REPORT

For

Altumview Systems Inc.

607-220 Brew Street
Port Moody, British Columbia
V3H 0H6, Canada

Date:	07 JUNE 2019
Report No.:	17539-1E
Revision No.:	0
Project No.:	17539
Equipment:	Cypress Visual Sensor
Model No.:	30-03-00004
FCC ID:	2ATH6-CYPVS1
IC ID:	25095-CYPVS1

ONE STOP GLOBAL CERTIFICATION SOLUTIONS

3128-20800 Westminster Hwy, Richmond, BC
V6V 2W3, Canada
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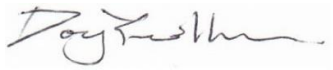
Contents

TEST REPORT-FCC Part15.247/RSS-247		
Report Reference No.....:	17539-1E	
Report Revision History. .....:	✓ Rev. 0: 07 JUNE 2019	
Compiled by (+ signature) .....:	Daniel Lee	
Approved by (+ signature).....:	Jeremy Lee	
Date of issue.....:	07 JUNE 2019	
Total number of pages .....:	47	
Testing Laboratory Name.....:	LabTest Certification Inc.	
Address .....:	Unit 205 – 8291 92ST., Delta, BC, V4G 0A4 Canada	
FCC Site Registration No......:	CA5970	
IC Site Registration No. .....:	5970A-2	
Test Site Location Name ..... :	LabTest Certification Inc.	
Address ..... :	3128–20800 Westminster Hwy, Richmond, B.C. V6V 2W3 Canada	
Applicant's name.....:	Altumview Systems Inc.	
Address .....:	607-220 Brew St. Port Moody, B.C., Canada V3H 0H6	
Manufacturer's Name .....:	Same as applicant	
Address .....:	Same as applicant	
Test specification:		
Standard.....:	➢ FCC Part 15:2019, Subpart C. ➢ RSS-247, issue 2, February 2017	
Test procedure .....:	➢ ANSI C63.4:2014 ➢ ANSI C63.10:2013 ➢ KDB 558074 D01 15.247 Meas Guidance v05r02	
Non-standard test method……..:	N/A	
Test item description .....:	Cypress Visual Sensor	
Trade Mark .....:	AltumView	
Model/Type reference .....:	30-03-00004	
Serial Number .....:	HW11, HW14 & HW16	
FCC ID.....:	2ATH6-CYPVS1	
IC ID .....:	25095-CYPVS1	
Ratings .....:	120VAC, 60Hz, Single Phase, < 16A	

Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement .....:	P (Pass)
- test object does not meet the requirement .....:	F (Fail)
Testing:	
Date of receipt of test item .....:	06 MAY 2019
Date (s) of performance of tests.....:	16 MAY to 06 JUNE, 2019

Revision History

Revision	Date	Reason For Change	Author(s)
0	07 JUNE 2019	Initial Data	Daniel Lee

Device Under Test Description

Application for	BLE Transceiver
Operating Frequency	2402 to 2480MHz
Rated RF Output(Conducted)	+4dBm
Type of Antenna	Integrated PCB Antenna
Antenna Gain	0dBi
Number of Channels	40
Channel Bandwidth	2MHz
Modulation Type	Bluetooth Low Energy
Bit Rate	2Mbps
Equipment mobility	Fixed
RF Power Setting in Test SW	n/a
Firmware Version	1.0
Software Version	n/p
Nominal Voltages for	
Supply Voltage:	__120V__ AC ___60___ Hz _____ DC

Program details

Testing Facility by procedure:		
☒	**All Testing**:	LabTest Certification Inc.
Testing location/ address .....:		Unit 3128-20800 Westminster HWY, Richmond, B.C. V6V 2W3 Canada

Summary of testing:	
Tests performed (name of test and test clause):	**Testing location:**
Conducted Measurement for Radio	**on GRP, Richmond**
Radiated Emissions	**in SAC, Richmond**
Conducted Emissions on AC Line	**in SAC, Richmond**
The tests indicated in Test Summary were performed on the product constructed as described below. The test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted. Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. LabTest does not make any claims of compliance for samples or variants which were not tested.	

Available channel number and frequency

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	11	2422	21	2442	31	2462
2	2404	12	2424	22	2444	32	2464
3	2406	13	2426	23	2446	33	2466
4	2408	14	2428	24	2448	34	2468
5	2410	15	2430	25	2450	35	2470
6	2412	16	2432	26	2452	36	2480
7	2414	17	2434	27	2454	37	2482
8	2416	18	2436	28	2456	38	2484
9	2418	19	2438	29	2458	39	2486
10	2420	20	2440	30	2460	40	2480

Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
1	120	-	-	60Hz	-	

Client Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	Cypress	Altumview	30-03-00004	Serial Number:HW11, Radiated Measurement unit for BLE Transceiver
EUT	Cypress	Altumview	30-03-00004	Serial Number:HW14, Conducted Measurement unit for BLE Transceiver
EUT	Cypress	Altumview	30-03-00004	Serial Number:HW16, General Operating Unit for Digital part testing.
EUT	Power Adapter	Altumview	SJ-12020001	AC to DC converter, 12VDC/2.0A
SIM	WiFI Router	TP_LINK	TL-WR740N	WiFi Wireless Router, connecting to Server
SIM	SmartPhone	Apple	iPhone	Installed control App.

Abbreviations:
EUT - Equipment Under Test,
AE - Auxiliary/Associated Equipment, or
SIM - Simulator (Not Subjected to Test)

Software and Firmware

Use*	Description	Version
EUT	Firmware	1.0

Abbreviations:
EUT - Equipment Under Test,
AE - Auxiliary/Associated Equipment, or
SIM - Simulator (Not Subjected to Test)

EUT Modification

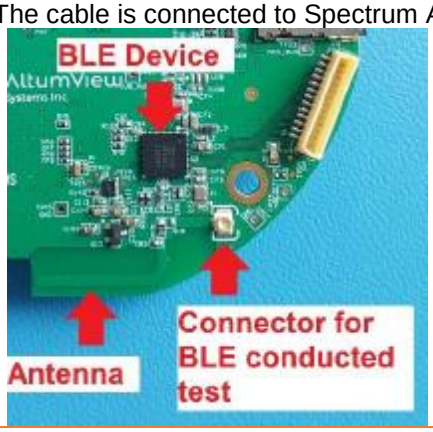
None

EUT Operation Modes

Mode #	Description
1	For Radio measurement, select Channel #1, Maximum Output power, +4dBm, WiFi off, Bit rate is 2Mbps.
2	For Radio measurement, select Channel #20, Maximum Output power, +4dBm, WiFi off, Bit rate is 2Mbps.

3	For Radio measurement, select Channel #40, Maximum Output power, +4dBm, WiFi off, Bit rate is 2Mbps.
4	For Digital measurement, imitating continues multiple human activities with Green LED. Both the EUT and power supply are placed on the tabletop. Router is placed in Chamber below Ground Plane.

EUT Configuration Modes

Mode #	Description
1	Conducted Measurement for Radio: the RF Cable are connected to test port of BLE transceiver as see below in EUT, HW14. The cable is connected to Spectrum Analyzer. 
2	Radiated Measurement for Radio: EUT, HW11 was set on 1.5meter tabletop for measuring spurious in restriction band described in FCC15.205.
3	Intentional Radiated Emissions: measuring for Digital emissions, EUT, HW16 was put on 0.8m tabletop.

Test Equipment Verified for function

Model #	Description	Checked Function	Results
N9038A	EMI Receiver	Frequency and Amplitude	Connected 50MHz and -20 dBm Ref_signal and checked OK.
SAS-540	Antenna, 30 to 300MHz	Checked structure	Normal – no damage.
VUSLP9111B	Antenna, 300 to 1,000MHz	Checked structure	Normal – no damage.
SAS-571	Antenna, 1 to 18GHz	Checked structure	Normal – no damage.
SAS-572	Antenna, 18 to 26.5GHz	Checked structure	Normal – no damage.
JB1	Antenna, 30 to 1000MHz	Checked structure	Normal – no damage.
LIN-120C	LISN	Checked Insertion Losses from 150kHz to 30MHz	Losses were normal.
5001i	AC Power Source	Measured the Output power, 120VAC, 60Hz	Working normally

Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests:

Parameter	Uncertainty
Radiated Emission, 30 to 300MHz	± 3.86 dB
Radiated Emission, 300 to 1,000MHz	± 3.77 dB
Radiated Emission, 1 to 26.5GHz	± 4.97 dB
Conducted Measurements, 0.15 to 30MHz	± 1.61 dB

Uncertainty figures are valid to a confidence level of 95%.

Result Summary

The Compliance Status is a judgment based on the calculated highest emissions to appropriate standard limits. Measurement uncertainty values were not used in the determination of compliance.

FCC 15.247/RSS-247			
Test Type	**Regulation**	**Measurement Method**	**Compliance Status**
Occupied Bandwidth	FCC15.247(a)(2)/RSS-247, 5.2(a)	ANSI C63.10	**P**
Maximum Peak Output Power	FCC15.247(b)(3)/RSS-247, 5.4(d)	ANSI C63.10	**P**
Antenna Gain	FCC15.247(b)(4)/RSS-247, 5.4(e)	n/a	**P**
Conducted Spurious Emissions	FCC15.247(d)/RSS-247, 5.5	ANSI C63.10	**P**
Band Edge	FCC15.247(d)/RSS-247, 5.5	ANSI C63.10	**P**
Radiated Spurious Emissions	FCC 15.247(d), 15.205(a),15.209(a)/ RSS-247, 5.5	ANSI C63.10	**P**
Power Spectral Density	FCC15.247(e)/RSS-247, 5.2(b)	ANSI C63.10	**P**
Radiated Emissions-Unintentional radiators	FCC 15.209(a)/RSS-GEN	ANSI C63.4	**P**
AC Power Line Conducted Emission	FCC 15.207(a)/RSS-GEN	ANSI C63.4	**P**

Occupied Bandwidth

Governing Doc	FCC 15.247(a)(2)/RSS-247, 5.2(a)	Room Temperature (°C)	24.5
Basic Standard	ANSI C63.10	Relative Humidity (%)	43.2
Test Location	Richmond	BAROMETRIC PRESSURE	101.9
Test Engineer	Daniel Lee	DATE	06 JUNE 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration
EMC Analyzer	KeySight	N9038A	702	13-May-2019	13-May-2020
RF Cable	n/a	n/a	n/a	IHC[1]	IHC[1]
AC Power Source	California Instruments	5001i	059	IHC[2]	IHC[2]

Note1) In House Calibration Ref. # 6
Note2) In House Calibration Ref. # 7

Method ☒ Option 1 ☐ Option 2

Channel	Frequency(MHz)	6dB Bandwidth(kHz)	99%(kHz)	Limit(kHz)
Low(1)	2402	866.6	1840.8	> 500
Middle(20)	2440	885.9	1840.8	
High(40)	2480	868.2	1843.9	

Compliant ☒ Non-Compliant ☐

Test Method

Reference to KDB 558074 D01 15.247 Meas Guidance v05 and ANSI C63.10, 11.8.1 Option1.

- RBW=100kHz
- VBW=300kHz
- Detector=Peak
- Trace mode=max hold
- Sweep=auto couple
- Max hold to stabilize

Test setup

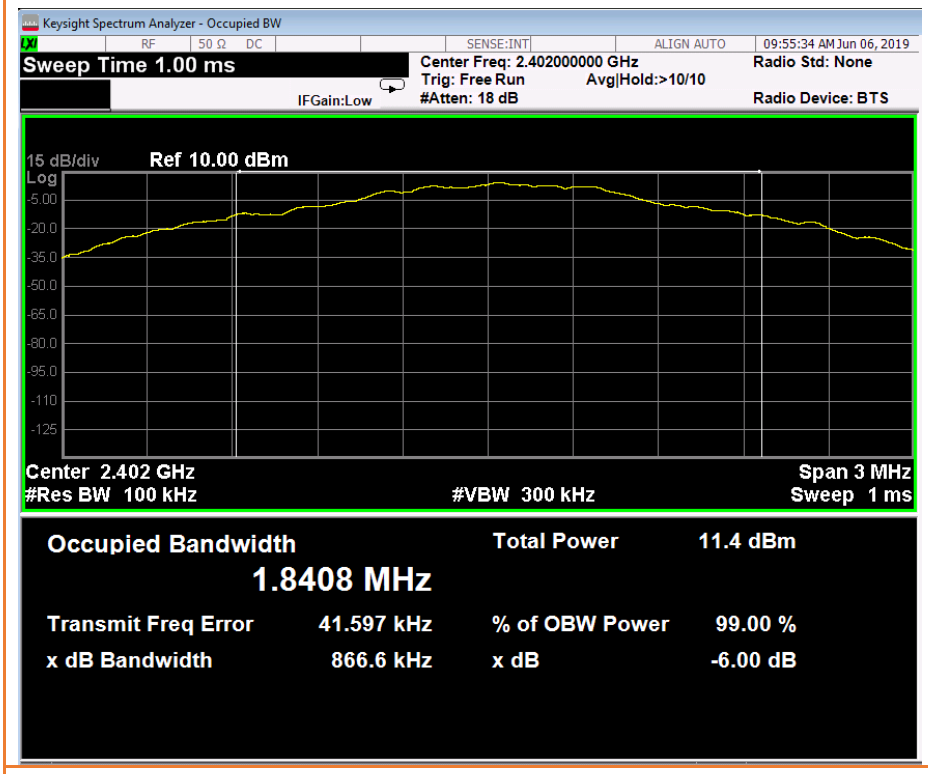
Description of test set-up:

The EUT was placed on a 0.8m non-conducting table above a ground reference plane (GRP).

