

FCC 15.247 & RSS-247 2.4GHz Test Report

for

Sunrex Technology Corp

**No. 475, Sec. 4, Chang Ping Road, Daya Dist.,
Taichung City 428, Taiwan**

Product Name : Wireless Dongle
Model Name : TPA-S001D
Brand : hp
FCC ID : J75TPAS001D
IC : 7090A-TPAS001D

**Prepared by: : AUDIX Technology Corporation,
EMC Department**



The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.

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APPENDIX A TEST DATA AND PLOTS

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TEST REPORT

Applicant : Sunrex Technology Corp
Manufacturer : Sunrex Technology Corp
Factory : Jing Mold Electronics Technology (ShenZhen) Co., Ltd.
EUT Description
(1) Product : Wireless Dongle
(2) Model : TPA-S001D
(3) Brand : hp
(4) Power Supply: DC 5V

Applicable Standards:

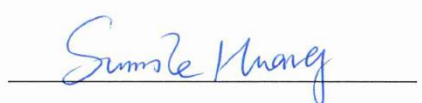
Title 47 CFR FCC Part 15 Subpart C
RSS-Gen (Issue 5), Amendment 2, February 2021
RSS-247 (Issue 2), February 2017
ANSI C63.10:2013

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Audix Technology Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

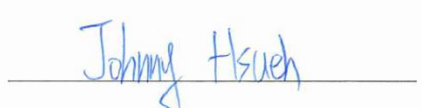
Date of Report: 2023. 05. 15

Reviewed by:



(Sunnie Huang/Administrator)

Approved by:



(Johnny Hsueh/Section Manager)



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1. REVISION RECORD OF TEST REPORT

Edition No	Issued Date	Revision Summary	Report Number
0	2023. 05. 15	Original Report	EM-F230249

2. SUMMARY OF TEST RESULTS

Rule		Description	Results
FCC	IC		
15.207	RSS-Gen §8.8	Conducted Emission	PASS
15.247(d)/ 15.205	RSS-Gen §8.9 RSS-247 §5.5	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(2)	RSS-247 §5.2(1)	DTS/Occupied Bandwidth	PASS
15.247(b)(3)	RSS-247 §5.4(4)	Maximum Peak Output Power	PASS
15.247(d)	RSS-247 §5.5	Conducted Band Edges and Conducted Spurious Emission	PASS
15.247 (e)	RSS-247 §5.2(2)	Peak Power Spectral Density	PASS
15.203	---	Antenna Requirement	Compliance
Note:			
1. Decision rule according to the limit of the test standard chapter, the test value is lower than the limit specified in the test chapter, and it is judged as Pass.			
2. The uncertainties value is not used in determining the result.			

3. GENERAL INFORMATION

3.1. Description of Application

Applicant	Sunrex Technology Corp No. 475, Sec. 4, Chang Ping Road, Daya Dist., Taichung City 428, Taiwan
Manufacturer	Sunrex Technology Corp No. 475, Sec. 4, Chang Ping Road, Daya Dist., Taichung City 428, Taiwan
Factory	Jing Mold Electronics Technology (ShenZhen) Co., Ltd. Xinqiao 3rd Industrial Estate, Shajing, Baoan, Shenzhen, Guangdong, China
Product	Wireless Dongle
Brand	hp
Model	TPA-S001D

3.2. Description of EUT

Test Model	TPA-S001D		
Serial Number	N/A		
Software Version	N/A		
Power Rating	DC 5V		
RF Features	Wireless 2.4GHz: GFSK		
Transmit Type	1T1R		
Sample Status	Trial sample		
Test Sample	Sample No.	Test Item	Firmware
	01	AC Conduction, RSE, Output Power	N/A
Date of Receipt	2023. 04. 18		
Date of Test	2023. 04. 24 ~ 28		
Interface Ports of EUT	• USB Port		
Accessories Supplied	• Wireless Keyboard		

Note: Pursuant ISO 17025:2017 section 7.8.2, **Audix Technology Corp.** does not assume responsibility for all EUT's information including RF features, transmit type, antenna information...etc. are provided by customer.

3.3. Antenna Information

No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (MHz)	Gain(dBi)
1.	WAN5020D245W36	ONEWAVE	Chip	2400-2500	3.49

3.4. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
Wireless 2.4GHz	2402-2480	79	GFSK	1

Channel List							
Wireless 2.4GHz							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

3.5. Descriptions of Key Components

Item	Supplier/Brand	Model	Specification
Wireless Keyboard	hp	TPA-S001K	(1)Wireless 2.4GHz: GFSK (2)BLE: GFSK DC 1.5V (Battery AAAx2)

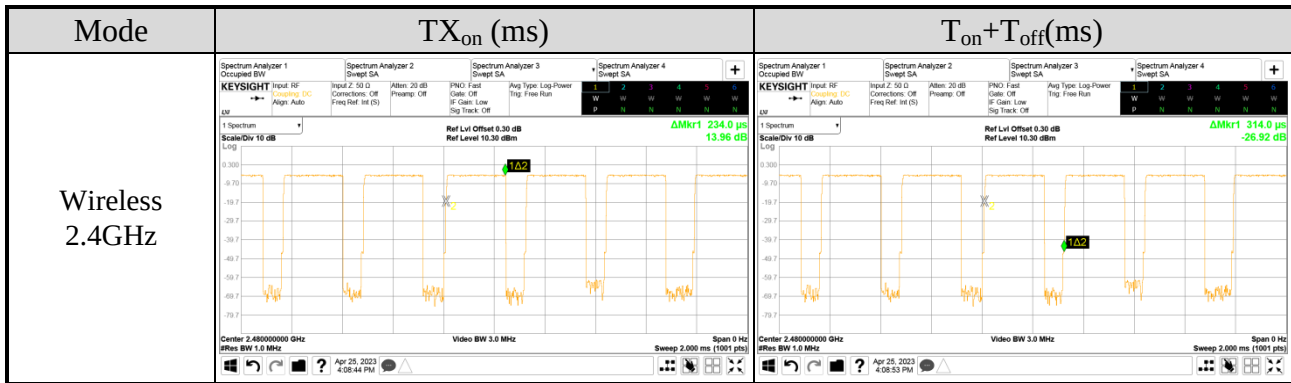
Remark: For more detailed features description, please refer to the manufacturer's specifications or the user manual.

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3.6. Test Configuration

Mode	TX _{on} (ms)	TX _{on+off} (ms)	1/ TX _{on} (kHz)	Duty Cycle (x)	VBW(>1/ TX _{on}) (kHz)
Wireless 2.4GHz	0.234	0.314	4.274	0.745	4.3



AC Conduction				
Operating				

Item		Mode	Data Rate	Test Frequency
Radiated Test Case	Radiated Spurious Emission (30MHz~1GHz)	Wireless 2.4GHz	1Mbps	2480
	Radiated Band Edge ^{Note1}	Wireless 2.4GHz	1Mbps	2402/2480
	Radiated Spurious Emission ^{Note1 & 2}	Wireless 2.4GHz	1Mbps	2402/2441/2480

Item		Mode	Data Rate	Test Frequency
Conducted Test Case	DTS/Occupied Bandwidth	Wireless 2.4GHz	1Mbps	2402/2441/2480
	Peak Output Power	Wireless 2.4GHz	1Mbps	2402/2441/2480
	Band Edge	Wireless 2.4GHz	1Mbps	2402/2480
	Spurious Emission	Wireless 2.4GHz	1Mbps	2402/2441/2480
	Peak Power Spectral Density	Wireless 2.4GHz	1Mbps	2402/2441/2480

Note 1: ☐ Mobile Device ☒ Portable Device,

and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ☒ Lie ☐ Side ☐ Stand

Note 2: Low, mid, and high channels were measured, only the worst channel was presented in this report.

