

FCC Part 15C

Measurement and Test Report

For

Guangdong Shunde Sankey Electronic Technology Co.,Ltd

FCC ID: 2A6TK-S21

FCC Rule(s): FCC Part 15.231(a)

Product Description: Ceiling Fan Remote controller

Tested Model: S21

Report No.: BSL241131901602RF

Tested Date: Nov. 14~29, 2024

Issued Date: Nov. 29, 2024

Tested By: Lris. Yao / Engineer

Reviewed By: Livi. Xiao / EMC Manager

Approved & Authorized By: Salon.ouyang/ PSQ Manager

Prepared By:

Lris Yao

Levi Xiao

Salon ouyang

BSL Testing Co.,LTD.
1/F, Building B, Xinshidai GR Park, Shiyan Street,
Bao'an District, Shenzhen, ShiyanStreet, Bao'an District,
Shenzhen,Guangdong,518052,People' s Republic of China

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	3
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	3
1.2 TEST STANDARDS.....	4
1.3 TEST METHODOLOGY.....	4
1.4 TEST FACILITY	4
1.5 EUT SETUP AND TEST MODE.....	4
1.5 EUT SETUP AND TEST MODE.....	5
1.6 MEASUREMENT UNCERTAINTY	5
1.7 TEST EQUIPMENT LIST AND DETAILS	6
2. SUMMARY OF TEST RESULTS	7
3. ANTENNA REQUIREMENT	8
3.1 STANDARD APPLICABLE.....	8
3.2 TEST RESULT.....	8
4. CONDUCTED EMISSIONS	9
4.1 TEST PROCEDURE.....	9
4.2 BASIC TEST SETUP BLOCK DIAGRAM.....	9
4.3 ENVIRONMENTAL CONDITIONS	9
4.4 TEST RECEIVER SETUP	9
4.6 CONDUCTED EMISSIONS TEST DATA.....	10
5. RADIATED EMISSIONS.....	11
5.1 STANDARD APPLICABLE.....	11
5.2 TEST PROCEDURE.....	12
5.3 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	14
5.4 ENVIRONMENTAL CONDITIONS	14
5.5 SUMMARY OF TEST RESULTS/PLOTS	14
6. 20DB BANDWIDTH	18
6.1 STANDARD APPLICABLE.....	18
6.1 TEST PROCEDURE.....	18
6.2 ENVIRONMENTAL CONDITIONS	18
6.3 SUMMARY OF TEST RESULTS/PLOTS	18
7. TRANSMISSION TIME	20
7.1 STANDARD APPLICABLE.....	20
7.2 TEST PROCEDURE.....	20
7.3 ENVIRONMENTAL CONDITIONS	20
7.4 SUMMARY OF TEST RESULTS/PLOTS	20
8. DUTY CYCLE	21
8.1 STANDARD APPLICABLE.....	21
8.2 TEST PROCEDURE.....	21
8.3 ENVIRONMENTAL CONDITIONS	21
8.4 SUMMARY OF TEST RESULTS	21

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Guangdong Shunde Sankey Electronic Technology Co.,Ltd
Address of applicant: 3F/4F, Baotian Furniture Park, No.3 Chengcai Road, Leliu Street, Shunde District, Foshan City, Guangdong Province
Manufacturer: Guangdong Shunde Sankey Electronic Technology Co.,Ltd
Address of manufacturer: 3F/4F, Baotian Furniture Park, No.3 Chengcai Road, Leliu Street, Shunde District, Foshan City, Guangdong Province

General Description of EUT	
Product Name:	Ceiling Fan Remote controller
Trade Name:	/
Model No.:	S21
Adding Model(s):	N/A
Rated Voltage:	3.0V by battery
Power Adapter Model:	N/A

Technical Characteristics of EUT	
Frequency Range:	433.914 MHz
Max. Field Strength:	76.75 dBuV/m
Data Rate:	N/A
Modulation:	ASK
Antenna Type:	PCB antenna

1.2 Test Standards

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.4 Test Facility

BSL Testing Co.,LTD.

