

TEST REPORT

FCC ID: 2AEXY507DRX

Product: X4 STAR FPV

Model No.: H507D

Additional Model: N/A

Trade Mark: Hubsan

Report No.: TCT161201E041

Issued Date: Dec. 12, 2016

Issued for:

SHENZHEN HUBSAN INTELLIGENT COMPANY LIMITED
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Appendix A: Photographs of Test Setup

Appendix B: Photographs of EUT

1. Test Certification

| | |
|------------------------------|--|
| Product: | X4 STAR FPV |
| Model No.: | H507D |
| Additional Model No.: | N/A |
| Applicant: | SHENZHEN HUBSAN INTELLIGENT COMPANY LIMITED |
| Address: | 13th Floor, Bldg 1C, Shenzhen Software Industry Base, Xuefu Road, Nanshan District, Shenzhen, China |
| Manufacturer: | DONGGUAN TENGSHENG INDUSTRIAL CO., LTD |
| Address: | A22# Luyi Street, Tianxin Village, Tangxia Town, Dongguan, China |
| Date of Test: | Dec. 01 – Dec. 09, 2016 |
| Applicable Standards: | FCC CFR Title 47 Part 15 Subpart E Section 15.407:2014 789033 D02 General UNII Test Procedures New Rules v01r03 |

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:

Garen

Date: Dec. 09, 2016**Reviewed By:**

Joe Zhou

Date: Dec. 12, 2016**Approved By:**

Tomsin

Date: Dec. 12, 2016

2. Test Result Summary

| Requirement | CFR 47 Section | Result |
|--|-----------------------------|--------|
| Antenna requirement | §15.203 | PASS |
| AC Power Line Conducted Emission | §15.207 | PASS |
| Maximum Conducted Output Power | §15.407(a) §2.1046 | PASS |
| 6dB Emission Bandwidth | §15.407(e) §2.1049 | PASS |
| 26dB Emission Bandwidth& 99% Occupied Bandwidth | §15.407(a)(5) §2.1049 | PASS |
| Power Spectral Density | §15.407(a) | PASS |
| Band edge | §15.407 | PASS |
| Radiated Emission& Unwanted Emission Measurement | §15.205, §15.209 §15.407 | PASS |

Note:

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

3. EUT Description

| | |
|-----------------------------|------------------------------------|
| Product Name: | X4 STAR FPV |
| Model : | H507D |
| Additional Model: | N/A |
| Trade Mark: | Hubsan |
| Operation Frequency: | 5735MHz~5841MHz |
| Number of Channel: | 24 |
| Modulation Type | GFSK |
| Antenna Type: | Internal antenna |
| Antenna Gain: | 2dBi |
| Power Supply: | Rechargeable Li-ion Battery DC7.6V |

Operation Frequency each of channel

| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|---------|-----------|---------|-----------|
| 1 | 5735MHz | 7 | 5765MHz | 13 | 5797MHz | 19 | 5825MHz |
| 2 | 5740MHz | 8 | 5770MHz | 14 | 5800MHz | 20 | 5830MHz |
| 3 | 5745MHz | 9 | 5775MHz | 15 | 5805MHz | 21 | 5835MHz |
| 4 | 5750MHz | 10 | 5780MHz | 16 | 5810MHz | 22 | 5841MHz |
| 5 | 5755MHz | 11 | 5785MHz | 17 | 5815MHz | | |
| 6 | 5760MHz | 12 | 5790MHz | 18 | 5820MHz | | |

Remark: Channel 1(Lowest), 13(Middle) & 22(Highest) have been tested.

4. General Information

4.1. Test environment and mode

| Operating Environment: | |
|---|--|
| Temperature: | 25.0 °C |
| Humidity: | 56 % RH |
| Atmospheric Pressure: | 1010 mbar |
| Test Mode: | |
| Engineering mode: | Keep the EUT in continuous transmitting by select channel and modulations(The value of duty cycle is 100%) |
| The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. | |
| Final Test Mode: | |
| Operation mode: | Keep the EUT in continuous transmitting with modulation |

4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| Equipment | Model No. | Serial No. | FCC ID | Trade Name |
|-----------|--------------|------------|--------|------------|
| Adapter | XC-0500-100U | / | / | / |

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
3. The router is provided by Testing Lab.
4. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

5. Facilities and Accreditations

5.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 572331

Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

- CNAS - Registration No.: CNAS L6165

Shenzhen TCT Testing Technology Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6165.

5.2. Location

Shenzhen Tongce Testing Lab

Address: 1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China

Tel: 86-755-36638142

5.3. Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expended 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 | MU |
|-----|-------------------------------|-------------------------|
| 1 | Conducted Emission | $\pm 2.56\text{dB}$ |
| 2 | RF power, conducted | $\pm 0.12\text{dB}$ |
| 3 | Spurious emissions, conducted | $\pm 0.11\text{dB}$ |
| 4 | All emissions, radiated(<1G) | $\pm 3.92\text{dB}$ |
| 5 | All emissions, radiated(>1G) | $\pm 4.28\text{dB}$ |
| 6 | Temperature | $\pm 0.1^\circ\text{C}$ |
| 7 | Humidity | $\pm 1.0\%$ |

6. Test Results and Measurement Data

6.1. Antenna requirement

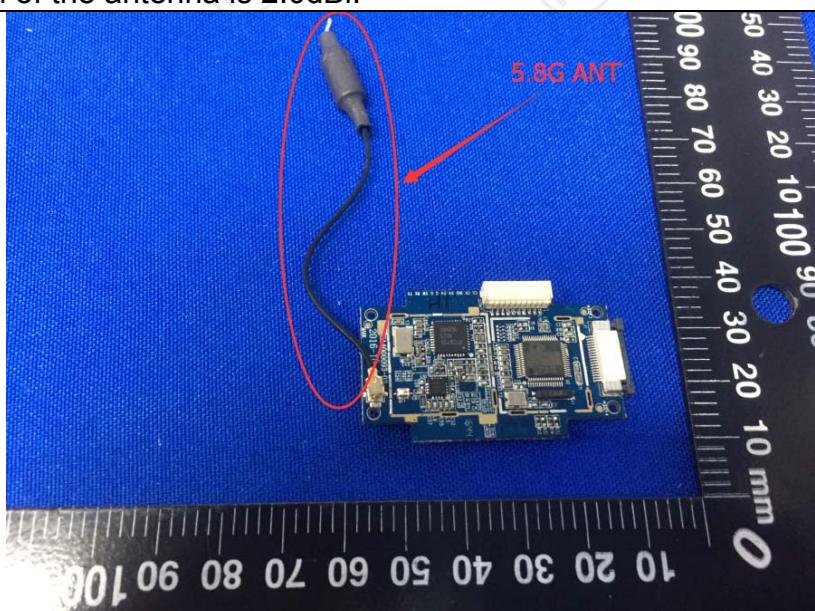
| | |
|------------------------------|-----------------------------|
| Standard requirement: | FCC Part15 C Section 15.203 |
|------------------------------|-----------------------------|

15.203 requirement:

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, 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.

