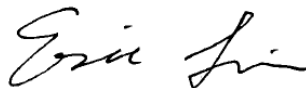


TEST REPORT

Application No.: KSCR2201000022AT (SHCR2112001091AT)
FCC ID: SVNDH-IPC-PFW5X49
Applicant: ZHEJIANG DAHUA VISION TECHNOLOGY CO.,LTD.
Address of Applicant: No.1199, Bin'an Road, Binjiang District, Hangzhou, P.R. China
Manufacturer: ZHEJIANG DAHUA VISION TECHNOLOGY CO.,LTD.
Address of Manufacturer: No.1199, Bin'an Road, Binjiang District, Hangzhou, P.R. China
Equipment Under Test (EUT):
EUT Name: IP CAMERA
Model No.: DH-IPC-PFW5849P-A180-E2-RD-ASTE-0360B;DH-IPC-PFW5849-A180-E2-RD-ASTE;DH-IPC-PFW5849-A180-E2-RD-ASTE-0360B;IPC-PFW5849P-A180-E2-RD-ASTE-0360B;IPC-PFW5849-A180-E2-RD-ASTE;IPC-PFW5849-A180-E2-RD-ASTE-0360B^α
α Please refer to section 2 of this report which indicates which model was actually tested and which were electrically identical.
Standard(s) : 47 CFR Part 15, Subpart C 15.255
Date of Receipt: 2021-12-03
Date of Test: 2021-12-24 to 2022-08-16
Date of Issue: 2022-08-17

| | |
|---------------------|--------------|
| Test Result: | Pass* |
|---------------------|--------------|

* In the configuration tested, the EUT complied with the standards specified above.



Eric Lin
EMC Laboratory Manager



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| Revision Record | | | | |
|-----------------|---------|------------|----------|----------|
| Version | Chapter | Date | Modifier | Remark |
| 01 | | 2022-08-17 | | Original |
| | | | | |
| | | | | |

| | | | |
|--------------------------|--|-------------------------------|--|
| Authorized for issue by: | | | |
| | | Damon Zhou | |
| | | Damon Zhou / Project Engineer | |
| | | Eric Lin | |
| | | Eric Lin / Reviewer | |



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2 Test Summary

| Radio Spectrum Technical Requirement | | | | |
|--------------------------------------|----------------------------------|--------|----------------------------------|--------|
| Item | Standard | Method | Requirement | Result |
| Antenna Requirement | 47 CFR Part 15, Subpart C 15.255 | N/A | 47 CFR Part 15, Subpart C 15.203 | Pass |

N/A: Not applicable

| Radio Spectrum Matter Part | | | | |
|---|----------------------------------|--------------------------------------|---|--------|
| Item | Standard | Method | Requirement | Result |
| Conducted Emissions at AC Power Line (150kHz-30MHz) | 47 CFR Part 15, Subpart C 15.255 | ANSI C63.10 (2013) Section 6.2 | 47 CFR Part 15, Subpart C 15.207 | PASS |
| Transmitter power and power spectral density | 47 CFR Part 15, Subpart C 15.255 | ANSI C63.10, Sections 9.4, 9.5 | 47 CFR Part 15, Subpart C 15.255(c)(2), (d)(1) | PASS |
| Occupied bandwidth | 47 CFR Part 15, Subpart C 15.255 | ANSI C63.10 (2013) Section 9.3 | 47 CFR Part 15, Subpart C 15.215(c), 15.255(c2) | PASS |
| Radiated spurious emissions below 40 GHz | 47 CFR Part 15, Subpart C 15.255 | ANSI C63.10 (2013) Section 9.13 | 47 CFR Part 15, Subpart C 15.255(d)(2) | PASS |
| Radiated emissions outside assigned band and above 40 GHz up to 200 GHz | 47 CFR Part 15, Subpart C 15.255 | ANSI C63.10 (2013) Section 9.9, 9.12 | 47 CFR Part 15, Subpart C 15.255(d)(3) | PASS |
| Frequency stability | 47 CFR Part 15, Subpart C 15.255 | ANSI C63.10 (2013) Section 9.4 | 47 CFR Part 15, Subpart C 15.255(f) | PASS |

Declaration of EUT Family Grouping:

Note: There are series models mentioned in this report, and they are the similar in electrical and electronic characters. Only the model DH-IPC-PFW5849-A180-E2-RD-ASTE was tested since their differences were the model number and appearance.



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4 General Information

4.1 Details of E.U.T.

| | |
|-----------------------|--------------------------|
| Power supply: | DC 12V, 2A; POE+ |
| Test voltage: | AC120V/60Hz |
| Frequency: | 61GHz-61.5GHz |
| Modulation Technique: | FMCW |
| Antenna Type: | Integrated Patch Antenna |
| Antenna Gain: | 2dBi |
| Test Voltage: | AC 120V/60Hz |

4.2 Description of Support Units

| Description | Manufacturer | Model No. | Serial No. |
|-------------|--------------|--------------------------|------------|
| Adapter | HONOTO | ADS-12AM-12 12012EPCU | / |
| Notebook | ThinkPad | L14 | / |
| POE Adapter | SUPLET | LAS60-57CN-RJ45 | / |



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4.3 Measurement Uncertainty

| No. | Item | Measurement Uncertainty |
|-----|---------------------------------|-------------------------|
| 1 | Radio Frequency | 8.4 x 10 ⁻⁸ |
| 2 | Timeout | 2s |
| 3 | Duty Cycle | 0.37% |
| 4 | Occupied Bandwidth | 3% |
| 5 | RF Conducted Power | 0.6dB |
| 6 | RF Power Density | 2.9dB |
| 7 | Conducted Spurious Emissions | 0.75dB |
| 8 | RF Radiated Power | 5.2dB (Below 1GHz) |
| | | 5.9dB (Above 1GHz) |
| 9 | Radiated Spurious Emission Test | 4.2dB (Below 30MHz) |
| | | 4.5dB (30MHz-1GHz) |
| | | 5.1dB (1GHz-18GHz) |
| | | 5.4dB (Above 18GHz) |
| 10 | Temperature Test | 1°C |
| 11 | Humidity Test | 3% |
| 12 | Supply Voltages | 1.5% |
| 13 | Time | 3% |

Note: The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



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4.4 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc.

No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

Tel: +86 512 5735 5888 Fax: +86 512 5737 0818

No tests were sub-contracted.

Note:

1.SGS is not responsible for wrong test results due to incorrect information (e.g. max. clock frequency, highest internal frequency, antenna gain, cable loss, etc) is provided by the applicant. (if applicable).

2.SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (if applicable).

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• CNAS (No. CNAS L4354)

CNAS has accredited Compliance Certification Services (Kunshan) Inc. to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• A2LA (Certificate No. 2541.01)

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

• FCC (Designation Number: CN1172)

Compliance Certification Services Inc. has been recognized as an accredited testing laboratory. Designation Number: CN1172.

• ISED (CAB Identifier: CN0072)

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development (ISED) Canada as an accredited testing laboratory.

CAB Identifier: CN0072.

• VCCI (Member No.: 1938)

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-20134, R-11600,C-11707, T-11499, G-10216 respectively.

4.6 Deviation from Standards

None



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None



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5 Equipment List

| Item | Equipment | Manufacturer | Model | Serial Number | Cal Date | Cal. Due Date |
|---|--|--------------|-------------------|-----------------|------------|---------------|
| Conducted Emission at Mains Terminals (150kHz-30MHz) | | | | | | |
| 1 | EMI Test Receive | R&S | ESCI | 100781 | 01/30/2022 | 01/29/2023 |
| 2 | LISN | R&S | ENV216 | 101604 | 10/12/2021 | 10/11/2022 |
| 3 | LISN | Schwarzbeck | NNLK 8129 | 8129-143 | 10/12/2021 | 10/11/2022 |
| 4 | Pulse Limiter | R&S | ESH3-Z2 | 100609 | 01/30/2022 | 01/29/2023 |
| 5 | CE test Cable | Thermax | / | 14 | 10/16/2021 | 10/15/2022 |
| 6 | Test Software | Farad | EZ-EMC | CCS-03A1 | N.C.R | N.C.R |
| RF Radiated Test | | | | | | |
| 1 | Spectrum Analyzer | R&S | FSV40 | 101493 | 10/11/2021 | 10/10/2022 |
| 2 | Signal Generator | Agilent | E8257C | MY43321570 | 10/18/2021 | 10/17/2022 |
| 3 | Loop Antenna | Schwarzbeck | HXYZ9170 | 9170-108 | 02/21/2022 | 02/20/2023 |
| 4 | Bilog Antenna | TESEQ | CBL 6112D | 35403 | 06/21/2021 | 06/20/2023 |
| 5 | Bilog Antenna | SCHWARZBECK | VULB9160 | 9160-3342 | 04/13/2021 | 04/12/2023 |
| 6 | Horn-antenna(1-18GHz) | Schwarzbeck | BBHA9120D | 267 | 10/26/2020 | 10/25/2022 |
| 7 | Horn-antenna(1-18GHz) | ETS-LINDGREN | 3117 | 00143290 | 02/22/2021 | 02/21/2023 |
| 8 | Horn Antenna(18-40GHz) | Schwarzbeck | BBHA9170 | BBHA9170171 | 02/21/2022 | 02/20/2023 |
| 9 | Horn-antenna(40-60GHz) | REBES | SAZ-2410-19-S1 | 06299-01 | N/A | N/A |
| 10 | Horn-antenna(50-75GHz) | REBES | SAZ-2410-15-S1 | 01731-01 | N/A | N/A |
| 11 | Horn-antenna(75-110GHz) | REBES | SAZ-2410-10-S1 | 01773-09 | N/A | N/A |
| 12 | Horn-antenna(110-170GHz) | REBES | SAZ-2410-06-S1 | 01776-05 | N/A | N/A |
| 13 | Horn-antenna(140-220GHz) | REBES | SAZ-2410-05-S1 | 01759-04 | N/A | N/A |
| 14 | Horn-antenna(220-325GHz) | REBES | SAR-2309-03-S2 | 06300-01 | N/A | N/A |
| 15 | Extended waveguide(40-60GHz) | REBES | SWG-19025-FB | 06303-01 | N/A | N/A |
| 16 | Extended waveguide(50-75GHz) | REBES | SWG-15025-FB | 01525-09 | N/A | N/A |
| 17 | Extended waveguide(75-110GHz) | REBES | SWG-10025-FB | 01509-01 | N/A | N/A |
| 18 | Extended waveguide(110-170GHz) | REBES | SWG-06025-FB | 06302-01 | N/A | N/A |
| 19 | Extended waveguide(140-220GHz) | REBES | SWG-05025-FB | 06304-01 | N/A | N/A |
| 20 | Extended waveguide(220-325GHz) | REBES | SWG-03025-FB | 06301-01 | N/A | N/A |
| 21 | Harmonic mixer(110-170GHz) | REBES | STH-06SF-S1 | 06110-01 | N/A | N/A |
| 22 | Harmonic mixer(40-60GHz) | REBES | STH-19SF-S1 | 06937-01 | N/A | N/A |
| 23 | Harmonic mixer(140-220GHz) | REBES | STH-06SF-S1 | 0220-210-002-3D | N/A | N/A |
| 24 | Harmonic mixer(220-325GHz) | REBES | STH-19SF-S1 | 0325-210-002-2F | N/A | N/A |
| 25 | Waveguide Harmonic Mixer(50-75GHz) | KEYSIGHT | M1970V | MY51390966 | N/A | N/A |
| 26 | Waveguide Harmonic Mixer(50-75GHz) cable | Silverline | SLU18-SMSM-01.00M | 99612 | N/A | N/A |
| 27 | Waveguide Harmonic Mixer(75-110GHz) | KEYSIGHT | M1970W | MY51430883 | N/A | N/A |
| 28 | Waveguide Harmonic Mixer(75-110GHz) cable | Silverline | SLU18-SMSM-01.00M | 94202 | N/A | N/A |
| 29 | Waveguide Harmonic Mixer(40-60GHz) cable | Silverline | SLU18-SMSM-01.00M | 94011 | N/A | N/A |
| 30 | Waveguide Harmonic Mixer(110-170GHz) cable | Silverline | SLU18-SMSM-01.00M | 96416 | N/A | N/A |
| 31 | Waveguide Harmonic Mixer(140-220GHz) cable | Silverline | SLU18-SMSM-01.00M | 99632 | N/A | N/A |



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Report No.: KSCR220100002201

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| | | | | | | |
|----|--|---------------|-------------------|-------------|------------|------------|
| 32 | Waveguide Harmonic Mixer(220-325GHz) cable | Silverline | SLU18-SMSM-01.00M | 94215 | N/A | N/A |
| 33 | Pre-Amplifier(30MHz~18GHz) | LNA | / | / | 04/14/2022 | 04/13/2023 |
| 34 | Amplifier(18~40GHz) | COM-POWER | PAM-840A | 461332 | 10/18/2021 | 10/17/2022 |
| 35 | Low Pass Filter | MICRO-TRONICS | VLFX-950 | RV142900829 | N.C.R | N.C.R |
| 36 | High Pass Filter | Mini-Circuits | VHF-1200 | 15542 | N.C.R | N.C.R |
| 37 | RE test cable | / | RE01-RE04 | / | 04/14/2022 | 04/13/2023 |
| 38 | PXA Spectrum Analyzer | KEYSIGHT | N9030B | KSEM021-1 | 01/30/2022 | 01/29/2023 |
| 39 | Vector Signal Generator | R&S | SMW200A | 110074 | 10/12/2021 | 10/12/2022 |
| 40 | Software | Farad | EZ-EMC | CCS-03A1 | N/A | N/A |

Note: N.C.R means Not Calibration Requirements.



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6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

FCC 47 CFR Part 15C Section 15.203

6.1.2 Conclusion

Standard Requirement:

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. The use of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of an so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is Integrated Patch Antenna and no consideration of replacement.

Antenna location: Refer to EUT Photos.



