

FCC 47 CFR PART 15 SUBPART C

RF Test Report

Applicant : Unitech Electronics Co., Ltd.
Product Type : Rugged Handheld Computer
Trade Name : unitech
Model Number : TB128
Test Specification : FCC 47 CFR PART 15 SUBPART C
ANSI C63.10:2013
Receive Date : Mar. 15, 2017
Test Period : Mar. 22 ~ Apr. 26, 2017
Issue Date : Jun. 13, 2017

Issue by

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: 1330

Test Firm MRA designation number: TW0010

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Revision History

Rev.	Issue Date	Revisions	Revised By
00	Apr. 27, 2017	Initial Issue	Janet Chao
01	Jun. 13, 2017	Revised Report Information	Janet Chao



Verification of Compliance

Issued Date: Jun. 13, 2017

Applicant : Unitech Electronics Co., Ltd.
Product Type : Rugged Handheld Computer
Trade Name : unitech
Model Number : TB128
FCC ID : HLETB128BTNF
EUT Rated Voltage : DC 5V, 3A
Test Voltage : 120 Vac / 60 Hz
Applicable Standard : FCC 47 CFR PART 15 SUBPART C
ANSI C63.10:2013
Test Result : Complied
Performing Lab. : A Test Lab Techno Corp.

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Taoyuan City 33465, Taiwan (R.O.C)

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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 :

Fly Lu

(Manager)

(Fly Lu)

Reviewed By :

Eric Ou Yang

(Testing Engineer)

(Eric Ou Yang)

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1 General Information

1.1 Summary of Test Result

Reference	Test	Results	Remark
47 CFR Part 15.225			
15.203	Antenna Requirement	Meet Require	---
15.207(a)	Conducted Emissions Voltage	PASS	---
15.225 (a), (b), (c), (d) 15.209	Radiated Emission Limits	PASS	---
15.225(e)	Frequency Stability	PASS	---
15.215(c)	20dB Bandwidth	-----	---
CFR 47 Part 15.225 / 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
Conducted Emission	9kHz ~ 150KHz	2.7
	150kHz ~ 30MHz	2.7
Radiated Emission	9kHz ~ 30MHz	1.7
	30MHz ~ 1000MHz	5.7
	1000MHz ~ 18000MHz	5.5
	18000MHz ~ 26500MHz	4.8
	26500MHz ~ 40000MHz	4.8
RF Bandwidth		4.96%
Frequency Stability		+ 2.212 x 10 ⁻⁷ % / - 2.170 x 10 ⁻⁷

2 EUT Description

Applicant	Unitech Electronics Co., Ltd. 5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan 231, R.O.C.
Manufacturer	Unitech Electronics Co., Ltd. 5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan 231, R.O.C.
Product	Rugged Handheld Computer
Trade Name	unitech
Model Number	TB128
FCC ID	HLETB128BTNF
Frequency Range	13.56 MHz
Modulation Type	ASK
Number of Channels	1 Channel
Antenna Type	Loop Antenna

3 Test Methodology

3.1. Mode of Operation

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

Test Mode
Mode 1: Transmit Mode
Mode 2: NFC Continuous TX Mode

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in TX mode only.

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

Note: Eut connected to the cradle charging data than the power cord charging data is even worse, so the report only shows EUT connected to cradle charging test data.

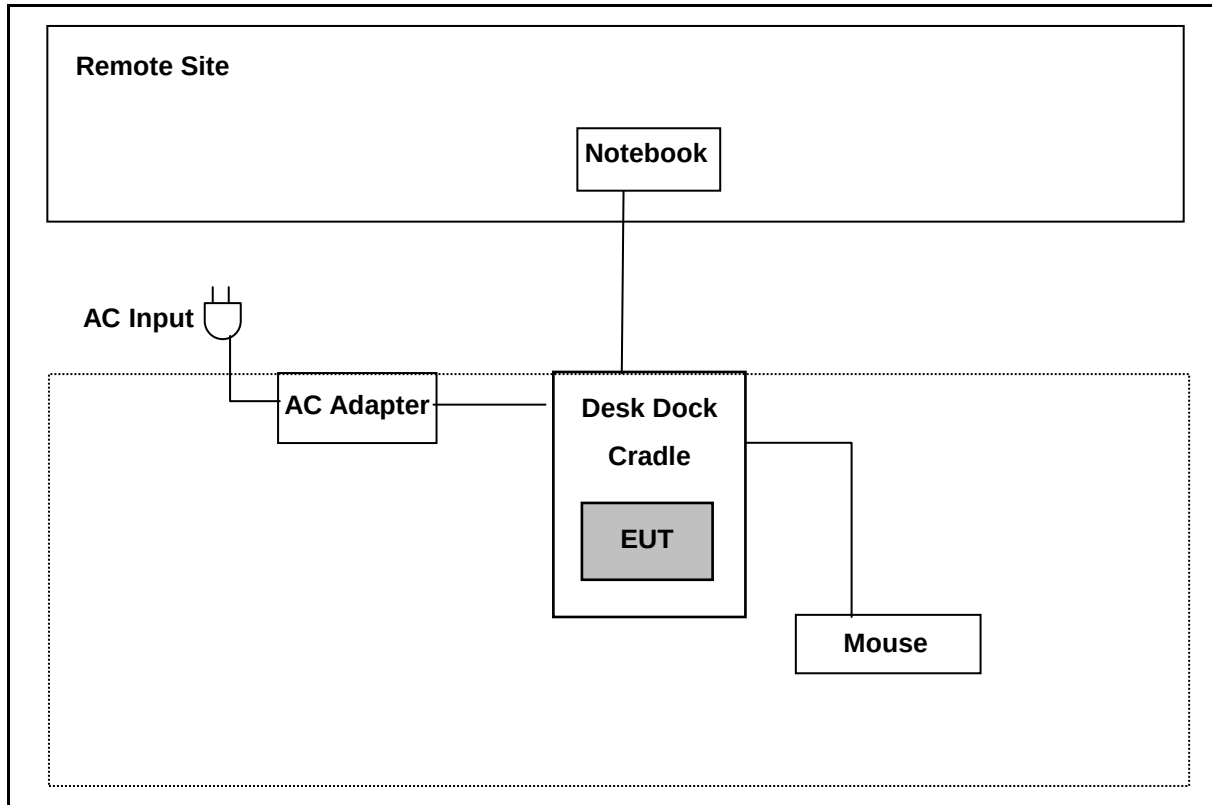
3.2. EUT Exercise Software

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.

