

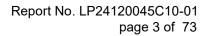
TEST REPORT

Applicant: Address:	Wuchao (Shenzhen) Technology Development Co., Ltd. Room 1916, Tower A, Rongchuang Zhihui Building, Minzhi Street, Longhua District, Shenzhen City, Guangdong, China				
Manufacturer: Address:	Room 1916, Tower A,	Wuchao (Shenzhen) Technology Development Co., Ltd. Room 1916, Tower A, Rongchuang Zhihui Building, Minzhi Street, Longhua District, Shenzhen City, Guangdong, China			
Factory: Address:	Room 1916, Tower Á,	Fechnology Development Co., Ltd. Rongchuang Zhihui Building, Minzhi Street, enzhen City, Guangdong, China			
E.U.T.:	True Wireless Earpho	ones			
Model Number:	HY-C09				
Trade Mark:	HYUNDAI				
FCC ID:	2BMKL-HY-C09				
Date of Receipt:	2024-12-21	Date of Test: 2024-12-21 to 2024-12-24			
Test Specification:	FCC 47 CFR Part 15,	Subpart C			
Test Result:	The equipment under requirements of the s	test was found to be compliance with the tandards applied.			
Prepared by:		Approved & Authorized Signer:			
Jerry Hu/ Engine	er	Frank Shen/ Manager			
Date: 2024-12-24	4	Issue Date: 2024-12-31			
		sample of above mentioned products. It is not permitted to ongguan Lepont Service Co., Ltd.			



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	Revision History of This Test Report				
Report Number	Description	Issued Date			
LP24120045C10-01	Initial Issue	2024-12-31			



1. GENERAL PRODUCT INFORMATION

1.1. PRODUCT FUNCTION

Refer to Technical Construction Form and User Manual.

1.2. EUT TECHNICAL DESCRIPTION

Product Name:	True Wireless Earphones
Model No.:	HY-C09
Test Model No:	HY-C09
Difference:	N/A
Serial No.:	N/A
Test sample(s) ID:	LP24120045C10-S001
Sample(s) Status	Engineer sample
Hardware:	V 1.0
Software:	V 1.0
Operation Frequency:	2402MHz-2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation type:	GFSK, π/4-DQPSK, 8DPSK
Antenna Type:	Chip Antenna
Antenna gain:	2.7dBi
Power supply:	 ☑ DC 5V form USB ☑ DC 3.7V form battery



1.3. INDEPENDENT OPERATION MODES

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (1Mbps for GFSK modulation; 2Mbps for pi/4-DQPSK modulation; 3Mbps for 8DPSK modulation) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441		
1	2403	40	2442	76	2478
2	2404	41	2443	77	2479
				78	2480
Note: fc=2402MHz+(k-1)×1MHz k=1 to 79					

Frequency and Channel list:

Test Frequency and channel

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441	78	2480



1.4. TEST SOFTWARE

Software	Description
FCC assist 1.0.2.2.exe	Set the COM Port Test Tool to set the
	corresponding Test conditions

1.5. GENERAL CONDITION

	Temperature	Humidity
Ambient Condition:	23.5 ℃	49.1%RH

1.6. SUPPORT EQUIPMENT

EUT Cable List and Details				
Cable Description Length (m) Shielded/Unshielded With / Without Ferrite				
/	/	/	/	

Auxiliary Cable List and Details				
Cable Description Length (m) Shielded/Unshielded With / Without Ferrite				
/	/	/	/	

Auxiliary Equipment List and Details					
Description	Description Manufacturer Model Serial Number				
Laptop computer Lenovo Xiaoxin Pro IA5HR PF490VB0					

Notes:

1.All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2.Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



2. TEST STANDARDS AND SITES

2.1. DESCRIPTION OF STANDARDS AND RESULTS

The EUT have been tested according to the applicable standards as referenced below.

FCC Part Clause	Test Parameter	Verdict	Remark
15.247(a)(1)	20 dB Bandwidth	PASS	
15.247(a)(1)	Carrier Frequency Separation	PASS	
15.247(a)(1)	Number of Hopping Frequencies	PASS	
15.247(a)(1)	Average Time of Occupancy (Dwell Time)	PASS	
15.247(b)(1)	Maximum Peak Conducted Output Power	PASS	
15.247(d)	Conducted Spurious Emissions	PASS	
15.247(d)	Radiated Spurious Emissions	PASS	
15.209	Radiated Spurious Emissions		
15.207	Conducted Emission	PASS	
15.203	Antenna Application	PASS	
15.247 (a) (1)/g/h	Frequency Hopping System	PASS	
15.247 (a) (1)/g/h		PASS	

NOTE1: N/A (Not Applicable)

NOTE2: According to FCC KDB 558074 D01 15.247 Meas Guidance v05r02, the report use radiated measurements in the restricted frequency bands. In addition, the radiated test is also performed to ensure the emissions emanating from the device cabinet also comply with the applicable limits.



