TEST REPORT

Applicant Name :	Launch Tech Co., Ltd.
Address :	Launch Industrial Park, North of Wuhe Rd., Banxuegang, Longgang, Shenzhen, China.
Report Number :	RA230509-25078E-RF
FCC ID:	XUJLTRV

Test Standard (s)

FCC PART 15.231

Sample Description

Product Type:	RF-Sensor
Model No.:	LTR-V
Trade Mark:	LAUNCH
Date Received:	2023-05-09
Date of Test:	2023-05-26 to 2023-06-09
Report Date:	2023-06-09

Test Result:	Pass*

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

Prepared and Checked By:

Amanda Wei

Amanda Wei
EMC Engineer

Approved By:

Candy Li

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	RA230509-25078E-RF	Original Report	2023-06-09

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	RF-Sensor
Tested Model	LTR-V
Frequency Range	TX: 315MHz; 433.92MHz
E-field strength	315MHz: 69.77dBuV/m@3m 433.92MHz: 72.94dBuV/m@3m
Modulation Technique	FSK, ASK
Antenna Specification*	Integral antenna (It is provided by the applicant)
Voltage Range	DC 3V from battery
Sample serial number	RA230509-25078E-RF-S1 (Assigned by ATC, Shenzhen)
Sample/EUT Status	Good condition

Objective

All the test measurements were performed according to the measurement procedure described in ANSI C63.10 - 2013.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209, 15.35(c) and 15.231 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 output power, conducted		0.71dB
Unwanted Emission, conducted		1.6dB
Emissions, Radiated	30MHz - 1GHz	5.08dB
	1GHz - 18GHz	4.96dB
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 Floor 1, KuMaKe Building, Dongzhou Community, Guangming Street, Guangming District, Shenzhen, Guangdong, 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 4297.01.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0016. The Registration Number is 30241.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in Engineering Mode and the power is default, which was provided and declared by manufacturer.

The device operating at two frequencies: 315MHz and 433.92MHz, two type of modulation: FSK and ASK, both the two frequencies and two modulation mode support 'manually' operated transmit (follow the 15.231(a)), the 433.92MHz FSK modulation also support automatically transmit at a periodic rate (follow the 15.231(e)).
For the 433.92MHz FSK modulation two operate mode, they have same RF parameter setting, so for the fundamental strength, radiated emission, bandwidth measurement, the two mode share same test data.

Special Accessories

No special accessories was used

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

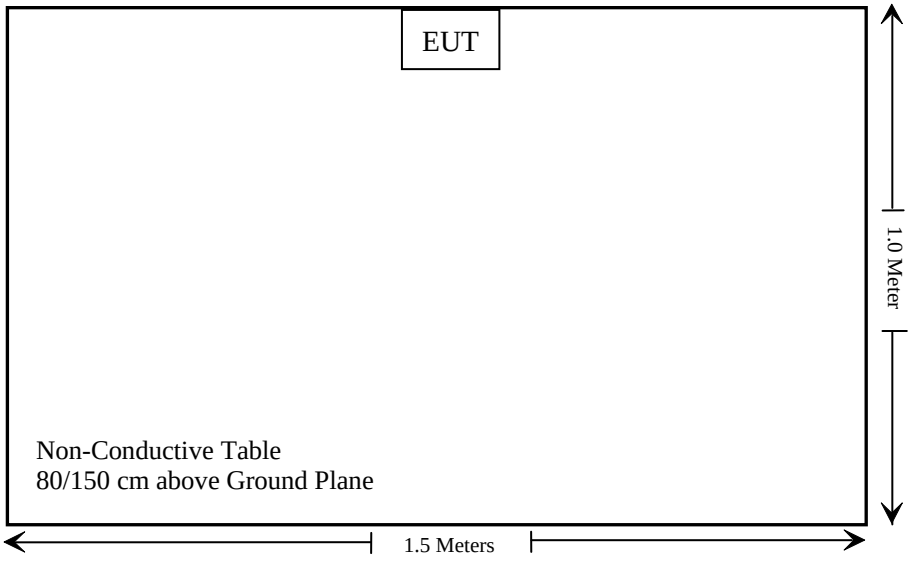
N/A

External I/O Cable

N/A

Block Diagram of Test Setup

For Radiated Emission



Note: the support table edge was flush with the center of turntable

SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 (b) & §2.1093	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§15.207	AC Line Conducted Emission	Not Applicable
§15.205, §15.209, §15.231(b);§15.231(e)	Radiated Emissions	Compliant
§15.231 (c)	20dB Emission Bandwidth	Compliant
§15.231 (a) (1), §15.231 (e)	Deactivation	Compliant

Not Applicable: The device is powered by battery only.

TEST EQUIPMENT LIST AND DETAILS

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
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	9163-194	2023/02/14	2026/02/13
Schwarzbeck	Horn Antenna	BBHA9120D	837	2023/02/22	2026/02/21
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
Radiated Emission Test Software:e3 191218 (V9)					

*** 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 §1.1307 (b) & §2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 and §1.1307(b), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D04 Interim General RF Exposure Guidance v01, clause 2.1.2 – 1-mW test Exemption:

Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance.
This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

Test Result:

For worst case:

Mode	Frequency	Maximum Power		1-mW test Exemption
	(MHz)	(dBm)	(mW)	
SRD	315	-25.43	0.003	Yes
SRD	433.92	-22.26	0.006	Yes

Note: use the maximum E-field strength for the evaluation
E(dBuV/m)=EIRP(dBm)-95.2 for distance 3m
so for 315MHz, the EIRP=69.77dBuV/m-95.2=-25.43dBm
so for 433.92MHz, the EIRP=72.94dBuV/m-95.2=-22.26dBm

Result: Compliant.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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.

Antenna Connector Construction

The EUT has one internal antenna arrangement which was permanently attached, fulfill the requirement of this section. Please refer to EUT photos.

Result: Compliant.

FCC §15.205, §15.209, §15.231 (b), §15.231(e) - RADIATED EMISSIONS

Applicable Standard

FCC §15.205, §15.209, §15.231 (b), §15.231(e)

According to FCC §15.231(b), in addition to the provisions of § 15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field Strength of Fundamental (Microvolts /meter)	Field Strength of spurious emissions (Microvolts /meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250**
Above 470	12500	1250

**linear interpolations

According to FCC §15.231(e), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

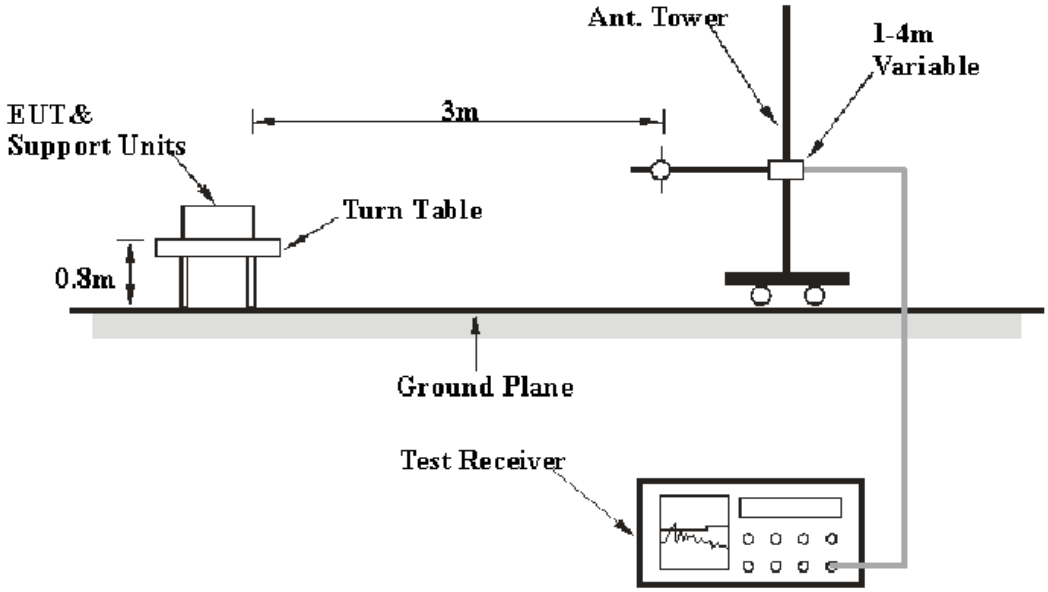
Fundamental frequency (MHz)	Field Strength of Fundamental (Microvolts /meter)	Field Strength of spurious emissions ((Microvolts /meter)
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1500*	50 to 150*
174-260	1500	150
260-470	1500 to 5000*	150 to 500*
Above 470	5000	500

*Linear interpolations.

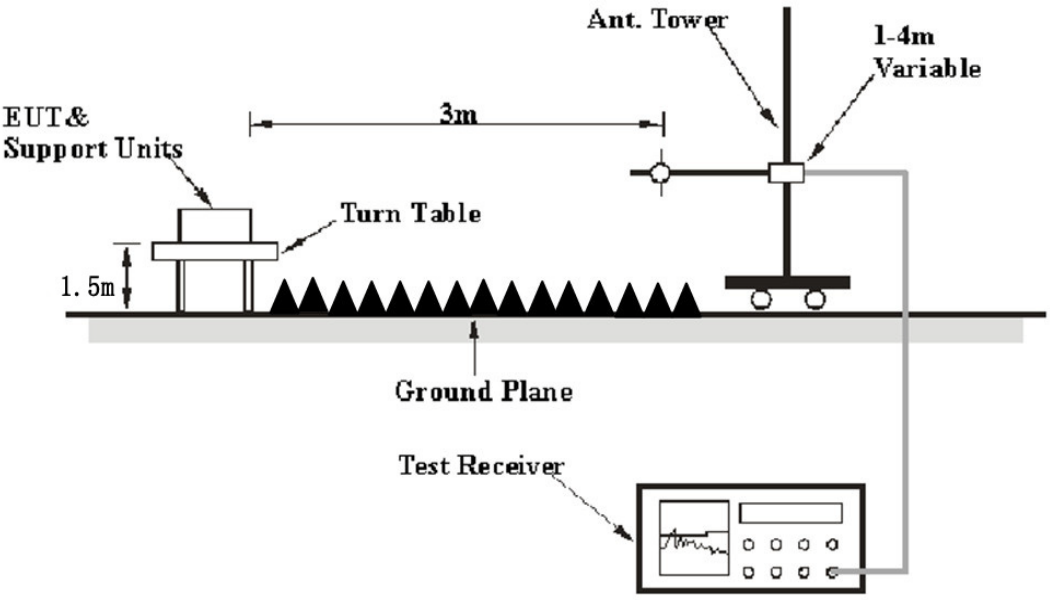
The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10 - 2013. The specification used was the FCC 15 § 15.209, 15.205 and 15.231.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 5 GHz.

During the radiated emission test, the test receiver was set with the following configurations:

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

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 the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode above 1 GHz.

If the maximized peak measured value complies with the limit, then it is unnecessary to perform QP/Average measurement.

Corrected Amplitude & Margin Calculation

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

Factor = Antenna Factor + Cable Loss - Amplifier Gain

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

Over Limit/Margin = Level / Corrected Amplitude – Limit
Level / Corrected Amplitude = Read Level + Factor

Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.205, §15.209, §15.231 (b), §15.231 (e).

