

# FCC Test Report

**FCC ID** : NYOSYECNWPC1904  
**Equipment** : Wireless Charging System  
**Brand Name** : SEOYON ELECTRONICS CO., LTD.  
**Model Name** : SYECNWPC1904  
**Applicant/Manufacturer** : SEOYON ELECTRONICS Co.,Ltd  
100, Saneop-ro 156beon-gil, Gwonseon-gu, Suwon-si,  
Gyeonggi-do, South Korea  
**Standard** : 47 CFR FCC Part 15.225

The product was received on May 06, 2019, and testing was started from May 17, 2019 and completed on May 18, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of United States government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Allen Lin

**SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory**

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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### Appendix A. Test Photos

#### Photographs of EUT V01

[illegible]

## Summary of Test Result

| Report Clause | Ref. Std. Clause | Test Items                                                | Result (PASS/FAIL) | Remark                                                                         |
|---------------|------------------|-----------------------------------------------------------|--------------------|--------------------------------------------------------------------------------|
| 1.1.2         | 15.203           | Antenna Requirement                                       | PASS               | FCC 15.203                                                                     |
| 3.1           | 15.207           | AC Power-line Conducted Emissions                         | PASS               | FCC 15.207                                                                     |
| 3.2           | 15.215(c)        | Emission Bandwidth                                        | PASS               | Fall in band<br>$F_L \geq 13.553 \text{ MHz}$<br>$F_H \leq 13.567 \text{ MHz}$ |
| 3.3           | 15.225(a)~(d)    | Field Strength of Fundamental Emissions and Spectrum Mask | PASS               | 124 dBuV/m at 3m                                                               |
| 3.4           | 15.225(d)        | Transmitter Radiated Unwanted Emissions                   | PASS               | FCC 15.209                                                                     |
| 3.5           | 15.225(e)        | Frequency Stability                                       | PASS               | $\pm 0.01\%$ (100ppm)                                                          |

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and explanations:**

Transmit by EUT itself

**Reviewed by: Sam Tsai**

**Report Producer: Jenny Yang**

# 1 General Description

## 1.1 Information

### 1.1.1 RF General Information

| RF General Information                             |                                                             |                     |                |                         |
|----------------------------------------------------|-------------------------------------------------------------|---------------------|----------------|-------------------------|
| Frequency Range                                    | Modulation Mode                                             | Ch. Frequency (MHz) | Channel Number | Field Strength (dBuV/m) |
| 13.553 – 13.567 MHz                                | ISO 14443-3A (ASK)<br>ISO 14443-3B (ASK)<br>ISO 18092 (ASK) | 13.56               | 1              | 57.58                   |
| Note 1: Field strength performed peak level at 3m. |                                                             |                     |                |                         |

### 1.1.2 Antenna Information

| Antenna Category                    |                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/>            | Equipment placed on the market without antennas                                                                                                                                                                                                                                                                   |
| <input checked="" type="checkbox"/> | Integral antenna (antenna permanently attached)                                                                                                                                                                                                                                                                   |
| <input type="checkbox"/>            | Temporary RF connector provided                                                                                                                                                                                                                                                                                   |
| <input checked="" type="checkbox"/> | No temporary RF connector provided<br>Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path. |
| <input type="checkbox"/>            | External antenna (dedicated antennas)                                                                                                                                                                                                                                                                             |

| Antenna General Information |           |           |
|-----------------------------|-----------|-----------|
| No.                         | Ant. Cat. | Ant. Type |
| 1                           | Integral  | Loop      |

### 1.1.3 EUT Information

| Operational Condition               |                                                                                                                               |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| EUT Power Type                      | From DC Power supply                                                                                                          |
| Type of EUT                         |                                                                                                                               |
| <input checked="" type="checkbox"/> | Stand-alone                                                                                                                   |
| <input type="checkbox"/>            | Combined (EUT where the radio part is fully integrated within another device)<br>Combined Equipment - Brand Name / Model No.: |
| <input type="checkbox"/>            | Plug-in radio (EUT intended for a variety of host systems)<br>Host System - Brand Name / Model No.:                           |
| <input type="checkbox"/>            | Other:                                                                                                                        |

**1.1.4 Test Signal Duty Cycle**

| Duty Cycle Operation Restriction                                                  |                                                             |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------|
| The transmitter is used for                                                       | The transmitter is operated                                 |
| <input checked="" type="checkbox"/> Inductive applications                        | <input checked="" type="checkbox"/> Automatically triggered |
| <input type="checkbox"/> Duty cycle fixed mode                                    | <input checked="" type="checkbox"/> Duty cycle random mode  |
| <input checked="" type="checkbox"/> <b>Duty cycle mode - NFC-A (ISO 14443-3A)</b> |                                                             |
| Declare transmitter duty cycle / 1 hour =                                         | 100%                                                        |
| <input checked="" type="checkbox"/> <b>Duty cycle mode - NFC-B (ISO 14443-3B)</b> |                                                             |
| Declare transmitter duty cycle / 1 hour =                                         | 100%                                                        |
| <input checked="" type="checkbox"/> <b>Duty cycle mode - NFC-F (ISO 18092)</b>    |                                                             |
| Declare transmitter duty cycle / 1 hour =                                         | 100%                                                        |
| <input type="checkbox"/> <b>Duty cycle mode - NFC-V (ISO 15693)</b>               |                                                             |
| Declare transmitter duty cycle / 1 hour =                                         | 100%                                                        |

## 1.2 Testing Applied Standards

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

- ♦ 47 CFR FCC Part 15
- ♦ ANSI C63.10-2013
- ♦ KDB 174176 D01 v01r01

## 1.3 Testing Location Information

| Testing Location                           |        |                                                                           |                      |
|--------------------------------------------|--------|---------------------------------------------------------------------------|----------------------|
| <input checked="" type="checkbox"/>        | HWA YA | ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) |                      |
|                                            |        | TEL : 886-3-327-3456                                                      | FAX : 886-3-327-0973 |
| Test site Designation No. TW1190 with FCC. |        |                                                                           |                      |

| Test Condition    | Test Site No. | Test Engineer | Test Environment         | Test Date   |
|-------------------|---------------|---------------|--------------------------|-------------|
| AC Conduction     | CO01-HY       | Lego          | 23.1~24.2°C / 53.5~57.1% | 18/May/2019 |
| RF Conducted      | TH01-HY       | Andy          | 23.1~24.8°C / 60.9~62.1% | 17/May/2019 |
| Radiated Emission | 03CH03-HY     | Patrick       | 23.2~24.1°C / 51.1~53.8% | 17/May/2019 |

## 1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

| Test Items                           | Uncertainty | Remark                   |
|--------------------------------------|-------------|--------------------------|
| Conducted Emission (150kHz ~ 30MHz)  | 3.54 dB     | Confidence levels of 95% |
| Radiated Emission (9kHz ~ 30MHz)     | 1.6 dB      | Confidence levels of 95% |
| Radiated Emission (30MHz ~ 1,000MHz) | 4.3 dB      | Confidence levels of 95% |
| Conducted Emission                   | 1.3 dB      | Confidence levels of 95% |
| Temperature                          | 0.7 °C      | Confidence levels of 95% |
| Humidity                             | 4 %         | Confidence levels of 95% |

## 2 Test Configuration of EUT

### 2.1 Test Condition

| Condition Item      | Abbreviation/Remark | Remark |
|---------------------|---------------------|--------|
| Frequency Stability | Tnom                | 20°C   |
| -                   | Tmin                | -30°C  |
| -                   | Tmax                | 75°C   |
| -                   | Vnom                | 12V    |
| -                   | Vmin                | 10.8V  |
| -                   | Vmax                | 13.2V  |

### 2.2 The Worst Case Modulation Configuration

| Modulation Used for Conformance Testing |                                |
|-----------------------------------------|--------------------------------|
| Modulation Mode                         | Field Strength (dBuV/m at 3 m) |
| NFC                                     | 57.58                          |

### 2.3 Test Channel Frequencies Configuration

| Modulation Mode | Test Channel Frequencies (MHz) |
|-----------------|--------------------------------|
| NFC             | 13.56                          |

## 2.4 The Worst Case Measurement Configuration

| The Worst Case Mode for Following Conformance Tests |                                                                               |
|-----------------------------------------------------|-------------------------------------------------------------------------------|
| <b>Tests Item</b>                                   | AC power-line conducted emissions                                             |
| <b>Condition</b>                                    | AC power-line conducted measurement for line and neutral<br>Test Voltage: 12V |
| <b>Operating Mode</b>                               | <input checked="" type="checkbox"/> 1. DC power supply                        |

| The Worst Case Mode for Following Conformance Tests |                                         |
|-----------------------------------------------------|-----------------------------------------|
| <b>Tests Item</b>                                   | Emission Bandwidth, Frequency Stability |
| <b>Test Condition</b>                               | Conducted measurement                   |

| The Worst Case Mode for Following Conformance Tests |                                                                                                   |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>Tests Item</b>                                   | Field Strength of Fundamental Emissions<br>Spectrum Mask, Transmitter Radiated Unwanted Emissions |
| <b>Test Condition</b>                               | Radiated measurement                                                                              |
| <b>Pretest Mode</b>                                 | <input checked="" type="checkbox"/> 1. NFC-A (ISO 14443-3A)                                       |
|                                                     | <input checked="" type="checkbox"/> 2. NFC-B (ISO 14443-3B)                                       |
|                                                     | <input checked="" type="checkbox"/> 3. NFC-F (ISO 18092)                                          |
| <b>Operating Mode</b>                               | <input checked="" type="checkbox"/> 1. DC power supply                                            |
| <b>Orthogonal Planes of EUT</b>                     | <b>Z Plane</b>                                                                                    |
|                                                     |               |
| <b>Worst Planes of EUT</b>                          | <b>V</b>                                                                                          |

