FCC- TEST REPORT									
Report Number	64.790.21.02220.01 Date of Issue: June 11, 2021	_							
Model	: TREKC2	_							
Product Type	: Temperature Data logger	_							
Applicant	: Parsyl Inc.	_							
Manufacturer	: Parsyl Inc.	_							
Address	: 2825 Larimer Street, Denver CO 80205 USA	_							
Test Result	Positive Degative								
Total pages including Appendices	29								

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# SUD

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# 2 Details about the Test Laboratory

### Details about the Test Laboratory

Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052, P. R. China
FCC Registration Number:	514049
IC Registration Number:	10320A
Telephone: Fax:	86 755 8828 6998 86 755 828 5299

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# 3 Description of the Equipment under Test

Product: Temperature Data logger

Model no.: TREKC2

FCC ID: 2AQ8LTREKC2

Battery type: 3V, CR2032

Operating Frequency Range: 2402~2480MHz

Modulation: GFSK

Antenna Type: PCB Antenna

Antenna Gain: 2.23dBi

Description of the EUT: EUT is a Temperature Data logger, 2.4GHz Bluetooth technology was used for communicating.

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# 4 Summary of Test Standards

Test Standards					
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES				
10-1-2020 Edition	Subpart C - Intentional Radiators				

All the test methods were according to KDB558074 D01 v05r02 and ANSI C63.10 (2013).

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# 5 Summary of Test Results

	Technical Requirements							
FCC Part 15 Subpart C								
Test Condition		Pages	Test Result	Test Site				
§15.207	Conducted emission AC power port	10	N/A	N/A				
§15.247(b)(1)	Conducted peak output power	11-12	Pass	Site 1				
§15.247(e)	Power spectral density	17-18	Pass	Site 1				
§15.247(a)(2)	6dB bandwidth and 99% occupied bandwidth	13-16	Pass	Site 1				
§15.247(d)	Spurious RF conducted emissions	19-22	Pass	Site 1				
§15.247(d)	Band edge	23-24	Pass	Site 1				
§15.247(d) & §15.209 & §15.205	Spurious radiated emissions for transmitter	25-27	Pass	Site 1				
§15.203	Antenna requirement	See note 1	Pass					

Note 1: The EUT uses an PCB Antenna, which gain is 2.23dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

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#### **General Remarks** 6

#### Remarks

This submittal(s) (test report) is intended for FCC ID: 2AQ8LTREKC2 complies with Section 15.247,15.209, 15.205 and 15.203 of the FCC Part 15, Subpart C. This report is for the BLE part.

#### SUMMARY:

All tests according to the regulations cited on page 5 were

Performed

□ - Not Performed

The Equipment under Test

- Fulfills the general approval requirements.
- □ **Does not** fulfill the general approval requirements.

Sample Received Date: April 30, 2021

Testing Start Date: May 5, 2021

Testing End Date:

- TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch -

May 18, 2021

Reviewed by:

Prepared by:

Tested by:

eter

Matt zhang

Peter Jia

Matt Zhang

Hardy Huang

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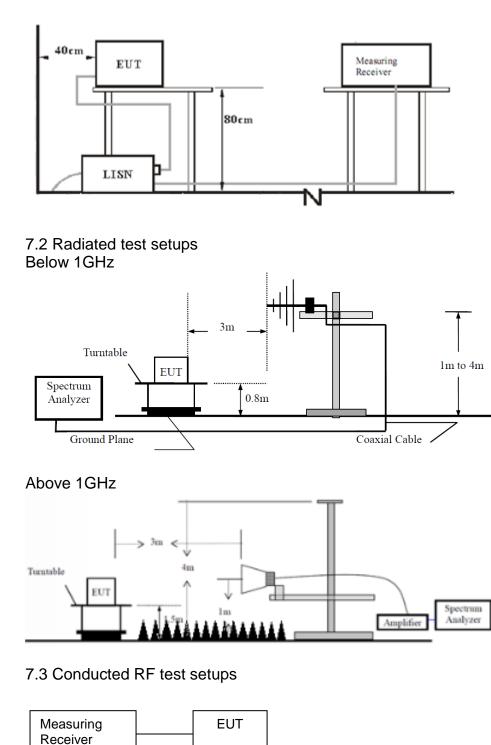
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# 7 Test Setups

