



RF MEASUREMENT REPORT

FCC ID: VZ4-360204N

Applicant: Doran Manufacturing LLC

Product: Doran TPMS Sensor for Truck

Model No.: 3604, 3602, 3603

Brand Name: Doran

FCC Classification: FCC Part 15 Security/Remote Control Transmitter (DSC)

FCC Rule Part(s): Part 15.231

Result: Complies

Received Date: 2022-12-14

Test Date: 2022-12-26 ~ 2023-01-09

Reviewed By:

Kevin Guo

Approved By:

Robin Wu



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2212RSU053-U2	Rev. 01	Initial Report	2023-01-19	Valid

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1. General Information

1.1. Applicant

Doran Manufacturing LLC
2851 Massachusetts Avenue Cincinnati, OH 45225 USA

1.2. Manufacturer

Doran Manufacturing LLC
2851 Massachusetts Avenue Cincinnati, OH 45225 USA

1.3. Testing Facility

☒	Test Site – MRT Suzhou Laboratory
	Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
	Laboratory Location (Suzhou - SIP) 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China
	Laboratory Accreditations
	A2LA: 3628.01 FCC: CN1166 VCCI:
	CNAS: L10551 ISED: CN0001 ☐R-20025 ☐G-20034 ☐C-20020 ☐T-20020 ☐R-20141 ☐G-20134 ☐C-20103 ☐T-20104
☐	Test Site – MRT Shenzhen Laboratory
	Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China
	Laboratory Accreditations
	A2LA: 3628.02 FCC: CN1284
	CNAS: L10551 ISED: CN0105
☐	Test Site – MRT Taiwan Laboratory
	Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
	Laboratory Accreditations
	TAF: L3261-190725 FCC: 291082, TW3261
	ISED: TW3261

1.4. Product Information

Product	Doran TPMS Sensor for Truck
Model No.	3604, 3602, 3603
Brand Name	Doran
Operating Voltage	2.3 ~ 3.6Vdc, Nominal 3.0Vdc (By internal lithium battery)
Operating Temperature	-40 ~ 120°C
Test Device Information	
Test Model	3604
Test Device Identification No.	20221219Sample#07
Notes:	
- The models 3602 is the same as model 3684 except 3602 does not have low- frequency inductor, which does not affect radio parameters. - The model 3603 is the same as 3604 except different appearance, model number and software coding format, which does not affect radio parameters. - The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification

Frequency Range	434.1MHz
Type of Modulation	FSK
Antenna Type	PCB Antenna
Antenna Gain	0 dBi

2. Test Configuration

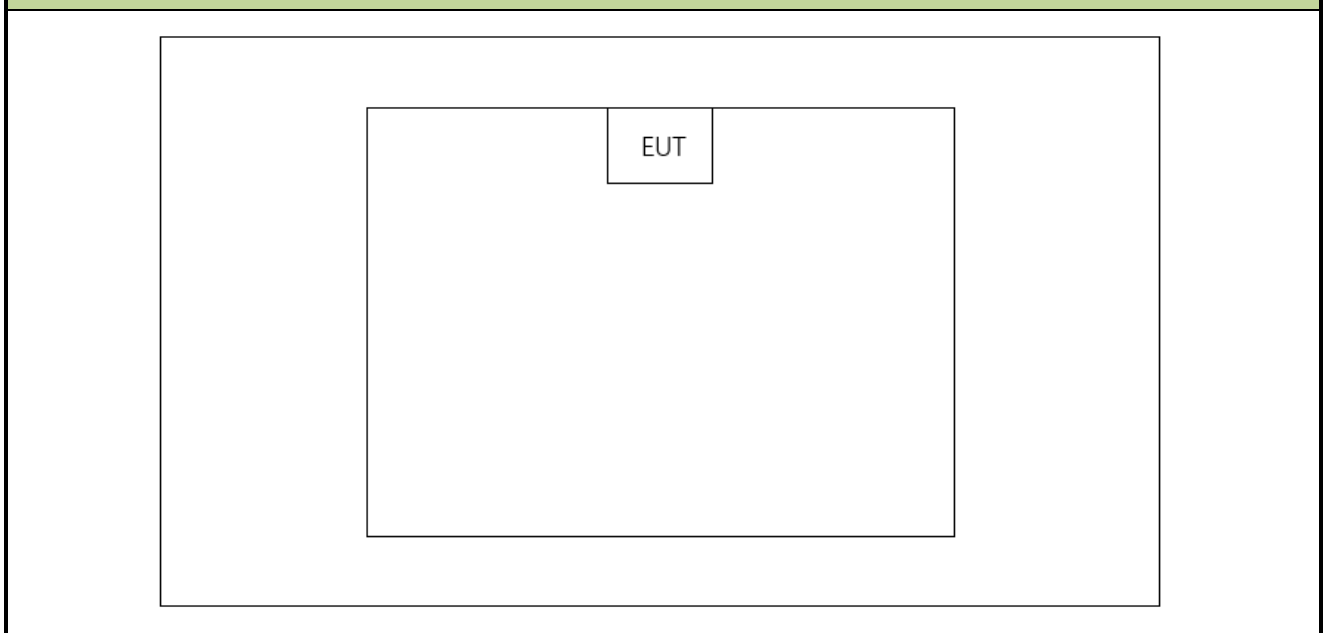
2.1. Test Mode

Mode 1: Transmit at 434.1MHz

2.2. Test System Connection Diagram

The device was tested per the guidance ANSI C63.10: 2013 was used to reference the appropriate EUT setup for radiated emissions testing and AC line conducted testing.

