FCC 47 CFR PART 15 SUBPART C

RF Test Report

Applicant	:	Grand Mate Co., Ltd
Address	:	No. 30 Lugong S 2nd Rd, Lugang Town, Changhua Hsien 505,Taiwan
Product Type	:	TX-01 Remote controller
Trade Name	:	GRANDMATE
Model Number	:	TX-01/650A/B
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Application Purpose	:	Original
Receive Date	:	Aug. 03, 2015
Test Period	:	Aug. 10 ~ 13, 2015
Issue Date	:	Nov. 09, 2015

Issue by

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Taiwan Accreditation Foundation accreditation number: 1330

Revision History

Rev.	Issue Date	Revisions	Revised By
00	Nov. 09, 2015	Initial Issue	

Verification of Compliance

Issued Date: 2015/11/09

Applicant	:	Grand Mate Co., Ltd
Address	:	No. 30 Lugong S 2nd Rd, Lugang Town, Changhua Hsien 505,Taiwan
Product Type	:	TX-01 Remote controller
Trade Name	:	GRANDMATE
Model Number	:	TX-01/650A/B
FCC ID	:	UMPTX-01
EUT Rated Voltage	:	TX: DC 12V (23A Battery *1PCS) RX: DC 6V (AA Battery * 4PCS)
Test Voltage	:	TX: DC 12V, RX: DC 6V
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Application Purpose	:	Original
Test Result	:	Complied
Performing Lab.	:	A Test Lab Techno Corp. No. 140-1, Changan Street, Bade City, Taoyuan County 334, Taiwan R.O.C. Tel：+886-3-2710188 / Fax：+886-3-2710190 Taiwan Accreditation Foundation accreditation number: 1330 http://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. Measurement Uncertainties were not taken into account and are published for informational purposes only. 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

Reference	Test	Results	Remark
FCC Part 15.231			
15.207	Ac Power Conducted Emission	N/A	This device uses DC power source.
15.231(a)	Transmitter Deactivation Time	PASS	----
15.231(b)	Transmitter Field Strength of Emissions	PASS	----
15.231(c)	Bandwidth of the Emission	PASS	----

The test results of this report relate only to the tested sample(s) identified in this report. Manufacturer or whom it may concern should recognize the pass or fail of the test result.

1.2. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	9kHz ~ 150kHz	2.7
	150kHz ~ 30MHz	2.8
Radiated Emission	30MHz ~ 1000MHz	6.300
	1000MHz ~ 18000MHz	5.474
	18000MHz ~ 26500MHz	5.630
	26500MHz ~ 40000MHz	5.054

2 EUT Description

Applicant	Grand Mate Co., Ltd No. 30 Lugong S 2nd Rd, Lugang Town, Changhua Hsien 505,Taiwan
Manufacturer	Grand Mate Co., Ltd No. 30 Lugong S 2nd Rd, Lugang Town, Changhua Hsien 505,Taiwan
Product Type	TX-01 Remote controller
Trade Name	GRANDMATE
Model Number	TX-01/650A/B
FCC ID	UMPTX-01
Frequency Range	315 MHz
Modulation Type	AKS
Number of Channels	1 Channel
Antenna Type	PCB Antenna

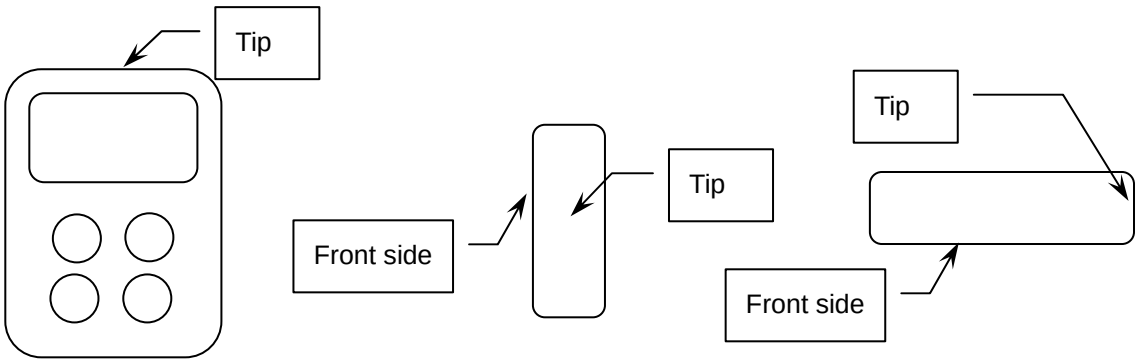
3 Test Methodology

3.1. Mode of Operation

Test Mode
Mode 1: Transmitter Mode
Mode 2: Receiver 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.

