

FCC Test Report (Part 15 Subpart C)

FCC ID : 2AM8R-D210

Client Information:

Applicant: Netradyne Inc.

Applicant add.: 9191 Towne Centre Drive, Suite 200, San Diego, CA 92122

Manufacturer: Netradyne Inc.

Manufacturer add.: 9191 Towne Centre Drive, Suite 200, San Diego, CA 92122

Product Information:

Product Name: Driveri

Model No.: D-210

Derivative model No.: D-210A, D-211

Brand Name: Netradyne

Applied Standard:

FCC PART 15 Subpart C section 15.247

Prepared By:



Anshul Tyagi

Laboratory Details:

AA Electro Magnetic Test Laboratory Private Limited
PlotNo174, Udyog Vihar-Phase4, Sector18, Gurgaon, Haryana, India

Date of Receipt: Jun. 23, 2020

Date of Test: Jun. 25, 2020

Date of Issue: Jul. 14, 2020

Test Result: **In Compliance/Pass**

This device has been tested and found to comply with the stated standard(s) and indicated in the test report and are applicable only to the tested sample identified in the report.

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Reviewed by: _____ **Approved by:** _____

(Dr R Lenin Raja) (Authorized Representative) (/ lenin83/)

(Steven Wu)

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An ISO 17025: 2017, Accredited Laboratory, VCCI (support member – #4053),ISED#: 26046, FCC #137777 CE #800058_00


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2 Test Summary

2.1 Compliance with FCC Part 15 subpart C

Test	Test Requirement	Standard Paragraph	Result
Antenna Requirement	FCC Part 15 C	Section 15.247(c)	PASS
Conduction Emissions	FCC Part 15 C	Section 15.207(a)	PASS
Radiated Emissions	FCC Part 15 C	Section 15.247(d)	PASS
Occupied Bandwidth	FCC Part 15 C	Section 15.247(a)(2)	PASS
Peak power density	FCC Part 15 C	Section 15.247(e)	PASS
Maximum Peak Output Power	FCC Part 15 C	Section 15.247(b)(1)	PASS
Band edge	FCC Part 15 C	Section 15.247(d)	PASS
Conducted Spurious Emissions	FCC Part 15 C	Section 15.247(d)	PASS
Note: N/A is an abbreviation for Not Applicable. Model description: D-210 : Intelligent Driver Monitoring System Smart Dash-cam D-210A : Intelligent Driver Monitoring System Smart Dash-cam Series 1 D-211 : Intelligent Driver Monitoring System Smart Dash-cam WA Driveri is an AI powered vision based IoT system, sold as an aftermarket product to fleets. The device is installed in trucks/cars behind the rear-view mirror, and the power is supplied from the car battery through a custom power cable. When the vehicle is being driven, the road facing camera is enabled by default, records and generates real time safety alerts to assist the driver. The camera facing the driver / passenger's optional due to privacy requirements and enabled at customers' request. The recorded videos are processed (using our patented machine learning algorithms) on the device together with the other sensor data and can detect any events related to driving behavior and driver behavior. The device has 2 buttons on the bottom side of the device, when pressed creates alerts which are user generated. 2 LEDs on driver facing side indicate the current operational state of device & also indicate privacy setting (driver facing camera recording status).			
(1)	Reference to the KDB 558074 D01 DTS Meas Guidance v03r03		
(2)	Reference to ANSI C63.10:2013.		

2.2 Test Location

All tests were performed at:

AA Electro Magnetic Test Laboratory Private Limited

Plot No 174, Udyog Vihar - Phase 4, Sector 18, Gurgaon, Haryana, India

Tel.: +91-0124-4235350

2.3 Measurement Uncertainty

All measurements involve certain levels of uncertainties, The following measurements uncertainty Levels have estimated based on ANSI C63.4:2014, the maximum value of the uncertainty as below

No.	Item	Uncertainty
1	Conducted Emission Test	2.79dB
2	Radiated Emission Test	2.81dB

3 Test Facility
AA Electro Magnetic Test Laboratory is an ISO 17025:2017 certified lab by NABL, Certification No.TC-8597, CE Marking Certificate from Phoenix Germany #800058_00 and ILAC-MRA #0366. We are also accredited ISO17025:2017 by A2LA(American association for laboratory accreditation) #5593.01 ,FCC Recognized #137777, ISED recognized for wireless product #26046, VCCI(Japan) supporting member #4053..
3.1 Deviation from standard None
3.2 Abnormalities from standard conditions None

4 General Information

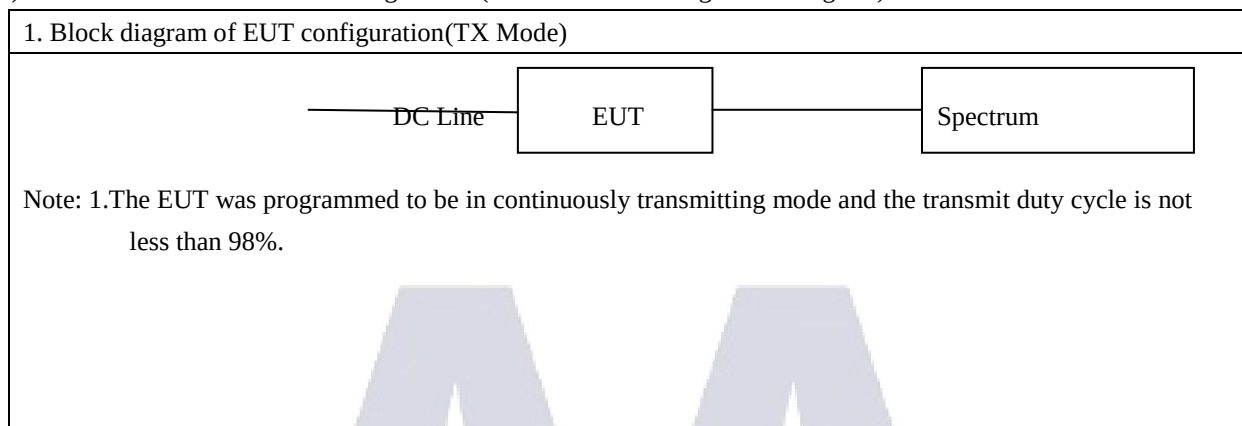
4.1 General Description of EUT

Manufacturer:	Netradyne Inc.
Manufacturer Address:	9191 Towne Centre Drive, Suite 200, San Diego, CA 92122
EUT Name:	Driveri
Model No:	D-210
Brand Name:	Netradyne
Serial No:	N/A
Derivative model No.:	D-210A, D-211
Operation frequency:	2402 MHz to 2480 MHz
NUMBER OF CHANNEL:	40
Modulation Technology:	GFSK(2Mbps)
Bluetooth version:	Bluetooth v5.0
Antenna Gain:	3 dBi
H/W No.:	501-1-00908_B1
S/W No.:	2.4.9.rc.2
Power Supply Range:	12VDC @ 3A
Power Cord:	1.1 m x 2 wires unscreened DC cable
Note:	
1.	For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

Description of Channel:			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

4.2 Description of Test conditions

(1) EUT was tested in normal configuration (Please See following Block diagram)



(2) E.U.T. test conditions:

15.31(e): For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

(3) Test frequencies:

According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and. If required reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

(4) Frequency range of radiated measurements:

According to the 15.33, the test range will be up to the tenth harmonic of the highest fundamental frequency.

4.3 Test Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	signal cable
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

4.4 EUT Peripheral List

No.	Equipment	Manufacturer	FCC ID	Model No.	Serial No.	Power cord	Remark
1	DriverI/DCM LTE Module	Netradyne Inc.	2AM8R-DC M-NA1-100	DriverI/DCM	N/A	N/A	
2	CAN Adaptor Board	Netradyne Inc.	N/A	A1 version : D-210-AD1 A2 version : D-210-AD2 A3 Version : D-210-AD3	N/A	N/A	

5 Equipments List for All Test Items

No	Test Equipment	Manufacturer	Model No	Serial No	Cal. Date	Cal. Due Date
1	EMI TEST Receiver	Rohde and Schwarz	ESIB26	838786/010	2020/01/28	2021/01/27
2	Loop antenna	DAZE Beijing	ZN30900C	18052	2020/01/29	2021/01/28
3	Hi power horn antenna	DAZE Beijing	ZN30700	18012	2020/01/30	2021/01/29
4	Horn antenna	DAZE Beijing	ZN30702	18006	2020/01/30	2021/01/29
5	Horn antenna	DAZE Beijing	ZN30703	18005	2020/01/30	2021/01/29
6	Preamplifier	KELIANDA	LNA-0009295	-	2020/01/28	2021/01/29
7	Preamplifier	KELIANDA	CF-00218	-	2020/01/28	2021/01/27
8	Bi conical Antenna	DAZE Beijing	ZN30505C	17038	2020/01/28	2021/01/29
9	EMI-RECEIVER	Schwarzbeck	FCKL	1528194	2020/01/28	2021/01/27
10	Spectrum Analyzer	ADVANTEST	R3361	-	2019/05/15	2021/05/14
11	LISN	Kyoritsu	KNW-407	8-1789-5	2020/01/28	2021/01/27
12	Network-LISN	Schwarzbeck	NNBM8125	81251314	2020/01/28	2021/01/27
13	Network-LISN	Schwarzbeck	NNBM8125	81251315	2020/01/28	2021/01/27
14	PULSELIMITER	Rohde and Schwarz	ESH3-Z2	100681	2019/05/13	2021/05/12
15	50ΩCoaxialSwitch	DAIWA	1565157	-	2019/05/13	2021/05/12
16	50ΩCoaxialSwitch	-	-	-	2019/05/13	2021/05/12
17	Wireless signal power meter	DARE!!	RPR3006W	RFSW190220	2020/01/29	2021/01/28

18	Signal Generator	KEYSIGHT	N5181A	512071	2020/01/29	2021/01/28
19	RF Vector Signal Generator	Keysight	N5182B	512094	2020/01/29	2021/01/28
20	Spectrum analyzer	R&S	FSV-40N	101385	2020/01/29	2021/01/28
21	Radio Communication Tester	R&S	CMW 500	124589	2019/5/15	2021/5/14
22	Signal Generator	R&S	SMP02	837017/004 836593/005	2019/5/15	2021/5/14
23	DC Power Supply	Guanker	JK15040K	TNC/ET/C/0 01/15	2020/2/2	2021/2/1
24	Pro. Temp & Humi. chamber	MENTEK	MHP-150-1C	MAA081125 01	2020/2/2	2021/2/1
25	Attenuators	AGILENT	8494B	-	-	-
26	Attenuators	AGILENT	8495B	-	-	-

6 Test Result

6.1 Antenna Requirement

6.1.1 Standard requirement

15.203 requirements: For intentional device, according to 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.

15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

6.1.2 EUT Antenna

The antenna is layout on PCB board and no consideration of replacement. Antenna gain is Maximum 3dBi from 2.4GHz to 2.5GHz.

6.2 Conduction Emissions Measurement

6.2.1 Applied procedures / Limit

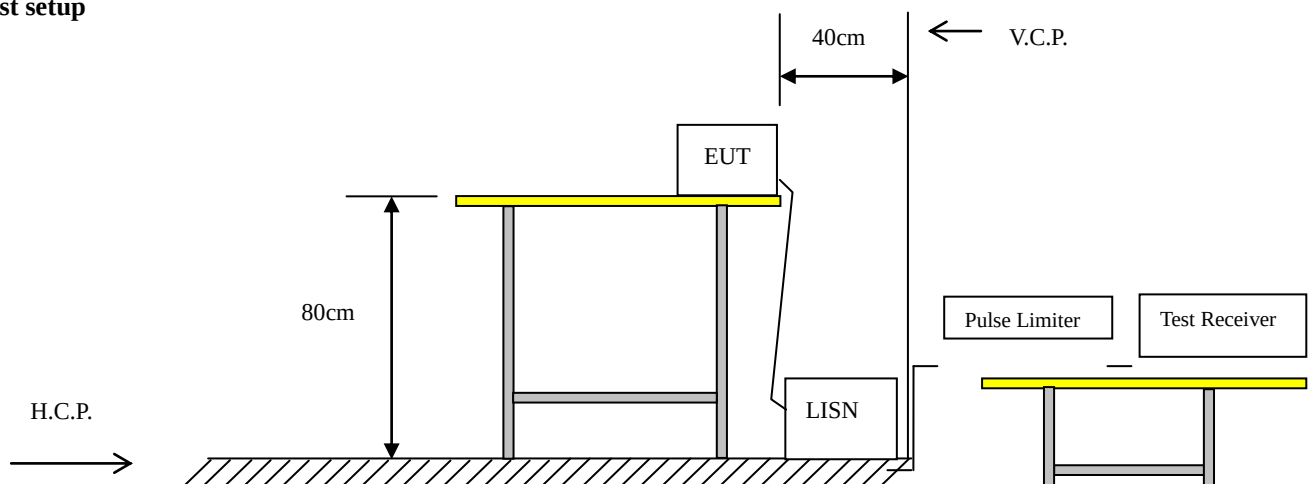
Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

Note: Decreases with the logarithm of the frequency.

