

# TEST REPORT

Reference No. .... : WTU20S04016795W001 V2  
FCC ID ..... : 2AIIH-OQB2020  
Applicant..... : Optiqo Sweden AB  
Address..... : Roxviksgatan 8A, 58273 Linköping, Sweden  
Manufacturer ..... : Magnificent Cleaning Equipment Co., Ltd.  
Address..... : 369 Pujin Raod, Linhu Town, Wuzhong District, Suzhou 215105, China  
Product..... : Optiqo - Qlvr Box  
Model(s) ..... : OQB2020  
Brand..... : N/A  
Standards..... : FCC CFR47 Part 15 Section 15.225: 2018  
Date of Receipt sample .... : 2020-04-07  
Date of Test ..... : 2020-04-14 to 2020-04-20  
Date of Issue..... : 2020-06-16  
Test Result..... : Pass

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

**Prepared By:**

**Waltek Services (Shenzhen) Co., Ltd.**

Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Tel :+86-755-83551033

Fax:+86-755-83552400

Compiled by:

*Ford Wang*

Ford Wang / Project Engineer

Approved by:



*Philo Zhong*

Philo Zhong / Manager

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### 3 Revision History

| Test report No.           | Date of Receipt sample | Date of Test                | Date of Issue | Purpose   | Comment | Approved |
|---------------------------|------------------------|-----------------------------|---------------|-----------|---------|----------|
| WTU20S04016795<br>W001    | 2020-04-07             | 2020-04-14<br>to 2020-04-20 | 2020-04-21    | original  | -       | Replaced |
| WTU20S04016795<br>W001 V1 | 2020-04-07             | 2020-04-14<br>to 2020-04-20 | 2020-06-11    | Version 1 | Updated | Replaced |
| WTU20S04016795<br>W001 V2 | 2020-04-07             | 2020-04-14<br>to 2020-04-20 | 2020-06-16    | Version 2 | Updated | Valid    |

## 4 General Information

### 4.1 General Description of E.U.T.

|                    |                   |
|--------------------|-------------------|
| Product Name:      | Optiqo - Qlvr Box |
| Model No.:         | OQB2020           |
| Model Description: | N/A               |
| NFC:               | Support           |
| Hardware Version:  | OPTIQO V3         |
| Software Version:  | OPTIQO20200402    |
| Storage Location:  | Internal Storage  |
| Note:              | N/A               |

### 4.2 Details of E.U.T.

|                      |               |
|----------------------|---------------|
| Operation Frequency: | NFC:13.56MHz  |
| Ratings:             | Battery DC 9V |

### 4.3 Channel List

| NFC Test Mode |             |                 |
|---------------|-------------|-----------------|
| Channel No.   | Channel No. | Frequency (MHz) |
| 0             | 0           | 13.56MHz        |

### 4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests; the worst data were recorded and reported.

| Test mode    | Lower channel | Middle channel | Upper channel |
|--------------|---------------|----------------|---------------|
| Transmitting | N/A           | 13.56MHz       | N/A           |

### 4.5 Test Facility

The test facility has a test site registered with the following organizations:

**ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.**

Waltek Services(Shenzhen) Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration number 7760A, October 15, 2016.

**FCC Designation No.: CN1201. Test Firm Registration No.: 523476.**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration number 523476, September 10, 2019.

## 5 Test Summary

| Test Items                                                                | Test Requirement              | Result |
|---------------------------------------------------------------------------|-------------------------------|--------|
| Conducted Emissions                                                       | 15.207                        | N/A    |
| Radiated Emission                                                         | 15.205(a)<br>15.209<br>15.225 | PASS   |
| Frequency Tolerance                                                       | 15.225                        | PASS   |
| 20dB Bandwidth                                                            | 15.215(c)                     | PASS   |
| Antenna Requirement                                                       | 15.203                        | PASS   |
| Note: C=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable. |                               |        |

