

FCC Test Report

Applicant : Tsingaoal (Beijing) Technology Co., Ltd.

Address : Room A1002-1, Block A, 10th Floor, Building
1, Yard 1, Zhongguancun East Road, Haidian
District, Beijing, China

Product Name : Ranging Anchor

Report Date : Oct. 30, 2024



Shenzhen Anbotek Compliance Laboratory Limited



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TEST REPORT

Applicant : Tsingol (Beijing) Technology Co., Ltd.

Manufacturer : Tsingol (Beijing) Technology Co., Ltd.

Product Name : Ranging Anchor

Model No. : MA2000

Trade Mark : N/A

Rating(s) : Input: 24V-48V DC

Test Standard(s) : FCC Part15 Subpart F, Section 15.517

Test Method(s) : ANSI C63.10: 2020, KDB 447498 D01 General RF Exposure Guidance v06

The device described above is tested by Shenzhen Anbotech Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotech Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart F requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotech Compliance Laboratory Limited.

Date of Receipt

Sept. 26, 2024

Date of Test

Sept. 26, 2024 ~ Oct. 16, 2024

Prepared By

Ella Liang

(Ella Liang)

Approved & Authorized Signer

Kingkong Jin

(Kingkong Jin)



Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Oct. 30, 2024



1. General Information

1.1. Client Information

Applicant	:	Tsingoal (Beijing) Technology Co., Ltd.
Address	:	Room A1002-1, Block A, 10th Floor, Building 1, Yard 1, Zhongguancun East Road, Haidian District, Beijing, China
Manufacturer	:	Tsingoal (Beijing) Technology Co., Ltd.
Address	:	Room A1002-1, Block A, 10th Floor, Building 1, Yard 1, Zhongguancun East Road, Haidian District, Beijing, China
Factory	:	Tsingoal (Beijing) Technology Co., Ltd.
Address	:	Room A1002-1, Block A, 10th Floor, Building 1, Yard 1, Zhongguancun East Road, Haidian District, Beijing, China

1.2. Description of Device (EUT)

Product Name	:	Ranging Anchor
Model No.	:	MA2000
Trade Mark	:	N/A
Test Power Supply	:	DC 48V from adapter input AC 120V/60Hz
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	N/A

RF Specification

Operation Frequency	:	6489.6MHz
Number of Channel	:	1 Channels
Modulation Type	:	OFDM
Antenna Type	:	PCB Antenna
Antenna Gain(Peak)	:	5dBi

Remark: 1) All of the RF specification are provided by customer. 2) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



1.3. Auxiliary Equipment Used During Test

Description	Rating(s)
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1.4. Description of Test Configuration

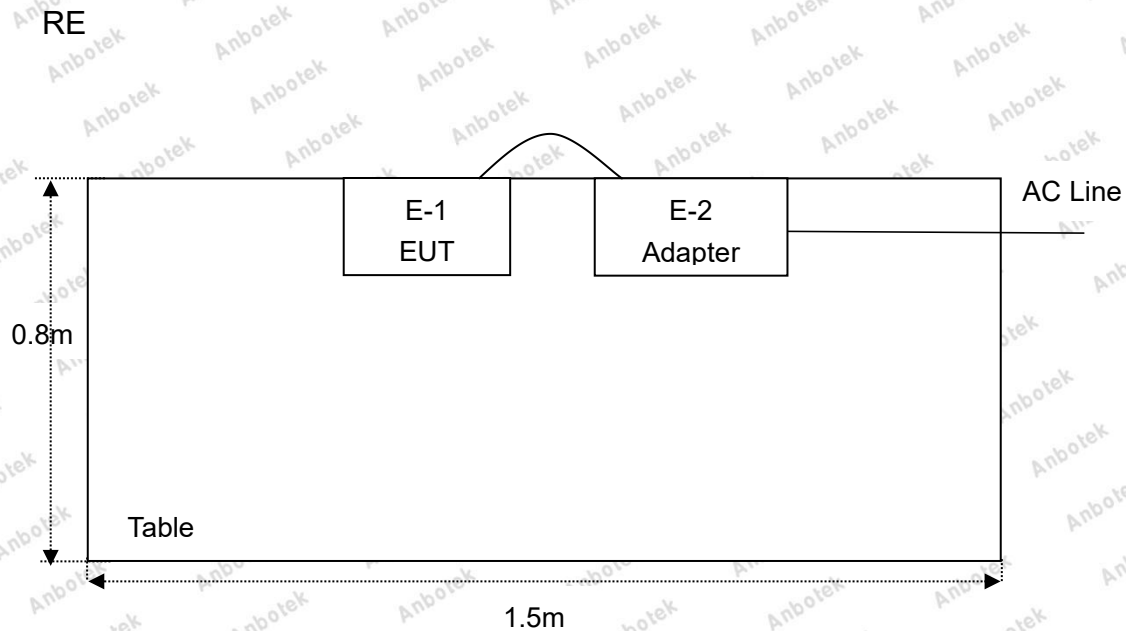
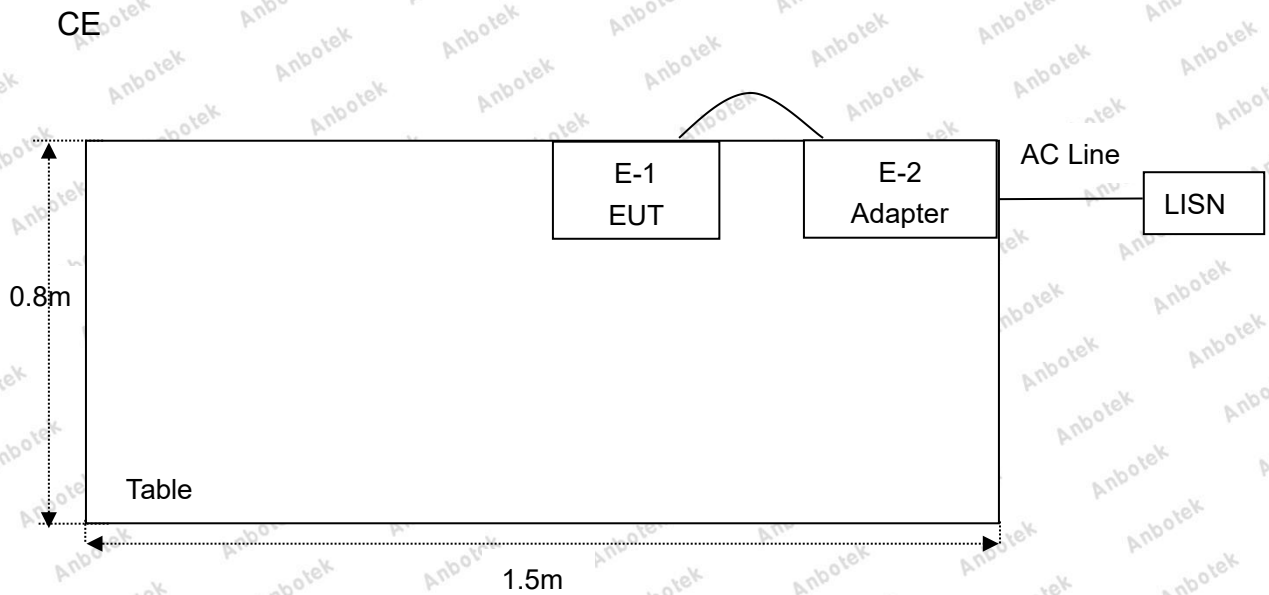
Channel	Freq. (MHz)		
01	6489.6		

