

# **TEST REPORT**

FCC ID: 2ACJAHNM13

**Product: TABLET PC** 

Model No.: SC-813

Additional Model No.: HN-M1301, HN-M13XX("XX" can be replaced by digital

from "00" to "99")
Trade Mark: N/A

Report No.: TCT190723E023

Issued Date: Aug. 01, 2019

Issued for:

Shenzhen Harmony Technology Co., Ltd
Block 2, Jiayuan Industrial Zone, Heping Community high-tech park, No 2
Fuyuan Road, Fuyong, Bao'an, Shenzhen, China

Issued Bv:

Shenzhen Tongce Testing Lab.

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## 1. Test Certification

Report No.: TCT190723E023

Product:	TABLET PC
Model No.:	SC-813
Additional Model No.:	HN-M1301, HN-M13XX("XX" can be replaced by digital from "00" to "99")
Trade Mark:	N/A
Applicant:	Shenzhen Harmony Technology Co., Ltd
Address:	Block 2, Jiayuan Industrial Zone, Heping Community high-tech park, No 2 Fuyuan Road, Fuyong, Bao'an, Shenzhen, China
Manufacturer:	Shenzhen Harmony Technology Co., Ltd
Address:	Block 2, Jiayuan Industrial Zone, Heping Community high-tech park, No 2 Fuyuan Road, Fuyong, Bao'an, Shenzhen, China
Date of Test:	Jul. 24, 2019 – Jul. 31, 2019
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247 FCC KDB 558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10:2013

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:	m Wang	Date:	Jul. 31, 2019
	Jin Wang		
Reviewed By:	Beryl Zhao	Date:	Aug. 01, 2019
Approved By:	Tomsin	Date:	Aug. 01, 2019

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**Tomsin** 



# 2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203/§15.247 (c)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247 (b)(3)	PASS
6dB Emission Bandwidth	§15.247 (a)(2)	PASS
Power Spectral Density	§15.247 (e)	PASS
Band Edge	§15.247(d)	PASS
Spurious Emission	§15.205/§15.209	PASS

- 1. PASS: Test item meets the requirement.
- 2. Fail: Test item does not meet the requirement.
- 3. N/A: Test case does not apply to the test object.
- 4. The test result judgment is decided by the limit of test standard.





## 3. EUT Description

Product:	TABLET PC
Model No.:	SC-813
Additional Model No.:	HN-M1301, HN-M13XX("XX" can be replaced by digital from "00" to "99")
Trade Mark:	N/A
Hardware Version:	XT-L133P-V20
Software Version:	9.0
Operation Frequency:	2412MHz~2462MHz (802.11b/802.11g/802.11n(HT20)) 2422MHz~2452MHz (802.11n(HT40))
Channel Separation:	5MHz
Number of Channel:	11 for 802.11b/802.11g/802.11n(HT20) 7 for 802.11n(HT40)
Modulation Technology: (IEEE 802.11b)	Direct Sequence Spread Spectrum (DSSS)
Modulation Technology: (IEEE 802.11g/802.11n)	Orthogonal Frequency Division Multiplexing(OFDM)
Data speed (IEEE 802.11b):	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Data speed (IEEE 802.11g):	6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps
Data speed (IEEE 802.11n):	Up to 150Mbps
Antenna Type:	Internal Antenna
Antenna Gain:	-0.24dBi
Power Supply:	Rechargeable Li-ion Battery DC 3.7V
AC adapter:	Adapter Information: MODEL: HJ-050200U INPUT: AC 100-240V, 50/60Hz, 0.6A Max OUTPUT: DC 5V, 2A
Remark:	All models above are identical in interior structure, electrical circuits and components, and just model names are different for the marketing requirement.



Operation Frequency each of channel For 802.11b/g/n(HT20)

41			7.1			<u> </u>	1 / /	
	Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
	1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
	2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
	3	2422MHz	6	2437MHz	9	2452MHz		(.c.)

Operation Frequency each of channel For 802.11n (HT40)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
	- X	4	2427MHz	7	2442MHz	$(C_{-})$	
	-	5	2432MHz	8	2447MHz		
3	2422MHz	6	2437MHz	9	2452MHz		

#### Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

802.11b/802.11g/802.11n (HT20)

Channel	Frequency
The lowest channel	2412MHz
The middle channel	2437MHz
The Highest channel	2462MHz

#### 802.11n (HT40)

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Channel	Frequency
The lowest channel	2422MHz
The middle channel	2437MHz
The Highest channel	2452MHz



TESTING CENTRE TECHNOLOGY Report No.: TCT190723E023

## 4. General Information

#### 4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 98.46%)

The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. 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, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case (Z axis) are shown in Test Results of the following pages. For the full battery state and The output power to the maximum state.

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	Data rate
802.11b	1Mbps
802.11g	6Mbps
802.11n(H20)	6.5Mbps
802.11n(H40)	13.5Mbps
Final Test Mode:	
Operation mode:	Keep the EUT in continuous transmitting with modulation

- 1. For WIFI function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.
- 2.According to ANSI C63.10 standards, the test results are both the "worst case" and "worst setup" 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20),



13.5Mbps for 802.11(H40). Duty cycle setting during the transmission is 98.46% with maximum power setting for all modulations.

## 4.2. 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.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/			1 6	1

#### Note:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
- 3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.



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5. Facilities and Accreditations

#### 5.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

• FCC - Registration No.: 645098

Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

• IC - Registration No.: 10668A-1

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

## 5.2. Location

Shenzhen Tongce Testing Lab

Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District,

Shenzhen, Guangdong, China

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## 5.3. Measurement Uncertainty

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	±2.56dB
2	RF power, conducted	±0.12dB
3	Spurious emissions, conducted	±0.11dB
4	All emissions, radiated(<1G)	±3.92dB
5	All emissions, radiated(>1G)	±4.28dB
6	Temperature	±0.1°C
7	Humidity	±1.0%

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## 6. Test Results and Measurement Data

## 6.1. Antenna requirement

## **Standard requirement:** FCC Part15 C Section 15.203 /247(c)

15.203 requirement:

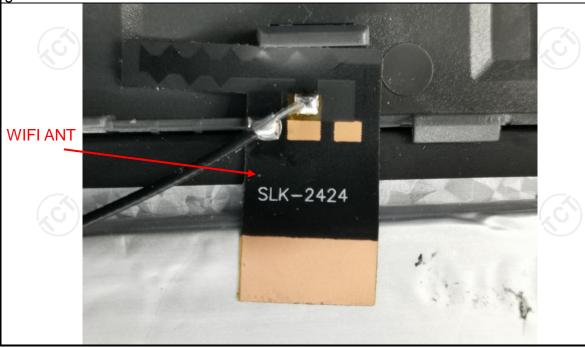
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

#### **E.U.T Antenna:**

The WIFI antenna is internal antenna which permanently attached, and the best case gain of the antenna is -0.24dBi.