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7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

| Frequency of Emission (MHz) | Conducted Limit (dBµV) | |
|-----------------------------|------------------------|-----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

7.1.1 E.U.T. Operation

Operating Environment:

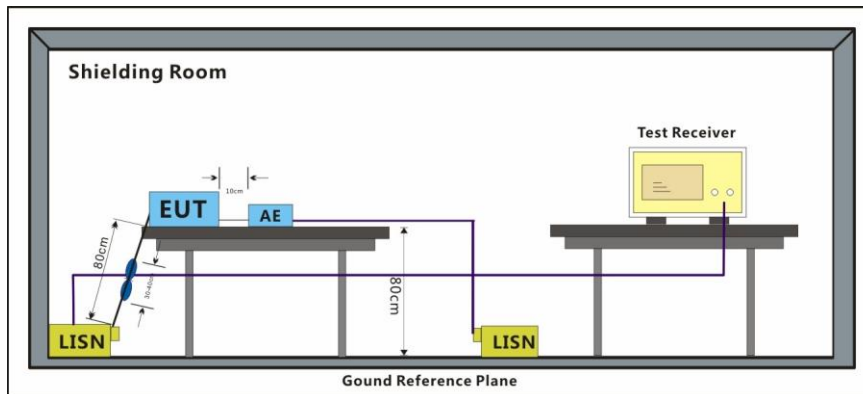
Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Pretest these modes to find the worst case: a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.

b: TX mode _ Keep the EUT in continuously transmitting mode powered by PoE Adapter.

The worst case for final test: a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.

7.1.2 Test Setup Diagram



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7.1.3 Measurement Procedure and Data

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark:

LISN = Read Level + Cable Loss + LISN Factor



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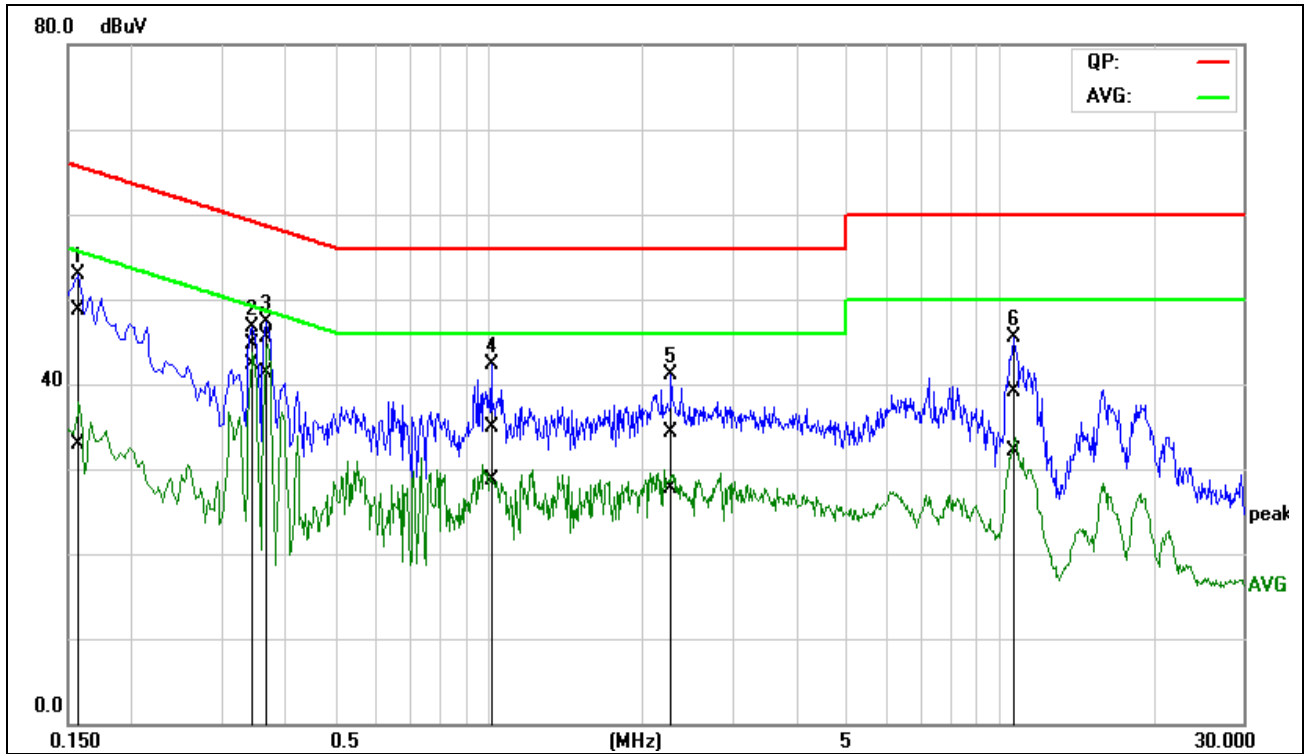
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Mode: a; Line: Live Line



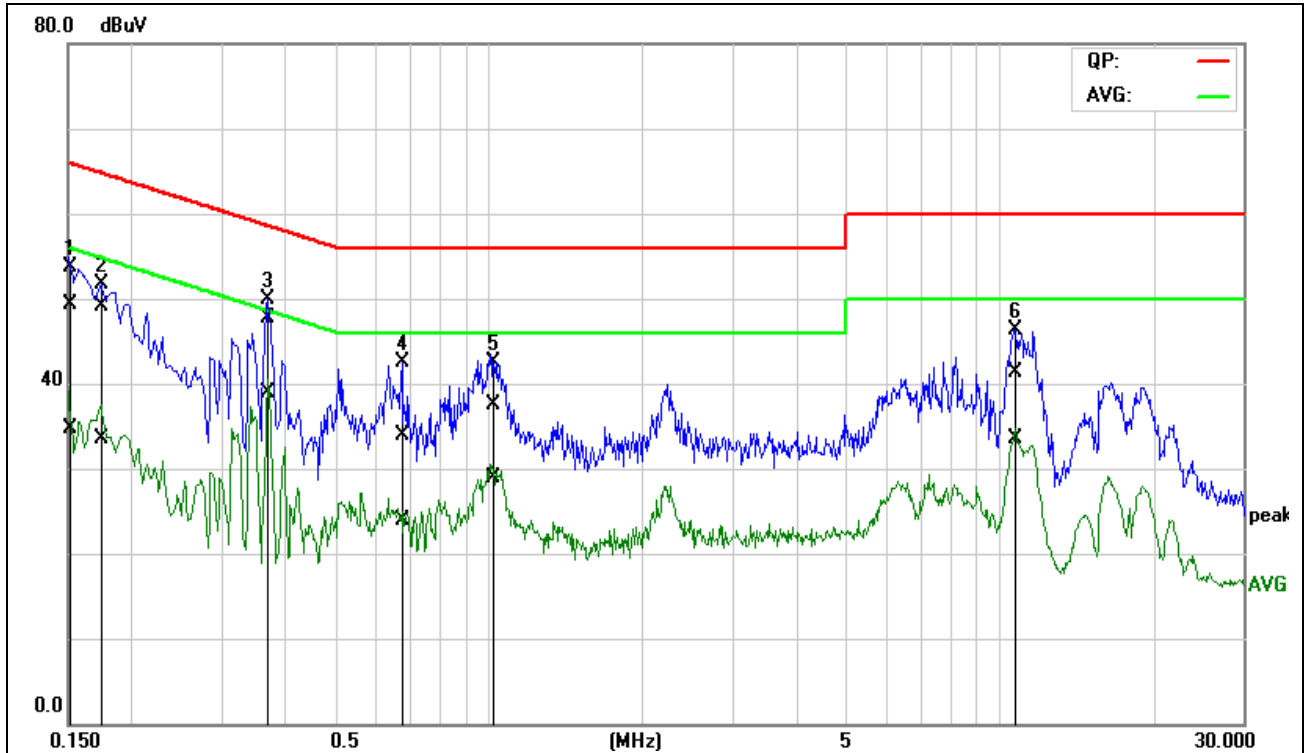
| No. | Frequency (MHz) | QuasiPeak reading (dBuV) | Average reading (dBuV) | Correction factor (dB) | QuasiPeak result (dBuV) | Average result (dBuV) | QuasiPeak limit (dBuV) | Average limit (dBuV) | QuasiPeak margin (dB) | Average margin (dB) | Remark |
|-----|-----------------|--------------------------|------------------------|------------------------|-------------------------|-----------------------|------------------------|----------------------|-----------------------|---------------------|--------|
| 1 | 0.1575 | 29.27 | 13.41 | 19.46 | 48.73 | 32.87 | 65.59 | 55.59 | -16.86 | -22.72 | Pass |
| 2* | 0.3441 | 25.20 | 22.78 | 19.48 | 44.68 | 42.26 | 59.10 | 49.10 | -14.42 | -6.84 | Pass |
| 3 | 0.3663 | 25.99 | 21.87 | 19.49 | 45.48 | 41.36 | 58.58 | 48.58 | -13.10 | -7.22 | Pass |
| 4 | 1.0133 | 15.33 | 9.11 | 19.55 | 34.88 | 28.66 | 56.00 | 46.00 | -21.12 | -17.34 | Pass |
| 5 | 2.2700 | 14.79 | 8.04 | 19.61 | 34.40 | 27.65 | 56.00 | 46.00 | -21.60 | -18.35 | Pass |
| 6 | 10.6889 | 19.19 | 12.03 | 20.00 | 39.19 | 32.03 | 60.00 | 50.00 | -20.81 | -17.97 | Pass |



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Mode: a; Line: Neutral Line



| No. | Frequency (MHz) | QuasiPeak reading (dBuV) | Average reading (dBuV) | Correction factor (dB) | QuasiPeak result (dBuV) | Average result (dBuV) | QuasiPeak limit (dBuV) | Average limit (dBuV) | QuasiPeak margin (dB) | Average margin (dB) | Remark |
|-----|--------------------|--------------------------------|------------------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|---------------------------|--------|
| 1 | 0.1522 | 29.91 | 15.24 | 19.42 | 49.33 | 34.66 | 65.88 | 55.88 | -16.55 | -21.22 | Pass |
| 2 | 0.1724 | 29.62 | 14.13 | 19.42 | 49.04 | 33.55 | 64.84 | 54.84 | -15.80 | -21.29 | Pass |
| 3* | 0.3712 | 28.31 | 19.34 | 19.47 | 47.78 | 38.81 | 58.47 | 48.47 | -10.69 | -9.66 | Pass |
| 4 | 0.6745 | 14.45 | 4.35 | 19.52 | 33.97 | 23.87 | 56.00 | 46.00 | -22.03 | -22.13 | Pass |
| 5 | 1.0243 | 17.95 | 9.29 | 19.53 | 37.48 | 28.82 | 56.00 | 46.00 | -18.52 | -17.18 | Pass |
| 6 | 10.8058 | 21.35 | 13.47 | 19.99 | 41.34 | 33.46 | 60.00 | 50.00 | -18.66 | -16.54 | Pass |



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7.2 Occupied bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.215(c),15.255(c2)

Test Method: ANSI C63.10, Section 9.3

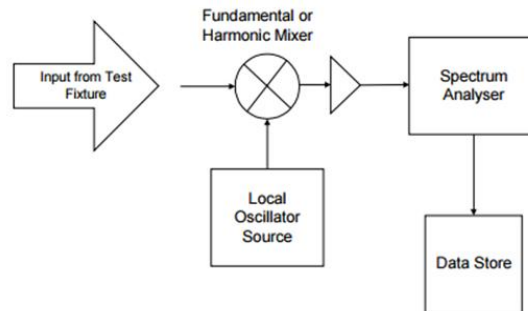
7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test Mode: a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.

