A Test Lab Techno Corp.

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MPE Report

Test Report No.	：	1811FS13
Applicant	：	DIGI SINGAPORE PTE LTD
Product Type	：	IEEE 802.11a/b/g/n/ac 2x2 WirelessLAN USB Client
Trade Name	：	DIGI
Model Number	：	AP-3002AN
Received Date	：	Oct. 04, 2018
Test Period	：	Oct. 22 ~ Nov. 01, 2018
Issue Date	：	Oct. 15, 2018
Test Specification	：	ANSI / IEEE Std.C95.1-1992 / IEEE Std. 1528-2013
		47 CFR § 2.1091
		47 CFR § 1.1310
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 ： Edison Hu (Edison Hu)　　Tested By ： Kris Pan (Kris Pan)

Contents

1. Description of Equipment under Test (EUT)

Applicant	DIGI SINGAPORE PTE LTD 4 Leng Kee Rd, #05-03/04/05&11, SIS Building, Singapore 159088	
Manufacturer	DIGI SINGAPORE PTE. LTD. 4 Leng Kee Rd, #05-03/04/05&11, SIS Building, Singapore 159088	
Product Type	IEEE 802.11a/b/g/n/ac 2x2 WirelessLAN USB Client	
Trade Name	DIGI	
Model Number	AP-3002AN	
FCC ID	SUFAP3002AN	
Frequency Range	Operate Band	Frequency Range (MHz)
	IEEE 802.11b / 802.11g IEEE 802.11n 2.4 GHz 20 MHz	2412 - 2462
	IEEE 802.11n 2.4 GHz 40 MHz	2422 - 2452
	IEEE 802.11a U-NII Band I	5180 - 5240
	IEEE 802.11a U-NII Band II-A	5260 - 5320
	IEEE 802.11a U-NII Band II-C	5500 - 5700
	IEEE 802.11a U-NII Band III	5745 - 5825
	IEEE 802.11ac / 802.11n 5 GHz 20 MHz U-NII Band I	5180 - 5240
	IEEE 802.11ac / 802.11n 5 GHz 20 MHz U-NII Band II-A	5260 - 5320
	IEEE 802.11ac / 802.11n 5 GHz 20 MHz U-NII Band II-C	5500 - 5700
	IEEE 802.11ac / 802.11n 5 GHz 20 MHz U-NII Band III	5745 - 5825
	IEEE 802.11ac / 802.11n 5 GHz 40 MHz U-NII Band I	5190 - 5230
	IEEE 802.11ac / 802.11n 5 GHz 40 MHz U-NII Band II-A	5270 - 5310
	IEEE 802.11ac / 802.11n 5 GHz 40 MHz U-NII Band II-C	5510 - 5670
	IEEE 802.11ac / 802.11n 5 GHz 40 MHz U-NII Band III	5755 - 5795
	IEEE 802.11ac 80 MHz U-NII Band I	5210
	IEEE 802.11ac 80 MHz U-NII Band II-A	5290
	IEEE 802.11ac 80 MHz U-NII Band II-C	5530
	IEEE 802.11ac 80 MHz U-NII Band III	5775

Antenna information	ANT	Model	Type	Max. Gain (dBi)	
	ANT-0	AP-3002AN-ANT1	PIFA antenna	2.4 GHz	2.41
				U-NII Band I	4.67
				U-NII Band II-A	4.65
				U-NII Band II-C	4.54
				U-NII Band III	3.69
	ANT-1	AP-3002AN-ANT2	PIFA antenna	2.4 GHz	2.75
				U-NII Band I	4.36
				U-NII Band II-A	3.70
				U-NII Band II-C	4.38
				U-NII Band III	4.72
	G_{ANT}			2.4 GHz	2.58
				U-NII Band I	4.52
				U-NII Band II-A	4.20
				U-NII Band II-C	4.46
				U-NII Band III	4.24
	Directional Gain			IEEE 802.11b	2.41
				IEEE 802.11g	2.41
				IEEE 802.11n 2.4 GHz 20 MHz	2.58
				IEEE 802.11n 2.4 GHz 40 MHz	2.58
				IEEE 802.11a U-NII Band I	4.67
				IEEE 802.11a U-NII Band II-A	4.65
				IEEE 802.11a U-NII Band II-C	4.54
				IEEE 802.11a U-NII Band III	3.69
				IEEE 802.11ac 20 MHz U-NII Band I	4.52
				IEEE 802.11ac 20 MHz U-NII Band II-A	4.20
				IEEE 802.11ac 20 MHz U-NII Band II-C	4.46
				IEEE 802.11ac 20 MHz U-NII Band III	4.24
				IEEE 802.11ac 40 MHz U-NII Band I	4.52
				IEEE 802.11ac 40 MHz U-NII Band II-A	4.20
				IEEE 802.11ac 40 MHz U-NII Band II-C	4.46
				IEEE 802.11ac 40 MHz U-NII Band III	4.24
				IEEE 802.11ac 80 MHz U-NII Band I	4.52
				IEEE 802.11ac 80 MHz U-NII Band II-A	4.20
				IEEE 802.11ac 80 MHz U-NII Band II-C	4.46
				IEEE 802.11ac 80 MHz U-NII Band III	4.24

