

# JianYan Testing Group Shenzhen Co., Ltd.

Report No: JYTSZB-R12-2100954

# FCC REPORT (WIFI)

Applicant: Shenzhen LINGDU Auto Electronics Co., Ltd.

Address of Applicant: 1801-1808 Haiyun Building, No. 468 Minzhi Avenue, Longhua,

Shenzhen, China

**Equipment Under Test (EUT)** 

Product Name: CAR DVR

Model No.: LS05D, M550, LS05, V550

FCC ID: 2ASWVLS05D

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Date of sample receipt: 24 May, 2021

**Date of Test:** 25 May, to 27 Aug., 2021

Date of report issued: 27 Aug., 2021

Test Result: PASS\*

\* In the configuration tested, the EUT complied with the standards specified above.

## Authorized Signature:



Bruce Zhang Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

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# Version

Version No.	Date	Description
00	27 Aug., 2021	Original

Tested by:	Test Engineer	_ Date:	27 Aug., 2021
Reviewed by:	Winner thang	Date:	27 Aug., 2021

**Project Engineer** 

Telephone: +86 (0) 755 23118282 Fax: +86 (0) 755 23116366



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4 Test Summary

Test Items	Section in CFR 47	Test Data	Result
Antenna requirement	15.203 & 15.247 (b)	See Section 6.1	Pass
AC Power Line Conducted Emission	15.207	See Section 6.2	N/A
Duty Cycle	ANSI C63.10-2013	Appendix A – 2.4G Wi-Fi	Pass
Conducted Peak Output Power	15.247 (b)(3)	Appendix A – 2.4G Wi-Fi	Pass
6dB Emission Bandwidth 99% Occupied Bandwidth	15.247 (a)(2)	Appendix A – 2.4G Wi-Fi	Pass
Power Spectral Density	15.247 (e)	Appendix A – 2.4G Wi-Fi	Pass
Conducted Band Edge	45 247 (4)	Appendix A – 2.4G Wi-Fi	Pass
Radiated Band Edge	15.247 (d) See Section 6.6.2		Pass
Conducted Spurious Emission	45 205 8 45 200	Appendix A – 2.4G Wi-Fi	Pass
Radiated Spurious Emission	15.205 & 15.209	See Section 6.7.2	Pass

## Remark:

- 1. Pass: The EUT complies with the essential requirements in the standard.
- 2. N/A: Not Applicable.
- 3. The cable insertion loss used by "RF Output Power" and other conduction measurement items is 0.5dB (provided by the customer).

Test Method: ANSI C63.10-2013

KDB 558074 D01 15.247 Meas Guidance v05r02

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# 5 General Information

# **5.1 Client Information**

Applicant:	Shenzhen LINGDU Auto Electronics Co., Ltd.
Address:	1801-1808 Haiyun Building, No. 468 Minzhi Avenue, Longhua, Shenzhen, China
Manufacturer/ Factory:	Dongguan Lingdu Electronic Technology Co., Ltd
Address:	1 Longcheng Street, Qingxi Town, Dongguan City, Guangdong Province, China

5.2 General Description of E.U.T.

Product Name:	CAR DVR
Model No.:	LS05D, M550, LS05, V550
Operation Frequency:	2412MHz~2462MHz: 802.11b/802.11g/802.11n(HT20)
	2422MHz~2452MHz: 802.11n(HT40)
Channel numbers:	11: 802.11b/802.11g/802.11(HT20)
	7: 802.11n(HT40)
Channel separation:	5MHz
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:	2.0dBi
Car Adapter:	Model: XHC052501
	Input: DC 12-24V
	Output: DC 5.0V, 2.5A
Test Sample Condition:	The test samples were provided in good working order with no visible defects.
Remarks:	Model No.: LS05D, M550, LS05, V550 were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being model name

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		

#### Note:

- 1. For 802.11n-HT40 mode, the channel number is from 3 to 9;
- 2. Channel 1, 6 & 11 selected for 802.11b/g/n-HT20 as Lowest, Middle and Highest channel. Channel 3, 6 & 9 selected for 802.11n-HT40 as Lowest, Middle and Highest Channel.

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# 5.3 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test mode:	
Transmitting mode	Keep the EUT in continuous transmitting with modulation

Radiated Emission: 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 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, the follow list were the worst case.				
Mode Data rate				
802.11b 1Mbps				
802.11g	6Mbps			
802.11n(HT20)	6.5Mbps			
802.11n(HT40)	13.5Mbps			

# 5.4 Description of Support Units

The EUT has been tested as an independent unit.

# 5.5 Measurement Uncertainty

Parameters	Expanded Uncertainty
10M SAC Radiated Emission (30MHz ~ 1000MHz)	4.32 dB (k=2)
3M SAC Radiated Emission (1GHz ~ 18GHz)	5.34 dB (k=2)
Power	1.28 dB (k=2)
Frequency	0.074 ppm (k=2)
Conduction Emission	2.27 dB (k=2)

# 5.6 Laboratory Facility

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

#### • FCC - Designation No.: CN1211

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

#### • ISED - CAB identifier.: CN0021

The 3m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

## • A2LA - Registration No.: 4346.01

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

# 5.7 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.

Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xingiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.

Tel: +86-755-23118282, Fax: +86-755-23116366

Email: info-JYTee@lets.com, Website: http://www.ccis-cb.com

JianYan Testing Group Shenzhen Co., Ltd.

No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.