# 7.1 AC Power Line Conducted Emission test setups



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# 8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Laptop	Lenovo	X240	L34015282

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# 9 Technical Requirement

# 9.1 Conducted Emission

#### **Test Method**

- 1. The EUT was placed on a table, which is 0.8m above ground plane
- 2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
- 3. Maximum procedure was performed to ensure EUT compliance
- 4. A EMI test receiver is used to test the emissions from both sides of AC line

# Limit

Frequency	QP Limit	AV Limit
MHz	dBµV	dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

#### \* Decreasing linear

### **Test result: Not Performed**

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# 9.2 Conducted peak output power

#### **Test Method**

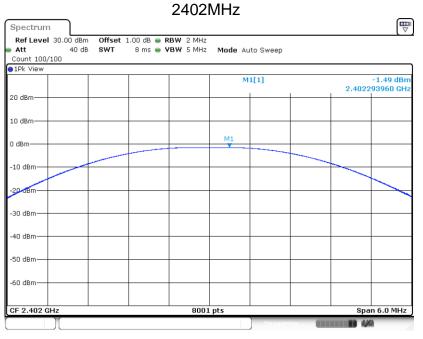
- Use the following spectrum analyzer settings: RBW > the 6 dB bandwidth of the emission being measured, VBW≥3RBW, Span≥3RBW Sweep = auto, Detector function = peak, Trace = max hold.
- 2. Add a correction factor to the display.
- 3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

#### Limits

Frequency Range	Limit	Limit
MHz	W	dBm
2400-2483.5	≤1	≤30

Test result as below table

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	-1.49	Pass
Middle channel 2440MHz	-1.87	Pass
High channel 2480MHz	-2.11	Pass

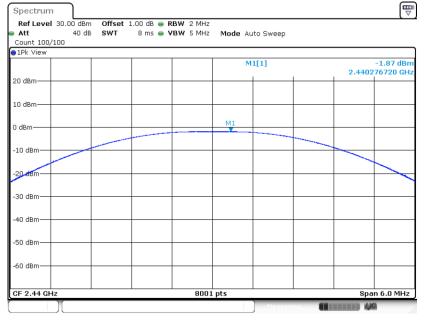


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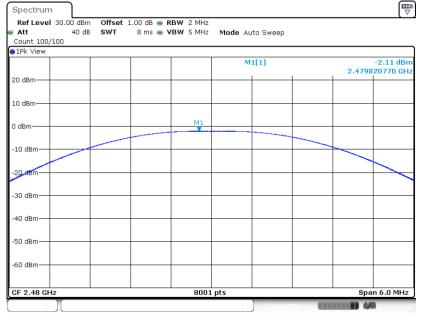
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#### 2480MHz



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# 9.3 6dB bandwidth and 99% Occupied Bandwidth

#### **Test Method**

- 1. Use the following spectrum analyzer settings:
- RBW=100K, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold 2. Use the automatic bandwidth measurement capability of an instrument, may be
- employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be  $\geq$  6 dB.
- 3. Allow the trace to stabilize, record the X dB Bandwidth value.

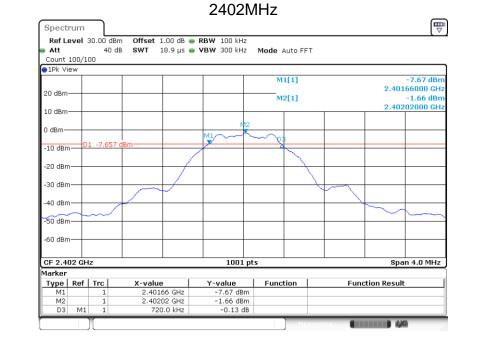
#### Limit

Limit [kHz]

