RADIO TEST REPORT

FCC 47 CFR PART 15 SUBPART C

Test Standard	**FCC Part 15.247**
Product name	**Image sensor with LoRa module**
Brand Name	**Sercomm**
Model No.	**SL-IMG01**
Test Result	**Pass**
Statements of Conformity	**Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.**

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.
The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc.(Wugu Laboratory)

Approved by:

Shawn Wu
Supervisor

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	June 8, 2023	Initial Issue	ALL	Doris Chu
01	June 16, 2023	See the following Note Rev. (01)	P.4, P.35-40, P.43-48	Doris Chu
02	June 26, 2023	See the following Note Rev. (02)	P.4	Doris Chu

Rev. (01)
1. Modify power supply in section 1.1.
2. Added remark in page 35-40.
3. Added Average and remark in page 43-48
Rev. (02)
1. Modify power supply in section 1.1.

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1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	Sercomm Corporation 8F, No. 3-1, YuanQu St., NanKang, Taipei 115, Taiwan
Manufacturer	Sercomm Corporation 8F, No. 3-1, YuanQu St., NanKang, Taipei 115, Taiwan
Equipment	Image sensor with LoRa module
Model Name	SL-IMG01
Model Discrepancy	N/A
Brand Name	Sercomm
Received Date	May 9, 2023
Date of Test	May 15 ~ June 1, 2023
Power Supply	Power from Battery. (DC 3V)

Remark:
1. For more details, please refer to the User's manual of the EUT.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

1.2 EUT CHANNEL INFORMATION

Frequency Range	902.3MHz-914.9MHz
Modulation Type	LoRa
Number of channels	64 Channels

Remark:
Refer as ANSI C63.10: 2013 clause 5.6.1 Table 4 for test channels

Number of frequencies to be tested		
Frequency range in which device operates	**Number of frequencies**	**Location in frequency range of operation**
☐ 1 MHz or less	1	Middle
☐ 1 MHz to 10 MHz	2	1 near top and 1 near bottom
☒ More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

1.3 ANTENNA INFORMATION

Antenna Type	☐ CHIP ☒ PIFA ☐ PCB ☐ Dipole ☐ Coils
Antenna Gain	Gain: -2.8 dBi
Antenna Connector	N/A

Remark:
1. The industrial epoxy adhesive is used making Antenna connection permanently prior to shipping. It complies with rule 15.203.

1.4 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	± 2.1183
Channel Bandwidth	± 2.1863
RF output power (Power Meter + Power sensor)	± 1.2688
Channel Separation	± 2.1848
Conducted Bandedge	± 2.1866
Conducted Spurious Emission	± 2.1859
Radiated Emission_9kHz-30MHz	± 3.842
Radiated Emission_30MHz-200MHz	± 4.517
Radiated Emission_200MHz-1GHz	± 4.844
Radiated Emission_1GHz-6GHz	± 5.411
Radiated Emission_6GHz-18GHz	± 5.266
Radiated Emission_18GHz-26GHz	± 4.270
Radiated Emission_26GHz-40GHz	± 4.203

Remark:
1.This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

1.5 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at
☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.
☒ No. 12, Ln. 116, Wugong 3rd Rd., Wugu Dist., New Taipei City, Taiwan 24803
CAB identifier: TW1309

Test site	Test Engineer	Remark
AC Conduction Room	-	Not applicable, because EUT doesn't connect to AC Main Source direct.
Radiation	Czerny Lin	-
RF Conducted	Jack Chen	-

Remark: The lab has been recognized as the FCC accredited lab. under the KDB 974614 D01 and is listed in the FCC pubic Access Link (PAL) database, FCC Registration No. :444940, the FCC Designation No.:TW1309

1.6 INSTRUMENT CALIBRATION

RF Conducted Test Site					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Power Sensor	Anritsu	MA2411B	1911386	2022-08-08	2023-08-07
Power Sensor	Anritsu	MA2411B	1911387	2022-08-08	2023-08-07
EXA Signal Analyzer	Keysight	N9010B	MY55460167	2022-09-07	2023-09-06
EXA Signal Analyzer	Keysight	N9010A	MY54200716	2022-10-13	2023-10-12
Power Meter	Anritsu	ML2496A	2136002	2022-11-24	2023-11-23
Software	Radio Test Software Ver. 21				

3M 966 Chamber Test Site					
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Antenna	SHWARZBECK	VULB 9168	1277	2023-01-13	2024-01-12
Pre-Amplifier	EMCI	EMC118A45SE	980820	2022-12-23	2023-12-22
Pre-Amplifier	EMCI	EMC330N	980853	2022-12-23	2023-12-22
Coaxial Cable	EMC	EMC101G-KM-KM-9000	220407+211228+230205	2023-03-21	2024-03-20
Signal Generator	Agilent	N9010A	MY52220817	2023-03-09	2024-03-08
Coaxial Cable	EMC	EMCCFD400	211212+211222+211020	2023-03-21	2024-03-20
Thermo-Hygro Meter	EDSDS	EDS-A49	966D1	2023-05-11	2024-05-10
Pre-Amplifier	EMCI	EMC184045SE	980872	2023-01-03	2024-01-02
Horn Antenna	RF SPIN	DRH18-E	210301A18ES	2023-02-03	2024-02-02
Horn Antenna	SHWARZBECK	BBHA 9170	1134	2022-12-30	2023-12-29
Loop Antenna	SCHWARZBECK	FMZB 1513-60	1513-60-028	2022-12-27	2023-12-26
High Pass Filter	TITAN	T04H10001000060S01	211215-7-2	2023-02-02	2024-02-01
Software	e3 6.11-20180413				

AC Conducted Emissions Test Site					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal Date**	**Cal Due**
N/A					

Remark:
1. Each piece of equipment is scheduled for calibration once a year.
2. N.C.R. = No Calibration Required.

1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

EUT Accessories Equipment					
No.	**Equipment**	**Brand**	**Model**	**Series No.**	**FCC ID**
	N/A				

Support Equipment					
No.	**Equipment**	**Brand**	**Model**	**Series No.**	**FCC ID**
1	NB(E)	Lenovo	T460	N/A	N/A

1.8 TEST METHODOLOGY AND APPLIED STANDARDS

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 2, FCC Part 15.247.

2. TEST SUMMARY

FCC Standard Section	Report Section	Test Item	Result
15.203	1.3	Antenna Requirement	Pass
15.207(a)	4.1	AC Conducted Emission	N/A
15.247(a)(1)(i)	4.2	20 dB Bandwidth	Pass
-	4.2	Occupied Bandwidth (99%)	Pass
15.247(b)(2)	4.3	Output Power Measurement	Pass
15.247(a)(1)	4.4	Frequency Separation	Pass
15.247(a)(1)(i)	4.5	Number of Hopping	Pass
15.247(d)	4.6	Conducted Band Edge	Pass
15.247(d)	4.6	Conducted Spurious Emission	Pass
15.247(f)	4.7	Time of Occupancy	Pass
15.247(d)	4.8	Radiation Band Edge	Pass
15.247(d)	4.8	Radiation Spurious Emission	Pass

3. DESCRIPTION OF TEST MODES

3.1 THE WORST MODE OF OPERATING CONDITION

Operation mode	LoRa with 125kHz Bandwidth
Test Channel Frequencies (MHz)	1.Lowest Channel: 902.3 MHz 2.Middle Channel: 908.5 MHz 3.Highest Channel: 914.9 MHz
Channel List	

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
CH0	902.3	CH22	906.7	CH44	911.1
CH1	902.5	CH23	906.9	CH45	911.3
CH2	902.7	CH24	907.1	CH46	911.5
CH3	902.9	CH25	907.3	CH47	911.7
CH4	903.1	CH26	907.5	CH48	911.9
CH5	903.3	CH27	907.7	CH49	912.1
CH6	903.5	CH28	907.9	CH50	912.3
CH7	903.7	CH29	908.1	CH51	912.5
CH8	903.9	CH30	908.3	CH52	912.7
CH9	904.1	CH31	908.5	CH53	912.9
CH10	904.3	CH32	908.7	CH54	913.1
CH11	904.5	CH33	908.9	CH55	913.3
CH12	904.7	CH34	909.1	CH56	913.5
CH13	904.9	CH35	909.3	CH57	913.7
CH14	905.1	CH36	909.5	CH58	913.9
CH15	905.3	CH37	909.7	CH59	914.1
CH16	905.5	CH38	909.9	CH60	914.3
CH17	905.7	CH39	910.1	CH61	914.5
CH18	905.9	CH40	910.3	CH62	914.7
CH19	906.1	CH41	910.5	CH63	914.9
CH20	906.3	CH42	910.7		
CH21	906.5	CH43	910.9		

Remark:
1. The device supports hybrid mode.
2. RF output power was measured with Average detector

3.2 THE WORST MODE OF MEASUREMENT

Radiated Emission Measurement Above 1G	
Test Condition	**Radiated Emission Above 1G**
Power supply Mode	**Mode 1: EUT power by Battery**
Worst Mode	☒ **Mode 1** ☐ **Mode 2** ☐ **Mode 3** ☐ **Mode 4**
Worst Position	☐ **Placed in fixed position.** ☐ **Placed in fixed position at X-Plane (E2-Plane)** ☒ **Placed in fixed position at Y-Plane (E1-Plane)** ☐ **Placed in fixed position at Z-Plane (H-Plane)**

Radiated Emission Measurement Below 1G	
Test Condition	**Radiated Emission Below 1G**
Power supply Mode	**Mode 1: EUT power by Battery**
Worst Mode	☒ **Mode 1** ☐ **Mode 2** ☐ **Mode 3** ☐ **Mode 4**

Remark:
1. The worst mode was record in this test report.
2. EUT pre-scanned in three axis ,X,Y, Z and two polarity, for radiated measurement. The worst case(Y-Plane) were recorded in this report

