RF Test Report

Applicant	:	Grand Mate Co., Ltd
Product Type	:	Remote controller
Trade Name	:	GRAND MATE
Model Number	:	TX143, TX142, TX121
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Receive Date	:	Nov. 23, 2018
Test Period	:	Dec. 13, 2018 ~ Mar. 05, 2019
Issue Date	:	Mar. 08, 2019

Issue by

A Test Lab Techno Corp.
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Taiwan Accreditation Foundation accreditation number: 1330
Test Firm MRA designation number: TW0010

Revision History

Rev.	Issue Date	Revisions	Revised By
00	Dec. 24, 2018	Initial Issue.	Nina Lin
01	Mar. 07, 2019	Page 17 Revised Fundamental Frequency Test Results.	Nina Lin
02	Mar. 08, 2019	Page 7 Added Note. Page 9 Revised Test Instruments. Page 19 Revised Fundamental Frequency Test Results.	Nina Lin

Verification of Compliance

Issued Date: Mar. 08, 2019

Applicant	:	Grand Mate Co., Ltd
Product Type	:	Remote controller
Trade Name	:	GRAND MATE
Model Number	:	TX143, TX142, TX121
FCC ID	:	UMPTX143
EUT Rated Voltage	:	DC 4.5 V, 100 mA (AAA Battery x 3 PCS)
Test Voltage	:	DC 4.5 V
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Test Result	:	Complied
Performing Lab.	:	A Test Lab Techno Corp. No. 140-1, Changan Street, Bade District, Taoyuan City 33465, Taiwan (R.O.C) Tel：+886-3-2710188 / Fax：+886-3-2710190 Taiwan Accreditation Foundation accreditation number: 1330http://www.atl-lab.com.tw/e-index.htm

A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By	:	Fly Lu	Reviewed By	:	Eric Ou Yang
(Manager)		(Fly Lu)	(Testing Engineer)		(Eric Ou Yang)

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1 General Information

1.1. Summary of Test Result

Standard	Item	Results	Remark
FCC			
15.207	AC Power Conducted Emission	N/A	This device use DC power source.
15.231(a)	Transmitter Deactivation Time	PASS	----
15.231(b)	Transmitter Radiated Emissions	PASS	----
15.231(c)	20 dB Bandwidth	PASS	----
CFR 47 Part 15.231(2010) / ANSI C63.10:2013			

The test results of this report relate only to the tested sample(s) identified in this report.

Standard	Description
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63. 10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.2. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	9 kHz ~ 150 kHz	2.7
	150 kHz ~ 30 MHz	2.7
Radiated Emission	30 MHz ~ 1000 MHz	5.7
	1000 MHz ~ 18000 MHz	5.5
	18000 MHz ~ 26500 MHz	4.8
	26500 MHz ~ 40000 MHz	4.8
RF Bandwidth	4.96 %	

2 EUT Description

Applicant	Grand Mate Co., Ltd No.30 Lugong S. 2nd Road, Lukang Township, Changhua County, 505 Taiwan
Manufacturer	Grand Mate Co., Ltd No.30, Lugong S. 2nd Rd., Lukang Township, Changhua County 50544, Taiwan
Product Type	Remote controller
Trade Name	GRAND MATE
Model Number	TX143, TX142, TX121
Models different description	Due to market demand, several series models are added. The button design is different, but rest of the spare parts such as circuit design and printed circuit boards remain the same.
FCC ID	UMPTX143
Frequency Range	315 MHz
Modulation Type	ASK
Number of Channels	1 Channel
Antenna Type	PCB Antenna
Operate Temp. Range	0 ~ +50 ℃

