



RF MEASUREMENT REPORT

FCC ID: VZ4-3604AG

Applicant: Doran Manufacturing LLC

Product: Doran TPMS Sensor for Agriculture Truck

Model No.: 3604AG

Brand Name: Doran

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

FCC Rule Part(s): Part 15.231

Result: Complies

Received Date: 2023-03-01

Test Date: 2023-03-07 ~ 2023-03-09

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
2303RSU002-U2	V01	Initial Report	2023-03-22	Valid

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1.4. Product Information

Product	Doran TPMS Sensor for Agriculture Truck
Model No.	3604AG
Brand Name	Doran
Operating Voltage	Internal lithium battery (2.3 ~ 3.6Vdc, Nominal 3.0Vdc)
Operating Temperature	-40 ~ 120°C
EUT Identification No.	20230301Sample#06

Note:

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

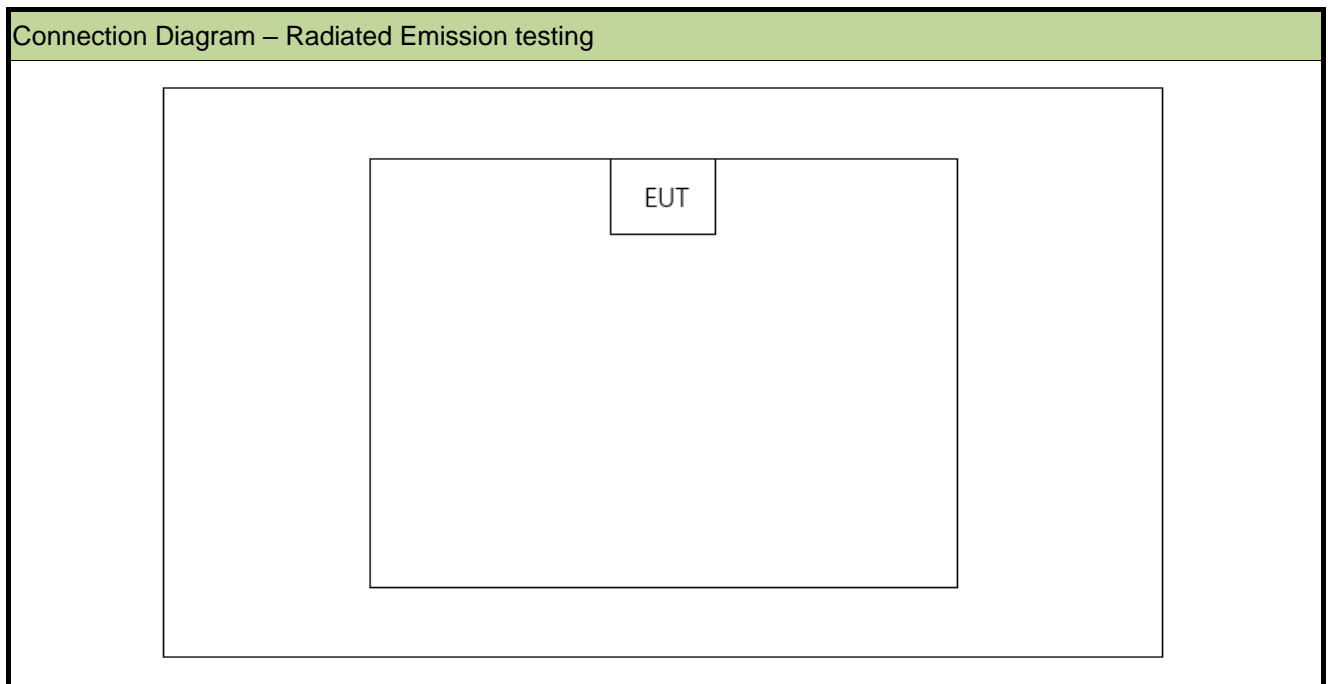
2.1. Test Mode

Mode 1: Transmit at 434.1MHz

Note: The sample is configured to engineering mode by manufacturer, which can be set to transmit continuously and normal status.

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.



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
TRILOG Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2023-05-20	WZ-AC2
EMI Test Receiver	Agilent	N9038A	MRTSUE06125	1 year	2023-06-04	WZ-AC2
Thermohygrometer	Mingle	ETH529	MRTSUE06170	1 year	2023-11-27	WZ-AC2
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06171	1 year	2023-10-13	WZ-AC2
Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2023-05-08	WZ-AC2
Anechoic Chamber	RIKEN	WZ-AC2	MRTSUE06213	1 year	2023-04-21	WZ-AC2
Thermohygrometer	testo	608-H1	MRTSUE11038	1 year	2023-11-01	WZ-AC2
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2023-09-29	WZ-AC2

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802	1.02	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~40GHz: 4.98dB
Vertical:	30MHz~200MHz: 4.06dB
	200MHz~1GHz: 5.28dB
	1GHz~40GHz: 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

