

FCC Test Report

FCC ID : 2AJ4H-T812
Equipment : TPMS Sensor
Model No. : TPMS
Brand Name : TYC-TIY
Applicant : I YUAN PRECISION INDUSTRIAL CO., LTD.
Address : NO.24, Dinghu Rd., Guishan Dist., Taoyuan
City 33378, Taiwa(R.O.C.)
Standard : 47 CFR FCC Part 15.231
Received Date : Oct. 13, 2016
Tested Date : Mar. 31, 2017

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:


Along Chen / Assistant Manager

Approved by:


Gary Chang / Manager



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Release Record

Report No.	Version	Description	Issued Date
FR6O1301	Rev. 01	Initial issue	Oct. 13, 2017

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emissions	Note ¹	N/A
15.231(e)	Field Strength of Fundamental emissions	Meet the requirement of limit	Pass
15.231(b) 15.209	Unwanted Emissions	Meet the requirement of limit	Pass
15.231(a) 15.231(e)	Transmission and Deactivation Time	Meet the requirement of limit	Pass
15.231(c)	20dB bandwidth	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

N/A means Not Applicable.
Note¹: The EUT consumes DC power from battery, so the test is not required.

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	Modulation	Ch. Freq. (MHz)	Channel Number	Channel Bandwidth (kHz)
315	ASK	315	1	---
315	FSK	315	1	---

Note: The device supports below 3 modes:
 1) Rotating mode
 2) Stationary mode
 3) Alert mode

1.1.2 Antenna Details

Ant. No.	Type	Gain (dBi)	Connector
1	Monopole	---	---

1.1.3 EUT Operational Condition

Power Supply Type	3Vdc from battery
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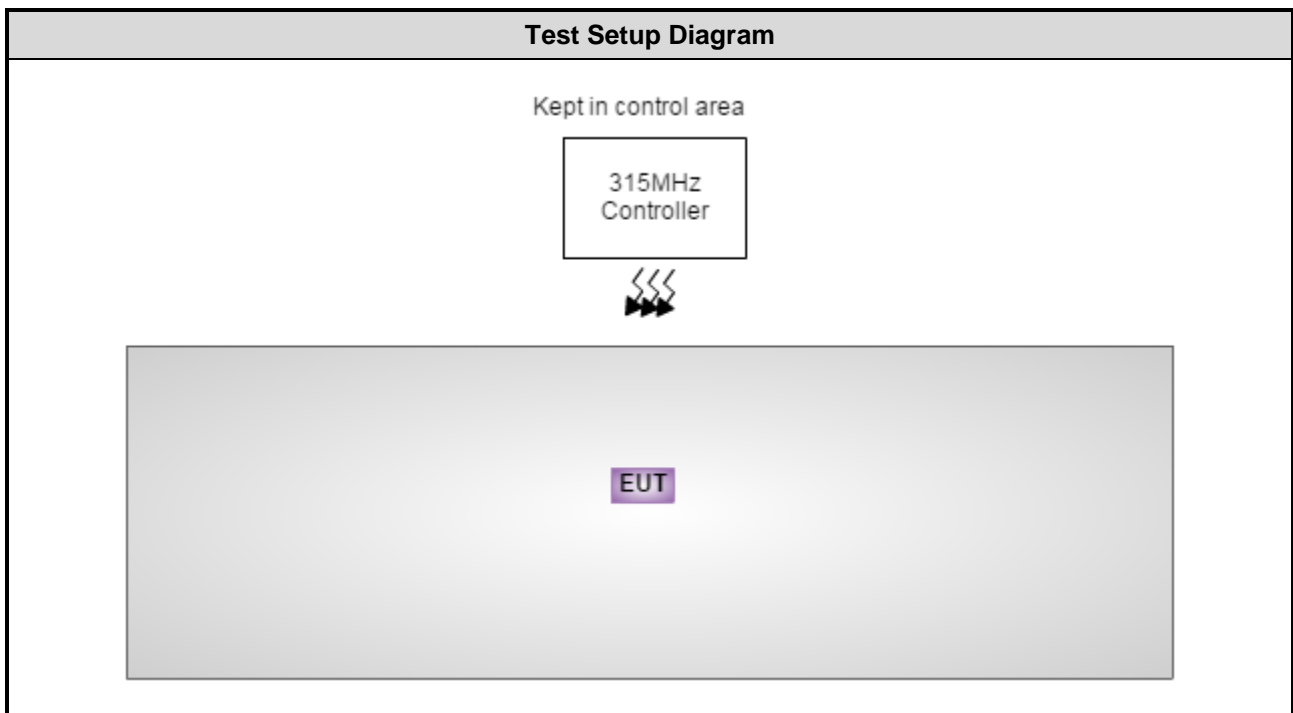
Note: The equipment tests are performed using a new battery.

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Signal cable / Length (m)
1	315MHz Controller	BARTEC USA	TECH400SD	---	---

Note: No.1 was provided by applicant

1.3 Test Setup Chart



1.4 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber 3 / (03CH03-WS)				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	Agilent	N9010A	MY53400091	Sep. 09, 2016	Sep. 08, 2017
Receiver	Agilent	N9038A	MY53290044	Oct. 06, 2016	Oct. 05, 2017
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-685	Apr. 26, 2016	Apr. 25, 2017
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1206	Feb. 09, 2017	Feb. 08, 2018
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 10, 2016	Nov. 09, 2017
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Dec. 09, 2016	Dec. 08, 2017
Preamplifier	EMC	EMC02325	980187	Sep. 08, 2016	Sep. 07, 2017
Preamplifier	Agilent	83017A	MY53270014	Aug. 22, 2016	Aug. 21, 2017
RF cable-3M	HUBER+SUHNER	SUCOFLEX104	MY22620/4	Feb. 04, 2017	Feb. 03, 2018
RF cable-8M	HUBER+SUHNER	SUCOFLEX104	MY22600/4	Feb. 04, 2017	Feb. 03, 2018
RF cable-1M	HUBER+SUHNER	SUCOFLEX104	MY22624/4	Feb. 04, 2017	Feb. 03, 2018
LF cable-0.8M	EMC	EMC8D-NM-NM-800	EMC8D-NM-NM-800-001	Feb. 04, 2017	Feb. 03, 2018
LF cable-3M	EMC	EMC8D-NM-NM-3000	131103	Feb. 04, 2017	Feb. 03, 2018
LF cable-13M	EMC	EMC8D-NM-NM-13000	131104	Feb. 04, 2017	Feb. 03, 2018
Measurement Software	AUDIX	e3	6.120210g	NA	NA

Note: Calibration Interval of instruments listed above is one year.

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.231

ANSI C63.10-2013

1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2))

Measurement Uncertainty	
Parameters	Uncertainty
Radiated emission \leq 1GHz	± 3.66 dB
Radiated emission $>$ 1GHz	± 5.37 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
Radiated Emissions	03CH03-WS	24°C / 65%	Aska Huang Brad Wu
RF Conducted	TH01-WS	24°C / 65%	Aska Huang

- FCC Designation No.: TW0009
- FCC site registration No.: 207696
- IC site registration No.: 10807C-1

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Test Configuration
Field Strength of Fundamental emissions	ASK, FSK	315	a
Unwanted Emissions	ASK, FSK	315	a
Deactivation Time	ASK, FSK	315	a / b / c
20dB bandwidth	ASK, FSK	315	a

Note:

1. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement – X, Y, and Z-plane. The **Y-plane** results were found as the worst case and were shown in this report.
2. Three test configurations are listing as follows:
 Configuration a: Rotating mode.
 Configuration b: Stationary mode.
 Configuration c: Alert mode.
3. The output power of above 3 configurations is same thus only one mode (Configuration a) is selected to perform emission and 20 dB bandwidth test item.

3 Transmitter Test Results

3.1 Radiated Emission

This section includes field strength of fundamental, field strength of harmonics and emissions radiated outside of the operating frequency bands.

3.1.1 Limit of field strength of fundamental and field strength of harmonics

Fundamental Frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
40.66~40.70	1000	100
70 -130	500	50
130 – 174	500 to 1500 ^{Note}	50 to 150 ^{Note}
174 – 260	1500	150
260 – 470	1500 to 5000 ^{Note}	150 to 500 ^{Note}
above 470	5000	500

Note: Linear interpolations.

3.1.2 Limit of Unwanted Emissions

The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

Radiated emission limits			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:

Quasi-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:

Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.1.3 Test Procedures

1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

1. Radiated emission below 1GHz
120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission
 2. Radiated emission Peak value for harmonics
RBW=1MHz, VBW=3MHz and Peak detector
 3. Radiated emission Peak value for fundamental
RBW=1MHz, VBW=3MHz and Peak detector
- Radiated emission Average value for field strength of fundamental and harmonics
The average value is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:

4. ASK mode

$$20\log (\text{Duty cycle}) = 20\log \frac{30.29 \text{ ms}}{100 \text{ ms}} = -10.37\text{dB}$$