Note:

1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.



1.5. Description Of Test Setup



1.6. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Jan. 18, 2024	1 Year
2.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jan. 18, 2024	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Jan. 17, 2024	1 Year
4.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Jan. 23, 2024	1 Year
5.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Sept. 09, 2024	1 Year
6.	EMI Preamplifier	SKET Electronic	LNPA-0118G -45	SKET-PA-002	Jan. 17, 2024	1 Year
7.	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D	02555	Oct. 16, 2022	3 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	345	Oct. 23, 2022	3 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Sept. 12, 2024	1 Year
10.	Horn Antenna	A-INFO	LB-180400- KF	J211060628	Jan. 22, 2024	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Jan. 17, 2024	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Sept. 09, 2024	1 Year
14.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Feb. 04, 2024	1 Year
15.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 10, 2024	1 Year
16.	DC Power Supply	IVYTECH	IV3605	1804D360510	Sept. 09, 2024	1 Year
17.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80 B	N/A	Oct. 16, 2023	1 Year



1.7. Measurement Uncertainty

Parameter	Uncertainty
Conducted emissions (AMN 150kHz~30MHz)	3.8dB
Occupied Bandwidth	925Hz
Power Spectral Density	0.76dB
Conducted Spurious Emission	1.24dB
Radiated spurious emissions (Below 30MHz)	3.53dB
Radiated spurious emissions (30MHz~1GHz)	Horizontal: 3.92dB; Vertical: 4.52dB
Radiated spurious emissions (above 1GHz)	1G-6GHz: 4.78dB; 6G-18GHz: 4.88dB 18G-40GHz: 5.68dB
The measurement uncertainty and decision risk evaluated according to AB/WI-RF-F-032. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

1.8. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 434132

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 434132.

ISED-Registration No.: 8058A

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotek Compliance Laboratory Limited.

Sogood Industrial Zone Laboratory & 1/F. of Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Subdistrict, Bao'an District, Shenzhen, Guangdong, China.



1.9.Disclaimer

1. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
2. The test report is invalid if there is any evidence and/or falsification.
3. The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
4. This document may not be altered or revised in any way unless done so by Anbotek and all revisions are duly noted in the revisions section.
5. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
6. The authenticity of the information provided by the customer is the responsibility of the customer and the laboratory is not responsible for its authenticity.

The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.



2. Summary of Test Results

Standard Section	Test Item	Result
15.203/15.517(a)	Antenna Requirement	PASS
15.207(a)	Conducted Emission	PASS
15.209/ 15.517(c)(d)	Radiated Emissions	PASS
15.503 (a)(d), 15.517(b)	UWB Operation bandwidth	PASS
15.517(e)	Peak Emission in a 50 MHz bandwidth	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		



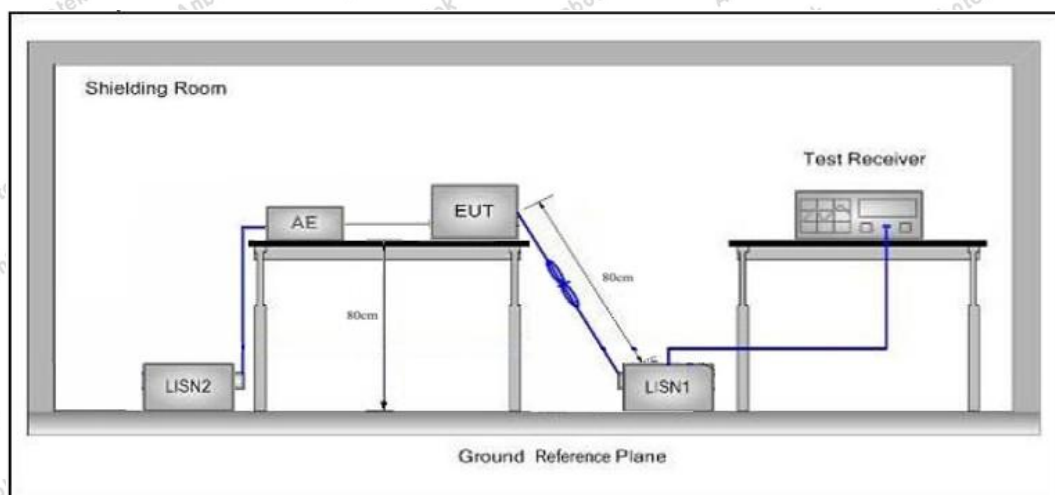
3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207(a)		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50

Remark:(1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequency.