Connection Diagram – Radiated Emission testing



2.3. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15.231
- ANSI C63.10-2013

2.4. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20 ~75%RH

3. Antenna Requirements

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antenna of the device is **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

4. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2023-08-22	WZ-AC1
Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2023-05-08	WZ-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2023-06-21	WZ-AC1
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2023-09-29	WZ-AC1
Anechoic Chamber	TDK	WZ-AC1	MRTSUE06212	1 year	2023-04-21	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE06403	1 year	2023-06-06	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06457	1 year	2023-06-04	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11039	1 year	2023-11-01	WZ-AC1

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802	2.03C	RE Antenna & Turntable

5. Decision Rules and Measurement Uncertainty

5.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2.
(Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.2. Measurement Uncertainty

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

Conducted Emission Measurement	
The maximum measurement uncertainty is evaluated as:	
9kHz~150kHz: 3.58dB	
150kHz~30MHz: 3.20dB	
Radiated Emission Measurement	
The maximum measurement uncertainty is evaluated as:	
Coaxial:	9kHz~30MHz: 2.59dB
Coplanar:	9kHz~30MHz: 2.60dB
Horizontal:	30MHz~200MHz: 3.85dB
	200MHz~1GHz: 4.36dB
	1GHz~5GHz: 4.98dB
Vertical:	30MHz~200MHz: 4.06dB
	200MHz~1GHz: 5.28dB
	1GHz~5GHz: 4.91dB

6. Test Result

6.1. Summary

FCC Part Section(s)	Test Description	Test Condition	Verdict
15.207	AC Conducted Emissions 150kHz - 30MHz	Line Conducted	N/A
15.205,15.231(e)	Radiated Spurious Emissions	Radiated	Pass
15.231(c)	20dB Bandwidth		Pass
15.231(e)	Transmission Time		Pass

Notes:

- 1) The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.
- 2) "N/A" means this item is not applicable, and the details refer to relevant section.

6.2. Conducted Emission

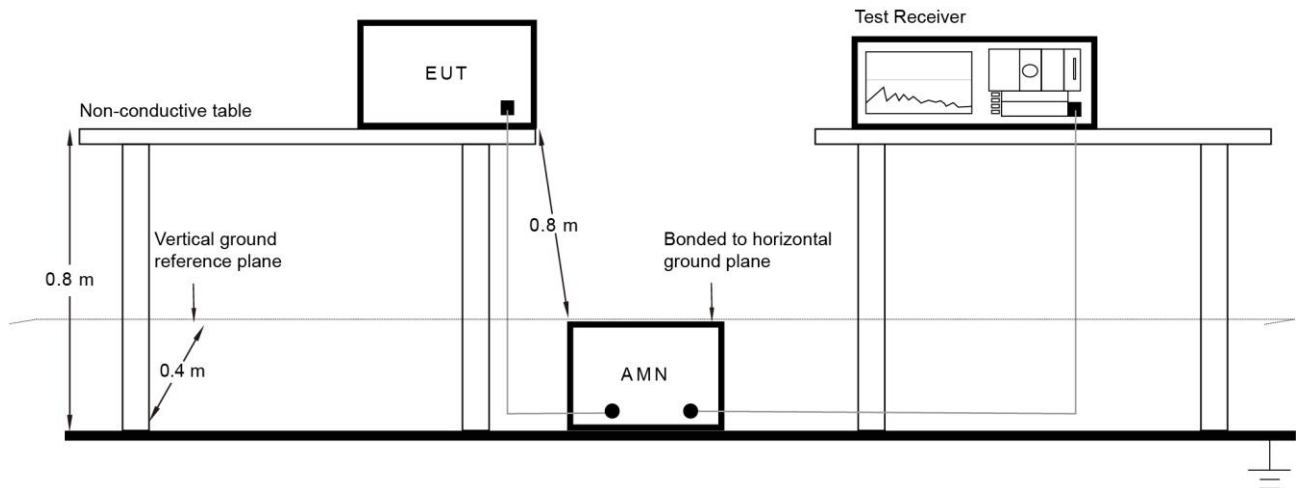
6.2.1. Test Limit

FCC Part 15.207 Limits		
Frequency (MHz)	QP (dB μ V)	AV (dB μ V)
0.15 ~ 0.50	66 ~ 56	56 ~ 46
0.50 ~ 5.0	56	46
5.0 ~ 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

6.2.2. Test Setup



6.2.3. Test Result

The device is powered by internal battery, so this requirement is not applicable.

6.3. Radiated Emissions

6.3.1. Test Limit

According to §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 emission (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

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.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements start below or at the lowest crystal frequency.

Compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

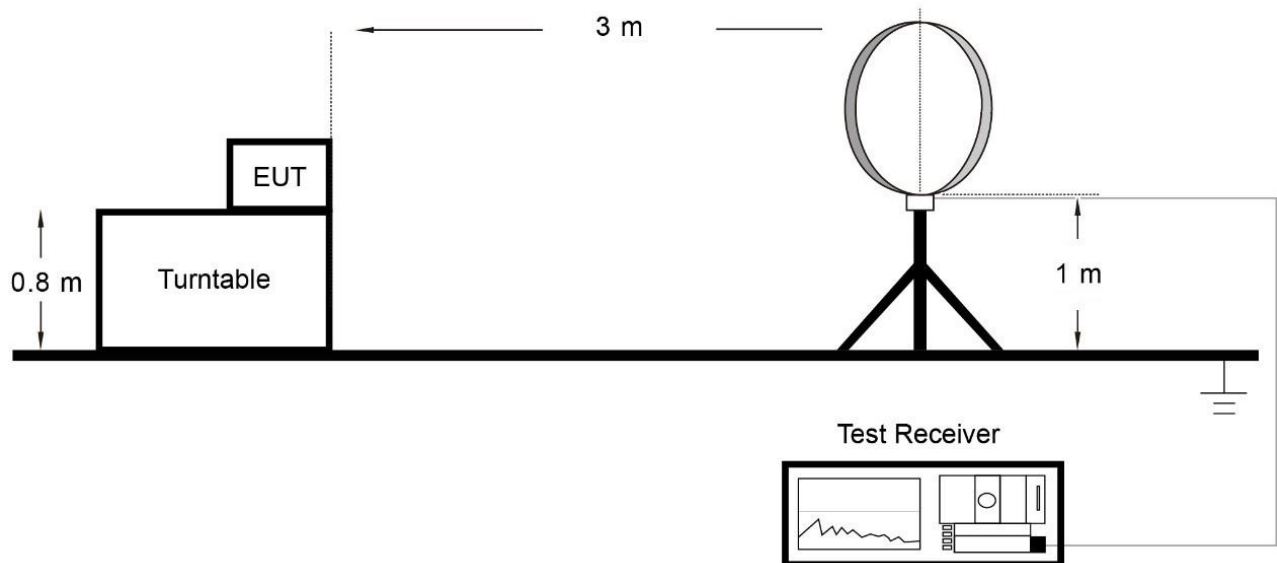
For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