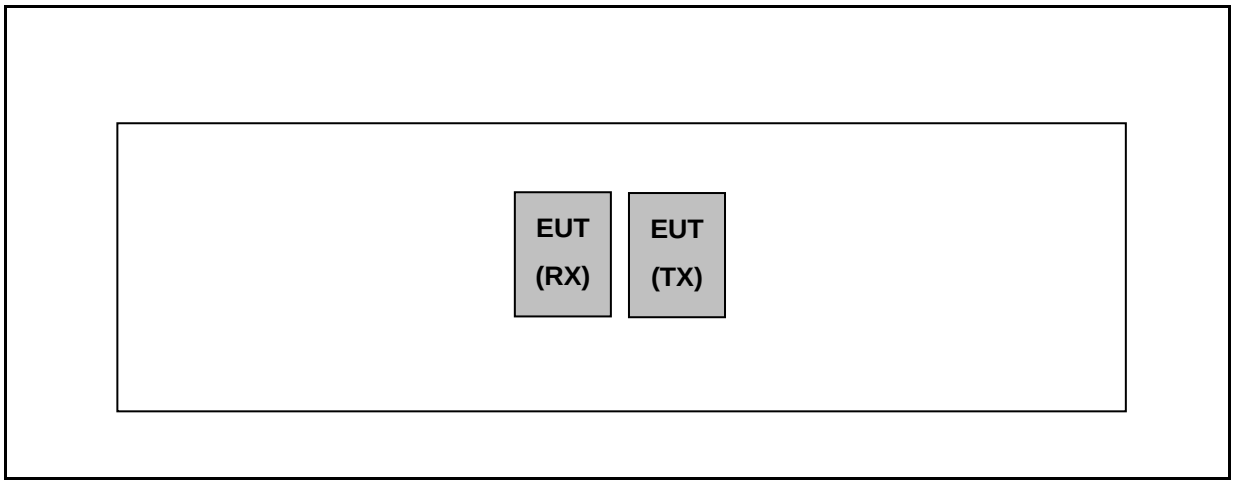


X axis mode Y axis mode Z axis mode

3.2. EUT Exercise Software

1.	Setup the EUT as shown on 3.3.
2.	Turn on the power of all equipment.
3.	The EUT will start to operate function.

3.3. Configuration of Test System Details



3.4. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

4 Test Results

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@3m)	(dBμV/m@3m)	(dBμV/m@3m)
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 3m)	(uV/m at 3m)
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.