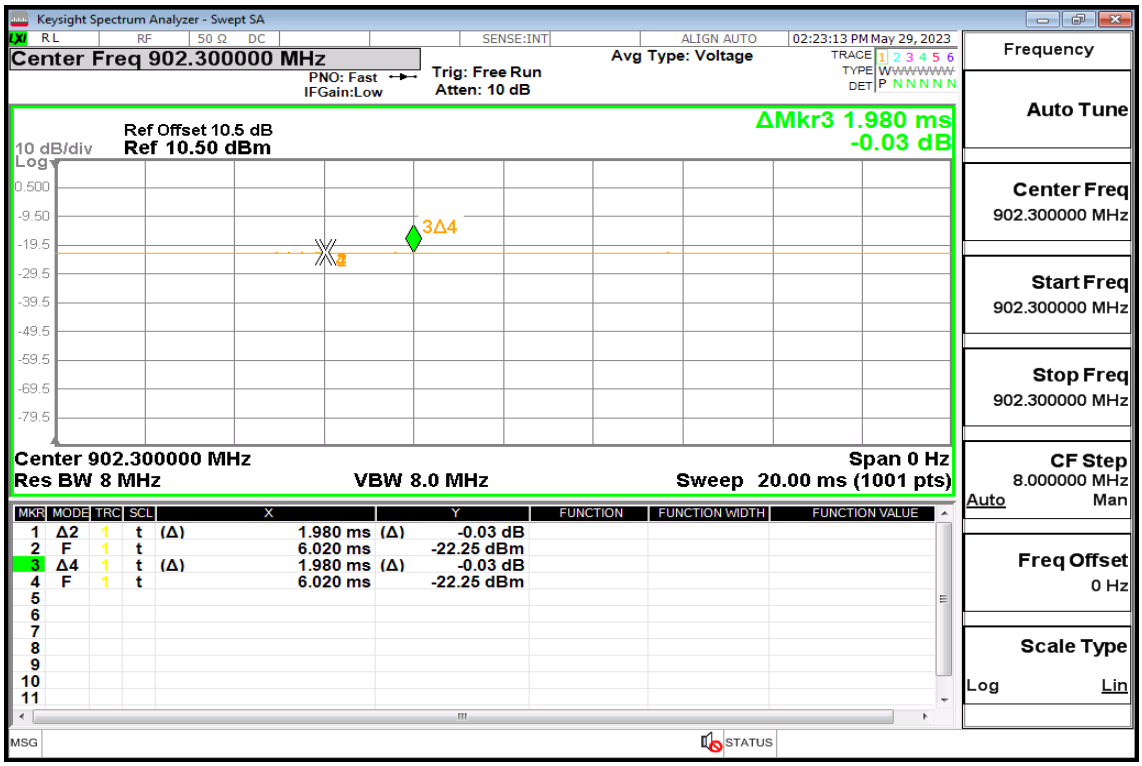
3.3 EUT DUTY CYCLE

Temperature: 22.8 ~ 26.8℃ **Test date:** May 15 ~ June 1, 2023

Humidity: 52 ~ 60% RH **Tested by:** Jack Chen

Duty Cycle				
Configuration	Duty Cycle (%)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
LoRa-125kHz	100.00	0.00	1.00	0.01

LoRa-125kHz



4. TEST RESULT

4.1 AC POWER LINE CONDUCTED EMISSION

4.1.1 Test Limit

According to §15.207(a),

Frequency Range (MHz)	Limits(dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

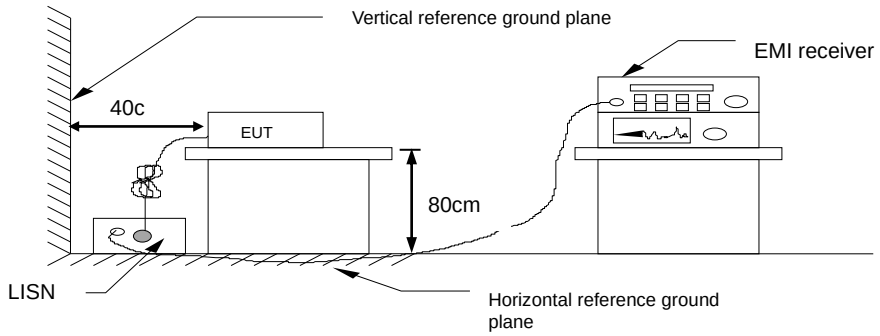
* Decreases with the logarithm of the frequency.

4.1.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 6.2,

1. The EUT was placed on a non-conducted table, which is 0.8m above horizontal ground plane and 0.4m above vertical ground plane.
2. EUT connected to the line impedance stabilization network (LISN)
3. Receiver set RBW of 9kHz and Detector Peak, and note as quasi-peak and average.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Recorded Line for Neutral and Line.

4.1.3 Test Setup



4.1.4 Test Result

Not applicable, because EUT not connect to AC Main Source direct.

4.2 20dB BANDWIDTH AND OCCUPIED BANDWIDTH (99%)

4.2.1 Test Limit

According to §15.247(a)(1)(i),

20 dB Bandwidth ：For reporting purposes only.

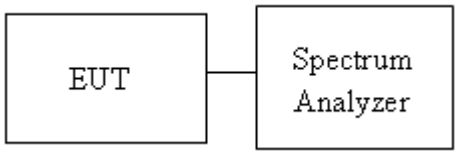
Occupied Bandwidth(99%) ：For reporting purposes only.

4.2.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 7.8.7,

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 3kHz, VBW = 10kHz and Detector = Peak, to measurement 20 dB Bandwidth.
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth
5. Measure and record the result of 20 dB Bandwidth and 99% Bandwidth. in the test report.

4.2.3 Test Setup



4.2.4 Test Result

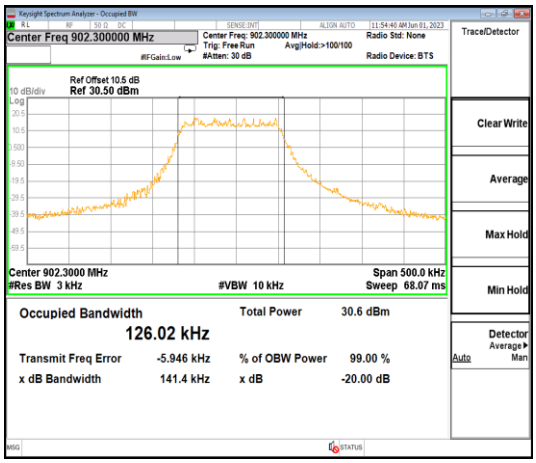
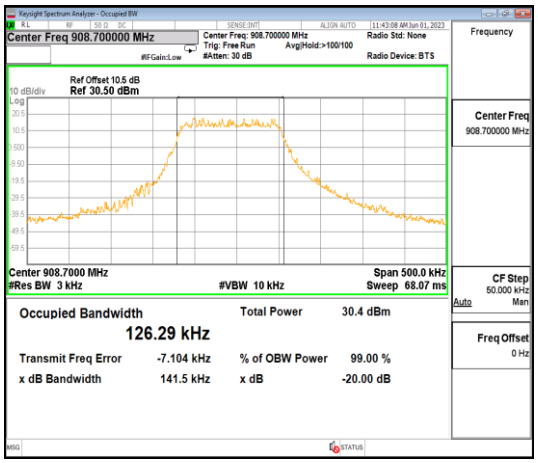
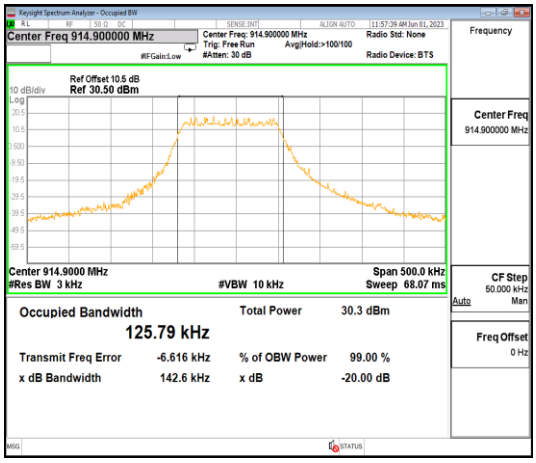
Temperature: 22.8 ~ 26.8℃ **Test date:** May 15 ~ June 1, 2023

Humidity: 52 ~ 60% RH **Tested by:** Jack Chen

Test mode: LoRa-125kHz / 902.3-914.9 MHz			
Channel	**Frequency (MHz)**	**OBW(99%) (MHz)**	**20dB BW (MHz)**
Low	902.3	0.12520	0.1414
Mid	908.7	0.12655	0.1415
High	914.9	0.12588	0.1426

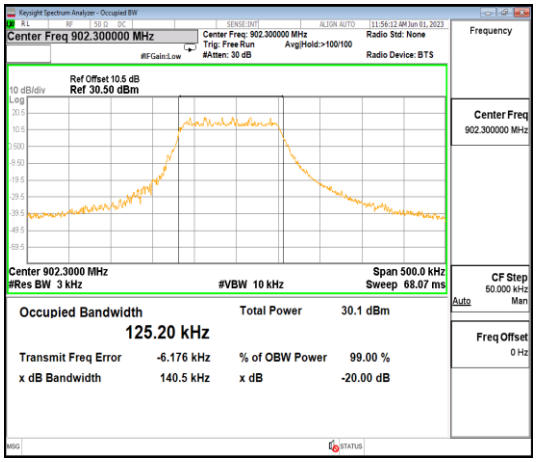
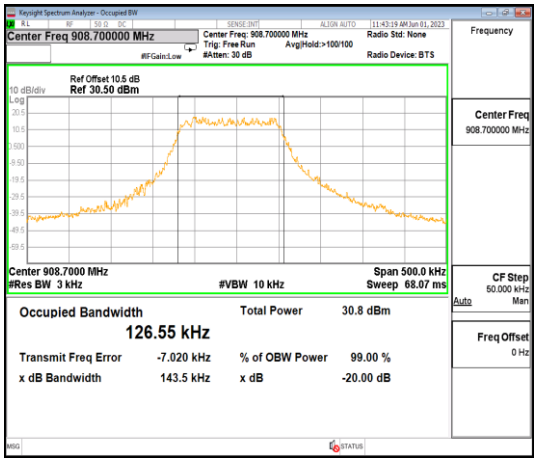
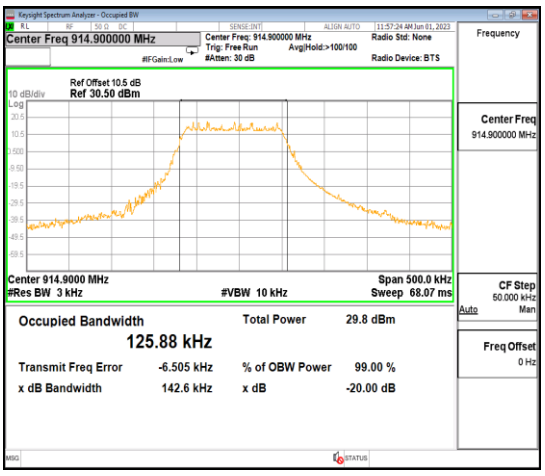
Test Data

20dB BANDWIDTH

LoRa-125kHz	
Low CH	**Mid CH**
	
High CH	
	

Test Data

BANDWIDTH 99%

LoRa-125kHz	
Low CH	**Mid CH**
	
High CH	
	

4.3 OUTPUT POWER MEASUREMENT

4.3.1 Test Limit

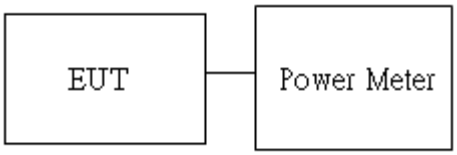
According to §15.247(b)(2)

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.

