

FCC - TEST REPORT

Report Number : **60.790.20.001.01R01** Date of Issue : April 16, 2020

Model : **mcSens**

Product Type : **IOT Sensor**

Applicant : **mcThings Inc.**

Address : **POBOX 687 Stn Main, Cochrane, Alberta, Canada**

Production Facility : **mcThings Inc.**

Address : **POBOX 687 Stn Main, Cochrane, Alberta, Canada**

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

Total pages including Appendices : 37

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch is a subcontractor to TÜV SÜD Product Service GmbH according to the principles outlined in ISO 17025.

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch reports apply only to the specific samples tested under stated test conditions. Construction of the actual test samples has been documented. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. The manufacturer/importer is responsible to the Competent Authorities in Europe for any modifications made to the production units which result in non-compliance to the relevant regulations. TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval

1 Table of Contents

1 Table of Contents.....	2
2 Description of Equipment Under Test	3
3 Summary of Test Standards	4
4 Details about the Test Laboratory	5
4.1 Test Equipment Site List	6
4.2 Measurement System Uncertainty	7
5 Summary of Test Results.....	8
6 General Remarks	9
7 Test Setups.....	10
7.1 Radiated test setups 9kHz-30MHz.....	10
7.2 Radiated test setups Below 1GHz.....	10
7.3 Radiated test setups Above 1GHz	10
7.4 AC Power Line Conducted Emission	11
7.5 Conducted RF test.....	11
8 Emission Test Results	12
8.1 Spurious Radiated Emission	12
8.2 Conducted Emission at AC Power line.....	16
8.3 6dB & 99% Bandwidth	17
8.4 Peak Output Power.....	20
8.5 Spurious Emissions at Antenna Terminals.....	23
8.6 100kHz Bandwidth of band edges.....	29
8.7 Power Spectral Density.....	32
8.8 Antenna Requirement.....	35
9 Appendix A - General Product Information	36

2 Description of Equipment Under Test

Description of the Equipment Under Test

Product: IOT Sensor

Model no.: mcSens

FCC ID: 2AGBO-MCSENS

Rating: 3V DC (2 x AA type batteries)

Frequency: 2402MHz-2480MHz (Tx and Rx)

Antenna gain: 3.3 dBi

Number of operated channel: 78

Modulation: GFSK

Auxiliary Equipment and Software Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
-	-	-	-

Remark: EUT is controlled by firmware to keep continuous transmitting at a wanted channel.

Auxiliary Software Used during Test:

DESCRIPTION	SOFTWARE NAME	VERSION	REMARK
-	-	-	-

Remark: EUT is controlled by firmware to keep continuous transmitting at a wanted channel.

3 Summary of Test Standards

Test Standards
FCC Part 15 Subpart C 10-1-19 Edition Federal Communications Commission, PART 15 — Radio Frequency Devices, Subpart C — Unintentional Radiators
All the tests were performed using the procedures from ANSI C63.4(2014) and ANSI C63.10 (2013).

4 Details about the Test Laboratory

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,
 Shenzhen 518052, P.R.China
 FCC Registration Number: 502708
 ISED test site number: 10320A-1

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 1
FCC Title 47 Part 15.207 Conduct Emission	NIL
FCC Title 47 Part 15.247(a)(1) 6dB & 99% Bandwidth	Site 1
FCC Title 47 Part 15.247(b) Peak Output Power	Site 1
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	Site 1
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	Site 1
FCC Title 47 Part 15.247(e) Power Spectral Density	Site 1
FCC Title 47 Part 15.203 & 15.247(b) Antenna Requirement	Site 1

4.1 Test Equipment Site List

Radiated emission Test – Site 1

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2020-6-28
Signal Analyzer	Rohde & Schwarz	FSV40	101031	2020-6-28
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100398	2020-7-7
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2020-7-5
Horn Antenna	Rohde & Schwarz	HF907	102294	2020-6-22
Wideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	12827	2020-7-5
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2020-6-28
Pre-amplifier	Rohde & Schwarz	SCU 40A	100432	2020-6-28
Attenuator	Agilent	8491A	MY39264334	2020-6-28
3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

Conducted Emission Test – Site 1

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2020-6-28
LISN	Rohde & Schwarz	ENV4200	100249	2020-6-28
LISN	Rohde & Schwarz	ENV432	101318	2020-7-19
LISN	Rohde & Schwarz	ENV216	100326	2020-6-28
ISN	Rohde & Schwarz	ENY81	100177	2020-6-28
ISN	Rohde & Schwarz	ENY81-CA6	101664	2020-6-28
High Voltage Probe	Rohde & Schwarz	TK9420(VT9420)	9420-584	2020-6-24
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2020-7-2
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2020-6-28
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A

20dB & 99% Bandwidth, Peak Output Power, Spurious Emissions at Antenna Terminals, 100kHz Bandwidth of band edges, Power Spectral Density – Site 1

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2020-6-28
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2020-6-28

4.2 Measurement System Uncertainty

Measurement System Uncertainty Emissions

System Measurement Uncertainty	
Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz	4.46dB
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.91dB; Vertical: 4.89dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-25000MHz	Horizontal: 4.80dB; Vertical: 4.79dB;
Uncertainty for Conducted Emission at AC Power Line 150kHz-30MHz	3.21dB
Uncertainty for frequency test	0.6×10^{-7}

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	12-15	☒	☐	☐
FCC Title 47 Part 15.207 Conduct Emission (1)	16	☐	☐	☒
FCC Title 47 Part 15.247(a)(2) 6dB & 99% Bandwidth	17-19	☒	☐	☐
FCC Title 47 Part 15.247(b) Peak Output Power	20-22	☒	☐	☐
FCC Title 47 Part 2.1051 & 15.247(d) Spurious Emissions at Antenna Terminals	23-28	☒	☐	☐
FCC Title 47 Part 15.247(d) 100kHz Bandwidth of band edges	29-31	☒	☐	☐
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) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation, and which do not operate from the AC power lines.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for **FCC ID: 2AGBO-MCSENS**, complies with Section 15.203, 15.205, 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules for the DTS grant

The TX and RX range is 2402MHz-2480MHz.

SUMMARY:

- All tests according to the regulations cited on page 8 were

■ - Performed

□ - **Not** Performed

- The Equipment Under Test

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

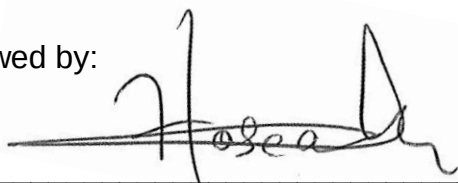
□ - **Does not** fulfill the general approval requirements.