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## 6.2. Conducted Emission

## 6.2.1. Test Specification

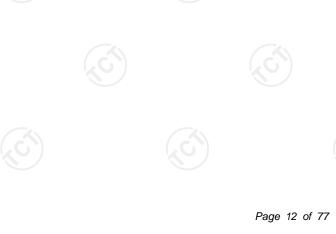
Test Requirement:	FCC Part15 C Section	15.207				
Test Method:	ANSI C63.10:2013	ANSI C63.10:2013				
Frequency Range:	150 kHz to 30 MHz					
Receiver setup:	RBW=9 kHz, VBW=30	kHz, Sweep time	=auto			
Limits:	Frequency range (MHz) 0.15-0.5 0.5-5 5-30	Limit (d Quasi-peak 66 to 56* 56 60	Average 56 to 46* 46 50			
Test Setup:	Reference 40cm  E.U.T AC powe  Test table/Insulation plane  Remark E.U.T. Equipment Under Test LISN: Line Impedence Stabilization Na Test table height=0.8m	80cm Filter Filter EMI Receiver	— AC power			
Test Mode:	Charging + transmitting	g with modulation				
Test Procedure:	<ol> <li>The E.U.T is conneline impedance state provides a 500hm/s measuring equipme</li> <li>The peripheral device power through a LI coupling impedance refer to the block photographs).</li> <li>Both sides of A.C. conducted interferer emission, the relative the interface cables ANSI C63.10: 2013</li> </ol>	bilization network 50uH coupling im nt. ces are also connects with 50ohm term diagram of the line are checkence. In order to fire must be change	(L.I.S.N.). This pedance for the ected to the main a 500hm/50uH nination. (Please test setup and d for maximum and the maximum ipment and all of ed according to			
Test Result:	PASS					



## 6.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)						
Equipment	Manufacturer	Model	Serial Number	Calibration Due		
Test Receiver	R&S	ESPI	101402	Sep. 17, 2019		
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 20, 2019		
Coax cable (9KHz-30MHz)	TCT	CE-05	N/A	Sep. 16, 2019		
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A		

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



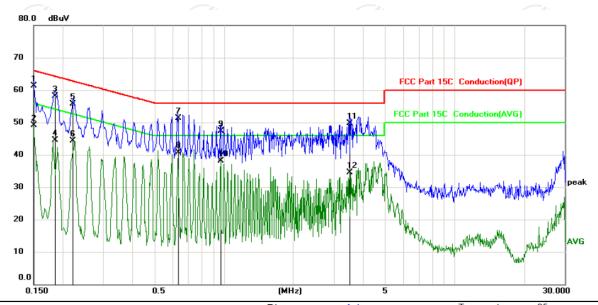


6.2.3. Test data

#### Report No.: TCT190723E023

## Please refer to following diagram for individual

## Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



Site	Phase:	L1	Temperature:	25
Limit: FCC Part 15C Conduction(QP)	Power:	AC 120V/60Hz	Humidity: 5	55 %

	No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
_		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
_	1	0.1500	51.05	10.23	61.28	66.00	-4.72	QP	
_	2	0.1500	38.82	10.23	49.05	56.00	-6.95	AVG	
<u></u>	3	0.1859	47.96	10.22	58.18	64.22	-6.04	QP	
_	4	0.1859	34.19	10.22	44.41	54.22	-9.81	AVG	
_	5	0.2220	45.45	10.23	55.68	62.74	-7.06	QP	
_	6	0.2220	34.10	10.23	44.33	52.74	-8.41	AVG	
_	7 *	0.6312	41.06	10.23	51.29	56.00	-4.71	QP	
_	8	0.6312	30.57	10.23	40.80	46.00	-5.20	AVG	
_	9	0.9687	37.00	10.35	47.35	56.00	-8.65	QP	
_	10	0.9687	27.81	10.35	38.16	46.00	-7.84	AVG	
X-	11	3.5024	39.29	10.47	49.76	56.00	-6.24	QP	
- ر	12	3.5024	23.96	10.47	34.43	46.00	-11.57	AVG	

#### Note:

Freq. = Emission frequency in MHz

Reading level  $(dB\mu V)$  = Receiver reading

Corr. Factor (dB) = LISN factor + Cable loss

Measurement  $(dB\mu V)$  = Reading level  $(dB\mu V)$  + Corr. Factor (dB)

Limit (dBµV) = Limit stated in standard

 $Margin (dB) = Measurement (dB\mu V) - Limits (dB\mu V)$ 

Q.P. =Quasi-Peak

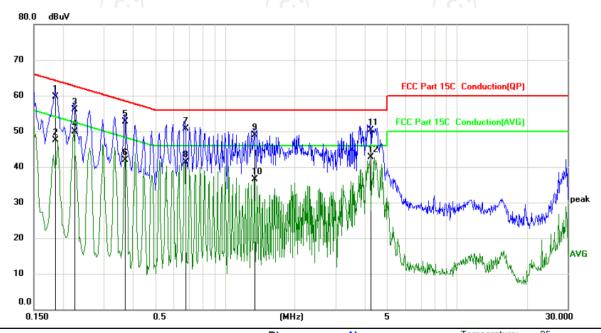
AVG =average

<sup>\*</sup> is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.





## Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



Site	Phase:	N	Temperature: 25
Limit: ECC Part 15C Conduction(OD)	Dower:	AC 120V/60Hz	Humidity: 55 %

	No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
			MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
	1		0.1859	49.50	10.22	59.72	64.22	-4.50	QP	
_	2		0.1859	37.36	10.22	47.58	54.22	-6.64	AVG	
	3		0.2232	45.88	10.23	56.11	62.70	-6.59	QP	
Κ_	4	*	0.2232	39.68	10.23	49.91	52.70	-2.79	AVG	
_	5		0.3704	42.55	10.22	52.77	58.49	-5.72	QP	
_	6		0.3704	31.59	10.22	41.81	48.49	-6.68	AVG	
_	7		0.6719	40.51	10.23	50.74	56.00	-5.26	QP	
	8		0.6719	31.02	10.23	41.25	46.00	-4.75	AVG	
	9		1.3424	38.59	10.39	48.98	56.00	-7.02	QP	
	10		1.3424	26.09	10.39	36.48	46.00	-9.52	AVG	
_	11		4.2358	39.84	10.47	50.31	56.00	-5.69	QP	
<	12		4.2358	32.14	10.47	42.61	46.00	-3.39	AVG	

#### Note:

Freq. = Emission frequency in MHz

Reading level  $(dB\mu V)$  = Receiver reading

Corr. Factor (dB) = LISN factor + Cable loss

Measurement  $(dB\mu V)$  = Reading level  $(dB\mu V)$  + Corr. Factor (dB)

 $Limit (dB\mu V) = Limit stated in standard$ 

 $Margin (dB) = Measurement (dB\mu V) - Limits (dB\mu V)$ 

Q.P. =Quasi-Peak

AVG =average

<sup>\*</sup> is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.