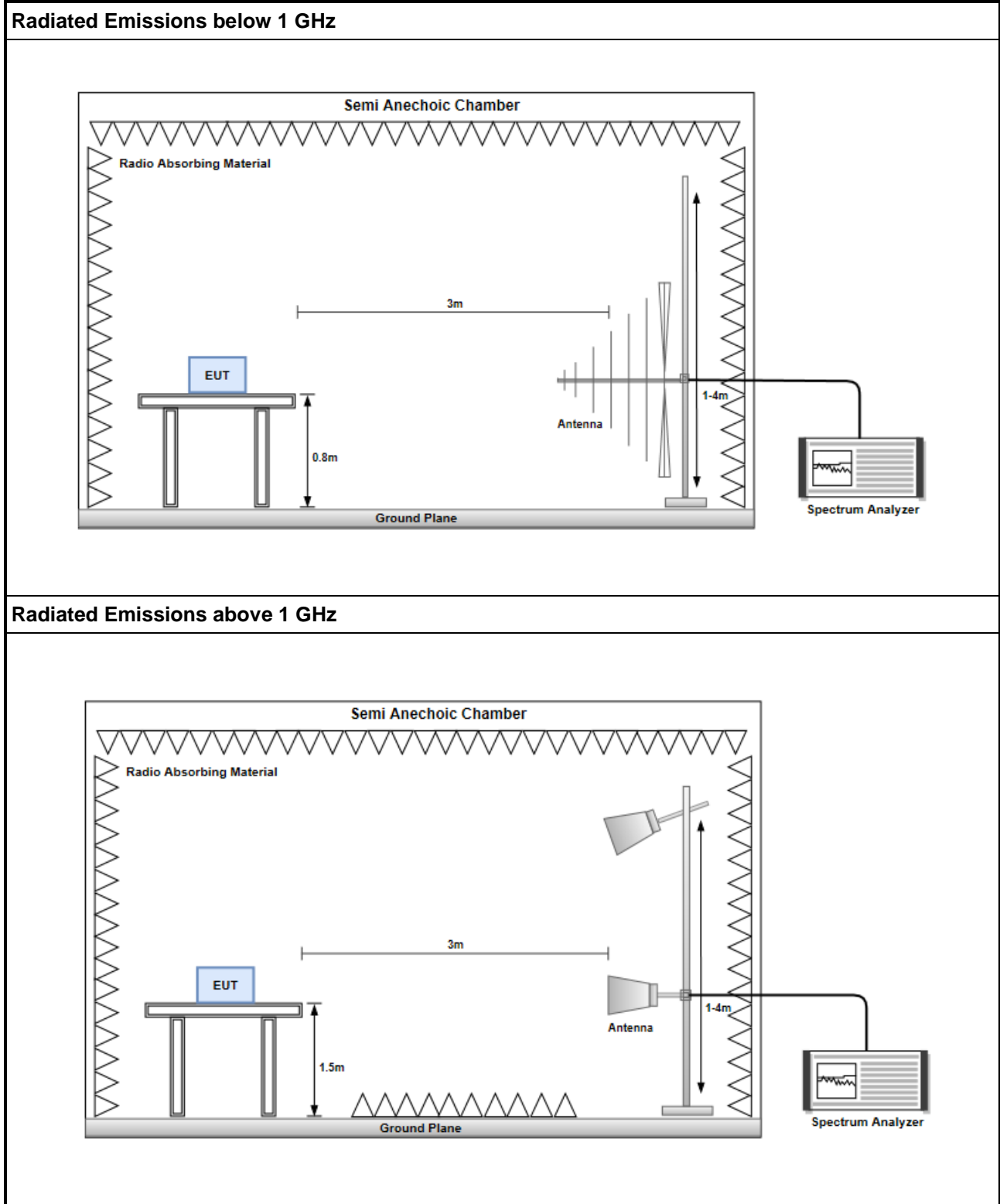
Please see page 18 for plotted duty

FSK mode

$$20\log (\text{Duty cycle}) = 20\log \frac{14.058 \text{ ms}}{100 \text{ ms}} = -17.04\text{dB}$$

Please see page 25 for plotted duty

3.1.4 Test Setup

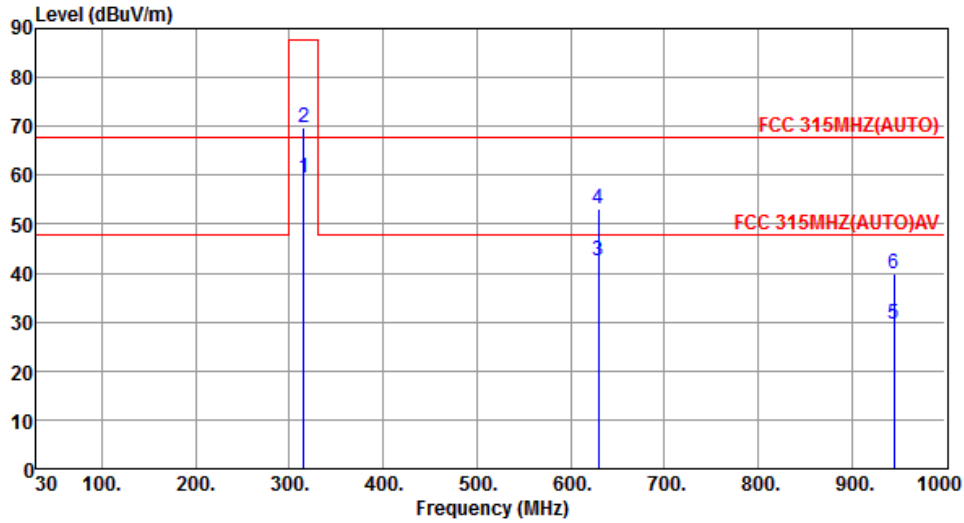


ASK mode

3.1.5 Transmitter Field strength of fundamental emissions and harmonics

Modulation	ASK	Test Freq. (MHz)	315																																																																												
Polarization	Horizontal																																																																														
	<table border="1"> <thead> <tr> <th>Freq.</th> <th>Emission level</th> <th>Limit</th> <th>Margin</th> <th>SA reading</th> <th>Factor</th> <th>Remark</th> <th>ANT High</th> <th>Turn Table</th> </tr> <tr> <th>MHz</th> <th>dBuV/m</th> <th>dBuV/m</th> <th>dB</th> <th>dBuV</th> <th>dB</th> <th></th> <th>cm</th> <th>deg</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>315.00</td> <td>66.59</td> <td>67.66</td> <td>-1.07</td> <td>74.13</td> <td>-7.54</td> <td>Average</td> <td>100</td> <td>245</td> </tr> <tr> <td>2</td> <td>315.00</td> <td>76.96</td> <td>87.66</td> <td>-10.70</td> <td>84.50</td> <td>-7.54</td> <td>Peak</td> <td>100</td> <td>245</td> </tr> <tr> <td>3</td> <td>630.00</td> <td>47.43</td> <td>47.66</td> <td>-0.23</td> <td>47.89</td> <td>-0.46</td> <td>Average</td> <td>135</td> <td>135</td> </tr> <tr> <td>4</td> <td>630.00</td> <td>57.80</td> <td>67.66</td> <td>-9.86</td> <td>58.26</td> <td>-0.46</td> <td>Peak</td> <td>135</td> <td>135</td> </tr> <tr> <td>5</td> <td>945.00</td> <td>29.78</td> <td>47.66</td> <td>-17.88</td> <td>24.75</td> <td>5.03</td> <td>Average</td> <td>100</td> <td>163</td> </tr> <tr> <td>6</td> <td>945.00</td> <td>40.15</td> <td>67.66</td> <td>-27.51</td> <td>35.12</td> <td>5.03</td> <td>Peak</td> <td>100</td> <td>163</td> </tr> </tbody> </table>	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table	MHz	dBuV/m	dBuV/m	dB	dBuV	dB		cm	deg	1	315.00	66.59	67.66	-1.07	74.13	-7.54	Average	100	245	2	315.00	76.96	87.66	-10.70	84.50	-7.54	Peak	100	245	3	630.00	47.43	47.66	-0.23	47.89	-0.46	Average	135	135	4	630.00	57.80	67.66	-9.86	58.26	-0.46	Peak	135	135	5	945.00	29.78	47.66	-17.88	24.75	5.03	Average	100	163	6	945.00	40.15	67.66	-27.51	35.12	5.03	Peak	100	163
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Modulation	ASK	Test Freq. (MHz)	315
Polarization	Vertical		



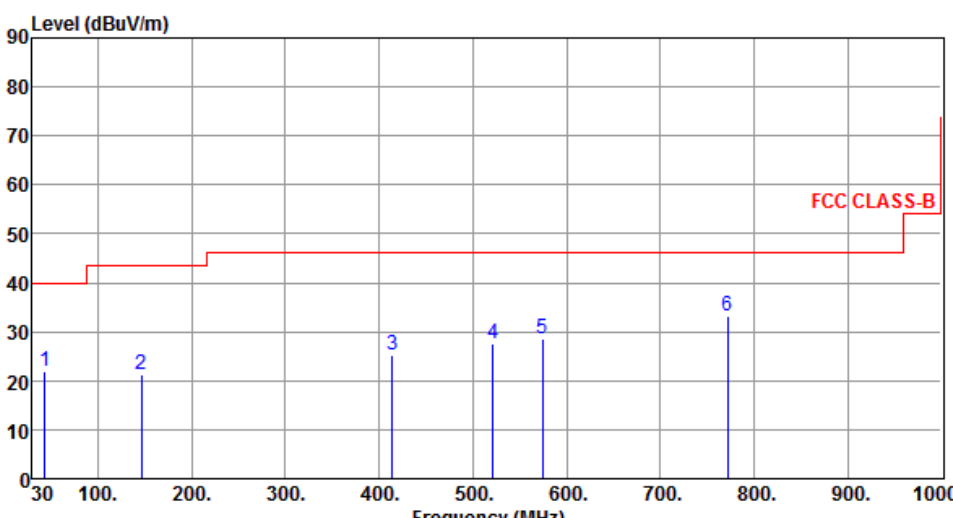
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	315.00	59.47	67.66	-8.19	67.01	-7.54	Average	272	119
2	315.00	69.84	87.66	-17.82	77.38	-7.54	Peak	272	119
3	630.00	42.66	47.66	-5.00	43.12	-0.46	Average	100	62
4	630.00	53.03	67.66	-14.63	53.49	-0.46	Peak	100	62
5	945.00	29.51	47.66	-18.15	24.48	5.03	Average	100	53
6	945.00	39.88	67.66	-27.78	34.85	5.03	Peak	100	53

