

RF Exposure Evaluation declaration

Product Name : ConnectCore 6 Plus
Trade Name : DIGI
Model No. : CC-WMX-KK8D-TN
FCC ID. : MCQ-CCIMX6P

Applicant : DIGI INTERNATIONAL INC

Address : 11001 Bren Road East Minnetonka, MN 55343 (USA)

Date of Receipt : Dec. 11, 2017
Date of Declaration : Feb. 13, 2018
Report No. : 17C0115R-SAUSP03V00
Report Version : V2.0



The declaration results relate only to the samples calculated.

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1. RF Exposure Evaluation

1.1. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

1.2. Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

The temperature and related humidity: 18°C and 78% RH.

1.3. Test Result of RF Exposure Evaluation

Product	ConnectCore 6 Plus
Test Mode	Transmit Mode
Test Condition	RF Exposure Evaluation

Antenna Gain

2.4G Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.5 dBi or 1.78 in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

BT 2.0 Function			
GFSK			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
0	2402	8.356	0.003
39	2441	8.811	0.003
78	2480	8.241	0.003

BT 2.0 Function			
$\pi/4$ DQPSK			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
0	2402	6.871	0.002
39	2441	7.295	0.003
78	2480	6.792	0.002

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

The results are evaluated using the maximum power.

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Antenna Gain

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Output Power into Antenna & RF Exposure Evaluation Distance:

BT 2.0 Function			
8-QPSK			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
0	2402	7.6033	0.003
39	2441	7.9616	0.003
78	2480	7.4817	0.003

BLE Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
0	2402	1.507	0.001
19	2440	1.663	0.001
39	2480	1.694	0.001

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WiFi

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Test Condition	RF Exposure Evaluation

Antenna Gain

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11b (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	66.681	0.024
6	2437	65.163	0.023
11	2462	66.222	0.023

IEEE 802.11g (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	60.814	0.022
6	2437	57.943	0.021
11	2462	53.334	0.019

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Test Condition	RF Exposure Evaluation

Antenna Gain

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11n (20MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
1	2412	51.9996	0.01841
6	2437	53.0884	0.01880
11	2462	47.2063	0.01672

IEEE 802.11n (40MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
3	2422	44.9780	0.01593
6	2437	47.2063	0.01672
9	2452	32.8095	0.01162

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Product	ConnectCore 6 Plus
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Antenna Gain

5G Antenna Gain: The maximum Gain measured in fully anechoic chamber is 4.6 dBi or 2.88 in linear scale.

Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11a (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
36	5180	20.1837	0.01156
40	5220	21.2814	0.01219
44	5240	21.0378	0.01205

IEEE 802.11a (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
149	5745	20.0909	0.01151
157	5785	20.6538	0.01183
165	5825	20.9894	0.01203

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

The results are evaluated using the maximum power.

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IEEE 802.11a (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
52	5260	20.9411	0.01200
60	5300	20.6538	0.01183
64	5320	20.7491	0.01189

IEEE 802.11a (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
100	5500	20.0447	0.01148
116	5580	19.9986	0.01146
140	5700	20.1372	0.01154

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IEEE 802.11n (20MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
36	5180	21.2324	0.01217
40	5220	20.4644	0.01173
44	5240	20.8449	0.01194

IEEE 802.11n (20MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
149	5745	21.0863	0.01208
157	5785	20.1837	0.01156
165	5825	20.3236	0.01164

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WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
52	5260	19.9986	0.01146
60	5300	20.1372	0.01154
64	5320	20.0909	0.01151

IEEE 802.11a (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
100	5500	20.5116	0.01175
116	5580	21.1836	0.01214
144	5720	20.5116	0.01036

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Antenna Gain

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11n (40MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
38	5190	14.2233	0.00815
46	5230	16.2181	0.00929

IEEE 802.11n (40MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
151	5755	16.1065	0.00923
159	5795	16.0694	0.00921

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Antenna Gain

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11n (40MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
54	5270	1.2706	0.00073
62	5310	17.2982	0.00991

IEEE 802.11n (40MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
102	5510	10.7895	0.00618
110	5550	16.1436	0.00925
142	5710	15.9956	0.00808

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Antenna Gain

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11ac (80MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
42	5210	8.3946	0.00481

IEEE 802.11ac (80MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
155	5775	13.4276	0.00769

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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Antenna Gain

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Output Power into Antenna & RF Exposure Evaluation Distance:

IEEE 802.11ac (80MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
58	5290	9.6828	0.00555

IEEE 802.11ac (80MHz) (ANT 0)			
WLAN Function			
Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at R = 20 cm (mW/cm ²)
106	5530	6.5163	0.00373
138	5690	13.1220	0.00663

The power density Pd (4th column) at a distance of 20 cm calculated from the Friis transmission formula is far below the limit of 1 mW/cm².

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Power Density (WIFI 5G) (mW/cm ²)	Power Density (BT) (mW/cm ²)	Total Power Density (WIFI+BT) (mW/cm ²)	Limit (mW/cm ²)
0.1219	0.003	0.1249	1

Only Wi-Fi 5 GHz can transmit at the same time as Bluetooth.