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10: 2020 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

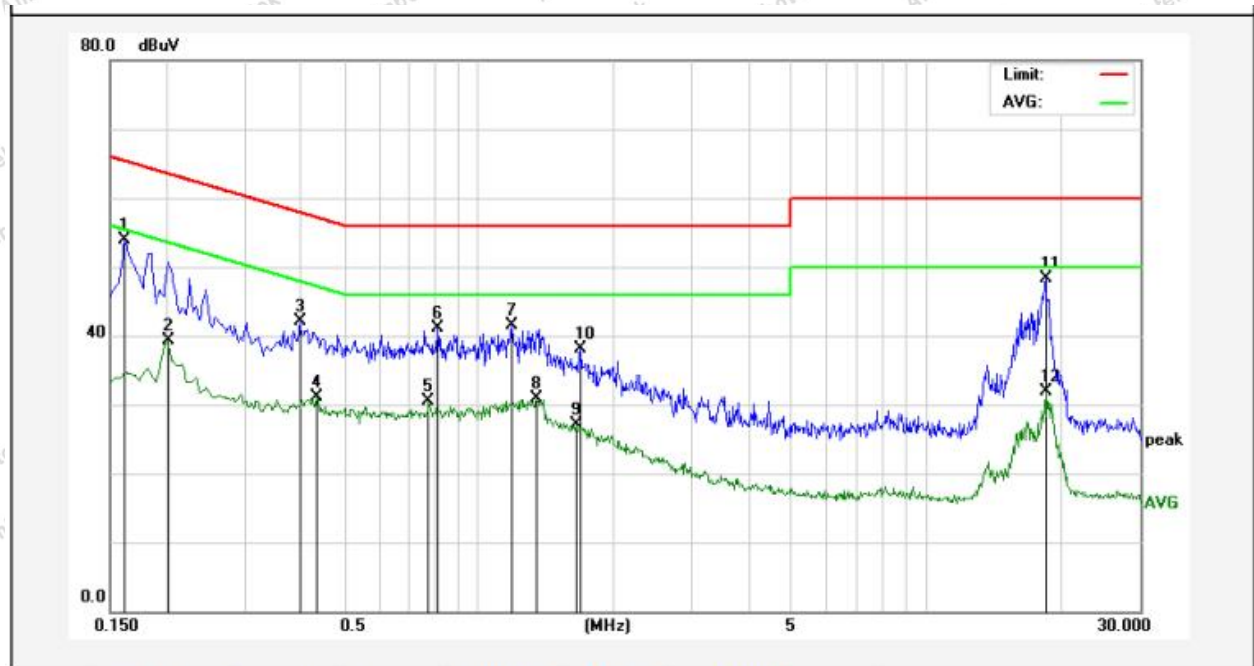
3.4. Test Data

Please to see the following pages.



Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: 6489.6MHz
Test Specification: DC 48V from adapter input AC 120V/60Hz
Comment: Live Line
Temp.(°C)/Hum.(%RH): 23.9°C/50%RH

