Testing Laboratory 3787

RADIO EXPOSURE TEST REPORT

FCC ID	:	LDK-RUSS9105AXW
Equipment	:	Catalyst 9105AX 802.11ax Access Point
Brand Name	:	Cisco
Model Name	:	C9105AXW-B, C9105AXW-C, C9105AXW-D, C9105AXW-F, C9105AXW-N, C9105AXW-S, C9105AXW-K, C9105AXW-x (Refer to section 1.3 for more details)
Applicant	:	Cisco Systems, Inc. 125 West Tasman Drive, San Jose, California, United States, 95134-1706
Manufacturer	:	Cisco Systems, Inc. 125 West Tasman Drive, San Jose, California, United States, 95134-1706
Standard	:	47 CFR Part 2.1091

The product was received on Feb. 27, 2020, and testing was started from Mar. 05, 2020 and completed on Jul. 08, 2022. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory
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History of this test report

Report No.	Version	Description	Issued Date
FA992017-11	01	Initial issue of report	Jul. 19, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-
Note: Reference to Sporton Project No.: FA992017-02				

Declaration of Conformity:
1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results. 2. The measurement uncertainty please refer to report "Measurement Uncertainty".
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Jessie Wei

1 General Description

1.1 EUT General Information

RF General Information			
Evaluation Mode	**Frequency Range (MHz)**	**Operating Frequency (MHz)**	**Modulation Type**
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850	5180-5240 5260-5320 5500-5720 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Bluetooth	2400-2483.5	2402-2480	LE: GFSK

1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	PEGATRON	WIFI_1 ant	PIFA	I-PEX	Note 1
2	2	PEGATRON	WIFI_2 ant	PIFA	I-PEX	
3	1	PEGATRON	BLE ant	PIFA	I-PEX	

Note 1:

Ant.	Port	WLAN 2.4GHz Gain (dBi)							
		2400 MHz	2412 MHz	2437 MHz	2442 MHz	2450 MHz	2462 MHz	2472 MHz	2500 MHz
1	1	2.02	1.81	2.25	2.37	2.51	2.48	2.20	2.14
2	2	1.55	1.63	2.10	2.23	2.20	2.07	1.75	1.99

Ant.	Port	WLAN 5GHz Gain (dBi)							
		5150 MHz	5250 MHz	5350 MHz	5470 MHz	5500 MHz	5600 MHz	5725 MHz	5850 MHz
1	1	4.91	4.97	4.88	4.93	4.82	4.73	4.78	4.93
2	2	4.58	4.76	4.60	4.41	4.35	4.25	4.40	4.56

Ant.	Port	BT Gain (dBi)							
		2400 MHz	2412 MHz	2437 MHz	2442 MHz	2450 MHz	2462 MHz	2472 MHz	2500 MHz
3	1	2.47	2.45	2.55	2.70	2.69	2.64	2.58	2.62

Note 2: The above information was declared by manufacturer.

Note 3: Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$Directional\ Gain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{sc}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$
BF	$Directional\ Gain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{sc}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$	$Directional\ Gain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{sc}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

Ex.

Directional Gain (NSS1) formula : $Directional\ Gain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{sc}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$

NSS1(g1,1) = $10^{G1/20}$; NSS1(g1,2)= $10^{G2/20}$;

gj,k =(Nss1(g1,1) + Nss1(g1,2)

DG = 10 log[(Nss1(g1,1) + Nss1(g1,2) / N_{ANT}] => 10 log[($10^{G1/20}$ + $10^{G2/20}$)^2 / N_{ANT}]

Where ;

G1 = 10 ; G2 = 10 ; G3 = 10 ; G4 = 10 ;

2.4G
2412MHz G1 = 1.81dBi ; G2 = 1.63dBi ;2T1S DG=4.73 dBi 2T2S DG=1.72 dBi
2437MHz G1 = 2.25dBi ; G2 = 2.1dBi ;2T1S DG=5.19 dBi 2T2S DG=2.18 dBi
2462MHz G1 = 2.48dBi ; G2 = 2.07dBi ;2T1S DG=5.29 dBi 2T2S DG=2.28 dBi

