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Novatel Wireless Inc Collocated MPE Report

For

FCC ID # NBZNRMUNDP-1D

Project Code CG-1327

(Report CG-1327-RA-4-1)

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Register of revisions

Revision	Date	Description of Revisions
1	September 14, 2009	Initial release

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INTRODUCTION

1.1 PURPOSE

This Maximum Permissive Exposure report demonstrates compliance with FCC CFR 47 1.1310 and 2.1091 for collocated transmitters used in simultaneous conditions with the PCIe wireless WAN Card, model UNDP-1D PCI Express Mini Card (FCC ID: NBZNRMUNDP-1D) installed in a host platform categorized as “mobile”. The mobile classification applies when 20 cm or greater separation distance is maintained between the end user and all transmission antennas. The host platform in this application is the Dell host notebooks model Type: PP08X-PP08X001, marketed under the name: Precision 6500).

2.0 DESCRIPTION OF COLLOCATED DEVICES

2.1 COLLOCATION CONFIGURATIONS

The following devices will be collocated with the PCIe wireless WAN Card, model UNDP-1D (FCC ID: NBZNRMUNDP-1D) within the Host system. The host platform in this application is the Dell host notebooks model Type: PP08X-PP08X001, marketed under the name: Precision 6500).

Host Platform	Collocated Transmitter(s) Name/Model	Description	FCC ID	IC ID
Dell Model PP13S	WiFi 5100	802.11 a, g, n	E2K512ANHMW	1514B-512ANH
	WiFi 5300	802.11 a, g, n	E2K533ANH	1514B-533ANH
	WLan PCI-E Minicard	802.11 a, b, g draft n	QDS-BRCM1030	4324A-BRCM1030
	WLan PCI-E Minicard	802.11 a, b, g draft n	QDS-BRCM1031	4324A-BRCM1031

2.2 TRANSMIT ANTENNA SPECIFICATIONS

the PCIe wireless WAN Card, model E725 (FCC ID: PKRNVWE725, IC: 3229B-E725) within the host includes the following antenna types for consideration in this class II permissive change application.

Manufacturer	Model Number	Designation	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
Auden	220189-09	WWAN Main	824-960	1.45
			1710-2170	2.82
Yaego	CAN4313974022501B	WWAN Main	824-960	0.62
			1710-2170	2.45

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3.0 RF EXPOSURE LIMITS AND EQUATIONS

In compliance with FCC CFR 47 1.1310, the criteria listed in the table below shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1303 (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 (f=frequency)				
30-300	61.4	0.163	1	6
300-1500	.....	.....	f/300	6
1500-100,000	.....	.....	5.0	6
(B) Limits for General Population/Uncontrolled Exposure (f=frequency)				
30-300	27.5	0.073	0.2	30
300-1500	.....	.....	f/1500	30
1500-100,000	.....	.....	1.0	30

Friis Transmission Formula

Friis transmission formula:

$$P_d = (P_{out} * G) / (4\pi R^2)$$

Where,

P_d = power density (mW/cm²)

P_{out} = output power to antenna (mW)

G = gain of antenna in linear scale

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

The resulted power density at a distance of 20cm can be calculated as follows:

$$\text{Power Density} = (\text{EIRP} * \text{DutyCycle}) / (4\pi R^2)$$

The MPE limit for General Population/Uncontrolled Exposure is shown in the table above and can be derived as follows:

$$\text{MPE limit} = 824/1500 = 0.55\text{mW/cm}^2$$

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4.0 STANDALONE TRANSMITTER MPE CALCULATIONS

The table below summarizes the collocation calculations for the various combinations of transmitters and antenna gains as provided by the applicant.

