 802.11b	1M	1	2412.0	20.80	21.76	20.72	25.89
		6	2437.0	24.22	23.99	23.40	28.65
		11	2462.0	21.12	21.91	20.55	26.00
	2M	6	2437.0	24.21	23.78	23.39	28.58
	5.5M	6	2437.0	24.19	23.77	23.38	28.56
	11M	6	2437.0	24.16	23.75	23.37	28.54
IEEE 802.11g	6M	1	2412.0	18.20	17.90	17.71	22.71
		6	2437.0	23.65	23.47	22.98	28.15
		11	2462.0	18.12	17.85	17.66	22.65
	9M	6	2437.0	23.63	23.45	22.96	28.13
	12M	6	2437.0	23.62	23.44	22.95	28.12
	18M	6	2437.0	23.59	23.42	22.93	28.09
	24M	6	2437.0	23.57	23.39	22.90	28.07
	36M	6	2437.0	23.56	23.37	22.88	28.05
	48M	6	2437.0	23.54	23.36	22.87	28.04
	54M	6	2437.0	23.51	23.33	22.84	28.01
IEEE 802.11n 2.4 GHz 20MHz	19.5M	1	2412.0	18.12	17.92	17.53	22.63
		6	2437.0	22.81	22.82	22.63	27.53
		11	2462.0	18.43	18.40	18.02	23.06
	39M	6	2437.0	22.80	22.81	22.61	27.51
	58.5M	6	2437.0	22.77	22.79	22.60	27.49
	78M	6	2437.0	22.76	22.76	22.58	27.47
	117M	6	2437.0	22.74	22.74	22.56	27.45
	156M	6	2437.0	22.73	22.73	22.54	27.44
	175.5M	6	2437.0	22.71	22.71	22.51	27.42
	195M	6	2437.0	22.68	22.69	22.49	27.39
	234M	6	2437.0	22.65	22.65	22.45	27.36
IEEE 802.11n 2.4 GHz 40MHz	40.5M	3	2422.0	15.90	15.05	15.21	20.17
		6	2437.0	19.44	19.01	19.05	23.94
		9	2452.0	15.67	14.99	15.14	20.05
	81M	6	2437.0	19.42	18.69	19.04	23.83
	121.5M	6	2437.0	19.39	18.67	19.02	23.81
	162M	6	2437.0	19.38	18.15	19.00	23.64
	243M	6	2437.0	19.36	18.12	18.97	23.62
	324M	6	2437.0	19.35	18.10	18.95	23.60
	364.5M	6	2437.0	19.33	18.09	18.92	23.58
	405M	6	2437.0	19.28	18.05	18.88	23.54
	486M	6	2437.0	19.22	18.05	18.85	23.50
540M	6	2437.0	19.20	18.03	18.85	23.49	



Band	Date Rate	CH	Frequency (MHz)	Average Power (dBm)			
				ANT-0	ANT-1	ANT-2	ANT-0+1+2
IEEE 802.11a	6M	36	5180.0	18.38	18.50	18.02	23.08
		40	5200.0	21.86	22.03	21.49	26.57
		44	5220.0	19.79	19.90	19.41	24.48
		48	5240.0	19.89	19.97	19.37	24.52
		149	5745.0	23.93	24.44	24.24	28.98
		153	5765.0	23.86	24.39	24.31	28.96
		157	5785.0	23.77	24.17	24.33	28.87
		161	5805.0	23.43	24.26	24.38	28.81
	165	5825.0	23.33	24.21	24.19	28.70	
	54M	36	5180.0	18.11	18.25	17.77	22.82
		40	5200.0	21.67	21.87	21.28	26.38
		44	5220.0	19.51	19.63	19.13	24.20
		48	5240.0	19.64	19.72	19.10	24.27
		149	5745.0	23.80	24.31	24.01	28.82
		153	5765.0	23.73	24.25	24.07	28.79
		157	5785.0	23.65	24.01	24.14	28.71
161		5805.0	23.38	24.12	24.19	28.68	
165	5825.0	23.30	24.06	23.97	28.56		
IEEE 802.11ac 5GHz 20MHz	19.5M	36	5180.0	18.44	18.61	17.89	23.10
		40	5200.0	21.94	22.25	21.31	26.62
		44	5220.0	22.19	22.33	21.55	26.81
		48	5240.0	22.09	22.31	21.60	26.78
		149	5745.0	23.76	24.17	24.38	28.88
		153	5765.0	23.73	24.29	24.23	28.86
		157	5785.0	23.54	24.24	24.14	28.76
		161	5805.0	23.44	24.20	24.11	28.70
	165	5825.0	23.28	23.99	24.25	28.63	
	195M	36	5180.0	18.09	18.23	17.54	22.73
		40	5200.0	21.76	21.99	21.01	26.38
		44	5220.0	21.83	21.96	21.17	26.44
		48	5240.0	21.71	21.96	21.25	26.42
		149	5745.0	23.64	24.05	24.11	28.71
		153	5765.0	23.62	24.18	23.90	28.68
		157	5785.0	23.45	24.11	23.83	28.58
161		5805.0	23.33	24.08	23.79	28.52	
165	5825.0	23.19	23.86	23.94	28.45		