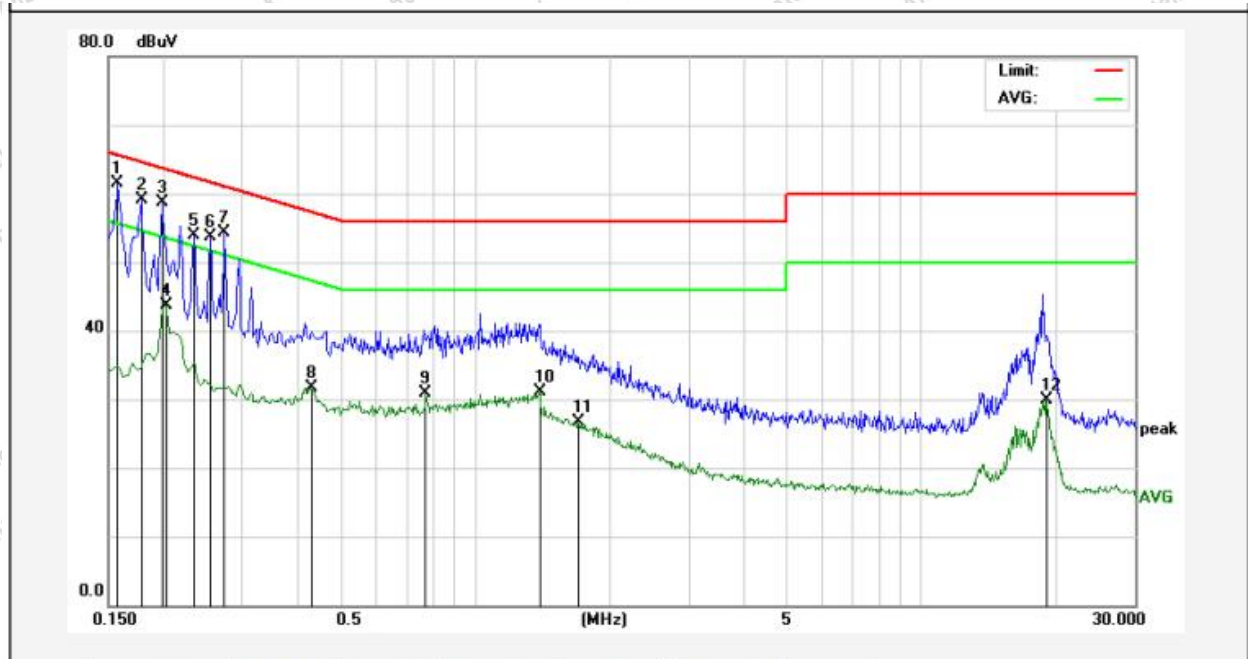


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1620	36.10	17.83	53.93	65.36	-11.43	QP	
2	0.2020	21.39	17.82	39.21	53.52	-14.31	AVG	
3	0.3980	24.39	17.81	42.20	57.89	-15.69	QP	
4	0.4340	13.31	17.82	31.13	47.18	-16.05	AVG	
5	0.7740	12.61	17.87	30.48	46.00	-15.52	AVG	
6	0.8100	23.27	17.87	41.14	56.00	-14.86	QP	
7	1.1900	23.60	17.85	41.45	56.00	-14.55	QP	
8	1.3460	12.96	17.86	30.82	46.00	-15.18	AVG	
9	1.6500	9.19	17.85	27.04	46.00	-18.96	AVG	
10	1.6940	20.18	17.85	38.03	56.00	-17.97	QP	
11	18.4420	30.01	18.24	48.25	60.00	-11.75	QP	
12	18.4420	13.65	18.24	31.89	50.00	-18.11	AVG	



Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: 6489.6MHz
Test Specification: DC 48V from adapter input AC 120V/60Hz
Comment: Neutral Line
Temp.(°C)/Hum.(%RH): 23.9°C/50%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Over Limit (dB)	Detector	Remark
1	0.1580	43.61	17.83	61.44	65.56	-4.12	QP	
2	0.1780	41.20	17.82	59.02	64.57	-5.55	QP	
3	0.1980	40.85	17.82	58.67	63.69	-5.02	QP	
4	0.2020	25.92	17.82	43.74	53.52	-9.78	AVG	
5	0.2340	36.06	17.82	53.88	62.30	-8.42	QP	
6	0.2540	35.84	17.84	53.68	61.62	-7.94	QP	
7	0.2740	36.55	17.84	54.39	60.99	-6.60	QP	
8	0.4260	13.98	17.82	31.80	47.33	-15.53	AVG	
9	0.7740	12.99	17.87	30.86	46.00	-15.14	AVG	
10	1.3900	13.34	17.86	31.20	46.00	-14.80	AVG	
11	1.6980	8.83	17.85	26.68	46.00	-19.32	AVG	
12	19.0100	11.65	18.25	29.90	50.00	-20.10	AVG	



4. Radiation Spurious Emission

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

(1)The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Test Standard	FCC Part15 C Section 15.517(c)(d)	
Test Limit	Frequency (MHz)	EIRP in dBm
	960~1610	-75.3
	1610~1990	-53.3
	1990~3100	-51.3
	3100~10600	-41.3
	Above 10600	-51.3

Test Standard	FCC Part15 C Section 15.517(d)	
Test Limit	Frequency (MHz)	EIRP in dBm
	1164~1240	-85.3
	1559~1610	-85.3



