

FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

For

Network Video Recorder

MODEL NUMBER: DHI-NVR2108HS-W-4KS2

FCC ID: SVNDHNVR21HSW

REPORT NUMBER: 4788560194.2-4

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Prepared for

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Revision History

Rev.	Issue Date	Revisions	Revised By
	09/12/2018	Initial Issue	

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Summary of Test Results				
Clause	Test Items	FCC Rules	Test Results	
1	6dB Bandwidth	FCC 15.247 (a) (2)	PASS	
2	Peak Conducted Output Power	FCC 15.247 (b) (3)	PASS	
3	Power Spectral Density	FCC 15.247 (e)	PASS	
4	Conducted Bandedge and Spurious Emission	FCC 15.247 (d)	PASS	
5	Radiated Bandedge and Spurious Emission	FCC 15.247 (d) FCC 15.209 FCC 15.205	PASS	
6	Conducted Emission Test For AC Power Port	FCC 15.207	PASS	
7	Antenna Requirement	FCC 15.203	PASS	

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Address:	ZHEJIANG DAHUA VISION TECHNOLOGY CO., LTD. No.1199, Bin'an Road, Binjiang District, Hangzhou, P.R. China
Manufacturer Information Company Name: Address:	ZHEJIANG DAHUA VISION TECHNOLOGY CO.,LTD. No.1199, Bin'an Road, Binjiang District, Hangzhou, P.R. China
EUT Description	

Product Name Model Name Network Video Recorder DHI-NVR2108HS-W-4KS2

Sample Status Sample Received date Date Tested

Good August 13, 2018 August 15~September 10, 2018

APPLICABLE STANDARDS

STANDARD

TEST RESULTS PASS

CFR 47 Part 15 Subpart C

Tested By:

Checked By:

Kebo. zhang.

Kebo Zhang Engineer

Shemy les

Shawn Wen Laboratory Leader

Approved By:

Aephenbuo

Stephen Guo Laboratory Manager

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB558074 D01 DTS Meas Guidance v05, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013 and KDB 662911 D01 Multiple Transmitter Output v02r01.

3. FACILITIES AND ACCREDITATION

Accreditation	A2LA (Certificate No.: 4102.01) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA. FCC (FCC Designation No.: CN1187) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Delcaration of Conformity (DoC) and Certification rules IC(Company No.: 21320)
Certificate	has been registered and fully described in a report filed with ISED. The Company Number is 21320. VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011

Note 1: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

Note 2: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

Note 3: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz had been correlated to measurements performed on an OATS.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognize national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty		
Uncertainty for Conduction emission test	2.90dB		
Uncertainty for Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	2.2dB		
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.52dB		
Uncertainty for Radiation Emission test	5.04dB(1-6GHz)		
(1GHz to 26GHz)(include Fundamental	5.30dB (6GHz-18Gz)		
emission)	5.23dB (18GHz-26Gz)		
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.			

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Equipment	Network Video Recorder
Model Name	DHI-NVR2108HS-W-4KS2
Series model	DHI-NVR2108HS-W-4KS2,DHI-NVR2104HS-W-4KS2 N41B1W,DHI-NVR21XYHS-W-4KSZ,DH-NVR21XYHS-W-4KSZ, NVR21XYHS-W-4KSZ, N41BZW
Model difference	Different: only the name and the number of channels for audio, video input and output are different (different ways are supported by software functions, the hardware structure is the same), 04 stands for 4 channels, 08 stands for 8 channels; XY can be 04,08,16,32,64. Z can be 0~9 (only the version number of different product models of the same product is different, no hardware information is involved); the structure of the product is the same as that of the power supply. The electrical principle and key components are identical and do not affect the safety and electromagnetic compatibility of the product.
Radio Technology	IEEE802.11b/g/n HT20
Operation frequency	IEEE 802.11b: 2412MHz—2462MHz IEEE 802.11g: 2412MHz—2462MHz IEEE 802.11n HT20: 2412MHz—2462MHz
Modulation	IEEE 802.11b: DSSS(CCK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)
Power Supply	AC120V/60Hz

5.2. MAXIMUM OUTPUT POWER

Frequency Range (MHz)	Number of Transmit ANTs (NTX)	IEE Std. 802.11	Channel Number	Max Conducted PEAK Power (dBm)
2412-2462	2	b	1-11[11]	10.25
2412-2462	2	g	1-11[11]	17.67
2412-2462	2	n HT20	1-11[11]	17.51

Note: All mode support MIMO mode.

