

FCC Test Report

Report No.: RF190314C28A

FCC ID: MSQG531G

Test Model: G531G

Series Model: G531GD, G531GT, PX531, GL531GT, G531GU, G531GV, G531GW, GL531GU, GL531GV, GL531GW, G531, GL531GD, GL531G, G531G_N, G531GU_N, G531GV_N, G531GW_N

(Refer to section 3.1 for more detail)

Received Date: Apr. 24, 2019

Test Date: Apr. 29 ~ Apr. 30, 2019

Issued Date: May 03, 2019

Applicant: ASUSTeK COMPUTER INC.

Address: 4F, No. 150, LI-TE Rd., PEITOU, TAIPEI 112, TAIWAN

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.

Test Location: No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

FCC Registration / Designation Number: 788550 / TW0003



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Release Control Record

| Issue No. | Description | Date Issued |
|--------------|-------------------|--------------|
| RF190314C28A | Original release. | May 03, 2019 |

1 Certificate of Conformity

Product: Notebook PC

Brand: ASUS

Test Model: G531G

Series Model: G531GD, G531GT, PX531, GL531GT, G531GU, G531GV, G531GW, GL531GU, GL531GV, GL531GW, G531, GL531GD, GL531G, G531G_N, G531GU_N, G531GV_N, G531GW_N

(Refer to section 3.1 for more detail)

Sample Status: Identical Prototype

Applicant: ASUSTeK COMPUTER INC.

Test Date: Apr. 29 ~ Apr. 30, 2019

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.225)
47 CFR FCC Part 15, Subpart C (Section 15.215)
ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Pettie Chen , **Date:** May 03, 2019
Pettie Chen / Senior Specialist

Approved by : Bruce Chen , **Date:** May 03, 2019
Bruce Chen / Project Engineer

2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.225, 15.215) | | | |
|--|--|--------|---|
| FCC Clause | Test Item | Result | Remarks |
| 15.207 | Conducted emission test | Pass | Meet the requirement of limit. Minimum passing margin is -13.94dB at 27.12118MHz |
| 15.225 (a) | The field strength of any emissions within the band 13.553-13.567 MHz | Pass | Meet the requirement of limit. Minimum passing margin is -76.5dB at 13.56MHz. |
| 15.225 (b) | The field strength of any emissions within the bands 13.410-13.553 MHz and 13.567-13.710 MHz | Pass | Meet the requirement of limit. |
| 15.225 (c) | The field strength of any emissions within the bands 13.110-13.410 MHz and 13.710-14.010 MHz | Pass | Meet the requirement of limit. |
| 15.225 (d) | The field strength of any emissions appearing outside of the 13.110-14.010 MHz band | Pass | Meet the requirement of limit. Minimum passing margin is -6.80dB at 201.00MHz. |
| 15.225 (e) | The frequency tolerance | Pass | Meet the requirement of limit. |
| 15.215 (c) | 20dB Bandwidth | Pass | Meet the requirement of limit. |

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement | Frequency | Expanded Uncertainty (k=2) (\pm) |
|------------------------------------|-----------------|--------------------------------------|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 2.94 dB |
| Radiated Emissions up to 1 GHz | 9kHz ~ 30MHz | 3.04 dB |
| | 30MHz ~ 200MHz | 3.63 dB |
| | 200MHz ~1000MHz | 3.64 dB |

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

| | |
|---------------------|---|
| Product | Notebook PC |
| Brand | ASUS |
| Test Model | G531G |
| Series Model | G531GD, G531GT, PX531, GL531GT, G531GU, G531GV, G531GW, GL531GU, GL531GV, GL531GW, G531, GL531GD, GL531G, G531G_N, G531GU_N, G531GV_N, G531GW_N |
| Model Difference | Refer to Note |
| Sample Status | Identical Prototype |
| Nominal Voltage | 20.0 Vdc (Adapter) 15.4 Vdc (Li-ion battery) |
| Modulation Type | ASK |
| Operating Frequency | 13.56MHz |
| Data Rate | 26.69 kbit/s |
| NFC type | Type V |
| Field Strength | 47.5dBuV/m |
| Antenna Type | PCB antenna |
| Antenna Connector | NA |
| Accessory Device | Battery, Adapter |
| Cable Supplied | NA |

Note:

1. All models are listed as below.

| Brand | Model | Function | Difference |
|-------------------------|-------------------------|------------------------------------|---|
| ASUS | G531G (Main Model) | WLAN + BT or WLAN + BT + NFC | All models are electrically identical, different model names are for marketing purpose. |
| | G531GD (Series Model) | | |
| | G531GT (Series Model) | | |
| | PX531 (Series Model) | | |
| | GL531GT (Series Model) | | |
| | G531GU (Series Model) | | |
| | G531GV (Series Model) | | |
| | G531GW (Series Model) | | |
| | GL531GU (Series Model) | | |
| | GL531GV (Series Model) | | |
| | GL531GW (Series Model) | | |
| | G531 (Series Model) | | |
| | GL531GD (Series Model) | | |
| | GL531G (Series Model) | | |
| | G531G_N (Series Model) | | |
| | G531GU_N (Series Model) | | |
| G531GV_N (Series Model) | | | |
| G531GW_N (Series Model) | | | |

2. The EUT is powered by the following battery.

| Battery | |
|--------------|------------------------------------|
| Brand | ASUS |
| Manufacturer | DP |
| Model | C41N1731-2 |
| Rating | 15.4Vdc/66WH |
| Capacity | 4335mAh(Typical) / 4210mAh (Rated) |

3. The EUT is powered by the following adapter.

| Adapter 280W | |
|--------------|---|
| Brand | ASUS |
| Manufacturer | DELTA |
| Model | ADP-280BB B |
| Input Power | 100-240Vac, 3.2A |
| Output Power | 20 Vdc , 14 A |
| Power Cord | AC: 1.8m non-shielded power cord DC: 1.2m shielded power cord with 2 cores |

4. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

1 channel is provided to this EUT

| Channel | Freq. (MHz) |
|---------|-------------|
| 1 | 13.56 |

3.2.1 Test Mode Applicability and Tested Channel Data

| EUT Configure Mode | Applicable to | | | | Description |
|--------------------|---------------|-----|----|----|-------------|
| | RE | PLC | FS | EB | |
| - | √ | √ | √ | √ | - |

Where RE: Radiated Emission
 FS: Frequency Stability
 PLC: Power Line Conducted Emission
 EB: 20dB Bandwidth measurement

Note: The antenna had been pre-tested on the positioned of each 3 axis. The worst cases were found when positioned on X-plane.