3 Test Methodology

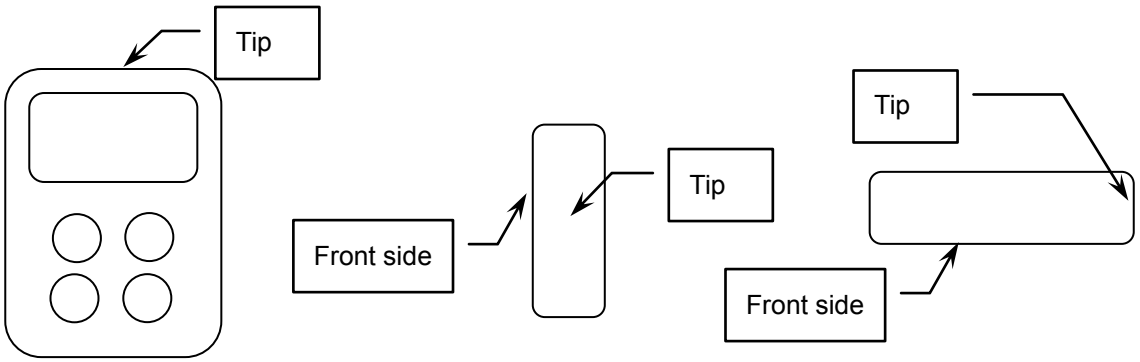
3.1. Mode of Operation

Test Mode
Mode 1: Transmitter Mode
Mode 2: Continuous TX Mode

Then, the above highest fundamental level mode of the configuration of the EUT and antenna was chosen for all final test items.

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

Note: Model Number: TX143 is the worst case.

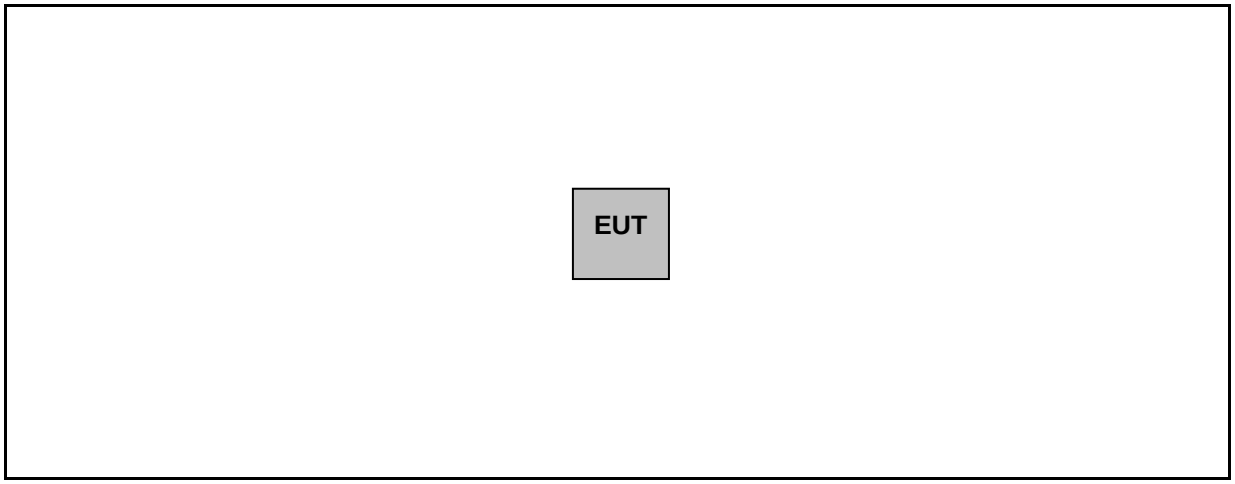


3.2. EUT Test Step

1.	Setup the EUT shown on “Configuration of Test System Details”.
2.	Turn on the power of all equipment.
3.	The EUT will start to operate function.

