

TEST REPORT

Report No.: SHATBL2404001W03

Applicant : Star Systems International Limited

Product Name : Tarvos Pro

Brand Name : SSI

Model Name : HRD31000

FCC ID : 2AA7KTARVOSPRO31000

Test Standard : 47 CFR Part 15.247

Date of Test : Jan. 10,2024~Apr.01,2024

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(Chris Xu)

Report Approved by : Ghost Li.
(Ghost Li)

Authorized Signatory : Terry Yang
(Terry Yang)



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REVISION HISTORY

| Rev. | Issue Date | Revisions | Revised by |
|------|------------|-----------------|------------|
| 00 | 2024.04.01 | Initial Release | Ghost Li |

DECLARATION OF REPORT

1. The device has been tested by ATBL, and the test results show that the equipment under test (EUT) is in compliance with the requirements of 47 CFR 15.247 . And it is applicable only to the tested sample identified in the report.
2. This report shall not be reproduced except in full, without the written approval of ATBL, this document only be altered or revised by ATBL, personal only, and shall be noted in the revision of the document.
3. The general information of EUT in this report is provided by the customer or manufacture, ATBL is only responsible for the test data but not for the information provided by the customer or manufacture.
4. The results in this report is only apply to the sample as tested under conditions. The customer or manufacturer is responsible for ensuring that the additional production units of this model have the same electrical and mechanical components.
5. In this report, '☐' indicates that EUT does not support content after '☐', and '☑' indicates that it supports content after '☑'.

SUMMARY OF TEST RESULT

| Report Section | Standard Section | Test Item | Judgment | Remark |
|----------------|--------------------------------------|--|----------|--------|
| 3.1 | 47 CFR 15.247(b)(1) | Maximum Peak Conducted Output Power | PASS | -- |
| 3.2 | 47 CFR 15.247(a)(1)(iii) | Number of Hopping Frequencies | PASS | -- |
| 3.3 | 47 CFR 15.247(a)(1)(iii) | Dwell Time | PASS | -- |
| 3.4 | 47 CFR 15.247(a)(1) | Bandwidth | PASS | -- |
| 3.5 | 47 CFR 15.247(a)(1) | Carrier Frequency Separation | PASS | -- |
| 3.6 | 47 CFR 15.247(d) | Conducted Band Edge | PASS | -- |
| 3.7 | 47 CFR 15.247(d) | Conducted Spurious Emission | PASS | -- |
| 3.8 | 47 CFR 15.247(d)/15.209(a)/15.205(a) | Radiated Spurious Emission and Restricted Band | PASS | -- |
| 3.9 | 47 CFR 15.207(a) | AC Power-Line Conducted Emission | PASS | -- |
| 3.10 | 47 CFR 15.203 | Antenna Requirements | PASS | -- |

1. GENERAL DESCRIPTION

1.1. Applicant

Name : Star Systems International Limited

Address : Unit 7, 8/F, Vanta Industrial Centre, 21-33 Tai Lin Pai Road, Kwai Chung, NT, Hong Kong

1.2. Manufacturer

Name : Star Systems International Limited

Address : Unit 7, 8/F, Vanta Industrial Centre, 21-33 Tai Lin Pai Road, Kwai Chung, NT, Hong Kong

Factory

Name : SumoSys Inc

Address : Unit 3B-C, Philexcel Business Park Annex, Clark Freeport Zone, Pampanga 2023
Philippines

1.3. General Information of EUT

| General Information | |
|----------------------|--|
| Equipment Name | Tarvos Pro |
| Brand Name | SSI |
| Model Name | HRD31000 |
| Series Model | HRD310XY(X,Y=0-9, A-Z, a-z, blank) |
| Model Difference | Different in Antenna option, and names are different between models, everything else is the same. |
| Adapter | Model: MIT-09G-56D Brand: MsTronic Input: 90-264 V Output: 56 V Manufacturer: MSTRONIC Co., Ltd. |
| Battery | Model: BR-1225A/BN Brand: Panasonic Battery Rated Voltage: 3 V Charge Limit Voltage: N/A Capacity: 48 mAh Manufacturer: Panasonic |
| Frequency Range | 902.75MHz~ 927.25MHz |
| Modulation Technique | FHSS |
| Temperature Range | -40C to +70C |
| Hardware Version | R1 |
| Software Version | 1.1.1.32641 |