6.2.2 Test procedure

1. The mains terminal disturbance voltage test was conducted in a shielded room.
2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.
4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

Test setup

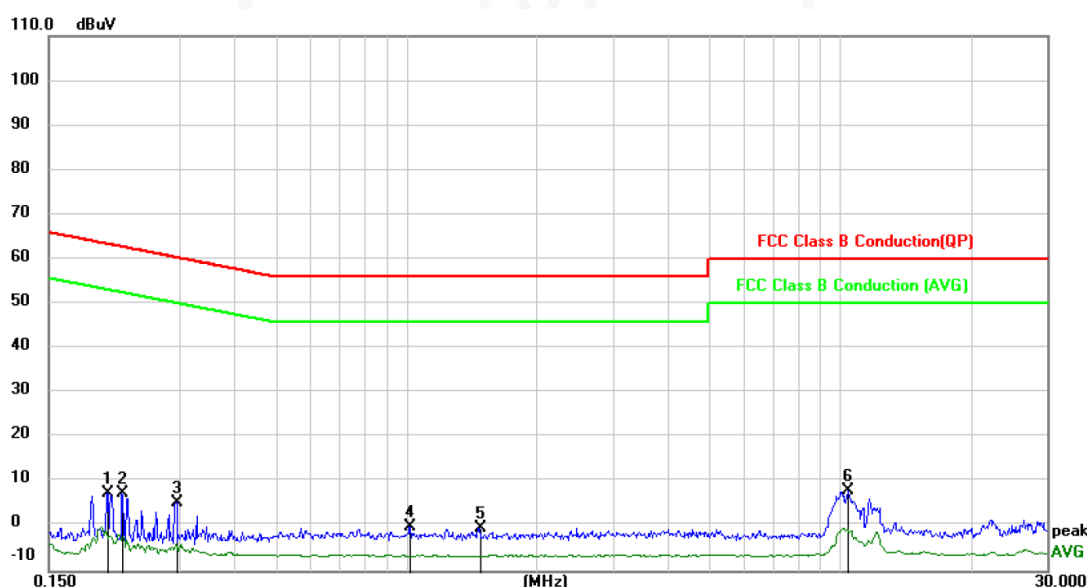


6.2.3 Test results(Worst Case)

EUT:	Driveri	Model Name. :	D-210
Temperature:	25 °C	Relative Humidity:	51%
Pressure:	1010hPa	Test Date :	2020-07-02
Test Mode:	TX CH00 (2Mbps worst case)	Phase :	Ambient
Test Voltage :	DC 12V		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.2042	6.27	1.27	7.54	63.43	-55.89	peak
2		0.2210	6.34	1.26	7.60	62.78	-55.18	peak
3		0.2942	4.12	1.25	5.37	60.40	-55.03	peak
4		1.0175	-0.73	0.90	0.17	56.00	-55.83	peak
5		1.4720	-1.20	0.85	-0.35	56.00	-56.35	peak
6	*	10.3500	7.36	0.85	8.21	60.00	-51.79	peak

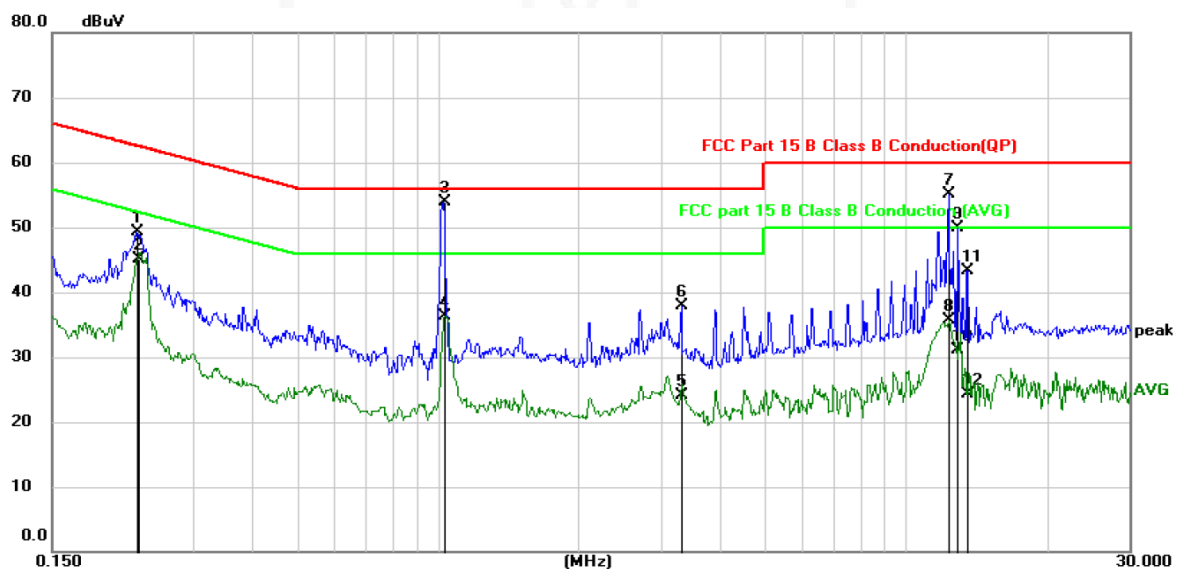
Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.



EUT:	Driveri	Model Name. :	D-210
Temperature:	25 °C	Relative Humidity:	51%
Pressure:	1010hPa	Test Date :	2020-07-02
Test Mode:	TX CH00 (2Mbps worst case)	Phase :	Line
Test Voltage :	DC 12V		

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.2268	33.81	15.46	49.27	62.56	-13.29	QP
2		0.2280	29.72	15.46	45.18	52.52	-7.34	AVG
3	*	1.0303	38.42	15.40	53.82	56.00	-2.18	QP
4		1.0354	20.87	15.40	36.27	46.00	-9.73	AVG
5		3.2945	8.66	15.41	24.07	46.00	-21.93	AVG
6		3.3079	22.58	15.41	37.99	56.00	-18.01	QP
7		12.3000	39.78	15.35	55.13	60.00	-4.87	QP
8		12.3000	20.39	15.35	35.74	50.00	-14.26	AVG
9		12.9000	34.61	15.35	49.96	60.00	-10.04	QP
10		12.9000	15.68	15.35	31.03	50.00	-18.97	AVG
11		13.5000	28.04	15.34	43.38	60.00	-16.62	QP
12		13.5000	8.94	15.34	24.28	50.00	-25.72	AVG

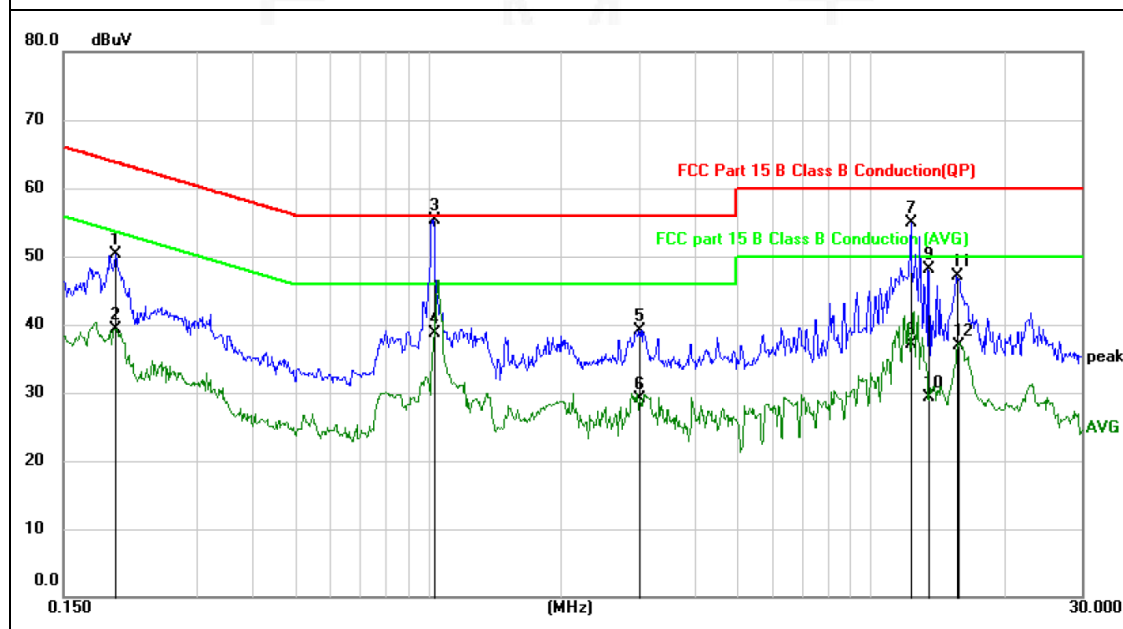
Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.



EUT:	Driveri	Model Name. :	D-210
Temperature:	25 °C	Relative Humidity:	50%
Pressure:	1010hPa	Test Date :	2020-07-02
Test Mode:	TX CH00 (2Mbps worst case)	Phase :	Neutral
Test Voltage :	DC 12V		

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector
1		0.1958	34.80	15.47	50.27	63.78	-13.51	QP
2		0.1958	23.90	15.47	39.37	53.78	-14.41	AVG
3	*	1.0304	39.86	15.40	55.26	56.00	-0.74	QP
4		1.0354	23.38	15.40	38.78	46.00	-7.22	AVG
5		2.9975	23.71	15.41	39.12	56.00	-16.88	QP
6		2.9975	13.74	15.41	29.15	46.00	-16.85	AVG
7		12.3246	39.57	15.35	54.92	60.00	-5.08	QP
8		12.3246	21.78	15.35	37.13	50.00	-12.87	AVG
9		13.5000	32.71	15.34	48.05	60.00	-11.95	QP
10		13.5000	13.99	15.34	29.33	50.00	-20.67	AVG
11		15.6500	31.70	15.34	47.04	60.00	-12.96	QP
12		15.7248	21.49	15.34	36.83	50.00	-13.17	AVG

Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.



6.3 Radiated Emissions Measurement

6.3.1 Applied procedures / Limit

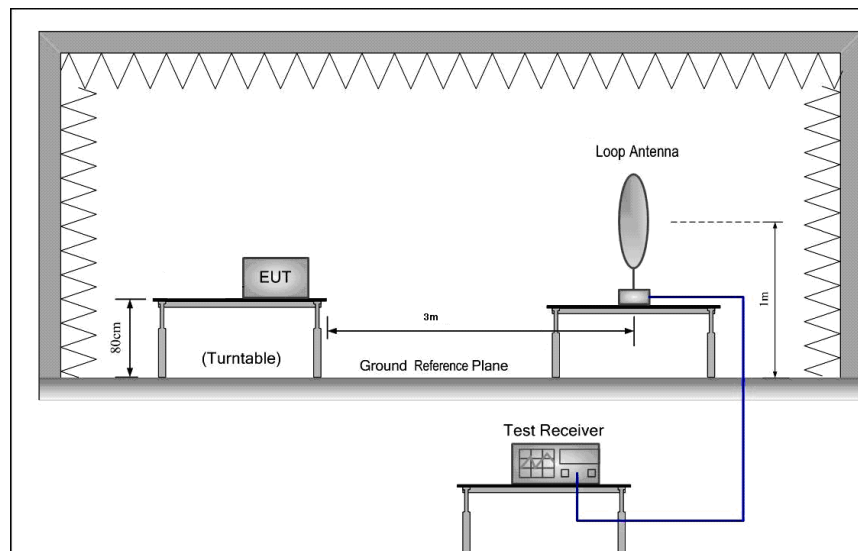
15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Frequency of Emission (MHz)	Field Strength		Measurement Distance (meters)
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	
0.009-0.49	2400/F(kHz)		300
0.49-1.705	24000/F(kHz)		30
1.705-30	30		30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

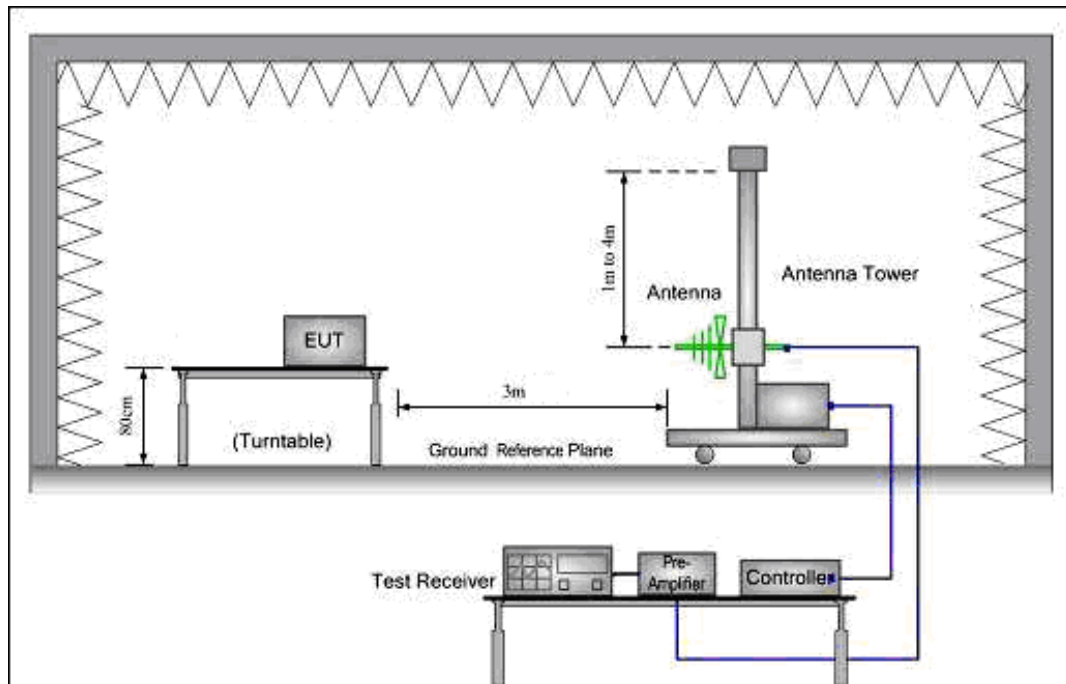
6.3.2 Test setup

Test Configuration:

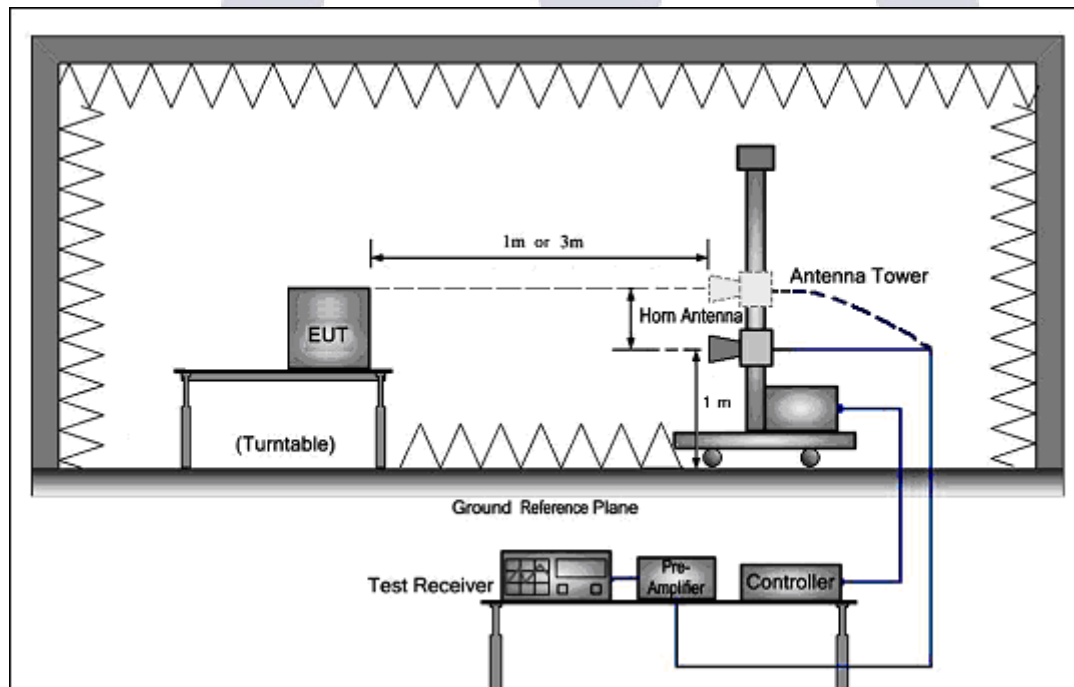
- 1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 25 GHz emissions:



6.3.3 Test procedure

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter, for the test frequency of above 1GHz, horn antenna opening in the test would have been facing the EUT when rise or fall) and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. The resolution bandwidth and video bandwidth of the test receiver was 1MHz and 1MHz for Peak detection at frequency above 1GHz.
- g. Test the EUT in the lowest channel (2402MHz), the middle channel (2440MHz), the Highest channel (2480MHz)
- h. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.
- i. Repeat above procedures until all frequencies measured was complete.

