

## TEST REPORT



Applicant	Asian Express Holdings Limited
Address	RM1702, Sino Centre, 582-592 Nathan Road, Mongkok ,Kowloon, Hong Kong.

Manufacturer or Supplier	Asian Express Holdings Limited
Address	RM1702, Sino Centre, 582-592 Nathan Road, Mongkok ,Kowloon, Hong Kong.
Product	720P camera
Brand Name	PROPEL
Model	PL-1540
Additional Model & Model Difference	PL-1541, PL-1542, PL-1543, PL-1544, PL-1545, PL-1546, PL-1547, PL-1548, PL-1549, HS-2407, HS-2408, HS-2409, HS-2410, HS-2411, See item 3.1 note
Date of tests	Jul. 26, 2016 ~ Aug. 02, 2016

The tests have been carried out according to the requirements of the following standard:

**FCC Part 15, Subpart C, Section 15.247**

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

Tested by Breeze Jiang Project Engineer / EMC Department	Approved by Glyn He Supervisor / EMC Department
	  Date: Aug. 06, 2016
<p>This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification</p>	

## TABLE OF CONTENTS

<b>RELEASE CONTROL RECORD .....</b>	<b>4</b>
<b>1 SUMMARY OF TEST RESULTS.....</b>	<b>5</b>
<b>2 MEASUREMENT UNCERTAINTY .....</b>	<b>5</b>
<b>3 GENERAL INFORMATION .....</b>	<b>6</b>
3.1 GENERAL DESCRIPTION OF EUT.....	6
3.2 DESCRIPTION OF TEST MODES.....	7
3.2.1 CONFIGURATION OF SYSTEM UNDER TEST .....	7
3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL.....	7
3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS.....	10
3.4 DESCRIPTION OF SUPPORT UNITS.....	10
<b>4 TEST TYPES AND RESULTS.....</b>	<b>11</b>
4.1 RADIATED EMISSION MEASUREMENT .....	11
4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT .....	11
4.2.2 TEST INSTRUMENTS.....	12
4.2.3 TEST PROCEDURES .....	13
4.2.4 DEVIATION FROM TEST STANDARD .....	13
4.2.5 TEST SETUP.....	14
4.2.6 EUT OPERATING CONDITIONS .....	14
4.2.7 TEST RESULTS .....	15
4.2 6dB BANDWIDTH MEASUREMENT .....	20
4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT .....	20
4.3.2 TEST INSTRUMENTS.....	20
4.3.3 TEST PROCEDURE .....	20
4.3.4 DEVIATION FROM TEST STANDARD .....	20
4.3.5 TEST SETUP.....	21
4.3.6 EUT OPERATING CONDITIONS .....	21
4.3.7 TEST RESULTS .....	22
4.4 CONDUCTED OUTPUT POWER.....	25
4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT .....	25
4.4.2 TEST SETUP.....	25
4.4.3 TEST INSTRUMENTS.....	25
4.4.4 TEST PROCEDURES .....	26
4.4.5 DEVIATION FROM TEST STANDARD .....	26



**BUREAU  
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**Test Report No.: RF160722N064-1**

4.4.6	EUT OPERATING CONDITIONS .....	26
4.4.7	TEST RESULTS .....	27
4.4.7.1	MAXIMUM PEAK OUTPUT POWER .....	27
4.4.7.2	AVERAGE OUTPUT POWER (FOR REFERENCE) .....	28
4.5	POWER SPECTRAL DENSITY MEASUREMENT .....	29
4.5.1	LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT .....	29
4.5.2	TEST SETUP .....	29
4.5.3	TEST INSTRUMENTS .....	29
4.5.4	TEST PROCEDURE .....	29
4.5.5	DEVIATION FROM TEST STANDARD .....	29
4.5.6	EUT OPERATING CONDITION .....	30
4.5.7	TEST RESULTS .....	30
4.6	OUT OF BAND EMISSION MEASUREMENT .....	33
4.6.1	LIMITS OF OUT OF BAND EMISSION MEASUREMENT .....	33
4.6.2	TEST SETUP .....	33
4.6.3	TEST INSTRUMENTS .....	33
4.6.4	TEST PROCEDURE .....	33
4.6.5	DEVIATION FROM TEST STANDARD .....	34
4.6.6	EUT OPERATING CONDITION .....	34
4.6.7	TEST RESULTS .....	35
<b>5</b>	<b>PHOTOGRAPHS OF THE TEST CONFIGURATION .....</b>	<b>37</b>
<b>6</b>	<b>APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB .....</b>	<b>38</b>



**BUREAU  
VERITAS**

Test Report No.: RF160722N064-1

## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF160722N064-1	Original release	Aug. 06, 2016



# 1 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 AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	N/A	Powered from Battery
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	Conducted Output power	PASS	Meet the requirement of limit.
15.247(e)	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Unique antenna connector is used

# 2 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	9KHz ~ 30MHz	2.90dB
	30MHz ~ 1GMHz	3.83dB
	1GHz ~ 18GHz	4.93dB
	18GHz ~ 40GHz	4.80dB

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>PRODUCT</b>	720P camera
<b>MODEL NO.</b>	PL-1540
<b>ADDITIONAL MODELS</b>	PL-1541, PL-1542, PL-1543, PL-1544, PL-1545, PL-1546, PL-1547, PL-1548, PL-1549, HS-2407, HS-2408, HS-2409, HS-2410, HS-2411
<b>FCC ID</b>	VLEPL1540R
<b>NOMINAL VOLTAGE</b>	DC7.4V from Li-ion Battery with Host Unit
<b>MODULATION TYPE</b>	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
<b>MODULATION TECHNOLOGY</b>	DSSS, OFDM
<b>OPERATING FREQUENCY</b>	2417MHz for 802.11b/g/n(HT20)
<b>PEAK POWER</b>	WLAN: 16.64dBm (Maximum)
<b>ANTENNA TYPE</b>	Wire Antenna, 2.5dBi Gain
<b>I/O PORTS</b>	Refer to user's manual
<b>CABLE SUPPLIED</b>	N/A

**NOTE:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions, but only the worst case was shown in test report.
3. Please refer to the EUT photo document (Reference No.: 160722N064-1) for detailed product photo.
4. Additional models are identical with the test model PL-1540 except the model no. for trading purpose.
5. The EUT provides completed transmitters and receivers.