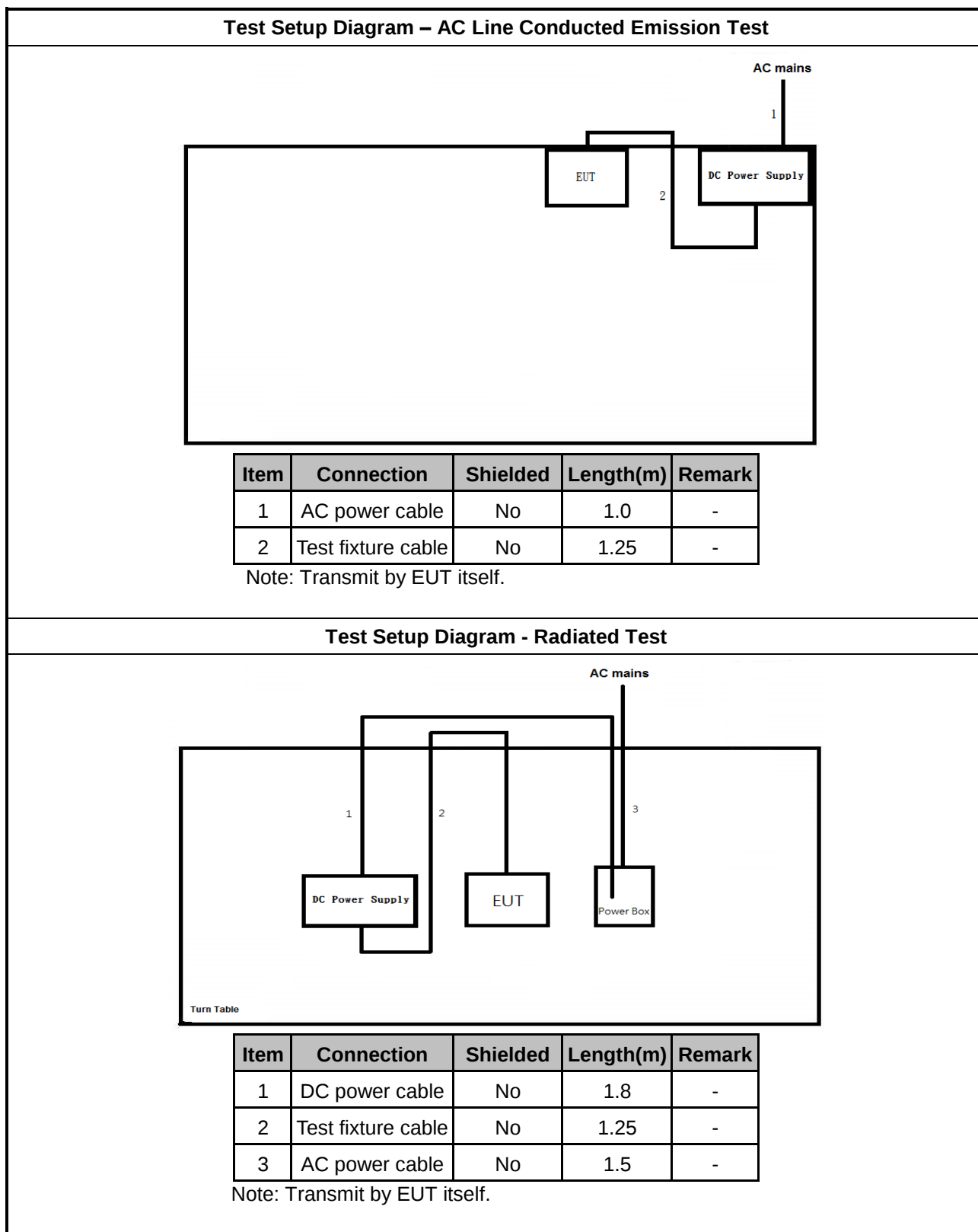
## 2.5 Support Equipment

| Support Equipment - AC Conduction |                 |            |            |
|-----------------------------------|-----------------|------------|------------|
| No.                               | Equipment       | Brand Name | Model Name |
| 1                                 | DC power supply | GW         | GPS-3030DD |

| Support Equipment - RF Conducted |                 |            |            |
|----------------------------------|-----------------|------------|------------|
| No.                              | Equipment       | Brand Name | Model Name |
| 1                                | DC Power Supply | GW         | GPS-3030DD |

| Support Equipment - Radiated |                 |            |            |
|------------------------------|-----------------|------------|------------|
| No.                          | Equipment       | Brand Name | Model Name |
| 1                            | DC power supply | GW         | GPS-3030DD |

## 2.6 Test Setup Diagram



### 3 Transmitter Test Result

#### 3.1 AC Power-line Conducted Emissions

##### 3.1.1 AC Power-line Conducted Emissions Limit

| AC Power-line Conducted Emissions Limit |            |           |
|-----------------------------------------|------------|-----------|
| Frequency Emission (MHz)                | Quasi-Peak | Average   |
| 0.15-0.5                                | 66 - 56 *  | 56 - 46 * |
| 0.5-5                                   | 56         | 46        |
| 5-30                                    | 60         | 50        |

Note 1: \* Decreases with the logarithm of the frequency.

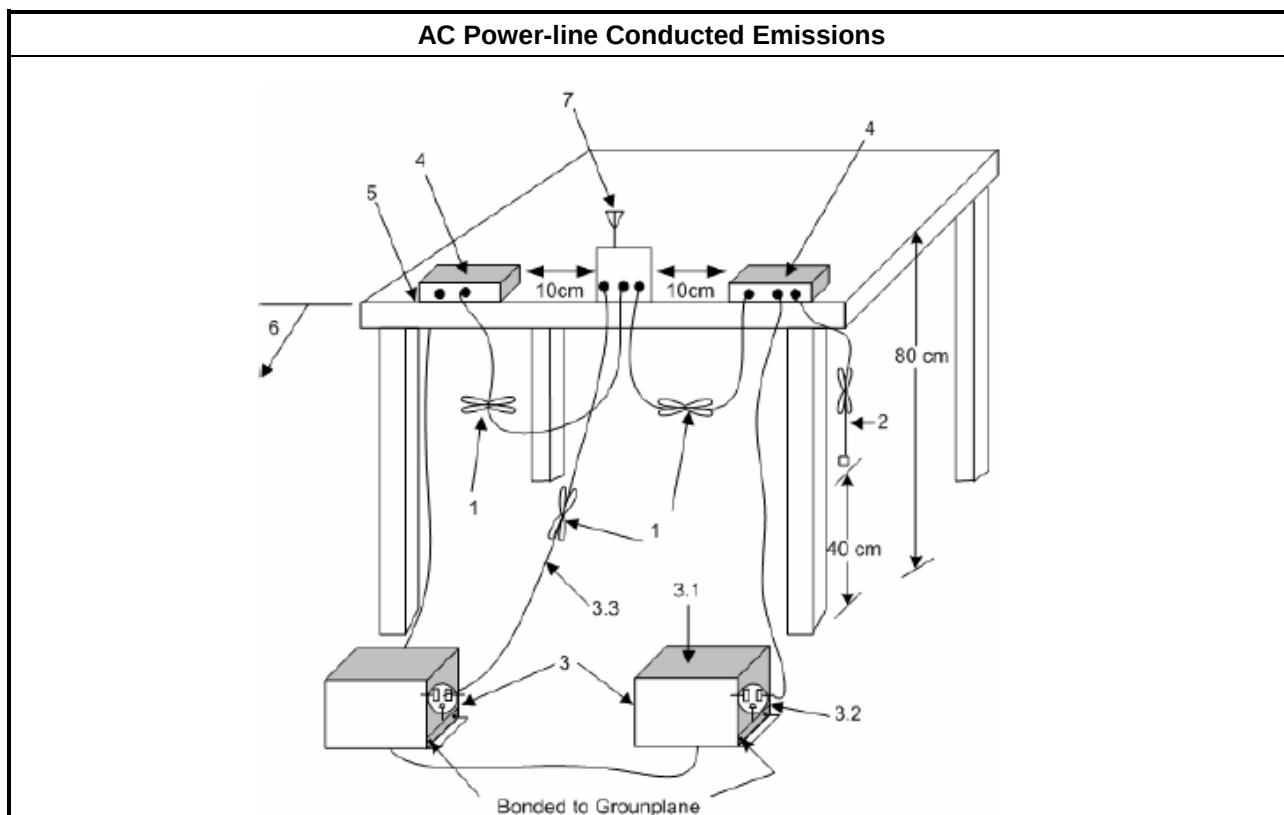
##### 3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

