TEST REPORT

Applicant Name :	Shenzhen VanTop Technology & Innovation Co., Ltd.
Address :	506, BLDG 4, MinQi Technology Park, No. 65 Lishan Road, Pingshan Community,Taoyuan Street, Nanshan District, Shenzhen, China
Report Number :	RA230110-01783E-RF-00A
FCC ID:	2AQ3A-SG500CT0522

Test Standard (s)

FCC PART 15.247

Sample Description

Product Type:	R/C QUADCOPTER
Model No.:	DR-SG500C
Multiple Model(s) No.:	DR-SG500E, DR-SG500F
Trade Mark:	N/A
Date Received:	2023/01/10
Report Date:	2023/04/13

Test Result:	Pass*

* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Nick Fang

EMC Engineer

Approved By:

Candy Li

EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	RA230110-01783E-RF-00A	Original Report	2023/04/13

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	R/C QUADCOPTER
Tested Model	DR-SG500C
Multiple Models	DR-SG500E, DR-SG500F (model difference see product declaration letter of similarity)
Frequency Range	2405-2478MHz
Maximum conducted output power	7.60dBm
Modulation Technique	GFSK
Antenna Specification*	0.85dBi (provided by the applicant)
Voltage Range	DC 7.4V from battery
Sample serial number	1YF8-2 for RF Conducted Test 1YF9-3 for Radiated Emissions (Assigned by ATC)
Sample/EUT Status	Good condition

Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commission rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209 and 15.247 rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF Frequency		$0.082*10^{-7}$
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
AC Power Lines Conducted Emissions		2.72dB
Emissions, Radiated	9kHz - 30MHz	2.66dB
	30MHz - 1GHz	4.28dB
	1GHz - 18GHz	4.98dB
	18GHz - 26.5GHz	5.06dB
	26.5GHz - 40GHz	4.72dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in an engineering mode.

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2405	4	2424	8	2444	12	2464
1	2409	5	2429	9	2449	13	2469
2	2414	6	2434	10	2454	14	2474
3	2419	7	2440	11	2459	15	2478

Channel 0, 8, 15 was tested

EUT Exercise Software

No exercise software was used, EUT was confirgured in testing mode by applicnat and the power level is default*. The power level was provided by applicant

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

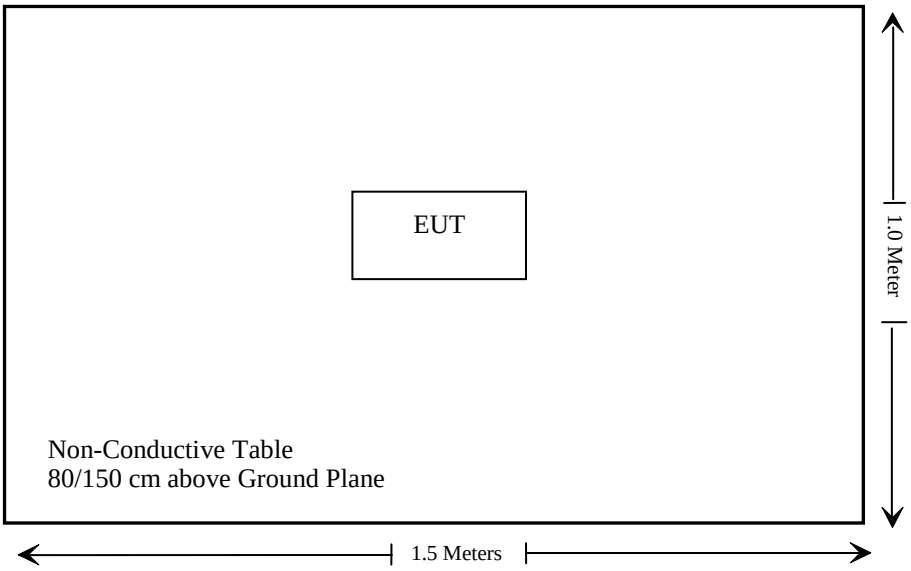
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From/Port	To
/	/	/	/

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i) & §1.1307 (b) (3) & §2.1091	MPE-Based Exemption	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209 & §15.247(d)	Radiated Emissions	Compliant
§15.247(a)(1)	20 dB Emission Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant
§15.247(a)(1)(i)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(i)	Quantity of hopping channel Test	Compliant
§15.247(b)(2)	Peak Output Power Measurement	Compliant
§15.247(d)	Band edges	Compliant

Not Applicable: The RF function cannot use when in charging.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emissions Test					
Rohde& Schwarz	Test Receiver	ESR	102725	2022/11/25	2023/11/24
Rohde&Schwarz	Spectrum Analyzer	FSV40	101949	2022/11/25	2023/11/24
SONOMA INSTRUMENT	Amplifier	310 N	186131	2022/11/08	2023/11/07
A.H. Systems, inc.	Preamplifier	PAM-0118P	135	2022/11/08	2023/11/07
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2021/07/06	2024/07/05
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2022/11/30	2025/11/29
Radiated Emission Test Software: e3 19821b (V9)					
Unknown	RF Coaxial Cable	No.10	N050	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.11	N1000	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.12	N040	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.13	N300	2022/11/25	2023/11/24
Unknown	RF Coaxial Cable	No.14	N800	2022/11/25	2023/11/24
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV-40	101948	2022/11/25	2023/11/24
SPECTRUM ANALYZER	Rohde & Schwarz	FSU26	200982	2022/07/04	2023/07/03
WEINSCHEL	10dB Attenuator	5324	AU 3842	2022/11/25	2023/11/24

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.247 (i) & §1.1307 (b) (3) & §2.1091- MPE-Based Exemption

Applicable Standard

According to subpart 15.247 and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Result

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Test result

Mode	Frequency (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
FHSS	2405-2478	0.85	1.22	8.0	6.31	20	0.002	1
Wi-Fi	5150-5250	2.0	1.58	9.5	8.91	20	0.003	1
	5725-5850	2.0	1.58	11.5	14.13	20	0.004	1

Note 1: The tune-up power and antenna gain was declared by the applicant.
Note 2: The FHSS can transmit at same time with 5GHz Wi-Fi.

Simultaneous transmitting consideration:
The ratio= 0.002+0.004=0.006＜1.0, so simultaneous exposure is compliant.
To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.

FCC §15.203 – ANTENNA REQUIREMENT

Applicable Standard

According to FCC §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Antenna Connector Construction

The EUT has one internal Antenna arrangement which was permanently attached and the antenna gain is 0.85dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

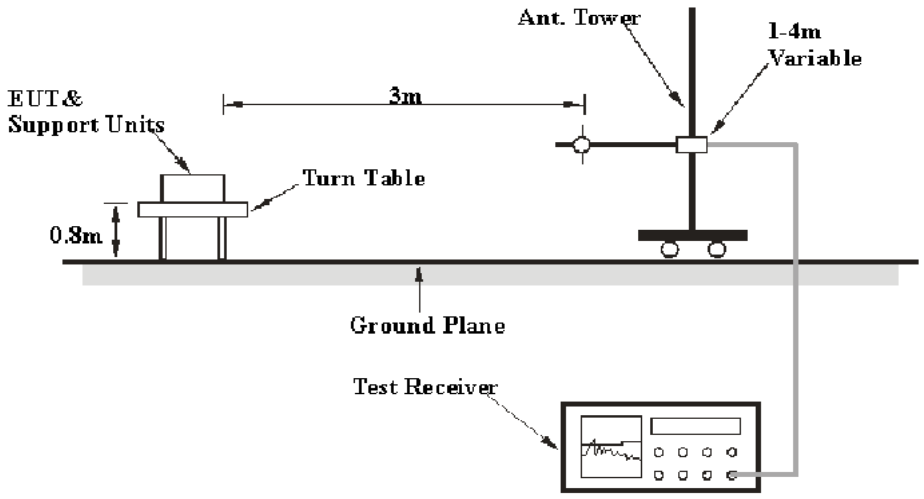
FCC §15.205, §15.209 & §15.247(d) – RADIATED EMISSIONS

