

## FCC CERTIFICATION TEST REPORT

### FOR

|                      |   |                                                             |
|----------------------|---|-------------------------------------------------------------|
| Applicant            | : | Leica Camera AG                                             |
| Address              | : | Leica Camera AG, Am Leitz-Park 5, 35578<br>Wetzlar, Germany |
| Equipment under Test | : | SFC1                                                        |
| Model No.            | : | 1222                                                        |
| Trade Mark           | : | Leica                                                       |
| FCC ID               | : | N5A1222                                                     |

**Issued By: Dongguan Dongdian Testing Service Co., Ltd.**

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City, Guangdong Province, China, 523808

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# REPORT

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## TEST REPORT DECLARE

|                             |   |                                                          |
|-----------------------------|---|----------------------------------------------------------|
| <b>Applicant</b>            | : | Leica Camera AG                                          |
| <b>Address</b>              | : | Leica Camera AG, Am Leitz-Park 5, 35578 Wetzlar, Germany |
| <b>Equipment under Test</b> | : | SFC1                                                     |
| <b>Model No.</b>            | : | 1222                                                     |
| <b>Trade mark</b>           | : | Leica                                                    |

**Test Standard Used:**

FCC Rules and Regulations Part 15 Subpart C

**Test procedure used:**

ANSI C63.10:2013

**We Declare:**

The equipment described above is tested by Dongguan Dongdian Testing Service Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Dongguan Dongdian Testing Service Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

**After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC standards.**

|                      |                                                  |                        |               |
|----------------------|--------------------------------------------------|------------------------|---------------|
| <b>Report No:</b>    | DDT-R18011102-1E5                                |                        |               |
| <b>Date of Test:</b> | Aug. 09, 2017~Oct. 10, 2017<br>and Mar. 09, 2018 | <b>Date of Report:</b> | Mar. 09, 2018 |

**Prepared By:**

*Sam Li*

**Sam Li/Engineer**

**Approved By:**



**Kevin Feng/EMC Manager**

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Dongguan Dongdian Testing Service Co., Ltd.

## Revision history

| Rev. | Revisions     | Issue Date    | Revised By |
|------|---------------|---------------|------------|
| ---  | Initial issue | Mar. 09, 2018 |            |
|      |               |               |            |

## 1. Summary of test results

| The EUT have been tested according to the applicable standards as referenced below.                                                                                                                                                                                                                                                                                                                                                                  |                                                                |         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|---------|
| Description of Test Item                                                                                                                                                                                                                                                                                                                                                                                                                             | Standard                                                       | Results |
| 20dB Bandwidth                                                                                                                                                                                                                                                                                                                                                                                                                                       | FCC Part 15: 15.215<br>ANSI C63.10:2013                        | PASS    |
| Radiated Emission                                                                                                                                                                                                                                                                                                                                                                                                                                    | FCC Part 15: 15.209<br>FCC Part 15: 15.249<br>ANSI C63.10:2013 | PASS    |
| Band Edge Compliance                                                                                                                                                                                                                                                                                                                                                                                                                                 | FCC Part 15: 15.249<br>ANSI C63.10:2013                        | PASS    |
| Power Line Conducted Emission                                                                                                                                                                                                                                                                                                                                                                                                                        | FCC Part 15: 15.207<br>ANSI C63.10: 2013                       | N/A     |
| <p>Note 1: N/A is an abbreviation for Not Applicable.</p> <p>Note 2: This report was based on the original report: DDT- R17080703-1E6. There is difference such as the basic information, the appearance and the camera interface circuit in this report. This change don't influence the RF performance, so radiated emission(below 1GHz) was tested and recorded in this report only, and the original test data were retained in this report.</p> |                                                                |         |

## 2. General test information

### 2.1. Description of EUT

|                          |                                                 |
|--------------------------|-------------------------------------------------|
| EUT* Name                | : SFC1                                          |
| Model Number             | : 1222                                          |
| EUT function description | : Please reference user manual of this device   |
| Power supply             | : DC 3V from battery (2*“AAA” batteries)        |
| Operation frequency      | : 2409MHz -2476MHz                              |
| Modulation               | : GFSK                                          |
| Data rate                | : 2Mbps                                         |
| Antenna Type             | : Integrated PCB Antenna, maximum PK gain: 0dBi |
| Sample Type              | : Series production                             |

Note: EUT is the ab. of equipment under test.

EUT channels and frequencies list:

| Channel | Frequency (MHz) |
|---------|-----------------|
| 2       | 2409            |
| 3       | 2419            |
| 4       | 2429            |
| 5       | 2449            |
| 6       | 2459            |
| 7       | 2469            |
| 8       | 2476            |

### 2.2. Accessories of EUT

| Description of Accessories | Manufacturer | Model number | Serial No. | Other |
|----------------------------|--------------|--------------|------------|-------|
| N/A                        | N/A          | N/A          | N/A        | N/A   |

### 2.3. Assistant equipment used for test

| Assistant equipment | Manufacturer | Model number | Serial No. | Other |
|---------------------|--------------|--------------|------------|-------|
| N/A                 | N/A          | N/A          | N/A        | N/A   |

### 2.4. Block diagram of EUT configuration for test

Tx Mode:



For Tx Mode, A special test firmware was installed in EUT and which can exercise the EUT work in continues RF test mode at specified test channel as below:

Note: New battery is used during all test

| Tested mode, channel, information |         |                 |
|-----------------------------------|---------|-----------------|
| Mode                              | Channel | Frequency (MHz) |
| GFSK Tx mode                      | CH2     | 2409            |
|                                   | CH5     | 2449            |
|                                   | CH8     | 2476            |

## 2.5. Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

|                    |           |
|--------------------|-----------|
| Temperature range: | 21-25℃    |
| Humidity range:    | 40-75%    |
| Pressure range:    | 86-106kPa |

## 2.6. Deviations of test standard

No Deviation.

## 2.7. Test laboratory

Dongguan Dongdian Testing Service Co., Ltd

Add: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City,  
Guangdong Province, China, 523808

Tel: +86-0769-89201699, E-mail: ddt@dgddt.com, <http://www.dgddt.com>

CNAS Accreditation No. L6451; A2LA Accreditation No. 3870.01

Designation Number: CN1182; Test Firm Registration Number: 540522

Industry Canada site registration number: 10288A-1

## 2.8. Measurement uncertainty

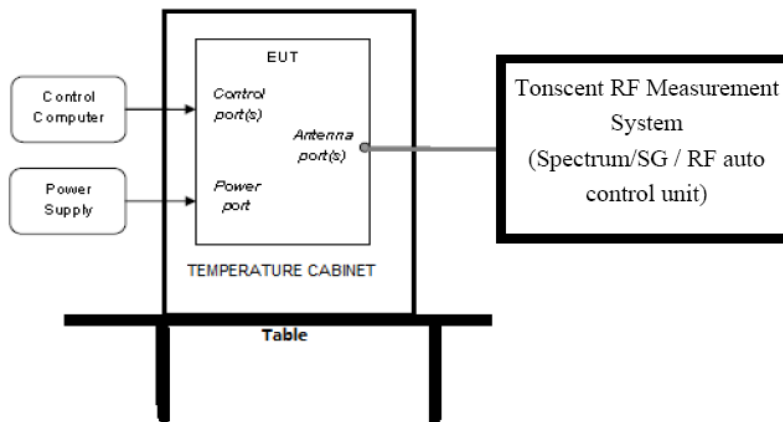
| Test Item                                                                                                                                     | Uncertainty                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Bandwidth                                                                                                                                     | 1.1%                                              |
| Peak Output Power(Conducted)(Spectrum analyzer)                                                                                               | 0.86dB( $10\text{ MHz} \leq f < 3.6\text{GHz}$ ); |
|                                                                                                                                               | 1.38dB( $3.6\text{GHz} \leq f < 8\text{GHz}$ )    |
| Peak Output Power(Conducted)(Power Sensor)                                                                                                    | 0.74dB                                            |
| Power Spectral Density                                                                                                                        | 0.74dB( $10\text{ MHz} \leq f < 3.6\text{GHz}$ ); |
|                                                                                                                                               | 1.38dB( $3.6\text{GHz} \leq f < 8\text{GHz}$ )    |
| Conducted spurious emissions                                                                                                                  | 0.86dB( $10\text{ MHz} \leq f < 3.6\text{GHz}$ ); |
|                                                                                                                                               | 1.40dB( $3.6\text{GHz} \leq f < 8\text{GHz}$ )    |
|                                                                                                                                               | 1.66dB( $8\text{GHz} \leq f < 22\text{GHz}$ )     |
| Uncertainty for radio frequency (RBW<20kHz)                                                                                                   | $3 \times 10^{-8}$                                |
| Temperature                                                                                                                                   | 0.4℃                                              |
| Humidity                                                                                                                                      | 2%                                                |
| Uncertainty for Radiation Emission test<br>(30MHz-1GHz)                                                                                       | 4.70 dB (Antenna Polarize: V)                     |
|                                                                                                                                               | 4.84 dB (Antenna Polarize: H)                     |
| Uncertainty for Radiation Emission test<br>(1GHz-26GHz)                                                                                       | 4.10dB(1-6GHz)                                    |
|                                                                                                                                               | 4.40dB (6GHz-26GHz)                               |
| Uncertainty for Power line conduction emission test                                                                                           | 3.32dB (150kHz-30MHz)                             |
| Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2. |                                                   |