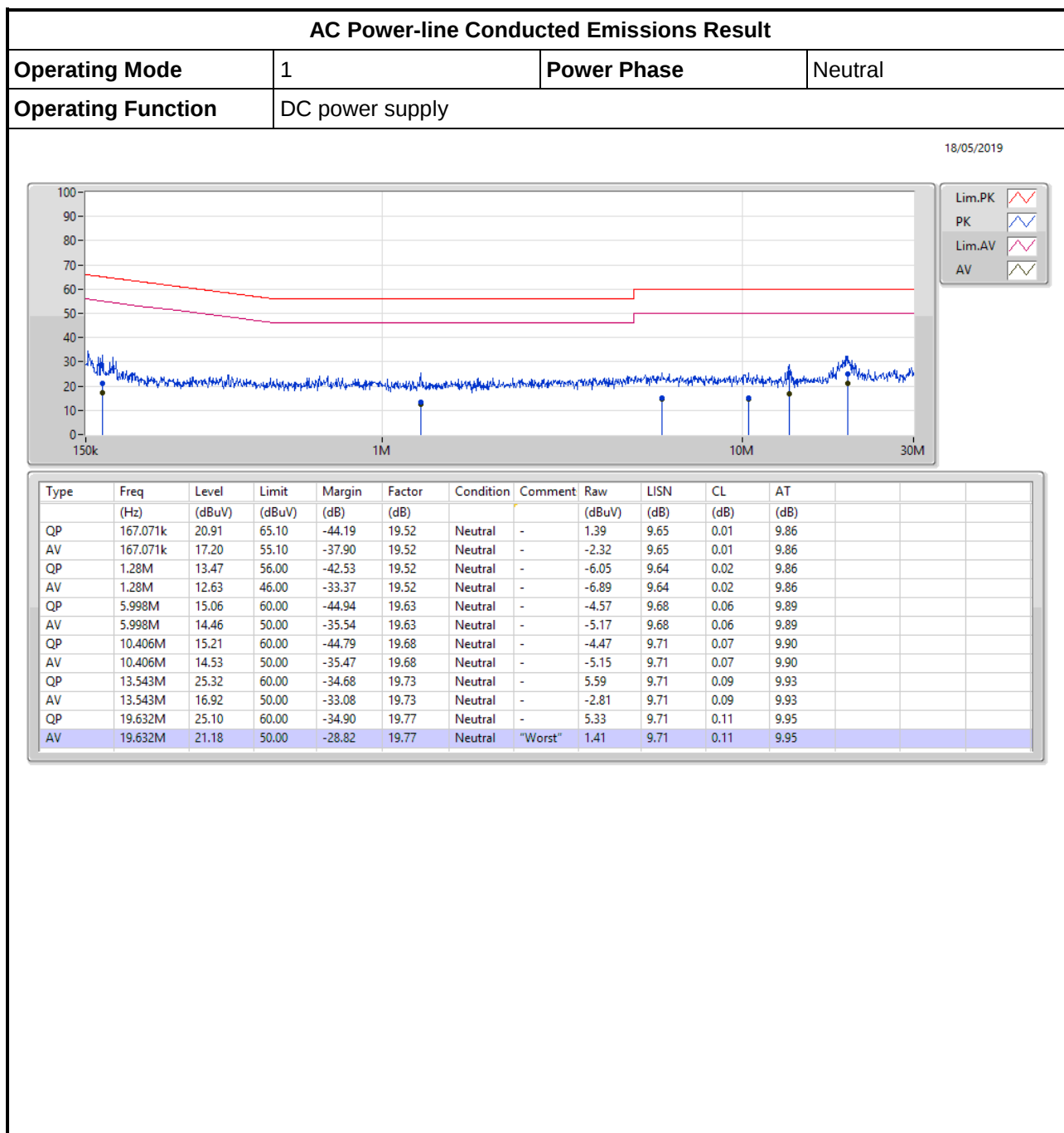
##### 3.1.3 Test Procedures

| Test Method                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <input checked="" type="checkbox"/> | If AC conducted emissions fall in operating band, then following below test method confirm final result.                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <input type="checkbox"/>            | Accept measurements done with a suitable dummy load replacing the antenna under the following conditions:<br>(1) Perform the AC line conducted tests with the antenna connected to determine compliance with FCC 15.207 limits outside the transmitter's fundamental emission band;<br>(2) Retest with a dummy load to determine compliance with FCC 15.207 limits within the transmitter's fundamental emission band.                                                                                                                          |
| <input checked="" type="checkbox"/> | For a device with a permanent antenna operating at or below 30 MHz, accept measurements done with a suitable dummy load, in lieu of the permanent antenna under the following conditions:<br>(1) Perform the AC line conducted tests with the permanent antenna to determine compliance with the FCC 15.207 limits outside the transmitter's fundamental emission band;<br>(2) Retest with a dummy load in lieu of the permanent antenna to determine compliance with the FCC 15.207 limits within the transmitter's fundamental emission band. |

### 3.1.4 Test Setup



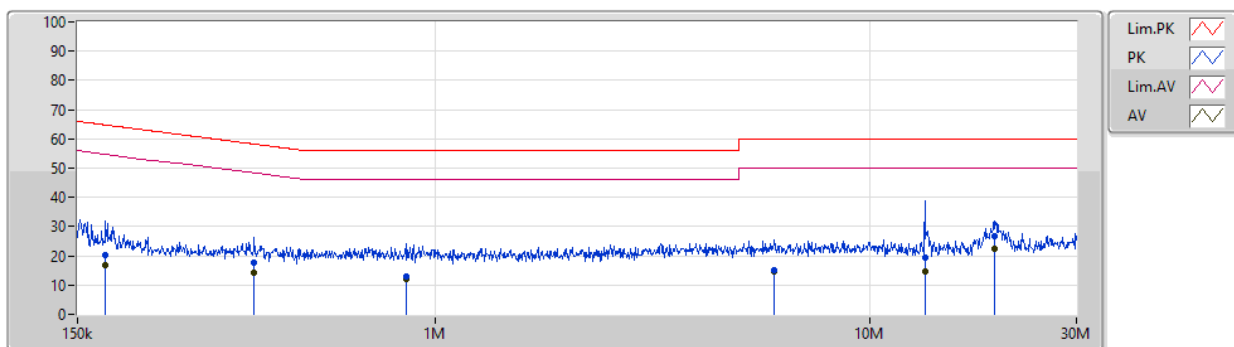
### 3.1.5 Test Result of AC Power-line Conducted Emissions



**AC Power-line Conducted Emissions Result**

|                    |                 |             |      |
|--------------------|-----------------|-------------|------|
| Operating Mode     | 1               | Power Phase | Line |
| Operating Function | DC power supply |             |      |

18/05/2019



| Type | Freq<br>(Hz) | Level<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) | Factor | Condition | Comment | Raw<br>(dBuV) | LISN<br>(dB) | CL<br>(dB) | AT<br>(dB) |  |  |  |
|------|--------------|-----------------|-----------------|----------------|--------|-----------|---------|---------------|--------------|------------|------------|--|--|--|
| QP   | 173.876k     | 20.13           | 64.78           | -44.65         | 19.48  | Line      | -       | 0.65          | 9.61         | 0.01       | 9.86       |  |  |  |
| AV   | 173.876k     | 16.78           | 54.78           | -38.00         | 19.48  | Line      | -       | -2.70         | 9.61         | 0.01       | 9.86       |  |  |  |
| QP   | 383.278k     | 17.68           | 58.20           | -40.52         | 19.48  | Line      | -       | -1.80         | 9.61         | 0.01       | 9.86       |  |  |  |
| AV   | 383.278k     | 14.14           | 48.20           | -34.06         | 19.48  | Line      | -       | -5.34         | 9.61         | 0.01       | 9.86       |  |  |  |
| QP   | 855.047k     | 12.88           | 56.00           | -43.12         | 19.49  | Line      | -       | -6.61         | 9.61         | 0.02       | 9.86       |  |  |  |
| AV   | 855.047k     | 12.14           | 46.00           | -33.86         | 19.49  | Line      | -       | -7.35         | 9.61         | 0.02       | 9.86       |  |  |  |
| QP   | 6.047M       | 15.04           | 60.00           | -44.96         | 19.59  | Line      | -       | -4.55         | 9.64         | 0.06       | 9.89       |  |  |  |
| AV   | 6.047M       | 14.47           | 50.00           | -35.53         | 19.59  | Line      | -       | -5.12         | 9.64         | 0.06       | 9.89       |  |  |  |
| QP   | 13.435M      | 19.55           | 60.00           | -40.45         | 19.66  | Line      | -       | -0.11         | 9.65         | 0.08       | 9.93       |  |  |  |
| AV   | 13.435M      | 14.71           | 50.00           | -35.29         | 19.66  | Line      | -       | -4.95         | 9.65         | 0.08       | 9.93       |  |  |  |
| QP   | 19.398M      | 26.82           | 60.00           | -33.18         | 19.69  | Line      | -       | 7.13          | 9.63         | 0.11       | 9.95       |  |  |  |
| AV   | 19.398M      | 22.50           | 50.00           | -27.50         | 19.69  | Line      | "Worst" | 2.81          | 9.63         | 0.11       | 9.95       |  |  |  |

## 3.2 Emission Bandwidth

### 3.2.1 Emission Bandwidth Limit

| 20dB Bandwidth Limit                |                                                                                                                                        |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (13.553 – 13.567 MHz). |

