

Suppleme	ental "Transmit Simultaneously" Test Report			
Report No.:	RF150107E07B-4			
FCC ID:	PPD-QCNFA364AH			
Test Model:	QCNFA364A			
Received Date:	Jan. 26, 2015			
Test Date:	Feb. 04, 2015 and Feb. 11, 2015			
Issued Date:	May 12, 2015			
Annlicante	Qualcomm Atheros, Inc.			
	1700 Technology Drive, San Jose, CA 95110			
Audress.	Troo recinology Drive, San Jose, CA 95110			
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory			
Lab Address:	No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.			
Test Location (1):	No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.			
Test Location (2):	No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan R.O.C.			
	BIC-MRA Testing Laboratory 2022			

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 non, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.



## Table of Contents

R	elease	e Control Record	3
1	С	Certificate of Conformity	4
2	S	Summary of Test Results	5
	2.1 2.2	Measurement Uncertainty Modification Record	
3	G	General Information	6
		General Description of EUT Description of Antenna Test Mode Applicability and Tested Channel Detail Duty Cycle of Test Signal Description of Support Units Configuration of System under Test	9 . 10 11 . 12 . 12
4	Т	est Types and Results	13
		Radiated Emission and Bandedge Measurement Limits of Radiated Emission and Bandedge Measurement	. 13
	4.1.3	Test Instruments Test Procedures Deviation from Test Standard	. 16
	4.1.5 4.1.6	Test Setup EUT Operating Conditions	. 17 . 17
	4.2	Test Results Conducted Emission Measurement Limits of Conducted Emission Measurement	20
	4.2.2 4.2.3	Test Instruments Test Procedures	20 21
	4.2.5	Deviation from Test Standard Test Setup EUT Operating Conditions	21
		Test Results	. 22
	4.3.2	Limits of Conducted Out of Band Emission Measurement Test Setup	. 24
	4.3.4	Test Instruments Test Procedures Deviation from Test Standard	. 24
	4.3.6	EUT Operating Conditions Test Results	. 24
5	Р	Pictures of Test Arrangements	26
A	ppend	lix – Information on the Testing Laboratories	27



				A D I
	Re	lease Control F	Record	
Issue No.	Description			Date Issued
RF150107E07B-4	Original release.			May 12, 2015
D IN DEIGNATE		D N 0/07		



## 1 Certificate of Conformity

Product:	802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card
Brand:	Qualcomm Atheros
Test Model:	QCNFA364A
Sample Status:	ENGINEERING SAMPLE
Applicant:	Qualcomm Atheros, Inc.
Test Date:	Feb. 04, 2015 and Feb. 11, 2015
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247)
	ANSI C63.10:2009

The above equipment 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 :	Phoen's Huang	, Date:	May 12, 2015
Approved by :	May Chen / Manager	, Date:	May 12, 2015



## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)						
FCC Clause	Test Item	Result	Remarks			
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -18.48dB at 2.05469MHz.			
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -4.8dB at 499.53MHz.			

## 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	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.86 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.43 dB
	1GHz ~ 6GHz	3.65 dB
Radiated Emissions above 1 GHz	6GHz ~ 18GHz	3.88 dB
	18GHz ~ 40GHz	4.11 dB

## 2.2 Modification Record

There were no modifications required for compliance.



## 3 General Information

## 3.1 General Description of EUT

Product	802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card
Brand	Qualcomm Atheros
Test Model	QCNFA364A
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	3.3Vdc form host equipment
Modulation Type	WLAN: CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT (20/40) mode in 2.4GHz Bluetooth (EDR): GFSK, π/4-DQPSK, 8DPSK Bluetooth (LE): GFSK
Modulation Technology	WLAN: DSSS,OFDM Bluetooth (EDR): FHSS Bluetooth (LE): DTS
Transfer Rate	WLAN:   802.11b: up to 11Mbps   802.11a/g: up to 54Mbps   802.11n : up to 300Mbps   802.11ac: up to 866.7Mbps   Bluetooth (EDR):   up to 3Mbps   Bluetooth (LE):   up to 1Mbps
Operating Frequency	WLAN: For 15.407 5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.50 ~ 5.72GHz For 15.247 2.412 ~ 2.472GHz, 5.745 ~ 5.825GHz Bluetooth: 2402MHz ~ 2480MHz
Number of Channel	WLAN:   For 15.407   20 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)   10 for 802.11n (HT40), 802.11ac (VHT40)   5 for 802.11ac (VHT80)   For 15.247(2.4GHz)   13 for 802.11b/g, 802.11n (HT20), VHT20   9 for 802.11n (HT40), VHT40   5GHz(5GHz)   5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)   2 for 802.11a, 802.11n (HT20), 802.11ac (VHT20)   2 for 802.11a (VHT80)   Bluetooth (EDR): 79   Bluetooth (LE): 40