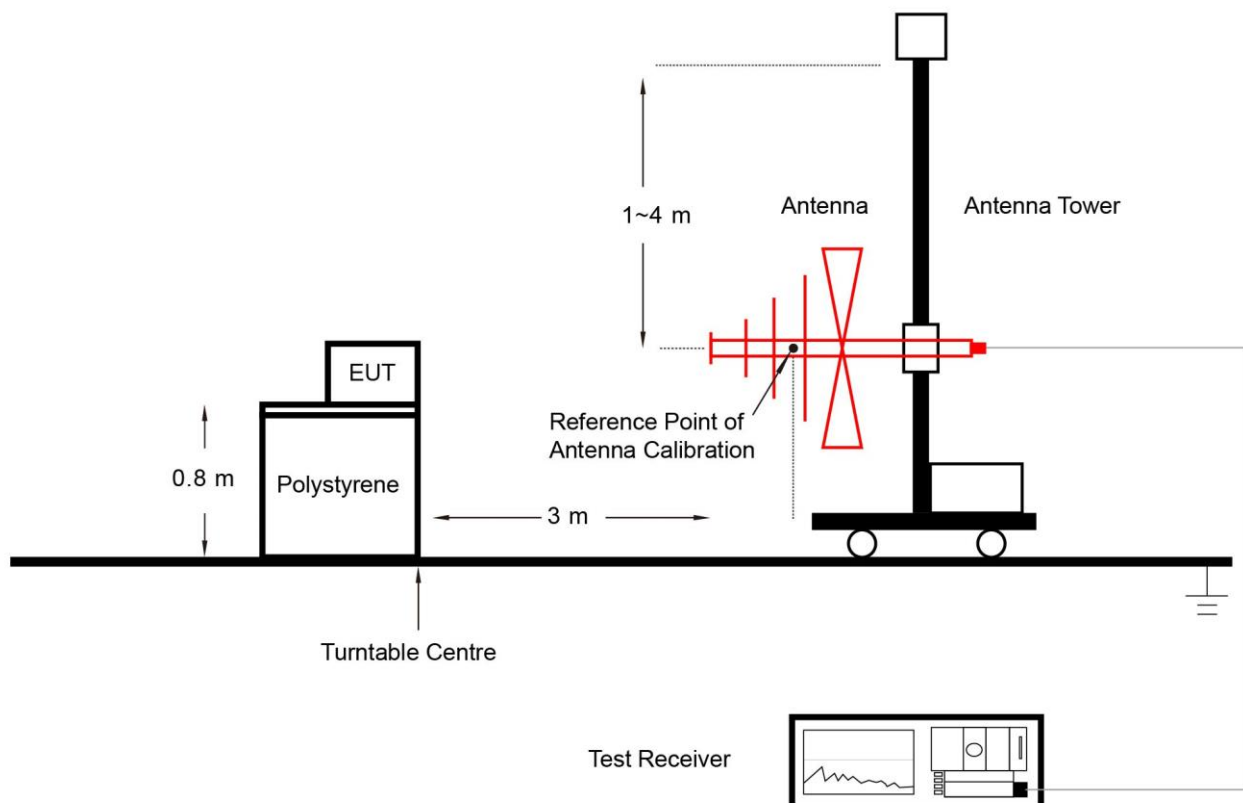
Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41	--	--	--

