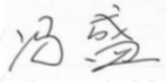
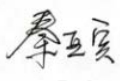
Industrial Internet Innovation Center (Shanghai) Co.,Ltd.

EMC TEST REPORT

PRODUCT	**ELECTRONIC SHELF LABEL**
BRAND	**SUNMI**
MODEL	**BL260**
APPLICANT	**Shanghai Sunmi Technology Co.,Ltd.**
FCC ID	**2AH25BL260**
ISSUE DATE	**September 16, 2022**
STANDARD(S)	**FCC CFR47 Part 2, FCC CFR47 Part 15C, ANSI C63.10-2013.**

Prepared by:Feng Sheng	**Reviewed by:** ***Qin Yabin***	**Approved by:** ***Liu Long***
		

CONTENTS

1 Summary of Test Report

1.1 Test Standard (s)

No.	Test Standard(s)	Title	Version
1	FCC CFR47 Part 2	Frequency allocations and radio treaty matters; general rules and regulations	2020/10/01
2	FCC CFR47 Part 15C	Radio Frequency Devices-Intentional Radiators	2020/10/01
3	ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013
NOTE: According to customer requirements, test and report using the latest version of the standard.			

1.2 Summary of Test Results

No.	Item(s)	Standard(s)	Verdicts for Single Item	Detaied Results
1	20 dB bandwidth	2.1049	Pass	See section 6.1
2	Frequency Stability	15.225(e)	Pass	See section 6.2
3	Radiated Emission	15.225 (a) (b) (c) (d) and 15.209	Pass	See section 6.3
4	Occupied bandwidth	N/A	Pass	See section 6.4

NOTE:
The BL420, manufactured by Shanghai Sunmi Technology Co.,Ltd. is a new product for testing.
Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 1.3.
Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 4 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 1 of this test report.

2 General Information of The Laboratory

2.1 Testing Laboratory

Lab Name	Industrial Internet Innovation Center (Shanghai) Co.,Ltd.
Address	Building 4, No. 766, Jingang Road, Pudong, Shanghai, China
Telephone	021-68866880
FCC Registration No.	958356
FCC Designation No.	CN1177

2.2 Laboratory Environmental Requirements

Temperature	15℃~35℃
Relative Humidity	25%RH~75%RH
Atmospheric Pressure	86kPa~106kPa
Supply Voltage	3V Battery Power Supply

2.3 Project Information

Project Manager	Gao Hongning
Test Date	August 24, 2022 to September 09, 2022

3 General Information of The Customer

3.1 Applicant

Company	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18826519551

3.2 Manufacturer

Company	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18826519551

3.3 Factory

Company	N/A
Address	N/A

4 General Information of The Product

4.1 Product Description for Equipment under Test (EUT)

Product	ELECTRONIC SHELF LABEL
Model	BL260
Date of Receipt	August 18, 2022
EUT ID*	S03aa
SN/IMEI	B110D27T00010
Supported Radio Technology and Bands	NFC BLE
Hardware Version	N/A
Software Version	N/A
Product Class	1
NOTE1: EUT ID is the internal identification code of the laboratory. NOTE2: Photographs of EUT are shown in ANNEX A of this test report.	

4.2 Description for Auxiliary Equipment (AE)

AE ID*	Description	Model	SN/Remark
AE1	Smart Phone	Redmi K50	N/A
AE2	Mobile APP	Sunmi Price Tag Assistant	N/A
NOTE: *AE ID is the internal identification code of the laboratory.			

5 Test Configuration Information

5.1 Laboratory Environmental Conditions

5.1.1 Permanent Facilities

Semi-anechoic chamber SAC3-1 (9 m*8m*6.2m) & SAC3-2 (9.8m*6.7m*6.7m)	
Shielding effectiveness	0.014MHz ~1MHz, >60dB; 1MHz~1000MHz, >90dB.
Electrical insulation	> 2MΩ
Ground system resistance	< 4Ω
Normalised site attenuation (NSA)	< ± 4 dB, 3m distance, from 30 to 1000 MHz
Site voltage standing-wave ratio (SVSWR)	Between 0 and 6 dB, from 1GHz to 18GHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

Shielded room	
Shielding effectiveness	0.014MHz~1MHz, >60dB; 1MHz~1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω

5.2 Decision of final test mode

The EUT was tested in conjunction with the accessories in Section 4.2. We tested all of the following test modes and selected the worst mode from the test results and recorded them in the report.

The test configuration modes are as the following:

Test Item	Test setup and operating modes
20 dB bandwidth	Mode 1: TX Mode
Frequency Stability	Mode 1: TX Mode
Radiated emission	Mode 1: TX Mode
Occupied bandwidth	Mode 1: TX Mode
Note: N/A	

5.3 EUT System Operation

1. Connect the EUT with AE.
2. Setup the EUT according to the standard.
3. Start testing and monitoring the function.
4. TX mode: The mobile phone controls the EUT through Sunmi Price Tag Assistant APP to be in the state of NFC transmit.

