

# **TEST REPORT**

FCC ID: 2AJ3GRS-CH222H1CGA

**Product: Wireless Camera** 

Model No.: RS-CH222H1CGA-WL-36W

Additional Model No.: RS-CHxxxyxzzz-xxyy-zz-xxzz-zz (x= 0-9 or blank; y=A-Z;

z = A-Z or blank)
Trade Mark: N/A

Report No.: TCT191016E017 Issued Date: Jan. 14, 2020

Issued for:

Zhuhai RaySharp Technology Co., Ltd NO.100 OF TECHNOLOGY ROAD 6, NATIONAL HI-TECH ZONE, ZHUHAI, China

Issued By:

Shenzhen Tongce Testing Lab.

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## 1. Test Certification

Report No.: TCT191016E017

Product:	Wireless Camera
Model No.:	RS-CH222H1CGA-WL-36W
Additional Model:	RS-CHxxxyxzzz-xxyy-zz-xxzz-zz (x= 0-9 or blank; y=A-Z; z = A-Z or blank)
Trade Mark:	N/A
Applicant:	Zhuhai RaySharp Technology Co., Ltd
Address:	NO.100 OF TECHNOLOGY ROAD 6, NATIONAL HI-TECH ZONE, ZHUHAI, China
Manufacturer:	Zhuhai RaySharp Technology Co., Ltd
Address:	NO.100 OF TECHNOLOGY ROAD 6, NATIONAL HI-TECH ZONE, ZHUHAI, China
Date of Test:	Oct. 17, 2019 - Jan. 13, 2020
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:

Date:

Jan. 13, 2020

Rleo

Tomsin

Reviewed By:

Date:

Jan. 14, 2020

Approved By:

Date:

Jan. 14, 2020



# 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:	Wireless Camera
Model No.:	RS-CH222H1CGA-WL-36W
Additional Model:	RS-CHxxxyxzzz-xxyy-zz-xxzz-zz (x= 0-9 or blank; y=A-Z; z = A-Z or blank)
Trade Mark:	N/A
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:	External Antenna
Antenna Gain:	2dBi
Power Supply:	AC 120V/60Hz
AC adapter:	Adapter Information: MODEL: RSF-DY056-0502000 INPUT: AC 100-240V, 50/60Hz, 0.4A OUTPUT: DC 5V, 2.0A
Remark:	All models above are identical in interior structure, electrical circuits and components, and just model names and colors are different for the marketing requirement.



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

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		

Operation Frequency each of channel For 802.11n (HT40)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Chamile	rrequericy	Charine	rrequericy	Charmer	1 requericy	Charmer	rrequericy
		4	2427MHz	7	2442MHz		
	- (5)	5	2432MHz	8	2447MHz	4	-
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)

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



General Information

4.1. Test environment and mode

Operating Environment:						
Condition	Radiated Emission					
Temperature:	25.0 °C	25.0 °C				
Humidity:	55 % RH	55 % RH				
Atmospheric Pressure:	1010 mbar	1010 mbar				
T (14 )						

Test Mode:

Keep the EUT in continuous transmitting by select Engineering mode: channel and modulations with Fully-charged battery

The sample was placed 0.8m & 1.5m for the measurement below & 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.

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.

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## 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
		,	/ /	

#### 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

TEL: +86-755-27673339

## 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 external antenna which permanently attached, and the best case gain of the antenna is 2dBi.



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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					
Frequency Range:	150 kHz to 30 MHz					
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto					
	Frequency range (MHz)	Limit (d	mit (dBuV)			
Limits:	0.15-0.5 0.5-5 5-30	66 to 56* 56 60	56 to 46* 46 50			
	Reference Plane					
Test Setup:	Test table/Insulation plane  Remark  E.U.T. Equipment Under Test LISN: Line Impedence Stabilization Network Test table height=0.8m					
Test Mode:	Charging + transmitting	g with modulation				
Test Procedure:	<ol> <li>Charging + transmitting with modulation</li> <li>The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</li> <li>Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</li> </ol>					
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	Jul. 29, 2020				
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 11, 2020				
Coax cable (9KHz-30MHz)	ТСТ	CE-05	N/A	Sep. 08, 2020				
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).

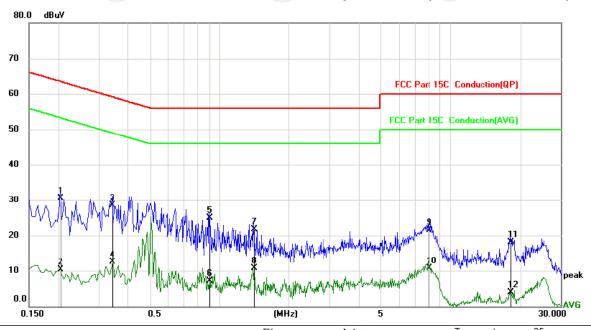




#### 6.2.3. Test data

## Please refer to following diagram for individual

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



Site	Phase:	L1	i emperature:	25
Limit: FCC Part 15C Conduction(QP)	Power:	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		0.2040	20.46	10.13	30.59	63.45	-32.86	QP	
_	2		0.2040	0.27	10.13	10.40	53.45	-43.05	AVG	
ζ_	3	*	0.3435	18.46	10.13	28.59	59.12	-30.53	QP	
_	4		0.3435	2.39	10.13	12.52	49.12	-36.60	AVG	
	5		0.9015	14.79	10.12	24.91	56.00	-31.09	QP	
_	6		0.9015	-3.06	10.12	7.06	46.00	-38.94	AVG	
_	7		1.4100	11.53	10.12	21.65	56.00	-34.35	QP	
_	8		1.4100	0.49	10.12	10.61	46.00	-35.39	AVG	
_	9		8.0565	11.46	10.14	21.60	60.00	-38.40	QP	
_	10		8.0565	0.50	10.14	10.64	50.00	-39.36	AVG	
ζ_	11		18.2265	7.85	10.19	18.04	60.00	-41.96	QP	
) _	12		18.2265	-6.32	10.19	3.87	50.00	-46.13	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

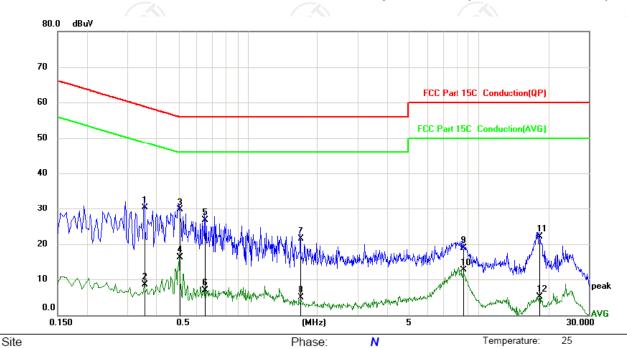
Any value more than 10dB below limit have not been specifically reported.