Antenna Delivery	IEEE 802.11b / IEEE 802.11g: 1TX (Diversity) IEEE 802.11n 2.4GHz 20 MHz / 40 MHz: 2TX (STBC) IEEE 802.11a: 1TX (Diversity) IEEE 802.11ac 20 MHz / 40 MHz / 80 MHz: 2TX (STBC)
RF Evaluation	0.129 mW/cm^2
Temperature Range	0 ~ +60°C

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

The conducted power turn-up tolerance reference manufacturer specification.

Band	Date Rate (Mbps)	Frequency (MHz)	Average Conducted power (dBm)		
			ANT-0	ANT-1	ANT-0+1
IEEE 802.11b	1	2412.0	18.30	18.13	---
		2437.0	**18.34**	18.11	**---**
		2462.0	18.28	18.20	---
	2	2437.0	18.25	18.08	**---**
	5.5	2437.0	18.27	18.10	---
	11	2437.0	18.22	18.04	**---**
IEEE 802.11g	6	2412.0	15.65	15.57	---
		2437.0	**17.37**	17.23	**---**
		2462.0	17.28	17.19	---
	9	2437.0	17.25	17.18	**---**
	12	2437.0	17.24	17.16	---
	18	2437.0	17.20	17.10	**---**
	24	2437.0	17.23	17.10	---
	36	2437.0	17.27	17.13	**---**
	48	2437.0	17.26	17.15	---
	54	2437.0	17.28	17.20	**---**
IEEE 802.11n 2.4 GHz 20 MHz	13	2412.0	14.90	15.62	18.29
		2437.0	16.49	17.26	**19.90**
		2462.0	14.69	14.71	17.71
	28.8	2437.0	16.39	17.17	19.81
	43.4	2437.0	16.38	17.15	19.79
	57.8	2437.0	16.41	17.13	19.80
	86.6	2437.0	16.39	17.14	19.79
	115.6	2437.0	16.43	17.13	19.80
	130	2437.0	16.40	17.18	19.82
	144.4	2437.0	16.38	17.17	19.80
IEEE 802.11n 2.4 GHz 40 MHz	27	2422.0	14.92	16.10	18.56
		2437.0	17.01	17.16	**20.10**
		2452.0	14.34	14.15	17.26
	60	2437.0	16.89	17.02	19.97
	90	2437.0	16.88	17.05	19.98
	120	2437.0	16.90	17.09	20.01
	180	2437.0	16.92	17.05	20.00
	240	2437.0	16.92	17.06	20.00
	270	2437.0	16.89	17.02	19.97
	300	2437.0	16.93	17.03	19.99

Note: The relevant measured result has the offset with cable loss already.