Band	Data Rate	CH	Frequency (MHz)	Average Power (dBm)			
				ANT-0	ANT-1	ANT-2	ANT-0+1+2
IEEE 802.11ac 5GHz 40MHz	40.5M	38	5190.0	15.48	16.73	16.34	20.99
		46	5230.0	24.75	24.95	23.88	29.32
		151	5755.0	23.68	24.06	23.91	28.66
		159	5795.0	23.45	23.99	23.83	28.53
	405M	38	5190.0	15.15	16.44	16.04	20.68
		46	5230.0	23.76	23.97	22.85	28.32
		151	5755.0	23.53	23.91	23.64	28.47
		159	5795.0	23.38	23.81	23.59	28.37
IEEE 802.11ac 80MHz	87.9M	42	5210.0	14.63	15.42	14.97	19.79
		155	5775.0	23.55	23.93	23.84	28.55
	1170M	42	5210.0	13.86	14.52	14.05	18.92
		155	5775.0	23.41	23.76	23.65	28.38





Beamforming on

Band	Date Rate	CH	Frequency (MHz)	Average Power (dBm)			
				ANT-0	ANT-1	ANT-2	ANT-0+1+2
IEEE 802.11ac 5GHz 20MHz	19.5M	36	5180.0	16.04	16.26	15.56	20.73
		40	5200.0	19.55	19.97	19.01	24.30
		44	5220.0	19.81	20.08	18.91	24.40
		48	5240.0	19.69	19.98	19.31	24.44
		149	5745.0	19.44	19.85	20.05	24.56
		153	5765.0	19.39	19.93	19.94	24.53
		157	5785.0	19.21	19.91	19.81	24.43
		161	5805.0	19.08	19.88	19.79	24.37
	165	5825.0	18.94	19.67	19.91	24.30	
	195M	36	5180.0	15.69	15.93	15.24	20.40
		40	5200.0	19.38	19.61	18.84	24.06
		44	5220.0	19.48	19.71	18.71	24.09
		48	5240.0	19.31	19.65	18.96	24.09
		149	5745.0	19.27	19.71	19.78	24.36
		153	5765.0	19.25	19.85	19.57	24.33
		157	5785.0	19.12	19.73	19.45	24.21
		161	5805.0	19.00	19.72	19.44	24.17
	165	5825.0	18.86	19.53	19.53	24.09	
IEEE 802.11ac 5GHz 40MHz	40.5M	38	5190.0	13.02	14.44	14.05	18.65
		46	5230.0	22.19	22.52	21.48	26.86
		151	5755.0	19.31	19.69	19.52	24.28
		159	5795.0	19.05	19.62	19.46	24.15
	405M	38	5190.0	12.68	14.11	13.75	18.33
		46	5230.0	21.20	21.68	20.55	25.94
		151	5755.0	19.15	19.54	19.28	24.10
		159	5795.0	19.00	19.44	19.22	23.99
IEEE 802.11ac 80MHz	87.9M	42	5210.0	12.09	13.06	12.67	17.40
		155	5775.0	19.13	19.55	19.39	24.13
	1170M	42	5210.0	11.39	12.25	11.69	16.56
		155	5775.0	19.01	19.37	19.24	23.98



#### 4. Test Result

Band	Data Rate	Frequency (MHz)	Limit (mw/cm <sup>2</sup> )	Distance (cm) [R]	Max power (dBm) [P]	ANT Gain (dBi)	Numeric Gain [G] (dBi)	Duty Cycle	[P] x [G] With Duty Cycle (mW) [TP]	Power Density [S] (mw/cm <sup>2</sup> )
IEEE 802.11b	1 M	2412.0	1	20	25.89	2	1.58	1	613.400	0.122
		2437.0	1	20	28.65	2	1.58	1	1159.130	0.231
		2462.0	1	20	26.00	2	1.58	1	629.090	0.125
IEEE 802.11g	6 M	2412.0	1	20	22.71	2	1.58	1	295.060	0.059
		2437.0	1	20	28.15	2	1.58	1	1031.070	0.205
		2462.0	1	20	22.65	2	1.58	1	290.980	0.058
IEEE 802.11n 2.4GHz 20MHz	19.5 M	2412.0	1	20	22.63	2	1.58	1	289.820	0.058
		2437.0	1	20	27.53	2	1.58	1	893.710	0.178
		2462.0	1	20	23.06	2	1.58	1	319.530	0.064
IEEE 802.11n 2.4GHz 40MHz	40.5 M	2422.0	1	20	20.17	2	1.58	1	164.450	0.033
		2437.0	1	20	23.94	2	1.58	1	391.640	0.078
		2452.0	1	20	20.05	2	1.58	1	159.750	0.032

Note: The Numeric Gain calculated by  $10^{(\text{ant. Gain(dBi)} / 10)}$ .



