

RF TEST REPORT

For

Shenzhen Weixue Electronics Co., Ltd.

Product Name: ESP32-S3-Relay-6CH

Test Model(s): ESP32-S3-Relay-6CH

Report Reference No. : DACE260414015RL001

FCC ID : 2BNXN-S3R6

Applicant's Name : Shenzhen Weixue Electronics Co., Ltd.

Address : 202, 2F, World Trade Plaza, Funan Community, Futian Sub-district, Futian District, Shenzhen

Testing Laboratory : Shenzhen DACE Testing Technology Co., Ltd.

Address : 102, Building H1, & 1/F., Building H, Hongfa Science & Technology Park, Tangtou Community, Shiyan Subdistrict, Bao'an District, Shenzhen, Guangdong, China

Test Specification Standard : 47 CFR Part 15.247

Date of Receipt : April 14, 2026

Date of Test : April 14, 2026 to April 20, 2026

Date of Issue : April 20, 2026

Result : Pass

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Apply for company information

Applicant's Name	:	Shenzhen Weixue Electronics Co., Ltd.
Address	:	202, 2F, World Trade Plaza, Funan Community, Futian Sub-district, Futian District, Shenzhen
Product Name	:	ESP32-S3-Relay-6CH
Test Model(s)	:	ESP32-S3-Relay-6CH
Series Model(s)	:	N/A
Test Specification Standard(s)	:	47 CFR Part 15.247

NOTE1:

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

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April 20, 2026

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April 20, 2026

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April 20, 2026

Revision History Of Report

Version	Description	REPORT No.	Issue Date
V1.0	Original	DACE260414015RL001	April 20, 2026

CONTENTS

1 TEST SUMMARY	6
1.1 TEST STANDARDS	6
1.2 SUMMARY OF TEST RESULT	6
2 GENERAL INFORMATION	7
2.1 CLIENT INFORMATION	7
2.2 DESCRIPTION OF DEVICE (EUT)	7
2.3 DESCRIPTION OF TEST MODES	8
2.4 DESCRIPTION OF SUPPORT UNITS	9
2.5 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	9
2.6 EQUIPMENTS USED DURING THE TEST	9
2.7 STATEMENT OF THE MEASUREMENT UNCERTAINTY	11
2.8 IDENTIFICATION OF TESTING LABORATORY	11
2.9 ANNOUNCEMENT	11
3 EVALUATION RESULTS (EVALUATION)	12
3.1 ANTENNA REQUIREMENT	12
3.1.1 Conclusion:	12
4 RADIO SPECTRUM MATTER TEST RESULTS (RF)	13
4.1 6dB BANDWIDTH	13
4.1.1 E.U.T. Operation:	13
4.1.2 Test Setup Diagram:	14
4.1.3 Test Data:	14
4.2 MAXIMUM CONDUCTED OUTPUT POWER	15
4.2.1 E.U.T. Operation:	15
4.2.2 Test Setup Diagram:	16
4.2.3 Test Data:	16
4.3 POWER SPECTRAL DENSITY	17
4.3.1 E.U.T. Operation:	17
4.3.2 Test Setup Diagram:	17
4.3.3 Test Data:	17
4.4 EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS	18
4.4.1 E.U.T. Operation:	18
4.4.2 Test Setup Diagram:	18
4.4.3 Test Data:	18
4.5 BAND EDGE EMISSIONS (RADIATED)	19
4.5.1 E.U.T. Operation:	19
4.5.2 Test Setup Diagram:	19
4.5.3 Test Data:	20
4.6 EMISSIONS IN FREQUENCY BANDS (BELOW 1GHz)	21
4.6.1 E.U.T. Operation:	22
4.6.2 Test Setup Diagram:	22
4.6.3 Test Data:	23
4.7 EMISSIONS IN FREQUENCY BANDS (ABOVE 1GHz)	25
4.7.1 E.U.T. Operation:	26
4.7.2 Test Setup Diagram:	26
4.7.3 Test Data:	26
5 TEST SETUP PHOTOS	28

6 PHOTOS OF THE EUT	29
APPENDIX	37
1. -6DB BANDWIDTH	38
2. 99% OCCUPIED BANDWIDTH	42
3. DUTY CYCLE	46
4. PEAK OUTPUT POWER	50
5. POWER SPECTRAL DENSITY	54
6. BANDEDGE	58
7. SPURIOUS EMISSION	62

1 TEST SUMMARY

1.1 Test Standards

The tests were performed according to following standards:

47 CFR Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

1.2 Summary of Test Result

Item	Standard	Method	Requirement	Result
Antenna requirement	47 CFR Part 15.247	---	47 CFR 15.203	Pass
6dB Bandwidth	47 CFR Part 15.247	ANSI C63.10-2020, section 11.8 KDB 558074 D01 15.247 Meas Guidance v05r02	47 CFR 15.247(a)(2)	Pass
Maximum Conducted Output Power	47 CFR Part 15.247	ANSI C63.10-2020 section 11.9.1 KDB 558074 D01 15.247 Meas Guidance v05r02	47 CFR 15.247(b)(3)	Pass
Power Spectral Density	47 CFR Part 15.247	ANSI C63.10-2020, section 11.10 KDB 558074 D01 15.247 Meas Guidance v05r02	47 CFR 15.247(e)	Pass
Emissions in non-restricted frequency bands	47 CFR Part 15.247	ANSI C63.10-2020 section 11.11 KDB 558074 D01 15.247 Meas Guidance v05r02	47 CFR 15.247(d)	Pass
Band edge emissions (Radiated)	47 CFR Part 15.247	ANSI C63.10-2020 section 6.10 KDB 558074 D01 15.247 Meas Guidance v05r02	47 CFR 15.247(d), 15.209, 15.205	Pass
Emissions in frequency bands (below 1GHz)	47 CFR Part 15.247	ANSI C63.10-2020 section 6.5.4 KDB 558074 D01 15.247 Meas Guidance v05r02	47 CFR 15.247(d), 15.209, 15.205	Pass
Emissions in frequency bands (above 1GHz)	47 CFR Part 15.247	ANSI C63.10-2020 section 6.5.4 KDB 558074 D01 15.247 Meas Guidance v05r02	47 CFR 15.247(d), 15.209, 15.205	Pass

2 GENERAL INFORMATION

2.1 Client Information

Applicant's Name : Shenzhen Weixue Electronics Co., Ltd.
Address : 202, 2F, World Trade Plaza, Funan Community, Futian Sub-district, Futian District, Shenzhen

Manufacturer : Shenzhen Weixue Electronics Co., Ltd.
Address : 202, 2F, World Trade Plaza, Funan Community, Futian Sub-district, Futian District, Shenzhen

2.2 Description of Device (EUT)

Product Name:	ESP32-S3-Relay-6CH
Model/Type reference:	ESP32-S3-Relay-6CH
Series Model:	N/A
Trade Mark:	Waveshare
Power Supply:	DC:12V
Operation Frequency:	2402MHz to 2480MHz
Number of Channels:	40
Modulation Type:	GFSK
Antenna Type:	External
Antenna Gain:	2.83dBi
Hardware Version:	V1.0
Software Version:	V1.0

(Remark:The Antenna Gain is supplied by the customer.DACE is not responsible for This data and the related calculations associated with it)

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402 MHz	11	2422 MHz	21	2442 MHz	31	2462 MHz
2	2404 MHz	12	2424 MHz	22	2444 MHz	32	2464 MHz
3	2406 MHz	13	2426 MHz	23	2446 MHz	33	2466 MHz
4	2408 MHz	14	2428 MHz	24	2448 MHz	34	2468 MHz
5	2410 MHz	15	2430 MHz	25	2450 MHz	35	2470 MHz
6	2412 MHz	16	2432 MHz	26	2452 MHz	36	2472 MHz
7	2414 MHz	17	2434 MHz	27	2454 MHz	37	2474 MHz
8	2416 MHz	18	2436 MHz	28	2456 MHz	38	2476 MHz
9	2418 MHz	19	2438 MHz	29	2458 MHz	39	2478 MHz
10	2420 MHz	20	2440 MHz	30	2460 MHz	40	2480 MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Test channel	Frequency (MHz)
	BLE
Lowest channel	2402MHz
Middle channel	2440MHz
Highest channel	2480MHz
Remark: Only the data of the worst mode would be recorded in this report.	

2.3 Description of Test Modes

No	Title	Description
TM1	TX mode	Keep the EUT works in continuously transmitting mode with GFSK modulation at lowest, middle and highest channel.

Remark: Only the data of the worst mode would be recorded in this report.

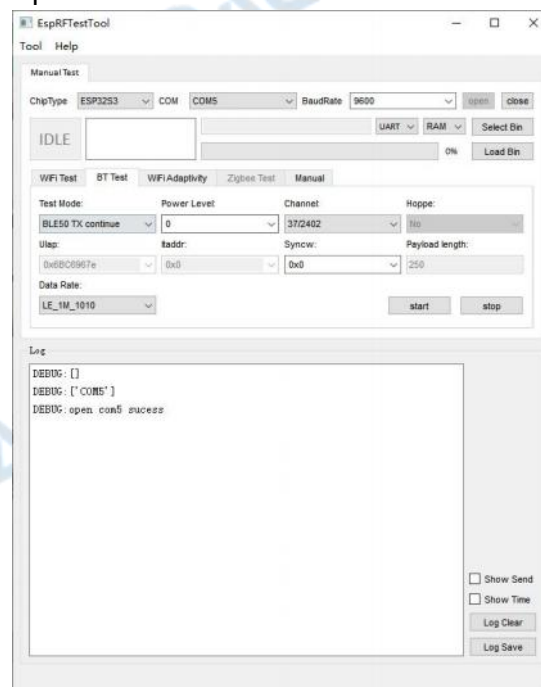
☒ Special software is used.

☐ Through engineering command into the engineering mode.

engineering command: *##3646633##*

☐ Other method:

Special software:



Test channel	Frequency (MHz)	EspRFTTestTool
	BLE1/2M	Test software power setting parameters:
Lowest channel	2402MHz	default
Middle channel	2440MHz	default
Highest channel	2480MHz	default

2.4 Description of Support Units

Title	Manufacturer	Model No.	Serial No.
Battery (DC12V)	Camel	DC12V	

2.5 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Conducted Emission

N/A

Radiated Emission

DC 12V EUT

RF Conducted emission

DC 12V EUT

2.6 Equipments Used During The Test

6dB Bandwidth

Maximum Conducted Output Power

Power Spectral Density

Emissions in non-restricted frequency bands

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
RF Test Software	Tachoy Information Technology(she nzheng) Co.,Ltd.	RTS-01	V1.0.0	/	/
Power divider	MIDEWEST	PWD-2533	SMA-79	2026-04-16	2027-04-15
RF Sensor Unit	Tachoy Information Technology(she nzheng) Co.,Ltd.	TR1029-2	000001	/	/
Wideband radio communication tester	R&S	CMW500	113410	2026-04-14	2027-04-13
Vector Signal Generator	Keysight	N5181A	MY50143455	2025-12-02	2026-12-01
Signal Generator	Keysight	N5182A	MY48180415	2025-12-02	2026-12-01
Spectrum Analyzer	Keysight	N9020A	MY53420323	2025-12-02	2026-12-01
Power meter	Agilent	E4416	MY48200166	2025-12-06	2026-12-05

Band edge emissions (Radiated)**Emissions in frequency bands (below 1GHz)****Emissions in frequency bands (above 1GHz)**

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test software	Farad	EZ -EMC	V1.1.42	/	/
Positioning Controller	MF	MF-7802	/	/	/
Amplifier(18-40G)	COM-POWER	AH-1840	10100008-1	2024-04-26	2027-04-25
Horn antenna	COM-POWER	AH-1840 (18-40G)	10100008	2024-04-26	2027-04-25
Loop antenna	ZHINAN	ZN30900C	ZN30900C	2026-04-14	2027-04-13
Cable(LF)#2	Schwarzbeck	/	/	2026-04-13	2027-04-12
Cable(LF)#1	Schwarzbeck	/	/	2026-04-14	2027-04-13
Cable(HF)#2	Schwarzbeck	AK9515E	96250	2026-04-14	2027-04-13
Cable(HF)#1	Schwarzbeck	SYV-50-3-1	/	2026-04-14	2027-04-13
Power amplifier(LF)	Schwarzbeck	BBV9743	9743-151	2026-04-14	2027-04-13
Power amplifier(HF)	Schwarzbeck	BBV9718	9718-282	2026-04-14	2027-04-13
Wideband radio communication tester	R&S	CMW500	113410	2026-04-14	2027-04-13
Spectrum Analyzer	R&S	FSP30	1321.3008K40-101729-jR	2026-04-14	2027-04-13
Test Receiver	R&S	ESCI 3	1166.5950K03-101431-Jq	2026-04-14	2027-04-13
Horn Antenna	Sunol Sciences	DRH-118	A091114	2026-04-14	2027-04-13
Broadband Antenna	Sunol Sciences	JB6 Antenna	A090414	2024-09-28	2026-09-27

2.7 Statement Of The Measurement Uncertainty

Test Item	Measurement Uncertainty
Occupied Bandwidth	$\pm 3.63\%$
RF conducted power	$\pm 0.733\text{dB}$
RF power density	$\pm 0.234\%$
Conducted Spurious emissions	$\pm 1.98\text{dB}$
Radiated Emission (Above 1GHz)	$\pm 5.46\text{dB}$
Radiated Emission (Below 1GHz)	$\pm 5.79\text{dB}$

Note: (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

2.8 Identification of Testing Laboratory

Company Name:	Shenzhen DACE Testing Technology Co., Ltd.
Address:	102, Building H1, & 1/F., Building H, Hongfa Science & Technology Park, Tangtou Community, Shiyan Subdistrict, Bao'an District, Shenzhen, Guangdong, China
Phone Number:	+86-13267178997
Fax Number:	86-755-29113252

Identification of the Responsible Testing Location

Company Name:	Shenzhen DACE Testing Technology Co., Ltd.
Address:	102, Building H1, & 1/F., Building H, Hongfa Science & Technology Park, Tangtou Community, Shiyan Subdistrict, Bao'an District, Shenzhen, Guangdong, China
Phone Number:	+86-13267178997
Fax Number:	86-755-29113252
Designation Number:	CN1342
Test Firm Registration Number:	778666
A2LA Certificate Number:	6270.01

2.9 Announcement

- (1) The test report reference to the report template version v0.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) This document may not be altered or revised in any way unless done so by DACE and all revisions are duly noted in the revisions section.
- (5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- (6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

3 Evaluation Results (Evaluation)

3.1 Antenna requirement

Test Requirement:	Refer to 47 CFR Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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.
Test Method:	---

3.1.1 Conclusion:



4 Radio Spectrum Matter Test Results (RF)

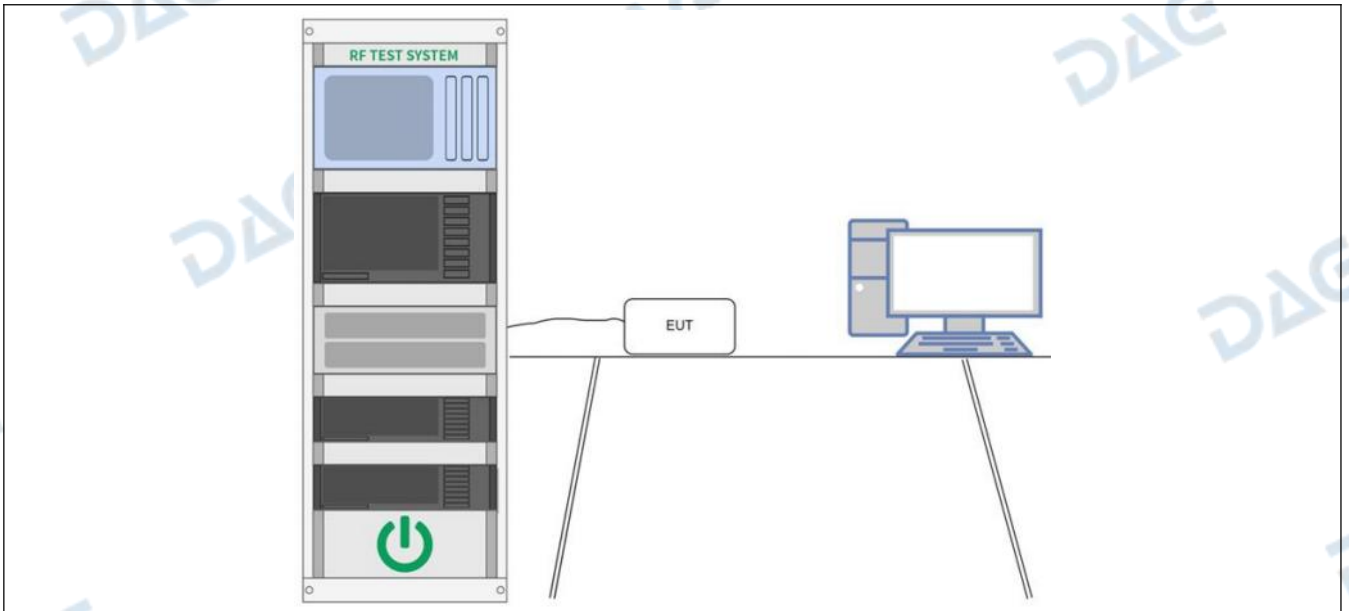
4.1 6dB Bandwidth

Test Requirement:	47 CFR 15.247(a)(2)
Test Limit:	Refer to 47 CFR 15.247(a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Test Method:	ANSI C63.10-2020, section 11.8 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	11.8.1 Option 1 The steps for the first option are as follows: a) Set RBW = shall be in the range of 1% to 5% of the OBW but not less than 100 kHz. b) Set the VBW $\geq [3 \times \text{RBW}]$. c) Detector = peak. d) Trace mode = max-hold. e) Sweep = No faster than coupled (auto) time. f) Allow the trace to stabilize. g) Measure the maximum width of the emission by placing two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “-6 dB down amplitude”. If a marker is below this “-6 dB down amplitude” value, then it shall be as close as possible to this value. 11.8.2 Option 2 The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., RBW = 100 kHz, VBW $\geq 3 \times \text{RBW}$, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

4.1.1 E.U.T. Operation:

Operating Environment:					
Temperature:	23.9 °C	Humidity:	51 %	Atmospheric Pressure:	102 kPa
Pretest mode:	TM1				
Final test mode:	TM1				

4.1.2 Test Setup Diagram:



4.1.3 Test Data:

Please Refer to Appendix for Details.