Measurement Software			
No.	Description	Software	Version
1	Radiated Emission	EZ EMC	1.1.4.4

3.3. Configuration of Test System Details



Devices Description					
Product		Manufacturer	Model Number	Serial Number	Power Cord
(1)	---	---	---	---	---

3.4. Test Instruments

For Radiated Emissions

Test Period: Dec. 13, 2018 / Mar. 05, 2019

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer (10 Hz~44 GHz)	Keysight	N9010A	MY52221312	01/15/2018 01/14/2019	1 year
Pre Amplifier (1~26.5 GHz)	Agilent	8449B	3008A02237	10/16/2018	1 year
Pre Amplifier (100 kHz~1.3 GHz)	Agilent	8447D	2944A11119	01/10/2018 01/14/2019	1 year
Broadband Antenna	Schwarzbeck	VULB9168	416	10/19/2018	1 year
Horn Antenna (1~18 GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	08/23/2018	1 year
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	03/13/2018	1 year
RF Cable	EMCI	EMC104-N-N-6000	TE01-1	02/20/2018 02/20/2019	1 year
Microwave Cable	EMCI	EMC104-SM-SM-13000	170814	10/30/2018	1 year
Microwave Cable	EMCI	EMC102-KM-KM-14000	151001	02/20/2018 02/20/2019	1 year

For Conducted

Test Period: Dec. 18 ~ Dec. 19, 2018

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer (3 Hz~50 GHz)	Agilent	N9030A	MY53120541	01/02/2018	1 year

3.5. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	990

4 Measurement Procedure

4.1. Radiated Emissions Measurement

■ Limit

According to FCC Part 15.231(b) requirement:

In addition to the provisions of §15.205, the field strength of emissions from intentional radiator operated under this section shall not exceed the following:

Fundamental and harmonics emission limits

Frequency range	Average Field Strength of Fundamental		Peak Field Strength of Fundamental
(MHz)	(μV/m@3 m)	(dBμV/m@3 m)	(dBμV/m@3 m)
315	6041.772	75.62	95.62

General Radiated emission Limit

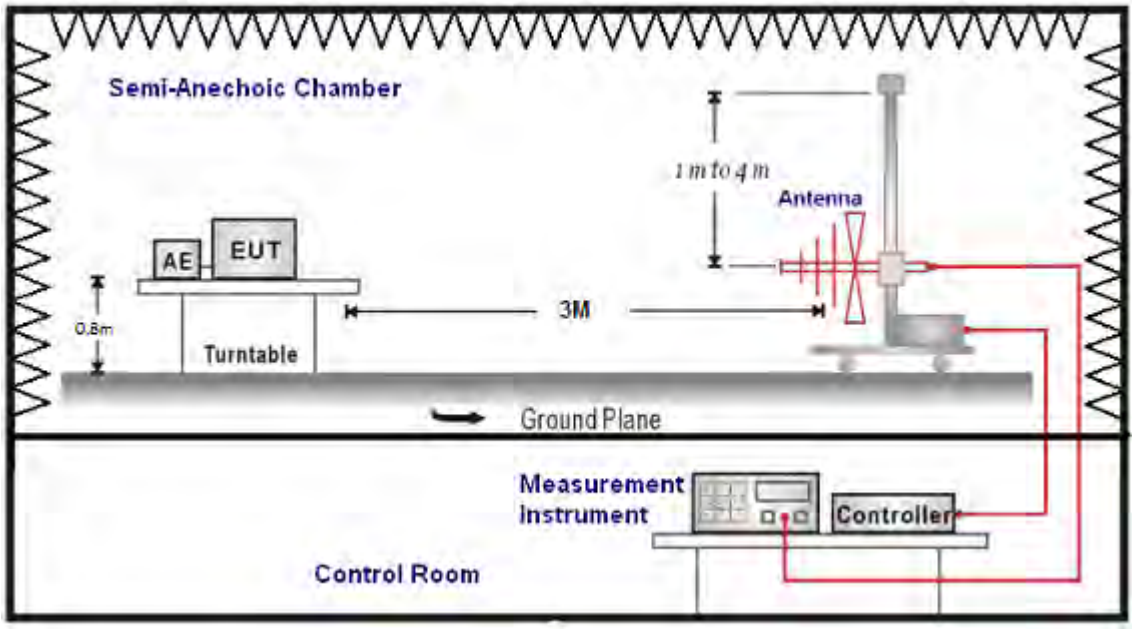
Frequency range	Field Strength of Fundamental	Field Strength of Harmonics
(MHz)	(uV/m at 3 m)	(uV/m at 3 m)
40.66 to 40.70	2250 (67.04 dBuV)	225 (47.04 dBuV)
70 to 130	1250 (61.94 dBuV)	125 (41.94 dBuV)
130 to 174	1250 (61.94 dBuV) to 3750 (71.48 dBuV)	125 (41.94 dBuV) to 375 (51.48 dBuV)
174 to 260	3750 (71.48 dBuV)	375 (51.48 dBuV)
260 to 470	3750 (71.48 dBuV) to 12500 (81.94 dBuV)	375 (51.48 dBuV) to 1250 (61.94 dBuV)
470 and above	12500 (81.94 dBuV)	1250 (61.94 dBuV)