### 3. Equipment used during test

| Equipment                        | Manufacturer  | Model No.        | Serial No.        | Last Cal.     | Cal. Interval |
|----------------------------------|---------------|------------------|-------------------|---------------|---------------|
| <b>RF Connected Test</b>         |               |                  |                   |               |               |
| Spectrum analyzer                | R&S           | FSU26            | 1166.1660.26      | Oct. 16, 2016 | 1 Year        |
| Vector Signal Generator          | Agilent       | E8267D           | MY52098743        | Oct. 20, 2016 | 1 Year        |
| Vector Signal Generator          | Agilent       | N5182A           | MY48180737        | Jun. 16, 2017 | 1 Year        |
| Power Sensor                     | Agilent       | U2021XA          | MY55150010        | Apr. 18, 2017 | 1 Year        |
| Power Sensor                     | Agilent       | U2021XA          | MY55150011        | Apr. 19, 2017 | 1 Year        |
| DC Power Source                  | MATRIS        | MPS-3005L-3      | D813058W          | Oct. 24, 2016 | 1 Year        |
| Attenuator                       | Mini-Circuits | BW-S10W2         | 101109            | Aug. 18, 2016 | 1 Year        |
| Attenuator                       | Mini-Circuits | BW-S10W2         | 101109            | Aug. 18, 2017 | 1 Year        |
| RF Cable                         | Micable       | C10-01-01-1      | 100309            | Aug. 18, 2016 | 1 Year        |
| RF Cable                         | Micable       | C10-01-01-1      | 100309            | Aug. 18, 2017 | 1 Year        |
| Test Software                    | JS Tonscend   | JS1120-2         | Ver.2.5           | N/A           | N/A           |
| USB Data acquisition             | Agilent       | U2531A           | TW55043503        | N/A           | N/A           |
| Auto control Unit                | JS Tonscend   | JS0806-2         | 158060010         | N/A           | N/A           |
| <b>Radiated Emission Test 1#</b> |               |                  |                   |               |               |
| EMI Test Receiver                | R&S           | ESU8             | 100316            | Oct. 16, 2016 | 1 Year        |
| EMI Test Receiver                | R&S           | ESU8             | 100316            | Oct. 21, 2017 | 1 Year        |
| Spectrum analyzer                | R&S           | FSU26            | 1166.1660.26      | Oct. 16, 2016 | 1 Year        |
| Spectrum analyzer                | Agilent       | E4447A           | MY50180031        | Jun. 16, 2017 | 1 Year        |
| Trilog Broadband Antenna         | Schwarzbeck   | VULB9163         | 9163-462          | Oct. 27, 2016 | 1 Year        |
| Trilog Broadband Antenna         | Schwarzbeck   | VULB9163         | 9163-462          | Nov. 09, 2017 | 1 Year        |
| Active Loop antenna              | Schwarzbeck   | FMZB-1519        | 1519-038          | Oct. 16, 2016 | 1 Year        |
| Active Loop antenna              | Schwarzbeck   | FMZB-1519        | 1519-038          | Oct. 17, 2017 | 1 Year        |
| Double Ridged Horn Antenna       | R&S           | HF907            | 100276            | Oct. 12, 2016 | 1 Year        |
| Double Ridged Horn Antenna       | R&S           | HF907            | 100276            | Oct. 17, 2017 | 1 Year        |
| Pre-amplifier                    | A.H.          | PAM-0118         | 360               | Oct. 16, 2016 | 1 Year        |
| Pre-amplifier                    | TERA-MW       | TRLA-0040G35     | 101303            | Oct. 21, 2017 | 1 Year        |
| RF Cable                         | HUBSER        | CP-X2            | W11.03            | Oct. 16, 2016 | 1 Year        |
| RF Cable                         | HUBSER        | CP-X2+<br>CP-X1  | W11.03+<br>W12.02 | Oct. 21, 2017 | 1 Year        |
| RF Cable                         | HUBSER        | CP-X1            | W12.02            | Oct. 16, 2016 | 1 Year        |
| MI Cable                         | HUBSER        | C10-01-01-1M     | 1091629           | Oct. 16, 2016 | 1 Year        |
| RF Cable                         | N/A           | SMAJ-SMAJ-1M+11M | 17070133+17070131 | Nov. 08, 2017 | 1 Year        |
| Test software                    | Audix         | E3               | V 6.11111b        | N/A           | N/A           |

## 4. 20dB Bandwidth

### 4.1. Block diagram of test setup



### 4.2. Limits

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### 4.3. Test Procedure

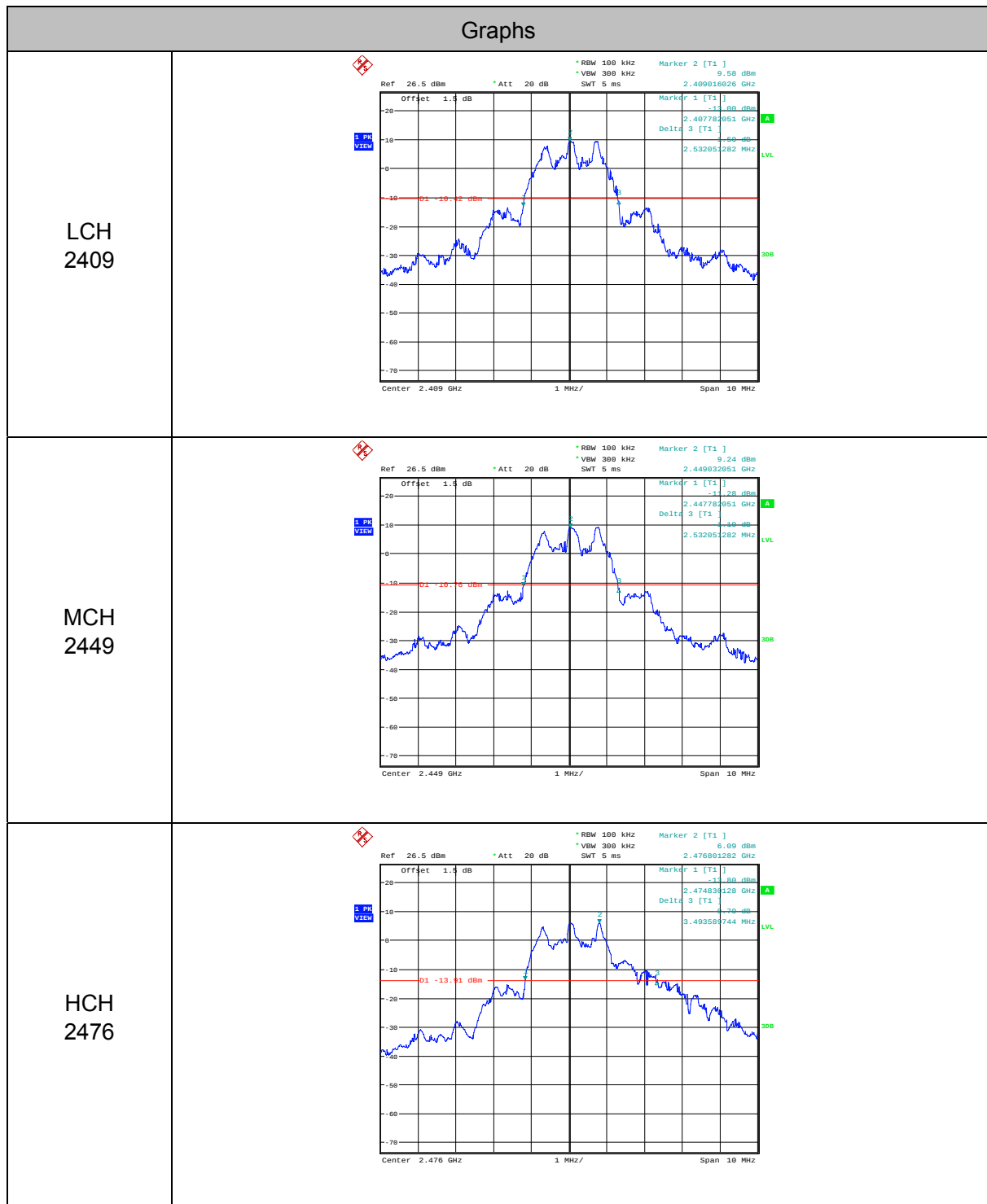
- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) Set the spectrum analyzer as follows:
 

|                |          |
|----------------|----------|
| RBW:           | 100kHz   |
| VBW:           | 300kHz   |
| Detector Mode: | Peak     |
| Sweep time:    | auto     |
| Trace mode     | Max hold |
- (3) Allow the trace to stabilize, measure the 6dB and 99% bandwidth of signal.