Remark:

The above information of EUT was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4. Equipment Specification

Table for Filed Antenna
Antenna 1(External Antenna)

| Ant. | Brand | Model Name | Antenna Name | Connector | Gain (dBi) | Antenna Cable loss (dB) | Antenna combination(dB) |
|------|-------|-----------------------|--------------|-----------|------------|-------------------------|-------------------------|
| 1 | SSI | Tarvos Pro (HRD31000) | Avior | N/A | 15 | 12 | 3 |
| 2 | SSI | Tarvos Pro (HRD31000) | Avalon | N/A | 13 | 12 | 1 |
| 3 | SSI | Tarvos Pro (HRD31000) | Cheetah | N/A | 12 | 12 | 0 |
| 4 | SSI | Tarvos Pro (HRD31000) | Kuma | N/A | 10 | 12 | -2 |
| 5 | SSI | Tarvos Pro (HRD31000) | Bobcat | N/A | 8 | 12 | -4 |

Antenna 2(Internal Antenna)

| Ant. | Brand | Model Name | Antenna Name | Connector | Gain (dBi) | Antenna Cable loss (dB) | Antenna combination(dB) |
|------|-------|-----------------------|--------------|-----------|------------|-------------------------|-------------------------|
| 1 | SSI | Tarvos Pro (HRD31000) | Avalon | SMA Type | 13 | 0 | 13 |

Note:

- 1.Internal antenna port only with Avalon (SMA Type).
- 2.The worst antenna with external antenna port is Avior, report only shows the worst antenna data.
- 3.The antenna information refer the manufacturer provide report, applicable only to the tested sample identified in the report. Due to the incorrect antenna information, a series of problems such as the accuracy of the test results will be borne by the customer.
- 4.The EUT internal antenna, external antenna,Simultaneous transmission is not supported.
- 5.Antenna gain, all provided by customer.

1.5. Modification of EUT

No modifications are made to the EUT during all test items.

1.6. Laboratory Information

| | | |
|--------------|---|---|
| Company Name | : | Shanghai ATBL Technology Co., Ltd. |
| Address | : | Building 8,No.160 Basheng Road, Waigaoqiao Free Trade Zone, Pudong New Area, Shanghai |
| Telephone | : | +86(0)21-51298625 |

1.7. Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

47 CFR Part 15 Subpart C §15.247

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10-2020

Remark:

All test items were verified and recorded according to the standards and without any deviation during the test.

2. TEST CONFIGURATION OF EUT

2.1. Frequency Channel

| Frequency Band | Channel | Frequency MHz | Channel | Frequency MHz |
|----------------|-----------|---------------|-----------|---------------|
| 902-928 MHz | 01 | 902.75 | 28 | 916.25 |
| | 02 | 903.25 | 29 | 916.75 |
| | 03 | 903.75 | 30 | 917.25 |
| | 04 | 904.25 | 31 | 917.75 |
| | 05 | 904.75 | 32 | 918.25 |
| | 06 | 905.25 | 33 | 918.75 |
| | 07 | 905.75 | 34 | 919.25 |
| | 08 | 906.25 | 35 | 919.75 |
| | 09 | 906.75 | 36 | 920.25 |
| | 10 | 907.25 | 37 | 920.75 |
| | 11 | 907.75 | 38 | 921.25 |
| | 12 | 908.25 | 39 | 921.75 |
| | 13 | 908.75 | 40 | 922.25 |
| | 14 | 909.25 | 41 | 922.75 |
| | 15 | 909.75 | 42 | 923.25 |
| | 16 | 910.25 | 43 | 923.75 |
| | 17 | 910.75 | 44 | 924.25 |
| | 18 | 911.25 | 45 | 924.75 |
| | 19 | 911.75 | 46 | 925.25 |
| | 20 | 912.25 | 47 | 925.75 |
| | 21 | 912.75 | 48 | 926.25 |
| | 22 | 913.25 | 49 | 926.75 |
| | 23 | 913.75 | 50 | 927.25 |
| | 24 | 914.25 | | |
| | 25 | 914.75 | | |
| | 26 | 915.25 | | |
| | 27 | 915.75 | | |

2.2. Test Modes

The table below is showing all test modes to demonstrate in compliance with the standard.

| Test Mode | Description | Operation mode |
|-----------|-------------|--------------------|
| Mode 1 | CH01 | Dense reader mode |
| Mode 2 | CH26 | Dense reader mode |
| Mode 3 | CH50 | Dense reader mode |
| Mode 4 | CH01 | Single reader mode |
| Mode 5 | CH26 | Single reader mode |
| Mode 6 | CH50 | Single reader mode |

Note:

- (1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.
- (2) We tested for all available U.S. voltage and frequencies(For 120V,50/60Hz and 240V,50/60Hz) for which the device is capable of operation, and the worst case of 120V/60Hz is shown in the report.

