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TEST REPORT

Report No. : CQASZ20191201316E-04

Applicant: SHENZHEN HUBSAN TECHNOLOGY CO., LTD

Address of Applicant: 13th Floor, Bldg 1C, Shenzhen Software Industry Base, Xuefu Road, Nanshan District, Shenzhen, China 518054

Equipment Under Test (EUT):

EUT Name: HUBSAN ZINO 2

Model No.: ZINO 2

Brand Name: HUBSAN

Standards: ETSI EN 300 440 V2.1.1 (2017-03)

Date of Receipt: 2019-12-16

Date of Test: 2019-12-16 to 2020-01-03

Date of Issue: 2020-01-03

Test Result : PASS*

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

Tested By:

Tom Chen

(Tom chen)

Reviewed By:

Aaron Ma

(Aaron Ma)

Approved By:

Jack Ai

(Jack Ai)



The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of COA, this report can't be reproduced except in full.

1 Version

Revision History of Report

| Report No. | Version | Description | Issue Date |
|----------------------|---------|----------------|------------|
| CQASZ20191201316E-04 | Rev.01 | Initial report | 2020-01-03 |

2 Test Summary

| Radio Spectrum Matter (RSM) Part | | | |
|--|--------------------------------|----------------|--------|
| Test item | Test Requirement | Limit | Result |
| Equivalent Isotropically Radiated Power | EN 300 440 V2.1.1 Clause 4.2.2 | Clause 4.2.2.4 | PASS |
| Permitted Range of Operating Frequencies | EN 300 440 V2.1.1 Clause 4.2.3 | Clause 4.2.3.5 | PASS |
| Spurious Emission from Tx | EN 300 440 V2.1.1 Clause 4.2.4 | Clause 4.2.4.4 | PASS |
| Duty Cycle | EN 300 440 V2.1.1 Clause 4.2.5 | Clause 4.2.5.4 | PASS |
| Additional requirements for FHSS equipment | EN 300 440 V2.1.1 Clause 4.2.6 | Clause 4.2.6.4 | N/A |
| Adjacent channel selectivity | EN 300 440 V2.1.1 Clause 4.3.3 | Clause 4.3.3.4 | N/A |
| Blocking or desensitization | EN 300 440 V2.1.1 Clause 4.3.4 | Clause 4.3.4.4 | PASS |
| Spurious Emission from Rx | EN 300 440 V2.1.1 Clause 4.3.5 | Clause 4.3.5.4 | PASS |

Remark:

The tested sample(s) and the sample information are provided by the client.

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

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

RF: In this whole report RF means Radiated Frequency.

CH: In this whole report CH means channel.

Volt: In this whole report Volt means Voltage.

Temp: In this whole report Temp means Temperature.

Humid: In this whole report Humid means humidity.

Press: In this whole report Press means Pressure.

N/A: The EUT is spread spectrum equipment and it belongs to receiver category 3.

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4 General Information

4.1 Client information

| | |
|--------------------------|--|
| Applicant: | SHENZHEN HUBSAN TECHNOLOGY CO., LTD |
| Address of Applicant: | 13th Floor, Bldg 1C, Shenzhen Software Industry Base, Xuefu Road, Nanshan District, Shenzhen, China 518054 |
| Manufacturer: | SHENZHEN HUBSAN TECHNOLOGY CO., LTD |
| Address of Manufacturer: | 13th Floor, Bldg 1C, Shenzhen Software Industry Base, Xuefu Road, Nanshan District, Shenzhen, China 518054 |

4.2 General Description of EUT

| | | |
|----------------------------------|---|---|
| Product Name: | HUBSAN ZINO 2 | |
| Model No.: | ZINO 2 | |
| Trade Mark: | HUBSAN | |
| EUT Supports Radios application: | 5G WIFI: 5150MHz~5250 MHz, 5725MHz~5850 MHz | |
| Power Supply: | remote-control unit | Battery: 3.6V 3350 mAh Li-Po |
| | plane unit | Battery: 15.2 V 3800 mAh Li-Po Power Supply: MODEL: P173D3000 INPUT: 100-240V~50/60Hz 1.2A OUTPUT: 17.3V 3000mA |

4.3 Product Specification subjective to this standard

| | |
|--|---|
| Frequency Range: | 5725MHz~5850MHz |
| Producte Category: | Non specific radio equipment (provider declaration) |
| Receiver category | Receiver category 3 (provider declaration) |
| Modulation Technique: | Spread spectrum |
| Modulation Type: | IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK) |
| Transmitter Operating channel width(OCW) | ≤20MHz (provider declaration) |
| Number of Channels: | 5 (declared by the client) |
| Sample Type: | Portable production |
| Hardware version: | EA04058086-02 |
| Software version: | V0.1.1 |
| Test Software of EUT: | Atheros Radio test 2(manufacturer declare) |
| Antenna Type: | Integral antenna |
| Antenna Gain: | ANT1: 3.0dBi ANT2: 3.0dBi |
| Test voltage: | 15.2 V |

| Operation Frequency Each of Channel | | | | | | | |
|--|-----------|---------|-----------|---------|-----------|---------|-----------|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| For IEEE 802.11a/n-HT20 operation in the 5725 MHz to 5850 MHz band | | | | | | | |
| 149 | 5745 MHz | 153 | 5765 MHz | 157 | 5785 MHz | 161 | 5805 MHz |
| 165 | 5825 MHz | -- | -- | -- | -- | -- | -- |

Using test software was control EUT work in continuous transmitter and receiver mode.and select test channel as below:

| Mode | Tx/Rx Frequency | Test RF Channel Lists | | |
|--------------|----------------------|-----------------------|-------------|-------------|
| | | Lowest(L) | Middle(M) | Highest(H) |
| IEEE 802.11a | 5725 MHz to 5850 MHz | Channel 149 | Channel 157 | Channel 165 |
| | | 5745 MHz | 5785 MHz | 5825 MHz |

4.4 Description of Support Units

The EUT has been tested with associated equipment below.

1) support equipment

| Description | Manufacturer | Model No. | Certification | Supplied by |
|-------------|--------------|-----------|---------------|-------------|
| / | / | / | / | / |

2) Cable

| Cable No. | Description | Manufacturer | Cable Type/Length | Supplied by |
|-----------|-------------|--------------|-------------------|-------------|
| / | / | / | / | / |

4.5 Test Location

All tests were performed at:

Shenzhen Huaxia Testing Technology Co., Ltd.,

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

4.6 Deviation from Standards

None.

4.7 Abnormalities from Standard Conditions

None.

4.8 Other Information Requested by the Customer

None.

4.9 Measurement Uncertainty (95% confidence levels, k=2)

| No. | Item | Measurement Uncertainty |
|-----|------------------------------------|-------------------------|
| 1 | Radiated Emission (Below 1GHz) | 5.12dB |
| 2 | Radiated Emission (Above 1GHz) | 4.60dB |
| 3 | Conducted Disturbance (0.15~30MHz) | 3.34dB |
| 4 | Radio Frequency | 3×10^{-8} |
| 5 | Duty cycle | 0.6 %. |
| 6 | Occupied Bandwidth | 1.1% |
| 7 | RF conducted power | 0.86dB |
| 8 | RF power density | 0.74 |
| 9 | Conducted Spurious emissions | 0.86dB |
| 10 | Temperature test | 0.8℃ |
| 11 | Humidity test | 2.0% |
| 12 | Supply voltages | 0.5 %. |
| 13 | Frequency Error | 5.5 Hz |