Applicable Standard

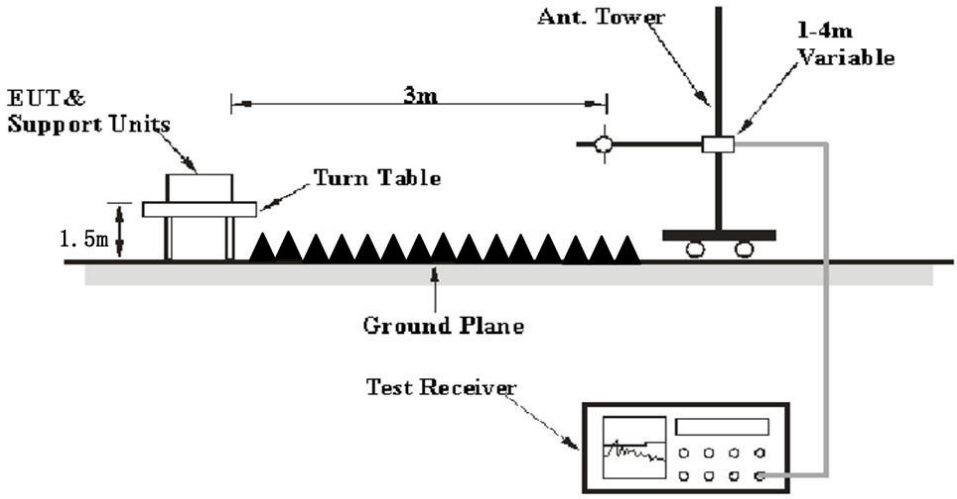
FCC §15.205; §15.209; §15.247(d)

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

The EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK

For average measurement:

use the duty cycle factor correction factor method per 15.35(c).
Duty cycle=On time/100milliseconds, On time=N1*L1+N2*L2+…Nn-1*Ln-1+Nn*Ln,
where N1 is number of type 1 pulses, L1 is length of type 1 pulse, etc.
Average Emission Level=Peak Emission Level+20*log(Duty cycle)

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All final data was recorded in Quasi-peak detection mode for frequency range of 30 MHz -1 GHz and peak and Average detection modes for frequencies above 1 GHz.

Corrected Factor & Margin Calculation

The Corrected Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

Corrected Factor = Antenna Factor + Cable Loss - Amplifier Gain

The "**Over Limit or Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a overlimit/margin of -7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin/Over Limit = Corrected Amplitude/Level-Limit
Corrected Amplitude/Level = Reading + Corrected Factor

Test Data

Environmental Conditions

Temperature:	24~26℃
Relative Humidity:	55~57 %
ATM Pressure:	101.0 kPa

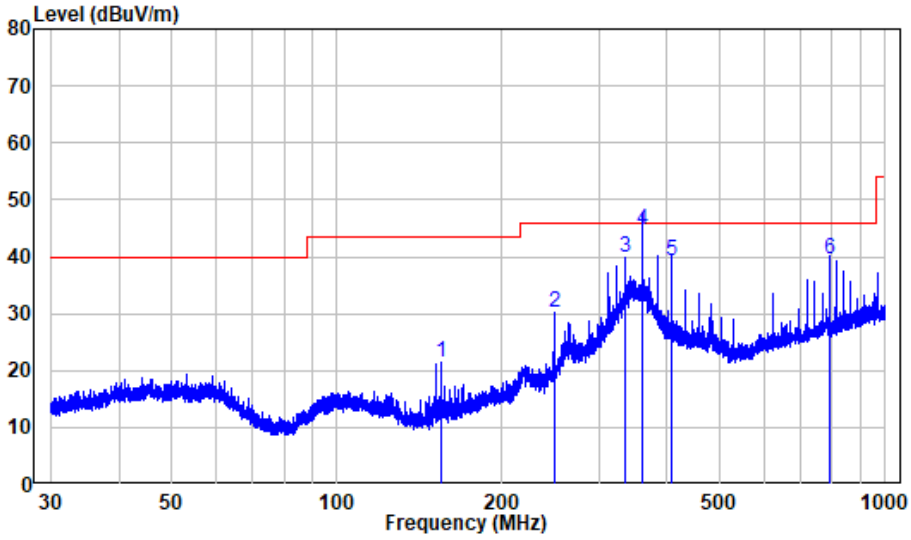
The testing was performed by Jimi Zheng on 2023-02-03 for below 1GHz, And on 2023-02-16 for above 1GHz.

EUT operation mode: Transmitting (Pre-scan in the X,Y and Z axes of orientation, the worst case X-axes orientation was recorded)

30MHz-1GHz: *(worst case is low channel)*

Note: When the test result of peak was less than the limit of QP more than 6dB, so just peak value were recorded.

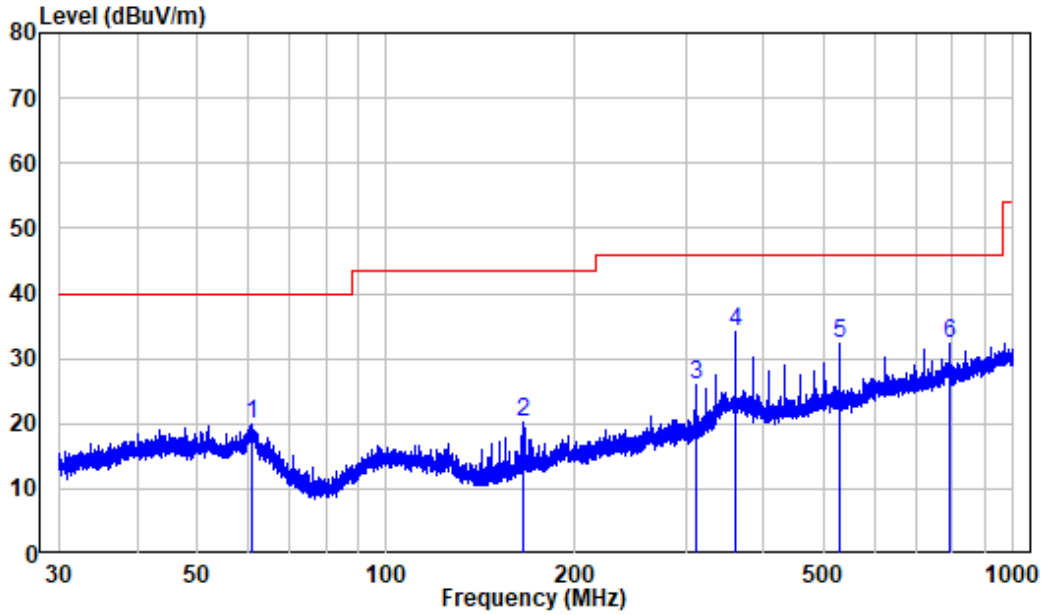
Horizontal:



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230110-01783E-RF
Test Mode: Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	154.956	-14.93	36.34	21.41	43.50	-22.09	Peak
2	249.972	-10.74	40.98	30.24	46.00	-15.76	Peak
3	336.035	-7.58	47.42	39.84	46.00	-6.16	Peak
4	359.974	-7.68	52.50	44.82	46.00	-1.18	QP
5	408.051	-6.49	45.70	39.21	46.00	-6.79	QP
6	792.353	-0.19	39.80	39.61	46.00	-6.39	QP