4.3.2 Test Procedure

1. The EUT RF output connected to the power meter by RF cable.
2. Setting maximum power transmit of EUT.
3. The path loss was compensated to the results for each measurement.
4. Measure and record the result of Peak output power and Average output power. in the test report.

4.3.3 Test Setup



4.3.4 Test Result

Temperature:	22.8 ~ 26.8℃	**Test date:**	May 15 ~ June 1, 2023
Humidity:	52 ~ 60% RH	**Tested by:**	Jack Chen

LoRa-125kHz:

CH	Freq. (MHz)	Power set	Maximum Output power (dBm)	Output Power (mW)	Limit (mW)
Low	902.3	22	**20.34**	108.143	1000
Mid	908.7	22	20.23	105.439	1000
High	914.9	22	20.23	105.439	1000

4.4 FREQUENCY SEPARATION

4.4.1 Test Limit

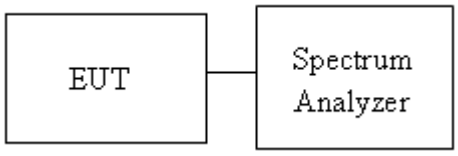
15.247(a)(1)

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.

4.4.2 Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set the spectrum analyzer as RBW = 10kHz, VBW = 30kHz, Sweep = auto.
   Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency

4.4.3 Test Setup



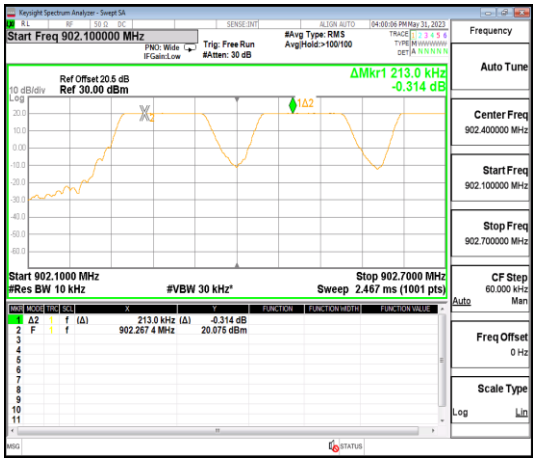
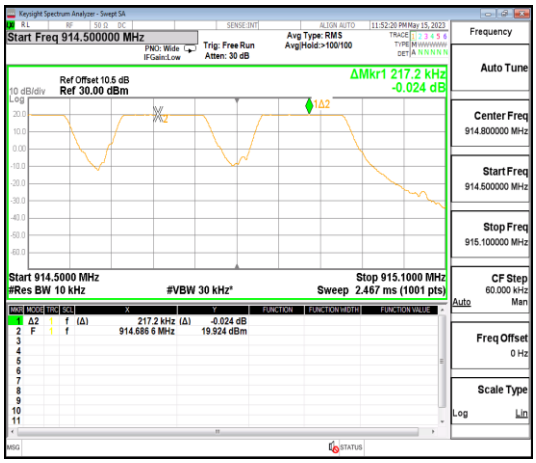
4.4.4 Test Result

Temperature: 22.8 ~ 26.8℃ **Test date:** May 15 ~ June 1, 2023

Humidity: 52 ~ 60% RH **Tested by:** Jack Chen

Test mode: LoRa-125kHz / 902.3-914.9 MHz				
Channel	**Frequency (MHz)**	**Channel Separation (MHz)**	**Channel Separation Limits (MHz)**	**Result**
Low	902.3	0.2130	0.1414	PASS
Mid	908.7	0.2124	0.1415	PASS
High	914.9	0.2172	0.1426	PASS

Test Data

LoRa-125kHz	
Low CH	**Mid CH**
	
High CH	
	

4.5 NUMBER OF HOPPING

4.5.1 Test Limit

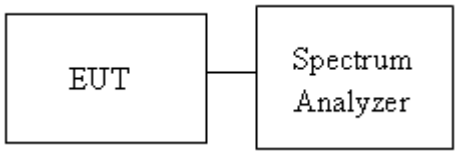
According to §15.247(a)(1)(i)

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; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.

4.5.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 7.8.3
1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set spectrum analyzer Start Freq. = 902 MHz, Stop Freq. = 928 MHz, RBW =100KHz, VBW = 300KHz.
4. Max hold, view and count how many channels in the band.

4.5.3 Test Setup



4.5.4 Test Result

Temperature:	22.8 ~ 26.8℃	**Test date:**	May 15 ~ June 1, 2023
Humidity:	52 ~ 60% RH	**Tested by:**	Jack Chen

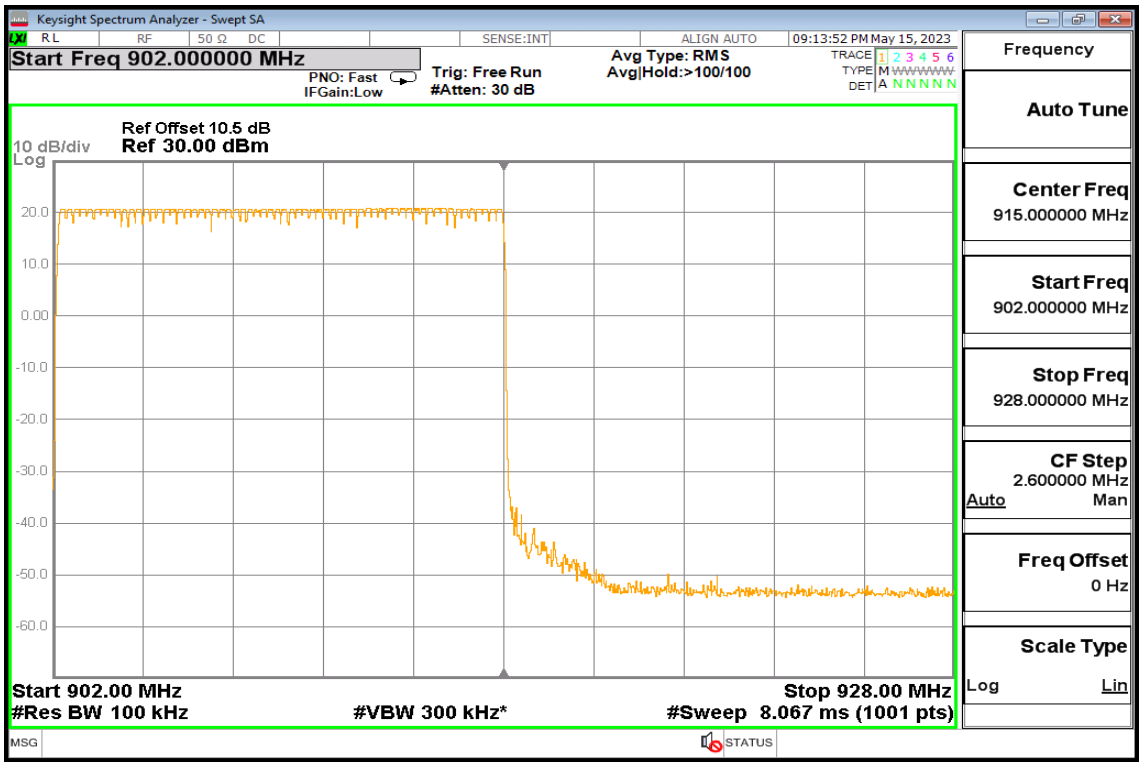
Number of Hopping				
Mode	**Frequency (MHz)**	**Hopping Channel Number**	**Hopping Channel Number Limits**	**Result**
LoRa-125kHz	902.3-914.9	64	N/A[1]	Pass

Note:
1. Hybrid mode, No minimum number of hopping channels with hybrid system.

Test Data

Number of Hopping

LoRa-125kHz



4.6 CONDUCTED BANDEDGE AND SPURIOUS EMISSION

4.6.1 Test Limit

According to §15.247(d)

Limit	-30 dBc

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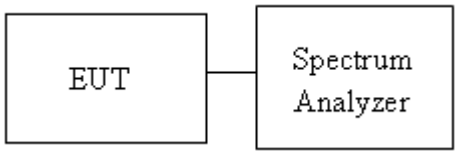
4.6.2 Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.

2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.