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Channel List for 802.11b/g/n (20 MHz)						
Channel	Frequency (MHz)	Channel	Frequency(M Hz)	Channel	Frequency (MHz)	
1	2412	5	2432	9	2452	
2	2417	6	2437	10	2457	
3	2422	7	2442	11	2462	
4	2427	8	2447	12	/	

5.3. CHANNEL LIST

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
WiFi TX(802.11b)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11g)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11n HT20)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz

5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band						
Test Softwa	re	Tera Term				
	Transmit	Test Channel NCB: 20MHz				
Modulation Mode	Antenna					
	Number	CH 1	CH 6	CH 11		
802.11b	1	4	4	4		
802.11g	1	6.5	6.5	6.5		
802.11n HT20	1	6.5	6.5	6.5		
802.11b	2	4	4	4		
802.11g	2	6.5	6.5	6.5		
802.11n HT20	2	6.5	6.5	6.5		

5.6. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests			
Relative Humidity	55 ~ 65%			
Atmospheric Pressure:	1025Pa			
Temperature	TN	23 ~ 28°C		
Voltage :	VL	N/A		
	VN	AC 120V/60Hz		
	VH	N/A		

Note: VL= Lower Extreme Test Voltage

VN= Nominal Voltage

VH= Upper Extreme Test Voltage

TN= Normal Temperature

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5.7. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2412-2462	Omni-directional	4.44
2	2412-2462	Omni-directional	3.74

Note: Directional gain= $10\log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}] = 7.11 > 6dBi$

N_{ANT}: the number of Antenna

Test Mode	Transmit and Receive Mode	Description
IEEE 802.11b	⊠2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.
IEEE 802.11g	⊠2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.
IEEE 802.11n HT20	⊠2TX, 2RX	ANT 1, 2 can be used as transmitting/receiving antenna.

Note: All mode support MIMO mode.

5.8. WORST-CASE CONFIGURATIONS

IEE Std. 802.11	Modulation Technology	Modulation Type	Data Rate (Mbps)	Worst Case (Mbps)
b	DSSS	CCK	11/5.5/2/1	1
g	OFDM	BPSK, QPSK, 16QAM, 64QAM	54/48/36/24/18/12/9/6	6
n HT20	OFDM	BPSK, QPSK, 16QAM, 64QAM	MCS0~MCS15	MCS0

Note: 1.All mode support MIMO mode.

2.SISO mode and MIMO mode have the same power setting, so only the worst case MOMI mode will be record in the report.

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5.9. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	PC	Dell	Vostro 3902	8KNDDB2
2	USB TO RS232	N/A	N/A	N/A

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	N/A	N/A	0.5	N/A
2	Network Line	N/A	N/A	0.8	N/A

ACCESSORY

Item	Accessory	Brand Name	Model Name	Description	
1	Adapter	HONOR	ADS-26FSG-12	Input: AC 100-240, 50/60Hz, 0.6A Output: 12V 2A	
2	2 Adapter MASS S024-1A12020		S024-1A120200	Input: AC 100-240, 50/60Hz, 0.6A Output: 12V 2A	
Note: Both adapters have been pre-tested and only the worst case adapter data(MASS) is recorded in the report.					

TEST SETUP

The EUT can work in engineering mode with a software through a PC.

SETUP DIAGRAM FOR TESTS



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	Conducted Emissions							
			Instru	ument				
Used	Equipment	Manufacturer	Mod	lel No.	Seria	l No.	Last Cal.	Next Cal.
\checkmark	EMI Test Receiver	R&S	E	SR3	101	961	Dec.12,2017	Dec.11,2018
\checkmark	Two-Line V- Network	R&S	EN	V216	101	983	Dec.12,2017	Dec.11,2018
\checkmark	Artificial Mains Networks	Schwarzbeck	NSL	K 8126	8126	6465	Dec.12,2017	Dec.11,2018
			Soft	ware				
Used	Des	cription		Manu	ufactu	rer	Name	Version
\checkmark	Test Software for C	Conducted distu	rbance	e F	arad		EZ-EMC	Ver. UL-3A1
		Rad	iated I	Emissio	ns			
			Instru	ument				
Used	Equipment	Manufacturer	Mod	lel No.	Seria	l No.	Last Cal.	Next Cal.
\checkmark	MXE EMI Receiver	KESIGHT	N9	038A	MY50 03	6400 36	Dec.12,2017	Dec.11,2018
\checkmark	Hybrid Log Periodic Antenna	TDK	HLP	-3003C	130	960	Jan.09, 2016	Jan.09, 2019
\checkmark	Preamplifier	HP	84	8447D		A090 9	Dec.12,2017	Dec.11,2018
\checkmark	EMI Measurement Receiver	R&S	ES	SR26	101	377	Dec.12,2017	Dec.11,2018
\checkmark	Horn Antenna	TDK	HRN	N-0118	130	939	Jan. 09, 2016	Jan. 09, 2019
\checkmark	High Gain Horn Antenna	Schwarzbeck	BBH.	A-9170	69	91	Jan.06, 2016	Jan.06, 2019
\checkmark	Preamplifier	TDK	PA-0	2-0118	TRS- 000	-305-)66	Dec.12,2017	Dec.11,2018
\checkmark	Preamplifier	TDK	PA	-02-2	TRS- 000	-307-)03	Dec.12,2017	Dec.11,2018
\checkmark	Loop antenna	Schwarzbeck	15	519B	000	800	Mar. 26, 2016	Mar. 25, 2019
V	Band Reject Filter	Wainwright	WRCJV8- 2350-2400- 2483.5- 2533 5-4055		2	1	Dec.12, 2017	Dec.11, 2018
V	High Pass Filter	Wi	WHKX10- 2700-3000- 18000-40SS		2	3	Dec.12, 2017	Dec.11, 2018
			Soft	ware				
Used	Descr	iption	Ν	/lanufact	urer		Name	Version
\checkmark	Test Software for Ra	adiated disturba	ince	Farac	k		EZ-EMC	Ver. UL-3A1

