



Test Report No.: FCC2024-0029-RF

TEST REPORT

FCC ID	:	WiDAR Sensor
Applicant	:	NSB500
Product Name	:	NAMI.AI PTE. LTD.
Model No.	:	Commission Test
Classification Of Test:		COMMISSION TEST

CVC Testing Technology Co., Ltd.

Applicant		Name : NAMI.AI PTE. LTD.	
		Address : #03-01, 25 Duxton Hill Singapore 089608 Singapore	
Manufacturer		Name : NAMI.AI PTE. LTD.	
		Address : #03-01, 25 Duxton Hill Singapore 089608 Singapore	
Production plant		Name : Vexos Dongguan Industrial Company Limited	
		Address : 5th floor of Building 8 of Dongjian Intelligent Industrial Park, No. 2 Qianmei Road, Dongkeng Town. Dongguan City. China	
Equipment Under Test		Name : WiDAR Sensor	
		Model/Type : NSB500	
		Trade mark : nami	
		Serial no. : —	
		Sampling : 1-1	
Date of Receipt.	2024.6.18	Date of Testing	2024.8.8
Test Specification		Test Result	
FCC CFR47 Part 15C Radio Frequency Devices ANSI C63.10-2020/Cor1-2023 KDB 558074 D01 15.247 Meas Guidance v05r02		PASS	
Evaluation of Test Result		The equipment under test was found to comply with the requirements of the standards applied.	
		Seal of CVC Issue Date: 2024.10.14	
Approved by: Chen Huawen 	Reviewed by: Xu Zhenfei 	Tested by: Lu Weiji 	
Other Aspects: NONE.			
Abbreviations:OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested			
Note: This test report relates only to the EUT, and shall not be reproduced except in full, without written approval of CVC .			

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1. General Product Information

1.1 General information

Product Name	WiDAR Sensor	
Model No.	NSB500	
Additional model	/	
Power Supply	Rated voltage	DC 5.0V
	Battery voltage	/
Serial Number(SN)	NSB5000001	
Hardware	v2.6	
Software	v2.1	
Bluetooth Version	5.0	
Specific power settings	ESP32-S3	Bluetooth(LE_1M/LE_2M): 10 IEEE 802.11b: 60 IEEE 802.11g: 52 IEEE 802.11n(20MHz/40MHz): 52
	ESP32-C3	IEEE 802.11b: 60 IEEE 802.11g: 60 IEEE 802.11n(20MHz/40MHz): 60
Antenna Type	Internal antenna	
Antenna Gain	ESP32-S3	WiFi: 2.6 dBi (provided by client) Bluetooth: 2.6 dBi (provided by client)
	ESP32-C3	WiFi: 2.6 dBi (provided by client)
Beamforming gain	Unsupported (provided by client)	
Frequency Range	Bluetooth(LE_1M/LE_2M): 2402~2480MHz IEEE 802.11b/g/n(20MHz): 2412~2462MHz IEEE 802.11n(40MHz): 2422~2452MHz	
Channel Number	Bluetooth(LE_1M/LE_2M):40 Channels IEEE 802.11b/g/n(20MHz): 11 Channels IEEE 802.11n(40MHz): 9 Channels	
Type of Modulation	Bluetooth(LE_1M/LE_2M):GFSK IEEE 802.11b: DSSS (CCK,DQPSK,DBPSK); IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK); IEEE 802.11n(HT20/HT40) : OFDM (64QAM, 16QAM,QPSK,BPSK);	
Max. Conducted Power	ESP32-S3	Bluetooth: 5.24 dBm WiFi2.4G:13.33dBm
	ESP32-C3	WiFi2.4G:12.54dBm
Operate Temp.Range	0~+40°C	

Note:

1. The information of the EUT is declared by the manufacturer.
2. The laboratory is not responsible for the product technical specification provided by the client.
3. The WiDAR sensor has three built-in modules: ESP32-S3, ESP32-C3, ESP32-H2-MINI-1. This report only tested the ESP32-S3 and ESP32-C3 modules. The module with model number ESP32-H2-MINI-1 has been certified, Report No: EP342705A. All the RF modules are active intermittently, not at the same time.

2. Test Sites

2.1 Test Facilities

The tests and measurements refer to this report were performed by RF testing Lab. of CVC Testing Technology Co., Ltd.

Add.: No.3, Tiantaiyi Road, Kaitai Avenue, Science City, Guangzhou,Guangdong,510663, People's Republic of China

Telephone : +86-20-32293888

Fax : +86-20-32293889

FCC(Test firm designation number: CN1282)

IC(Test firm CAB identifier number: CN0103)

2.2 Description of Non-standard Method and Deviations

The testing and measurement methods used in this report are applied by all standard methods. Not any non-standard method or deviation from the used standards was used.

2.3 List of Test and Measurement Instruments

Refer to **Appendix X**.

3. Test Configuration

3.1 Test Mode

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

Test Mode	Antenna Delivery	Test Channel
Bluetooth(LE_1M)	1TX / 1RX	0,19,39
Bluetooth(LE_2M)	1TX / 1RX	0,19,39
IEEE 802.11b	1TX / 1RX	1,6,11
IEEE 802.11g	1TX / 1RX	1,6,11
IEEE 802.11n 20 SISO	1TX / 1RX	1,6,11
IEEE 802.11n 40 SISO	1TX / 1RX	3,6,9

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

In order to find the worst case condition, Pre-tests are needed at the presence of different data rate and different channels. Preliminary tests have been done on all the configurations for confirming worst case. Data rate below means worst-case rate of each test item.

Worst-case data rates and channels are shown as following table.

ESP32-S3 Test Mode	Data Rate		
	Antenna 1	Antenna 2	MIMO
Bluetooth(LE_1M)	1	/	/
Bluetooth(LE_2M)	1	/	/
IEEE 802.11b	1	/	/
IEEE 802.11g	6	/	/
IEEE 802.11n 2.4GHz 20MHz	MCS 0	/	/
IEEE 802.11n 2.4GHz 40MHz	MCS 0	/	/

ESP32-C3 Test Mode	Data Rate		
	Antenna 1	Antenna 2	MIMO
IEEE 802.11b	1	/	/
IEEE 802.11g	6	/	/
IEEE 802.11n 2.4GHz 20MHz	MCS 0	/	/
IEEE 802.11n 2.4GHz 40MHz	MCS 0	/	/

Test Items	Test Antennas	Test Modes	Test Channels
Conducted Emissions	Antenna 1	IEEE 802.11n 40 Bluetooth(LE_2M)	3/ 0
Radiated Emissions	Antenna 1	IEEE 802.11n 40 Bluetooth(LE_2M)	3,6,9/ 0,19,39
Radiated Emissions (Band Edge)	Antenna 1	IEEE 802.11n 40 Bluetooth(LE_2M)	3,9/ 0,39
Maximum conducted output power	Antenna 1	IEEE 802.11b/ IEEE 802.11g/ IEEE 802.11n 20/ IEEE 802.11n 40/ Bluetooth(LE_1M) Bluetooth(LE_2M)	1,6,11/ 1,6,11/ 1,6,11/ 3,6,9/ 0,19,39 0,19,39
Minimum 6 dB bandwidth	Antenna 1	IEEE 802.11b/ IEEE 802.11g/ IEEE 802.11n 20/ IEEE 802.11n 40/ Bluetooth(LE_1M) Bluetooth(LE_2M)	1,6,11/ 1,6,11/ 1,6,11/ 3,6,9/ 0,19,39 0,19,39
Occupied Channel Bandwidth	Antenna 1	IEEE 802.11b/ IEEE 802.11g/ IEEE 802.11n 20/ IEEE 802.11n 40/ Bluetooth(LE_1M) Bluetooth(LE_2M)	1,6,11/ 1,6,11/ 1,6,11/ 3,6,9/ 0,19,39 0,19,39
Band Edge Measurement	Antenna 1	IEEE 802.11b/ IEEE 802.11g/ IEEE 802.11n 20/ IEEE 802.11n 40/ Bluetooth(LE_1M) Bluetooth(LE_2M)	1,6,11/ 1,6,11/ 1,6,11/ 3,6,9/ 0,19,39 0,19,39
Maximum Power spectral density	Antenna 1	IEEE 802.11b/ IEEE 802.11g/ IEEE 802.11n 20/ IEEE 802.11n 40/ Bluetooth(LE_1M) Bluetooth(LE_2M)	1,6,11/ 1,6,11/ 1,6,11/ 3,6,9/ 0,19,39 0,19,39
Spurious RF Conducted Emissions	Antenna 1	IEEE 802.11b/ IEEE 802.11g/ IEEE 802.11n 20/ IEEE 802.11n 40/ Bluetooth(LE_1M) Bluetooth(LE_2M)	1,6,11/ 1,6,11/ 1,6,11/ 3,6,9/ 0,19,39 0,19,39

3.2 Duty cycle

ESP32-S3:

TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Limit	Verdict
11B	Ant1	2412	12.00	12.00	100.00	---	---
		2437	12.00	12.00	100.00	---	---
		2462	7.00	7.00	100.00	---	---
11G	Ant1	2412	5.49	5.52	99.46	---	---
		2437	5.49	5.51	99.64	---	---
		2462	5.49	5.52	99.46	---	---
11N20SISO	Ant1	2412	5.08	5.10	99.61	---	---
		2437	5.08	5.10	99.61	---	---
		2462	5.08	5.10	99.61	---	---
11N40SISO	Ant1	2422	2.46	2.49	98.80	---	---
		2437	2.46	2.49	98.80	---	---
		2452	2.46	2.49	98.80	---	---
BLE_1M	Ant1	2402	20.00	20.00	100.00	---	---
		2440	20.00	20.00	100.00	---	---
		2480	20.00	20.00	100.00	---	---
BLE_2M	Ant1	2402	20.00	20.00	100.00	---	---
		2440	20.00	20.00	100.00	---	---
		2480	20.00	20.00	100.00	---	---

ESP32-C3:

TestMode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]	Limit	Verdict
11B	Ant1	2412	7.00	7.00	100.00	---	---
		2437	17.00	17.00	100.00	---	---
		2462	12.00	12.00	100.00	---	---
11G	Ant1	2412	5.48	5.51	99.46	---	---
		2437	5.49	5.51	99.64	---	---
		2462	5.48	5.51	99.46	---	---
11N20SISO	Ant1	2412	5.08	5.10	99.61	---	---
		2437	5.08	5.10	99.61	---	---
		2462	5.08	5.11	99.41	---	---
11N40SISO	Ant1	2422	2.47	2.49	99.20	---	---
		2437	2.46	2.49	98.80	---	---
		2452	2.47	2.49	99.20	---	---

4. Summary of measurement results

Summary of measurements of results	Clause in FCC rules	Verdict	Note
Conducted Emissions	15.207	PASS	/
Radiated Emissions	15.247(d),15.205,15.209	PASS	/
Maximum conducted output power	15.247(b)(3)	PASS	Appendix C of WIFI2.4G_diagram_S3_1, Appendix C of WIFI2.4G_diagram_C3_1 and Appendix C of BLE_diagram_1
Minimum 6 dB bandwidth	15.247(a)(2)	PASS	Appendix A of WIFI2.4G_diagram_S3_1, Appendix A of WIFI2.4G_diagram_C3_1 and Appendix A of BLE_diagram_1
Occupied Channel Bandwidth	15.247(a)(2)	PASS	Appendix B of WIFI2.4G_diagram_S3_1, Appendix B of WIFI2.4G_diagram_C3_1 and Appendix B of BLE_diagram_1
Band Edge Measurement	15.247(d)	PASS	Appendix E of WIFI2.4G_diagram_S3_2, Appendix E of WIFI2.4G_diagram_C3_2 and Appendix E of BLE_diagram_2
Maximum Power spectral density	15.247(e)	PASS	Appendix D of WIFI2.4G_diagram_S3_2, Appendix D of WIFI2.4G_diagram_C3_2 and Appendix D of BLE_diagram_1
Spurious RF Conducted Emissions	15.247(d)	PASS	Appendix F of WIFI2.4G_diagram_S3_3, Appendix F of WIFI2.4G_diagram_C3_3 and Appendix F of BLE_diagram_2
Antenna Requirement	15.203	PASS	See note 1

Note 1: According to 15.203, it is considered sufficient to comply with the provisions of this section.