3. The Band Edge at 902 MHz and 928 MHz are investigated with both hopping “ON” and “OFF” modes “.

4.6.3 Test Setup



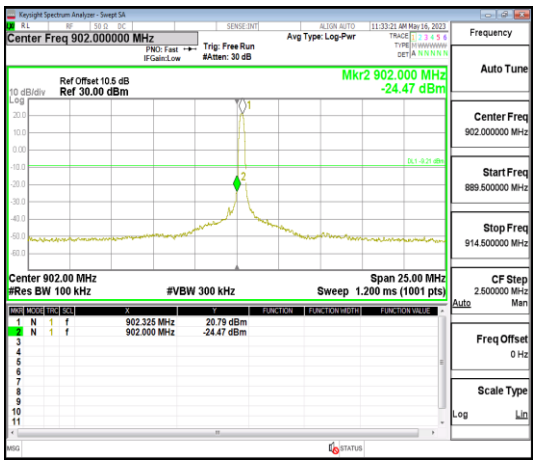
4.6.4 Test Result

Temperature:	22.8 ~ 26.8℃	**Test date:**	May 15 ~ June 1, 2023
Humidity:	52 ~ 60% RH	**Tested by:**	Jack Chen

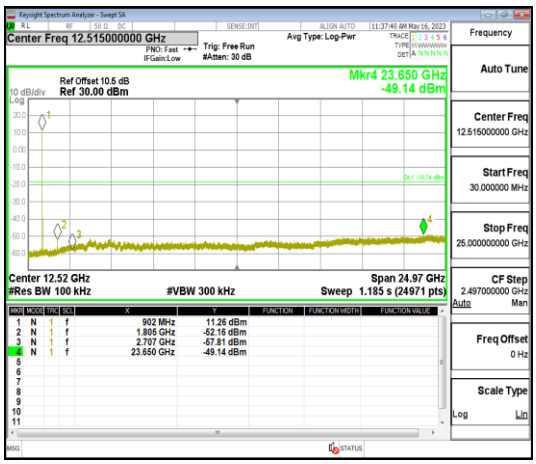
Test Data

LoRa-125kHz Low CH

Band Edge

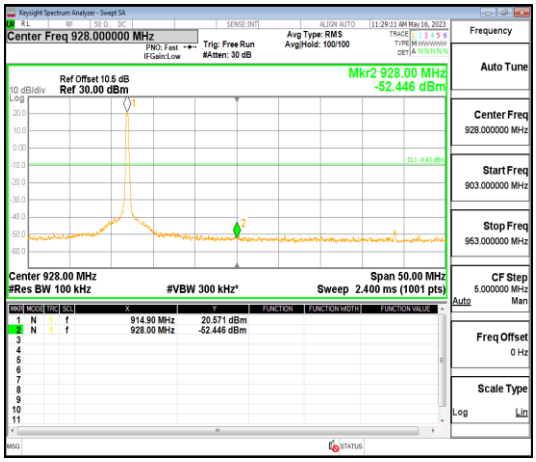


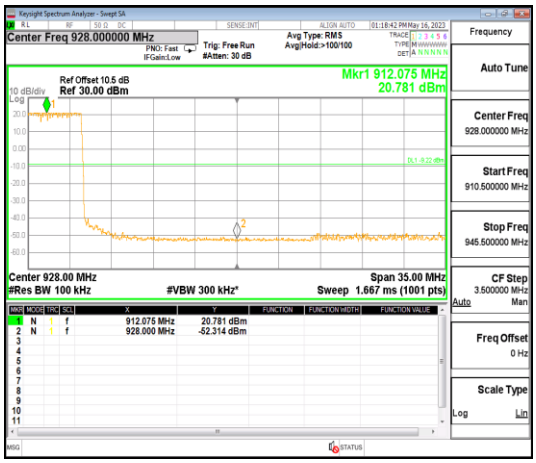
Spurious Emission 30MHz-25GHz



LoRa-125kHz Mid CH

Spurious Emission 30MHz-25GHz

LoRa-125kHz High CH	
Band Edge	**Spurious Emission 30MHz-25GHz**
	

LoRa-125kHz Hopping mode	
Low Band Edge	**High Band Edge**
	

4.7 TIME OF OCCUPANCY (DWELL TIME)

4.7.1 Test Limit

According to §15.247(f)

The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

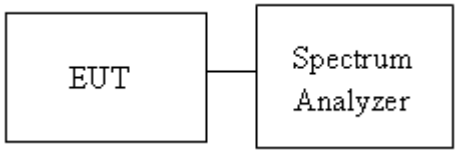
4.7.2 Test Procedure

1. EUT RF output port connected to the SA by RF cable.

2. Set center frequency of spectrum analyzer = operating frequency.

5. 3. Set the spectrum analyzer as RBW=100 kHz, VBW= 300 kHz, Sweep = 500 ms

5.1.1 Test Setup

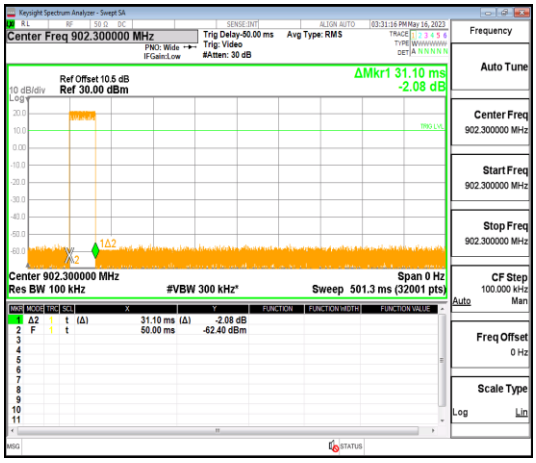


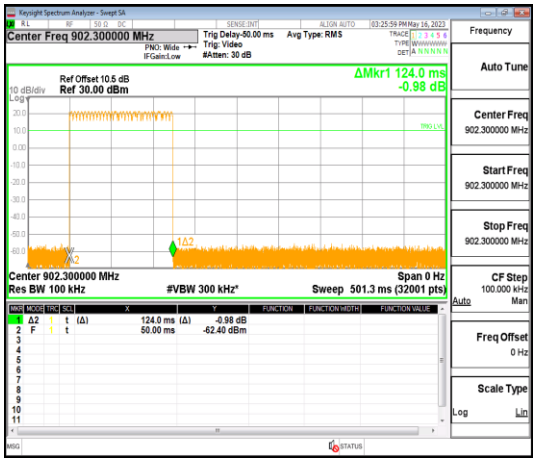
5.1.2 Test Result

Temperature:	22.8 ~ 26.8℃	**Test date:**	May 15 ~ June 1, 2023
Humidity:	52 ~ 60% RH	**Tested by:**	Jack Chen

Time of Occupancy (Dwell Time)					
Mode/SF	**Freq.(MHz)**	**Length of Transmission Time (sec)**	**Number of Transmission in a 25.6 S (64 Hopping*0.4S)**	**Result (s)**	**Limit (s)**
Lora / 7	902.3	0.0311	1	0.0311	0.4
Lora / 8	902.3	0.06207	1	0.06207	0.4
Lora / 9	902.3	0.124	1	0.124	0.4
Lora / 10	902.3	0.248	1	0.248	0.4

Test Data

Time of Occupancy (Dwell Time)	
LoRa-125kHz / SF7-1	**LoRa-125kHz / SF7-2**
	
LoRa-125kHz / SF8-1	**LoRa-125kHz / SF8-2**
	

Time of Occupancy (Dwell Time)	
LoRa-125kHz / SF9-1	**LoRa-125kHz / SF9-2**
	
LoRa-125kHz / SF10-1	**LoRa-125kHz / SF10-2**
	

5.2 RADIATION BANDEDGE AND SPURIOUS EMISSION

5.2.1 Test Limit

FCC according to §15.247(d), §15.209 and §15.205,

In any 100 kHz bandwidth outside the authorized frequency band, all harmonic and spurious must be least 20 dB below the highest emission level with the authorized frequency band. Radiation emission which fall in the restricted bands must also follow the FCC section 15.209 as below limit in table.

Below 30 MHz

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/F (F in kHz)	30
1.705-30 MHz	30	N/A	30

Above 30 MHz

Frequency (MHz)	Field Strength microvolts/m at 3 metres (watts, e.i.r.p.)	
	Transmitters	Receivers
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

Remark:
Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

5.2.2 Test Procedure

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m and below 1 GHz is 0.8m above ground plane. The EUT Configured un accordance with ANSI C63.10: 2013, and the EUT set in a continuous mode.

2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. And EUT is set 3m away from the receiving antenna, which is scanned from 1m to 4m above the ground plane to find out the highest emissions. Measurement are made polarized in both the vertical and the horizontal positions with antenna.

3. Span shall wide enough to full capture the emission measured. The SA from 9kHz to 26.5GHz set to the low, Mid and High channels with the EUT transmit.

Note: No emission found between lowest internal used/generated frequency to 30MHz(9KHz~30MHz)

4. For harmonic, the worst case of output power was BDR-1Mbps. Therefore only BDR-1Mbps record in the report.

5. The SA setting following：

(1) Below 1G：RBW = 100kHz, VBW ≥ 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.

(2) Above 1G：

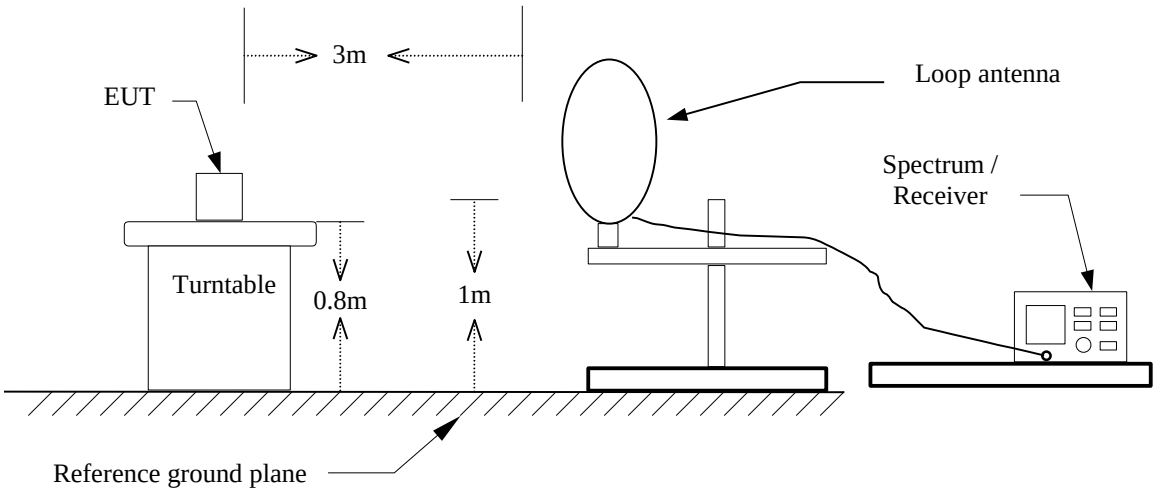
(2.1) For Peak measurement：RBW = 1MHz, VBW ≥ 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.