Radiated Emission Test:

- 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).
- Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type |
|--------------------|-------------------|----------------|-----------------|
| - | 1 | 1 | ASK |

Power Line Conducted Emission Test:

- 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).
- Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type |
|--------------------|-------------------|----------------|-----------------|
| - | 1 | 1 | ASK |

Frequency Stability:

- 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).
- Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type |
|--------------------|-------------------|----------------|-----------------|
| - | 1 | 1 | ASK |

20dB Bandwidth:

- 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).
- Following channel(s) was (were) selected for the final test as listed below.

| EUT Configure Mode | Available Channel | Tested Channel | Modulation Type |
|--------------------|-------------------|----------------|-----------------|
| - | 1 | 1 | ASK |

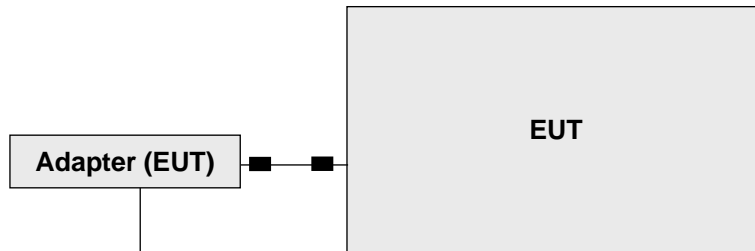
Test Condition:

| Applicable to | Environmental Conditions | Input Power | Tested by |
|---------------|--------------------------|--------------|------------|
| RE | 23 deg. C, 67% RH | 120Vac, 60Hz | Adair Peng |
| PLC | 23 deg. C, 67% RH | 120Vac, 60Hz | Adair Peng |
| FS | 23 deg. C, 67% RH | 120Vac, 60Hz | Adair Peng |
| BW | 23 deg. C, 67% RH | 120Vac, 60Hz | Adair Peng |

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.225)

FCC Part 15, Subpart C (15.215)

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission Measurement

4.1.1 Limits of Radiated Emission Measurement

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-------------------|-----------------------------------|-------------------------------|
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 |
| 1.705 ~ 30.0 | 30 | 30 |
| 30 ~ 88 | 100 | 3 |
| 88 ~ 216 | 150 | 3 |
| 216 ~ 960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Due |
|--|---------------------------------------|---------------------------------|---------------|---------------|
| Test Receiver ROHDE & SCHWARZ | ESIB7 | 100187 | May 29, 2018 | May 28, 2019 |
| BILOG Antenna SCHWARZBECK | VULB9168 | 9168-171 | Nov. 22, 2018 | Nov. 21, 2019 |
| HORN Antenna SCHWARZBECK | 9120D | 209 | Nov. 25, 2018 | Nov. 24, 2019 |
| HORN Antenna SCHWARZBECK | BBHA 9170 | BBHA9170241 | Nov. 25, 2018 | Nov. 24, 2019 |
| HORN Antenna SCHWARZBECK | BBHA 9170 | BBHA9170241 | Nov. 25, 2018 | Nov. 24, 2019 |
| Loop Antenna TESEQ | HLA 6121 | 45745 | Jun. 14, 2018 | Jun. 13, 2019 |
| Preamplifier Agilent (Below 1GHz) | 8447D | 2944A10738 | Aug. 21, 2018 | Aug. 20, 2019 |
| Preamplifier Agilent (Above 1GHz) | 8449B | 3008A02465 | Mar. 27, 2019 | Mar. 26, 2020 |
| RF signal cable HUBER+SUHNER | SUCOFLEX 104 | Cable-CH3-03 (223653/4) | Aug. 21, 2018 | Aug. 20, 2019 |
| RF signal cable HUBER+SUHNER& EMCI | SUCOFLEX 104&EMC104-SM- SM-8000 | Cable-CH3-03 (309224+170907) | Aug. 21, 2018 | Aug. 20, 2019 |
| Software BV ADT | ADT_Radiated_ V7.6.15.9.5 | NA | NA | NA |
| Antenna Tower inn-co GmbH | MA 4000 | 013303 | NA | NA |
| Antenna Tower Controller BV ADT | AT100 | AT93021702 | NA | NA |
| Turn Table BV ADT | TT100 | TT93021702 | NA | NA |
| Turn Table Controller BV ADT | SC100 | SC93021702 | NA | NA |
| Boresight Antenna Fixture | FBA-01 | FBA-SIP01 | NA | NA |

- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Chamber 3.
 3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

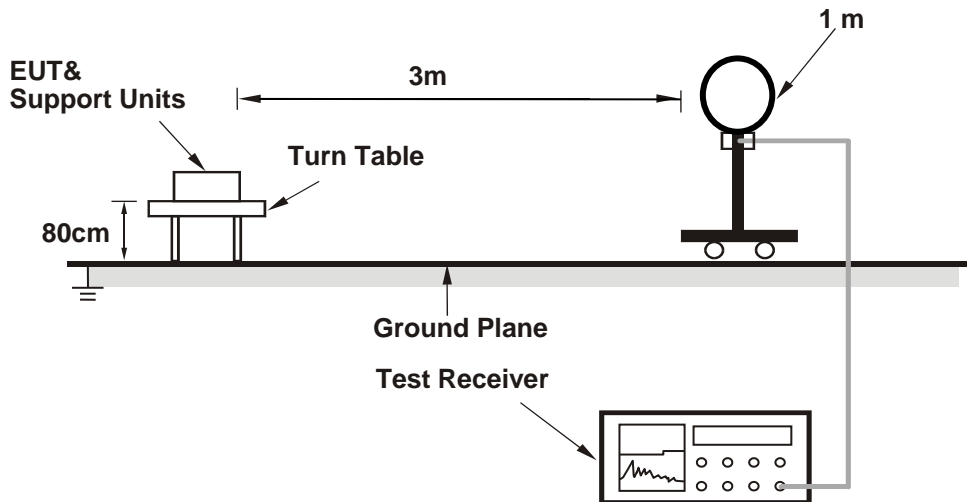
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

