

FCC 47 CFR PART 15 SUBPART C

Product Type : Rugged Tablet Computer

Applicant : Unitech Electronics Co., Ltd.

Address : 5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan 231, R.O.C.

Trade Name : unitech

Model Number : TB120

Test Specification : FCC 47 CFR PART 15 SUBPART C: Oct., 2014
ANSI C63.10:2013

Receive Date : Apr. 30, 2015

Test Period : May 25 ~ Jun. 22, 2015

Issue Date : Jul. 27, 2015

Issue by

A Test Lab Techno Corp.
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Taiwan Accreditation Foundation accreditation number: 1330

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Revision History

Rev.	Issue Date	Revisions	Revised By
00	Jul. 27, 2015	Initial Issue	

Verification of Compliance

Issued Date: 2015/07/27

Product Type : Rugged Tablet Computer
Applicant : Unitech Electronics Co., Ltd.
Address : 5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New
Trade Name : unitech
Model Number : TB120
FCC ID : HLETB120BTNFP
EUT Rated Voltage : DC 5V, 3A
Test Voltage : 120 Vac / 60 Hz
Applicable : FCC 47 CFR PART 15 SUBPART C: Oct., 2014
Standard : ANSI C63.10:2013
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

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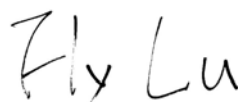
<http://www.atl-lab.com.tw/e-index.htm>



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

:

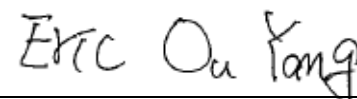


(Manager)

(Fly Lu)

Reviewed By

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(Testing Engineer)

(Eric Ou Yang)

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1 General Information

1.1 Summary of Test Result

Reference	Test	Results	Section	Remark
47 CFR Part 15.225				
15.207(a)	Conducted Emissions Voltage	PASS	4.5	---
15.225 (a), (b), (c), (d) 15.209	Radiated Emission Limits	PASS	5.5	---
15.225(e)	Frequency Stability	PASS	6.5	---
CFR 47 Part 15.225(2006) / ANSI C63.10:2013				

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 ~ 30MHz		± 2.02
Radiated Emission	30MHz ~ 1000MHz	Horizontal	± 3.98
		Vertical	± 3.62
	1000MHz ~ 18000MHz	Horizontal	± 3.11
		Vertical	± 3.07
	18000MHz ~ 40000MHz	Horizontal	± 3.66
		Vertical	± 3.54

2 EUT Description

Applicant	:	Unitech Electronics Co., Ltd.
Applicant Address	:	5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan 231, R.O.C.
Manufacturer	:	Unitech Electronics Co., Ltd.
Manufacturer Address	:	5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan 231, R.O.C.
Product	:	Rugged Tablet Computer
Trade Name	:	unitech
Model Number	:	TB120
IMEI No.	:	359570021578553
FCC ID	:	HLETB120BTNFP
Frequency Range	:	13.56 MHz
Modulation Type	:	ASK
Number of Channels	:	1 Channel
Antenna Type	:	FPCB Antenna

3 Test Methodology

3.1. Mode of Operation

The following test mode(s) were scanned during the preliminary test :