Sample Received Date: March 5, 2020

Testing Start Date: March 10, 2020

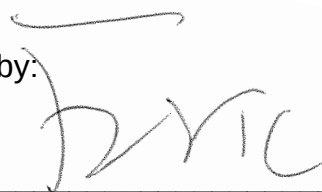
Testing End Date: March 17, 2020

Reviewed by:



Hosea CHAN
EMC Project Engineer

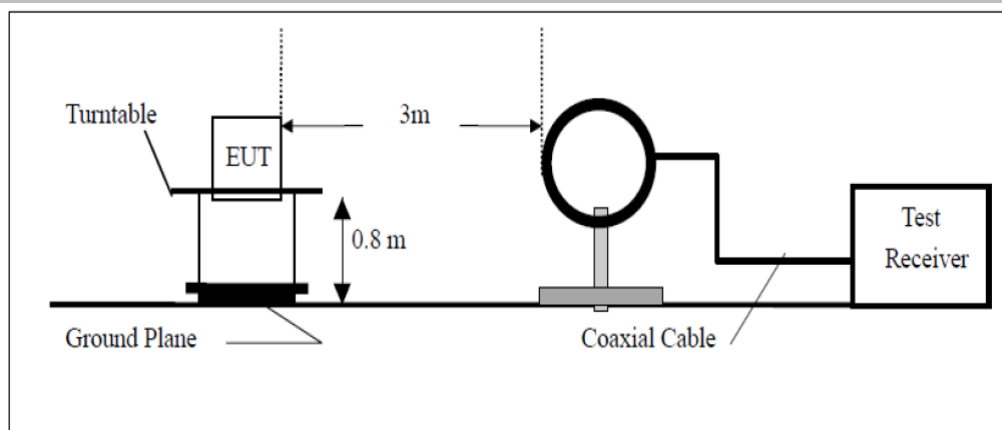
Prepared by:



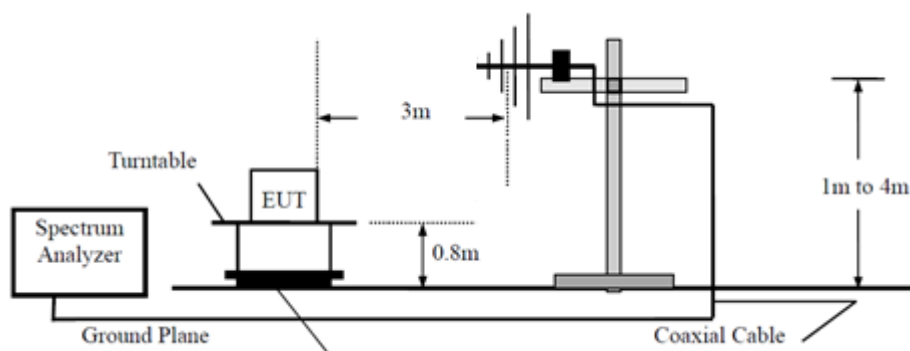
Eric LI
EMC Senior Project Engineer

7 Test Setups

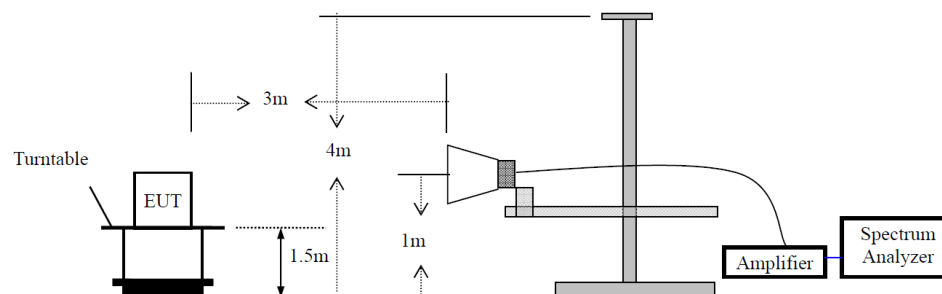
7.1 Radiated test setups 9kHz-30MHz



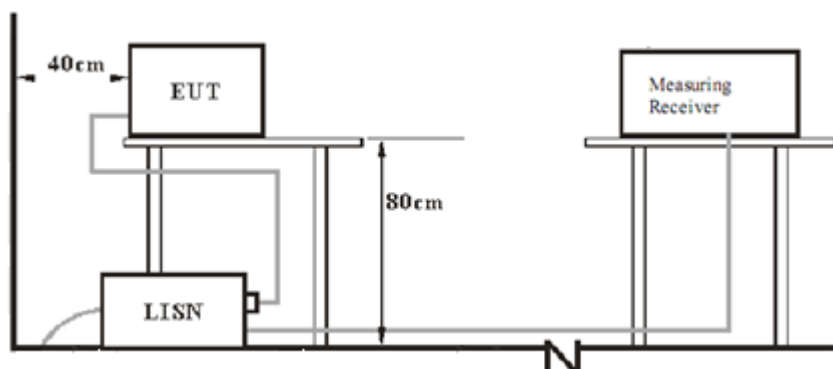
7.2 Radiated test setups Below 1GHz



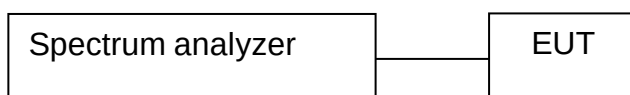
7.3 Radiated test setups Above 1GHz



7.4 AC Power Line Conducted Emission



7.5 Conducted RF test



8 Emission Test Results

8.1 Spurious Radiated Emission

EUT: mcSens
 Op Condition: Operated, TX Mode
 (Middle channel is the worst case)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Comment: 3V DC
 Remark: 9kHz to 1GHz

Test Result

☒ Passed☐ Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector PK/QP/AV	Ant. Polarity H/V	Corr. (dB)
52.310000	14.64	40.00	-25.36	Peak	H	-24.8
101.719375	14.22	43.50	-29.28	Peak	H	-28.8
200.235000	15.76	43.50	-27.74	Peak	H	-28.5
313.664375	18.34	46.00	-27.66	Peak	H	-26.2
510.877500	22.91	46.00	-23.09	Peak	H	-21.2
985.389375	31.26	54.00	-22.74	Peak	H	-15.4
45.944375	20.01	40.00	-19.99	Peak	V	-24.4
100.325000	13.79	43.50	-29.71	Peak	V	-28.7
203.448125	15.49	43.50	-28.01	Peak	V	-28.4
427.700000	23.03	46.00	-22.97	Peak	V	-23.5
697.420625	27.33	46.00	-18.67	Peak	V	-19.2
956.350000	31.19	46.00	-14.81	Peak	V	-15.9

