

FCC Part 15C Measurement and Test Report

For

K-Mark Industrial Limited.

Flat A, 7/F., Mai On Ind. Bldg, 17-21 Kung Yip St., Kwai Chung, Hong Kong

FCC ID: VEP-MP100

FCC Rule(s): FCC Part 15.231

Product Description: Mantis Pro 100

Tested Model: WRC-MP100

Report No.: STR17018006I

Tested Date: 2017-01-07 to 2017-01-19

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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM.Test Technology Co., Ltd.

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.....	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. RADIATED EMISSIONS	9
4.1 STANDARD APPLICABLE.....	9
4.2 TEST PROCEDURE.....	10
4.3 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	11
4.4 ENVIRONMENTAL CONDITIONS.....	11
4.5 SUMMARY OF TEST RESULTS/PLOTS.....	11
5. 20DB BANDWIDTH	16
5.1 STANDARD APPLICABLE.....	16
5.1 TEST PROCEDURE.....	16
5.2 ENVIRONMENTAL CONDITIONS.....	16
5.3 SUMMARY OF TEST RESULTS/PLOTS.....	16
6. TRANSMISSION TIME	18
6.1 STANDARD APPLICABLE.....	18
6.2 TEST PROCEDURE.....	18
6.3 ENVIRONMENTAL CONDITIONS.....	18
6.4 SUMMARY OF TEST RESULTS/PLOTS.....	18
7. DUTY CYCLE	20
7.1 STANDARD APPLICABLE.....	20
7.2 TEST PROCEDURE.....	20
7.3 ENVIRONMENTAL CONDITIONS.....	20
7.4 SUMMARY OF TEST RESULTS/PLOTS.....	20

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: K-Mark Industrial Limited.
Address of applicant: Flat A, 7/F, Mai On Ind Bldg, 17-21, Kung Yip St.,
Kwai Chung, Hong Kong

Manufacturer: K-Mark Industrial Limited.
Address of manufacturer: Flat A, 7/F, Mai On Ind Bldg, 17-21, Kung Yip St.,
Kwai Chung, Hong Kong

General Description of EUT	
Product Name:	Mantis Pro 100
Trade Name:	/
Model No.:	WRC-MP100
Adding Model(s):	/
Rated Voltage:	DC 9V by battery
<i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	434.00 MHz
Max. Field Strength:	78.60dBuV/m(3m)
Data Rate:	256kbps
Modulation:	FSK/GSK/OOK
Antenna Type:	Integral Antenna
Antenna Gain:	-3.0dBi
Lowest Internal Frequency of EUT:	8MHz

1.2 Test Standards

The following report is prepared on behalf of the K-Mark Industrial Limited. in accordance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

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

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. 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 and the Registration is 934118.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

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	With modulation

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

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2016-06-04	2017-06-03
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2016-06-04	2017-06-03
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2016-06-04	2017-06-03
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2016-06-04	2017-06-03
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2016-06-04	2017-06-03
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2016-06-04	2017-06-03
SEMT-1042	Horn Antenna	ETS	3117	00086197	2016-06-04	2017-06-03
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2016-06-04	2017-06-03
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2016-06-04	2017-06-03
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2016-06-04	2017-06-03
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2016-06-04	2017-06-03
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2016-06-04	2017-06-03

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	N/A
§ 15.209	Radiated Spurious Emissions	Compliant
§15.231(a)	Deactivation Testing	Compliant
§15.231(b)	Radiated Emissions	Compliant
§15.231(c)	20dB Bandwidth Testing	Compliant

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 an integral antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Standard Applicable

According to §15.231(b), 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	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