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<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)



	Oito						i iida	ю.				
	Lim	it: FC	C Part 15	C Conduct	ion(QP)		Powe	er: A0	120V/60Hz		Humidity:	55 %
_	No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over				
-			MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment		
-	1		0.3570	20.16	10.13	30.29	58.80	-28.51	QP			
-	2		0.3570	-1.66	10.13	8.47	48.80	-40.33	AVG			
-	3	*	0.5055	19.56	10.13	29.69	56.00	-26.31	QP			
	4		0.5055	6.12	10.13	16.25	46.00	-29.75	AVG			
ζ-	5		0.6540	16.49	10.12	26.61	56.00	-29.39	QP			
_	6		0.6540	-3.19	10.12	6.93	46.00	-39.07	AVG			
-	7		1.6980	11.31	10.12	21.43	56.00	-34.57	QP			
-	8		1.6980	-5.22	10.12	4.90	46.00	-41.10	AVG			
-	9		8.5470	8.79	10.14	18.93	60.00	-41.07	QP			
-	10		8.5470	2.48	10.14	12.62	50.00	-37.38	AVG			
-	11		18.2985	11.84	10.19	22.03	60.00	-37.97	QP			
-	12		18.2985	-5.06	10.19	5.13	50.00	-44.87	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

Any value more than 10dB below limit have not been specifically reported.

<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

	1/2 / 1/2 /					
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

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 12, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2020

**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

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020
RF Cable (9KHz-26.5GHz)	ТСТ	RE-06	N/A	Sep. 12, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2020

**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

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Sep. 12, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2020

**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
	-1.6.7 $1.6.7$



## 6.6.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due	
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020	
RF Cable (9KHz-26.5GHz)	тст	RE-06	N/A	Sep. 12, 2020	
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2020	

**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. Radiated Spurious Emission Measurement

## 6.7.1. Test Specification

Test Requirement:	FCC Part15	C Sectio	n 1	5.209			
Test Method:	ANSI C63.10	0: 2013		Ž)			
Frequency Range:	9 kHz to 25 (	GHz	100	5)		(	(0)
Measurement Distance:	3 m						
Antenna Polarization:	Horizontal &	Vertical					
Operation mode:	Transmitting	mode w	ith r	nodulat	ion		
	Frequency 9kHz- 150kHz 150kHz-	Detector Quasi-pea Quasi-pea	ak	RBW 200Hz 9kHz	VBW 1kHz 30kHz	Quas	Remark si-peak Value si-peak Value
Receiver Setup:	30MHz 30MHz-1GHz Above 1GHz	Quasi-pea Peak	KC	120KHz 1MHz	300KHz 3MHz	Quas	si-peak Value eak Value
	Above 1G112	Peak		1MHz	10Hz	Ave	erage Value
	Frequen		Field Stre (microvolts/		/meter)	Measurement Distance (meters)	
	0.009-0.490		2400/F(K 24000/F(R		,	300 30	
	0.490-1.705 1.705-30			30	NΠZ)		30
	30-88		(.c	100			3
	88-216			150			3
Limit:	216-96		200			3	
	Above 9		500			3	
	Frequency		Field Strength (microvolts/meter)		Measure Distan (meter	се	Detector
	Above 1GHz	<u></u>	500 5000		3		Average Peak
Test setup:	For radiated	Turn table	ns b	lm	Pre-/	Compu	
	30MHz to 10	SHz					

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

measurement antenna elevation shall be that which

T通测检测	
TESTING CENTRE TECHNOLOGY	Report No.: TCT191016E017
	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
	<ul> <li>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.</li> <li>5. Use the following spectrum analyzer settings: <ul> <li>(1) Span shall wide enough to fully capture the emission being measured;</li> <li>(2) Set RBW=120 kHz for f &lt; 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;</li> </ul> </li> </ul>
	(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	Jul. 29, 2020
Spectrum Analyzer	ROHDE&SCHW ARZ	FSQ40	200061	Sep. 11, 2020
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 08, 2020
Pre-amplifier	HP	8447D	2727A05017	Sep. 08, 2020
Loop antenna	ZHINAN	ZN30900A	12024	Sep. 11, 2020
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 06, 2020
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 06, 2020
Horn Antenna	A-INFO	LB-180400-KF	J211020657	Sep. 06, 2020
Antenna Mast	Keleto	RE-AM	N/A	N/A
Coax cable (9KHz-40GHz)	тст	RE-high-02	N/A	Sep. 08, 2020
Coax cable (9KHz-40GHz)	тст	RE-high-04	N/A	Sep. 08, 2020
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

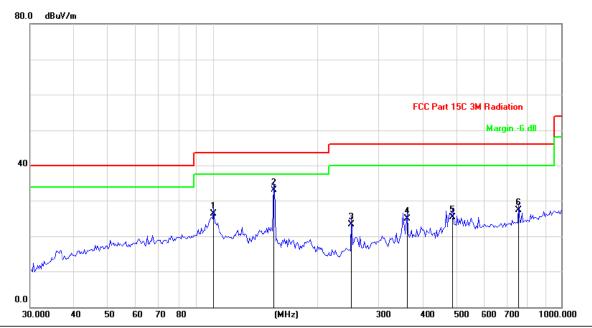
**Note:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).



