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FCC REPORT

For LTE Cat NB

Report No. ..... :	**CHTEW2209007402**	Report Verification:
Project No.....:	**SHT2103098303EW**	
Applicant ..... :	**HARDWARIO a.s.**	
Address.....:	U Jezu 525/4, 460 01 Liberec, CZECHIA	
Product Name ..... :	**CHESTER**	
Trade Mark .....:	-	
Model No .....:	CHESTER	
Listed Model(s) .....:	-	
Standard ..... :	**FCC CFR Title 47 Part 2** **FCC CFR Title 47 Part 90**	
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 (position+printedname+signature)...:	File administrators Silvia Li	Silvia Li
Supervised by (position+printedname+signature)....:	Project Engineer David Chen	David Chen
Approved by (position+printedname+signature)....:	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. Applicable Standards

The tests were performed according to following standards:

FCC Rules Part 2: FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
FCC Rules Part 90: PRIVATE LAND MOBILE RADIO SERVICES.
ANSI C63.26: 2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
KDB 971168 D01 Power Meas License Digital Systems v03: MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS

1.2. Report version information

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

2. Test Description

Section	Test Item	Section in CFR 47	Result #1	Test Engineer
	Conducted Output Power	Part 2.1046 Part 90.635(b)	Pass*	N/A
	Peak-to-Average Ratio	-	Pass*	N/A
	99% Occupied Bandwidth & 26 dB Bandwidth	Part 2.1049	Pass*	N/A
	Band Edge	Part 2.1051 Part 90.691	Pass*	N/A
	Conducted Spurious Emissions	Part 2.1051 Part 90.691	Pass*	N/A
	Frequency stability vs temperature	Part 2.1055(a)(1)(b) Part 90.213	Pass*	N/A
	Frequency stability vs voltage	Part 2.1055(d)(1)(2) Part 90.213	Pass*	N/A
5.1	ERP	Part 22.913(a) Part 90.635(b)	Pass	Tiancheng Huang
5.2	Radiated Spurious Emissions	Part 2.1053 Part 90.691	Pass	Pan Xie

Note:

1) #1: The test result does not include measurement uncertainty value

2) *Refer to module FCC ID:2ANPO00NRF9160

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 from Primary lithium battery
Hardware version:	R3.2
Software version:	v1.0.0

3.3. Radio Specification Description

Support LTE type:	☒ Cat NB1 ☐ Cat NB2
Support Operating Band:	☒ FDD Band 26
Operating Frequency Range:	Please refer to note #2
Channel bandwidth:	200kHz
Subcarrier spacing:	☒ 3.75kHz ☒ 15kHz
Uplink Modulation type:	☒ BPSK ☒ QPSK
Downlink Modulation type:	☒ BPSK ☒ QPSK
Antenna type	PCB antenna
Antenna Gain#3	3.5 dBi

Note:

- ☒: means that this feature is supported; ☐: means that this feature is not supported
- #2: Operating frequency range is as follow:

LTE Band	Uplink frequency	Downlink frequency
FDD Band 26	814.7 – 823.3 MHz	859.7 – 868.3 MHz

- #3: 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

3.4. 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 E-mail: cs@szhtw.com.cn http://www.szhtw.com.cn	
Qualifications	Type	Accreditation Number
	FCC	762235

4. TEST CONFIGURATION

4.1. Test frequency list

TDD Band 26

Test Frequency ID	N_{UL}	M_{UL}	Frequency of Uplink [MHz]	N_{DL}	M_{DL}	Frequency of Downlink [MHz]
Low Range	26691	0	814.1	8691	-0.5	859.1
Mid Range	26865	0	831.5	8865	-0.5	876.5
High Range	27039	0	848.9	9039	-0.5	893.9
NOTE 1: Applicable to either 3.75 kHz or 15 kHz NB-IoT UL subcarrier spacing						

4.2. Descriptions of Test mode

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems and ANSI C63.26 with maximum output power.

Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

Test configuration is as follow:

Test Items	Modulation	Subcarrier spacing	N_{Tones}		
			1	Half	Full
Radiated Spurious Emission	#4	#5	○	-	-

Note:

- #4: Test all kind of uplink modulation in section 3.3
- #5: Test all kind of subcarrier spacing in section 3.3
- ○: means that this configuration is chosen for testing
- -: means that this configuration is not test.
- The device is investigatedfrom 30MHz to10 times offundamental signal for radiated spurious emission test under different modulations,Subcarrier spacing and N_{Tones} in exploratory test. Subsequently, only the worst case emissions(QPSK,15kHz SCS,and 1@0) are reported.