Remark: 1. The table above tighter limit applies at the band edges.

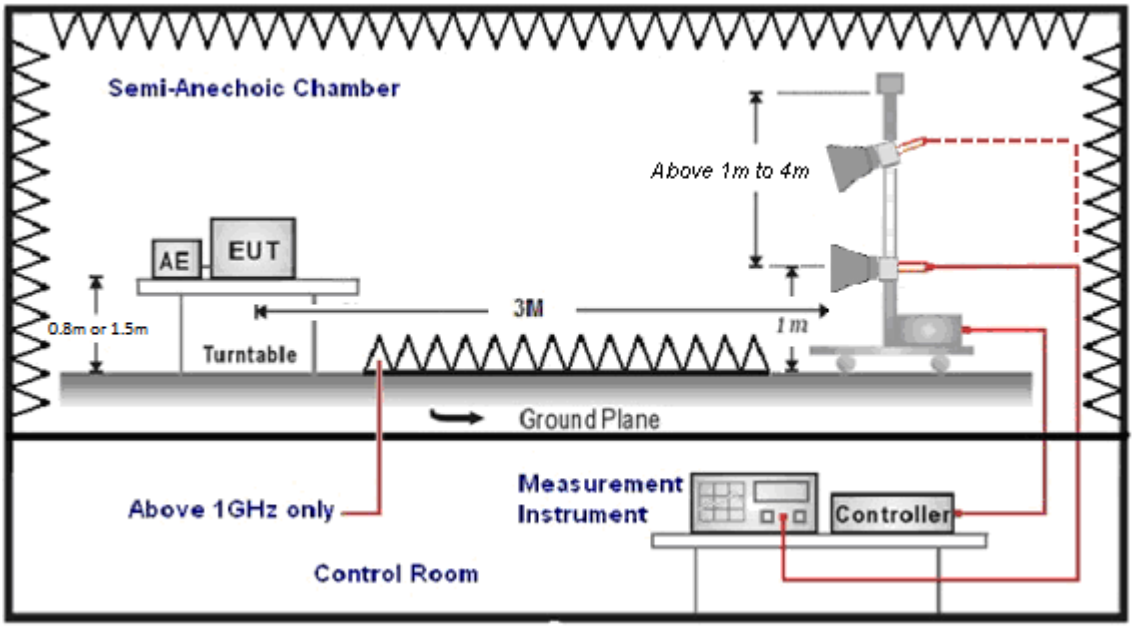
2. The measurement distance in meters, which that between form closest point of EUT to instrument antenna.

