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Test report No:
2520983R.701

FCC TEST REPORT

Product Name	Smart Controller
Trademark	N/A
Model and /or type reference	TENSO-DUAL
FCC ID	2A8JK-TENSO-2BAND
Applicant´s name / address	ACSL Ltd. Hulic Kasai Rinkai Building 2F, 3-6-4 Rinkaicho, Edogawa-ku, Tokyo 134-0086, Japan
Test method requested, standard	47 CFR FCC Part 15 (Section 15.247) ANSI C63.10: 2013
Verdict Summary	IN COMPLIANCE
Tested by (name / position & signature)	Tim Cao / Project Manager
Approved by (name / position & signature)	Frank He / Technical Manager
Date of issue	2025-04-20
Report Version	V1.0
Report template No	Template_FCC Part 15C-RF-V1.0

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COMPETENCES AND GUARANTEES

DEKRA is a testing laboratory competent to carry out the tests described in this report.
In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

GENERAL CONDITIONS

Test Location A	No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China
Test Location B	No. 8213, Fanhua Avenue, Baohe District, Hefei City, Anhui Province, China
Date(receive sample)	Feb. 20, 2025
Date (start test)	Mar. 10, 2025
Date (finish test)	Mar. 30, 2025

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT : Equipment Under Test
QP : Quasi-Peak
CAV : CISPR Average
AV : Average
CDN : Coupling Decoupling Network
SAC : Semi-Anechoic Chamber
OATS : Open Area Test Site
BW : Bandwidth
AM : Amplitude Modulation
PM : Pulse Modulation
HCP : Horizontal Coupling Plane
VCP : Vertical Coupling Plane
U_N : Nominal voltage
*T*x : Transmitter
*R*x : Receiver
N/A : Not Applicable
N/M : Not Measured

DOCUMENT HISTORY

Report No.	Version	Description	Issued Date
2520983R.701	V1.0	Initial issue of report.	2025-04-20

REMARKS AND COMMENTS

1. The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).
2. These test results on a sample of the device are for the purpose of demonstrating Compliance with 47 CFR FCC Part 15 (Section 15.247).
3. The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
4. The test results presented in this report relate only to the object tested.
5. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification (Suzhou) Co., Ltd.
6. This report will not be used for social proof function in China market.
7. DEKRA declines any responsibility with the following test data provided by customer that may affect the validity of result:

- Chapter 1.1 General Description of the Item(s);
- Chapter 1.2 Channel List.

USED EQUIPMENT

Test Location A :AC Power Line Conducted Emission / TR1

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
EMI Test Receiver	R&S	ESCI	100726	2024.07.06	2025.07.05
Two-Line V-Network	R&S	ENV 216	101044	2024.10.26	2025.10.25
Two-Line V-Network	R&S	ENV 216	101189	2024.07.06	2025.07.05
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2024.04.20	2025.04.19
Coaxial Cable	Huber+Suhner	RG 223	TR1-C1	2024.04.27	2025.04.26
Impedance Stabilization Network	Teseq GmbH	ISN T800	57318	2024.02.27	2025.02.26
Impedance Stabilization Network	Teseq GmbH	ISN T800	57318	2025.02.25	2026.02.24
Temperature/Humidity Meter	RTS	RTS-8S	EMC01	2024.07.04	2025.07.03
Dekra test software	Dekra	N/A	N/A	N/A	N/A

Test Location A :Conducted Test/ TR8

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Wireless Connectivity Tester	R&S	CMW 270	102593	2024.05.15	2025.05.14
Coaxial Cable	N/A	N/A	2477	2024.06.11	2025.06.10
Coaxial Cable	N/A	N/A	2478	2024.06.11	2025.06.10
High and low temperature and fast temperature change test box	ASTUOD	ASTD-FBT-225K	N/A	2024.04.21	2025.04.20
Temperature/Humidity Meter	RTS	RTS-8S	RF07	2024.07.04	2025.07.03
Test system					
Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
MAX Signal Analyzer	Keysight	N9010A	MY48030494	2024.10.26	2025.10.25
RF Control Unit	Tonscend	JS0806-2	22G8060594	2025.01.26	2026.01.25
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY61252529	2024.05.12	2025.05.11
Frequency extender for EXG or MXG	Keysight	N5182BX07	MY59362500	2024.05.12	2025.05.11
EXG-B MW Analog Signal Generator	Keysight	N5173B	MY61252566	2024.07.06	2025.07.05
Test Software	Tonscend	TS1120	JS1120-3	N/A	N/A

Test Location A :Radiated Emission(9KHz-1GHz) / AC2

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
EMI Test Receiver	R&S	ESCI	100176	2024.05.12	2025.05.11
Loop Antenna	R&S	HFH2-Z2E	101149	2024.03.27	2025.03.26
Bilog Antenna	Teseq GmbH	CBL6112D	27613	2024.09.08	2025.09.07

Temperature/Humidity Meter	RTS	RTS-8S	AC2-TH	2024.07.04	2025.07.03
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2024.04.27	2025.04.26
Dekra test software	Dekra	N/A	N/A	N/A	N/A

Test Location B: Radiated Emission Band Edge / AC103

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal analyzer	keysight	N9020B	MY63490118	2024.07.26	2025.07.25
Bilog Antenna	TESEQ	CBL6112D	64164	2024.11.23	2025.11.22
Horn Antenna	RF SPIN	DRH18-E	KV2D11A18ES	2024.11.02	2025.11.01
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	01312	2024.10.28	2025.10.27
Amplifier	ESE	LNA0118	LNA23100009	2024.08.10	2025.08.09
Amplifier	Tonscend	TAP01018048S	AP23J8060307	2024.11.16	2025.11.15
Band Reject Filter Group	Tonscend	JS0806-F	23G806F0701	2024.11.20	2025.11.19
Temperature/Humidity Meter	RTS	RTS-8S	026	2024.09.04	2025.09.03
Test Software	Tonscend	JS36	N/A	N/A	N/A

Test Location A :AC Power Line Conducted Emission / TR1

Instrument	Manufacturer	Model No.	Serial No.	Firmware Versiom	Software version
EMI Test Receiver	R&S	ESCI	100726	4.42 SP1	N/A
Two-Line V-Network	R&S	ENV 216	101044	N/A	N/A
Two-Line V-Network	R&S	ENV 216	101189	N/A	N/A
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	N/A	N/A
Coaxial Cable	Huber+Suhner	RG 223	TR1-C1	N/A	N/A
Impedance Stabilization Network	Teseq GmbH	ISN T800	57318	N/A	N/A
Impedance Stabilization Network	Teseq GmbH	ISN T800	57318	N/A	N/A
Temperature/Humidity Meter	RTS	RTS-8S	EMC01	N/A	N/A
Dekra test software	Dekra	N/A	N/A	N/A	N/A

Test Location A :Conducted Test/ TR8

Instrument	Manufacturer	Model No.	Serial No.	Firmware Versiom	Software version
Wireless Connectivity Tester	R&S	CMW 270	102593	V 4.0.60	N/A
Coaxial Cable	N/A	N/A	2477	N/A	N/A
Coaxial Cable	N/A	N/A	2478	N/A	N/A
High and low temperature and fast temperature change test box	ASTUOD	ASTD-FBT-225K	N/A	N/A	N/A
Temperature/Humidity Meter	RTS	RTS-8S	RF07	N/A	N/A
Test system					
Instrument	Manufacturer	Model No.	Serial No.	Firmware Versiom	Software version
MAX Signal Analyzer	Keysight	N9010A	MY48030494	A.14.03	N/A
RF Control Unit	Tonscend	JS0806-2	22G8060594	N/A	N/A
MXG-B RF Vector Signal Generator	Keysight	N5182B	MY61252529	B.01.96	N/A
Frequency extender for EXG or MXG	Keysight	N5182BX07	MY59362500	N/A	N/A
EXG-B MW Analog Signal Generator	Keysight	N5173B	MY61252566	B.01.95	N/A
Test Software	Tonscend	TS1120	JS1120-3	N/A	V3.0.22

Test Location A :Radiated Emission(9KHz-1GHz) / AC2

Instrument	Manufacturer	Model No.	Serial No.	Firmware Versiom	Software version
EMI Test Receiver	R&S	ESCI	100176	4.42 SP3	N/A
Loop Antenna	R&S	HFH2-Z2E	101149	N/A	N/A

Bilog Antenna	Teseq GmbH	CBL6112D	27613	N/A	N/A
Temperature/Humidity Meter	RTS	RTS-8S	AC2-TH	N/A	N/A
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	N/A	N/A
Dekra test software	Dekra	N/A	N/A	N/A	3

Test Location B: Radiated Emission Band Edge / AC103

Instrument	Manufacturer	Model No.	Serial No.	Firmware Versiom	Software version
Signal analyzer	keysight	N9020B	MY63490118	A 08.54	N/A
Bilog Antenna	TESEQ	CBL6112D	64164	N/A	N/A
Horn Antenna	RF SPIN	DRH18-E	KV2D11A18ES	N/A	N/A
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	01312	N/A	N/A
Amplifier	ESE	LNA0118	LNA23100009	N/A	N/A
Amplifier	Tonscend	TAP01018048S	AP23J8060307	N/A	N/A
Band Reject Filter Group	Tonscend	JS0806-F	23G806F0701	N/A	N/A
Temperature/Humidity Meter	RTS	RTS-8S	026	N/A	N/A
Test Software	Tonscend	JS36	N/A	N/A	5.0.0

UNCERTAINTY

Uncertainties have been calculated according to the DEKRA internal document.The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.The Uncertainties is complice with standard required as below.

Test item Test Location A	Uncertainty
AC Power Line Conducted Emission	9kHz~150kHz: 2.8 dB 150kHz~30MHz: 2.4 dB
Radiated Emission(30MHz~1GHz)	Horizontal: 30MHz~300MHz: 3.5 dB, 300MHz~1GHz: 3.6 dB Vertical: 30MHz~300MHz: 3.6 dB, 300MHz~1GHz: 3.5 dB
Radiated Emission(1GHz~40GHz)	Horizontal: 1GHz~18GHz: 5.0 dB Vertical: 1GHz~18GHz: 4.8 dB
Bandwidth	± 1 kHz
Carrier Frequency Separation	± 1 kHz
Number of Hopping Frequencies	± 1 kHz
Time of Occupancy (Dwell Time)	± 0.1 us
Peak OutputPower	± 1.3 dB
Emissions in non-restricted frequency bands	± 1.0 dB
Radiated Emission Band Edge	± 3.9 dB

Test item Test Location B	Uncertainty
Radiated Emission(30MHz~1GHz)	Horizontal: 30MHz~300MHz: 4.9 dB, 300MHz~1GHz: 4.9 dB Vertical: 30MHz~300MHz: 4.9 dB, 300MHz~1GHz: 4.9 dB
Radiated Emission(1GHz~40GHz)	Horizontal: 1GHz~40GHz: 6.0 dB Vertical: 1GHz~40GHz: 5.8 dB
Radiated Emission Band Edge	± 6.0 dB

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Product Name ..... :	Smart Controller					
Trademark ..... :	N/A					
Model No. ..... :	TENSO-DUAL					
FCC ID. ..... :	2A8JK-TENSO-2BAND					
Hardware Version ..... :	V1.1					
Software Version ..... :	T44					
Operating Temperature ..... :	-40℃ ~ 70℃					
Power Supply ..... :	DC 3.3 V, 4.5 A 15 W from internal rechargeable battery which can be charged by AC/DC adapter.					
Manufacturer ..... :	Aerora North America, Inc.					
Manufacturer address ..... :	2445 Augustine Drive, Suites 150, Santa Clara, CA 95054					
Factory ..... :	ROTOTEK VIETNAM CO., LTD					
Factory address..... :	House S4_2nd floor, Hap Linh Industrial Park, Bac Ninh City, Vietnam					
Test Matrix/ IMEI ..... :	RF Conducted	G55V462337F3B00203				
	RSE	G55V462337F3B00216				
Wireless specification..... :	Bluetooth					
Operating frequency range(s) :	2402~2480MHz					
Type of Modulation..... :	GFSK					
PHYs ..... :	☒	GFSK	☐	Pi/4 DQPSK	☐	8DPSK
Data Rate ..... :	☒	1Mbit/s	☐	2Mbit/s	☐	3Mbit/s
Number of channels ..... :	79					
Antenna Type ..... :	FPC					
Antenna Gain ..... :	0.90 dBi					

1.2 Channel List

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

Note: The general description of the Item(s), antenna information and channel list in clause 1 are provided and confirmed by the client.

2 DESCRIPTION OF TEST SETUP

2.1 Auxiliary equipment /Accessories/Test software for the EUT

Auxiliary equipment	Type / Version	Manufacturer	Supplied by
(1) Notebook	Think pad x220	Lenovo	Adapter
(2) USB Control Cable	N/A	N/A	N/A
(3) USB Control Cable	N/A	N/A	N/A
software	Type / Version	Manufacturer	Supplied by
QRCT	N/A	N/A	N/A

3 VERDICT SUMMARY SECTION

This chapter presents an overview of standards and results. Refer to the next chapters for details of measured test results and applied test levels.

3.1 Standards

Standard	Year	Description
CFR 47, FCC Part 15 C	2024	Operation within the bands902–928 MHz, 2400–2483.5 MHz, and5725–5850 MHz.
ANSI C63.10	2013	American National Standard ofProcedures for Compliance Testing ofUnlicensed Wireless Devices

3.2 Deviation(s) from the Standard(s) / Test Specification(s)

The following deviation(s) was / were made from the published requirements of the listed standards: N/A.

