



Shenzhen CTL Testing Technology Co., Ltd.
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TEST REPORT

FCC PART 15.247

Report Reference No.....: **CTL2408075021-WF**

Compiled by: Happy Guo
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Approved by: Ivan Xie
(position+printed name+signature) (Manager)



Product Name : Lora Module

Model/Type reference : MCR-SGLA00391T0

List Model(s)..... : N/A

Trade Mark..... : N/A

FCC ID..... : **2BH8O-SGLA00391T0**

Applicant's name : **Hangzhou Laizhi Technology Co., Ltd**

Address of applicant : No. 1818 Wenyi West Road, Yuhang District, Hangzhou ,
Zhejiang Province, China Artificial Intelligence Town 7-703

Test Firm..... : **Shenzhen CTL Testing Technology Co., Ltd.**

Address of Test Firm : Floor 1-A, Baisha Technology Park, No.3011, Shahehexi Road,
Nanshan District, Shenzhen, China 518055

Test specification..... :

Standard : **FCC Part 15.247:** Operation within the bands 902-928 MHz,
2400-2483.5 MHz and 5725-5850 MHz.

TRF Originator : Shenzhen CTL Testing Technology Co., Ltd.

Master TRF..... : Dated 2011-01

Date of receipt of test item : Aug. 08, 2024

Date of Test Date..... : Aug. 08, 2024- Aug. 22 2024

Date of Issue : Aug. 23 2024

Result..... : **Pass**

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TEST REPORT

Test Report No. :	CTL2408075021-WF	Aug. 23 2024
		Date of issue

Equipment under Test : Lora Module

Sample No : CTL2408075021

Model /Type : MCR-SGLA00391T0

Listed Models : N/A

Applicant : **Hangzhou Laizhi Technology Co., Ltd**

Address : No. 1818 Wenyi West Road, Yuhang District, Hangzhou ,
Zhejiang Province, China Artificial Intelligence Town 7-703

Manufacturer : **Hangzhou Laizhi Technology Co., Ltd**

Address : No. 1818 Wenyi West Road, Yuhang District, Hangzhou ,
Zhejiang Province, China Artificial Intelligence Town 7-703

Test result	Pass *
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*In the configuration tested, the EUT complied with the standards specified page 5.

The test results presented in this report relate only to the object tested.

This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.

** Modified History **

[illegible]

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1. SUMMARY

1.1. TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

[ANSI C63.10: 2013](#): American National Standard for Testing Unlicensed Wireless Devices

1.2. Test Description

FCC PART 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)(1)(i)	20dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Peak Output Power	PASS
FCC Part 15.247(b)	Pseudorandom Frequency Hopping Sequence	PASS
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency& Time of Occupancy	PASS
FCC Part 15.247(a)(1)	Frequency Separation	PASS
FCC Part 15.205/15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge Compliance of RF Emission	PASS
FCC Part 15.203/15.247 (b)	Antenna Requirement	PASS

1.3. Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co.,Ltd.

Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.10 and CISPR 32/EN 55032 requirements.

1.3.2 Laboratory accreditation

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

CNAS-Lab Code: L7497

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No. 4343.01

Shenzhen CTL Testing Technology Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

IC Registration No.: 9618B

CAB identifier: CN0041

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9618B .

FCC-Registration No.: 399832

Designation No.: CN1216

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 399832.

1.4. Auxiliary test equipment information

Manufacturer	Description	Model	Serial Number
HUAWEI TECHNOLOGIES CO.LTD	Laptops	KPL-W00	---
HUAWEI TECHNOLOGIES CO.LTD	Adapter	HW-200200CP1	---

Note: The above notebook device is only used for fixed-frequency transmission

1.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power Radiated	± 2.20 dB	(1)
Occupied Bandwidth	± 0.02 ppm	(1)
Radiated Emission 30~1000MHz	± 4.08 dB	(1)
Radiated Emission Above 1GHz	± 4.32 dB	(1)
Conducted Disturbance 0.15~30MHz	± 2.96 dB	(1)
20dB Emission Bandwidth	$\pm 1.9\%$	(1)
Carrier Frequency Separation	$\pm 1.9\%$	(1)
Maximum Power Spectral Density Level	± 0.98 dB	(1)
Number of Hopping Channel	$\pm 1.9\%$	(1)
Time of Occupancy	$\pm 0.11\%$	(1)
Max Peak Conducted Output Power	± 0.98 dB	(1)
Band-edge Spurious Emission	± 1.21 dB	(1)
Conducted RF Spurious Emission	9kHz-7GHz: ± 1.09 dB 7GHz-26.5GHz: ± 3.27 dB	(1)

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

2. GENERAL INFORMATION

2.1. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

2.2. General Description of EUT

Product Name:	Lora Module
Model/Type reference:	MCR-SGLA00391T0
Power supply:	DC 3.3V
SRD:	
Supported type:	MCR-SGLA00391T0
Modulation:	Lora-FHSS
Operation frequency:	902.9MHz~924.9MHz
Channel number:	102
Channel separation:	125kHz
Antenna type:	External antenna
Antenna gain:	1.89 dBi

Note1: For more details, please refer to the user's manual of the EUT.

Note2: Antenna gain provided by the applicant.

2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 102 channels provided to the EUT and Channel 00/51/102 were selected to test.

Operation Frequency :

Channel	Frequency (MHz)
00	902.9
01	903.1
⋮	⋮
50	913.9
51	914.1
52	914.3
⋮	⋮
101	924.7
102	924.9

Preliminary tests were performed in each mode and packet length of BT, and found worst case as bellow, finally test were conducted at those mode and recorded in this report.

Test Items	Worst case
Conducted Emissions	Lora-FHSS
Radiated Emissions and Band Edge	Lora-FHSS
Maximum Conducted Output Power	Lora-FHSS
20dB Bandwidth	Lora-FHSS
Frequency Separation	Lora-FHSS
Number of hopping frequency	Lora-FHSS
Time of Occupancy (Dwell Time)	Lora-FHSS
Out-of-band Emissions	Lora-FHSS

2.4. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ESH2-Z5	860014/010	2024/04/30	2025/04/29
Limitator	ROHDE & SCHWARZ	ESH3-Z2	100408	2024/04/30	2025/04/29
EMI Test Receiver	ROHDE & SCHWARZ	ESCI	1166.5950.03	2024/04/30	2025/04/29
Double cone logarithmic antenna	Schwarzbeck	VULB 9168	824	2023/02/13	2026/02/12
EMI Test Receiver	R&S	ESCI	1166.5950.03	2024/04/30	2025/04/29
Spectrum Analyzer	Agilent	N9020A	US46220290	2024/05/02	2025/05/01
Spectrum Analyzer	Keysight	N9020A	MY53420874	2024/05/02	2025/05/01
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2021/12/23	2024/12/22
Active Loop Antenna	Da Ze	ZN30900A	/	2024/04/30	2025/04/29
Amplifier	Agilent	8449B	3008A02306	2024/04/30	2025/04/29
Amplifier	Brief&Smart	LNA-4018	2104197	2024/05/03	2025/05/02
Temperature/Humidity Meter	Ji Yu	MC501	/	2024/05/04	2025/05/03
Power measurement module	TSTPASS	TSPS2023R	TSCB220016	2024/05/03	2025/05/02
Power Sensor	Agilent	U2021XA	MY53340004	2024/05/04	2025/05/03
Power Sensor	Agilent	U2021XA	MY54080012	2024/05/03	2025/05/02
Spectrum Analyzer	RS	FSP	1164.4391.38	2024/05/03	2025/05/02
Test Software					
Name of Software			Version		
TST-PASS			V2.0		
EZ_EMC(Below 1GHz)			V1.1.4.2		
EZ_EMC((Above 1GHz)			V1.1.4.2		

2.5. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.6. Modifications

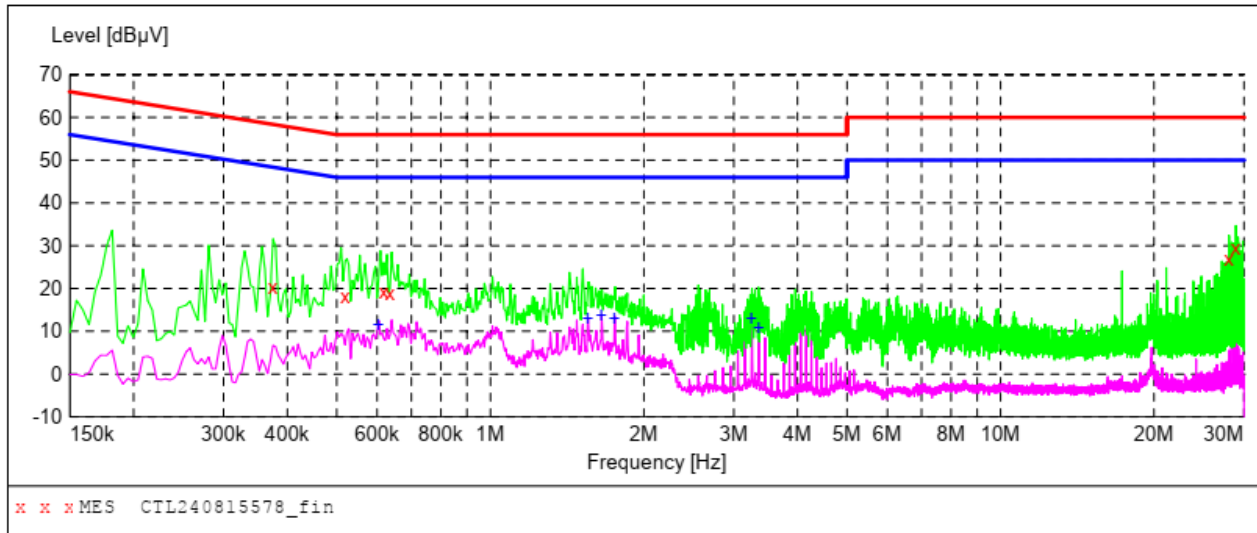
No modifications were implemented to meet testing criteria.

