

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: _____

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



Approved by: _____

(Steven Wu)

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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
Carrier Frequencies Separated	FCC Part 15 C	Section 15.247(a)(1)	PASS
Hopping Channel Number	FCC Part 15 C	Section 15.247(a)(1) (iii)	PASS
Dwell Time	FCC Part 15 C	Section 15.247(a)(1) (iii)	PASS
Maximum Peak Output Power	FCC Part 15 C	Section 15.247(b)	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 FCC Public Notice DA 00-705
(2)	Reference to ANSI C63.10:2013.
(3)	The product support for Bluetooth 5.0 dual mode (including classic rate / EDR and low energy mode), this report is test for Bluetooth classic rate / EDR mode, for low energy mode please refers to the report number AAEMT/EMC/200623-02-05.

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 C63.4:2009, the maximum value of the uncertainty as below

No.	Item	Uncertainty
1	Conducted Emission Test	2.82dB
2	Radiated Emission Test	2.77dB

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 ILC-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

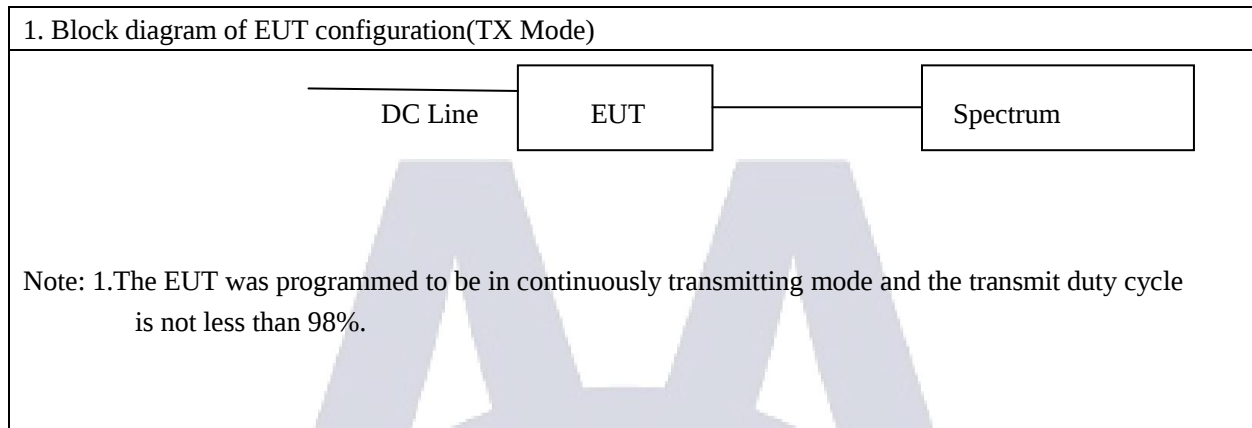
4.1 General Description of EUT

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
Derivative model No.:	N/A
Serial No:	D-210A, D-211
Operation frequency:	2402 MHz to 2480 MHz
NUMBER OF CHANNEL:	79
Modulation Technology:	GFSK, $\pi/4$ -DQPSK, 8DPSK(1/2Mbps)
Bluetooth version:	Bluetooth v5.0
Antenna Gain:	3dBi
H/W No.:	501-1-00908_B1
S/W No.:	2.4.9.rc.2
Power Supply Range:	Input : 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)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

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.

- (5) Pre-test the EUT in all transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet and conducted to determine the worst-case mode, only the worst-case results(1Mbps/2Mbps) are recorded in this report.

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 requirement: 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

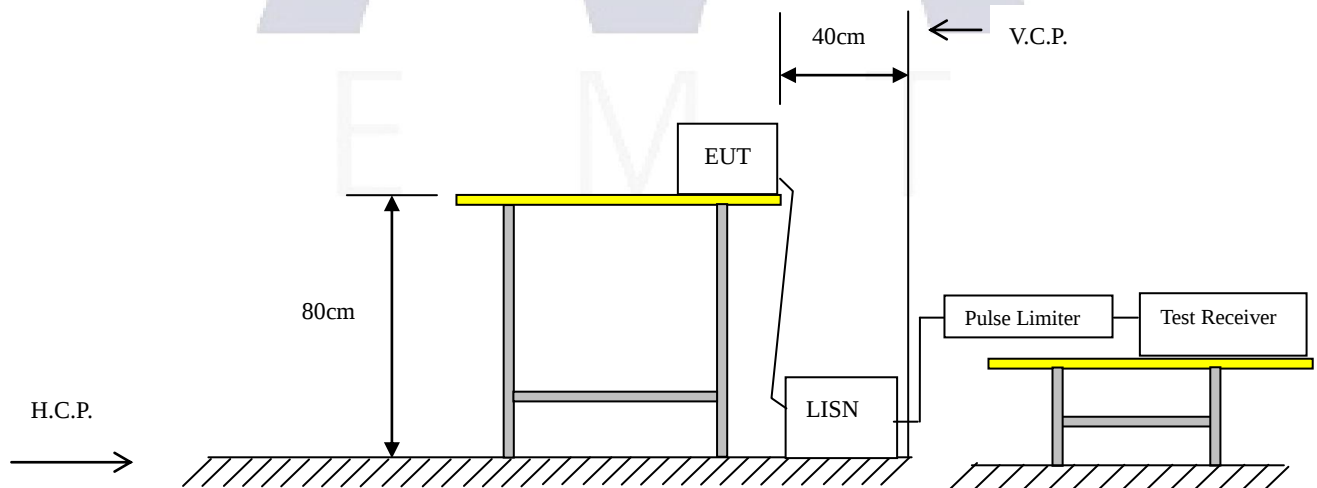
Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

Note: Decreases with the logarithm of the frequency.

6.2.2 Test procedure

EUT was placed upon a wooden test table 0.8m above the horizontal metal reference plane and 0.4m from the Vertical ground plane, and it was connected to an AMN. The closest distance between the boundary of the EUT and the surface of the AMN is 0.8m. All peripherals were connected to another AMN, and placed at a distance of 10cm from each other. A spectrum and receiver was connected to the RF output port of the AMN. Both average and quasi-peak value were detected.

6.2.3 Test setup

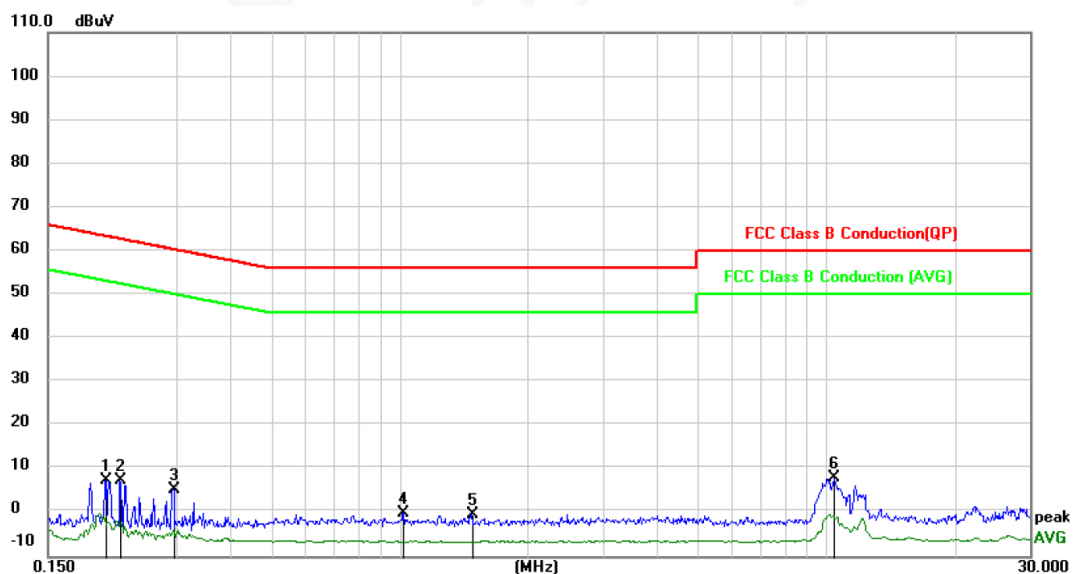


6.2.4 Test results

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. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over 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

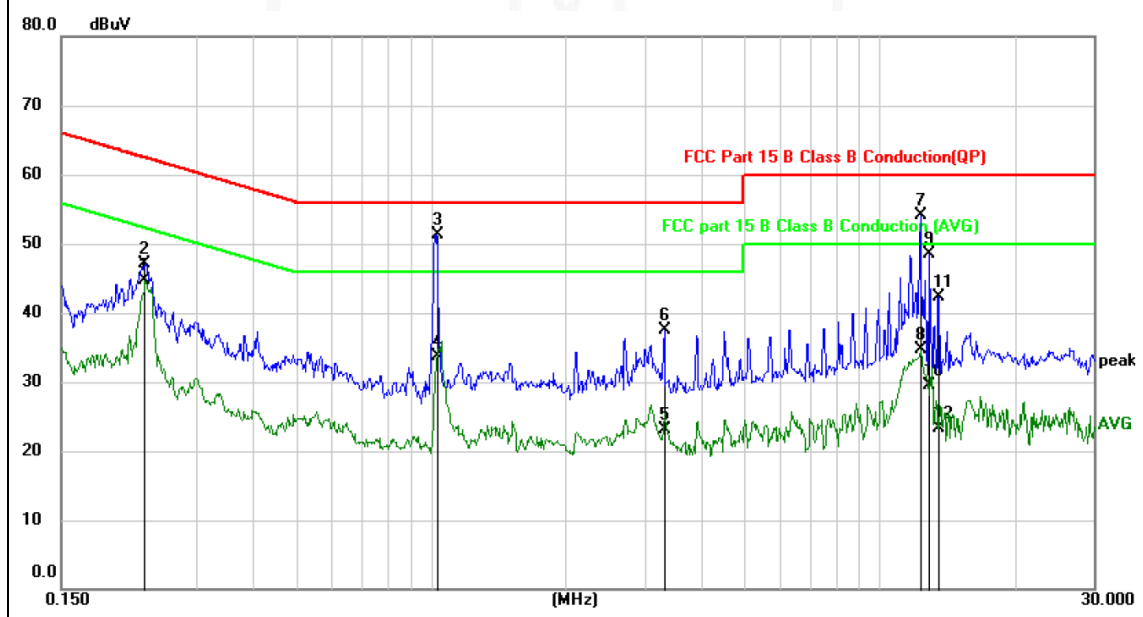
Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.



