

EMC TEST REPORT

No. 130401396SHA-001

Applicant : RAE Systems Inc.
3775 North First Street, San Jose,
CA 95134-1708 USA

Manufacturer : RAE Systems Inc.
3775 North First Street, San Jose,
CA 95134-1708 USA

Equipment : Dosimeter Reader

Type/Model : PRR-1

SUMMARY

The equipment complies with the requirements according to the following standard(s):

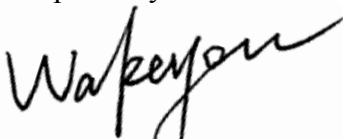
47CFR Part 15 (2012): Radio Frequency Devices

ANSI C63.4 (2009): 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

ANSI C63.10 (2009): American National Standard for Testing Unlicensed Wireless Devices

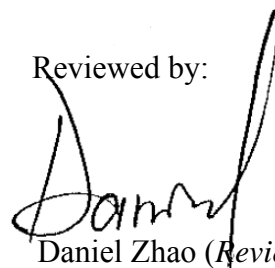
Date of issue: May 30, 2013

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Content

SUMMARY	1
DESCRIPTION OF TEST FACILITY	2
1. GENERAL INFORMATION	4
1.1 Applicant Information.....	4
1.2 Identification of the EUT	4
1.3 Technical specification	5
1.4 Mode of operation during the test / Test peripherals used.....	5
2. TEST SPECIFICATION	6
2.1 Instrument list	6
2.2 Test Standard	6
3. FUNDAMENTAL EMISSION	8
3.1 Test limit	8
3.2 Test Configuration	8
3.3 Test procedure and test setup.....	9
3.4 Test protocol	9
4. SPURIOUS EMISSION	10
4.1 Test limit	10
4.2 Test Configuration	10
4.3 Test procedure and test setup.....	11
4.4 Test protocol	12
5. FREQUENCY STABILITY (TEMPERATURE VARIATION)	18
5.1 Test limit	18
5.2 Test Configuration	18
5.3 Test procedure and test setup.....	18
5.4 Test protocol	19
6. FREQUENCY STABILITY (VOLTAGE VARIATION)	20
6.1 Test limit	20
6.2 Test Configuration	20
6.3 Test procedure and test setup.....	20
6.4 Test protocol	21
7. POWER LINE CONDUCTED EMISSION	22
7.1 Limit.....	22
7.2 Test configuration	22
7.3 Test procedure and test set up.....	23
7.4 Test protocol	24



1. General Information

1.1 Applicant Information

Applicant:	RAE Systems Inc. 3775 N. 1st St., San Jose, California USA 95134
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Fax:	408-752-0724
Email:	jliu@raesystems.com
Manufacturer:	RAE Systems Inc. 3775 N. 1st St., San Jose, California USA 95134
Date of sample receipt:	April 10, 2013
Date of test:	April 10, 2013 ~ May 9, 2013

1.2 Identification of the EUT

Equipment:	Dosimeter Reader
Type/model:	PRR-1
FCC ID:	SU3PRR-1
IC:	/



1.3 Technical specification

Operation Frequency Band: 13.56MHz - 13.56MHz
Modulation: ASK
Antenna Designation: Integral antenna, non-user removable.
Rating: DC 5V
Description of EUT: There is one model only.
The EUT is a NFC device.
Channel Description: The EUT contains one channel only, namely 13.56MHz.

1.4 Mode of operation during the test / Test peripherals used

Within this test report, EUT was tested with modulation and tested under its rating voltage and frequency.

The EUT is a tabletop device. It was set up as its normal use.

Test peripheral:

Device	Manufacturer	Model	Detachable
AC/DC Power adapter	Click Technology Limited	CPS008050100*	Yes (USB port)



2. Test Specification

2.1 Instrument list

Instruments.	EC no.	Model	Valid until date
Shielded room	EC 2838	GB88	2014-1-11
EMI test receiver	EC 2107	ESCS 30	2013-10-20
A.M.N.	EC 3119	ESH2-Z5	2014-1-8
Shielded room	EC 2839	GB88	2014-1-11
Log-periodical antenna	EC 3044-7	AT1080	2013-5-21
Semi anechoic chamber	EC 3048	-	2013-5-12
EMI test receiver	EC 3045	ESIB26	2013-10-20
Broadband antenna	EC 4206	CBL 6112D	2013-5-15
Loop Antenna	/	FMZB 1516	2013-11-28
Temperature Camber	EC4315	SETH-E	2014-4-9

2.2 Test Standard

47CFR Part 15 (2012)
ANSI C63.4 (2009)
ANSI C63.10 (2009)

2.3 Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERANCE	RESULT
Fundamental emission	15.225(a) (b) (c)	Pass
Spurious emission	15.225(d)	Pass
Frequency stability	15.225(e)	Pass
Power line conducted emission	15.207	Pass

