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Huatongwei Building, keji'nan 12th Road, High-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, China.
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ACCREDITED Testing Cert #:3902.01

# TEST REPORT

**For RF**

| | | |
|---|---|---|
| **Report No. ..... :** | **CHTEW22090084** | Report Verification: |
| **Project No..... :** | **SHT2103098305EW** | |
| **Applicant's name ..... :** | **HARDWARIO a.s.** | |
| Address ..... : | U Jezu 525/4, 460 01 Liberec, CZECHIA | |
| **Test item description ..... :** | **CHESTER** | |
| Trade Mark ..... : | - | |
| Model/Type reference ..... : | CHESTER | |
| Listed Model(s)..... : | - | |
| **Standard..... :** | **ETSI EN 300 220-1 V3.1.1: 2017-02**<br>**ETSI EN 300 220-2 V3.1.1: 2017-02** | |
| Date of receipt of test sample.....: | Jun. 29, 2022 | |
| Date of testing.....: | Jun. 30, 2022- Sep. 20, 2022 | |
| Date of issue.....: | Sep. 21, 2022 | |
| **Result.....:** | **PASS** | |

| | | |
|---|---|---|
| Compiled by<br>( position+printedname+signature) .. : | File administrators Silvia Li | Silvia Li |
| Supervised by<br>(position+printedname+signature) ... : | Project Engineer David Chen | David Chen |
| Approved by<br>(position+printedname+signature) ... : | RF Manager Hans Hu | Hans Hu |

| | |
|---|---|
| **Testing Laboratory Name..... :** | **Shenzhen Huatongwei International Inspection Co., Ltd** |
| Address ..... : | 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China |

# Contents

# 1. Test standards and Report version

## 1.1. Test Standards

The tests were performed according to following standards:

ETSI EN 300 220-1 V3.1.1: 2017-02-Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 1: Technical characteristics and methods of measurement

ETSI EN 300 220-2 V3.1.1(2017-02)-Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for non specific radio equipment

## 1.2. Report version information

| Revision No. | Date of issue | Description |
|---|---|---|
| N/A | 2022-09-21 | Original |
| | | |
| | | |
| | | |
| | | |

# 2. Test Description

| General requirement | | | | |
|---|---|---|---|---|
| Section | Test Item | Standard requirement | Result | Test engineer |
| - | Operating frequency | clause 4.2.1 | Pass* | N/A |
| - | Unwanted emissions in the spurious domain-conducted | clause 4.2.2 | Pass* | N/A |
| 5.1.1 | Unwanted emissions in the spurious domain-radiated | clause 4.2.2 | PASS | Pan Xie |
| **Transmitter requirement** | | | | |
| Section | Test Item | Standard requirement | Result | Test engineer |
| - | Effective radiated power | clause 4.3.1 | Pass* | N/A |
| - | Maximum e.r.p. spectral density | clause 4.3.2 | N/A | N/A |
| - | Duty cycle | clause 4.3.3 | Pass* | N/A |
| - | Occupied bandwidth | clause 4.3.4 | Pass* | N/A |
| - | TX Out of band emissions | clause 4.3.5 | Pass* | N/A |
| - | Transient power | clause 4.3.6 | Pass* | N/A |
| - | Adjacent channel power | clause 4.3.7 | N/A | N/A |
| - | TX Behaviour under low voltage conditions | clause 4.3.8 | N/A | N/A |
| - | Adaptive power control | clause 4.3.9 | N/A | N/A |
| - | FHSS | clause 4.3.10 | N/A | N/A |
| - | Short term behaviour | clause 4.3.11 | N/A | N/A |
| **Receiver requirement** | | | | |
| Section | Test Item | Standard requirement | Result | Test engineer |
| - | RX sensitivity | clause 4.4.1 | N/A | N/A |
| - | Clear channel assessment threshold | clause 4.5.2 | N/A | N/A |
| - | Polite spectrum access timing parameters | clause 4.5.3 | N/A | N/A |
| - | Blocking | clause 4.4.2 | Pass* | N/A |
| - | Adaptive Frequency Agility | clause 4.5.4 | N/A | N/A |

Note:
1. N/A is not application
2. For applicable test item please see ETSI EN 300 220-2 Annex A EN Requirements Table
3. EUT is belong to ETSI EN 300 220-2 Annex C AA Band
   *refer to module report No. SHEM160900621702

# 3. Summary

## 3.1. Client Information

| | |
|---|---|
| Applicant: | HARDWARIO a.s. |
| Address: | U Jezu 525/4, 460 01 Liberec, CZECHIA |
| Manufacturer: | HARDWARIO a.s. |
| Address: | U Jezu 525/4, 460 01 Liberec, CZECHIA |

## 3.2. Product Description

| **Main unit information:** | |
|---|---|
| Product Name: | CHESTER |
| Trade Mark: | - |
| Model No.: | CHESTER |
| Listed Model(s): | **-** |
| Power supply: | DC 3.6V |
| Hardware version: | R3.2 |
| Software version: | v1.0.0 |