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		0.2293	29.15	15.46	44.61	52.47	-7.86	AVG
2		0.2303	31.66	15.46	47.12	62.44	-15.32	QP
3	*	1.0302	35.92	15.40	51.32	56.00	-4.68	QP
4		1.0354	18.37	15.40	33.77	46.00	-12.23	AVG
5		3.2945	7.66	15.41	23.07	46.00	-22.93	AVG
6		3.3079	22.08	15.41	37.49	56.00	-18.51	QP
7		12.3000	38.78	15.35	54.13	60.00	-5.87	QP
8		12.3000	19.39	15.35	34.74	50.00	-15.26	AVG
9		12.9000	33.11	15.35	48.46	60.00	-11.54	QP
10		12.9000	14.18	15.35	29.53	50.00	-20.47	AVG
11		13.5000	27.04	15.34	42.38	60.00	-17.62	QP
12		13.5000	7.94	15.34	23.28	50.00	-26.72	AVG

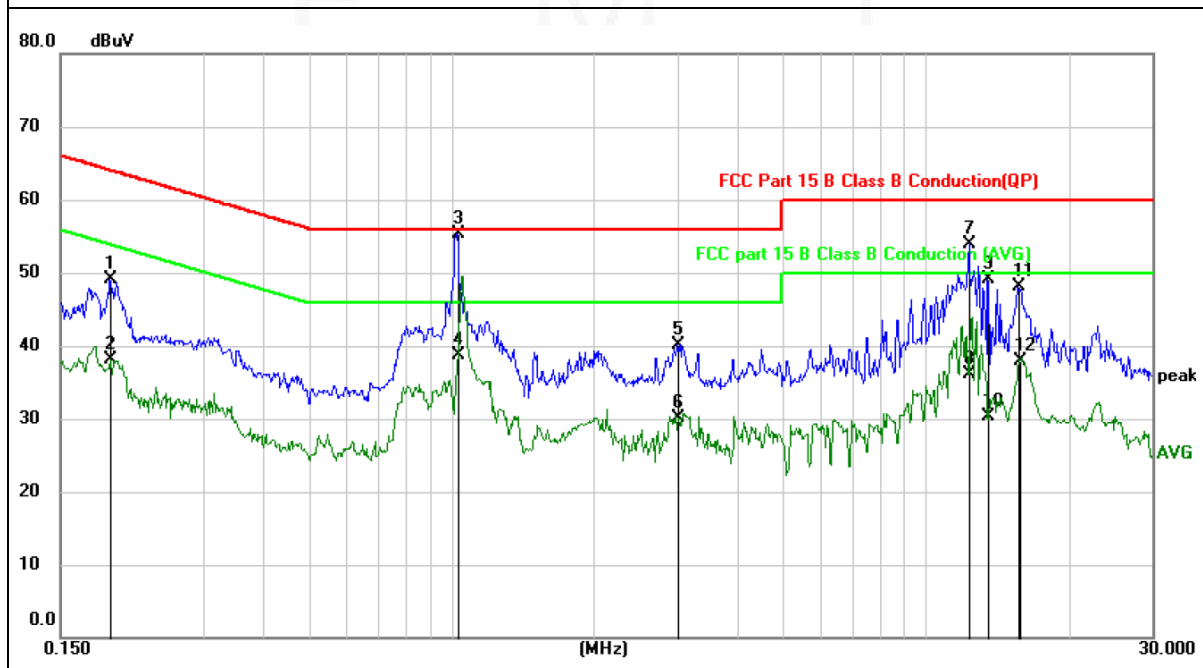
Remark: Factor = LISN factor + Cable Loss + Pulse limiter factor.



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		0.1905	33.64	15.48	49.12	64.01	-14.89	QP
2		0.1905	22.71	15.48	38.19	54.01	-15.82	AVG
3	*	1.0302	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	24.71	15.41	40.12	56.00	-15.88	QP
6		2.9975	14.74	15.41	30.15	46.00	-15.85	AVG
7		12.3246	38.57	15.35	53.92	60.00	-6.08	QP
8		12.3246	20.78	15.35	36.13	50.00	-13.87	AVG
9		13.5000	33.71	15.34	49.05	60.00	-10.95	QP
10		13.5000	14.99	15.34	30.33	50.00	-19.67	AVG
11		15.6500	32.70	15.34	48.04	60.00	-11.96	QP
12		15.7248	22.49	15.34	37.83	50.00	-12.17	AVG

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



6.3 Radiated Emissions Measurement

6.3.1 Applied procedures / Limit

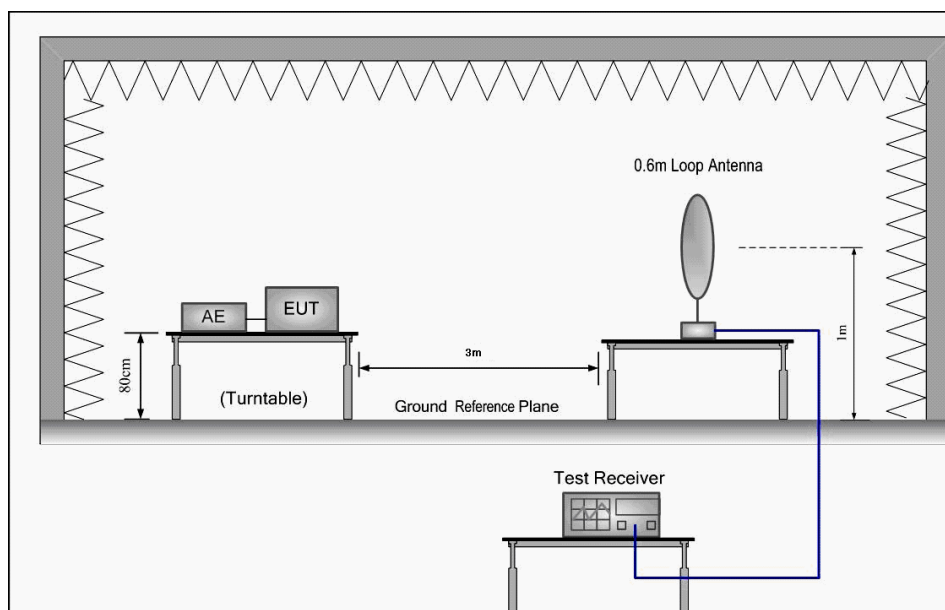
15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that 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

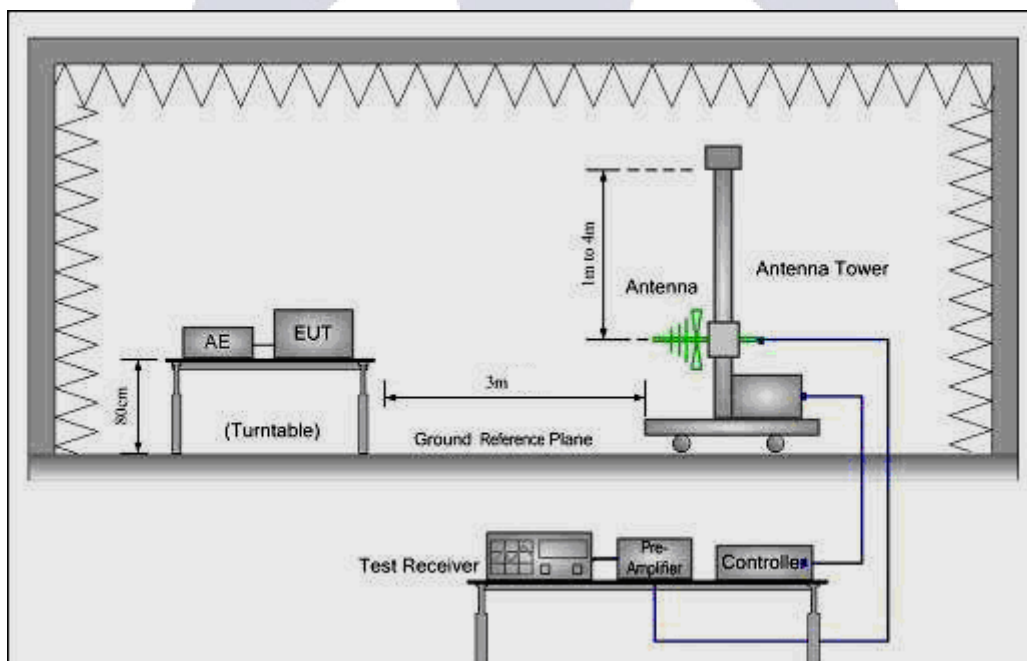
6.3.2 Test setup

Test Configuration:

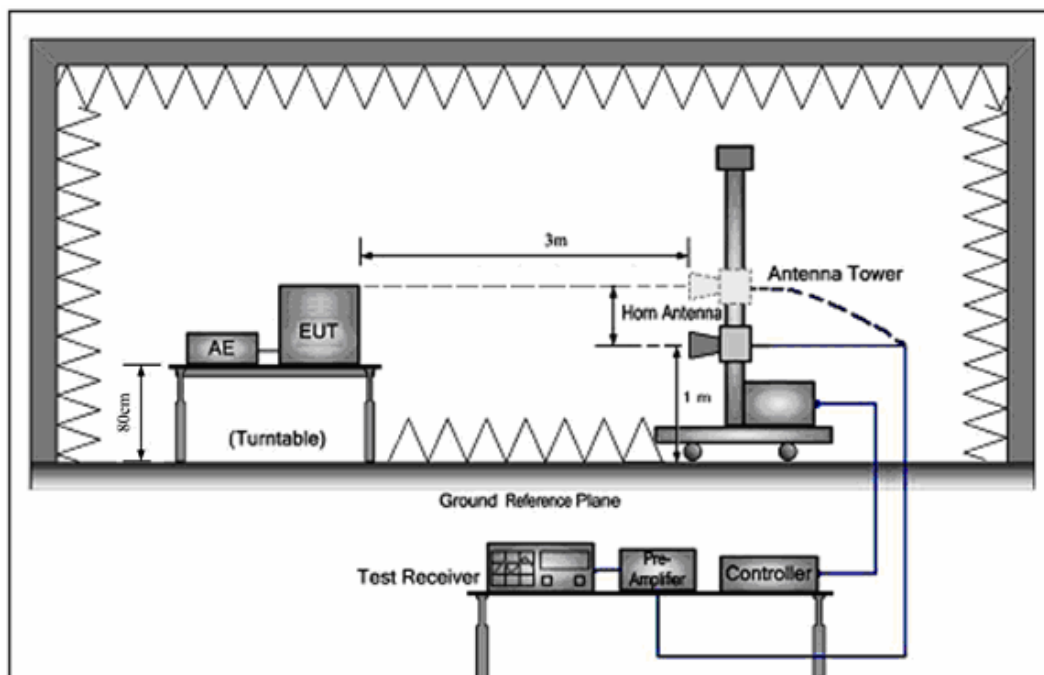
- 1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 25 GHz emissions:



6.3.3 Test procedure

EUT was placed upon a wooden test table which was placed on the turn table 0.8m above the horizontal metal ground plane, and operating in the mode as mentioned above. A receiving antenna was placed 3m away from the EUT. During testing, turn around the turn table and move the antenna from 1m to 4m to find the maximum field-strength reading. All peripherals were placed at a distance of 10cm between each other. Both horizontal and Vertical antenna polarities were tested. The worst case emissions were reported.

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.

6.3.4 Test Result

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	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	Frenqucy Range	30MHz to 1GHz
RBW/VBW	100KHz / 300KHz for spectrum, RBW=120KHz for receiver.		

