# FCC PART 15C TEST REPORT FOR CERTIFICATION
## On Behalf of

Changsha Benlei Technology Co., Ltd.

Smart Cutting Maching

Model Number: SA501

Additional Model: S501,SA01,SA502,S502,SA02,SA501-PK,SA501-OG,

SA501-PL,SA501-GN,SA501-YL,SA501-BU,SA501-RD,SA501-WH

FCC ID: 2BEVY-SA501

| | |
|---|---|
| Applicant : | Changsha Benlei Technology Co., Ltd. |
| Address: | Room 3002-621, Comprehensive Building, Sifang Community, |
| | No.168 Shuangyong Road, Sifangping Street, Kaifu District, |
| | Changsha City,Hunan Province,China |
| | |
| Prepared By: | EST Technology Co., Ltd. |
| | Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China |
| Tel: 86-769-83081888-808 | |

| | |
|---|---|
| Report Number: | ESTE-R2401204 |
| Date of Test: | Nov. 20, 2023~Jan. 17, 2024 |
| Date of Report: | Jan. 19, 2024 |

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| | | | |
|---|---|---|---|
| **Applicant:**<br>**Address:** | Changsha Benlei Technology Co., Ltd.<br>Room 3002-621, Comprehensive Building, Sifang Community, No.168 Shuangyong Road, Sifangping Street, Kaifu District, Changsha City,Hunan Province,China | | |
| **Manufacturer:**<br>**Address:** | Changsha Benlei Technology Co., Ltd.<br>Room 3002-621, Comprehensive Building, Sifang Community, No.168 Shuangyong Road, Sifangping Street, Kaifu District, Changsha City,Hunan Province,China | | |
| **E.U.T:** | Smart Cutting Maching | | |
| **Model Number:** | SA501 | | |
| **Additional Model:** | S501,SA01,SA502,S502,SA02,SA501-PK,SA501-OG,SA501-PL,SA501-GN,SA501-YL,SA501-BU,SA501-RD,SA501-WH<br>(They are identical except model name and color) | | |
| **Power Supply:** | DC 18V From Adapter Input AC 100-240V, 50/60Hz | | |
| **Trade Name:** | ------ | Serial No.: | EST-231120010-001;<br>EST-231120010-005 |
| **Date of Receipt:** | Nov. 20, 2023 | Date of Test: | Nov. 20, 2023~Jan. 17, 2024 |
| **Test Specification:** | FCC Part 15 Subpart C (15.247)<br>ANSI C63.10:2013<br>FCC KDB 558074 D01 15.247 Meas Guidance v05r02 | | |
| **Test Result:** | The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart C requirements.<br><br>This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd. | | |

**Date:** Jan. 19, 2024

| Prepared by: | Reviewed by: | Approved by: |
|---|---|---|
| Ring Yang / Assistant | Seven Wang / Engineer | Iceman Hu / Manager |

**Other Aspects:** None.

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.

# 1.GENERAL INFORMATION

## 1.1.Description of Device (EUT)

| | | |
|---|---|---|
| Product Name | : | Smart Cutting Maching |
| Model Number | : | SA501 |
| Software Version | : | 1.0.1 |
| Hardware Version | : | E001_A |
| Operation frequency | : | 2402MHz~2480MHz |
| Number of channel | : | 79 |
| Max Output Power (PEAK) | : | 0.45dBm |
| Modulation Type | : | BT BDR(1Mbps): GFSK<br>BT EDR(2Mbps): π/4-DQPSK |
| Sample Type | : | Prototype production |

Note:For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

## 1.2.Antenna Information

| Ant No. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) |
|---|---|---|---|---|---|
| 1 | - | - | PCB | - | -0.58 |

Note:
1.The antenna gain is declared by the customer and the laboratory is not responsible for the accuracy of the antenna gain.
2.The test results of this report only apply to the sample as received.

## 1.3.Information of RF Cable

| Cable Loss(dB) | Provided by |
|---|---|
| 1.0 | Changsha Benlei Technology Co., Ltd. |

Note:
1.The customer declared the loss value of the RF Cable. and the test results of this report only apply to the sample as received.
2.The laboratory is not responsible for the accuracy of the cable loss.

# 2.SUMMARY OF TEST

## 2.1.Summary of test result

| No. | Description of Test Item | FCC Standard Section | Results |
|---|---|---|---|
| 1 | Maximum Peak Output Power | 15.247(a)(1) | PASS |
| 2 | 20dB Bandwidth | 15.247(a)(1) | PASS |
| 3 | Carrier Frequency Separation | 15.247(a)(1) | PASS |
| 4 | Number Of Hopping Channel | 15.247(a)(1)(iii) | PASS |
| 5 | Dwell Time | 15.247(a)(1)(iii) | PASS |
| 6 | Conducted Band Edge | 15.247(d) | PASS |
| 7 | Conducted Spurious Emissions | 15.247(d) | PASS |
| 8 | Radiated Spurious Emissions and Band Edge | 15.205<br>15.209<br>15.247(d) | PASS |
| 9 | AC Power Line Conducted Emissions | 15.207 | PASS |
| 10 | Antenna Requirement | 15.203 | PASS |

Note:“N/A” denotes test is not applicable in this test report.

## 2.2.Test Facilities

| | | |
|---|---|---|
| EMC Lab | : | Accredited by CNAS, CHINA<br>Registration No.: L5288<br>This Accreditation is valid until: November 12, 2029<br><br>Recognized by FCC, USA<br>Designation Number: CN1215<br>This Recognition is valid until: February 29, 2024<br><br>Accredited by A2LA, USA<br>Registration No.: 4366.01<br>This Accreditation is valid until: February 29, 2024<br><br>Recognized by Industry Canada<br>CAB identifier No.: CN0035<br>This Recognition is valid until: February 29, 2024<br><br>Recognized by VCCI, Japan<br>Registration No.:C-14103; T-20073; R-13663; R-20103; G-20097<br>Date of registration: Apr. 20, 2020<br>This Recognition is valid until: Apr. 19, 2026<br><br>Recognized by TUV Rheinland, Germany<br>Registration No.: UA 50413872 0001<br>Date of registration: July 31, 2018<br><br>Recognized by Intertek<br>Registration No.: 2011-RTL-L2-64<br>Date of registration: November 08, 2018 |
| Name of Firm | : | EST Technology Co., Ltd. |
| Site Location | : | Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China |

## 2.3.Measurement uncertainty

| Test Item | Uncertainty |
|---|---|
| Uncertainty for Conduction emission test | ±3.48dB |
| Uncertainty for spurious emissions test (Below 30MHz) | ±1.62 dB |
| Uncertainty for spurious emissions test (30MHz-1GHz) | ±4.60 dB(Polarize: H) |
| | ±4.68 dB(Polarize: V) |
| Uncertainty for spurious emissions test (1GHz to 25GHz) | ±4.96dB |
| Uncertainty for radio frequency | $7\times10^{-8}$ |
| Uncertainty for conducted RF Power | 1.08dB |
| Uncertainty for Power density test | 0.26dB |

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

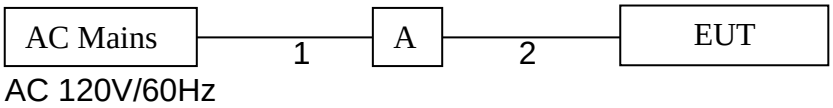
## 2.4.Assistant equipment used for test

| Item | Equipment | Brand | Model Name/Type No. | FCC ID | Series No. |
|---|---|---|---|---|---|
| A | Adapter | - | MKE-1801500C8 | - | - |

| Item | Shielded Type | Ferrite Core | Length | Note |
|---|---|---|---|---|
| 1 | NO | NO | 1.0m | AC Cable |
| 2 | NO | NO | 1.5m | DC Cable |

## 2.5.Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was beset into Bluetooth test mode by software before test.




(EUT: Smart Cutting Maching)

## 2.6.Test mode

Combining all the rates, modulations, and packet types, the Pre-scans had been carried out. The worst case test mode was selected for the final test as listed below.

| Test Item | Modulation Type | Operating Mode | Packet Type | Test Channel |
|---|---|---|---|---|
| Maximum Peak Output Power | GFSK& π/4-DQPSK | Non Hopping | DH5 | Low/Middle/High |
| 20dB Bandwidth | GFSK& π/4-DQPSK | Non Hopping | DH5 | Low/Middle/High |
| Carrier Frequency Separation | GFSK& π/4-DQPSK | Hopping | DH5 | Low/Middle/High |
| Number Of Hopping Channel | GFSK& π/4-DQPSK | Hopping | DH5 | All Channel Hopping |
| Dwell Time | GFSK& π/4-DQPSK | Hopping | DH1/DH 3/DH5 | Middle( All Channel Hopping) |
| Conducted Band Edge | GFSK& π/4-DQPSK | Non Hopping&Hopping | DH5 | Low/ High& All Channel Hopping |
| Conducted Spurious Emissions | GFSK& π/4-DQPSK | Non Hopping | DH5 | Low/Middle/High |
| Radiated Spurious Emissions(Below 1GHz) | GFSK& π/4-DQPSK | Non Hopping | DH5 | Low/Middle/High |
| Radiated Spurious Emissions(Above 1GHz) | GFSK& π/4-DQPSK | Non Hopping | DH5 | Low/Middle/High |
| Radiated Band Edge | GFSK& π/4-DQPSK | Non Hopping | DH5 | Low/High |
| AC Power Line Conducted Emissions | GFSK& π/4-DQPSK | Non Hopping | DH5 | Low/Middle/High |

Note: In radiated measurement,the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on **X-plane.**

## 2.7.Channel List

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) |
|---|---|---|---|---|---|---|---|
| 0 | 2402 | 1 | 2403 | 2 | 2404 | 3 | 2405 |
| 4 | 2406 | 5 | 2407 | 6 | 2408 | 7 | 2409 |
| 8 | 2410 | 9 | 2411 | 10 | 2412 | 11 | 2413 |
| 12 | 2414 | 13 | 2415 | 14 | 2416 | 15 | 2417 |
| 16 | 2418 | 17 | 2419 | 18 | 2420 | 19 | 2421 |
| 20 | 2422 | 21 | 2423 | 22 | 2424 | 23 | 2425 |
| 24 | 2426 | 25 | 2427 | 26 | 2428 | 27 | 2429 |
| 28 | 2430 | 29 | 2431 | 30 | 2432 | 31 | 2433 |
| 32 | 2434 | 33 | 2435 | 34 | 2436 | 35 | 2437 |
| 36 | 2438 | 37 | 2439 | 38 | 2440 | 39 | 2441 |
| 40 | 2442 | 41 | 2443 | 42 | 2444 | 43 | 2445 |
| 44 | 2446 | 45 | 2447 | 46 | 2448 | 47 | 2449 |
| 48 | 2450 | 49 | 2451 | 50 | 2452 | 51 | 2453 |
| 52 | 2454 | 53 | 2455 | 54 | 2456 | 55 | 2457 |
| 56 | 2458 | 57 | 2459 | 58 | 2460 | 59 | 2461 |
| 60 | 2462 | 61 | 2463 | 62 | 2464 | 63 | 2465 |
| 64 | 2466 | 65 | 2467 | 66 | 2468 | 67 | 2469 |
| 68 | 2470 | 69 | 2471 | 70 | 2472 | 71 | 2473 |
| 72 | 2474 | 73 | 2475 | 74 | 2476 | 75 | 2477 |
| 76 | 2478 | 77 | 2479 | 78 | 2480 | - | - |

## 2.8.Power Setting of Test Software

| Software Name | FCC Assist 1.0.2.2 | | |
|---|---|---|---|
| Frequency(MHz) | 2402 | 2441 | 2480 |
| GFSK(1Mbps) Setting | 10 | 10 | 10 |
| π/4-DQPSK (2Mbps) Setting | 10 | 10 | 10 |

Note: This information is provided by the applicant.