3.7. Output Power Setting

Mode	Centre Frequency (MHz)	Power Setting
Wireless 2.4GHz	2402	Default
	2441	Default
	2480	Default

3.8. Tested Supporting System List

3.8.1. Support Peripheral Unit

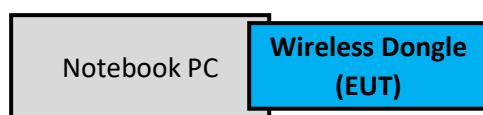
No.	Product	Brand	Model No.	Serial No.	Approval
1.	Notebook PC	Dynabook	Dynabook CS40L-HB	N/A	N/A

3.8.2. Cable Lists

No.	Cable Description Of The Above Support Units
1.	USB Cable: Unshielded, Detachable, 2.0m Adapter: BSY, M/N: BSY065T1902103 D, DC Cord : Shielded, Undetachable, 1.8m AC Power Cord : Unshielded, Detachable, 1.8m

3.9. Setup Configuration

3.9.1. EUT Configuration for Radiated Emission



3.9.2. EUT Configuration for RF Conducted Test Items



3.10. Operating Condition of EUT

The Spectrum Analyzer run the test program “PXI_Link_TOOL” is used for enabling EUT Wireless 2.4GHz function under continues transmitting and choosing channel.

3.11. Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 491, Zhongfu Rd., Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2017 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	FCC OET Designation Number under APEC MRA by NCC is : TW1724 ISED CAB Identifier Number under APEC TEL MRA by NCC is TW1724 (1) No.1 3m Semi Anechoic Chamber

3.12.Measurement Uncertainty

The measurement uncertainty levels have been estimated as specified in ETSI TR 100 028-2001

Test Items/Facilities			Frequency Range	Uncertainty
Conduction Test	☐	No. 7 Shielded Room	30MHz-200MHz, 3m, Horizontal	±3.7dB
			200MHz-1000MHz, 3m, Horizontal	±3.4dB
	☒	No. 8 Shielded Room	30MHz-200MHz, 3m, Vertical	±3.7dB
			200MHz-1000MHz, 3m, Vertical	±3.5dB
Radiation Test	☒	No.1 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.6dB
			200MHz-1000MHz, 3m, Horizontal	±4.3dB
			30MHz-200MHz, 3m, Vertical	±4.4dB
			200MHz-1000MHz, 3m, Vertical	±4.8dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.5dB
	☐	No.3 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±3.7dB
			200MHz-1000MHz, 3m, Horizontal	±4.1dB
			30MHz-200MHz, 3m, Vertical	±4.6dB
			200MHz-1000MHz, 3m, Vertical	±4.9dB
			1GHz-6GHz, 3m	±4.7dB
			6GHz-18GHz, 3m	±4.1dB
	☐	No.4 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.0dB
			200MHz-1000MHz, 3m, Horizontal	±4.4dB
			30MHz-200MHz, 3m, Vertical	±4.7dB
			200MHz-1000MHz, 3m, Vertical	±4.5dB
			1GHz-6GHz, 3m	±4.8dB
			6GHz-18GHz, 3m	±4.5dB
	☐	No.5 3m Semi Anechoic Chamber	30MHz-200MHz, 3m, Horizontal	±4.3dB
			200MHz-1000MHz, 3m, Horizontal	±4.2dB
			30MHz-200MHz, 3m, Vertical	±4.8dB
			200MHz-1000MHz, 3m, Vertical	±4.7dB
			1GHz-6GHz, 3m	±4.6dB
			6GHz-18GHz, 3m	±4.4dB
		Radiated emissions (18GHz-40GHz)	18GHz-40GHz, 3m	±3.4dB

Remark : Uncertainty = $k_{uc}(y)$

Test Items	Uncertainty
6dB Bandwidth	± 0.05kHz
Maximum peak output power	± 0.33dB
Power spectral density	± 0.13dB
Conducted Emission Limitations	± 0.13dB

4. MEASUREMENT EQUIPMENT LIST

4.1. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2022.08.24	1 Year
2.	Test Receiver	R&S	ESCS30	100038	2022.06.15	1 Year
3.	Amplifier	HP	8447D	2944A06305	2022.12.29	1 Year
4.	Microwave Amplifier	Agilent	8449B	3008A01284	2022.06.01	1 Year
5.	Microwave Amplifier	Keysight	83051A	MY56480113	2022.09.07	1 Year
6.	Loop Antenna	TESEQ	HLA 6121	60478	2023.02.21	1 Year
7.	Bilog Antenna	TESEQ	CBL6112D	33821	2022.07.01	1 Year
8.	Horn Antenna	EMCO	3115	9609-4927	2022.07.13	1 Year
9.	Horn Antenna	COM-POWER	AH-840	101092	2022.12.30	1 Year
10.	2.4GHz Notch Filter	K&L Microwave	7NSL10-2441.5/ E130.5-O/O	2	2022.07.23	1 Year
11.	3GHz Notch Filter	Microwave	H3G018G1	484796	2022.07.23	1 Year
12.	Coaxial Cable	MIYAZAKI	5D2W	RE-11	2023.01.07	1 Year
13.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 106	RE-14	2023.01.07	1 Year
14.	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102	RE-30	2022.08.22	1 Year
15.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.1 3m A/C	2023.04.13	1 Year
16.	Test Software	Audix	e3	V9 18621a	N.C.R.	N.C.R.

4.2. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9020B-544	MY57120357	2023.02.22	1 Year
2.	Digital Thermo-Hygro Meter	iMax	HTC-1	RF-03	2023.04.13	1 Year



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5. CONDUCTED EMISSION

The conducted disturbance voltage limits are not required for EUT which only employ DC battery for operation.

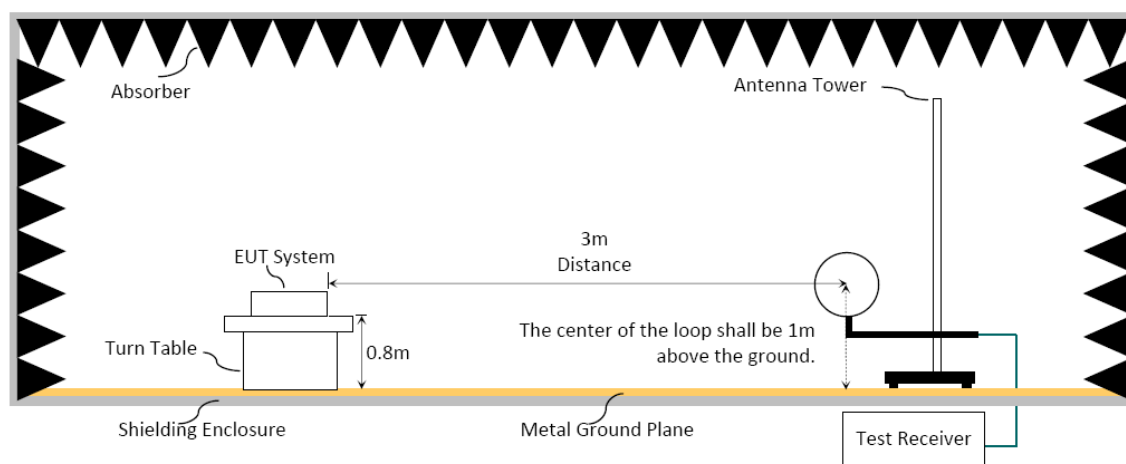
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