## 6.3. Maximum Conducted (Average) Output Power

## 6.3.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)					
Test Method:	KDB 558074 D01 v05r02					
Limit:	30dBm					
Test Setup:	Spectrum Analyzer EUT					
Test Mode:	Transmitting mode with modulation					
Test Procedure:	<ol> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Measure the conducted output power and record the results in the test report.</li> </ol>					
Test Result:	PASS					

## 6.3.2. Test Instruments

RF Test Room						
Equipment	Manufacturer	Model	Serial Number	Calibration Due		
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 20, 2019		
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Sep. 20, 2019		
Antenna Connector	TCT	RFC-01	N/A	Sep. 20, 2019		

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

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## 6.4. Emission Bandwidth

## 6.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)					
Test Method:	KDB 558074 D01 v05r02					
Limit:	>500kHz					
Test Setup:	Spectrum Analyzer EUT					
Test Mode:	Transmitting mode with modulation					
Test Procedure:	<ol> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.</li> <li>Measure and record the results in the test report.</li> </ol>					
Test Result:	PASS					

#### 6.4.2. Test Instruments

RF Test Room						
Equipment	Manufacturer	Model	Serial Number	Calibration Due		
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 20, 2019		
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 20, 2019		
Antenna Connector	TCT	RFC-01	N/A	Sep. 20, 2019		

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

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## 6.5. Power Spectral Density

## 6.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB 558074
Limit:	The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
Test Setup:	
	Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): 3 kHz ≤ RBW ≤ 100 kHz. Video bandwidth VBW ≥ 3 x RBW. Set the span to at least 1.5 times the OBW.</li> <li>Detector = RMS, Sweep time = auto couple.</li> <li>Employ trace averaging (RMS) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level.</li> <li>Measure and record the results in the test report.</li> </ol>
Test Result:	PASS

## 6.5.2. Test Instruments

RF Test Room									
Equipment	Manufacturer	Model	Serial Number	Calibration Due					
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 20, 2019					
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 20, 2019					
Antenna Connector	TCT	RFC-01	N/A	Sep. 20, 2019					

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

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## 6.6. Conducted Band Edge and Spurious Emission Measurement

## 6.6.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074
Limit:	In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and 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).
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).</li> <li>Measure and record the results in the test report.</li> <li>The RF fundamental frequency should be excluded against the limit line in the operating frequency band.</li> </ol>
Test Result:	PASS



## 6.6.2. Test Instruments

RF Test Room									
Equipment	Manufacturer Model Se		Serial Number	Calibration Due					
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 20, 2019					
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 20, 2019					
Antenna Connector	TCT	RFC-01	N/A	Sep. 20, 2019					

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



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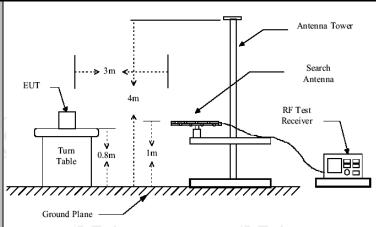
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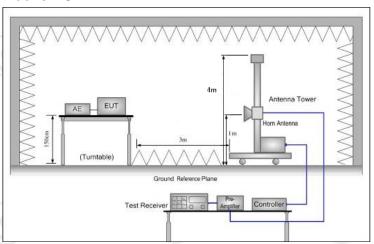
## 6.7. Radiated Spurious Emission Measurement

## 6.7.1. Test Specification

Test Requirement:	FCC Part15	FCC Part15 C Section 15.209							
Test Method:	ANSI C63.10	0: 2013							
Frequency Range:	9 kHz to 25 (	GHz			,				
Measurement Distance:	3 m								
Antenna Polarization:	Horizontal &	Vertical							
Operation mode:	Transmitting	mode wi	th modulat	ion					
	Frequency 9kHz- 150kHz	Detector Quasi-pea	/ / / / /	VBW 1kHz	Quas	Remark i-peak Value			
Receiver Setup:	150kHz- 30MHz	Quasi-pea		30kHz		i-peak Value			
	30MHz-1GHz	Quasi-pea		300KHz		i-peak Value			
	Above 1GHz	Peak	1MHz	3MHz		eak Value			
		Peak	1MHz	10Hz	Ave	rage Value			
	Frequen	псу	Field Stro (microvolts	7 /	Measurement Distance (meters)				
	0.009-0.490		2400/F(I	(Hz)	300				
	0.490-1.705		24000/F(KHz)		30				
	1.705-30		30		30				
	30-88		100		3				
I impit.	88-216		150			3			
Limit:	216-96		200			3			
	Above 9	00	500		3				
	Frequency		ld Strength ovolts/meter)	Measure Distan (meter	ce	Detector			
	Above 1GHz	7	500	3		Average			
	Above 10112	_	5000	3		Peak			
Test setup:	For radiated emissions below 30MHz  Distance = 3m  Computer  Pre-Amplifier  Receiver  30MHz to 1GHz								
	30IVITZ 10 TO	J∏Z							



#### Above 1GHz



#### Test Procedure:

1. For the radiated emission test below 1GHz: The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level. For the radiated emission test above 1GHz: Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final

「通测检测 Report No.: TCT190723E023 measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. 3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level 4. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported. 5. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=120 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold; (3) Set RBW = 1 MHz, VBW = 3MHz for f > 1 GHz for peak measurement. For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Test results: **PASS** 





## 6.7.2. Test Instruments

	Radiated Em	ission Test Site	e (966)	
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	ROHDE&SCHW ARZ	ESIB7	100197	Sep. 17, 2019
Spectrum Analyzer	ROHDE&SCHW ARZ	FSQ40	200061	Sep. 20, 2019
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 16, 2019
Pre-amplifier	HP	8447D	2727A05017	Sep. 16, 2019
Loop antenna	ZHINAN	ZN30900A	12024	Oct. 20, 2019
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 02, 2019
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Oct. 20, 2019
Horn Antenna	A-INFO	LB-180400-KF	J211020657	Sep. 16, 2019
Antenna Mast	Keleto	RE-AM	N/A	N/A
Coax cable (9KHz-1GHz)	тст	RE-low-01	N/A	Sep. 16, 2019
Coax cable (9KHz-40GHz)	тст	RE-high-02	N/A	Sep. 16, 2019
Coax cable (9KHz-1GHz)	тст	RE-low-03	N/A	Sep. 16, 2019
Coax cable (9KHz-40GHz)	TCT	RE-high-04	N/A	Sep. 16, 2019
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

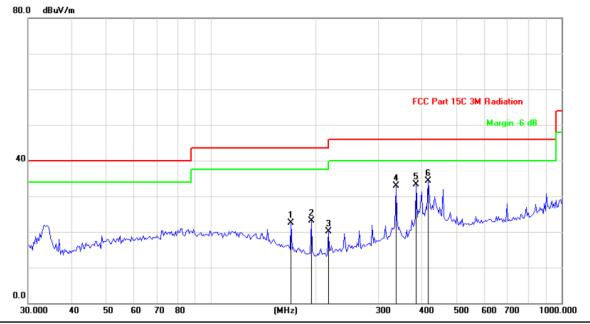
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## 6.7.3. Test Data

# Please refer to following diagram for individual Below 1GHz

Horizontal:

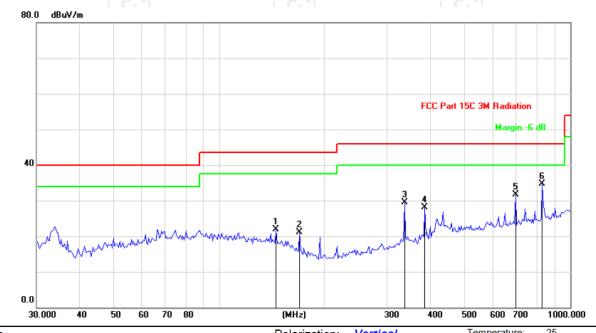


Site Polarization: Horizontal Temperature: 25
Limit: FCC Part 15C 3M Radiation Power: DC 3.7V Humidity: 55 %

	No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
			MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
	1		168.9970	38.01	-15.41	22.60	43.50	-20.90	peak
-	2		193.1366	37.46	-14.33	23.13	43.50	-20.37	peak
-	3		216.1197	33.75	-13.55	20.20	46.00	-25.80	peak
-	4		336.4817	42.89	-10.01	32.88	46.00	-13.12	peak
` `X	5		384.5447	42.58	-9.18	33.40	46.00	-12.60	peak
-`ر	6	*	415.4486	43.01	-8.75	34.26	46.00	-11.74	peak



#### Vertical:



Site	Polarization: Vertical	remperature.	23
Limit: FCC Part 15C 3M Radiation	Power: DC 3.7V	Humidity:	55 %

	No.	MŁ	c. Freq	Reading . Level	Correct Factor	Measure- ment	Limit	Over	
_			MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
_	1		144.7899	38.16	-16.17	21.99	43.50	-21.51	peak
3	2		168.9970	36.52	-15.41	21.11	43.50	-22.39	peak
_	3		336.4817	7 39.49	-10.01	29.48	46.00	-16.52	peak
	4		384.5447	7 37.36	-9.18	28.18	46.00	-17.82	peak
_	5		698.803	37.09	-5.47	31.62	46.00	-14.38	peak
	6	*	833.0127	7 38.81	-4.10	34.71	46.00	-11.29	peak

**Note:** 1.The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

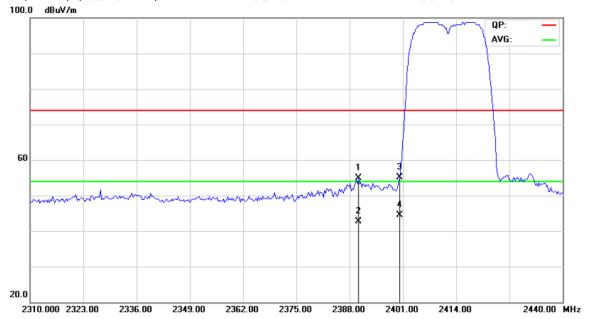
2. Measurements were conducted in all three channels (high, middle, low) and all modulation(802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40)), and the worst case Mode (Highest channel and 802.11b) was submitted only.



#### Test Result of Radiated Spurious at Band edges

Horizontal:

802.11n(HT20) (2412 MHz):



Site Limit: FCC part 15 (PK) Polarization: Horizontal AC 120V/60Hz Power:

Temperature:

25 (C)

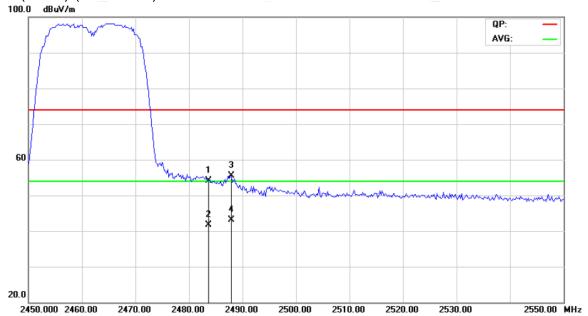
Humidity: 55 %

-	No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
Ī			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
_	1		2390.240	52.16	2.66	54.82	74.00	-19.18	peak
)	2		2390.240	40.10	2.66	42.76	54.00	-11.24	AVG
_	3		2400.000	52.47	2.66	55.13	74.00	-18.87	peak
Ī	4	*	2400.000	41.91	2.66	44.57	54.00	-9.43	AVG





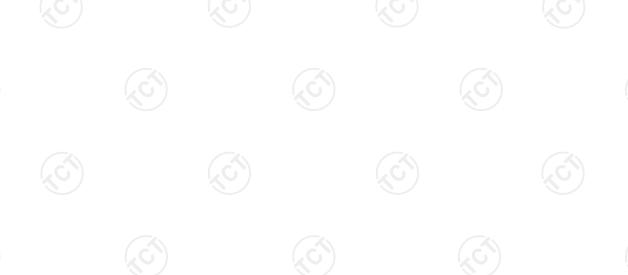
# 802.11n(HT20) (2462 MHz):



Site Polarization: Horizontal Temperature: 25 (C)

Limit: FCC part 15 (PK) Power: AC 120V/60Hz Humidity: 55 %

No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2483.500	51.51	2.67	54.18	74.00	-19.82	peak
2		2483.500	38.98	2.67	41.65	54.00	-12.35	AVG
3		2487.876	52.90	2.67	55.57	74.00	-18.43	peak
4	*	2487.876	40.36	2.67	43.03	54.00	-10.97	AVG

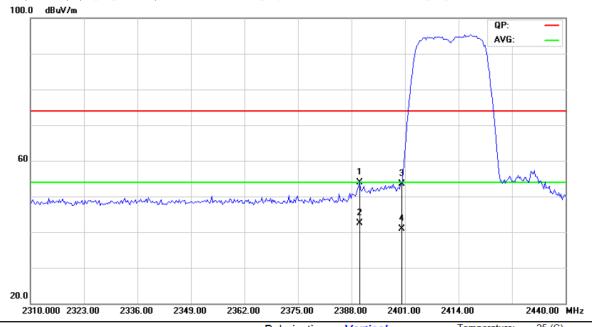




Vertical:

802.11n(HT20) (2412 MHz):

Report No.: TCT190723E023



Site Limit: FCC part 15 (PK) Polarization: Vertical

Temperature: 25

25 (C)

Power:

AC 120V/60Hz

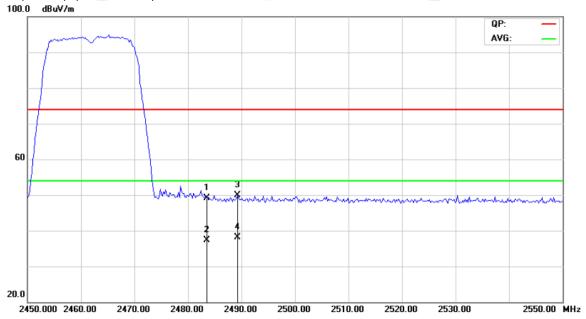
Humidity: 55 %

	No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
_			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
_	1		2389.980	51.34	2.66	54.00	74.00	-20.00	peak
_	2	*	2389.980	39.90	2.66	42.56	54.00	-11.44	AVG
) _	3		2400.000	50.79	2.66	53.45	74.00	-20.55	peak
_	4		2400.000	38.32	2.66	40.98	54.00	-13.02	AVG





## 802.11n(HT20) (2462 MHz):



Site Polarization: Vertical Temperature: 25 (C)

Limit: FCC part 15 (PK) Power: AC 120V/60Hz Humidity: 55 %

No	).	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	1		2483.500	46.47	2.67	49.14	74.00	-24.86	peak
2	2		2483.500	34.69	2.67	37.36	54.00	-16.64	AVG
) = 3	3		2489.279	47.19	2.67	49.86	74.00	-24.14	peak
	1	*	2489.279	35.46	2.67	38.13	54.00	-15.87	AVG

- 1. Peak Final Emission Level=Peak Reading + Correction Factor;
- 2. Correction Factor= Antenna Factor + Cable loss Pre-amplifier
- 3. Measurements were conducted in all modulation(802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40)), and the worst case Mode (802.11n(HT20)) was submitted only.