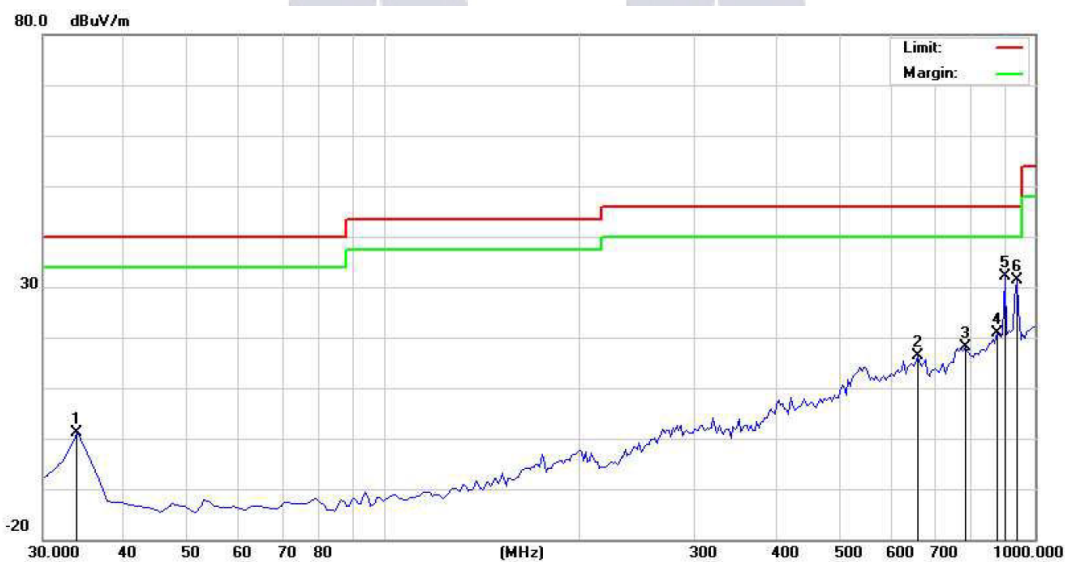
Test at Channel 00 (2.402 GHz) in transmitting status

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)



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		30.0000	54.57	-28.29	26.28	40.00	-13.72	peak
2	*	37.7754	64.88	-31.64	33.24	40.00	-6.76	peak
3		86.3726	60.10	-28.76	31.34	40.00	-8.66	peak
4		99.9799	56.73	-25.88	30.85	43.50	-12.65	peak
5		115.5310	61.23	-24.50	36.73	43.50	-6.77	peak
6		142.7452	56.45	-22.65	33.80	43.50	-9.70	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	!	82.4848	65.23	-29.63	35.60	40.00	-4.40	peak
2		101.9235	60.44	-25.68	34.76	43.50	-8.74	peak
3		115.5310	60.92	-24.50	36.42	43.50	-7.08	peak
4	*	228.2761	58.87	-17.06	41.81	46.00	-4.19	peak
5		245.7715	51.72	-15.73	35.99	46.00	-10.01	peak
6		455.7114	46.06	-10.72	35.34	46.00	-10.66	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(1Mbps)	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	55.04	5.06	60.10	74	-13.90	PEAK
4804.000	40.63	5.06	45.69	54	-8.31	AVERAGE
7206.000	47.32	7.03	54.35	74	-19.65	PEAK
7206.000	33.93	7.03	40.96	54	-13.04	AVERAGE
9608.000	46.20	10.63	56.83	74	-17.17	PEAK
9608.000	34.55	10.63	45.18	54	-8.82	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	53.90	5.06	58.96	74	-15.04	PEAK
4804.000	43.02	5.06	48.08	54	-5.92	AVERAGE
7206.000	47.22	7.03	54.25	74	-19.75	PEAK
7206.000	35.46	7.03	42.49	54	-11.51	AVERAGE
9608.000	45.23	10.63	55.86	74	-18.14	PEAK
9608.000	33.62	10.63	44.25	54	-9.75	AVERAGE

Note:

10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss–Pre-amplifier

Lowest channel: 2402 MHz

Data rate: 1Mbps

(a) Antenna polarization: Horizontal

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4882.000	53.46	5.06	58.52	74	-15.48	PEAK
4882.000	41.44	5.06	46.50	54	-7.50	AVERAGE
7323.000	45.91	7.03	52.94	74	-21.06	PEAK
7323.000	34.30	7.03	41.33	54	-12.67	AVERAGE
9764.000	45.19	10.63	55.82	74	-18.18	PEAK
9764.000	33.74	10.63	44.37	54	-9.63	AVERAGE

(b) Antenna polarization: Vertical

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4882.000	54.00	5.06	59.06	74	-14.94	PEAK
4882.000	42.25	5.06	47.31	54	-6.69	AVERAGE
7323.000	46.14	7.03	53.17	74	-20.83	PEAK
7323.000	35.60	7.03	42.63	54	-11.37	AVERAGE
9764.000	44.69	10.63	55.32	74	-18.68	PEAK
9764.000	32.03	10.63	42.66	54	-11.34	AVERAGE

Note:

10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss–Pre-amplifier

Middle Channel: 2441 MHz

Data rate: 1Mbps

(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	53.47	5.06	58.53	74	-15.47	PEAK
4960.000	40.63	5.06	45.69	54	-8.31	AVERAGE
7440.000	46.52	7.03	53.55	74	-20.45	PEAK
7440.000	34.19	7.03	41.22	54	-12.78	AVERAGE
9920.000	43.01	10.63	53.64	74	-20.36	PEAK
9920.000	33.09	10.63	43.72	54	-10.28	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	54.15	5.06	59.21	74	-14.79	PEAK
4960.000	39.48	5.06	44.54	54	-9.46	AVERAGE
7440.000	43.49	7.03	50.52	74	-23.48	PEAK
7440.000	32.70	7.03	39.73	54	-14.27	AVERAGE
9920.000	44.47	10.63	55.10	74	-18.90	PEAK
9920.000	33.49	10.63	44.12	54	-9.88	AVERAGE

Note:

10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss–Pre-amplifier

Highest Channel: 2480 MHz

Data rate: 1Mbps

EUT:	Driveri	Model Name :	D-210
Temperature:	25 °C	Test Data	2020-07-02
Pressure:	1010 hPa	Relative Humidity:	60%
Test Mode :	TX(2Mbps)	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	53.61	5.06	58.67	74	-15.33	PEAK
4804.000	41.47	5.06	46.53	54	-7.47	AVERAGE
7206.000	46.39	7.03	53.42	74	-20.58	PEAK
7206.000	36.14	7.03	43.17	54	-10.83	AVERAGE
9608.000	45.01	10.63	55.64	74	-18.36	PEAK
9608.000	34.16	10.63	44.79	54	-9.21	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	53.32	5.06	58.38	74	-15.62	PEAK
4804.000	40.52	5.06	45.58	54	-8.42	AVERAGE
7206.000	45.80	7.03	52.83	74	-21.17	PEAK
7206.000	34.13	7.03	41.16	54	-12.84	AVERAGE
9608.000	43.46	10.63	54.09	74	-19.91	PEAK
9608.000	32.29	10.63	42.92	54	-11.08	AVERAGE

Note:

10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss–Pre-amplifier

Lowest Channel: 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
4882.000	54.16	5.06	59.22	74	-14.78	PEAK
4882.000	43.05	5.06	48.11	54	-5.89	AVERAGE
7323.000	46.06	7.03	53.09	74	-20.91	PEAK
7323.000	34.43	7.03	41.46	54	-12.54	AVERAGE
9764.000	44.09	10.63	54.72	74	-19.28	PEAK
9764.000	32.59	10.63	43.22	54	-10.78	AVERAGE

(b) Antenna polarization: Vertical

Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Type
4882.000	53.88	5.06	58.94	74	-15.06	PEAK
4882.000	42.92	5.06	47.98	54	-6.02	AVERAGE
7323.000	47.32	7.03	54.35	74	-19.65	PEAK
7323.000	36.36	7.03	43.39	54	-10.61	AVERAGE
9764.000	45.53	10.63	56.16	74	-17.84	PEAK
9764.000	32.62	10.63	43.25	54	-10.75	AVERAGE

Note:

10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss–Pre-amplifier

Middle Channel: 2441 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	54.85	5.06	59.91	74	-14.09	PEAK
4960.000	42.61	5.06	47.67	54	-6.33	AVERAGE
7440.000	46.11	7.03	53.14	74	-20.86	PEAK
7440.000	35.89	7.03	42.92	54	-11.08	AVERAGE
9920.000	42.17	10.63	52.80	74	-21.20	PEAK
9920.000	31.56	10.63	42.19	54	-11.81	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	53.48	5.06	58.54	74	-15.46	PEAK
4960.000	40.84	5.06	45.90	54	-8.10	AVERAGE
7440.000	46.17	7.03	53.20	74	-20.80	PEAK
7440.000	34.10	7.03	41.13	54	-12.87	AVERAGE
9920.000	45.22	10.63	55.85	74	-18.15	PEAK
9920.000	35.12	10.63	45.75	54	-8.25	AVERAGE

Note:

10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss–Pre-amplifier

Highest channel: 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(1Mbps,2Mbps)	Test Voltage :	DC 12V
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)
Data rate 1Mbps	V	2390.00	43.62	33.68	-5.79	37.83	27.89	74.00	54.00
	H	2390.00	42.66	33.91	-5.79	36.87	28.12	74.00	54.00
	V	2483.50	44.69	32.19	-4.98	39.71	27.21	74.00	54.00
	H	2483.50	44.39	34.22	-4.98	39.41	29.24	74.00	54.00
Data rate 2Mbps	V	2390.00	46.38	32.68	-5.79	40.59	26.89	74.00	54.00
	H	2390.00	44.67	34.62	-5.79	38.88	28.83	74.00	54.00
	V	2483.50	46.2	33.91	-4.98	41.22	28.93	74.00	54.00
	H	2483.50	45.67	33.42	-4.98	40.69	28.44	74.00	54.00

Remark:

- (1) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode.
- (2) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (3) Corr.Factor = Antenna Factor + Cable Loss – Pre-amplifier.

6.4 BANDWIDTH TEST

6.4.1 Applied procedures / Limit

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

6.4.2 Test procedure

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW $\geq$ 1% of the 20 dB bandwidth, VBW $\geq$ RBW, Sweep = auto, Detector function = peak
Trace = max hold

6.4.3 Deviation from standard

No deviation.

6.4.4 Test setup

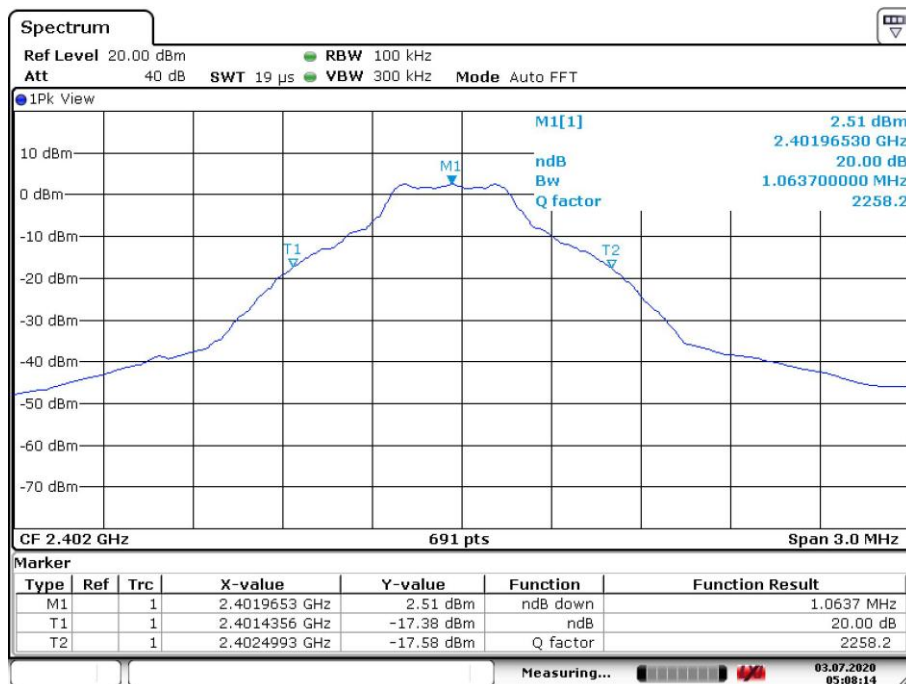


6.4.5 Test results

EUT:	Driveri	Model Name :	D-210
Temperature:	26 °C	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 12V
Test Mode :	TX 1Mbps/ 2Mbps		