## 3.3. Radio Specification Description

| **Transmitter unit:** | | | |
|---|---|---|---|
| Operation Frequency: | GFSK: 863.1-869.9MHz<br>LoRa: 125KHz bandwidth: 863.1-869.9MHz<br>250kHz bandwidth: 863.2-869.8MHz | | |
| Modulation type: | GFSK, LoRa | | |
| Occupied bandwidth[#1]: | 125kHz /250kHz | | |
| Antenna type: | PCB Antenna | | |
| Antenna gain: [#2]: | 3.5dBi | | |
| **Receiver unit:** | | | |
| Receiver categories: [#3]: | ☒ 2 | ☐ 1.5 | ☐ 1 |

Note:

#1: Declared by the manufacturer

#2: The antenna gain is provided by the applicant, and the applicant should be responsible for its authenticity, HTW lab has not verified the authenticity of its information.

#3: Declared by the manufacturer

## 3.4. Testing Laboratory Information

| Laboratory Name | Shenzhen Huatongwei International Inspection Co., Ltd. |
|---|---|
| Laboratory Location | 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China |
| Connect information: | Tel: 86-755-26715499<br>E-mail: cs@szhtw.com.cn<br>http://www.szhtw.com.cn |

## 3.5. Modifications

No modifications were implemented to meet testing criteria.

# 4. Test Configuration

## 4.1. Test frequency list

| Test Channel | Frequency (MHz) |
|---|---|
| CH-L | **863.1** |
| CH-M | **868.5** |
| CH-H | **869.9** |

## 4.2. Test mode

| Test mode | Transmitting | Receiving |
|---|---|---|
| TX | √ | |
| RX | | √ |

√: is operation mode and modulation type .

| Test mode | Test item |
|---|---|
| TX | Unwanted emissions in the spurious domain |
| RX | Unwanted emissions in the spurious domain |

## 4.3. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

● - supplied by the manufacturer

○ - supplied by the lab

| | | | |
|---|---|---|---|
| | | Manufacturer : | |
| | | Model No. : | |
| | | Manufacturer : | / |
| | | Model No. : | / |

## 4.4. Test conditions

| | | | |
|---|---|---|---|
| **Normal Conditon** | Temperature | 15 °C to 35 °C | |
| | Relative humidity | 20 % to 75 %. | |
| | Voltage | ☐Mains voltage | Nominal mains voltage |
| | | ☐USB 5V power supply | |
| | | ☐Lead-acid battery | 1.1 * the nominal voltage of the battery |
| | | ☒Other | the normal test voltage shall be that declared by the equipment provider |
| **Extreme Conditon** | Temperature | ☐ The temperature range as declared by the provider | |
| | | ☒ -40 °C to +70°C for Temperature category I (General) | |
| | | ☐ -10 °C to +55 °C for Temperature category II (Portable) | |
| | | ☐ +5 °C to +35 °C for Temperature category III (Equipment for normal indoor use) | |
| | Voltage | ☐Mains voltage | ±10 %* the nominal mains voltage |
| | | ☐Lead-acid battery | 1,3 and 0,9 multiplied by the nominal voltage of the battery |
| | | ☐Leclanché or the lithium battery | Lower extreme voltage: 0.85*the nominal voltage<br>upper extreme voltage: declared by the equipment provider |
| | | ☐Nickel-cadmium battery | Lower extreme voltage: 0.9*the nominal voltage<br>upper extreme voltage: declared by the equipment provider |
| | | ☐Other | the Extreme test voltage shall be that declared by the equipment provider |
| Normal Conditon | | $V_N$=Nominal Voltage | DC 3.60V |
| | | $T_N$=Normal Temperature | 25 °C |
| Extreme Conditon | | $V_L$=Lower Voltage | DC 3.24V |
| | | $T_L$=Lower Temperature | -20 °C |
| | | $V_H$=Nominal Voltage | DC 3.96V |
| | | $T_H$=Higher Temperature | 40 °C |

## 4.5. Statement of the measurement uncertainty

| Test Items | Measurement Uncertainty | Notes |
|---|---|---|
| Frequency range | 70Hz for <1GHz<br>130Hz for >1GHz | (1) |
| Occupied Bandwidth | 70Hz for <1GHz<br>130Hz for >1GHz | (1) |
| Transmitter power conducted | 0.77 dB | (1) |
| Conducted spurious emissions 9kHz~40GHz | 0.77 dB | (1) |
| Radiated spurious emissions | 4.36dB for <1GHz<br>5.10dB for >1GHz | (1) |
| Adjacent Channel Selectivity | 1.25 dB | (1) |
| Blocking | 1.91 dB | (1) |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

