EMC
TEST REPORT

Report No. : **150500010TWN-001R1**
Model No. : **UMC-I210C**
Issued Date : **Sep. 14, 2015**

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

Test Method/ Standard: **47 CFR FCC Part 15.247**
KDB 558074 D01 v03r02, ANSI C63.4: 2009
Registration No.: **93910**
Test By: **Intertek Testing Services Taiwan Ltd.**
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1. Summary of Test Data

Test Requirement	Applicable Rule (Section 15.247)	Result
Maximum Peak Conducted Output Power	15.247(b)(3) KDB 558074 D01 v03r02	Pass
Emissions In Restricted Frequency Bands (Radiated emission measurements)	15.247(d), 15.205, 15.209	Pass

2. General Information

2.1 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
Channel Number:	15 channels 2350 MHz +5k, k=11~25
Modulation:	O-QPSK
Rated Power:	DC 5 V from adapter
Power Cord:	N/A
Sample Received:	Aug. 25, 2015
Sample condition:	Workable
Test Date(s):	Aug. 30, 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.

2.2 Description of EUT

Modulation mode	Transmit path
	Chain 0 / Main
Zigbee	V

Product SW/HW version :	3.1.0
Radio SW/HW version :	N/A
Test SW Version :	socat 1.7.2.1

RF power setting in TEST SW:

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

2.3 Antenna description

The EUT uses a permanently connected antenna.

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

2.4 Operation mode

EUT can transmit continuously with specific software “socat command”.

2.5 Adapter information

The EUT will be supplied with a power supply from below list:

No.	Brand	Model no.	Specification
Adapter	Ktec	KSAS0120500200HU	I/P: 100-240V~, 50-60Hz, 0.4A, O/P: 5.0Vdc, 2.0A

The above EUT information is declared by Wistron Neweb Corporation and for more detailed features description, please refers to the manufacturer's specifications or user's manual

2.6 Applied test modes and channels

Test items	Mode	Channel	Antenna
Maximum peak conducted output power	Zigbee TX	High	Chain0
Radiated Spurious Emission 1GHz~10th Harmonic	Zigbee TX	High	Chain0

Note: The couducted output power in «Channel High» is the highest value.We considerate «Channel High» as the worst case.

3. Maximum Peak Conducted Output Power

3.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement & Test method	15.247(b)(3) KDB 558074 D01 v03r02	
Channel number	High	

3.2 Limit for maximum peak conducted output power

For systems using digital modulation in the 2400-2483.5 MHz: 1 Watt (30dBm)

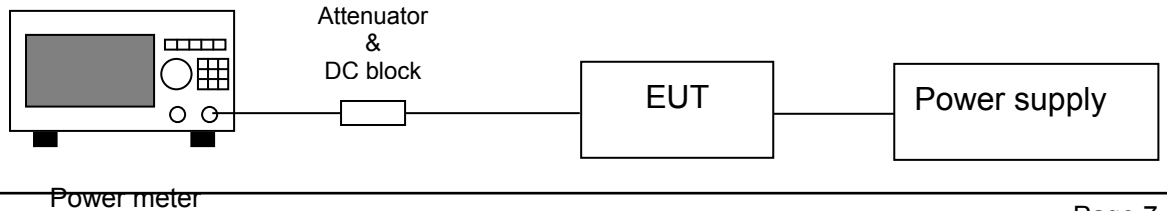
3.3 Measuring instrument setting

Power meter	
Power meter	**Setting**
Bandwidth	50MHz bandwidth is greater than the EUT emission bandwidth
Detector	Peak & Average

3.4 Test procedure

Test procedures refer to clause 9.1.3 peak power meter method and clause 9.2.3.2 measurement using a gated RF average power meter of KDB 558074 D01.