Pre-Test Mode
Mode 1: Normal Operation Mode
Mode 2: Transmit Mode

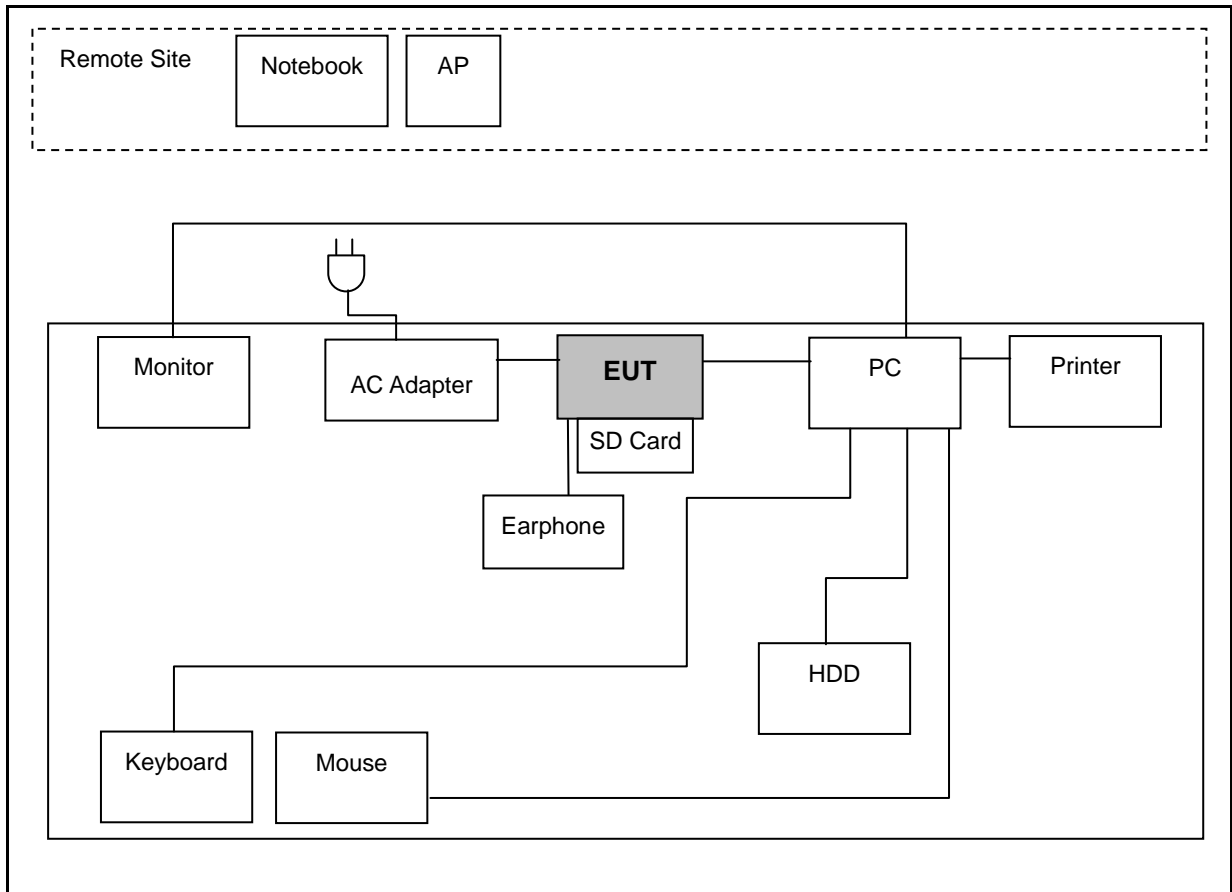
ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation.

3.2. EUT Exercise Software

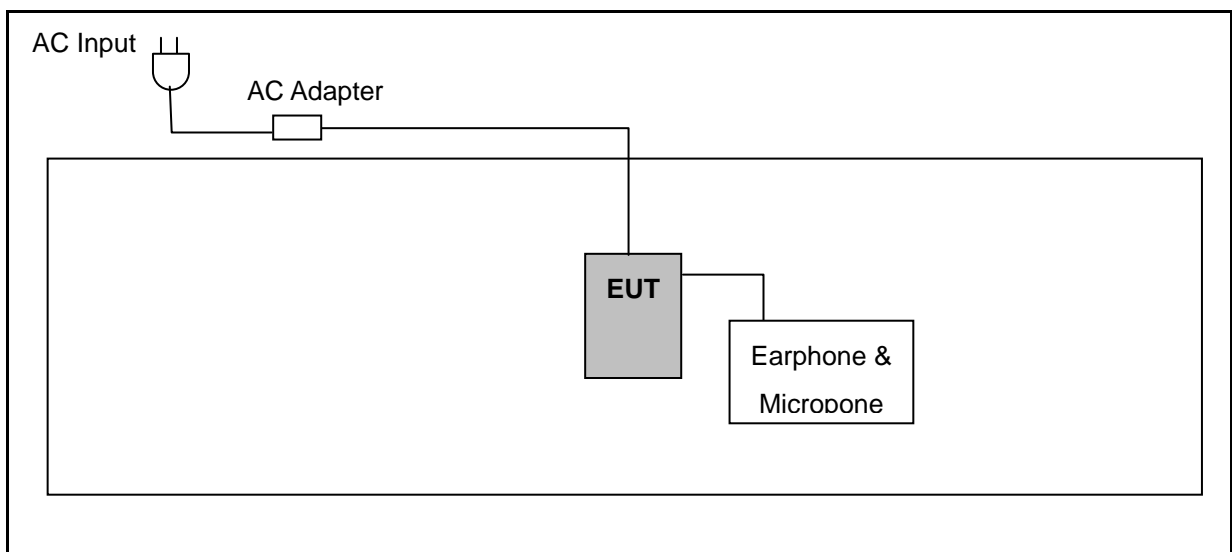
1.	Setup the EUT as shown on 3.3.
2.	Turn on the power of all equipment.
3.	The EUT will start to operate function.