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : RA230110-01783E-RF
Test Mode: Transmitting

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	60.944	-11.01	30.99	19.98	40.00	-20.02	Peak
2	165.777	-14.01	34.32	20.31	43.50	-23.19	Peak
3	312.043	-8.82	34.76	25.94	46.00	-20.06	Peak
4	360.132	-7.68	41.84	34.16	46.00	-11.84	Peak
5	528.014	-4.48	36.79	32.31	46.00	-13.69	Peak
6	792.006	-0.18	32.37	32.19	46.00	-13.81	Peak

Above 1GHz:

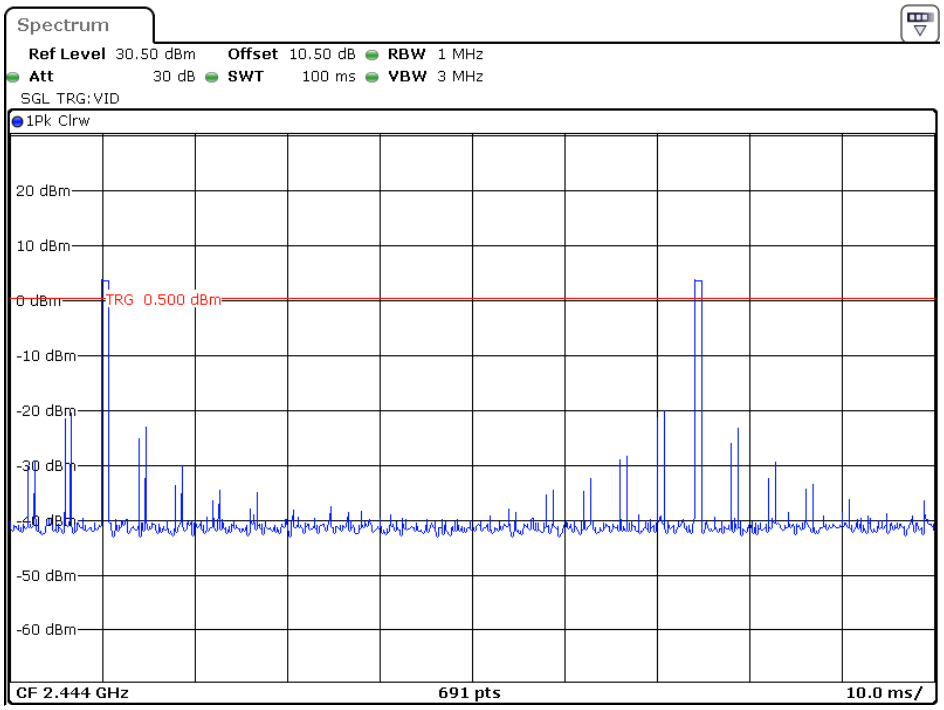
Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/Ave		Height (m)	Polar (H/V)				
Low Channel(2405MHz)									
2310	61.60	PK	257	1.6	H	-7.24	54.36	74	-19.64
2310	61.20	PK	212	1.7	V	-7.24	53.96	74	-20.04
2390	67.33	PK	95	1.1	H	-7.22	60.11	74	-13.89
2390	62.89	PK	93	2.5	V	-7.22	55.67	74	-18.33
4810	74.76	PK	339	2.1	H	-3.52	71.24	74	-2.76
4810	68.14	PK	147	2.1	V	-3.52	64.62	74	-9.38
Middle Channel(2444MHz)									
4888	73.16	PK	257	1.9	H	-3.33	69.83	74	-4.17
4888	67.86	PK	5	1.9	V	-3.33	64.53	74	-9.47
High Channel(2478MHz)									
2483.5	80.86	PK	230	2.2	H	-7.20	73.66	74	-0.34
2483.5	71.64	PK	104	2	V	-7.20	64.44	74	-9.56
2500	69.49	PK	52	2.2	H	-7.18	62.31	74	-11.69
2500	63.65	PK	257	1.6	V	-7.18	56.47	74	-17.53
4956	69.65	PK	127	2.3	H	-3.02	66.63	74	-7.37
4956	63.74	PK	158	2.3	V	-3.02	60.72	74	-13.28

Field Strength of Average							
Frequency (MHz)	Peak Measurement @3m (dBμV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Corrected Ampitude (dBμV/m)	FCC Part 15.247		
					Limit (dBμV/m)	Margin (dB)	Comment
Low Channel(2405MHz)							
2310	54.36	H	-36.72	17.64	54	-36.36	Bandedge
2310	53.96	V	-36.72	17.24	54	-36.76	Bandedge
2390	60.11	H	-36.72	23.39	54	-30.61	Bandedge
2390	55.67	V	-36.72	18.95	54	-35.05	Bandedge
4810	71.24	H	-36.72	34.52	54	-19.48	Harmonic
4810	64.62	V	-36.72	27.90	54	-26.10	Harmonic
Middle Channel(2444MHz)							
4888	69.83	H	-36.72	33.11	54	-20.89	Harmonic
4888	64.53	V	-36.72	27.81	54	-26.19	Harmonic
High Channel(2478MHz)							
2483.5	73.66	H	-36.72	36.94	54	-17.06	Bandedge
2483.5	64.44	V	-36.72	27.72	54	-26.28	Bandedge
2500	62.31	H	-36.72	25.59	54	-28.41	Bandedge
2500	56.47	V	-36.72	19.75	54	-34.25	Bandedge
4956	66.63	H	-36.72	29.91	54	-24.09	Harmonic
4956	60.72	V	-36.72	24.00	54	-30.00	Harmonic

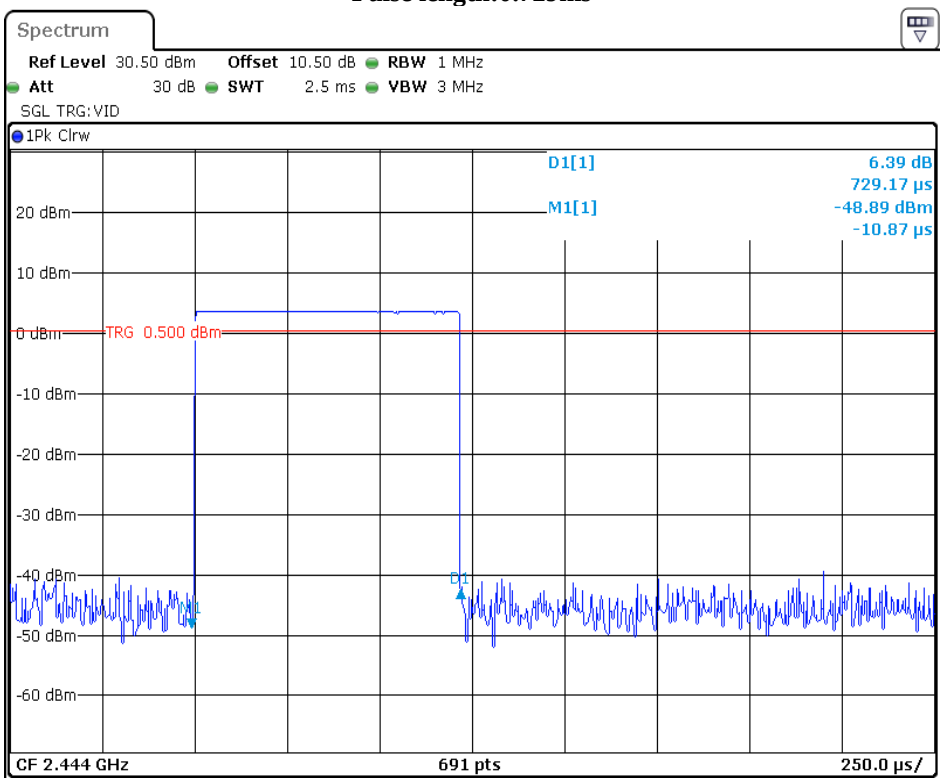
Note:

Corrected. Amplitude = Factor + Reading
Margin = Corrected. Amplitude - Limit
Average level= Peak level+ Duty Cycle Corrected Factor
For fundamental, the peak value compliance with the limit of Average.
Duty cycle = Ton/100ms = 0.729*2/100=0.01458
Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.01458= -36.72

Duty cycle:

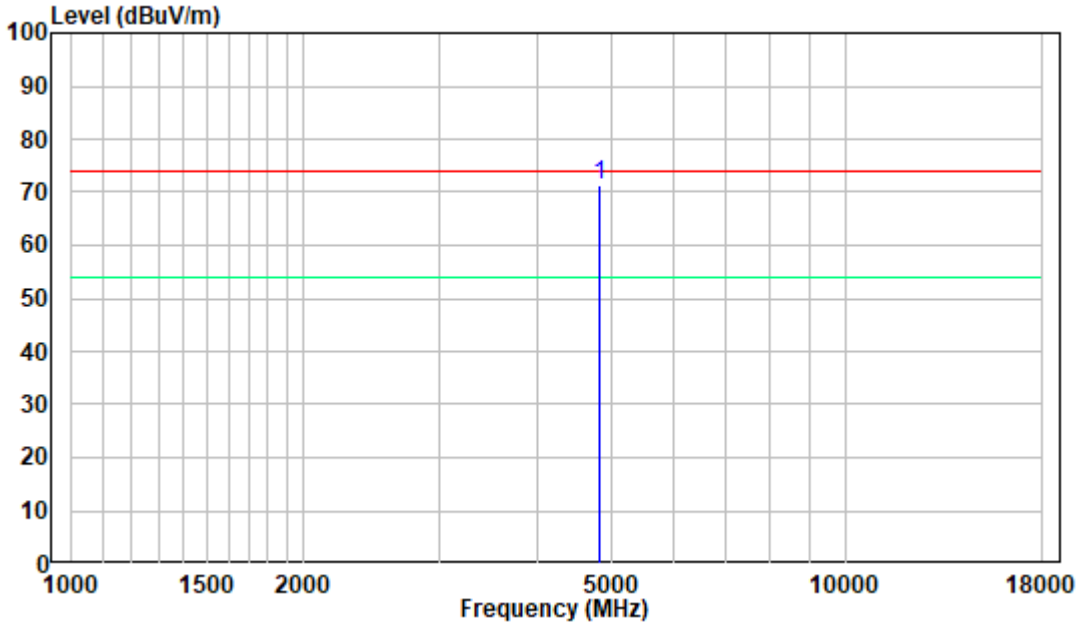


Pulse length:0.729ms

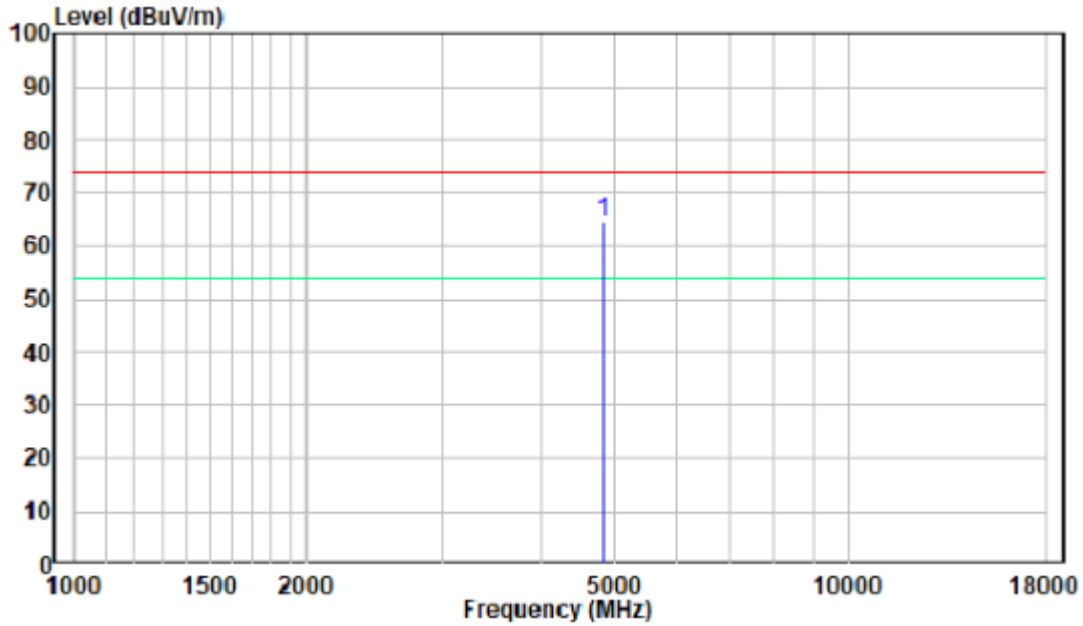


1-18GHz
Pre-scan for High Channel

Horizontal:



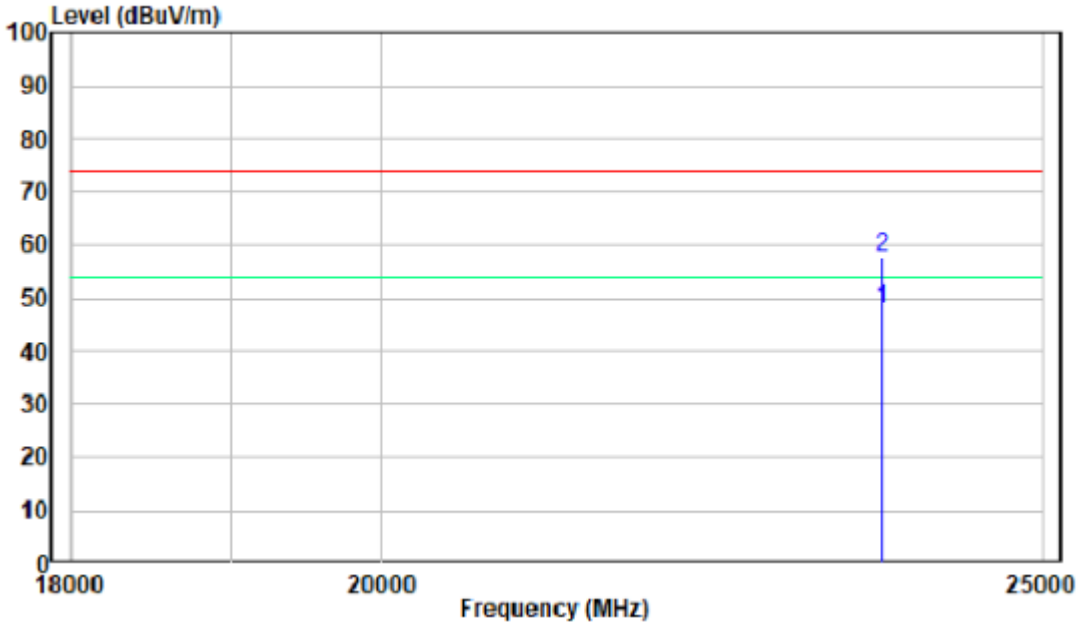
Vertical:



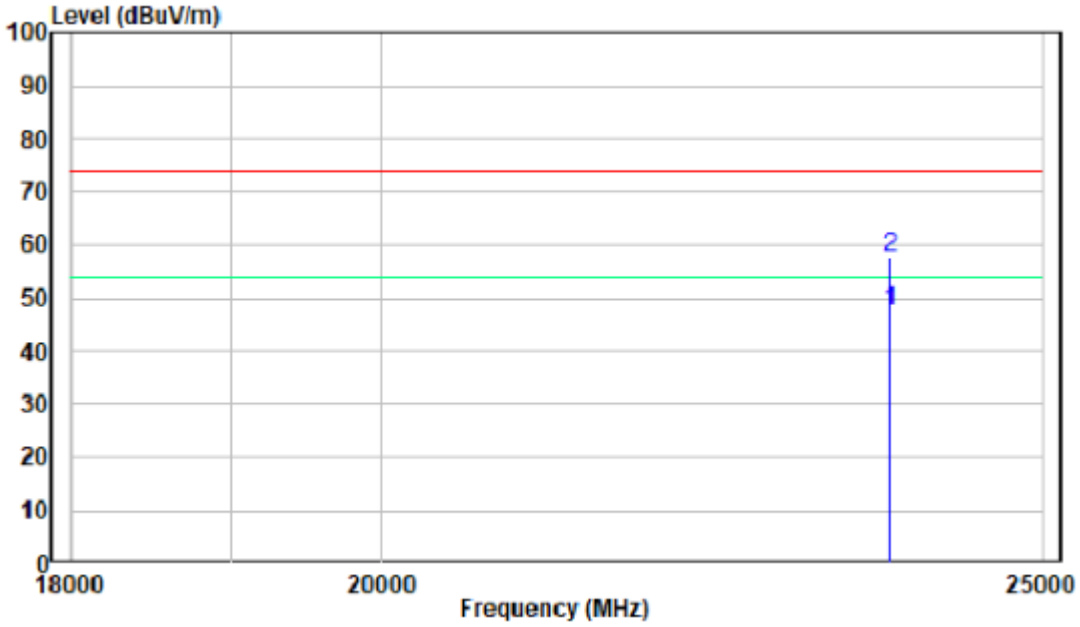
18-25GHz

Pre-scan for High Channel

Horizontal:



Vertical:



FCC §15.247(a) (1)-CHANNEL SEPARATION TEST

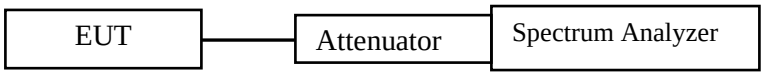
Applicable Standard

Frequency hopping systems shall have hoping 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.2

1. Set the EUT in transmitting mode, maxhold the channel.
2. Set the adjacent channel of the EUT and maxhold another trace.
3. Measure the channel separation.



Test Data

Environmental Conditions

Temperature:	28.3℃
Relative Humidity:	44%
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2023-02-27.

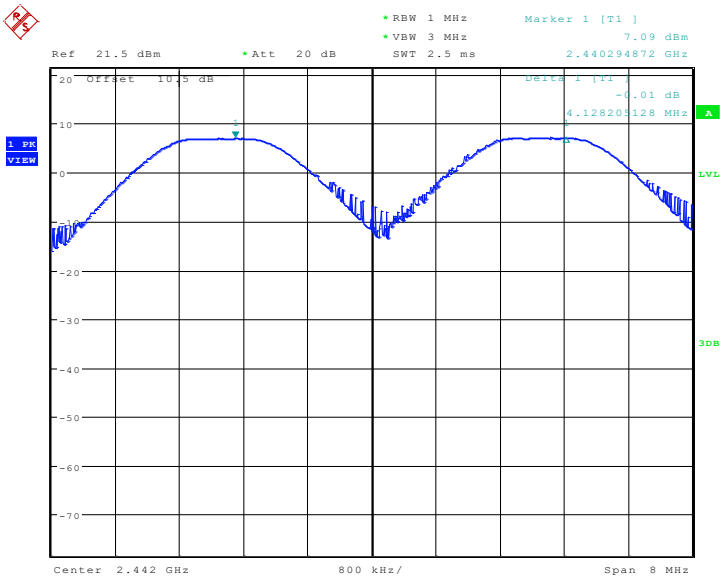
EUT operation mode: Transmitting

Test Result: Compliant.

According to the frequency tabel and analyzer hopping sequence, the worst case as below:

Test Mode	Channel Separation (MHz)	20 dBc BW (MHz)	Two-thirds of the 20 dB bandwidth (MHz)	Channel Separation Limit	Result
GFSK					
Hopping	4.128	1.26	0.84	> two-thirds of the 20 dB bandwidth	Pass

Please refer to the below plots:


RBW 1 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
7.09 dBm
2.440294872 GHz
Ref 21.5 dBm
Att 20 dB
Offset 10.5 dB
Delta 1 [T1]
-0.01 dB
4.128205128 MHz
1 PK
VIEW
LVL
3DB
Center 2.442 GHz
800 kHz/
Span 8 MHz

FCC §15.247(a) (1) – 20 dB EMISSION BANDWIDTH & 99% OCCUPIED BANDWIDTH

Applicable Standard

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.

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.7 & Clause 6.9.2

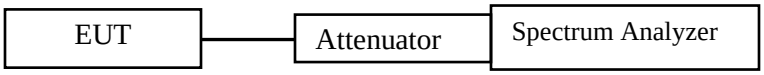
The following conditions shall be observed for measuring the occupied bandwidth and 20 dB bandwidth:
• The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

• The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

• The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / 20 dB bandwidth if the device is not transmitting continuously.

• The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / 20 dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.
For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).



Test Data

Environmental Conditions

Temperature:	28.3℃
Relative Humidity:	44%
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2023-02-27.

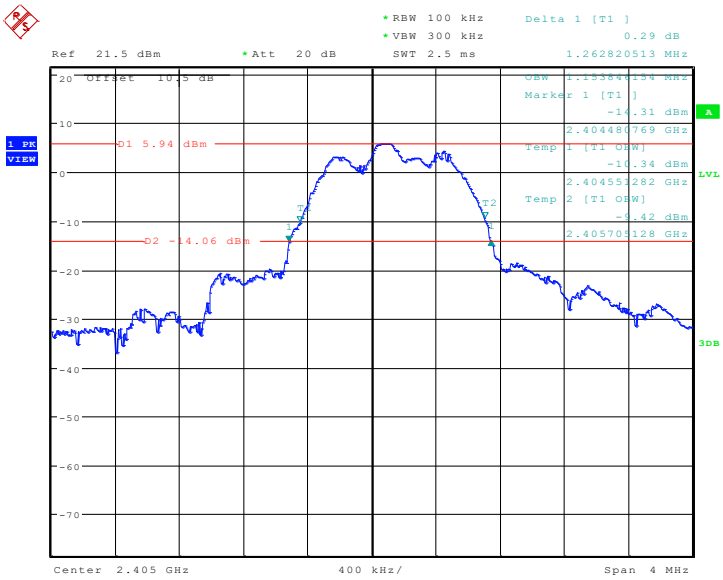
EUT operation mode: Transmitting

Test Result: Compliant.