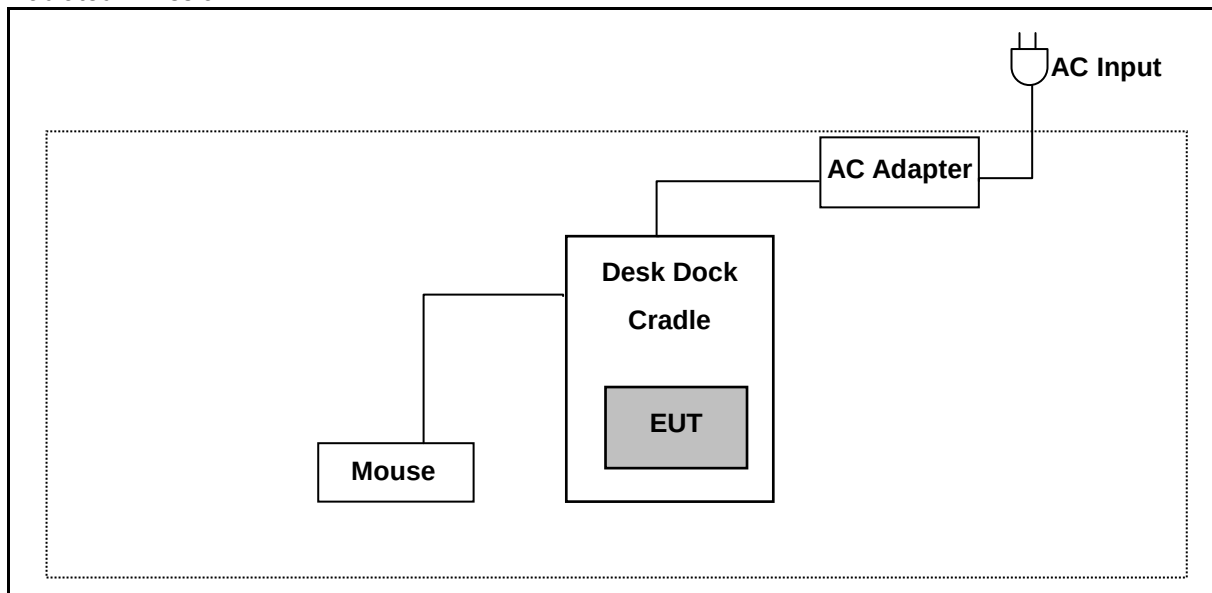
Measurement Software	
1	EZ-EMC Ver. ATL-03A1-1
2	EZ-EMC Ver ATL-ITC-3A1-1

3.3. Configuration of Test System Details

Conducted Emission



Radiated Emission





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 AC Power Line Conducted Emission Measurement

4.1. Limit

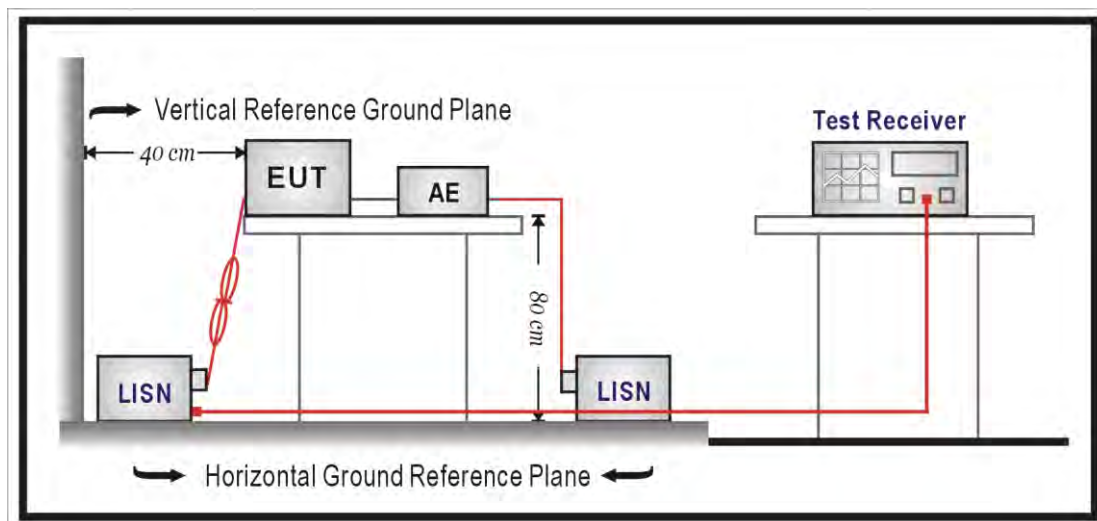
Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

4.2. Test Instruments

Describe	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Test Receiver	R&S	ESCI	100367	05/31/2016	1 year
LISN	R&S	ENV216	101040	04/01/2017	1 year
LISN	R&S	ENV216	101041	03/15/2017	1 year
Microwave Cable	EMCI	EMC104-SM-SM-1500	140303	02/22/2017	1 year
Test Site	ATL	TE02	TE02	N.C.R.	-----

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

4.3. Test Setup



4.4. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a $50\Omega // 50\mu\text{H}$ coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a $50\Omega // 50\mu\text{H}$ coupling impedance with 50ohm termination.

Tabletop device shall be placed on a non-conducting platform, of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The wall of screened room shall be located 40cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80cm from any other ground conducting surface including one or more LISNs. For floor-standing device shall be placed under the EUT with a 12mm insulating material.