Remark:

1. As the measured peak value not exceeded the Quasi-peak limit, Quasi-peak value no need to be measured.

Spurious Radiated Emission

EUT: mcSens
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Comment: 3V DC
 Remark: 1GHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency	Result	Limit	Margin	Detector	Ant. Polarity	Corr.
MHz	dBμV/m	dBμV/m	dB	PK/QP/AV	H/V	(dB)
1711.500000	43.55	54.00	-10.45	Peak	H	-8.0
2359.000000	42.97	54.00	-11.03	Peak	H	-4.8
3903.500000	47.16	54.00	-6.84	Peak	H	0.6
5018.000000	48.82	54.00	-5.18	Peak	H	3.0
10454.500000	48.35	54.00	-5.65	Peak	H	8.0
15153.000000	49.56	54.00	-4.44	Peak	H	12.4
1875.000000	41.00	54.00	-13.00	Peak	V	-6.6
2378.000000	42.18	54.00	-11.82	Peak	V	-4.7
4632.500000	48.01	54.00	-5.99	Peak	V	2.7
5481.500000	48.17	54.00	-5.83	Peak	V	2.7
12237.000000	47.91	54.00	-6.09	Peak	V	9.6
17563.000000	50.09	54.00	-3.91	Peak	V	17.3

Remark:

1.As the measured peak value not exceeded the average limit, average value no need to be measured.

Spurious Radiated Emission

EUT: mcSens
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Comment: 3V DC
 Remark: 1GHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector PK/QP/AV	Ant. Polarity H/V	Corr. (dB)
1903.500000	44.80	54.00	-9.20	Peak	H	-5.6
2831.500000	44.73	54.00	-9.27	Peak	H	-3.0
4346.000000	46.95	54.00	-7.05	Peak	H	2.7
6000.000000	49.55	54.00	-4.45	Peak	H	4.9
11544.000000	48.45	54.00	-5.55	Peak	H	8.8
14836.500000	48.31	54.00	-5.69	Peak	H	12.0
2031.500000	43.47	54.00	-10.53	Peak	V	-5.0
2566.000000	44.54	54.00	-9.46	Peak	V	-3.2
3837.500000	45.89	54.00	-8.11	Peak	V	1.0
5162.500000	49.30	54.00	-4.70	Peak	V	2.5
6683.500000	50.02	54.00	-3.98	Peak	V	6.6
12423.500000	48.63	54.00	-5.37	Peak	V	10.3

Remark:

1.As the measured peak value not exceeded the average limit, average value no need to be measured.

Spurious Radiated Emission

EUT: mcSens
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.205, 15.209 & 15.247(d)
 Comment: 3V DC
 Remark: 1GHz to 25GHz

Test Result	
☒	Passed
☐	Not Passed

Frequency	Result	Limit	Margin	Detector	Ant. Polarity	Corr.
MHz	dBμV/m	dBμV/m	dB	PK/QP/AV	H/V	(dB)
2606.000000	44.44	54.00	-9.56	Peak	H	-3.3
4235.500000	47.35	54.00	-6.65	Peak	H	2.0
5020.000000	48.46	54.00	-5.54	Peak	H	3.1
5657.500000	49.61	54.00	-4.39	Peak	H	3.2
11855.000000	48.24	54.00	-5.76	Peak	H	9.4
15529.500000	50.05	54.00	-3.95	Peak	H	12.8
2334.500000	43.42	54.00	-10.58	Peak	V	-4.1
3918.500000	45.83	54.00	-8.17	Peak	V	0.7
4730.000000	48.46	54.00	-5.54	Peak	V	2.7
5983.000000	49.76	54.00	-4.24	Peak	V	4.7
12092.000000	47.70	54.00	-6.30	Peak	V	10.0
15496.000000	50.33	54.00	-3.67	Peak	V	13.0

Remark:

- 1.As the measured peak value not exceeded the average limit, average value no need to be measured.

8.2 Conducted Emission at AC Power line

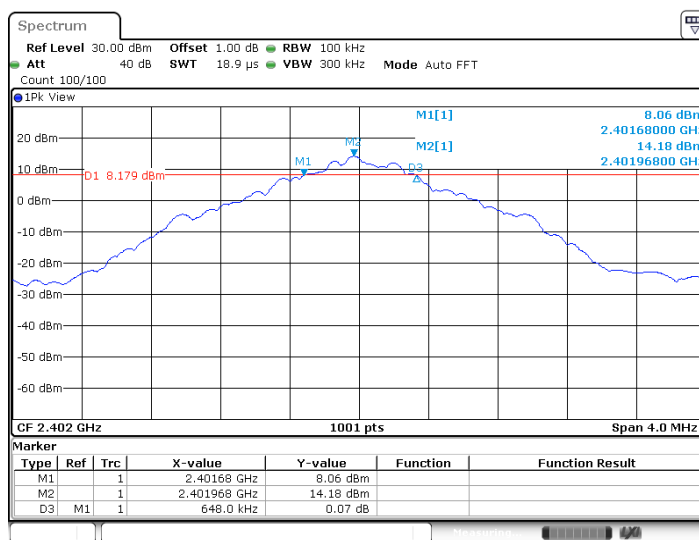
Conducted Emission testing is not applicable for this device as it is a battery operating device.

8.3 6dB & 99% Bandwidth

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

Test Result

☒ Passed
☐ Not Passed



Date: 17 MAR 2020 22:03:42



Date: 17 MAR 2020 22:03:54

Bandwidth	Measured Value	Limit
6dB bandwidth	0.648 MHz	> 0.5MHz
99% OCB	1.718 MHz	NA