2.2. LIST OF TEST AND MEASUREMENT INSTRUMENTS

For co	onducted emission	on at the main	s terminals tes	st(Shielded R	oom 1)		
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
EMI Test Receiver	Rohde & Schwarz	ESHS30	8290501003	Jan. 24, 2024	1 Year	LEP-E002	\checkmark
Artificial Mains Network	Baluelec	LSN016	BL0411220501 21	Nov. 01, 2021	1 Year	LEP-E067	V
Shielded Room 1	MR	MR-L05	LEP-E053	Nov. 17, 2022	3 Year	LEP-E053	\checkmark
Test software	EZ-EMC	Fala	LEPONT-03A2	N/A	N/A	N/A	\checkmark
	For radiated(9K-30M) emis	sion test(966 C	hamber 1)			
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
EMI Test Receiver	Rohde & Schwarz	ESR 3	101849	Jan. 31, 2024	1 Year	LEP-E006	\checkmark
Active Loop Antenna	Schwarzbeck	FMZB 1519C	00008	Jan. 24, 2024	3 Year	LEP-E068	N
966 Chamber 1	MR	MR-L02	LEP-E051	Nov. 17, 2022	3 Year	LEP-E051	\checkmark
Test software	EZ-EMC	Fala	EMEC-3A1	N/A	N/A	N/A	\checkmark
	For radiated(30M-1G) emis	sion test(966 C	hamber 1)			1
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
EMI Test Receiver	Rohde & Schwarz	ESR 3	101849	Jan. 31, 2024	1 Year	LEP-E006	\mathbf{N}
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	743	Nov. 20, 2022	3 Year	LEP-E005	
Signal Amplifier	HP	8447D	1726A01222	Jan. 24, 2024	1 Year	LEP-E007	
6dB Attenuator	RswTech	5W 6dB	LEP-E084	Jan. 24, 2024	1 Year	LEP-E084	
966 Chamber 1	MR	MR-L02	LEP-E051	Nov. 17, 2022	3 Year	LEP-E051	\checkmark
Test software	EZ-EMC	Fala	EMEC-3A1	N/A	N/A	N/A	$\overline{\mathbf{A}}$
	For radiated	(1-18G) emiss	ion test(966 Cl	namber 1)		•	1
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
Spectrum analyzer	Rohde & Schwarz	FSV40	101412	Jan. 24, 2024	1 Year	LEP-E076	\checkmark
Spectrum analyzer	Agilent	N9020A	MY49100060	Jan. 24, 2024	1 Year	LEP-E020	\checkmark
Horn antenna	Schwarzbeck	BBHA 9120D	01875	Nov. 20, 2022	3 Year	LEP-E024	\checkmark
Preamplifier	Schwarzbeck	BBN 9718B	00010	Jan. 24, 2024	1 Year	LEP-E025	\checkmark
966 Chamber 1	MR	MR-L02	LEP-E051	Nov. 17, 2022	3 Year	LEP-E051	\mathbf{N}
Test software	EZ-EMC	Fala	EMEC-3A1	N/A	N/A	N/A	$\overline{\mathbf{A}}$
	For radiated	(18-40G) emiss	sion test(966 C	hamber 1)			
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
Spectrum analyzer	Rohde & Schwarz	FSV40	101412	Jan. 24, 2024	1 Year	LEP-E076	$\overline{\mathbf{A}}$
Horn antenna+Preamplifier	COM-POWER	AH840	10100020	Sep. 05, 2022	3 Year	LEP-E075	V
966 Chamber 1	MR	MR-L02	LEP-E051	Nov. 17, 2022	3 Year	LEP-E051	\checkmark
Test software	EZ-EMC	Fala	EMEC-3A1	N/A	N/A	N/A	$\overline{\mathbf{A}}$
		For RF	test				
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval	Lab No.	Remark
Spectrum analyzer	Rohde & Schwarz	FSV40	101412	Jan. 24, 2024	1 Year	LEP-E076	$\overline{\checkmark}$
Spectrum analyzer	Agilent	N9020A	MY49100060	Jan. 24, 2024	1 Year	LEP-E020	\checkmark
Vector source	Agilent	N5182A	MY47420382	Jan. 24, 2024	1 Year	LEP-E021	V
Analog signal source	Agilent	N5171B	MY51350292	Jan. 24, 2024	1 Year	LEP-E022	V
All instrument	Rohde & Schwarz	CMW 500	1201.002K50	Jan. 24, 2024	1 Year	LEP-E019	
High and low temperature chamber	Math-mart	MT-1202-40	LEP-E041	Jan. 24, 2024	1 Year	LEP-E041	
control unit	Tonscend	JS0806-2	10165	Jan. 24, 2024	1 Year	LEP-E034	V
Testing software	Tonscend	JSTS1120-3	Ver 2.6.77.0518	N/A	N/A	N/A	$\overline{\mathbf{A}}$



2.3. MEASUREMENT UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	±1x10^-5
Maximum Peak Output Power Test	±1.0%
Conducted Emissions Test	±3.08dB
Radiated Emission Test	±4.60dB
Power Density	±0.9%
Occupied Bandwidth Test	±2.3%
Band Edge Test	±1.2%
Antenna Port Emission	±3dB
Temperature	±3.2%
Humidity	±2.5%
Measurement Uncertainty for a level of Co	onfidence of 95%

2.4. TEST FACILITY

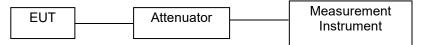
EMC Lab. :	The Laboratory has been assessed and proved to be in compliance with CNAS/CL01 The Certificate Registration Number is L10100. The Laboratory has been assessed and proved to be in compliance with A2LA The Certificate Registration Number is 6901.01
	FCC Designation No.: CN1351 Test Firm Registration No.: 397428
	ISED CAB identifier: CN0151 Test Firm Registration No.: 20133
Test Location :	Dongguan Lepont Testing Service Co., Ltd.
Address :	Room 102, Building 11, No.7, Houjie Science And Technology Avenue, Houjie, Dongguan, Guangdong, China



3. SETUP OF EQUIPMENT UNDER TEST

3.1. RADIO FREQUENCY TEST SETUP 1

The component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



3.2. RADIO FREQUENCY TEST SETUP 2

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m.The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 32.

Below 30MHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

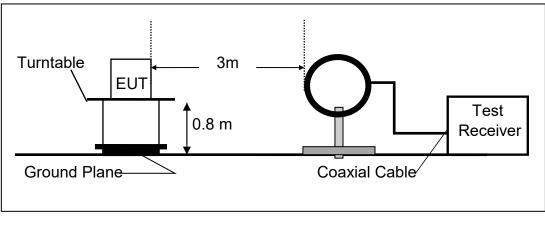
Above 30MHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

Above 1GHz:

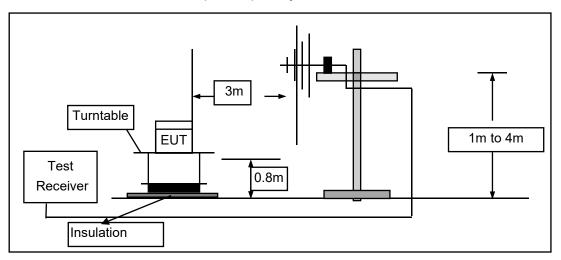
(Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

(a) Radiated Emission Test Set-Up, Frequency Below 30MHz

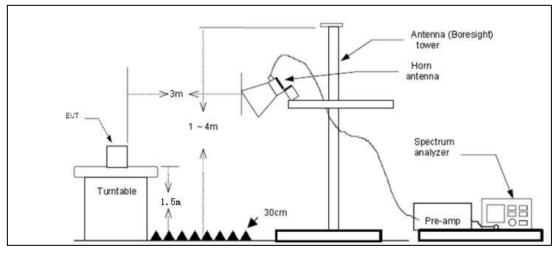


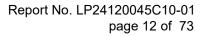


(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(c) Radiated Emission Test Set-Up, Frequency above 1000MHz