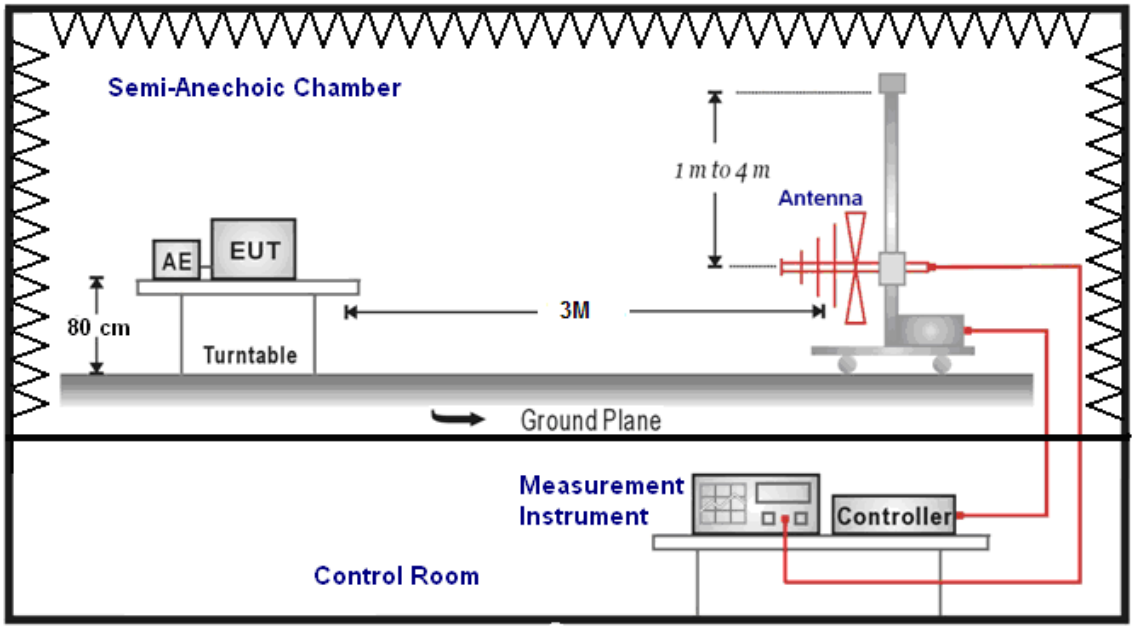
■ **Test Instruments**

3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
RF Pre-selector	Agilent	N9039A	MY46520256	01/06/2015	1 year
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/06/2015	1 year
Pre Amplifier	Agilent	8449B	3008A02237	02/24/2015	1 year
Pre Amplifier	Agilent	8447D	2944A10961	02/24/2015	1 year
Broadband Antenna (30MHz~1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	9163-270	08/11/2015	1 year
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/12/2015	1 year
Horn Antenna (18~40GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170	9170-320	07/06/2015	1 year
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	02/02/2015	1 year
Microwave Cable	EMCI	EMC-104-SM-SM-14000	140202	02/24/2015	1 year
Microwave Cable	EMCI	EMC104-SM-SM-600	140301	02/24/2015	1 year
Test Site	ATL	TE01	888001	08/28/2014	1 year

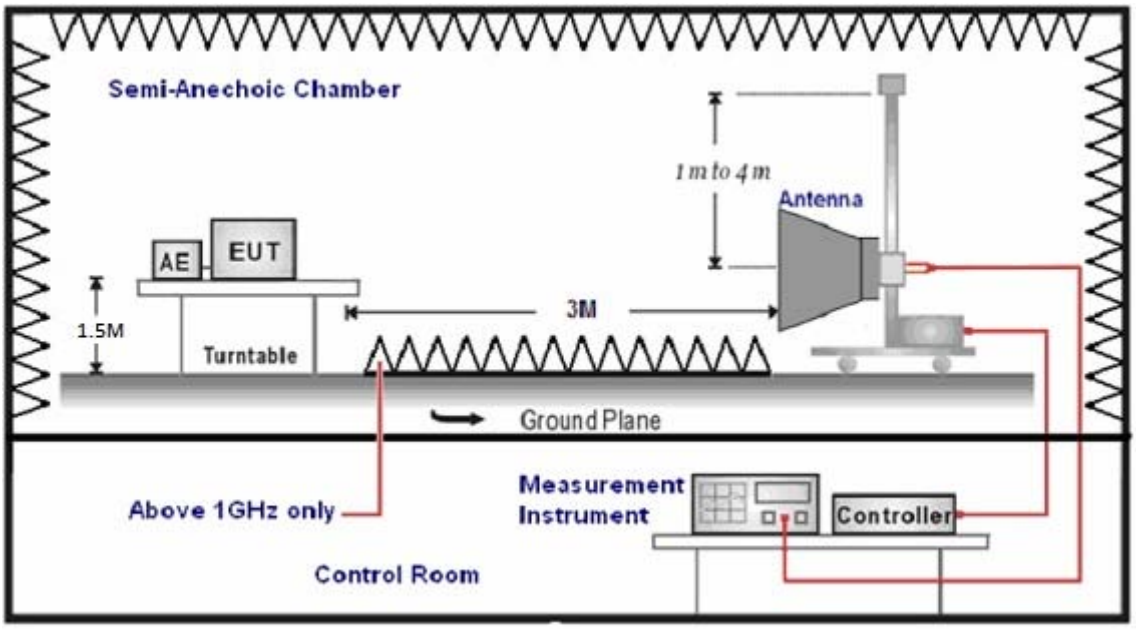
Note: N.C.R. = No calibration request.

■ **Setup**

Below 1GHz



Above 1GHz



■ **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(below 1GHz use 0.8m turntable / above 1GHz use 1.5m turntable), 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 1 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 (mode VULB9163) at 3 Meter and the SCHWARZBECK Double Ridged Guide Antenna (model BBHA9120D&9170) 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 (20dB/decade).