## 4.6. Equipments Used during the Test

| ● Radiated emission-6th test site | | | | | | | |
|---|---|---|---|---|---|---|---|
| Used | Test Equipment | Manufacturer | Equipment No. | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Semi-Anechoic Chamber | Albatross projects | HTWE0127 | SAC-3m-02 | C11121 | 2018/09/30 | 2023/09/29 |
| ● | EMI Test Receiver | R&S | HTWE0099 | ESCI | 100900 | 2022/08/30 | 2023/08/29 |
| ● | Loop Antenna | R&S | HTWE0170 | HFH2-Z2 | 100020 | 2021/04/06 | 2024/04/05 |
| ● | Ultra-Broadband Antenna | SCHWARZBECK | HTWE0123 | VULB9163 | 538 | 2021/04/06 | 2024/04/05 |
| ● | Pre-Amplifer | SCHWARZBECK | HTWE0295 | BBV 9742 | N/A | 2021/11/05 | 2022/11/04 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0062-01 | N/A | N/A | 2022/02/25 | 2023/02/24 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0062-02 | SUCOFLEX104 | 501184/4 | 2022/02/25 | 2023/02/24 |
| ● | Test Software | R&S | N/A | ES-K1 | N/A | N/A | N/A |

| ● Radiated emission-7th test site | | | | | | | |
|---|---|---|---|---|---|---|---|
| Used | Test Equipment | Manufacturer | Equipment No. | Model No. | Serial No. | Last Cal. Date (YY-MM-DD) | Next Cal. Date (YY-MM-DD) |
| ● | Semi-Anechoic Chamber | Albatross projects | HTWE0122 | SAC-3m-01 | C11121 | 2018/09/27 | 2023/09/26 |
| ● | Spectrum Analyzer | R&S | HTWE0098 | FSP40 | 100597 | 2022/08/25 | 2023/08/24 |
| ● | Horn Antenna | SCHWARZBECK | HTWE0126 | 9120D | 1011 | 2020/04/01 | 2023/03/31 |
| ● | Broadband Horn Antenna | SCHWARZBECK | HTWE0103 | BBHA9170 | BBHA9170472 | 2020/04/27 | 2023/04/26 |
| ● | Pre-amplifier | CD | HTWE0071 | PAP-0102 | 12004 | 2021/11/05 | 2022/11/04 |
| ● | Broadband Pre-amplifier | SCHWARZBECK | HTWE0201 | BBV 9718 | 9718-248 | 2022/02/28 | 2023/02/27 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0120-01 | 6m 18GHz S Serisa | N/A | 2022/02/25 | 2023/02/24 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0120-02 | 6m 3GHz RG Serisa | N/A | 2022/02/25 | 2023/02/24 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0119-05 | 6m 3GHz RG Serisa | N/A | 2022/02/25 | 2023/02/24 |
| ● | RF Connection Cable | HUBER+SUHNER | HTWE0120-04 | 6m 3GHz RG Serisa | N/A | 2022/02/25 | 2023/02/24 |
| ● | Test Software | Audix | N/A | E3 | N/A | N/A | N/A |

# 5. Test conditions and Results

## 5.1.1. Unwanted emissions in the spurious domain(Radiated)

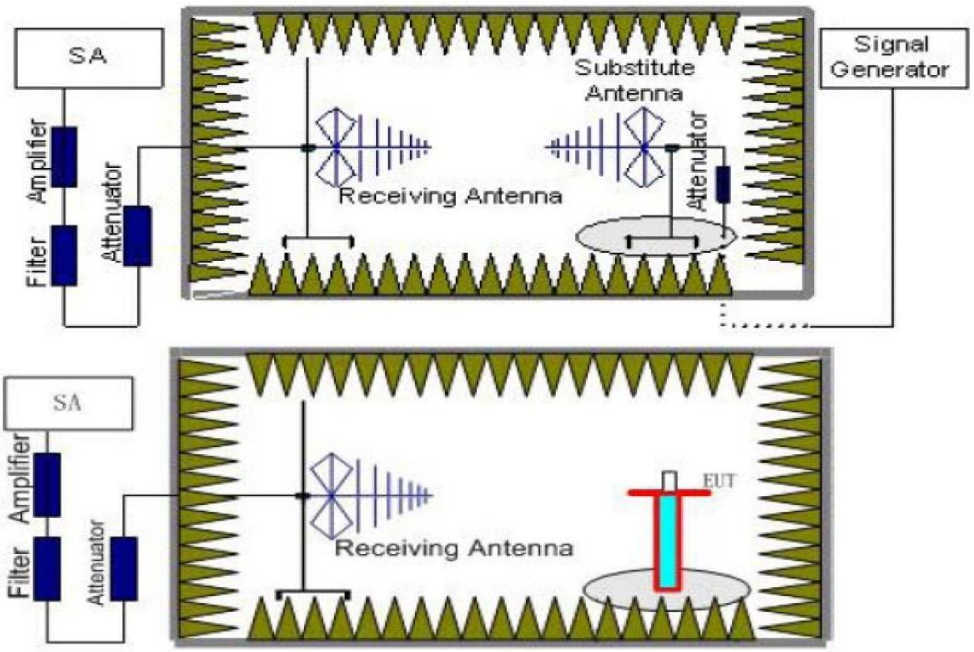
Spurious emissions are unwanted emissions in the spurious domain are emissions at frequencies other than those of the wanted carrier frequency and its sidebands associated with normal test modulation

**LIMIT**

**ETSI EN 300 220-1 Sub-clause 5.9.2**

| Frequency / State | 47 MHz to 74 MHz<br>87,5 MHz to 118 MHz<br>174 MHz to 230 MHz<br>470 MHz to 790 MHz | Other frequencies below 1 000 MHz | Frequencies above 1 000 MHz |
|---|---|---|---|
| TX mode | -54 dBm | -36 dBm | -30 dBm |
| RX and all other modes | -57 dBm | -57 dBm | -47 dBm |

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The test conditions.

