

## FCC 47 CFR PART 15 SUBPART C ISED RSS 247 ISSUE 2 CERTIFICATION TEST REPORT

For

**Massage Chair** 

## MODEL NUMBER: NS-MGC600BK2

PROJECT NUMBER: 4789993507

**REPORT NUMBER: 4789993507-1** 

FCC ID: 2A2JA-NSMGC600BK2

IC: 27853-600S

**ISSUE DATE: Dec. 13, 2021** 

Prepared for

Zhejiang Haozhonghao Health Product Co., Ltd.

Prepared by

UL-CCIC COMPANY LIMITED No. 2, Chengwan Road, Suzhou Industrial Park, People's Republic of China

> Tel: +86 512 6808 6400 Fax: +86 512 6808 4099 Website: www.ul.com



## **Revision History**

Rev.	Issue Date	Revisions	Revised By
V0	12/13/2021	Initial Issue	



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# **1. ATTESTATION OF TEST RESULTS**

## **Applicant Information**

Company Name: Address:	Zhejiang Haozhonghao Health Produ No.18 Xinglong Road, Furniture Garde Pingyang, Wenzhou, Zhejiang, China	uct Co., Ltd. en Wanquan Industry Base,
Manufacturer Information		
Company Name:	Zhejiang Haozhonghao Health Produ	uct Co., Ltd.
Address:	No.18 Xinglong Road, Furniture Garde Pingyang Wenzhou, Zheijang China	en Wanquan Industry Base,
Factory Information		
Company Name:	Zhejiang Haozhonghao Health Produ	uct Co., Ltd.
Address:	No.18 Xinglong Road, Furniture Garde	en Wanguan Industry Base.
	Pingyang, Wenzhou, Zhejiang, China	
EUT Description		
Product Name	Massage Chair	
Model Name	NS-MGC600BK2	
Sample Number	2936358	
Date of Receipt Sample	Aug. 18, 2021	
Date Tested	Aug. 18, 2021~ Dec.13, 2021	
	APPLICABLE STANDARDS	
STA	ANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C		PASS
ISED RS	S-247 Issue 2	PASS
ISED RSS	S-GEN Issue 5	PASS

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Summary of Test Results						
Clause	Test Items	FCC/ISED Rules	Test Results			
1	20dB Bandwidth And 99% Bandwidth	FCC 15.247 (a) (1) RSS-247 Clause 5.1 (a)	Complied			
2	Peak Conducted Output Power	FCC 15.247 (b) (1) RSS-247 Clause 5.1 (b)	Complied			
3	Carrier Hopping Channel Separation	FCC 15.247 (a) (1) RSS-247 Clause 5.1 (b)	Complied			
4	Number of Hopping Frequency	15.247 (a) (1) III RSS-247 Clause 5.1 (d)	Complied			
5	Time of Occupancy (Dwell Time)	15.247 (a) (1) III RSS-247 Clause 5.1 (d)	Complied			
6	Conducted Bandedge	FCC 15.247 (d) RSS-247 Clause 5.5	Complied			
7	Radiated Bandedge and Spurious	FCC 15.247 (d) FCC 15.209 FCC 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9 RSS-GEN Clause 8.10	Complied			
8	Conducted Emission Test for AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	Complied			
9	Antenna Requirement	FCC 15.203 RSS-GEN Clause 6.8	Complied			
Remark <sup>.</sup>			•			

Remark:

1) The measurement result for the sample received is <Pass> according to < ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15C, ISED RSS-GEN Issue5, ISED RSS-247 Issue2> > when <Accuracy Method> decision rule is applied.

2) The EUT is power supply by the battery

Prepared By:

Tom Tang

Tom Tang Project Engineer

Authorized By:

Chris Zhong.

Chris Zhong Laboratory Leader Reviewed By:

Leon Wu

Leon Wu Senior Project Engineer



# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, ISED RSS-GEN ISSUE5 and ISED RSS-247 ISSUE2.

# 3. FACILITIES AND ACCREDITATION

Test Location	UL-CCIC Company Limited, EMC&RF Lab
Address	No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122 ,China
Accreditation Certificate	A2LA (Certificate No.: 4829.01) UL-CCIC COMPANY LIMITED has been assessed and proved to be in compliance with A2LA. FCC (FCC Designation No.: CN1247) UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules. IC (IC Designation No.: 25056; CAB No.: CN0073) UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.

Note 1: All tests measurement facilities use to collect the measurement data are located at No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, People's Republic of China

Note 2: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. These measurements below 30MHz had been correlated to measurements performed on an OFS.

Note 3: The test anechoic chamber in UL-CCIC COMPANY LIMITED 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.



# 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 recognized 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		
Conduction emission	3.1dB		
Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	3.4dB		
Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	3.4dB		
Radiation Emission test (1GHz to 26GHz)( include Fundamental emission)	3.9dB (1GHz-18Gz)		
	4.2dB (18GHz-26.5Gz)		
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.			

# 5. EQUIPMENT UNDER TEST 5.1. DESCRIPTION OF EUT

Product Name:	Massage Chair			
Model No.:	NS-MGC600BK2			
	Operation Frequency	2402 MHz ~ 2480 MHz		
	Modulation Type	Data Rate		
Product Description	GFSK	1Mbps		
(Bluetooth)	∏/4-DQPSK	2Mbps		
	8DPSK	3Mbps		
Test software of EUT:	BT FCC Tools 2.00 (manufacturer declare)			
Antenna Type:	PCB antenna			
	0 dBi			
Antenna Gain:	Remark: This data is provided by customer and our lab isn't responsible this data			



# 5.2. MAXIMUM OUTPUT POWER

Bluetooth Mode	Frequency(MHz)	Channel Number	Max Output Power (dBm)
GFSK	2402-2480	0-78[79]	-5.09
8DPSK	2402-2480	0-78[79]	-2.29

## 5.3. PACKET TYPE CONFIGURATION

Test Mode	Packet Type	Setting(Packet Length)		
	DH1	27		
GFSK	DH3	183		
	DH5	339		
	2-DH1	54		
∏/4-DQPSK	2-DH3	367		
	2-DH5	679		
	3-DH1	83		
8DPSK	3-DH3	552		
	3-DH5	1021		



# 5.4. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

# 5.5. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel Number	Test Channel		
GFSK	CH 00, CH 39, CH 78	Low, Middle, High		
8DPSK	CH 00, CH 39, CH 78	Low, Middle, High		

# 5.6. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band								
Test Se	oftware	FCCTool						
	Transmit Antenna	Test Channel						
modulation Type	Number	CH 00	CH 39	CH 78				
GFSK	1	3	3	3				
8DPSK	1	3	3	3				



## 5.7. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2402-2480	PCB antenna	0

Test Mode	Transmit and Receive Mode	Description			
GFSK	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.			
8DPSK	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.			