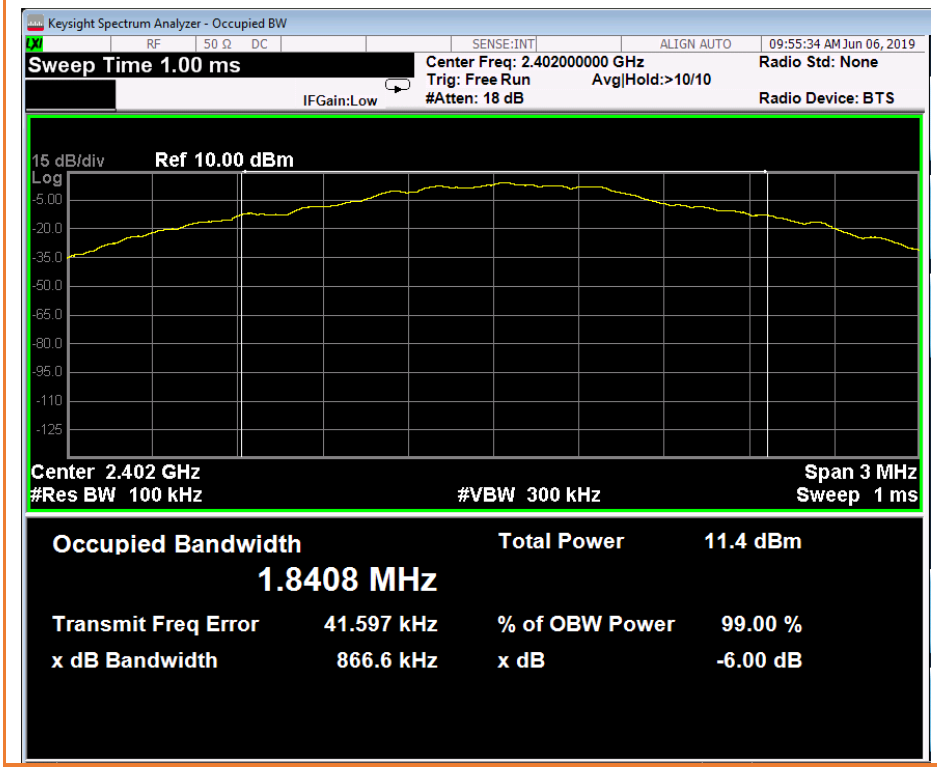
The EUT was set to **Operation Mode #1, #2, #3 with configuration Mode #1.**

Test Plots

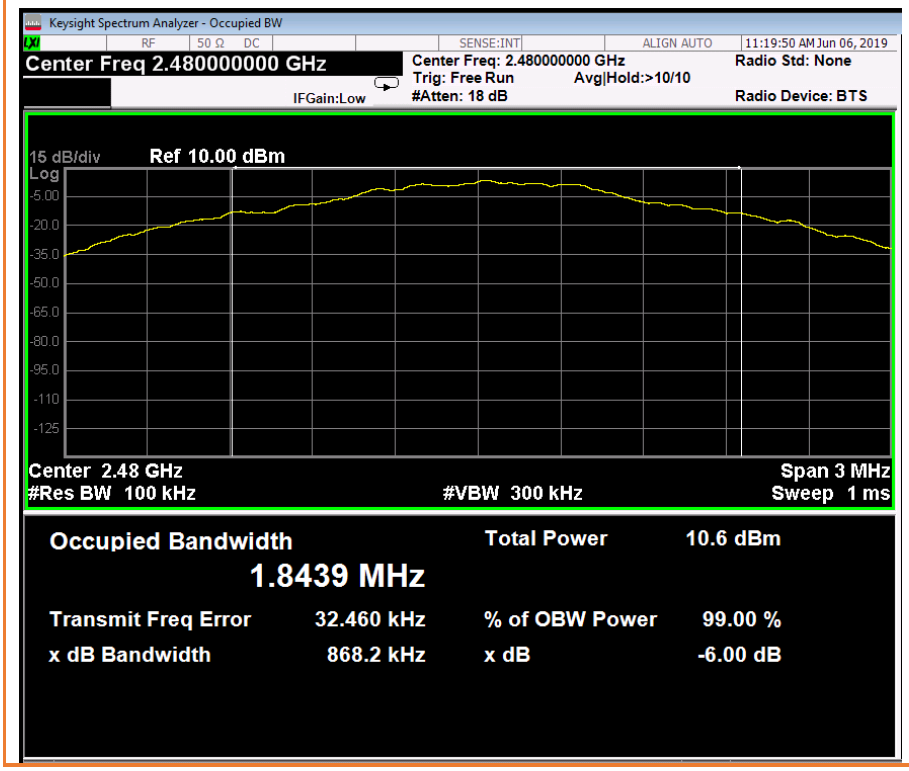
- Low Channel



- Middle Channel



- High Channel



Maximum Peak Output Power

Governing Doc	FCC 15.247(b)(3)/RSS-247, 5.4(d)	Room Temperature (°C)	24.5
Basic Standard	ANSI C63.10	Relative Humidity (%)	43.2
Test Location	Richmond	BAROMETRIC PRESSURE	101.9
Test Engineer	Daniel Lee	DATE	06 JUNE 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration
EMC Analyzer	KeySight	N9038A	702	13-May-2019	13-May-2020
RF Cable	n/a	n/a	n/a	IHC[1]	IHC[1]
AC Power Source	California Instruments	5001i	059	IHC[2]	IHC[2]

Note1) In House Calibration Ref. # 6
Note2) In House Calibration Ref. # 7

Method	☒ RBW ≥ DTS BW ☐ Integrated band power ☐ PKPM1 Peak power meter			
Channel	Frequency(MHz)	Measured(dBm)	Limit(dBm)	Margin(dB)
Low(1)	2402	+3.62	+30.00	26.38
Middle(20)	2440	+3.62		26.38
High(40)	2480	+3.26		26.74

Compliant ☒ Non-Compliant ☐

Test Method

Reference to KDB 558074 D01 15.247 Meas Guidance v05 and ANSI C63.10, 11.9.1 Maximum peak conducted output power.

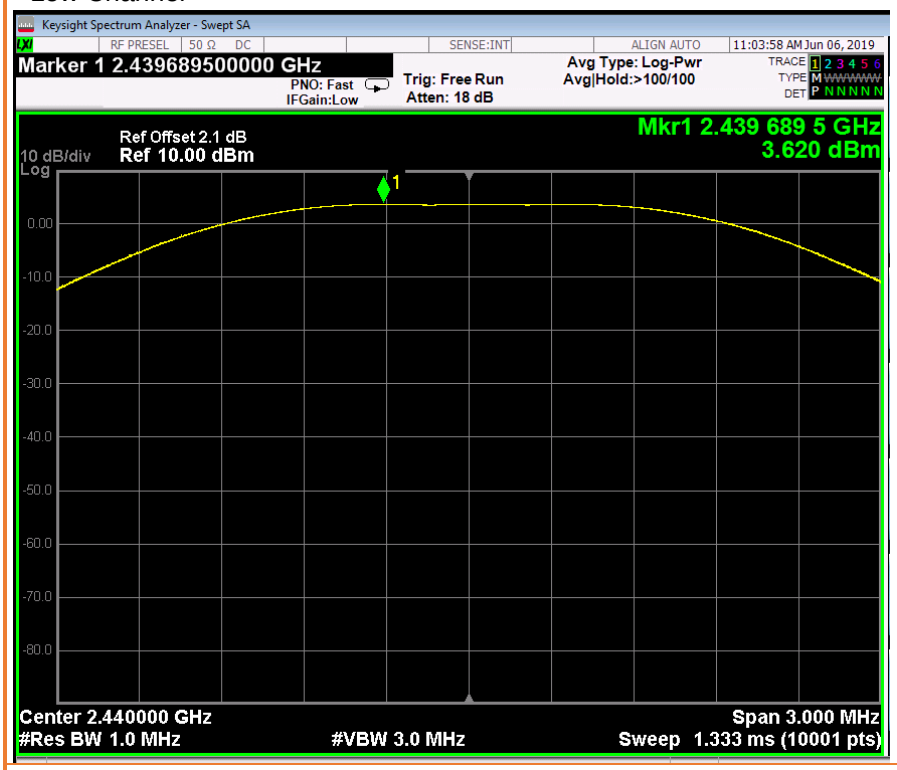
- RBW=1MHz
- VBW=3MHz
- Span=3MHz
- Sweep=auto couple
- Detector=Peak
- Trace mode=max hold
- Max hold to stabilize

Test setup

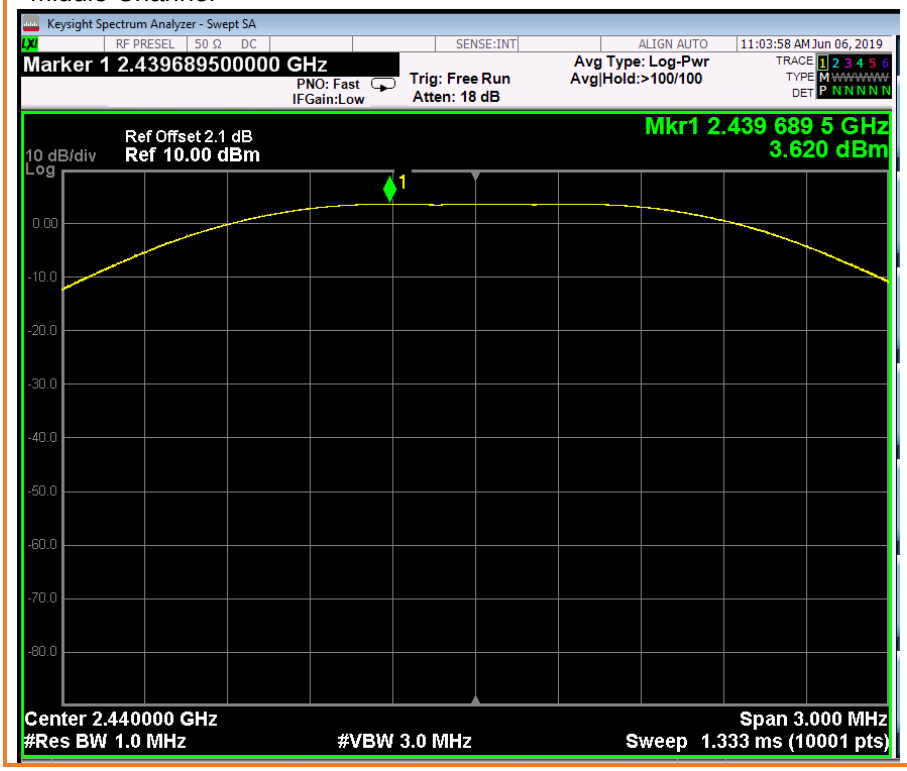
Description of test set-up:
The EUT was placed on a 0.8m non-conducting table above a ground reference plane (GRP).
The EUT was set to **Operation Mode #1, #2, #3 with configuration Mode #1.**

Test Plots

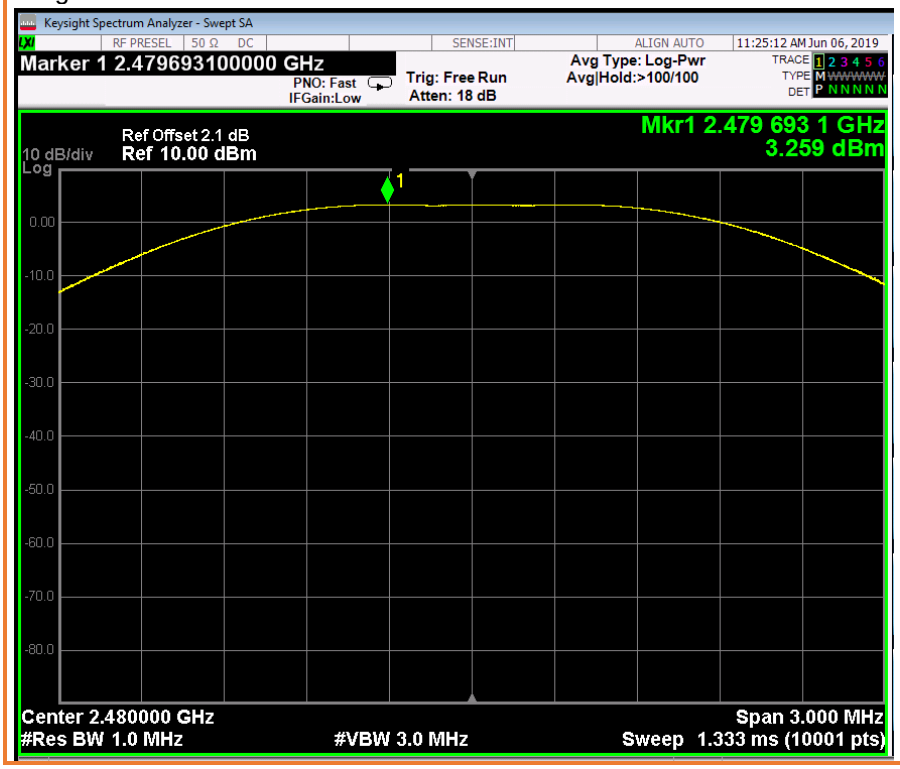
- Low Channel



- Middle Channel



- High Channel



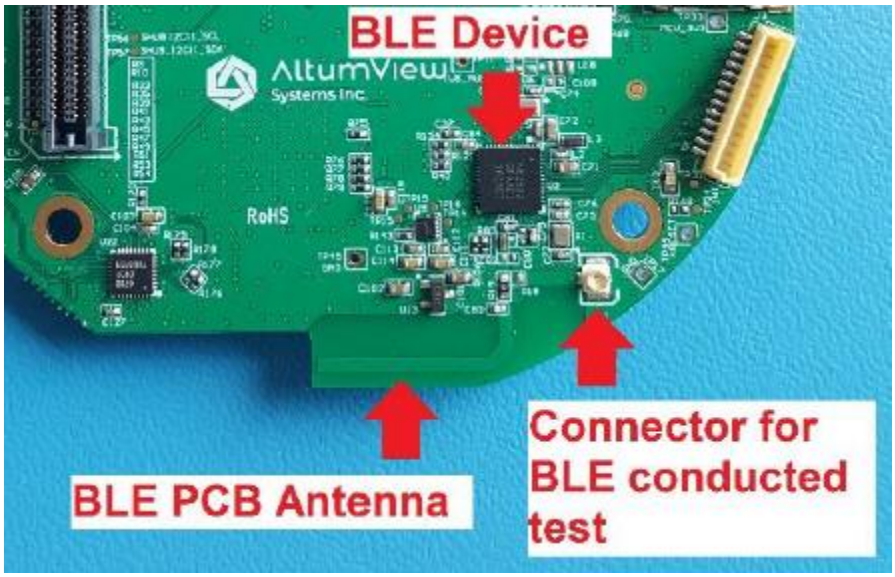
Antenna Gain

Governing Doc	FCC 15.247(b)(4)/RSS-247, 5.4(e)	Room Temperature (°C)	24.5
Basic Standard	FCC 15.203/RSS-GEN	Relative Humidity (%)	43.2
Test Location	Richmond	BAROMETRIC PRESSURE	101.9
Test Engineer	Daniel Lee	DATE	06 JUNE 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		
Antenna Type	☒ Permanently attached ☐ Can replacement by user		
Antenna Type	☒ PCB ☐ Chip ☐ External Antenna Port		
Antenna Gain	☒ ≤ 6dBi ☐ > 6dBi		
Compliant ☒	Non-Compliant ☐		

Conclusion

As see below, the antenna is permanently designed on PCB, so user cannot change the antenna.

The antenna port is only available for conduced measurement purpose, not providing to be accessing by users.