## 6.7.3. Test Data

# Please refer to following diagram for individual Below 1GHz

Horizontal:

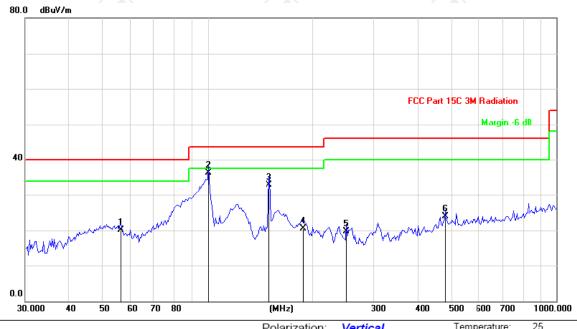


Site Polarization: Horizontal Temperature: 25
Limit: FCC Part 15C 3M Radiation Power: AC 120V/60Hz Humidity: 55 %

	No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
	1		100.4712	34.36	-8.04	26.32	43.50	-17.18	QP
	2	*	149.9676	49.32	-16.26	33.06	43.50	-10.44	QP
	3		250.4859	35.76	-12.55	23.21	46.00	-22.79	QP
	4		360.9775	34.51	-9.53	24.98	46.00	-21.02	QP
	5		488.3263	33.02	-7.62	25.40	46.00	-20.60	QP
_	6		754.9628	31.89	-4.49	27.40	46.00	-18.60	QP



#### Vertical:



Site Polarization: Vertical Temperature: 25
Limit: FCC Part 15C 3M Radiation 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		56.4662	31.57	-11.53	20.04	40.00	-19.96	QP
_	2	*	100.4712	44.38	-8.04	36.34	43.50	-7.16	QP
	3		149.9676	49.25	-16.26	32.99	43.50	-10.51	QP
_	4		187.7833	35.16	-14.56	20.60	43.50	-22.90	QP
-	5		250.4859	32.23	-12.55	19.68	46.00	-26.32	QP
_	6		481.5112	31.65	-7.74	23.91	46.00	-22.09	QP

**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 (Middle channel and 802.11b) was submitted only.
- 3. Freg. = Emission frequency in MHz

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

Correction Factor= Antenna Factor + Cable loss - Pre-amplifier

Limit (dBµV/m) = Limit stated in standard

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

Any value more than 10dB below limit have not been specifically reported.

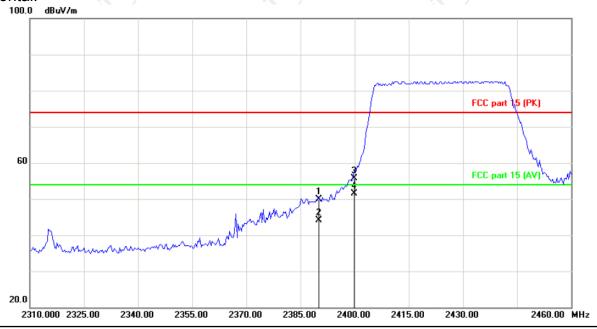
<sup>\*</sup> is meaning the worst frequency has been tested in the test frequency range



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

Lowest channel 2422:

Horizontal:

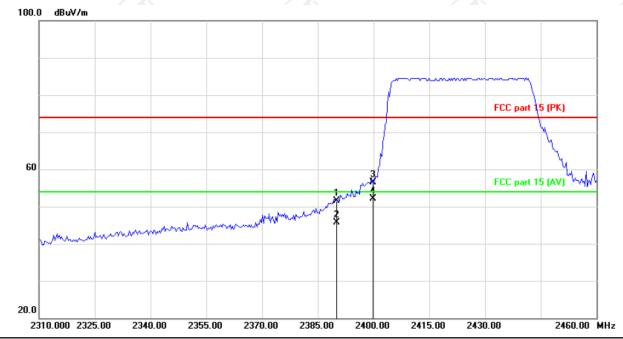


Site Polarization: Horizontal Temperature: 25 Limit: FCC part 15 (PK) Power: Humidity: 55 %

	No. Mk.		. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	,
-			MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
` ``	1		2390.000	63.02	-13.05	49.97	74.00	-24.03	peak
<u> </u>	2		2390.000	57.24	-13.05	44.19	54.00	-9.81	AVG
	3		2400.000	68.74	-13.02	55.72	74.00	-18.28	peak
-	4	*	2400.000	64.48	-13.02	51.46	54.00	-2.54	AVG



#### Vertical:



Site Polarization: Vertical Temperature: 25
Limit: FCC part 15 (PK) Power: Humidity: 55 %

•	No. Mk. Freq.		Reading Level	Correct Measure- Factor ment		Limit	Over		
•			MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
	1		2390.000	64.56	-13.05	51.51	74.00	-22.49	peak
く	2		2390.000	58.71	-13.05	45.66	54.00	-8.34	AVG
	3		2400.000	69.55	-13.02	56.53	74.00	-17.47	peak
	4	*	2400.000	65.16	-13.02	52.14	54.00	-1.86	AVG

**Note:** Measurements were conducted in all two channels (high, low) and all modulation (802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40)), and the worst case Mode 802.11n(HT20)



Temperature:

55 %

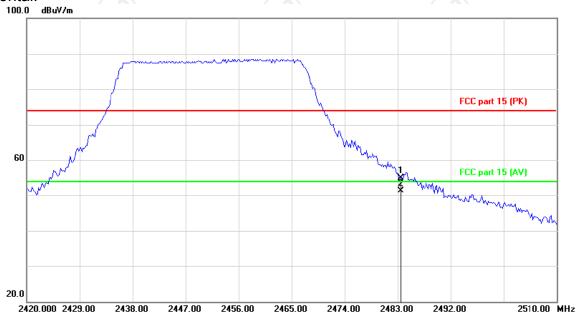
Humidity:

Highest channel 2462:

Horizontal:

Site

Limit: FCC part 15 (PK)



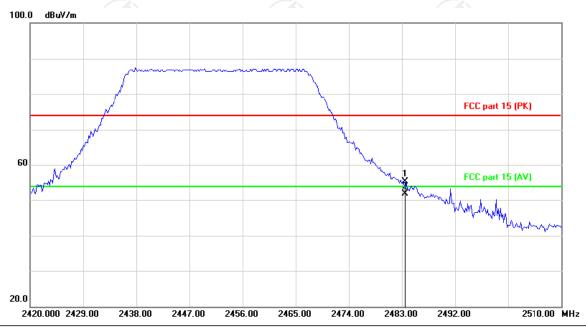
No. Mk.		Freq.	Reading Level		Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	24	83.500	67.77	-12.84	54.93	74.00	-19.07	peak
2 '	* 24	83.500	64.22	-12.84	51.38	54.00	-2.62	AVG

