



**SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch**

No. 1 Workshop, M-10, Middle section, Science & Technology Park,
Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053
Fax: +86 (0) 755 2671 0594
Email: ee.shenzhen@sgs.com

Report No.: SZEM180500412604
Page: 1 of 29

TEST REPORT

Application No.: SZEM1805004126CR
Applicant: Scosche Industries Inc
Address of Applicant: 1550 Pacific Ave, Oxnard, California, United States, 93033
Manufacturer: Scosche Industries Inc
Address of Manufacturer: 1550 Pacific Ave, Oxnard, California, United States, 93033
Factory: Scosche Industries Inc
Equipment Under Test (EUT):
EUT Name: Armband Heart Rate Monitor
Model No.: RTHM24
FCC ID: IKQRTHM24
Standard(s) : 47 CFR Part 15, Subpart C 15.249
Date of Receipt: 2018-05-17
Date of Test: 2018-05-22 to 2018-05-24
Date of Issue: 2018-05-28

| | |
|---------------------|--------------|
| Test Result: | Pass* |
|---------------------|--------------|

* In the configuration tested, the EUT complied with the standards specified above.



Keny Xu
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Documents.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.



| Revision Record | | | | |
|------------------------|----------------|-------------|-----------------|---------------|
| Version | Chapter | Date | Modifier | Remark |
| 01 | | 2018-05-28 | | Original |
| | | | | |
| | | | | |

| Authorized for issue by: | | | | |
|---------------------------------|--|---|--|--|
| | |  | | |
| | | <hr/> | | |
| | | Peter Geng /Project Engineer | | |
| | |  | | |
| | | <hr/> | | |
| | | Eric Fu /Reviewer | | |



2 Test Summary

| Radio Spectrum Technical Requirement | | | | |
|--------------------------------------|----------------------------------|--------|----------------------------------|--------|
| Item | Standard | Method | Requirement | Result |
| Antenna Requirement | 47 CFR Part 15, Subpart C 15.249 | N/A | 47 CFR Part 15, Subpart C 15.203 | Pass |

| Radio Spectrum Matter Part | | | | |
|--|----------------------------------|--|---|--------|
| Item | Standard | Method | Requirement | Result |
| 20dB Bandwidth | 47 CFR Part 15, Subpart C 15.249 | ANSI C63.10 (2013) Section 6.9 | 47 CFR Part 15, Subpart C 15.215 | Pass |
| Field Strength of the Fundamental Signal (15.249(a)) | 47 CFR Part 15, Subpart C 15.249 | ANSI C63.10 (2013) Section 6.5&6.6 | 47 CFR Part 15, Subpart C 15.249(a) | Pass |
| Restricted Band Around Fundamental Frequency | 47 CFR Part 15, Subpart C 15.249 | ANSI C63.10 (2013) Section 6.4&6.5&6.6 | 47 CFR Part 15, Subpart C 15.205 & 15.249(d) & 15.209 | Pass |
| Radiated Emissions | 47 CFR Part 15, Subpart C 15.249 | ANSI C63.10 (2013) Section 6.4&6.5&6.6 | 47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d) | Pass |



3 Contents

| | Page |
|--|-----------|
| 1 COVER PAGE | 1 |
| 2 TEST SUMMARY | 3 |
| 3 CONTENTS | 4 |
| 4 GENERAL INFORMATION | 5 |
| 4.1 DETAILS OF E.U.T. | 5 |
| 4.2 DESCRIPTION OF SUPPORT UNITS | 5 |
| 4.3 MEASUREMENT UNCERTAINTY | 5 |
| 4.4 TEST LOCATION | 6 |
| 4.5 TEST FACILITY | 6 |
| 4.6 DEVIATION FROM STANDARDS | 6 |
| 4.7 ABNORMALITIES FROM STANDARD CONDITIONS | 6 |
| 5 EQUIPMENT LIST | 7 |
| 6 RADIO SPECTRUM TECHNICAL REQUIREMENT | 10 |
| 6.1 ANTENNA REQUIREMENT | 10 |
| 6.1.1 <i>Test Requirement:</i> | 10 |
| 6.1.2 <i>Conclusion</i> | 10 |
| 7 RADIO SPECTRUM MATTER TEST RESULTS | 11 |
| 7.1 20dB BANDWIDTH | 11 |
| 7.1.1 <i>E.U.T. Operation</i> | 11 |
| 7.1.2 <i>Test Setup Diagram</i> | 11 |
| 7.1.3 <i>Measurement Procedure and Data</i> | 11 |
| 7.2 FIELD STRENGTH OF THE FUNDAMENTAL SIGNAL (15.249(A)) | 13 |
| 7.2.1 <i>E.U.T. Operation</i> | 13 |
| 7.2.2 <i>Test Setup Diagram</i> | 13 |
| 7.2.3 <i>Measurement Procedure and Data</i> | 14 |
| 7.3 RESTRICTED BAND AROUND FUNDAMENTAL FREQUENCY | 17 |
| 7.3.1 <i>E.U.T. Operation</i> | 17 |
| 7.3.2 <i>Test Setup Diagram</i> | 17 |
| 7.3.3 <i>Measurement Procedure and Data</i> | 18 |
| 7.4 RADIATED EMISSIONS | 21 |
| 7.4.1 <i>E.U.T. Operation</i> | 22 |
| 7.4.2 <i>Test Setup Diagram</i> | 22 |
| 7.4.3 <i>Measurement Procedure and Data</i> | 22 |
| 8 PHOTOGRAPHS | 28 |
| 8.1 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS TEST SETUP | 28 |
| 8.2 RADIATED SPURIOUS EMISSIONS TEST SETUP | 28-29 |

4 General Information

4.1 Details of E.U.T.

| | |
|---------------------|--|
| Power supply: | BATTERY: 3.7V Li-ion battery 160mAh 0.6Wh DC 5V POWERED BY USB PORT |
| USB cable: | USB CABEL:110CM UNSHIELDED |
| Antenna Type: | Micro strip |
| Antenna Gain: | 0dBi |
| ANT+ | |
| Modulation Type | GFSK |
| Number of Channels | 1 |
| Operation Frequency | 2457MHz |

4.2 Description of Support Units

None.

4.3 Measurement Uncertainty

| No. | Item | Measurement Uncertainty |
|-----|---------------------------------|-------------------------|
| 1 | Radio Frequency | 7.25×10^{-8} |
| 2 | Duty cycle | 0.37% |
| 3 | Occupied Bandwidth | 3% |
| 4 | RF conducted power | 0.75dB |
| 5 | RF power density | 2.84dB |
| 6 | Conducted Spurious emissions | 0.75dB |
| 7 | RF Radiated power | 4.5dB (below 1GHz) |
| | | 4.8dB (above 1GHz) |
| 8 | Radiated Spurious emission test | 4.5dB (Below 1GHz) |
| | | 4.8dB (Above 1GHz) |
| 9 | Temperature test | 1 °C |
| 10 | Humidity test | 3% |
| 11 | Supply voltages | 1.5% |
| 12 | Time | 3% |



4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China. 518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