≥500

#### Test result

TestMode	Channel [MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Verdict
	2402	0.720	2401.660	2402.380	PASS
BLE	2440	0.720	2439.656	2440.376	PASS
	2480	0.716	2479.660	2480.376	PASS



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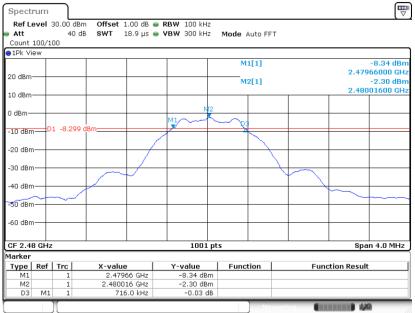
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Ref Level Att				RBW 100 kHz					
Att Count 100/		IGB SWI	18.9 hz 🖷	VBW 300 kHz	Mode /	Auto FFT			
1Pk View									
					M	1[1]			-8.20 dBn
20 dBm								2.43	965600 GH
					M	2[1]			-2.05 dBn
LO dBm —								2.44	001600 GH
				N <sub>12</sub>					
) dBm —				M1	~				-
10.10	01 -8.05	53 dBm			~~ v				
-10 dBm									
20 dBm									
Lo ubiii									
30 dBm-+									
			~			`			
40 dBm				+				~~	-
	~~~								+
50 dBm									
60 dBm									
CF 2.44 GH	-			1001 m				- Con	an 4.0 MHz
arker	2			1001 p				spo	3N 4.0 MHZ
	Trc	X-value		Y-value	Func	tion	Euno	tion Resul	•
M1	1	2.4396		-8.20 dBm	Func	cion	Func	aon kesu	
M2	1	2.4400		-2.05 dBm					
D3 M:	ι 1	720	.0 kHz	0.05 dB					

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#### 2480MHz

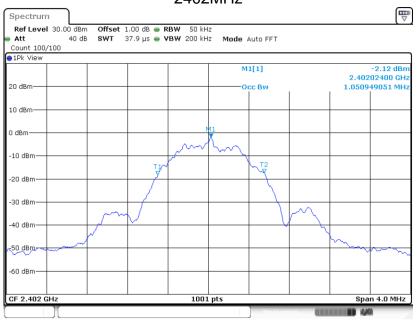


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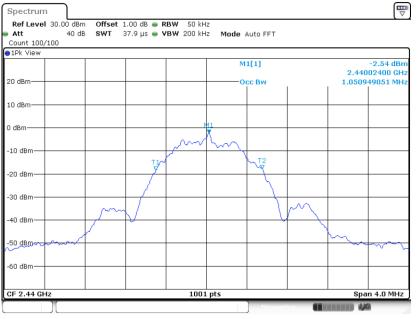


TestMode	Channel [MHz]	OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
	2402	1.051	2401.500	2402.551	PASS
BLE	2440	1.051	2439.500	2440.551	PASS
	2480	1.051	2479.500	2480.551	PASS



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#### 2440MHz



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## 9.4 Power spectral density

#### **Test Method**

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

- Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW≥3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
- 2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
- 3. Repeat above procedures until other frequencies measured were completed.

#### Limit

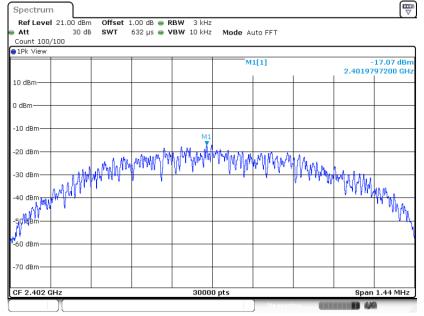
#### Limit [dBm/3KHz]

≪8

Test result

	Power spectral	
Frequency	density	Result
MHz	dBm/3KHz	
Top channel 2402MHz	-17.07	Pass
Middle channel 2440MHz	-17.48	Pass
Bottom channel 2480MHz	-17.76	Pass



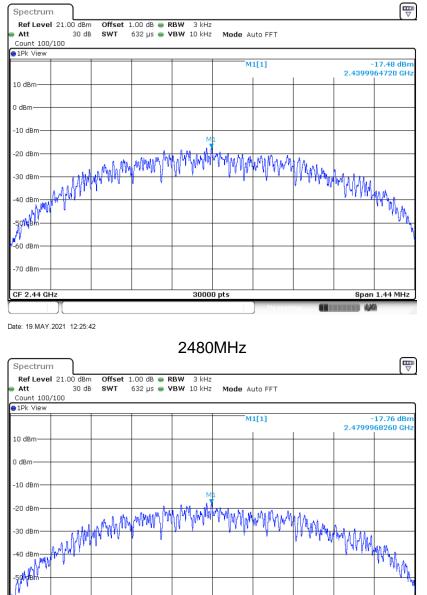


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Date: 19.MAY.2021 12:29:29

-70 dBm -70 dBm CF 2.48 GH:

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Span 1.432 MHz

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30000 pts



# 9.5 Spurious RF conducted emissions

#### **Test Method**

- 1. Establish a reference level by using the following procedure:
  - a. Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.
  - b. Allow trace to fully stabilize, use the peak marker function to determine the maximum PSD level.
- 2. Use the maximum PSD level to establish the reference level.
  - a. Set the center frequency and span to encompass frequency range to be measured.
  - b. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements, report the three highest emissions relative to the limit.
- 3. Repeat above procedures until other frequencies measured were completed.