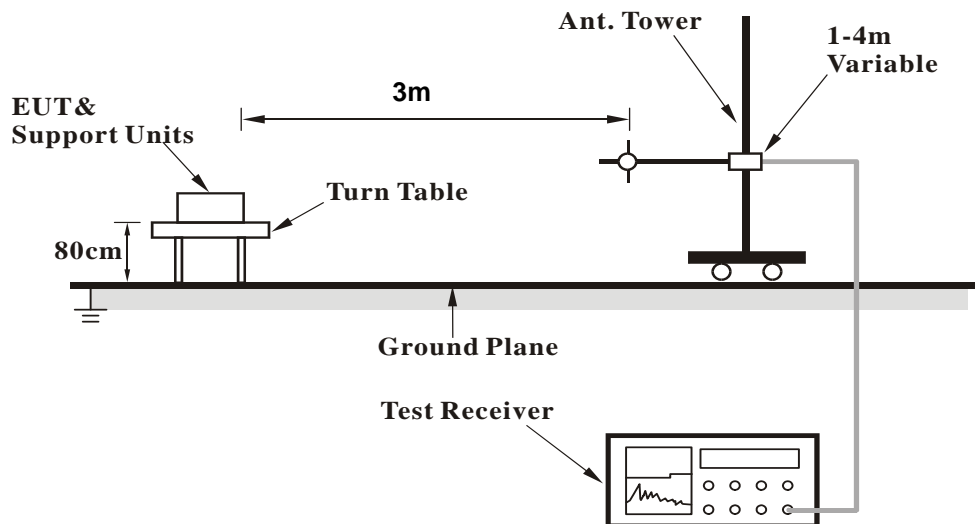
No deviation.

4.1.5 Test Set Up

For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

- a. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

| EUT Test Condition | | Measurement Detail | |
|--------------------------|-------------------|--------------------|--------------------|
| Channel | Channel 1 | Frequency Range | 13.553 ~ 13.567MHz |
| Input Power | 120Vac, 60Hz | Detector Function | Quasi-Peak |
| Environmental Conditions | 23 deg. C, 67% RH | Tested By | Adair Peng |

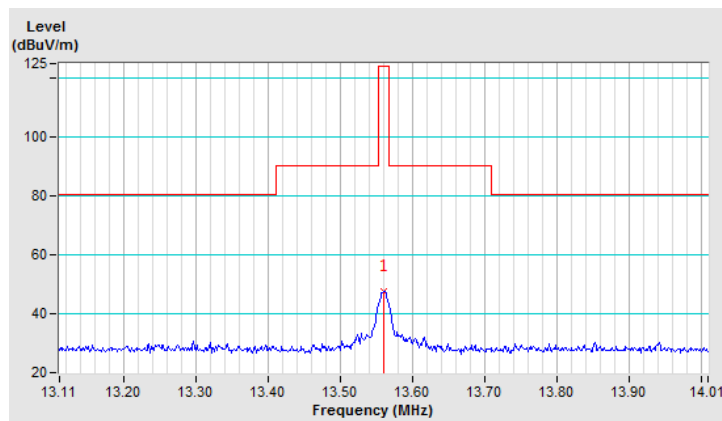
| Antenna Polarity & Test Distance: Loop Antenna Open At 3m | | | | | | | | |
|---|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | *13.56 | 47.5 QP | 124.0 QP | -76.5 | 1.00 | 277 | 25.7 | 21.8 |

- Remarks:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
 2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level – Limit value.
 5. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56\text{MHz} &= 15848\text{uV/m} && 30\text{m} \\
 &= 84\text{dBuV/m} && 30\text{m} \\
 &= 84+20\log(30/3)^2 && 3\text{m} \\
 &= 124\text{dBuV/m}
 \end{aligned}$$



| | | | |
|--------------------------|-------------------|--------------------|--------------------|
| EUT Test Condition | | Measurement Detail | |
| Channel | Channel 1 | Frequency Range | 13.553 ~ 13.567MHz |
| Input Power | 120Vac, 60Hz | Detector Function | Quasi-Peak |
| Environmental Conditions | 23 deg. C, 67% RH | Tested By | Adair Peng |

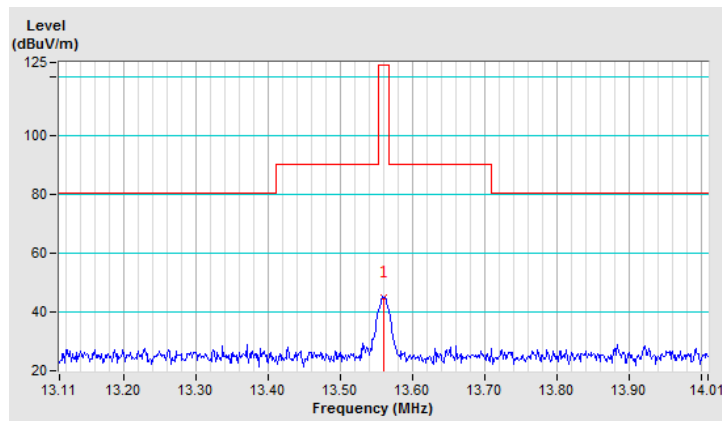
| Antenna Polarity & Test Distance: Loop Antenna Close At 3m | | | | | | | | |
|--|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | *13.56 | 45.1 QP | 124.0 QP | -78.9 | 1.00 | 263 | 23.3 | 21.8 |

