

# Orientronic Manufacturing Ltd.

## TEST REPORT

**SCOPE OF WORK**

EMC TESTING— C2Me24MPA

**REPORT NUMBER**

190325064GZU-001

**ISSUE DATE**

10 August 2020

**[REVISED DATE]**

[-----]

**PAGES**

35

**DOCUMENT CONTROL NUMBER**

FCC Part 15.249-c

© 2017 INTERTEK



## TEST REPORT

Telephone: 86-20-8213 9688  
Facsimile: 86-20-3205 7538  
[www.intertek.com](http://www.intertek.com)

Applicant Name & : Orientronic Manufacturing Ltd.  
Address : No.6 Zhongjiazhuang North Road, Shigangdong Village, Dalong  
Street, Panyu. GUANGZHOU Guangdong 511450  
Manufacturing Site : Orientronic Manufacturing Ltd.  
No.6 Zhongjiazhuang North Road, Shigangdong Village, Dalong  
Street, Panyu. GUANGZHOU Guangdong 511450  
Intertek Report No: : 190325064GZU-001  
FCC ID: 2AS3D-C2ME24MPA

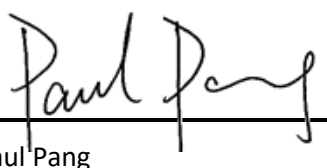
## Test standards

**47 CFR PART 15 Subpart C: 2018 section 15.249**

## Sample Description

Product : Wireless module  
Model No. : C2Me24MPA  
Electrical Rating : DC 2.0-3.6V  
**Serial No.** : Not Labeled  
Date Received : 28 March 2019  
Date Test : 28 March 2019 to 22 May 2019  
Conducted

Prepared and Checked By



Paul Pang

Project Engineer

Intertek Guangzhou

Approved By:



Helen Ma

Team Leader

Intertek Guangzhou

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

## TEST REPORT

### CONTENT

|                                            |           |
|--------------------------------------------|-----------|
| <b>TEST REPORT</b>                         | <b>1</b>  |
| <b>CONTENT</b>                             | <b>3</b>  |
| <b>1.0 TEST RESULT SUMMARY</b>             | <b>4</b>  |
| <b>2.0 GENERAL DESCRIPTION</b>             | <b>5</b>  |
| 2.1 PRODUCT DESCRIPTION                    | 5         |
| 2.2 RELATED SUBMITTAL(S) GRANTS            | 5         |
| 2.3 TEST METHODOLOGY                       | 5         |
| 2.4 TEST FACILITY                          | 6         |
| <b>3.0 SYSTEM TEST CONFIGURATION</b>       | <b>6</b>  |
| 3.1 JUSTIFICATION                          | 6         |
| 3.2 EUT EXERCISING SOFTWARE                | 7         |
| 3.3 SPECIAL ACCESSORIES                    | 7         |
| 3.4 MEASUREMENT UNCERTAINTY                | 7         |
| 3.5 EQUIPMENT MODIFICATION                 | 8         |
| 3.6 SUPPORT EQUIPMENT LIST AND DESCRIPTION | 8         |
| <b>4.0 MEASUREMENT RESULTS</b>             | <b>9</b>  |
| 4.1 ANTENNA REQUIREMENT                    | 9         |
| 4.2 OCCUPIED BANDWIDTH                     | 10        |
| 4.3 RADIATED EMISSION                      | 14        |
| 4.4 BAND EDGES REQUIREMENT                 | 28        |
| 4.5 CONDUCTED EMISSIONS AT MAINS TERMINALS | 32        |
| <b>5.0 TEST EQUIPMENT LIST</b>             | <b>35</b> |

## TEST REPORT

### 1.0 TEST RESULT SUMMARY

| Test Item                                 | Test Requirement                         | Test Method                              | Result |
|-------------------------------------------|------------------------------------------|------------------------------------------|--------|
| Antenna Requirement                       | FCC PART 15 C<br>Section 15.203          | FCC PART 15 C<br>Section 15.203          | PASS   |
| Occupied Bandwidth                        | FCC PART 15 C<br>section 15.215(c)       | ANSI C63.10:<br>Clause 6.9               | PASS   |
| Radiated Emission                         | FCC PART 15 C<br>section 15.249 (a), (d) | ANSI C63.10:<br>Clause 6.4, 6.5 &<br>6.6 | PASS   |
| Band Edges Measurement                    | FCC PART 15 C<br>section 15.249 (d)      | ANSI C63.10:<br>Clause 6.10              | PASS   |
| Conducted Emissions at<br>Mains Terminals | FCC PART 15 C<br>section 15.207          | ANSI C63.10:<br>Clause 6.2               | PASS   |

**Remark:**

N/A: not applicable. Refer to the relative section for the details.

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

ANSI C63.10: the detail version is ANSI C63.10:2013 in the whole report.

## TEST REPORT

### 2.0 General Description

#### 2.1 Product Description

|                      |                            |
|----------------------|----------------------------|
| Operating Frequency: | 2402 MHz, 2426MHz, 2480MHz |
| Type of Modulation:  | GFSK                       |
| Number of Channels:  | 3 Channels                 |
| Channel Separation:  | 24 MHz, 54MHz              |
| Antenna Type:        | Integral                   |
| Antenna Gain:        | 0 dBi                      |
| Speciality function: | Wireless module            |
| Power Supply:        | DC 2.0-3.6V                |
| Power cord:          | N/A                        |

EUT modulation and data packet during test:  
GFSK, 1Mbps

EUT channels and frequencies list:

Test frequencies are lowest channel 0: 2402 MHz, middle channel 1: 2426 MHz and highest channel 2: 2480 MHz.

#### 2.2 Related Submittal(s) Grants

This is an application for certification of:

DXX – Part 15 Low Power Communication Device Transmitter.

Remaining portions are subject to the following procedures:

Receiver portion: exempt from technical requirement of this Part.

#### 2.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10. Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans and final tests were performed in the semi-anechoic chamber to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise.

## TEST REPORT

### 2.4 Test Facility

All tests were performed at:

Room102/104, No 203, KeZhu Road, Science City, GETDD Guangzhou, China

Except Conducted Emissions was performed at:

Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD Guangzhou, China

A2LA Certificate Number 0078.10

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch is accredited by A2LA and Listed in FCC website. FCC accredited test labs may perform both Certification testing under Parts 15 and 18 and Declaration of Conformity testing.

### 3.0 System Test Configuration

#### 3.1 Justification

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, AC power line was manipulated to produce worst case emissions. It was powered by DC 2.0-3.6V supply.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. The spurious emissions more than 20dB below the permissible value are not reported.

For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Frequency range of radiated emission measurements

| Lowest frequency generated in the device | Upper frequency range of measurement                                                                                    |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 9 kHz to below 10 GHz                    | 10 <sup>th</sup> harmonic of highest fundamental frequency or to 40 GHz, whichever is lower                             |
| At or above 10 GHz to below 30 GHz       | 5 <sup>th</sup> harmonic of highest fundamental frequency or to 100 GHz, whichever is lower                             |
| At or above 30 GHz                       | 5 <sup>th</sup> harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified |

## TEST REPORT

Number of fundamental frequencies to be tested in EUT transmit band

| Frequency range in which device operates | Number of frequencies | Location in frequency range of operation    |
|------------------------------------------|-----------------------|---------------------------------------------|
| 1 MHz or less                            | 1                     | Middle                                      |
| 1 MHz to 10 MHz                          | 2                     | 1 near top and 1 near bottom                |
| More than 10 MHz                         | 3                     | 1 near top, 1 near middle and 1 near bottom |

### 3.2 EUT Exercising Software

No software used.

### 3.3 Special Accessories

No special accessories used.

### 3.4 Measurement Uncertainty

| No. | Item                                   | Measurement Uncertainty |
|-----|----------------------------------------|-------------------------|
| 1   | 20 dB Bandwidth                        | 2.3%                    |
|     | 6dB Bandwidth                          |                         |
|     | 99% Bandwidth                          |                         |
| 2   | Carrier Frequencies Separated          | 2.3%                    |
| 3   | Dwell Time                             | 1.2%                    |
| 4   | Maximum Peak Conducted Output Power    | 1.5dB                   |
| 5   | Peak Power Spectral Density            | 1.5dB                   |
| 6   | Out of Band Conducted Emissions        | 1.5dB                   |
| 7   | Band edges measurement                 | 1.5dB                   |
| 8   | Radiated Emissions                     | 4.7 dB (25 MHz-1 GHz)   |
|     |                                        | 4.8 dB (1 GHz-18 GHz)   |
|     |                                        | 5.21dB (18GZH-26GHz)    |
| 9   | Conducted Emissions at Mains Terminals | 2.58dB                  |
| 10  | Temperature                            | 0.5 °C                  |
| 11  | Humidity                               | 0.4 %                   |
| 12  | Time                                   | 1.2%                    |

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.

## TEST REPORT

Measurement uncertainty is calculated in accordance with ETSI TR 100 028-2001.  
The measurement uncertainty is given with a confidence of 95%, k=2.

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance – Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value

### 3.5 Equipment Modification

Any modifications installed previous to testing by Orientronic Manufacturing Ltd. will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Guangzhou Branch.

### 3.6 Support Equipment List and Description

This product was tested with corresponding support equipment as below:

Support Equipment

| Description     | Manufacturer | Model No. | SN/Version | Supplied by |
|-----------------|--------------|-----------|------------|-------------|
| DC Power supply | -            | IT6721    | SA040-22   | Intertek    |

## TEST REPORT

### 4.0 Measurement Results

#### 4.1 Antenna Requirement

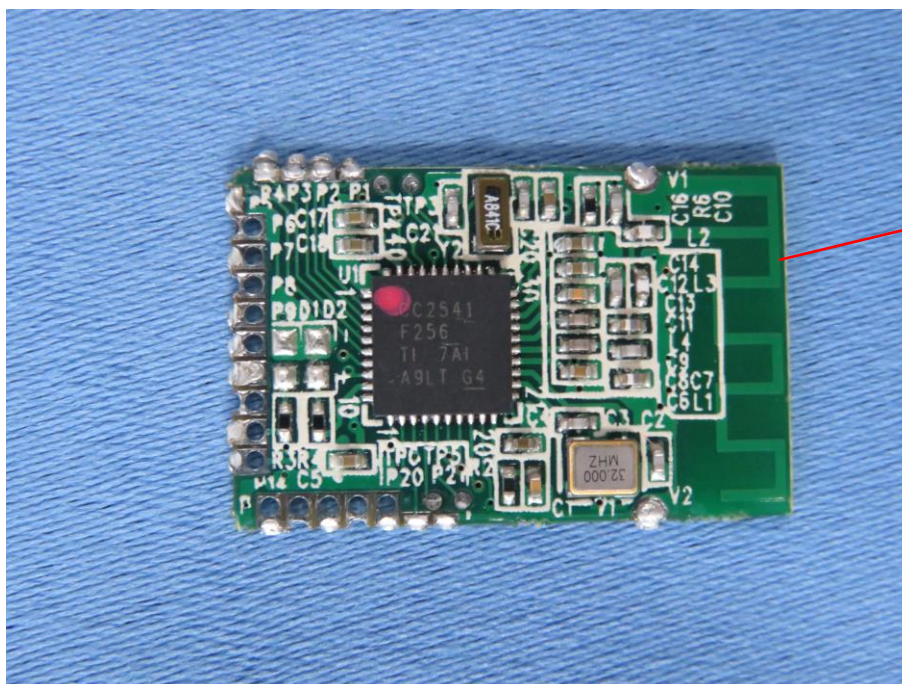
Standard requirement:

15.203 requirement:

For intentional device. According to 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.