## 2.9.Test Equipment

| For conducted emission test | | | | | | |
|---|---|---|---|---|---|---|
| Equipment | Manufacturer | Model No. | Serial No. | Calibration Body | Last Cal. | Next Cal. |
| EMI Test Receiver | Rohde & Schwarz | ESHS30 | EST-E001 | LISAI | June 12,23 | 1 Year |
| Artificial Mains Network | Rohde & Schwarz | ENV216 | EST-E002 | LISAI | June 12,23 | 1 Year |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | EST-E078 | LISAI | June 12,23 | 1 Year |
| Test Software | Audix | e3-6.111221a | N/A | N/A | N/A | N/A |

| For radiated emission test(9 kHz-30MHz) | | | | | | |
|---|---|---|---|---|---|---|
| Equipment | Manufacturer | Model No. | Serial No. | Calibration Body | Last Cal. | Next Cal. |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | EST-E047 | LISAI | June 12,23 | 1 Year |
| Active Loop Antenna | SCHWAREBECK | FMZB 1519B | EST-E054 | LISAI | June 12,23 | 1 Year |
| Test Software | Audix | e3-6.111221a | N/A | N/A | N/A | N/A |
| 9kHz-30MHz Cable | N/A | EST-001 | N/A | N/A | N/A | N/A |

| For radiated emissions test (30-1000MHz) | | | | | | |
|---|---|---|---|---|---|---|
| Equipment | Manufacturer | Model No. | Serial No. | Calibration Body | Last Cal. | Next Cal. |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | EST-E047 | LISAI | June 12,23 | 1 Year |
| Bilog Antenna | Teseq | CBL 6111D | EST-E034 | LISAI | June 12,23 | 1 Year |
| Test Software | Audix | e3-6.111221a | N/A | N/A | N/A | N/A |
| 30-1000MHz Cable | N/A | EST-002 | N/A | N/A | N/A | N/A |

| For radiated emission test(Above 1000MHz) | | | | | | |
|---|---|---|---|---|---|---|
| Equipment | Manufacturer | Model No. | Serial No. | Calibration Body | Last Cal. | Next Cal. |
| Horn Antenna | SCHWARZBECK | BBHA9120D | EST-E144 | LISAI | June 12,23 | 1 Year |
| Horn Antenna | Com-Power | AHA-840 | EST-E133 | LISAI | June 12,23 | 1 Year |
| Low Noise Amplifier | RF | TRLA-010180 G45N | EST-E142 | LISAI | June 12,23 | 1 Year |
| Spectrum Analyzer | Rohde &Schwarz | FSV40 | EST-E069 | LISAI | June 12,23 | 1 Year |
| Test Software | Audix | e3-6.111221a | N/A | N/A | N/A | N/A |
| Above 1GHz Cable | N/A | EST-003 | N/A | N/A | N/A | N/A |

| For connect EUT antenna terminal test | | | | | | |
|---|---|---|---|---|---|---|
| Equipment | Manufacturer | Model No. | Serial No. | Calibration Body | Last Cal. | Next Cal. |
| TS 1120 | Tonscend | / | / | / | / | / |
| Test Software | Tonscend | TS1120-3 | 3.3.38 | / | / | / |
| RF Control Unit | Tonscend | JS0806-2 | EST-E134 | LISAI | June 12,23 | 1 Year |
| Signal and Spectrum Analyzer | Keysight | N9010B | EST-E141 | LISAI | June 12,23 | 1 Year |

# 3.MAXIMUM PEAK OUTPUT POWER

## 3.1.Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

## 3.2.Test Setup

## 3.3.Spectrum Analyzer Setting

| Spectrum Parameters | Setting |
|---|---|
| RBW | 3MHz |
| VBW | 3MHz |
| Span | 7.5MHz |
| Sweep Time | Auto |
| Detector | Peak |
| Trace Mode | Max Hold |

## 3.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 3.3.
c. Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
d. Allow trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission.
e. Repeat above procedures until all channels and test modes were measured.
f. Record the results in the test report.

## 3.5.Test Result

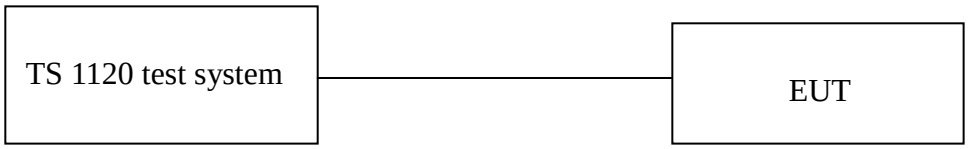
Refer to section 13: Appendix B

# 4.20 DB BANDWIDTH

## 4.1.Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

## 4.2.Test Setup




## 4.3.Spectrum Analyzer Setting

| Spectrum Parameters | Setting |
|---|---|
| RBW | 30KHz |
| VBW | 100KHz |
| Span | 3MHz |
| Sweep Time | Auto |
| Detector | Peak |
| Trace Mode | Max Hold |

## 4.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 4.3.
c. Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
d. Allow trace to stabilize, use the ndB down function to measure 20dB Bandwidth.
e. Repeat above procedures until all channels and test modes were measured.
f. Record the results in the test report.

## 4.5.Test Result

Refer to section 13: Appendix A

# 5.CARRIER FREQUENCY SEPARATION

## 5.1.Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

## 5.2.Test Setup

## 5.3.Spectrum Analyzer Setting

| Spectrum Parameters | Setting |
|---|---|
| RBW | 30KHz |
| VBW | 100KHz |
| Span | 3MHz |
| Sweep Time | Auto |
| Detector | Peak |
| Trace Mode | Max Hold |

## 5.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 5.3.
c. Set the EUT transmit continuously with maximum output power in all channel hopping mode.
d. Allow trace to stabilize, use the marker-delta function to measure channel separation between two adjacent channels.
e. Repeat above procedures until all channels and test modes were measured.
f. Record the results in the test report.

## 5.5.Test Result

Refer to section 13: Appendix C

# 6.NUMBER OF HOPPING CHANNEL

## 6.1.Limit

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

## 6.2.Test Setup

## 6.3.Spectrum Analyzer Setting

| Spectrum Parameters | Setting |
|---|---|
| RBW | 300KHz |
| VBW | 300KHz |
| Start frequency | 2400MHz |
| Stop frequency | 2483.5MHz |
| Sweep Time | Auto |
| Detector | Peak |
| Trace Mode | Max Hold |

## 6.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 6.3.
c. Set the EUT transmit continuously with maximum output power in all channel hopping mode.
d. Allow trace to stabilize, use the marker-peak function to mark the first and last frequency hopping channel.
e. Repeat above procedures until all test modes were measured.
f. Record the results in the test report.

## 6.5.Test Result

Refer to section 13: Appendix E

# 7.DWELL TIME

## 7.1.Limit

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.

## 7.2.Test Setup

## 7.3.Spectrum Analyzer Setting

| Spectrum Parameters | Setting |
|---|---|
| RBW | 1MHz |
| VBW | 1MHz |
| Span | Zero |
| Detector | Peak |
| Sweep Time | 2.5ms(DH1)/10ms(DH3)/20ms(DH5) |
| Sweep Mode | Single Sweep |

## 7.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 7.3.
c. Set the EUT transmit continuously with maximum output power in all channel hopping mode.
d. Allow trace to stabilize, use the marker-delta function to measure single pulse duration.
e. Repeat above procedures until all test modes were measured.
f. Record the results in the test report.

## 7.5.Test Result

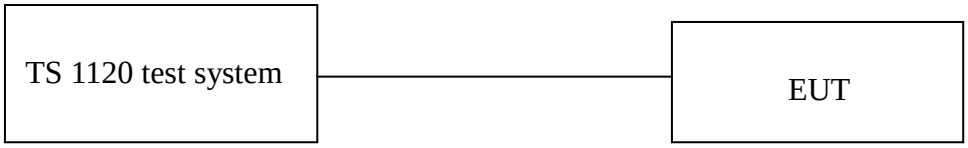
Refer to section 13: Appendix D

# 8.CONDUCTED BAND EDGE

## 8.1.Limit

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. 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)).

## 8.2.Test Setup




## 8.3.Spectrum Analyzer Setting

| Spectrum Parameters | Setting |
|---|---|
| RBW | 100KHz |
| VBW | 300KHz |
| Span | 100MHz |
| Sweep Time | Auto |
| Detector | Peak |
| Trace Mode | Max Hold |

## 8.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 8.3.
c. Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
d. Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
e. Repeat above procedures until all channels and test modes were measured(including frequency hopping off and frequency hopping on).
f. Record the results in the test report.

## 8.5.Test Result

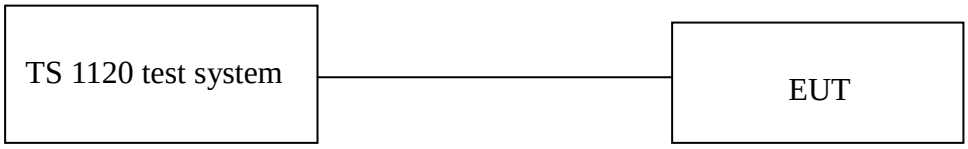
Refer to section 13: Appendix F & H

# 9.CONDUCTED SPURIOUS EMISSIONS

## 9.1.Limit

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 ntentional 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. 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)).

## 9.2.Test Setup




## 9.3.Spectrum Analyzer Setting

| Spectrum Parameters | Setting |
|---|---|
| RBW | 100KHz |
| VBW | 300KHz |
| Start frequency | 30MHz |
| Stop frequency | 26.5GHz |
| Sweep Time | Auto |
| Detector | Peak |
| Trace Mode | Max Hold |

## 9.4.Test Procedure

a. Connect EUT antenna terminal to the spectrum analyzer with RF cable.
b. Spectrum analyzer setting parameters in accordance with section 9.3.
c. Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
d. Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
e. Repeat above procedures until all channels and test modes were measured.
f. Record the results in the test report.

## 9.5.Test Result

Refer to section 13: Appendix G & H

# 10. RADIATED SPURIOUS EMISSIONS AND BAND EDGE

## 10.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| [1]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 |
| 8.41425 - 8.41475 | 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 | ([2]) |

15.209 Limit

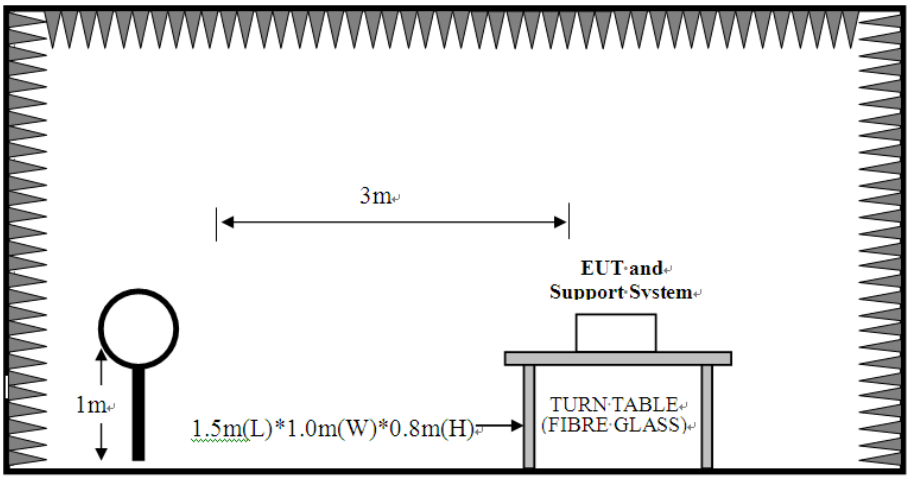
| Frequency (MHz) | Field Strength(μV/m) | Distance(m) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note:

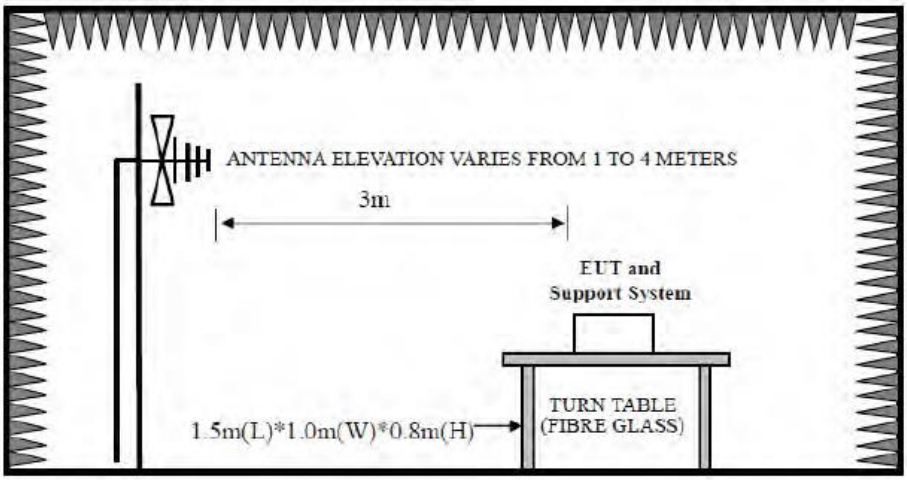
(1) Emission level dBμV = 20 log Emission level μV/m.
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) Distance is the distance in meters between the measuring instrument,antenna and the closest point of any part of the device or system.