## 6 Equipment Used during Test

### 6.1 Equipments List

| Conducted Emissions Test Site 1#                              |                            |                      |              |                 |                       |                      |
|---------------------------------------------------------------|----------------------------|----------------------|--------------|-----------------|-----------------------|----------------------|
| Item                                                          | Equipment                  | Manufacturer         | Model No.    | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1.                                                            | EMI Test Receiver          | R&S                  | ESCI         | 100947          | 2019-09-12            | 2020-09-11           |
| 2.                                                            | LISN                       | R&S                  | ENV216       | 101215          | 2019-09-12            | 2020-09-11           |
| 3.                                                            | Cable                      | Top                  | TYPE16(3.5M) | -               | 2019-09-12            | 2020-09-11           |
| Conducted Emissions Test Site 2#                              |                            |                      |              |                 |                       |                      |
| Item                                                          | Equipment                  | Manufacturer         | Model No.    | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1.                                                            | EMI Test Receiver          | R&S                  | ESCI         | 101155          | 2019-09-12            | 2020-09-11           |
| 2.                                                            | LISN                       | SCHWARZBECK          | NSLK 8128    | 8128-289        | 2019-09-12            | 2020-09-11           |
| 3.                                                            | Limiter                    | York                 | MTS-IMP-136  | 261115-001-0024 | 2019-09-12            | 2020-09-11           |
| 4.                                                            | Cable                      | LARGE                | RF300        | -               | 2019-09-12            | 2020-09-11           |
| 3m Semi-anechoic Chamber for Radiation Emissions Test site 1# |                            |                      |              |                 |                       |                      |
| Item                                                          | Equipment                  | Manufacturer         | Model No.    | Serial No.      | Last Calibration Date | Calibration Due Date |
| 1                                                             | Spectrum Analyzer          | R&S                  | FSP          | 100091          | 2019-04-19            | 2020-04-18           |
|                                                               |                            |                      |              |                 | 2020-04-29            | 2021-04-28           |
| 2                                                             | Amplifier                  | Agilent              | 8447D        | 2944A10178      | 2020-01-13            | 2021-01-12           |
| 3                                                             | Active Loop Antenna        | Beijing Dazhi        | ZN30900A     | 0703            | 2019-10-17            | 2020-10-16           |
| 4                                                             | Trilog Broadband Antenna   | SCHWARZBECK          | VULB9163     | 33 6            | 2019-04-29            | 2020-04-28           |
| 5                                                             | Coaxial Cable (below 1GHz) | Top                  | TYPE16(13M)  | -               | 2019-09-12            | 2020-09-11           |
| 6                                                             | Broad-band Horn Antenna    | SCHWARZBECK          | BBHA 9120 D  | 667             | 2019-04-29            | 2020-04-28           |
| 7                                                             | Broadband Preamplifier     | COMPLIANCE DIRECTION | PAP-1G18     | 2004            | 2020-04-13            | 2021-04-12           |
| 8                                                             | Coaxial Cable (above 1GHz) | Top                  | 1GHz-18GHz   | EW02014-7       | 2020-04-13            | 2021-04-12           |
| 3m Semi-anechoic Chamber for Radiation Emissions Test site 2# |                            |                      |              |                 |                       |                      |
| Item                                                          | Equipment                  | Manufacturer         | Model No.    | Serial No       | Last Calibration Date | Calibration Due Date |
| 1                                                             | Test Receiver              | R&S                  | ESCI         | 101296          | 2020-04-13            | 2021-04-12           |
| 2                                                             | Trilog Broadband Antenna   | SCHWARZBECK          | VULB9160     | 9160-3325       | 2019-04-29            | 2020-04-28           |
| 3                                                             | Amplifier                  | ANRITSU              | MH648A       | M43381          | 2020-04-13            | 2021-04-12           |

| 4                           | Cable                           | HUBER+SUHNER | CBL2      | 525178     | 2020-04-13            | 2021-04-12           |
|-----------------------------|---------------------------------|--------------|-----------|------------|-----------------------|----------------------|
| <b>RF Conducted Testing</b> |                                 |              |           |            |                       |                      |
| Item                        | Equipment                       | Manufacturer | Model No. | Serial No. | Last Calibration Date | Calibration Due Date |
| 1.                          | EMC Analyzer<br>(9k~26.5GHz)    | Agilent      | E7405A    | MY45114943 | 2019-09-12            | 2020-09-11           |
| 2.                          | Spectrum Analyzer<br>(9k-6GHz)  | R&S          | FSL6      | 100959     | 2019-09-12            | 2020-09-11           |
| 3.                          | Signal Analyzer<br>(9k~26.5GHz) | Agilent      | N9010A    | MY50520207 | 2019-09-12            | 2020-09-11           |