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

- **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

- **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

- **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



5 Equipment List

| Minimum 6dB Bandwidth | | | | | |
|-----------------------|----------------------|-------------------------|--------------|------------|--------------|
| Equipment | Manufacturer | Model No | Inventory No | Cal Date | Cal Due Date |
| DC Power Supply | ZhaoXin | RXN-305D | SEM011-02 | 2017-09-27 | 2018-09-26 |
| Spectrum Analyzer | Rohde & Schwarz | FSP | SEM004-06 | 2017-09-27 | 2018-09-26 |
| Measurement Software | JS Tonscend | JS1120-2 BT/WIFI V2. | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM031-02 | 2017-07-13 | 2018-07-12 |
| Attenuator | Weinschel Associates | WA41 | SEM021-09 | N/A | N/A |
| Signal Generator | KEYSIGHT | N5173B | SEM006-05 | 2017-09-27 | 2018-09-26 |
| Power Meter | Rohde & Schwarz | NRVS | SEM014-02 | 2017-09-27 | 2018-09-26 |

| Radiated Emissions which fall in the restricted bands | | | | | |
|---|------------------------------------|-------------------|--------------|------------|--------------|
| Equipment | Manufacturer | Model No | Inventory No | Cal Date | Cal Due Date |
| 3m Semi-Anechoic Chamber | AUDIX | N/A | SEM001-02 | 2018-03-13 | 2021-03-12 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM026-01 | 2017-07-13 | 2018-07-12 |
| Spectrum Analyzer | Rohde & Schwarz | FSU43 | SEM004-08 | 2018-04-02 | 2019-04-01 |
| BiConiLog Antenna (26-3000MHz) | ETS-Lindgren | 3142C | SEM003-01 | 2017-06-27 | 2020-06-26 |
| Horn Antenna (1-18GHz) | Rohde & Schwarz | HF907 | SEM003-07 | 2018-04-13 | 2021-04-12 |
| Horn Antenna (15GHz-40GHz) | Schwarzbeck | BBHA 9170 | SEM003-15 | 2017-10-17 | 2020-10-16 |
| Pre-amplifier (0.1-1300MHz) | HP | 8447D | SEM005-02 | 2017-09-27 | 2018-09-26 |
| Low Noise Amplifier (100MHz-18GHz) | Black Diamond Series | BDLNA-0118-352810 | SEM005-05 | 2017-09-27 | 2018-09-27 |
| Pre-amplifier (18-26GHz) | Rohde & Schwarz | CH14-H052 | SEM005-17 | 2018-04-02 | 2019-04-01 |
| Pre-amplifier (26GHz-40GHz) | Compliance Directions Systems Inc. | PAP-2640-50 | SEM005-08 | 2018-04-02 | 2019-04-01 |
| DC Power Supply | Zhao Xin | RXN-305D | SEM011-02 | 2017-09-27 | 2018-09-26 |
| Active Loop Antenna | ETS-Lindgren | 6502 | SEM003-08 | 2017-08-22 | 2020-08-21 |
| Band filter | N/A | N/A | SEM023-01 | N/A | N/A |



| Radiated Spurious Emissions | | | | | |
|------------------------------------|------------------------------------|-------------------|--------------|------------|--------------|
| Equipment | Manufacturer | Model No | Inventory No | Cal Date | Cal Due Date |
| 3m Semi-Anechoic Chamber | AUDIX | N/A | SEM001-02 | 2018-03-13 | 2021-03-12 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM026-01 | 2017-07-13 | 2018-07-12 |
| Spectrum Analyzer | Rohde & Schwarz | FSU43 | SEM004-08 | 2018-04-02 | 2019-04-01 |
| BiConiLog Antenna (26-3000MHz) | ETS-Lindgren | 3142C | SEM003-01 | 2017-06-27 | 2020-06-26 |
| Horn Antenna (1-18GHz) | Rohde & Schwarz | HF907 | SEM003-07 | 2018-04-13 | 2021-04-12 |
| Horn Antenna (15GHz-40GHz) | Schwarzbeck | BBHA 9170 | SEM003-15 | 2017-10-17 | 2020-10-16 |
| Pre-amplifier (0.1-1300MHz) | HP | 8447D | SEM005-02 | 2017-09-27 | 2018-09-26 |
| Low Noise Amplifier (100MHz-18GHz) | Black Diamond Series | BDLNA-0118-352810 | SEM005-05 | 2017-09-27 | 2018-09-27 |
| Pre-amplifier (18-26GHz) | Rohde & Schwarz | CH14-H052 | SEM005-17 | 2018-04-02 | 2019-04-01 |
| Pre-amplifier (26GHz-40GHz) | Compliance Directions Systems Inc. | PAP-2640-50 | SEM005-08 | 2018-04-02 | 2019-04-01 |
| DC Power Supply | Zhao Xin | RXN-305D | SEM011-02 | 2017-09-27 | 2018-09-26 |
| Active Loop Antenna | ETS-Lindgren | 6502 | SEM003-08 | 2017-08-22 | 2020-08-21 |
| Band filter | N/A | N/A | SEM023-01 | N/A | N/A |

| Radiated Emissions (30MHz-1GHz) | | | | | |
|---------------------------------|----------------------|-----------------|--------------|------------|--------------|
| Equipment | Manufacturer | Model No | Inventory No | Cal Date | Cal Due Date |
| 3m Semi-Anechoic Chamber | ETS-LINDGREN | N/A | SEM001-01 | 2017-08-05 | 2020-08-04 |
| Measurement Software | AUDIX | e3 V8.2014-6-27 | N/A | N/A | N/A |
| Coaxial Cable | SGS | N/A | SEM025-01 | 2017-07-13 | 2018-07-12 |
| EMI Test Receiver | Agilent Technologies | N9038A | SEM004-05 | 2017-09-27 | 2018-09-26 |
| BiConiLog Antenna (26-3000MHz) | ETS-LINDGREN | 3142C | SEM003-01 | 2017-06-27 | 2020-06-26 |
| Pre-amplifier (0.1-1300MHz) | Agilent Technologies | 8447D | SEM005-01 | 2018-04-02 | 2019-04-01 |



**SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch**

Report No.: SZEM180500412604

Page: 9 of 29

| General used equipment | | | | | |
|---------------------------------|---|-----------------|---------------------|-----------------|---------------------|
| Equipment | Manufacturer | Model No | Inventory No | Cal Date | Cal Due Date |
| Humidity/ Temperature Indicator | Shanghai Meteorological Industry Factory | ZJ1-2B | SEM002-03 | 2017-09-29 | 2018-09-28 |
| Humidity/ Temperature Indicator | Shanghai Meteorological Industry Factory | ZJ1-2B | SEM002-04 | 2017-09-29 | 2018-09-28 |
| Humidity/ Temperature Indicator | Mingle | N/A | SEM002-08 | 2017-09-29 | 2018-09-28 |
| Barometer | Changchun Meteorological Industry Factory | DYM3 | SEM002-01 | 2018-04-08 | 2019-04-07 |

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(c)

6.1.2 Conclusion

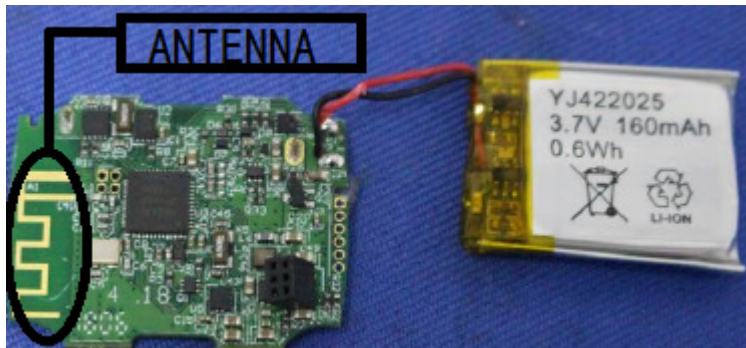
Standard Requirement:

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.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:



The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.