5G
5180MHz G1 = 4.91dBi ; G2 = 4.58dBi ;2T1S DG=7.76 dBi 2T2S DG=4.75 dBi
5200MHz G1 = 4.97dBi ; G2 = 4.76dBi ;2T1S DG=7.88 dBi 2T2S DG=4.87 dBi
5240MHz G1 = 4.97dBi ; G2 = 4.76dBi ;2T1S DG=7.88 dBi 2T2S DG=4.87 dBi
5260MHz G1 = 4.97dBi ; G2 = 4.76dBi ;2T1S DG=7.88 dBi 2T2S DG=4.87 dBi
5300MHz G1 = 4.97dBi ; G2 = 4.76dBi ;2T1S DG=7.88 dBi 2T2S DG=4.87 dBi
5320MHz G1 = 4.88dBi ; G2 = 4.6dBi ;2T1S DG=7.75 dBi 2T2S DG=4.74 dBi
5500MHz G1 = 4.82dBi ; G2 = 4.35dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5580MHz G1 = 4.73dBi ; G2 = 4.25dBi ;2T1S DG=7.5 dBi 2T2S DG=4.5 dBi
5700MHz G1 = 4.78dBi ; G2 = 4.4dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5720MHz G1 = 4.78dBi ; G2 = 4.4dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5745MHz G1 = 4.78dBi ; G2 = 4.56dBi ;2T1S DG=7.6 dBi 2T2S DG=4.67 dBi
5785MHz G1 = 4.78dBi ; G2 = 4.56dBi ;2T1S DG=7.6 dBi 2T2S DG=4.67 dBi
5825MHz G1 = 4.93dBi ; G2 = 4.56dBi ;2T1S DG=7.76 dBi 2T2S DG=4.75 dBi
5190MHz G1 = 4.91dBi ; G2 = 4.58dBi ;2T1S DG=7.76 dBi 2T2S DG=4.75 dBi
5230MHz G1 = 4.97dBi ; G2 = 4.76dBi ;2T1S DG=7.88 dBi 2T2S DG=4.87 dBi
5270MHz G1 = 4.97dBi ; G2 = 4.76dBi ;2T1S DG=7.88 dBi 2T2S DG=4.87 dBi
5310MHz G1 = 4.88dBi ; G2 = 4.6dBi ;2T1S DG=7.75 dBi 2T2S DG=4.74 dBi
5510MHz G1 = 4.82dBi ; G2 = 4.35dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5550MHz G1 = 4.82dBi ; G2 = 4.35dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5670MHz G1 = 4.78dBi ; G2 = 4.4dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5710MHz G1 = 4.78dBi ; G2 = 4.4dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5755MHz G1 = 4.78dBi ; G2 = 4.4dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5795MHz G1 = 4.93dBi ; G2 = 4.56dBi ;2T1S DG=7.76 dBi 2T2S DG=4.75 dBi
5210MHz G1 = 4.97dBi ; G2 = 4.76dBi ;2T1S DG=7.88 dBi 2T2S DG=4.87 dBi
5290MHz G1 = 4.97dBi ; G2 = 4.76dBi ;2T1S DG=7.88 dBi 2T2S DG=4.87 dBi
5530MHz G1 = 4.82dBi ; G2 = 4.35dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5610MHz G1 = 4.73dBi ; G2 = 4.25dBi ;2T1S DG=7.5 dBi 2T2S DG=4.5 dBi
5690MHz G1 = 4.78dBi ; G2 = 4.4dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi
5775MHz G1 = 4.78dBi ; G2 = 4.4dBi ;2T1S DG=7.6 dBi 2T2S DG=4.59 dBi

Note 4:

For 2.4GHz function:
For IEEE 802.11 b/g/n/ax (1TX/1RX):
Only Port 1 can be used as transmitting/receiving antenna.
For IEEE 802.11 b/g/n/ax (2TX/2RX):
Port 1 and Port 2 can be used as transmitting/receiving antenna.
Port 1 and Port 2 could transmit/receive simultaneously.
For 5GHz function:
For IEEE 802.11a/n/ac/ax (1TX/1RX):
Only Port 1 can be used as transmitting/receiving antenna.
For IEEE 802.11a/n/ac/ax (2TX/2RX):
Port 1 and Port 2 can be used as transmitting/receiving antenna.
Port 1 and Port 2 could transmit/receive simultaneously.
For Bluetooth function:
Only Port 1 can be used as transmitting/receiving antenna.