## 6.2 Measurement Uncertainty

| Parameter                                       | Uncertainty                                    |
|-------------------------------------------------|------------------------------------------------|
| Radio Frequency                                 | $\pm 1 \times 10^{-6}$                         |
| RF Power                                        | $\pm 1.0$ dB                                   |
| RF Power Density                                | $\pm 2.2$ dB                                   |
| Radiated Spurious Emissions test                | $\pm 5.03$ dB<br>(Bilog antenna 30M~1000MHz)   |
|                                                 | $\pm 5.47$ dB<br>(Horn antenna 1000M~25000MHz) |
| Confidence interval: 95%. Confidence factor:k=2 |                                                |

## 6.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.



## 7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209

Test Method: ANSI C63.10

Test Result: PASS

Measurement Distance: 3m

Limit:

| Frequency<br>(MHz) | Field Strength |                 | Field Strength Limit at 3m Measurement Dist |                                |
|--------------------|----------------|-----------------|---------------------------------------------|--------------------------------|
|                    | uV/m           | Distance<br>(m) | uV/m                                        | dBuV/m                         |
| 0.009 ~ 0.490      | 2400/F(kHz)    | 300             | $10000 * 2400/F(kHz)$                       | $20\log^{(2400/F(kHz))} + 80$  |
| 0.490 ~ 1.705      | 24000/F(kHz)   | 30              | $100 * 24000/F(kHz)$                        | $20\log^{(24000/F(kHz))} + 40$ |
| 1.705 ~ 30         | 30             | 30              | $100 * 30$                                  | $20\log^{(30)} + 40$           |
| 30 ~ 88            | 100            | 3               | 100                                         | $20\log^{(100)}$               |
| 88 ~ 216           | 150            | 3               | 150                                         | $20\log^{(150)}$               |
| 216 ~ 960          | 200            | 3               | 200                                         | $20\log^{(200)}$               |
| Above 960          | 500            | 3               | 500                                         | $20\log^{(500)}$               |

### 7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

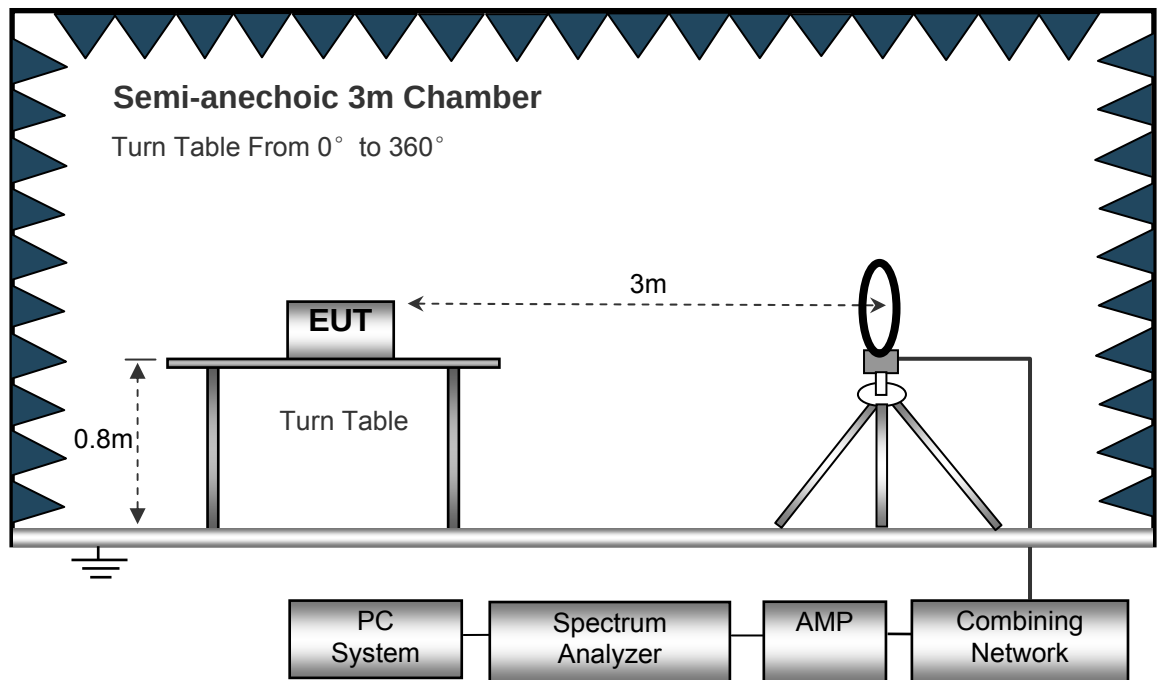
EUT Operation :

