



# RF EXPOSURE REPORT

**REPORT NO.:** SA991201E03 R1

**MODEL NO.:** MC319ZUS

**FCC ID:** UZ7MC319ZUS

**ACCORDING:** FCC Guidelines for Human Exposure  
IEEE C95.1

**APPLICANT:** Motorola Solutions Inc.

**ADDRESS:** One Motorola Plaza Holts ville NY 11742-1300 USA

**ISSUED BY:** Bureau Veritas Consumer Products Services  
(H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

**LAB ADDRESS:** No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen,  
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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	NA	Mar. 15, 2011
SA991201E03 R1	Added signatures in the report.	Mar. 31, 2011



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## 1.CERTIFICATION

**PRODUCT:** Mobile Computing Terminal  
**BRAND NAME:** MOTOROLA  
**MODEL NO.:** MC319ZUS  
**TEST SAMPLE:** ENGINEERING SAMPLE  
**APPLICANT:** Motorola Solutions Inc.  
**TESTED:** Mar. 16 to 18, 2011  
**STANDARD:** IEEE C95.1

The above equipment (Model: MC319ZUS) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and was in compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY** :  , **DATE:** Mar. 31, 2011  
( Claire Kuan, Specialist )

**APPROVED BY** :  , **DATE:** Mar. 31, 2011  
( May Chen, Deputy Manager )

# RF Exposure Measurement

## 1. Introduction

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this product is measured in a Fully Anechoic Chamber (FAC) calibrated for antenna measurement in our lab, and also the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

## 2. RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (minutes)
<b>(A)Limits For Occupational / Control Exposures</b>				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
<b>(B)Limits For General Population / Uncontrolled Exposure</b>				
300-1500	...	...	F/1500	30
1500-100,000	...	...	1.0	30

F = Frequency in MHz

### 3. Friis Formula

Friis transmission formula :  $P_d = (P_{out} * G) / (4 * \pi * r^2)$

where

$P_d$  = power density in  $mW/cm^2$

$P_{out}$  = output power to antenna in mW

$G$  = gain of antenna in linear scale

$\pi = 3.1416$

$R$  = distance between observation point and center of the radiator in cm

$P_d$  is the limit of MPE,  $1 mW/cm^2$ . If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the MPE value at distance 20cm.

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition,  
Page 640, Eq. (11-133).

### 4. EUT Operating condition

The software provided by Manufacturer enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

### 5. Classification

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. So, this device is classified as **Mobile Device**

## 6. TEST RESULTS

### 6.1 Antenna Gain

There are antennas provided to this EUT, please refer to the following table:

WLAN Antenna Spec.								
NO.	Brand	Antenna Type	Peak Gain(dBi) with cable loss	Connecter Type	Frequency range (MHz)	Cable Loss (dB)	Cable Length	
1	Auden	Monopole + coupling	3.4 dBi (2.4GHz) 4.5 dBi (5GHz)	hirose	2.4 ~ 2.5 GHz 4.92 ~ 5.85 GHz	-0.2640 dB -0.6168 dB	52 mm	
2	Auden	PIFA	1.3 dBi (2.4GHz) 3.6 dBi (5GHz)	hirose	2.4 ~ 2.5 GHz 4.92 ~ 5.85 GHz	-0.6409 dB -1.0418 dB	68 mm	
RFID Antenna Spec.								
NO.	Brand	Antenna Type	Peak Gain(dBi) with cable loss	Connecter Type	Frequency range (MHz)	Cable Loss (dB)	Cable Length	
1	Auden	Dipole	3.66	hirose	902 ~ 928 MHz	-0.43 dB	85 mm	
2	Auden	Slot Dipole	1.95	hirose	902 ~ 928 MHz	-0.43 dB	85 mm	
Bluetooth Antenna Spec.								
NO.	Brand	Model No.	Antenna Type	Peak Gain(dBi)	Connecter Type	Frequency range (MHz)	Cable Loss (dB)	Cable Length
1	Antenova	(Mica 2.4GHz) 303DA5654-01	Chip Antenna	-1.34	U.FL	2400-2500	0.185	74 mm

## 6.2 Output Power Into Antenna & RF Exposure value at distance 20cm:

### For WLAN 15.247 (2.4GHz)

#### 802.11b:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	47.9	0.021	1.0
6	2437	46.8	0.020	1.0
11	2462	45.7	0.020	1.0
12	2467	1.9	0.001	1.0
13	2472	1.9	0.001	1.0

#### 802.11g:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
1	2412	125.9	0.055	1.0
6	2437	151.4	0.066	1.0
11	2462	125.9	0.055	1.0
12	2467	11.2	0.005	1.0
13	2472	11.0	0.005	1.0

**For WLAN 15.247 (5GHz)**

**802.11a:**

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
149	5745	134.9	0.076	1.0
157	5785	128.8	0.072	1.0
161	5805	123.0	0.069	1.0

**For WLAN 15.407 (5GHz)**

**802.11a:**

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
36	5180	17.8	0.010	1.0
40	5200	25.1	0.014	1.0
48	5240	19.1	0.011	1.0
52	5260	27.5	0.015	1.0
60	5300	27.5	0.015	1.0
64	5320	15.8	0.009	1.0
100	5500	20.4	0.011	1.0
120	5600	33.1	0.019	1.0
140	5700	9.1	0.005	1.0



## For Bluetooth

### GFSK:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
0	2402	1.8	0.00026	1.0
39	2441	1.5	0.00022	1.0
78	2480	1.3	0.00019	1.0

### $\pi/4$ -DQPSK

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
0	2402	2.7	0.00039	1.0
39	2441	2.3	0.00034	1.0
78	2480	2.1	0.00031	1.0

### 8DPSK

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
0	2402	2.9	0.00042	1.0
39	2441	2.6	0.00038	1.0
78	2480	2.2	0.00032	1.0

## For RFID

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
0	902.75	955.0	0.441	0.6
24	914.75	891.3	0.412	0.6
49	927.25	871.0	0.402	0.6

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