EUT Antenna

The antenna is an integral antenna and no consideration of replacement. The best case gain of the antenna is 0 dBi.

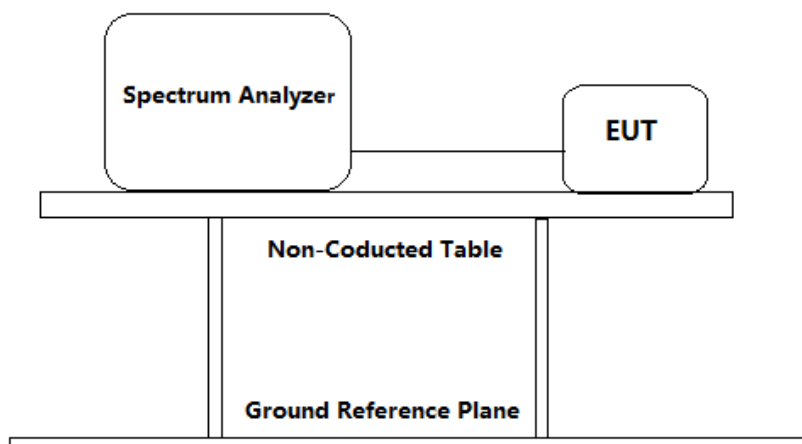


Antenna

## TEST REPORT

### 4.2 Occupied Bandwidth

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement:   | FCC PART 15 C section 15.215(c)<br>(c) 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 |
| Test Method:        | ANSI C63.10: Clause 6.9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Test Status:        | Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The highest, middle and the lowest channels were selected for the final test as listed below.                                                                                                                                                                                                                |
| Test Configuration: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |



#### Test Procedure:

The transmitter was operated at its maximum carrier power measured under normal test conditions.

- The instrument center frequency was set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer was between 1.5 times and 5.0 times the OBW(20 dB Bandwidth).
- The nominal IF filter bandwidth (3 dB RBW) was in the range of 1% to 5% of the OBW, and VBW was approximately three times the RBW.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope was more than  $[10 \log (OBW/RBW)]$  below the reference level.

## TEST REPORT

- d) Step a) through step c) might require iteration to adjust within the specified range.
- e) The dynamic range of the instrument at the selected RBW was more than 10 dB below the target “-20 dB down” requirement; that is, if the requirement calls for measuring the -20 dB OBW, the instrument noise floor at the selected RBW was at least 30 dB below the reference value.
- f) Peak detection and max hold mode (until the trace stabilizes) was used.
- g) Used the 20dB bandwidth function of the instrument and reported the measured bandwidth.
- h) The occupied bandwidth was reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division was clearly labeled. Tabular data was reported in addition to the plot(s).

### Used Test Equipment List

Spectrum Analyzer. Refer to Clause 5 Test Equipment List for details.

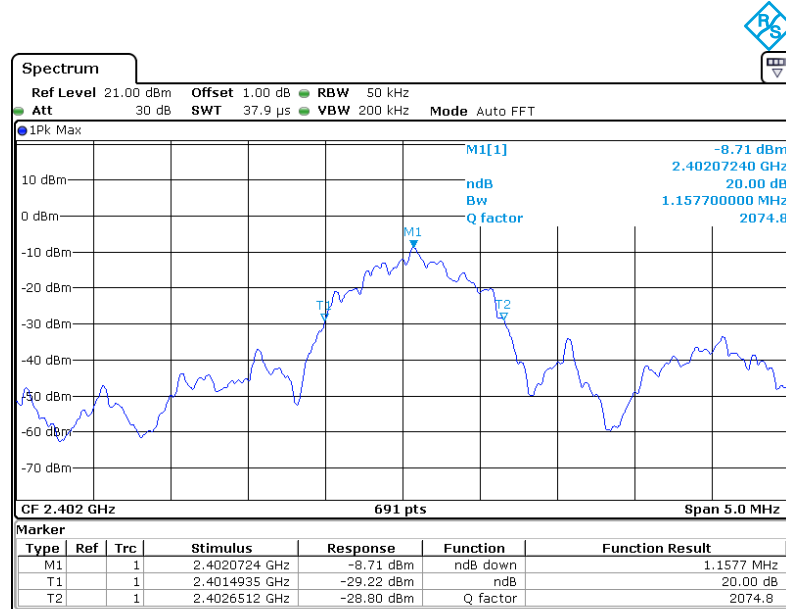
### 20 dB bandwidth:

| Channel No. | Frequency (MHz) | Measured 20dB bandwidth (kHz) | Limit (MHz) | Result |
|-------------|-----------------|-------------------------------|-------------|--------|
| 0           | 2402            | 1157.7                        | 2400-2483.5 | Pass   |
| 1           | 2426            | 1128.8                        |             | Pass   |
| 2           | 2480            | 1157.7                        |             | Pass   |

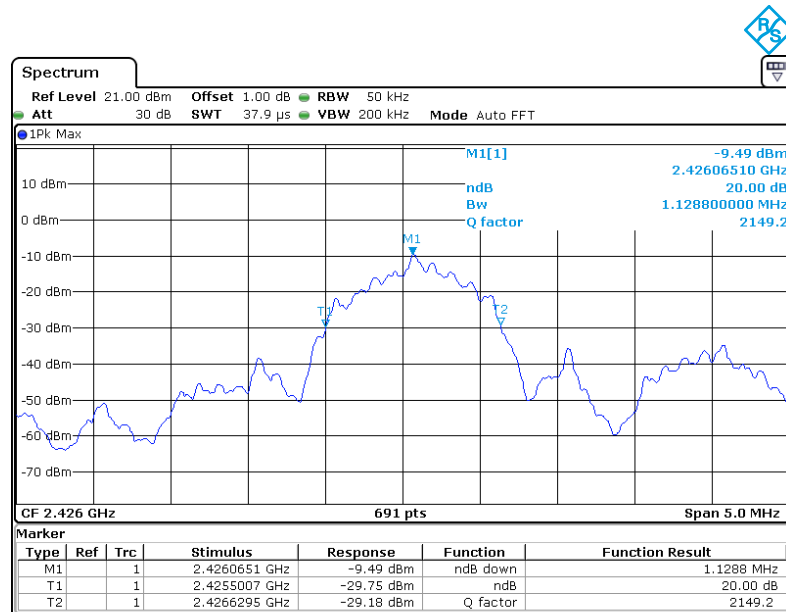
## TEST REPORT

Result plot as follows:

Lowest Channel(2.402 GHz):

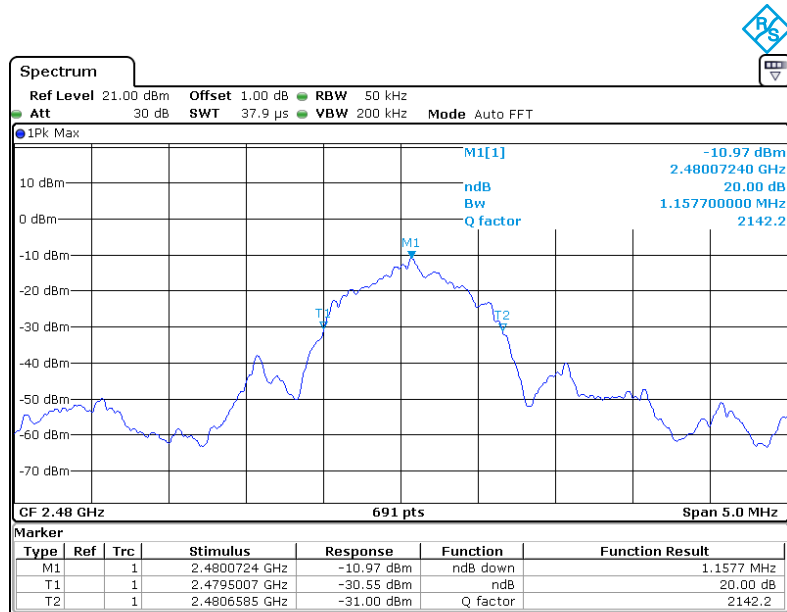


Middle Channel(2.426 GHz):



## TEST REPORT

Highest Channel(2.480 GHz):



## TEST REPORT

### 4.3 Radiated Emission

Test Requirement:

FCC PART 15 C section 15.249 (a), (d)

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental Frequency (MHz) | Field Strength of Fundamental (dB $\mu$ V/m @ 3m) | Field Strength of Harmonics (dB $\mu$ V/m @ 3m) |
|-----------------------------|---------------------------------------------------|-------------------------------------------------|
| 902 to 928                  | 94.0                                              | 54.0                                            |
| 2400 to 2483.5              | 94.0                                              | 54.0                                            |
| 5725 to 5875                | 94.0                                              | 54.0                                            |

Note: The limits shown in the above table are based on measurements using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using a CISPR quasi-peak detector.

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

Test Method:

ANSI C63.10: Clause 6.4, 6.5 and 6.6

Test Status:

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The lowest, middle and the highest channels were selected for the final test as listed below.

Test site:

Measurement Distance: 3m (Semi-Anechoic Chamber)

Limit:

The field strength of radiated emission outside of the specified frequency bands, except for harmonics at a distance of 3 meters shall not exceed the following values:

| Frequency (MHz) | Field Strength (dB $\mu$ V/m @ 3m) |
|-----------------|------------------------------------|
| 30-88           | 40.0                               |
| 88-216          | 43.5                               |
| 216-960         | 46.0                               |
| Above 960       | 54.0                               |

Detector:

For Peak and Quasi-Peak value:

200 Hz for 9 kHz to 150 kHz

9 kHz for 150 kHz to 30 MHz

120 kHz for 30 MHz to 1GHz

RBW = 1 MHz for  $f \geq 1$  GHz

## TEST REPORT

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak for  $f \geq 1$  GHz, QP for  $f < 1$  GHz

Trace = max hold

According 15.35(c), when the field strength (or envelope power) is not constant or it is in pulses, and an average detector is specified to be used, the value of field strength or power shall be determined by averaging over one complete pulse train, including blanking intervals within the pulse train, as long as the pulse train does not exceed 0.1 seconds. In cases where the pulse train exceeds 0.1 second, the average value of field strength or output power shall be determined during a 0.1 second interval during which the field strength or power is at its maximum value.