1/F, Building B, Xinshidai GR Park, Shiyan Street, Bao'an District, Shenzhen, ShiyanStreet, Bao'an District, Shenzhen,Guangdong,518052,People' s Republic of China

FCC Test Firm Registration Number: 562200

Designation Number: CN1338

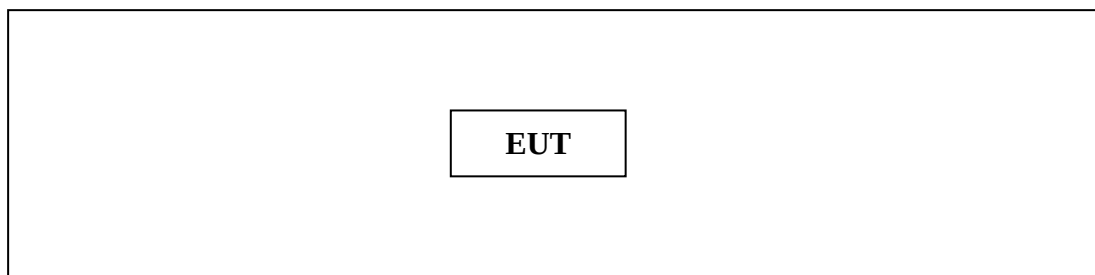
Tel: 400-882-9628

Fax: 86-755-26508703

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

TX Mode



1.5 EUT Setup and Test Mode

The EUT was operated at continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitting	Modulation
TM2		
TM3		

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Transmission Time	Conducted	$\pm 5\%$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2024-10-26	2024-10-25
Spectrum Analyzer	R&S	FSP40	100550	2024-10-26	2024-10-25
Test Receiver	R&S	ESCI7	US47140102	2024-10-26	2024-10-25
Signal Generator	HP	83630B	3844A01028	2024-10-26	2024-10-25
Test Receiver	R&S	ESPI-3	100180	2024-10-26	2024-10-25
Amplifier	Agilent	8449B	4035A00116	2024-10-26	2024-10-25
Amplifier	HP	8447E	2945A02770	2024-10-26	2024-10-25
Signal Generator	IFR	2023A	202307/242	2024-10-26	2024-10-25
Broadband Antenna	SCHAFFNER	2774	2774	2024-10-26	2024-10-25
Biconical and log periodic antennas	ELECTRO-METRIC CS	EM-6917B-1	171	2024-10-26	2024-10-25
Horn Antenna	R&S	HF906	100253	2024-10-26	2024-10-25
Horn Antenna	EM	EM-6961	60.8762	2024-10-26	2024-10-25
LISN	R&S	ESH3-Z5	100196	2024-10-26	2024-10-25
LISN	COM-POWER	LI-115	02027	2024-10-26	2024-10-25
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2024-10-26	2024-10-25
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2024-10-26	2024-10-25
20dB Attenuator	ICPROBING	IATS1	BSL1003	2024-10-26	2024-10-25
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2024-10-26	2024-10-25
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2024-10-26	2024-10-25
Loop Antenna	Schwarz beck	FMZB 1516	9773	2024-10-26	2024-10-25

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§ 15.207(e)	Conducted Emission	N/A
§15.231(a)	Release Time	Compliant
	Radiation Emission	Compliant
	20 dB Bandwidth	Compliant
	Duty Cycle	Compliant

Note: PASS: applicable, N/A: not applicable.

3. Antenna Requirement

3.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.2 Test Result

This product has a PCB antenna, fulfill the requirement of this section.

4. Conducted Emissions

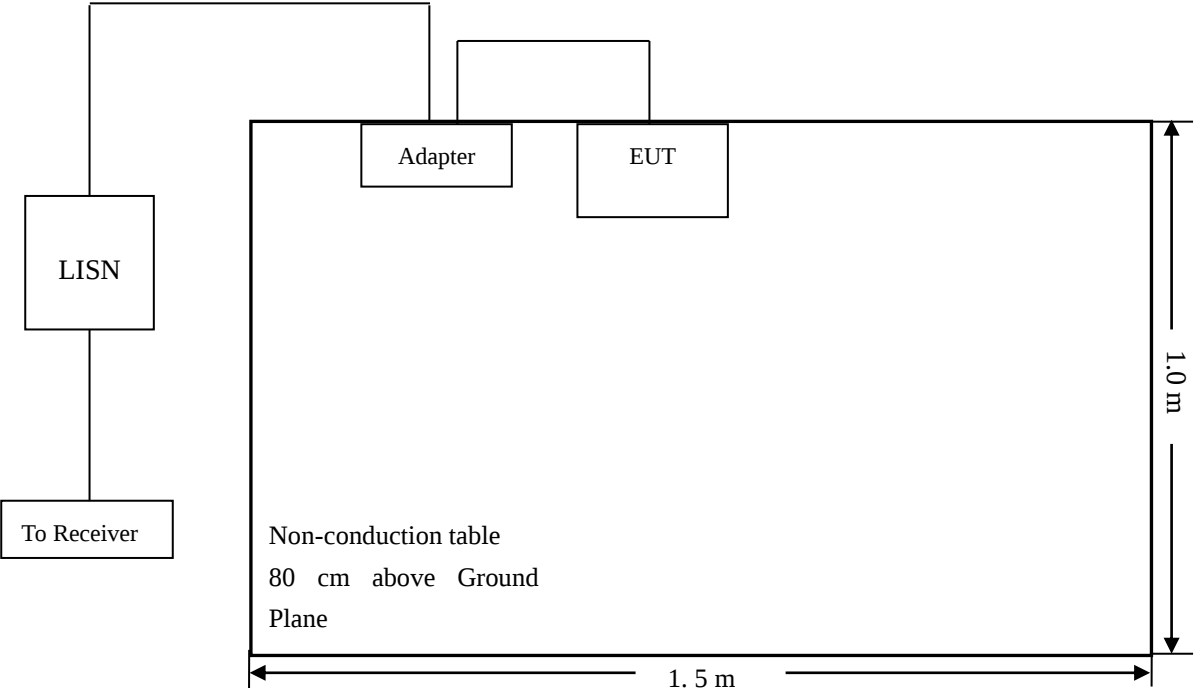
4.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