## 10.2. Test Setup

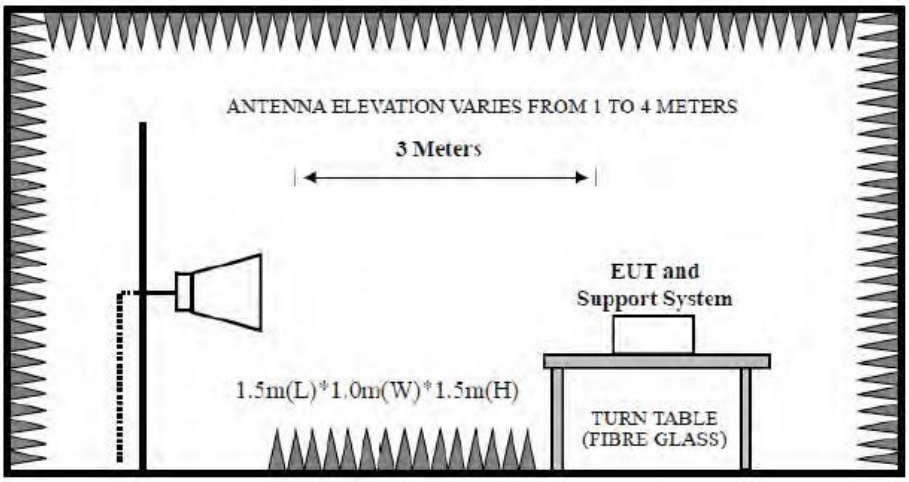
9kHz~30MHz




30~1000MHz




Above 1GHz



## 10.3. Spectrum Analyzer Setting

For 9KHz-150KHz

| Spectrum Parameters | Setting |
|---|---|
| RBW | 300Hz(for Peak&AVG)/CISPR 200Hz(for QP) |
| VBW | 300Hz(for Peak&AVG)/CISPR 200Hz(for QP) |
| Start frequency | 9KHz |
| Stop frequency | 150KHz |
| Sweep Time | Auto |
| Detector | PEAK/QP/AVG |
| Trace Mode | Max Hold |

For 150KHz-30MHz

| Spectrum Parameters | Setting |
|---|---|
| RBW | 9KHz |
| VBW | 9KHz |
| Start frequency | 150KHz |
| Stop frequency | 30MHz |
| Sweep Time | Auto |
| Detector | QP |
| Trace Mode | Max Hold |

For 30MHz-1GHz

| Spectrum Parameters | Setting |
|---|---|
| RBW | 120KHz |
| VBW | 300KHz |
| Start frequency | 30MHz |
| Stop frequency | 1GHz |
| Sweep Time | Auto |
| Detector | QP |
| Trace Mode | Max Hold |

For Above 1GHz

| Spectrum Parameters | Setting | |
|---|---|---|
| RBW | 1MHz | |
| VBW | PEAK Measurement | AVG Measurement |
| | 3MHz | Duty cycle≥98%,VBW=10Hz |
| | | Duty cycle＜98%,VBW≥1/T |
| Start frequency | 1GHz | |
| Stop frequency | 25GHz | |
| Sweep Time | Auto | |
| Detector | PEAK | |
| Trace Mode | Max Hold | |

## 10.4. Test Procedure

a. EUT was placed on a turn table, which is 0.8 meter high above ground for below 1GHz test, and which is 1.5 meter high above ground for above 1GHz test.
b. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower.
c. Set the EUT transmit continuously with maximum output power.
d. The turn table can rotate 360 degrees to determine the position of the maximum emission level.
e. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.
f. Spectrum analyzer setting parameters in accordance with section 10.3.
g. Repeat above procedures until all channels and test modes were measured.
h. Record the results in the test report.

Note:

1. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
2. The frequency 2402MHz ,2441MHz and 2480MHz is fundamental frequency which no limit, the limit on plots is automatically generated by the software, it's not fundamental limit, we can't remove it.

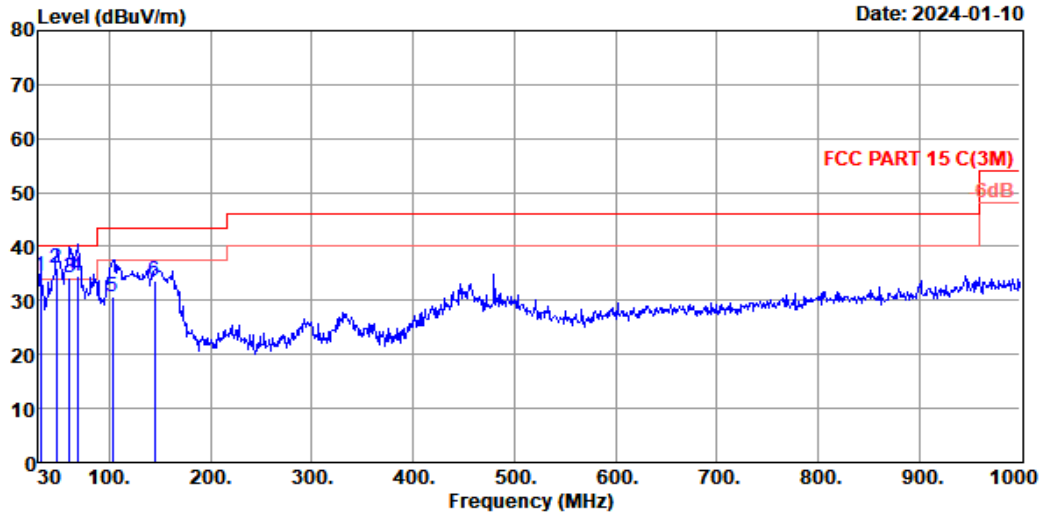
## 10.5. Test Result

### Radiated Emissions Below 1GHz

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 3 File: \\EMC-966-3\test data\2024\RF\Q\Qu yin\SA501.EM6 (6)




Site no. : 3# 966 Chamber Data no. : 3
Dis. / Ant. : 3m 31218 Ant. pol. : VERTICAL
Limit : FCC PART 15 C(3M)
Env. / Ins. : Temp:23.6°C;Humi:56%;Press:101.52kPa
Engineer : JBR
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : TX Mode

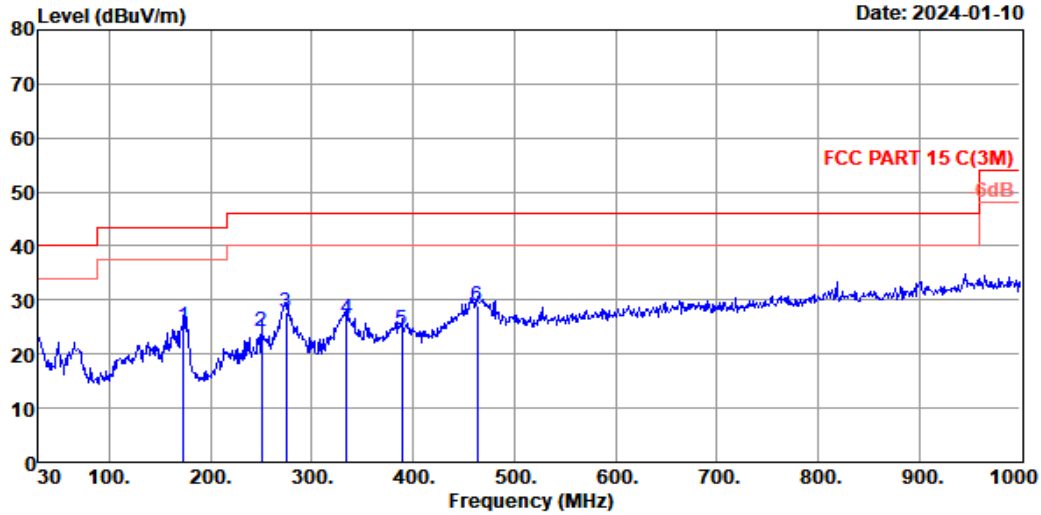
| | Freq. (MHz) | ANT Factor (dB/m) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 31.94 | 17.10 | 0.22 | 17.09 | 34.41 | 40.00 | 5.59 | QP |
| 2 | 47.46 | 9.70 | 0.27 | 26.00 | 35.97 | 40.00 | 4.03 | QP |
| 3 | 61.04 | 5.10 | 0.39 | 28.70 | 34.19 | 40.00 | 5.81 | QP |
| 4 | 68.80 | 6.30 | 0.53 | 27.70 | 34.53 | 40.00 | 5.47 | QP |
| 5 | 102.75 | 10.30 | 0.81 | 19.70 | 30.81 | 43.50 | 12.69 | QP |
| 6 | 144.46 | 11.73 | 0.96 | 21.08 | 33.77 | 43.50 | 9.73 | QP |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 4 File: \\EMC-966-3\test data\2024\RF\Q\Qu yin\SA501.EM6 (6)




Site no. : 3# 966 Chamber Data no. : 4
Dis. / Ant. : 3m 31218 Ant. pol. : HORIZONTAL
Limit : FCC PART 15 C(3M)
Env. / Ins. : Temp:23.6°C;Humi:56%;Press:101.52kPa
Engineer : JBR
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : TX Mode

| | Freq. (MHz) | ANT Factor (dB/m) | Cable Loss (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 173.56 | 9.68 | 1.10 | 14.31 | 25.09 | 43.50 | 18.41 | QP |
| 2 | 250.19 | 12.60 | 1.44 | 10.27 | 24.31 | 46.00 | 21.69 | QP |
| 3 | 274.44 | 12.98 | 1.54 | 13.12 | 27.64 | 46.00 | 18.36 | QP |
| 4 | 334.58 | 14.55 | 1.75 | 10.14 | 26.44 | 46.00 | 19.56 | QP |
| 5 | 388.90 | 16.06 | 1.83 | 6.59 | 24.48 | 46.00 | 21.52 | QP |
| 6 | 463.59 | 17.77 | 2.24 | 8.81 | 28.82 | 46.00 | 17.18 | QP |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note:

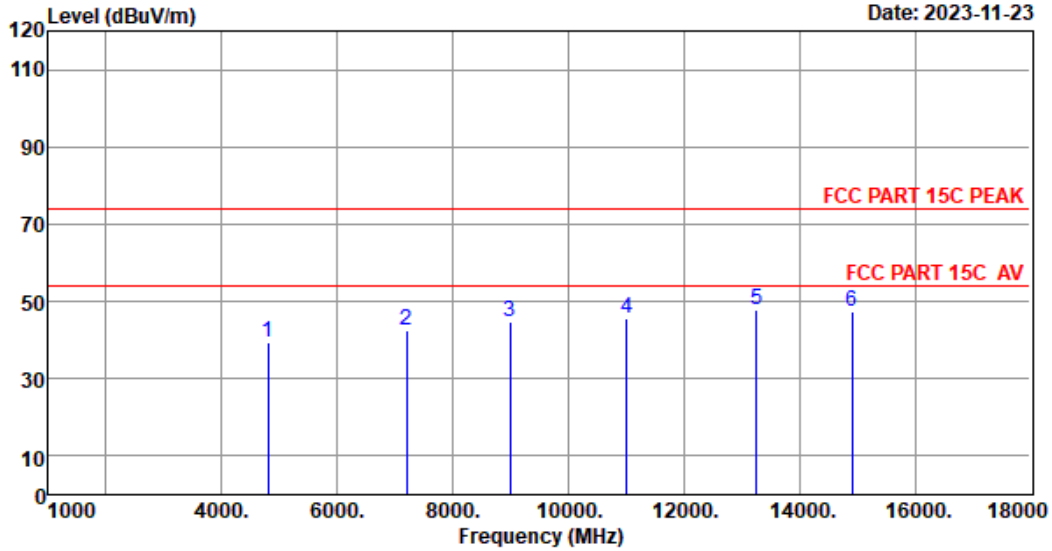
1. The amplitude of 9KHz to 30MHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
2. All test mode had been pre-test,only the worst case was reported.

# Radiated Emissions Above 1G

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 45 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 45
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : GFSK TX 2402MHz

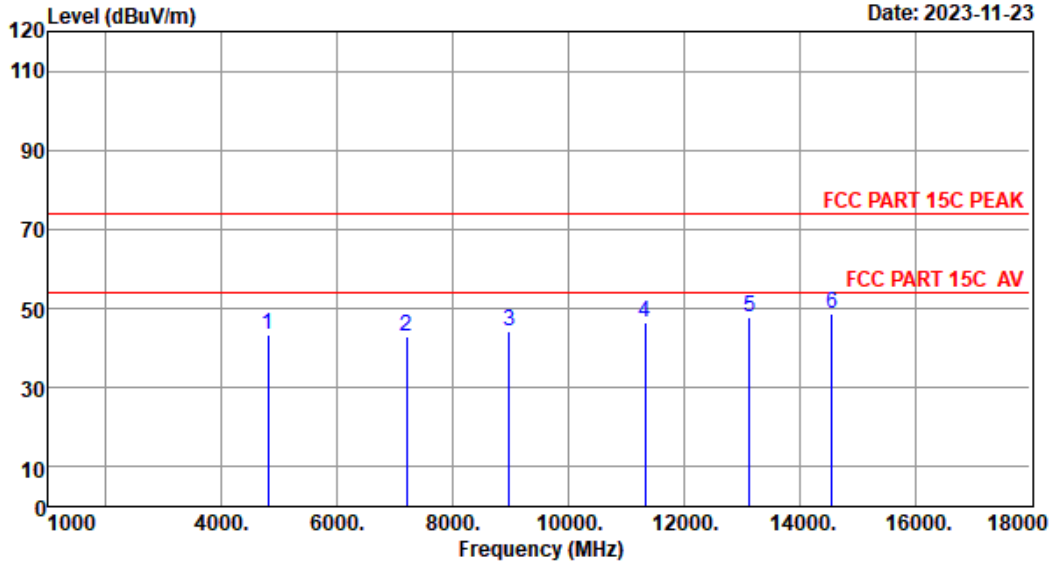
| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4804.00 | 32.39 | 5.20 | 44.49 | 46.50 | 39.60 | 74.00 | 34.40 | Peak |
| 2 | 7206.00 | 36.16 | 6.67 | 44.08 | 43.59 | 42.34 | 74.00 | 31.66 | Peak |
| 3 | 8990.00 | 37.99 | 7.77 | 43.41 | 42.48 | 44.83 | 74.00 | 29.17 | Peak |
| 4 | 11013.00 | 38.90 | 8.27 | 42.99 | 41.48 | 45.66 | 74.00 | 28.34 | Peak |
| 5 | 13257.00 | 39.78 | 9.39 | 40.80 | 39.50 | 47.87 | 74.00 | 26.13 | Peak |
| 6 | 14906.00 | 39.55 | 10.20 | 43.05 | 40.76 | 47.46 | 74.00 | 26.54 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 46 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 46
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : GFSK TX 2402MHz