#### Above 1GHz Modulation Type: 802.11b

					J 1							
	Low channel: 2412 MHz											
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)			
4824	I	46.96		0.75	47.71		74	54	-6.29			
7236	Н	40.14	f	9.87	50.01		74	54	-3.99			
'	Н					4-						
4824	V	47.03		0.75	47.78		74	54	-6.22			
7236	V	39.75		9.87	49.62		74	54	-4.38			
	V			(	<u> </u>				(			

			M	iddle chann	el: 2437MF	·lz			
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4874	H O	48.19	<del>[-</del> C]	0.97	49.16	, C <del>-</del>	74	54	-4.84
7311	H	39.26	-22	9.83	49.09		74	54	-4.91
	Н								
4874	V	47.38		0.97	48.35		74	54	-5.65
7311	V	38.94		9.83	48.77		74	54	-5.23
/	V				J				🤇

	High channel: 2462 MHz											
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)		Margin (dB)			
4924	H	47.89		1.18	49.07		74	54	-4.93			
7386	Ι	39.02		10.07	49.09		74	54	-4.91			
	I											
					<b>X</b> 1							
4924	V	46.88		1.18	48.06		74	54	-5.94			
7386	V	37.69		10.07	47.76		74	54	-6.24			
	V											

- 1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss Pre-amplifier
- 2. Margin (dB) = Emission Level (Peak) (dB $\mu$ V/m)-Average limit (dB $\mu$ V/m)
- 3. The emission levels of other frequencies are very lower than the limit and not show in test report.
- 4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
- 5. Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.





Modulation Type: 802.11g	
--------------------------	--

	Low channel: 2412 MHz										
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)		
4824	Н	49.04		0.75	49.79		74	54	-4.21		
7236	Н	38.67		9.87	48.54	-	74	54	-5.46		
/	Н		<del></del>		(			<del></del>			
,			'(()	/	4			KO)			
4824	V	47.85		0.75	48.60	1	74	54	-5.40		
7236	V	40.12		9.87	49.99		74	54	-4.01		
	V										

		KO)	M	iddle chann	el: 2437MF	Ηz	KO)		X
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4874	H	48.37		0.97	49.34		74	54	-4.66
7311	, C H	39.44	<del>(-</del> C)	9.83	49.27	·C <sup>24</sup>	74	54	-4.73
	И					<u></u>		-4-	
4874	V	47.25		0.97	48.22		74	54	-5.78
7311	V	38.18		9.83	48.01		74	54	-5.99
<b></b>	V	(		( . c			(		(

			Н	ligh channe	l: 2462 MH	Z			
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4924	(OH	48.45	70	1.18	49.63	(O)	74	54	-4.37
7386	H	39.61	-33	10.07	49.68		74	54	-4.32
	Н								
4924	V	46.98		1.18	48.16		74	54	-5.84
7386	V	40.15		10.07	50.22		74	54	-3.78
<i>/</i>	V			(	<i></i>				()

- 1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss Pre-amplifier
- 2. Margin (dB) = Emission Level (Peak) (dB $\mu$ V/m)-Average limit (dB $\mu$ V/m)
- 3. The emission levels of other frequencies are very lower than the limit and not show in test report.
- 4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
- 5. Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.



Modulation Type: 802.11n (HT20)

			Modu	iation Type:	. 802.11n (f	7120)			
			L	ow channe	I: 2412 MH	Z			
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4824	Н	46.89		0.75	47.64		74	54	-6.36
7236	Н	37.58		9.87	47.45		74	54	-6.55
	Н								
(				\	(				
4824	V	47.12	*	0.75	47.87	7-	74	54	-6.13
7236	V	40.05		9.87	49.92		74	54	-4.08

	Middle channel: 2437MHz											
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)			
4874	I	48.34		0.97	49.31		74	54	-4.69			
7311	H	39.68		9.83	49.51		74	54	-4.49			
(	H		<del>[-</del> G]		(			<del>(-,</del> G)				
				/					,			
4874	V	47.79		0.97	48.76		74	54	-5.24			
7311	V	38.91		9.83	48.74		74	54	-5.26			
	V											

	High channel: 2462 MHz												
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)				
4924	Ŧ	49.04	<del>-/-</del> ()	1.18	50.22		74	54	-3.78				
7386	O H	38.26	<del>7.</del> 0 ,	10.07	48.33	(O)	74	54	-5.67				
	H												
4924	V	46.74		1.18	47.92		74	54	-6.08				
7386	V	39.12		10.07	49.19		74	54	-4.81				
5 )	V	(,G)		(, (	( )		(, <del>G</del> ))		( , (				

#### Note:

- 1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss Pre-amplifier
- 2. Margin (dB) = Emission Level (Peak) (dB $\mu$ V/m)-Average limit (dB $\mu$ V/m)
- 3. The emission levels of other frequencies are very lower than the limit and not show in test report.
- 4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
- 5. Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.



Report No.: TCT190723E023



Modulation Type: 802.11n (HT40)

	Low channel: 2422 MHz										
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)		
4844	Н	45.93		0.66	46.59		74	54	-7.41		
7266	Н	38.64		9.50	48.14	-	74	54	-5.86		
	Н		<i>f</i>		(			<i></i>			
	( )		'X'	/				KO)			
4824	V	44.78		0.66	45.44		74	54	-8.56		
7236	V	37.36		9.50	46.86		74	54	-7.14		
	V										

	Middle channel: 2437MHz											
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)			
4874	H	45.59		0.99	46.58		74	54	-7.42			
7311	Н	39.25	<del>[</del> C)	9.85	49.10		74	54	-4.90			
	Н											
4874	V	46.44		0.99	47.43		74	54	-6.57			
7311	V	37.93		9.85	47.78		74	54	-6.22			
	V			( (			(c)		(_			

High channel: 2452 MHz										
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBµV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)	
4904	O H	47.18		1.33	48.51	(O-i)	74	54	-5.49	
7356	Н	36.92		10.22	47.14		74	54	-6.86	
	Н									
4904	V	48.03		1.33	49.36		74	54	-4.64	
7356	V	38.76		10.22	48.98		74	54	-5.02	
<i></i>	V									