For AC conducted Emission

| Test case | |
|-----------------------|-----------------------------------|
| AC Conducted Emission | Mode 5:Single reader mode CH26 TX |

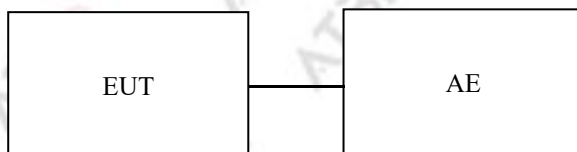
Table of parameters of test software setting

During testing, the channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS.

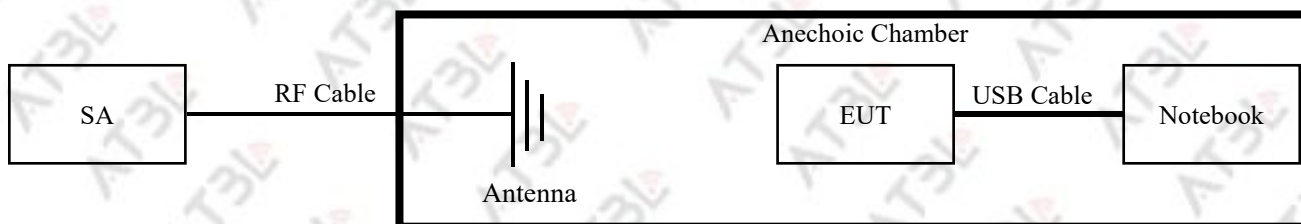
| Type | Mode or Modulation type | Power class | Software for Testing |
|------------|-------------------------|-------------|----------------------|
| 902~928MHz | FHSS | Default | Ctest |

2.3. Block Diagram of Test System

2.3.1. For AC Power-Line Conducted Emission



2.3.2. For Radiated Spurious Emission



2.3.3. For Conducted Test



2.4. Description of Support Units

| NO. | Unit | Manufacturer | Model | ID or Specification | Description | Note |
|-----|---------------|--------------|-------|---------------------|-----------------|---------------|
| 1 | PC | DELL | G15 | N/A | 1.2m unshielded | Support units |
| 2 | RF cable | N/A | N/A | 9KHz-18GHz | 1.6m shielded | Support units |
| 3 | Network cable | N/A | N/A | N/A | 1.5m shielded | Support units |

2.5. Test Software and Power Level

During the test, the channel and power control software provided by the customer is used to control the operation channel and output power level.

2.6. EUT Operating Conditions

For radiated spurious emission and conducted test, the engineering test program was provided and make the EUT to continuous transmit/receive.

2.7. Equipment List

2.7.1. For AC Power-Line Conducted Emission

| Kind of Equipment | Manufacturer | Type No. | Serial No. | Equipment No. | Calibrated Until |
|------------------------|--------------|---------------------------|------------|---------------|------------------|
| EMI Test Receiver | R&S | ESPI | 100679 | SHATBL-E012 | 2024.05.09 |
| LISN | R&S | ENV216 | 101300 | SHATBL-E013 | 2024.05.30 |
| LISN | R&S | ENV216 | 100333 | SHATBL-E041 | 2024.05.09 |
| CE Cable | Chuangcexing | 2M | N/A | SHATBL-E014 | 2024.05.09 |
| Temperature & Humidity | Deli | Deli | N/A | SHATBL-E015 | 2024.09.19 |
| Testing Software | FALA | EZ-EMC(Ver.EMC-CON 3A1.1) | | SHATBL-E044 | N/A |