Power:

Polarization: Horizontal



#### Vertical:



Site Polarization: Vertical Temperature: 25
Limit: FCC part 15 (PK) Power: Humidity: 55 %

No. IV	1k. Freq.	_		Measure- ment	Limit	Over	
	MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	2483.500	68.13	-12.84	55.29	74.00	-18.71	peak
2 *	2483.500	64.69	-12.84	51.85	54.00	-2.15	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

	Low channel: 2412 MHz								
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emissio Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4824	Η	48.60		0.75	49.35		74	54	-4.65
7236	Н	40.28		9.87	50.15		74	54	-3.85
	H		<del></del>		/			<del></del>	
	(O)		(20)			(0)		(,0)	
4824	V	47.46	-77	0.75	48.21		74	54	-5.79
7236	V	40.71		9.87	50.58		74	54	-3.42
	V								

			М	iddle chann	nel: 2437MF	łz			
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	48.54		0.97	49.51	-	74	54	-4.49
7311	Н	41.09	<del></del>	9.83	50.92		74	54	-3.08
	ЭН		120			2		750	/
4874	V	49.97		0.97	50.94		74	54	-3.06
7311	V	41.13		9.83	50.96		74	54	-3.04
	V								(

			H	ligh channe					
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)
4924	H	49.72	4	1.18	50.90	-	74	54	-3.10
7386	Н	38.35		10.07	48.42	<del></del>	74	54	-5.58
	H							-	
4924	<b>\</b>	48.81		1.18	49.99		74	54	-4.01
7386	V	40.26		10.07	50.33		74	54	-3.67
Y )	V	<u> </u>			)		X2/		

- 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.
- 6. All the restriction bands are compliance with the limit of 15.209.





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	Η	49.71		0.75	50.46		74	54	-3.54			
7236	Η	40.39		9.87	50.26		74	54	-3.74			
	Η											
4824	>	47.06	<del>[.</del> C]	0.75	47.81		74	54	-6.19			
7236	V	40.82		9.87	50.69		74	54	-3.31			
	<b>V</b>											

<b>X</b> \			М	iddle chanr	el: 2437MF	Ηz			
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	ΑV reading (dBμV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4874	Ι	48.50		0.97	49.47		74	54	-4.53
7311	Ι	40.24	-	9.83	50.07		74	54	-3.93
/	I		<i>+-</i> \(\)	\	/	<del></del>		+-~	\ <del></del>
1	(0)		Ϋ́O	)				KO.	)
4874	<b>\</b>	47.65		0.97	48.62		74	54	-5.38
7311	V	40.18		9.83	50.01		74	54	-3.99
	V								

		<del></del>			1 0 400 1411				
		スシノ	H	ligh channe	l: 2462 MH	Z	12 O )		
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	I	47.93		1.18	49.11		74	54	-4.89
7386	Н	39.47	fc	10.07	49.54		74	54	-4.46
	Н					<del>-</del>			
4924	V	46.81		1.18	47.99		74	54	-6.01
7386	V	40.35		10.07	50.42		74	54	-3.58
	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.
- 6. All the restriction bands are compliance with the limit of 15.209.





Modulation Type: 802.11n (HT20)

	Woddiation Type: 602.1111 (11120)									
Low channel: 2412 MHz										
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emissio Peak (dBµV/m)	n Level AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)	
4824	Н	49.14		0.75	49.89		74	54	-4.11	
7236	Н	40.56		9.87	50.43		74	54	-3.57	
	Η									
/										
4824	V	47.28	<del>//</del> C,	0.75	48.03	$\leftarrow$	74	54	-5.97	
7236	V	40.60		9.87	50.47		74	54	-3.53	
	V									

<b>X</b> \			М	iddle chanr	el: 2437MF	Ηz			
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	ΑV reading (dBμV)	Correction Factor (dB/m)	Emission Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
4874	Ι	47.92		0.97	48.89		74	54	-5.11
7311	Ι	40.37	-	9.83	50.20		74	54	-3.80
/	I		<i>+-</i> \(\)	\	/	<del></del>		+-~	\
1	(0)		Ϋ́O	)				KO.	/
4874	<b>\</b>	47.71		0.97	48.68		74	54	-5.32
7311	V	40.49		9.83	50.32		74	54	-3.68
	V								

		$(C_{i})$	F	ligh channe	l: 2462 MH	Z	(CO)		1/4
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)
4924	Н	48.05		1.18	49.23		74	54	-4.77
7386	H	40.83	4	10.07	50.90	. 6, 24	74	54	-3.10
'	Н	-	-					-4-	
4924	<b>V</b>	47.26		1.18	48.44		74	54	-5.56
7386	V	40.74		10.07	50.81		74	54	-3.19
	V			(					(

#### 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.
- 6. All the restriction bands are compliance with the limit of 15.209.



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Report No.: TCT191016E017 Modulation Type: 802.11n (HT40)

ĺ	Low channel: 2422 MHz											
	Frequency (MHz)	Ant. Pol. H/V	(dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emissio Peak (dBµV/m)	AV (dBµV/m)	Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)		
	4844	Н	45.84		0.75	46.59		74	54	-7.41		
	7266	Η	38.20		9.87	48.07		74	54	-5.93		
		Η										
	/					/						
	4824	CV	44.59	<del>/2</del> 0,	0.75	45.34	(C)	74	54	-8.66		
	7236	V	35.07		9.87	44.94	<u> </u>	74	54	-9.06		
		V										

-	Middle channel: 2437MHz										
Fı	requency (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	Н	42.72		0.97	43.69		74	54	-10.31	
	7311	Н	34.36		9.83	44.19		74	54	-9.81	
	/	Ξ		<i>+-</i>		/			+-~		
				KO,		l,			KO.	)	
	4874	V	43.18		0.97	44.15		74	54	-9.85	
	7311	V	37.93		9.83	47.76		74	54	-6.24	
		V									

		$(C_{i})$	F	ligh channe	el: 2452 MH	Z	(CO)		(20
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	ΑV 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)
4904	Н	45.61	/.	1.18	46.79	<del></del>	74	54	-7.21
7356	H	36.45	4	10.07	46.52	. 672	74	54	-7.48
'	Н					<i>-</i>			
4904	V	43.29		1.18	44.47		74	54	-9.53
7356	V	36.54		10.07	46.61		74	54	-7.39
<u> </u>	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.
- 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.
- 6. All the restriction bands are compliance with the limit of 15.209.