E.U.T Antenna:

The Integrated antenna is an internal antenna which permanently attached, and the best case gain of the antenna is 2.0dBi.



| | |
|------------------------------|--|
| Standard requirement: | FCC Part15 C Section 15.203 |
| E.U.T Antenna: | The Integrated antenna is an internal antenna which permanently attached, and the best case gain of the antenna is 2.0dBi. |

6.2. Conducted Emission

6.2.1. Test Specification

| Test Requirement: | FCC Part15 C Section 15.207 | | | | | | | | | | | | | | |
|--------------------------|---|--------------------------|--------------|--|------------|---------|----------|-----------|-----------|-------|----|----|------|----|----|
| Test Method: | ANSI C63.10:2013 | | | | | | | | | | | | | | |
| Frequency Range: | 150 kHz to 30 MHz | | | | | | | | | | | | | | |
| Receiver setup: | RBW=9 kHz, VBW=30 kHz, Sweep time=auto | | | | | | | | | | | | | | |
| Limits: | <table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15-0.5</td> <td>66 to 56*</td> <td>56 to 46*</td> </tr> <tr> <td>0.5-5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5-30</td> <td>60</td> <td>50</td> </tr> </tbody> </table> | Frequency range (MHz) | Limit (dBuV) | | Quasi-peak | Average | 0.15-0.5 | 66 to 56* | 56 to 46* | 0.5-5 | 56 | 46 | 5-30 | 60 | 50 |
| Frequency range (MHz) | Limit (dBuV) | | | | | | | | | | | | | | |
| | Quasi-peak | Average | | | | | | | | | | | | | |
| 0.15-0.5 | 66 to 56* | 56 to 46* | | | | | | | | | | | | | |
| 0.5-5 | 56 | 46 | | | | | | | | | | | | | |
| 5-30 | 60 | 50 | | | | | | | | | | | | | |
| Test Setup: | <p>Reference Plane</p> <p>40cm 80cm</p> <p>E.U.T — AC power</p> <p>LISN</p> <p>Filter — AC power</p> <p>EMI Receiver</p> <p>Test table/Insulation plane</p> <p>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p> | | | | | | | | | | | | | | |
| Test Mode: | Charging + transmitting with modulation | | | | | | | | | | | | | | |
| Test Procedure: | <ol style="list-style-type: none"> The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement. | | | | | | | | | | | | | | |
| Test Result: | PASS | | | | | | | | | | | | | | |

6.2.2. Test Instruments

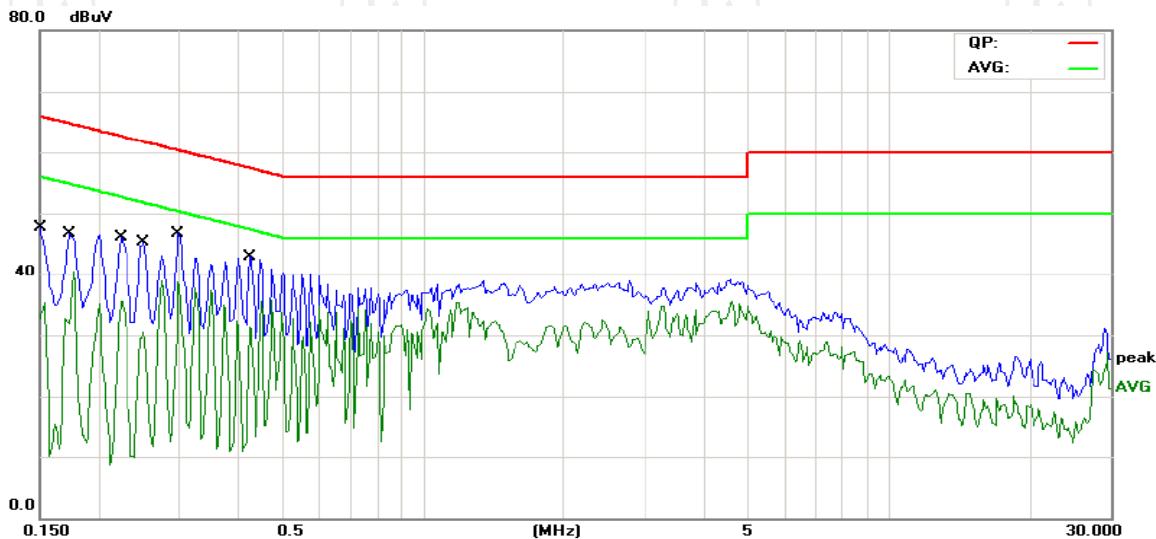
| Conducted Emission Shielding Room Test Site (843) | | | | |
|---|---------------------|-----------|---------------|-----------------|
| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| EMI Test Receiver | R&S | ESCS30 | 100139 | Aug. 11, 2017 |
| LISN | Schwarzbeck | NSLK 8126 | 8126453 | Aug. 16, 2017 |
| Coax cable | TCT | CE-05 | N/A | Aug. 11, 2017 |
| EMI Test Software | Shurples Technology | EZ-EMC | N/A | N/A |

