

Test Report

Verified code: 581820

Report No.: E20230117700901-1

Customer: Lumi United Technology Co., Ltd

Address: B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District,
Nanshan District, Shenzhen, China

Sample Name: Smart Lock U100

Sample Model: SDL-D01

Receive Sample
Test Date: Jan.18,2023

Test Date: Jan.30,2023 ~ Feb.17,2023

Reference
Document: CFR 47 FCC Part 15 Subpart C
RADIO FREQUENCY DEVICES:Subpart C—Intentional Radiators

Test Result: Pass

Prepared by: Chen Xiaocong

Reviewed by: Wu Haoming

Approved by: Zhao Zetian

GUANGZHOU GRG METROLOGY & TEST CO., LTD

Issued Date: 2023-03-03

GUANGZHOU GRG METROLOGY & TEST CO., LTD.

Address: No.163, Pingyun Road, West of Huangpu Avenue, Guangzhou, Guangdong, China
Tel: (+86) 400-602-0999 FAX: (+86) 020-38698685 Web: <http://www.grgtest.com>



Statement

1. The report is invalid without "special seal for inspection and testing"; some copies are invalid; The report is invalid if it is altered or missing; The report is invalid without the signature of the person who prepared, reviewed and approved it.
2. The sample information is provided by the client and responsible for its authenticity; The content of the report is only valid for the samples sent this time.
3. When there are reports in both Chinese and English, the Chinese version will prevail when the language problems are inconsistent.
4. If there is any objection concerning the report, please inform us within 15 days from the date of receiving the report.
5. Without the agreement of the laboratory, the client is not authorized to use the test results for unapproved propaganda.

----- The following blanks -----

TABLE OF CONTENTS

1.	TEST RESULT SUMMARY	6
2.	GENERAL DESCRIPTION OF EUT	7
2.1	APPLICANT	7
2.2	MANUFACTURER	7
2.3	BASIC DESCRIPTION OF EQUIPMENT UNDER TEST	7
2.4	CHANNEL LIST	8
2.5	TEST OPERATION MODE	8
2.6	LOCAL SUPPORTIVE	8
2.7	CONFIGURATION OF SYSTEM UNDER TEST	8
2.8	DUTY CYCLE	9
3.	LABORATORY	11
4.	ACCREDITATIONS	11
5.	MEASUREMENT UNCERTAINTY	12
6.	LIST OF USED TEST EQUIPMENT AT GRGT	13
7.	CONDUCTED EMISSION MEASUREMENT	14
7.1	LIMITS	14
7.2	TEST PROCEDURES	14
7.3	TEST SETUP	15
7.4	DATA SAMPLE	15
7.5	TEST RESULTS	16
8.	RADIATED SPURIOUS EMISSIONS	18
8.1	LIMITS	18
8.2	TEST PROCEDURES	18
8.3	TEST SETUP	21
8.4	DATA SAMPLE	22
8.5	TEST RESULTS	23
9.	6DB BANDWIDTH	31
9.1	LIMITS	31
9.2	TEST PROCEDURES	31
9.3	TEST SETUP	31
9.4	TEST RESULTS	31
10.	MAXIMUM PEAK OUTPUT POWER	34
10.1	LIMITS	34
10.2	TEST PROCEDURES	34
10.3	TEST SETUP	34
10.4	TEST RESULTS	34
11.	POWER SPECTRAL DENSITY	35
11.1	LIMITS	35
11.2	TEST PROCEDURES	35
11.3	TEST SETUP	35
11.4	TEST RESULTS	35
12.	CONDUCTED BAND EDGES AND SPURIOUS EMISSIONS	38

12.1	LIMITS.....	38
12.2	TEST PROCEDURES.....	38
12.3	TEST SETUP	38
12.4	TEST RESULTS	38
13.	RESTRICTED BANDS OF OPERATION	45
13.1	LIMITS.....	45
13.2	TEST PROCEDURES.....	46
13.3	TEST SETUP	46
13.4	TEST RESULTS	47
APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM		52
APPENDIX B. PHOTOGRAPH OF THE EUT.....		52

----- The following blanks -----

REPORT ISSUED HISTORY

Report Version	Report No.	Description	Compile Date
1.0	E20230117700901-1	Original Issue	2023-02-22

----- The following blanks -----

1. TEST RESULT SUMMARY

Technical Requirements		
CFR 47 FCC Part 15 Subpart C (§15.247)		
Limit / Severity	Item	Result
§15.247(b)(3)	Maximum peak output power	Pass
§15.207 (a)	Conducted Emissions	Pass
§15.247(e)	Power spectral density	Pass
§15.247(a)(2)	6dB bandwidth	Pass
§15.247(d)	Restricted bands of operation	Pass
§15.247(d)	Conducted band edges and spurious emissions	Pass
§15.247(d) & §15.209 & §15.205	Radiated spurious emissions	Pass
§15.203	Antenna requirement	Pass

Note: The EUT has one antenna. The antenna is internal antenna.

The max gain of antenna is 2dBi, which accordance 15.203 is considered sufficient to comply with the provisions of this section.

----- The following blanks -----

2. GENERAL DESCRIPTION OF EUT

2.1 APPLICANT

Name: Lumi United Technology Co., Ltd
Address: B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen, China

2.2 MANUFACTURER

Name: Lumi United Technology Co., Ltd
Address: B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen, China

2.3 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment: Smart Lock U100
Model No.: SDL-D01
Adding Model: DL-D01D
Models Difference: That EUT (Smart Lock U100) Model Numbers SDL-D01 and DL-D01D have the same technical construction including circuit diagram PCB layout, hardware version and software version identical, except sales area, packaging and accessories are different, and all the tests were performed on the model SDL-D01.
Trade Name: Aqara
FCC ID: 2AKIT-SDLD01
Power Supply: DC 6V power supplied by 4 AA batteries, DC 5V power supplied by USB-C emergency port
Frequency Range: 2405MHz-2475MHz
Transmit Power: 7.71dBm
Modulation type: O-QPSK
Antenna Specification: FPC antenna with 2 dBi gain (Max)
Temperature Range: -35 °C~66 °C
Hardware Version: V2.1
Software Version: 1.0.4_0007
Sample No: E20230117700901-0003, E20230117700901-0004
Note: /

2.4 CHANNEL LIST

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
11	2405	12	2410	13	2415	14	2420
15	2425	16	2430	17	2435	18	2440
19	2445	20	2450	21	2455	22	2460
23	2465	24	2470	25	2475	/	/

2.5 TEST OPERATION MODE

Test Item	Mode No.	Description of the modes
Radiated Emission	1	Zigbee fixed frequency transmitting

2.6 LOCAL SUPPORTIVE

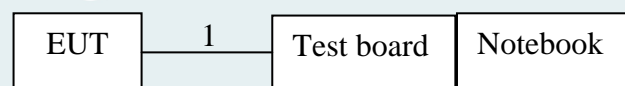
Name of Equipment	Manufacturer	Model	Serial Number	Note
Notebook	LENOVO	TianYi 310-14ISK	MP18DLC6	/
Test board	/	/	/	/
Adapter	/	/	/	/

No.	Cable Type	Qty.	Shielded Type	Ferrite Core(Qty.)	Length
1	USB cable	1	No	0	0.5m
2	DC cable	1	No	0	1.5m

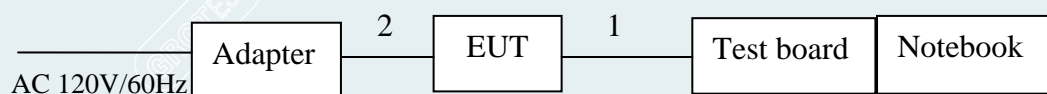
Note: The notebook is just used to produce fixed frequency transmitting.

2.7 CONFIGURATION OF SYSTEM UNDER TEST

For Radiated Spurious Emission, 6dB Bandwidth, Maximum Peak Output Power, Power Spectral Density, Conducted band edges and Spurious Emission, Restricted bands of operation



For Conducted Emissions



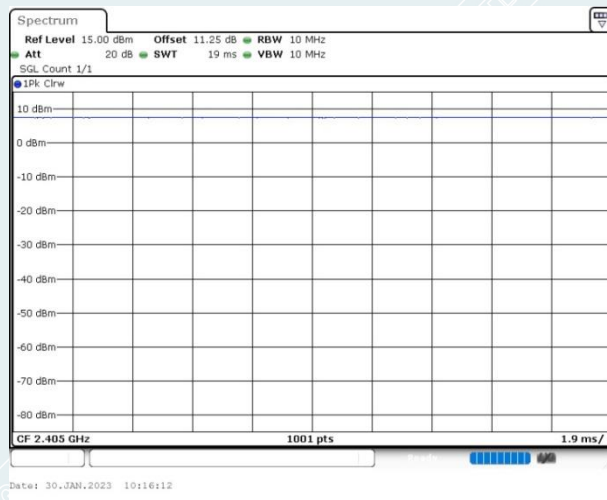
Test software:

Software version	Test level
QCOM_V1.0	8

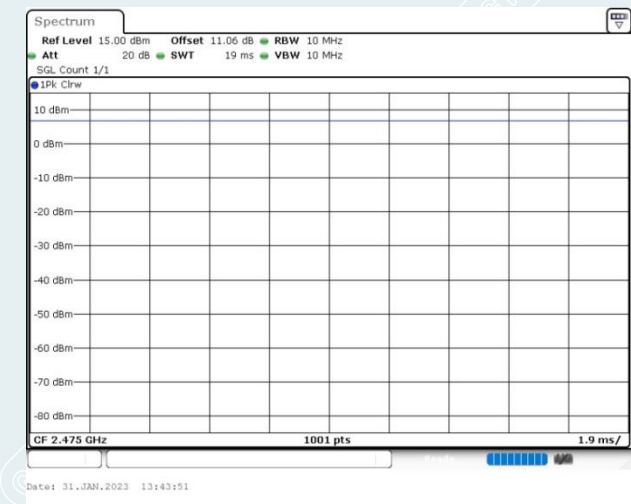
2.8 DUTY CYCLE

EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0004
Test Engineer:	Yang Zhaoyun	Test Date:	2023-01-30~2023-01-31
Environmental Conditions:	21.3℃/59%RH/101.0kPa	/	/

Test Mode	Antenna	Frequency (MHz)	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
Zigbee	Ant1	2405	0.00	0.00	100
		2440	0.00	0.00	100
		2475	0.00	0.00	100

Zigbee_2405MHz**Zigbee_2440MHz**

Zigbee_2475MHz



----- The following blanks -----

3. LABORATORY

The tests & measurements refer to this report were performed by Shenzhen EMC Laboratory of Guangzhou GRG Metrology & Test Co., Ltd.

Add : Address: No.1301 Guangang Road Xinlan Community, Guanlan Street, Longhua
District Shenzhen, 518110, People's Republic of China

P.C. : 518110

Tel : 0755-61180008

Fax : 0755-61180008

4. ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025:2017.

USA A2LA(Certificate #2861.01)

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada ISED (Company Number: 24897, CAB identifier:CN0069)

USA FCC (Registration Number: 759402, Designation Number:CN1198)

Copies of granted accreditation certificates are available for downloading from our web site,
<http://www.grgtest.com>

----- The following blanks -----

5. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement		Frequency	Uncertainty
Radiated Emission	Horizontal	9kHz~30MHz	5.1dB ¹⁾
		30MHz~200MHz	4.5dB ¹⁾
		200MHz~1000MHz	4.4dB ¹⁾
		1GHz~18GHz	5.6dB ¹⁾
		18GHz~26.5GHz	3.7dB ¹⁾
	Vertical	9kHz~30MHz	5.1dB ¹⁾
		30MHz~200MHz	4.4dB ¹⁾
		200MHz~1000MHz	4.5dB ¹⁾
		1GHz~18GHz	5.6dB ¹⁾
		18GHz~26.5GHz	3.7dB ¹⁾
Conduction Emission		150kHz~30MHz	3.4dB ¹⁾

Measurement	Uncertainty
RF frequency	6.0×10^{-6}
RF power conducted	0.8dB
Power spectral density conducted	0.8dB
Occupied channel bandwidth	0.4dB
Unwanted emission, conducted	0.7dB
Humidity	6%
Temperature	2°C

Note:

¹⁾ This uncertainty represents an expanded uncertainty expressed at approximately the 95%.

This uncertainty represents an expanded uncertainty factor of $k=2$.

6. LIST OF USED TEST EQUIPMENT AT GRGT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Radiated Spurious Emission&Restricted bands of operation				
Test S/W	EZ	CCS-2ANT	/	/
Test Receiver	R&S	ESR7	102444	2023-09-02
Preamplifier	EMEC	EM330	I00426	2023-03-05
Bi-log Antenna	Schwarzbeck	CBL6143A	26039	2024-10-23
Spectrum Analyzer	KEYSIGHT	N9010A	MY52221469	2023-06-29
Loop Antenna	TESEQ	HLA6121	52599	2023-04-02
Horn Antenna	Schwarzbeck	BBHA9120D	02143	2023-10-15
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170-497	2023-10-14
Amplifier	Tonscend	TAP037030	AP20E8060081	2023-05-08
Amplifier	Tonscend	TAP01018048	AP20E8060075	2023-05-05
Amplifier	Tonscend	TAP184050	AP20E806071	2023-05-05
Test S/W	Tonscend	JS32-RE/2.5.2.4		
6dB Bandwidth				
Spectrum Analyzer	R&S	FSV30	1321.3008K30-10 4381-rH	2023-11-17
Maximum Peak Output Power				
Pulse power sensor	Agilent	MA2411B	1126150	2023-03-01
Power meter	Anritsu	ML2495A	1204003	2023-02-28
Conducted band edges and Spurious Emission				
Spectrum Analyzer	KEYSIGHT	N9010A	MY52221469	2023-06-29
Peak Output Spectral Density Measurement				
Spectrum Analyzer	KEYSIGHT	N9010A	MY52221469	2023-06-29
Conduction Emission				
EMI TESTRECEIVER	R&S	ESCI	100783	2023-08-28
LISN(EUT)	R&S	ENV216	101543	2023-09-13
Test S/W	EZ	CCS-3A1-CE		

Note: The calibration cycle of the above instruments is 12 months except for the Bi-log Antenna which is 24 months.

7. CONDUCTED EMISSION MEASUREMENT

7.1 LIMITS

Frequency range	Limits (dB μ V)	
	Quasi-peak	Average
150kHz~0.5MHz	66~56	56~46
0.5MHz~5MHz	56	46
5MHz~30MHz	60	50

NOTE: (1) The lower limit shall apply at the transition frequencies.

(2) The limit decreases in line with the logarithm of the frequency in the range of 150 kHz to 0.5MHz.

7.2 TEST PROCEDURES

Procedure of Preliminary Test

Test procedures follow ANSI C63.10:2013.