## TEST REPORT

The average correction factor was computed by analyzing the on time in 100ms over one complete pulse train. Analysis of the remote transmitter on time in one complete pulse train, therefore the average value of fundamental frequency was: Average = Peak value + 20log (Duty cycle), where the duty factor is calculated from following formula:

2402MHz

The duration of one cycle =104.30ms

Effective period of the cycle =0.20ms

DC =0.20/100=0.002 or 0.2%

Therefore, the averaging factor is found by  $20\lg(0.002)=-53.979$

2426MHz

The duration of one cycle =108.04ms

Effective period of the cycle =0.19ms

DC =0.19/100=0.0019 or 0.19%

Therefore, the averaging factor is found by  $20\lg(0.0019)=-54.425$

2480MHz

The duration of one cycle =104.38ms

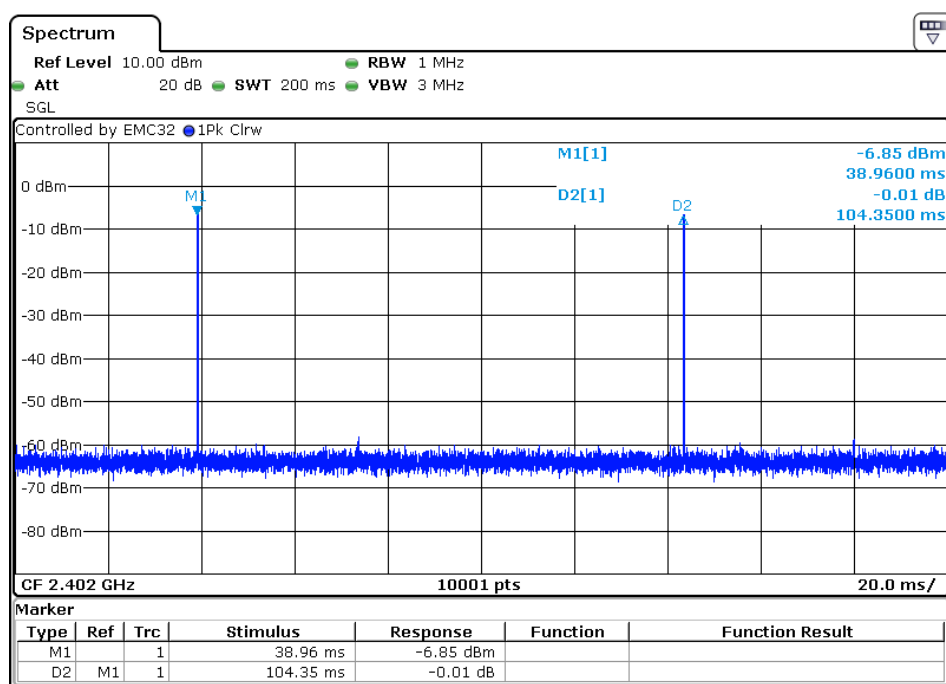
Effective period of the cycle =0.20ms

DC =0.20/100=0.002or 0.2%

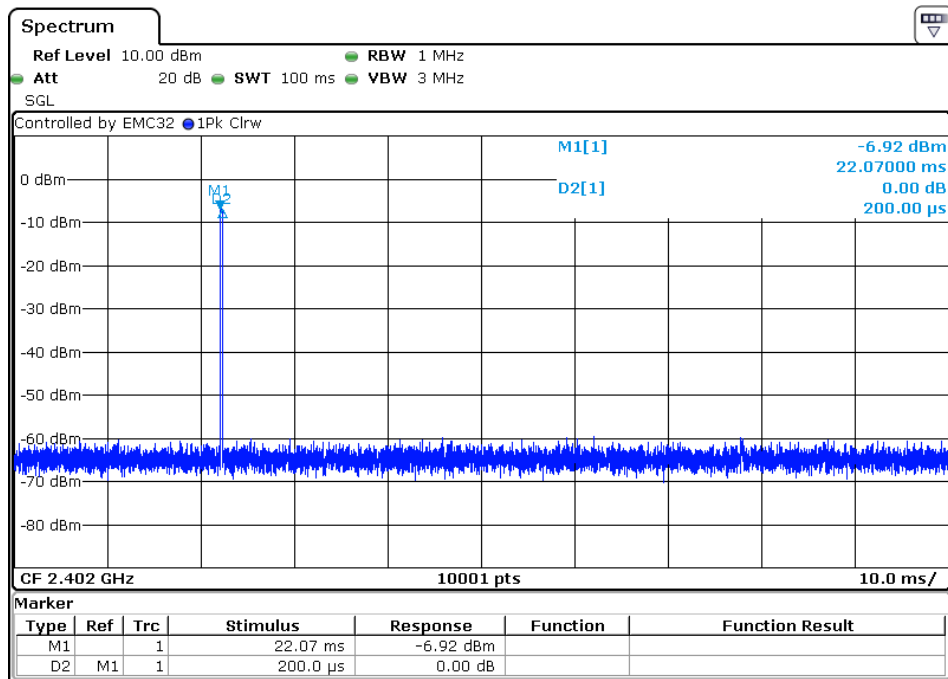
Therefore, the averaging factor is found by  $20\lg(0.002)=-53.979$

Please refer to below plots for more details.