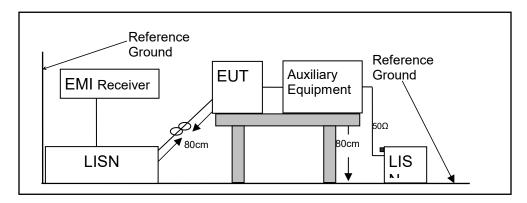


3.3. CONDUCTED EMISSION TEST SETUP

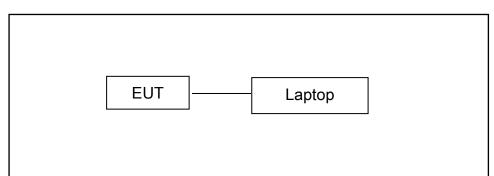
The mains cable of the EUT (Perfect Share Mini) must be connected to LISN. The LISN shall be placed 0.8m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.8m.

According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



3.4. BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM





4. TEST RESULTS AND MEASUREMENT DATA

4.1. 20DB BANDWIDTH

4.1.1. Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.1.2. Conformance Limit

No limit requirement.

4.1.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.1.4. Test Procedure

The EUT was operating in Bluetooth mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously Set RBW = 30 kHz.

Set the video bandwidth (VBW) =100 kHz.

Set Span= approximately 2 to 3 times the 20 dB bandwidth

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. Measure and record the results in the test report.



Test Results:

TestMode	Antenna	Freq(MHz)	20dB EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]
		2402	1.005	2401.484	2402.489	N/A
DH5	Ant1	2441	1.005	2440.487	2441.492	N/A
		2480	1.020	2479.466	2480.486	N/A
		2402	1.311	2401.331	2402.642	N/A
2DH5	Ant1	2441	1.362	2440.304	2441.666	N/A
		2480	1.296	2479.349	2480.645	N/A
		2402	1.026	2401.475	2402.501	N/A
3DH5	Ant1	2441	1.020	2440.481	2441.501	N/A
		2480	1.026	2479.481	2480.507	N/A



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Test Graphs





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4.2. CARRIER FREQUENCY SEPARATION

4.2.1. Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.2.2. Conformance 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 125 mW.

4.2.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.2.4. Test Procedure

■ According to FCC Part15.247(a)(1)

The EUT must have its hopping function enabled.

Set the RBW =300kHz.

Set VBW =300kHz.

Set the span = wide enough to capture the peaks of two adjacent channels Set Sweep time = auto couple.

Set Detector = peak. Set Trace mode = max hold.

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 Results:

TestMode	Antenna	Freq(MHz)	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Нор	1.306	≥1.020	PASS
2DH5	Ant1	Нор	0.996	≥0.908	PASS
3DH5	Ant1	Нор	0.974	≥0.684	PASS

Test Graphs



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			3DH5_A	nt1_Hop		
XX	ilent Spectrum Analyzer - Swept SA RL RF 50 Ω AC enter Freq 2.441500000	GHz PNO: Fast ↔ IFGain:Low	SENSE:INT Trig: Free Run #Atten: 40 dB	ALIGN AUTC #Avg Type: RMS Avg Hold: 5000/5000	TRACE 1 2 3 4 5 6	
	Ref Offset 8.94 dB				ΔMkr2 952 kHz -0.082 dB	Auto Tune
	0.0					Center Freq 2.441500000 GHz
1				2Δ1		Start Freq 2.440500000 GHz
-1	0.0 preserver		"When the state of			Stop Freq 2.442500000 GHz
3	0.0					CF Step 200.000 kHz <u>Auto</u> Man
-5	0.0					Freq Offset 0 Hz
s	tart 2.440500 GHz				Stop 2.442500 GHz	
#1 MS	Res BW 300 kHz	#VBW	/ 300 kHz	Sweep	1.000 ms (1001 pts) ^{us}	



4.3. NUMBER OF HOPPING FREQUENCIES

4.3.1. Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.3.2. Conformance Limit

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

4.3.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.3.4. Test Procedure

According to FCC Part15.247(a)(1)(iii)
 The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
 Span = the frequency band of operation (2400-2483.5MHz)
 RBW ≥ 100KHz
 VBW ≥ RBW
 Sweep = auto
 Detector function = peak
 Trace = max hold
 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.

Test Results:

TestMode	Antenna	Freq(MHz)	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Нор	79	≥15	PASS
2DH5	Ant1	Нор	79	≥15	PASS
3DH5	Ant1	Нор	79	≥15	PASS



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Test Graphs





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UX/RL	RF 50 Ω	AC		SE	ISE:INT		ALIGNAUTO	09:07:13 AM De		
Center Fre	q 2.4417		PNO: Fast	Trig: Free #Atten: 44		#Avg Typ	e: RMS	TYPE IN	23456 WWWWW PPPPP	Frequency
10 dB/div	Ref Offset 9.0 Ref 30.00 (07 dB d B m								Auto Tune
20.0										Center Freq
										2.441750000 GHz
10.0										Start Freq 2.40000000 GHz
-10.0		WWW	MMMM	mm	YWWW	YNAAAAAA		MANAM	M	
						11				Stop Freq 2.483500000 GHz
-20.0										CF Step
-30.0									La	8.350000 MHz Auto Man
-40.0										Freq Offset
-50.0										0 Hz
-60.0										
Start 2.400 #Res BW 3			<i>(</i>) () ()	300 kHz				Stop 2.4835 1.133 ms (10	0 GHz	



4.4. AVERAGE TIME OF OCCUPANCY (DWELL TIME)

4.4.1. Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.4.2. Conformance Limit

For frequency hopping systems operating in the 2400-2483.5MHz band, the average time of occupancy on any channel shall not be greater than 0.4s within a period of 0.4s multiplied by the number of hopping channels employed.

4.4.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.4.4. Test Procedure

■ According to FCC Part15.247(a)(1)(iii)

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW = 1 MHz

 $VBW \ge RBW$

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

If possible, 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.