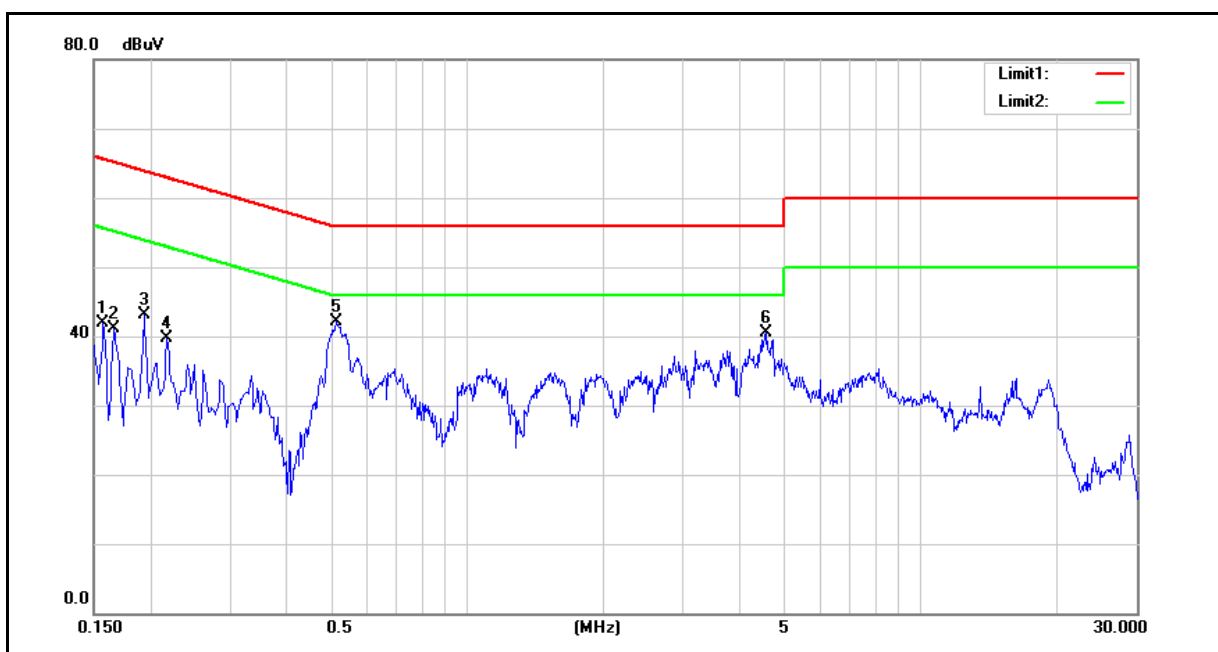
Conducted emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a resolution bandwidth of 9 kHz. The equipment under test (EUT) shall be meet the limits in section 4.1, as applicable, including the average limit and the quasi-peak limit when using respectively, an average detector and quasi-peak detector measured in accordance with the methods described of related standard. When all of peak value were complied with quasi-peak and average limit from 150kHz to 30MHz then quasi-peak and average measurement was unnecessary.

The AMN shall be placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for AMNs mounted on top of the ground reference plane. This distance is between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment shall be at least 0,8 m from the AMN. If the mains power cable is longer than 1m then the cable shall be folded back and forth at the centre of the lead to form a bundle no longer than 0.4m. All of interconnecting cables that hang closer than 40cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long. All of EUT and AE shall be separate place more than 0.1m. All 50 Ω ports of the LISN shall be resistively terminated into 50 Ω loads when not connected to the measuring instrument.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

4.5. Test Result

Standard:	FCC Part 15C	Power:	AC 120V/60Hz
Test item:	Conducted Emission	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Test Mode:	Mode 1	Date:	04/02/2017
Line:	L1		
Description:			

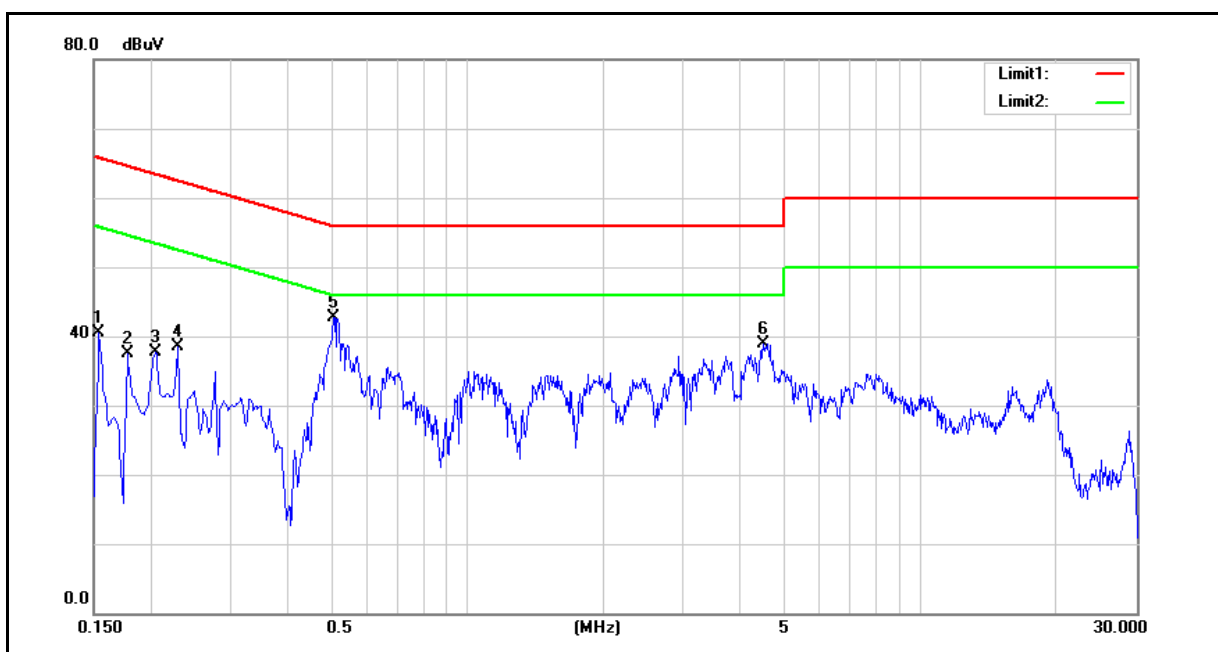


No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1580	30.35	16.50	9.60	39.95	26.10	65.57	55.57	-25.62	-29.47	Pass
2	0.1660	29.19	15.34	9.60	38.79	24.94	65.16	55.16	-26.37	-30.22	Pass
3	0.1940	27.49	18.62	9.59	37.08	28.21	63.86	53.86	-26.78	-25.65	Pass
4	0.2180	26.07	17.21	9.59	35.66	26.80	62.89	52.89	-27.23	-26.09	Pass
5	0.5140	31.53	23.80	9.61	41.14	33.41	56.00	46.00	-14.86	-12.59	Pass
6	4.5740	26.05	21.37	9.76	35.81	31.13	56.00	46.00	-20.19	-14.87	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	Power:	AC 120V/60Hz
Test item:	Conducted Emission	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Test Mode:	Mode 1	Date:	04/02/2017
Line:	N		
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	27.98	12.21	9.59	37.57	21.80	65.78	55.78	-28.21	-33.98	Pass
2	0.1780	25.77	9.31	9.58	35.35	18.89	64.58	54.58	-29.23	-35.69	Pass
3	0.2060	23.87	11.87	9.58	33.45	21.45	63.37	53.37	-29.92	-31.92	Pass
4	0.2300	25.07	16.15	9.58	34.65	25.73	62.45	52.45	-27.80	-26.72	Pass
5	0.5100	30.35	24.63	9.60	39.95	34.23	56.00	46.00	-16.05	-11.77	Pass
6	4.5100	24.81	20.01	9.77	34.58	29.78	56.00	46.00	-21.42	-16.22	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 ($\mu\text{V/m}$ 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.