5.4 EUT Connection Diagram of Test System

<Figure 5.4-1> Mode 1

5.5 Test Equipment Utilized

No.	Name	Model	S/N	Manufacturer	Cal. Date	Cal. Interval
1	Test Receiver	ESCI	101235	R&S	2022-02-23	1 year
2	Test Receiver	ESU40	100307	R&S	2022-02-23	1 year
3	Trilog Antenna	VULB9163	VULB9163-515	Schwarzbeck	2022-03-11	1 year
4	Loop Antenna	AL-130R	121083	COM-POWER	2021-11-25	2 years
5	Temperature Box	B-TF-107C	201804107	Boyi	2021-05-10	1.5 year
6	EMI Test Software	EMC32 V10.35.02	N/A	R&S	N/A	N/A
7	Vector Signal Analyser	FSQ26	101096	R&S	2021-11-02	1 year

5.6 Measurement Uncertainty

Item (s)	Uncertainty
20 dB bandwidth	60.8 Hz
Frequency Stability	60.8 Hz
Electric Field Strength of Fundamental Emissions	4.48 dB
Electric Field Radiated Emissions (Below 30MHz)	4.48 dB
Electric Field Radiated Emissions (Above 30MHz)	4.94 dB
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

6 Test Results

6.1 20dB Bandwidth

6.1.1 Measurement Methods

a. The transmitter output signal was picked up by coil antenna to the spectrum analyzer.

b. The transmitter output signal was picked up by coil antenna connected to the spectrum analyzer.

c. The bandwidth of the center frequency was measured with 140Hz RBW, 420Hz VBW and 14kHz span.

6.1.2 EUT Connection Diagram of Test System

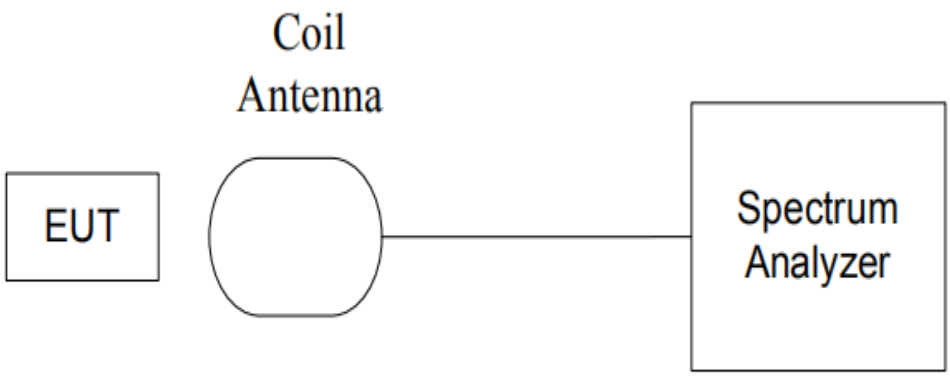


Figure 6.1.2-1 20dB Bandwidth Connection Diagram

6.1.3 Test Condition

The measurement of EUT is carried out under the transmit state of NFC and without modulation.

EUT had been not connected to a travel adapter.

During the measurements, the ambient temperature is in the range of 15~25℃.

6.1.4 Limit/Criterion

The 20dB bandwidth shall be less than 80% of the permitted frequency band. For 13.56MHz NFC, the permitted frequency band is 14kHz, so the limit is 11.2kHz.

6.1.5 Test environmental conditions

Temperature	24℃
Relative Humidity	52%RH
Atmospheric Pressure	101.7kPa

6.1.6 Test Results

Carrier frequency (MHz)	20dB Bandwidth (kHz)	Test Results	Conclusion
13.56	0.628	See Annex A.1-1	Pass

6.2 Frequency Stability

6.2.1 Measurement Methods

The transmitter output single was picked up by coil antenna connected to the frequency counter. The center frequency was measured with 30Hz RBW and 1kHz span.

During the test, the EUT was placed in a thermal chamber until thermal balance and lasting appropriate time.