4.2. Test Setup

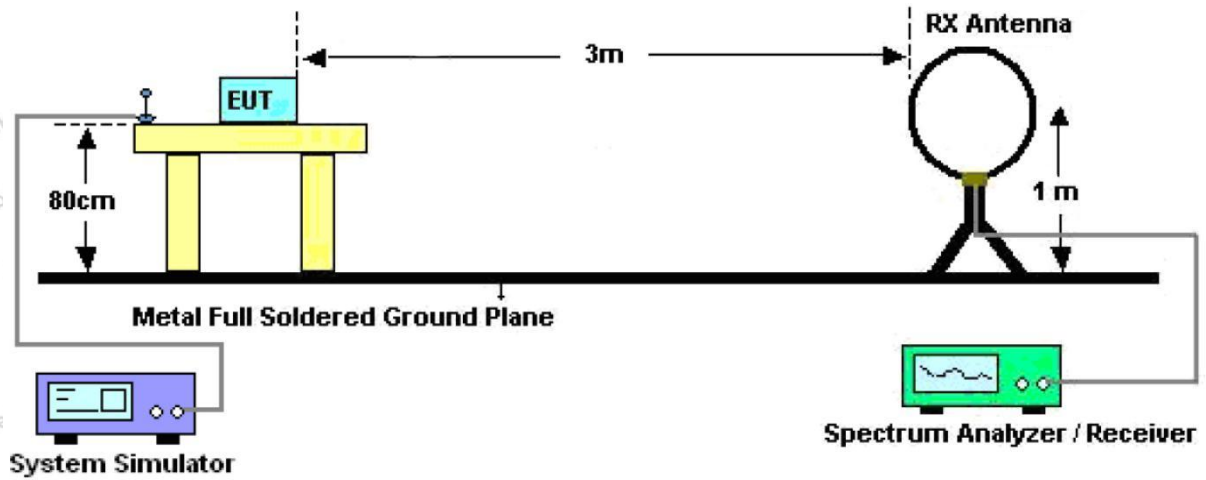


Figure 1. Below 30MHz

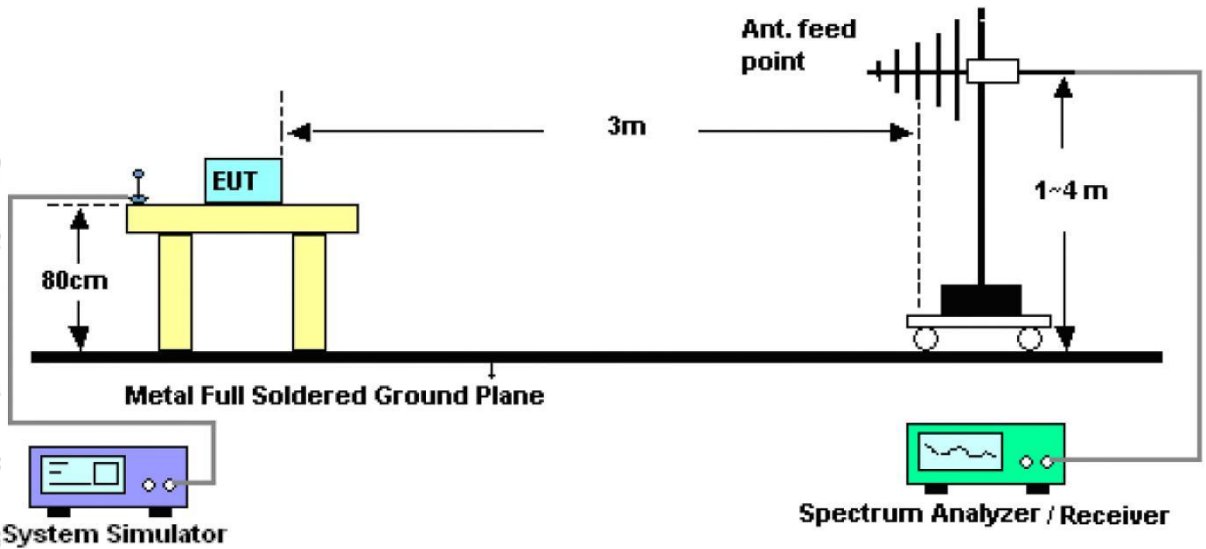


Figure 2. 30MHz to 1GHz



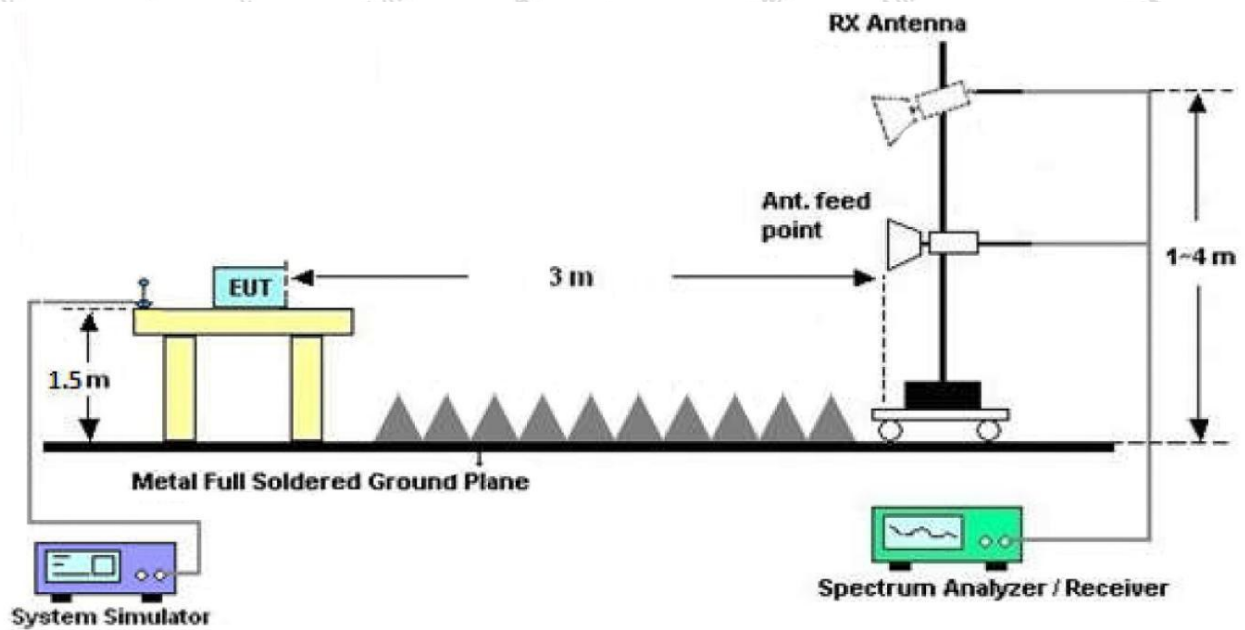


Figure 3. Above 1 GHz

4.3. Test Procedure

Refer to the ANSI C63.10: 2020 Section 10.2 & 10.3.