<b>MODULATION MODE</b>	<b>TX FUNCTION</b>
<b>802.11b</b>	1TX/1RX
<b>802.11g</b>	1TX/1RX
<b>802.11n(20MHz)</b>	1TX/1RX



### 3.2 DESCRIPTION OF TEST MODES

1 channels are provided for 802.11b, 802.11g and 802.11n(HT20):

CHANNEL	FREQUENCY
2	2417 MHz

#### 3.2.1 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photographs of the test configuration for reference.

#### 3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned on X axis for radiated emission. Following test modes were selected for the final test, and the final worst case is marked in boldface and recorded in the report:

EUT CONFIGURE MODE	APPLICABLE TO				MODE
	RE<1G	RE≥1G	PLC	APCM	
<b>A</b>	√	√	-	√	Powered by fully battery with WIFI function

Where **RE<1G**: Radiated Emission below 1GHz      **RE≥1G**: Radiated Emission above 1GHz  
**PLC**: Power Line Conducted Emission      **APCM**: Antenna Port Conducted Measurement

#### 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, XYZ axis 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)	AXIS
A	802.11g	2	2	OFDM	BPSK	6.0	X



**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, XYZ axis 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)	AXIS
A	802.11b	2	2	CCK	DBPSK	1.0	X
A	802.11g	2	2	OFDM	BPSK	6.0	X
A	802.11n HT20	2	2	OFDM	BPSK	6.5	X

**BANDEDGE MEASUREMENT:**

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)
B	802.11b	2	2	CCK	DBPSK	1.0
B	802.11g	2	2	OFDM	BPSK	6.0
B	802.11n HT20	2	2	OFDM	BPSK	6.5





**ANTENNA PORT CONDUCTED MEASUREMENT:**

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- 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)
B	802.11b	2	2	CCK	DBPSK	1.0
B	802.11g	2	2	OFDM	BPSK	6.0
B	802.11n HT20	2	2	OFDM	BPSK	6.5

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE	TESTED BY
RE<1G	26deg. C, 50%RH	DC 7.4V From Battery	Breeze Jiang
RE≥1G	26deg. C, 50%RH	DC 7.4V From Battery	Breeze Jiang
PLC	---	---	---
APCM	25deg. C, 55%RH	DC 7.4V From Battery	Breeze Jiang



### 3.3 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, Section 15.247**
- 558074 D01 DTS Meas Guidance v03r05**
- ANSI C63.10-2013**

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

**NOTE:** It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B(VoC). The test report has been issued separately.

### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Plane	PROPEL	PL-1540	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A



## 4 TEST TYPES AND RESULTS

### 4.1 RADIATED EMISSION MEASUREMENT

#### 4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

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. As shown in 15.35(b), 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.

**4.2.2 TEST INSTRUMENTS**

<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Last Cal.</b>	<b>Next Cal.</b>
EMI Test Receiver	Rohde&Schwarz	ESR7	101494	Apr. 05,16	Apr. 04,17
Signal and Spectrum Analyzer	Rohde&Schwarz	FSV7	102331	Nov. 09,15	Nov. 08,16
Bilog Antenna	Teseq	CBL 6111D	30643	Jul. 16, 16	Jul. 15, 17
Horn Antenna (1GHz -18GHz)	ETS -Lindgren	3117	00062558	May 18,16	May 17,17
GPS Generator+ Antenna	TOJOIN	GNSS-5000A	E1-010119	Aug. 08, 15	Aug. 07, 17
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	NSEMC003	Mar. 12,16	Mar. 11,18
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170242	Mar. 12,16	Mar. 11,17
Amplifier (9kHz-1GHz)	SONOMA	310D	186955	Mar. 04,16	Mar. 03, 17
Pre-Amplifier(1-18G)	HP	8449B	3008A00409	Apr. 25,16	Apr. 24,17
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Nov. 20,15	Nov. 19,16
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	Sep. 01,15	Aug. 31,16

**NOTE:**

1. The test was performed in 966 Chamber.
2. The calibration interval of the above test instruments are 12, 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
3. The horn antenna is used only for the measurement of emission frequency above 1 GHz if tested.
4. The FCC Site Registration No. is 494399.

#### 4.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 1.5 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. The antenna is a broadband antenna, and its height 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. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

#### NOTE:

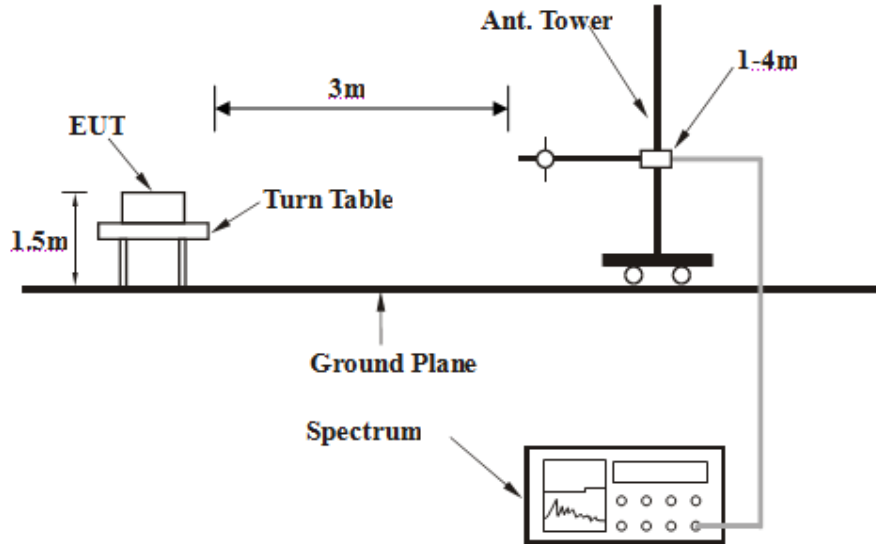
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. For WiFi, the resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file Test Setup Photo.

#### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation.



#### 4.2.5 TEST SETUP



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

#### 4.2.6 EUT OPERATING CONDITIONS

- Set the EUT under full load condition and placed them on a testing table.
- Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the EUT in full functions.



### 4.2.7 TEST RESULTS

#### BELOW 1GHz WORST-CASE DATA:

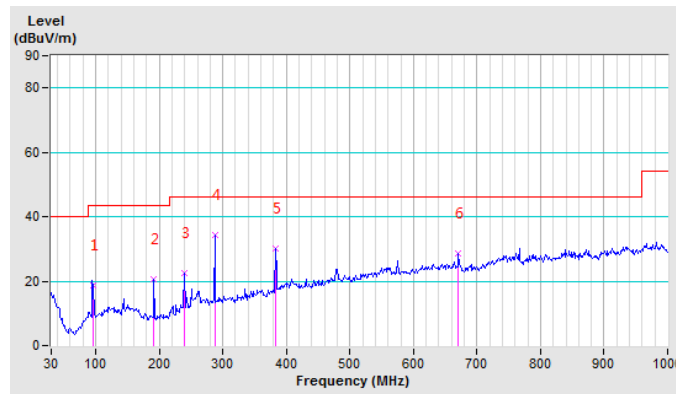
802.11g

<b>CHANNEL</b>	Channel 2	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	96.07	18.6 QP	43.5	-24.9	2.00 H	0	38.04	-19.40
2	191.67	20.6 QP	43.5	-22.9	2.00 H	0	40.66	-20.04
3	239.46	22.5 QP	46.0	-23.5	2.00 H	0	39.73	-17.24
4	<b>287.26</b>	<b>34.4 QP</b>	<b>46.0</b>	<b>-11.6</b>	<b>2.00 H</b>	<b>0</b>	<b>49.14</b>	<b>-14.71</b>
5	382.86	30.2 QP	46.0	-15.8	2.00 H	0	41.36	-11.15
6	671.04	28.7 QP	46.0	-17.3	2.00 H	0	32.04	-3.36

#### REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.



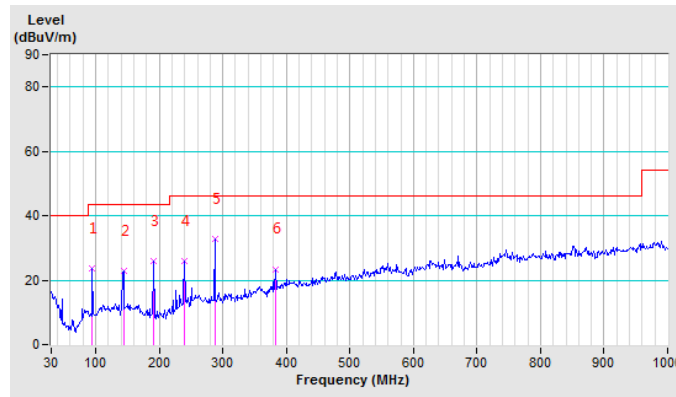


<b>CHANNEL</b>	Channel 2	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	94.67	23.8 QP	43.5	-19.7	1.00 V	0	43.25	-19.49
2	143.87	22.7 QP	43.5	-20.8	1.00 V	0	40.45	-17.71
3	191.67	25.8 QP	43.5	-17.7	1.00 V	0	45.81	-20.04
4	239.46	26.0 QP	46.0	-20.0	1.00 V	0	43.22	-17.24
5	287.26	32.9 QP	46.0	-13.1	1.00 V	0	47.59	-14.71
6	382.86	23.5 QP	46.0	-22.6	1.00 V	0	34.60	-11.15

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.







**ABOVE 1GHZ DATA**

**802.11b**

<b>CHANNEL</b>	TX Channel 2	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

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

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	52.23 PK	74.0	-21.77	1.68 H	291	49.70	2.53
2	2390.00	38.02 AV	54.0	-15.98	1.68 H	291	35.49	2.53
3	*2417.00	74.30 PK			1.68 H	291	71.71	2.59
4	*2417.00	55.02 AV			1.68 H	291	52.43	2.59
5	4834.00	57.09 PK	74.0	-16.91	1.28 H	302	49.30	7.79
6	4834.00	41.95 AV	54.0	-12.05	1.28 H	302	34.16	7.79
7	7251.00	58.40 PK	74.0	-15.60	1.12 H	278	44.92	13.48
8	7251.00	46.25 AV	54.0	-7.75	1.12 H	278	32.77	13.48

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

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	50.26 PK	74.0	-23.74	1.56 V	230	47.73	2.53
2	2390.00	37.08 AV	54.0	-16.92	1.56 V	230	34.55	2.53
3	*2417.00	72.97 PK			1.56 V	230	70.38	2.59
4	*2417.00	54.31 AV			1.56 V	230	51.72	2.59
5	4834.00	54.15 PK	74.0	-19.85	1.63 V	238	46.36	7.79
6	4834.00	42.32 AV	54.0	-11.68	1.63 V	238	34.53	7.79
7	7251.00	58.73 PK	74.0	-15.27	1.68 V	152	45.25	13.48
8	7251.00	46.48 AV	54.0	-7.52	1.68 V	152	33.00	13.48

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.



