

FCC Test Report

Report No.: RF180828C01-2

FCC ID: DMOM3IETWR

Test Model: M3IETW R

Received Date: Aug. 24, 2018

Test Date: Aug. 31, 2018

Issued Date: Sep. 10, 2018

Applicant: Sennheiser electronic GmbH & Co. KG

Address: Am Labor 1 D-30900 Wedemark, Germany

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

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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 |
|---------------|------------------|---------------|
| RF180828C01-2 | Original release | Sep. 10, 2018 |

1 Certificate of Conformity

Product: MOMENTUM True Wireless (M3IETW)

Brand: SENNHEISER

Test Model: M3IETW R

Sample Status: Engineering sample

Applicant: Sennheiser electronic GmbH & Co. KG

Test Date: Aug. 31, 2018

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.209)
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 : Celine Chou , **Date:** Sep. 10, 2018
Celine Chou / Senior Specialist

Approved by : Bruce Chen , **Date:** Sep. 10, 2018
Bruce Chen / Project Engineer

2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.209) | | | |
|--|-----------------------------|--------|--|
| FCC Clause | Test Item | Result | Remarks |
| 15.207 | AC Power Conducted Emission | Pass | Meet the requirement of limit. Minimum passing margin is -9.02dB at 0.46058MHz. |
| 15.209 | Radiated Emission Test | Pass | Meet the requirement of limit. Minimum passing margin is -18.3dB at 951.59MHz. |

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) |
|--------------------------------|------------------|--------------------------------------|
| Radiated Emissions up to 1 GHz | 30MHz ~ 200MHz | 3.59 dB |
| | 200MHz ~ 1000MHz | 3.60 dB |

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

| | |
|---------------------|--|
| Product | MOMENTUM True Wireless (M3IETW) |
| Brand | SENNHEISER |
| Test Model | M3IETW R |
| Sample Status | Engineering sample |
| Power Supply Rating | 5Vdc (from USB interface) 3.7Vdc (from battery) |
| Modulation Type | D8PSK |
| Operating Frequency | 10.60MHz |
| Field Strength | 41.59dBuV/m |
| Antenna Type | T-Coil antenna |
| Accessory Device | NA |
| Cable Supplied | 0.2m shielded USB cable without core |

Note:

1. The EUT system (M3IETW) contains the following devices:

| Item | Brand | Model |
|---------------|------------|----------|
| Left Earbud | SENNHEISER | M3IETW L |
| Right Earbud | SENNHEISER | M3IETW R |
| Charging Case | SENNHEISER | M3IETW C |

* M3IETW R with BT & BT LE TX/RX function + NFMI TX function

* M3IETW L with NFMI RX function only

* Charging case is solely used for charging M3IETW R and M3IETW L only

2. The EUT uses following charging case and battery.

| | |
|---------------|-------------|
| Charging Case | |
| Brand | SENNHEISER |
| Model | M3IETW C |
| Input Rating | 5Vdc, 650mA |
| Output Rating | 5Vdc, 220mA |

| | |
|---------------------------|-----------------|
| Battery for Charging Case | |
| Brand | SENNHEISER |
| Model | AHB702535PCT-01 |
| Power Rating | 3.7Vdc, 600mAh |

| | |
|-------------------------|---------------|
| Battery for Left Earbud | |
| Brand | VARTA |
| Model | CP1254 A3 |
| Power Rating | 3.7Vdc, 60mAh |

| | |
|--------------------------|---------------|
| Battery for Right Earbud | |
| Brand | VARTA |
| Model | CP1454 A3 |
| Power Rating | 3.7Vdc, 85mAh |

3.2 Description of Test Modes

1 channel is provided to this EUT

| Channel | Freq. (MHz) |
|---------|-------------|
| 1 | 10.60 |

3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT CONFIGURE MODE | APPLICABLE TO | | DESCRIPTION |
|--------------------|---------------|-----|--|
| | RE | PLC | |
| A | √ | - | EUT (Right Earbud, Model: M3IETW R + Left Earbud) |
| B | - | √ | EUT (Right Earbud, Model: M3IETW R + Left Earbud + Charging case) + Adapter |
| C | - | √ | EUT (Right Earbud, Model: M3IETW R + Left Earbud + Charging case) + Notebook |

Where **RE<1G**: Radiated Emission

PLC: Power Line Conducted Emission

Note:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.
2. No need to concern of Conducted Emission due to the EUT is powered by battery.

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 |
|--------------------|-------------------|----------------|
| A | 1 | 1 |

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 |
|--------------------|-------------------|----------------|
| B, C | 1 | 1 |

Test Condition:

| Applicable To | Environmental Conditions | Input Power | Tested by |
|---------------|--------------------------|--------------|------------|
| RE | 25 deg. C, 69% RH | 3.7Vdc | Noah Chang |
| PLC | 22 deg. C, 66% RH | 120Vac, 60Hz | Adair Peng |

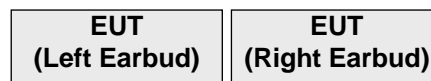
3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

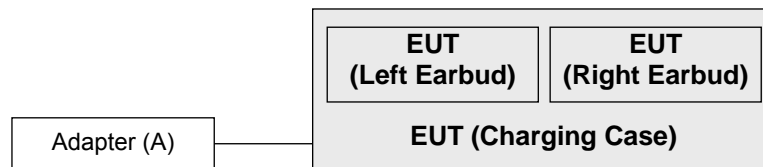
| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|----|----------|-------|------------|------------|------------------|--------------|
| A. | Adapter | HTC | TC-P900-US | NA | NA | Not supplied |
| B. | Notebook | DELL | E5410 | 1HC2XM1 | FCC DoC Approved | - |