Test Data

Environmental Conditions

Temperature:	23-24 ℃
Relative Humidity:	53-56 %
ATM Pressure:	101.0 kPa

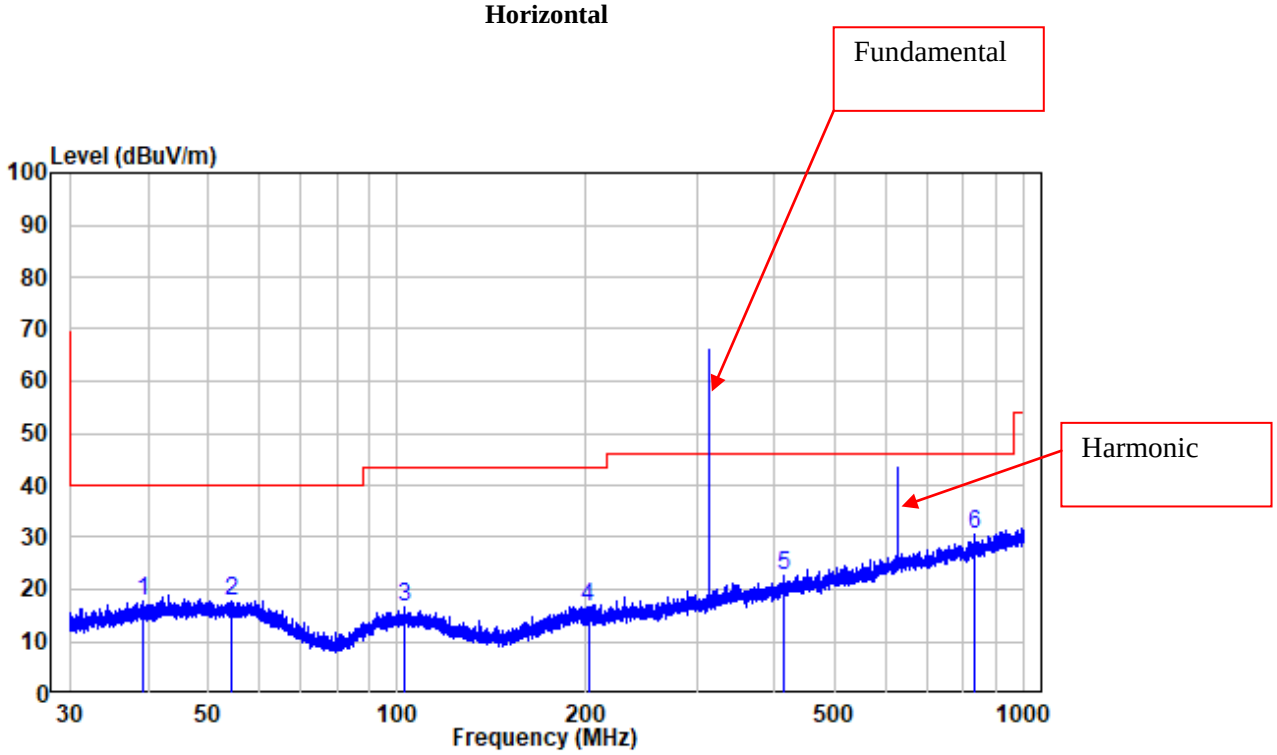
The Below 1G testing was performed by Jason Liu on 2023-05-26 and 2023-06-09.
The Above 1G testing was performed by Jimi Zheng on 2023-05-26 and 2023-06-09.
The Duty Cycle was performed by Jason Liu on 2023-06-02 and 2023-06-08.

Test mode: Transmitting (Pre-scan in the X, Y and Z axes of orientation, the worst case as setup photos was recorded)

30MHz – 1 GHz:

FSK (315MHz)

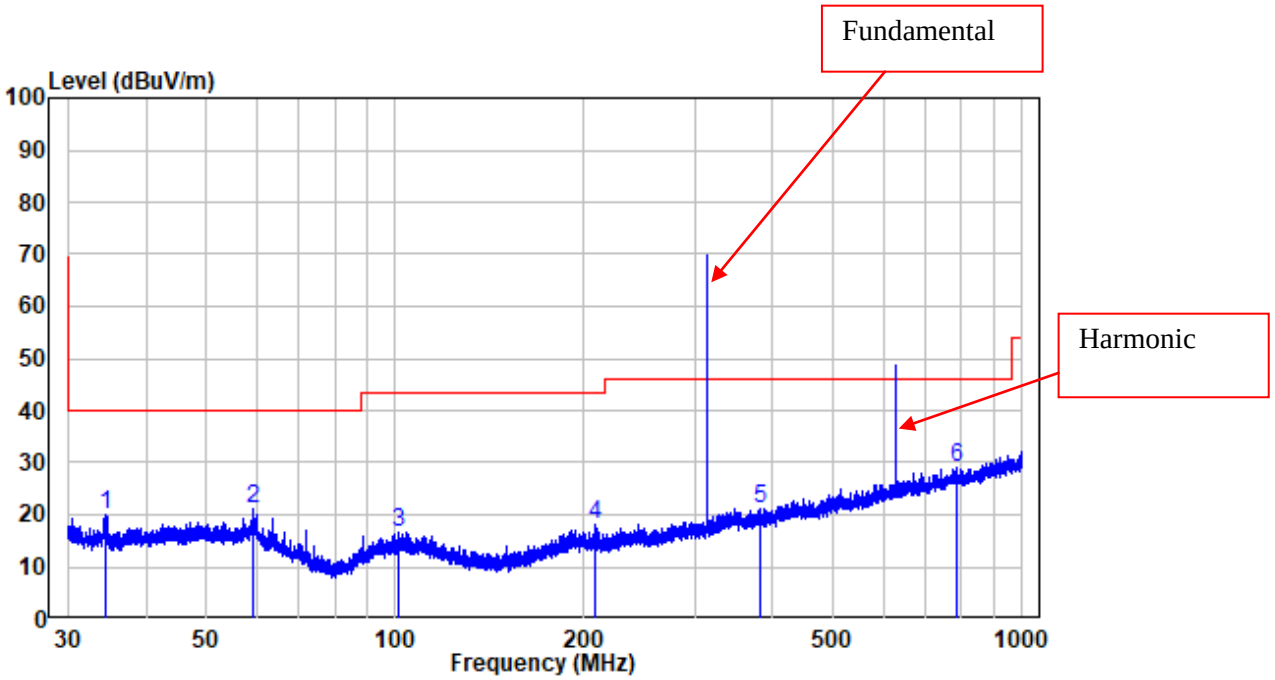
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230509-25078E-RF
Test Mode: 315MHz TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	39.213	-10.53	28.41	17.88	40.00	-22.12	Peak
2	54.475	-10.32	27.87	17.55	40.00	-22.45	Peak
3	102.315	-11.60	28.35	16.75	43.50	-26.75	Peak
4	201.570	-11.54	28.28	16.74	43.50	-26.76	Peak
5	412.547	-6.28	28.80	22.52	46.00	-23.48	Peak
6	835.512	0.21	30.29	30.50	46.00	-15.50	Peak

Vertical

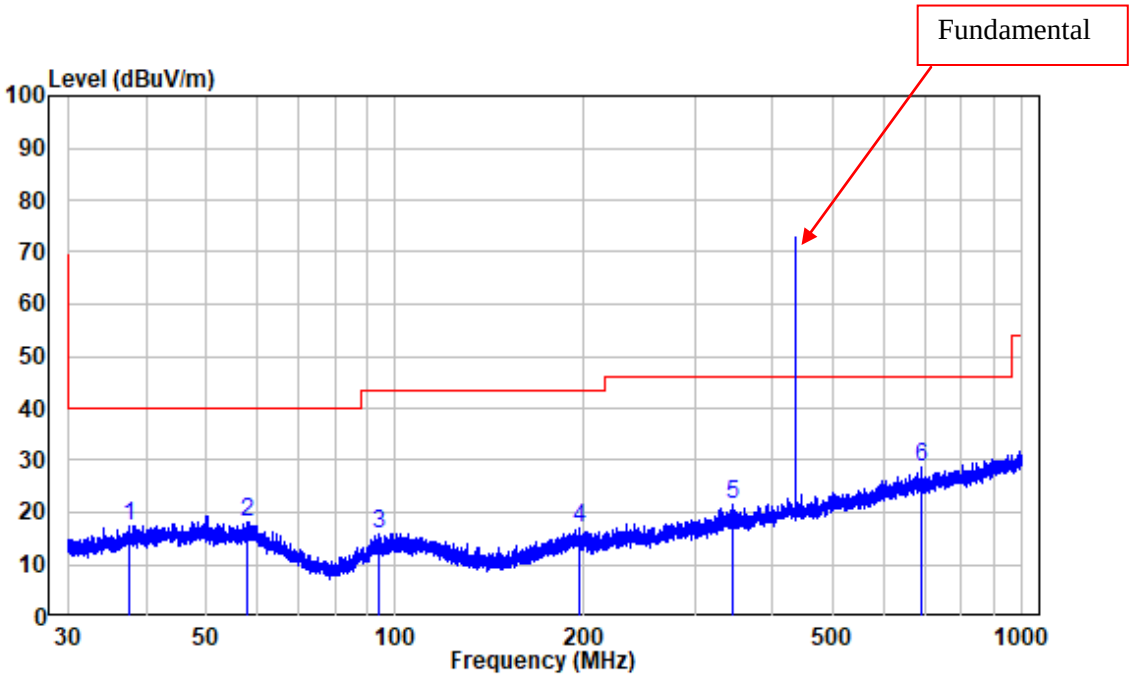


Site : chamber
Condition: 3m VERTICAL
Job No. : RA230509-25078E-RF
Test Mode: 315MHz TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.442	-11.72	31.70	19.98	40.00	-20.02	Peak
2	59.388	-10.40	31.41	21.01	40.00	-18.99	Peak
3	101.200	-11.66	28.16	16.50	43.50	-27.00	Peak
4	208.032	-11.85	29.97	18.12	43.50	-25.38	Peak
5	381.416	-7.11	28.26	21.15	46.00	-24.85	Peak
6	784.406	-0.01	28.97	28.96	46.00	-17.04	Peak

FSK (433.92MHz)

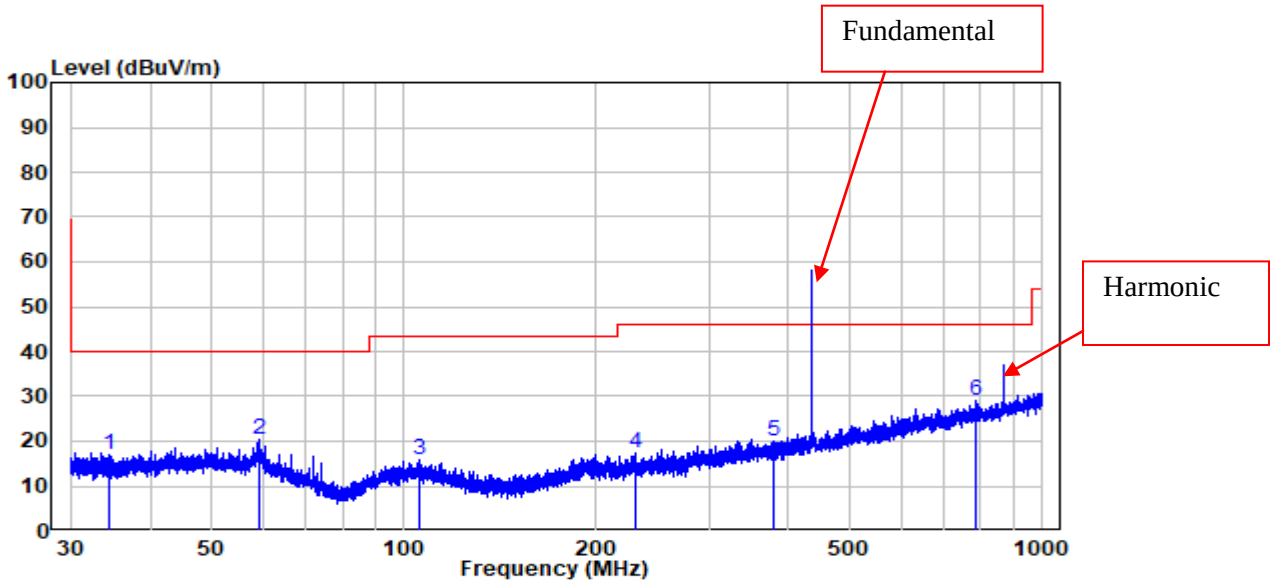
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230509-25078E-RF
Test Mode: 433.92MHz TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	37.614	-10.89	28.41	17.52	40.00	-22.48	Peak
2	58.127	-9.95	28.04	18.09	40.00	-21.91	Peak
3	94.346	-12.62	28.62	16.00	43.50	-27.50	Peak
4	196.252	-11.57	28.57	17.00	43.50	-26.50	Peak
5	345.292	-7.23	28.71	21.48	46.00	-24.52	Peak
6	691.077	-1.51	30.07	28.56	46.00	-17.44	Peak