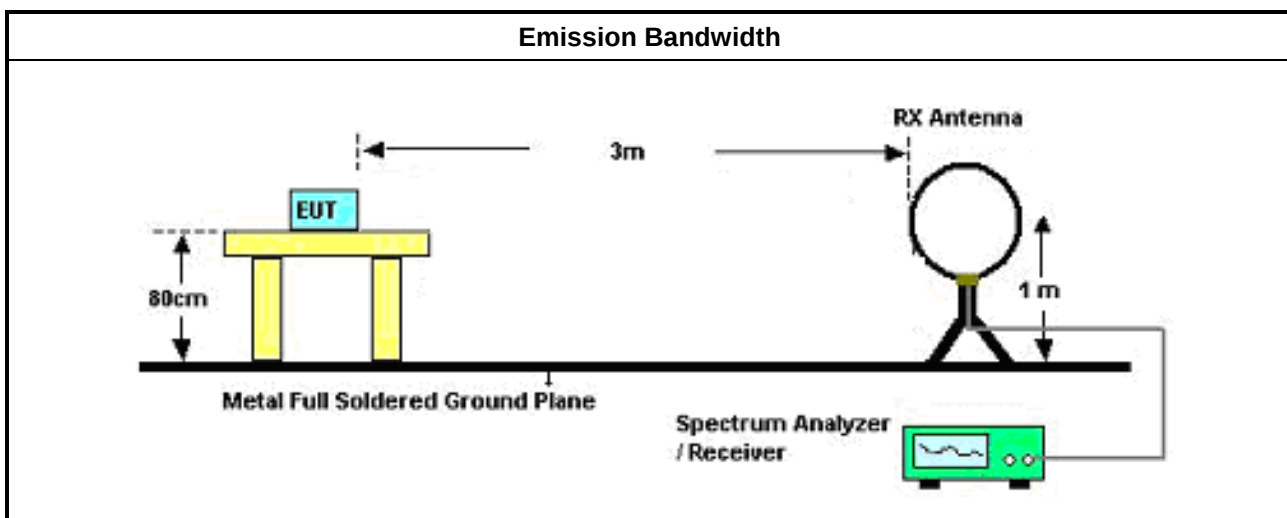
### 3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

### 3.2.3 Test Procedures

| Test Method                         |                                                                                                                                                                                                                       |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | For the emission bandwidth refer ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.                                                                                                                            |
| <input checked="" type="checkbox"/> | For radiated measurement. Loop antenna was rotated about the horizontal and vertical axis and the equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted field strength level. |

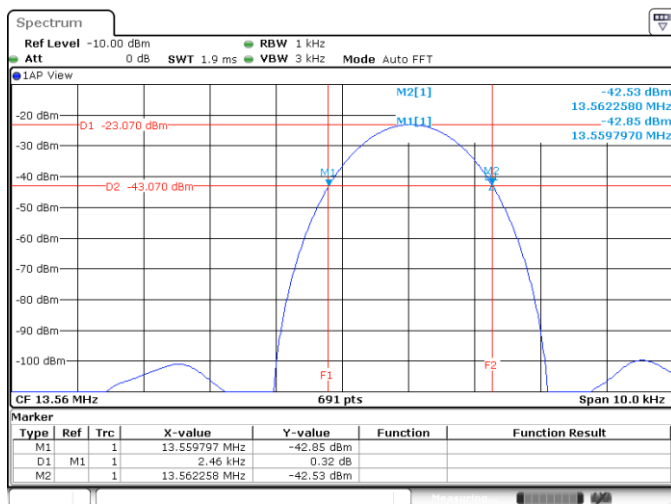
### 3.2.4 Test Setup



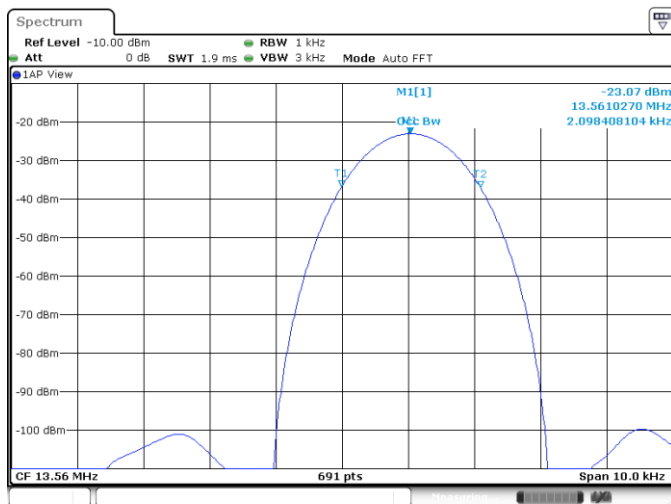
### 3.2.5 Test Result of Emission Bandwidth

| Occupied Channel Bandwidth Result |                 |                      |                     |                                 |                                 |
|-----------------------------------|-----------------|----------------------|---------------------|---------------------------------|---------------------------------|
| Modulation Mode                   | Frequency (MHz) | 20dB Bandwidth (kHz) | 99% Bandwidth (kHz) | F <sub>L</sub> at 20dB BW (MHz) | F <sub>H</sub> at 20dB BW (MHz) |
| NFC                               | 13.56           | 2.46000              | 2.09841             | 13.55980                        | 13.56226                        |
| Limit                             |                 | N/A                  | N/A                 | 13.553                          | 13.567                          |
| Result                            |                 | Complied             |                     |                                 |                                 |

**Emission Bandwidth Plot - 20dB Bandwidth**



**Emission Bandwidth Plot - 99% Bandwidth**



### 3.3 Field Strength of Fundamental Emissions and Spectrum Mask

#### 3.3.1 Field Strength of Fundamental Emissions and Spectrum Mask Limit

| Field Strength of Fundamental Emissions For FCC |            |              |              |             |             |
|-------------------------------------------------|------------|--------------|--------------|-------------|-------------|
| Emissions                                       | (uV/m)@30m | (dBuV/m)@30m | (dBuV/m)@10m | (dBuV/m)@3m | (dBuV/m)@1m |
| fundamental                                     | 15848      | 84.0         | 103.1        | 124.0       | 143.1       |
| Quasi peak measurement of the fundamental.      |            |              |              |             |             |

| Spectrum Mask For FCC   |            |              |              |             |             |
|-------------------------|------------|--------------|--------------|-------------|-------------|
| Freq. of Emission (MHz) | (uV/m)@30m | (dBuV/m)@30m | (dBuV/m)@10m | (dBuV/m)@3m | (dBuV/m)@1m |
| 1.705~13.110            | 30         | 29.5         | 48.6         | 69.5        | 88.6        |
| 13.110~13.410           | 106        | 40.5         | 59.6         | 80.5        | 99.6        |
| 13.410~13.553           | 334        | 50.5         | 69.6         | 90.5        | 109.6       |
| 13.553~13.567           | 15848      | 84.0         | 103.1        | 124.0       | 143.1       |
| 13.567~13.710           | 334        | 50.5         | 69.6         | 90.5        | 109.6       |
| 13.710~14.010           | 106        | 40.5         | 59.6         | 80.5        | 99.6        |
| 14.010~30.000           | 30         | 29.5         | 48.6         | 69.5        | 88.6        |

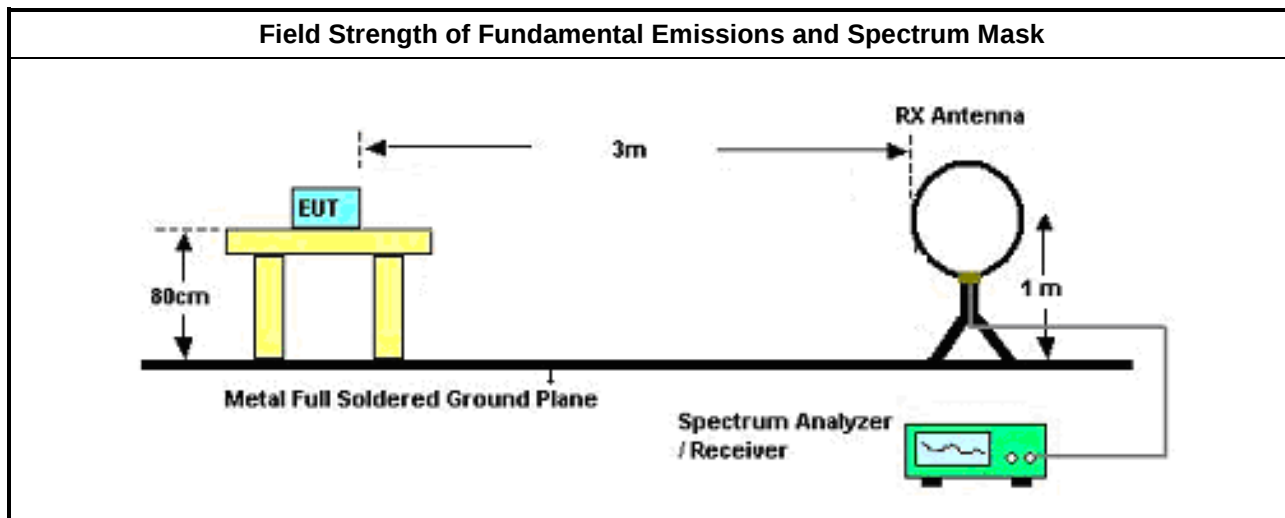
#### 3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