7 Radio Spectrum Matter Test Results

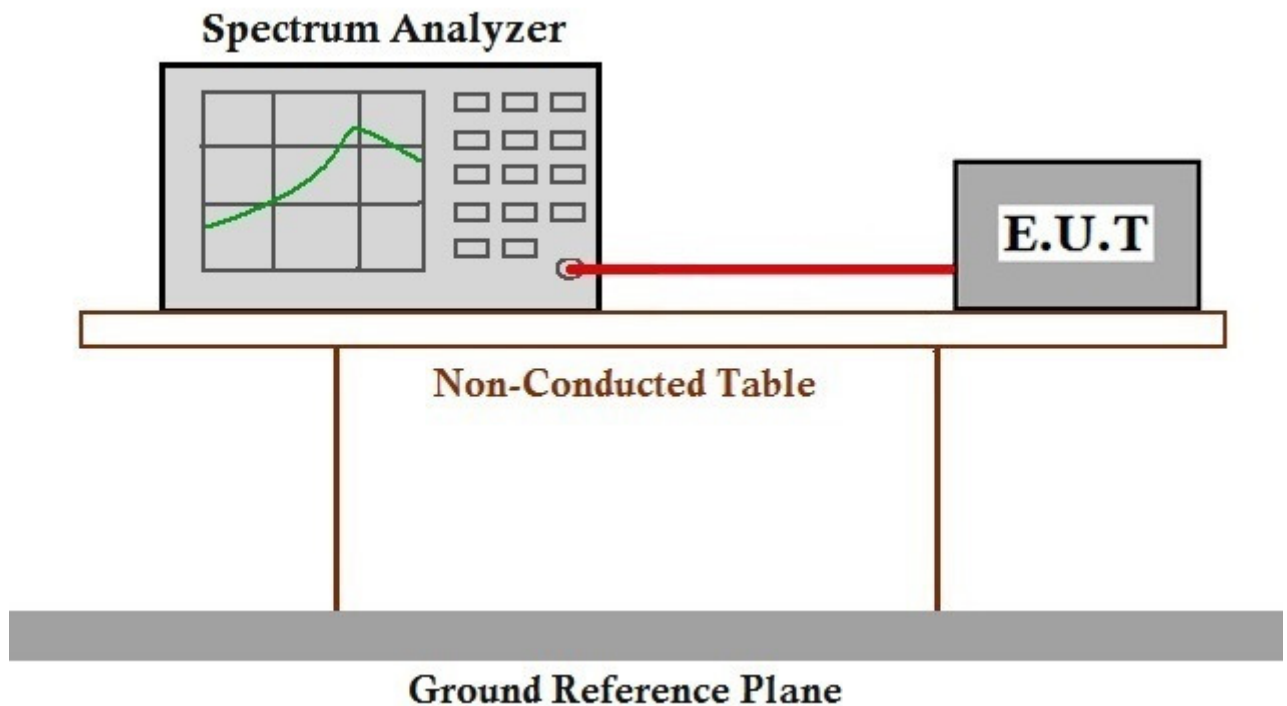
7.1 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.215
Test Method: ANSI C63.10 (2013) Section 6.9
Limit: N/A

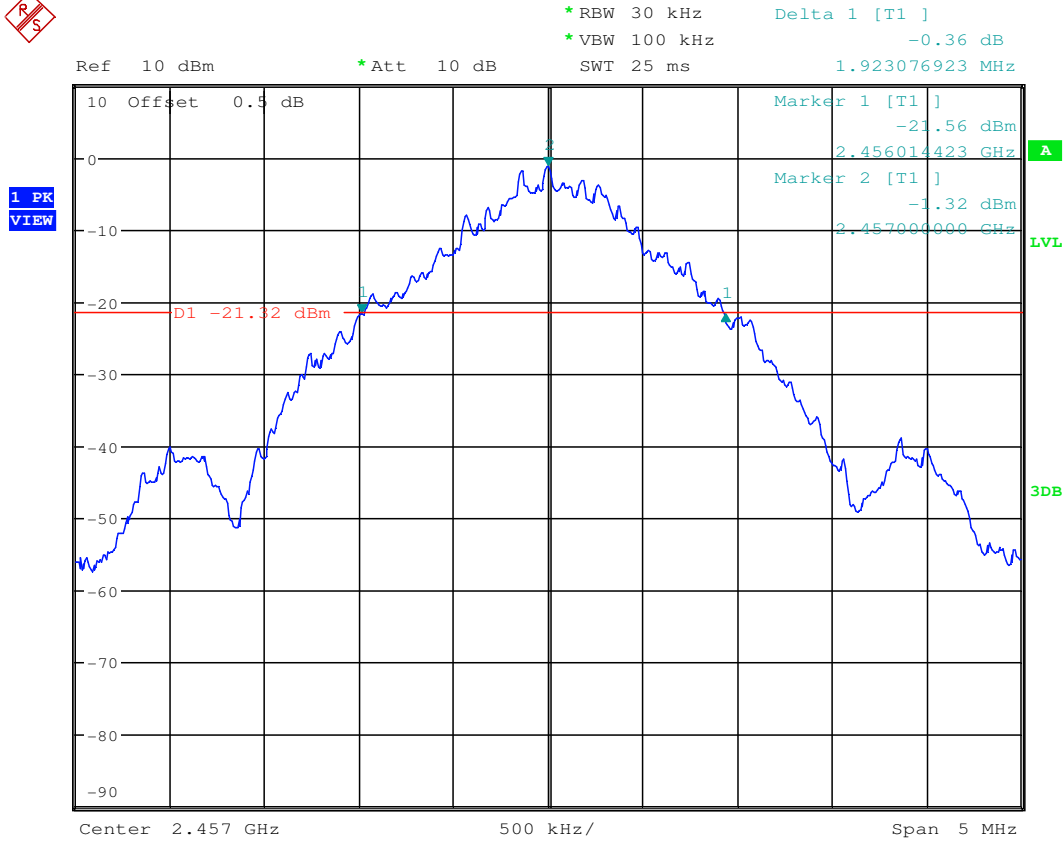
7.1.1 E.U.T. Operation

Operating Environment:
Temperature: 24.5 °C Humidity: 55.2 % RH Atmospheric Pressure: 1020 mbar
Test mode f: TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.1.2 Test Setup Diagram



7.1.3 Measurement Procedure and Data



7.2 Field Strength of the Fundamental Signal (15.249(a))

Test Requirement 47 CFR Part 15, Subpart C 15.249(a)
 Test Method: ANSI C63.10 (2013) Section 6.5&6.6
 Measurement Distance: 3m
 Limit:

| Frequency | Limit (dBuV/m @3m) | Remark |
|-------------------|--------------------|---------------|
| 2400MHz-2483.5MHz | 94.0 | Average Value |
| | 114.0 | Peak Value |

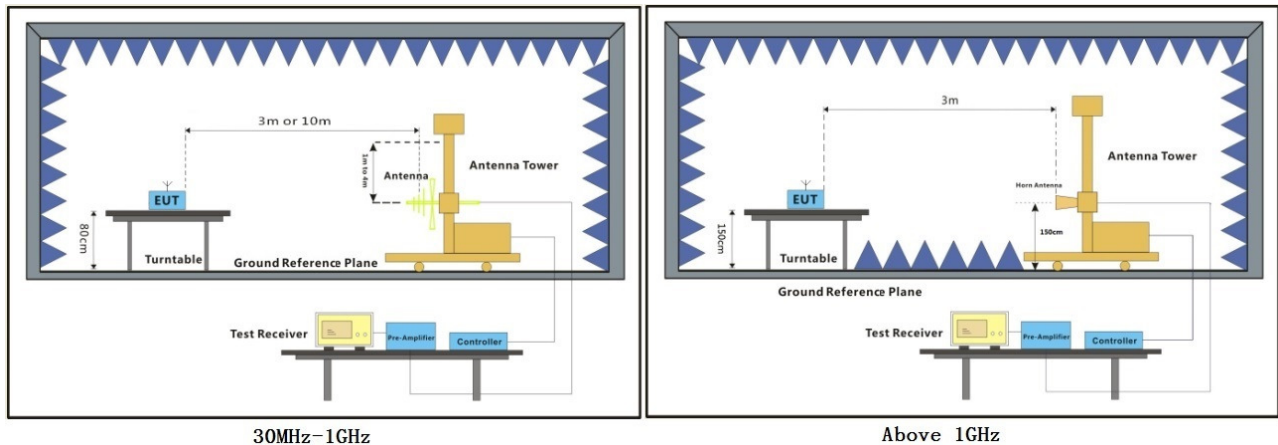
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 21.9 °C Humidity: 58 % RH Atmospheric Pressure: 1020 mbar

