

FCC - TEST REPORT

Report Number : **60.790.18.034.01R01** Date of Issue : June 23, 2018

Model : TCD

Product Type : Turbo Connect Display

Applicant : DAYTON INDUSTRIAL CO., LTD

Address : 2-12 Kwai Fat Road, 11-A Kwai Chung, New Territories, Hong Kong

Production Facility : KENDY ENTERPRISE LTD

Address : 2-12 Kwai Fat Road, 11-A Kwai Chung, New Territories, Hong Kong

Test Result : ☒ **Positive** ☐ **Negative**

Total pages
including
Appendices : 36

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2 Description of Equipment Under Test

Description of the Equipment Under Test

Product:	Turbo Connect Display
Model no.:	TCD
FCC ID:	O4GTCD
Rating:	3 VDC (1 x CR2302 battery)
Frequency:	2402MHz-2480MHz
Antenna gain:	0 dBi
Number of operated channel:	40
Modulation:	GFSK

3 Summary of Test Standards

Test Standards
FCC Part 15 Subpart C 10-1-17 Edition Federal Communications Commission, PART 15 — Radio Frequency Devices, Subpart C — Unintentional Radiators

4 Details about the Test Laboratory

Site 1

Company name: TÜV SÜD Hong Kong Ltd.
3/F, West Wing, Lakeside 2,
10 Science Park West Avenue,
Science Park, Shatin, Hong Kong

Site 2

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13 Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2,
Shenzhen 518052, P.R.China
FCC Registration Number: 502708

Emission Tests	
Test Item	Test Site
FCC Part 15 Subpart C	
FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission	Site 2
FCC Title 47 Part 15.207 Conduct Emission	NIL
FCC Title 47 Part 15.247 Bandedge Emission	Site 2
FCC Title 47 Part 15.247(a)(1) 6dB & 99% Bandwidth	Site 2
FCC Title 47 Part 15.247(b) Peak Output Power	Site 2
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	Site 2
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	Site 2
FCC Title 47 Part 15.247(e) Power Spectral Density	Site 2
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	Site 2

4.1 Test Equipment Site List

Radiated emission Test – Site 2

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2018-7-14
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2018-7-14
Horn Antenna	Rohde & Schwarz	HF907	102294	2018-7-14
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2018-7-14
Signal Generator	Rohde & Schwarz	SMY01	839369/005	2018-7-7
Attenuator	Agilent	8491A	MY39264334	2018-7-7
3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

20dB & 99% Bandwidth, Peak Output Power, Spurious Emissions at Antenna Terminals, 100kHz Bandwidth of band edges, Power Spectral Density – Site 2

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Generator	Rohde & Schwarz	SMB100A	108272	2018-7-7
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2018-7-7
Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2018-7-7
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2018-7-7

4.2 Measurement System Uncertainty

Measurement System Uncertainty Emissions

System Measurement Uncertainty	
Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz	4.54dB
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.83dB; Vertical: 4.91dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-25000MHz	Horizontal: 4.89dB; Vertical: 4.88dB;
Uncertainty for Conducted RF test	2.04dB

5 Summary of Test Results

Emission Tests				
FCC Part 15 Subpart C				
Test Condition	Pages	Test Result		
		Pass	Fail	N/A
FCC Title 47 Part 15.205, 15.209 & 15.247(d) Spurious Radiated Emission	10-15	☒	☐	☐
FCC Title 47 Part 15.207 Conduct Emission (1)	NIL	☐	☐	☒
FCC Title 47 Part 15.247Bandedge Emission	16-17	☒	☐	☐
FCC Title 47 Part 15.247(a)(2) 6dB & 99% Bandwidth	18-20	☒	☐	☐
FCC Title 47 Part 15.247(b) Peak Output Power	21-23	☒	☐	☐
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	24-29	☒	☐	☐
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	30-31	☒	☐	☐
FCC Title 47 Part 15.247(e) Power Spectral Density	32-34	☒	☐	☐
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	35	☒	☐	☐

Remark:

- 1) These requirements do not apply for equipment which employ battery power for operation and which do not operate from the AC power lines.

6 General Remarks

Remarks

NIL

SUMMARY:

- All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

- The Equipment Under Test

■ - **Fulfills** the general approval requirements.

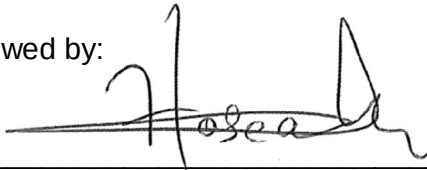
□ - **Does not** fulfill the general approval requirements.

Sample Received Date: May 30, 2018

Testing Start Date: May 31, 2018

Testing End Date: June 12, 2018

Reviewed by:



Hosea CHAN
EMC Project Engineer

Prepared by:



Eric LI
EMC Senior Project Engineer

7 Emission Test Results

7.1 Spurious Radiated Emission

EUT: TCD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 3 VDC
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
58.722	21.23	40	-18.77	Quasi Peak
258.974	27.86	46	-18.14	Quasi Peak
767.254	29.31	46	-16.69	Quasi Peak
874.601	24.41	46	-21.59	Quasi Peak
1243.600	31.23*	54	-22.77	Peak
4804.000	42.65*	54	-11.35	Peak
7000.000	39.75*	54	-14.25	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT: TCD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 3 VDC
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
44.388	17.98	40	-22.02	Quasi Peak
58.669	20.52	40	-19.48	Quasi Peak
282.847	18.65	46	-27.35	Quasi Peak
871.098	25.87	46	-20.13	Quasi Peak
1242.938	28.45*	54	-15.55	Peak
4804.000	40.11*	54	-13.89	Peak
7494.000	40.36*	54	-13.64	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT: TCD
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 3 VDC
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
58.722	22.48	40	-17.52	Quasi Peak
258.974	26.90	46	-19.10	Quasi Peak
767.254	28.53	46	-17.47	Quasi Peak
874.601	25.17	46	-20.83	Quasi Peak
1243.188	31.53*	54	-22.47	Peak
3688.125	32.41*	54	-21.59	Peak
5188.593	34.26*	54	-19.74	Peak
7020.467	39.76*	54	-14.24	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT: TCD
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 3 VDC
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
44.388	18.17	40	-21.83	Quasi Peak
58.669	21.07	40	-18.93	Quasi Peak
282.847	19.75	46	-26.25	Quasi Peak
871.098	24.28	46	-21.72	Quasi Peak
2166.250	31.24*	54	-22.76	Peak
4605.000	34.97*	54	-19.03	Peak
7485.000	40.03*	54	-13.97	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT: TCD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Horizontal
 Comment: 3 VDC
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
58.722	25.16	40	-14.84	Quasi Peak
258.974	24.88	46	-21.12	Quasi Peak
767.254	27.54	46	-18.46	Quasi Peak
874.601	23.87	46	-22.13	Quasi Peak
1247.885	31.58*	54	-22.42	Peak
3586.875	32.69*	54	-21.31	Peak
5547.656	36.09*	54	-17.91	Peak
8747.813	41.20*	54	-12.80	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