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# 5.8 Test Instruments list

Radiated Emission:	Radiated Emission:						
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)		
3m SAC	ETS	RFD-100	Q1984	04-14-2021	04-13-2024		
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-03-2021	03-02-2022		
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-03-2021	03-02-2022		
EMI Test Software	Tonscend	TS+		Version:3.0.0.1			
Pre-amplifier	HP	8447D	2944A09358	03-03-2021	03-02-2022		
Pre-amplifier	CD	TRLA- 010180G50B	20120401	03-03-2021	03-02-2022		
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-03-2021	03-02-2022		
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-03-2021	03-02-2022		
Simulated Station	Anritsu	MT8820C	6201026545	03-03-2021	03-02-2022		
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-03-2021	03-02-2022		
Cable	MICRO-COAX	MFR64639	K10742-5	03-03-2021	03-02-2022		
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-03-2021	03-02-2022		
10m SAC	ETS	RFSD-100-F/A	Q2005	04-28-2021	04-27-2024		
BiConiLog Antenna	SCHWARZBECK	VULB 9168	1249	04-02-2021	04-01-2022		
BiConiLog Antenna	SCHWARZBECK	VULB 9168	1250	04-02-2021	04-01-2022		
EMI Test Receiver	R&S	ESR 3	102800	04-08-2021	04-07-2022		
EMI Test Receiver	R&S	ESR 3	102802	04-08-2021	04-07-2022		
Pre-amplifier	Bost	LNA 0920N	2016	04-06-2021	04-07-2022		
Pre-amplifier	Bost	LNA 0920N	2019	04-06-2021	04-07-2022		
Test Software	R&S	EMC32		Version: 10.50.40			

Conducted method:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Spectrum Analyzer	Keysight	N9010B	MY60240202	11-27-2020	11-26-2021
Vector Signal Generator	Keysight	N5182B	MY59101009	11-27-2020	11-26-2021
Analog Signal Generator	Keysight	N5173B	MY59100765	11-27-2020	11-26-2021
Power Detector Box	MWRF-test	MW100-PSB	MW201020JYT	11-27-2020	11-26-2021
Simulated Station	Rohde & Schwarz	CMW270	102335	11-27-2020	11-26-2021
RF Control Box	MWRF-test	MW100-RFCB	MW200927JYT	N/A	N/A
PDU	MWRF-test	XY-G10	N/A	N/A	N/A
Test Software	MWRF-tes	MTS 8310	Version: 2.0.0.0		
DC Power Supply	Keysight	E3642A	MY60296194	11-27-2020	11-26-2021

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# 6 Test results and Measurement Data

# 6.1 Antenna requirement

## **Standard requirement:** FCC Part 15 C Section 15.203 /247(b)

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(b) (4) requirement:

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

The Wi-Fi antenna is an Internal antenna which cannot replace by end-user, the best case gain of the antenna is 2.0 dBi.

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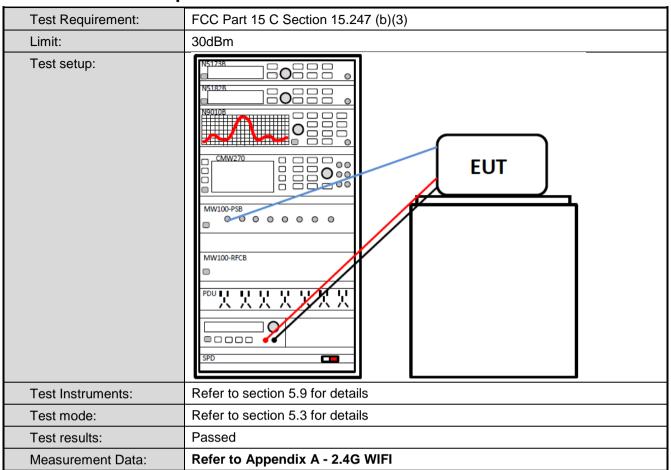
# 6.2 Conducted Emission

Test Requirement:	FCC Part 15 C Section 15.2	207				
Test Frequency Range:	150 kHz to 30 MHz					
Class / Severity:	Class B					
Receiver setup:	RBW=9 kHz, VBW=30 kHz					
Limit:	Limit (dRu\/)					
	Frequency range (MHz)	Quasi-peak	Average			
	0.15-0.5	66 to 56*	56 to 46*			
	0.5-5	56	46			
	5-30	60	50			
	* Decreases with the logarit					
Test procedure	<ol> <li>The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.), which 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(latest version) on conducted measurement.</li> </ol>					
Test setup:	LISN	st	er — AC power			
Test Instruments:	Refer to section 5.9 for details					
Test mode:	Refer to section 5.3 for deta	Refer to section 5.3 for details				
Test results:	Not Applicable					

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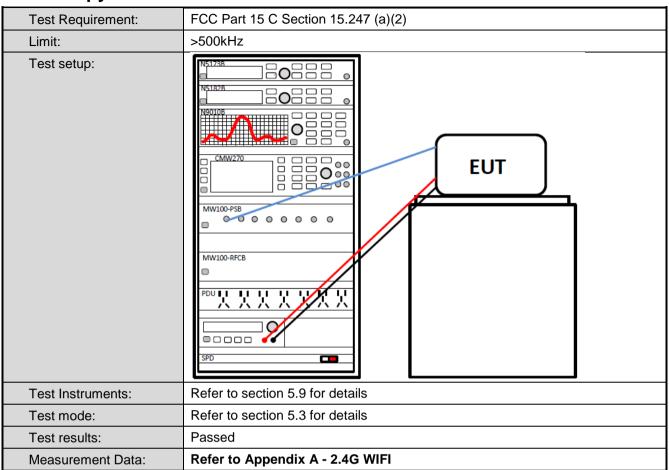
# **6.3 Conducted Output Power**



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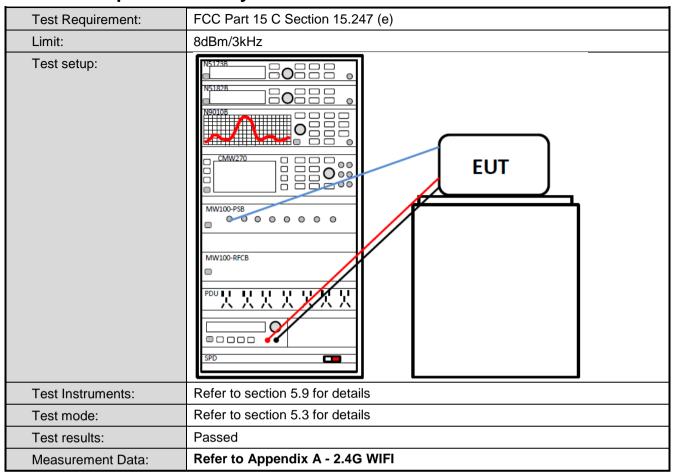
# 6.4 Occupy Bandwidth