For measurement of the disturbance voltage the equipment under test (EUT) is connected to the power supply mains and any other extended network via one or more artificial network(s). An EUT, whether intended to be grounded or not, and which is to be used on a table is configured as follows:

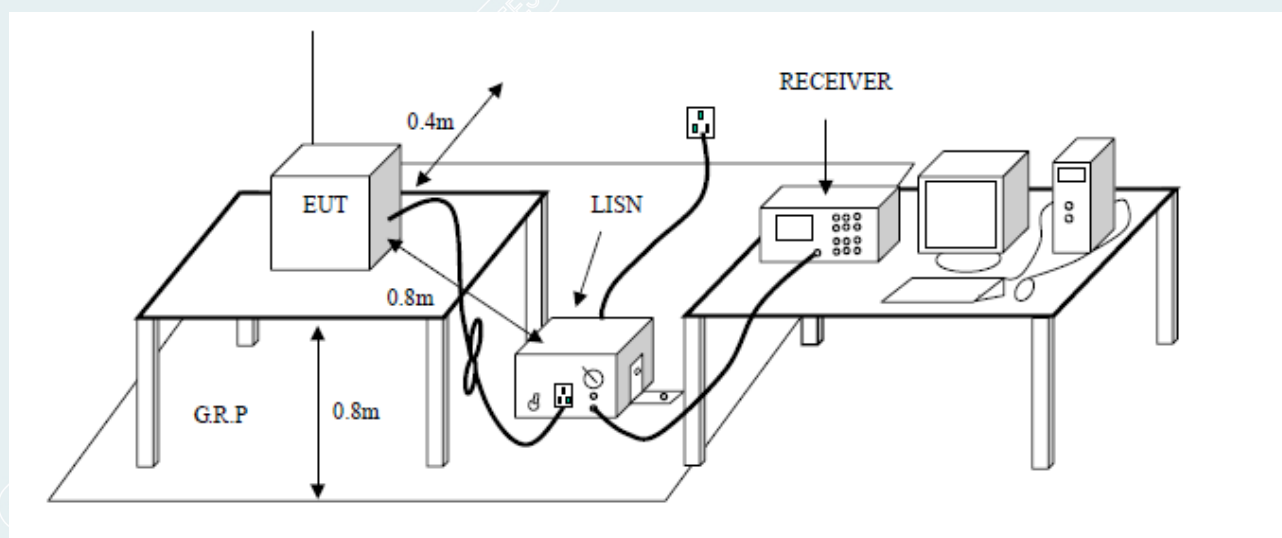
- Either the bottom or the rear of the EUT shall be at a controlled distance of 40 cm from a reference ground plane. This ground plane is normally the wall or floor of a shielded room. It may also be a grounded metal plane of at least 2 m by 2 m. This is physically accomplished as follows:
 - 1) place the EUT on a table of non-conducting material which is at least 80 cm high. Place the EUT so that it is 40 cm from the wall of the shielded room, or
 - 2) place the EUT on a table of non-conducting material which is 40 cm high so that the bottom of the EUT is 40 cm above the ground plane;
- All other conductive surfaces of the EUT shall be at least 80 cm from the reference ground plane;
- The EUT are placed on the floor that one side of the housings is 40 cm from the vertical reference ground plane and other metallic parts;
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 cm to 40 cm long, hanging approximately in the middle between the ground plane and the table.
- I/O cables that are connected to a peripheral shall be bundled in the centre. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

The test mode(s) described in Item 2.6 were scanned during the preliminary test. After the preliminary scan, we found the test mode described in Item 2.6 producing the highest emission level. The EUT configuration and cable configuration of the above highest emission levels were recorded for reference of the final test.

Procedure of Final Test

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test. A scan was taken on both power lines, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. The test data of the worst-case condition(s) was recorded.

7.3 TEST SETUP



7.4 DATA SAMPLE

Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
X.XXXX	32.69	25.65	11.52	44.21	37.17	65.78	55.79	-21.57	-18.62	Pass

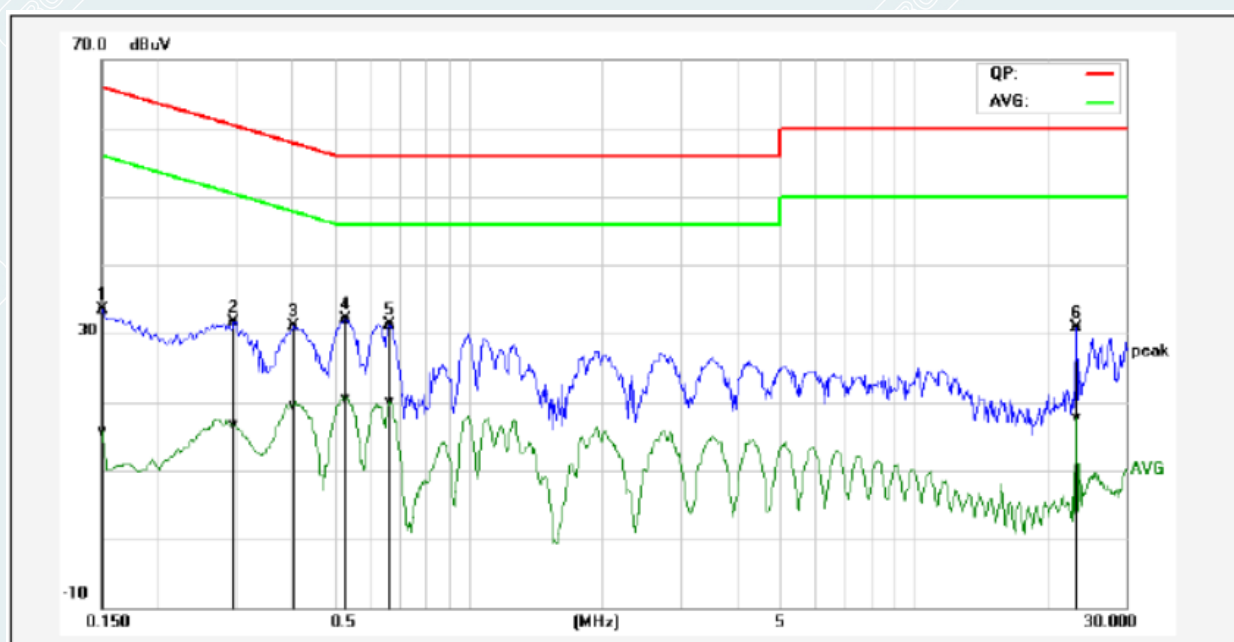
Factor = Insertion loss of LISN + Cable Loss
 Result = Quasi-peak Reading/ Average Reading + Factor
 Limit = Limit stated in standard
 Margin = Result (dBuV) – Limit (dBuV)

----- The following blanks -----

7.5 TEST RESULTS

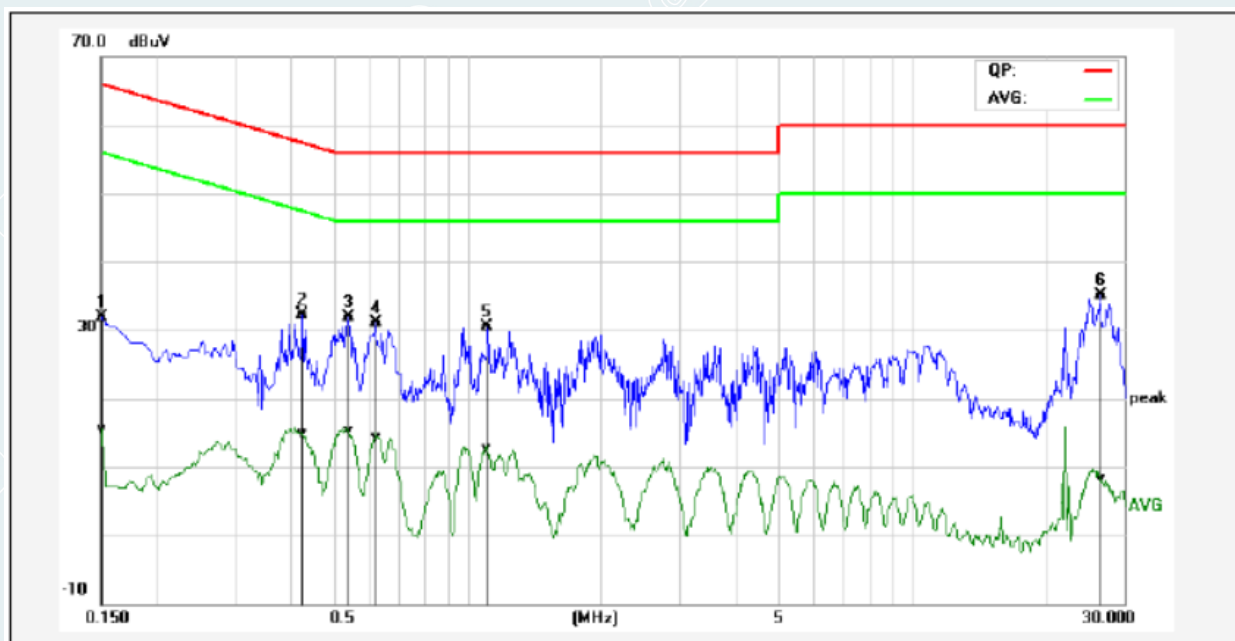
All modes were pretested and only the worst modes and channels were recorded in this report.
(Zigbee 2405MHz)

EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0003
Power supply:	AC 120V/60Hz	Environmental Conditions:	24.1°C/51%RH/101.0kPa
Test Engineer:	Wang Xinyuan	Test Date:	2023-02-11
Channel	Lowest channel (2405MHz)	Line:	L



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.1500	23.84	6.14	9.61	33.45	15.75	65.99	56.00	-32.54	-40.25	Pass
2	0.2980	22.03	7.08	9.61	31.64	16.69	60.30	50.30	-28.66	-33.61	Pass
3	0.4060	21.55	9.88	9.61	31.16	19.49	57.73	47.73	-26.57	-28.24	Pass
4*	0.5299	22.52	10.92	9.61	32.13	20.53	56.00	46.00	-23.87	-25.47	Pass
5	0.6660	21.78	10.48	9.62	31.40	20.10	56.00	46.00	-24.60	-25.90	Pass
6	23.2340	21.03	7.75	9.93	30.96	17.68	60.00	50.00	-29.04	-32.32	Pass

EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0003
Power supply:	AC 120V/60Hz	Environmental Conditions:	24.1 °C/51%RH/101.0kPa
Test Engineer:	Wang Xinyuan	Test Date:	2023-02-11
Channel	Lowest channel (2405MHz)	Line:	N



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.1500	22.30	5.98	9.60	31.90	15.58	65.99	56.00	-34.09	-40.42	Pass
2	0.4260	22.62	5.21	9.60	32.22	14.81	57.33	47.33	-25.11	-32.52	Pass
3*	0.5420	22.30	5.62	9.60	31.90	15.22	56.00	46.00	-24.10	-30.78	Pass
4	0.6220	21.49	4.74	9.61	31.10	14.35	56.00	46.00	-24.90	-31.65	Pass
5	1.1100	20.91	3.03	9.63	30.54	12.66	56.00	46.00	-25.46	-33.34	Pass
6	26.4340	25.13	-1.73	10.07	35.20	8.34	60.00	50.00	-24.80	-41.66	Pass

8. RADIATED SPURIOUS EMISSIONS

8.1 LIMITS

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.

Frequency (MHz)	Quasi-peak($\mu\text{V/m}$)	Measurement distance(m)	Quasi-peak(dB $\mu\text{V/m}$)@distance 3m
0.009-0.490	2400/F(kHz)	300	128.5~93.8
0.490-1.705	24000/F(kHz)	30	73.8~63
1.705-30.0	30	30	69.5
30~88	100	3	40
88~216	150	3	43.5
216~960	200	3	46
Above 960	500	3	54

NOTE: (1) The lower limit shall apply at the transition frequencies.

(2) Above 18GHz test distance is 1m, so the Peak Limit=74+20*log(3/1)=83.54 (dB $\mu\text{V/m}$).

The Avg Limit=54+20*log(3/1)=63.54 (dB $\mu\text{V/m}$).

8.2 TEST PROCEDURES

1) Sequence of testing 9kHz to 30MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

--- The EUT is placed on a desktop position in the center of the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 ° to 360 °.

--- The antenna height is 1.0 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- Identified emissions during the pre measurement the software maximizes by rotating the turntable position (0 ° to 360 °) and by rotating the elevation axes (0 ° to 360 °).

--- The final measurement will be done in the position (turntable and elevation) causing the highest

emissions with QP detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement and the limit will be stored.

2) Sequence of testing 30MHz to 1GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

--- The EUT is placed on a desktop position in the center of the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

--- The turntable rotates from 0 ° to 360 °.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 4 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of pre measurement the software maximize the peaks by changing turntable rotates from 0 ° to 360 ° and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1GHz to 18GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.

--- The EUT is placed on a desktop position in the center of the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Pre measurement:

- The turntable rotates from 0 ° to 360 °.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 4 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of pre measurement the software maximize the peaks by changing turntable rotates from 0 ° to 360 ° and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18GHz**Setup:**

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Use serial board or connecting line to make EUT and notebook to communicate, according to the actual need to make EUT send constant frequency signal continuously.
- The EUT is placed on a desktop position in the center of the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

Pre measurement:

- The antenna is moved spherical over the EUT in different polarisations of the antenna.

Final measurement:

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the pre measurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the pre measurement and the limit will be stored.

NOTE:

- (a). The frequency from 9kHz to 150kHz, Set RBW=300Hz(for Peak&AVG), RBW=300Hz(for Peak&AVG). the frequency from 150kHz to 30MHz, Set RBW=9kHz, RBW=9kHz, (for QP Detector).
- (b). The frequency from 30MHz to 1GHz, Set RBW=120kHz, RBW=300kHz, (for QP Detector).
- (c). The frequency above 1GHz, for Peak detector: Set RBW=1MHz, RBW=3MHz.
- (d). The frequency above 1GHz, for Avg detector: Set RBW=1MHz, the EUT is configured to transmit with duty cycle \geq 98%, set VBW \leq RBW/100 (i.e., 10kHz) but not less than 10 Hz.