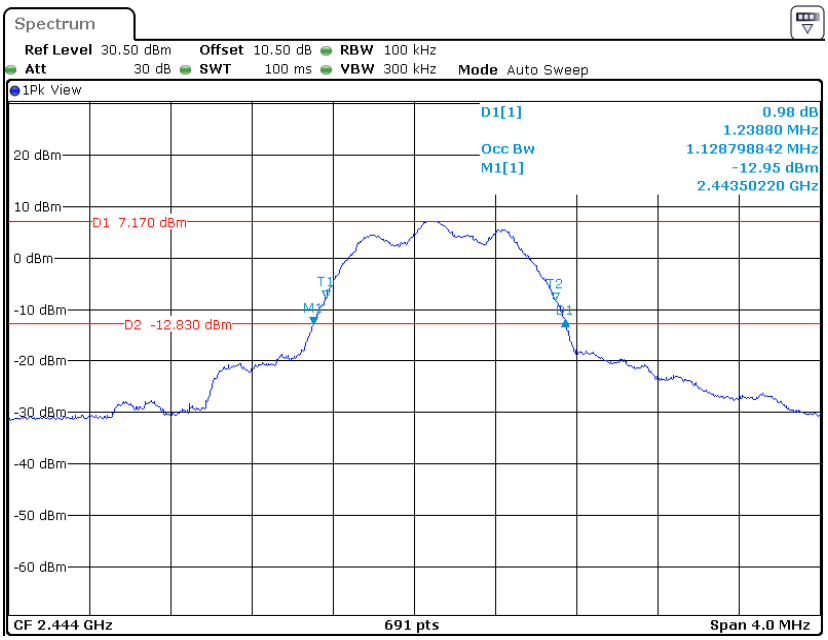
Mode	Channel	Frequency (MHz)	20 dB Emission Bandwidth (MHz)	OBW (MHz)
GFSK	Low	2405	1.26	1.15
	Middle	2444	1.24	1.13
	High	2478	1.25	1.12

Please refer to the below plots:

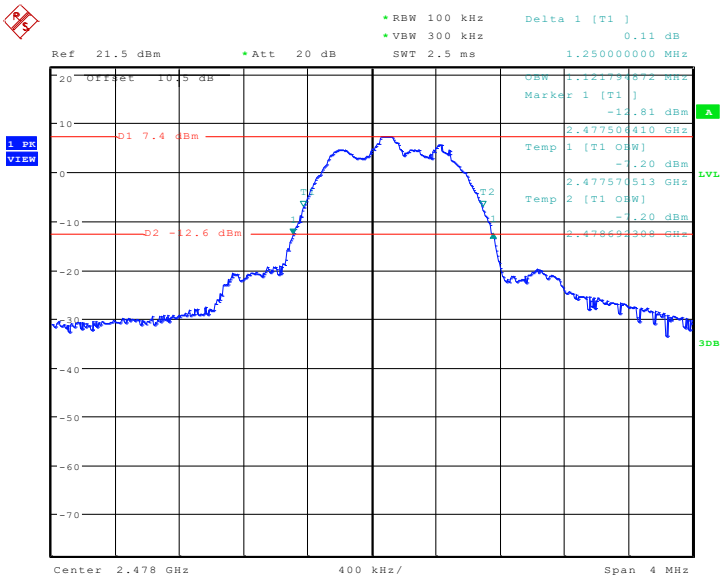
Low Channel



Middle Channel



High Channel



FCC §15.247(a) (1) (i)-QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

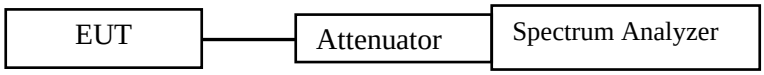
Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.3

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Set the EUT in hopping mode from first channel to last.

3. By using the max-hold function record the quantity of the channel.



Test Data

Environmental Conditions

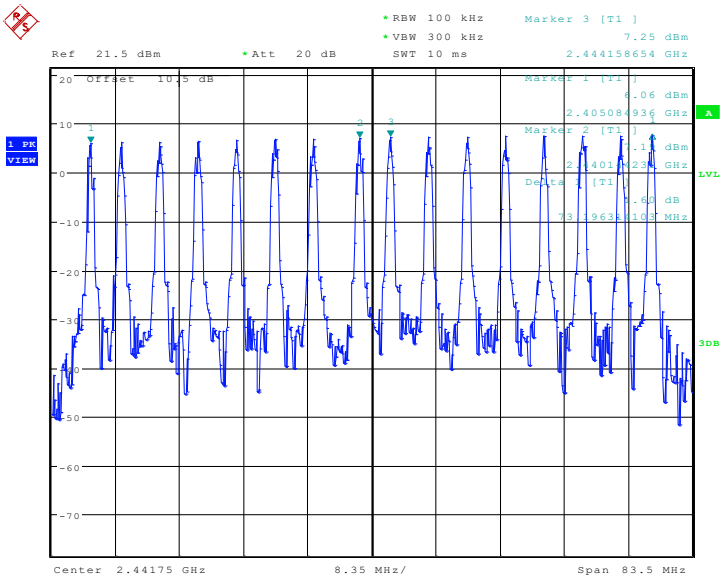
Temperature:	28.3℃
Relative Humidity:	44%
ATM Pressure:	101.0 kPa

The testing was performed by Nick Fang on 2023-02-27.

EUT operation mode: Transmitting

Test Result: Compliant.

Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
GFSK	2400-2483.5	16	≥15


RBW 100 kHz
VBW 300 kHz
SWT 10 ms
Marker 3 [T1]
7.25 dBm
2.444158654 GHz
Ref 21.5 dBm
Att 20 dB
Offset 10.5 dB
Marker 1 [T1]
6.06 dBm
2.405084936 GHz
Marker 2 [T1]
Delta 1 [T1]
1 PK VIEW
A
LVL
3DB
Center 2.44175 GHz
8.35 MHz/
Span 83.5 MHz

FCC §15.247(a) (1) (i) - TIME OF OCCUPANCY (DWELL TIME)

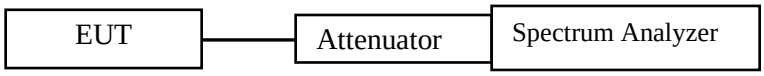
Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz 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.

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.4

1. The EUT was worked in channel hopping.
2. Set the RBW to: 1MHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 0Hz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Recorded the time of single pulses



Test Data

Environmental Conditions

Temperature:	28.3℃
Relative Humidity:	44%
ATM Pressure:	101.0 kPa

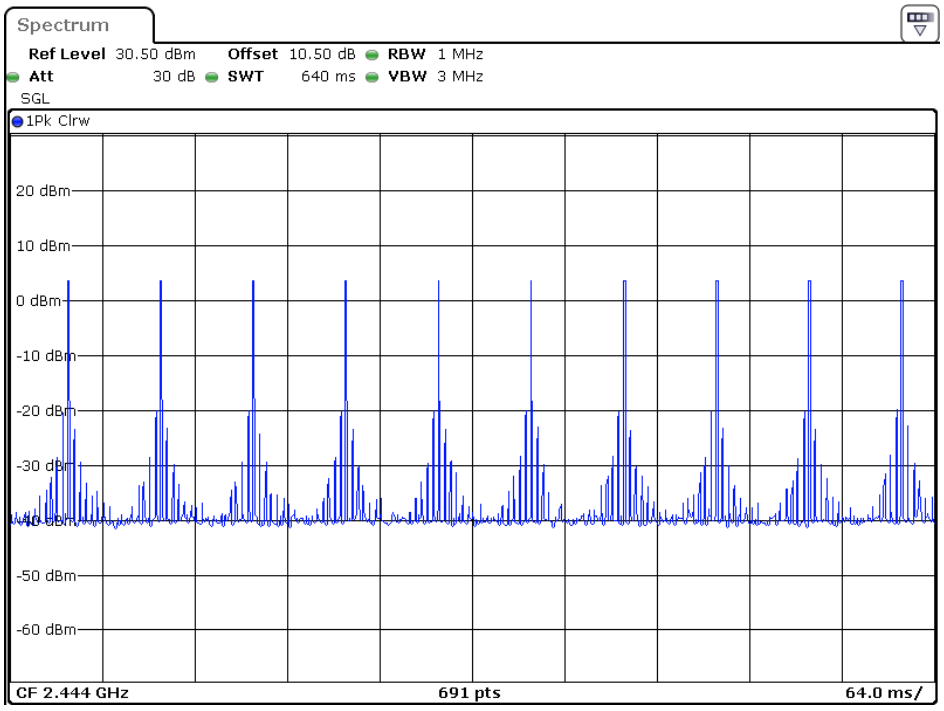
The testing was performed by Nick Fang on 2023-02-27.

