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RF exposure analysis for the equipment FCC ID: PD917265NG; IC: 1000M-17265NG

The device (FCC ID: PD917265NG; IC: 1000M-17265NG) is designed as module to be installed in and used in a mixed mobile and portable exposure host platform. Portable exposure conditions are evaluated in a separate exhibit. The analysis provided in this document only covers mobile exposure conditions and for that the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter except in the conditions described in this document.

MPE exposure limits

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1,0	30

The table below is excerpted from RSS-102, Issue 4, 4.2, titled “RF Limits for Devices used by the General Public”:

Frequency Range (MHz)	Power density (W/m ²)	Averaging time (minutes)
300 – 1500	f (MHz) /150	6
1500 – 100.000	10	6

As all the operating frequencies of this device are higher than 1500 MHz, the applicable maximum permissive exposure is: 1 mW/cm².

Using the equation $S = \frac{PG}{4\pi R^2}$ to calculate the exposure to electromagnetic fields

where: S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW)

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 (appropriate units, e.g., cm)

Compliance with FCC and IC maximum permissive exposure limits is demonstrated based on the following calculations.



1. Standalone operations analysis

DSS GRANT (Bluetooth Basic and EDR)

Frequency band (MHz)	Mode	BW (MHz)	Channel / Freq.	Data Rate	CONDUCTED OUTPUT POWER										ANTENNA GAIN		Duty cycle (%)	Evaluation distance (cm)	Power density (mW/cm ²)	FCC/IC MPE limit (mW/cm ²)	MPE RATIO
					SISO Chain A Measured Value (dBm)	SISO Chain A Measured Value (mW)	SISO Chain B Measured Value (dBm)	SISO Chain B Measured Value (mW)	MIMO Chain A Measured Value (dBm)	MIMO Chain A Measured Value (mW)	MIMO Chain B Measured Value (dBm)	MIMO Chain B Measured Value (mW)	MIMO Chain A+B Measured Value (dBm)	Worst Case Conducted Output Power (mW)	Antenna gain (dBi)	Antenna gain (numerical)					
2400-2483,5	Bluetooth BR (Modulation: GFSK)	1	0 / 2402	1 Mbps	n/a	n/a	6.26	4.227	n/a	n/a	n/a	n/a	4.227	3.24	2.11	100%	20	0.001774	1.000	0.001774	
			40 / 2441		n/a	n/a	6.60	4.571	n/a	n/a	n/a	n/a	4.571	3.24	2.11	100%	20	0.001918	1.000	0.001918	
		79 / 2480	n/a		n/a	6.49	4.457	n/a	n/a	n/a	n/a	4.457	3.24	2.11	100%	20	0.00187	1.000	0.00187		
		Bluetooth EDR (Modulation: 1/4-DQPSK)	1.5	0 / 2402	2 Mbps	n/a	n/a	5.30	3.388	n/a	n/a	n/a	n/a	3.388	3.24	2.11	100%	20	0.001422	1.000	0.001422
	40 / 2441			n/a		n/a	5.46	3.745	n/a	n/a	n/a	n/a	3.745	3.24	2.11	100%	20	0.001475	1.000	0.001475	
	79 / 2480		n/a	n/a		5.57	3.606	n/a	n/a	n/a	n/a	3.606	3.24	2.11	100%	20	0.001513	1.000	0.001513		
	Bluetooth EDR (Modulation: 8-DPSK)		1.5	0 / 2402	3 Mbps	n/a	n/a	4.47	2.799	n/a	n/a	n/a	n/a	2.799	3.24	2.11	100%	20	0.001175	1.000	0.001175
		40 / 2441		n/a		n/a	4.85	3.062	n/a	n/a	n/a	n/a	3.062	3.24	2.11	100%	20	0.001285	1.000	0.001285	
		79 / 2480	n/a	n/a		4.77	2.999	n/a	n/a	n/a	n/a	2.999	3.24	2.11	100%	20	0.001259	1.000	0.001259		

DTS GRANT (Bluetooth Low Energy operation + WLAN operation in 2400-2483,5 MHz frequency band)