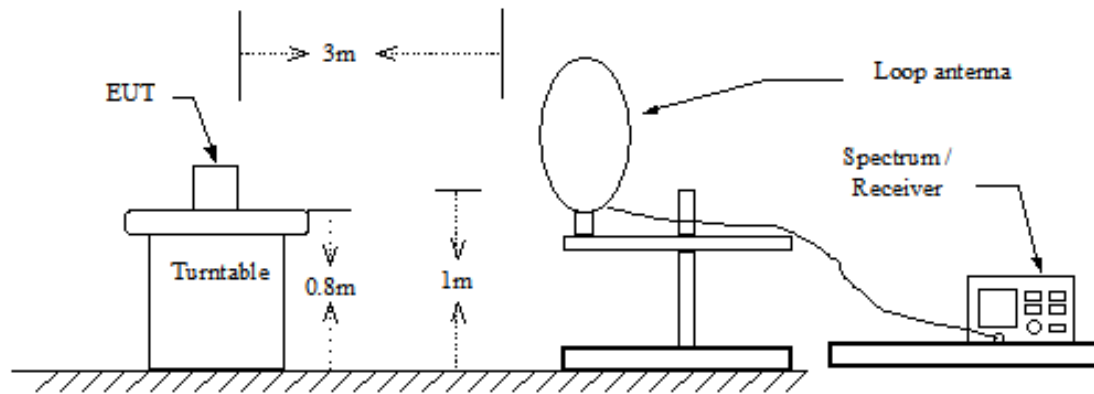
5.2. Test Instruments

3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
RF Pre-selector	Agilent	N9039A	MY46520255	05/19/2016	1 year
Spectrum Analyzer	Agilent	N9020A	US47520902	09/21/2016	1 year
Pre Amplifier	Agilent	8449B	3008A02237	10/11/2016	1 year
Pre Amplifier	Agilent	8447D	2944A11119	01/12/2017	1 year
Broadband Antenna	Schwarzbeck	VULB9168	416	10/13/2016	1 year
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/06/2016	1 year
Horn Antenna (18~40GHz)	ETS	3116	86467	09/05/2016	1 year
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	01/26/2017	1 year
Microwave Cable	EMCI	EMC102-KM-KM-14000	151001	02/20/2017	1 year
Microwave Cable	EMCI	EMC-104-SM-SM-14000	140202	02/20/2017	1 year
Microwave Cable	EMCI	EMC104-SM-SM-600	140301	02/20/2017	1 year
Test Site	ATL	TE01	888001	08/29/2016	1 year

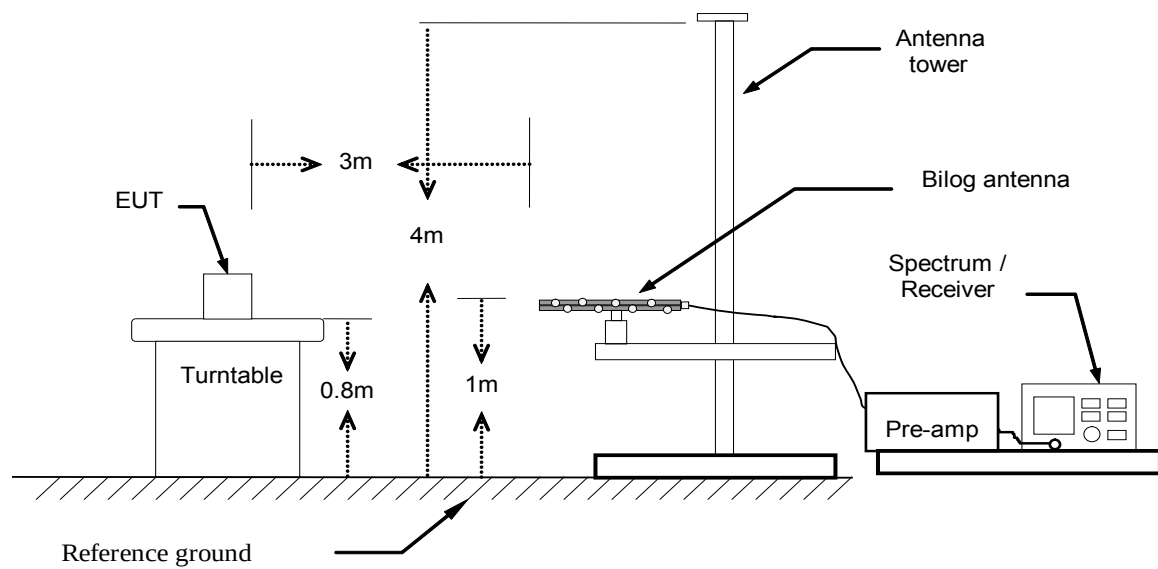
NOTE: N.C.R. = No Calibration Request.

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 3 Hz to 44 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.

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.

Broadband/Horn Antenna were used in frequency 30MHz to 18 GHz at a distance of 3 meter. Loop/Horn Antenna was used in frequency 9kHz to 30MHz and 18 to 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.

$$(1) \text{ Amplitude (dBuV/m) = FI (dBuV) + AF (dBuV) + CL (dBuV) - Gain (dB)}$$

FI= Reading of the field intensity.

AF= Antenna factor.

CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

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

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

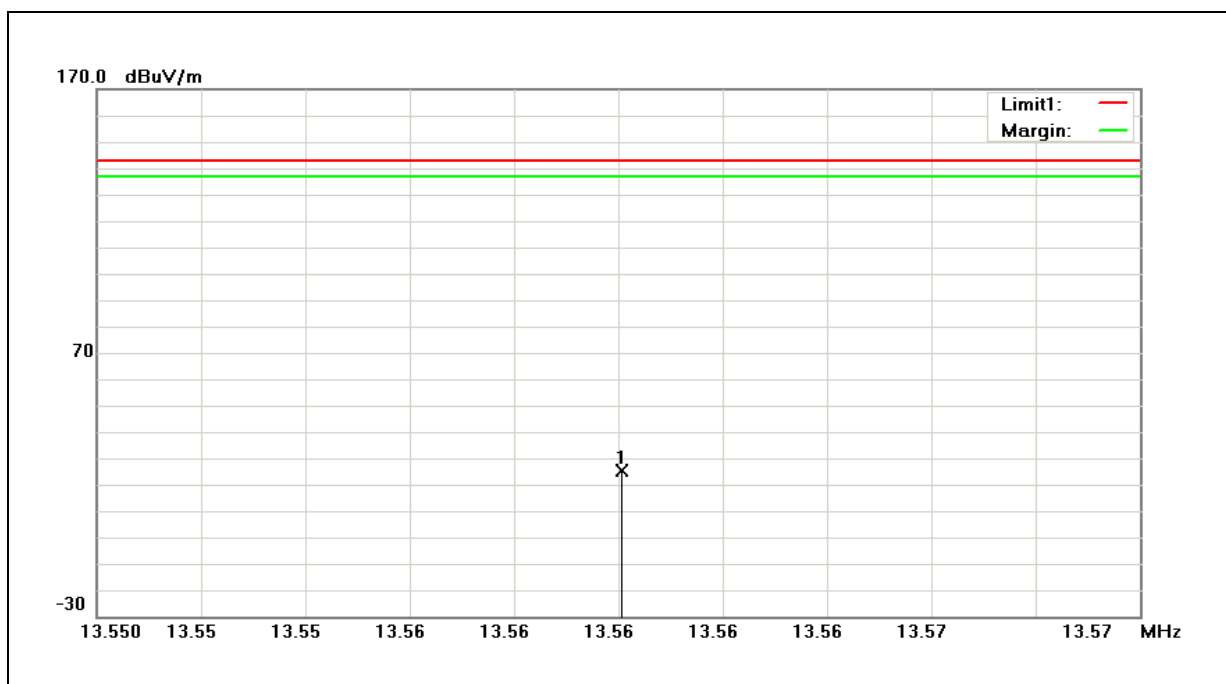
(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

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.

5.5. Test Result

Fundamental Test Result:

Standard:	FCC Part 15C	Test Distance:	1m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Test Mode:	Mode 2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Ant.Polar.:	Horizontal	Date:	06/09/2017



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Near-Field Result (dBuV)	Derived Value (dBuV)	Limit (dBuV/m)	Margin (dB)	Remark
1	13.5601	9.56	15.76	25.32	-15.15	84.00	-99.15	QP

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

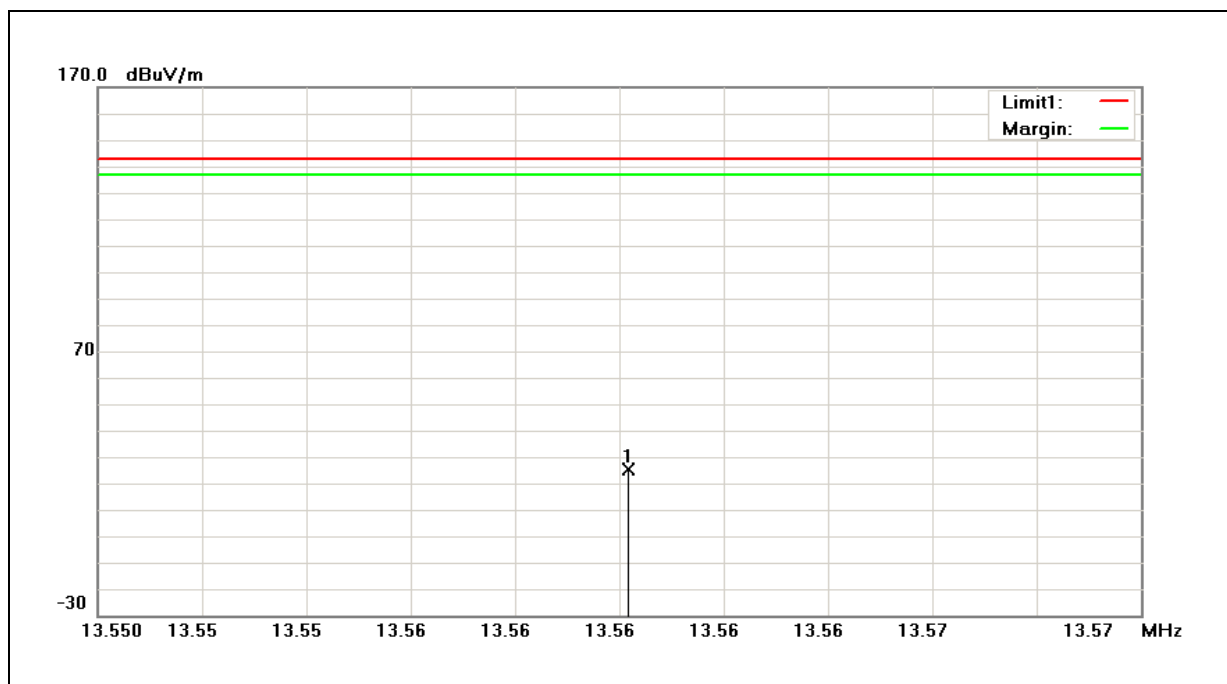
Compute result (30 meter distance): A

$d_{\text{near field}} = \lambda/2\pi$, $d_{\text{measure}} = 1$ meter distance

$A = a - 40 \cdot \log(d_{\text{near field}} / d_{\text{measure}}) - 20 \cdot \log(d_{\text{limit}} / d_{\text{near field}})$

ex. $a = 25.32$ dBuV, $A = 25.32 - 40 \cdot \log(3.52 / 1) - 20 \cdot \log(30 / 3.52)$ dBuV = -15.15 dBuV

Standard:	FCC Part 15C	Test Distance:	1m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Test Mode:	Mode 2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Ant.Polar.:	Vertical	Date:	06/09/2017