#### 3.3.3 Test Procedures

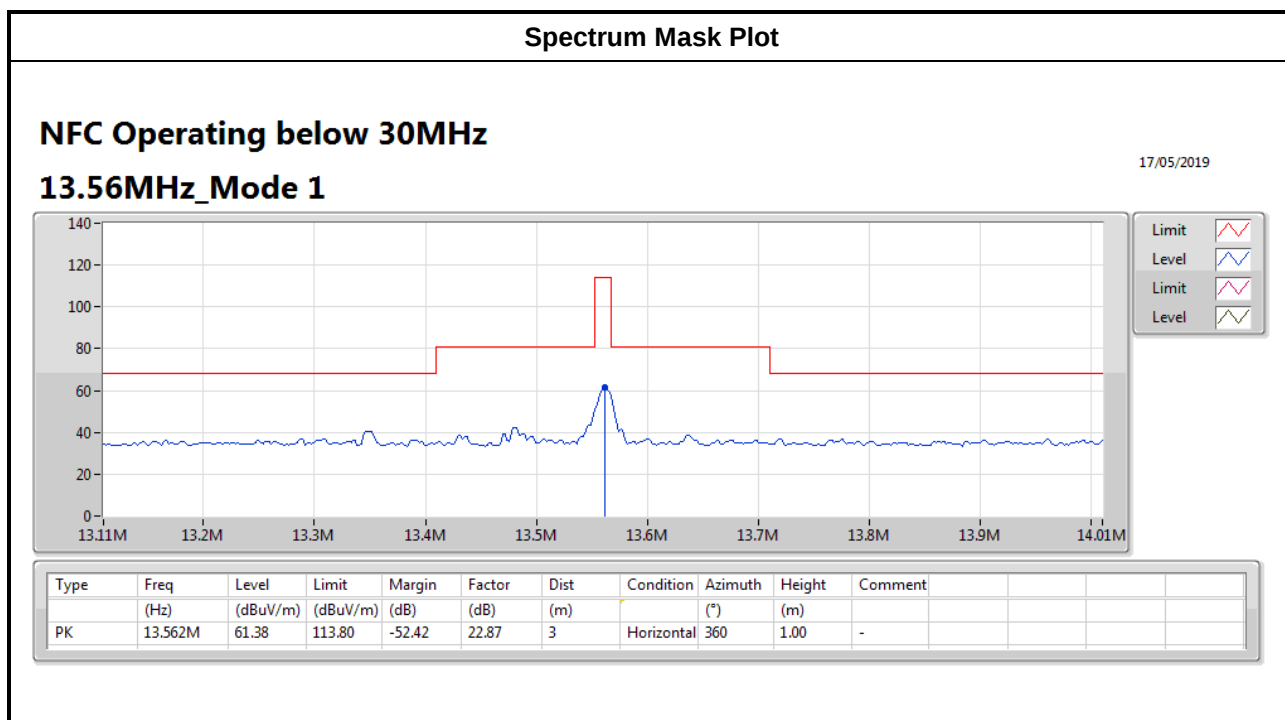
| Test Method                         |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz and test distance is 3m.                                                                                                                                                                                                                                                                                                                                   |
| <input checked="" type="checkbox"/> | At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the requirements; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be following below methods. |
| <input type="checkbox"/>            | The results shall be extrapolated to the specified distance by making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor.                                                                                                                                                                                                                                                |
| <input checked="" type="checkbox"/> | The results shall be by using the square of an inverse linear distance extrapolation factor (40 dB/decade).                                                                                                                                                                                                                                                                                                                          |
| <input checked="" type="checkbox"/> | For radiated measurement. Loop antenna was rotated about the horizontal and vertical axis and the equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted field strength level.                                                                                                                                                                                                                |

### 3.3.4 Test Setup



### 3.3.5 Test Result of Field Strength of Fundamental Emissions and Spectrum Mask

| Field Strength of Fundamental Emissions Result                                      |                 |                         |              |             |                   |
|-------------------------------------------------------------------------------------|-----------------|-------------------------|--------------|-------------|-------------------|
| Modulation Mode                                                                     | Frequency (MHz) | Fundamental (dBuV/m)@3m | Polarization | Margin (dB) | Limit (dBuV/m)@3m |
| NFC                                                                                 | 13.56           | 61.38                   | H            | 52.42       | 124.00            |
| Result                                                                              |                 | Complied                |              |             |                   |
| Note 1: Measurement worst emissions of receive antenna polarization: H(Horizontal). |                 |                         |              |             |                   |



### 3.4 Transmitter Radiated Unwanted Emissions

#### 3.4.1 Transmitter Radiated Unwanted Emissions Limit

| Transmitter Radiated Unwanted Emissions Limit |                       |                         |                      |
|-----------------------------------------------|-----------------------|-------------------------|----------------------|
| Frequency Range (MHz)                         | Field Strength (uV/m) | Field Strength (dBuV/m) | Measure Distance (m) |
| 0.009~0.490                                   | 2400/F(kHz)           | 48.5 - 13.8             | 300                  |
| 0.490~1.705                                   | 24000/F(kHz)          | 33.8 - 23               | 30                   |
| 1.705~30.0                                    | 30                    | 29                      | 30                   |
| 30~88                                         | 100                   | 40                      | 3                    |
| 88~216                                        | 150                   | 43.5                    | 3                    |
| 216~960                                       | 200                   | 46                      | 3                    |
| Above 960                                     | 500                   | 54                      | 3                    |

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

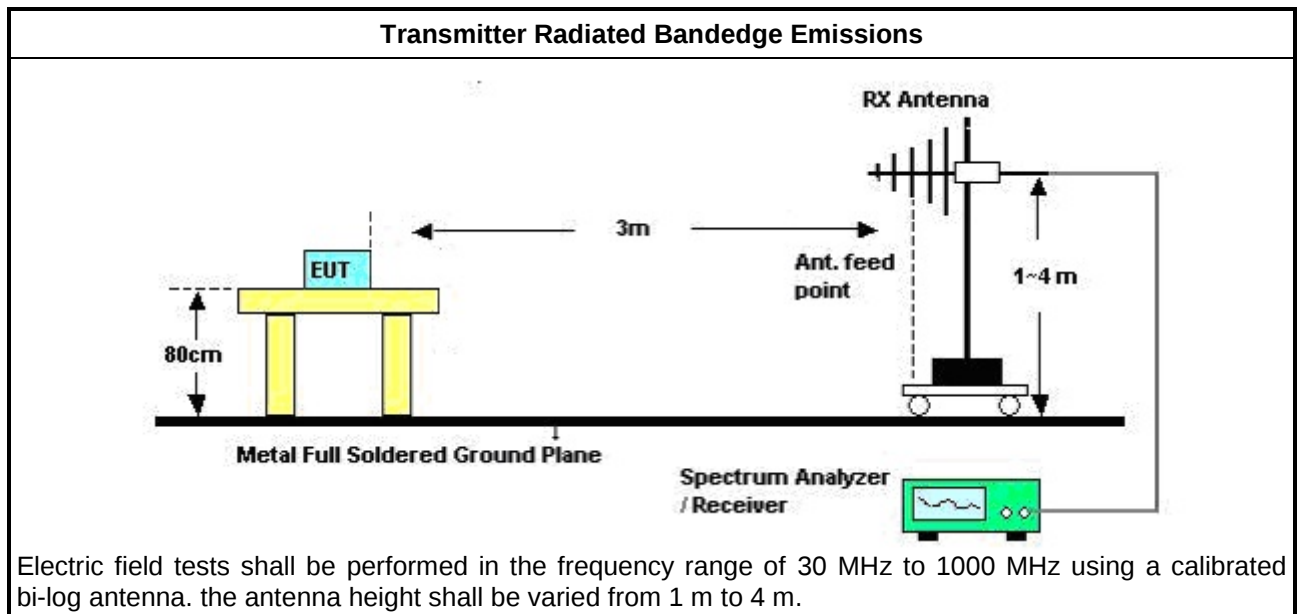
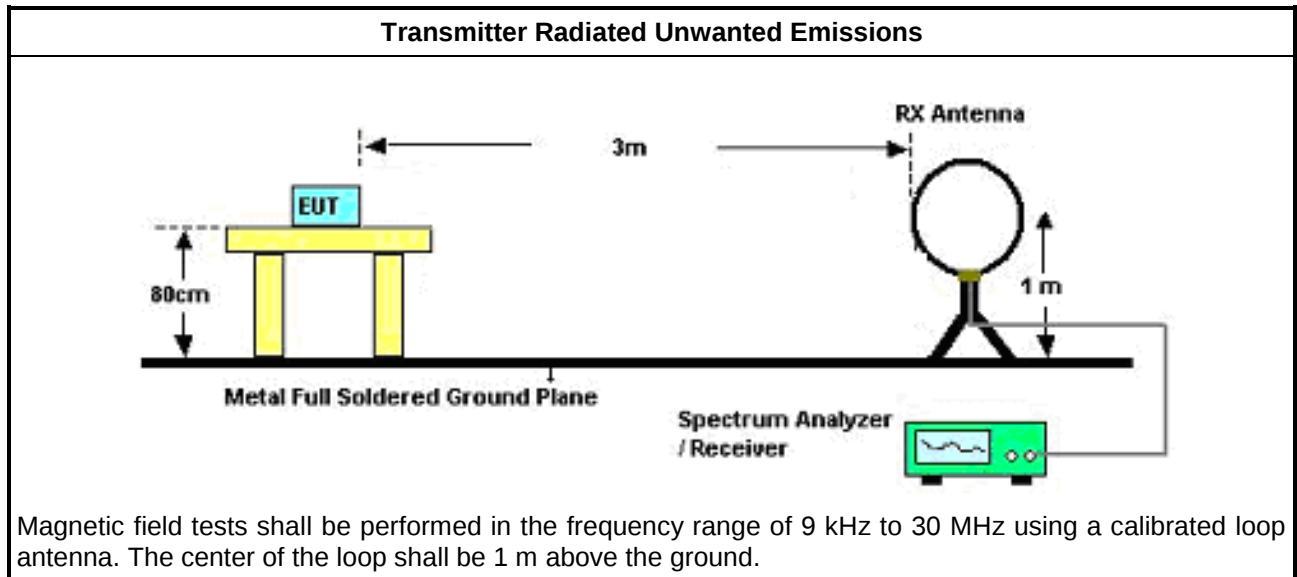
#### 3.4.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