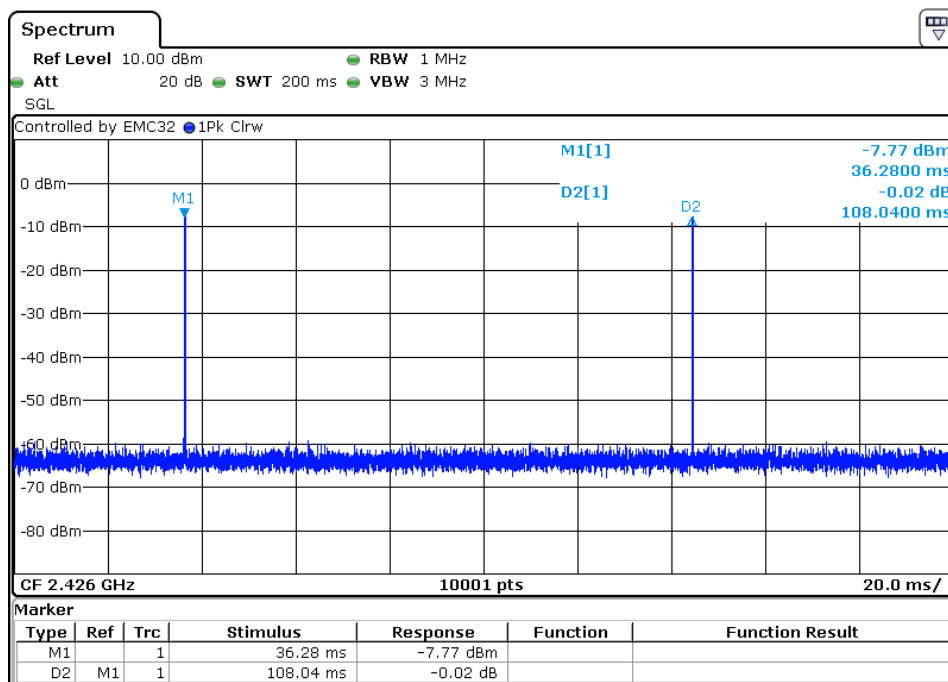
2402MHz



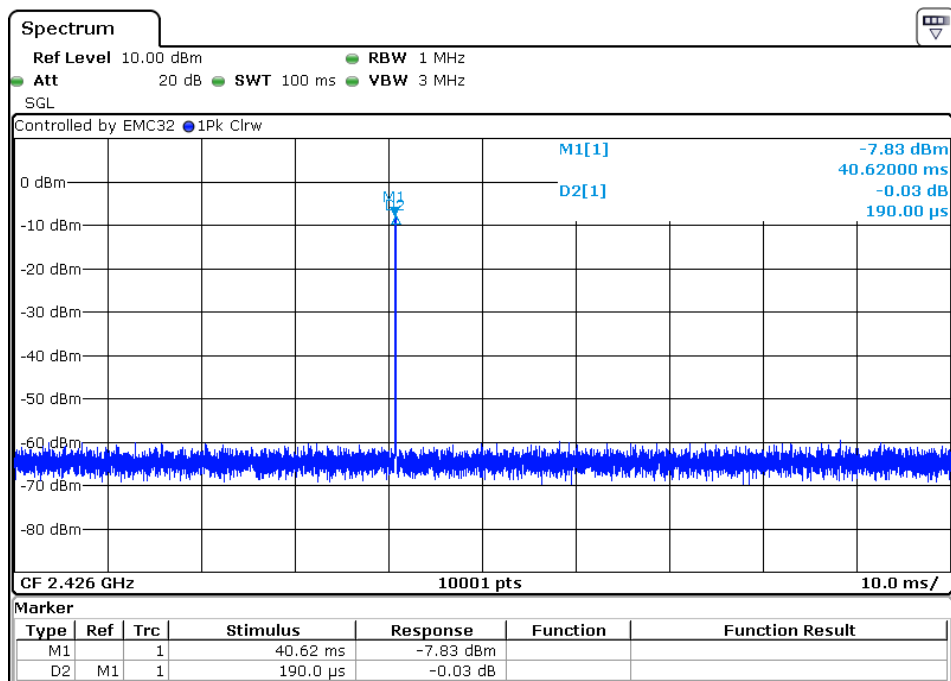
## TEST REPORT



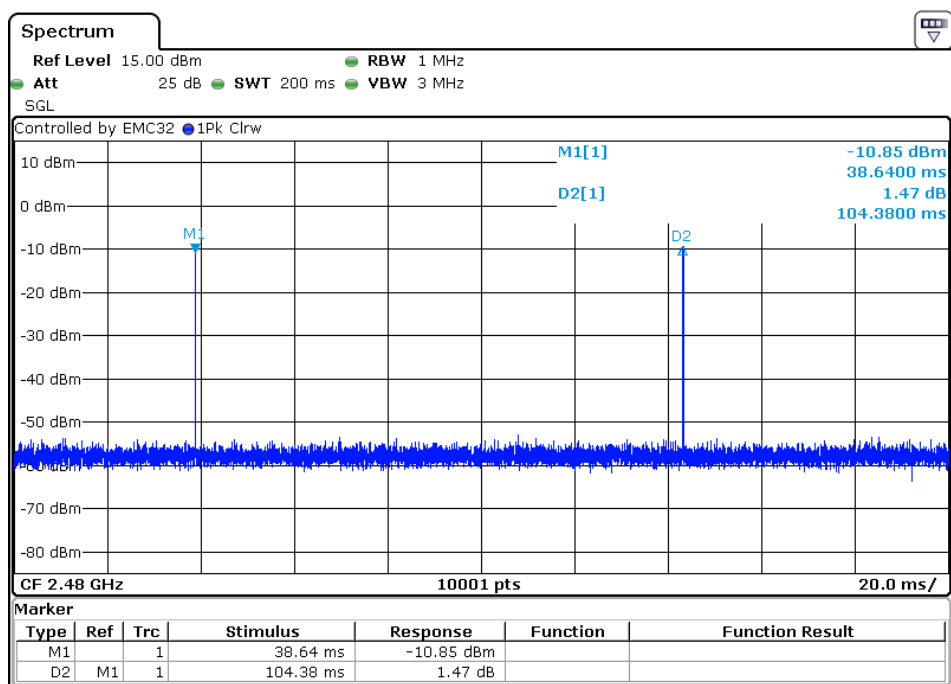
2426MHz



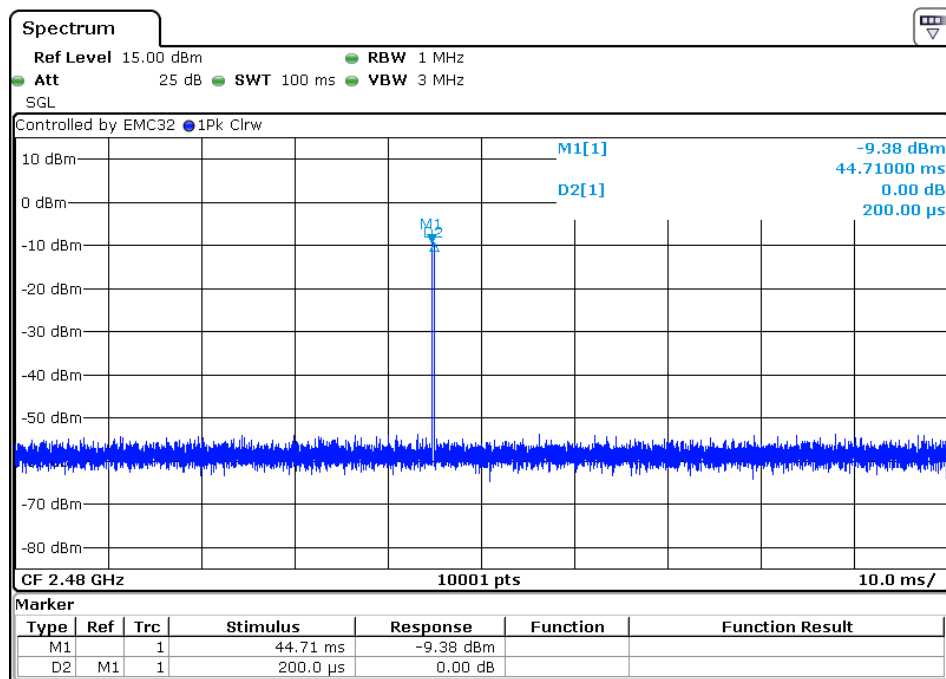
## TEST REPORT



2480MHz



## TEST REPORT



### Field Strength Calculation:

Where:

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below:

$$FS = RA + AF + CF - AG + PD + AV$$

$$FS = RA + \text{Correct Factor} + AV$$

$$FS = \text{Field Strength in dB}\mu\text{V/m}$$

$$RA = \text{Receiver Amplitude (including preamplifier) in dB}\mu\text{V}$$

$$AF = \text{Antenna Factor in dB}$$

$$CF = \text{Cable Attenuation Factor in dB}$$

$$AG = \text{Amplifier Gain in dB}$$

$$PD = \text{Pulse Desensitization in dB}$$

$$AV = \text{Average Factor in -dB}$$

$$\text{Correct Factor} = AF + CF - AG + PD$$

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG + PD + AV$$

Assume a receiver reading of 62.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBμV/m.

## TEST REPORT

RA = 62.0 dB $\mu$ V

AF = 7.4 dB

CF = 1.6 dB

AG = 29.0 dB

PD = 0 dB

AV = -10 dB

Correct Factor = 7.4 + 1.6 – 29.0 + 0 = -20 dB

FS = 62 + (-20) + (-10) = 32 dB $\mu$ V/m

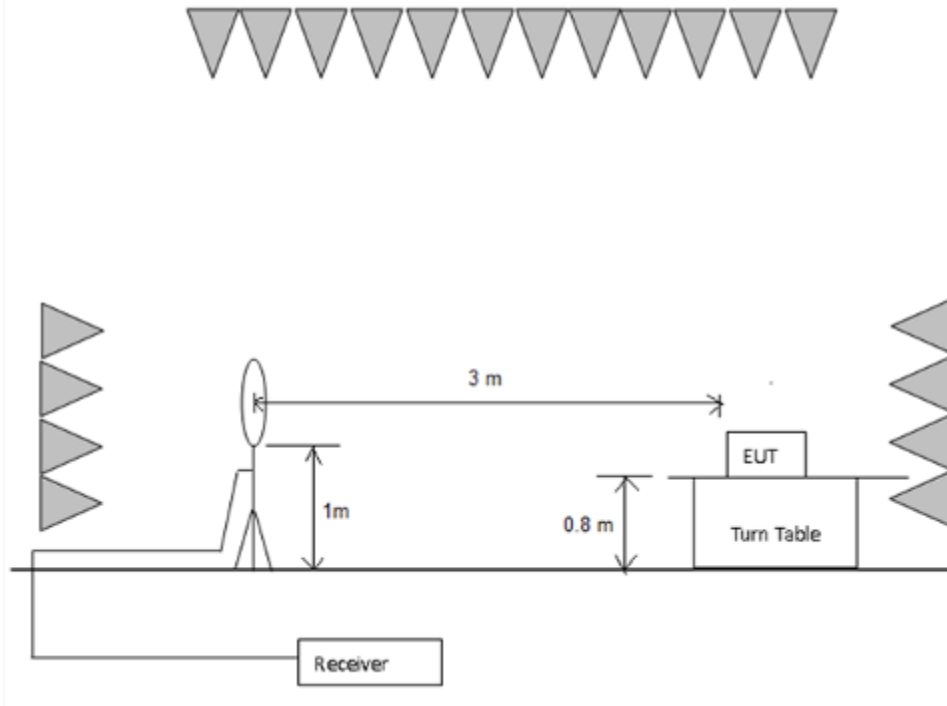
Section 15.205 Restricted bands of operation.

| MHz                 | MHz                 | MHz             | GHz           |
|---------------------|---------------------|-----------------|---------------|
| 0.090 - 0.110       | 16.42 - 16.423      | 399.9 - 410     | 4.5 - 5.15    |
| 10.495 - 0.505      | 16.69475 - 16.69525 | 608 - 614       | 5.35 - 5.46   |
| 2.1735 - 2.1905     | 16.80425 - 16.80475 | 960 - 1240      | 7.25 - 7.75   |
| 4.125 - 4.128       | 25.5 - 25.67        | 1300 - 1427     | 8.025 - 8.5   |
| 4.17725 - 4.17775   | 37.5 - 38.25        | 1435 - 1626.5   | 9.0 - 9.2     |
| 4.20725 - 4.20775   | 73 - 74.6           | 1645.5 - 1646.5 | 9.3 - 9.5     |
| 6.215 - 6.218       | 74.8 - 75.2         | 1660 - 1710     | 10.6 - 12.7   |
| 6.26775 - 6.26825   | 108 - 121.94        | 1718.8 - 1722.2 | 13.25 - 13.4  |
| 6.31175 - 6.31225   | 123 - 138           | 2200 - 2300     | 14.47 - 14.5  |
| 8.291 - 8.294       | 149.9 - 150.05      | 2310 - 2390     | 15.35 - 16.2  |
| 8.362 - 8.366       | 156.52475 -         | 2483.5 - 2500   | 17.7 - 21.4   |
| 8.37625 - 8.38675   | 156.52525           | 2655 - 2900     | 22.01 - 23.12 |
| 8.41425 - 8.41475   | 156.7 - 156.9       | 3260 - 3267     | 23.6 - 24.0   |
| 12.29 - 12.293      | 162.0125 - 167.17   | 3332 - 3339     | 31.2 - 31.8   |
| 12.51975 - 12.52025 | 167.72 - 173.2      | 3345.8 - 3358   | 36.43 - 36.5  |
| 12.57675 - 12.57725 | 240 - 285           | 3600 - 4400     |               |
| 13.36 - 13.41       | 322 - 335.4         |                 |               |

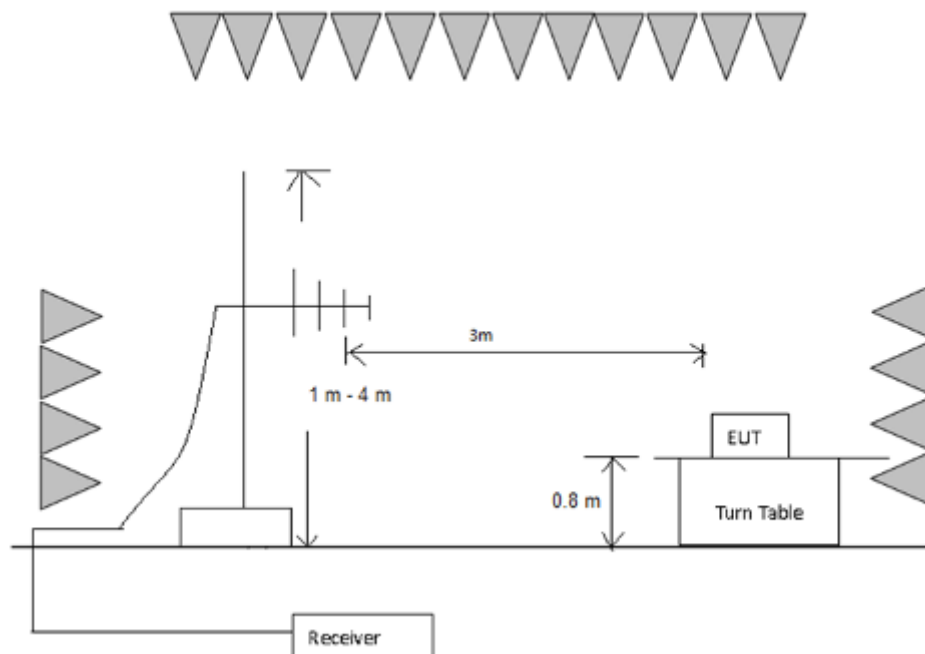
## TEST REPORT

### Test Configuration:

#### 1) 9 kHz to 30 MHz emissions:

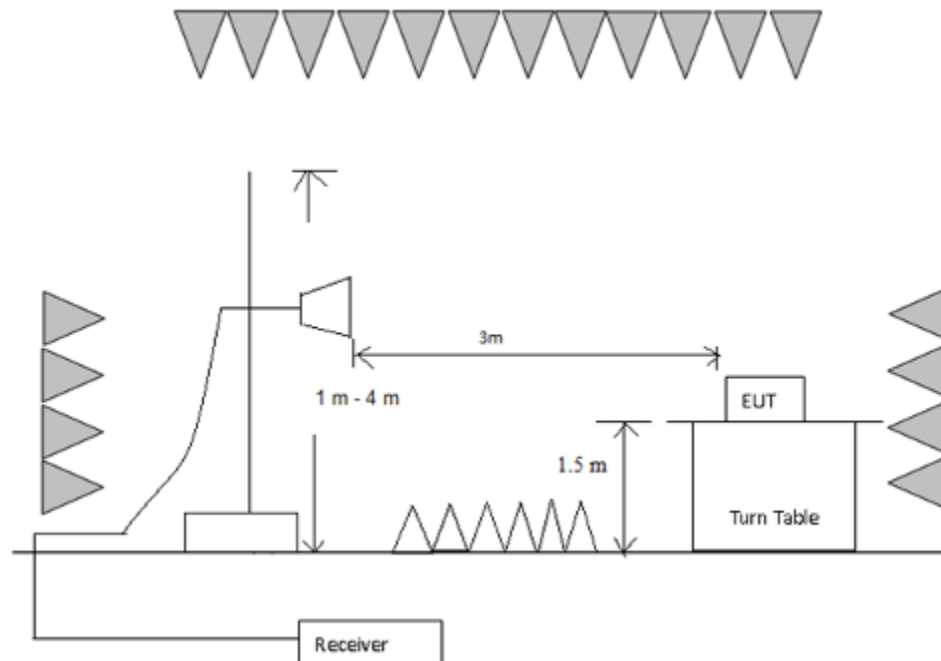


#### 2) 30 MHz to 1 GHz emissions:



## TEST REPORT

### 3) 1 GHz to 40 GHz emissions:



### Test Procedure:

#### 1) 9 kHz to 30 MHz emissions:

For testing performed with the loop antenna. The centre of the loop was positioned 1 m above the ground and positioned with its plane vertical at the special distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane.