3.5 Test diagram



3.6 Test result

Original data

Mode	Channel	Frequency (MHz)	Output Power (AV) (dBm)	Total Power (AV) (mW)	Maximum power (PK) (dBm)	Maximum power (PK) (mW)	Limit (dBm)	Margin (dB)
Zigbee TX	High	2475	19.42	87.50	19.45	88.10488	30	-10.55

New Test result

Mode	Channel	Frequency (MHz)	Output Power (AV) (dBm)	Total Power (AV) (mW)	Maximum power (PK) (dBm)	Maximum power (PK) (mW)	Limit (dBm)	Margin (dB)
Zigbee TX	High	2475	19.68	92.90	19.73	93.97	30	-10.27

4. Emissions In Restricted Frequency Bands (Radiated emission measurements)

4.1 Operating environment

Temperature:	25	℃
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa
Requirement	15.247(d), 15.205, 15.209	
Channel number	High	

4.2 Limit for emission in restricted frequency bands (Radiated emission measurement)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	2400/F(kHz)	30
1.705~30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

4.3 Measuring instrument setting

Below 1GHz measurement

Receiver settings	
Receiver function	**Setting**
Detector	QP
RBW	9-150 kHz ; 200-300 Hz 0.15-30 MHz; 9-10 kHz 30-1000 MHz; 100-120 kHz
VBW	≧3 x RBW
Sweep	Auto couple
Attenuation	Auto

Above 1GHz measurement

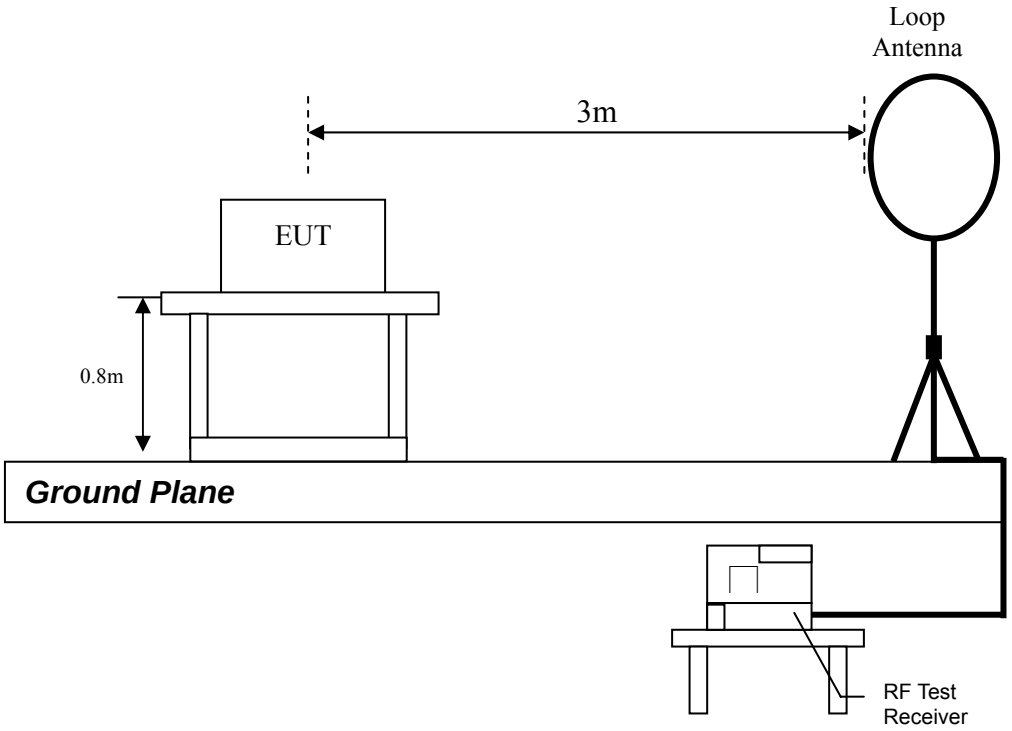
Spectrum analyzer settings	
Spectrum Analyzer function	**Setting**
Detector	Peak
RBW	1MHz
VBW	3MHz for Peak; 10Hz for Average
Sweep	Auto couple
Start Frequency	1GHz
Stop Frequency	Tenth harmonic
Attenuation	Auto