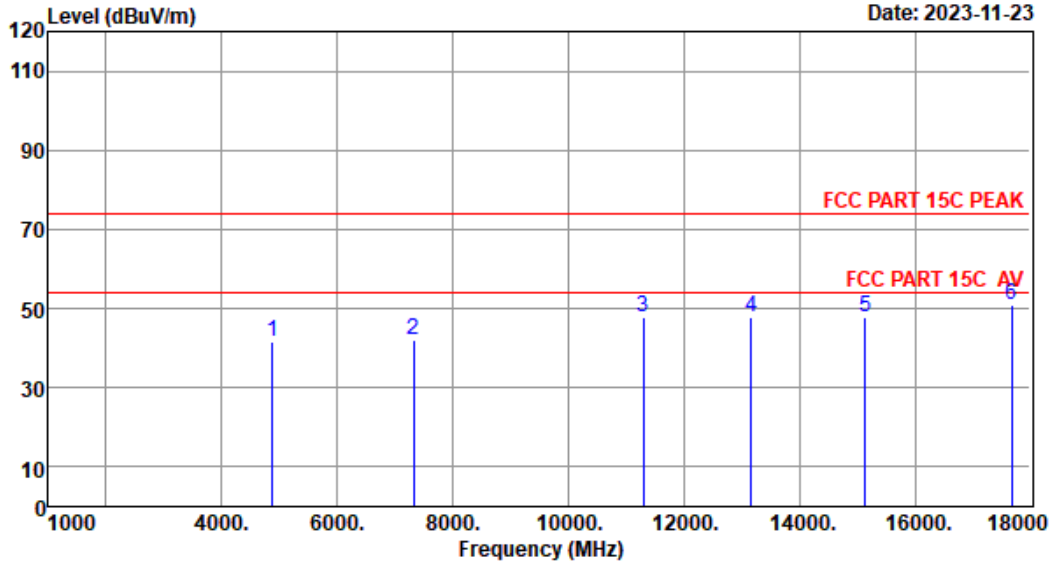
| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4804.00 | 32.39 | 5.20 | 44.49 | 50.11 | 43.21 | 74.00 | 30.79 | Peak |
| 2 | 7206.00 | 36.16 | 6.67 | 44.08 | 44.15 | 42.90 | 74.00 | 31.10 | Peak |
| 3 | 8973.00 | 37.97 | 7.75 | 43.42 | 41.78 | 44.08 | 74.00 | 29.92 | Peak |
| 4 | 11336.00 | 38.87 | 8.45 | 42.73 | 41.75 | 46.34 | 74.00 | 27.66 | Peak |
| 5 | 13138.00 | 39.74 | 9.33 | 40.80 | 39.46 | 47.73 | 74.00 | 26.27 | Peak |
| 6 | 14566.00 | 39.72 | 10.04 | 42.20 | 41.05 | 48.61 | 74.00 | 25.39 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 47 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 47
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : GFSK TX 2441MHz

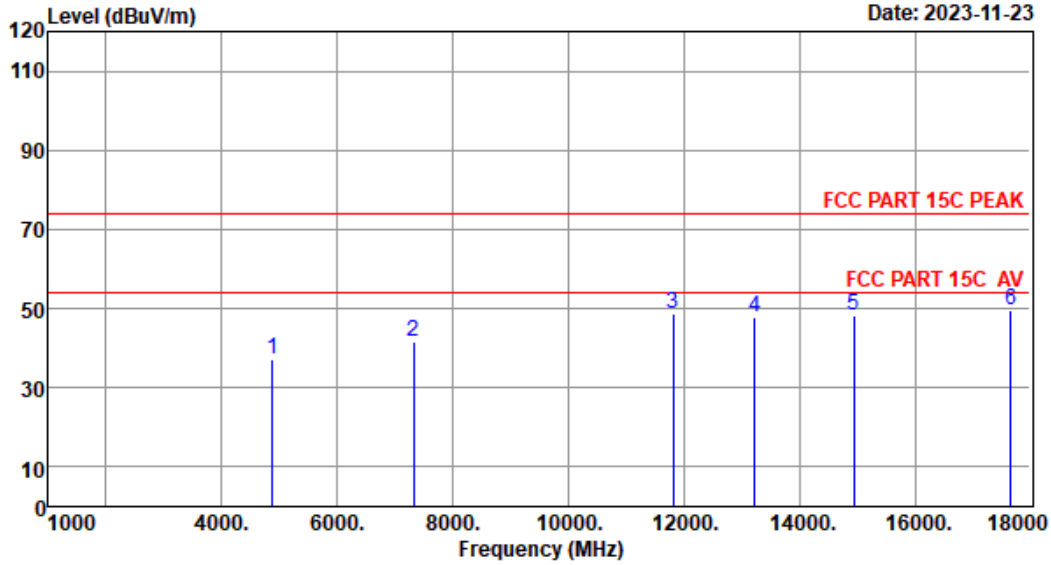
| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4882.00 | 32.55 | 5.28 | 44.42 | 48.26 | 41.67 | 74.00 | 32.33 | Peak |
| 2 | 7323.00 | 36.26 | 6.70 | 44.07 | 43.14 | 42.03 | 74.00 | 31.97 | Peak |
| 3 | 11302.00 | 38.87 | 8.43 | 42.76 | 43.09 | 47.63 | 74.00 | 26.37 | Peak |
| 4 | 13172.00 | 39.75 | 9.35 | 40.80 | 39.49 | 47.79 | 74.00 | 26.21 | Peak |
| 5 | 15144.00 | 39.26 | 10.30 | 43.41 | 41.85 | 48.00 | 74.00 | 26.00 | Peak |
| 6 | 17677.00 | 40.53 | 12.17 | 43.18 | 41.36 | 50.88 | 74.00 | 23.12 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 48 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 48
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : GFSK TX 2441MHz

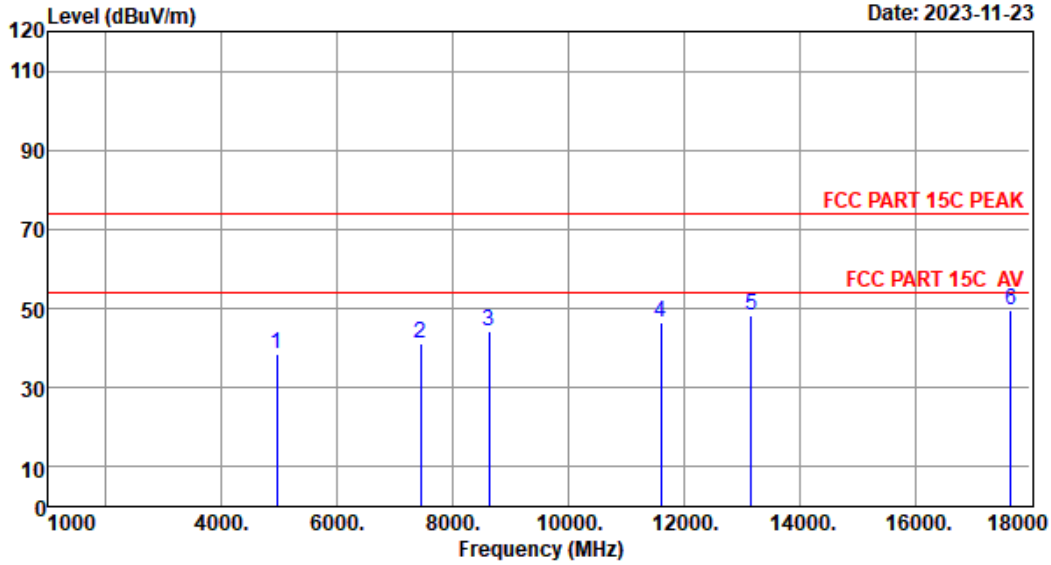
| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4882.00 | 32.55 | 5.28 | 44.42 | 43.65 | 37.06 | 74.00 | 36.94 | Peak |
| 2 | 7323.00 | 36.26 | 6.70 | 44.07 | 42.59 | 41.48 | 74.00 | 32.52 | Peak |
| 3 | 11812.00 | 38.82 | 8.72 | 42.35 | 43.59 | 48.78 | 74.00 | 25.22 | Peak |
| 4 | 13223.00 | 39.77 | 9.37 | 40.80 | 39.53 | 47.87 | 74.00 | 26.13 | Peak |
| 5 | 14940.00 | 39.53 | 10.22 | 43.13 | 41.84 | 48.46 | 74.00 | 25.54 | Peak |
| 6 | 17660.00 | 40.48 | 12.15 | 43.21 | 40.27 | 49.69 | 74.00 | 24.31 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 49 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 49
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : GFSK TX 2480MHz

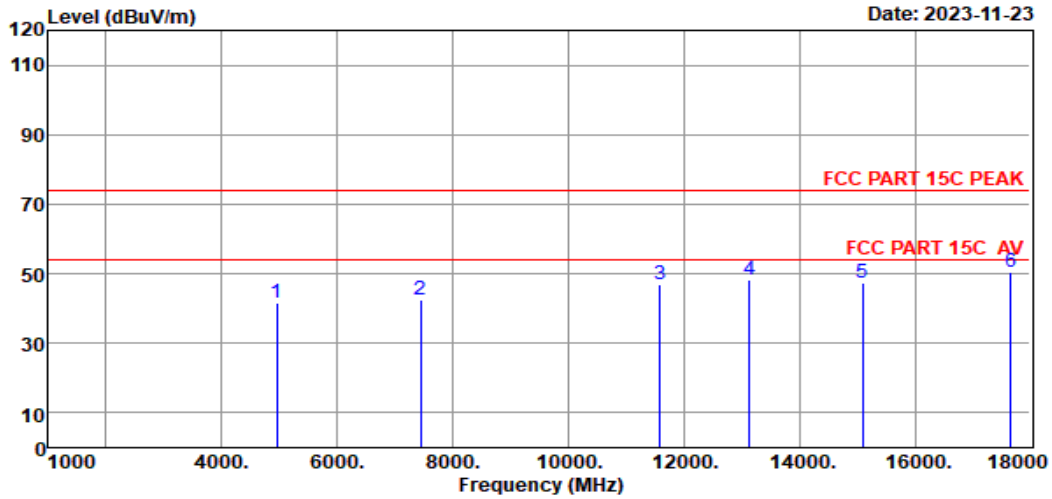
| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4960.00 | 32.72 | 5.37 | 44.33 | 44.59 | 38.35 | 74.00 | 35.65 | Peak |
| 2 | 7440.00 | 36.35 | 6.74 | 44.06 | 41.96 | 40.99 | 74.00 | 33.01 | Peak |
| 3 | 8633.00 | 37.56 | 7.46 | 43.62 | 42.94 | 44.34 | 74.00 | 29.66 | Peak |
| 4 | 11608.00 | 38.84 | 8.61 | 42.51 | 41.45 | 46.39 | 74.00 | 27.61 | Peak |
| 5 | 13172.00 | 39.75 | 9.35 | 40.80 | 39.80 | 48.10 | 74.00 | 25.90 | Peak |
| 6 | 17660.00 | 40.48 | 12.15 | 43.21 | 40.20 | 49.62 | 74.00 | 24.38 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 50 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 50
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : GFSK TX 2480MHz

| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4960.00 | 32.72 | 5.37 | 44.33 | 48.01 | 41.77 | 74.00 | 32.23 | Peak |
| 2 | 7440.00 | 36.35 | 6.74 | 44.06 | 43.29 | 42.32 | 74.00 | 31.68 | Peak |
| 3 | 11591.00 | 38.84 | 8.60 | 42.53 | 42.18 | 47.09 | 74.00 | 26.91 | Peak |
| 4 | 13138.00 | 39.74 | 9.33 | 40.80 | 40.04 | 48.31 | 74.00 | 25.69 | Peak |
| 5 | 15093.00 | 39.34 | 10.28 | 43.37 | 41.03 | 47.28 | 74.00 | 26.72 | Peak |
| 6 | 17660.00 | 40.48 | 12.15 | 43.21 | 41.11 | 50.53 | 74.00 | 23.47 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note:

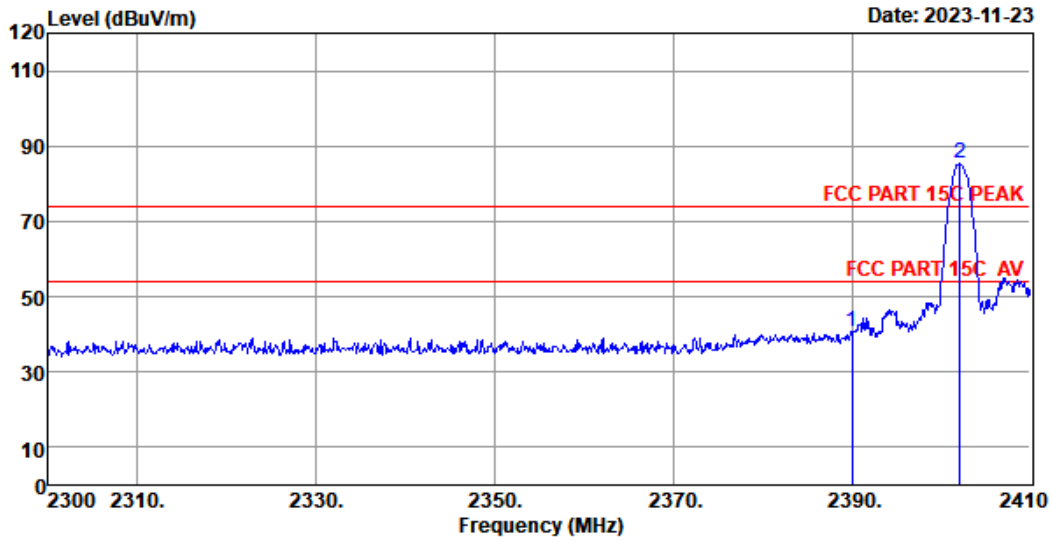
1. The amplitude of 18GHz to 25GHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
2. All test mode had been pre-test,only Low/Middle/High Channel of the worst case modulation mode was reported.