7.2.2 Test Setup Diagram



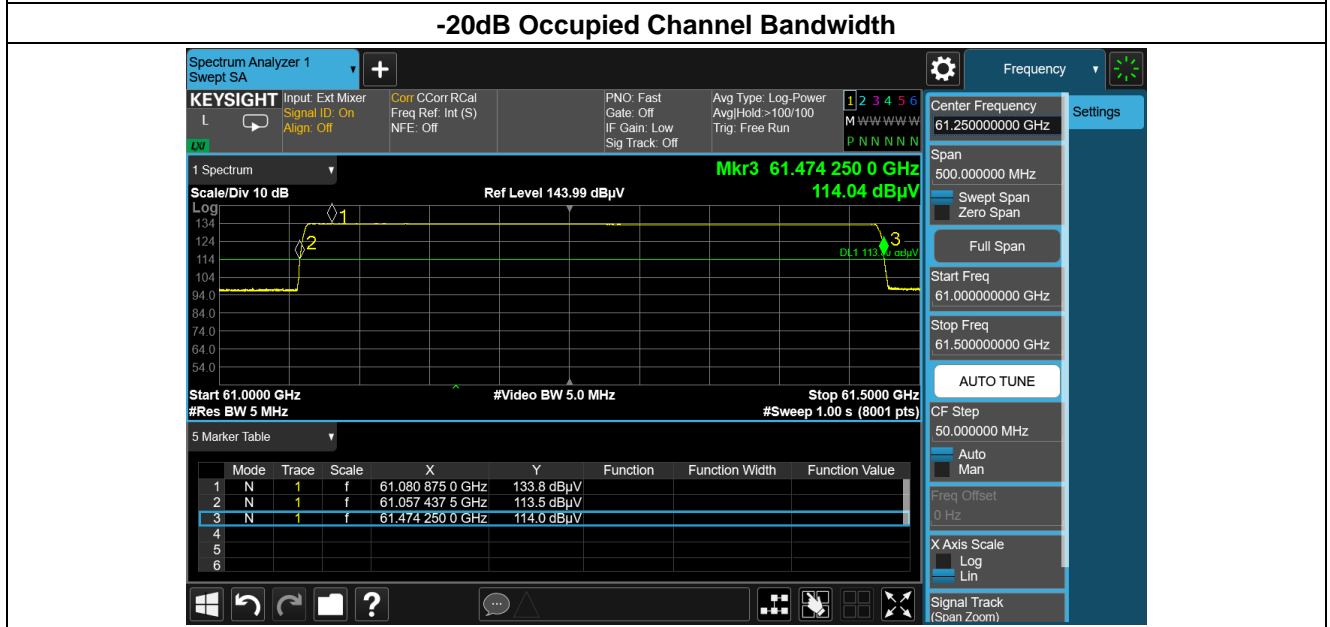
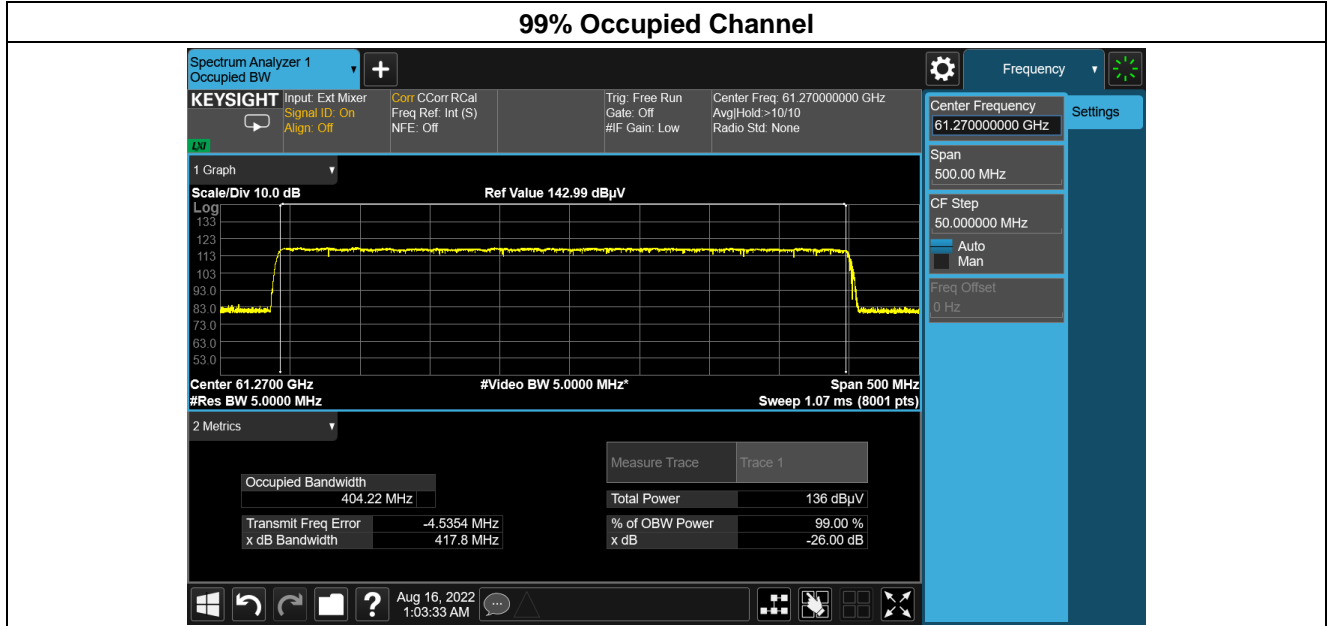
7.2.3 Measurement Procedure and Data

- 1) Place the EUT on the table and set it in the transmitting mode
- 2) SA set RBW=1%~5% OBW, VBW=RBW and Detector=Peak
- 3) Measure and record the result of 20dB and 99% bandwidth



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| Centre Frequency (GHz) | -20dB OCW (MHz) | 99% OCW (MHz) | F _L (GHz) | Limit (GHz) | F _H (GHz) | Limit (GHz) | Result |
|------------------------|-----------------|---------------|----------------------|-------------|----------------------|-------------|--------|
| 61.266 | 416.9 | 404.22 | 61.057 | 61 | 61.474 | 61.5 | Pass |

Remark:

F_L: Frequency Low Band Edge, F_H: Frequency High Band Edge. F_C(Centre Frequency)=(F_L+ F_H)/2



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7.3 Transmitter power and power spectral density

Test Requirement 47 CFR Part 15, Subpart C 15.255(c)(2), (d)(1)

Test Method: ANSI C63.10, Sections 9.4, 9.5

Limit:

| Assigned frequency range (MHz) | Maximum output power | |
|--------------------------------|----------------------|-----------------|
| | Average EIRP (dBm) | Peak EIRP (dBm) |
| 61000 - 61500 | 40 | 43 |

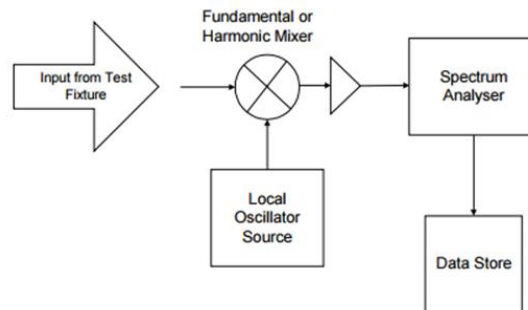
7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test Mode: a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.

7.3.2 Test Setup Diagram



7.3.3 Measurement Procedure and Data

- 1) Place the EUT on the table and set it in the transmitting mode
- 2) SA set RBW=3MHz , VBW=3*RBW , Detector=Peak/Average, Trace: Mask Hold, Peak Search
- 3) The EUT was turned from 0 degrees to 360 degrees to find the maximum reading.

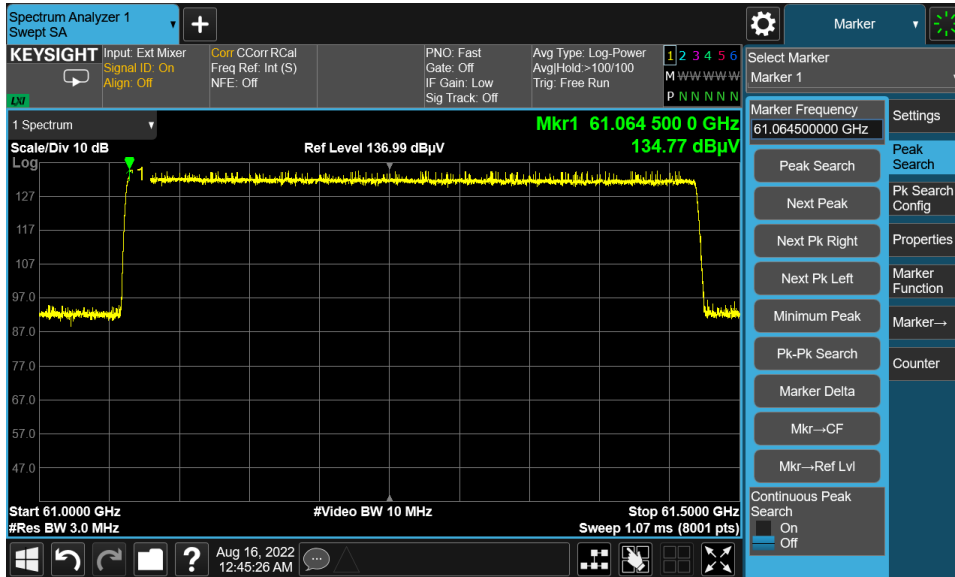
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



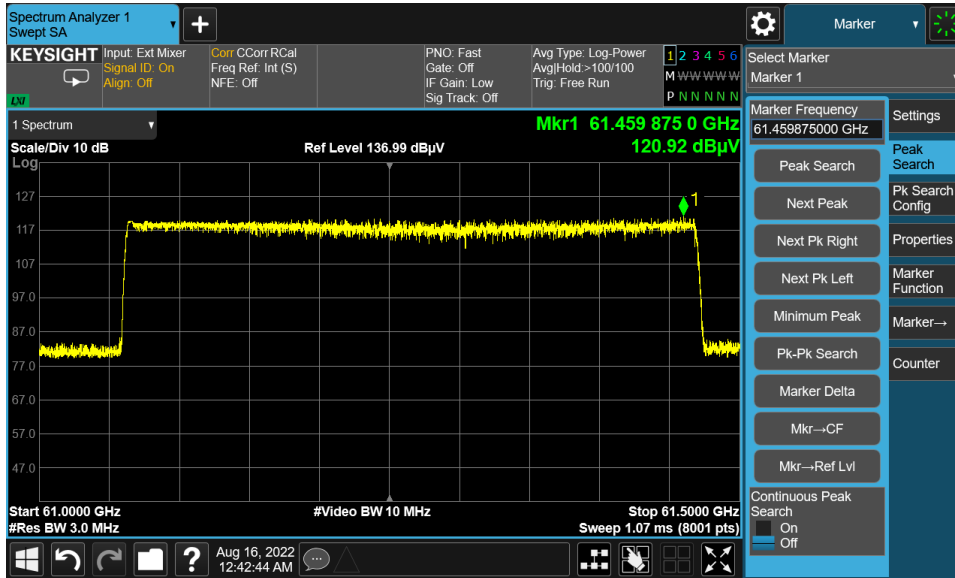
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Peak Power- Horizontal



Peak Power- Vertical

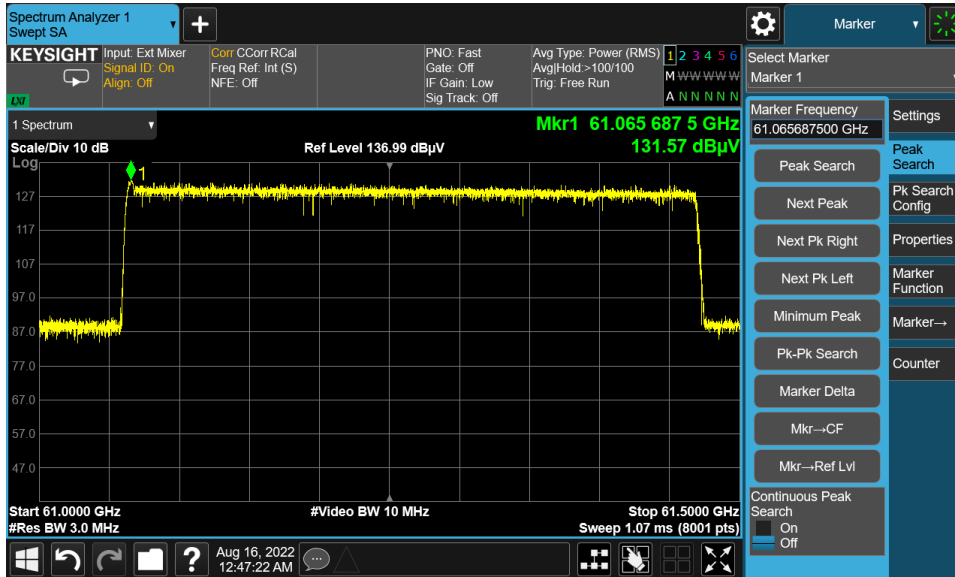


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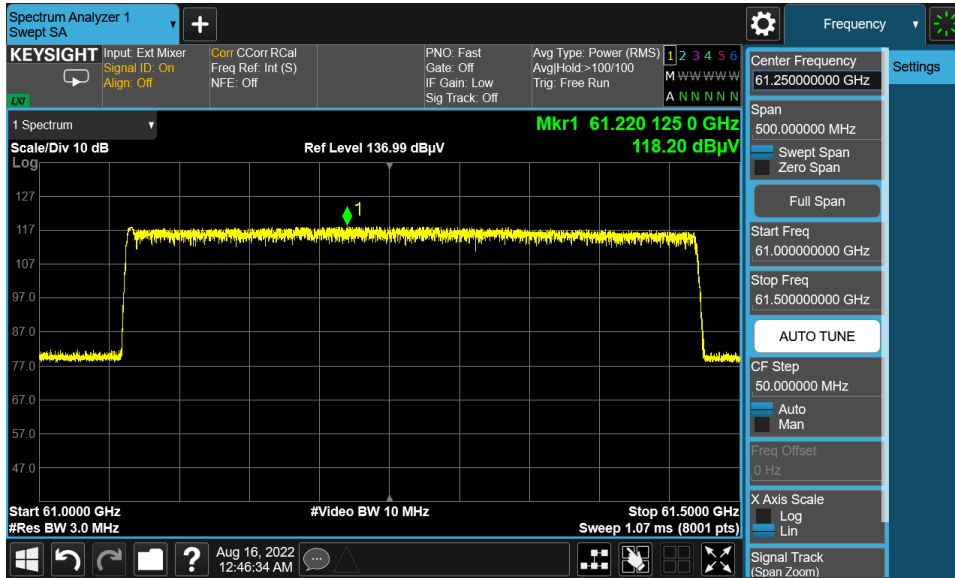
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Average Power- Horizontal



Average Power- Vertical



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| Frequency (GHz) | Distance (cm) | Polarity | dBuV/m @ 0.15m | E.I.R.P. Power (dBm) | E.I.R.P. Limit (dBm) | Result | Remark |
|-----------------|---------------|------------|----------------|----------------------|----------------------|--------|---------|
| 61.266 | 15 | Horizontal | 134.77 | 13.52 | 43 | Pass | peak |
| | | Vertical | 120.92 | -0.33 | 43 | Pass | peak |
| | | Horizontal | 131.57 | 10.32 | 40 | Pass | Average |
| | | Vertical | 118.20 | -3.05 | 40 | Pass | Average |

Remark:

$E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$, where E = field strength and d = distance at which field strength limit is specified in the rules

$\text{EIRP}[\text{dBm}] = E[\text{dB}\mu\text{V}/\text{m}] + 20 \log(d[\text{meters}]) - 104.77$



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7.4 Emission within the 57-71GHz, except 61.0-61.5GHz band

Test Requirement 47 CFR Part 15, Subpart C 15.255(c)(2)

Test Method: ANSI C63.10, Sections 9.10

Limit:

| Frequency (GHz) | Average Power(dBm) | Peak Power(dBm) | Distance(m) | Field strength (dBuV/m)*, peak | Field strength (dBuV/m)*, average |
|-----------------|--------------------|-----------------|-------------|--------------------------------|-----------------------------------|
| 57-61 | 10 | 13 | 0.15 | 134.25 | 131.25 |
| 61.5-71 | 10 | 13 | 0.15 | 134.25 | 131.25 |

$E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$, where E = field strength and d = distance at which field strength limit is specified in the rules

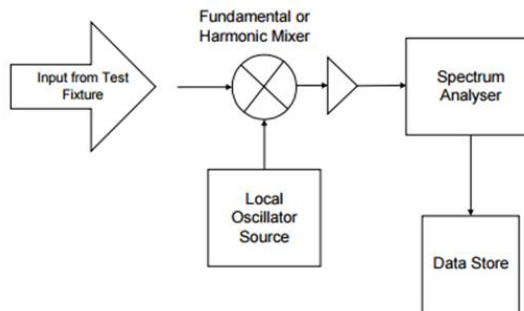
7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test Mode: a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.