5 Equipment List

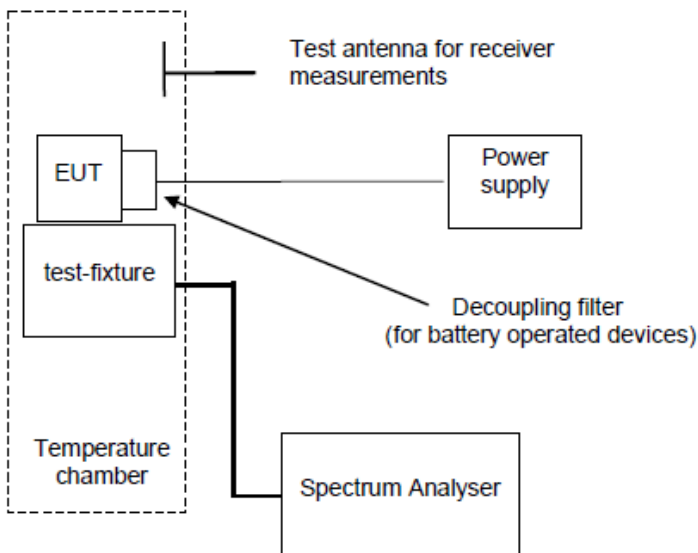
| Equipment | Manufacturer | Model No | Inventory No | Cal Date | Cal Due Date |
|--------------------------------------|-----------------|------------------------|--------------|------------|--------------|
| Horn Antenna | R&S | HF906 | CQA-012 | 2019/9/26 | 2020/9/25 |
| Bilog Antenna | R&S | HL562 | CQA-011 | 2019/9/26 | 2020/9/25 |
| EMI Test Receiver | R&S | ESR7 | CQA-005 | 2019/10/25 | 2020/10/24 |
| Spectrum analyzer | R&S | FSU26 | CQA-038 | 2019/10/25 | 2020/10/24 |
| Spectrum analyzer | R&S | FSV40 | CQA-075 | 2019/6/11 | 2020/6/10 |
| Preamplifier | MITEQ | AFS4-00010300-18-10P-4 | 4012339 | 2019/10/25 | 2020/10/24 |
| Preamplifier | MITEQ | AMF-6D-02001800-29-20P | CQA-036 | 2019/10/25 | 2020/10/24 |
| Preamplifier | EMCI | EMC184055SE | CQA-089 | 2019/9/25 | 2020/9/24 |
| Universal Radio Communication Tester | Rohde & Schwarz | CMW500 | CQA-022 | 2019/9/25 | 2020/9/24 |
| high-low temperature chamber | Auchno | OJN-9606 | CQA-S003 | 2019/9/25 | 2020/9/24 |
| Signal generator | R&S | SME06 | CQA-024 | 2019/9/26 | 2020/9/25 |
| Vector signal generator | R&S | SMBV100A | CQA-039 | 2019/9/25 | 2020/9/24 |
| DC power | KEYSIGHT | E3631A | CQA-028 | 2019/9/26 | 2020/9/25 |
| RF Control Unit | Tonsced | JS0806-2 | CQA-057 | 2019/9/26 | 2020/9/25 |
| Coaxial Cable (Above 1GHz) | CQA | N/A | C007 | 2019/9/26 | 2020/9/25 |
| Coaxial Cable (Below 1GHz) | CQA | N/A | C013 | 2019/9/26 | 2020/9/25 |
| RF Cable (9KHz~40GHz) | CQA | N/A | C005 | 2019/9/26 | 2020/9/25 |

6 Radio Technical Requirements Specification in EN 300 440

6.1 Transmitter Requirements

6.1.1 Equivalent Isotropically Radiated Power

6.1.1.1 -6dB Bandwidth

| | | | |
|--------------------------|--|-------------|-------------------|
| Test Requirement: | EN 300 440 Clause 4.2.2.3.2 | | |
| Ambient: | Temp.: 24.5°C | Humid.: 56% | Press.: 1015 mbar |
| Test Status: | Test the unmodulated carrier at the highest, middle and the lowest channels under normal and extreme conditions. | | |
| Equipment Used: | Refer to section 5 for details. | | |
| Test Setup: |  | | |

| | |
|-------------------------------|-------------------------|
| Bandwidth Requirement: | ≥1MHz channel bandwidth |
| Test Result: | N/A |

Test Data:

ANT1:

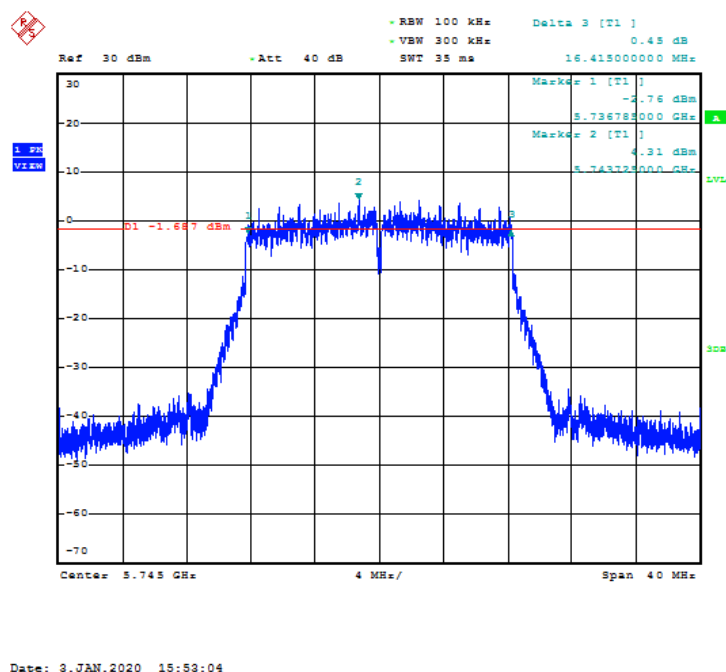
| Channel (Frequency) | -6dB Bandwidth(MHz) | Requirement (MHz) | Conclusion |
|---------------------|---------------------|-------------------|------------|
| CH149 (5745MHz) | 16.415 | ≥1MHz | N/A |
| CH157 (5785MHz) | 16.360 | ≥1MHz | N/A |
| CH165 (5825MHz) | 16.395 | ≥1MHz | N/A |

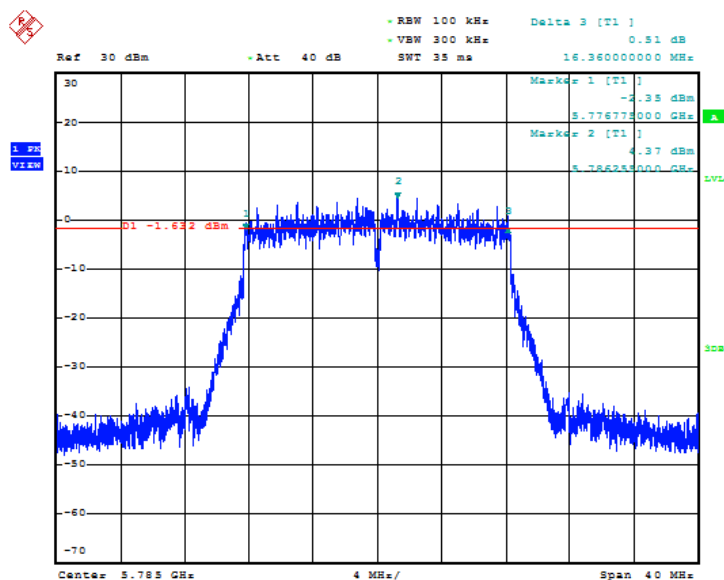
ANT2:

| Channel (Frequency) | -6dB Bandwidth(MHz) | Requirement (MHz) | Conclusion |
|---------------------|---------------------|-------------------|------------|
| CH149 (5745MHz) | 16.370 | ≥1MHz | N/A |
| CH157 (5785MHz) | 16.405 | ≥1MHz | N/A |
| CH165 (5825MHz) | 16.345 | ≥1MHz | N/A |

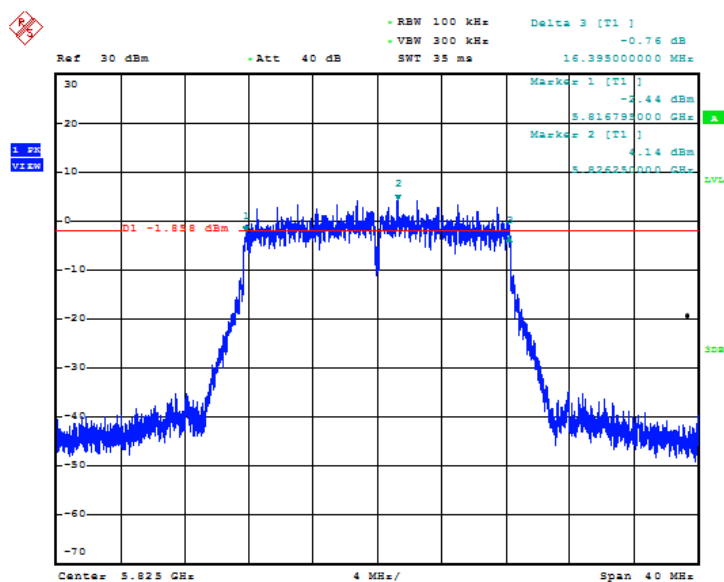
Test plot as follows:

ANT1:



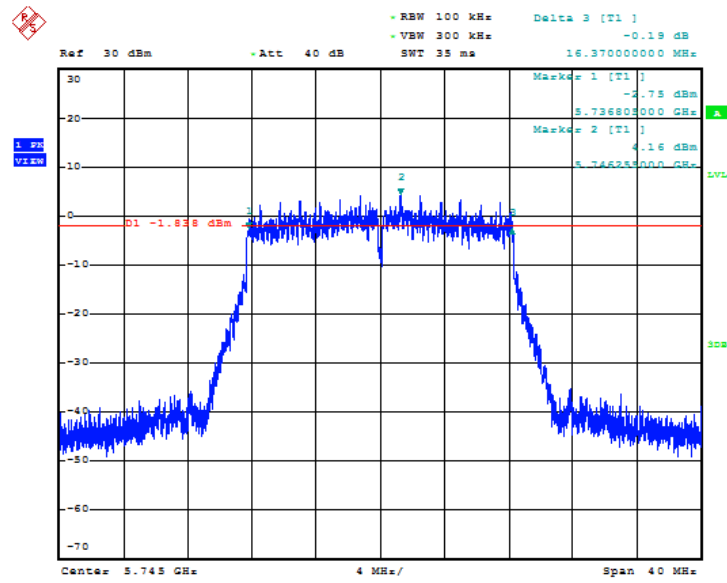


Date: 3.JAN.2020 16:06:35

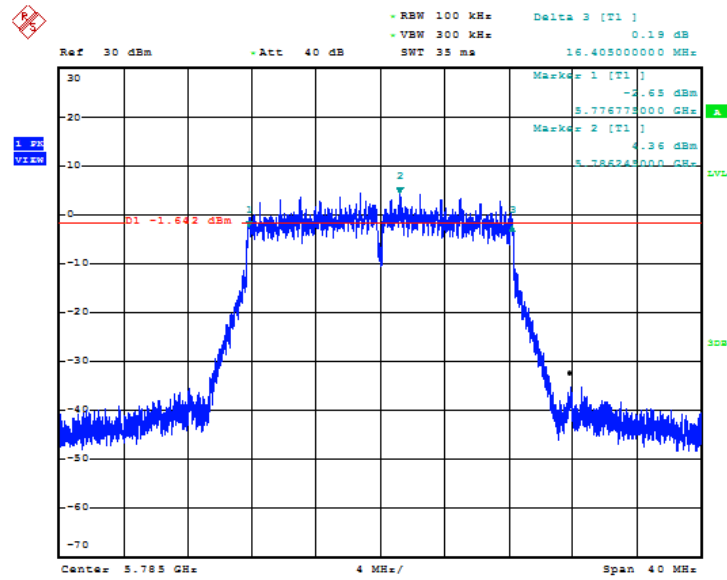


Date: 3.JAN.2020 16:11:00

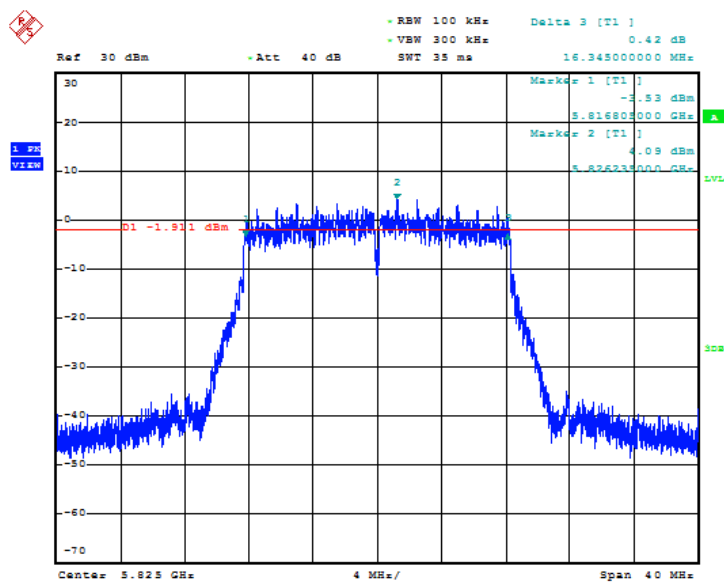
ANT2:



Date: 3.JAN.2020 16:30:15



Date: 3.JAN.2020 16:35:56



Date: 8.JAN.2020 16:52:03

6.1.1.2 Duty Cycle

Test Requirement:

EN 300 440 Clause 4.2.2.3.2

Ambient:

Temp.: 24.5°C

Humid.: 56°C

Press.: 1015 mbar

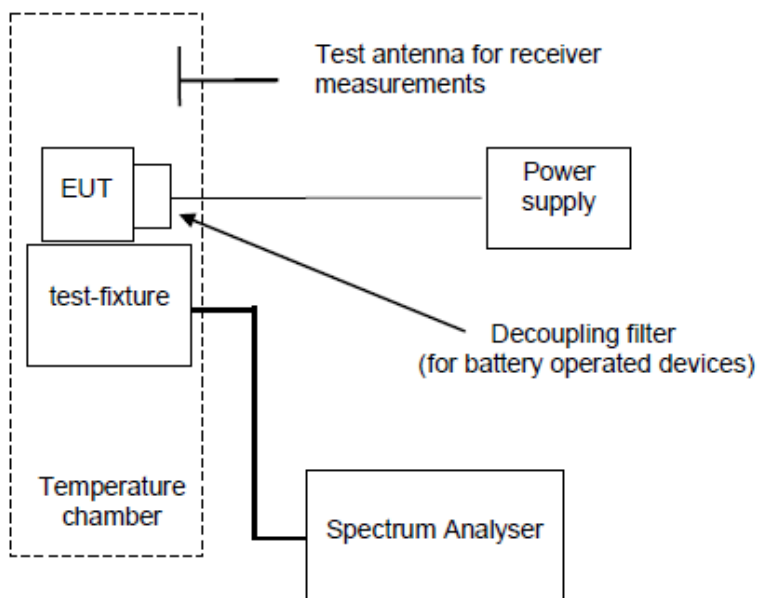
Test Status:

Test the unmodulated carrier at the highest, middle and the lowest channels under normal and extreme conditions.

Equipment Used:

Refer to section 5 for details.

Test Setup:



Duty Cycle Requirement:

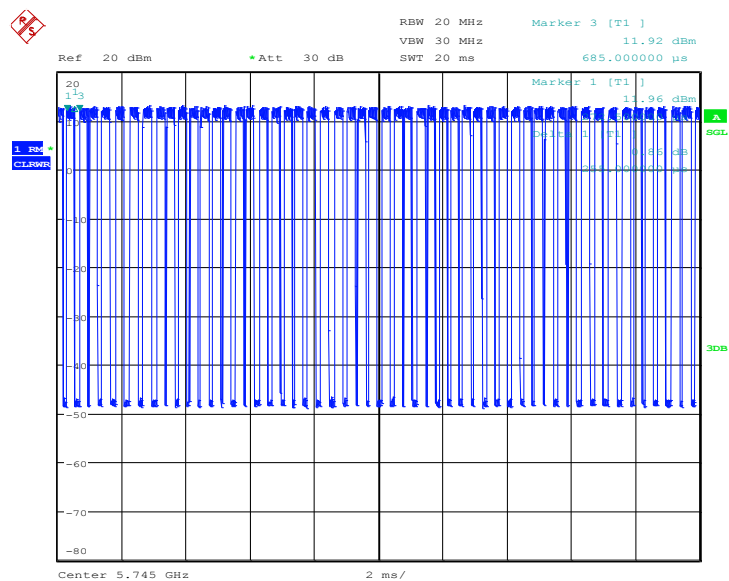
N/A

Test Result:

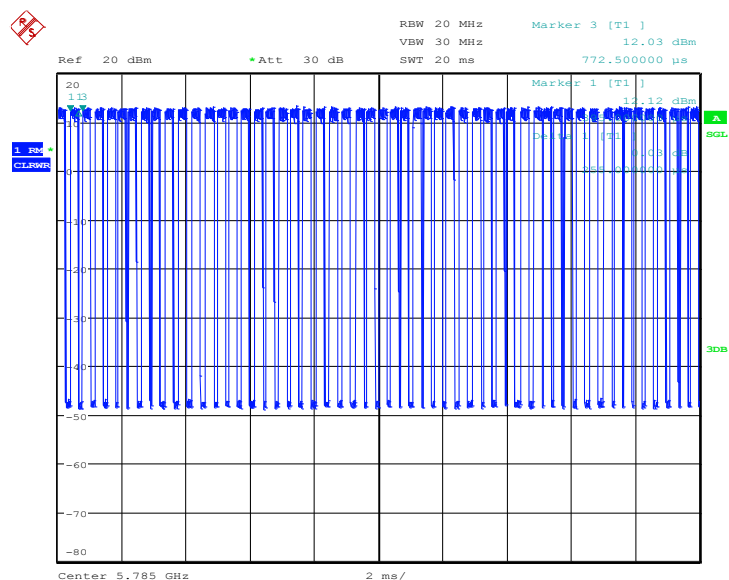
N/A

Test plot as follows:

ANT1:



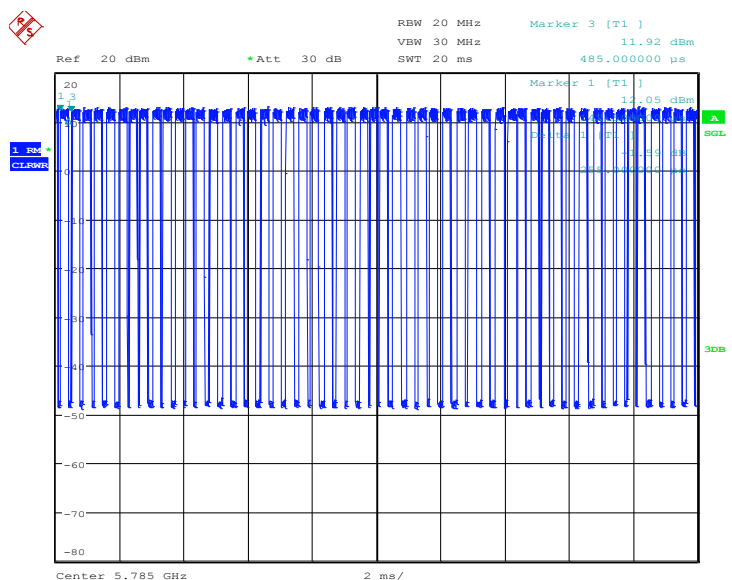
Date: 3.JAN.2020 15:49:48



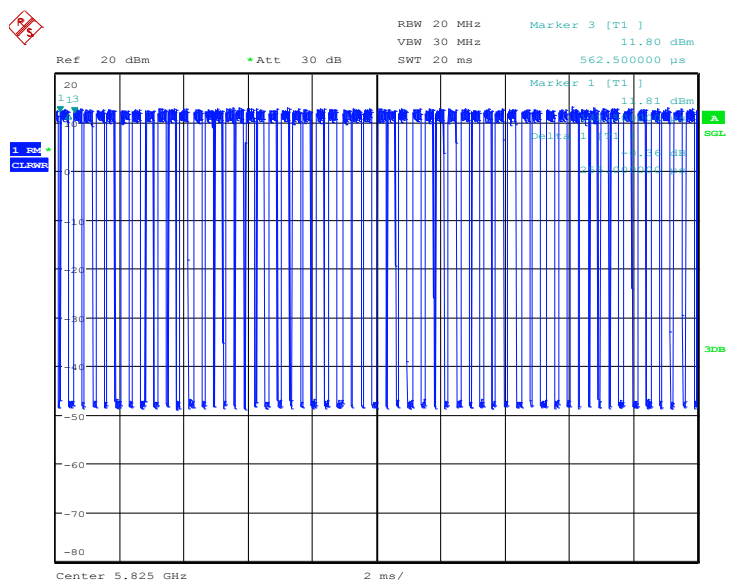
Date: 3.JAN.2020 16:03:03



Date: 3.JAN.2020 16:23:14



Date: 3.JAN.2020 16:32:38



Date: 3.JAN.2020 16:49:46

6.1.1.3 Equivalent Isotropically Radiated Power

Test Requirement: EN 300 440 Clause 4.2.2

Ambient: Temp.: 22.5°C Humid.: 57% Press.: 1015 mbar

Test Status: Test the unmodulated carrier at the highest, middle and the lowest channels under normal and extreme conditions.

Equipment Used: Refer to section 5 for details.

Test Setup:

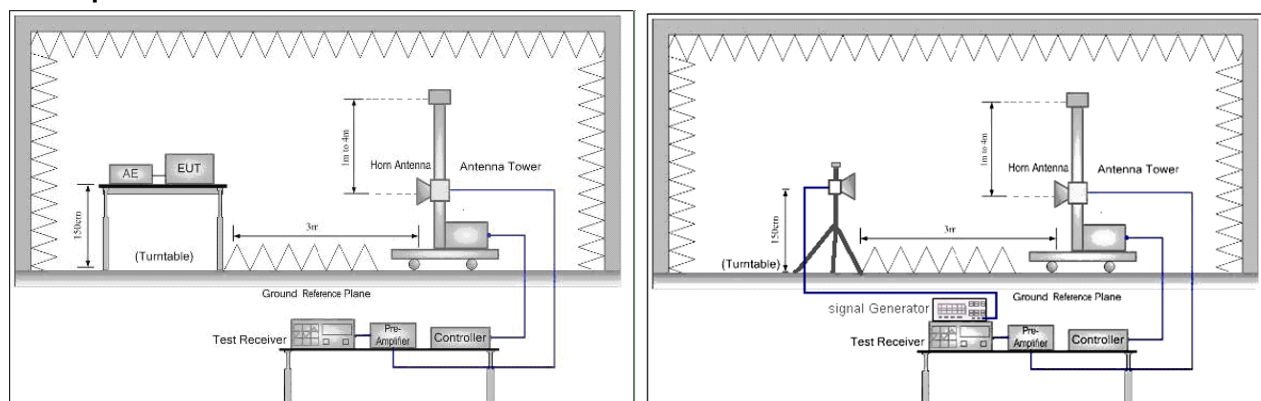
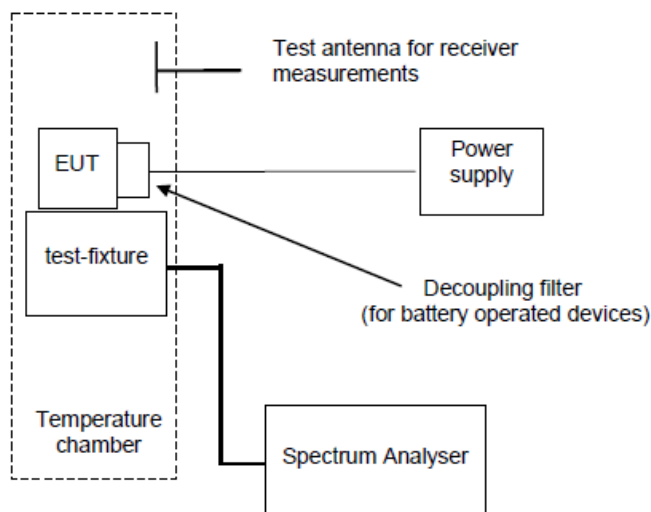


Figure 1. Above 1GHz(Normal Condition)

Test Setup:

(Extreme Condition)



Test Procedure:

Test procedure as below:

- 1) The EUT was powered ON and placed on a 1.5m high table at a 3 meter fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- 2) The EUT was set 3 meters (above 18GHz the distance is 1 meter) away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the

transmitter.