2.7.2. For Radiated Spurious Emission

| Equipment Name | Manufacturer | Model | Serial No. | Equipment No. | Calibration Until |
|-------------------------------|--------------|-----------------|------------------|---------------|-------------------|
| Signal analyzer | Agilent | N9020A | MY50200811 | SHATBL-E017 | 2024.07.09 |
| Amplifier | JPT | JPA0118-55-303A | 1910001800055000 | SHATBL-E006 | 2024.07.09 |
| Amplifier | JPT | JPA-10M1G32 | 21010100035001 | SHATBL-E005 | 2024.07.09 |
| Antenna/Turn table Controller | Brilliant | N/A | N/A | SHATBL-E007 | N/A |
| Loop Antenna | Daze | ZN30900C | 20077 | SHATBL-E042 | 2024.07.09 |
| Bilog Antenna | SCHWARZBECK | VULB 9168 | 01174 | SHATBL-E008 | 2024.07.09 |
| Broad-band Horn Antenna | SCHWARZBECK | BBHA 9120D | 02334 | SHATBL-E009 | 2024.07.09 |
| Horn Antenna | COM-POWER | AH-1840 | 10100008 | SHATBL-E043 | 2024.07.09 |
| Thermometer | DeLi | N/A | N/A | SHATBL-E015 | 2024.07.09 |
| Test Software | FALA | EMC-RI | N/A | SHATBL-E046 | N/A |

2.7.3. For Conducted Test

| Equipment Name | Manufacturer | Model | Serial No. | Equipment No. | Calibration Until |
|-----------------|--------------|--------------------|------------|---------------|-------------------|
| Signal analyzer | Agilent | N9020A | MY50200811 | SHATBL-E017 | 2024.07.09 |
| Attenuator | Keleto | AP-DC01G-2W-N-20dB | N/A | DGATBL-W41 | 2025.02.15 |
| Power meter | keysight | U2021XA | MY55520005 | SHATBL-E062 | 2024.07.09 |

2.8. Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

| No. | Item | Uncertainty |
|-----|------------------------------------|--------------------|
| 1 | RF output power, conducted | $\pm 0.6\text{dB}$ |
| 2 | Conducted spurious emissions | $\pm 0.6\text{dB}$ |
| 3 | All emissions, radiated 30MHz-1GHz | $\pm 4.6\text{dB}$ |
| 4 | All emissions, radiated 1GHz-6GHz | $\pm 5.2\text{dB}$ |
| 5 | All emissions, radiated 6GHz-18GHz | $\pm 4.4\text{dB}$ |
| 6 | Occupied bandwidth | 4%Hz |

3. TEST RESULT

3.1. Maximum Output Power

3.1.1. Limit

| FCC Part 15.247 ,Subpart C | | | | |
|----------------------------|--------------|-------|--------------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247 (b)(2) | Output Power | 1W | 902-928 | Pass |

3.1.2. Test Procedure

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

1. Use the following spectrum analyzer settings:

- ① Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- ② RBW > 20 dB bandwidth of the emission being measured.
- ③ VBW \geq RBW.
- ④ Sweep: Auto.
- ⑤ Detector function: Peak.
- ⑥ Trace: Max hold.

2. Allow trace to stabilize.

3. Use the marker-to-peak function to set the marker to the peak of the emission.

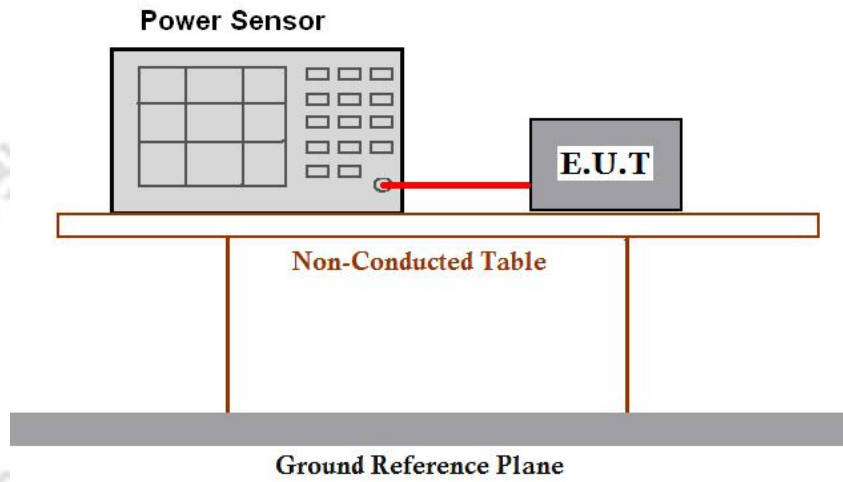
4. The indicated level is the peak output power, after any corrections for external attenuators and cables.