- 1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss Pre-amplifier
- 2. Margin (dB) = Emission Level (Peak) (dB $\mu$ V/m)-Average limit (dB $\mu$ V/m)
- 3. The emission levels of other frequencies are very lower than the limit and not show in test report.
- 4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
- 5. Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

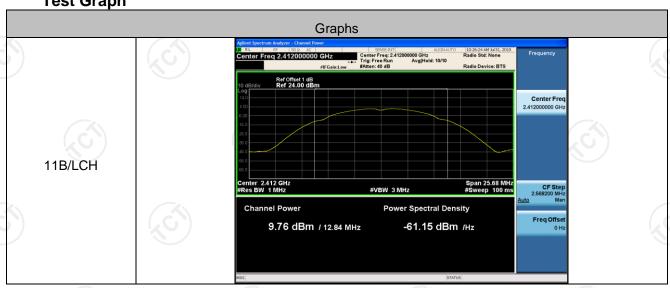


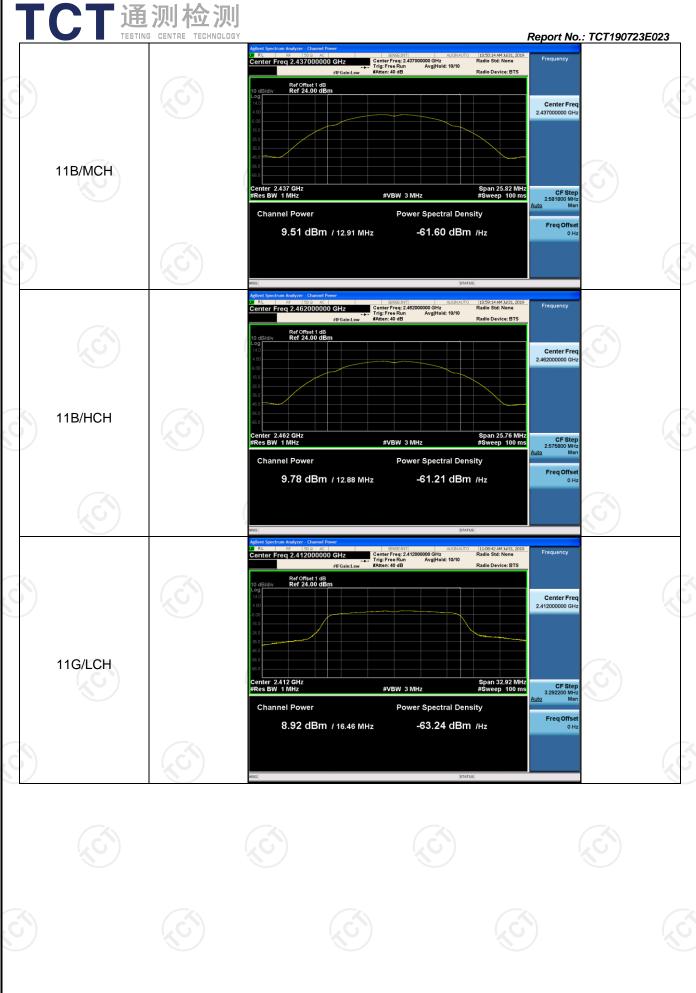
# Appendix A: Test Result of Conducted Test Conducted Average Output Power

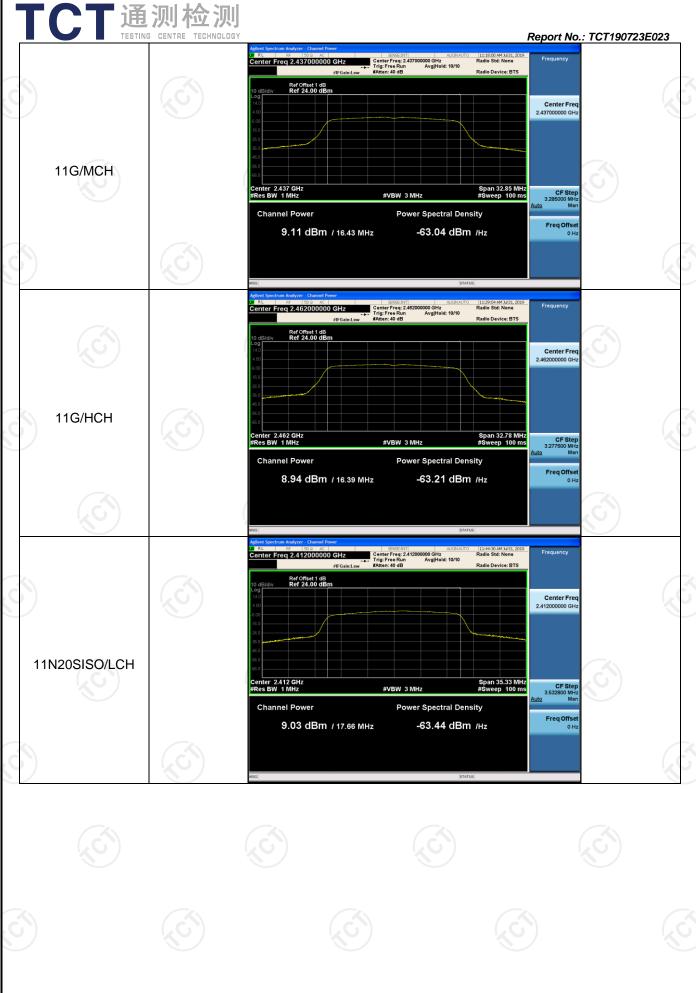
#### **Result Table**

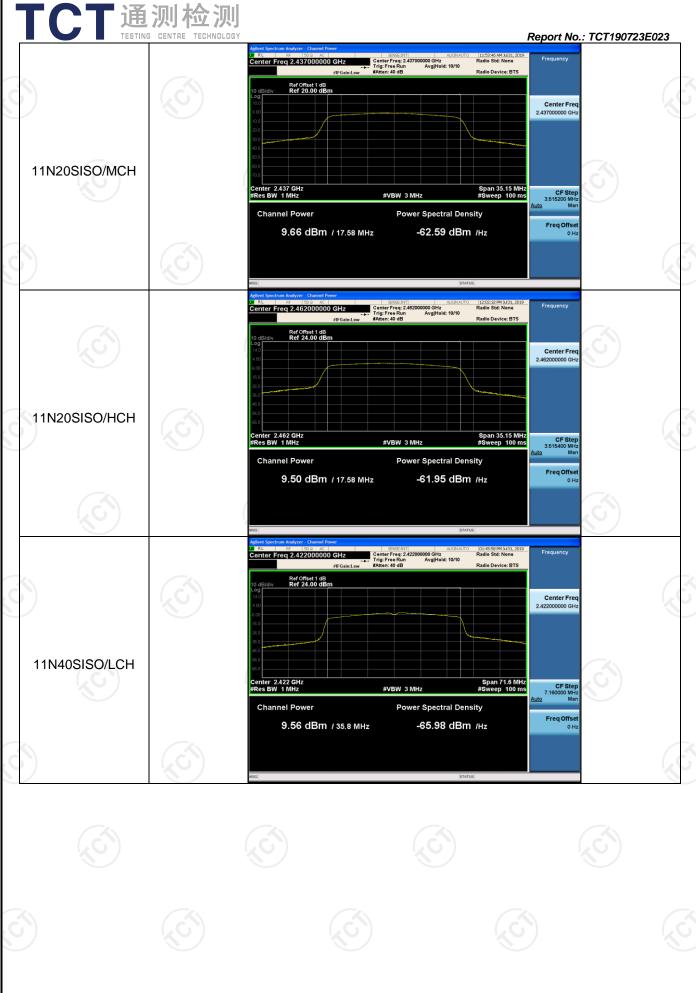
Mode	Channel	Meas.Level [dBm]	Verdict				
11B	LCH	9.76	PASS				
11B	MCH	9.51	PASS				
11B	HCH	9.78	PASS				
11G	LCH	8.92	PASS				
11G	MCH	9.11_	PASS				
11G	НСН	8.94	PASS				
11N20SISO	LCH	9.03	PASS				
11N20SISO	MCH	9.66	PASS				
11N20SISO	НСН	9.50	PASS				
11N40SISO	LCH	9.56	PASS				
11N40SISO	MCH	9.73	PASS				
11N40SISO	НСН	9.75	PASS				