Output Power	WLAN:   For 15.407   802.11a: 106.283 mW   802.11ac (VHT20): 114.377mW   802.11ac (VHT40): 102.472mW   802.11ac (VHT80): 86.25mW   For 15.247 (2.4GHz)   802.11b: 273.536mW   802.11g: 509.97mW   VHT20: 503.893mW   VHT40: 422.516mW   For 15.247 (5GHz)   802.11a: 356.491mW   802.11ac (VHT20): 371.14mW   802.11ac (VHT40): 400.946mW   802.11ac (VHT80): 568.929mW   Bluetooth (EDR): 14.928mW   Bluetooth (LE): 1.995mW
Antenna Type	See item 3.2
Antenna Connector	See item 3.2
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. There are Bluetooth technology and WLAN technology used for the EUT.



	2.4	GHz Band				
MODULATION MODE	MODULATION MODE DATA RATE (MCS) TX & RX CONFIGURATION					
802.11b	1 ~ 11Mbps	2TX	2RX			
802.11g	6 ~ 54Mbps	2TX	2RX			
000 44# (11700)	MCS 0~7	2TX	2RX			
802.11n (HT20)	MCS 8~15	2TX	2RX			
000 44m (UT 40)	MCS 0~7	2TX	2RX			
802.11n (HT40)	MCS 8~15	2TX	2RX			
VUT20	MCS 0~8, Nss=1	2TX	2RX			
VHT20	MCS 0~8, Nss=2	2TX	2RX			
	MCS 0~9, Nss=1	2TX	2RX			
VHT40	MCS 0~9, Nss=2	2TX	2RX			
		GHz Band				
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION				
802.11a	6 ~ 54Mbps	2TX	2RX			
802.11n (HT20)	MCS 0~7	2TX	2RX			
о <b>02.1111 (</b> П120)	MCS 8~15	2TX	2RX			
802.11n (HT40)	MCS 0~7	2TX	2RX			
о <b>02.1111 (П140)</b>	MCS 8~15	2TX	2RX			
902 44ee (V/UT20)	MCS 0~8, Nss=1	2TX	2RX			
802.11ac (VHT20)	MCS 0~8, Nss=2	2TX	2RX			
902 11aa (\/UT40)	MCS 0~9, Nss=1	2TX	2RX			
802.11ac (VHT40)	MCS 0~9, Nss=2	2TX	2RX			
902 11cc (\/UT90)	MCS 0~9, Nss=1	2TX	2RX			
802.11ac (VHT80)	MCS 0~9, Nss=2	2TX	2RX			

2. The EUT incorporates a 2T2R function.

3. WLAN/BT coexistence mode:

- 2x2 WLAN + BT:
  - 5GHz 802.11a/an (or 11ac) transmit concurrent with BT.
  - 2.4GHz: timely shared coexistence.
- 4. The emission (conducted & radiated emission) of the simultaneous operation (WiFi <5GHz> & Bluetooth) have been evaluated and no non-compliance found. The detail combinations of transmitters / frequencies / modes as below table

Mode	Available Channel	Tested Channel	Modulation Technology
5 GHz (802.11ac (VHT40))	38 to 159	159	OFDM
+ Bluetooth (LE)	0 to 39	0	GFSK