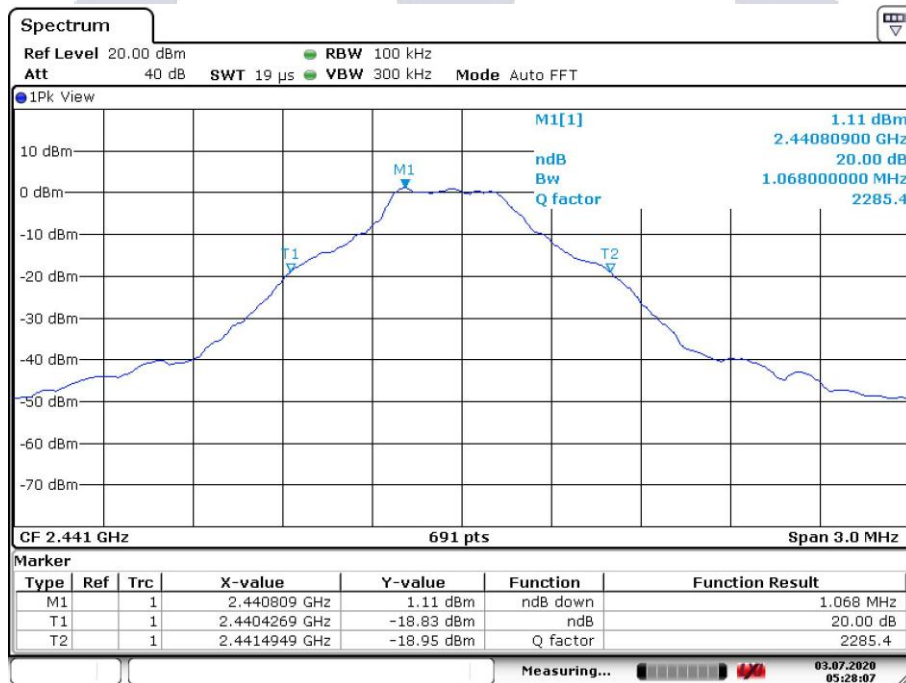
Channel		Channel frequency (MHz)	20dB bandwidth (MHz)	Limit (MHz)	Conclusion
1Mbps	Low	2402	1.0367	N/A	Pass
	Middle	2441	1.0680	N/A	Pass
	High	2480	1.0680	N/A	Pass
2Mbps	Low	2402	1.0680	N/A	Pass
	Middle	2441	1.0550	N/A	Pass
	High	2480	1.0550	N/A	Pass

CH00-1Mbps



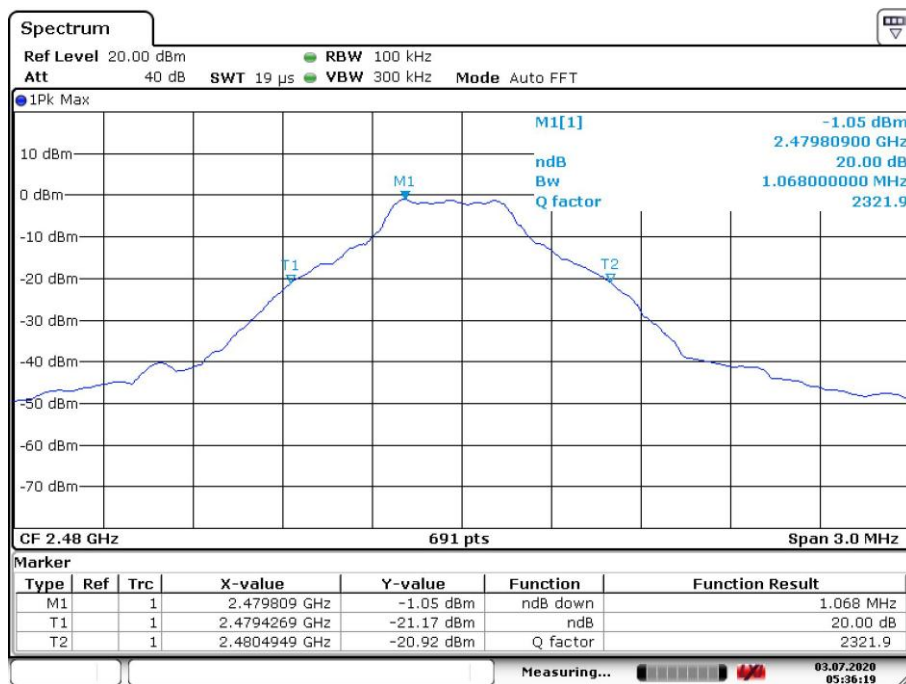
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CH 39-1Mbps



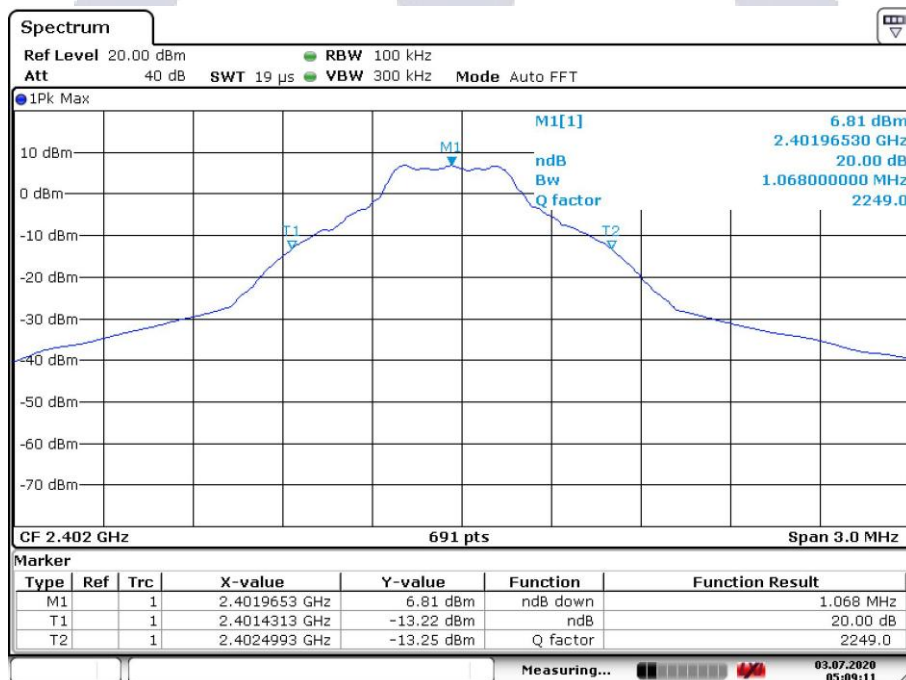
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CH 78-1Mbps



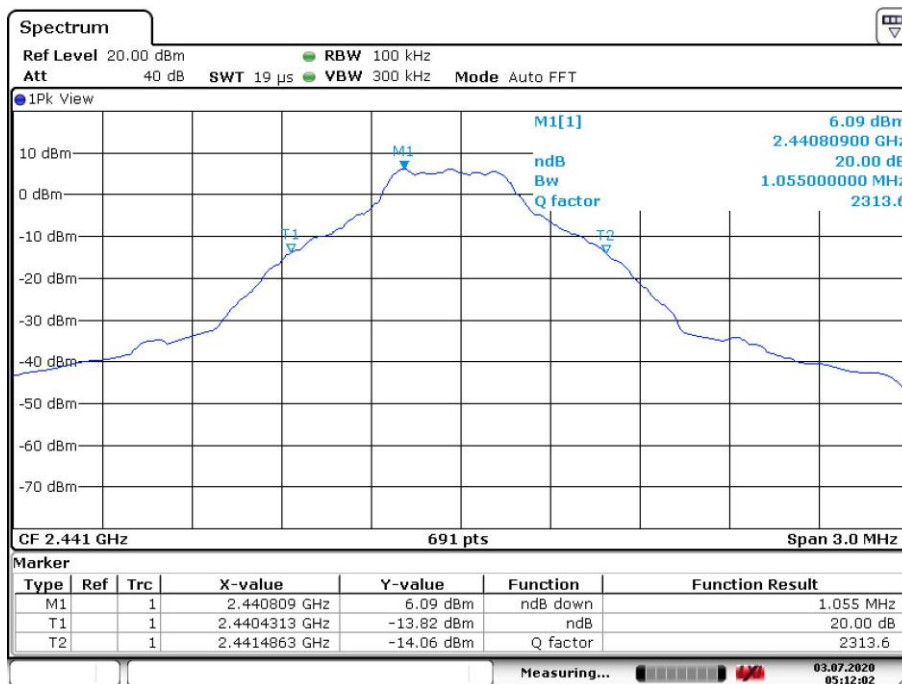
Date: 3.JUL.2020 05:36:19

CH 00-2Mbps



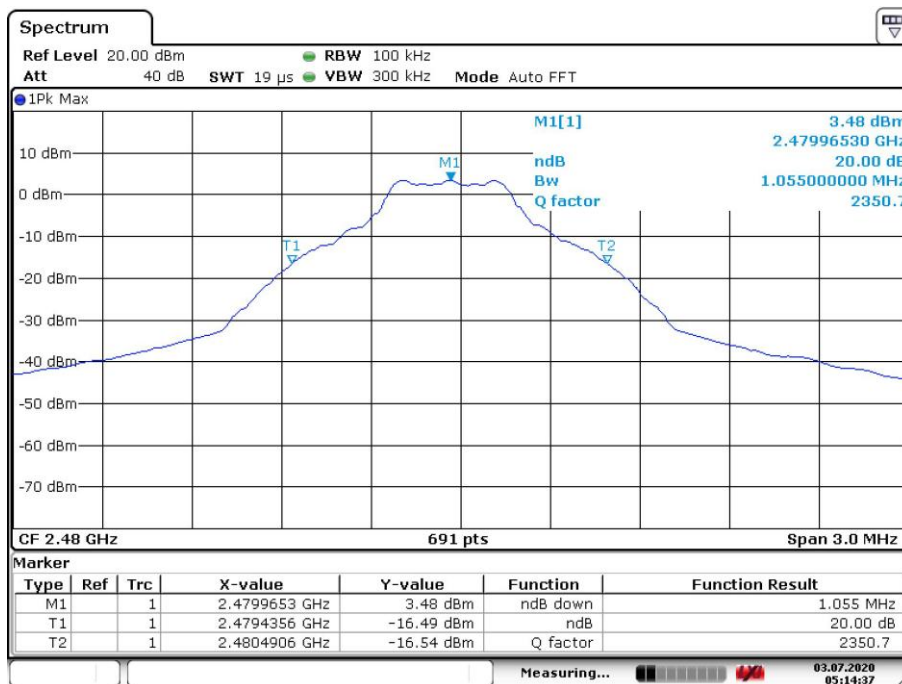
Date: 3.JUL.2020 05:09:11

CH 39-2Mbps



Date: 3.JUL.2020 05:12:02

CH 78-2Mbps



Date: 3.JUL.2020 05:14:36

6.5 Carrier Frequencies Separated

6.5.1 Applied procedures / Limit

15.247(a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

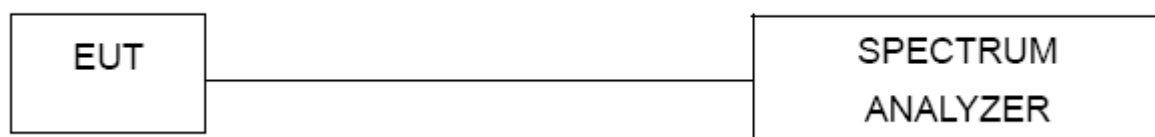
6.5.2 Test procedure

- (1) Connected the antenna port to the Spectrum Analyzer, set the Spectrum Analyzer as
Span = wide enough to capture the peaks of two adjacent channels, Resolution (or IF) Bandwidth (RBW) $\geq 1\%$ of the span, Video (or Average) Bandwidth (VBW) $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
- (2) The EUT should be transmitting at its maximum data rate. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.
- (3) The above procedure shall be repeated at the lowest, the middle, and the highest frequency of the stated frequency range with modulated mode. also shall be performed at different modes of operation.