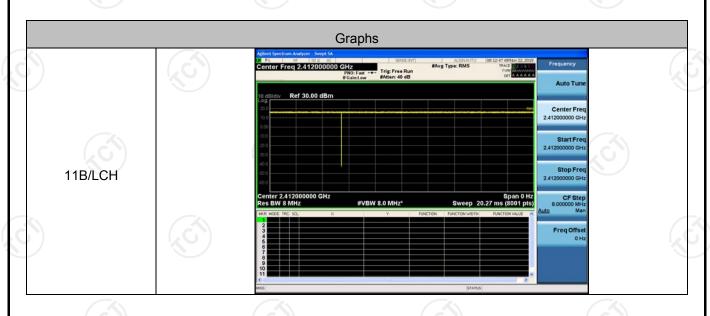


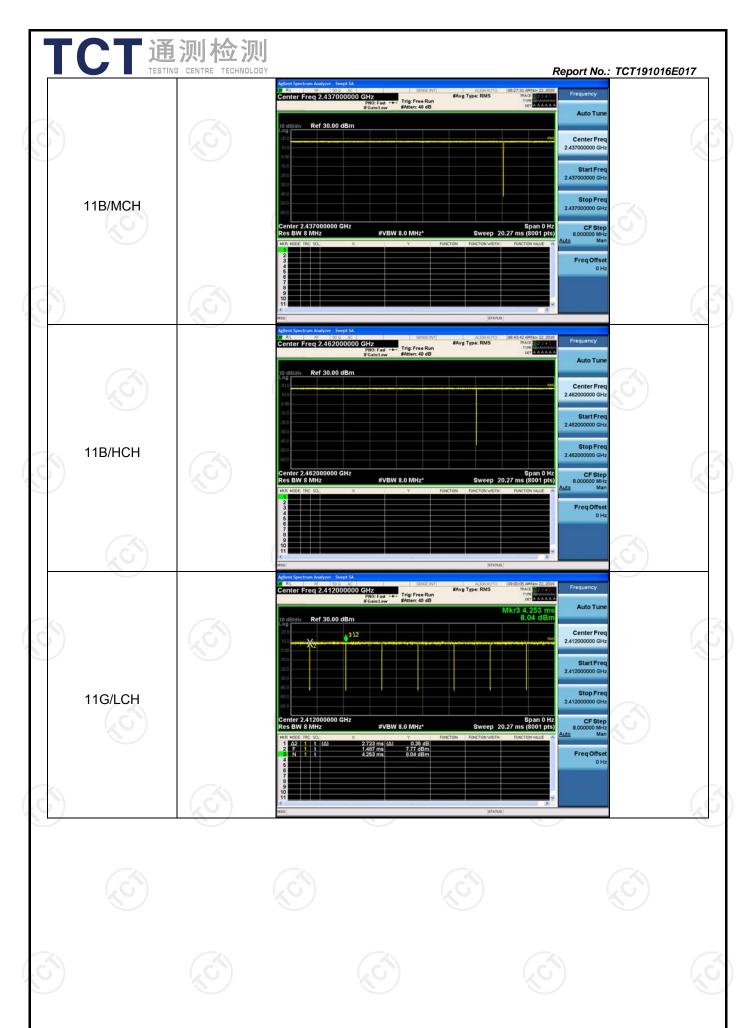
# Appendix A: Test Result of Conducted Test Duty Cycle