For measurement at frequency above 1GHz

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

For Average measurement at frequency above 1GHz.

The resolution bandwidth of the test receiver was 1MHz; due to the shortest pulse width T is 116us, according the video bandwidth should not smaller than 1/T, so the video bandwidth is 10Hz.

In 18GHz to 25GHz, The EUT was checked by Horn ANT. But the test result at least have 20dB margin.

The EUT was tested in Chamber Site.

6.3.4 Test Result(Worst Case)

Radiated Emissions Test Data Below 30MHz

EUT:	Driveri	Model Name :	D-210
Temperature:	26 °C	Test Data	2020-07-02
Pressure:	1005 hPa	Relative Humidity:	56%
Test Mode :	TX(2Mbps worst case)	Test Voltage :	DC 12V
Measurement Distance	3 m	Frenqucy Range	9KHz to 30MHz
RBW/VBW	9KHz~150KHz/RB 200Hz for QP, 150KHz~30MHz/RB 9KHz for QP		

No emission found between lowest internal used/generated frequencies to 30MHz.

Radiated Emissions Test Data Below 1GHz

EUT:	Driveri	Model Name :	D-210
Temperature:	25 °C	Test Data	2020-07-02
Pressure:	1010 hPa	Relative Humidity:	60%
Test Mode :	TX (2Mbps) CH00 (worst case)	Test Voltage :	DC 12V
Measurement Distance	3 m	Frequency Range	30MHz to 1GHz
RBW/VBW	100KHz / 300KHz for spectrum, RBW=120KHz for receiver.		

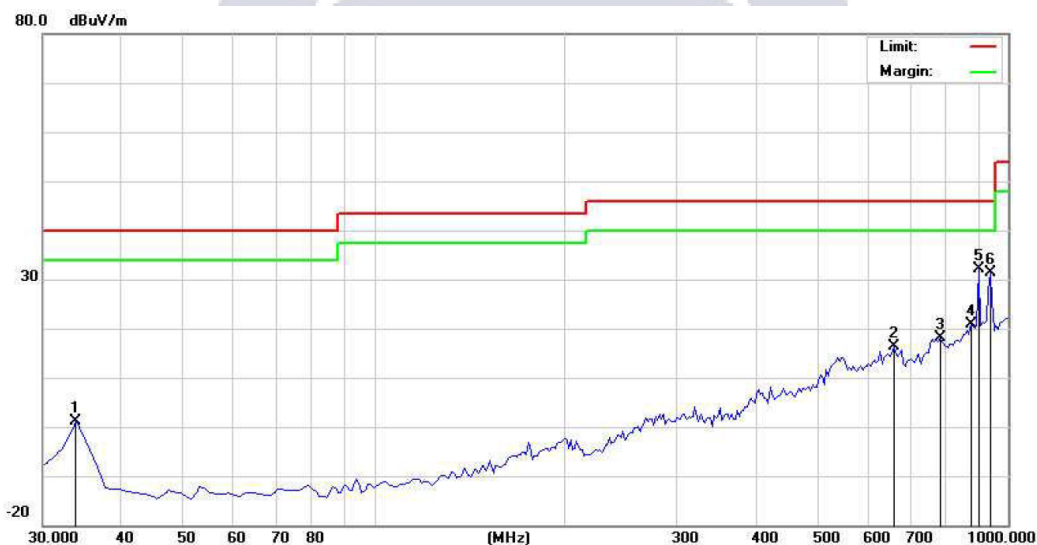
Test at Channel 00 (2.402 GHz) in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Ambient:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV/m	Limit dB/m	Over dB	Detector
1		33.8878	16.77	-15.52	1.25	40.00	-38.75	peak
2		661.7635	23.16	-6.75	16.41	46.00	-29.59	peak
3		782.2846	22.88	-4.78	18.10	46.00	-27.90	peak
4		877.5351	25.54	-4.61	20.93	46.00	-25.07	peak
5	*	902.8056	36.60	-4.49	32.11	46.00	-13.89	peak
6		941.6834	34.74	-3.31	31.43	46.00	-14.57	peak

Note: '*' means the worst case

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

Test at Channel 00 (2.402 GHz) in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV/m	Limit dB/m	Over dB	Detector
1		35.8316	61.54	-30.79	30.75	40.00	-9.25	peak
2		53.3265	61.05	-33.73	27.32	40.00	-12.68	peak
3		82.4848	58.78	-29.63	29.15	40.00	-10.85	peak
4		101.9235	60.08	-25.68	34.40	43.50	-9.10	peak
5	*	115.5310	62.73	-24.50	38.23	43.50	-5.27	peak
6		142.7452	56.95	-22.65	34.30	43.50	-9.20	peak

Note: '*' means the worst case

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

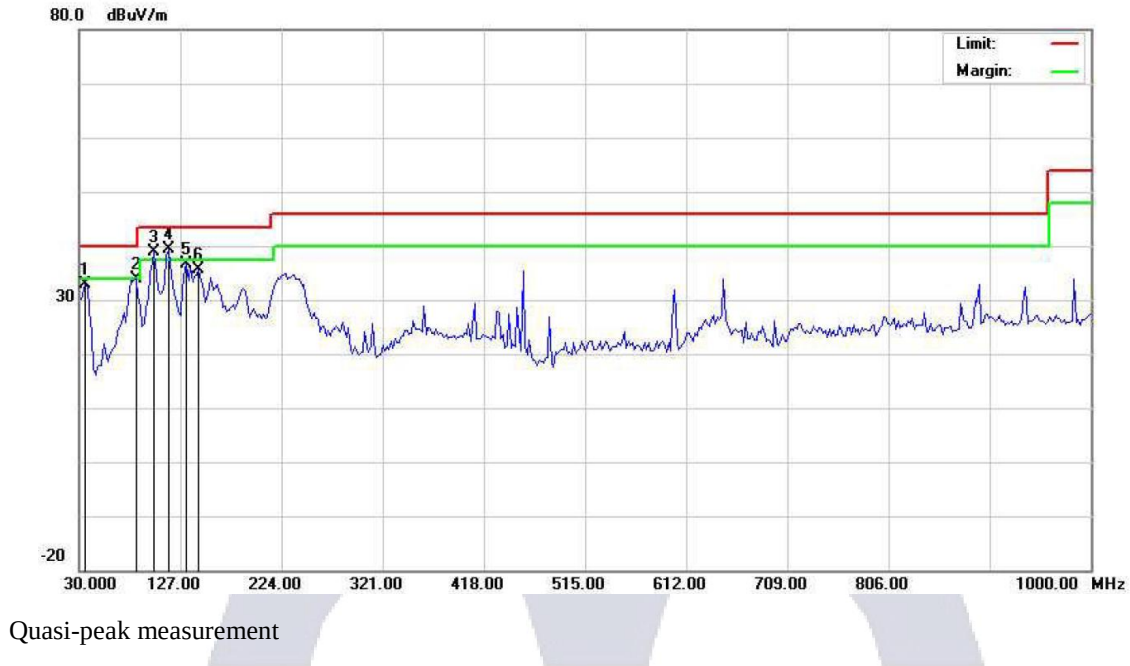
Test at Channel 00 (2.402 GHz) in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV/m	Limit dB/m	Over dB	Detector
1		35.8316	63.75	-30.79	32.96	40.00	-7.04	peak
2		84.4287	63.00	-29.19	33.81	40.00	-6.19	peak
3	!	101.9235	64.44	-25.68	38.76	43.50	-4.74	peak
4	*	115.5310	63.92	-24.50	39.42	43.50	-4.08	peak
5		133.0260	59.77	-23.25	36.52	43.50	-6.98	peak
6		144.6893	58.26	-22.51	35.75	43.50	-7.75	peak

Note: '*' means the worst case

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

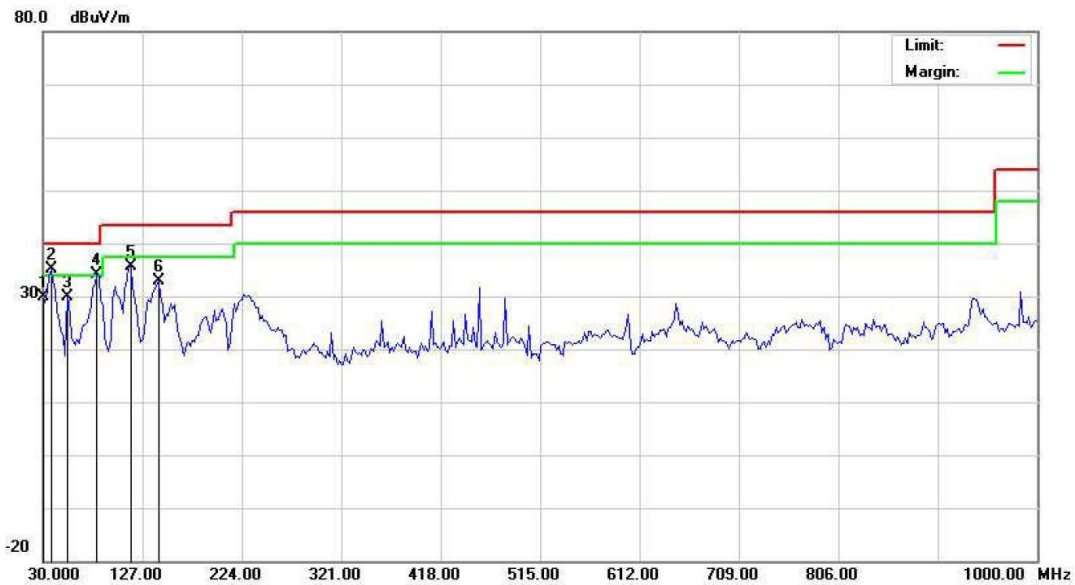
Test at Channel 19 (2.440 GHz) in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV/m	Limit dB/m	Over dB	Detector
1		30.0000	58.07	-28.29	29.78	40.00	-10.22	peak
2	*	37.7754	66.88	-31.64	35.24	40.00	-4.76	peak
3		53.3265	63.55	-33.73	29.82	40.00	-10.18	peak
4	!	82.4848	63.78	-29.63	34.15	40.00	-5.85	peak
5		115.5310	60.23	-24.50	35.73	43.50	-7.77	peak
6		142.7452	55.45	-22.65	32.80	43.50	-10.70	peak

Note: '*' means the worst case

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

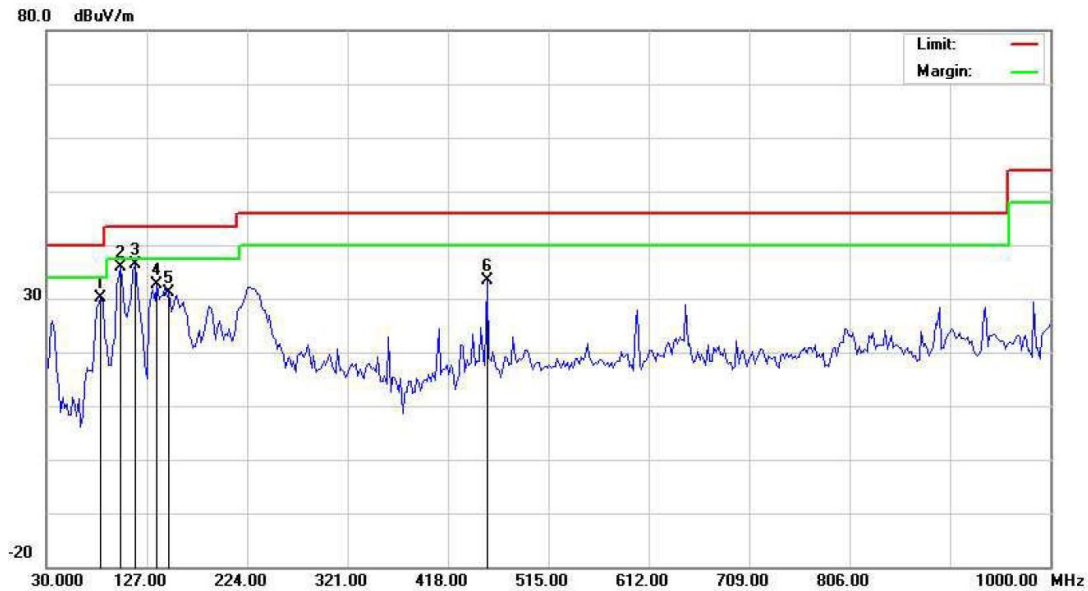
Test at Channel 19 (2.440 GHz) in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV/m	Limit dB/m	Over dB	Detector
1		82.4848	59.73	-29.63	30.10	40.00	-9.90	peak
2		101.9235	61.44	-25.68	35.76	43.50	-7.74	peak
3	*	115.5310	60.92	-24.50	36.42	43.50	-7.08	peak
4		136.9138	55.74	-23.02	32.72	43.50	-10.78	peak
5		148.5771	53.23	-22.21	31.02	43.50	-12.48	peak
6		455.7114	44.06	-10.72	33.34	46.00	-12.66	peak