Conducted Spurious Emissions

Governing Doc	FCC 15.247(d)/ RSS-247, 5.5	Room Temperature (°C)	24.5
Basic Standard	ANSI C63.10	Relative Humidity (%)	43.2
Test Location	Richmond	BAROMETRIC PRESSURE	101.9
Test Engineer	Daniel Lee	DATE	06 JUNE 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration
EMC Analyzer	KeySight	N9038A	702	13-May-2019	13-May-2020
RF Cable	n/a	n/a	n/a	IHC[1]	IHC[1]
AC Power Source	California Instruments	5001i	059	IHC[2]	IHC[2]

Note1) In House Calibration Ref. # 6
Note2) In House Calibration Ref. # 7

Frequency (MHz)	Channel Power (dBm)	Emissions (dBm)	Marker-delta (dB)	Limit (dB)	Margin (dB)
Low(1)					
2273.916	+3.655	-56.932	60.587	> 20	40.587
5180.0	+3.655	-42.612	46.267		20.267
Middle(20)					
2312.073	+3.574	-60.332	63.906	> 20	43.906
7319.0	+3.574	-55.738	59.312		39.312
High(40)					
2312.073	+3.124	-60.332	63.456	> 20	43.456
4961.7	+3.124	-56.045	59.169		39.169

Compliant ☒ Non-Compliant ☐

Test Method

Reference to KDB 558074 D01 15.247 Meas Guidance v05 and ANSI C63.10, 11.11. Option1.

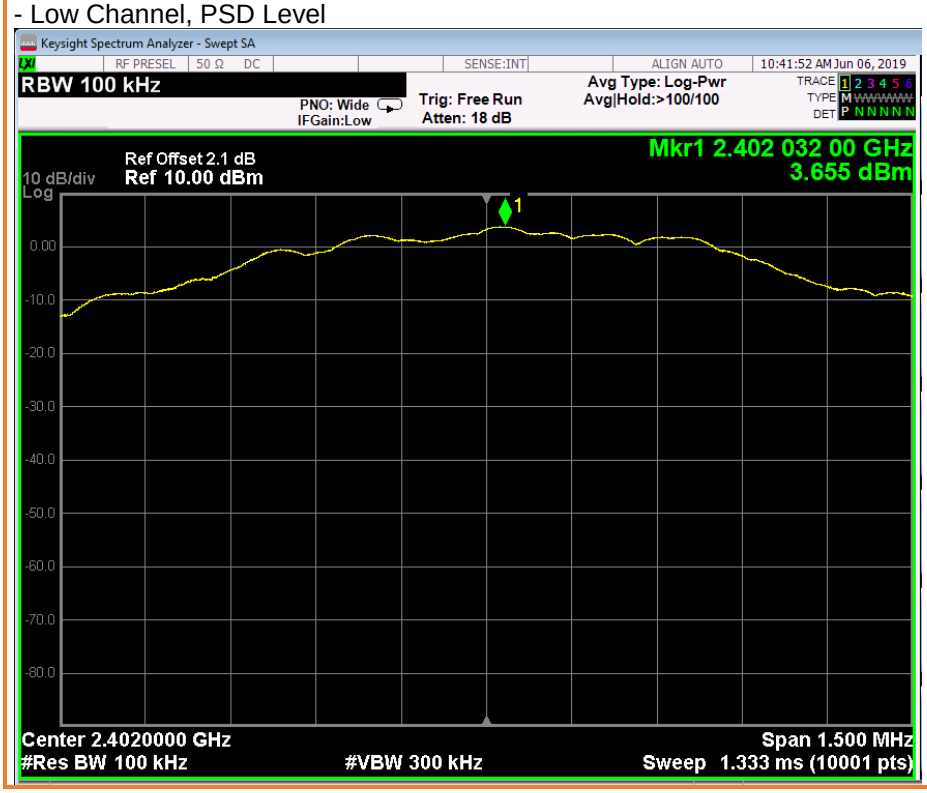
- RBW=100kHz
- VBW=300kHz
- Detector=Peak
- Trace mode=max hold
- Sweep=auto couple
- Max hold to stabilize

Test setup

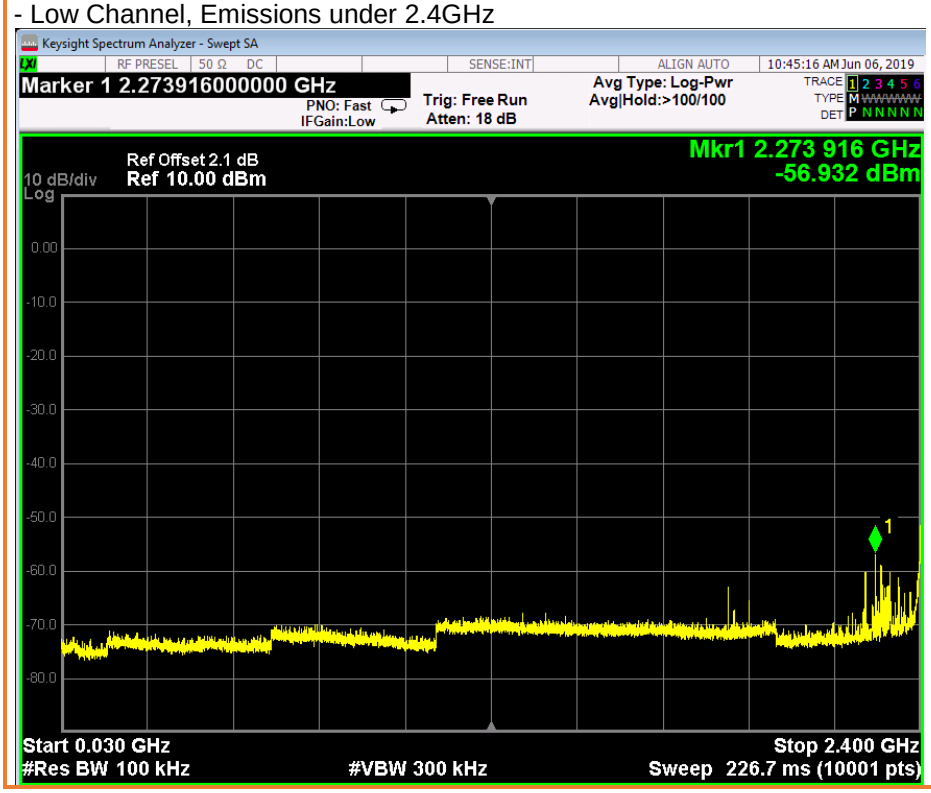
Description of test set-up:
The EUT was placed on a 0.8m non-conducting table above a ground reference plane (GRP).
The EUT was set to **Operation Mode #1, #2, #3 with configuration Mode #1.**