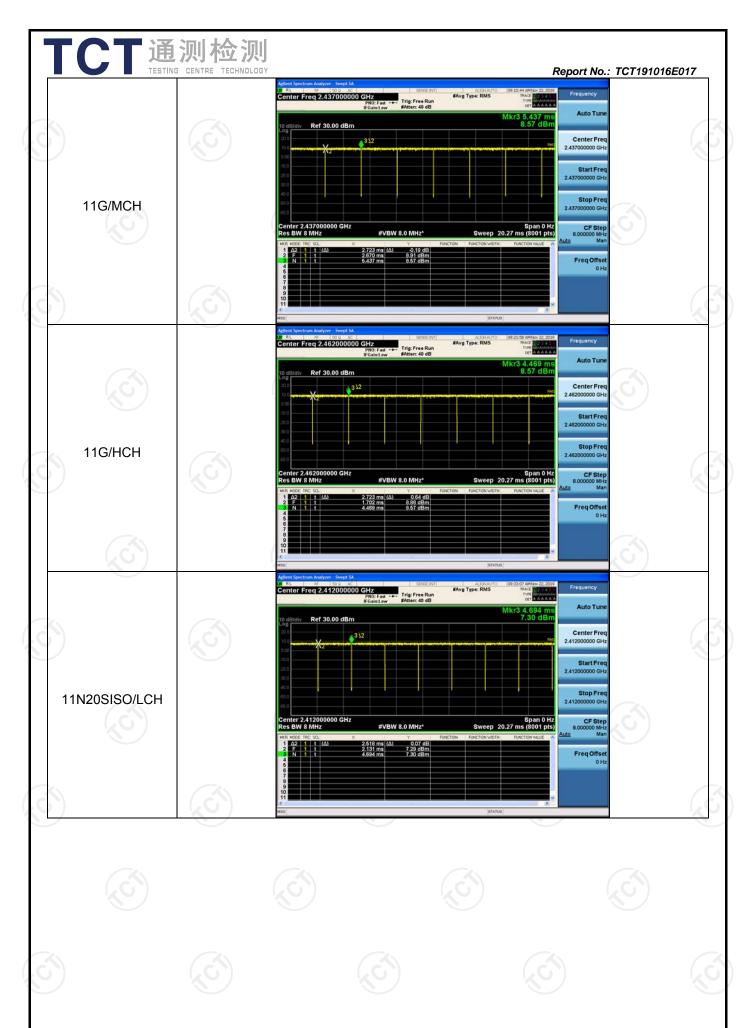
## **Result Table**

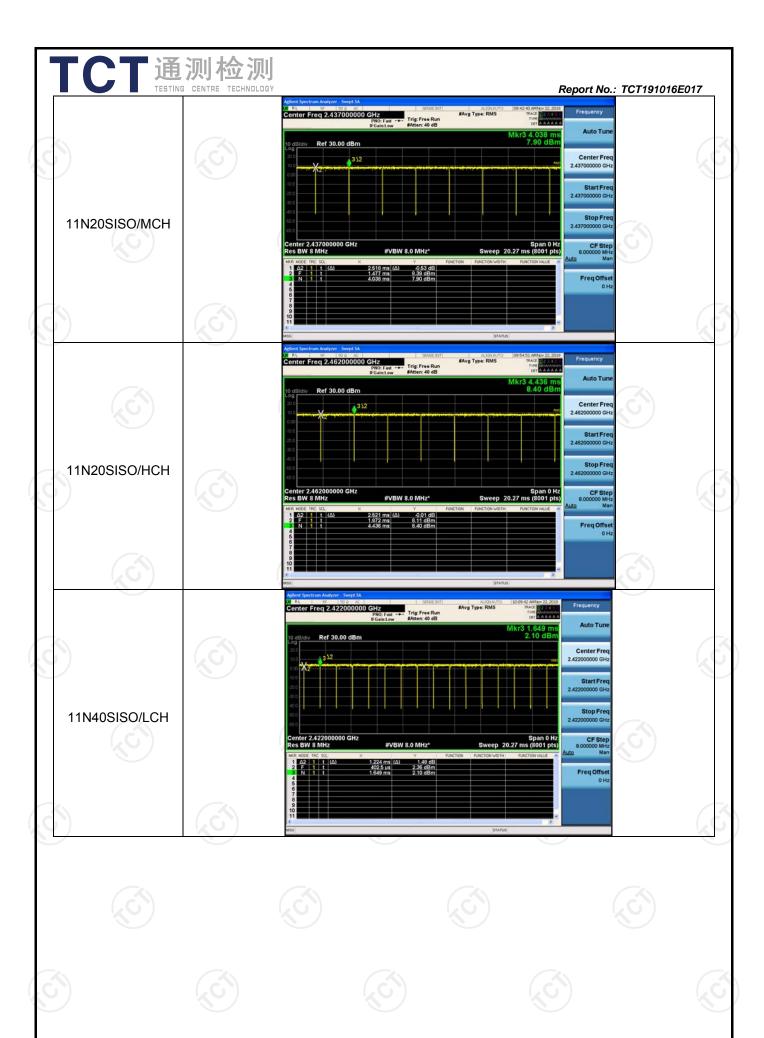
Mode	Channel	Meas.Level [%]
11B	LCH	100
11B	MCH	100
11B	HCH	100
11G	LCH	98.44
11G	MCH	98.44
11G	HCH	98.44
11N20SISO	LCH	98.22
11N20SISO	MCH	98.32
11N20SISO	HCH	98.32
11N40SISO	LCH	98.19
11N40SISO	MCH	98.19
11N40SISO	HCH	98.19