   ☒ normal condition ☐ Extreme conditions

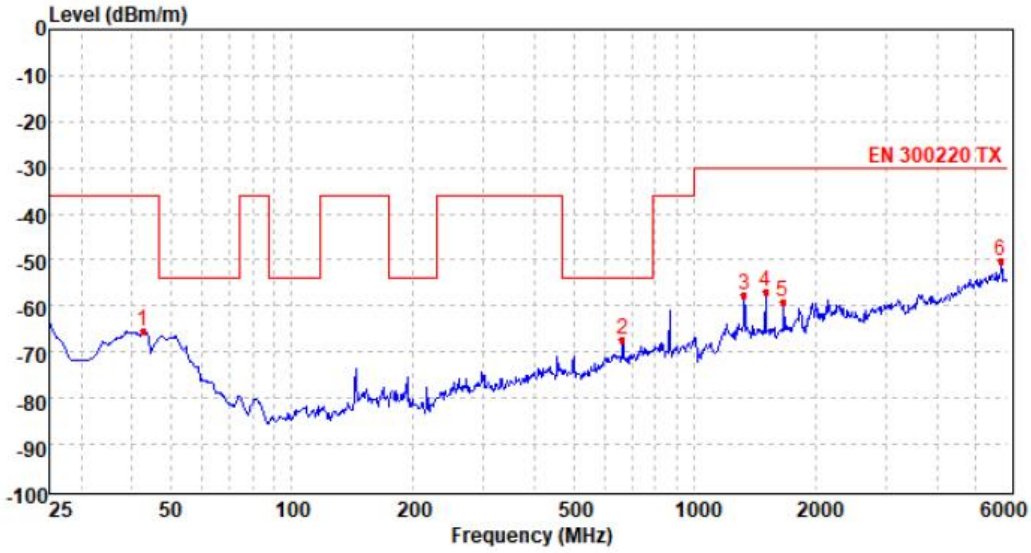
2. Refer to ETSI EN 300 220-1 Sub-clause 5.9.3.3.2 for the measurement method.

**TEST RESULTS**

☒ **Passed** ☐ **Not Applicable**

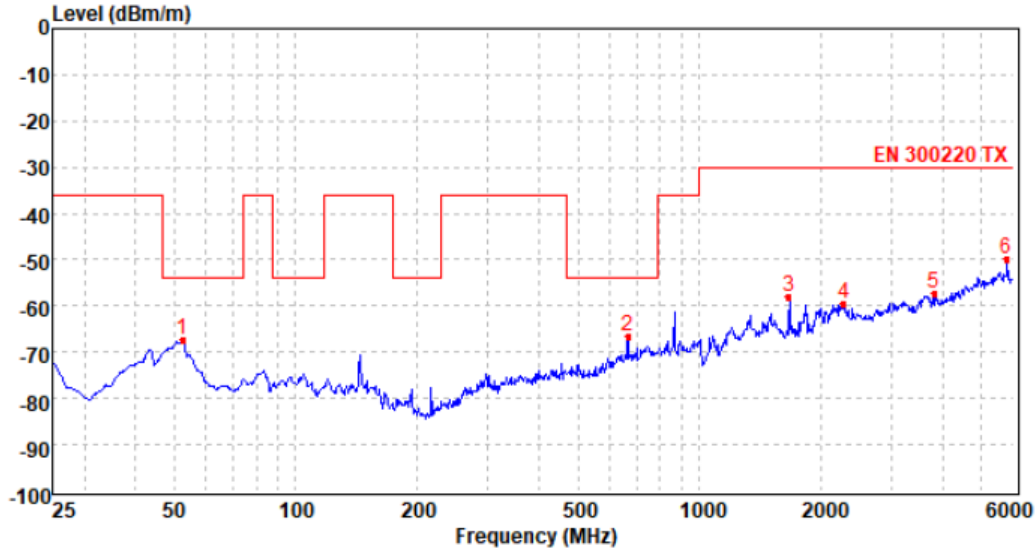
Please refer to the below test data:

| CH-L | | | |
|---|---|---|---|
| Test mode: | TX | Polarization | Horizontal |



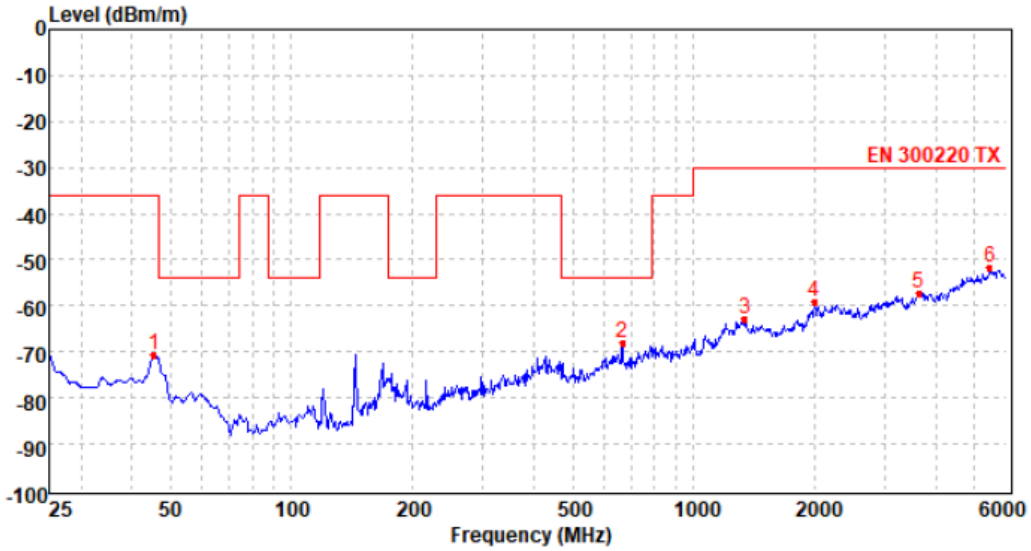

| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 42.74 | -67.92 | 26.52 | 6.96 | 30.89 | -65.33 | -36.00 | -29.33 | Peak |
| 2 | 662.51 | -75.48 | 28.04 | 10.13 | 30.08 | -67.39 | -54.00 | -13.39 | Peak |
| 3 | 1327.24 | -62.32 | 37.01 | 4.07 | 36.41 | -57.65 | -30.00 | -27.65 | Peak |
| 4 | 1499.21 | -60.69 | 36.54 | 4.32 | 36.93 | -56.76 | -30.00 | -26.76 | Peak |
| 5 | 1660.42 | -62.63 | 36.20 | 4.56 | 37.17 | -59.04 | -30.00 | -29.04 | Peak |
| 6 | 5768.09 | -70.48 | 43.96 | 9.58 | 33.39 | -50.33 | -30.00 | -20.33 | Peak |

| Test mode: | TX | Polarization | Vertical |
|---|---|---|---|



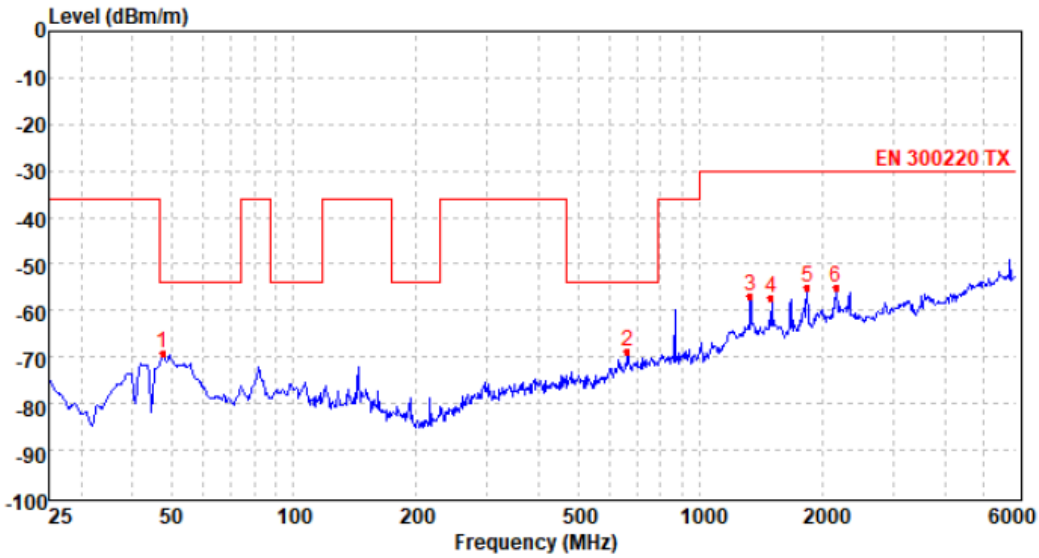

| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 52.58 | -65.76 | 22.54 | 7.07 | 31.04 | -67.19 | -54.00 | -13.19 | Peak |
| 2 | 664.97 | -74.92 | 28.33 | 10.13 | 30.08 | -66.54 | -54.00 | -12.54 | Peak |
| 3 | 1666.38 | -61.71 | 36.16 | 4.57 | 37.14 | -58.12 | -30.00 | -28.12 | Peak |
| 4 | 2280.08 | -68.30 | 40.74 | 5.40 | 37.41 | -59.57 | -30.00 | -29.57 | Peak |
| 5 | 3806.28 | -69.72 | 42.00 | 7.13 | 36.75 | -57.34 | -30.00 | -27.34 | Peak |
| 6 | 5768.09 | -70.21 | 44.09 | 9.58 | 33.39 | -49.93 | -30.00 | -19.93 | Peak |