#### Limit

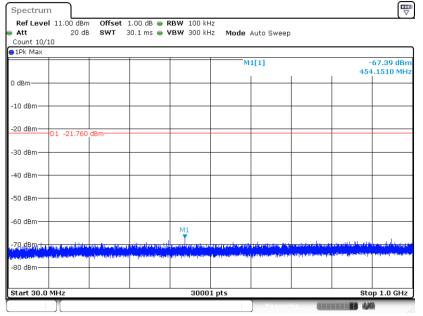
Frequency Range MHz	Limit (dBc)
30-25000	-20

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# SUD

## **Spurious RF conducted emissions**

2402MHz



Date: 19.MAY.2021 12:24:18

Ref Level 20.	00 dBm Offset	1.00 dB 😑 🛙	RBW 100 kH	z				
Att	30 dB SWT	255 ms 😑 🕻	<b>VBW</b> 300 kH	z Mode	Auto Sweep			
Count 9/10								
1Pk Max				м	1[1]			52.02 dBr
LO dBm							22.6	46100 GH
I dBm								
10 dBm								
20 dBm D1 -	21.760 dBm							
30 dBm								
40 dBm		-						
							M1	
50 dBm	1 .			a sector da sida	alles at a tra	المراجع والمحمد الم		U
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70 dBm								
tart 1.0 GHz		1	3000	1 nts	1	1	Stor	26.5 GHz

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Count 10/1 1Pk Max	10								
1 K MGA					м	1[1]			-68.02 dBr 2.9630 MH
I dBm									
10 dBm									
20 dBm	D1 -22.050	dBm							
30 dBm									
0 dBm									
i0 dBm—									
i0 dBm—									M1
			a linia na sa					www.bijp.ell.p	The second second
io dBm	ي والالانترانية ومن الرومي الاروالانترانية ومن الرومي	genterer (d. Constaller	al ()) ani al t-durgan air.	Filmelle Mandalad Mada	an faran fariha ya ƙasar	a here a first her to be first from	an a	ويتطري يبير أستغالي بطير	at a high median fight out,
tart 30.0				3000					p 1.0 GHz

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	30 dB SWT	1.00 dB 👄 R 255 ms 👄 V			Auto Sweep			
Count 9/10 1Pk Max								
				М	1[1]			-51.54 dBn 599200 GH
LO dBm								
) dBm								
10 dBm								
20 dBm-01 -22	2.050 dBm							
30 dBm								
10 dBm								
50 dBm					M1 Malana ata	and a s		
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and we have been a state of the second		of the P. St. a. Lard	1					
70 dBm								
start 1.0 GHz			3000					26.5 GHz

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Att 20 dB S Count 10/10	WT 30.1 ms 👄 🕅	/BW 300 kHz	Mode Auto Sweep	)		
) 1Pk Max			M1[1]			67.07 dBn .0850 MH:
) dBm						
10 dBm						
20 dBmD1 -22.350_dBm						
30 dBm						
40 dBm						
50 dBm						
60 dBm					M1	
70 dBm and the second budget	and the state of the sector of	a a a a a a a a a a a a a a a a a a a		hippotetoretateret	halden	hatthatal
80 dBm	internet (Automorphic Constraints) (Automorphic Constraints)	n an an gu tha an an thirth	and and a state of a st	e dour de Transfor politici de Transforma	or her party and her the	and generation from the
Start 30.0 MHz		30001 p				p 1.0 GHz

Date: 19.MAY.2021 12:29:50

Ref Level 20.00 dBm	Offect 1 00 dB	RBW 100 kH;	7		
Att 30 dB		VBW 300 kH;		ер	
Count 8/10					
1Pk Max			M1[1]		-51.28 dBn 20.021300 GH
0 dBm				+ +	
dBm					
LO dBm					
20 dBm D1 -22.350	dBm				
30 dBm					
10 dBm					
50 dBm	di anno di sa ci ci ci ci ci ci	المراقبة الأربي والمراجع	والمراجع وال	M1	Millioans and a direct color
	ana na kata ng Katalang. Ng tanggang katalang	Subsequences and a strain of the	a sector and the sect	- Andread and a second s	A A STATE OF THE OWNER
70 dBm					
tart 1.0 GHz		3000			Stop 26.5 GHz

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# 9.6 Band edge