For testing above 1GHz, the emission level of the EUT in peak mode was 20dB 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)

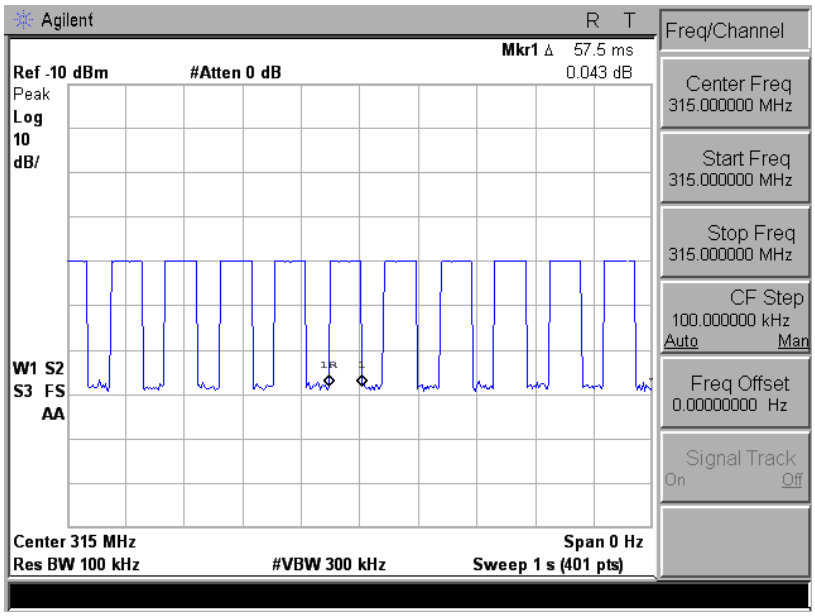
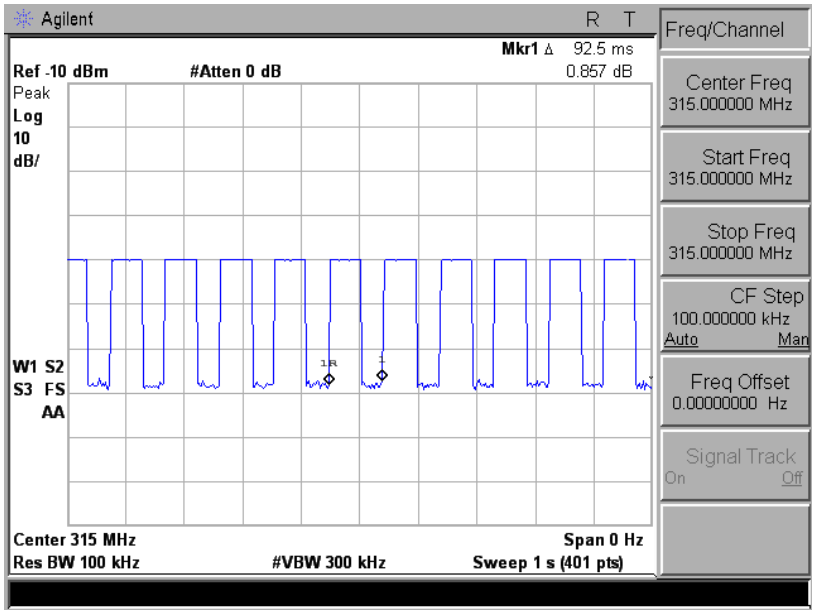
The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:

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

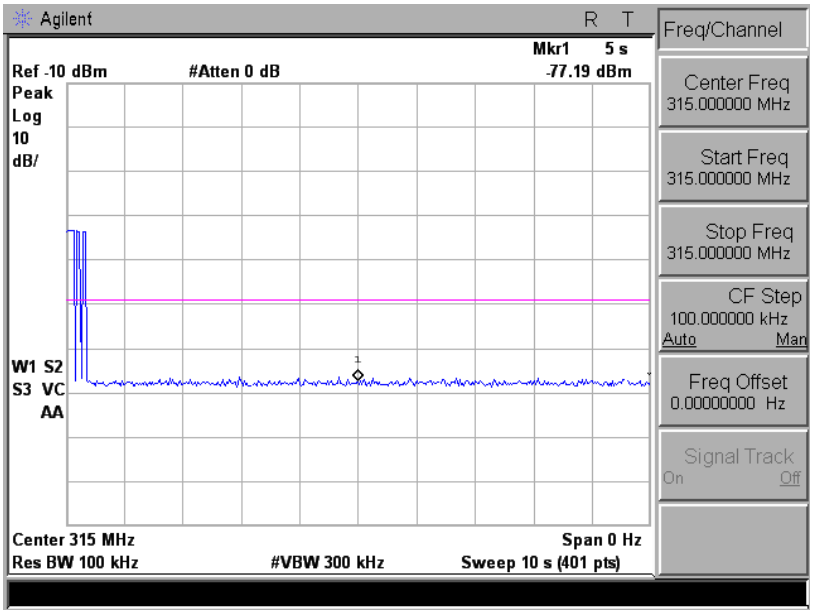
(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

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

■ **Test Result**

Duty Cycle Test Diagrams	
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.