4.3. Test sample information

Test item	HTW sample no.
Radiated test items	YPHT21030983005

Note:

Radiated test items: Radiated Spurious Emission

4.4. Support unit used in test configuration and system

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

Whether support unit is used?				
✓ No				
Item	Equipment	Trade Name	Model No.	Other
1				
2				

4.5. Testing environmental condition

Voltage	VN=Nominal Voltage	DC 3.6V
	VL=Lower Voltage	DC 3.24V
	VH=Higher Voltage	DC 3.96V
Temperature	TN=Normal Temperature	25 °C
	Extreme Temperature	From −30°C to + 50°C
Humidity	30~60 %	
Air Pressure	950-1050 hPa	

4.6. Statement of the measurement uncertainty

Test Items	MeasurementUncertainty
Radiated spurious emission	<1GHz: 2.85dB >1GHz: 3.66dB

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

4.7. Equipments Used during the Test

● Radiated Spurious Emission							
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
●	Loop Antenna	R&S	HTWE0170	HFH2-Z2	100020	2021/04/06	2024/04/05
●	Broadband Horn Antenna	SCHWARZBECK	HTWE0103	BBHA9170	BBHA9170472	2020/04/27	2023/04/26
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0123	VULB9163	538	2021/04/06	2024/04/05
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2020/04/01	2023/03/31
●	Pre-amplifier	CD	HTWE0071	PAP-0102	12004	2021/11/05	2022/11/04
●	Broadband Preamplifier	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
●	EMI Test Software	Audix	N/A	E3	N/A	N/A	N/A

5. TEST CONDITIONS AND RESULTS

5.1. ERP

LIMIT

LTE Band 26: 100W(50dBm) ERP

TEST PROCEDURE

Use the following formula to calculate the corresponding ERP/EIRP:
ERP = Conducted power + Gain(dBd)
EIRP = Conducted power + Gain(dBi)

ERP = EIRP - 2.15

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Band	Conducted power(dBm)#6	Antenna gain(dBi)	ERP		Limit (W)	Verdict
			dBm	W		
Band 26	23.02	3.50	24.37	0.2735	100	PASS
	23.01	3.50	24.36	0.2729	100	PASS

Note:
1) #6: Refer to module FCC ID:2ANPO00NRF9160

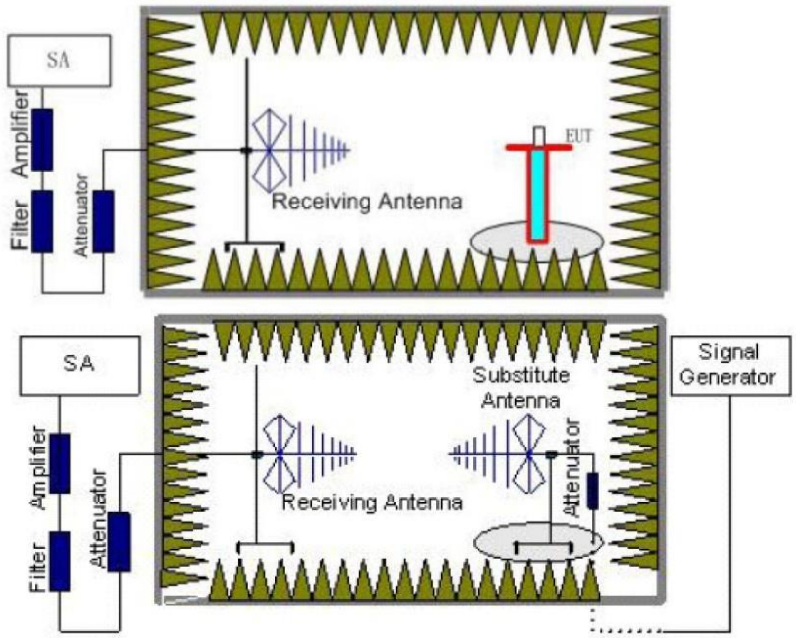
5.2. Radiated Spurious Emission

LIMIT

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 $Log_{10}(f/6.1)$ decibels or 50 + 10 $Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT in the center of the turntable.
   a) For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, the EUT shall be placed on a RF-transparent table at a nominal height of 80 cm above the reference ground plane
   b) For radiated measurements performed at frequencies above 1 GHz, the EUT shall be placed on an RF transparent table at a nominal height of 1.5 m above the ground plane.
2. Unless the EUT uses an integral antenna, the EUT shall be terminated with a non-radiating transmitter load. In cases where the EUT uses an adjustable antenna, the antenna shall be adjusted through typical positions and lengths to maximize emissions levels.
3. The EUT shall be tested while operating on the frequency per manufacturer specification. Set the transmitter to operate in continuous transmit mode.
4. Receiver or Spectrum set as follow:

   Below 1GHz, RBW=100kHz, VBW=300kHz, Detector=Peak, Sweep time=Auto

   Above 1GHz, RBW=1MHz, VBW=3MHz, Detector=Peck, Sweep time=Auto
5. Each emission under consideration shall be evaluated:
   a) Raise and lower the measurement antenna from 1 m to 4 m, as necessary to enable detection of the maximum emission amplitude relative to measurement antenna height.

b) Rotate the EUT through 360° to determine the maximum emission level relative to the axial position.

c) Return the turntable to the azimuth where the highest emission amplitude level was observed.

d) Vary the measurement antenna height again through 1 m to 4 m again to find the height associated with the maximum emission amplitude.

e) Record the measured emission amplitude level and frequency

6. Repeat step 5 for each emission frequency with the measurement antenna oriented in both the horizontal and vertical polarizations to determine the orientation that gives the maximum emissions amplitude.

7. Set-up the substitution measurement with the reference point of the substitution antenna located as near as possible to where the center of the EUT radiating element was located during the initial EUT measurement.

8. Maintain the previous measurement instrument settings and test set-up, with the exception that the EUT is removed and replaced by the substitution antenna.

9. Connect a signal generator to the substitution antenna; locate the signal generator so as to minimize any potential influences on the measurement results. Set the signal generator to the frequency where emissions are detected, and set an output power level such that the radiated signal can be detected by the measurement instrument, with sufficient dynamic range relative to the noise floor.

10. For each emission that was detected and measured in the initial test

a) Vary the measurement antenna height between 1 m to 4 m to maximize the received (measured) signal amplitude.

b) Adjust the signal generator output power level until the amplitude detected by the measurement instrument equals the amplitude level of the emission previously measured directly in step 5 and step 6.

c) Record the output power level of the signal generator when equivalence is achieved in step b).

11. Repeat step 8 through step 10 with the measurement antenna oriented in the opposite polarization.

12. Calculate the emission power in dBm referenced to a half-wave dipole using the following equation:

Pe = Ps(dBm) − cable loss (dB) + antenna gain (dBd)

where

Pe = equivalent emission power in dBm

Ps = source (signal generator) power in dBm

NOTE—dBd refers to the measured antenna gain in decibels relative to a half-wave dipole.

13. Correct the antenna gain of the substitution antenna if necessary to reference the emission power to a half-wave dipole. When using measurement antennas with the gain specified in dBi, the equivalent dipole-referenced gain can be determined from:

gain (dBd) = gain (dBi) − 2.15 dB.

If necessary, the antenna gain can be calculated from calibrated antenna factor information

14. Provide the complete measurement results as a part of the test report.

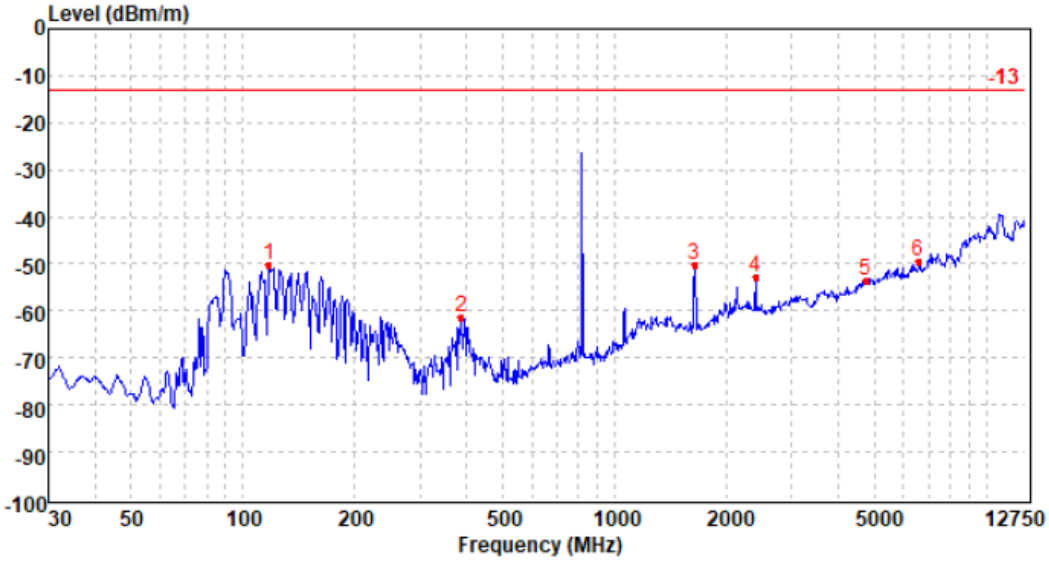
TEST MODE:

Please refer to the clause 4.2

TEST RESULTS

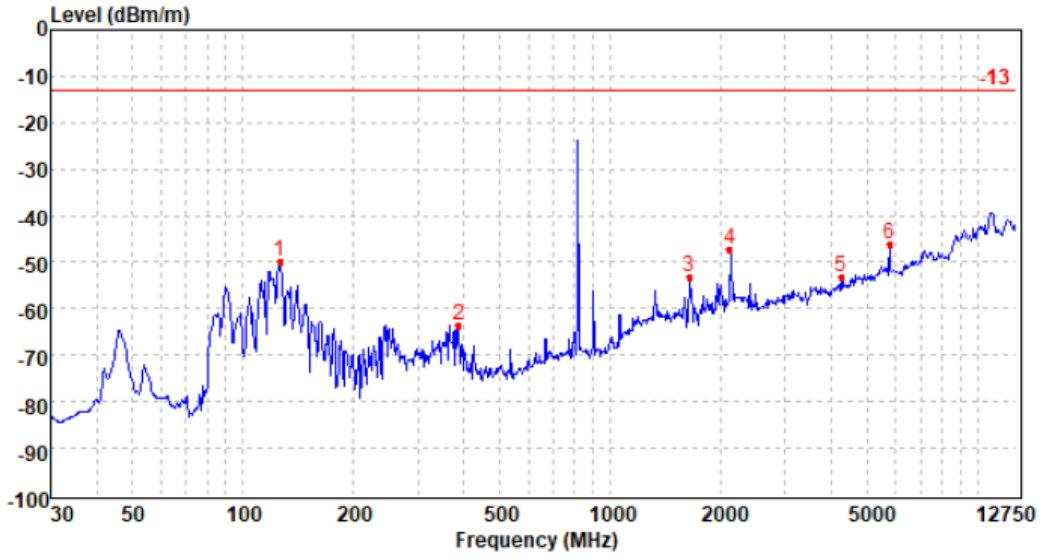
☒ **Passed** ☐ **Not Applicable**

LTE Band26			
Test channel:	Low	Polarization:	Horizontal



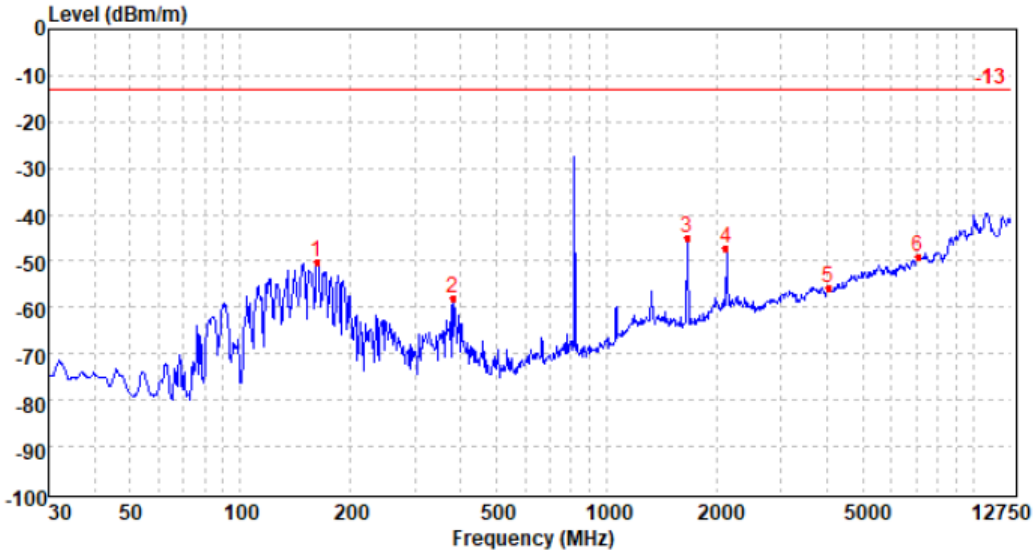
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	117.40	-44.09	17.08	7.64	30.93	-50.30	-13.00	-37.30	Peak
2	388.08	-65.36	25.17	9.12	30.43	-61.50	-13.00	-48.50	Peak
3	1642.76	-52.18	36.13	3.22	37.27	-50.10	-13.00	-37.10	Peak
4	2394.36	-59.58	39.85	3.99	37.22	-52.96	-13.00	-39.96	Peak
5	4736.60	-68.35	43.59	5.68	34.32	-53.40	-13.00	-40.40	Peak
6	6577.75	-68.79	46.44	6.89	34.08	-49.54	-13.00	-36.54	Peak