TEST RESULTS

Remark: Were test at Low, Middle, and High channel; only the worst result of Middle Channel was reported as below:

Line:**L****SCAN TABLE: "Voltage (9K-30M)FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "CTL240815578_fin"**

8/15/2024 9:59AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.375000	20.40	10.0	58	38.0	QP	L1	GND
0.519000	18.20	10.0	56	37.8	QP	L1	GND
0.618000	19.20	10.0	56	36.8	QP	L1	GND
0.636000	18.80	10.0	56	37.2	QP	L1	GND
28.041000	26.90	10.3	60	33.1	QP	L1	GND
28.941000	29.60	10.2	60	30.4	QP	L1	GND

MEASUREMENT RESULT: "CTL240815578_fin2"

8/15/2024 9:59AM

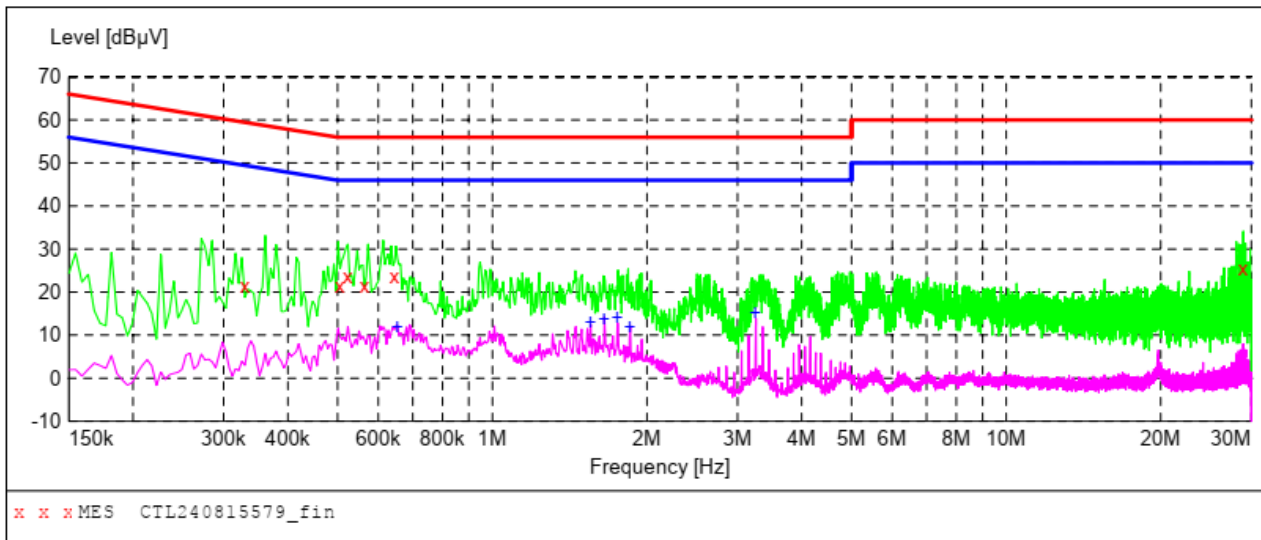
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.604500	11.40	10.0	46	34.6	AV	L1	GND
1.554000	13.10	10.1	46	32.9	AV	L1	GND
1.653000	13.60	10.1	46	32.4	AV	L1	GND
1.752000	13.20	10.1	46	32.8	AV	L1	GND
3.255000	13.10	10.1	46	32.9	AV	L1	GND
3.358500	11.00	10.1	46	35.0	AV	L1	GND

Line:

N

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "CTL240815579_fin"**

8/15/2024 10:02AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.330000	21.60	10.0	60	37.9	QP	N	GND
0.505500	21.50	10.0	56	34.5	QP	N	GND
0.523500	23.80	10.0	56	32.2	QP	N	GND
0.564000	21.40	10.0	56	34.6	QP	N	GND
0.645000	23.80	10.0	56	32.2	QP	N	GND
28.945500	25.50	10.2	60	34.5	QP	N	GND

MEASUREMENT RESULT: "CTL240815579_fin2"

8/15/2024 10:02AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.654000	11.80	10.0	46	34.2	AV	N	GND
1.554000	13.20	10.1	46	32.8	AV	N	GND
1.653000	13.80	10.1	46	32.2	AV	N	GND
1.752000	14.00	10.1	46	32.0	AV	N	GND
1.855500	12.00	10.1	46	34.0	AV	N	GND
3.255000	15.30	10.1	46	30.7	AV	N	GND

3.2. Radiated Emissions and Band Edge

Limit

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

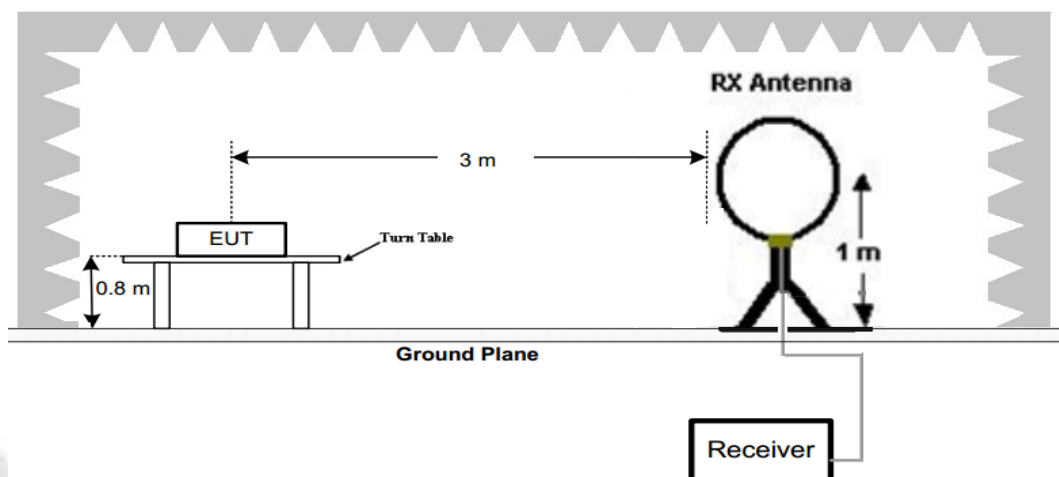
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

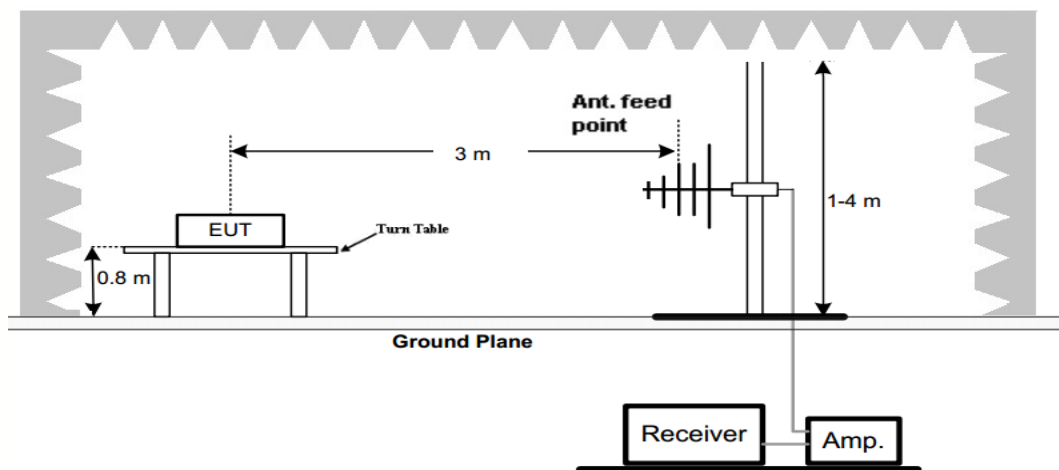
Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	$20\log(2400/F(\text{KHz})) + 40\log(300/3)$	$2400/F(\text{KHz})$
0.49-1.705	3	$20\log(24000/F(\text{KHz})) + 40\log(30/3)$	$24000/F(\text{KHz})$
1.705-30	3	$20\log(30) + 40\log(30/3)$	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

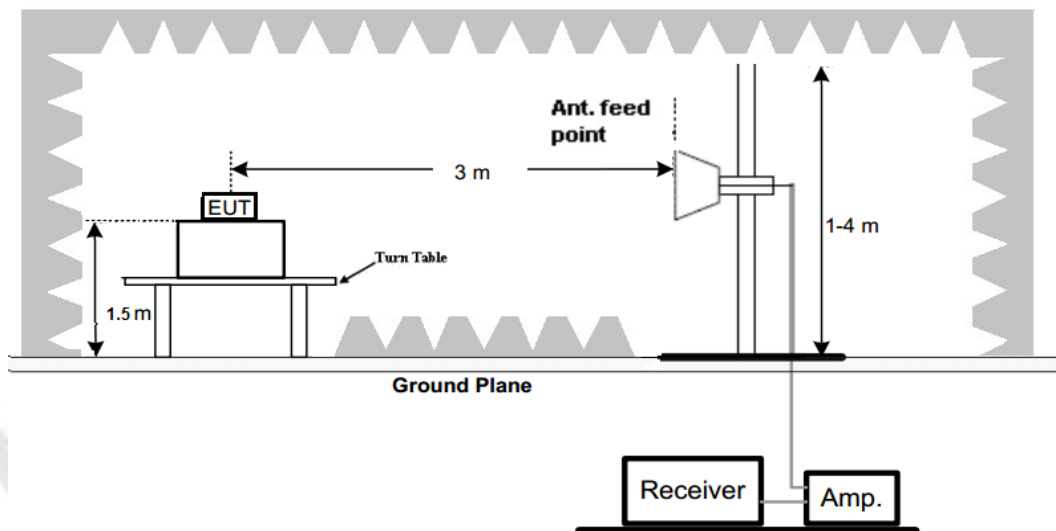
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz

**Test Procedure**

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement –X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.

TEST RESULTS

Remark:

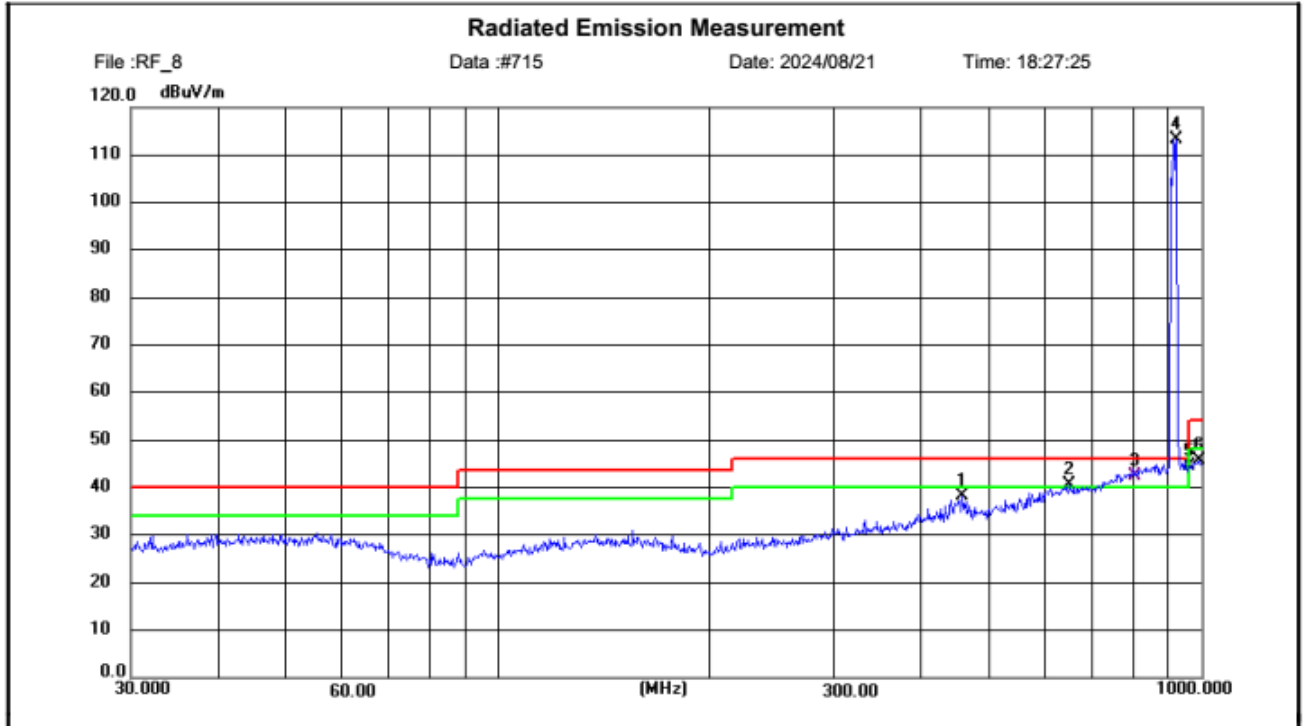
1. For below 1GHz testing recorded worst at high channel.
2. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, Found the emission level are attenuated 20dB below the limits from 9 kHz to 30MHz, so it does not recorded in report.