					CONDUCTED OUTPUT POWER										ANTENNA GAIN									
Frequency band (MHz)	Mode	BW (MHz)	Channel / Freq.	Data Rate	SISO Chain A Measured Value (dBm)	SISO Chain A Measured Value (mW)	SISO Chain B Measured Value (dBm)	SISO Chain B Measured Value (mW)	MIMO Chain A Measured Value (dBm)	MIMO Chain A Measured Value (mW)	MIMO Chain B Measured Value (dBm)	MIMO Chain B Measured Value (mW)	MIMO Chain A+B Measured Value (mW)	Worst Case Conducted Output Power (mW)	Antenna gain (dBi)	Antenna gain (numerical)	Duty cycle (%)	Evaluation distance (cm)	Power density (mW/cm ²)	FCC/IC MPE limit (mW/cm ²)	MPE RATIO			
2400-2483.5	Bluetooth Low Energy (Modulation: GFSK)	1	0 / 2402	200 kbps	n/a	n/a	4.97	3.141	n/a	n/a	n/a	n/a	3.141	3.24	2.11	100%	20	0.001318	1.000	0.001318				
			40 / 2441		n/a	n/a	5.14	3.266	n/a	n/a	n/a	3.266	3.24	2.11	100%	20	0.001371	1.000	0.001371					
		20	79 / 2480	n/a	n/a	5.42	3.483	n/a	n/a	n/a	3.483	3.24	2.11	100%	20	0.001462	1.000	0.001462						
			1 / 2412	16.64	0.046	16.88	16.880	n/a	n/a	n/a	16.880	3.24	2.11	100%	20	0.007082	1.000	0.007082						
		802.11b	6 / 2437	17.66	0.058	17.62	17.620	n/a	n/a	n/a	n/a	17.620	3.24	2.11	100%	20	0.007392	1.000	0.007392					
			11 / 2462	16.60	0.046	16.85	16.850	n/a	n/a	n/a	n/a	16.850	3.24	2.11	100%	20	0.007069	1.000	0.007069					
	802.11g	20	1 / 2412	6 Mbps	14.03	0.025	14.77	14.770	n/a	n/a	n/a	n/a	14.770	3.24	2.11	100%	20	0.006196	1.000	0.006196				
			6 / 2437		17.22	0.053	17.67	17.670	n/a	n/a	n/a	n/a	17.670	3.24	2.11	100%	20	0.007413	1.000	0.007413				
		20	11 / 2462	12.37	0.017	12.81	12.810	n/a	n/a	n/a	n/a	12.810	3.24	2.11	100%	20	0.005374	1.000	0.005374					
			1 / 2412	14.15	0.026	14.34	14.340	11.89	15.453	12.15	16.406	31.858	3.24	2.11	100%	20	0.013365	1.000	0.013365					
		802.11n	20	6 / 2437	HT4	17.57	0.057	17.43	17.430	17.67	58.479	17.76	59.704	118.183	3.24	2.11	100%	20	0.049578	1.000	0.049578			
				11 / 2462		12.26	0.017	12.64	12.640	12.29	16.943	12.26	16.827	33.770	3.24	2.11	100%	20	0.014167	1.000	0.014167			
2400-2483.5	802.11n	40	3 / 2422	HT4	13.73	0.024	13.43	13.430	9.56	9.036	9.72	9.376	18.412	18.412	3.24	2.11	100%	20	0.007724	1.000	0.007724			
			6 / 2437		16.58	0.045	16.360	16.360	13.66	23.227	13.89	24.491	47.718	47.718	3.24	2.11	100%	20	0.020018	1.000	0.020018			
		40	9 / 2452	HT4	12.23	0.017	11.35	11.350	9.39	8.690	9.88	9.727	18.417	18.417	3.24	2.11	100%	20	0.007726	1.000	0.007726			
			6 / 2437		16.58	0.045	16.36	16.360	13.66	23.227	13.89	24.491	47.718	47.718	3.24	2.11	100%	20	0.020018	1.000	0.020018			
		802.11ac	20	1 / 2412	6 Mbps	14.03	0.025	14.77	14.770	n/a	n/a	n/a	n/a	14.770	3.24	2.11	100%	20	0.006196	1.000	0.006196			
				6 / 2437		17.22	0.053	17.67	17.670	n/a	n/a	n/a	n/a	17.670	3.24	2.11	100%	20	0.007413	1.000	0.007413			
	802.11ac	20	11 / 2462	6 Mbps	12.37	0.017	12.81	12.810	n/a	n/a	n/a	n/a	12.810	3.24	2.11	100%	20	0.005374	1.000	0.005374				
			1 / 2412		14.03	0.025	14.77	14.770	n/a	n/a	n/a	n/a	14.770	3.24	2.11	100%	20	0.006196	1.000	0.006196				
		40	3 / 2422	HT4	13.73	0.024	13.43	13.430	9.56	9.036	9.72	9.376	18.412	18.412	3.24	2.11	100%	20	0.007724	1.000	0.007724			
			6 / 2437		16.58	0.045	16.36	16.360	13.66	23.227	13.89	24.491	47.718	47.718	3.24	2.11	100%	20	0.020018	1.000	0.020018			
		802.11ax	20	1 / 2412	6 Mbps	14.03	0.025	14.77	14.770	n/a	n/a	n/a	n/a	14.770	3.24	2.11	100%	20	0.006196	1.000	0.006196			
				6 / 2437		17.22	0.053	17.67	17.670	n/a	n/a	n/a	n/a	17.670	3.24	2.11	100%	20	0.007413	1.000	0.007413			