6.2.2 EUT Connection Diagram of Test System

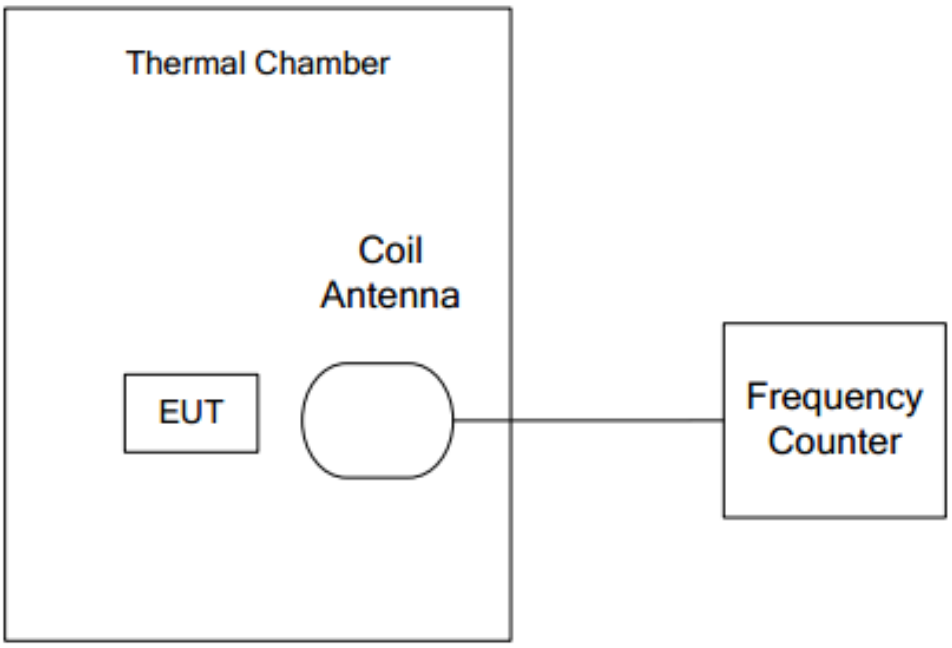


Figure 6.2.2-1 Frequency Stability Connection Diagram

6.2.3 Test Condition

The measurement of EUT is carried out under the transmit state of without modulation , EUT1 had been not connected to a travel adapter.

Operation Temperature: Tmin=3℃, Tnom=25℃, and Tmax=40℃

Operation Voltage: Vmin=2.2V, Vmax=3.3V, and Tnom=3V.

6.2.4 Limit/Criterion

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency.

6.2.5 Test environmental conditions

Temperature	24℃
Relative Humidity	52%RH
Atmospheric Pressure	101.7kPa

6.2.6 Test Results

Temperature	Voltage	Frequency Error（MHz）	Frequency Error（%）
Tmin	Vnom	See Annex A.2-1	
Tmax	Vnom		
Tnom	Vnom		
Tnom	Vmin		
Tnom	Vmax		

6.3 Radiated Emission

6.3.1 Electric Field Strength of Fundamental Emissions

6.3.1.1 Method of Measurement

a. The test set-up was made in accordance to the general provisions of ANSI C63.10-2013.The transmitter carrier output levels (E-Field) from the EUT are measured in a semi-anechoic chamber. The EUT is placed on a non-conductive stand of 80cm high, and at a measurement distance of 3m from the receiving antenna. The center of the receiving antenna is 1 meter above the ground. The E-field is measured with a shielded loop antenna connected to a measurement receiver. Detected E-field was maximized by rotating the EUT through 360° and adjusting the receiving antenna polarizations. Both horizontal and vertical polarizations of the antenna were set during the measurement. The maximization processes were repeated with the EUT positioned respectively in its three orthogonal axes. The measurements were performed with the peak detector and if required, the quasi-peak detector.

b. The measurement bandwidth:

Frequency (MHz)	RBW / VBW
12.56-14.56	10 / 30kHz

6.3.1.2 EUT Connection Diagram of Test System

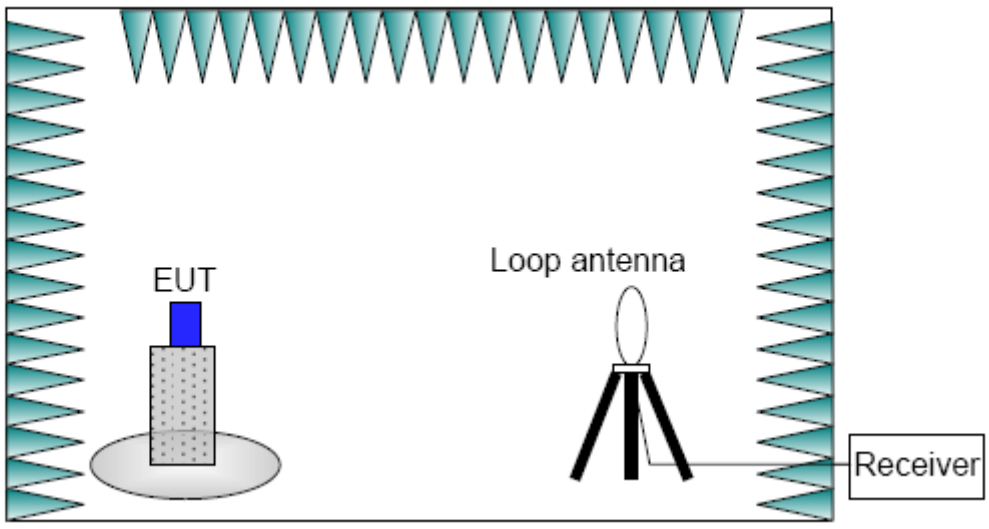


Figure 6.3.1.2-1Electric Field Strength of Fundamental Emissions Connection Diagram