#### 2) 30 MHz to 1 GHz emissions:

For testing performed with the bi-log type antenna. The measurement is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

#### 3) 1 GHz to 25 GHz emissions:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2010 was used to perform radiated emission test above 1 GHz.

For testing performed with the horn antenna. The measurement is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

#### 4) The receiver was scanned from 9 kHz to 25 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed

## TEST REPORT

with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.  
The worst case emissions were reported.

### Used Test Equipment List:

3m Semi-Anechoic Chamber, EMI Test Receiver (9 kHz~7 GHz), Signal and Spectrum Analyzer (10 Hz~40 GHz), Loop antenna (9 kHz-30 MHz). TRILOG Super Broadband test Antenna(30 MHz-3 GHz) (RX), Double-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX) and High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX). Refer to Clause 5 Test Equipment List for details.

### 9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

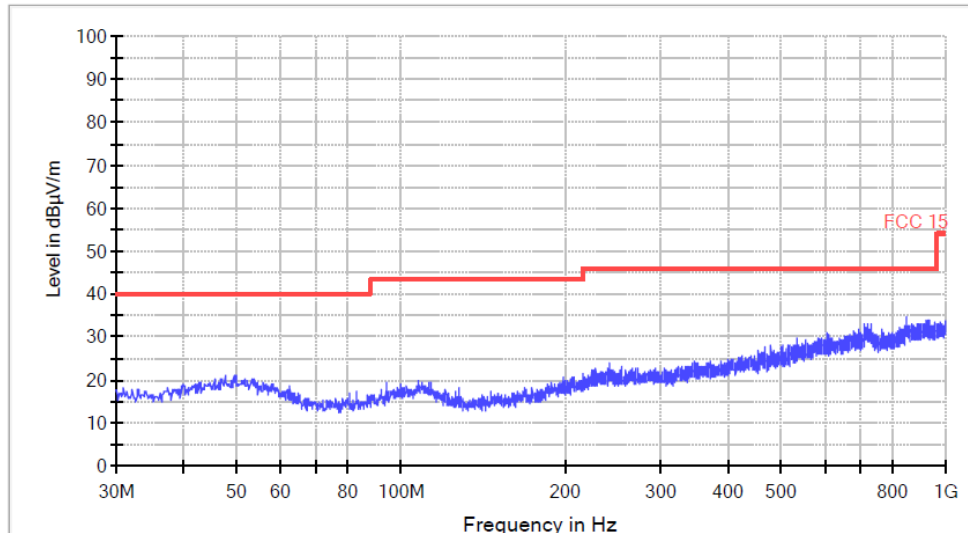
The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

## TEST REPORT

### Radiated Emissions (Below 1GHz)

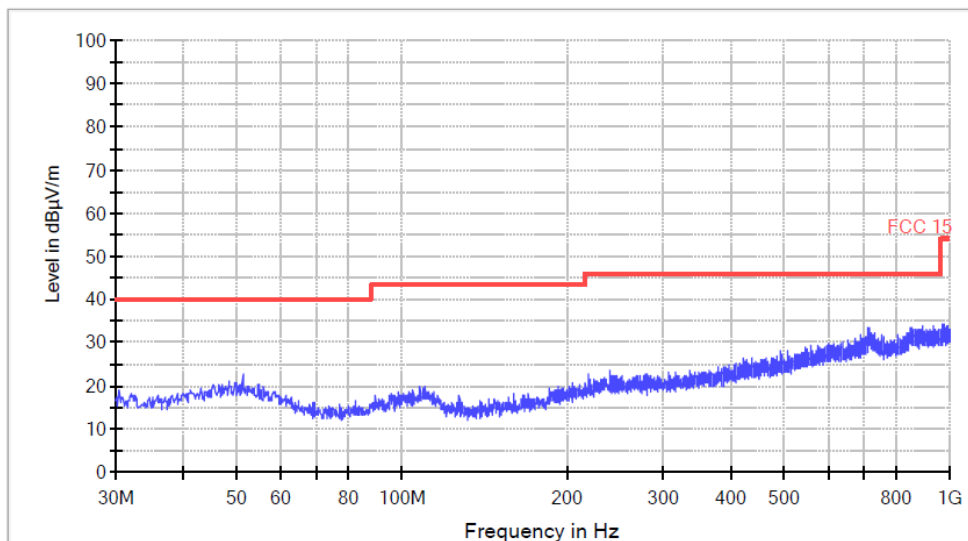
Operation Frequency: 2402MHz

Vertical



All emission levels are more than 6 dB below the limit.

Horizontal



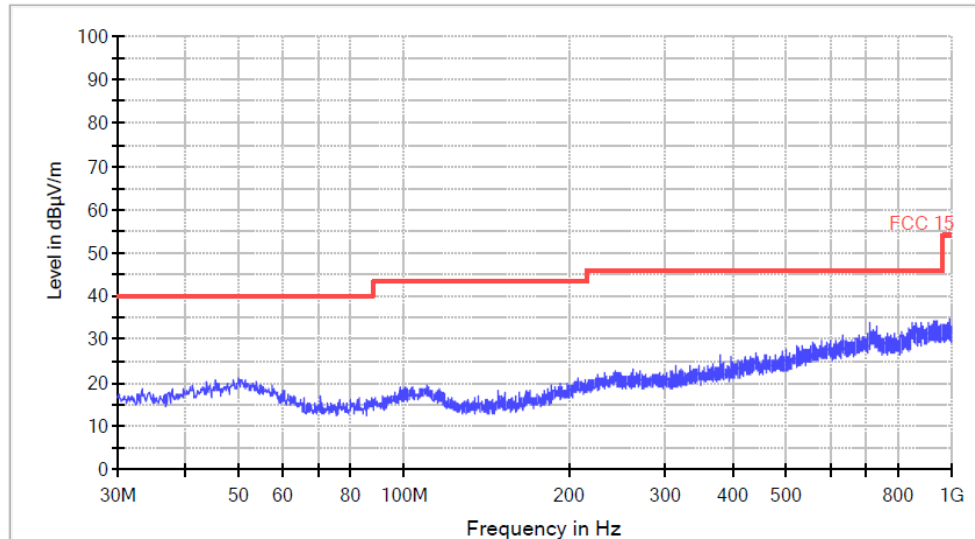
All emission levels are more than 6 dB below the limit.

1. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
2. Quasi Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
3. Margin (dB) = Limit QPK (dBμV/m) – Quasi Peak (dBμV/m)

## TEST REPORT

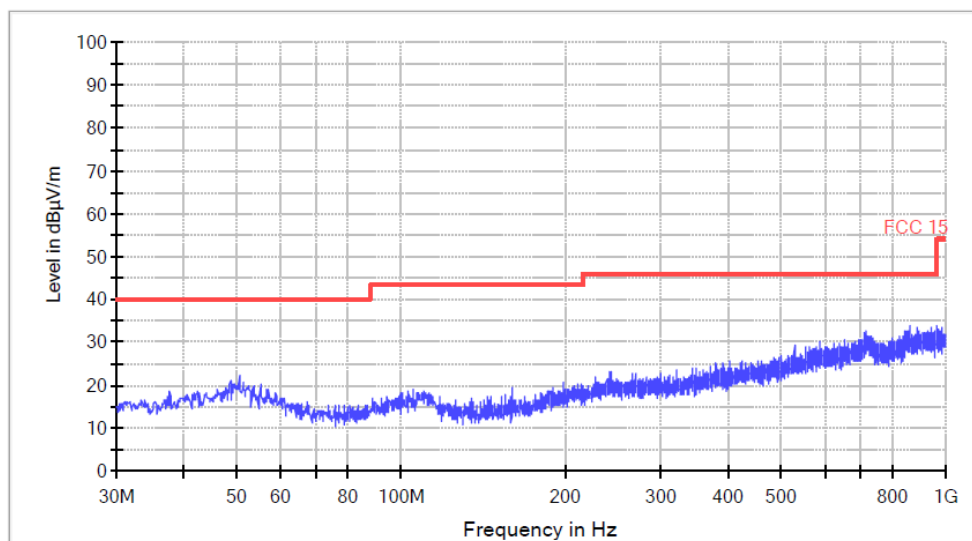
Operation Frequency: 2426MHz

Vertical



All emission levels are more than 6 dB below the limit.

Horizontal



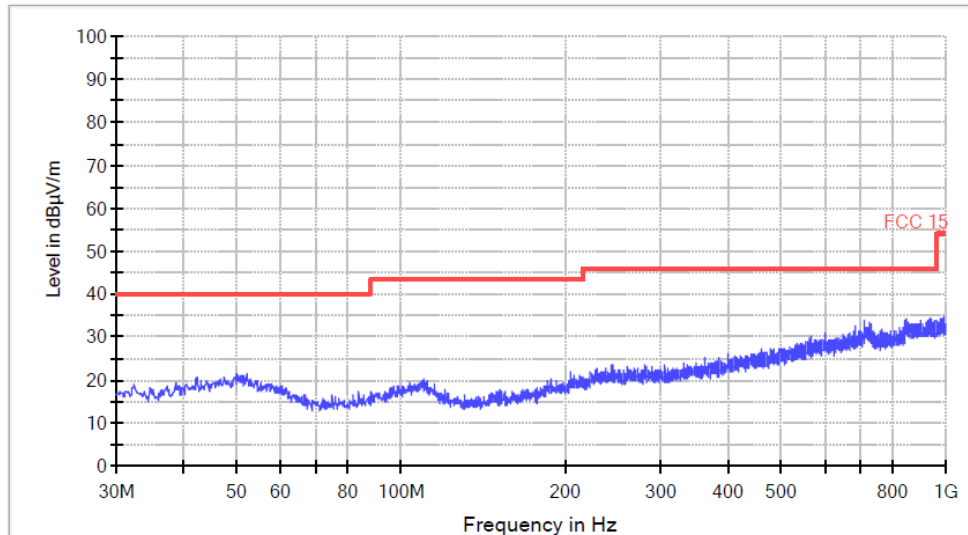
All emission levels are more than 6 dB below the limit.

1. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
2. Quasi Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
3. Margin (dB) = Limit QPK (dBμV/m) – Quasi Peak (dBμV/m)

## TEST REPORT

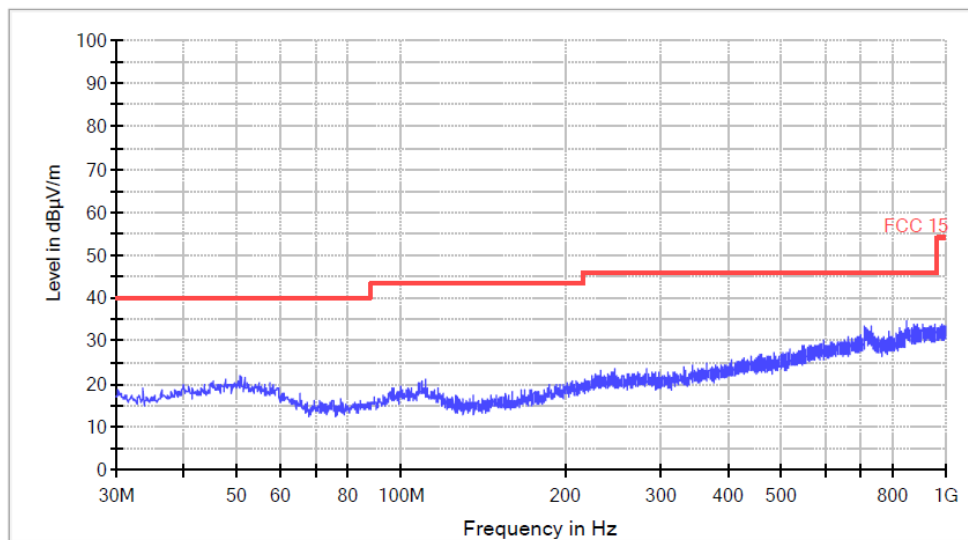
Operation Frequency: 2480MHz

Vertical



All emission levels are more than 6 dB below the limit.

Horizontal



All emission levels are more than 6 dB below the limit.

1. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
2. Quasi Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
3. Margin (dB) = Limit QPK (dBμV/m) – Quasi Peak (dBμV/m)

## TEST REPORT

### Radiated Emissions (Above 1GHz)

Operation Frequency: 2402MHz:

| Polarization | Frequency (MHz) | PK Reading (dBμV) | Correction Factor (dB) | PK Net at 3m (dBμV/m) | Average Limit at 3m (dBμV/m) |
|--------------|-----------------|-------------------|------------------------|-----------------------|------------------------------|
| Horizontal   | 10419.6         | 35.3              | 9.6                    | 44.9                  | 54.0                         |
| Horizontal   | 6560.8          | 36.6              | 3.2                    | 39.8                  | 54.0                         |
| Horizontal   | 3012.8          | 35.8              | -6.2                   | 29.6                  | 54.0                         |
| Horizontal   | 2402.2          | 93.4              | -9.1                   | 84.3                  | 94.0                         |
| Vertical     | 8677.2          | 34.2              | 7.4                    | 41.6                  | 54.0                         |
| Vertical     | 5765.2          | 35.7              | 0.8                    | 36.5                  | 54.0                         |
| Vertical     | 3070.4          | 34.4              | -6.1                   | 28.3                  | 54.0                         |
| Vertical     | 2402.4          | 79.4              | -9.1                   | 70.3                  | 94.0                         |

Operation Frequency: 2426MHz:

| Polarization | Frequency (MHz) | PK Reading (dBμV) | Correction Factor (dB) | PK Net at 3m (dBμV/m) | Average Limit at 3m (dBμV/m) |
|--------------|-----------------|-------------------|------------------------|-----------------------|------------------------------|
| Horizontal   | 11250.8         | 33.8              | 10.3                   | 44.1                  | 54.0                         |
| Horizontal   | 7896.8          | 34.8              | 7.9                    | 42.7                  | 54.0                         |
| Horizontal   | 2773.2          | 36.3              | -7.3                   | 29.0                  | 54.0                         |
| Horizontal   | 2426.3          | 94.0              | -8.2                   | 85.8                  | 94.0                         |
| Vertical     | 7412.4          | 36.2              | 7.0                    | 43.2                  | 54.0                         |
| Vertical     | 3410.4          | 36.0              | -5.4                   | 30.6                  | 54.0                         |
| Vertical     | 11222.0         | 31.2              | 10.3                   | 41.5                  | 54.0                         |
| Vertical     | 2426.3          | 83.0              | -8.2                   | 74.8                  | 94.0                         |

Operation Frequency: 2480MHz:

| Polarization | Frequency (MHz) | PK Reading (dBμV) | Correction Factor (dB) | PK Net at 3m (dBμV/m) | Average Limit at 3m (dBμV/m) |
|--------------|-----------------|-------------------|------------------------|-----------------------|------------------------------|
| Horizontal   | 7624.8          | 34.1              | 7.6                    | 41.7                  | 54.0                         |
| Horizontal   | 4658.4          | 34.6              | -2.5                   | 32.1                  | 54.0                         |
| Horizontal   | 2213.6          | 35.4              | -10.0                  | 25.4                  | 54.0                         |
| Horizontal   | 2480.0          | 88.3              | -8.7                   | 79.6                  | 94.0                         |
| Vertical     | 7555.2          | 32.6              | 7.5                    | 40.1                  | 54.0                         |
| Vertical     | 4714.4          | 36.6              | -2.5                   | 34.1                  | 54.0                         |
| Vertical     | 3055.2          | 37.6              | -6.1                   | 31.5                  | 54.0                         |
| Vertical     | 2480.0          | 78.7              | -8.7                   | 70.0                  | 94.0                         |

## TEST REPORT

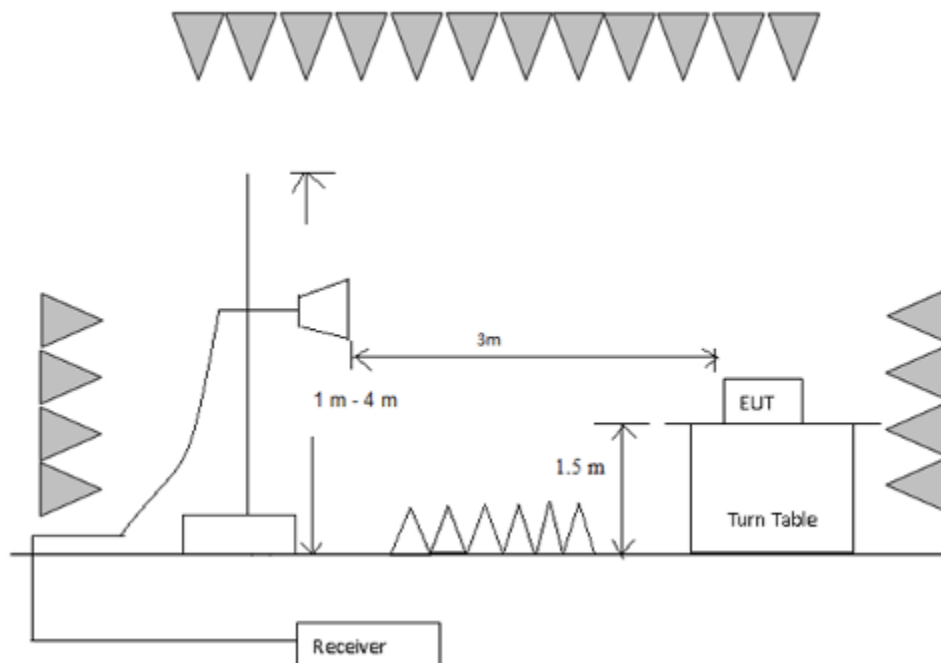
### Notes:

1. AT frequencies equal to or less than 1000MHz, quasi-peak detector was used, above 1000MHz, Peak detector was used.
2. All measurements were made at 3 meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.
5. When Peak emission level was below AV limit, the AV emission level was not recorded.

### 4.4 Band Edges Requirement

|                   |                                                                                                                                                                                                                                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | FCC PART 15 C section 15.249 (d)<br>(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.    |
| Frequency Band:   | 2400 MHz to 2483.5 MHz                                                                                                                                                                                                                                                                              |
| Test Method:      | ANSI C63.10: Clause 6.10                                                                                                                                                                                                                                                                            |
| Test Status:      | Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The lowest, middle and the highest channels were selected for the final test as listed below. |

### Test Configuration:



### Used Test Equipment List:

3m Semi-Anechoic Chamber, EMI Test Receiver (9 kHz~7 GHz), Signal and Spectrum Analyzer (10 Hz~40 GHz), Loop antenna (9 kHz-30 MHz). TRILOG Super Broadband test Antenna(30 MHz-3 GHz) (RX), Double-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX) and High

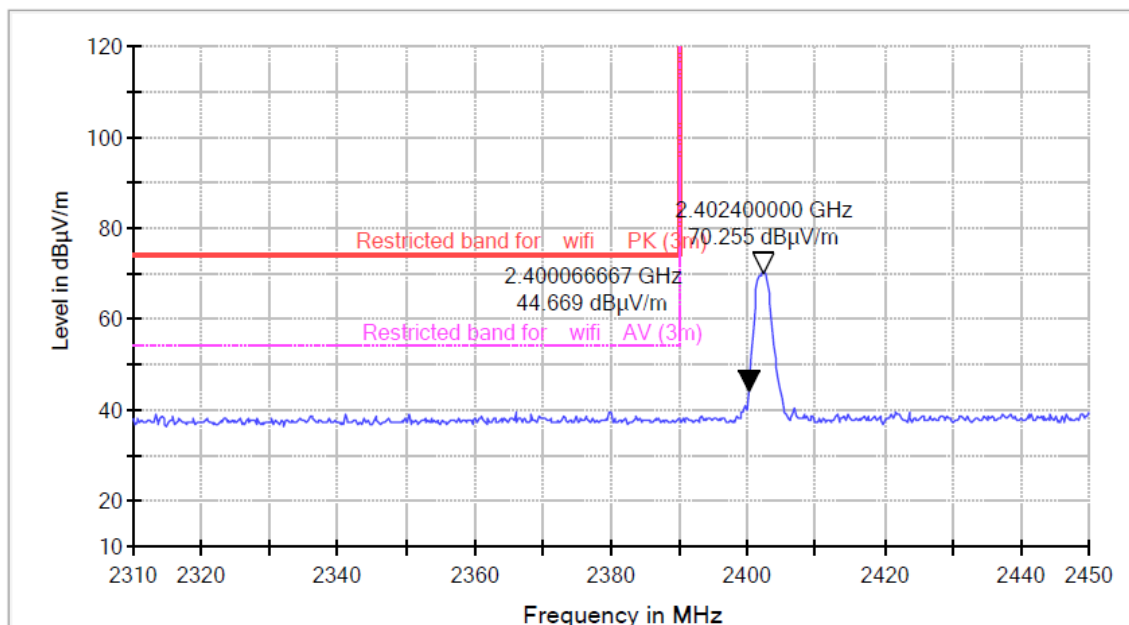
## TEST REPORT

Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX). Refer to Clause 5 Test Equipment List for details.