4.4. Test Data

PASS

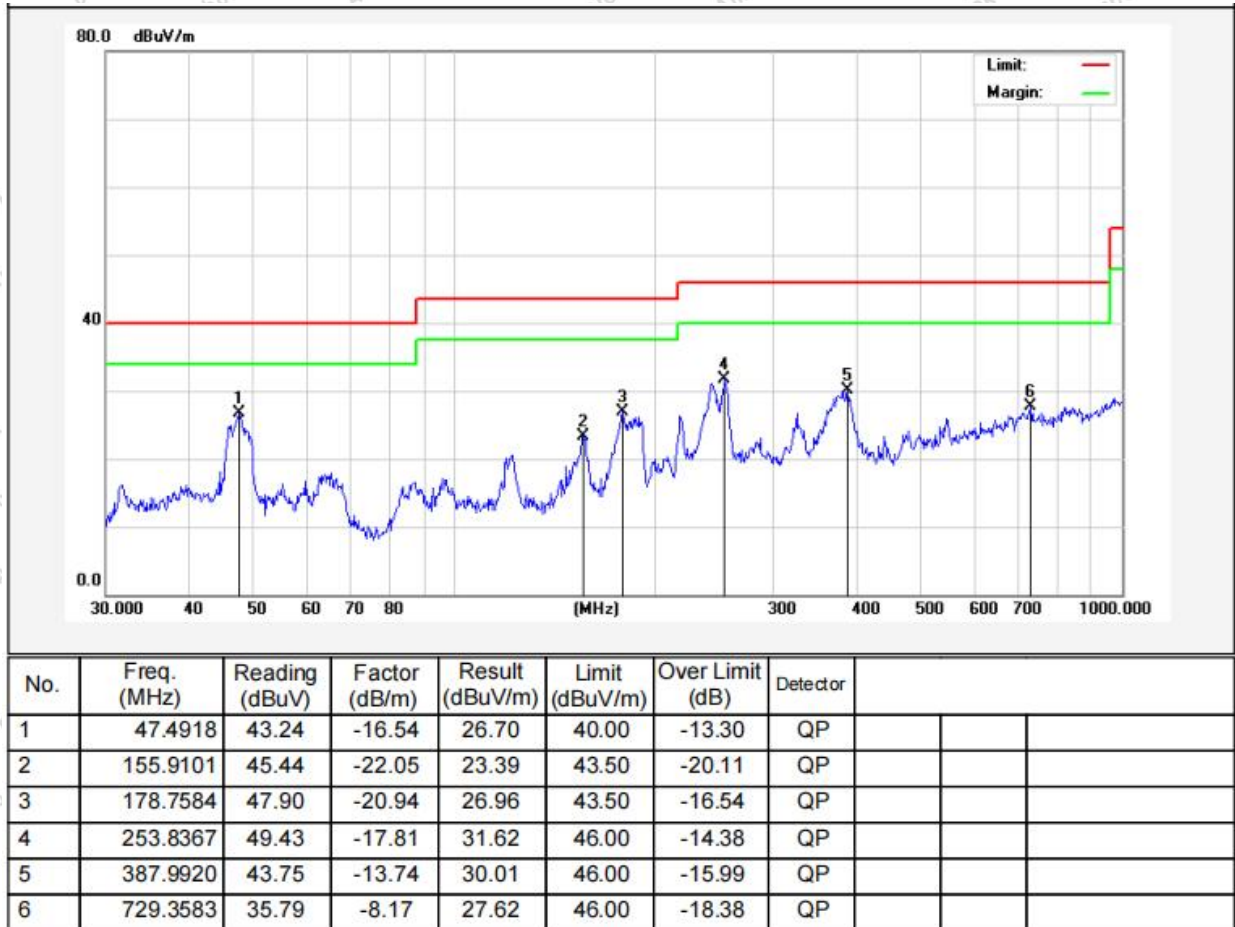
During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.



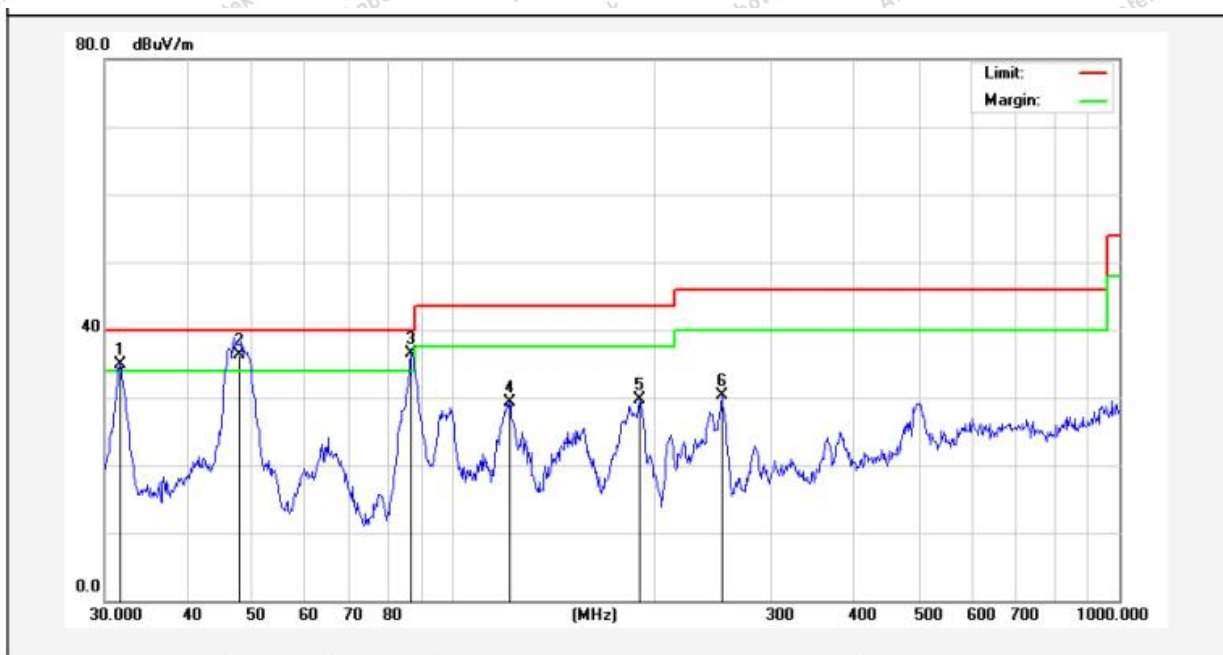
Test Results (30~1000MHz)

Test Mode: 6489.6MHz
Power Source: DC 48V from adapter input AC 120V/60Hz
Polarization: Horizontal
Temp.(°C)/Hum.(%RH): 22.6°C/56%RH



Test Results (30~1000MHz)