7.4.2 Test Setup Diagram



7.4.3 Measurement Procedure and Data

- 4) Place the EUT on the table and set it in the transmitting mode
- 5) SA set RBW=3MHz , VBW=3*RBW , Detector=Peak/Average, Trace: Mask Hold, Peak Search
- 6) The EUT was turned from 0 degrees to 360 degrees to find the maximum reading.

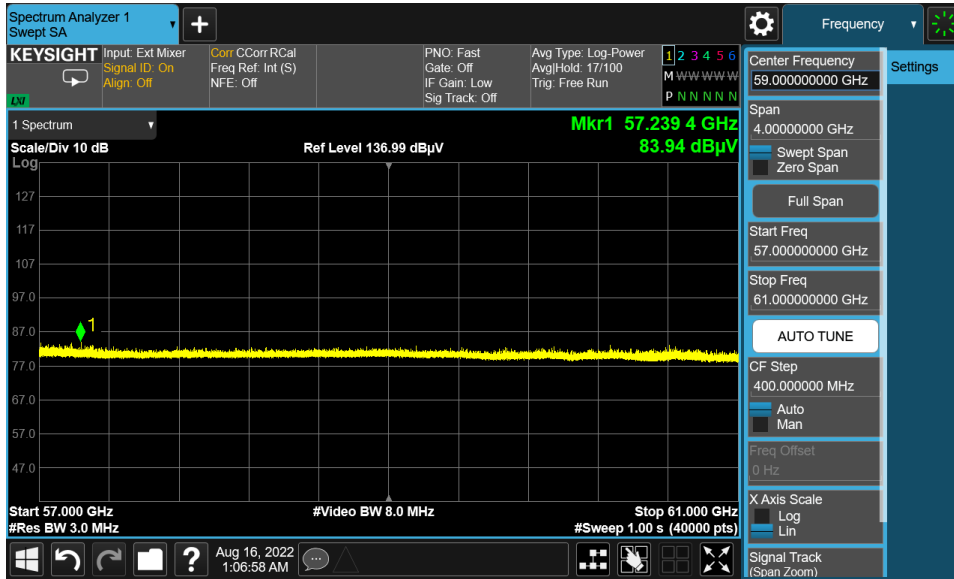
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor



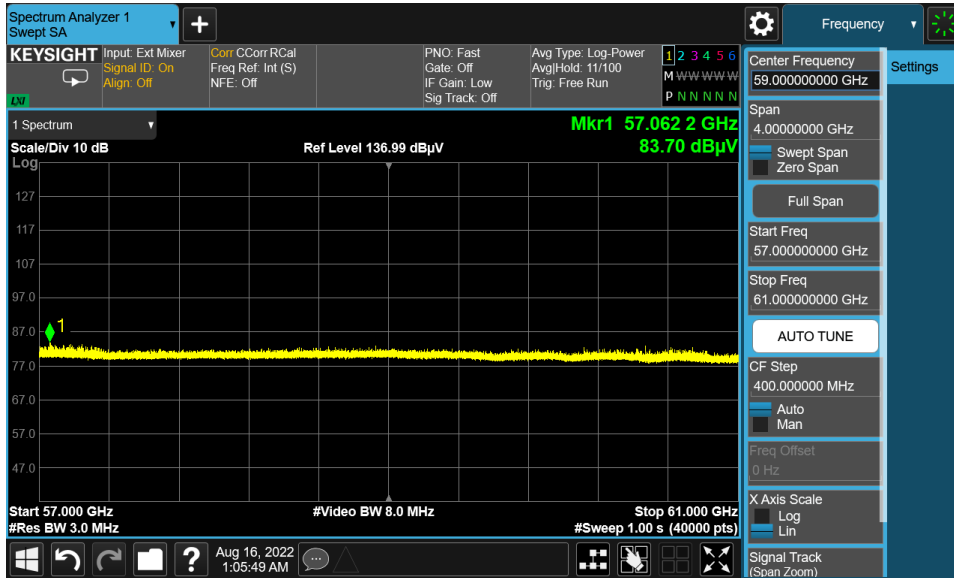
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57-61GHz-Peak- Horizontal



57-61GHz-Peak - Vertical



| Frequency (GHz) | Distance (M) | Peak Value (dBuV/m) | Peak Limit (dBuV/m) | Polarization | Result |
|-----------------|--------------|---------------------|---------------------|--------------|--------|
| 57.2394 | 0.15 | 83.94 | 134.25 | H | PASS |
| 57.0622 | 0.15 | 83.70 | 134.25 | V | PASS |

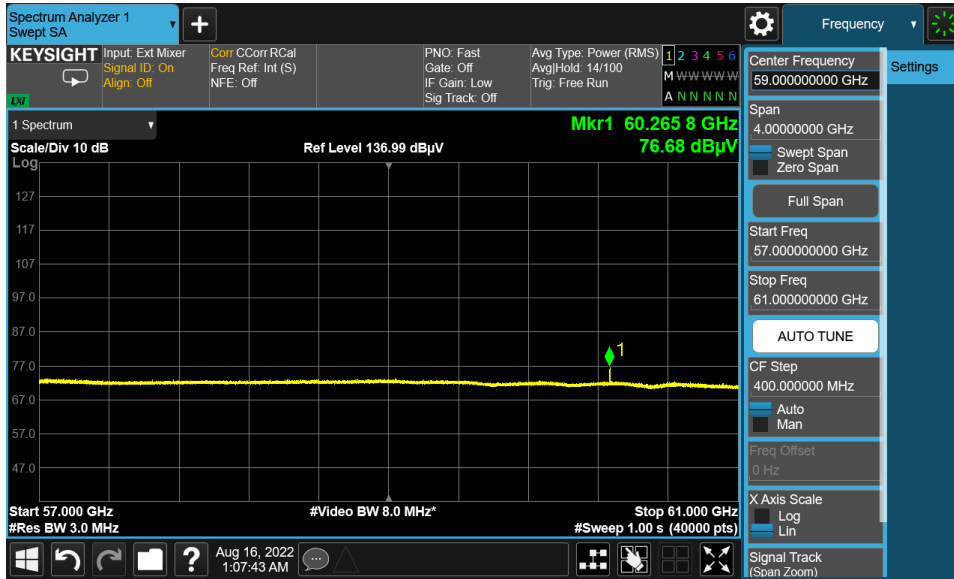


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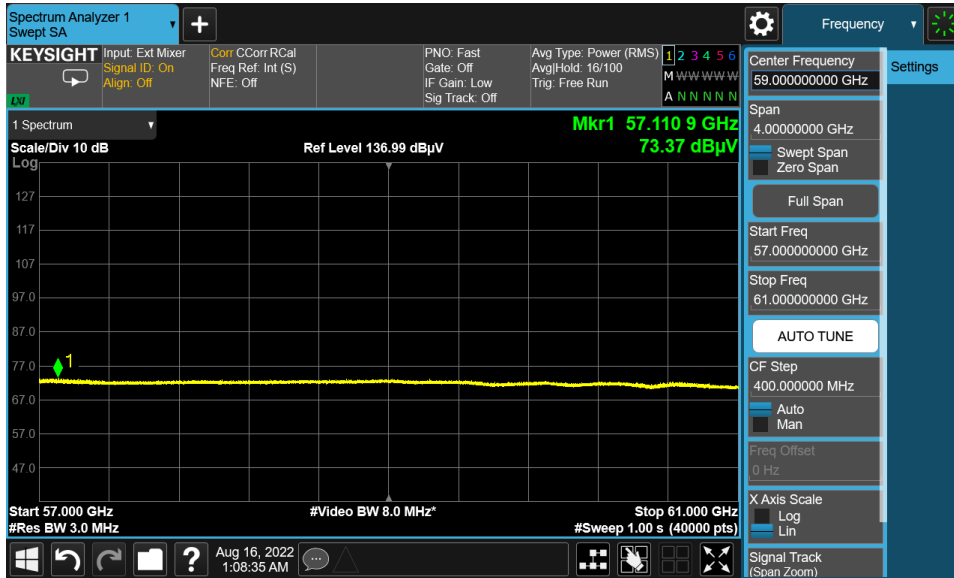
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57-61GHz- Average-Horizontal



57-61GHz-Average-Vertical



| Frequency (GHz) | Distance (M) | Average Value (dBuV/m) | Average Limit (dBuV/m) | Polarization | Result |
|-----------------|--------------|------------------------|------------------------|--------------|--------|
| 60.2685 | 0.15 | 76.68 | 131.25 | H | PASS |
| 57.1109 | 0.15 | 73.37 | 131.25 | V | PASS |

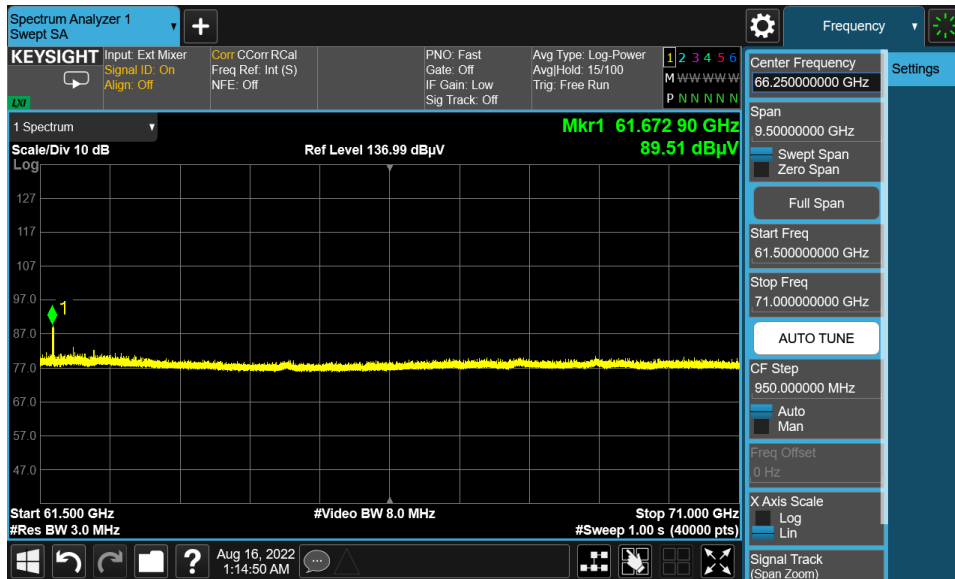


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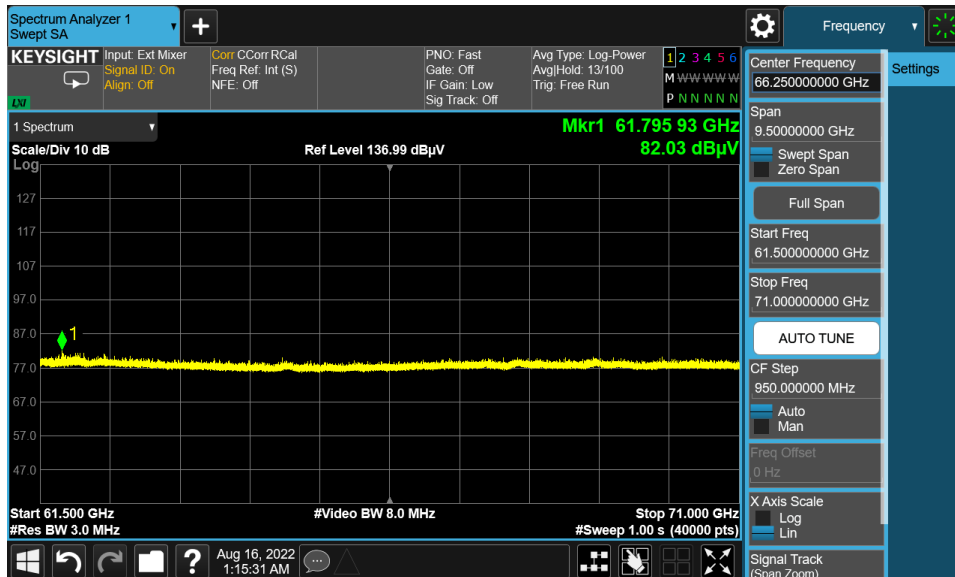
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61.5-71GHz-Peak- Horizontal



61.5-71GHz-Peak - Vertical



| Frequency (GHz) | Distance (M) | Peak Value (dBuV/m) | Peak Limit (dBuV/m) | Polarization | Result |
|-----------------|--------------|---------------------|---------------------|--------------|--------|
| 61.67290 | 0.15 | 89.51 | 134.25 | H | PASS |
| 61.79593 | 0.15 | 82.03 | 134.25 | V | PASS |