1.3 Table for Multiple Listing

The model names in the following table are all refer to the identical product.

Model Name	Description
C9105AXW-B	All the models are identical, the difference model for difference marketing strategy.
C9105AXW-C	
C9105AXW-D	
C9105AXW-F	
C9105AXW-N	
C9105AXW-S	
C9105AXW-K	
C9105AXW-x (x can be A-Z, regional country code)	

Note 1: From the above models, model: C9105AXW-B was selected as representative model for the test and its data was recorded in this report.

Note 2: The above information was declared by manufacturer.

1.4 Accessories

Optional				
No.	**Equipment Name**	**Brand Name**	**Model Name**	**Remark**
1	Mounting bracket*1	PEGATRON	13BK-30N1601	-
2	Jumper cable*1	Tung-Li	1402-00WF000	Non-Shielded, 0.07m
3	Back cover*1	PEGATRON	13BK-30B0901	-
4	Spacer box*1	PEGATRON	13BK-30Q0701	-
5	RJ-45 cable*1	CISCO	72-101204-01	Non-Shielded, 1.5m

1.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 2.1091
- KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- 47 CFR Part 1.1307
- 47 CFR Part 1.1310

1.6 Testing Location

Testing Location Information		
Test Lab.：Sporton International Inc. Hsinchu Laboratory		
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)	
(TAF: 3787)	TEL: 886-3-656-9065	FAX: 886-3-656-9085
	Test site Designation No. TW3787 with FCC.	
	Conformity Assessment Body Identifier (CABID) TW3787 with ISED.	

Note: The tested sample of the test item (output power of bluetooth) was received on Jun. 13, 2022.

2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
0.3-3.0	614	1.63	*(100)	<6
3.0-30	1842/f	4.89/f	*(900/f^2)	<6
30-300	61.4	0.163	1.0	<6
300-1500	-	-	f/300	<6
1500-100,000	-	-	5	<6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time |E|²,|H|² or S (minutes)
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
300-1500	-	-	f/1500	<30
1500-100,000	-	-	1.0	<30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE Calculation Method

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

Pd = $\frac{30 \times P \times G}{377 \times d^2}$

2.3 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth.

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

Option (C): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance R between the person and the antenna / radiating structure, where R > λ / 2 π.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	**Threshold ERP (watts)**
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 R^2f.
1,500-100,000	19.2R^2.
Note: R is in meters, f is in MHz.	

2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm^2)	S Limit (mW/cm^2)
2.4G;D1D	5.19	20.48	25.67	0.50	26.17	0.41400	20	0.08236	1.00000
5.2G;D1D	7.88	20.74	28.62	0.50	29.12	0.81658	20	0.16245	1.00000
5.3G;D1D	7.88	20.75	28.63	0.50	29.13	0.81846	20	0.16283	1.00000
5.6G;D1D	7.50	20.67	28.17	0.50	28.67	0.73621	20	0.14646	1.00000
5.8G;D1D	7.76	20.46	28.22	0.50	28.72	0.74473	20	0.14816	1.00000
2.4G;BT-LE	2.70	5.55	8.25	0.50	8.75	0.00750	20	0.00149	1.00000

MPE Exemption Option B						
Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	MPE Exemption
2437	0.2	26.17	24.02	0.252	3.060	Complies
5300		29.13	26.98	0.499	3.060	Complies
2440		8.75	6.60	0.005	3.060	Complies

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz + WLAN 5GHz + Bluetooth LE

Simultaneous Transmissions Option B							
Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	Simultaneous Transmissions	Simultaneous Transmissions Limit
2437	0.2	26.17	24.02	0.252	3.060	0.25	<= 1
5300		29.13	26.98	0.499	3.060		
2440		8.75	6.60	0.005	3.060		

THE END