Test Mode: 6489.6MHz
Power Source: DC 48V from adapter input AC 120V/60Hz
Polarization: Vertical
Temp.(°C)/Hum.(%RH): 22.6°C/56%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector			
1	31.6202	53.93	-19.11	34.82	40.00	-5.18	QP			
2	47.7793	52.95	-16.57	36.38	40.00	-3.62	QP			
3	86.5027	57.26	-20.69	36.57	40.00	-3.43	QP			
4	121.5485	50.03	-20.74	29.29	43.50	-14.21	QP			
5	190.4050	49.77	-20.11	29.66	43.50	-13.84	QP			
6	252.9482	48.14	-17.84	30.30	46.00	-15.70	QP			



Spurious radiated emission above 960MHz in non GPS band:**Average value:**

Frequency (MHz)	Mea EIRP (dBm)	EIRP Limit (dBm)	Over Limit (dBm)	polarization
1415.29	-80.30	-75.3	-5.00	Vertical
1722.55	-79.08	-53.3	-25.78	Vertical
2657.80	-80.16	-51.3	-28.86	Vertical
8028.37	-81.50	-41.3	-40.20	Vertical
10656.40	-82.49	-51.3	-31.19	Vertical
1240.64	-79.04	-75.3	-3.74	Horizontal
1700.32	-78.99	-53.3	-25.69	Horizontal
2534.76	-79.13	-51.3	-27.83	Horizontal
4428.81	-82.02	-41.3	-40.72	Horizontal
10808.65	-79.88	-51.3	-28.58	Horizontal

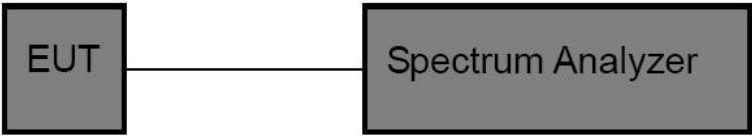


5. UWB Operation Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.503 (a)(d), 15.517(b)
Test Limit	<p>15.503(a): UWB bandwidth. For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated fH and the lower boundary is designated fL. The frequency at which the highest radiated emission occurs is designated fM.</p> <p>15.503(d): Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.</p> <p>15.517(b) The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.</p>

5.2. Test Setup



5.3. Test Procedure

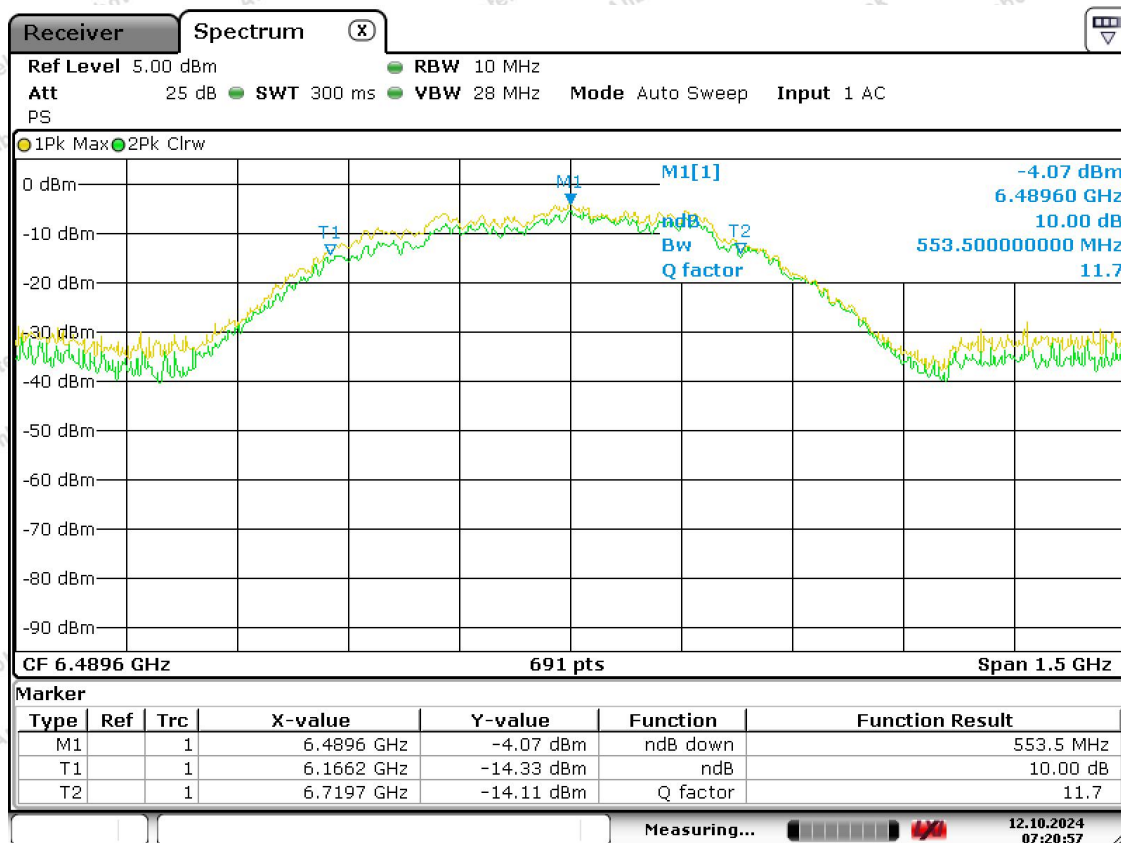
Refer to the ANSI C63.10: 2020 Section 10.1

5.4. Test Data

Pass.