Spurious Radiated Emission

EUT: TCD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d) Antenna: Vertical
 Comment: 3 VDC
 Remark: 9kHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
44.388	20.21	40	-19.79	Quasi Peak
58.669	19.86	40	-20.14	Quasi Peak
282.847	17.48	46	-28.52	Quasi Peak
871.098	22.44	46	-23.56	Quasi Peak
1269.500	27.70*	54	-26.30	Peak
3411.563	33.84*	54	-20.16	Peak
7015.781	40.18*	54	-13.82	Peak
11144.531	43.27*	54	-10.73	Peak

Remark*: As the peak value were below the average limit, so average value no need to be measured.

7.2 Bandedge Emission

EUT: TCD
Op Condition: Operated, TX Mode (2402 and 2480)
Test Specification: FCC15.247, Antenna: Horizontal
Comment: 3 VDC

Test Result	
☒	Passed
☐	Not Passed

Band	Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector
Low	2399.875	47.22	74	-26.78	Peak
Low	2399.875	36.11	54	-17.89	Average
High	2483.500	43.21	74	-30.79	Peak
High	2483.500	33.89	54	-20.11	Average

Bandedge Emission

EUT: TCD
 Op Condition: Operated, TX Mode (2402 and 2480)
 Test Specification: FCC15.247, Antenna: Vertical
 Comment: 3 VDC

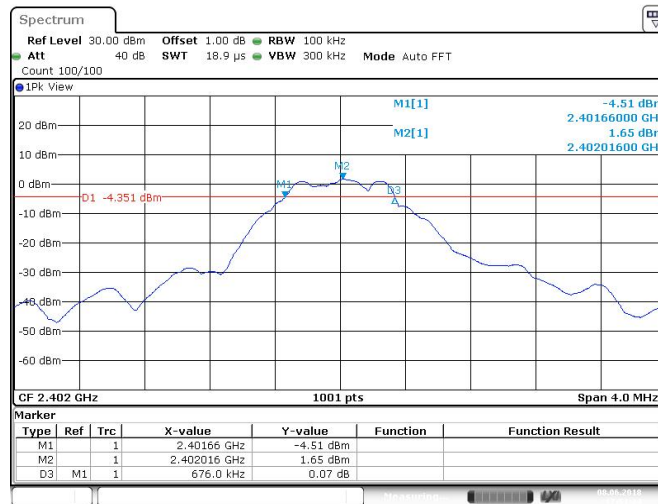
Test Result	
☒	Passed
☐	Not Passed

Band	Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector
Low	2399.875	47.22	74	-26.78	Peak
Low	2399.875	36.11	54	-17.89	Average
High	2483.500	42.15	74	-31.85	Peak
High	2483.500	34.22	54	-19.78	Average

7.3 6dB & 99% Bandwidth

EUT: TCD
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
Comment: 3 VDC

Test Result
☒ Passed
☐ Not Passed



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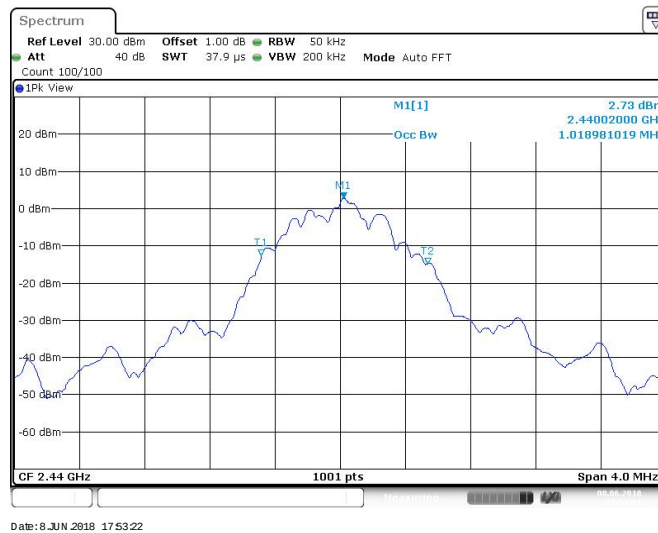
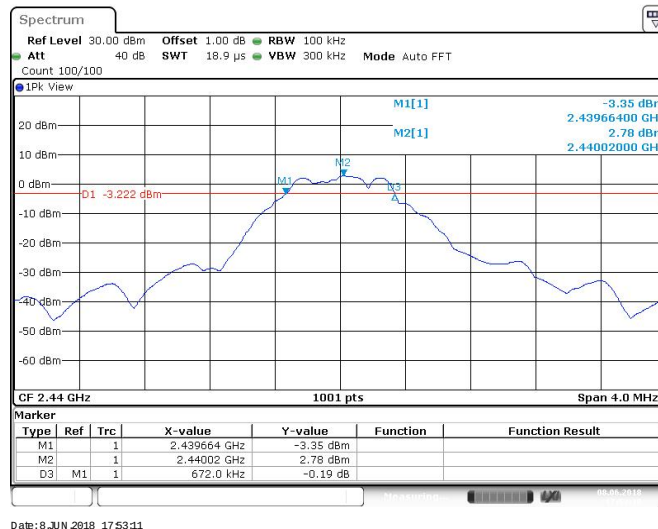
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Bandwidth	Measured Value	Limit
6dB bandwidth	676.000 kHz	> 500 kHz
99% OCB	1022.977 kHz	NA