### 4.4. Test Result

| Mode | Freq (MHz) | 20dB bandwidth Result (MHz) | Limit (MHz) | Conclusion |
|------|------------|-----------------------------|-------------|------------|
| GFSK | 2409       | 2.532                       | /           | PASS       |
|      | 2449       | 2.532                       | /           | PASS       |
|      | 2476       | 3.494                       | /           | PASS       |

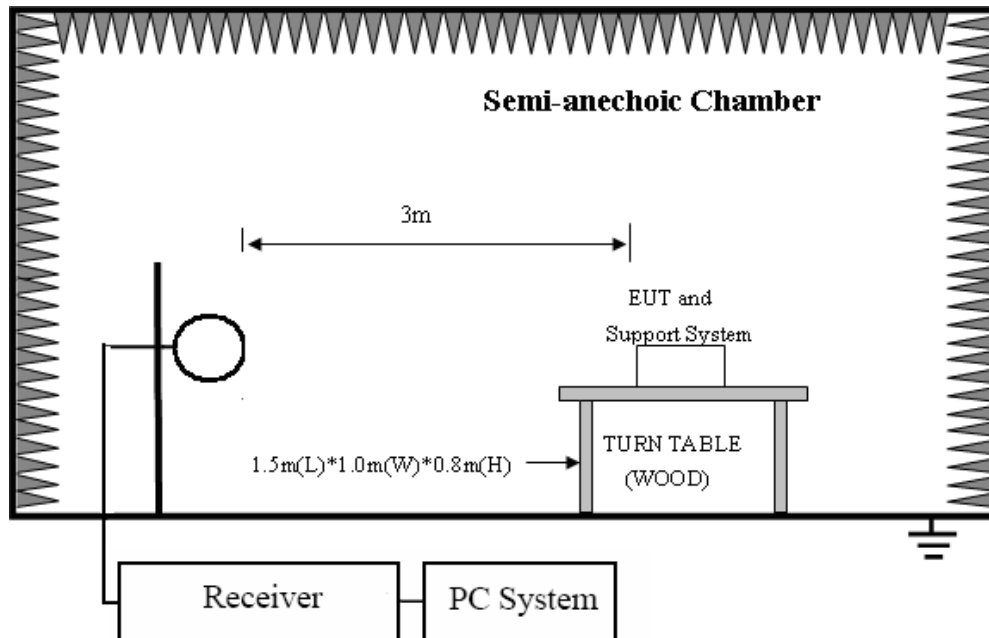
## 4.5. Original test data



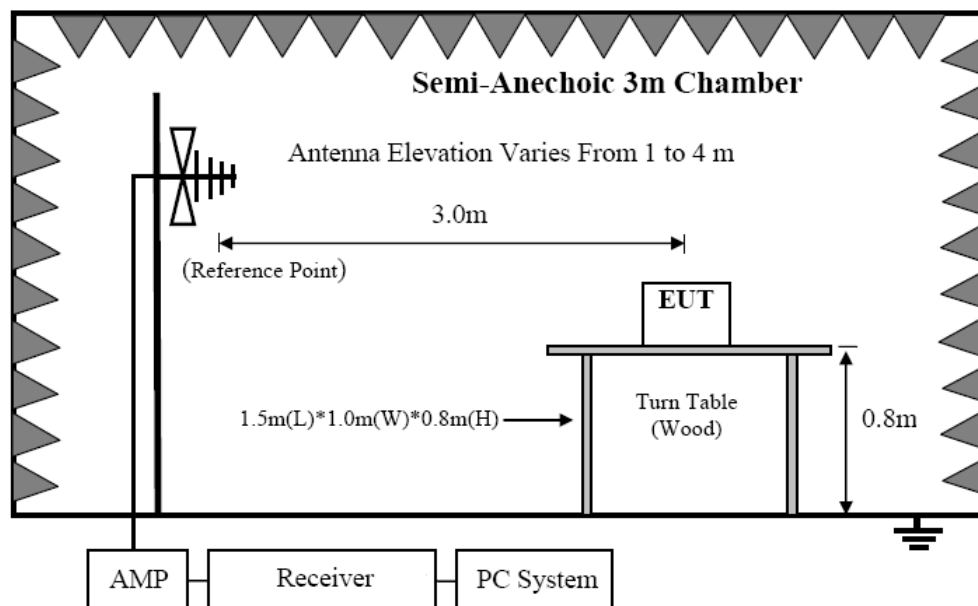
## 5. Radiated emission

### 5.1. Block diagram of test setup

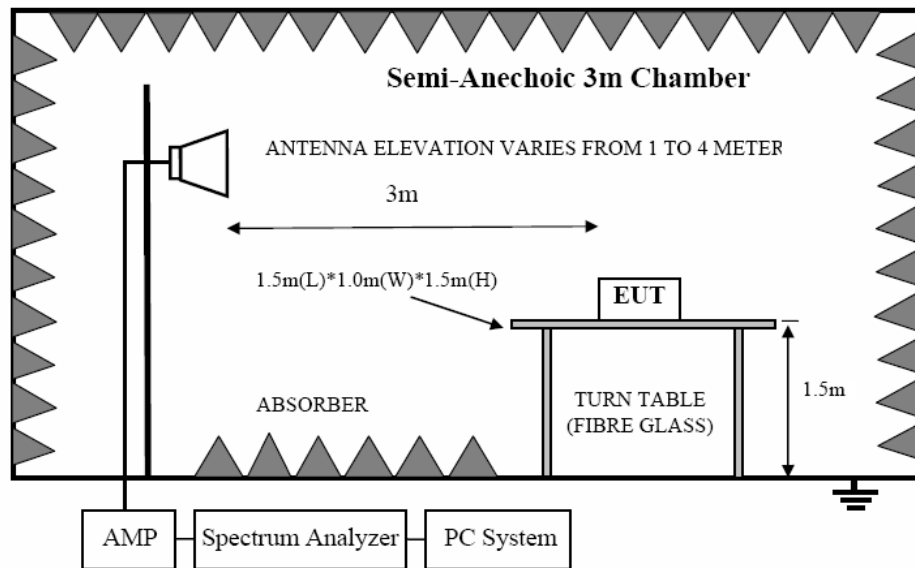
In 3m Anechoic Chamber Test Setup Diagram for 9kHz-30MHz



In 3m Anechoic Chamber Test Setup Diagram for 30MHz-1GHz



In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

## 5.2. Limit

| FREQUENCY<br>MHz                                                  | DISTANCE<br>Meters | FIELD STRENGTHS LIMIT                                                                              |                                   |
|-------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------|-----------------------------------|
|                                                                   |                    | $\mu\text{V}/\text{m}$                                                                             | $\text{dB}(\mu\text{V})/\text{m}$ |
| 30 ~ 88                                                           | 3                  | 100                                                                                                | 40.0                              |
| 88 ~ 216                                                          | 3                  | 150                                                                                                | 43.5                              |
| 216 ~ 960                                                         | 3                  | 200                                                                                                | 46.0                              |
| 960 ~ 1000                                                        | 3                  | 500                                                                                                | 54.0                              |
| Above 1000MHz                                                     | 3                  | 74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak)<br>54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)  |                                   |
| Field Strength of<br>Fundamental emission for<br>2.4GHz-2.4835GHz | 3                  | 94.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)<br>114.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak) |                                   |
| Field Strength of<br>Harmonics                                    | 3                  | 74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak)<br>54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)  |                                   |

Remark:

- (1) Emission level  $\text{dB}\mu\text{V} = 20 \log \text{Emission level } \mu\text{V}/\text{m}$
- (2) The smaller limit shall apply at the cross point between two frequency bands.
- (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.
- (4) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

## 5.3. Test Procedure

- (1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.

- (2) Setup EUT and assistant system according clause 2.3 and 4.2
- (3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
  - (a) Change work frequency or channel of device if practicable.
  - (b) Change modulation type of device if practicable.
  - (c) Change power supply range from 85% to 115% of the rated supply voltage
  - (d) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions
- (4) Spectrum frequency from 9kHz to 25GHz (tenth harmonic of fundamental frequency) was investigated, and no any obvious emission were detected from 9kHz to 30MHz and 18GHz to 25GHz, so below final test was performed with frequency range from 30MHz to 18GHz.
- (5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 2013 on Radiated Emission test.
- (6) For emissions from 30MHz to 1GHz, Quasi-Peak values were measured with EMI Receiver and the bandwidth of Receiver is 120 kHz.
- (7) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure. Peak detector is used for both PK and AV test.
- (8) For fundamental frequency test, set spectrum analyzer's RBW=5MHz, VBW=10MHz. peak detector for PK, RMS detector for AV, Read the Level in spectrum analyzer and record.
- (9) X axis, Y axis, Z axis are tested, and worse setup X axis is reported.