3.3.1 Configuration of System under Test

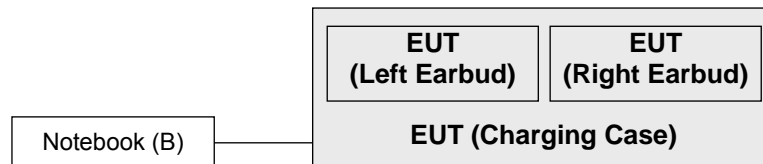
Test Mode A



Test Mode B



Test Mode C



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 (15.209)

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 and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a). Other emissions shall be at least 20dB below the highest level of the desired power.

| 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 |

As shown in 15.35(b), 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 KEYSIGHT | N9038A | MY55420137 | Apr. 11, 2018 | Apr. 10, 2019 |
| Spectrum Analyzer ROHDE & SCHWARZ | FSP40 | 100269 | May 29, 2018 | May 28, 2019 |
| BILOG Antenna SCHWARZBECK | VULB9168 | 9168-148 | Dec. 11, 2017 | Dec. 10, 2018 |
| HORN Antenna SCHWARZBECK | BBHA 9120 D | 9120D-1169 | Dec. 12, 2017 | Dec. 11, 2018 |
| HORN Antenna SCHWARZBECK | BBHA 9170 | BBHA9170241 | Dec. 01, 2017 | Nov. 30, 2018 |
| Loop Antenna TESEQ | HLA 6121 | 45745 | Jun. 14, 2018 | Jun. 13, 2019 |
| Preamplifier Agilent (Below 1GHz) | 8447D | 2944A10638 | Aug. 08, 2018 | Aug. 07, 2019 |
| Preamplifier Agilent (Above 1GHz) | 8449B | 3008A01638 | Feb. 22, 2018 | Feb. 21, 2019 |
| RF signal cable HUBER+SUHNER&EMCI | SUCOFLEX 104 & EMC104-SM-SM800 0 | CABLE-CH9-02 (248780+171006) | Jan. 15, 2018 | Jan. 14, 2019 |
| RF signal cable HUBER+SUHNER | SUCOFLEX 104 | CABLE-CH9-(250795/4) | Aug. 08, 2018 | Aug. 07, 2019 |
| RF signal cable Woken | 8D-FB | Cable-CH9-01 | Jul. 31, 2018 | Jul. 30, 2019 |
| Software BV ADT | ADT_Radiated_ V7.6.15.9.5 | NA | NA | NA |
| Antenna Tower EMCO | 2070/2080 | 512.835.4684 | NA | NA |
| Turn Table EMCO | 2087-2.03 | NA | NA | NA |
| Antenna Tower & Turn BV ADT | AT100 | AT93021705 | NA | NA |
| Turn Table BV ADT | TT100 | TT93021705 | NA | NA |
| Turn Table Controller BV ADT | SC100 | SC93021705 | 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 9.
3. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
4. The IC Site Registration No. is IC 7450F-9.

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.
2. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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:

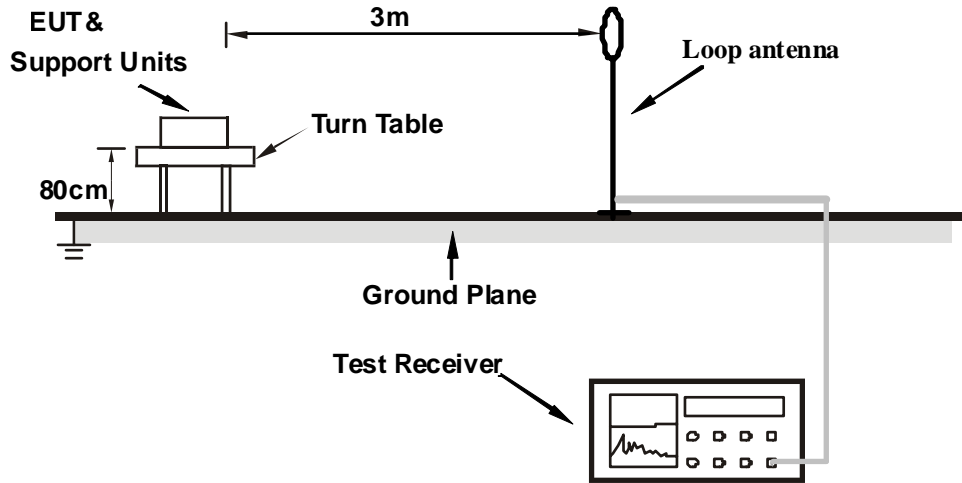
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