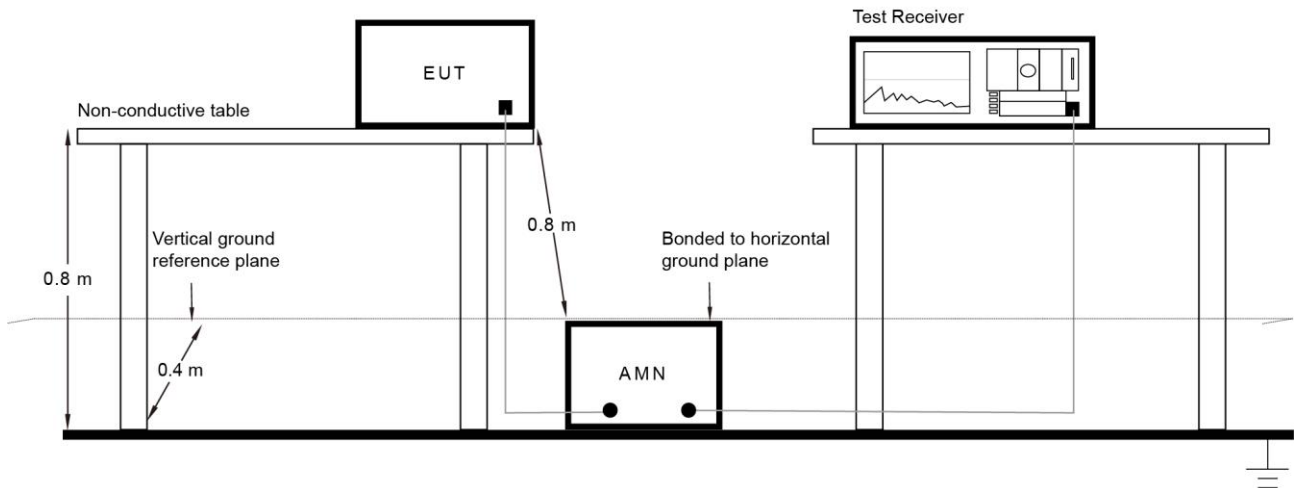
6.2.1. Test Limit

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.

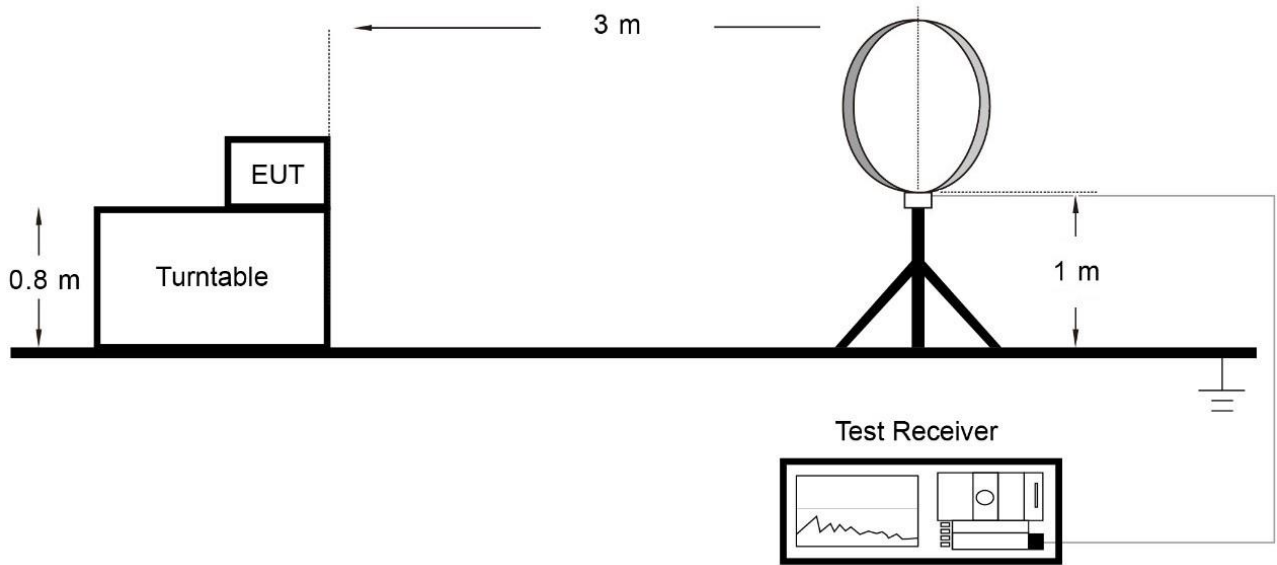
For 15.205 requirement:

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).