4.4 Test procedure

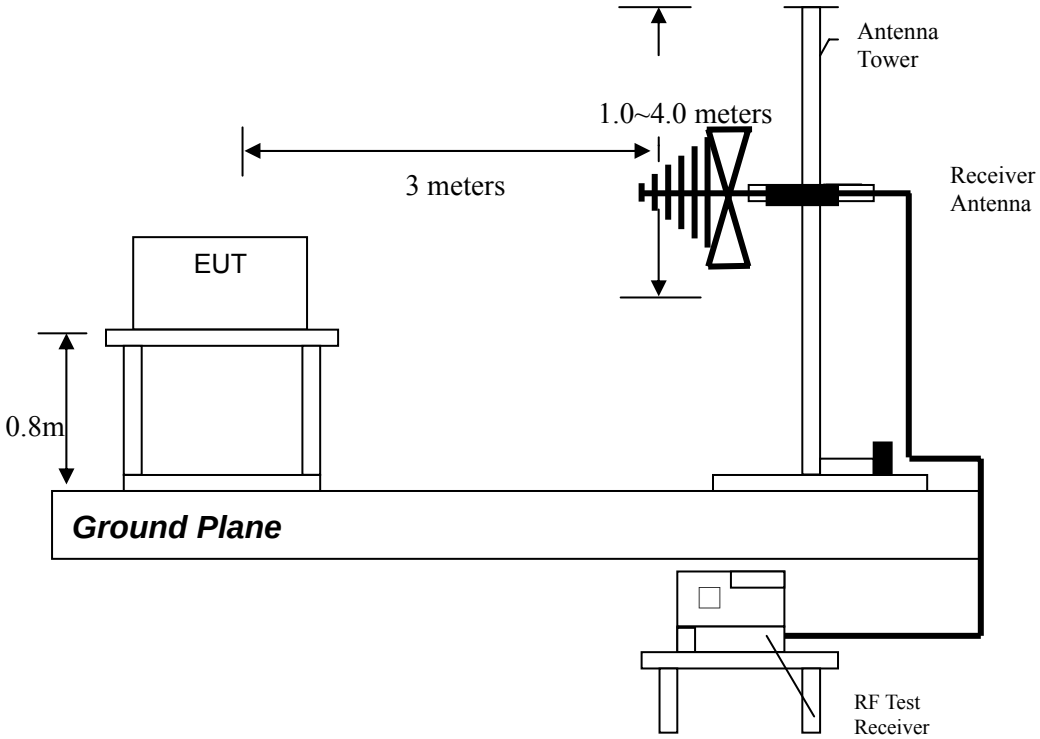
1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
3. The height of the receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of the both horizontal and vertical polarization
4. If find the frequencies above the limit or below within 3dB, the antenna tower was scan (from 1m to 4m) and then the turntable was rotated to find the maximum reading.
5. Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. If the emissions level of the EUT in peak mode was 3dB lower than the average limit specified then testing will be stopped and peak values of the EUT will be reported. Otherwise, the emissions which do not have 3dB margin will be measured using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, The emissions level of the EUT in peak mode was lower than average limit, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.
9. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be quasi-peak measured by receiver.