### 3.4.3 Test Procedures

| Test Method                         |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | Refer as ANSI C63.10, clause 6.5 for radiated emissions from 30 MHz to 1 GHz and test distance is 3m.                                                                                                                                                                                                                                                                                                                                |
| <input checked="" type="checkbox"/> | Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz and test distance is 3m.                                                                                                                                                                                                                                                                                                                                   |
| <input checked="" type="checkbox"/> | At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the requirements; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be following below methods. |
| <input type="checkbox"/>            | The results shall be extrapolated to the specified distance by making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor.                                                                                                                                                                                                                                                |
| <input checked="" type="checkbox"/> | The results shall be by using the square of an inverse linear distance extrapolation factor (40 dB/decade).                                                                                                                                                                                                                                                                                                                          |
| <input checked="" type="checkbox"/> | For radiated measurement. Loop antenna was rotated about the horizontal and vertical axis and the equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted field strength level.                                                                                                                                                                                                                |
| <input checked="" type="checkbox"/> | The any unwanted emissions level shall not exceed the fundamental emission level.                                                                                                                                                                                                                                                                                                                                                    |
| <input checked="" type="checkbox"/> | All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.                                                                                                                                                                                                                                                                                                   |

### 3.4.4 Test Setup



**3.4.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)****Summary**

| Mode             | Result | Type | Freq<br>(Hz) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Factor<br>(dB) | Dist<br>(m) | Azimuth<br>(°) | Height<br>(m) | Comments |
|------------------|--------|------|--------------|-------------------|-------------------|----------------|----------------|-------------|----------------|---------------|----------|
| 13.553-13.567MHz | -      | -    | -            | -                 | -                 | -              | -              | -           | -              | -             | -        |
| NFC              | Pass   | PK   | 2.06M        | 56.63             | 69.50             | -12.87         | 20.54          | 3           | 360            | 1.00          | -        |

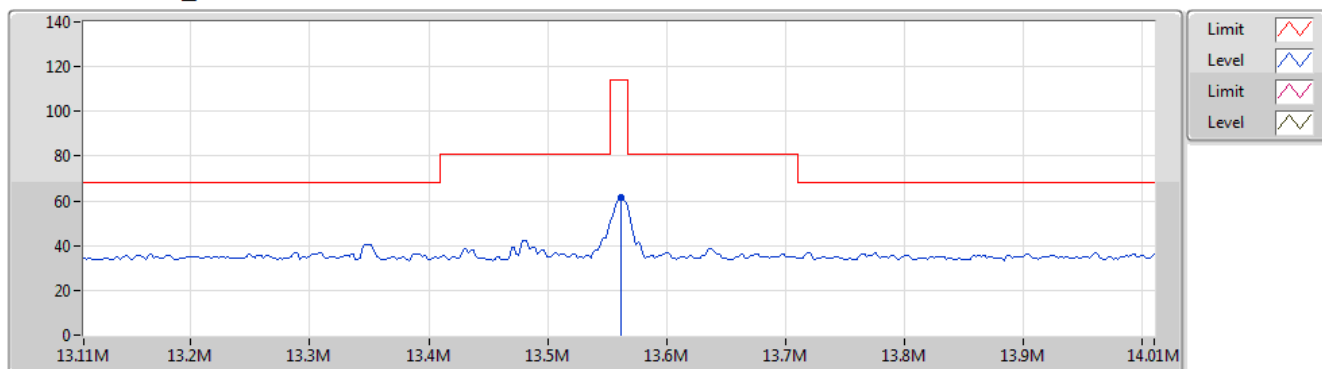
**Result**

| Mode            | Result | Type | Freq<br>(Hz) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Factor<br>(dB) | Dist<br>(m) | Azimuth<br>(°) | Height<br>(m) | Comments |
|-----------------|--------|------|--------------|-------------------|-------------------|----------------|----------------|-------------|----------------|---------------|----------|
| NFC             | -      | -    | -            | -                 | -                 | -              | -              | -           | -              | -             | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 13.562M      | 61.38             | 124.00            | -62.62         | 22.87          | 3           | 360            | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 30.15k       | 56.96             | 126.97            | -70.01         | 20.39          | 3           | 0              | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 83.73k       | 48.21             | 123.11            | -74.90         | 19.52          | 3           | 0              | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 98.958k      | 45.43             | 122.01            | -76.58         | 19.21          | 3           | 0              | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 388.8k       | 53.41             | 101.10            | -47.69         | 20.71          | 3           | 360            | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 2.06M        | 56.63             | 69.50             | -12.87         | 20.54          | 3           | 360            | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 27.134M      | 40.06             | 69.50             | -29.44         | 24.06          | 3           | 360            | 1.00          | -        |

## NFC Operating below 30MHz

17/05/2019

### 13.56MHz\_Mode 1



| Type | Freq    | Level    | Limit    | Margin | Factor | Dist | Condition  | Azimuth | Height | Comment |
|------|---------|----------|----------|--------|--------|------|------------|---------|--------|---------|
|      | (Hz)    | (dBuV/m) | (dBuV/m) | (dB)   | (dB)   | (m)  |            | (°)     | (m)    |         |
| PK   | 13.562M | 61.38    | 113.80   | -52.42 | 22.87  | 3    | Horizontal | 360     | 1.00   | -       |

# **NFC Operating below 30MHz**

17/05/2019

## **13.56MHz\_Mode 1**

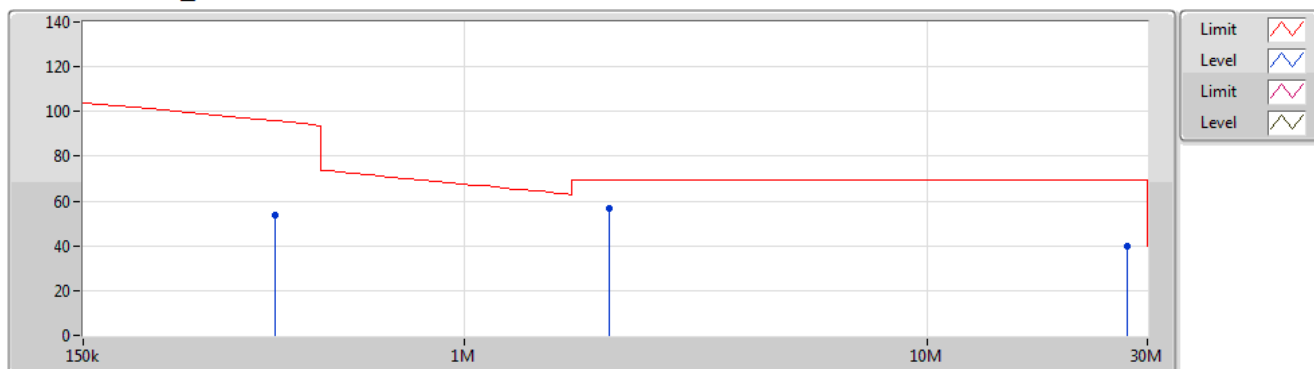


| Type | Freq<br>(Hz) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Factor<br>(dB) | Dist<br>(m) | Condition  | Azimuth<br>(°) | Height<br>(m) | Comment |  |  |  |  |
|------|--------------|-------------------|-------------------|----------------|----------------|-------------|------------|----------------|---------------|---------|--|--|--|--|
| PK   | 30.15k       | 56.96             | 126.97            | -70.01         | 20.39          | 3           | Horizontal | 0              | 1.00          | -       |  |  |  |  |
| PK   | 83.73k       | 48.21             | 123.11            | -74.90         | 19.52          | 3           | Horizontal | 0              | 1.00          | -       |  |  |  |  |
| PK   | 98.958k      | 45.43             | 122.01            | -76.58         | 19.21          | 3           | Horizontal | 0              | 1.00          | -       |  |  |  |  |