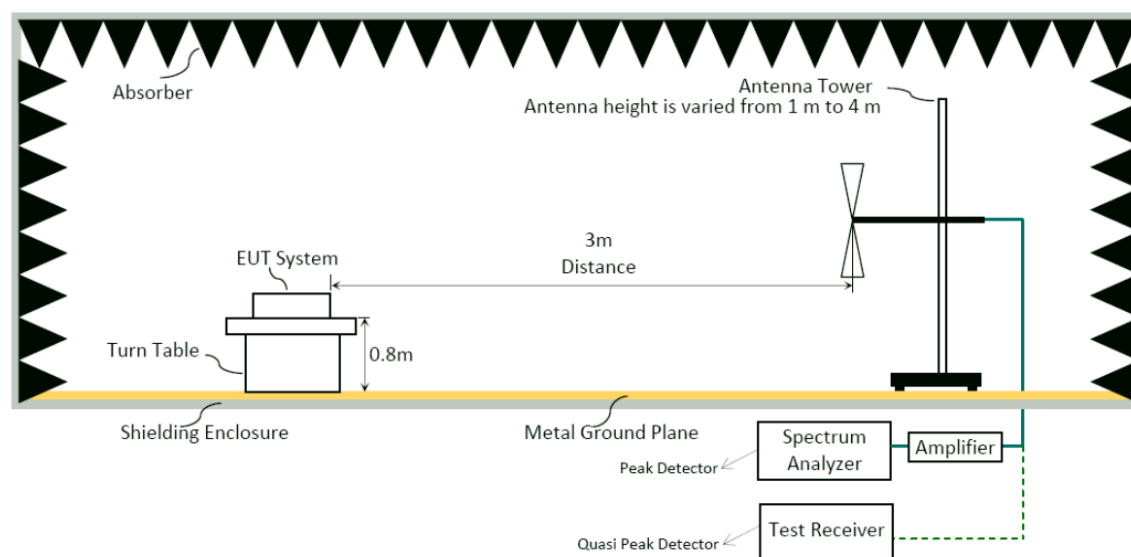
6.1.1. Block Diagram of EUT

Indicated as section 3.10

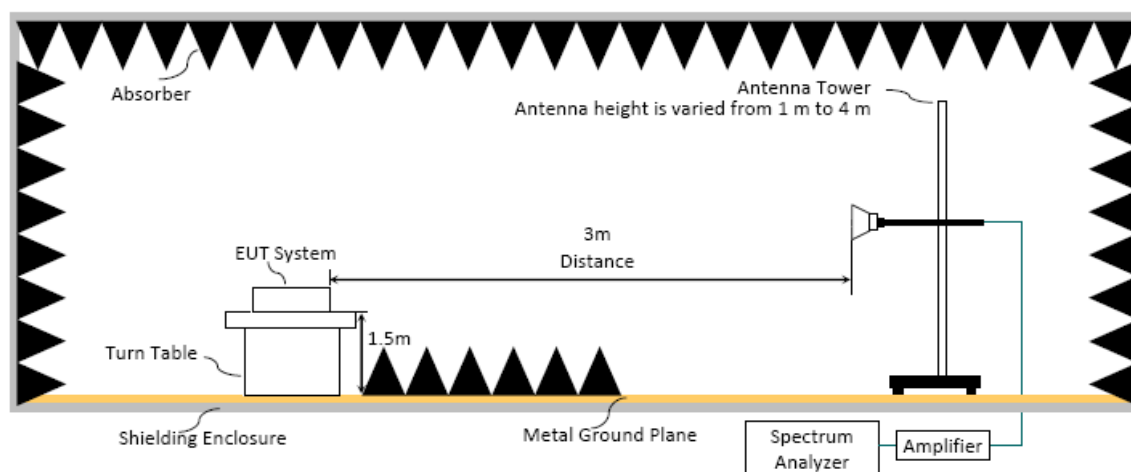
6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000MHz



6.1.4. Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance(m)	Limits	
		dBμV/m	μV/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark : (1) $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

6.3. Test Procedure

Frequency Range 9kHz~30MHz:

The EUT setup on the turntable which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

- (1) RBW = 9kHz with peak and average detector.
- (2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

Frequency Range 30MHz ~ 25GHz:

The EUT setup on the turn table which has 80cm (for 30-1000MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1GHz:

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120KHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.

Note 1: When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required, otherwise using Q.P. for final measurement.

Note 2: When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Frequency above 1GHz to 10th harmonic (up to 25 GHz):

Peak Detector:

- (1) RBW = 1MHz
- (2) VBW $\geq 3 \times$ RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.

Note: When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

Average Detector:

■ Option 1:

(1) RBW = 1MHz

(2) VBW $\geq 1/T$. (Duty Cycle $< 98\%$, when duty cycle presented in section 3.7)

Modulation Type	VBW Setting (VBW $\geq 1/T$)
Wireless 2.4GHz	4.3 kHz

(3) VBW = 10Hz (Duty Cycle $\geq 98\%$, when duty cycle presented in section 3.7)

(4) Detector = Peak.

(5) Sweep time = auto.

(6) Trace mode = max hold.

(7) Allow sweeps to continue until the trace stabilizes.

□ Option 2:

Average Emission Level = Peak Emission Level + D.C.C.F.

6.4. Measurement Result Explanation

■ Peak Emission Level (dB μ V/m) = Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) + Reading (dB μ V).

■ Average Emission Level (dB μ V/m) = Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) + Reading (dB μ V).

□ Average Emission Level (dB μ V/m) = Peak Emission Level (dB μ V/m) + DCCF (dB)
Duty Cycle Correction Factor (DCCF) (dB) = $20\log(TX_{on}/TX_{on+off})$ presented in section 3.7.

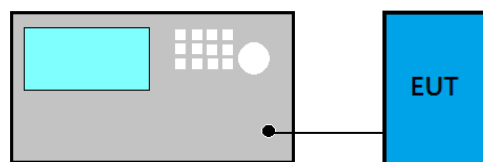
□ ERP (dBm) = Peak Emission Level (dB μ V/m) - 95.2dB - 2.14dB

6.5. Test Results

Please refer to Appendix A.

7. DTS/OCCUPIED BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The minimum 6dB bandwidth shall be at least 500kHz.

7.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

For DTS Bandwidth

- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x to -6dB power to record the final bandwidth..

For 99% Occupied Bandwidth

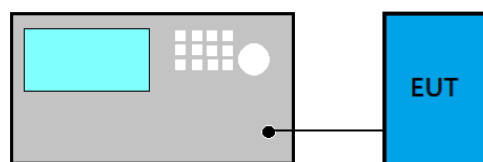
- (1) Set Span range 1.5~5 times the OBW
- (2) Set RBW close to 1% to 5% of OBW.
- (3) Set $\text{VBW} \geq 3 \times \text{RBW}$.
- (4) Detector = Peak.
- (5) Trace mode = Max hold
- (6) Sweep = Auto couple.
- (7) Allow the trace to stabilize.

7.4. Test Results

Please refer to Appendix A

8. MAXIMUM PEAK OUTPUT POWER

8.1. Block Diagram of Test Setup



8.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5MHz is : 1Watt. (30dBm), and E.I.R.P.: 4Watt (36dBm)

8.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

■ PKPM1 Peak power meter method:

EUT is connected to power sensor and record the maximum output power.

■ Maximum peak conducted output power method:

- (1) Set the RBW $\geq$ DTS bandwidth
- (2) Set VBW $\geq 3 \times$ RBW
- (3) Set span $\geq 3 \times$ RBW.
- (4) Sweep time = auto couple
- (5) Detector = peak.
- (6) Trace mode = max hold.
- (7) Allow trace to fully stabilize.
- (8) Use peak marker function to determine the peak amplitude level.

■ Method AVGPM (Measurement using an RF average power meter):

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.7 is $< 98\%$.

□ Method AVGSA-2 (Spectrum channel power)

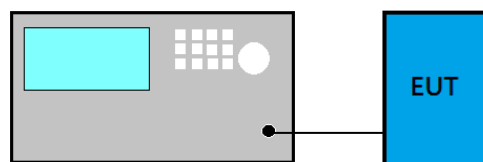
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 -5% of OBW
- (3) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.
- (8) Duty cycle factor is added when duty cycle presented in section 3.7 is $< 98\%$.

8.4. Test Results

Please refer to Appendix A

9. EMISSION LIMITATIONS

9.1. Block Diagram of Test Setup



9.2. Specification Limits

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, that the required attenuation shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4 is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a)/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4 (See Section 15.205(c)).

9.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

■ Reference Level

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max PSD as reference level.

■ Emission Level Measurement

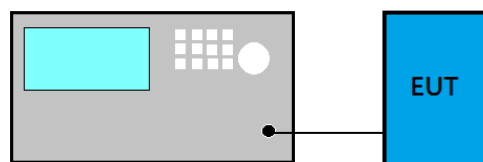
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW $\geq 3 \times$ RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max level.