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

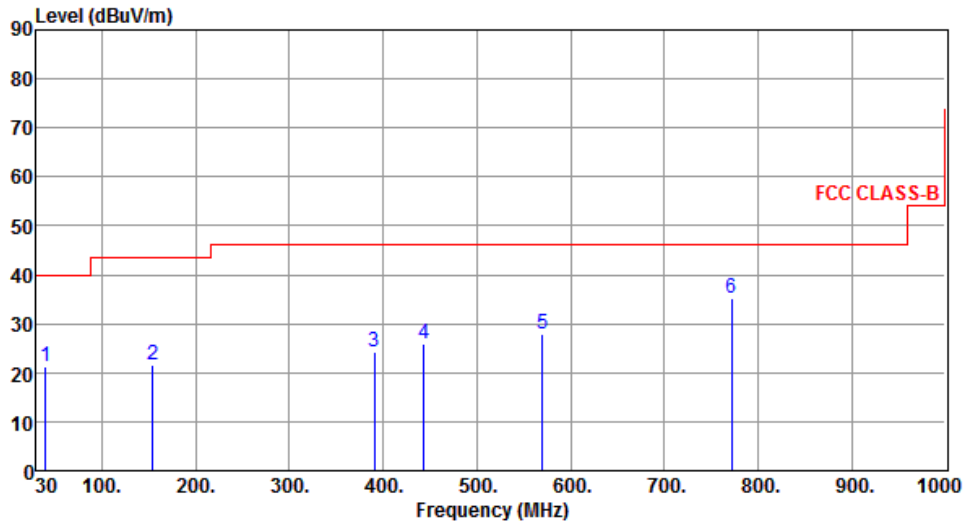
*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.1.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	ASK	Test Freq. (MHz)	315																																																													
Polarization	Horizontal																																																															
 <p>The graph displays the radiated unwanted emissions for an ASK transmitter at 315 MHz. The y-axis represents the emission level in dBuV/m, ranging from 0 to 90. The x-axis represents the frequency in MHz, ranging from 30 to 1000. A red line indicates the FCC CLASS-B limit, which is 40 dBuV/m from 30 MHz to 100 MHz, 43.5 dBuV/m from 100 MHz to 200 MHz, 46.0 dBuV/m from 200 MHz to 1000 MHz, and 70 dBuV/m at 1000 MHz. Six emission peaks are identified and labeled 1 through 6, with their respective frequencies, emission levels, limits, margins, SA readings, and factors listed in the table below.</p>																																																																
	<table border="1"> <thead> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> </tr> </thead> <tbody> <tr> <td>43.58</td> <td>146.40</td> <td>414.12</td> <td>521.79</td> <td>574.17</td> <td>772.05</td> </tr> <tr> <td>21.93</td> <td>21.19</td> <td>25.10</td> <td>27.41</td> <td>28.63</td> <td>33.19</td> </tr> <tr> <td>40.00</td> <td>43.50</td> <td>46.00</td> <td>46.00</td> <td>46.00</td> <td>46.00</td> </tr> <tr> <td>-18.07</td> <td>-22.31</td> <td>-20.90</td> <td>-18.59</td> <td>-17.37</td> <td>-12.81</td> </tr> <tr> <td>30.31</td> <td>29.82</td> <td>29.92</td> <td>30.14</td> <td>30.18</td> <td>30.94</td> </tr> <tr> <td>-8.38</td> <td>-8.63</td> <td>-4.82</td> <td>-2.73</td> <td>-1.55</td> <td>2.25</td> </tr> <tr> <td>Peak</td> <td>Peak</td> <td>Peak</td> <td>Peak</td> <td>Peak</td> <td>Peak</td> </tr> <tr> <td>---</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	1	2	3	4	5	6	43.58	146.40	414.12	521.79	574.17	772.05	21.93	21.19	25.10	27.41	28.63	33.19	40.00	43.50	46.00	46.00	46.00	46.00	-18.07	-22.31	-20.90	-18.59	-17.37	-12.81	30.31	29.82	29.92	30.14	30.18	30.94	-8.38	-8.63	-4.82	-2.73	-1.55	2.25	Peak	Peak	Peak	Peak	Peak	Peak	---	---	---	---	---	---	---	---	---	---	---	---			
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Modulation	ASK	Test Freq. (MHz)	315
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	39.70	21.10	40.00	-18.90	29.84	-8.74	Peak	---	---
2	154.16	21.60	43.50	-21.90	30.06	-8.46	Peak	---	---
3	390.84	24.32	46.00	-21.68	29.79	-5.47	Peak	---	---
4	443.22	25.98	46.00	-20.02	30.01	-4.03	Peak	---	---
5	570.29	27.93	46.00	-18.07	29.58	-1.65	Peak	---	---
6	772.05	35.09	46.00	-10.91	32.84	2.25	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

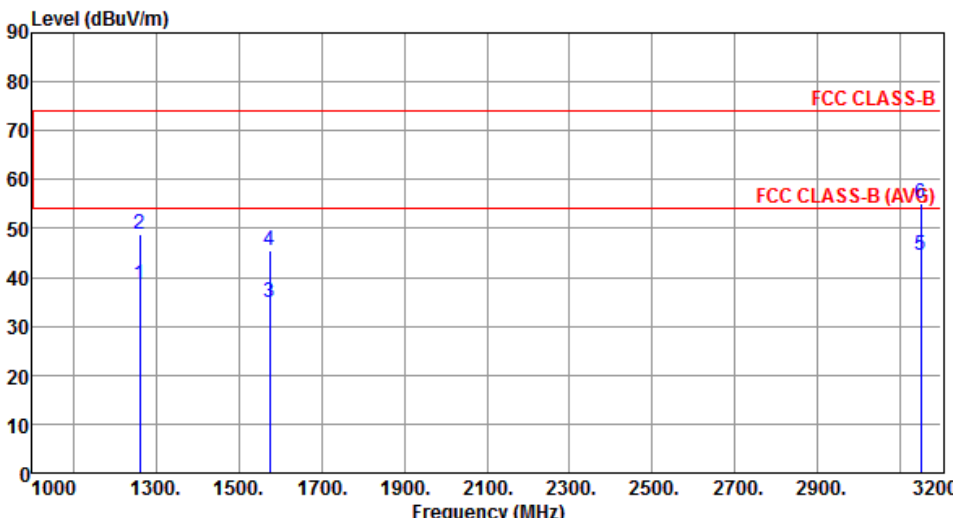
*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.1.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation	ASK	Test Freq. (MHz)	315
Polarization	Horizontal		

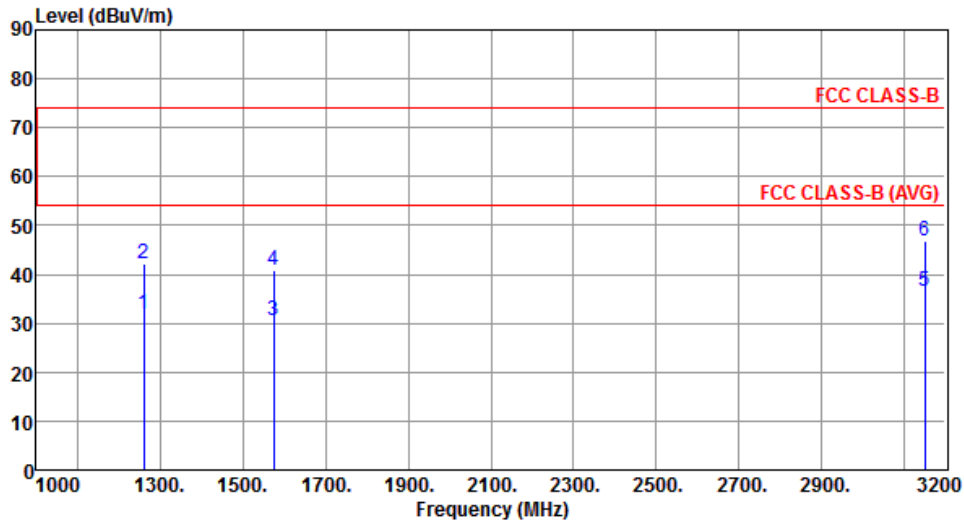


The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (1000 to 3200). Two horizontal red lines represent limits: 'FCC CLASS-B' at approximately 74 dBuV/m and 'FCC CLASS-B (AVG)' at approximately 54 dBuV/m. Three vertical blue lines with arrows point to specific data points labeled 2, 4, and 5. Point 2 is at 1260 MHz, point 4 is at 1575 MHz, and point 5 is at 3150 MHz. All points are below the FCC CLASS-B limit but above the FCC CLASS-B (AVG) limit.

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1260.00	38.50	54.00	-15.50	45.28	-6.78	Average	100	99
2	1260.00	48.87	74.00	-25.13	55.65	-6.78	Peak	100	99
3	1575.00	34.97	54.00	-19.03	39.83	-4.86	Average	100	103
4	1575.00	45.34	74.00	-28.66	50.20	-4.86	Peak	100	103
5	3150.00	44.62	54.00	-9.38	44.28	0.34	Average	157	67
6	3150.00	54.99	74.00	-19.01	54.65	0.34	Peak	157	67

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	ASK	Test Freq. (MHz)	315
Polarization	Vertical		