6.3.2. Test Setup

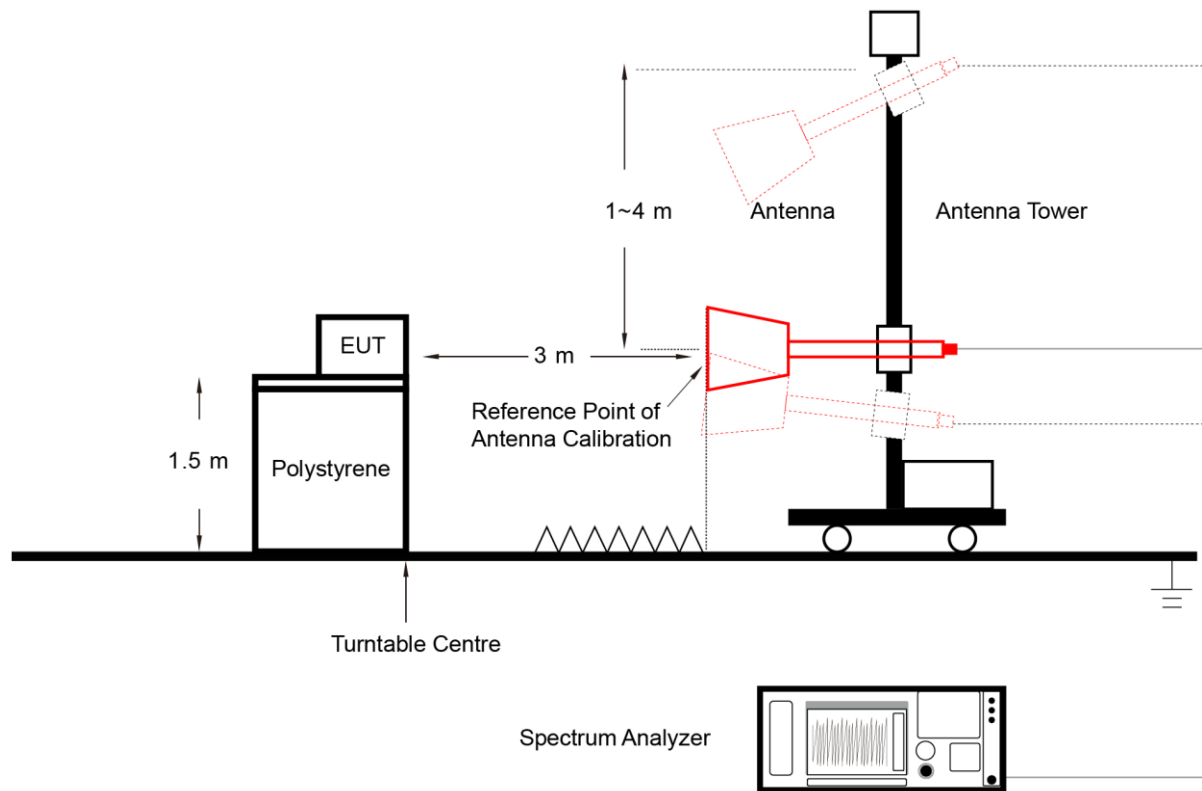
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:

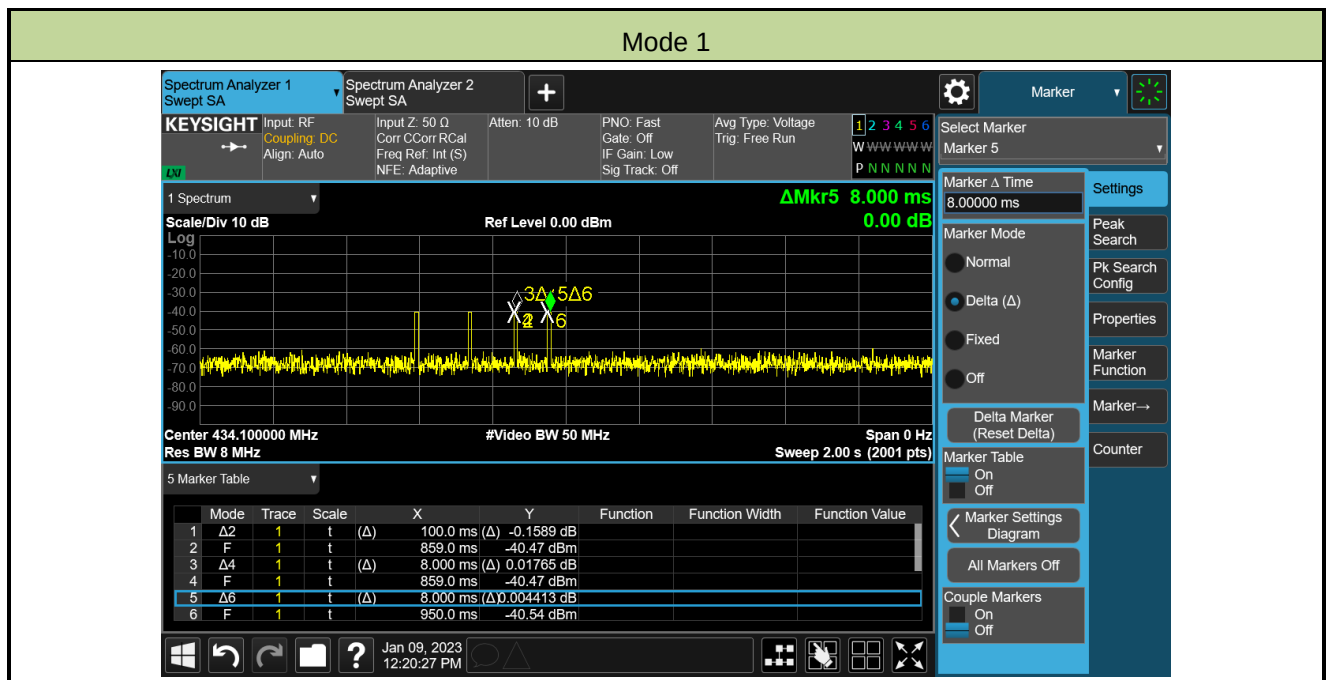


6.3.3. Test Results

Test Site	WZ-AC1	Test Engineer	Charles Zhang
Test Date	2023-01-09		

Test Mode	Time On (ms)	One Period (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
Mode 1	16.00	100	16	-15.92

Note: Duty Cycle Factor (dB) = $20 \cdot \log_{10}(\text{Duty Cycle})$ (dB).