5. Measurement procedure

5.1 Conducted Emission

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

The EUT was setup according to ANSI C63.10-2020/Cor1-2023 for compliance to FCC 47CFR 15.247 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

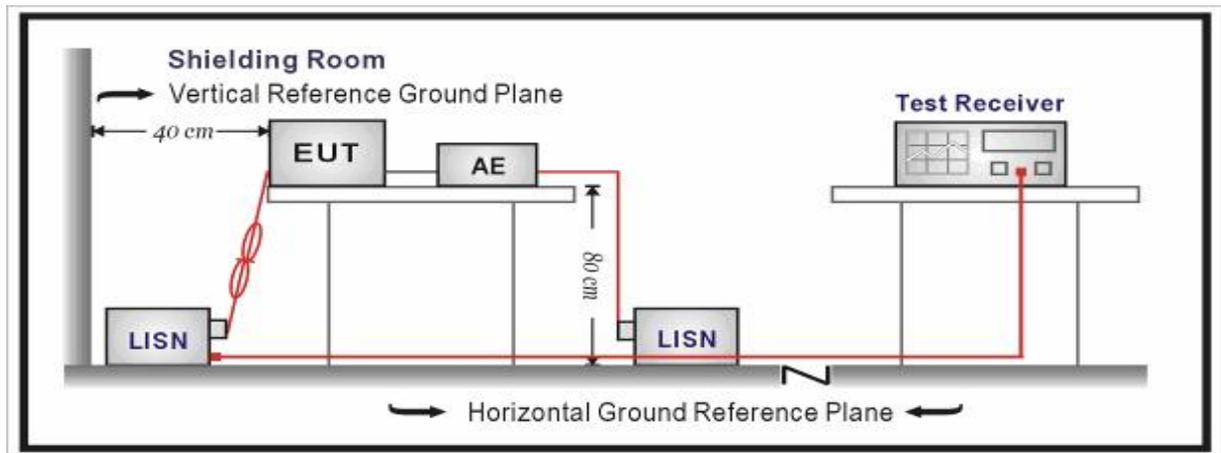
Limits:

Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Test Setup:



Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Level = Reading + Factor.

Measurement Uncertainty:

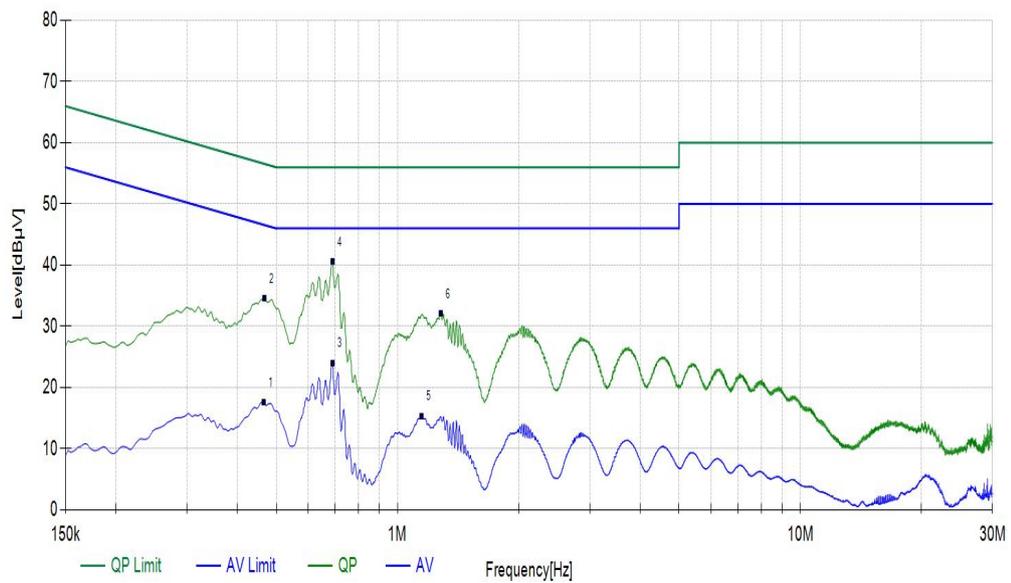
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$. $U = 3.12$ dB.

Test Results:

During the test, the Conducted Emission from 150kHz to 30MHz was performed in all modes with all channels, and all antennas. WIFI2.4G, 11N40, Channel 1, Antenna 1, ESP32-S3 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

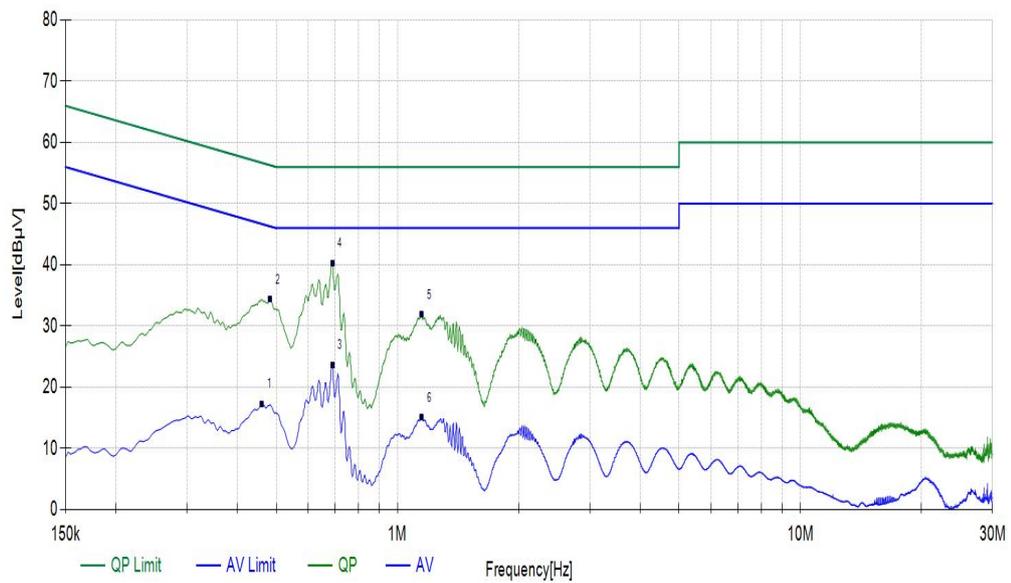
Power Line	L
Test channel	Worst-Case

NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/Fail
1	1.2795	10.36	21.66	32.02	56.00	23.98	QP	PASS
3	0.4673	10.32	24.24	34.56	56.56	22.00	QP	PASS
5	0.6900	10.34	30.22	40.56	56.00	15.44	QP	PASS
2	0.6900	10.34	13.63	23.97	46.00	22.03	AV	PASS
4	1.1468	10.36	4.95	15.31	46.00	30.69	AV	PASS
6	0.4650	10.32	7.22	17.54	46.60	29.06	AV	PASS



Power Line	N
Test channel	Worst-Case

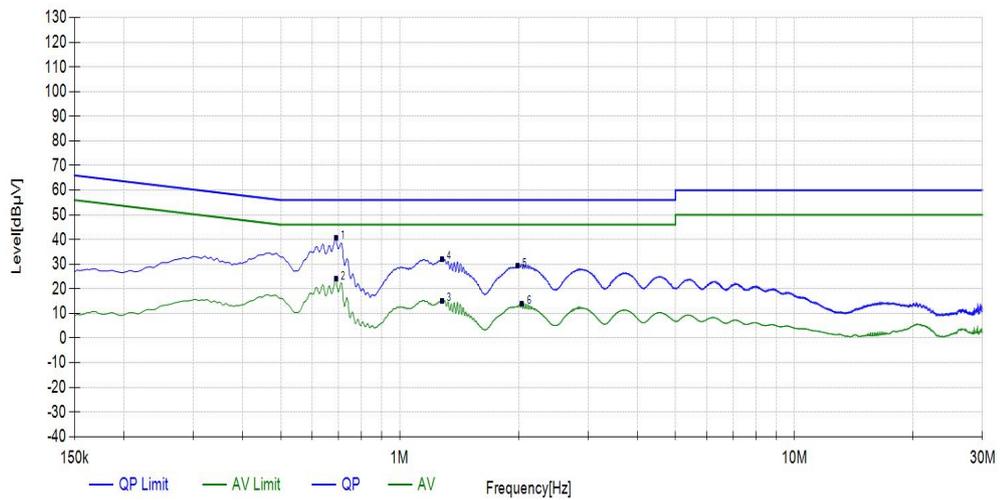
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/Fail
1	0.4830	10.31	24.03	34.34	56.29	21.95	QP	PASS
3	0.6900	10.33	29.95	40.28	56.00	15.72	QP	PASS
5	1.1490	10.35	21.52	31.87	56.00	24.13	QP	PASS
2	0.6900	10.33	13.32	23.65	46.00	22.35	AV	PASS
4	1.1490	10.35	4.67	15.02	46.00	30.98	AV	PASS
6	0.4605	10.31	6.93	17.24	46.68	29.44	AV	PASS



During the test, the Conducted Emission from 150kHz to 30MHz was performed in all modes with all channels, and all antennas. Bluetooth(LE_2M), Channel 0, Antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