Vertical

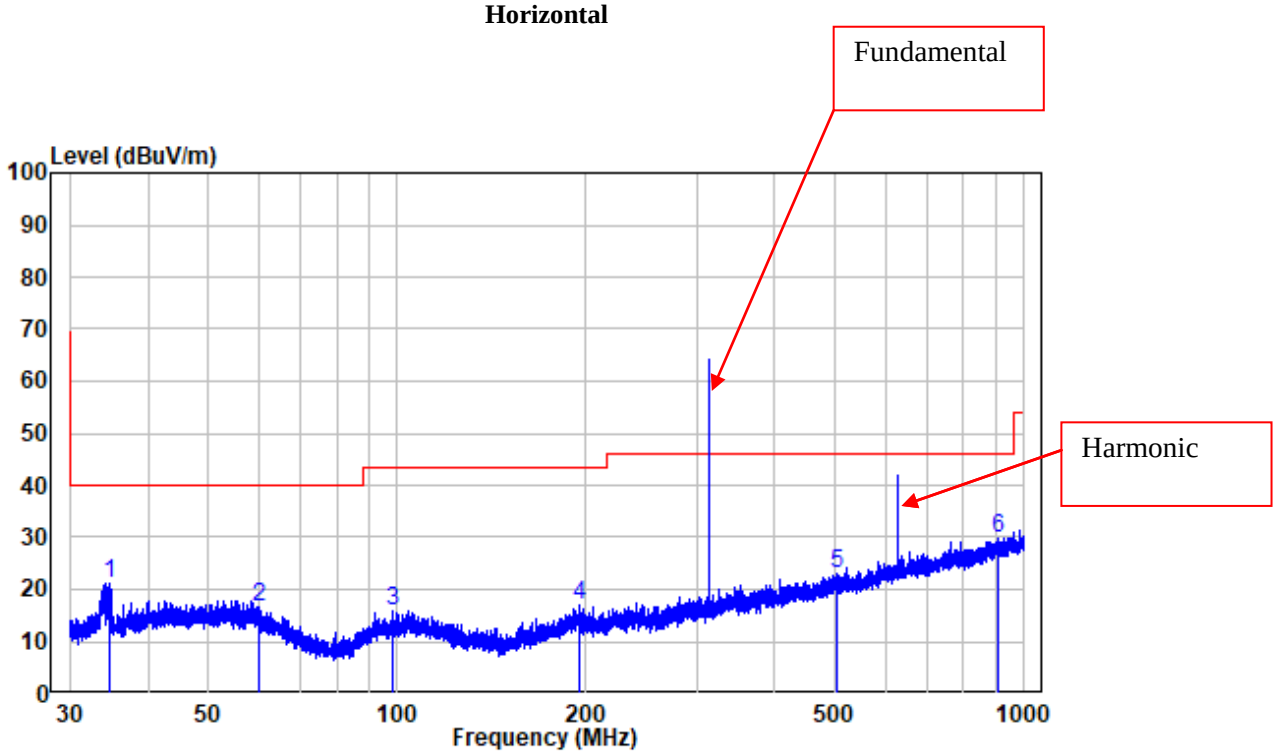


Site : chamber
Condition: 3m VERTICAL
Job No. : RA230509-25078E-RF
Test Mode: 433.92MHz TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.442	-11.72	28.61	16.89	40.00	-23.11	Peak
2	59.414	-10.41	30.80	20.39	40.00	-19.61	Peak
3	105.318	-11.86	27.75	15.89	43.50	-27.61	Peak
4	230.199	-11.10	28.27	17.17	46.00	-28.83	Peak
5	379.082	-7.17	27.36	20.19	46.00	-25.81	Peak
6	787.161	-0.07	29.15	29.08	46.00	-16.92	Peak

ASK (315MHz)

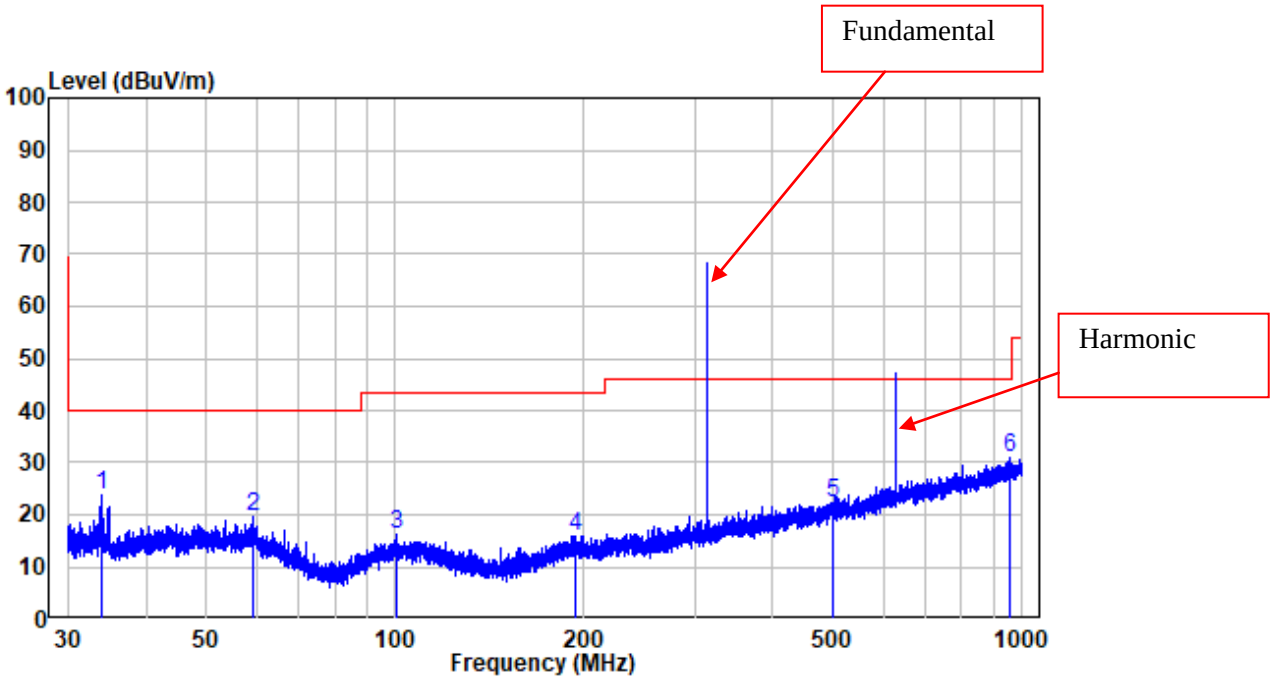
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230509-25078E-RF
Test Mode: 315MHz TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.821	-11.59	32.86	21.27	40.00	-18.73	Peak
2	60.016	-10.63	27.09	16.46	40.00	-23.54	Peak
3	98.400	-12.16	27.97	15.81	43.50	-27.69	Peak
4	195.650	-11.53	28.50	16.97	43.50	-26.53	Peak
5	501.179	-4.25	27.33	23.08	46.00	-22.92	Peak
6	910.066	1.65	28.15	29.80	46.00	-16.20	Peak

Vertical

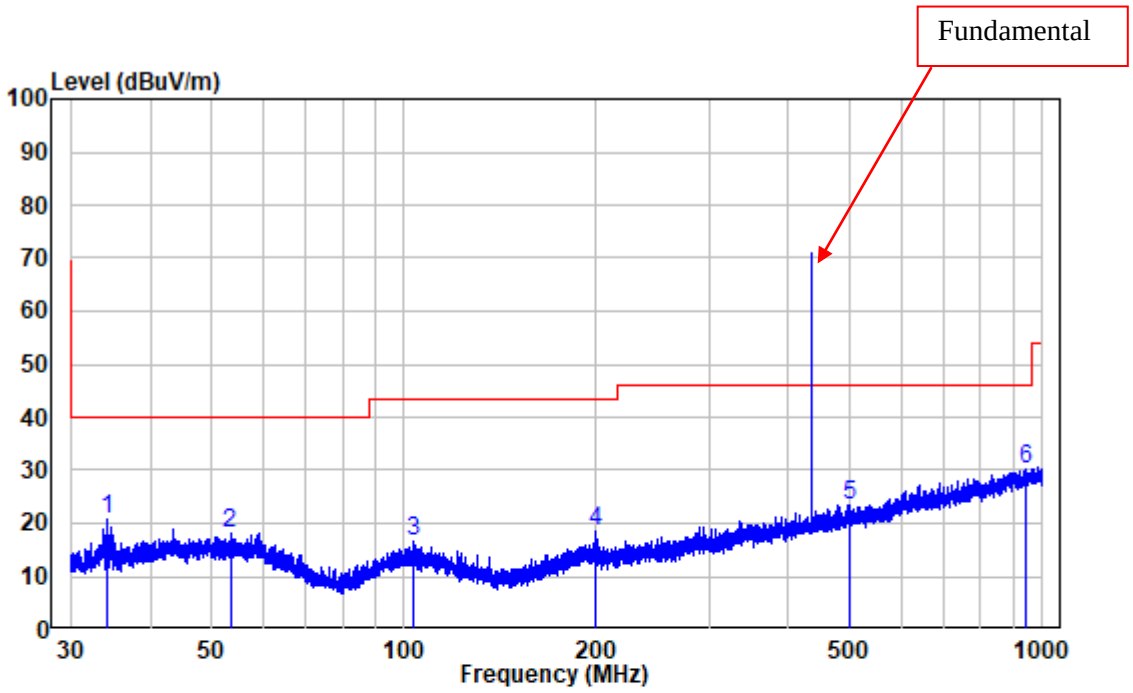


Site : chamber
Condition: 3m VERTICAL
Job No. : RA230509-25078E-RF
Test Mode: 315MHz TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.111	-11.82	35.64	23.82	40.00	-16.18	Peak
2	59.388	-10.40	29.88	19.48	40.00	-20.52	Peak
3	100.185	-11.78	27.95	16.17	43.50	-27.33	Peak
4	193.264	-11.29	27.28	15.99	43.50	-27.51	Peak
5	500.301	-4.25	26.50	22.25	46.00	-23.75	Peak
6	953.347	2.09	28.78	30.87	46.00	-15.13	Peak

ASK (433.92MHz)

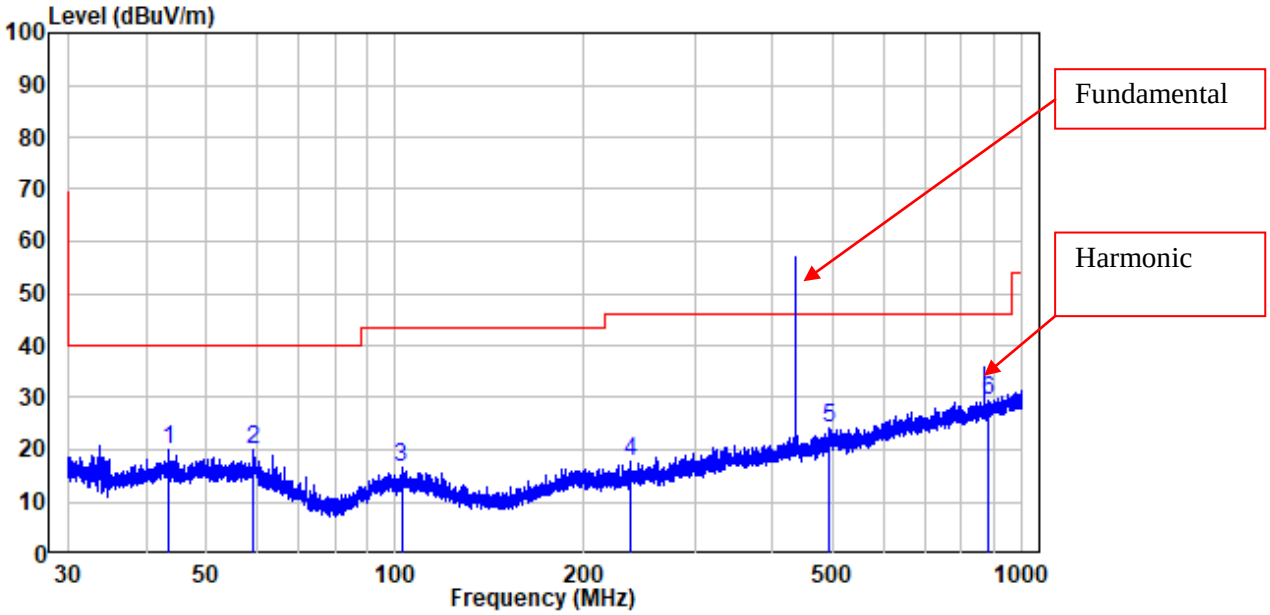
Horizontal



Site : chamber
Condition: 3m HORIZONTAL
Job No. : RA230509-25078E-RF
Test Mode: 433.92MHz TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	34.201	-11.79	32.36	20.57	40.00	-19.43	Peak
2	53.388	-10.24	28.35	18.11	40.00	-21.89	Peak
3	103.170	-11.67	28.26	16.59	43.50	-26.91	Peak
4	199.898	-11.41	30.06	18.65	43.50	-24.85	Peak
5	500.082	-4.25	27.68	23.43	46.00	-22.57	Peak
6	943.784	1.85	28.34	30.19	46.00	-15.81	Peak

Vertical



Site : chamber
Condition: 3m VERTICAL
Job No. : RA230509-25078E-RF
Test Mode: 433.92MHz TX

	Freq	Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
1	43.582	-9.92	30.03	20.11	40.00	-19.89	Peak
2	59.467	-10.43	30.59	20.16	40.00	-19.84	Peak
3	102.270	-11.60	28.24	16.64	43.50	-26.86	Peak
4	236.852	-10.93	28.74	17.81	46.00	-28.19	Peak
5	491.606	-4.61	28.88	24.27	46.00	-21.73	Peak
6	882.567	1.15	28.26	29.41	46.00	-16.59	Peak

Fundamental:

Frequency (MHz)	Receiver		Turn-Table	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.231	
	Reading (dBμV)	PK/QP/Ave.	Angle Degree	Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
FSK(315MHz)									
315	74.68	PK	220	1.7	H	-8.72	65.96	95.62	-29.66
315	78.49	PK	174	2.1	V	-8.72	**69.77**	95.62	-25.85
FSK(433.92MHz)									
433.92	78.66	PK	220	1.7	H	-5.72	**72.94**	92.87	-19.93
433.92	63.87	PK	174	2.1	V	-5.72	58.15	92.87	-34.72
ASK(315MHz)									
315	72.93	PK	220	1.7	H	-8.72	64.21	95.62	-31.41
315	76.95	PK	174	2.1	V	-8.72	68.23	95.62	-27.39
ASK(433.92MHz)									
433.92	68.94	PK	220	1.7	H	-5.72	63.22	100.83	-37.61
433.92	54.79	PK	174	2.1	V	-5.72	49.07	100.83	-51.76

Harmonic and 1-5GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.231	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
FSK(315MHz)									
630	45.37	PK	287	1.8	H	-2.07	43.3	75.62	-32.32
630	50.76	PK	319	1.8	V	-2.07	48.69	75.62	-26.93
1260	58.88	PK	131	1.7	H	-14.41	44.47	75.62	-31.15
1260	58.46	PK	225	1.5	V	-14.41	44.05	75.62	-31.57
1575	62.61	PK	131	1.7	H	-13.8	48.81	74	-25.19
1575	65.06	PK	225	1.5	V	-13.8	51.26	74	-22.74
1890	75.51	PK	265	1.4	H	-13.33	62.18	75.62	-13.44
1890	74.51	PK	19	2.1	V	-13.33	61.18	75.62	-14.44
2205	64.33	PK	247	1.5	H	-10.71	53.62	74	-20.38
2205	57.67	PK	135	1.3	V	-10.71	46.96	74	-27.04
2520	75.97	PK	247	1.5	H	-10.51	65.46	75.62	-10.16
2520	78.83	PK	135	1.3	V	-10.51	68.32	75.62	-7.3
3150	63.18	PK	310	1.4	H	-10.26	52.92	75.62	-22.7
3150	60.59	PK	304	1.5	V	-10.26	50.33	75.62	-25.29
FSK(433.92MHz)									
867.84	29	PK	287	1.8	H	0.86	29.86	72.87	-43.01
867.84	35.98	PK	319	1.8	V	0.86	36.84	72.87	-36.03
1301.76	58.96	PK	102	2.1	H	-13.98	44.98	74	-29.02
1301.76	60.17	PK	61	1.0	V	-13.98	46.19	74	-27.81
1735.68	75.99	PK	95	1.4	V	-13.42	62.57	74	-11.43
2169.6	64.97	PK	102	2.1	H	-11.27	53.7	74	-20.3
2603.52	67.91	PK	249	1.9	H	-10.5	57.41	74	-16.59
2603.52	62.48	PK	280	1.6	V	-10.5	51.98	74	-22.02
3471.36	68.17	PK	76	1.9	H	-9.56	58.61	74	-15.39
3471.36	65.42	PK	131	1.7	V	-9.56	55.86	74	-18.14
3905.28	67.14	PK	225	1.5	H	-8.75	58.39	74	-15.61
3905.28	67.85	PK	265	1.4	V	-8.75	59.1	74	-14.9

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.231	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
ASK(315MHz)									
630	44.22	PK	90	1.5	H	-2.07	42.15	75.62	-33.47
630	49.42	PK	335	1.1	V	-2.07	47.35	75.62	-28.27
1260	58.88	PK	269	2.1	H	-14.41	44.47	75.62	-31.15
1260	60.46	PK	205	1.9	V	-14.41	46.05	75.62	-29.57
1575	60.61	PK	269	2.1	H	-13.8	46.81	74	-27.19
1575	66.06	PK	205	1.9	V	-13.8	52.26	74	-21.74
1890	70.51	PK	20	1.9	H	-13.33	57.18	75.62	-18.44
1890	73.51	PK	211	1.8	V	-13.33	60.18	75.62	-15.44
2205	62.33	PK	47	1.8	H	-10.71	51.62	74	-22.38
2205	59.67	PK	252	1.4	V	-10.71	48.96	74	-25.04
2520	71.97	PK	47	1.8	H	-10.51	61.46	75.62	-14.16
2520	71.83	PK	252	1.4	V	-10.51	61.32	75.62	-14.3
3150	63.18	PK	271	1.5	H	-10.26	52.92	75.62	-22.7
3150	62.59	PK	189	1.7	V	-10.26	52.33	75.62	-23.29
ASK(433.92MHz)									
867.84	19.77	PK	114	1.3	H	0.86	20.63	80.83	-60.2
867.84	26.84	PK	43	1.6	V	0.86	27.7	80.83	-53.13
1301.76	60.96	PK	248	1.2	H	-13.98	46.98	74	-27.02
1301.76	61.17	PK	208	2.0	V	-13.98	47.19	74	-26.81
1735.68	77.99	PK	180	1.2	V	-13.42	64.57	74	-9.43
2169.6	64.67	PK	248	1.2	H	-11.27	53.4	74	-20.6
2603.52	67.01	PK	20	1.4	H	-10.5	56.51	74	-17.49
2603.52	63.28	PK	313	1.5	V	-10.5	52.78	74	-21.22
3471.36	67.67	PK	205	2.1	H	-9.56	58.11	74	-15.89
3471.36	66.62	PK	269	2.1	V	-9.56	57.06	74	-16.94
3905.28	66.74	PK	205	1.9	H	-8.75	57.99	74	-16.01
3905.28	66.75	PK	20	1.9	V	-8.75	58	74	-16

Field Strength of Average							
Frequency (MHz)	Peak Measurement @3m (dBµV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Corrected Ampitude (dBµV/m)	Part 15.231		
					Limit (dBµV/m)	Margin (dB)	Comment
FSK(315MHz)							
315	65.96	H	-22.13	43.83	75.62	-31.79	Fundamental
315	69.77	V	-22.13	47.64	75.62	-27.98	Fundamental
630	43.3	H	-22.13	21.17	55.62	-34.45	Harmonic
630	48.69	V	-22.13	26.56	55.62	-29.06	Harmonic
1260	44.47	H	-22.13	22.34	55.62	-33.28	Harmonic
1260	44.05	V	-22.13	21.92	55.62	-33.70	Harmonic
1575	48.81	H	-22.13	26.68	54	-27.32	Harmonic
1575	51.26	V	-22.13	29.13	54	-24.87	Harmonic
1890	62.18	H	-22.13	40.05	55.62	-15.57	Harmonic
1890	61.18	V	-22.13	39.05	55.62	-16.57	Harmonic
2205	53.62	H	-22.13	31.49	54	-22.51	Harmonic
2205	46.96	V	-22.13	24.83	54	-29.17	Harmonic
2520	65.46	H	-22.13	43.33	55.62	-12.29	Harmonic
2520	68.32	V	-22.13	46.19	55.62	-9.43	Harmonic
3150	52.92	H	-22.13	30.79	55.62	-24.83	Harmonic
3150	50.33	V	-22.13	28.20	55.62	-27.42	Harmonic
FSK(433.92MHz)							
433.92	72.94	H	-22.13	50.81	72.87	-22.06	Fundamental
433.92	58.15	V	-22.13	36.02	72.87	-36.85	Fundamental
867.84	29.86	H	-22.13	7.73	52.87	-45.14	Harmonic
867.84	36.84	V	-22.13	14.71	52.87	-38.16	Harmonic
1301.76	44.98	H	-22.13	22.85	54	-31.15	Harmonic
1301.76	46.19	V	-22.13	24.06	54	-29.94	Harmonic
1735.68	62.57	V	-22.13	40.44	54	-13.56	Harmonic
2169.6	53.7	H	-22.13	31.57	54	-22.43	Harmonic
2603.52	57.41	H	-22.13	35.28	54	-18.72	Harmonic
2603.52	51.98	V	-22.13	29.85	54	-24.15	Harmonic
3471.36	58.61	H	-22.13	36.48	54	-17.52	Harmonic
3471.36	55.86	V	-22.13	33.73	54	-20.27	Harmonic
3905.28	58.39	H	-22.13	36.26	54	-17.74	Harmonic
3905.28	59.1	V	-22.13	36.97	54	-17.03	Harmonic

Field Strength of Average							
Frequency (MHz)	Peak Measurement @3m (dBμV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Corrected Ampitude (dBμV/m)	Part 15.231		
					Limit (dBμV/m)	Margin (dB)	Comment
ASK(315MHz)							
315	64.21	H	-10.93	53.28	75.62	-22.34	Fundamental
315	68.23	V	-10.93	57.3	75.62	-18.32	Fundamental
630	42.15	H	-10.93	31.22	55.62	-24.4	Harmonic
630	47.35	V	-10.93	36.42	55.62	-19.2	Harmonic
1260	44.47	H	-10.93	33.54	55.62	-22.08	Harmonic
1260	46.05	V	-10.93	35.12	55.62	-20.5	Harmonic
1575	46.81	H	-10.93	35.88	54	-18.12	Harmonic
1575	52.26	V	-10.93	41.33	54	-12.67	Harmonic
1890	57.18	H	-10.93	46.25	55.62	-9.37	Harmonic
1890	60.18	V	-10.93	49.25	55.62	-6.37	Harmonic
2205	51.62	H	-10.93	40.69	54	-13.31	Harmonic
2205	48.96	V	-10.93	38.03	54	-15.97	Harmonic
2520	61.46	H	-10.93	50.53	55.62	-5.09	Harmonic
2520	61.32	V	-10.93	50.39	55.62	-5.23	Harmonic
3150	52.92	H	-10.93	41.99	55.62	-13.63	Harmonic
3150	52.33	V	-10.93	41.4	55.62	-14.22	Harmonic
ASK(433.92MHz)							
433.92	63.22	H	-10.93	52.29	80.83	-28.54	Fundamental
433.92	49.07	V	-10.93	38.14	80.83	-42.69	Fundamental
867.84	20.63	H	-10.93	9.7	60.83	-51.13	Harmonic
867.84	27.7	V	-10.93	16.77	60.83	-44.06	Harmonic
1301.76	46.98	H	-10.93	36.05	54	-17.95	Harmonic
1301.76	47.19	V	-10.93	36.26	54	-17.74	Harmonic
1735.68	64.57	V	-10.93	53.64	54	-0.36	Harmonic
2169.6	53.4	H	-10.93	42.47	54	-11.53	Harmonic
2603.52	56.51	H	-10.93	45.58	54	-8.42	Harmonic
2603.52	52.78	V	-10.93	41.85	54	-12.15	Harmonic
3471.36	58.11	H	-10.93	47.18	54	-6.82	Harmonic
3471.36	57.06	V	-10.93	46.13	54	-7.87	Harmonic
3905.28	57.99	H	-10.93	47.06	54	-6.94	Harmonic
3905.28	58	V	-10.93	47.07	54	-6.93	Harmonic

Note:
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Factor + Reading
Margin = Corrected Amplitude – Limit
Average=Peak + duty cycle factor
The other spurious emission which is 20dB below the limit or in the noise floor level was not recorded.
For 433.92MHz FSK modulation, the tight limit was used.

