Maximum Permissible Exposure (MPE) Evaluation Report

Report No. : **150400346TWN-001**
Model No. : **UMC-I210C**
Issued Date : **May 18, 2015**

Applicant: **Wistron Neweb Corporation**
20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan

Test Method/ Standard: **FCC 1.1310**

Test By: **Intertek Testing Services Taiwan Ltd.**
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Testing Laboratory
0597

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Summary of Tests

MPE Evaluation meet FCC OET No. 65: 1997, IEEE C95.1-2005

Test	Reference	Results
MPE Evaluation	FCC Guidelines for Human Exposure IEEE C95.1	Complies

1. General information

1.1 Identification of the EUT

Product:	Integrate with certified module-End product
Model No:	UMC-I210C
FCC ID:	NKR-CB1GI210C
Manufacturer:	Wistron Neweb Corporation
Address:	20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan
Operating Frequency:	2405 MHz ~ 2475 MHz for Zigbee mode LTE Band 4: 1710.7 MHz ~ 1754.3 MHz (TX) LTE Band 13: 779.5 MHz ~ 784.5 MHz (TX) LTE Band 4: 2110.7 MHz ~ 2154.3 MHz (RX) LTE Band 13: 748.5MHz ~ 753.5 MHz (RX)
Channel Number:	15 channels, 2350 MHz +5k, k=11~25 for Zigbee mode
Modulation:	O-QPSK, 16QAM
Rated Power:	DC 5 V from adapter
Power Cord:	N/A
Sample Received:	Apr. 30, 2015
Sample condition:	Workable
Test Date(s):	Apr. 27, 2015 ~ May 20, 2015
Note 1:	This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Additional information about the EUT

For Zigbee mode:

Modulation mode	Transmit path
	Chain 0 / Main
Zigbee	V

Product SW/HW version :	2.11.0-Beta2/ DGB
Radio SW/HW version :	N/A
Test SW Version :	socat 1.7.2.1 (Zigbee)

RF power setting in TEST SW:

Frequency	2405MHz	2440MHz	2475MHz
IEEE 802.15.4 Zigbee	-3	-3	-3

For LTE mode:

Product SW/HW version :	2.11.0-Beta2/ DGB
Radio SW/HW version :	N/A
Test SW Version :	N/A

1.3 Antenna description

For Zigbee mode:
The EUT uses a permanently connected antenna.

Antenna Gain : 4.0 dBi max
Antenna Type : PIFA antenna
Connector Type : Fixed

For LTE mode:
The EUT uses a permanently connected antenna.

Antenna Gain : 5.0 dBi max (Band 4), 2.5 dBi max (Band 13)
Antenna Type : PCB antenna
Connector Type : I-PEX

2. Test specifications

2.1 Introduction

The EUT operates in the 2.4 GHz ISM band. Due to the EUT (include antenna) at its normal operation distance is at least 20 cm from the human body, the EUT was defined as a Mobile Device.

The reason to do the MPE Evaluation is to avoid the RF hazard to human body. The maximum output power and gain of the antenna were used to calculate the limited Power density (S) at 20 cm distance away from the product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 and Safety Code 6 are followed.

According to 1.1307 (b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission’s guideline.

2.2 RF Exposure calculations

From §FCC 1.1310 table 1, the maximum permissible RF exposure for an uncontrolled environment is 1 mW/(cm^2) (or 10 W/m^2)*

Power density (S) is calculated by the following formula:

$S = (P * G)/4\pi R^2$

where, S = Power density (mW/cm^2)
P = Output power to antenna (mW)
R = Distance between radiating structure and observation point (cm)
G = Gain of antenna in numeric
π = 3.1416

Example:
Assume a mobile device operates at 2412MHz and its maximum output power is 50mW, and the maximum gain of antenna is 1 (numeric) /0dBi.

then the power density (S) = $(50 * 1)/4*\pi*20^2$ = 0.00995 (mW/cm^2) (or = 0.0995 W/m^2)

2.3 Operation mode

For Zigbee mode:
EUT can transmit continuously with specific software “socat command”.

For LTE mode:
The EUT was established communication with base station simulator and set up to transmit the maximum power.

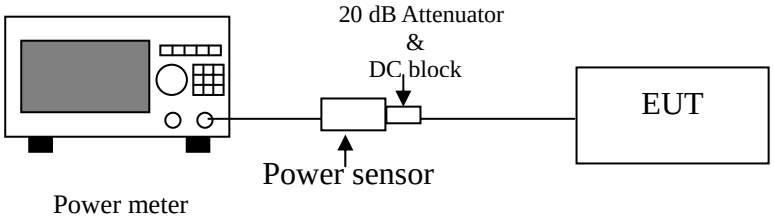
2.4 Test equipment

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
Power Meter	Anritsu	ML2495A	0844001	2014/11/12	2015/11/11
Power Sensor	Anritsu	MA2411B	0738452	2014/11/12	2015/11/11
RF Cable	Mini-Circuits	CBL-4FT-SMSM+	CB0003	2015/05/06	2016/05/05
Simulator	Rohde & Schwarz	CMW 500	124781	2014/10/03	2015/10/02

Note: The above equipments are within the valid calibration period.

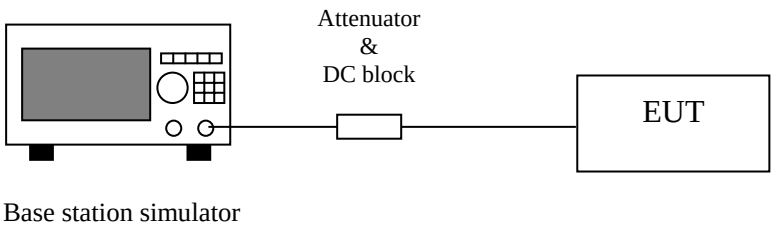
2.5 Test Set-up

For Zigbee mode:



Remark: Cable loss is 2 dB.