| CH-H | | | |
|---|---|---|---|
| Test mode: | TX | Polarization | Horizontal |



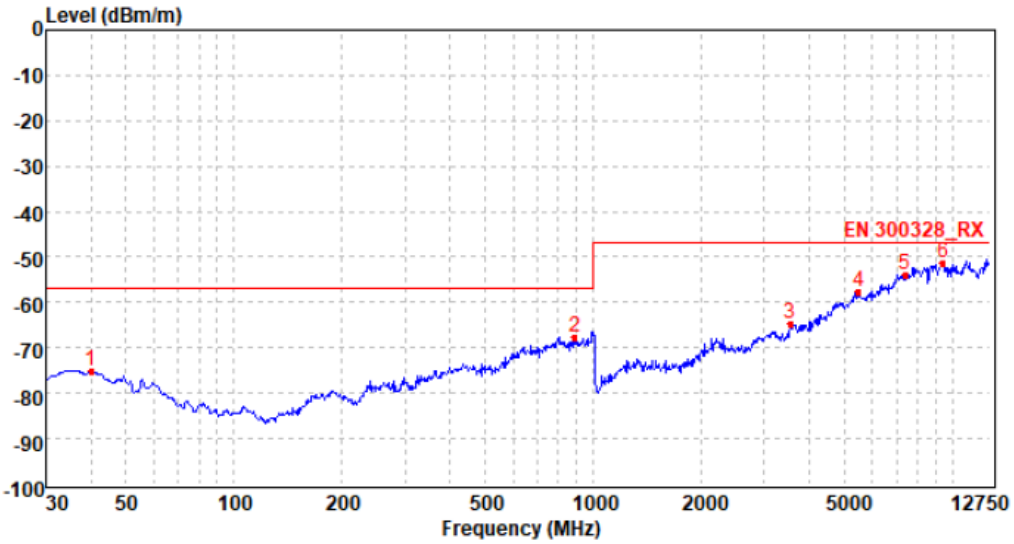

| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 45.69 | -71.85 | 25.25 | 7.00 | 30.93 | -70.53 | -36.00 | -34.53 | Peak |
| 2 | 664.97 | -76.14 | 28.04 | 10.13 | 30.08 | -68.05 | -54.00 | -14.05 | Peak |
| 3 | 1341.58 | -67.72 | 37.04 | 4.09 | 36.28 | -62.87 | -30.00 | -32.87 | Peak |
| 4 | 1996.95 | -66.07 | 39.08 | 5.01 | 37.22 | -59.20 | -30.00 | -29.20 | Peak |
| 5 | 3626.53 | -69.45 | 42.36 | 6.94 | 37.02 | -57.17 | -30.00 | -27.17 | Peak |
| 6 | 5456.44 | -72.32 | 43.98 | 9.35 | 32.65 | -51.64 | -30.00 | -21.64 | Peak |

| Test mode: | TX | Polarization | Vertical |
|---|---|---|---|



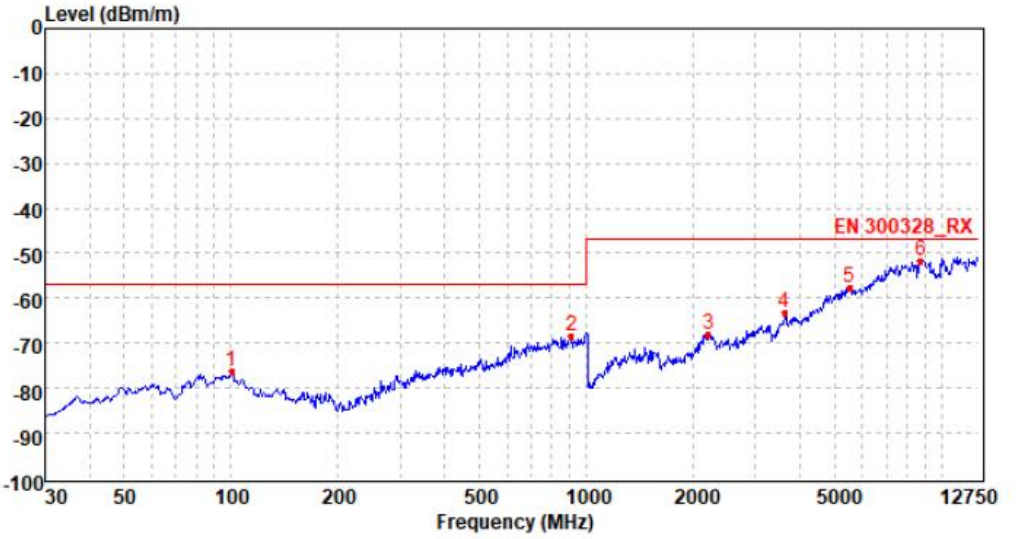

| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 47.58 | -67.19 | 21.85 | 7.02 | 30.96 | -69.28 | -54.00 | -15.28 | Peak |
| 2 | 662.51 | -76.97 | 28.27 | 10.13 | 30.08 | -68.65 | -54.00 | -14.65 | Peak |
| 3 | 1327.24 | -61.85 | 37.44 | 4.07 | 36.41 | -56.75 | -30.00 | -26.75 | Peak |
| 4 | 1496.53 | -62.44 | 37.76 | 4.32 | 36.94 | -57.30 | -30.00 | -27.30 | Peak |
| 5 | 1832.38 | -59.66 | 36.78 | 4.80 | 37.11 | -55.19 | -30.00 | -25.19 | Peak |
| 6 | 2156.89 | -63.80 | 41.02 | 5.24 | 37.48 | -55.02 | -30.00 | -25.02 | Peak |

| CH-L | | | |
|---|---|---|---|
| Test mode: | RX and all other modes | Polarization | Horizontal |