Duty cycle: FSK (315MHz):
Ton1 =7.826ms, N1=1; Tp = 100ms
Duty cycle = Ton/Tp =7.826*1/100=0.07826
Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.07826= -22.13

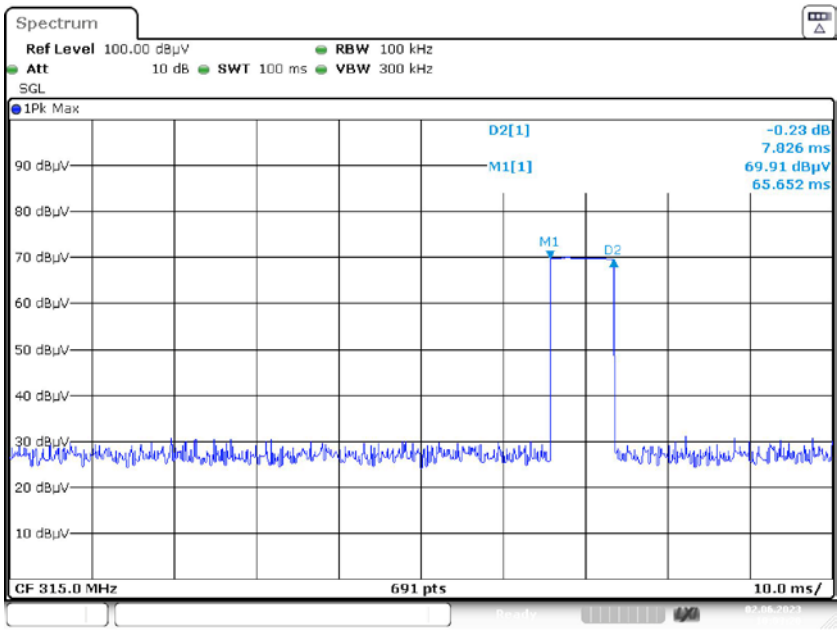
Duty cycle: FSK (433.92MHz):
Ton1 =7.826ms, N1=1; Tp = 100ms
Duty cycle = Ton/Tp =7.826*1/100=0.07826
Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.07826= -22.13

Duty cycle: ASK (315MHz):
Ton1 =28.406ms, N1=1; Tp = 100ms
Duty cycle = Ton/Tp =28.406*1/100=0.28406
Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.28406= -10.93

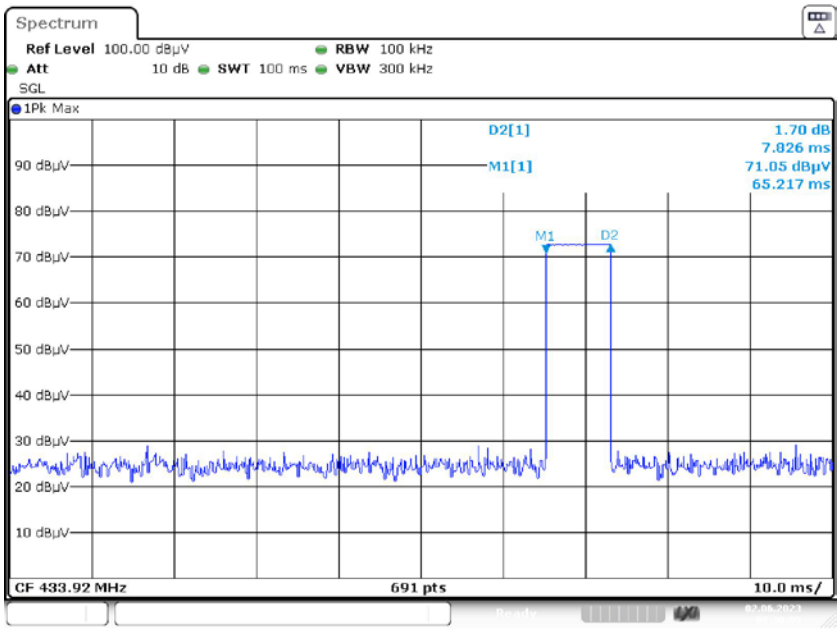
Duty cycle: ASK (433.92MHz):
Ton1 =28.406ms, N1=1; Tp = 100ms
Duty cycle = Ton/Tp =28.406*1/100=0.28406
Duty Cycle Corrected Factor = 20lg (Duty cycle) = 20lg0.28406= -10.93

Duty Cycle

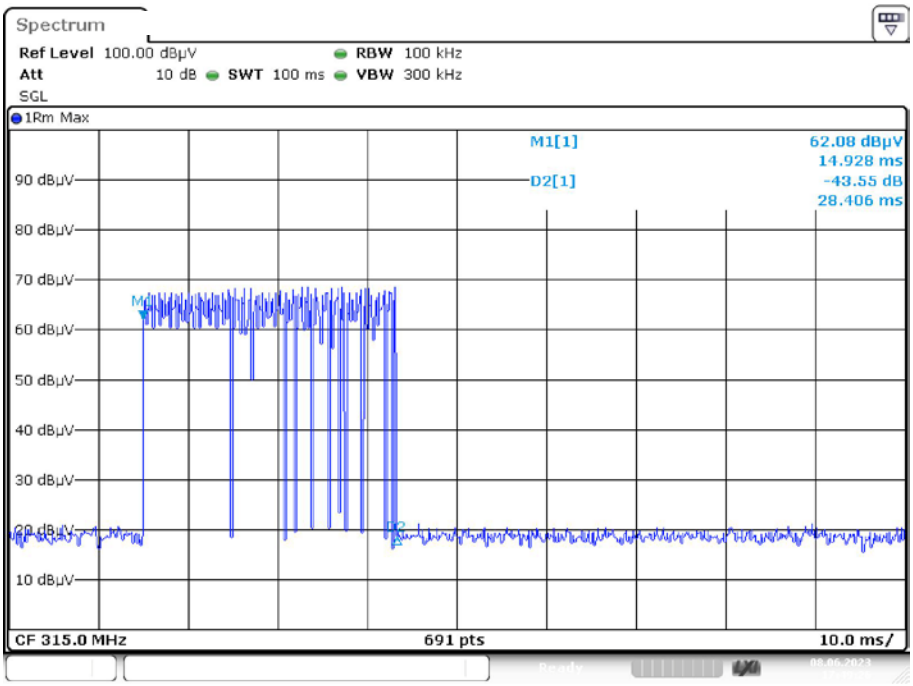
FSK (315MHz)



FSK (433.92MHz)



ASK (315MHz)



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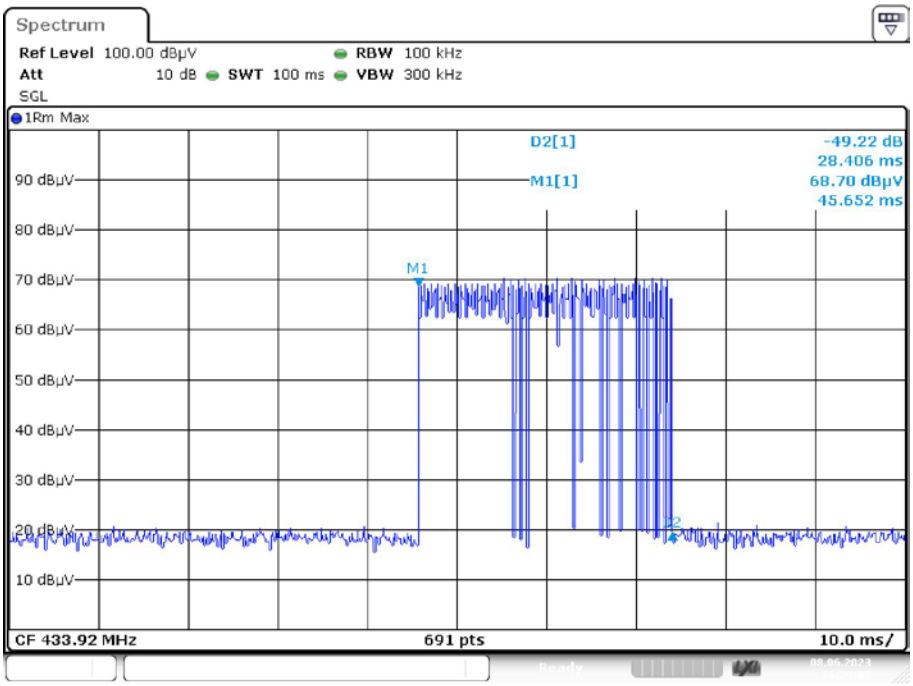
ASK (433.92MHz)



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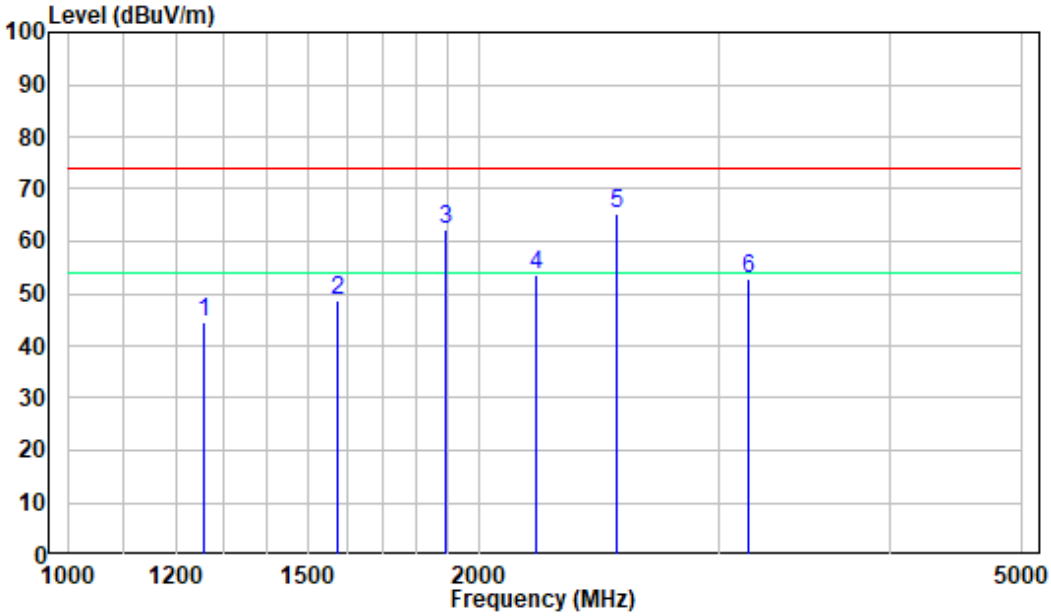
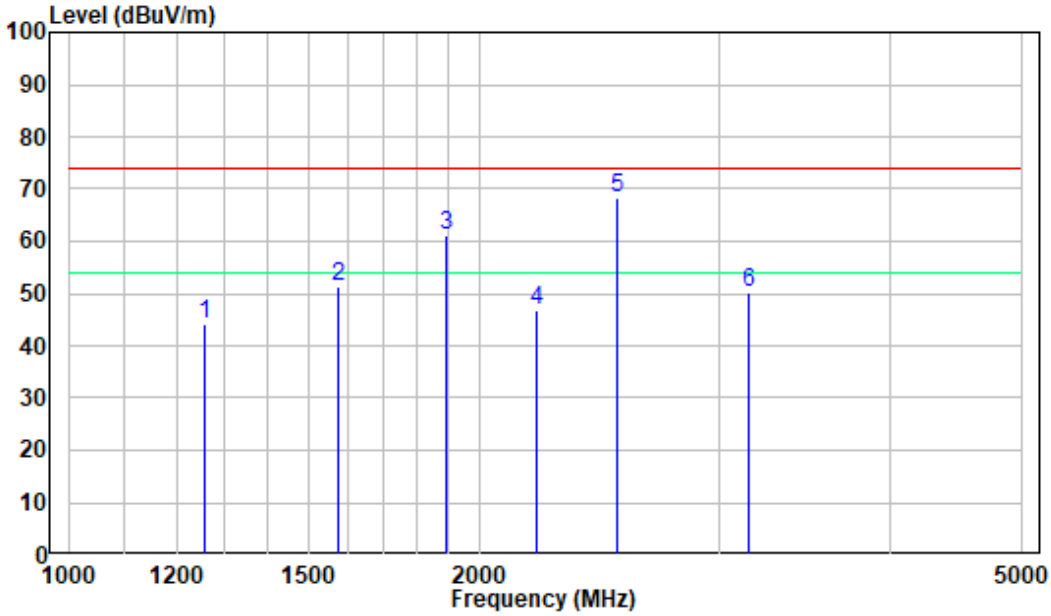
Above 1 GHz:

FSK (315 MHz)