5.10. MEASURING INSTRUMENT AND SOFTWARE USED

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Other instruments								
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.		
\checkmark	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec.12,2017	Dec.11,2018		
\checkmark	Power Meter	Keysight	N1911A	MY55416024	Dec.12,2017	Dec.11,2018		
\checkmark	Power Sensor	Keysight	N1921A	MY51100041	Dec.12,2017	Dec.11,2018		

6. MEASUREMENT METHODS

No.	Test Item	KDB Name	Section
1	6dB Bandwidth	KDB 558074 D01 DTS Meas Guidance v05	8.0
2	Peak Output Power	KDB 558074 D01 DTS Meas Guidance v05	9.1.1
3	Power Spectral Density	KDB 558074 D01 DTS Meas Guidance v05	10.2
4	Out-of-band emissions in non-restricted bands	KDB 558074 D01 DTS Meas Guidance v05	11.0
5	Out-of-band emissions in restricted bands	KDB 558074 D01 DTS Meas Guidance v05	12.1
6	Band-edge	KDB 558074 D01 DTS Meas Guidance v05	13.3.2
7	Conducted Emission Test For AC Power Port	ANSI C63.10-2013	7.3
8	99% Occupied bandwidth	ANSI C63.10-2013	6.9.3

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7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

TEST SETUP



TEST ENVIRONMENT

Temperature	24.5°C	Relative Humidity	59%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V

<u>RESULTS</u>

ANTENNA1

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/B Minimum VBW (KHz)
11b	127.8	127.8	1	100	0	0.01
11g	2.01	2.08	0.97	97	0.13	0.50
11n20	1.88	1.93	0.97	97	0.13	1.00

Note: Duty Cycle Correction Factor=10log(1/x). Where: x is Duty Cycle (Linear)

Where: B is On Time

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Antenna 1 and Antenna 2 has the same duty cycle, only Antenna 1 data show here.

L RF larker 3 Δ 127.	50 Ω DC 800 ms		SENSE:INT Trig Delay-1.000 ms	ALIGN AUTO	06:35:18 PM Sep 04, 2018 TRACE 1 2 3 4 5 6	Marker
	NFE	PNO: Fast ++- IFGain:Low	#Atten: 40 dB	Avginoia: 1/1	DET PNNNN	Select Marker
Ref Off 10 dB/div Ref 30	set 11 dB).00 dBm			2	Mkr3 127.8 ms 0.662 dB	3
20.0					▲3△2	Norm
10.0 ~ 2~~						NOTING
-10.0					TRIG LVL	
-20.0						Delt
-30.0						
-50.0		_				Fixed
-60.0						
Center 2.437000 Res BW 8 MHz	000 GHz	#VBW	50 MHz	Sweep 1	Span 0 Hz 60.0 ms (1001 pts)	o
MKR MODE TRC SCL 1 Δ2 1 t (Δ	X	127.8 ms (Δ)	Y FU 0.662 dB	NCTION FUNCTION WIDTH	FUNCTION VALUE	
2 F 1 t 3 Δ2 1 t (Δ 4 5		9.000 ms 127.8 ms (Δ)	7.366 dBm 0.662 dB		E	Properties
7 8 9 10						Mor 1 of

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NOIDOT MORIAR	TYPE A WWWWW DET P N N N N N	100.54.05 TF	ALIGN AUTO De: RMS I: 1/1	#Avg T Avg Ho	4SE:INT y-1.000 ms eo 0 dB	SEN Trig Delay Trig: Vide #Atten: 40	st ↔→	PNO: Fas	50 Ω DC 000 ms NFE	Δ 2.0	rker
3 Select Marker	3 2.080 ms -0.400 dB	۵Mkr3	Ĺ					IFGam.LO	et 11 dB .00 dBm	Ref (Ref	dB/div
Norma				2	. () 3/						.0
	ward and a start	entropy and	a grand and a grand and a grand a g	n and a start of the second	onania fi <mark>o</mark> ngela	≈dirahalphipstorations	X 2	and a state of the	hangertillenast	en and a state of the state of	.0 <mark>~~~~</mark> 10
Dolt	TRIG LVL										.0 ==
Deit					l		U				
											.0
Fixed											0
	Span 0 Hz								00 GHz	43700	nter 2
0	ns (1001 pts)	10.00 ms	Sweep 1			50 MHz	VBW	#\		3 MHz	s BW
	NCTION VALUE	I FUNC	NCTION WIDTH	TION F	dB 3m dB	1.908 (8.014 dE -0.400 ((Δ) (Δ)	2.010 ms 3.560 ms 2.080 ms	X	RC SCL t t	MODE Δ2 F Δ2
Properties	=										