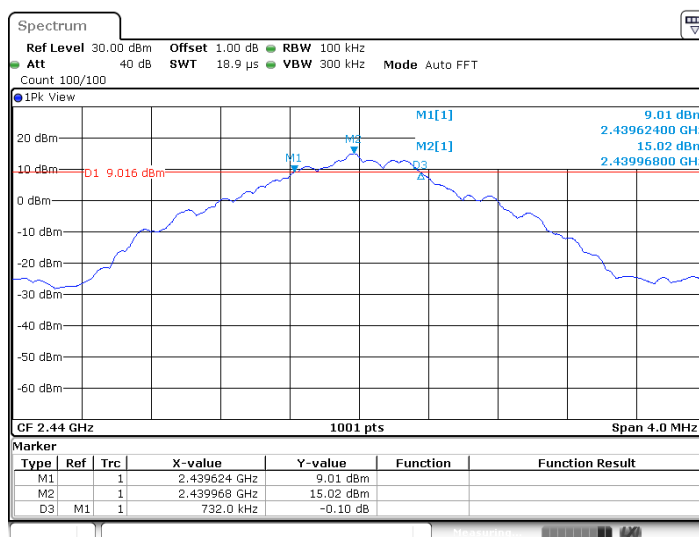
6dB & 99% Bandwidth

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

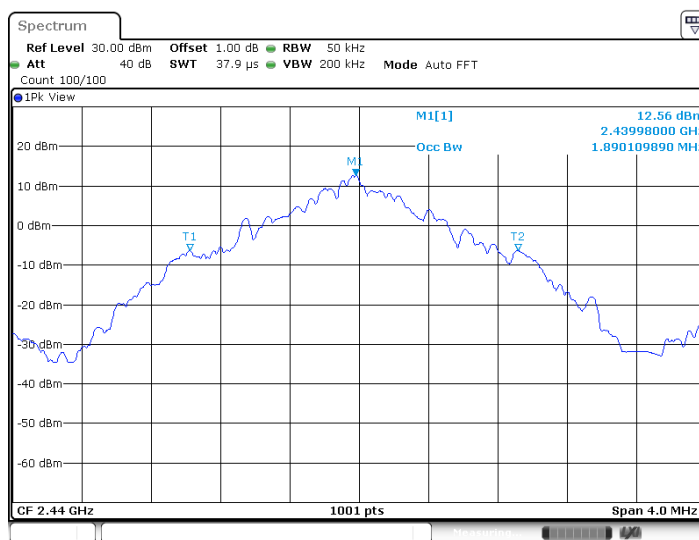
Test Result

☒ Passed

☐ Not Passed



Date: 17 MAR 2020 22:10:28



Date: 17 MAR 2020 22:10:39

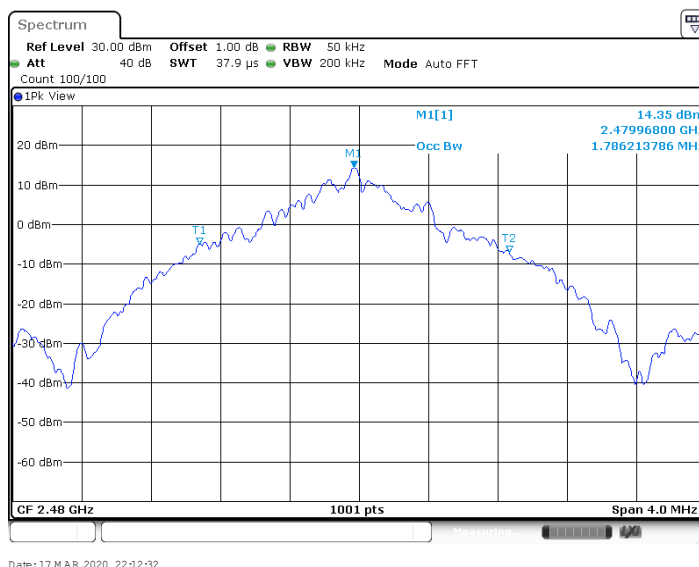
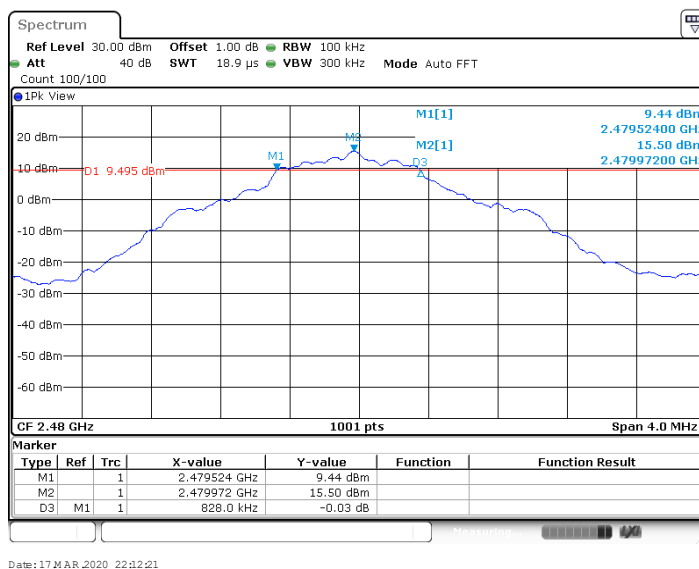
Bandwidth	Measured Value	Limit
6dB bandwidth	0.732 MHz	> 0.5 MHz
99% OCB	1.890 MHz	NA

6dB & 99% Bandwidth

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

Test Result

☒ Passed
☐ Not Passed



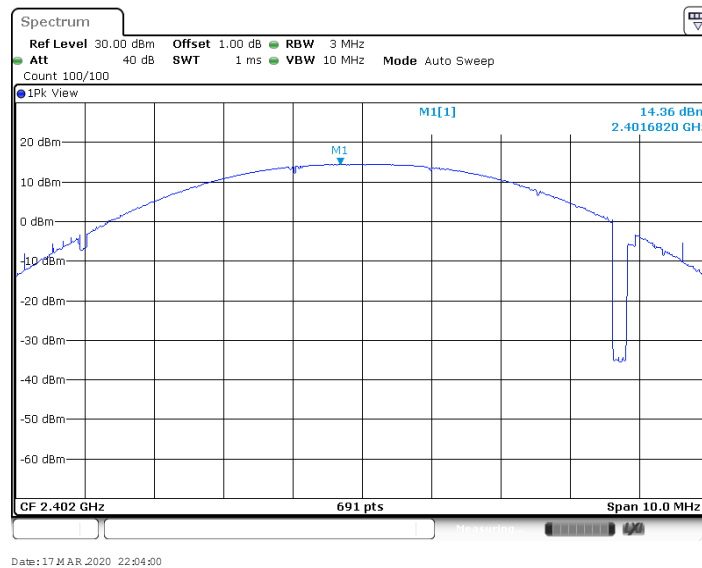
Bandwidth	Measured Value	Limit
6dB bandwidth	0.828 MHz	> 0.5 MHz
99% OCB	1.786 MHz	NA

8.4 Peak Output Power

EUT: mcSens
 Op Condition: Operated, TX Mode (2402MHz)
 Test Specification: FCC15.247(b)
 Comment: 3V DC

