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# PARTIAL FCC TEST REPORT (15.247)

**REPORT NO.:** RF130506C21

**MODEL NO.:** TP00042A

**FCC ID:** GKR-TP00042AKP

**RECEIVED:** May 06, 2013

**TESTED:** May 13, 2013 ~ May 23, 2013

**ISSUED:** May 27, 2013

**APPLICANT:** COMPAL ELECTRONICS, INC.

**ADDRESS:** No. 581, Ruiguang RD., Neihu District, Taipei City  
11492, Taiwan, R.O.C.

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

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**TEST LOCATION:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei  
Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

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Testing Laboratory  
2021

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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF130506C21	Original release	May 27, 2013



## 1. CERTIFICATION

**PRODUCT:** Convertible Tablet Computer, ThinkPad S230u  
**MODEL NO.:** TP00042A  
**BRAND:** Lenovo  
**APPLICANT:** COMPAL ELECTRONICS, INC.  
**TESTED:** May 13, 2013 ~ May 23, 2013  
**TEST SAMPLE:** ENGINEERING SAMPLE  
**STANDARDS:** **FCC Part 15, Subpart C (Section 15.247)**  
ANSI C63.10-2009

The above equipment (model: TP00042A) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found 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** : Ivonne Wu , **DATE** : May 27, 2013  
Ivonne Wu / Senior Specialist

**APPROVED BY** : Sam chen , **DATE** : May 27, 2013  
Sam Chen / Assistant Manager



## 2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.207	AC Power Conducted Emission	NA	Refer to Note
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -3.38dB at 498.1MHz.
15.247(d)	Band Edge Measurement	NA	Refer to Note
15.247(a)(2)	6dB bandwidth	NA	Refer to Note
15.247(b)	Conducted power	NA	Refer to Note
15.247(e)	Power Spectral Density	NA	Refer to Note
15.203	Antenna Requirement	NA	Refer to Note

**Note:** Only the radiated emission test was performed for this report. Other test data please refer to module report on FCC ID: PD9622ANXHU (File: R76779).

### 2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Radiated emissions	30MHz ~ 200MHz	2.93 dB
	200MHz ~ 1000MHz	2.95 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

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



### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>EUT</b>	Convertible Tablet Computer, ThinkPad S230u
<b>MODEL NO.</b>	TP00042A
<b>POWER SUPPLY</b>	20Vdc (adapter)
<b>MODULATION TYPE</b>	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
<b>MODULATION TECHNOLOGY</b>	DSSS, OFDM
<b>TRANSFER RATE</b>	802.11b:11.0/ 5.5/ 2.0/ 1.0Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to HT8
<b>OPERATING FREQUENCY</b>	<b>2.4GHz:</b> 2412 ~ 2462MHz <b>5.0GHz:</b> 5745 ~ 5825MHz
<b>NUMBER OF CHANNEL</b>	<b>2.4GHz:</b> 11 for 802.11b, 802.11g, 802.11n (20MHz) 7 for 802.11n (40MHz) <b>5.0GHz:</b> 5 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz)
<b>ANTENNA TYPE</b>	Refer to Note as below
<b>ANTENNA CONNECTOR</b>	NA
<b>DATA CABLE</b>	Refer to Note as below
<b>I/O PORTS</b>	Refer to user's manual
<b>ACCESSORY DEVICES</b>	Refer to Note as below

**NOTE:**

- The module (Intel Centrion Advanced-N + WiMAX 6250, model: 622ANXHMW) is allocated in the EUT.
- The antenna information is listed as below.

Antenna Type	Brand Name	Parts Number	Antenna Gain
PIFA	Jess-Link Products CO., LTD.	Main Antenna: PANT11A00034-1	<b>2.4G:</b> -2.03 <b>5GHz:</b> 0.45
		Auxiliary Antenna: PANT11A00035-1	<b>2.4G:</b> -3.47 <b>5G:</b> 0.42

- The EUT contains following accessory devices.

ITEM	BRAND	MODEL	SPECIFICATION
Adapter	lenovo	45N0185	I/P: 100-240Vac, 50/60Hz, 1.5A O/P: 20Vdc, 3.25A 1.8m non-shielded cable with ferrite core

- The above EUT information is declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.