Test channel:	Low	Polarization:	Vertical



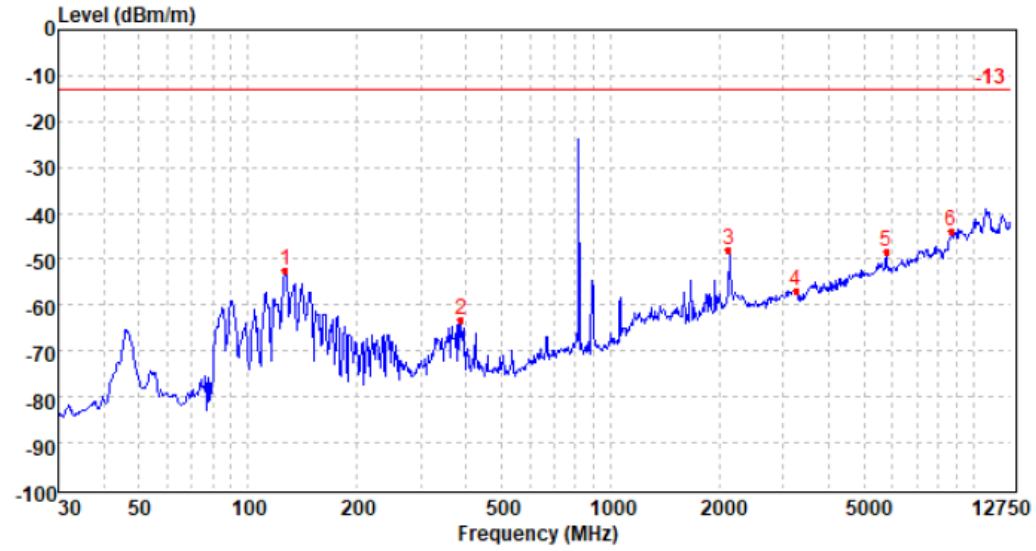
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	126.40	-48.18	21.59	7.70	30.83	-49.72	-13.00	-36.72	Peak
2	388.08	-67.23	25.00	9.12	30.43	-63.54	-13.00	-50.54	Peak
3	1642.76	-55.15	36.10	3.22	37.27	-53.10	-13.00	-40.10	Peak
4	2118.97	-53.80	40.38	3.70	37.42	-47.14	-13.00	-34.14	Peak
5	4267.18	-65.49	42.69	5.45	35.82	-53.17	-13.00	-40.17	Peak
6	5762.24	-63.49	44.09	6.63	33.42	-46.19	-13.00	-33.19	Peak