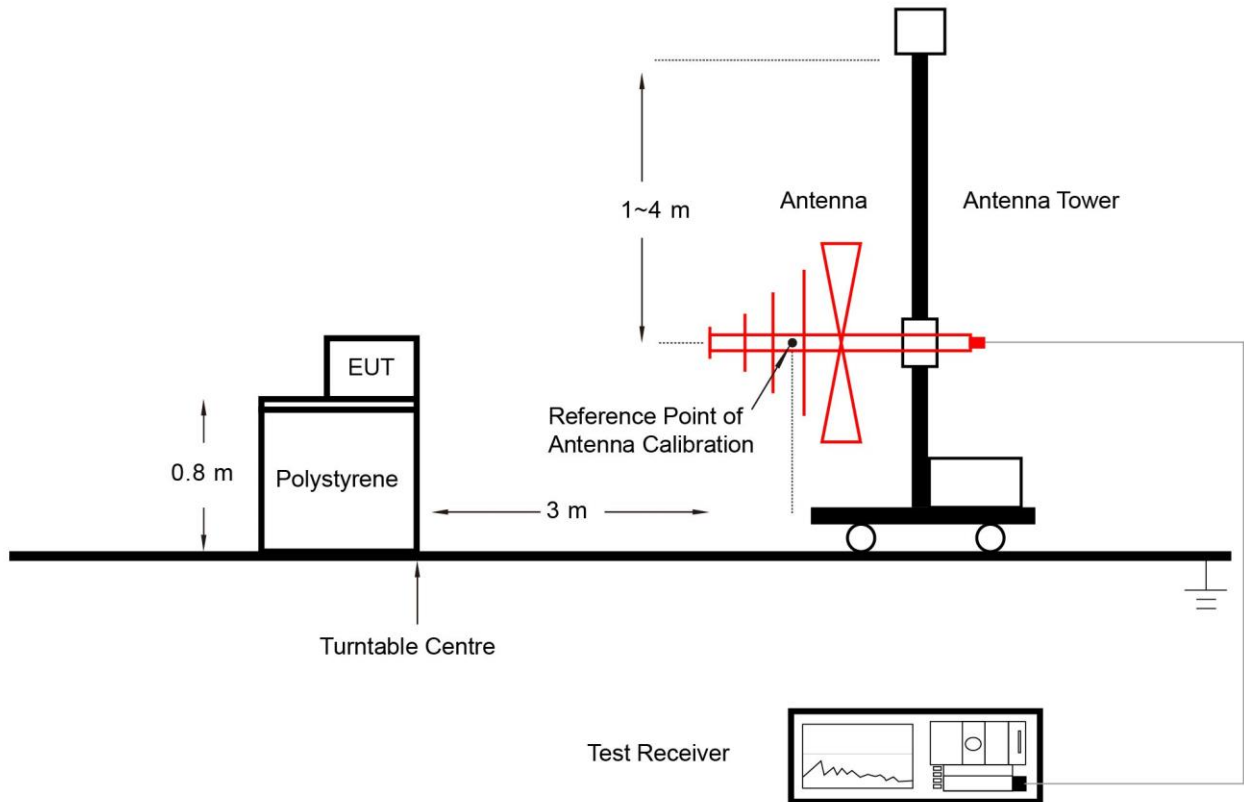
Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	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

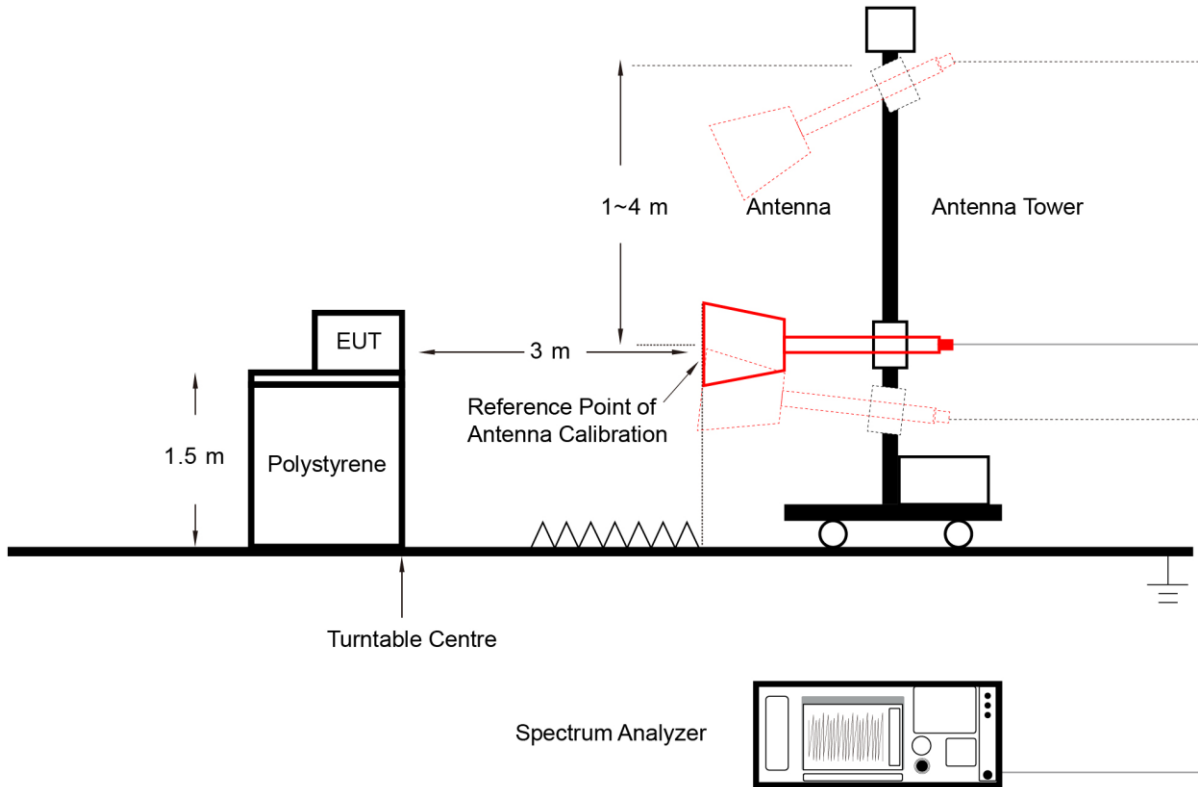
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:

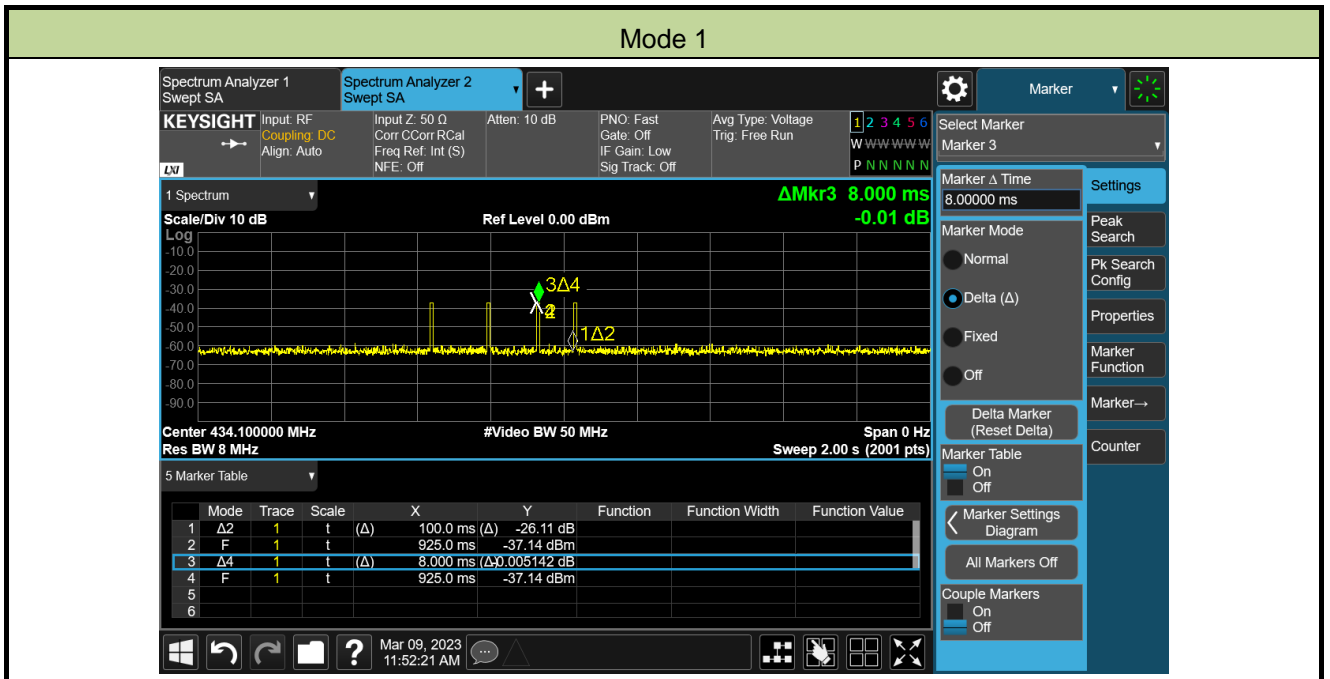


6.3.3. Test Results

Test Site	WZ-AC2	Test Engineer	Dick Shen
Test Date	2023-03-09		

Test Mode	Time On (ms)	One Period (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
Mode 1	8	100	8	-21.94

Note: Duty Cycle Factor (dB) = 20*Log₁₀(Duty Cycle) (dB).



Test Site	WZ-AC2	Test Engineer	Dick Shen
Test Date	2023-03-07	Remark	Fundamental Radiated Emission

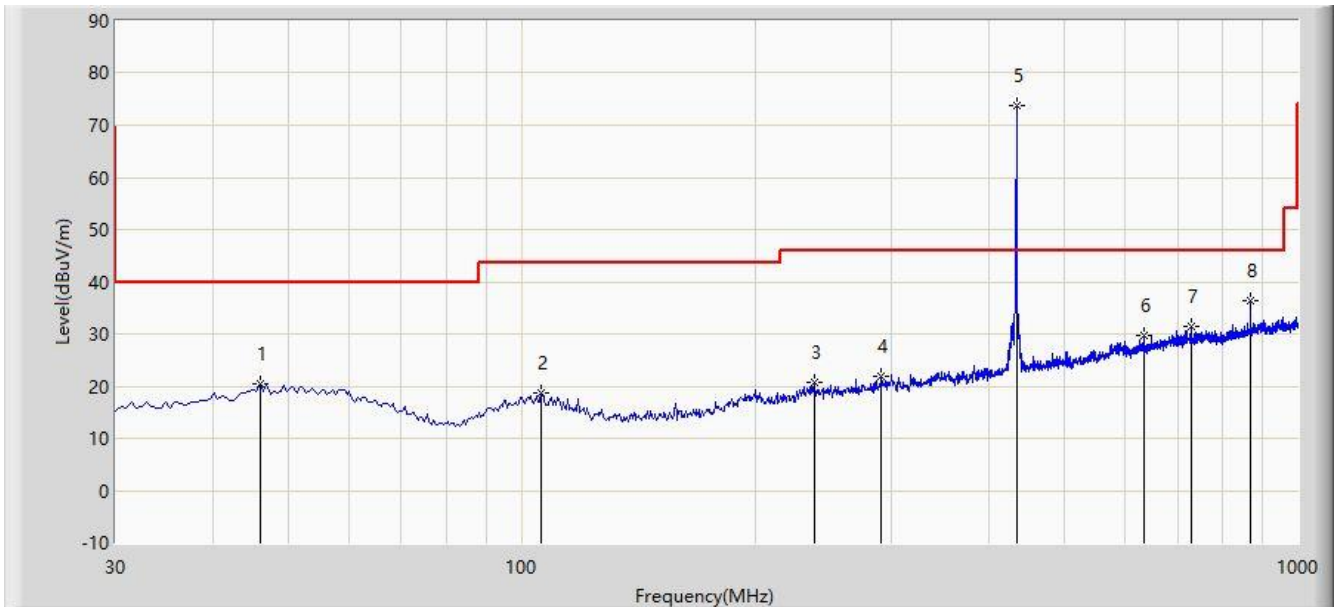
Frequency (MHz)	Reading Level (dB μ V)	Factor (dB/m)	Duty Cycle Factor (dB)	Measure Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Polarization
Mode 1								
434.1	50.039	23.774	N/A	73.813	92.872	-19.059	PK	Horizontal
	50.039	23.774	-21.940	51.873	72.872	-20.999	AV	Horizontal
	50.555	23.774	N/A	74.329	92.872	-18.543	PK	Vertical
	50.555	23.774	-21.940	52.389	72.872	-20.483	AV	Vertical
Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + 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-AC2	Test Engineer	Dick Shen
Test Date	2023-03-07	Remark	Radiated Spurious Emissions

