

	rum Analyzer - Swept SA		JESK IVI		-	
Marker 1	RF 50 Ω AC 2.44076000000	PNO: Fast	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	12:04:45 PM Jul 26, 2021 TRACE 1 2 3 4 5 6 TYPE MMAAAAAAA DET P. N.N.N.N.N	Peak Search
0 dB/div	Ref Offset 0.5 dB Ref 10.00 dBm	IFGain:Low	Atten: 20 dB	Mkr	1 2.440 76 GHz -2.399 dBm	NextPeak
			∳ <sup>1</sup>			Next Pk Right
0.0						Next Pk Lef
0.0 0.0						Marker Delta
0.0						Mkr→CF
0.0						Mkr→RefLv
						More 1 of 2
enter 2.4 Res BW (	41000 GHz 3.0 MHz	#VBW	3.0 MHz	Sweep 1	Span 10.00 MHz .000 ms (1001 pts)	
SG				STATUS		

**GFSK Middle Channel** 

**GFSK High Channel** 



No. : BCTC/RF-EMC-007



📕 Agilent Spec	trum Analyzer - Swept SA					
X/RL	RF 50 Ω AC 2.40178000000		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	12:03:24 PM Jul 26, 2021 TRACE 1 2 3 4 5 6	Peak Search
Marker	2.40178000000	PNO: East	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100		
10 dB/div Log	Ref Offset 0.5 dB Ref 10.00 dBm			Mkr	1 2.401 78 GHz -2.011 dBm	Next Peak
0.00			↓1			Next Pk Right
-10.0						
-20.0	And a					Next Pk Left
-30.0						Marker Delta
-40.0						Marker Della
-50.0						Mkr→CF
-60.0						
-70.0						Mkr→RefLvl
-80.0						Marro
	402000 GHz				Span 10.00 MHz .000 ms (1001 pts)	More 1 of 2
#Res BW	3.0 MHz	#VBW 3	.0 MHz	Sweep 1	.000 ms (1001 pts)	
MSG				STATUS		

#### Pi/4 DQPSK Low Channel

Pi/4 DQPSK Middle Channel

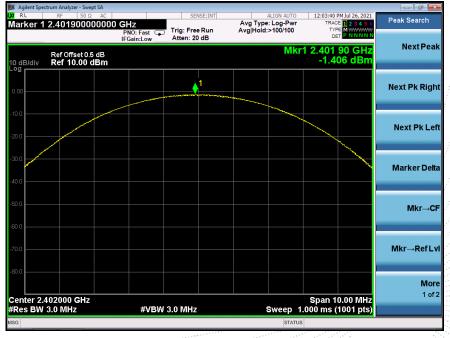




			IX High One		
📕 Agilent Spectrum Analyze					
K RL RF	50 Ω AC	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	12:05:17 PM Jul 26, 2021 TRACE 1 2 3 4 5 6	Peak Search
Marker 1 2.4798		ast 🕞 Trig: Free Run Low Atten: 20 dB	Avg Hold:>100/100	TYPE MWWWWW DET PNNNNN	
Ref Offs 0 dB/div Ref 10	et 0.5 dB .00 dBm		Mkr	1 2.479 81 GHz -1.044 dBm	NextPeak
0.00		<b>↓</b> 1			Next Pk Righ
10.0					
20.0					Next Pk Lef
10.0					Marker Delt
0.0					Warker Dei
0.0					Mkr→C
0.0					Mkr→RefL
0.0					
enter 2.480000				Spap 10 00 MHz	<b>Mor</b> 1 of
Res BW 3.0 MHz		#VBW 3.0 MHz	Sweep 1	Span 10.00 MHz .000 ms (1001 pts)	
SG			STATUS		