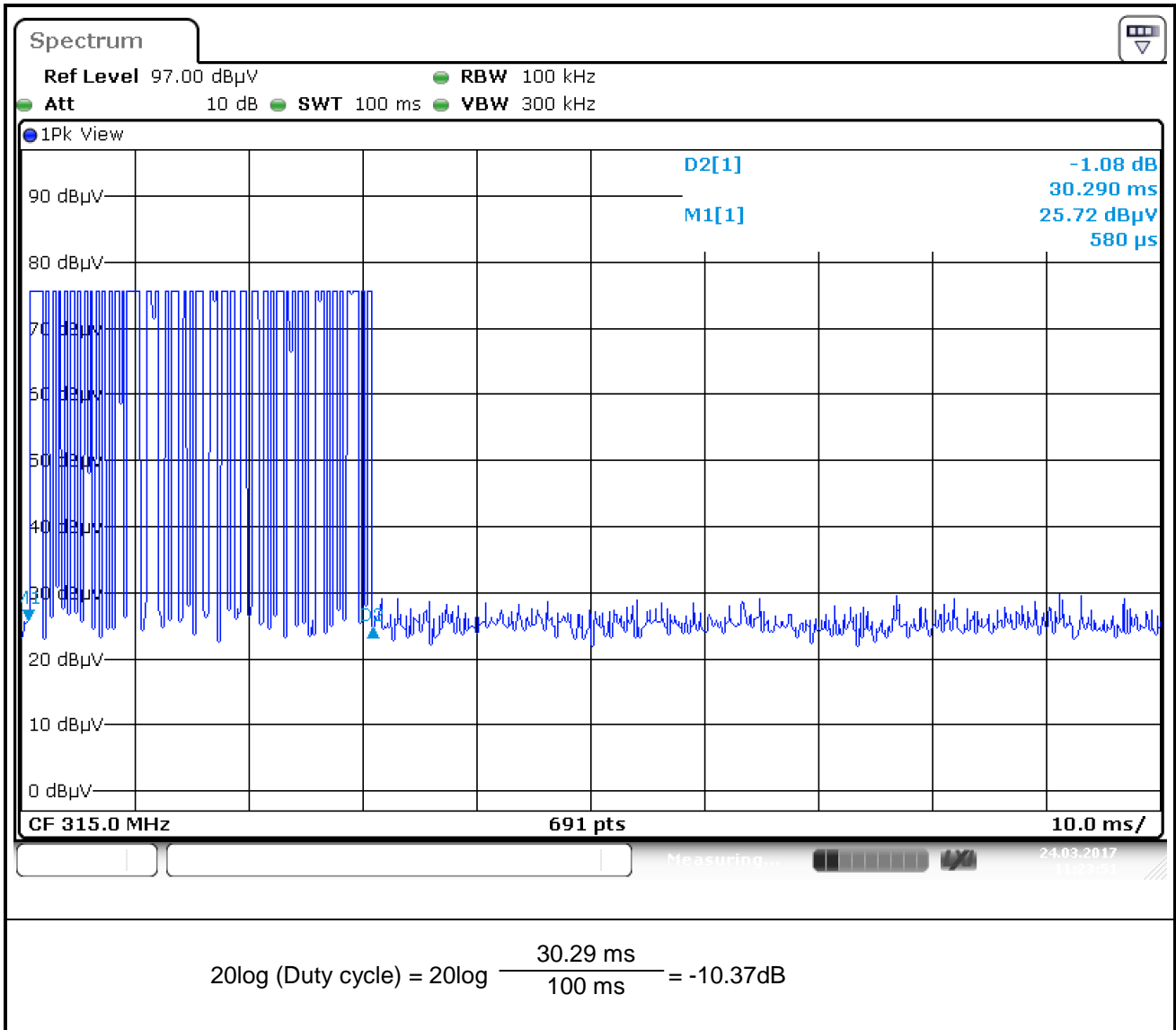


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1260.00	31.87	54.00	-22.13	38.65	-6.78	Average	100	179
2	1260.00	42.24	74.00	-31.76	49.02	-6.78	Peak	100	179
3	1575.00	30.48	54.00	-23.52	35.34	-4.86	Average	144	164
4	1575.00	40.85	74.00	-33.15	45.71	-4.86	Peak	144	164
5	3150.00	36.53	54.00	-17.47	36.19	0.34	Average	153	142
6	3150.00	46.90	74.00	-27.10	46.56	0.34	Peak	153	142

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

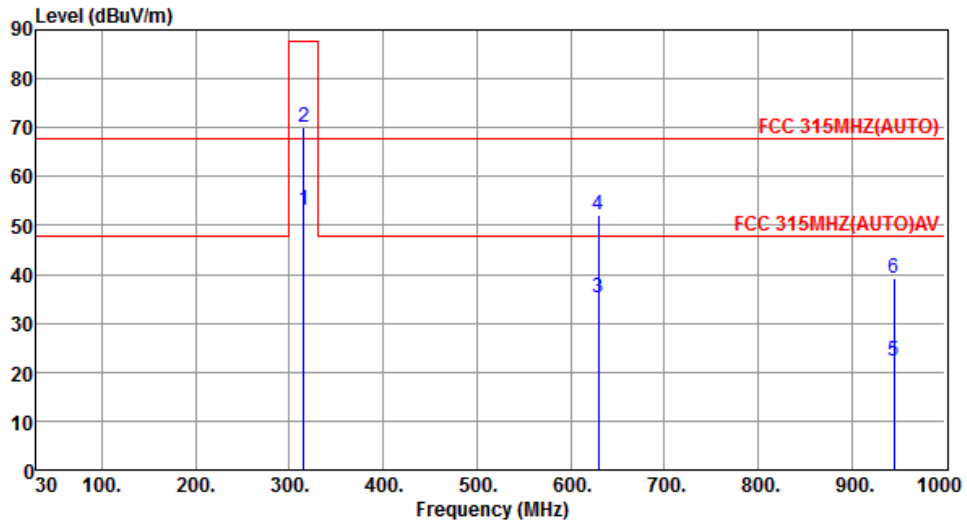


FSK mode

3.1.8 Transmitter Field strength of fundamental emissions

Modulation	FSK	Test Freq. (MHz)	315																																																																			
Polarization	Horizontal																																																																					
	<table border="1"> <thead> <tr> <th>Freq. MHz</th> <th>Emission level dBuV/m</th> <th>Limit dBuV/m</th> <th>Margin dB</th> <th>SA reading dBuV</th> <th>Factor dB</th> <th>Remark</th> <th>ANT High cm</th> <th>Turn Table deg</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>315.00</td> <td>60.17</td> <td>67.66</td> <td>-7.49</td> <td>67.71</td> <td>-7.54</td> <td>Average</td> <td>100</td> <td>318</td> </tr> <tr> <td>2</td> <td>315.00</td> <td>77.21</td> <td>87.66</td> <td>-10.45</td> <td>84.75</td> <td>-7.54</td> <td>Peak</td> <td>100</td> <td>318</td> </tr> <tr> <td>3</td> <td>630.00</td> <td>40.56</td> <td>47.66</td> <td>-7.10</td> <td>41.02</td> <td>-0.46</td> <td>Average</td> <td>144</td> <td>127</td> </tr> <tr> <td>4</td> <td>630.00</td> <td>57.60</td> <td>67.66</td> <td>-10.06</td> <td>58.06</td> <td>-0.46</td> <td>Peak</td> <td>144</td> <td>127</td> </tr> <tr> <td>5</td> <td>945.00</td> <td>23.62</td> <td>47.66</td> <td>-24.04</td> <td>18.59</td> <td>5.03</td> <td>Average</td> <td>123</td> <td>145</td> </tr> <tr> <td>6</td> <td>945.00</td> <td>40.66</td> <td>67.66</td> <td>-27.00</td> <td>35.63</td> <td>5.03</td> <td>Peak</td> <td>123</td> <td>145</td> </tr> </tbody> </table>	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg	1	315.00	60.17	67.66	-7.49	67.71	-7.54	Average	100	318	2	315.00	77.21	87.66	-10.45	84.75	-7.54	Peak	100	318	3	630.00	40.56	47.66	-7.10	41.02	-0.46	Average	144	127	4	630.00	57.60	67.66	-10.06	58.06	-0.46	Peak	144	127	5	945.00	23.62	47.66	-24.04	18.59	5.03	Average	123	145	6	945.00	40.66	67.66	-27.00	35.63	5.03	Peak	123	145
Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg																																																														
1	315.00	60.17	67.66	-7.49	67.71	-7.54	Average	100	318																																																													
2	315.00	77.21	87.66	-10.45	84.75	-7.54	Peak	100	318																																																													
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5	945.00	23.62	47.66	-24.04	18.59	5.03	Average	123	145																																																													
6	945.00	40.66	67.66	-27.00	35.63	5.03	Peak	123	145																																																													
<p>Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB) *Factor includes antenna factor , cable loss and amplifier gain Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).</p>																																																																						

Modulation	FSK	Test Freq. (MHz)	315
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	315.00	52.98	67.66	-14.68	60.52	-7.54	Average	306	241
2	315.00	70.02	87.66	-17.64	77.56	-7.54	Peak	306	241
3	630.00	35.12	47.66	-12.54	35.58	-0.46	Average	180	163
4	630.00	52.16	67.66	-15.50	52.62	-0.46	Peak	180	163
5	945.00	22.22	47.66	-25.44	17.19	5.03	Average	142	138
6	945.00	39.26	67.66	-28.40	34.23	5.03	Peak	142	138

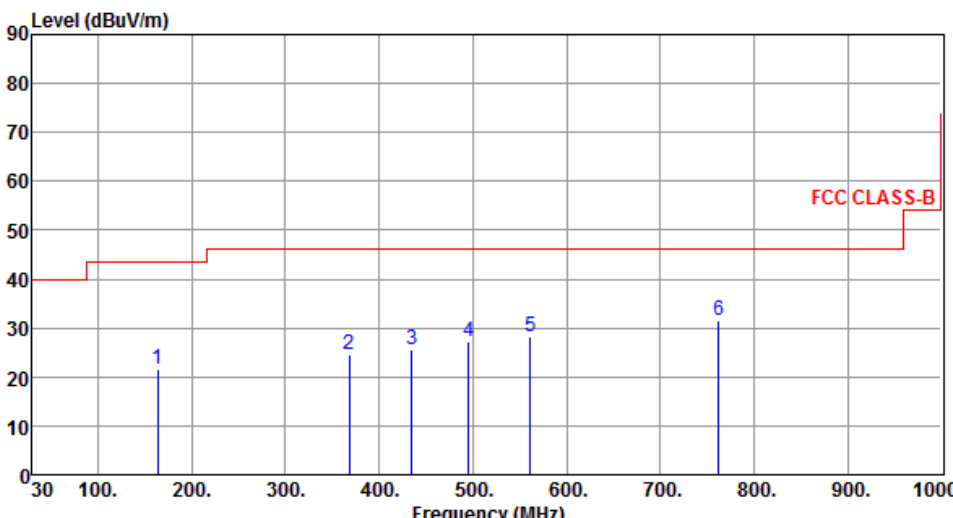
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.1.9 Transmitter Radiated Unwanted Emissions (Below 1GHz)