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.2.3. Test data

Please refer to following diagram for individual

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



| Site Chamber #2 | | | | Phase: | L1 | Temperature: | 25 (C) |
|--|-----|--------|---------------|----------------|--------------|--------------|----------|
| Limit: FCC Part 15B Class B Conduction(QP) | | | | Power: | AC 120V/60Hz | Humidity: | 54 % |
| No. | Mk. | Freq. | Reading Level | Correct Factor | Measurement | Limit | Over |
| | | MHz | dB μ V | dB | dB μ V | dB | Detector |
| 1 | | 0.1500 | 34.74 | 11.52 | 46.26 | 65.99 | -19.73 |
| 2 | | 0.1500 | 22.00 | 11.52 | 33.52 | 55.99 | -22.47 |
| 3 | | 0.1734 | 33.21 | 11.50 | 44.71 | 64.79 | -20.08 |
| 4 | | 0.1734 | 23.17 | 11.50 | 34.67 | 54.79 | -20.12 |
| 5 | | 0.2242 | 33.04 | 11.47 | 44.51 | 62.66 | -18.15 |
| 6 | | 0.2242 | 24.66 | 11.47 | 36.13 | 52.66 | -16.53 |
| 7 | | 0.2516 | 32.83 | 11.45 | 44.28 | 61.70 | -17.42 |
| 8 | | 0.2516 | 22.44 | 11.45 | 33.89 | 51.70 | -17.81 |
| 9 | | 0.2983 | 32.48 | 11.43 | 43.91 | 60.29 | -16.38 |
| 10 | * | 0.2983 | 23.32 | 11.43 | 34.75 | 50.29 | -15.54 |
| 11 | | 0.4234 | 28.19 | 11.35 | 39.54 | 57.38 | -17.84 |
| 12 | | 0.4234 | 17.26 | 11.35 | 28.61 | 47.38 | -18.77 |

Note:

Freq. = Emission frequency in MHz

Reading level (dB μ V) = Receiver reading

Corr. Factor (dB) = Antenna factor + Cable loss

Measurement (dB μ V) = Reading level (dB μ V) + Corr. Factor (dB)

Limit (dB μ V) = Limit stated in standard

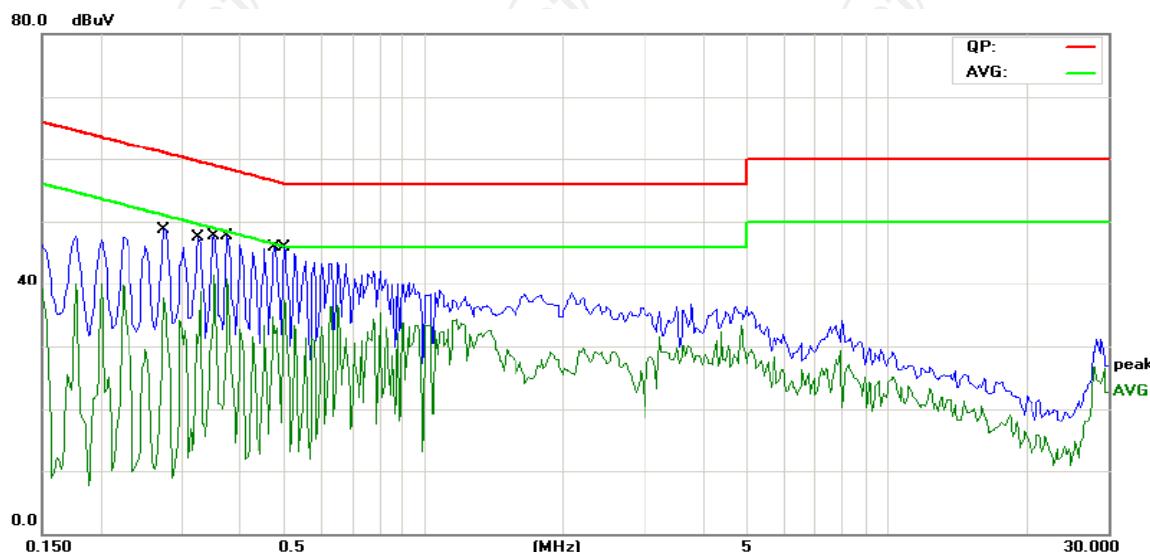
Margin (dB) = Measurement (dB μ V) - Limits (dB μ V)

Q.P. =Quasi-Peak

AVG =average

* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



| Site | Chamber #2 | Phase: | N | Temperature: | 25 (C) | | | | |
|-------|--|--------------|--------------------------------|-------------------------|--------------------------------|---------------------|------------|----------|---------|
| | Limit: FCC Part 15B Class B Conduction(QP) | Power: | AC 120V/60Hz | Humidity: | 54 % | | | | |
| <hr/> | | | | | | | | | |
| No. | Mk. | Freq. MHz | Reading Level dB μ V | Correct Factor dB | Measure- ment dB μ V | Limit dB μ V | Over dB | Detector | Comment |
| 1 | | 0.2750 | 35.30 | 11.44 | 46.74 | 60.96 | -14.22 | QP | |
| 2 | | 0.2750 | 25.34 | 11.44 | 36.78 | 50.96 | -14.18 | AVG | |
| 3 | | 0.3258 | 33.98 | 11.42 | 45.40 | 59.56 | -14.16 | QP | |
| 4 | | 0.3258 | 22.58 | 11.42 | 34.00 | 49.56 | -15.56 | AVG | |
| 5 | | 0.3531 | 35.30 | 11.39 | 46.69 | 58.89 | -12.20 | QP | |
| 6 * | | 0.3531 | 25.74 | 11.39 | 37.13 | 48.89 | -11.76 | AVG | |
| 7 | | 0.3766 | 34.20 | 11.37 | 45.57 | 58.35 | -12.78 | QP | |
| 8 | | 0.3766 | 22.95 | 11.37 | 34.32 | 48.35 | -14.03 | AVG | |
| 9 | | 0.4781 | 32.48 | 11.32 | 43.80 | 56.37 | -12.57 | QP | |
| 10 | | 0.4781 | 22.52 | 11.32 | 33.84 | 46.37 | -12.53 | AVG | |
| 11 | | 0.5016 | 30.51 | 11.31 | 41.82 | 56.00 | -14.18 | QP | |
| 12 | | 0.5016 | 18.78 | 11.31 | 30.09 | 46.00 | -15.91 | AVG | |

Note1:

Freq. = Emission frequency in MHz

Reading level (dB μ V) = Receiver reading

Corr. Factor (dB) = Antenna factor + Cable loss

Measurement (dB μ V) = Reading level (dB μ V) + Corr. Factor (dB)