### 3.2 DESCRIPTION OF TEST MODES

#### FOR 2.4GHz:

11 channels are provided for 802.11b, 802.11g and 802.11n (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz		

7 channels are provided for 802.11n (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz		

#### FOR 5.0GHz (5745 ~ 5825MHz):

5 channels are provided for 802.11a, 802.11n (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz		

2 channels are provided for 802.11n (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
151	5755MHz	159	5795MHz



### 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

#### FOR 2.4GHz:

EUT CONFIGURE MODE	APPLICABLE TO		DESCRIPTION
	RE≥1G	RE<1G	
A	√	-	EUT with antenna B (NB Mode)
B	√	√	EUT with antenna A+B (NB Mode)

Where **RE≥1G**: Radiated Emission above 1GHz **RE<1G**: Radiated Emission below 1GHz

**NOTE:** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Z-plane.

**NOTE:** The system antenna type is the same as module antenna type, so Radiated Spurious Emission is re-tested on worst channel of the module report, which is FCC ID PD9622ANXHU.

**NOTE:** The EUT had been pre tested on NB mode and Pad mode for all bands, and only the worst case was presented in this report.

#### RADIATED EMISSION TEST (ABOVE 1GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A, B	802.11n (40MHz)	3 to 9	3, 9	OFDM	BPSK	HT0

#### RADIATED EMISSION TEST (BELOW 1GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A	802.11n (40MHz)	3 to 9	9	OFDM	BPSK	HT0

#### TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Johnson Liao
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	David Huang





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**FOR 5.0GHz (5745 ~ 5825MHz):**

EUT CONFIGURE MODE	APPLICABLE TO		DESCRIPTION
	RE≥1G	RE<1G	
A	√	√	EUT with antenna A (NB Mode)
B	√	-	EUT with antenna A+B (Pad Mode)

Where **RE≥1G**: Radiated Emission above 1GHz **RE<1G**: Radiated Emission below 1GHz

**NOTE:** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Z-plane.

**NOTE:** The system antenna type is the same as module antenna type, so Radiated Spurious Emission is re-tested on worst channel of the module report, which is FCC ID PD9622ANXHU.

**NOTE:** The EUT had been pre tested on NB mode and Pad mode for all bands, and only the worst case was presented in this report.

**RADIATED EMISSION TEST (ABOVE 1GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A	802.11a	149 to 165	149, 165	OFDM	BPSK	6.0
B	802.11n (40MHz)	151 to 159	151, 159	OFDM	BPSK	HT8

**RADIATED EMISSION TEST (BELOW 1GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
A	802.11a	149 to 165	149	OFDM	BPSK	6.0

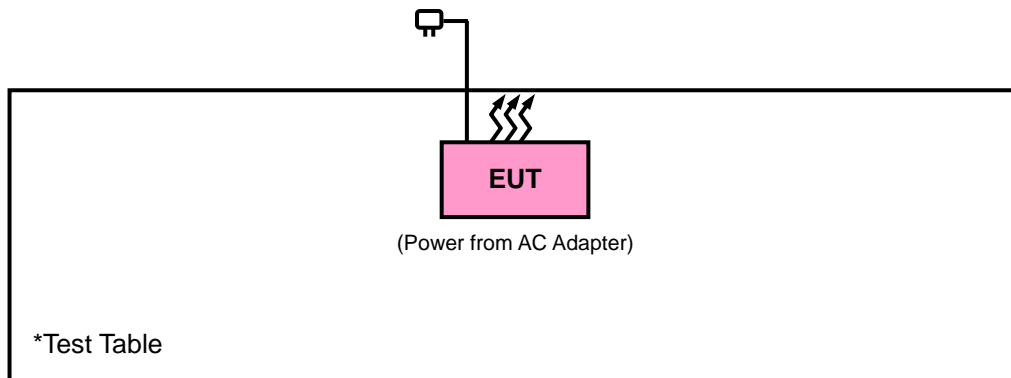
**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Johnson Liao
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	David Huang

### 3.3 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

#### 3.3.1 CONFIGURATION OF SYSTEM UNDER TEST



### 3.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

#### **FCC Part 15, Subpart C (15.247)**

ANSI C63.10-2009

KDB 558074 D01 DTS Meas Guidance v02

All test items have been performed and recorded as per the above standards.