8.3 TEST SETUP

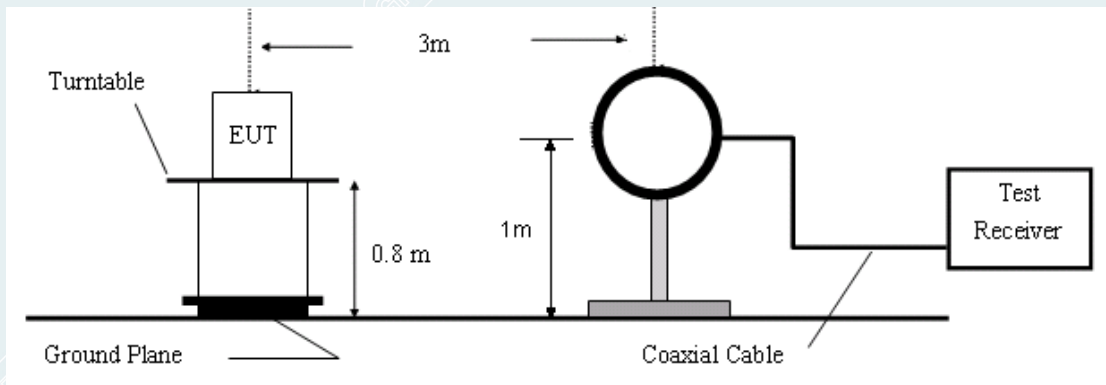


Figure 1. 9kHz to 30MHz radiated emissions test configuration

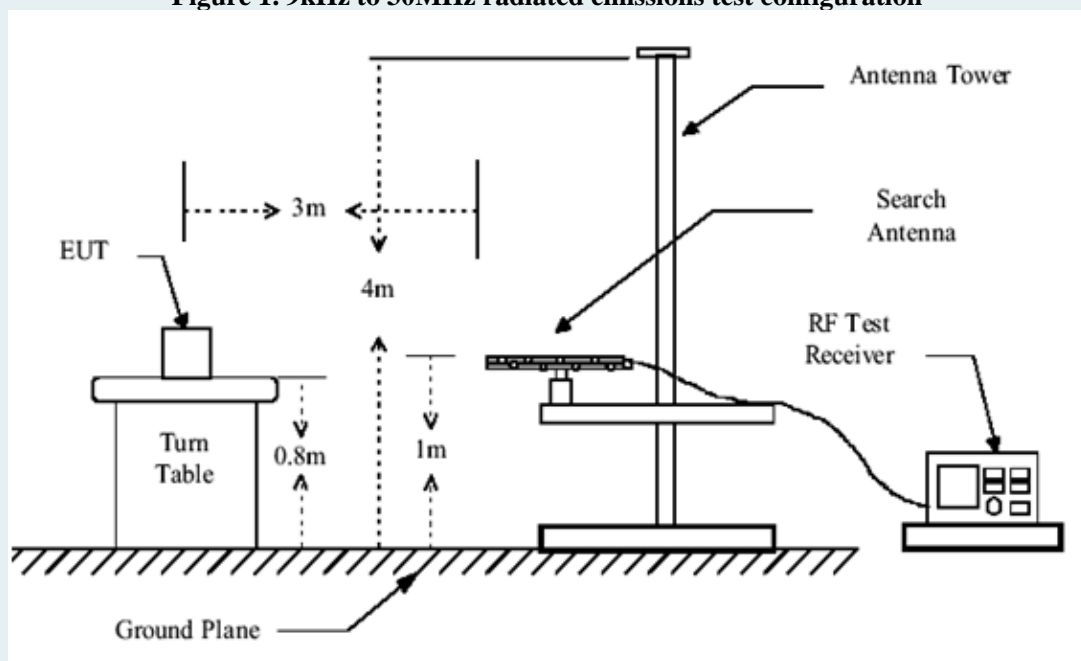


Figure 2. 30MHz to 1GHz radiated emissions test configuration

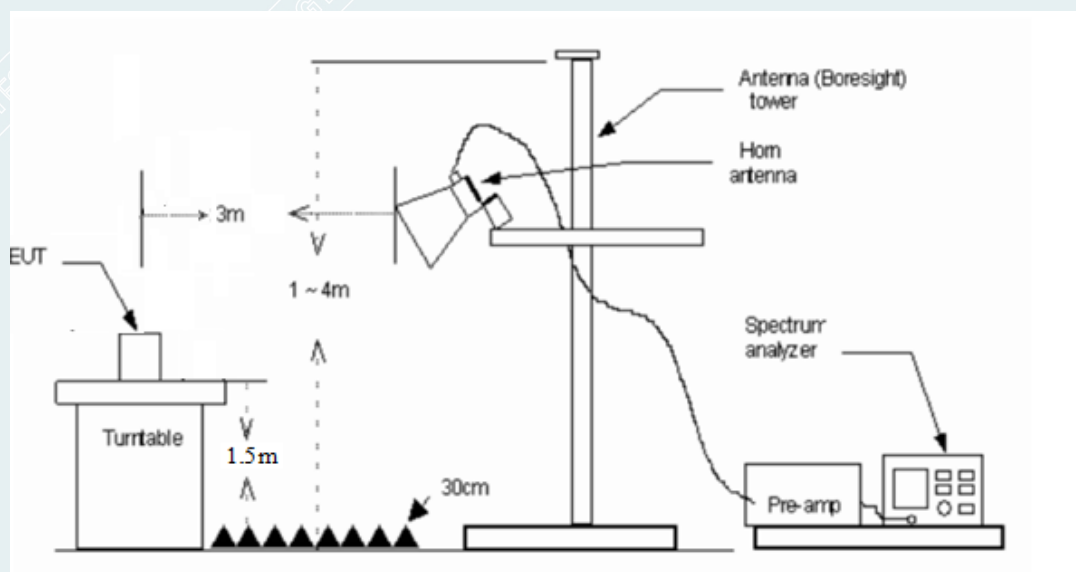


Figure 3. 1GHz-18GHz radiated emissions test configuration

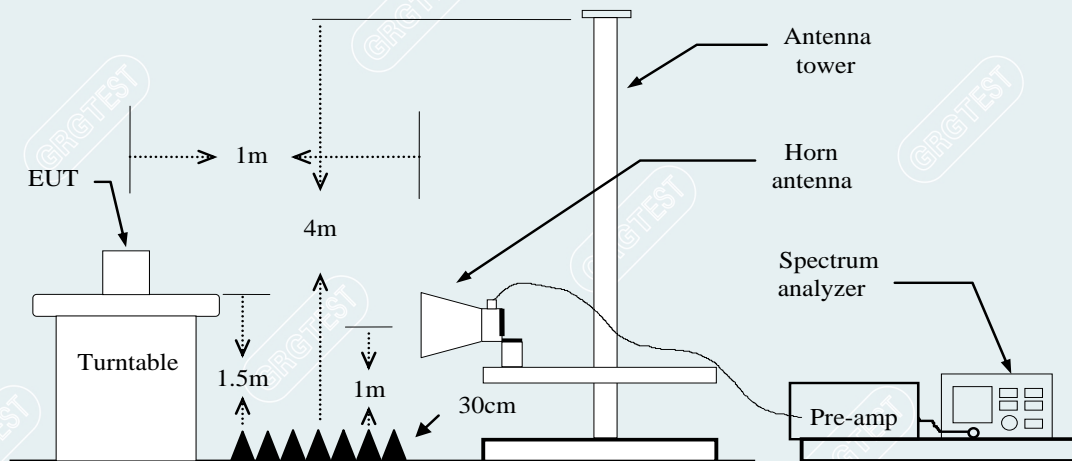


Figure 4. 18GHz-26.5GHz radiated emissions test configuration

8.4 DATA SAMPLE

30MHz to 1GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	37.06	-15.48	21.58	40.00	-18.42	QP	Vertical

1GHz to 18GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	65.45	-11.12	54.33	74.00	-19.67	Peak	Vertical
xxx	xxx	63.00	-11.12	51.88	54.00	-2.12	AVG	Vertical

Above 18GHz

No.	Frequency (MHz)	Reading (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Pole
xxx	xxx	68.86	57.66	-11.20	83.54	25.88	peak	Vertical
xxx	xxx	68.89	-11.20	57.69	63.54	5.85	AVG	Vertical

Frequency (MHz) = Emission frequency in MHz

Ant.Pol. (H/V) = Antenna polarization

Reading (dBuV) = Uncorrected Analyzer / Receiver reading

Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain

Result (dBuV/m) = Reading (dBuV) + Correction Factor (dB/m)

Limit (dBuV/m) = Limit stated in standard

Margin (dB) = Remark Result (dBuV/m) – Limit (dBuV/m)

Peak = Peak Reading

QP = Quasi-peak Reading

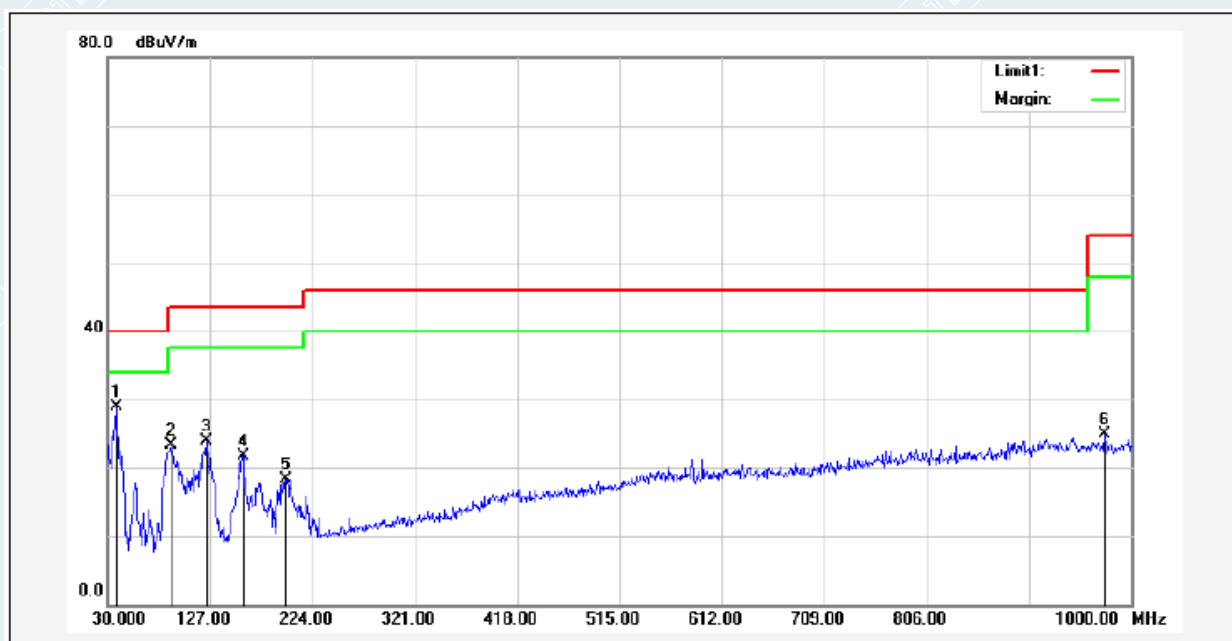
AVG = Average Reading

8.5 TEST RESULTS

Below 1GHz

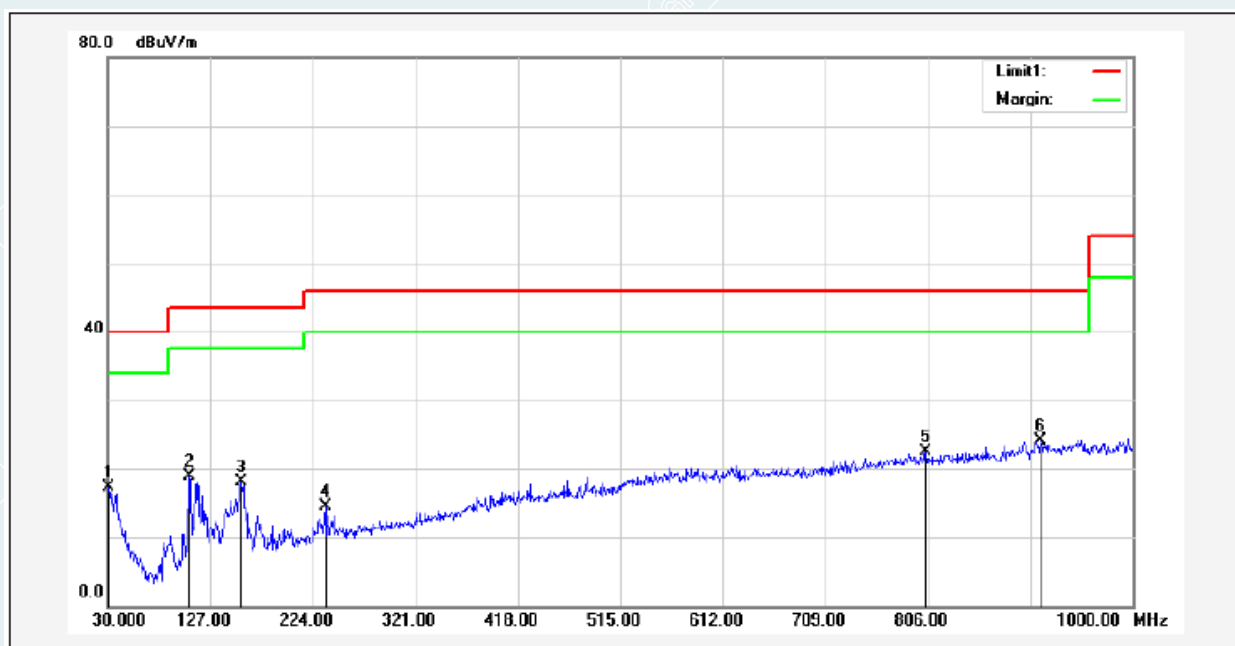
For adapter power supply, only the worst mode and channel were recorded in this report. (Zigbee 2405MHz)

EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0003
Power supply:	AC 120V/60Hz	Environmental Conditions:	21.2°C/43%RH/101.0kPa
Test Engineer:	Huang Xinlong	Test Date:	2023-02-17
Channel	Lowest channel (2405MHz)	Polarity:	Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Detector type
1*	37.7600	49.30	-20.41	28.89	40.00	-11.11	347	200	QP
2	90.1400	53.84	-30.47	23.37	43.50	-20.13	260	100	QP
3	123.1200	49.88	-26.02	23.86	43.50	-19.64	75	100	QP
4	158.0400	49.01	-27.21	21.80	43.50	-21.70	123	100	QP
5	198.7800	45.05	-26.70	18.35	43.50	-25.15	106	100	QP
6	974.7800	37.12	-12.29	24.83	54.00	-29.17	39	300	QP

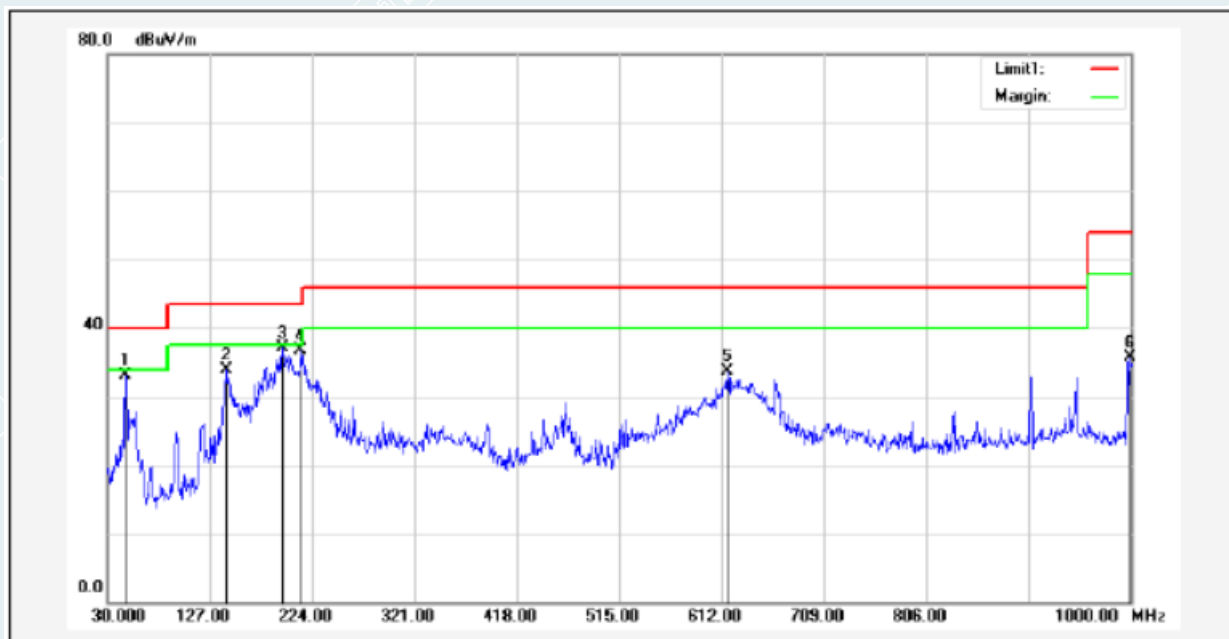
EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0003
Power supply:	AC 120V/60Hz	Environmental Conditions:	21.2℃/43%RH/101.0kPa
Test Engineer:	Huang Xinlong	Test Date:	2023-02-17
Channel	Lowest channel (2405MHz)	Polarity:	Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Detector type
1	30.0000	34.00	-16.65	17.35	40.00	-22.65	93	200	QP
2	106.6300	46.28	-27.40	18.88	43.50	-24.62	170	300	QP
3	156.1000	45.12	-27.08	18.04	43.50	-25.46	360	200	QP
4	235.6400	39.66	-25.22	14.44	46.00	-31.56	360	172	QP
5	804.0600	36.30	-13.71	22.59	46.00	-23.41	78	200	QP
6*	912.7000	36.88	-12.87	24.01	46.00	-21.99	342	200	QP