6.5.3 Deviation from standard

No deviation.

6.5.4 Test setup



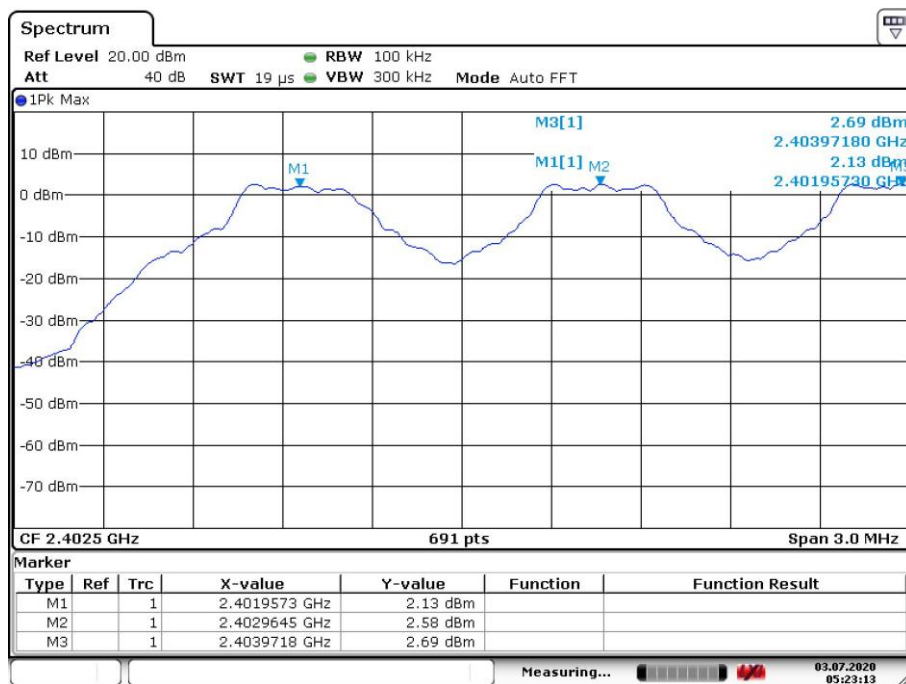
6.5.5 Test results

EUT:	Driveri	Model Name :	D-210
Temperature:	26 °C	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 12V
Test Mode :	TX 1Mbps/ 2Mbps		

Channel		Channel frequency (MHz)	Channel Separation (MHz)	Conclusion
1Mbps	Low	2402	1.0072MHz	Pass
	Middle	2441	0.9768MHz	Pass
	Highest	2480	1.0289MHz	Pass
2Mbps	Low	2402	0.9551MHz	Pass
	Middle	2441	0.9985MHz	Pass
	Highest	2480	0.9986MHz	Pass

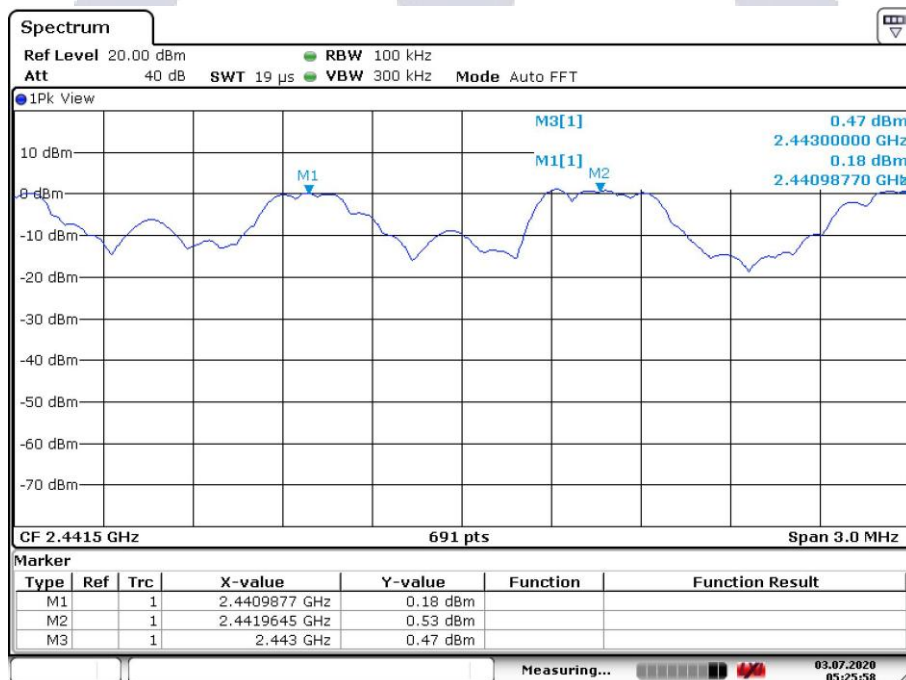
Ch. Separation >2/3(20dB bandwidth)

CH 00-1Mbps



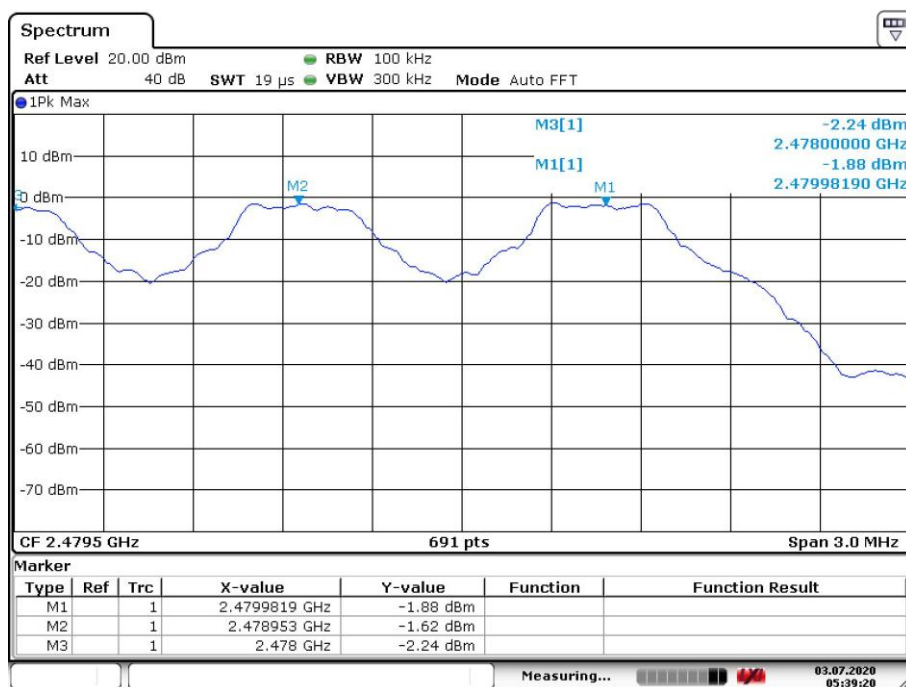
Date: 3.JUL.2020 05:23:13

CH 39-1Mbps



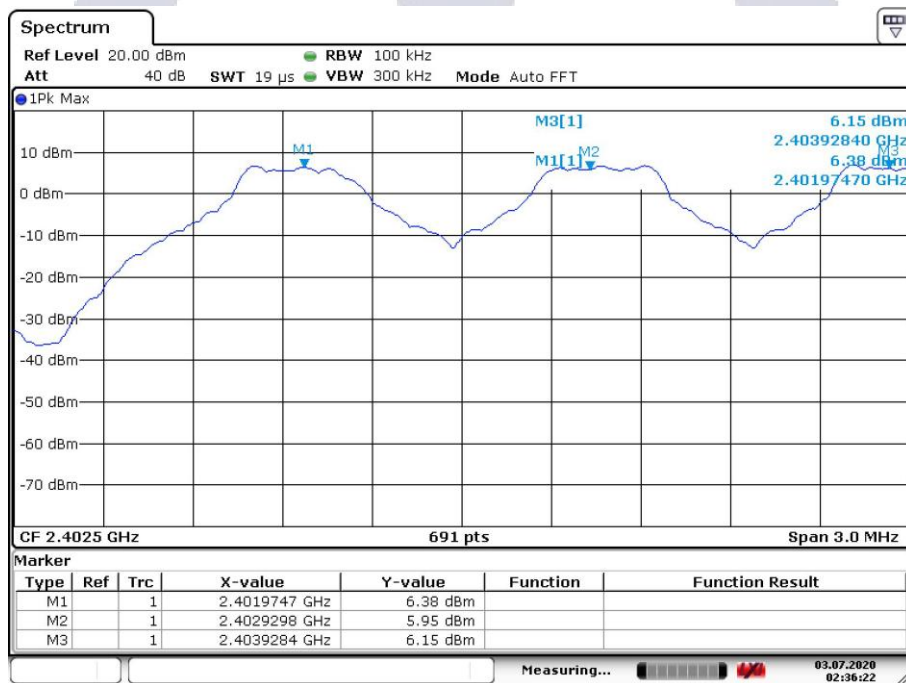
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CH 78-1Mbps