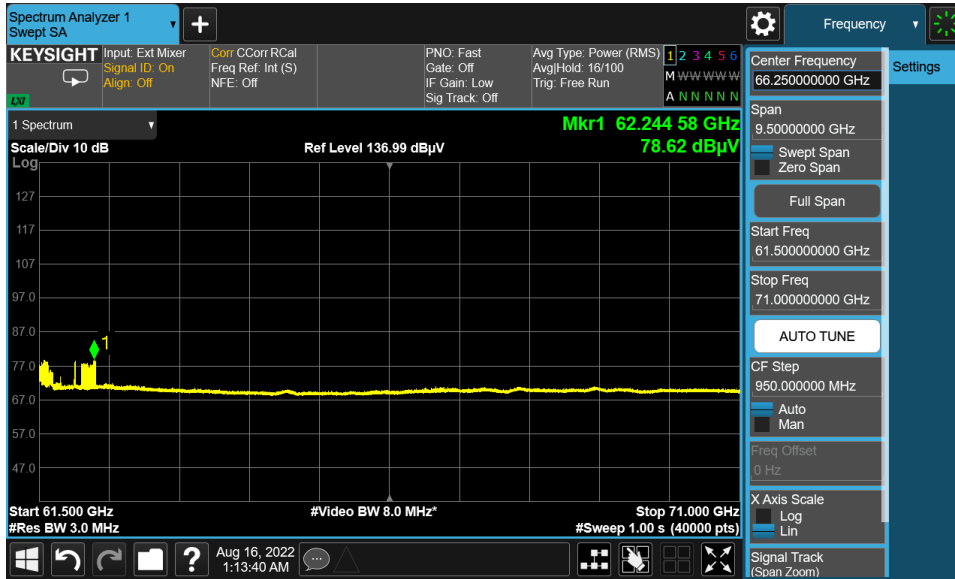


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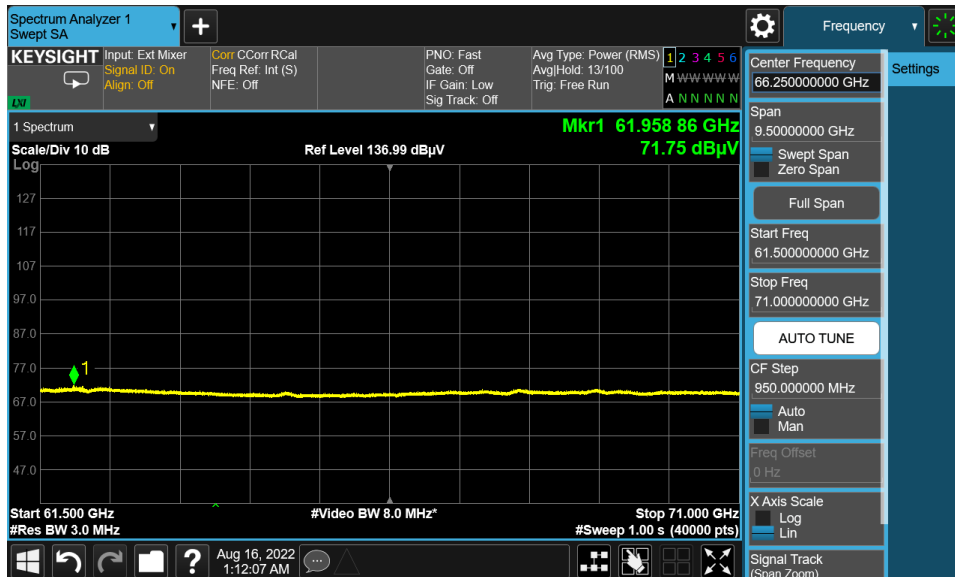
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61.5-71GHz- Average-Horizontal



61.5-71GHz-Average-Vertical



| Frequency (GHz) | Distance (M) | Average Value (dBuV/m) | Average Limit (dBuV/m) | Polarization | Result |
|-----------------|--------------|------------------------|------------------------|--------------|--------|
| 62.24458 | 0.15 | 86.18 | 131.25 | H | PASS |
| 61.95886 | 0.15 | 71.75 | 131.25 | V | PASS |



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7.5 Out of band radiated emissions below 40 GHz

Test Requirement 47 CFR Part 15, Subpart C 15.255(d)(2)

Test Method: ANSI C63.10, Section 9.13

Limit:

Below 30MHz

| Frequency | Field Strength ($\mu\text{V}/\text{m}$) | Measurement Distance (metres) |
|-----------------|---|-------------------------------|
| 9 - 490 kHz | 2,400/F (kHz) | 300 |
| 490 - 1,705 kHz | 24,000/F (kHz) | 30 |
| 1.705-30 MHz | 30 | 30 |

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Above 30MHz

| Frequency (MHz) | Field Strength ($\mu\text{V}/\text{m}$) | Measurement Distance (metres) |
|-----------------|---|-------------------------------|
| 30-88 | 100** | 3 |
| 88-216 | 150** | 3 |
| 216-960 | 200** | 3 |
| Above 960 | 500 | 3 |

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

| Frequency (MHz) | Field strength at 3 m, dB($\mu\text{V}/\text{m}$)* | | |
|-----------------|--|-----------------|-----------------|
| | Within restricted bands | | |
| | Peak | Quasi Peak | Average |
| 0.009 - 0.090 | 148.5 - 128.5 | NA | 128.5 - 108.5** |
| 0.090 - 0.110 | NA | 108.5 - 106.8** | NA |
| 0.110 - 0.490 | 126.8 - 113.8 | NA | 106.8 - 93.8** |
| 0.490 - 1.705 | NA | 73.8 - 63.0** | NA |
| 1.705 - 30.0* | | 69.5 | |
| 30 - 88 | | 40.0 | |
| 88 - 216 | | 43.5 | |
| 216 - 960 | | 46.0 | |
| Above 960 | 54.0 | | |
| 1000 - 200000 | 74.0 | N/A | 54.0 |



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*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lims}_2 = \text{Lims}_1 + 20 \log (S1/S2),$$

where S1 and S2 - standard defined and test distance respectively in meters.

** - The limit decreases linearly with the logarithm of frequency.

Note: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency but not exceeding 40 GHz for intentional radiators operated below 10 GHz and up to the fifth harmonic of the highest fundamental frequency but not exceeding 200 GHz for intentional radiators operated above 30 GHz.

| Frequency (MHz) | Field strength at 1 m, dB(uV/m)* | | |
|-----------------|----------------------------------|------------|---------|
| | Within restricted bands | | |
| | Peak | Quasi Peak | Average |
| 1000 - 200000 | 83.5 | N/A | 63.5 |

7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Pretest these modes to find the worst case:
 a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.
 b: TX mode _ Keep the EUT in continuously transmitting mode powered by PoE Adapter.

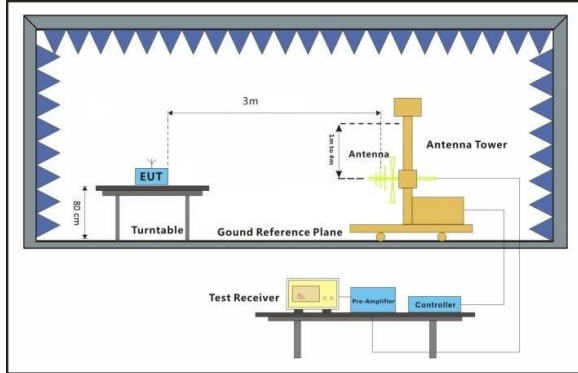
The worst case for final test:
 a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.



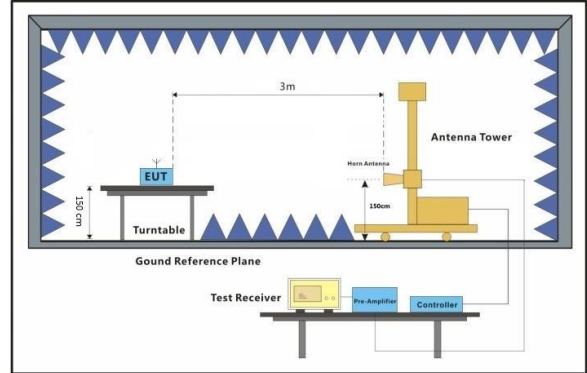
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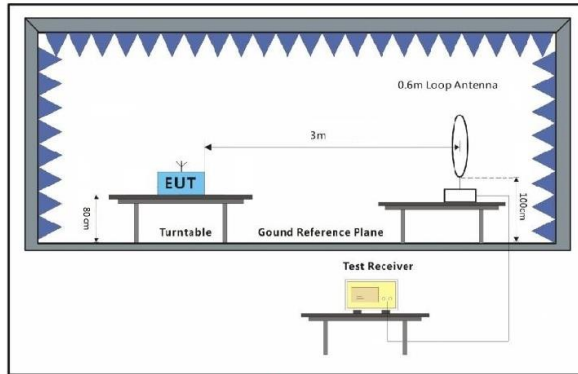
7.5.2 Test Setup Diagram



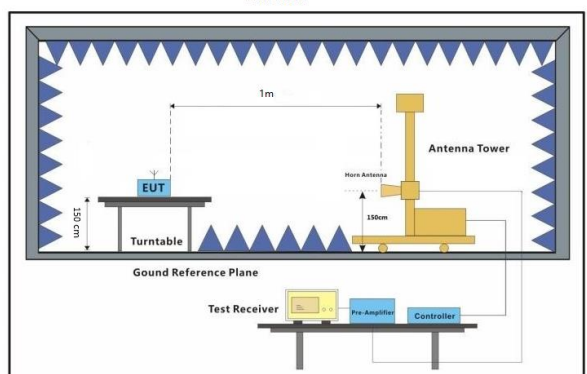
30MHz-1GHz



1GHz-18GHz



Below 30MHz



18GHz-40GHz



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7.5.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For 1-18GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. For 18-40GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 1 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna height 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.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the same height (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- i. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Remark 3: Scan from 9kHz to 40GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

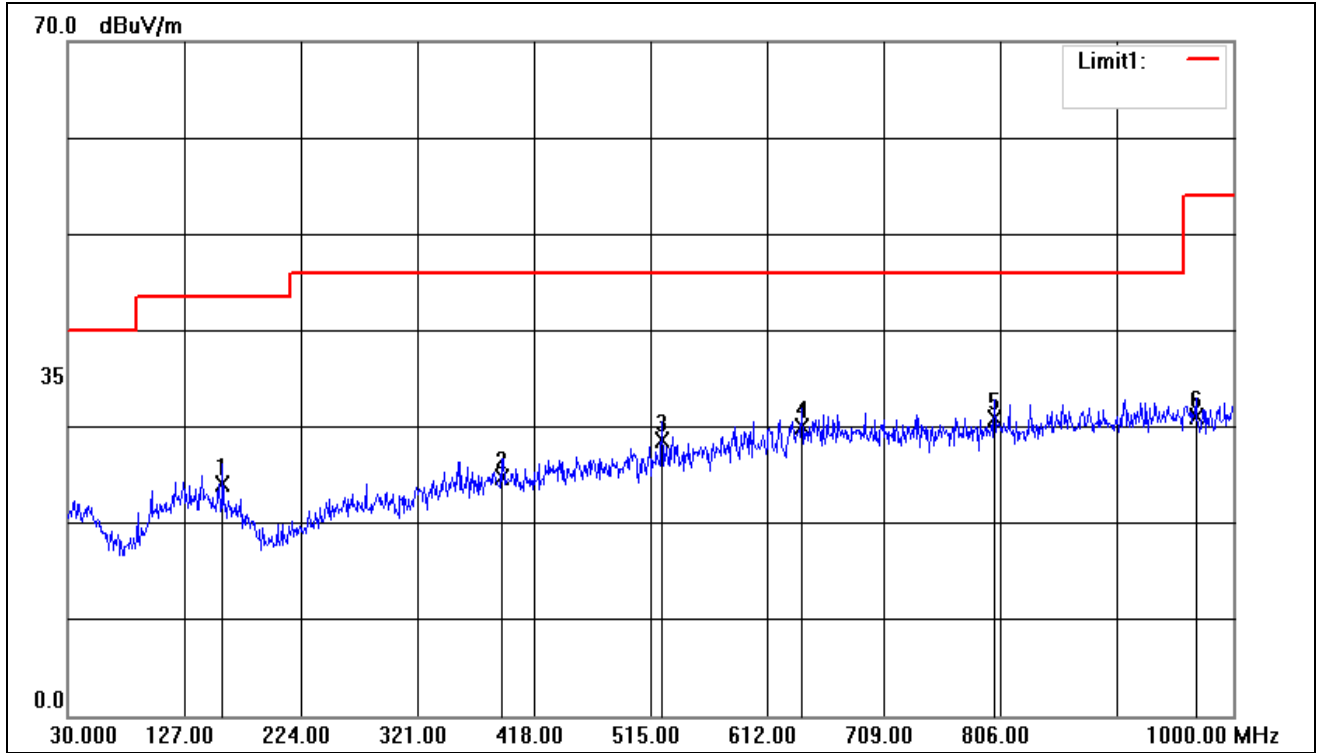


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Radiation Spurious Emission 30MHz-1GHz Horizontal



| No. | Frequency (MHz) | Reading (dBUV) | Correct Factor(dB/m) | Result (dBUV/m) | Limit (dBUV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|--------|
| 1 | 159.0100 | 4.69 | 19.44 | 24.13 | 43.50 | -19.37 | QP |
| 2 | 390.8400 | 1.39 | 23.36 | 24.75 | 46.00 | -21.25 | QP |
| 3 | 524.7000 | 3.02 | 25.53 | 28.55 | 46.00 | -17.45 | QP |
| 4 | 641.1000 | 2.96 | 27.00 | 29.96 | 46.00 | -16.04 | QP |
| 5 | 801.1500 | 3.01 | 27.84 | 30.85 | 46.00 | -15.15 | QP |
| 6 | 968.9600 | 1.77 | 29.26 | 31.03 | 54.00 | -22.97 | QP |