**NOTE:** The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

## 4. TEST TYPES AND RESULTS (FOR 2.4GHz BAND)

### 4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

#### 4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



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#### 4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCI	100744	Apr. 15, 2013	Apr. 14, 2014
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 17, 2012	Dec. 16, 2013
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Mar. 25, 2013	Mar. 24, 2014
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Jan. 07, 2013	Jan. 06, 2014
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Dec. 25, 2012	Dec. 24, 2013
Loop Antenna	HFH2-Z2	100070	Jan. 31, 2012	Jan. 30, 2014
Preamplifier EMCI	EMC 012645	980115	Dec. 28, 2012	Dec. 27, 2013
Preamplifier EMCI	EMC 184045	980116	Dec. 28, 2012	Dec. 27, 2013
Preamplifier EMCI	EMC 330H	980112	Dec. 28, 2012	Dec. 27, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4	Oct. 19, 2012	Oct. 18, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 19, 2012	Oct. 18, 2013
RF signal cable Worken	RG-213	NA	Dec. 29, 2012	Dec. 28, 2013
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	NA	NA	NA
Power Meter	ML2495A	1232002	Aug. 10, 2012	Aug. 09, 2013
Power Sensor	MA2411B	1207325	Aug. 15, 2012	Aug. 14, 2013

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  2. The calibration interval of the loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. The test was performed in HwaYa Chamber 10.
  4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
  5. The FCC Site Registration No. is 690701.
  6. The IC Site Registration No. is IC 7450F-10.

#### 4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Height of receiving antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

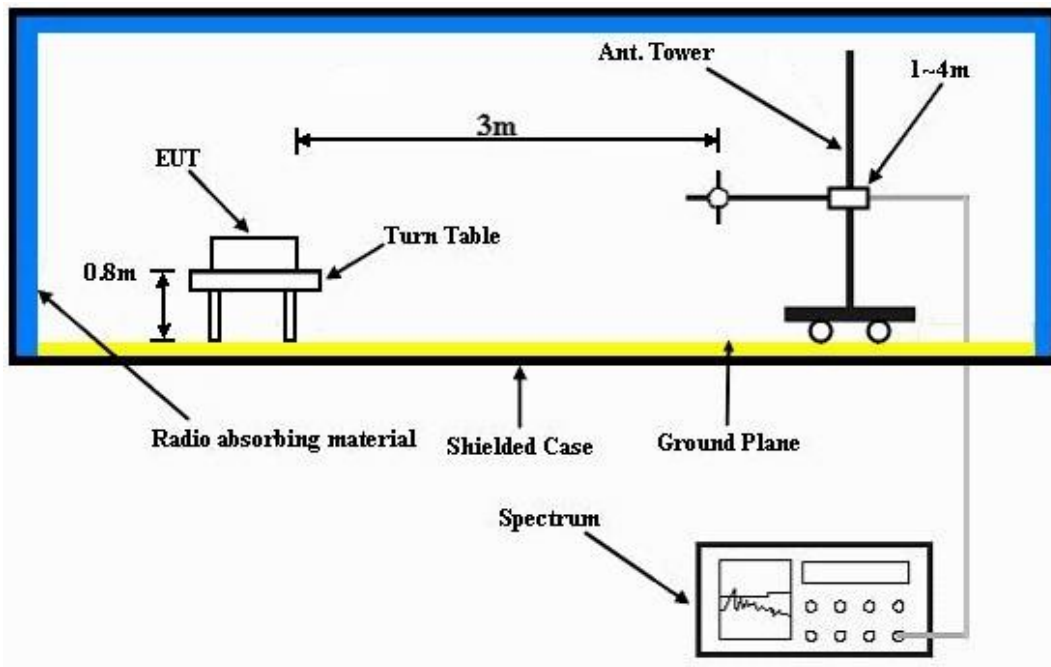
**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.1.5 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT OPERATING CONDITIONS

- a. Placed the EUT on a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.



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### 4.1.7 TEST RESULTS

#### ABOVE 1GHz WORST-CASE DATA

Mode A

802.11n (40MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 3	FREQUENCY RANGE	1GHz ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Johnson Liao

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2386	36.07	42.43	54	-17.93	26.91	4.23	37.5	100	267	Average
2386	47.37	53.73	74	-26.63	26.91	4.23	37.5	100	267	Peak
2422	81.68	87.87			27.01	4.26	37.46	100	267	Average
2422	91.46	97.65			27.01	4.26	37.46	100	267	Peak
2498	35.34	41.1	54	-18.66	27.2	4.29	37.25	100	267	Average
2498	47.86	53.62	74	-26.14	27.2	4.29	37.25	100	267	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2388	36.1	42.46	54	-17.9	26.91	4.23	37.5	100	348	Average
2388	47.91	54.27	74	-26.09	26.91	4.23	37.5	100	348	Peak
2422	80.83	87.02			27.01	4.26	37.46	100	348	Average
2422	90.73	96.92			27.01	4.26	37.46	100	348	Peak
2498	35.06	40.82	54	-18.94	27.2	4.29	37.25	100	348	Average
2498	47.61	53.37	74	-26.39	27.2	4.29	37.25	100	348	Peak