## 5.8. WORST-CASE CONFIGURATIONS

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BR	FHSS	GFSK	1Mbit/s
EDR	FHSS	8DPSK	3Mbit/s

Note: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.



# 5.9. DESCRIPTION OF TEST SETUP

#### SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Description	
1	Laptop	ThinkPad	E550c	N/A	
2	Fixed Frequency Board	N/A	N/A	Supply by Customer	
3	USB Cable	N/A	N/A	Supply by UL Lab(100cm length)	
4	Portable Power Source	XIAOMI Portable Power Source	PLM09ZM	Supply by UL Lab	

## ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

#### TEST SETUP

The EUT can work in an engineer mode with a software through a PC. Test Voltage is 120Vac 60Hz.

#### SETUP DIAGRAM FOR TESTS





		Cor	nducted	Emiss	sions	(Instru	ment)						
Used	Equipment	Manufacturer	Model No.		Seri	al No.	Upper Last Cal.	Last Cal.	Next Cal.				
$\checkmark$	EMI Test Receiver	R&S	ESF	3	12	6700	2020-12-05	2021-12-04	2022-12-03				
$\checkmark$	Two-Line V- Network	R&S	ENV2	216	12	6701	2020-12-05	2021-12-04	2022-12-03				
				Soft	ware								
Used	Des	cription		Ma	nufac	turer	Name	Version					
$\checkmark$	Test Software for C	Conducted distu	irbance		R&S	6	EMC32	Ver. 9.25					
		Ra	diated E	Emissi	ions (	Instrum	nent <b>)</b>						
Used	Equipment	Manufacturer	Model	No.	Seri	al No.	Upper Last Cal.	Last Cal.	Next Cal.				
$\checkmark$	Spectrum Analyzer	Keysight	N901	0B	15	5727	2020-05-10	2021-05-09	2022-05-08				
$\checkmark$	EMI test receiver	R&S	ESR	26	12	6703	2020-12-05	2021-12-04	2022-12-03				
$\checkmark$	Receiver Antenna (9kHz-30MHz)	Schwarzbeck	FMZB	1513	15	5456	2018-06-15	2021-06-03	2024-06-02				
$\checkmark$	Receiver Antenna (30MHz-1GHz)	SunAR RF Motion	JB	1	17	7821	N/A	2019-01-28	2022-01-27				
$\checkmark$	Receiver Antenna (1GHz-18GHz)	R&S	HF9	07	126705		2018-01-29	2019-01-28	2022-01-27				
$\checkmark$	Receiver Antenna (18GHz-26.5GHz)	Schwarzbeck	BBHA	9170	126706		2018-01-06	2019-01-05	2022-01-04				
V	Pre-amplification (To 18GHz)	Compliance Direction System Inc.	PAP-10 50	PAP-1G18- 50		PAP-1G18- 50		-1G18- 50 177825		7825	2019-03-18	2020-12-05	2022-03-25
$\checkmark$	Pre-amplification (To 26.5GHz)	R&S	SCU-2	26D	135391		2020-12-05	2021-12-04	2022-12-03				
V	Band Reject Filter	Wainwright	WRCJ 2350-2 2483 2533.5-	WRCJV8- 350-2400- 2483.5- 533 5-4055		1	2020-05-10	2021-05-09	2022-05-08				
V	Highpass Filter	Wainwright	WHKX10- 2700-3000- 18000-40SS			2	2020-05-10	2021-05-09	2022-05-08				
				Soft	ware								
Used Description Manufacturer Name Version													
✓ Test Software for Radiated disturbance Tonscend TS+ Ver. 2.5													
			Oth	er ins	trum	ents							
Used	Equipment	Manufacturer	Model	Model No. Se		al No.	Upper Last Cal.	Last Cal.	Next Cal.				
$\checkmark$	Spectrum Analyzer	Keysight	N901	0B	15	5368	2020-05-10	2021-05-09	2022-05-08				
$\checkmark$	Power Meter	Keysight	U202	IXA	155370		2020-05-10	2021-05-09	2022-05-08				

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# 6. ANTENNA PORT TEST RESULTS

## 6.1. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests
Relative Humidity	65%
Atmospheric Pressure:	1005hPa
Temp, Test Voltage	21.9 deg C, 120Vac 60Hz



# 6.2. ON TIME AND DUTY CYCLE

#### LIMITS

None; for reporting purposes only

#### PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

## TEST SETUP



## **RESULTS**

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/T Minimum VBW (KHz)	Final VBW(kHz)
GFSK	2.876	3.749	0.767	76.7	1.15	0.35	1
8DPSK	2.881	3.751	0.768	76.8	1.15	0.35	1

Note: Duty Cycle Correction Factor=10log(1/x). Where: x is Duty Cycle (Linear) Where: T is On Time (transmit duration)





					DH5		IE AN	ID DI	JTY	CYCL	E MI	О СН			
Spect Swept	rum Ana : SA	lyzer 1	•	+									<b>\</b>	Frequency	· · · 崇
KEY RL	SIGH1 • <b>→</b> •	Input: I Coupli Align: J	RF ng: DC Auto	Input Corre Freq	:Z: 50 Ω ections: Off Ref: Int (S)	#Atten: 40 dB Preamp: Off	PNC Gate IF G	): Fast e: Off ain: Low		#Avg Type: P Trig: Video Trig Delay: -2	ower (RM 000 ms	S <mark>1</mark> 23456 WWWWWW	Center I 2.4410	Frequency 00000 GHz	Settings
1 Sper Scale	ctrum / <b>Div 10</b>	dB	•		F	Ref LvI Offset Ref Level 30.0	8.60 dB 0 dBm			Δ	Mkr3	3.749 ms -0.66 dB	Span 0.0000 Sw Zei	0000 Hz ept Span o Span	
20.0 10.0 0.00		<u></u>		1		2	Δ1 🥠	3∆1 —					F	ull Span	
-10.0 -20.0 -30.0			a data sekind			Looper Lo	aika da ki e						Start Fro 2.4410	eq 00000 GHz	
-40.0 -50.0			1911-9-14-14-14				4						Stop Fro 2.4410	eq 00000 GHz	
-60.0 Cente	r 2.441( W 8 MH	000000	GHz			#Video BW 8.	0 MHz			Swee	n 10 13	Span 0 Hz	AU CE Ster	TO TUNE	
5 Mari	ker Table		T							<u>on</u> ce			8.0000	00 MHz to	
	Mode	Trace	Scale		X	Y 1 335 dBr	Fund	tion	Fun	ction Width	Fund	tion Value	Ma	n	
2	Δ1	1	t t	(Δ)	2.876 ms	<ul> <li>-1.335 dBr</li> <li>(Δ) -0.7967 dI</li> </ul>	3						Freq Of	fset	
3	Δ1	1	t	(Δ)	3.749 ms	(Δ) -0.6622 di	3						0 Hz		
4 5 6													X Axis S Log Lin	Scale 9	
	ら	2		? Sep 6:2	0 13, 2021 27:40 PM	$\mathbb{D}$							Signal T (Span Zo	rack	