Test Site	WZ-AC1	Test Engineer	Charles Zhang
Test Date	2022-12-29	Note	Fundamental Radiated Emission

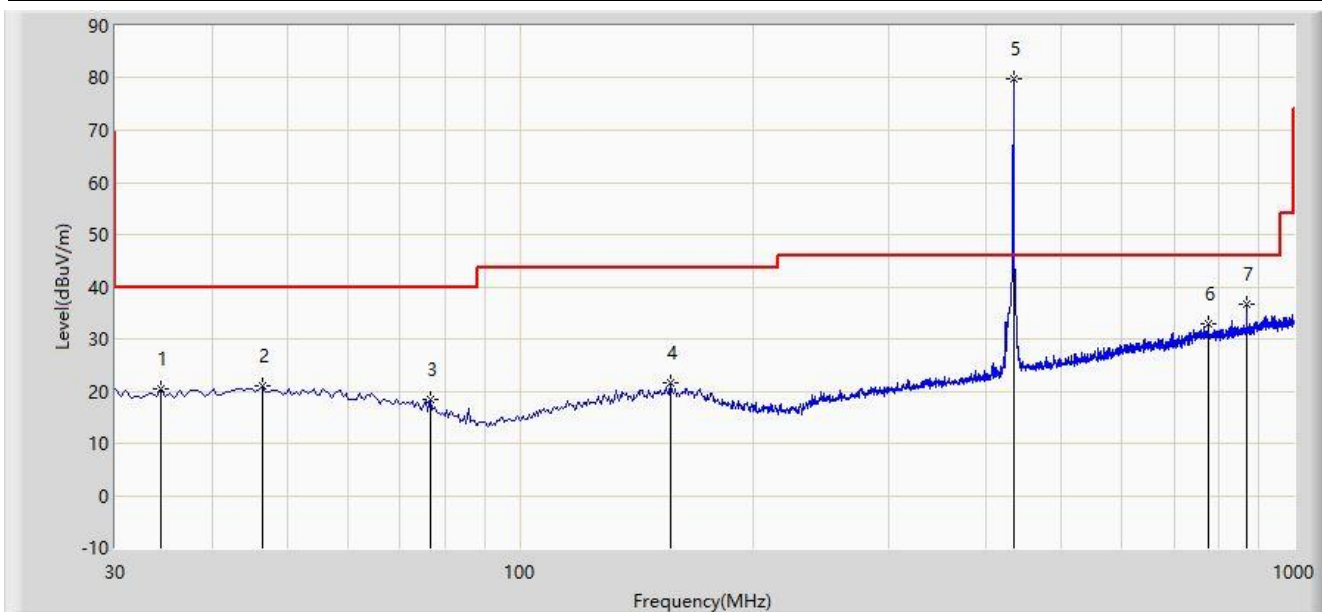
Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Duty Cycle Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Mode 1								
434.1	54.003	21.877	N/A	75.880	92.872	-16.992	PK	Horizontal
	54.003	21.877	-15.920	59.960	72.872	-12.912	AV	Horizontal
	57.174	21.877	N/A	73.728	92.872	-19.144	PK	Vertical
	57.174	21.877	-15.920	63.131	72.872	-9.741	AV	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m) Average Measure Level = Peak Measure Level + Duty Cycle Factor Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m)								

Test Site	WZ-AC1	Test Engineer	Charles Zhang
Test Date	2022-12-26	Note	Radiated Spurious Emissions

Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Duty Cycle Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Mode 1								
1302.000	54.737	-6.106	N/A	48.631	74.000	-25.369	PK	Horizontal
1302.000	54.737	-6.106	-15.920	32.711	54.000	-21.289	AV	Horizontal
2170.000	54.052	-3.341	N/A	50.711	74.000	-23.289	PK	Horizontal
2170.000	54.052	-3.341	-15.920	34.791	54.000	-19.209	AV	Horizontal
2604.000	58.836	-3.131	N/A	55.705	74.000	-18.295	PK	Horizontal
2604.000	58.836	-3.131	-15.920	39.785	54.000	-14.215	AV	Horizontal
3040.000	59.591	-1.434	N/A	58.157	74.000	-15.843	PK	Horizontal
3040.000	59.591	-1.434	-15.920	42.237	54.000	-11.763	AV	Horizontal
3906.000	44.945	0.269	N/A	45.214	74.000	-28.786	PK	Horizontal
3906.000	44.945	0.269	-15.920	29.294	54.000	-24.706	AV	Horizontal
4774.000	43.051	2.528	N/A	45.579	74.000	-28.421	PK	Horizontal
4774.000	43.051	2.528	-15.920	29.659	54.000	-24.341	AV	Horizontal
1302.000	46.410	-6.106	N/A	40.304	74.000	-33.696	PK	Vertical
1302.000	46.410	-6.106	-15.920	24.384	54.000	-29.616	AV	Vertical
2170.000	57.683	-3.341	N/A	54.342	74.000	-19.658	PK	Vertical
2170.000	57.683	-3.341	-15.920	38.422	54.000	-15.578	AV	Vertical
2606.000	60.112	-3.122	N/A	56.990	74.000	-17.010	PK	Vertical
2606.000	60.112	-3.122	-15.920	41.070	54.000	-12.930	AV	Vertical
3040.000	56.141	-1.434	N/A	54.707	74.000	-19.293	PK	Vertical
3040.000	56.141	-1.434	-15.920	38.787	54.000	-15.213	AV	Vertical
3908.000	47.486	0.273	N/A	47.759	74.000	-26.241	PK	Vertical
3908.000	47.486	0.273	-15.920	31.839	54.000	-22.161	AV	Vertical
4774.000	40.404	2.528	N/A	42.932	74.000	-31.068	PK	Vertical
4774.000	40.404	2.528	-15.920	27.012	54.000	-26.988	AV	Vertical
Note 1: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m)								
Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)								
Average Measure Level = Peak Measure Level + Duty Cycle Factor								

The Result of Radiated Emission below 1GHz:

Site: WZ-AC1	Test Date: 2022-12-27
Limit: FCC_Part15.209_RSE(3m)	Engineer: Charles Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Horizontal
EUT: Doran TPMS Sensor for Truck	Power: By Battery
Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		34.365	20.423	2.821	-19.577	40.000	17.603	PK
2		46.490	21.001	2.642	-18.999	40.000	18.359	PK
3		76.560	18.424	3.497	-21.576	40.000	14.927	PK
4		156.585	21.590	3.439	-21.910	43.500	18.151	PK
5	*	434.005	79.925	58.051	N/A	N/A	21.873	PK
6		776.415	33.022	4.834	-12.978	46.000	28.188	PK
7		868.080	36.678	7.605	-9.322	46.000	29.073	PK