U-NII GRANT (WLAN operation in 5150-5250 MHz, 5250-5350 MHz, 5470-5725 and 5725-5850 MHz frequency bands)

Frequency band (MHz)	Mode	BW (MHz)	Channel / Freq.	Data Rate	CONDUCTED OUTPUT POWER										ANTENNA GAIN				Duty cycle (%)	Evaluation distance (cm)	Power density (mW/cm ²)	FCC/IC MPE limit (mW/cm ²)	MPE RATIO
					SISO Chain A Measured Value (dBm)	SISO Chain A Measured Value (mW)	SISO Chain B Measured Value (dBm)	SISO Chain B Measured Value (mW)	MIMO Chain A Measured Value (dBm)	MIMO Chain A Measured Value (mW)	MIMO Chain B Measured Value (dBm)	MIMO Chain B Measured Value (mW)	MIMO Chain A+B Measured Value (mW)	Worst Case Conducted Output Power (mW)	Antenna gain (dBi)	Antenna gain (numerical)							
5150-5250	802.11a	20	36 / 5180	6 Mbps	13.99	0.025	14.12	25.823	n/a	n/a	n/a	n/a	25.823	3.64	2.31	100%	20	0.011878	1.000	0.011878			
			40 / 5200		14.33	0.027	14.27	26.730	n/a	n/a	n/a	26.730	3.64	2.31	100%	20	0.012296	1.000	0.012296				
		20	48 / 5240	6 Mbps	14.29	0.027	14.32	27.040	n/a	n/a	n/a	27.040	3.64	2.31	100%	20	0.012438	1.000	0.012438				
			36 / 5180		14.11	0.026	13.98	25.003	10.96	12.474	10.98	12.531	25.005	25.005	3.64	2.31	100%	20	0.011502	1.000	0.011502		
	802.11n	20	40 / 5200	HT4	14.41	0.028	14.45	27.861	11.18	13.122	10.98	12.531	25.653	27.861	3.64	2.31	100%	20	0.012816	1.000	0.012816		
			48 / 5240		14.43	0.028	14.41	27.606	10.93	12.388	11.05	12.735	25.123	27.606	3.64	2.31	100%	20	0.012698	1.000	0.012698		
		40	38 / 5190	HT4	12.16	0.016	13.60	22.909	10.58	11.429	10.37	10.889	22.318	22.909	3.64	2.31	100%	20	0.010538	1.000	0.010538		
			46 / 5230		16.67	0.046	13.60	22.909	13.89	24.491	13.96	24.889	49.379	49.379	3.64	2.31	100%	20	0.022713	1.000	0.022713		
	802.11ac	80	42 / 5210	VHT6	13.47	0.022	13.60	22.909	11.55	14.289	11.64	14.588	28.877	28.877	3.64	2.31	100%	20	0.013283	1.000	0.013283		
			52 / 5260		15.97	0.040	16.46	44.259	n/a	n/a	n/a	n/a	44.259	3.73	2.36	100%	20	0.020785	1.000	0.020785			
		20	60 / 5300	6 Mbps	16.13	0.041	16.55	45.186	n/a	n/a	n/a	n/a	45.186	3.73	2.36	100%	20	0.021222	1.000	0.021222			
			64 / 5320		13.42	0.022	13.47	22.233	n/a	n/a	n/a	n/a	22.233	3.73	2.36	100%	20	0.010441	1.000	0.010441			
5250-5350	802.11n	20	52 / 5260	6 Mbps	15.97	0.040	16.45	44.157	13.63	23.067	13.57	22.751	45.818	45.818	3.73	2.36	100%	20	0.021517	1.000	0.021517		
			60 / 5300		15.95	0.039	16.63	46.026	13.63	23.067	13.51	22.439	45.506	46.026	3.73	2.36	100%	20	0.021614	1.000	0.021614		
		40	54 / 5280	HT4	13.61	0.023	13.61	22.233	14.51	28.713	14.51	28.713	28.713	3.73	2.36	100%	20	0.013404	1.000	0.013404			
			64 / 5320		16.68	0.047	16.40	43.752	14.63	43.652	16.48	44.463	88.115	3.73	2.36	100%	20	0.041379	1.000	0.041379			
	802.11n	40	62 / 5310	HT4	13.62	0.023	13.55	22.646	11.64	14.588	11.47	14.028	28.616	28.616	3.73	2.36	100%	20	0.013439	1.000	0.013439		
			62 / 5310		13.62	0.023	13.55	22.646	11.64	14.588	11.47	14.028	28.616	28.616	3.73	2.36	100%	20	0.013439	1.000	0.013439		