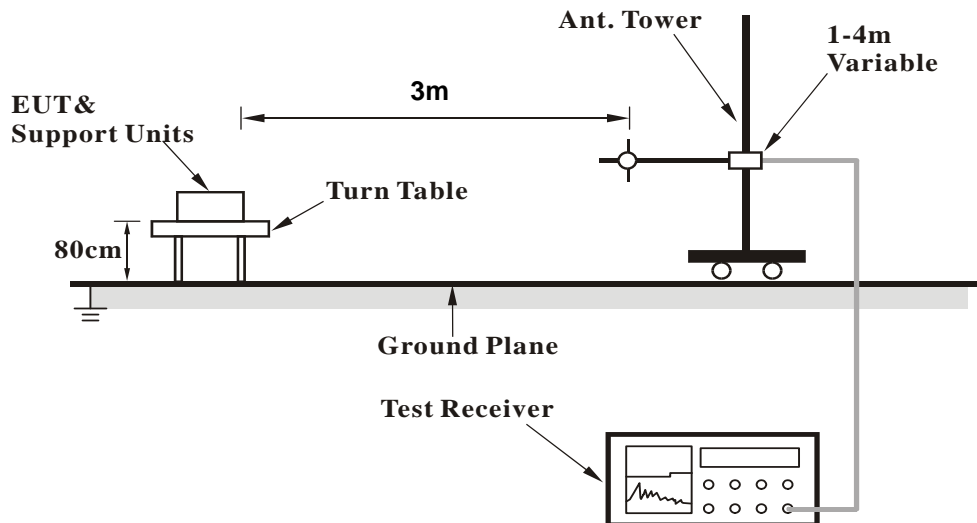
No deviation.

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

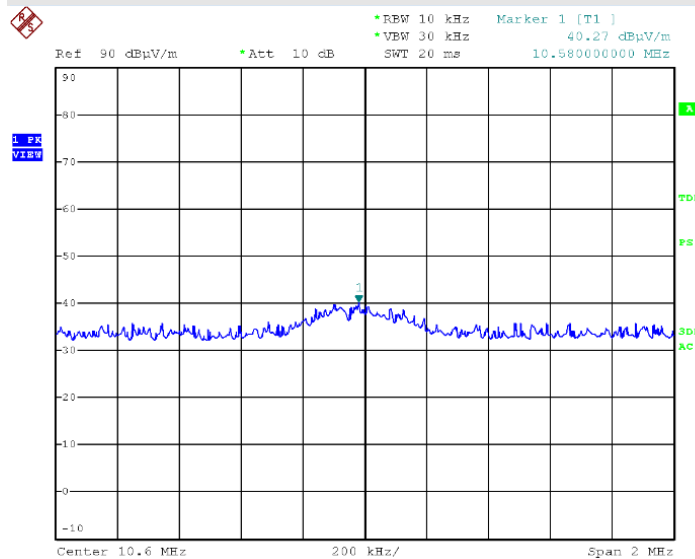
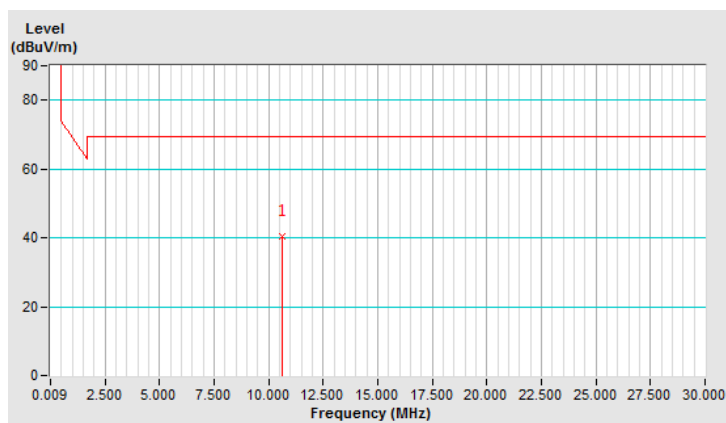
Below 30MHz Data:

| | | | |
|-----------------|----------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 9 kHz ~ 30 MHz | | |

| 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 | *10.60 | 40.27 | 69.54 | -29.27 | 1.00 | 293 | 18.48 | 21.79 |

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
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80
8. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

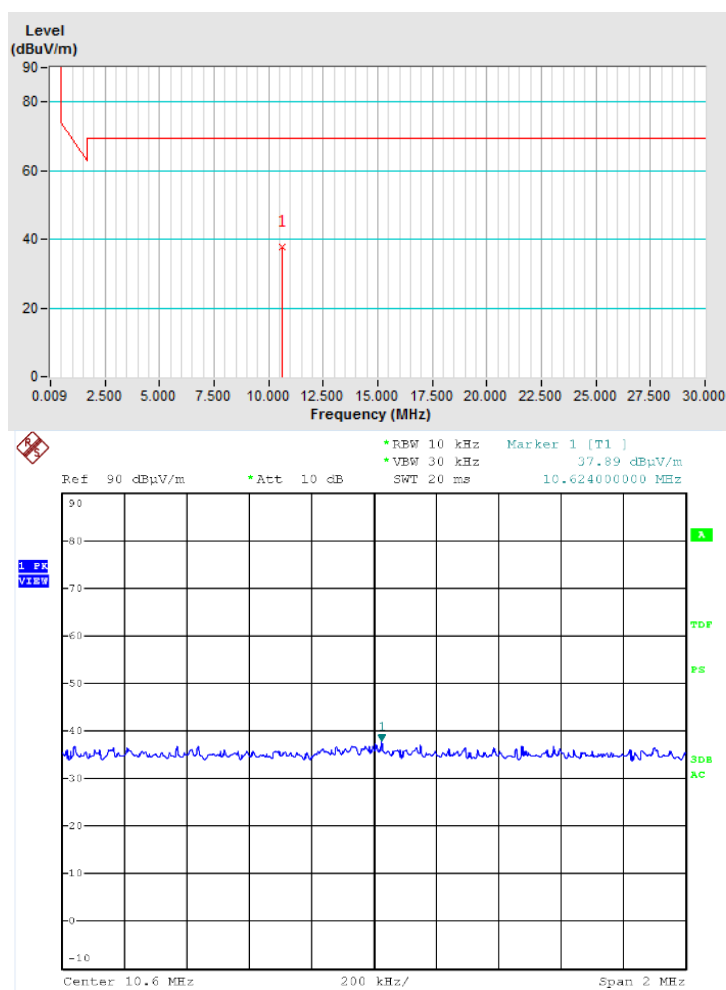


| | | | |
|-----------------|----------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 9 kHz ~ 30 MHz | | |

| 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 | *10.60 | 37.89 | 69.54 | -31.65 | 1.00 | 152 | 16.10 | 21.79 |