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7.2. 6 dB DTS BANDWIDTH AND 99% BANDWIDTH

<u>LIMITS</u>

FCC Part15 (15.247) Subpart C						
Section	Test Item	Limit	Frequency Range (MHz)			
FCC 15.247(a)(2) RSS-247 5.1 (a)	6 dB Bandwidth	>= 500KHz	2400-2483.5			
C63.10 Clause 6.9.3	99% Bandwidth	For reporting purposes only.	2400-2483.5			

TEST PROCEDURE

Connect the UUT to the spectrum analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6dB Bandwidth :100K For 99% Bandwidth :1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth : ≥3 × RBW For 99% Bandwidth : approximately 3×RBW
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB and 99% relative to the maximum level measured in the fundamental emission.

TEST SETUP



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TEST ENVIRONMENT

Temperature	24.5°C	Relative Humidity	59%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V

RESULTS

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7.2.1. 802.11b MIMO MODE

ANTENNA1

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2412	6.92	11.393	500	Pass
2437	7.08	11.228	500	Pass
2462	6.28	11.001	500	Pass









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ANTENNA2

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2412	6.64	11.005	500	Pass
2437	7.56	10.289	500	Pass
2462	6.16	11.053	500	Pass





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7.2.2. 802.11g MIMO MODE

ANTENNA1

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2412	15.60	16.270	500	Pass
2437	16.36	16.287	500	Pass
2462	15.92	16.247	500	Pass





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ANTENNA2

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2412	16.32	16.234	500	Pass
2437	16.28	16.282	500	Pass
2462	16.08	16.194	500	Pass





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7.2.3. 802.11n20 MIMO MODE

ANTENNA1

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2412	15.52	17.410	500	Pass
2437	15.48	17.425	500	Pass
2462	17.52	17.387	500	Pass





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ANTENNA2

Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit For 6dB (kHz)	Result
2412	15.52	17.306	500	Pass
2437	16.32	17.235	500	Pass
2462	16.52	17.291	500	Pass





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7.3. PEAK CONDUCTED OUTPUT POWER

LIMITS

FCC Part15 (15.247) Subpart C						
Section	Test Item	Limit	Frequency Range (MHz)			
FCC 15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5			
Noto						

Note:

1. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2. Limit=30dBm - (Directional gain -6)dBi

Directional gain = $10\log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}] = 7.11 > 6$ dBi, where N_{ANT} is the number of outputs, G_{1/2} is the Antenna gain. So the power limit shall be reduced to 30-(7.11-6)=28.89dBm

TEST PROCEDURE

Place the EUT on the table and set it in the transmitting mode.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor.

Measure peak power each channel.

TEST SETUP



TEST ENVIRONMENT

Temperature	24.5°C	Relative Humidity	59%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V

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RESULTS

7.3.1. 802.11b MODE

MIMO MODE

Mode Frequency		ANT	Maximum PK Conducted Output Power (dBm)		Result
	(MHz)	(MHz)	Single	Total	
	2412	1	7.56	10.25	
	2412	2	6.90		PASS
002 11h	0407	1	6.37	9.86	
802.110	2437	2	7.28		
	2462	1	6.12	9.33	
	2462	2	6.52		

Mode Frequency		ANT	Maximum AV Conducted Output Power (dBm)		Result
	(MHz)		Single	Total	
	2442	1	4.42	7.16	
	2412	2	3.87		PASS
000 116	0440	1	3.42	6.79	
802.110	2442	2	4.11		
	2462	1	3.12	6.14	
	2462	2	3.13		

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SISO MODE

Mode Frequency		ANT	Maximum PK Conducted Output Power (dBm)		Result
	(MHz)	(MHz)	Single	Total	
	2442	1	7.52		
	2412	2	6.88	1	PASS
002 11h	2437	1	6.33	/	
802.110		2	7.21		
	2462	1	6.10	- /	
	2462	2	6.51		

Mode Frequency		ANT	Maximum AV Condu (dBi	Result	
	(MHz)	1Hz)	Single	Total	
2412	2412	1	4.41	- /	PASS
	2412	2	3.85		
002 11h	2442	1	3.41	1	
802.110		2	4.10	1	
	2462	1	3.11	- /	
	2462	2	3.12		

