



RF Exposure Evaluation Report

FOR

Amazon

Model Name:
D5N83A

Product Description:
Networking Device

FCC ID: UUU-5411

Per:

CFR Part Part1 (1.1307 & 1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General RF Exposure Guidance v06

Report number: EMC_A2ZDE-048-18001_FCC_ISED_MPE-Rev2

DATE: 2019-05-23



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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

1 Assessment

This RF Exposure evaluation report provides evidence for compliance of the below identified device with the RF Exposure limits for mobile devices as defined in FCC CFR Part 1 (1.1307 & 1.1310), Part 2 (2.1091). The measured or rated RF output power, antenna gain, distance towards human body and multiple transmitter information as presented by the applicant are used in the evaluation. In addition maximum antenna gain or minimum distance towards the human body is calculated where required.

The device meets the limits as stipulated by the above given FCC rule parts based on available specifications and at a worst case condition at 20cm distance to the body.

Company	Description	Model #
Amazon	Networking Device	D5N83A

Report reviewed by: TCB Evaluator

2019-05-23 Compliance Cindy Li
(Lab Manager)

Date	Section	Name	Signature
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Responsible for the Report:

2019-05-23 Compliance James Donnellan
(Compliance)

Date	Section	Name	Signature
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2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
EMC Lab Manager:	Cindy Li
Responsible Project Leader:	Rami Saman

2.2 Identification of the Client / Manufacturer

Client Firm/Name:	Amazon
Street Address:	410 Terry Ave
City/Zip Code	Seattle, WA 98109
Country	USA

Identification of the Manufacturer

Manufacturer's Name:	Foxconn Cloud Network Technology Singapore Pte.
Manufacturers Address:	No.2, 2nd Donghuan Road, 10th Yousong Industrial District, Longhua, Baoan,
City/Zip Code	Shenzhen City, Guangdong Province
Country	China

3 Equipment under Assessment

Model No:	D5N83A
HW Version :	DVT
SW Version :	emmc-denali_dvt-ipq806x-1.0.0.217_1205
FCC-ID:	UUU-5411
FVIN:	N/A
N/A	D5N83A
PMN:	Networking device
Regulatory Band:	<ul style="list-style-type: none"> • Wi-Fi 2.4GHz: 2412 MHz (ch1) – 2462 MHz (ch11), 11 channels 2 802.11b/g/n via 1 Qualcomm QCA9882 radio chip with dual antenna ports supporting TX diversity • Wi-Fi 5GHz: UNII-1 5150 MHz (ch36) – 5250 MHz (ch48) and UNII-3 5725 MHz (ch149) – 5850 MHz (ch165) Supported via 4X Qualcomm QCA9886 radio chips each driving dual antenna ports supporting TX diversity.
Antenna Type:	<ul style="list-style-type: none"> ➤ Embedded 2.4GHZ,WLAN : Peak gain: <ul style="list-style-type: none"> • 2400 MHz – 2483.5 MHz : 3dBi ➤ Embedded 5 GHZ, WLAN : Peak gain (Each of 4 5 GHz radio can drive 2 antennas with TX Diversity) <ul style="list-style-type: none"> • 5150 MHz – 5250 MHz : 11 dBi • 5725 MHz – 5850 MHz: 11 dBi ➤ Additional Information <ul style="list-style-type: none"> • 2.4 GHz antenna pair is Omni directional. • 5 GHz Radio B2 and B3 drive two of the four side antenna pairs • 5 GHz Radio B1 and B4 radios drive the top and bottom antenna pairs. • B1, B2, B3, and B4 can switch to the other two available side antenna pairs.
Maximum Conducted Output Power Target plus Tune up Tolerance	Wi-Fi 2.4 GHz: 28 dBm Wi-Fi 5GHz: From 18 dBm UNII-3 Wi-Fi 5GHz: From 18 dBm UNII-1
Power Supply/ Rated Operating Voltage Range:	AC/DC Adapter: Vlow:10.3 V / Vnom: 12.0 VDC / Vmax: 15.0 VDC
Operating Temperature Range:	Low 0° C, Nominal 25° C, High 40° C
Sample Revision	<input type="checkbox"/> Prototype Unit; <input type="checkbox"/> Production Unit; <input checked="" type="checkbox"/> Pre-Production

4 RF Exposure Limits FCC Basic Rules

For the specific described radio apparatus the following basic limits and rules apply for FCC

4.1 Power Density Limits acc. to FCC 1.1310(e):

FCC

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 10,000	1.0	30

4.2 Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.109(c)

FCC

operating frequency < 1.5GHz: excluded if ERP < 1.5W / 31.8dBm (EIRP: 33.9);

operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8dBm (EIRP: 36.9);

4.3 RF Exposure Estimation (MPE Estimation)

Having available the source based average output power and peak antenna gain or the ERP/EIRP of the specified device and for a known minimum distance of its radiating structures from the body of persons according to its use cases (at least 20cm) the power density at that distance can be estimated by the following formula for plane-wave equivalent conditions (far-field conditions), when ground reflection is neglected.