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# 6.5 Power Spectral Density



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# 6.6 Band Edge

# 6.6.1 Conducted Emission Method

Test Requirement:	FCC Part 15 C Section 15.247 (d)				
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.				
Test setup:	NS173B				
Test Instruments:	Refer to section 5.9 for details				
Test mode:	Refer to section 5.3 for details				
Test results:	Passed				
Measurement Data:	Refer to Appendix A - 2.4G WIFI				

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# 6.6.2 Radiated Emission Method

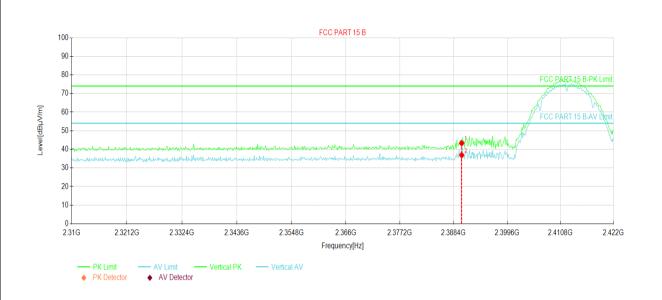
Test Requirement:	FCC Part 15 C Section 15.209 and 15.205					
Test Frequency Range:	2310 MHz to 2390 MHz and 2483.5 MHz to 2500 MHz					
Test Distance:	3m					
Receiver setup:	Frequency	Detector	RBW	VBW		
	Above 1GHz	Peak	1MHz	3MHz	+	
Limite	Frequency	RMS	<u>        1MHz                            </u>	3MHz	z Average Value Remark	
Limit:			54.00	3111)	Average Value	
	Above 1GH		74.00		Peak Value	
Test procedure:	<ol> <li>The EUT was placed on the top of a rotating table 1.5 reters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li> <li>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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</li> </ol>					
Test setup:	- 150cm	AE EUT (Turntable)	Ground Reference Plane		na Tower	
Test Instruments:	Refer to section 5	.9 for details				
Test mode:	Refer to section 5	.3 for details				
Test results:	Passed					

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#### 802.11b mode:

Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11b Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



NO.₽	Freq.⊬ [MHz]∉	Reading⊬ [dBµV/m]⊬	Level- [dBµV/m]⊲	Factor⊬ [dB]∉	Limit⊬ [dBµV/m]∂	Margin⊬ [dB]∉	Trace∂	Polarity∉
1₽	2390.08	60.55₽	43.30₽	-17.25₽	74.00₽	30.70₽	PK₽	Vertical₽
2₽	2390.08	54.13₽	36.88₽	-17.25₽	54.00₽	17.12₽	AV₽	Vertical₽

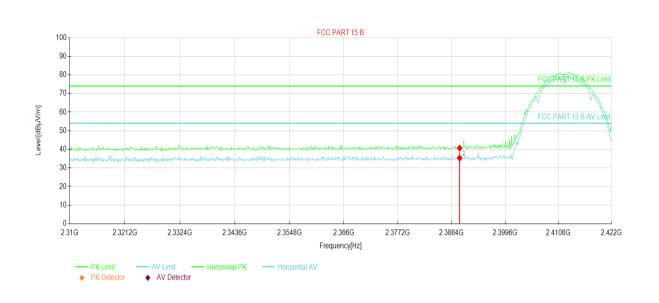
# Remark:

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11b Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



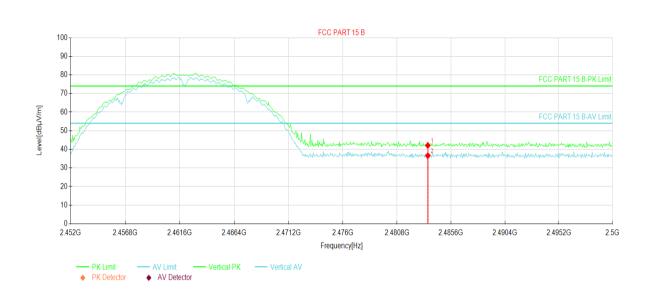
NO.₽	Freq.	Reading⊬	Level⊬	Factor	Limit⊬	Margin⊬	Trans	Polarity∂
NO.₽	[MHz]∂	[dBµV/m]₽	[dBµV/m]₽	[dB]∂	[dBµV/m]∂	[dB]₽	Trace	Polanty
1₽	2390.08	57.89₽	40.64₽	-17.25₽	74.00₽	33.36₽	PK₽	Horizontal₽⊸
2↩	2390.08	52.52₽	35.27₽	-17.25₽	54.00₽	18.73₽	AV₽	Horizontal₽⊸

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11b Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC 24V	Environment:	Temp: 24℃ Huni: 57%

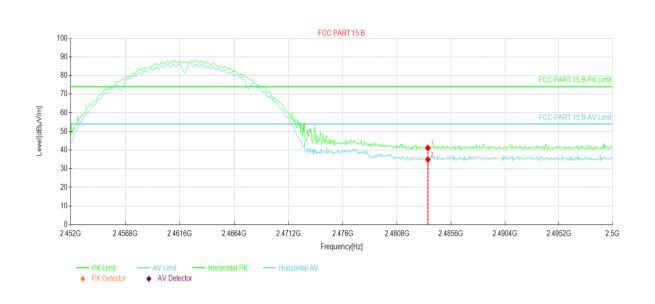


NO.₽	Freq.	Reading∉	Level	Factor⊬	Limitℯ	Margin⊌	Trace	Polarity <i></i> ∂
110.	[MHz]∂	[dBµV/m]₽	[dBµV/m]₽	[dB]∂	[dBµV/m]₽	[dB]∂	Hace	Folality
1₽	2483.53	58.96₽	42.09₽	-16.87₽	74.00₽	31.91₽	PK₽	Vertical₽
2₽	2483.53	53.47₽	36.60₽	-16.87₽	54.00₽	17.40₽	AV₽	Vertical <sub>€</sub>

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.



Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11b Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



NO.₽	Freq. <i></i> [MHz]∂	Reading⊬ [dBµV/m]⊬	Level. [dBµV/m].	Factor⊬ [dB]⊮	Limit⊬ [dBµV/m]∂	Margin⊬ [dB]⊮	Trace	Polarity
1₽	2483.53	58.01₽	41.14₽	-16.87₽	74.00₽	32.86₽	PK₽	Horizontal₽
<b>2</b> 43	2483.53	51.84₽	34.97₽	-16.87₽	54.00₽	19.03₽	AV₽	Horizontal₽

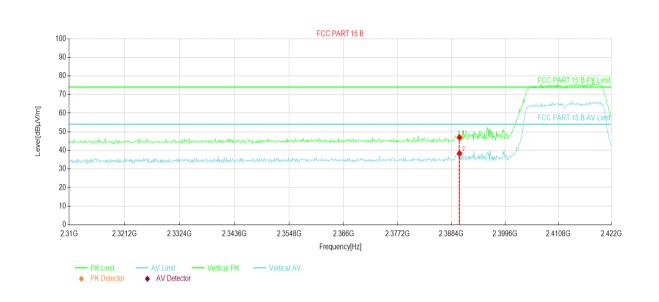
- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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## 802.11g mode:

Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11g Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC 24V	Environment:	Temp: 24℃ Huni: 57%



NO.₽	Freq.∉ [MHz]∉	Reading√ [dBµV/m]√	Level. [dBµV/m].	Factor⊬ [dB]∉	Limit⊬ [dBµV/m]∉	Margin⊬ [dB]⊮	Trace	Polarity∂
1₽	2390.08	64.17₽	46.92₽	-17.25₽	74.00₽	27.08₽	PK₽	Vertical₽
2₊⋾	2390.08	55.61₽	38.36₽	-17.25₽	54.00₽	15.64₽	AV₽	Vertical₽

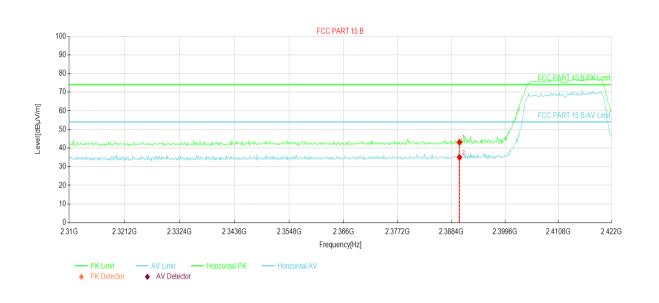
#### Remark

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11g Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



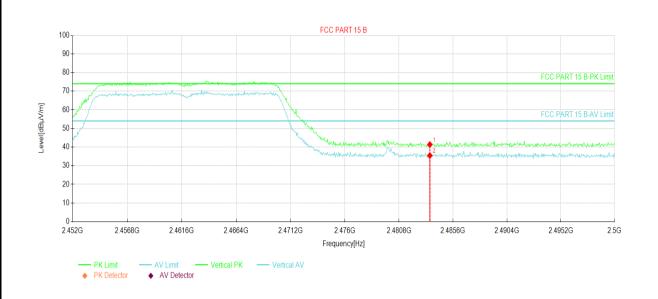
NO.₽	Freq.⊬ [MHz]∂	Reading√ [dBµV/m]√	Level. [dBµV/m].	Factor⊬ [dB]⊮	Limit⊬ [dBµV/m]⊮	Margin⊬ [dB]⊮	Trace∂	Polarity∉
<b>1</b> ₽	2390.08	60.34₽	43.09₽	-17.25₽	74.00₽	30.91₽	PK₽	Horizontal₽⊸
2₊□	2390.08	52.29₽	35.04₽	-17.25₽	54.00₽	18.96₽	AV₽	Horizontal₽⊸

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Product Name:	CAR DVR	Product Model:	LS05D	
Test By:	Carey	Test mode:	802.11g Tx mode	
Test Channel:	Highest channel	Polarization:	Vertical	
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%	



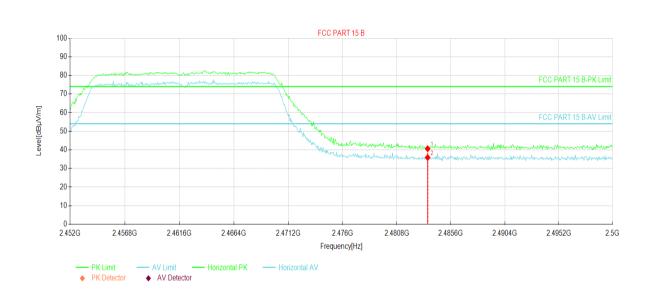
NO	Freq.	Reading⊮ [dBµV/m]⊮	Level⊬ [dBµV/m]₽	Factor⊬ [dB]∉	Limit⊬ [dBµV/m]∂	Margin⊬ [dB]⊮	Trace∂	Polarity∂
1∉	2483.53	58.21₽	41.34₽	-16.87₽	74.00₽	32.66₽	PK₽	Vertical₽
<b>2</b> ÷	2483.53	52.33₽	35.46₽	-16.87₽	54.00₽	18.54₽	AV₽	Vertical₽

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11g Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



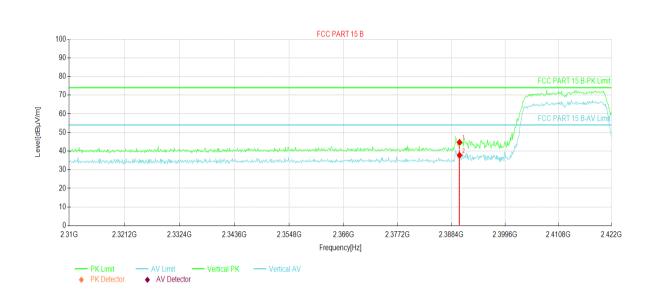
NO.₽	Freq.↵ [MHz]↵	Reading⊬ [dBµV/m]⊮	Level⊬ [dBµV/m]∉	Factor⊬ [dB]∂	Limit⊬ [dBµV/m]∂	Margin⊬ [dB]⊮	Trace∂	Polarity
1₽	2483.53	57.49₽	40.62₽	-16.87₽	74.00₽	33.38₽	PK₽	Horizontal₽
2₽	2483.53	52.74₽	35.87₽	-16.87₽	54.00₽	18.13₽	AV₽	Horizontal₽

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.