		80	58 / 5290	VHT6	13.69	0.023	13.70	23.442	11.38	13.740	11.40	13.804	27.544	27.544	3.73	2.36	100%	20	0.012935	1.000	0.012935		
			1400 / 5500		13.63	0.023	13.31	21.429	n/a	n/a	n/a	n/a	n/a	21.429	4.77	3.00	100%	20	0.012786	1.000	0.012786		
	5470-5725	802.11a	20	120 / 5600	6 Mbps	16.18	0.041	16.51	44.771	n/a	n/a	n/a	n/a	44.771	4.77	3.00	100%	20	0.026714	1.000	0.026714		
				140 / 5700		13.18	0.021	12.95	19.724	n/a	n/a	n/a	n/a	19.724	4.77	3.00	100%	20	0.011769	1.000	0.011769		
			20	100 / 5500	6 Mbps	13.41	0.022	12.284	22.789	10.40	10.865	10.33	10.789	22.789	4.77	3.00	100%	20	0.013287	1.000	0.013287		
				120 / 5600		16.17	0.041	15.94	39.264	14.43	27.733	14.44	27.797	55.530	55.530	4.77	3.00	100%	20	0.033133	1.000	0.033133	
802.11n		20	140 / 5700	HT4	13.20	0.021	12.87	19.364	11.20	13.183	10.77	11.840	25.122	25.122	4.77	3.00	100%	20	0.01499	1.000	0.01499		
			102 / 5510		13.41	0.022	13.36	24.121	14.588	14.12	14.588	28.943	28.943	4.77	3.00	100%	20	0.017127	1.000	0.017127			
		40	118 / 5590	HT4	16.62	0.046	16.45	44.157	16.75	47.315	16.44	44.955	91.371	91.371	4.77	3.00	100%	20	0.054518	1.000	0.054518		
			134 / 5670		16.66	0.046	16.41	43.752	16.60	45.709	16.38	43.451	89.160	89.160	4.77	3.00	100%	20	0.053199	1.000	0.053199		
802.11ac		80	144 / 5720 (*)	VHT6	13.61	0.023	13.61	22.233	14.51	28.713	14.51	28.713	28.713	4.77	3.00	100%	20	0.025858	1.000	0.025858			
			142 / 5710 (*)		16.36	0.043	16.41	43.709	16.61	45.826	16.40	43.668	89.494	89.494	4.77	3.00	100%	20	0.053398	1.000	0.053398		
		80	106 / 5530	VHT6	13.61	0.023	13.56	22.699	11.50	14.125	11.63	14.555	28.680	28.680	4.77	3.00	100%	20	0.017113	1.000	0.017113		
			122 / 5610		16.62	0.046	16.57	45.394	16.77	47.534	16.46	44.259	91.792	91.792	4.77	3.00	100%	20	0.054777	1.000	0.054777		
5725-5850	802.11a	20	138 / 5690 (*)	6 Mbps	16.51	0.039	16.56	45.305	16.71	46.638	16.59	45.559	92.397	92.397	4.77	3.00	100%	20	0.055131	1.000	0.055131		
			149 / 5745		16.05	0.040	15.37	34.435	n/a	n/a	n/a	n/a	34.435	4.97	3.14	100%	20	0.021515	1.000	0.021515			
		20	157 / 5785	6 Mbps	15.62	0.036	14.92	31.046	n/a	n/a	n/a	n/a	31.046	4.97	3.14	100%	20	0.019397	1.000	0.019397			
			165 / 5825		15.36	0.039	14.70	29.923	n/a	n/a	n/a	n/a	29.923	4.97	3.14	100%	20	0.018696	1.000	0.018696			
	802.11n	20	149 / 5745	6 Mbps	15.93	0.039	15.29	33.806	13.67	23.281	13.33	21.528	44.809	44.809	4.97	3.14	100%	20	0.027996	1.000	0.027996		
			157 / 5785		15.60	0.036	15.42	34.834	13.67	23.281	13.47	22.233	45.514	45.514	4.97	3.14	100%	20	0.028437	1.000	0.028437		
		40	165 / 5825	HT4	16.14	0.044	16.14	43.752	16.14	43.752	16.14	43.752	88.115	88.115	4.97	3.14	100%	20	0.028464	1.000	0.028464		
			151 / 5755		16.61	0.046	16.33	42.954	16.65	46.238	16.45	44.157	90.395	90.395	4.97	3.14	100%	20	0.056478	1.000	0.056478		
	802.11n	40	159 / 5795	HT4	16.59	0.046	16.43	43.954	16.62	45.920	16.43	43.954	89.874	89.874	4.97	3.14	100%	20	0.056152	1.000	0.056152		
			155 / 5775		16.57	0.045	16.49	44.566	16.62	45.920	16.49	44.566	90.485	90.485	4.97	3.14	100%	20	0.056534	1.000	0.056534		