Test Result

☒ Passed
☐ Not Passed



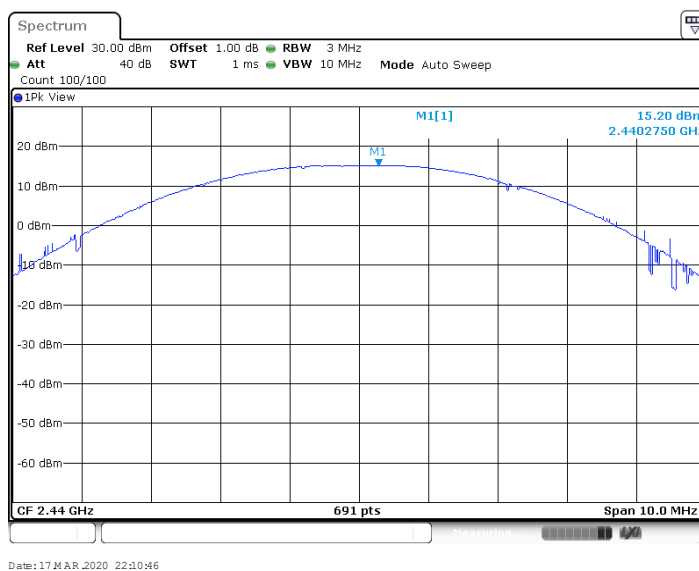
Conducted Output Power	Limit
14.36 dBm	< 30dBm

Peak Output Power

EUT: mcSens
 Op Condition: Operated, TX Mode (2440MHz)
 Test Specification: FCC15.247(b)
 Comment: 3V DC

Test Result

☒ Passed
☐ Not Passed



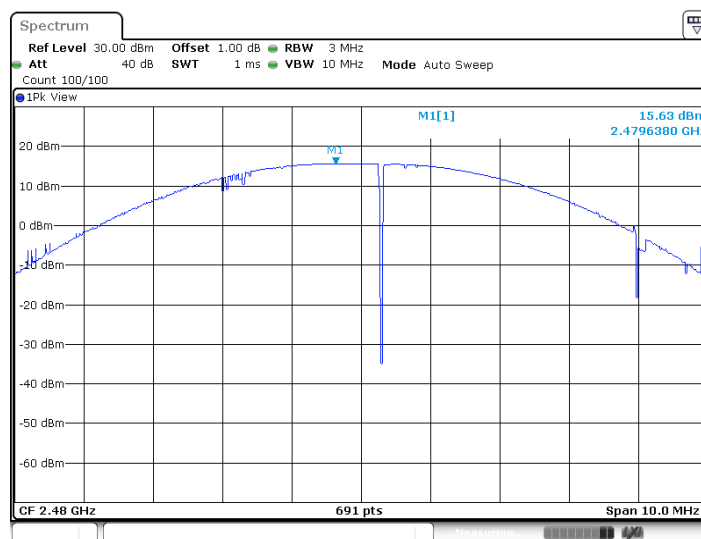
Conducted Output Power	Limit
15.20 dBm	< 30dBm

Peak Output Power

EUT: mcSens
 Op Condition: Operated, TX Mode (2480MHz)
 Test Specification: FCC15.247(b)
 Comment: 3V DC

Test Result

☒ Passed
☐ Not Passed



Date: 17 MAR 2020 22:12:39

Conducted Output Power	Limit
15.63 dBm	< 30dBm

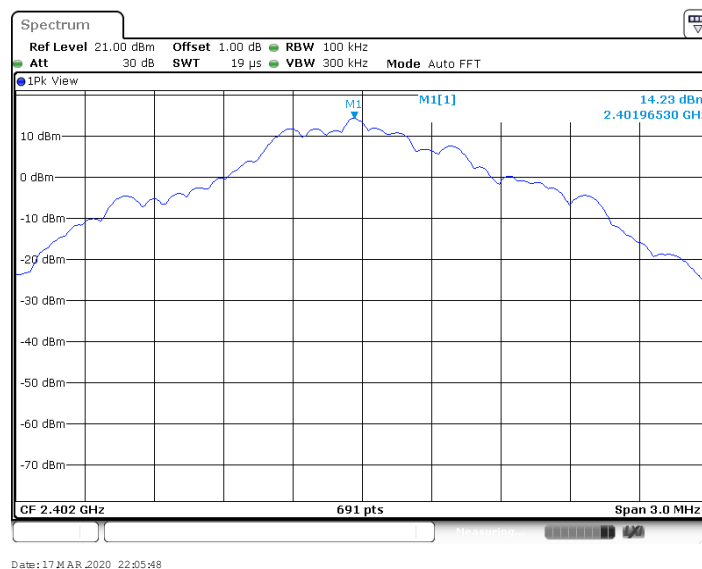
8.5 Spurious Emissions at Antenna Terminals

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

Test Result

☒ Passed
☐ Not Passed

Channel	FreqRange	RefLevel	Result	Limit	Verdict
2402	Reference	14.23	14.23	---	PASS
2402	30~1000	14.23	-67.66	≤ -5.77	PASS
2402	1000~26500	14.23	-32.48	≤ -5.77	PASS