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



## 3.2 Description of Antenna

	The antenna gain was declared by client, please relet to the following table.								
Transmitter Circuit	Brand	Model	Ant. Type	2.4GHz Gain with cable loss (dBi)	5GHz Gain with cable loss (dBi)	2.4GHz Cable Loss (dBi)	5G Cable Loss (dBi)	Connector Type	Cable Length (mm)
Chain (0)	WNC	81-EBJ15.005	PIFA	3.00	Band 1&2: 2.56 Band 3: 4.76 Band 4: 4.76	1.15	Band 1&2: 1.70 Band 3: 1.74 Band 4: 1.79	IPEX	300
Chain (1)	WNC	81-EBJ15.005	PIFA	3.62	Band 1&2: 3.08 Band 3: 3.31 Band 4: 2.42	1.15	Band 1&2: 1.70 Band 3: 1.74 Band 4: 1.79	IPEX	300

The antenna gain was declared by client; please refer to the following table:

Note: 1. Above antenna gains of antenna are Total (H+V).



## 3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGUE	DE	APPLIC	ABLE TO	DESCRIPTION			
MODE	RE≥1G	RE<1G	PLC	OB	DESCRIPTION		
-	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	-		
Where RE≥1G: Radiated Emission above 1GHz & RE<1G: Radiated Emission below 1GHz							
F	PLC: Power Line Conducted Emission				t-Band Emission Measurement		

## Radiated Emission Test (Above 1GHz):

Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
5GHz 802.11ac	38 to 159	159	OFDM	13.5
(VHT40) + Bluetooth GFSK	0 to 78	0	FHSS	3

## Radiated Emission Test (Below 1GHz):

Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
5GHz 802.11ac	38 to 159	159	OFDM	13.5
(VHT40) + Bluetooth GFSK	0 to 78	0	FHSS	3

#### Power Line Conducted Emission Test:

Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
5GHz 802.11ac	38 to 159	159	OFDM	13.5
(VHT40) + Bluetooth GFSK	0 to 78	0	FHSS	3

#### **Conducted Out-Band Emission Measurement:**

Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
5GHz 802.11ac	38 to 159	159	OFDM	13.5
(VHT40) + Bluetooth GFSK	0 to 78	0	FHSS	3

## **Test Condition:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥1G	24deg. C, 64%RH	120Vac, 60Hz	Tim Ho
RE<1G	24deg. C, 68%RH	120Vac, 60Hz	Tim Ho
PLC	20deg. C, 60%RH	120Vac, 60Hz	Barry Lee



## 3.3 Duty Cycle of Test Signal

-68.5

Center 5.795 GHz

Duty cycle of test signal is ≥ 98 %, duty factor is not required. <u>5GHz 802.11ac (VHT40)</u>: Duty cycle = 9.54 ms/9.645 ms = 0.989 802.11ac (VHT40) RBW 10 MHz VBW 10 MHz SWT 20 ms [T1] MP VEW Marker 1 [T1] 31.5 - Ref 31.5 dBm Offset 11.5 dB Att 30 dB 3.44 dB 9.540000 ms Deta 3 [11] 0.28 dB 9.645000 ms 10 0 -10 -20 -30 -40 -50 -60

> 1 2 ms/



## 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	Remark
А	NOTEBOOK COMPUTER	DELL	E5430	4YV4VY1	FCC DoC	Provided by Lab
В	PCI-E Test tool	Qualcomm Atheros	NA	NA	NA	Supplied by Client

**NOTE:** All power cords of the above support units are non-shielded (1.8 m).

# 3.4.1 Configuration of System under Test

NOTEBOOK	PCI-E Test tool (B)	
COMPUTER (A)	EUT	



## 4 Test Types and Results

## 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 30dB 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.



## 4.1.2 Test Instruments

#### For Above 1GHz:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY51210105	July 21,2014	July 20,2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-03	Nov. 12, 2014	Nov. 11, 2015
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-360	Feb. 26, 2014	Feb. 25, 2015
RF Cable	NA	CHGCAB_001	Oct. 04, 2014	Oct. 03, 2015
Horn_Antenna AISI	AIH.8018	0000320091110	Aug. 27, 2014	Aug. 26, 2015
Pre-Amplifier Agilent	8449B	3008A02578	June 24, 2014	June 23, 2015
RF Cable	NA	131205 131214 SNMY23684/4	Jan. 16, 2015	Jan. 15, 2016
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Pre-Amplifier EMCI	EMC184045	980143	Jan. 16, 2015	Jan. 15, 2016
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Aug. 26, 2014	Aug. 25, 2015
RF Cable	NA	RF104-121 RF104-204	Dec. 11, 2014	Dec. 10, 2015
Antenna Tower & Turn Table CT	NA	NA	NA	NA
SPECTRUM ANALYZER R&S	FSP 40	100060	May 08, 2014	May 07, 2015