6.3.1.3 Test Condition

Frequency Range (MHz)	RBW/VBW	Sweep Time (s)
12.56-14.56	10kHz/30kHz	AUTO

6.3.1.4 Limit/Criterion

Clause 15.225(a) the field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Clause 15.225(b) within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Clause 15.225(c) within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

Frequency Range (MHz)	E-field Strength Limit @30m (uV/m)	E-field Strength Limit @3m (dBuV/m)
13.560 ± 0.007	+15,848	124
13.410 to 13.553 13.567 to 13.710	+334	90
13.110 to 13.410 13.710 to 14.010	+106	81
Note: Where the limits have been defined at one distance, and a signal level measured at another, the limits have been extrapolated using the following formula: Extrapolation (dB) = 40log10(Measurement Distance / Specification Distance)		

6.3.1.5 Test environmental conditions

Temperature	22.6℃
Relative Humidity	54.9%RH
Atmospheric Pressure	101.3kPa

6.3.1.6 Test Results

Mode	Frequency (MHz)	Test Results	Verdicts
Mode 1: TX Mode	12.56-14.56	See Annex A.3.1-1	Pass

NOTE:

a. Abbreviations used in this clause: Pass—P; Fail—F; Not applicable—N/A

b. The result displayed take into account applicable antenna factors and cable losses.

6.3.2 Electric Field Radiated Emissions (Below 30MHz)

6.3.2.1 Method of Measurement

a. The electric field radiated emissions from the EUT are measured in a semi-anechoic chamber. The EUT is placed on a non-conductive stand of 80cm high, and at a measurement distance of 3m from the receiving antenna. The center of the receiving antenna is 1 meter above the ground. The E-field is measured with a shielded loop antenna connected to a measurement receiver. Detected E-field was maximized by rotating the EUT through 360° and adjusting the receiving antenna polarizations. Both horizontal and vertical polarizations of the antenna were set during the measurement. The maximization processes were repeated with the EUT positioned respectively in its three orthogonal axes. The measurements were performed with the peak detector and if required, the quasi-peak detector.

b. The measurement bandwidth:

Frequency (MHz)	RBW / VBW
0.009-30	10 / 30kHz

6.3.2.2 EUT Connection Diagram of Test System

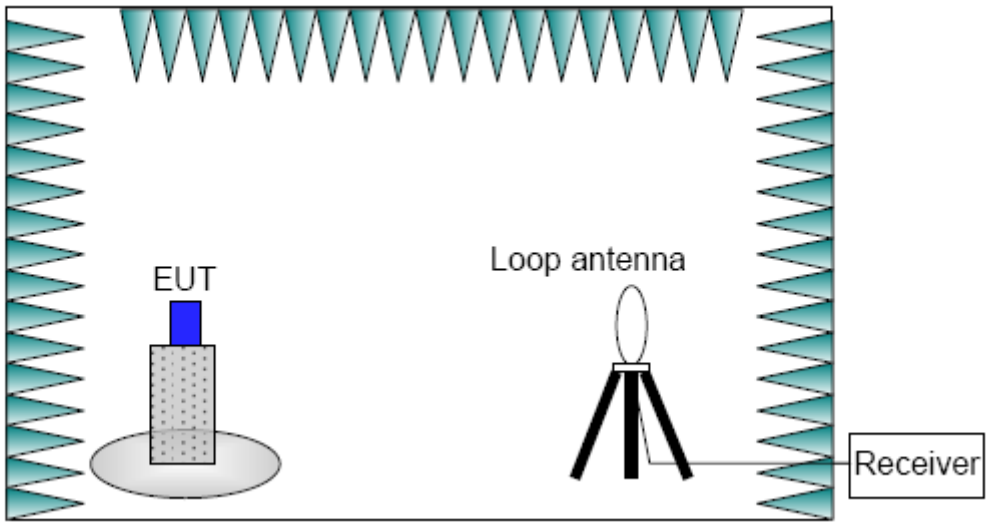


Figure 6.3.2.2-1 Electric Field Radiated Emissions (Below 30MHz) Connection Diagram

6.3.2.3 Test Condition

Frequency Range (MHz)	RBW/VBW	Sweep Time (s)
0.009-30	10kHz/30kHz	AUTO

6.3.2.4 Limit/Criterion

Frequency Range (MHz)	E-field Strength Limit @30m (mV/m)	E-field Strength Limit @3m (dBuV/m)
0.009-0490	2400/F (kHz)	129-94
0.490-1.705	24000/F (kHz)	74-63
1.705-30	30	70
Note: Where the limits have been defined at one distance, and a signal level measured at another, the limits have been extrapolated using the following formula: Extrapolation (dB) = 40log10(Measurement Distance / Specification Distance) dBuA/m=dBuV/m / 120π		