#### **Test Method**

1 Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold.

- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.

### Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

#### **Test result**

Ref Leve	20.00 dBr	n Offset 1.00 dB	BRBW 100 kHz			
Att Count 300	30 di	в <b>SWT</b> 246.5 µs (	<b>9 VBW</b> 300 kHz	Mode Auto F	FT	
1Pk View	/300					
				M1[1]		-1.66 dB
10 dBm						2.402040 G
				M2[1]		-52.04 dB 2.400000
0 dBm——					1	1 1
-10 dBm—						
-20 dBm	D1 -21.660	) dBm				
-30 dBm						
-30 ubiii						
-40 dBm—						
						Ma
-50 dBm						
-60 dBm		mound	Moto North	0.0	N. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	M3 W
and marked M	mmunor	and more than and the		marken	www.www.www.	markatheren
-70 dBm—						
Start 2.3 (	GHz		691 pts			Stop 2.405 GH
larker						
	f Trc	X-value	Y-value	Function	Fun	ction Result
M1	1	2.40204 GHz	-1.66 dBm			
M2 M3	1	2.4 GHz 2.39 GHz	-52.04 dBm -61.48 dBm			
M4	1	2.39 GHz	-52.89 dBm			

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	evel :	20.00 dBn			RBW 100 kHz				
Att		30 dE	SWT	1.1 ms 🧉	<b>VBW</b> 300 kHz	Mode Auto	Sweep		
Count :		00							
1Pk Vi	e₩								
						M1[1]			.45 dBr
10 dBm·									010 GH
						M2[1]			.12 dBr
) dBm—	1	41						2.483	500 GH
		ň							
10 dBm	י <b>⊢</b> רי	Н					<u> </u>		
		}					1		
20 dBm		1 -22.450	dBm						
		1							
30 dBm	י די	f h							
40 dBm	.	1							
40 081	'								
-50 dBm		<u> </u>							
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70 dBm	∩+-				++				
Start 2	.47 G	Hz			691 p	s		Stop 2.	55 GHz
larker									
	Ref	Trc	X-value	- 1	Y-value	Function	1	Function Result	
M1		1		01 GHz	-2.45 dBm				-
M2		1	2.48	35 GHz	-55.12 dBm				
M3		1	2	.5 GHz	-60.12 dBm				
M4		1	2.5440	37 GHz	-56.37 dBm				

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# 9.7 Spurious radiated emissions for transmitter

#### **Test Method**

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3-meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.

3: The height of antenna 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.

4: 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

5: Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 KHz to 120KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement ,Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1 MHz.

b) VBW  $\ [3 \times RBW]$ .

c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.

d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D,where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

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g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows: 1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels. 2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels. 3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

#### Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK



#### Spurious radiated emissions for transmitter

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

#### Transmitting spurious emission test result as below:

	Frequency	Emission Level	Polarization	Limit	Detector	Result