3.3. Configuration of Test System Details

Conducted Emissions



Radiated Emissions



3.4. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	25
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950

4 Conducted Emission Measurement

4.1. Limit

Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

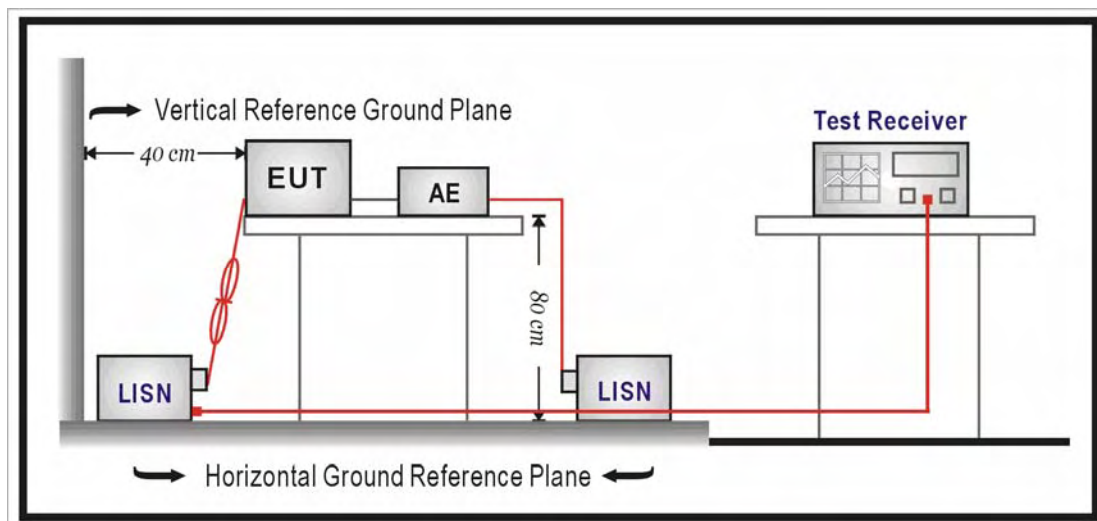
4.2. Test Instruments

Describe	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Test Receiver	R&S	ESCI	100367	06/12/2014	(1)
LISN	R&S	ENV216	101040	03/10/2015	(1)
LISN	R&S	ENV216	101041	03/06/2015	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

NOTE: N.C.R. = No Calibration Request.

4.3. Test Setup



4.4. Test Procedure

The power line conducted emission measurements were performed in a shielded enclosure. The EUT was assembled on a wooden table which is 80 centimeters high, was placed 40 centimeters from the back wall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and EMCO Model 3162/2 SH Line Impedance Stabilization Networks (LISN). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPR quasi-peak detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