For 30MHz-1GHz

Horizontal



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Site LAB Chamber 2

Limit: FCC Part15 RE-Class C_30-1000MHz

EUT:

M/N: MCR-SGLA00391T0

Mode: 924.9MHz

Note: Hangzhou Laizhi Technology Co., Ltd

Polarization: *Horizontal*

Power:

Distance: 3m

Temperature: 25(C)

Humidity: 50 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	458.5110	9.15	28.97	38.12	46.00	7.88	peak	100	125	P	
2	650.5145	7.71	32.90	40.61	46.00	5.39	peak	100	115	P	
3	802.5064	6.08	36.27	42.35	46.00	3.65	QP	100	0	P	
4	924.9157	75.56	37.69	113.25	46.00	-67.25	peak	100	9	F	
5	961.3191	6.45	38.04	44.49	54.00	9.51	peak	100	260	P	
6	994.3180	7.42	38.33	45.75	54.00	8.25	peak	100	187	P	

Vertical



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Radiated Emission Measurement

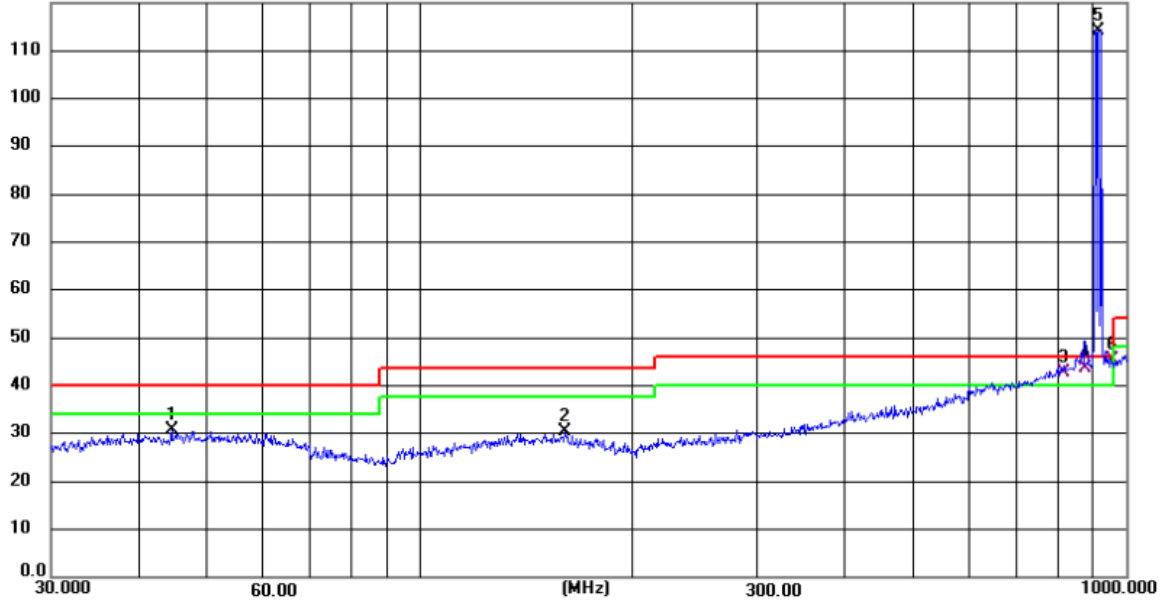
File :RF_8

Data :#716

Date: 2024/08/21

Time: 18:28:29

120.0 dBuV/m



Site LAB Chamber 2

Limit: FCC Part15 RE-Class C_30-1000MHz

EUT:

M/N: MCR-SGLA00391T0

Mode: 924.9MHz

Note: Hangzhou Laizhi Technology Co., Ltd

Polarization: **Vertical**

Power:

Distance: 3m

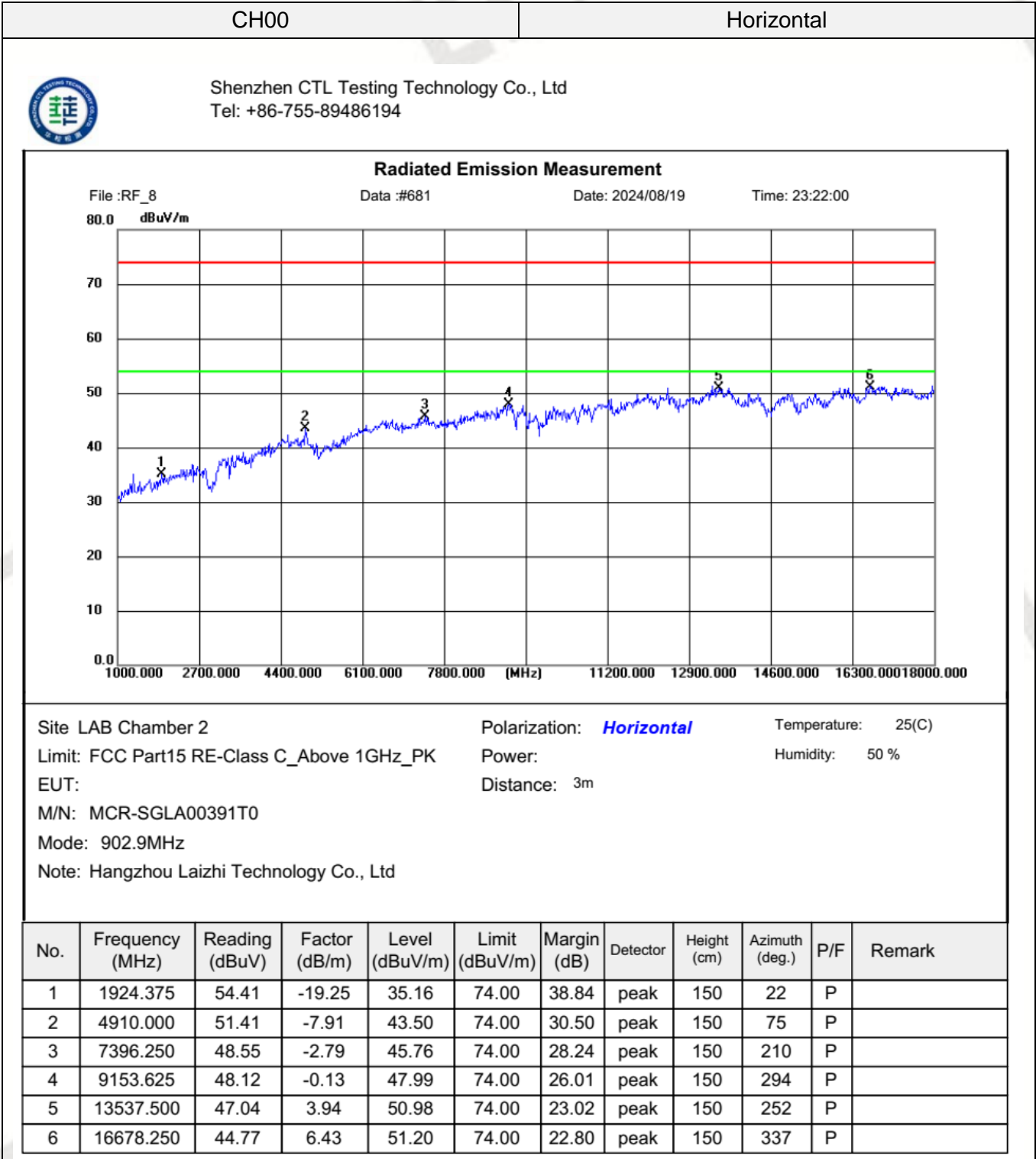
Temperature: 25(C)