## Test Graph













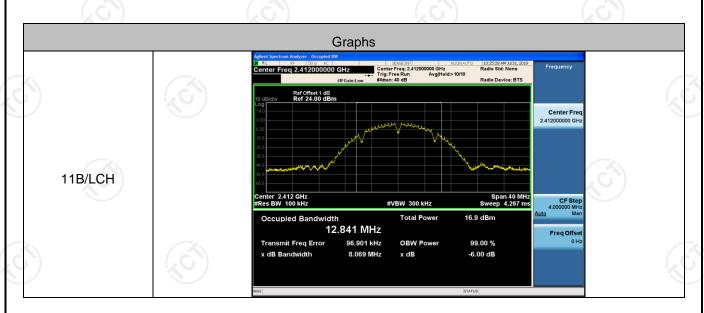
Report No.: TCT190723E023

## 6dB Occupied Bandwidth

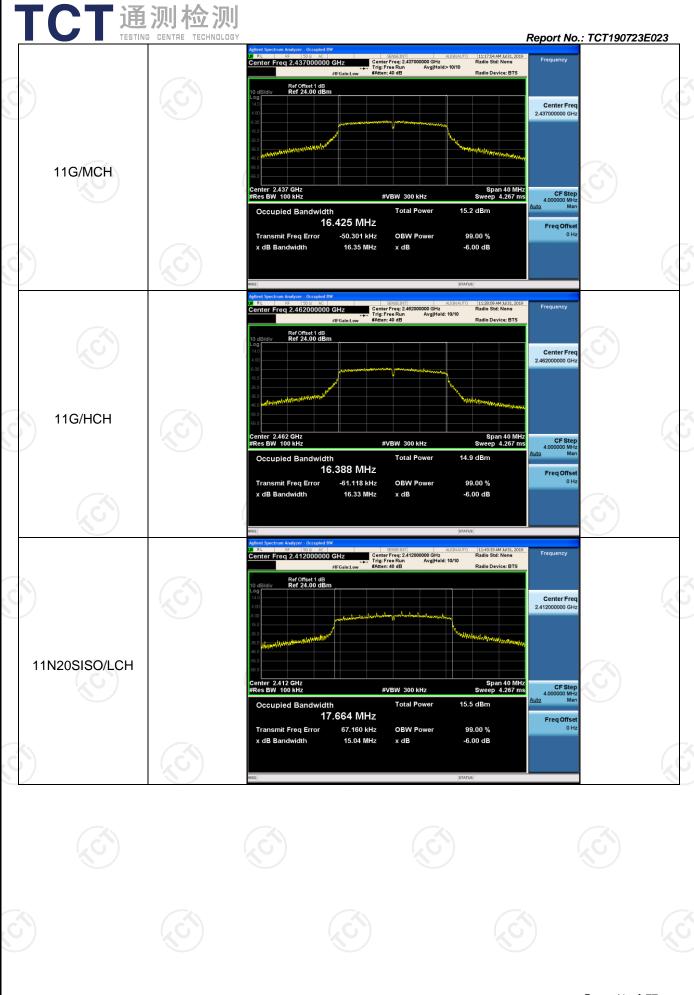
### Result Table

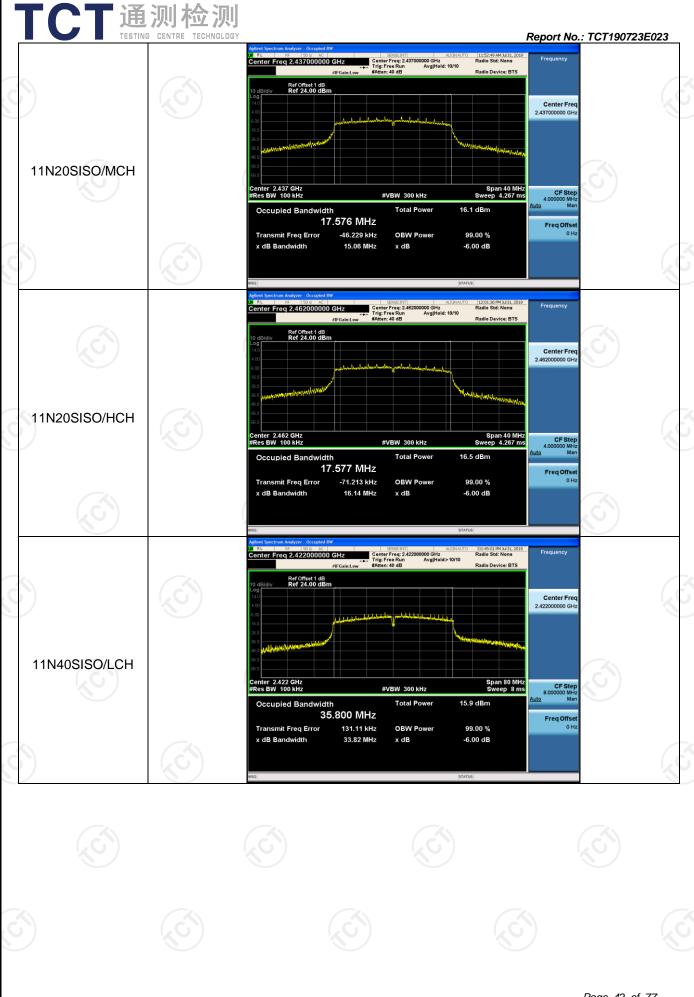
Mode	Channel	6dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
11B	LCH	8.069	12.841	PASS
11B	MCH	7.601	12.909	PASS
11B	HCH	8.058	12.879	PASS
11G	LCH	16.29	16.461	PASS
11G	мсн	16.35	16.425	PASS
11G	HCH	16.33	16.388	PASS
11N20SISO	LCH	15.04	17.664	PASS
11N20SISO	MCH	15.06	17.576	PASS
11N20SISO	HCH	16.14	17.577	PASS
11N40SISO	LCH	33.82	35.800	PASS
11N40SISO	MCH	32.53	35.816	PASS
11N40SISO	НСН	32.61	35.767	PASS