4.2 Basic Test Setup Block Diagram



4.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

4.4 Test Receiver Setup

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

Start Frequency 150 kHz

Stop Frequency 30 MHz

Sweep Speed Auto

IF Bandwidth..... 10 kHz

Quasi-Peak Adapter Bandwidth 9 kHz

Quasi-Peak Adapter Mode Normal

4.6 Conducted Emissions Test Data

The test not applicable.

5. Radiated Emissions

5.1 Standard Applicable

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

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66–40.70	2,250	225
70–130	1,250	125
130–174	¹ 1,250 to 3,750	¹ 125 to 375
174–260	3,750	375
260–470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

(1) Linear interpolations.

(2) Emission level (dB)uV = 20 log Emission level uV/m

(3) The smaller limit shall apply at the cross point between two frequency bands.

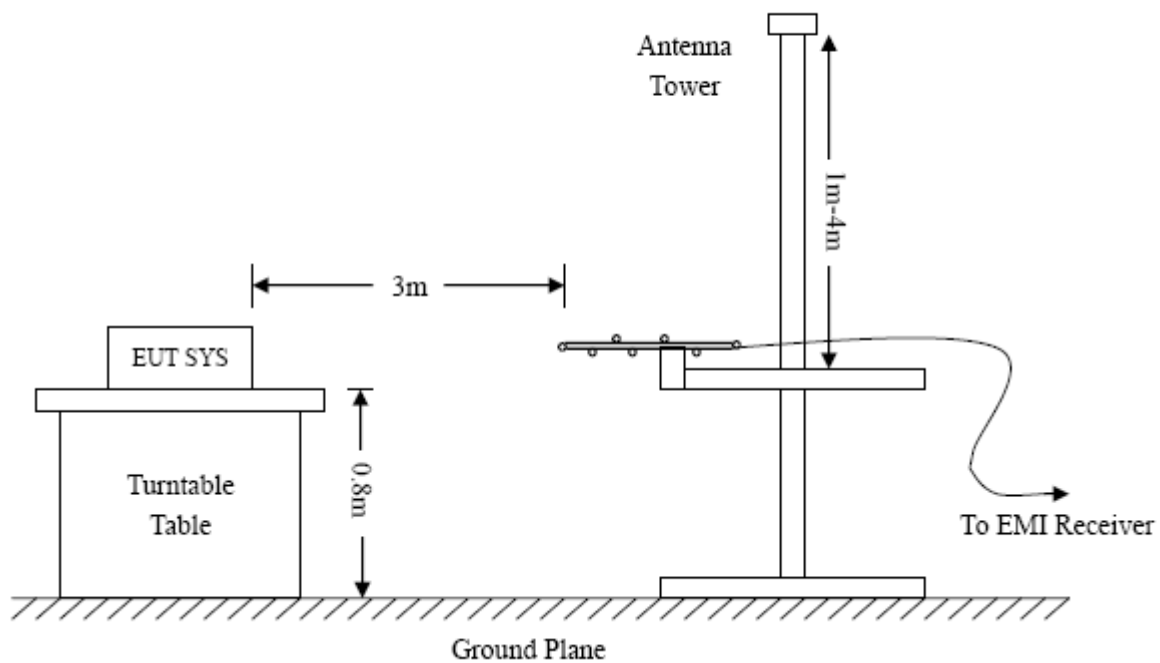
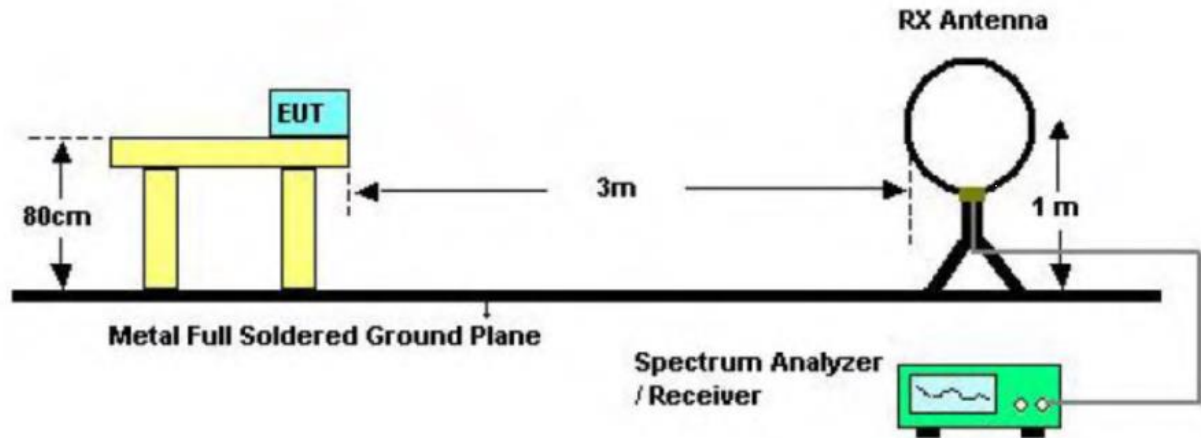
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209,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