- Remarks:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
 2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level – Limit value.
 5. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56\text{MHz} &= 15848\mu\text{V/m} && 30\text{m} \\
 &= 84\text{dBuV/m} && 30\text{m} \\
 &= 84+20\log(30/3)^2 && 3\text{m} \\
 &= 124\text{dBuV/m}
 \end{aligned}$$



| | | | |
|--------------------------|-------------------|--------------------|--------------------|
| EUT Test Condition | | Measurement Detail | |
| Channel | Channel 1 | Frequency Range | 13.553 ~ 13.567MHz |
| Input Power | 120Vac, 60Hz | Detector Function | Quasi-Peak |
| Environmental Conditions | 23 deg. C, 67% RH | Tested By | Adair Peng |

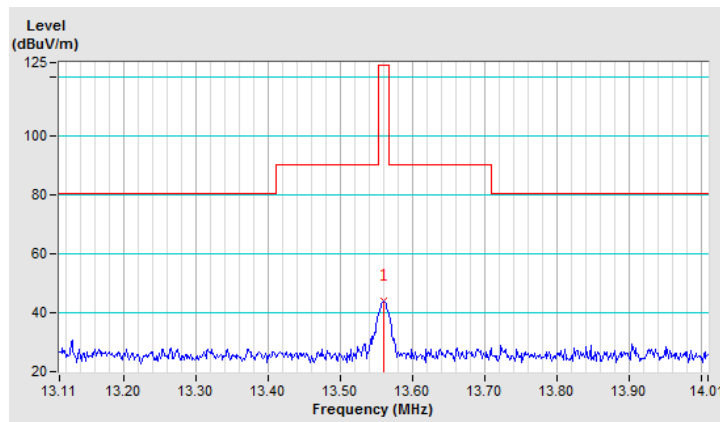
| Antenna Polarity & Test Distance: Loop Antenna Ground Parallel At 3m | | | | | | | | |
|--|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | *13.56 | 44.0 QP | 124.0 QP | -80.0 | 1.00 | 177 | 22.2 | 21.8 |

- Remarks:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
 2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level – Limit value.
 5. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}
 13.56\text{MHz} &= 15848\text{uV/m} && 30\text{m} \\
 &= 84\text{dBuV/m} && 30\text{m} \\
 &= 84+20\log(30/3)^2 && 3\text{m} \\
 &= 124\text{dBuV/m}
 \end{aligned}$$

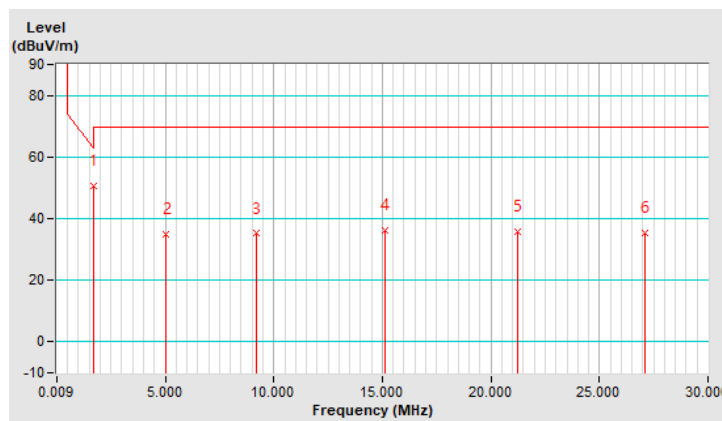


| | | | |
|--------------------------|-------------------|--------------------|-------------|
| EUT Test Condition | | Measurement Detail | |
| Channel | Channel 1 | Frequency Range | Below 30MHz |
| Input Power | 120Vac, 60Hz | Detector Function | Quasi-Peak |
| Environmental Conditions | 23 deg. C, 67% RH | Tested By | Adair Peng |

| Antenna Polarity & Test Distance: Loop Antenna Open At 3m | | | | | | | | |
|---|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 1.69 | 50.4 QP | 63.0 QP | -12.6 | 1.00 | 207 | 30.5 | 19.9 |
| 2 | 5.06 | 35.1 QP | 69.5 QP | -34.4 | 1.00 | 88 | 14.5 | 20.6 |
| 3 | 9.19 | 35.1 QP | 69.5 QP | -34.4 | 1.00 | 237 | 13.5 | 21.6 |
| 4 | 15.15 | 36.3 QP | 69.5 QP | -33.2 | 1.00 | 339 | 14.5 | 21.8 |
| 5 | 21.25 | 35.7 QP | 69.5 QP | -33.8 | 1.00 | 186 | 13.8 | 21.9 |
| 6 | 27.12 | 35.3 QP | 69.5 QP | -34.2 | 1.00 | 116 | 13.2 | 22.1 |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

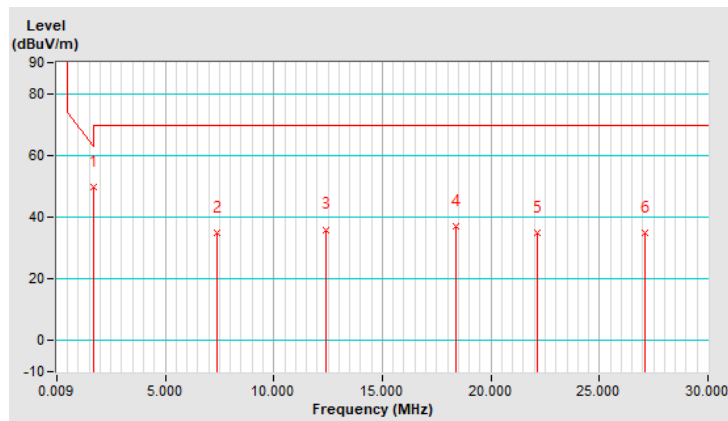


| EUT Test Condition | | Measurement Detail | |
|--------------------------|-------------------|--------------------|-------------|
| Channel | Channel 1 | Frequency Range | Below 30MHz |
| Input Power | 120Vac, 60Hz | Detector Function | Quasi-Peak |
| Environmental Conditions | 23 deg. C, 67% RH | Tested By | Adair Peng |

| Antenna Polarity & Test Distance: Loop Antenna Close At 3m | | | | | | | | |
|--|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 1.69 | 49.9 QP | 63.0 QP | -13.1 | 1.00 | 106 | 30.0 | 19.9 |
| 2 | 7.41 | 35.0 QP | 69.5 QP | -34.5 | 1.00 | 332 | 13.9 | 21.1 |
| 3 | 12.41 | 36.0 QP | 69.5 QP | -33.5 | 1.00 | 236 | 14.2 | 21.8 |
| 4 | 18.42 | 36.9 QP | 69.5 QP | -32.6 | 1.00 | 34 | 15.1 | 21.8 |
| 5 | 22.12 | 34.9 QP | 69.5 QP | -34.6 | 1.00 | 195 | 13.0 | 21.9 |
| 6 | 27.12 | 35.1 QP | 69.5 QP | -34.4 | 1.00 | 51 | 13.0 | 22.1 |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