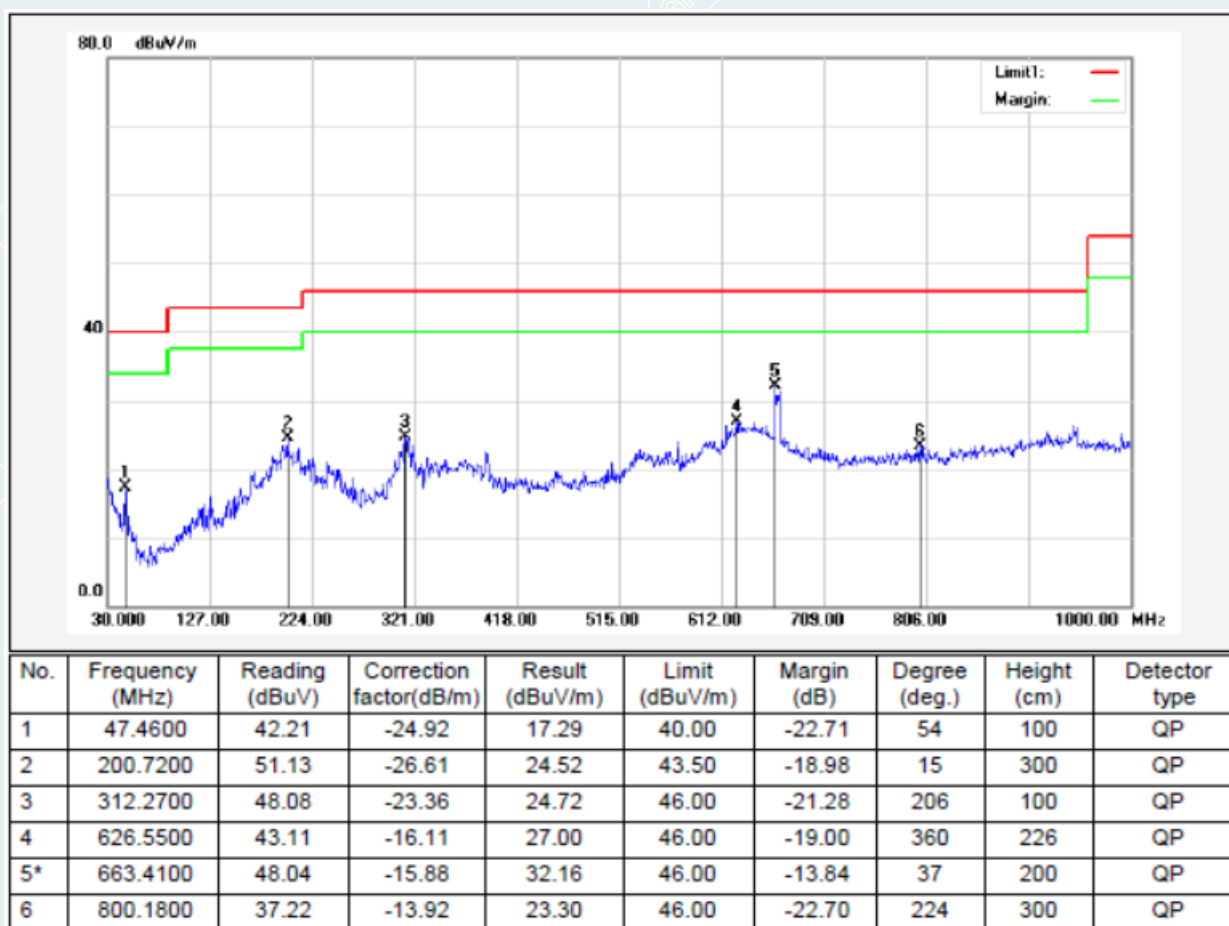
For battery power supply, only the worst mode and channel were recorded in this report. (Zigbee 2405MHz)

EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0003
Power supply:	DC 6V	Environmental Conditions:	23.4°C/50%RH/101.0kPa
Test Engineer:	Huang Xinlong	Test Date:	2023-02-13
Channel	Lowest channel (2405MHz)	Polarity:	Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Detector type
1	47.4600	57.94	-24.92	33.02	40.00	-6.98	219	100	QP
2	142.5200	59.97	-26.13	33.84	43.50	-9.66	31	100	QP
3*	195.8700	63.90	-26.85	37.05	43.50	-6.45	36	100	QP
4	213.3300	62.81	-26.11	36.70	43.50	-6.80	1	100	QP
5	617.8200	49.92	-16.15	33.77	46.00	-12.23	321	100	QP
6	999.0300	47.75	-12.02	35.73	54.00	-18.27	359	100	QP

EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0003
Power supply:	DC 6V	Environmental Conditions:	23.4°C/50%RH/101.0kPa
Test Engineer:	Huang Xinlong	Test Date:	2023-02-13
Channel	Lowest channel (2405MHz)	Polarity:	Horizontal

**Remark:**

- 1 No emission found between lowest internal used/generated frequency to 30MHz.
- 2 Radiated emissions measured in frequency range from 9 kHz to 1GHz were made with an instrument using Quasi-peak detector mode.
- 3 Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 4 The IF bandwidth of Receiver between 30MHz to 1GHz was 120 kHz.

1GHz-18GHz:

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Mode: TX/ Zigbee

Lowest Frequency (2405MHz)

Environment: 25.0°C/60%RH/101.0kPa

Tested By:Zhang Zishan

Voltage: DC 6V

Date: 2023-01-31

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1328.5411	67.92	44.86	-23.06	74.00	29.14	100	161	Horizontal
2	2001.3752	74.56	53.40	-21.16	74.00	20.60	100	93	Horizontal
3	2313.4142	69.21	50.02	-19.19	74.00	23.98	100	93	Horizontal
4	3322.5403	64.67	47.50	-17.17	74.00	26.50	100	127	Horizontal
5	4810.726	58.87	46.27	-12.60	74.00	27.73	200	346	Horizontal
6	7213.6517	60.57	57.39	-3.18	74.00	16.61	200	43	Horizontal

AV Final Data List

NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1996.4563	-21.16	58.02	36.86	54.00	17.14	101	102	Horizontal
2	2313.4142	-19.19	65.23	46.04	54.00	7.96	100	93	Horizontal
3	7213.3634	-3.18	50.90	47.72	54.00	6.28	199	54.7	Horizontal

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1165.5207	74.90	50.63	-24.27	74.00	23.37	100	114	Vertical
2	1332.2915	71.26	48.72	-22.54	74.00	25.28	100	104	Vertical
3	1666.3333	74.67	52.31	-22.36	74.00	21.69	100	104	Vertical
4	2666.4583	69.13	51.48	-17.65	74.00	22.52	100	123	Vertical
5	6654.8319	59.15	53.34	-5.81	74.00	20.66	100	169	Vertical
6	7215.5269	57.70	55.35	-2.35	74.00	18.65	200	40	Vertical

AV Final Data List

NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1165.5207	-24.27	60.12	35.85	54.00	18.15	100	114	Vertical
2	1332.2915	-22.54	62.33	39.79	54.00	14.21	100	104	Vertical
3	1666.3333	-22.36	68.45	46.09	54.00	7.91	100	104	Vertical
4	2666.4583	-17.65	61.75	44.10	54.00	9.90	100	123	Vertical
5	6654.8319	-5.81	48.12	42.31	54.00	11.69	100	169	Vertical
6	7216.6083	-2.35	49.68	47.33	54.00	6.67	200	46.9	Vertical

Mode: TX/ Zigbee
 Middle Frequency (2440MHz)
 Environment: 25.0°C/60%RH/101.0kPa
 Tested By:Zhang Zishan

Voltage: DC 6V
 Date: 2023-01-31

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1326.5408	68.58	45.55	-23.03	74.00	28.45	100	151	Horizontal
2	1665.0831	69.26	46.16	-23.10	74.00	27.84	100	14	Horizontal
3	2581.6977	65.70	47.36	-18.34	74.00	26.64	100	308	Horizontal
4	3330.0413	64.83	47.70	-17.13	74.00	26.30	100	23	Horizontal
5	3986.3733	60.58	45.22	-15.36	74.00	28.78	200	139	Horizontal
6	7320.5401	59.32	56.28	-3.04	74.00	17.72	200	50	Horizontal

AV Final Data List

NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7318.5654	-3.04	51.11	48.07	54.00	5.93	198	294.8	Horizontal

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1162.0203	77.18	52.99	-24.19	74.00	21.01	100	93	Vertical
2	1665.0831	73.46	51.06	-22.40	74.00	22.94	100	113	Vertical
3	2657.2072	69.96	52.19	-17.77	74.00	21.81	100	289	Vertical
4	3438.8049	65.49	48.93	-16.56	74.00	25.07	200	32	Vertical
5	6636.0795	58.44	52.80	-5.64	74.00	21.20	100	140	Vertical
6	7318.6648	56.73	53.75	-2.98	74.00	20.25	100	266	Vertical

AV Final Data List

NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1164.4002	-24.19	62.46	38.27	54.00	15.73	100	102.3	Vertical
2	1666.4967	-22.40	56.57	34.17	54.00	19.83	100	110.2	Vertical
3	2654.2072	-17.77	49.53	31.76	54.00	22.24	142	127.1	Vertical
4	3441.1069	-16.56	49.71	33.15	54.00	20.85	110	124.1	Vertical
5	6635.5491	-5.64	42.97	37.33	54.00	16.67	100	164.6	Vertical
6	7318.5185	-2.98	48.26	45.28	54.00	8.72	122	256.4	Vertical

Mode: TX/ Zigbee

Highest Frequency (2475MHz)

Environment: 25.0°C/60%RH/101.0kPa

Tested By:Zhang Zishan

Voltage: DC 6V

Date: 2023-01-31

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1164.5206	64.23	39.59	-24.64	74.00	34.41	100	344	Horizontal
2	1332.7916	64.21	41.11	-23.10	74.00	32.89	100	344	Horizontal
3	1659.8325	65.99	42.84	-23.15	74.00	31.16	100	344	Horizontal
4	3320.6651	64.17	47.00	-17.17	74.00	27.00	100	17	Horizontal
5	4727.0909	56.54	44.19	-12.35	74.00	29.81	100	283	Horizontal
6	7423.678	58.59	55.76	-2.83	74.00	18.24	200	338	Horizontal

AV Final Data List

NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7425.6066	-2.83	46.20	43.37	54.00	10.63	200	296.4	Horizontal

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1161.7702	76.78	52.59	-24.19	74.00	21.41	100	109	Vertical
2	1665.3332	73.79	51.40	-22.39	74.00	22.60	100	109	Vertical
3	2665.2082	68.77	51.10	-17.67	74.00	22.90	100	138	Vertical
4	3326.2908	69.89	53.54	-16.35	74.00	20.46	100	64	Vertical
5	6652.9566	59.34	53.53	-5.81	74.00	20.47	100	161	Vertical
6	7425.5532	57.02	54.08	-2.94	74.00	19.92	100	230	Vertical

AV Final Data List

NO.	Freq. [MHz]	Factor [dB]	AV Reading [dBμV/m]	AV Value [dBμV/m]	AV Limit [dBμV/m]	AV Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1161.7718	-24.19	54.03	29.84	54.00	24.16	100	70	Vertical
2	1665.3460	-22.38	56.18	33.79	54.00	20.21	200	169	Vertical
3	2654.9842	-17.67	51.44	33.77	54.00	20.23	100	163.7	Vertical
4	3327.8523	-16.35	50.47	34.12	54.00	19.88	129	70	Vertical
5	6645.3798	-5.81	44.26	38.45	54.00	15.55	100	163.8	Vertical
6	7426.6654	-2.94	48.67	45.73	54.00	8.27	106	227.1	Vertical

18GHz-26.5GHz:

Only the worst mode and channel were recorded in this report. (Zigbee 2405MHz)

Mode: TX/ Zigbee

Lowest Frequency (2405MHz)

Environment: 25.0°C/60%RH/101.0kPa

Tested By: Zhang Zishan

Voltage: DC 6V

Date: 2023-01-31

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18957.95	53.44	41.62	-11.82	83.54	41.92	PK	100	Horizontal
2	19796.05	53.86	42.67	-11.19	83.54	40.87	PK	100	Horizontal
3	20342.6	52.70	42.01	-10.69	83.54	41.53	PK	100	Horizontal
4	21390.65	50.86	40.93	-9.93	83.54	42.61	PK	100	Horizontal
5	22869.225	49.86	41.17	-8.69	83.54	42.37	PK	100	Horizontal
6	25526.75	48.11	40.70	-7.41	83.54	42.84	PK	100	Horizontal

Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	18521.475	53.40	41.30	-12.10	83.54	42.24	PK	100	Vertical
2	19803.7	55.08	44.00	-11.08	83.54	39.54	PK	100	Vertical
3	22439.975	50.09	40.87	-9.22	83.54	42.67	PK	100	Vertical
4	23068.975	50.85	42.22	-8.63	83.54	41.32	PK	100	Vertical
5	23744.3	50.40	41.88	-8.52	83.54	41.66	PK	100	Vertical
6	26365.275	46.88	39.80	-7.08	83.54	43.74	PK	100	Vertical

Remark:

- 1 Measuring frequencies from 1GHz to 26.5GHz.
- 2 Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 3 Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- 4 Above 18G test distance is 1m, so the Peak Limit=74+20*log(3/1)=83.54 (dBμV/m), The limits are relaxed.

9. 6dB BANDWIDTH

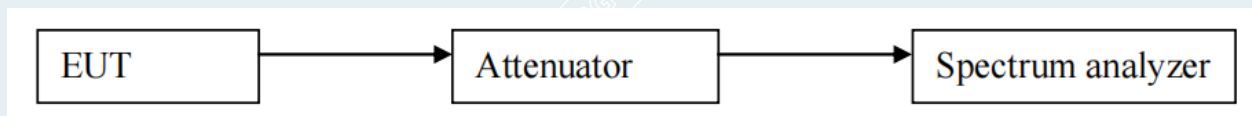
9.1 LIMITS

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

9.2 TEST PROCEDURES

- 1) Remove the antenna from the EUT, and then connect a low loss RF cable from antenna port to the spectrum analyzer.
- 2) Set resolution bandwidth (RBW) = 100kHz. Set the video bandwidth (VBW) $\geq 3 \times$ RBW. Detector = Peak. Trace mode = max hold. Sweep = auto couple. Allow the trace to stabilize, record 6dB bandwidth value.
- 3) Repeat above procedures until all frequencies measured were complete.