Band	Date Rate (Mbps)	Frequency (MHz)	Average Conducted power (dBm)		
			ANT-0	ANT-1	ANT-0+1
IEEE 802.11a	6	5180.0	19.57	19.43	---
		5200.0	19.58	19.44	**---**
		5220.0	18.75	18.60	---
		5240.0	19.59	19.48	**---**
		5260.0	19.53	19.40	---
		5280.0	19.61	19.48	**---**
		5300.0	19.61	19.49	---
		5320.0	19.54	19.35	**---**
		5500.0	19.54	19.36	---
		5520.0	19.56	19.32	**---**
		5540.0	19.53	19.35	---
		5560.0	19.51	19.36	**---**
		5580.0	19.49	19.36	---
		5660.0	19.49	19.38	**---**
		5680.0	19.53	19.39	---
		5700.0	19.58	19.29	**---**
		5745.0	19.57	19.31	---
		5765.0	19.57	19.26	**---**
		5785.0	19.60	19.33	---
		5805.0	19.54	19.28	**---**
		5825.0	**19.67**	19.33	---
IEEE 802.11ac 20 MHz	13	5180.0	15.58	15.59	18.60
		5200.0	15.57	15.52	18.56
		5220.0	15.48	15.55	18.53
		5240.0	15.50	15.52	18.52
		5260.0	15.43	15.48	18.47
		5280.0	15.47	15.56	18.53
		5300.0	15.53	15.47	18.51
		5320.0	15.59	15.51	18.56
		5500.0	15.55	15.58	18.58
		5520.0	15.56	15.50	18.54
		5540.0	15.51	15.54	18.54
		5560.0	15.47	15.59	18.54
		5580.0	15.44	15.54	18.50
		5660.0	15.64	15.61	18.64
		5680.0	15.56	15.62	18.60
		5700.0	15.56	15.63	18.61
		5745.0	18.55	18.53	21.55
		5765.0	18.50	18.56	21.54
		5785.0	18.54	18.62	21.59
		5805.0	18.54	18.49	21.53
		5825.0	18.61	18.58	**21.61**

Note: The relevant measured result has the offset with cable loss already.

Band	Date Rate (Mbps)	Frequency (MHz)	Average Conducted power (dBm)		
			ANT-0	ANT-1	ANT-0+1
IEEE 802.11ac 40 MHz	27	5190.0	18.60	18.57	21.60
		5230.0	18.65	18.61	**21.64**
		5270.0	18.58	18.65	21.63
		5310.0	18.50	18.60	21.56
		5510.0	18.57	18.50	21.55
		5550.0	18.52	18.55	21.55
		5670.0	18.60	18.62	21.62
		5755.0	18.63	18.49	21.57
		5795.0	18.53	18.57	21.56
IEEE 802.11ac 80 MHz	58.6	5210.0	18.48	18.48	21.49
		5290.0	18.56	18.59	21.59
		5530.0	18.56	18.51	21.55
		5775.0	18.62	18.59	**21.62**

Note: The relevant measured result has the offset with cable loss already.

4. Test Results

WLAN Antenna_Diversity_Ant-0										
Band	Data Rate (Mbps)	Frequency (MHz)	Limit (mw)	Distance [R] (cm)	Max tune-up Power (upper limit) [P] (dBm)	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	Power with Duty cycle [TP] (mW)	Power Density [S] (mw/cm^2)
IEEE 802.11b	1	2412.0	1	20	18.50	2.41	1.74	1	123.18	0.025
		2437.0	1	20	18.50	2.41	1.74	1	123.18	0.025
		2462.0	1	20	18.50	2.41	1.74	1	123.18	0.025
IEEE 802.11g	6	2412.0	1	20	17.50	2.41	1.74	1	97.85	0.019
		2437.0	1	20	17.50	2.41	1.74	1	97.85	0.019
		2462.0	1	20	17.50	2.41	1.74	1	97.85	0.019
IEEE 802.11a	6	5180.0	1	20	20	4.67	2.93	1	293	0.058
		5200.0	1	20	20	4.67	2.93	1	293	0.058
		5220.0	1	20	20	4.67	2.93	1	293	0.058
		5240.0	1	20	20	4.67	2.93	1	293	0.058
		5260.0	1	20	20	4.65	2.92	1	292	0.058
		5280.0	1	20	20	4.65	2.92	1	292	0.058
		5300.0	1	20	20	4.65	2.92	1	292	0.058
		5320.0	1	20	20	4.65	2.92	1	292	0.058
		5500.0	1	20	20	4.54	2.84	1	284	0.057
		5520.0	1	20	20	4.54	2.84	1	284	0.057
		5540.0	1	20	20	4.54	2.84	1	284	0.057
		5560.0	1	20	20	4.54	2.84	1	284	0.057
		5580.0	1	20	20	4.54	2.84	1	284	0.057
		5660.0	1	20	20	4.54	2.84	1	284	0.057
		5680.0	1	20	20	4.54	2.84	1	284	0.057
		5700.0	1	20	20	4.54	2.84	1	284	0.057
		5745.0	1	20	20	3.69	2.34	1	234	0.047
		5765.0	1	20	20	3.69	2.34	1	234	0.047
		5785.0	1	20	20	3.69	2.34	1	234	0.047
		5805.0	1	20	20	3.69	2.34	1	234	0.047
		5825.0	1	20	20	3.69	2.34	1	234	0.047