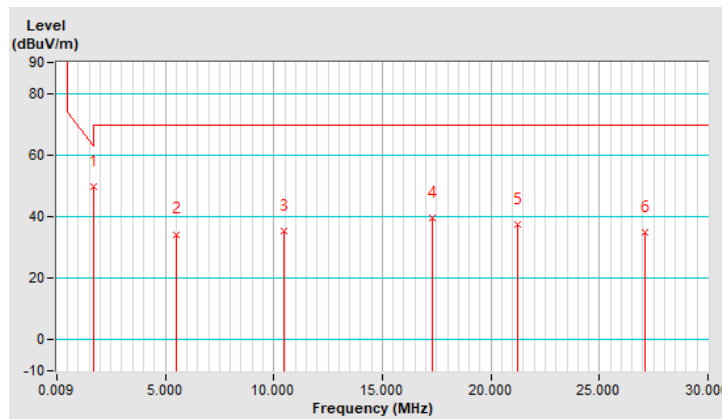


| EUT Test Condition | | Measurement Detail | |
|--------------------------|-------------------|--------------------|-------------|
| Channel | Channel 1 | Frequency Range | Below 30MHz |
| Input Power | 120Vac, 60Hz | Detector Function | Quasi-Peak |
| Environmental Conditions | 23 deg. C, 67% RH | Tested By | Adair Peng |

| Antenna Polarity & Test Distance: Loop Antenna Ground Paralle At 3m | | | | | | | | |
|---|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 1.69 | 49.9 QP | 63.0 QP | -13.1 | 1.00 | 106 | 30.0 | 19.9 |
| 2 | 5.54 | 34.3 QP | 69.5 QP | -35.2 | 1.00 | 124 | 13.6 | 20.7 |
| 3 | 10.49 | 35.2 QP | 69.5 QP | -34.3 | 1.00 | 118 | 13.4 | 21.8 |
| 4 | 17.31 | 39.4 QP | 69.5 QP | -30.1 | 1.00 | 300 | 17.6 | 21.8 |
| 5 | 21.25 | 37.4 QP | 69.5 QP | -32.1 | 1.00 | 103 | 15.5 | 21.9 |
| 6 | 27.12 | 35.1 QP | 69.5 QP | -34.4 | 1.00 | 51 | 13.0 | 22.1 |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

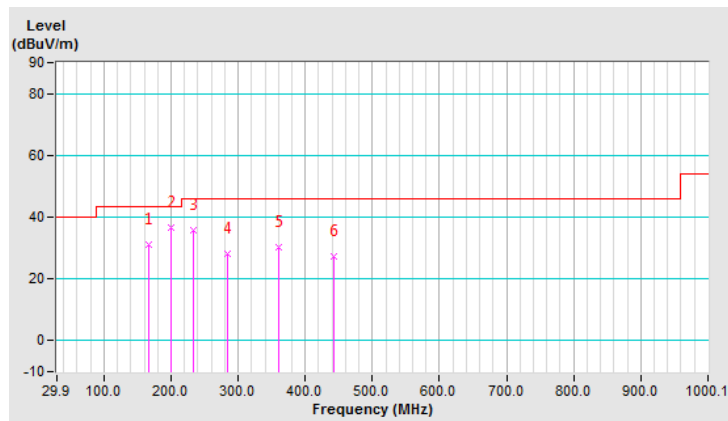


| EUT Test Condition | | Measurement Detail | |
|--------------------------|-------------------|--------------------|---------------|
| Channel | Channel 1 | Frequency Range | Below 1000MHz |
| Input Power | 120Vac, 60Hz | Detector Function | Quasi-Peak |
| Environmental Conditions | 23 deg. C, 67% RH | Tested By | Adair Peng |

| Antenna Polarity & Test Distance: Horizontal At 3m | | | | | | | | |
|--|---------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 166.00 | 31.1 QP | 43.5 | -12.4 | 1.51 H | 92 | 40.2 | -9.1 |
| 2 | 201.00 | 36.7 QP | 43.5 | -6.8 | 1.00 H | 239 | 47.8 | -11.1 |
| 3 | 234.05 | 35.7 QP | 46.0 | -10.3 | 1.51 H | 286 | 45.8 | -10.1 |
| 4 | 284.60 | 28.2 QP | 46.0 | -17.8 | 1.00 H | 254 | 35.9 | -7.7 |
| 5 | 360.43 | 30.3 QP | 46.0 | -15.7 | 1.00 H | 184 | 36.7 | -6.4 |
| 6 | 442.09 | 27.4 QP | 46.0 | -18.6 | 1.99 H | 118 | 31.8 | -4.4 |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

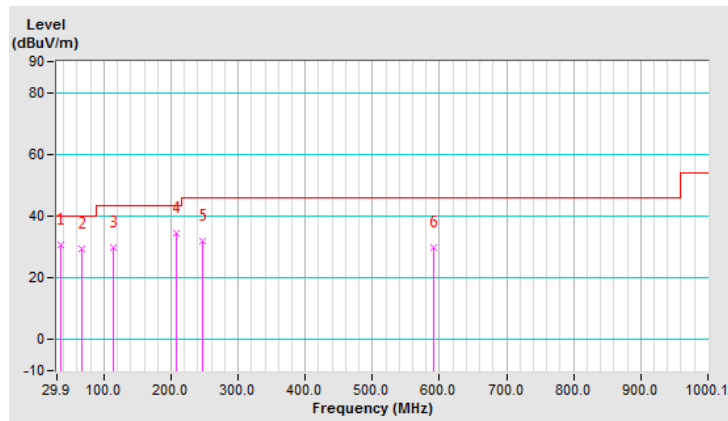


| EUT Test Condition | | Measurement Detail | |
|--------------------------|-------------------|--------------------|---------------|
| Channel | Channel 1 | Frequency Range | Below 1000MHz |
| Input Power | 120Vac, 60Hz | Detector Function | Quasi-Peak |
| Environmental Conditions | 23 deg. C, 67% RH | Tested By | Adair Peng |