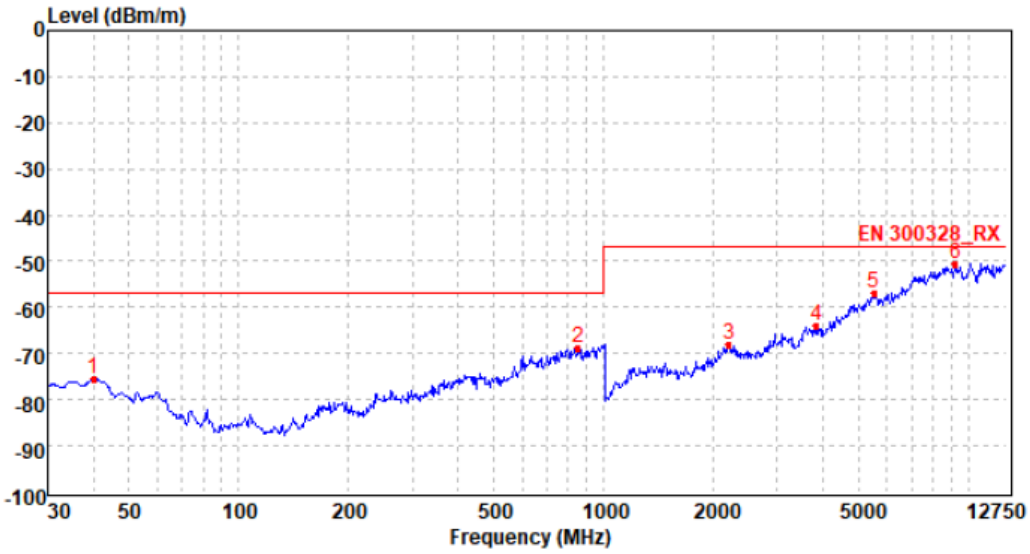

| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 40.03 | -79.09 | 27.77 | 6.93 | 30.84 | -75.23 | -57.00 | -18.23 | Peak |
| 2 | 893.04 | -78.05 | 29.56 | 10.84 | 30.00 | -67.65 | -57.00 | -10.65 | Peak |
| 3 | 3552.58 | -76.27 | 41.74 | 6.85 | 36.99 | -64.67 | -47.00 | -17.67 | Peak |
| 4 | 5490.18 | -78.46 | 43.92 | 9.34 | 32.42 | -57.62 | -47.00 | -10.62 | Peak |
| 5 | 7394.88 | -78.65 | 48.53 | 10.25 | 33.95 | -53.82 | -47.00 | -6.82 | Peak |
| 6 | 9417.91 | -81.04 | 50.01 | 11.86 | 32.22 | -51.39 | -47.00 | -4.39 | Peak |

| Test mode: | RX and all other modes | Polarization | Vertical |
|---|---|---|---|