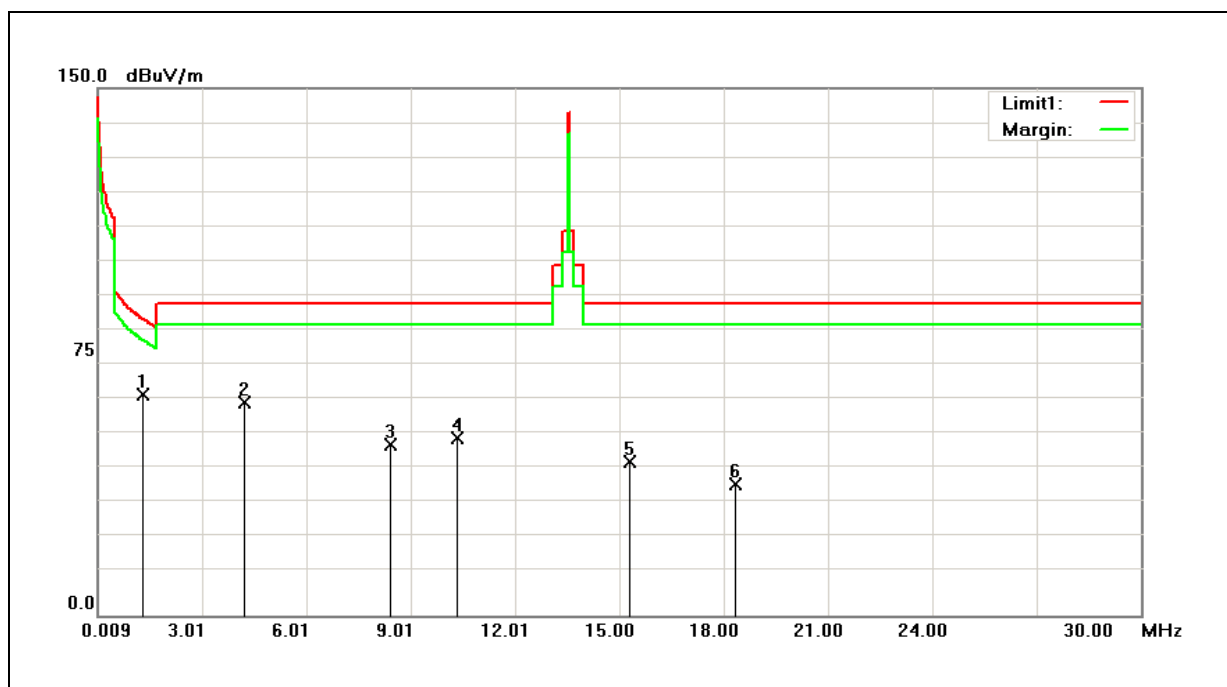


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Near-Field Result (dBuV)	Derived Value (dBuV)	Limit (dBuV/m)	Margin (dB)	Remark
1	13.5602	9.65	15.76	25.41	-15.06	84.00	-99.06	QP

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

9kHz ~ 30MHz:

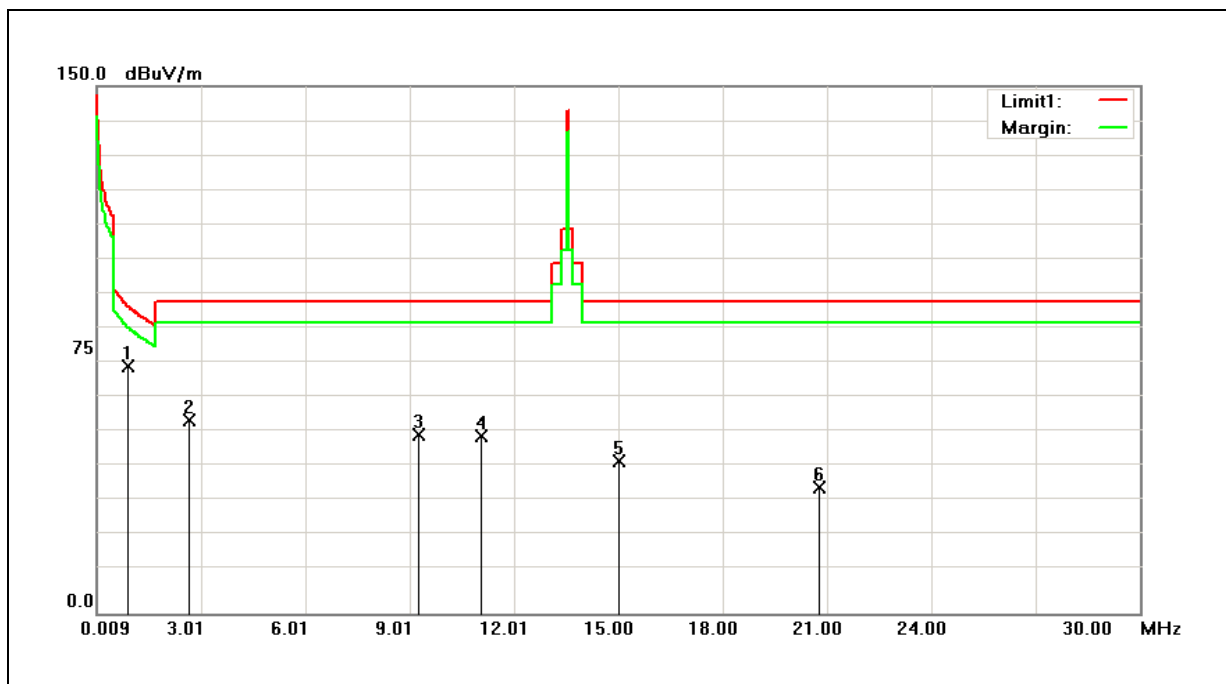
Standard:	FCC Part 15C	Test Distance:	1m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Test Mode:	Mode 2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Ant.Polar.:	Horizontal	Date:	03/25/2017



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Near-Field Result (dBuV/m)	Derived Value (dBuV)	Limit (dBuV/m)	Margin (dB)	Remark
1	1.2983	48.32	14.62	62.94	2.09	25.34	-23.25	QP
2	4.2377	45.52	14.99	60.51	9.93	29.54	-19.61	QP
3	8.4062	33.12	15.60	48.72	4.09	29.54	-25.45	QP
4	10.326	34.65	15.76	50.41	7.57	29.54	-21.97	QP
5	15.3041	28.09	15.75	43.84	4.41	29.54	-25.13	QP
6	18.3632	21.48	15.75	37.23	-0.61	29.54	-30.15	QP