3DH5 ON TIME AND DUTY CYCLE MID CH								
Spectrum Analyzer 1			Frequency V 🔆					
KEYSIGHT         Input: RF         Input Z: 50 Ω           R L         Coupling: DC         Corrections: Off           Align: Auto         Freq Ref: Int (S)	#Atten: 40 dB PNO: Fast Preamp: Off Gate: Off IF Gain: Low	#Avg Type: Power (RMS 1 2 3 4 5 6 Trig: Video Trig Delay: -2.000 ms	Center Frequency 2.441000000 GHz					
1 Spectrum v Scale/Div 10 dB	Ref Lvi Offset 8.60 dB Ref Level 30.00 dBm	ΔMkr3 3.751 ms 0.29 dB	Span 0.00000000 Hz Swept Span					
20.0 10.0 0.00			Full Span					
-10.0 -20.0 -30.0		politika ika na si ja	Start Freq 2.441000000 GHz Stop Freq					
			2.441000000 GHz					
Center 2.441000000 GHz Res BW 8 MHz 5 Marker Table	#Video BW 8.0 MHz	Span 0 Hz Sweep 5.000 ms (8000 pts)	CF Step 8.000000 MHz					
Mode         Trace         Scale         X           1         N         1         t         1.050 m           2         Δ1         1         t         (Δ)         2.881 m           3         Δ1         1         t         (Δ)         3.751 m           4         -         -         -         -         -	Y Function Fu s -1.839 dBm s (Δ) -0.4145 dB s (Δ) 0.2881 dB	nction Width Function Value	Auto Man Freq Offset 0 Hz X Axis Scale					
Sep 13, 2021 6:57:31 PM			Log Lin Signal Track (Span Zoom)					

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## 6.3. 20 dB BANDWIDTH AND 99% BANDWIDTH

#### <u>LIMITS</u>

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2							
Section	Frequency Range (MHz)						
RSS-247 Clause 5.1 (a)	20dB Bandwidth	500KHz	2400-2483.5				
RSS-Gen Clause 6.7	99% Bandwidth	N/A	2400-2483.5				

#### TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 20dB Bandwidth:1% of the 20 dB bandwidth
	For 99% Bandwidth: 1% to 5% of the occupied bandwidth
	For 20dB Bandwidth: ≥ RBW
V D V V	For 99% Bandwidth: approximately 3×RBW
Span	approximately 2 to 5 times the 20 dB bandwidth
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 20 dB relative to the maximum level measured in the fundamental emission.

## TEST SETUP



## **RESULTS TABLE**

Test Mode	Test Channel	20dB Bandwidth (MHz)	Result
	LCH	0.822	Pass
GFSK	MCH	0.882	Pass
	НСН	0.822	Pass
8DPSK	LCH	1.236	Pass
	MCH	1.233	Pass
	HCH	1.236	Pass

Test Mode	Test Channel	99% Bandwidth (MHz)	Result
	LCH	0.84175	Pass
GFSK	MCH	0.84128	Pass
	HCH	0.83573	Pass
8DPSK	LCH	1.1911	Pass
	MCH	1.1942	Pass
	HCH	1.1894	Pass



## Test Graphs For 20dB Bandwidth Part:



20 DB BANDWIDTH MID CH_DH5							
Spectrum Analyzer 1			Frequency V				
KEYSIGHT         Input: RF         Input: Z           RL         Coupling: DC         Correct           Align: Auto         Freq Rd	: 50 Ω #Atten: 40 dB PNO: E tions: Off Preamp: Off Gate: C ef: Int (S) IF Gain	lest Wide #Avg Type: Power (RMS) off Avg Hold: 100/100 : Low Trig: Free Run	1 2 3 4 5 6 M WWWWW 2.441000000 GHz Settings				
1 Spectrum V Scale/Div 10 dB Log	Ref Lvi Offset 8.60 dB Ref Level 30.00 dBm	ΔMkr3	Span         Span           882 kHz         3.0000000 MHz           0.28 dB         Swept Span           Zero Span         Zero Span				
20.0 10.0 0.00	2		Full Span				
-10.0 -20.0 -30.0	1 And Man	3Δ1	Start Freq           DL1-24 89 dBm         2.439500000 GHz				
-40.0 -50.0 m when when the mark have		- MA Manana	Stop Freq 2.442500000 GHz				
-00.0 Center 2.441000 GHz #Res BW 10 kHz	#Video BW 30 kHz	Spar Sweep 28.7 m	AUTO TUNE				
5 Marker Table			300.000 kHz				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	X Y Function ) 559 GHz -25.98 dBm ) 928 GHz -4.890 dBm 882 kHz (Δ) 0.2750 dB	n Function Wiath Function	Freq Offset 0 Hz				
4 5 6			X Axis Scale Log Lin				
	13, 2021 :53 PM		Signal Track (Span Zoom)				

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20 DB BANDWIDTH LOW CH_3DH5							
Spectrum Analyzer 1				Frequency V			
KEYSIGHT     Input: RF     In       R L     ↔     Coupling: DC     C       Align: Auto     F	nput Z: 50 Ω #Atten: 40 dB Corrections: Off Preamp: Off Freq Ref: Int (S)	PNO: Best Wide #Avg Gate: Off Avg - IF Gain: Low Trig: I Sig Track: Off	Type: Power (RMS 1 2 3 4 5           Iold: 100/100           Free Run           P P P P P	6 Center Frequency 2.402000000 GHz Settings			
1 Spectrum V Scale/Div 10 dB	Ref LvI Offset 8.5 Ref Level 30.00 di	6 dB Bm	ΔMkr3 1.236 MH 0.04 d	Span           3.00000000 MHz           B           Swept Span           Zero Span			
20.0 10.0 0.00 -10.0 -20.0	2 01_~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		.1	Full Span Start Freq 2 400500000 GHz			
-30.0 -40.0 -50.0			when you want	Stop Freq 2.403500000 GHz			
Center 2.402000 GHz #Res BW 15 kHz	#Video BW 47 k	Hz	Span 3.000 M Sweep 12.7 ms (1001 p	AUTO TUNE Hz S) CF Step			
5 Marker Table v Mode Trace Scale 1 N 1 f	X Y 2.401 379 GHz -24.32 dBm	Function Function	Width Function Value	300.000 kHz Auto Man			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2:401 928 GHz -4.275 dBm 1.236 MHz (Δ) 0.03988 dB			0 Hz X Axis Scale			
4 h C 1 ?	Sep 13, 2021 6:51:13 PM			Signal Track (Span Zoom)			