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
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80
8. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

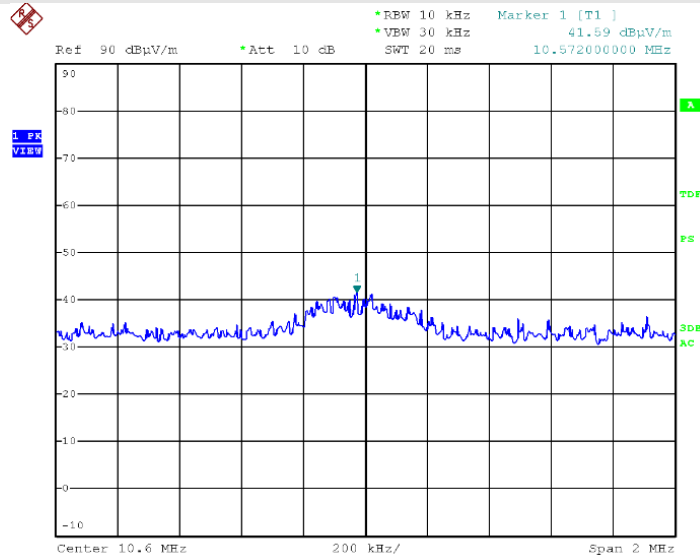
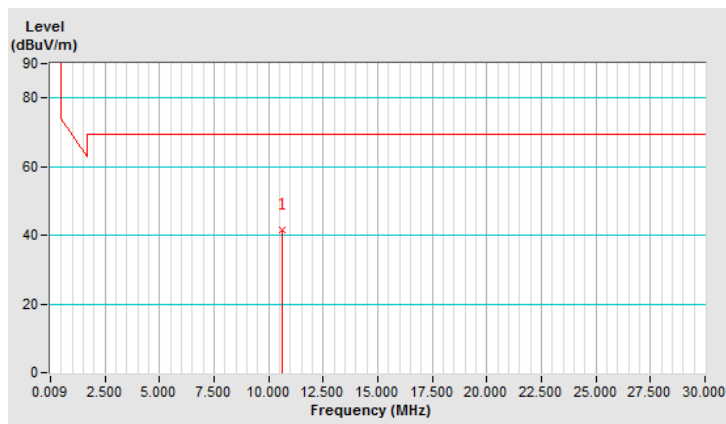


| | | | |
|-----------------|----------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 9 kHz ~ 30 MHz | | |

| 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 | *10.60 | 41.59 | 69.54 | -27.95 | 1.00 | 200 | 19.80 | 21.79 |

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
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80
8. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

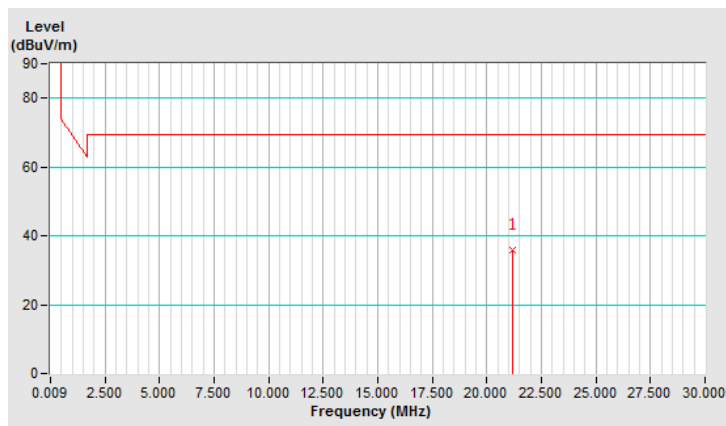


| | | | |
|-----------------|----------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 9 kHz ~ 30 MHz | | |

| 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 | 21.20 | 35.87 | 69.54 | -33.67 | 1.00 | 189 | 13.98 | 21.89 |

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
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80
8. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

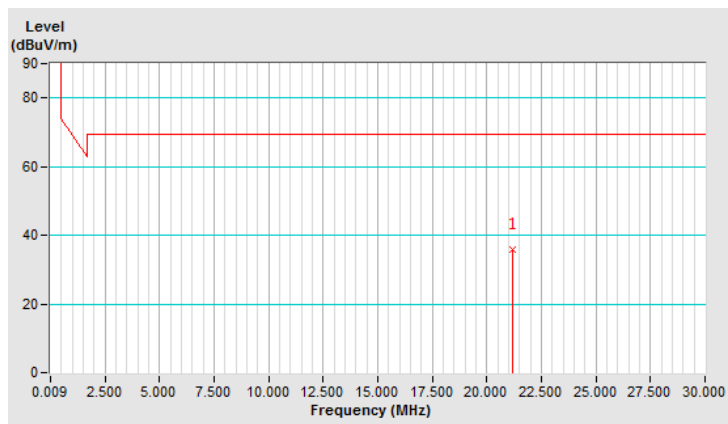


| | | | |
|-----------------|----------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 9 kHz ~ 30 MHz | | |

| 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 | 21.20 | 35.81 | 69.54 | -33.73 | 1.00 | 351 | 13.92 | 21.89 |