#### Pi/4 DQPSK High Channel

**8DPSK Low Channel** 

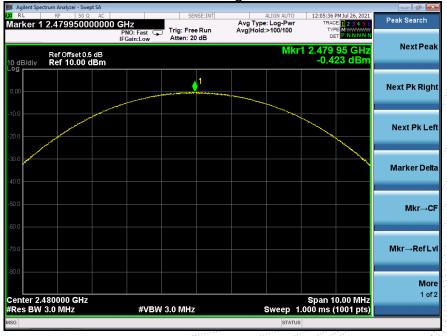




🗴 Agilent Spectrum Analyzer - Swept SA			
ARL RF 50 Ω AC Marker 1 2.440880000000	O GHZ PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	ALIGN AUTO 12:04:02 PM Jul 26, Avg Type: Log-Pwr TRACE 23 Avg Hold:>100/100 TVPE DET PNN	4 5 6 WWW
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm		Mkr1 2.440 88 G -0.848 dl	Hz NextPeal Bm
0.00	1		Next Pk Righ
0.0			Next Pk Lef
0.0			
0.0			Marker Delta
0.0			Mkr→C
0.0			Mkr→RefLy
0.0			
enter 2.441000 GHz		Span 10.00 M Sweep 1.000 ms (1001	Mon 1 of:
Res BW 3.0 MHz	#VBW 3.0 MHz	Sweep 1.000 ms (1001	

8DPSK Middle Channel

8DPSK High Channel



No. : BCTC/RF-EMC-007



# 12. HOPPING CHANNEL SEPARATION

12.1 Block Diagram Of Test Setup



# 12.2 Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125W.

# 12.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port

to the spectrum.

2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz, Span = 2.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.





# 12.4 Test Result

Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.000	0.585	PASS
GFSK	Middle	1.006	0.587	PASS
GFSK	High	1.006	0.585	PASS
Pi/4 DQPSK	Low	1.002	0.835	PASS
Pi/4 DQPSK	Middle	0.998	0.837	PASS
Pi/4 DQPSK	High	0.998	0.838	PASS
8DPSK	Low	1.006	0.815	PASS
8DPSK	Middle	1.000	0.813	PASS
8DPSK	High	1.002	0.828	PASS

Test plots GFSK Low Channel



No. : BCTC/RF-EMC-007



Magilent Spectrum Analyzer - Swept S RL RF 50 Ω	AC AC	SENSE:INT	ALIGN AUTO	12:50:32 PM Jul 26, 2021	
Marker 1 Δ 1.0060000	000 MHz PNO: Wide 🔾	Trig: Free Run Atten: 20 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE M WWWWW	Peak Search
Ref Offset 0.5 d 0 dB/div Ref 10.00 dE	IFGain:Low	Atten: 20 dB	ΔN	lkr1 1.006 MHz -0.381 dB	NextPeak
og 0.00 X2	AD		1Δ2		Next Pk Right
0.0 M	M M M	Ma mont	www.	Monny	Next Pk Lef
40.0					Marker Delta
50.0					Mkr→CF
					Mkr→RefLv
Center 2.441500 GHz Res BW 30 kHz	#VBW	100 kHz	Sweep 2	Span 2.000 MHz 133 ms (1001 pts)	More 1 of 2
3 <mark>G</mark>			STATUS		

**GFSK Middle Channel** 

**GFSK High Channel** 



No. : BCTC/RF-EMC-007





#### Pi/4 DQPSK Low Channel

Pi/4 DQPSK Middle Channel



No.: BCTC/RF-EMC-007



Agilent Spectrum Analyzer - Swept SA		or right on		
RL RF 50Ω AC arker 1 Δ 998.000000 kH	PNO: Wide Trig: Free Ru IEGain: Jow Atten: 20 dB	Avg Type: Log-Pwr Avg Hold:>100/100	12:47:08 PM Jul 26, 2021 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Peak Search
Ref Offset 0.5 dB			ΔMkr1 998 kHz 0.480 dB	Next Pea
.00 X.		1Δ2		Next Pk Righ
	how	V.M. M.M.	Manny	Next Pk Le
.0				Marker Del
.0				Mkr→C
.0				Mkr→RefL
enter 2.479500 GHz Res BW 30 kHz	#VBW 100 kHz	Sween	Span 2.000 MHz 2.133 ms (1001 pts)	Mor 1 of
File <picture.png> save</picture.png>		STATU		