Test mode: f: TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.2.2 Test Setup Diagram



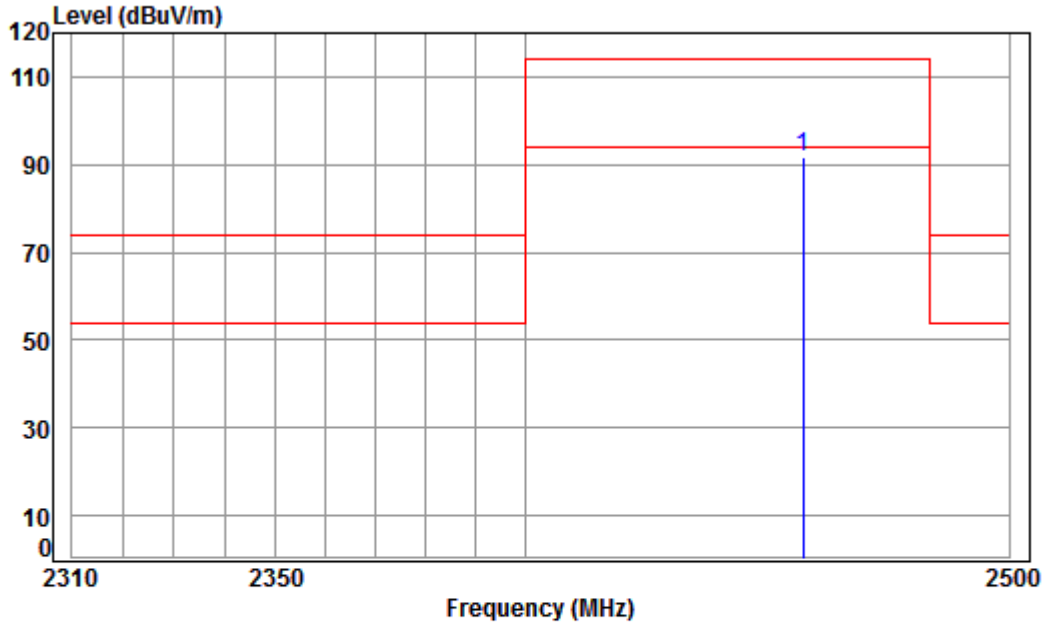
7.2.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



Mode:f; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



Condition: 3m HORIZONTAL

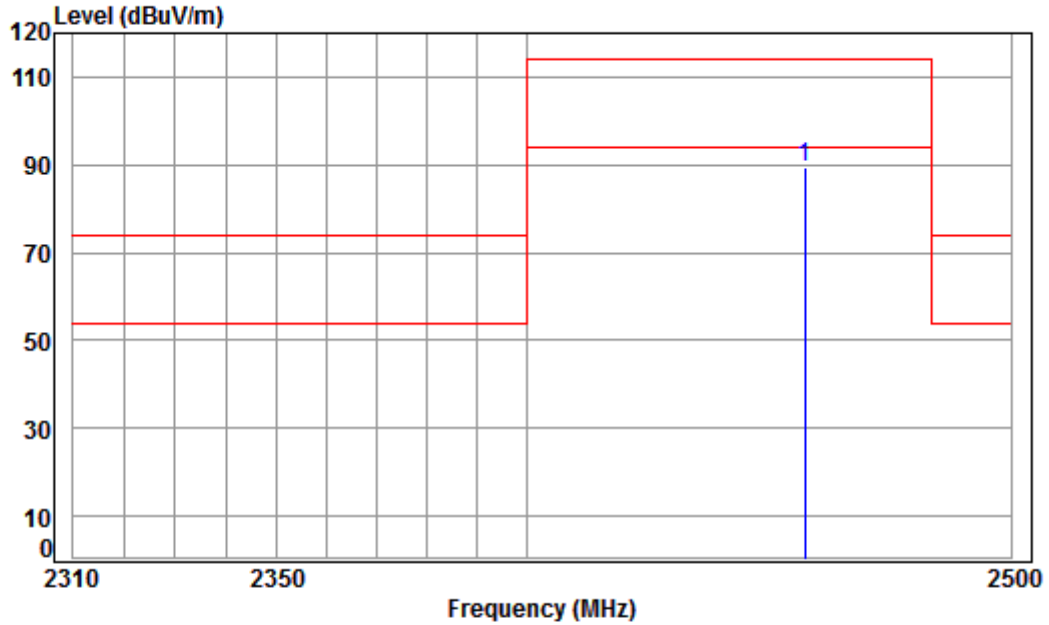
Job No : 04126CR

Mode : 2457 Band edge

| | Cable | Ant | Preamp | Read | Limit | Over | | |
|---------------|-------|--------|--------|-------|--------|--------|--------|--------|
| Freq | Loss | Factor | Factor | Level | Level | Line | Limit | Remark |
| MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 pp 2457.000 | 5.56 | 28.63 | 41.90 | 99.65 | 91.94 | 114.00 | -22.06 | peak |



Mode:f; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



Condition: 3m VERTICAL

Job No : 04126CR

Mode : 2457 Band edge

| | Cable | Ant | Preamp | Read | Limit | Over | | |
|---------------|-------|--------|--------|-------|--------|--------|--------|--------|
| Freq | Loss | Factor | Factor | Level | Level | Line | Limit | Remark |
| MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 pp 2457.000 | 5.56 | 28.63 | 41.90 | 97.01 | 89.30 | 114.00 | -24.70 | peak |

7.3 Restricted Band Around Fundamental Frequency

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.249(d) & 15.209
 Test Method: ANSI C63.10 (2013) Section 6.4&6.5&6.6
 Measurement Distance: 3m
 Limit:

| Frequency | Limit (dBuV/m @3m) | Remark |
|---------------|--------------------|------------------|
| 30MHz-88MHz | 40.0 | Quasi-peak Value |
| 88MHz-216MHz | 43.5 | Quasi-peak Value |
| 216MHz-960MHz | 46.0 | Quasi-peak Value |
| 960MHz-1GHz | 54.0 | Quasi-peak Value |
| Above 1GHz | 54.0 | Average Value |
| Above 1GHz | 74.0 | Peak Value |

Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

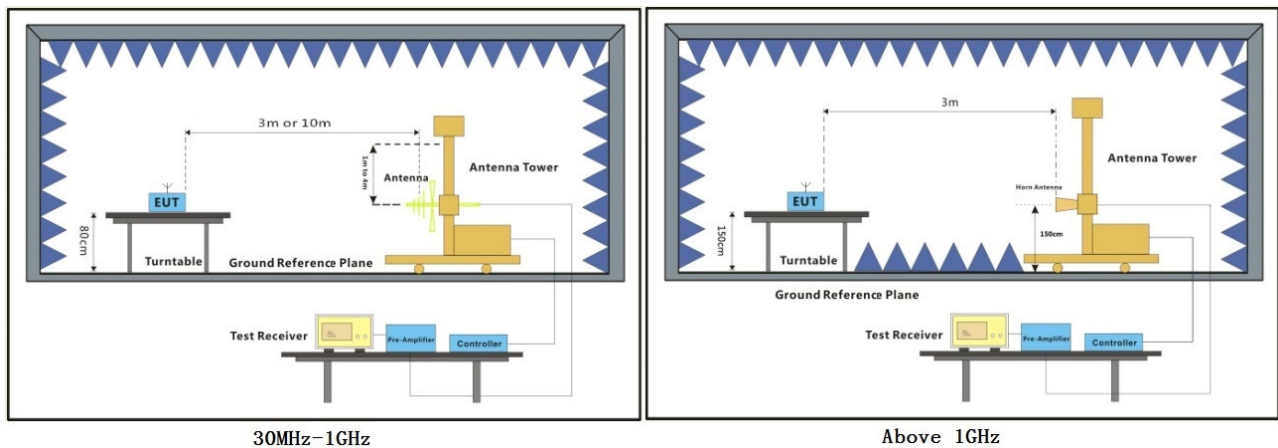
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 21.9 °C Humidity: 56 % RH Atmospheric Pressure: 1020 mbar