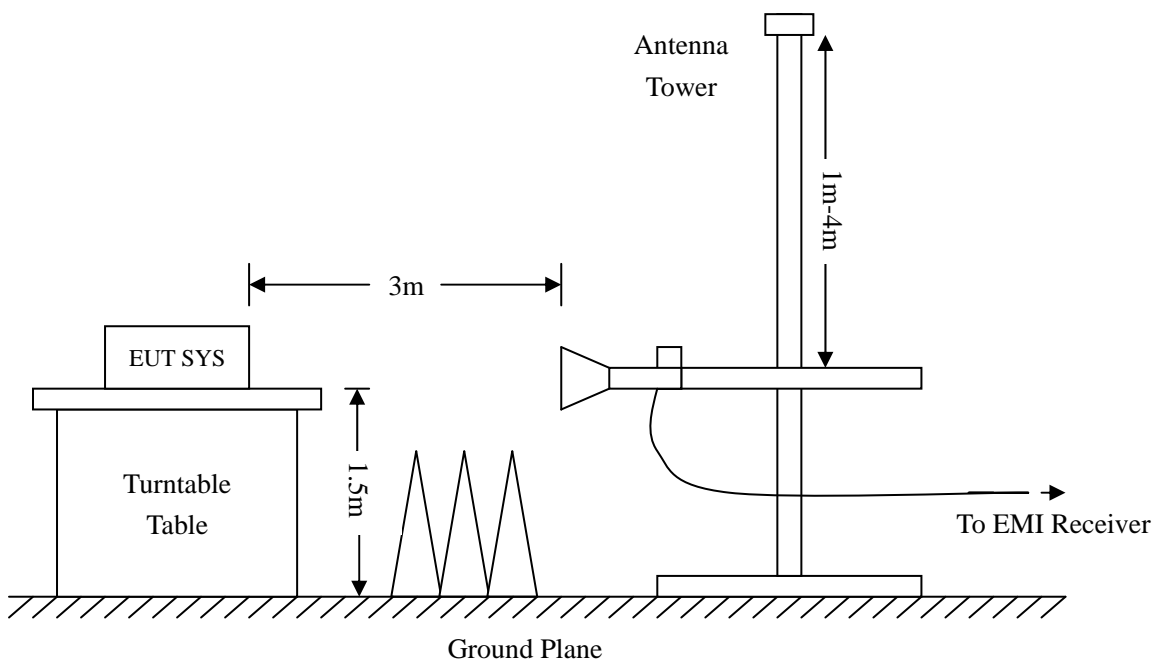
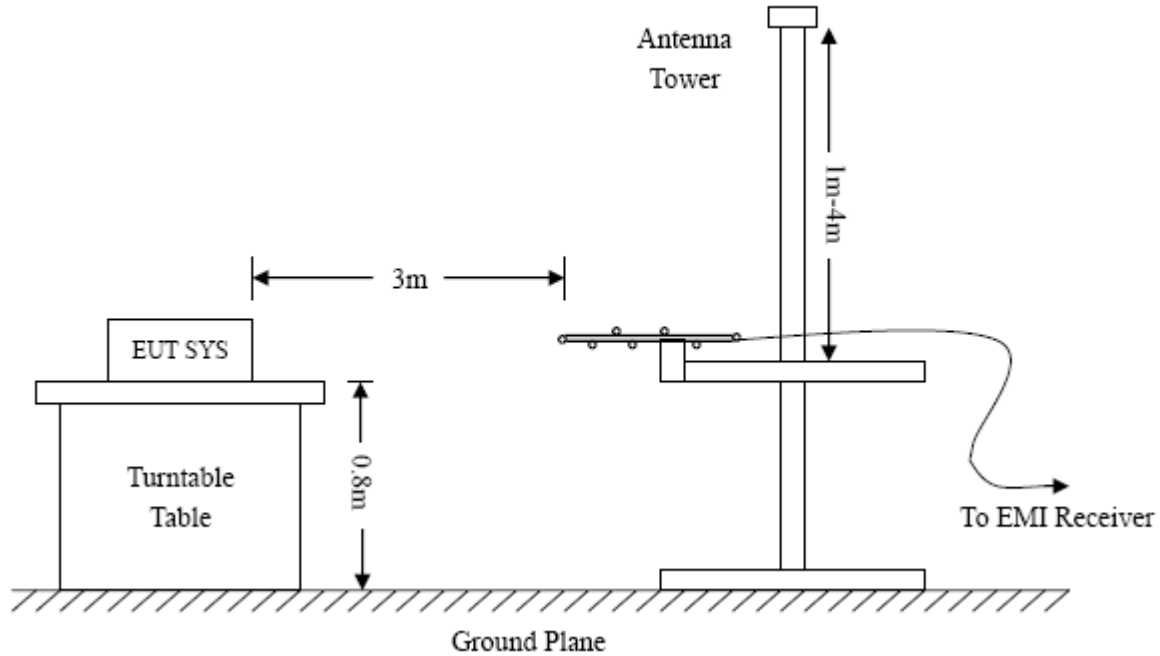
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209,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

4.2 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(b) and FCC Part 15.209 Limit.