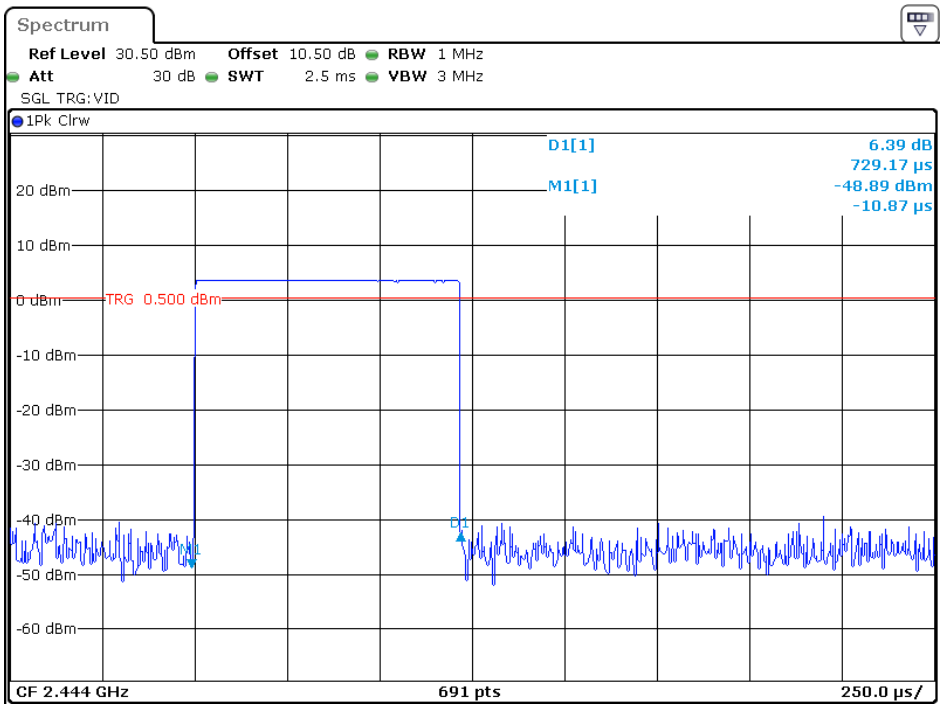
EUT operation mode: Transmitting

Test Result: Compliant.

Test Mode	Channel	Pulse Time [ms]	Total Hops [Num]	Result[s]	Limit[s]	Verdict
GFSK	Hop	0.729	100	0.0729	<=0.4	PASS

Note : Period time=0.4s*16=6.4s, Result= Pulse Time*Total hops


Spectrum
Ref Level 30.50 dBm Offset 10.50 dB RBW 1 MHz
Att 30 dB SWT 640 ms VBW 3 MHz
SGL
1Pk Clrw
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.444 GHz
691 pts
64.0 ms/


Spectrum
Ref Level 30.50 dBm Offset 10.50 dB RBW 1 MHz
Att 30 dB SWT 2.5 ms VBW 3 MHz
SGL TRG:VID
1Pk Clrw
D1[1] 6.39 dB
729.17 µs
M1[1] -48.89 dBm
-10.87 µs
20 dBm
10 dBm
0 dBm
TRG 0.500 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
D1
CF 2.444 GHz
691 pts
250.0 µs/

FCC §15.247(b) (2) - PEAK OUTPUT POWER MEASUREMENT

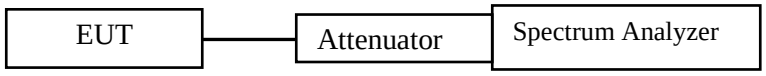
Applicable Standard

According to §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. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.5

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	28.3℃
Relative Humidity:	44%
ATM Pressure:	101.0 kPa

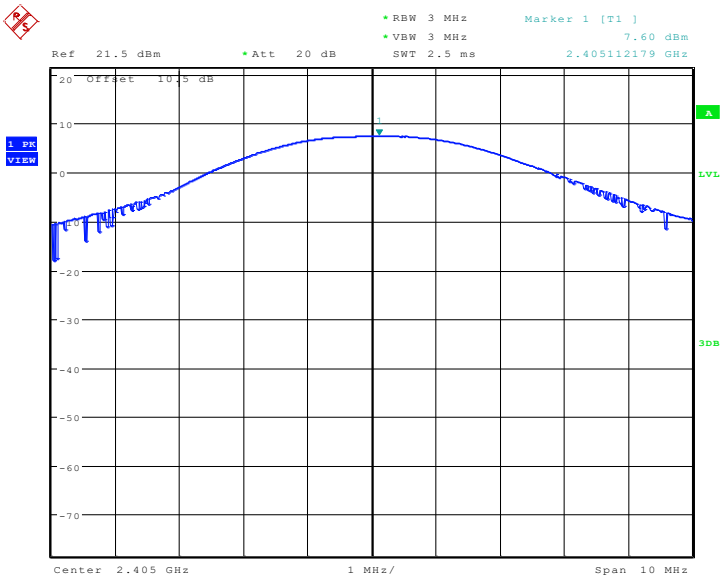
The testing was performed by Nick Fang on 2023-03-27.

EUT operation mode: Transmitting

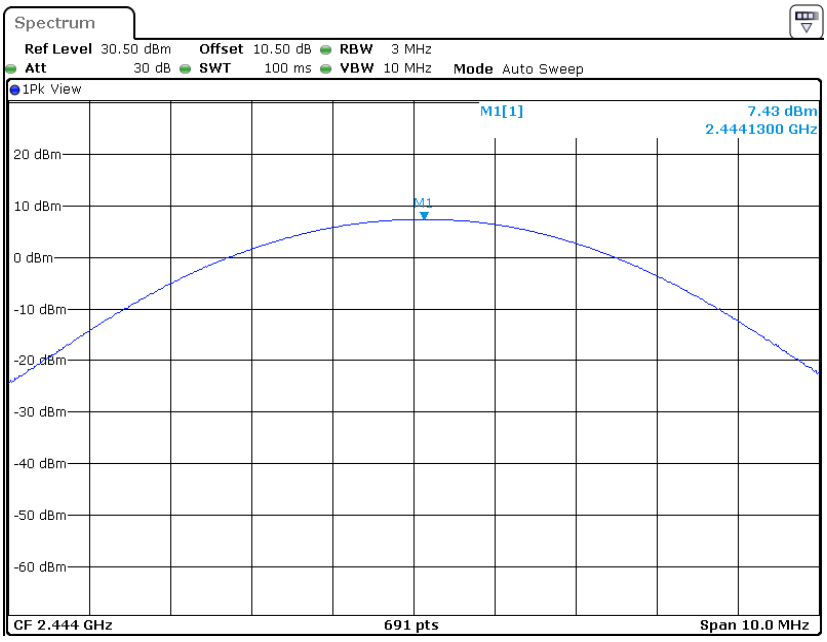
Test Result: Compliant.