# 802.11n(HT20):

Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11n(HT20) Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



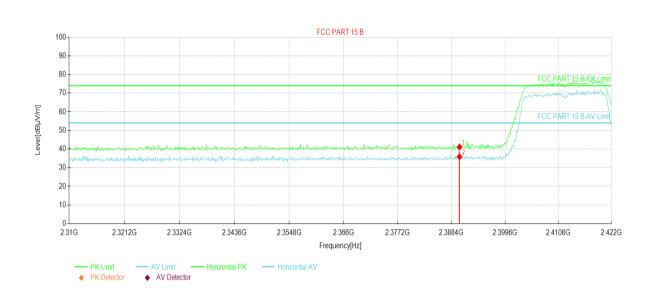
NO.₽	Freq.⊬ [MHz]∂	Reading⊮ [dBµV/m]⊮	Level. [dBµV/m].	Factor⊬ [dB]∉	Limit⊬ [dBµV/m]⊮	Margin⊬ [dB]⊮	Trace	Polarity∂
1₽	2390.08	61.94₽	44.69₽	-17.25₽	74.00₽	29.31₽	PK₽	Vertical₽
<b>2</b> 43	2390.08	55.01₽	37.76₽	-17.25₽	54.00₽	16.24₽	AV₽	Vertical₽

## Remark:

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.



Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11n(HT20) Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%

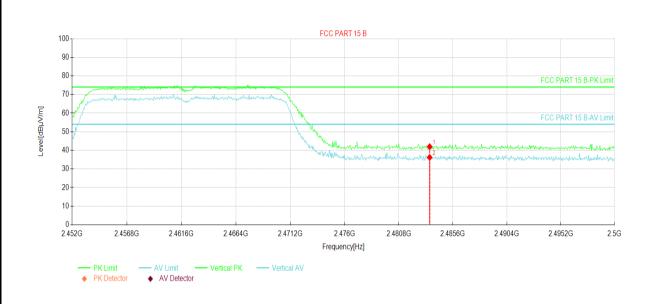


NO	Freq  [MHz]  [MHz]	Reading√ [dBµV/m]√	Level. [dBµV/m].	Factor [dB]∂	Limit⊬ [dBµV/m]⊬	Margin⊬ [dB]⊮	Trace∂	Polarity∂
1∉	2390.08	58.37₽	41.12₽	-17.25₽	74.00₽	32.88₽	PK₽	Horizontal₽⊸
<b>2</b> ∉	2390.08	53.12₽	35.87₽	-17.25₽	54.00₽	18.13 <sub>0</sub>	AV₽	Horizontal₽⊸

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.



Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11n(HT20) Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%

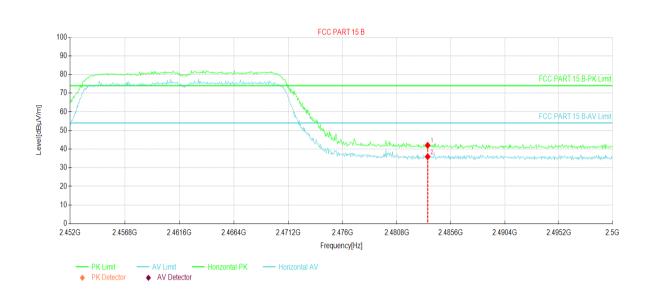


NO.₽	Freq.∉ [MHz]∂	Reading√ [dBµV/m]√	Level⊬ [dBµV/m]₽	Factor⊬ [dB]∉	Limit⊬ [dBµV/m]∂	Margin⊬ [dB]⊮	Trace	Polarity
1₽	2483.53	58.83₽	41.96₽	-16.87₽	74.00₽	32.04₽	PK₽	Vertical₽
2₽	2483.53	53.09₽	36.22₽	-16.87₽	54.00₽	17.78₽	AV₽	Vertical₽

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.



Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11n(HT20) Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



NO.₽	Freq. <i></i> [MHz]∂	Reading√ [dBµV/m]√	Level⊬ [dBµV/m]₽	Factor⊬ [dB]⊮	Limit⊬ [dBµV/m]⊮	Margin⊬ [dB]⊮	Trace∂	Polarity
1₽	2483.53	58.89₽	42.02₽	-16.87₽	74.00₽	31.98₽	PK₽	Horizontal₽
<b>2</b> 43	2483.53	52.78₽	35.91₽	-16.87₽	54.00₽	18.09₽	AV₽	Horizontal₽

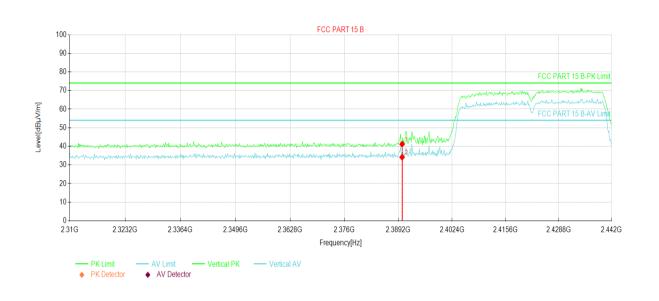
- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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## 802.11n(HT40):

Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11n(HT40) Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



NO.₽	Freq.⊬ [MHz]∂	Reading√ [dBµV/m]⊬	Level⊬ [dBµV/m]₽	Factor⊬ [dB]⊮	Limit⊍ [dBµV/m]₽	Margin⊬ [dB]⊬	Trace	Polarity∂
1₽	2390.12	58.43₽	41.18₽	-17.25₽	74.00₽	32.82₽	PK₽	Vertical₽
2₽	2390.12	51.43₽	34.18₽	-17.25₽	54.00₽	19.82₽	AV₽	Vertical₽