Frequency (MHz)	Reading Level (dB μ V)	Factor (dB/m)	Duty Cycle Factor (dB)	Measure Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Polarization
Mode 1								
1416.000	40.511	-5.131	N/A	35.380	74.000	-38.620	PK	Horizontal
1416.000	40.511	-5.131	-21.940	13.440	54.000	-40.560	AV	Horizontal
2170.000	52.614	-2.598	N/A	50.016	74.000	-23.984	PK	Horizontal
2170.000	52.614	-2.598	-21.940	28.076	54.000	-25.924	AV	Horizontal
2266.000	38.550	-2.195	N/A	36.355	74.000	-37.645	PK	Horizontal
2266.000	38.550	-2.195	-21.940	14.415	54.000	-39.585	AV	Horizontal
2604.000	62.650	-2.687	N/A	59.963	74.000	-14.037	PK	Horizontal
2604.000	62.650	-2.687	-21.940	38.023	54.000	-15.977	AV	Horizontal
3038.000	56.931	-2.960	N/A	53.971	74.000	-20.029	PK	Horizontal
3038.000	56.931	-2.960	-21.940	32.031	54.000	-21.969	AV	Horizontal
3906.000	40.162	0.038	N/A	40.200	74.000	-33.800	PK	Horizontal
3906.000	40.162	0.038	-21.940	18.260	54.000	-35.740	AV	Horizontal
1302.000	53.309	-5.083	N/A	48.226	74.000	-25.774	PK	Vertical
1302.000	53.309	-5.083	-21.940	26.286	54.000	-27.714	AV	Vertical
1736.000	45.397	-5.845	N/A	39.552	74.000	-34.448	PK	Vertical
1736.000	45.397	-5.845	-21.940	17.612	54.000	-36.388	AV	Vertical
2170.000	51.517	-2.598	N/A	48.919	74.000	-25.081	PK	Vertical
2170.000	51.517	-2.598	-21.940	26.979	54.000	-27.021	AV	Vertical
2604.000	63.794	-2.687	N/A	61.107	74.000	-12.893	PK	Vertical
2604.000	63.794	-2.687	-21.940	39.167	54.000	-14.833	AV	Vertical
3040.000	54.373	-2.968	N/A	51.405	74.000	-22.595	PK	Vertical
3040.000	54.373	-2.968	-21.940	29.465	54.000	-24.535	AV	Vertical
3474.000	48.166	-1.508	N/A	46.658	74.000	-27.342	PK	Vertical
3474.000	48.166	-1.508	-21.940	24.718	54.000	-29.282	AV	Vertical
Note 1: Peak Measure Level (dB μ V/m) = Reading Level (dB μ V) + 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-AC2	Test Date: 2023-03-07
Limit: FCC_Part15.209_RSE(3m)	Engineer: Dick Shen
Probe: VULB9162_30-7000MHz	Polarity: Horizontal
EUT: Doran TPMS Sensor for Agriculture Truck	Power: By Battery
Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB/m)	Type
1		46.005	20.376	0.270	-19.624	40.000	20.106	PK
2		106.145	18.730	0.251	-24.770	43.500	18.479	PK
3		238.550	20.706	0.981	-25.294	46.000	19.725	PK
4		290.930	21.967	1.197	-24.033	46.000	20.770	PK
5	*	434.005	73.814	50.039	N/A	N/A	23.774	PK
6		634.795	29.654	2.387	-16.346	46.000	27.267	PK
7		727.915	31.348	2.453	-14.652	46.000	28.895	PK
8		869.535	36.376	5.600	-9.624	46.000	30.776	PK