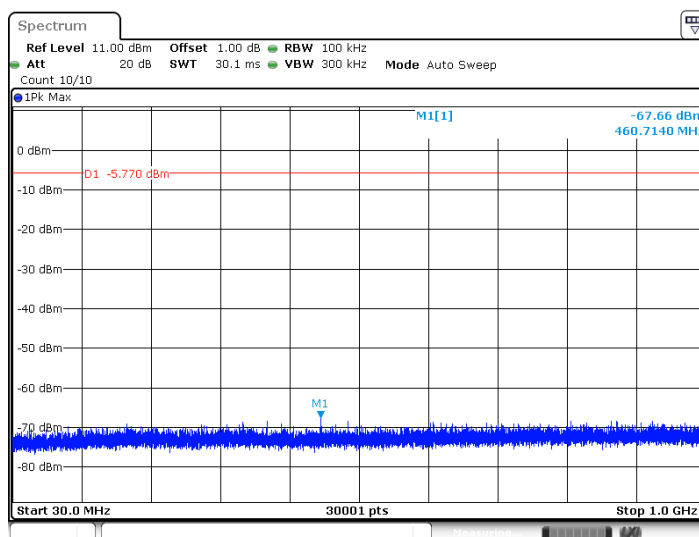
Spurious Emissions at Antenna Terminals

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

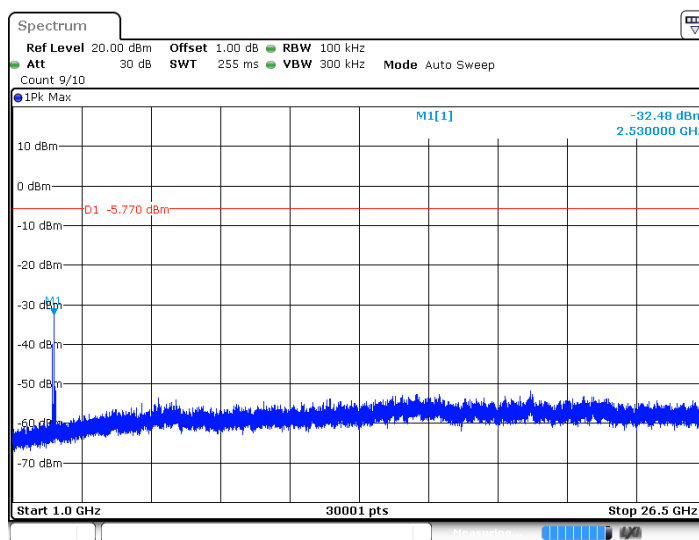
Test Result

☒ Passed

☐ Not Passed



Date: 17 MAR 2020 22:05:57



Date: 17 MAR 2020 22:06:09

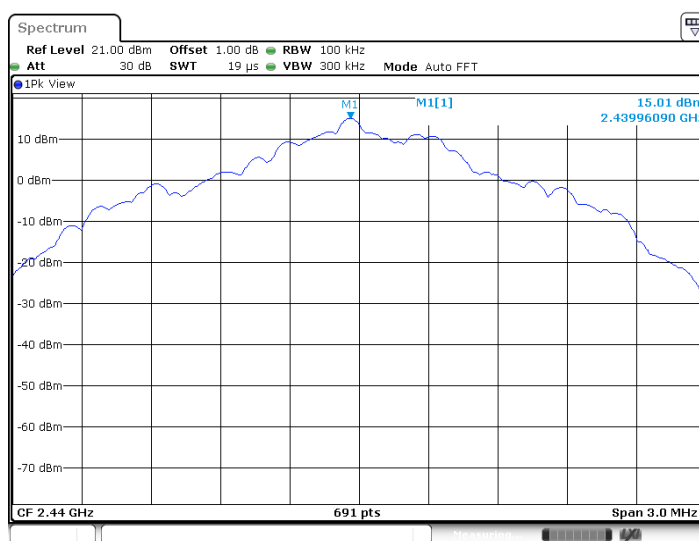
Spurious Emissions at Antenna Terminals

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

Test Result

☒ Passed
☐ Not Passed

Channel	FreqRange	RefLevel	Result	Limit	Verdict
2440	Reference	15.01	15.01	---	PASS
2440	30~1000	15.01	-68.23	<=-4.99	PASS
2440	1000~26500	15.01	-52.82	<=-4.99	PASS



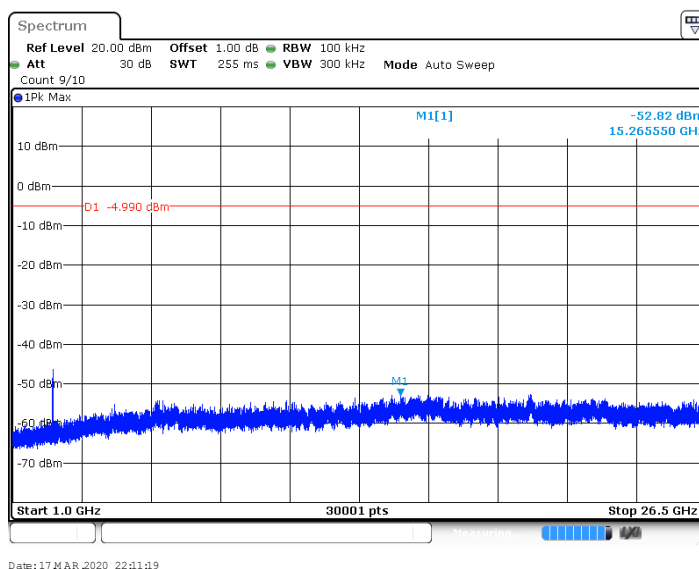
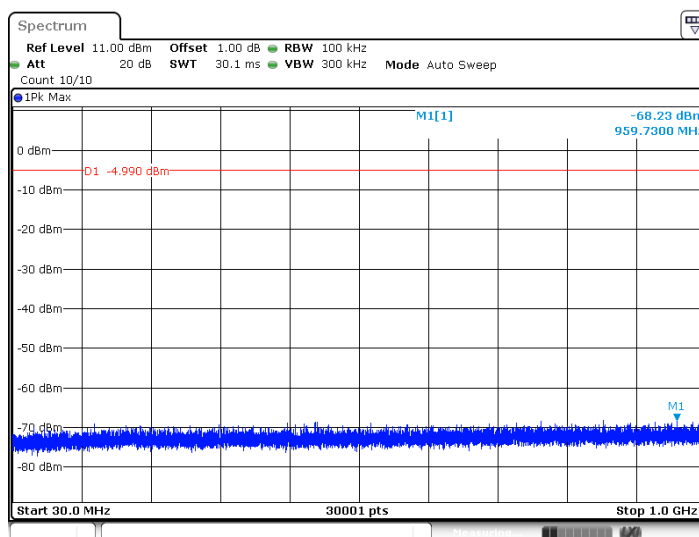
Date: 17 MAR 2020 22:10:58