For LTE mode:



3. Test results

Mode	Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0 (mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)
Zigbee	Low	2405	2.51	62.37	0.031169522	1.0
	Middle	2440	2.51	85.70	0.042828232	1.0
	High	2475	2.51	87.50	0.043725033	1.0

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 1.4MHz

Modulation: QPSK

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
19957	1710.7	3.16227766	177.0108958	0.11136	1.0	20
20175	1732.5	3.16227766	147.9108388	0.093053	1.0	20
20393	1754.3	3.16227766	191.8668741	0.120706	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 1.4MHz

Modulation: 16QAM

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
19957	1710.7	3.16227766	146.5547841	0.0922	1.0	20
20175	1732.5	3.16227766	119.3988104	0.075116	1.0	20
20393	1754.3	3.16227766	161.0645635	0.101328	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 3MHz

Modulation: QPSK

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
19965	1711.5	3.16227766	183.2314422	0.115274	1.0	20
20175	1732.5	3.16227766	149.279441	0.093914	1.0	20
20385	1753.5	3.16227766	186.2087137	0.117147	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 3MHz

Modulation: 16QAM

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
19965	1711.5	3.16227766	149.9684836	0.094347	1.0	20
20175	1732.5	3.16227766	113.5010816	0.071405	1.0	20
20385	1753.5	3.16227766	146.2177174	0.091988	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 5MHz

Modulation: QPSK

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
19975	1712.5	3.16227766	176.1976046	0.110849	1.0	20
20175	1732.5	3.16227766	153.1087462	0.096323	1.0	20
20375	1752.5	3.16227766	190.107828	0.1196	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 5MHz

Modulation: 16QAM

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
19975	1712.5	3.16227766	148.9361078	0.093698	1.0	20
20175	1732.5	3.16227766	125.025903	0.078656	1.0	20
20375	1752.5	3.16227766	183.6538343	0.115539	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 10MHz

Modulation: QPSK

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
20000	1715	3.16227766	180.3017741	0.113431	1.0	20
20175	1732.5	3.16227766	155.5965632	0.097888	1.0	20
20350	1750	3.16227766	181.5515663	0.114217	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 10MHz

Modulation: 16QAM

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
20000	1715	3.16227766	147.2312502	0.092625	1.0	20
20175	1732.5	3.16227766	126.7651866	0.07975	1.0	20
20350	1750	3.16227766	151.3561248	0.09522	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 15MHz

Modulation: QPSK

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
20025	1717.5	3.16227766	189.2343619	0.11905	1.0	20
20175	1732.5	3.16227766	167.4942876	0.105373	1.0	20
20325	1747.5	3.16227766	195.8844674	0.123234	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 15MHz

Modulation: 16QAM

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
20025	1717.5	3.16227766	159.9558029	0.100631	1.0	20
20175	1732.5	3.16227766	154.525444	0.097214	1.0	20
20325	1747.5	3.16227766	159.9558029	0.100631	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 20MHz

Modulation: QPSK

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
20050	1720	3.16227766	180.3017741	0.113431	1.0	20
20175	1732.5	3.16227766	161.8080038	0.101796	1.0	20
20300	1745	3.16227766	186.2087137	0.117147	1.0	20

Average E.I.R.P. for LTE Band 4

Channel Bandwidth: 20MHz

Modulation: 16QAM

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
20050	1720	3.16227766	157.761127	0.0992499	1.0	20
20175	1732.5	3.16227766	148.2518085	0.0932675	1.0	20
20300	1745	3.16227766	169.0440932	0.1063482	1.0	20

Average E.R.P. for LTE Band 13

Channel Bandwidth: 5MHz

Modulation: QPSK

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
23207	779.5	1.77827941	264.2408757	0.093482463	1.0	20
23230	782.5	1.77827941	251.1886432	0.088864877	1.0	20
23255	784.5	1.77827941	250.0345362	0.08845658	1.0	20

Average E.R.P. for LTE Band 13

Channel Bandwidth: 5MHz

Modulation: 16QAM

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
23207	779.5	1.77827941	213.3044913	0.075462319	1.0	20
23230	782.5	1.77827941	222.8435149	0.07883701	1.0	20
23255	784.5	1.77827941	216.7704105	0.076688483	1.0	20

Average E.R.P. for LTE Band 13

Channel Bandwidth: 10MHz

Modulation: QPSK

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
23230	782	1.77827941	279.2543841	0.098793903	1.0	20

Average E.R.P. for LTE Band 13

Channel Bandwidth: 10MHz

Modulation: 16QAM

Channel	Frequency (MHz)	Antenna Gain0 (numeric)	Output power to antenna 0(mW)	Power density (mW/cm2)	Limit of power density (mW/cm2)	Distance (cm)
23230	782	1.77827941	205.1162179	0.072565492	1.0	20

The Notice in Installation Manual has been stated as below:
While installing and operating this transmitter, the radio frequency exposure limit of 1 mW/ (cm^2) may be exceeded at distances close to the transmitter. Therefore, the user must maintain a minimum distance of 20 cm from the device at all time.

The worst value of Zigbee mode is 0.0437 mW/ cm^2. The worst value of LTE mode is 0.1232 mW/ cm^2. When the Zigbee mode and LTE mode are transmitting at the same time, the worst MPE value is 0.0437+0.1232=0.1669 mW/ cm^2. It is also met the limit.