Note: '*' means the worst case

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

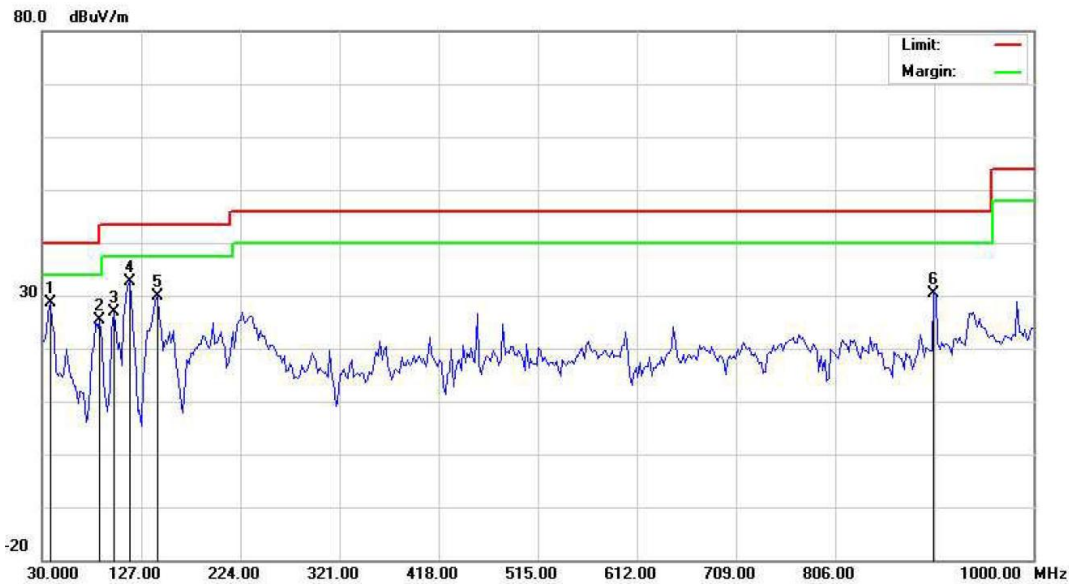
Test at Channel 39 (2.480 GHz) in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV/m	Limit dB/m	Over dB	Detector
1		37.7754	60.38	-31.64	28.74	40.00	-11.26	peak
2		86.3726	54.10	-28.76	25.34	40.00	-14.66	peak
3		99.9799	52.73	-25.88	26.85	43.50	-16.65	peak
4	*	115.5310	57.23	-24.50	32.73	43.50	-10.77	peak
5		142.7452	52.45	-22.65	29.80	43.50	-13.70	peak
6		902.8056	35.79	-5.29	30.50	46.00	-15.50	peak

Note: '*' means the worst case

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

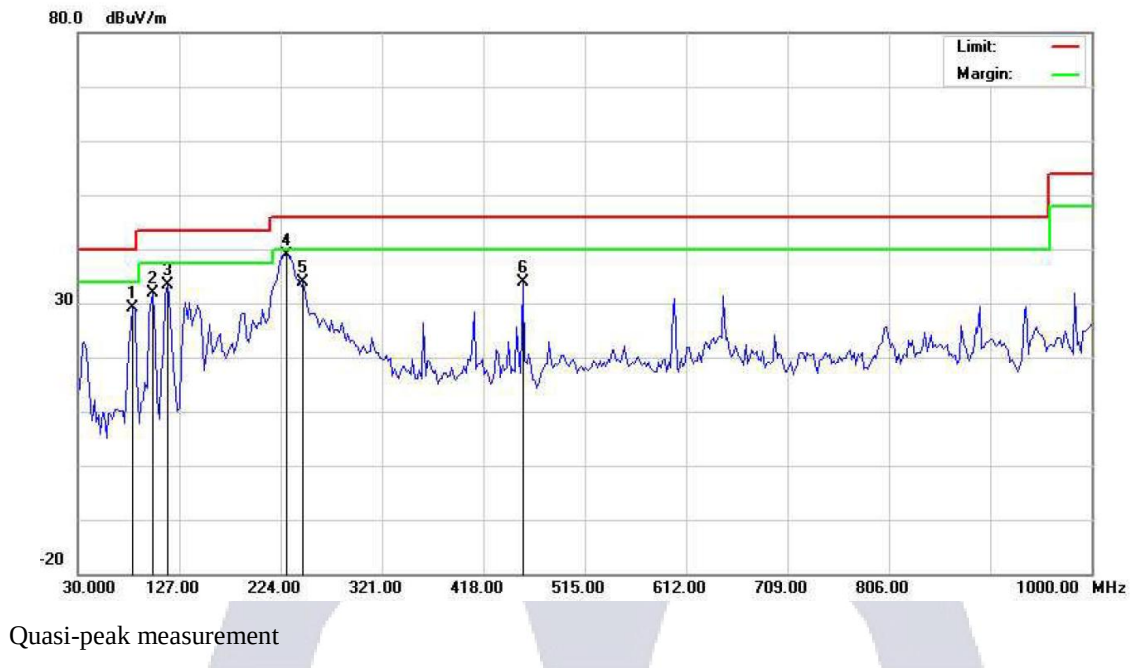
Test at Channel 39 (2.480 GHz) in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



No.	Mk.	Freq. MHz	Reading Level dBμV	Correct Factor dB	Measure- ment dBμV/m	Limit dB/m	Over dB	Detector
1		82.4848	58.73	-29.63	29.10	40.00	-10.90	peak
2		101.9235	57.44	-25.68	31.76	43.50	-11.74	peak
3		115.5310	57.92	-24.50	33.42	43.50	-10.08	peak
4	*	230.2204	55.75	-16.80	38.95	46.00	-7.05	peak
5		245.7715	49.72	-15.73	33.99	46.00	-12.01	peak
6		455.7114	44.56	-10.72	33.84	46.00	-12.16	peak

Note: '*' means the worst case

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

Radiated Emissions Test Data Above 1GHz

EUT:	Driveri	Model Name :	D-210
Temperature:	25 °C	Test Data	2020-07-02
Pressure:	1010 hPa	Relative Humidity:	60%
Test Mode :	TX(2Mbps)(Worst case)	Test Voltage :	DC 12V
Measurement Distance	3 m	Frequency Range	1GHz to 25GHz
RBW/VBW	Spurious emission: 1MHz/1MHz for Peak, 1MHz/10Hz for Average. non-restricted band: 100KHz/300KHz for Peak.		

(a) Antenna polarization: Horizontal

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4804.000	51.76	5.06	56.35	74.00	39.17	PEAK
4804.000	38.99	5.06	44.49	54.00	34.54	AVERAGE
7206.000	46.87	7.03	53.70	74.00	33.60	PEAK
7206.000	35.64	7.03	42.59	54.00	31.26	AVERAGE

(b) Antenna polarization: Vertical

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4804.000	50.22	5.06	55.25	74.00	36.53	PEAK
4804.000	36.72	5.06	42.01	54.00	29.79	AVERAGE
7206.000	45.61	7.03	52.69	74.00	31.33	PEAK
7206.000	33.82	7.03	41.32	54.00	28.17	AVERAGE

Note:

8~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

Low Channel 00: 2402 MHz

Data rate: 2Mbps

(a) Antenna polarization: Horizontal

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4880.000	49.25	5.14	53.91	74.00	34.30	PEAK
4880.000	36.70	5.14	42.27	54.00	30.11	AVERAGE
7320.000	44.83	7.52	52.37	74.00	30.72	PEAK
7320.000	32.09	7.52	39.43	54.00	25.04	AVERAGE

(b) Antenna polarization: Vertical

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4880.000	48.79	5.14	53.67	74.00	33.60	PEAK
4880.000	35.73	5.14	41.11	54.00	27.98	AVERAGE
7320.000	43.26	7.52	51.19	74.00	27.97	PEAK
7320.000	33.62	7.52	41.37	54.00	28.51	AVERAGE

Note:

8~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

Middle Channel 19: 2440 MHz

Data rate: 2Mbps

(a) Antenna polarization: Horizontal

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4960.000	49.10	5.14	54.42	74.00	34.66	PEAK
4960.000	38.19	5.14	43.53	54.00	32.86	AVERAGE
7440.000	45.12	7.52	53.03	74.00	31.67	PEAK
7440.000	35.28	7.52	42.90	54.00	31.70	AVERAGE

(b) Antenna polarization: Vertical

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4960.000	47.86	5.14	53.46	74.00	32.46	PEAK
4960.000	37.33	5.14	42.38	54.00	30.85	AVERAGE
7440.000	45.90	7.52	53.39	74.00	32.81	PEAK
7440.000	34.83	7.52	42.33	54.00	30.68	AVERAGE

Note:

8~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Factor= Ant Factor + Cable Loss - Pre-amplifier

Low Channel 39: 2480 MHz

Data rate: 2Mbps

6.3.5 TEST RESULTS (Restricted Bands Requirements)

EUT:	Driveri	Model Name :	D-210
Temperature:	25 °C	Test Data	2020-07-02
Pressure:	1010 hPa	Relative Humidity:	60%
Test Mode :	TX(2Mbps) (Worst case)	Test Voltage :	DC 12V
RBW/VBW	1MHz/1MHz for Peak, 1MHz/10Hz for Average.		
Note:	1. The transmitter was setup to transmit at the lowest channel. Then the field strength was measured at 2310-2390 MHz. 2. The transmitter was setup to transmit at the highest channel. Then the field strength was measured at 2483.5-2500 MHz. 3. The data of 2390MHz and 2483.5MHz was the worst.		

Test Mode	Ant.Pol. H/V	Freq. (MHz)	Reading		Ant/CF CF(dB)	Act		Limit	
			Peak (dBuv)	AV (dBuv)		Peak (dBuv/m)	AV (dBuv/m)	Peak (dBuv/m)	AV (dBuv/m)
TX Data rate 2Mbps(Worst Case)	H	2390	45.29	36.22	-5.79	39.5	30.43	74	54
	V	2390	44.38	37.61	-5.79	38.59	31.82	74	54
	H	2483.5	42.61	31.04	-4.98	37.63	26.06	74	54
	V	2483.5	43.69	32.94	-4.98	38.71	27.96	74	54

6.4 BANDWIDTH TEST

6.4.1 Applied procedures / Limit

15.247(a) (2) Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

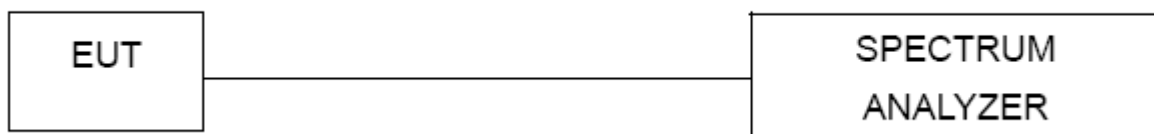
6.4.2 Test procedure

- The testing follows FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 100KHz, VBW $\geq$ 3 $\times$ RBW, Sweep time = Auto, Detector Function = Peak, centering on a hopping channel Trace = Max Hold.
- Mark the peak frequency and -6 dB points bandwidth.

6.4.3 Deviation from standard

No deviation.

6.4.4 Test setup



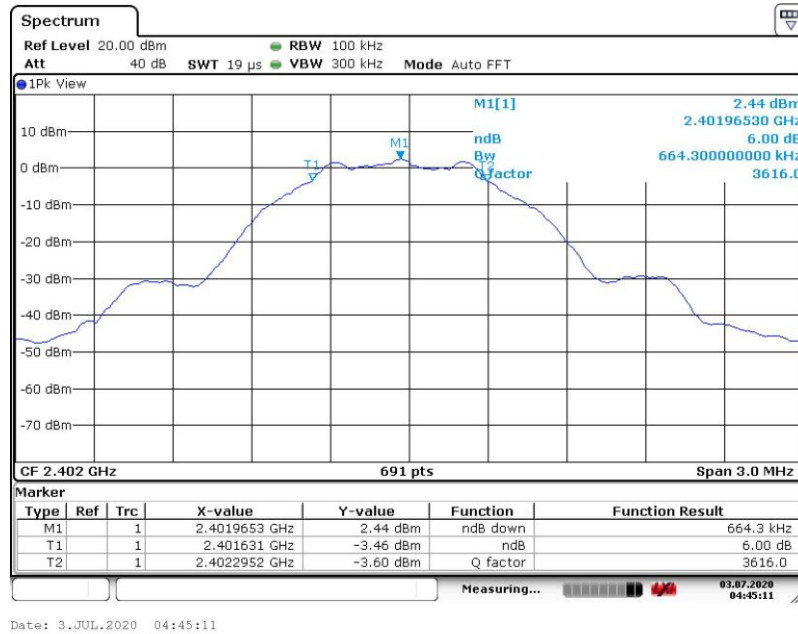
6.4.5 Test results(Worst Case)

EUT:	Driveri	Model Name :	D-210
Temperature:	26 °C	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 12V
Test Mode :	TX(2Mbps)		

Test Mode	Test Channel	Frequency (MHz)	6 dB Bandwidth (KHz)	Limit (kHz)
Data rate 2Mbps	CH00	2402	664.3	≥500
	CH19	2440	659.9	≥500
	CH39	2480	668.6	≥500