Test mode: f: TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.3.2 Test Setup Diagram





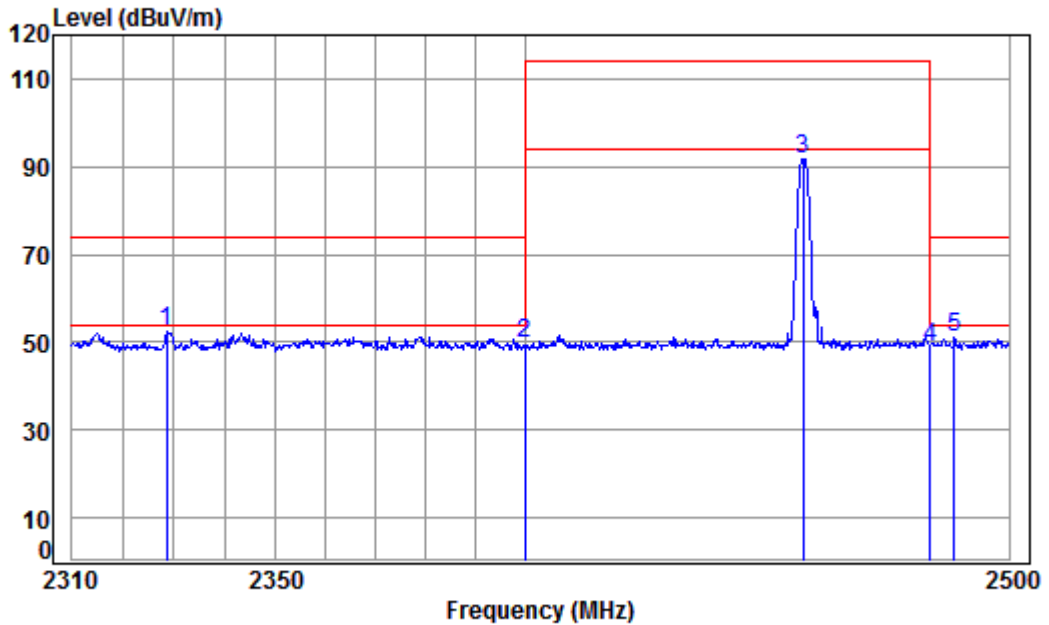
7.3.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



Mode:f; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle



Condition: 3m HORIZONTAL

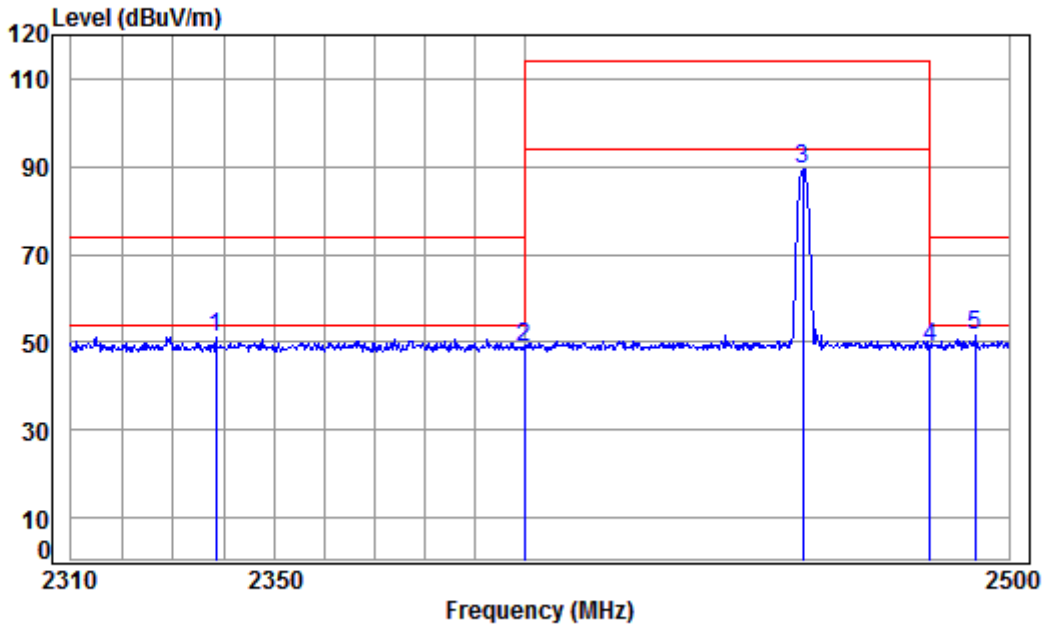
Job No : 04126CR

Mode : 2457 Band edge

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Limit Level | Limit Line | Over Limit | Remark |
|------|----------|------------|------------|---------------|------------|-------------|------------|------------|--------|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 pp | 2328.515 | 5.39 | 28.41 | 41.85 | 60.60 | 52.55 | 74.00 | -21.45 | peak |
| 2 | 2400.000 | 5.47 | 28.52 | 41.87 | 57.55 | 49.67 | 74.00 | -24.33 | peak |
| 3 | 2457.000 | 5.56 | 28.63 | 41.90 | 99.65 | 91.94 | 114.00 | -22.06 | peak |
| 4 | 2483.500 | 5.60 | 28.67 | 41.91 | 56.64 | 49.00 | 74.00 | -25.00 | peak |
| 5 | 2488.565 | 5.61 | 28.68 | 41.91 | 58.55 | 50.93 | 74.00 | -23.07 | peak |



Mode:f; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



Condition: 3m VERTICAL

Job No : 04126CR

Mode : 2457 Band edge

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Limit Level | Limit Line | Over Limit | Remark |
|------|----------|------------|------------|---------------|------------|-------------|------------|------------|--------|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 2338.476 | 5.40 | 28.43 | 41.85 | 59.11 | 51.09 | 74.00 | -22.91 | peak |
| 2 | 2400.000 | 5.47 | 28.52 | 41.87 | 56.55 | 48.67 | 74.00 | -25.33 | peak |
| 3 | 2457.000 | 5.56 | 28.63 | 41.90 | 97.01 | 89.30 | 114.00 | -24.70 | peak |
| 4 | 2483.500 | 5.60 | 28.67 | 41.91 | 56.48 | 48.84 | 74.00 | -25.16 | peak |
| 5 pp | 2492.896 | 5.61 | 28.69 | 41.91 | 59.17 | 51.56 | 74.00 | -22.44 | peak |



7.4 Radiated Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.249 (a),(d)

Test Method: ANSI C63.10 (2013) Section 6.4&6.5&6.6

Limit:

| Frequency(MHz) | Field strength (microvolts/meter) | Limit (dBuV/m) | Detector | 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 | 40.0 | QP | 3 |
| 88-216 | 150 | 43.5 | QP | 3 |
| 216-960 | 200 | 46.0 | QP | 3 |
| 960-1000 | 500 | 54.0 | QP | 3 |
| Above 1000 | 500 | 54.0 | AV | 3 |