| Antenna Polarity & Test Distance: Vertical At 3m | | | | | | | | |
|--|-------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No. | Freq. (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1 | 35.73 | 30.7 QP | 40.0 | -9.3 | 1.00 V | 9 | 41.8 | -11.1 |
| 2 | 66.84 | 29.6 QP | 40.0 | -10.4 | 1.00 V | 5 | 40.7 | -11.1 |
| 3 | 113.50 | 29.8 QP | 43.5 | -13.7 | 1.00 V | 210 | 41.9 | -12.1 |
| 4 | 208.77 | 34.5 QP | 43.5 | -9.0 | 1.50 V | 359 | 45.5 | -11.0 |
| 5 | 247.66 | 32.0 QP | 46.0 | -14.0 | 1.99 V | 7 | 41.2 | -9.2 |
| 6 | 591.80 | 29.8 QP | 46.0 | -16.2 | 1.00 V | 288 | 31.2 | -1.4 |

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

| Frequency (MHz) | Conducted Limit (dBuV) | |
|-----------------|------------------------|---------|
| | Quasi-peak | Average |
| 0.15 - 0.5 | 66 - 56 | 56 - 46 |
| 0.50 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Due |
|---|--------------------------|----------------|---------------|---------------|
| Test Receiver ROHDE & SCHWARZ | ESCS 30 | 100288 | Jan. 03, 2019 | Jan. 02, 2020 |
| RF signal cable Woken | 5D-FB | Cable-cond1-01 | Sep. 05, 2018 | Sep. 04, 2019 |
| LISN ROHDE & SCHWARZ (EUT) | ENV216 | 101826 | Feb. 21, 2019 | Feb. 20, 2020 |
| LISN ROHDE & SCHWARZ (Peripheral) | ESH3-Z5 | 100311 | Aug. 19, 2018 | Aug. 18, 2019 |
| Software ADT | BV ADT_Cond_ V7.3.7.4 | NA | NA | NA |

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-12040.

4.2.3 Test Procedures

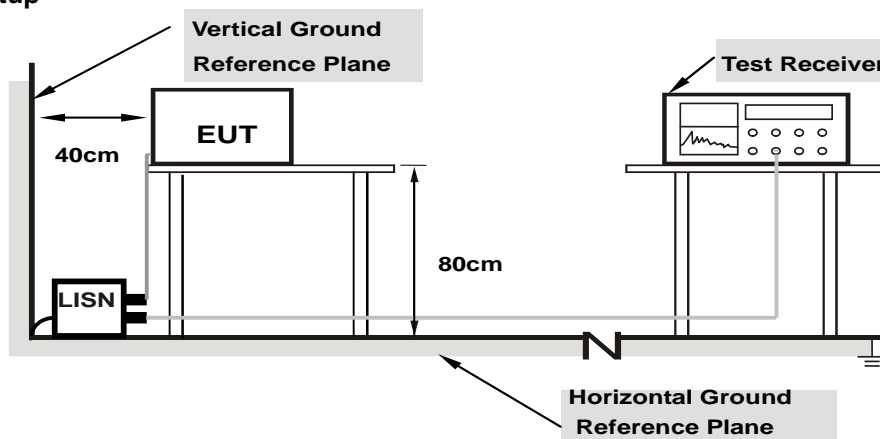
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

Same as 4.1.6.

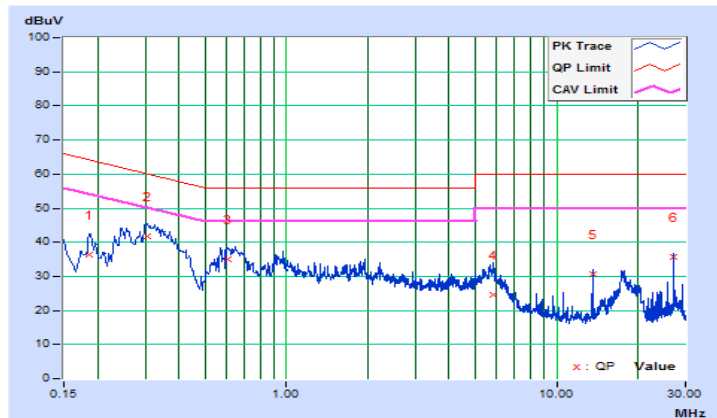
4.2.7 Test Results

| Phase | Line (L) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|----------|-------------------|--------------------------------|
|-------|----------|-------------------|--------------------------------|

| No | Freq. [MHz] | Corr. Factor (dB) | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|----|----------------|-------------------------|----------------------------|---------|-----------------------------|-------|--------------------|-------|----------------|--------|
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| | | | 1 | 0.18557 | 9.68 | 26.69 | 13.21 | 36.37 | 22.89 | 64.23 |
| 2 | 0.30640 | 9.68 | 32.23 | 23.45 | 41.91 | 33.13 | 60.07 | 50.07 | -18.16 | -16.94 |
| 3 | 0.60418 | 9.68 | 25.32 | 8.71 | 35.00 | 18.39 | 56.00 | 46.00 | -21.00 | -27.61 |
| 4 | 5.83123 | 9.79 | 14.86 | 6.96 | 24.65 | 16.75 | 60.00 | 50.00 | -35.35 | -33.25 |
| 5 | 13.56130 | 9.89 | 20.72 | 20.45 | 30.61 | 30.34 | 60.00 | 50.00 | -29.39 | -19.66 |
| 6 | 27.12118 | 9.94 | 25.62 | 25.33 | 35.56 | 35.27 | 60.00 | 50.00 | -24.44 | -14.73 |