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

Standard:	FCC Part 15C	Test Distance:	1m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Test Mode:	Mode 2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Ant.Polar.:	Vertical	Date:	03/25/2017

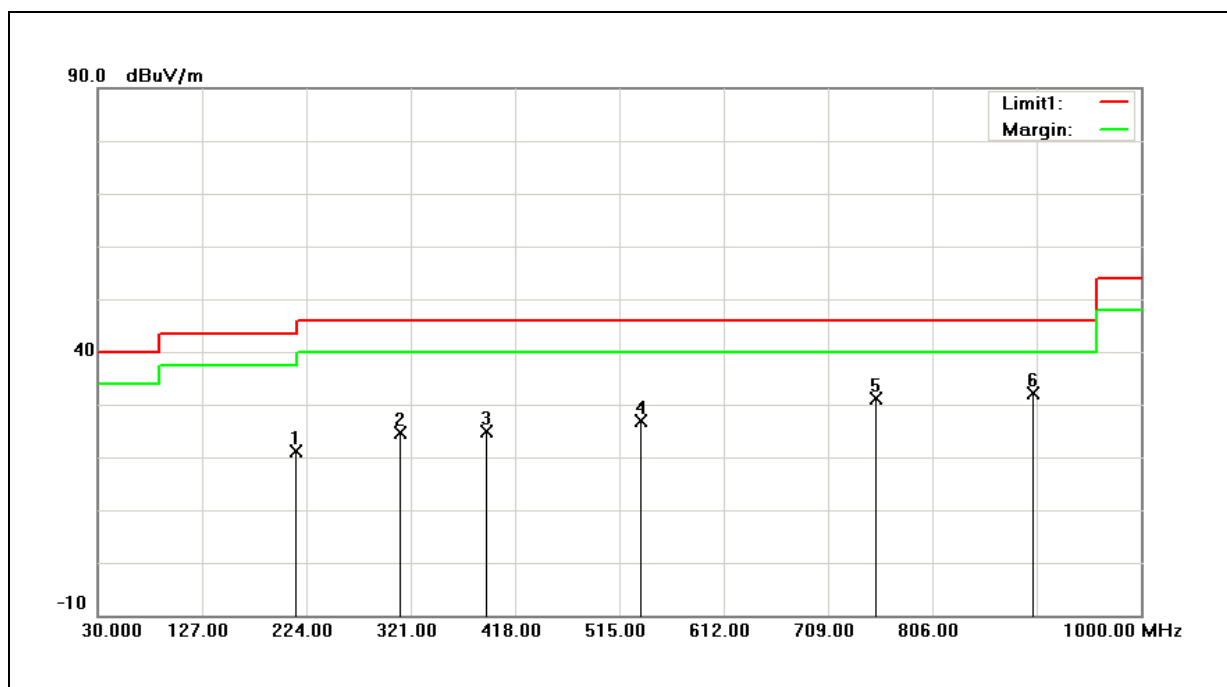


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Near-Field Result (dBuV/m)	Derived Value (dBuV)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.9084	55.87	14.54	70.41	6.45	28.44	-21.98	QP
2	2.6781	40.23	14.58	54.81	0.24	29.54	-29.30	QP
3	9.2461	35.07	15.69	50.76	6.96	29.54	-22.58	QP
4	11.0754	34.84	15.76	50.60	8.37	29.54	-21.17	QP
5	15.0045	27.54	15.76	43.30	3.71	29.54	-25.83	QP
6	20.7926	20.36	15.56	35.92	-0.86	29.54	-30.40	QP

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

30MHz ~ 1GHz:

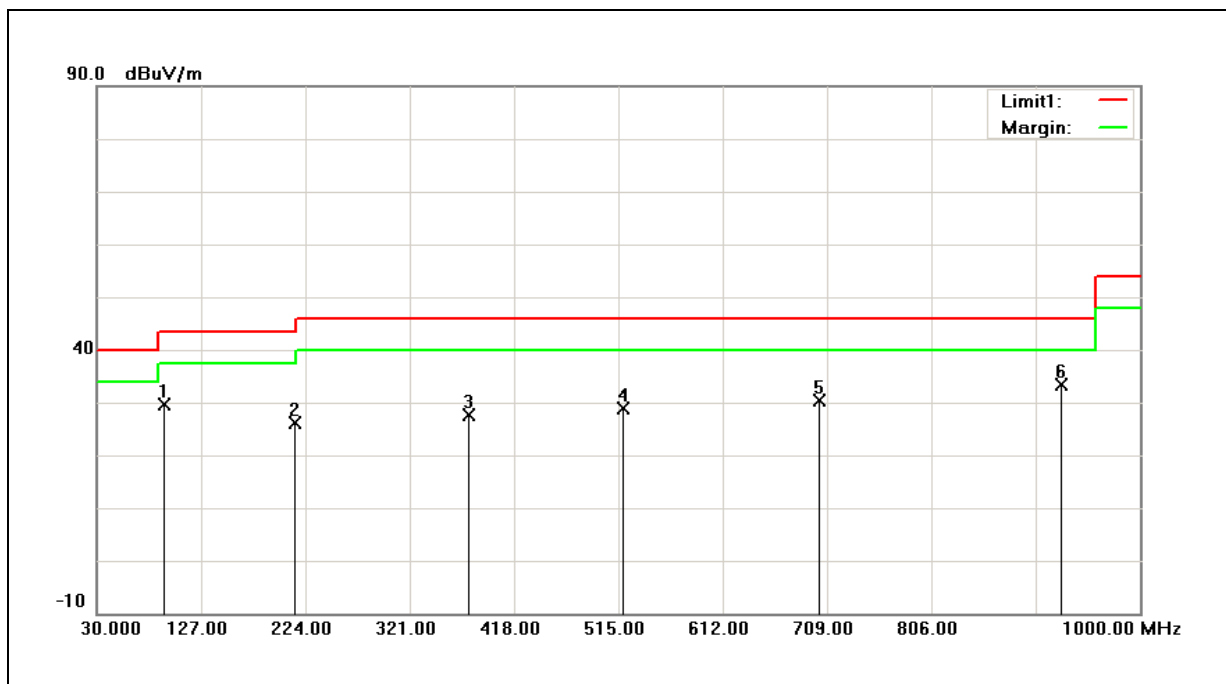
Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Test Mode:	Mode 2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Ant.Polar.:	Horizontal	Date:	03/25/2017