■ **Setup**

Below 1 GHz



Above 1 GHz



■ Test Procedure

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 or 1.5 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 250 MHz to 2.5 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously & Measurements spectrum range from 30 MHz to 26.5 GHz is investigated.
For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements and 10 Hz for average measurements.
A nonconductive material surrounded the EUT to supporting the EUT for standing on tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.
SCHWARZBECK MESS-ELEKTRONIK Biconilog Antenna at 3 Meter and the SCHWARZBECK Double Ridged Guide Antenna was used in frequencies 1 – 26.5 GHz at a distance of 1 meter. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20 dB/decade).

For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer's 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.
The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in micro volts pre meter (uV/m).
The actual field intensity in decibels referenced to 1 microvolt in to field intensity in micro colts per meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

(1) Amplitude (dBuV/m) = FI (dBuV) +AF (dBuV) +CL (dBuV)-Gain (dB)

FI= Reading of the field intensity.

AF= Antenna factor.

CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

(2) Actual Amplitude (dBuV/m) = Amplitude (dBuV)-Dis(dB)

The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:

(a) For fundamental frequency : Transmitter Output < +30 dBm

(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

Data of measurement within this frequency range without mark in the table above means the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.

■ Calculation of Average Factor

The output field strengths of specification in accordance with the FCC rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.
Please see the diagrams below.

(*) When the field strength (or envelope power) is not constant or when it is in pulses, and an averaging detector is specified to be used, the value of field strength or power over one complete pulse train, excluding blanking intervals, shall be averaged as long as the pulse train does not exceed 0.1 seconds. In cases where the pulse train exceeds 0.1 seconds, the average value (of field strength or output power) shall be determined during a 0.1 second interval during which the field strength or power is at its maximum value.

4.2. 20 dB Bandwidth Measurement

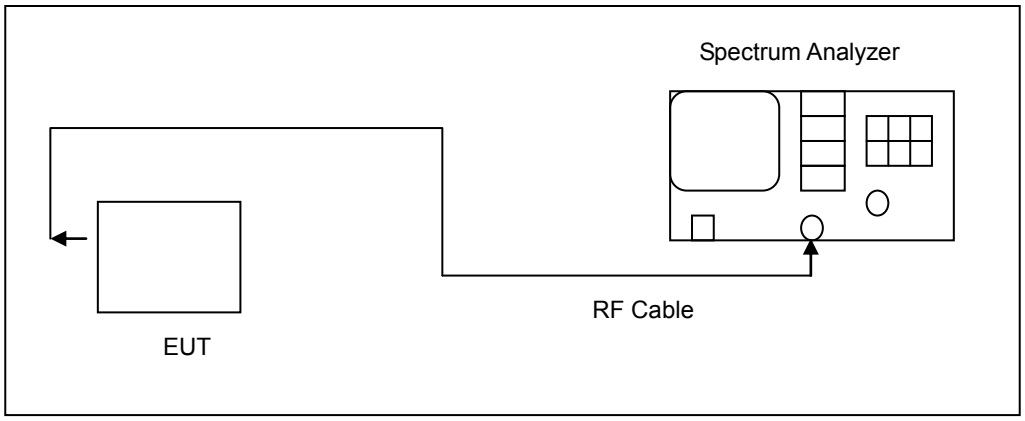
■ Limit

According to FCC Part 15.231(c) requirement:

The 20 dB

B.W Limit = 0.25 % * f (MHz) = 0.25 % * 315 MHz = 787.5 kHz

■ Test Setup



■ Test Procedure

The RF output port of the Equipment-Under-Test is directly coupled to the input of the analyzer through a specialized RF connector and a 10 dB passive attenuator. A fully charged battery was used for the supply voltage. The RF function of the EUT was enabled. The spectrum analyzer used the following settings:

1. Span = 1 MHz
2. RBW ≥ 1 % of the 20 dB span
3. VBW ≥ RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

The trace was allowed to stabilize. The EUT was transmitting at its maximum data rate. The marker-to-peak function was used to set the marker to the peak of the emission. The marker-delta function was used to measure 20 dB down one side of the emission. The marker-delta function and marker was moved to the other side of the emission until it was even with the reference marker. The marker-delta reading at this point was the 20 dB bandwidth of the emission.