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7.3.2. 802.11g MODE

MIMO MODE

Mode Frequency		ANT	Maximum PK Conducted Output Power (dBm)		Result
	(MHz)	(MHz)	Single	Total	
	2412	1	14.42	17.67	
	2412	2	14.88	17.07	PASS
002 11a	0407	1	14.35	17.60	
802.11g	2437	2	14.81		
	2462	1	13.64	17.30	
	2462	2	14.86		

Mode	Frequency ANT		Maximum AV Condu (dBr	Result	
	(MHz)		Single	Total	
	2412	1	6.25	9.22	PASS
	2412	2	6.16		
002 11a	2442	1	6.25	9.19	
802.11g		2	6.11		
	2462	1	5.46	8.63	
	2462	2	5.77		

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SISO MODE

Mode		ANT	Maximum PK Conducted Output Power (dBm)		Result
	(MHz)		Single	Total	
	2412	1	14.41		
	2412	2	14.76	1	PASS
002 11a	2437	1	14.33	- /	
802.11g		2	14.77		
	2462	1	13.61	- /	
	2462	2	14.82		

Mode Frequency		ANT	Maximum AV Condu (dBi	Result	
	(MHz)		Single	Total	
	2412	1	6.21	1	DASS
	2412	2	6.13	1	
902 11a	0440	1	6.23	1	
802. TTg	2442	2	6.10	1	FA33
	2462	1	5.43	- /	
	2462	2	5.73		

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7.3.1. 802.11n HT20 MODE

SISO MODE

Mode	Frequency ANT		Maximum AV Condu (dB	Result	
	(MHz)		Single	Total	
	2412	1	14.71	1	PASS
	2412	2	14.15		
902 11n UT20	2437	1	14.14	/	
802.111 H120		2	14.23		
	2462	1	13.66	- /	
		2	13.87		

Mode	Frequency ANT		Maximum AV Condu (dB	Result	
	(MHz)		Single	Total	
	2412	1	6.48	1	PASS
	2412	2	5.84	1	
202 11p UT20	2442	1	5.54	/	
802.110 1120		2	5.82		
	2462	1	5.12	- /	
		2	5.47		

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MIMO MODE

Mode	Frequency	requency ANT		AV Conducted Output Power (dBm)		
	(MHz)		Single	Total		
802.11n HT20	2412	1	14.73	17.51		
		2	14.25		PASS	
	0407	1	14.25	47.07		
	2437	2	14.27	17.27		
	2462 1	1	13.74	16.87		
		2	13.97			

Mode	Frequency ANT		Maximum AV Conducted Output Power (dBm)		Result
	(MHz)		Single	Total	
802.11n HT20	2412	1	6.58	9.27	
		2	5.91		DASS
	2442	1	5.65	0 00	
	2442	2	5.92	0.00	FA33
	2462 1 2	1	5.22	8.39	
		2	5.54		

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7.4. POWER SPECTRAL DENSITY

<u>LIMITS</u>

FCC Part15 (15.247) Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	
FCC §15.247 (e)Power Spectral Density8 dBm in any 3 kHz band2400-2483.5				
Note: 1. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. 2. Limit=30dBm – (Directional gain -6)dBi Directional gain = $10\log[(10^{G1/20} + 10^{G2/20})^2 /N_{ANT}] = 7.11 > 6dBi$, where N _{ANT} is the number of outputs, G _{1/2} is the Antenna gain.				

TEST PROCEDURE

Connect the UUT to the spectrum analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}.$
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP



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TEST ENVIRONMENT

Temperature	24.5°C	Relative Humidity	59%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V

RESULTS

7.4.1. 802.11b MIMO MODE

Frequency	ANT	Power Spectral Density (dBm/3kHz)		Limit	
(MHz)		Single	Total	(abm/3knz)	
2412	1	-20.81	-17.53		
2412	2	-20.28			
0407	1	-20.14	-17.41	6.90	
2437	2	-20.71		0.89	
2462	0.400	1	-20.90	17.00	
	2	-20.92	-17.90		

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Frequency	ANT	Power Spectral Density (dBm/3kHz)		Limit
(MHz)		Single	Total	(abm/skHz)
0440	1	-19.89	16.26	
2412	2	-18.90	-10.30	
2437	1	-19.21	-17.12	6 90
	2	-21.30		0.09
2462	1	-20.62	17.60	
	2	-20.79	-17.09	

7.4.2. 802.11g MIMO MODE

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Frequency	ANT	Power Spectral Density (dBm/3kHz)		Limit
(MHz)		Single	Total	(abm/skhz)
0440	1	-20.42	-18.08	
2412	2	-21.89		
0407	1	-20.20	-17.77	6 90
2437	2	-21.44		0.09
2462	1	-21.00	40.00	
	2	-21.61	-10.20	

7.4.3. 802.11n20 MIMO MODE

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7.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

<u>LIMITS</u>

FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	
FCC §15.247 (d)	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power	

TEST PROCEDURE

Connect the UUT to the spectrum analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100K
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100K
VBW	≥3 × RBW
measurement points	≥span/RBW
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum amplitude level.