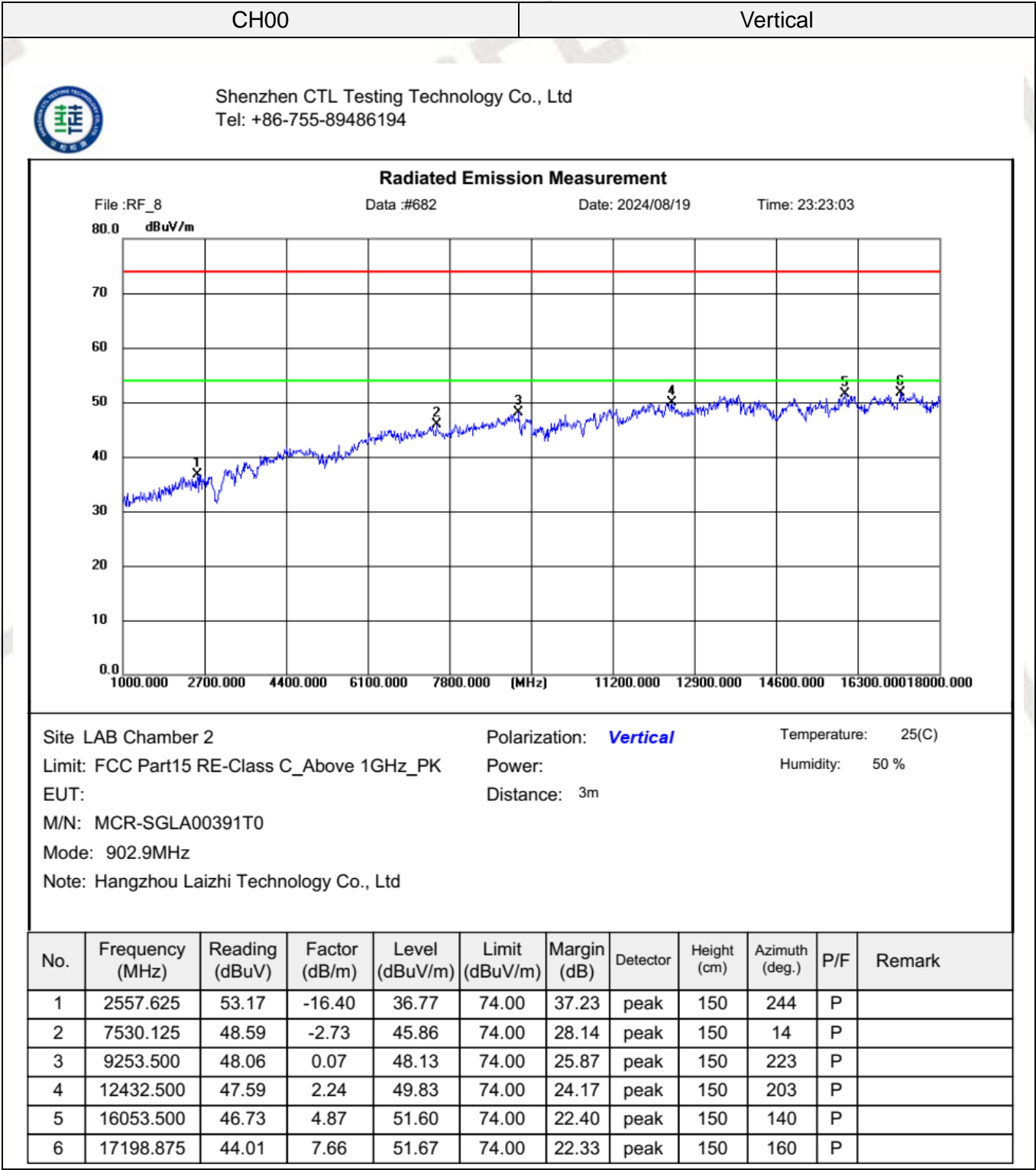
Humidity: 50 %

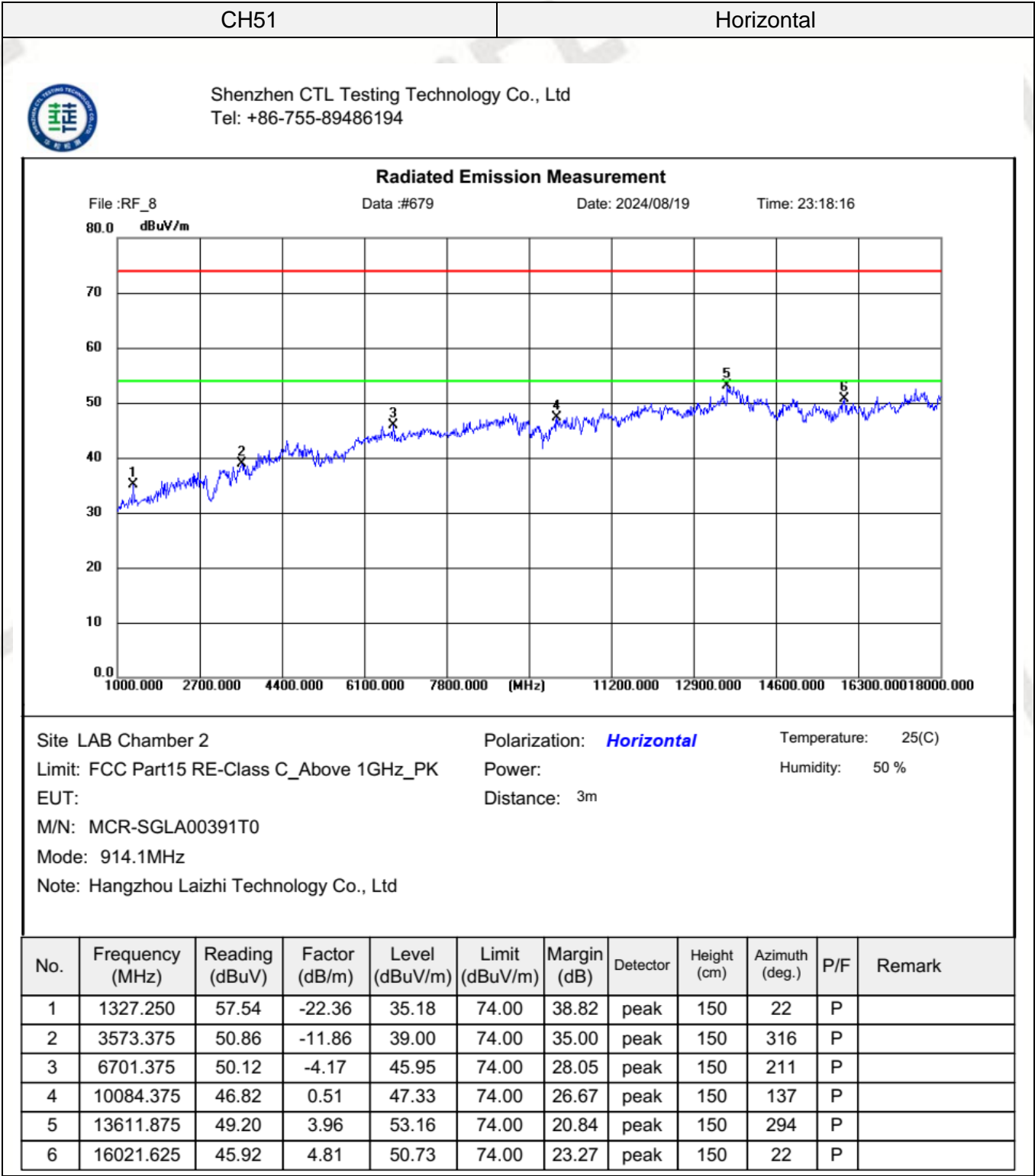
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	44.5086	6.40	24.48	30.88	40.00	9.12	peak	100	44	P	
2	160.8384	6.78	23.79	30.57	43.50	12.93	peak	100	12	P	
3	816.8456	6.05	36.62	42.67	46.00	3.33	QP	100	360	P	
4	872.2921	7.10	36.50	43.60	46.00	2.40	QP	100	360	P	
5	924.9672	76.56	37.63	114.19	46.00	-68.19	peak	100	277	F	
6	954.4725	7.49	37.96	45.45	46.00	0.55	QP	100	0	P	