6dB & 99% Bandwidth

EUT: TCD
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 3 VDC

Test Result
☒ Passed
☐ Not Passed

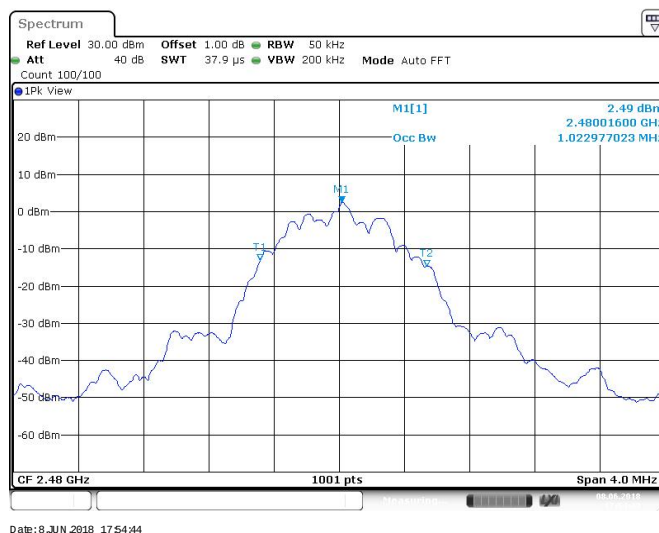
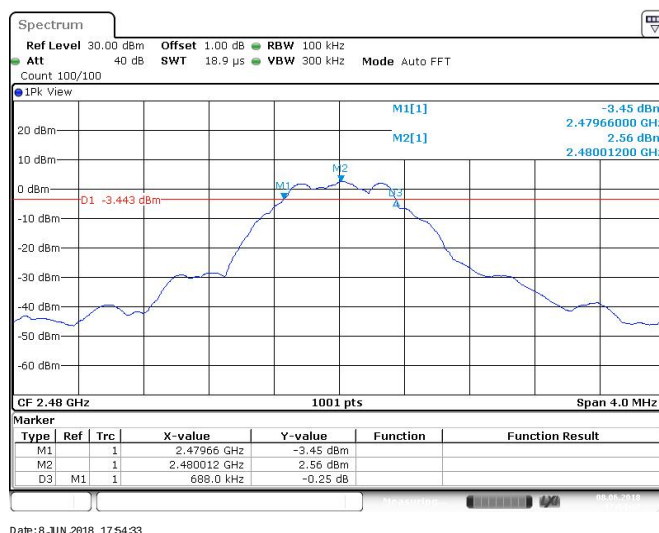


Bandwidth	Measured Value	Limit
6dB bandwidth	672.000 kHz	> 500 kHz
99% OCB	1018.981 kHz	NA

6dB & 99% Bandwidth

EUT: TCD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.247(a)(2), 6dB Bandwidth & 99% Bandwidth
 Comment: 3 VDC

Test Result
☒ Passed
☐ Not Passed

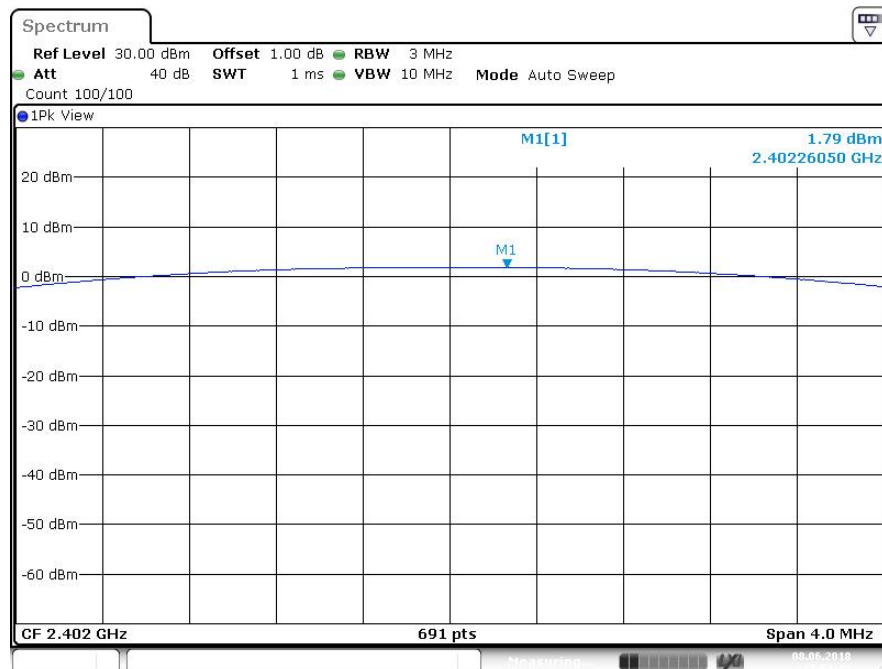


Bandwidth	Measured Value	Limit
6dB bandwidth	688.000 kHz	> 500 kHz
99% OCB	1022.977 kHz	NA

7.4 Peak Output Power

EUT: TCD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.247(b)
 Comment: 3 VDC, Antenna gain: 0 dBi,
 Cable Loss: 0.5 dB

Test Result	
☒	Passed
☐	Not Passed

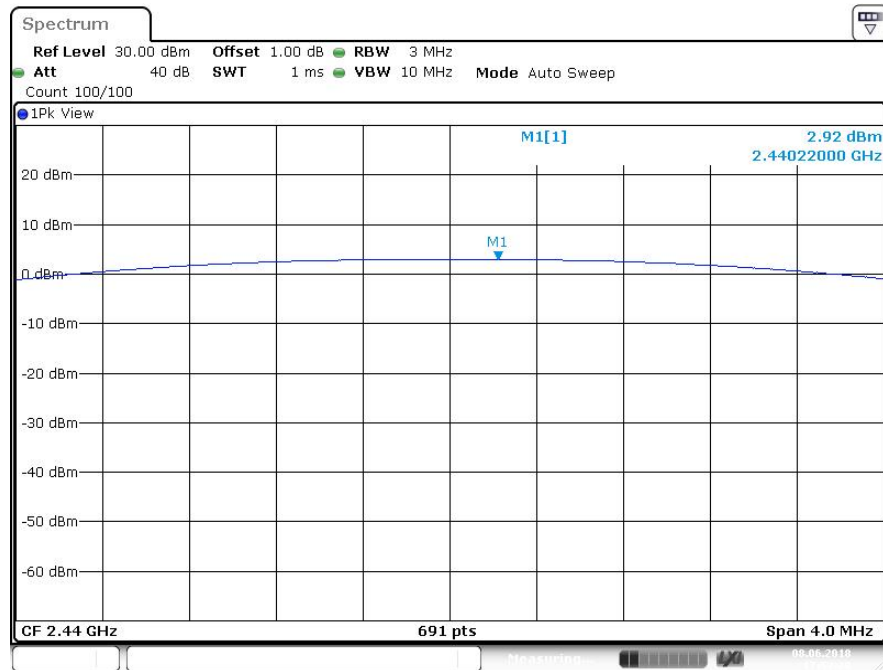


Conducted Output Power	Limit
1.79 dBm	< 30dBm

Peak Output Power

EUT: TCD
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC15.247(b)
Comment: 3 VDC, Antenna gain: 0 dBi,
Cable Loss: 0.5 dB