# Radiated Band Edge

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 7 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 7
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 230V/50Hz
M/N : SA501
Test Mode : GFSK TX 2402MHz

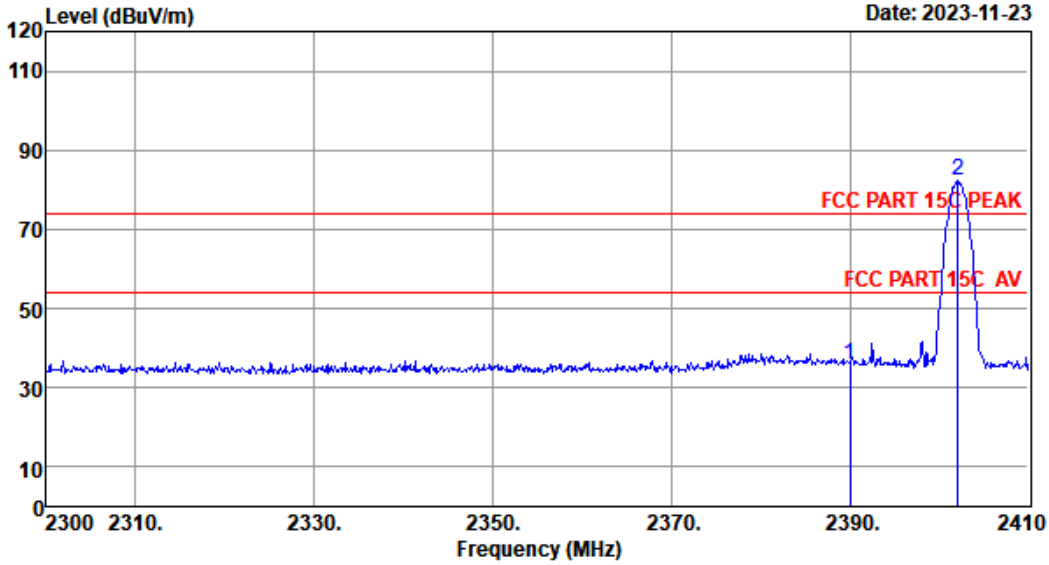
| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | 27.43 | 3.55 | 45.01 | 54.93 | 40.90 | 74.00 | 33.10 | Peak |
| 2 | 2402.08 | 27.47 | 3.55 | 45.01 | 99.32 | 85.33 | 74.00 | -11.33 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 8 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 8
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 230V/50Hz
M/N : SA501
Test Mode : GFSK TX 2402MHz

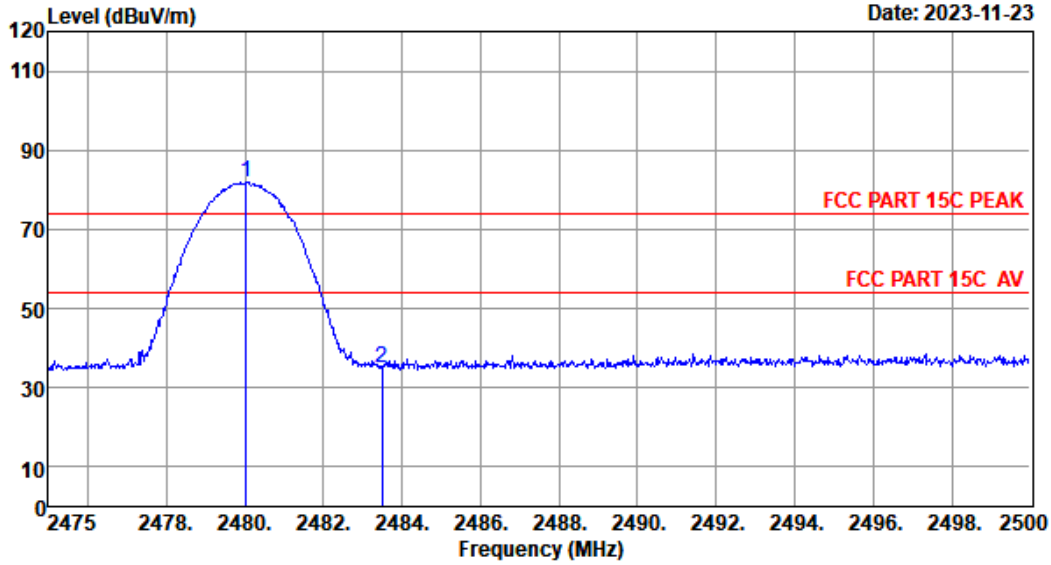
| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.00 | 27.43 | 3.55 | 45.01 | 49.70 | 35.67 | 74.00 | 38.33 | Peak |
| 2 | 2402.08 | 27.47 | 3.55 | 45.01 | 96.35 | 82.36 | 74.00 | -8.36 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 9 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 9
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 230V/50Hz
M/N : SA501
Test Mode : GFSK TX 2480MHz

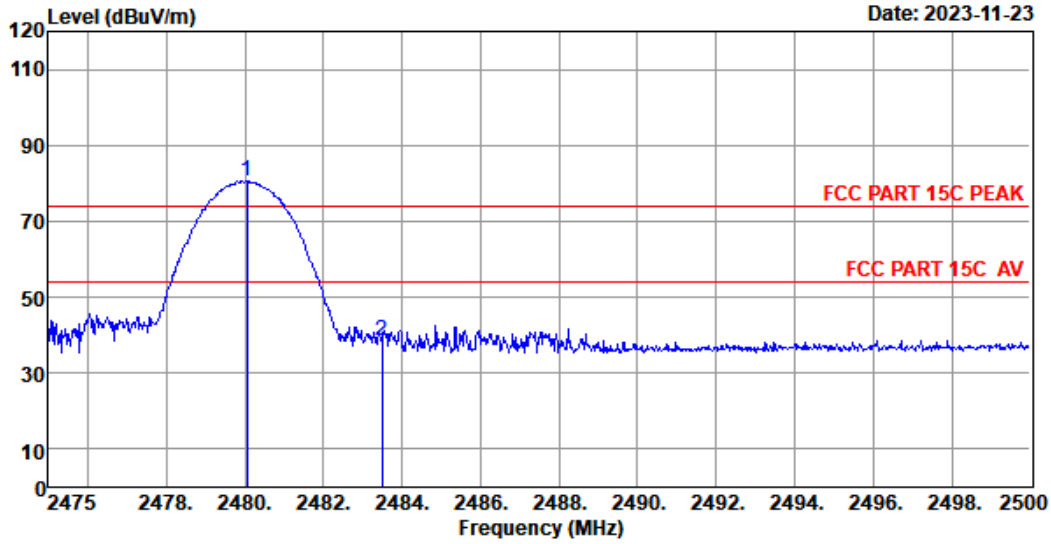
| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2480.03 | 27.69 | 3.62 | 44.93 | 95.58 | 81.96 | 74.00 | -7.96 | Peak |
| 2 | 2483.50 | 27.70 | 3.62 | 44.93 | 48.72 | 35.11 | 74.00 | 38.89 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 10 File: \\EMC-966-1\test data\2023\RF\Q\Qu Yin\SA501.EM6 (84)




Site no. : 1# 966 Chamber Data no. : 10
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:21.5°C;Humi:50%;Press:101.52kPa
Engineer : QQZ
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 230V/50Hz
M/N : SA501
Test Mode : GFSK TX 2480MHz

| | Freq. (MHz) | Ant. Factor (dB/m) | Cable Loss (dB) | Amp Factor (dB) | Reading (dBuV) | Emission Level (dBuV/m) | Limits (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2480.05 | 27.69 | 3.62 | 44.93 | 94.19 | 80.57 | 74.00 | -6.57 | Peak |
| 2 | 2483.50 | 27.70 | 3.62 | 44.93 | 51.92 | 38.31 | 74.00 | 35.69 | Peak |

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note: All test mode had been pre-test,only Low/High Channel of the worst case modulation mode was reported.

# 11. AC POWER LINE CONDUCTED EMISSIONS

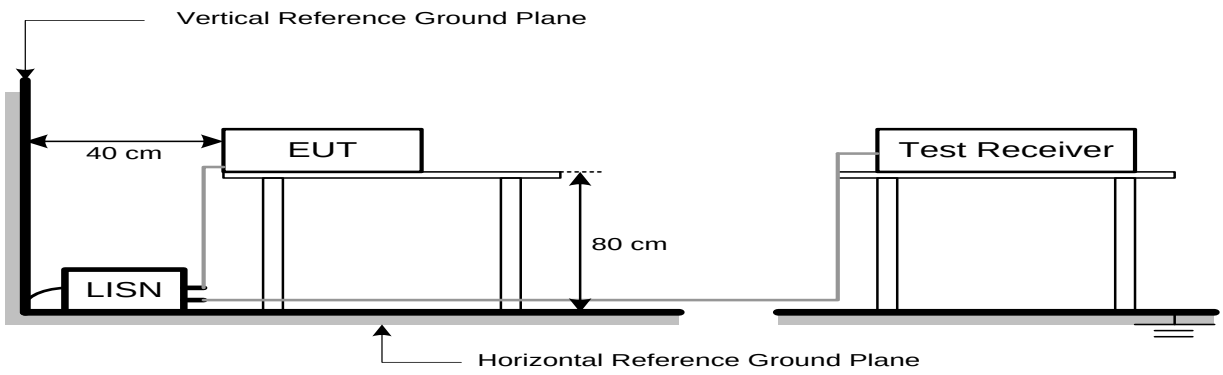
## 11.1. Limit

| Frequency | | | Maximum RF Line Voltage | |
|---|---|---|---|---|
| | | | Quasi-Peak Level dB(μV) | Average Level dB(μV) |
| 150kHz | ~ | 500kHz | 66 ~ 56* | 56 ~ 46* |
| 500kHz | ~ | 5MHz | 56 | 46 |
| 5MHz | ~ | 30MHz | 60 | 50 |

Note:

1. * Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

## 11.2. Test Setup




## 11.3. Spectrum Analyzer Setting

| Spectrum Parameters | Setting |
|---|---|
| RBW | 9KHz |
| VBW | 9KHz |
| Start frequency | 150KHz |
| Stop frequency | 30MHz |
| Sweep Time | Auto |
| Detector | QP/AVG |
| Trace Mode | Max Hold |

## 11.4. Test Procedure

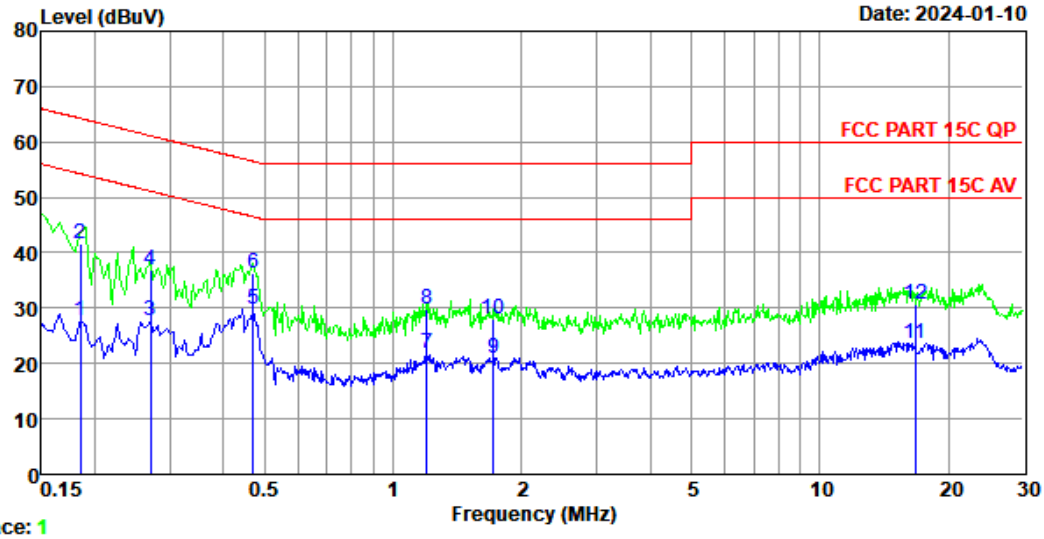
a. The EUT was placed on a non-metallic table, 80cm above the ground plane.
b. The EUT Power connected to the power mains through a line impedance stabilization network.
c. Provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs).
d. Set the EUT transmit continuously with maximum output power.
e. Spectrum analyzer setting parameters in accordance with section 11.3.
f. The AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10: 2013 on Conducted Emission Test.
g. Record the results in the test report.