(Please define the deviations from the standard(s) if applicable)

3.3 Overview of results

Requirement – Test Item	Standard(s)	Verdict	Tset Location	Remark
20dB Emission Bandwidth	FCC 15.247(a)(1)	PASS	**A**	Test data please refer to **Appendix A**
Maximum conducted output power	FCC 15.247(b)(1)	PASS	**A**	Test data please refer to **Appendix B**
Carrier Frequency Separation	FCC 15.247(a)(1)	PASS	**A**	Test data please refer to **Appendix C**
Time of Occupancy (Dwell Time)	FCC 15.247(a)(1)(iii)	PASS	**A**	Test data please refer to **Appendix D**
Number of Hopping Frequencies	FCC 15.247(a)(1)(iii)	PASS	**A**	Test data please refer to **Appendix E**
Band edge measurements	FCC 15.247(d)	PASS	**B**	Test data please refer to **Appendix F**
Conducted Spurious Emission	FCC 15.247(d), FCC 15.209	PASS	**A**	Test data please refer to **Appendix G**
Duty Cycle	ANSI C63.10:2013	PASS	**A**	Test data please refer to **Appendix H**
Emissions in Restricted Bands	FCC 15.247(b)(3)	PASS	**B**	Test data please refer to **Appendix I**
AC Power Line Conducted Emission	FCC 15.207	PASS	**A**	Test data please refer to **Appendix J**
Antenna Requirement	FCC 15.203	PASS	**---**	**---**

3.4 Power setting in test

Mode	Channel	Frequency (MHz)	Power Setting
DH5	00	2402	Default
	39	2441	Default
	78	2480	Default

3.5 Test Facility

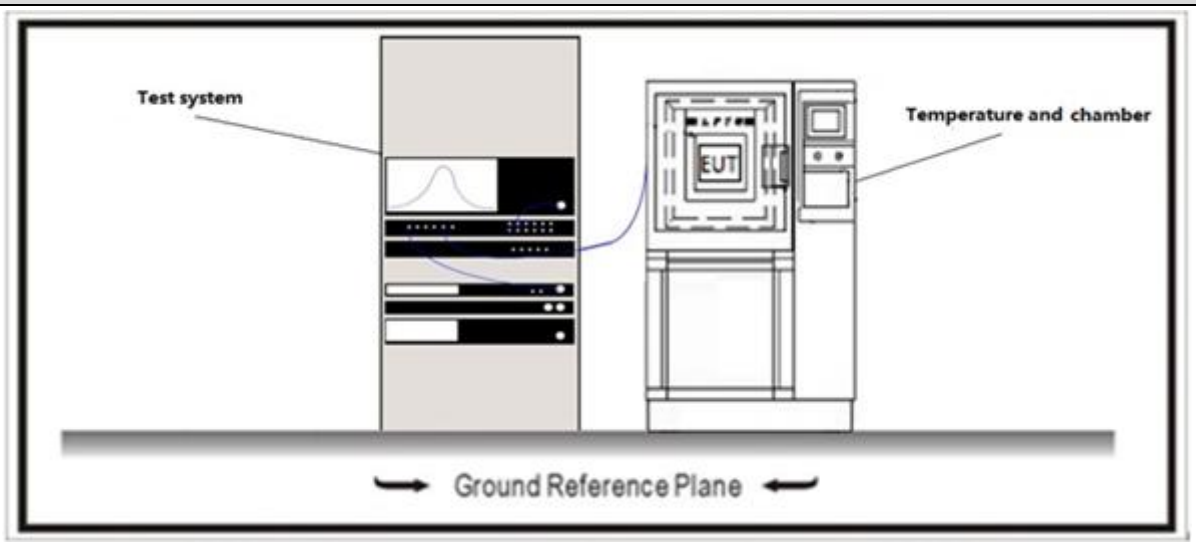
Tset Location A	**:**	**FCC Designation Number: CN1199**
Tset Location B	**:**	**FCC Designation Number: CN1321**

4 TEST ITEMS OF LIMIT/SETUP/PROCEDURE

4.1 20dB Emission Bandwidth	VERDICT: PASS

4.1.1 Limit		
Standard		FCC Part 15 Subpart C Paragraph 15.247(a)
☒	For frequency hopping systems operating in 2400-2483.5 MHz band, within frequency range.	
☐	For frequency hopping systems operating in 902-928 MHz band, the maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.	
☐	For frequency hopping systems operating in 5725-5850 MHz band, the maximum 20 dB bandwidth of the hopping channel is 1 MHz.	

4.1.2 Test Setup

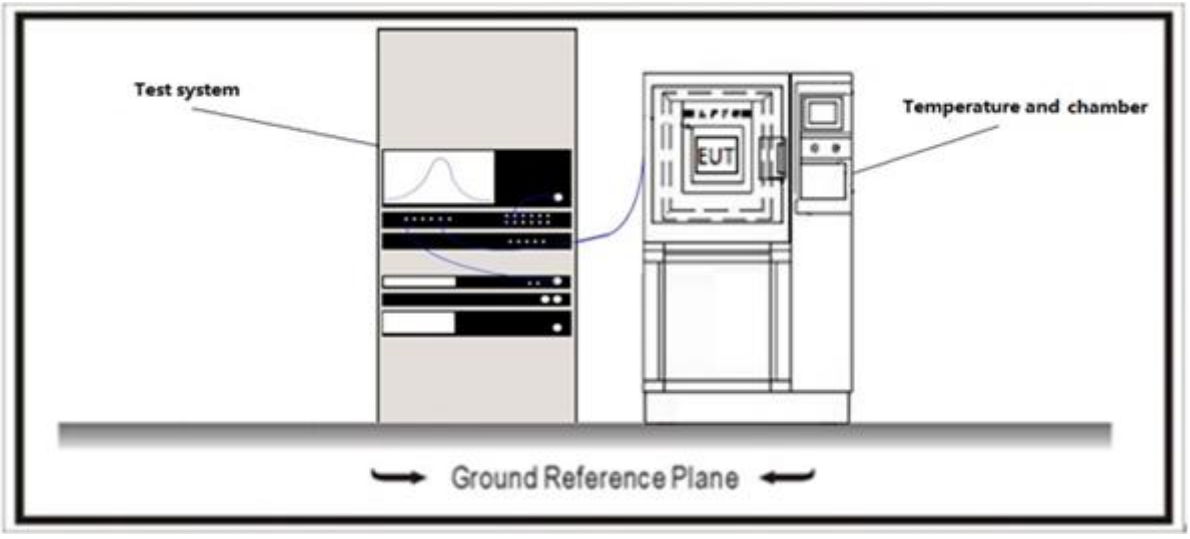


4.1.3 Test Procedure				
References Rule			Chapter	Description
☒	ANSI C63.10		6.9	Occupied bandwidth tests
	☒	ANSI C63.10	6.9.2	Occupied bandwidth—relative measurement procedure

4.2 Maximum Conducted Output Power	VERDICT: PASS

4.2.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15.247(b);
☒	Frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
☒	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.
☐	For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels

4.2.2 Test Setup



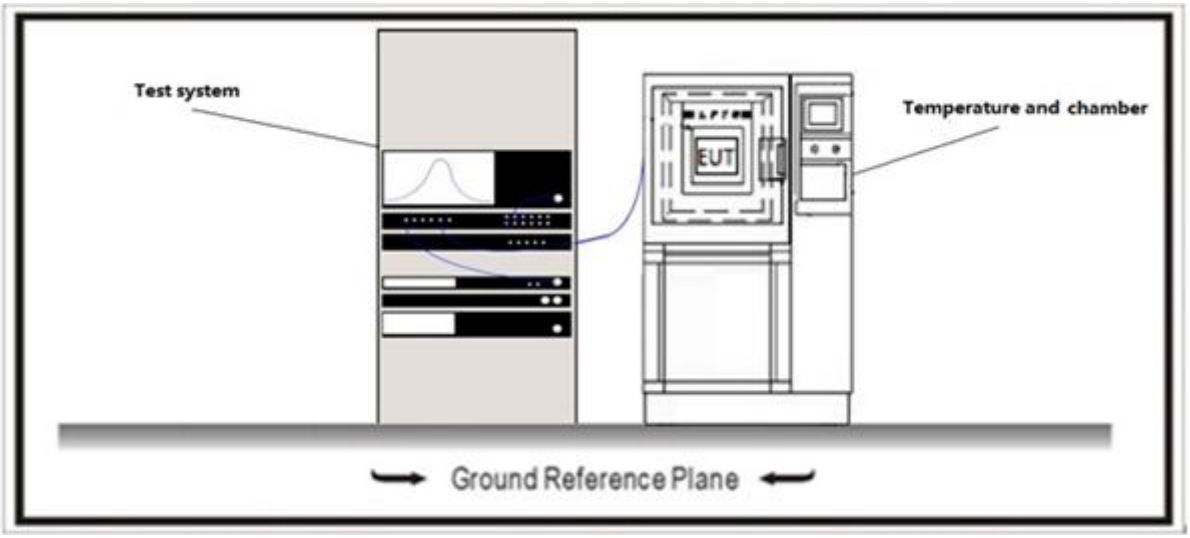
4.2.3 Test Procedure

	References Rule	Chapter	Description
☒	ANSI C63.10	7.8	Evaluation of frequency-hopping device parameters
	☒ ANSI C63.10	7.8.5	Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices

4.3 Carrier Frequency Separation	VERDICT: PASS

4.3.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15.247(a);
☐	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.
☒	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.
☐	The 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period;
☐	The 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
☐	Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz.

4.3.2 Test Setup

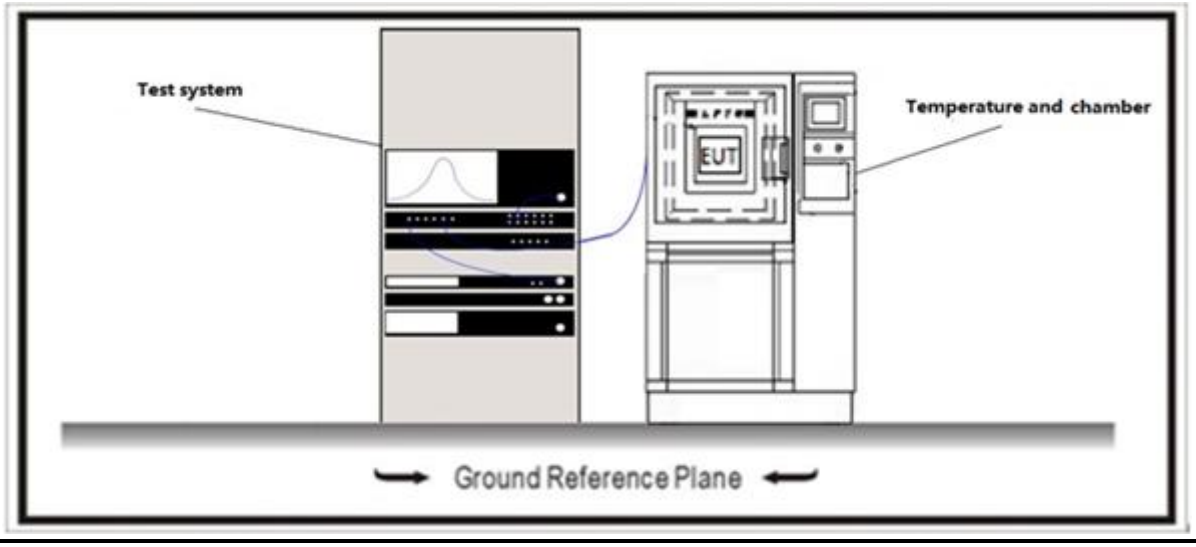


4.3.3 Test Procedure			
References Rule		Chapter	Description
☒	ANSI C63.10	7.8	Evaluation of frequency-hopping device parameters
☒	ANSI C63.10	7.8.2	Carrier frequency separation

4.4 Time of Occupancy	VERDICT: PASS

4.4.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15.247(a);
☒	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.
☐	For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period
☐	For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.
☐	Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

4.4.2 Test Setup



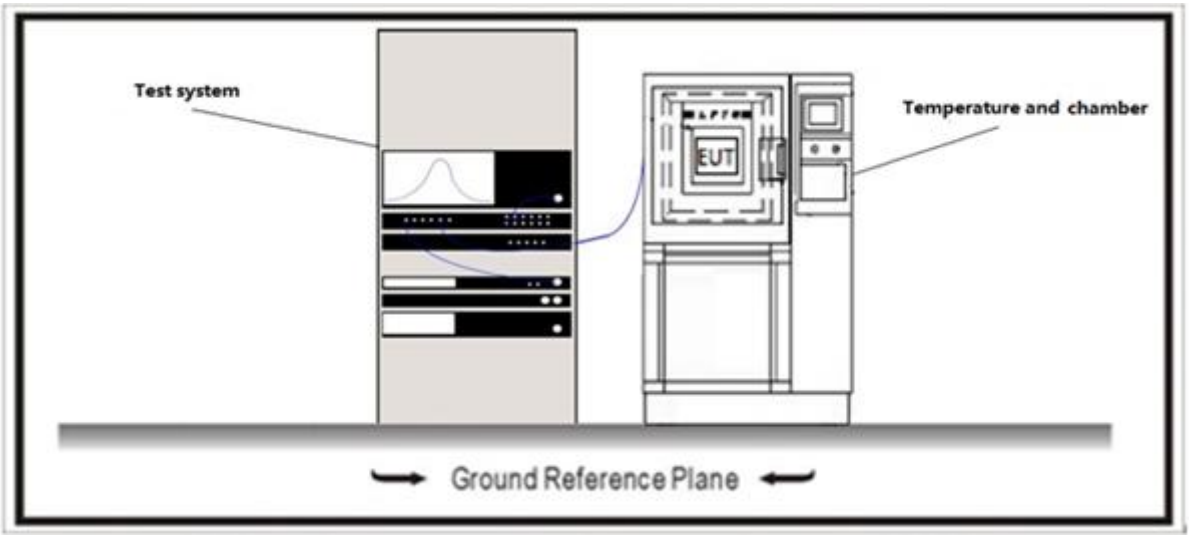
4.4.3 Test Procedure

References Rule			Chapter	Description
☒	ANSI C63.10		7.8	Evaluation of frequency-hopping device parameters
	☒	ANSI C63.10	7.8.4	Time of occupancy (dwell time)

4.5 Number of hopping Frequencies	VERDICT: PASS

4.5.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15.247(a);
☒	For frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 hopping frequencies.
☐	For frequency hopping systems operating in 902-928 MHz band, if the 20 dB bandwidth of the hopping channel is less than 250 kHz, shall use at least 50 hopping frequencies.
☐	For frequency hopping systems operating in 902-928 MHz band, if the 20 dB bandwidth of the hopping channel is higher than 250 kHz, shall use at least 25 hopping frequencies.
☐	For frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies.

4.5.2 Test Setup



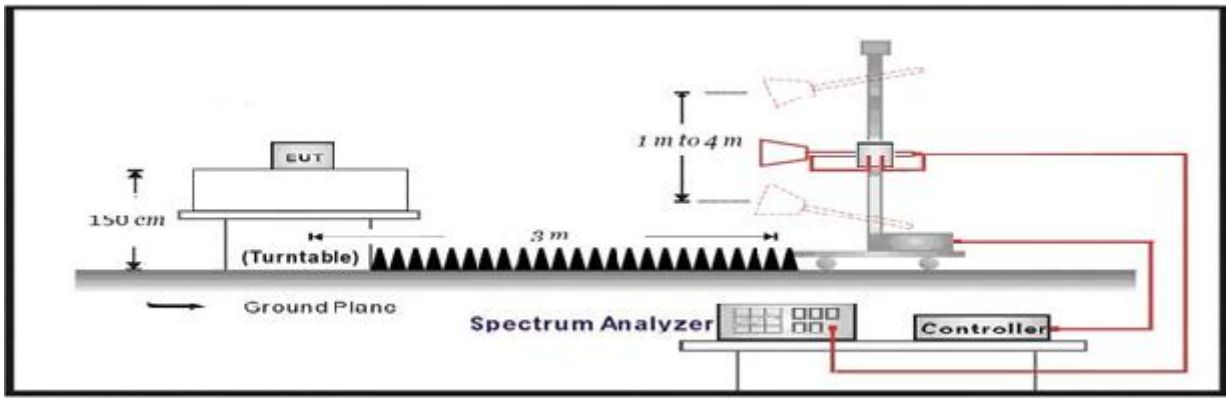
4.5.3 Test Procedure				
References Rule			Chapter	Description
☒	ANSI C63.10		7.8.	Evaluation of frequency-hopping device parameters
	☒	ANSI C63.10	7.8.3	Number of Hopping Frequencies

4.6 Band edge measurements	VERDICT: PASS

4.6.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.247(d) ,15.209;			
Frequency bands (MHz)	Detector	Limit (dB μV/m)	RBW (MHz)	Distance (m)
2310-2390 2483.5-2500	PK	74	1	3
	AV	54	1	3
Note: The field strength of emissions appearing within these frequency bands shall not exceed the limits.				