9.4. Test Results

Please refer to Appendix A

10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band.

10.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

■ Method PKPSD (peak PSD)

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- (4) Set the VBW $\geq 3 \times \text{RBW}$.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize.
- (9) Use the peak marker function to determine the maximum amplitude level.
- (10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

□ Method AVGPSD-2

- (1) Using peak PSD procedure step 1 to step 4.
- (2) Detector = RMS detector
- (3) Sweep time = auto couple
- (4) Trace mode = trace averaging over a minimum of 100 traces
- (5) Use the peak marker function to determine the maximum amplitude level.
- (6) Duty cycle factor is added when duty cycle presented in section 3.7 < 98%.
- (7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.4. Test Results

Please refer to Appendix A



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11.DEVIATION TO TEST SPECIFICATIONS

【NONE】



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APPENDIX A

TEST DATA AND PLOTS

(Model: TPA-S001D)

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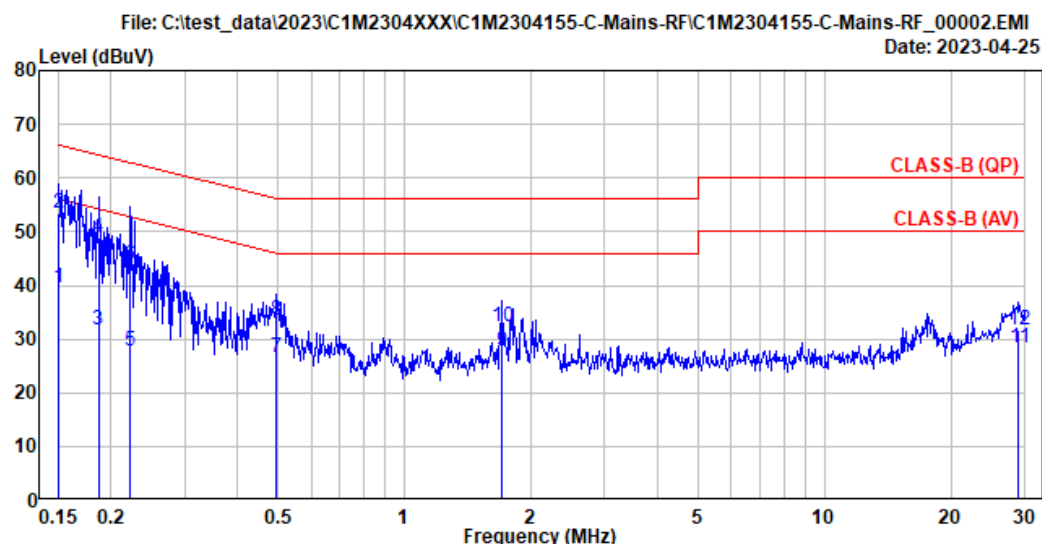
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A.1 CONDUCTED EMISSION

Test Date	2023/02/21	Temp./Hum.	22°C/50%
Test Voltage	DC 5V (Via Notebook PC)	Tested By	Harry Huang



Site No.	: No.8 Shielded Room	Data No.	: 2
Instrument 1	: Receiver ESR(774)		
Instrument 2	: ENV432 (567)(A) CE-08 ESH3-Z2 (354)		
Limit	: CLASS-B (QP)	Phase	: Neutral
Environment	: 26°C/53%	Test Rating	: DC 5V
EUT Model	: TPA-S001D	Engineer	: Nick Du
Test Mode	: Operating		

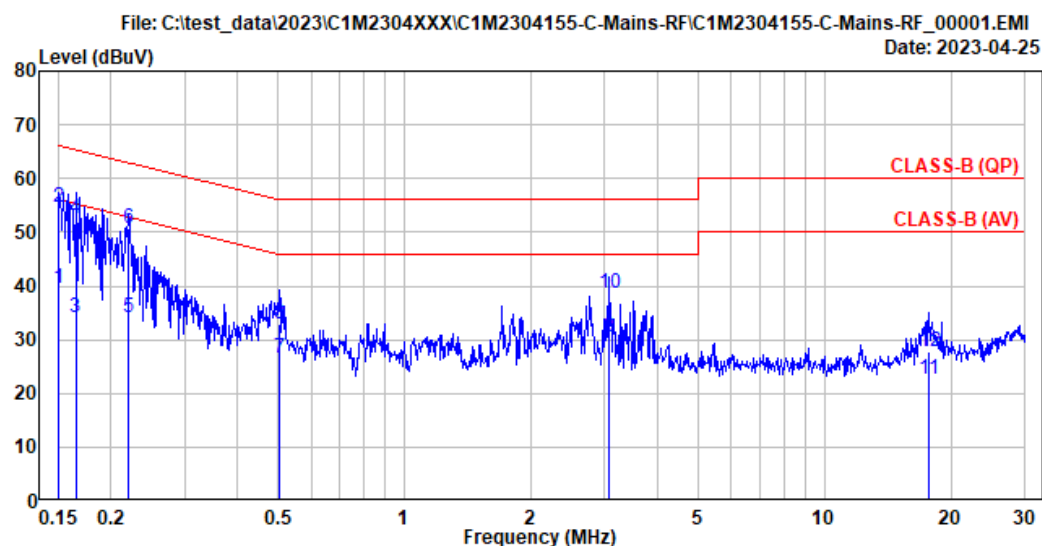
	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.151	10.34	0.03	9.85	19.29	39.51	55.96	16.45	Average
2	0.151	10.34	0.03	9.85	33.20	53.42	65.96	12.54	QP
3	0.187	10.32	0.03	9.85	11.38	31.58	54.18	22.60	Average
4	0.187	10.32	0.03	9.85	28.74	48.94	64.18	15.24	QP
5	0.222	10.32	0.03	9.85	7.56	27.76	52.73	24.97	Average
6	0.222	10.32	0.03	9.85	23.56	43.76	62.73	18.97	QP
7	0.496	10.32	0.03	9.85	6.45	26.65	46.06	19.41	Average
8	0.496	10.32	0.03	9.85	13.22	33.42	56.06	22.64	QP
9	1.708	10.36	0.05	9.86	7.46	27.73	46.00	18.27	Average
10	1.708	10.36	0.05	9.86	12.02	32.29	56.00	23.71	QP
11	28.971	11.33	0.24	10.00	6.74	28.31	50.00	21.69	Average
12	28.971	11.33	0.24	10.00	10.21	31.78	60.00	28.22	QP

Remarks: 1. Emission Level(dBμV)= AMN Factor(dB) + Cable Loss(dB) + Pulse Att.(dB) + Reading(dBμV).

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Test Date	2023/02/21	Temp./Hum.	22°C/50%
Test Voltage	DC 5V (Via Notebook PC)	Tested By	Harry Huang



Site No. : No.8 Shielded Room
Instrument 1 : Receiver ESR(774)
Instrument 2 : ENV432 (567)(A)|CE-08|ESH3-Z2 (354)
Limit : CLASS-B (QP)
Environment : 26°C/53%
EUT Model : TPA-S001D
Test Mode : Operating

Data No. : 1
Phase : Line
Test Rating : DC 5V
Engineer : Nick Du

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.151	10.22	0.03	9.85	19.49	39.59	55.96	16.37	Average
2	0.151	10.22	0.03	9.85	34.56	54.66	65.96	11.30	QP
3	0.165	10.22	0.03	9.85	14.16	34.26	55.21	20.95	Average
4	0.165	10.22	0.03	9.85	32.36	52.46	65.21	12.75	QP
5	0.220	10.22	0.03	9.85	14.01	34.11	52.81	18.70	Average
6	0.220	10.22	0.03	9.85	30.55	50.65	62.81	12.16	QP
7	0.504	10.22	0.03	9.85	6.53	26.63	46.00	19.37	Average
8	0.504	10.22	0.03	9.85	12.88	32.98	56.00	23.02	QP
9	3.075	10.27	0.07	9.86	10.28	30.48	46.00	15.52	Average
10	3.075	10.27	0.07	9.86	18.39	38.59	56.00	17.41	QP
11	17.688	10.60	0.19	9.93	1.81	22.53	50.00	27.47	Average
12	17.688	10.60	0.19	9.93	6.95	27.67	60.00	32.33	QP

Remarks: 1. Emission Level(dBμV)= AMN Factor(dB) + Cable Loss(dB) + Pulse Att.(dB) + Reading(dBμV).