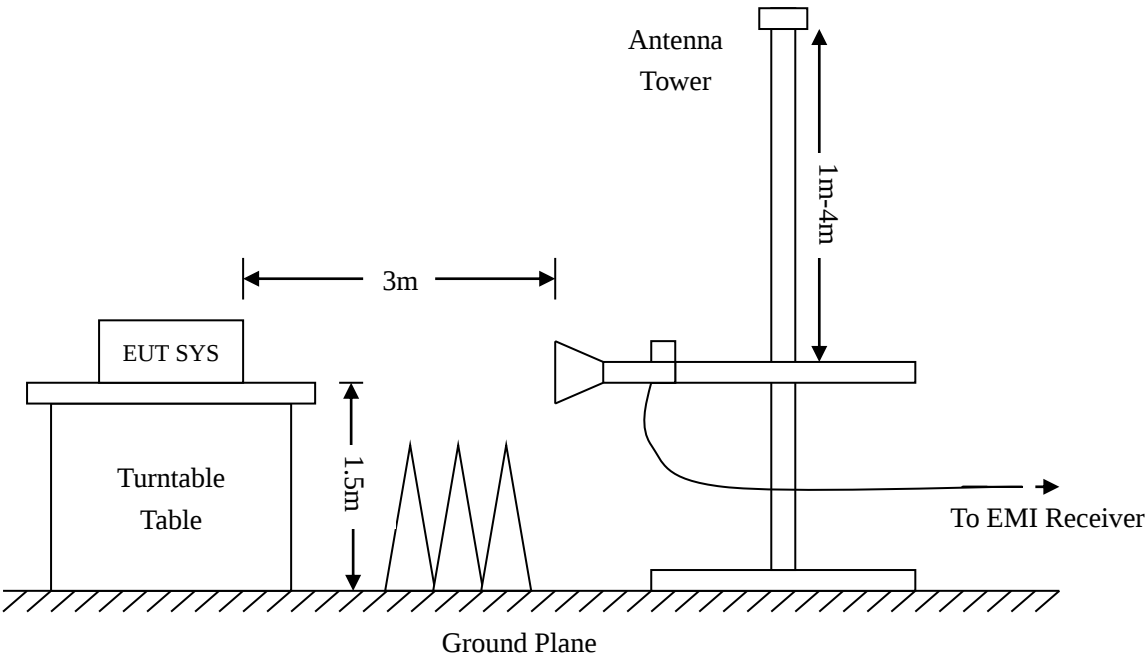
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

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

5.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.231(e) and FCC Part 15.209 Limit.