TEST SETUP



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TEST ENVIRONMENT

Temperature	24.5°C	Relative Humidity	59%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V

RESULTS

7.5.1. 802.11b MIMO MODE

ANTENNA1

	LC	OW CH BA			
L RF 50 Center Freq 2.4000	Ω DC 000000 GHz NFE PNO: Fast ↔ IEGain:Low	SENSE:INT	ALIGN AUTO #Avg Type: RMS	05:25:07 PM Sep 04, 2018 TRACE 1 2 3 4 5 6 TYPE M	Frequency
Ref Offset 10 dB/div Ref 30.00	11 dB I dBm		M	r1 2.411 5 GHz -4.84 dBm	Auto Tune
20.0 10.0			▲1		Center Freq 2.400000000 GHz
-10.0			North Manager	DL1 -24.84 dBm	Start Freq 2.350000000 GHz
-40.0	100 mer 100 to the former 190 mer 1			gennen an	Stop Freq 2.45000000 GHz
Center 2.40000 GHz #Res BW 100 kHz	#VB\	₩ 300 kHz	Sweep 3	Span 100.0 MHz 7.733 ms (1001 pts)	CF Step 10.000000 MHz <u>Auto</u> Man
I N 1 f 2 N 1 f 3 N 1 f 4 5 5 5	* 2.411 5 GHz 2.400 0 GHz 2.384 4 GHz	-4.84 dBm -42.19 dBm -39.96 dBm	PUNCTION		Freq Offset 0 Hz
7 8 9					Scale Type
10 11 •		m	STATU	5	Log <u>Lin</u>

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		V CH SP	URIOUS	EMISSIONS	30M-26G	
	RF 50 Ω DC eq 13.0150000 NFE	DOO GHz PNO: Fast ↔ IFGain:Low	SENSE:INT → Trig: Free Run #Atten: 30 dB	ALIGN AUTO #Avg Type: RMS	05:25:37 PM Sep 04, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N	Frequency
10 dB/div	Ref Offset 11 dB Ref 20.00 dBm	ı		Mkr4	4 25.653 7 GHz -44.73 dBm	Auto Tune
10.0	↓					Center Free 13.015000000 GH
-20.0 -30.0 -40.0		. 2			DL1 -24.84 dBm	Start Free 30.000000 MH
-50.0 -60.0 -70.0		e saya and a set of last against	ter bi dang bang panggapan dang pangga Barté Di Kana Ali Sala Dianada pang ak dipanggapan dan di bi	en nær stadssegt for som et alle at som et som et som et som et som et at som et som et som et at som et at so Andre i som et alle som et alle som et at	a ferrar a second a second front of the second s Second second	Stop Free 26.000000000 GH
Start 30 MH #Res BW 1	Hz 00 kHz	#VBV	V 300 kHz	Sweep 95	Stop 26.00 GHz 6.0 ms (30000 pts)	CF Step 2.597000000 GH Auto Mar
1 N 1 2 N 1 3 N 1 4 N 1 5 6	f f f f	× 2.412 0 GHz 4.824 0 GHz 7.236 0 GHz 25.653 7 GHz	-9.46 dBm -54.12 dBm -52.73 dBm -44.73 dBm	PUNCTION WIDTH		Freq Offse 0 H:
7 8 9						Scale Type
10 11 •			m			Log <u>Lir</u>
ISG				STATUS		



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Frequency	05:29:25 PM Sep 04, 2018 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N	ALIGN AUTO #Avg Type: RMS	SENSE:INT Trig: Free Run #Atten: 30 dB	50 Ω DC 015000000 GHz NFE NFE PNO: Fast IFGain:Low	RF eq 13.	er Fre	i en
Auto Tun	25.883 1 GHz -45.55 dBm	Mkr		et 11 dB .00 dBm	Ref Off: Ref 20	3/div	0 dl
Center Fre 13.015000000 GH					01		.og 10.0
Start Fre 30.000000 MH	DL1 -24.48 dBm						10.0 20.0 30.0
Stop Fre 26.000000000 GH	en e	nen en en fan die en een een die eerste die Gebeure van geween geween geween die eerste d	ni din dana manganya papa di kata ini. Lata dipinana pana pana kata di	halas (22) an single grant of the state of the second state of the	A REAL PROPERTY.		40.0 50.0 60.0
CF Ste 2.597000000 GH Auto Ma	Stop 26.00 GHz 5.0 ms (30000 pts)	Sweep 95	W 300 kHz	: #VI	Hz 100 kHz	: 30 M 5 BW 1	tar Re
Freq Offse	FUNCTION VALUE	TION FUNCTION WDTH	Y FU -7.34 dBm -53.83 dBm -50.65 dBm -45.55 dBm	X 2.437 0 GHz 4.874 0 GHz 7.311 0 GHz 25.883 1 GHz	f f f f	N 1 N 1 N 1 N 1 N 1	1 2 3 4 5
Scale Typ							6 7 8
Log <u>Li</u>							10