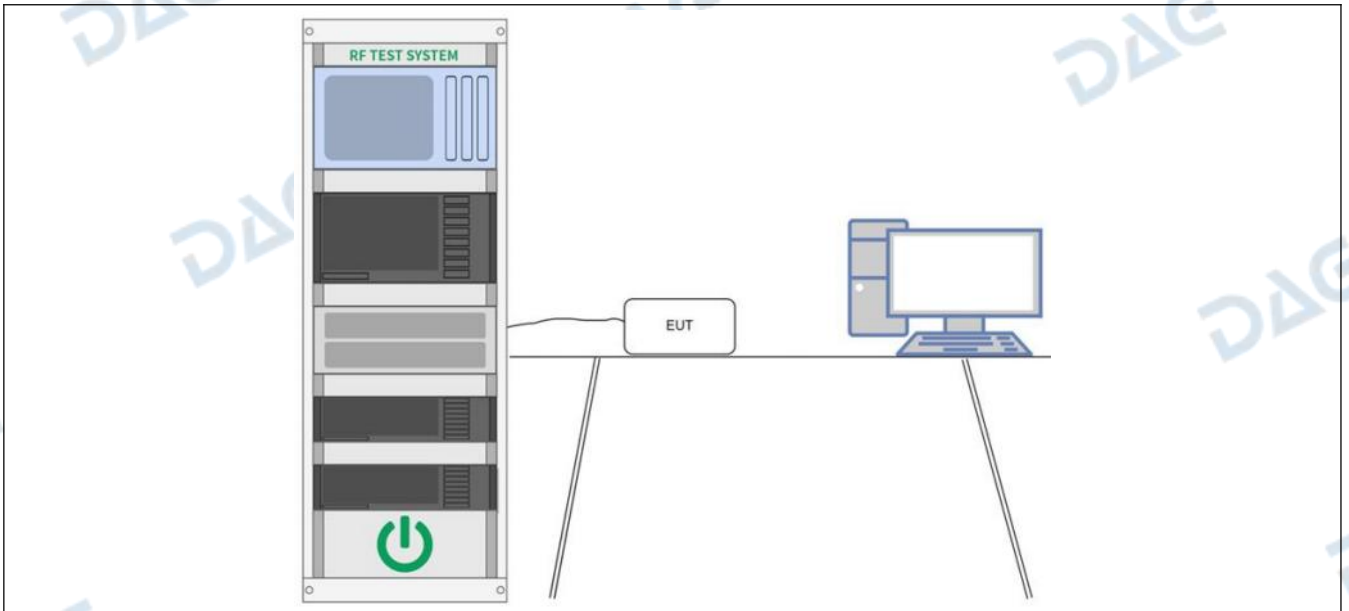
4.2 Maximum Conducted Output Power

Test Requirement:	47 CFR 15.247(b)(3)
Test Limit:	Refer to 47 CFR 15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
Test Method:	ANSI C63.10-2020 section 11.9.1 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	ANSI C63.10-2020, section 11.9.1 Maximum peak conducted output power Note: Per ANSI C63.10-2020, if there are two or more antennas, the conducted powers at Core 0, Core 1, ..., Core i were first measured separately, as shown in the section above (this product only have one antenna). The measured values were then summed in linear power units then converted back to dBm. Per ANSI C63.10-2020 Section 14.4.3.2.3, the directional gain is calculated using the following formula, where GN is the gain of the nth antenna and NANT, the total number of antennas used. For correlated unequal antenna gain Directional gain = $10 \cdot \log[(10G_1/20 + 10G_2/20 + \dots + 10G_N/20)^2 / NANT]$ dBi For completely uncorrelated unequal antenna gain Directional gain = $10 \cdot \log[(10G_1/10 + 10G_2/10 + \dots + 10G_N/10) / NANT]$ dBi Sample Multiple antennas Calculation: Core 0 + Core 1 + ... Core i. = MIMO/CDD (i is the number of antennas) (#VALUE! mW + mW) = #VALUE! mW = dBm Sample e.i.r.p. Calculation: e.i.r.p. (dBm) = Conducted Power (dBm) + Ant gain (dBi)

4.2.1 E.U.T. Operation:

Operating Environment:					
Temperature:	22.3 °C	Humidity:	48 %	Atmospheric Pressure:	102 kPa
Pretest mode:	TM1				
Final test mode:	TM1				

4.2.2 Test Setup Diagram:



4.2.3 Test Data:

Please Refer to Appendix for Details.

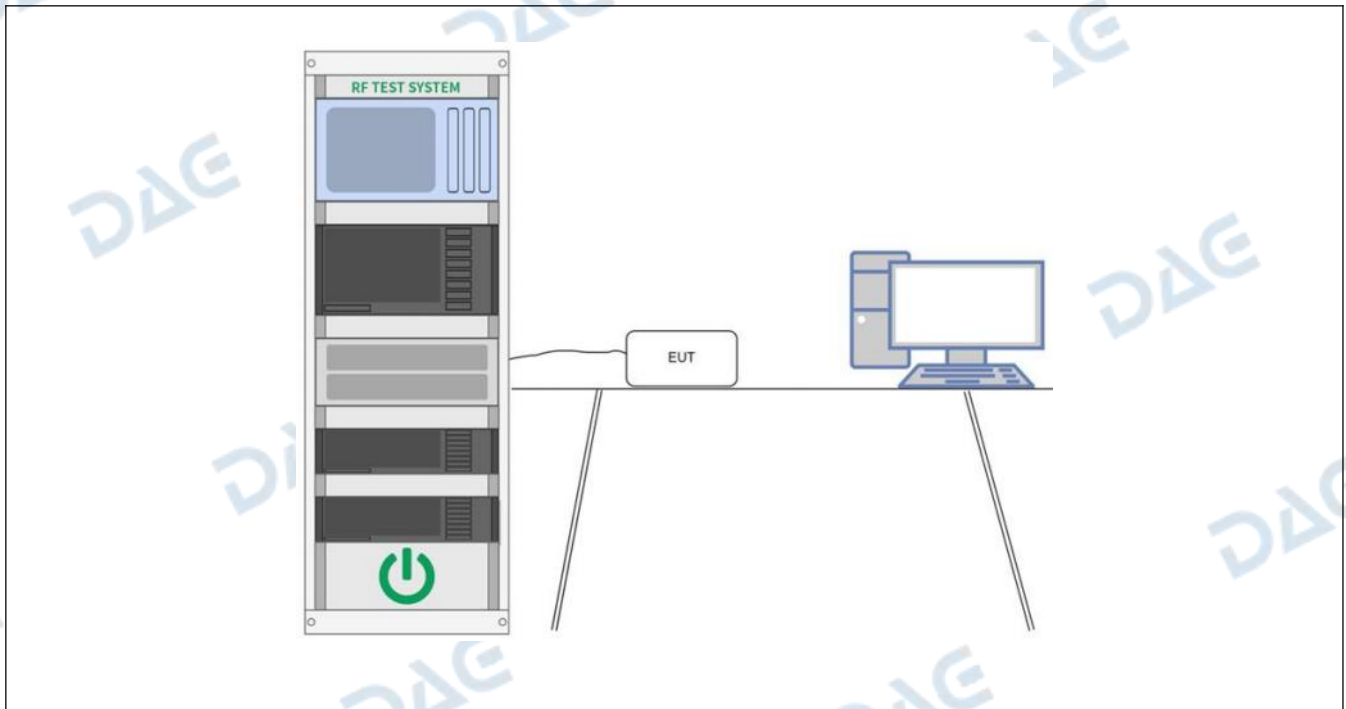
4.3 Power Spectral Density

Test Requirement:	47 CFR 15.247(e)
Test Limit:	Refer to 47 CFR 15.247(e), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
Test Method:	ANSI C63.10-2020, section 11.10 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	ANSI C63.10-2020+Cor 1-2023, section 11.10, Maximum power spectral density level in the fundamental emission

4.3.1 E.U.T. Operation:

Operating Environment:					
Temperature:	23.6 °C	Humidity:	49 %	Atmospheric Pressure:	102 kPa
Pretest mode:	TM1				
Final test mode:	TM1				

4.3.2 Test Setup Diagram:



4.3.3 Test Data:

Please Refer to Appendix for Details.

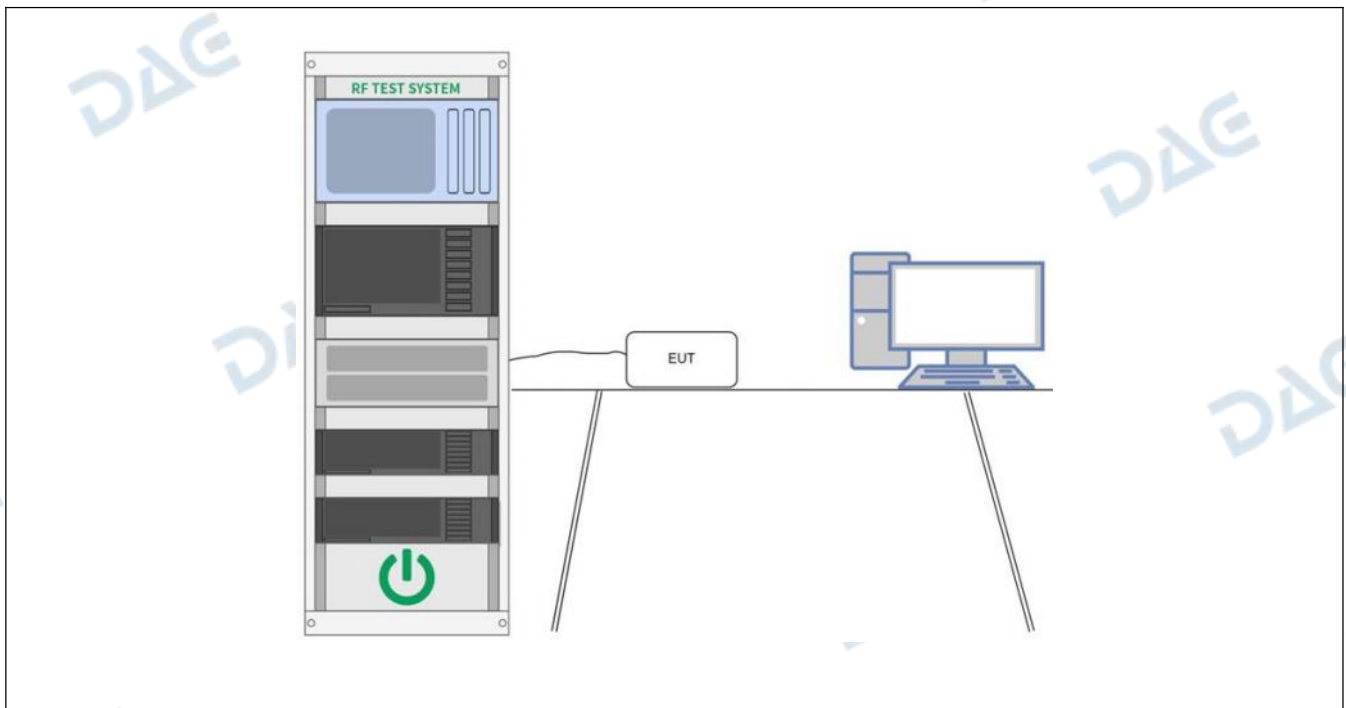
4.4 Emissions in non-restricted frequency bands

Test Requirement:	47 CFR 15.247(d)
Test Limit:	Refer to 47 CFR 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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 or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Test Method:	ANSI C63.10-2020 section 11.11 KDB 558074 D01 15.247 Meas Guidance v05r02
Procedure:	ANSI C63.10-2020 Section 11.11.1, Section 11.11.2, Section 11.11.3

4.4.1 E.U.T. Operation:

Operating Environment:					
Temperature:	22.3 °C	Humidity:	49 %	Atmospheric Pressure:	102 kPa
Pretest mode:	TM1				
Final test mode:	TM1				

4.4.2 Test Setup Diagram:



4.4.3 Test Data:

Please Refer to Appendix for Details.

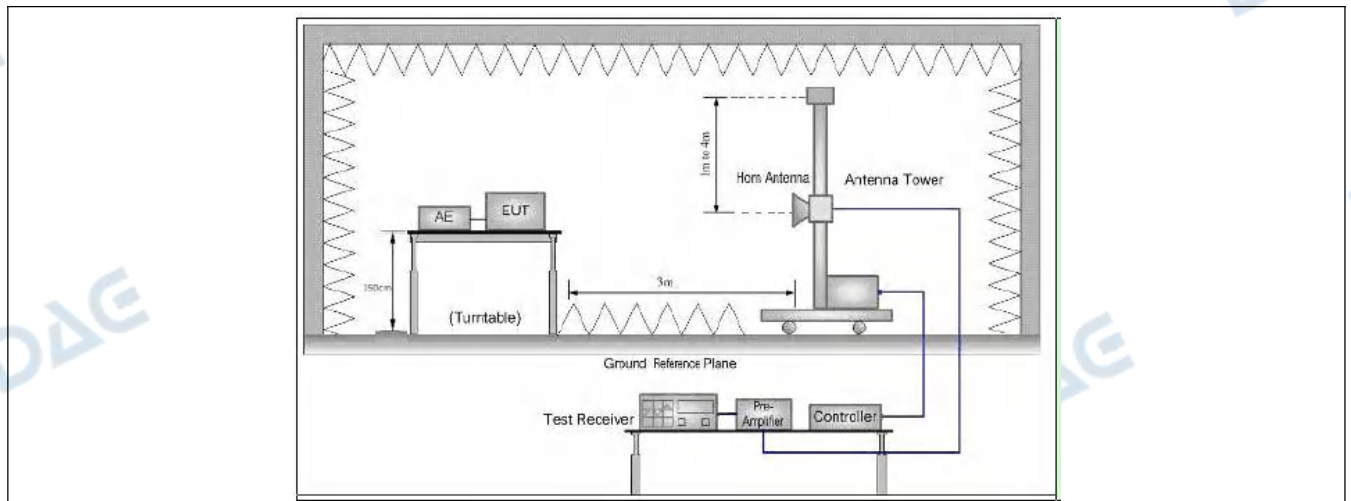
4.5 Band edge emissions (Radiated)

Test Requirement:	Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).		
Test Limit:	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100 **	3
	88-216	150 **	3
	216-960	200 **	3
	Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241. In the emission table above, the tighter limit applies at the band edges. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.			
Test Method:	ANSI C63.10-2020 section 6.10 KDB 558074 D01 15.247 Meas Guidance v05r02		
Procedure:	ANSI C63.10-2020 section 6.10.5.2		

4.5.1 E.U.T. Operation:

Operating Environment:					
Temperature:	22.4 °C	Humidity:	50 %	Atmospheric Pressure:	102 kPa
Pretest mode:	TM1				
Final test mode:	TM1				

4.5.2 Test Setup Diagram:



4.5.3 Test Data:

Remark: During the test, pre-scan the 1M,2M modulation, and found the 1M modulation which it is worse case.

DH5								
Polar	Frequency	Meter Reading	Cable Loss	Level	Limit (dBuV/m)	Margin	Detector Type	Result
(H/V)	(MHz)	(dBuV)	(dB)	(dBuV/m)		(dBuV/m)		
Low Channel: 2402MHz								
H	2390	48.24	-6.62	41.62	74	-32.38	PK	Pass
H	2390	32.17	-6.62	25.55	54	-28.45	AV	Pass
H	2400	48.42	-6.43	41.99	74	-32.01	PK	Pass
H	2400	31.24	-6.43	24.81	54	-29.19	AV	Pass
V	2390	48.00	-6.62	41.38	74	-32.62	PK	Pass
V	2390	30.01	-6.62	23.39	54	-30.61	AV	Pass
V	2400	49.04	-6.43	42.61	74	-31.39	PK	Pass
V	2400	30.29	-6.43	23.86	54	-30.14	AV	Pass
High Channel: 2480MHz								
H	2483.5	53.19	-6.17	47.02	74	-26.98	PK	Pass
H	2483.5	33.16	-6.17	26.99	54	-27.01	AV	Pass
H	2500	48.31	-6.13	42.18	74	-31.82	PK	Pass
H	2500	31.40	-6.13	25.27	54	-28.73	AV	Pass
V	2483.5	48.53	-6.17	42.36	74	-31.64	PK	Pass
V	2483.5	31.42	-6.17	25.25	54	-28.75	AV	Pass
V	2500	47.76	-6.13	41.63	74	-32.37	PK	Pass
V	2500	31.04	-6.13	24.91	54	-29.09	AV	Pass

Remark: Margin=Level - Limit, Level=Test receiver reading + correction factor

The test software will only record the worst test angle and height, and only the worst case will be recorded in the test report.