The test was performed in transmitting mode, the test data were shown in the report.

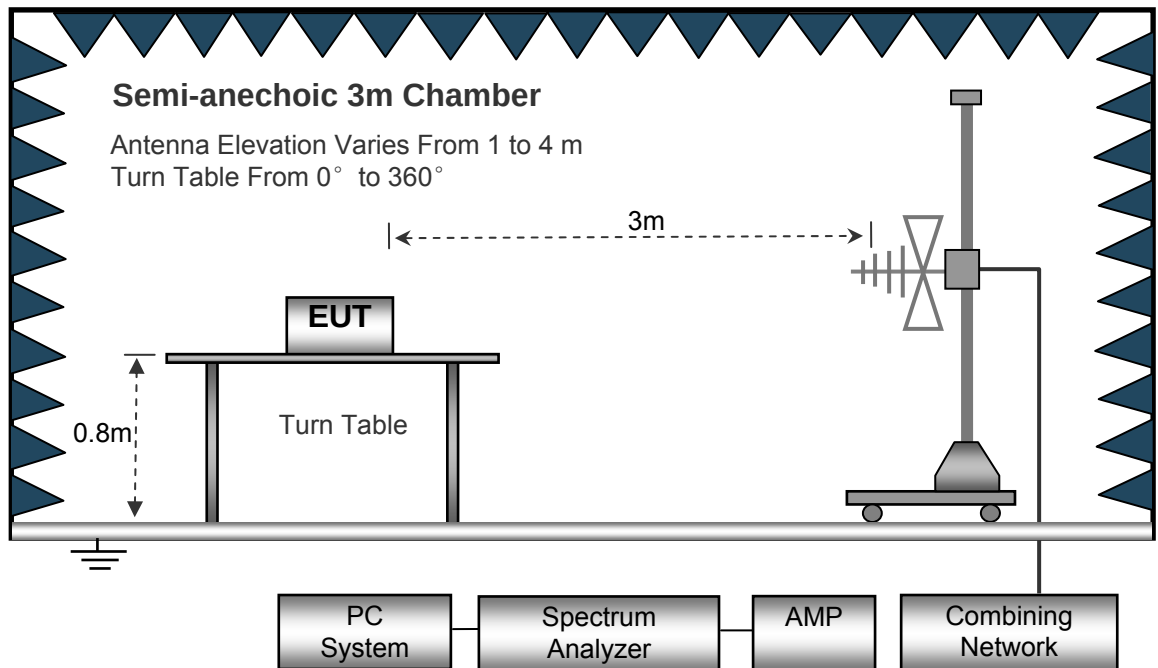
## 7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013

The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



### 7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed .....Auto  
 IF Bandwidth.....10kHz  
 Video Bandwidth.....10kHz  
 Resolution Bandwidth.....10kHz

30MHz ~ 1GHz

Sweep Speed .....Auto  
 Detector .....PK  
 Resolution Bandwidth.....100kHz  
 Video Bandwidth.....300kHz