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	05-42-22 DM Cree 04, 2010		-	CENCEN	07),49091,	er - APv7.0(20170	trum Analy	ht Spect	Keysi
Frequency	TRACE 1 2 3 4 5 6	Type: RMS	#A\	SENSE:1	00 GHz	1500000	eq 13.	r Fre	ente
Auto Tune	DET P N N N N		1	#Atten: 30 dB	PNO: Fast • IFGain:Low	NFE			
	4 25.715 2 GHz	Mkr4				-+ 44 dD	D-608		
	-45.09 dBm					.00 dBm	Ref 2	liv	dB/
Center Ere									10
13.015000000 GH									00 -
							Q.		1.0
	DI 1 - 24 90 vPm								0.0
30.000000 MH	021-24.00 0241								1.0
									0.0
	والمحافظ المراسلين ومرمر ومراسر المراسي	and an and a second second	und de dens				AD DATE OF	, Jui).0 -
Stop Free 26.00000000 GH	and high ships and a sub-		alidhaa ay saalina	a the disease of the process group of the	operation of the first states of the	Band Mile Mary		يەر يەر ئىلمىيەلەر).O
								- r).0 <mark>(</mark> "
CESta	Stop 26 00 GHz						Hz	30 MI	_L art
2.597000000 GH	6.0 ms (30000 pts)	Sweep 950		N 300 kHz	#VB		00 kH	BW 1	les
Auto Ma	FUNCTION VALUE	FUNCTION WIDTH	FUNCTION	Y		х	SCL	de trc	r Mo
				-9.34 dBm -54.50 dBm	.462 0 GHz .924 0 GHz	2.	f	1	1 N 2 N
FreqOffse				-55.29 dBm	.386 0 GHz	7.	f	1	3 N
	E			10.00 0.2.			•	- ·	5
Scale Tre									2
Scale Typ									5
Log <u>Li</u>) 1
	•			m					

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Frequency	06:45:45 PM Sep 04, 2018 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N	ALIGN AUTO #Avg Type: RMS	SENSE:INT Trig: Free Run #Atten: 40 dB	IZ NO: Fast ↔ Gain:Low	50 Ω DC 33500000 GH NFE PI IFC	RF req 2.4	ter F	ien
Auto Tuno	r1 2.461 5 GHz -5.39 dBm	Mk			et 11 dB .00 dBm	Ref Off Ref 30	B/div	0 d
Center Fre 2.483500000 GH								.og 20.0 10.0
Start Fre 2.433500000 GH	DL1 -25.39 dBm			Mary Mary	A Market A			0.00 10.0 20.0
Stop Fre 2.533500000 GH	2 million and the selection of the	anner van gebruiken gebruiken soor		- 14 	ww.sp	Marine Autores	-	30.0 40.0 50.0
CF Ste 10.000000 MH	Span 100.0 MHz 733 ms (1001 pts)	Sweep 3.	800 kHz	#VBW	Hz	48350 G 100 kH	ter 2. s BW	en Re
Freq Offse	FUNCTION VALUE	ON FUNCTION WIDTH	Y FUN -5.39 dBm -39.38 dBm -40.44 dBm	5 GHz 5 GHz 5 GHz	x 2.461 2.513 2.483	RC SCL f f f	NODE T N N N	KR 2 3 4 5
Scale Typ								6 7 8
Log <u>Li</u>								10



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7.5.2. 802.11g MIMO MODE

ANTENNA1





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Frequency	05:54:50 PM Sep 04, 2018 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N	ALIGN AUTO #Avg Type: RMS	SENSE:INT Trig: Free Run #Atten: 40 dB	000 GHz PNO: Fast ↔ IFGain:Low	RF 50 Ω D req 2.4835000 NFE	er Frec	ent
Auto Tun	r1 2.460 8 GHz -5.33 dBm	Mk		3 m	Ref Offset 11 dB Ref 30.00 dBi	R div R	0 dE
Center Free 2.483500000 GH							og 20.0 10.0
Start Fre				1 Where have have been and			0.00
2.433500000 GH	DL1 -25.34 dBm	And the state of t	3 2		January Manufactor M. Car	et mart de la cast	80.0 80.0
Stop Fre 2.533500000 GH							50.0 50.0
CF Ste 10.000000 MH	Span 100.0 MHz 733 ms (1001 pts)	Sweep 3.	W 300 kHz	#VBV	48350 GHz 100 kHz	er 2.483 BW 10	ent Res
Freq Offse	FUNCTION VALUE	TION FUNCTION WIDTH	Y FUN -5.33 dBm -38.66 dBm -42.17 dBm	X 2.460 8 GHz 2.488 0 GHz 2.483 5 GHz	ice sel f f f	DDE TRC S N 1 N 1 N 1	KR N 2 3 4 5
Scale Typ							6 7 8
Log <u>Li</u>							9 0 1