#### 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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 The test was performed in 966 Chamber No. G.
- 4. The FCC Site Registration No. is 966073.
- 5 The VCCI Site Registration No. is G-137.
- 6 The CANADA Site Registration No. is IC 7450H-2.
- 7 Tested Date: Feb. 11, 2015



#### CALIBRATED **DESCRIPTION &** CALIBRATED MODEL NO. SERIAL NO. MANUFACTURER DATE UNTIL **MXE EMI Receiver** N9038A MY50010156 Aug. 10, 2015 Aug. 11, 2014 Agilent ZFL-1000VH2 **Pre-Amplifier** AMP-ZFL-04 Nov. 12, 2014 Nov. 11, 2015 Mini-Circuits В Trilog Broadband Antenna **VULB 9168** 9168-361 Feb. 27, 2014 Feb. 26, 2015 SCHWARZBECK **RF** Cable NA CHHCAB 001 Oct. 05, 2014 Oct. 04, 2015 Horn Antenna AIH.8018 0000220091110 Aug. 26, 2014 Aug. 25, 2015 AISI **Pre-Amplifier** 8449B 300801923 Oct. 28, 2014 Oct. 27, 2015 Agilent 131206 **RF** Cable NA 131215 Jan. 16, 2015 Jan. 15, 2016 SNMY23685/4 Spectrum Analyzer FSV40 100964 July 05, 2014 July 04, 2015 R&S **Pre-Amplifier** EMC184045 980143 Jan. 16, 2015 Jan. 15, 2016 EMCI Horn\_Antenna **BBHA 9170** 9170-424 Aug. 26, 2014 Aug. 25, 2015 SCHWARZBECK RF104-121 **RF** Cable NA Dec. 11, 2014 Dec. 10, 2015 RF104-204 ADT\_Radiated NA NA NA Software V8.7.07 Antenna Tower & Turn Table NA NA NA NA CT SPECTRUM ANALYZER **FSP 40** 100060 May 08, 2014 May 07, 2015 R&S

#### Note:

For Below 1GHz:

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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

3 The test was performed in 966 Chamber No. H.

- 4. The FCC Site Registration No. is 797305.
- 5 The CANADA Site Registration No. is IC 7450H-3.
- 6 Tested Date: Feb. 09, 2015



## 4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. 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 height of 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 quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

## NOTE:

- 1. For emission measurements above 1 GHz, the EUT shall be placed at a height of 1.5 m above the ground at 3 meter chamber room for test
- 2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
- 5. All modes of operation were investigated and the worst-case emissions are reported.

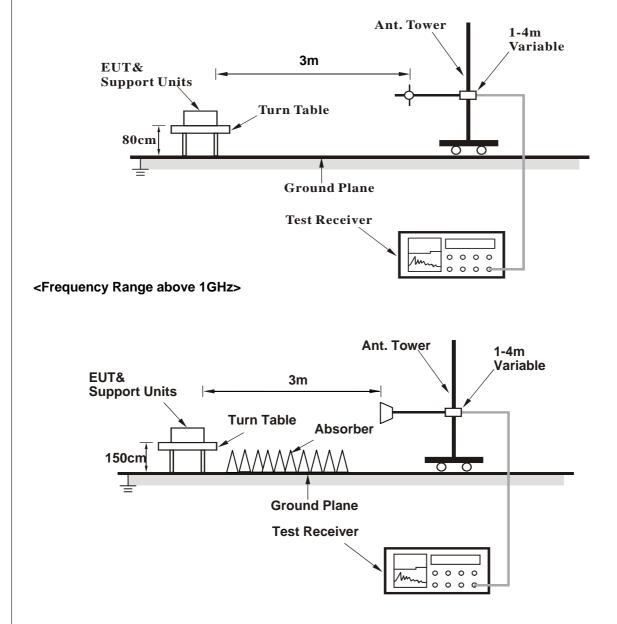
#### 4.1.4 Deviation from Test Standard

C63.10:2009 requires a 0.8m EUT height above 1GHz, but in accordance with the FCC December 2014 TCB Conference call, a 1.5m EUT height is allowed.