2. Co-location analysis

2.1. Co-location with other transmitter in mobile exposure conditions

According to KDB 447498 D01 General RF Exposure Guidance v05r01, 7.2:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0 .

As the maximum calculated MPE ratio for the device is **0,056534**, the product can be co-located with other antennas providing that the sum of the MPE ratios for all the other simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density is $\leq 1.0 - 0,056534 = 0,943466$.

2.2. Co-location with other transmitter in mixed mobile and portable host platform exposure conditions

According to KDB 447498 D01 General RF Exposure Guidance v05r01, 7.2:

When one of the following test exclusion conditions is satisfied for all combinations of simultaneous transmission configurations, further equipment approval is not required to incorporate transmitter modules in host devices that operate in the mixed mobile and portable host platform exposure conditions. The grantee is responsible for documenting this according to Class I permissive change requirements. Antennas that qualify for standalone SAR test exclusion must apply the estimated standalone SAR to determine simultaneous transmission test exclusion.

- The $[\sum \text{ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg} + [\sum \text{ of MPE ratios}]]$ is ≤ 1.0 .
- The SAR to peak location separation ratios of all simultaneous transmitting antenna pairs operating in portable exposure conditions are all ≤ 0.04 and the $[\sum \text{ of MPE ratios}]$ is ≤ 1.0 .

As the maximum calculated MPE ratio for the device is **0,056534**, the equipment can be co-located with other transmitters in a mixed mobile and portable conditions providing that the exposure of the co-located transmitter complies with:

- The $[\sum \text{ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg} + [\sum \text{ of MPE ratios}]]$ is $\leq 1.0 - 0,056534 = 0,943466$
- OR**
- The SAR to peak location separation ratios of all simultaneous transmitting antenna pairs operating in portable exposure conditions are all ≤ 0.04 and the $[\sum \text{ of MPE ratios}]$ is $\leq 1.0 - 0,056534 = 0,943466$

Sincerely,

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