## 5.4. Test result

### **PASS. (See below detailed test result)**

All the emissions except fundamental emission from 9kHz to 25GHz were comply with 15.209 limit.

Note1: According exploratory test no any obvious emission were detected from 9kHz to 30MHz and 18GHz to 25GHz, so the final test was performed with frequency range from 30MHz to 18GHz and recorded in below.

Note2: For emissions below 1GHz, according exploratory explorer test, when change Tx mode and channel, have no distinct influence on emissions level, so for emissions below 1GHz, the final test was only performed with EUT working in GFSK, Tx 2449MHz mode.

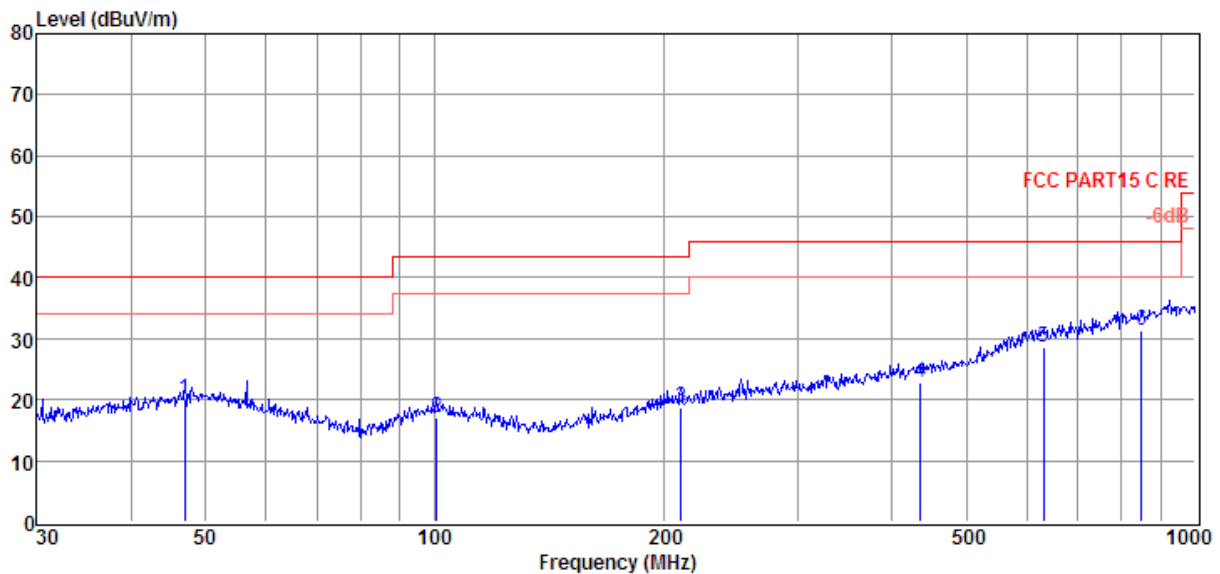
Note3: For emissions above 1GHz. If peak results comply with AV limit, AV Result is deemed to comply with AV limit.

### **Radiated Emission test (below 1GHz)**

## TR-4-E-009 Radiated Emission Test Result

**Test Site** : DDT 3m Chamber 1# **D:\2018 RE1# Report Data\Q18011102-1E SEC1\RF.EM6**  
**Test Date** : 2018-03-09 **Tested By** : Sunny  
**EUT** : SFC1 **Model Number** : 1222  
**Power Supply** : DC 3.0V **Test Mode** : TX mode  
**Condition** : Temp:24.5'C,Humi:55%,  
 Press:100.1kPa **Antenna/Distance** : 2017 VULB 9163 1#/3m/HORIZONTAL  
**Memo** :

Data: 9



| Item<br>(Mark) | Freq.<br>(MHz) | Read<br>Level<br>(dBuV) | Antenna<br>Factor<br>(dB/m) | Cable<br>Loss<br>dB | Result<br>Level<br>(dBuV/m) | Limit<br>Line<br>(dBuV/m) | Over<br>Limit<br>(dB) | Detector | Polarization |
|----------------|----------------|-------------------------|-----------------------------|---------------------|-----------------------------|---------------------------|-----------------------|----------|--------------|
| 1              | 47.00          | 2.64                    | 13.47                       | 3.96                | 20.07                       | 40.00                     | -19.93                | QP       | HORIZONTAL   |
| 2              | 100.58         | 1.18                    | 11.43                       | 4.42                | 17.03                       | 43.50                     | -26.47                | QP       | HORIZONTAL   |
| 3              | 210.79         | 1.95                    | 11.73                       | 5.08                | 18.76                       | 43.50                     | -24.74                | QP       | HORIZONTAL   |
| 4              | 435.59         | 1.14                    | 16.08                       | 5.71                | 22.93                       | 46.00                     | -23.07                | QP       | HORIZONTAL   |
| 5              | 631.69         | 2.26                    | 19.50                       | 6.78                | 28.54                       | 46.00                     | -17.46                | QP       | HORIZONTAL   |
| 6              | 851.04         | 1.95                    | 21.98                       | 7.46                | 31.39                       | 46.00                     | -14.61                | QP       | HORIZONTAL   |

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

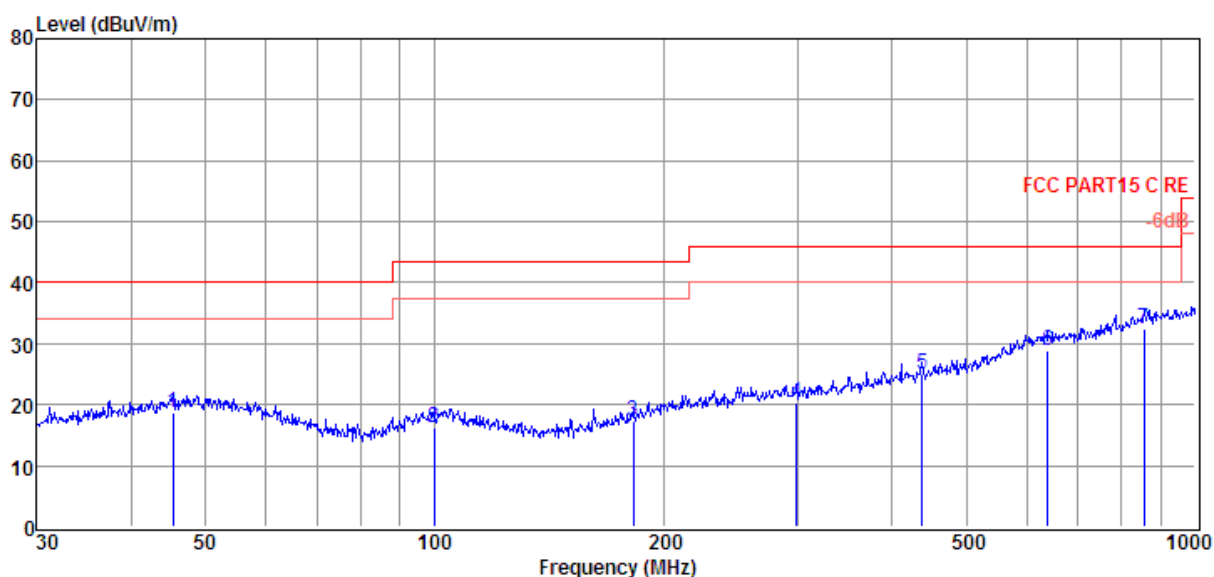
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

## TR-4-E-009 Radiated Emission Test Result

**Test Site** : DDT 3m Chamber 1# **D:\2018 RE1# Report Data\Q18011102-1E SEC1\RF.EM6**  
**Test Date** : 2018-03-09 **Tested By** : Sunny  
**EUT** : SFC1 **Model Number** : 1222  
**Power Supply** : DC 3.0V **Test Mode** : TX mode  
**Condition** : Temp:24.5'C,Humi:55%,  
 Press:100.1kPa **Antenna/Distance** : 2017 VULB 9163 1#/3m/VERTICAL  
**Memo** :