Test Plots

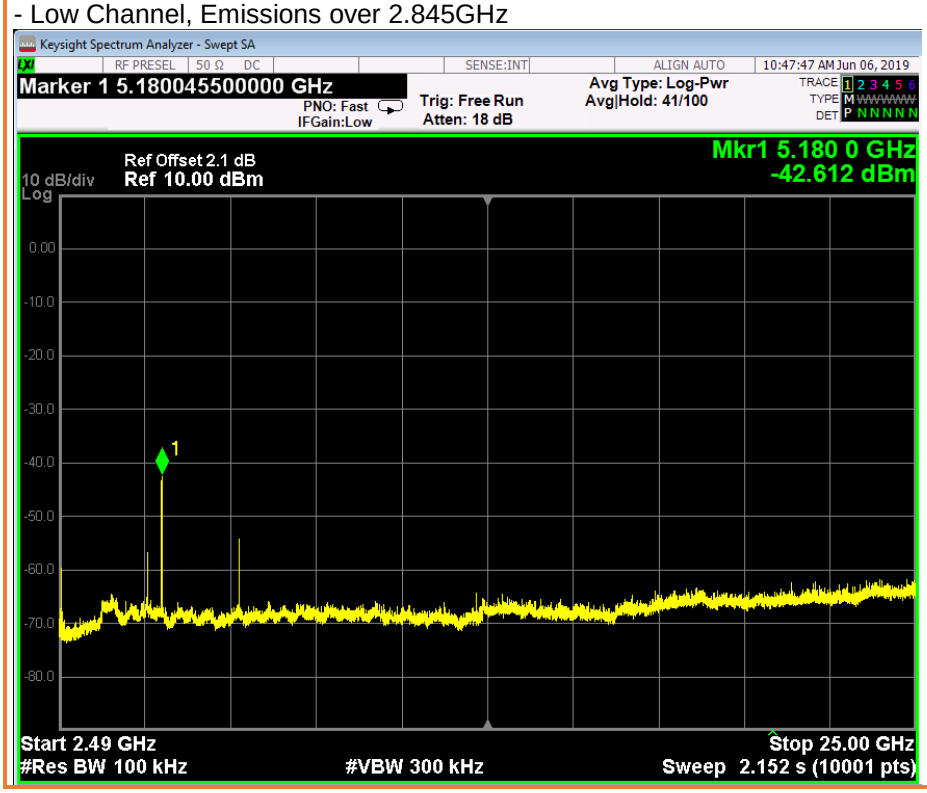
- Low Channel, PSD Level



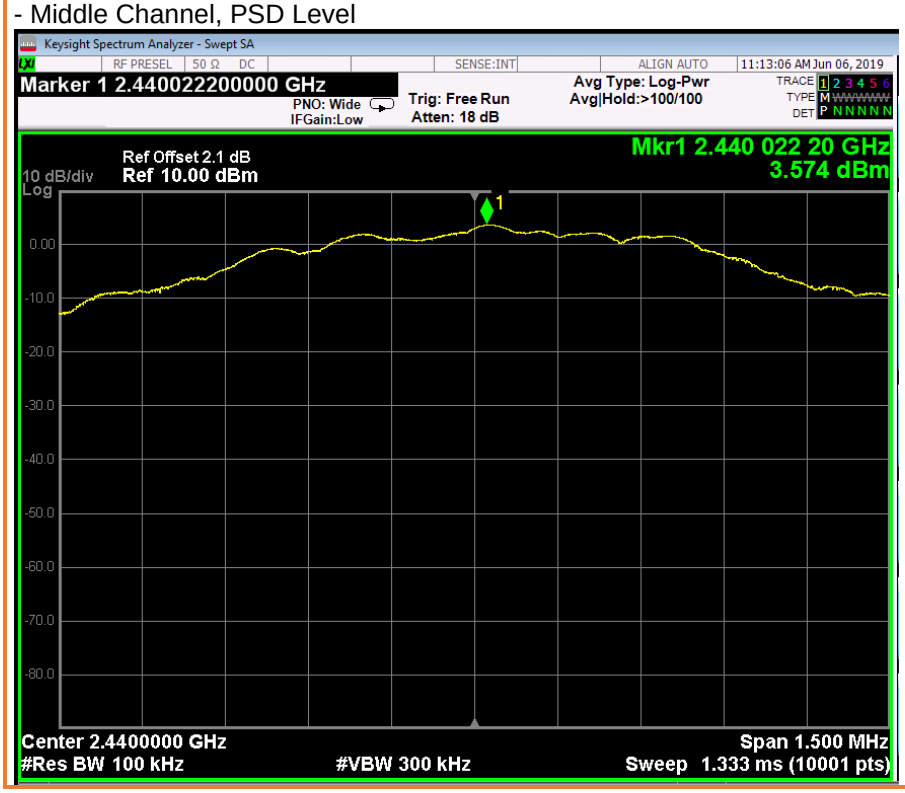
- Low Channel, Emissions under 2.4GHz



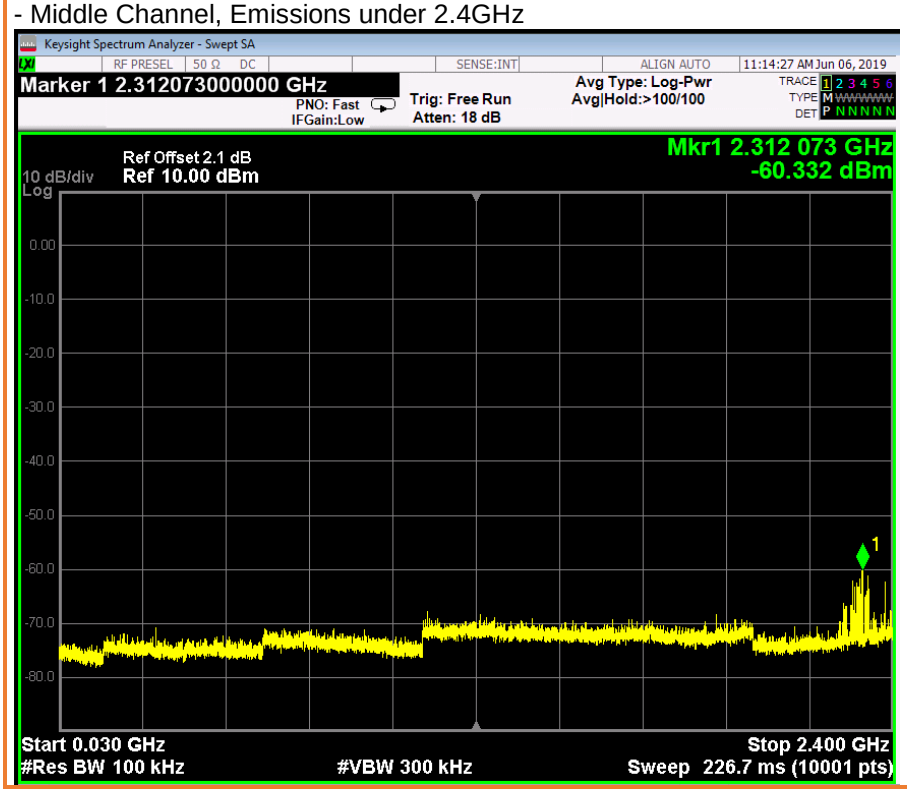
- Low Channel, Emissions over 2.845GHz



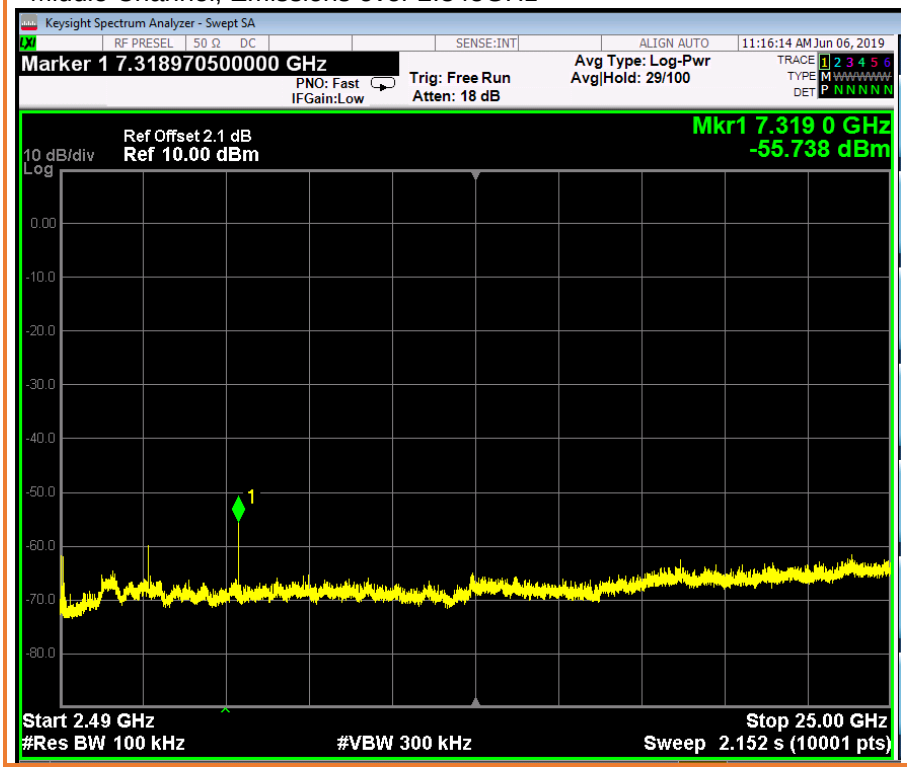
- Middle Channel, PSD Level



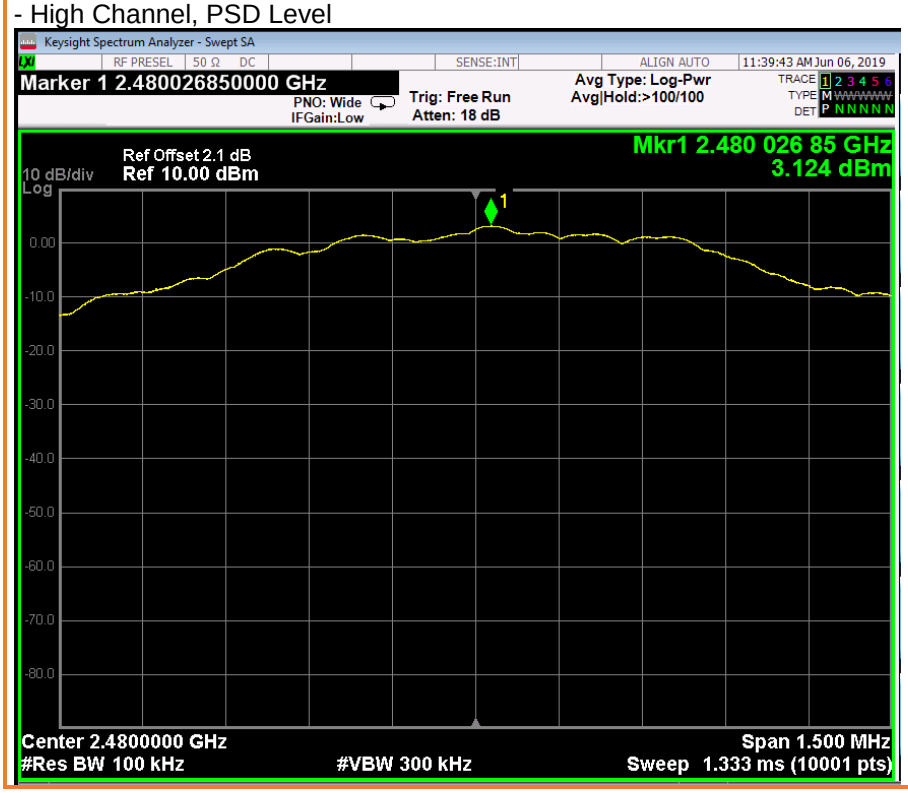
- Middle Channel, Emissions under 2.4GHz



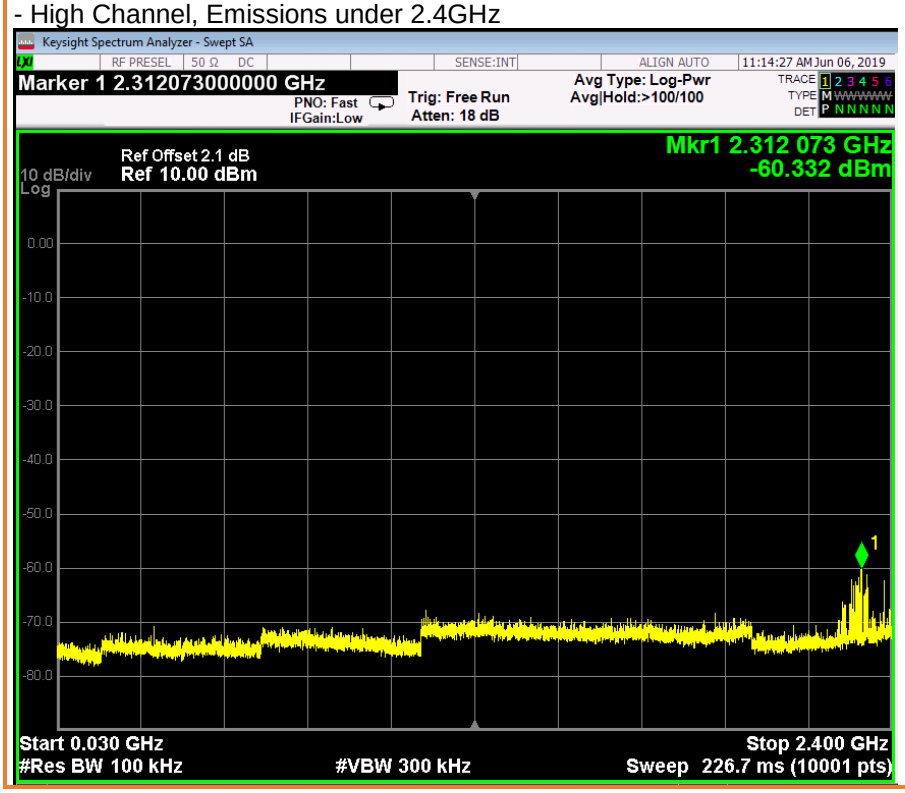
- Middle Channel, Emissions over 2.845GHz



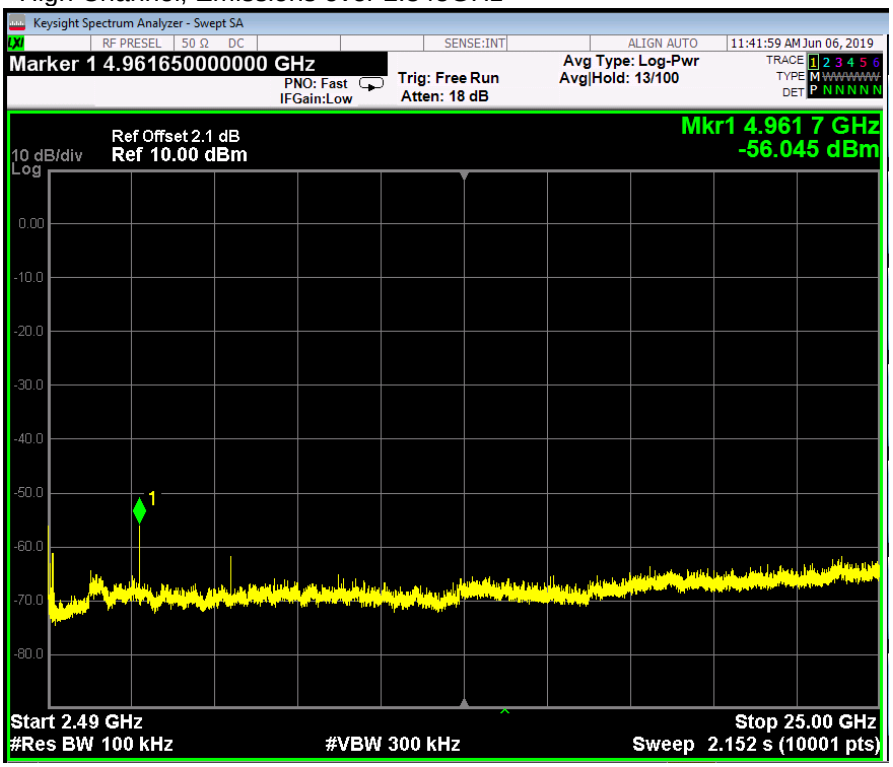
- High Channel, PSD Level



- High Channel, Emissions under 2.4GHz



- High Channel, Emissions over 2.845GHz



Band Edge

Governing Doc	FCC 15.247(d)/ RSS-247, 5.5	Room Temperature (°C)	24.5
Basic Standard	ANSI C63.10	Relative Humidity (%)	43.2
Test Location	Richmond	BAROMETRIC PRESSURE	101.9
Test Engineer	Daniel Lee	DATE	06 JUNE 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration
EMC Analyzer	KeySight	N9038A	702	13-May-2019	13-May-2020
RF Cable	n/a	n/a	n/a	IHC[1]	IHC[1]
AC Power Source	California Instruments	5001i	059	IHC[2]	IHC[2]

Note1) In House Calibration Ref. # 6
Note2) In House Calibration Ref. # 7

Method	☒ Marker-delta	☐ Integration			
Band edge	Channel Power (dBm)	Emissions (dBm)	Marker-delta (dB)	Limit (dB)	Margin (dB)
Low end	3.715	-36.541	40.256	> 20	20.256
High end	3.546	-53.674	57.22		37.22

Compliant ☒ Non-Compliant ☐

Test Method

Reference to KDB 558074 D01 15.247 Meas Guidance v05 and ANSI C63.10, 11.13. 2 Marker-delta Method.

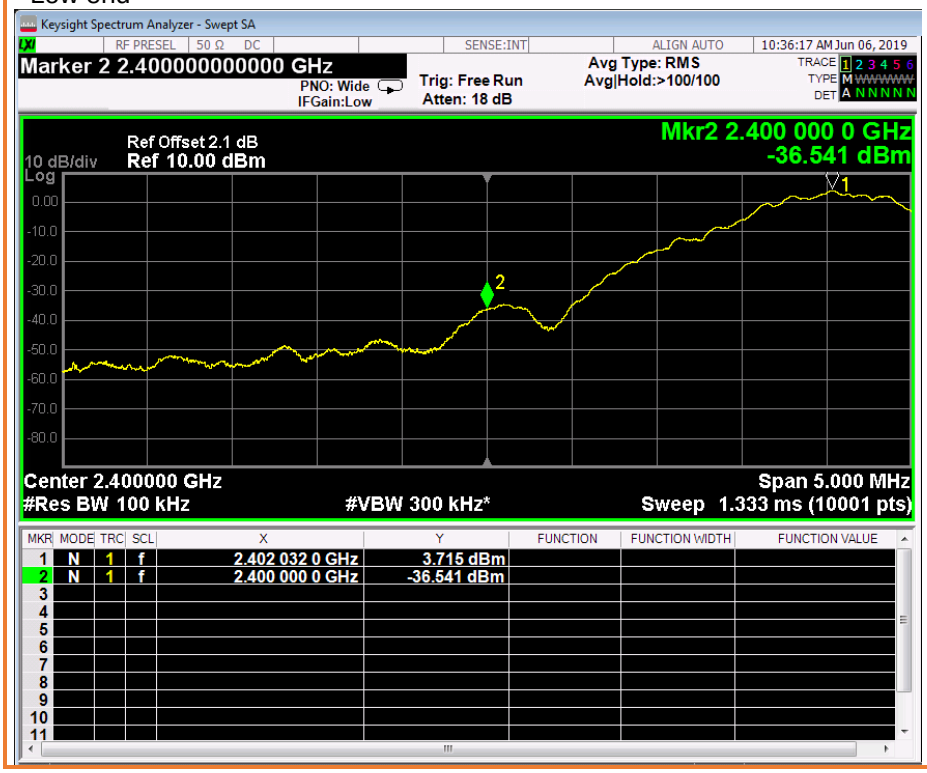
- RBW=100kHz
- VBW=300kHz
- Detector=Peak
- Trace mode=max hold
- Sweep=auto couple
- Max hold to stabilize

Test setup

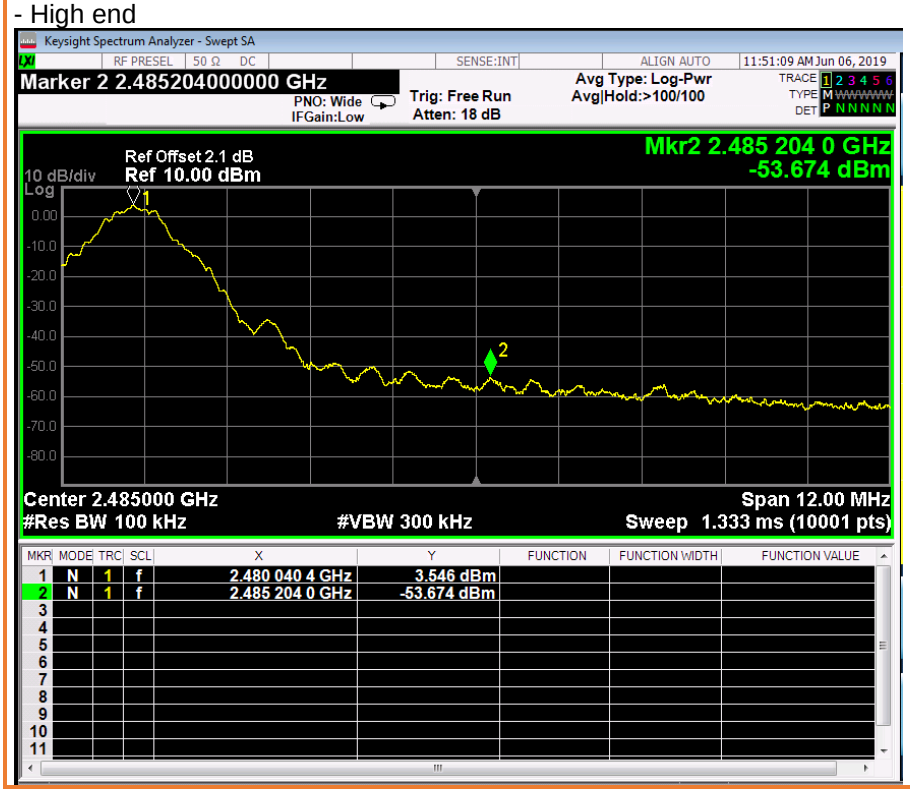
Description of test set-up:
The EUT was placed on a 0.8m non-conducting table above a ground reference plane (GRP).
The EUT was set to **Operation Mode #1, #3 with configuration Mode #1.**

Test Plots

- Low end



- High end



Radiated Spurious Emissions

Governing Doc	FCC 15.247(d), 15.205(a),15.209(a) / RSS-247, 5.5	Room Temperature (°C)	23.8
Basic Standard	ANSI C63.10	Relative Humidity (%)	44.7
Test Location	Richmond	BAROMETRIC PRESSURE	101.9
Test Engineer	Daniel Lee	DATE	29 MAY 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration
Horn Antenna	A.H Systems	SAS-571	227C	18-Oct-2018	18-Oct-2020
Horn Antenna	A.H Systems	SAS-572	227D	11-Dec-2018	11-Dec-2021
EMC Analyzer	KeySight	N9038A	702	13-May-2019	13-May-2020
Motion Controller	Sunol	SC104V	235A	IHC[1]	IHC[1]
Antenna Tower	Sunol	TWR95-4	235B	IHC[1]	IHC[1]
Turn Table	Sunol	SM46C	235C	IHC[1]	IHC[1]
EMC Shielded Enclosure	USC	USC-26	374	IHC[1]	IHC[1]
RF Cable	A.H. Systems	SAC-26G-3	227D	IHC[2]	IHC[2]
RF Preamplifier	Agilent	8449B	273	IHC[2]	IHC[2]
AC Power Source	California Instruments	5001i	059	IHC[1]	IHC[1]