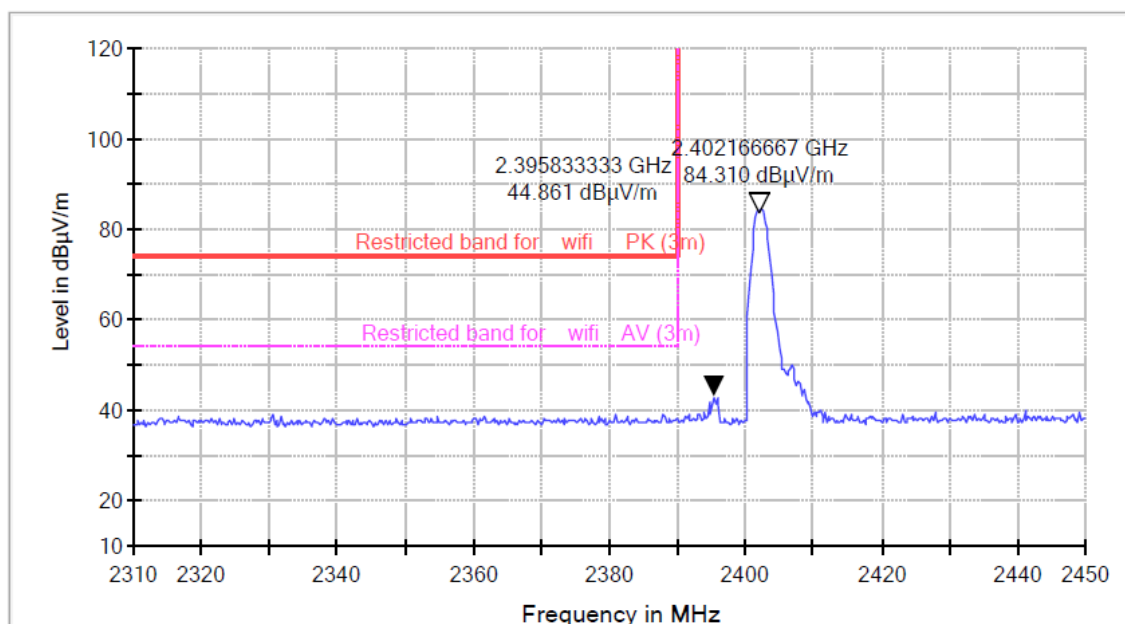
Test result with plots as follows:

Lowest channel (2.402 GHz):

Vertical



Horizontal



Peak Measurement:

## TEST REPORT

| Frequency (MHz) | Reading Level (dBμV) | Correct Factor | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
|-----------------|----------------------|----------------|-------------------------|----------------|----------------------|
| 2400.0          | 53.769               | -9.1           | 44.669                  | 74             | V                    |
| 2395.8          | 53.961               | -9.1           | 44.861                  | 74             | H                    |

### Average Measurement:

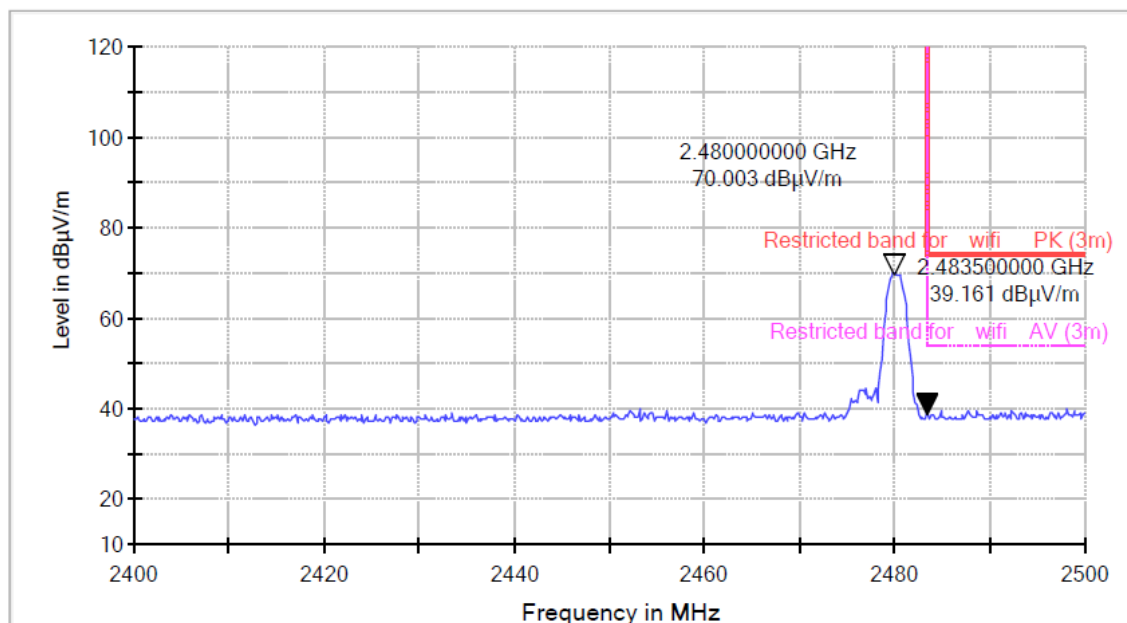
| Frequency (MHz) | Reading Level (dBμV) | Correct Factor | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
|-----------------|----------------------|----------------|-------------------------|----------------|----------------------|
| 2400.0          | /                    | -9.1           | /                       | 54             | V                    |
| 2395.8          | /                    | -9.1           | /                       | 54             | H                    |

### Remark:

When Peak emission level was below AV limit, the AV emission level was not recorded.

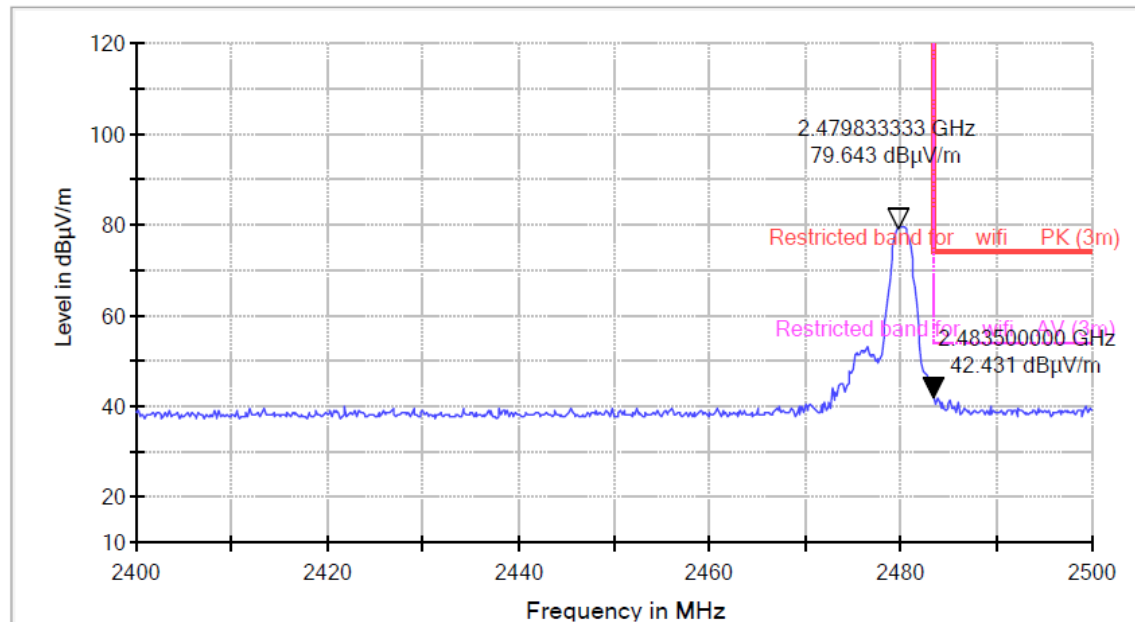
### Highest Channel (2.480 GHz):

#### Vertical



#### Horizontal

## TEST REPORT



### Peak Measurement:

| Frequency (MHz) | Reading Level (dBμV) | Correct Factor | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
|-----------------|----------------------|----------------|-------------------------|----------------|----------------------|
| 2483.5          | 47.861               | -8.7           | 39.161                  | 74             | V                    |
| 2483.5          | 51.131               | -8.7           | 42.431                  | 74             | H                    |

### Average Measurement:

| Frequency (MHz) | Reading Level (dBμV) | Correct Factor | Emission Level (dBμV/m) | Limit (dBμV/m) | Antenna polarization |
|-----------------|----------------------|----------------|-------------------------|----------------|----------------------|
| 2483.5          | /                    | -8.7           | /                       | 54             | V                    |
| 2483.5          | /                    | -8.7           | /                       | 54             | H                    |

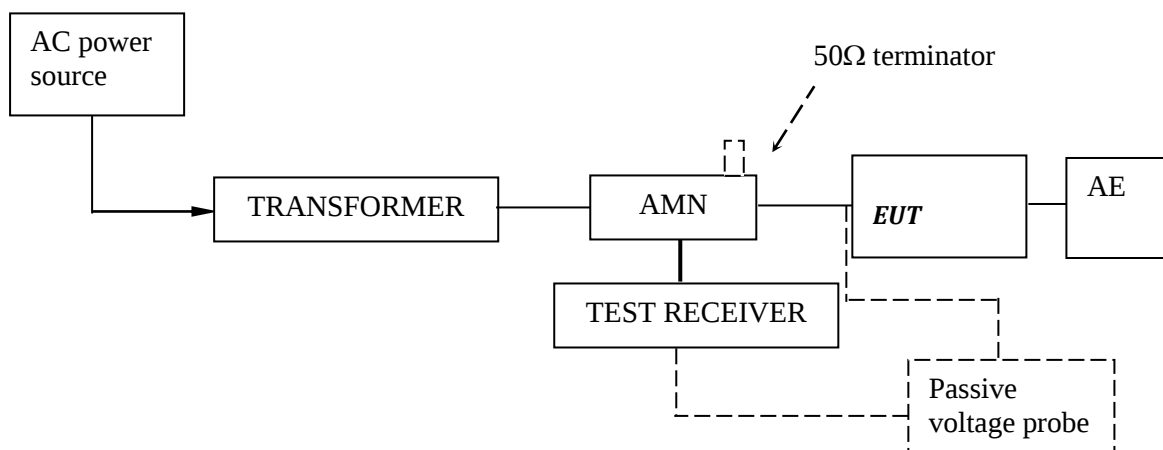
### Remark:

When Peak emission level was below AV limit, the AV emission level did not be recorded.

## TEST REPORT

### 4.5 Conducted Emissions at Mains Terminals

Test Configuration:



Test Setup and Procedure:

Test was performed according to ANSI C63.10 Clause 6.2. The EUT was set to achieve the maximum emission level. The mains terminal disturbance voltage was measured with the EUT in a shielded room. The EUT was connected to AC power source through an Artificial Mains Network which provides a 50Ω linear impedance. Artificial hand is used if appropriate (for handheld apparatus). The load/control terminal disturbance voltage was measured with passive voltage probe if appropriate.

The table-top EUT was placed on a 0.8m high non-metallic table above earthed ground plane (Ground Reference Plane). And for floor standing EUT, was placed on a 0.1m high non-metallic supported on GRP. The EUT keeps a distance of at least 0.8m from any other of the metallic surface. The Artificial Mains Network is situated at a distance of 0.8m from the EUT.

During the test, mains lead of EUT excess 0.8m was folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0.3m and 0.4m

The bandwidth of test receiver was set at 9 kHz. The frequency range from 150 kHz to 30MHz was checked.

Pre-test in the three channels: 2402MHz, 2426MHz and 2480MHz and found the conducted emission on 2402MHz was the worst case, so below test data was for 2402MHz.