4.5 Test configuration

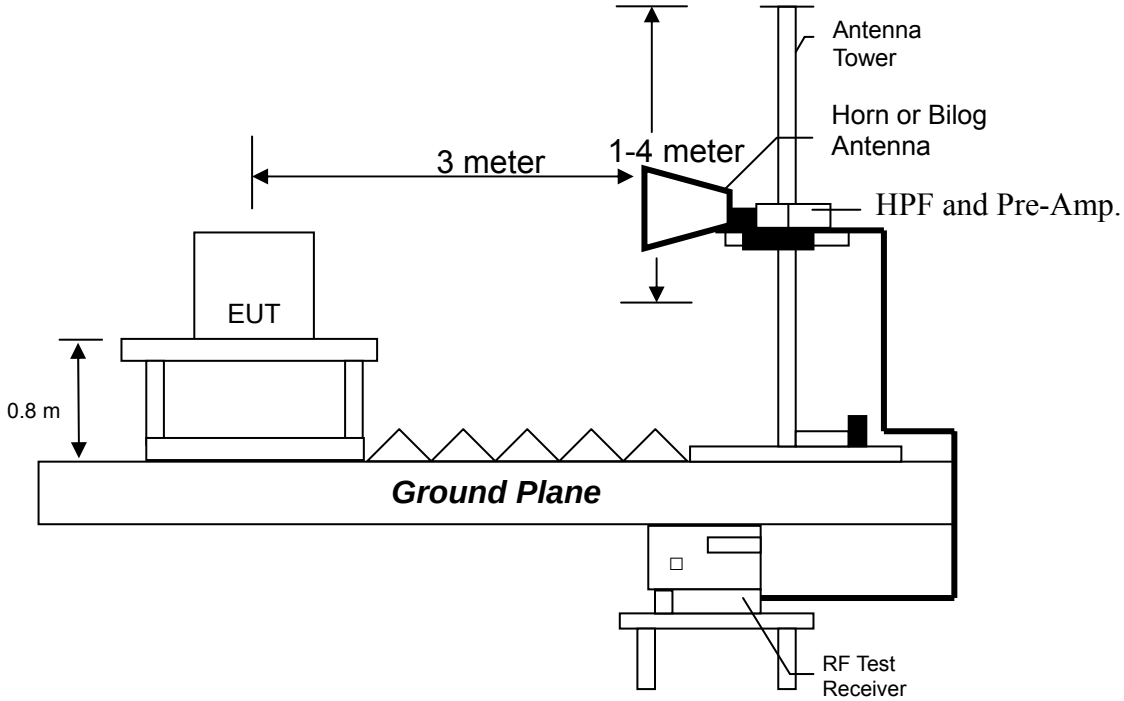
Radiated emission from 9kHz to 30MHz uses Loop Antenna:



Radiated emission from 30MHz to 1GHz uses Bilog Antenna:



Radiated emission above 1GHz using Horn Antenna



4.6 Test result

4.6.1 Measurement results: frequency below 1GHz

The test was performed on EUT under O-QPSK continuously transmitting Low, Middle, High Channel. The worst case occurred at High channel.

EUT : UMC-I210C
Worst Case : High channel.

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBμV)	Calculated level (dBμV/m)	Limit @ 3m (dBμV/m)	Margin (dB)
Vertical	191.02	QP	13.98	15.37	29.35	43.50	-14.15
Vertical	216.24	QP	14.65	14.82	29.47	46.00	-16.53
Vertical	255.04	QP	16.01	14.33	30.34	46.00	-15.66
Vertical	322.94	QP	18.02	14.17	32.19	46.00	-13.81
Vertical	503.36	QP	22.10	9.18	31.28	46.00	-14.72
Vertical	577.08	QP	23.69	9.11	32.80	46.00	-13.20

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBμV)	Calculated level (dBμV/m)	Limit @ 3m (dBμV/m)	Margin (dB)
Horizontal	216.24	QP	16.44	17.42	33.86	46.00	-12.14
Horizontal	288.02	QP	17.70	12.34	30.04	46.00	-15.96
Horizontal	322.94	QP	18.31	12.68	30.99	46.00	-15.01
Horizontal	359.80	QP	18.96	13.84	32.80	46.00	-13.20
Horizontal	542.16	QP	22.16	9.60	31.76	46.00	-14.24
Horizontal	586.78	QP	22.94	10.21	33.15	46.00	-12.85