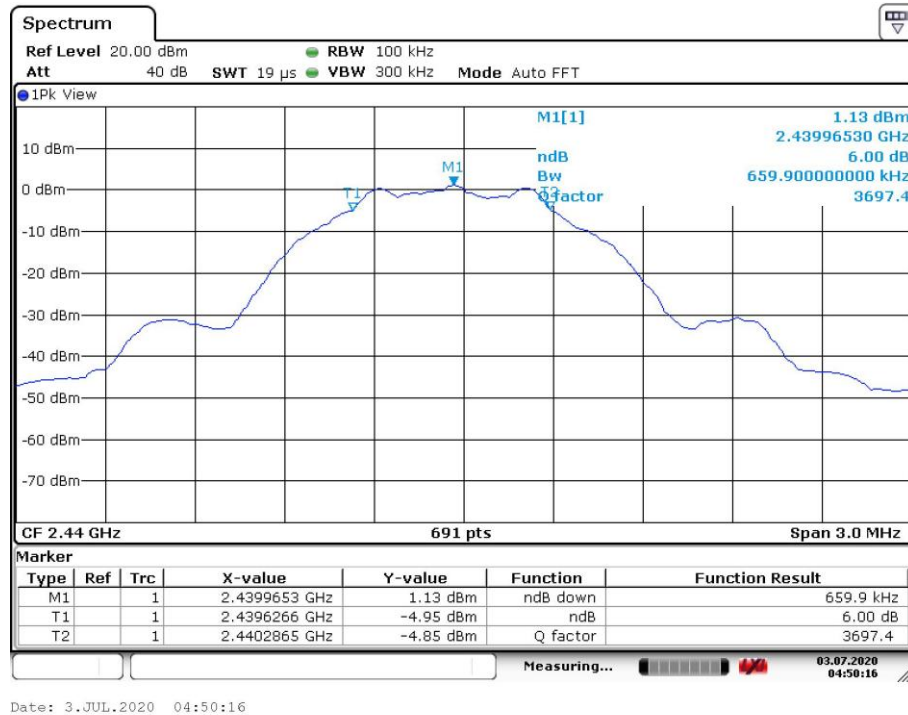
(2Mbps)

The Lowest Channel 00: 2402 MHz

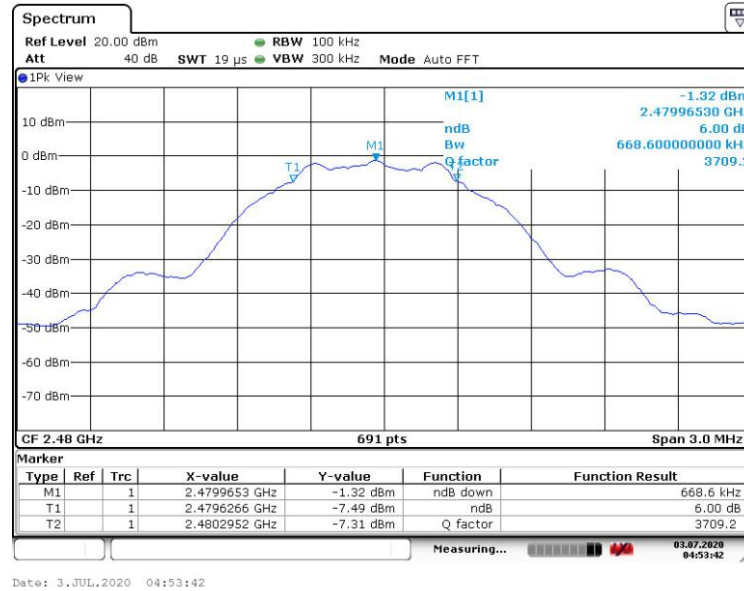


(2Mbps)

The Middle Channel 19: 2440 MHz



(2Mbps)
The High Channel 39: 2480MHz



6.5 Peak Power Density

6.5.1 Applied procedures / Limit

15.247(a) (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

6.5.2 Test procedure

- The testing follows Measurement procedure 10.2 Method PKPSD of FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Connected the antenna port to the Spectrum Analyzer, set the Spectrum Analyzer as center frequency to channel center frequency, span=1.5 times the bandwidth, detector = peak
 $3\text{kHz} \leq \text{RBW} \leq 100\text{kHz}$, $\text{VBW} \geq 3 \times \text{RBW kHz}$, Sweep time=Auto.
- Trace mode = max hold. Mark the peak.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.5.3 Deviation from standard

No deviation.

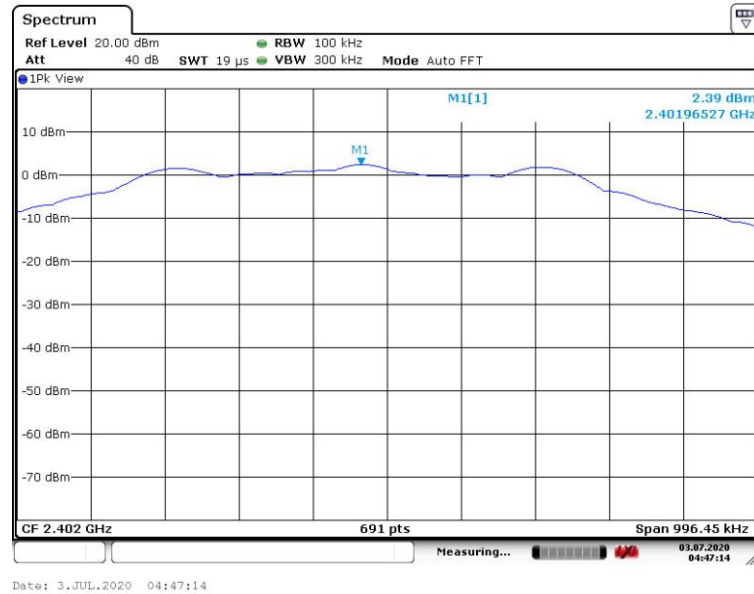
6.5.4 Test results(Worst Case)

EUT:	Driveri	Model Name :	D-210
Temperature:	24 °C	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 12V
Test Mode :	TX(2Mbps)		

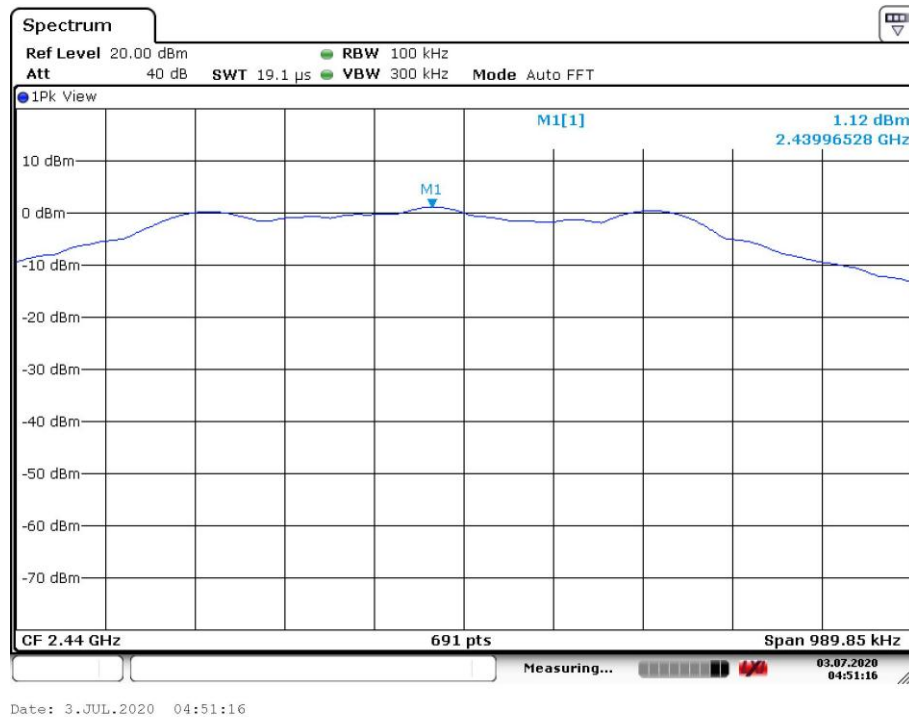
Test Mode	Channel frequency (MHz)	Power Density	Limit (dBm/3kHz)	Result
		PSD 100kHz (dBm/100kHz)		
TX (2Mbps)	2402	2.39	8	Pass
	2440	1.12	8	Pass
	2480	-1.31	8	Pass

Note: The cable loss is 1.0dB

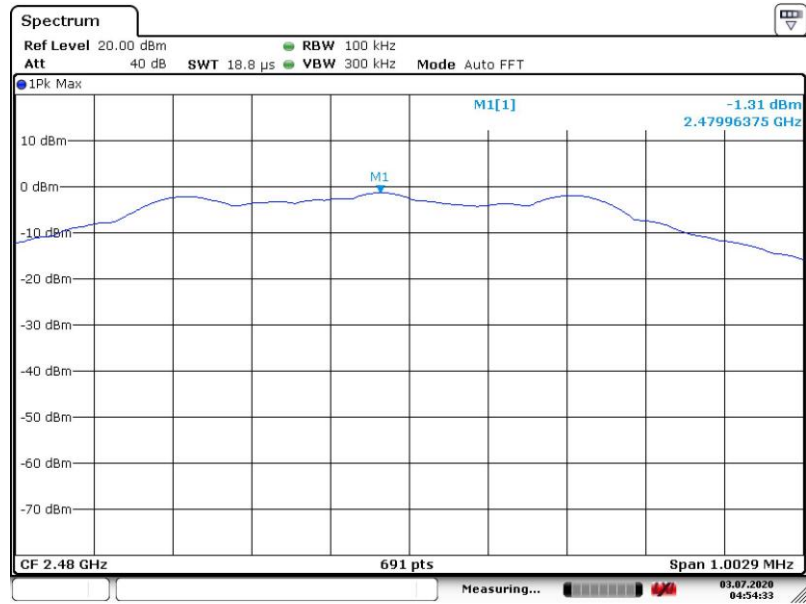
PSD 100kHz (2Mbps)
The Lowest Channel 00: 2402MHz



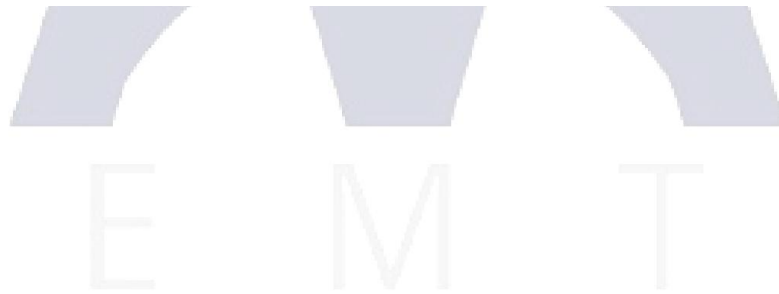
PSD 100kHz (2Mbps)
The Middle Channel 19: 2440MHz



PSD 100kHz (2Mbps)
The High Channel 39: 2480MHz



Date: 3.JUL.2020 04:54:33



6.6 Maximum Peak Output Power

6.6.1 Applied procedures / Limit

15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

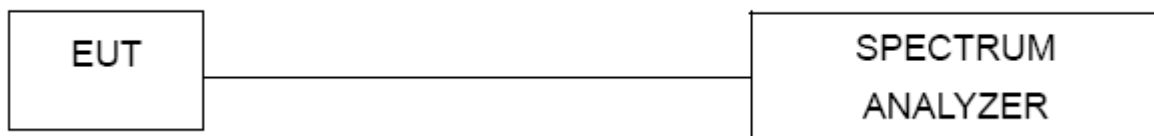
6.6.2 Test procedure

- The testing follows FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: $RBW \geq \text{Bandwidth}$, $VBW \geq 3 \times RBW$, Sweep time = Auto, $\text{Span} \geq 3 \times RBW$,
- Detector = peak. Trace mode = max hold.
- Use peak marker function to determine the peak amplitude level.

6.6.3 Deviation from standard

No deviation.

6.6.4 Test setup



6.6.5 Test results(Worst Case)

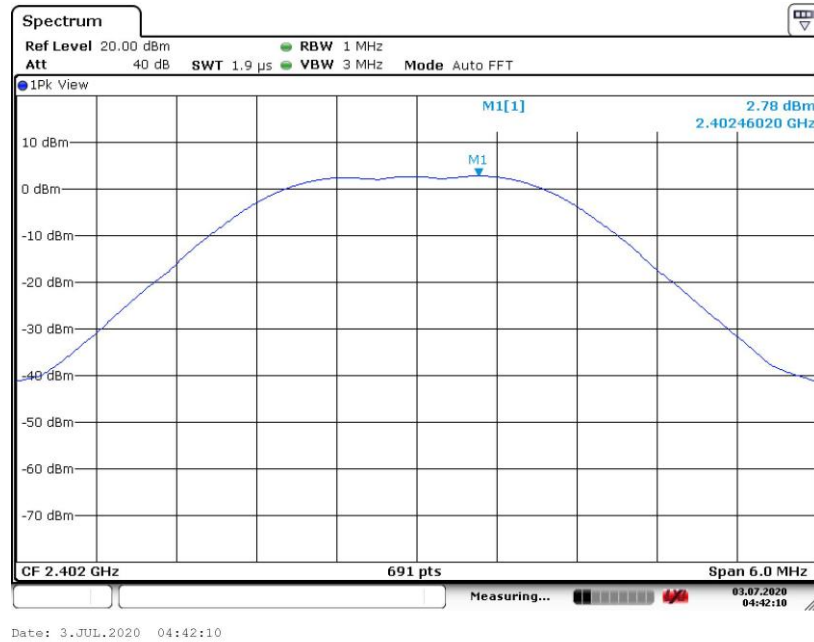
EUT:	Driveri	Model Name :	D-210
Temperature:	26 °C	Relative Humidity:	60%
Pressure:	1010 hPa	Test Voltage :	DC 12V
Test Mode :	TX (2Mbps)		
Note: N/A			

Test Mode	Frequency	Peak Output Power (dBm)	Limit (dBm)	Result
Data rate 2Mbps	2402 MHz	2.78	30	Pass
	2440 MHz	1.39	30	Pass
	2480 MHz	-1.01	30	Pass