4.3 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:

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

4.4 Environmental Conditions

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

4.5 Summary of Test Results/Plots

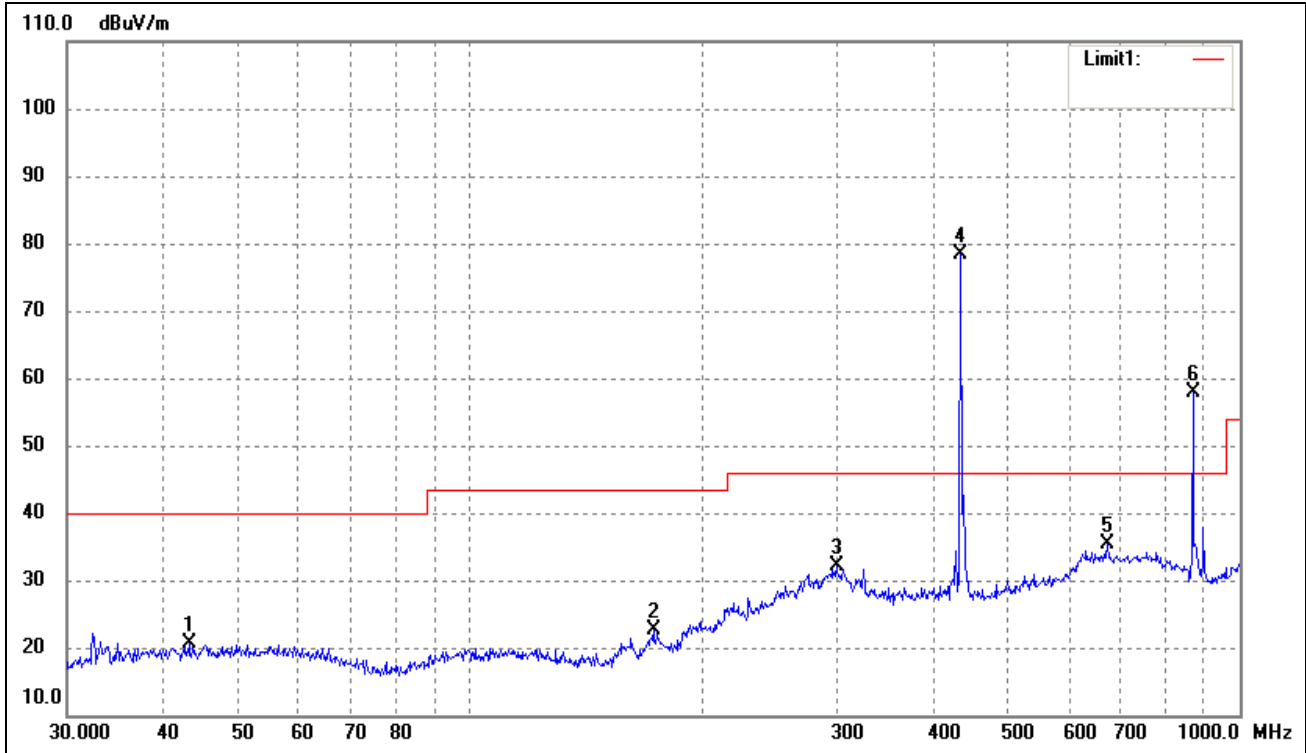
According to the data below, the FCC Part 15.205, 15.209 and 15.231 standards, and had the worst margin of:

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

Plot of Radiated Emissions Test Data

EUT: *Mantis Pro 100*
 Tested Model: *WRC-MP100*
 Operating Condition: *TM1*
 Comment: *DC 9V*