Band	Data Rate	Frequency (MHz)	Limit (mw/cm <sup>2</sup> )	Distance (cm) [R]	Max power (dBm) [P]	ANT Gain (dBi)	Numeric Gain [G] (dBi)	Duty Cycle	[P] x [G] With Duty Cycle (mW) [TP]	Power Density [S] (mw/cm <sup>2</sup> )
IEEE 802.11a	6M	5180.0	1	20	23.08	2	1.58	1	320.810	0.064
		5200.0	1	20	26.57	2	1.58	1	717.290	0.143
		5220.0	1	20	24.48	2	1.58	1	442.870	0.088
		5240.0	1	20	24.52	2	1.58	1	447.630	0.089
		5745.0	1	20	28.98	2	1.58	1	1249.150	0.249
		5765.0	1	20	28.96	2	1.58	1	1244.700	0.248
		5785.0	1	20	28.87	2	1.58	1	1217.340	0.242
		5805.0	1	20	28.81	2	1.58	1	1202.590	0.239
		5825.0	1	20	28.70	2	1.58	1	1171.310	0.233
IEEE 802.11ac 5GHz 20MHz	19.5M	5180.0	1	20	23.10	2	1.58	1	322.240	0.064
		5200.0	1	20	26.62	2	1.58	1	725.860	0.144
		5220.0	1	20	26.81	2	1.58	1	757.560	0.151
		5240.0	1	20	26.78	2	1.58	1	752.980	0.150
		5745.0	1	20	28.88	2	1.58	1	1221.430	0.243
		5765.0	1	20	28.86	2	1.58	1	1215.700	0.242
		5785.0	1	20	28.76	2	1.58	1	1186.300	0.236
		5805.0	1	20	28.70	2	1.58	1	1171.510	0.233
		5825.0	1	20	28.63	2	1.58	1	1152.610	0.229
IEEE 802.11ac 5GHz 40MHz	40.5M	5190.0	1	20	20.99	2	1.58	1	198.240	0.039
		5230.0	1	20	29.32	2	1.58	1	1351.670	0.269
		5755.0	1	20	28.66	2	1.58	1	1159.820	0.231
		5795.0	1	20	28.53	2	1.58	1	1127.280	0.224
IEEE 802.11ac 80MHz	87.9M	5210.0	1	20	19.79	2	1.58	1	150.540	0.030
		5775.0	1	20	28.55	2	1.58	1	1130.870	0.225

Note: The Numeric Gain calculated by  $10^{(\text{ant. Gain(dBi)} / 10)}$ .



Beamforming on

Band	Data Rate	Frequency (MHz)	Limit (mw/cm <sup>2</sup> )	Distance (cm) [R]	Max power (dBm) [P]	ANT Gain (dBi)	Numeric Gain [G] (dBi)	Duty Cycle	[P] x [G] With Duty Cycle (mW) [TP]	Power Density [S] (mw/cm <sup>2</sup> )
IEEE 802.11ac 5GHz 20MHz	19.5M	5180.0	1	20	20.73	6.77	4.75	1	562.500	0.112
		5200.0	1	20	24.30	6.77	4.75	1	1278.150	0.254
		5220.0	1	20	24.40	6.77	4.75	1	1308.070	0.260
		5240.0	1	20	24.44	6.77	4.75	1	1320.320	0.263
		5745.0	1	20	24.56	6.77	4.75	1	1356.910	0.270
		5765.0	1	20	24.53	6.77	4.75	1	1348.640	0.268
		5785.0	1	20	24.43	6.77	4.75	1	1315.920	0.262
		5805.0	1	20	24.37	6.77	4.75	1	1298.950	0.258
IEEE 802.11ac 5GHz 40MHz	40.5M	5190.0	1	20	18.65	6.77	4.75	1	347.950	0.069
		5230.0	1	20	26.86	6.77	4.75	1	2302.940	0.458
		5755.0	1	20	24.28	6.77	4.75	1	1272.800	0.253
		5795.0	1	20	24.15	6.77	4.75	1	1236.340	0.246
IEEE 802.11ac 80MHz	87.9M	5210.0	1	20	17.40	6.77	4.75	1	260.790	0.052
		5775.0	1	20	24.13	6.77	4.75	1	1229.770	0.245

Note: 1.The Numeric Gain calculated by  $10^{(\text{ant. Gain(dBi)} / 10)}$ .

2.The ANT Gain = Directional Gain = GANT +  $10 \cdot \log(\text{NANT/NSS}) = 6.77 \text{ dBi}$

**Simultaneous Transmitting:**

Simultaneous MPE = 2.4GHz MPE+5GHz MPE =  $0.231+0.458=0.689 \text{ mw/cm}^2 < 1 \text{ mw/cm}^2$