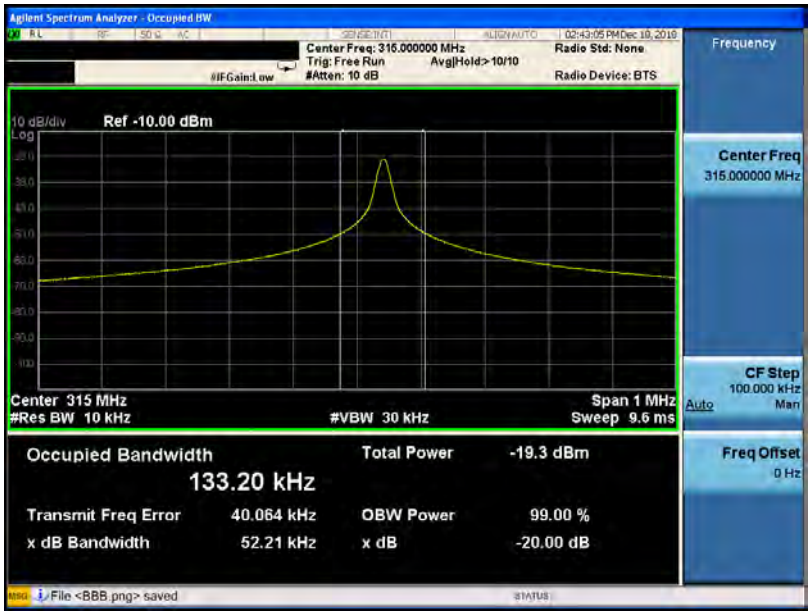
5 Test Results

Annex A. Conducted Test Results

20 dB Measurement

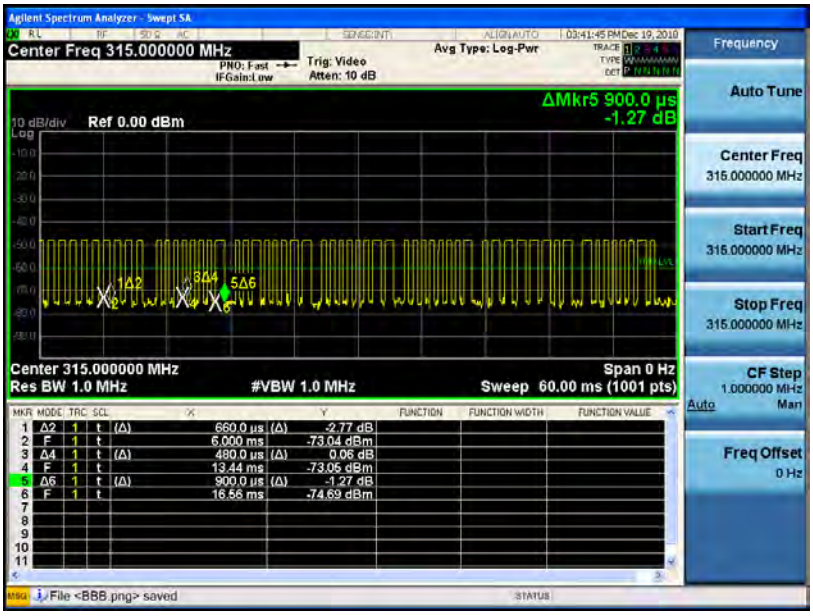
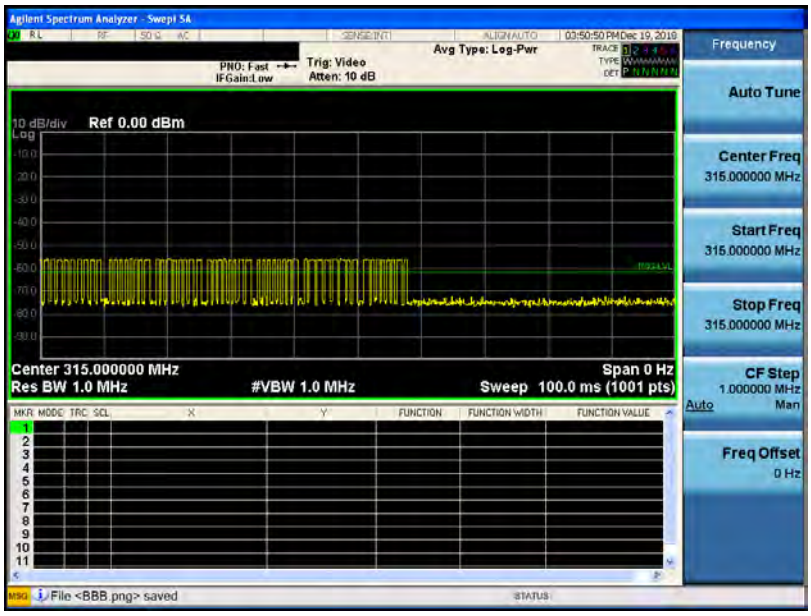
Test Mode	Mode 2	
Frequency (MHz)	20 dB Bandwidth (kHz)	Limited (kHz)
315	52.21	787.5