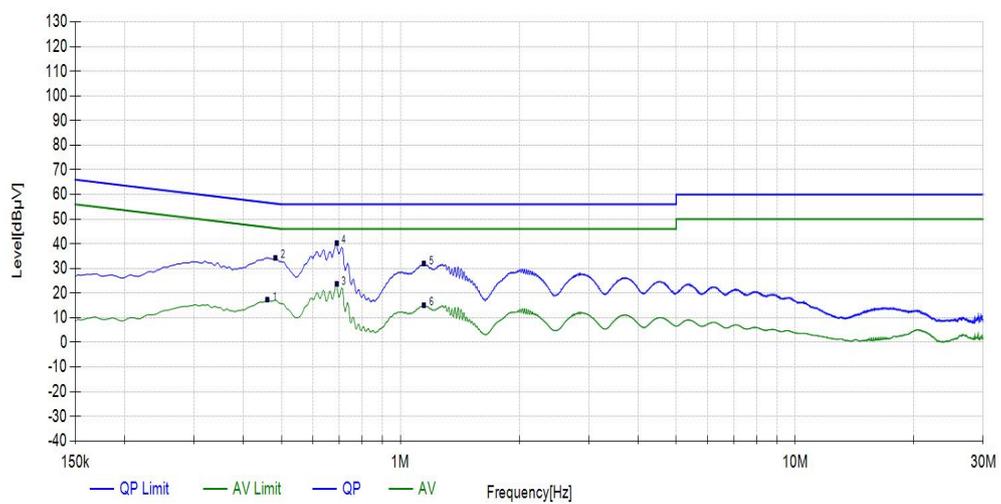
Power Line	L
Test channel	Worst-Case

NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/Fail
1	0.6900	10.34	30.22	40.56	56.00	15.44	QP	PASS
3	0.6900	10.34	13.63	23.97	46.00	22.03	QP	PASS
5	1.2795	10.36	4.84	15.20	46.00	30.80	QP	PASS
2	1.2795	10.36	21.66	32.02	56.00	23.98	AV	PASS
4	1.9905	10.39	18.79	29.18	56.00	26.82	AV	PASS
6	2.0423	10.39	3.64	14.03	46.00	31.97	AV	PASS



Power Line	N
Test channel	Worst-Case

NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV]	Level [dBμV]	Limit [dBμV]	Margin [dB]	Detector	Pass/Fail
1	0.4605	10.31	6.93	17.24	46.68	29.44	QP	PASS
3	0.4830	10.31	24.03	34.34	56.29	21.95	QP	PASS
5	0.6900	10.33	13.32	23.65	46.00	22.35	QP	PASS
2	0.6900	10.33	29.95	40.28	56.00	15.72	AV	PASS
4	1.1490	10.35	21.52	31.87	56.00	24.13	AV	PASS
6	1.1490	10.35	4.67	15.02	46.00	30.98	AV	PASS



5.2 Radiated Emission

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

The EUT was setup and tested according to ANSI C63.10-2020/Cor1-2023.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from Antenna to the EUT was 3 meters.

The Antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the Antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2020/Cor1-2023 on radiated measurement. The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn Antenna will be bended down a little (as horn Antenna has the narrow beamwidth) in order to keeping the Antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 10~60 degrees for H-plane and 10~90 degrees for E-plane.

Limits:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

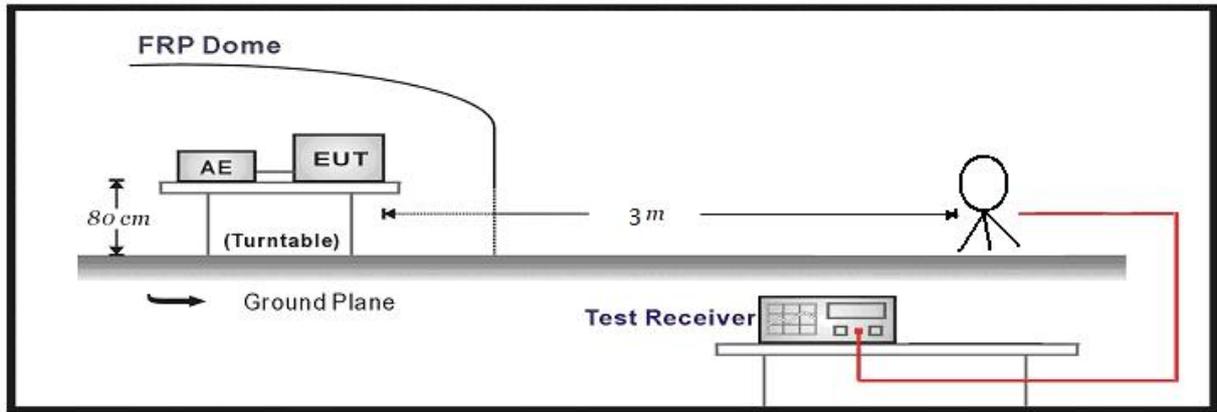
Frequency	Limit (µV/m)	Limit (dBµV/m @3m)	Remark
0.009MHz-0.490MHz	2400/F(kHz)@300m	20lg(2400000/F(kHz))	Quasi-peak Level
0.490MHz~1.705MHz	24000/F(kHz)@30m	20lg(2400000/F(kHz))	Quasi-peak Level
1.705MHz~30.0MHz	30@30m	69.54	Quasi-peak Level
30MHz-88MHz	100@3m	40.0	Quasi-peak Level
88MHz-216MHz	150@3m	43.5	Quasi-peak Level
216MHz-960MHz	200@3m	46.0	Quasi-peak Level
960MHz-1GHz	500@3m	54.0	Quasi-peak Level
Above 1GHz	500@3m	54.0	Average Level
	5000@3m	74.0	Peak Level

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

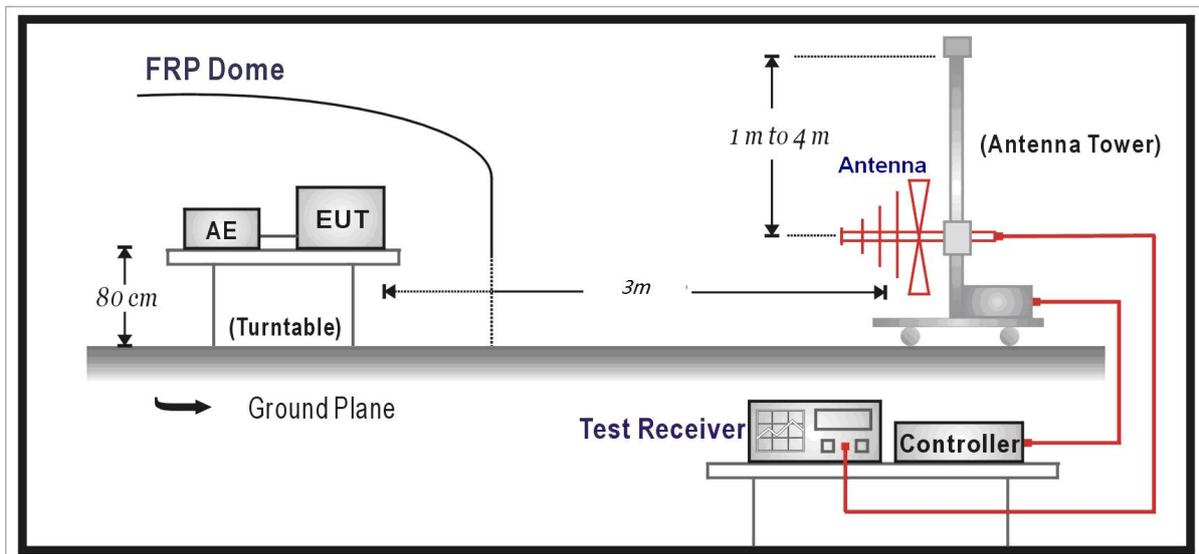
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	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	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	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.
12.57675-12.57725	322-335.4	3600-4400	/
13.36-13.41	/	/	/

Test Setup:

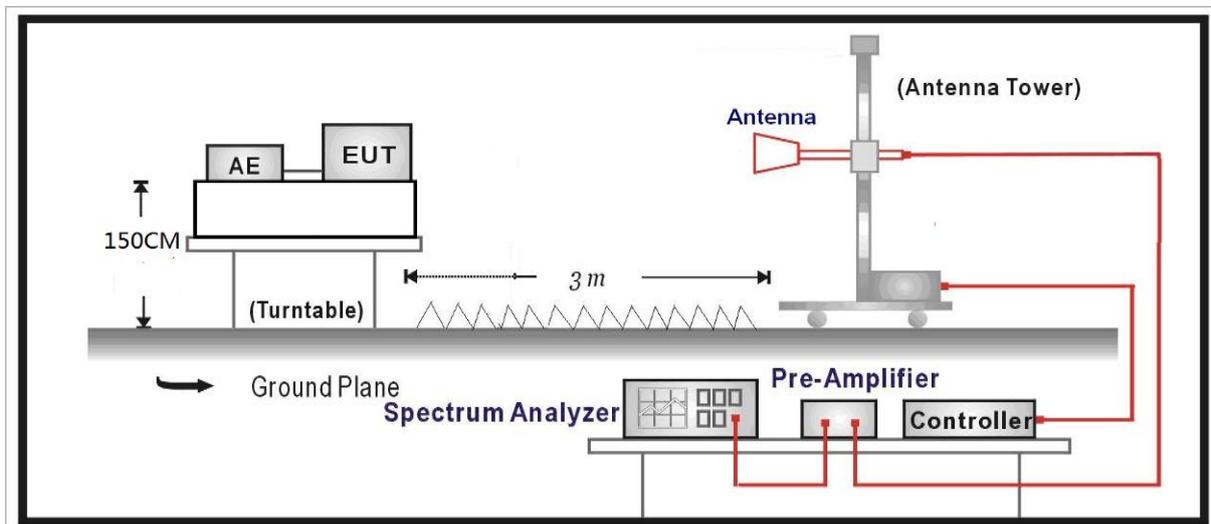
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



Measurement Data:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Level = Reading - Factor

Factor = Preamplifier Factor – Antenna Factor–Cable Loss

Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.19 dB
200MHz-1GHz	3.63 dB
Above 1GHz	3.68 dB

Test Results:

SPURIOUS EMISSIONS:

WIFI:

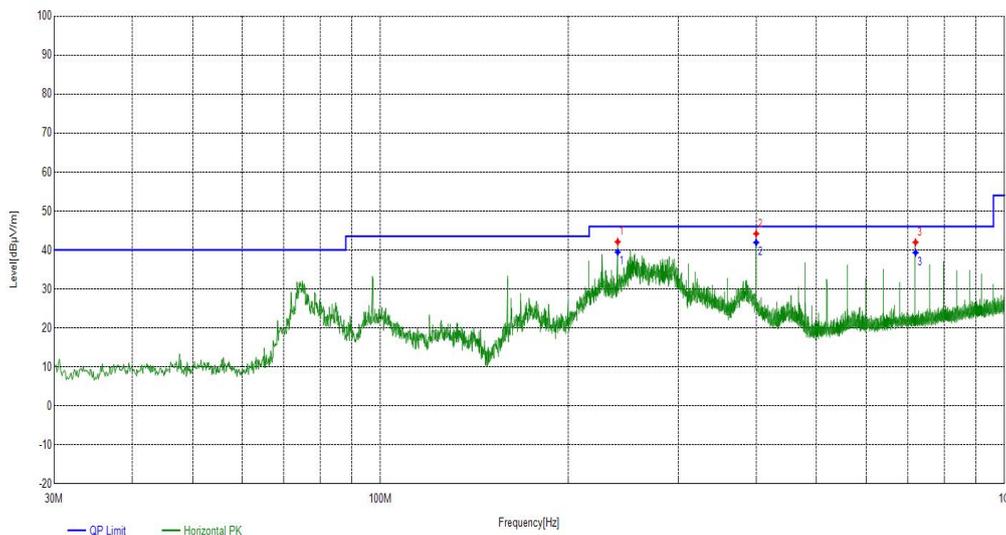
During the test, the Radiates Emission from 9kHz to 1GHz was performed in WIFI all modes with all channels and all antennas. 802.11n40, Channel 1, Ant1, ESP32-S3 and ESP32-C3 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

ESP32-S3:

Radiates Emission		9k~1G								
Test channel		Worst-Case								
Suspected List										
Frequency [MHz]	Polarity	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
239.929	Horizontal	13.97	28.12	42.09	46.00	3.91	PK	100	69	PASS
399.995	Horizontal	17.89	26.27	44.16	46.00	1.84	PK	100	0	PASS
720.03	Horizontal	23.49	18.48	41.97	46.00	4.03	PK	100	182	PASS

Note: 9kHz~30MHz have been test and test data more than 20dB margin.

