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Novatel Wireless Inc Collocated MPE Report and Calculations

For

FCC ID # NBZNRMUNDP-1D
Project Code CG-1211

(Report CG-1211-RA-1-1)
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Register of revisions

Revision	Date	Description of Revisions
0	April 22, 2009	Initial release

1.0 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 UNDP-1 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 Latitude Z Model P01L-P01L001 laptop.

2.0 DESCRIPTION OF COLLOCATED DEVICES

2.1 COLLOCATION CONFIGURATIONS

The following devices will be collocated with the UNDP-1 PCI Express Mini Card (FCC ID: NBZNRMUNDP-1D, IC:3229A-UNDP-1D) within the Host system. The host system referred to in this application is Dell Latitude Z, Type P01L-P01L001.

Host Platform	Collocated Transmitter(s) Name/Model	Description	FCC ID	IC ID
Dell Latitude Z Model P01L-P01L001 laptop	WiFi 5100	802.11 a, g, n	E2K512ANHMW	1514B-512ANH
	WiFi 5300	802.11 a, g, n	E2K533ANH	1514B-533ANH
	WiMax/WiFi Link 5150	Wimax/802.11 a, g, n	PD9512ANXHD	NA

2.2 ANTENNA SPECIFICATIONS

The UNDP-1D Card (FCC ID: NBZNRMUNDP-1D, IC:3229A-UNDP-1D) In the DELL Latitude Z600, will use the following antennas in the Dell Z600 Platform

Manufacturer	Model Number	Designation	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
Smart Approach Co., Ltd	PE-080050-A	WWAN Main	824-960	2.17
			1710-2170	1.77
Smart Approach Co., Ltd	PE-080060-A	WWAN Aux	869-925	-0.09
			1930-2170	-1.78
Tyco Electronics Co., Ltd	REDBULL	WWAN Main	824-960	-0.67
			1710-2170	2.33
Tyco Electronics Co., Ltd	REDBULL	WWAN Aux	824-960	0.85
			1710-2170	1.23

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/cm2)	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/cm^2)

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:

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

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

MPE limit = $824/1500 = 0.55 mW/cm^2$

4.0 STANDALONE TRANSMITTER MPE CALCULATIONS

FCC ID	Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (W)	Max Ant 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	824	32.98	1.986	2.17	0.25	29.13	0.8185	0.163	0.549	29.7
NBZNRMUNDP-1	CDMA2000	824	24.91	0.310	2.17	1.00	27.08	0.510	0.101	0.549	18.4
NBZNRMUNDP-1	UMTS	824	24.42	0.277	2.17	1.00	26.59	0.456	0.091	0.549	16.6
NBZNRMUNDP-1	GPRS 2 UL	1850	29.47	0.885	2.33	0.25	25.77	0.378	0.099	1.000	9.9
NBZNRMUNDP-1	CDMA2000	1850	24.61	0.289	2.33	1.00	26.94	.495	0.129	1.000	12.9
NBZNRMUNDP-1	UMTS	1850	24.56	0.286	2.33	1.00	26.89	0.488	0.127	1.000	12.7
E2K512ANHMW	WLAN	2412-2462	18.60	0.0724	3.2	1.00	21.80	0.1514	0.03	1.000	3
E2K512ANHMW	WLAN	5180-5320	16.60	0.0457	5.0	1.00	21.60	0.1445	0.03	1.000	3
E2K512ANHMW	WLAN	5500-5700	18.50	0.0708	5.0	1.00	23.50	0.2239	0.04	1.000	4
E2K512ANHMW	WLAN	5745-5825	17.90	0.0617	5.0	1.00	22.90	0.1950	0.03	1.000	3
E2K533ANH	Ethertronics Chain A	2400	23.84	0.2421	3.0	1.00	26.84	0.4831	0.096	1.000	9.6
E2K533ANH	Ethertronics Chain A	5000	24.03	0.2531	5.0	1.00	29.03	0.7998	0.159	1.000	15.9
E2K533ANH	Ethertronics Chain B	2400	23.84	0.2421	3.0	1,00	26.84	0.4831	0.096	1.000	9.6
E2K533ANH	Ethertronics Chain B	5000	24.64	0.29107	5.0	1.00	29.64	0.9204	0.183	1.000	18.3
E2K533ANH	Ethertronics Chain C	2400	24.04	0.25351	3.0	1.00	27.04	0.5058	0.101	1.000	10.1
E2K533ANH	Ethertronics Chain C	5000	24.54	0.28445	5.0	1.00	29.54	0.8995	0.179	1.000	17.9
E2K533ANH	Wistron Chain A	2400	23.84	0.24210	4.95	1.00	28.79	0.7568	0.151	1.000	15.1
E2K533ANH	Wistron Chain A	5000	24.04	0.25351	4.87	1.00	28.91	0.778	0.155	1.000	15.5
E2K533ANH	Wistron Chain B	2400	23.84	0.24210	4.95	1.00	28.79	0.7568	0.151	1.000	15.1
E2K533ANH	Wistron Chain B	5000	24.64	0.29107	4.87	1.00	29.51	0.8933	0.178	1.000	17.8
E2K533ANH	Wistron Chain B	2400	24.04	0.25351	4.95	1.00	28.99	0.7925	0.158	1.000	15.8
E2K533ANH	Wistron Chain B	5000	24.54	0.28445	4.87	1.00	29.41	0.873	0.174	1.000	17.4

PD9512ANXHD	WiFi	2400	27.67	0.58479	3.24	1.00	30.91	1.233	0.245	1.000	24.5
PD9512ANXHD	WiFi	5000	25.79	0.37931	4.96	1.00	30.75	1.189	0.237	1.000	23.7
PD9512ANXHD	WiMax	2500	24.05	0.25410	3.45	1.00	27.5	0.562	0.112	1.000	11.2

Note: For NBZNRMUNDP-1 GPRS Mode 25% duty cycle is based on worst case time slot configuration as per original filing

RESULTS SUMMARY

The highest power density relative to the MPE limit is 29.7% of the limit at a distance of 20 cm from the installed antenna. The worst case combined power density of the NBZNRMUNDP-1 module with any one of the referenced collocated transmitters in the table above is 54.2%.

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