Test Result	
☒	Passed
☐	Not Passed



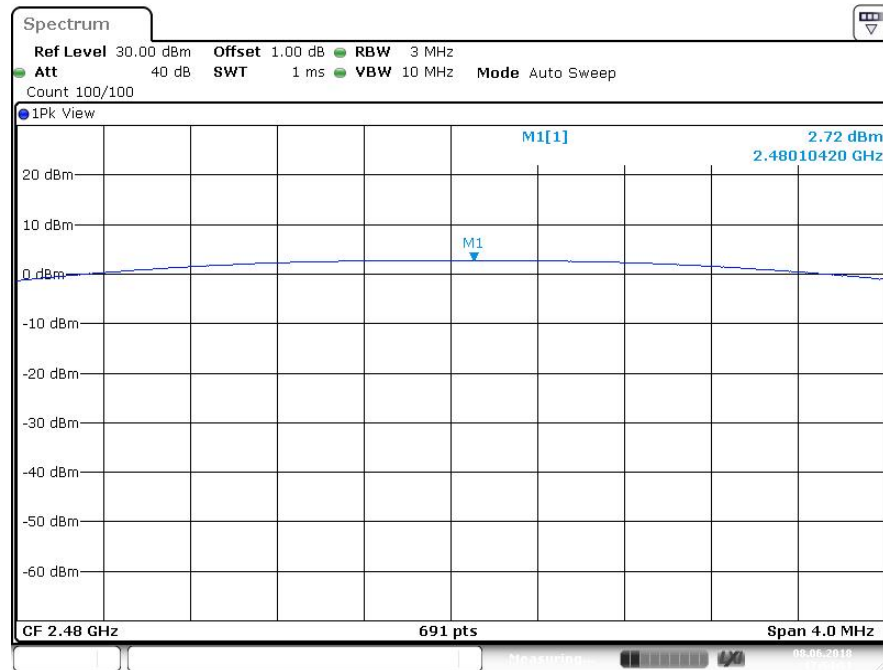
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Conducted Output Power	Limit
2.92 dBm	< 30dBm

Peak Output Power

EUT: TCD
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC15.247(b)
Comment: 3 VDC, Antenna gain: 0 dBi,
Cable Loss: 0.5 dB

Test Result	
☒	Passed
☐	Not Passed



Date: 8 JUN 2018 17:54:51

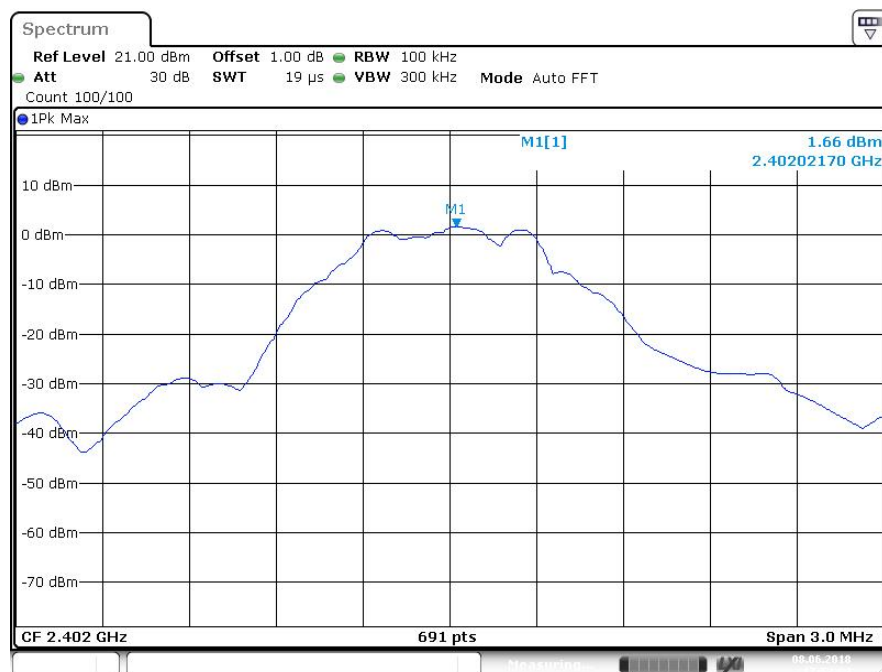
Conducted Output Power	Limit
2.72 dBm	< 30dBm

7.5 Spurious Emissions at Antenna Terminals

EUT: TCD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 3 VDC

Test Result
☒ Passed
☐ Not Passed

Channel	FreqRange	RefLevel	Result	Limit	Verdict
2402	Reference	1.65	1.65	---	PASS
2402	30~1000	1.65	-67.02	-18.35	PASS
2402	1000~26500	1.65	-42.33	-18.35	PASS