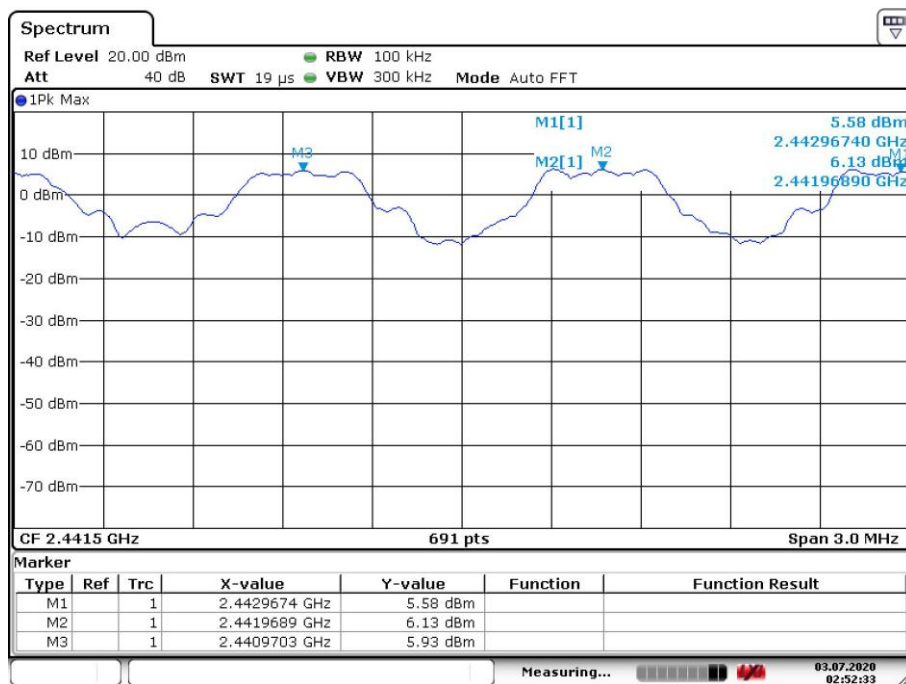
Date: 3.JUL.2020 05:39:20

CH 00-2Mbps



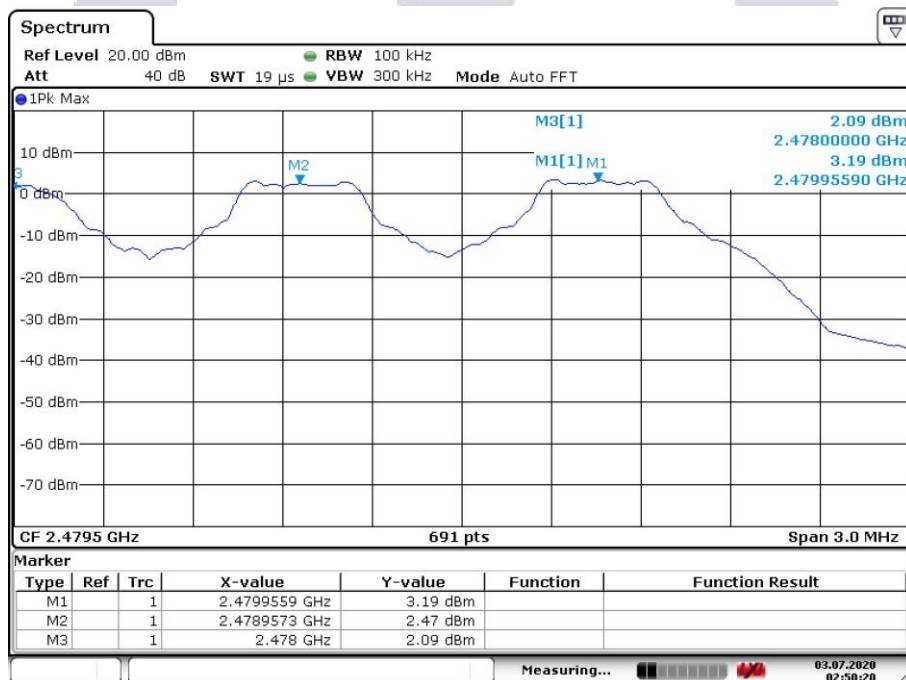
Date: 3.JUL.2020 02:36:22

CH 39-2Mbps



Date: 3.JUL.2020 02:52:33

CH 78-2Mbps



Date: 3.JUL.2020 02:50:19

6.6 Hopping Channel Number

6.6.1 Applied procedures / Limit

15.247(a) (1) (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

6.6.2 Test procedure

- (1) Connected the antenna port to the Spectrum Analyzer , set the Spectrum Analyzer as
Span = the frequency band of operation, RBW $\geq$ 1% of the span, VBW $\geq$ RBW Sweep = auto
Detector function = peak, Trace = max hold
- (2) The EUT should be have its hopping function enabled. Maxhold and record hopping channels It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies.

6.6.3 Deviation from standard

No deviation.

6.6.4 Test setup

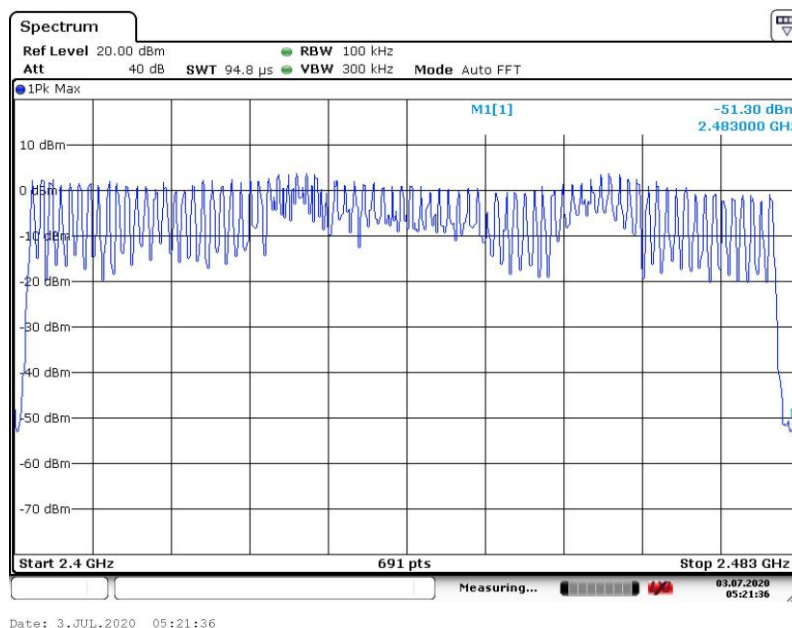


6.6.5 Test result

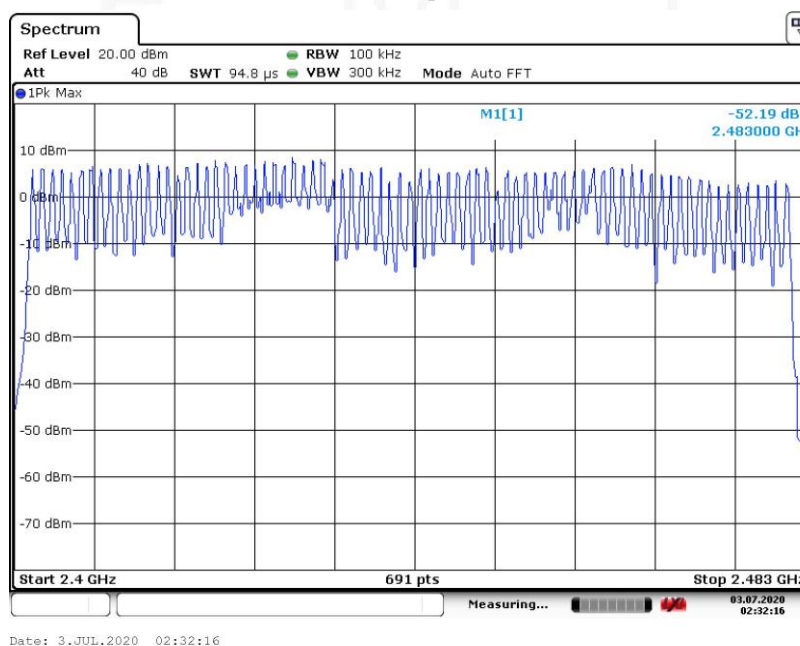
Hopping Channel Number result		
Operating Mode: 1Mbps/ 2Mbps Mode		Test date:2020-07-03
Result	Limit	Conclusion
79	>15	Pass

EUT:	Driveri	Model Name :	D-210
Temperature:	26 °C	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 12V
Test Mode :	TX 1Mbps/ 2Mbps		

1Mbps



2Mbps



6.7 Dwell time

6.7.1 Applied procedures / Limit

15.247(a) (1) (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

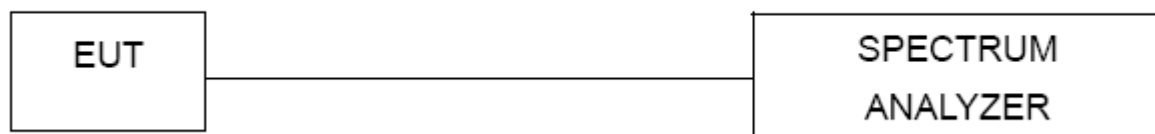
6.7.2 Test procedure

- (1) Place the EUT on the table in the chamber or connect the antenna port of the EUT to spectrum analyzer and set it in transmitting mode.
- (2) Set RBW of spectrum analyzer to 1MHz, VBW $\geq$ RBW
- (3) Use a video trigger with the trigger level set to enable triggering only on full pulses.
- (4) Sweep Time is more than once pulse time.
- (5) Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- (6) Measure the maximum time duration of one single pulse.
- (7) Set the EUT for DH5, DH3 and DH1 packet transmitting.
- (8) Measure the maximum time duration of one single pulse.
- (9) A Period Time = $79 \times 0.4 = 31.6$ S
 - DH1 Time Slot: Reading * $(1600/2) \times 31.6/79$
 - DH3 Time Slot: Reading * $(1600/4) \times 31.6/79$
 - DH5 Time Slot: Reading * $(1600/6) \times 31.6/79$

6.7.3 Deviation from standard

No deviation.

6.7.4 Test setup

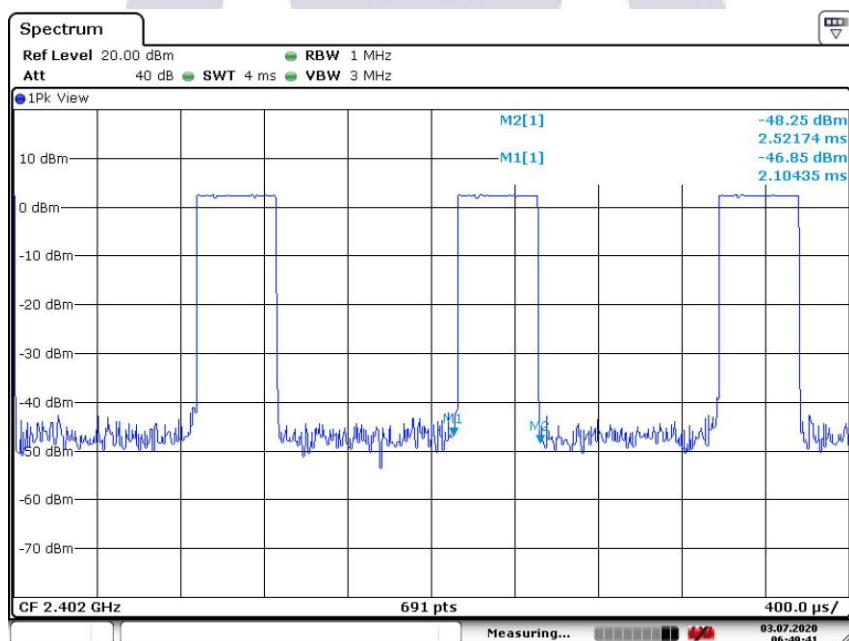


6.7.5 Test result

EUT:	Driveri	Model Name :	D-210
Temperature:	26 °C	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 12V
Test Mode :	CH00-DH1/DH3/DH5 (1Mbps Mode)		