(2.2) For Average measurement：RBW = 1MHz, VBW

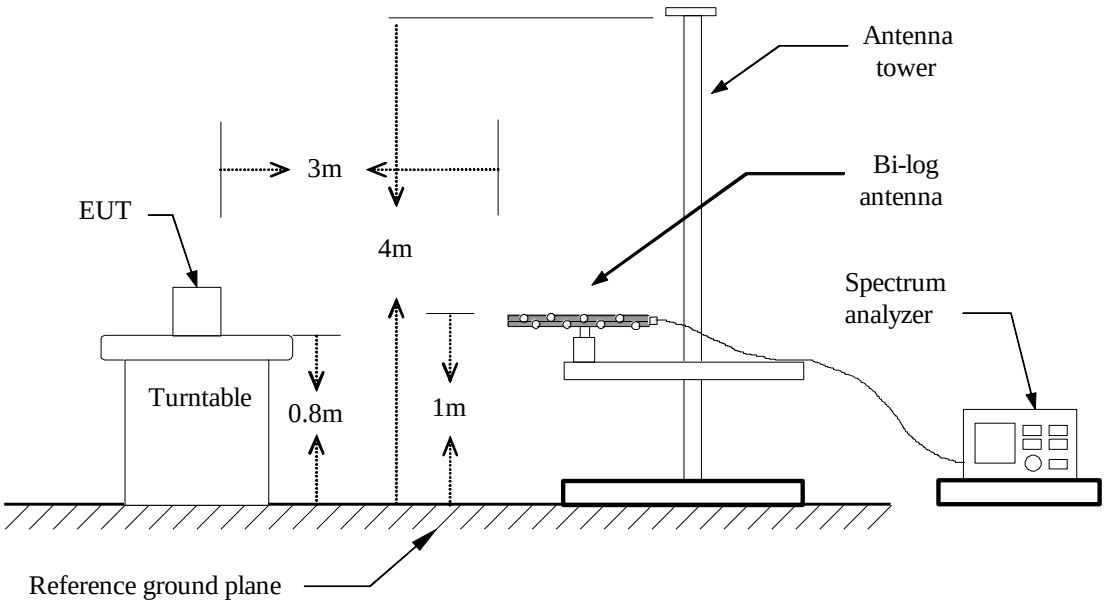
- If Duty Cycle ≥ 98%, VBW=10Hz.
- If Duty Cycle < 98%, VBW≥1/T.

5.2.3 Test Setup

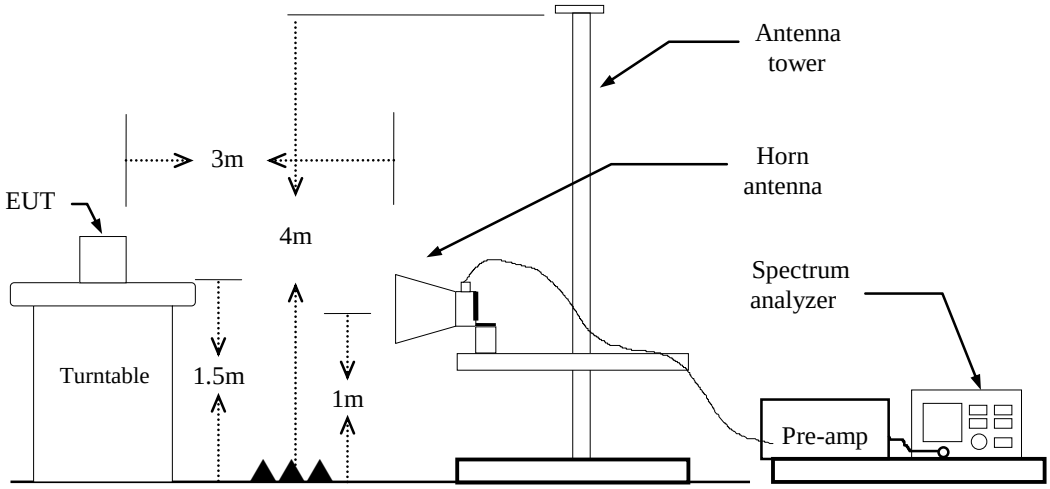
9kHz ~ 30MHz



30MHz ~ 1GHz



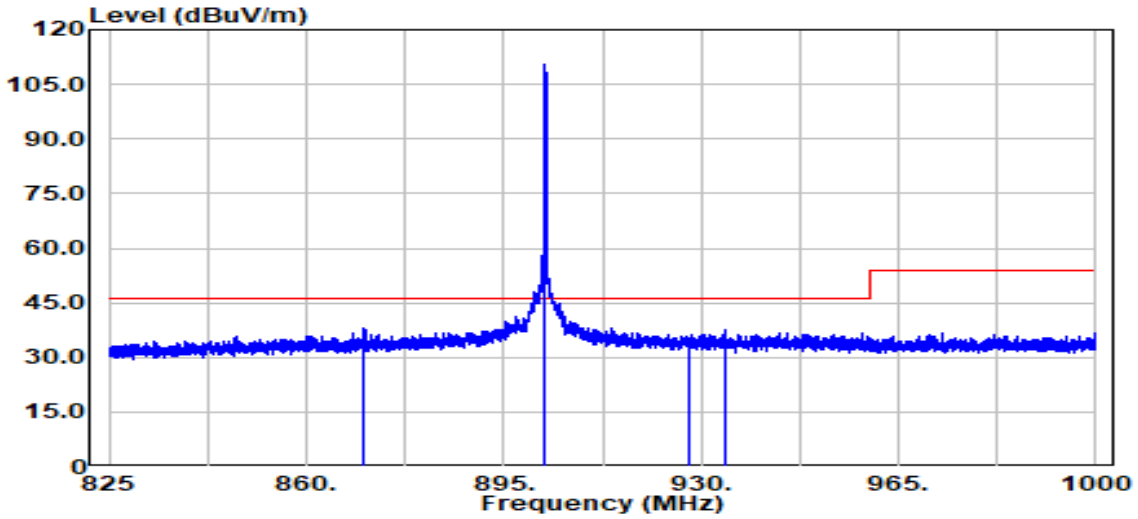
Above 1 GHz



5.2.4 Test Result

Band Edge Test Data

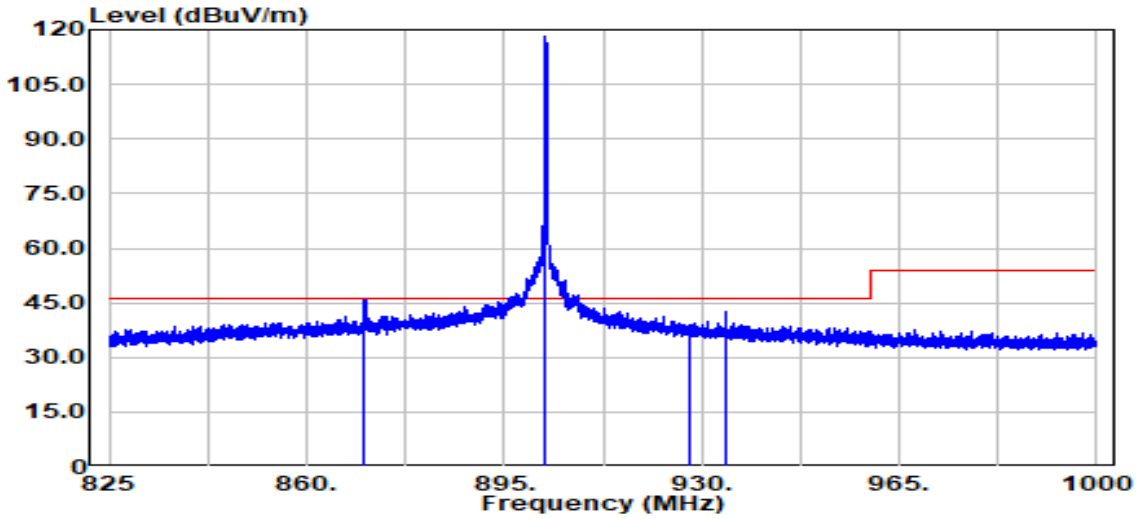
Test Mode:	Low CH 902.3 MHz	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Band Edge	Test Date	May 22, 2023
Polarize	Vertical	Test Engineer	Czerny Lin
Detector	Peak / Average		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
870.31	Peak	39.19	-1.25	37.94	80.66[1]	-42.72
902.00	QP	56.77	-0.84	55.93	80.26[1]	-24.33
902.00	Peak	64.11	-0.84	63.27	80.66[1]	-17.39
902.30	QP	111.10	-0.84	110.26	--	--
902.30	Peak	111.50	-0.84	110.66	--	--
902.30	Average	109.20	-0.84	108.36	--	--
928.01	Peak	34.34	-0.19	34.14	80.66[1]	-46.52
934.27	Peak	37.83	-0.02	37.80	80.66[1]	-42.86