# **NFC Operating below 30MHz**

17/05/2019

## **13.56MHz\_Mode 1**



| Type | Freq    | Level    | Limit    | Margin | Factor | Dist | Condition  | Azimuth | Height | Comment |
|------|---------|----------|----------|--------|--------|------|------------|---------|--------|---------|
|      | (Hz)    | (dBuV/m) | (dBuV/m) | (dB)   | (dB)   | (m)  |            | (°)     | (m)    |         |
| PK   | 388.8k  | 53.41    | 101.10   | -47.69 | 20.71  | 3    | Horizontal | 360     | 1.00   | -       |
| PK   | 2.06M   | 56.63    | 69.50    | -12.87 | 20.54  | 3    | Horizontal | 360     | 1.00   | -       |
| PK   | 27.134M | 40.06    | 69.50    | -29.44 | 24.06  | 3    | Horizontal | 360     | 1.00   | -       |

**3.4.6 Transmitter Radiated Unwanted Emissions (Above 30MHz)****Summary**

| Mode             | Result | Type | Freq<br>(Hz) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Factor<br>(dB) | Dist<br>(m) | Azimuth<br>(°) | Height<br>(m) | Comments |
|------------------|--------|------|--------------|-------------------|-------------------|----------------|----------------|-------------|----------------|---------------|----------|
| 13.553-13.567MHz | -      | -    | -            | -                 | -                 | -              | -              | -           | -              | -             | -        |
| NFC              | Pass   | QP   | 542.16M      | 42.97             | 46.00             | -3.03          | -1.30          | 3           | 23             | 1.00          | -        |

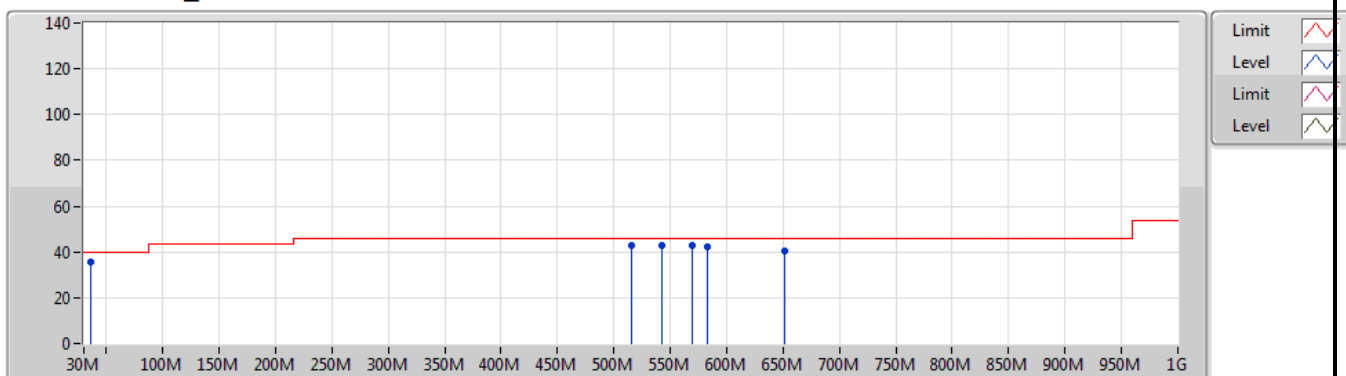
**Result**

| Mode            | Result | Type | Freq<br>(Hz) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Factor<br>(dB) | Dist<br>(m) | Azimuth<br>(°) | Height<br>(m) | Comments |
|-----------------|--------|------|--------------|-------------------|-------------------|----------------|----------------|-------------|----------------|---------------|----------|
| NFC             | -      | -    | -            | -                 | -                 | -              | -              | -           | -              | -             | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 35.82M       | 35.33             | 40.00             | -4.67          | -7.68          | 3           | 0              | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 515M         | 42.60             | 46.00             | -3.40          | -2.36          | 3           | 0              | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 650.8M       | 40.59             | 46.00             | -5.41          | -0.33          | 3           | 0              | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | QP   | 542.16M      | 42.97             | 46.00             | -3.03          | -1.30          | 3           | 23             | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | QP   | 569.32M      | 42.81             | 46.00             | -3.19          | -1.15          | 3           | 143            | 1.12          | -        |
| 13.56MHz_Mode 1 | Pass   | QP   | 582.9M       | 41.96             | 46.00             | -4.04          | -1.38          | 3           | 89             | 1.02          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 37.76M       | 33.16             | 40.00             | -6.84          | -8.64          | 3           | 360            | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 379.2M       | 33.35             | 46.00             | -12.65         | -4.45          | 3           | 360            | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 515M         | 42.51             | 46.00             | -3.49          | -2.36          | 3           | 360            | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 542.16M      | 42.95             | 46.00             | -3.05          | -1.30          | 3           | 360            | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 569.32M      | 41.72             | 46.00             | -4.28          | -1.15          | 3           | 360            | 1.00          | -        |
| 13.56MHz_Mode 1 | Pass   | PK   | 677.96M      | 38.52             | 46.00             | -7.48          | -0.27          | 3           | 360            | 1.00          | -        |

## NFC Operating above 30MHz

17/05/2019

### 13.56MHz\_Mode 1

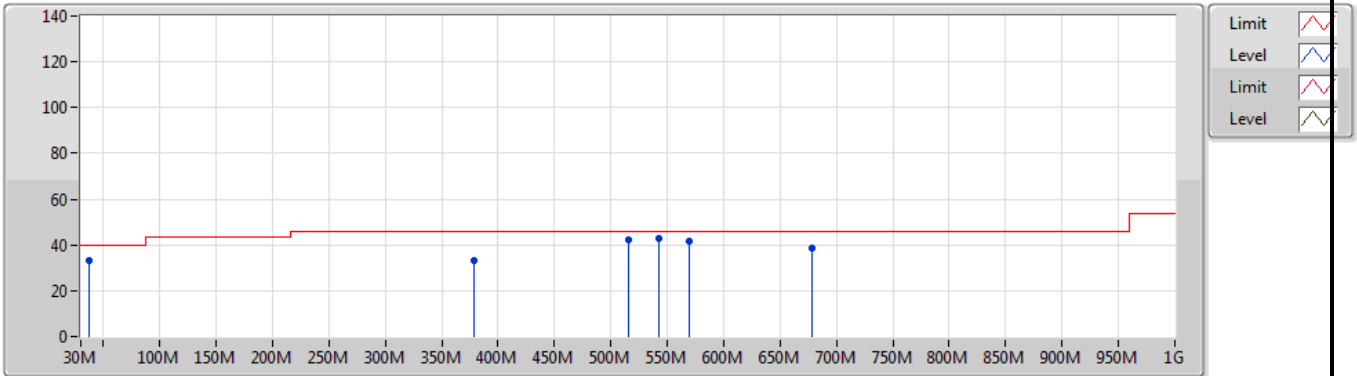


| Type | Freq<br>(Hz) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Factor<br>(dB) | Dist<br>(m) | Condition | Azimuth<br>(°) | Height<br>(m) | Comment |
|------|--------------|-------------------|-------------------|----------------|----------------|-------------|-----------|----------------|---------------|---------|
| PK   | 35.82M       | 35.33             | 40.00             | -4.67          | -7.68          | 3           | Vertical  | 0              | 1.00          | -       |
| PK   | 515M         | 42.60             | 46.00             | -3.40          | -2.36          | 3           | Vertical  | 0              | 1.00          | -       |
| PK   | 650.8M       | 40.59             | 46.00             | -5.41          | -0.33          | 3           | Vertical  | 0              | 1.00          | -       |
| QP   | 542.16M      | 42.97             | 46.00             | -3.03          | -1.30          | 3           | Vertical  | 23             | 1.00          | -       |
| QP   | 569.32M      | 42.81             | 46.00             | -3.19          | -1.15          | 3           | Vertical  | 143            | 1.12          | -       |
| QP   | 582.9M       | 41.96             | 46.00             | -4.04          | -1.38          | 3           | Vertical  | 89             | 1.02          | -       |

## NFC Operating above 30MHz

17/05/2019

### 13.56MHz\_Mode 1



| Type | Freq<br>(Hz) | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Factor<br>(dB) | Dist<br>(m) | Condition  | Azimuth<br>(°) | Height<br>(m) | Comment |  |  |  |  |
|------|--------------|-------------------|-------------------|----------------|----------------|-------------|------------|----------------|---------------|---------|--|--|--|--|
| PK   | 37.76M       | 33.16             | 40.00             | -6.84          | -8.64          | 3           | Horizontal | 360            | 1.00          | -       |  |  |  |  |
| PK   | 379.2M       | 33.35             | 46.00             | -12.65         | -4.45          | 3           | Horizontal | 360            | 1.00          | -       |  |  |  |  |
| PK   | 515M         | 42.51             | 46.00             | -3.49          | -2.36          | 3           | Horizontal | 360            | 1.00          | -       |  |  |  |  |
| PK   | 542.16M      | 42.95             | 46.00             | -3.05          | -1.30          | 3           | Horizontal | 360            | 1.00          | -       |  |  |  |  |
| PK   | 569.32M      | 41.72             | 46.00             | -4.28          | -1.15          | 3           | Horizontal | 360            | 1.00          | -       |  |  |  |  |
| PK   | 677.96M      | 38.52             | 46.00             | -7.48          | -0.27          | 3           | Horizontal | 360            | 1.00          | -       |  |  |  |  |

### 3.5 Frequency Stability

#### 3.5.1 Frequency Stability Limit

| Frequency Stability Limit           |                                                                                   |
|-------------------------------------|-----------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | Carrier frequency stability shall be maintained to $\pm 0.01\%$ ( $\pm 100$ ppm). |