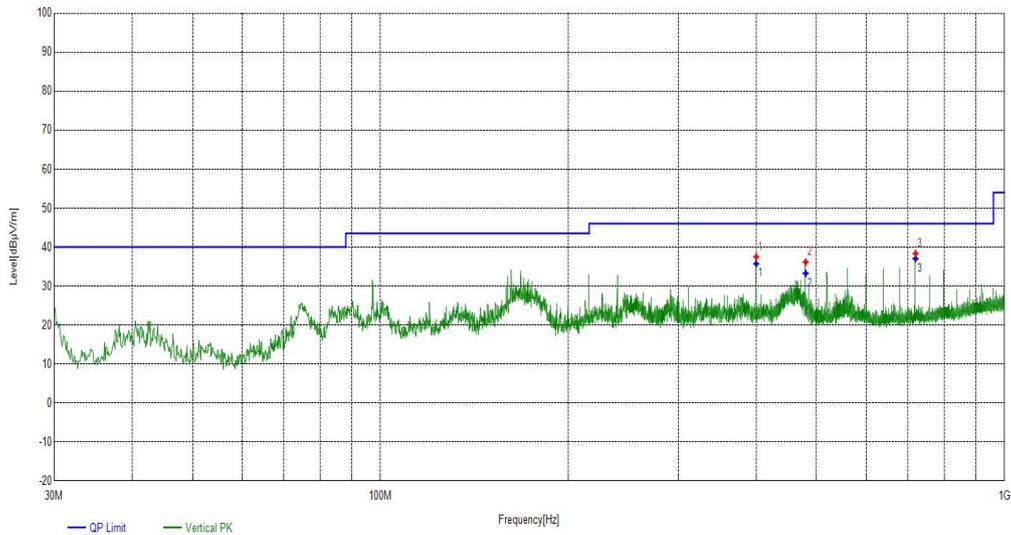
Final Data List									
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail	
239.929	Horizontal	13.97	39.46	46.00	6.54	250	69	PASS	
399.995	Horizontal	17.89	41.92	46.00	4.08	180	0	PASS	
720.03	Horizontal	23.49	39.32	46.00	6.68	100	182	PASS	



Radiates Emission		9k~1G								
Test channel		Worst-Case								
Suspected List										
Frequency [MHz]	Polarity	Factor [dB]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
399.995	Vertical	17.89	19.61	37.50	46.00	8.50	PK	100	159	PASS
480.028	Vertical	19.34	16.80	36.14	46.00	9.86	PK	100	159	PASS
720.03	Vertical	23.49	14.84	38.33	46.00	7.67	PK	100	178	PASS

Note: 9kHz~30MHz have been test and test data more than 20dB margin.

Final Data List									
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dB μ V/m]	QP Limit [dB μ V/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail	
399.995	Vertical	17.89	35.73	46.00	10.27	140	159	PASS	
480.028	Vertical	19.34	33.26	46.00	12.74	260	159	PASS	
720.03	Vertical	23.49	37.04	46.00	8.96	180	178	PASS	

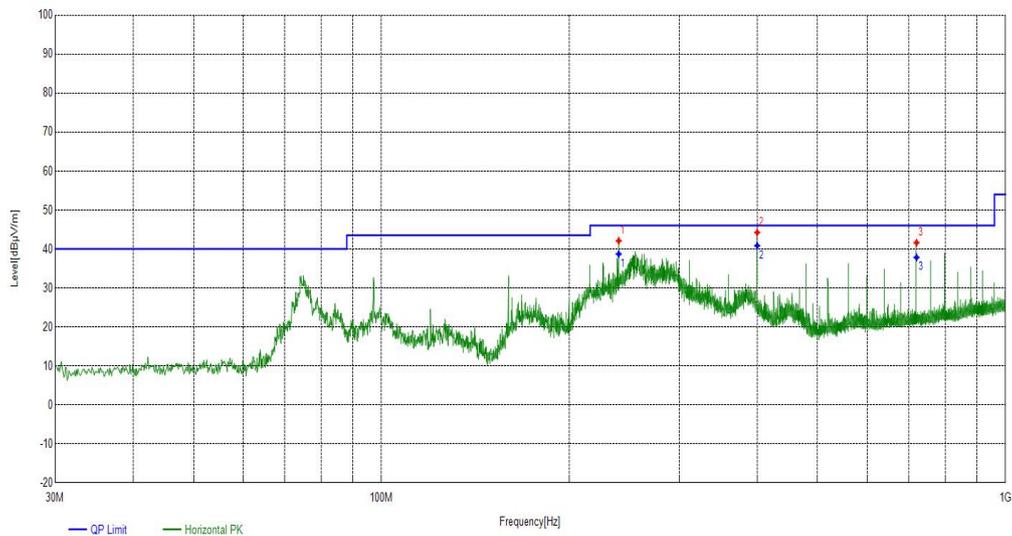


ESP32-C3:

Radiates Emission		9k~1G								
Test channel		Worst-Case								
Suspected List										
Frequency [MHz]	Polarity	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
239.929	Horizontal	13.97	28.12	42.09	46.00	3.91	PK	100	195	PASS
399.995	Horizontal	17.89	26.33	44.22	46.00	1.78	PK	100	1	PASS
720.03	Horizontal	23.49	18.12	41.61	46.00	4.39	PK	100	189	PASS

Note: 9kHz~30MHz have been test and test data more than 20dB margin.

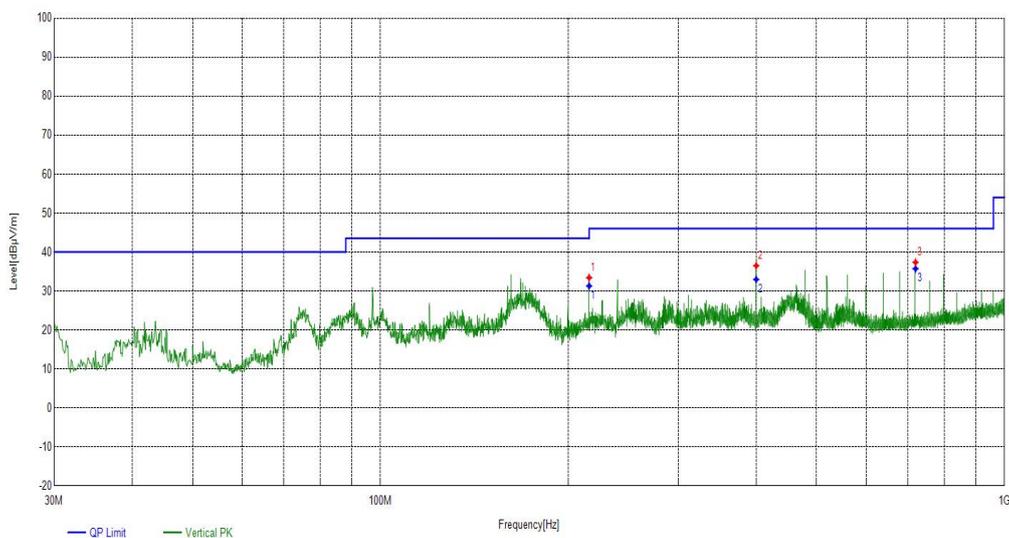
Final Data List									
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail	
239.929	Horizontal	13.97	38.71	46.00	7.29	320	195	PASS	
399.995	Horizontal	17.89	40.84	46.00	5.16	170	1	PASS	
720.03	Horizontal	23.49	37.82	46.00	8.18	240	189	PASS	



Radiates Emission		9k~1G								
Test channel		Worst-Case								
Suspected List										
Frequency [MHz]	Polarity	Factor [dB]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
215.9676	Vertical	13.31	20.10	33.41	43.50	10.09	PK	100	153	PASS
399.995	Vertical	17.89	18.60	36.49	46.00	9.51	PK	100	173	PASS
720.03	Vertical	23.49	13.86	37.35	46.00	8.65	PK	100	166	PASS

Note: 9kHz~30MHz have been test and test data more than 20dB margin.

Final Data List									
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dB μ V/m]	QP Limit [dB μ V/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail	
215.9676	Vertical	13.31	31.29	43.50	12.21	180	153	PASS	
399.995	Vertical	17.89	32.96	46.00	13.04	250	173	PASS	
720.03	Vertical	23.49	35.72	46.00	10.28	120	166	PASS	



During the test, the Radiates Emission from Above 1G was performed in WIFI all modes with all channels and all antennas. 802.11n40, Highest, medium, lowest channels, Ant1, ESP32-S3 and ESP32-C3 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

ESP32-S3:

Radiates Emission		Above 1G							
Test channel		Lowest							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4842.184218	1.42	43.91	45.33	74.00	28.67	PK	150	320	PASS
8630.063006	10.11	33.27	43.38	74.00	30.62	PK	150	90	PASS
14533.153315	18.26	30.71	48.97	74.00	25.03	PK	150	270	PASS
4842.184218	1.42	32.71	34.13	54.00	19.87	AV	150	20	PASS
8630.063006	10.11	25.46	35.57	54.00	18.43	AV	150	10	PASS
14533.153315	18.26	23.14	41.40	54.00	12.60	AV	150	10	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Lowest							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4218.121812	0.40	36.81	37.21	74.00	36.79	PK	150	100	PASS
7143.414341	8.99	35.21	44.20	74.00	29.80	PK	150	290	PASS
8147.014702	9.45	33.40	42.85	74.00	31.15	PK	150	290	PASS
4218.121812	0.40	26.74	27.14	54.00	26.86	AV	150	20	PASS
7143.414341	8.99	23.02	32.01	54.00	21.99	AV	150	280	PASS
8147.014702	9.45	23.13	32.58	54.00	21.42	AV	150	40	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Medium							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4880.189019	1.62	42.05	43.67	74.00	30.33	PK	150	13	PASS
7851.485149	9.24	36.29	45.53	74.00	28.47	PK	150	204	PASS
11402.340234	12.00	33.96	45.96	74.00	28.04	PK	150	350	PASS
4880.189019	1.62	32.85	34.47	54.00	19.53	AV	150	6	PASS
7851.485149	9.24	23.34	32.58	54.00	21.42	AV	150	39	PASS
11402.340234	12.00	22.62	34.62	54.00	19.38	AV	150	6	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Medium							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4932.193219	1.80	35.77	37.57	74.00	36.43	PK	150	270	PASS
7725.472547	9.18	35.60	44.78	74.00	29.22	PK	150	280	PASS
13744.074407	14.93	30.89	45.82	74.00	28.18	PK	150	260	PASS
4932.193219	1.80	26.37	28.17	54.00	25.83	AV	150	50	PASS
7725.472547	9.18	23.67	32.85	54.00	21.15	AV	150	100	PASS
13744.074407	14.93	21.17	36.10	54.00	17.90	AV	150	180	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Highest							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4912.193219	1.80	42.14	43.94	74.00	30.06	PK	150	6	PASS
8585.058506	10.08	34.39	44.47	74.00	29.53	PK	150	78	PASS
14566.156616	18.15	33.18	51.33	74.00	22.67	PK	150	183	PASS
4912.193219	1.80	31.10	32.90	54.00	21.10	AV	150	6	PASS
8585.058506	10.08	23.36	33.44	54.00	20.56	AV	150	360	PASS
14566.156616	18.15	21.33	39.48	54.00	14.52	AV	150	39	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Highest							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4185.118512	0.45	38.89	39.34	74.00	34.66	PK	150	190	PASS
7011.40114	8.95	35.23	44.18	74.00	29.82	PK	150	110	PASS
11057.305731	12.57	35.54	48.11	74.00	25.89	PK	150	220	PASS
4185.118512	0.45	26.94	27.39	54.00	26.61	AV	150	130	PASS
7011.40114	8.95	23.38	32.33	54.00	21.67	AV	150	30	PASS
11057.305731	12.57	22.02	34.59	54.00	19.41	AV	150	20	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