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
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80
8. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

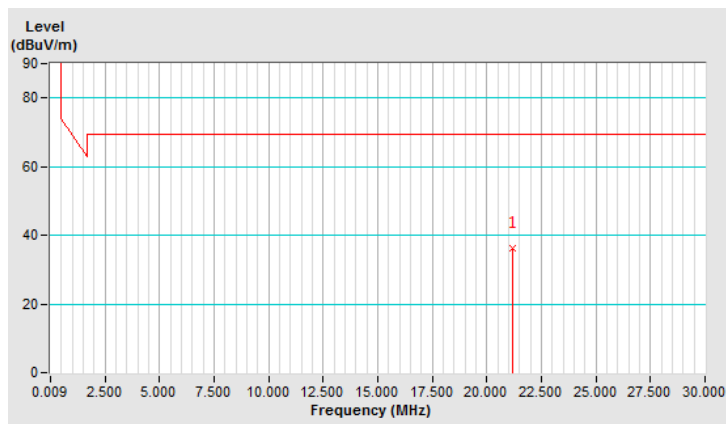


| | | | |
|-----------------|----------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 9 kHz ~ 30 MHz | | |

| 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 | 21.20 | 36.21 | 69.54 | -33.33 | 1.00 | 25 | 14.32 | 21.89 |

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
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80
8. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

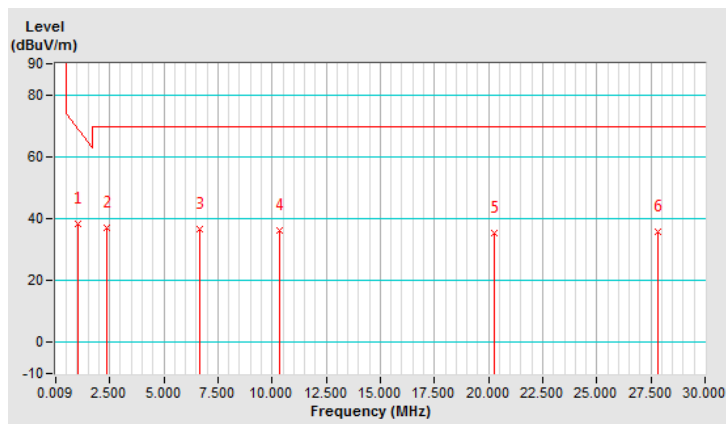


| | | | |
|-----------------|----------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 9 kHz ~ 30 MHz | | |

| 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 | 1.03 | 38.50 | 67.36 | -28.86 | 1.00 | 62 | 18.46 | 20.04 |
| 2 | 2.35 | 37.12 | 69.54 | -32.42 | 1.00 | 62 | 17.43 | 19.69 |
| 3 | 6.67 | 36.81 | 69.54 | -32.73 | 1.00 | 185 | 15.85 | 20.96 |
| 4 | 10.33 | 36.18 | 69.54 | -33.36 | 1.00 | 139 | 14.39 | 21.79 |
| 5 | 20.28 | 35.44 | 69.54 | -34.10 | 1.00 | 102 | 13.58 | 21.86 |
| 6 | 27.84 | 35.81 | 69.54 | -33.73 | 1.00 | 37 | 13.69 | 22.12 |

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
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80
8. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

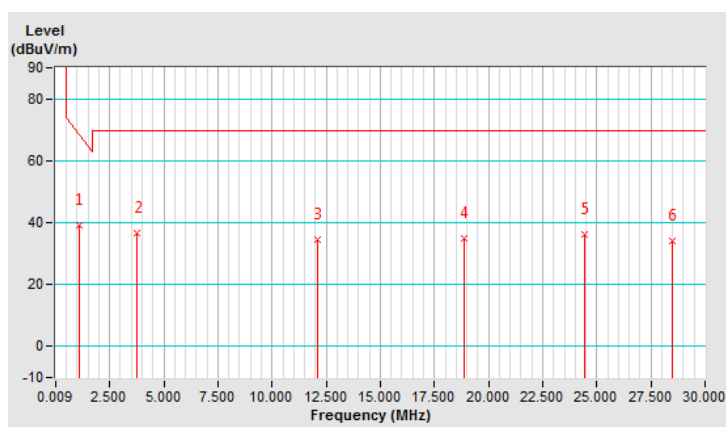


| | | | |
|-----------------|----------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 9 kHz ~ 30 MHz | | |

| 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 | 1.09 | 39.18 | 66.87 | -27.69 | 1.00 | 302 | 19.15 | 20.03 |
| 2 | 3.79 | 36.44 | 69.54 | -33.10 | 1.00 | 289 | 16.52 | 19.92 |
| 3 | 12.13 | 34.45 | 69.54 | -35.09 | 1.00 | 63 | 12.65 | 21.80 |
| 4 | 18.90 | 34.83 | 69.54 | -34.71 | 1.00 | 90 | 12.99 | 21.84 |
| 5 | 24.42 | 36.12 | 69.54 | -33.42 | 1.00 | 91 | 14.12 | 22.00 |
| 6 | 28.50 | 34.08 | 69.54 | -35.46 | 1.00 | 165 | 11.93 | 22.15 |

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
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80
8. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40