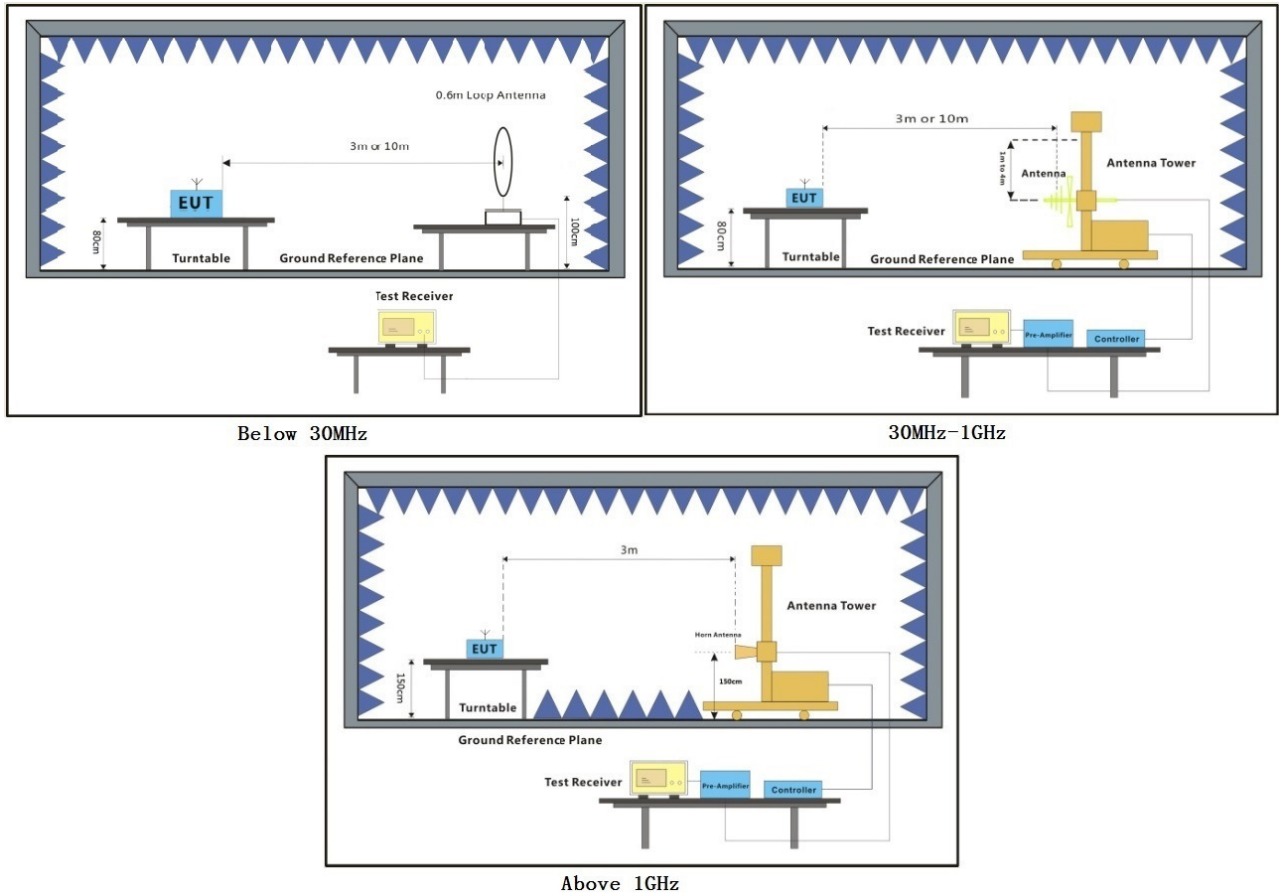
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 21.8 °C Humidity: 58 % RH Atmospheric Pressure: 1020 mbar

Test mode: f: TX mode_Keep the EUT in continuously transmitting mode with GFSK modulation

7.4.2 Test Setup Diagram

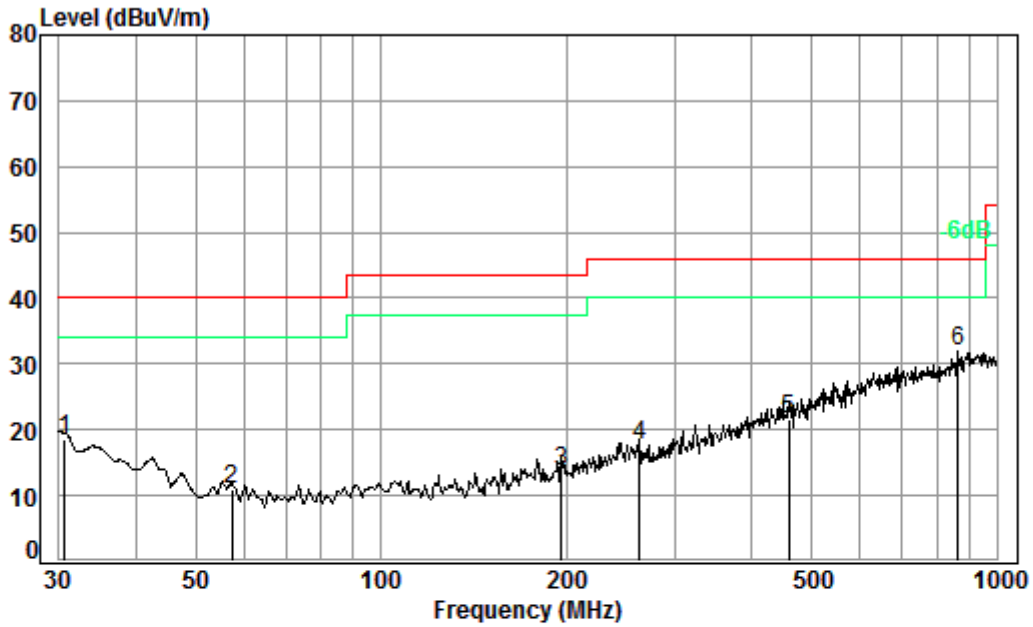


7.4.3 Measurement Procedure and Data

For testing performed with the loop antenna, the center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane. Only the worst position of vertical was shown in the report.

Radiated emission below 1GHz

Mode:f; Polarization:Horizontal

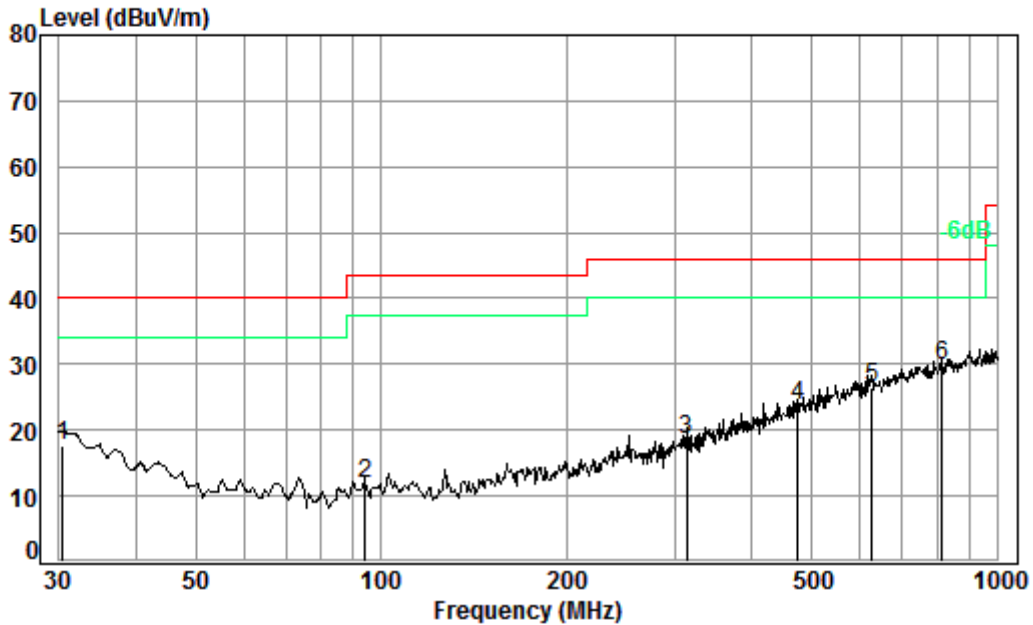


Condition: 3m HORIZONTAL
 Job No. : 04126CR
 Test mode: f

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit |
|------|--------|------------|------------|---------------|------------|--------|------------|------------|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 30.64 | 0.60 | 22.13 | 27.67 | 23.42 | 18.48 | 40.00 | -21.52 |
| 2 | 57.19 | 0.80 | 13.46 | 27.57 | 24.40 | 11.09 | 40.00 | -28.91 |
| 3 | 196.51 | 1.39 | 16.40 | 27.53 | 23.57 | 13.83 | 43.50 | -29.67 |
| 4 | 262.90 | 1.74 | 19.06 | 27.54 | 24.29 | 17.55 | 46.00 | -28.45 |
| 5 | 459.11 | 2.45 | 23.76 | 27.82 | 23.10 | 21.49 | 46.00 | -24.51 |
| 6 pp | 866.09 | 3.47 | 29.38 | 27.19 | 26.33 | 31.99 | 46.00 | -14.01 |