4.6.2 Test Setup



4.6.3 Test Procedure

Test Method

	References Rule	Chapter	Description
☐	DA 00-705	N/A	duty cycle correction factor
☒	ANSI C63.10	6.10	Band-edge testing
	☒ ANSI C63.10	6.10.5	Restricted-band band-edge measurements
	☐ ANSI C63.10	6.10.6	Marker-delta method
☐	ANSI C63.10	6.4	Radiated emissions from unlicensed wireless devices below 30 MHz
☐	ANSI C63.10	6.5	Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz
☐	ANSI C63.10	6.6	Radiated emissions from unlicensed wireless devices above 1 GHz

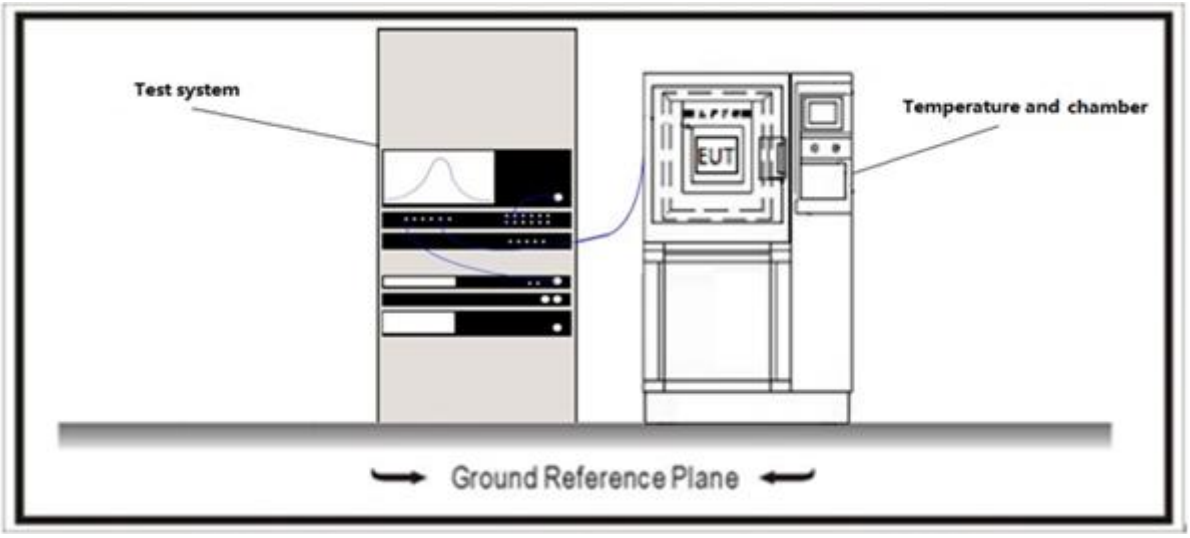
4.7 Conducted Spurious Emission	VERDICT: PASS

4.7.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15.247(d);
RF Output power (Detection methods)	Limit(dB)
RF Output power(Average detector)	30dBc(Note1)
RF Output power(PK detector)	20dBc(Note2)

Note 1: If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

Note 2: If the maximum peak conducted output power procedure was used, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

4.7.2 Test Setup

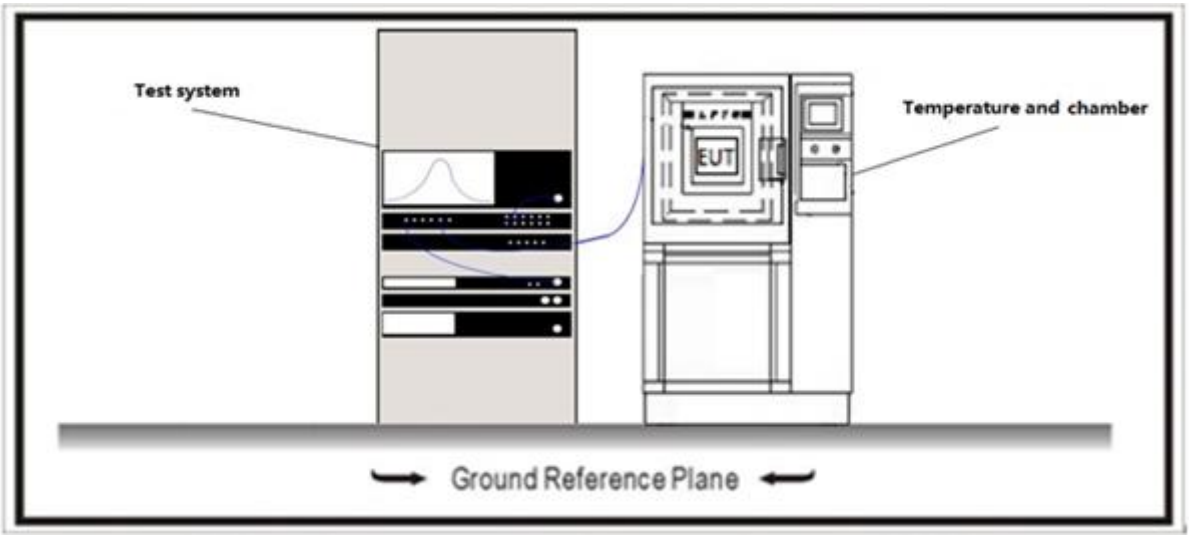


4.7.3 Test Procedure				
References Rule			Chapter	Description
☒	ANSI C63.10		7.8	Evaluation of frequency-hopping device parameters
	☒	ANSI C63.10	7.8.6	Band-edge measurements for RF conducted emissions

4.8 Duty cycle	VERDICT: PASS

4.8.1 Limit
N/A

4.8.2 Test Setup



4.8.3 Test Procedure			
References Rule		Chapter	Description
☒	ANSI C63.10	11.6	Duty cycle (D), transmission duration (T), and maximum power control level

4.9 Emissions in Restricted Bands — VERDICT: PASS

4.9.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.205		
Restricted Bands of operation			
Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 –16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.81425 – 8.81475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975–12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675–12.57725	322 – 335.4	3600 – 4400	
13.36 – 13.41			

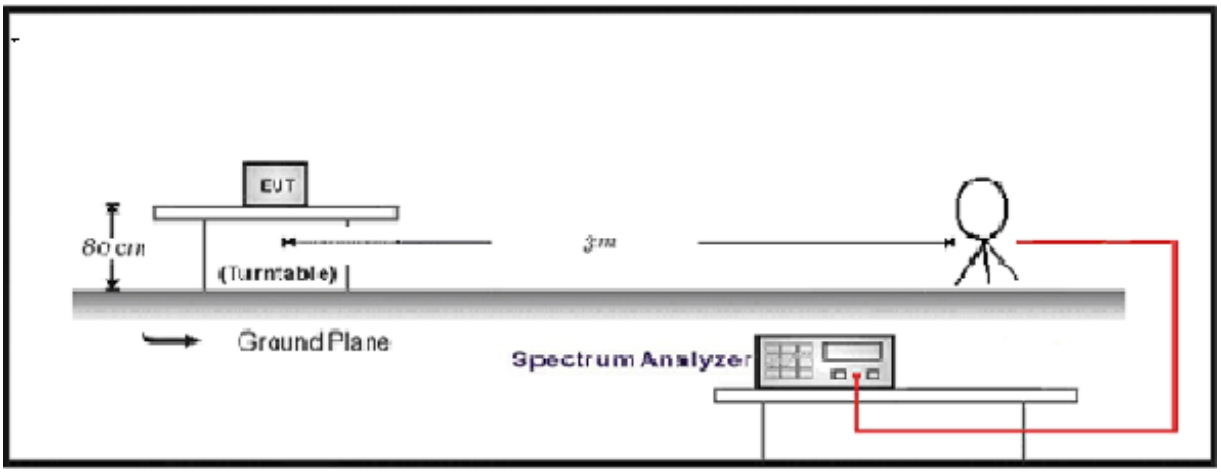
Restricted Band Emissions Limit			
FCC Part 15 Subpart C Paragraph 15.209			
Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009 - 0.49	2400/F(kHz)	48.5 – 13.8	300(Note 1)
0.49 - 1.705	24000/F(kHz)	33.8 - 23	30(Note 1)
1.705 - 30	30	29.5	30(Note 1)
30 - 88	100	40	3(Note 2)
88 - 216	150	43.5	3(Note 2)
216 - 960	200	46	3(Note 2)
Above 960	500	54	3(Note 2)

Note 1: At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

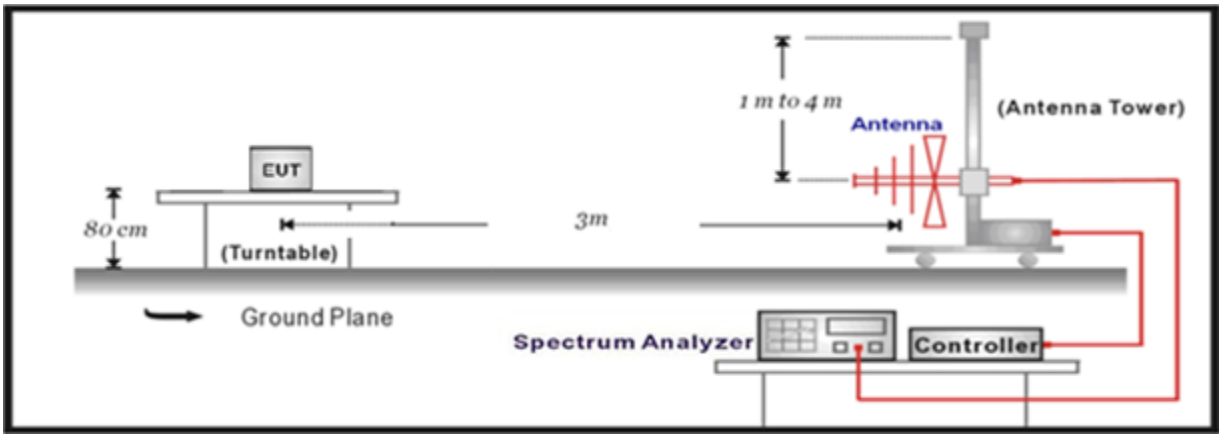
Note 2: At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

4.9.2 Test Setup

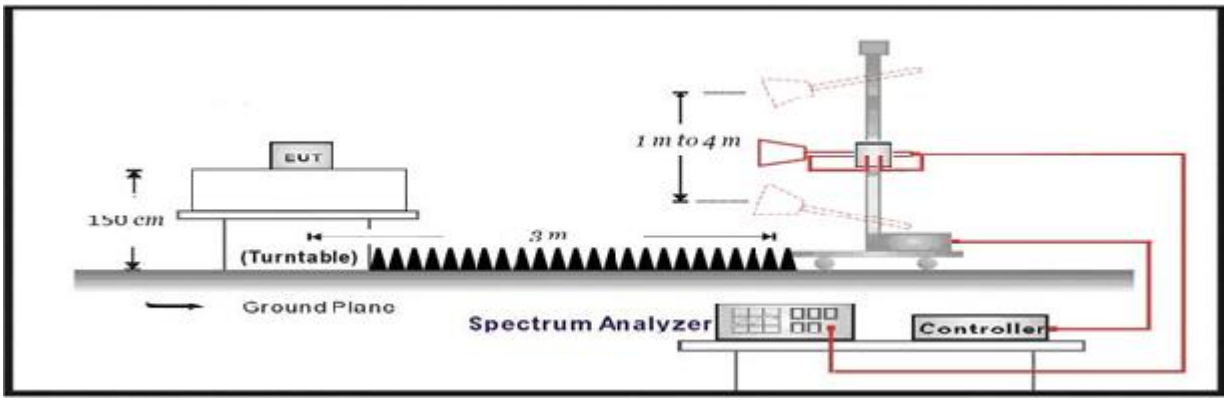
Below 30MHz Test Setup:



30MHz-1GHz Test Setup:



Above 1GHz Test Setup:



4.10.3 Test Procedure					
	References Rule			Chapter	Description
☒	ANSI C63.10			11.12	Emissions in restricted frequency bands
	☒	ANSI C63.10		11.12.1	Radiated emission measurements
	☒	ANSI C63.10		11.12.2.7	Radiated spurious emission test
		☒	ANSI C63.10	6.4	Radiated emissions from unlicensed wireless devices below 30 MHz
		☒	ANSI C63.10	6.5	Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz
		☒	ANSI C63.10	6.6	Radiated emissions from unlicensed wireless devices above 1 GHz

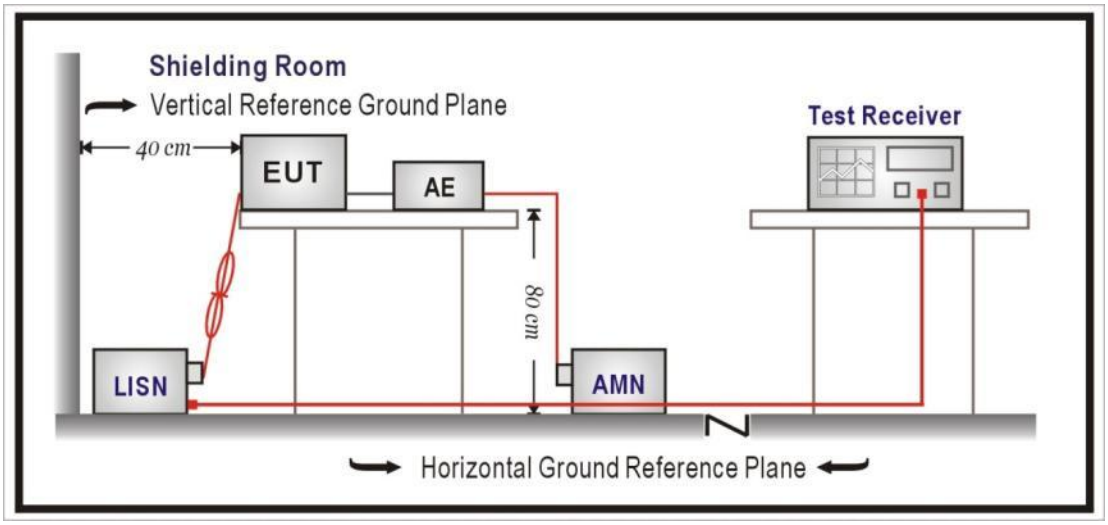
4.10 AC Power Line Conducted Emission	VERDICT: PASS

4.10.1 Limit

Standard	FCC Part 15 Subpart C Paragraph 15.207; RSS-Gen Issue 5 Paragraph 8.8.	
Frequency range [MHz]	Limit: QP [dB(μV)[1)]]	Limit: AV [dB(μV)[1)]]
0,15 - 0,50	66 – 56 [2)]	56 - 46 [2)]
0,50 - 5,0	56	46
5,0 - 30	60	50

[1)] At the transition frequency, the lower limit applies.
[2)] The limit decreases linearly with the logarithm of the frequency.
NOTE 1: The exclusion band for transmitters shall be considered for transmitters operating at frequencies below 30 MHz.
NOTE 2: Where the AC output port is directly connected (or via a circuit breaker) to the AC power input port of the EUT the AC power output port need not to be tested.