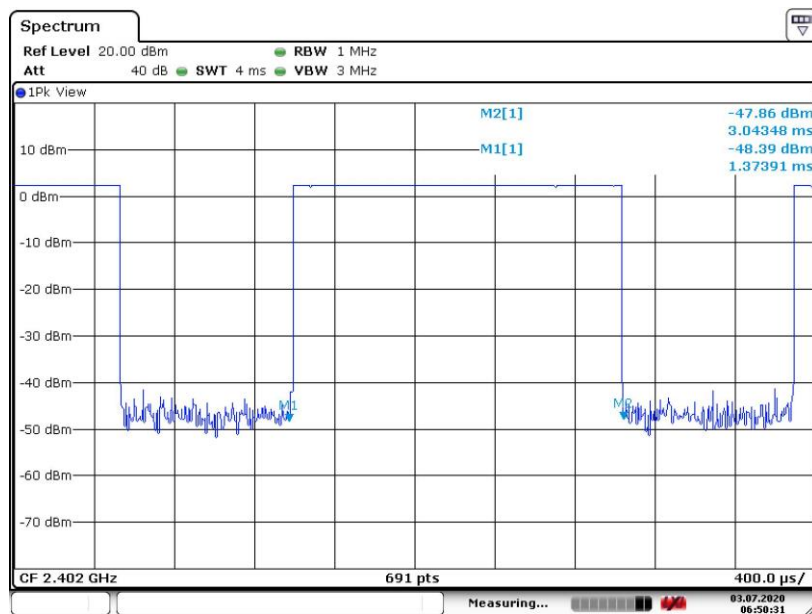
Data Packet	Frequency	Pulse Duration (ms)	Dwell Time (ms)	Limits (s)
DH1	2402 MHz	0.41739	133.5648	0.4000
DH3	2402 MHz	1.66957	267.1312	0.4000
DH5	2402 MHz	3.182604	339.4778	0.4000

CH 00- DH1



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CH 00- DH3



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CH 00- DH5

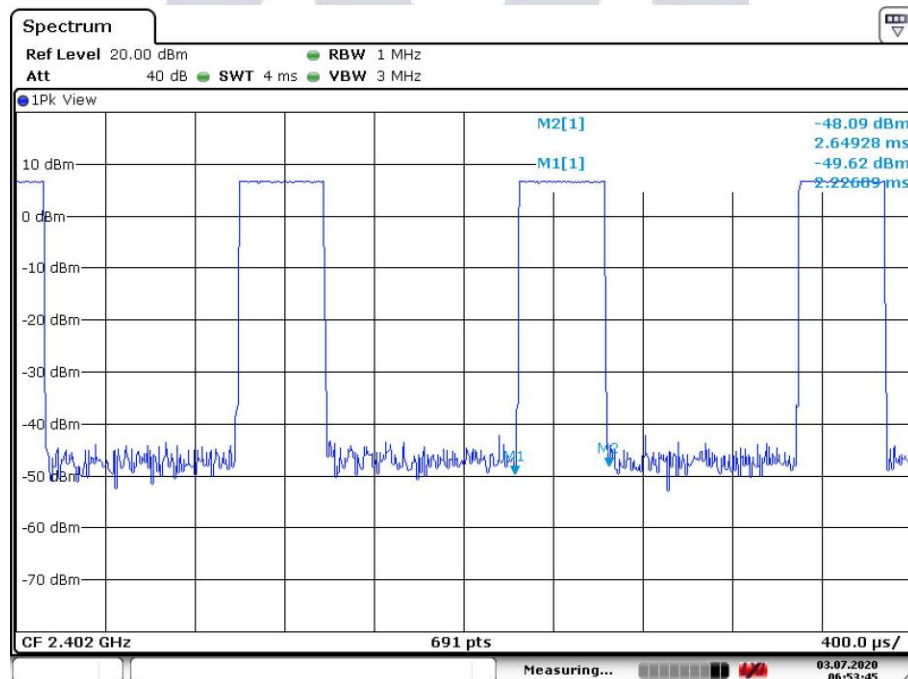


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EUT:	Driveri	Model Name :	D-210
Temperature:	26 °C	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 12V
Test Mode :	CH00-2DH1/2DH3/2DH5 (2Mbps Mode)		

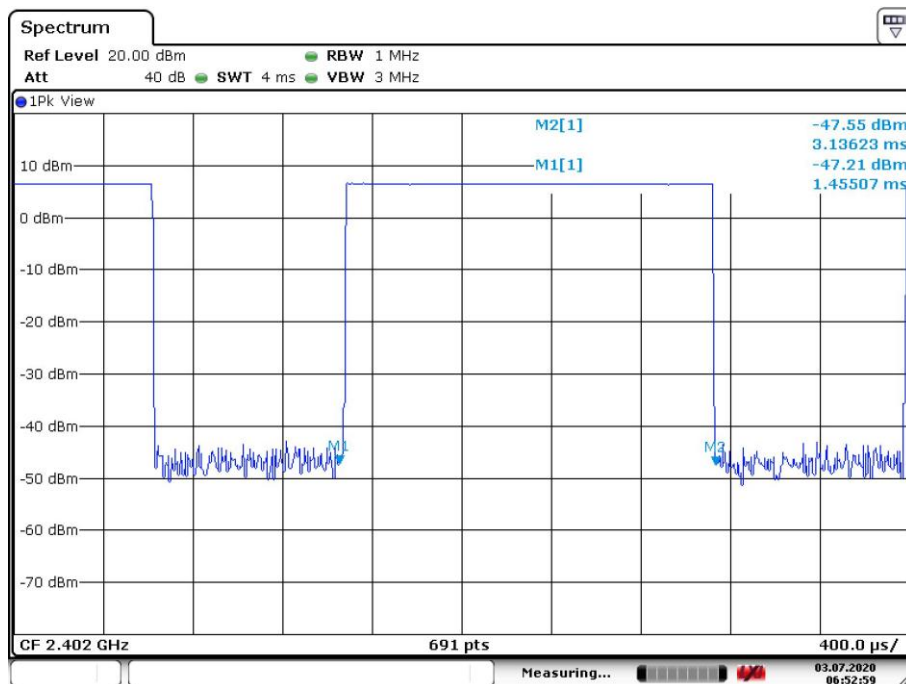
Data Packet	Frequency	Pulse Duration (ms)	Dwell Time (ms)	Limits (s)
2DH1	2402 MHz	0.42319	135.4208	0.4000
2DH3	2402 MHz	1.68116	268.9856	0.4000
2DH5	2402 MHz	3.146662	335.6439	0.4000

CH 00- DH1



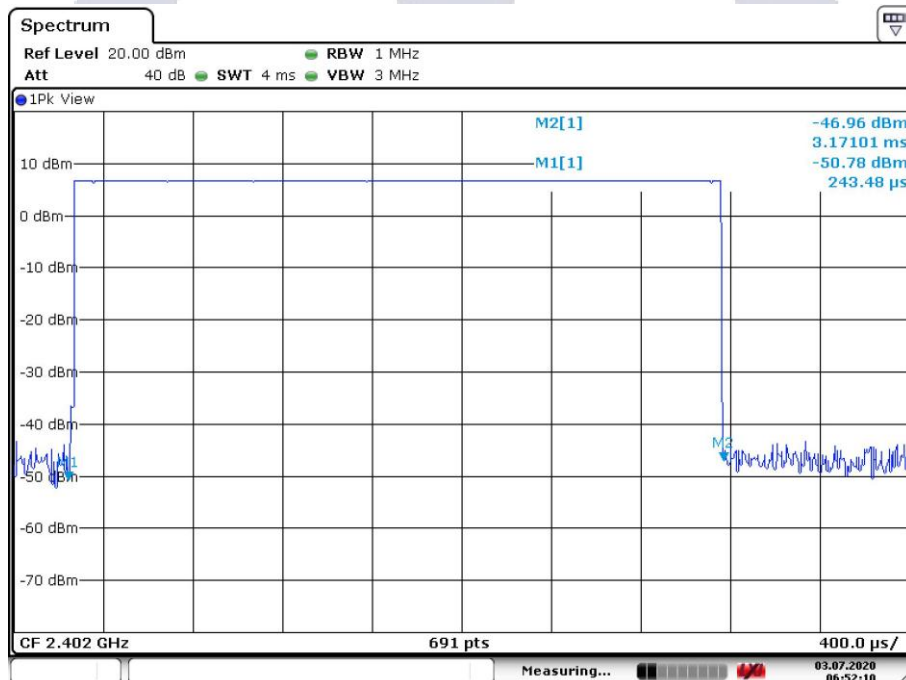
Date: 3.JUL.2020 06:53:45

CH 00- DH3



Date: 3.JUL.2020 06:52:59

CH 00- DH5



Date: 3.JUL.2020 06:52:10

6.8 Maximum Peak Output Power

6.8.1 Applied procedures / Limit

15.247(a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

15.247(b) (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

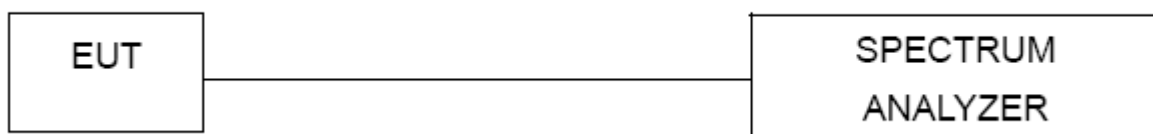
6.8.2 Test procedure

- (1) Connected the antenna port to the Spectrum Analyzer, set the Spectrum Analyzer as
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured, VBW ≥ RBW, Sweep = auto
Detector function = peak, Trace = max hold
- (2) The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.
- (3) The above procedure shall be repeated at the lowest, the middle, and the highest frequency of the stated frequency range with modulated mode. Also shall be performed at different modes of operation.

6.8.3 Deviation from standard

No deviation.

6.8.4 Test setup

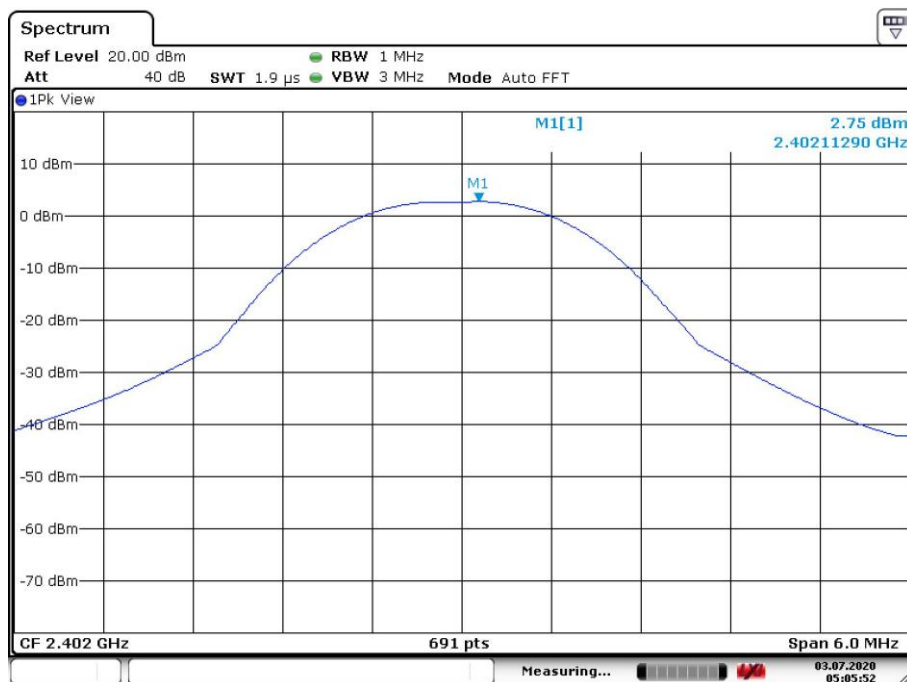


6.8.5 Test results

EUT:	Driveri	Model Name :	D-210
Temperature:	26 °C	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 12V
Test Mode :	TX 1Mbps/ 2Mbps		
Note: All the data rates have be tested and the worst-case as the table below.			