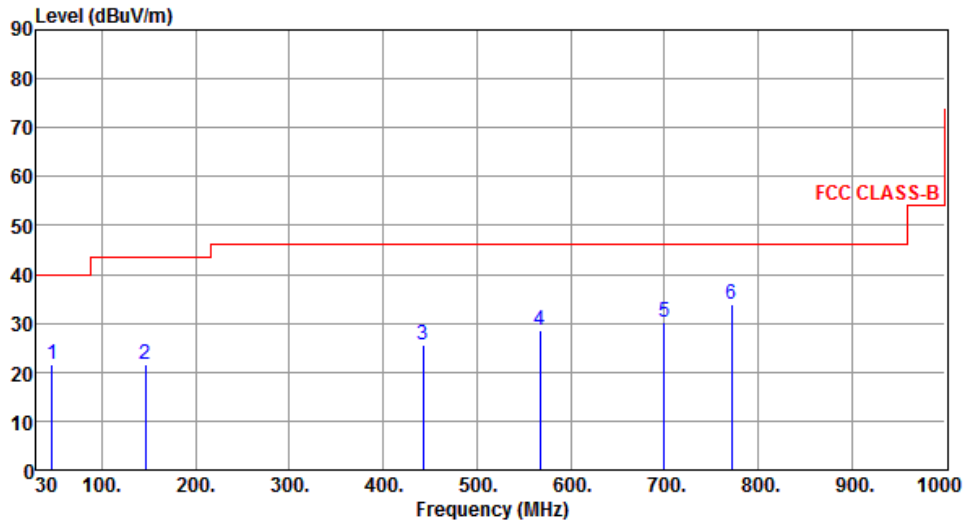
Modulation	FSK	Test Freq. (MHz)	315
Polarization	Horizontal		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	163.86	21.56	43.50	-21.94	30.08	-8.52	Peak	---	---
2	368.53	24.58	46.00	-21.42	30.66	-6.08	Peak	---	---
3	434.49	25.47	46.00	-20.53	29.74	-4.27	Peak	---	---
4	495.60	27.14	46.00	-18.86	30.33	-3.19	Peak	---	---
5	561.56	28.15	46.00	-17.85	30.05	-1.90	Peak	---	---
6	762.35	31.65	46.00	-14.35	29.56	2.09	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).
Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

Modulation	FSK	Test Freq. (MHz)	315
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	46.49	21.64	40.00	-18.36	29.86	-8.22	Peak	---	---
2	146.40	21.59	43.50	-21.91	30.22	-8.63	Peak	---	---
3	442.25	25.71	46.00	-20.29	29.78	-4.07	Peak	---	---
4	567.38	28.42	46.00	-17.58	30.15	-1.73	Peak	---	---
5	700.27	30.14	46.00	-15.86	29.58	0.56	Peak	---	---
6	772.05	33.74	46.00	-12.26	31.49	2.25	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

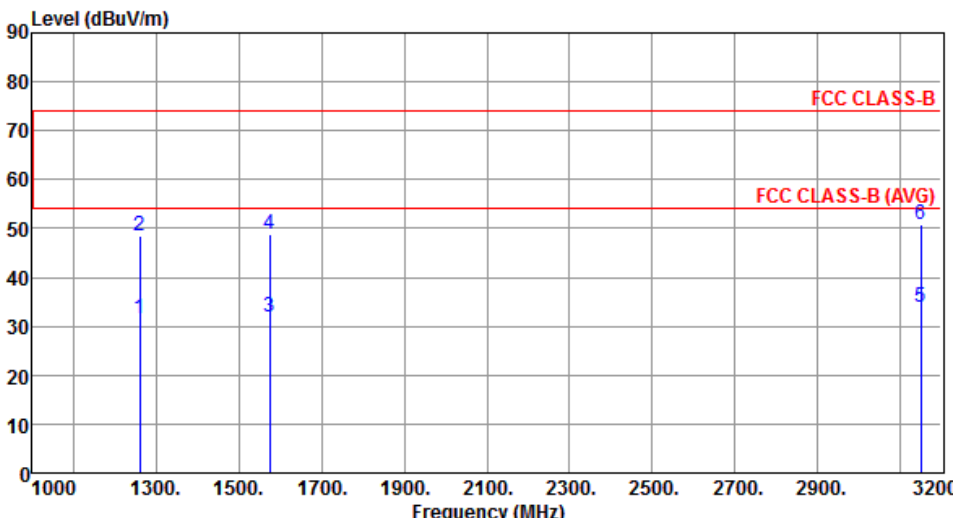
*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.1.10 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation	FSK	Test Freq. (MHz)	315
Polarization	Horizontal		

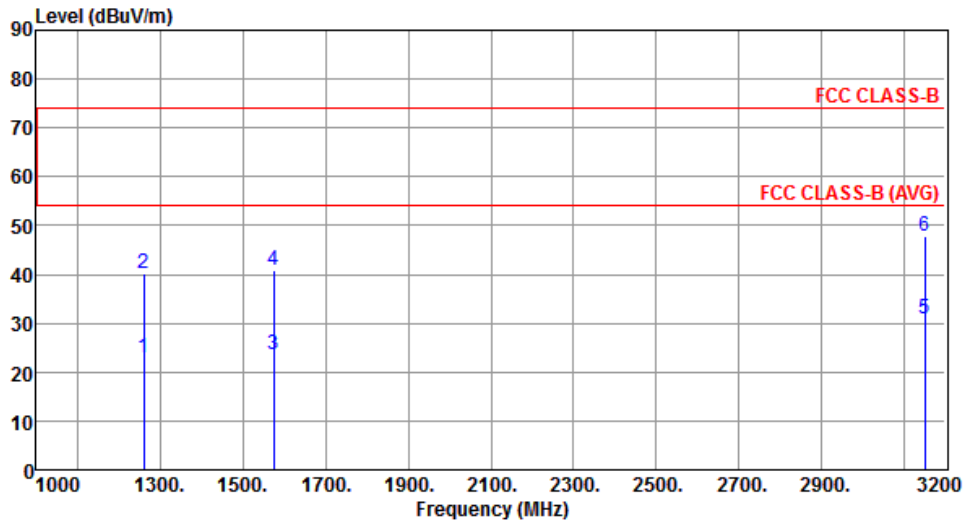


The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (1000 to 3200). Two horizontal red lines represent FCC CLASS-B (at ~75 dBuV/m) and FCC CLASS-B (AVG) (at ~55 dBuV/m). Six vertical blue lines indicate measured emission levels at various frequencies, labeled 2, 4, 5, and 6. The highest measured level is at 3150 MHz (50.76 dBuV/m).

	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1260.00	31.40	54.00	-22.60	38.18	-6.78	Average	155	138
2	1260.00	48.44	74.00	-25.56	55.22	-6.78	Peak	155	138
3	1575.00	31.88	54.00	-22.12	36.74	-4.86	Average	123	148
4	1575.00	48.92	74.00	-25.08	53.78	-4.86	Peak	123	148
5	3150.00	33.72	54.00	-20.28	33.38	0.34	Average	100	215
6	3150.00	50.76	74.00	-23.24	50.42	0.34	Peak	100	215

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)
*Factor includes antenna factor , cable loss and amplifier gain
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	FSK	Test Freq. (MHz)	315
Polarization	Vertical		