802.11g

<b>CHANNEL</b>	TX Channel 2	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

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

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	49.97 PK	74.0	-24.03	1.96 H	295	47.44	2.53
2	2390.00	36.81 AV	54.0	-17.19	1.96 H	295	34.28	2.53
3	*2417.00	74.14 PK			1.96 H	295	71.55	2.59
4	*2417.00	45.22 AV			1.96 H	295	42.63	2.59
5	4834.00	56.25 PK	74.0	-17.75	1.85 H	102	48.46	7.79
6	4834.00	39.19 AV	54.0	-14.81	1.85 H	102	31.40	7.79
7	7251.00	58.76 PK	74.0	-15.24	1.00 H	201	45.28	13.48
8	7251.00	44.16 AV	54.0	-9.84	1.00 H	201	30.68	13.48

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

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	50.53 PK	74.0	-23.47	1.54 V	230	48.00	2.53
2	2390.00	40.06 AV	54.0	-13.94	1.54 V	230	37.53	2.53
3	*2417.00	74.22 PK			1.69 V	253	71.63	2.59
4	*2417.00	44.91 AV			1.69 V	253	42.32	2.59
5	4834.00	56.15 PK	74.0	-17.85	1.59 V	84	48.36	7.79
6	4834.00	41.82 AV	54.0	-12.18	1.59 V	84	34.03	7.79
7	7251.00	59.03 PK	74.0	-14.97	1.48 V	295	45.55	13.48
8	7251.00	44.45 AV	54.0	-9.55	1.48 V	295	30.97	13.48

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.



802.11n (20MHz)

CHANNEL	TX Channel 2	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	50.71 PK	74.0	-23.29	1.85 H	203	48.18	2.53
2	2390.00	38.47 AV	54.0	-15.53	1.85 H	203	35.94	2.53
3	*2417.00	72.75 PK			1.85 H	261	70.16	2.59
4	*2417.00	40.42 AV			1.85 H	261	37.83	2.59
5	4834.00	55.42 PK	74.0	-18.58	1.34 H	306	47.63	7.79
6	4834.00	41.06 AV	54.0	-12.94	1.34 H	306	33.27	7.79
7	7251.00	58.72 PK	74.0	-15.28	1.56 H	321	45.24	13.48
8	7251.00	45.84 AV	54.0	-8.16	1.56 H	321	32.36	13.48

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	50.03 PK	74.0	-23.97	1.85 V	142	47.50	2.53
2	2390.00	36.89 AV	54.0	-17.11	1.85 V	142	34.36	2.53
3	*2417.00	74.81 PK			1.85 V	142	72.22	2.59
4	*2417.00	41.10 AV			1.85 V	142	38.51	2.59
5	4834.00	53.88 PK	74.0	-20.12	1.96 V	295	46.09	7.79
6	4834.00	41.09 AV	54.0	-12.91	1.96 V	295	33.30	7.79
7	7251.00	58.53 PK	74.0	-15.47	1.14 V	102	45.05	13.48
8	7251.00	44.50 AV	54.0	-9.50	1.14 V	102	31.02	13.48

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " \* ": Fundamental frequency.



## 4.2 6dB BANDWIDTH MEASUREMENT

### 4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

### 4.3.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Power Sensor	Keysight	U2021XA	MY55060016	May 04,16	May 03,17
Power Sensor	Keysight	U2021XA	MY55060018	May 04,16	May 03,17
Digital Multimeter	FLUKE	15B	A1220010DG	Oct. 12, 15	Oct.11, 16
Humid & Temp Programmable Tester	Haida	HD-2257	110807201	Sep.07,15	Sep. 06,16
Oscilloscope	Agilent	DSO9254A	MY51260160	Nov. 28,15	Nov. 27,16
Signal Analyzer	Rohde & Schwarz	FSV7	102331	Nov. 09,15	Nov. 08,16
Signal Generator	Agilent	N5183A	MY50140980	Nov. 09,15	Nov. 08,16
ESG Vector Signal Generator	Agilent	E4438C	MY49072505	Apr. 22, 16	Apr. 21, 17
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	Sep. 01,15	Aug. 31,16

#### NOTE:

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

### 4.3.3 TEST PROCEDURE

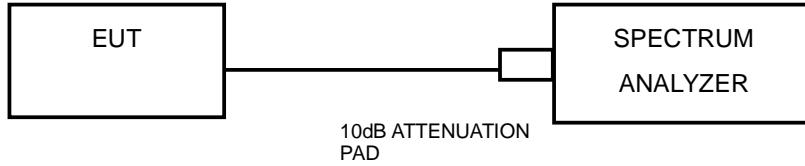
1. Set resolution bandwidth (RBW) = 100KHz
2. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
3. Trace mode = max hold.
4. Sweep = auto couple.
5. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation.



