FCC Part 1 Subpart I
FCC Part 2 Subpart J
INDUSTRY CANADA RSS 102 ISSUE 3

RF EXPOSURE REPORT
GX400 and MC8705

FOR

802.11b/g/n 1x1 WLAN RADIO and
GSM/GPRS/EDGE/WCDMA/HSDPA/HSUPA/HSPA+Module

WLAN MODEL NUMBER: GX400
WWAN MODEL: MC8705

REPORT NUMBER: 12U14203-5, Revision A

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Prepared for
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Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/08/12	Initial Issue	T. Chan
A	03/14/12	Revised model numbers	A. Zaffar

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SIERRA WIRELESS INC.
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EUT DESCRIPTION: 802.11bgn 1x1 WLAN RADIO (CONTAINED IN MODEM: GX400)
Co-locate with GSM/GPRS/EDGE/WCDMA/HSDPA/HSUPA/
HSPA + Module

MODEL: GX400 / MC8705

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 1 SUBPART I & PART 2 SUBPART J	Pass
INDUSTRY CANADA RSS 102 ISSUE 3	Pass

Compliance Certification Services (UL CCS) calculated the RF Exposure of the above equipment in accordance with the requirements set forth in the above standards, using test results reported in the test report documents referenced below and/or documentation furnished by the applicant. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations of these calculations. The results show that the equipment 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 by the referenced documents. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS 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.

Approved & Released For UL CCS By: Calculated By:

THU CHAN   CHIN PANG
ENGINEERING MANAGER   EMC ENGINEER
UL CCS   UL CCS

2. METHODOLOGY

All calculations were made in accordance with FCC OET Bulletin 65 Edition 97-01 and IC Safety Code 6.

3. REFERENCES

All measurements were made as documented in test report Document SRTC2010-H024-E0017 for operation in the 900 and 1800 MHz bands, UL CCS Document 12U14203-1 for operation in the 2.4 GHz band.

Output power, Duty cycle and Antenna gain data is excerpted from the applicable test reports.

Antenna gain data is excerpted from the applicable test reports.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

5. EUT DESCRIPTION

The EUT is an 802.11b/g/n1x1 wlan radio installed inside a host modem, model No: GX400 that co-locate with GSM/GPRS/EDGE/WCDMA/HSDPA/HSUPA/HSPA+Module

Other details regarding the EUT are documented in the applicable test reports and product documentation.

6. REQUIREMENTS - LIMITATION OF EXPOSURE

6.1. LIMITS

6.1.1. FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f²)	6
30–300	61.4	0.163	1.0	6
300–1500	....	....	f/300	6
1500–100,000	....	....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
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
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

6.1.2. IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000\,/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000\,/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

6.1.3. LIMITS APPLICABLE TO THE EUT

For mobile radio equipment operating in the cellular phone band, the lowest power density limit is calculated using the lowest frequency, as 824 MHz / 1500 = 0.55 mW/cm^2 (FCC) and 824 MHz / 150 = 5.5 W/m^2 (IC).

For operation in the PCS band, the 2.4 GHz band and the 5 GHz bands, from FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2 and from IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2.

6.2.   EQUATIONS

Power density is given by:

$$S = EIRP / (4 * Pi * D\verb|^|2)$$

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Distance is given by:

$$D = SQRT (EIRP / (4 * Pi * S))$$

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

$$Source\text{-}based\ time\text{-}averaged\ EIRP = (DC / 100) * EIRP$$

where

DC = Duty Cycle in %, as applicable
EIRP = Equivalent Isotropic Radiated Power in W

For multiple chain devices, and colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

$$Total\ EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)$$

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply, either the lowest limit applicable to the co-located transmitters can be applied or a fraction of the exposure limit is established for each band, such that the sum of the fractions is less than or equal to one.

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

6.3. RESULTS

GX-400 and MC8705 Co-location

Separation Distance	**(m)**	0.2		
Band		800 MHz	1900 MHz	2.4GHz
Mode		GSM	GSM	WLAN
IC Single Tx Limit	**(W/m^2)**	5.5	10	10
FCC Single Tx Limit	**(mW/cm^2)**	0.55	1	1
Fractional Allocation of Limit	**(%)**	75.0	20.0	5.0
Fractional Total	**(%)**	100.0		
IC Power Density Limit	**(W/m^2)**	4.125	2	0.5
FCC Power Density Limit	**(mW/cm^2)**	0.4125	0.2	0.05
Output Power	**(dBm)**	32	29.7	17.75
Antenna Gain	**(dBi)**	6	3	2
EIRP	**(dBm)**	38.00	32.70	19.75
EIRP	**(W)**	6.31	1.86	0.09
Duty Cycle	**(%)**	25	50	100
Time-Average EIRP	**(W)**	1.58	0.93	0.09
IC Power Density	**(W/m^2)**	3.14	1.85	0.19
FCC Power Density	**(mW/cm^2)**	0.314	0.185	0.019
Fractional Limit / Actual Red indicates over the limit	**|(dB)|**	2.37	0.66	8.50

END OF REPORT