Limit (dB μ V) = Limit stated in standard

Margin (dB) = Measurement (dB μ V) – Limits (dB μ V)

Q.P. = Quasi-Peak AVG =average

* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

6.3. Maximum Conducted Output Power

6.3.1. Test Specification

| | | |
|--|---|--|
| Test Requirement: | FCC Part15 E Section 15.407(a)& Part 2 J Section 2.1046 | |
| Test Method: | KDB789033 D02 General UNII Test Procedures New Rules v01r03 Section E | |
| Limit: | Frequency Band (MHz) | Limit |
| | 5150-5250 | 1W for indoor access point |
| | 5250-5350 | 250 mW or 11 dBm + 10log B, whichever is less. |
| | 5470-5725 | 250 mW or 11 dBm + 10log B, whichever is less. |
| | 5725-5850 | 1 W |
| | Note: Where "B" is the 26 dB emissions bandwidth in MHz. | |
| | RSS-247, 6.2 | |
| | Frequency Band (MHz) | Limit |
| | 5150-5250 | N/A |
| | 5250-5350 | 250 mW or 11 dBm + 10log B, whichever is less. |
| | 5470-5725 | 250 mW or 11 dBm + 10log B, whichever is less. |
| | 5725-5850 | 1 W |
| | Note: Where "B" is the 99% emissions bandwidth in MHz. | |
| The maximum e.i.r.p. shall not exceed: | | |
| | Frequency Band (MHz) | Limit |
| | 5150-5250 | 200 mW or 10 dBm + 10log B, whichever is less. |
| | 5250-5350 | 1W or 17 dBm + 10log B, whichever is less. |
| | 5470-5725 | 1W or 17 dBm + 10log B, whichever is less. |
| | 5725-5850 | N/A |
| | Note: Where "B" is the 99% emissions bandwidth in MHz. | |

| | |
|------------------------|--|
| Test Setup: | <p>Spectrum Analyzer EUT</p> |
| Test Mode: | Transmitting mode with modulation |
| Test Procedure: | <ol style="list-style-type: none"> 1. The testing follows the Measurement Procedure of KDB789033 D02 General UNII Test Procedures New Rules v01r03 Section E, 3, a 2. 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. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Set the spectrum analyzer: RBW = 1 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Average, Set the span to fully encompass the DTS bandwidth. 5. Measure the conducted output power and record the results in the test report. |
| Test Result: | PASS |
| Remark: | Conducted output power= measurement power +10log(1/x) X is duty cycle=1, so 10log(1/1)=0 Conducted output power= measurement power |

6.3.2. Test Instruments

| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|-------------------|--------------|--------|---------------|-----------------|
| Spectrum Analyzer | Agilent | N9020A | MY49100060 | Aug. 12, 2017 |
| RF cable | TCT | RE-06 | N/A | Aug. 12, 2017 |
| Antenna Connector | TCT | RFC-01 | N/A | Aug. 12, 2017 |

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.3.3. Test Data

| Test channel | Conducted Power (dBm) | Output Limit (dBm) | Result |
|--------------|-----------------------|--------------------|--------|
| 5735MHZ | 4.87 | 30.00 | PASS |
| 5797MHZ | 4.36 | 30.00 | PASS |
| 5841MHZ | 9.10 | 30.00 | PASS |

Test plots as follows:

Lowest channel



Middle channel

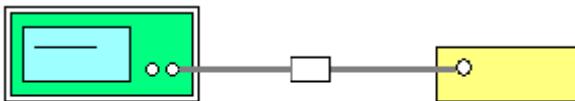


Highest channel



6.4. 6dB Emission Bandwidth

6.4.1. Test Specification

| | |
|--------------------------|--|
| Test Requirement: | FCC CFR47 Part 15 Section 15.407(e)& Part 2 J Section 2.1049 |
| Test Method: | KDB789033 D02 General UNII Test Procedures New Rules v01r03 Section C |
| Limit: | >500kHz |
| Test Setup: |  |
| Test Mode: | Transmitting mode with modulation |
| Test Procedure: | <ol style="list-style-type: none">1. KDB789033 D02 General UNII Test Procedures New Rules v01r03 Section C2. Set to the maximum power setting and enable the EUT transmit continuously.3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.4. Measure and record the results in the test report. |
| Test Result: | PASS |

6.4.2. Test Instruments

| RF Test Room | | | | |
|-------------------|--------------|--------|---------------|-----------------|
| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Spectrum Analyzer | Agilent | N9020A | MY49100060 | Aug. 12, 2017 |
| RF cable | TCT | RE-06 | N/A | Aug. 12, 2017 |
| Antenna Connector | TCT | RFC-01 | N/A | Aug. 12, 2017 |

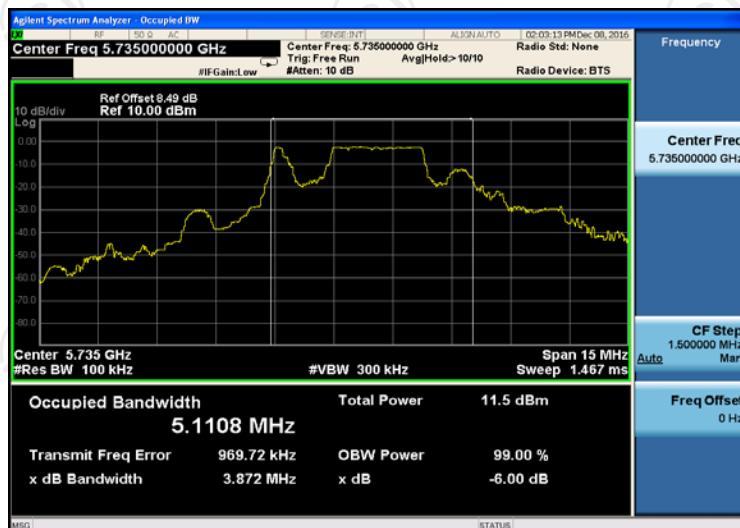
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.4.3. Test data

| Test channel | 6dB Emission Bandwidth (MHz) |
|--------------|------------------------------|
| Lowest | 3.872 |
| Middle | 3.957 |
| Highest | 4.296 |
| Limit: | >500k |
| Test Result: | PASS |

Test plots as follows:

Lowest channel



Middle channel



Highest channel



6.5. 26dB Bandwidth and 99% Occupied Bandwidth

6.5.1. Test Specification

| | |
|--------------------------|---|
| Test Requirement: | 47 CFR Part 15C Section 15.407 (a)& Part 2 J Section 2.1049 |
| Test Method: | KDB789033 D02 General UNII Test Procedures New Rules v01r03 Section D |
| Limit: | No restriction limits |
| Test Setup: |  <p style="text-align: center;">Spectrum Analyzer EUT</p> |
| Test Mode: | Transmitting mode with modulation |
| Test Procedure: | <ol style="list-style-type: none"> 1. KDB789033 D02 General UNII Test Procedures New Rules v01r03 Section D 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. 4. Measure and record the results in the test report. |
| Test Result: | PASS |

6.5.2. Test Instruments

| RF Test Room | | | | |
|-------------------|--------------|--------|---------------|-----------------|
| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Spectrum Analyzer | Agilent | N9020A | MY49100060 | Aug. 12, 2017 |
| RF cable | TCT | RE-06 | N/A | Aug. 12, 2017 |
| Antenna Connector | TCT | RFC-01 | N/A | Aug. 12, 2017 |

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.5.3. Test data

| Test channel | 26dB Emission Bandwidth (MHz) | 99% Occupied Bandwidth(MHz) |
|--------------|-------------------------------|-----------------------------|
| Lowest | 10.13 | 6.03 |
| Middle | 10.32 | 6.24 |
| Highest | 10.32 | 6.36 |

Test plots as follows:

Lowest channel



Middle channel



Highest channel



6.6. Power Spectral Density

6.7. Test Specification

| | |
|--------------------------|--|
| Test Requirement: | FCC Part15 E Section 15.407 (a) |
| Test Method: | KDB789033 D02 General UNII Test Procedures New Rules v01r03 Section F |
| Limit: | $\leq 30.00\text{dBm}/500\text{KHz}$ for Operation in the band IV(5725MHz-5850MHz)of device |
| Test Setup: | <p>Spectrum Analyzer EUT</p> |
| Test Mode: | Transmitting mode with modulation |
| Test Procedure: | <ol style="list-style-type: none"> Set the spectrum analyzer or EMI receiver span to view the entire emission bandwidth. Set RBW = 510 kHz/1 MHz, VBW $\geq 3 \times \text{RBW}$, Sweep time = Auto, Detector = RMS. Allow the sweeps to continue until the trace stabilizes. Use the peak marker function to determine the maximum amplitude level. The E.I.R.P spectral density used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment. |
| Test Result: | PASS |

6.7.1. Test Instruments

| RF Test Room | | | | |
|-------------------|--------------|--------|---------------|-----------------|
| Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| Spectrum Analyzer | Agilent | N9020A | MY49100060 | Aug. 12, 2017 |
| RF cable | TCT | RE-06 | N/A | Aug. 12, 2017 |
| Antenna Connector | TCT | RFC-01 | N/A | Aug. 12, 2017 |

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.7.2. Test data

| Test channel | Meas.Level (dBm) | Limit (dBm/500KHz) | Test Result: |
|--------------|---------------------|--------------------|--------------|
| Lowest | -3.758 | 30 | PASS |
| Middle | -3.694 | 30 | PASS |
| Highest | -1.332 | 30 | PASS |

Test plots as follows:

Lowest channel



Middle channel

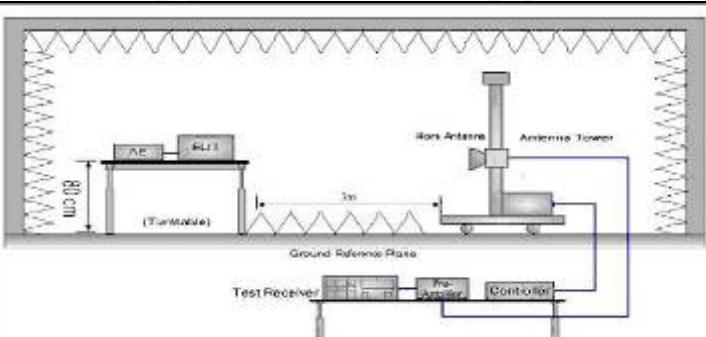


Highest channel



6.8. Band edge

6.8.1. Test Specification

| | | | |
|--------------------------|--|--------------------------|---------------|
| Test Requirement: | FCC CFR47 Part 15E Section 15.407 | | |
| Test Method: | ANSI C63.10 2013 | | |
| | Bands | Limit (dB μ V/m @3m) | Remark |
| | For band I&II&III | 68.2 | Peak Value |
| | | 54.0 | Average Value |
| | For band IV | 78.2 | Peak Value |
| | | 54.0 | Average Value |
| Limit: | <p>Remark: For band I&II&III, $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] + 95.2 = 68.2$ $\text{dB}\mu\text{V}/\text{m}$, for $\text{EIRP}(\text{dBm}) = -27\text{dBm}$ For band IV, $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] + 95.2 = 78.2$ $\text{dB}\mu\text{V}/\text{m}$, for $\text{EIRP}(\text{dBm}) = -17\text{dBm}$ For band IV(other un-restricted band): $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] + 95.2 = 68.2 \text{ dB}\mu\text{V}/\text{m}$, for $\text{EIRP}(\text{dBm}) = -27\text{dBm}$</p> | | |
| Test Setup: |  | | |
| Test Mode: | Transmitting mode with modulation | | |
| Test Procedure: | <ol style="list-style-type: none"> The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. | | |

| | |
|---------------------|--|
| | 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasipeak or average method as specified and then reported in a data sheet. |
| Test Result: | PASS |