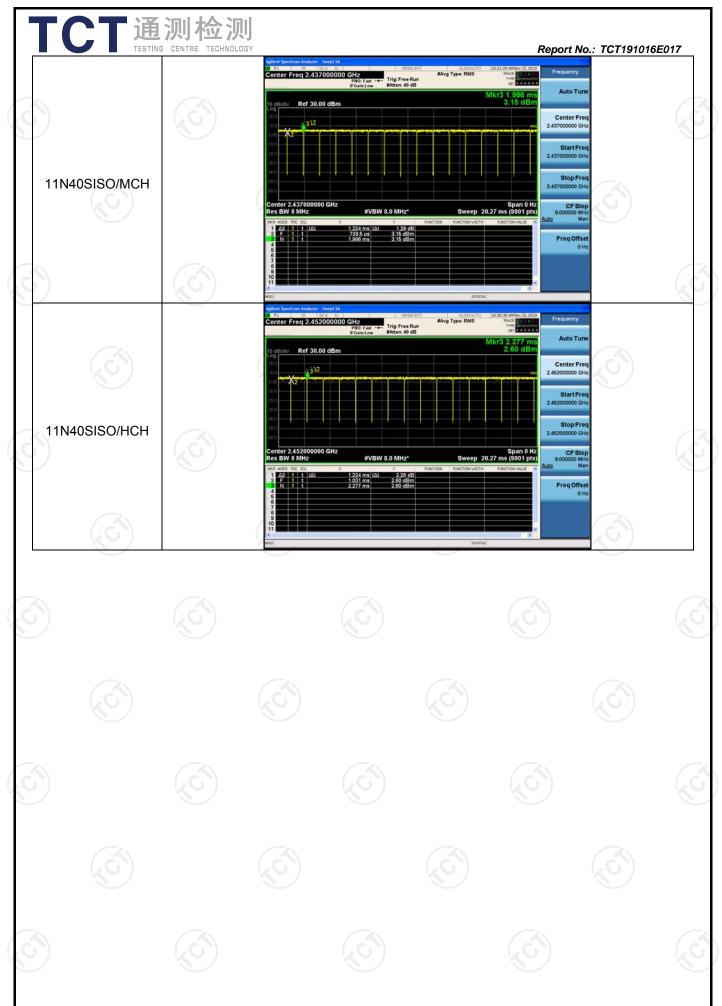
## **Test Graph**













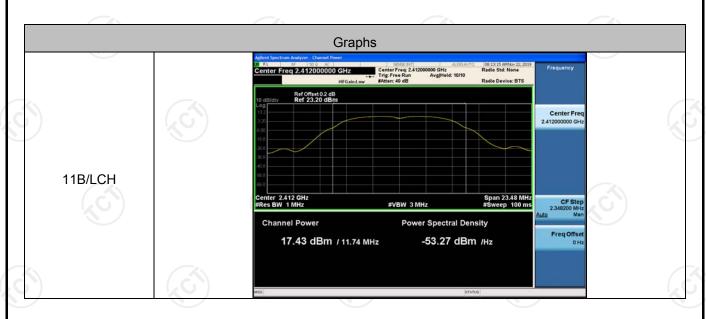
Report No.: TCT191016E017

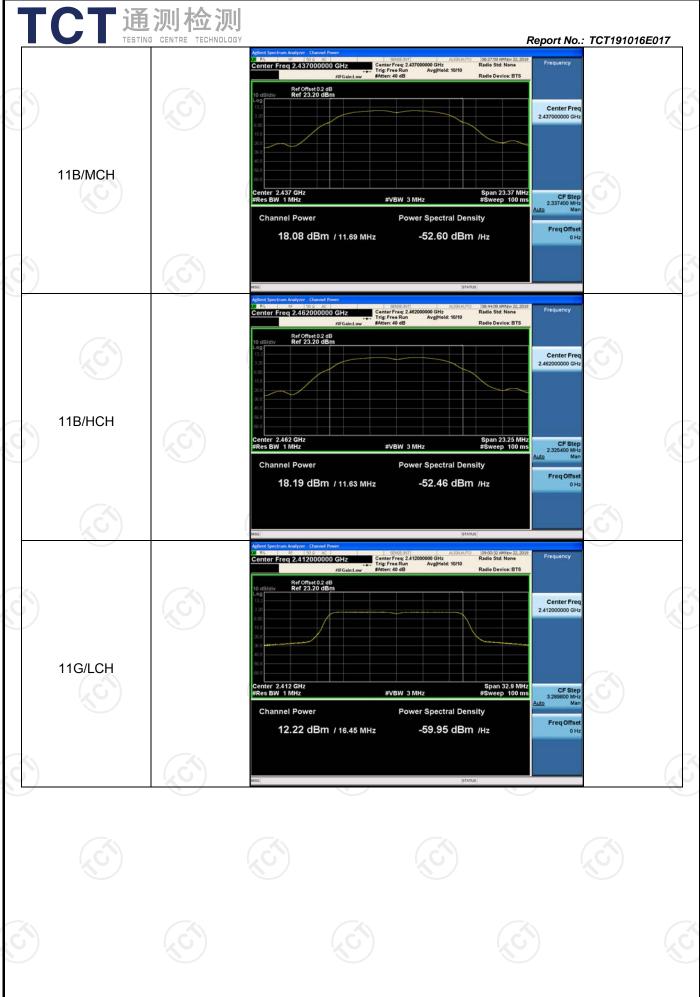
# **Conducted Average Output Power**

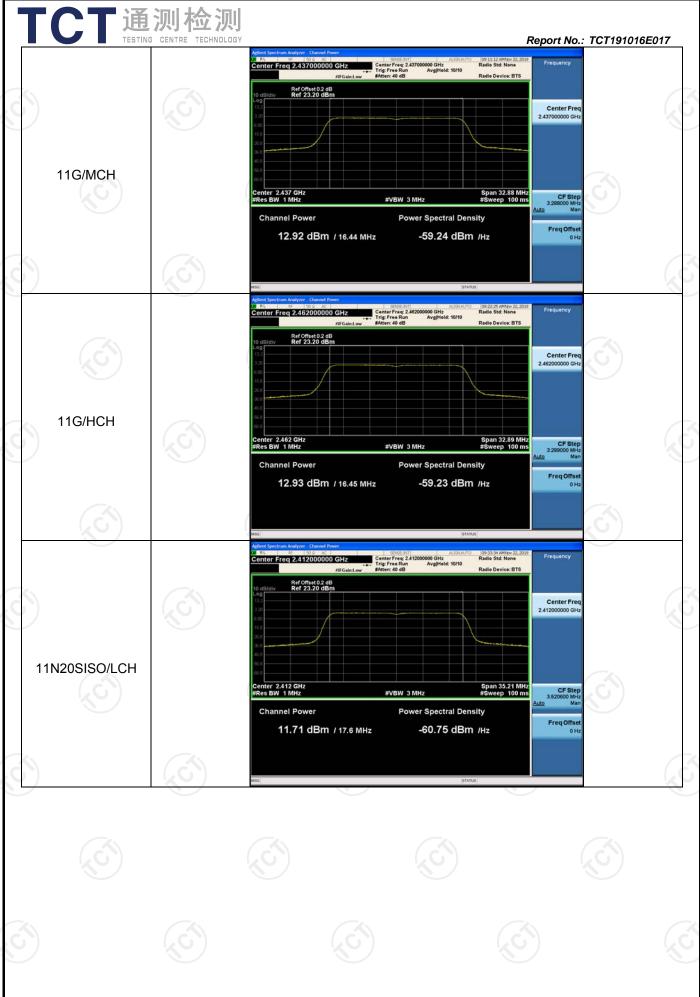
#### **Result Table**

Mode	Channel	Meas.Level [dBm]	Verdict
11B	LCH	17.43	PASS
11B	MCH	18.08	PASS
11B	нсн	18.19	PASS
11G	LCH	12.22	PASS
11G	MCH	12.92	PASS
11G	HCH	12.93	PASS
11N20SISO	LCH	11.71	PASS
11N20SISO	MCH	12.31	PASS
11N20SISO	HCH	12.43	PASS
11N40SISO	LCH	11.61	PASS
11N40SISO	MCH	12.54	PASS
11N40SISO	HCH	12.05	PASS