#### 4.3.5 TEST SETUP



#### 4.3.6 EUT OPERATING CONDITIONS

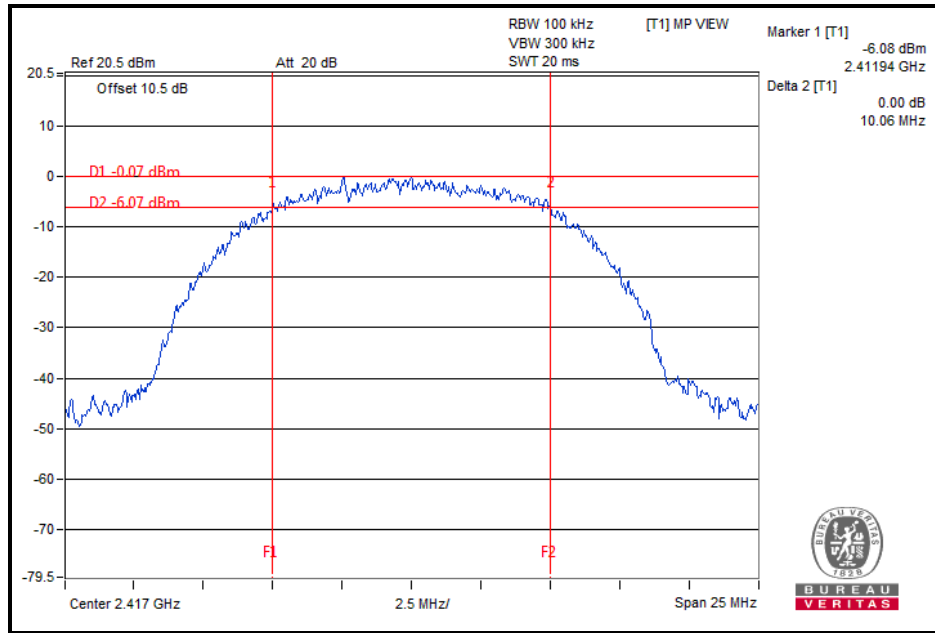
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



### 4.3.7 TEST RESULTS

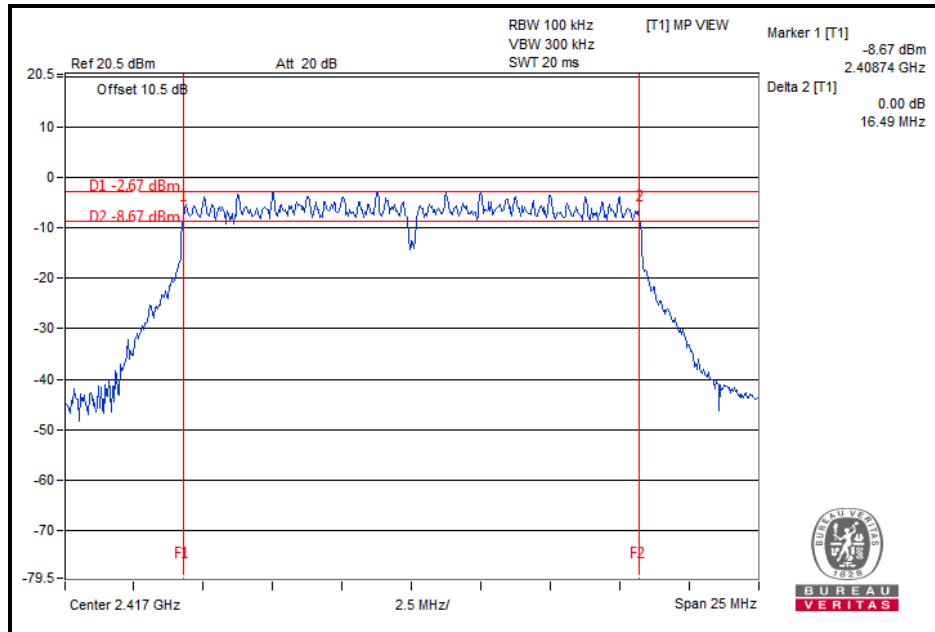
#### 802.11b

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
2	2417	10.06	0.5	PASS



802.11g

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
2	2417	16.49	0.5	PASS



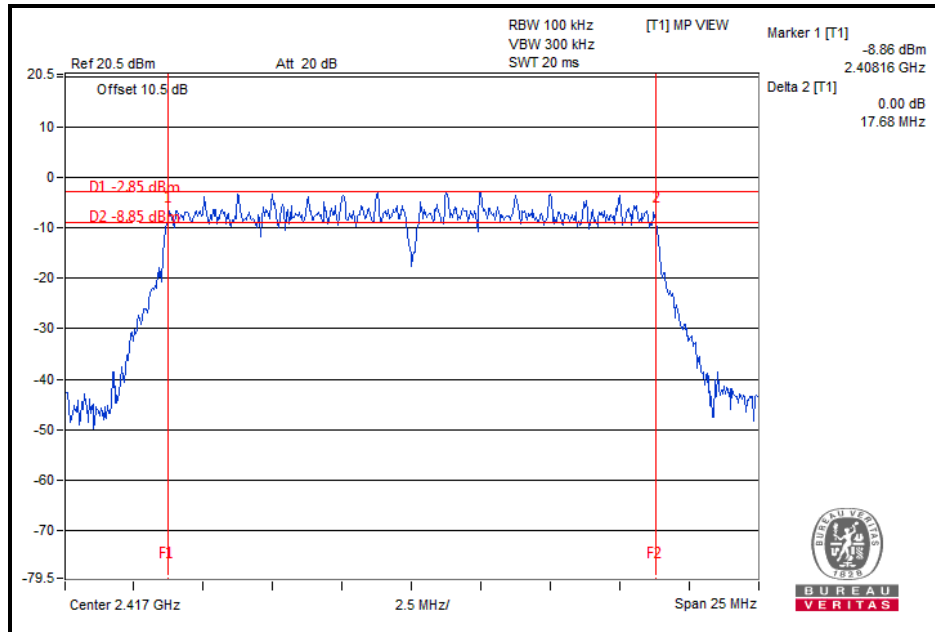


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Test Report No.: RF160722N064-1

802.11n (20MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
2	2417	17.68	0.5	PASS