9.3 TEST SETUP

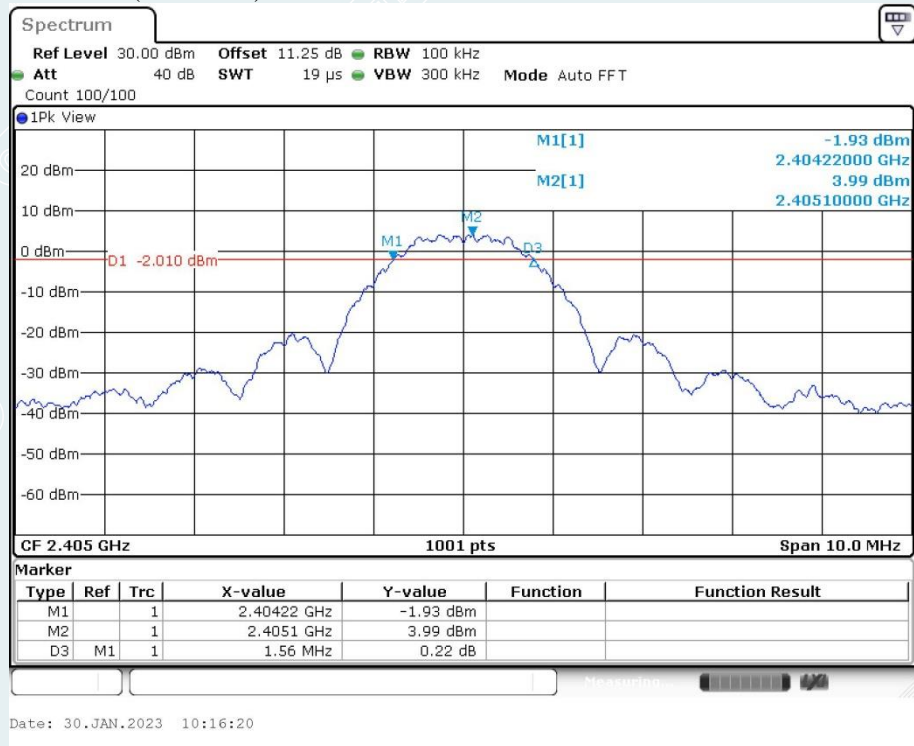


9.4 TEST RESULTS

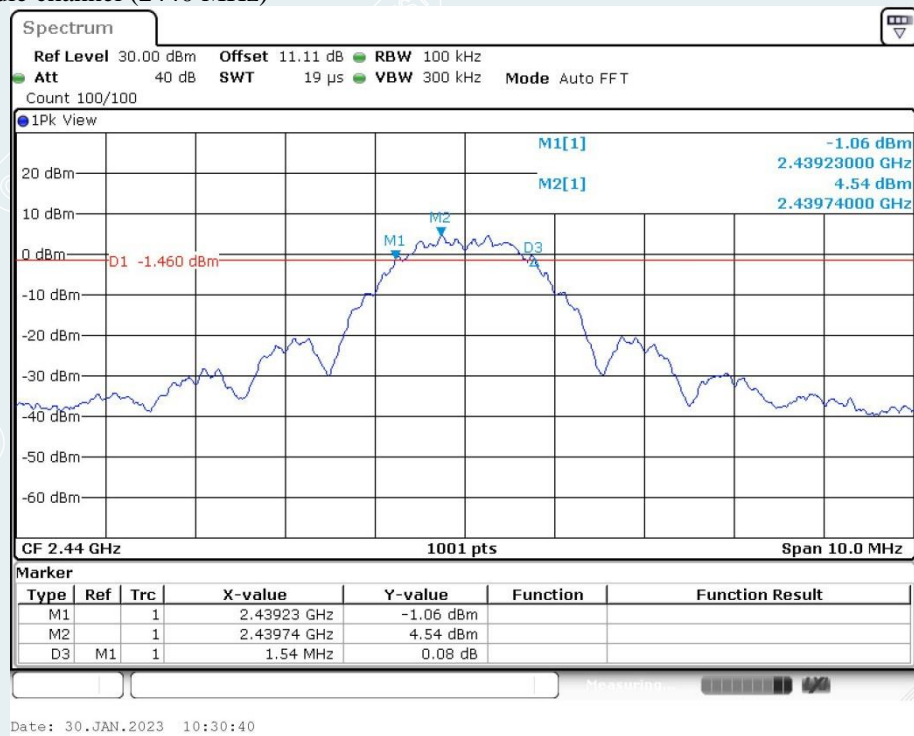
EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0004
Test Engineer:	Yang Zhaoyun	Test Date:	2023-01-30~2023-01-31
Environmental Conditions:	21.3℃/59%RH/101.0kPa	/	/

ChName	Frequency (MHz)	Bandwidth [kHz]	Limit[kHz]	Verdict
Lowest	2405	1560	≥ 500	PASS
Middle	2440	1540		PASS
Highest	2475	1520		PASS

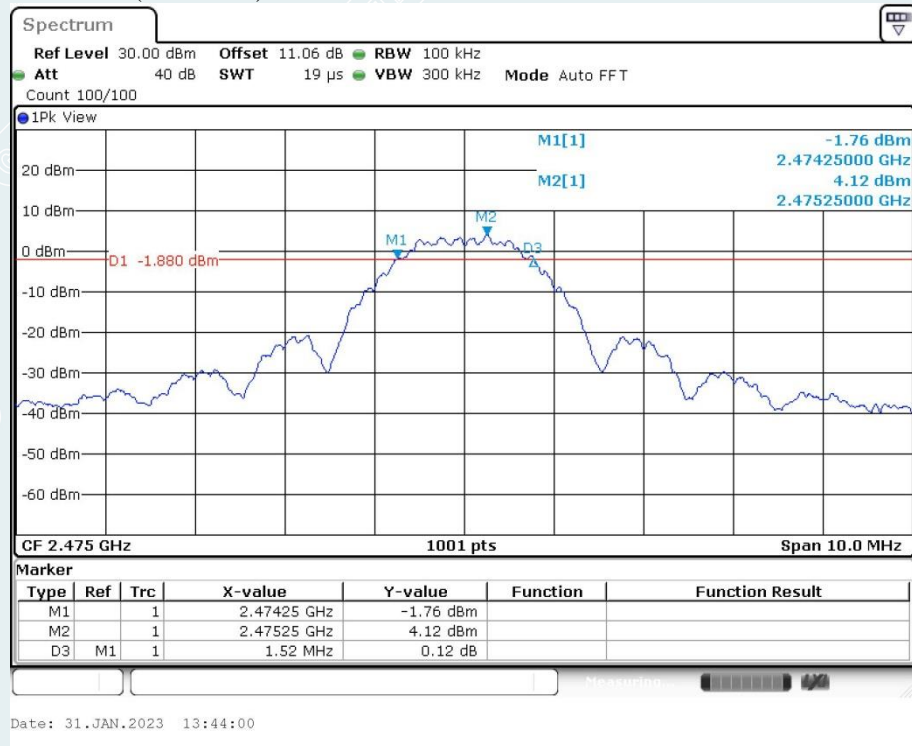
Lowest channel (2405MHz)



Middle channel (2440 MHz)



Highest channel (2475MHz)



----- The following blanks -----

10. MAXIMUM PEAK OUTPUT POWER

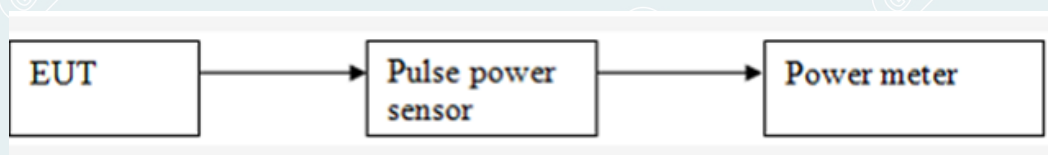
10.1 LIMITS

The maximum Peak output power measurement is 1W

10.2 TEST PROCEDURES

- 1) According to the test mode, the channel requirements set EUT to continuous transmission mode.
- 2) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

10.3 TEST SETUP



10.4 TEST RESULTS

EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0004
Test Engineer:	Yang Zhaoyun	Test Date:	2023-01-30~2023-01-31
Environmental Conditions:	21.3℃/59%RH/101.0kPa	/	/

ChName	Frequency (MHz)	Measured Channel Power (dBm)	Limit	Peak/Average	Result
Lowest	2405	7.63	1W (30dBm)	Peak	Pass
Middle	2440	7.71			Pass
Highest	2475	7.68			Pass

----- The following blanks -----

11. POWER SPECTRAL DENSITY

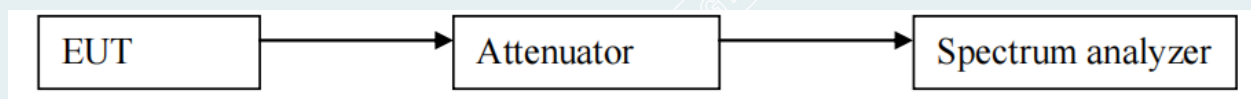
11.1 LIMITS

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

11.2 TEST PROCEDURES

- 1) Remove the antenna from the EUT, and then connect a low loss RF cable from antenna port to the spectrum analyzer.
- 2) Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- 3) The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:
 - a) Set analyzer center frequency to DTS channel center frequency.
 - b) Set the span to 1.5 times the DTS bandwidth.
 - c) Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
 - d) Set the VBW $\geq [3 \times \text{RBW}]$.
 - e) Detector = peak
 - f) Sweep time = auto couple.
 - g) Trace mode = max hold.
 - h) Allow trace to fully stabilize.
 - i) Use the peak marker function to determine the maximum amplitude level within the RBW.
 - j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.
- 4) Repeat above procedures until all frequencies measured were complete.

11.3 TEST SETUP

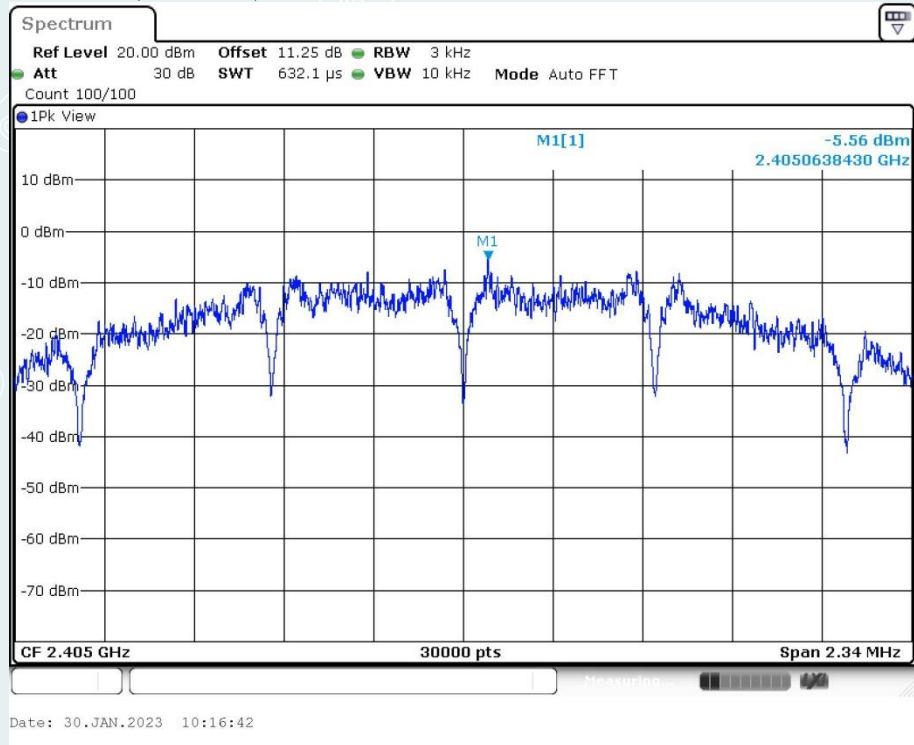


11.4 TEST RESULTS

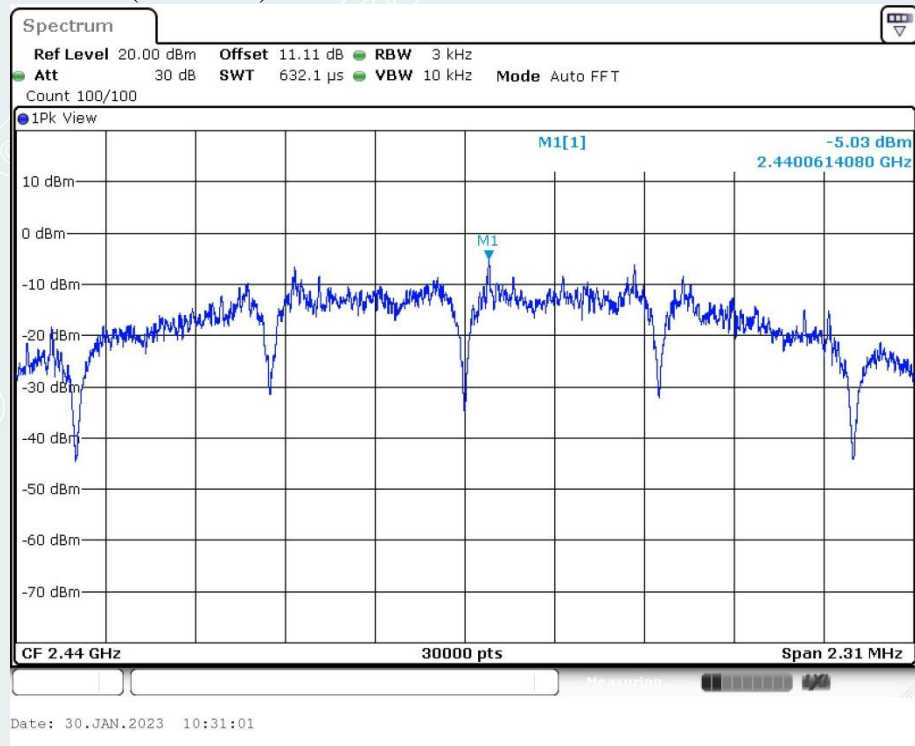
EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0004
Test Engineer:	Yang Zhaoyun	Test Date:	2023-01-30~2023-01-31
Environmental Conditions:	21.3℃/59%RH/101.0kPa	/	/

ChName	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
Lowest	2405	-5.56	8.00	Pass
Middle	2440	-5.03	8.00	Pass
Highest	2475	-7.11	8.00	Pass

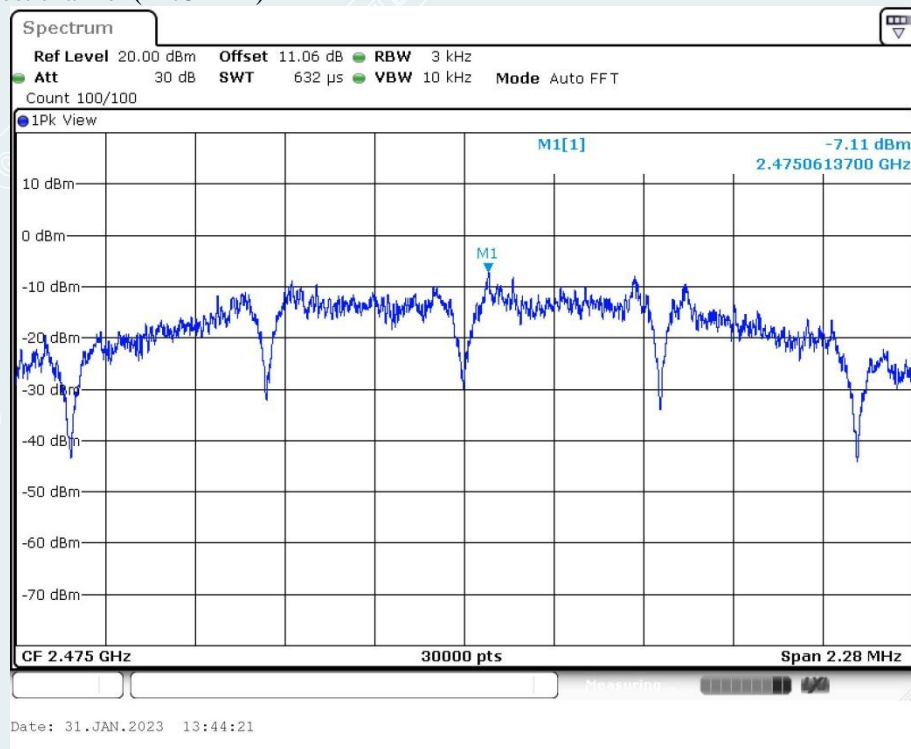
Lowest channel (2405MHz)



Middle channel (2440 MHz)



Highest channel (2475MHz)



----- The following blanks -----

12. CONDUCTED BAND EDGES AND SPURIOUS EMISSIONS

12.1 LIMITS

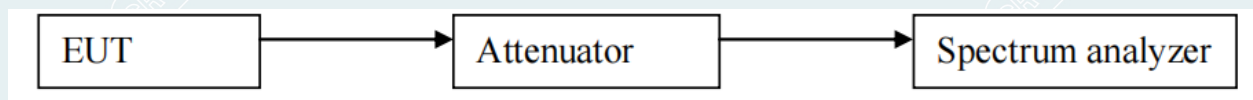
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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.