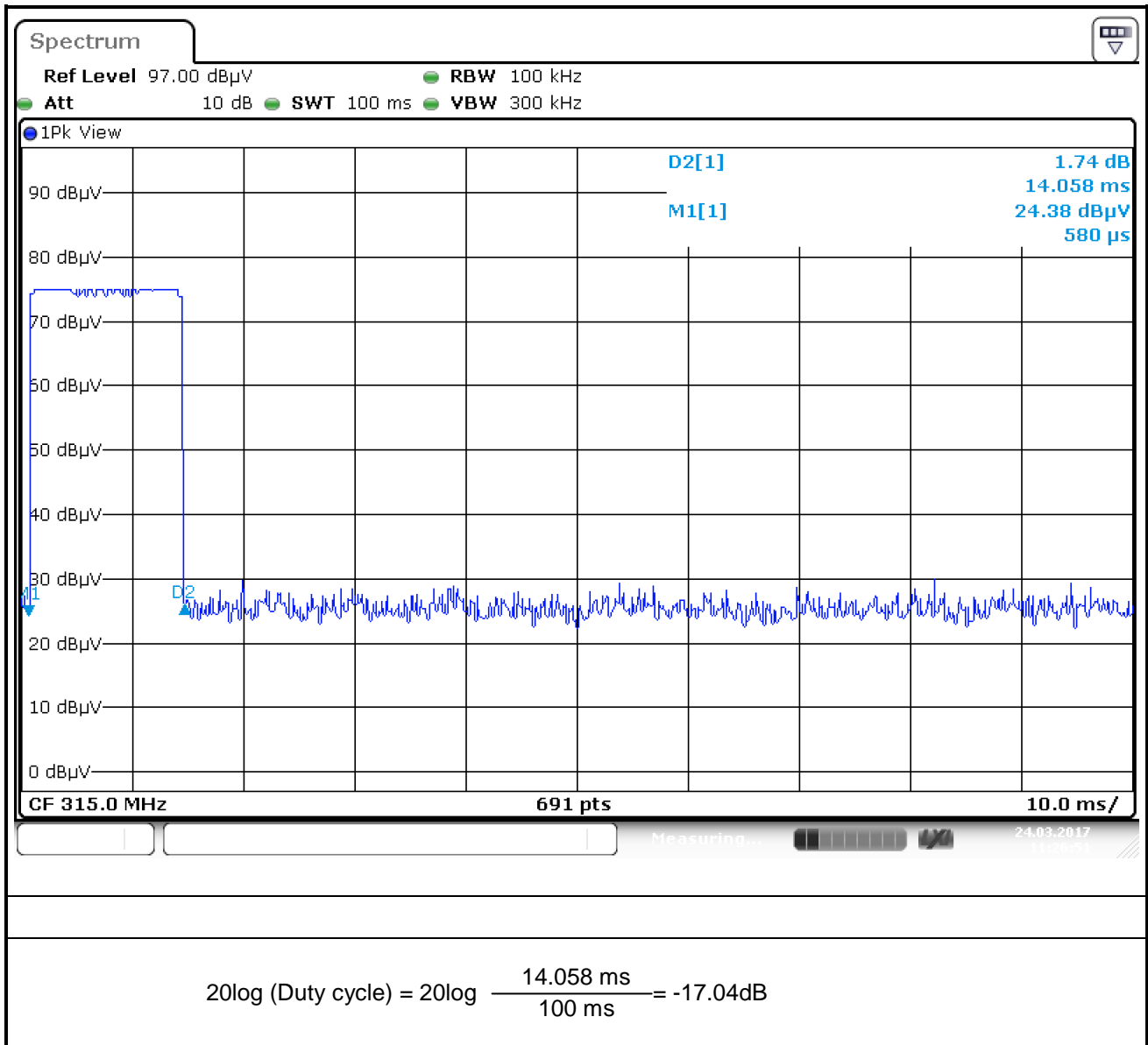


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1260.00	23.03	54.00	-30.97	29.81	-6.78	Average	100	156
2	1260.00	40.07	74.00	-33.93	46.85	-6.78	Peak	100	156
3	1575.00	23.66	54.00	-30.34	28.52	-4.86	Average	100	143
4	1575.00	40.70	74.00	-33.30	45.56	-4.86	Peak	100	143
5	3150.00	30.87	54.00	-23.13	30.53	0.34	Average	100	216
6	3150.00	47.91	74.00	-26.09	47.57	0.34	Peak	100	216

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).



3.2 Transmission and Deactivation Time

3.2.1 Limit of Transmission and Deactivation Time

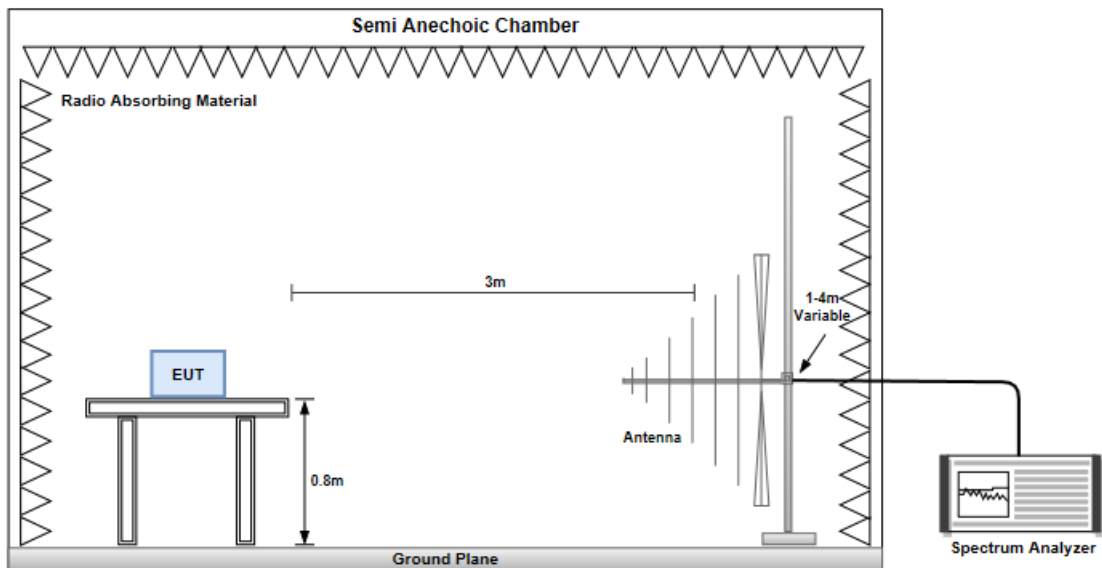
15.231(a): A transmitter activated automatically shall cease transmission within 5 seconds after activation.

15.231(e): Devices operated 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.

3.2.2 Test Procedures

1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
2. Detector = Peak, Trace mode = max hold.
3. Set Sweep = fitting time as shown on plots of next pages, Allow the trace to stabilize.
4. Set the EUT to operates at operation modes then record the transmission and deactivation time.

3.2.3 Test Setup

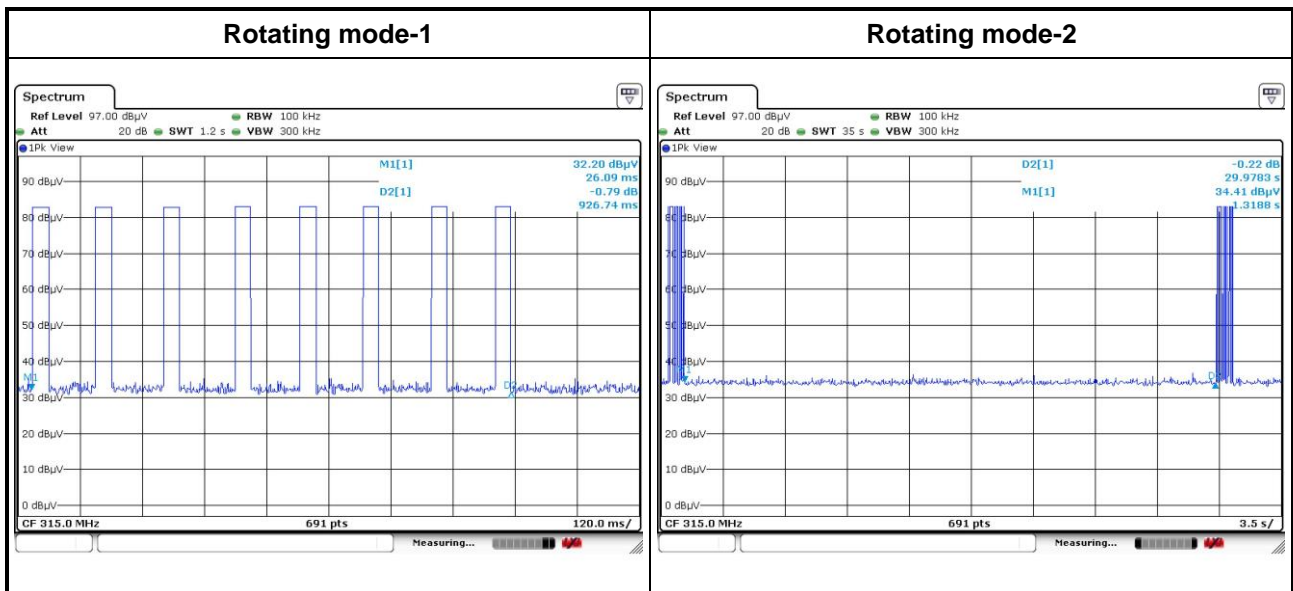


3.2.4 Test Result of Rotating mode

ASK mode

Rotating mode			
Frequency(MHz)	Transmission time (S)	Limit (s)	Pass/Fail
315.00	0.927	1.0	PASS
Frequency(MHz)	Deactivation Time (S)	Limit (s)	Pass/Fail
315.00	29.978	27.80	PASS

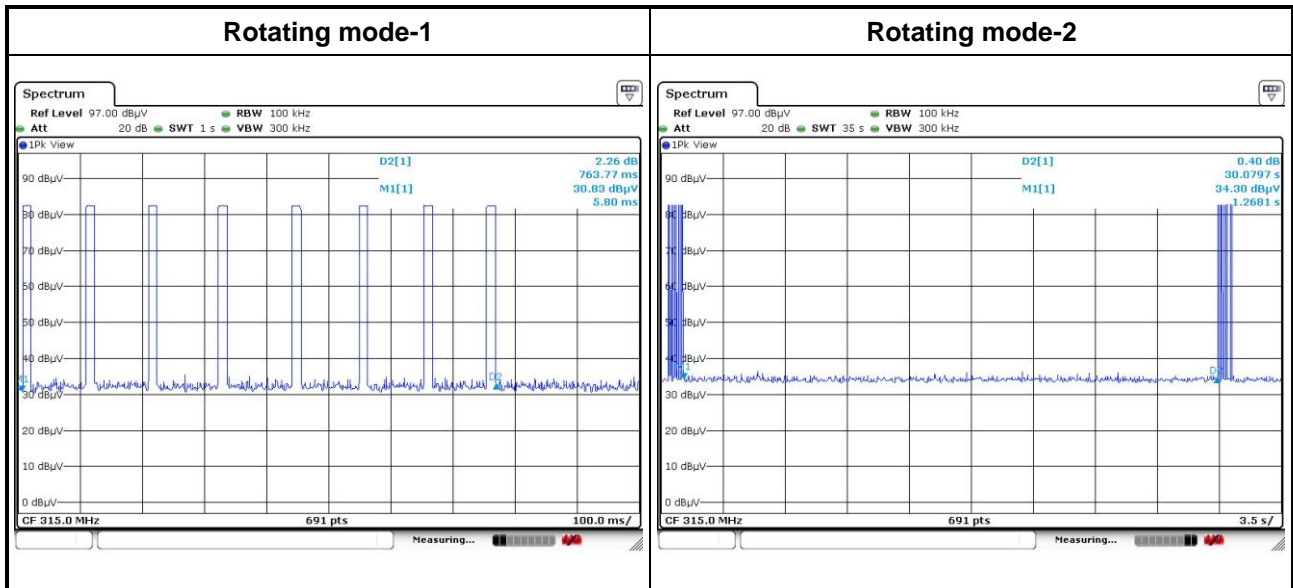
Note: The limit is longer than 10 seconds and is not shorter than transmission time multiplied by 30 (0.92674 s * 30 = 27.80 s)