#### Pi/4 DQPSK High Channel

**8DPSK Low Channel** 



No. : BCTC/RF-EMC-007



		ddie Char		ODF			
Peak Search	12:43:23 PM Jul 26, 2021 TRACE 1 2 3 4 5 6	ALIGN AUTO	SENSE:INT		AC	rtrum Analyzer - Swep RF 50 Ω	RL
		Avg Hold:>100/100	Free Run n: 20 dB	NO: Wide 🕟 Trig: F	P	Δ 1.000000	arker
NextPea	lkr1 1.000 MHz 0.215 dB	ΔΝ			5 dB d <b>Bm</b>	Ref Offset 0.5 Ref 10.00 d	) dB/div
Next Pk Righ		1					.00
Next Pk Le	Mymm	$\sim$	~~~~	mm		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
NEXL PR Le				• V			0.0
Marker Del							).0 ).0
Mkr→C							.0
							.0
Mkr→RefL							.0
Mor 1 of							).0
10	Span 2.000 MHz 133 ms (1001 pts)	Sweep 2	ίHz	#VBW 100 kH		441500 GHz 30 kHz	
		STATUS					3

**8DPSK Middle Channel** 

8DPSK High Channel



No. : BCTC/RF-EMC-007



# 13. NUMBER OF HOPPING FREQUENCY

13.1 Block Diagram Of Test Setup



# 13.2 Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

# 13.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.

4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;



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# 13.4 Test Result

### Test Plots:

79 Channels in total GFSK



					F	Pi/4 [	DQPS	SK			
Ag X/R	ilent Spectrum /	Analyzer - Swep F 50 Ω	AC AC		SEN	ISE:INT		ALIGN AUTO	12:37:05	PM Jul 26, 2021	
Mar	ker1∆7	78.07250		Z IO: Fast 🖵 Gain:Low	Trig: Free Atten: 20	Run dB	Avg Type Avg Hold:			E 1 2 3 4 5 6 E M WWWWW T P N N N N N	Marker Select Marker
10 dl Log	Re B/div <b>R</b> e	f Offset 0.5 ef 10.00 c	dB IBm					ΔMkr	1 78.072 0	2 5 MHz .610 dB	
0.00										102	Normal
	<u>Mr</u> hhh	MMM	MMMM	MMM	MMM	WWW	MMMM	NAMAN	MAANN		
											Delta
											Fixed⊳
										Wł	Off
											Properties►
	t 2.40000								Stop 2.48	350 GHz	More 1 of 2
#Re	s BW 100	kHz		#VBW	300 kHz			Sweep 8		1001 pts)	
								UNITOS			



KI RL	lent Spect Ker 1 .	RJ		50 Ω	AC	Р	NO:	Fast C		Trig: Fi	ee l			/pe	ALIGN AUTO : Log-Pw >100/100		12:39:08 TRAC TYP	PM Jul 26, 2021	Marker
0 dE	/div		Offsei f 10.0			IF	Gain	Low		Atten:	20 c	iB			ΔM	<b>۲</b> ۲	1 78.15	6 0 MHz .822 dB	Select Marker 1
.og 0.00	XPALA	เกN	1.1.1.1	hu	UN NA	MAA	በለከ	MAW	hah	1 MAN	М	MANANA	NANANA	An	Alatia		www	102 MMU	Norm
10.0 20.0	/*#¥V	<b>y</b> ~ 1		4.14	• • •					10.15.						<b>r</b> 0			Del
30.0 10.0																			Fixed
0.0																		Į,	c
:0.0 :0.0																			Properties
0.0																			<b>Mo</b> 1 of
	: 2.400 3 BW 1							#VB۱	M 3	00 24	-				Swoon			3350 GHz 1001 pts	

onder

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# 14. DWELL TIME

# 14.1 Block Diagram Of Test Setup



### 14.2 Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

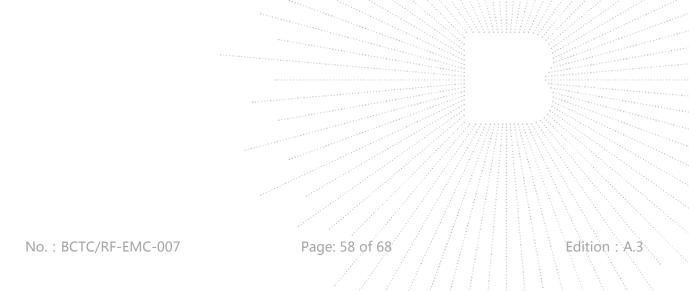
### 14.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set spectrum analyzer span = 0. Centred on a hopping channel;

3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.

4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).