- 6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
- 7) The output power into the substitution antenna was then measured.
- 8) Steps 6) and 7) were repeated with both antennas polarized.
- 9) Calculate power in dBm by the following formula:

$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

Where: Pg is the generator output power into the substitution antenna.

- 10) Test the EUT in the lowest channel ,middle channel, the Highest channel
- 11) Repeat above procedures until all frequencies measured was complete.

Limit:

14dBm

Test result:

PASS

Test Data:

ANT1:

| Test Conditions | | Mode | Channel (Frequency) | EIRP Value (dBm) | Limit (dBm) | Result |
|--|-------------------------|------|------------------------|---------------------|----------------|--------|
| Temp (°C) | Volt (V DC) | | | | | |
| Normal (22.5) | V _{norm} : 3.6 | OFDM | CH149(5745MHz) | 10.68 | 14 | PASS |
| | | | CH157(5785MHz) | 10.65 | 14 | PASS |
| | | | CH165(5825MHz) | 10.63 | 14 | PASS |
| -20 | V _{min} : 3.4 | OFDM | CH149(5745MHz) | 10.65 | 14 | PASS |
| | | | CH157(5785MHz) | 10.66 | 14 | PASS |
| | | | CH165(5825MHz) | 10.64 | 14 | PASS |
| -20 | V _{max} : 4.2 | OFDM | CH149(5745MHz) | 10.60 | 14 | PASS |
| | | | CH157(5785MHz) | 10.59 | 14 | PASS |
| | | | CH165(5825MHz) | 10.63 | 14 | PASS |
| 55 | V _{min} : 3.4 | OFDM | CH149(5745MHz) | 10.58 | 14 | PASS |
| | | | CH157(5785MHz) | 10.62 | 14 | PASS |
| | | | CH165(5825MHz) | 10.65 | 14 | PASS |
| 55 | V _{max} : 4.2 | OFDM | CH149(5745MHz) | 10.60 | 14 | PASS |
| | | | CH157(5785MHz) | 10.62 | 14 | PASS |
| | | | CH165(5825MHz) | 10.67 | 14 | PASS |
| Remark: EIRP= Read EIRP value (dBm) + 10 log (1/x) X=duty cycle | | | | | | |

ANT2:

| Test Conditions | | Mode | Channel (Frequency) | EIRP Value (dBm) | Limit (dBm) | Result |
|--|-------------------------|------|------------------------|---------------------|----------------|--------|
| Temp (°C) | Volt (V DC) | | | | | |
| Normal (22.5) | V _{norm} : 3.6 | OFDM | CH149(5745MHz) | 10.52 | 14 | PASS |
| | | | CH157(5785MHz) | 10.48 | 14 | PASS |
| | | | CH165(5825MHz) | 10.48 | 14 | PASS |
| -20 | V _{min} : 3.4 | OFDM | CH149(5745MHz) | 10.50 | 14 | PASS |
| | | | CH157(5785MHz) | 10.46 | 14 | PASS |
| | | | CH165(5825MHz) | 10.53 | 14 | PASS |
| -20 | V _{max} : 4.2 | OFDM | CH149(5745MHz) | 10.55 | 14 | PASS |
| | | | CH157(5785MHz) | 10.52 | 14 | PASS |
| | | | CH165(5825MHz) | 10.49 | 14 | PASS |
| 55 | V _{min} : 3.4 | OFDM | CH149(5745MHz) | 10.60 | 14 | PASS |
| | | | CH157(5785MHz) | 10.56 | 14 | PASS |
| | | | CH165(5825MHz) | 10.53 | 14 | PASS |
| 55 | V _{max} : 4.2 | OFDM | CH149(5745MHz) | 10.57 | 14 | PASS |
| | | | CH157(5785MHz) | 10.51 | 14 | PASS |
| | | | CH165(5825MHz) | 10.52 | 14 | PASS |
| Remark: EIRP= Read EIRP value (dBm) + 10 log (1/x) X=duty cycle | | | | | | |

6.1.2 Permitted Range of Operating Frequencies

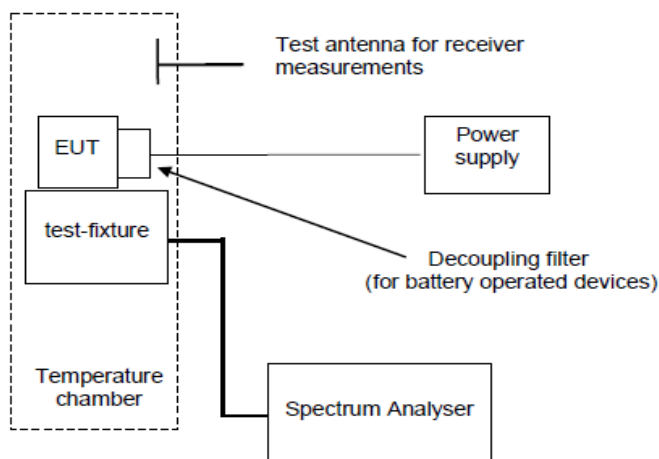
Test Requirement: EN 300 440 Clause 4.2.3

Ambient: Temp.: 25.5°C Humid.: 59% Press.: 1005 mbar

Test Status: Test the unmodulated carrier at the highest, middle and the lowest channels under normal and extreme conditions.

Equipment Used: Refer to section 5 for details.

Test Setup:



Limit: $F_L > 5.725\text{GHz}$ and $F_H < 5.875\text{GHz}$ (-30dBm)

Test result: PASS

Test Data:

ANT1:

| Test Conditions | | Mode | CH(Frequency) | Result(MHz) | Limit (MHz) | Conclusion |
|--|-------------------------|------|----------------|-------------|-------------|------------|
| Temp (°C) | Volt (V DC) | | | | | |
| Normal (24.5) | V _{norm} : 3.6 | OFDM | CH149(5745MHz) | 5734.14 | >5725 | PASS |
| | | | CH165(5825MHz) | 5836.12 | <5875 | PASS |
| -20 | V _{min} : 3.4 | OFDM | CH149(5745MHz) | 5735.85 | >5725 | PASS |
| | | | CH165(5825MHz) | 5836.04 | <5875 | PASS |
| -20 | V _{max} : 4.2 | OFDM | CH149(5745MHz) | 5734.59 | >5725 | PASS |
| | | | CH165(5825MHz) | 5835.36 | <5875 | PASS |
| 55 | V _{min} : 3.4 | OFDM | CH149(5745MHz) | 5735.02 | >5725 | PASS |
| | | | CH165(5825MHz) | 5836.57 | <5875 | PASS |
| 55 | V _{max} : 4.2 | OFDM | CH149(5745MHz) | 5734.26 | >5725 | PASS |
| | | | CH165(5825MHz) | 5835.39 | <5875 | PASS |
| Remark: Actual Test Line=-30dBm-10 log (1/x) X=duty cycle | | | | | | |

ANT2:

| Test Conditions | | Mode | CH(Frequency) | Result(MHz) | Limit (MHz) | Conclusion |
|--|-------------------------|------|----------------|-------------|-------------|------------|
| Temp (℃) | Volt (V DC) | | | | | |
| Normal (24.5) | V _{norm} : 3.6 | OFDM | CH149(5745MHz) | 5735.82 | >5725 | PASS |
| | | | CH165(5825MHz) | 5835.45 | <5875 | PASS |
| -20 | V _{min} : 3.4 | OFDM | CH149(5745MHz) | 5735.16 | >5725 | PASS |
| | | | CH165(5825MHz) | 5834.35 | <5875 | PASS |
| -20 | V _{max} : 4.2 | OFDM | CH149(5745MHz) | 5733.95 | >5725 | PASS |
| | | | CH165(5825MHz) | 5836.84 | <5875 | PASS |
| 55 | V _{min} : 3.4 | OFDM | CH149(5745MHz) | 5734.96 | >5725 | PASS |
| | | | CH165(5825MHz) | 5835.26 | <5875 | PASS |
| 55 | V _{max} : 4.2 | OFDM | CH149(5745MHz) | 5734.64 | >5725 | PASS |
| | | | CH165(5825MHz) | 5835.06 | <5875 | PASS |
| Remark: Actual Test Line=-30dBm-10 log (1/x) X=duty cycle | | | | | | |

6.1.3 Spurious Emissions

Test Requirement: EN 300 440 Clause 4.2.4

Ambient: Temp.: 25.9°C Humid.: 44% Press.: 1005 mbar
Test Status: Test the unmodulated carrier at the highest, middle and the lowest channels under normal and extreme conditions.