## 11.5. Test Result

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 2 File: \\Emc-cE1\Test data\2024\RF\Q\QU YIN\SA501.EM6 (12)




Trace: 1

Site no : 1#CE Shield Room Data no. : 2
Env. / Ins. : Temp:21.8°C;Humi:50.8%;Press:101.50kPa LINE Phase : NEUTRAL
Limit : FCC PART 15C QP
Engineer : HXW
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : TX Mode

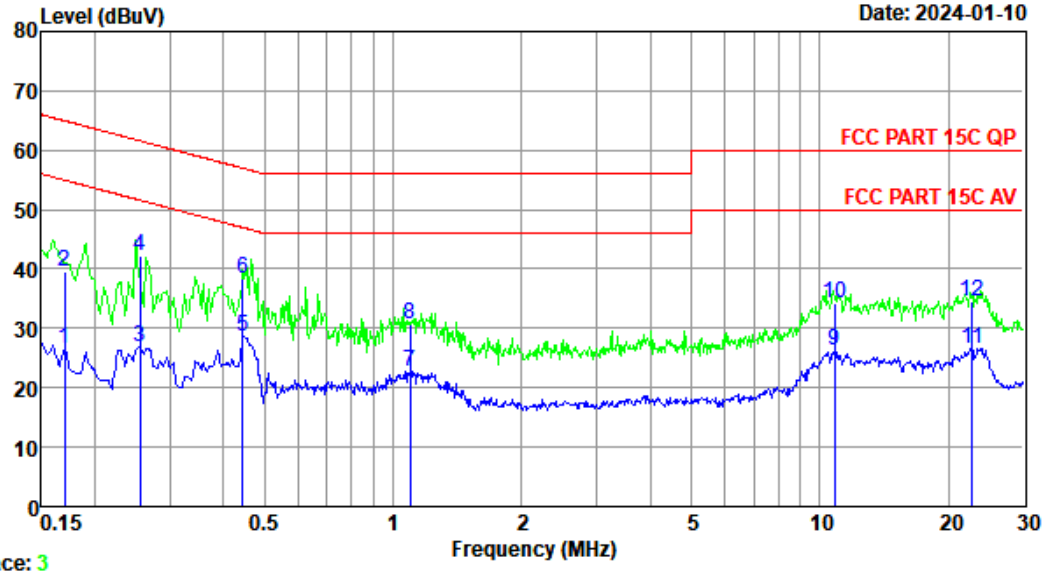
| | Freq. (MHz) | LISN Factor (db) | Cable Loss (db) | Reading dBuV) | Emission Level (dBuv) | Limits (dBuv) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.185 | 10.37 | 9.77 | 7.64 | 27.78 | 54.24 | 26.46 | Average |
| 2 | 0.185 | 10.37 | 9.77 | 21.54 | 41.68 | 64.24 | 22.56 | QP |
| 3 | 0.270 | 10.21 | 9.92 | 7.54 | 27.67 | 51.12 | 23.45 | Average |
| 4 | 0.270 | 10.21 | 9.92 | 16.69 | 36.82 | 61.12 | 24.30 | QP |
| 5 | 0.471 | 9.90 | 9.92 | 9.98 | 29.80 | 46.49 | 16.69 | Average |
| 6 | 0.471 | 9.90 | 9.92 | 16.62 | 36.44 | 56.49 | 20.05 | QP |
| 7 | 1.197 | 9.71 | 9.94 | 2.25 | 21.90 | 46.00 | 24.10 | Average |
| 8 | 1.197 | 9.71 | 9.94 | 10.14 | 29.79 | 56.00 | 26.21 | QP |
| 9 | 1.716 | 9.75 | 9.95 | 1.27 | 20.97 | 46.00 | 25.03 | Average |
| 10 | 1.716 | 9.75 | 9.95 | 8.47 | 28.17 | 56.00 | 27.83 | QP |
| 11 | 16.750 | 9.86 | 10.13 | 3.68 | 23.67 | 50.00 | 26.33 | Average |
| 12 | 16.750 | 9.86 | 10.13 | 10.65 | 30.64 | 60.00 | 29.36 | QP |

Remarks: 1. Emission Level= LISN Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. If the average limit is met when useing a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

EST Technology

Chilingxiang, Qishantou, Santun,
Houjie, Dongguan,Guangdong,China
Tel:+86-769-83081888
Fax:+86-769-83081878

Data: 4 File: \\Emc-cE1\Test data\2024\RF\Q\QU YIN\SA501.EM6 (12)




Site no : 1#CE Shield Room Data no. : 4
Env. / Ins. : Temp:21.8°C;Humi:50.8%;Press:101.50kPa LINE Phase : LINE
Limit : FCC PART 15C QP
Engineer : HXW
EUT : Smart Cutting Maching
Power : DC 18V From Adapter Input AC 120V/60Hz
M/N : SA501
Test Mode : TX Mode

| | Freq. (MHz) | LISN Factor (db) | Cable Loss (db) | Reading dBuV) | Emission Level (dBuv) | Limits (dBuv) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.170 | 9.98 | 9.69 | 6.96 | 26.63 | 54.94 | 28.31 | Average |
| 2 | 0.170 | 9.98 | 9.69 | 19.85 | 39.52 | 64.94 | 25.42 | QP |
| 3 | 0.255 | 9.94 | 9.92 | 6.99 | 26.85 | 51.60 | 24.75 | Average |
| 4 | 0.255 | 9.94 | 9.92 | 22.47 | 42.33 | 61.60 | 19.27 | QP |
| 5 | 0.444 | 9.75 | 9.92 | 9.09 | 28.76 | 46.98 | 18.22 | Average |
| 6 | 0.444 | 9.75 | 9.92 | 18.61 | 38.28 | 56.98 | 18.70 | QP |
| 7 | 1.094 | 9.77 | 9.94 | 3.04 | 22.75 | 46.00 | 23.25 | Average |
| 8 | 1.094 | 9.77 | 9.94 | 11.01 | 30.72 | 56.00 | 25.28 | QP |
| 9 | 10.847 | 9.95 | 10.07 | 6.14 | 26.16 | 50.00 | 23.84 | Average |
| 10 | 10.847 | 9.95 | 10.07 | 14.30 | 34.32 | 60.00 | 25.68 | QP |
| 11 | 22.775 | 9.75 | 10.16 | 6.80 | 26.71 | 50.00 | 23.29 | Average |
| 12 | 22.775 | 9.75 | 10.16 | 14.57 | 34.48 | 60.00 | 25.52 | QP |

Remarks: 1. Emission Level= LISN Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. If the average limit is met when useing a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

# 12. ANTENNA REQUIREMENTS

## 12.1. Limit

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, 15.221, or §15.236. 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.

## 12.2. Test Result

The antennas used for this product is PCB antenna, so compliance with antenna requirements. ( Please refer to the EUT photo for details)

# 13.APPENDIX

## Appendix A: 20dB Emission Bandwidth

Test Result

| TestMode | Antenna | Frequency[MHz] | 20db EBW[MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|---|---|
| DH5 | Ant1 | 2402 | 0.963 | 2401.547 | 2402.510 | --- | --- |
| DH5 | Ant1 | 2441 | 1.017 | 2440.499 | 2441.516 | --- | --- |
| DH5 | Ant1 | 2480 | 1.017 | 2479.493 | 2480.510 | --- | --- |
| 2DH5 | Ant1 | 2402 | 1.272 | 2401.373 | 2402.645 | --- | --- |
| 2DH5 | Ant1 | 2441 | 1.263 | 2440.397 | 2441.660 | --- | --- |
| 2DH5 | Ant1 | 2480 | 1.320 | 2479.346 | 2480.666 | --- | --- |

# Test Graphs

## DH5-Ant1-2402

## DH5-Ant1-2441

## DH5-Ant1-2480

## 2DH5-Ant1-2402

## 2DH5-Ant1-2441

## 2DH5-Ant1-2480

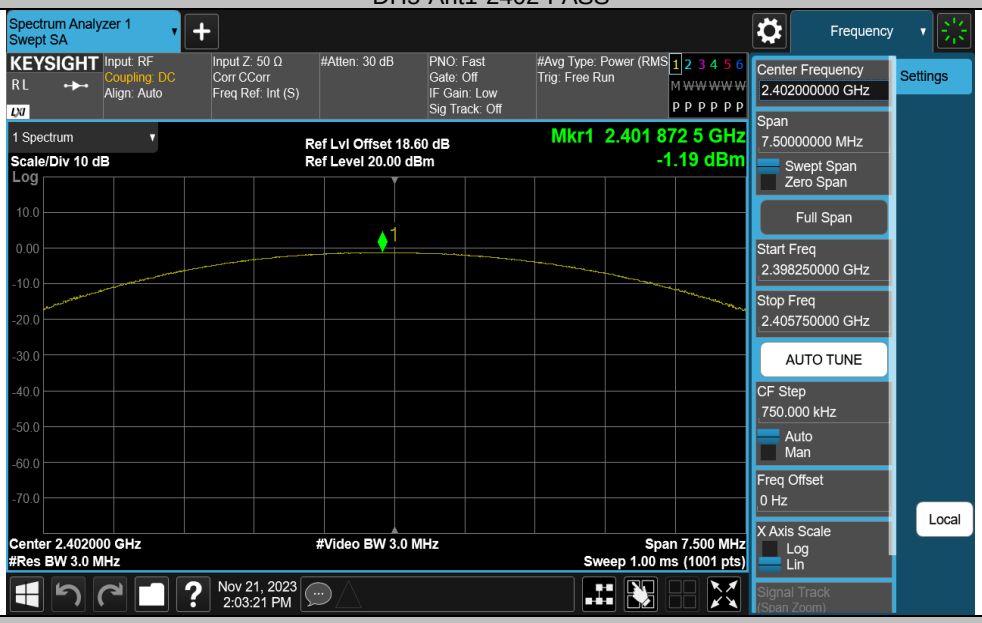
## Appendix B: Maximum conducted output power

Test Result Peak

| Test Mode | Antenna | Frequency[MHz] | Conducted Peak Powert[dBm] | Conducted Limit[dBm] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | 2402 | -1.19 | ≤20.97 | PASS |
| DH5 | Ant1 | 2441 | -1.10 | ≤20.97 | PASS |
| DH5 | Ant1 | 2480 | -0.19 | ≤20.97 | PASS |
| 2DH5 | Ant1 | 2402 | -0.52 | ≤20.97 | PASS |
| 2DH5 | Ant1 | 2441 | -0.47 | ≤20.97 | PASS |
| 2DH5 | Ant1 | 2480 | 0.45 | ≤20.97 | PASS |

# Test Graphs

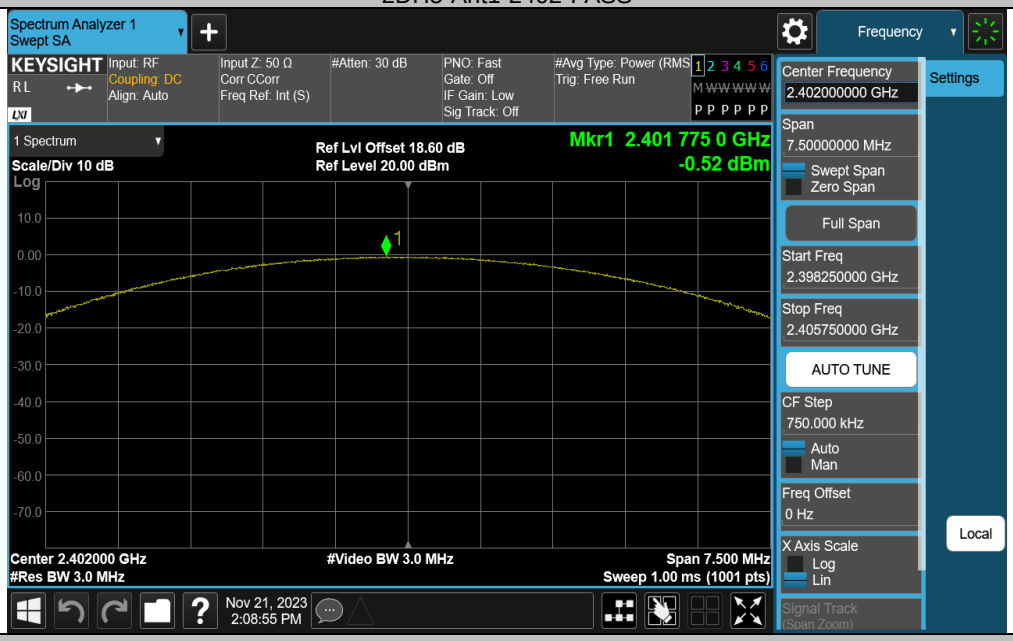
DH5-Ant1-2402-PASS




DH5-Ant1-2441-PASS

DH5-Ant1-2480-PASS

2DH5-Ant1-2402-PASS




2DH5-Ant1-2441-PASS

2DH5-Ant1-2480-PASS

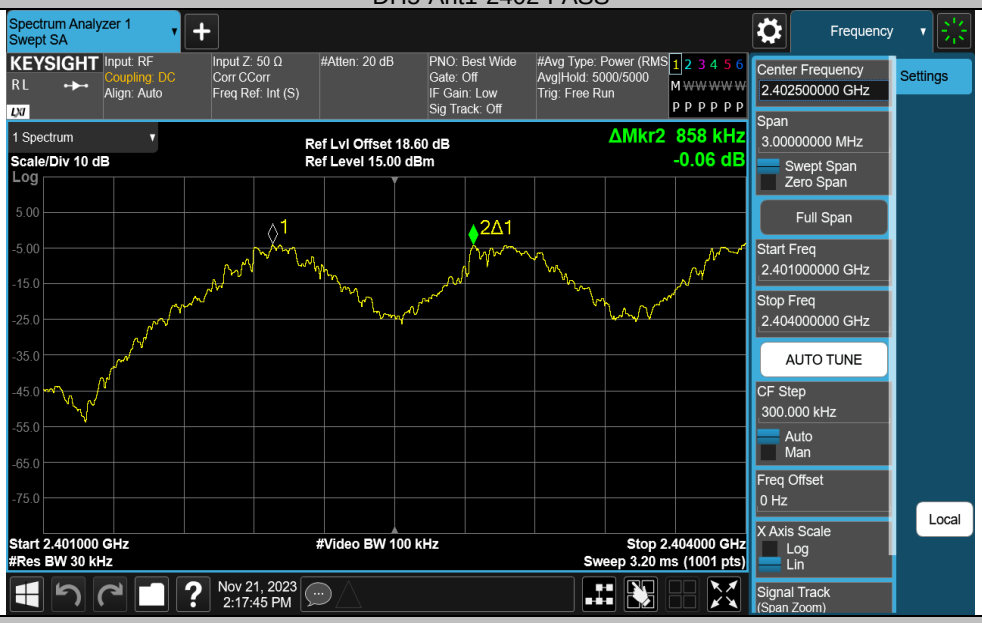
# Appendix C: Carrier frequency separation