6.3.2.5 Test environmental conditions

Temperature	22.6℃
Relative Humidity	54.9%RH
Atmospheric Pressure	101.3kPa

6.3.2.6 Test Results

Mode	Frequency (MHz)	Test Results	Verdicts
Mode 1: TX Mode	0.009-30	See Annex A.3.2-1	Pass
NOTE: a. Abbreviations used in this clause: Pass—P; Fail—F; Not applicable—N/A b. The result displayed take into account applicable antenna factors and cable losses c. dBuV/m and dBuA/m can be converted to each other, so the test data of dBuV/m are reflected in the report			

6.3.3 Electric Field Radiated Emissions (Above 30MHz)

6.3.3.1 Method of Measurement

a. The electric field radiated emissions from the EUT are measured in a semi-anechoic chamber. The EUT is placed on a non-conductive stand of 80cm high, and at a measurement distance of 3m from the receiving antenna. The center of the receiving antenna is 1 meter above the ground. The E-field is measured with a shielded loop antenna connected to a measurement receiver. Detected E-field was maximized by rotating the EUT through 360° and adjusting the receiving antenna polarizations. Both horizontal and vertical polarizations of the antenna were set during the measurement. The maximization processes were repeated with the EUT positioned respectively in its three orthogonal axes. The measurements were performed with the peak detector and if required, the quasi-peak detector.

b. The measurement bandwidth:

Frequency (MHz)	RBW / VBW
30-1000	120 kHz / 300kHz

6.3.3.2 EUT Connection Diagram of Test System

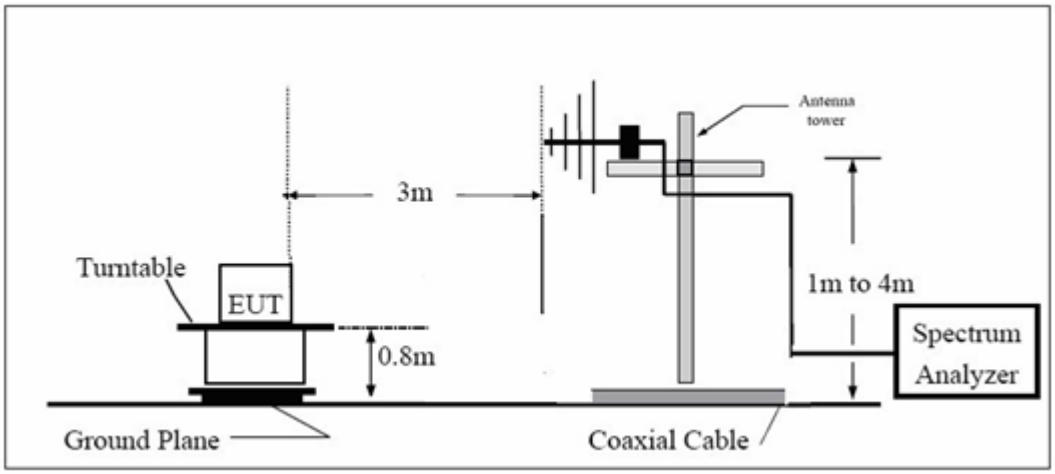


Figure 6.3.3.2-1 Electric Field Radiated Emissions (Above 30MHz) Connection Diagram

6.3.3.3 Test Condition

Frequency Range (MHz)	RBW/VBW	Sweep Time (s)
30-1000	120kHz/300kHz	AUTO

6.3.3.4 Limit/Criterion

Frequency Range (MHz)	Quasi-Peak (dBμV/m)	Peak (dBμV/m)	Average (dBμV/m)
30-88	40	N/A	N/A
88-216	43.5	N/A	N/A
216-960	46	N/A	N/A
Above 960	54	N/A	N/A
Above 1000	N/A	74	54

6.3.3.5 Test environmental conditions

Temperature	22.6℃
Relative Humidity	54.9%RH
Atmospheric Pressure	101.3kPa

6.3.3.6 Test Results

Mode	Frequency (MHz)	Test Results	Verdicts
Mode 1: TX Mode	30-1000	See Annex A.3.3-1	Pass

NOTE:

a. Abbreviations used in this clause: Pass—P; Fail—F; Not applicable—N/A

b. The result displayed take into account applicable antenna factors and cable losses

c. QP detection is used in radiated emissions test, and the Duty Cycle of NFC main frequency signal is 100%.

6.4 Occupied bandwidth

6.4.1 Reference

See Clause 6.7 of RSS-Gen.