■ **Test Graphs**

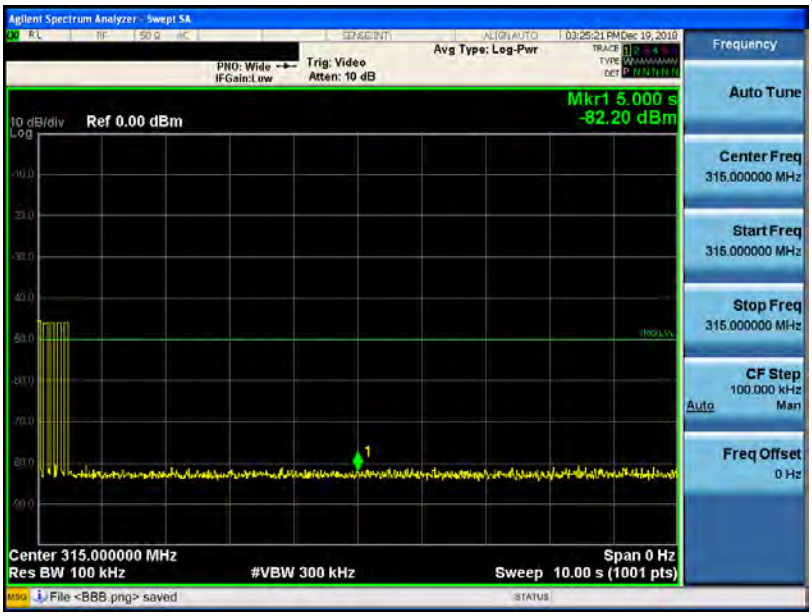


Annex C. Radiated Emissions Measurement

Duty Cycle Test Diagrams

Mode 2	
On time	
On+off time	

The EUT was complied with the requirement of FCC 15.231 (a) (1), which employed a switch that will automatically deactivate the transmitter within less than 5 seconds of being released.

Mode 2


Duty Cycle Results

Test Mode	Mode 2	
Item	Results	Note
Ton	36.66 ms	-----
Tp	100 ms	-----
Duty Cycle	0.36666	-----
Averaging Factor (20 log * Duty Cycle)	-8.716	-----

Please see the diagrams below.