ESP32-C3:

Radiates Emission		Above 1G							
Test channel		Lowest							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4059.105911	0.52	39.21	39.73	74.00	34.27	PK	150	140	PASS
7248.424843	9.01	33.97	42.98	74.00	31.02	PK	150	270	PASS
12821.482148	13.59	31.83	45.42	74.00	28.58	PK	150	60	PASS
4059.105911	0.52	26.49	27.01	54.00	26.99	AV	150	10	PASS
7248.424843	9.01	24.08	33.09	54.00	20.91	AV	150	10	PASS
12821.482148	13.59	22.23	35.82	54.00	18.18	AV	150	10	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Lowest							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4845.184519	1.43	42.09	43.52	74.00	30.48	PK	150	140	PASS
7650.465047	9.13	33.66	42.79	74.00	31.21	PK	150	270	PASS
11429.342934	11.98	34.93	46.91	74.00	27.09	PK	150	60	PASS
4845.184519	1.43	29.92	31.35	54.00	22.65	AV	150	10	PASS
7650.465047	9.13	23.96	33.09	54.00	20.91	AV	150	10	PASS
11429.342934	11.98	22.20	34.18	54.00	19.82	AV	150	10	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Medium							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4188.118812	0.44	35.95	36.39	74.00	37.61	PK	150	110	PASS
8600.060006	10.11	35.19	45.30	74.00	28.70	PK	150	160	PASS
13852.085209	15.17	30.73	45.90	74.00	28.10	PK	150	240	PASS
4188.118812	0.44	27.24	27.68	54.00	26.32	AV	150	160	PASS
8600.060006	10.11	24.31	34.42	54.00	19.58	AV	150	30	PASS
13852.085209	15.17	21.69	36.86	54.00	17.14	AV	150	20	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Medium							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4875.187519	1.56	39.56	41.12	74.00	32.88	PK	150	310	PASS
7704.470447	9.16	32.57	41.73	74.00	32.27	PK	150	280	PASS
11411.341134	12.00	31.43	43.43	74.00	30.57	PK	150	180	PASS
4875.187519	1.56	29.54	31.10	54.00	22.90	AV	150	10	PASS
7704.470447	9.16	22.97	32.13	54.00	21.87	AV	150	360	PASS
11411.341134	12.00	22.57	34.57	54.00	19.43	AV	150	10	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Highest							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4182.118212	0.46	39.03	39.49	74.00	34.51	PK	150	6	PASS
6822.382238	8.06	33.38	41.44	74.00	32.56	PK	150	78	PASS
13003.0003	14.08	30.57	44.65	74.00	29.35	PK	150	183	PASS
4182.118212	0.46	26.88	27.34	54.00	26.66	AV	150	6	PASS
6822.382238	8.06	22.96	31.02	54.00	22.98	AV	150	360	PASS
13003.0003	14.08	21.53	35.61	54.00	18.39	AV	150	39	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Highest							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4917.191719	1.74	38.92	40.66	74.00	33.34	PK	150	120	PASS
8252.025203	9.60	33.29	42.89	74.00	31.11	PK	150	270	PASS
11192.319232	12.59	32.26	44.85	74.00	29.15	PK	150	350	PASS
4917.191719	1.74	28.14	29.88	54.00	24.12	AV	150	20	PASS
8252.025203	9.60	23.21	32.81	54.00	21.19	AV	150	160	PASS
11192.319232	12.59	23.05	35.64	54.00	18.36	AV	150	20	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

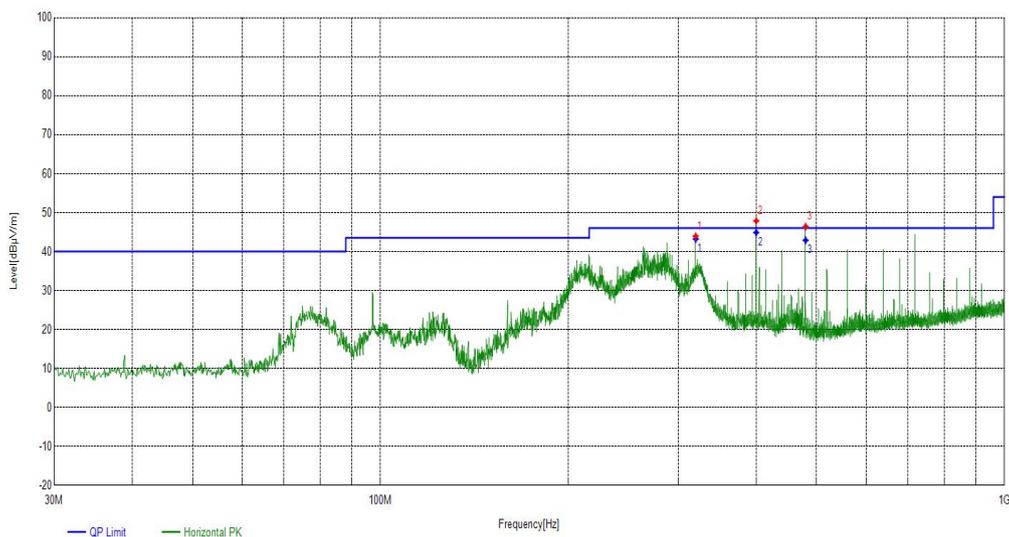
Bluetooth(Low Energy):

During the test, the Radiates Emission from 9kHz to 1GHz was performed in Bluetooth(Low Energy) all modes with all channels and all antennas. BLE(2Mbps), channel 0, antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Radiates Emission		9k~1G								
Test channel		Worst-Case								
Suspected List										
Frequency [MHz]	Polarity	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
319.962	Horizontal	15.99	27.94	43.93	46.00	2.07	PK	100	196	---
399.995	Horizontal	17.89	29.95	47.84	46.00	-1.84	PK	100	296	---
480.028	Horizontal	19.34	27.04	46.38	46.00	-0.38	PK	100	164	---

Note: 9kHz~30MHz have been test and test data more than 20dB margin.

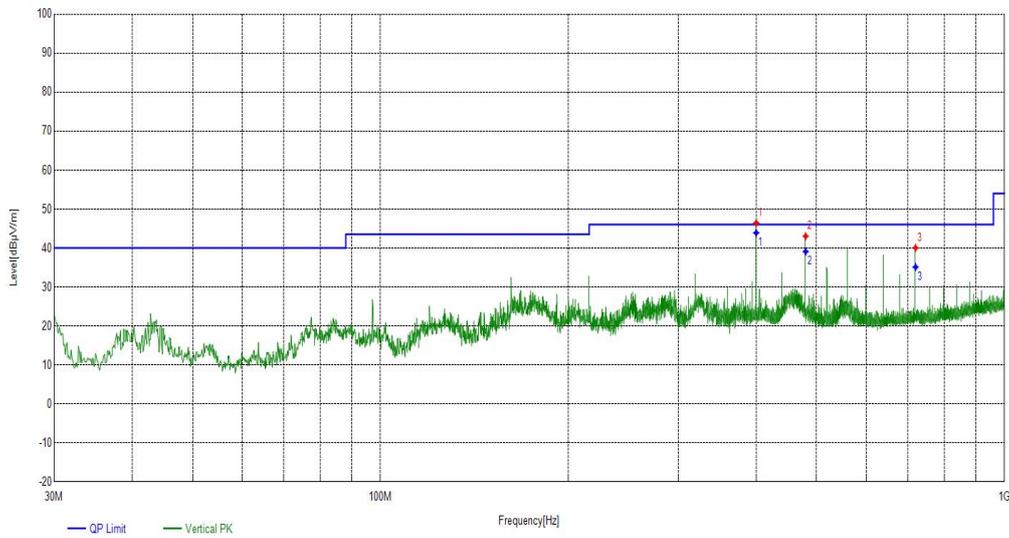
Final Data List									
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail	
320.0037	Horizontal	15.99	43.21	46.00	2.03	370	201	PASS	
400.0066	Horizontal	17.89	44.86	46.00	1.14	230	293	PASS	
480.0072	Horizontal	19.34	42.89	46.00	3.11	300	167	PASS	



Radiates Emission		9k~1G								
Test channel		Worst-Case								
Suspected List										
Frequency [MHz]	Polarity	Factor [dB]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
399.995	Vertical	17.89	28.52	46.41	46.00	-0.41	PK	100	175	---
480.028	Vertical	19.34	23.68	43.02	46.00	2.98	PK	100	89	---
720.03	Vertical	23.49	16.55	40.04	46.00	5.96	PK	100	280	---

Note: 9kHz~30MHz have been test and test data more than 20dB margin.