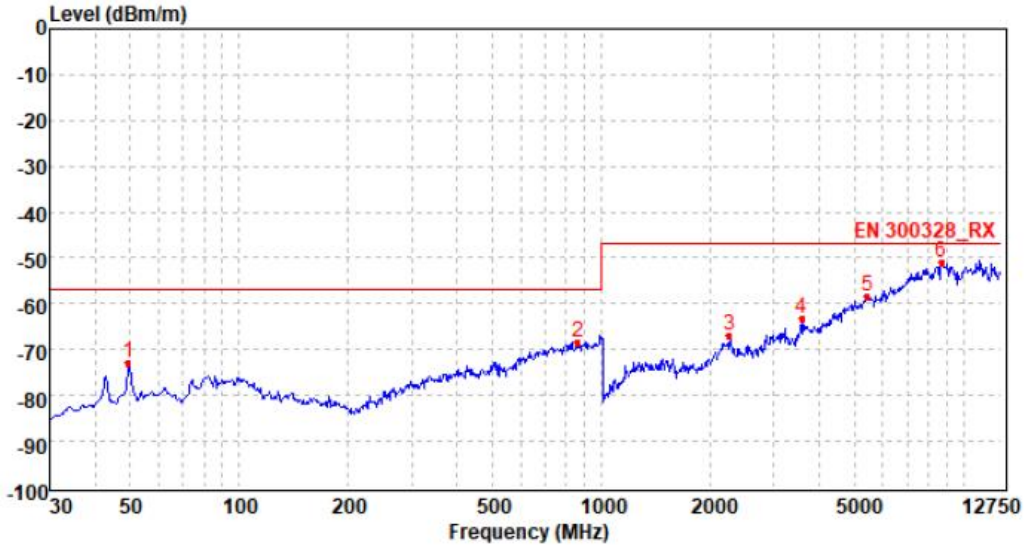

| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 100.57 | -78.56 | 25.67 | 7.52 | 30.91 | -76.28 | -57.00 | -19.28 | Peak |
| 2 | 908.88 | -79.31 | 29.82 | 10.88 | 29.92 | -68.53 | -57.00 | -11.53 | Peak |
| 3 | 2207.06 | -77.39 | 41.64 | 5.32 | 37.55 | -67.98 | -47.00 | -20.98 | Peak |
| 4 | 3625.67 | -75.73 | 42.54 | 6.94 | 37.02 | -63.27 | -47.00 | -16.27 | Peak |
| 5 | 5518.20 | -78.33 | 43.98 | 9.36 | 32.46 | -57.45 | -47.00 | -10.45 | Peak |
| 6 | 8770.01 | -82.48 | 49.27 | 11.95 | 30.39 | -51.65 | -47.00 | -4.65 | Peak |

| CH-H | | | |
|---|---|---|---|
| Test mode: | RX and all other modes | Polarization | Horizontal |




| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 40.03 | -79.39 | 27.77 | 6.93 | 30.84 | -75.53 | -57.00 | -18.53 | Peak |
| 2 | 853.13 | -79.12 | 29.72 | 10.72 | 30.14 | -68.82 | -57.00 | -11.82 | Peak |
| 3 | 2207.06 | -76.58 | 40.93 | 5.32 | 37.55 | -67.88 | -47.00 | -20.88 | Peak |
| 4 | 3844.28 | -76.13 | 41.97 | 7.20 | 36.83 | -63.79 | -47.00 | -16.79 | Peak |
| 5 | 5532.26 | -77.56 | 43.84 | 9.37 | 32.52 | -56.87 | -47.00 | -9.87 | Peak |
| 6 | 9228.06 | -80.53 | 49.34 | 11.57 | 31.10 | -50.72 | -47.00 | -3.72 | Peak |

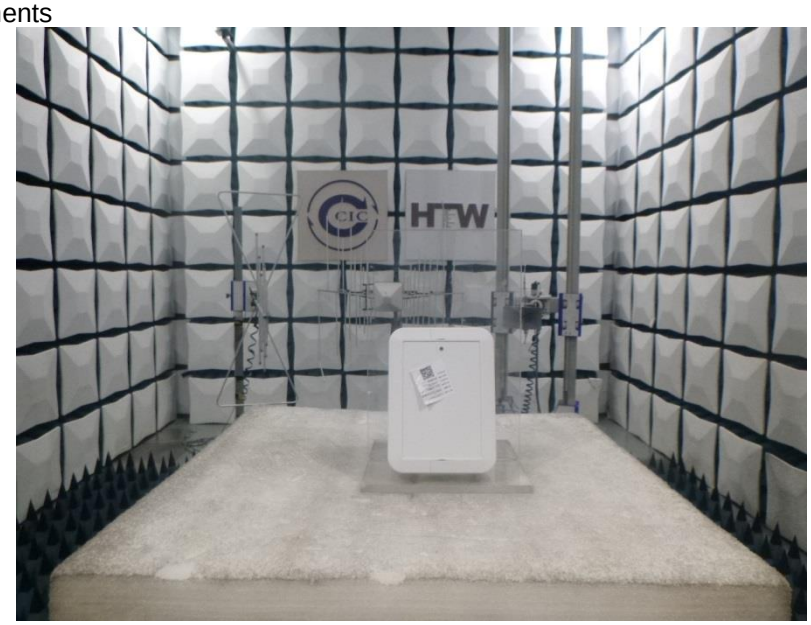
| Test mode: | RX and all other modes | Polarization | Vertical |
|---|---|---|---|




| Mark | Frequency MHz | Reading dBm | Antenna dB | Cable dB | Preamp dB | Level dBm | Limit dBm | Over limit | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 49.60 | -70.83 | 22.04 | 7.04 | 31.00 | -72.75 | -57.00 | -15.75 | Peak |
| 2 | 862.18 | -78.92 | 29.88 | 10.75 | 30.15 | -68.44 | -57.00 | -11.44 | Peak |
| 3 | 2263.96 | -75.88 | 40.94 | 5.38 | 37.41 | -66.97 | -47.00 | -19.97 | Peak |
| 4 | 3579.82 | -75.45 | 42.32 | 6.88 | 37.00 | -63.25 | -47.00 | -16.25 | Peak |
| 5 | 5420.74 | -78.63 | 44.09 | 9.36 | 33.22 | -58.40 | -47.00 | -11.40 | Peak |
| 6 | 8725.48 | -81.54 | 48.88 | 11.97 | 30.09 | -50.78 | -47.00 | -3.78 | Peak |

## 6. Test Setup Photos of the EUT

Radiated measurements



## 7. External and Internal Photos of the EUT

Please refer to test report No. CHTEW22090081

--------End of Report--------