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	215.0000	28.76	-7.52	21.24	43.50	-22.26	QP
2	312.0000	27.71	-3.20	24.51	46.00	-21.49	QP
3	392.0000	26.77	-1.85	24.92	46.00	-21.08	QP
4	534.5000	25.65	1.23	26.88	46.00	-19.12	QP
5	754.0000	24.96	6.08	31.04	46.00	-14.96	QP
6	900.0000	23.45	8.60	32.05	46.00	-13.95	QP



Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Test Mode:	Mode 2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Ant.Polar.:	Vertical	Date:	03/25/2017



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	93.0000	41.21	-11.60	29.61	43.50	-13.89	QP
2	215.0000	33.58	-7.52	26.06	43.50	-17.44	QP
3	376.5000	29.90	-2.16	27.74	46.00	-18.26	QP
4	520.0000	27.91	1.02	28.93	46.00	-17.07	QP
5	702.0000	25.77	4.70	30.47	46.00	-15.53	QP
6	927.0000	24.24	9.17	33.41	46.00	-12.59	QP

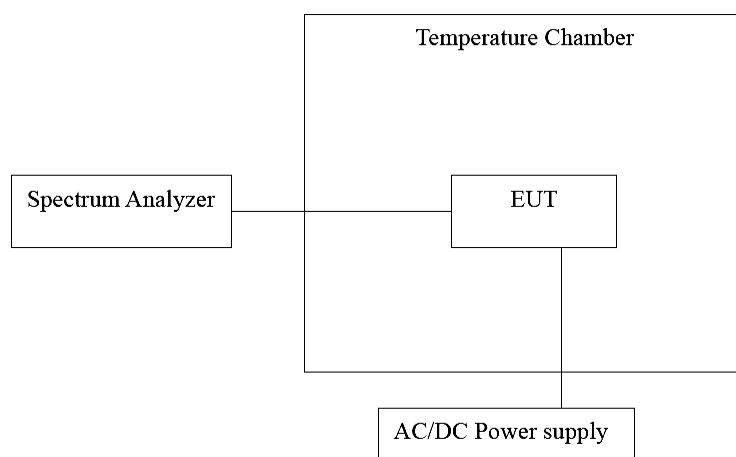


6 Frequency Stability Measurement

6.1. Limit

According to §15.207(e), the frequency tolerance of the carrier signal shall be maintained within +/- 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	08/08/2016	1 year
Temperature & Humidity Chamber	TAICHY	MHU-225LA	980729	04/18/2016	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

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

Test Mode	Mode 2					
Date of Test	03/22/2017					
Temp. (°C)	Voltage (VAC)	Measured Frequency (MHz)	Delta Frequency (Hz)	Tolerance (%)	Limit (±%)	Result (Pass/Fail)
-20	120	13.5607	700.0000	0.0052	±0.01	Pass
-10		13.5607	700.0000	0.0052	±0.01	Pass
0		13.5605	500.0000	0.0037	±0.01	Pass
10		13.5603	300.0000	0.0022	±0.01	Pass
20		13.5600	0.0000	0.0000	±0.01	Pass
30		13.5602	200.0000	0.0015	±0.01	Pass
40		13.5607	700.0000	0.0052	±0.01	Pass
50		13.5608	800.0000	0.0059	±0.01	Pass

Voltage Variations

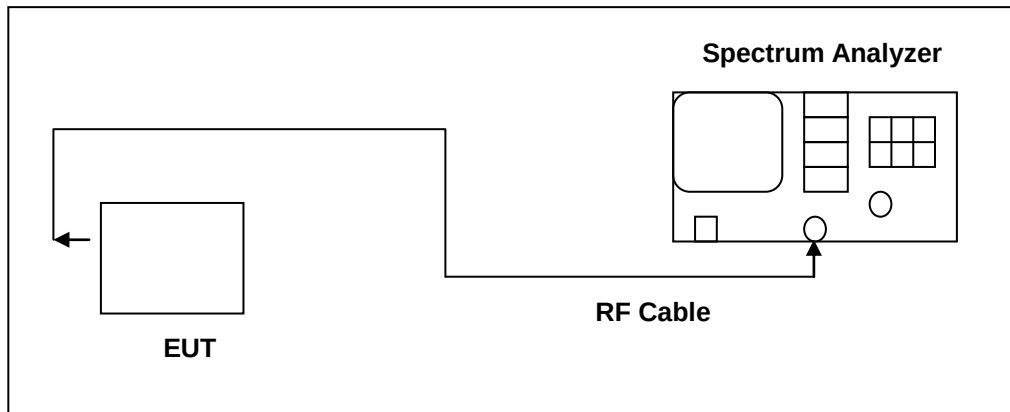
Test Mode	Mode 2					
Date of Test	03/22/2017					
Temp. (°C)	Voltage (VAC)	Measured Frequency (MHz)	Delta Frequency (Hz)	Tolerance (%)	Limit (±%)	Result (Pass/Fail)
20	102	13.5600	0.0000	0.0000	±0.01	Pass
	120	13.5600	0.0000	0.0000	±0.01	Pass
	138	13.5601	100.0000	0.0007	±0.01	Pass

7 20dB Bandwidth Measurement

7.1. Limit

N/A

7.2. Test Setup



7.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4445A	MY46181986	05/19/2016	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

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



7.4. Test Procedure

Connect RF output port to the input of the spectrum analyzer. Connect the DUT to appropriate power supply.

Turn RFID function of DUT on.

Analyzer used the following settings:

1. Span = 30 kHz
2. RBW $\geq$ 1% of the 20dB span
3. VBW $\geq$ 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.



7.5. Test Result

Test Mode	Mode 2		
Date of Test	04/26/2017		
Frequency (MHz)	20dBc Low Point (MHz)	20dBc High Point (MHz)	Operating Frequency Band (MHz)
13.5600	13.5576	13.5627	13.553~13.567

7.6. Test Graphs





8 Antenna Requirement

8.1. Require

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

8.2. Antenna Connector Construction

The antenna connector used in this product is internal antenna, cannot be replaced by the end-user.