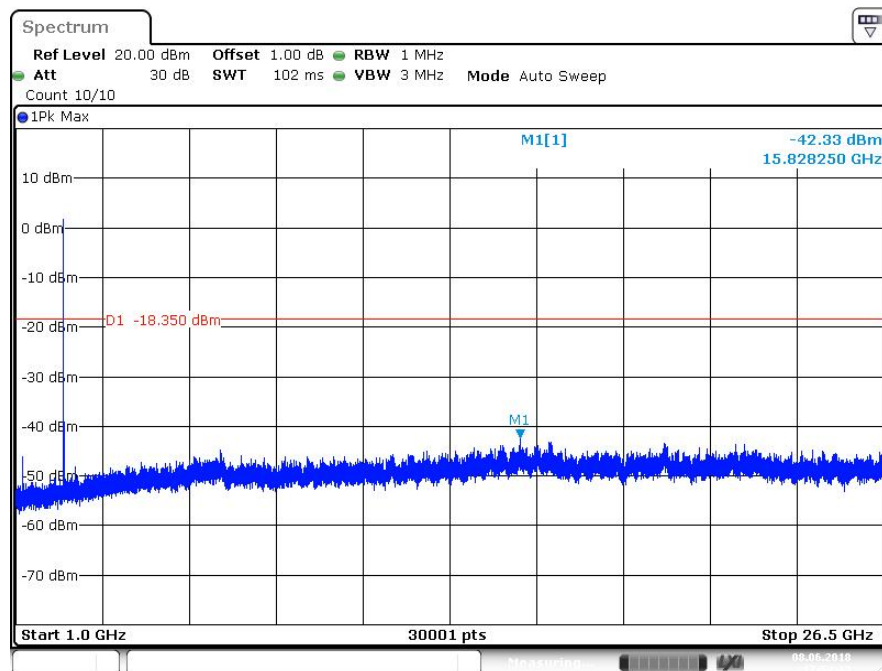
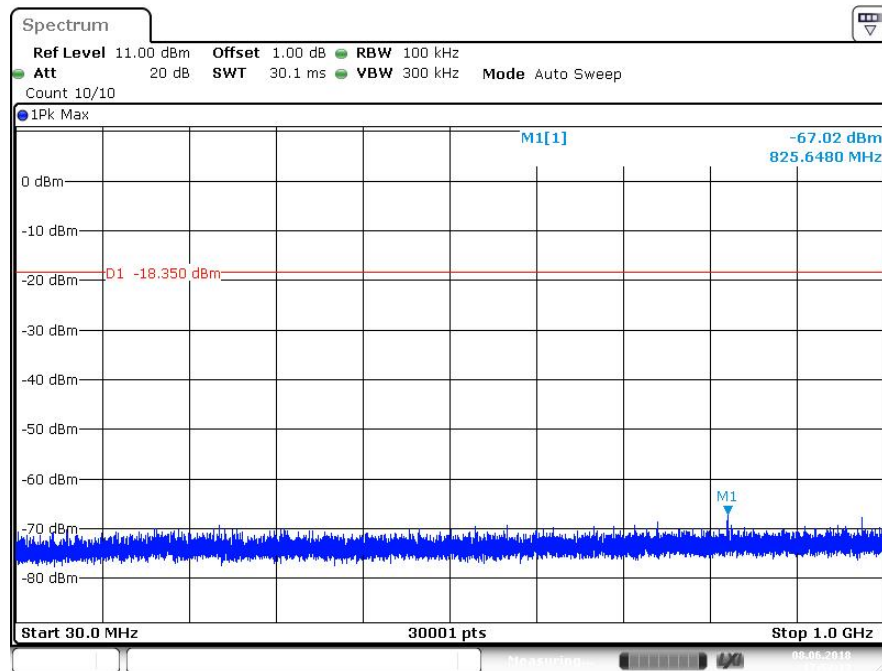


Date: 8 JUN 2018 17:52:05

Spurious Emissions at Antenna Terminals

EUT: TCD
Op Condition: Operated, TX Mode (2402MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 3 VDC

Test Result
☒ Passed
☐ Not Passed

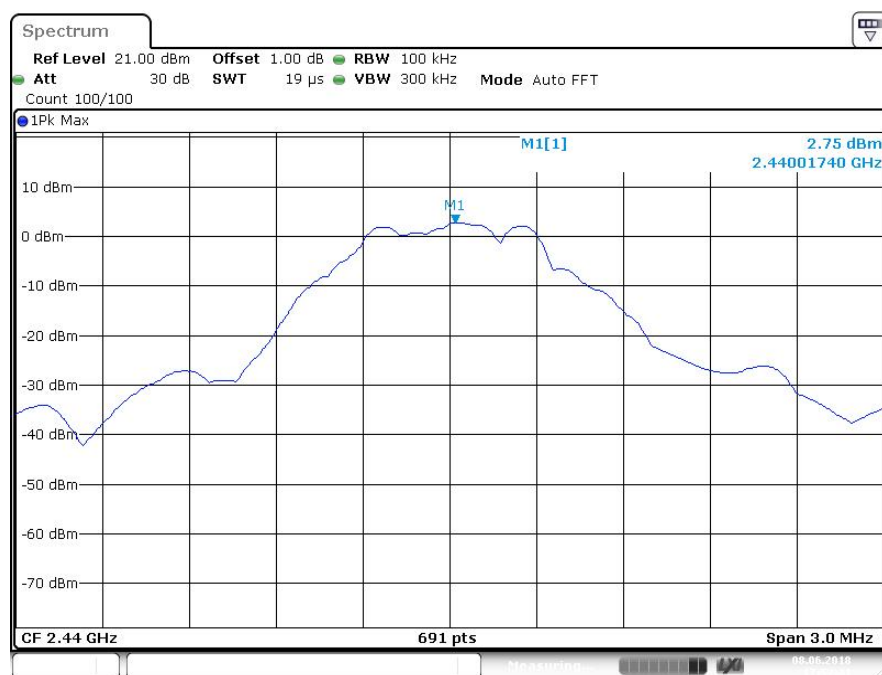


Spurious Emissions at Antenna Terminals

EUT: TCD
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 3 VDC

Test Result	
☒	Passed
☐	Not Passed

Channel	FreqRange	RefLevel	Result	Limit	Verdict
2440	Reference	2.75	2.75	---	PASS
2440	30~1000	2.75	-66.59	-17.25	PASS
2440	1000~26500	2.75	-42.92	-17.25	PASS