4.10.2 Test Setup



4.10.3 Test Procedure

	References Rule	Chapter	Item
☒	ANSI C63.10-2013	6.2	Standard test method for ac power-line conducted emissions from unlicensedwireless devices

4.11 Antenna Requirement	VERDICT: PASS

4.11.1 Limit	
Standard	FCC Part 15 Subpart C Paragraph 15.247(d) ,15.209
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.	

4.11.2 Antenna Connector Construction:	
☒	The use of a permanently attached antenna
☐	The antenna use of a unique coupling to the intentional radiator
☐	The use of a nonstandard antenna jack or electrical connector
Please refer to the attached document “Internal Photograph” to show the antenna connector.	

5 TEST SETUP PHOTO AND EUT PHOTO

Remark: The test setup photo and EUT Photo please see appendix.

6 TEST RESULT

Appendix A: 20dB Emission Bandwidth

TestMode	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	2402	0.969	2401.487	2402.456	---	---
DH5	2441	1.032	2440.433	2441.465	---	---
DH5	2480	0.954	2479.493	2480.447	---	---

Test Graphs

DH5-Ant1-2402

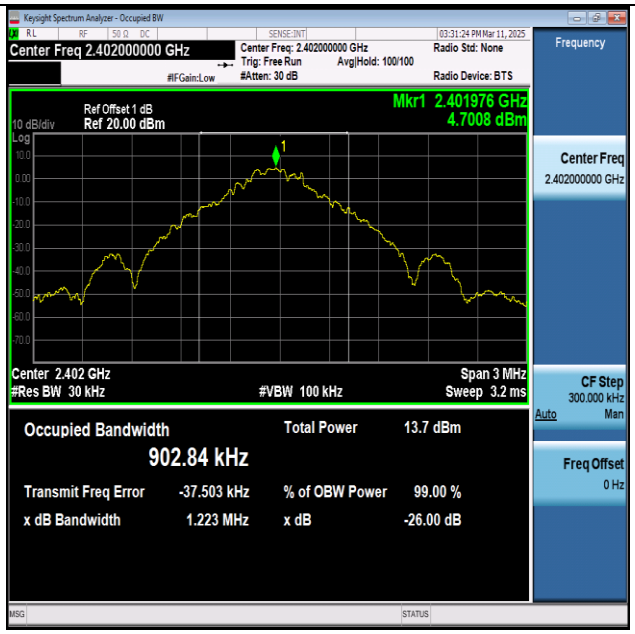
DH5-Ant1-2441

DH5-Ant1-2480

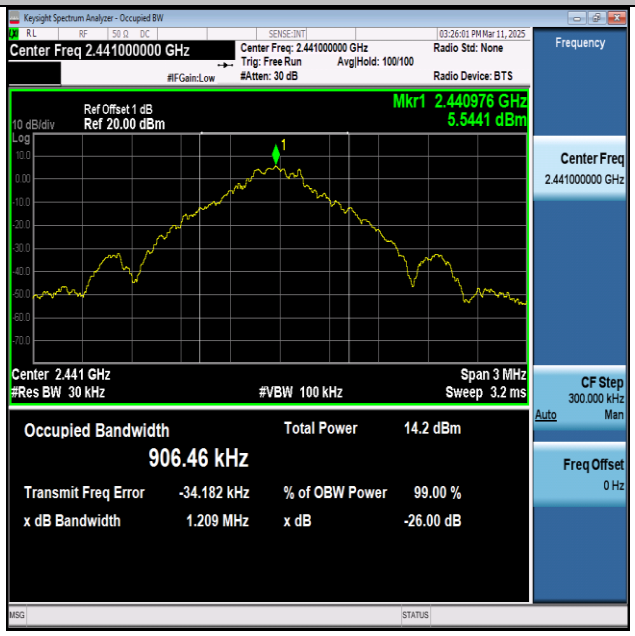
Appendix B: Occupied Channel Bandwidth

TestMode	Frequency[MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	2402	0.90284	2401.5111	2402.4139	---	---
DH5	2441	0.90646	2440.5126	2441.4191	---	---
DH5	2480	0.90855	2479.5084	2480.4170	---	---

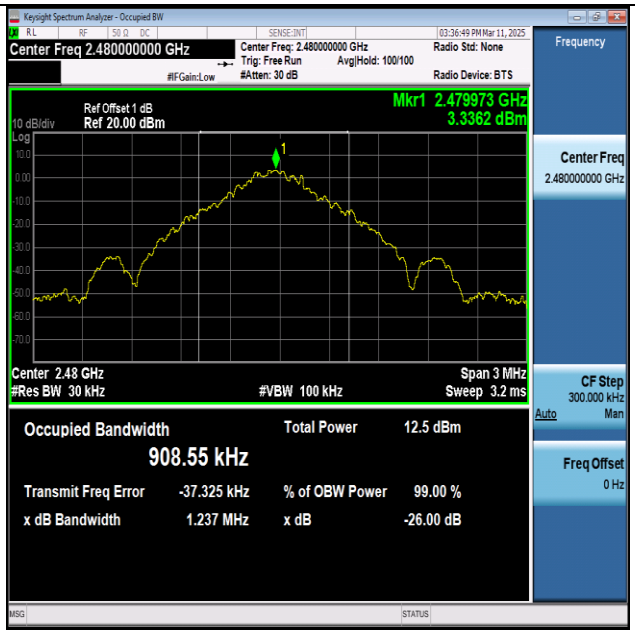
Test Graphs



DH5-Ant1-2402



DH5-Ant1-2441



DH5-Ant1-2480

Appendix C: Maximum conducted output power

Test Mode	Frequency [MHz]	Conducted Power [dBm]	Limit [dBm]	Verdict
DH5	2402	3.53	≤20.97	PASS
	2441	4.32	≤20.97	PASS
	2480	2.83	≤20.97	PASS

Appendix D: Carrier frequency separation

TestMode	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
DH5	Hop	1	≥0.688	PASS

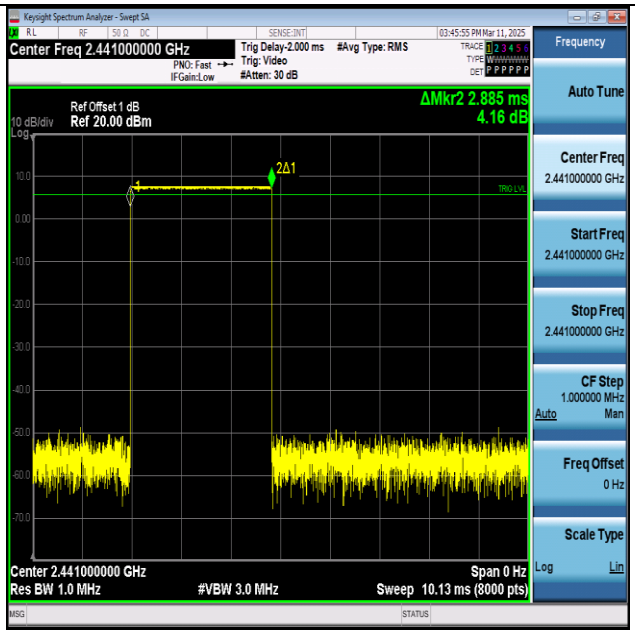
Test Graphs

DH5-Ant1-Hop-PASS

Appendix E: Time of occupancy

TestMode	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH5	Hop	2.885	106.67	0.308	≤0.4	PASS

Test Graphs

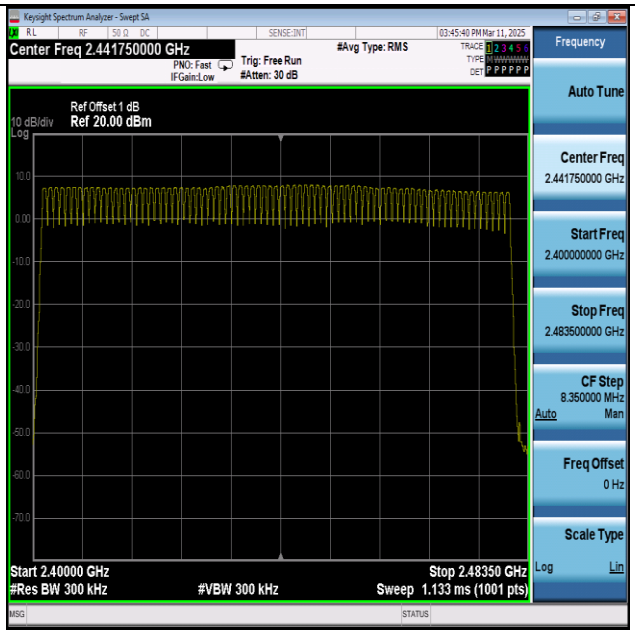


DH5-Ant1-Hop-PASS

Appendix F: Number of hopping channels

TestMode	Frequency[MHz]	Result[Num]	Limit[Num]	Verdict
DH5	Hop	79	≥15	PASS

Test Graphs



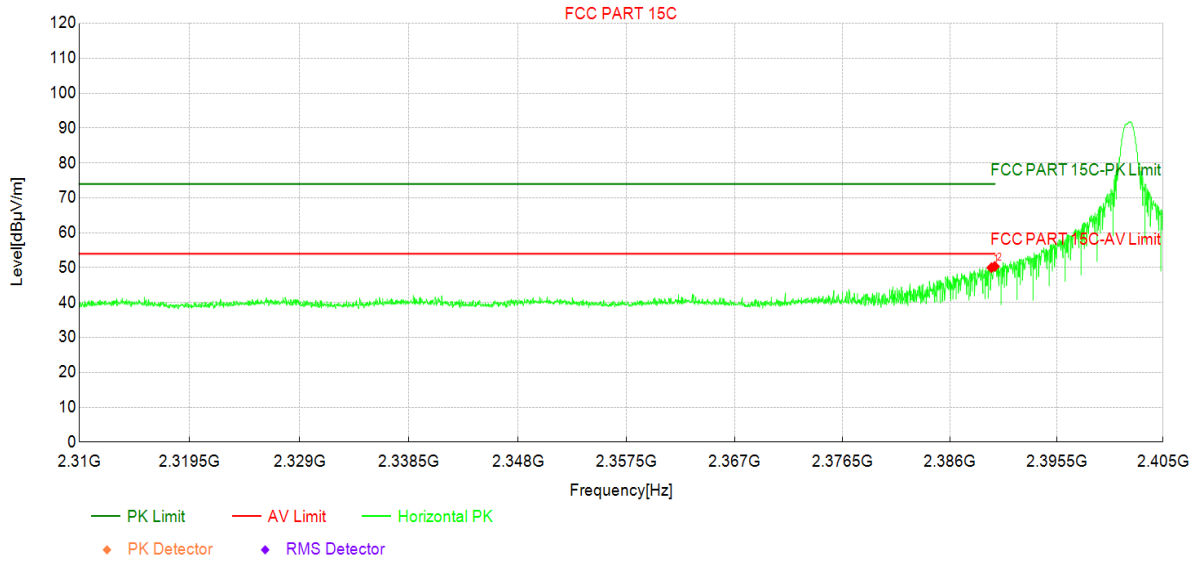
DH5-Ant1-Hop-PASS

Appendix G: Band Edge measurements

Test Report

Project Information			
Profile:	2520983R	EUT:	Smart Controller
Mode:	Mode1:Transmit at 2402MHz by DH5	Volta	120 Vac / 60 Hz
Environment:	Temp: 25℃; Humi:60%	Engi	Reyn Chen
Test Standard:	FCC PART 15C		

Test Graph

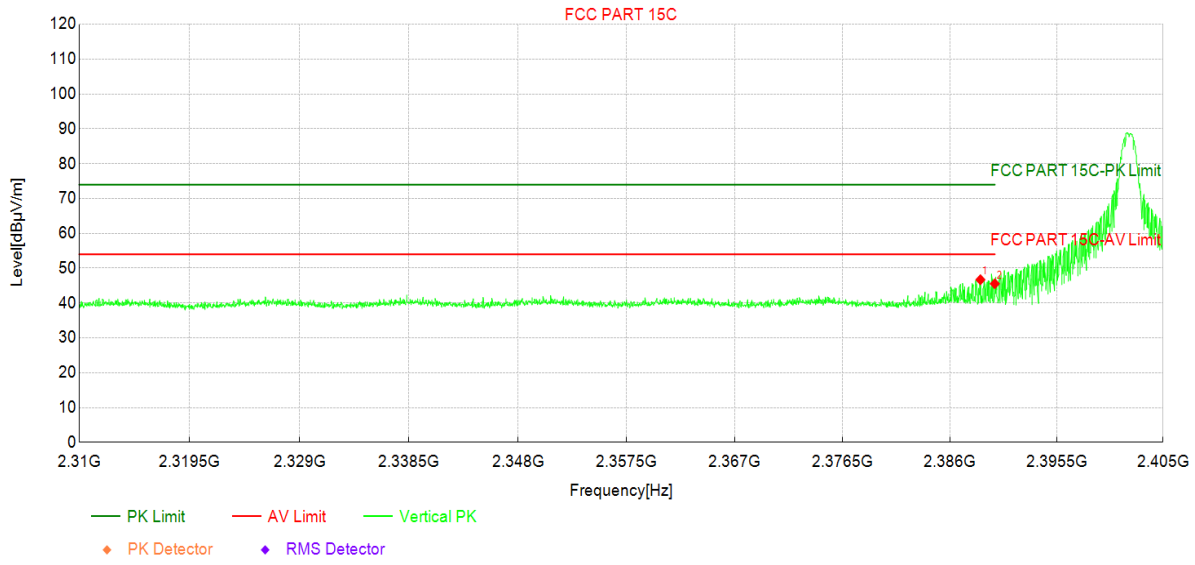


Suspected Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Det	Pol	Verdict
1	2389.71	46.33	49.98	3.65	74.00	24.02	PK	Horizo	PASS
	2389.71	-	25.22	-	54.00	28.78	AV	Horizo	PASS
2	2390.00	46.71	50.36	3.65	74.00	23.64	PK	Horizo	PASS
	2390.00	-	25.60	-	54.00	28.40	AV	Horizo	PASS