	MHz	dBuV/m		dBµV/m		
	952.71	36.70	Horizontal	46.00	QP	Pass
	948.95	36.22	Vertical	46.00	QP	Pass
2402MHz (At	oove 1GHz)					
,	Frequency	Emission Level	Polarization	Limit	Detector	Result
	MHz	dBuV/m		dBµV/m		
	2781.42*	44.35	Horizontal	74.00	PK	Pass
	11140.50*	47.15	Horizontal	74.00	PK	Pass
	2576.66	43.49	Vertical	74.00	PK	Pass
	9831.50	42.47	Vertical	74.00	PK	Pass
2440MHz (At	oove 1GHz)					
,	Frequency	Emission Level	Polarization	Limit	Detector	r Resul
	MHz	dBuV/m		dBµV/m	1	
	6645.50	43.63	Horizontal	74	PK	Pass
	9689.00	42.20	Horizontal	74	PK	Pass
	2666.66	43.68	Vertical	74	PK	Pass
	9677.50	43.10	Vertical	74	PK	Pass
2480MHz (At	oove 1GHz)					
	Frequency	Emission Level	Polarization	Limit	Detector	Result
	MHz	dBuV/m		dBµV/m		
	2830.00*	43.09	Horizontal	74.00	PK	Pass
	9731.00	42.70	Horizontal	74.00	PK	Pass
	2257.61*	43.68	Vertical	74.00	PK	Pass
	8694.50	43.06	Vertical	74.00	PK	Pass

- (1) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 10dB below the permissible limits or the field strength is too small to be measured.
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

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# **10 Test Equipment List**

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
CE	EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2021-6-29
	LISN	Rohde & Schwarz	ENV4200	100249	2021-6-12
	LISN	Rohde & Schwarz	ENV216	100326	2021-6-12
	ISN	Rohde & Schwarz	ENY81	100177	2021-6-12
	ISN	Rohde & Schwarz	ENY81- CAT6	101664	2021-6-12
	High Voltage Proble	Rohde & Schwarz	TK9420(VT9 420)	9420-584	2021-6-23
	RF Current probe	Rohde & Schwarz	EZ-17	100816	2021-6-28
С	Signal Generator	Rohde & Schwarz	SMB100A	108272	2021-6-21
	Signal Analyzer	Rohde & Schwarz	FSV40	101030	2021-6-21
	Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2021-6-22
	RF Switch Module	Rohde & Schwarz	OSP120/OS P-B157	101226/10085 1	2021-6-21
RE	EMI Test Receiver	Rohde & Schwarz	ESR 7	102176	2021-6-29
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2021-8-4
	Horn Antenna	Rohde & Schwarz	HF907	102294	2021-7-4
	Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2021-6-21
	3m Semi-anechoic chamber	TDK	9X6X6		2022-10-28

#### **List of Test Instruments**

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- Power spectral density
- Spurious RF conducted emissions
- Band edge
- Conducted emission AC power port

RE - Radiated RF tests

• Spurious radiated emissions for transmitter

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# **11 System Measurement Uncertainty**

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty				
Test Items	Extended Uncertainty			
Uncertainty for Radiated Emission in 3m chamber 30MHz-	Horizontal: 5.12dB;			
1000MHz	Vertical: 5.10dB;			
Uncertainty for Radiated Emission in 3m chamber 1000MHz-	Horizontal: 5.01dB;			
25000MHz	Vertical: 5.00dB;			
Uncertainty for Conducted Emission 150KHz-30MHz	U=3.21dB			
Uncertainty for conducted power test	1.16dB			
Frequency test involved:	0.6×10 <sup>-7</sup>			

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