### 7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.

### 7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

## 7.6 Summary of Test Results

Test Frequency: 9 kHz ~ 30MHz Note: Correct factor = Cable loss + Antenna factor

| Frequency | Receiver Reading (PK) | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude (PK) | FCC Part 15.225 |        |
|-----------|-----------------------|------------------|------------|-------|------------------|--------------------------|-----------------|--------|
|           |                       |                  | Height     | Polar |                  |                          | Limit           | Margin |
| (MHz)     | (dBμV) @3m            | Degree           | (m)        | (H/V) | (dB/m)           | (dBμV/m) @3m             | (dBμV/m)@3m     | (dB)   |
| 13.56     | 87.25                 | 123              | 1.9        | H     | 19.68            | 106.93                   | 124             | -17.07 |
| 13.56     | 81.69                 | 316              | 1.5        | V     | 19.68            | 101.37                   | 124             | -22.63 |

| Frequency (MHz) | Receiver Reading | Detector | Correct factor | Extrapolation factor | Measurement results (calculated) | Limits     | Margin |
|-----------------|------------------|----------|----------------|----------------------|----------------------------------|------------|--------|
|                 | dBμV @3m         | QP       | dB/m           | dB                   | dBμV/m @3m                       | dBμV/m @3m | dB     |
| 4.259           | 32.64            | QP       | 20.20          | 40.00                | 12.84                            | 29.54      | -16.70 |
| 11.437          | 35.38            | QP       | 19.90          | 40.00                | 15.28                            | 29.54      | -14.26 |

| Frequency Range (MHz) | Frequency (MHz) | Maximum Reading | Detector | Correct factor | Extrapolation factor | Measurement results (calculated) | Limits     | Margin |
|-----------------------|-----------------|-----------------|----------|----------------|----------------------|----------------------------------|------------|--------|
|                       |                 | dBμV @3m        | QP       | dB/m           | dB                   | dBμV/m @3m                       | dBμV/m @3m | dB     |
| 13.110~13.41          | 13.401          | 40.12           | QP       | 21.55          | 40                   | 21.67                            | 40.51      | -18.84 |
| 13.410~13.553         | 13.546          | 48.65           | QP       | 21.55          | 40                   | 30.20                            | 50.47      | -20.27 |
| 13.567~13.71          | 13.587          | 48.05           | QP       | 21.55          | 40                   | 29.60                            | 50.47      | -20.87 |
| 13.710~14.01          | 13.719          | 37.65           | QP       | 21.55          | 40                   | 19.20                            | 40.51      | -21.31 |

**Test Frequency: 30MHz ~ 1GHz**

| Frequency | Receiver Reading | Detector | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | FCC Part 15.225/209/205 |        |
|-----------|------------------|----------|------------------|------------|-------|------------------|---------------------|-------------------------|--------|
|           |                  |          |                  | Height     | Polar |                  |                     | Limit                   | Margin |
| (MHz)     | (dBμV) @3m       | (QP)     | Degree           | (m)        | (H/V) | (dB)             | (dBμV/m) @3m        | (dBμV/m) @3m            | (dB)   |
| 32.59     | 31.41            | QP       | 150              | 1.2        | H     | -14.30           | 17.11               | 40.00                   | -22.89 |
| 32.59     | 32.96            | QP       | 206              | 2.0        | V     | -14.30           | 18.66               | 40.00                   | -21.34 |
| 223.45    | 36.12            | QP       | 51               | 1.8        | H     | -13.58           | 22.54               | 46.00                   | -23.46 |
| 223.45    | 40.81            | QP       | 117              | 1.6        | V     | -13.58           | 27.23               | 46.00                   | -18.77 |
| 517.98    | 39.25            | QP       | 192              | 1.7        | H     | -5.63            | 33.62               | 46.00                   | -12.38 |
| 517.98    | 40.13            | QP       | 173              | 1.6        | V     | -5.63            | 34.50               | 46.00                   | -11.50 |

## 8 Frequency Tolerance

Test Requirement:

FCC Part15.225

Test Method:

ANSI C63.10: 2013

Limit

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 8.1 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Centre Frequency = fundamental frequency, RBW=30 Hz, VBW= 100 Hz, Span =3 kHz.
4. Set SPA Max hold. Mark peak.