4.6 Emissions in frequency bands (below 1GHz)

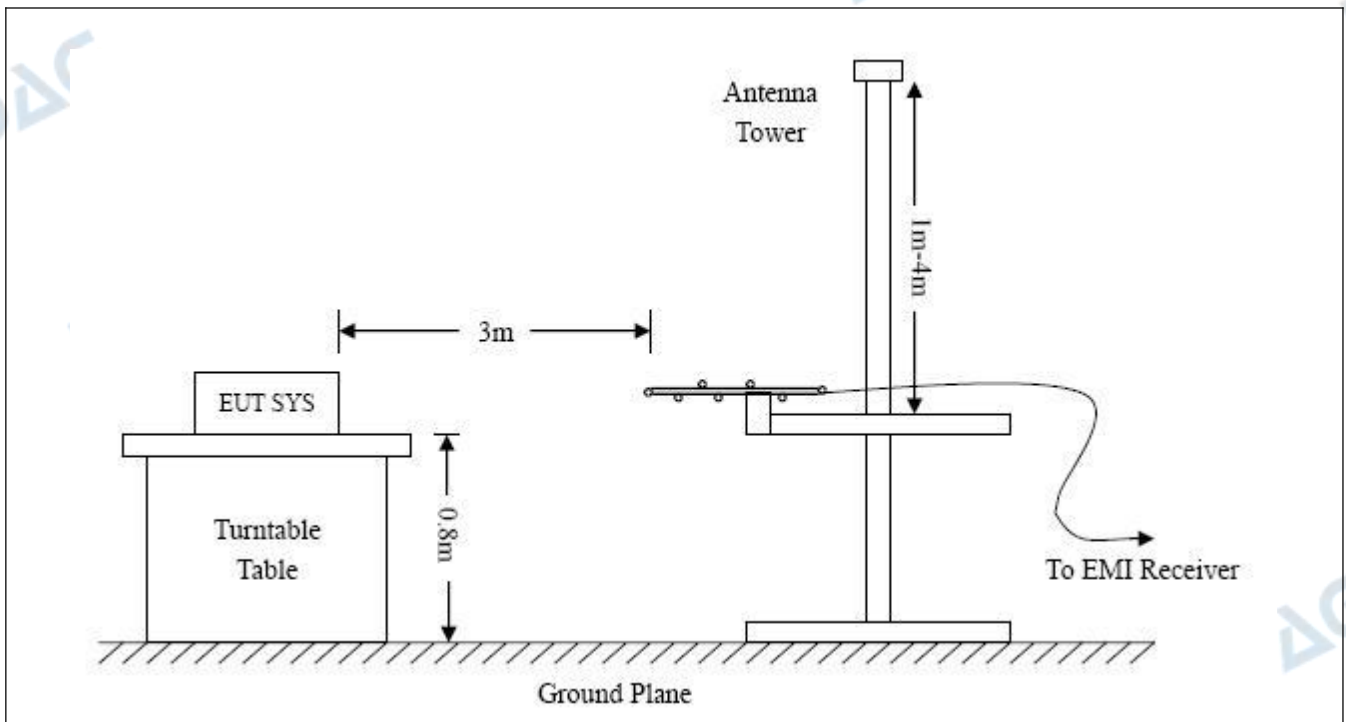
Test Requirement:	Refer to 47 CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).		
Test Limit:	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100 **	3
	88-216	150 **	3
	216-960	200 **	3
	Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241. In the emission table above, the tighter limit applies at the band edges. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.			
Test Method:	ANSI C63.10-2020 section 6.5.4 KDB 558074 D01 15.247 Meas Guidance v05r02		
Procedure:	a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. h. Test the EUT in the lowest channel, the middle channel, the Highest channel. i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case. j. Repeat above procedures until all frequencies measured was complete. Remark: 1) For emission below 1GHz, through pre-scan found the worst case is the lowest		

	channel. Only the worst case is recorded in the report. 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows: $\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} + \text{Preamplifier Factor}$ 3) Scan from 9kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter, and only spurious emission is shown.
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4.6.1 E.U.T. Operation:

Operating Environment:					
Temperature:	23.5 °C	Humidity:	47 %	Atmospheric Pressure:	102 kPa
Pretest mode:	TM1				
Final test mode:	TM1				

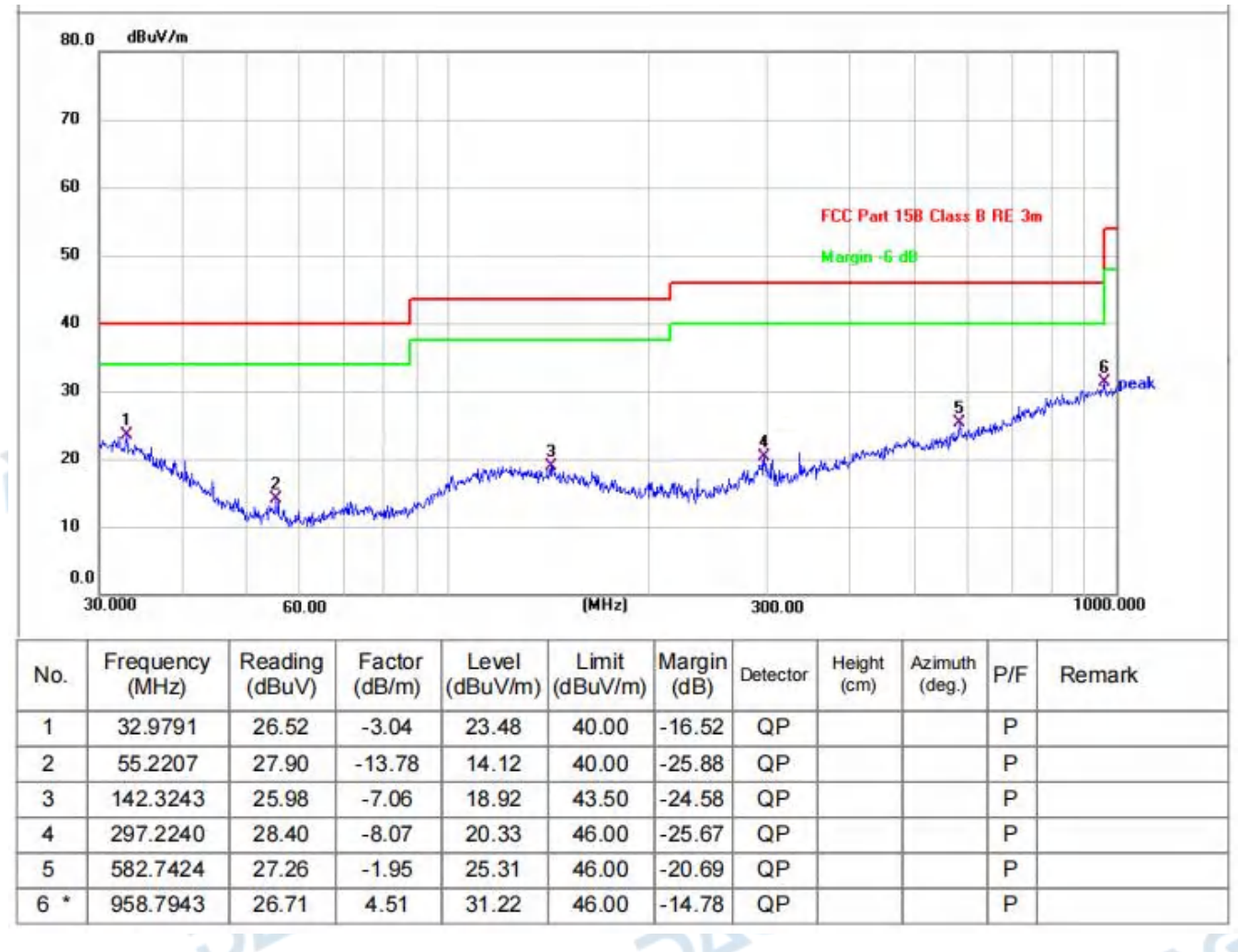
4.6.2 Test Setup Diagram:



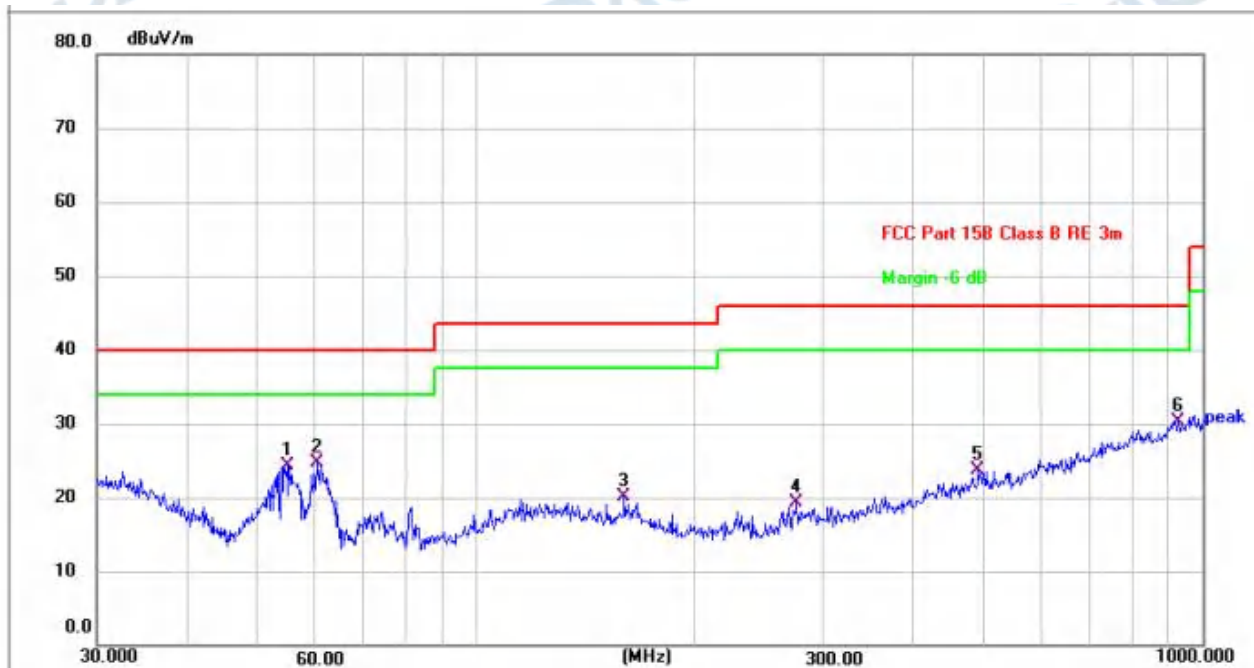
4.6.3 Test Data:

Remark: During the test, pre-scan the 1M,2M modulation, and found the 1M modulation which it is worse case.

TM1 / Polarization: Horizontal / Band: 2400-2483.5 MHz / BW: 1 / CH: L



TM1 / Polarization: Vertical / Band: 2400-2483.5 MHz / BW: 1 / CH: L



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	54.8348	38.17	-13.80	24.37	40.00	-15.63	QP	100		P	
2 *	60.2801	39.00	-14.38	24.62	40.00	-15.38	QP	100		P	
3	159.7844	28.50	-8.39	20.11	43.50	-23.39	QP	100		P	
4	276.1235	27.51	-8.20	19.31	46.00	-26.69	QP	100		P	
5	490.7447	27.00	-3.33	23.67	46.00	-22.33	QP	100		P	
6	925.7563	26.00	4.32	30.32	46.00	-15.68	QP	100		P	

4.7 Emissions in frequency bands (above 1GHz)

Test Requirement:	Refer to 47 CFR 15.247(d), in addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).		
Test Limit:	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
	0.009-0.490	2400/F(kHz)	300
	0.490-1.705	24000/F(kHz)	30
	1.705-30.0	30	30
	30-88	100 **	3
	88-216	150 **	3
	216-960	200 **	3
	Above 960	500	3
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241. In the emission table above, the tighter limit applies at the band edges. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.			
Test Method:	ANSI C63.10-2020 section 6.5.4 KDB 558074 D01 15.247 Meas Guidance v05r02		
Procedure:	a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. h. Test the EUT in the lowest channel, the middle channel, the Highest channel. i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case. j. Repeat above procedures until all frequencies measured was complete. Remark: 1) For emission below 1GHz, through pre-scan found the worst case is the lowest		

channel. Only the worst case is recorded in the report.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor + Preamplifier Factor

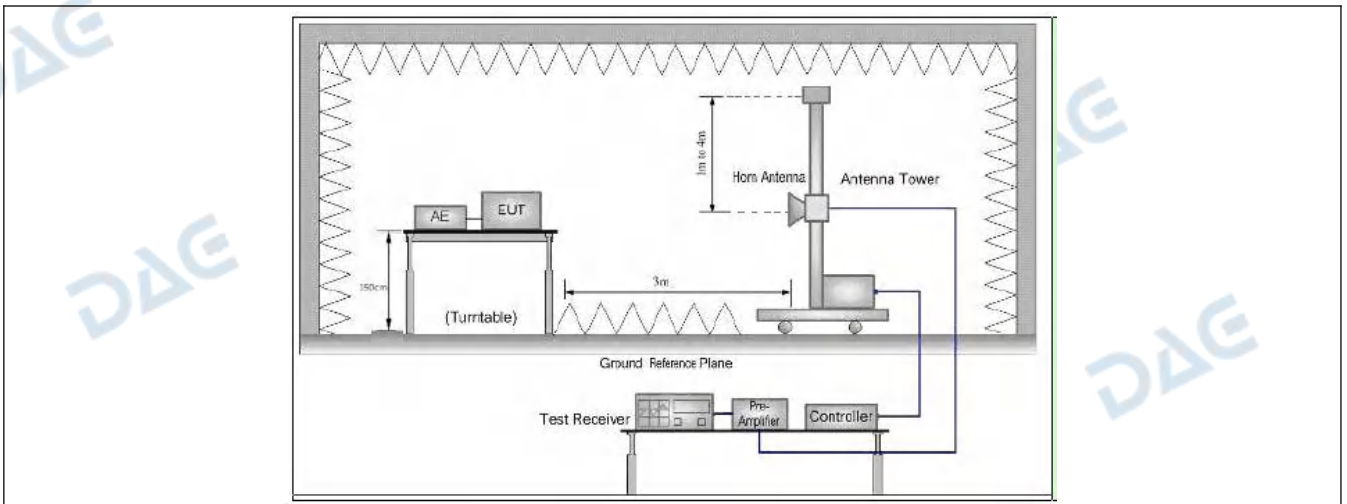
3) Scan from 9kHz to 25GHz, the disturbance above 12.75GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported. Fundamental frequency is blocked by filter, and only spurious emission is shown.

4.7.1 E.U.T. Operation:

Operating Environment:

Temperature:	23 °C	Humidity:	52 %	Atmospheric Pressure:	102 kPa
Pretest mode:	TM1				
Final test mode:	TM1				

4.7.2 Test Setup Diagram:



4.7.3 Test Data:

Remark: During the test, pre-scan the 1M,2M modulation, and found the 1M modulation which it is worse case.

