



FCC 47 CFR PART 2.1091

MPE EVALUATION FOR CDMA/LTE MINI-CARD MODULE

**MODEL NUMBER: NM7371
FCC ID: PY3NM7371**

**REPORT NUMBER: 13U15614-3 REV A
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Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
---	9/17/13	Initial Issue	P.Kim
A	9/27/13	Add MPE calculation for WIFI	P.Kim

ATTESTATION OF TEST RESULTS

COMPANY NAME: NETGEAR INC
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EUT DESCRIPTION: CDMA/LTE MINI-CARD MODULE
MODEL: NM7371

SERIAL NUMBER: GR325700840102

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 2.1091	PASS

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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1. Introduction

In this application we also seek approval for the NM7371 mini-card module to operate as a mobile device using external antennas. The MPE report demonstrates compliance with FCC CFR 47 §2.1091 in usage of external antenna under mobile exposure conditions.

2. RF Exposure Limits and Equations

The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure.

FCC RULES:

According to FCC CFR 47 §1.310, the criteria listed in the Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1307.

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz *Plane-wave equivalent power density

Table 1: Limits for Maximum Permissible Exposure (MPE)

EQUATIONS:

Power density is given by:

$$S = \text{EIRP} / (4 * \pi * D^2)$$

where

S = Power density (mW/cm²)

EIRP = Equivalent Isotropic Radiated Power (mW)

D = Separation distance (cm)

3. MPE Assessment

The power density calculations for individual transmitters per wireless technology at a separation distance of 20cm are shown in the following table. For frequency dependent limits, the lowest transmitter frequency was used to represent the most stringent limit in this analysis (eg. 824MHz = 0.55mW/cm²). The calculations are based on the highest conducted power to represent the worst-case scenario.

Operating Mode	TX Freq (MHz)	Max Time-Avg Cond Power (dBm)	Max Time-Avg Cond Power (W)	Max Ant Gain (dBi)	Duty Cycle	Power Density @20 cm (mW/cm ²)	FCC MPE Limit (mW/cm ²)	Power Density to MPE Limit Ratio
CDMA BC 0	824	25	0.32	7.9	1	0.39	0.55	-0.16
CDMA BC 1	1850	25	0.32	8	1	0.40	1	-0.60
CDMA BC 10	816	25	0.32	7.9	1	0.39	0.54	-0.15
LTE Band 25	1850	24	0.25	8	1	0.32	1	-0.68
LTE Band 26	814	24	0.25	7.9	1	0.31	0.54	-0.23
LTE Band 41	2496	23.5	0.22	9.5	0.6	0.24	1	-0.76
WIFI 2.4	2400	27	0.50	4	1	0.25	1	-0.75
WIFI 5G	5.8	27	0.50	4	1	0.25	1	-0.75

The the highest power density to MPE limit ratio of WWAN and WIFI transmitters is as follows:

$$0.39/0.54 + 0.25/1 = 0.97 < 1$$

3.1 LTE TDD Duty Cycle

The duty cycle of the testing for LTE TDD Band 41 used the worst-case Configuration 0, which is 60% transmit duty cycle. This is verified by using the test settings in the call box to control the device under test. The duty cycle is controlled by the call box, and the device under test follows these settings. The call box uses the 3GPP settings as per below:

3GPP Table 4.2-1: Configuration of special subframe (lengths of DwPTS/GP/UpPTS).

Special subframe configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink			EUT Support Special subframe	Worst case UpPTS
	DwPTS	UpPTS		DwPTS	UpPTS			
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		
0	$6592 \times T_s$	$2192 \times T_s$	$2560 \times T_s$	$7680 \times T_s$	$2192 \times T_s$	$2560 \times T_s$	<input type="checkbox"/>	<input type="checkbox"/>
1	$19760 \times T_s$			$20480 \times T_s$			<input type="checkbox"/>	<input type="checkbox"/>
2	$21952 \times T_s$			$23040 \times T_s$			<input type="checkbox"/>	<input type="checkbox"/>
3	$24144 \times T_s$			$25600 \times T_s$			<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	$26336 \times T_s$	$4384 \times T_s$	$5120 \times T_s$	$7680 \times T_s$	$4384 \times T_s$	$5120 \times T_s$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	$6592 \times T_s$			$20480 \times T_s$			<input type="checkbox"/>	<input type="checkbox"/>
6	$19760 \times T_s$			$23040 \times T_s$			<input type="checkbox"/>	<input type="checkbox"/>
7	$21952 \times T_s$			$12800 \times T_s$			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
8	$24144 \times T_s$			-	-	-	<input type="checkbox"/>	<input type="checkbox"/>
9	$13168 \times T_s$			-	-	-	<input type="checkbox"/>	<input type="checkbox"/>

Table 4.2.2: Uplink-downlink configuration.

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity	Subframe number									
		0	1	2	3	4	5	6	7	8	9
0	5ms	D	S	U	U	U	D	S	U	U	U
1	5ms	D	S	U	U	D	D	S	U	U	D
2	5ms	D	S	U	D	D	D	S	U	D	D
3	10ms	D	S	U	U	U	D	D	D	D	D
4	10ms	D	S	U	U	D	D	D	D	D	D
5	10ms	D	S	U	D	D	D	D	D	D	D
6	5ms	D	S	U	U	U	D	S	U	U	D

Conclusion

Based on the analysis above, the NM7371 mini-card module complies with the FCC RF exposure requirements in mobile exposure condition using external antennas, provided the maximum antenna gains do not exceed the limits listed in the table below.

Transmitter Frequency Band (MHz)	Max External Antenna Gain (dBi)
824 - 849	7.9
1850 - 1915	8
814-849	7.9
2496 - 2690	9.5