### 8.2 Test Result

| Power Supply | Temperature (°C) | Measured Frequency (MHz) | Frequency Error | Part 15.225 Limit |
|--------------|------------------|--------------------------|-----------------|-------------------|
| DC 9V        | -20              | 13.5612                  | 0.0091%         | ±0.01%            |
|              | -10              | 13.5606                  | 0.0043%         | ±0.01%            |
|              | 0                | 13.5598                  | -0.0018%        | ±0.01%            |
|              | +10              | 13.5595                  | -0.0035%        | ±0.01%            |
|              | +20              | 13.5608                  | 0.0059%         | ±0.01%            |
|              | +30              | 13.5592                  | -0.0058%        | ±0.01%            |
|              | +40              | 13.5593                  | -0.0053%        | ±0.01%            |
|              | +50              | 13.5605                  | 0.0037%         | ±0.01%            |
| DC 7.65V     | -20              | 13.5607                  | 0.0052%         | ±0.01%            |
|              | -10              | 13.5602                  | 0.0016%         | ±0.01%            |
|              | 0                | 13.5597                  | -0.0022%        | ±0.01%            |

|          |     |         |          |        |
|----------|-----|---------|----------|--------|
|          | +10 | 13.5608 | 0.0061%  | ±0.01% |
|          | +20 | 13.5609 | 0.0066%  | ±0.01% |
|          | +30 | 13.5611 | 0.0083%  | ±0.01% |
|          | +40 | 13.5594 | -0.0044% | ±0.01% |
|          | +50 | 13.5609 | 0.0070%  | ±0.01% |
| DC10.35V | -20 | 13.5604 | 0.0029%  | ±0.01% |
|          | -10 | 13.5601 | 0.0076%  | ±0.01% |
|          | 0   | 13.5596 | -0.0032% | ±0.01% |
|          | +10 | 13.5601 | 0.0006%  | ±0.01% |
|          | +20 | 13.5600 | 0.0001%  | ±0.01% |
|          | +30 | 13.5593 | -0.0055% | ±0.01% |
|          | +40 | 13.5606 | 0.0046%  | ±0.01% |
|          | +50 | 13.5603 | 0.0024%  | ±0.01% |

## 9 20dB Bandwidth

Test Requirement: FCC Part15.215(C)

Test Method: ANSI C63.10: 2013

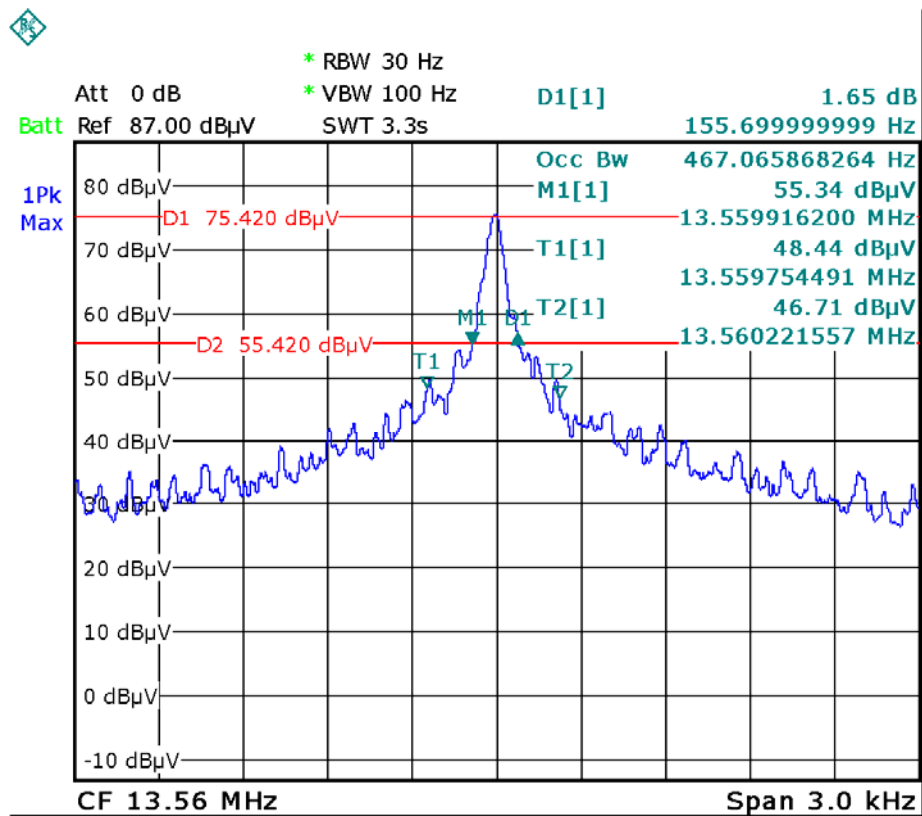
### 9.1 Test Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
2. 20dB Bandwidth the resolution bandwidth of 30 Hz and the video bandwidth of 100 Hz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