3. Fundamental Emission

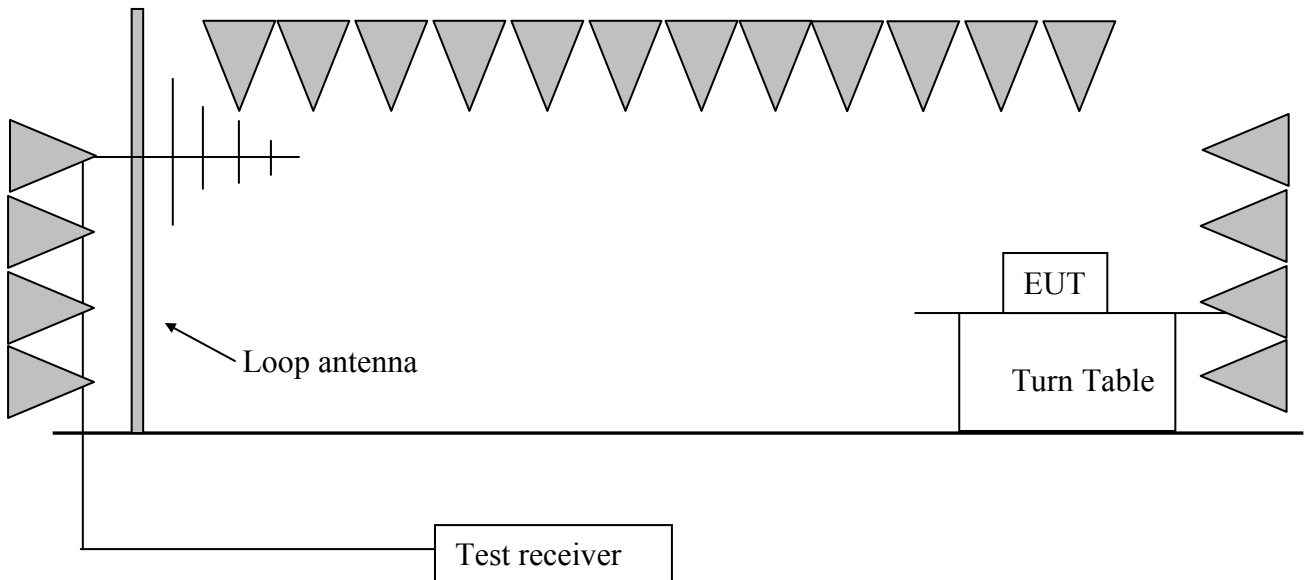
Test result: **PASS**

3.1 Test limit

3.1.1 The fundamental emission shall comply with the limits below:

Fundamental Frequency (MHz)	Limit at 30m (dBuV/m)	Limit at 10m (dBuV/m)
13.110 – 13.410	40.50	59.50
13.410 – 13.553	50.50	69.50
13.553 – 13.567	84.00	103.00
13.567 – 13.710	50.50	69.50
13.710 – 14.010	40.50	59.50

3.2 Test Configuration



3.3 Test procedure and test setup

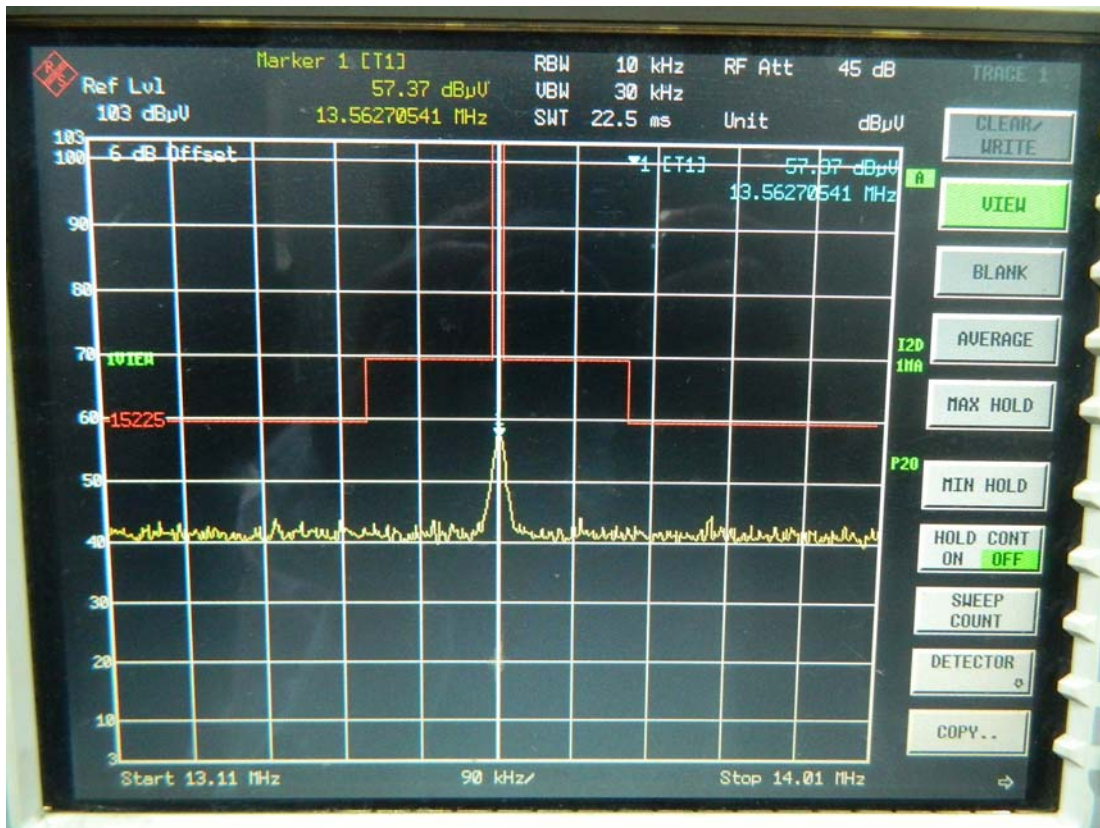
The measurement was applied in a 10m semi-anechoic chamber.

The center of the loop antenna shall be 1 m above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The X, Y and Z polarities of the loop antenna were assessed and the max hold reading of the three axes was listed in this report.

The radiated emission was measured using the test receiver with the resolutions bandwidth set as:

RBW = 10kHz, VBW = 30kHz.

3.4 Test protocol



Fundamental Emission	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Electric Emission (dBuV/m)	Limit (dBuV/m)	Margin	Detector
	Y	13.56	62.00	57.37	103.00	45.63	PK

- Remark:
1. Correct Factor = Antenna Factor + Cable Loss
 2. Electric Emission = Original Receiver Reading + Correct Factor
 3. Margin = Limit - Electric Emission