Used Software	☒ Tile 7! v7.3.0.6
Used Template	_FCC_RadEmi_1-18GHz_20190528.TIL _FCC_RadEmi_18-26.5GHz_20190529.TIL

Note1) In House Calibration Ref. # 5
Note2) In House Calibration Ref. # 6
Note3) In House Calibration Ref. # 7

Frequency Range:	☐ 1.0-10GHz ☒ 1.0-25.0GHz
Detector:	☒ Peak(for Prescan & Formal) ☒ Averaging(for Formal)
RBW/VBW:	☒1/3MHz ☐ Others
Type of Facility:	☒ FSOATS ☐ FAR ☐ *in-situ*
Distance:	☒ 3meter ☐ 1meter
Arrangement of EUT:	☒ Table-top only ☐ Floor-standing only ☐ Rack Mounted

Frequency (GHz)	Detector	Pol	Measured (dBuV)	Limit(dBuV)	Margin(dB)
Low end					
4.804	Peak	H	56.02	73.98	17.96
	AVG	H	50.52	53.98	3.46
12.01	Peak	H	44.24	73.98	29.74
	AVG	V	31.93	53.98	22.05
19.216	Peak	V	48.66	73.98	25.32
	AVG	V	36.05	53.98	17.93
Middle end					

4.88	Peak	H	55.74	73.98	18.24
	AVG	H	50.52	53.98	3.46
7.32	Peak	H	50.05	73.98	23.93
	AVG	H	37.96	53.98	16.02
12.2	Peak	V	45.66	73.98	28.32
	AVG	V	32.72	53.98	21.26
19.52	Peak	V	48.80	73.98	25.18
	AVG	H	35.87	53.98	18.11
High end					
4.96	Peak	H	53.08	73.98	20.90
	AVG	H	46.68	53.98	7.30
7.44	Peak	V	49.01	73.98	24.97
	AVG	V	37.71	53.98	16.27
12.4	Peak	V	46.11	73.98	27.87
	AVG	V	33.59	53.98	20.39
19.84	Peak	H	48.22	73.98	25.76
	AVG	V	35.87	53.98	18.11
23.32	Peak	V	49.17	73.98	24.81
	AVG	V	36.32	53.98	17.66
Compliant ☒	Non-Compliant ☐				

Test Method

Reference to KDB 558074 D01 15.247 Meas Guidance v05 and ANSI C63.10, 11.13. 2 Marker-delta Method.

- RBW=120kHz
- VBW=300kHz
- Detector=Peak & Averaging

Test Result

Emission level (dBuV/m) = Detected level (dBuV) +Cable Loss (dB) + Antenna Factor (dB/m) + Pre-Amplifier Gain (dB)

Test setup

Description of test set-up:

The EUT was placed on a 1.5m non-conducting table above a ground reference plane (GRP).

The EUT was set to **Operation Mode #1, #2, #3 with configuration Mode #2.**

Test Plots

- Low Channel, 1 to 18GHz

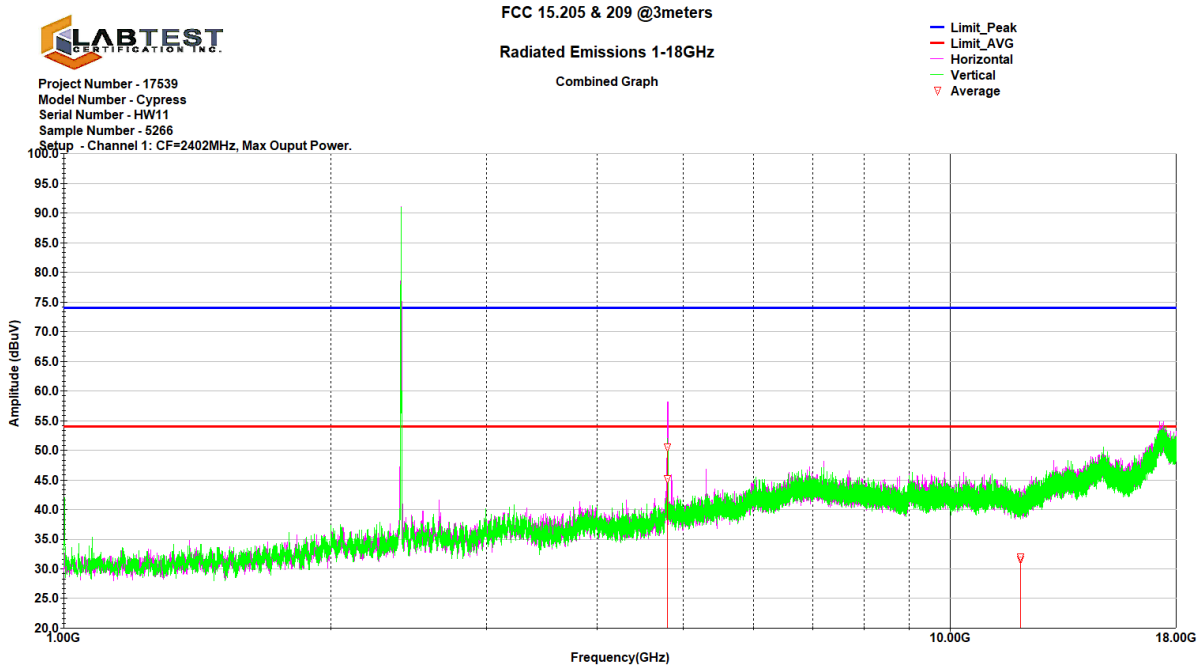


Table : Top Horizontal

Frequency(MHz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Hor_Margin
4.80400001 GHz	0	149	73.98	56.02	53.98	50.52	3.46
12.01000000 GHz	206	187	73.98	44.24	53.98	31.60	22.38

Table : Top Vertical

Frequency(Hz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Margin (dB)
4.804000 GHz	343	133	73.98	51.67	53.98	45.22	8.76
12.010000 GHz	166	106	73.98	44.03	53.98	31.93	22.05

- Low Channel, 18 to 25GHz

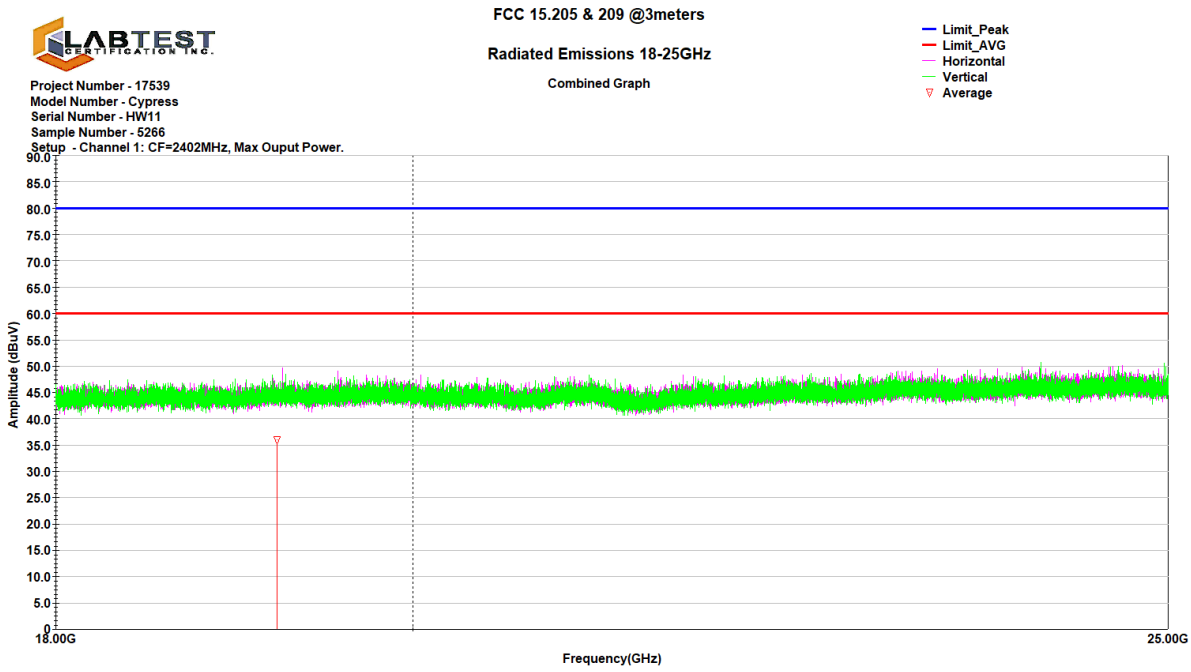


Table : Top Horizontal

Frequency(Hz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Margin (dB)
19.216000 GHz	122	152	73.98	48.09	53.98	36.02	17.96

Table : Top Vertical

Frequency(Hz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Margin (dB)
19.216000 GHz	99	300	73.98	48.66	53.98	36.05	17.93

- Middle Channel, 1 to 18GHz

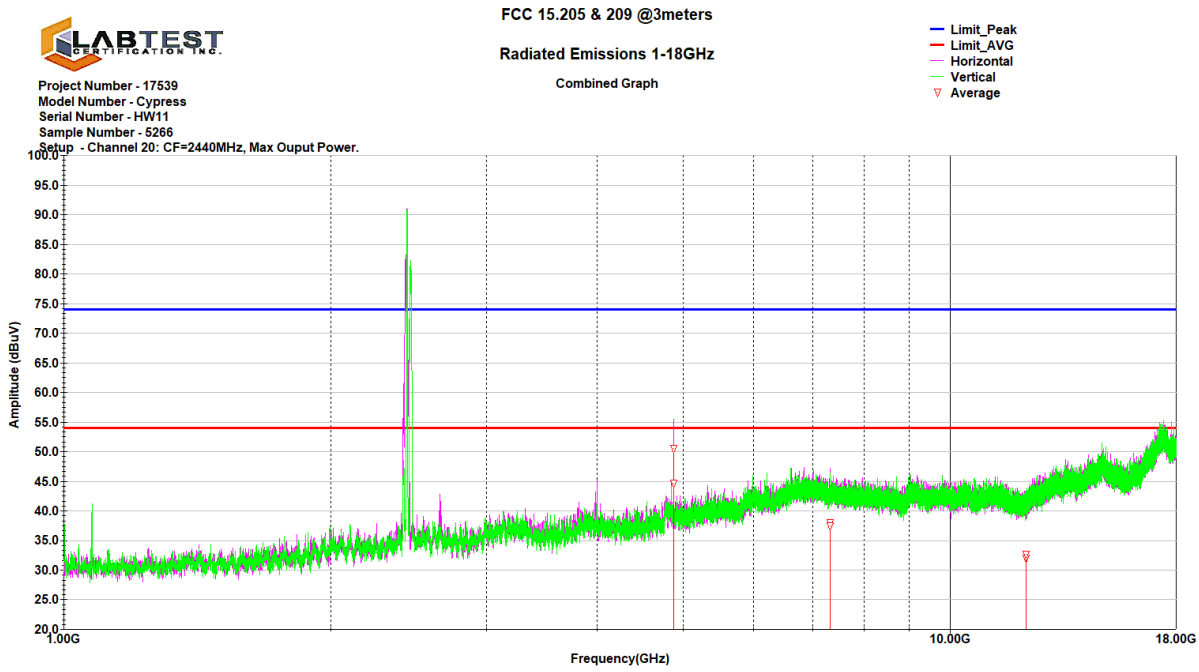


Table : Top Horizontal

Frequency(MHz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Hor_Margin
4.88000000 GHz	4	116	73.98	55.74	53.98	50.52	3.46
7.32000000 GHz	110	102	73.98	50.05	53.98	37.96	16.02
12.20000001 GHz	144	229	73.98	44.18	53.98	32.01	21.97

Table : Top Vertical

Frequency(Hz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Margin (dB)
4.880000 GHz	315	150	73.98	51.73	53.98	44.59	9.39
7.320000 GHz	120	220	73.98	49.40	53.98	37.51	16.47
12.200000 GHz	167	201	73.98	45.66	53.98	32.72	21.26

- Middle Channel, 18 to 25GHz

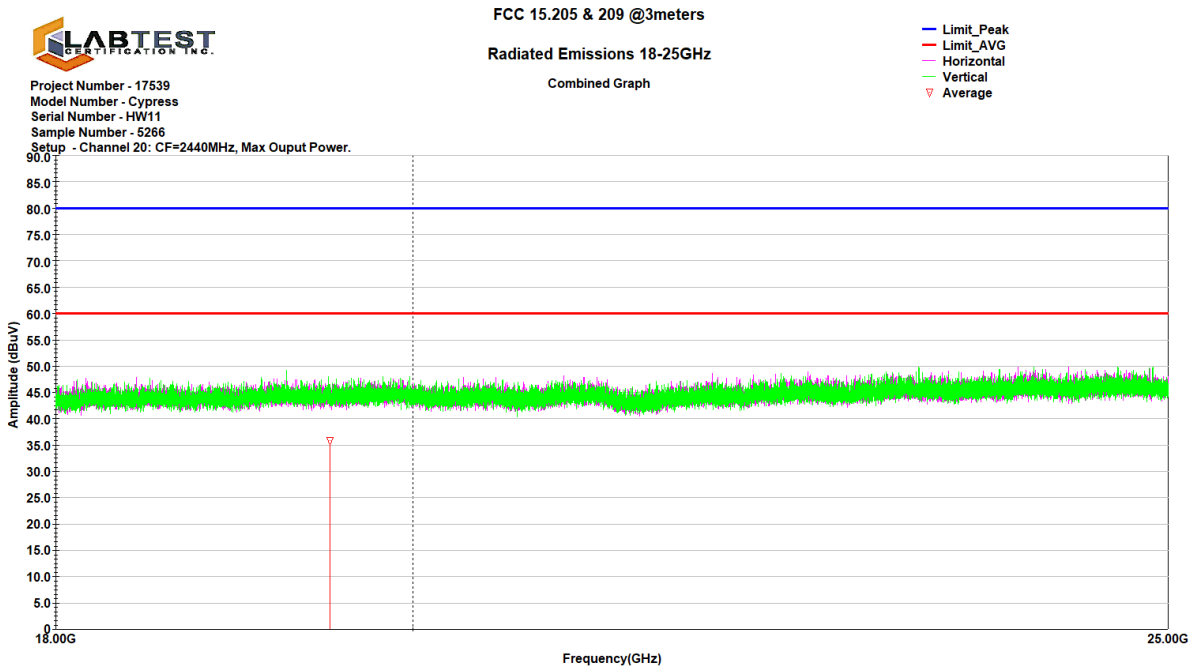


Table : Top Horizontal

Frequency(Hz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Margin (dB)
19.520000 GHz	300	130	73.98	48.53	53.98	35.87	18.11