Horizontal

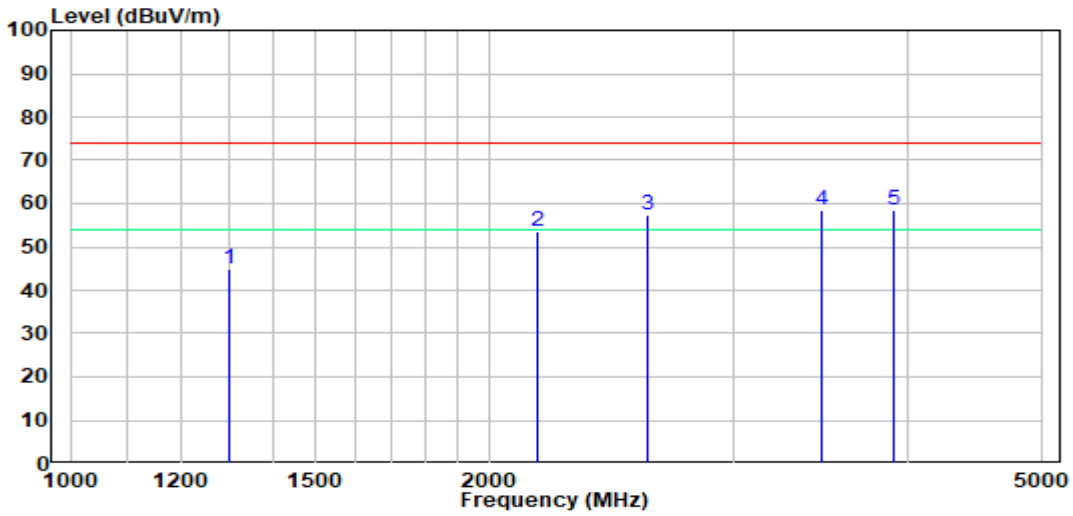


Vertical

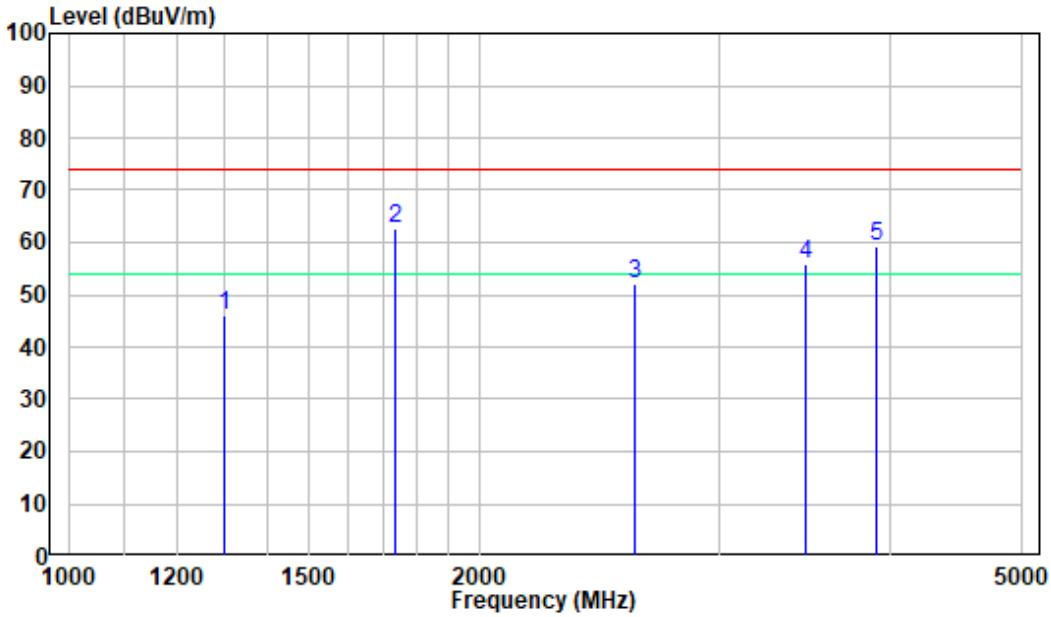


FSK (433.92 MHz)

Horizontal

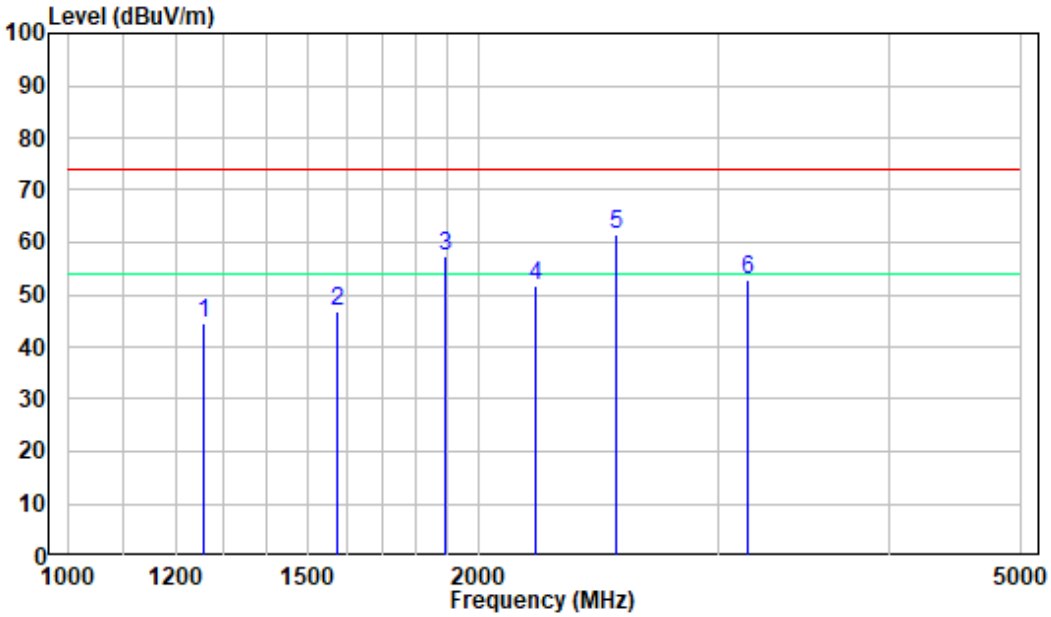


Vertical

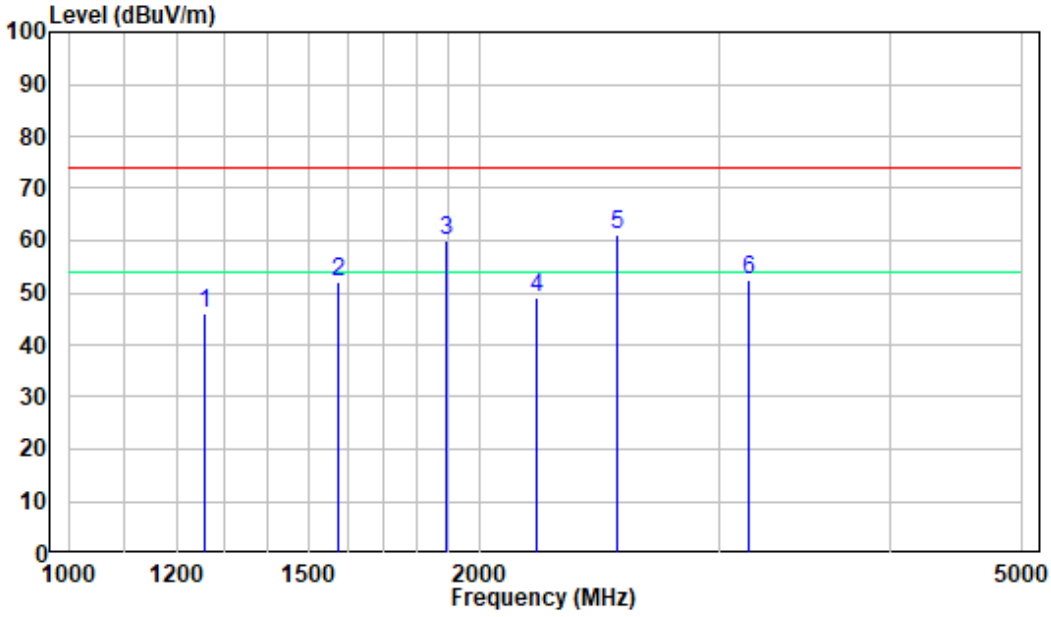


ASK (315 MHz)

Horizontal

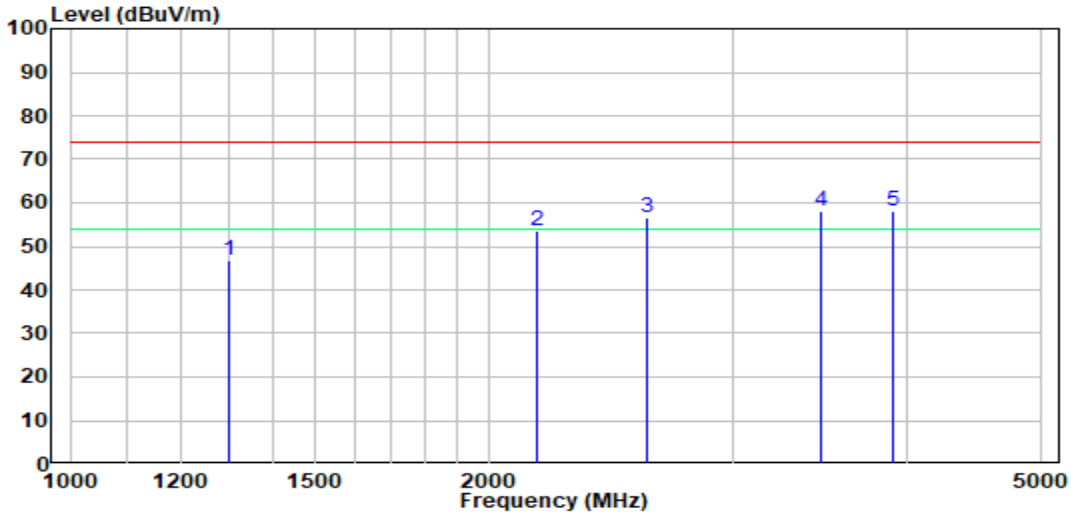


Vertical

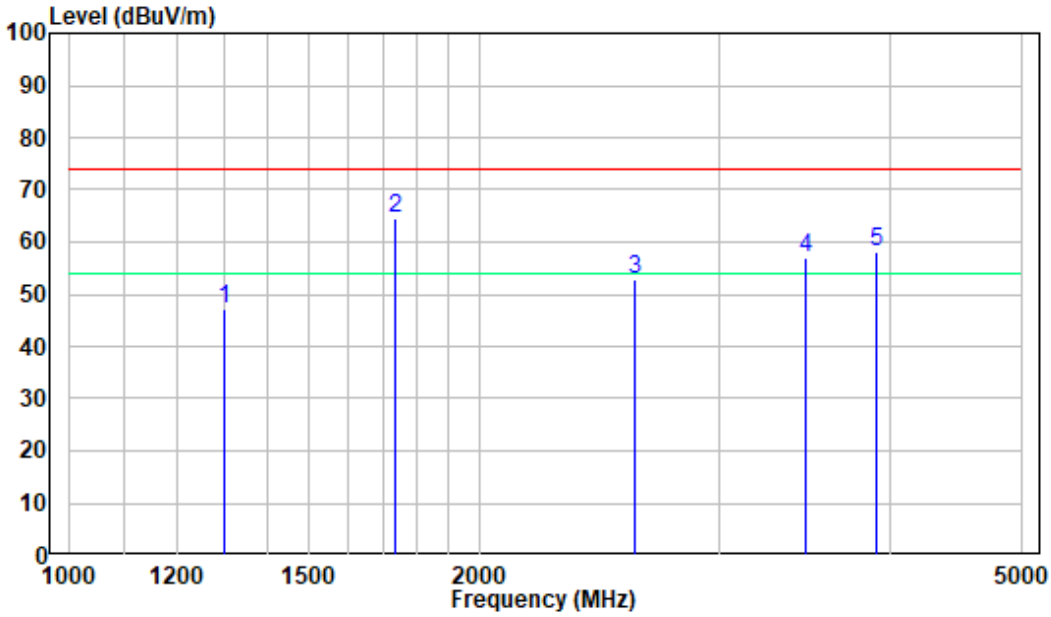


ASK (433.92 MHz)

Horizontal



Vertical



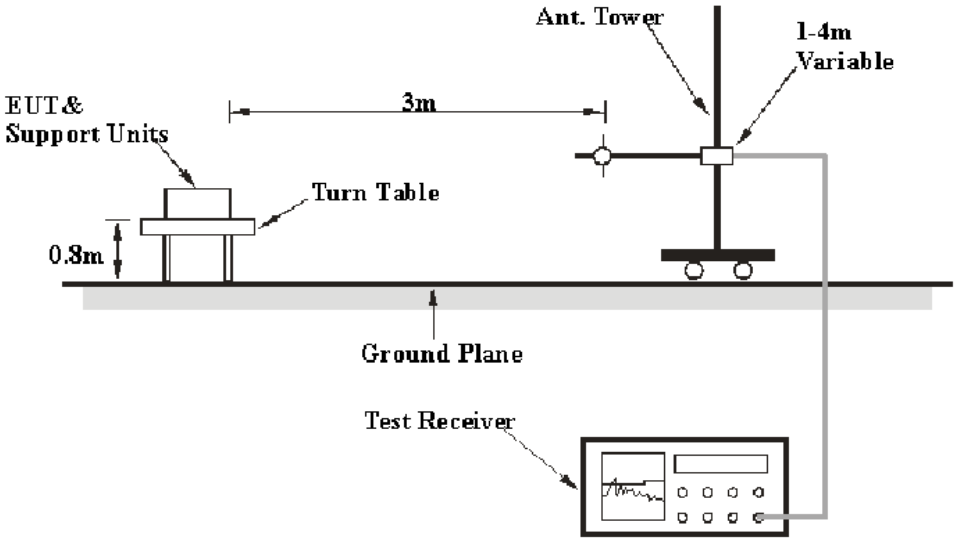
FCC §15.231(a) (1) - DEACTIVATION TESTING

Applicable Standard

Per FCC §15.231(a) (1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Procedure

1. Set center frequency of spectrum analyzer=operating frequency.
2. Set the spectrum analyzer as RBW=100kHz/ VBW=300kHz/ Span=0Hz.
3. Repeat above procedures until all frequency measured was complete.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	50-53 %
ATM Pressure:	101.0 kPa