5. A plot of the test results and setup description shall be included in the test report.

Remark:

A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

3.1.3. Test Setup



3.1.4. Test Result of Maximum Peak Conducted Output Power

Please refer to the Appendix E.

3.2. Number of Hopping Frequencies

3.2.1. Limit

For frequency hopping systems operating in the 902-9028MHz band:if the 20dB bandwidth of the hopping channel is less than 250kHz,the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20dB bandwidth of the hopping channel is 250kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.The maximum allowed 20dB bandwidth of the hopping channel is 500kHz.

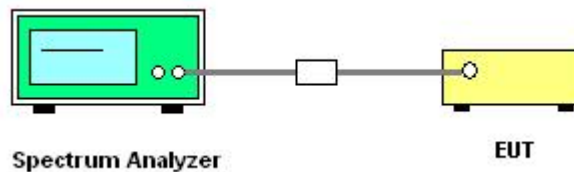
3.2.2. Test Procedure

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

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW \geq RBW.
4. Sweep: Auto.
5. Detector function: Peak.
6. Trace: Max hold.
7. Allow the trace to stabilize.

It might prove necessary to break the span up into sub ranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

3.2.3. Test Setup



3.2.4. Test Result of Number of Hopping Frequencies

Please refer to the Appendix E.

3.3. Average Time Occupancy

3.3.1. Limit

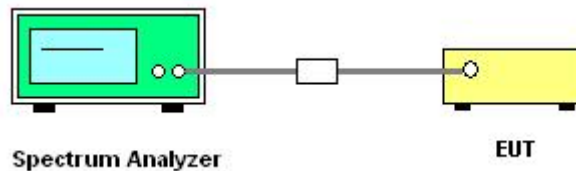
47 CFR 15.247(a)(1)(i) : The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 20 seconds.

3.3.2. Test Procedure

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

1. Span: Zero span, centered on a hopping channel.
2. RBW shall be \leq channel spacing and where possible RBW should be set $\gg 1 / T$, where T is the expected dwell time per channel.
3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
4. Detector function: Peak.
5. Trace: Max hold.
6. Use the marker-delta function to determine the transmit time per hop.
7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

3.3.3. Test Setup



3.3.4. Test Result of Dwell Time

Please refer to the Appendix E.

3.4. 20dB Bandwidth

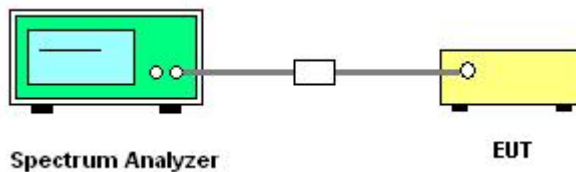
3.4.1. Limit

| FCC Part15.247 Subpart C | | | | |
|--------------------------|----------------|--------|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(a)(1)(i); | 20dB Bandwidth | 500kHz | 902-928 | Pass |

3.4.2. Test Procedure

1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel; RBW \geq 1% of the 20 dB bandwidth; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold.
4. Measure and record the results in the test report.

3.4.3. Test Setup



3.4.4. Test Result of 20dB Bandwidth

Please refer to the Appendix E.

3.5. Hopping Frequency Separation

3.5.1. Limit

47 CFR 15.247(a)(1) : 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.

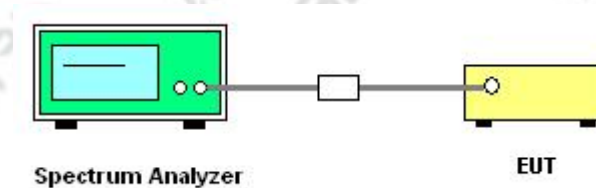
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

3.5.2. Test Procedure

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

1. Span: Wide enough to capture the peaks of two adjacent channels.
2. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. VBW \geq RBW.
4. Sweep: Auto.
5. Detector function: Peak.
6. Trace: Max hold.
7. Allow the trace to stabilize.
8. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. A plot of the data shall be included in the test report.

3.5.3. Test Setup



3.5.4. Test Result of Carrier Frequency Separation

Please refer to the Appendix E.