### 14.4 Test Result

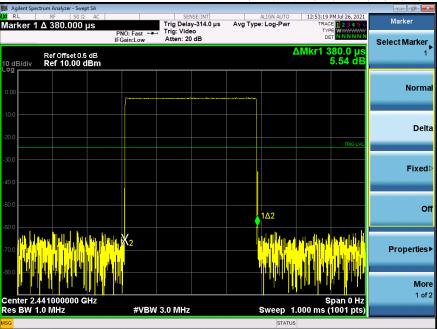
DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel

(3 time slots RX, 1 time slot TX). DH1 Packet permit maximum 1600 / 79 /2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

DH5:1600/79/6\*0.4\*79\*(MkrDelta)/1000 DH3:1600/79/4\*0.4\*79\*(MkrDelta)/1000 DH1:1600/79/2\*0.4\*79\*(MkrDelta)/1000 Remark: Mkr Delta is once pulse time.

Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
		DH1	0.380	0.122	0.4
GFSK	Middle	DH3	1.644	0.263	0.4
		DH5	2.910	0.310	0.4
	K Middle	2DH1	0.392	0.125	0.4
Pi/4DQPSK		2DH3	1.650	0.264	0.4
		2DH5	2.910	0.310	0.4
		3DH1	0.394	0.126	0.4
8DPSK	Middle	3DH3	1.650	0.264	0.4
		3DH5	2.910	0.310	0.4



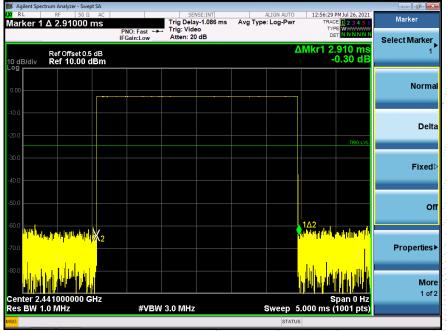
Test Plots GFSK DH1 Middle Channel



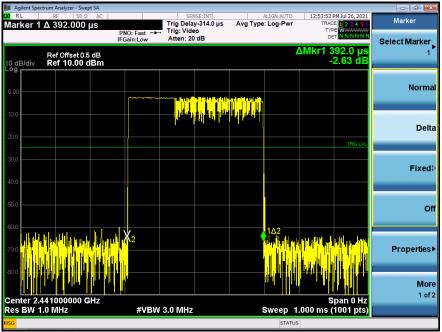
Observe Ref 50.0 AC Serve:Intri ALIGN AUTO 12:54:59 PM.bid 26, 2021   Marker 1 Δ 1.64400 ms PN0: Fast Trig Delay-868.0 µs Avg Type: Log-Pwr Trace [P.N.3: 8 - 37]   PN0: Fast Trig: Video Atten: 20 dB Avg Type: Log-Pwr Trace [P.N.3: 8 - 37]   IFGain: Low IFGain: Low Atten: 20 dB Atten: 20 dB Select Ma   10 dB/div Ref Offset 0.5 dB 23.72 dB 23.72 dB	
PNO: Fast → Trig: Video IFGain:Low Atten: 20 dB DEFINITION DEFINITAMENTO DEFINITION DEFINITION DEFINITION DE	irker 1
Ref Offset 0.5 dB     ΔMkr1 1.644 ms     Select Ma       10 dB/div     Ref 10.00 dBm     23.72 dB	arker 1
Ref Offset 0.5 dB     ΔMkr1 1.644 ms       10 dB/div     Ref 10.00 dBm     23.72 dB	1
Net of the construction of	
	ormal
	-
-10.0	
	Delta
-20.0	Dena
TRICLYL	
-30.0	
	ixed⊳
	incur
-40.0	
-50.0	Off
-700 Prope	rties►
	More
	1 of 2
Center 2.441000000 GHz Span 0 Hz	1012
Res BW 1.0 MHz #VBW 3.0 MHz Sweep 3.000 ms (1001 pts)	
ISG STATUS	