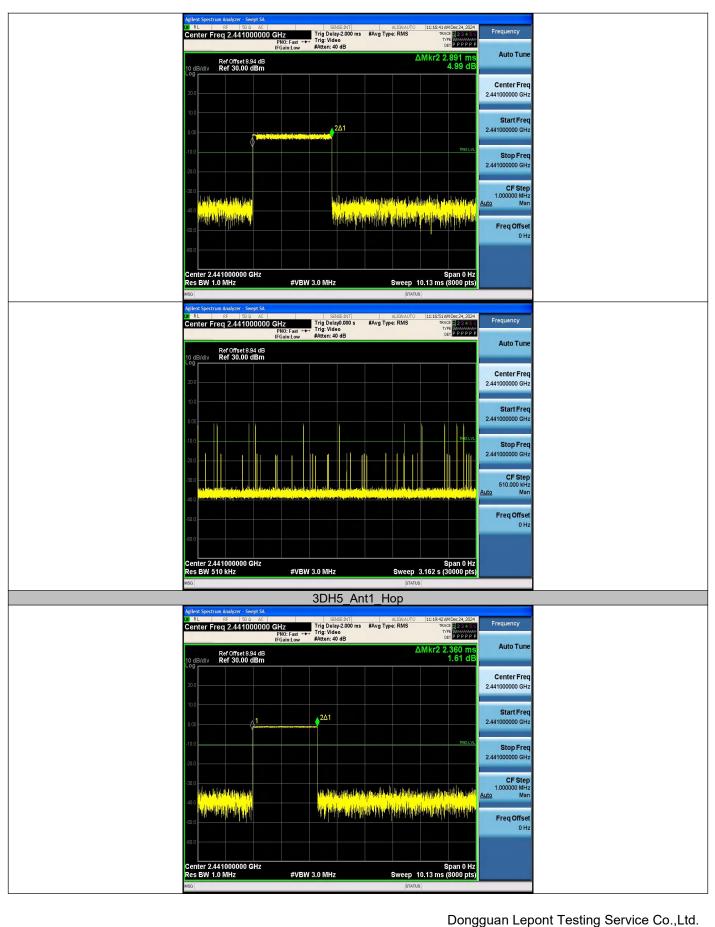
Test Results:

TestMode	Antenna	Freq(MHz)	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH5	Ant1	Нор	2.885	120	0.346	≤0.4	PASS
2DH5	Ant1	Нор	2.891	120	0.347	≤0.4	PASS
3DH5	Ant1	Нор	2.360	110	0.26	≤0.4	PASS

Test Graphs

	DH5_Ant1_Hop		
Aplent Spectrum Analyzer – Swept SA OI RU Center Freq 2.441000000		TYPE WWWWWW	
Ref Offset 8.94 dB		ΔMkr2 2.885 ms 6.99 dB	
200		Center Freq 2.441000000 GHz	
0.00		Start Freq 2.44100000 GHz	
-10.0		TRIZION. Stop Freq 2.441000000 GHz	
-200 -200 spilografy-skil britker	lad op heid Horp Reduced anjight daariik	CF Step 1.00000 MHz Auto Man	
	and the second		
+800 Center 2.441000000 GHz Res BW 1.0 MHz		Span 0 Hz p 10.13 ms (8000 pts)	
Res BW 1.0 MHz		p 10.13 ms (8000 pts)	
Agilent Spectrum Analyzer - Swept SA OU RL RF (5002 AC) Center Freq 2.441000000	SERSE:INT ALIGNA GHz Trig Delay0.000 s #Avg Type: RMS PN0: Fast +→ Trig: Video IFGaintLow #Atten: 40 dB #Atten: 40 dB Iffall	UTO 11114/24 AM Dec 24, 2024 Frequency TYPE DET P P P P P Auto Tune	
10 dB/div Ref 30.00 dBm Log			
20.0		Center Freq 2.441000000 GHz	
10.0		Start Freq 2.44100000 GHz	
-10.0		Tidel WA	
-20.0		2.441000000 GHz	
al fe bender i beli nitere . A se bli de se service 1.400 se service servic	a dikati di yada bisala mba, alamina di yada bisalini dikati jula di si anga bisala di ya mana magina malipingi na mana mana ng kanana mana na mana mana mana mana na mana mana mana mana mana mana mana m	s unter a deline de la tradición de la constante de la constante de la constante de la constante de la constant Force de la constante de la cons Force de la constante de la cons	
-50.0		Freq Offset 0 Hz	
60.0			
Center 2.441000000 GHz Res BW 510 kHz		Span 0 Hz ep 3.162 s (30000 pts)	







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02 RL RF 50 Ω AC Center Freq 2.441000000		0		Frequency Auto Tune
Ref Offset 8.94 dB 10 dB/div Ref 30.00 dBm				
20.0				Center Freq 2.441000000 GHz
0.00				Start Freq 2.441000000 GHz
-10.0			BIG LVL	Stop Freq
-20.0				2.441000000 GHz
T. Discussion on a first finding strand discussion				510.000 kHz <u>Auto</u> Man
-50.0				Freq Offset 0 Hz
-60.0				
Center 2.441000000 GHz Res BW 510 kHz	#VBW 3.0 MHz	Sillo	Span 0 Hz ep 3.162 s (30000 pts)	



4.5. MAXIMUM PEAK CONDUCTED OUTPUT POWER

4.5.1. Applicable Standard

According to FCC Part 15.247(b)(1) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.5.2. Conformance Limit

The max For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

4.5.3. Test Configuration

Test according to clause 4.5.4 radio frequency test setup 1

4.5.4. Test Procedure

■ According to FCC Part15.247(b)(1)

As an alternative to a peak power measurement, compliance with the limit can be based on a measurement of the maximum conducted output power.

Use the following spectrum analyzer settings:

Set Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel Set RBW > the 20 dB bandwidth of the emission being measured

Set VBW \geq RBW

Set Sweep = auto

Set Detector function = peak

Set Trace = max hold

Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission to determine the peak amplitude level.