4. Spurious Emission

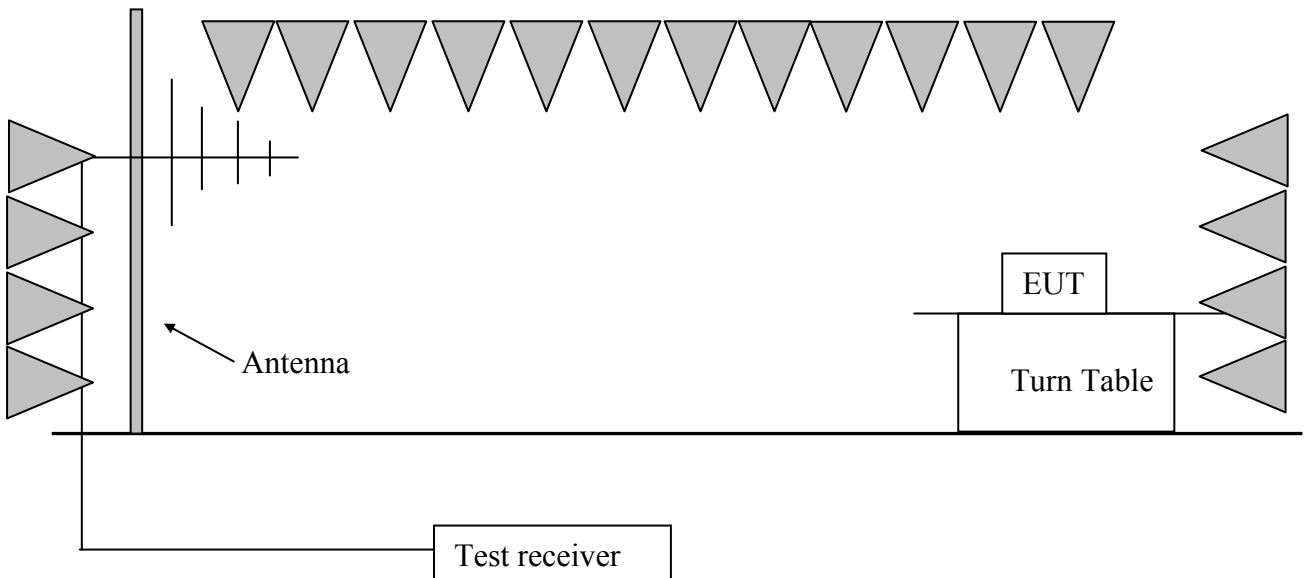
Test result: **PASS**

4.1 Test limit

The emission shall test through the 10th harmonic or to 40GHz, whichever is lower. For emission outside the band 13.110–14.010 MHz, it should comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
0.009 - 0.490	126.70-20lg (F _{kHz})	10
0.490 - 1.705	106.70-20lg (F _{kHz})	10
1.705 - 30.0	48.60	10
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

4.2 Test Configuration



4.3 Test procedure and test setup

The measurement was applied in a **10m** semi-anechoic chamber for emission lower than 30MHz and **3m** semi-anechoic chamber for that higher than 30MHz.

For emission test lower than 30MHz, The center of the loop antenna shall be 1 m above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level.

Both X, Y and Z polarities of the loop antenna were assessed and the highest reading was listed in this report.

For emission test higher than 30MHz, the EUT and simulators were placed on a 0.8m high turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1 meter to 4 meters to find out the maximum emission level.

Both horizontal and vertical polarities of the receiving antenna were assessed and the higher reading was listed in this report.

The radiated emission was measured using the test receiver with the resolutions bandwidth set as:

RBW = 300Hz, VBW = 1kHz (9kHz~0.15MHz)

RBW = 10kHz, VBW = 30kHz (0.15MHz~30MHz)

RBW = 100kHz, VBW = 300kHz (30MHz~1000MHz)

4.4 Test protocol

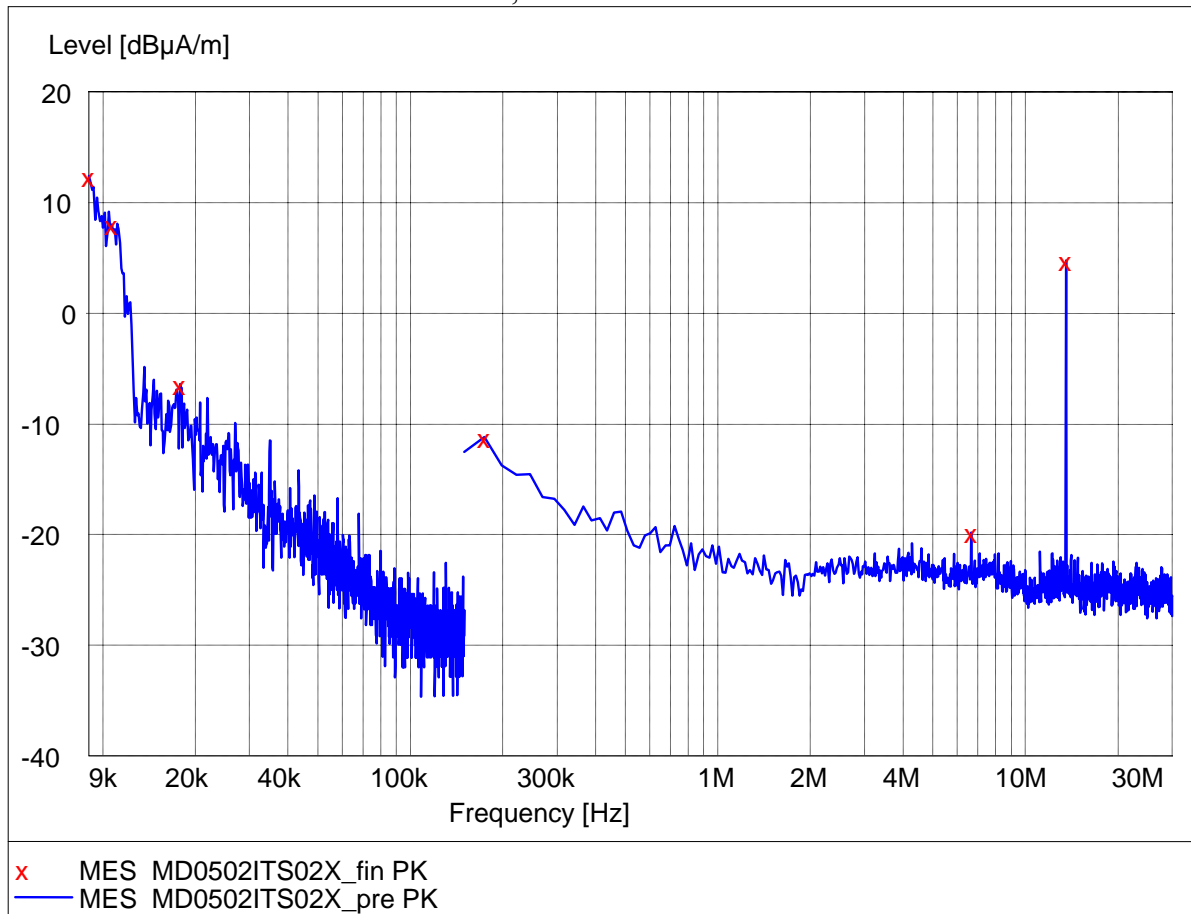
Antenna	Frequency (MHz)	Correct Factor (dB/m)	Magnetic Emission (dBuA/m)	Electric Emission (dBuV/m)	Limit (dBuV/m)	Margin	Detector
Z	13.02	10.50	-15.10	36.40	48.60	12.20	PK
Y	27.13	9.50	-19.90	31.60	48.60	17.00	PK
V	40.62	15.20	/	28.50	40.00	11.50	PK
V	54.22	9.50	/	28.90	40.00	11.10	PK
V	61.01	7.90	/	30.90	40.00	9.10	PK
V	67.81	8.40	/	36.40	40.00	3.60	PK
V	81.41	10.30	/	34.10	40.00	5.90	PK
V	95.02	13.10	/	35.60	43.50	7.90	PK
H	108.60	14.80	/	21.30	43.50	22.20	PK
V	115.39	15.20	/	29.50	43.50	14.00	PK
V	122.18	15.50	/	37.50	43.50	6.00	PK
V	135.79	15.90	/	37.30	43.50	6.20	PK