Data: 10



| Item<br>(Mark) | Freq.<br>(MHz) | Read<br>Level<br>(dBuV) | Antenna<br>Factor<br>(dB/m) | Cable<br>Loss<br>dB | Result<br>Level<br>(dBuV/m) | Limit<br>Line<br>(dBuV/m) | Over<br>Limit<br>(dB) | Detector | Polarization |
|----------------|----------------|-------------------------|-----------------------------|---------------------|-----------------------------|---------------------------|-----------------------|----------|--------------|
| 1              | 45.38          | 1.39                    | 13.28                       | 3.94                | 18.61                       | 40.00                     | -21.39                | QP       | VERTICAL     |
| 2              | 99.88          | 0.37                    | 11.48                       | 4.41                | 16.26                       | 43.50                     | -27.24                | QP       | VERTICAL     |
| 3              | 182.56         | 2.53                    | 9.94                        | 4.94                | 17.41                       | 43.50                     | -26.09                | QP       | VERTICAL     |
| 4              | 299.32         | 1.60                    | 13.29                       | 5.52                | 20.41                       | 46.00                     | -25.59                | QP       | VERTICAL     |
| 5              | 437.12         | 3.25                    | 16.11                       | 5.70                | 25.06                       | 46.00                     | -20.94                | QP       | VERTICAL     |
| 6              | 640.61         | 2.41                    | 19.53                       | 6.81                | 28.75                       | 46.00                     | -17.25                | QP       | VERTICAL     |
| 7              | 857.03         | 2.85                    | 22.06                       | 7.48                | 32.39                       | 46.00                     | -13.61                | QP       | VERTICAL     |

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

**Radiated Emission test (above 1GHz)**

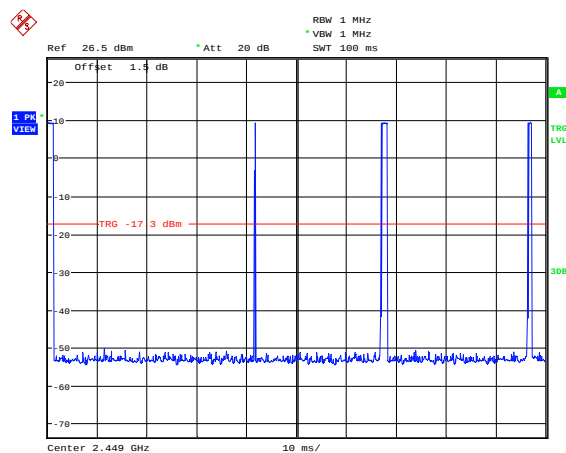
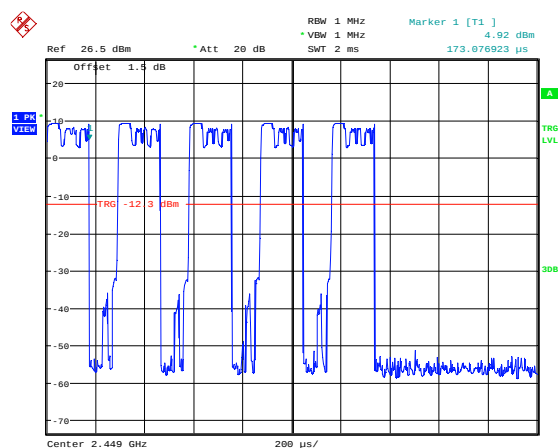
| Freq.<br>(MHz)       | Read<br>level<br>(dBμV)        | Antenn<br>a<br>Factor<br>(dB/m) | PRM<br>Factor(<br>dB) | Cable<br>Loss<br>(dB) | Result<br>Level<br>(dBμV/<br>m) | Limit<br>(dBμV/<br>m) | Margin<br>(dB) | Detector<br>type | Polarization |
|----------------------|--------------------------------|---------------------------------|-----------------------|-----------------------|---------------------------------|-----------------------|----------------|------------------|--------------|
| GFSK Tx mode 2409MHz |                                |                                 |                       |                       |                                 |                       |                |                  |              |
| 2409.00              | 95.20                          | 29.83                           | 29.44                 | 6.03                  | 101.62                          | 114.00                | -12.38         | Peak             | HORIZONTAL   |
| 2409.00              | AV=PK-29.22=101.62-29.22=72.40 |                                 |                       |                       |                                 | 94.00                 | -21.60         | Average          | HORIZONTAL   |
| 4818.00              | 53.85                          | 33.74                           | 29.32                 | 8.46                  | 66.73                           | 74.00                 | -7.27          | Peak             | HORIZONTAL   |
| 4818.00              | AV=PK-29.22=66.73-29.22=37.51  |                                 |                       |                       |                                 | 54.00                 | -16.49         | Average          | HORIZONTAL   |
| 7227.00              | 35.90                          | 36.37                           | 30.49                 | 10.60                 | 52.38                           | 74.00                 | -21.62         | Peak             | HORIZONTAL   |
| 9636.00              | 42.69                          | 36.51                           | 32.73                 | 12.37                 | 58.84                           | 74.00                 | -15.16         | Peak             | HORIZONTAL   |
| 9636.00              | AV=PK-29.22=58.84-29.22=29.62  |                                 |                       |                       |                                 | 54.00                 | -24.38         | Average          | HORIZONTAL   |
| 12100.00             | 34.00                          | 37.74                           | 34.87                 | 14.30                 | 51.17                           | 74.00                 | -22.83         | Peak             | HORIZONTAL   |
| 2409.00              | 91.20                          | 29.83                           | 29.44                 | 6.03                  | 97.62                           | 114.00                | -16.38         | Peak             | VERTICAL     |
| 2409.00              | AV=PK-29.22=97.62-29.22=68.40  |                                 |                       |                       |                                 | 94.00                 | -25.60         | Average          | VERTICAL     |
| 4818.00              | 41.81                          | 33.74                           | 29.32                 | 8.46                  | 54.69                           | 74.00                 | -19.31         | Peak             | VERTICAL     |
| 4818.00              | AV=PK-29.22=54.69-29.22=25.47  |                                 |                       |                       |                                 | 54.00                 | -28.53         | Average          | VERTICAL     |
| 7227.00              | 36.11                          | 36.37                           | 30.49                 | 10.60                 | 52.59                           | 74.00                 | -21.41         | Peak             | VERTICAL     |
| 9636.00              | 46.02                          | 36.51                           | 32.73                 | 12.37                 | 62.17                           | 74.00                 | -11.83         | Peak             | VERTICAL     |
| 9636.00              | AV=PK-29.22=62.17-29.22=32.95  |                                 |                       |                       |                                 | 54.00                 | -21.05         | Average          | VERTICAL     |
| 12016.00             | 35.95                          | 37.62                           | 34.80                 | 14.24                 | 53.01                           | 74.00                 | -20.99         | Peak             | VERTICAL     |
| GFSK Tx mode 2449MHz |                                |                                 |                       |                       |                                 |                       |                |                  |              |
| 2449.00              | 96.09                          | 29.97                           | 29.54                 | 6.10                  | 102.62                          | 114.00                | -11.38         | Peak             | HORIZONTAL   |
| 2449.00              | AV=PK-29.22=102.62-29.22=73.40 |                                 |                       |                       |                                 | 94.00                 | -20.60         | Average          | HORIZONTAL   |
| 4898.00              | 57.21                          | 33.72                           | 29.33                 | 8.58                  | 70.18                           | 74.00                 | -3.82          | Peak             | HORIZONTAL   |
| 4898.00              | AV=PK-29.22=70.18-29.22=40.96  |                                 |                       |                       |                                 | 54.00                 | -13.04         | Average          | HORIZONTAL   |
| 7347.00              | 39.09                          | 36.48                           | 30.61                 | 10.72                 | 55.68                           | 74.00                 | -18.32         | Peak             | HORIZONTAL   |
| 7347.00              | AV=PK-29.22=55.68-29.22=26.46  |                                 |                       |                       |                                 | 54.00                 | -27.54         | Average          | HORIZONTAL   |
| 9796.00              | 40.16                          | 36.70                           | 32.84                 | 12.41                 | 56.43                           | 74.00                 | -17.57         | Peak             | HORIZONTAL   |
| 9796.00              | AV=PK-29.22=56.43-29.22=27.21  |                                 |                       |                       |                                 | 54.00                 | -26.79         | Average          | HORIZONTAL   |
| 2449.00              | 92.68                          | 29.97                           | 29.54                 | 6.10                  | 99.21                           | 114.00                | -14.79         | Peak             | VERTICAL     |
| 2449.00              | AV=PK-29.22=99.21-29.22=69.99  |                                 |                       |                       |                                 | 94.00                 | -24.01         | Average          | VERTICAL     |
| 4898.00              | 48.58                          | 33.72                           | 29.33                 | 8.58                  | 61.55                           | 74.00                 | -12.45         | Peak             | VERTICAL     |
| 4898.00              | AV=PK-29.22=61.55-29.22=32.33  |                                 |                       |                       |                                 | 54.00                 | -21.67         | Average          | VERTICAL     |
| 7347.00              | 44.89                          | 36.47                           | 30.59                 | 10.72                 | 61.49                           | 74.00                 | -12.51         | Peak             | VERTICAL     |
| 7347.00              | AV=PK-29.22=61.49-29.22=32.27  |                                 |                       |                       |                                 | 54.00                 | -21.73         | Average          | VERTICAL     |
| 9796.00              | 42.04                          | 36.70                           | 32.84                 | 12.41                 | 58.31                           | 74.00                 | -15.69         | Peak             | VERTICAL     |
| 9796.00              | AV=PK-29.22=58.31-29.22=29.09  |                                 |                       |                       |                                 | 54.00                 | -24.91         | Average          | VERTICAL     |
| GFSK Tx mode 2476MHz |                                |                                 |                       |                       |                                 |                       |                |                  |              |
| 2476.00              | 95.53                          | 30.11                           | 29.69                 | 6.13                  | 102.08                          | 114.00                | -11.92         | Peak             | HORIZONTAL   |
| 2476.00              | AV=PK-29.22=102.08-29.22=72.86 |                                 |                       |                       |                                 | 94.00                 | -21.14         | Average          | HORIZONTAL   |
| 4952.00              | 51.54                          | 33.71                           | 29.35                 | 8.63                  | 64.53                           | 74.00                 | -9.47          | Peak             | HORIZONTAL   |
| 4952.00              | AV=PK-29.22=64.53-29.22=35.31  |                                 |                       |                       |                                 | 54.00                 | -18.69         | Average          | HORIZONTAL   |
| 7428.00              | 38.37                          | 36.56                           | 30.73                 | 10.81                 | 55.01                           | 74.00                 | -18.99         | Peak             | HORIZONTAL   |
| 7428.00              | AV=PK-29.22=55.01-29.22=25.79  |                                 |                       |                       |                                 | 54.00                 | -28.21         | Average          | HORIZONTAL   |
| 9904.00              | 44.72                          | 36.81                           | 32.88                 | 12.42                 | 61.07                           | 74.00                 | -12.93         | Peak             | HORIZONTAL   |
| 9904.00              | AV=PK-29.22=61.07-29.22=31.85  |                                 |                       |                       |                                 | 54.00                 | -22.15         | Average          | HORIZONTAL   |