#### GFSK DH3 Middle Channel

### GFSK DH5 High Middle Channel

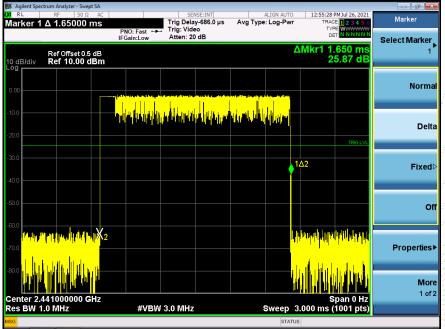






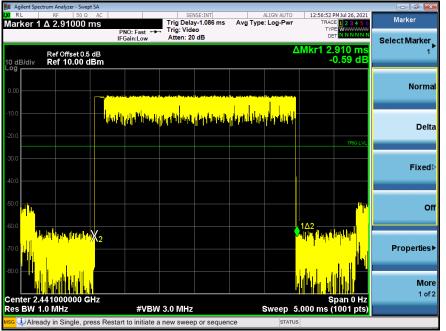
#### Pi/4DQPSK DH1 Middle Channel

# Pi/4DQPSK DH3 Middle Channel



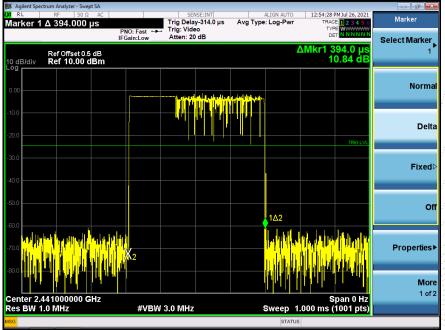
No.: BCTC/RF-EMC-007



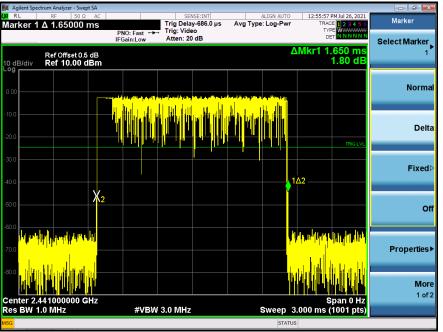


#### Pi/4DQPSK DH5 Middle Channel

8DPSK DH1 Middle Channel

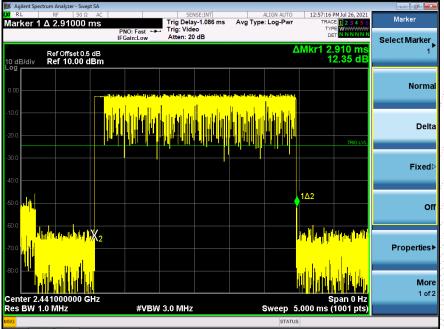






8DPSK DH3 Middle Channel

#### 8DPSK DH5 Middle Channel





# 15. ANTENNA REQUIREMENT

### 15.1 Limit

15.203 requirement: For intentional device, according to 15.203: 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.

### 15.2 Test Result

The EUT antenna is PCB antenna, fulfill the requirement of this section.



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# EUT Photo 1



#### **EUT Photo 2**

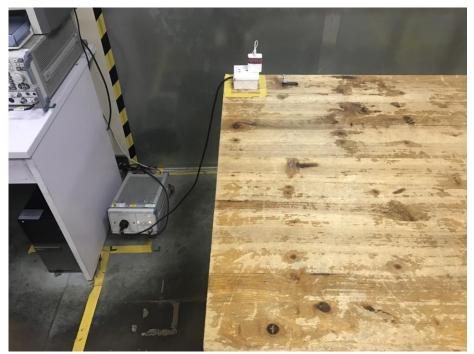


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# **Conducted emissions**



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# **Radiated Measurement Photos**







# STATEMENT

1. The equipment lists are traceable to the national reference standards.

2. The test report can not be partially copied unless prior written approval is issued from our lab.

3. The test report is invalid without stamp of laboratory.

4. The test report is invalid without signature of person(s) testing and authorizing.

5. The test process and test result is only related to the Unit Under Test.

6. The quality system of our laboratory is in accordance with ISO/IEC17025.

7.If there is any objection to report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

Address:

1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Tangwei, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

TEL: 400-788-9558

P.C.: 518103

FAX: 0755-33229357

Website : http://www.chnbctc.com

E-Mail : <u>bctc@bctc-lab.com.cn</u>

\*\*\*\*\* END \*\*\*\*\*

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