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

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

Average Measure Level = Peak Measure Level + Duty Cycle Factor

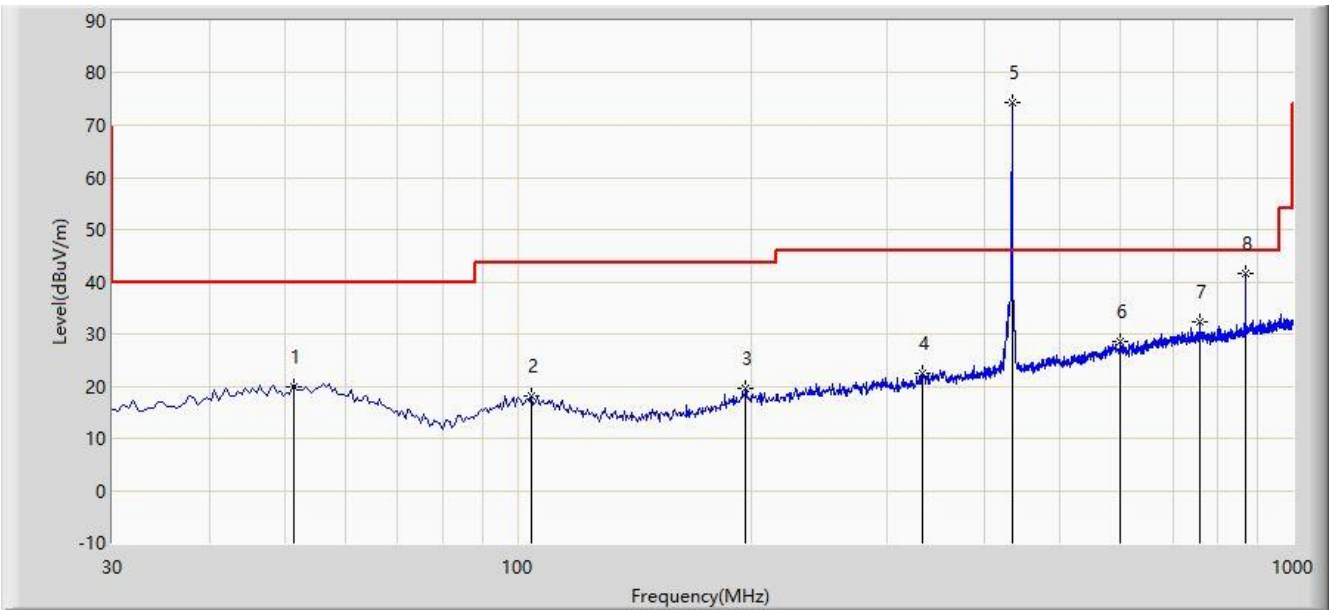
Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

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-AC2	Test Date: 2023-03-07
Limit: FCC_Part15.209_RSE(3m)	Engineer: Dick Shen
Probe: VULB9162_30-7000MHz	Polarity: Vertical
EUT: Doran TPMS Sensor for Agriculture Truck	Power: By Battery
Mode 1	



No	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Margin (dB)	Limit (dB μ V/m)	Factor (dB/m)	Type
1		51.340	20.000	-0.433	-20.000	40.000	20.433	PK
2		104.205	18.251	-0.322	-25.249	43.500	18.573	PK
3		196.840	19.598	0.782	-23.902	43.500	18.816	PK
4		332.640	22.356	0.563	-23.644	46.000	21.793	PK
5	*	434.005	74.330	50.555	N/A	N/A	23.774	PK
6		598.905	28.460	1.579	-17.540	46.000	26.882	PK
7		757.985	32.268	2.716	-13.732	46.000	29.552	PK
8		868.565	41.605	10.830	-4.395	46.000	30.775	PK