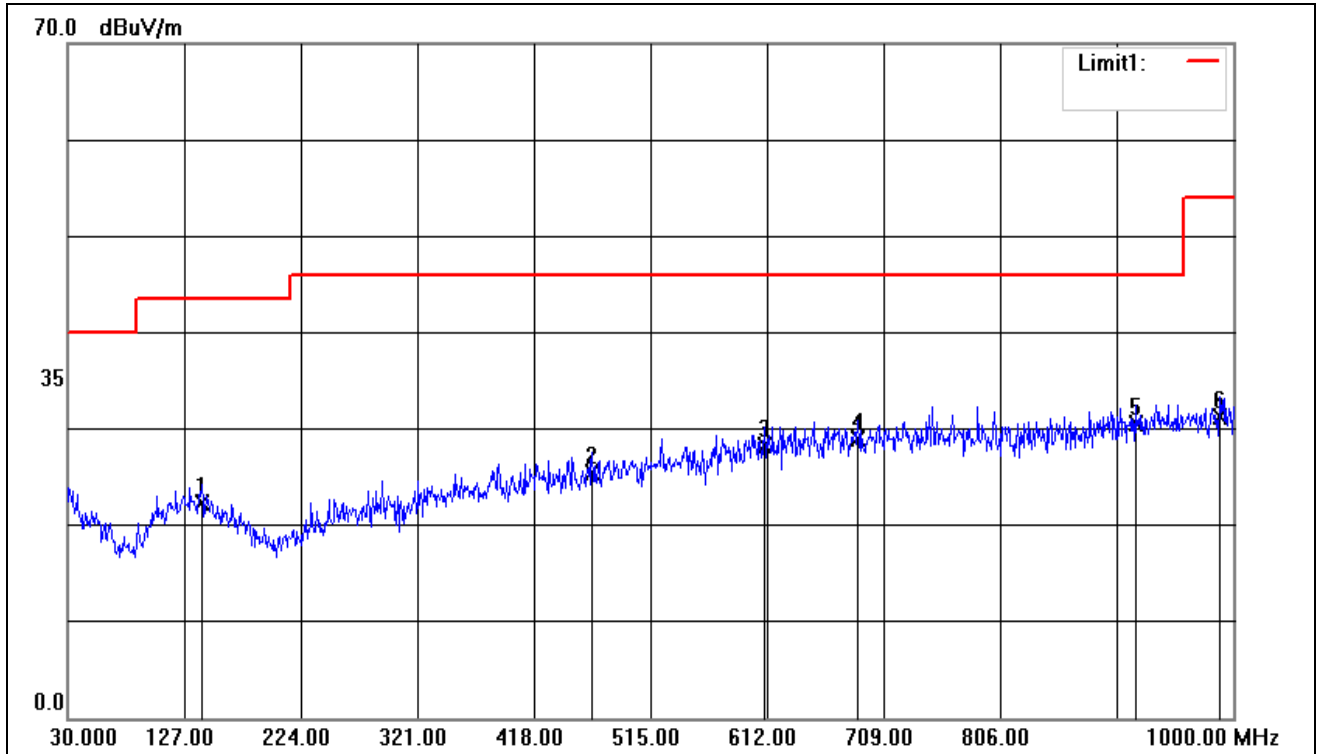


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30MHz-1GHz Vertical



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|--------|
| 1 | 141.5500 | 2.39 | 19.86 | 22.25 | 43.50 | -21.25 | QP |
| 2 | 466.5000 | 0.86 | 24.62 | 25.48 | 46.00 | -20.52 | QP |
| 3 | 610.0600 | 1.64 | 26.63 | 28.27 | 46.00 | -17.73 | QP |
| 4 | 687.6600 | 1.52 | 27.40 | 28.92 | 46.00 | -17.08 | QP |
| 5 | 918.5200 | 1.58 | 28.90 | 30.48 | 46.00 | -15.52 | QP |
| 6 | 989.3300 | 2.08 | 29.22 | 31.30 | 54.00 | -22.70 | QP |

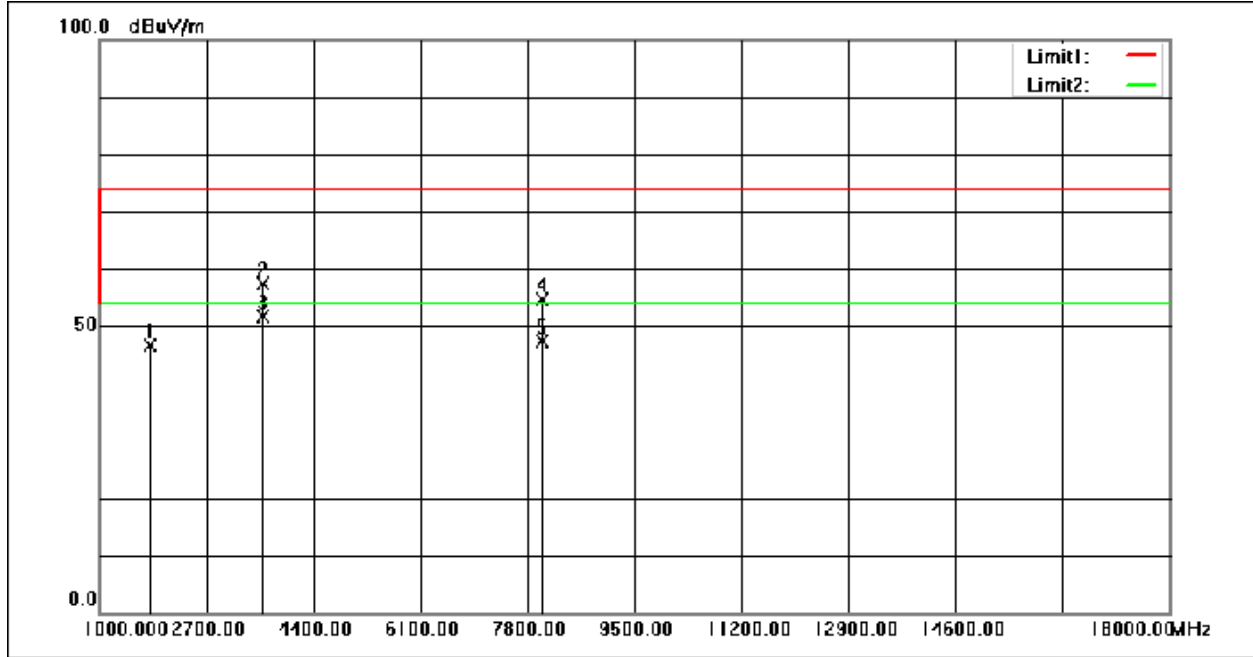


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1-18GHz Horizontal



| No. | Frequency (MHz) | Reading (dBuV) | Correction factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|-------------------------|-----------------|----------------|-------------|--------|
| 1 | 1799.000 | 66.21 | -19.48 | 46.73 | 74.00 | -27.27 | peak |
| 2 | 3584.000 | 67.71 | -10.33 | 57.38 | 74.00 | -16.62 | peak |
| 3 | 3584.000 | 62.01 | -10.33 | 51.68 | 54.00 | -2.32 | AVG |
| 4 | 8038.000 | 59.12 | -4.54 | 54.58 | 74.00 | -19.42 | peak |
| 5 | 8038.000 | 51.87 | -4.54 | 47.33 | 54.00 | -6.67 | AVG |

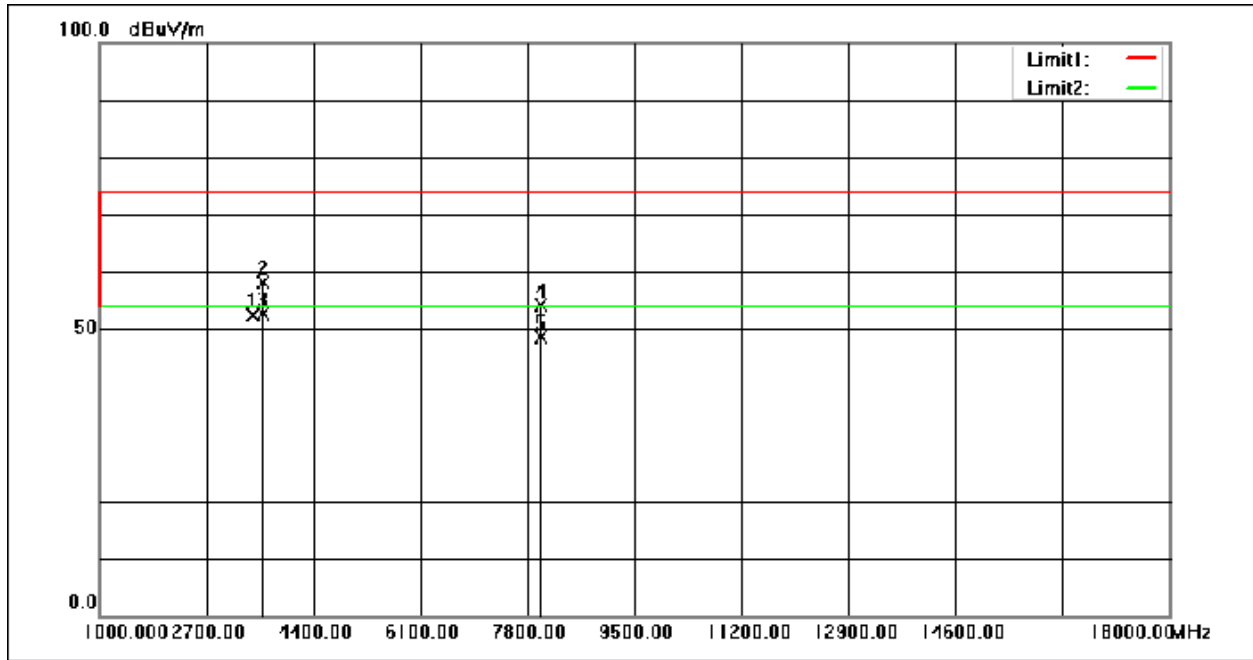


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1-18GHz Vertical



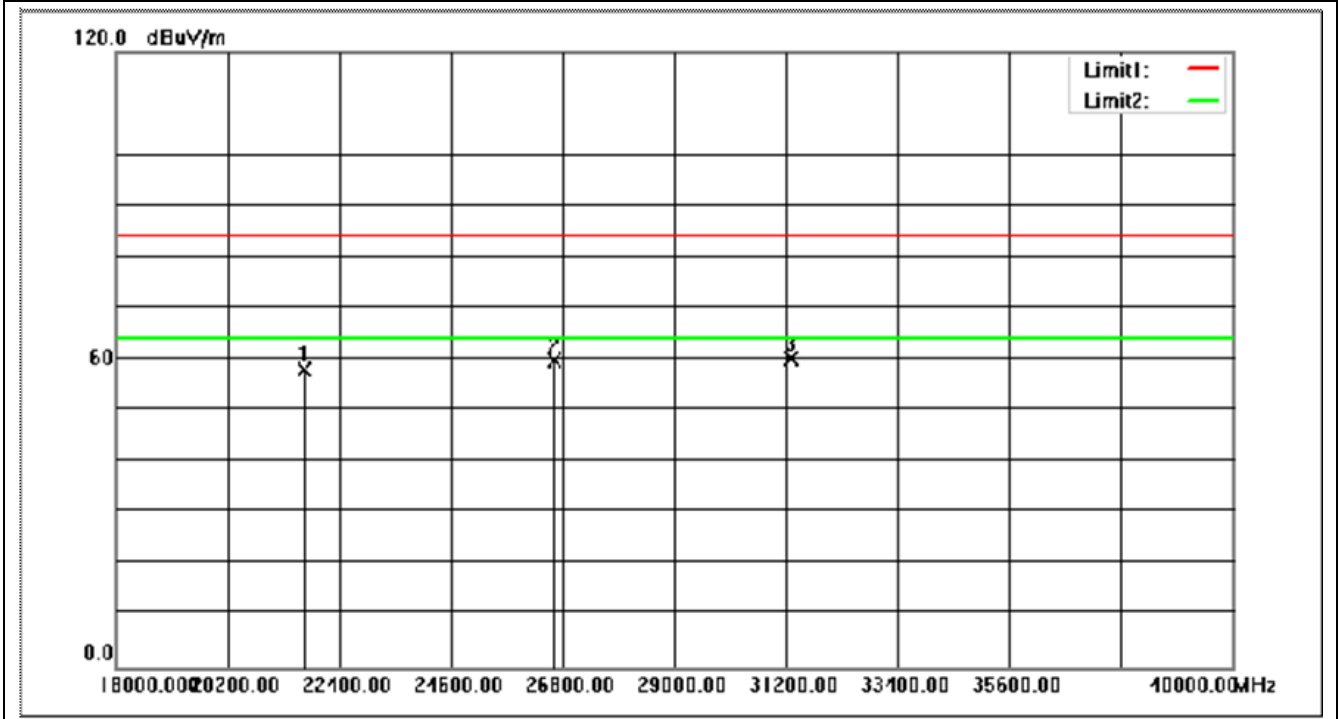
| No. | Frequency (MHz) | Reading (dBuV) | Correction factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|
| 1 | 3431.000 | 63.72 | -11.34 | 52.38 | 74.00 | -21.62 | peak |
| 2 | 3584.000 | 68.47 | -10.33 | 58.14 | 74.00 | -15.86 | peak |
| 3 | 3584.000 | 63.06 | -10.33 | 52.73 | 54.00 | -1.27 | AVG |
| 4 | 8004.000 | 58.74 | -4.51 | 54.23 | 74.00 | -19.77 | peak |
| 5 | 8004.000 | 53.26 | -4.51 | 48.75 | 54.00 | -5.25 | AVG |