Test Report

Project Information			
Profile:	2520983R	EUT:	Smart Controller
Mode:	Mode1:Transmit at 2402MHz by DH5	Volta	120 Vac / 60 Hz
Environment:	Temp: 25℃; Humi:60%	Engi	Reyn Chen
Test Standard:	FCC PART 15C		

Test Graph



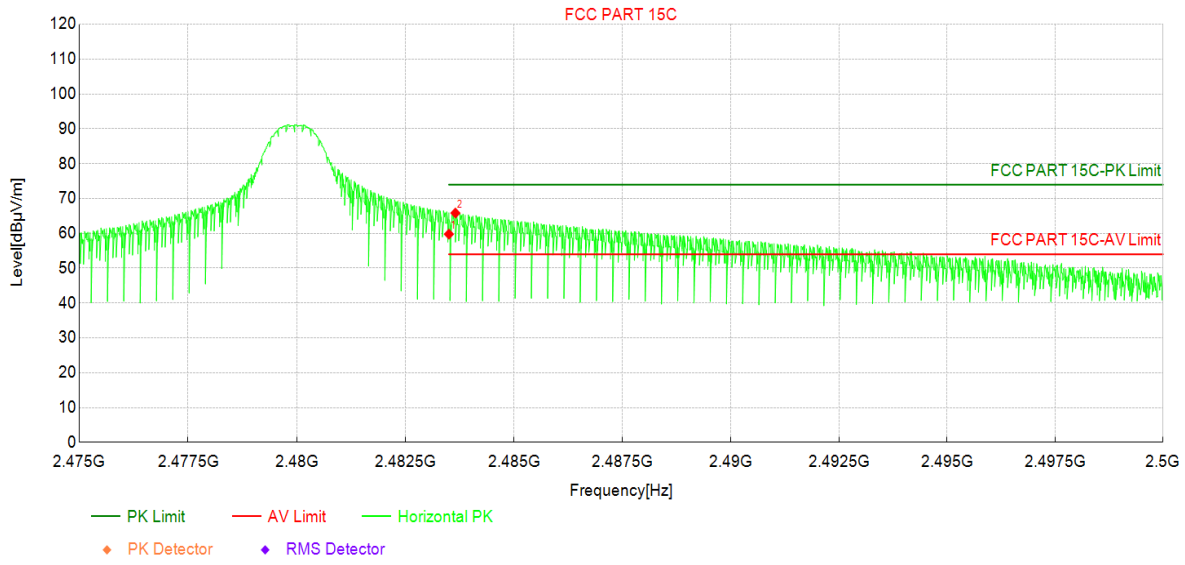
Suspected Data List

NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Det	Pol	Verdict
1	2388.72	43.05	46.69	3.64	74.00	27.31	PK	Vertic	PASS
	2388.72	-	21.93	-	54.00	32.07	AV	Vertic	PASS
2	2390.00	41.88	45.53	3.65	74.00	28.47	PK	Vertic	PASS
	2390.00	-	20.77	-	54.00	33.23	AV	Vertic	PASS

Test Report

Project Information			
Profile:	2520983R	EUT:	Smart Controller
Mode:	Mode1:Transmit at 2480MHz by DH5	Volta	120 Vac / 60 Hz
Environment:	Temp: 25℃; Humi:60%	Engi	Reyn Chen
Test Standard:	FCC PART 15C		

Test Graph



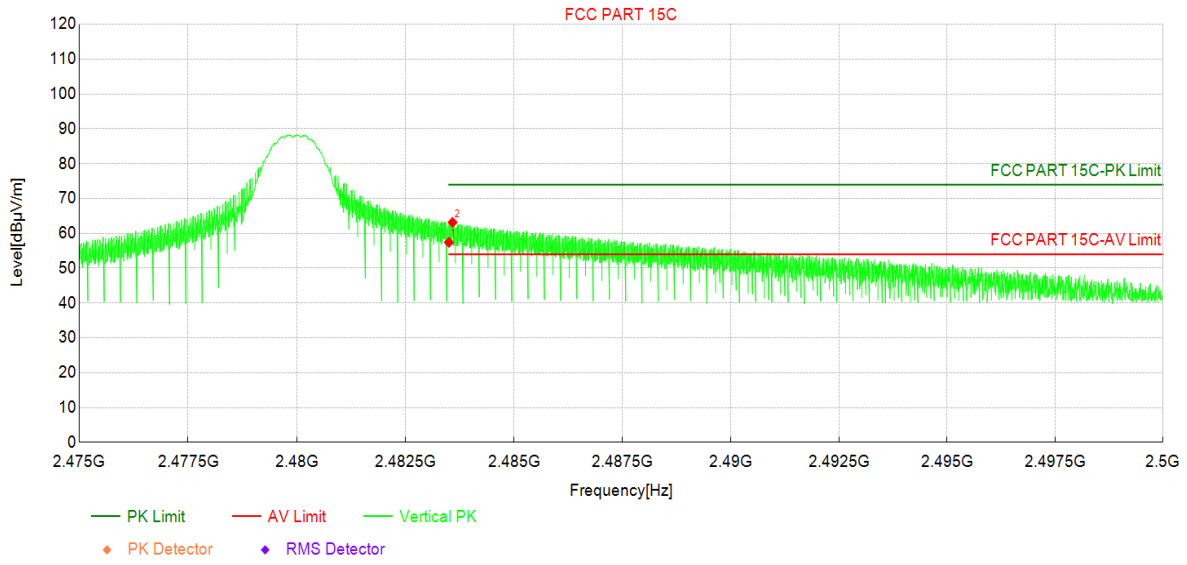
Suspected Data List

NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Det	Pol	Verdict
1	2483.50	55.68	59.77	4.09	74.00	14.23	PK	Horizo	PASS
	2483.50	-	35.01	-	54.00	18.99	AV	Horizo	PASS
2	2483.65	61.74	65.83	4.09	74.00	8.17	PK	Horizo	PASS
	2483.65	-	41.07	-	54.00	12.93	AV	Horizo	PASS

Test Report

Project Information			
Profile:	2520983R	EUT:	Smart Controller
Mode:	Mode1:Transmit at 2480MHz by DH5	Volta	120 Vac / 60 Hz
Environment:	Temp: 25℃; Humi:60%	Engi	Reyn Chen
Test Standard:	FCC PART 15C		

Test Graph



Suspected Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Det	Pol	Verdict
1	2483.50	53.32	57.41	4.09	74.00	16.59	PK	Vertic	PASS
	2483.50	-	32.65	-	54.00	21.35	AV	Vertic	PASS
2	2483.58	59.06	63.15	4.09	74.00	10.85	PK	Vertic	PASS
	2483.58	-	38.39	-	54.00	15.61	AV	Vertic	PASS

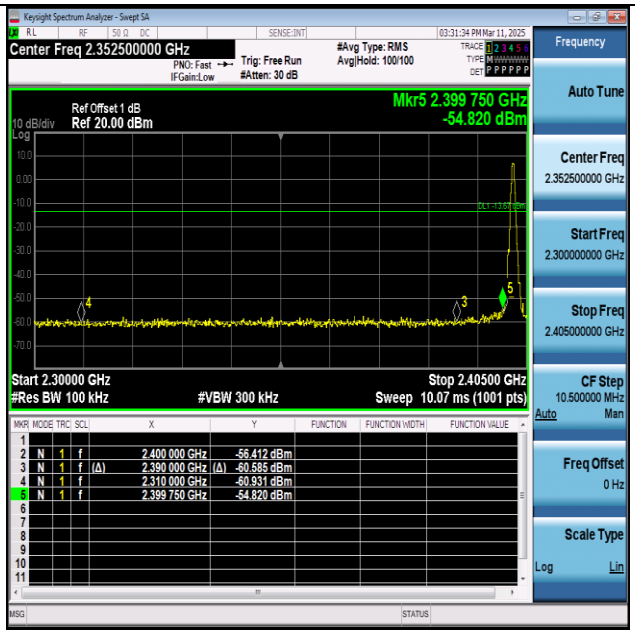
Note:
1.Level=Reading+Factor .
2. Margin=Limit-Level.
3. Margin=Limit-Level, AV Level = PK Level + Duty Cycle Factor.

Appendix H: Conducted Spurious Emission

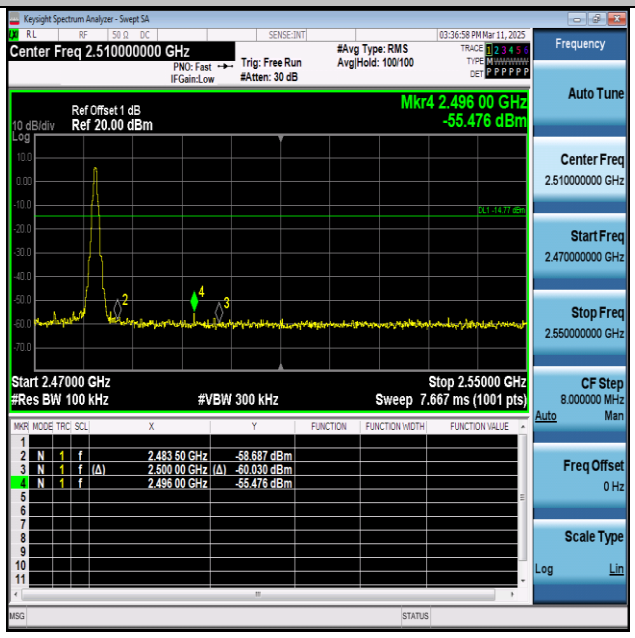
Test Result for Band edge:

TestMode	ChName	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Low	2402	6.33	-54.82	≤-13.67	PASS
DH5	High	2480	5.23	-55.48	≤-14.77	PASS
DH5	Low	Hop_2402	5.13	-53.16	≤-14.88	PASS
DH5	High	Hop_2480	5.87	-53.88	≤-14.13	PASS

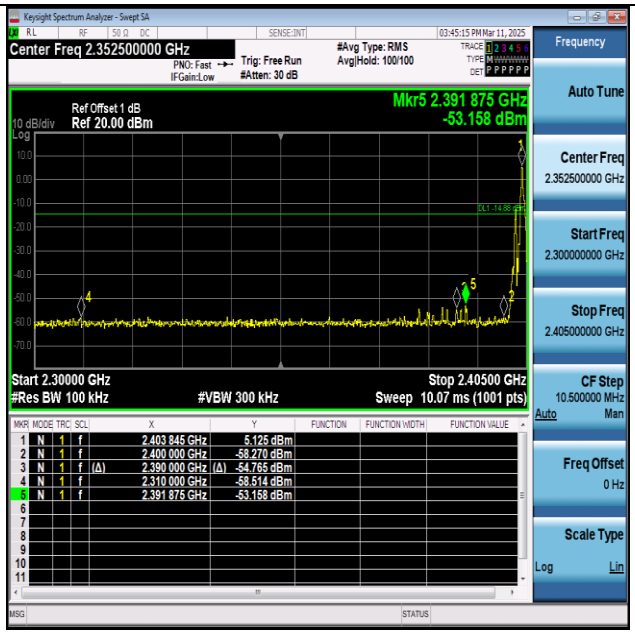
Test Graphs



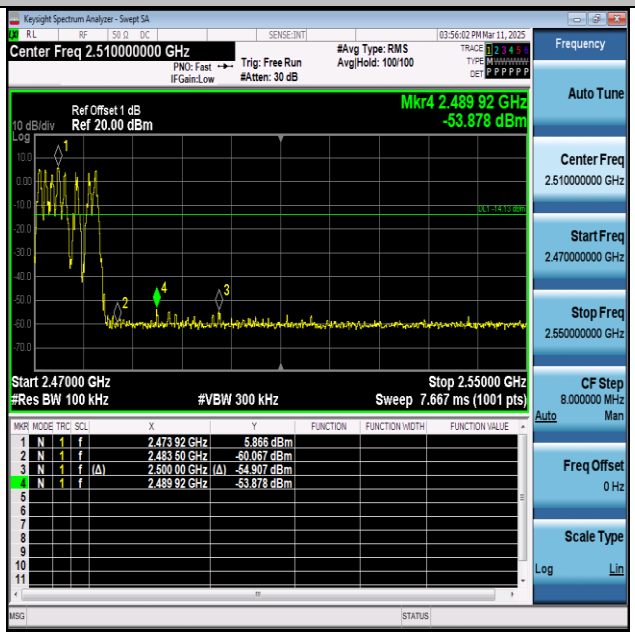
DH5-Ant1-2402-PASS



DH5-Ant1-2480-PASS



DH5-Ant1-Hop_2402-PASS

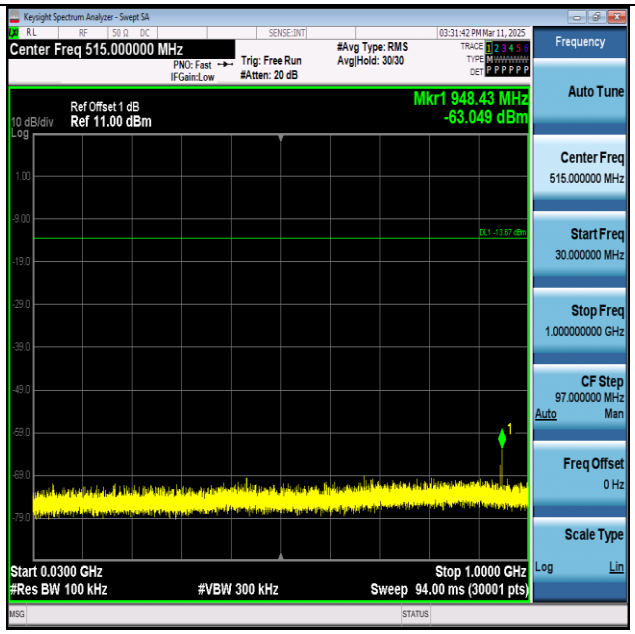


DH5-Ant1-Hop_2480-PASS

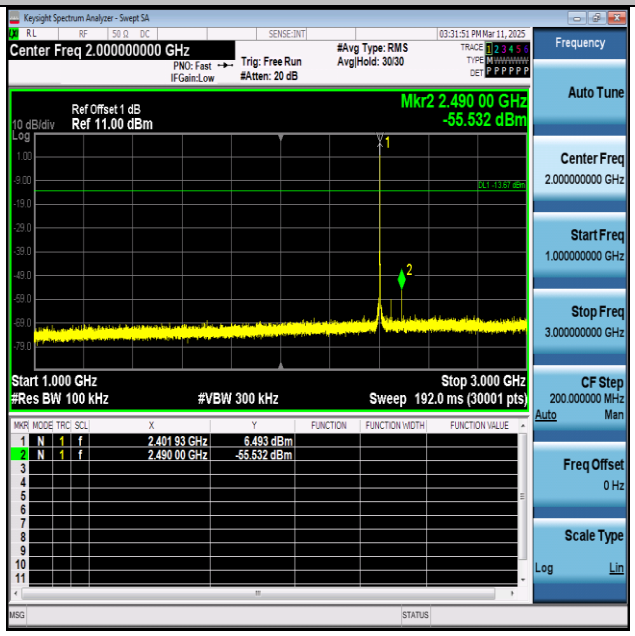
Test Result for Spurious Emission:

TestMode	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	2402	30~1000	6.33	-63.05	≤-13.67	PASS
DH5	2402	1000~3000	6.33	-55.53	≤-13.67	PASS
DH5	2402	3000~5000	6.33	-63.99	≤-13.67	PASS
DH5	2402	5000~7000	6.33	-60.86	≤-13.67	PASS
DH5	2402	7000~9000	6.33	-65	≤-13.67	PASS
DH5	2402	9000~11000	6.33	-65.04	≤-13.67	PASS
DH5	2402	11000~13000	6.33	-65.99	≤-13.67	PASS
DH5	2402	13000~15000	6.33	-64.78	≤-13.67	PASS
DH5	2402	15000~17000	6.33	-65.16	≤-13.67	PASS
DH5	2402	17000~19000	6.33	-63.88	≤-13.67	PASS
DH5	2402	19000~21000	6.33	-63.26	≤-13.67	PASS
DH5	2402	21000~23000	6.33	-61.39	≤-13.67	PASS
DH5	2402	23000~25000	6.33	-61.31	≤-13.67	PASS
DH5	2441	30~1000	6.71	-62.07	≤-13.29	PASS
DH5	2441	1000~3000	6.71	-66.46	≤-13.29	PASS
DH5	2441	3000~5000	6.71	-64.44	≤-13.29	PASS
DH5	2441	5000~7000	6.71	-61.09	≤-13.29	PASS
DH5	2441	7000~9000	6.71	-65.6	≤-13.29	PASS
DH5	2441	9000~11000	6.71	-60.75	≤-13.29	PASS
DH5	2441	11000~13000	6.71	-66.33	≤-13.29	PASS
DH5	2441	13000~15000	6.71	-64.31	≤-13.29	PASS
DH5	2441	15000~17000	6.71	-64.71	≤-13.29	PASS
DH5	2441	17000~19000	6.71	-64.01	≤-13.29	PASS
DH5	2441	19000~21000	6.71	-62.31	≤-13.29	PASS
DH5	2441	21000~23000	6.71	-61.75	≤-13.29	PASS
DH5	2441	23000~25000	6.71	-61.36	≤-13.29	PASS
DH5	2480	30~1000	5.23	-65.84	≤-14.77	PASS
DH5	2480	1000~3000	5.23	-54.5	≤-14.77	PASS
DH5	2480	3000~5000	5.23	-64.85	≤-14.77	PASS
DH5	2480	5000~7000	5.23	-61.74	≤-14.77	PASS
DH5	2480	7000~9000	5.23	-65.42	≤-14.77	PASS
DH5	2480	9000~11000	5.23	-62.62	≤-14.77	PASS
DH5	2480	11000~13000	5.23	-66.06	≤-14.77	PASS
DH5	2480	13000~15000	5.23	-64.95	≤-14.77	PASS
DH5	2480	15000~17000	5.23	-65.4	≤-14.77	PASS
DH5	2480	17000~19000	5.23	-63.91	≤-14.77	PASS
DH5	2480	19000~21000	5.23	-63.6	≤-14.77	PASS
DH5	2480	21000~23000	5.23	-62.52	≤-14.77	PASS
DH5	2480	23000~25000	5.23	-61.67	≤-14.77	PASS