Mode	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)
GFSK	Low	2405	7.60	21
	Middle	2444	7.43	21
	High	2478	7.58	21

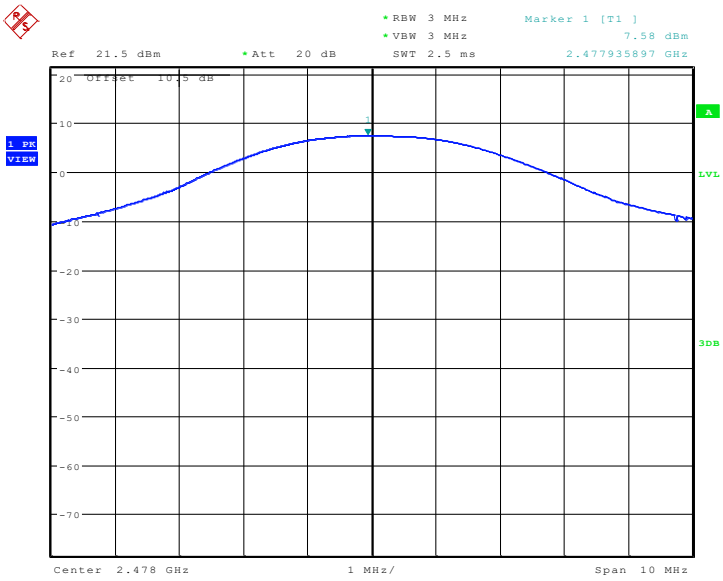
Low channel



Middle channel



High channel



FCC §15.247(d) - BAND EDGES TESTING

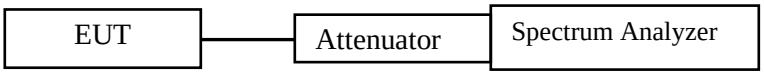
Applicable Standard

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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.6 & Clause 6.10

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



Test Data

Environmental Conditions

Temperature:	28.3℃
Relative Humidity:	44%
ATM Pressure:	101.0 kPa

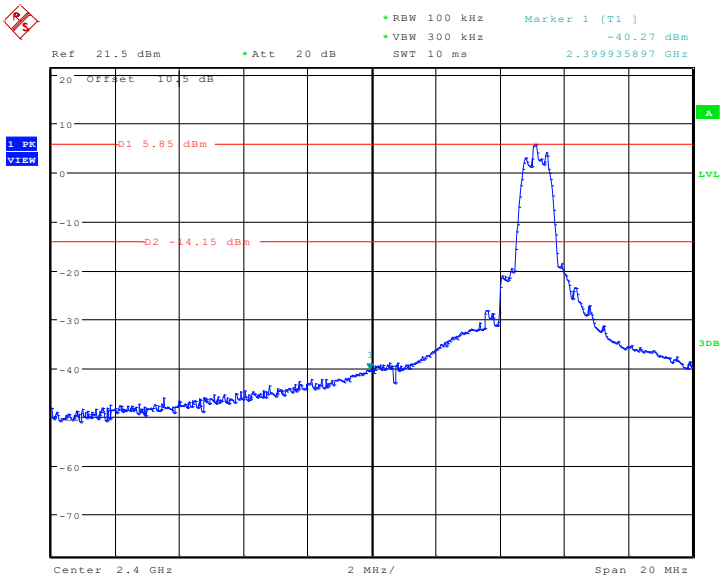
The testing was performed by Nick Fang on 2023-02-27.

EUT operation mode: Transmitting

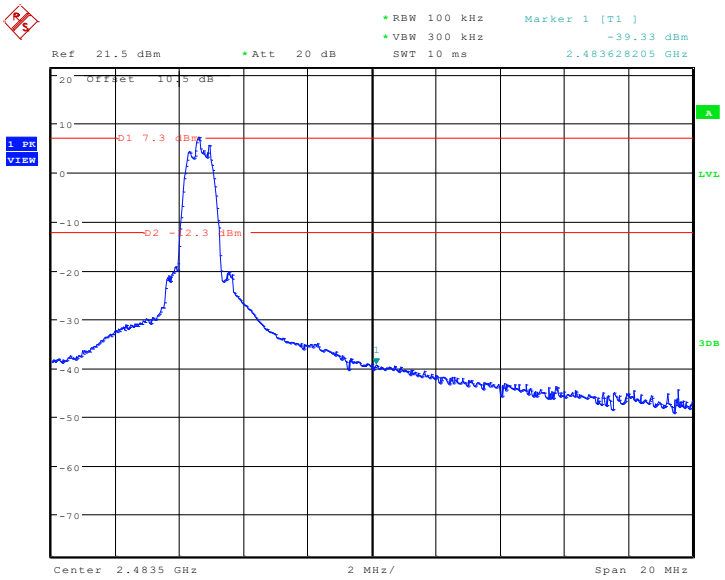
Test Result: Compliant.

Conducted Band Edge Result:

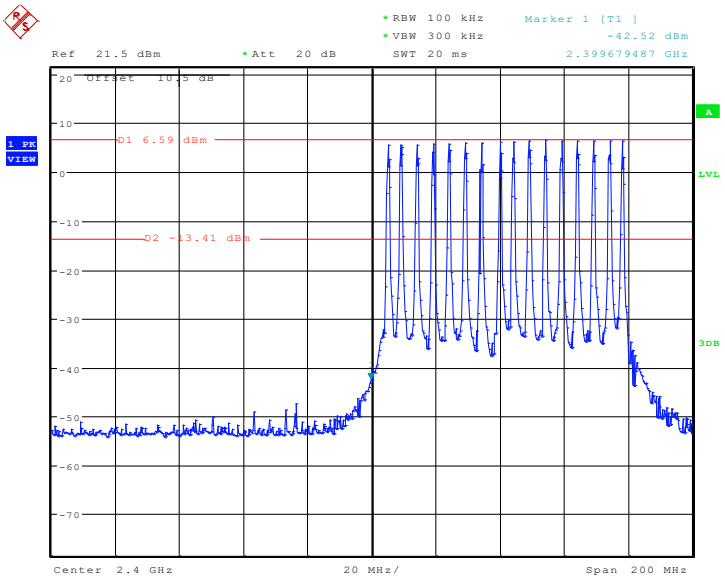
Low



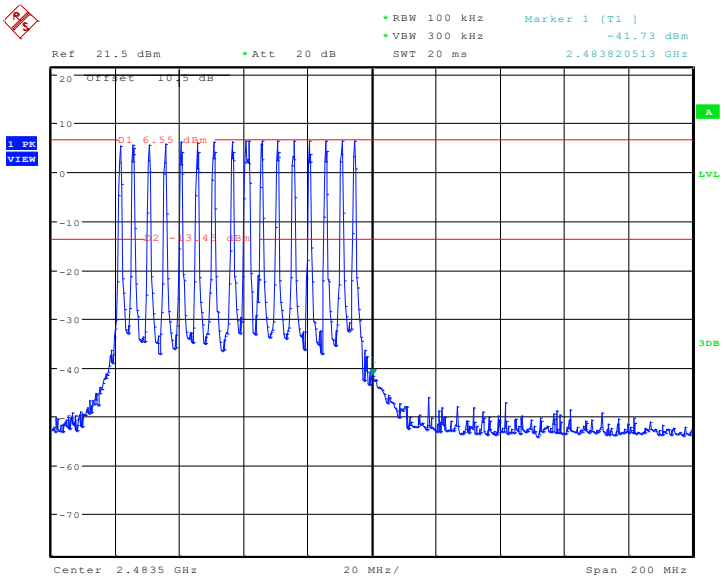
High



Low_Hop



High_Hop



******* END OF REPORT *******