6.4.2 Measurement Methods

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

The following conditions shall be observed for measuring the occupied bandwidth:

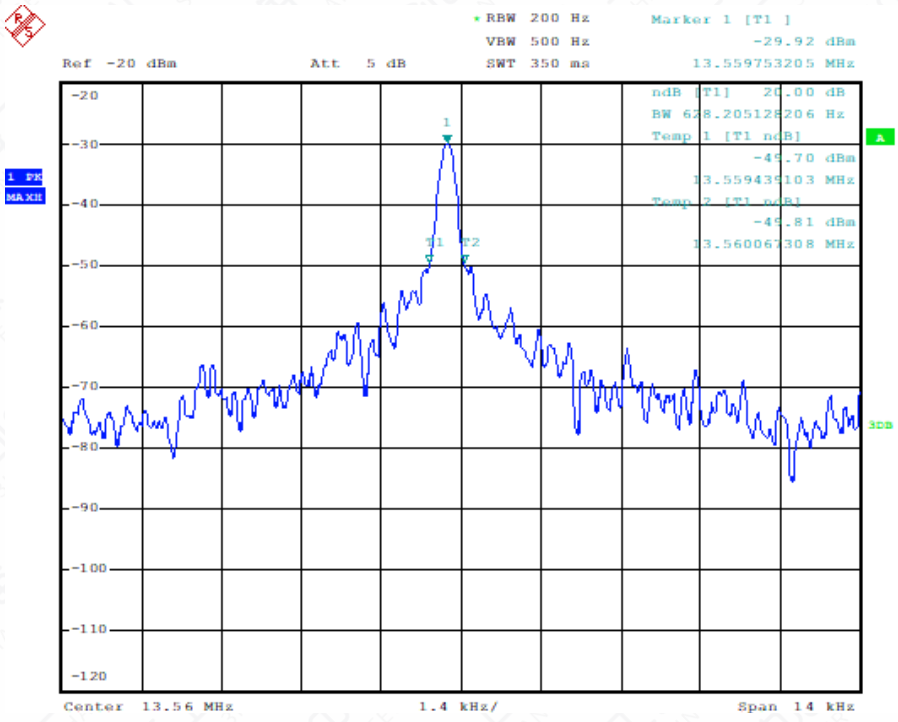
- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

6.4.3 Measurement Results

See Annex A.4-1

Annex A: Measurement Data



A.1-1 Mode 1 20dB Bandwidth

Temperature	Voltage	Frequency Error (MHz)			
		Startup	2Min Later	5Min Later	10Min Later
Tmin	Vnom	13.559752	13.559766	13.559747	13.559782
Tmax	Vnom	13.559737	13.559759	13.559738	13.559759
Tnom	Vnom	13.559743	13.559739	13.559742	13.559763
Tnom	Vmin	13.559745	13.559772	13.559771	13.559787
Tnom	Vmax	13.559757	13.559728	13.559752	13.559781
Temperature	Voltage	Frequency Error (%)			
Tmin	Vnom	-0.002	-0.002	-0.002	-0.002
Tmax	Vnom	-0.002	-0.002	-0.002	-0.002
Tnom	Vnom	-0.002	-0.002	-0.002	-0.002
Tnom	Vmin	-0.002	-0.002	-0.002	-0.002
Tnom	Vmax	-0.002	-0.002	-0.002	-0.002