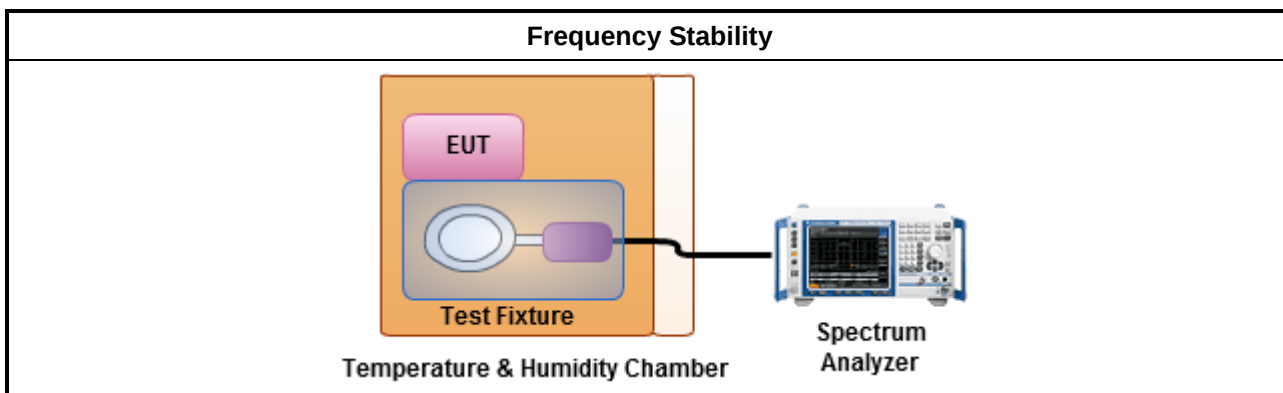
#### 3.5.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

#### 3.5.3 Test Procedures

| Test Method                         |                                                                                                                                          |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | Refer as ANSI C63.10, clause 6.8 for frequency stability tests                                                                           |
| <input checked="" type="checkbox"/> | Frequency stability with respect to ambient temperature                                                                                  |
| <input checked="" type="checkbox"/> | Frequency stability when varying supply voltage                                                                                          |
| <input type="checkbox"/>            | For conducted measurement.                                                                                                               |
| <input checked="" type="checkbox"/> | For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level. |

#### 3.5.4 Test Setup



### 3.5.5 Test Result of Frequency Stability

| Frequency Stability Result                                                                                                                                                                                                                                                  |                    |                           |          |          |          |                           |        |        |        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------|----------|----------|----------|---------------------------|--------|--------|--------|
| Condition                                                                                                                                                                                                                                                                   | Ch. Freq.<br>(MHz) | Frequency Stability (ppm) |          |          |          |                           |        |        |        |
|                                                                                                                                                                                                                                                                             |                    | Test Frequency (MHz)      |          |          |          | Frequency Stability (ppm) |        |        |        |
|                                                                                                                                                                                                                                                                             |                    | 0 min                     | 2 min    | 5 min    | 10 min   | 0 min                     | 2 min  | 5 min  | 10 min |
| T <sub>20°C</sub> V <sub>max</sub>                                                                                                                                                                                                                                          | 13.56              | 13.56065                  | 13.56066 | 13.56066 | 13.56066 | 48.23                     | 48.38  | 48.67  | 48.89  |
| T <sub>20°C</sub> V <sub>min</sub>                                                                                                                                                                                                                                          | 13.56              | 13.56064                  | 13.56064 | 13.56065 | 13.56065 | 46.83                     | 47.20  | 47.86  | 47.79  |
| T <sub>75°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                          | 13.56              | 13.56058                  | 13.56060 | 13.56058 | 13.56065 | 42.85                     | 44.54  | 42.77  | 48.01  |
| T <sub>60°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                          | 13.56              | 13.56062                  | 13.56065 | 13.56065 | 13.56065 | 45.87                     | 48.23  | 48.01  | 48.23  |
| T <sub>50°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                          | 13.56              | 13.56061                  | 13.56057 | 13.56065 | 13.56058 | 44.62                     | 41.81  | 48.01  | 42.77  |
| T <sub>40°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                          | 13.56              | 13.56062                  | 13.56058 | 13.56065 | 13.56065 | 45.87                     | 43.07  | 48.23  | 47.94  |
| T <sub>30°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                          | 13.56              | 13.56062                  | 13.56060 | 13.56065 | 13.56065 | 45.87                     | 44.54  | 48.23  | 48.23  |
| T <sub>20°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                          | 13.56              | 13.56058                  | 13.56058 | 13.56058 | 13.56065 | 42.85                     | 42.85  | 42.85  | 48.23  |
| T <sub>10°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                          | 13.56              | 13.55985                  | 13.55986 | 13.55987 | 13.55989 | -11.06                    | -10.32 | -9.59  | -8.11  |
| T <sub>0°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                           | 13.56              | 13.55980                  | 13.55981 | 13.55975 | 13.55977 | -14.75                    | -14.01 | -18.44 | -16.96 |
| T <sub>-10°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                         | 13.56              | 13.55972                  | 13.55975 | 13.55980 | 13.55979 | -20.65                    | -18.44 | -14.75 | -15.49 |
| T <sub>-20°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                         | 13.56              | 13.55960                  | 13.55967 | 13.55968 | 13.55973 | -29.50                    | -24.34 | -23.60 | -19.91 |
| T <sub>-30°C</sub> V <sub>nom</sub>                                                                                                                                                                                                                                         | 13.56              | 13.55962                  | 13.55970 | 13.55973 | 13.55979 | -28.02                    | -22.12 | -19.91 | -15.49 |
| Limit (ppm)                                                                                                                                                                                                                                                                 |                    | -                         |          |          |          | 100                       |        |        |        |
| Result                                                                                                                                                                                                                                                                      |                    | Complied                  |          |          |          |                           |        |        |        |
| Note 1: Measure at 85 % [Vmin] and 115 % [Vmax] of the nominal voltage [Vnom]. The nominal voltage refer test report clause 2.1 for EUT operational condition.<br>Note 2: Measure maximum deviation frequency at operating frequency at startup and two, five, and ten min. |                    |                           |          |          |          |                           |        |        |        |

## 4 Test Equipment and Calibration Data

### Instrument for AC Conduction

| Instrument                           | Manufacturer | Model No.  | Serial No. | Characteristics     | Calibration Date | Calibration Due Date |
|--------------------------------------|--------------|------------|------------|---------------------|------------------|----------------------|
| EMC Receiver                         | R&S          | ESR3       | 102052     | 9kHz ~ 3.6GHz       | 09/Apr/2019      | 08/Apr/2020          |
| LISN                                 | R&S          | ENV 216    | 101274     | 9kHz ~ 30MHz        | 12/Jun/2018      | 11/Jun/2019          |
| RF Cable-CON                         | MTJ          | RG142      | CB001-CO   | 9kHz ~ 30MHz        | 17/Sep/2018      | 16/Sep/2019          |
| AC POWER                             | APC          | AFC-11003G | F308010045 | 47Hz~63Hz<br>5~300V | NCR              | NCR                  |
| Impuls<br>Begrenzer Pulse<br>Limiter | SCHWARZBECK  | VTSD 9561F | 9495       | 9kHz ~ 30MHz        | 11/Oct/2018      | 10/Oct/2019          |

### Instrument for Conducted Test

| Instrument        | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Calibration Due Date |
|-------------------|--------------|-----------|------------|-----------------|------------------|----------------------|
| Spectrum Analyzer | R&S          | FSV 40    | 101013     | 9kHz~40GHz      | 13/Mar/2019      | 12/Mar/2020          |
| Loop Antenna      | TESEQ        | HLA 6120  | 31244      | 9kHz ~ 30MHz    | 15/Mar/2019      | 14/Mar/2020          |

### Instrument for Radiated Test

| Instrument                     | Manufacturer    | Model No.                 | Serial No. | Characteristics    | Calibration Date | Calibration Due Date |
|--------------------------------|-----------------|---------------------------|------------|--------------------|------------------|----------------------|
| 3m Semi Anechoic Chamber       | SIDT FRANKONIA  | SAC-3M                    | 03CH02-HY  | 30MHz ~ 1GHz<br>3m | 19/Oct/2018      | 18/Oct/2019          |
| Amplifier                      | Agilent         | 8447D                     | 2944A11149 | 100kHz ~ 1.3GHz    | 27Jul/2018       | 02/Jul/2019          |
| Signal Analyzer                | R&S             | FSV40                     | 101500     | 10Hz ~ 40GHz       | 18/Jul/2018      | 17/Jul/2019          |
| RF Cable-R03m                  | Jye Bao         | RG142                     | CB017      | 9kHz ~ 1GHz        | 18/Jan/2019      | 17/Jan/2020          |
| Bilog Antenna & 5dB Attenuator | SCHAFFNER / MTJ | CBL 6112B /<br>MTJ6102-05 | 2723 / 2   | 30MHz ~ 1GHz       | 08/Sep/2018      | 07/Sep/2019          |
| EMI Test Receiver              | R&S             | ESR                       | 102052     | 9kHz ~ 3.6GHz      | 09/Apr/2019      | 08/Apr/2020          |
| Loop Antenna                   | TESEQ           | HLA 6120                  | 31244      | 9k-30MHz           | 15/Mar/2019      | 14/Mar/2020          |