Item		Result	Limit (MHz)
f_m (MHz)	The highest emission frequency	6489.6	/
f_L (MHz)	10dB below the highest emission	6166.2	>3100
f_H (MHz)	10dB above the highest emission	6719.7	<10600
f_c (MHz)	$(f_H + f_L)/2$	6442.95	/
10dB bandwidth(MHz)	$f_H - f_L$	553.5	≥ 500
Fractional bandwidth	$2(f_H - f_L) / (f_H + f_L)$	0.0859	/



Date: 12.OCT.2024 07:20:57

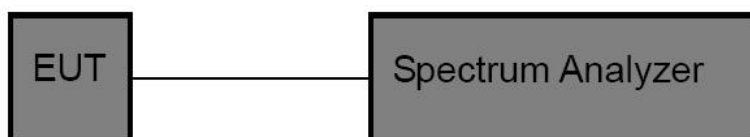


6. Peak Emission in a 50 MHz Bandwidth Test

6.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.517(e)
Test Limit	There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fm. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in § 15.521.

6.2. Test Setup



6.3. Test Procedure

Refer to the ANSI C63.10: 2020 Section 10.3.5.

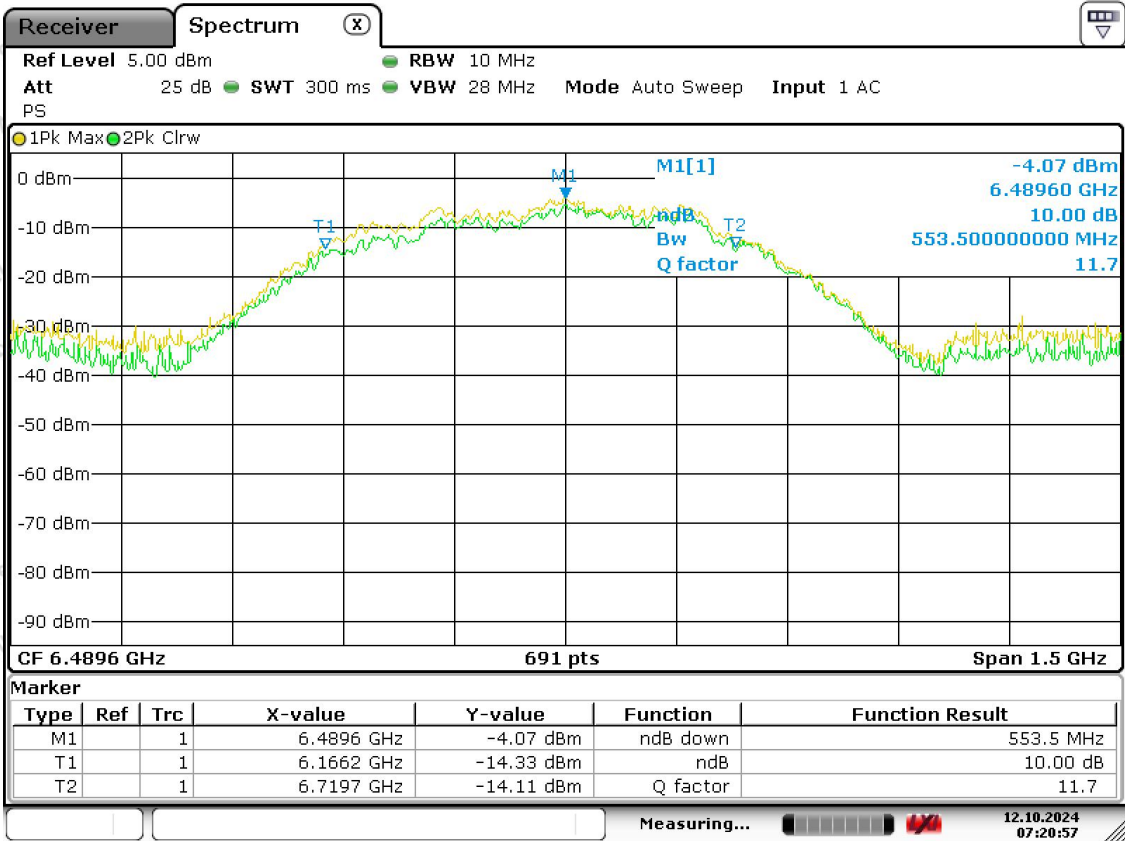
6.4. Test Data

Pass



Frequency (MHz)	EIRP (dBm/10MHz)	EIRP (dBm/50MHz)	Limit dBm/50MHz
6489.6	-4.07	-18.05	0

Note: the correct factor of RBW 10MHz to 50MHz is $20 \log (RBW/50) = -13.98$
The antenna factor, cable loss and preamplifier gain have been entered into the analyzer as the transducer factor.



Date: 12.OCT.2024 07:20:57



7. Antenna Requirement

7.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203/15.517(a)
Requirement	<p>1) 15.203 requirement:</p> <p>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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>2) 15.517(a) requirement:</p> <p>(a) Operation under the provisions of this section is limited to UWB transmitters employed solely for indoor operation.</p> <p>(1) Indoor UWB devices, by the nature of their design, must be capable of operation only indoors. The necessity to operate with a fixed indoor infrastructure, e.g., a transmitter that must be connected to the AC power lines, may be considered sufficient to demonstrate this.</p> <p>(2) The emissions from equipment operated under this section shall not be intentionally directed outside of the building in which the equipment is located, such as through a window or a doorway, to perform an outside function, such as the detection of persons about to enter a building.</p> <p>(3) The use of outdoor mounted antennas, e.g., antennas mounted on the outside of a building or on a telephone pole, or any other outdoors infrastructure is prohibited.</p> <p>(4) Field disturbance sensors installed inside of metal or underground storage tanks are considered to operate indoors provided the emissions are directed towards the ground.</p> <p>(5) A communications system shall transmit only when the intentional radiator is sending information to an associated receiver.</p>

7.2. Antenna Connected Construction

The antenna is a PCB Antenna which permanently attached, and the best case gain of the antenna is 5dBi. It complies with the standard requirement.



APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files Appendix I -- Test Setup Photograph_RF

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files Appendix II -- External Photograph

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files Appendix III -- Internal Photograph

-----End of Report-----