FCC ID	Technology	Antenna Path /TX Path Description	Operating Frequency/Band	Conducted Power (dBm)	Conducted Power (W)	Antenna Gain dBi	Duty Cycle	EIRP (dBm)	EIRP (W)	Power Density @ 20cm (mW/cm ²)	FCC MPE Limit (mW/cm ²)	Pd as % of Limit
NBZNRMUNDP-1	GPRS 2 UL	Auden	Cell	32.98	1.986	1.45	0.25	34.43	2.773	0.138	0.549	25.1
NBZNRMUNDP-1	CDMA 2000	Auden	Cell	24.91	0.310	1.45	1	26.36	0.433	0.086	0.549	15.7
NBZNRMUNDP-1	UMTS	Auden	Cell	24.42	0.277	1.45	1	25.87	0.386	0.077	0.549	14
NBZNRMUNDP-1	GPRS 2 UL	Auden	PCS	29.47	0.885	2.82	0.25	32.29	1.694	0.084	1	8.4
NBZNRMUNDP-1	CDMA 2000	Auden	PCS	24.61	0.289	2.82	1	27.43	0.553	0.110	1	11
NBZNRMUNDP-1	UMTS	Auden	PCS	24.56	0.286	2.82	1	27.38	0.547	0.109	1	10.9
NBZNRMUNDP-1	GPRS 2 UL	Yageo	Cell	32.98	1.986	0.62	0.25	33.6	2.291	0.114	0.549	20.8
NBZNRMUNDP-1	CDMA 2000	Yageo	Cell	24.91	0.310	0.62	1	25.53	0.357	0.071	0.549	12.9
NBZNRMUNDP-1	UMTS	Yageo	Cell	24.42	0.277	0.62	1	25.04	0.319	0.063	0.549	11.6
NBZNRMUNDP-1	GPRS 2 UL	Yageo	PCS	29.47	0.885	2.45	0.25	31.92	1.556	0.077	1	7.7
NBZNRMUNDP-1	CDMA 2000	Yageo	PCS	24.61	0.289	2.45	1	27.06	0.508	0.101	1	10.1
NBZNRMUNDP-1	UMTS	Yageo	PCS	24.56	0.286	2.45	1	27.01	0.502	0.100	1	10
QDS-BRCM1030	WLAN	Original Grant	2.4 GHz	22.28	0.169	3.9	1	26.18	0.415	0.083	1	8.3
QDS-BRCM1031	WLAN	802.11 a Legacy	5 GHz	14.7	0.030	5.6	1	20.3	0.107	0.021	1	2.1
QDS-BRCM1031	WLAN	802.11 a Legacy	5 GHz	18	0.063	5.6	1	23.6	0.229	0.046	1	4.6
QDS-BRCM1031	WLAN	802.11 a Legacy	5 GHz	18.2	0.066	4.2	1	22.4	0.174	0.035	1	3.5
QDS-BRCM1031	WLAN	802.11n 20 MHz	5 GHz	12.9	0.019	8.6	1	21.5	0.141	0.028	1	2.8
QDS-BRCM1031	WLAN	802.11n 20 MHz	5 GHz	18.7	0.074	8.6	1	27.3	0.537	0.107	1	10.7
QDS-BRCM1031	WLAN	802.11 n 20 MHz	5 GHz	19.6	0.091	7.2	1	26.8	0.479	0.095	1	9.5

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QDS-BRCM1031	WLAN	802.11 n 40 MHz	5 GHz	12.9	0.019	8.6	1	21.5	0.141	0.028	1	2.8
QDS-BRCM1031	WLAN	802.11 n 40 MHz	5 GHz	18.7	0.074	8.6	1	27.3	0.537	0.107	1	10.7
QDS-BRCM1031	WLAN	802.11 n 40 MHz	5 GHz	19.6	0.091	7.2	1	26.8	0.479	0.095	1	9.5
E2K512ANHMW	WLAN	Original Grant	2.4 GHz	18.6	0.072	3.2	1	21.8	0.151	0.030	1	3
E2K512ANHMW	WLAN	Original Grant	5 GHz	16.6	0.046	5	1	21.6	0.145	0.029	1	2.9
E2K512ANHMW	WLAN	Original Grant	5 GHz	18.5	0.071	5	1	23.5	0.224	0.045	1	4.5
E2K512ANHMW	WLAN	Original Grant	5 GHz	17.9	0.062	5	1	22.9	0.195	0.039	1	3.9
E2K533ANH	WLAN	Ethertronics Chain B	2.4 GHz	23.84	0.242	3	1	26.84	0.483	0.096	1	9.6
E2K533ANH	WLAN	Ethertronics Chain B	5 GHz	24.03	0.253	5	1	29.03	0.800	0.159	1	15.9
E2K533ANH	WLAN	Ethertronics Chain B	5 GHz	23.84	0.242	3	1	26.84	0.483	0.096	1	9.6
E2K533ANH	WLAN	Ethertronics Chain B	5 GHz	24.64	0.291	5	1	29.64	0.920	0.183	1	18.3
E2K533ANH	WLAN	Ethertronics Chain C	2.4 GHz	24.04	0.254	3	1	27.04	0.506	0.101	1	10.1
E2K533ANH	WLAN	Ethertronics Chain C	5 GHz	24.54	0.284	5	1	29.54	0.899	0.179	1	17.9
E2K533ANH	WLAN	Wistron Chain A	2.4 GHz	23.84	0.242	4.95	1	28.79	0.757	0.151	1	15.1
E2K533ANH	WLAN	Wistron Chain A	5 GHz	24.04	0.254	4.87	1	28.91	0.778	0.155	1	15.5
E2K533ANH	WLAN	Wistron Chain B	2.4 GHz	23.84	0.242	4.95	1	28.79	0.757	0.151	1	15.1
E2K533ANH	WLAN	Wistron Chain B	5 GHz	24.64	0.291	4.87	1	29.51	0.893	0.178	1	17.8
E2K533ANH	WLAN	Wistron Chain B	2.4 GHz	24.04	0.254	4.95	1	28.99	0.793	0.158	1	15.8
E2K533ANH	WLAN	Wistron Chain B	5 GHz	24.54	0.284	4.87	1	29.41	0.873	0.174	1	17.4

5.0 TRANSMITTER CO-LOCATION COMPLIANCE

Based on the compliance calculations above the combined power density of the NBZNRMUNDP-1D modular transmitter and any one combination of the other co-located transmitters does not exceed 100% of the MPE Limits. Note that for GPRS Mode a 25% duty cycle is based on worst case time slot configuration as per original filing.

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