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18-40GHz Horizontal



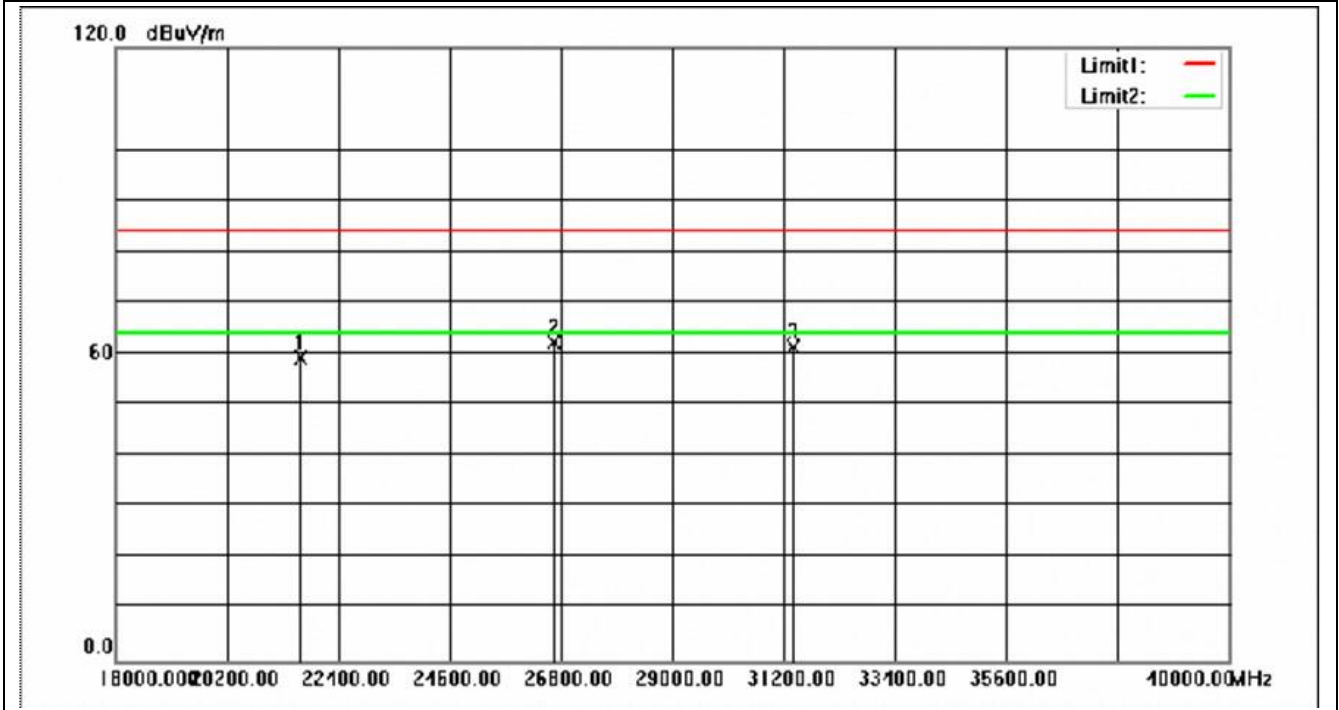
| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|--------|
| 1 | 21718.000 | 45.14 | 12.81 | 57.95 | 83.5 | -25.55 | peak |
| 2 | 26646.000 | 43.89 | 15.98 | 59.87 | 83.5 | -23.63 | peak |
| 3 | 31288.000 | 44.82 | 15.38 | 60.20 | 83.5 | -23.30 | peak |



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18-40GHz Vertical



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|--------|
| 1 | 21652.000 | 46.58 | 12.77 | 59.35 | 83.5 | -24.15 | peak |
| 2 | 26688.000 | 46.15 | 16.00 | 62.15 | 83.5 | -21.35 | peak |
| 3 | 31398.000 | 46.00 | 15.26 | 61.26 | 83.5 | -22.24 | peak |



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7.6 Out of band radiated emissions above 40 GHz

Test Requirement 47 CFR Part 15, Subpart C 15.255(d)(3)
 Test Method: ANSI C63.10, Section 9.9, 9.12
 Limit:

Above 40GHz

| Frequency (GHz) | Power density at 3 m distance (pW/cm ²) | Distance (m) | Field strength (dBuV/m)*, peak | Field strength (dBuV/m)*, average |
|-----------------|---|--------------|--------------------------------|-----------------------------------|
| 40 - 200 | 90 | 3.0 | 105.31 | 85.31 |
| 40 - 200 | 90 | 0.15 | 131.33** | 111.33** |

* - Field strength was calculated per equation (26) of ANSI C63.10-2013 section 9 as follows: $E = \sqrt{PD \times 377}$, where PD is the power density at the distance specified by the limit in W/m², E- field strength in V/m.
 ** - The limit for other test distance was calculated using the inverse distance extrapolation factor as follows: $LimS2 = LimS1 + 20 \log (S1/S2)$, where S1 and S2 - standard defined and test distance respectively in meters.

7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Pretest these modes to find the worst case: a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.

b: TX mode _ Keep the EUT in continuously transmitting mode powered by PoE Adapter.

The worst case for final test: a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.

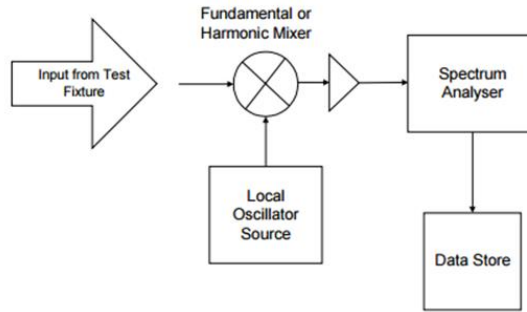


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7.6.2 Test Setup Diagram



Above 40GHz

7.6.3 Measurement Procedure and Data

- a. For above 40GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 0.15 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation
- b. The antenna height 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.
- c. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to the same height (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- e. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- f. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- g. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

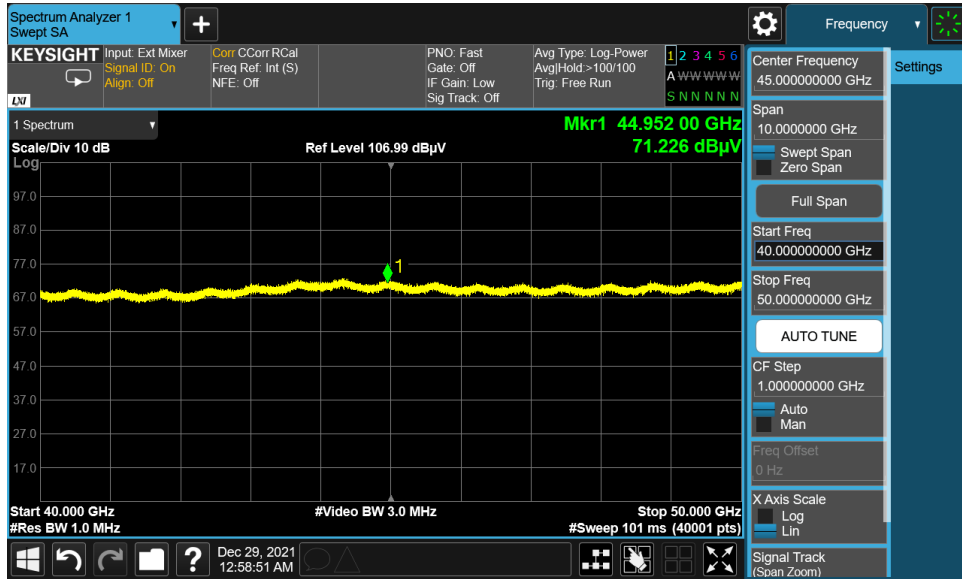
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Remark 3: The EUT has two power supply modes, DC 12V, 2A by AC adapter and Poe + (802.3at) by Poe Adapter. We have tested both power supply modes, but only the worst test results are presented, powered by the AC Adapter.

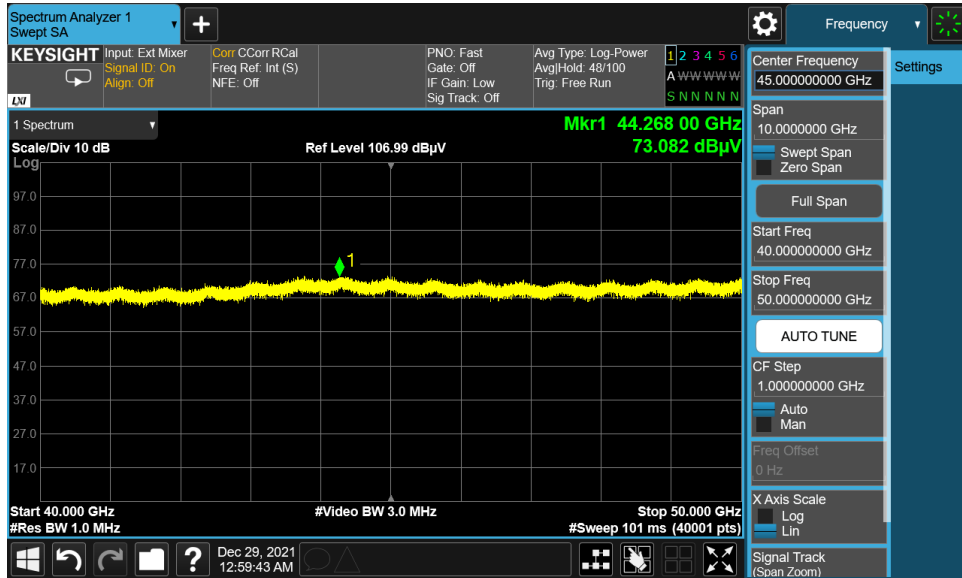


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40-50GHz Vertical



40-50GHz Horizontal



| Frequency (GHz) | Distance (M) | Peak Value (dBuV/m) | AV Limit (dBuV/m) | Polarization | Result |
|-----------------|--------------|---------------------|-------------------|--------------|--------|
| 44.952 | 0.15 | 71.226 | 111.33 | V | PASS |
| 44.268 | 0.15 | 73.028 | 111.33 | H | PASS |



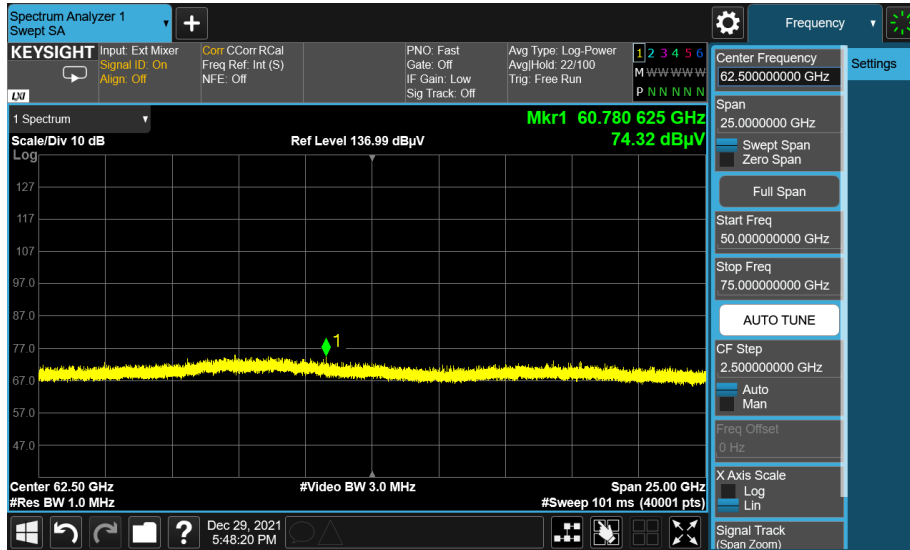
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Compliance Certification Services (Kunshan) Inc.
EMC Laboratory

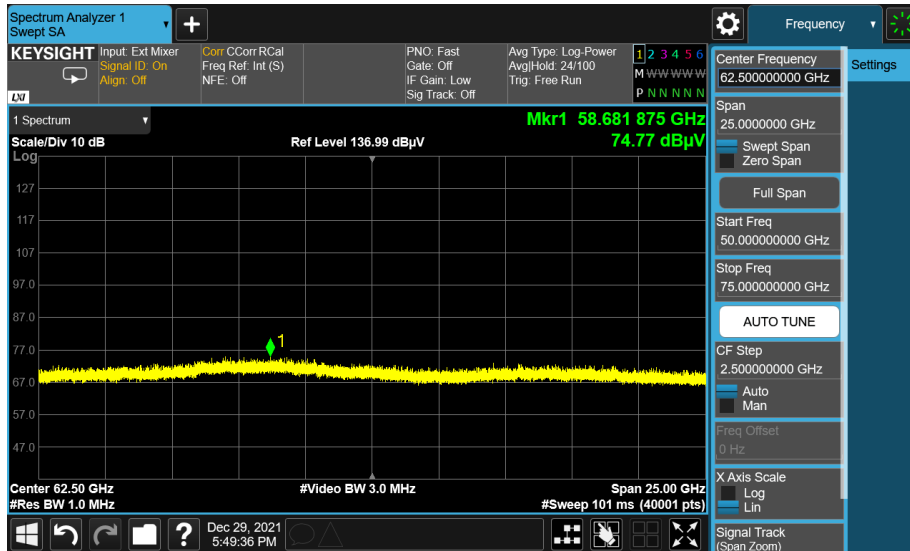
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50-75GHz Vertical



50-75GHz Horizontal



| Frequency (GHz) | Distance (M) | Peak Value (dBuv/m) | AV Limit (dBuv/m) | Polarization | Result |
|-----------------|--------------|---------------------|-------------------|--------------|--------|
| 60.781 | 0.15 | 74.32 | 111.33 | H | PASS |
| 58.682 | 0.15 | 74.77 | 111.33 | V | PASS |