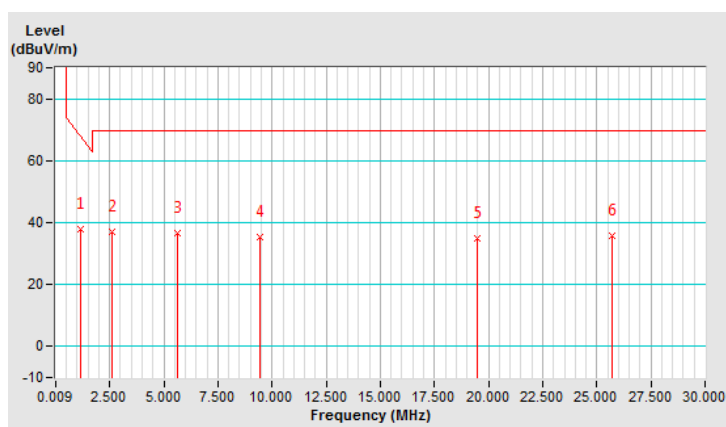


| | | | |
|-----------------|----------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 9 kHz ~ 30 MHz | | |

| 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 | 1.15 | 37.94 | 66.40 | -28.46 | 1.00 | 258 | 17.93 | 20.01 |
| 2 | 2.59 | 37.09 | 69.54 | -32.45 | 1.00 | 213 | 17.47 | 19.62 |
| 3 | 5.65 | 36.79 | 69.54 | -32.75 | 1.00 | 234 | 16.09 | 20.70 |
| 4 | 9.43 | 35.25 | 69.54 | -34.29 | 1.00 | 236 | 13.60 | 21.65 |
| 5 | 19.50 | 34.79 | 69.54 | -34.75 | 1.00 | 19 | 12.94 | 21.85 |
| 6 | 25.68 | 35.95 | 69.54 | -33.59 | 1.00 | 247 | 13.90 | 22.05 |

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
5. “ * “: Fundamental frequency.
6. Loop antenna was used for all radiated emission below 30MHz.
7. Limit @3m=Limit@300m+40log(300 / 3)=Limit@300m+80
8. Limit @3m=Limit@30m+40log(30 / 3)=Limit@30m+40



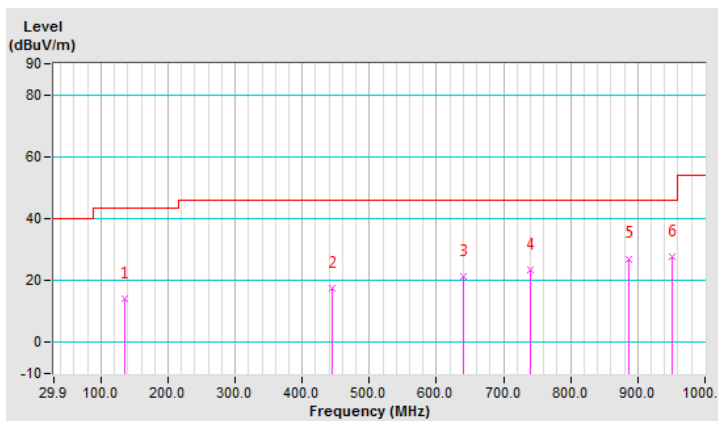
Below 1GHz Data:

| | | | |
|-----------------|---------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 30 MHz ~ 1GHz | | |

| 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 | 134.68 | 14.0 QP | 43.5 | -29.5 | 1.50 H | 66 | 23.7 | -9.7 |
| 2 | 445.15 | 17.7 QP | 46.0 | -28.3 | 1.00 H | 304 | 23.3 | -5.6 |
| 3 | 641.13 | 21.5 QP | 46.0 | -24.5 | 1.00 H | 58 | 23.0 | -1.5 |
| 4 | 740.09 | 23.6 QP | 46.0 | -22.4 | 1.00 H | 48 | 22.7 | 0.9 |
| 5 | 887.56 | 27.1 QP | 46.0 | -18.9 | 2.00 H | 10 | 23.8 | 3.3 |
| 6 | 951.59 | 27.7 QP | 46.0 | -18.3 | 1.00 H | 103 | 23.2 | 4.5 |

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

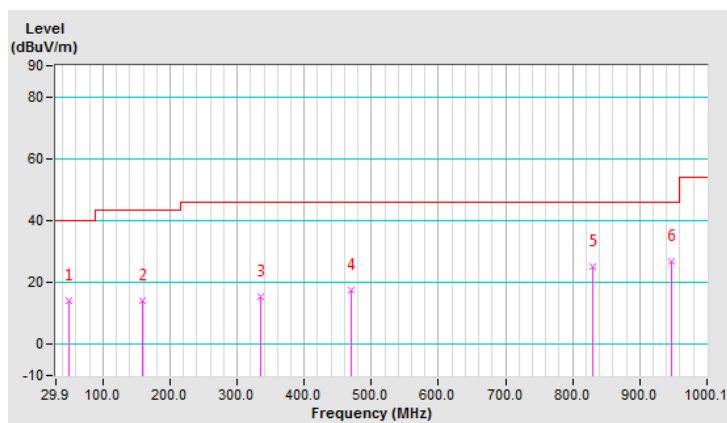


| | | | |
|-----------------|---------------|-------------------|------------|
| Channel | TX Channel 1 | Detector Function | Quasi-Peak |
| Frequency Range | 30 MHz ~ 1GHz | | |

| 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 | 49.30 | 14.2 QP | 40.0 | -25.8 | 1.50 V | 304 | 22.8 | -8.6 |
| 2 | 159.91 | 14.0 QP | 43.5 | -29.5 | 1.00 V | 272 | 22.6 | -8.6 |
| 3 | 334.54 | 15.6 QP | 46.0 | -30.4 | 1.00 V | 208 | 22.9 | -7.3 |
| 4 | 470.37 | 17.7 QP | 46.0 | -28.3 | 1.00 V | 97 | 22.9 | -5.2 |
| 5 | 829.34 | 25.0 QP | 46.0 | -21.0 | 1.50 V | 35 | 22.5 | 2.5 |
| 6 | 947.71 | 26.9 QP | 46.0 | -19.1 | 1.00 V | 106 | 22.4 | 4.5 |