## 4.1.5 Test Setup

#### <Frequency Range below 1GHz>



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

## 4.1.6 EUT Operating Conditions

- 1. Connect the EUT with the support unit A (Notebook Computer) which is placed on a testing table.
- 2. The communication partner run test program "QCART Version: 3.0.33.0" to enable EUT under transmission/receiving condition continuously at specific channel frequency.



## 4.1.7 Test Results

#### Above 1GHz Data

FREQUENCY RANGE 1G		1GHz ~ 40GHz	Z DETECTOR FUNCTION			Peak (PK) Average (AV)				
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	LEVE		MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)			
4804.00	51.9 P	K 74.0	-22.1	1.00 H	354	46.28	5.62			
4804.00	38.3 A	V 54.0	-15.7	1.00 H	354	32.68	5.62			
11590.00	57.6 P	K 74.0	-16.4	1.03 H	221	43.30	14.30			
11590.00	43.5 A	V 54.0	-10.5	1.03 H	221	29.20	14.30			
#17385.00	60.9 P	K 74.0	-13.1	1.02 H	63	37.87	23.03			
#17385.00	47.5 A	V 54.0	-6.5	1.02 H	63	24.47	23.03			
	ANTE		/ & TEST D	ISTANCE: V	ERTICAL A	AT 3 M				
FREQ. (MHz)	LEVE		MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)			
4804.00	51.1 P	K 74.0	-22.9	1.22 V	49	45.48	5.62			
4804.00	39.1 A	√ 54.0	-14.9	1.22 V	49	33.48	5.62			
11590.00	56.2 P	K 74.0	-17.8	1.00 V	107	41.90	14.30			
11590.00	42.6 A	V 54.0	-11.4	1.00 V	107	28.30	14.30			
#17385.00	61.6 P	K 74.0	-12.4	1.00 V	79	38.57	23.03			
#17385.00	48.2 A	V 54.0	-5.8	1.00 V	79	25.17	23.03			
	FREQ. (MHz)     4804.00     4804.00     11590.00     #17385.00     #17385.00     4804.00     417385.00     #17385.00     #17385.00     #17385.00     #17385.00     #17385.00     #17385.00     #17385.00     #17385.00     #17385.00     #17385.00	FREQ. (MHz)   EMISSIC (LEVEI) (dBUV/r 4804.00     4804.00   51.9 P     4804.00   51.9 P     4804.00   57.6 P     11590.00   57.6 P     11590.00   43.5 A     #17385.00   60.9 P     #17385.00   47.5 A     FREQ. (MHz)   EMISSIC (dBUV/r 4804.00     4804.00   51.1 P     4804.00   51.1 P     4804.00   51.1 P     4804.00   51.1 P     11590.00   56.2 P     11590.00   42.6 A     #17385.00   61.6 P	FREQ. (MHz)   EMISSION LEVEL (dBuV/m)   LIMIT (dBuV/m)     4804.00   51.9 PK   74.0     4804.00   38.3 AV   54.0     11590.00   57.6 PK   74.0     11590.00   60.9 PK   74.0     #17385.00   60.9 PK   74.0     #17385.00   61.9 PK   54.0     #17385.00   60.9 PK   74.0     #17385.00   61.1 PK   74.0     #17385.00   51.1 PK   74.0     4804.00   51.1 PK   74.0     4804.00   51.1 PK   74.0     4804.00   51.1 PK   74.0     11590.00   56.2 PK   74.0     11590.00   42.6 AV   54.0     11590.00   61.6 PK   74.0	REQ. (MHz)   EMISSION LEVEL (dBuV/m)   LIMIT (dBuV/m)   MARGIN (dB)     4804.00   51.9 PK   74.0   -22.1     4804.00   51.9 PK   74.0   -15.7     11590.00   57.6 PK   74.0   -16.4     11590.00   57.6 PK   74.0   -10.5     #17385.00   60.9 PK   74.0   -13.1     #17385.00   60.9 PK   74.0   -6.5     KEQ. (MHz)   EMISSION (dBuV/m)   LIMIT (dBuV/m)   MARGIN (dB)     #17385.00   61.1 PK   74.0   -12.9     4804.00   51.1 PK   74.0   -22.9     4804.00   51.1 PK   74.0   -14.9     11590.00   56.2 PK   74.0   -17.8     11590.00   42.6 AV   54.0   -11.4     #17385.00   61.6 PK   74.0   -12.4	EMISSION (MHz)   LIMIT (dBuV/m)   MARGIN (dB)   ANTENNA HEIGHT (dBuV/m)     4804.00   51.9 PK   74.0   -22.1   1.00 H     4804.00   38.3 AV   54.0   -15.7   1.00 H     11590.00   57.6 PK   74.0   -16.4   1.03 H     11590.00   43.5 AV   54.0   -10.5   1.02 H     #17385.00   60.9 PK   74.0   -6.5   1.02 H     #17385.00   47.5 AV   54.0   -6.5   1.02 H     #17385.00   47.5 AV   54.0   -6.5   1.02 H     #100 V   1.02 H   -6.5   1.02 H   -0.02 H     #17385.00   61.1 PK   74.0   -22.9   1.22 V     4804.00   51.1 PK   74.0   -22.9   1.22 V     4804.00   51.1 PK   74.0	QUENCY RANGE   1GHz ~ 40GHz   FUNCTION     FUNCTION     ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL (MHz)     EMISSION LEVEL (dBuV/m)   LIMIT (dBuV/m)   MARGIN (dB)   ANTENNA HEIGHT (m)   TABLE ANGLE (Degree)     4804.00   51.9 PK   74.0   -22.1   1.00 H   354     4804.00   38.3 AV   54.0   -15.7   1.00 H   354     11590.00   57.6 PK   74.0   -16.4   1.03 H   221     11590.00   43.5 AV   54.0   -10.5   1.03 H   221     #17385.00   60.9 PK   74.0   -13.1   1.02 H   63     #17385.00   47.5 AV   54.0   -6.5   1.02 H   63     ANTENNA POLARITY & TEST DISTANCE: VERTICAL A (MHz)     FREQ. (MHz)   EMISSION LEVEL (dBuV/m)   LIMIT (dBuV/m)   MARGIN (dB)   ANTENNA HEIGHT (m)   TABLE ANGLE (Degree)     4804.00   51.1 PK   74.0   -22.9   1.22 V   49     4804.00   39.1 AV   54.0   -114.9   1.22 V   49	Emission   Limit (dBuV/m)   Margin (dBuV/m)   Antenna (dB)   Antenna Height (dB)   Table Antenna Height (m)   RAW Value (Degree)     4804.00   51.9 PK   74.0   -22.1   1.00 H   354   46.28     4804.00   51.9 PK   74.0   -22.1   1.00 H   354   46.28     11590.00   57.6 PK   74.0   -15.7   1.00 H   354   32.68     11590.00   57.6 PK   74.0   -16.4   1.03 H   221   43.30     11590.00   43.5 AV   54.0   -10.5   1.02 H   63   37.87     #17385.00   60.9 PK   74.0   -6.5   1.02 H   63   24.47     FREQ. (MH2)   Emission LEVEL (dBuV/m)   LIMIT (dBuV/m)   MARGIN (dB)   ANTENNA HEIGHT (m)   TABLE ANGLE (Degree)   RAW VALUE (dBuV)     4804.00   51.1 PK   74.0   -22.9   1.22 V   49   33.48     11590.00   56.2 PK   74.0   -17.8   1.00 V   107   41.90     11590.00   56.2 PK   7			

#### **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) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

5. " # ": The radiated frequency is out of the restricted band.