Note: The cable loss is 1.0dB

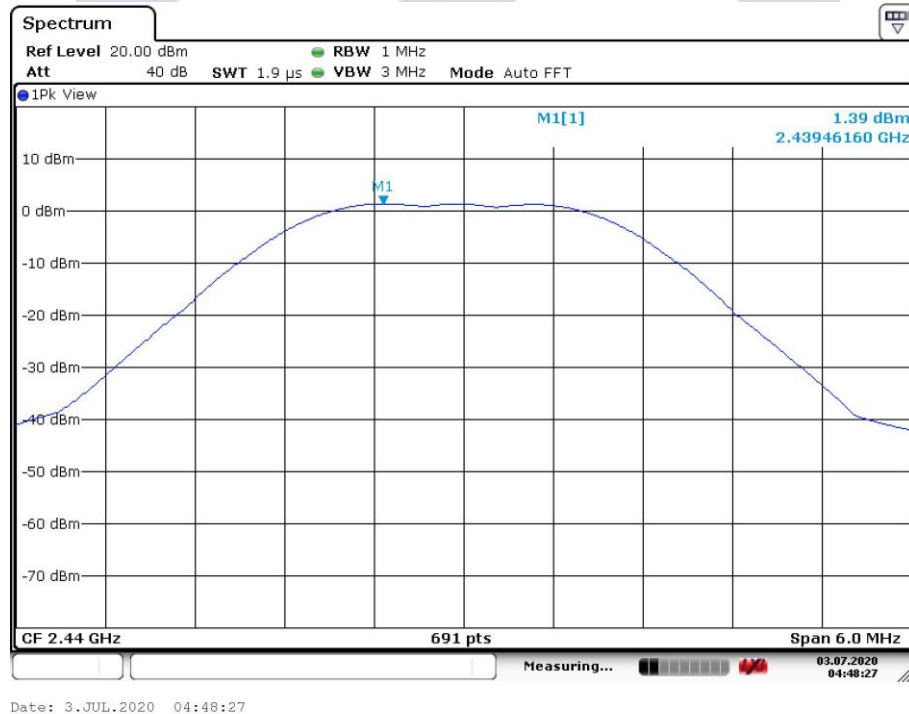
(2Mbps)

The Lowest Channel 00: 2402MHz

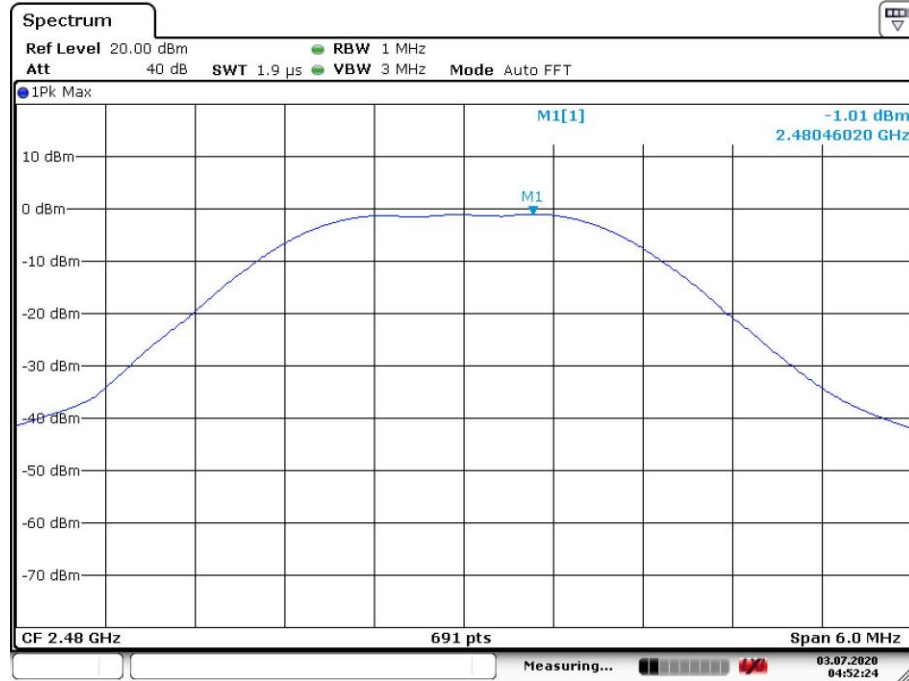


(2Mbps)

The Middle Channel 19: 2440MHz



(2Mbps)
The High Channel 39: 2480MHz



Date: 3.JUL.2020 04:52:24

E M T

6.7 Band edge

6.7.1 Applied procedures / Limit

15.247(d) In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.7.2 Test procedure

- a. The testing follows FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
- b. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- c. Spectrum Setting: RBW=100kHz, VBW $\geq$ 300kHz, Sweep time=Auto, Detector Function=Peak.
- d. The band edges was measured and recorded Result:
The Lower Edges attenuated more than 20dB.
The Upper Edges attenuated more than 20dB.

6.7.3 Deviation from standard

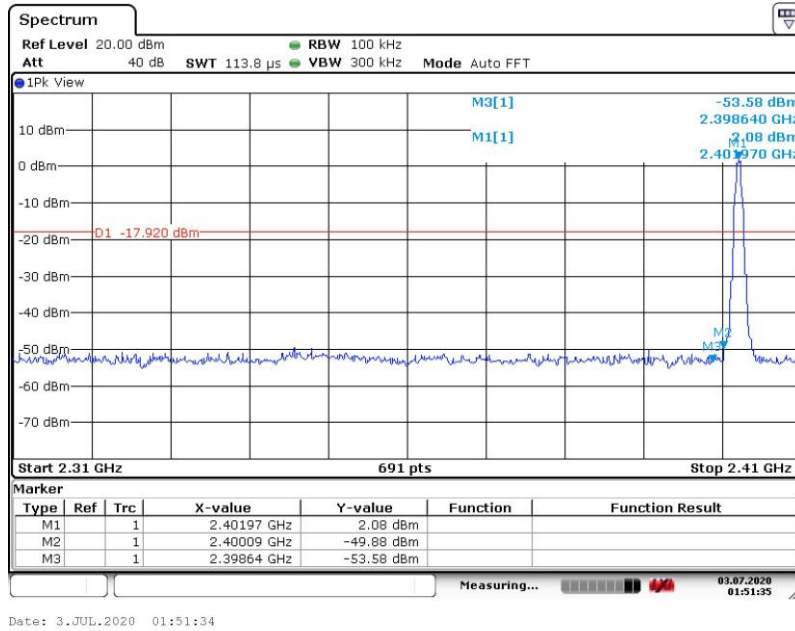
No deviation.

6.7.4 Test setup

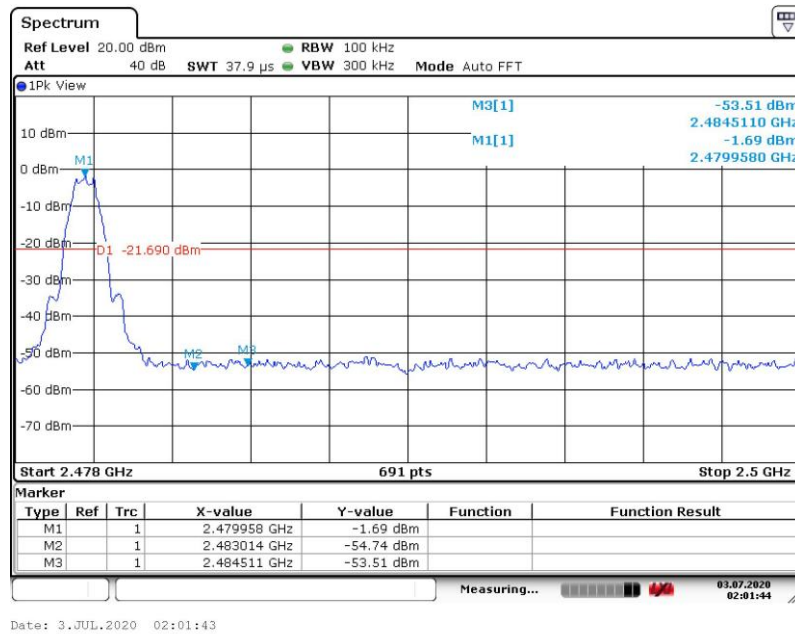


6.7.5 Test results(Worst Case)

(2Mbps) The Lowest Channel 00: 2402MHz



(2Mbps) The High Channel 39: 2480MHz



6.8 Conducted Spurious Emissions

6.8.1 Applied procedures / Limit

15.247(d) In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

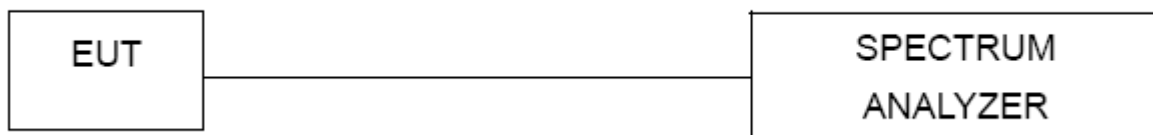
6.8.2 Test procedure

- The testing follows FCC KDB publication No. 558074 D01 DTS Meas. Guidance v03r03
- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW=100kHz, VBW=300kHz, Sweep time=Auto, Detector Function=Peak, sweep points $\geq$ investigated frequency range/RBW.

6.8.3 Deviation from standard

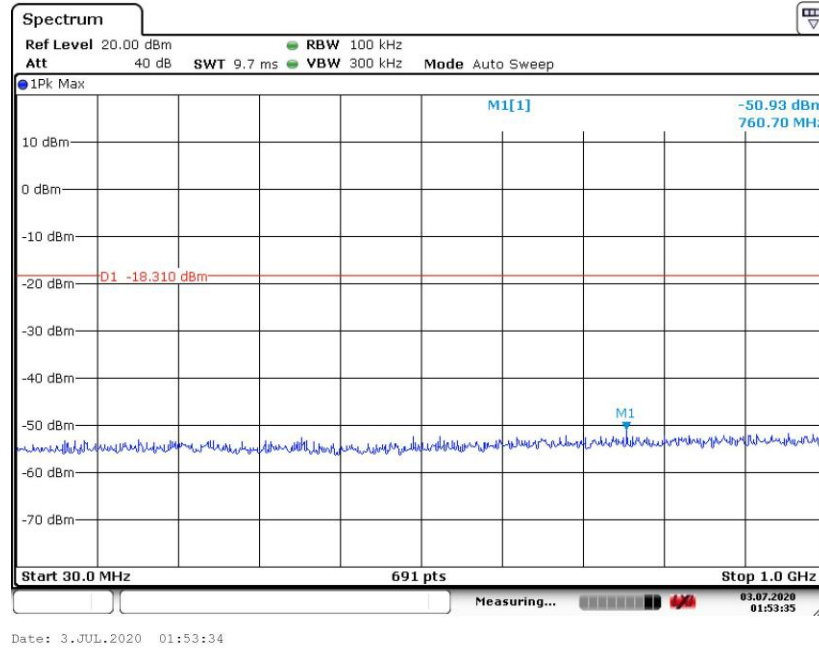
No deviation.