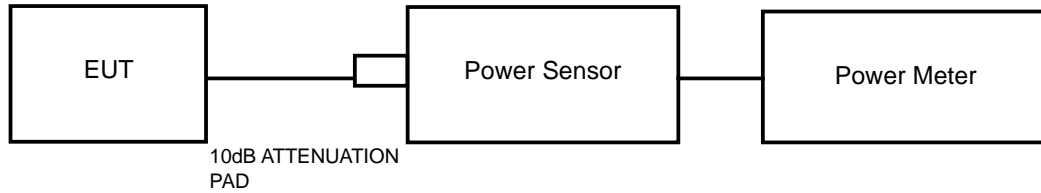


### 4.4 CONDUCTED OUTPUT POWER

#### 4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

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

#### 4.4.2 TEST SETUP



#### 4.4.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Power Sensor	Keysight	U2021XA	MY55060016	May 04,16	May 03,17
Power Sensor	Keysight	U2021XA	MY55060018	May 04,16	May 03,17
Digital Multimeter	FLUKE	15B	A1220010DG	Oct. 12, 15	Oct.11, 16
Humid & Temp Programmable Tester	Haida	HD-2257	110807201	Sep.07,15	Sep. 06,16
Oscilloscope	Agilent	DSO9254A	MY51260160	Nov. 28,15	Nov. 27,16
Signal Analyzer	Rohde & Schwarz	FSV7	102331	Nov. 09,15	Nov. 08,16
Signal Generator	Agilent	N5183A	MY50140980	Nov. 09,15	Nov. 08,16
ESG Vector Signal Generator	Agilent	E4438C	MY49072505	Apr. 22, 16	Apr. 21, 17
BLUETOOTH TESTER	Rohde&Schwarz	CBT32	100811	Sep. 01,15	Aug. 31,16

**NOTE:**

1. The test was performed in RF Oven room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.



#### 4.4.4 TEST PROCEDURES

A peak power sensor was used on the output port of the EUT. A peak power meter was used to read the response of the peak power sensor. Record the peak power level.

#### 4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.4.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



#### 4.4.7 TEST RESULTS

##### 4.4.7.1 MAXIMUM PEAK OUTPUT POWER

###### 802.11b

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
2	2417	16.64	46.132	1	PASS

###### 802.11g

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
2	2417	15.81	38.107	1	PASS

###### 802.11n (20MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)	PEAK POWER (mW)	PEAK POWER LIMIT (W)	PASS/FAIL
2	2417	16.07	40.458	1	PASS

#### 4.4.7.2 AVERAGE OUTPUT POWER (FOR REFERENCE)

The average power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

##### 802.11b

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	AVG. POWER (mW)
2	2417	9.11	8.147

##### 802.11g

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	AVG. POWER (mW)
2	2417	8.51	7.096

##### 802.11n (20MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	AVERAGE POWER (dBm)	AVG. POWER (mW)
2	2417	8.16	6.546

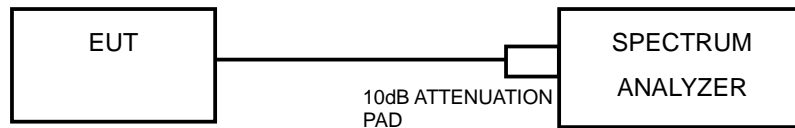


## 4.5 POWER SPECTRAL DENSITY MEASUREMENT

### 4.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm/3KHz.

### 4.5.2 TEST SETUP



### 4.5.3 TEST INSTRUMENTS

Refer to section 4.3.2 to get information of above instrument.

### 4.5.4 TEST PROCEDURE

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set span to at least 1.5 times the OBW.
- c) Set RBW to: 3 kHz
- d) Set VBW  $\geq 3 \times$  RBW.
- e) Detector = peak.
- g) Sweep time = auto couple.
- h) Use the peak marker function to determine the maximum amplitude level.

### 4.5.5 DEVIATION FROM TEST STANDARD

No deviation.



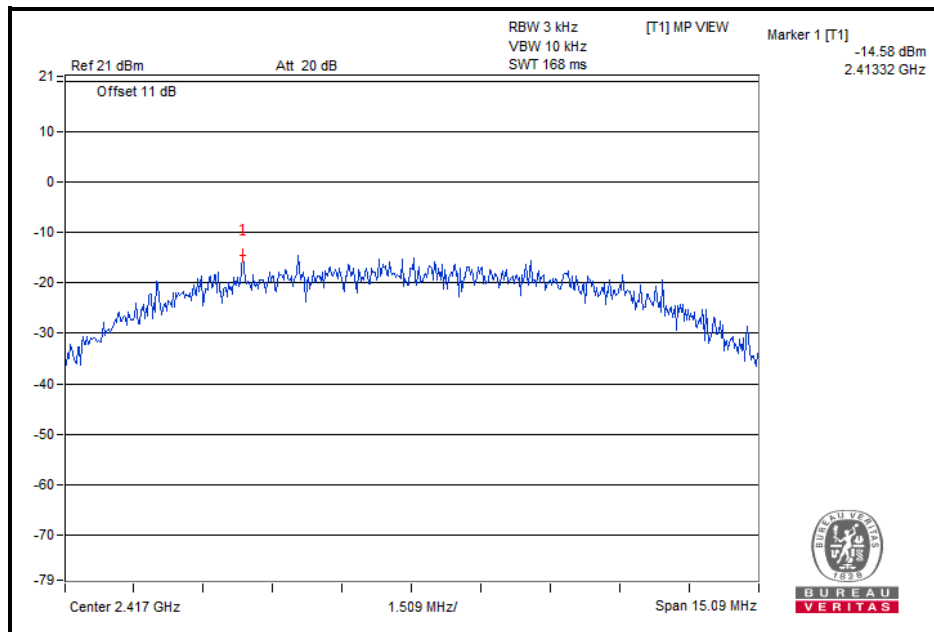
### 4.5.6 EUT OPERATING CONDITION

Same as item 4.3.6

### 4.5.7 TEST RESULTS

802.11b

Channel	FREQ. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
2	2417	-14.58	8	PASS