#### REMARKS:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
- 2422MHz: Fundamental frequency.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 9	FREQUENCY RANGE	1GHz ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Johnson Liao

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2382	34.4	40.81	54	-19.6	26.86	4.23	37.5	100	150	Average
2382	46.48	52.89	74	-27.52	26.86	4.23	37.5	100	150	Peak
2452	80.2	86.26			27.06	4.27	37.39	100	150	Average
2452	90.92	96.98			27.06	4.27	37.39	100	150	Peak
2490	36.49	42.33	54	-17.51	27.2	4.28	37.32	100	150	Average
2490	48.14	53.98	74	-25.86	27.2	4.28	37.32	100	150	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2382	34.65	41.06	54	-19.35	26.86	4.23	37.5	100	272	Average
2382	47.82	54.23	74	-26.18	26.86	4.23	37.5	100	272	Peak
2452	79.62	85.68			27.06	4.27	37.39	100	272	Average
2452	89.55	95.61			27.06	4.27	37.39	100	272	Peak
2488	35.97	41.81	54	-18.03	27.2	4.28	37.32	100	272	Average
2488	48.57	54.41	74	-25.43	27.2	4.28	37.32	100	272	Peak

**REMARKS:**

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
2. 2452MHz: Fundamental frequency.





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## Mode B

### 802.11n (40MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 3	FREQUENCY RANGE	1GHz ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Johnson Liao

#### ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2386	42.64	48.38	54	-11.36	26.91	4.85	37.5	100	349	Average
2386	56.87	62.61	74	-17.13	26.91	4.85	37.5	100	349	Peak
2422	85.53	91.09			27.01	4.89	37.46	100	349	Average
2422	95.96	101.52			27.01	4.89	37.46	100	349	Peak
2486	36.52	41.77	54	-17.48	27.15	4.92	37.32	100	349	Average
2486	48.47	53.72	74	-25.53	27.15	4.92	37.32	100	349	Peak

#### ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2386	41.02	46.76	54	-12.98	26.91	4.85	37.5	100	94	Average
2386	54.02	59.76	74	-19.98	26.91	4.85	37.5	100	94	Peak
2422	84.58	90.14			27.01	4.89	37.46	100	94	Average
2422	94.6	100.16			27.01	4.89	37.46	100	94	Peak
2492	36.93	42.04	54	-17.07	27.2	4.94	37.25	100	94	Average
2492	47.83	52.94	74	-26.17	27.2	4.94	37.25	100	94	Peak

#### REMARKS:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
2. 2422MHz: Fundamental frequency.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 9	FREQUENCY RANGE	1GHz ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Johnson Liao

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2390	37.25	42.99	54	-16.75	26.91	4.87	37.52	100	15	Average
2390	48.29	54.03	74	-25.71	26.91	4.87	37.52	100	15	Peak
2452	86.47	91.89			27.06	4.91	37.39	100	15	Average
2452	96.56	101.98			27.06	4.91	37.39	100	15	Peak
2484	44.69	49.94	54	-9.31	27.15	4.92	37.32	100	15	Average
2484	59.07	64.32	74	-14.93	27.15	4.92	37.32	100	15	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2386	36.35	42.09	54	-17.65	26.91	4.85	37.5	100	90	Average
2386	48.43	54.17	74	-25.57	26.91	4.85	37.5	100	90	Peak
2452	85.59	91.01			27.06	4.91	37.39	100	90	Average
2452	95.75	101.17			27.06	4.91	37.39	100	90	Peak
2484	43.08	48.33	54	-10.92	27.15	4.92	37.32	100	90	Average
2484	57.14	62.39	74	-16.86	27.15	4.92	37.32	100	90	Peak

**REMARKS:**

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
2. 2452MHz: Fundamental frequency.