#### **Test Graph**













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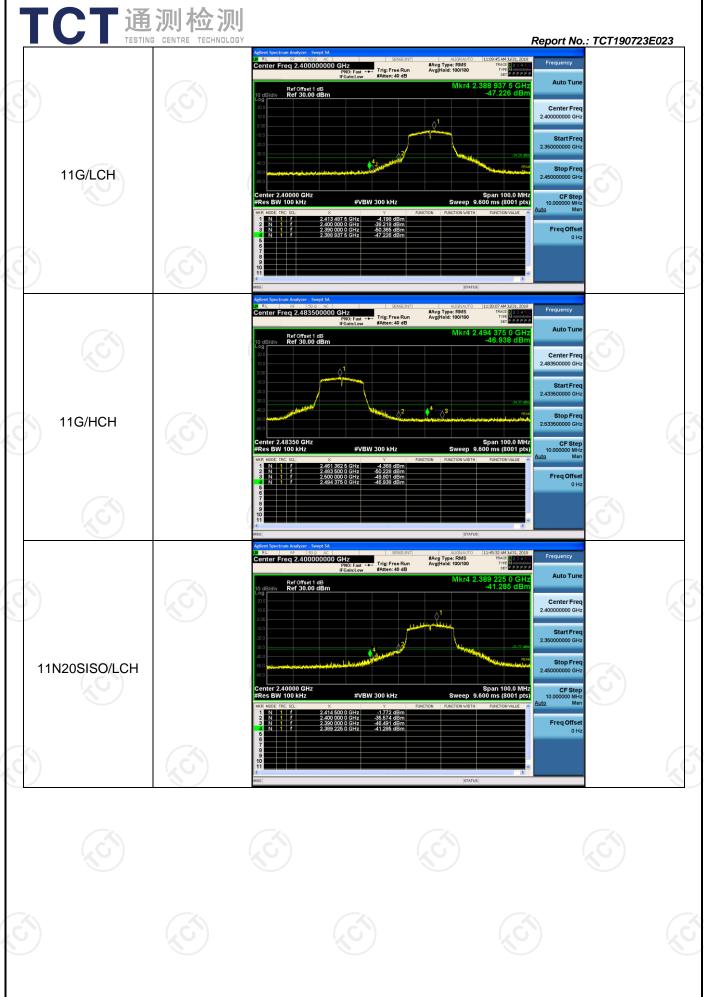
# Band-edge for RF Conducted Emissions

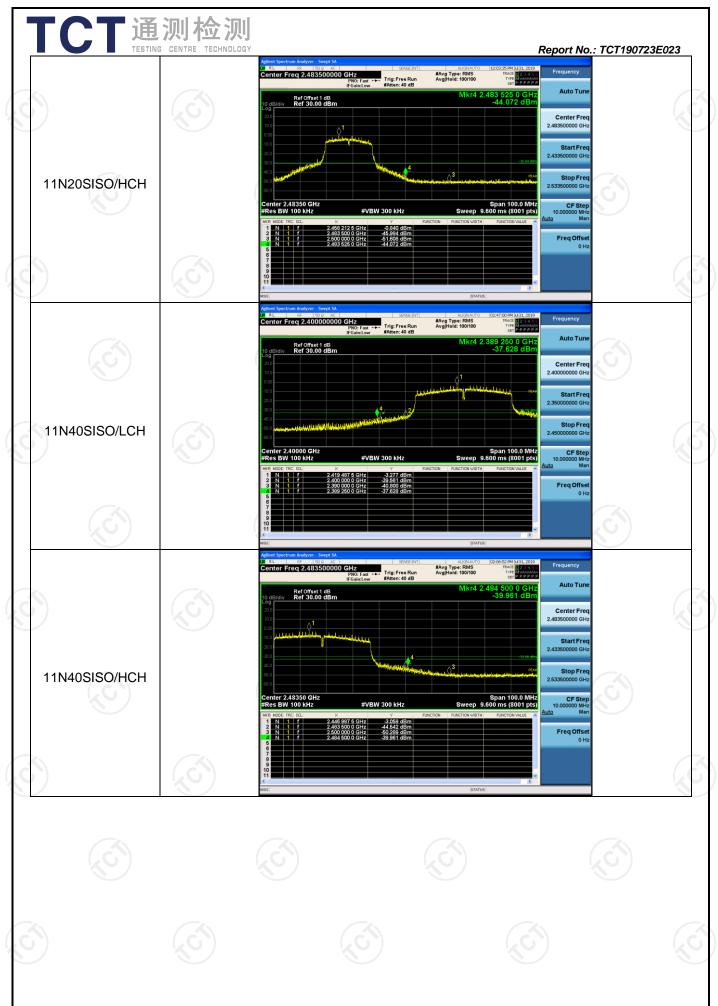
#### **Result Table**

Mode	Channel	Carrier Power [dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
11B	LCH	1.197	-47.297	-28.80	PASS
11B	HCH	1.071	-47.779	-28.93	PASS
11G	LCH	-4.198	-47.226	-34.20	PASS
11G	HCH	-4.368	-46.938	-34.37	PASS
11N20SISO	LCH	-1.772	-41.285	-31.77	PASS
11N20SISO	HCH	-0.840	-44.072	-30.84	PASS
11N40SISO	LCH	-3.277	-37.628	-33.28	PASS
11N40SISO	НСН	-3.059	-39.961	-33.06	PASS

### **Test Graph**









Report No.: TCT190723E023

## **RF Conducted Spurious Emissions**

### Result Table

Mode	Channel	Pref [dBm]	Puw [dBm]	Verdict
11B	LCH	1.201	<limit< td=""><td>PASS</td></limit<>	PASS
11B	MCH	0.942	<limit< td=""><td>PASS</td></limit<>	PASS
11B	HCH	1.634	<limit< td=""><td>PASS</td></limit<>	PASS
11G	LCH	-4.014	<limit< td=""><td>PASS</td></limit<>	PASS
11G	MCH	-4.246	<limit< td=""><td>PASS</td></limit<>	PASS
11G	HCH	-4.267	<limit< td=""><td>PASS</td></limit<>	PASS
11N20SISO	LCH	-2.215	<limit< td=""><td>PASS</td></limit<>	PASS
11N20SISO	MCH	-0.216	<limit< td=""><td>PASS</td></limit<>	PASS
11N20SISO	HCH	-0.215	<limit< td=""><td>PASS</td></limit<>	PASS
11N40SISO	LCH	-3.329	<limit< td=""><td>PASS</td></limit<>	PASS
11N40SISO	MCH	-3.244	<limit< td=""><td>PASS</td></limit<>	PASS
11N40SISO	HCH	-3.111	<limit< td=""><td>PASS</td></limit<>	PASS

#### **Test Graph**