#### **Below 1GHz Data**

199.51

336.04

34.3 QP

39.3 QP

FREQUENCY RANGE		Below 1GHz		DETECTOR FUNCTION		Quasi-Peak (QP)		
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSIC LEVEI (dBuV/r	LIMIT	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	166.29	38.1 Q	P 43.5	-5.4	1.50 H	177	51.34	-13.23

-9.2

-6.7

1.50 H

2.00 H

214

208

50.44

50.51

-16.13

-11.17

4	432.02	37.1 QP	46.0	-8.9	1.00 H	178	45.64	-8.50				
5	798.19	40.3 QP	46.0	-5.7	1.50 H	197	41.69	-1.43				
6	896.21	36.2 QP	46.0	-9.8	1.00 H	124	36.15	0.08				
	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	122.78	38.2 QP	43.5	-5.3	1.50 V	198	52.91	-14.73				
2	299.76	35.2 QP	46.0	-10.8	1.00 V	211	47.33	-12.09				
3	499.53	41.3 QP	46.0	-4.8	1.00 V	131	48.45	-7.20				
4	599.44	35.2 QP	46.0	-10.8	1.00 V	258	39.89	-4.72				
5	697.07	35.3 QP	46.0	-10.7	1.50 V	247	38.63	-3.36				
6	902.66	39.2 QP	46.0	-6.8	1.00 V	295	38.98	0.22				
DEM												

#### **REMARKS**:

2

3

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

43.5

46.0

4. Margin value = Emission Level – Limit value



## 4.2 Conducted Emission Measurement

## 4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)						
	Quasi-peak	Average					
0.15 - 0.5	66 - 56	56 - 46					
0.50 - 5.0	56	46					
5.0 - 30.0	60	50					

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

#### 4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS 30	100375	Apr. 29, 2014	Apr. 28, 2015
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-522	Sep. 15, 2014	Sep. 14, 2015
Line-Impedance Stabilization Network (for Peripheral) ROHDE & SCHWARZ	ENV216	100071	Nov. 10, 2014	Nov. 09, 2015
RF Cable (JYEBAO)	5DFB	COCCAB-001	Mar. 10 , 2014	Mar. 09, 2015
50 ohms Terminator	N/A	EMC-03	Sep. 22, 2014	Sep. 21, 2015
50 ohms Terminator	N/A	EMC-02	Sep. 30, 2014	Sep. 29, 2015
Software ADT	BV ADT_Cond_V7.3.7. 3	NA	NA	NA

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 test was performed in Shielded Room No. C.

3 The VCCI Con C Registration No. is C-3611.

4 Tested Date: Feb. 11, 2015



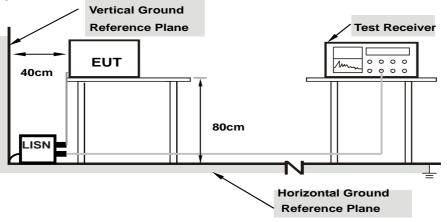
#### 4.2.3 Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit 20dB) was not recorded.
- **NOTE:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

#### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

#### 4.2.6 EUT Operating Conditions

Same as 4.1.6.

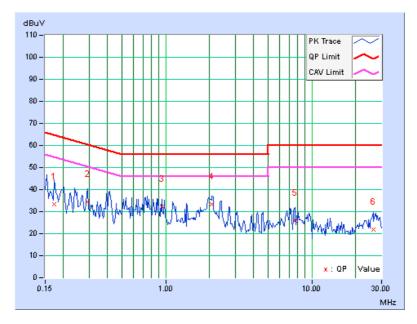


## 4.2.7 Test Results

Phase Line (L)						LIPETECTOL FUNCTION				Quasi-Peak (QP) / Average (AV)		
	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin			
No		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)			
	[MHz]	(dB)	Q.P.	AV.	Q.P	).	AV.	Q.P.	AV.	Q.P.	AV.	
1	0.17344	0.07	33.28	24.68	33.3	35	24.75	64.79	54.79	-31.45	-30.05	
2	0.29453	0.08	34.22	27.52	34.3	80	27.60	60.40	50.40	-26.10	-22.80	
3	0.93906	0.13	32.22	23.62	32.3	35	23.75	56.00	46.00	-23.65	-22.25	
4	2.06641	0.18	33.30	25.84	33.4	8	26.02	56.00	46.00	-22.52	-19.98	
5	7.64063	0.37	25.54	16.52	25.9	)1	16.89	60.00	50.00	-34.09	-33.11	
6	26.25781	0.83	21.06	12.82	21.8	89	13.65	60.00	50.00	-38.11	-36.35	