BLE 1M								
Polar	Frequency	Meter Reading	Cable Loss	Level	Limit	Margin	Detector Type	Result
(H/V)	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)		
Low Channel: 2402MHz								
V	4804	55.07	-0.17	54.90	74	-19.10	PK	Pass
V	4804	35.30	-0.17	35.13	54	-18.87	AV	Pass
V	7206	53.81	4.78	58.59	74	-15.41	PK	Pass
V	7206	33.92	4.78	38.70	54	-15.30	AV	Pass
V	9608	55.12	8.08	63.20	74	-10.80	PK	Pass
V	9608	35.32	8.08	43.40	54	-10.60	AV	Pass

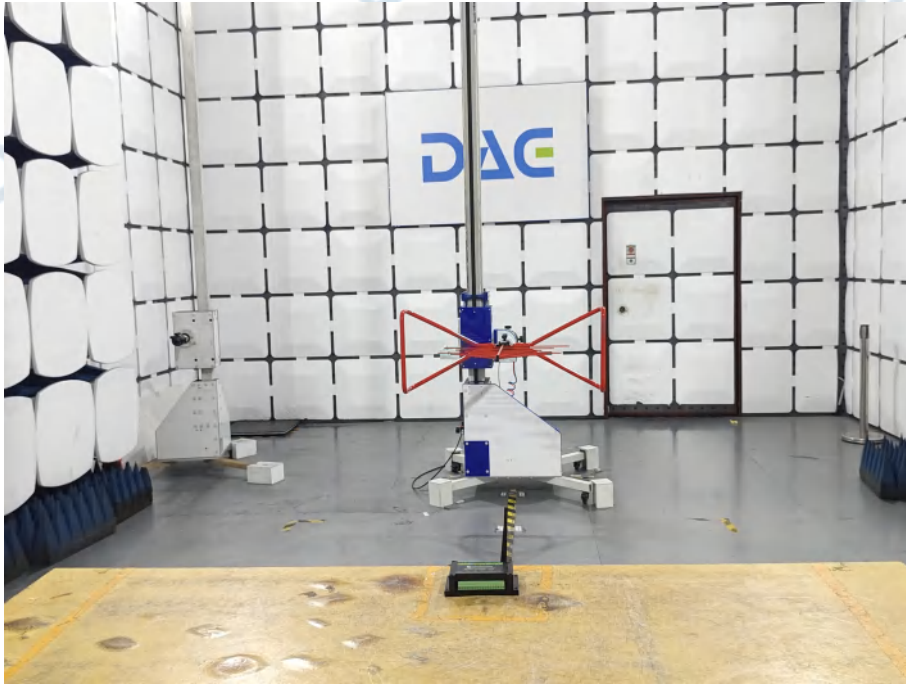
H	4804	53.21	-0.17	53.04	74	-20.96	PK	Pass
H	4804	35.08	-0.17	34.91	54	-19.09	AV	Pass
H	7206	55.23	4.78	60.01	74	-13.99	PK	Pass
H	7206	34.43	4.78	39.21	54	-14.79	AV	Pass
H	9608	55.02	8.08	63.10	74	-10.90	PK	Pass
H	9608	33.26	8.08	41.34	54	-12.66	AV	Pass
Middle Channel:2440MHz								
V	4880	54.78	-0.17	54.61	74	-19.39	PK	Pass
V	4880	33.89	-0.17	33.72	54	-20.28	AV	Pass
V	7320	55.50	4.78	60.28	74	-13.72	PK	Pass
V	7320	35.19	4.78	39.97	54	-14.03	AV	Pass
V	9760	53.68	8.08	61.76	74	-12.24	PK	Pass
V	9760	35.43	8.08	43.51	54	-10.49	AV	Pass
H	4880	55.48	-0.17	55.31	74	-18.69	PK	Pass
H	4880	33.55	-0.17	33.38	54	-20.62	AV	Pass
H	7320	55.40	4.78	60.18	74	-13.82	PK	Pass
H	7320	33.45	4.78	38.23	54	-15.77	AV	Pass
H	9760	53.09	8.08	61.17	74	-12.83	PK	Pass
H	9760	33.52	8.08	41.60	54	-12.40	AV	Pass
High Channel:2480MHz								
V	4960	53.34	-0.17	53.17	74	-20.83	PK	Pass
V	4960	35.06	-0.17	34.89	54	-19.11	AV	Pass
V	7440	54.09	4.78	58.87	74	-15.13	PK	Pass
V	7440	34.60	4.78	39.38	54	-14.62	AV	Pass
V	9920	53.15	8.08	61.23	74	-12.77	PK	Pass
V	9920	34.62	8.08	42.70	54	-11.30	AV	Pass
H	4960	54.90	-0.17	54.73	74	-19.27	PK	Pass
H	4960	34.43	-0.17	34.26	54	-19.74	AV	Pass
H	7440	54.45	4.78	59.23	74	-14.77	PK	Pass
H	7440	34.02	4.78	38.80	54	-15.20	AV	Pass
H	9920	54.66	8.08	62.74	74	-11.26	PK	Pass
H	9921	34.91	8.08	42.99	54	-11.01	PK	Pass

Remark:Margin=Level - Limit, Level=Test receiver reading + correction factor

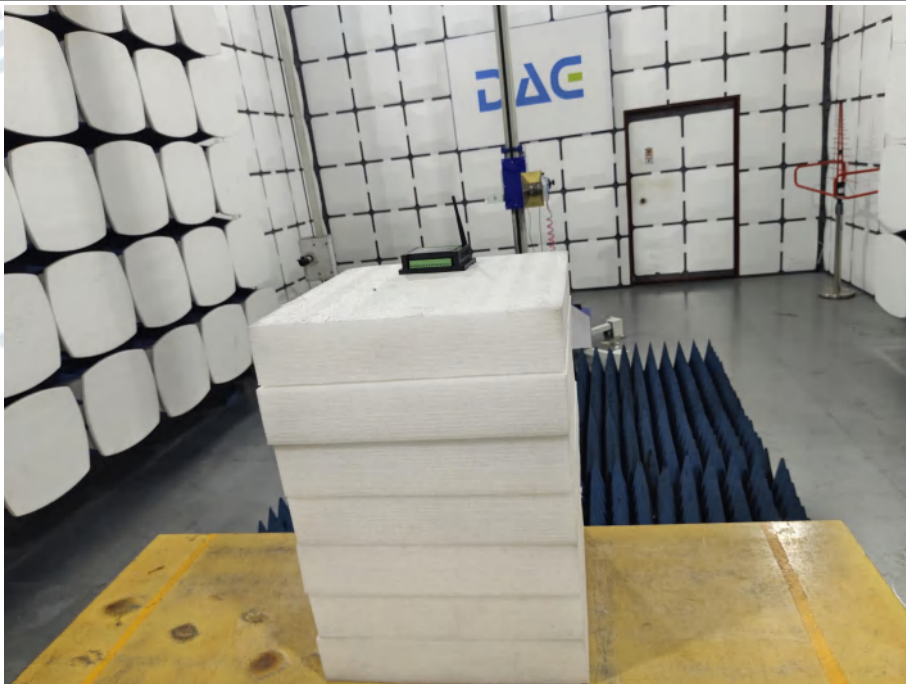
The test software will only record the worst test angle and height, and only the worst case will be recorded in the test report.

5 TEST SETUP PHOTOS

Emissions in frequency bands (below 1GHz)



Emissions in frequency bands (above 1GHz)



6 PHOTOS OF THE EUT

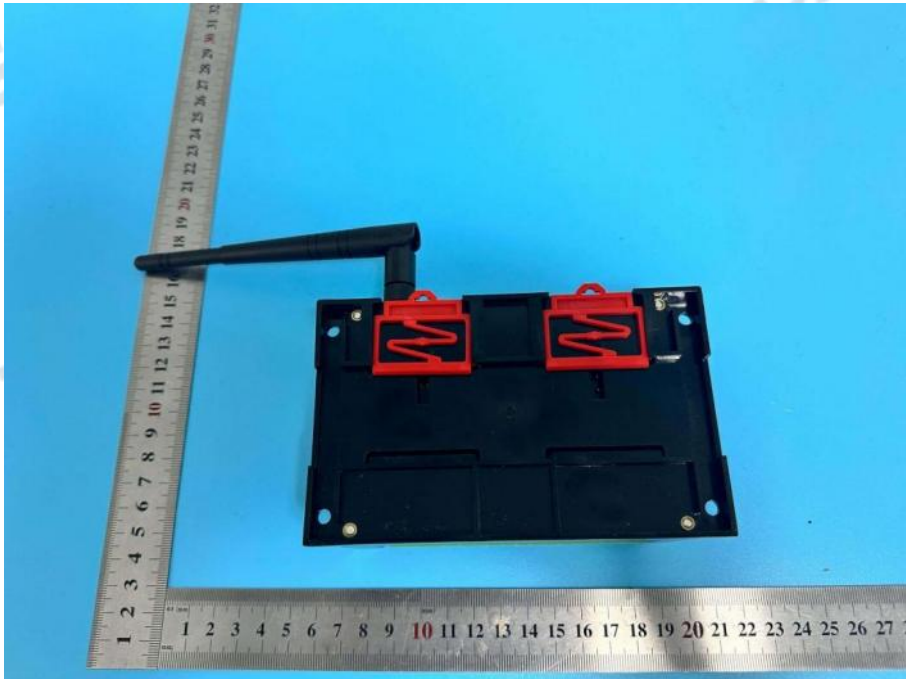
External



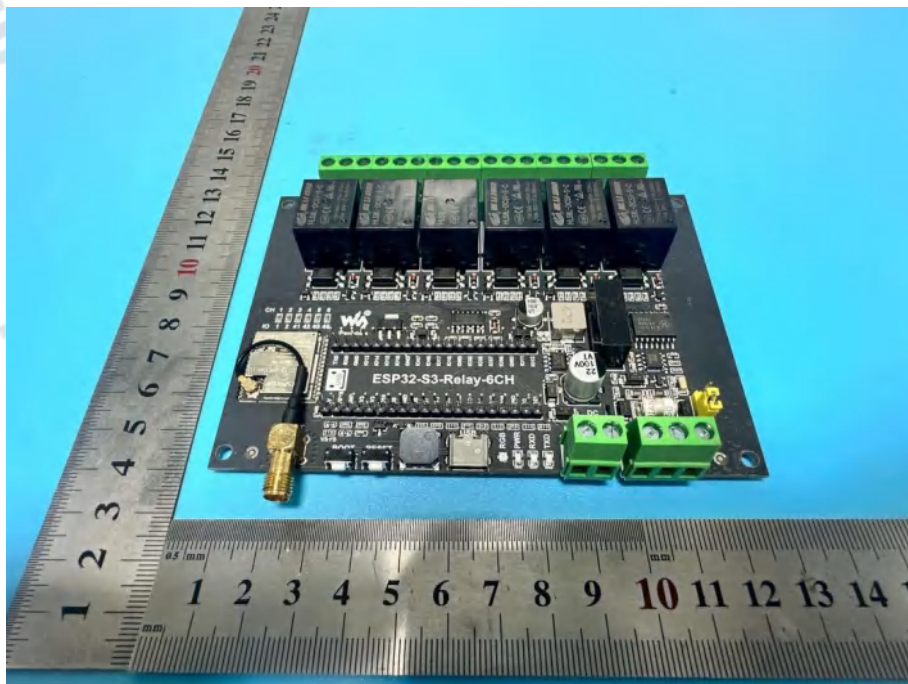
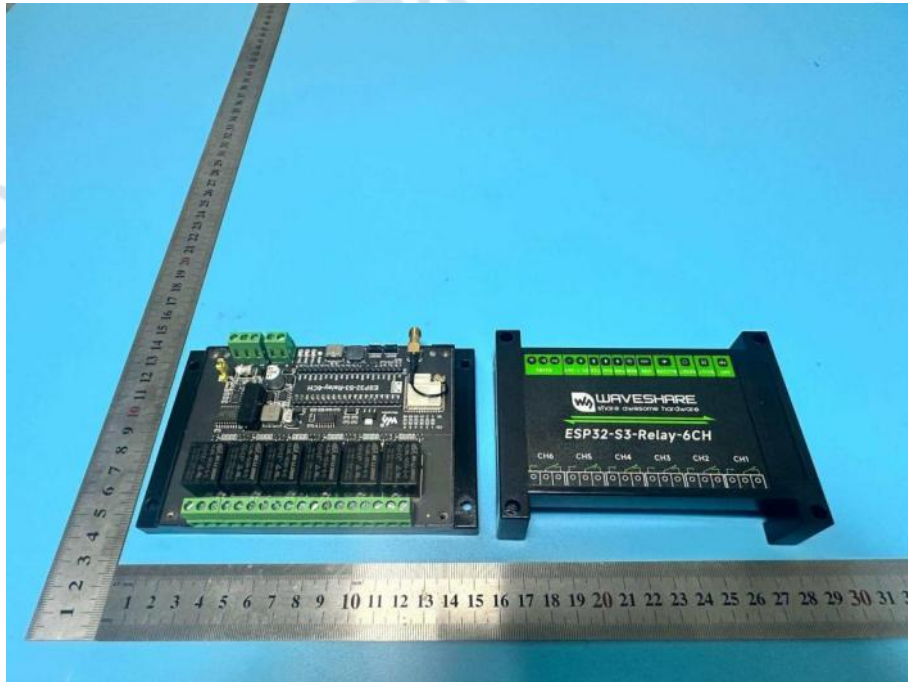


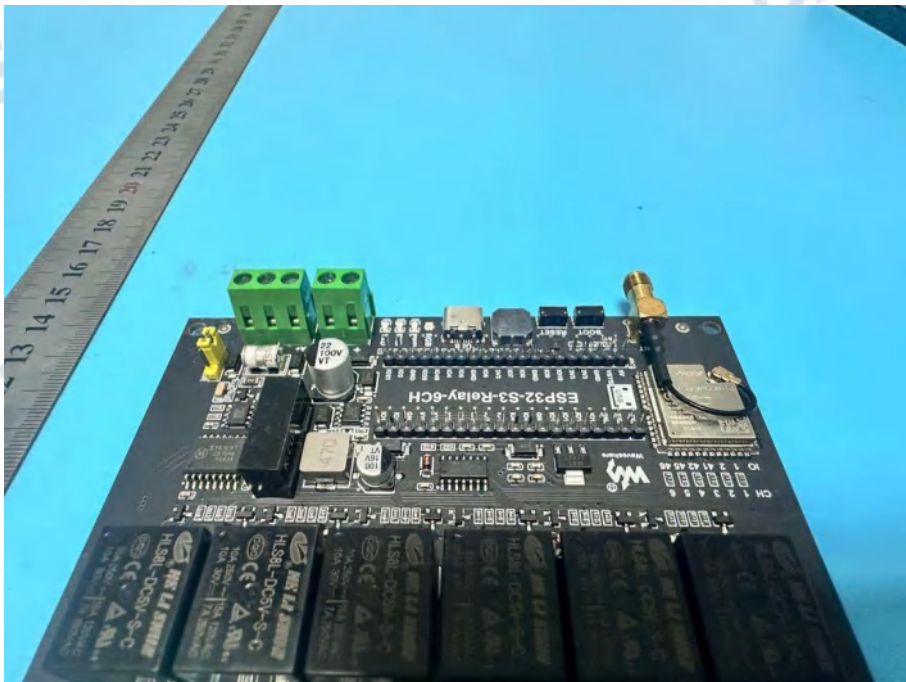
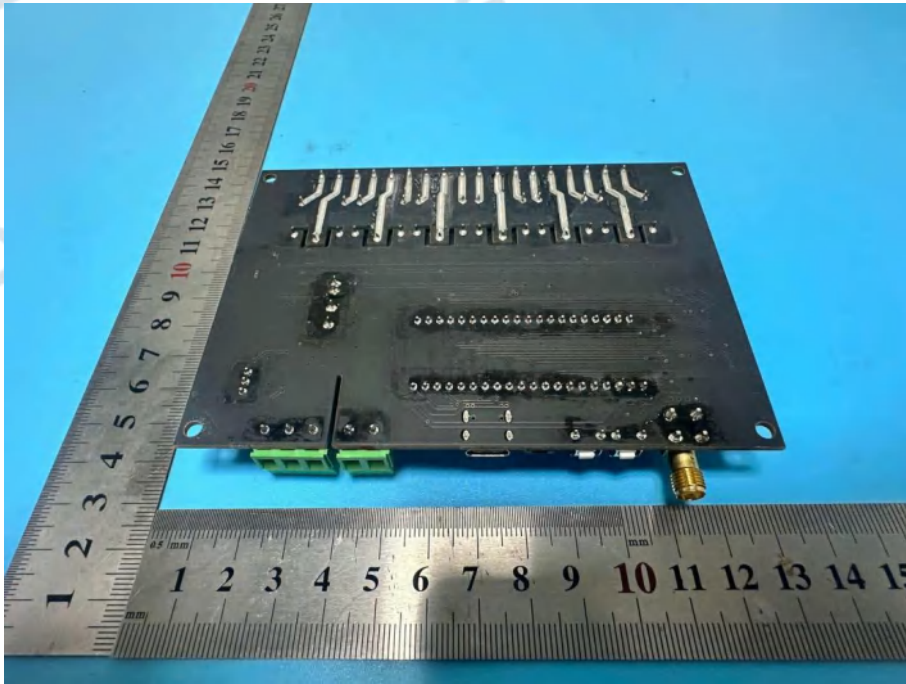
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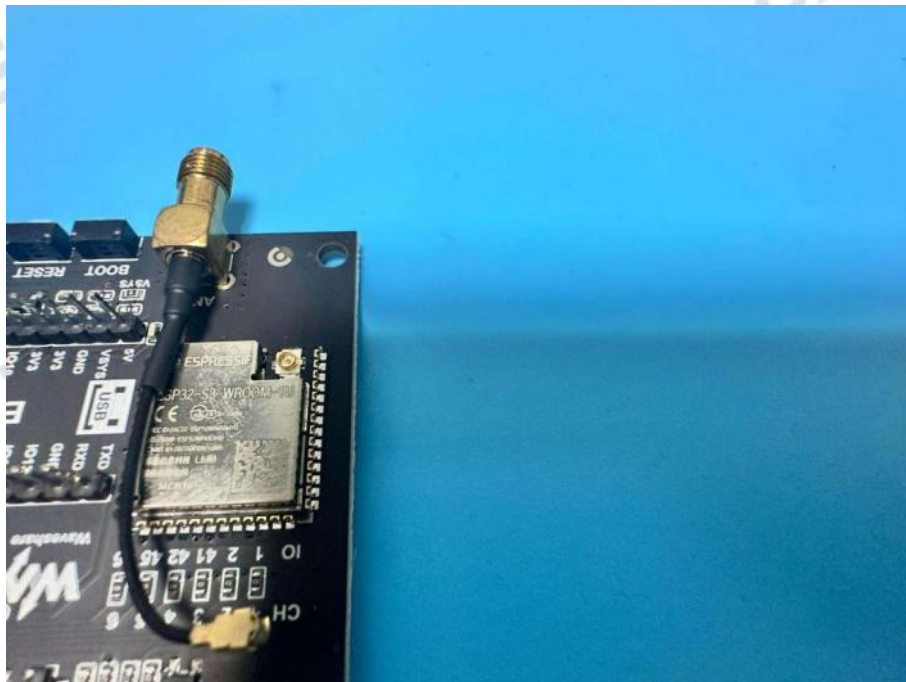
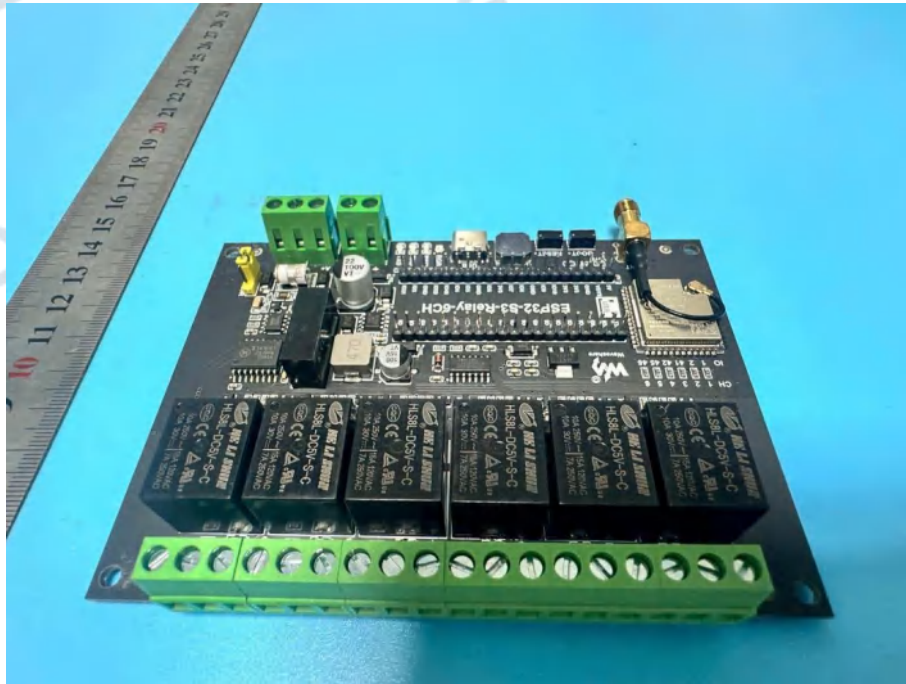