|              |                               |       |       |       |       |        |        |         |          |
|--------------|-------------------------------|-------|-------|-------|-------|--------|--------|---------|----------|
| 2476.00      | 89.60                         | 30.11 | 29.69 | 6.13  | 96.15 | 114.00 | -17.85 | Peak    | VERTICAL |
| 2476.00      | AV=PK-29.22=96.15-29.22=66.93 |       |       |       |       | 94.00  | -27.07 | Average | VERTICAL |
| 4952.00      | 40.76                         | 33.71 | 29.35 | 8.63  | 53.75 | 74.00  | -20.25 | Peak    | VERTICAL |
| 7428.00      | 45.75                         | 36.56 | 30.73 | 10.81 | 62.39 | 74.00  | -11.61 | Peak    | VERTICAL |
| 7428.00      | AV=PK-29.22=62.39-29.22=33.17 |       |       |       |       | 54.00  | -20.83 | Average | VERTICAL |
| 9904.00      | 45.65                         | 36.81 | 32.88 | 12.42 | 62.00 | 74.00  | -12.00 | Peak    | VERTICAL |
| 9904.00      | AV=PK-29.22=62.00-29.22=32.78 |       |       |       |       | 54.00  | -21.22 | Average | VERTICAL |
| 10960.00     | 32.65                         | 37.69 | 33.92 | 13.45 | 49.87 | 74.00  | -24.13 | Peak    | VERTICAL |
| Result: Pass |                               |       |       |       |       |        |        |         |          |

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.

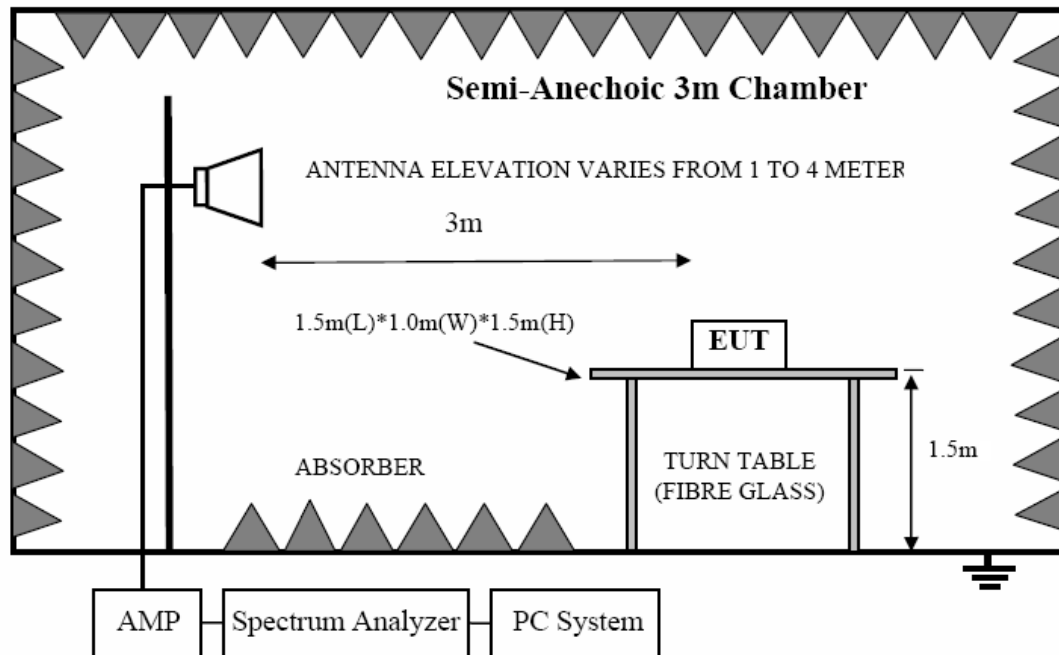
2. Average value=Peak value + PDCF, since the PDCF<-20dB, so the Average value is complied with the AV limit.

| Average value:     |                                  |
|--------------------|----------------------------------|
| Calculate Formula: | Average value=Peak value + PDCF  |
|                    | PDCF=20 log(Duty cycle)          |
|                    | Duty cycle= T on time / T period |
| Test data:         | Ton time =0.173*5*4=3.46ms       |
|                    | T period =100ms                  |
|                    | PDCF=-29.22                      |



## 6. Band Edge Compliance

### 6.1. Block diagram of test setup



### 6.2. Limit

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz and 5725MHz to 5850MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

### 6.3. Test Procedure

Same with clause 8.3 except change investigated frequency range from 2310MHz to 2415MHz and 2475MHz to 2500MHz.

Remark: All restriction band have been tested, and only the worse case is shown in report.

### 6.4. Test result

**PASS.** (See below detailed test result)

## TR-4-E-009 Radiated Emission Test Result

Test Site : DDT 3m Chamber 1#

Y:\2017 RE1# Report

Data\Q17080703-01E\RF-FCC30M-13G.EM6

Test Date : 2017-09-20

Tested By : Sunny

EUT : SFC1

Model Number : 1222

Power Supply : DC 3.0V

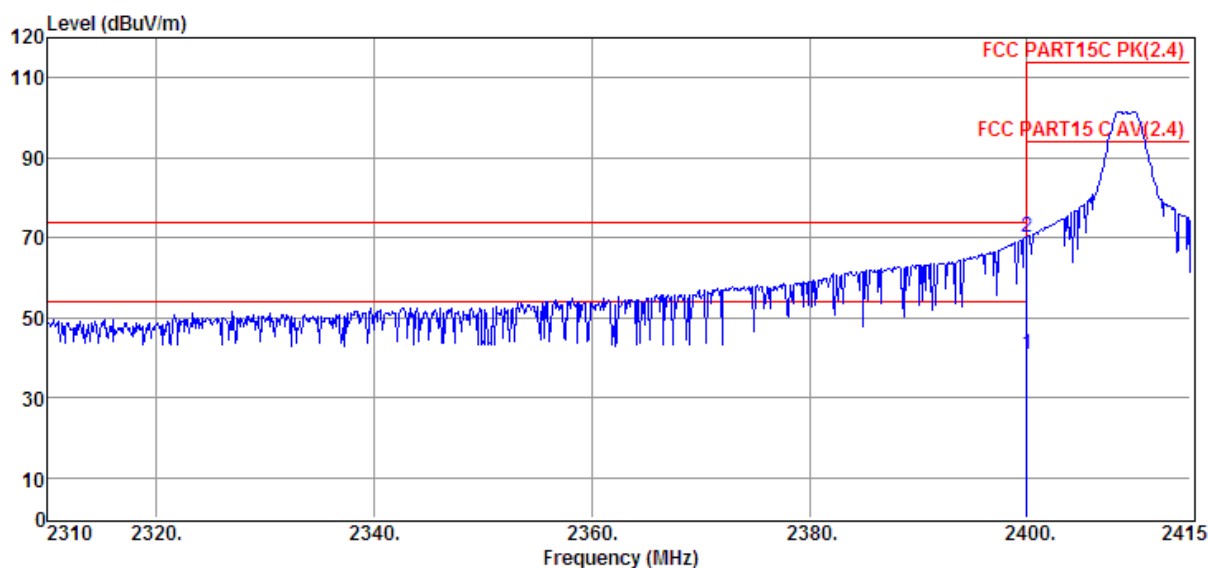
Test Mode : 2409MHz Bandedge

Condition : Temp:24.5'C,Humi:55%,  
Press:100.1kPa

Antenna/Distance : 2016 HF907/3m/HORIZONTAL

Memo :