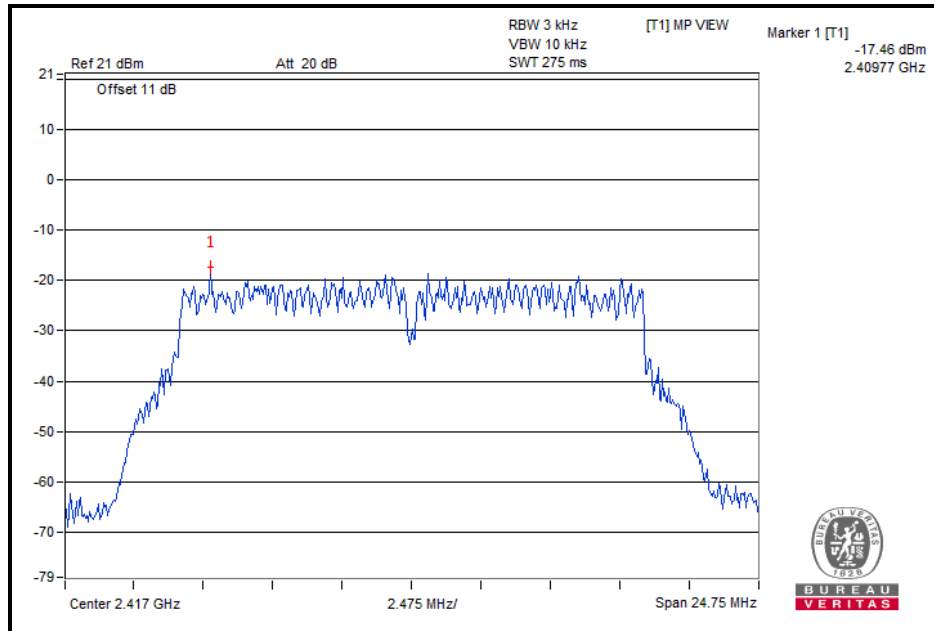




Test Report No.: RF160722N064-1

802.11g

Channel	FREQ. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
2	2417	-17.46	8	PASS

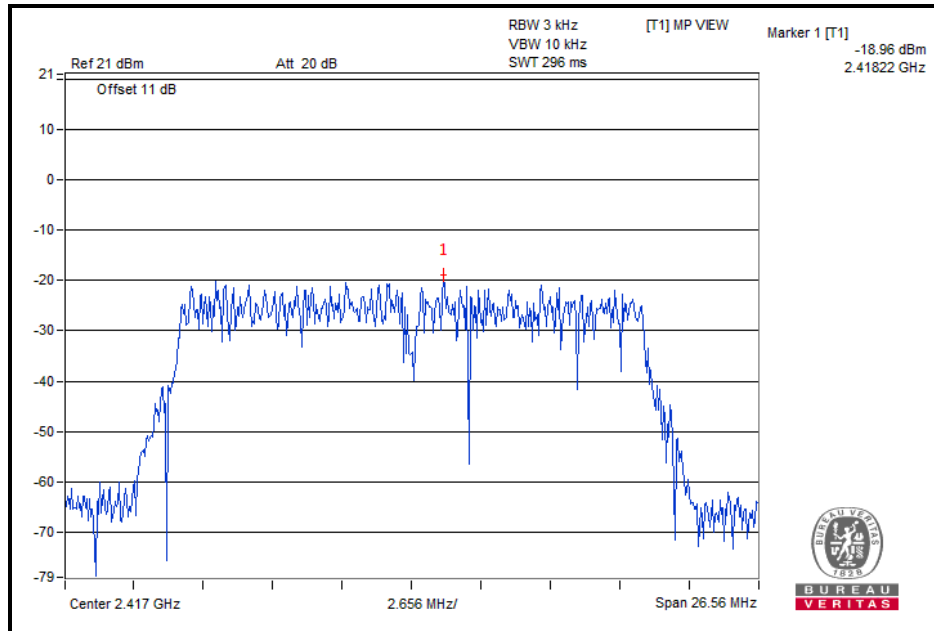




Test Report No.: RF160722N064-1

802.11n (20MHz)

Channel	FREQ. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
2	2417	-18.96	8	PASS





## 4.6 OUT OF BAND EMISSION MEASUREMENT

### 4.6.1 LIMITS OF OUT OF BAND EMISSION MEASUREMENT

Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### 4.6.2 TEST SETUP



### 4.6.3 TEST INSTRUMENTS

Refer to section 4.3.2 to get information of above instrument.

### 4.6.4 TEST PROCEDURE

#### Measurement Procedure - Reference Level

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.



### **Measurement Procedure –Unwanted Emission Level**

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Set span to encompass the spectrum to be examined
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

#### **4.6.5 DEVIATION FROM TEST STANDARD**

No deviation.