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

where: S = power density (mW/cm² or W/m²)

P = power input to the antenna (mW or W)

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 (cm or m)

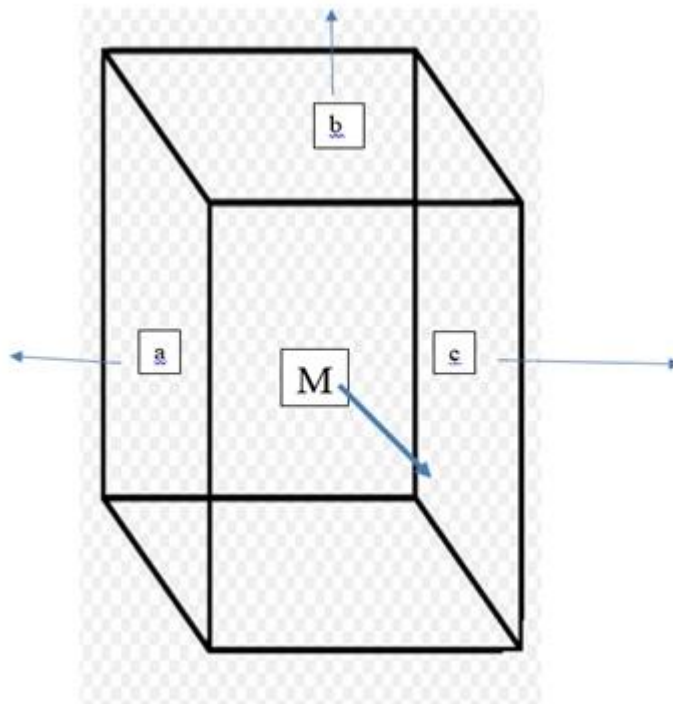
5 Evaluations

5.1 Routine RF Exposure evaluation for Stand Alone Operation

Band	Radio	Lowest frequency [MHz]	FCC EIRP limit [dBm]	EIRP [dBm]	Verdict
				SISO operation	
WIFI 2.4	-	2412	36.90	31	Complies
WIFI 5.0	B1	5180	36.90	29.00	Complies
WIFI 5.0	B2	5180	36.90	29.00	Complies
WIFI 5.0	B3	5745	36.90	29.00	Complies
WIFI 5.0	B4	5745	36.90	29.00	Complies
				MIMO Operation	
WIFI 2.4	-	2412	36.90	34	Complies
WIFI 5.0	B1	5180	36.90	32	Complies
WIFI 5.0	B2	5180	36.90	32	Complies
WIFI 5.0	B3	5745	36.90	32	Complies
WIFI 5.0	B4	5745	36.90	32	Complies

The single radios are exempt from routine environmental evaluation.

EUT Depiction for RF Exposure evaluation.



Evaluation is from the full impact of one of the 5 GHz antenna pairs from the front main beam M in addition to the side lobe impact of the antenna pairs from adjacent sides a, b and c.

5.2 Analysis of RF Exposure for simultaneous transmission

- Evaluations are based on a worst case power density limits for FCC only.
- Calculations are made for 20cm distance from the body.
- Evaluations are based on the Max. Target power plus the tune up tolerance and client declared antenna gains.
- While operating at Maximum target power and tune up on each of the four 5 GHz radios the evaluation is made with the assumption that the worst case orientation is directly in front of a directional antenna pair with three other 5GHz radio antenna pairs transmitting on orthogonal sides of the device relative to the side being evaluated.
- Relative to the side being evaluated the other three pairs of 5 GHz antennas have a gain of 0dBi in the direction of evaluation based on the antenna patterns provided by the client.
- For this evaluation the assumption is that we can transmit with 2 radios in both the UNII-1 and UNII-3 bands along with the 2.4GHz radio operating at maximum target power plus tune up tolerance and with both chains transmitting for all radios.
- No Beamforming supported by the device per clients declaration.

Radio	Frequency [MHz]	MIMO EIRP [W] *	FCC [W/m ²] Limit	comment	Actual [W/m ²]	How much of FCC limit is used up [%]
						By Individual radios in plane of interest
WIFI 2.4	2412	2.5119	10.000	Main beam 2.4 GHz Omnidirectional	4.997	49.97%
WIFI 5.0 B1	5180	0.1259	10.000	Side lobe power of antenna facing adjacent direction a	0.250	2.50%
WIFI 5.0 B2	5180	0.1259	10.000	Side lobe power of antenna facing adjacent direction b	0.250	2.50%
WIFI 5.0 B3	5745	1.5849	10.000	Main beam 5 GHz M	3.153	31.53%
WIFI 5.0 B4	5745	0.1259	10.000	Side lobe power of antenna facing adjacent direction c	0.250	2.50%
						By all Radios combined in the plane of interest
WIFI 2.4	2412	2.5119	10.000	Main beam 2.4 GHz Omnidirectional	4.997	89.02%
WIFI 5.0 B1	5180	0.1259	10.000	Side lobe power of antenna facing adjacent direction a	0.250	89.02%
WIFI 5.0 B2	5180	0.1259	10.000	Side lobe power of antenna facing adjacent direction b	0.250	89.02%
WIFI 5.0 B3	5745	1.5849	10.000	Main beam 5 GHz M	3.153	89.02%
WIFI 5.0 B4	5745	0.1259	10.000	Side lobe power of antenna facing adjacent direction c	0.250	89.02%

Conclusion:

- **Passes RF Exposure at a distance of 20 cm from any particular exterior of the device.**
- **The worst case for simultaneous transmission is with all radios transmitting on both chains.**
- **For above calculations two 5GHz radios operating in UNII 1 band and UNII 3 band is considered, in addition to the 2.4 GHz radio that is also operating on both chains.**

6 Revision History

Date	Report Name	Changes to report	Report prepared by
2019-02-26	EMC_A2ZDE-048-18001_FCC_ISED_MPE	Initial Release	James Donnellan
2019-03-08	EMC_A2ZDE-048-18001_FCC_ISED_MPE-Rev1	Updated Mfg. Address.	James Donnellan
2019-05-22	EMC_A2ZDE-048-18001_FCC_ISED_MPE-Rev2	Updated tables and calculations with max target powers and recently provided tune up tolerances in sections 5.1 and 5.2	James Donnellan