5.3 Corrected Amplitude & Margin Calculation

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

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Loss} + \text{Cab. Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

5.4 Environmental Conditions

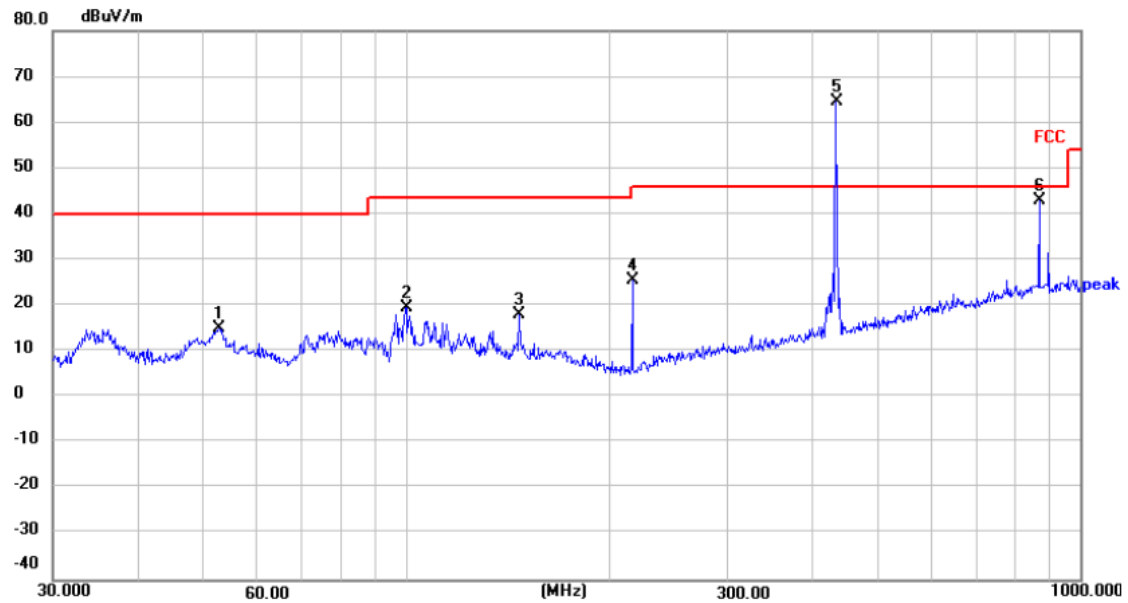
Temperature:	21° C
Relative Humidity:	50%
ATM Pressure:	1011 mbar

5.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.231 standards, and had the worst margin of:

76.75 dBuV/m at 433.914 MHz in the Vertical polarization, Peak Detector, 9 kHz to 5 GHz, 3 Meters

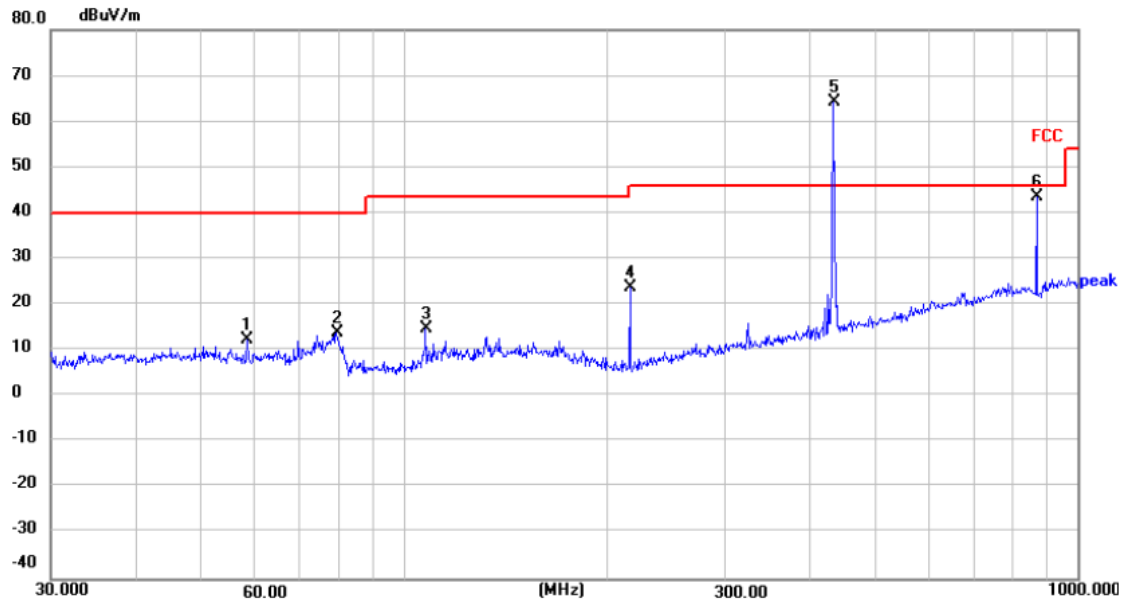
Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	52.9453	31.84	-16.65	15.19	40.00	-24.81	peak
2	100.2286	39.41	-19.87	19.54	43.50	-23.96	peak
3	147.4036	34.29	-16.15	18.14	43.50	-25.36	peak
4	216.7828	44.80	-19.34	25.46	46.00	-20.54	peak
5 *	434.0651	76.75	-12.11	64.64	46.00	18.64	peak
6	869.1302	46.85	-4.03	42.82	46.00	-3.18	peak