### 9.2 Test Result

| Frequency(MHz) | Bandwidth Emission(Hz) |
|----------------|------------------------|
| 13.56          | 155.700                |

Test Plot





## **10 Antenna Requirement**

According to the FCC Part 15 Paragraph 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.

This product has an Loop antenna, fulfil the requirement of this section.

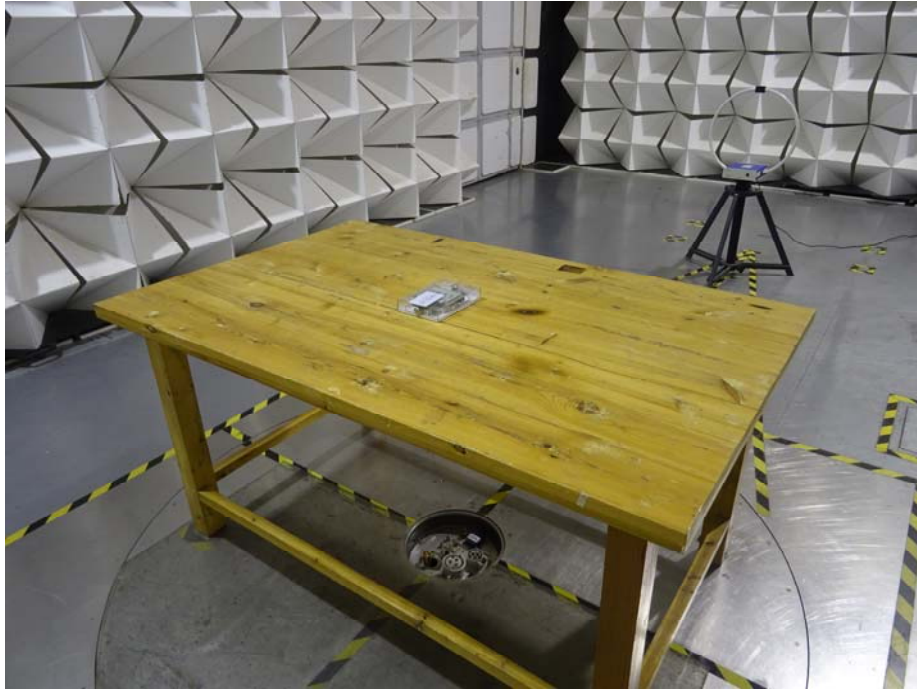
## **11 RF Exposure**

Remark: refer to MPE test report: WTU20S04016795W002.

## 12 Photographs- Test Setup Photos

### 12.1 Photograph – Radiation Emission Test Setup

Test frequency from 9 KHz to 30MHz



Test frequency from 30MHz to 1GHz



### **13 Photographs of EUT.**

Note: Please refer to appendix: Appendix-OQB2020-Photos.

=====End of Report=====