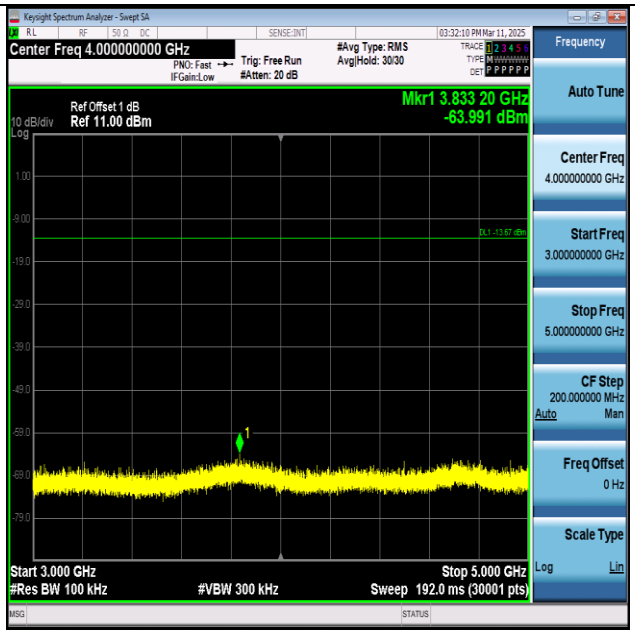
Test Graphs



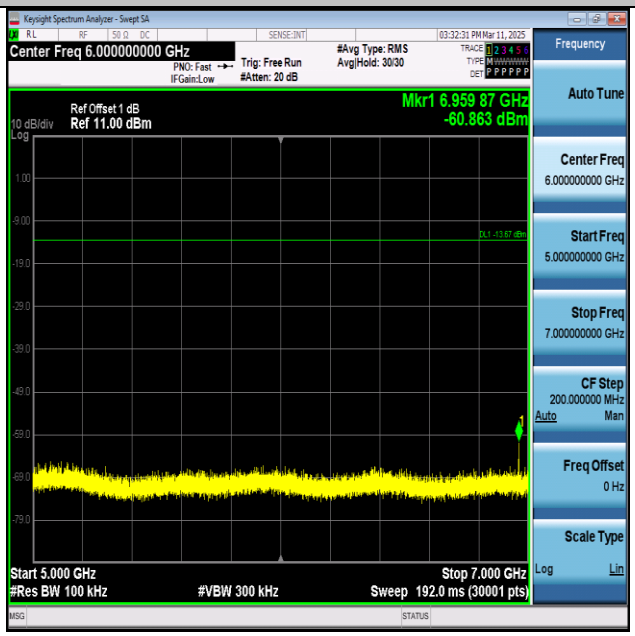
DH5-Ant1-2402-30~1000-PASS



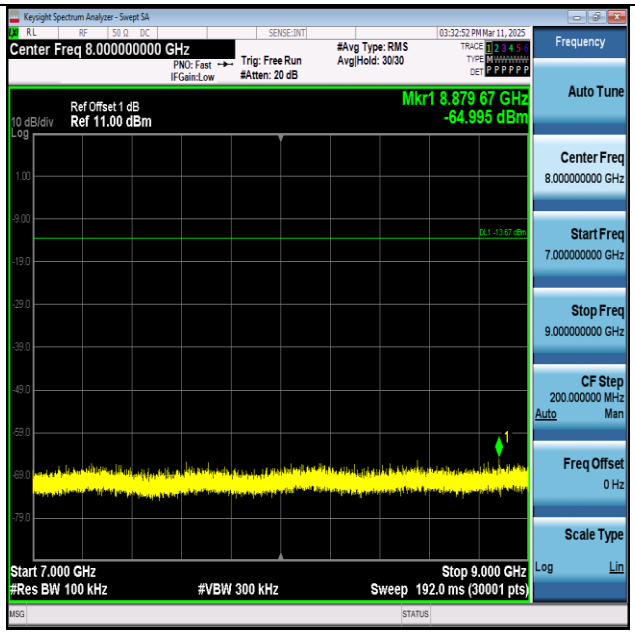
DH5-Ant1-2402-1000~3000-PASS



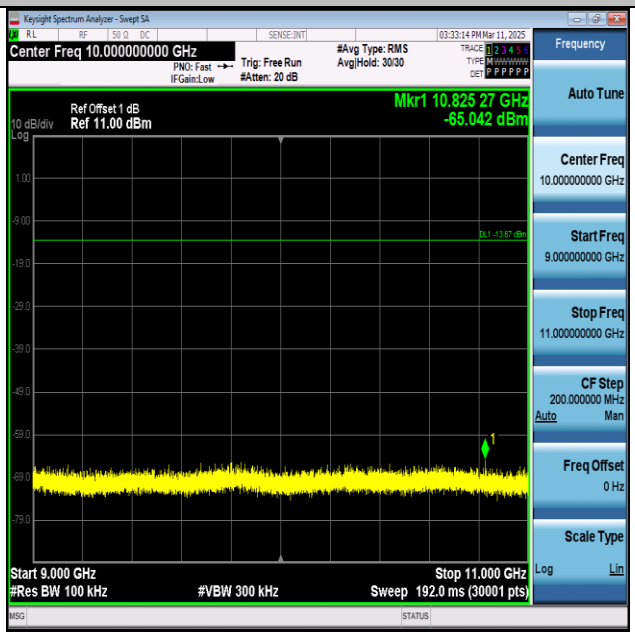
DH5-Ant1-2402-3000~5000-PASS



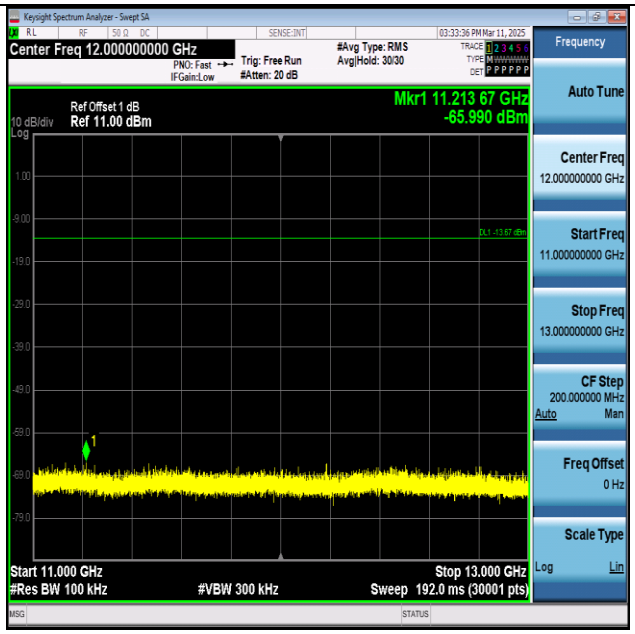
DH5-Ant1-2402-5000~7000-PASS



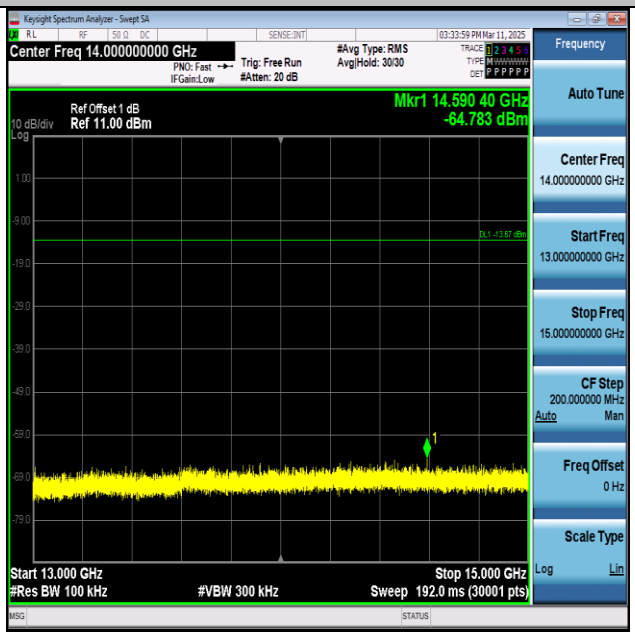
DH5-Ant1-2402-7000~9000-PASS



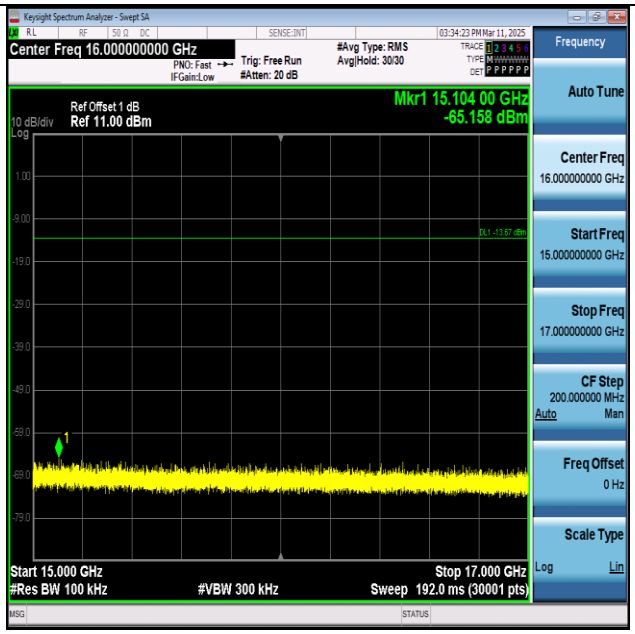
DH5-Ant1-2402-9000~11000-PASS



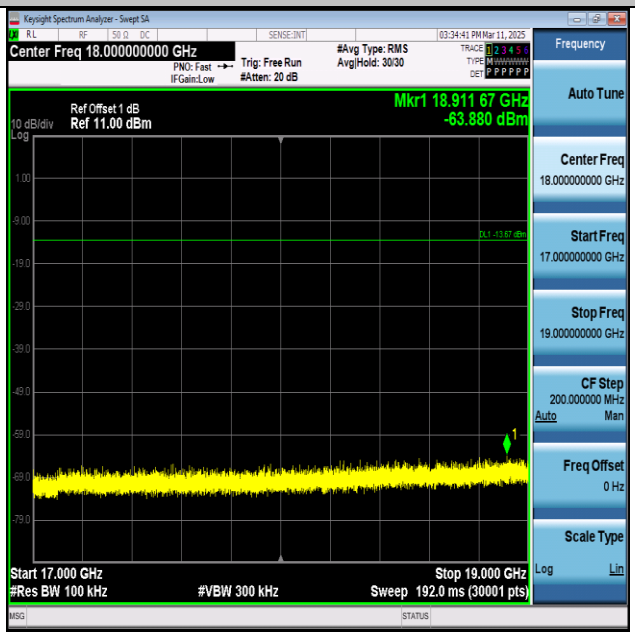
DH5-Ant1-2402-11000~13000-PASS



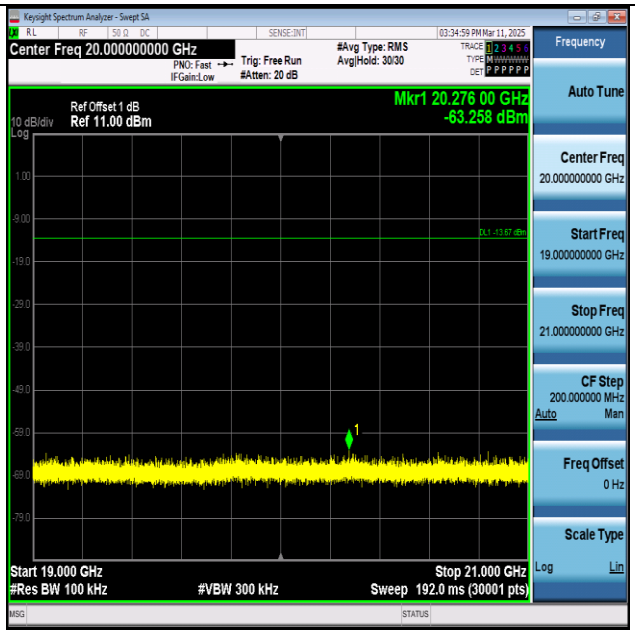
DH5-Ant1-2402-13000~15000-PASS



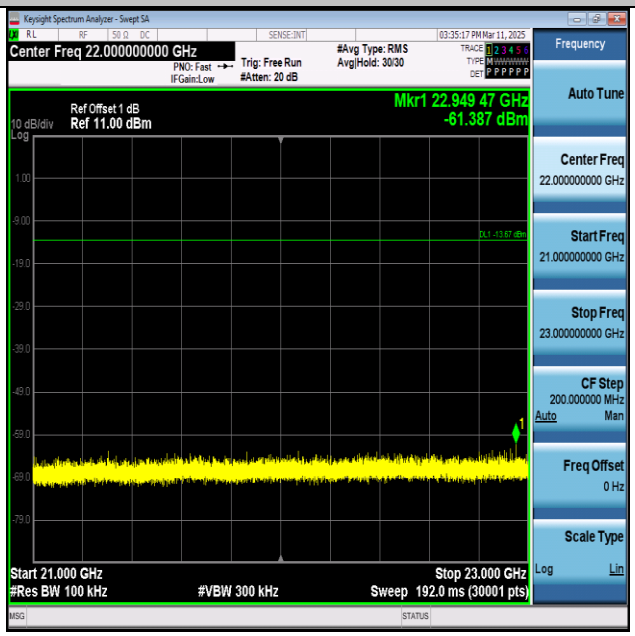
DH5-Ant1-2402-15000~17000-PASS



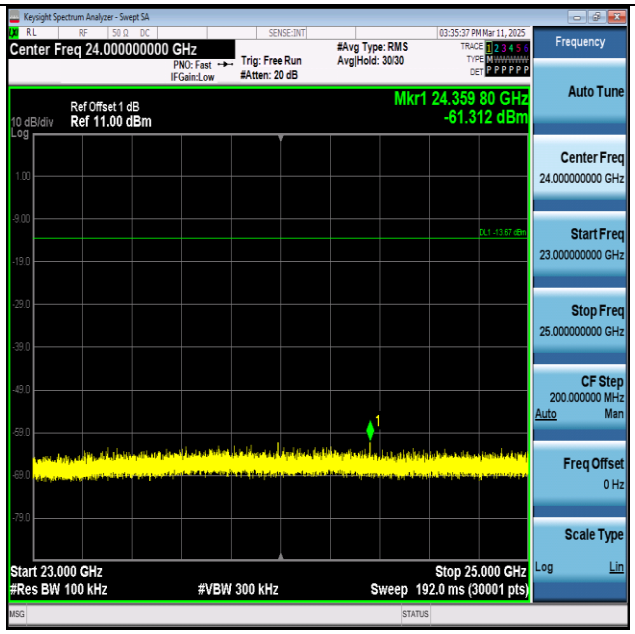
DH5-Ant1-2402-17000~19000-PASS



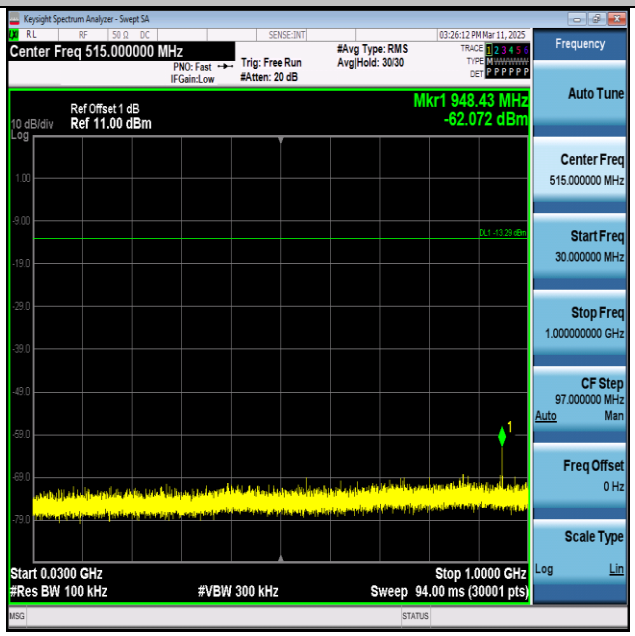
DH5-Ant1-2402-19000~21000-PASS



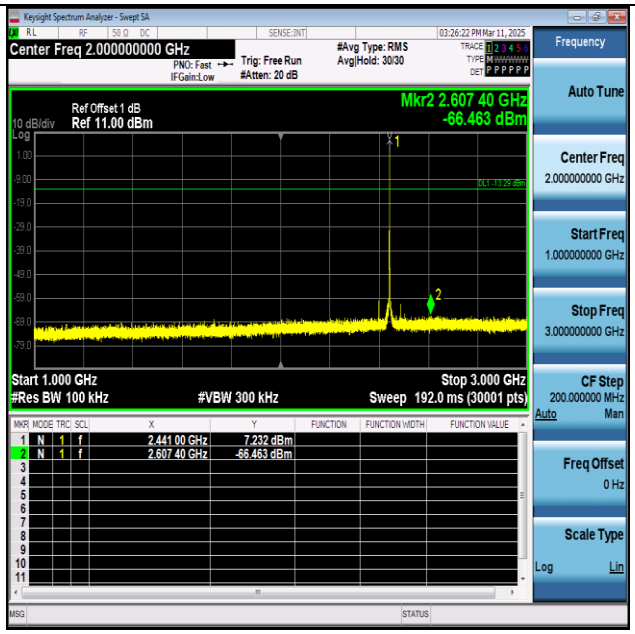
DH5-Ant1-2402-21000~23000-PASS



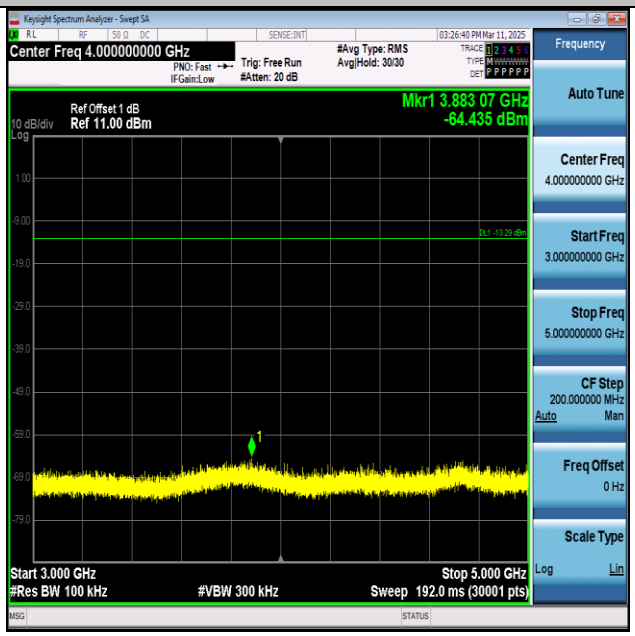
DH5-Ant1-2402-23000~25000-PASS



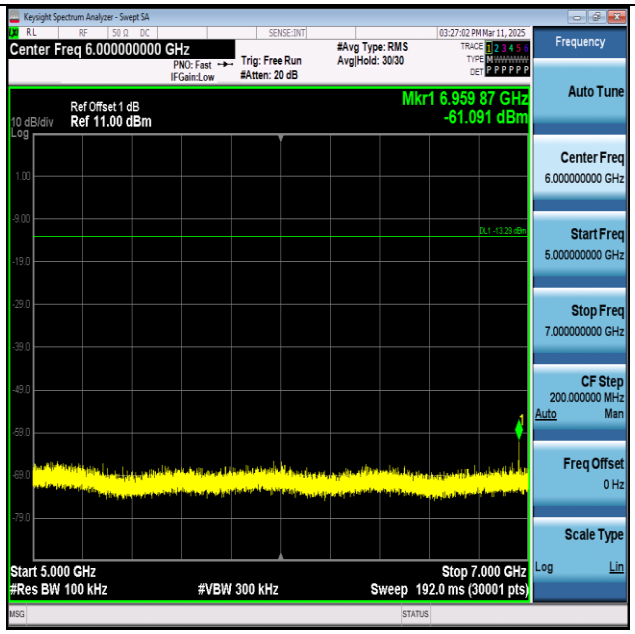
DH5-Ant1-2441-30~1000-PASS



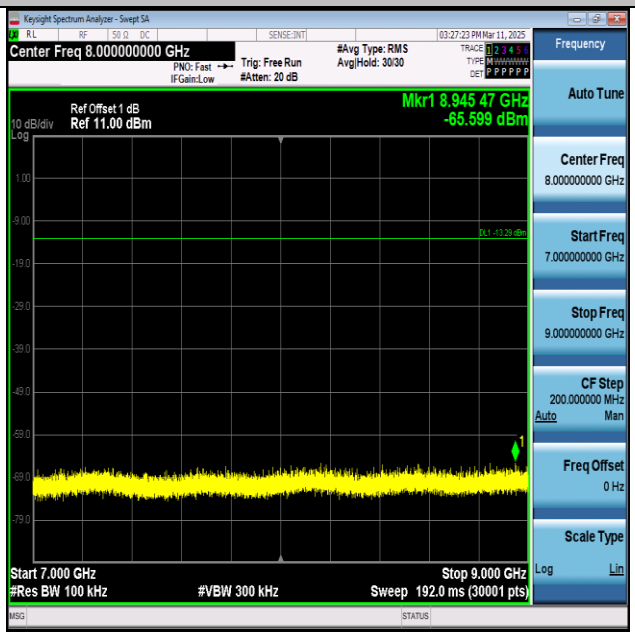