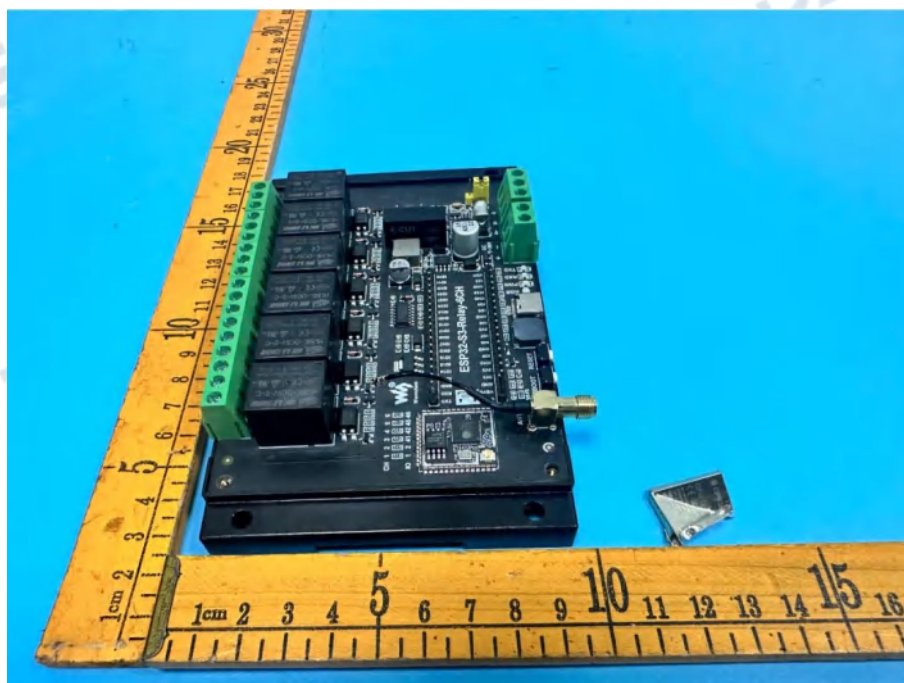
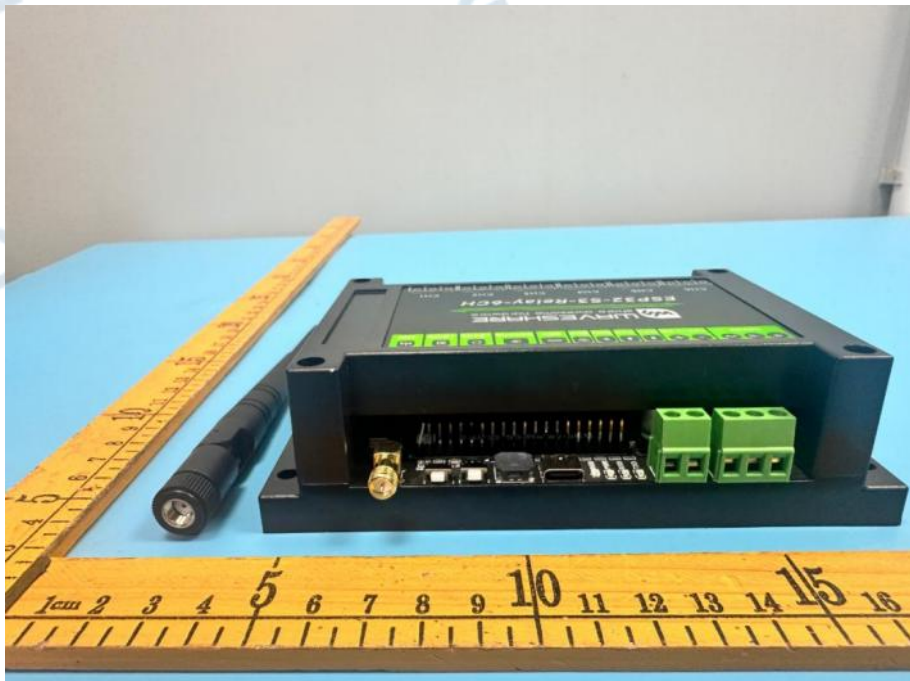


Internal











Appendix

HT260414008-ESP32-S3-Relay-6CH--FCC ID-BLE FCC_BLE (Part15.247) Test Data

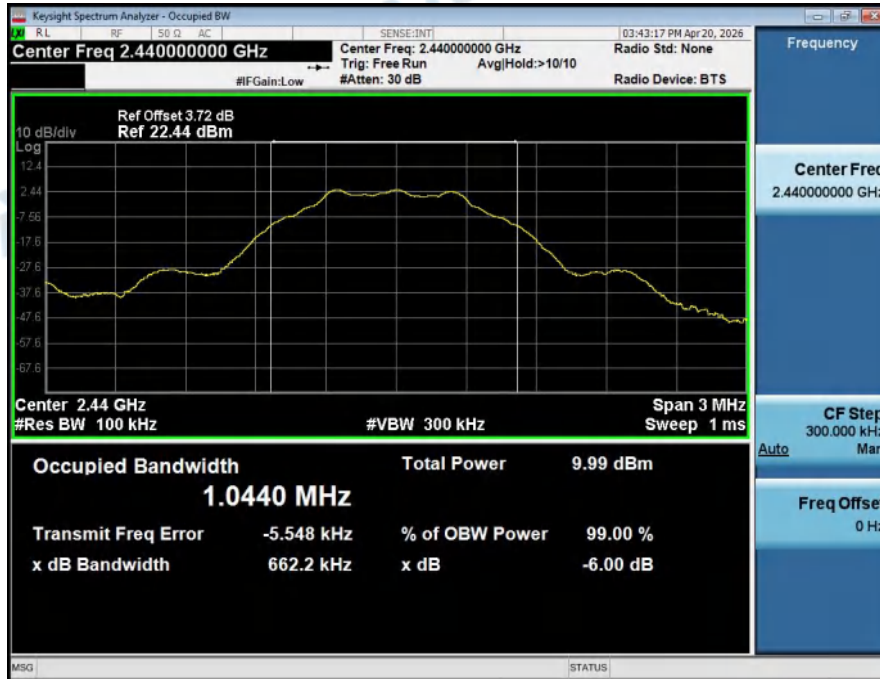
1. -6dB Bandwidth

Condition	Antenna	Rate	Frequency (MHz)	-6dB BW(kHz)	limit(kHz)	Result
NVNT	ANT1	1Mbps	2402.00	664.20	500	Pass
NVNT	ANT1	1Mbps	2440.00	662.15	500	Pass
NVNT	ANT1	1Mbps	2480.00	662.45	500	Pass
NVNT	ANT1	2Mbps	2402.00	1144.69	500	Pass
NVNT	ANT1	2Mbps	2440.00	1136.15	500	Pass
NVNT	ANT1	2Mbps	2480.00	1136.34	500	Pass

-6dB_Bandwidth_NVNT_ANT1_1Mbps_2402



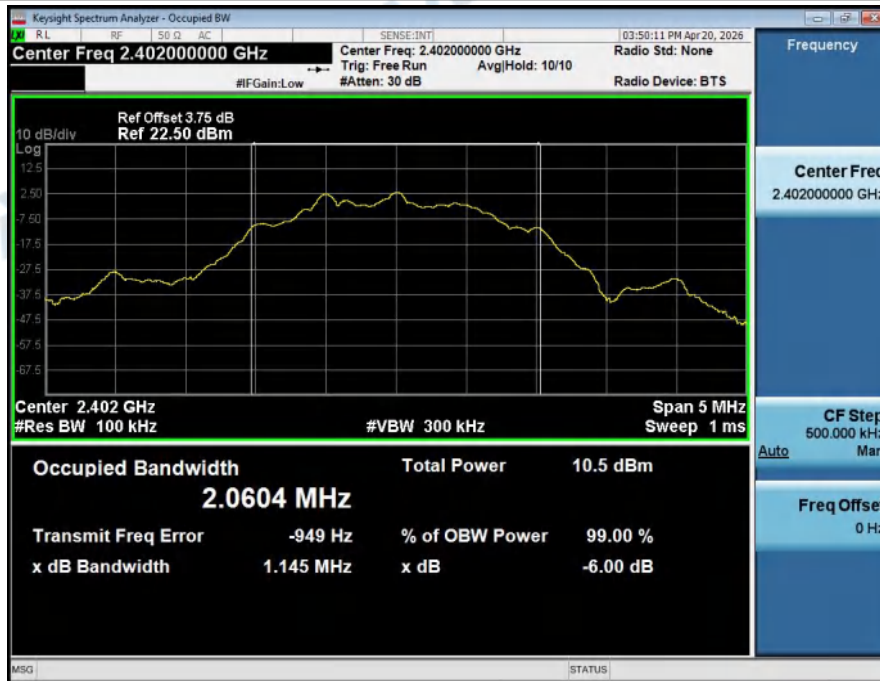
-6dB_Bandwidth_NVNT_ANT1_1Mbps_2440



-6dB_Bandwidth_NVNT_ANT1_1Mbps_2480



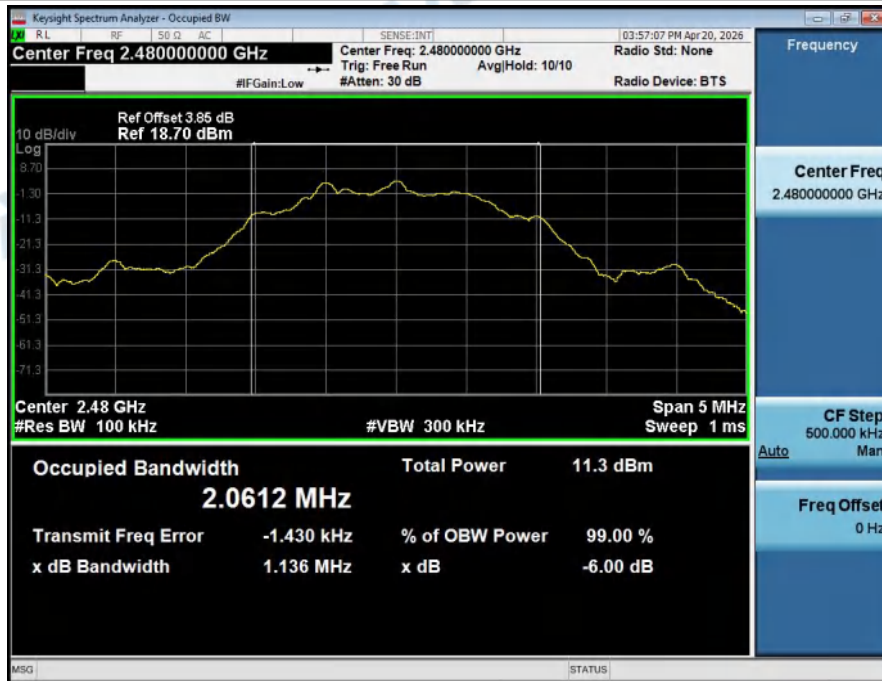
-6dB_Bandwidth_NVNT_ANT1_2Mbps_2402



-6dB_Bandwidth_NVNT_ANT1_2Mbps_2440



-6dB_Bandwidth_NVNT_ANT1_2Mbps_2480



2. 99% Occupied Bandwidth

Condition	Antenna	Rate	Frequency (MHz)	99% BW (MHz)
NVNT	ANT1	1Mbps	2402.00	1.022
NVNT	ANT1	1Mbps	2440.00	1.022
NVNT	ANT1	1Mbps	2480.00	1.022
NVNT	ANT1	2Mbps	2402.00	2.031
NVNT	ANT1	2Mbps	2440.00	2.033
NVNT	ANT1	2Mbps	2480.00	2.032

99%_Occupied_Bandwidth_NVNT_ANT1_1Mbps_2402



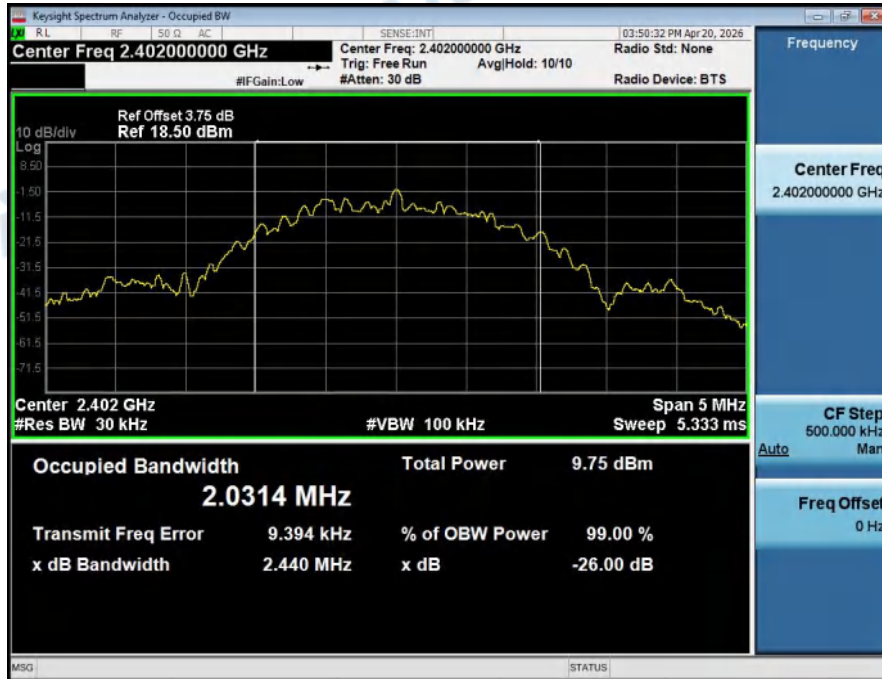
99%_Occupied_Bandwidth_NVNT_ANT1_1Mbps_2440



99%_Occupied_Bandwidth_NVNT_ANT1_1Mbps_2480



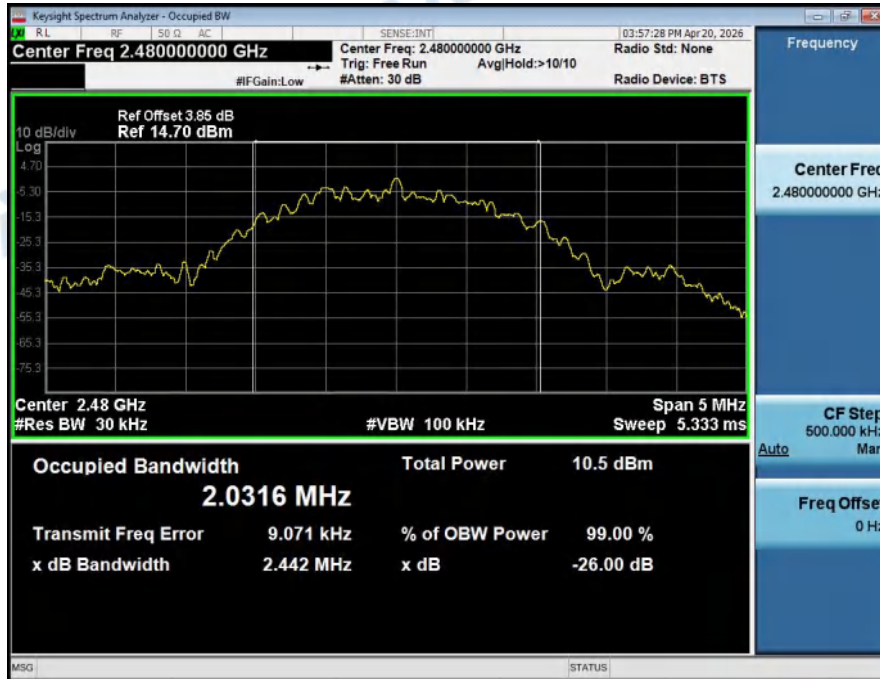
99%_Occupied_Bandwidth_NVNT_ANT1_2Mbps_2402