Remark:
1. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

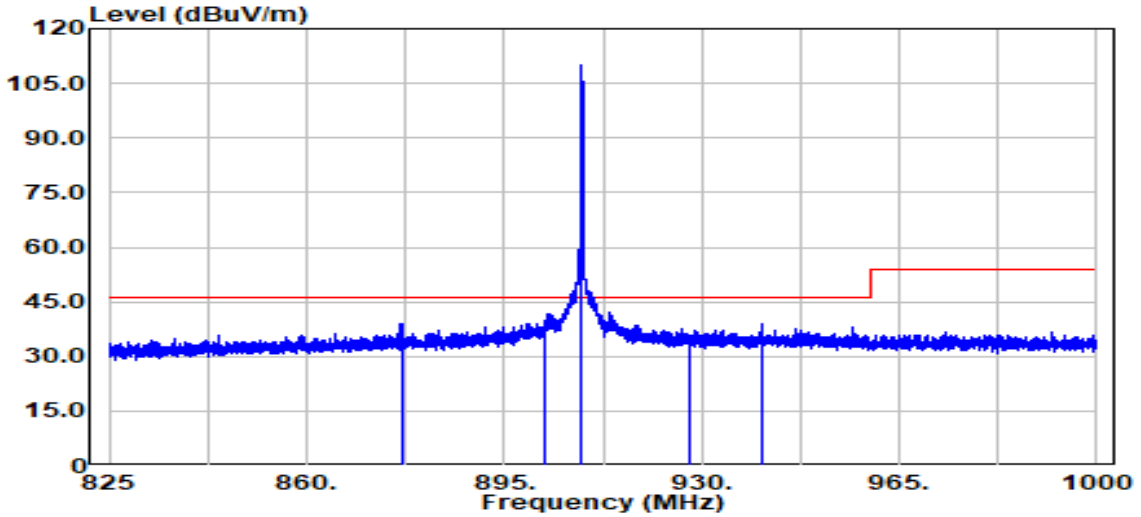
Test Mode:	Low CH 902.3 MHz	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Band Edge	Test Date	May 22, 2023
Polarize	Horizontal	Test Engineer	Czerny Lin
Detector	Peak / Average		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
870.31	Peak	47.16	-1.25	45.91	88.66[1]	-42.75
902.00	QP	62.21	-0.84	61.37	86.36[1]	-24.99
902.00	Peak	69.84	-0.84	69.00	88.66[1]	-19.66
902.30	QP	119.20	-0.84	118.36	--	--
902.30	Peak	119.50	-0.84	118.66	--	--
902.30	Average	117.20	-0.84	116.36	--	--
928.00	Peak	37.53	-0.19	37.33	88.66[1]	-51.33
934.32	Peak	42.77	-0.02	42.74	88.66[1]	-45.92

Remark:
1. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

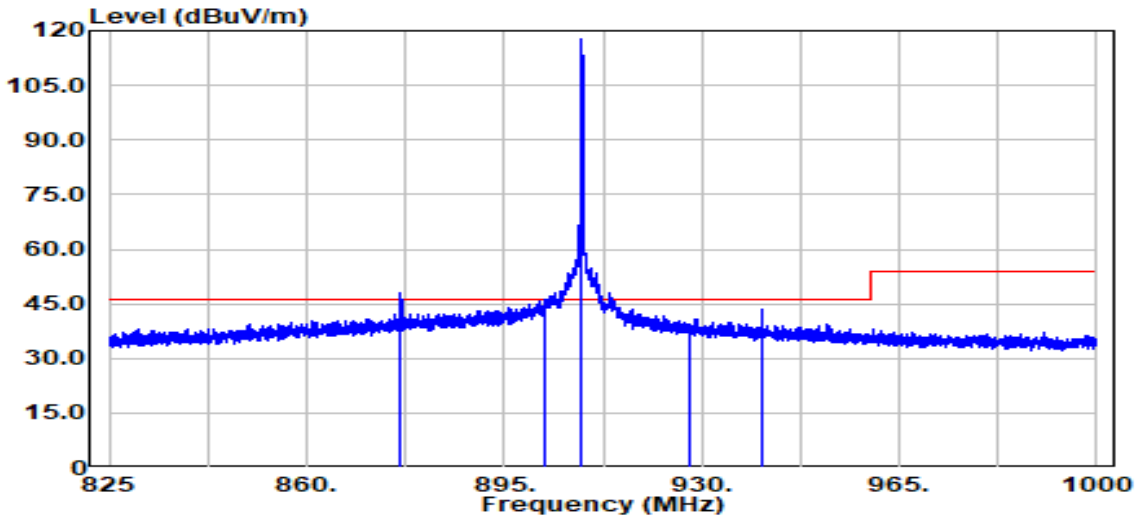
Test Mode:	Mid CH 908.7 MHz	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Band Edge	Test Date	May 22, 2023
Polarize	Vertical	Test Engineer	Czerny Lin
Detector	Peak / Average		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
876.77	Peak	39.93	-1.19	38.74	80.39[1]	-41.65
902.00	Peak	38.32	-0.84	37.48	80.39[1]	-42.91
908.70	QP	110.70	-0.71	109.99	--	--
908.70	Peak	111.10	-0.71	110.39	--	--
908.70	Average	108.70	-0.71	107.99	--	--
928.00	Peak	34.28	-0.19	34.09	80.39[1]	-46.30
940.69	Peak	38.72	0.16	38.88	80.39[1]	-41.51

Remark:
1. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

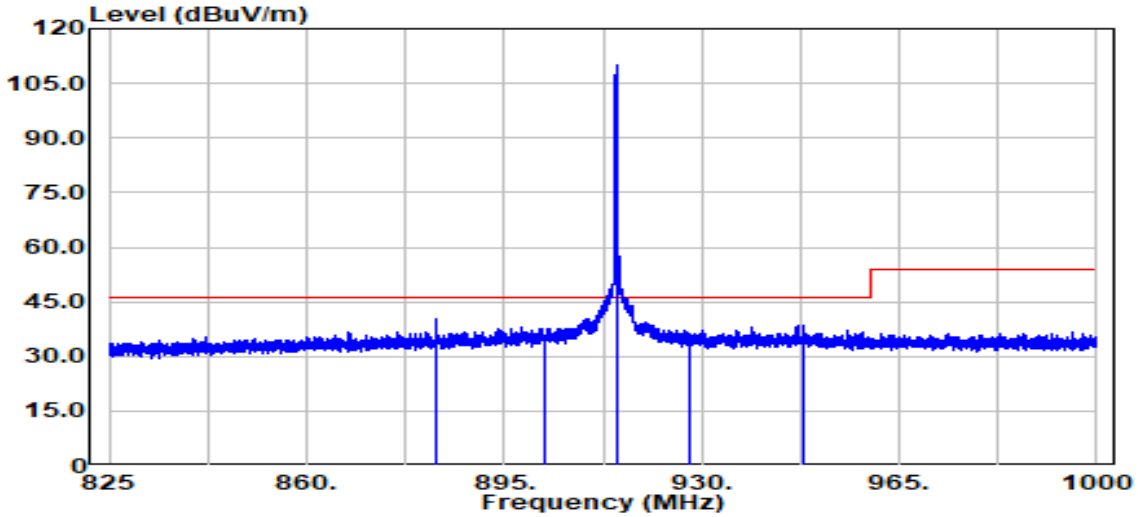
Test Mode:	Mid CH 908.7 MHz	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Band Edge	Test Date	May 22, 2023
Polarize	Horizontal	Test Engineer	Czerny Lin
Detector	Peak / Average		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
876.70	QP	45.76	-1.19	44.57	87.65[1]	-43.08
876.70	Peak	49.45	-1.19	48.26	87.88[1]	-39.62
902.00	QP	41.99	-0.84	41.15	87.65[1]	-46.50
902.00	Peak	47.40	-0.84	46.56	87.88[1]	-41.32
908.70	QP	118.36	-0.71	117.65	--	--
908.70	Peak	118.59	-0.71	117.88	--	--
908.70	Average	116.64	-0.71	115.93	--	--
928.00	Peak	38.26	-0.19	38.07	87.88[1]	-49.81
940.68	Peak	43.20	0.16	43.36	87.88[1]	-44.52

Remark:
1. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

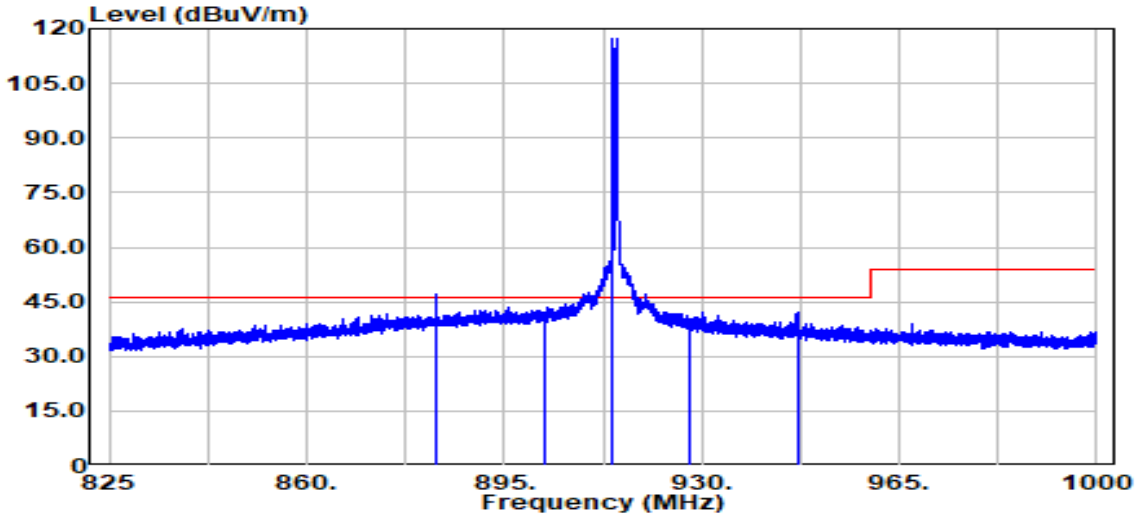
Test Mode:	High CH 914.9 MHz	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Band Edge	Test Date	May 22, 2023
Polarize	Vertical	Test Engineer	Czerny Lin
Detector	Peak / Average		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
882.84	Peak	41.33	-1.16	40.17	80.13[1]	-39.96
902.00	Peak	34.48	-0.84	33.64	80.13[1]	-46.49
914.90	QP	110.12	-0.63	109.49	--	--
914.90	Peak	110.76	-0.63	110.13	--	--
914.90	Average	109.25	-0.63	108.62	--	--
928.01	Peak	34.33	-0.19	34.14	80.13[1]	-45.99
947.87	Peak	38.19	0.26	38.45	80.13[1]	-41.68

Remark:
1. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

Test Mode:	High CH 914.9 MHz	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Band Edge	Test Date	May 22, 2023
Polarize	Horizontal	Test Engineer	Czerny Lin
Detector	Peak / Average		