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	20 DB BANDWIDTH MID CH_3DH5														
Spect Swep	rum Ana t SA	lyzer 1	•	+								₽	Frequency	<b>∕ ▼</b>	$\sum_{i=1}^{N}$
KEY RL	SIGH1	Input: F Couplin Align: 7	RF ng: DC Auto	Input Z: 50 Correction Freq Ref:	)Ω # is:Off I Int(S)	#Atten: 40 dB Preamp: Off	PNO: E Gate: ( IF Gair	Best Wide Off n: Low	#Avg Type: F Avg Hold: 10 Trig: Free Ri	Power (RM )0/100 un	S123456 MWWWWW	Center 2.4410	Frequency 000000 GHz	Setting	js
1 Spe Scale	ctrum /Div 10	dB	v		Re	ef LvI Offset 8 ef Level 30.00	Sig fra 60 dB dBm	ack. Oli	Δ	Mkr3 1	1.233 MHz 0.23 dB	Span 3.0000	00000 MHz vept Span		
Log 20.0 10.0 0.00												Ze	ero Span Full Span		
-10.0 -20.0 -30.0					~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	m.A.A.		· · · · · · · · · · · · · · · · · · ·	3∆1		DL1 -22.37 dBm	Start F 2.439	req 500000 GHz		
-40.0 -50.0 -60.0	ᡊ᠆ᡘᠬᠬᠯ᠈ᡀᡘᡑ	LL Contraction	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	wowning					- hanne	Non	-norman - norman	Stop Fi 2.442	req 500000 GHz		
Cente #Res	er 2.4410 BW 15 I	00 GHz Hz			#	Video BW 47	' kHz		Sw	Sp eep 12.7	oan 3.000 MHz ms (1001 pts)	CF Ste			
5 Mar	ker Table Mode	Trace	▼ Scale	X		Y	Functi	on F	unction Width	Fund	ction Value	AL	JU KHZ uto an		
1 2 3 4	Ν Ν Δ1	1 1 1	f f	2.440 3 2.440 93 (Δ) 1.23	79 GHZ 31 GHz 33 MHz (Δ	-22.79 dBm -2.366 dBm () 0.2298 dB						Freq O 0 Hz	ffset		
5												X Axis Lo	Scale og n		
	う	6		Sep 13, 6:57:41	2021 PM							Signal (Span Z	Track oom)		

20	DB BANDWIDTH HI	GH CH_3DH5	
Spectrum Analyzer 1		i	Frequency 🔹 🔆
KEYSIGHT         Input: RF         Input Z: 50 Ω         #/           RL         ↔         Coupling: DC         Corrections: Off         P           Align: Auto         Freq Ref: Int (S)         Freq Ref: Int (S)         F	Atten: 40 dB PNO: Best Wide # Preamp: Off Gate: Off / IF Gain: Low	#Avg Type: Power (RMS 1 2 3 4 5 6 Avg Hold: 100/100 Trig: Free Run	Center Frequency Settings 2.480000000 GHz
1 Spectrum ▼ Ref Scale/Div 10 dB Ref	f Lvl Offset 8.60 dB f Level 30.00 dBm	ΔMkr3 1.236 MHz -0.34 dB	Span 3.00000000 MHz Swept Span
20.0	2		E Zero Span Full Span
-10.0 -20.0 -30.0	and har and har	3Δ1	Start Freq 2.478500000 GHz
-40.0 -50.0 -60.0		Mun Mannan market	2.481500000 GHz
Center 2.480000 GHz # #Res BW 15 kHz	Video BW 47 kHz	Span 3.000 MHz Sweep 12.7 ms (1001 pts)	CF Step 300.000 kHz
5 Marker lable Mode Trace Scale X 1 N 1 f 2.479 382 GHz	Y Function Function	ction Width Function Value	Auto Man
2 N 1 f 2.479 934 GHz 3 Δ1 1 f (Δ) 1.236 MHz (Δ) 4 5	-1.090 dBm ) -0.3391 dB		Freq Offset 0 Hz X Axis Scale
6 Sep 13, 2021			Log Lin Signal Track
□ □ □ □ 6:58:36 PM →			(Span Zoom)

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#### Test Graphs For 99% Bandwidth Part:





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# 6.4. OUTPUT POWER

#### LIMITS

FCC Part15 (15.247) , Subpart C RSS-247 ISSUE 2						
Section	Test Item	Limit	Frequency Range (MHz)			
FCC 15.247 (b) (1), RSS-247 Clause 5.4 (b)	Peak Conducted Output Power	Hopping channel carrier frequencies separated by a minimum of 25KHz or the 20dB bandwidth of the hopping channel: 1 watt or 30dBm; Hopping channel carrier frequencies that are separated by 25KHz or two- thirds of the 20 dB bandwidth of hopping channel: 125mW or 21dBm	2400-2483.5			

## TEST PROCEDURE

Disable the hopping function, 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	≥ 20 dB bandwidth of the emission being measured
VBW	≥RBW
Span	Approximately five times the 20 dB bandwidth
Trace	Max hold
Sweep time	Auto couple

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

## TEST SETUP

for peak power measurement:



## 6.4.1. GFSK MODE

Channel	Frequency	Maximum Output Power	Result	
	(MHz)	(dBm)		
Low	2402	-5.09	Pass	
Middle	2441	-6.83	Pass	
High	2480	-5.32	Pass	







OUTPUT POWER HIGH CH								
Spectrum Anal Swept SA	yzer 1	F					Frequency	v 🔆
KEYSIGHT RL ↔→	Input: RF Coupling: DC Align: Auto	Input Ζ: 50 Ω Corrections: Off Freq Ref: Int (S)	#Atten: 40 dB Preamp: Off	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Pow Avg Hold: 100/1 Trig: Free Run	ver (RMS 1 2 3 4 5 6 100 M WWWW P P P P P P	Center Frequency 2.480000000 GHz	Settings
1 Spectrum Scale/Div 10 c Log	₹ IB		Ref LvI Offset 8.6 Ref Level 30.00 d	0 dB Bm	Mkr1	2.480 112 GHz -5.32 dBm	Span 8.00000000 MHz Swept Span Zero Span	
20.0							Full Span Start Freq	
-10.0			<u>1</u>		an a		2.476000000 GHz Stop Freq 2.484000000 GHz	
-20.0							AUTO TUNE CF Step	
-40.0							Auto Man	
-60.0	00 GHz		#Video BW 8.0 A	AH2		Span 8 000 MHz	Preq Offset 0 Hz X Axis Scale	
#Res BW 3.0 I		Dec 13, 2021 10:43:26 AM			Swee	p 1.00 ms (1001 pts)	Log Lin Signal Track (Span Zoom)	