99%_Occupied_Bandwidth_NVNT_ANT1_2Mbps_2440



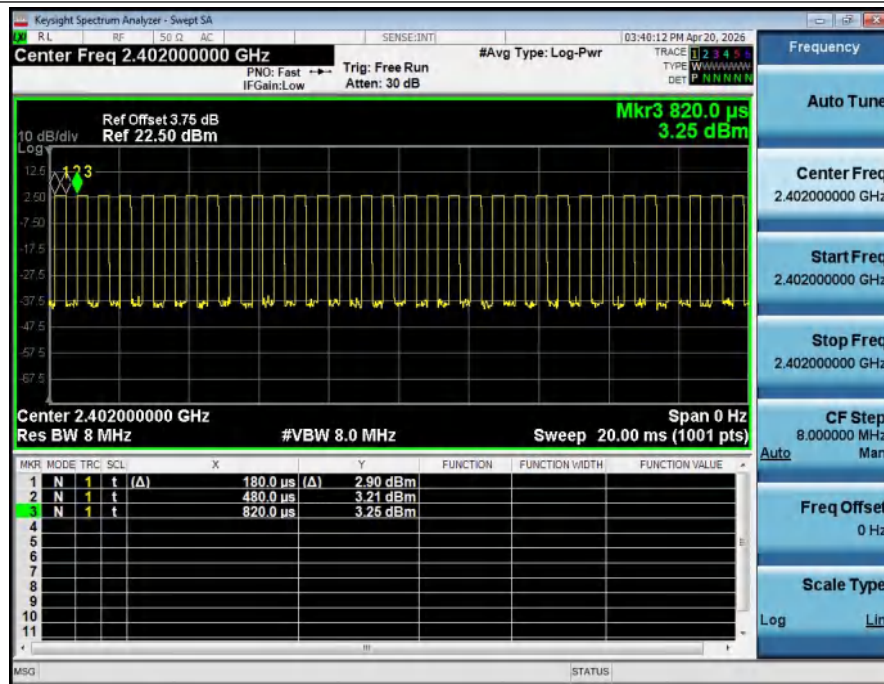
99%_Occupied_Bandwidth_NVNT_ANT1_2Mbps_2480



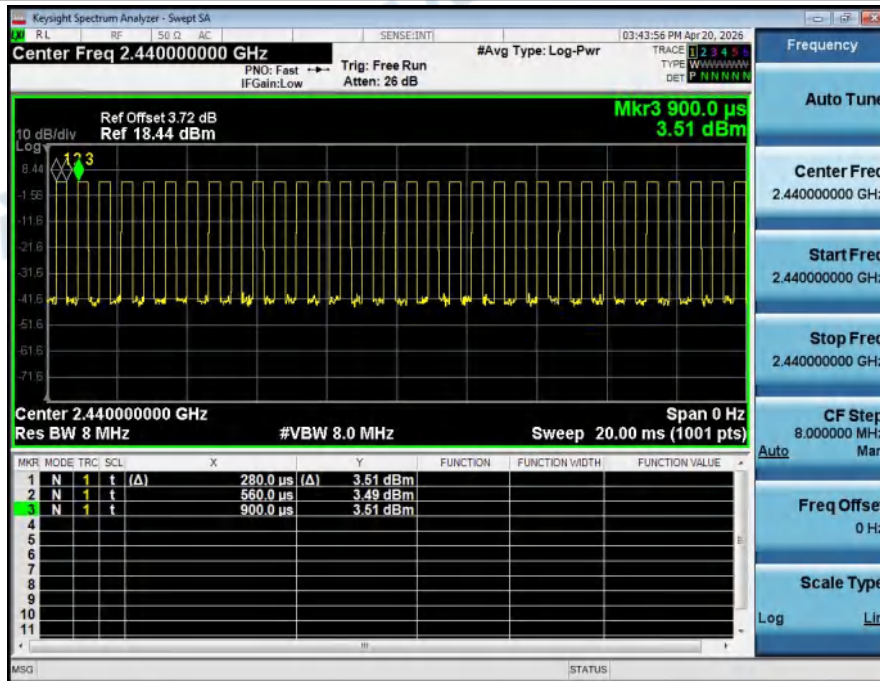
3. Duty Cycle

Condition	Antenna	Rate	Frequency (MHz)	Dutycycle(%)	Duty_factor
NVNT	ANT1	1Mbps	2402.00	46.88	3.29
NVNT	ANT1	1Mbps	2440.00	45.16	3.45
NVNT	ANT1	1Mbps	2480.00	46.88	3.29
NVNT	ANT1	2Mbps	2402.00	25.81	5.88
NVNT	ANT1	2Mbps	2440.00	28.13	5.51
NVNT	ANT1	2Mbps	2480.00	29.03	5.37

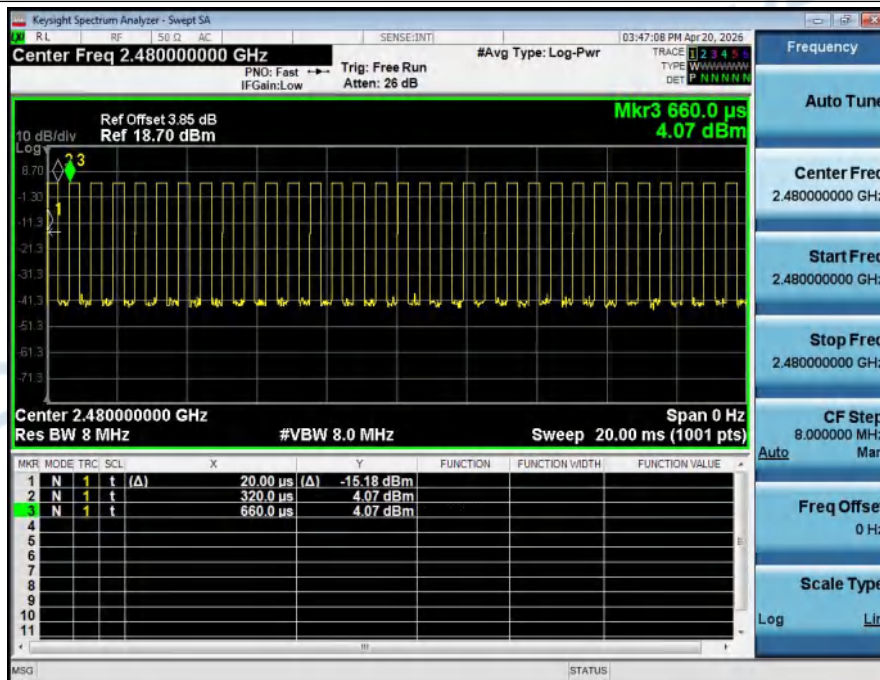
Duty_Cycle_NVNT_ANT1_1Mbps_2402



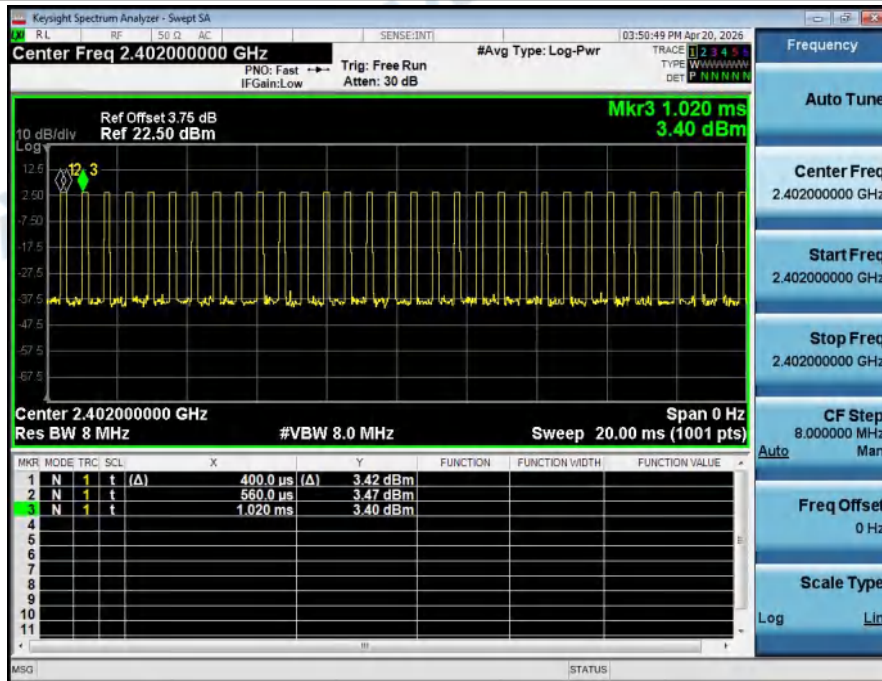
Duty_Cycle_NVNT_ANT1_1Mbps_2440



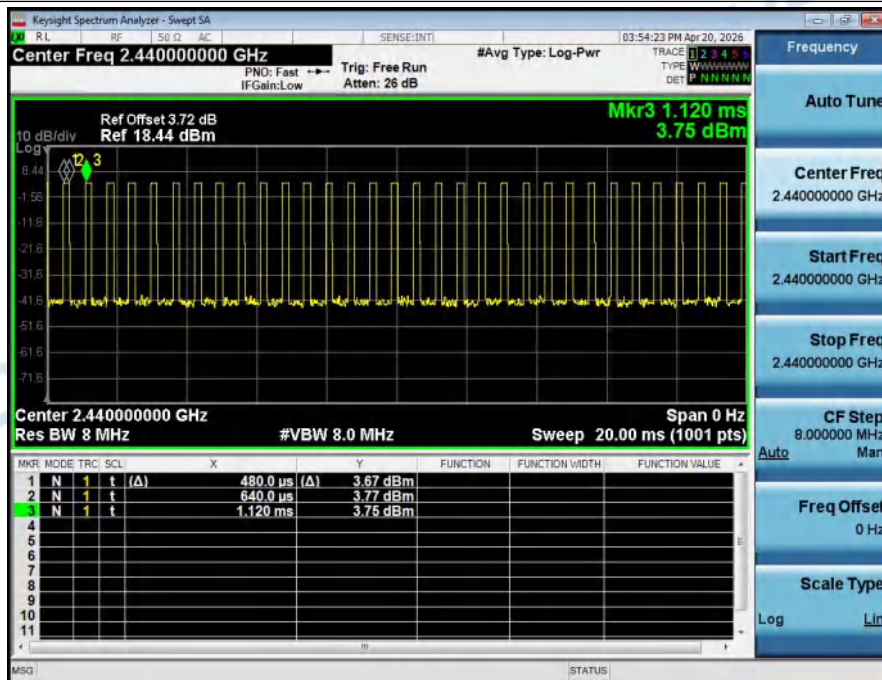
Duty_Cycle_NVNT_ANT1_1Mbps_2480



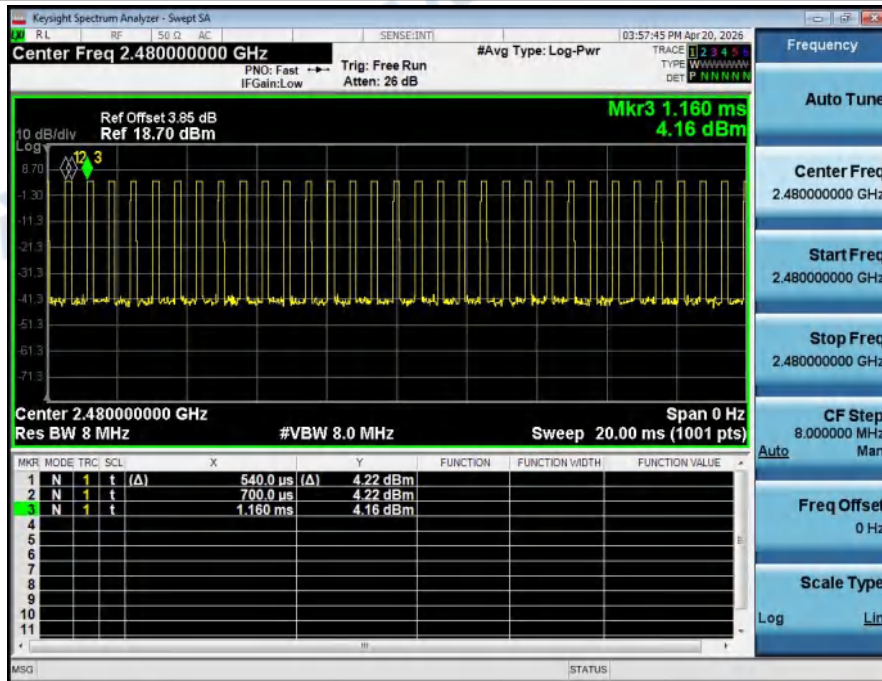
Duty_Cycle_NVNT_ANT1_2Mbps_2402



Duty_Cycle_NVNT_ANT1_2Mbps_2440



Duty_Cycle_NVNT_ANT1_2Mbps_2480



4. Peak Output Power

Condition	Antenna	Rate	Frequency (MHz)	Max. Conducted Power(dBm)	Max. Conducted Power(mW)	Limit(mW)	Result
NVNT	ANT1	1Mbps	2402.00	3.25	2.11	1000	Pass
NVNT	ANT1	1Mbps	2440.00	3.51	2.24	1000	Pass
NVNT	ANT1	1Mbps	2480.00	4.06	2.55	1000	Pass
NVNT	ANT1	2Mbps	2402.00	3.53	2.25	1000	Pass
NVNT	ANT1	2Mbps	2440.00	3.79	2.39	1000	Pass
NVNT	ANT1	2Mbps	2480.00	4.26	2.67	1000	Pass

Peak_Output_Power_NVNT_ANT1_1Mbps_2402



Peak_Output_Power_NVNT_ANT1_1Mbps_2440



Peak_Output_Power_NVNT_ANT1_1Mbps_2480



Peak_Output_Power_NVNT_ANT1_2Mbps_2402



Peak_Output_Power_NVNT_ANT1_2Mbps_2440



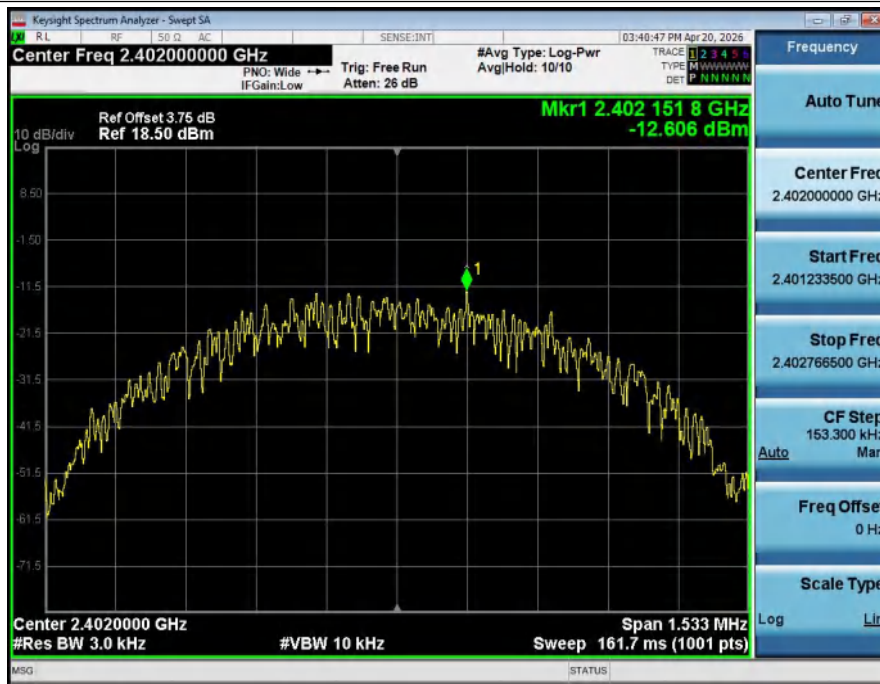
Peak_Output_Power_NVNT_ANT1_2Mbps_2480



5. Power Spectral Density

Condition	Antenna	Rate	Frequency (MHz)	Power Spectral Density(dBm/3kHz)	Limit(dBm/3kHz)	Result
NVNT	ANT1	1Mbps	2402.00	-12.61	8	Pass
NVNT	ANT1	1Mbps	2440.00	-12.21	8	Pass
NVNT	ANT1	1Mbps	2480.00	-11.69	8	Pass
NVNT	ANT1	2Mbps	2402.00	-15.72	8	Pass
NVNT	ANT1	2Mbps	2440.00	-15.48	8	Pass
NVNT	ANT1	2Mbps	2480.00	-14.95	8	Pass