A D T

**BELOW 1GHz WORST-CASE DATA: 802.11n (40MHz)**

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 9	FREQUENCY RANGE	30MHz ~ 1GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Kay Wu

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
55.92	27.73	45.92	40	-12.27	12.35	0.8	31.34	200	0	Peak
165.27	34.13	52.27	43.5	-9.37	12.25	1.42	31.81	200	0	Peak
260.31	41.99	60.21	46	-4.01	11.77	1.86	31.85	200	0	Peak
332.9	40.28	56.19	46	-5.72	13.73	2.17	31.81	100	0	QP
399.4	36.75	51.13	46	-9.25	15.33	2.42	32.13	100	0	Peak
498.1	36.79	48.38	46	-9.21	17.29	2.77	31.65	100	0	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
184.17	33.63	53.42	43.5	-9.87	10.46	1.52	31.77	200	0	Peak
264.9	40.05	58.19	46	-5.95	11.91	1.89	31.94	200	0	Peak
298.92	40.14	57	46	-5.86	12.91	2.05	31.82	200	0	Peak
332.2	40.41	56.32	46	-5.59	13.73	2.17	31.81	100	0	Peak
<b>498.1</b>	<b>42.62</b>	<b>54.21</b>	<b>46</b>	<b>-3.38</b>	<b>17.29</b>	<b>2.77</b>	<b>31.65</b>	<b>100</b>	<b>0</b>	<b>QP</b>
829.2	35.26	40.6	46	-10.74	22.6	3.77	31.71	100	0	Peak

**REMARKS:** Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor

## 5. TEST TYPES AND RESULTS (FOR 5.0GHz BAND)

### 5.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

#### 5.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



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### 5.1.2 TEST INSTRUMENTS

Same as item 4.1.2.

### 5.1.3 TEST PROCEDURES

Same as item 4.1.3.

### 5.1.4 DEVIATION FROM TEST STANDARD

No deviation.

### 5.1.5 TEST SETUP

Same as item 4.1.5.

### 5.1.6 EUT OPERATING CONDITIONS

Same as 4.1.6.



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### 5.1.7 TEST RESULTS

#### ABOVE 1GHz WORST-CASE DATA

Mode A

802.11a

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 149	FREQUENCY RANGE	1GHz ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Johnson Liao

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5725	45.21	42.97	67.99	-22.78	31.96	7.71	37.43	100	179	Average
5725	58.12	55.88	77.27	-19.15	31.96	7.71	37.43	100	179	Peak
5745	87.99	85.73			31.99	7.74	37.47	100	179	Average
5745	97.27	95.01			31.99	7.74	37.47	100	179	Peak
5850	40.46	37.99	67.99	-27.53	32.15	7.83	37.51	100	179	Average
5850	50.08	47.61	77.27	-27.19	32.15	7.83	37.51	100	179	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5725	44.56	42.32	67.55	-22.99	31.96	7.71	37.43	100	354	Average
5725	60.39	58.15	77.02	-16.63	31.96	7.71	37.43	100	354	Peak
5745	87.55	85.29			31.99	7.74	37.47	100	354	Average
5745	97.02	94.76			31.99	7.74	37.47	100	354	Peak
5850	40.29	37.82	67.55	-27.26	32.15	7.83	37.51	100	354	Average
5850	52.1	49.63	77.02	-24.92	32.15	7.83	37.51	100	354	Peak

#### REMARKS:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
2. 5745MHz: Fundamental frequency.
3. 5725MHz & 5850MHz: Out of restricted band



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 165	FREQUENCY RANGE	1GHz ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Johnson Liao

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5725	40.26	38.02	67.43	-27.17	31.96	7.71	37.43	100	176	Average
5725	50.84	48.6	77.73	-26.89	31.96	7.71	37.43	100	176	Peak
5825	87.43	85.02			32.12	7.82	37.53	100	176	Average
5825	97.73	95.32			32.12	7.82	37.53	100	176	Peak
5850	41.1	38.63	67.43	-26.33	32.15	7.83	37.51	100	176	Average
5850	53.83	51.36	77.73	-23.9	32.15	7.83	37.51	100	176	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5725	40.3	38.06	66.17	-25.87	31.96	7.71	37.43	100	352	Average
5725	50.49	48.25	76.47	-25.98	31.96	7.71	37.43	100	352	Peak
5825	86.17	83.76			32.12	7.82	37.53	100	352	Average
5825	96.47	94.06			32.12	7.82	37.53	100	352	Peak
5850	40.92	38.45	66.17	-25.25	32.15	7.83	37.51	100	352	Average
5850	52.76	50.29	76.47	-23.71	32.15	7.83	37.51	100	352	Peak