*:Maximum data x:Over limit !:over margin

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	58.6126	29.38	-16.98	12.40	40.00	-27.60	peak
2	79.5209	34.32	-20.55	13.77	40.00	-26.23	peak
3	107.8877	33.91	-19.15	14.76	43.50	-28.74	peak
4	216.7828	43.11	-19.34	23.77	46.00	-22.23	peak
5 *	434.0651	76.23	-12.11	64.12	46.00	18.12	peak
6	869.1302	47.63	-4.03	43.60	46.00	-2.40	peak

*:Maximum data x:Over limit !:over margin

Horizontal

Above 1GHz									
Frequency	Reading	Corr.	Duty cycle	Result	Limit	Margin	Deq.	Height	Remark
MHz	dBuV/m	Factor(dB)	Factor	dBuV/m	dBuV/m	(dB)	(°)	(cm)	
			(dB)						
1002.8200	54.24	-13.64	N/A	40.60	74.00	-33.40	110	150	Peak
1002.8200	/	/	-6.47	34.13	54.00	-19.87	185	150	Ave
1737.5000	51.67	-15.20	N/A	36.47	80.83	-44.36	23	150	Peak
1737.5000	/	/	-6.47	30.00	60.83	-30.83	196	150	Ave

Vertical

Above 1GHz									
Frequency	Reading	Corr.	Duty cycle	Result	Limit	Margin	Deq.	Height	Remark
MHz	dBuV/m	Factor(dB)	Factor	dBuV/m	dBuV/m	(dB)	(°)	(cm)	
			(dB)						
1002.8200	56.21	-13.64	N/A	42.57	74.00	-31.43	110.00	150.00	Peak
1002.8200	/	/	-6.47	36.10	54.00	-17.90	185.00	150.00	Ave
1737.5000	51.37	-15.20	N/A	36.17	80.83	-44.66	23.00	150.00	Peak
1737.5000	/	/	-6.47	29.70	60.83	-31.13	196.00	150.00	Ave

Note:

Margin = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor)

Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz.

The fundamental frequency is 433.914, so the fundamental and spurious emissions radiated limit base on the the operating frequency 433.914.

6. 20dB Bandwidth

6.1 Standard Applicable

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 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

6.1 Test Procedure

With the EUT's antenna attached, the EUT's 20dBc Bandwidth power was received by the test antenna, which was connected to the spectrum analyzer with the START, and STOP frequencies set to the EUT's operation band.

6.2 Environmental Conditions

Temperature:	21° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

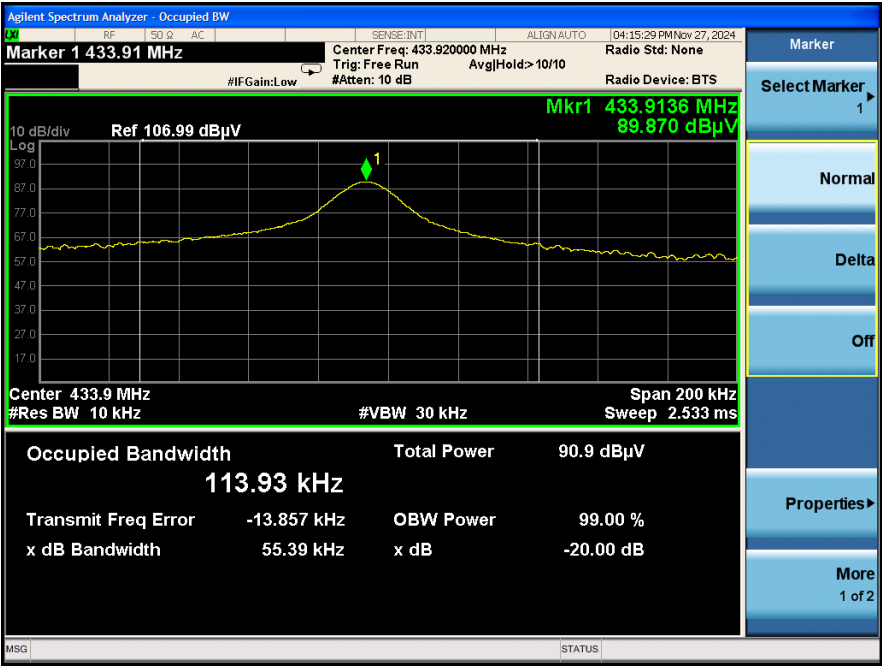
6.3 Summary of Test Results/Plots

Test Frequency MHz	20dBc Bandwidth kHz	Limit kHz	Result
433.914	113.93	1084	Pass

Limit = Fundamental Frequency X 0.25% = 433.953 MHz X 0.25% = 1084 kHz

Please refer to the attached plots.