Receiver Setup:

| Frequency range | Measuring receiver bandwidth | Detector mode |
|-----------------|------------------------------|---------------|
| 25MHz-1000MHz | 120kHz | QP |
| 1GHz-40GHz | 1MHz | Peak |

Equipment Used: Refer to section 5 for details.

Test Setup:

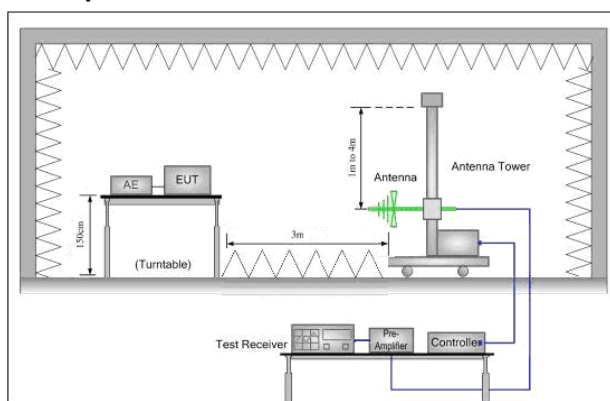


Figure 1. 25MHz to 1GHz

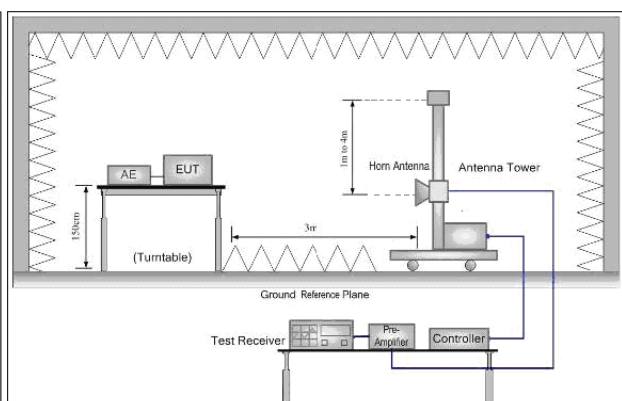


Figure 2. Above 1GHz

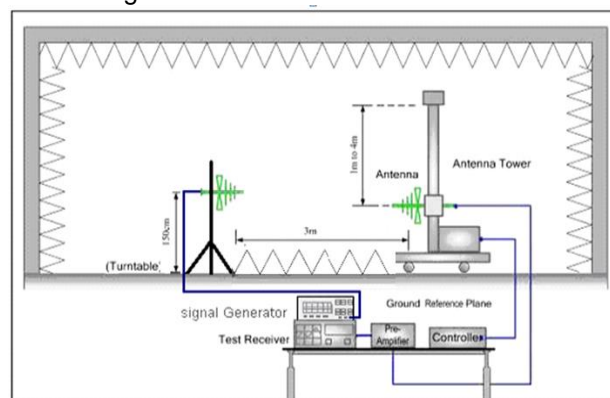


Figure 1. 25MHz to 1GHz

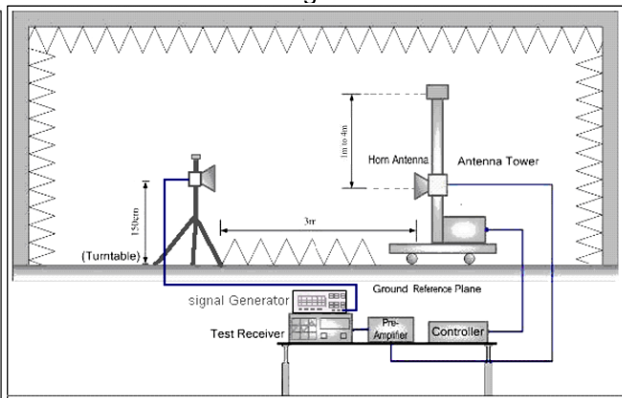


Figure 2. Above 1GHz

Test Procedure:

- 1 Scan from 25MHz to 40GHz; find the maximum radiation frequency to measure.
- 2 The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Test procedure as below:

- 1) The EUT was powered ON and placed on a 1.5m high table at a 3 meter fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- 2) The EUT was set 3 meters (above 18GHz the distance is 1 meter) away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength

measurement was made.

- 4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
- 6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
- 7) The output power into the substitution antenna was then measured.
- 8) Steps 6) and 7) were repeated with both antennas polarized.
- 9) Calculate power in dBm by the following formula:

$$\text{ERP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$

$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

Where: Pg is the generator output power into the substitution antenna.

Repeat above procedures until all frequencies measured was complete.

Limit:

| | | | |
|------------------|--|---------------------------------|---------------------------|
| Frequency ranges | 47 MHz to 74 MHz 87.5 MHz to 108 MHz | Other Frequencies ≤ 1000 MHz | Frequencies > 1000 MHz |
| state | 174 MHz to 230 MHz 470 MHz to 862 MHz | | |
| Operating | 4 nW | 250 nW | 1 μW |
| Standby | 2 nW | 2 nW | 20 nW |

Test result:

PASS

Test Data:

ANT1:

| Lowest channel (5745MHz) | | | | | | | |
|--------------------------|-------------|---------------|-------------------------------|-------------|-----------------|--------|------------------|
| Frequency (MHz) | Height (cm) | Azimuth (deg) | Spurious Emission Level (dBm) | Limit (dBm) | Over Limit (dB) | Result | Antenna Polaxis. |
| 11490 | 150 | 325 | -42.19 | -30 | -12.19 | Pass | H |
| 11490 | 150 | 274 | -44.29 | -30 | -14.29 | Pass | V |
| 17235 | 150 | 349 | -44.67 | -30 | -14.67 | Pass | H |
| 17235 | 150 | 325 | -42.19 | -30 | -12.19 | Pass | V |

| Highest channel (5825MHz) | | | | | | | |
|---------------------------|-------------|---------------|-------------------------------|-------------|-----------------|--------|------------------|
| Frequency (MHz) | Height (cm) | Azimuth (deg) | Spurious Emission Level (dBm) | Limit (dBm) | Over Limit (dB) | Result | Antenna Polaxis. |
| 11650 | 150 | 77 | -44.34 | -30 | -14.34 | Pass | H |
| 11650 | 150 | 22 | -44.92 | -30 | -14.92 | Pass | V |
| 17475 | 150 | 170 | -43.42 | -30 | -13.42 | Pass | H |
| 17475 | 150 | 178 | -42.23 | -30 | -12.23 | Pass | V |

| Standby mode | | | | | | | |
|-----------------|-------------|---------------|-------------------------------|-------------|-----------------|--------|------------------|
| Frequency (MHz) | Height (cm) | Azimuth (deg) | Spurious Emission Level (dBm) | Limit (dBm) | Over Limit (dB) | Result | Antenna Polaxis. |
| 422.47 | 150 | 339 | -64.50 | -57 | -7.50 | Pass | H |
| 422.47 | 150 | 200 | -65.86 | -57 | -8.86 | Pass | V |
| 675.04 | 150 | 161 | -65.38 | -57 | -8.38 | Pass | H |
| 675.04 | 150 | 54 | -64.88 | -57 | -7.88 | Pass | V |
| 1023.88 | 150 | 152 | -56.75 | -47 | -9.75 | Pass | H |
| 1023.88 | 150 | 104 | -55.33 | -47 | -8.33 | Pass | V |
| 1287.68 | 150 | 318 | -55.57 | -47 | -8.57 | Pass | H |
| 1287.68 | 150 | 167 | -57.62 | -47 | -10.62 | Pass | V |