6.8.2. Test Instruments

| Radiated Emission Test Site (966) | | | | |
|-----------------------------------|------------------------------------|------------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| ESPI Test Receiver | ROHDE&SCHW ARZ | ESVD | 100008 | Aug. 11, 2017 |
| Spectrum Analyzer | ROHDE&SCHW ARZ | FSEM | 848597/001 | Aug. 11, 2017 |
| Spectrum Analyzer | ROHDE&SCHW ARZ | FSP40 | 100056 | Aug. 11, 2017 |
| Spectrum Analyzer | Agilent | N9020A | MY49100060 | Aug. 12, 2017 |
| Pre-amplifier | EM Electronics Corporation CO.,LTD | EM30265 | 07032613 | Aug. 11, 2017 |
| Pre-amplifier | HP | 8447D | 2727A05017 | Aug. 11, 2017 |
| Loop antenna | ZHINAN | ZN30900A | 12024 | Aug. 13, 2017 |
| Broadband Antenna | Schwarzbeck | VULB9163 | 340 | Aug. 13, 2017 |
| Horn Antenna | Schwarzbeck | BBHA 9120D | 631 | Aug. 13, 2017 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | 373 | Aug. 13, 2017 |
| Coax cable | TCT | RE-low-01 | N/A | Aug. 11, 2017 |
| Coax cable | TCT | RE-high-02 | N/A | Aug. 11, 2017 |
| Coax cable | TCT | RE-low-03 | N/A | Aug. 11, 2017 |
| Coax cable | TCT | RE-High-04 | N/A | Aug. 11, 2017 |
| Antenna Mast | CCS | CC-A-4M | N/A | Aug. 12, 2017 |
| EMI Test Software | Shurples Technology | EZ-EMC | N/A | N/A |

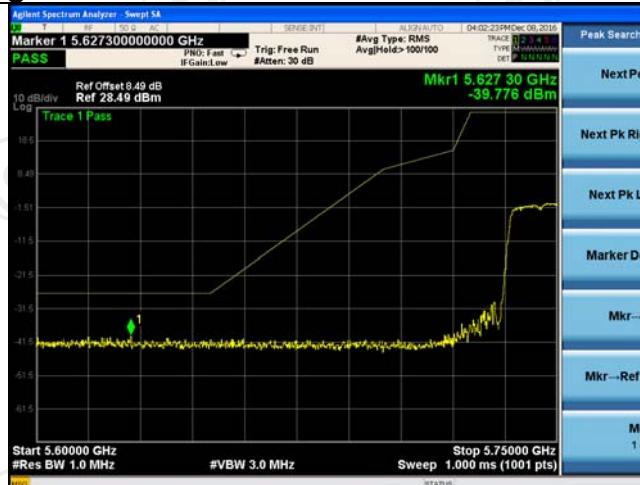
Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.7.3 Test Data

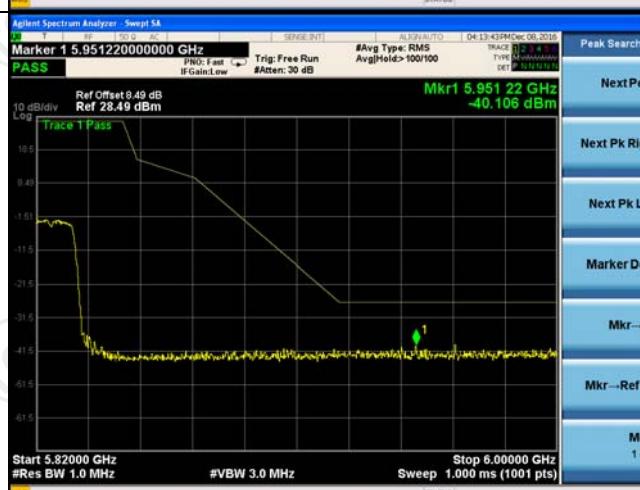
| CH | Freq. (MHz) | Read_level (dBuV/m) | Factor (dB) | Peak (dBuV/m) | Limit (dBuV/m) (Peak) | Limit (dBuV/m)t (Avg) | Over | Ant. Pol. H/V |
|--|-------------|---------------------|-------------|---------------|-----------------------|-----------------------|-------|---------------|
| Lowest | 5725 | 39.58 | 8.21 | 47.79 | 78.2 | 54 | -6.21 | H |
| | 5725 | 40.26 | 8.21 | 48.47 | 78.2 | 54 | -5.53 | V |
| Highest | 5850 | 39.12 | 8.87 | 47.99 | 78.2 | 54 | -6.01 | H |
| | 5850 | 40.73 | 8.87 | 49.60 | 78.2 | 54 | -4.40 | V |
| Remark: Factor (dB)=Ant. Factor + Cable Loss-Amp. Factor | | | | | | | | |

Band-edge for RF Conducted Emissions

LCH



HCH



6.9. Radiated Emission & Unwanted Emission Measurement

6.9.1. Test Specification

| | | | | | |
|------------------------------|--|-----------------------------------|-------------------------------|--------|------------------|
| Test Requirement: | FCC CFR47 Part 15 Section 15.407 & 15.209 & 15.205 | | | | |
| Test Method: | KDB 789033 D02 v01r03 | | | | |
| Frequency Range: | 9 kHz to 40 GHz | | | | |
| Measurement Distance: | 3 m | | | | |
| Antenna Polarization: | Horizontal & Vertical | | | | |
| Operation mode: | Transmitting mode with modulation | | | | |
| Receiver Setup: | Frequency | Detector | RBW | VBW | Remark |
| | 9kHz- 150kHz | Quasi-peak | 200Hz | 1kHz | Quasi-peak Value |
| | 150kHz- 30MHz | Quasi-peak | 9kHz | 30kHz | Quasi-peak Value |
| | 30MHz-1GHz | Quasi-peak | 100KHz | 300KHz | Quasi-peak Value |
| | Above 1GHz | Peak | 1MHz | 3MHz | Peak Value |
| | | Peak | 1MHz | 10Hz | Average Value |
| Limit: | (1) For transmitters operating in the 5725-5850 MHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17dBm/MHz (78.3dBuV/m); for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz (68.3dBuV/m). (2) Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table, | | | | |
| | Frequency | 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 | 30 | 30 | | |
| | 30-88 | 100 | 3 | | |
| | 88-216 | 150 | 3 | | |
| | 216-960 | 200 | 3 | | |
| | Above 960 | 500 | 3 | | |

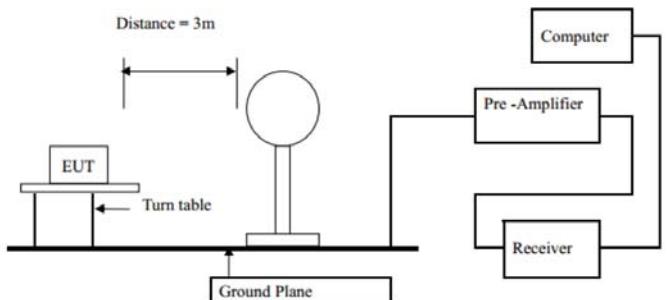
Note: The following formula is used to convert the EIRP to field strength.