Final Data List									
Frequency [MHz]	Polarity	Factor [dB]	QP Value [dB μ V/m]	QP Limit [dB μ V/m]	QP Margin [dB]	Height [cm]	Angle [°]	Pass/Fail	
399.995	Vertical	17.89	43.88	46.00	2.12	230	175	PASS	
480.028	Vertical	19.34	39.08	46.00	6.92	120	89	PASS	
720.03	Vertical	23.49	35.10	46.00	10.90	150	280	PASS	



During the test, the Radiates Emission from Above 1G was performed in Bluetooth(Low Energy) all modes with all channels and all antennas. BLE(2Mbps), Highest, medium, lowest channels, antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Radiates Emission		Above 1G							
Test channel		Lowest							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
4293.129313	0.25	39.11	39.36	74.00	34.64	PK	150	92	PASS
8627.062706	10.12	36.54	46.66	74.00	27.34	PK	150	269	PASS
14593.159316	18.05	31.43	49.48	74.00	24.52	PK	150	275	PASS
4293.129313	0.25	27.12	27.37	54.00	26.63	AV	150	1	PASS
8627.062706	10.12	23.38	33.50	54.00	20.50	AV	150	92	PASS
14593.159316	18.05	20.82	38.87	54.00	15.13	AV	150	360	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Lowest							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
4296.129613	0.25	39.04	39.29	74.00	34.71	PK	150	100	PASS
7623.462346	9.11	34.19	43.30	74.00	30.70	PK	150	330	PASS
12990.9991	14.06	32.95	47.01	74.00	26.99	PK	150	230	PASS
4296.129613	0.25	27.63	27.88	54.00	26.12	AV	150	30	PASS
7623.462346	9.11	24.31	33.42	54.00	20.58	AV	150	20	PASS
12990.9991	14.06	21.52	35.58	54.00	18.42	AV	150	340	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		medium							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
3993.09931	0.53	39.54	40.07	74.00	33.93	PK	150	295	PASS
8603.060306	10.11	34.76	44.87	74.00	29.13	PK	150	288	PASS
10265.226523	12.69	34.07	46.76	74.00	27.24	PK	150	203	PASS
3993.09931	0.53	26.86	27.39	54.00	26.61	AV	150	347	PASS
8603.060306	10.11	24.69	34.80	54.00	19.20	AV	150	347	PASS
10265.226523	12.69	21.63	34.32	54.00	19.68	AV	150	99	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		medium							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
3699.069907	-0.03	39.43	39.40	74.00	34.60	PK	150	150	PASS
6672.367237	7.25	35.15	42.40	74.00	31.60	PK	150	160	PASS
10811.281128	12.75	33.54	46.29	74.00	27.71	PK	150	320	PASS
3699.069907	-0.03	27.51	27.48	54.00	26.52	AV	150	50	PASS
6672.367237	7.25	23.78	31.03	54.00	22.97	AV	150	10	PASS
10811.281128	12.75	22.20	34.95	54.00	19.05	AV	150	20	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Highest							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4185.118512	0.45	39.00	39.45	74.00	34.55	PK	150	120	PASS
7626.462646	9.11	35.98	45.09	74.00	28.91	PK	150	330	PASS
12990.9991	14.06	33.98	48.04	74.00	25.96	PK	150	150	PASS
4185.118512	0.45	26.59	27.04	54.00	26.96	AV	150	70	PASS
7626.462646	9.11	23.62	32.73	54.00	21.27	AV	150	340	PASS
12990.9991	14.06	22.02	36.08	54.00	17.92	AV	150	10	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Radiates Emission		Above 1G							
Test channel		Highest							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/ Fail
4923.192319	1.75	38.22	39.97	74.00	34.03	PK	150	10	PASS
8423.042304	9.87	34.82	44.69	74.00	29.31	PK	150	240	PASS
15160.216022	17.29	33.46	50.75	74.00	23.25	PK	150	310	PASS
4923.192319	1.75	26.09	27.84	54.00	26.16	AV	150	40	PASS
8423.042304	9.87	23.23	33.10	54.00	20.90	AV	150	10	PASS
15160.216022	17.29	20.83	38.12	54.00	15.88	AV	150	10	PASS

Note: The emission levels of other frequencies were greater than 20dB margin.

Band Edge:

During the test, the Band Edge was performed in WIFI all modes with all channels and all antennas. 802.11n40, Highest and lowest channels, Ant1, ESP32-S3 and ESP32-C3 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

ESP32-S3:

Test mode		802.11n40							
Test channel		Lowest channel							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
2240.1240	-5.69	41.89	36.20	74.00	37.80	PK	150	62	PASS
2390.1390	-5.21	54.72	49.51	74.00	24.49	PK	150	68	PASS
2438.1438	-5.08	86.51	81.43	74.00	-7.43	PK	150	55	---
2240.1240	-5.69	31.74	26.05	54.00	27.95	AV	150	42	PASS
2390.1390	-5.21	36.49	31.28	54.00	22.72	AV	150	48	PASS
2438.1438	-5.08	75.86	70.78	54.00	-16.78	AV	150	29	---
Test mode		802.11n40							
Test channel		Lowest channel							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
2249.9249	-5.47	39.25	33.78	74.00	40.22	PK	150	290	PASS
2390.1390	-5.04	39.19	34.15	74.00	39.85	PK	150	360	PASS
2425.3425	-4.94	85.51	80.57	74.00	-6.57	PK	150	110	---
2249.9249	-5.47	28.27	22.80	54.00	31.20	AV	150	250	PASS
2390.1390	-5.04	28.28	23.24	54.00	30.76	AV	150	10	PASS
2418.9418	-4.96	74.57	69.61	54.00	-15.61	AV	150	30	---

The signal beyond the limit is carrier.

Test mode		802.11n40							
Test channel		Highest channel							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
2460.1470	-4.82	95.48	90.66	74.00	-16.66	PK	150	73	---
2483.5483	-4.79	65.16	60.37	74.00	13.63	PK	150	60	PASS
2560.1560	-4.52	45.99	41.47	74.00	32.53	PK	150	86	PASS
2454.7464	-4.83	83.17	78.34	54.00	-24.34	AV	150	34	---
2483.5483	-4.79	44.97	40.18	54.00	13.82	AV	150	34	PASS
2560.1560	-4.52	37.25	32.73	54.00	21.27	AV	150	40	PASS
Test mode		802.11n40							
Test channel		Highest channel							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
2451.7471	-4.82	82.07	77.25	74.00	-3.25	PK	150	90	---
2483.5483	-4.79	54.91	50.12	74.00	23.88	PK	150	360	PASS
2550.1550	-4.56	39.66	35.10	74.00	38.90	PK	150	340	PASS
2451.7471	-4.82	72.95	68.13	54.00	-14.13	AV	150	10	---
2483.5483	-4.79	36.31	31.52	54.00	22.48	AV	150	50	PASS
2550.1550	-4.56	29.54	24.98	54.00	29.02	AV	150	20	PASS

The signal beyond the limit is carrier.

ESP32-C3:

Test mode	802.11n40
Test channel	Lowest channel
polarization	Horizontal

Suspected List

Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
2265.1265	-5.43	39.19	33.76	74.00	40.24	PK	150	40	PASS
2390.1390	-5.04	38.30	33.26	74.00	40.74	PK	150	80	PASS
2430.1430	-4.93	79.18	74.25	74.00	-0.25	PK	150	220	---
2265.1265	-5.43	28.92	23.49	54.00	30.51	AV	150	20	PASS
2390.1390	-5.04	27.85	22.81	54.00	31.19	AV	150	360	PASS
2430.1430	-4.93	69.91	64.98	54.00	-10.98	AV	150	120	---

Test mode	802.11n40
Test channel	Lowest channel
polarization	Vertical

Suspected List

Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
2240.1240	-5.50	40.48	34.98	74.00	39.02	PK	150	30	PASS
2390.1390	-5.04	40.77	35.73	74.00	38.27	PK	150	280	PASS
2430.9430	-4.93	88.54	83.61	74.00	-9.61	PK	150	100	---
2240.1240	-5.50	30.53	25.03	54.00	28.97	AV	150	10	PASS
2390.1390	-5.04	30.28	25.24	54.00	28.76	AV	150	70	PASS
2430.9430	-4.93	79.61	74.68	54.00	-20.68	AV	150	330	---

The signal beyond the limit is carrier.

Test mode		802.11n40							
Test channel		Highest channel							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
2455.3465	-4.83	79.58	74.75	74.00	-0.75	PK	150	160	---
2483.5483	-4.79	51.40	46.61	74.00	27.39	PK	150	220	PASS
2551.1551	-4.56	41.67	37.11	74.00	36.89	PK	150	360	PASS
2455.3465	-4.83	69.75	64.92	54.00	-10.92	AV	150	20	---
2483.5483	-4.79	35.57	30.78	54.00	23.22	AV	150	10	PASS
2551.1551	-4.56	29.54	24.98	54.00	29.02	AV	150	290	PASS
Test mode		802.11n40							
Test channel		Highest channel							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detector	Height [cm]	Angle deg	Pass/Fail
2455.1465	-4.83	89.41	84.58	74.00	-10.58	PK	150	130	---
2483.5483	-4.79	59.99	55.20	74.00	18.80	PK	150	350	PASS
2560.1560	-4.52	44.47	39.95	74.00	34.05	PK	150	80	PASS
2455.1465	-4.83	79.75	74.92	54.00	-20.92	AV	150	310	---
2483.5483	-4.79	41.40	36.61	54.00	17.39	AV	150	10	PASS
2560.1560	-4.52	36.85	32.33	54.00	21.67	AV	150	10	PASS

The signal beyond the limit is carrier.

During the test, the Band Edge was performed in BLE all modes with all channels and all antennas. BLE(2Mbps), Highest and lowest channels, Antenna 1 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

Test mode		BLE(2Mbps)							
Test channel		Lowest channel							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
2277.9277	-5.38	39.43	34.05	74.00	39.95	PK	150	195	PASS
2390.1390	-5.04	39.01	33.97	74.00	40.03	PK	150	321	PASS
2402.1402	-5.00	91.46	86.46	74.00	-12.46	PK	150	68	---
2277.9277	-5.38	28.33	22.95	54.00	31.05	AV	150	315	PASS
2390.1390	-5.04	27.78	22.74	54.00	31.26	AV	150	359	PASS
2402.1402	-5.00	86.11	81.11	54.00	-27.11	AV	150	42	---
Test mode		BLE(2Mbps)							
Test channel		Lowest channel							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
2237.3237	-5.51	41.54	36.03	74.00	37.97	PK	150	310	PASS
2390.1390	-5.04	38.07	33.03	74.00	40.97	PK	150	130	PASS
2402.1402	-5.00	75.10	70.10	74.00	3.90	PK	150	350	---
2237.3237	-5.51	28.52	23.01	54.00	30.99	AV	150	350	PASS
2390.1390	-5.04	27.77	22.73	54.00	31.27	AV	150	70	PASS
2402.1402	-5.00	73.45	68.45	54.00	-14.45	AV	150	10	---

The signal beyond the limit is carrier.

Test mode		BLE(2Mbps)							
Test channel		Highest channel							
polarization		Horizontal							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
2480.1480	-4.80	88.08	83.28	74.00	-9.28	PK	150	66	---
2483.5483	-4.79	41.28	36.49	74.00	37.51	PK	150	238	PASS
2567.1567	-4.50	41.02	36.52	74.00	37.48	PK	150	310	PASS
2480.1480	-4.80	83.34	78.54	54.00	-24.54	AV	150	93	---
2483.5483	-4.79	30.13	25.34	54.00	28.66	AV	150	100	PASS
2567.1567	-4.50	28.11	23.61	54.00	30.39	AV	150	251	PASS
Test mode		BLE(2Mbps)							
Test channel		Highest channel							
polarization		Vertical							
Suspected List									
Frequency [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Detect or	Height [cm]	Angle deg	Pass/Fail
2480.14801	-8.24	47.98	39.74	74.00	34.26	PK	150	240	---
2483.54835	-6.75	39.55	32.80	74.00	41.20	PK	150	80	PASS
2550.95509	-4.90	74.36	69.46	74.00	4.54	PK	150	280	PASS
2480.14801	-8.24	34.47	26.23	54.00	27.77	AV	150	140	---
2483.54835	-6.75	29.96	23.21	54.00	30.79	AV	150	40	PASS
2550.95509	-4.90	72.22	67.32	54.00	-13.32	AV	150	10	PASS

The signal beyond the limit is carrier.