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

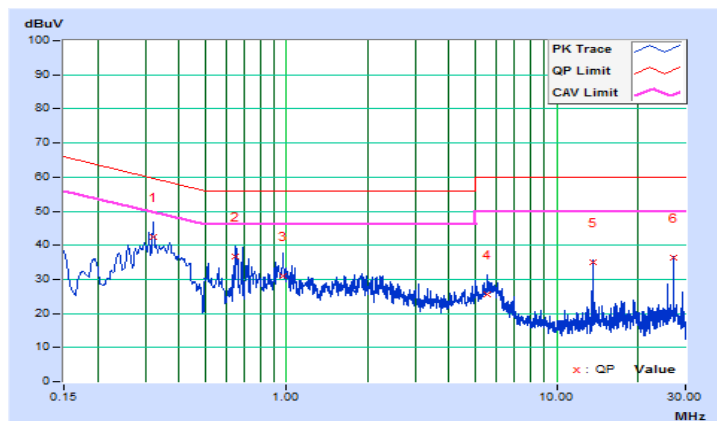


| | | | |
|-------|-------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|-------|-------------|-------------------|--------------------------------|

| No | Freq. [MHz] | Corr. Factor (dB) | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|----------|-----------------|----------------------|----------------------------|--------------|-----------------------------|--------------|--------------------|--------------|----------------|---------------|
| | | | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| | | | 1 | 0.32187 | 9.65 | 32.93 | 22.19 | 42.58 | 31.84 | 59.66 |
| 2 | 0.64702 | 9.65 | 27.13 | 10.74 | 36.78 | 20.39 | 56.00 | 46.00 | -19.22 | -25.61 |
| 3 | 0.96719 | 9.64 | 21.37 | 12.71 | 31.01 | 22.35 | 56.00 | 46.00 | -24.99 | -23.65 |
| 4 | 5.52625 | 9.75 | 15.69 | 7.55 | 25.44 | 17.30 | 60.00 | 50.00 | -34.56 | -32.70 |
| 5 | 13.56130 | 9.91 | 25.06 | 24.67 | 34.97 | 34.58 | 60.00 | 50.00 | -25.03 | -15.42 |
| 6 | 27.12118 | 10.03 | 26.41 | 26.03 | 36.44 | 36.06 | 60.00 | 50.00 | -23.56 | -13.94 |

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

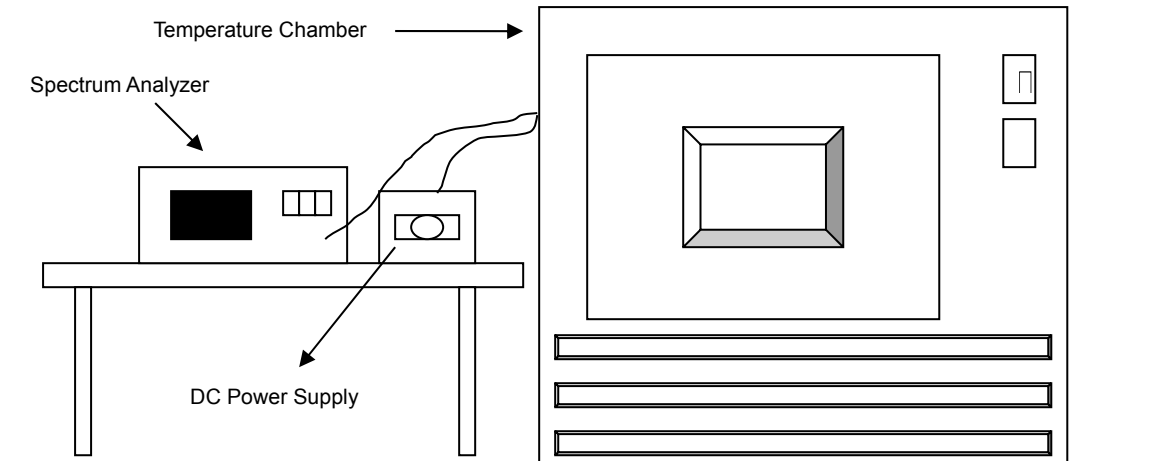


4.3 Frequency Stability

4.3.1 Limits of Frequency Stability Measurement

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.

4.3.2 Test Setup



4.3.3 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Due |
|---|-----------|------------|---------------|---------------|
| Spectrum Analyzer ROHDE & SCHWARZ | FSP40 | 100039 | Jun. 11, 2018 | Jun. 10, 2019 |
| WIT Standard Temperature And Humidity Chamber | TH-4S-C | W981030 | Jun. 04, 2018 | Jun. 03, 2019 |
| Digital Multimeter Fluke | 87-III | 70360742 | Jun. 29, 2018 | Jun. 28, 2019 |
| DC Power Supply Topward | 6306A | 727263 | NA | NA |

4.3.4 Test Procedure

- The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
- Turned the EUT on and coupled its output to a spectrum analyzer.
- Turned the EUT off and set the chamber to the highest temperature specified.
- Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency after 2, 5, and 10 minutes.
- Repeated step d with the temperature chamber sets to each desired temperature.
- The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

Same as Item 4.1.6.

4.3.7 Test Result

| Frequency Stability Versus Temp. | | | | | | | | | |
|----------------------------------|-----------------------|--------------------|-----------------|--------------------|-----------------|--------------------|-----------------|--------------------|-----------------|
| TEMP. (°C) | Power Supply (Vdc) | 0 Minute | | 2 Minute | | 5 Minute | | 10 Minute | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 50 | 20 | 13.55997 | -0.00022 | 13.55997 | -0.00022 | 13.55998 | -0.00015 | 13.55997 | -0.00022 |
| 40 | 20 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56002 | 0.00015 | 13.56003 | 0.00022 |
| 30 | 20 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56007 | 0.00052 | 13.56007 | 0.00052 |
| 20 | 20 | 13.55996 | -0.00029 | 13.55996 | -0.00029 | 13.55996 | -0.00029 | 13.55996 | -0.00029 |
| 10 | 20 | 13.56001 | 0.00007 | 13.56001 | 0.00007 | 13.56002 | 0.00015 | 13.56001 | 0.00007 |
| 0 | 20 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 |
| -10 | 20 | 13.55993 | -0.00052 | 13.55993 | -0.00052 | 13.55994 | -0.00044 | 13.55994 | -0.00044 |
| -20 | 20 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 | 13.56003 | 0.00022 |