A.2 RADIATED EMISSION

Test Date	2023/04/27 ~ 28	Temp./Hum.	21-24°C/66-72%
Test Voltage	DC 5V (Via Notebook PC)	Tested By	Harry Huang

A.2.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

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A.2.1.2 Frequency Below 1GHz

Mode	Wireless 2.4GHz	Frequency	TX 2441MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
59.100	12.55	1.73	26.45	39.64	27.47	40.00	12.53	Peak
128.940	17.78	2.64	26.13	40.69	34.98	43.50	8.52	Peak
411.210	21.85	5.62	26.59	42.15	43.03	46.00	2.97	Peak
545.070	23.91	6.57	27.28	34.29	37.49	46.00	8.51	Peak
798.240	25.28	7.94	27.28	37.89	43.82	46.00	2.18	Peak
980.600	26.90	9.17	26.81	32.46	41.71	54.00	12.29	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
59.100	12.55	1.73	26.45	46.50	34.33	40.00	5.67	Peak
108.570	17.38	2.40	26.25	39.13	32.67	43.50	10.83	Peak
447.100	22.54	5.95	26.83	34.45	36.12	46.00	9.88	Peak
564.470	24.09	6.64	27.33	39.98	43.38	46.00	2.62	Peak
796.300	25.27	7.93	27.28	32.77	38.69	46.00	7.31	Peak
985.450	26.96	9.19	26.80	27.23	36.59	54.00	17.41	Peak

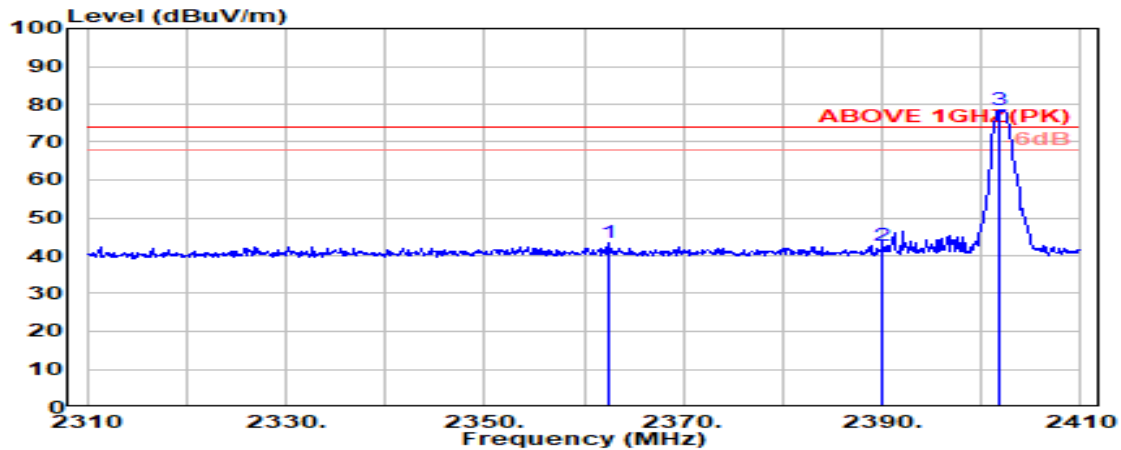
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A.2.1.3 Frequency Above 1 GHz to 10th harmonics

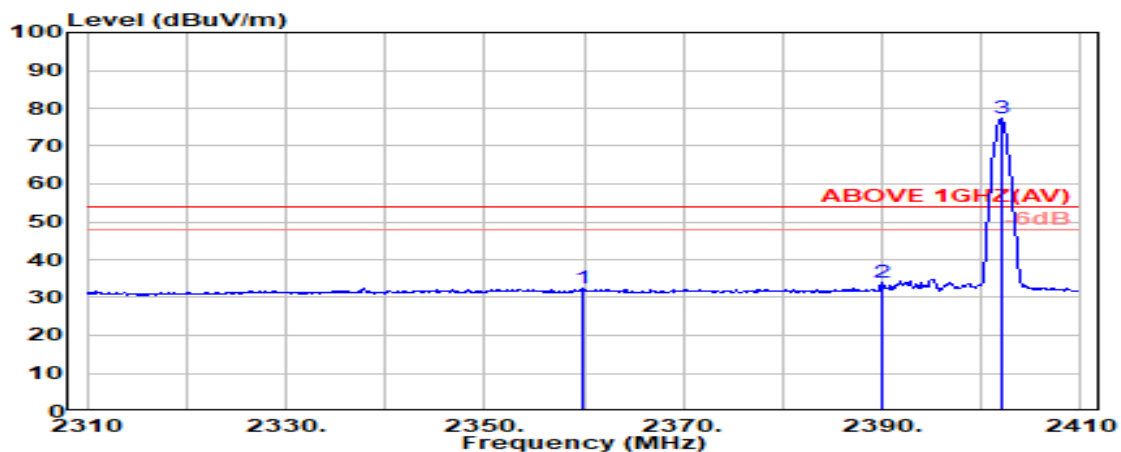
Band Edge:

Mode	Wireless 2.4GHz	Frequency	TX 2402MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2362.400	28.30	5.99	39.93	49.09	43.45	74.00	30.55	Peak
2390.000	28.30	6.03	39.93	48.27	42.68	74.00	31.32	Peak
@ 2401.800	28.30	6.05	39.93	83.97	78.39	---	---	Peak

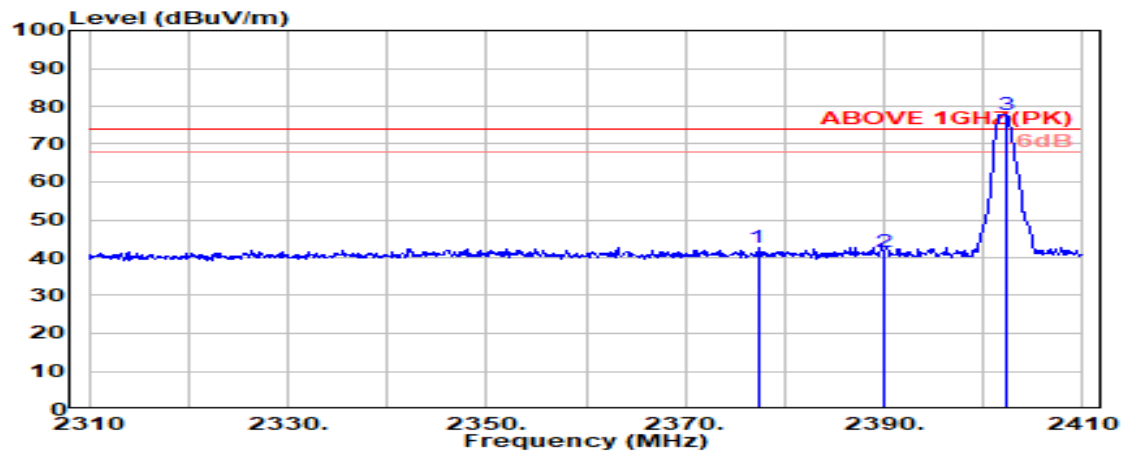


Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2359.800	28.30	5.99	39.93	38.17	32.53	54.00	21.47	Average
2390.000	28.30	6.03	39.93	39.67	34.07	54.00	19.93	Average
@ 2402.000	28.30	6.05	39.93	82.80	77.23	---	---	Average