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## 6.4.2. 8DPSK MODE

Channel	Frequency	Maximum PK Conducted Output Power	Result
	(MHz)	(dBm)	
Low	2402	-2.29	Pass
Middle	2441	-3.92	Pass
High	2480	-2.72	Pass







	OUTPUT PO	WER HIGH CH	
Spectrum Analyzer 1			Frequency V
KEYSIGHT     Input: RF     Input: Z       RL     Imput: RF     Coupling: DC       Align: Auto     Freq Re	50 Ω #Atten: 40 dB PNO: Fas ions: Off Preamp: Off Gate: Off ef. Int (S) IF Gain: L Sig Track	st #Avg Туре: Power (RMS 1 2 3 4 5 6 Avg Hold: 100/100 .ow Trig: Free Run РРРРРР : Off РРРРРР	Center Frequency 2.48000000 GHz
1 Spectrum v Scale/Div 10 dB Log	Ref LvI Offset 8.60 dB Ref Level 30.00 dBm	Mkr1 2.480 136 GHz -2.72 dBm	Span 8.00000000 MHz Swept Span Zero Span
20.0			Full Span Start Freq
-10.0	1	when where a start and a start	2.476000000 GHz Stop Freq 2.484000000 GHz
-20.0			AUTO TUNE CF Step
-40.0			Auto
-60.0			Freq Offset 0 Hz X Axis Scale
Center 2.480000 GHz #Res BW 3.0 MHz	#Video BW 8.0 MHz	Span 8.000 MHz Sweep 1.00 ms (1001 pts)	Log Lin
	:20 AM		(Span Zoom)

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# 6.5. CARRIER HOPPING CHANNEL SEPARATION

#### **LIMITS**

FCC Part15 (15.247) , Subpart C RSS-247 ISSUE 2				
Section	Test Item	Frequency Range (MHz)		
FCC 15.247 (a) (1), RSS-247 Clause 5.1 (b)	Carrier Hopping Channel Separation	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25KHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25KHz or two-thirds of the 20 dB bandwidth of the hopping channel.	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
Span	wide enough to capture the peaks of two adjacent channels
Detector	Peak
RBW	Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel
VBW	≥RBW
Trace	Max hold
Sweep time	Auto couple

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.

#### TEST SETUP





**RESULTS** 

## 6.5.1. GFSK MODE

Channel	Carrier Hopping Channel Separation (MHz)	Result
Middle	1.000	PASS

	Channel Sepa	ration MID CH	
Spectrum Analyzer 1			Frequency 🕇 🔆
KEYSIGHT         Input: RF         Input: Z: 50 Ω           RL         Coupling: DC         Corrections: Off           Align: Auto         Freq Ref: Int (S)	#Atten: 40 dB PNO: Best Preamp: Off Gate: Off IF Gain: Lo	Wide         #Avg Type: Power (RMS 1 2 3 4 5 6 Avg Hold: 100/100         M WWWW           v         Trig: Free Run         M WWWWW	Center Frequency 2.441500000 GHz
1 Spectrum V Scale/Div 10 dB	Ref LvI Offset 8.60 dB Ref Level 30.00 dBm	ΔMkr2 1.000 MHz 0.21 dB	Span 2.00000000 MHz
20.0			Eull Span
10.0 0.00		2Δ1	Start Freq 2.440500000 GHz
-10.0 M			Stop Freq 2.442500000 GHz
-30.0			AUTO TUNE CF Step
-40.0			Auto Man
-60.0			Freq Offset 0 Hz Y Avis Scale
Start 2.440500 GHz #Res BW 100 kHz	#Video BW 300 kHz	Stop 2.442500 GHz Sweep 1.00 ms (1001 pts)	

Note: For 20 dB Bandwidth of The Hopping Channel, please refer to clause 6.3.



## 6.5.2. 8DPSK MODE

Channel	Carrier Hopping Channel Separation (MHz)	Result
Middle	1.006	PASS

			Chann	el Separatio	on MID CH			
Spectrum Analyzer Swept SA	1 <b>• +</b>	•					Frequency	
RL + Alig	ut: RF ipling: DC in: Auto	Input Z: 50 Ω Corrections: Off Freq Ref: Int (S)	#Atten: 40 dB Preamp: Off	PNO: Best Wide Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Power (R Avg Hold: 100/100 Trig: Free Run	MS 1 2 3 4 5 6 M WWWWW P P P P P P P	Center Frequency 2.441500000 GHz	Settings
1 Spectrum Scale/Div 10 dB	•	F	Ref LvI Offset 8.6 Ref Level 30.00 c	60 dB iBm	ΔMkr2	1.006 MHz 0.23 dB	Span 2.00000000 MHz Swept Span	
20.0							Full Span	
-10.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	man har			<u>2</u> Δ1	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2.440500000 GHz Stop Freq 2.442500000 GHz	
-20.0							AUTO TUNE	
-40.0							200.000 kHz Auto Man	
-60.0							Freq Offset 0 Hz	
Start 2.440500 GHz #Res BW 100 kHz		Son 13, 2024	#Video BW 300	kHz	Sto Sweep 1.0	p 2.442500 GHz 0 ms (1001 pts)	X Axis Scale Log Lin	
<b>1</b> 0 6		11:00:53 PM					Signal Track (Span Zoom)	

Note: For 20 dB Bandwidth of The Hopping Channel, please refer to clause 6.3.



# 6.6. NUMBER OF HOPPING FREQUENCY

#### <u>LIMITS</u>

FCC Part15 (15.247),Subpart C RSS-247 ISSUE 2			
Section Test Item Limit			
15.247 (a) (1) III	Number of Hopping Frequency	at least 15 hopping channels	
RSS-247 Clause 5.1 (d)	Number of Hopping Frequency	at least 15 hopping channels	

#### TEST PROCEDURE

Connect the EUT to the spectrum Analyzer and use the following settings:

Detector	Peak
RBW	To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller
VBW	≥RBW
Span	The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen
Trace	Max hold
Sweep time	Auto couple

Set EUT to transmit maximum output power and switch on frequency hopping function. then set enough count time (larger than 5000 times) to get all the hopping frequency channel displayed on the screen of spectrum analyzer.

Count the quantity of peaks to get the number of hopping channels.

Normal Mode: 79 Channels observed.

AFH Mode: 20 Channels declared.