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Frequency	06:56:48 PM Sep 04, 2018 TRACE 1 2 3 4 5 6 TYPE M	ALIGN AUTO #Avg Type: RMS	SENSE:INT Trig: Free Run #Atten: 40 dB	Igzer - APv7.0(201707),49091, 50 Ω DC 483500000 GHz NFE PNO: Fast IFGain:Low	rsight Spectrum An RF ter Freq 2.	ent
Auto Tuno	r1 2.465 8 GHz -5.98 dBm	Mk		ffset 11 dB 30.00 dBm	Ref C B/div Ref 3	0 dE
Center Fre 2.483500000 GH						. og 20.0 10.0
Start Fre 2.433500000 GH	DL1 -25.98 dBm			periodeletationalewindaget		0.00 10.0 20.0
Stop Fre 2.533500000 G⊦	the water of the second and the second se	Caler-graderitherry back Mayner			din territori de maria	40.0 50.0 60.0
CF Ste 10.000000 M⊦ <u>Auto</u> Ma	Span 100.0 MHz 733 ms (1001 pts)	Sweep 3.	300 kHz	GHz Hz #VI	ter 2.48350 s BW 100 k	ent Res
Freq Offse 0 H	FUNCTION VALUE		-5.98 dBm -39.27 dBm -41.54 dBm	x 2.465 8 GHz 2.527 0 GHz 2.483 5 GHz	N 1 f N 1 f N 1 f N 1 f	1 2 3 4 5
Scale Typ						6 7 8 9
Log <u>Li</u> i						10 11



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7.5.3. 802.11n20 MIMO MODE

ANTENNA1





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Frequency Auto Tun	06:07:47 PM Sep 04, 2018 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N	ALIGN AUTO #Avg Type: RMS	SENSE:INT →→→ Trig: Free Run #Atten: 40 dB	2 DC 00000 GHz NFE PNO: Fast IFGain:Low	RF 50	L nter F
	1 2.460 7 GHz -4.77 dBm	Mk		1 dB dBm	Ref Offset Ref 30.00	dB/div
Center Fre 2.483500000 GH						
Start Fre 2.433500000 GH	DL1 -24.77 dBm		1	Jarm Supeliter		
Stop Fre 2.533500000 GH		and the second			satur an Ikinus IV	
CF Ste 10.000000 MH <u>Auto</u> Ma	Span 100.0 MHz 733 ms (1001 pts)	Sweep 3	BW 300 kHz	#VI	8350 GHz 100 kHz	nter 2. es BW
Freq Offse 0 H		NCTION FUNCTION WIDTH	-4.77 dBm -39.25 dBm -41.04 dBm	x 2.460 7 GHz 2.511 0 GHz 2.483 5 GHz	f f f	N 1 N 1 N 1
Scale Typ						
Log <u>Li</u>						



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ANTENNA2





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Frequency	07:13:18 PM Sep 04, 2018 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N	ALIGN AUTO #Avg Type: RMS	SENSE:INT → Trig: Free Run #Atten: 40 dB	IQ DC 500000 GHz NFE PNO: Fast IFGain:Low	RF req 2.4	ter Fr	ien
Auto Tune	r1 2.467 0 GHz -5.82 dBm	Mk		11 dB 0 dBm	Ref Off Ref 3	B/div	0 d
Center Free 2.483500000 GH							.og 20.0 10.0
Start Fre 2.433500000 GH	DL1 -25.82 dBm			permyanda			0.00 10.0 20.0 30.0
Stop Fre 2.533500000 GH	stration of the protocol and the protoco	marthe anna a statistica a st	3		Mar Antonia	light you Mine	40.0 50.0 60.0
CF Ste 10.000000 MH Auto Ma	Span 100.0 MHz 733 ms (1001 pts)	Sweep 3.	V 300 kHz	#VE	8350 C 100 kH	ter 2.4 s BW	en Re
Freq Offse	FUNCTION VALUE	ON FUNCTION WIDTH	Y FUN -5.82 dBm -39.12 dBm -42.12 dBm	x 2.467 0 GHz 2.513 3 GHz 2.483 5 GHz	f f f	MODE TR N 1 N 1 N 1	1 2 3 4 5
Scale Typ							6 7 8
Log <u>Li</u> i							10 11



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