- Remark: 1. Correct Factor = Antenna Factor + Cable Loss
 2. Magnetic Emission = Original Receiver Reading + Correct Factor
 3. Electric Emission = Magnetic Emission + 51.50
 4. Margin = Limit - Electric Emission

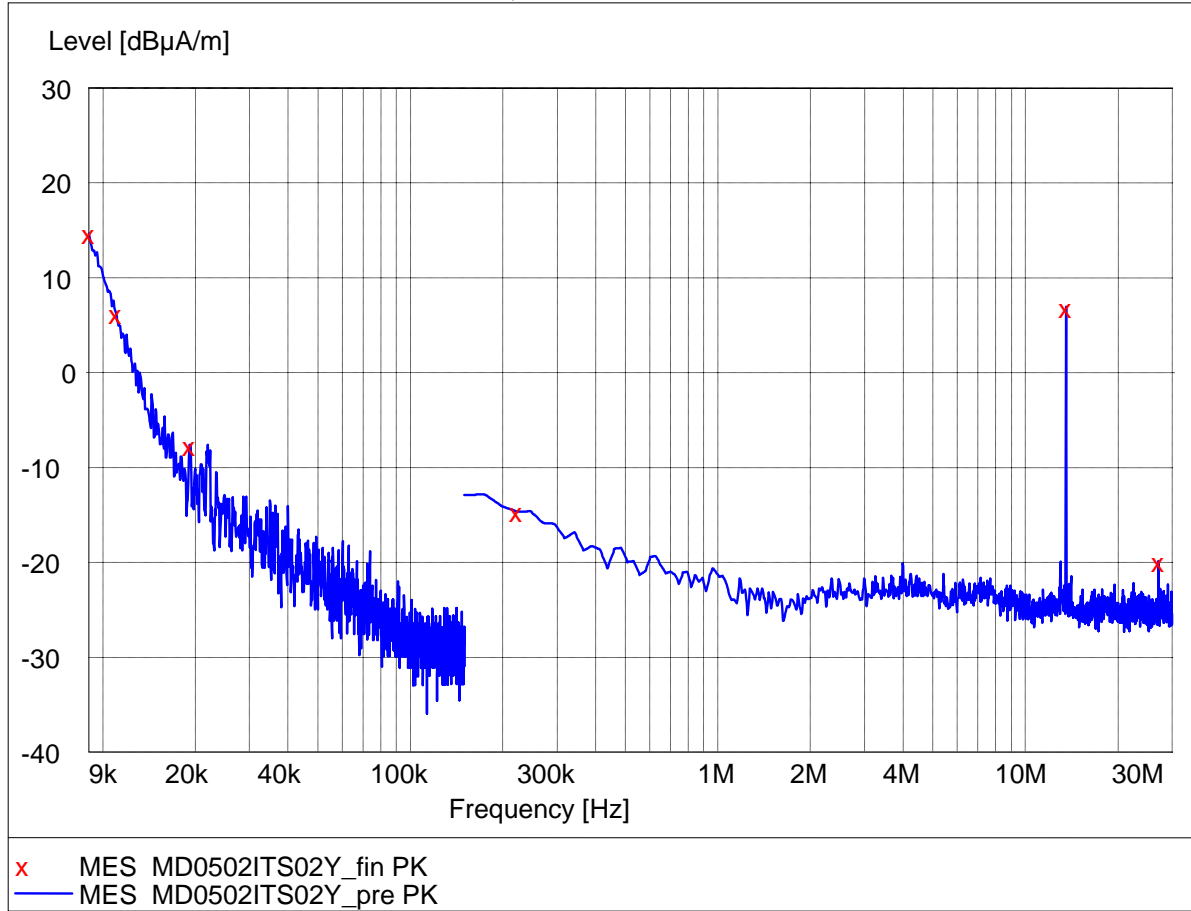
Example: Assuming Antenna Factor = 20.20dB/m, Cable Loss = 2.00dB,
 Original Receiver Reading = -30.00dBuA, limit = 40.00dBuV/m.

Then Correct Factor = 20.20 + 2.00 = 22.20dB/m; Electric Emission = -30dBuA + 22.20dB/m = -7.80dBuA/m; Electric Emission = -7.80dBuA/m + 51.50 = 43.70dBuV/m; Margin = 40.00dBuV/m - 43.70dBuV/m = -3.70dB.