## **REMARKS:**

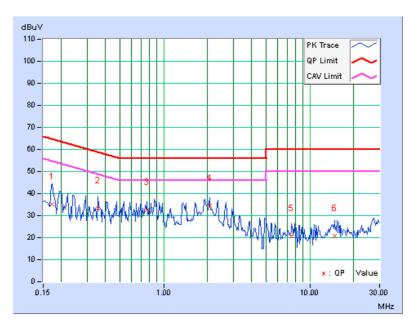
- 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
- 2. The emission levels of other frequencies were very low against the limit.
- 3. Margin value = Emission Level Limit value
- 4. Correction Factor = Insertion loss + Cable loss
- 5. Emission Level = Correction Factor + Reading Value



_											
Phase			Neutral (N)			Detector Function			Quasi-Peak (QP) /		
									Average (AV)		
	Freq.	Corr.	Readin	Emission Level Lir			mit Margin				
No	ricq.	Factor	[dB (uV)]			[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	- 1	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17344	0.06	34.96	26.40	35.0	2	26.46	64.79	54.79	-29.77	-28.33
2	0.35703	0.08	33.12	23.82	33.2	0	23.90	58.80	48.80	-25.59	-24.89
3	0.77109	0.11	32.62	23.02	32.7	3	23.13	56.00	46.00	-23.27	-22.87
4	2.05469	0.18	34.12	27.34	34.3	0	27.52	56.00	46.00	-21.70	-18.48
5	7.49609	0.38	20.52	9.88	20.9	0	10.26	60.00	50.00	-39.10	-39.74
6	14.71484	0.60	20.00	12.68	20.6	0	13.28	60.00	50.00	-39.40	-36.72

## **REMARKS**:

- 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
- 2. The emission levels of other frequencies were very low against the limit.
- 3. Margin value = Emission Level Limit value
- 4. Correction Factor = Insertion loss + Cable loss
- 5. Emission Level = Correction Factor + Reading Value





## 4.3 Conducted Out of Band Emission Measurement

## 4.3.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

## 4.3.2 Test Setup



## 4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

## 4.3.4 Test Procedures

## MEASUREMENT PROCEDURE REF

- 1. Set the RBW = 100 kHz.
- 2. Set the VBW  $\ge$  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 OOBE

- 1. Set RBW = 100 kHz.
- 2. Set VBW ≥ 300 kHz.
- 3. Detector = peak.
- 4. Sweep = auto couple.
- 5. Trace Mode = max hold.
- 6. Allow trace to fully stabilize.
- 7. Use the peak marker function to determine the maximum amplitude level.

## 4.3.5 Deviation from Test Standard

No deviation.

## 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

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



# 5GHz 802.11ac (VHT40) CH159 + Bluetooth GFSK CH0

21.5-1	Ref 21.5 dBm	Att 20 dB	RBW 100 kHz VBW 300 kHz SWIT 4 s	[T1] MP VIEW	Marker 1 [T1] -46.59 dBm 249.84 MHz
21.2	Offset 11.5 dB				Marker 2 [T1] 8 24 dBm
10-	2 D1 0 24 dDm				2.39822 GHz Marker 3 [T1]
0-	- 4				-46.20 dBm 4.60656 GHz
1					Marker 4 [T1]
-10-	02 11.76 dBm				5.79567 GHz
-20-					Marker 5 [T1] -28.99 dBm 39.73020 GHz
					5
-30-					*
-40-	1 3	the factor of the second second	an and the second s	www.wh	-
-50-	tering have to a low state	ing and the second s			-
-60 -					-
-70-					
78.5-					
	Stort 30 MHz	3.997	GHz/	Stop 40 GH	A D T



# 5 Pictures of Test Arrangements

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



## Appendix – 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:

Linko EMC/RF Lab Tel: 886-2-26052180 Fax: 886-2-26051924 Hsin Chu EMC/RF/Telecom Lab Tel: 886-3-5935343 Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety Lab Tel: 886-3-3183232 Fax: 886-3-3270892

Email: <u>service.adt@tw.bureauveritas.com</u> Web Site: <u>www.bureauveritas-adt.com</u>

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

--- END ----