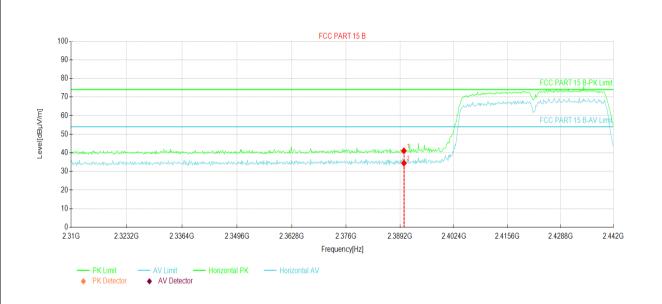
# Remark:

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11n(HT40) Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



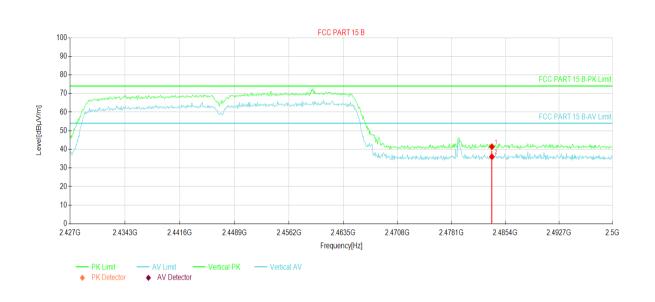
NO.₽	Freq.∉ [MHz]∉	Reading√ [dBµV/m]√	Level. [dBµV/m].	Factor⊬ [dB]∉	Limit⊬ [dBµV/m]⊮	Margin⊬ [dB]⊮	Trace	Polarity
1₽	2390.12	58.34₽	41.09₽	-17.25₽	74.00₽	32.91₽	PK₽	Horizontal₽
2₽	2390.12	51.72₽	34.47₽	-17.25₽	54.00₽	19.53₽	AV₽	Horizontal₽

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11n(HT40) Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	DC 24V	Environment:	Temp: 24℃ Huni: 57%



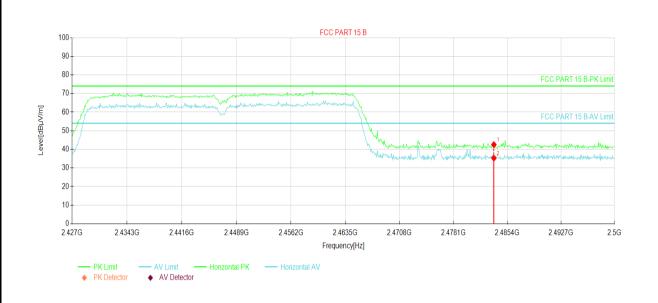
NO.₽	Freq.↵ [MHz]↵	Reading⊮ [dBµV/m]⊮	Level⊬ [dBµV/m]₽	Factor⊬ [dB]∉	Limit⊬ [dBµV/m]∂	Margin⊬ [dB]⊮	Trace	Polarity∂
1₽	2483.57	58.26₽	41.39₽	-16.87₽	74.00₽	32.61₽	PK₽	Vertical₽
<b>2</b> 43	2483.57	52.89₽	36.02₽	-16.87₽	54.00₽	17.98₽	AV₊⋾	Vertical₽

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Product Name:	CAR DVR	Product Model:	LS05D
Test By:	Carey	Test mode:	802.11n(HT40) Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	DC 24V	Environment:	Temp: 24°C Huni: 57%



NO.₽	Freq.⊬ [MHz]∂	Reading√ [dBµV/m]√	Level⊬ [dBµV/m]₽	Factor [dB]∂	Limit⊬ [dBµV/m]∉	Margin⊬ [dB]⊮	Trace	Polarity∂
1₽	2483.57	59.40₽	42.53₽	-16.87₽	74.00₽	31.47₽	PK₽	Horizontal₽⊸
2₽	2483.57	52.16₽	35.29₽	-16.87₽	54.00₽	18.71₽	AV₽	Horizontal₽⊸

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.



# 6.7 Spurious Emission

# 6.7.1 Conducted Emission Method

Test Requirement:	FCC Part 15 C Section 15.247 (d)					
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.					
Test setup:	NS1173R					
Test Instruments:	Refer to section 5.9 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Passed					
Measurement Data:	Refer to Appendix A - 2.4G WIFI					

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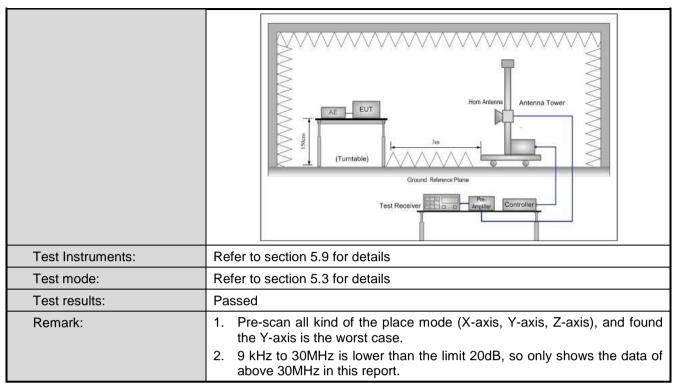