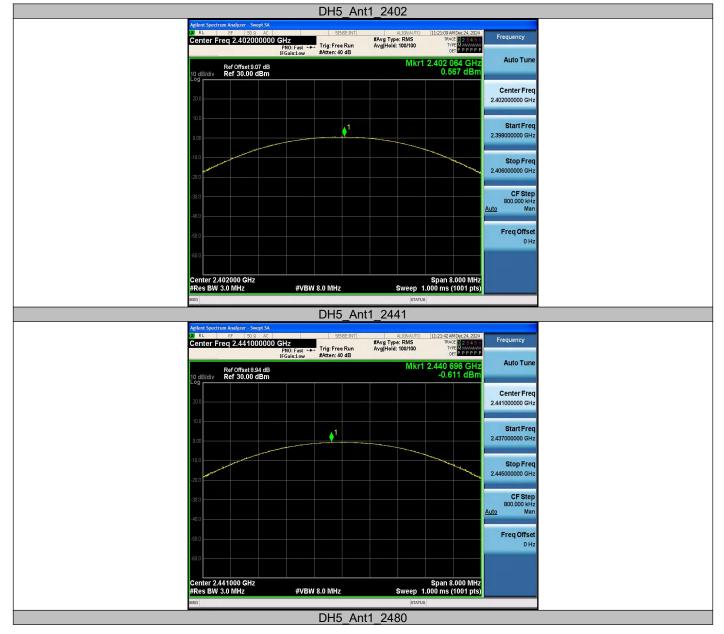


Test Results

Test Mode	Antenna	Freq(MHz)	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	Verdict
		2402	0.57	≤30	PASS
DH5	Ant1	2441	-0.61	≤30	PASS
		2480	-1.39	≤30	PASS
		2402	1.29	≤20.97	PASS
2DH5	Ant1	2441	0.15	≤20.97	PASS
		2480	-0.65	≤20.97	PASS
			0.56	≤20.97	PASS
3DH5	Ant1	2441	-0.53	≤20.97	PASS
		2480	-1.37	≤20.97	PASS

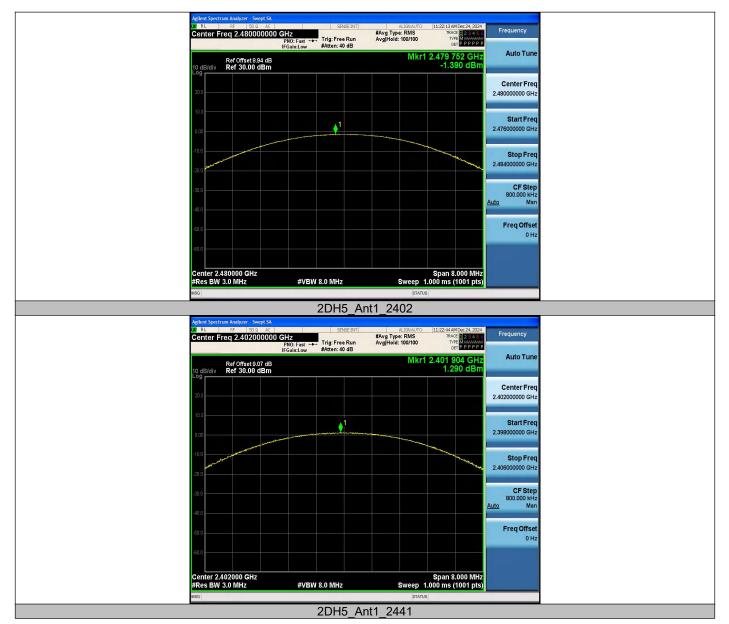


Test Graphs



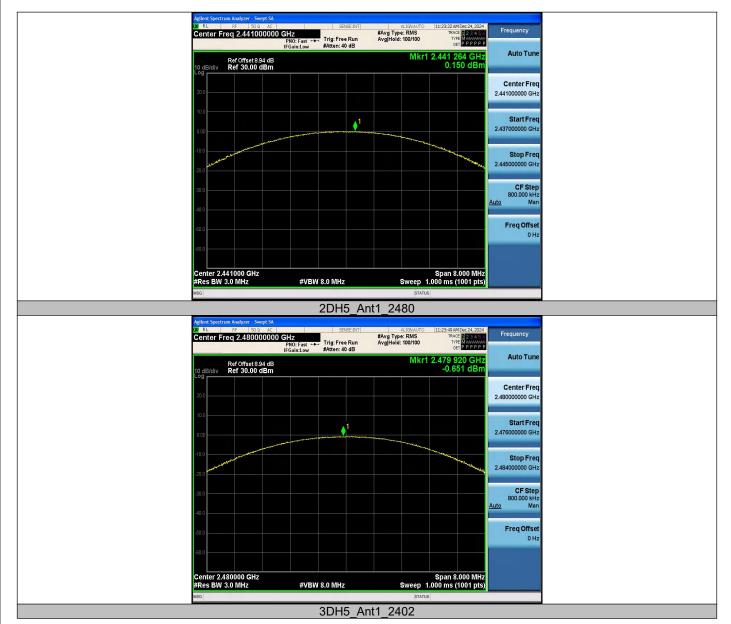


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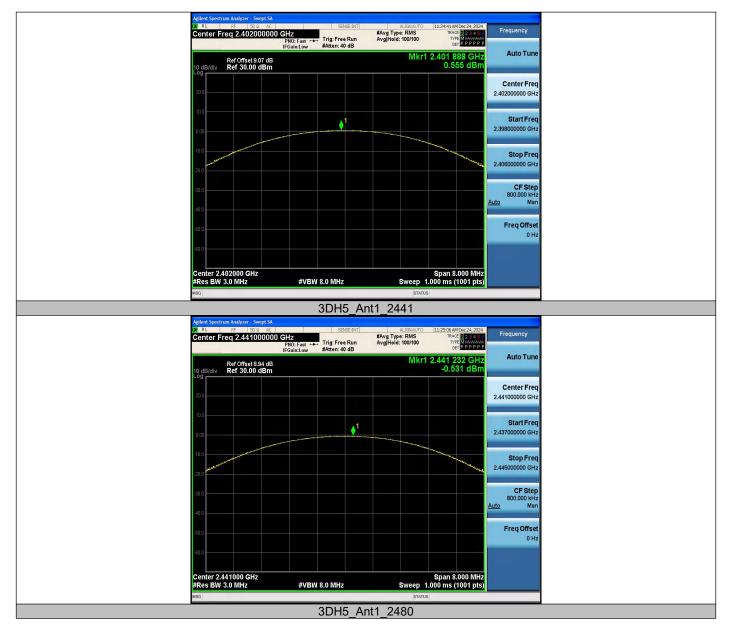