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

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

Average Measure Level = Peak Measure Level + Duty Cycle Factor

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

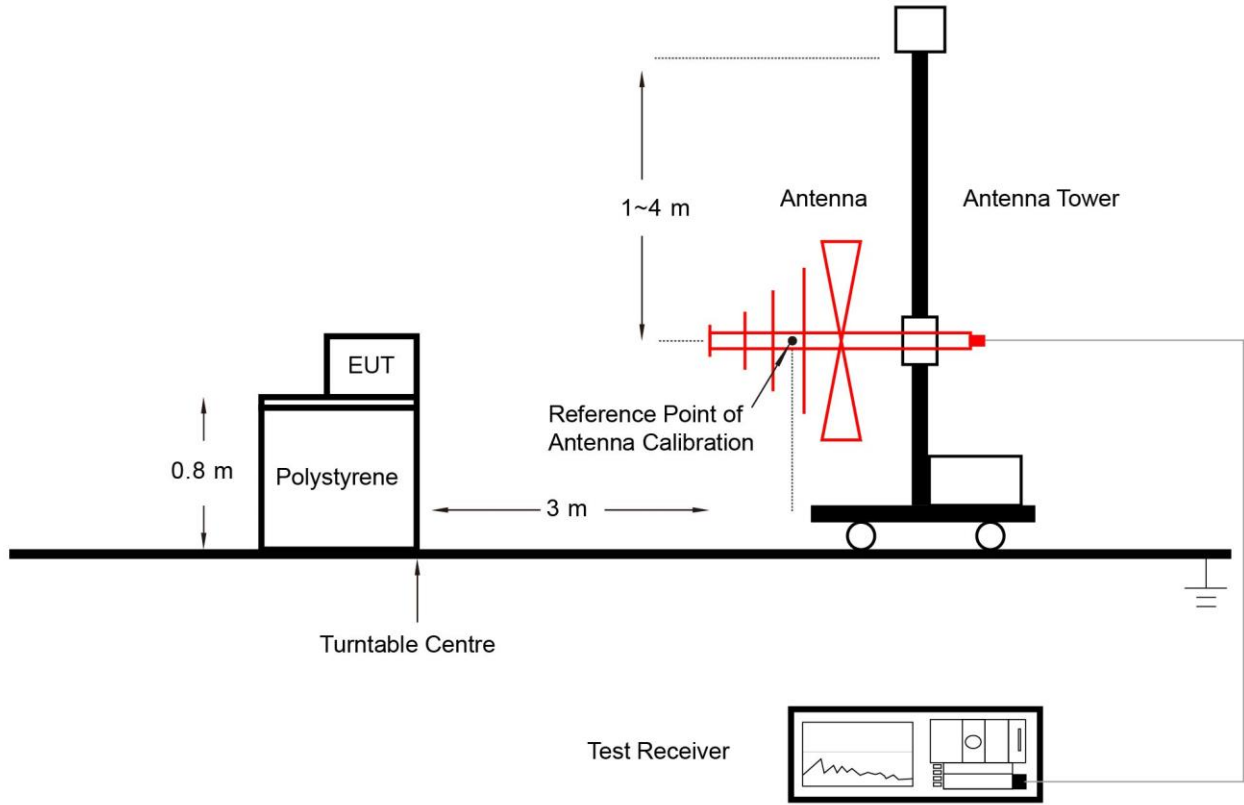
ANSI C63.10-2013 Clause 6.9.2

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

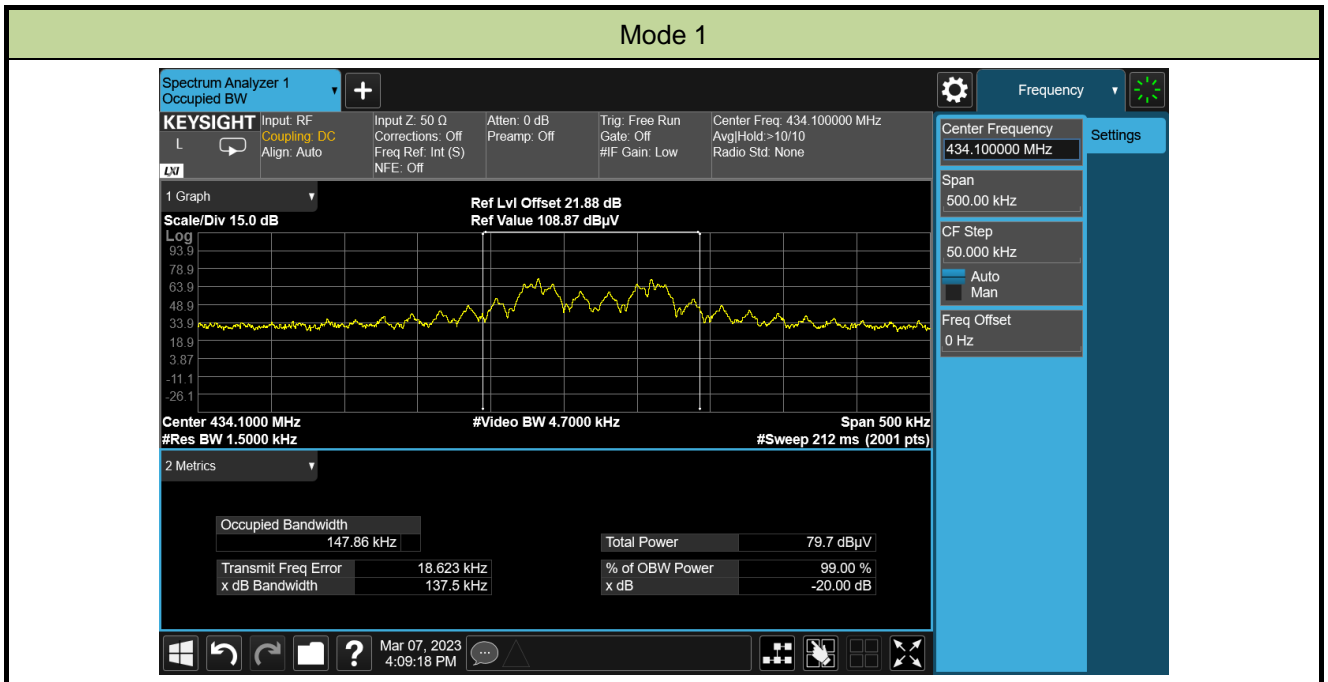


6.4.5. Test Result

Test Site	WZ-AC2	Test Engineer	Dick Shen
Test Date	2023-03-07		

Test Mode	20dB Bandwidth (kHz)	Limit (kHz)	Result
Mode 1	137.5	≤ 1085.25	Pass

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