A.2-1 Mode 1 Frequency Stability

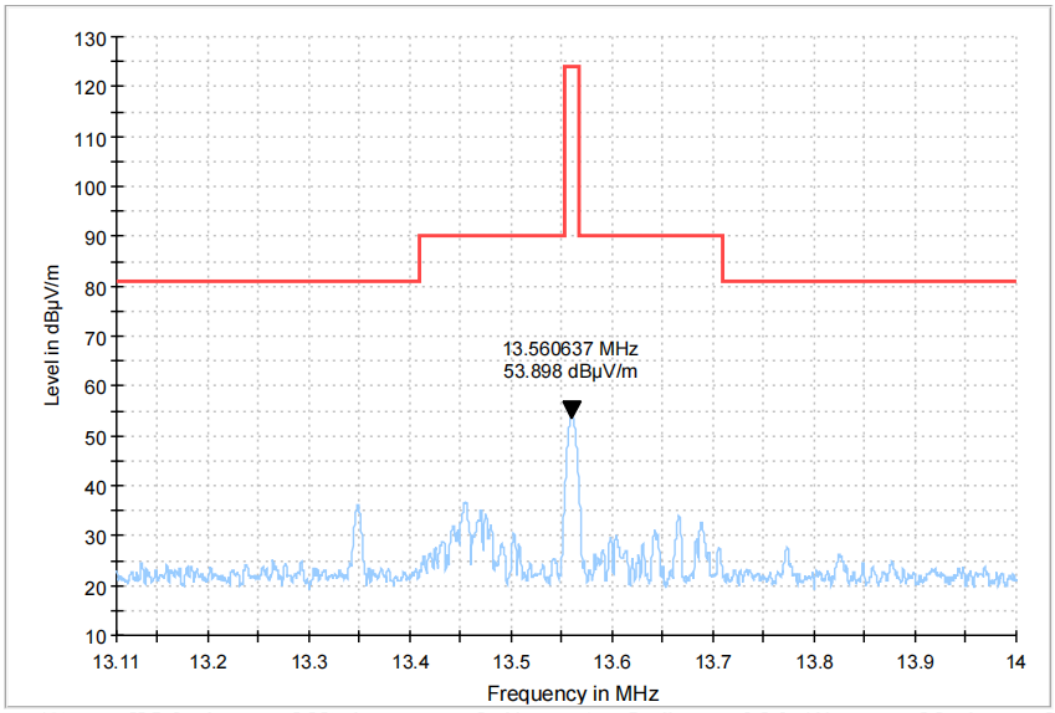


Figure A.3-1-1 Mode 1 Electric Field Strength of Fundamental Emissions

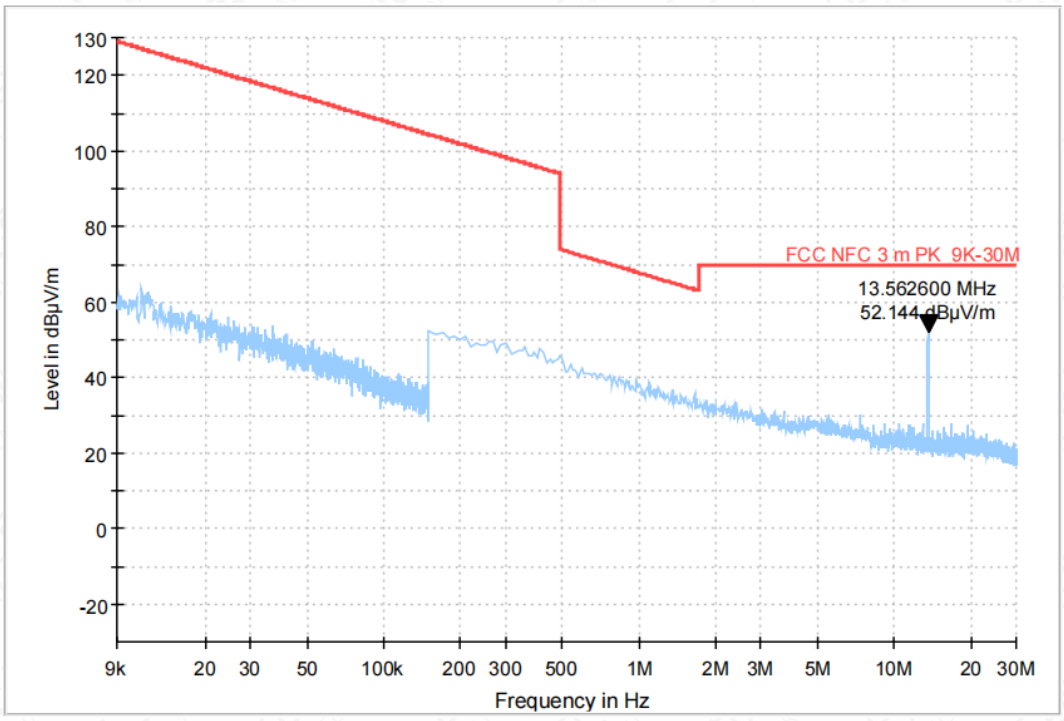


Figure A.3-2-1 Mode 1Electric Field Radiated Emissions (Below 30MHz)