### **Test Graph**













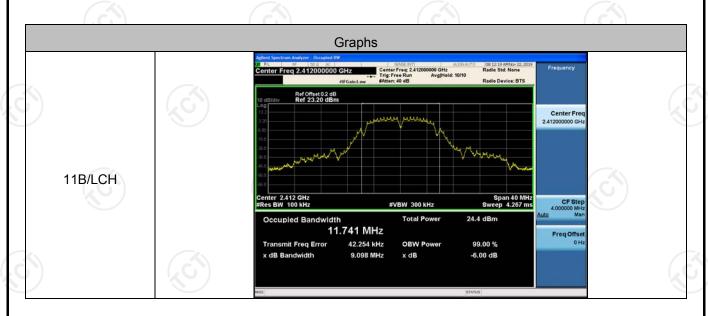
Report No.: TCT191016E017

# 6dB Occupied Bandwidth

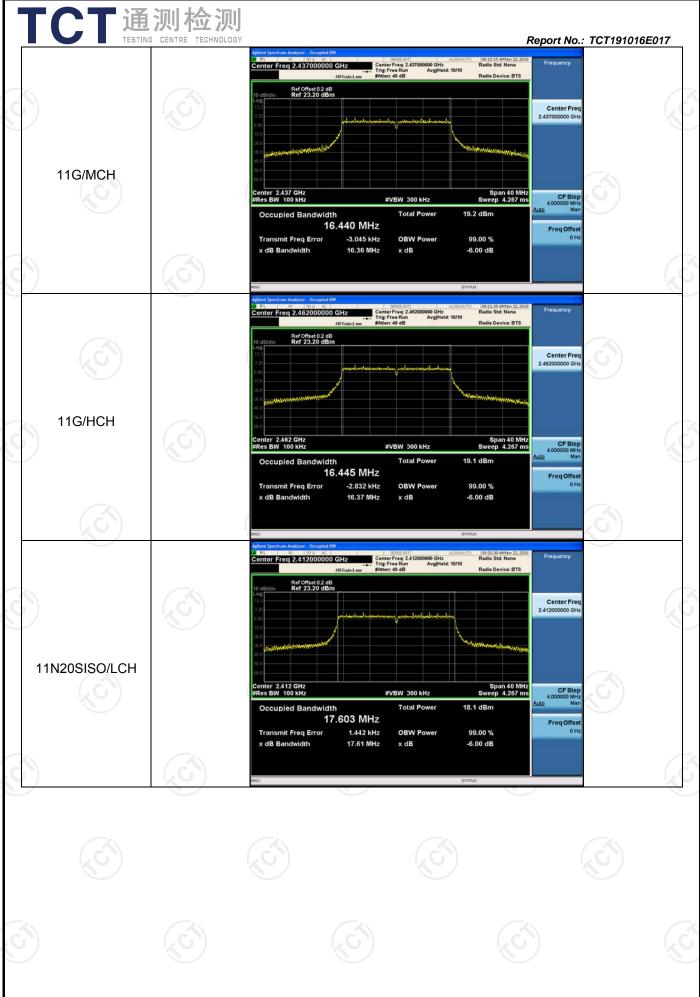
### **Result Table**

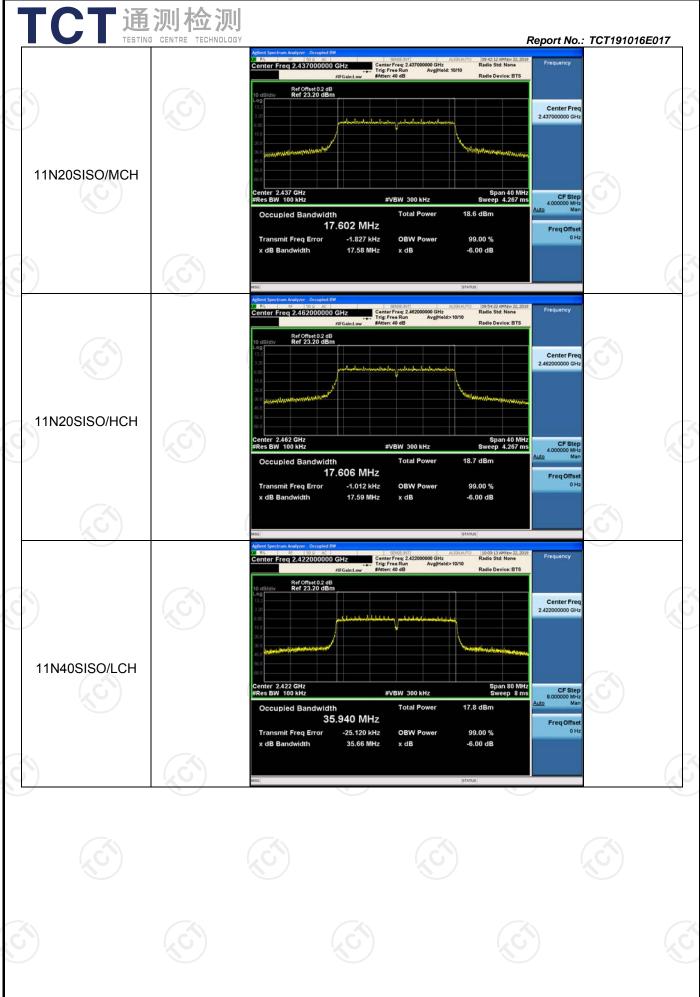
Mode	Channel	6dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
11B	LCH	9.098	11.741	PASS
11B	MCH	9.105	11.687	PASS
11B	HCH	9.103	11.627	PASS
11G	LCH	16.40	16.449	PASS
11G	MCH	16.36	16.440	PASS
11G	HCH	16.37	16.445	PASS
11N20SISO	LCH	17.61	17.603	PASS
11N20SISO	MCH	17.58	17.602	PASS
11N20SISO	HCH	17.59	17.606	PASS
11N40SISO	LCH	35.66	35.940	PASS
11N40SISO	MCH	35.69	35.947	PASS
11N40SISO	нсн	36.04	35.946	PASS

### **Test Graph**













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# **Band-edge for RF Conducted Emissions**

#### **Result Table**

<u></u>				'A -	
Mode	Channel	Carrier Power [dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
11B	LCH	8.408	-46.037	-21.59	PASS
11B	HCH	9.299	-44.443	-20.7	PASS
11G	LCH	0.822	-44.506	-29.18	PASS
11G	HCH	1.022	-42.865	-28.98	PASS
11N20SISO	LCH	-0.288	-42.696	-30.29	PASS
11N20SISO	HCH	0.804	-39.572	-29.2	PASS
11N40SISO	LCH	-3.051	-37.861	-33.05	PASS
11N40SISO	НСН	-2.386	-39.791	-32.39	PASS

### **Test Graph**