Test Specification: *Horizontal*

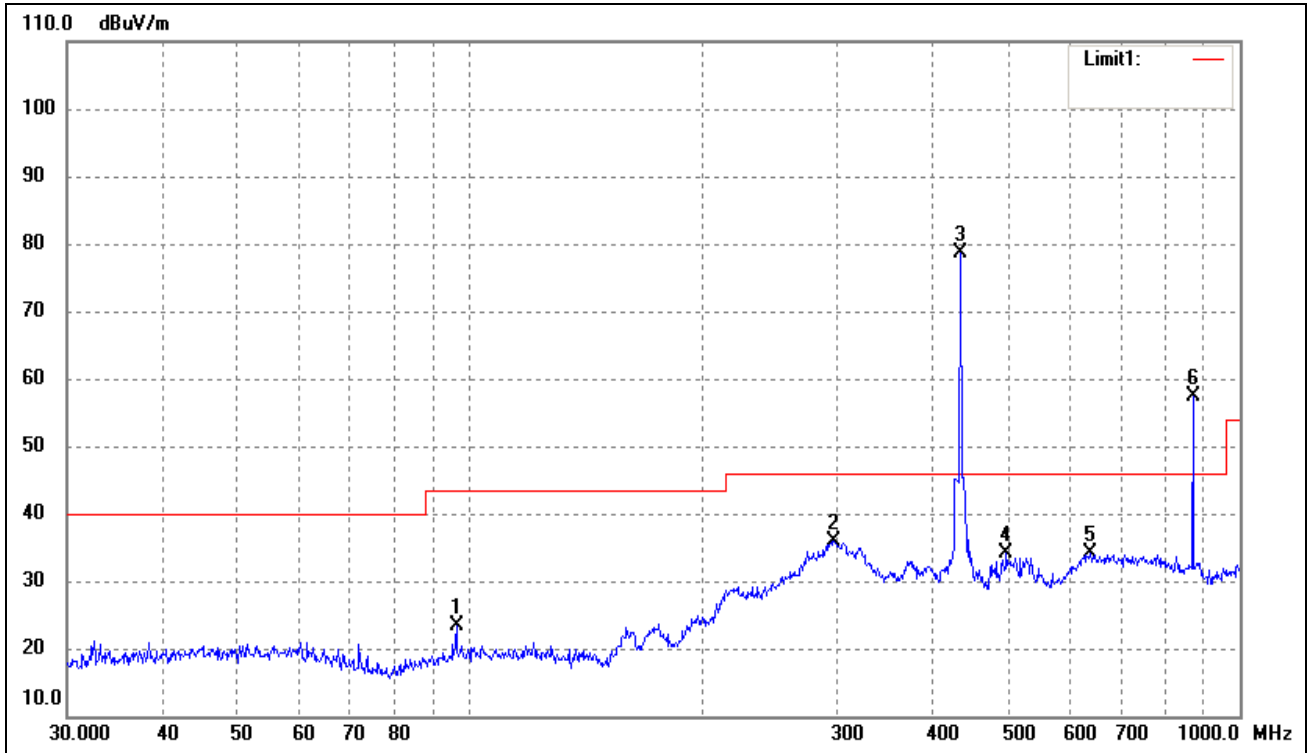


No.	Frequency MHz	Readin g dBuV/ m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/ m	Limit dBuV/ m	Margi n (dB)	Deg. (°)	Heigh t (cm)	Remar k
1	43.2017	15.73	4.94	N/A	20.67	40.00	-19.33	360	100	peak
2	173.2050	20.13	2.46	N/A	22.59	43.50	-20.91	360	100	peak
3	299.3158	20.21	11.92	N/A	32.13	46.00	-13.87	360	100	peak
4	434.00000	78.67	12.31	N/A	78.48	100.83	-22.35	360	100	peak
	434.00000	/	/	0	78.48	80.83	-2.35	360	100	Ave
5	672.8444	17.18	18.29	N/A	35.47	46.00	-10.53	360	100	peak
6	868.0000	45.00	15.94	N/A	57.94	80.83	-22.89	360	100	peak
	868.0000	/	/	0	57.94	60.83	-2.89	360	100	Ave

Above 1GHz

No.	Frequency	Reading	Corr.	Dutycycle	Result	Limit	Margin	Deg.	Height	Remark
	MHz	dBuV/m	Factor (dB)	Factor (dB)	dBuV/m	dBuV/m	dB	(°)	(cm)	
1	1302.00	31.26	26.95	N/A	42.95	74.00	-31.05	274	100	Peak
2	1736.00	29.27	27.77	N/A	41.78	74.00	-32.22	138	100	Peak
	1302.00	/	/	0	42.95	54.00	-11.05	129	100	Ave
	1736.00	/	/	0	41.78	54.00	-12.22	241	100	Ave