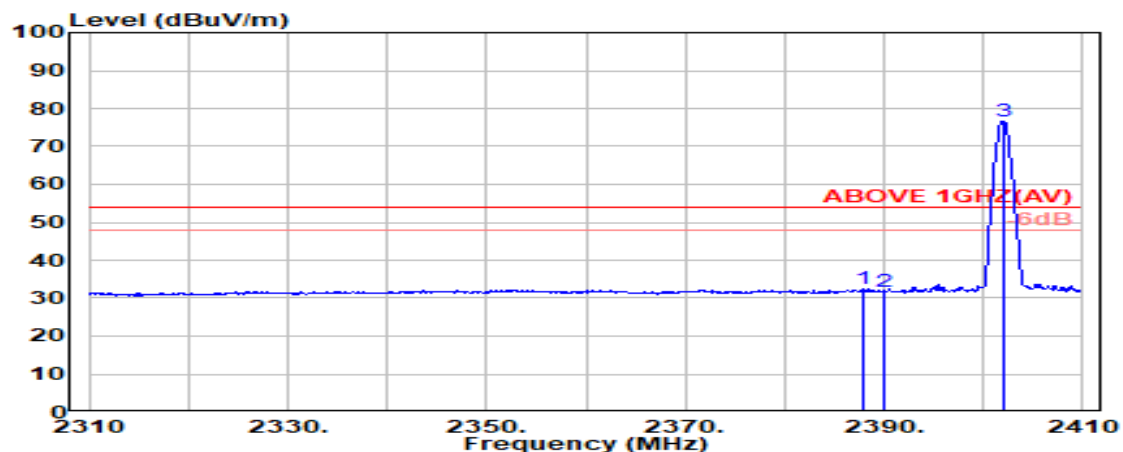
Remark: The “@” means fundamental frequency, it is ignored in this section.

Mode	Wireless 2.4GHz	Frequency	TX 2402MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2377.300	28.30	6.02	39.93	48.16	42.55	74.00	31.45	Peak
2390.000	28.30	6.03	39.93	47.14	41.55	74.00	32.45	Peak
@ 2402.400	28.30	6.05	39.93	83.46	77.89	---	---	Peak



Antenna at Vertical Polarization

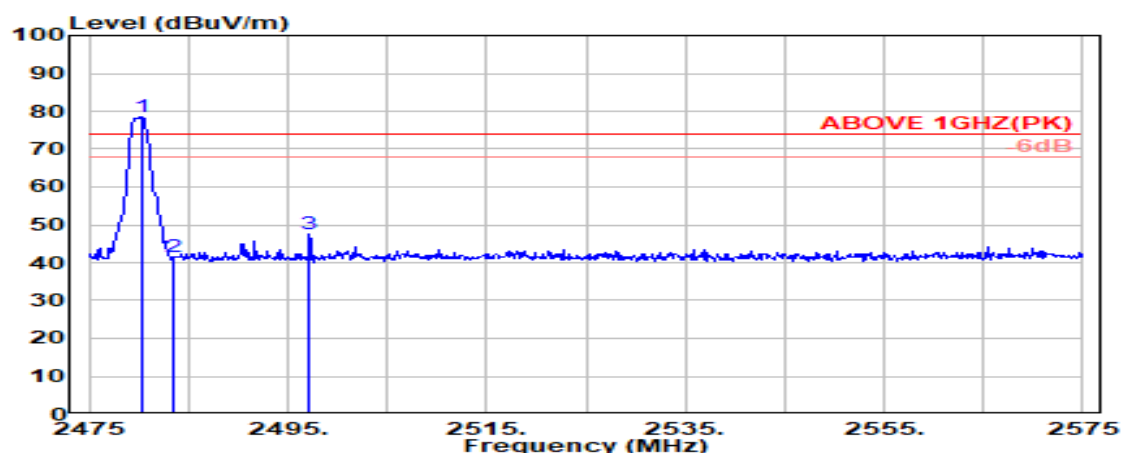
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2387.900	28.30	6.03	39.93	38.05	32.45	54.00	21.55	Average
2390.000	28.30	6.03	39.93	37.24	31.65	54.00	22.35	Average
@ 2402.000	28.30	6.05	39.93	82.29	76.71	---	---	Average

Remark: The “@” means fundamental frequency, it is ignored in this section.

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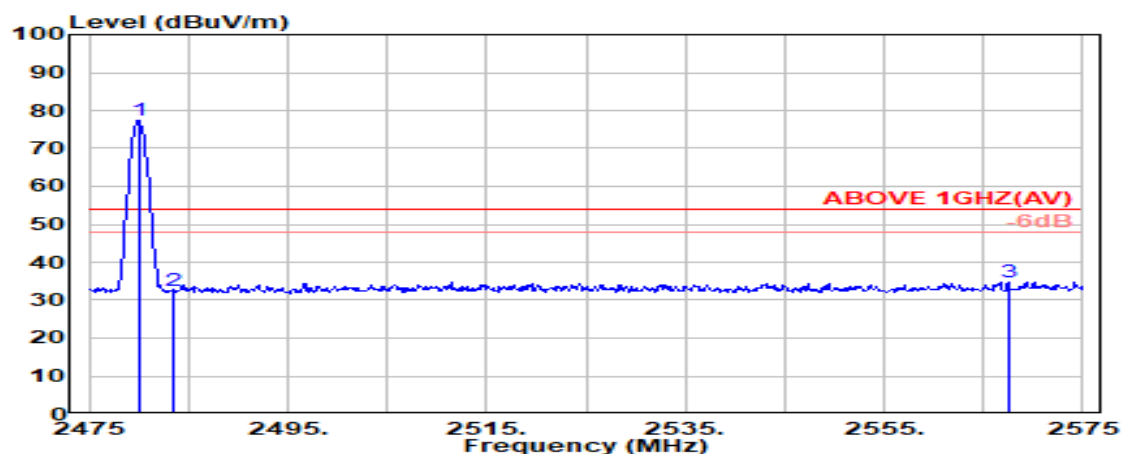
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Mode	Wireless 2.4GHz	Frequency	TX 2480MHz
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@ 2480.300	28.46	6.16	39.92	83.66	78.36	---	---	Peak
2483.500	28.47	6.17	39.92	46.77	41.48	74.00	32.52	Peak
2497.200	28.49	6.19	39.92	52.81	47.57	74.00	26.43	Peak



Antenna at Horizontal Polarization

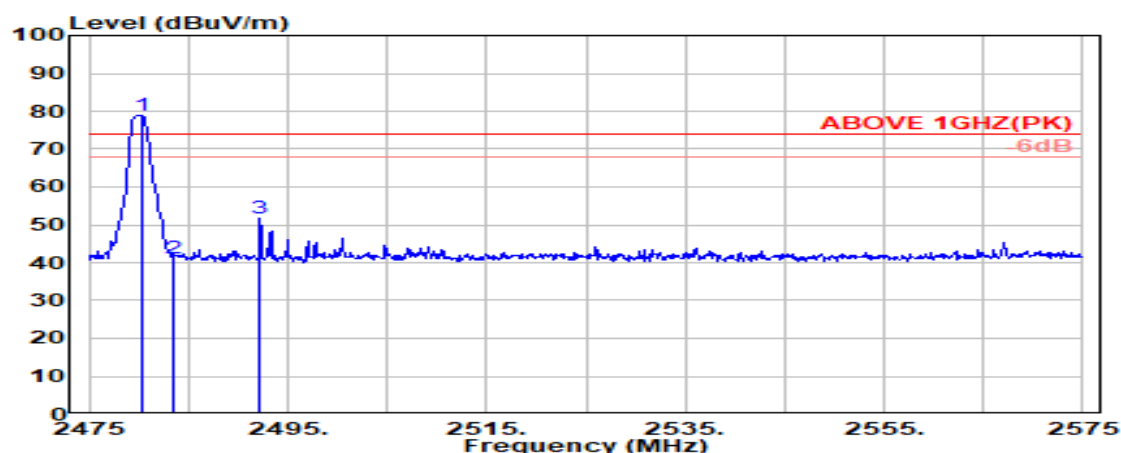
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@ 2480.000	28.46	6.16	39.92	82.60	77.30	---	---	Average
2483.500	28.47	6.17	39.92	37.89	32.60	54.00	21.40	Average
2567.500	28.64	6.27	39.94	39.70	34.67	54.00	19.33	Average

Remark: The “@” means fundamental frequency, it is ignored in this section.