Spurious Emissions at Antenna Terminals

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

Test Result

☒ Passed
☐ Not Passed

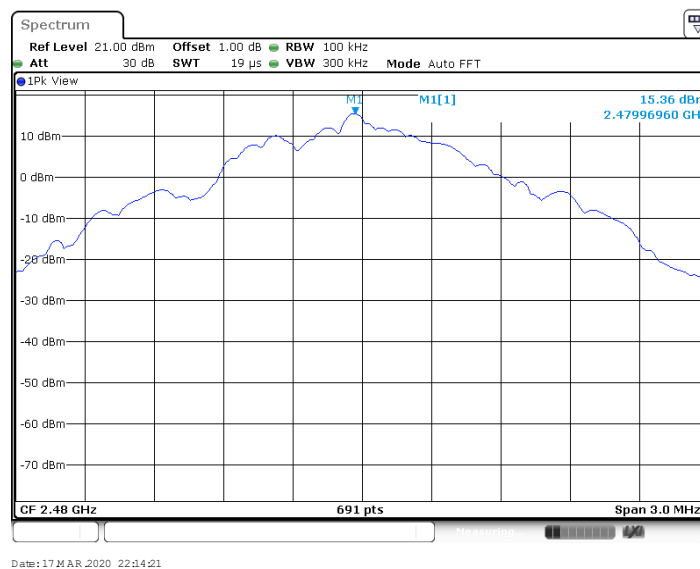


Spurious Emissions at Antenna Terminals

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

Test Result
☒ Passed
☐ Not Passed

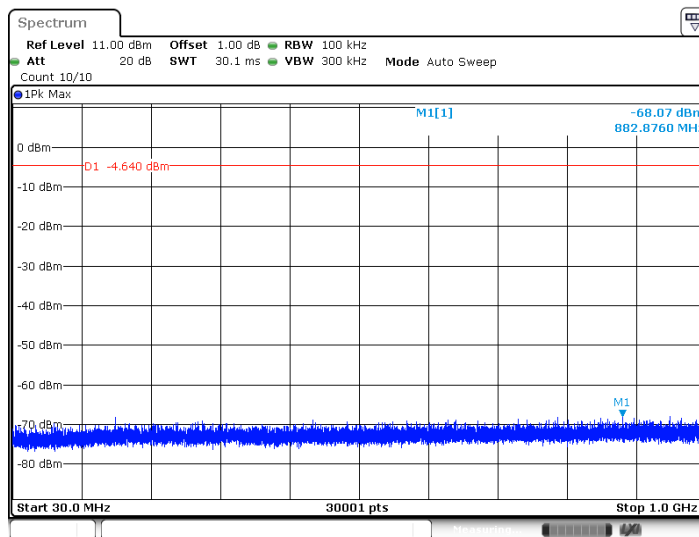
Channel	FreqRange	RefLevel	Result	Limit	Verdict
2480	Reference	15.36	15.36	---	PASS
2480	30~1000	15.36	-68.07	≤ -4.64	PASS
2480	1000~26500	15.36	-52.36	≤ -4.64	PASS



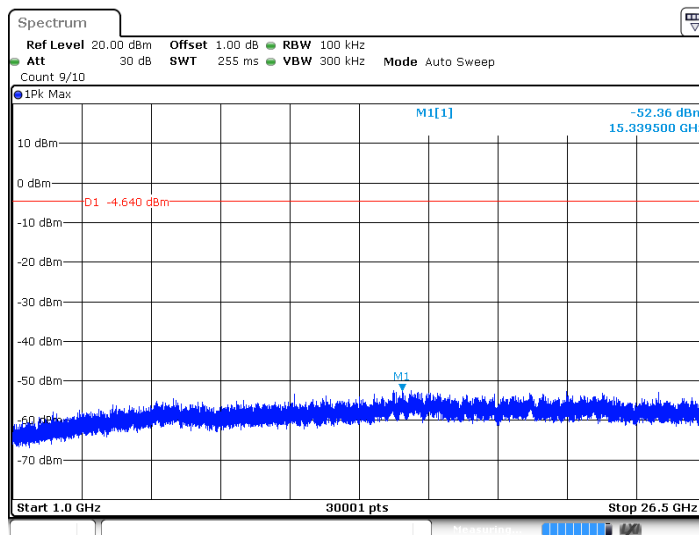
Spurious Emissions at Antenna Terminals

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

Test Result

☒ Passed☐ Not Passed

Date: 17 MAR 2020 22:14:30



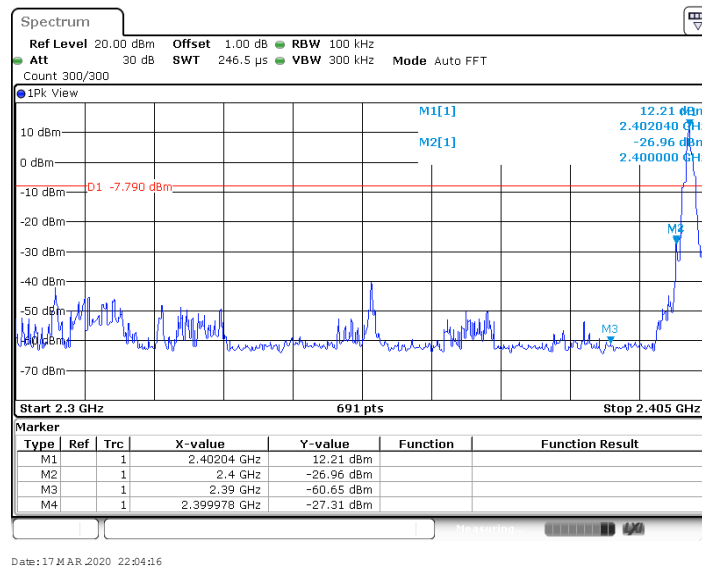
Date: 17 MAR 2020 22:14:42

8.6 100kHz Bandwidth of band edges

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

Test Result

☒ Passed
☐ Not Passed



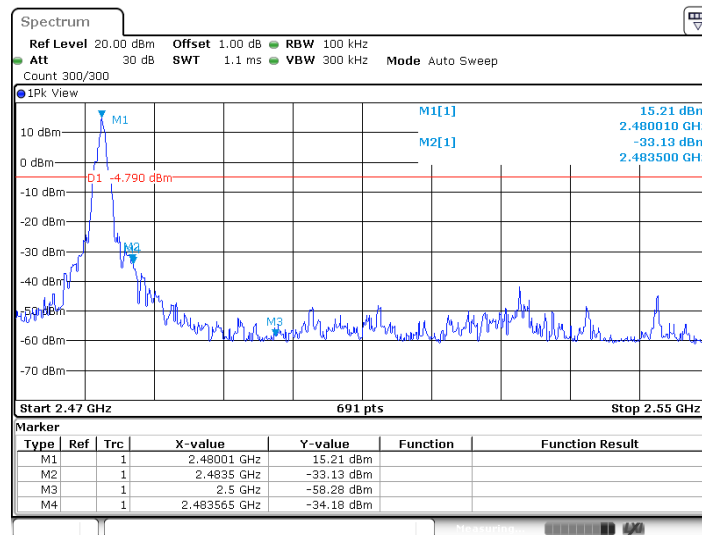
Band edges	Limit
39.17 dB	> 20dB

100kHz Bandwidth of band edges

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

Test Result

☒ Passed
☐ Not Passed



Date: 17 MAR 2020 22:12:54

Band edges	Limit
48.34 dB	> 20dB

100kHz Bandwidth of band edges

EUT: mcSens
 Op Condition: Operated, TX Mode (2402MHz & 2480MHz)
 Test Specification: FCC15.247(d), Radiated method
 Comment: 3V DC