■ 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.

■ Duty Cycle Results

Item	Results	Note
Ton	57.5 ms	-----
Tp	92.5 ms	-----
Duty Cycle	0.6216	-----
Averaging Factor (20 log * Duty Cycle)	-4.13	-----

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 15C	Test Distance:	3m
Test item:	Fundamental Frequency	Power:	DC 12V
Model Number:	TX-01/650A/B	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Test Mode:	Mode 1	Date:	08/10/2015
Ant.Polar.:	Horizontal	Test By:	Eric Ou Yang
Description:			

No.	Frequency (MHz)	Reading (dBuV)	Duty cycle Factor (dB)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	314.9820	81.33	-4.13	-12.49	68.84	95.62	-26.78	peak
2	314.9820	81.33	-4.13	-12.49	64.71	75.62	-10.91	AVG

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Fundamental Frequency	Power:	DC 12V
Model Number:	TX-01/650A/B	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Test Mode:	Mode 1	Date:	08/10/2015
Ant.Polar.:	Vertical	Test By:	Eric Ou Yang
Description:			

No.	Frequency (MHz)	Reading (dBuV)	Duty cycle Factor (dB)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	314.9844	78.30	-4.13	-12.49	65.81	95.62	-29.81	peak
2	314.9844	78.30	-4.13	-12.49	61.68	75.62	-13.94	AVG

Note: 1. Peak Result (dBuV) = Reading(dBuV) + Correction factor (dB).

Note: 2. Avg. Result (dBuV) = Reading(dBuV) + Correction factor (dB) + Duty Cycle Factor (dB).

■ **Below 1GHz**

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Transmitter Unwanted Emissions	Power:	DC 12V
Model Number:	TX-01/650A/B	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Test Mode:	Mode 1	Date:	08/10/2015
		Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
115.5000	29.74	-16.61	13.13	43.50	-30.37	QP	H
444.0000	27.67	-10.44	17.23	46.00	-28.77	QP	H
497.5000	29.59	-9.80	19.79	46.00	-26.21	QP	H
672.5000	27.73	-7.11	20.62	46.00	-25.38	QP	H
744.5000	27.20	-5.70	21.50	46.00	-24.50	QP	H
875.0000	27.13	-3.84	23.29	46.00	-22.71	QP	H
91.0000	36.75	-19.66	17.09	43.50	-26.41	QP	V
272.0000	27.75	-13.57	14.18	46.00	-31.82	QP	V
390.0000	26.38	-11.40	14.98	46.00	-31.02	QP	V
440.5000	28.36	-10.51	17.85	46.00	-28.15	QP	V
704.5000	26.94	-6.55	20.39	46.00	-25.61	QP	V
893.5000	27.16	-3.48	23.68	46.00	-22.32	QP	V

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

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

3. No emission found between lowest internal used/generated frequencies to 30MHz (9 kHz~30MHz).

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Transmitter Unwanted Emissions	Power:	DC 6V
Model Number:	GM8K-2	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Test Mode:	Mode 2	Date:	08/10/2015
		Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
132.0000	25.86	-14.97	10.89	43.50	-32.61	QP	H
257.5000	25.97	-14.06	11.91	46.00	-34.09	QP	H
444.0000	27.67	-10.44	17.23	46.00	-28.77	QP	H
615.0000	27.40	-7.73	19.67	46.00	-26.33	QP	H
744.5000	27.20	-5.70	21.50	46.00	-24.50	QP	H
942.0000	25.91	-2.81	23.10	46.00	-22.90	QP	H
145.0000	24.45	-13.85	10.60	43.50	-32.90	QP	V
382.0000	24.80	-11.53	13.27	46.00	-32.73	QP	V
463.5000	25.04	-10.19	14.85	46.00	-31.15	QP	V
572.0000	25.08	-8.52	16.56	46.00	-29.44	QP	V
747.0000	25.06	-5.64	19.42	46.00	-26.58	QP	V
882.0000	24.76	-3.70	21.06	46.00	-24.94	QP	V