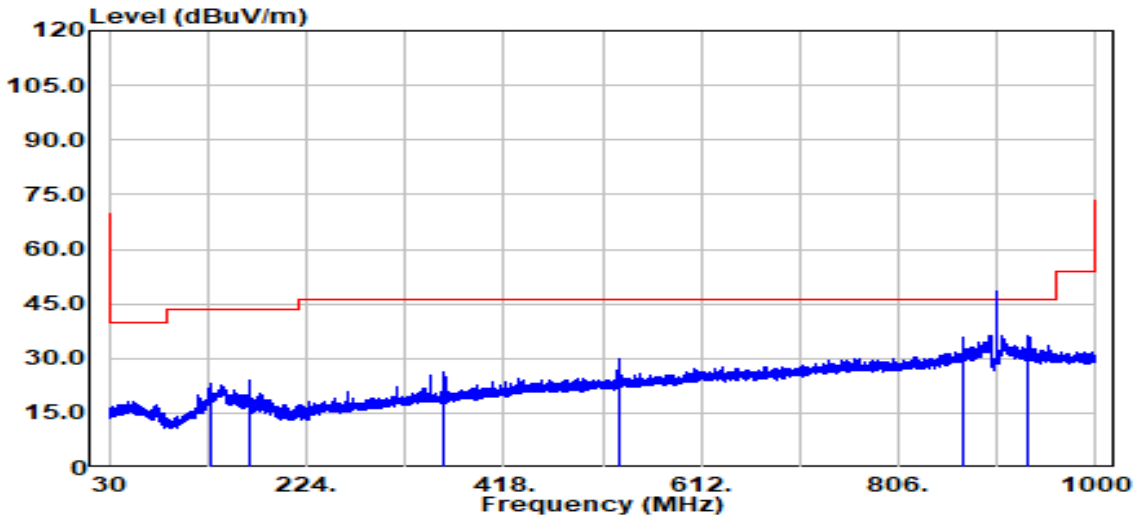


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
882.91	QP	44.60	-1.16	43.44	87.16[1]	-43.72
882.91	Peak	48.21	-1.16	47.05	87.56[1]	-40.51
902.00	Peak	41.81	-0.84	40.98	87.56[1]	-46.58
914.20	QP	117.80	-0.64	117.16	--	--
914.20	Peak	118.20	-0.64	117.56	--	--
914.20	Average	115.90	-0.64	115.26	--	--
928.00	Peak	38.24	-0.19	38.04	87.56[1]	-49.52
946.91	Peak	42.04	0.24	42.28	87.56[1]	-45.28

Remark:
1. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

Below 1G Test Data

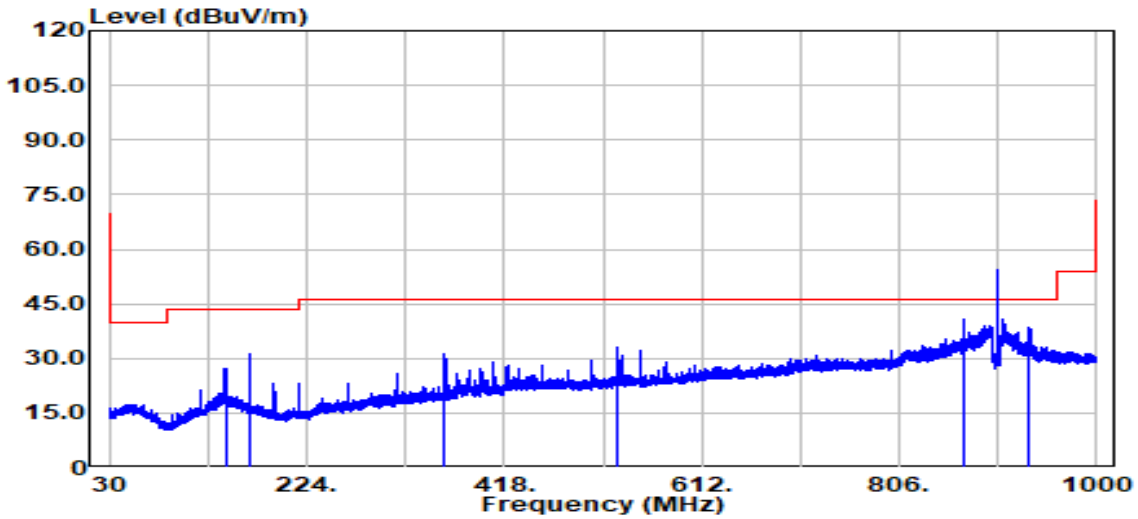
Test Mode:	LoRa-125kHz	Temp/Hum	23.2(℃)/ 63%RH
Test Item	30MHz-1GHz	Test Date	May 24, 2023
Polarize	Vertical	Test Engineer	Czerny Lin
Detector	Peak		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
129.52	Peak	37.46	-14.56	22.90	43.50	-20.60
168.03	Peak	37.54	-13.33	24.21	43.50	-19.29
359.99	Peak	37.22	-11.10	26.12	46.00	-19.88
531.39	Peak	36.67	-6.88	29.79	46.00	-16.21
870.31	Peak	36.82	-1.25	35.57	46.00	-10.43
934.23	Peak	36.29	-0.03	36.27	46.00	-9.73

Note: No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

Test Mode:	LoRa-125kHz	Temp/Hum	23.2(℃)/ 63%RH
Test Item	30MHz-1GHz	Test Date	May 24, 2023
Polarize	Horizontal	Test Engineer	Czerny Lin
Detector	Peak		

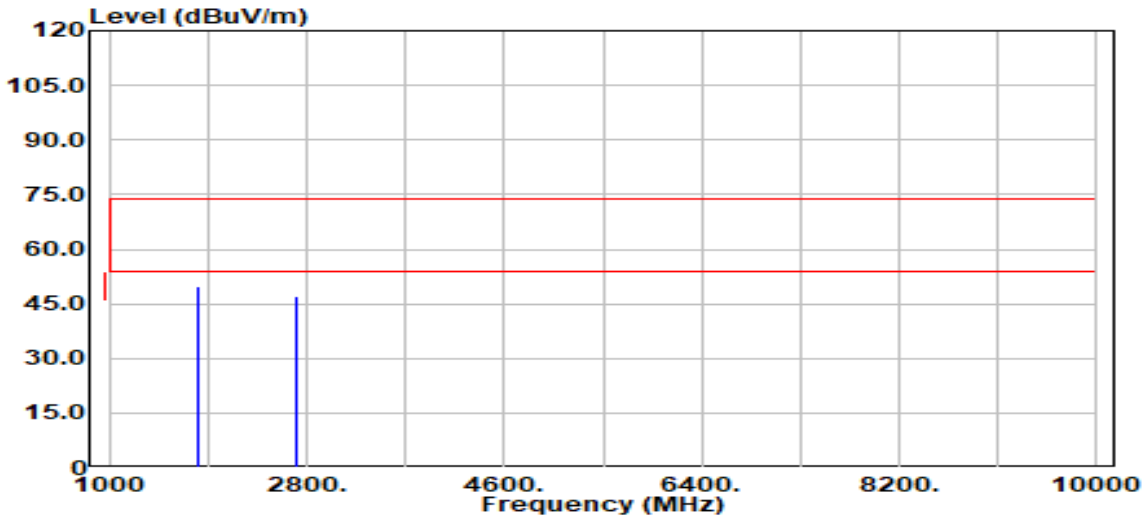


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
144.07	Peak	40.48	-13.18	27.30	43.50	-16.20
168.03	Peak	44.65	-13.33	31.33	43.50	-12.17
359.99	Peak	42.35	-11.10	31.25	46.00	-14.75
528.00	Peak	40.07	-7.01	33.06	46.00	-12.94
870.31	Peak	42.21	-1.25	40.97	46.00	-5.03
934.23	Peak	38.39	-0.03	38.36	46.00	-7.64

Note: No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

Above 1G Test Data

Test Mode:	Low CH	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Harmonic	Test Date	May 22, 2023
Polarize	Vertical	Test Engineer	Czerny Lin
Detector	Peak / Average		

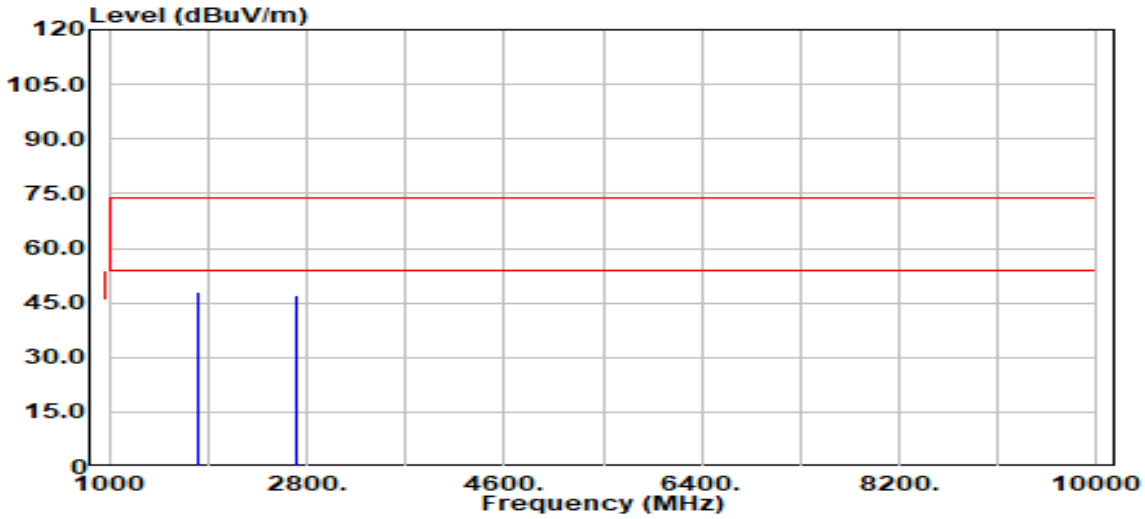


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
1804.60	Peak	57.17	-7.35	49.83	80.66[2]	-30.83
1804.60	Average	56.43	-7.35	49.09	78.36[2]	-29.27
2706.90	Peak	51.47	-4.41	47.06	74.00	-26.94
2706.90	Average	50.95	-4.41	46.54	54.00	-7.46

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

Test Mode:	Low CH	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Harmonic	Test Date	May 22, 2023
Polarize	Horizontal	Test Engineer	Czerny Lin
Detector	Peak / Average		