Test Specification: Vertical



No.	Frequency MHz	Reading dBuV/m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin (dB)	Deg. (°)	Height (cm)	Remark
1	96.0986	19.09	4.34	N/A	23.43	43.50	-20.07	360	100	peak
2	297.2241	24.12	11.84	N/A	35.96	46.00	-10.04	360	100	peak
3	434.0000	78.29	12.31	N/A	78.60	100.83	-22.23	360	100	peak
	434.0000	/	/	0	78.60	80.83	-2.23	360	100	Ave
4	497.6764	20.86	13.24	N/A	34.10	46.00	-11.90	360	100	peak
5	640.6109	16.17	18.05	N/A	34.22	46.00	-11.78	360	100	peak
6	868.0000	49.45	15.94	N/A	57.39	80.83	-23.44	360	100	peak
	868.0000	/	/	0	57.39	60.83	-3.44	360	100	Ave

Above 1GHz

No.	Frequency	Reading	Corr.	Dutycycle	Result	Limit	Margin	Deg.	Height	Remark
	MHz	dBuV/m	Factor (dB)	Factor (dB)	dBuV/m	dBuV/m	dB	(°)	(cm)	
1	1302.00	30.79	26.95	N/A	42.48	74.00	-31.52	128	100	Peak
2	1736.00	28.64	27.77	N/A	41.15	74.00	-32.85	351	100	Peak
	1302.00	/	/	0	42.48	54.00	-11.52	169	100	Ave
	1736.00	/	/	0	41.15	54.00	-12.85	173	100	Ave

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 4th 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 434.00MHz, so the fundamental and spurious emissions radiated limit base on the the operating frequency 434.00MHz.

5. 20dB Bandwidth

5.1 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.

5.1 Test Procedure

With the EUT's antenna attached, the EUT's 20dB 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.

5.2 Environmental Conditions

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

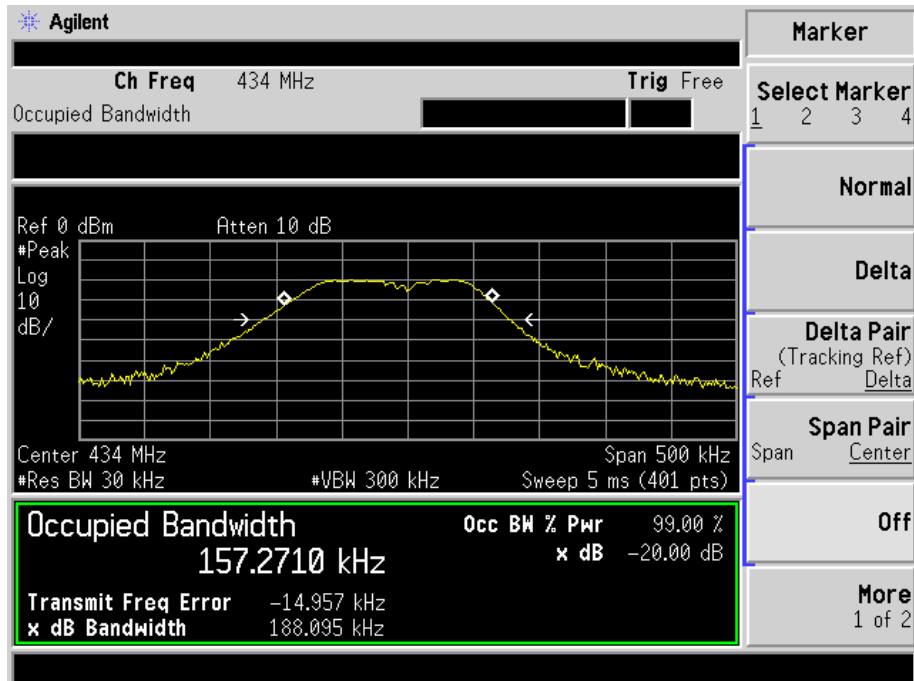
5.3 Summary of Test Results/Plots

Test Frequency MHz	20dB Bandwidth kHz	Limit kHz	Result
434.00	188.095	1085	Pass

Limit = Fundamental Frequency X 0.25% = 434 MHz X 0.25% = 1085 kHz

Please refer to the attached plots.

20dB Bandwidth Test Plot



6. Transmission Time

6.1 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.

6.2 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 434MHz, 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.