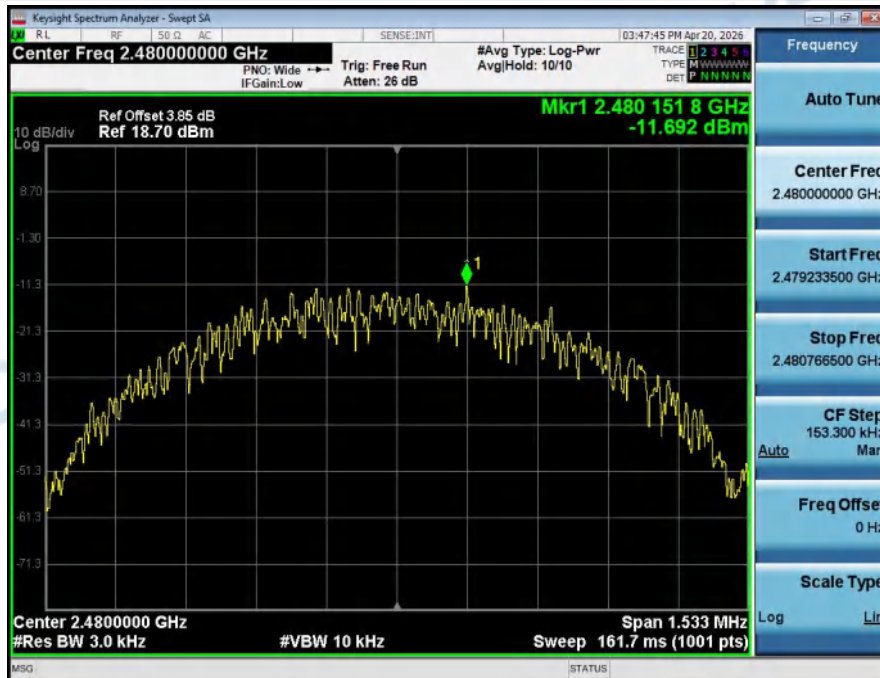
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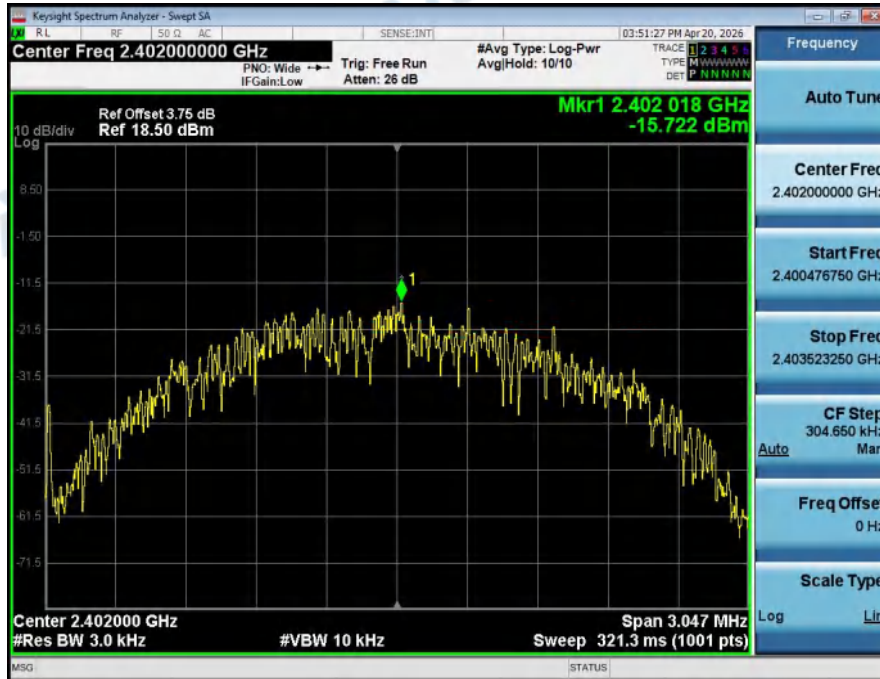
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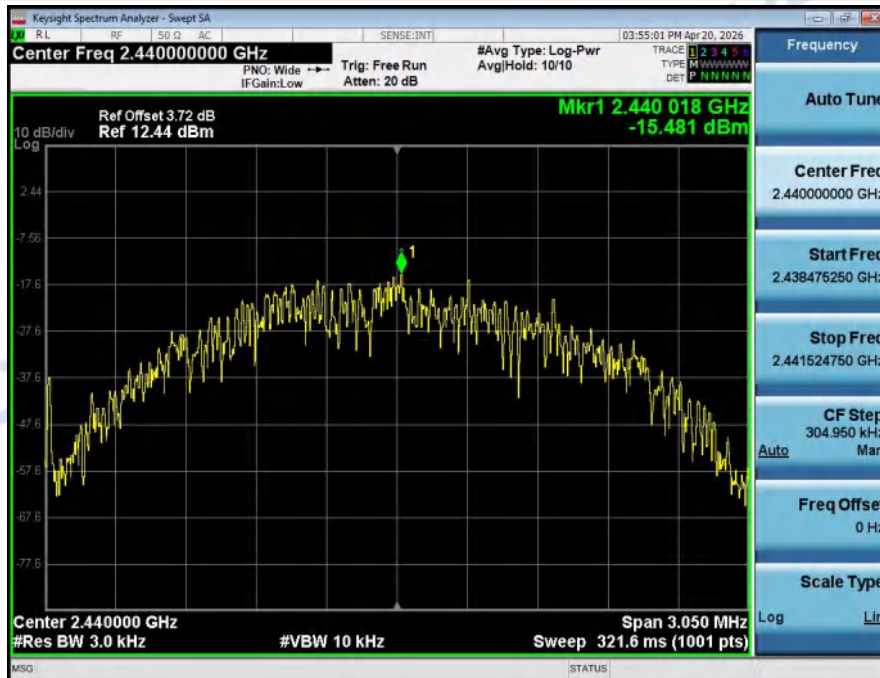
Power_Spectral_Density_NVNT_ANT1_1Mbps_2480



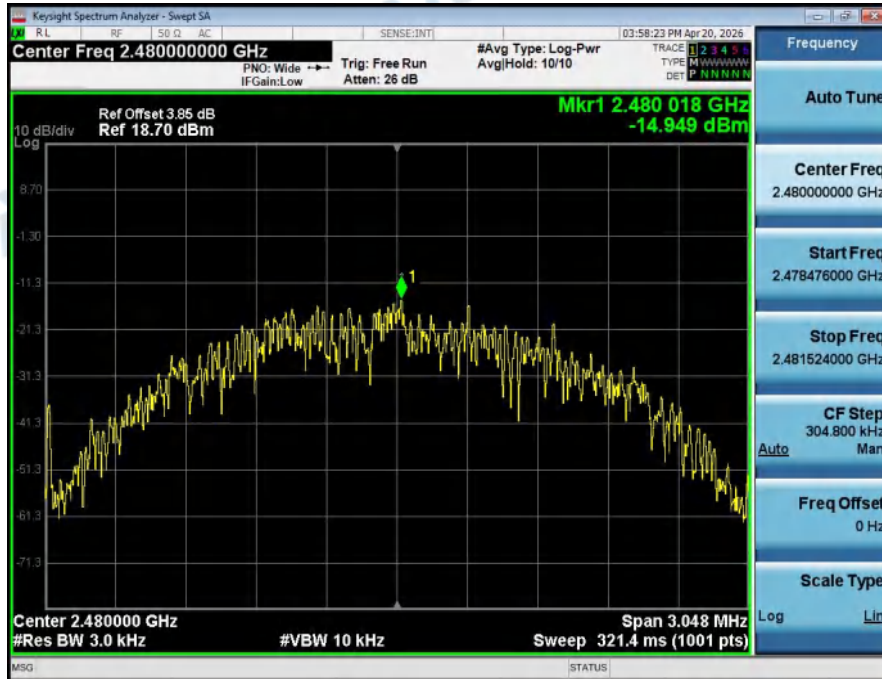
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Power_Spectral_Density_NVNT_ANT1_2Mbps_2440



Power_Spectral_Density_NVNT_ANT1_2Mbps_2480



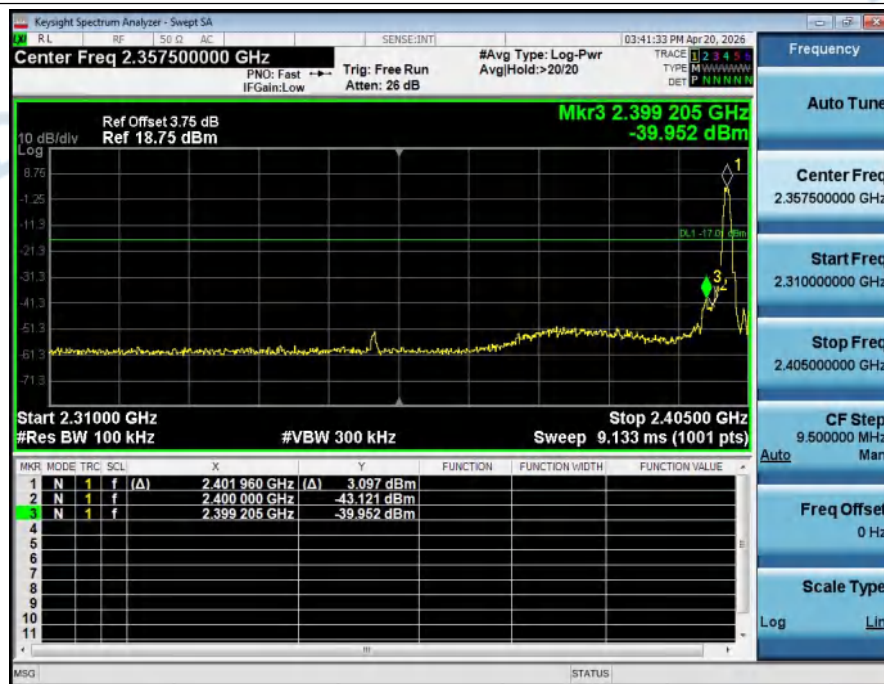
6. Bandedge

Condition	Antenna	Modulation	TX_Frequency (MHz)	Max. Mark_freq(MHz)	Ref_level(dBm)	Spurious level(dBm)	limit(dBm)	Result
NVNT	ANT1	1Mbps	2402.00	2399.205	2.988	-39.952	-17.012	Pass
NVNT	ANT1	1Mbps	2480.00	2483.750	3.829	-38.862	-16.171	Pass
NVNT	ANT1	2Mbps	2402.00	2399.965	3.137	-28.410	-16.863	Pass
NVNT	ANT1	2Mbps	2480.00	2484.450	3.861	-44.130	-16.139	Pass

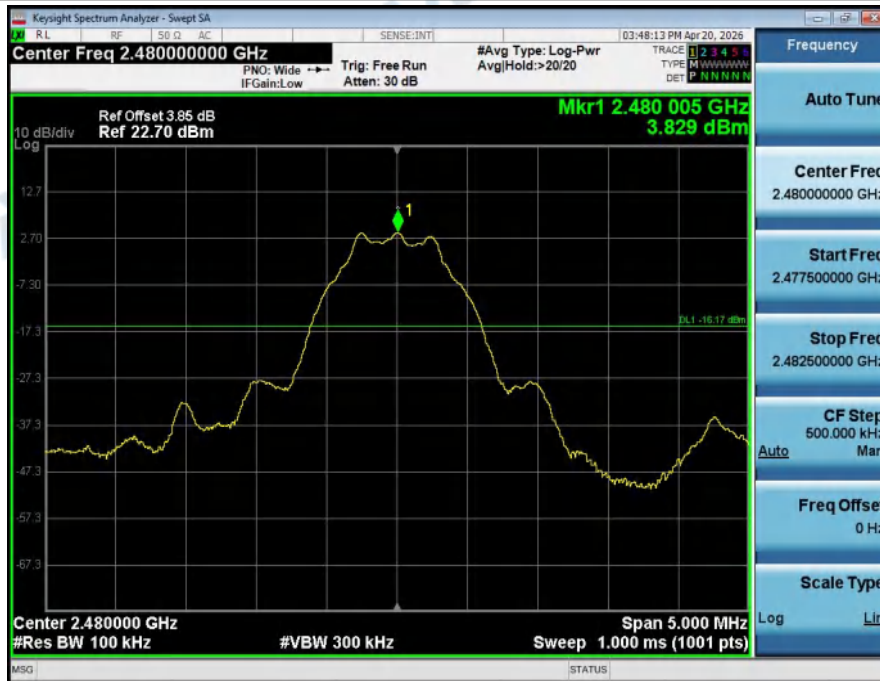
1_Reference_Level_NVNT_ANT1_1Mbps_2402



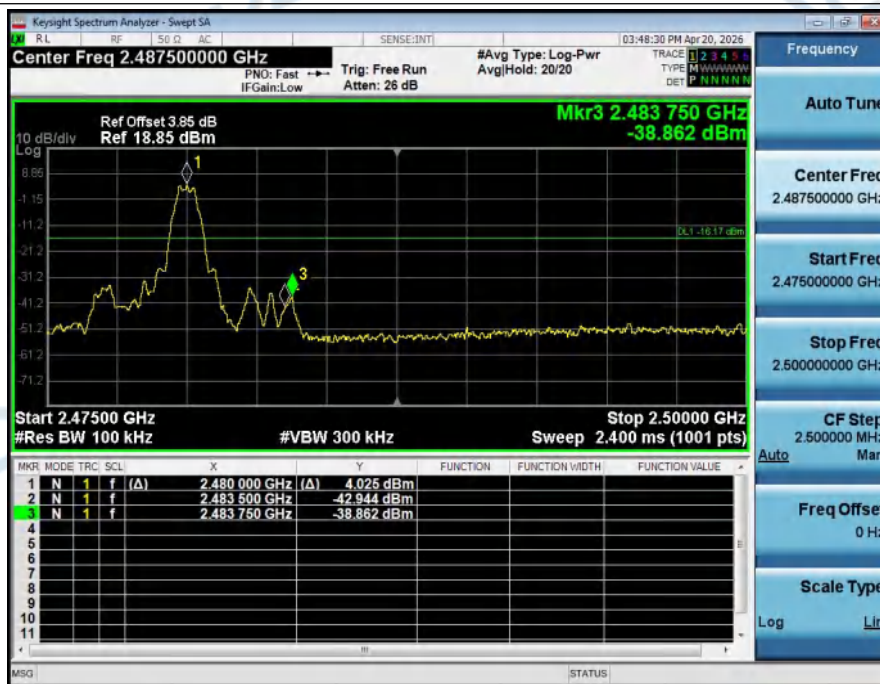
2_Bandedge_NVNT_ANT1_1Mbps_2402



1_Reference_Level_NVNT_ANT1_1Mbps_2480



2_Bandedge_NVNT_ANT1_1Mbps_2480



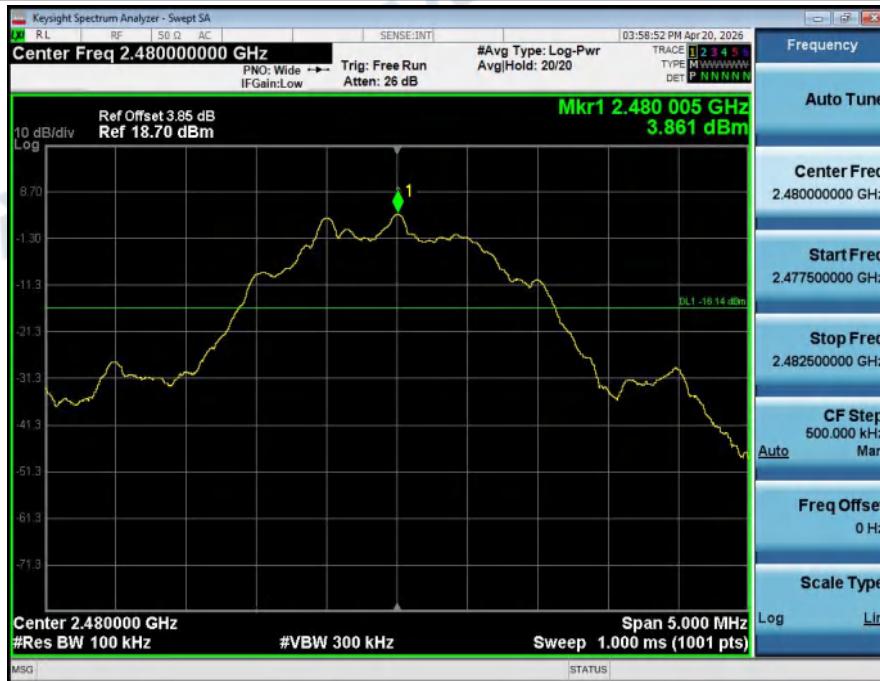
1_Reference_Level_NVNT_ANT1_2Mbps_2402



2_Bandedge_NVNT_ANT1_2Mbps_2402



1_Reference_Level_NVNT_ANT1_2Mbps_2480



2_Bandedge_NVNT_ANT1_2Mbps_2480



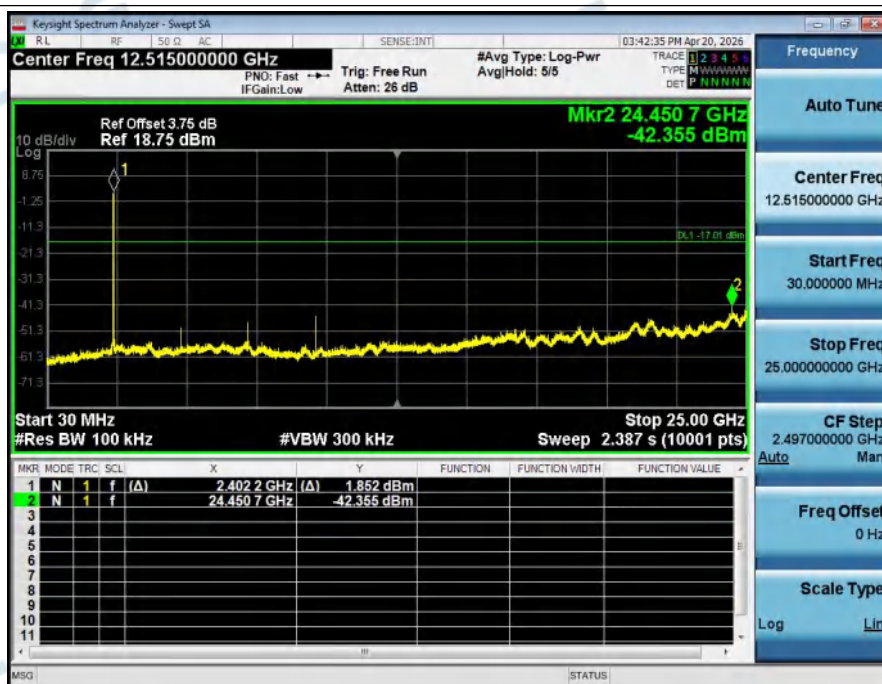
7. Spurious Emission

Condition	Antenna	Modulation	TX_Frequency (MHz)	Ref_level(dBm)	Spurious level(dBm)	limit(dBm)	Result
NVNT	ANT1	1Mbps	2402.00	2.988	-42.355	-17.012	Pass
NVNT	ANT1	1Mbps	2440.00	3.269	-42.567	-16.731	Pass
NVNT	ANT1	1Mbps	2480.00	3.829	-43.645	-16.171	Pass
NVNT	ANT1	2Mbps	2402.00	3.137	-43.055	-16.863	Pass
NVNT	ANT1	2Mbps	2440.00	3.405	-43.283	-16.595	Pass
NVNT	ANT1	2Mbps	2480.00	3.861	-46.702	-16.139	Pass