Table : Top Vertical

Frequency(Hz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Margin (dB)
19.520000 GHz	37	102	73.98	48.80	53.98	35.82	18.16

- High Channel, 1 to 18GHz

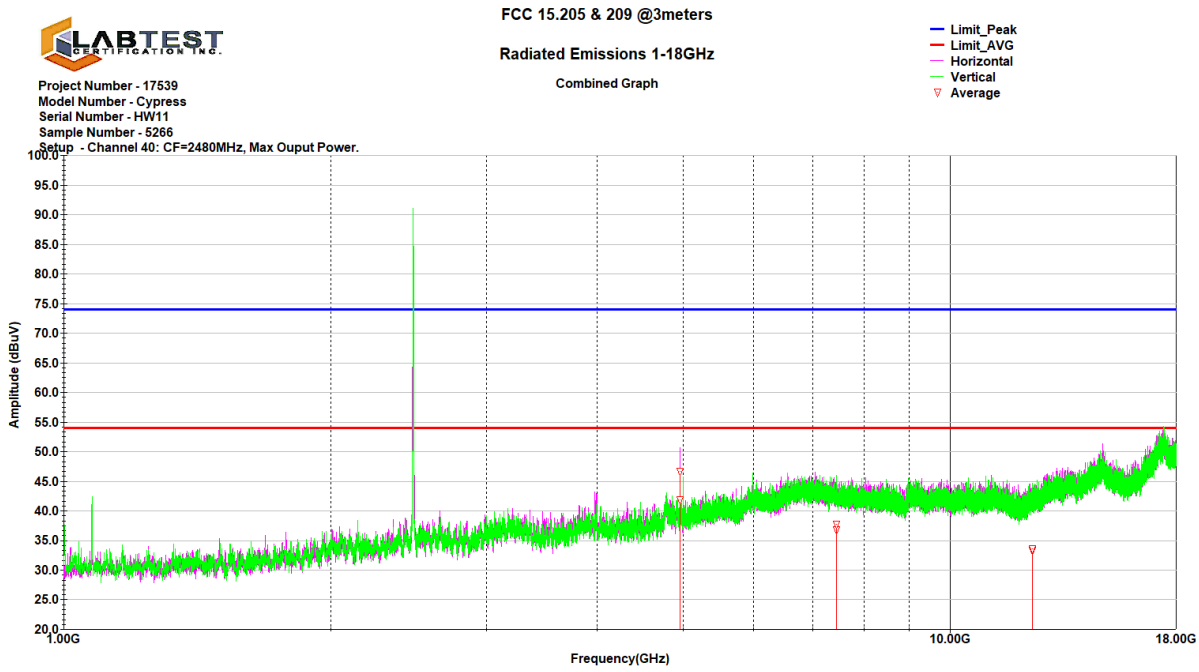


Table : Top Horizontal

Frequency(MHz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Hor_Margin
4.96000001 GHz	358	102	73.98	53.08	53.98	46.68	7.30
7.44000000 GHz	131	121	73.98	48.32	53.98	36.85	17.13
12.40000000 GHz	140	102	73.98	45.15	53.98	33.30	20.68

Table : Top Vertical

Frequency(Hz)	AZ (Deg)	HGT (cm)	Limit_Peak (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Margin (dB)
4.960000 GHz	88	102	73.98	49.18	53.98	41.83	12.15
7.440000 GHz	122	217	73.98	49.01	53.98	37.71	16.27
12.400000 GHz	170	196	73.98	46.11	53.98	33.59	20.39

- High Channel, 18 to 25GHz

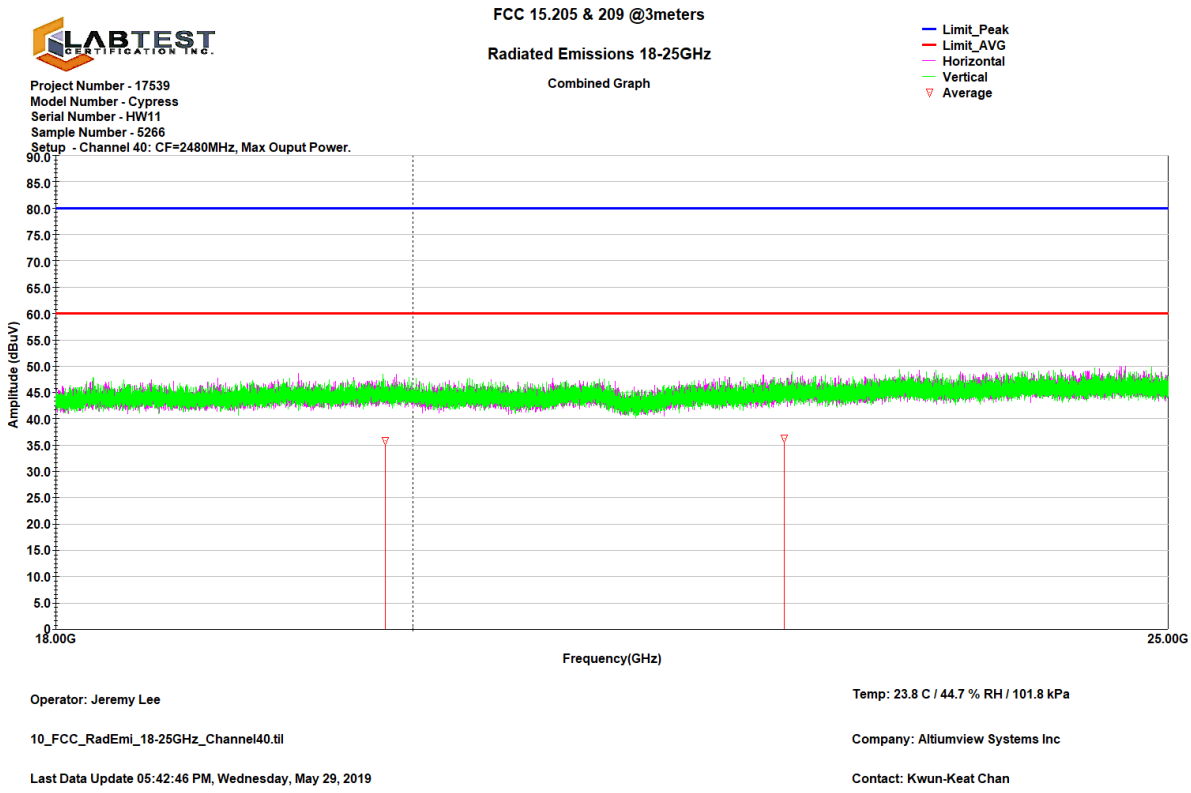


Table : Top Horizontal

Frequency(Hz)	AZ (Deg)	HGT (cm)	Limit_Peak (dB...	Peaks (dBuV/m)	Limit_AVG (dB...	AVG (dBuV/m)	Margin (dB)
19.840000 GHz	356	199	73.98	48.22	53.98	35.78	18.20
22.320000 GHz	135	267	73.98	48.68	53.98	36.29	17.69

Table : Top Vertical

Frequency(Hz)	AZ (Deg)	HGT (cm)	Limit_Peaks (dBuV/m)	Peaks (dBuV/m)	Limit_AVG (dBuV/m)	AVG (dBuV/m)	Margin (dB)
19.840000 GHz	128	125	73.98	48.05	53.98	35.87	18.11
22.320000 GHz	272	100	73.98	49.17	53.98	36.32	17.66

Power Spectral Density Power

Governing Doc	FCC 15.247(e)/ RSS-247, 5.2(b)	Room Temperature (°C)	24.5
Basic Standard	ANSI C63.10	Relative Humidity (%)	43.2
Test Location	Richmond	BAROMETRIC PRESSURE	101.9
Test Engineer	Daniel Lee	DATE	06 JUNE 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration
EMC Analyzer	KeySight	N9038A	702	13-May-2019	13-May-2020
RF Cable	n/a	n/a	n/a	IHC[1]	IHC[1]
AC Power Source	California Instruments	5001i	059	IHC[2]	IHC[2]

Note1) In House Calibration Ref. # 6
Note2) In House Calibration Ref. # 7

Method: ☐ PKPSD ☐ AVGPSD-1 ☒ AVGPSD-2 ☐ AVGPSD-3

Channel	Frequency (MHz)	Duty cycle (dB)	Measured (dBm)	Limit(dBm)	Margin(dB)
Low(1)	2402	0.42	+0.199	+8.00	7.801
Middle(20)	2440	0.42	0.064		7.936
High(40)	2480	0.42	-0.479		8.479

Compliant ☒ Non-Compliant ☐

Test Method

Reference to KDB 558074 D01 15.247 Meas Guidance v05 and ANSI C63.10, 11.10.5 Method AVGPSD-2.

- Measured Duty Cycle(D)
- SPAN=1.5MHz
- RBW=30kHz
- VBW=100kHz
- Detector=Power averaging(rms)
- Sweep=auto couple
- Trace averaging (rms) mode with 100 traces.

Test setup

Description of test set-up:

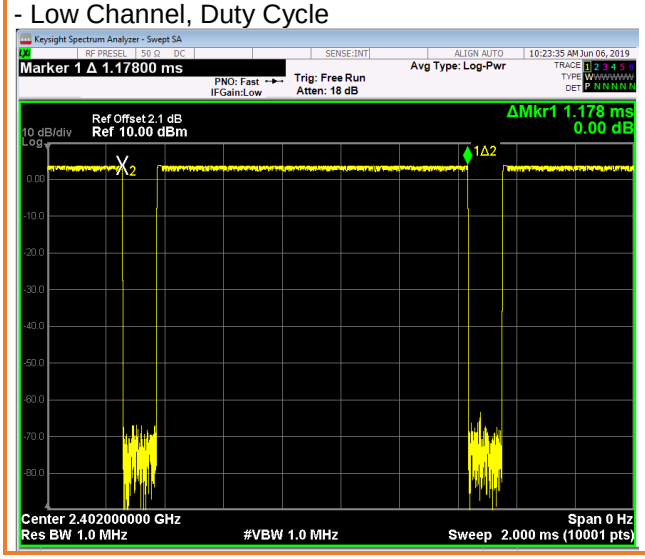
The EUT was placed on a 0.8m non-conducting table above a ground reference plane (GRP).

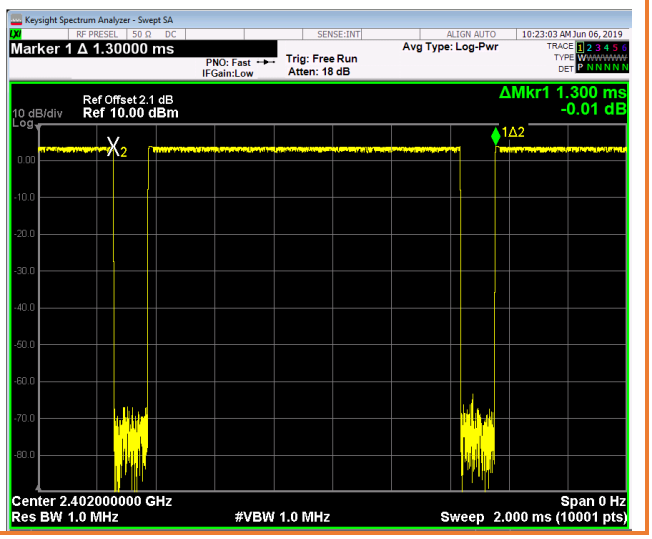
The EUT was set to **Operation Mode #1, #2, #3 with configuration Mode #1.**