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 | ESCI | 100613 | Nov. 23, 2017 | Nov. 22, 2018 |
| RF signal cable Woken | 5D-FB | Cable-cond1-01 | Sep. 05, 2018 | Sep. 04, 2019 |
| LISN ROHDE & SCHWARZ (EUT) | ENV216 | 101826 | Feb. 26, 2018 | Feb. 25, 2019 |
| 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-2040.

4.2.3 Test Procedures

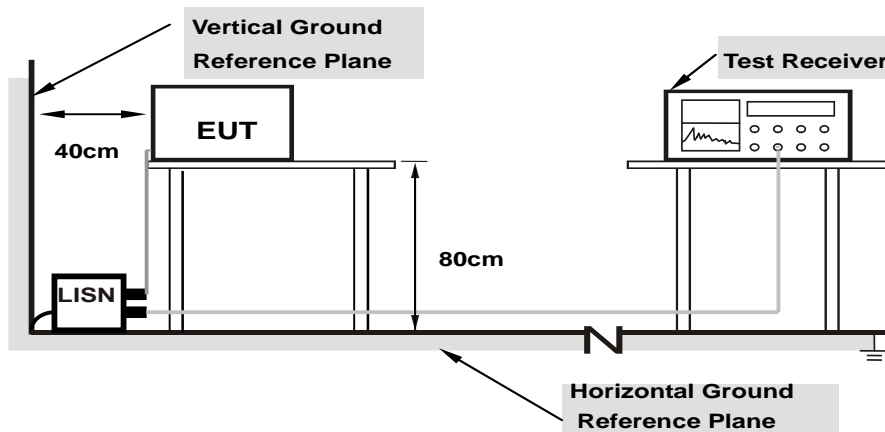
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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.

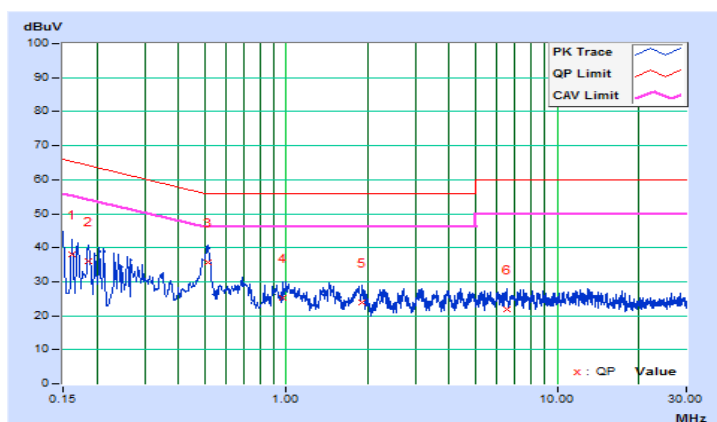
4.2.7 Test Results

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

| 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 | 0.16173 | 19.68 | 18.37 | 3.38 | 38.05 | 23.06 | 65.37 |
| 2 | 0.18519 | 19.67 | 16.33 | 2.27 | 36.00 | 21.94 | 64.25 | 54.25 | -28.25 | -32.31 |
| 3 | 0.51719 | 19.69 | 16.13 | 10.72 | 35.82 | 30.41 | 56.00 | 46.00 | -20.18 | -15.59 |
| 4 | 0.97501 | 19.64 | 5.55 | 2.54 | 25.19 | 22.18 | 56.00 | 46.00 | -30.81 | -23.82 |
| 5 | 1.91341 | 19.69 | 4.36 | 2.11 | 24.05 | 21.80 | 56.00 | 46.00 | -31.95 | -24.20 |
| 6 | 6.55067 | 19.79 | 2.13 | 1.23 | 21.92 | 21.02 | 60.00 | 50.00 | -38.08 | -28.98 |

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.

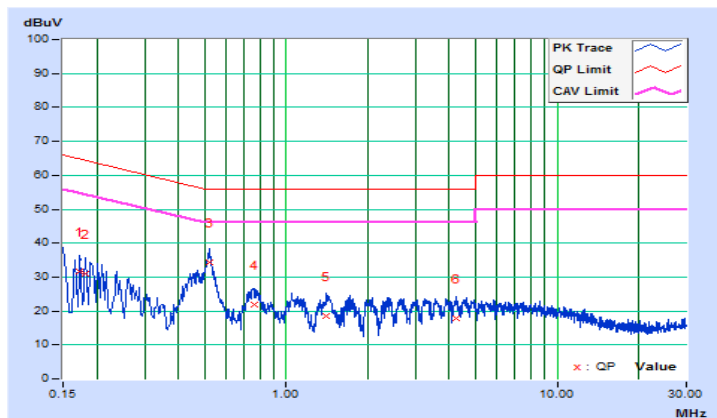


| | | | |
|-----------|-------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
| Test Mode | B | | |