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m}, \text{ where } P \text{ is the eirp (Watts)}$$

| EIRP(dBm) | Field Strength at 3m (dBuV/m) |
|-----------|-------------------------------|
| -17 | 78.3 |
| -27 | 68.3 |

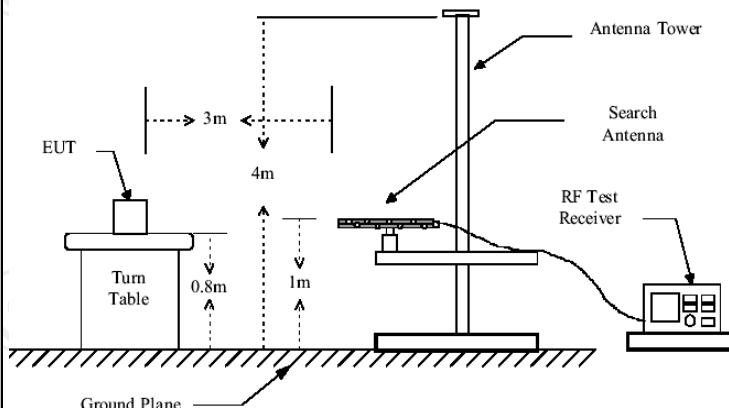
§ 15.407(b)(1)-(3) specifies that emissions outside of the respective U-NII bands are subject to a maximum emission limit of -27 dBm/MHz. § 15.407(b)(4) provides two requirement options for devices that operate in the 5.725 – 5.85 GHz band. If the option specified in § 15.407(b)(4)(ii) is exercised, then the procedures specified in Clause 11.11 of ANSI C63.10-2013 and/or in Section 11.0 of KDB Publication 558074 shall be utilized. In general, an out-of-band emission that complies with both the peak and average power limits of § 15.209 is not required to also satisfy the -27 dBm/MHz or -17 dBm/MHz maximum emission limit.

For radiated emissions below 30MHz

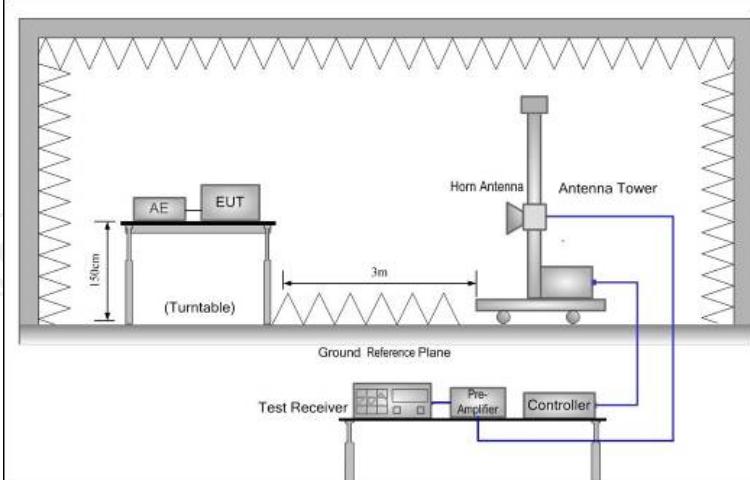


30MHz to 1GHz

Test setup:



Above 1GHz



| | |
|------------------------|--|
| Test Procedure: | <ol style="list-style-type: none"> 1. The testing follows FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01r03. Section G) Unwanted emissions measurement. 2. For the radiated emission test below 1GHz: The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. 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. For the radiated emission test above 1GHz: Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. 3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level 4. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB |
|------------------------|--|

| | |
|----------------------|---|
| | <p>lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.</p> <p>5. Use the following spectrum analyzer settings:</p> <ul style="list-style-type: none">(1) Span shall wide enough to fully capture the emission being measured;(2) Set RBW=100 kHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;(3) Set RBW = 1 MHz, VBW= 3MHz for $f > 1$ GHz for peak measurement. <p>For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. $VBW \geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.</p> <p>(4) A 5.8GHz high -PASS filter is used during radiated emissions above 1GHz measurement.</p> |
| Test results: | PASS |

6.9.2. Test Instruments

| Radiated Emission Test Site (966) | | | | |
|-----------------------------------|------------------------------------|------------|---------------|-----------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
| ESPI Test Receiver | ROHDE&SCHW ARZ | ESVD | 100008 | Aug. 11, 2017 |
| Spectrum Analyzer | ROHDE&SCHW ARZ | FSEM | 848597/001 | Aug. 11, 2017 |
| Spectrum Analyzer | Agilent | N9020A | MY49100060 | Aug. 12, 2017 |
| Pre-amplifier | EM Electronics Corporation CO.,LTD | EM30265 | 07032613 | Aug. 11, 2017 |
| Pre-amplifier | HP | 8447D | 2727A05017 | Aug. 11, 2017 |
| Loop antenna | ZHINAN | ZN30900A | 12024 | Aug. 13, 2017 |
| Broadband Antenna | Schwarzbeck | VULB9163 | 340 | Aug. 13, 2017 |
| Horn Antenna | Schwarzbeck | BBHA 9120D | 631 | Aug. 13, 2017 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | 373 | Aug. 13, 2017 |
| Coax cable | TCT | RE-low-01 | N/A | Aug. 11, 2017 |
| Coax cable | TCT | RE-high-02 | N/A | Aug. 11, 2017 |
| Coax cable | TCT | RE-low-03 | N/A | Aug. 11, 2017 |
| Coax cable | TCT | RE-High-04 | N/A | Aug. 11, 2017 |
| Antenna Mast | CCS | CC-A-4M | N/A | Aug. 12, 2017 |
| EMI Test Software | Shurples Technology | EZ-EMC | N/A | N/A |