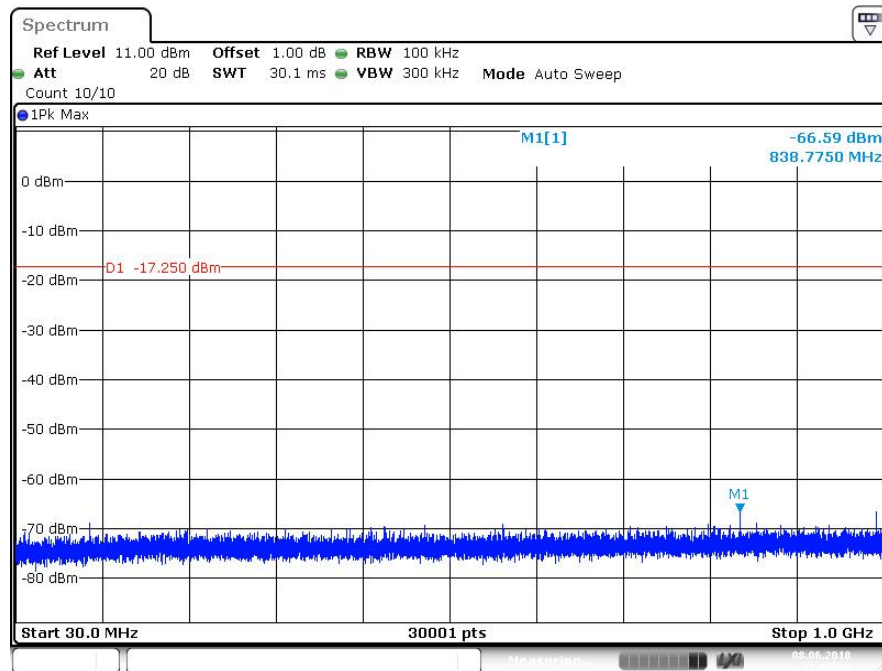


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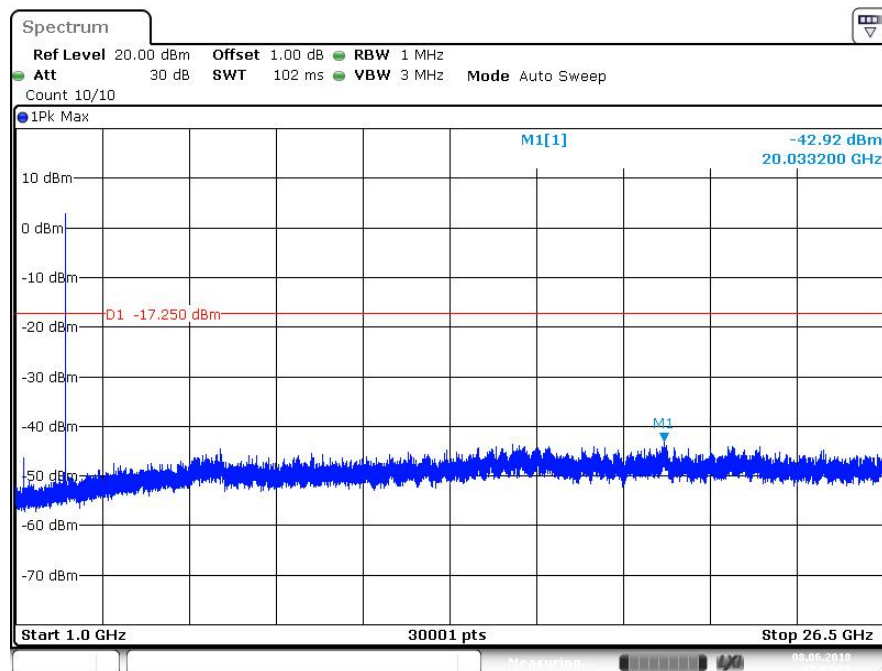
Spurious Emissions at Antenna Terminals

EUT: TCD
Op Condition: Operated, TX Mode (2440MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 3 VDC

Test Result
☒ Passed
☐ Not Passed



Date: 8 JUN 2018 17:53:50



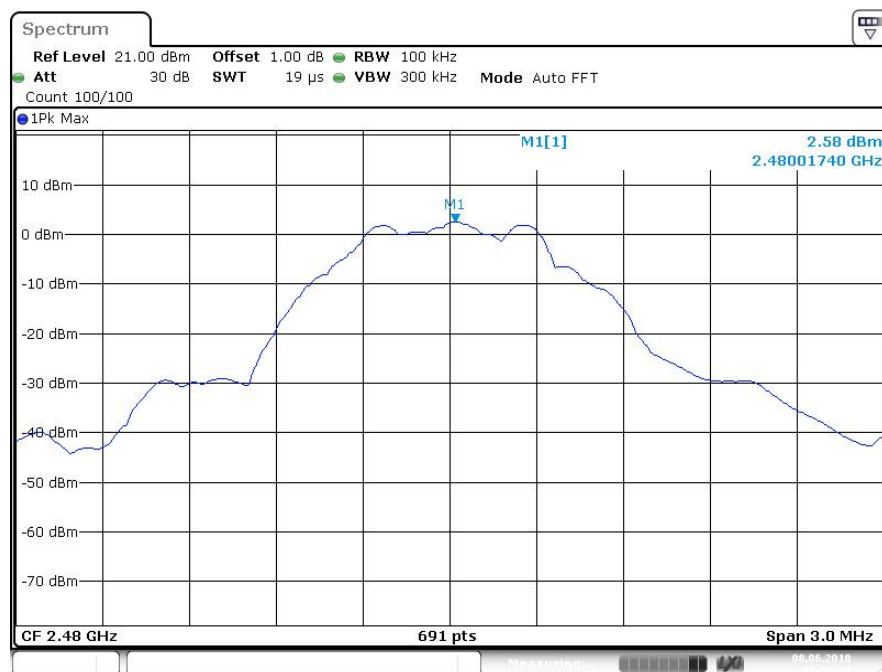
Date: 8 JUN 2018 17:53:59

Spurious Emissions at Antenna Terminals

EUT: TCD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC2.1051 & 15.247(d)
 Comment: 3 VDC

Test Result	
☒	Passed
☐	Not Passed

Channel	FreqRange	RefLevel	Result	Limit	Verdict
2480	Reference	2.58	2.58	---	PASS
2480	30~1000	2.58	-68.63	-17.42	PASS
2480	1000~26500	2.58	-42.78	-17.42	PASS

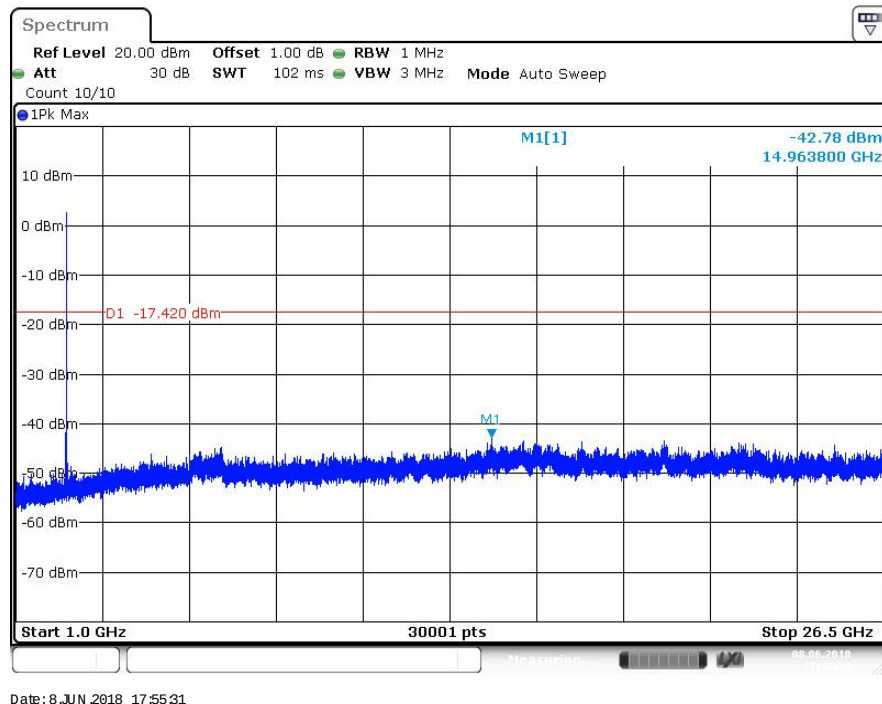
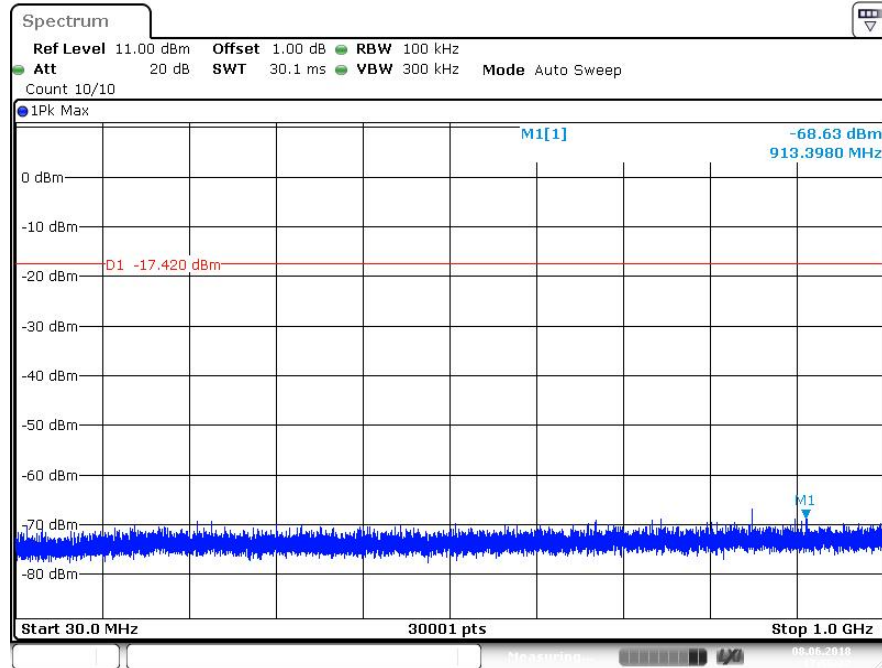