4.6.2 Measurement results: frequency above 1GHz to 25GHz

EUT : UMC-I210C

Original data

Mode	Freq. (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Channel_High	4980	PK	V	39.81	0.48	45.41	45.89	74.00	-28.11
	7425	PK	V	37.92	8.78	51.37	60.15	74.00	-13.85
	7425	AV	V	37.92	8.78	41.18	49.96	54.00	-4.04
	9900	PK	V	38.54	11.09	38.37	49.46	74.00	-24.54
	12375	PK	V	38.52	13.18	42.91	56.09	74.00	-17.91
	12375	AV	V	38.52	13.18	36.03	49.21	54.00	-4.79
	4980	PK	H	39.81	0.48	42.84	43.32	74.00	-30.68
	7425	PK	H	37.92	8.78	49.40	58.18	74.00	-15.82
	7425	AV	H	37.92	8.78	40.32	49.10	54.00	-4.90
	9900	PK	H	38.54	11.09	36.50	47.59	74.00	-26.41
	12375	PK	H	38.52	13.18	38.09	51.27	74.00	-22.73

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain

New test result

Mode	Freq. (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Channel_High	4980	PK	V	39.8072	0.480245	46.19975	46.68	74	-27.32
	7425	PK	V	37.923	8.775925	51.10408	59.88	74	-14.12
	7425	AV	V	37.923	8.775925	41.59408	50.37	54	-3.63
	9900	PK	V	38.54	11.08734	39.93266	51.02	74	-22.98
	12375	PK	V	38.515	13.18376	43.93624	57.12	74	-16.88
	12375	AV	V	38.515	13.18376	36.74624	49.93	54	-4.07
	4980	PK	H	39.8072	0.480245	42.27975	42.76	74	-31.24
	7425	PK	H	37.923	8.775925	49.18408	57.96	74	-16.04
	7425	AV	H	37.923	8.775925	41.29408	50.07	54	-3.93
	9900	PK	H	38.54	11.08734	37.19266	48.28	74	-25.72
	12375	PK	H	38.515	13.18376	39.86624	53.05	74	-20.95

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain

Appendix A: Test equipment list

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
ESCI EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2014/12/02	2015/12/01
Spectrum Analyzer	Rohde & Schwarz	FSP30	100137	2015/08/18	2016/08/16
Horn Antenna (1-18G)	SHWARZBECK	BBHA 9120 D	9120D-456	2014/08/29	2017/08/27
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2014/09/16	2017/09/14
Pre-Amplifier	MITEQ	AFS44-00102650--42-10P-44	1495287	2013/10/27	2015/10/26
Power Meter	Anritsu	ML2495A	0844001	2014/11/12	2015/11/11
Power Senor	Anritsu	MA2411B	0738452	2014/11/12	2015/11/11
Signal Analyzer	Agilent	N9030A	MY51380492	2014/09/19	2015/09/18
RF Cable	Mini-Circuits	CBL-4FT-SMSM+	CB0003	2015/05/06	2016/05/05
966-2(A) Cable	SUHNER	SMA / EX 100	N/A	2015/05/06	2016/05/05
966-2(B) Cable	JUNFLON	SMA / J12J100880-00	AUG-26-08-002	2015/05/06	2016/05/05
Brand		Software		Version	
ADT		Radiated test system		7.5.14	

Appendix B: Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of *k*=2.

Item	Uncertainty
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.15 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.23 dB
Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.19 dB
Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	4.3 dB
Vertically polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	4.19 dB
Horizontally polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	4.3 dB
Conducted Output power	0.86 dB
Radiated electromagnetic disturbances in the frequency range from 9kHz to 30MHz	2.92 dB
Conducted disturbance measurements at a mains port from 9 kHz to 30 MHz using a 50 Ω/50 μH +5Ω artificial mains network (AMN)	2.5 dB