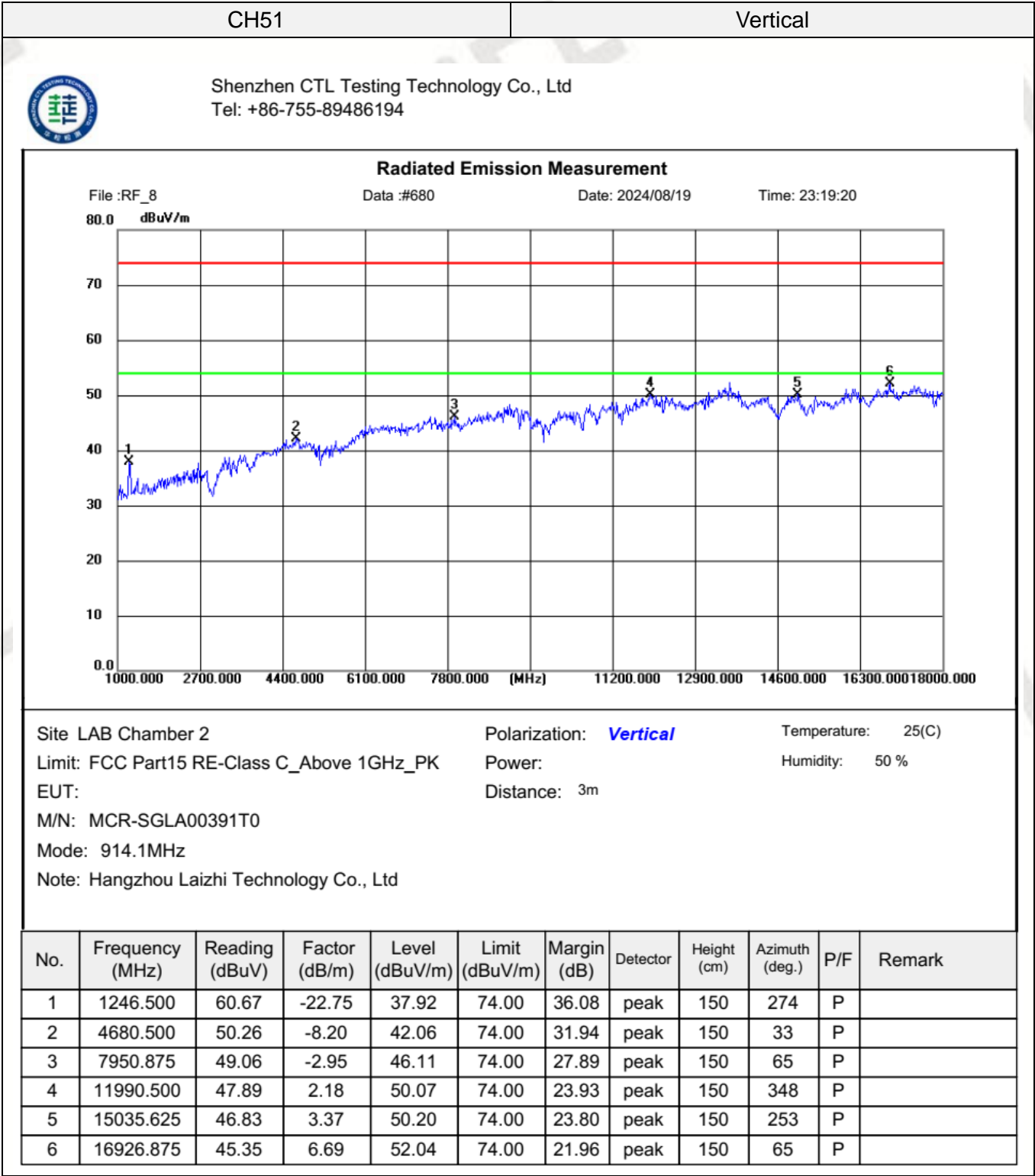
For 1GHz to 18GHz

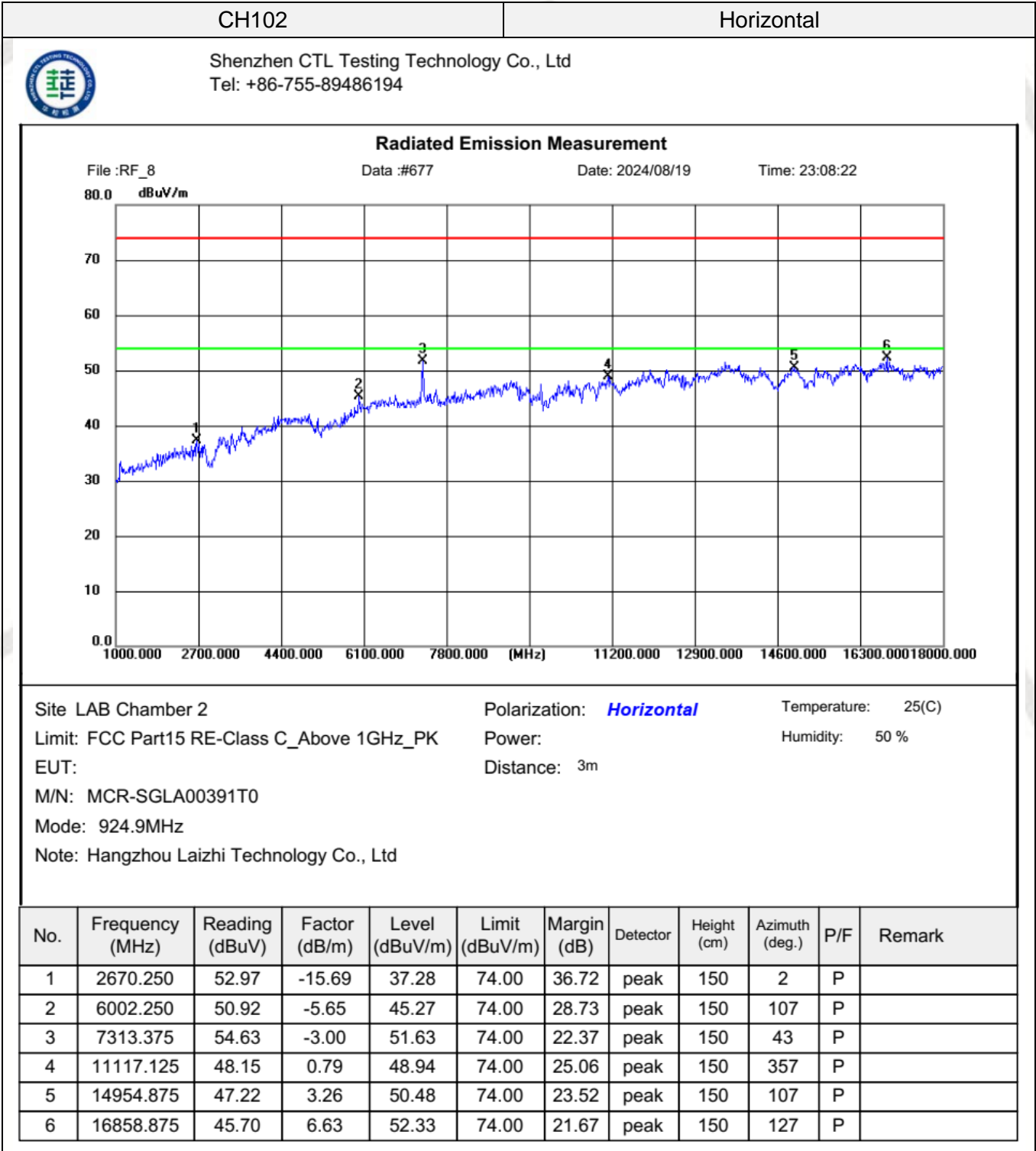
Lora-FHSS (above 1GHz)