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Spurious Emissions at Antenna Terminals

EUT: TCD
Op Condition: Operated, TX Mode (2480MHz)
Test Specification: FCC2.1051 & 15.247(d)
Comment: 3 VDC

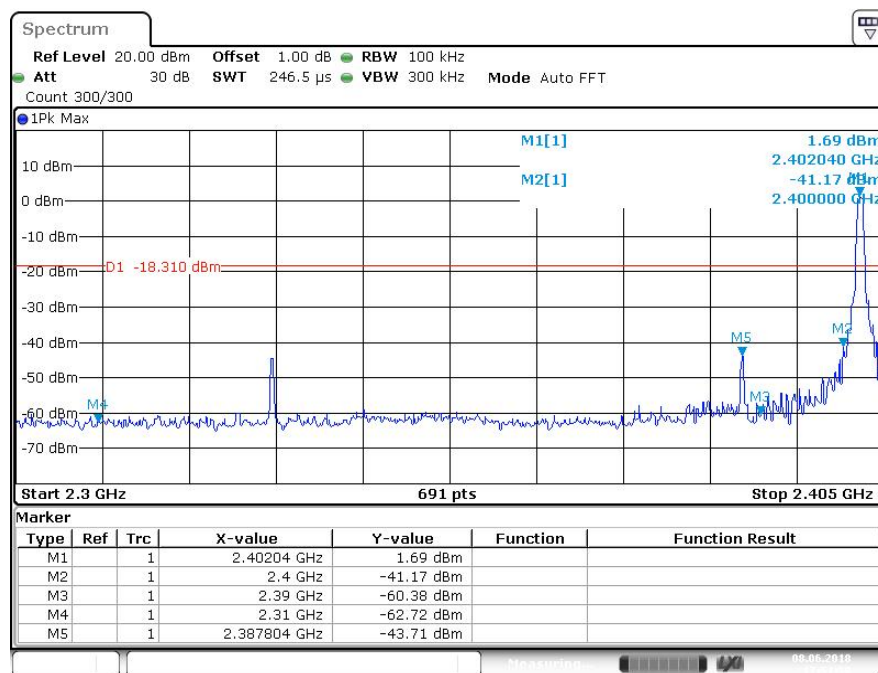
Test Result
☒ Passed
☐ Not Passed



7.6 100kHz Bandwidth of band edges

EUT: TCD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.247(d), Conducted
 Comment: 3 VDC

Test Result	
☒	Passed
☐	Not Passed



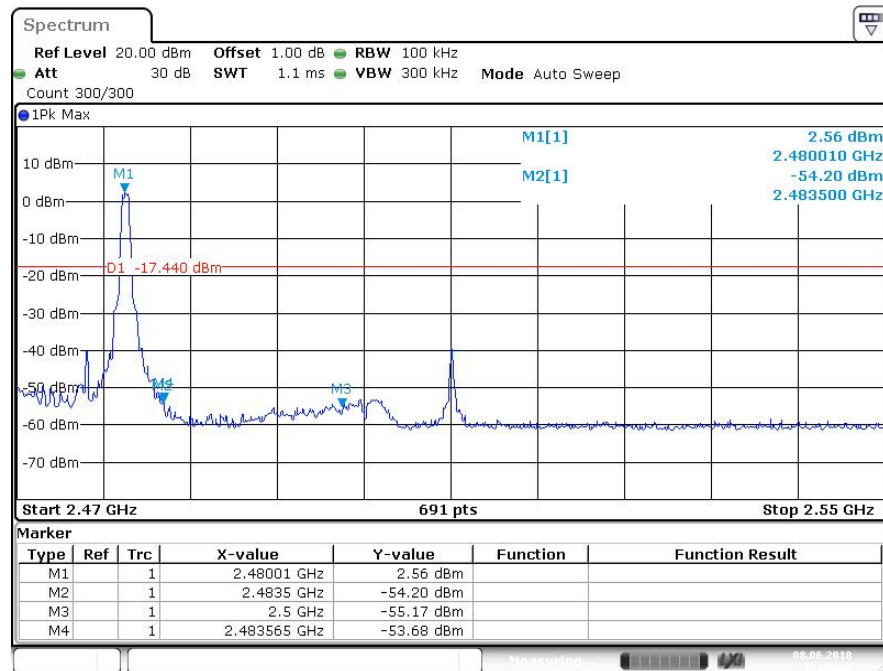
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Band edges	Limit
42.86 dB	> 20dB

100kHz Bandwidth of band edges

EUT: TCD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.247(d), Conducted
 Comment: 3 VDC