## TEST SETUP





**RESULTS** 

## 6.6.1. GFSK MODE

Hopping numbers	Limit	Results
79	>15	Pass



## 6.6.2. 8DPSK MODE

Hopping numbers	Limit	Results
79	>15	Pass

Spectrum Analy Swept SA	zer 1 ү .	+					Sweep	<b>、</b> 学
KEYSIGHT RL	Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Corrections: Off Freq Ref: Int (S)	#Atten: 40 dB Preamp: Off	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Power (RMS Avg Hold:>1000/1000 Trig: Free Run	<mark>1</mark> 23456 М₩₩₩₩₩ РРРРРР	Sweep Time 8.00 ms	Sweep/ Control Sweep
1 Spectrum Scale/Div 10 dl Log	т В	R	Ref LvI Offset 8. Ref Level 30.00	56 dB dBm			Man Sweep / Measure Continuous Single	Config
20.0							Restart	
0.00	ሦህዒላለትንለሌላ	ኊኊኊዀዀዀ	ሊኊኊጚጚ	www.www.	AN A	,41,11,11,11,11,11,11,11,11,11,11,11,11,		
-20.0								
-40.0						h		
-50.0								
Start 2.40000 G #Res BW 100 k	Hz Hz		#Video BW 300	kHz	Stop : Sweep 8.00 m	2.48350 GHz is (1001 pts)		
<b>1</b> 5		Sep 13, 2021 11:06:57 PM						



# 6.7. TIME OF OCCUPANCY (DWELL TIME)

#### LIMITS

FCC Part15 (15.247), Subpart C					
Section	Test Item	Limit			
15.247 (a) (1) III	Time of Occupancy (Dwell Time)	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.			

#### TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	1 MHz
VBW	≥RBW
Span	zero span
Trace	Max hold
Sweep time	As necessary to capture the entire dwell time per hopping channel

a. The transmitter output (antenna port) was connected to the spectrum analyzer

- b. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- d. Sweep Time is more than once pulse time.
- e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- f. Measure the maximum time duration of one single pulse.
- g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
- h. Measure the maximum time duration of one single pulse. A Period Time = (channel number)\*0.4

For Normal Mode (79 Channel):

DH1 Time Slot: Reading \* (1600/2)\*31.6/(channel number) DH3 Time Slot: Reading \* (1600/4)\*31.6/(channel number) DH5 Time Slot: Reading \* (1600/6)\*31.6/(channel number) For AFH Mode (20 Channel): DH1 Time Slot: Reading \* (800/2)\*8/(channel number)

DH3 Time Slot: Reading \* (800/4)\*8/(channel number) DH5 Time Slot: Reading \* (800/6)\*8/(channel number)

#### TEST SETUP



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## 6.7.1. GFSK MODE

Normal Mode					
Packet	Channel	Burst Width [ms/hop/ch]	Dwell Time [s]	Results	
DH1	МСН	0.373	0.119	PASS	
DH3	MCH	1.628	0.260	PASS	
DH5	MCH	2.874	0.307	PASS	
		AFH Mod	e		
DH1	MCH	0.373	0.060	PASS	
DH3	MCH	1.628	0.130	PASS	
DH5	MCH	2.874	0.154	PASS	

## **Test Graph**





TIME OF SINGLE SLOT (DH3)						
Spectrum Analyzer 1 Swept SA	• +				Frequency	· *
KEYSIGHT       Input: RF         R L       Coupling: D         Align: Auto	Input Ζ: 50 Ω C Corrections: Off Freq Ref: Int (S)	#Atten: 30 dB PNO: Preamp: Off Gate: IF Ga Sig T	Fast Avg Type: Log-I Off Trig: Video iin: Low Trig Delay: -2.00 rack: Off	Power         1 2 3 4 5 6           00 ms         WWWWWW           P P P P P P	Center Frequency 2.441000000 GHz	Settings
1 Spectrum   Scale/Div 10 dB Log 10 0	R	ef Level 20.00 dBm	ΔN	Mkr1 1.628 ms 12.36 dB	0.00000000 Hz Swept Span Zero Span	
0.00	And des a letter source of the star	X <sub>2</sub>			Full Span Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz	
Center 2.441000000 GHz Res BW 1.0 MHz 5 Marker Table	#	Video BW 3.0 MHz	Sweep	Span 0 Hz 5.000 ms (8001 pts)	CF Step 1.000000 MHz	
Mode Trace Sc. $1  \Delta 2  1  1$ 2  F  1  1 4  4 5  5 6  1	ale         X           (Δ)         1.628 ms (Δ           2.000 ms         2.000 ms           Sep 14, 2021         3:27:18 PM	Y Func 12.36 dB -33.09 dBm	tion Function Width	Function Value	Man Freq Offset 0 Hz X Axis Scale Log Lin Signal Track	

	TIME OF SINGLE SLOT (DH5)							
Spectrum Anal Swept SA	yzer 1	+					Frequency	· · · · · · · · · · · · · · · · · · ·
RL +>+	Input: RF Coupling: DC Align: Auto	Input Ζ: 50 Ω Corrections: Off Freq Ref: Int (S)	#Atten: 30 dB Preamp: Off	PNO: Fast Gate: Off IF Gain: Low	Avg Type: Log-Power Trig: Video Trig Delay: -2.000 ms	123456 W\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Center Frequency 2.441000000 GHz	Settings
1 Spectrum Scale/Div 10 c	JB		Ref Level 20.00 c	iBm	ΔMkr1	2.874 ms 7.65 dB	Span 0.00000000 Hz Swept Span Zero Span	
10.0 0.00 -10.0 -20.0 -30.0				1Δ2			Full Span Start Freq 2.441000000 GHz	
-40.0 -50.0 -60.0 -70.0	entre oferfill of the oferfill			a Makata balan <mark>Ushaka sakabara</mark>	n ya katala k		Stop Freq 2.441000000 GHz	
Center 2.4410 Res BW 1.0 M 5 Marker Table	Center 2.441000000 GHz #Video BW 3.0 MHz Span 0 Hz Res BW 1.0 MHz Sweep 8.000 ms (8001 pts) 5 Marker Table 1.000000 MHz							
Mode 1 Δ2 2 F 3 4 5 6	Trace Scale 1 t ( 1 t	X Δ) 2.874 ms 2.000 ms	Υ (Δ) 7.648 dB -34.41 dBm	Function Fu	nction Width Fund	ction Value	Auto Man Freq Offset 0 Hz X Axis Scale	
<b>1</b> 5	C 🗌 ?	Sep 14, 2021 3:29:46 PM					Signal Track (Span Zoom)	