Note:

1. RB=100 kHz, VB=300 kHz, SPAN=0
2. Duty Cycle= Ton/Tp

Fundamental Frequency Test Results

Standard:	FCC Part 15.231	Test Distance:	3 m
Test item:	Fundamental	Power:	DC 4.5 V
Test Mode:	Mode 2	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Ant.Polar.:	Horizontal		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	315.0400	82.58	-3.52	79.06	95.62	-16.56	peak
2	315.0400	73.86	-3.52	70.34	75.62	-5.28	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

Example: 79.06=-3.52+82.58

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.231	Test Distance:	3 m
Test item:	Fundamental	Power:	DC 4.5 V
Test Mode:	Mode 2	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH
Ant.Polar.:	Vertical		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	315.0400	70.27	-3.52	66.75	95.62	-28.87	peak
2	315.0400	61.55	-3.52	58.03	75.62	-17.59	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

Example: 66.75=-3.52+70.27

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Below 1 GHz

Standard:	FCC Part 15.231	Test Distance:	3 m
Test item:	Harmonic	Power:	DC 4.5 V
Test Mode:	Mode 1	Temp.(℃)/Hum.(%RH):	26(℃)/60 %RH

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
93.0500	39.46	-11.89	27.57	43.50	-15.93	QP	H
182.2900	24.51	-6.94	17.57	43.50	-25.93	QP	H
407.3300	25.84	-1.57	24.27	46.00	-21.73	QP	H
474.2600	25.62	-0.12	25.50	46.00	-20.50	QP	H
583.8700	25.45	2.02	27.47	46.00	-18.53	QP	H
630.0000	36.72	2.94	39.66	46.00	-6.34	QP	H
684.7500	25.60	3.94	29.54	46.00	-16.46	QP	H
945.0000	29.91	8.64	38.55	46.00	-7.45	QP	H
93.0500	44.81	-11.89	32.92	43.50	-10.58	QP	V
217.2100	27.02	-7.41	19.61	46.00	-26.39	QP	V
375.3200	27.80	-2.39	25.41	46.00	-20.59	QP	V
556.7100	28.06	1.24	29.30	46.00	-16.70	QP	V
630.0000	38.12	2.94	41.06	46.00	-4.94	QP	V
675.0500	28.35	3.75	32.10	46.00	-13.90	QP	V
803.0900	28.35	6.37	34.72	46.00	-11.28	QP	V
945.0000	31.74	8.64	40.38	46.00	-5.62	QP	V

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

Example: 27.57=-11.89+39.46

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15.231			Test Distance:		3 m	
Test item:	Band edge			Power:		DC 4.5 V	
Test Mode:	Mode 2			Temp.(℃)/Hum.(%RH):		26(℃)/60 %RH	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
283.6931	22.39	-4.20	18.19	46.00	-27.81	QP	H
285.0000	22.59	-4.19	18.40	46.00	-27.60	QP	H
322.0000	32.90	-3.40	29.50	46.00	-16.50	QP	H
322.2348	32.61	-3.40	29.21	46.00	-16.79	QP	H
273.2946	23.00	-4.68	18.32	46.00	-27.68	QP	V
285.0000	22.44	-4.19	18.25	46.00	-27.75	QP	V
322.0000	23.05	-3.40	19.65	46.00	-26.35	QP	V
322.6162	22.56	-3.39	19.17	46.00	-26.83	QP	V

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

Above 1 GHz

Standard:	FCC Part 15.231			Test Distance:		3 m	
Test item:	Harmonic			Power:		DC 4.5 V	
Test Mode:	Mode 2			Temp.(℃)/Hum.(%RH):		26(℃)/60 %RH	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
1890.000	58.17	-3.04	55.13	74.00	-18.87	peak	H
1890.000	55.77	-3.04	52.73	54.00	-1.27	AVG	H
2205.000	56.89	-1.84	55.05	74.00	-18.95	peak	H
2205.000	53.40	-1.84	51.56	54.00	-2.44	AVG	H
2205.000	50.09	-1.84	48.25	74.00	-25.75	peak	V

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

Example: 55.13=-3.04+58.17

2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.