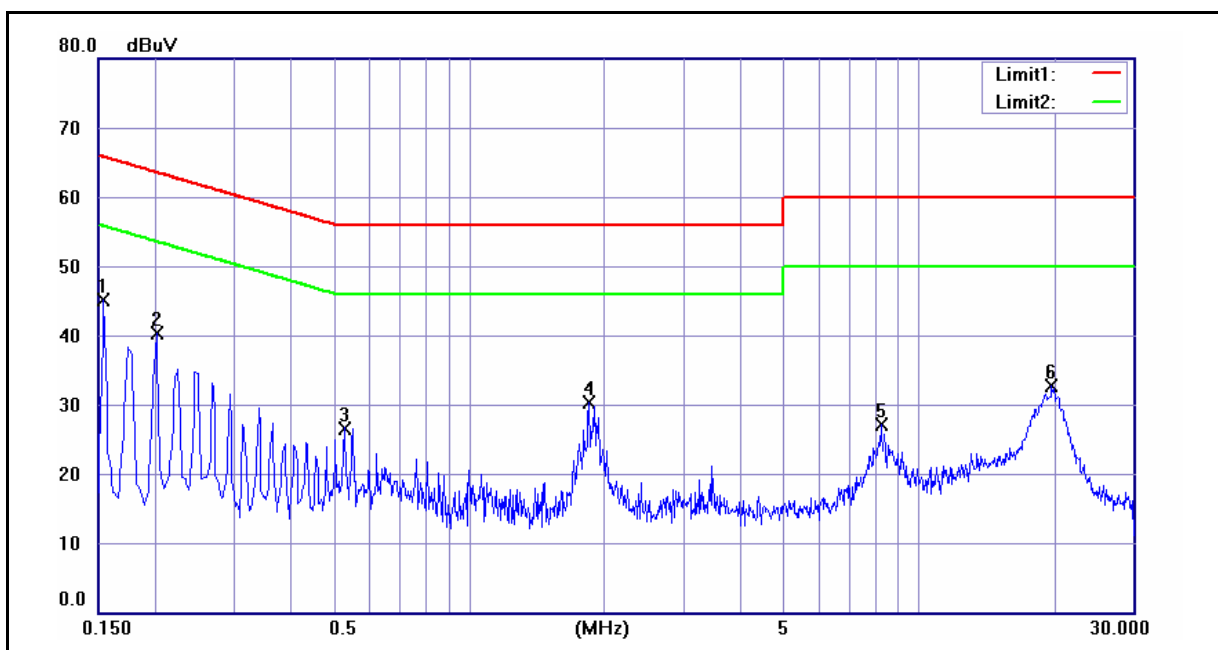
The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 4.1.

Spectrum Analyzer Settings

Measurement Frequency	Preliminary Peak Scan		Final Detection	
	Resolution Bandwidth	Video Bandwidth	Quasi-Peak Bandwidth	Average Video Bandwidth
9kHz to 150kHz	10kHz	10kHz	200Hz	10Hz
150kHz to 30MHz	100kHz	100kHz	9kHz	10Hz

4.5. Test Result

Standard:	FCC Part 15C	Line:	L1
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	TB120	Temp.(°C)/Hum.(%RH):	22(°C)/58%RH
Mode:	Mode 1	Date:	05/22/2015
		Test By:	Eric Ou Yang
Description:			