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## 6.7.2. 8DPSK MODE

Normal Mode					
Packet	Channel	Burst Width [ms/hop/ch]	Dwell Time [s]	Results	
3DH1	МСН	0.381	0.122	PASS	
3DH3	МСН	1.631	0.260	PASS	
3DH5	МСН	2.873	0.306	PASS	
		AFH Mod	е		
3DH1	МСН	0.381	0.061	PASS	
3DH3	MCH	1.631	0.130	PASS	
3DH5	MCH	2.873	0.153	PASS	

## **Test Graph**





	TIME OF SINGLE S	SLOT (3DH3)	
Spectrum Analyzer 1			Frequency V 🔆
KEYSIGHT         Input: RF         Input Z: 50 Ω           R L         →→         Coupling: DC         Corrections: Off           Align: Auto         Freq Ref: Int (S)         Freq Ref: Int (S)	#Atten: 30 dB PNO: Fast Preamp: Off Gate: Off IF Gain: Low Sig Track: Off	Avg Type: Log-Power         1 2 3 4 5 6           Trig: Video         W WWW WW           Trig Delay: -2.000 ms         P P P P P	Center Frequency 2.441000000 GHz
1 Spectrum v Scale/Div 10 dB Log	Ref Level 20.00 dBm	ΔMkr1 1.631 ms 11.37 dB	Span 0.00000000 Hz Swept Span Zero Span
0.00 -10.0 <b>Hereinschleicher angeste</b> -20.0 -30.0 -40.0 -50.0 <b>Hereinschleicher angeste</b> -20.0 <b>Hereinschleicher angeste</b>			Full Span Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz
-70.0 Center 2.441000000 GHz Res BW 1.0 MHz	#Video BW 3.0 MHz	bu الماريك المراجع الماريك Span 0 Hz Sweep 5.000 ms (8001 pts)	AUTO TUNE CF Step
5 Marker Table            Mode         Trace         Scale         X           1         Δ2         1         t         (Δ)         1.631 m.           2         F         1         t         1.701 m.           3         -         -         -         -           4         -         -         -         -           6         -         -         -         -	Y Function F s (Δ) 11.37 dB s -21.49 dBm	Function Width Function Value	1.000000 MHz Auto Man Freq Offset 0 Hz X Axis Scale Log Lin
Sep 14, 2021 3:33:43 PM			Signal Track (Span Zoom)



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# 6.8. CONDUCTED SPURIOUS EMISSION

## <u>LIMITS</u>

FCC Part15 (15.247) , Subpart C RSS-247 ISSUE 2					
Section	Test Item	Limit			
FCC §15.247 (d)	Conducted Spurious Emission	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power			
RSS-247 5.5	Conducted Spurious Emission	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

For Band-edge use the following settings:

Detector	Peak
RBW	100 kHz
VBW	300 kHz
Span	Wide enough to capture the peak level of the emission operating on the channel closest to the band edge
Trace	Max hold
Sweep time	Couple

For Spurious Emission use the following settings:

Detector	Peak
RBW	100 kHz
VBW	300 kHz
Span	Wide enough to capture the peak level of the emission operating on the channel closest to the band edge
Trace	Max hold
Sweep time	Couple

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

#### TEST SETUP



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## 6.8.1. GFSK MODE

#### Part I: CONDUCTED BANDEDGE

#### **RESULTS TABLE**

Test Mode	Test Channel	Test Results	Verdict
OFOK	LCH	Refer to the test Graphs	PASS
Grok	НСН	Refer to the test Graphs	PASS



## LOW CH BANDEDGE







### Part II: CONDUCTED SPURIOUS EMISSIONS

#### RESULTS TABLE

Test Mode	Channel	Pref(dBm)	Puw(dBm)	Verdict
	LCH	Refer to the test Graphs	<limit< td=""><td>PASS</td></limit<>	PASS
GFSK	MCH	Refer to the test Graphs	<limit< td=""><td>PASS</td></limit<>	PASS
	HCH	Refer to the test Graphs	<limit< td=""><td>PASS</td></limit<>	PASS

#### SPURIOUS EMISSIONS, LOW CHANNEL





LCF	SPURIOUS EMIS	SION_30MH;	z~1GHz	
Spectrum Analyzer 1 Swept SA KEYSIGHT Input RF	Input Z: 50 Ω #Atten: 20 dB PNO: Fast	#Ava Type: Power (RMS 1 2 3 4 5 6	Frequency v 🔆	
RL →→ Align: Auto	Corrections: Off Preamp: Off Gate: Off Freq Ref: Int (S) IF Gain: Low Sig Track: Off	Avg Hold: 10/10 Trig: Free Run P P P P P P	515.000000 MHz	
1 Spectrum v Scale/Div 10 dB	Ref LvI Offset 8.56 dB Ref Level 18.56 dBm	Mkr1 800.54 MHz -49.49 dBm	970.000000 MHz Swept Span	
8.55 -1.44 -11.4			Full Span	
-21.4 -31.4 -41.4		01-22.98 dBm	Start Freq 30.000000 MHz	
51.4 61.4 71.4 <b>autototototototototototototototototototo</b>		n para la la serie por la construcción de la co	1.000000000 GHz	
Start 0.0300 GHz #Res BW 100 kHz	#Video BW 300 kHz	Stop 1.0000 GHz Sweep 94.0 ms (30001 pts)	CF Step	
5 Marker Table V Mode Trace Sco	le X Y Function	Function Width Function Value	Auto Man	
			Freq Offset 0 Hz	
5 6			Log Lin	
1 5 C 1	4:39:54 PM	X 🕺 🎞	Signal Track (Span Zoom)	



Note: The point 1 which exceeds the limit is 2.4G main carrier.

## SPURIOUS EMISSIONS, MID CHANNEL





MCH SPURIOU	IS EMISS	SION_30MHz	~1GHz			
5	Spectrum Analyzer 1 Swept SA	· +			Frequency 🕇 🔆	
I	KEYSIGHT Input RF RL ↔ Coupling: DI Align: Auto	Input Z: 50 Ω #Atten: 20 dB Corrections: Off Freq Ref: Int (S)	PNO:Fast ≇ Gate:Off / IFGain:Low 1 Sig Track:Off	#Avg Type: Power (RMS 1 2 3 4 5 6 Avg Hold: 10/10 Trig: Free Run P P P P P	Center Frequency 515.00000 MHz	
	1 Spectrum v Scale/Div 10 dB	Ref LvI Offset Ref Level 18.6	8.60 dB 0 dBm	Mkr1 813.63 MHz -46.61 dBn	970.000000 MHz Swept Span	
	8.60 -1.40 -11.4				Full Span	
	-21.4			QL1-21.84 dBn	Start Freq 30.000000 MHz	
	-51.4 -61.4 -71.4				Stop Freq 1.00000000 GHz	
s	Start 0.0300 GHz	#Video BW 3	00 kHz	Stop 1.0000 GH	AUTO TUNE	
1	#Res BW 100 kHz 5 Marker Table v			Sweep 94.0 ms (30001 pts	) CF Step 97.000000 MHz	
	Mode Trace Sca		Function Func	ction Width Function Value	Auto Man	
	2 3	613.63 MIT2 -46.61 GDr			Freq Offset 0 Hz	
	5				X Axis Scale Log Lin	
	<u>ר</u> ר	? Sep 13, 2021 6:28:26 PM			Signal Track (Span Zoom)	



Note: The point 1 which exceeds the limit is 2.4G main carrier.