## Test Result

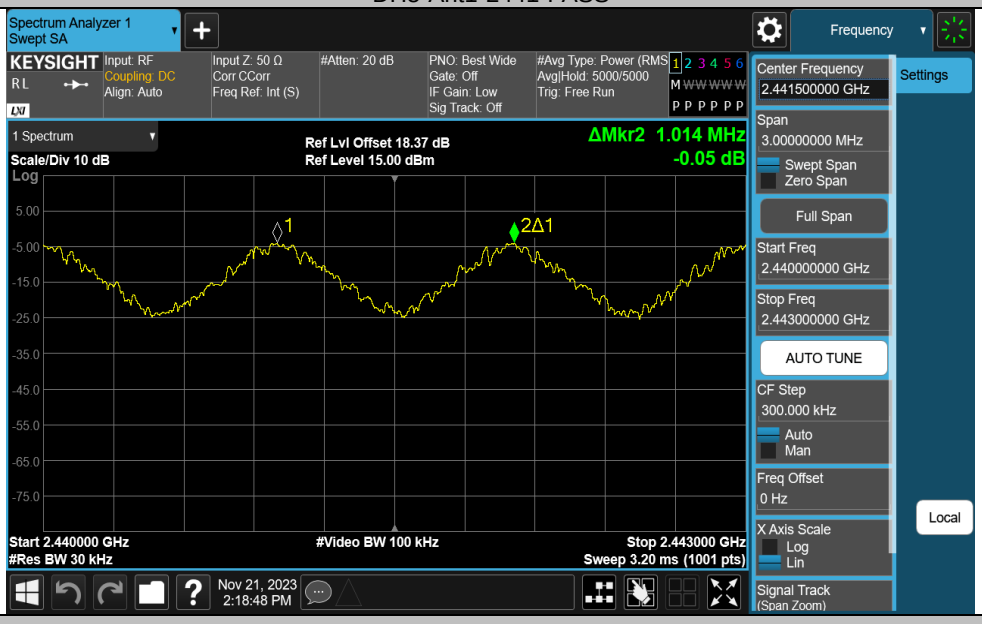
| TestMode | Antenna | Frequency[MHz] | Result[MHz] | Limit[MHz] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | 2402 | 0.858 | ≥0.678 | PASS |
| DH5 | Ant1 | 2441 | 1.014 | ≥0.678 | PASS |
| DH5 | Ant1 | 2480 | 0.972 | ≥0.678 | PASS |
| 2DH5 | Ant1 | 2402 | 1.041 | ≥0.880 | PASS |
| 2DH5 | Ant1 | 2441 | 1.161 | ≥0.880 | PASS |
| 2DH5 | Ant1 | 2480 | 1.011 | ≥0.880 | PASS |

# Test Graphs

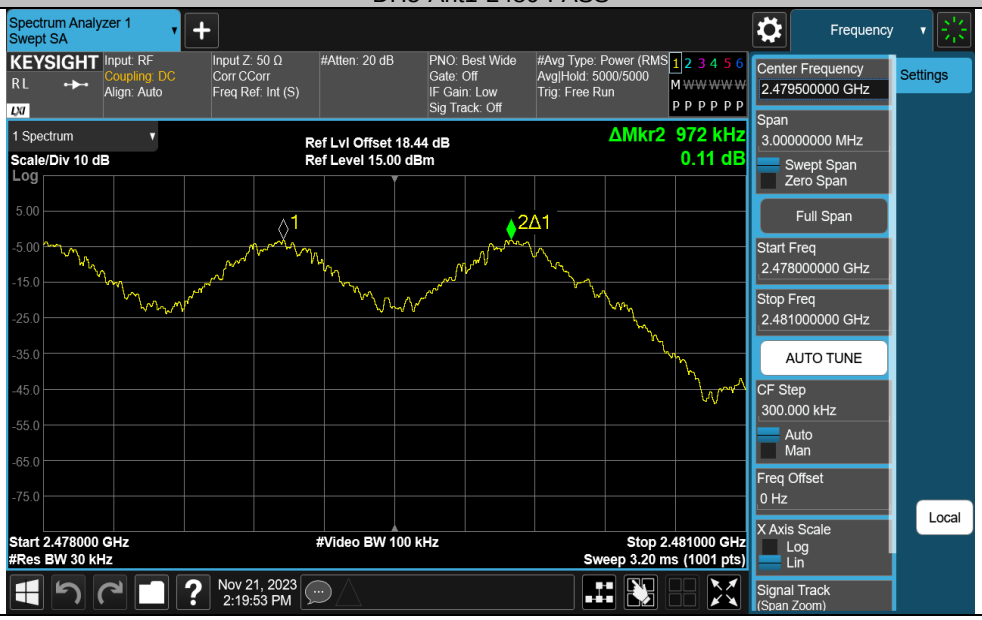
## DH5-Ant1-2402-PASS



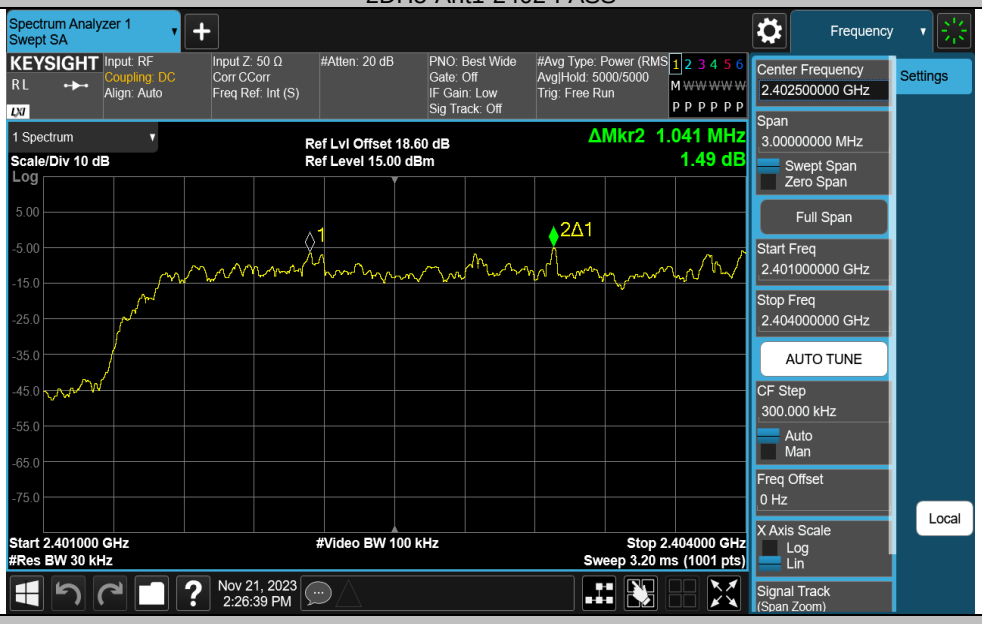

## DH5-Ant1-2441-PASS



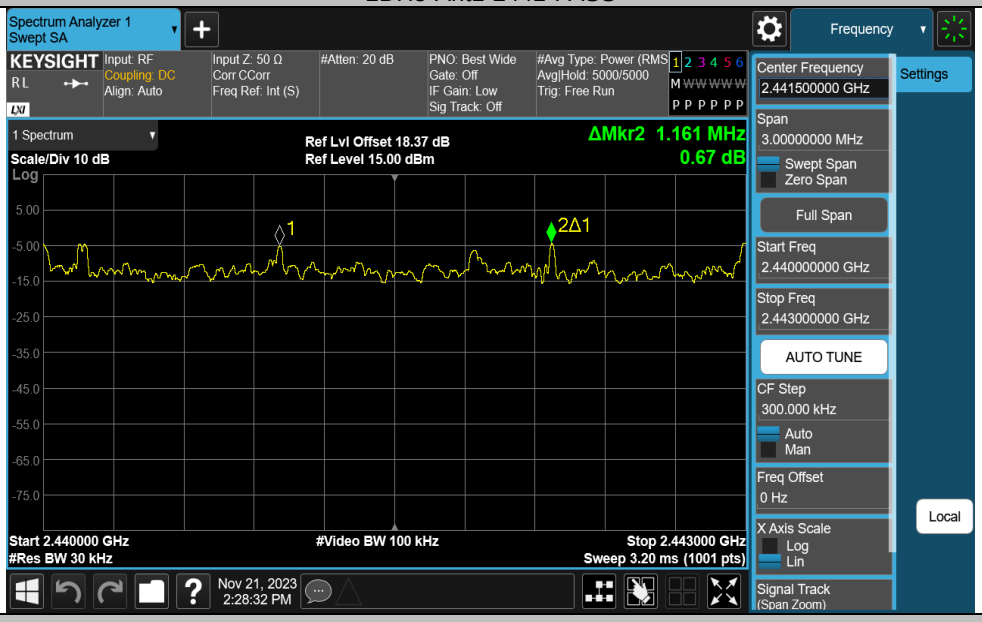

## DH5-Ant1-2480-PASS



2DH5-Ant1-2402-PASS




2DH5-Ant1-2441-PASS




2DH5-Ant1-2480-PASS

# Appendix D: Time of occupancy

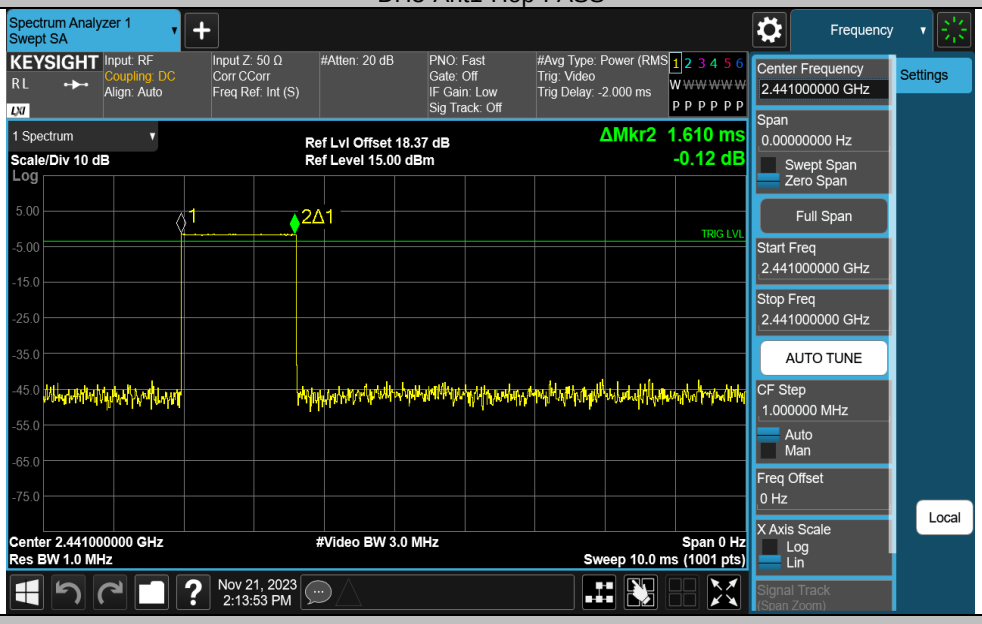
## Test Result

| TestMode | Antenna | Frequency[MHz] | BurstWidth [ms] | TotalHops [Num] | Result[s] | Limit[s] | Verdict |
|---|---|---|---|---|---|---|---|
| DH1 | Ant1 | Hop | 0.372 | 320 | 0.119 | ≤0.4 | PASS |
| DH3 | Ant1 | Hop | 1.610 | 160 | 0.258 | ≤0.4 | PASS |
| DH5 | Ant1 | Hop | 2.870 | 106.67 | 0.306 | ≤0.4 | PASS |
| 2DH1 | Ant1 | Hop | 0.383 | 320 | 0.123 | ≤0.4 | PASS |
| 2DH3 | Ant1 | Hop | 1.620 | 160 | 0.259 | ≤0.4 | PASS |
| 2DH5 | Ant1 | Hop | 2.860 | 106.67 | 0.305 | ≤0.4 | PASS |