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Center Freq 2.480000000	PNO: Fast +++ Trig: Free Run IFGain:Low #Atten: 40 dB	#Avg Type: RMS Avg Hold: 100/100	TRACE 2 3 4 5 6 TYPE MINIMUM DET P P P P P P	Frequency
Ref Offset 8.94 dB 10 dB/div Ref 30.00 dBm		Mkr1	2.479 856 GHz -1.374 dBm	Auto Tun
20.0				Center Free 2.480000000 GH
0.00	↓ 1			Start Free 2.476000000 GH:
-10.0			and the second s	Stop Free 2.484000000 GH;
-30.0				CF Step 800.000 kH: Auto Mar
-40.0				FreqOffse
-60.0				0 H:
Center 2.480000 GHz #Res BW 3.0 MHz	#VBW 8.0 MHz	Duran d	Span 8.000 MHz 000 ms (1001 pts)	



4.6. CONDUCTED SUPRIOUS EMISSION AND BAND EDGE

4.6.1. Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.6.2. Conformance Limit

According to FCC Part 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted, provided the transmitter demonstrates compliance with the peak conducted power limits.

4.6.3. Test Configuration

Test according to clause 3.1 radio frequency test setup 1

4.6.4. Test Procedure

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

Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DSS channel center frequency.

Set Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel.

Set the RBW = 100 kHz. Set the VBW \ge 3 x RBW.

Set Detector = peak. Set Sweep time = auto couple.

Set Trace mode = max hold. Allow trace to fully stabilize.

Use the peak marker function to determine the maximum Maximum conduceted level.

Note that the channel found to contain the maximum conduceted level can be used to establish the reference level.

Band-edge Compliance of RF Conducted Emissions

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation Set RBW $\ge 1\%$ of the span=100kHz Set VBW \ge RBW

Set Sweep = auto Set Detector function = peak Set Trace = max hold

Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section.

Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

■ Conduceted Spurious RF Conducted Emission

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.(30MHz to 26.5GHz). Set RBW = 100 kHz Set VBW \ge RBW

Set Sweep = auto Set Detector function = peak Set Trace = max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section.



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Test Results:

TestMode	Antenna	ChName	Freq(MHz)	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
	DH5 Ant1	Low	2402	-0.23	-49.09	≤-20.23	PASS
DUE		High	2480	-1.94	-49.54	≤-21.94	PASS
DHO		Low	Hop_2402	-0.02	-49.45	≤-20.02	PASS
		High	Hop_2480	-1.77	-49.14	≤-21.77	PASS
	2DH5 Ant1	Low	2402	-3.19	-49.2	≤-23.19	PASS
		High	2480	-2.84	-49.16	≤-22.84	PASS
2000		Low	Hop_2402	-0.60	-49.35	≤-20.6	PASS
		High	Hop_2480	-1.82	-49.21	≤-21.82	PASS
		Low	2402	-0.06	-49.23	≤-20.06	PASS
2DUE Ant1	High	2480	-2.03	-49.82	≤-22.03	PASS	
3005	3DH5 Ant1	Low	Hop_2402	-0.20	-48.62	≤-20.2	PASS
		High	Hop_2480	-1.64	-48.96	≤-21.64	PASS