Test Plots

- Low Channel, Measured Value

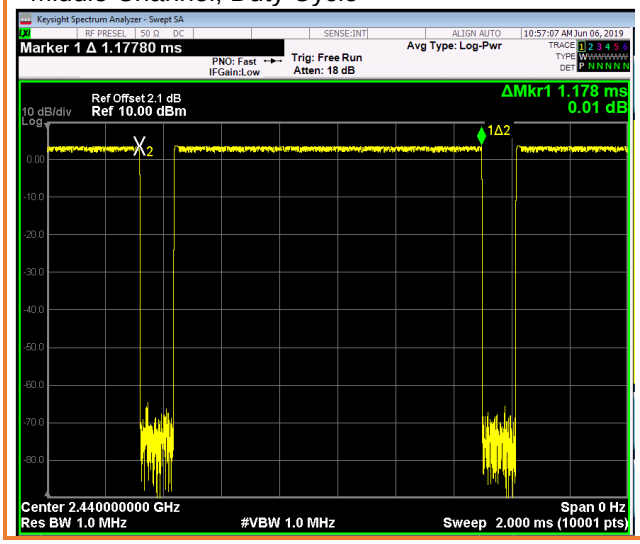
- Low Channel, Duty Cycle

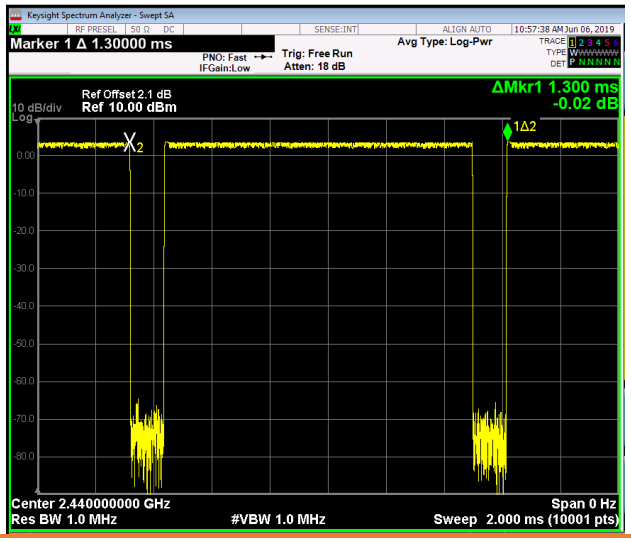




- Middle Channel, Measured Value

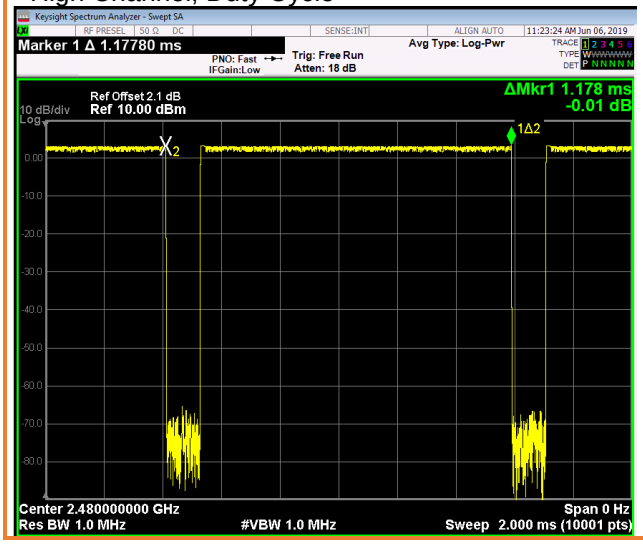
- Middle Channel, Duty Cycle

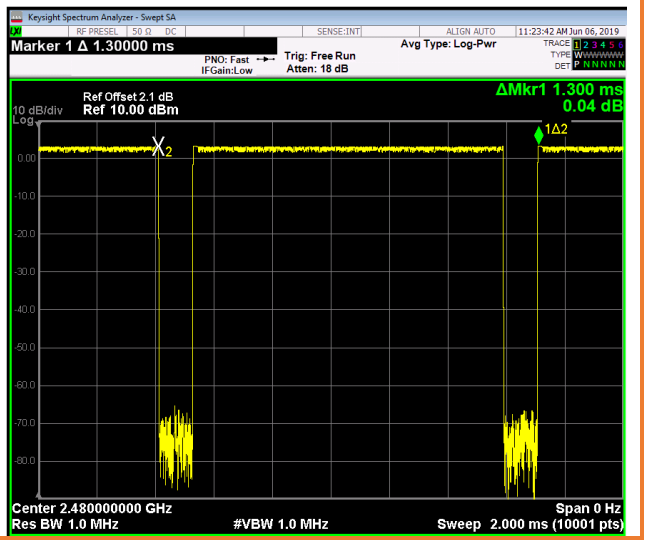




- High Channel, Measured Value

- High Channel, Duty Cycle





Radiated Emissions-Unintentional radiators, Below 1 GHz

Governing Doc	FCC 15.109/ICES-003	Room Temperature (°C)	24.3
Basic Standard	ANSI C63.4	Relative Humidity (%)	45.4
Test Location	Richmond	Barometric Pressure (kPa)	100.1
Test Engineer	Daniel Lee	DATE	16 May 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration due
EMC Analyzer	KeySight	N9038A	702	13-May-2019	13-May-2020
Broadband Antenna	Sunol	JB1	967	12-Oct-2018	12-Oct-2020
LPDA Antenna	Schwarzbeck Mess	VUSLP9111B	996	26-Mar-2019	26-Mar-2021
BiCon Antenna	A.H Systems	SAS-540	1115	29-Apr-2019	29-Apr-2021
Motion Controller	Sunol	SC104V	235A	IHC[1]	IHC[1]
Antenna Tower	Sunol	TWR95-4	235B	IHC[1]	IHC[1]
Turn Table	Sunol	SM46C	235C	IHC[1]	IHC[1]
EMC Shielded Enclosure	USC	USC-26	374	IHC[1]	IHC[1]
RF Cable	MRO	n/a	n/a	IHC[2]	IHC[2]
Attenuator	Mini-circuit	UNAT-6+	n/a	IHC[2]	IHC[2]
AC Power Source	California Instruments	5001i	059	IHC[3]	IHC[3]

Used Software	☒ Tile 7! v7.3.0.6
Used Template	_FCC_RadEmi_30-300MHz_Final_20190516.til _FCC_RadEmi_30-1000MHz_20181106.til

Note1) In House Calibration Ref. # 4
Note2) In House Calibration Ref. # 6
Note3) In House Calibration Ref. # 7

Frequency Range:	☒ 30-1000MHz	☐ 150kHz-30MHz	
Detector:	☒ Peak(for Prescan)	☒ Quasi-Peak(for Formal)	
RBW/VBW:	☒120/300kHz	☐ 9/30kHz	
Type of Facility:	☒ SAC	☐ OATS	☐ *in-situ*
Distance:	☒ 3meter	☐ 10meter	☐ 1meter
Arrangement of EUT:	☒ Table-top only	☐ Floor-standing only	☐ Rack Mounted
Classification:	☒ Class B	☐ Class A	

Compliant ☒ Non-Compliant ☐

Test Method

Test procedure is based on the FCC15.31(a)(3) - Other intentional and unintentional radiators are to be measured for compliance using the following procedure excluding sections 4.1.5.2, 5.7, 9 and 14: ANSI C63.4–2014: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see § 15.38). This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51.
NOTE to Paragraph (a)(3): Digital devices tested to show compliance with the provisions of §§ 15.107(e) and 15.109(g) must be tested following the ANSI C63.4 procedure described in paragraph (a)(3) of this section.[As stated in the adopting R&O, ANSI C63.4 is not used for measurements below 30 MHz.]

This test measures the radiating levels from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified by positioning a broadband receive antenna three meter from the EUT. A scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7, from 30 to 1,000 MHz with the receiver in the peak mode. The receiver IF bandwidth was 120 kHz and scan step was about 25 kHz. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters and rotated to produce horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. Measurements were then made using CISPR quasi peak when the peak readings were within 10dB of the limit line. The numerical results are included herein to demonstrate compliance.

Test Result

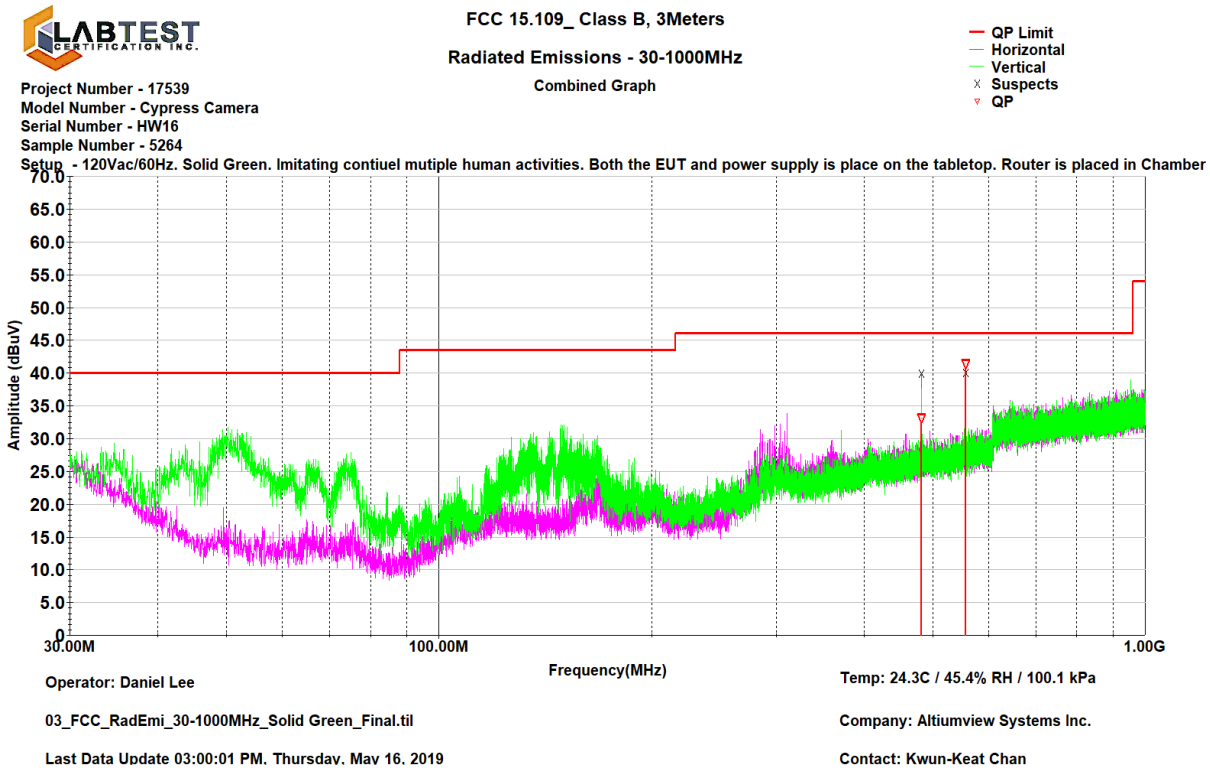
Emission level (dBuV/m) = Quasi-Peak detected level (dBuV) +Cable Loss (dB) + Antenna Factor (dB/m)

Test setup

Description of test set-up:
The EUT was placed on a 0.8m non-conducting table above a ground reference plane (GRP).
The EUT was set to **Operation Mode #4 with configuration Mode #3.**

Measurement Table/Graphical representation for Emission

- Graph, 30 to 1,000MHz



- Table: Horizontal

Table : Top_Horizontal1

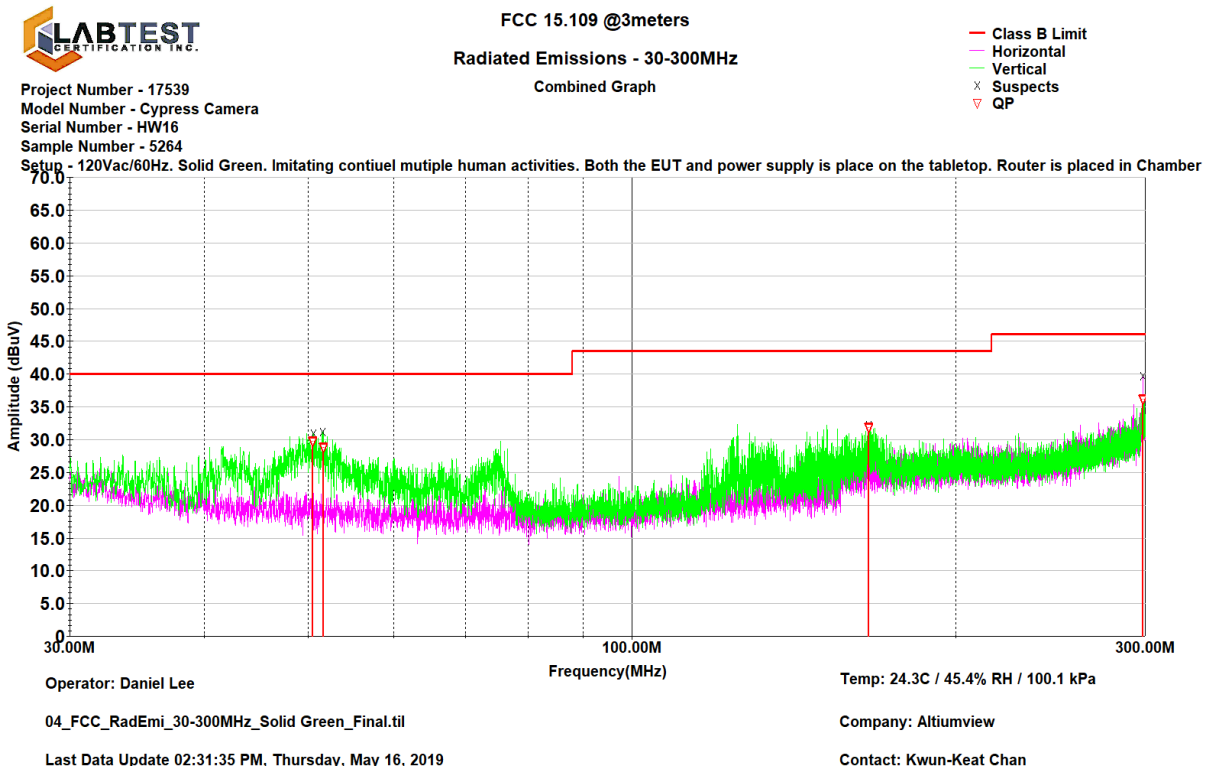
Frequency(MHz)	Ant Fac (dB)	Cable Loss (dB)	Preamp (dB)	AZ (Deg)	HGT (cm)	Peak (dBuV)	QP (dBuV)	Limit (dBuV)	Margin (dB)
482.5278 MHz	21.40	3.46	0.00	197	225	37.96	33.12	46.02	12.90

- Table: Vertical

Table : Top_Vertical1

Frequency(MHz)	Ant Fac (dB)	Cable loss (dB)	Preamp (dB)	AZ (Deg)	HGT (cm)	Peak (dBuV)	QP (dBuV)	Limit (dBuV)	Margin (dB)
556.8312 MHz	22.08	3.80	0.00	4	100	44.12	41.37	46.02	4.65

- Graph, 30 to 300MHz



- Table: Horizontal

Table : Top_Horizontal

Frequency(MHz)	Ant Fac (dB)	CableLoss (dB)	Preamp (dB)	AZ (Deg)	HGT (cm)	Peak (dBuV/m)	QP (dBuV/m)	Limit (dBuV/m)	Margin (dB)
298.5990 MHz	24.760	2.41	0.00	103	100	39.85	36.214	46.02	9.81

- Table: Vertical

Table : Top_Vertical

Frequency(MHz)	Ant Fac (dB)	Cable loss (dB)	Preamp (dB)	AZ (Deg)	HGT (cm)	Peak (dBuV)	QP (dBuV)	Limit (dBuV)	Margin (dB)
50.4465 MHz	15.46	0.82	0.00	216	100	34.19	29.72	40.00	10.28
51.6532 MHz	15.40	0.84	0.00	249	112	33.33	28.80	40.00	11.20
165.9855 MHz	19.10	1.62	0.00	272	100	36.86	31.83	43.52	11.69

Radiated Emissions-Unintentional radiators, above 1 GHz

Governing Doc	FCC 15.109/ICES-003	Room Temperature (°C)	24.3
Basic Standard	ANSI C63.4	Relative Humidity (%)	45.4
Test Location	Richmond	Barometric Pressure (KPA)	100.1
Test Engineer	Daniel Lee	DATE	16 May 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration due
Horn Antenna	A.H Systems	SAS-571	227C	18-Oct-2018	18-Oct-2020
Horn Antenna	A.H Systems	SAS-572	227D	11-Dec-2018	11-Dec-2021
EMC Analyzer	KeySight	N9038A	702	13-May-2019	13-May-2020
Motion Controller	Sunol	SC104V	235A	IHC[1]	IHC[1]
Antenna Tower	Sunol	TWR95-4	235B	IHC[1]	IHC[1]
Turn Table	Sunol	SM46C	235C	IHC[1]	IHC[1]
EMC Shielded Enclosure	USC	USC-26	374	IHC[1]	IHC[1]
RF Cable	A.H. Systems	SAC-26G-3	227D	IHC[2]	IHC[2]
RF Preamplifier	Agilent	8449B	273	IHC[2]	IHC[2]
AC Power Source	California Instruments	5001i	059	IHC[3]	IHC[3]

Used Software	☒ Tile 7! v7.3.0.6
Used Template	_FCC_RadEmi_1-18GHz_20190528.til

Note1) In House Calibration Ref. # 5
Note2) In House Calibration Ref. # 6
Note3) In House Calibration Ref. # 7

Frequency Range:	☐ 1.0-2.0GHz ☐ 1.0-5.0GHz ☒ 1.0-7.0GHz
Detector:	☒ Peak(for Prescan & Formal) ☒ Averaging(for Formal)
RBW/VBW:	☒1/3MHz ☐ Others
Type of Facility:	☒ FSOATS ☐ FAR ☐ *in-situ*
Distance:	☒ 3meter ☐ 1meter
Arrangement of EUT:	☒ Table-top only ☐ Floor-standing only ☐ Rack Mounted
Classification:	☒ Class B ☐ Class A

Compliant ☒ Non-Compliant ☐

Test Method

Test procedure is based on the FCC15.31(a)(3) - Other intentional and unintentional radiators are to be measured for compliance using the following procedure excluding sections 4.1.5.2, 5.7, 9 and 14: ANSI C63.4–2014: “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz” (incorporated by reference, see § 15.38). This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51.
NOTE to Paragraph (a)(3): Digital devices tested to show compliance with the provisions of §§ 15.107(e) and 15.109(g) must be tested following the ANSI C63.4 procedure described in paragraph (a)(3) of this section.[As stated in the adopting R&O, ANSI C63.4 is not used for measurements below 30 MHz.]