FSK mode

Rotating mode			
Frequency(MHz)	Transmission time (S)	Limit (s)	Pass/Fail
315.00	0.764	1.0	PASS
Frequency(MHz)	Deactivation Time (S)	Limit (s)	Pass/Fail
315.00	30.080	22.9	PASS

Note: The limit is longer than 10 seconds and is not shorter than transmission time multiplied by 30 ($0.76377 \text{ s} * 30 = 22.91 \text{ s}$)

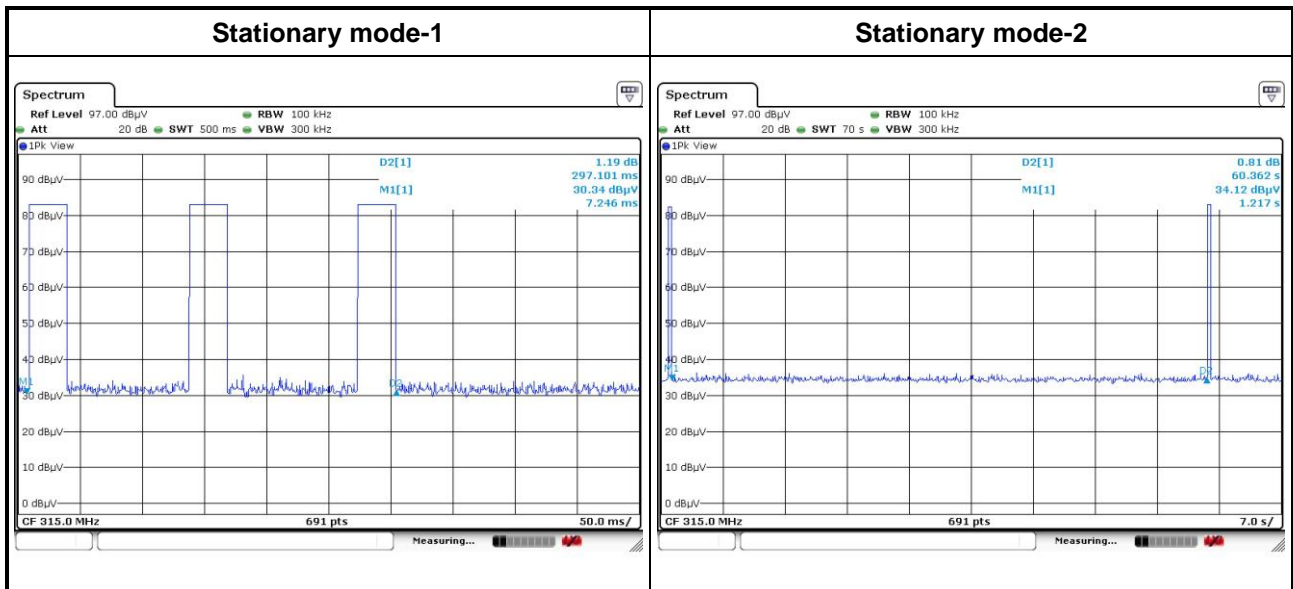


3.2.5 Test Result of Stationary mode

ASK mode

Stationary mode			
Frequency(MHz)	Transmission time (S)	Limit (s)	Pass/Fail
315.00	0.29710	1.0	PASS
Frequency(MHz)	Deactivation Time (S)	Limit (s)	Pass/Fail
315.00	60.362	10.0	PASS

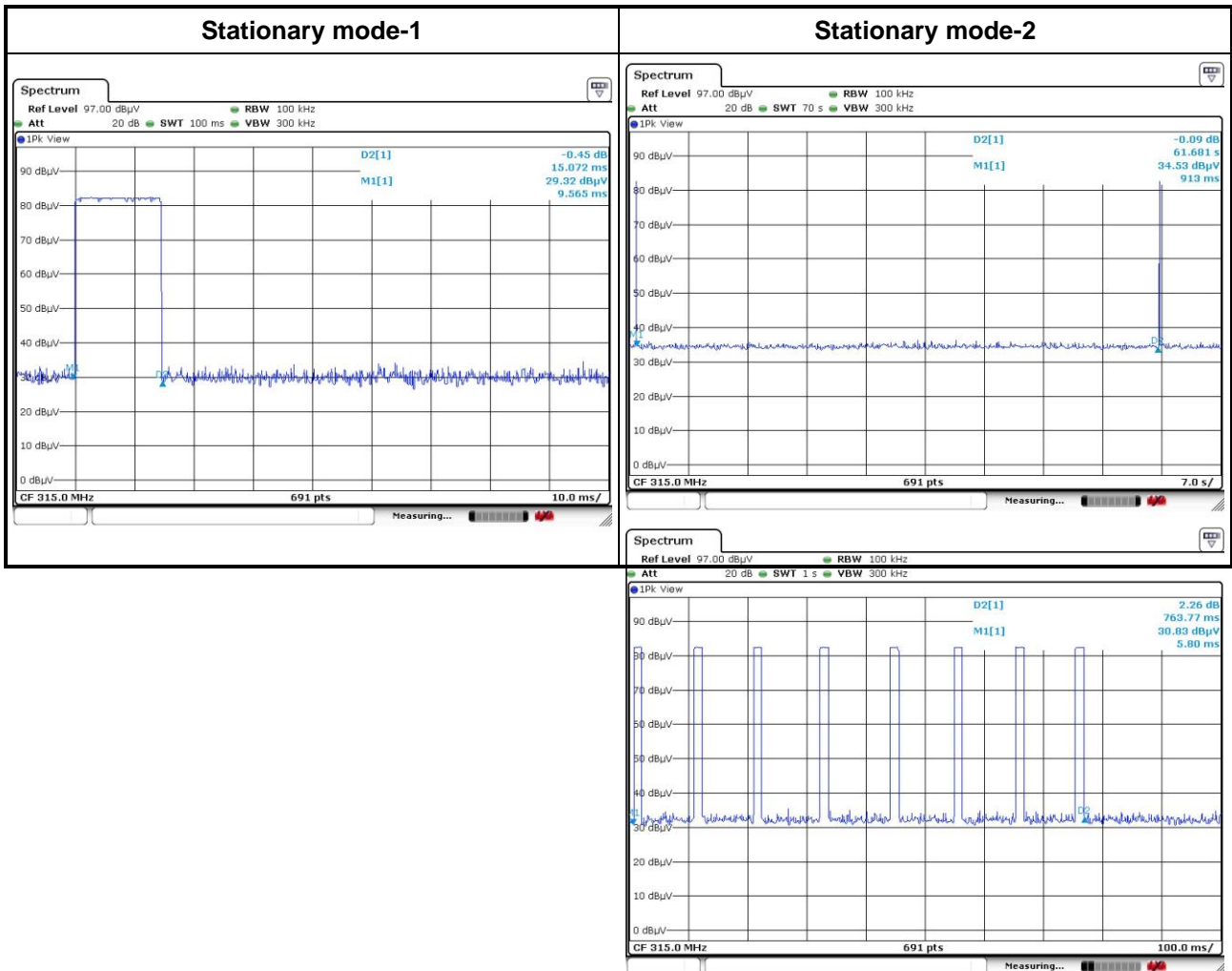
Note: The limit is longer than 10 seconds and is not shorter than transmission time multiplied by 30 (0.29710 s * 30 = 8.913 s)



FSK mode

Stationary mode			
Frequency(MHz)	Transmission time (S)	Limit (s)	Pass/Fail
315.00	0.01507	1.0	PASS
Frequency(MHz)	Deactivation Time (S)	Limit (s)	Pass/Fail
315.00	61.681	10.0	PASS

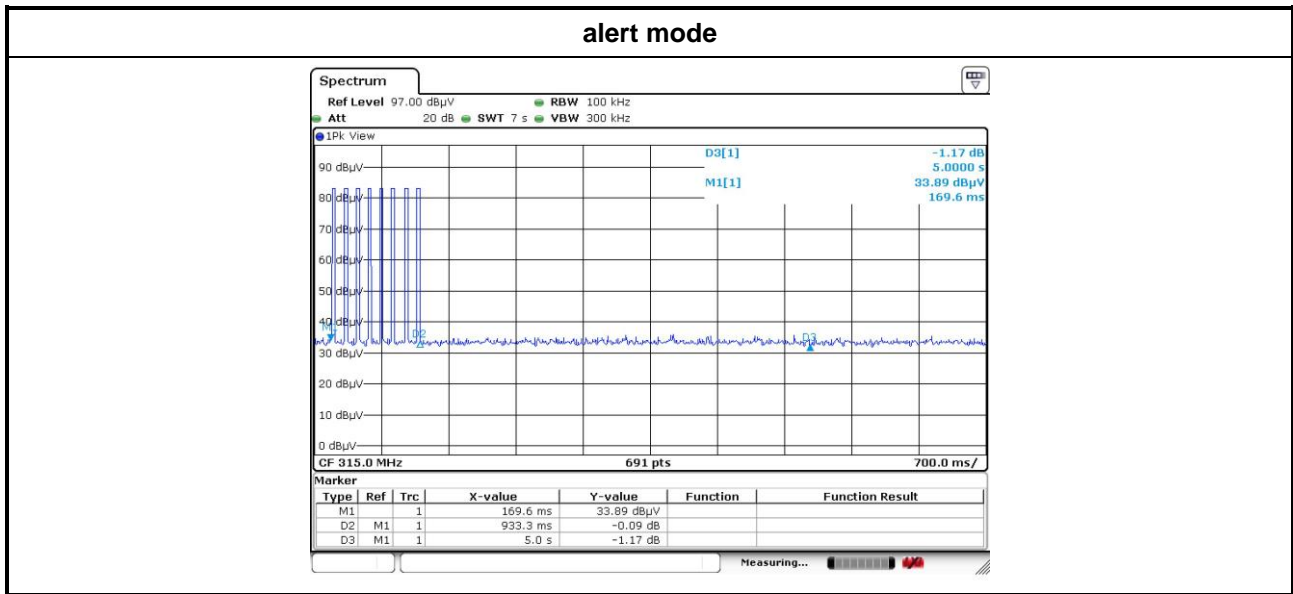
Note: The limit is longer than 10 seconds and is not shorter than transmission time multiplied by 30 (0.015072 s * 30 = 0.45261 s)