#### **4.6.6 EUT OPERATING CONDITION**

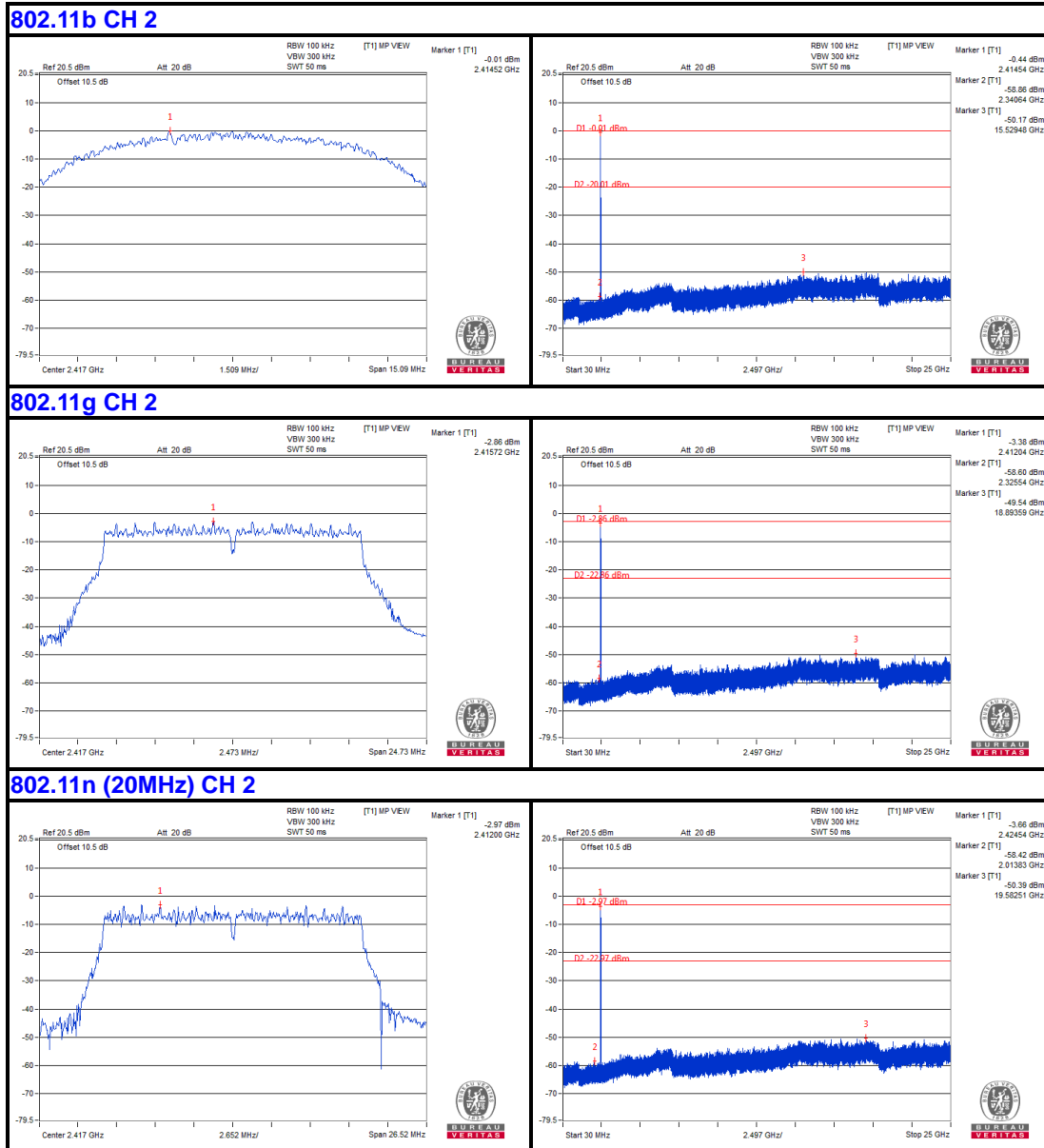
Same as item 4.3.6



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Test Report No.: RF160722N064-1

### 4.6.7 TEST RESULTS

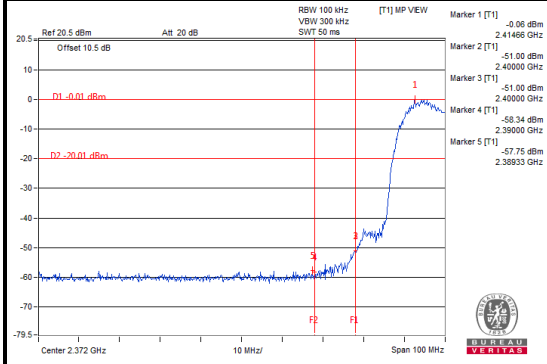




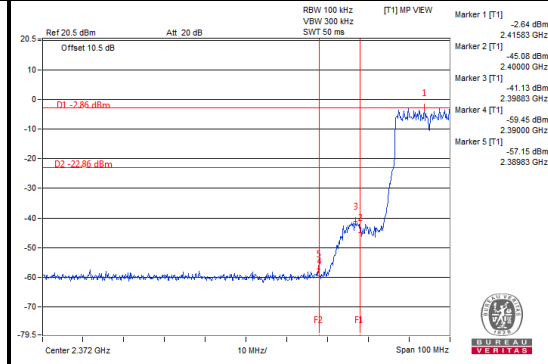
BUREAU VERITAS

Test Report No.: RF160722N064-1

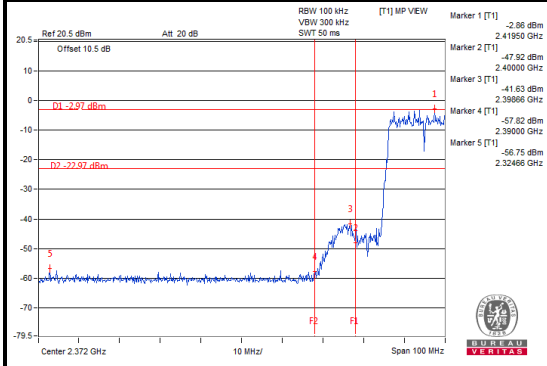
### 802.11b CH 2 Band edge



### 802.11g CH 2 Band edge



### 802.11n (20MHz) CH 2 Band edge





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Test Report No.: RF160722N064-1

## 5 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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Test Report No.: RF160722N064-1

## **6 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---**