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*:Maximum	n data	x:Over limit	!:over margin			<pre> Reference Only</pre>
Receiver:	ESR	1		Spectrum Analyzer:	ESP40	

#### **Test Result: Pass**

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## 6.9 Radiated emissions which fall in the restricted bands

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.10.5
Test Mode (Pre-Scan)	ТХ
Test Mode (Final Test)	ТХ

#### 6.9.1 Limit

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

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### 6.9.2 Test setup

Below 1GHz:



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#### 6.9.3 Procedure

- a) For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c) The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h) Test the EUT in the lowest channel, the middle channel, the highest channel.
- i) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j) Repeat above procedures until all frequencies measured was complete.

#### Note 1: Level (dBuV) = Reading (dBuV) + Factor (dB/m)

Note 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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#### 6.9.4 Test data

Remark: During the test, pre-scan the BLE1M/BLE2M mode, and found the BLE1M mode which it is worse case.



No.	M	k.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over			
			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment	
1		23	310.000	41.66	-2.87	38.79	74.00	-35.21	peak		
2	*	23	390.000	44.64	-2.44	42.20	74.00	-31.80	peak		

*:Maximum	data	x:Over limit	!:over margin			(Reference Only
Receiver:	ESR_	_1		Spectrum Analyzer:	FSP40	

#### **Test Result: Pass**

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*:Maximum	data	x:Over limit	!:over margin			Reference Only
Receiver:	ESR	1		Spectrum Analyzer:	FSP40	

#### **Test Result: Pass**

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\*:Maximum data x:Over limit !:over margin Receiver: ESR\_1 Spectrum Analyzer: FSP40

**Test Result: Pass** 

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\*:Maximum data x:Over limit !:over margin Receiver: ESR\_1 Spectrum Analyzer: FSP40

**Test Result: Pass** 

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# 7 Appendix A

#### **Duty Cycle**

Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	Correction Factor (dB)
BLE 1M	2402	Ant1	88	0.56
BLE 1M	2442	Ant1	87.99	0.56
BLE 1M	2480	Ant1	88	0.56
BLE 2M	2402	Ant1	46.01	3.37
BLE 2M	2442	Ant1	46.01	3.37
BLE 2M	2480	Ant1	46.4	3.34
	Mode BLE 1M BLE 1M BLE 2M BLE 2M BLE 2M	Mode Frequency (MHz)   BLE 1M 2402   BLE 1M 2442   BLE 1M 2480   BLE 2M 2402   BLE 2M 2442   BLE 2M 2442   BLE 2M 2442	Mode Frequency (MHz) Antenna   BLE 1M 2402 Ant1   BLE 1M 2442 Ant1   BLE 1M 2480 Ant1   BLE 2M 2402 Ant1   BLE 2M 2402 Ant1   BLE 2M 2442 Ant1   BLE 2M 2442 Ant1   BLE 2M 2442 Ant1	Mode Frequency (MHz) Antenna Duty Cycle (%)   BLE 1M 2402 Ant1 88   BLE 1M 2442 Ant1 87.99   BLE 1M 2480 Ant1 88   BLE 2M 2402 Ant1 46.01   BLE 2M 2480 Ant1 46.01   BLE 2M 2480 Ant1 46.4

#### Duty Cycle NVNT BLE 1M 2402MHz Ant1



Duty Cycle NVNT BLE 1M 2442MHz Ant1

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### Duty Cycle NVNT BLE 1M 2480MHz Ant1



### Duty Cycle NVNT BLE 2M 2402MHz Ant1



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### Duty Cycle NVNT BLE 2M 2442MHz Ant1



### Duty Cycle NVNT BLE 2M 2480MHz Ant1



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#### **Maximum Conducted Output Power**

Condition	Mode	Frequency	Antenna	Conducted	Limit	Verdict
		(MHz)		Power	(dBm)	
				(dBm)		
NVNT	BLE 1M	2402	Ant1	0.03	30	Pass
NVNT	BLE 1M	2442	Ant1	-0.193	30	Pass
NVNT	BLE 1M	2480	Ant1	-0.426	30	Pass
NVNT	BLE 2M	2402	Ant1	0.152	30	Pass
NVNT	BLE 2M	2442	Ant1	-0.026	30	Pass
NVNT	BLE 2M	2480	Ant1	-0.241	30	Pass

#### Power NVNT BLE 1M 2402MHz Ant1



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### Power NVNT BLE 1M 2480MHz Ant1



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#### -6dB Bandwidth

Condition	Mode	Frequency	Antenna	-6 dB	Limit -6 dB	Verdict
		(MHz)		Bandwidth	Bandwidth	
				(MHz)	(MHz)	
NVNT	BLE 1M	2402	Ant1	0.645	0.5	Pass
NVNT	BLE 1M	2442	Ant1	0.661	0.5	Pass
NVNT	BLE 1M	2480	Ant1	0.643	0.5	Pass
NVNT	BLE 2M	2402	Ant1	1.125	0.5	Pass
NVNT	BLE 2M	2442	Ant1	1.113	0.5	Pass
NVNT	BLE 2M	2480	Ant1	1.122	0.5	Pass

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### -6dB Bandwidth NVNT BLE 1M 2480MHz Ant1



-6dB Bandwidth NVNT BLE 2M 2402MHz Ant1



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### -6dB Bandwidth NVNT BLE 2M 2442MHz Ant1



-6dB Bandwidth NVNT BLE 2M 2480MHz Ant1

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#### **Occupied Channel Bandwidth**

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)
NVNT	BLE 1M	2402	Ant1	1.0234
NVNT	BLE 1M	2442	Ant1	1.0188
NVNT	BLE 1M	2480	Ant1	1.0262
NVNT	BLE 2M	2402	Ant1	2.0071
NVNT	BLE 2M	2442	Ant1	2.0037
NVNT	BLE 2M	2480	Ant1	1.9890

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## OBW NVNT BLE 1M 2480MHz Ant1



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## OBW NVNT BLE 2M 2442MHz Ant1



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#### **Maximum Power Spectral Density Level**

Condition	Mode	Frequency	Antenna	Max PSD	Limit	Verdict
		(MHz)		(dBm)	(dBm/3KHz)	
NVNT	BLE 1M	2402	Ant1	-10.31	8	Pass
NVNT	BLE 1M	2442	Ant1	-10.55	8	Pass
NVNT	BLE 1M	2480	Ant1	-10.782	8	Pass
NVNT	BLE 2M	2402	Ant1	-10.991	8	Pass
NVNT	BLE 2M	2442	Ant1	-11.059	8	Pass
NVNT	BLE 2M	2480	Ant1	-11.26	8	Pass

#### PSD NVNT BLE 1M 2402MHz Ant1



#### PSD NVNT BLE 1M 2442MHz Ant1

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### PSD NVNT BLE 1M 2480MHz Ant1



### PSD NVNT BLE 2M 2402MHz Ant1



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#### PSD NVNT BLE 2M 2442MHz Ant1



#### PSD NVNT BLE 2M 2480MHz Ant1

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#### Band Edge

Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	Ant1	-54.73	-20	Pass
NVNT	BLE 1M	2480	Ant1	-53.35	-20	Pass
NVNT	BLE 2M	2402	Ant1	-55.06	-20	Pass
NVNT	BLE 2M	2480	Ant1	-54.11	-20	Pass

#### Band Edge NVNT BLE 1M 2402MHz Ant1 Ref



#### Band Edge NVNT BLE 1M 2402MHz Ant1 Emission

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### Band Edge NVNT BLE 1M 2480MHz Ant1 Ref



### Band Edge NVNT BLE 1M 2480MHz Ant1 Emission