12.2 TEST PROCEDURES

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

- 1) Remove the antenna from the EUT and then connect a low attenuation cable from the antenna port to the spectrum.
- 2) Set the spectrum analyzer: RBW=100kHz; VBW=300kHz, Span=10MHz to 26.5GHz; Sweep=auto; Detector Function=Peak. Trace=Max, hold.
- 3) Measure and record the results in the test report.
- 4) The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
- 5) Measurements are made from 30MHz to 26.5GHz with the transmitter set to the lowest, middle, and highest channels.

12.3 TEST SETUP



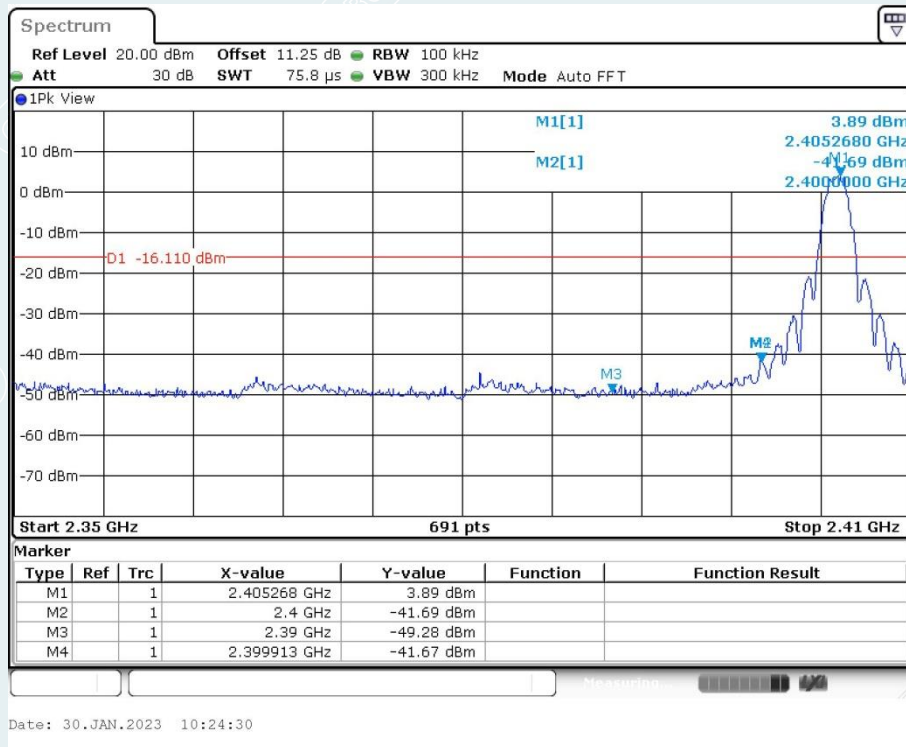
12.4 TEST RESULTS

EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0004
Test Engineer:	Yang Zhaoyun	Test Date:	2023-01-30~2023-01-31
Environmental Conditions:	21.3℃/59%RH/101.0kPa	/	/

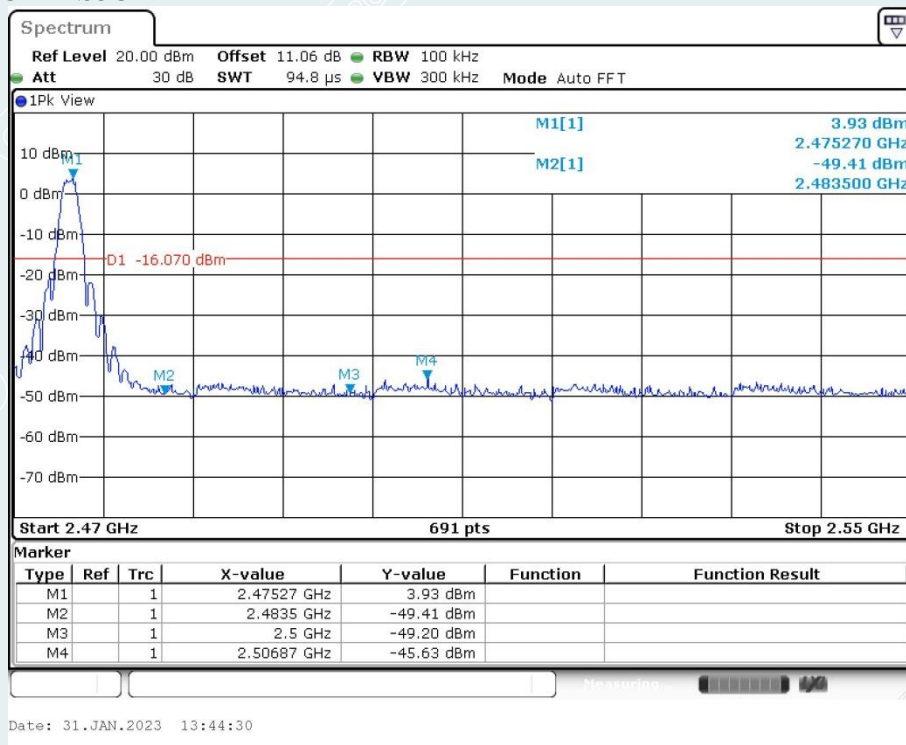
Band edge

Test Mode	Antenna	ChName	Frequency [MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
Zigbee	Ant1	Lowest	2405	3.89	-41.67	≤-16.11	PASS
		Highest	2475	3.93	-45.63	≤-16.07	PASS

Lowest channel (2405MHz)
2.30GHz-2.41GHz



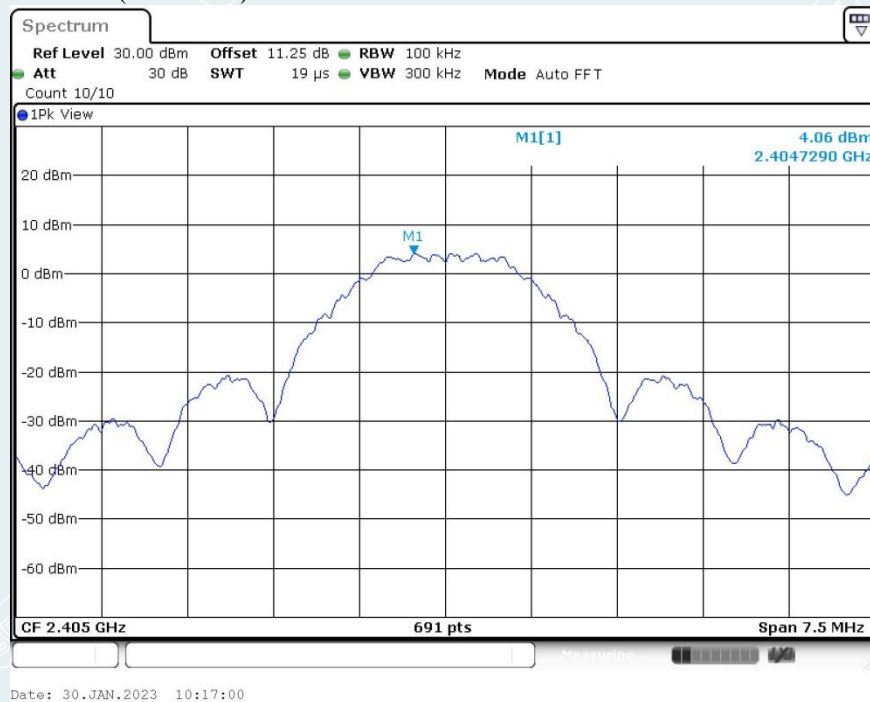
Highest channel (2475MHz)
2.47GHz-2.55GHz



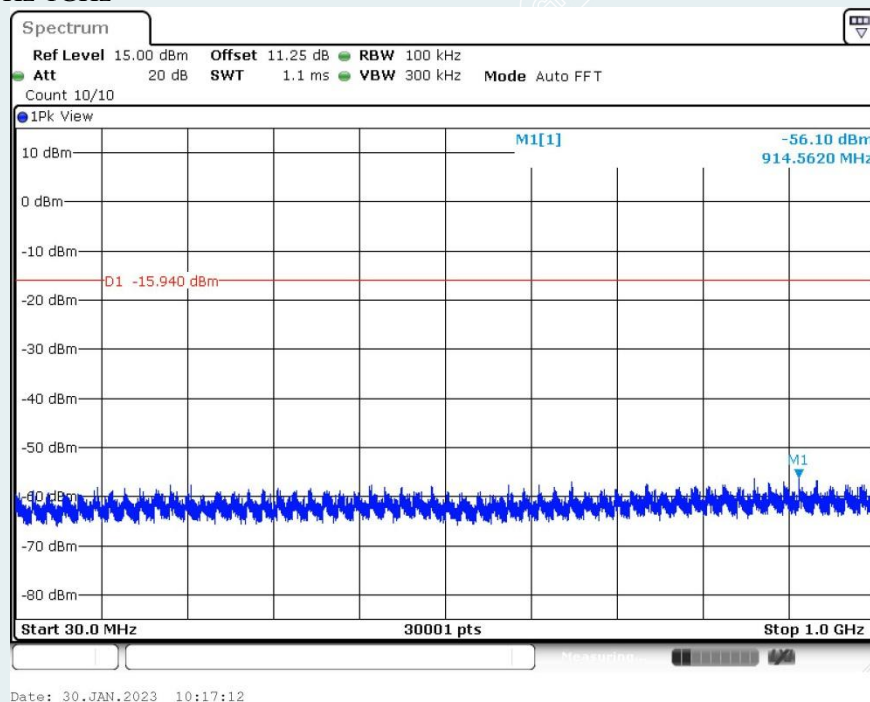
Conducted Spurious Emission

Test Mode	Antenna	Frequency [MHz]	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
Zigbee	Ant1	2405	Reference	4.06	4.06	---	PASS
			30~1000	4.06	-56.1	≤-15.94	PASS
			1000~26500	4.06	-51.71	≤-15.94	PASS
		2440	Reference	4.61	4.61	---	PASS
			30~1000	4.61	-56.78	≤-15.39	PASS
			1000~26500	4.61	-52.02	≤-15.39	PASS
		2475	Reference	4.07	4.07	---	PASS
			30~1000	4.07	-55.56	≤-15.93	PASS
			1000~26500	4.07	-51.69	≤-15.93	PASS

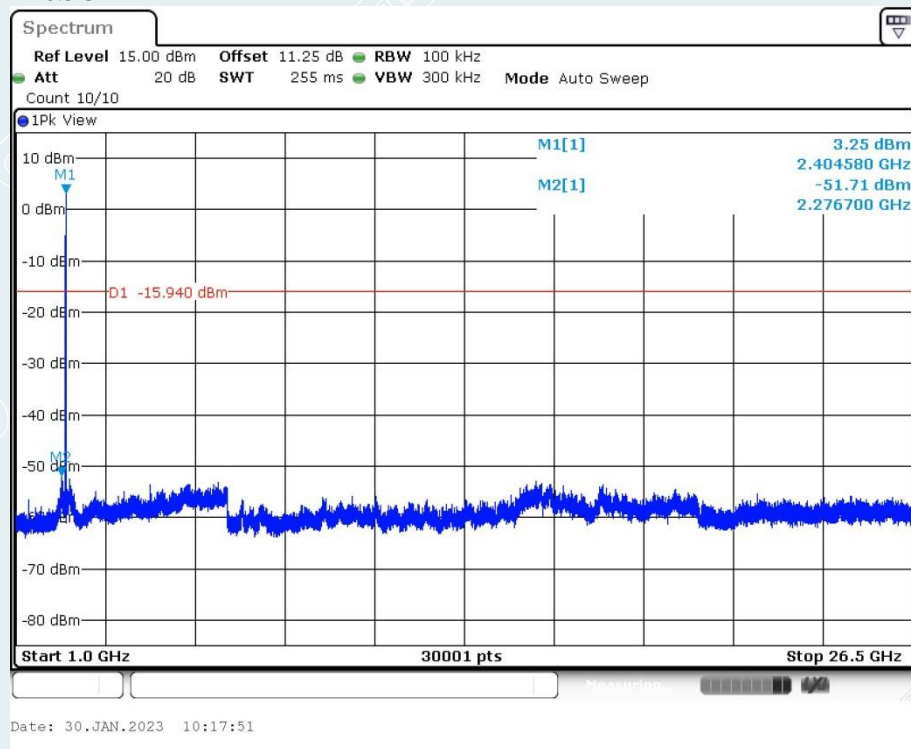
Lowest channel (2405MHz)



0.03GHz-1GHz



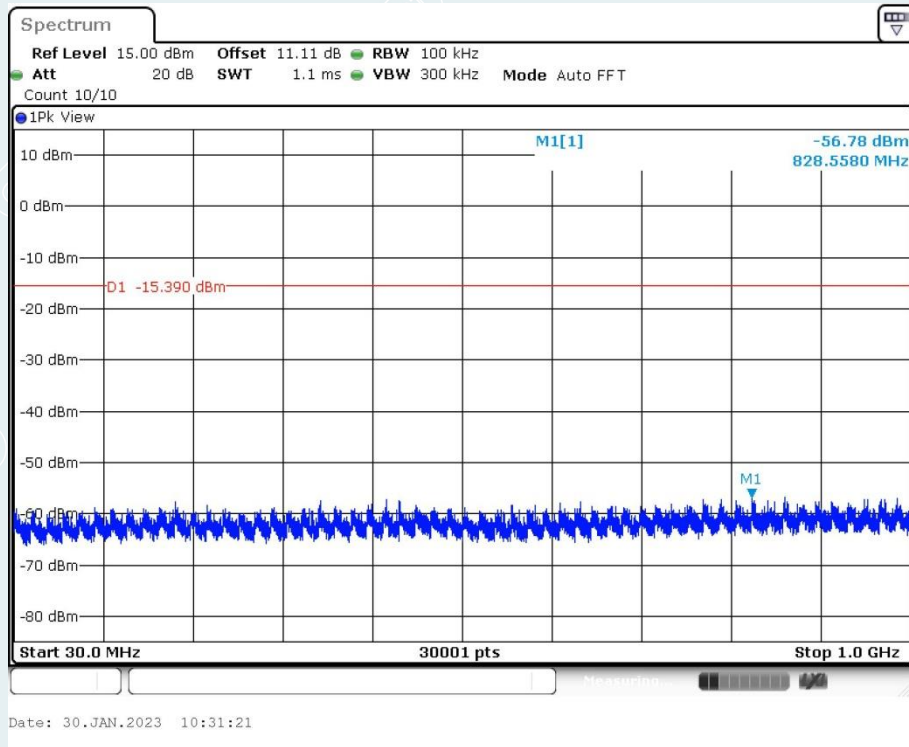
1GHz-26.5GHz



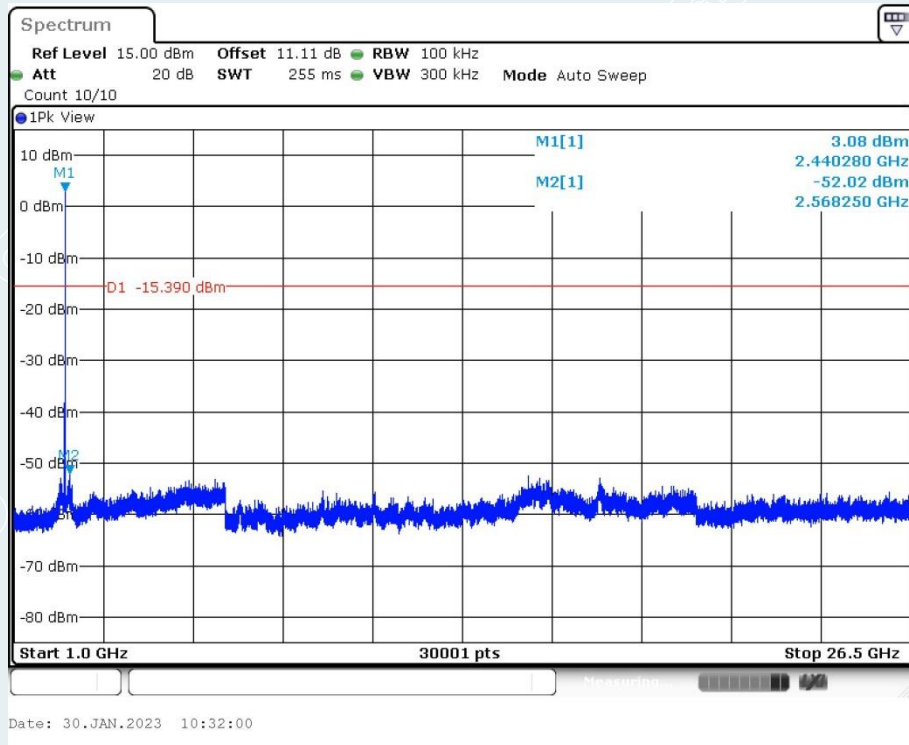
Middle channel (2440MHz)