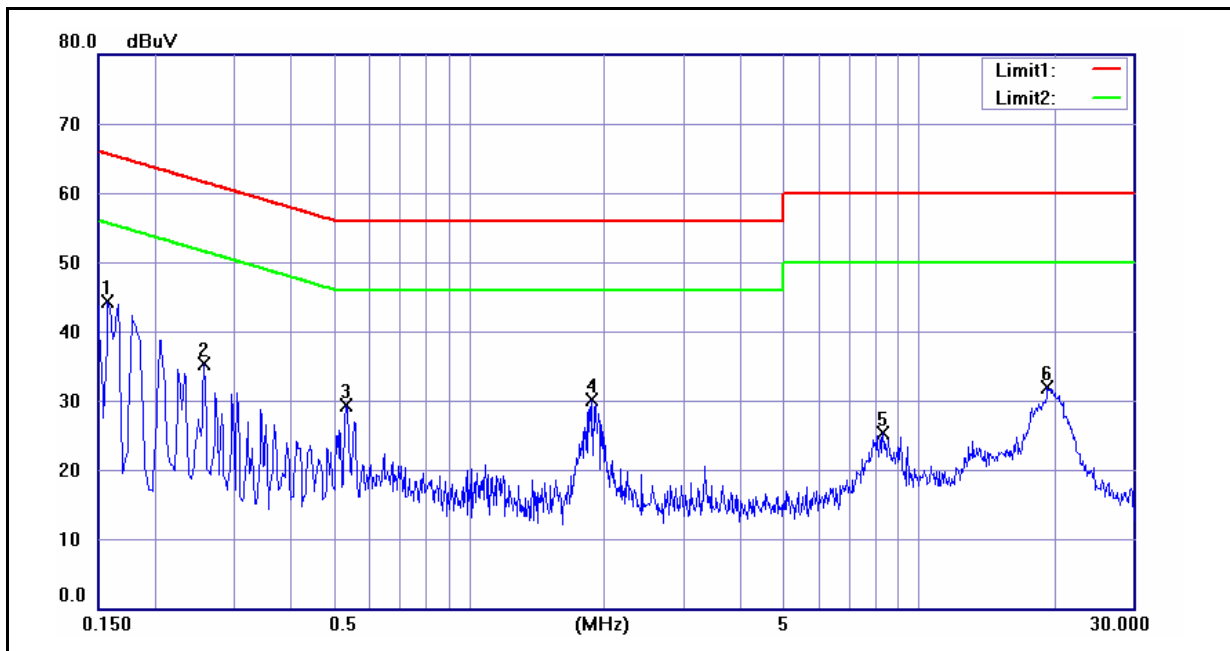


No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1540	30.47	10.91	9.60	40.07	20.51	65.78	55.78	-25.71	-35.27	Pass
2	0.2020	23.79	6.55	9.60	33.39	16.15	63.53	53.53	-30.14	-37.38	Pass
3	0.5300	12.98	3.47	9.62	22.60	13.09	56.00	46.00	-33.40	-32.91	Pass
4	1.8500	15.35	7.01	9.68	25.03	16.69	56.00	46.00	-30.97	-29.31	Pass
5	8.2780	8.90	1.53	9.89	18.79	11.42	60.00	50.00	-41.21	-38.58	Pass
6	19.8060	18.07	13.28	10.25	28.32	23.53	60.00	50.00	-31.68	-26.47	Pass

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

2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

Standard:	FCC Part 15C	Line:	N
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	TB120	Temp.(°C)/Hum.(%RH):	22(°C)/58%RH
Mode:	Mode 1	Date:	05/22/2015
		Test By:	Eric Ou Yang
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1580	29.70	11.18	9.60	39.30	20.78	65.57	55.57	-26.27	-34.79	Pass
2	0.2580	18.46	4.51	9.61	28.07	14.12	61.50	51.50	-33.43	-37.38	Pass
3	0.5340	15.56	7.05	9.62	25.18	16.67	56.00	46.00	-30.82	-29.33	Pass
4	1.8780	16.06	6.55	9.70	25.76	16.25	56.00	46.00	-30.24	-29.75	Pass
5	8.3260	9.54	3.74	9.92	19.46	13.66	60.00	50.00	-40.54	-36.34	Pass
6	19.4260	16.57	9.34	10.22	26.79	19.56	60.00	50.00	-33.21	-30.44	Pass

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

2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

5 Radiated Emissions Measurement

5.1. Limit

According to §15.225,

- (a) The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolt / meter at 30 meters.
- (b) Within the bands 13.410 – 13.553 MHz and 13.567 -13.710 MHz, the field strength of any emissions shall not exceed 334 microvolt / meter at 30 meters.
- (c) Within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz the field strength of any emissions shall not exceed 106 microvolt / meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz and shall not exceed the general radiated emission limits in §15.209.