WLAN Antenna_STBC										
Band	Data Rate (Mbps)	Frequency (MHz)	Limit (mw)	Distance [R] (cm)	Max tune-up Power (upper limit) [P] (dBm)	ANT Gain (dBi)	Numeric Gain [G]	Duty Cycle	Power with Duty cycle [TP] (mW)	Power Density [S] (mw/cm^2)
IEEE 802.11n 2.4 GHz 20 MHz	13	2412.0	1	20	20.50	2.58	1.81	1	203.09	0.040
		2437.0	1	20	20.50	2.58	1.81	1	203.09	0.040
		2462.0	1	20	20.50	2.58	1.81	1	203.09	0.040
IEEE 802.11n 2.4 GHz 40 MHz	27	2422.0	1	20	20.50	2.58	1.81	1	203.09	0.040
		2437.0	1	20	20.50	2.58	1.81	1	203.09	0.040
		2452.0	1	20	20.50	2.58	1.81	1	203.09	0.040
IEEE 802.11ac 20 MHz	13	5180.0	1	20	19	4.52	2.83	1	224.79	0.045
		5200.0	1	20	19	4.52	2.83	1	224.79	0.045
		5220.0	1	20	19	4.52	2.83	1	224.79	0.045
		5240.0	1	20	19	4.52	2.83	1	224.79	0.045
		5260.0	1	20	19	4.20	2.63	1	208.91	0.042
		5280.0	1	20	19	4.20	2.63	1	208.91	0.042
		5300.0	1	20	19	4.20	2.63	1	208.91	0.042
		5320.0	1	20	19	4.20	2.63	1	208.91	0.042
		5500.0	1	20	19	4.46	2.79	1	221.62	0.044
		5520.0	1	20	19	4.46	2.79	1	221.62	0.044
		5540.0	1	20	19	4.46	2.79	1	221.62	0.044
		5560.0	1	20	19	4.46	2.79	1	221.62	0.044
		5580.0	1	20	19	4.46	2.79	1	221.62	0.044
		5660.0	1	20	19	4.46	2.79	1	221.62	0.044
		5680.0	1	20	19	4.46	2.79	1	221.62	0.044
		5700.0	1	20	19	4.46	2.79	1	221.62	0.044
		5745.0	1	20	22	4.24	2.65	1	420	0.084
		5765.0	1	20	22	4.24	2.65	1	420	0.084
		5785.0	1	20	22	4.24	2.65	1	420	0.084
		5805.0	1	20	22	4.24	2.65	1	420	0.084
		5825.0	1	20	22	4.24	2.65	1	420	0.084
IEEE 802.11ac 40 MHz	27	5190.0	1	20	22	4.52	2.83	1	448.52	0.089
		5230.0	1	20	22	4.52	2.83	1	448.52	0.089
		5270.0	1	20	22	4.20	2.63	1	416.83	0.083
		5310.0	1	20	22	4.20	2.63	1	416.83	0.083
		5510.0	1	20	22	4.46	2.79	1	442.19	0.088
		5550.0	1	20	22	4.46	2.79	1	442.19	0.088
		5670.0	1	20	22	4.46	2.79	1	442.19	0.088
		5755.0	1	20	22	4.24	2.65	1	420	0.084
		5795.0	1	20	22	4.24	2.65	1	420	0.084
IEEE 802.11ac 80 MHz	58.6	5210.0	1	20	22	4.52	2.83	1	448.52	0.089
		5290.0	1	20	22	4.20	2.63	1	416.83	0.083
		5530.0	1	20	22	4.46	2.79	1	442.19	0.088
		5775.0	1	20	22	4.24	2.65	1	420	0.084

Note:

1. Mobile or fixed location transmitters, minimum separation distance is 20cm, even if calculations indicate MPE distance is less.
2. The Numeric Gain calculated by 10^(ant. Gain(dBi) /10).
3. Each band max power which perform MPE of any configurations.
4. The MPE results are evaluated by lowest data rate for WLAN.
5. The device operating IEEE 802.11 a/b/g mode is 1TX (Diversity).
6. The device operating IEEE 802.11 n/ac mode is 2TX (STBC).
7. The device support simultaneous transmission.

Simultaneous Transmitting:

Total MPE = 2.4 GHz MPE+5 GHz MPE = 0.040 + 0.089 = 0.129 mw/cm^2 < 1 mw/cm^2