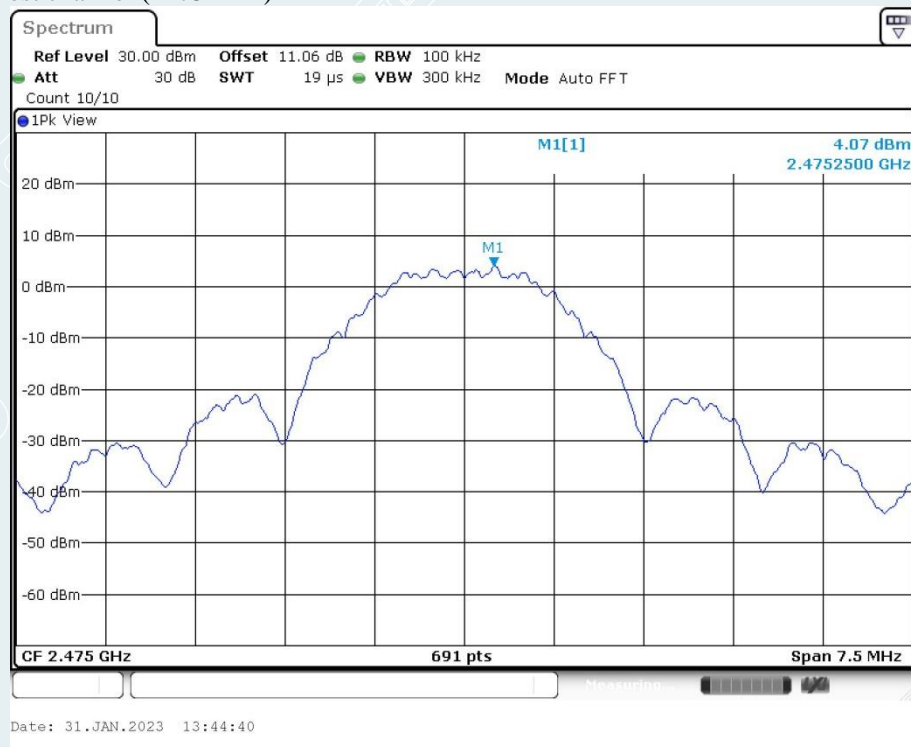
0.03GHz-1GHz



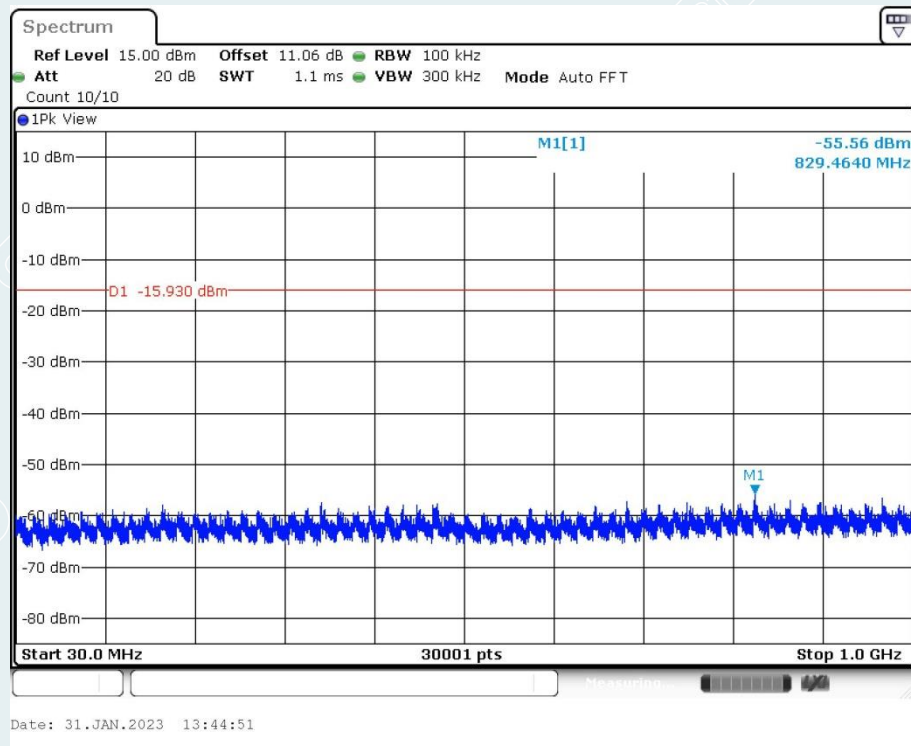
1GHz-26.5GHz



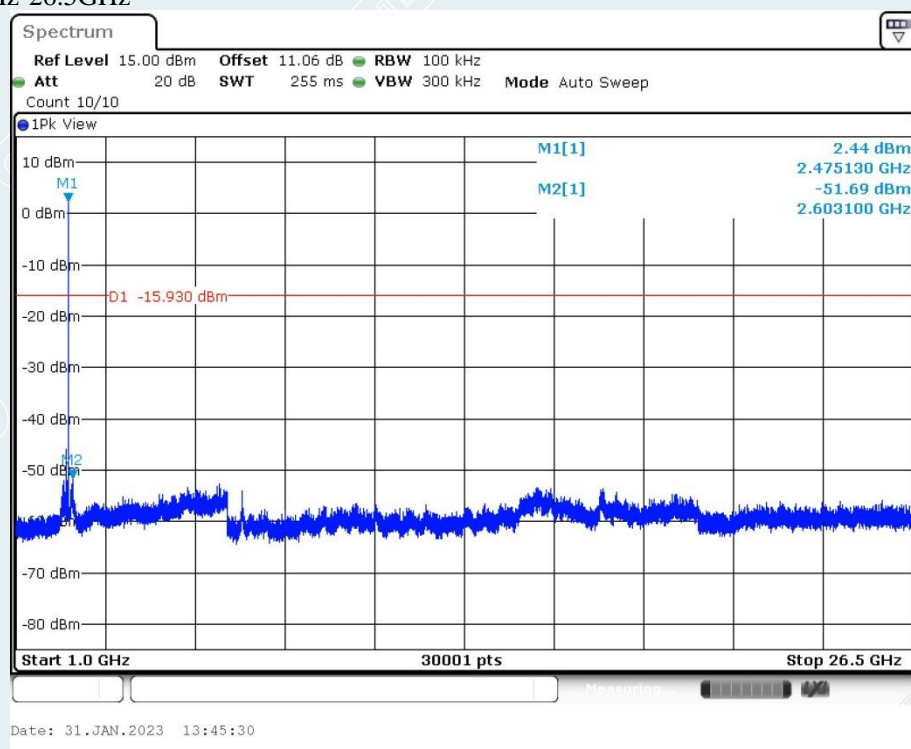
Highest channel (2475MHz)



0.03GHz-1GHz



1GHz-26.5GHz



----- The following blanks -----

13. RESTRICTED BANDS OF OPERATION

13.1 LIMITS

Section 15.247(d) 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) (see §15.205(c)).

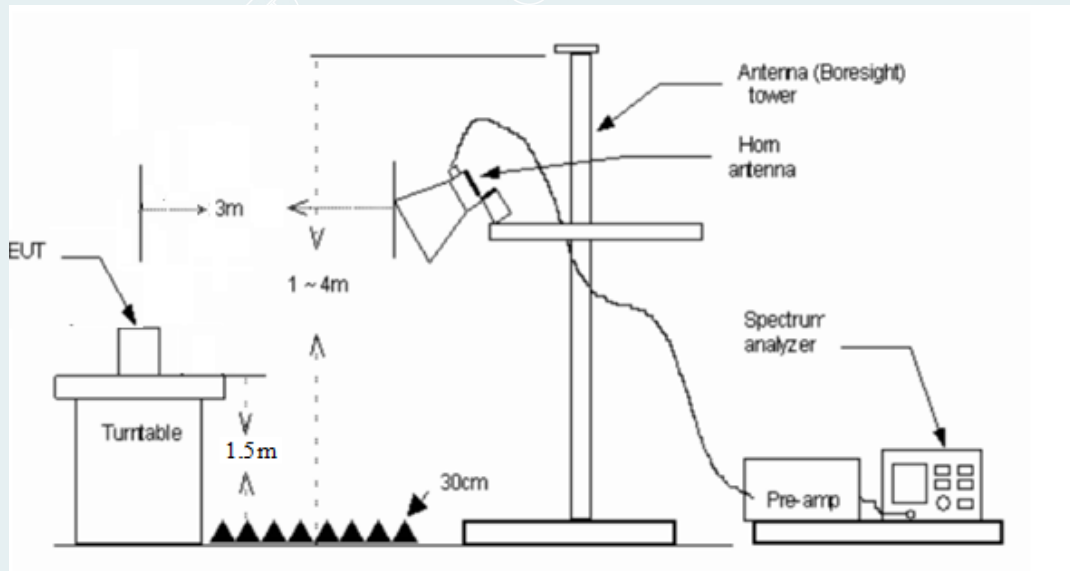
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52480 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	
13.36 - 13.41			

Frequency (MHz)	Quasi-peak(μ V/m)	Measurement distance(m)	Quasi-peak(dB μ V/m)@distance 3m
0.009-0.490	2400/F(kHz)	300	128.5~93.8
0.490-1.705	24000/F(kHz)	30	73.8~63
1.705-30.0	30	30	69.5
30 ~ 88	100	3	40
88~216	150	3	43.5
216 ~ 960	200	3	46
Above 960	500	3	54

13.2 TEST PROCEDURES

- 1) The EUT is placed on a turntable, which is 1.5m above the ground plane.
- 2) The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3) EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
- 4) Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - a) For Peak detector: Set RBW=1MHz, RBW=3MHz, Sweep=AUTO.
 - b) For Avg detector: Set RBW=1MHz, Sweep=AUTO, the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW \leq RBW/100 (i.e., 10kHz) but not less than 10 Hz.
- 5) Repeat the procedures until all the PEAK and AVERAGE versus polarization are measured.

13.3 TEST SETUP



13.4 TEST RESULTS

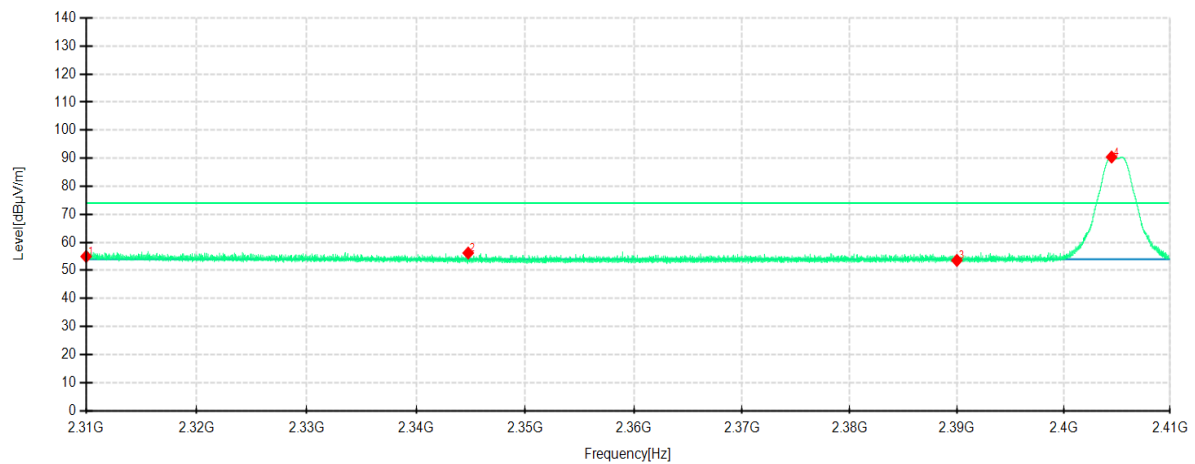
EUT Name:	Smart Lock U100	Test Mode:	Mode 1
Model:	SDL-D01	Sample No:	E20230117700901-0003
Test Engineer:	Huang Lifang	Test Voltage:	DC 6V
Environmental Conditions:	25.0°C /60%RH/101.0kPa	Test Date:	2023-01-30

Lowest Channel

Channel 2405MHz

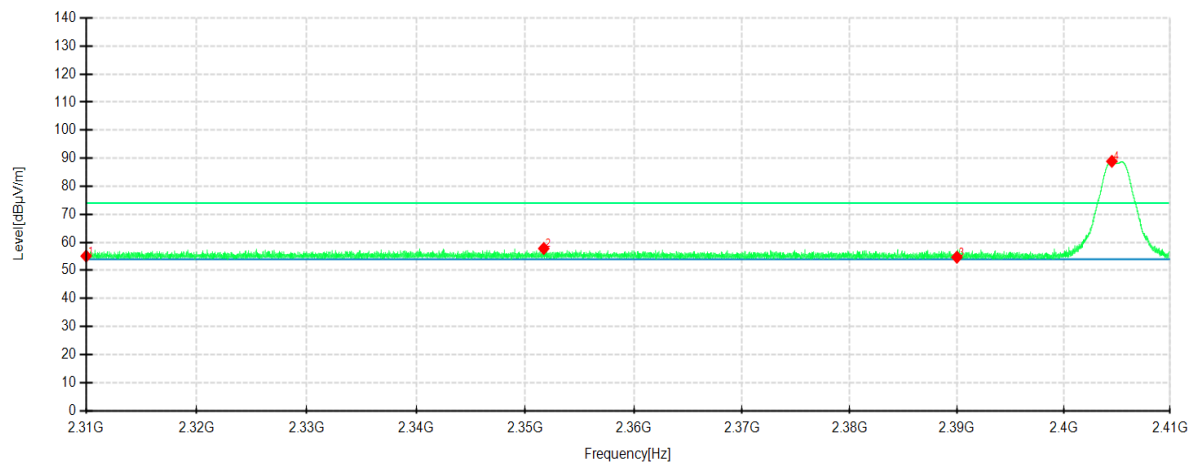
Detector mode: Peak

Polarity: Horizontal



Detector mode: Peak

Polarity: Vertical



No.	Frequency MHz	Reading dB μ V/m	Level dB μ V/m	Factor dB	Limit dB μ V/m	Margin dB	Height cm	Angle °	Pole	Comment
1	2310	45.62	54.97	9.35	74.00	19.03	100	258	Horizontal	/
2	2344.769	47.58	56.21	8.63	74.00	17.79	100	314	Horizontal	/
3	2390	44.64	53.57	8.93	74.00	20.43	200	213	Horizontal	
4	2404.4996	81.38	90.43	9.05	74.00	-16.43	200	2	Horizontal	No limit
1	2310	45.18	55.11	9.93	74.00	18.89	200	334	Vertical	/
2	2351.7028	47.61	57.82	10.21	74.00	16.18	100	214	Vertical	/
3	2390	44.64	54.71	10.07	74.00	19.29	100	115	Vertical	/
4	2404.5263	78.95	88.90	9.95	74.00	-14.90	100	314	Vertical	No limit