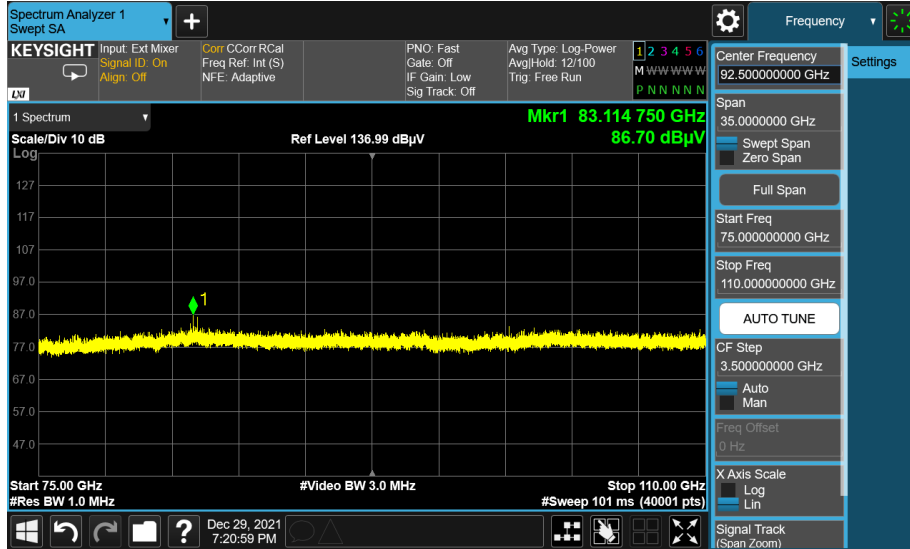


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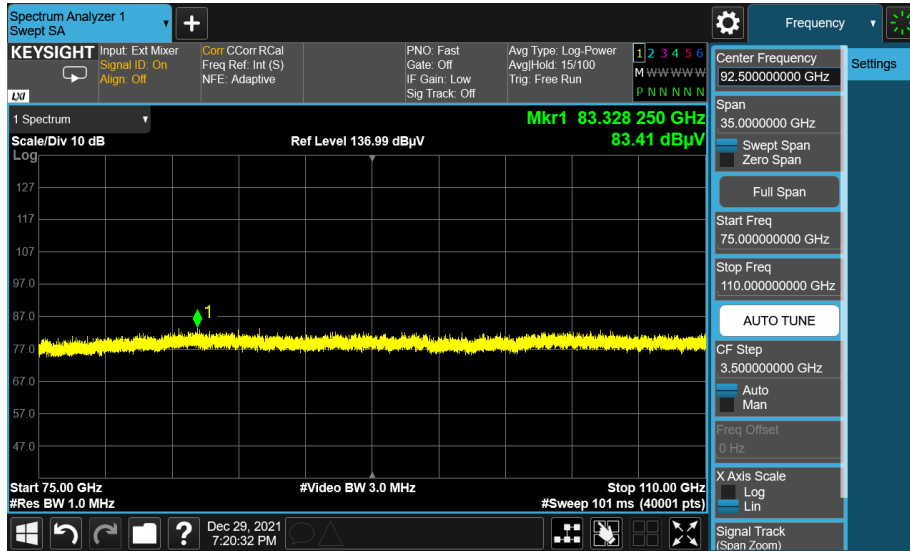
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75-110GHz Vertical



75-110GHz Horizontal



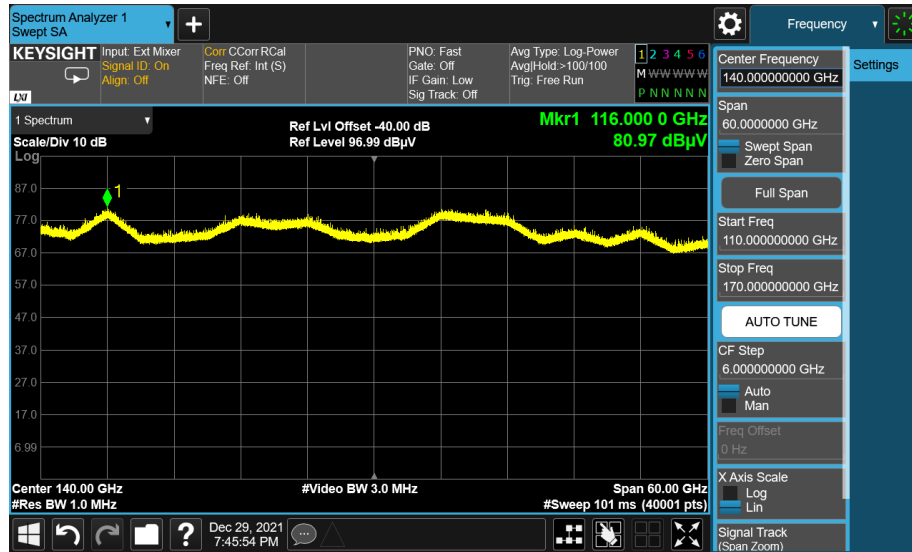
| Frequency (GHz) | Distance (M) | Peak Value (dBuv/m) | AV Limit (dBuv/m) | Polarization | Result |
|-----------------|--------------|---------------------|-------------------|--------------|--------|
| 83.115 | 0.15 | 86.70 | 111.33 | H | PASS |
| 83.328 | 0.15 | 83.41 | 111.33 | V | PASS |



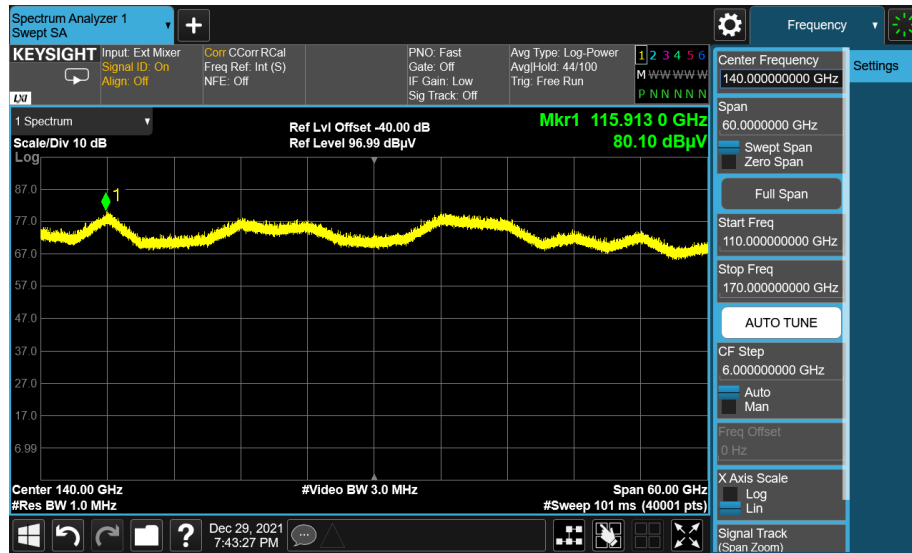
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110-170GHz Vertical



110-170GHz Horizontal



| Frequency (GHz) | Distance (M) | Peak Value (dBuV/m) | AV Limit (dBuV/m) | Polarization | Result |
|-----------------|--------------|---------------------|-------------------|--------------|--------|
| 116.000 | 0.15 | 80.97 | 111.33 | H | PASS |
| 115.913 | 0.15 | 80.10 | 111.33 | V | PASS |

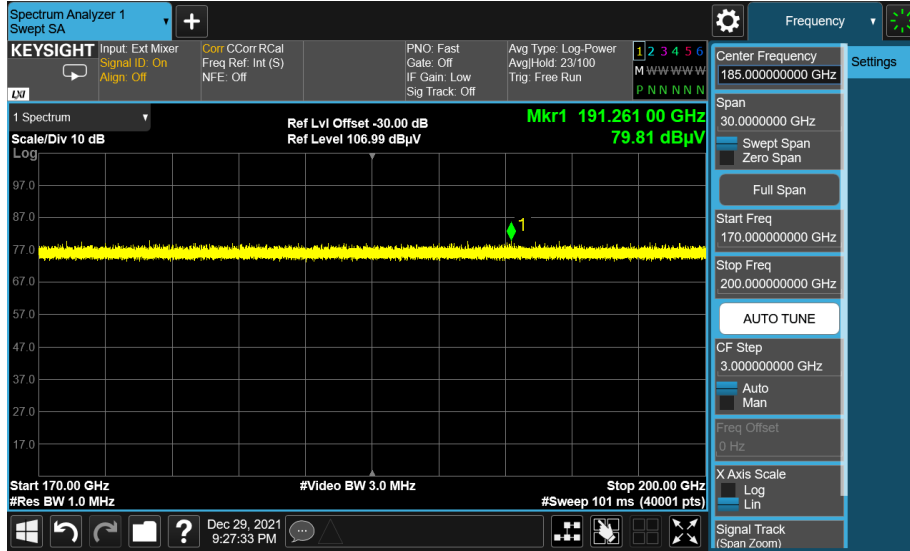


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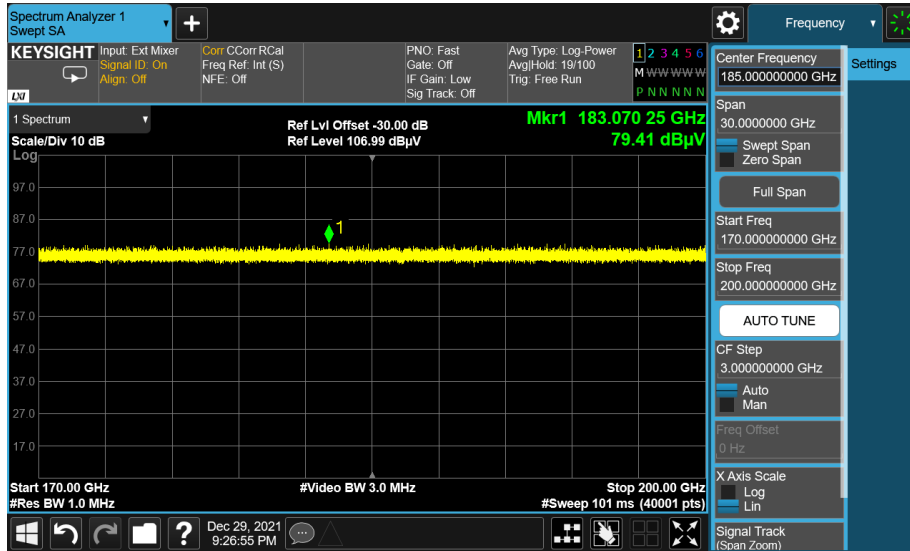
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170-200GHz Vertical



170-200GHz Horizontal



| Frequency (GHz) | Distance (M) | Peak Value (dBuV/m) | AV Limit (dBuV/m) | Polarization | Result |
|-----------------|--------------|---------------------|-------------------|--------------|--------|
| 191.261 | 0.15 | 79.81 | 111.33 | H | PASS |
| 183.070 | 0.15 | 79.41 | 111.33 | V | PASS |



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7.7 Frequency stability

Test Requirement: 47 CFR Part 15, Subpart C 15. 255(f)
 Test Method: ANSI C63.10, Section 9.14
 Limit:

| Frequency (GHz) | Limit |
|-----------------|---|
| 57 - 71 | The signal must be contained within assigned frequency band |

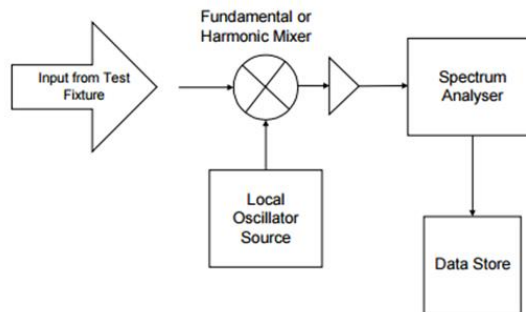
7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode: a: TX mode _ Keep the EUT in continuously transmitting mode powered by AC adapter.

7.7.2 Test Setup Diagram



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7.7.3 Measurement Procedure and Data

1. Temperature conditions:

- a) The RF output port of the EUT was connected to Frequency Meter;
- b) Set the working Frequency in the middle channel;
- c) record the 20°C and nominal voltage frequency value as reference point;
- d) vary the temperature from -40°C to 50°C with step 10°C
- e) when reach a temperature point, keep the temperature balance at least 1 hour to make the product working in this status;
- f) read the frequency at the relative temperature.

2. Voltage conditions:

- a) record the 20°C and nominal voltage frequency value as reference point;
- b) vary the voltage from -15% nominal voltage to +15% voltage;

read the frequency at the relative voltage.



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Frequency Stability vs temperature:

1. Test for 61GHz to 61.5GHz (Channel=61.266GHz)

| Frequency (GHz) | Temperature (°C) | Voltage (V ac) | F _L (GHz) | Limit (GHz) | F _H (GHz) | Limit (GHz) | Result |
|-----------------|------------------|----------------|----------------------|-------------|----------------------|-------------|--------|
| 61 – 61.5 | 50 | 120 | 61.051 | 61 | 61.465 | 61.5 | Pass |
| | 40 | 120 | 61.055 | 61 | 61.471 | 61.5 | Pass |
| | 30 | 120 | 61.049 | 61 | 61.474 | 61.5 | Pass |
| | 20 | 120 | 61.057 | 61 | 61.466 | 61.5 | Pass |
| | 10 | 120 | 61.046 | 61 | 61.473 | 61.5 | Pass |
| | 0 | 120 | 61.053 | 61 | 61.469 | 61.5 | Pass |
| | -10 | 120 | 61.052 | 61 | 61.467 | 61.5 | Pass |
| | -20 | 120 | 61.048 | 61 | 61.470 | 61.5 | Pass |
| | -30 | 120 | 61.055 | 61 | 61.472 | 61.5 | Pass |
| -40 | 120 | 61.049 | 61 | 61.467 | 61.5 | Pass | |

Frequency Stability vs voltage:

1. Test for 61GHz to 61.5GHz (Channel=61.266GHz)

| Frequency (GHz) | Voltage (V ac) | Temperature (°C) | F _L (GHz) | Limit (GHz) | F _H (GHz) | Limit (GHz) | Result |
|-----------------|----------------|------------------|----------------------|-------------|----------------------|-------------|--------|
| 61 – 61.5 | 108 | 20 | 61.053 | 61 | 61.469 | 61.5 | Pass |
| | 120 | 20 | 61.051 | 61 | 61.472 | 61.5 | Pass |
| | 132 | 20 | 61.049 | 61 | 61.470 | 61.5 | Pass |



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8 Test Setup Photographs

Refer to the < Test Setup photos-FCC>.

9 EUT Constructional Details

Refer to the < External Photos > & < Internal Photos >.

- End of the Report -



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