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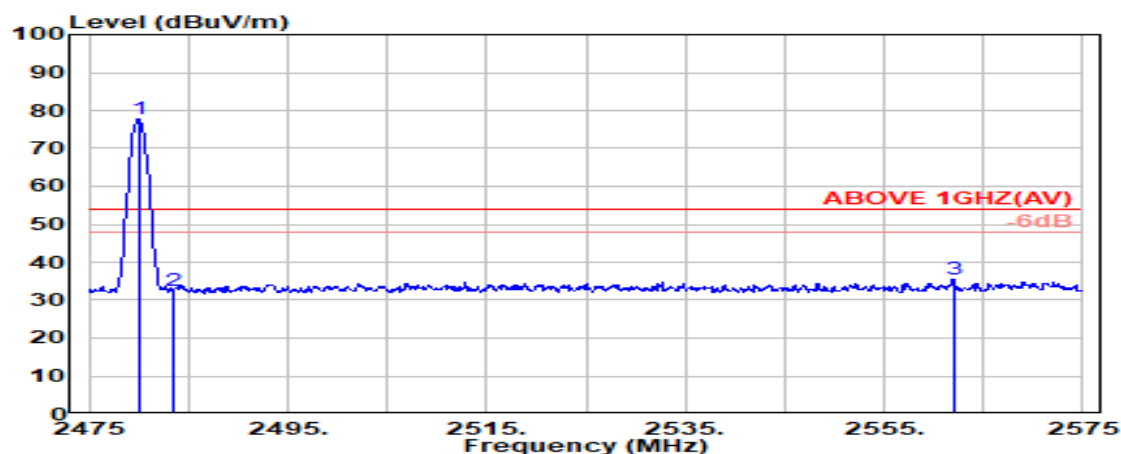
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Mode	Wireless 2.4GHz	Frequency	TX 2480MHz
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Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@ 2480.300	28.46	6.16	39.92	84.23	78.93	---	---	Peak
2483.500	28.47	6.17	39.92	46.51	41.23	74.00	32.77	Peak
2492.200	28.48	6.18	39.92	56.94	51.68	74.00	22.32	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
@ 2480.000	28.46	6.16	39.92	83.11	77.81	---	---	Average
2483.500	28.47	6.17	39.92	37.55	32.26	54.00	21.74	Average
2562.000	28.60	6.26	39.94	40.59	35.51	54.00	18.49	Average

Remark: The “@” means fundamental frequency, it is ignored in this section.

A.2.2 Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

Mode	Wireless 2.4GHz				Frequency	TX 2402MHz		
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4803.333	32.91	8.53	39.39	40.62	42.67	54.00	11.33	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4803.333	32.91	8.53	39.39	39.57	41.62	54.00	12.38	Peak

Mode	Wireless 2.4GHz				Frequency	TX 2441MHz		
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4882.000	33.16	8.64	39.35	37.99	40.44	54.00	13.56	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4882.000	33.16	8.64	39.35	37.99	40.44	54.00	13.56	Peak

Mode	Wireless 2.4GHz				Frequency	TX 2480MHz		
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Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.000	33.24	8.75	39.32	40.31	42.98	54.00	11.02	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Gain (dB)	Read Level (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.000	33.24	8.75	39.32	39.93	42.60	54.00	11.40	Peak

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A.2.3 Emissions in Non-restricted Frequency Bands:

Pursuant to ANSI C63.10:2013 that emission levels below the FCC 15.209(a)/RSS-Gen Section 8.9 table 4 general radiated emissions limits is not required.

A.3 DTS/OCCUPIED BANDWIDTH

Test Date	2023/04/24 ~ 25	Temp./Hum.	23°C/66-68%
Cable Loss	0.30dB	Tested By	Harry Huang
Test Voltage	DC 5V (Via Notebook PC)		

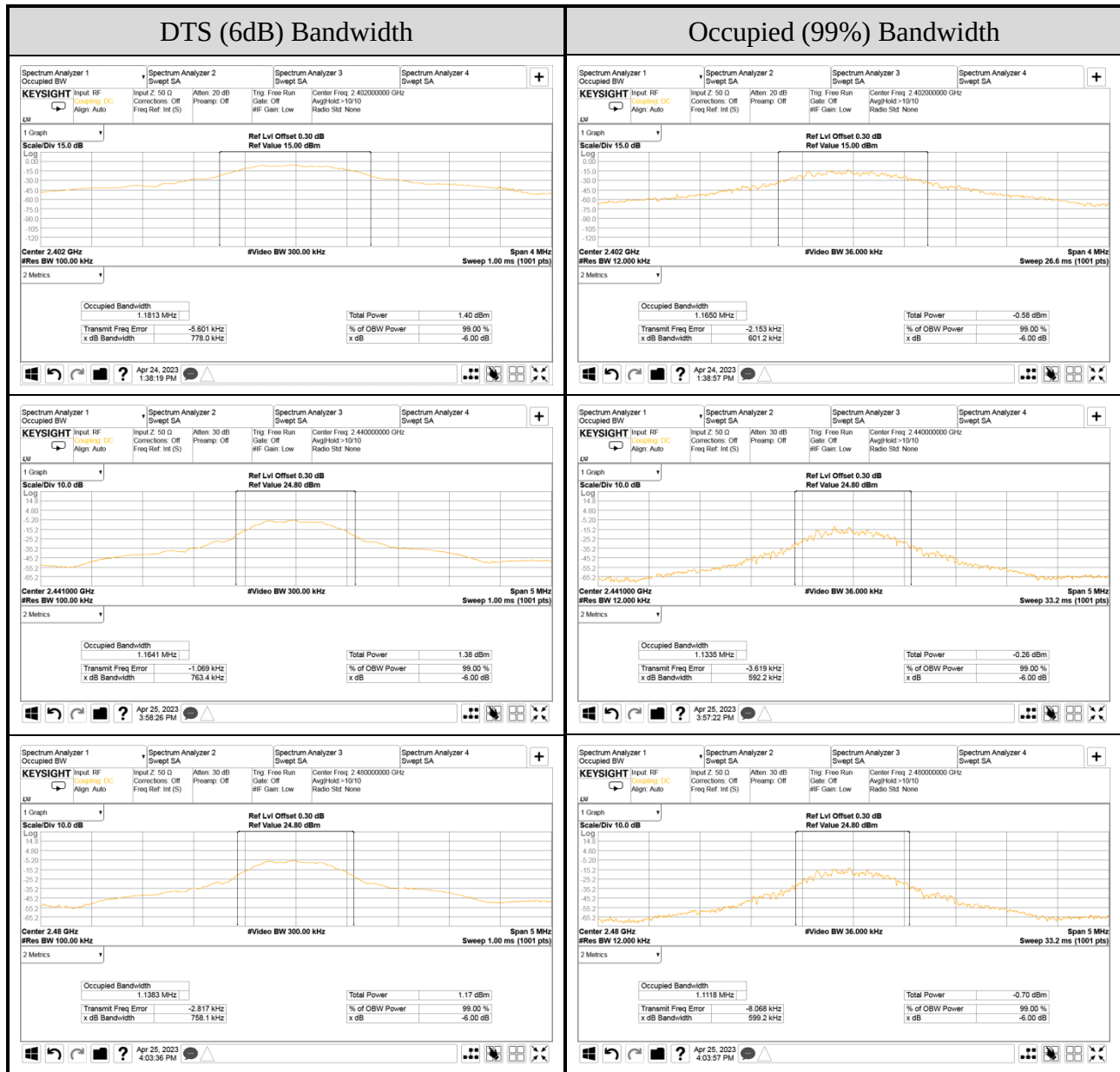
A.3.1 DTS/Occupied Bandwidth Result

Mode	Centre Frequency (MHz)	DTS (6dB) Bandwidth (MHz)	Occupied (99%) Bandwidth (MHz)	Limit
Wireless 2.4GHz	2402	0.7780	1.1650	>500kHz
	2441	0.7634	1.1335	
	2480	0.7581	1.1118	