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.9.3. Test Data

Please refer to following diagram for individual
Below 1GHz

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 25

Limit: FCC Part 15B Class B RE_3 m

Power: DC 7.6V

Humidity: 54 %

| No. | Mk. | Freq. MHz | Reading Level dBuV | Correct Factor dB | Measure- ment dBuV | Limit dBuV | Over dB | Antenna Height cm | | Table Degree | Comment |
|-----|----------|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|-------------------------|--------|-----------------|---------|
| | | | | | | | | Detector | degree | | |
| 1 | 67.3110 | 37.47 | -13.95 | 23.52 | 40.00 | -16.48 | QP | | 0 | | |
| 2 | 204.3052 | 35.21 | -11.58 | 23.63 | 43.50 | -19.87 | QP | | 0 | | |
| 3 | 252.2521 | 43.16 | -10.00 | 33.16 | 46.00 | -12.84 | QP | | 0 | | |
| 4 * | 320.3306 | 48.25 | -7.86 | 40.39 | 46.00 | -5.61 | QP | | 0 | | |
| 5 | 505.7891 | 31.48 | -2.69 | 28.79 | 46.00 | -17.21 | QP | | 0 | | |
| 6 | 899.9577 | 26.09 | 4.62 | 30.71 | 46.00 | -15.29 | QP | | 0 | | |

Vertical:



Site

Limit: FCC Part 15B Class B RE_3 m

 Polarization: **Vertical**

Power: DC 7.6V

Temperature: 25

Humidity: 54 %

| No. | Mk. | Freq. MHz | Reading Level | Correct Factor | Measure- ment | Limit | Over | Antenna Height cm | Table Degree | Comment |
|-----|-----|--------------|------------------|-------------------|------------------|-------|--------|-------------------------|-----------------|---------|
| | | | dBuV | dB | dBuV | dB | dB | | | |
| 1 | * | 46.0557 | 41.21 | -11.10 | 30.11 | 40.00 | -9.89 | QP | 0 | |
| 2 | | 67.3110 | 35.07 | -13.95 | 21.12 | 40.00 | -18.88 | QP | 0 | |
| 3 | | 121.4621 | 44.69 | -14.10 | 30.59 | 43.50 | -12.91 | QP | 0 | |
| 4 | | 157.5290 | 36.48 | -15.74 | 20.74 | 43.50 | -22.76 | QP | 0 | |
| 5 | | 322.5896 | 36.51 | -7.64 | 28.87 | 46.00 | -17.13 | QP | 0 | |
| 6 | | 749.6761 | 25.43 | 4.78 | 30.21 | 46.00 | -15.79 | QP | 0 | |

Note: 1. The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

2. Measurements were conducted in all three channels (high, middle, low), and the worst case Mode (Middle channel) was submitted only.

| Low channel: 5730 MHz | | | | | | | | | |
|-----------------------|---------------|---------------------------|-------------------------|--------------------------|---------------------|-------------------|---------------------------|-------------------------|-------------|
| Frequency (MHz) | Ant. Pol. H/V | Peak reading (dB μ V) | AV reading (dB μ V) | Correction Factor (dB/m) | Emission Level | | Peak limit (dB μ V/m) | AV limit (dB μ V/m) | Margin (dB) |
| | | | | | Peak (dB μ V/m) | AV (dB μ V/m) | | | |
| 11460 | H | 50.26 | --- | 1.18 | 51.44 | --- | 74 | 54 | -2.56 |
| 17190 | H | 41.74 | --- | 10.07 | 51.81 | --- | 74 | 54 | -2.19 |
| --- | H | --- | --- | --- | --- | --- | --- | --- | --- |
| 11460 | V | 50.01 | --- | 1.18 | 51.19 | --- | 74 | 54 | -2.81 |
| 17190 | V | 41.42 | --- | 10.07 | 51.49 | --- | 74 | 54 | -2.51 |
| --- | V | --- | --- | --- | --- | --- | --- | --- | --- |

| Middle channel: 5795MHz | | | | | | | | | |
|-------------------------|---------------|---------------------------|-------------------------|--------------------------|---------------------|-------------------|---------------------------|-------------------------|-------------|
| Frequency (MHz) | Ant. Pol. H/V | Peak reading (dB μ V) | AV reading (dB μ V) | Correction Factor (dB/m) | Emission Level | | Peak limit (dB μ V/m) | AV limit (dB μ V/m) | Margin (dB) |
| | | | | | Peak (dB μ V/m) | AV (dB μ V/m) | | | |
| 11590 | H | 49.07 | --- | 0.75 | 49.82 | --- | 74 | 54 | -4.18 |
| 17385 | H | 41.26 | --- | 9.87 | 51.13 | --- | 74 | 54 | -2.87 |
| --- | H | --- | --- | --- | --- | --- | --- | --- | --- |
| 11590 | V | 50.18 | --- | 0.75 | 50.93 | --- | 74 | 54 | -3.07 |
| 17385 | V | 40.85 | --- | 9.87 | 50.72 | --- | 74 | 54 | -3.28 |
| --- | V | --- | --- | --- | --- | --- | --- | --- | --- |

| High channel: 5845 MHz | | | | | | | | | |
|------------------------|---------------|---------------------------|-------------------------|--------------------------|---------------------|-------------------|---------------------------|-------------------------|-------------|
| Frequency (MHz) | Ant. Pol. H/V | Peak reading (dB μ V) | AV reading (dB μ V) | Correction Factor (dB/m) | Emission Level | | Peak limit (dB μ V/m) | AV limit (dB μ V/m) | Margin (dB) |
| | | | | | Peak (dB μ V/m) | AV (dB μ V/m) | | | |
| 11690 | H | 50.58 | --- | 0.97 | 51.55 | --- | 74 | 54 | -2.45 |
| 17535 | H | 42.09 | --- | 9.83 | 51.92 | --- | 74 | 54 | -2.08 |
| --- | H | --- | --- | --- | --- | --- | --- | --- | --- |
| 11690 | V | 50.31 | --- | 0.97 | 51.28 | --- | 74 | 54 | -2.72 |
| 17535 | V | 40.53 | --- | 9.83 | 50.36 | --- | 74 | 54 | -3.64 |
| --- | V | --- | --- | --- | --- | --- | --- | --- | --- |

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dB μ V/m)-Average limit (dB μ V/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 40GHz.
5. Data of measurement shown “---”in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

Appendix A: Photographs of Test Setup

Refer to test report TCT161201E014

Appendix B: Photographs of EUT

Refer to test report TCT161201E014

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