This test measures the radiating levels from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially, the primary emission frequencies are identified by positioning a broadband receive antenna three meter from the EUT. A scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7, from 1 to 6GHz with the receiver in the peak mode. The receiver IF bandwidth was 1MHz and scan step was about 0.5MHz. To ensure that the maximum emission at each discrete frequency of interest is observed, the receive antenna is varied in height from one to four meters and rotated to produce horizontal and vertical polarities while the turntable is rotated to determine the worst emitting configuration. Measurements were then made using CISPR Averaging when the peak readings were within 10dB of the limit line of P. The numerical results are included herein to demonstrate compliance.

Test Result

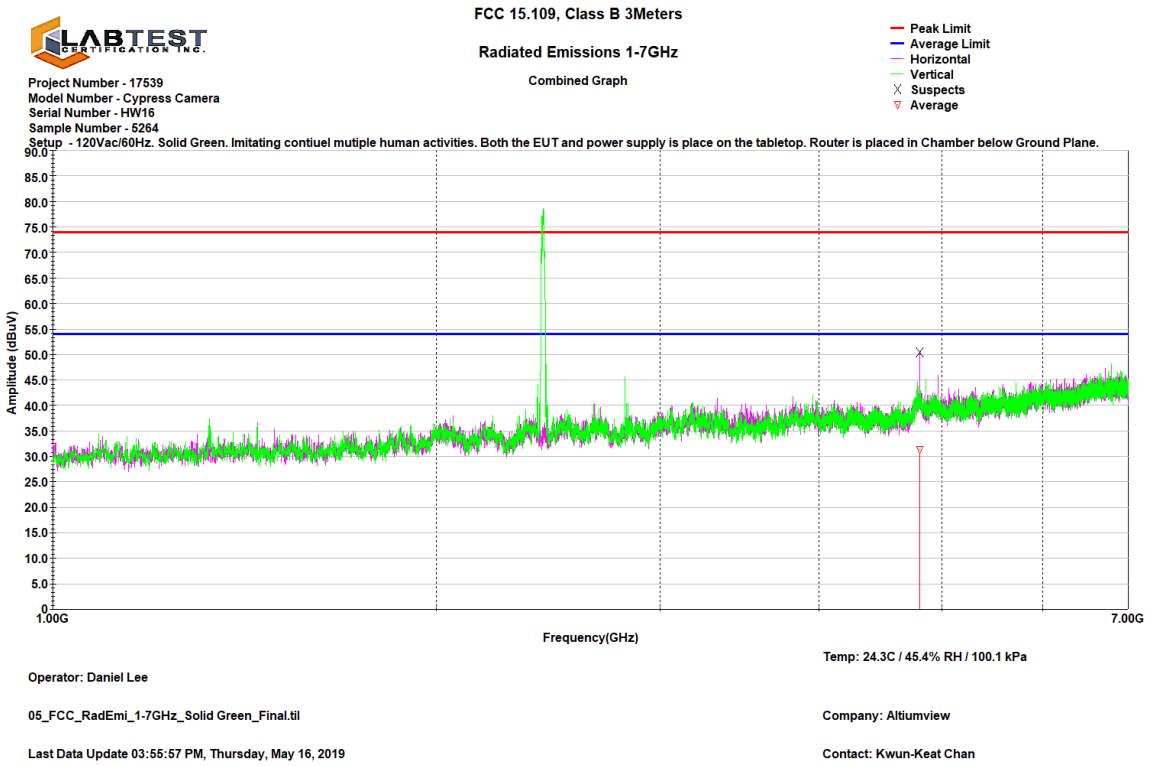
Emission level (dBuV/m) = Detected level (dBuV) +Cable Loss (dB) + Antenna Factor (dB/m) + Pre-Amplifier Gain (dB)

Test setup

Description of test set-up:
The EUT was placed on a 0.8m non-conducting table above a ground reference plane (GRP).
The EUT was set to **Operation Mode #4 with configuration Mode #3.**

Measurement Graphical representation for Emission

- Graph



- Table: Horizontal

Table : Top Horizontal

Frequency(GHz)	Ant Fac (dB)	Cable Fac (dB)	Preamp (dB)	AZ (Deg)	HGT (cm)	Peak (dBuV/m)	Average (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4.8017 GHz	33.34	1.86	-32.61	34	126	55.67	31.32	53.98	22.66

Test Conditions and Results - Emission - Conducted Emissions-voltage AC mains port

Governing Doc	FCC 15.107 & ICES-003	Room Temperature (°C)	24.3
Basic Standard	ANSI C63.4	Relative Humidity (%)	45.4
Test Location	Richmond	Barometric Pressure (KPA)	100.1
Test Engineer	Daniel Lee	DATE	16 May 2019
EUT Voltage	☒ 120VAC @ 60Hz ☐ 208VAC @ 60Hz		

Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration due
EMC Analyzer	KeySight	N9038A	702	13-May-2019	13-May-2020
LISN	Com-Power	LIN-120C	920	20-Nov-2018	20-Nov-2019
EMC Shielded Enclosure	USC	USC-26	374	IHC[1]	IHC[1]
Transient Limiter	Com-Power	LIT-930	215	IHC[2]	IHC[2]
RF Cable	MRO	n/a	n/a	IHC[2]	IHC[2]
AC Power Source	California Instruments	5001i	059	IHC[3]	IHC[3]
AC Power Source	Pacific Power Source	360AMXT-UPC32	955	IHC[3]	IHC[3]
DC Power Source	BK Precision	1670A	381	IHC[3]	IHC[3]

Used Software	☒ Tile 7! v7.3.0.6
Used Template	_FCC_ConEmi_AC Mains_LSN120C_TROff_20180309.til

Note1) In House Calibration Ref. # 4
Note2) In House Calibration Ref. # 6
Note3) In House Calibration Ref. # 7

Frequency Range:	☒ 150kHz-30MHz ☐ 9-150kHz
Detector:	☒ Peak ☒ Quasi-Peak ☒ Averaging
RBW/VBW:	☒ 9/30kHz ☐ 200/300Hz
Coupling device:	☒ AMN ☐ AAN ☐ Current Probe ☐ CVP
Arrangement of EUT:	☒ Table-top only ☐ Floor-standing only ☐ Rack Mounted
Classification:	☒ Class B ☐ Class A

Compliant ☒ Non-Compliant ☐

Test Method

This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Testing was performed in accordance with the test standard(s) referenced in the test summary section of this report. The Equipment Under Test (EUT) was configured based upon the requirements of the applicable test standard. Initially a scan was made with an EMC Analyzer, controlled by EMC Test Software, Tile7, from 150 kHz to 30 MHz on each phase with the receiver in the peak mode. The measuring bandwidth was set up 9 kHz. Measurements were then made using CISPR16-1 quasi peak and averaging detectors when the peak readings were within 10dB of the Quasi-peak limit line.

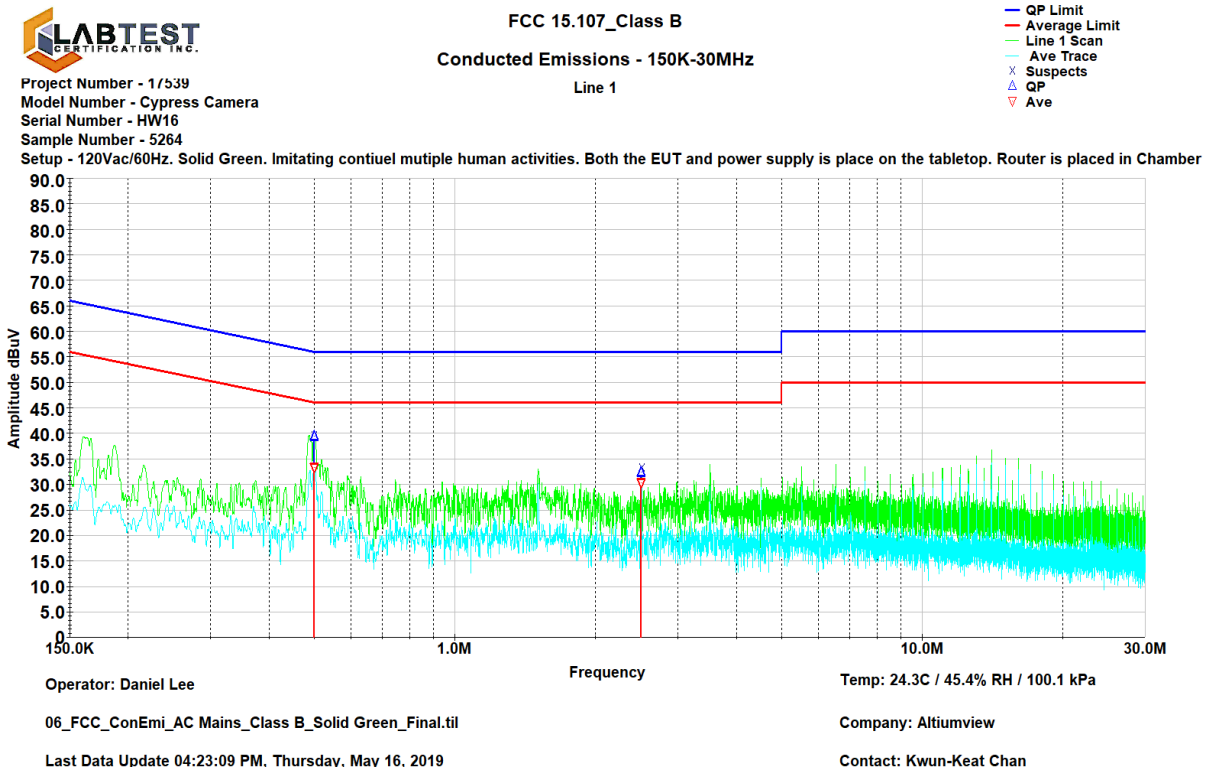
Test Result
Conducted Emission (dBuV) = Measured Emission (dBuV) + Cable Loss(dB)+LISN(dB)

Test setup

Description of test set-up:
The EUT was placed on a 0.8m non-conducting table above a ground reference plane (GRP). The EUT was set to **Operation Mode #4 with configuration Mode #3.**

Measurement Graphical representation for Emission

- Graph of Line 1(Hot)

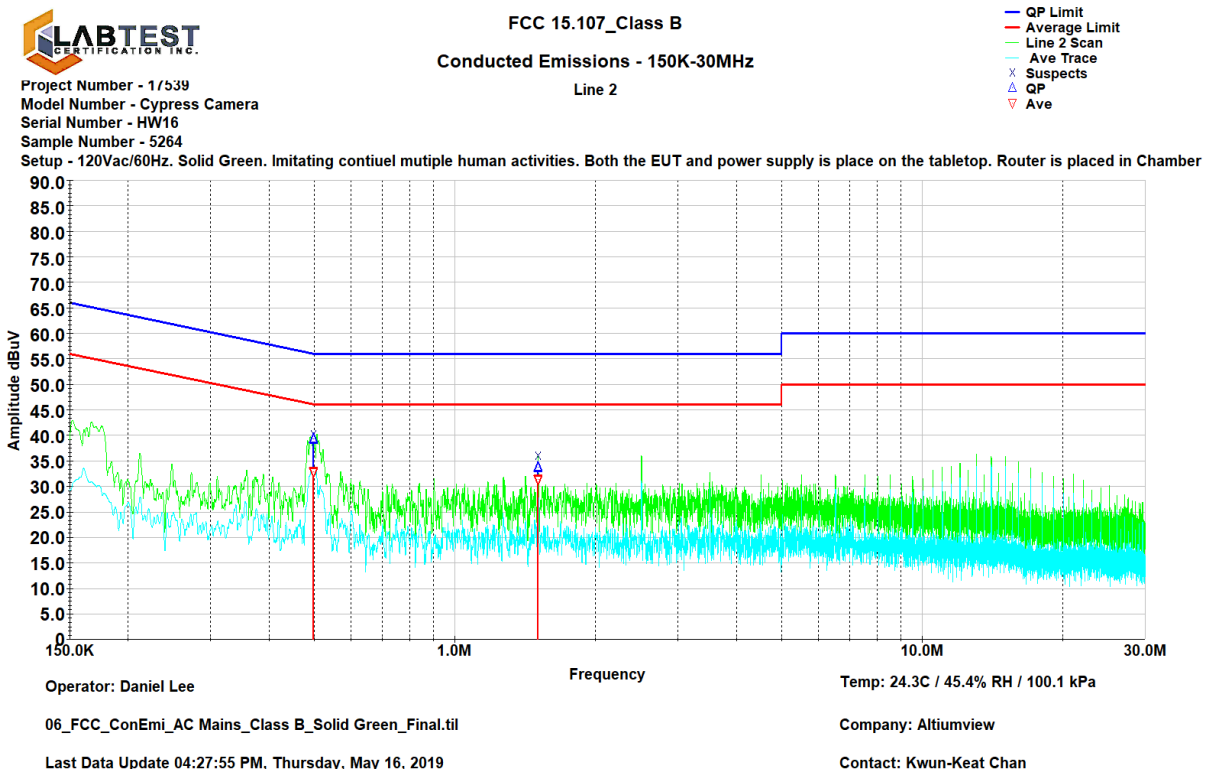


- Table of Line 1(Hot)

Table : Table_Line 1

Frequency(MHz)	Peak (dBuV)	QP (dBuV)	QP Limit (dBuV)	Margin_QP (dB)	AVG (dBuV)	AVG Limit (dB...	Margin_AVG (d...	LISN Losses (dB)	Path Losses (dB)
499.51500 KHz	42.72	39.40	56.01	16.61	33.29	46.01	12.72	0.09	9.93
2.50800 MHz	35.84	32.37	56.00	23.63	30.29	46.00	15.71	0.03	9.95

- Graph of Line 2(Neutral)



- Table of Line 2(Neutral)

Table : Table_Line 2

Frequency(MHz)	Peak (dBuV)	QP (dBuV)	QP Limit (dBuV)	Margin_QP (dB)	AVG (dBuV)	AVG Limit (dB...	Margin_AVG (d...	LISN Losses (dB)	Path Losses (dB)
497.62500 KHz	42.62	39.35	56.04	16.69	32.91	46.04	13.13	0.09	9.93
1.50675 MHz	37.64	33.80	56.00	22.20	31.30	46.00	14.70	0.07	9.98

END OF REPORT