Test channel:	Mid	Polarization:	Horizontal



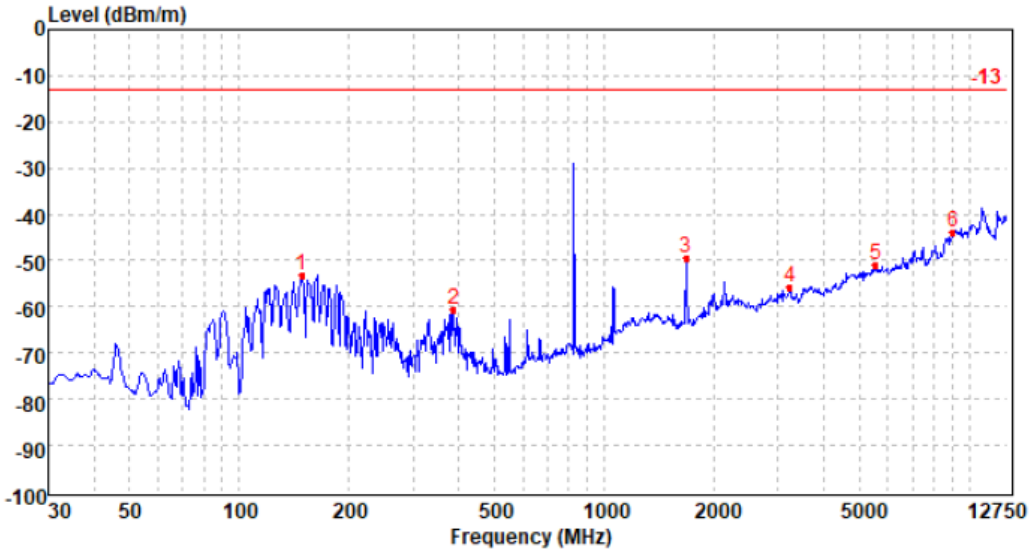
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	162.25	-47.41	19.70	7.95	30.61	-50.37	-13.00	-37.37	Peak
2	379.98	-61.68	25.01	9.08	30.40	-57.99	-13.00	-44.99	Peak
3	1659.57	-47.29	36.20	3.24	37.18	-45.03	-13.00	-32.03	Peak
4	2118.97	-53.84	40.24	3.70	37.42	-47.32	-13.00	-34.32	Peak
5	4045.06	-65.87	41.47	5.25	36.48	-55.63	-13.00	-42.63	Peak
6	7099.75	-70.90	47.76	7.23	33.11	-49.02	-13.00	-36.02	Peak

Test channel:	Mid	Polarization:	Vertical



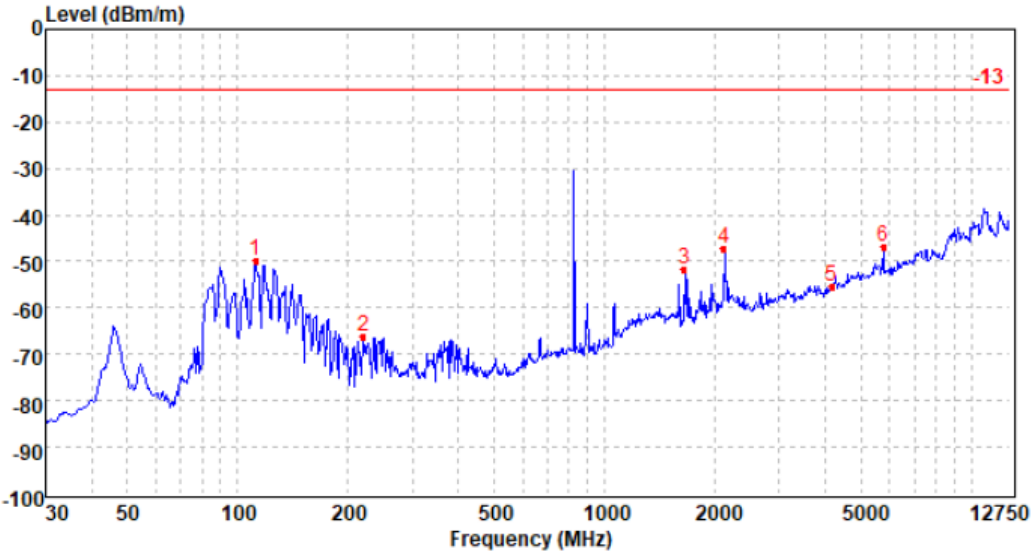
Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	126.85	-50.94	21.55	7.71	30.83	-52.51	-13.00	-39.51	Peak
2	388.08	-67.06	25.00	9.12	30.43	-63.37	-13.00	-50.37	Peak
3	2118.97	-54.80	40.38	3.70	37.42	-48.14	-13.00	-35.14	Peak
4	3241.50	-65.55	41.07	4.68	36.90	-56.70	-13.00	-43.70	Peak
5	5762.24	-65.53	44.09	6.63	33.42	-48.23	-13.00	-35.23	Peak
6	8725.48	-70.81	48.88	8.01	30.09	-44.01	-13.00	-31.01	Peak