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Test Graphs

		Low_2402			
Agilent Spectrum Analyzer - Swept	AC SENSE:INT 000 GHz PN0: Fast ↔ Trig: Free Run	ALIGNAUTO #Avg Type: RMS Avg Hold: 100/100	10:34:28 AM Dec 24, 2024 TRACE 1 2 3 4 5 5 TYPE MWWWWW DET P P P P P P	Frequency	
Ref Offset 9.07 10 dB/div Ref 20.00 dB	IFGain:Low Anden: 30 dB		2.399 855 GHz -49.093 dBm	Auto Tune	
				Center Freq 2.352500000 GHz	
-10.0			-20 22 ¢8n		
-30.0				Start Freq 2.300000000 GHz	
-50.0	ndersetablischaterstationsperaturellenserary.atraffisikere	าม _ี จารสารสารการสารสารสารสารสารสารสารสารสาร	the superior and the	Stop Freq 2.405000000 GHz	
Start 2.30000 GHz #Res BW 100 kHz	#VBW 300 kHz	Sween 1	Stop 2.40500 GHz 0.07 ms (1001 pts)	CF Step 10.500000 MHz	
MKR MODE TRC SCL	X Y R	NCTION FUNCTION WIDTH		Auto Man	
3 N 1 f 4 N 1 f 5 N 1 f	2.402.060 GHz 0.225 dBm 2.400.000 GHz 52.010 dBm 2.390.000 GHz 53.153 dBm 2.390.000 GHz 53.659 dBm 2.399 855 GHz 49.093 dBm			Freq Offset 0 Hz	
6 7 8 9 9					
10 11 <		STATUS			
	DH5_Ant1_				
Agilent Spectrum Analyzer - Swept	SA				
CORL RF 50 Q	AC SENSE:INT	ALIGNAUTO	10:43:13 AM Dec 24, 2024	Frequency	
Center Freq 2.510000		ALIGNAUTO #Avg Type: RMS Avg Hold: 100/100	10:43:13 AM Dec 24, 2024 TRACE 2 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	Frequency	
Center Freq 2.510000	OOO GHZ PNO: Fast ↔ IFGain:Low #Atten: 30 dB	#Avg Type: RMS Avg Hold: 100/100	TRACE 1 2 3 4 5 6	Frequency Auto Tune	
Center Freq 2.510000	OOO GHZ PNO: Fast ↔ IFGain:Low #Atten: 30 dB	#Avg Type: RMS Avg Hold: 100/100	TRACE 1 2 3 4 5 6 TYPE MWWWWWWW DET P P P P P P P		
Center Freq 2.510000 Ref Offset 8.94 10 dB/div Ref 20.00 dB 100 A1	OOO GHZ PNO: Fast ↔ IFGain:Low #Atten: 30 dB	#Avg Type: RMS Avg Hold: 100/100	TRACE 1 2 3 4 5 6 TYPE MWWWWWWW DET P P P P P P P	Auto Tune Center Freq 2.51000000 GHz	
Center Freq 2.510000	000 GHz PN0: Fast → Tig: Free Run #Atten: 30 dB dB m	#Avg Type: RMS Avg Hold: 100/100 MKr	4 2.505 84 GHz -49.543 dBm	Auto Tune Center Freq	
Center Freq 2.510000	000 GHz PN0: Fast → Tig: Free Run #Atten: 30 dB	#Avg Type: RMS Avg Hold: 100/100	4 2.505 84 GHz -49.543 dBm	Auto Tune Center Freq 2.51000000 GHz Start Freq	
Center Freq 2.510000	DOD GHz PN0: Fast	#Avg Type: RMS Avg Hold: 100/100 MKr	4 2:505 84 GHz -49.543 dBm -21.94 dbs -21.94	Auto Tune Center Freq 2.510000000 GHz Start Freq 2.470000000 GHz Stop Freq 2.550000000 GHz CF Step	
Center Freq 2.510000 Ref Offset 8.94 10 dB/div Ref 20.00 dB 10 d 10 d 20 0 30 0 40 0 30 0 40 0 50 0	2000 GHZ PRO: Feat	#Avg Type: RMS Avg Hold: 100/100 MKr	4 2:505 84 GHz 	Auto Tune Center Freq 2.510000000 GHz Start Freq 2.470000000 GHz Stop Freq 2.550000000 GHz 8.000000 GHz 8.000000 GHz Auto Man	
Center Freq 2.510000	000 GHz PN0: Fast → Trig: Fee Run Acten: 30 dB dB m 4 4 4 4 4 4 4 4 4 4 4 4 4	#Avg Type: RMS Avg Hold: 100/100 Mkr	4 2:505 84 GHz 	Auto Tune Center Freq 2.510000000 GHz Start Freq 2.470000000 GHz Stop Freq 2.550000000 GHz CF Step 8.0000000 MHz	
Center Freq 2.510000 Ref Offset 8.94 10 dB/div Ref 20.00 dB 10 dB/div Ref 20.00 dB 10 dB/div Ref 20.00 dB 10 dB/div Ref 20.00 dB 20 d 20 d 2	000 GHz PN0: Fast → IFGsinLow dB m dB m #VEW 300 kHz × VEW 300 kHz × VFW 400 GHz 2.483 00 GHz 2.483 00 GHz 2.500 00 GHz 2.500 00 GHz 4.1937 dBm 2.483 00 GHz 2.500 00 Hz 2.500 00 Hz 4.1937 dBm	#Avg Type: RMS Avg Hold: 100/100 Mkr	4 2:505 84 GHz 	Auto Tune Center Freq 2.51000000 GHz Start Freq 2.470000000 GHz Stop Freq 2.55000000 GHz 8.000000 MHz Man Freq Offset	
Center Freq 2.510000	000 GHz PN0: Fast → IFGsinLow dB m dB m #VEW 300 kHz × VEW 300 kHz × VFW 400 GHz 2.483 00 GHz 2.483 00 GHz 2.500 00 GHz 2.500 00 GHz 4.1937 dBm 2.483 00 GHz 2.500 00 Hz 2.500 00 Hz 4.1937 dBm	#Avg Type: RMS Avg Hold: 100/100 Mkr	2 2 4 5 0 TYPE D 2 9 4 5 0 CE D 2 9 P 0 P D 1 4 2,505 84 GHz -49.543 dBm -71.94 69 -71.94 69 -70.94 69	Auto Tune Center Freq 2.51000000 GHz Start Freq 2.470000000 GHz Stop Freq 2.55000000 GHz 8.000000 MHz Man Freq Offset	



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Center Freq 2.3	50 Ω AC SENSE:INT 352500000 GHz PN0: Fast ↔ Trig: Free Run IFGain:Low #Atten: 30 dB	ALIGNAUTO #Avg Type: RMS Avg Hold: 1000/1000	09:00:24 AM Dec 25, 2024 TRACE 1 2 3 4 5 5 TYPE MWWWWW DET P P P P P P	
10 dB/div Ref 2	fset 9 dB 20.00 dBm	Mkr5	2.308 295 GHz -49.448 dBm	ne
10.0			Center Fr 2.352500000 G	
-20.0			2007 034 Start Fr 2.300000000 G	
40.0 -50.0 -60.0	ya mana da ang mana na ang	and a start of the	Stop Fr 2,40500000 G	
Start 2.30000 GH #Res BW 100 kH			Stop 2.40500 GHz .07 ms (1001 pts)	Hz
MKR MODE TRC SCL 1 N 1 f 2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	X Y 2.403 845 GHz -0.020 dBm 2.400 000 GHz -49.733 dBm 2.390 000 GHz -49.972 dBm 2.310 000 GHz -50.640 dBm 2.302 295 GHz -49.448 dBm	FUNCTION FUNCTION WIDTH	Fonction value Freq Offs	an set Hz
11	1	STATUS	×	-

Mkr4 2.488 48 GH -49.140 dBn

Stop 2.55000 GHz Sweep 7.667 ms (1001 pts)