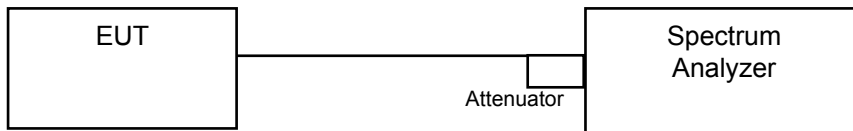
| Frequency Stability Versus Voltage | | | | | | | | | |
|------------------------------------|-----------------------|--------------------|-----------------|--------------------|-----------------|--------------------|-----------------|--------------------|-----------------|
| TEMP. (°C) | Power Supply (Vdc) | 0 Minute | | 2 Minute | | 5 Minute | | 10 Minute | |
| | | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift | Measured Frequency | Frequency Drift |
| | | (MHz) | % | (MHz) | % | (MHz) | % | (MHz) | % |
| 20 | 23 | 13.55996 | -0.00029 | 13.55996 | -0.00029 | 13.55996 | -0.00029 | 13.55996 | -0.00029 |
| | 20 | 13.55996 | -0.00029 | 13.55996 | -0.00029 | 13.55996 | -0.00029 | 13.55996 | -0.00029 |
| | 17 | 13.55996 | -0.00029 | 13.55996 | -0.00029 | 13.55996 | -0.00029 | 13.55996 | -0.00029 |

4.4 20dB Bandwidth

4.4.1 Limits of 20dB Bandwidth Measurement

The 20dB bandwidth shall be specified in operating frequency band.

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1kHz RBW and 3kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.4.5 Deviation from Test Standard

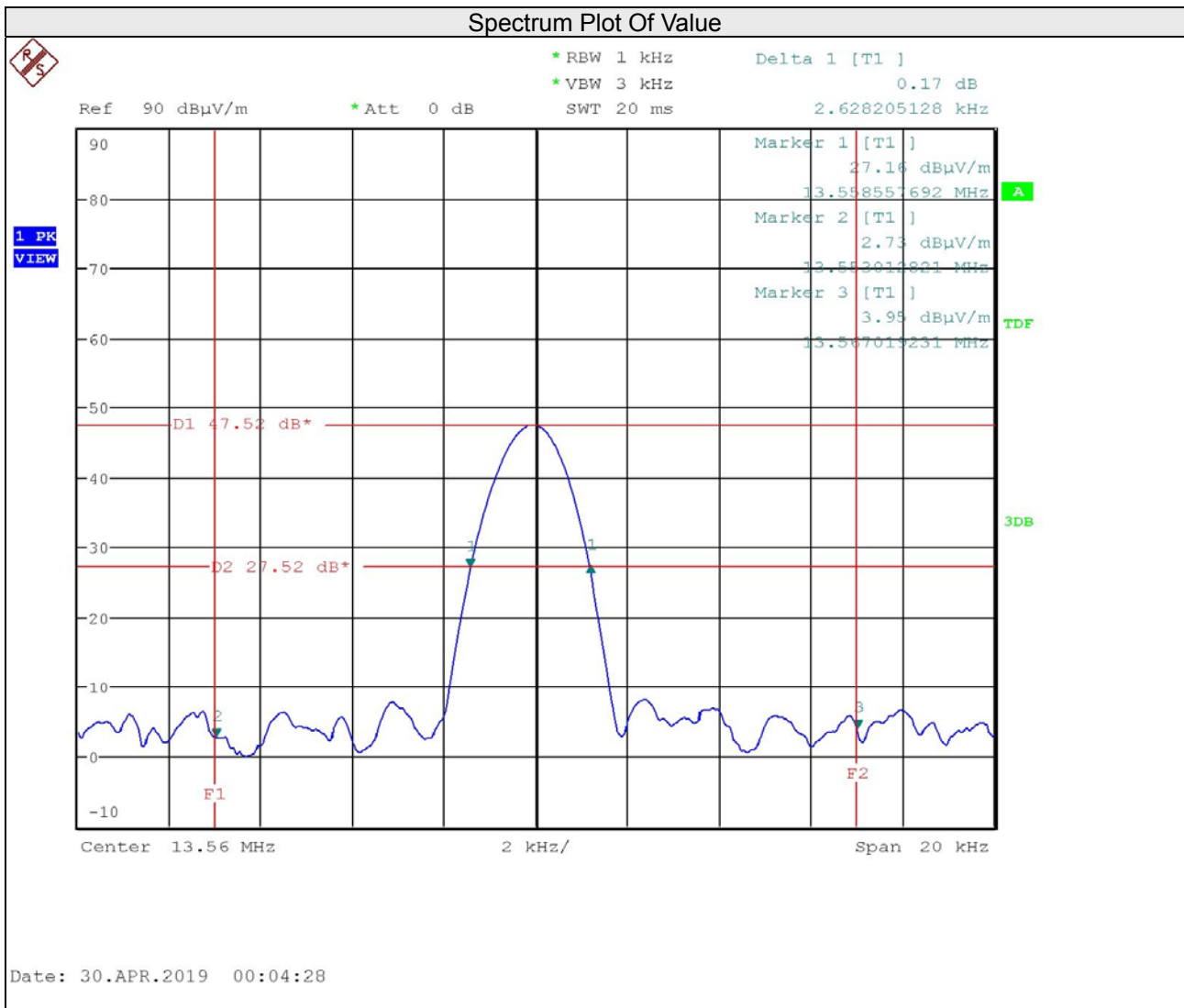
No deviation.

4.4.6 EUT Operating Conditions

Same as Item 4.1.6.

4.4.7 Test Results

| 20dBc point (Low) | 20dBc point (High) | Operating frequency band (MHz) | Pass / Fail |
|-------------------|--------------------|--------------------------------|-------------|
| 13.558557692 | 13.561185897 | 13.553~13.567 | Pass |



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Hsin Chu EMC/RF/Telecom Lab

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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