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

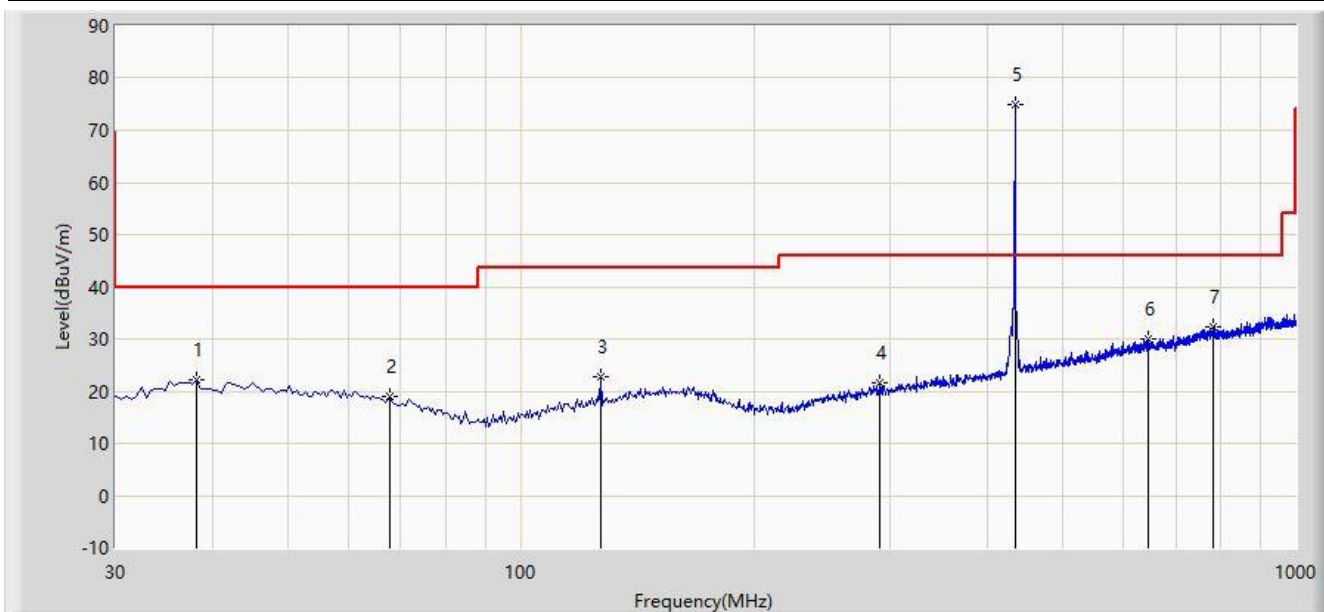
Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: Quasi-Peak measurement was not performed when peak measure level was lower than the quasi-peak limit.

Note 5: Point (5) is the fundamental frequency.

Note 6: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

Site: WZ-AC1	Test Date: 2022-12-27
Limit: FCC_Part15.209_RSE(3m)	Engineer: Charles Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Vertical
EUT: Doran TPMS Sensor for Truck	Power: By Battery
Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dBμV/m)	Reading Level (dBμV)	Margin (dB)	Limit (dBμV/m)	Factor (dB/m)	Type
1		38.245	22.157	4.081	-17.843	40.000	18.076	PK
2		67.830	19.083	2.555	-20.917	40.000	16.528	PK
3		127.000	22.744	6.312	-20.756	43.500	16.432	PK
4		290.445	21.676	3.479	-24.324	46.000	18.197	PK
5	*	434.005	74.992	53.118	N/A	N/A	21.873	PK
6		646.435	30.085	3.896	-15.915	46.000	26.188	PK
7		783.205	32.375	4.169	-13.625	46.000	28.206	PK

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: Quasi-Peak measurement was not performed when peak measure level was lower than the quasi-peak limit.

Note 5: Point (5) is the fundamental frequency.