According to §15.225(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m at meter)	Measurement Distance (meter)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 - 88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

5.2. Test Instruments

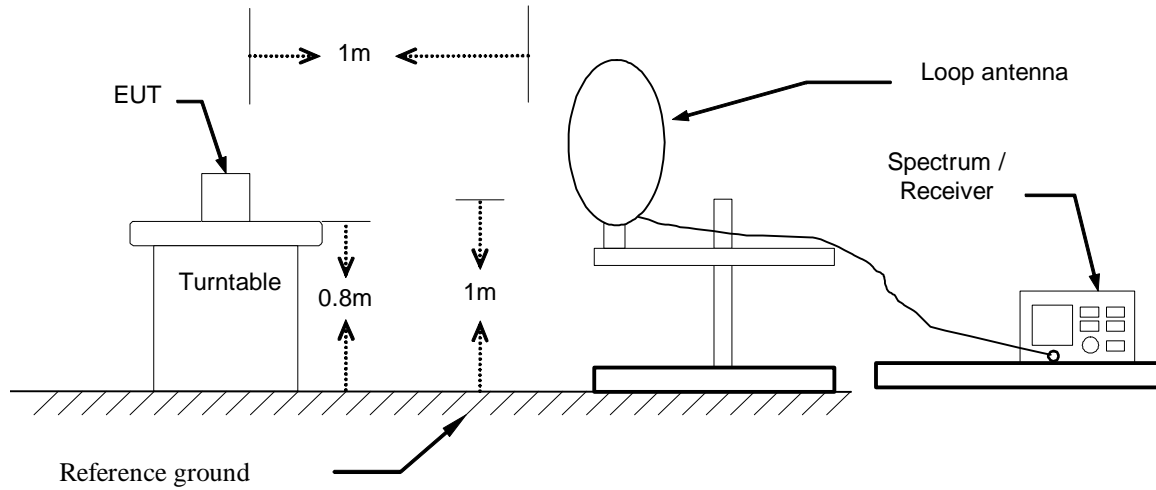
3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
RF Pre-selector	Agilent	N9039A	MY46520256	01/06/2015	(1)
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/06/2015	(1)
Pre Amplifier	Agilent	8449B	3008A02237	02/24/2015	(1)
Pre Amplifier	Agilent	8447D	2944A10961	02/24/2015	(1)
Broadband Antenna (30MHz~1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	9163-270	07/22/2014	(1)
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/11/2014	(1)
Horn Antenna (18~40GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170	9170-320	07/02/2014	(1)
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	02/02/2015	(1)
Test Site	ATL	TE01	888001	08/28/2014	(1)

Remark: ⁽¹⁾ Calibration period 1 year.

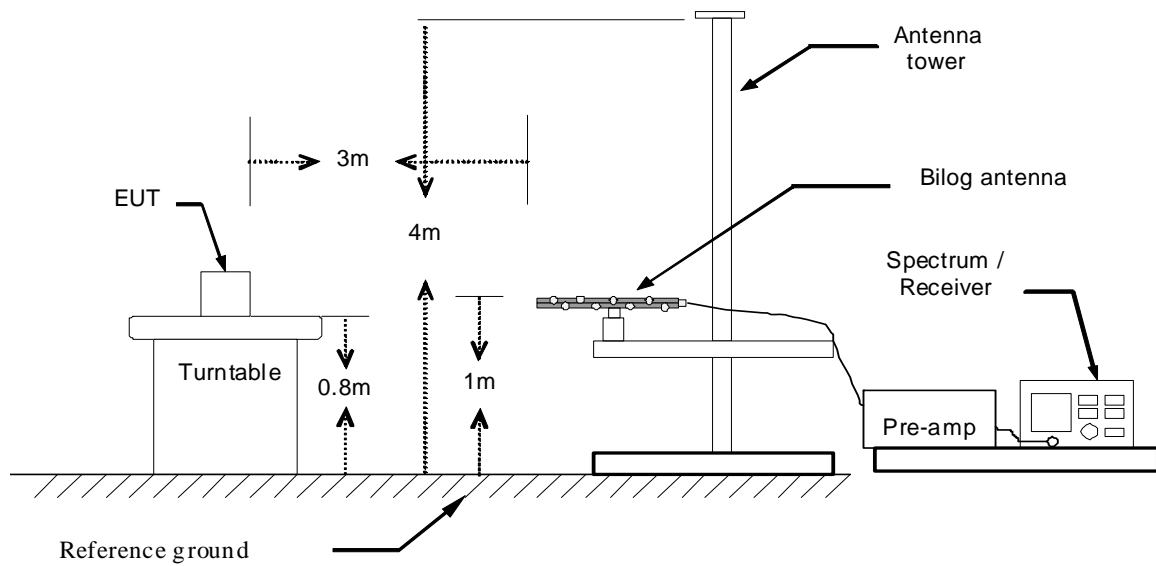
NOTE: N.C.R. = No Calibration Request.