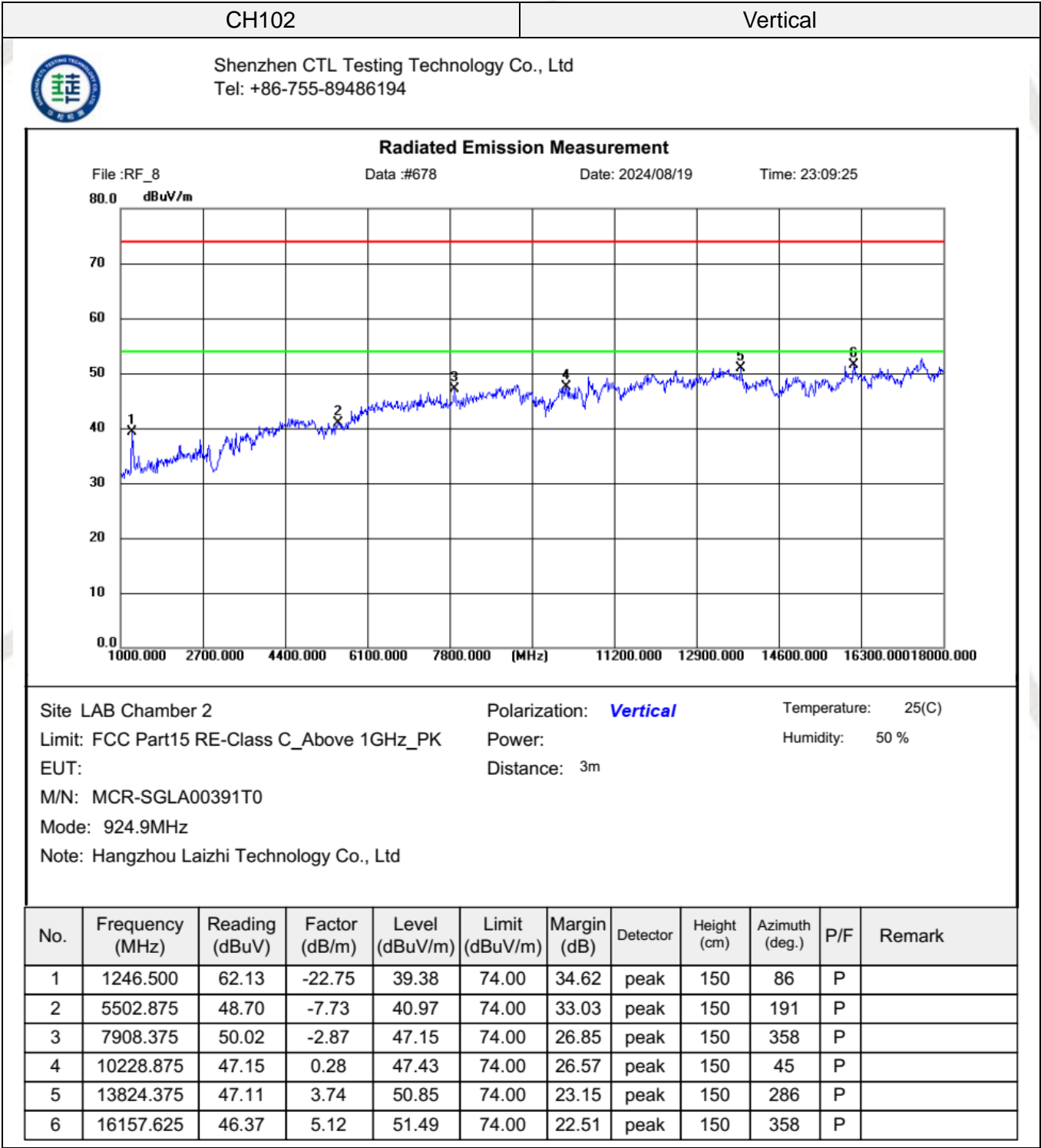










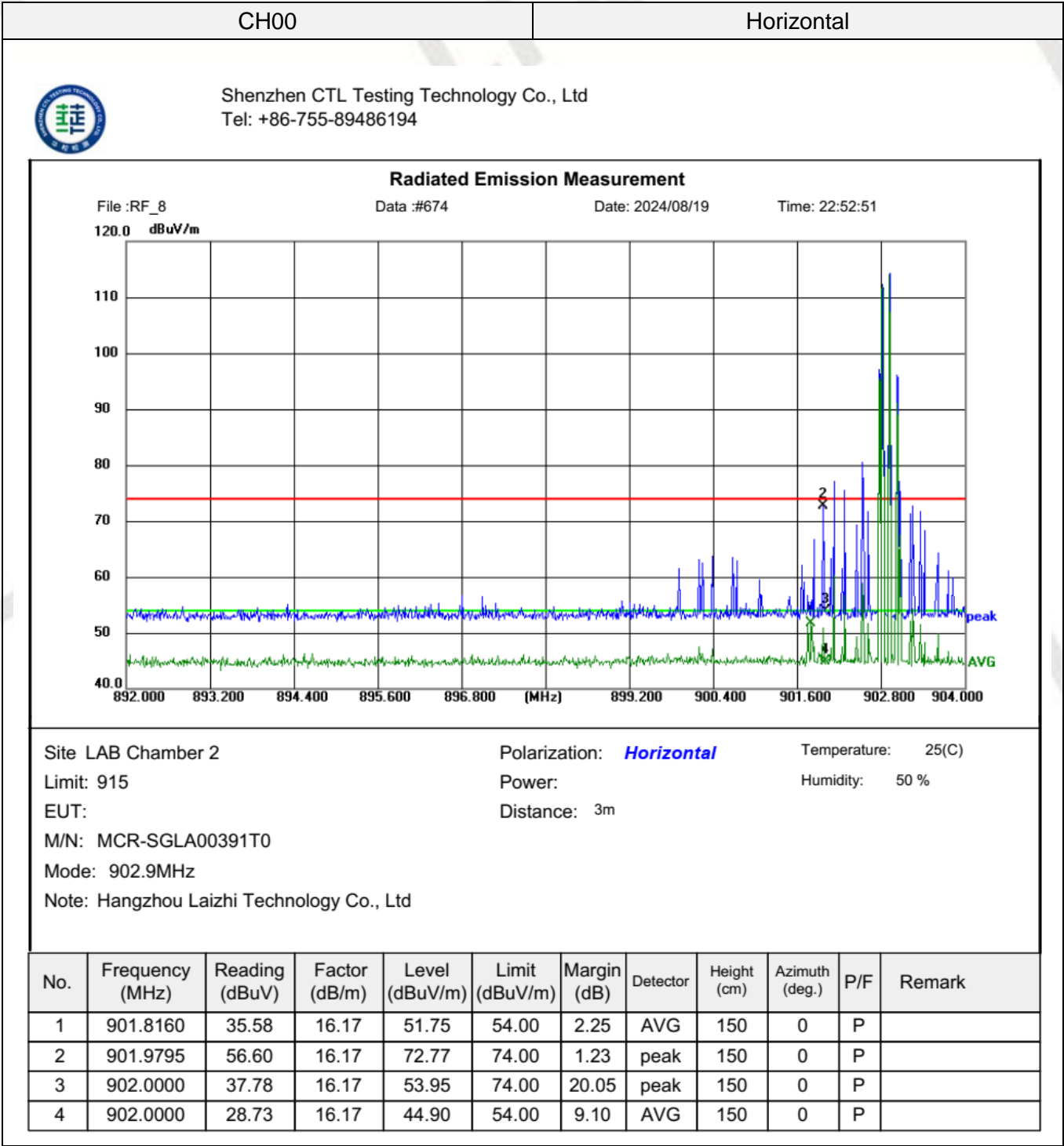


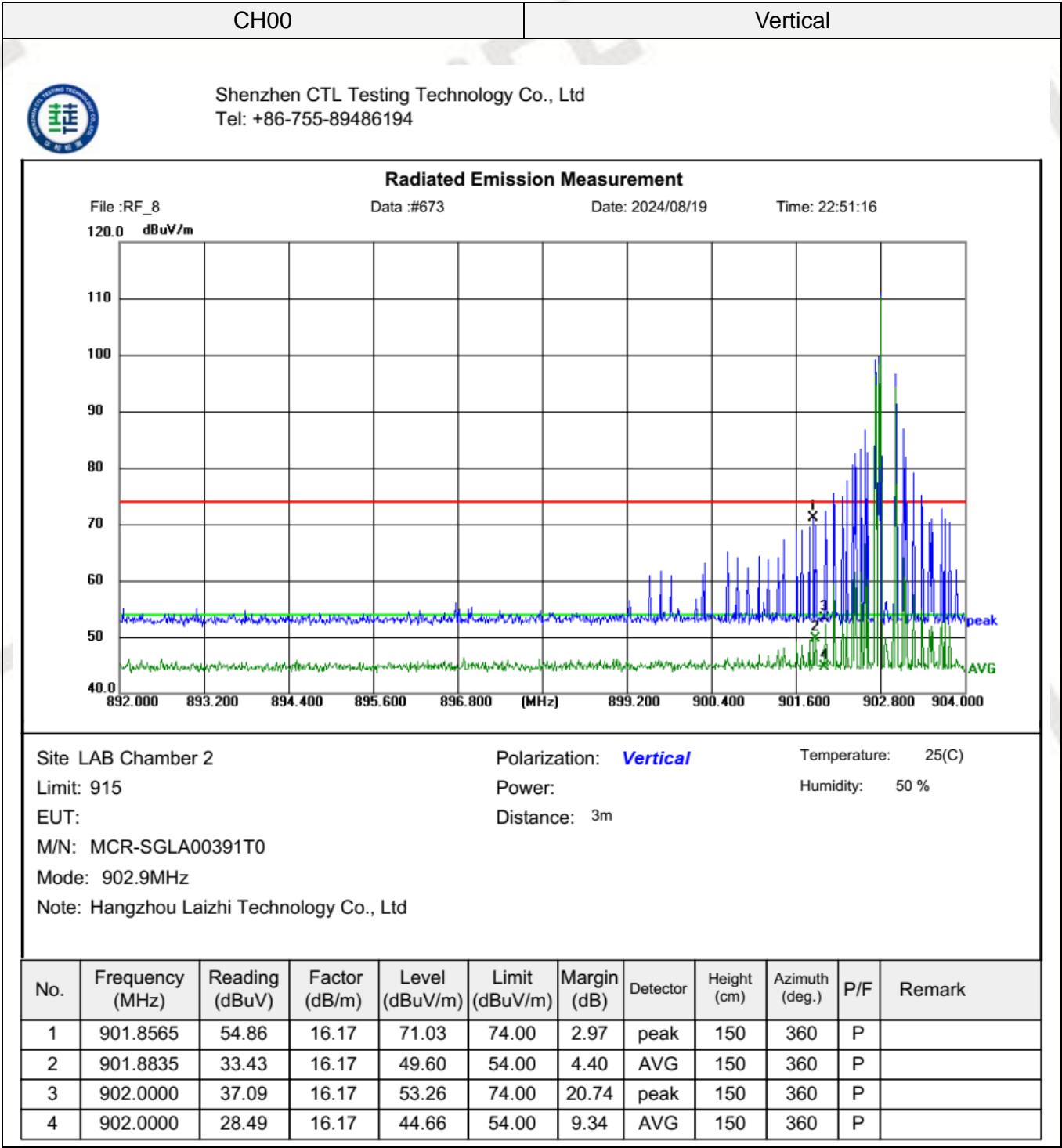
REMARKS:

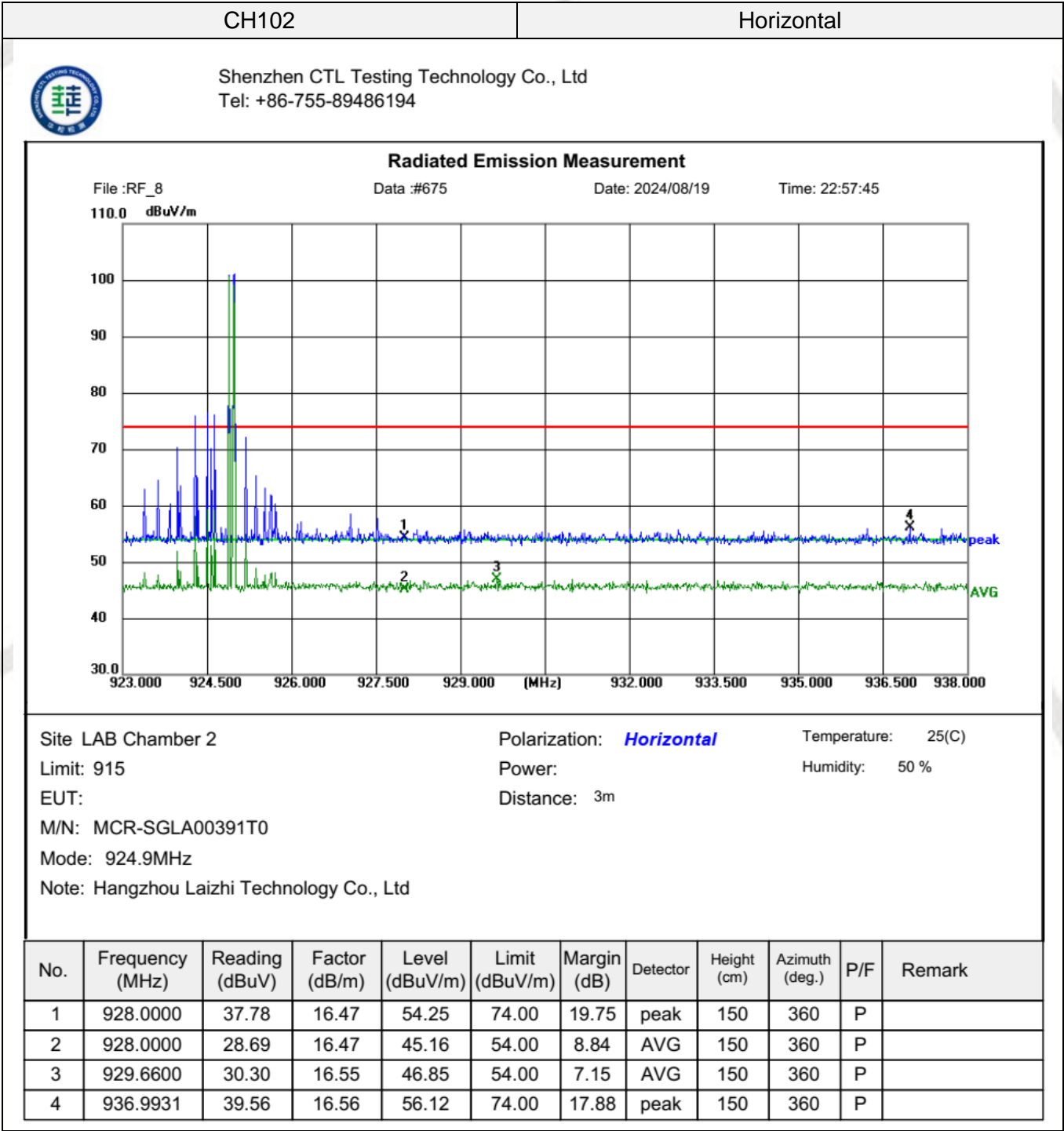
1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
5. Other emissions are attenuated 20dB below the limits from 9kHz to 30MHz, so it does not recorded in report.
6. 18GHz-26GHz not recorded for no spurious point have a margin of less than 6 dB with respect to the limits.

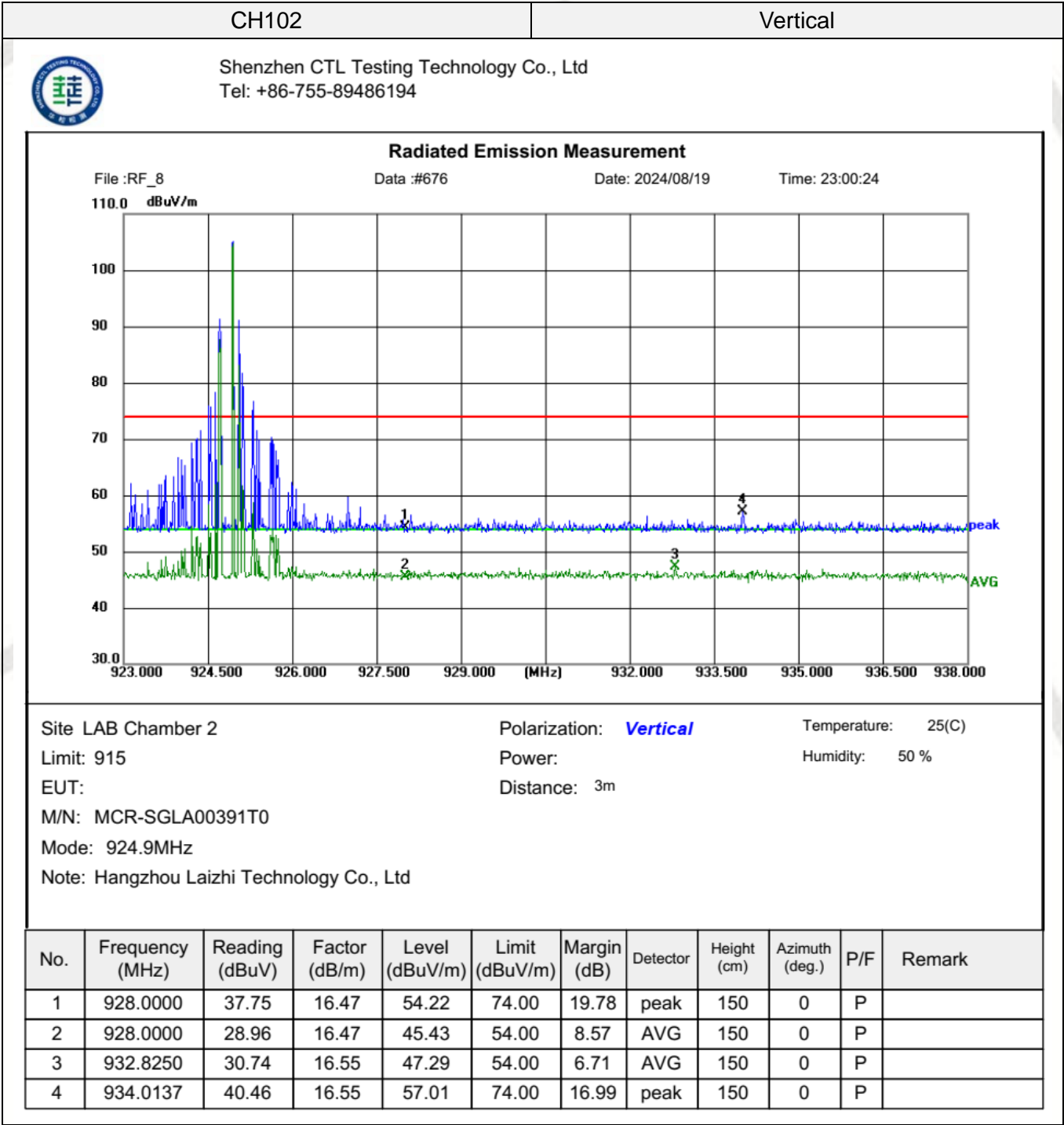
Results of Band Edges Test (Radiated)

Lora-FHSS









REMARKS:

- Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
- Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- Margin value = Limit value- Emission level.
- RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
- For fundamental frequency, RBW 3MHz VBW 3MHz Peak detector is for PK Value; RMS detector is for AV value.
- Other emissions are attenuated 20dB below the limits from 9kHz to 30MHz, so it does not recorded in report.