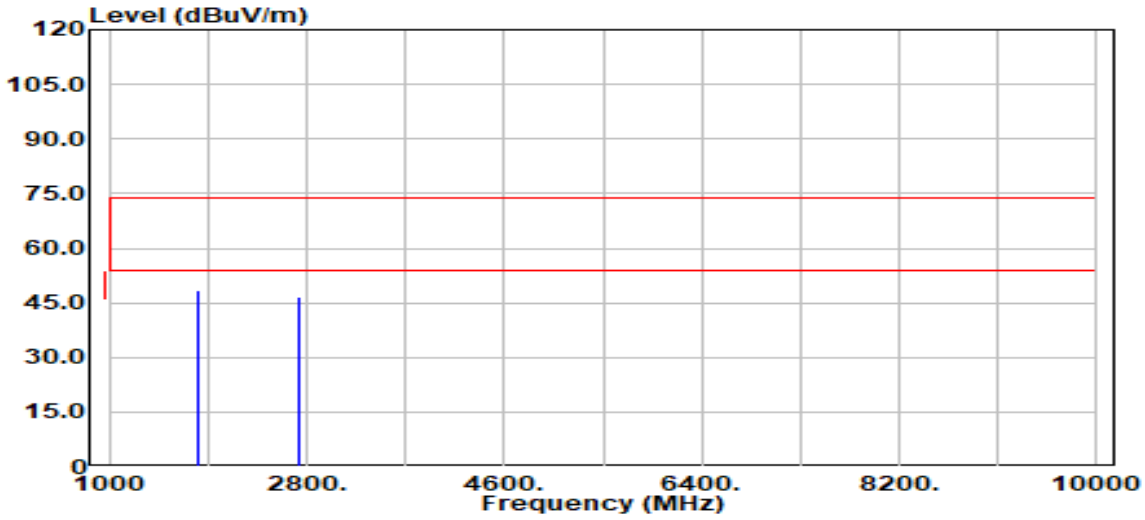


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
1804.60	Peak	55.28	-7.35	47.93	88.66[2]	-40.73
1804.60	Average	54.19	-7.35	46.84	86.36[2]	-39.52
2706.90	Peak	51.61	-4.41	47.20	74.00	-26.80
2706.90	Average	48.83	-4.41	44.42	54.00	-9.58

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

Test Mode:	Mid CH	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Harmonic	Test Date	May 22, 2023
Polarize	Vertical	Test Engineer	Czerny Lin
Detector	Peak / Average		

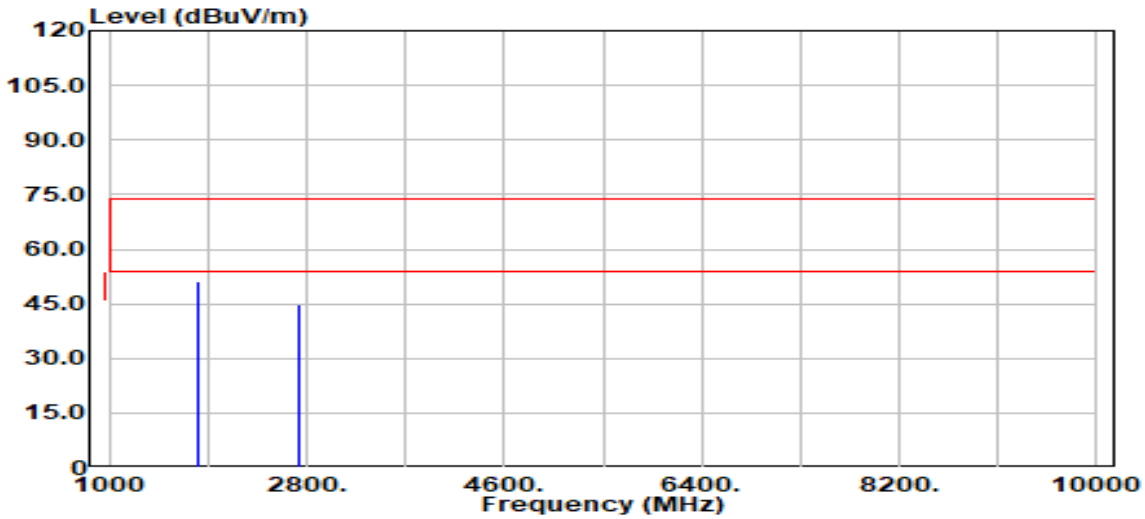


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
1817.40	Peak	55.91	-7.31	48.60	80.39[2]	-31.79
1817.40	Average	53.69	-7.31	46.38	77.99[2]	-31.61
2726.10	Peak	50.84	-4.30	46.54	74.00	-27.46
2726.10	Average	49.30	-4.30	44.99	54.00	-9.01

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

Test Mode:	Mid CH	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Harmonic	Test Date	May 22, 2023
Polarize	Horizontal	Test Engineer	Czerny Lin
Detector	Peak / Average		

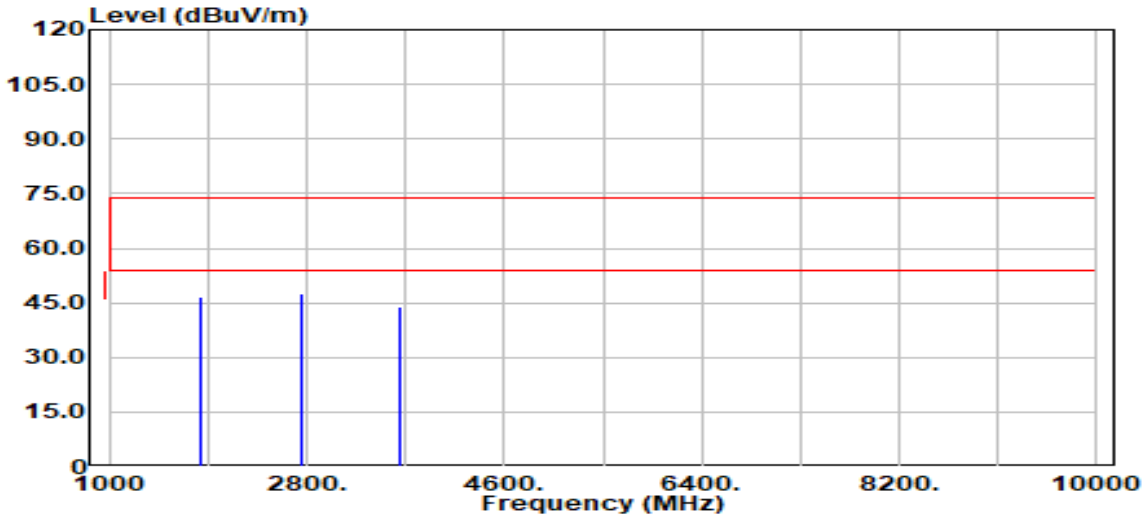


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
1817.40	Peak	58.32	-7.31	51.01	87.88[2]	-36.87
1817.40	Average	57.20	-7.31	49.90	85.93[2]	-36.03
2726.10	Peak	49.34	-4.30	45.04	74.00	-28.96
2726.10	Average	47.80	-4.30	43.50	54.00	-10.50

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

Test Mode:	High CH	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Harmonic	Test Date	May 22, 2023
Polarize	Vertical	Test Engineer	Czerny Lin
Detector	Peak / Average		

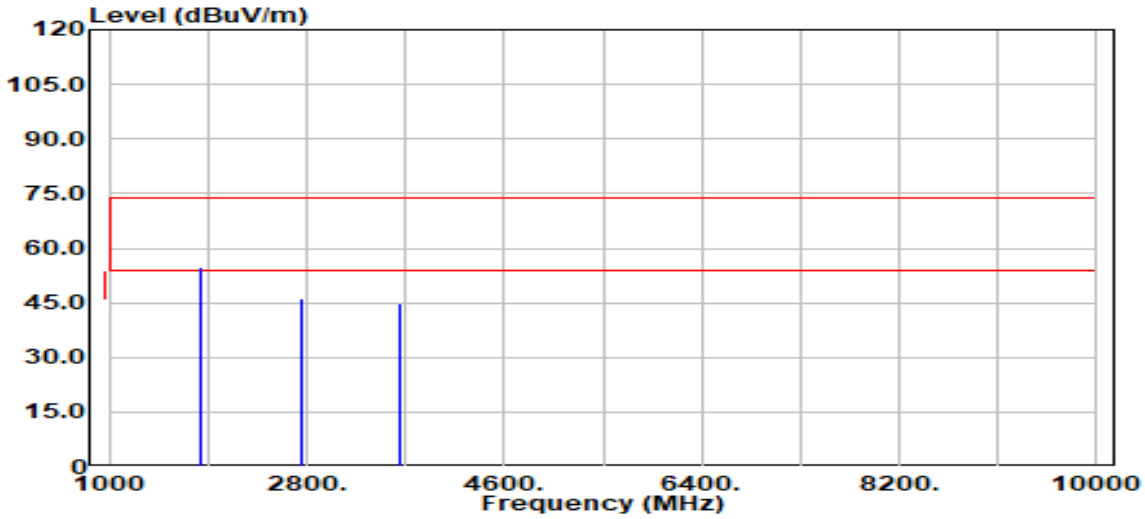


Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
1829.80	Peak	54.10	-7.32	46.78	80.13[2]	-33.35
1829.80	Average	53.17	-7.32	45.85	78.62[2]	-32.77
2744.70	Peak	51.63	-4.19	47.44	74.00	-26.56
2744.70	Average	48.83	-4.19	44.64	54.00	-9.36
3659.60	Peak	45.88	-2.04	43.84	74.00	-30.16
3659.60	Average	36.63	-2.04	34.59	54.00	-19.41

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

Test Mode:	High CH	Temp/Hum	25.5(℃)/ 54%RH
Test Item	Harmonic	Test Date	May 22, 2023
Polarize	Horizontal	Test Engineer	Czerny Lin
Detector	Peak / Average		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
1829.80	Peak	62.31	-7.32	54.99	87.56[2]	-32.57
1829.80	Average	61.40	-7.32	54.08	85.26[2]	-31.18
2744.70	Peak	50.24	-4.19	46.05	74.00	-27.95
2744.70	Average	46.43	-4.19	42.23	54.00	-11.77
3659.60	Peak	46.86	-2.04	44.82	74.00	-29.18
3659.60	Average	40.78	-2.04	38.74	54.00	-15.26

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. The limit is fundamental signal – 30 dB since the frequency of the unwanted emission was not in restricted band.

- End of Test Report -