Data: 107



| Item   | Freq.   | Read Level | Antenna Factor | PRM Factor | Cable Loss | Result Level | Limit Line | Over Limit | Detector | Polarization |
|--------|---------|------------|----------------|------------|------------|--------------|------------|------------|----------|--------------|
| (Mark) | (MHz)   | (dBμV)     | (dB/m)         | dB         | dB         | (dBμV/m)     | (dBμV/m)   | (dB)       |          |              |
| 1      | 2400.00 | 34.54      | 29.82          | 29.44      | 6.03       | 40.95        | 54.00      | -13.05     | Average  | HORIZONTAL   |
| 2      | 2400.00 | 63.76      | 29.82          | 29.44      | 6.03       | 70.17        | 74.00      | -3.83      | Peak     | HORIZONTAL   |

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. AV of 2400.00MHz=PK+PDCF=70.17-29.22=40.95dBuV/m<54dBuV/m

## TR-4-E-009 Radiated Emission Test Result

Test Site : DDT 3m Chamber 1#

Y:\2017 RE1# Report

Data\Q17080703-01E\RF-FCC30M-13G.EM6

Test Date : 2017-09-20

Tested By : Sunny

EUT : SFC1

Model Number : 1222

Power Supply : DC 3.0V

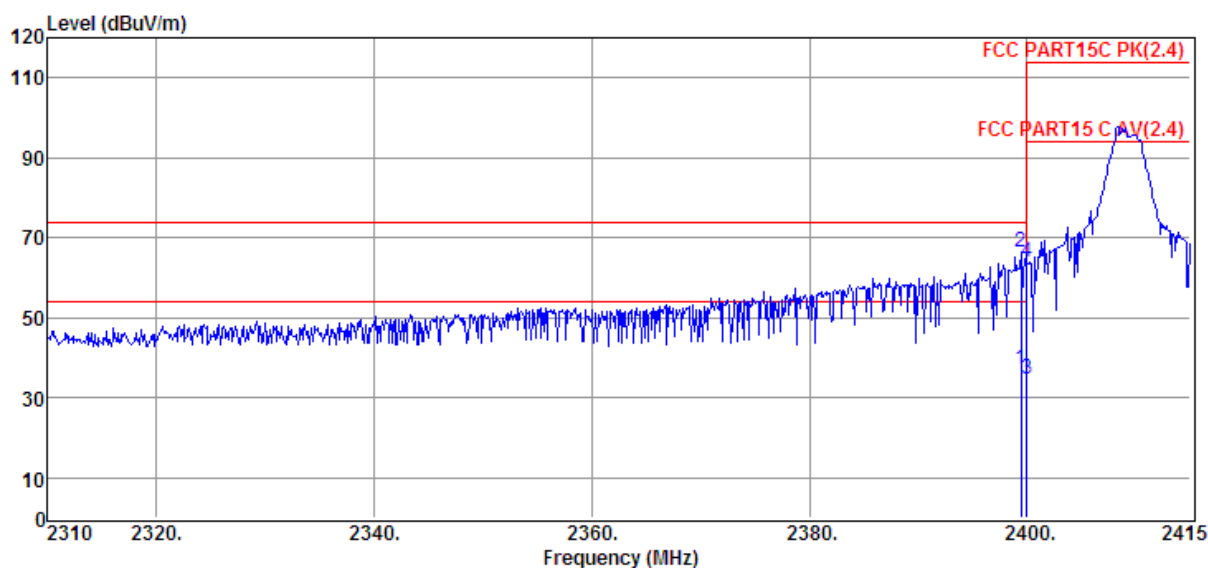
Test Mode : 2409MHz Bandedge

Condition : Temp:24.5'C,Humi:55%,  
Press:100.1kPa

Antenna/Distance : 2016 HF907/3m/VERTICAL

Memo :

Data: 108



| Item   | Freq.   | Read Level | Antenna Factor | PRM Factor | Cable Loss | Result Level | Limit Line | Over Limit | Detector | Polarization |
|--------|---------|------------|----------------|------------|------------|--------------|------------|------------|----------|--------------|
| (Mark) | (MHz)   | (dBμV)     | (dB/m)         | dB         | dB         | (dBμV/m)     | (dBμV/m)   | (dB)       |          |              |
| 1      | 2399.46 | 30.57      | 29.81          | 29.44      | 6.03       | 36.97        | 54.00      | -17.03     | Average  | VERTICAL     |
| 2      | 2399.46 | 59.79      | 29.81          | 29.44      | 6.03       | 66.19        | 74.00      | -7.81      | Peak     | VERTICAL     |
| 3      | 2400.00 | 28.39      | 29.82          | 29.44      | 6.03       | 34.80        | 54.00      | -19.20     | Average  | VERTICAL     |
| 4      | 2400.00 | 57.61      | 29.82          | 29.44      | 6.03       | 64.02        | 74.00      | -9.98      | Peak     | VERTICAL     |

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. AV of 2399.46MHz=PK+PDCF=66.19-29.22=36.97dBμV/m<54dBμV/m

AV of 2400.00MHz=PK+PDCF=64.02-29.22=34.80dBμV/m<54dBμV/m

## TR-4-E-009 Radiated Emission Test Result

Test Site : DDT 3m Chamber 1#

Y:\2017 RE1# Report

Data\Q17080703-01E\RF-FCC30M-13G.EM6

Test Date : 2017-09-20

Tested By : Sunny

EUT : SFC1

Model Number : 1222

Power Supply : DC 3.0V

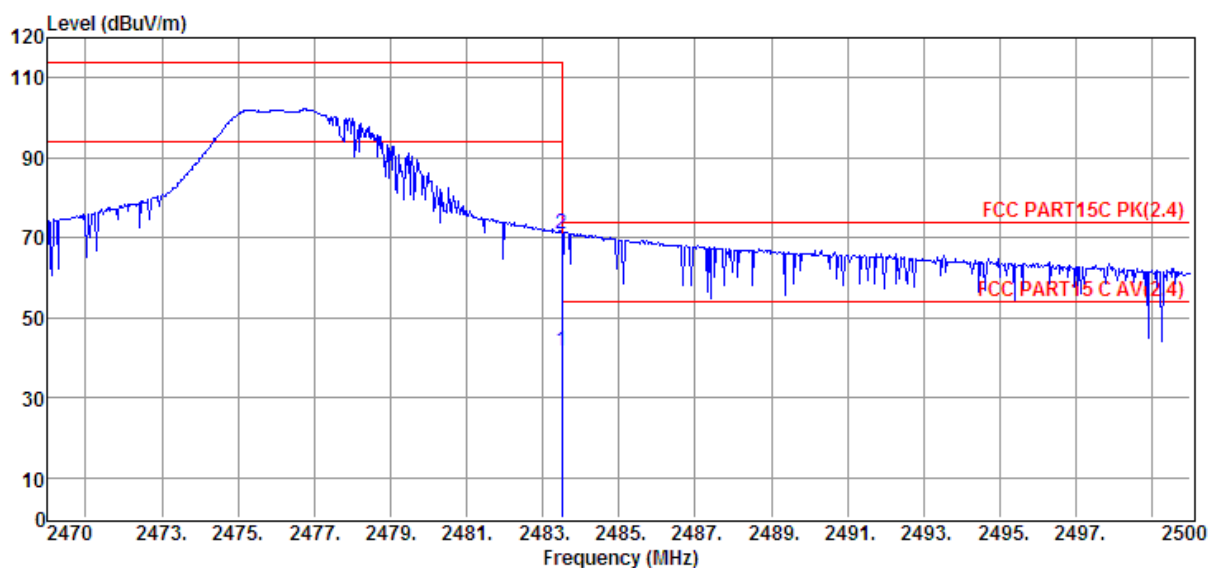
Test Mode : 2476MHz Bandedge

Condition : Temp:24.5'C,Humi:55%,  
Press:100.1kPa

Antenna/Distance : 2016 HF907/3m/HORIZONTAL

Memo :