## 6.7.2 Radiated Emission Method

6.7.2 Radiated Emission  Test Requirement:	FCC Part 15 C Se	ection 15.	.209 an	nd 15.205				
Test Frequency Range:	9kHz to 25GHz	9kHz to 25GHz						
Test Distance:	3m or 10m							
Receiver setup:	Frequency	Detec	ctor	RBW	V	BW	Remark	
Receiver Setup.	30MHz-1GHz	Quasi-		120KHz		)KHz	Quasi-peak Value	
		Pea		1MHz		ИHz	Peak Value	
	Above 1GHz	RM	S	1MHz	31	ИHz	Average Value	
Limit:	Frequency		Limit	(dBuV/m @10	)m)		Remark	
	30MHz-88MH			30.0			uasi-peak Value	
	88MHz-216MH			33.5			uasi-peak Value	
	216MHz-960M 960MHz-1GH			36.0 44.0			uasi-peak Value	
	Frequency	IZ.	Limi	44.0 t (dBuV/m @3i	m)	Q	uasi-peak Value Remark	
			LIIIII	54.0	111)		Average Value	
	Above 1GHz	<u>-</u>		74.0		,	Peak Value	
Test Procedure:	1. The EUT w	as place	ed on		a rot	ating	table 0.8m(below	
rest riocedure.	1GHz)/1.5m(i (below 1GHz) 360 degrees 2. The EUT wa away from the top of a volume of the top	above 10) or 3 me to detern s set 10 he interfe ariable-height is dermine the determine the determin	GHz) a ter cha mine the meters rence-leight a varied he max turned em was turned with Maf the El sting corted. (e) re-tes	above the grounder (above eposition of the solution of the solution) and the solution of the s	ound 1GHz the hi z) or enna, the ter to of the ante as arr es fror ees to Dete Mode ode v oed ar e emis ne us	at a 1 z). The ghest r 3 me which of our m field sinna are co 360 c ct Funce. was 10 and the pssions ing pea	O meter chamber table was rotated adiation. ters(above 1GHz) was mounted on meters above the trength. Both e set to make the to its worst case ter to 4 meters legrees to find the extion and dB lower than the beak values of that did not have ak, quasi-peak or	
Test setup:	average meth Below 1GHz	10m ∢					nna Tower h nna	
	, 10070 10112							

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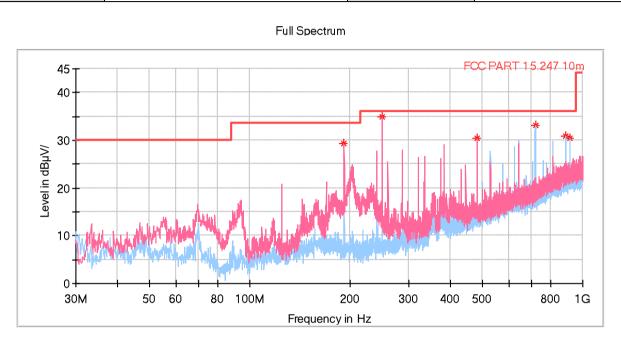
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## Measurement Data (worst case):

## **Below 1GHz:**

Product Name:	CAR DVR	Product Model:	LS05D		
Test By:	Carey	Test mode:	Wi-Fi Tx mode		
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical & Horizontal		
Test Voltage:	DC 12V	Environment:	Temp: 24℃ Huni: 57%		



Frequency↓ (MHz)∂	Max QP↓ (dB L V/m)⊲	Limit↓ (dB ₩V/m)∂	Margin↓ (dB)∂	Height↓ (cm)₽	Pol∂	Azimuth↓ (deg)∂	Corr.↓ (dB/m)₽
■ 191.990000₽	29.24	33.50₽	4.26₽	100.0₽	V₽	174.0₽	-17.9₽
■ 249.996000₽	34.84	36.00₽	1.16₽	100.0₽	V₽	317.0₽	-15.8₽
■ 479.983000₽	30.46	36.00₽	5.54₽	100.0₽	V₊⊃	21.0₽	-9.3₽
• 720.058000₽	33.23₽	36.00₽	2.77₽	100.0₽	H₽	180.0₽	-4.7₽
■ 891.0690004	30.96	36.00₽	5.04₽	100.0₽	H₽	135.0₽	-1.4₽
912.021000	30.39₽	36.00₽	5.61₽	100.0₽	H₽	226.0₽	-1.1₽

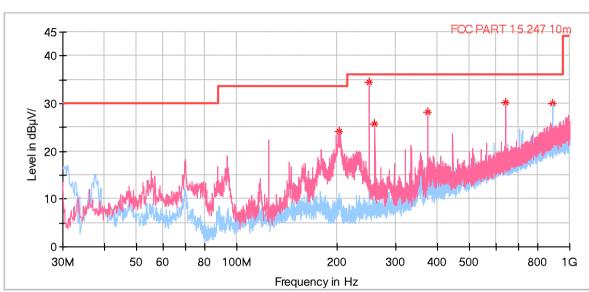
## Remark:

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.
- 3. The Aux Factor is a notch filter switch box loss, this item is not used.



Product Name:	CAR DVR	Product Model:	LS05D	
Test By:	Carey	Test mode:	Wi-Fi Tx mode	
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical & Horizontal	
Test Voltage:	DC 24V	Environment:	Temp: 24℃ Huni: 57%	





•	Frequency↓ (MHz)₽	MaxQP↓ (dB ルV/m)∂	Limit↓ (dB <b>⊬ V</b> /m)∂	Margin↓ (dB)∂	Height↓ (cm)₽	Pol₽	Azimuth↓ (deg)√	Corr.↓ (dB/m)₽
-	203.533000₽	24.12₽	33.50₽	9.38₽	100.0₽	V₽	134.0₽	-18.1∂
	249.9960004	34.43₽	36.00₽	1.57₽	100.0₽	V₽	296.0₽	-15.8₽
•	259.890000₽	25.74₽	36.00₽	10.26₽	100.0₽	V₄⊃	351.0∉	-15.9₽
•	375.029000₽	28.27₽	36.00₽	7.73₽	100.0₽	V₽	72.0∉	-11.9₽
•	640.033000₽	30.28₽	36.00₽	5.72₽	100.0₽	V₽	198.0∉	-5.9₽
•	891.069000₽	29.97₽	36.00₽	6.03₽	100.0₽	H₽	93.0∉	-1.4₽

- 1. Final Level = Receiver Read level + Antenna Factor + Cable Loss Preamplifier Factor.
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.
- 3. The Aux Factor is a notch filter switch box loss, this item is not used.