Mode:f; Polarization: Vertical



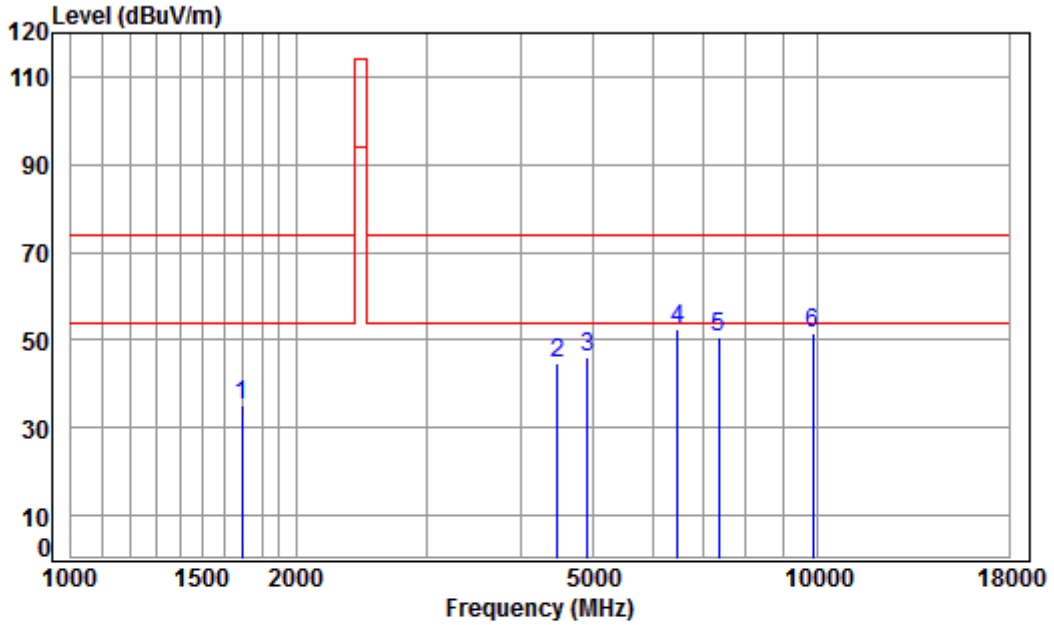
Condition: 3m VERTICAL
Job No. : 04126CR
Test mode: f

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit |
|------|--------|------------|------------|---------------|------------|--------|------------|------------|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB |
| 1 | 30.42 | 0.60 | 22.26 | 27.67 | 22.57 | 17.76 | 40.00 | -22.24 |
| 2 | 94.10 | 1.14 | 13.48 | 27.51 | 24.69 | 11.80 | 43.50 | -31.70 |
| 3 | 313.28 | 1.94 | 20.02 | 27.57 | 24.02 | 18.41 | 46.00 | -27.59 |
| 4 | 475.50 | 2.51 | 24.10 | 27.85 | 24.82 | 23.58 | 46.00 | -22.42 |
| 5 | 627.27 | 2.76 | 26.97 | 27.66 | 24.31 | 26.38 | 46.00 | -19.62 |
| 6 pp | 815.97 | 3.27 | 28.72 | 27.36 | 25.26 | 29.89 | 46.00 | -16.11 |



Transmitter emission above 1GHz

Mode:f; Polarization:Horizontal; Modulation:GFSK; ; Channel:middle

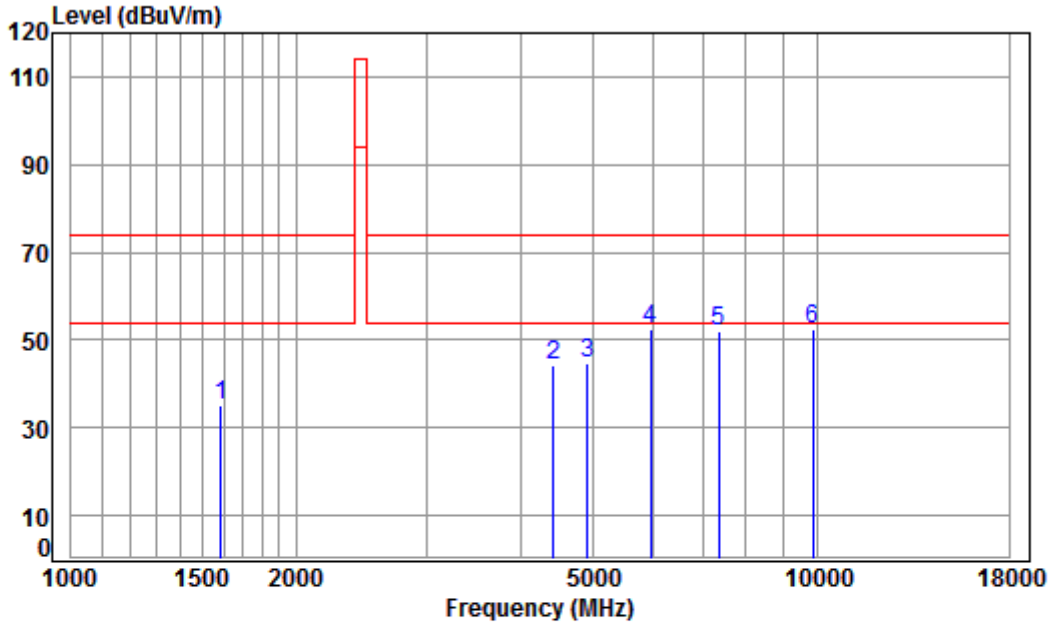


Condition: 3m HORIZONTAL
Job No : 04126CR
Mode : 2457 TX SE

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Level | Limit Line | Over Limit | Remark |
|------|----------|------------|------------|---------------|------------|--------|------------|------------|--------|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | |
| 1 | 1692.231 | 5.24 | 26.64 | 41.53 | 44.72 | 35.07 | 74.00 | -38.93 | peak |
| 2 | 4482.150 | 7.54 | 33.57 | 42.41 | 46.18 | 44.88 | 74.00 | -29.12 | peak |
| 3 | 4914.000 | 8.00 | 34.10 | 42.49 | 46.25 | 45.86 | 74.00 | -28.14 | peak |
| 4 pp | 6488.754 | 11.52 | 35.59 | 41.22 | 46.36 | 52.25 | 74.00 | -21.75 | peak |
| 5 | 7371.000 | 10.03 | 36.20 | 40.60 | 44.92 | 50.55 | 74.00 | -23.45 | peak |
| 6 | 9828.000 | 10.86 | 37.80 | 37.43 | 40.23 | 51.46 | 74.00 | -22.54 | peak |