## SPURIOUS EMISSIONS, HIGH CHANNEL





HCH SPURIOUS	EMISSI	ON_30MHz	~1GHz	<u>-</u>			
Spectr	rum Analyzer 1	+				Frequency	×1/2 715
KEY RL	SIGHT Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω #Atten: 20 dB Corrections: Off Freq Ref: Int (S)	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Powe Avg Hold: 10/10 Trig: Free Run	er (RMS <mark>1</mark> 23456 M\\\\\\\\\ PPPPPP	Center Frequency Setting	ġs
1 Spec Scale	ctrum v /Div 10 dB	Ref LvI Offset Ref Level 18.6	3.60 dB ) dBm	Mkr1	1 826.66 MHz -44.54 dBm	970.000000 MHz	
8 60 -1.40						Zero Span Full Span	
-21.4 -31.4					0L1 -19.83 dBm	Start Freq 30.000000 MHz	
-51.4 -61.4	Language and a strategy of the	ana kana ata mana kanakara kanakarata di	uter hyster of a star for the start of			Stop Freq 1.000000000 GHz	
Start 0	0.0300 GHz	#Video BW 30	0 kHz		Stop 1.0000 GHz	AUTO TUNE	
#Res I 5 Mark	BW 100 kHz ker Table v			Sweep 9	4.0 ms (30001 pts)	CF Step 97.000000 MHz	
	Mode Trace Scale	X Y 826 66 MHz - 44 54 dBn	Function F	unction Width	Function Value	Auto Man	
234						Freq Offset 0 Hz	
5						X Axis Scale Log Lin	
¥	<b>ا</b> م	Sep 13, 2021				Signal Track (Span Zoom)	



Note: The point 1 which exceeds the limit is 2.4G main carrier.



#### SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





## 6.8.2. 8DPSK MODE

## Part I: CONDUCTED BANDEDGE

## **RESULTS TABLE**

Test Mode	Test Channel	Test Results	Verdict
2009V	LCH	Refer to the test Graphs	PASS
ODESK	НСН	Refer to the test Graphs	PASS





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#### Part II: CONDUCTED SPURIOUS EMISSIONS

#### **RESULTS TABLE**

Test Mode	Channel	Pref(dBm)	Puw(dBm)	Verdict
	LCH	Refer to the test Graphs	<limit< td=""><td>PASS</td></limit<>	PASS
8DPSK	MCH	Refer to the test Graphs	<limit< td=""><td>PASS</td></limit<>	PASS
	HCH	Refer to the test Graphs	<limit< td=""><td>PASS</td></limit<>	PASS







LCH SPURIOUS	S EMISSIC	DN_30MHz	~1GHz					
	Spectrum Analyzer 1 Swept SA	+				Frequency	( ) 崇	
	KEYSIGHT Input: RF RL + Coupling: DC Align: Auto	Input Z: 50 Ω #Atten: 20 dE Corrections: Off Preamp: Off Freq Ref: Int (S)	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	#Avg Type: Power (R Avg Hold: 10/10 Trig: Free Run	MS <mark>1</mark> 2 3 4 5 6 M <del>wwww</del> P P P P P P	Center Frequency 515.000000 MHz	Settings	
	1 Spectrum v Scale/Div 10 dB	Ref LvI Offse Ref Level 18.	t 8.56 dB 56 dBm	Mkr1 8	300.86 MHz -48.76 dBm	970.000000 MHz Swept Span Zero Span		
	-1.44					Full Span		
	-21.4			1	DL1-24.19 dBm	Start Freq 30.000000 MHz		
	-61.4 -61.4					Stop Freq 1.000000000 GHz		
	-71.4 Start 0.0300 GHz	#Video BW	300 kHz	s	top 1.0000 GHz	AUTO TUNE		
	#Res BW 100 kHz 5 Marker Table v			Sweep 94.0	ms (30001 pts)	CF Step 97.000000 MHz		
	Mode Trace Scale	X Y 800 86 MHz 48 76 dF	Function	Function Width Fu	nction Value	Auto Man		
	2	000.00 mm2 40.10 02				Freq Offset 0 Hz		
	5					X Axis Scale Log Lin		
	<b>1</b> 961	Sep 26, 2021 5:18:40 PM				Signal Track (Span Zoom)		



Note: The point 1 which exceeds the limit is 2.4G main carrier.

## SPURIOUS EMISSIONS, MID CHANNEL





LCH SPURIOUS	S EMISSION_30MHz~1GHz
	Spectrum Analyzer 1 🕴 🙀 Frequency 🔹 👯
	KEYSIGHT     Input Z: 50 Ω     #Atten 20 dB     PND. Fast.     #Atten 20 dB     PND. Fast.     #Avg Type. Power (RMS 1 2 3 4 5 6 Conter Frequency       RL     →     Conjung DC     Contections: Off     Peamp: Off     Gate: Off     Augihidd: 1010       RL     →     Augin Auto     Freq. Ref. Int (S)     IF can Low     Ting Free Run     P P P P P       Context     Sig Track. Off     Sig Track. Off     Sig Track. Off     Sig Track. Off
	Spectrum         Ref Lvi Offset 8.60 dB         Mkr1         813.82 MHz         Span           Scale/Div 10 dB         Ref Level 18.60 dBm         -46.49 dBm
	8 60
	31.4 30.000000 MHz 41.4 51.4 Stop Freq 1 00000000 GHz
	013 THE REPORT OF THE REPORT
	Artes Bin 100 km2 Sweep Sku mis (20001 pils) Cr Skep 5 Marker Table • 97.000000 MHz Mode Trace Scale X Y Function Vieth Function Vieth Function Value
	1         1         6         6         6         6         6         6         6         6         6         7         6         7 <th7< th=""> <th7< th=""> <th7< th=""> <th7< th=""></th7<></th7<></th7<></th7<>
	5 X Avis Scale
	🗄 🗅 🖓 🖿 ? Sep 26, 2021



Note: The point 1 which exceeds the limit is 2.4G main carrier.

## SPURIOUS EMISSIONS, HIGH CHANNEL