3.3. Maximum Peak Output Power

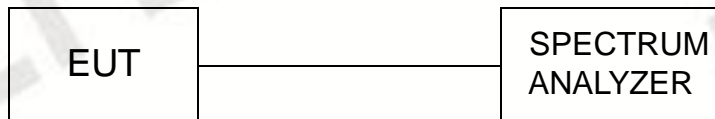
Limit

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum.

Test Configuration



Test Results

Raw data reference to Section 2 from Appendix for LoRa. .

3.4. 20dB Bandwidth

Limit

FCC §15.247 (a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 91 KHz VBW.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Configuration



Test Results

Raw data reference to Section 1 from Appendix for LoRa. .

3.5. Frequency Separation

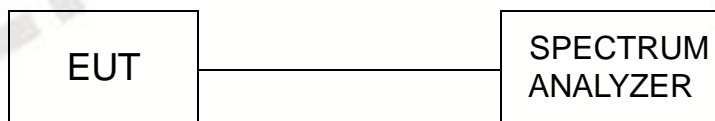
LIMIT

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the $2/3 \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.

TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 300 KHz RBW and 300 KHz VBW.

TEST CONFIGURATION



TEST RESULTS

Raw data reference to Section 3 from Appendix for LoRa. .

3.6. Number of hopping frequency

Limit

FCC §15.247 (a)(1)(i)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Procedure

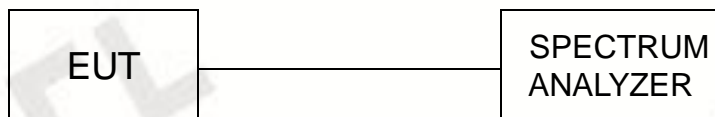
According to ANSI C63.10-2013 Section 7.8.3

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- c) VBW \geq RBW.
- d) Sweep: Auto.
- e) Detector function: Peak.
- f) Trace: Max hold.
- g) Allow the trace to stabilize

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

Test Configuration



Test Results

Raw data reference to Section 4 from Appendix for LoRa. .

3.7. Time of Occupancy (Dwell Time)

Limit

FCC §15.247 (a)(1)(i)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the averagetime of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period;if the20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 910 KHz RBW and 910 KHz VBW, Span 0Hz.

Test Configuration



Test Results

Raw data reference to Section 5 from Appendix for LoRa. .

3.8. Out-of-band Emissions

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, band edge and out-of-band emissions.

Test Configuration



Test Results

Raw data reference to Section 6 from Appendix for LoRa.

3.9. Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, 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.

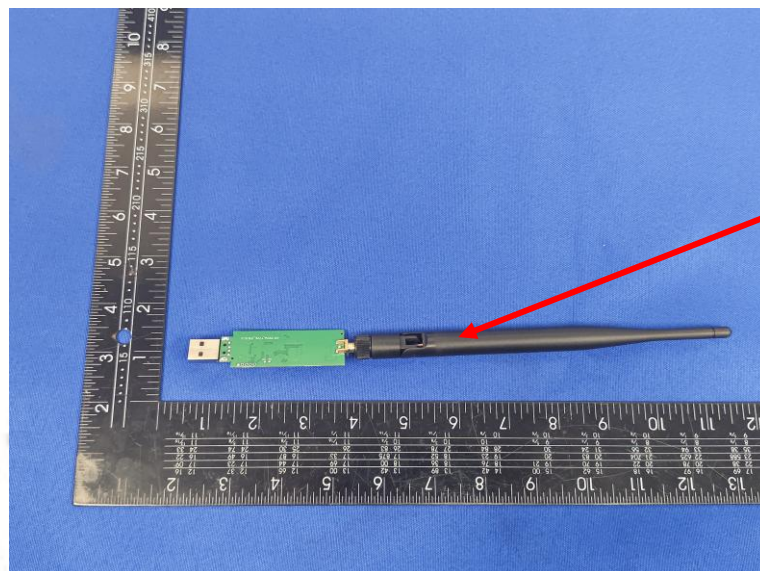
And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance

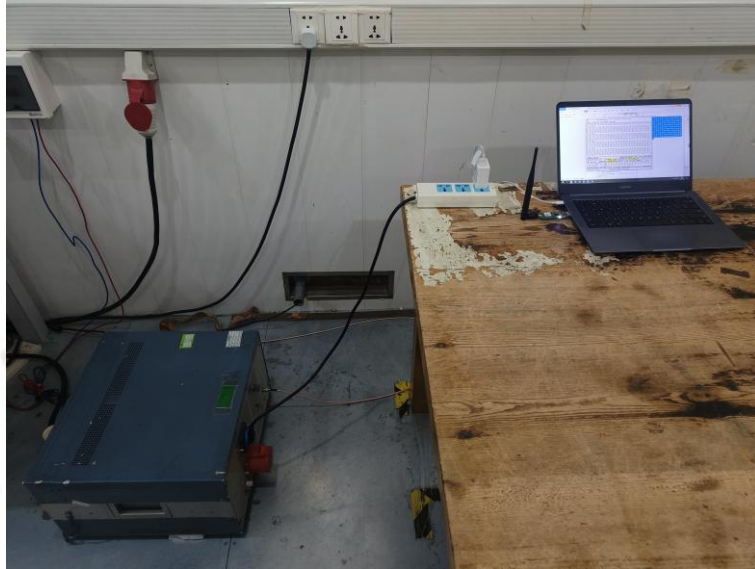
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The maximum gain of antenna was 1.89dBi

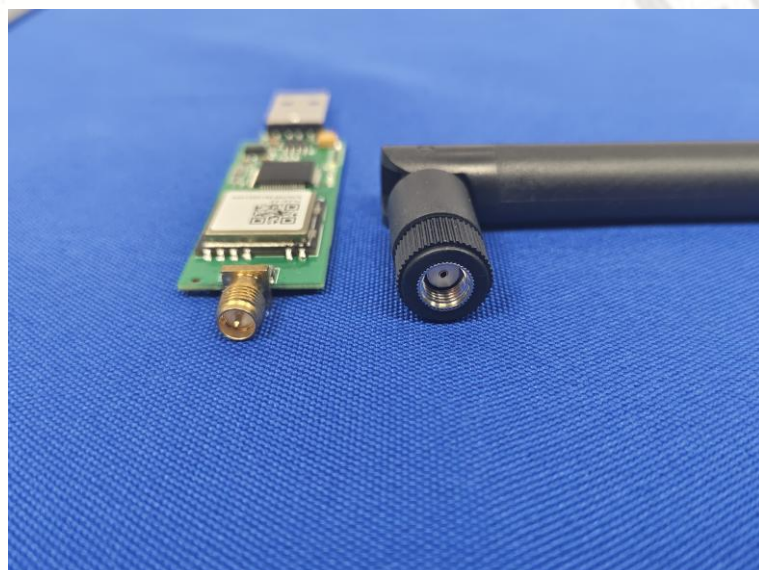
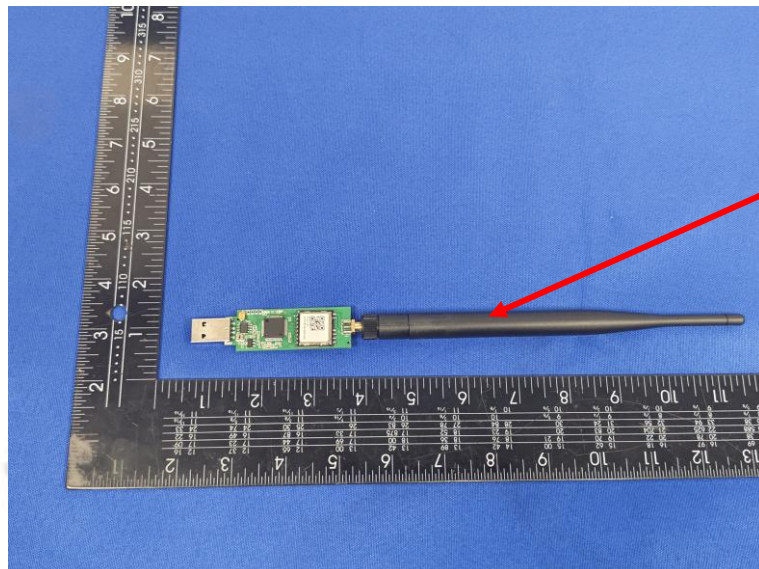