| 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 | 0.17346 | 10.11 | 21.65 | 8.23 | 31.76 | 18.34 | 64.79 |
| 2 | 0.18128 | 10.10 | 20.95 | 7.64 | 31.05 | 17.74 | 64.43 | 54.43 | -33.38 | -36.69 |
| 3 | 0.52130 | 10.09 | 24.15 | 18.56 | 34.24 | 28.65 | 56.00 | 46.00 | -21.76 | -17.35 |
| 4 | 0.75996 | 10.12 | 11.65 | 6.74 | 21.77 | 16.86 | 56.00 | 46.00 | -34.23 | -29.14 |
| 5 | 1.40902 | 10.16 | 8.42 | 3.95 | 18.58 | 14.11 | 56.00 | 46.00 | -37.42 | -31.89 |
| 6 | 4.25159 | 10.32 | 7.54 | 2.38 | 17.86 | 12.70 | 56.00 | 46.00 | -38.14 | -33.30 |

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.

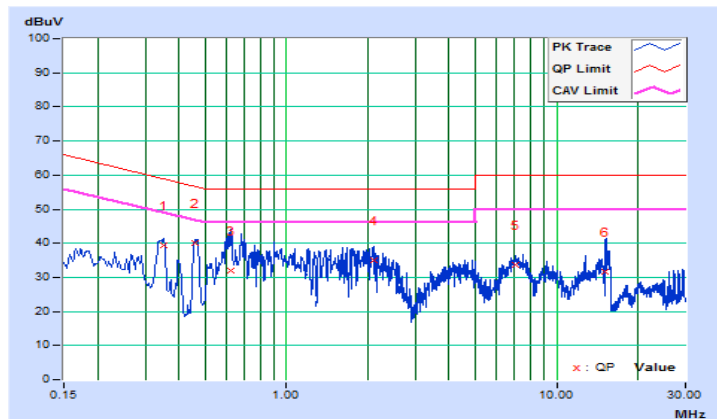


| | | | |
|-----------|----------|-------------------|--------------------------------|
| Phase | Line (L) | Detector Function | Quasi-Peak (QP) / Average (AV) |
| Test Mode | C | | |

| 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 | 0.34941 | 10.17 | 29.19 | 23.76 | 39.36 | 33.93 | 58.98 |
| 2 | 0.46058 | 10.18 | 29.98 | 27.48 | 40.16 | 37.66 | 56.68 | 46.68 | -16.52 | -9.02 |
| 3 | 0.62311 | 10.19 | 21.80 | 17.38 | 31.99 | 27.57 | 56.00 | 46.00 | -24.01 | -18.43 |
| 4 | 2.10109 | 10.24 | 24.82 | 11.83 | 35.06 | 22.07 | 56.00 | 46.00 | -20.94 | -23.93 |
| 5 | 7.02769 | 10.52 | 23.10 | 14.78 | 33.62 | 25.30 | 60.00 | 50.00 | -26.38 | -24.70 |
| 6 | 15.18786 | 11.01 | 20.68 | 12.32 | 31.69 | 23.33 | 60.00 | 50.00 | -28.31 | -26.67 |

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.

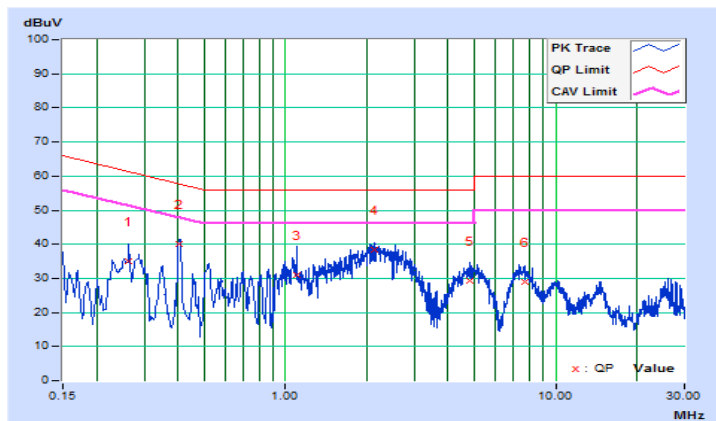


| | | | |
|-----------|-------------|-------------------|--------------------------------|
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
| Test Mode | C | | |

| 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 | 0.26339 | 10.13 | 24.93 | 15.05 | 35.06 | 25.18 | 61.32 |
| 2 | 0.40479 | 10.14 | 30.04 | 28.46 | 40.18 | 38.60 | 57.75 | 47.75 | -17.57 | -9.15 |
| 3 | 1.10404 | 10.22 | 20.91 | 13.22 | 31.13 | 23.44 | 56.00 | 46.00 | -24.87 | -22.56 |
| 4 | 2.14801 | 10.27 | 28.03 | 17.11 | 38.30 | 27.38 | 56.00 | 46.00 | -17.70 | -18.62 |
| 5 | 4.79508 | 10.40 | 19.00 | 10.57 | 29.40 | 20.97 | 56.00 | 46.00 | -26.60 | -25.03 |
| 6 | 7.73931 | 10.52 | 18.58 | 10.14 | 29.10 | 20.66 | 60.00 | 50.00 | -30.90 | -29.34 |

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.



5 Pictures of Test Arrangements

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

6 Construction Photos of EUT

Please refer to the attached file (180828C01 (EUT photo)).

Appendix – Information on 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:

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

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Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

--- END ---