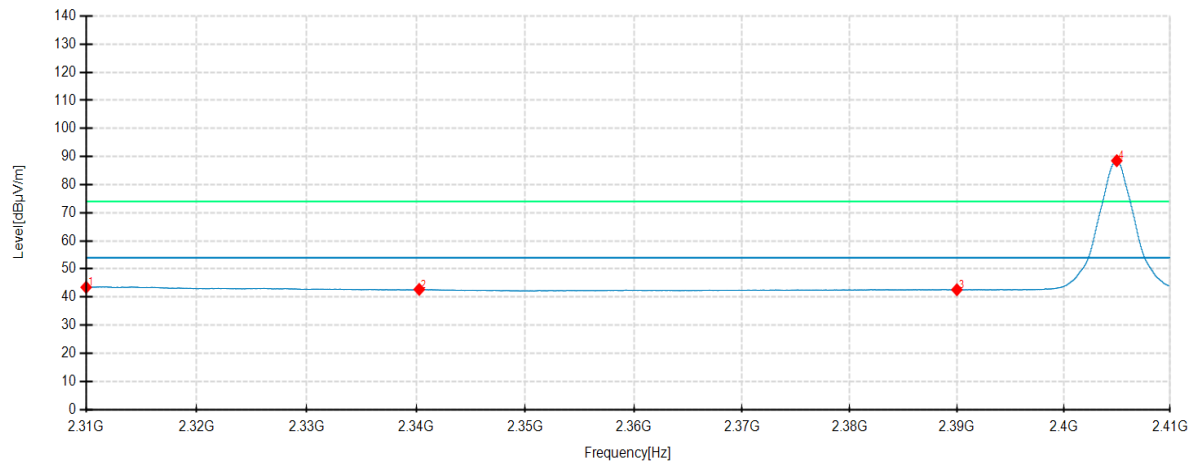
----- The following blanks -----

Lowest Channel

Channel 2405MHz

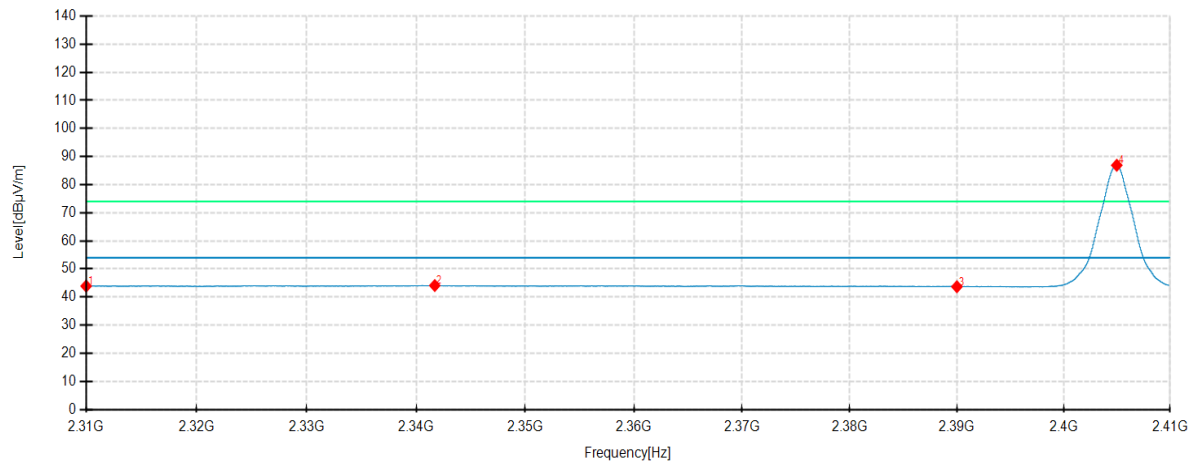
Detector mode: Average

Polarity: Horizontal



Detector mode: Average

Polarity: Vertical



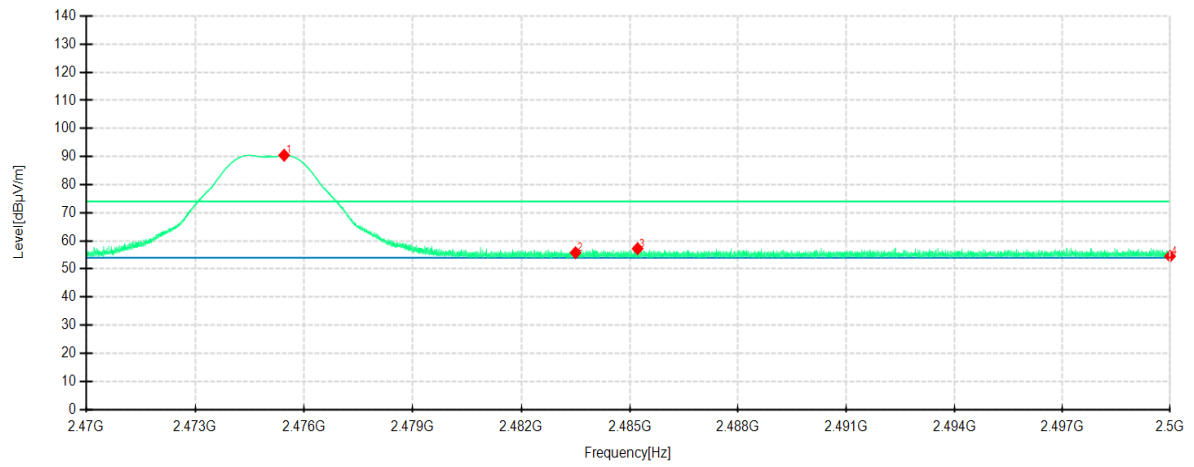
No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBμV/m	Margin dB	Height cm	Angle °	Pole	Comment
1	2310	34.14	43.49	9.35	54.00	10.51	100	103	Horizontal	/
2	2340.282	34.01	42.73	8.72	54.00	11.27	100	360	Horizontal	/
3	2390	33.68	42.61	8.93	54.00	11.39	100	213	Horizontal	/
4	2404.9863	79.49	88.54	9.05	54.00	-34.54	200	1	Horizontal	No limit
1	2310	33.98	43.91	9.93	54.00	10.09	200	322	Vertical	/
2	2341.7021	33.95	44.11	10.16	54.00	9.89	100	302	Vertical	/
3	2390	33.62	43.69	10.07	54.00	10.31	100	281	Vertical	/
4	2404.9863	76.98	86.92	9.94	54.00	-32.92	100	314	Vertical	No limit

Highest Channel

Channel 2475MHz

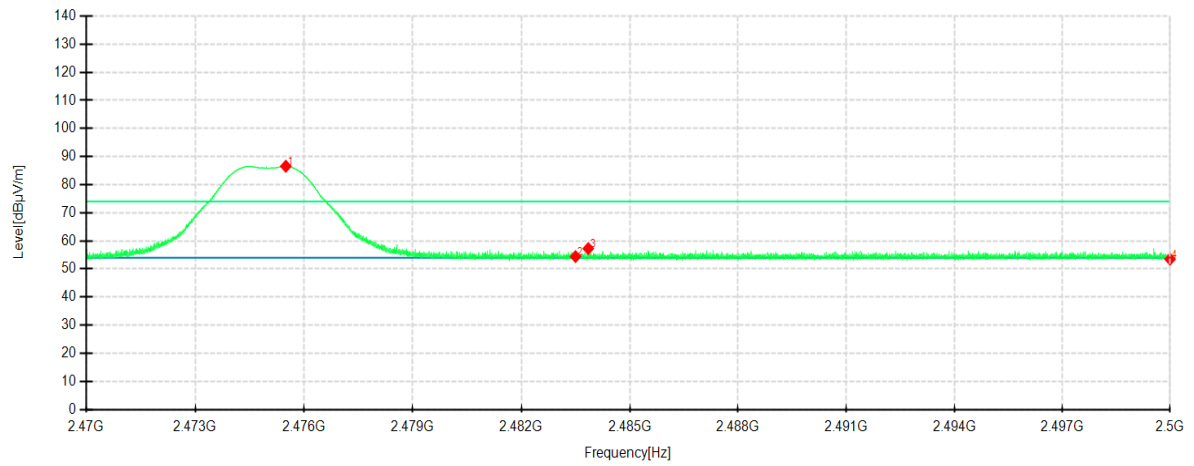
Detector mode: Peak

Polarity: Horizontal



Detector mode: Peak

Polarity: Vertical



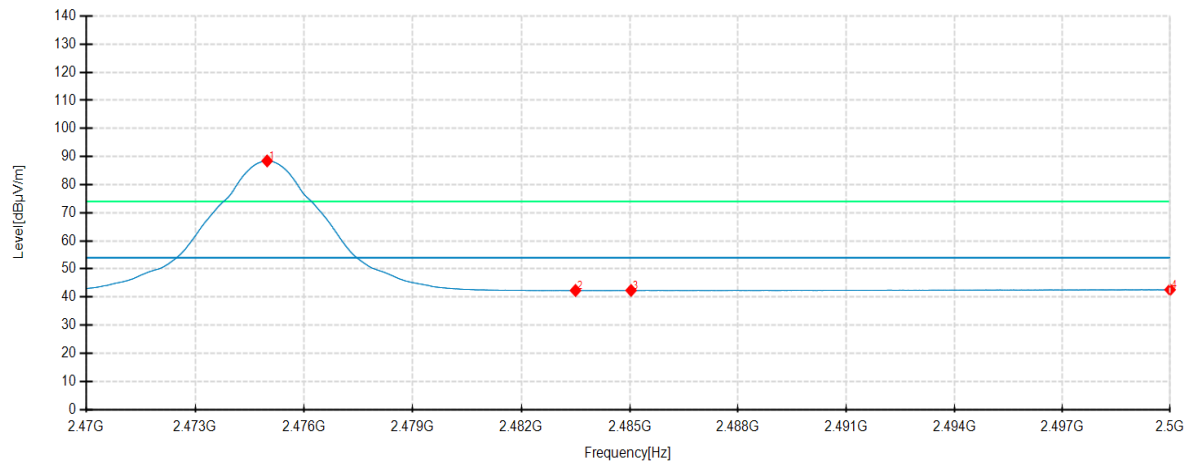
No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBμV/m	Margin dB	Height cm	Angle °	Pole	Comment
1	2475.4524	80.71	90.47	9.76	74.00	-16.47	200	343	Horizontal	No limit
2	2483.5	45.87	55.79	9.92	74.00	18.21	200	45	Horizontal	/
3	2485.217	47.28	57.23	9.95	74.00	16.77	100	360	Horizontal	/
4	2500	44.28	54.53	10.25	74.00	19.47	200	0	Horizontal	/
1	2475.4984	77.31	86.56	9.25	74.00	-12.56	100	326	Vertical	No limit
2	2483.5	45.12	54.40	9.28	74.00	19.60	200	0	Vertical	/
3	2483.8529	47.97	57.25	9.28	74.00	16.75	200	36	Vertical	/
4	2500	44.14	53.49	9.35	74.00	20.51	200	334	Vertical	/

Highest Channel

Channel 2475MHz

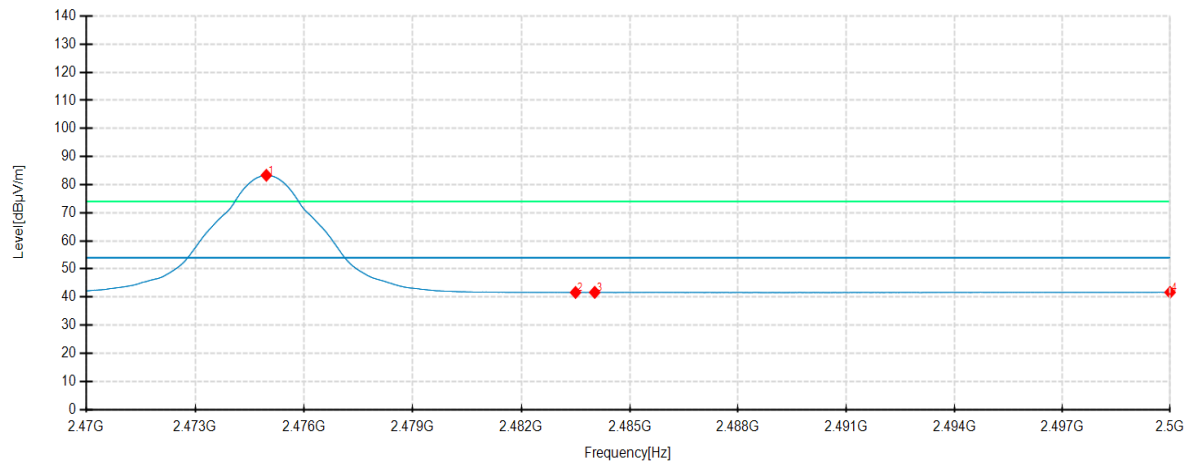
Detector mode: Average

Polarity: Horizontal



Detector mode: Average

Polarity: Vertical



No.	Frequency MHz	Reading dBμV/m	Level dBμV/m	Factor dB	Limit dBμV/m	Margin dB	Height cm	Angle °	Pole	Comment
1	2474.9843	78.71	88.45	9.74	54.00	-34.45	200	346	Horizontal	No limit
2	2483.5	32.43	42.35	9.92	54.00	11.65	200	312	Horizontal	/
3	2485.037	32.42	42.37	9.95	54.00	11.63	100	49	Horizontal	/
4	2500	32.35	42.60	10.25	54.00	11.40	100	170	Horizontal	/
1	2474.9623	74.09	83.33	9.24	54.00	-29.33	100	357	Vertical	No limit
2	2483.5	32.36	41.64	9.28	54.00	12.36	100	357	Vertical	/
3	2484.0309	32.40	41.68	9.28	54.00	12.32	100	48	Vertical	/
4	2500	32.33	41.68	9.35	54.00	12.32	200	244	Vertical	/

Remark: Max field strength in 3m distance. No any other emission which falls in restricted bands can be detected and be reported.

APPENDIX A. PHOTOGRAPH OF THE TEST CONNECTION DIAGRAM

Please refer to the attached document E20230117700901-11-Test Photo.

APPENDIX B. PHOTOGRAPH OF THE EUT

Please refer to the attached document E20230117700901-12-EUT Photo.

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