3.6. Conducted Band Edge

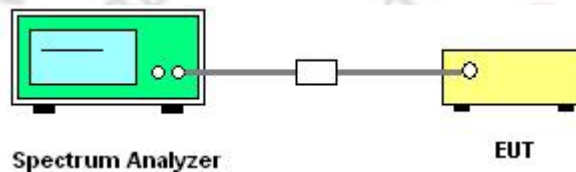
3.6.1. Limit

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.

3.6.2. Test Procedure

1. Set to the maximum power setting and enable the EUT transmit continuously.
2. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
3. Enable hopping function of the EUT and then repeat step 2. and 3.
4. Measure and record the results in the test report.

3.6.3. Test Setup



3.6.4. Test Result of Conducted Band Edge

Please refer to the Appendix E.

3.7. Conducted Spurious Emission

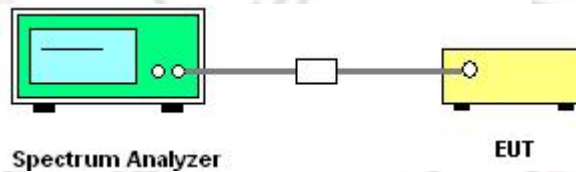
3.7.1. Limit

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.

3.7.2. Test Procedure

1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.7.3. Test Setup



3.7.4. Test Result of Conducted Spurious Emission

Please refer to the Appendix E.

Note: 1 only worst case was recorded in the test report, if no any others

2 have enough margin was no recorded in the test report.

3.8. Radiated Spurious Emission and Restricted Band

3.8.1. Limit

47 CFR 15.247(d) and : 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.

47 CFR 15.205(a) : Only spurious emissions are permitted in any of the frequency bands listed below:

| Frequency (MHz) | Frequency (MHz) | Frequency (MHz) | Frequency (MHz) | Frequency (MHz) |
|-----------------|-------------------|---------------------|-----------------|-----------------|
| 0.090-0.110 | 12.29-12.293 | 149.9-150.05 | 1660-1710 | 8.025-8.5 |
| 0.495-0.505 | 12.51975-12.52025 | 156.52475-156.52525 | 1718.8-1722.2 | 9.0-9.2 |
| 2.1735-2.1905 | 12.57675-12.57725 | 156.7-156.9 | 2200-2300 | 9.3-9.5 |
| 4.125-4.128 | 13.36-13.41 | 162.0125-167.17 | 2310-2390 | 10.6-12.7 |
| 4.17725-4.17775 | 16.42-16.423 | 167.72-173.2 | 2483.5-2500 | 13.25-13.4 |
| 4.20725-4.20775 | 16.69475-16.69525 | 240-285 | 2690-2900 | 14.47-14.5 |
| 6.215-6.218 | 16.80425-16.80475 | 322-335.4 | 3260-3267 | 15.35-16.2 |
| 6.26775-6.26825 | 25.5-25.67 | 399.9-410 | 3332-3339 | 17.7-21.4 |
| 6.31175-6.31225 | 37.5-38.25 | 608-614 | 3345.8-3358 | 22.01-23.12 |
| 8.291-8.294 | 73-74.6 | 960-1240 | 3600-4400 | 23.6-24.0 |
| 8.362-8.366 | 74.8-75.2 | 1300-1427 | 4500-5150 | 31.2-31.8 |
| 8.37625-8.38675 | 108-121.94 | 1435-1626.5 | 5350-5460 | 36.43-36.5 |
| 8.41425-8.41475 | 123-138 | 1645.5-1646.5 | 7250-7750 | Above 38.6 |

47 CFR 15.209(a): The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

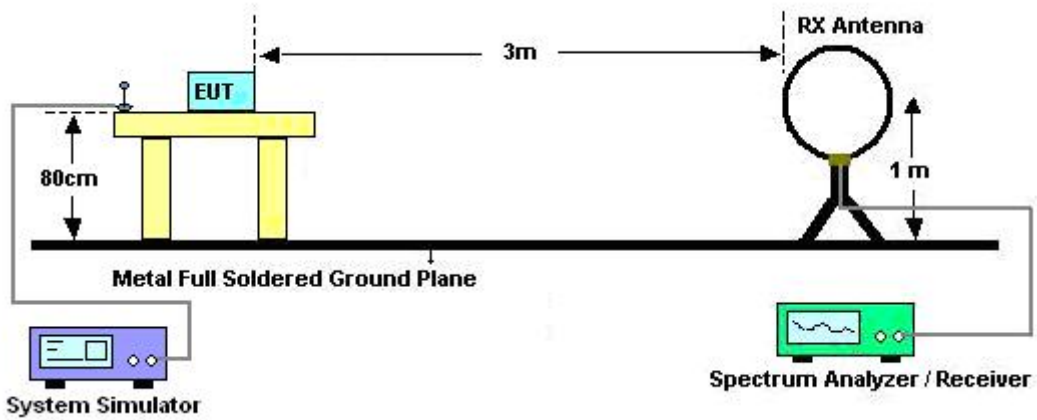
| Frequency (MHz) | Field strength (microvolts/meter) | Measurement distance (meters) |
|-----------------|-----------------------------------|-------------------------------|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