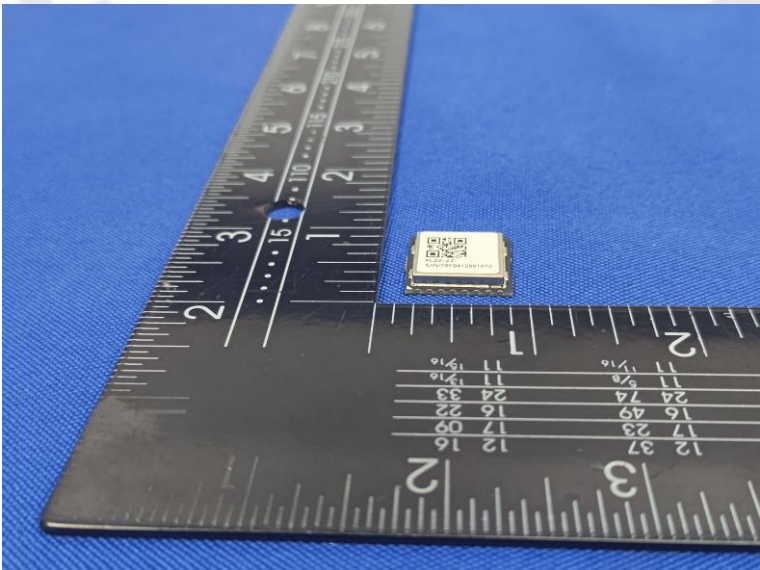
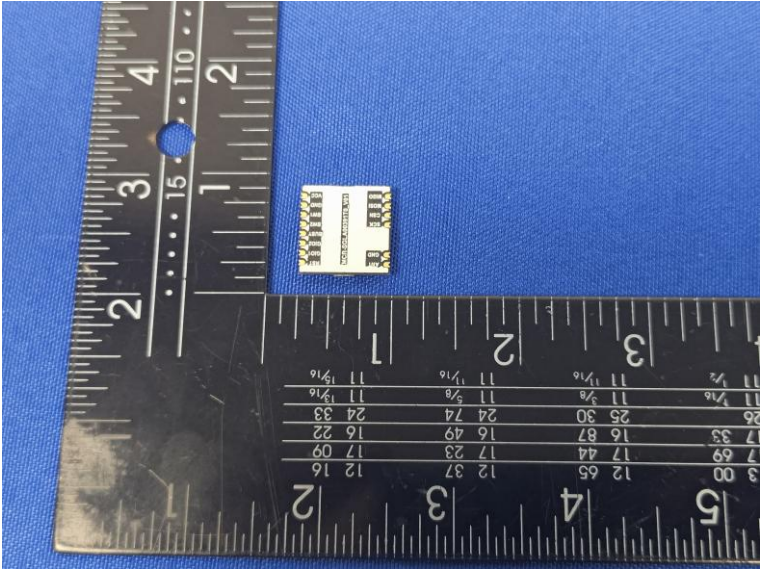
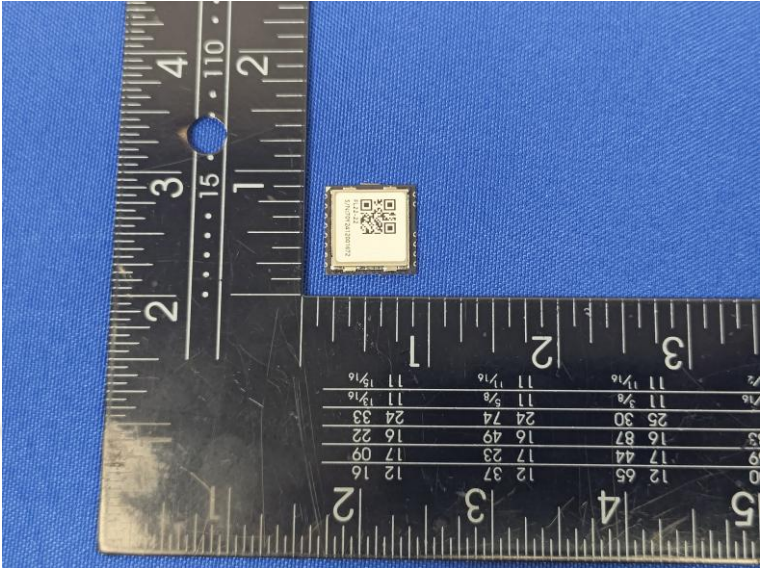
4. Test Setup Photos of the EUT

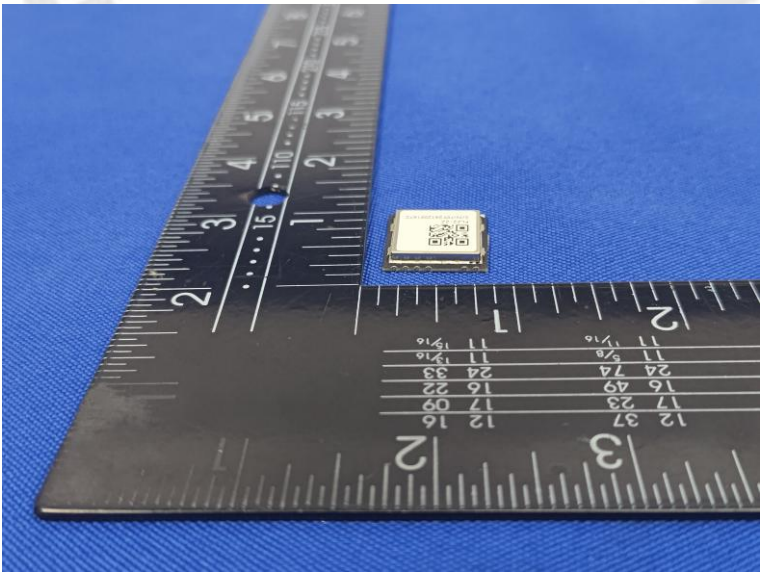
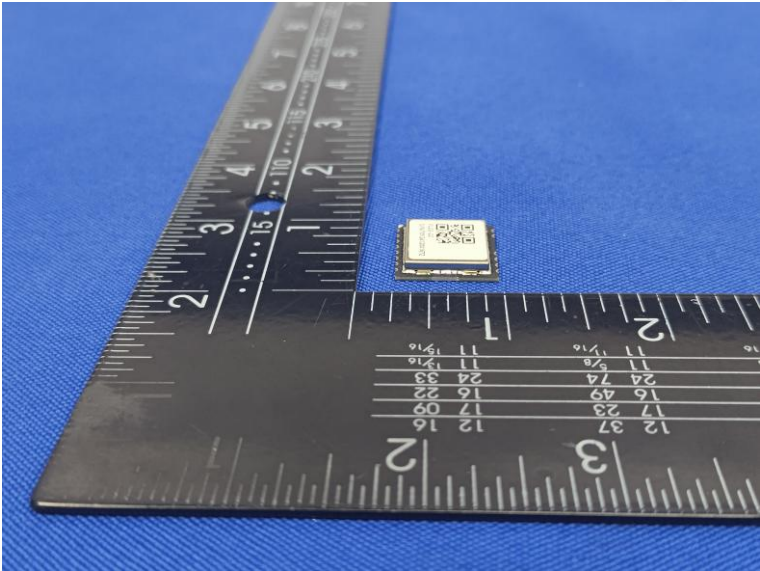
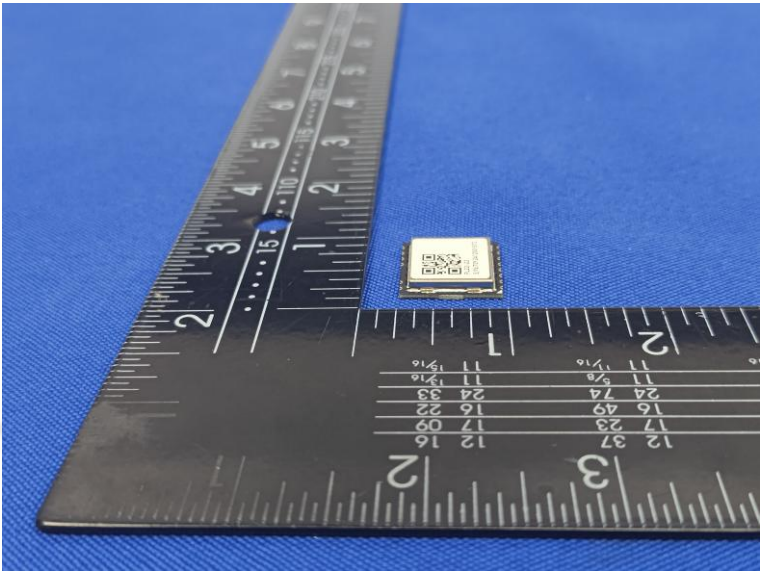


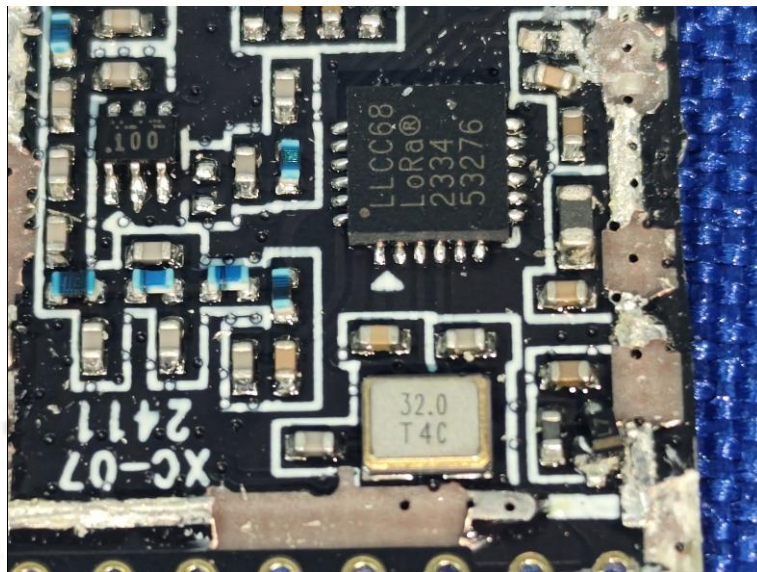
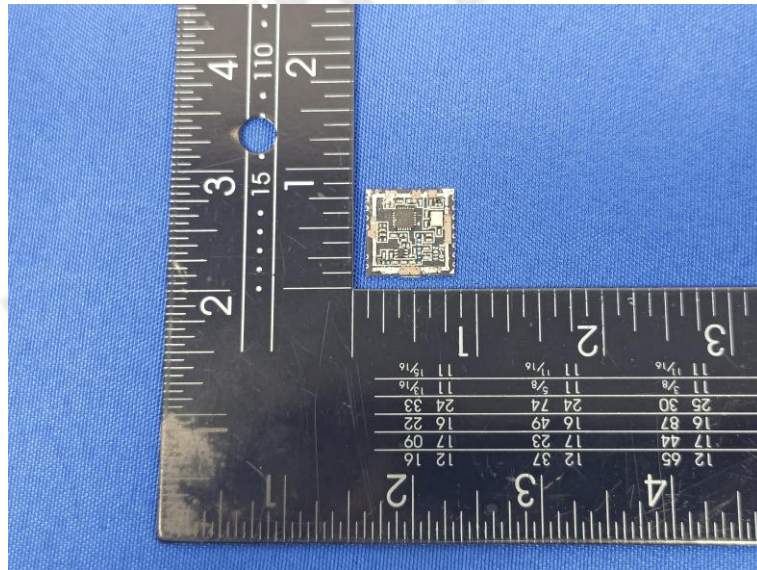
5. Photos of the EUT

External Photos of EUT







Internal Photos of EUT

***** End of Report *****