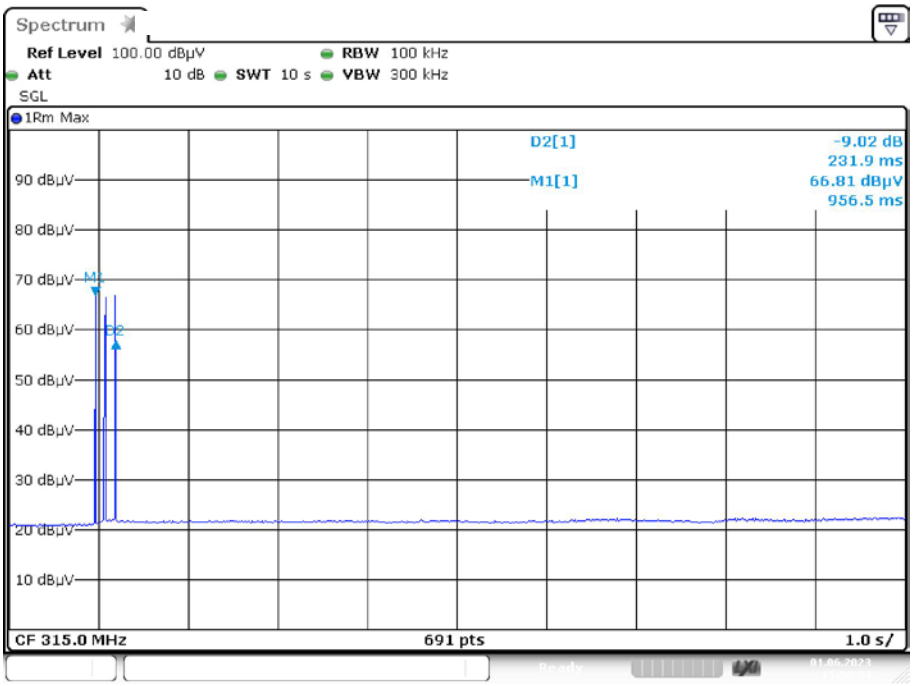
The testing was performed by Matt Liang on 2023-06-01 and 2023-06-08.

Test mode: Transmitting

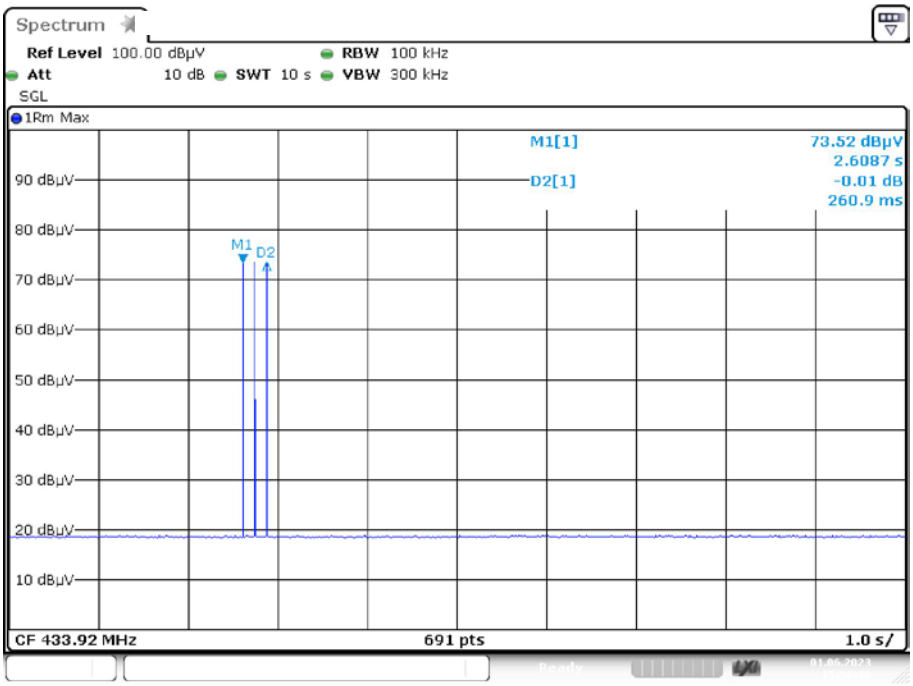
Test Result: Compliant. Please refer to following tables and plots.

This product will cease transmission within 5 seconds after activation. Please refer to following plots.

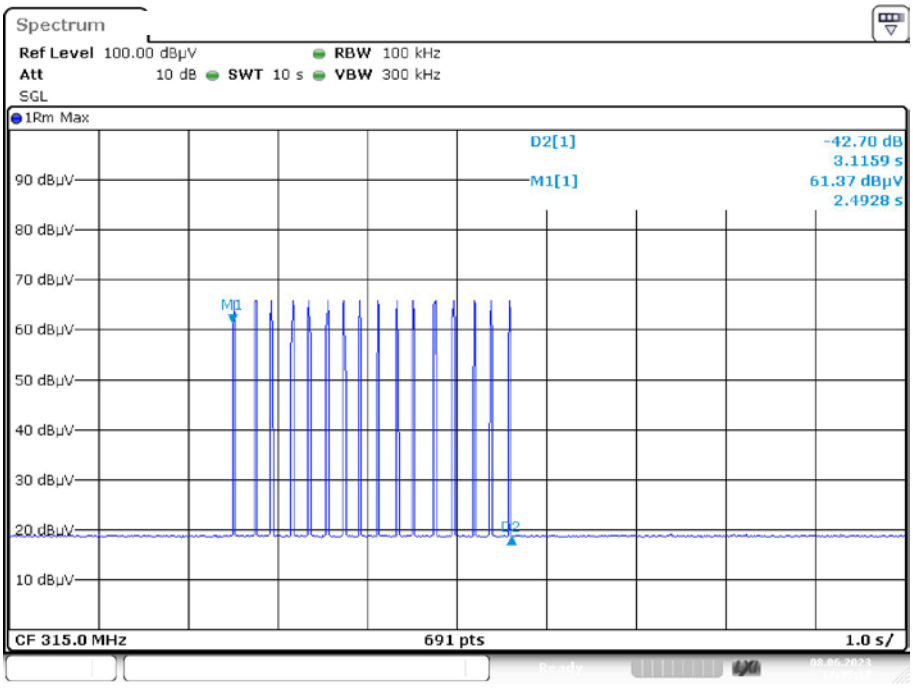
FSK(315 MHz)



FSK(433.92 MHz)

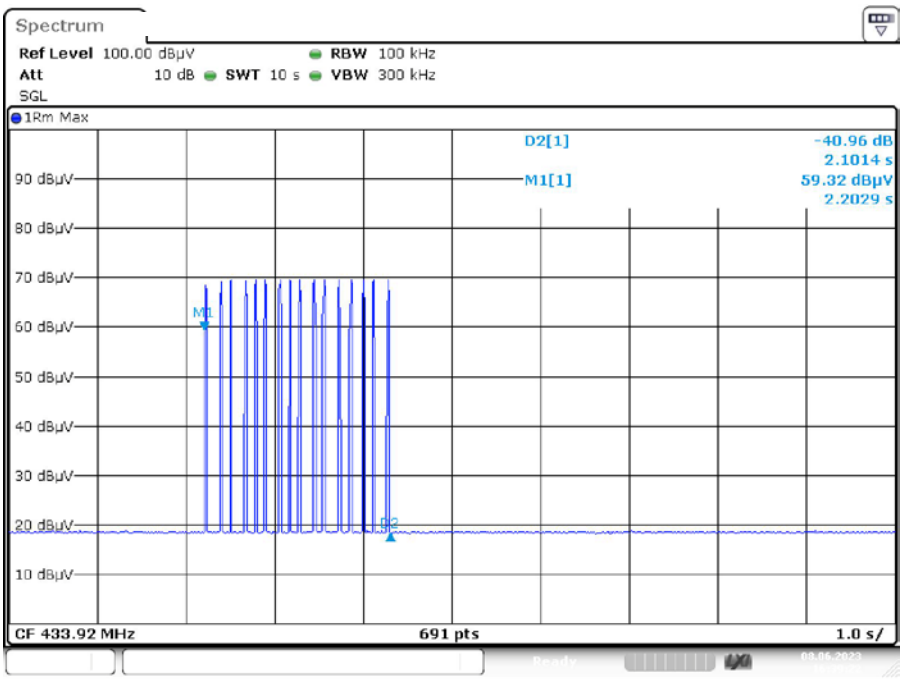


ASK(315 MHz)



Date: 8.JUN.2023 17:45:17

ASK(433.92 MHz)



Date: 8.JUN.2023 16:39:22

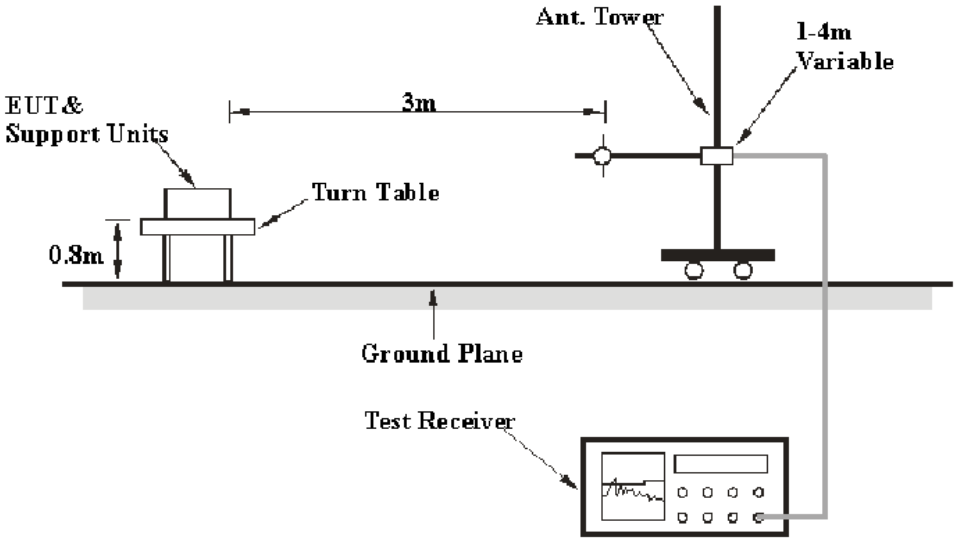
FCC §15.231(e) - DEACTIVATION TESTING

Applicable Standard

Per 15.231(e), devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Test Procedure

4. Set center frequency of spectrum analyzer=operating frequency.
5. Set the spectrum analyzer as RBW=100kHz/ VBW=300kHz/ Span=0Hz.
6. Repeat above procedures until all frequency measured was complete.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang on 2023-06-02.

Test mode: Transmitting

Test Result: Compliant. Please refer to following tables and plots.

Transmission period

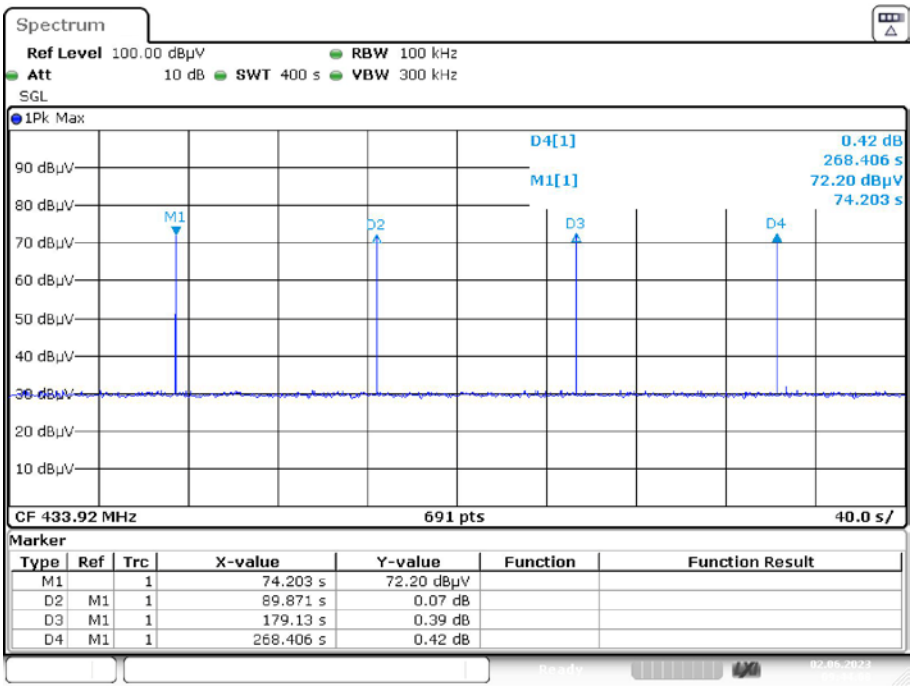
Test Mode	Frequency (MHz)	Transmission period (s)	Limit (s)	Result
FSK	433.92 MHz	0.007826	< 1	Pass