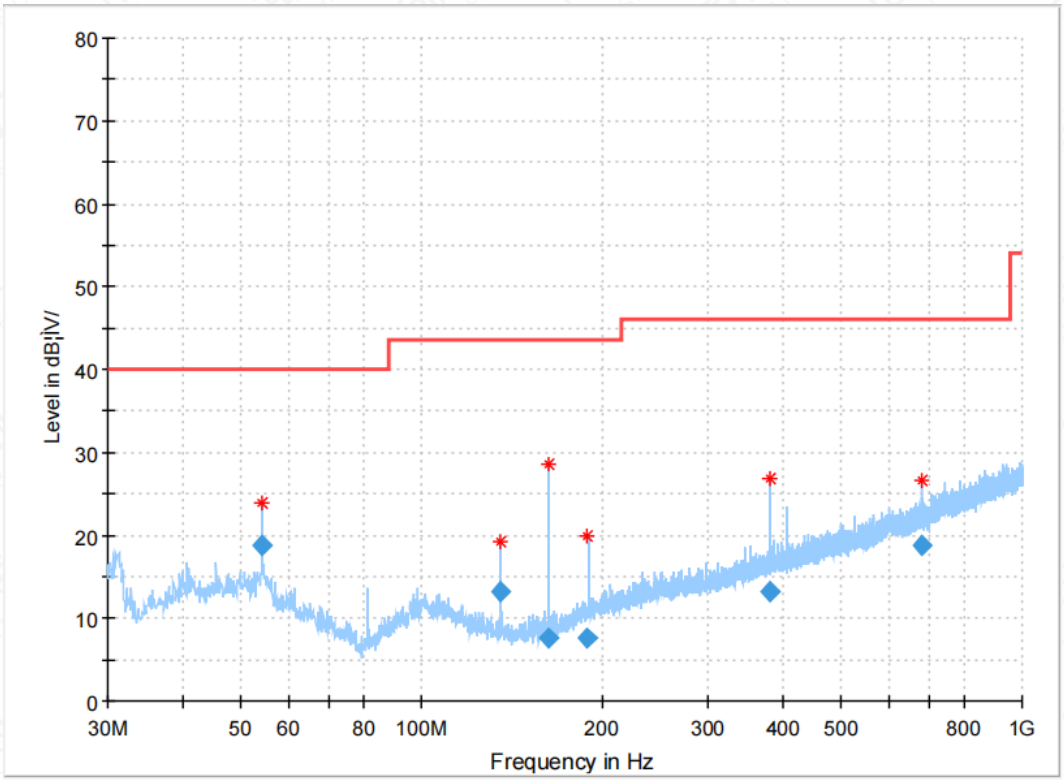


Figure A.3-3-1 Mode 1 Electric Field Radiated Emissions (Above 30MHz)

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
54.222880	18.88	40.00	21.12	100.0	V	148.0	-12.1
135.608600	13.25	43.50	30.25	100.0	V	148.0	-16.3
162.626640	7.62	43.50	35.88	200.0	H	0.0	-15.7
189.223680	7.49	43.50	36.01	200.0	H	356.0	-13.4
379.213400	13.08	46.00	32.92	100.0	H	182.0	-7.7
679.636640	18.71	46.00	27.29	100.0	V	9.0	-2.2

Center Freq. (MHz)	Threshold Level	f_L(MHz)	$f_{H(}$MHz)
13.56062	99% OBW	13.56056	13.56066

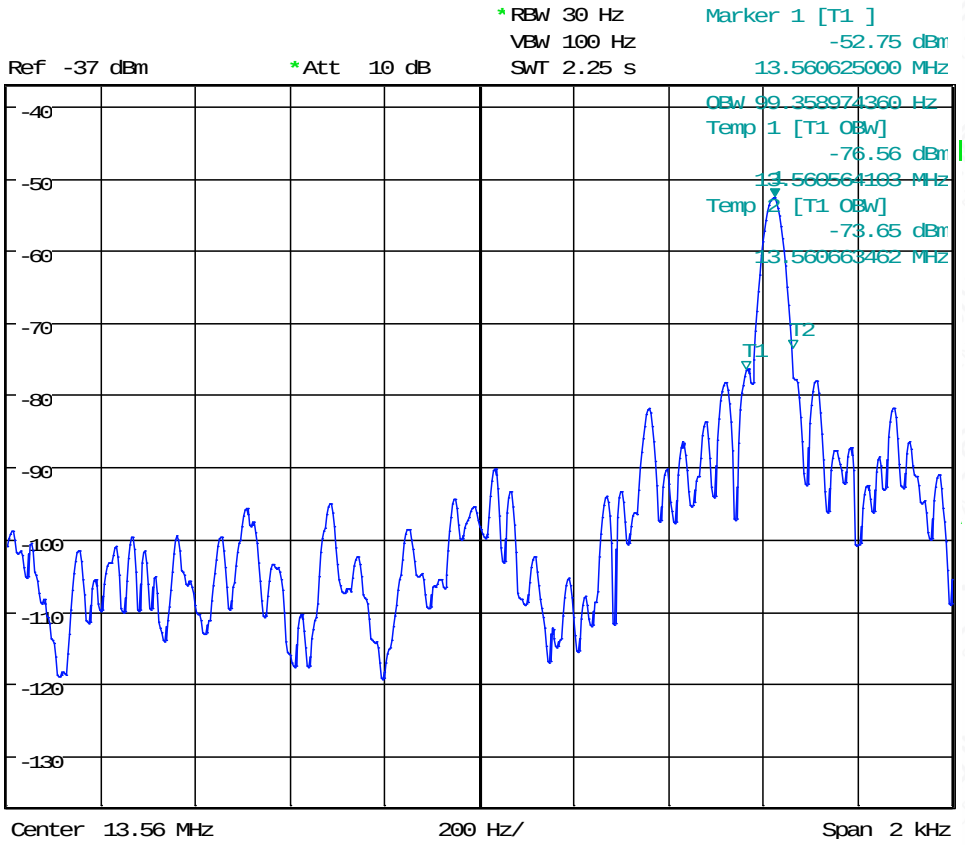


Figure A.4-1 Mode 1 Occupied bandwidth

Annex B: Revised History

Version	Revised Content
V00	Initial

Annex C: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

INDUSTRIAL INTERNET INNOVATION CENTER (SHANGHAI) CO., LTD.

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 12th day of April 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2023

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.