3.8.2. Test Procedure

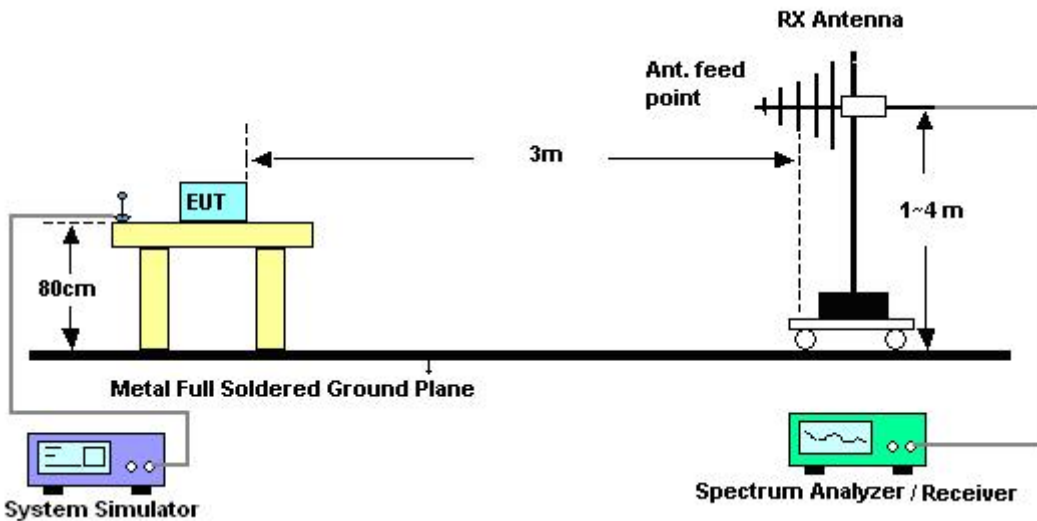
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
 - ① Span shall wide enough to fully capture the emission being measured;
 - ② Set RBW =200Hz for 9kHz to0.15MHz,Set RBW=9kHz for 0.15MHz to 30MHz;Set RBW=100 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$ GHz ; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak;
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Pre-amp Factor = Level
7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.8.3. Test Setup

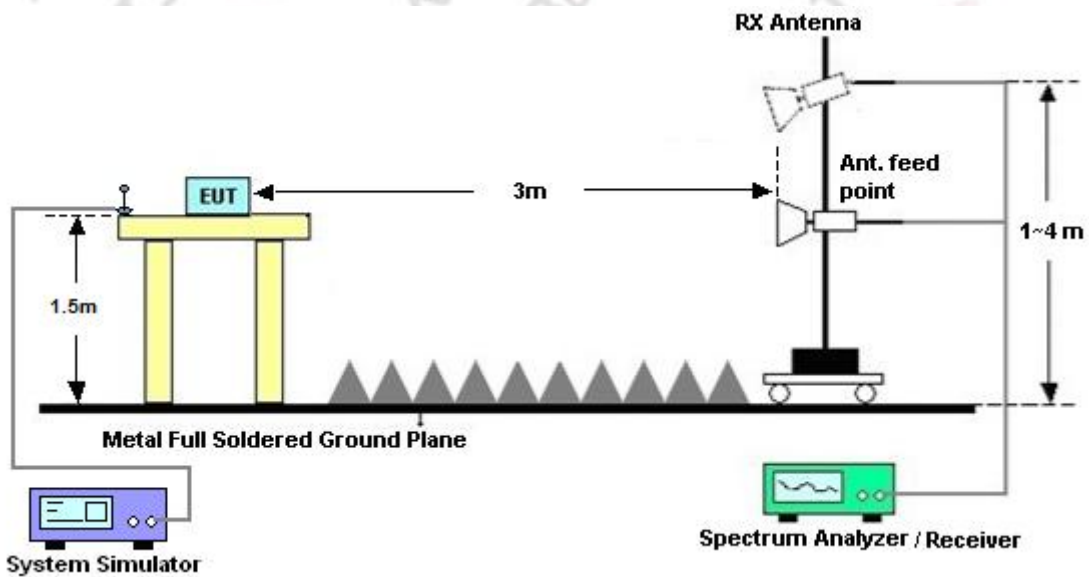
3.8.3.1. For radiated emissions below 30MHz