DH5-Ant1-2441-1000~3000-PASS



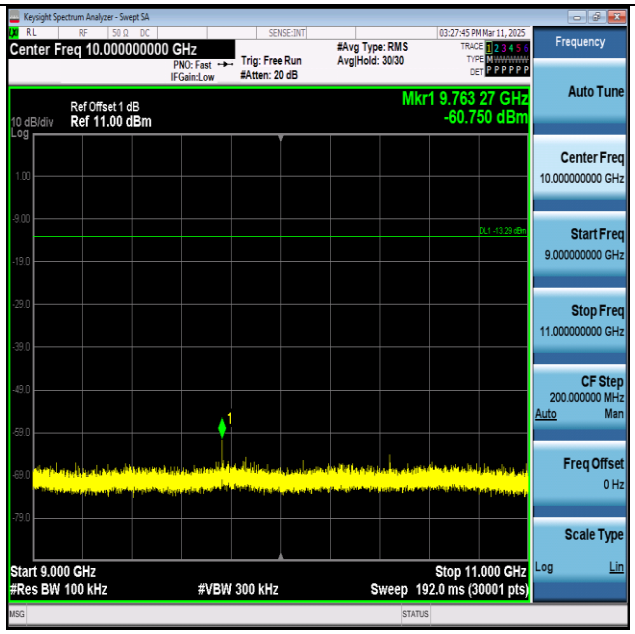
DH5-Ant1-2441-3000~5000-PASS



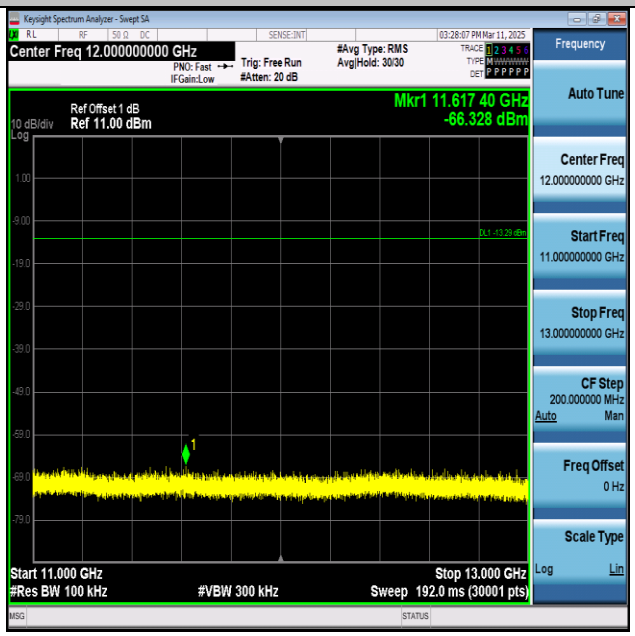
DH5-Ant1-2441-5000~7000-PASS



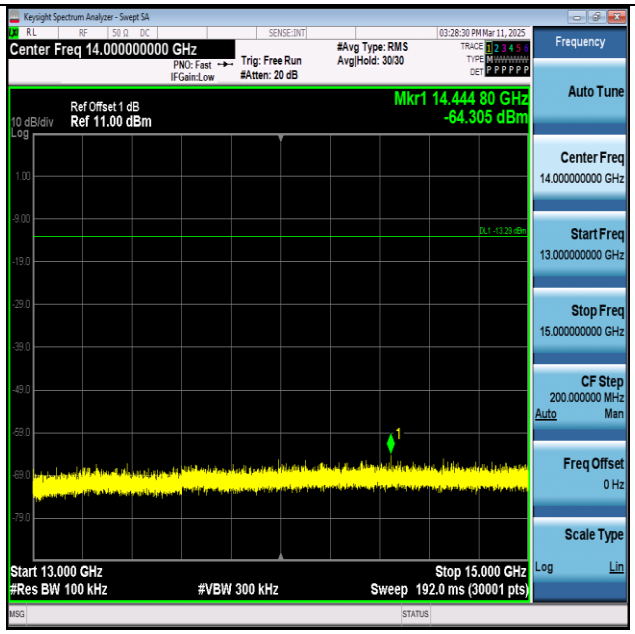
DH5-Ant1-2441-7000~9000-PASS



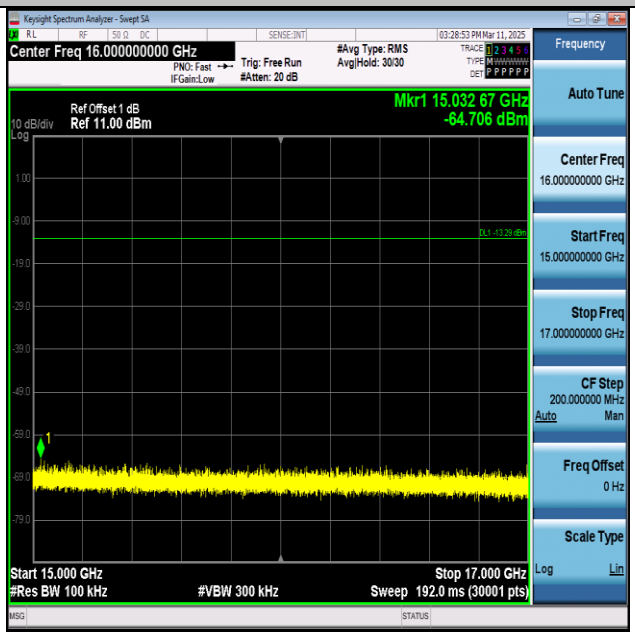
DH5-Ant1-2441-9000~11000-PASS



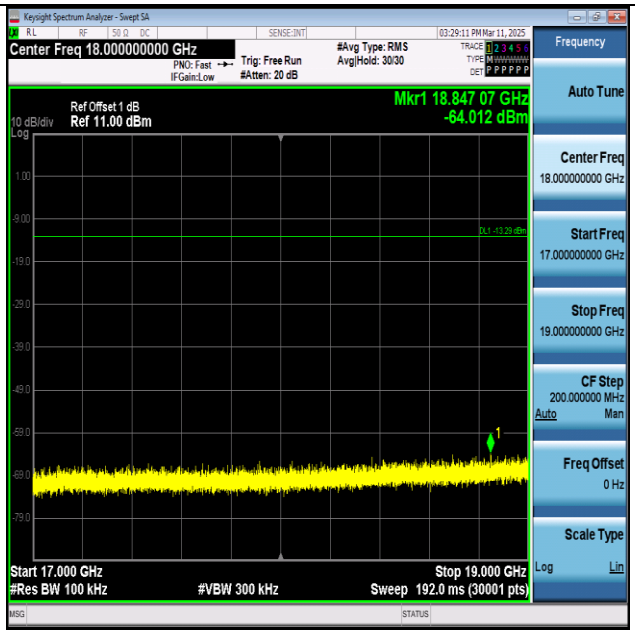
DH5-Ant1-2441-11000~13000-PASS



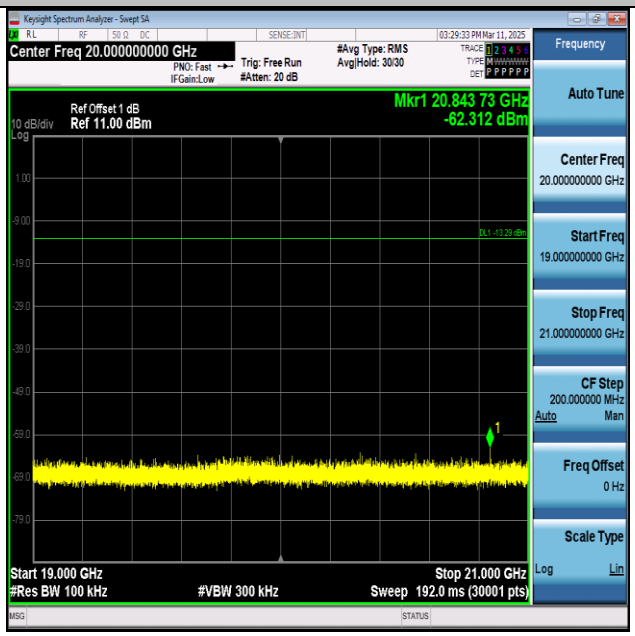
DH5-Ant1-2441-13000~15000-PASS



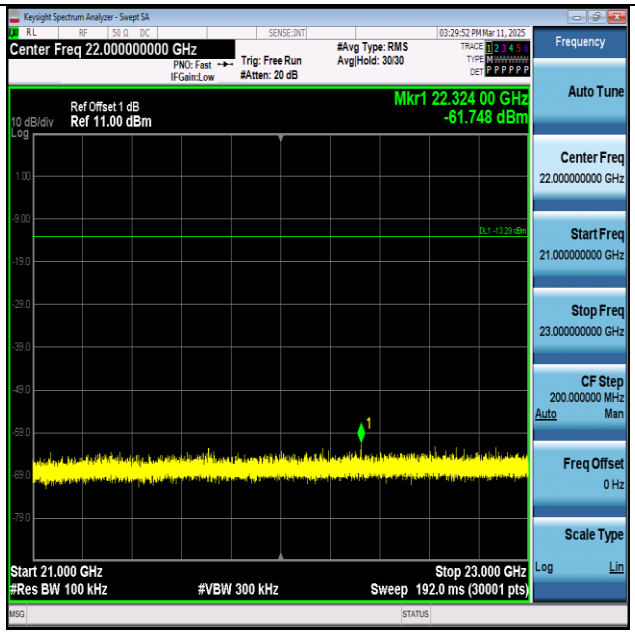
DH5-Ant1-2441-15000~17000-PASS



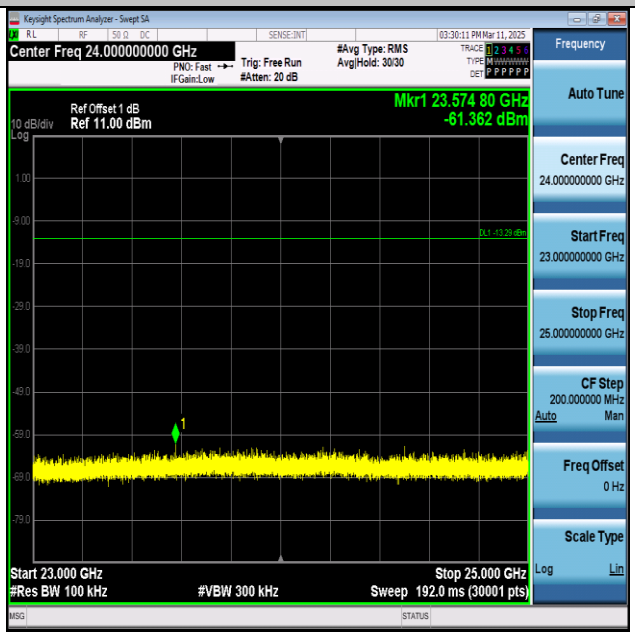
DH5-Ant1-2441-17000~19000-PASS



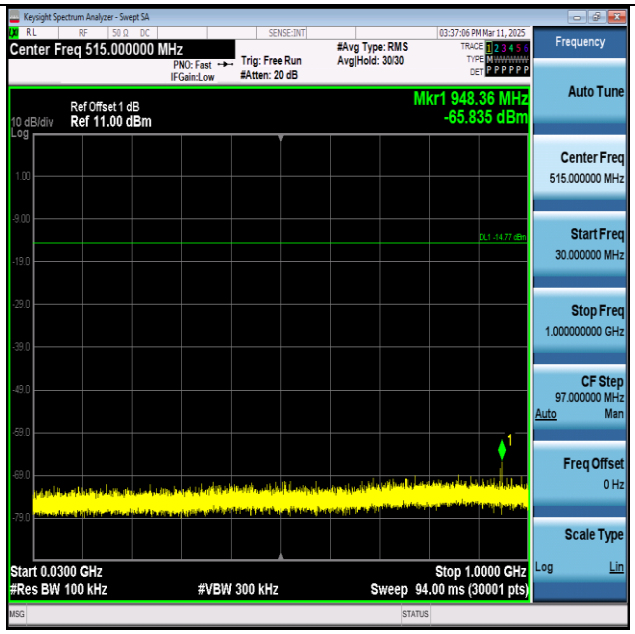
DH5-Ant1-2441-19000~21000-PASS



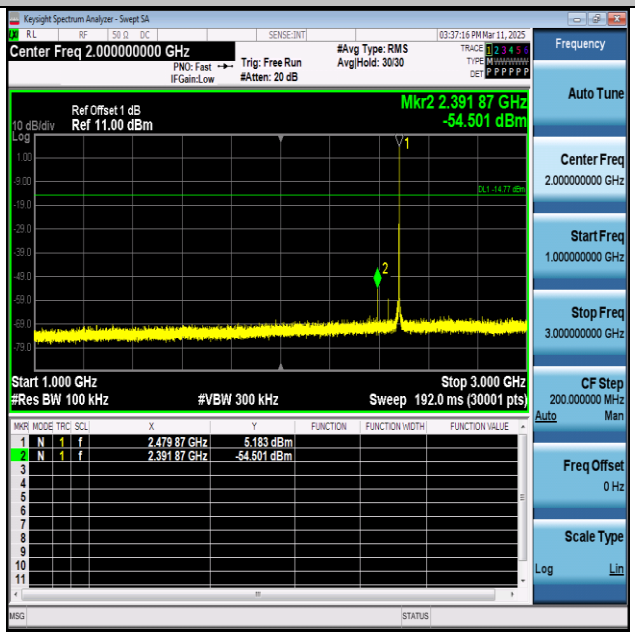
DH5-Ant1-2441-21000~23000-PASS



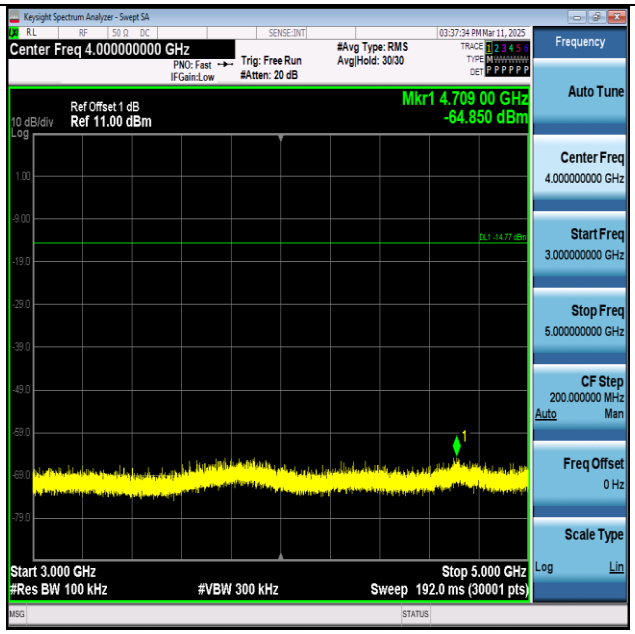
DH5-Ant1-2441-23000~25000-PASS



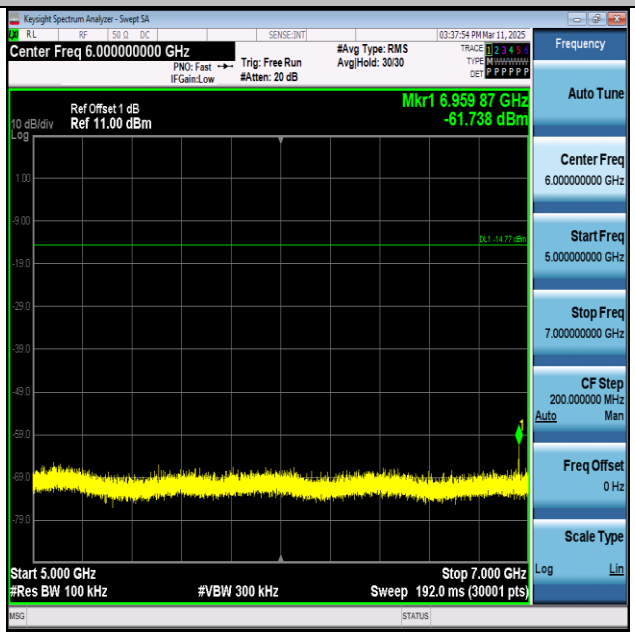
DH5-Ant1-2480-30~1000-PASS



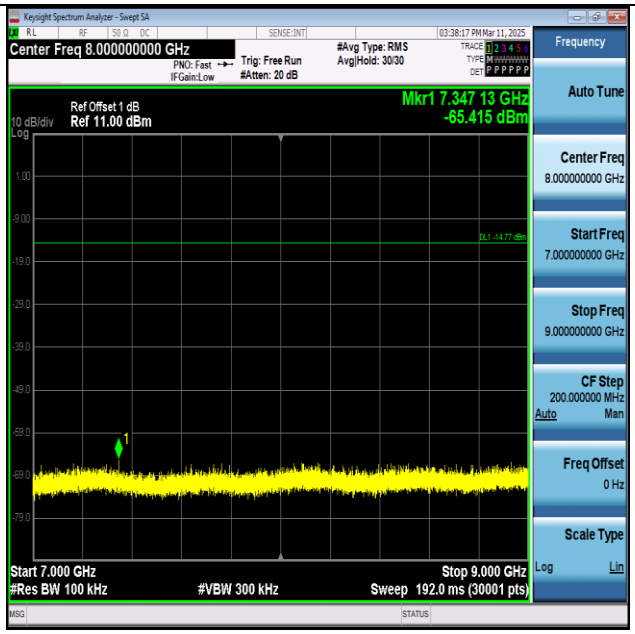
DH5-Ant1-2480-1000~3000-PASS



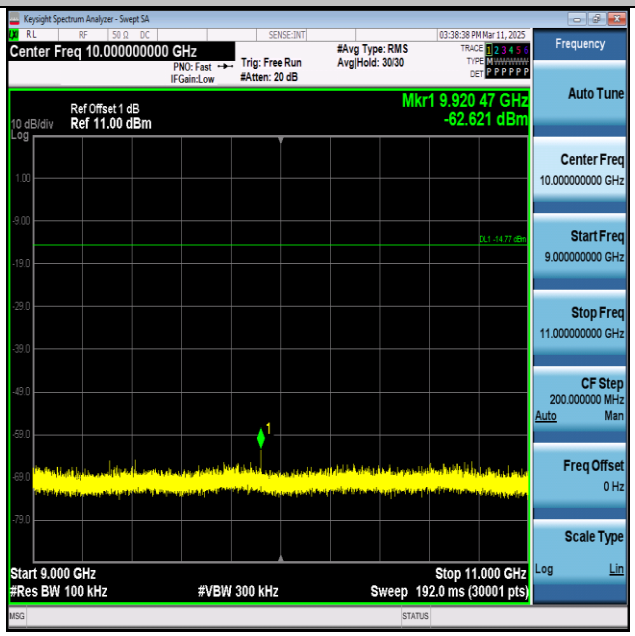
DH5-Ant1-2480-3000~5000-PASS



DH5-Ant1-2480-5000~7000-PASS



DH5-Ant1-2480-7000~9000-PASS



DH5-Ant1-2480-9000~11000-PASS