Note 6: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

6.4. 20dB Bandwidth

6.4.1. Test Limit

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

6.4.2. Test Procedure

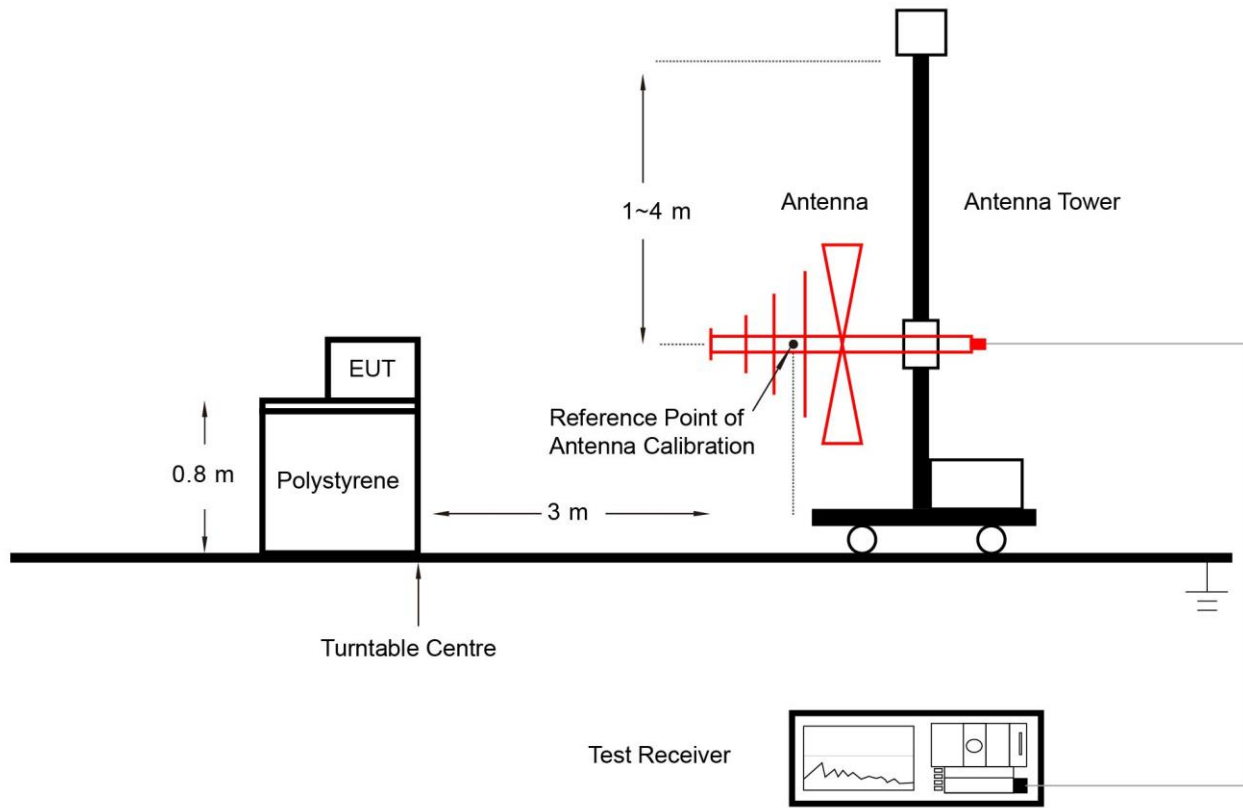
ANSI C63.10-2013 Clause 6.9.2

6.4.3. Test Setting

20dB Bandwidth:

1. Set the spectrum span shall be between 2 times and 5 times the OBW
2. Set RBW = 1% to 5% of the OBW
3. $VBW \geq 3 \times RBW$
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple

6.4.4. Test Setup

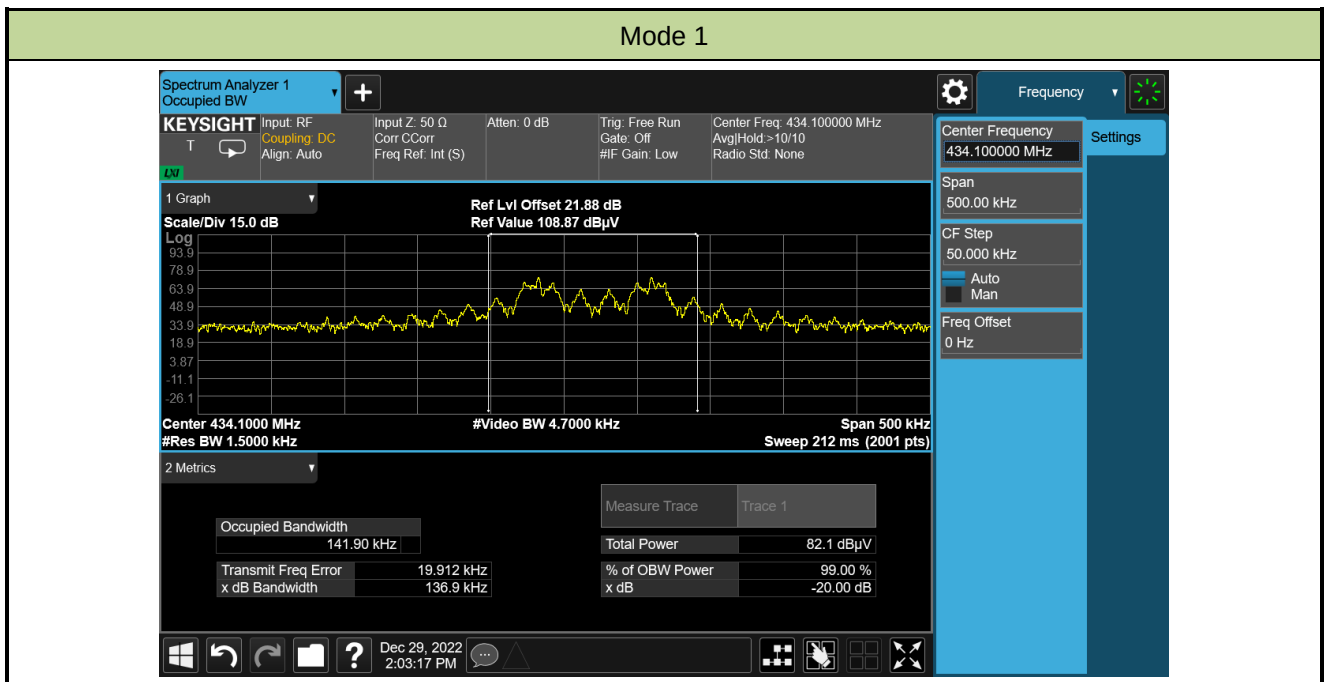


6.4.5. Test Result

Test Site	WZ-AC1	Test Engineer	Charles Zhang
Test Date	2022-12-29		

Test Mode	20dB Bandwidth (kHz)	Limit (kHz)	Result
Mode 1	136.9	≤ 1085.25	Pass

Note: Limit = Fundamental Frequency * 0.25% = 434.1MHz * 0.25% = 1085.25 kHz



6.5. Transmission Time

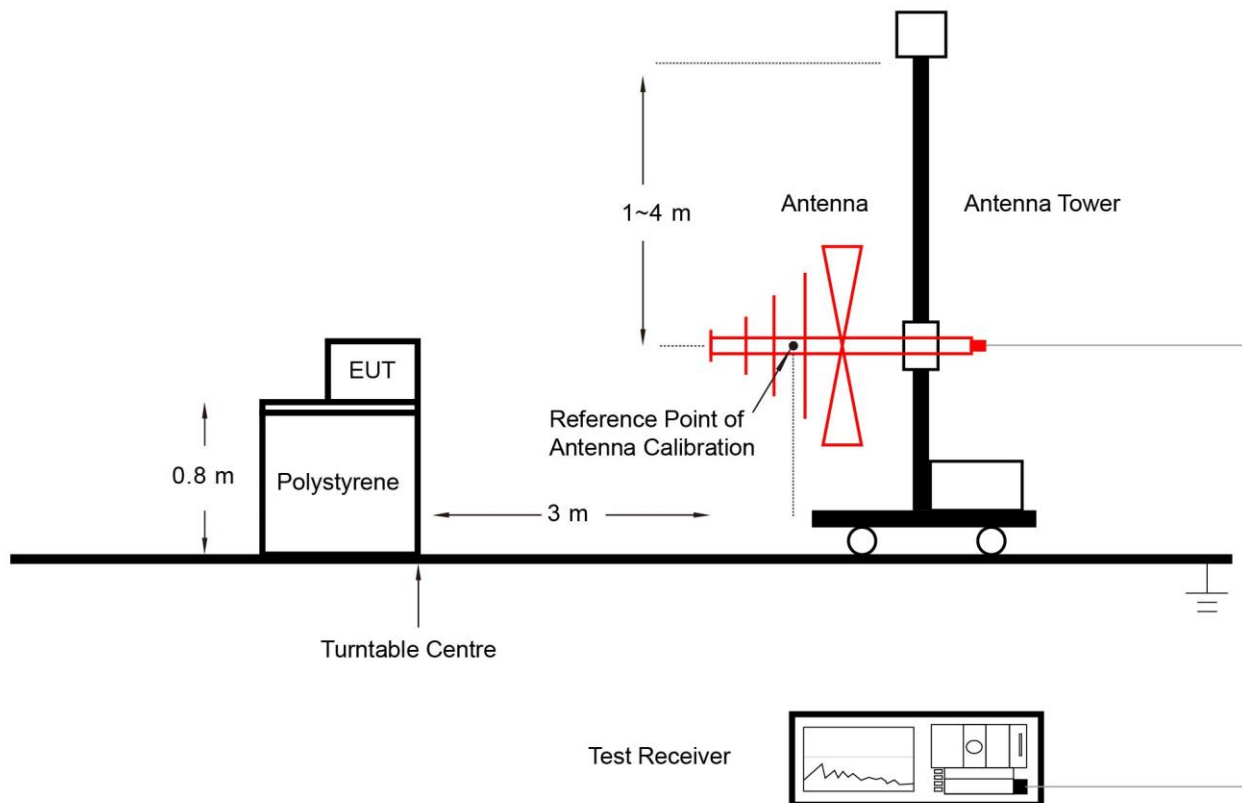
6.5.1. Test Limit

According to FCC 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.

6.5.2. Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to fundamental frequency, then set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

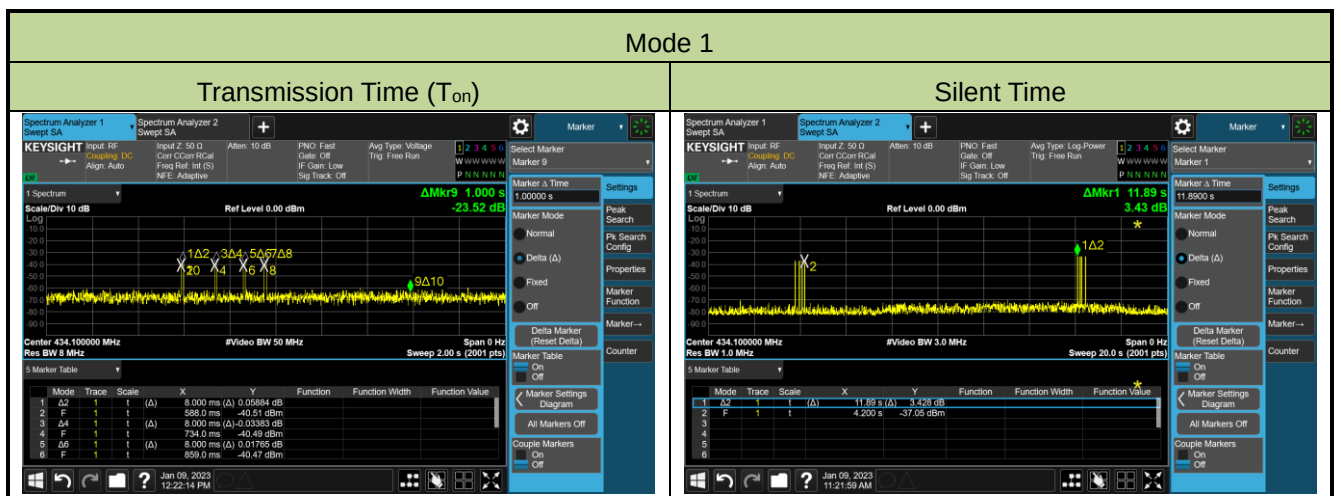
6.5.3. Test Setup



6.5.4. Test Result

Test Site	WZ-AC1	Test Engineer	Charles Zhang
Test Date	2023-01-09		

Test Mode	Item	Measured Value	Limit	Result
Mode 1	Transmission Time (T _{on})	32 ms	≤ 1 s	Pass
	Silent Time	11.89 s	≥ 10 s	Pass
	Silent Time/Transmission Time	371.56	≥ 30 times	Pass



Appendix A - Test Setup Photograph

Refer to “2212RSU053-UT” file.

Appendix B - EUT Photograph

Refer to "2212RSU053-UE" file.