6.8.4 Test setup

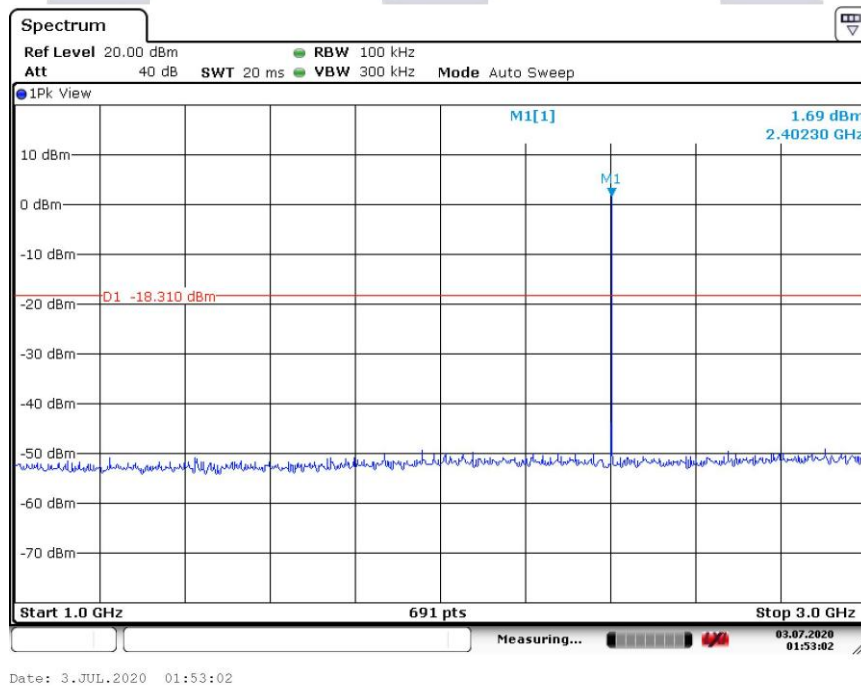


6.8.5 Test results(Worst Case)

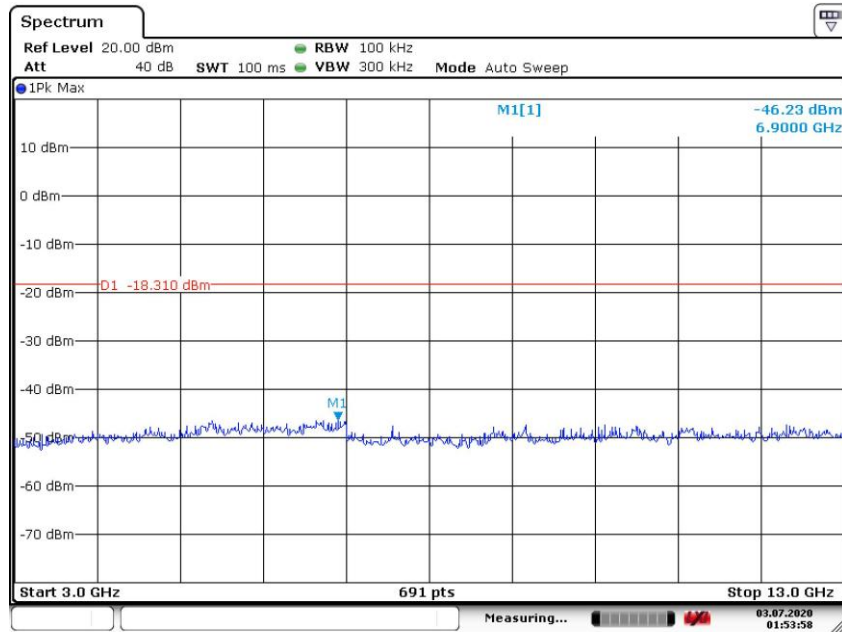
The Lowest Channel 00 (2Mbps): 2402MHz



Note: Sweep Points=691

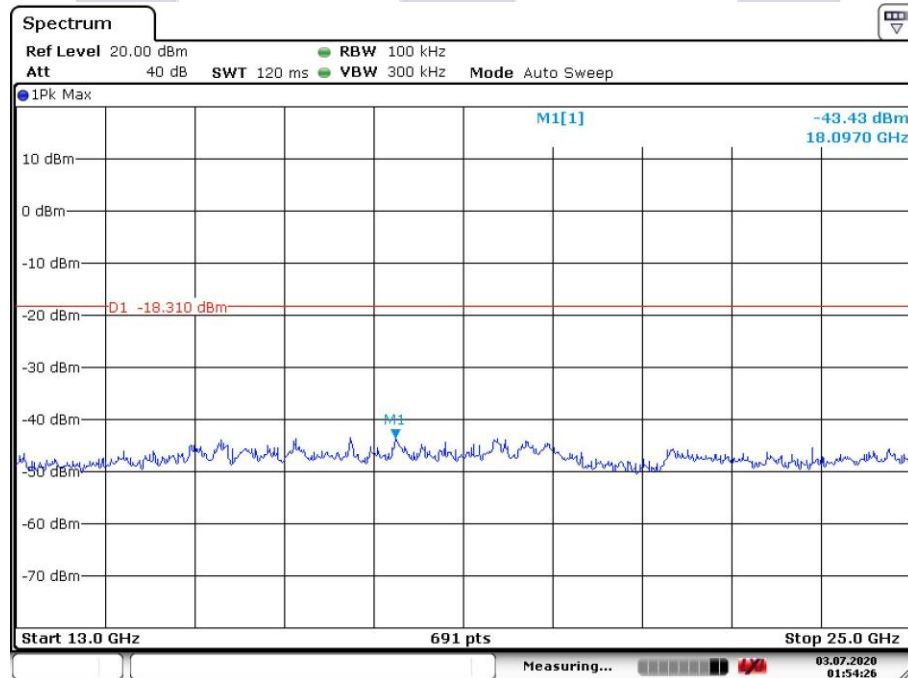


Note: Sweep Points=691



Date: 3.JUL.2020 01:53:58

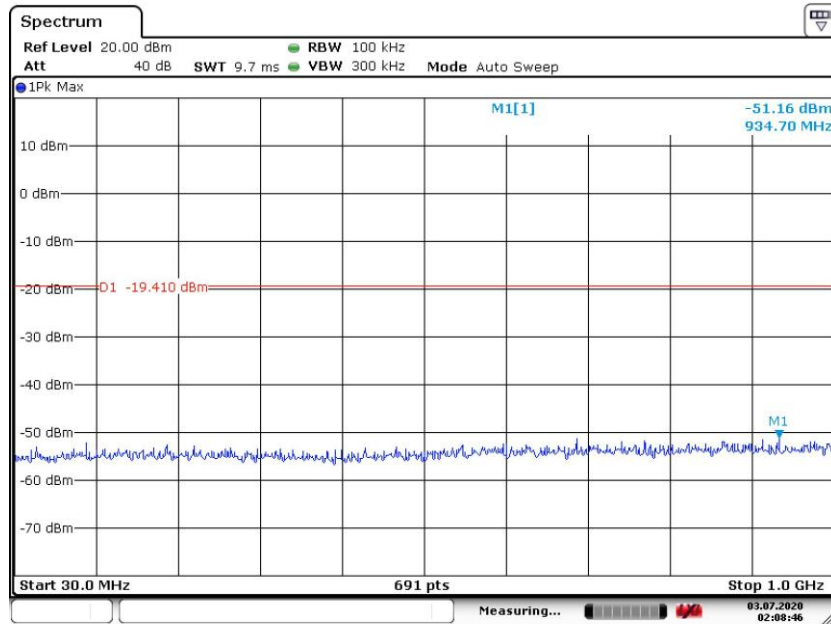
Note: Sweep Points=691



Date: 3.JUL.2020 01:54:26

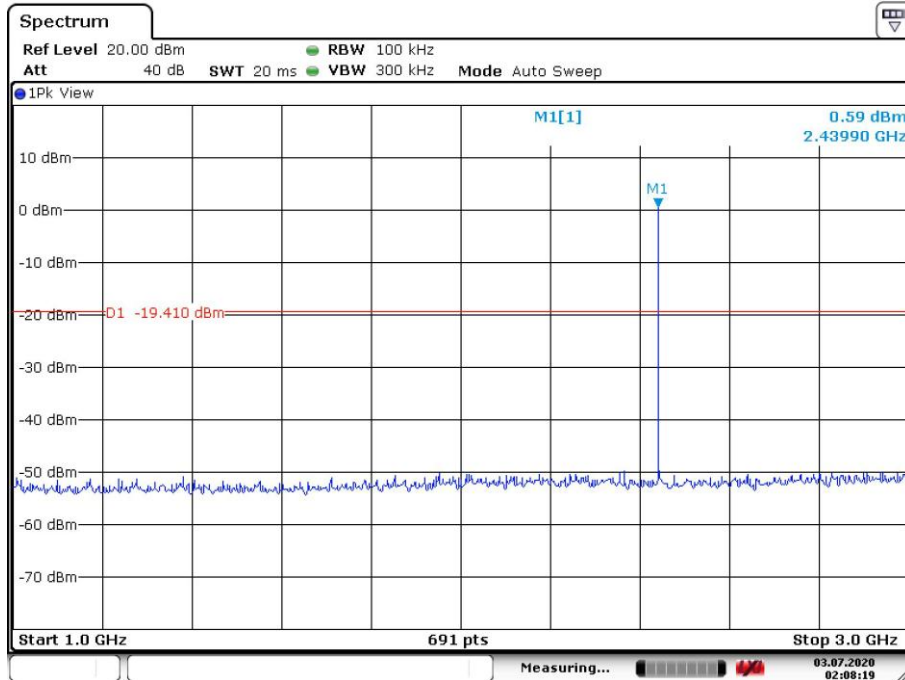
Note: Sweep Points=691

The Middle Channel 19(2Mbps): 2440MHz



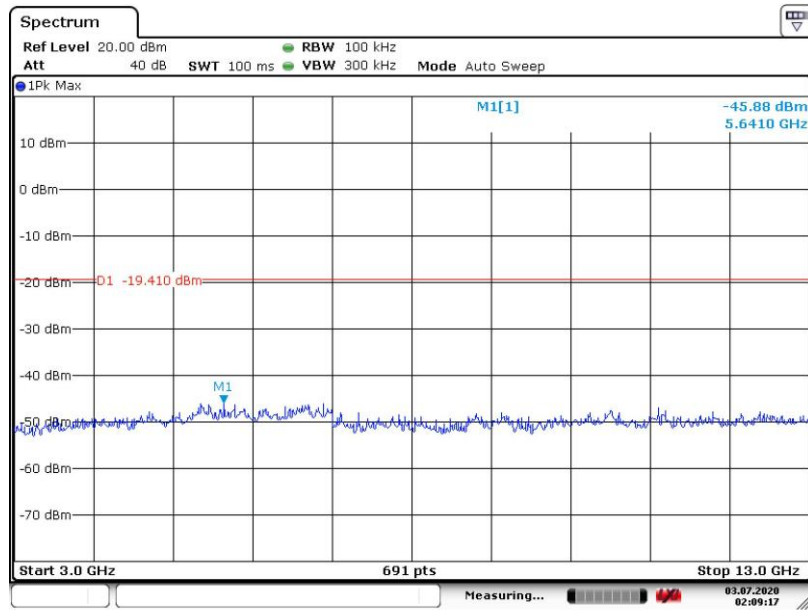
Date: 3.JUL.2020 02:08:46

Note: Sweep Points=691



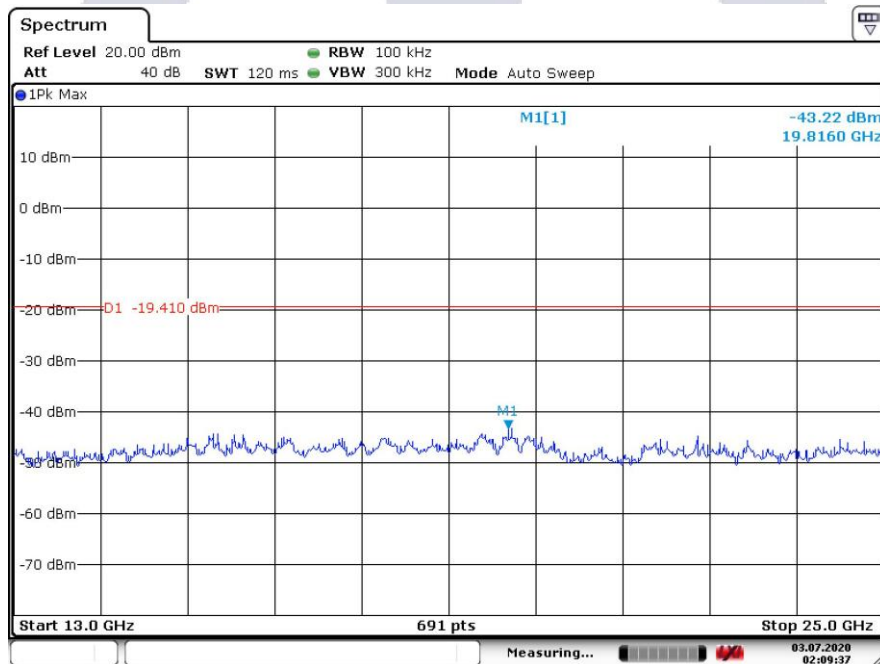
Date: 3.JUL.2020 02:08:19

Note: Sweep Points=691



Date: 3.JUL.2020 02:09:17

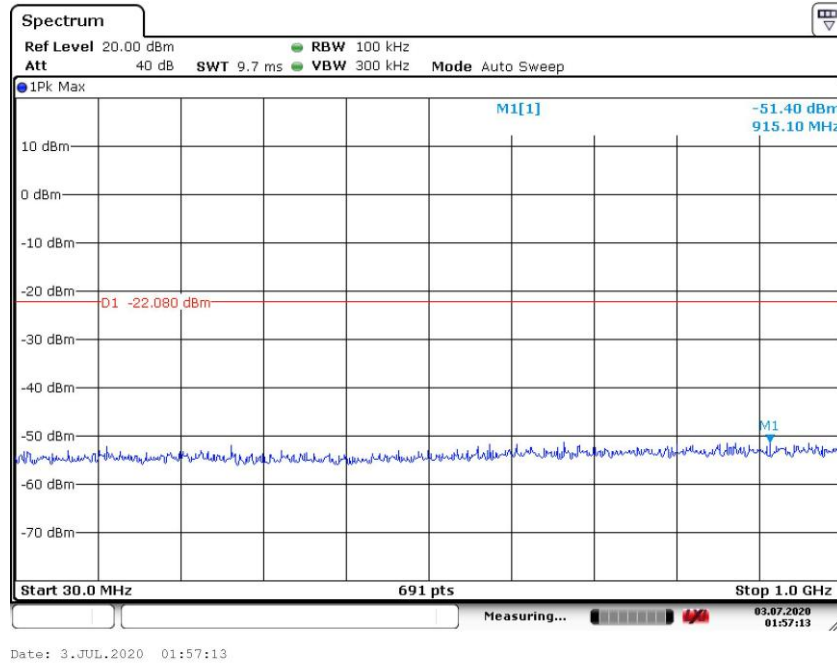
Note: Sweep Points=691



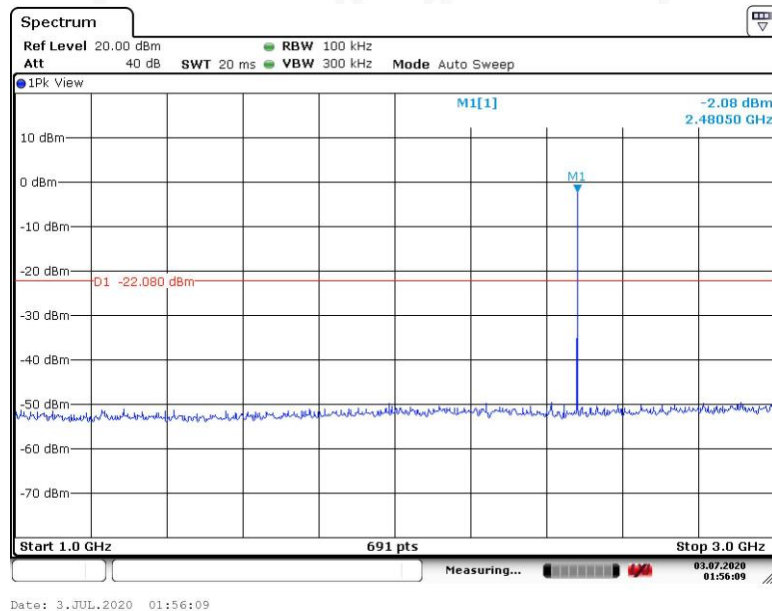
Date: 3.JUL.2020 02:09:36

Note: Sweep Points=691

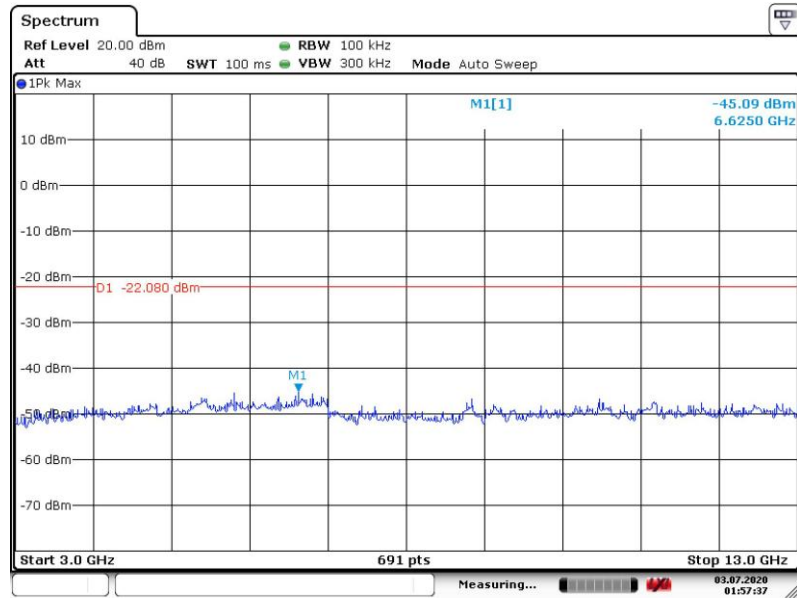