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

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

3. No emission found between lowest internal used/generated frequencies to 30MHz (9 kHz~30MHz).

■ **Above 1GHz**

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Transmitter Unwanted Emissions	Power:	DC 12V
Model Number:	TX-01/650A/B	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Test Mode:	Mode 1	Date:	08/10/2015
Frequency:	315MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
1575.000	56.48	-3.89	52.59	75.62	-23.03	peak	H
1575.000	50.80	-3.89	46.91	55.62	-8.71	AVG	H
1890.000	60.63	-2.60	58.03	75.62	-17.59	peak	H
1890.000	44.32	-2.60	41.72	55.62	-13.9	AVG	H
2520.000	58.09	0.08	58.17	75.62	-17.45	peak	H
2520.000	37.79	0.08	37.87	55.62	-17.75	AVG	H
1890.000	53.61	-2.60	51.01	75.62	-24.61	peak	V
1890.000	39.72	-2.60	37.12	55.62	-18.5	AVG	V
2520.000	55.00	0.08	55.08	75.62	-20.54	peak	V
2520.000	31.30	0.08	31.38	55.62	-24.24	AVG	V
3465.000	49.61	3.78	53.39	75.62	-22.23	peak	V
3465.000	49.09	3.78	52.87	55.62	-2.75	AVG	V

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Transmitter Unwanted Emissions	Power:	DC 6V
Model Number:	GM8K-2	Temp.(℃)/Hum.(%RH):	26(℃)/60%RH
Test Mode:	Mode 2	Date:	08/10/2015
Frequency:	315MHz	Test By:	Eric Ou Yang

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
1516.000	41.35	-4.13	37.22	75.62	-38.4	peak	H
2155.000	38.90	-1.48	37.42	75.62	-38.2	peak	H
3019.000	37.99	1.79	39.78	75.62	-35.84	peak	H
1528.000	41.21	-4.09	37.12	75.62	-38.5	peak	V
2392.000	38.65	-0.46	38.19	75.62	-37.43	peak	V
3382.000	38.34	3.41	41.75	75.62	-33.87	peak	V

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

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

4.2. 20dB Bandwidth Measurement

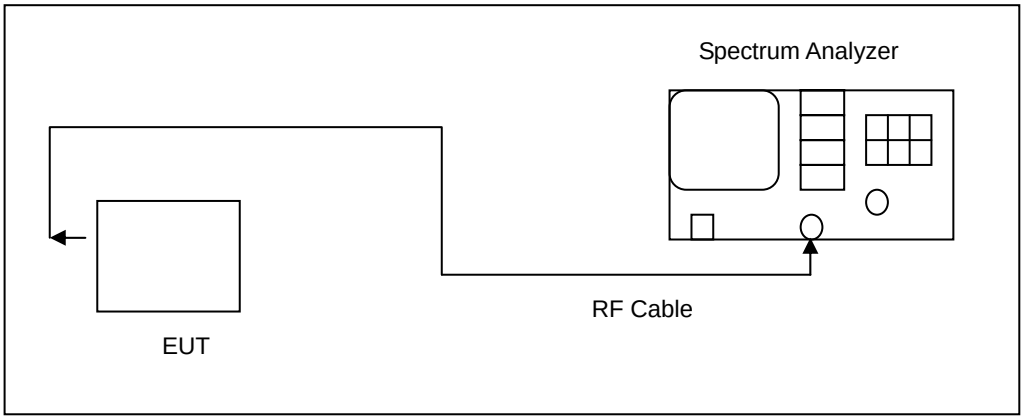
■ Limit

According to FCC Part 15.231(c) requirement:

The 20dB bandwidth shall be no wider than 0.25% of the centre frequency for devices operating between 70-900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency.

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

■ Test Setup



■ Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/14/2015	1 year
Test Site	ATL	TE02	TE05	N.C.R.	-----

Note: N.C.R. = No calibration request.

■ Test Procedure

20dB Bandwidth

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 10dB 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 20dB 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 20dB 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 20dB bandwidth of the emission.

■ Test Result

Model Number	TX-01/650A/B	
Mode	Mode 1	
Date of Test	08/13/2015	
Frequency (MHz)	20 dB Bandwidth (KHz)	Limited (KHz)
315	54.136	787.5000

■ **Test Graphs**

20 dB Bandwidth