5.3. Setup

9kHz ~ 30MHz



30MHz ~ 1 GHz



5.4. 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 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 1 MHz for peak measurements and 10 Hz for average measurements.

A nonconductive material surrounded the EUT to supporting the EUT for standing on three 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 (model 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 microvolt pre-meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in microvolt per-meter (dBuV/m).

The actual field 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) $\text{Amplitude (dBuV/m)} = \text{FI (dBuV)} + \text{AF (dBuV)} + \text{CL (dBuV)} - \text{Gain (dB)}$

FI= Reading of the field intensity.

AF= Antenna factor.

CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

(2) $\text{Actual Amplitude (dBuV/m)} = \text{Amplitude (dBuV)} - \text{Dis (dB)}$

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.

5.5. Test Result

Fundamental Test Result:

Standard:		FCC Part 15C		Test Distance:		30m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		TB120		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Mode:		Mode 2		Date:		05/22/2015	
				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
13.5600	-10.80	14.18	3.38	84.00	-80.62	peak	H
13.5586	-11.45	14.18	2.73	84.00	-81.27	peak	V

Note: The level is measured at 1 meter and is converted into result at 30 meter.

The converted formula listed below:

Measure result (1 meter distance): a

Compute result (30 meter distance): A

$$A = a + (40 \cdot \log(1/30))$$

$$\text{ex. } a = 48.28 \text{ dBuV, } A = 48.28 + (40 \cdot \log(1/30)) = -10.80 \text{ dBuV}$$

9kHz ~ 30MHz:

Standard:	FCC Part 15C			Test Distance:	300m/30m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	TB120			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Mode:	Mode 2			Date:	05/22/2015		
				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
0.4290	-36.66	14.26	-22.40	14.97	-37.37	QP	H
3.7880	-14.44	15.55	1.11	29.55	-28.44	QP	H
8.2263	-19.01	15.36	-3.65	29.55	-33.20	QP	H
14.7644	-13.62	13.91	0.29	29.55	-29.26	QP	H
18.3335	-19.98	14.19	-5.79	29.55	-35.34	QP	H
22.2023	-19.88	13.67	-6.21	29.55	-35.76	QP	H
0.7288	-6.72	14.38	7.66	30.51	-22.85	QP	V
2.8580	-12.92	15.92	3.00	29.55	-26.55	QP	V
5.1675	-12.24	16.01	3.77	29.55	-25.78	QP	V
8.9763	-20.42	15.19	-5.23	29.55	-34.78	QP	V
17.5837	-14.05	14.12	0.07	29.55	-29.48	QP	V
22.4723	-14.67	13.59	-1.08	29.55	-30.63	QP	V

Note: The level is measured at 1 meter and is converted into result at 300 or 30 meter.

The converted formula listed below:

Measure result (1 meter distance): a

Compute result (30 or 300 meter distance): A

$A = a + (40 \cdot \log(1/300 \text{ or } 1/30))$

ex. a (0.4290 MHz) = 62.42 dBuV, $A = 62.42 + (40 \cdot \log(1/300)) = -36.66 \text{ dBuV}$

30MHz ~ 1GHz:

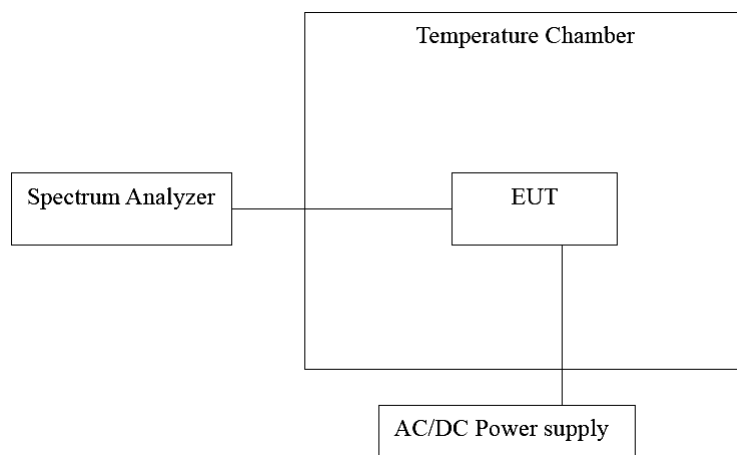
Standard:		FCC Part 15C		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		TB120		Temp.(℃)/Hum.(%RH):		26(℃)/60%RH	
Mode:		Mode 2		Date:		05/22/2015	
				Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
0.5188	54.04	14.28	68.32	92.50	-24.18	QP	H
3.7277	46.37	15.59	61.96	88.63	-26.67	QP	H
7.5068	40.03	15.51	55.54	88.63	-33.09	QP	H
11.4356	39.32	14.64	53.96	88.63	-34.67	QP	H
16.4740	44.62	14.00	58.62	88.63	-30.01	QP	H
20.8228	40.76	14.09	54.85	88.63	-33.78	QP	H
0.4290	62.02	14.26	76.28	114.05	-37.77	QP	V
3.8477	45.61	15.51	61.12	88.63	-27.51	QP	V
9.7261	41.20	15.03	56.23	88.63	-32.40	QP	V
15.3940	41.69	13.89	55.58	88.63	-33.05	QP	V
18.6934	37.91	14.22	52.13	88.63	-36.50	QP	V
21.6625	40.37	13.83	54.20	88.63	-34.43	QP	V

6 Frequency Stability Measurement

6.1. Limit

According to §15.207(e), the frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.2. Test Setup



6.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4408B	MY45107753	07/24/2014	⁽¹⁾
Temperature & Humidity Chamber	TAICHY	MHU-225LA	980729	08/14/2014	⁽¹⁾
Test Site	ATL	TE02	TE02	N.C.R.	-----

Remark: ⁽¹⁾ Calibration period 1 year. ⁽²⁾ Calibration period 2 years.

NOTE: N.C.R. = No Calibration Request.

6.4. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the environment into appropriate environment.
4. Set the spectrum analyzer as RBW=1kHz, VBW = RBW, Span = 200kHz, Sweep = auto.
5. Mark the peak frequency and measure the frequency tolerance using frequency counter function.
6. Repeat until all the results are investigated.

6.5. Test Result

Temperature Variations

Model Number	TB120					
Mode	Mode 2					
Date of Test	06/22/2015			Test Site	TE02	
Temp. (°C)	Voltage (VDC)	Measured Frequency (MHz)	Delta Frequency (Hz)	Tolerance (%)	Limit (±%)	Result (Pass/Fail)
-10	3.80	13.5594	-600.0000	-0.0044	±0.01	Pass
0		13.5602	200.0000	0.0015	±0.01	Pass
10		13.5601	100.0000	0.0007	±0.01	Pass
20		13.5606	600.0000	0.0044	±0.01	Pass
30		13.5601	100.0000	0.0007	±0.01	Pass
40		13.5602	200.0000	0.0015	±0.01	Pass
50		13.5603	300.0000	0.0022	±0.01	Pass

Voltage Variations

Model Number	TB120					
Mode	Mode 2					
Date of Test	06/22/2015			Test Site	TE02	
Temp. (°C)	Voltage (VDC)	Measured Frequency (MHz)	Delta Frequency (Hz)	Tolerance (%)	Limit (±%)	Result (Pass/Fail)
20	3.60	13.5603	300.0000	0.0022	±0.01	Pass
	3.80	13.5606	600.0000	0.0044	±0.01	Pass
	4.40	13.5594	-600.0000	-0.0044	±0.01	Pass

Note: This device temperature only support -10°C ~ 50°C.