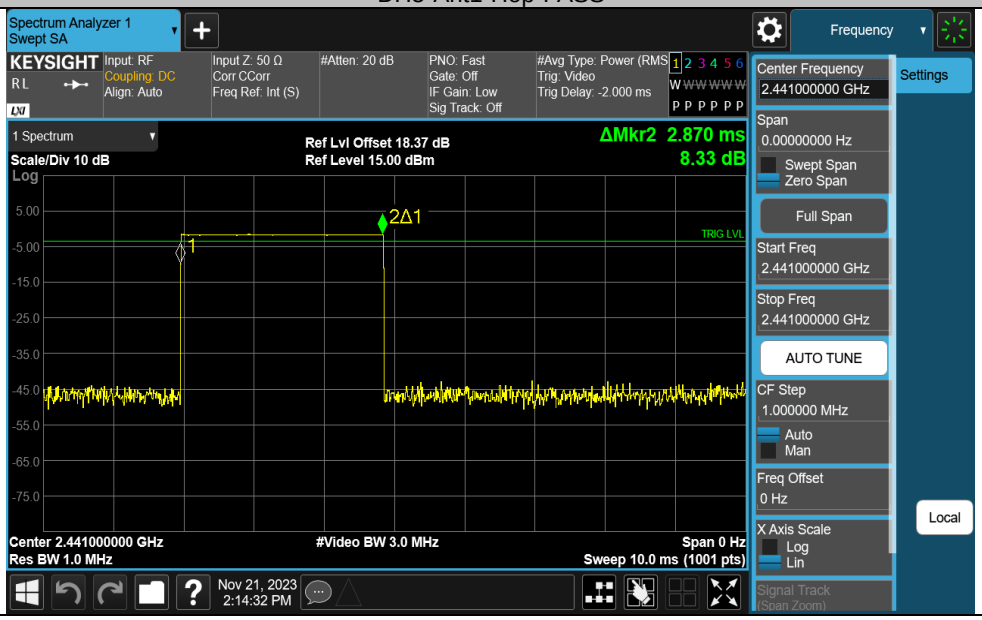
# Test Graphs

## DH1-Ant1-Hop-PASS

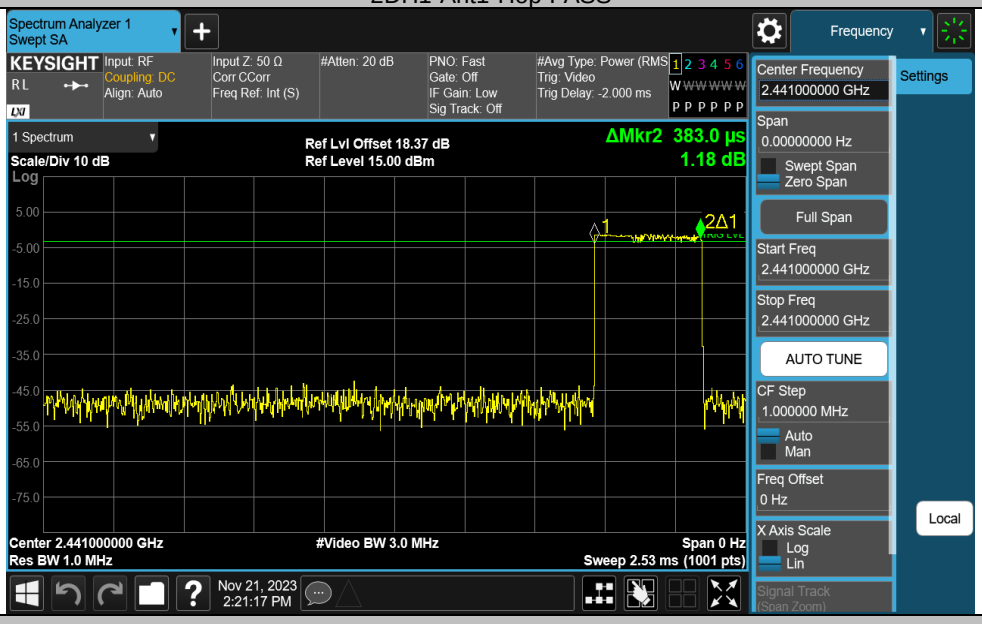
## DH3-Ant1-Hop-PASS



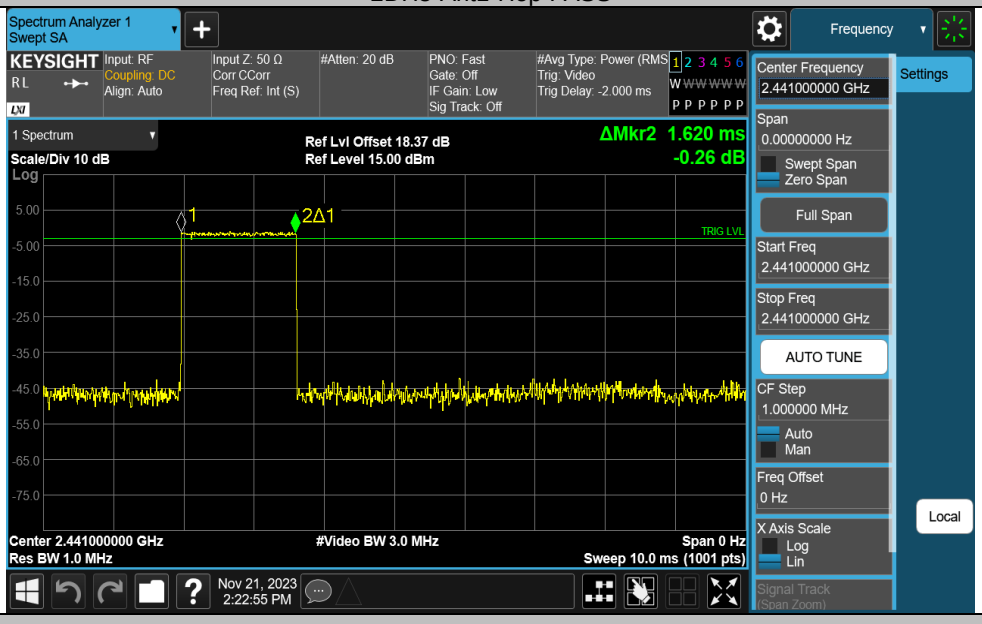

## DH5-Ant1-Hop-PASS



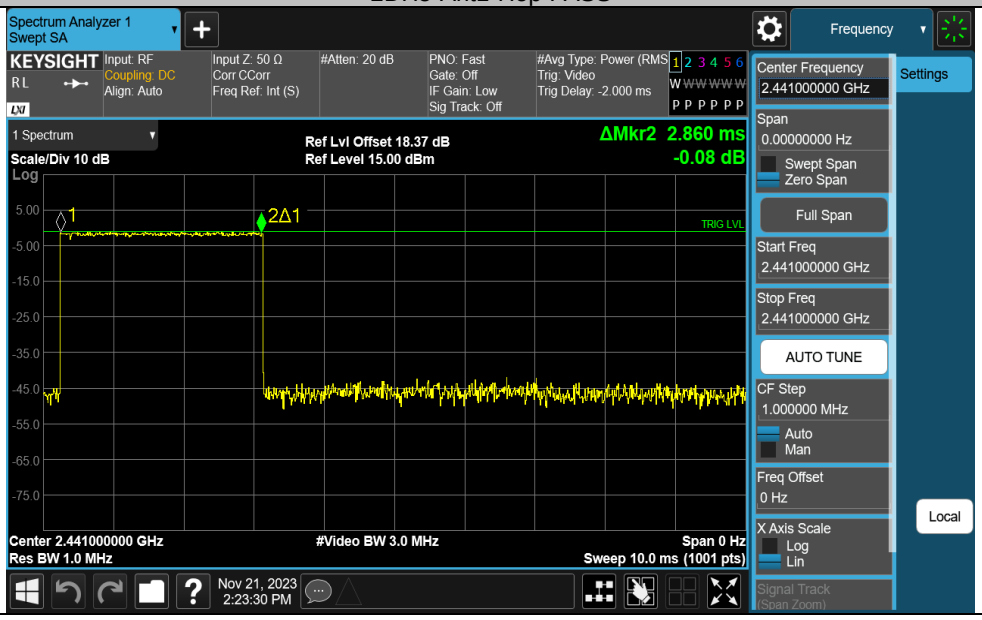
2DH1-Ant1-Hop-PASS




2DH3-Ant1-Hop-PASS




2DH5-Ant1-Hop-PASS



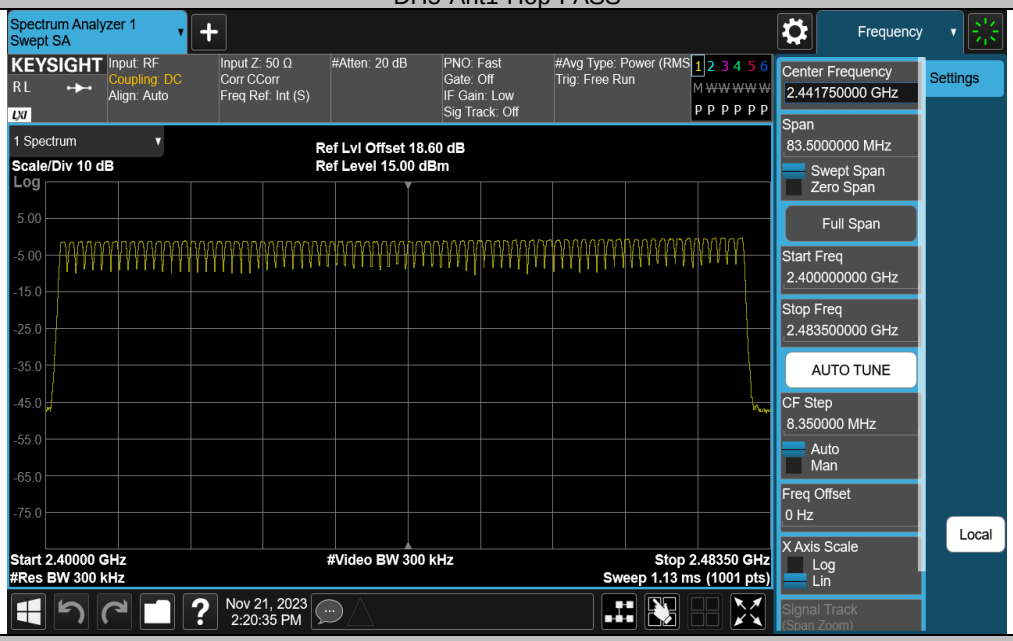
# Appendix E: Number of hopping channels

## Test Result

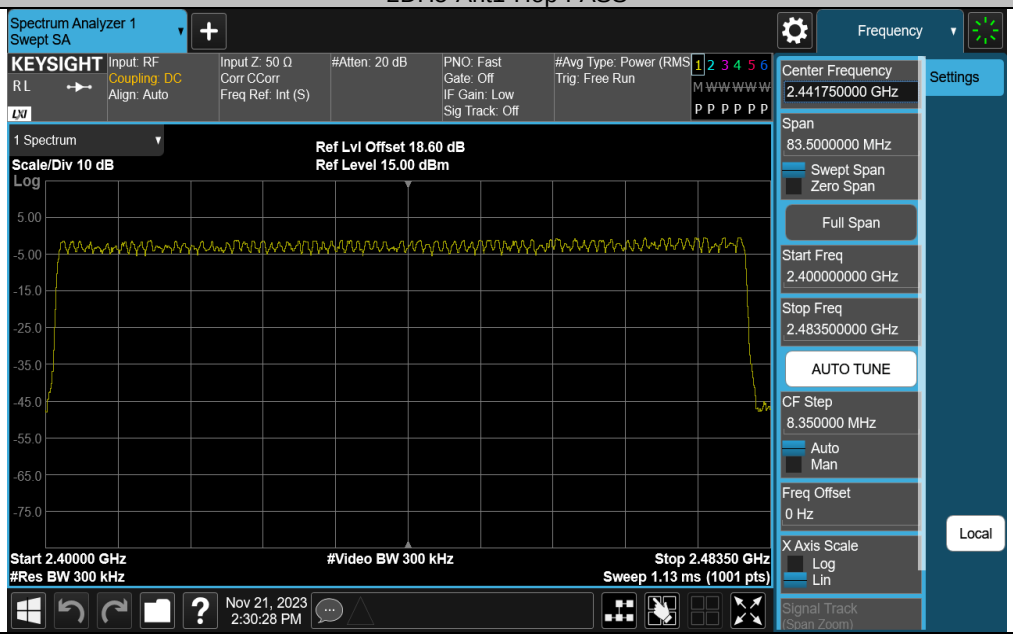
| TestMode | Antenna | Frequency[MHz] | Result[Num] | Limit[Num] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | Hop | 79 | ≥15 | PASS |
| 2DH5 | Ant1 | Hop | 79 | ≥15 | PASS |

# Test Graphs

DH5-Ant1-Hop-PASS




2DH5-Ant1-Hop-PASS



# Appendix F: Band edge measurements

## Test Result

| TestMode | Antenna | ChName | Frequency[MHz] | RefLevel [dBm] | Result [dBm] | Limit [dBm] | Verdict |
|---|---|---|---|---|---|---|---|
| DH5 | Ant1 | High | Hop_2480 | -0.97 | -50.22 | ≤-20.97 | PASS |
| 2DH5 | Ant1 | High | Hop_2480 | -2.15 | -50.4 | ≤-22.15 | PASS |
| DH5 | Ant1 | Low | Hop_2402 | -1.88 | -50.4 | ≤-21.88 | PASS |
| 2DH5 | Ant1 | Low | Hop_2402 | -3.75 | -50.35 | ≤-23.75 | PASS |
| DH5 | Ant1 | High | 2480 | -0.92 | -49.42 | ≤-20.92 | PASS |
| 2DH5 | Ant1 | High | 2480 | -0.94 | -50.04 | ≤-20.94 | PASS |
| DH5 | Ant1 | Low | 2402 | -1.71 | -49.69 | ≤-21.71 | PASS |
| 2DH5 | Ant1 | Low | 2402 | -2.24 | -50.57 | ≤-22.24 | PASS |