3.2.6 Test Result of Alert mode

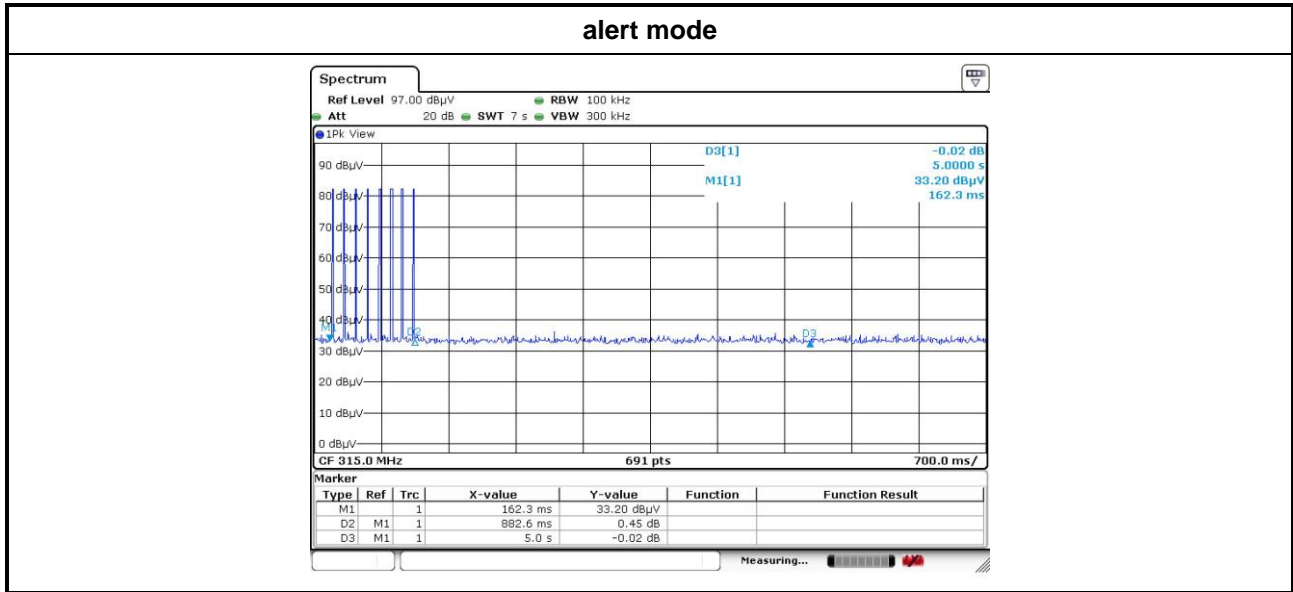
ASK mode

Transmission Time Alert mode			
Frequency(MHz)	Transmission time (S)	Limit (s)	Pass/Fail
315.00	0.933	5.0	PASS



FSK mode

Transmission Time Alert mode			
Frequency(MHz)	Transmission time (S)	Limit (s)	Pass/Fail
315.00	0.883	5.0	PASS



3.3 20dB and Occupied Bandwidth

3.3.1 Limit of 20 dB Bandwidth

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz.

3.3.2 Test Procedures

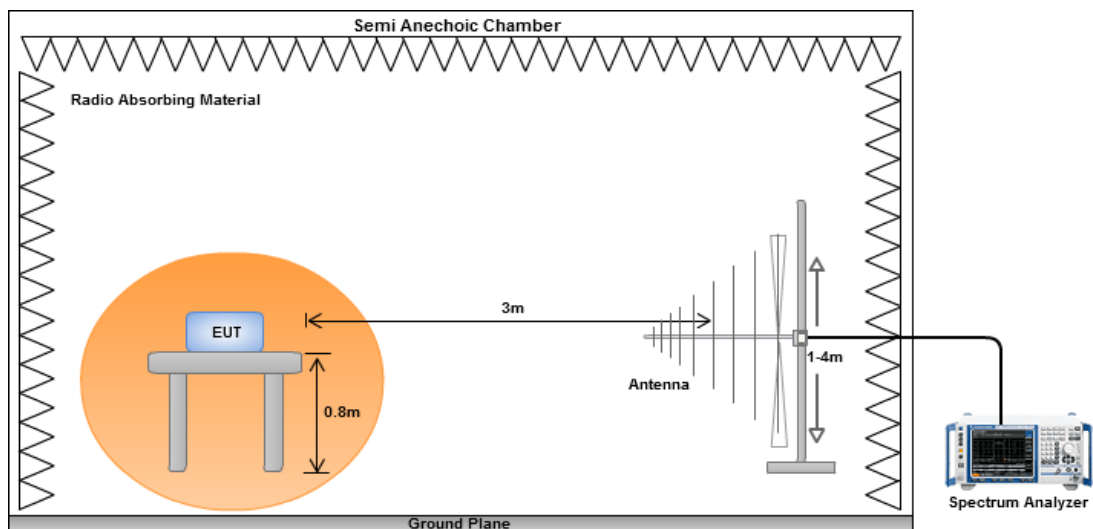
For 20dB bandwidth

1. Set resolution bandwidth (RBW) = 10 kHz, Video bandwidth = 30 kHz
2. Detector = Peak, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20dB relative to the maximum level measured in the fundamental emission.

For Occupied bandwidth

1. Set resolution bandwidth (RBW) = 3 kHz, Video bandwidth = 10 kHz
2. Detector = Sample, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Use the occupied measurement function of spectrum analyzer to measure 99% occupied bandwidth

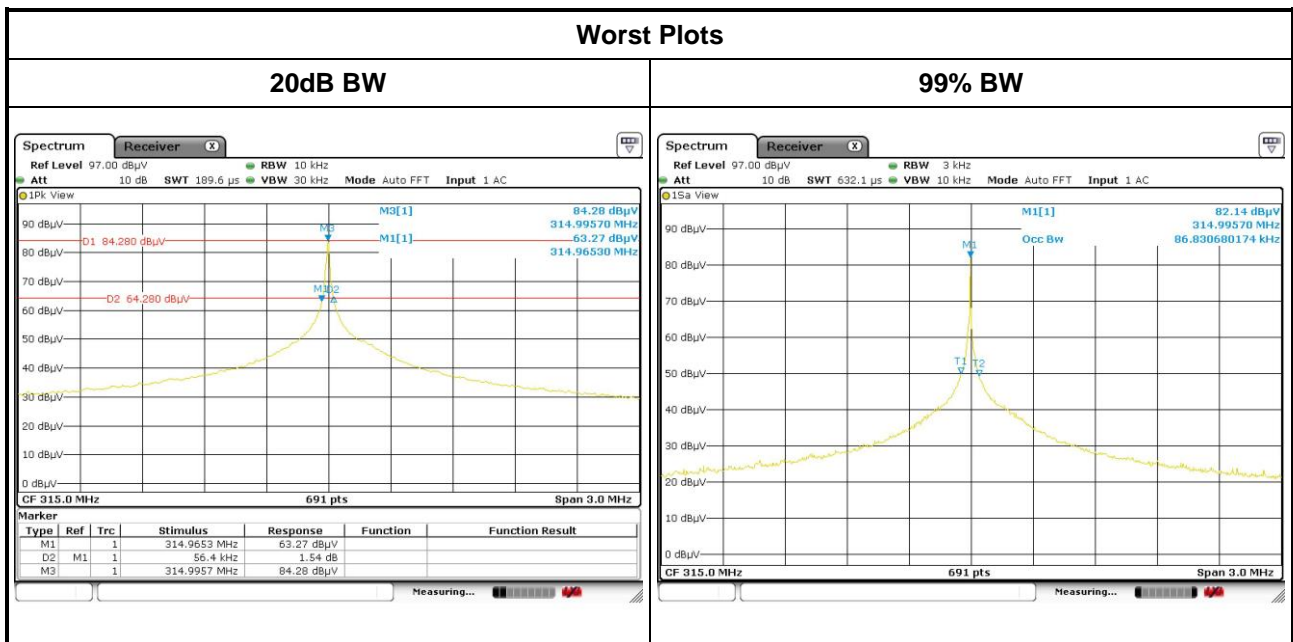
3.3.3 Test Setup



3.3.4 20dB and Occupied Bandwidth

ASK mode

20dB and Occupied Bandwidth				
Frequency(MHz)	20dB Bandwidth (MHz)	20dB BW Limit (MHz)	99% BW (MHz)	Pass/Fail
315.00	0.06	0.7875	0.09	PASS



FSK mode

20dB and Occupied Bandwidth				
Frequency(MHz)	20dB Bandwidth (MHz)	20dB BW Limit (MHz)	99% BW (MHz)	Pass/Fail
315.00	0.12	0.7875	0.12	PASS



4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website <http://www.icertifi.com.tw>.

Linkou

Tel: 886-2-2601-1640

No. 30-2, Ding Fwu Tsuen, Lin Kou
District, New Taipei City, Taiwan,
R.O.C.

Kwei Shan

Tel: 886-3-271-8666

No. 3-1, Lane 6, Wen San 3rd
St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640

No. 14-1, Lane 19, Wen San 3rd
St., Kwei Shan District, Tao Yuan
City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666

Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

==END==