Test channel:	High	Polarization:	Horizontal



Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	148.59	-48.22	17.95	7.87	30.65	-53.05	-13.00	-40.05	Peak
2	388.08	-64.44	25.17	9.12	30.43	-60.58	-13.00	-47.58	Peak
3	1680.83	-52.00	36.28	3.26	37.13	-49.59	-13.00	-36.59	Peak
4	3225.04	-64.44	41.14	4.68	37.06	-55.68	-13.00	-42.68	Peak
5	5560.50	-68.26	43.79	6.35	32.89	-51.01	-13.00	-38.01	Peak
6	9042.04	-69.91	48.65	8.53	31.24	-43.97	-13.00	-30.97	Peak

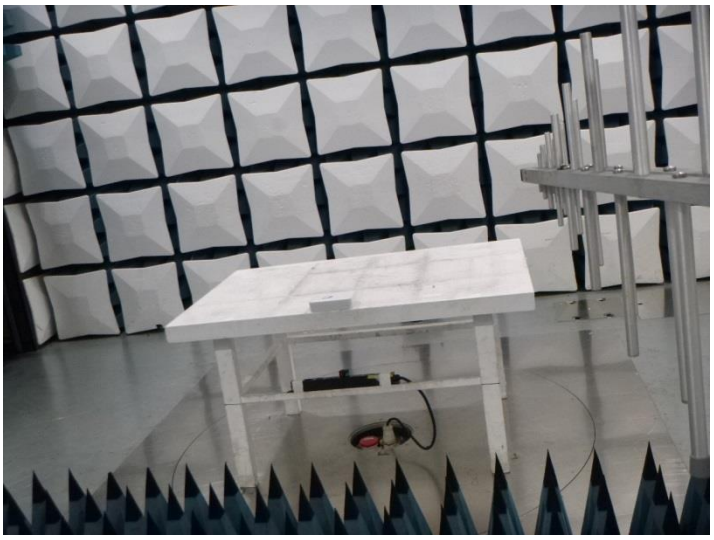
Test channel:	High	Polarization:	Vertical

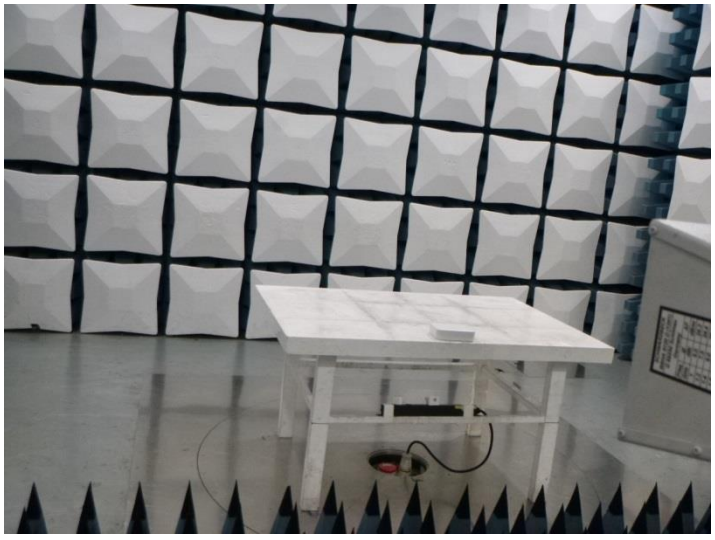


Mark	Frequency MHz	Reading dBm	Antenna dB	Cable dB	Preamp dB	Level dBm	Limit dBm	Over limit	Remark
1	112.16	-50.33	23.91	7.61	30.96	-49.77	-13.00	-36.77	Peak
2	221.09	-62.84	18.86	8.30	30.51	-66.19	-13.00	-53.19	Peak
3	1655.35	-53.77	36.13	3.24	37.20	-51.60	-13.00	-38.60	Peak
4	2124.37	-53.92	40.47	3.71	37.40	-47.14	-13.00	-34.14	Peak
5	4170.53	-67.10	42.39	5.51	36.18	-55.38	-13.00	-42.38	Peak
6	5762.24	-64.21	44.09	6.63	33.42	-46.91	-13.00	-33.91	Peak

Remark:
1. Remark"---" means that the emission level is too low to be measured
2. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

6. TEST SETUP PHOTOS OF THE EUT





7. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Refer to the test report No.: CHTEW22090074

----------END OF REPORT----------