5.3 Maximum conducted output power

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

a.A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor and set the detector to PEAK. Record the power level.

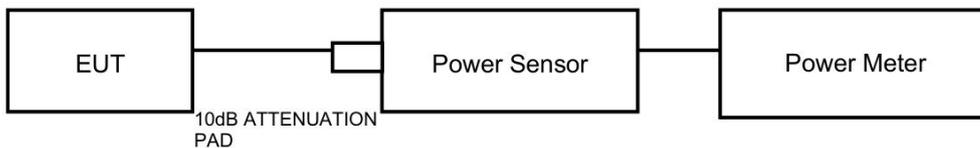
Limits:

Average Output Power	≤ 1W (30dBm)
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Note: the conducted output power limit specified above is based on the use the antennas with directional gains that do not exceed 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated Levels above, as appropriate, by the amount in dB that the directional gain of antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Test Setup:



Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 2, U= 0.44 dB.

Test Results:

ESP32-S3:

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	9.99	≤30	PASS
	Ant1	2437	9.75	≤30	PASS
	Ant1	2462	10.89	≤30	PASS
11G	Ant1	2412	13.21	≤30	PASS
	Ant1	2437	12.42	≤30	PASS
	Ant1	2462	13.33	≤30	PASS
11N20SISO	Ant1	2412	11.45	≤30	PASS
	Ant1	2437	11.11	≤30	PASS
	Ant1	2462	11.97	≤30	PASS
11N40SISO	Ant1	2422	11.32	≤30	PASS
	Ant1	2437	10.86	≤30	PASS
	Ant1	2452	11.29	≤30	PASS
BLE_1M	Ant1	2402	5.24	≤30	PASS
	Ant1	2440	4.67	≤30	PASS
	Ant1	2480	4.54	≤30	PASS
BLE_2M	Ant1	2402	5.21	≤30	PASS
	Ant1	2440	4.56	≤30	PASS
	Ant1	2480	4.61	≤30	PASS

ESP32-C3:

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	11.33	≤30	PASS
	Ant1	2437	10.21	≤30	PASS
	Ant1	2462	11.91	≤30	PASS
11G	Ant1	2412	11.51	≤30	PASS
	Ant1	2437	11.23	≤30	PASS
	Ant1	2462	12.54	≤30	PASS
11N20SISO	Ant1	2412	10.75	≤30	PASS
	Ant1	2437	10.26	≤30	PASS
	Ant1	2462	11.25	≤30	PASS
11N40SISO	Ant1	2422	10.67	≤30	PASS
	Ant1	2437	9.86	≤30	PASS
	Ant1	2452	10.19	≤30	PASS

5.4 Minimum 6 dB Bandwidth

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. Set RBW = shall be in the range of 1% to 5% of the OBW but not less than 100 kHz; VBW is set to greater than 3 times RBW on spectrum analyzer.

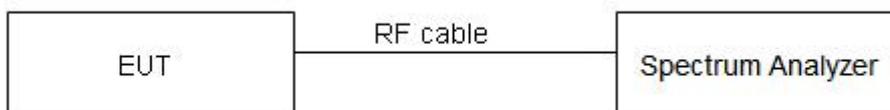
Detector=Peak, Trace mode=Max hold.

Limits:

Rule Part 15.247 (a) (2) specifies that “Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.”

Minimum 6dB Bandwidth	≥ 500 kHz
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Test Setup:



Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.

Test Results:

ESP32-S3:

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	8.76	2407.48	2416.24	≥0.5	PASS
		2437	9.04	2432.48	2441.52	≥0.5	PASS
		2462	8.04	2458.08	2466.12	≥0.5	PASS
11G	Ant1	2412	16.48	2403.72	2420.20	≥0.5	PASS
		2437	16.44	2428.76	2445.20	≥0.5	PASS
		2462	16.48	2453.72	2470.20	≥0.5	PASS
11N20SISO	Ant1	2412	16.80	2403.60	2420.40	≥0.5	PASS
		2437	17.32	2428.24	2445.56	≥0.5	PASS
		2462	17.04	2453.48	2470.52	≥0.5	PASS
11N40SISO	Ant1	2422	30.08	2405.12	2435.20	≥0.5	PASS
		2437	30.64	2420.52	2451.16	≥0.5	PASS
		2452	34.16	2435.36	2469.52	≥0.5	PASS
BLE_1M	Ant1	2402	0.68	2401.65	2402.33	≥0.5	PASS
		2440	0.68	2439.67	2440.34	≥0.5	PASS
		2480	0.65	2479.68	2480.33	≥0.5	PASS
BLE_2M	Ant1	2402	1.20	2401.43	2402.63	≥0.5	PASS
		2440	1.34	2439.33	2440.67	≥0.5	PASS
		2480	1.33	2479.33	2480.66	≥0.5	PASS

ESP32-C3:

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	8.40	2407.16	2415.56	0.5	PASS
		2437	8.88	2432.24	2441.12	0.5	PASS
		2462	9.96	2457.08	2467.04	0.5	PASS
11G	Ant1	2412	16.56	2403.72	2420.28	0.5	PASS
		2437	16.36	2428.80	2445.16	0.5	PASS
		2462	16.56	2453.72	2470.28	0.5	PASS
11N20SISO	Ant1	2412	16.92	2403.48	2420.40	0.5	PASS
		2437	17.60	2428.20	2445.80	0.5	PASS
		2462	16.80	2453.60	2470.40	0.5	PASS
11N40SISO	Ant1	2422	34.40	2405.12	2439.52	0.5	PASS
		2437	34.08	2419.48	2453.56	0.5	PASS
		2452	33.44	2435.12	2468.56	0.5	PASS

5.5 Occupied Channel Bandwidth

Ambient condition:

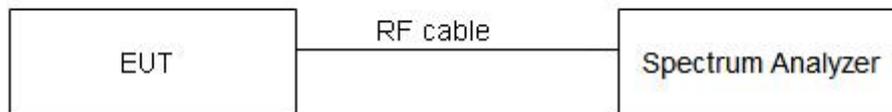
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 1% to 5% of the OBW; video bandwidth (VBW) shall be at least three times RBW on spectrum analyzer.

Detector=Peak, Trace mode=Max hold.

Test Setup:



Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.

Test Results:

ESP32-S3:

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	12.947	2405.4066	2418.3536	---	---
		2437	12.987	2430.4066	2443.3936	---	---
		2462	13.027	2455.4066	2468.4336	---	---
11G	Ant1	2412	16.623	2403.6883	2420.3117	---	---
		2437	16.583	2428.7283	2445.3117	---	---
		2462	16.703	2453.6883	2470.3916	---	---
11N20SISO	Ant1	2412	17.423	2403.2887	2420.7113	---	---
		2437	17.423	2428.2887	2445.7113	---	---
		2462	17.423	2453.2887	2470.7113	---	---
11N40SISO	Ant1	2422	35.644	2404.0979	2439.7423	---	---
		2437	35.724	2419.0979	2454.8222	---	---
		2452	35.804	2434.0979	2469.9021	---	---
BLE_1M	Ant1	2402	1.027	2401.4925	2402.5195	---	---
		2440	1.027	2439.4925	2440.5195	---	---
		2480	1.027	2479.4925	2480.5195	---	---
BLE_2M	Ant1	2402	2.038	2400.9970	2403.0350	---	---
		2440	2.034	2439.0050	2441.0390	---	---
		2480	2.042	2478.9890	2481.0310	---	---

ESP32-C3:

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	13.027	2405.4466	2418.4735	---	---
		2437	13.027	2430.4466	2443.4735	---	---
		2462	13.067	2455.4466	2468.5135	---	---
11G	Ant1	2412	16.823	2403.6084	2420.4316	---	---
		2437	16.863	2428.5684	2445.4316	---	---
		2462	16.863	2453.5684	2470.4316	---	---
11N20SISO	Ant1	2412	17.582	2403.2088	2420.7912	---	---
		2437	17.542	2428.2488	2445.7912	---	---
		2462	17.622	2453.2088	2470.8312	---	---
11N40SISO	Ant1	2422	35.804	2404.0979	2439.9021	---	---
		2437	35.804	2419.0979	2454.9021	---	---
		2452	35.884	2434.0979	2469.9820	---	---

5.6 Band Edge Measurement

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

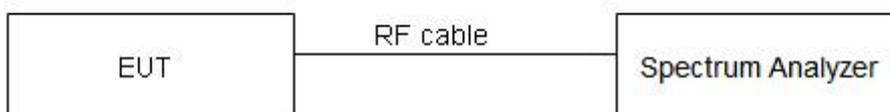
Method of Measurement:

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer.

Limits:

Rule Part 15.247(d) specifies that “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.

Test Setup:



Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U = 936 \text{ Hz}$, $2 \text{ GHz} - 3 \text{ GHz} = 1.407 \text{ dB}$.

Test Results:

ESP32-S3:

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	-6.52	-49.03	≤-26.52	PASS
		High	2462	-11.70	-48.98	≤-31.7	PASS
11G	Ant1	Low	2412	-8.90	-47.46	≤-28.9	PASS
		High	2462	-13.76	-47.9	≤-33.76	PASS
11N20SISO	Ant1	Low	2412	-10.29	-48.29	≤-30.29	PASS
		High	2462	-15.12	-49.05	≤-35.12	PASS
11N40SISO	Ant1	Low	2422	-13.28	-47.83	≤-33.28	PASS
		High	2452	-16.62	-48.79	≤-36.62	PASS
BLE_1M	Ant1	Low	2402	4.27	-45.29	≤-15.73	PASS
		High	2480	2.91	-48.23	≤-17.09	PASS
BLE_2M	Ant1	Low	2402	1.54	-42.01	≤-18.46	PASS
		High	2480	0.89	-49.36	≤-19.11	PASS

ESP32-C3:

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	-1.42	-45.97	≤-21.42	PASS
		High	2462	-1.83	-48.76	≤-21.83	PASS
11G	Ant1	Low	2412	-6.24	-44.61	≤-26.24	PASS
		High	2462	-6.46	-47.93	≤-26.46	PASS
11N20SISO	Ant1	Low	2412	-6.56	-46.58	≤-26.56	PASS
		High	2462	-8.65	-48.22	≤-28.65	PASS
11N40SISO	Ant1	Low	2422	-9.56	-47.11	≤-29.56	PASS
		High	2452	-11.04	-48.92	≤-31.04	PASS

5.7 Maximum Power Spectral Density

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

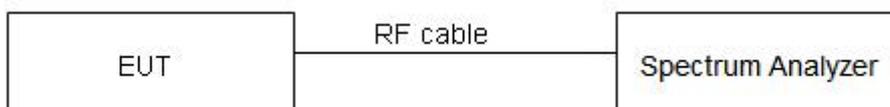
During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation. The Average detector is used. We use Method AVGPS-2 in KDB 558074 D01 for this test.