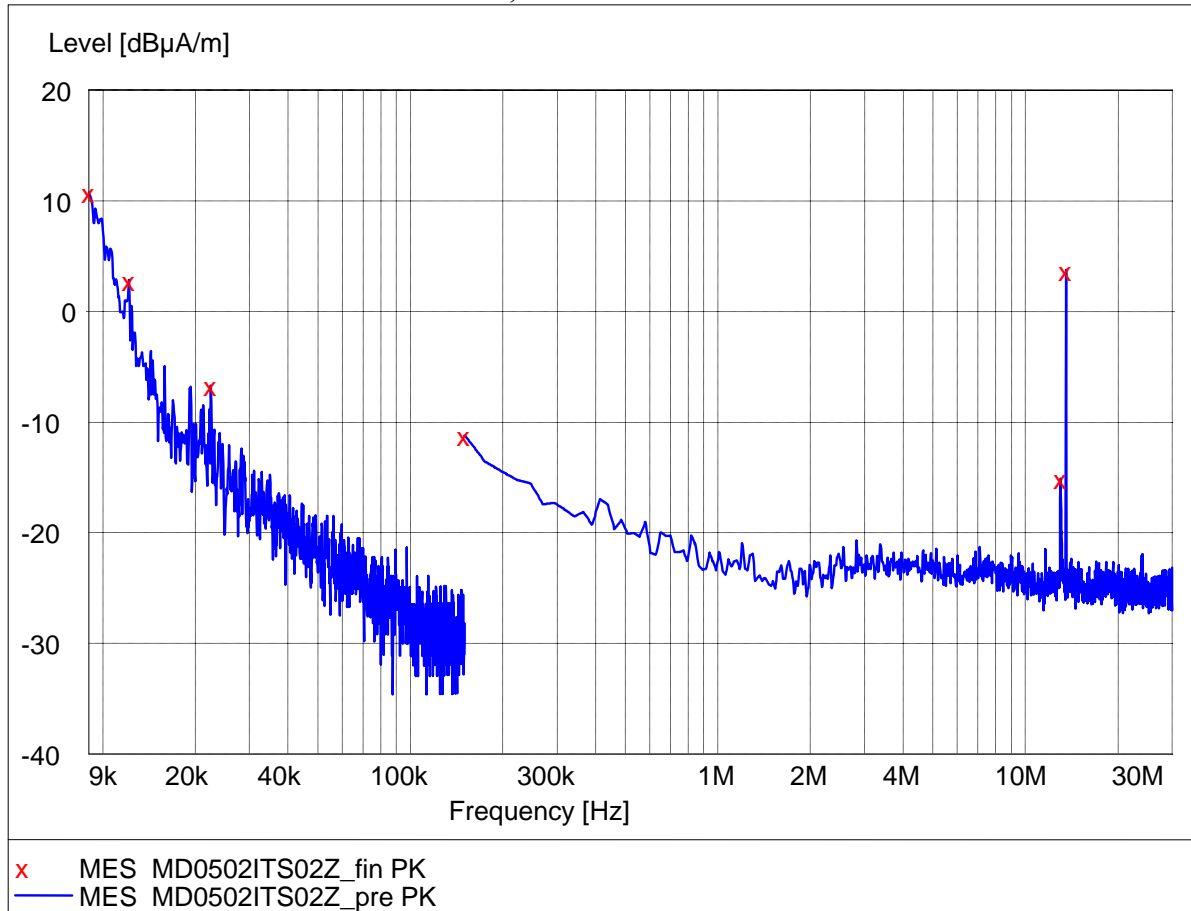
X axis, 0.15MHz - 30MHz



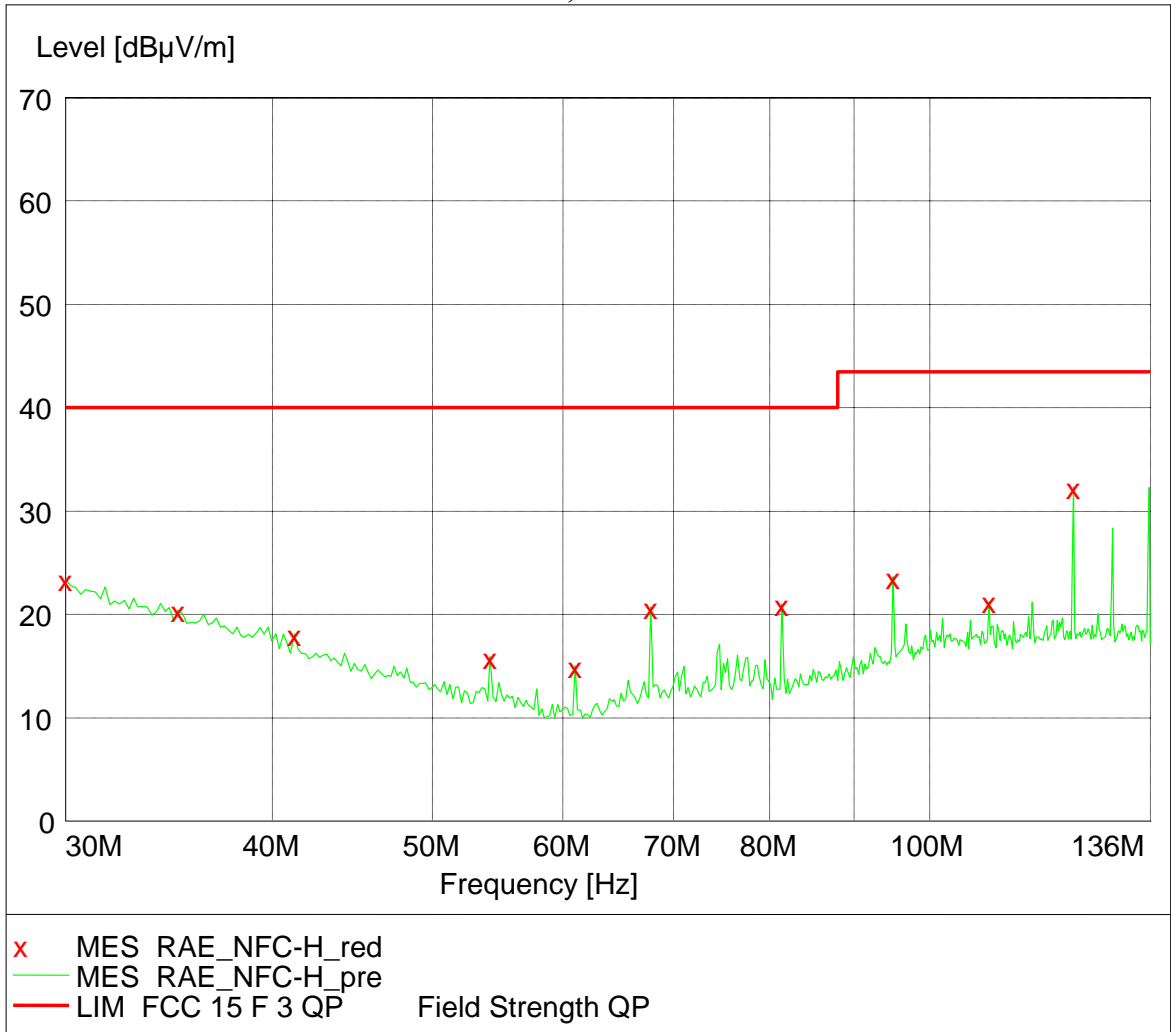
Y axis, 0.15MHz - 30MHz



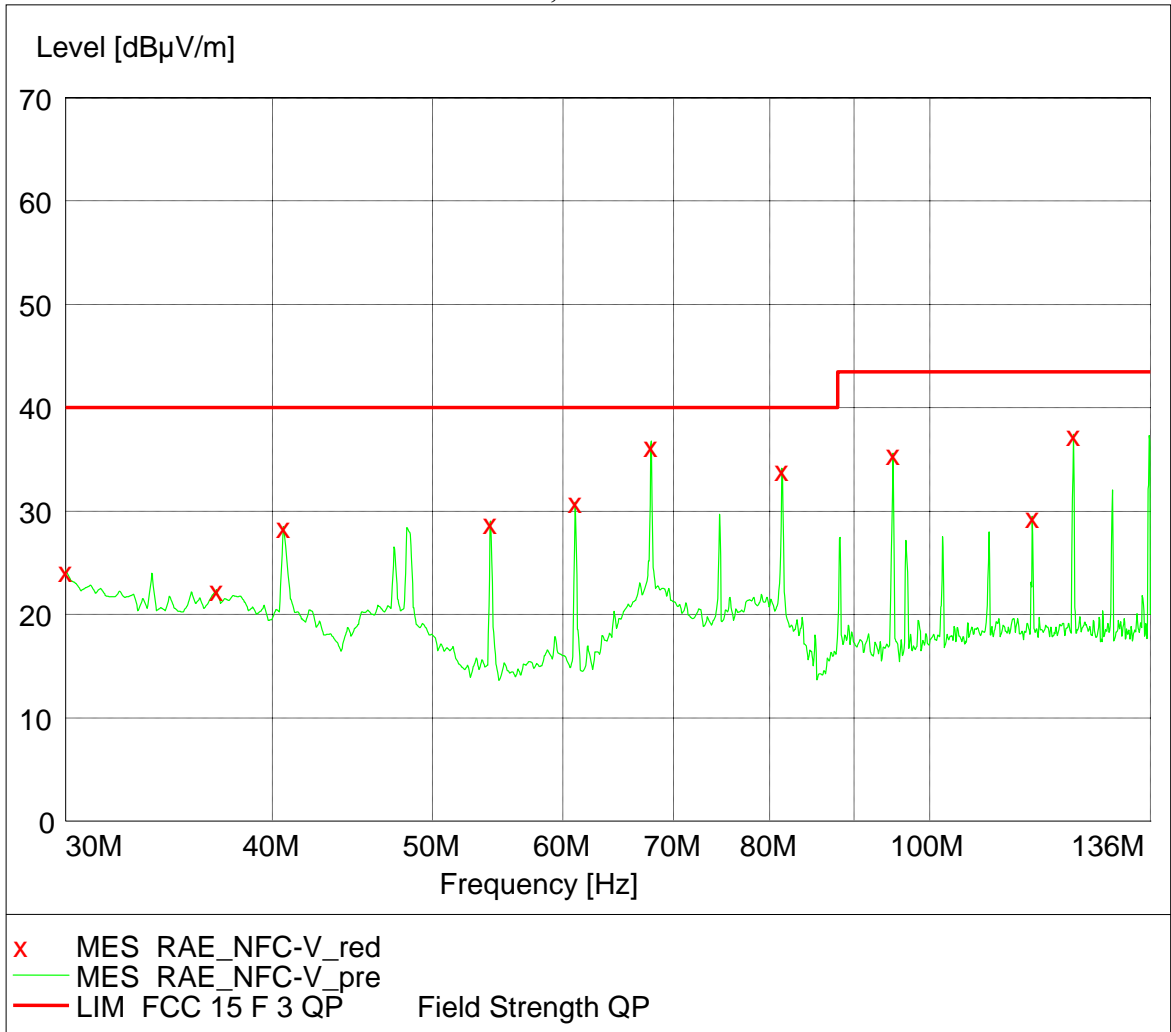
Z axis, 0.15MHz - 30MHz



Horizontal, 30 -136MHz



Vertical, 30 -136MHz



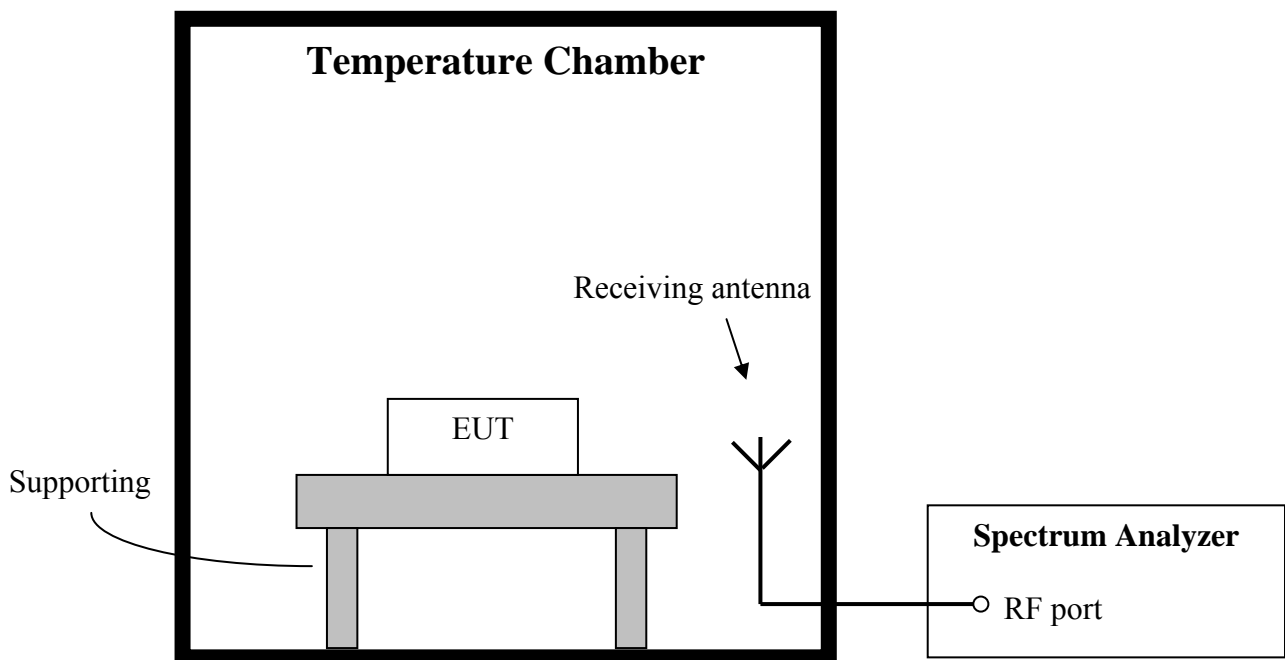
5. Frequency Stability (Temperature Variation)

Test result: PASS