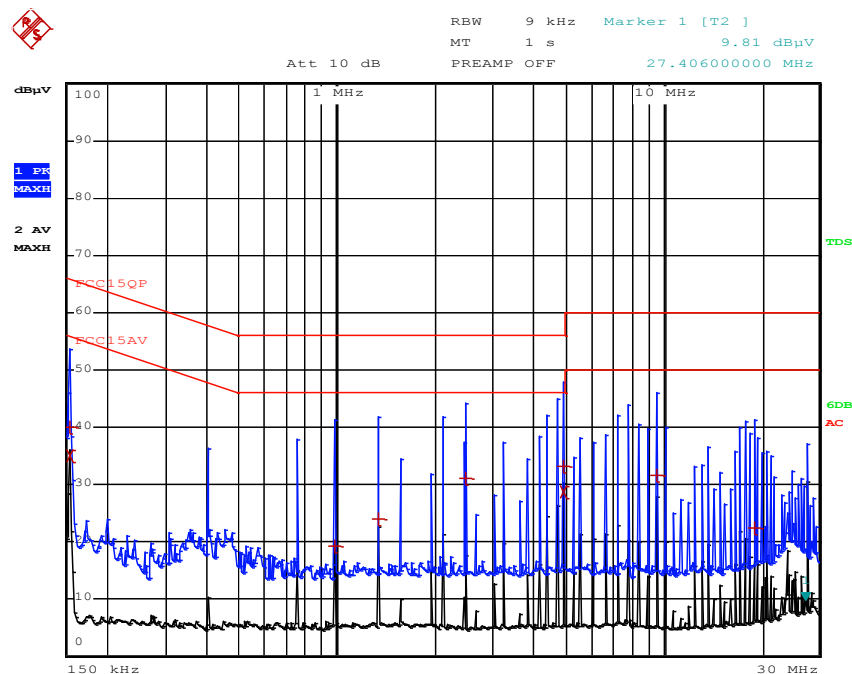
## TEST REPORT

Test Data and Curve

At main terminal: Pass

Tested Wire: Live

Operation Mode: transmitting on 2402MHz(worst case)

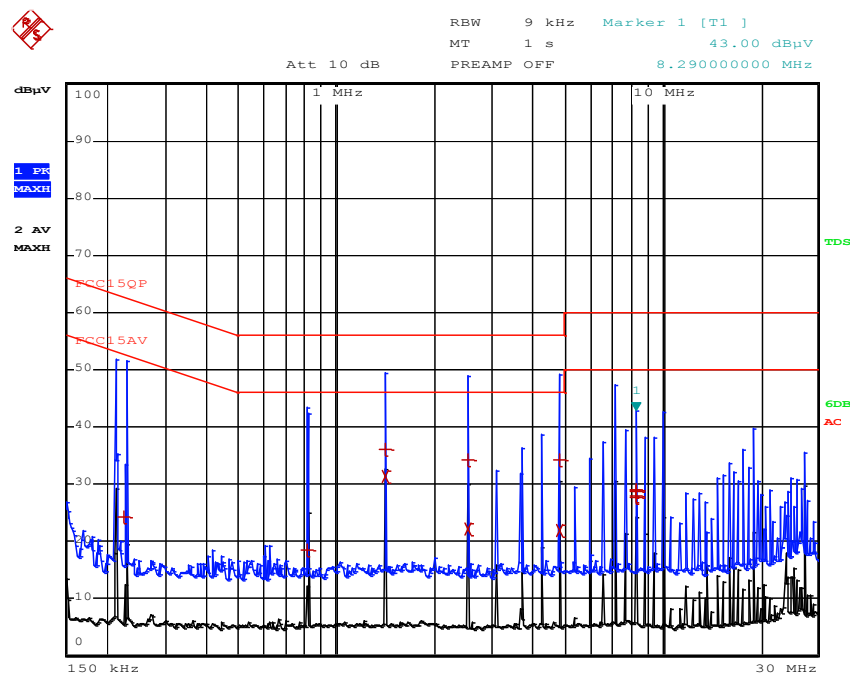


| EDIT PEAK LIST (Final Measurement Results) |            |            |  |                |
|--------------------------------------------|------------|------------|--|----------------|
| Trace1:                                    | FCC15QP    |            |  |                |
| Trace2:                                    | FCC15AV    |            |  |                |
| Trace3:                                    | ---        |            |  |                |
| TRACE                                      | FREQUENCY  | LEVEL dBμV |  | DELTA LIMIT dB |
| 1 Quasi Peak                               | 154 kHz    | 40.09 L1   |  | -25.68         |
| 2 Average                                  | 154 kHz    | 34.94 L1   |  | -20.83         |
| 1 Quasi Peak                               | 990 kHz    | 19.28 L1   |  | -36.71         |
| 1 Quasi Peak                               | 1.342 MHz  | 24.05 L1   |  | -31.94         |
| 1 Quasi Peak                               | 2.47 MHz   | 31.00 L1   |  | -25.00         |
| 1 Quasi Peak                               | 4.966 MHz  | 33.08 L1   |  | -22.91         |
| 2 Average                                  | 4.966 MHz  | 28.67 L1   |  | -17.33         |
| 1 Quasi Peak                               | 9.562 MHz  | 31.59 L1   |  | -28.40         |
| 1 Quasi Peak                               | 18.938 MHz | 22.40 L1   |  | -37.59         |

## TEST REPORT

Tested Wire: Neutral

Operation Mode: transmitting on 2402MHz(worst case)



| EDIT PEAK LIST (Final Measurement Results) |           |            |        |          |
|--------------------------------------------|-----------|------------|--------|----------|
| Trace1:                                    | FCC15QP   |            |        |          |
| Trace2:                                    | FCC15AV   |            |        |          |
| Trace3:                                    | ---       |            |        |          |
| TRACE                                      | FREQUENCY | LEVEL dBμV | DELTA  | LIMIT dB |
| 1 Quasi Peak                               | 226 kHz   | 24.21 L1   | -38.38 |          |
| 1 Quasi Peak                               | 810 kHz   | 18.58 L1   | -37.41 |          |
| 1 Quasi Peak                               | 1.414 MHz | 36.04 L1   | -19.95 |          |
| 2 Average                                  | 1.414 MHz | 31.33 L1   | -14.66 |          |
| 1 Quasi Peak                               | 2.534 MHz | 34.18 L1   | -21.81 |          |
| 2 Average                                  | 2.534 MHz | 22.05 L1   | -23.94 |          |
| 1 Quasi Peak                               | 4.826 MHz | 34.34 L1   | -21.65 |          |
| 2 Average                                  | 4.826 MHz | 22.02 L1   | -23.97 |          |
| 1 Quasi Peak                               | 8.29 MHz  | 28.91 L1   | -31.08 |          |

## TEST REPORT

### 5.0 Test Equipment List

#### Radiated Emission/Radio

| Equipment No. | Equipment                                                         | Model                | Manufacturer     | Cal. Due date<br>(YYYY-MM-DD) | Calibration<br>Interval |
|---------------|-------------------------------------------------------------------|----------------------|------------------|-------------------------------|-------------------------|
| EM030-04      | 3m Semi-Anechoic Chamber                                          | 9×6×6 m <sup>3</sup> | ETS•LINDGRE<br>N | 2019/6/10                     | 1Y                      |
| EM031-02      | EMI Test Receiver (9 kHz~7 GHz)                                   | R&S ESR7             | R&S              | 2019/10/22                    | 1Y                      |
| EM031-03      | Signal and Spectrum Analyzer<br>(10 Hz~40 GHz)                    | R&S FSV40            | R&S              | 2019/9/8                      | 1Y                      |
| EM011-04      | Loop antenna (9 kHz-30 MHz)                                       | HFH2-Z2              | R&S              | 2019/6/18                     | 1Y                      |
| EM061-03      | TRILOG Super Broadband test<br>Antenna (30 MHz-1.5 GHz) (TX)      | VULB 9161            | SCHWARZBECK      | 2019/6/18                     | 1Y                      |
| EM033-01      | TRILOG Super Broadband test<br>Antenna(30 MHz-3 GHz) (RX)         | VULB 9163            | SCHWARZBECK      | 2019/9/19                     | 1Y                      |
| EM033-02      | Bouble-Ridged Waveguide Horn<br>Antenna (800 MHz-18 GHz)(RX)      | R&S HF907            | R&S              | 2019/6/18                     | 1Y                      |
| EM033-03      | High Frequency Antenna &<br>preamplifier(18 GHz~26.5 GHz)<br>(RX) | R&S SCU-26           | R&S              | 2019/6/24                     | 1Y                      |
| EM033-04      | High Frequency Antenna &<br>preamplifier (26 GHz-40 GHz)          | R&S SCU-40           | R&S              | 2019/6/24                     | 1Y                      |
| EM031-02-01   | Coaxial cable(9 kHz-1 GHz)                                        | N/A                  | R&S              | 2019/6/12                     | 1Y                      |
| EM033-02-02   | Coaxial cable(1 GHz-18 GHz)                                       | N/A                  | R&S              | 2019/6/12                     | 1Y                      |
| EM033-04-02   | Coaxial cable(18 GHz~40 GHz)                                      | N/A                  | R&S              | 2019/6/24                     | 1Y                      |
| EM031-01      | Signal Generator (9 kHz~6 GHz)                                    | SMB100A              | R&S              | 2019/7/22                     | 1Y                      |
| EM040-01      | Band Reject/Notch Filter                                          | WRHFV                | Wainwright       | N/A                           | 1Y                      |
| EM040-02      | Band Reject/Notch Filter                                          | WRCGV                | Wainwright       | N/A                           | 1Y                      |
| EM040-03      | Band Reject/Notch Filter                                          | WRCGV                | Wainwright       | N/A                           | 1Y                      |
| EM022-03      | 2.45 GHz Filter                                                   | BRM50702             | Micro-Tronics    | 2019/6/10                     | 1Y                      |
| SA016-16      | Programmable Temperature &<br>Humidity Test Chamber               | MHU-800LJ            | TERCHY           | 2019/10/13                    | 1Y                      |
| SA016-22      | Climatic Test Chamber                                             | C7-1500              | Vötsch           | 2019/11/10                    | 1Y                      |
| SA012-74      | Digital Multimeter                                                | FLUKE175             | FLUKE            | 2019/10/13                    | 1Y                      |
| EM010-01      | Regulated DC Power supply                                         | PAB-3003A            | GUANHUA          | N/A                           | 1Y                      |
| SA040-22      | Regulated DC Power supply                                         | IT6721               | ITECH            | 2019/9/8                      | 1Y                      |
| EM084-06      | Audio Analyzer                                                    | 8903B                | HP               | 2019/6/15                     | 1Y                      |
| EM045-01-01   | EMC32 software (RE/RS)                                            | V10.01.00            | R&S              | N/A                           | N/A                     |
| EM045-01-09   | EMC32 software (328/893)                                          | V9.26.01             | R&S              | N/A                           | N/A                     |

#### Conducted emission at the mains terminals

| Equipment No. | Equipment       | Model    | Manufacturer | Cal. Due date<br>(YYYY-MM-DD) | Calibration<br>Interval |
|---------------|-----------------|----------|--------------|-------------------------------|-------------------------|
| EM080-05      | EMI receiver    | ESCI     | R&S          | 2019/7/19                     | 1Y                      |
| EM006-05      | LISN            | ENV216   | R&S          | 2019/6/7                      | 1Y                      |
| EM006-06      | LISN            | ENV216   | R&S          | 2019/9/8                      | 1Y                      |
| EM006-06-01   | Coaxial cable   | /        | R&S          | 2019/6/12                     | 1Y                      |
| EM004-04      | EMC shield Room | 8m×3m×3m | Zhongyu      | 2019/6/5                      | 1Y                      |

\*\*\*\*\*End of the test report\*\*\*\*\*