Limits:

Rule Part 15.247(e) specifies that” 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.

Maximum Power Spectral Density	$\leq 8 \text{ dBm} / 3\text{kHz}$
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Test Setup:



Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.75\text{dB}$.

Test Results:

ESP32-S3:

TestMode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-18.74	≤8.00	PASS
		2437	-20.44	≤8.00	PASS
		2462	-18.99	≤8.00	PASS
11G	Ant1	2412	-20.69	≤8.00	PASS
		2437	-20.47	≤8.00	PASS
		2462	-19.53	≤8.00	PASS
11N20SISO	Ant1	2412	-21.72	≤8.00	PASS
		2437	-20.66	≤8.00	PASS
		2462	-20.16	≤8.00	PASS
11N40SISO	Ant1	2422	-21.49	≤8.00	PASS
		2437	-26.46	≤8.00	PASS
		2452	-20.55	≤8.00	PASS
BLE_1M	Ant1	2402	-11.73	≤8.00	PASS
		2440	-11.41	≤8.00	PASS
		2480	-10.95	≤8.00	PASS
BLE_2M	Ant1	2402	-16.49	≤8.00	PASS
		2440	-15.44	≤8.00	PASS
		2480	-15.89	≤8.00	PASS

ESP32-C3:

TestMode	Antenna	Channel	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-18.78	≤8.00	PASS
		2437	-18.54	≤8.00	PASS
		2462	-18.08	≤8.00	PASS
11G	Ant1	2412	-22.23	≤8.00	PASS
		2437	-22.41	≤8.00	PASS
		2462	-21.66	≤8.00	PASS
11N20SISO	Ant1	2412	-23.42	≤8.00	PASS
		2437	-23.61	≤8.00	PASS
		2462	-22.52	≤8.00	PASS
11N40SISO	Ant1	2422	-26.76	≤8.00	PASS
		2437	-27.76	≤8.00	PASS
		2452	-27.23	≤8.00	PASS

5.8 Spurious RF Conducted Emissions

Ambient condition:

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.3kPa

Method of Measurement:

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW to 100kHz and VBW to 300 kHz, Sweep is set to AUTO. The test is in transmitting mode.

Limits:

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

Test Setup:



Measurement Uncertainty:

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-26GHz	1.407 dB

Test Results:

ESP32-S3:

TestMode	Antenna	Channel	FreqRange [Mhz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	Reference	-7.07	-7.07	---	PASS
			30~1000	-7.07	-48.85	≤-27.07	PASS
			1000~26500	-7.07	-37.57	≤-27.07	PASS
		2437	Reference	-6.12	-6.12	---	PASS
			30~1000	-6.12	-53.85	≤-26.12	PASS
			1000~26500	-6.12	-39.63	≤-26.12	PASS
		2462	Reference	-6.34	-6.34	---	PASS
			30~1000	-6.34	-50.15	≤-26.34	PASS
			1000~26500	-6.34	-38.08	≤-26.34	PASS
11G	Ant1	2412	Reference	-9.61	-9.61	---	PASS
			30~1000	-9.61	-53.49	≤-29.61	PASS
			1000~26500	-9.61	-40.12	≤-29.61	PASS
		2437	Reference	-9.74	-9.74	---	PASS
			30~1000	-9.74	-53.86	≤-29.74	PASS
			1000~26500	-9.74	-43.15	≤-29.74	PASS
		2462	Reference	-9.05	-9.05	---	PASS
			30~1000	-9.05	-53.77	≤-29.05	PASS
			1000~26500	-9.05	-41.73	≤-29.05	PASS
11N20SISO	Ant1	2412	Reference	-10.76	-10.76	---	PASS
			30~1000	-10.76	-53.87	≤-30.76	PASS
			1000~26500	-10.76	-44.82	≤-30.76	PASS
		2437	Reference	-11.52	-11.52	---	PASS
			30~1000	-11.52	-53.58	≤-31.52	PASS
			1000~26500	-11.52	-46.85	≤-31.52	PASS
		2462	Reference	-8.25	-8.25	---	PASS
			30~1000	-8.25	-53.82	≤-28.25	PASS
			1000~26500	-8.25	-44.86	≤-28.25	PASS
11N40SISO	Ant1	2422	Reference	-11.86	-11.86	---	PASS
			30~1000	-11.86	-53.9	≤-31.86	PASS
			1000~26500	-11.86	-47.04	≤-31.86	PASS
		2437	Reference	-13.69	-13.69	---	PASS
			30~1000	-13.69	-54.1	≤-33.69	PASS
			1000~26500	-13.69	-47.81	≤-33.69	PASS
		2452	Reference	-13.20	-13.20	---	PASS
			30~1000	-13.20	-48.98	≤-33.2	PASS
			1000~26500	-13.20	-48.24	≤-33.2	PASS

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	Reference	3.76	3.76	---	PASS
			30~1000	3.76	-53.54	≤-16.24	PASS
			1000~26500	3.76	-34.1	≤-16.24	PASS
		2440	Reference	2.21	2.21	---	PASS
			30~1000	2.21	-53.86	≤-17.79	PASS
			1000~26500	2.21	-38.81	≤-17.79	PASS
		2480	Reference	2.22	2.22	---	PASS
			30~1000	2.22	-53.8	≤-17.78	PASS
			1000~26500	2.22	-37.95	≤-17.78	PASS
BLE_2M	Ant1	2402	Reference	1.41	1.41	---	PASS
			30~1000	1.41	-53.69	≤-18.59	PASS
			1000~26500	1.41	-35.34	≤-18.59	PASS
		2440	Reference	0.74	0.74	---	PASS
			30~1000	0.74	-53.35	≤-19.26	PASS
			1000~26500	0.74	-39.07	≤-19.26	PASS
2480	Reference	0.45	0.45	---	PASS		

		30~1000	0.45	-53.73	≤-19.55	PASS
		1000~26500	0.45	-38.03	≤-19.55	PASS

ESP32-C3:

TestMode	Antenna	Channel	FreqRange [Mhz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	Reference	-5.04	-5.04	---	PASS
			30~1000	-5.04	-50.47	≤-25.04	PASS
			1000~26500	-5.04	-38.25	≤-25.04	PASS
		2437	Reference	-4.91	-4.91	---	PASS
			30~1000	-4.91	-55.47	≤-24.91	PASS
			1000~26500	-4.91	-38.69	≤-24.91	PASS
		2462	Reference	-6.22	-6.22	---	PASS
			30~1000	-6.22	-55.53	≤-26.22	PASS
			1000~26500	-6.22	-36.91	≤-26.22	PASS
11G	Ant1	2412	Reference	-11.11	-11.11	---	PASS
			30~1000	-11.11	-55.86	≤-31.11	PASS
			1000~26500	-11.11	-44.14	≤-31.11	PASS
		2437	Reference	-11.20	-11.20	---	PASS
			30~1000	-11.20	-55.37	≤-31.2	PASS
			1000~26500	-11.20	-44.47	≤-31.2	PASS
		2462	Reference	-10.15	-10.15	---	PASS
			30~1000	-10.15	-55.94	≤-30.15	PASS
			1000~26500	-10.15	-42.05	≤-30.15	PASS
11N20SISO	Ant1	2412	Reference	-11.71	-11.71	---	PASS
			30~1000	-11.71	-56.03	≤-31.71	PASS
			1000~26500	-11.71	-44.82	≤-31.71	PASS
		2437	Reference	-12.45	-12.45	---	PASS
			30~1000	-12.45	-55.47	≤-32.45	PASS
			1000~26500	-12.45	-45.25	≤-32.45	PASS
		2462	Reference	-11.33	-11.33	---	PASS
			30~1000	-11.33	-44.8	≤-31.33	PASS
			1000~26500	-11.33	-44.97	≤-31.33	PASS
11N40SISO	Ant1	2422	Reference	-14.96	-14.96	---	PASS
			30~1000	-14.96	-55.35	≤-34.96	PASS
			1000~26500	-14.96	-48.76	≤-34.96	PASS
		2437	Reference	-15.15	-15.15	---	PASS
			30~1000	-15.15	-55.83	≤-35.15	PASS
			1000~26500	-15.15	-48.7	≤-35.15	PASS
		2452	Reference	-14.79	-14.79	---	PASS
			30~1000	-14.79	-55.29	≤-34.79	PASS
			1000~26500	-14.79	-44.95	≤-34.79	PASS

6. Appendix X

Test Equipment	Type/Mode	SERIAL NO.	Equipment No.	Manufacturer	Cal. Due
Communication Shielded Room 2	4m*3m*3m	CRTDSWKS R4 4301	/	CRT	2027/04/22
Spectrum Analyzer	FSV40	101580	DZ-000238-3	R&S	2025/04/22
Power Meter	JS0806-2	19H9080187	DZ-000241	Tonscend	2025/04/27
5m Semi-Anechoic Chamber	SAC-5	SAC-5-2.0	EM-000557	COMTEST	2024/11/02
Spectrum Analyzer	N9010B	MY57470323	DZ-000174	KEYSIGHT	2025/01/02
EMI Test Receiver	N9038A-508	MY532290079	EM-000397	Agilent	2025/01/13
EMI Test Receiver	ESR7	102235	EM-000574	R&S	2025/01/13
loop antenna	HLA 6121	540046	EM-000546	TESEQ	2025/06/04
Broadband Antenna	VULB 9163	9163-530	EM-000342	SCHWAR ZBECK	2025/06/09
Waveguide Horn Antenna	HF906	360306/008	EM-000093	R&S	2025/01/13
Waveguide Horn Antenna	BBHA9170	00949	DZ-000209-2	SCHWAR ZBECK	2025/08/03
Preamplifier	BBV 9721	9721-050	DZ-000209-1	SCHWAR ZBECK	2025/06/02
Bandstop Filters	SW-BSF-2400-100-7-A1	/	EM-000495	/	2025/08/30
5G Bandstop Filters	WRCJV12-4900-5100-5900-6100-50EE	1	DZ-000186	WI	2024/12/03
Temperature and humidity meter	UT330THC	/	DZ-000249-5	UNI-T	2025/07/28
SuperCharge	HW-100400C01	/	/	HUAWEI	/

Dynacomm	Software Release	Software Developer
TS1120-3 Test System(Conduction test)	3.3.38	Tonscend
TS+ (5m,Radiation test)	JS32-RE 5.0.0	Tonscend

_____ The End _____

Important

1. The test report is invalid without the official stamp of CVC;
2. Any part photocopies of the test report are forbidden without the written permission from CVC;
3. The test report is invalid without the signatures of Author and Reviewer;
4. The test report is invalid if altered;
5. Objections to the test report must be submitted to CVC within 15 days;
6. Generally, commission test is responsible for the tested samples only;
7. As for the test result, “—” or “N/A” means “not applicable”, “/” means “not testing”, “P” means “pass” and “F” means “fail”.

Address: No.3,Tiantaiyi Road, Kaitai Avenue, Science City, Guangzhou, China (Test location)

Post Code: 510663 Tel: 020-32293888

FAX: 020 32293889 E-mail: office@cvc.org.cn