6.3 Environmental Conditions

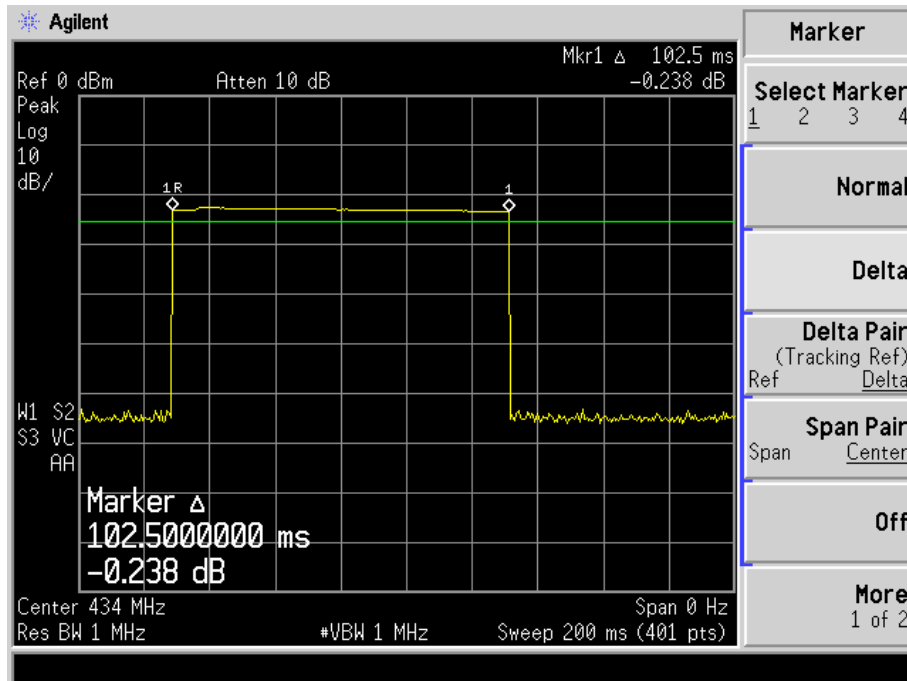
Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

6.4 Summary of Test Results/Plots

Transmission Type	Test Frequency MHz	Transmission Time seconds	Limit s	Result
Manually	434.00	0.1025	5	Pass

Please refer to the attached plots.

Transmission Time



7. Duty Cycle

7.1 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.

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 434MHz, 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

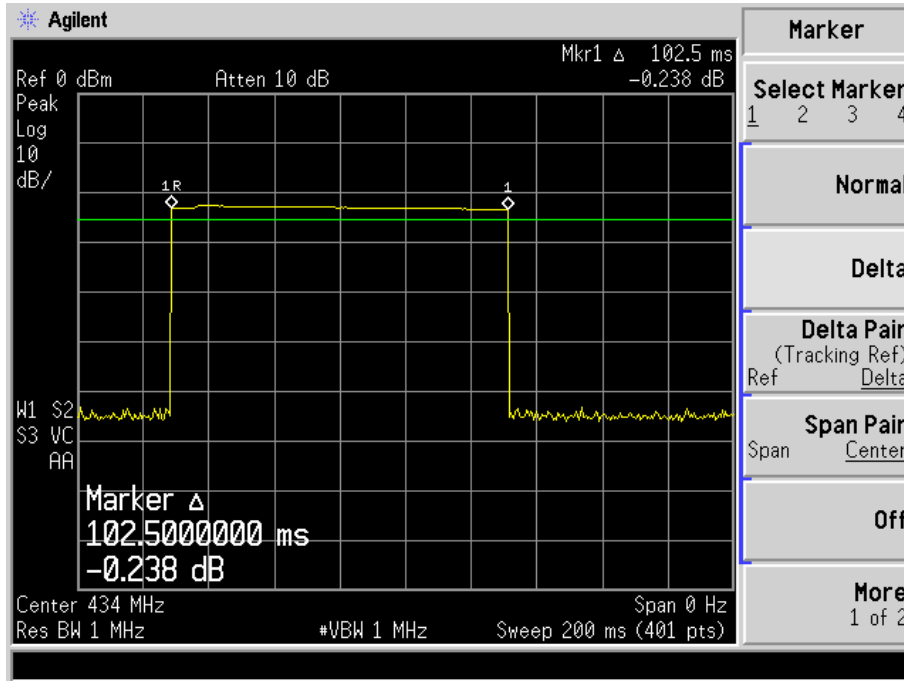
7.4 Summary of Test Results/Plots

Test Period (T_p) ms	Total Time (T_{on}) ms	Duty Cycle %	Duty Cycle Factor dB
102.5	102.5	1	0

Note: This device will cease transmission after transmission once if the keys are non-released.

Please refer to the attached test plots

Width of Pulse



***** END OF REPORT *****