ANT2:

| Lowest channel (5745MHz) | | | | | | | |
|---------------------------------|-------------|---------------|-------------------------------|-------------|-----------------|--------|------------------|
| Frequency (MHz) | Height (cm) | Azimuth (deg) | Spurious Emission Level (dBm) | Limit (dBm) | Over Limit (dB) | Result | Antenna Polaxis. |
| 11490 | 150 | 170 | -44.27 | -30 | -14.27 | Pass | H |
| 11490 | 150 | 276 | -42.01 | -30 | -12.01 | Pass | V |
| 17235 | 150 | 82 | -42.08 | -30 | -12.08 | Pass | H |
| 17235 | 150 | 246 | -42.65 | -30 | -12.65 | Pass | V |

| Highest channel (5825MHz) | | | | | | | |
|----------------------------------|-------------|---------------|-------------------------------|-------------|-----------------|--------|------------------|
| Frequency (MHz) | Height (cm) | Azimuth (deg) | Spurious Emission Level (dBm) | Limit (dBm) | Over Limit (dB) | Result | Antenna Polaxis. |
| 11650 | 150 | 237 | -42.64 | -30 | -12.64 | Pass | H |
| 11650 | 150 | 352 | -43.35 | -30 | -13.35 | Pass | V |
| 17475 | 150 | 324 | -43.51 | -30 | -13.51 | Pass | H |
| 17475 | 150 | 18 | -43.38 | -30 | -13.38 | Pass | V |

| Standby mode | | | | | | | |
|---------------------|-------------|---------------|-------------------------------|-------------|-----------------|--------|------------------|
| Frequency (MHz) | Height (cm) | Azimuth (deg) | Spurious Emission Level (dBm) | Limit (dBm) | Over Limit (dB) | Result | Antenna Polaxis. |
| 426.48 | 150 | 60 | -64.08 | -57 | -7.08 | Pass | H |
| 426.48 | 150 | 313 | -64.98 | -57 | -7.98 | Pass | V |
| 697.61 | 150 | 178 | -65.14 | -57 | -8.14 | Pass | H |
| 697.61 | 150 | 92 | -64.95 | -57 | -7.95 | Pass | V |
| 1034.04 | 150 | 314 | -57.40 | -47 | -10.40 | Pass | H |
| 1034.04 | 150 | 78 | -57.14 | -47 | -10.14 | Pass | V |
| 1281.44 | 150 | 140 | -55.41 | -47 | -8.41 | Pass | H |
| 1281.44 | 150 | 240 | -55.86 | -47 | -8.86 | Pass | V |

Remark:

The disturbance above 1GHz /below 1GHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

6.2 Receiver Requirements

| Receiver Classification, Table 5 of EN 300 440. | | |
|---|---------------------------|---|
| Receiver category | Relevant receiver clauses | Risk assessment of receiver performance |
| 1 | 4.3.3, 4.3.4 and 4.3.5 | Highly reliable SRD communication media; e.g. serving human life inherent systems (may result in a physical risk to a person). |
| 2 | 4.3.4 and 4.3.5 | Medium reliable SRD communication media e.g. causing Inconvenience to persons, which cannot simply be overcome by other means. |
| 3 | 4.3.4 and 4.3.5 | Standard reliable SRD communication media e.g. Inconvenience to persons, which can simply be overcome by other means (e.g. manual). |

The EUT (Receiver part) belong to Class 3.

6.2.1 Blocking or Desensitization

Test Requirement: EN 300 440 Clause 4.3.4

Test Results: Not applicable, since the test applied to class 1 or class 2 receivers only. Please refer to clause 4.3.1 of EN 300 440.

Test Requirement: EN 300 440 Clause 4.3.4

EUT Operation:

Ambient: Temp.: 25.5°C

Humid.: 59%

Press.: 1005 mbar

Test Status: Keep the Rx operating with receiver mode under normal test conditions.

Far Field Calculation Formula

Test Setup:

$$E = \frac{\sqrt{30PG(\theta, \phi)}}{r}$$

G = antenna gain relative to an isotropic antenna
 θ, ϕ = elevation and azimuth angles to point of investigation
 r = distance from observation point to the antenna

Equipment Used: Refer to section 6 for details.

Limits for blocking or desensitization

| Receiver category | Limit |
|-------------------|-------------|
| 1 | -30 dBm + k |
| 2 | -45 dBm + k |
| 3 | -60 dBm + k |

Limit:

The correction factor, k, is as follows:

$$k = -20 \log f - 10 \log BW$$

Where:

- f is the frequency in GHz;
- BW is the channel bandwidth in MHz.

The factor k is limited within the following:

$$0 < k < 40 \text{ dB.}$$

Test result: PASS

Test data:

| Receiver category | Bandwidth | Channel | Blocking test frequency | Test Value | Limit | Result |
|-------------------|-----------|---------|---|------------|--------|--------|
| 3 | 1MHz | 5745MHz | 50 times upper band edge of the receive channel | -55.05 | -87.34 | PASS |
| | | | 20 times upper band edge of the receive channel | -53.41 | | PASS |
| | | | 10 times upper band edge of the receive channel | -53.85 | | PASS |
| | | | 10 times lower band edge of the receive channel | -54.84 | | PASS |
| | | | 20 times lower band edge of the receive channel | -53.26 | | PASS |
| | | | 50 times lower band edge of the receive channel | -53.65 | | PASS |
| | | 5785MHz | 50 times upper band edge of the receive channel | -50.85 | -87.45 | PASS |
| | | | 20 times upper band edge of the receive channel | -51.23 | | PASS |
| | | | 10 times upper band edge of the receive channel | -50.55 | | PASS |
| | | | 10 times lower band edge of the receive channel | -53.48 | | PASS |
| | | | 20 times lower band edge of the receive channel | -52.95 | | PASS |
| | | | 50 times lower band edge of the receive channel | -53.85 | | PASS |
| | | 5825MHz | 50 times upper band edge of the receive channel | -54.21 | -87.48 | PASS |
| | | | 20 times upper band edge of the receive channel | -54.02 | | PASS |
| | | | 10 times upper band edge of the receive channel | -54.27 | | PASS |
| | | | 10 times lower band edge of the receive channel | -53.85 | | PASS |
| | | | 20 times lower band edge of the receive channel | -54.85 | | PASS |
| | | | 50 times lower band edge of the receive channel | -55.85 | | PASS |

6.2.2 Spurious Radiations

Test Requirement: EN 300 440 Clause 4.3.5

Ambient: Temp.: 25.9°C Humid.: 44% Press.: 1005mbar

Test Status: 1) Keep the EUT in continuously receiver with test single.
2) Keep the EUT searching and receiving the useful test signal.
3) Test EUT in normal conditions.

Receiver Setup:

| Frequency range | Measuring receiver bandwidth | Detector mode |
|-----------------|------------------------------|---------------|
| 25MHz-1000MHz | 120kHz | QP |
| 1GHz-40GHz | 1MHz | Peak |

Equipment Used: Refer to section 5 for details.

Test Setup:

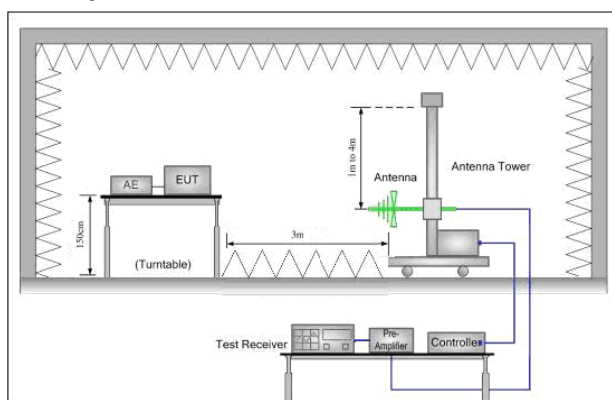


Figure 1. 25MHz to 1GHz

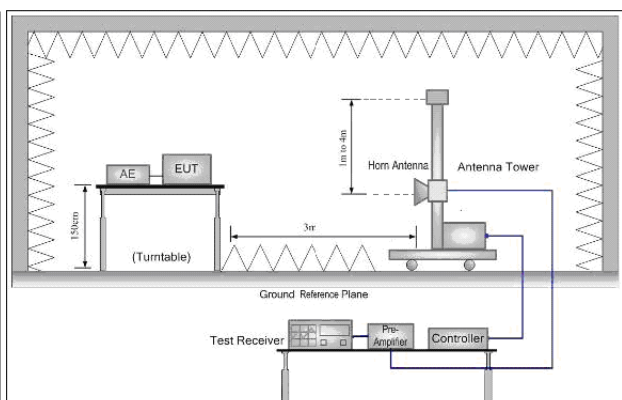


Figure 2. Above 1GHz

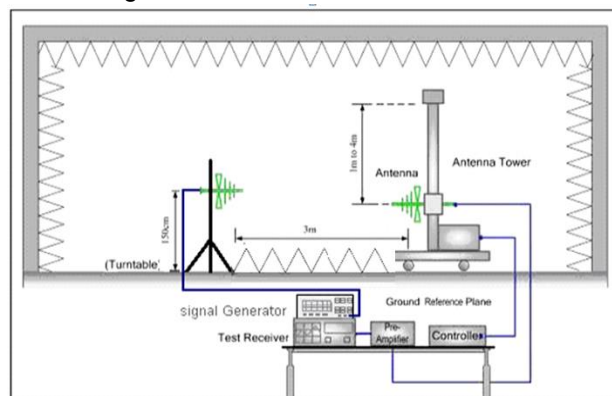


Figure 1. 25MHz to 1GHz

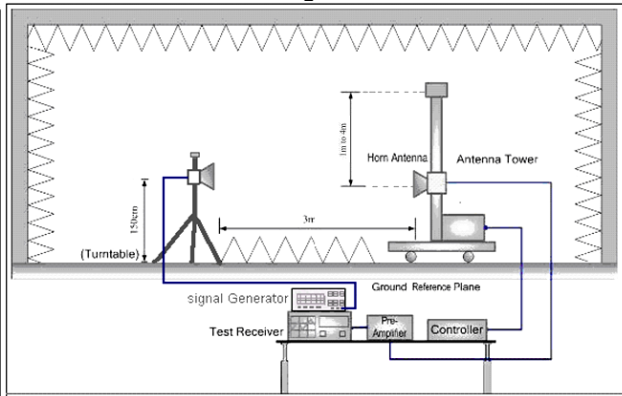


Figure 2. Above 1GHz

1. Scan from 25MHz to 40GHz; find the maximum radiation frequency to measure.
2. The technique used to find the Spurious Emissions of the transmitter was the antenna substitution method. Substitution method was performed to determine the actual ERP/EIRP emission levels of the EUT.

Test procedure as below:

Test Procedure:

- 1) The EUT was powered ON and placed on a 1.5m high table at a 3 meter fully Anechoic Chamber. The antenna of the transmitter was extended to its maximum length. Modulation mode and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- 2) The EUT was set 3 meters (above 18GHz the distance is 1 meter) away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

- 3) The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 4) Steps 1) to 3) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 5) The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.
- 6) A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 3) is obtained for this set of conditions.
- 7) The output power into the substitution antenna was then measured.
- 8) Steps 6) and 7) were repeated with both antennas polarized.
- 9) Calculate power in dBm by the following formula:

$$\text{ERP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$

$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

Where: Pg is the generator output power into the substitution antenna.
- 10) Repeat above procedures until all frequencies measured was complete.

Limit:

| Frequency range | Limit |
|-----------------|-------|
| 25MHz-1000MHz | 2nW |
| 1GHz-40GHz | 20nW |

Test result:

PASS

Test Data:

| Lowest channel (5745MHz) | | | | | | | |
|--------------------------|-------------|---------------|-------------------------------|-------------|-----------------|--------|------------------|
| Frequency (MHz) | Height (cm) | Azimuth (deg) | Spurious Emission Level (dBm) | Limit (dBm) | Over Limit (dB) | Result | Antenna Polaxis. |
| 217.96 | 125 | 118 | -64.92 | -57 | -7.92 | Pass | H |
| 217.96 | 173 | 89 | -64.38 | -57 | -7.38 | Pass | V |
| 805.55 | 137 | 77 | -64.94 | -57 | -7.94 | Pass | H |
| 805.55 | 182 | 308 | -64.68 | -57 | -7.68 | Pass | V |
| 3029.01 | 163 | 138 | -56.41 | -47 | -9.41 | Pass | H |
| 3029.01 | 172 | 82 | -55.20 | -47 | -8.20 | Pass | V |
| 7232.07 | 179 | 75 | -57.81 | -47 | -10.81 | Pass | H |
| 7232.07 | 178 | 64 | -55.19 | -47 | -8.19 | Pass | V |

| Highest channel (5825MHz) | | | | | | | |
|---------------------------|-------------|---------------|-------------------------------|-------------|-----------------|--------|------------------|
| Frequency (MHz) | Height (cm) | Azimuth (deg) | Spurious Emission Level (dBm) | Limit (dBm) | Over Limit (dB) | Result | Antenna Polaxis. |
| 340.79 | 145 | 172 | -64.07 | -57 | -7.07 | Pass | H |
| 340.79 | 142 | 346 | -65.23 | -57 | -8.23 | Pass | V |
| 684.85 | 176 | 179 | -65.66 | -57 | -8.66 | Pass | H |
| 684.85 | 100 | 344 | -64.22 | -57 | -7.22 | Pass | V |
| 4081.38 | 167 | 35 | -57.30 | -47 | -10.30 | Pass | H |
| 4081.38 | 146 | 242 | -57.65 | -47 | -10.65 | Pass | V |
| 6265.79 | 145 | 108 | -57.95 | -47 | -10.95 | Pass | H |
| 6265.79 | 184 | 51 | -56.39 | -47 | -9.39 | Pass | V |

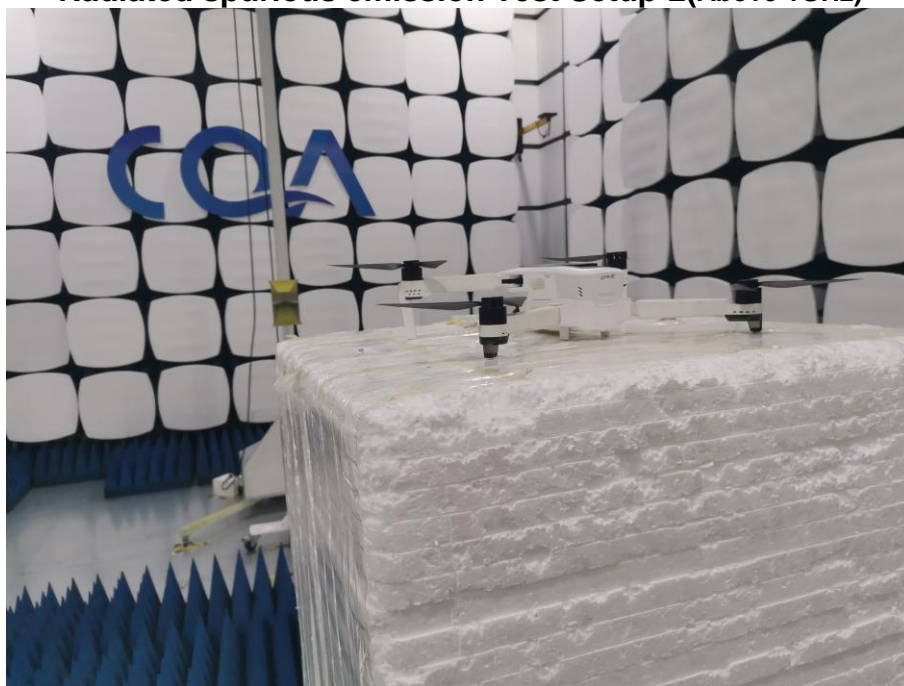
APPENDIX 1 PHOTOGRAPHS OF TEST SETUP

Test Model No.: ZINO 2

Radiated spurious emission Test Setup-1 (Below 1GHz)



Radiated spurious emission Test Setup-2(Above 1GHz)



PHOTOGRAPHS OF EUT Constructional Details

Refer to APPENDIX 2 PHOTOGRAPHS OF EUT for CQASZ20191201316E-01.

*** End of Report ***