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#### **Above 1GHz**

Above 1GHz									
			802.11b						
Test channel: Lowest channel									
Detector: Peak Value									
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization			
4824.00	47.48	-9.46	38.02	74.00	35.98	Vertical			
4824.00	46.02	-9.46	36.56	74.00	37.44	Horizontal			
		Dete	ctor: Average Va	alue					
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization			
4824.00	39.77	-9.46	30.31	54.00	23.69	Vertical			
4824.00	39.46	-9.46	30.00	54.00	24.00	Horizontal			
		Test ch	annel: Middle ch	nannel					
		Det	ector: Peak Valu	ie					
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization			
4874.00	47.43	-9.11	38.32	74.00	35.68	Vertical			
4874.00	46.22	-9.11	37.11	74.00	36.89	Horizontal			
		Dete	ctor: Average Va	alue					
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization			
4874.00	39.77	-9.11	30.66	54.00	23.34	Vertical			
4874.00	39.19	-9.11	30.08	54.00	23.92	Horizontal			
		Toot ob	annel: Highest cl	nannal					
			tector: Peak Valu						
Frequency	Read Level	Del	Level	Limit Line	Margin				
(MHz)	(dBuV)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	Polarization			
4924.00	47.66	-8.74	38.92	74.00	35.08	Vertical			
4924.00	46.36	-8.74	37.62	74.00	36.38	Horizontal			
	ı	Dete	ctor: Average Va		<b>.</b>				
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization			
4924.00	40.01	-8.74	31.27	54.00	22.73	Vertical			
4924.00	39.47	-8.74	30.73	54.00	23.27	Horizontal			

#### Remark:

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<sup>1.</sup> Final Level = Receiver Read level + Factor.

<sup>2.</sup> The emission levels of other frequencies are lower than the limit 20dB and not show in test report.





802.11g										
	Test channel: Lowest channel									
		De	tector: Peak Valu	ıe						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4824.00	47.90	-9.46	38.44	74.00	35.56	Vertical				
4824.00	45.75	-9.46	36.29	74.00	37.71	Horizontal				
		Dete	ctor: Average Va	alue						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4824.00	40.01	-9.46	30.55	54.00	23.45	Vertical				
4824.00	39.79	-9.46	30.33	54.00	23.67	Horizontal				

	Test channel: Middle channel									
	Detector: Peak Value									
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4874.00	47.26	-9.11	38.15	74.00	35.85	Vertical				
4874.00	45.54	-9.11	36.43	74.00	37.57	Horizontal				
		Dete	ctor: Average Va	alue						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4874.00	39.57	-9.11	30.46	54.00	23.54	Vertical				
4874.00	39.60	-9.11	30.49	54.00	23.51	Horizontal				
				-		•				

	Test channel: Highest channel									
	Detector: Peak Value									
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4924.00	47.47	-8.74	38.73	74.00	35.27	Vertical				
4924.00	45.74	-8.74	37.00	74.00	37.00	Horizontal				
		Dete	ctor: Average Va	alue						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4924.00	39.91	-8.74	31.17	54.00	22.83	Vertical				
4924.00	39.01	-8.74	30.27	54.00	23.73	Horizontal				

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<sup>1.</sup> Final Level = Receiver Read level + Factor.

<sup>2.</sup> The emission levels of other frequencies are lower than the limit 20dB and not show in test report.





			802.11n(HT20)			
			annel: Lowest ch			
_		Det	tector: Peak Valu		Τ	
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization
4824.00	47.74	-9.46	38.28	74.00	35.72	Vertical
4824.00	46.06	-9.46	36.60	74.00	37.40	Horizontal
		Dete	ctor: Average Va	alue		
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization
4824.00	39.29	-9.46	29.83	54.00	24.17	Vertical
4824.00	39.44	-9.46	29.98	54.00	24.02	Horizonta
		Test ch	annel: Middle ch	annel		
		Det	tector: Peak Valu	ıe		
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
4874.00	47.50	-9.11	38.39	74.00	35.61	Vertical
4874.00	46.30	-9.11	37.19	74.00	36.81	Horizonta
		Dete	ctor: Average Va	lue		
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
4874.00	39.59	-9.11	30.48	54.00	23.52	Vertical
4874.00	39.82	-9.11	30.71	54.00	23.29	Horizonta
		Test cha	annel: Highest cl	nannel		
		Det	tector: Peak Valu	ie		
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
4924.00	47.50	-8.74	38.76	74.00	35.24	Vertical
4924.00	46.25	-8.74	37.51	74.00	36.49	Horizonta
		Dete	ctor: Average Va	alue		
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
4924.00	39.44	-8.74	30.70	54.00	23.30	Vertical
4924.00						1

<sup>2.</sup> The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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			902 11¤(UT10)							
802.11n(HT40)  Test channel: Lowest channel										
	Detector: Peak Value									
Frequency	Read Level		Level	Limit Line	Margin					
(MHz)	(dBuV)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	Polarization				
4844.00	47.37	-9.32	38.05	74.00	35.95	Vertical				
4844.00	46.20	-9.32	36.88	74.00	37.12	Horizontal				
		Dete	ctor: Average Va	alue		_				
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4844.00	38.91	-9.32	29.59	54.00	24.41	Vertical				
4844.00	39.18	-9.32	29.86	54.00	24.14	Horizontal				
		Test ch	annel: Middle ch	nannel						
		De	tector: Peak Valu	ne						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4874.00	47.90	-9.11	38.79	74.00	35.21	Vertical				
4874.00	45.97	-9.11	36.86	74.00	37.14	Horizontal				
		Dete	ctor: Average Va	alue						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4874.00	39.20	-9.11	30.09	54.00	23.91	Vertical				
4874.00	39.70	-9.11	30.59	54.00	23.41	Horizontal				
		Test cha	annel: Highest cl	hannel						
		De	tector: Peak Valu	re						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4904.00	47.61	-8.90	38.71	74.00	35.29	Vertical				
4904.00	46.15	-8.90	37.25	74.00	36.75	Horizontal				
		Dete	ctor: Average Va	alue						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization				
4904.00	39.26	-8.90	30.36	54.00	23.64	Vertical				
4904.00 Remark:	39.83	-8.90	30.93	54.00	23.07	Horizontal				

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<sup>1.</sup> Final Level = Receiver Read level + Factor.

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