1_Reference_Level_NVNT_ANT1_1Mbps_2402



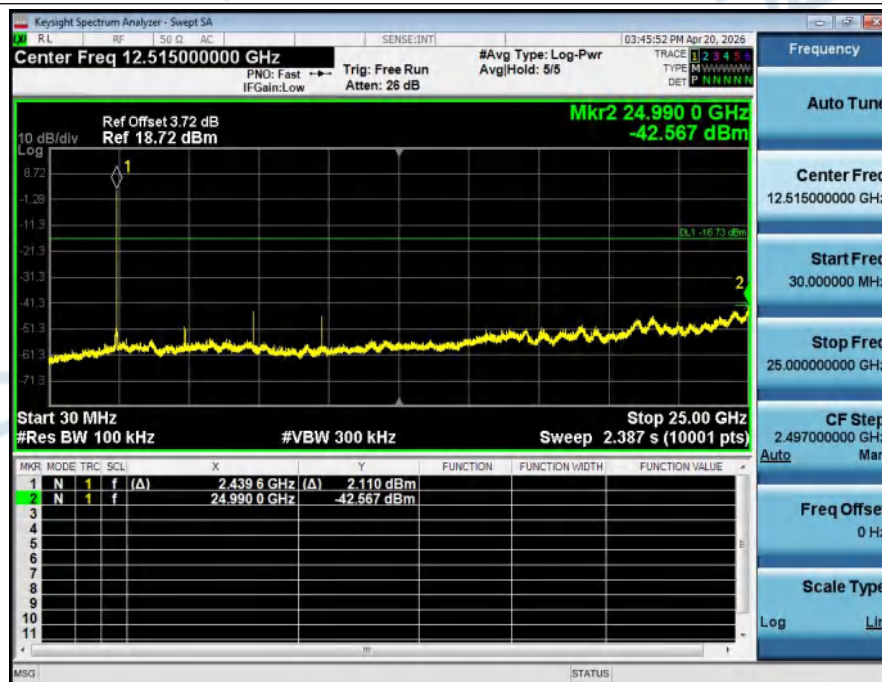
2_Spurious_Emission_NVNT_ANT1_1Mbps_2402



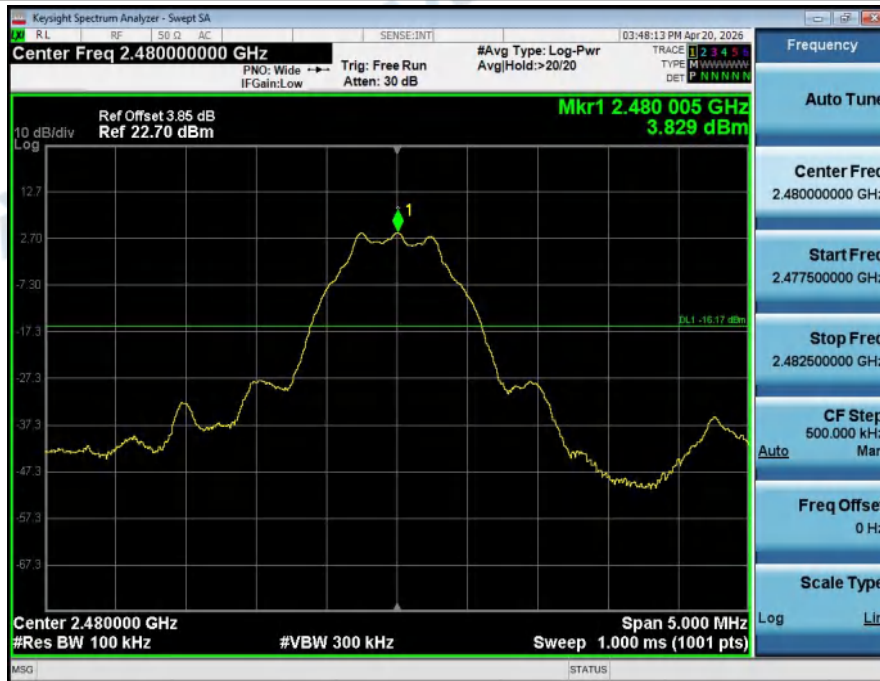
1_Reference_Level_NVNT_ANT1_1Mbps_2440



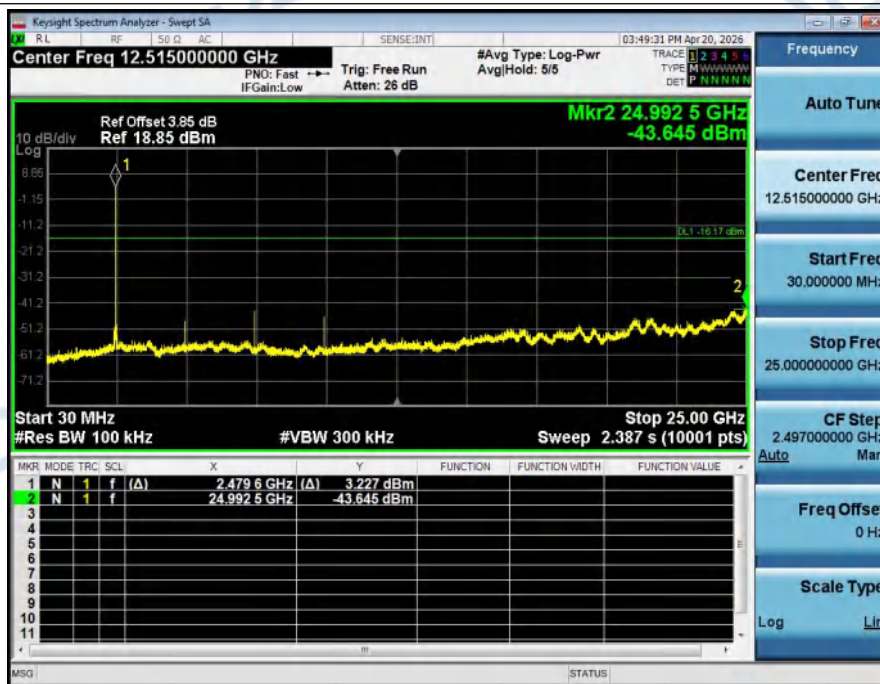
2_Spurious_Emission_NVNT_ANT1_1Mbps_2440



1_Reference_Level_NVNT_ANT1_1Mbps_2480



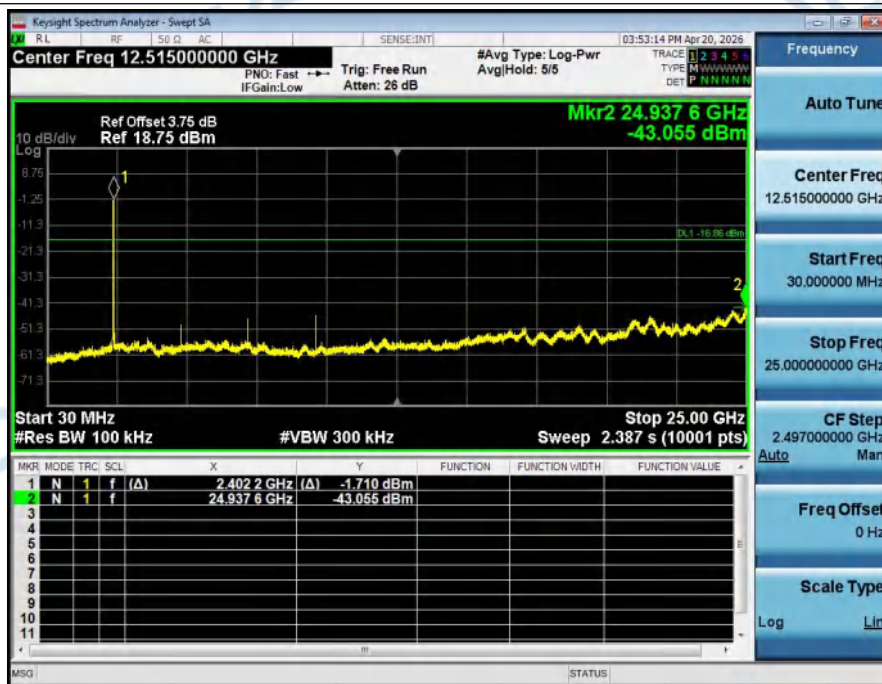
2_Spurious_Emission_NVNT_ANT1_1Mbps_2480



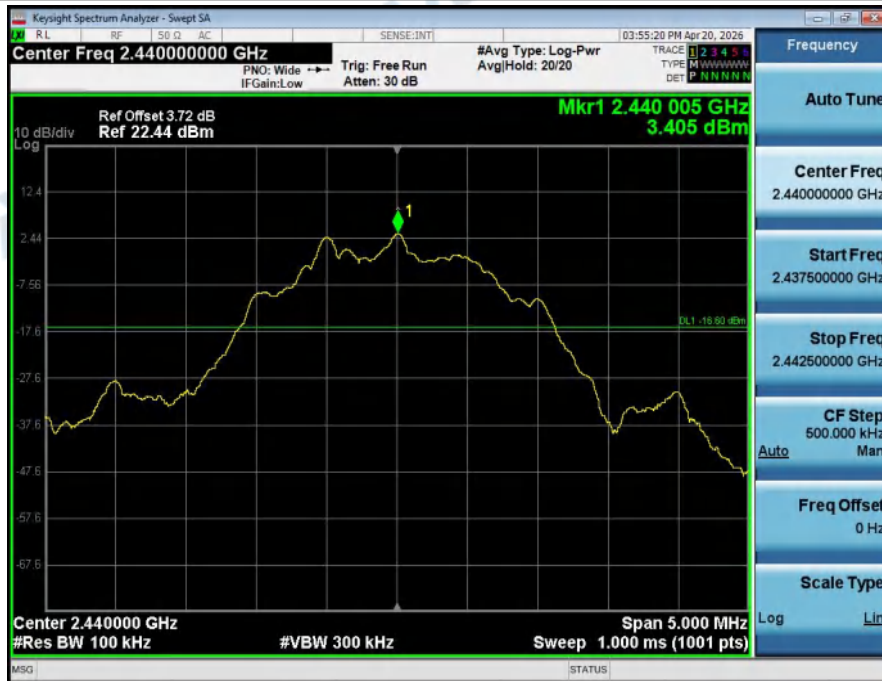
1_Reference_Level_NVNT_ANT1_2Mbps_2402



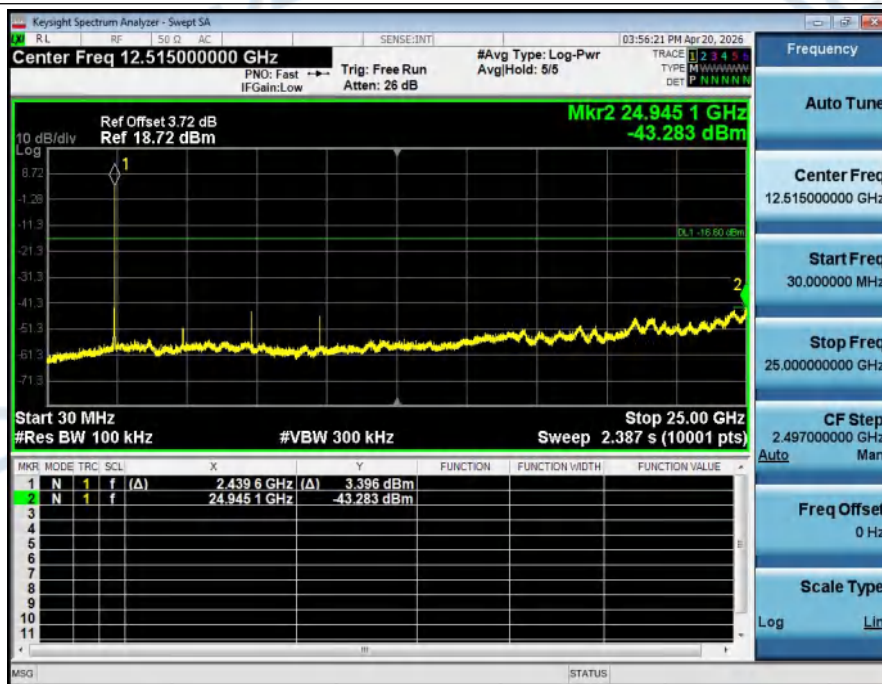
2_Spurious_Emission_NVNT_ANT1_2Mbps_2402



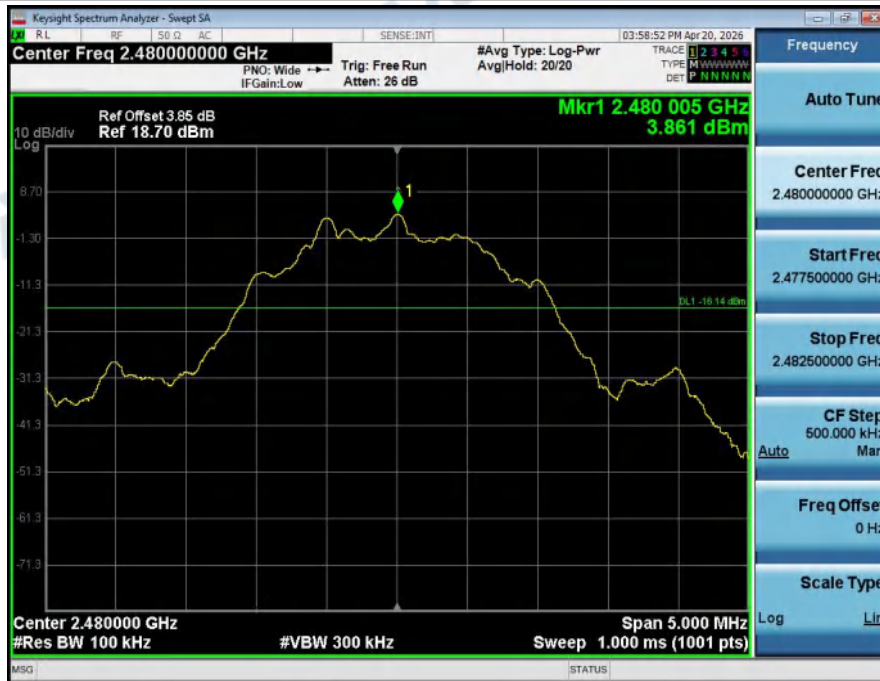
1_Reference_Level_NVNT_ANT1_2Mbps_2440



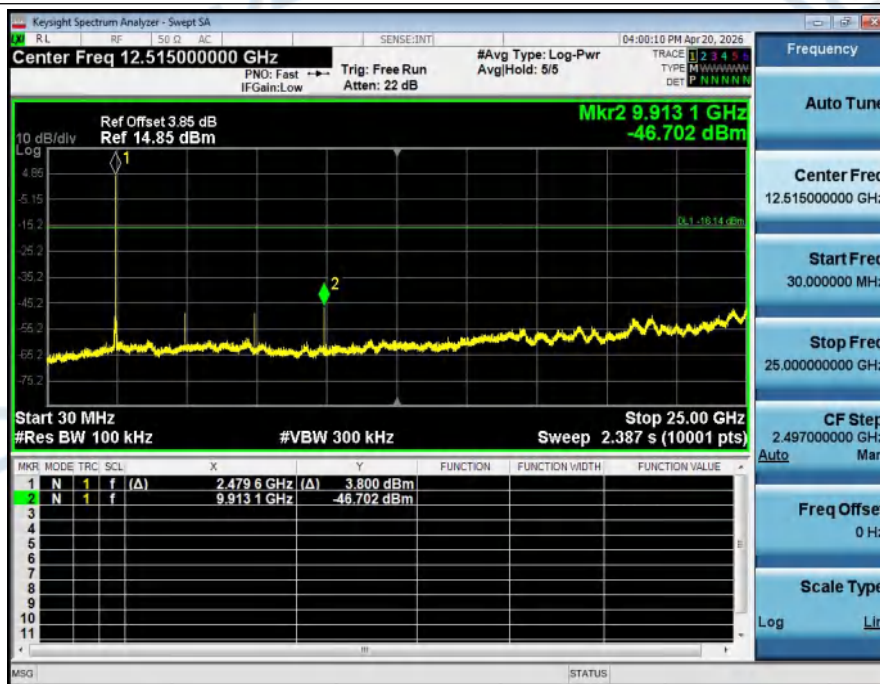
2_Spurious_Emission_NVNT_ANT1_2Mbps_2440



1_Reference_Level_NVNT_ANT1_2Mbps_2480



2_Spurious_Emission_NVNT_ANT1_2Mbps_2480



***** End of Report *****