Silent period

Test Mode	Frequency (MHz)	Silent period (s)	Limit (s)	Result
FSK	433.92 MHz	89.871	>10	Pass

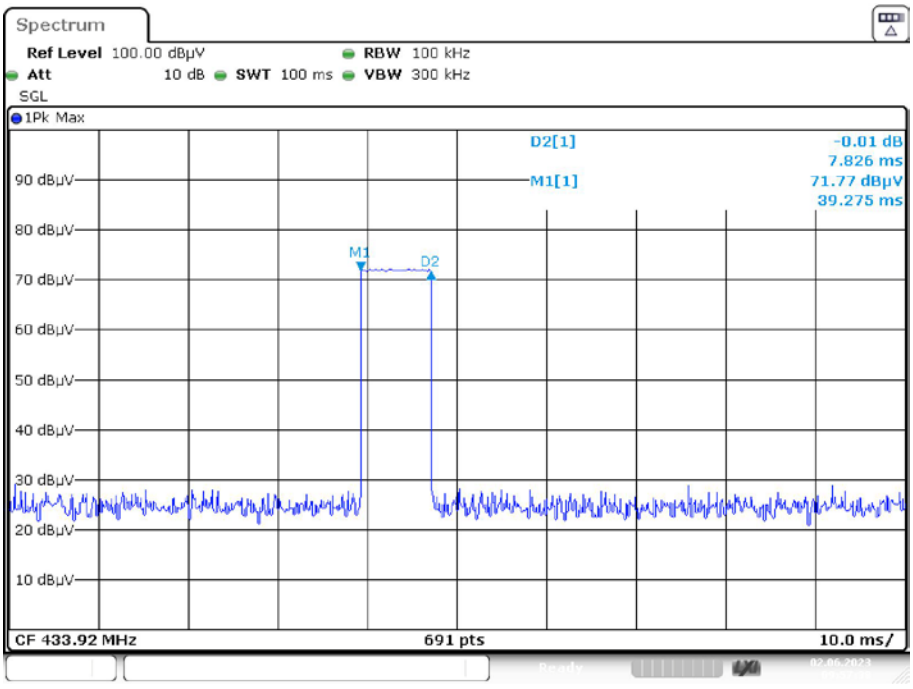
Note:
The silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

FSK (433.92 MHz)_Silent period



Date: 2.JUN.2023 09:44:08

FSK (433.92 MHz)_Duration time



Date: 2.JUN.2023 09:57:38

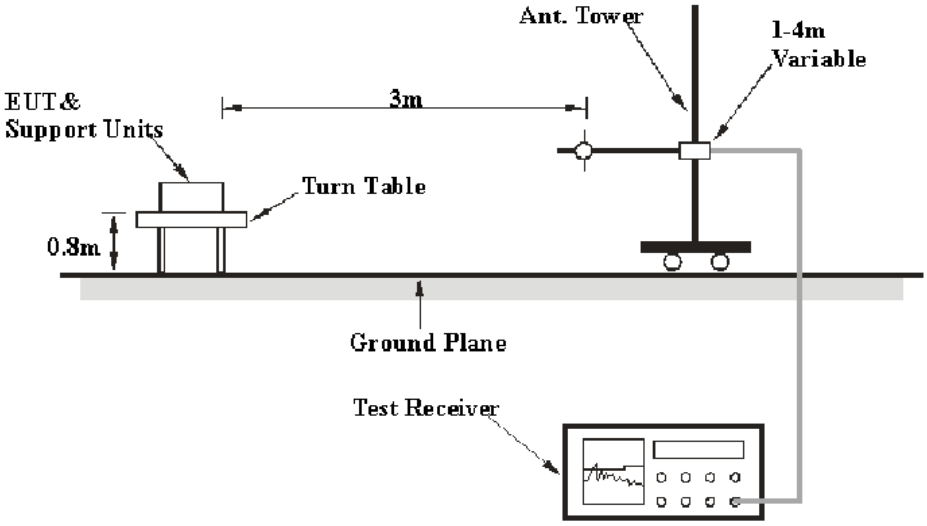
FCC §15.231(c) – 20 dB EMISSION BANDWIDTH TESTING

Applicable Standard

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Procedure

The EUT is setting to the transmit mode, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	46-50 %
ATM Pressure:	101.0 kPa

The testing was performed by Matt Liang on 2023-06-07 and 2023-06-08.

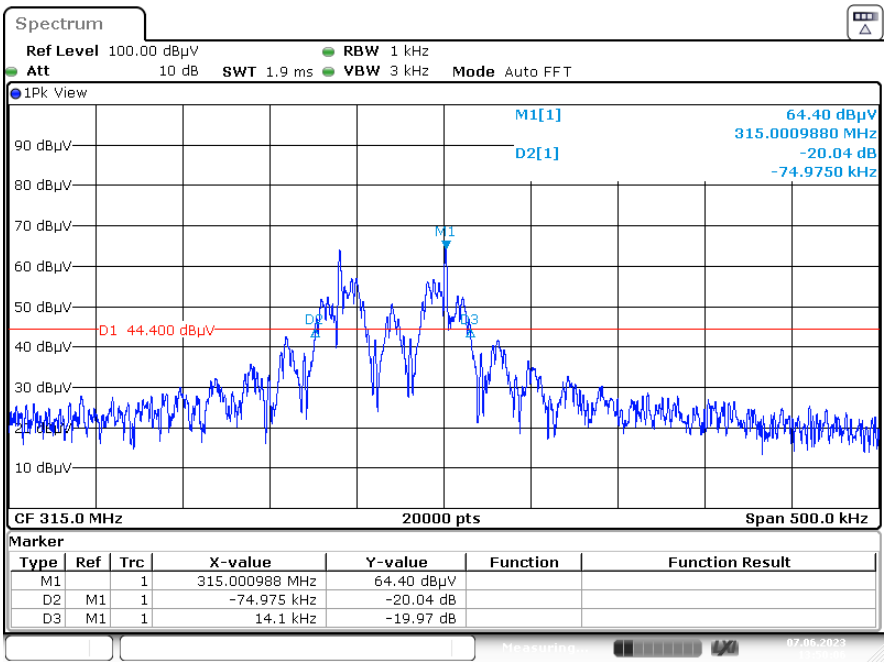
Test Mode: Transmitting

Test Result: Compliant. Please refer to following table and plots.

Test Mode	Frequency (MHz)	20 dB Emission Bandwidth (kHz)	Limit(kHz)	Result
FSK	315	89.075	<787.5	Pass
	433.92	144.825	<1084.8	Pass
ASK	315	34.675	<787.5	Pass
	433.92	52.1	<1084.8	Pass

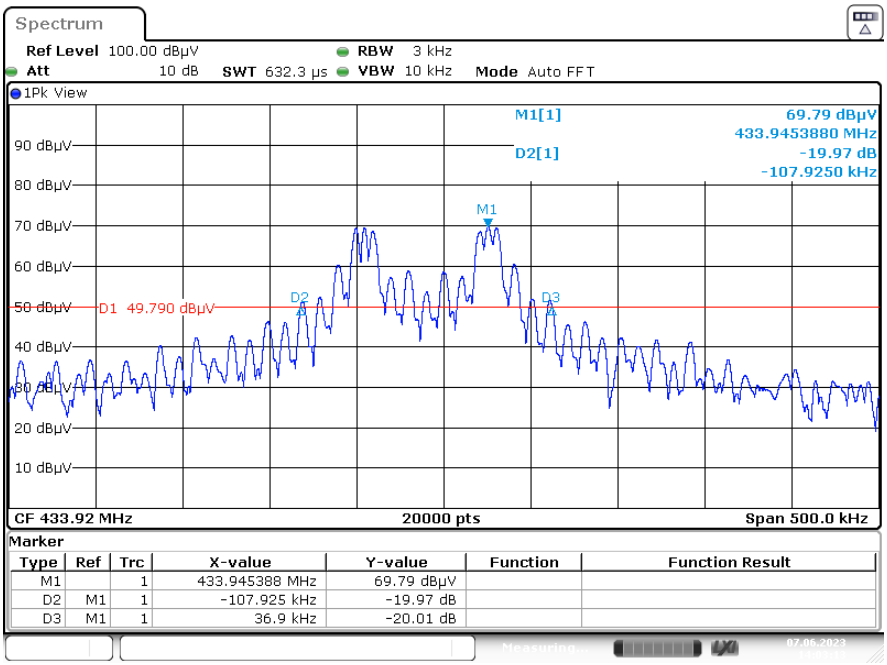
20 dB Emission Bandwidth

FSK(315 MHz)



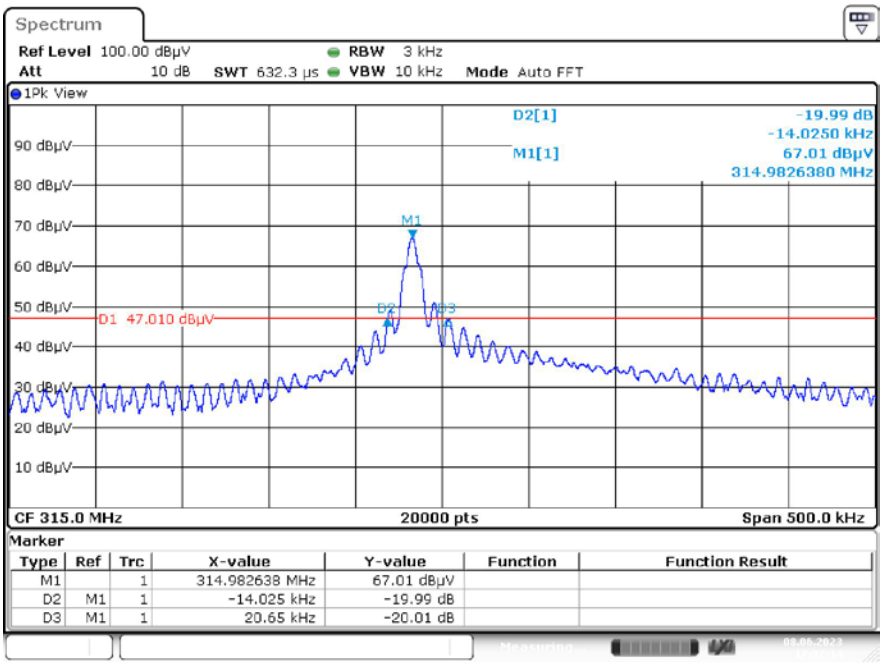
Date: 7.JUN.2023 13:50:07

FSK(433.92 MHz)



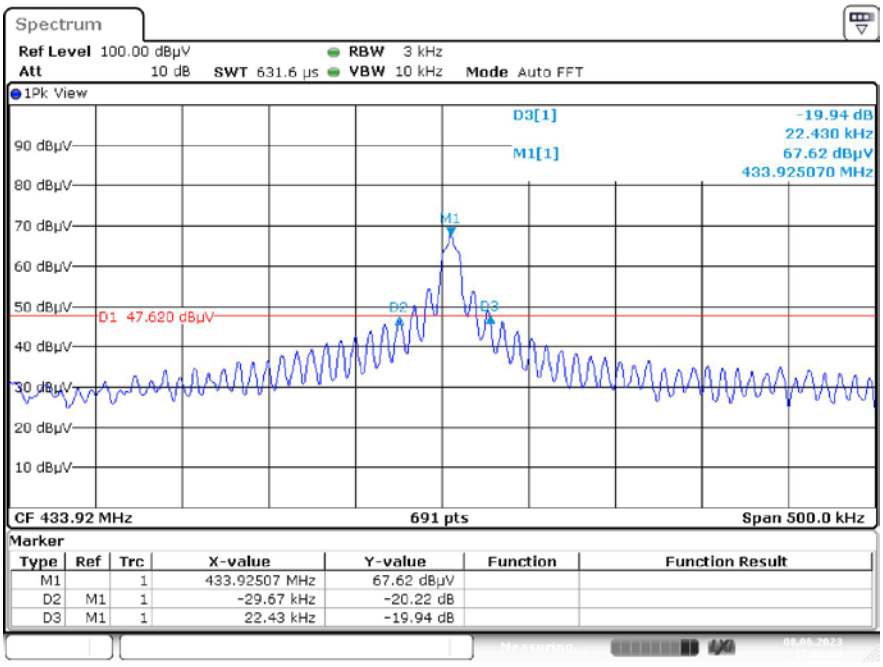
Date: 7.JUN.2023 14:03:13

ASK(315 MHz)



Date: 8.JUN.2023 17:32:14

ASK(433.92 MHz)



Date: 8.JUN.2023 17:07:03

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