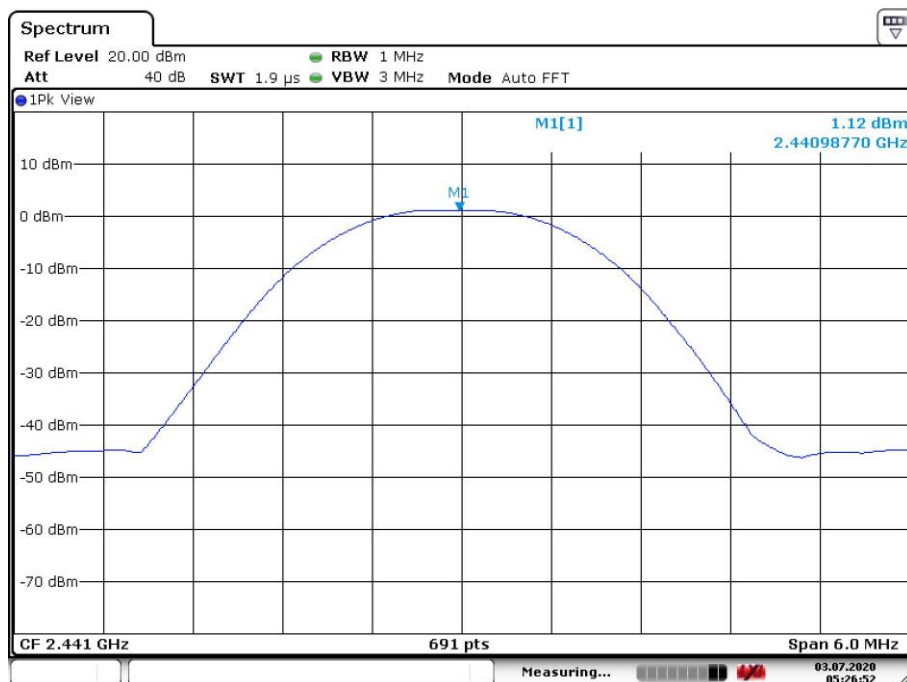
Test Mode	Frequency	Peak Output Power (dBm)	Limit (dBm)	Result
Data rate 1Mbps	2402 MHz	2.75	21	Pass
	2441 MHz	1.12	21	Pass
	2480 MHz	-0.94	21	Pass
Data rate 2Mbps	2402 MHz	6.93	21	Pass
	2441 MHz	6.14	21	Pass
	2480 MHz	3.59	21	Pass
Cable loss = 1.0 dBm				

CH 00-1Mbps



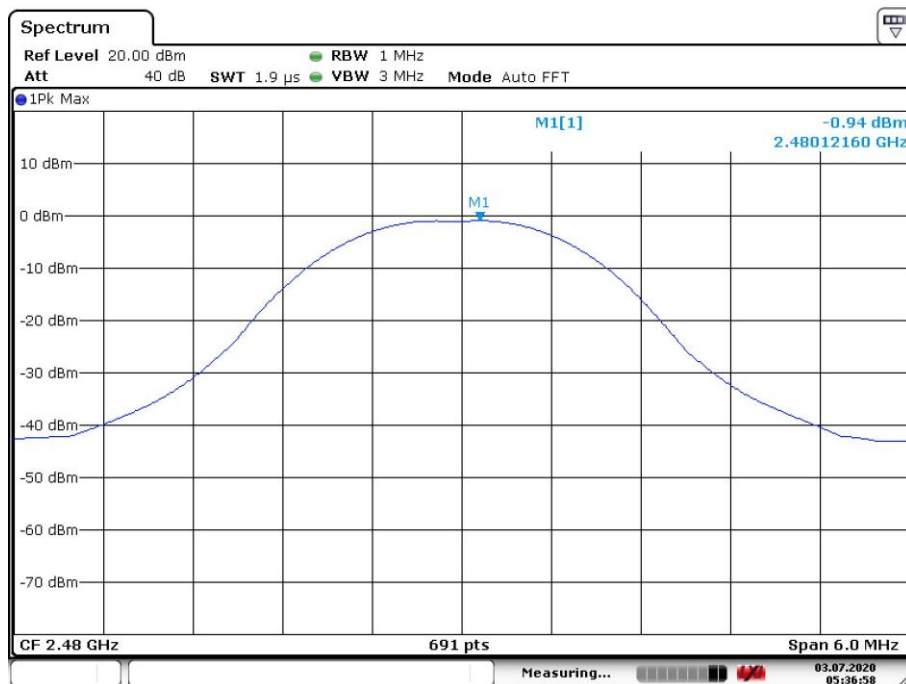
Date: 3.JUL.2020 05:05:52

CH 39-1Mbps



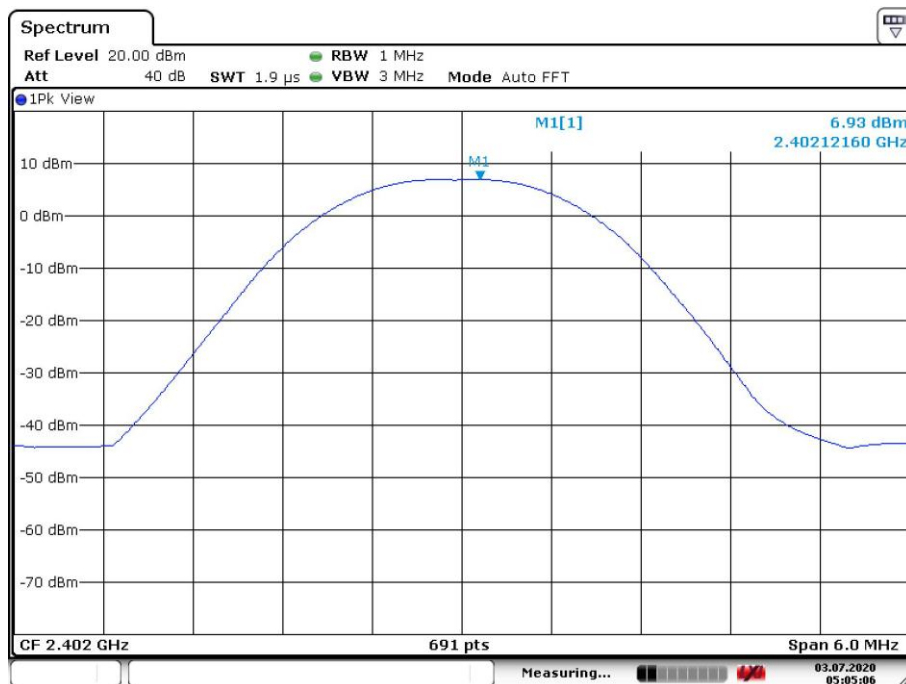
Date: 3.JUL.2020 05:26:52

CH 78-1Mbps



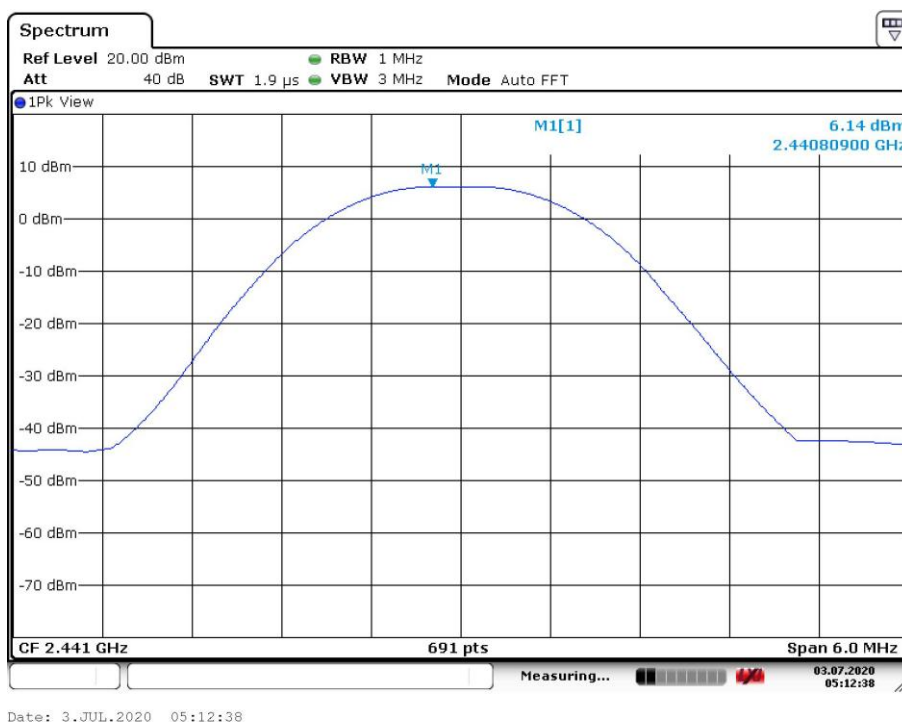
Date: 3.JUL.2020 05:36:58

CH 00-2Mbps

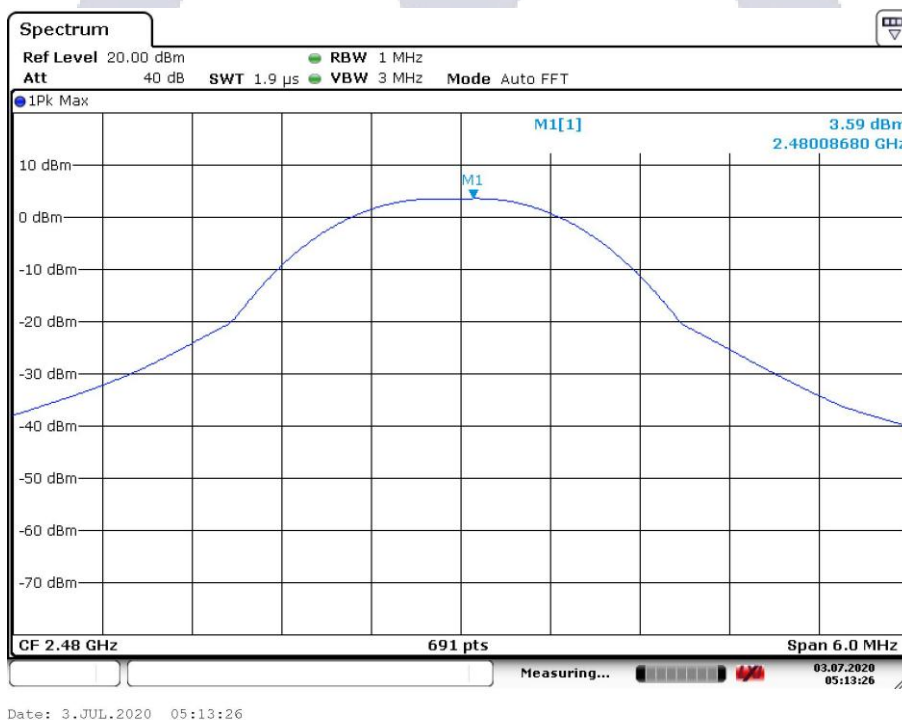


Date: 3.JUL.2020 05:05:05

CH 39-2Mbps



CH 78-2Mbps



6.9 Band edge

6.9.1 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)).

6.9.2 Test procedure

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation, RBW $\geq 1\%$ of the span, VBW $\geq$ RBW, Sweep = auto, Detector function = peak, Trace = max hold

6.9.3 Deviation from standard

No deviation.

6.9.4 Test setup



Note: Both Hopping-on mode and hopping-off mode had been pre-tested, and only the worst case was recorded in the report.