Test Result	
☒	Passed
☐	Not Passed



Date: 8 JUN 2018 17:55:07

Band edges	Limit
56.24 dB	> 20dB

7.7 Power Spectral Density

EUT: TCD
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.247(e)
 Comment: 3 VDC

Test Result	
☒	Passed
☐	Not Passed



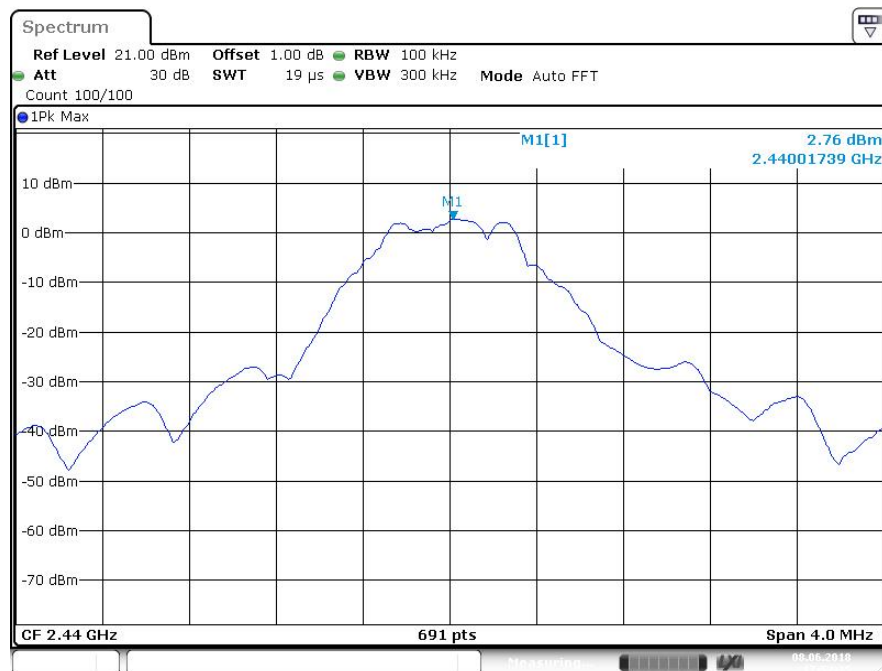
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PSD	Limit
1.67dBm	< 8 dBm

Power Spectral Density

EUT: TCD
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC15.247(e)
 Comment: 3 VDC

Test Result	
☒	Passed
☐	Not Passed



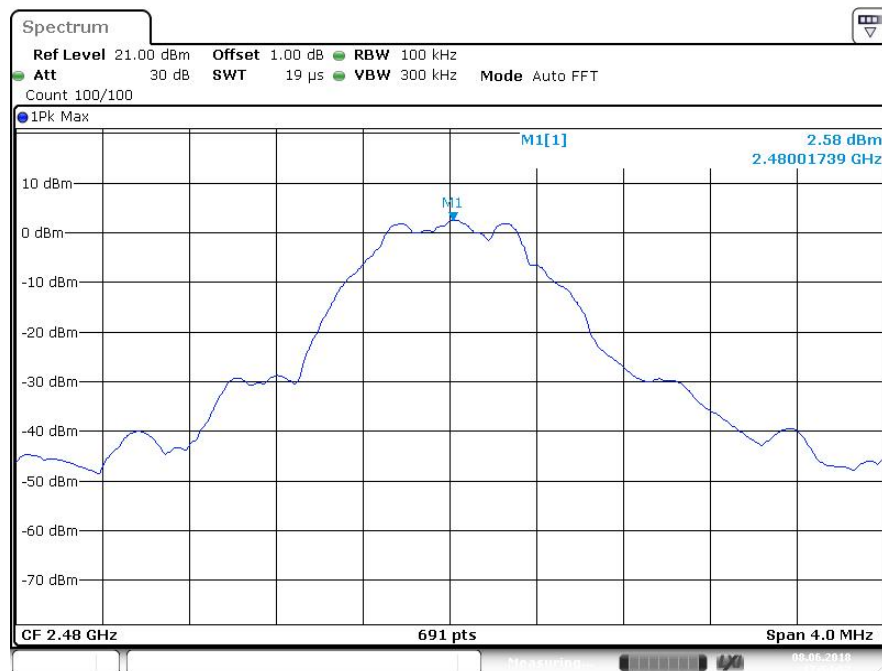
Date: 8 JUN 2018 17:53:35

PSD	Limit
2.76 dBm	< 8 dBm

Power Spectral Density

EUT: TCD
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.247(e)
 Comment: 3 VDC

Test Result	
☒	Passed
☐	Not Passed



Date: 8 JUN 2018 17:54:57

PSD	Limit
2.58 dBm	< 8 dBm

7.8 Antenna Requirement

EUT: TCD
Op Condition: Operated, TX Mode
Test Specification: FCC15.203 & 15.247(b)
Comment: 3 VDC

Test Result	
☒	Passed
☐	Not Passed

Limit

For intentional device, according to FCC Title 47 Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC Title 47 Part 15.247(b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The antenna used in this product is integrated antenna on PCB, and the maximum gain of this antenna is 0.0 dBi.

8 Appendix A - General Product Information

Radiofrequency radiation exposure evaluation

According to KDB 447498 D01v06 section 4.3.1, For frequencies between 100 MHz to 6GHz and test separation distances ≤ 50 mm, the Numeric threshold is determined as:

Step a)

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]
· $[\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR

>> The fundamental frequency of the EUT is 2402-2480MHz,
the test separation distance is ≤ 50 mm.
(Manufacturer specified the separation distance is: 20mm)

Step a)

>> Numeric threshold (2402MHz), $\text{mW} / 20\text{mm} * \sqrt{2.402\text{GHz}} \leq 3.0$
Numeric threshold (2402MHz) $\leq 38.713\text{mW}$

>> Numeric threshold (2440MHz), $\text{mW} / 20\text{mm} * \sqrt{2.440\text{GHz}} \leq 3.0$
Numeric threshold (2440MHz) $\leq 38.411\text{mW}$

>> Numeric threshold (2480MHz), $\text{mW} / 20\text{mm} * \sqrt{2.480\text{GHz}} \leq 3.0$
Numeric threshold (2480MHz) $\leq 38.100\text{mW}$

>> The power of EUT measured (2402MHz) is: 1.79dBm = 1.510mW
The power of EUT measured (2440MHz) is: 2.92dBm = 1.959mW
The power of EUT measured (2480MHz) is: 2.72dBm = 1.871mW

Which is smaller than the Numeric threshold.

Therefore, the device is exempt from stand-alone SAR test requirements.