5.1 Test limit

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.

5.2 Test Configuration



5.3 Test procedure and test setup

Test Procedure as per ANSI 63.10 clause 6.8.1.

5.4 Test protocol

Voltage (V)	Temp (°C)	Freq measured (MHz)	Freq nominal (MHz)	Tolerance (%)	Limit (%)
5	-20	13.560	13.560	0	0.01
	-10	13.560		0	
	0	13.560		0	
	10	13.560		0	
	20	13.560		0	
	30	13.560		0	
	40	13.560		0	
	50	13.560		0	

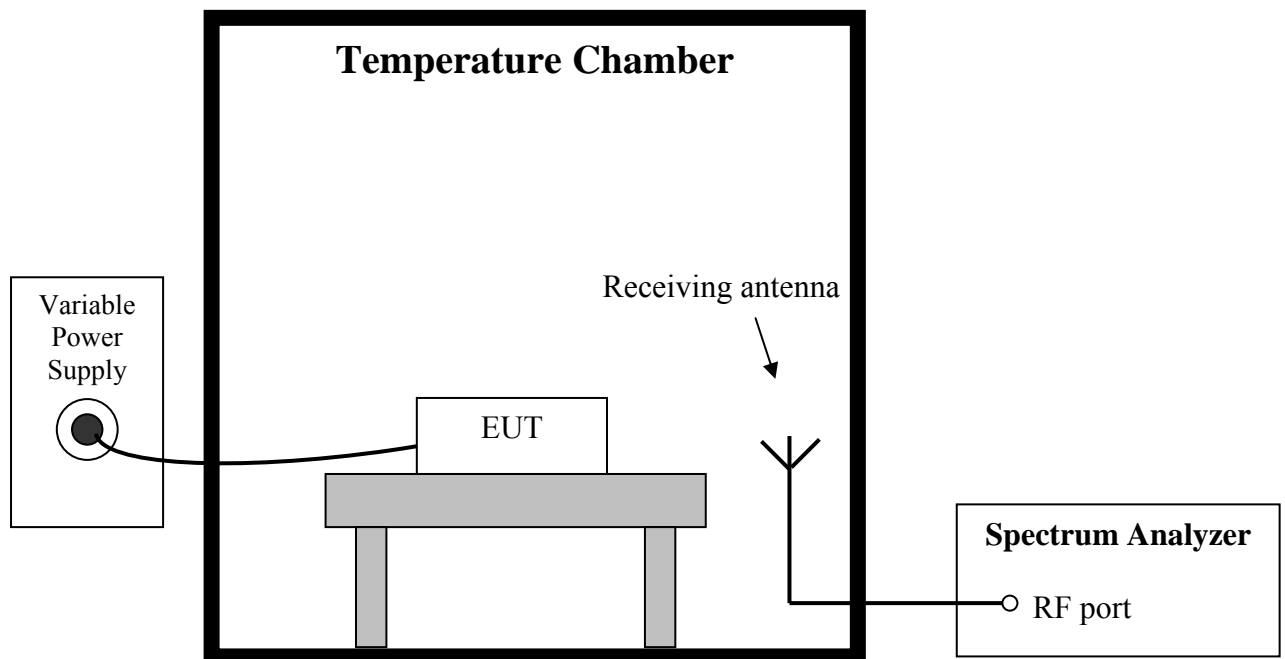
6. Frequency Stability (Voltage Variation)

Test result: PASS

6.1 Test limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ 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 Configuration



6.3 Test procedure and test setup

Test Procedure as per ANSI 63.10 clause 6.8.2.