Data: 109



| Item   | Freq.   | Read Level | Antenna Factor | PRM Factor | Cable Loss | Result Level | Limit Line | Over Limit | Detector | Polarization |
|--------|---------|------------|----------------|------------|------------|--------------|------------|------------|----------|--------------|
| (Mark) | (MHz)   | (dBμV)     | (dB/m)         | dB         | dB         | (dBμV/m)     | (dBμV/m)   | (dB)       |          |              |
| 1      | 2483.50 | 35.27      | 30.14          | 29.71      | 6.13       | 41.83        | 54.00      | -12.17     | Average  | HORIZONTAL   |
| 2      | 2483.50 | 64.49      | 30.14          | 29.71      | 6.13       | 71.05        | 74.00      | -2.95      | Peak     | HORIZONTAL   |

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. AV of 2483.50MHz=PK+PDCF=71.05-29.22=41.83dBμV/m<54dBμV/m

## TR-4-E-009 Radiated Emission Test Result

Test Site : DDT 3m Chamber 1#

Y:\2017 RE1# Report

Data\Q17080703-01E\RF-FCC30M-13G.EM6

Test Date : 2017-09-20

Tested By : Sunny

EUT : SFC1

Model Number : 1222

Power Supply : DC 3.0V

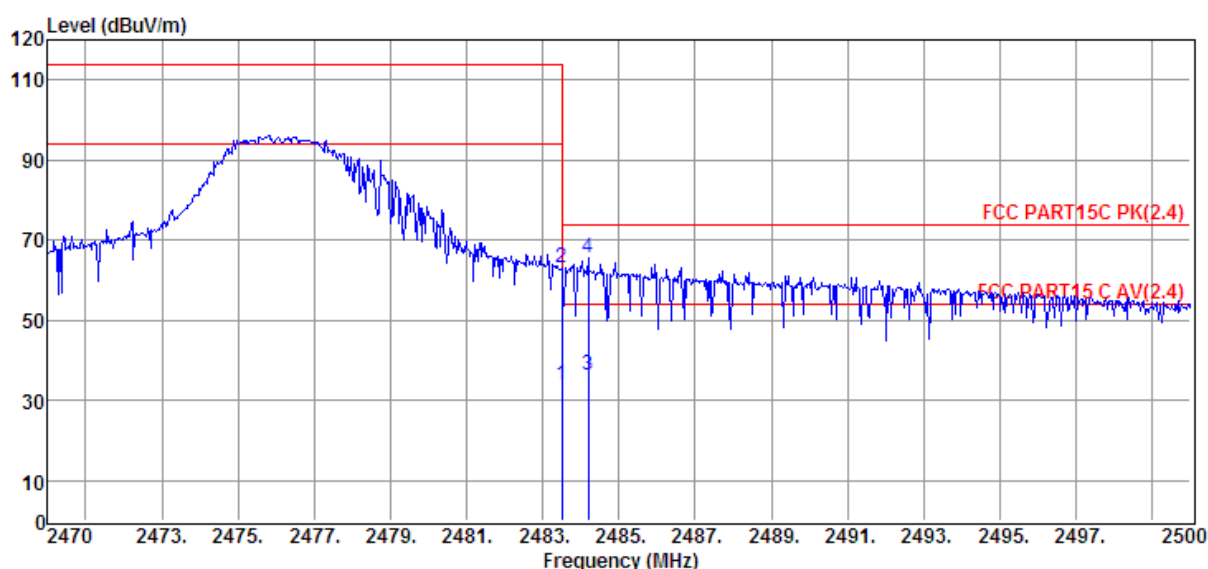
Test Mode : 2476MHz Bandedge

Condition : Temp:24.5'C,Humi:55%,  
Press:100.1kPa

Antenna/Distance : 2016 HF907/3m/VERTICAL

Memo :

Data: 110



| Item<br>(Mark) | Freq.<br>(MHz) | Read<br>Level<br>(dBμV) | Antenna<br>Factor<br>(dB/m) | PRM<br>Factor<br>dB | Cable<br>Loss<br>dB | Result<br>Level<br>(dBμV/m) | Limit<br>Line<br>(dBμV/m) | Over<br>Limit<br>(dB) | Detecto<br>r | Polarization |
|----------------|----------------|-------------------------|-----------------------------|---------------------|---------------------|-----------------------------|---------------------------|-----------------------|--------------|--------------|
| 1              | 2483.50        | 27.13                   | 30.14                       | 29.71               | 6.13                | 33.69                       | 54.00                     | -20.31                | Average      | VERTICAL     |
| 2              | 2483.50        | 56.35                   | 30.14                       | 29.71               | 6.13                | 62.91                       | 74.00                     | -11.09                | Peak         | VERTICAL     |
| 3              | 2484.19        | 29.68                   | 30.14                       | 29.71               | 6.13                | 36.24                       | 54.00                     | -17.76                | Average      | VERTICAL     |
| 4              | 2484.19        | 58.90                   | 30.14                       | 29.71               | 6.13                | 65.46                       | 74.00                     | -8.54                 | Peak         | VERTICAL     |

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. AV of 2483.50MHz=PK+PDCF=62.91-29.22=33.69dBuV/m&lt;54dBuV/m

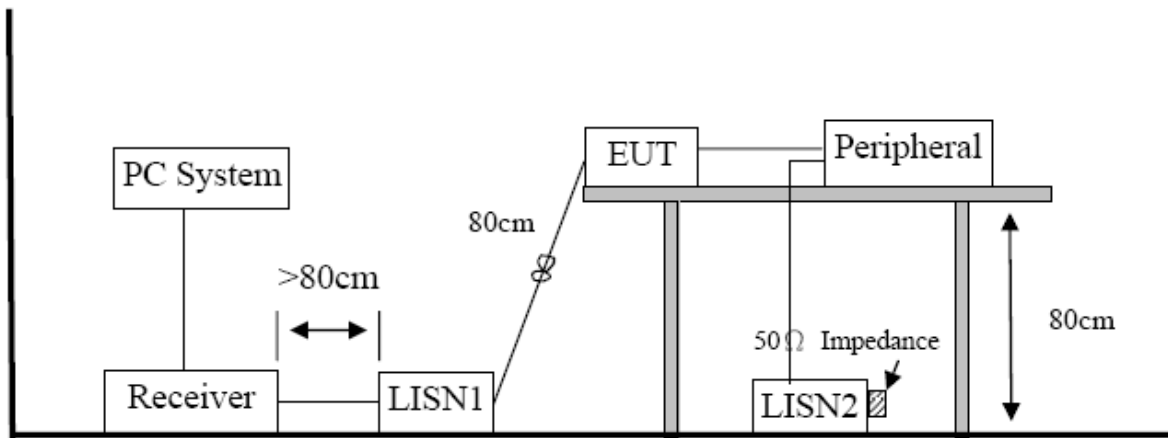
AV of 2483.50MHz=PK+PDCF=65.46-29.22=36.24dBuV/m&lt;54dBuV/m

| Average value:     |                                  |
|--------------------|----------------------------------|
| Calculate Formula: | Average value=Peak value + PDCF  |
|                    | PDCF=20 log(Duty cycle)          |
|                    | Duty cycle= T on time / T period |
| Test data:         | Ton time =0.173*5*4=3.46ms       |
|                    | T period =100ms                  |
|                    | PDCF=-29.22                      |

Note: Average value=Peak value + PDCF, since the PDCF&lt;-20dB, so the Average value is complied with the AV limit.

## 7. Power Line Conducted Emission

### 7.1. Block diagram of test setup



### 7.2. Power Line Conducted Emission Limits

| Frequency       | Quasi-Peak Level<br>dB(μV) | Average Level<br>dB(μV) |
|-----------------|----------------------------|-------------------------|
| 150kHz ~ 500kHz | 66 ~ 56*                   | 56 ~ 46*                |
| 500kHz ~ 5MHz   | 56                         | 46                      |
| 5MHz ~ 30MHz    | 60                         | 50                      |

Note 1: \* Decreasing linearly with logarithm of frequency.

Note 2: The lower limit shall apply at the transition frequencies.

### 7.3. Test Procedure

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 10.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.

All support equipment power received from a second LISN.

Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in clause 2.4 were scanned during the preliminary test.

After the preliminary scan, we found the test mode producing the highest emission level. The EUT configuration and worse cable configuration of the above highest emission levels were

recorded for reference of the final test.

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Neutral and Line, recording at least the six highest emissions.

Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

The bandwidth of test receiver is set at 9 kHz.

#### **7.4. Test Result**

Not Applicable, since the EUT is only battery-operated device.

## **8. Antenna Requirements**

### **8.1. Limit**

For intentional device, according to FCC 47 CFR Section 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.

### **8.2. Result**

The antennas used for this product are integral PCB Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0dBi.

**END OF REPORT**