6.5. Transmission Time

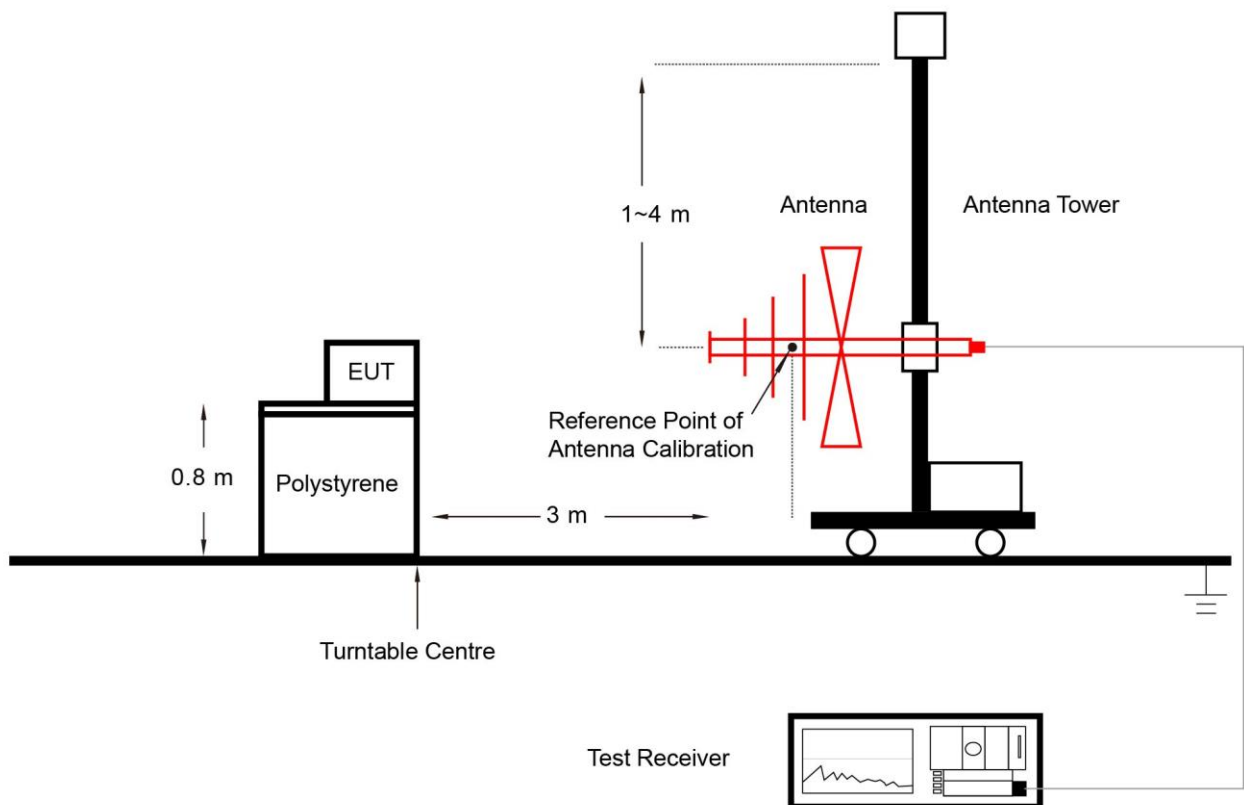
6.5.1. Test Limit

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

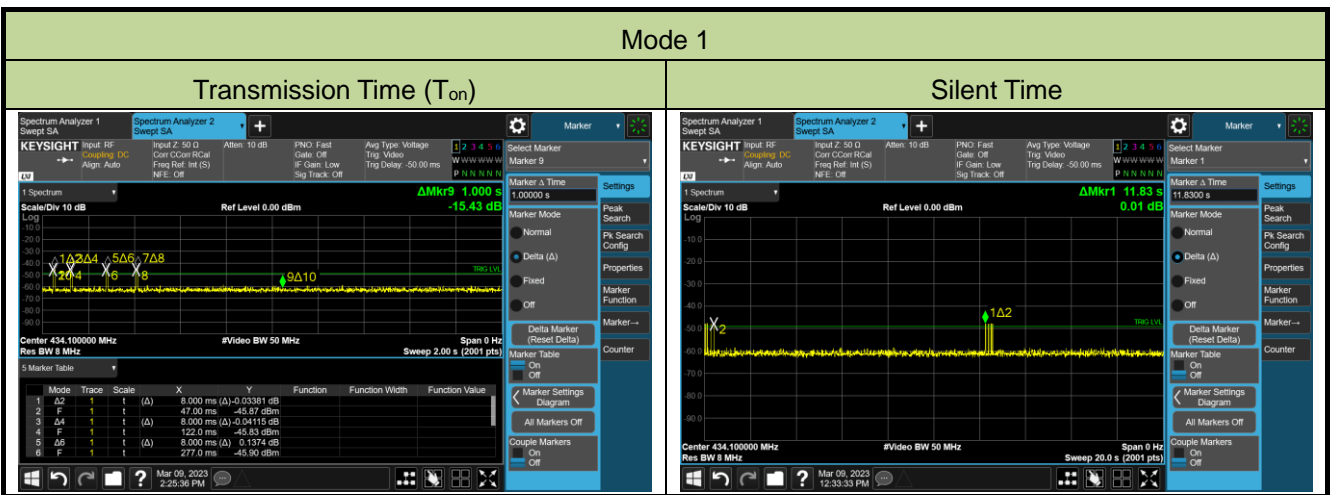


6.5.4. Test Result

Test Site	WZ-AC2	Test Engineer	Dick Shen
Test Date	2023-03-09		

Test Mode	Item	Measured Value	Limit	Result
Mode 1	Transmission Time (T _{on})	32 ms	≤ 1 s	Pass
	Silent Time	11.83 s	≥ 10 s	Pass
	Silent Time/Transmission Time	369.6875	≥ 30 times	Pass

Note: Transmission Time (T_{on}) = 8ms * 4 = 32ms



Appendix A - Test Setup Photograph

Refer to "2303RSU002-UT" file.

Appendix B - EUT Photograph

Refer to "2303RSU002-UE" file.