6.4 Test protocol

Temp (°C)	Voltage (V)	Freq Measured (MHz)	Freq nominal (MHz)	Tolerance (%)	Limit (%)
20	5	13.560	13.560	0	0.01
	4.25	13.559		0.007	
	5.75	13.560		0	

7. Power line conducted emission

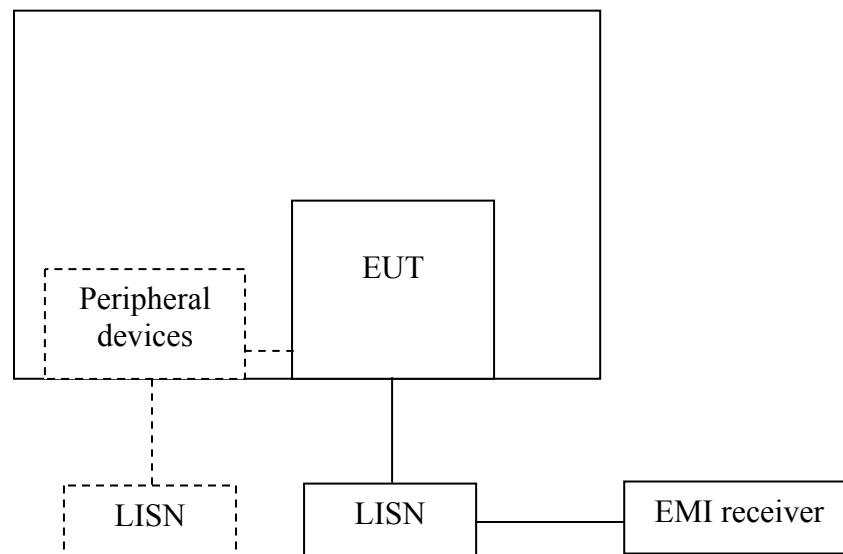
Test result: Pass

7.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

7.2 Test configuration



For table top equipment, wooden support is 0.8m height table

For floor standing equipment, wooden support is 0.1m height rack.

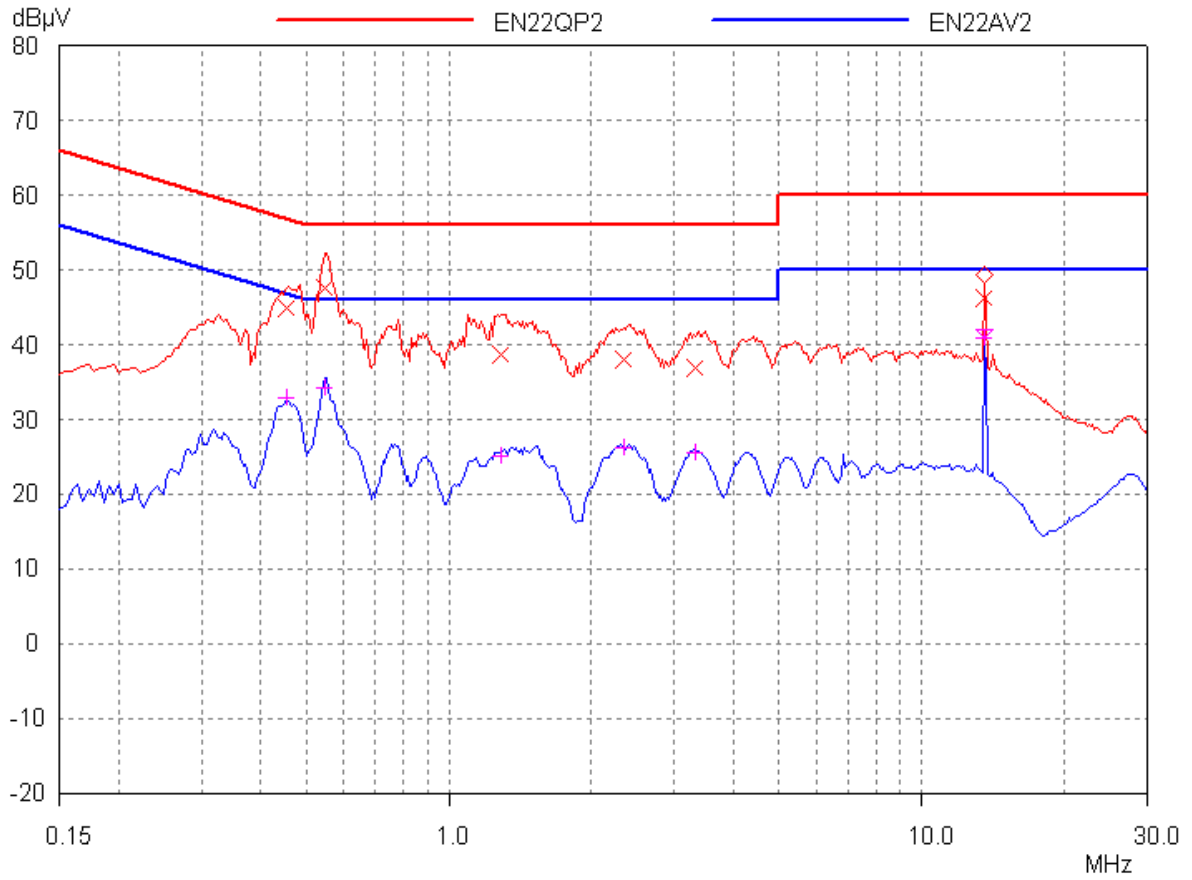
7.3 Test procedure and test set up

The EUT are connected to the main power through a line impedance stabilization network (LISN). 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 50Ω termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4 on conducted measurement. The bandwidth of the test receiver is set at 9 kHz.

A dummy load is applied for this measurement.

7.4 Test protocol



Frequency (MHz)	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
0.45 (N)	3.00	44.90	32.98	56.85	46.85	11.95	13.87
0.55 (N)	3.00	47.50	34.20	56.00	46.00	8.50	11.80
1.29 (L)	3.00	38.64	25.03	56.00	46.00	17.36	20.97
2.32 (L)	3.00	38.04	26.15	56.00	46.00	17.96	19.85
3.31 (N)	3.00	36.97	25.54	56.00	46.00	19.03	20.46
13.56 (L)	3.00	46.19	40.89	60.00	50.00	13.81	9.11

Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB).
 2. Margin (dB) = Limit - Corrected Reading.