Ref Offset 8.94 dB Ref 20.00 dBm

 $agree{}^2 e^4$

2.483 50 2.500 00 2 488 48 $\langle \rangle^3$

#VBW 300 kHz

2DH5 Ant1 Low 2402

WWW

Start 2.47000 GHz #Res BW 100 kHz Auto Tune

Center Freq 2.510000000 GHz

Start Freq 2.470000000 GHz

Stop Freq 2.55000000 GHz

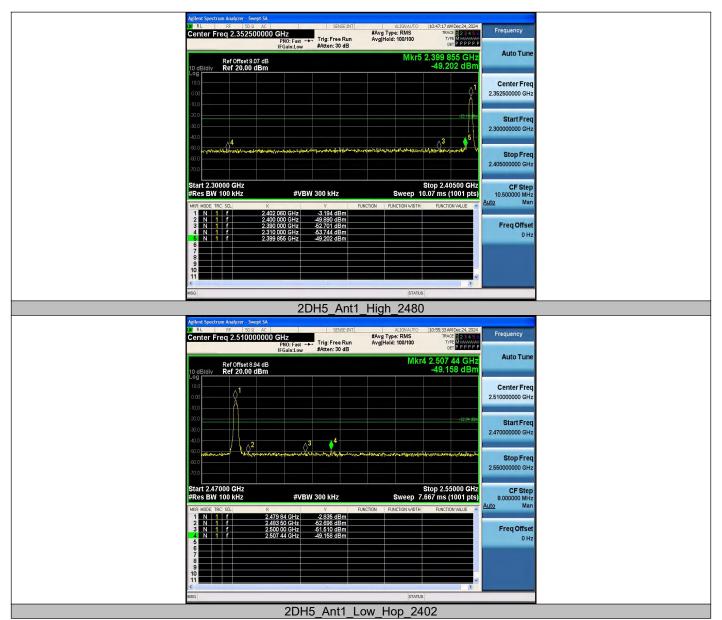
> CF Step 8.000000 MH Mar

Freq Offset 0 Hz

Auto

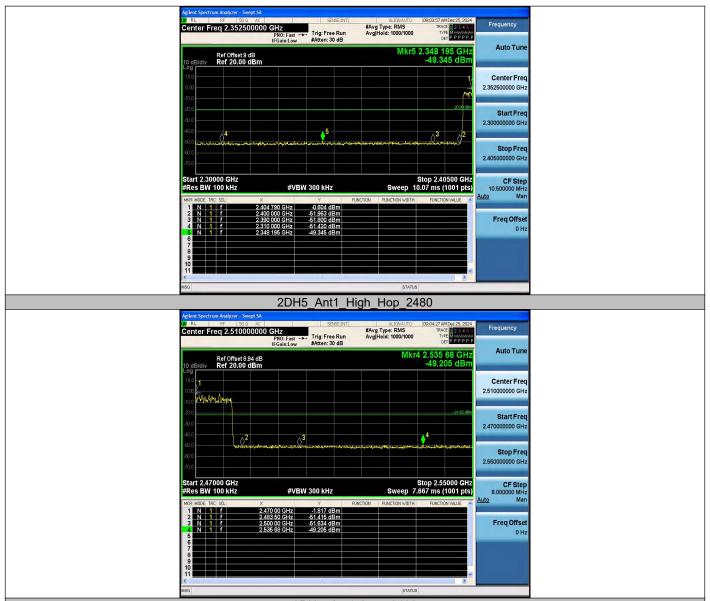


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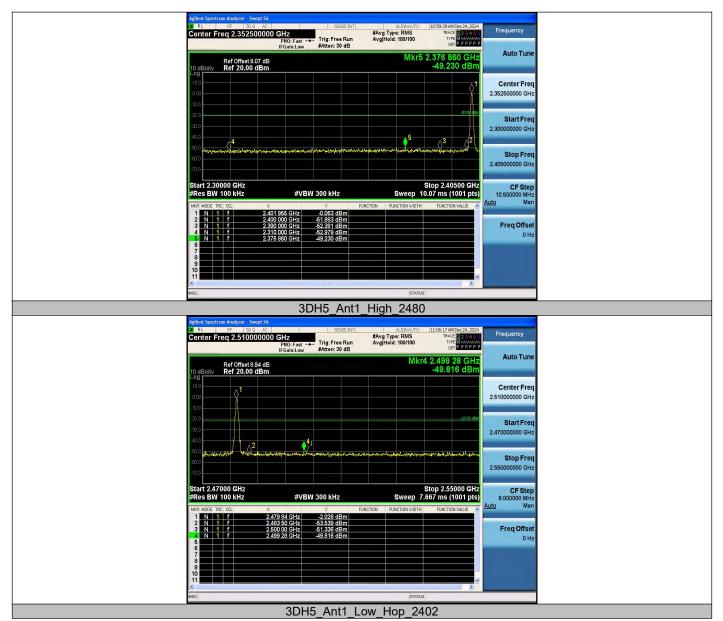
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3DH5_Ant1_Low_2402



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Agilent Spectrum Analyzer - Swept SA	
M RL RF 50.0 ΔC SENSE:NT ALIGNATO 09:05:22 AM Dec 25 20 Center Freq 2.352500000 GHz #Avg Type: RMS #RACE Toget #RACE Toget #RACE Toget Trace Toget<	1224 Frequency
IFGaint.ov #Atten: 30 dB CEIPPPP Ref Offset 9 dB Mkr5 2.368 985 GH 10 dB/div Ref 20.00 dBm -48.624 dB	Auto Tune
	1 Center Freq 2.352500000 GHz
200	2.30000000 GHz
000	Stop Freq 2.406000000 GHz
Start 2.30000 GHz Stop 2.40500 GH #Res BW 100 kHz #VBW 300 kHz Sweep 10.07 ms (1001 pt MRR MODE TRC SOL X Y Function Ranction width Ranction width Ranction width	HZ 10.500000 MHz Auto Man
1 N 1 f 2.405 000 GHz -0.204 dBm 2 N 1 f 2.400 000 GHz -56.993 dBm 3 N 1 f 2.390 000 GHz -56.993 dBm 4 N 1 f 2.390 000 GHz -51.956 dBm 6 N 1 f 2.328 985 GHz -49.624 dBm	Freq Offset 0 Hz
 C STATUS	
3DH5_Ant1_High_Hop_2480 Agilent Spectrum Analyzer - Swept SA	
OIL RF SO 8 AC SENSE ATI ALIZANTO DOD 73:00 MPecc5 20 Center Freq 2.510000000 GHz PN0: Fast + Trig: Free Run AvglHold: 1000/1000 Trig: Free Run BitGaint.dw Atten: 30 dB BitGaint.dw Atten: 30 dB Trig: Free Run	5.6 Frequency
Ref Offset 3.94 dB Mkr4 2.496 32 GF 10 dB/div Ref 20.00 dBm Log -48.956 dBi	Auto Tune
	Center Freq 2.51000000 GHz
200 WWWWW	er Start Freq 2.470000000 GHz
	Stop Freq 2.550000000 GHz
Start 2.47000 GHz Stop 2.55000 GH #Res BW 100 KHz #VBW 300 KHz Sweep 7.667 ms (1001 pt MKR MODE, TRC, SOL X Y Function Ranction width Ranction width MKR MODE, TRC, SOL X Y Function Ranction width Ranction width	
1 N 1 f 2.470 96 GHz -1.638 dBm 2 N 1 f 2.483 50 GHz -51 935 dBm 3 N 1 f 2.500 00 GHz -50 796 dBm 4 N 1 f 2.495 32 GHz -49 395 dBm 5	Freq Offset 0 Hz
9 9 10 11 11	
MSG STATUS	