3.8.3.2. For radiated emissions from 30MHz to 1GHz



3.8.3.3. For radiated emissions above 1GHz



3.8.4. Test Result of Radiated Spurious Emission

3.8.4.1. For 9 kHz ~ 30 MHz

Please refer to the Appendix F.

3.8.4.2. For 30 MHz ~ 1 GHz

Please refer to the Appendix F.

3.8.4.3. For 1 GHz ~ 18GHz

Please refer to the Appendix F.

3.8.5. Test Result of Restricted Band

Please refer to the Appendix F.

Remark: only worst case was recorded in the test report
have enough margin was no recorded in the test report.

3.9. Antenna Requirement

3.9.1. Standard Requirement

According to 47 CFR 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.

3.9.2. EUT Antenna

The EUT Antenna should be installed by professional installer only so that the limits in this part do not exceed.

3.11 Frequency Stability

3.11.1 Limits of Frequency stability measurement

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.02\%$ of the operating frequency over a temperature variation of -30°C to 50°C at normal supply voltage, and for a variation in primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C

3.11.2 Test Procedure

- 1 The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
- 2 Turn the EUT on and couple its output to spectrum analyzer.
- 3 Turn the EUT off and set the chamber to the highest temperature specified.
- 4 Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2.5 and 10 minutes.
- 5 Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
- 6 The test chamber was allowed to stabilize at $+20^{\circ}\text{C}$ for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and record the frequency.

3.11.3 Test Result

Please refer to the Appendix E.

3.10. AC Power-Line Conducted Emission

3.10.1. Limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table:

| Frequency of emission (MHz) | Conducted limit (dB μ V) | |
|-----------------------------|------------------------------|-----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

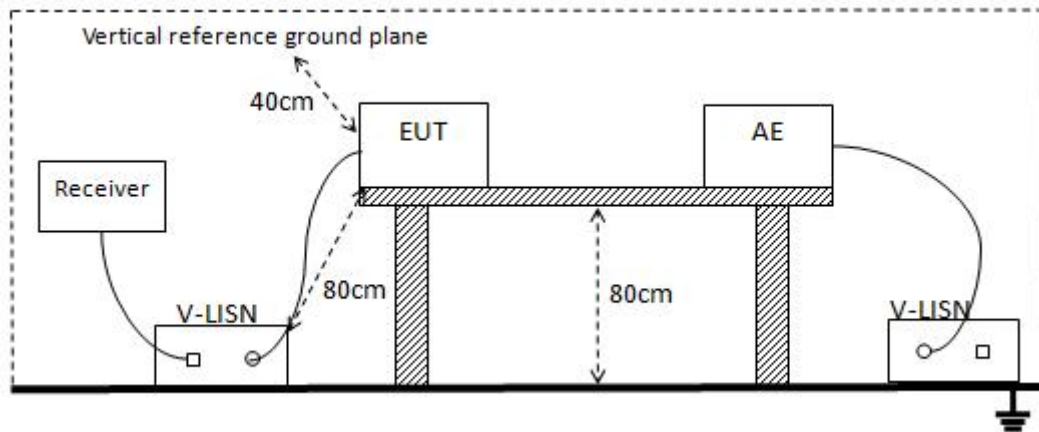
*Decreases with the logarithm of the frequency.

3.10.2. Test Procedure

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.

7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9 kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.10.3. Test Setup



3.10.4. Test Result of AC Power-Line Conducted Emission

Please refer to the Appendix F.

4. TEST SETUP PHOTOGRAPHS

Please refer to the Appendix C.

5. PHOTOGRAPHS OF EUT

Please refer to the Appendix D.

*****END OF THE REPORT*****