Mode:f; Polarization:Vertical; Modulation:GFSK; ; Channel:middle



Condition: 3m VERTICAL
Job No : 04126CR
Mode : 2457 TX SE

| | Freq | Cable Loss | Ant Factor | Preamp Factor | Read Level | Limit Level | Over Limit | Remark |
|------|----------|------------|------------|---------------|------------|-------------|------------|-------------|
| | MHz | dB | dB/m | dB | dBuV | dBuV/m | dB | |
| 1 | 1587.975 | 5.37 | 26.20 | 41.46 | 44.94 | 35.05 | 74.00 | -38.95 peak |
| 2 | 4417.841 | 7.47 | 33.46 | 42.40 | 45.87 | 44.40 | 74.00 | -29.60 peak |
| 3 | 4914.000 | 8.00 | 34.10 | 42.49 | 45.01 | 44.62 | 74.00 | -29.38 peak |
| 4 pp | 5967.033 | 10.46 | 35.07 | 41.63 | 48.78 | 52.68 | 74.00 | -21.32 peak |
| 5 | 7371.000 | 10.03 | 36.20 | 40.60 | 46.33 | 51.96 | 74.00 | -22.04 peak |
| 6 | 9828.000 | 10.86 | 37.80 | 37.43 | 41.04 | 52.27 | 74.00 | -21.73 peak |



Remark:

1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

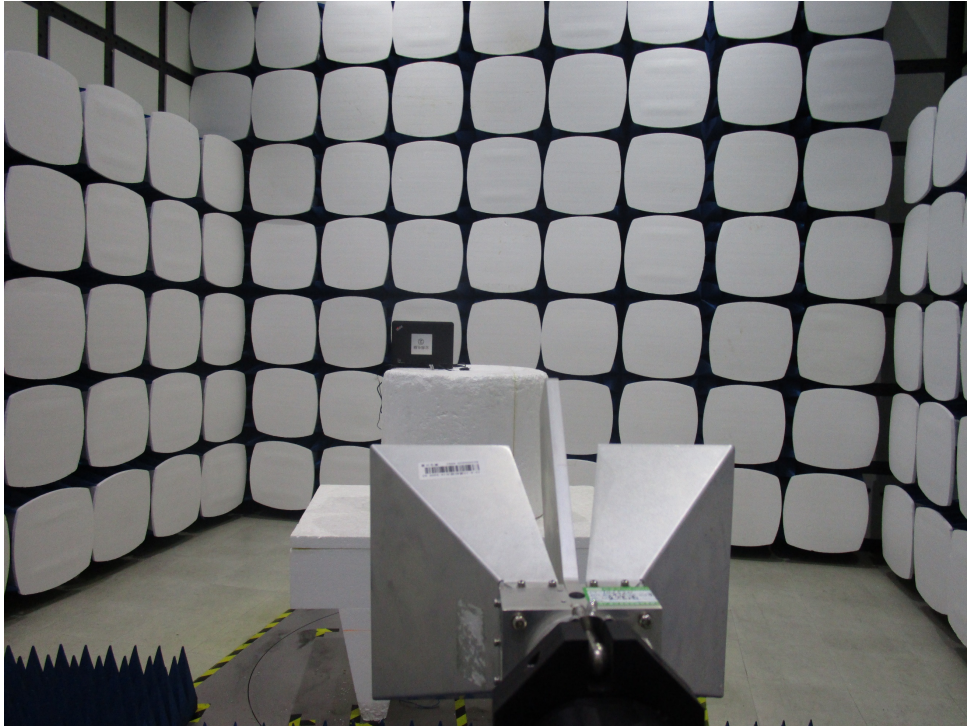
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

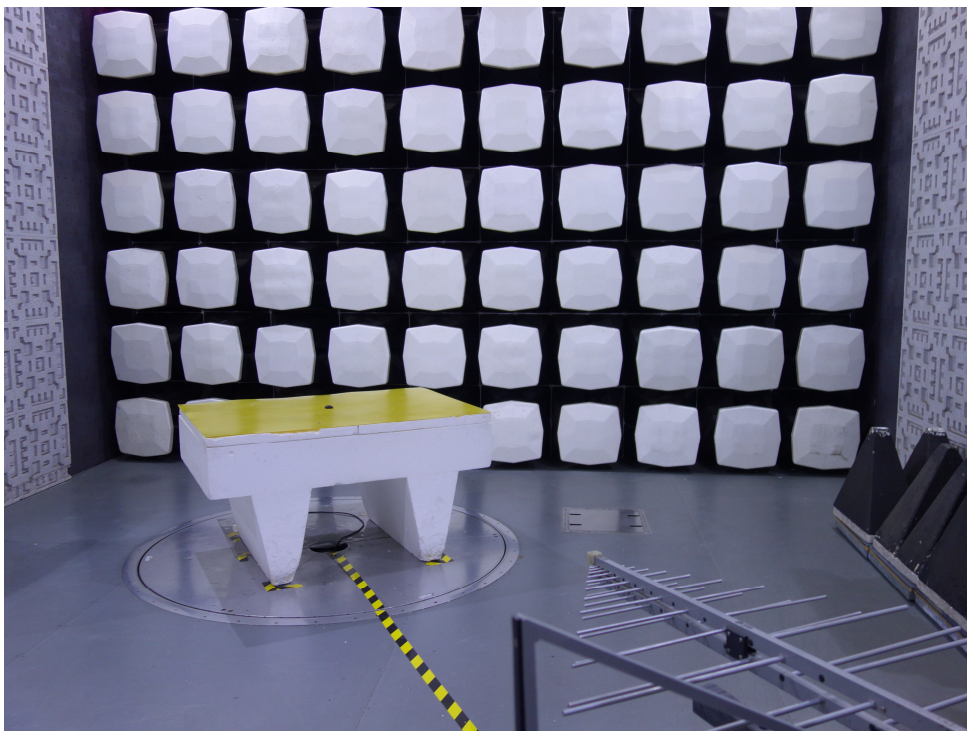
4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

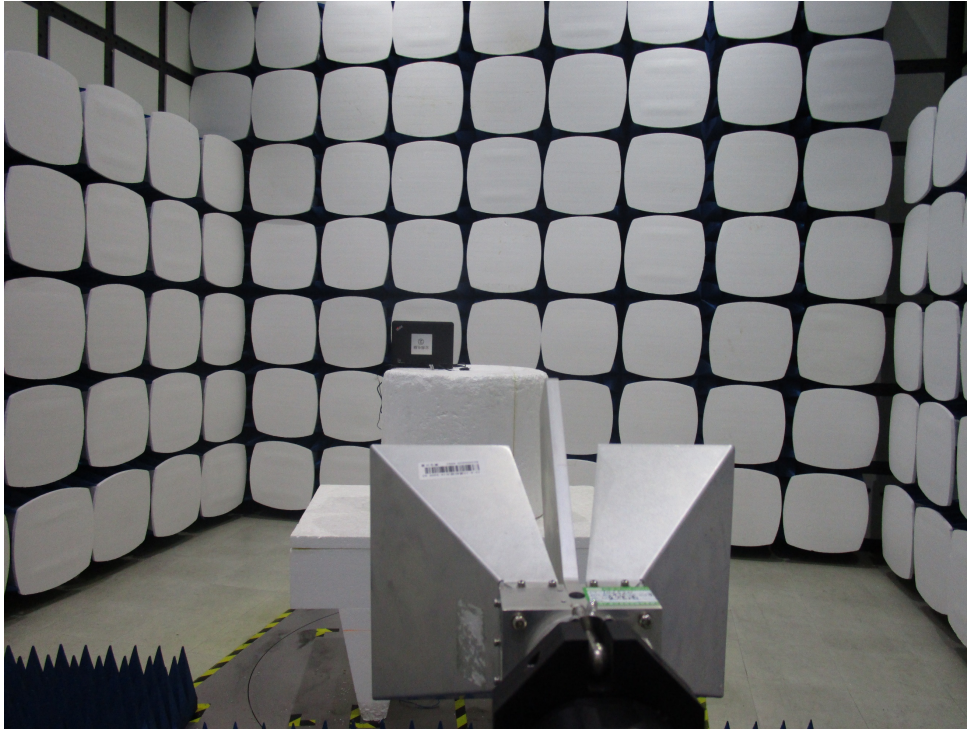
8 Photographs

8.1 Radiated Emissions which fall in the restricted bands Test Setup



8.2 Radiated Spurious Emissions Test Setup





- End of the Report -