**REMARKS:**

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
2. 5825MHz: Fundamental frequency.
3. 5725MHz & 5850MHz: Out of restricted band



A D T

Mode B

802.11n (40MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 151	FREQUENCY RANGE	1GHz ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Johnson Liao

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5725	43.95	41.71	63.28	-19.33	31.96	7.71	37.43	100	5	Average
5725	56.31	54.07	73.82	-17.51	31.96	7.71	37.43	100	5	Peak
5755	83.28	81			32.01	7.74	37.47	100	5	Average
5755	93.82	91.54			32.01	7.74	37.47	100	5	Peak
5850	41.26	38.79	63.28	-22.02	32.15	7.83	37.51	100	5	Average
5850	50.77	48.3	73.82	-23.05	32.15	7.83	37.51	100	5	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5725	43.92	41.68	63.18	-19.26	31.96	7.71	37.43	100	184	Average
5725	56.59	54.35	74.58	-17.99	31.96	7.71	37.43	100	184	Peak
5755	83.18	80.9			32.01	7.74	37.47	100	184	Average
5755	94.58	92.3			32.01	7.74	37.47	100	184	Peak
5850	40.91	38.44	63.18	-22.27	32.15	7.83	37.51	100	184	Average
5850	50.83	48.36	74.58	-23.75	32.15	7.83	37.51	100	184	Peak

REMARKS:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
2. 5755MHz: Fundamental frequency.
3. 5725MHz & 5850MHz: Out of restricted band





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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 159	FREQUENCY RANGE	1GHz ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Johnson Liao

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5725	40.88	38.64	62.38	-21.5	31.96	7.71	37.43	100	6	Average
5725	51.49	49.25	73.13	-21.64	31.96	7.71	37.43	100	6	Peak
5795	82.38	80.05			32.07	7.8	37.54	100	6	Average
5795	93.13	90.8			32.07	7.8	37.54	100	6	Peak
5850	41.13	38.66	62.38	-21.25	32.15	7.83	37.51	100	6	Average
5850	52.24	49.77	73.13	-20.89	32.15	7.83	37.51	100	6	Peak

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
5725	41.24	39	62.58	-21.34	31.96	7.71	37.43	100	185	Average
5725	51.8	49.56	73.75	-21.95	31.96	7.71	37.43	100	185	Peak
5795	82.58	80.25			32.07	7.8	37.54	100	185	Average
5795	93.75	91.42			32.07	7.8	37.54	100	185	Peak
5850	41.2	38.73	62.58	-21.38	32.15	7.83	37.51	100	185	Average
5850	52.03	49.56	73.75	-21.72	32.15	7.83	37.51	100	185	Peak

**REMARKS:**

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
2. 5795MHz: Fundamental frequency.
3. 5725MHz & 5850MHz: Out of restricted band



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**BELOW 1GHz WORST-CASE DATA : 802.11a**

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 149	FREQUENCY RANGE	30MHz ~ 1GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	David Huang

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
170.67	29.88	48.5	43.5	-13.62	11.67	1.45	31.74	100	120	Peak
250.32	32.53	51.15	46	-13.47	11.48	1.84	31.94	100	162	Peak
298.65	38.26	55.12	46	-7.74	12.91	2.05	31.82	100	136	Peak
300	37.46	54.31	46	-8.54	12.94	2.05	31.84	100	128	Peak
332.9	39.8	55.71	46	-6.2	13.73	2.17	31.81	100	163	Peak
498.8	33.69	45.28	46	-12.31	17.29	2.77	31.65	100	184	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB/m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
187.14	30.58	50.51	43.5	-12.92	10.26	1.53	31.72	100	162	Peak
232.23	28.24	47.62	46	-17.76	10.71	1.75	31.84	100	184	Peak
298.92	35.63	52.49	46	-10.37	12.91	2.05	31.82	100	114	Peak
332.9	40.73	56.64	46	-5.27	13.73	2.17	31.81	100	132	Peak
498.1	39.44	51.03	46	-6.56	17.29	2.77	31.65	100	163	QP
831.3	36.47	41.8	46	-9.53	22.63	3.77	31.73	100	110	Peak

**REMARKS:** Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor



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## 6. PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



## 7. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

The address and road map of all our labs can be found in our web site also.



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## 8. APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---