The High Channel 39(2Mbps): 2480MHz



Note: Sweep Points=691

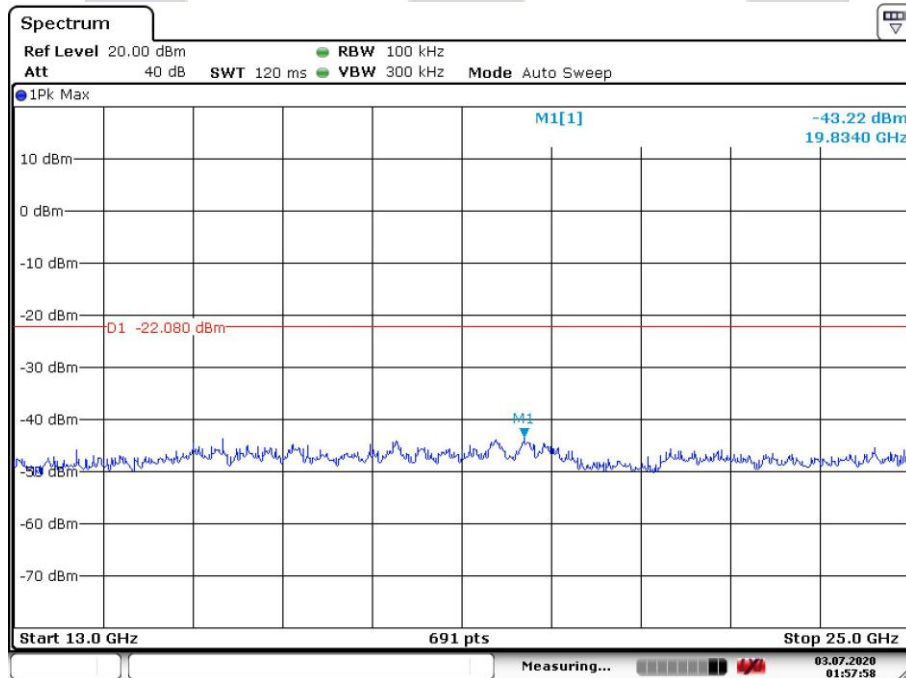


Note: Sweep Points=691



Date: 3.JUL.2020 01:57:37

Note: Sweep Points=691



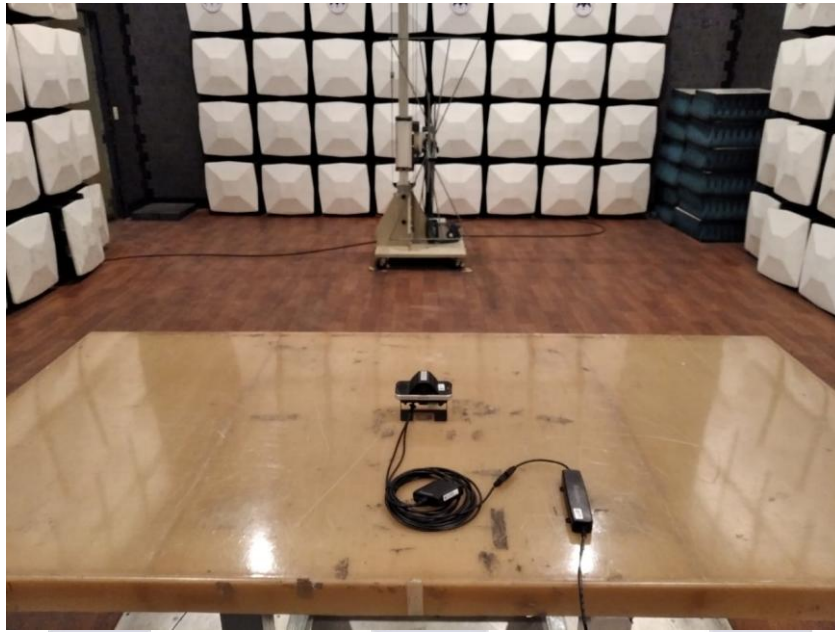
Date: 3.JUL.2020 01:57:58

Note: Sweep Points=691

6.9 Photographs

6.9.1 Radiated Spurious Emission Test Setup

Below 1GHz:



Above 1GHz:



6.9.2 Conducted Emission Test Setup

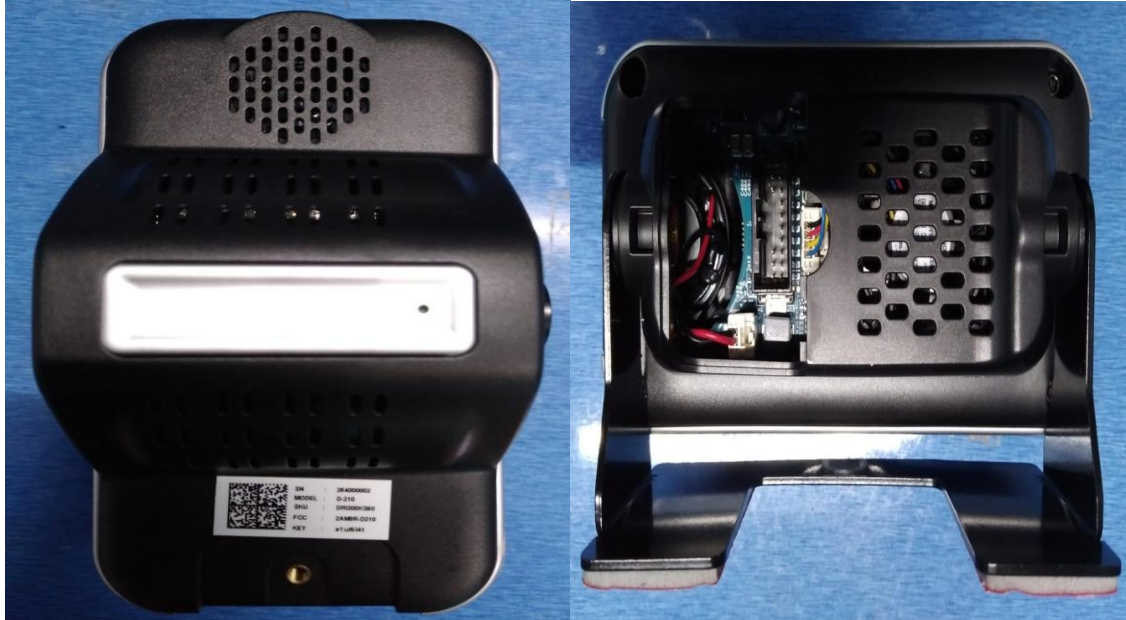


AA
E M T

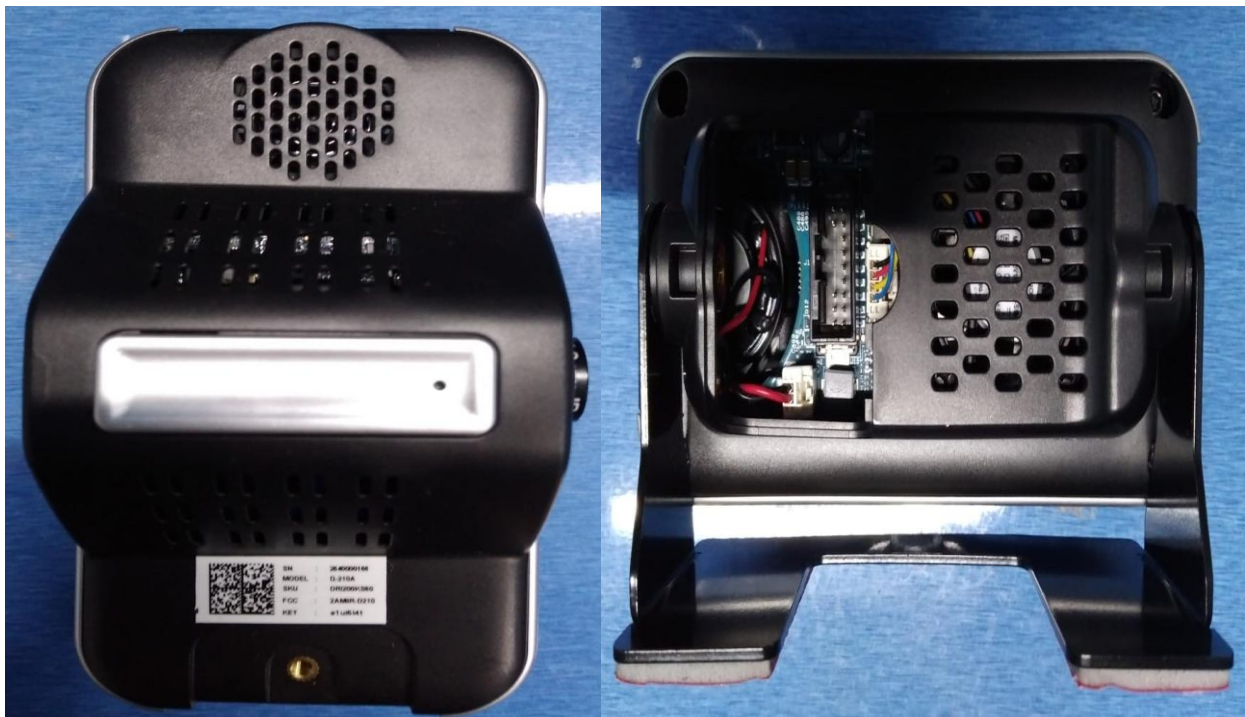
7 Appendix

7.1 EUT Photographs

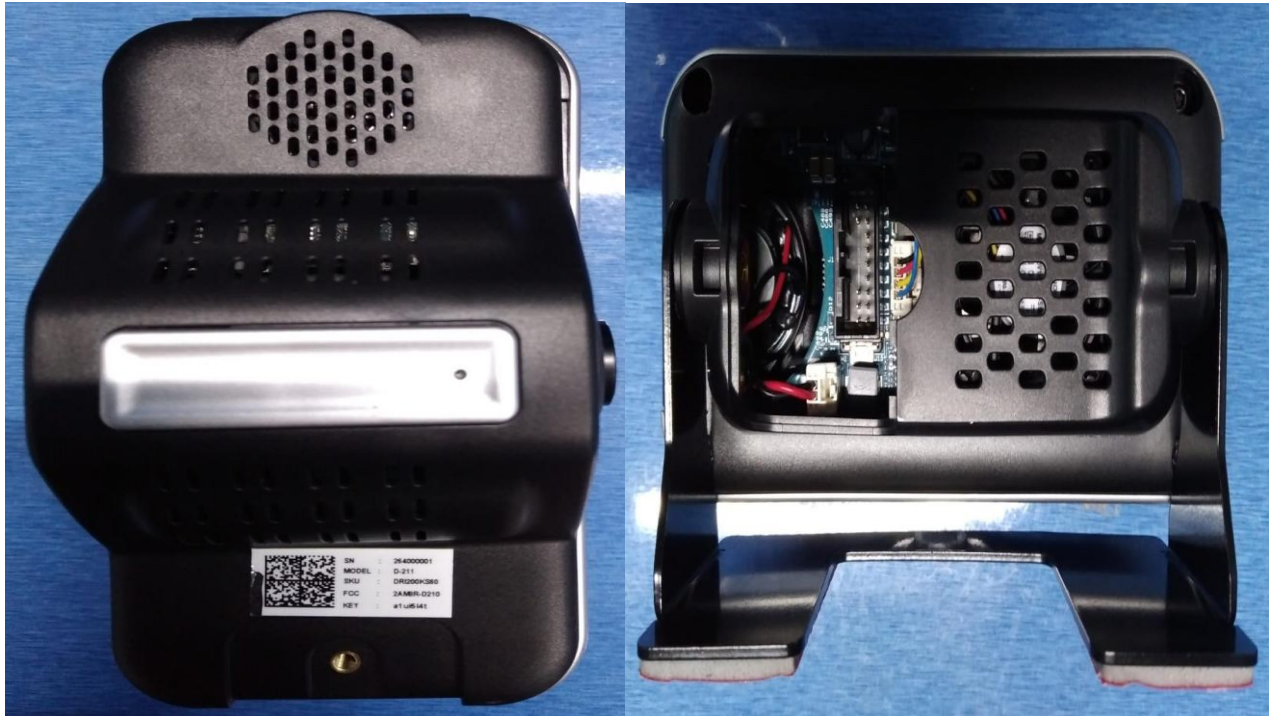
7.1.1 Main Model (D-210)



7.1.2 Serial Model 1 (D-210A)



7.1.3 Serial Model 2 (D-211)



7.2 Accessories Photographs

7.2.1 CAN Adapter AD01

Front



Back



7.2.2 CAN Adapter AD02

Front



Back



7.2.3 CAN Adapter AD03

Front



Back



7.2.4 LTE Module

Front



LTE Module



****End of Report****