Test Result	
☒	Passed
☐	Not Passed

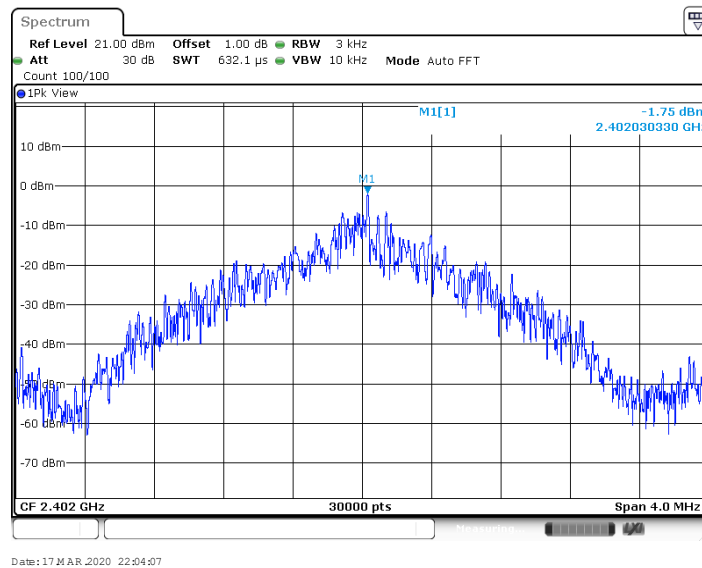
Channel	Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Detector PK /AV	Ant. Polarity H/V	Corr. (dB)
2402	2400.00	58.52	74	-15.48	Peak	H	-5.5
2402	2400.00	49.78	54	-4.22	Average	H	-5.5
2402	2400.00	61.24	74	-12.76	Peak	V	-5.5
2402	2400.00	51.09	54	-2.91	Average	V	-5.5
2480	2483.50	55.78	74	-18.22	Peak	H	-4.8
2480	2483.50	44.86	54	-9.14	Average	H	-4.8
2480	2483.50	57.49	74	-16.51	Peak	V	-4.8
2480	2483.50	46.57	54	-7.43	Average	V	-4.8

8.7 Power Spectral Density

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

Test Result

☒ Passed
☐ Not Passed

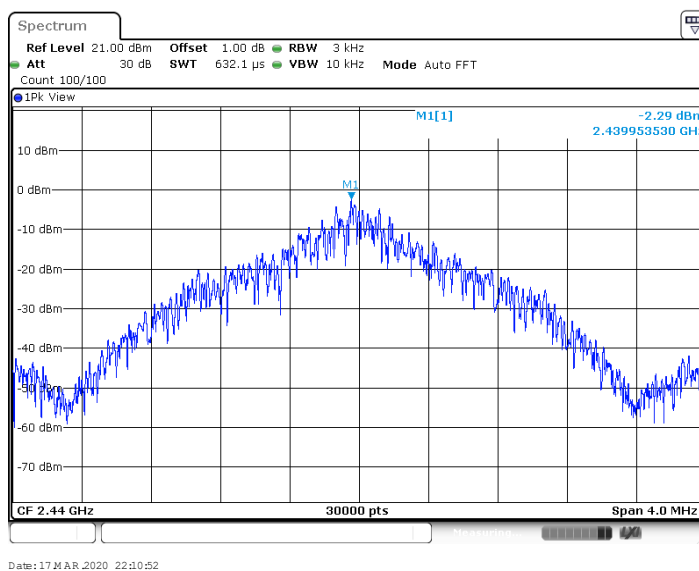


PSD	Limit
-1.75 dBm	< 8 dBm

Power Spectral Density

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

Test Result
☒ Passed
☐ Not Passed



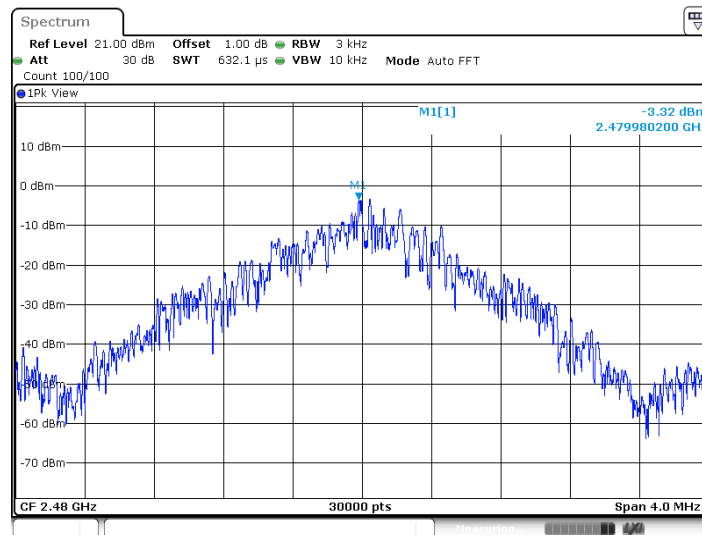
PSD	Limit
-2.29 dBm	< 8 dBm

Power Spectral Density

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

Test Result

☒ Passed
☐ Not Passed



Date: 17 MAR 2020 22:12:45

PSD	Limit
-3.32 dBm	< 8 dBm

8.8 Antenna Requirement

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

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 build-in antenna on PCB, and the maximum gain of this antenna is 3.3 dBi.

9 Appendix A - General Product Information

Radiofrequency radiation exposure evaluation

This exposure evaluation is intended for **FCC ID: 2AGBO-MCSENS**

According to FCC CFR 47 part1 1.1310, As specified in Table 1B of 47 CFR 1.1310 – Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f ²	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

MPE calculation method:

$Pd = (P \cdot G) / (4 \cdot \pi \cdot R^2)$, where

Pd = power density in mW/cm²

P = output power to antenna in mW

G = gain of antenna in linear scale

$\pi = 3.1416$

R = calculation distance in cm

>> The antenna gain is 3.3dBi (=2.138 in linear scale).

Manufacturer specified the separation distance is: 20cm

The power of EUT measured (2402MHz) is: 14.36dBm = 27.290mW

The power of EUT measured (2440MHz) is: 15.20dBm = 33.113mW

The power of EUT measured (2480MHz) is: 15.63dBm = 36.559mW

>> The Pd calculated of 2402MHz is 0.012mW/cm²

The Pd calculated of 2440MHz is 0.014mW/cm²

The Pd calculated of 2480MHz is 0.016mW/cm²

Which is smaller than the threshold of 1mW/cm².

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

Revision History

Revision History			
Edition	Date	Issued by	Modifications
1	April 16, 2020	Eric Li	First Edition