20dBc Bandwidth Test Plot



7. Transmission Time

7.1 Standard Applicable

According to FCC Part 15.231 (a), the transmitter shall be complied the following requirements:

- (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

7.2 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 433.94, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

7.3 Environmental Conditions

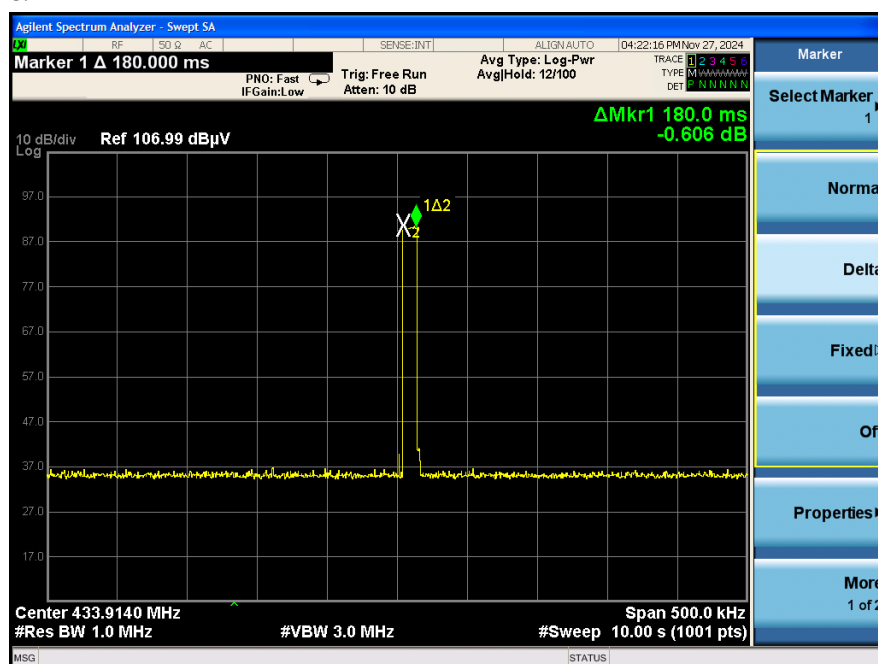
Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

7.4 Summary of Test Results/Plots

Dwell Time(seconds)	Limit(s)	Result
180ms	5s	PASS

Please refer to the attached plots.

Transmission Time:



8. Duty Cycle

8.1 Standard Applicable

According to FCC Part 15.231 (b)(2) and 15.35 (c), For pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

8.2 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 433.914, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