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A.3.2 Measurement Plots



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A.4 MAXIMUM PEAK OUTPUT POWER

Test Date	2023/04/24 ~ 25	Temp./Hum.	23°C/66-68%
Cable Loss	0.30dB	Tested By	Harry Huang
Test Voltage	DC 5V (Via Notebook PC)		

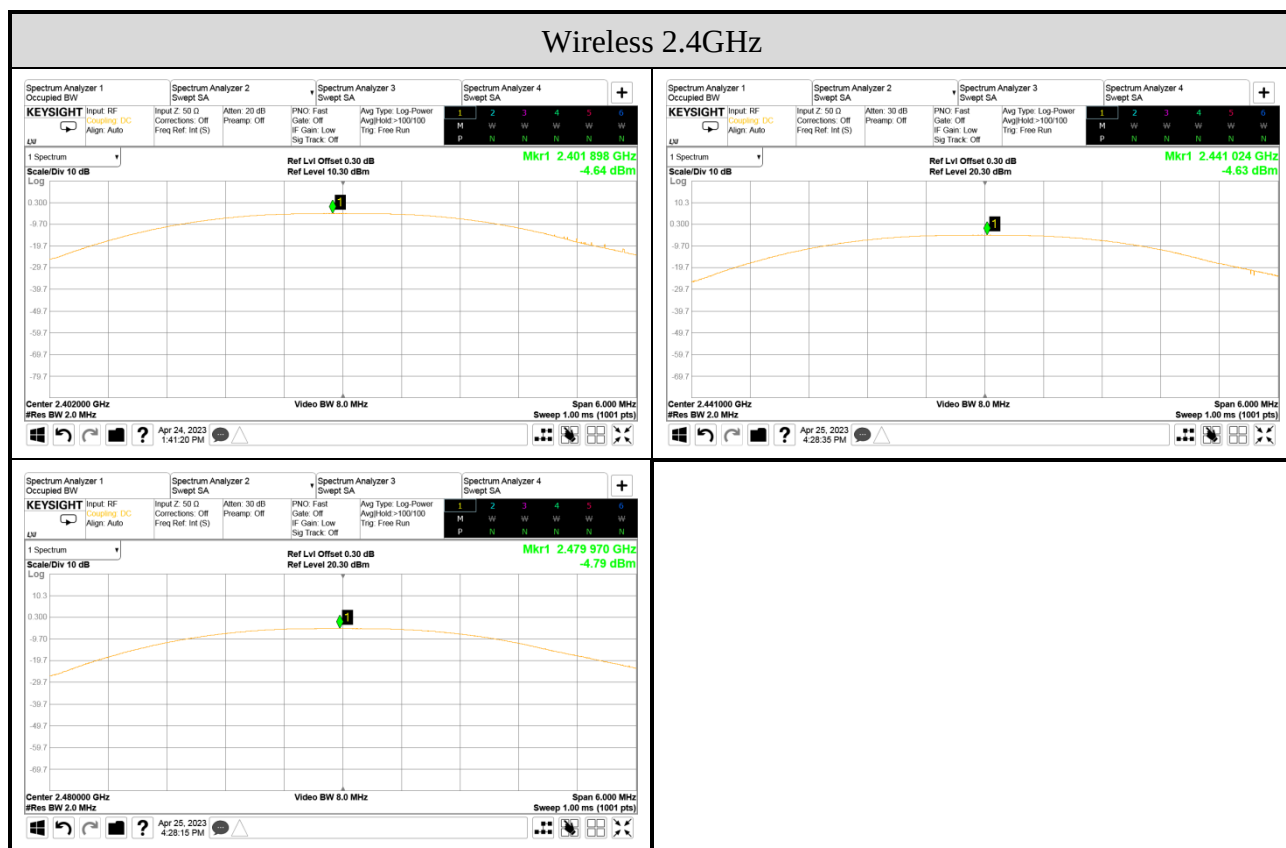
A.4.1 Peak Output Power

Mode	Centre Frequency (MHz)	Peak Output Power (dBm)	Antenna Gain (dBi)	E.I.R.P (dBm) Note 2	Limit
Wireless 2.4GHz	2402	-4.64	3.49	-1.15	<30dBm (Maximum Peak Output Power) <36dBm (E.I.R.P)
	2441	-4.63	3.49	-1.14	
	2480	-4.79	3.49	-1.30	

Note: 1. The results have been included cable loss.

2. E.I.R.P.= The Peak Output Power (dBm)+ Antenna Gain (dBi).

A.4.2 Measurement Plots



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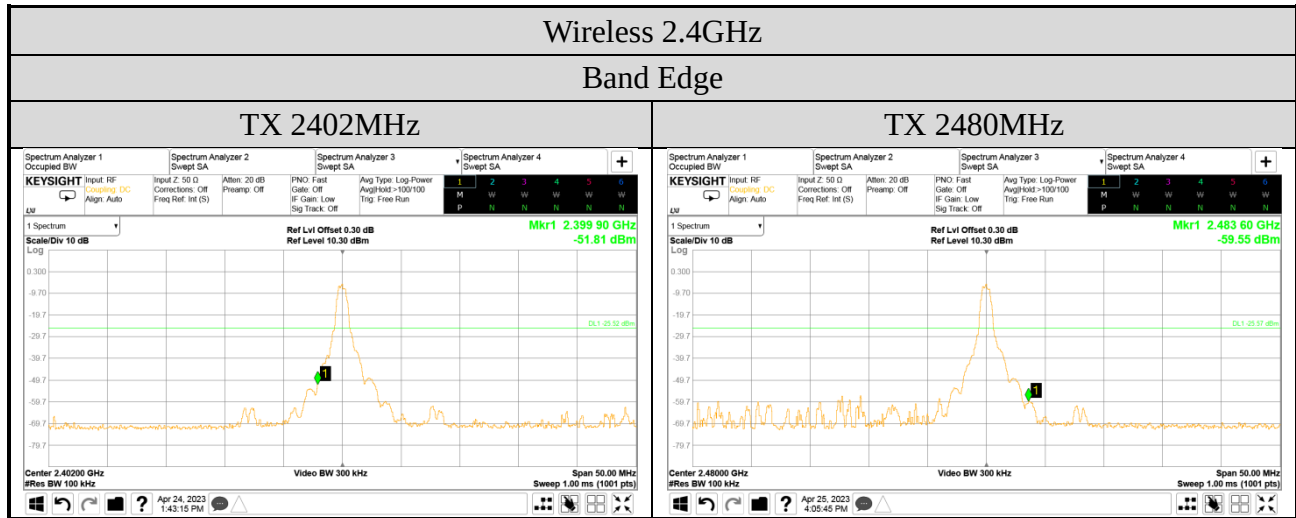
A.5 EMISSION LIMITATIONS

Test Date	2023/04/24 ~ 25	Temp./Hum.	23°C/66-68%
Cable Loss	0.30dB	Tested By	Harry Huang
Test Voltage	DC 5V (Via Notebook PC)		



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A.6 POWER SPECTRAL DENSITY

Test Date	2023/04/24 ~ 25	Temp./Hum.	23°C/66-68%
Cable Loss	0.30dB	Tested By	Harry Huang
Test Voltage	DC 5V (Via Notebook PC)		

A.6.1 Power Spectral Density Result

Mode	Centre Frequency (MHz)	Power Spectral Density (dBm)	Limit
Wireless 2.4GHz	2402	-5.52	<8 dBm/3kHz
	2441	-5.38	
	2480	-5.57	

Note: All results have been included cable loss.

A.6.2 Measurement Plots



Note: All results have been included cable loss.



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APPENDIX B

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APPENDIX B

TEST PHOTOGRAPHS

(Model: TPA-S001D)