8.3 Environmental Conditions

Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

8.4 Summary of Test Results

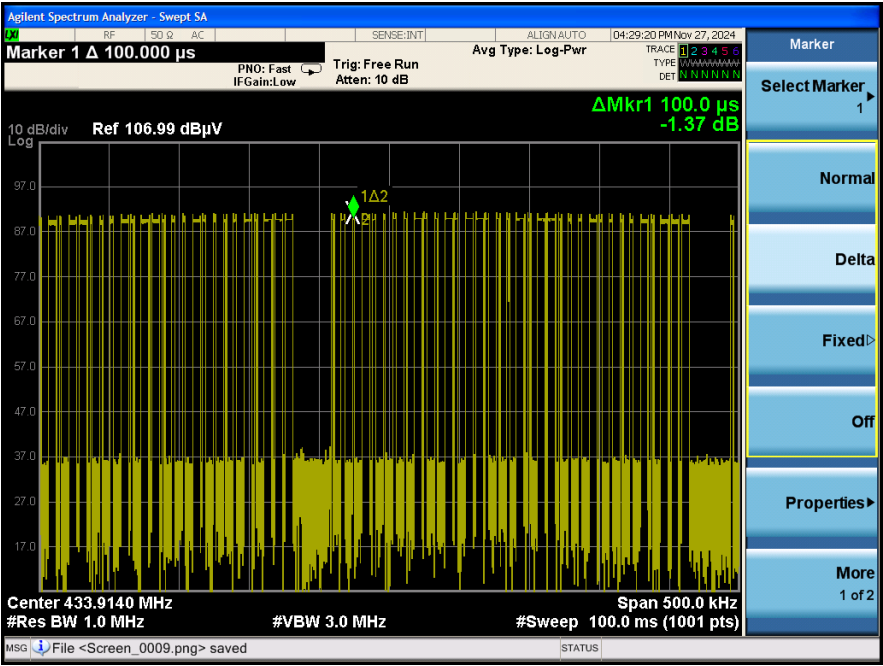
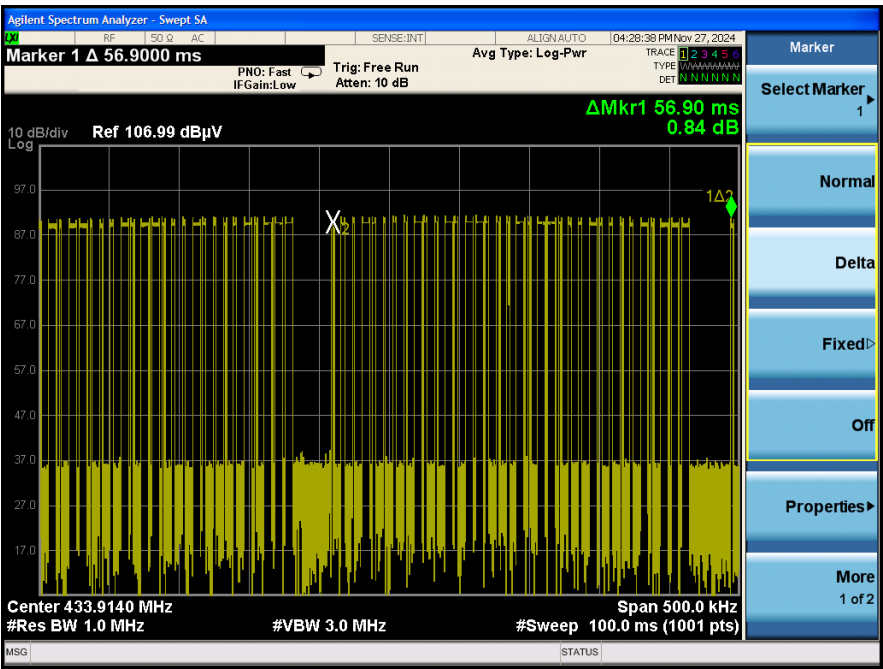
The duty cycle is simply the on-time divided the duration of one cycle

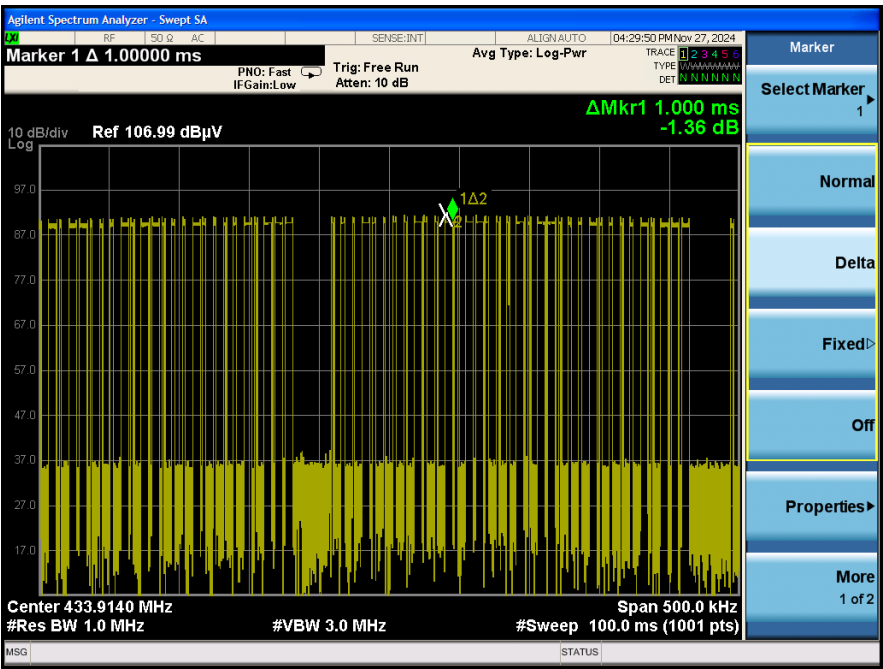
Duty Cycle $= (0.1\text{ms} \times 20 + 1\text{ms} \times 25) / 56.9 = 47.5\%$

Test Period (T_p) ms	Total Time (T_{on}) ms	Duty Cycle %	Duty Cycle Factor dB
56.9	27	47.5	-6.47

Duty Cycle Factor $= 20 \log(\text{Duty Cycle}) = -6.47$

Please refer to the attached test plots





END REPORT