

EMC TEST REPORT

No. 130900812SHA-001

Applicant : MICROS Systems Inc
7031 Columbia Gateway Dr, Columbia, 21046
MD, USA

Manufacturer : GES Singapore Pte Ltd
28 Marsiling Lane, Singapore 739152

Product Name : LCD Rear Display

Type/Model : LCD Rear Display w/RFID Series 2

SUMMARY

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

47CFR Part 15 (2012): Radio Frequency Devices

RSS 210 (Issue 8, December 2010): Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

RSS-Gen (Issue 3, December 2010): General Requirements and Information for the Certification of Radio Apparatus

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: Jan 5, 2014

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Reviewed by:



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FCC ID: A4HRWRFID
IC: 9870A-RWRFID

Description of Test Facility

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FCC ID: A4HRWRFID
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1. General Information

1.1 Applicant Information

Applicant:	MICROS Systems Inc 7031 Columbia Gateway Dr, Columbia, 21046 MD, USA
Name of contact:	Mr Marcel Tracy
Tel:	443-285-8000 ext 2576
Email:	MTreacy@MICROS.COM
Manufacturer:	GES Singapore Pte Ltd 28 Marsiling Lane, Singapore 739152
Date of sample receipt:	Oct 7, 2013
Date of test:	Oct 7, 2013 ~ Oct 24, 2013

1.2 Identification of the EUT

Equipment:	LCD Rear Display
Type/model:	LCD Rear Display w/RFID Series 2
FCC ID:	A4HRWRFID
IC:	9870A-RWRFID



1.3 Technical specification

Operation Frequency Band:	13.56MHz - 13.56MHz
Modulation:	ASK
Antenna Designation:	Integral antenna, non-user removable.
Rating:	5VDC, 250mA (powered indirectly by mStation, with AC 100-240V, 50/60Hz input)
Description of EUT:	There is one model only. The EUT is a RFID device.
Channel Description:	One channel only, namely 13.56MHz.

1.4 Mode of operation during the test / Test peripherals used

For the EUT can be configured in any axes as the user wants, it was set up in three axis (X, Y, Z) and performed test. The three axes were tested one by one while the test receiver worked as “max hold” continuously and the highest reading among the whole test procedure was recorded.

Test peripherals: mStation and mTablet manufactured by MICROS System Inc.

2. Test Specification

2.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESCS 30	R&S	EC 2107	2013-10-21	2014-10-20
Test Receiver	ESIB 26	R&S	EC 3045	2013-10-21	2014-10-20
Test Receiver	ESCI 7	R&S	EC4501	2013-12-13	2014-12-12
Voltage Probe	ESH2-Z3	R&S	EC 3405	2013-1-12	2014-1-11
Voltage Probe	TK9420	Schwarzbeck	EC 4888	2013-6-7	2014-6-6
A.M.N.	ESH2-Z5	R&S	EC 3119	2013-1-9	2014-1-8
A.M.N.	ENV 216	R&S	EC 3393	2013-8-11	2014-8-10
A.M.N.	ENV 216	R&S	EC 3394	2013-8-11	2014-8-10
A.M.N.	ENV4200	R&S	EC3558	2013-8-11	2014-8-10
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2013-4-28	2015-4-27
Horn antenna	HF 906	R&S	EC 3049	2013-4-28	2015-4-27
Horn antenna	3117	ETS	EC 4792-1	2012-4-17	2014-4-16
Horn antenna	HAP18-26W		EC 4792-3	2012-4-10	2014-4-9
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2013-4-12	2014-4-11
Pre-amplifier	Tpa0118-40	R&S	EC 4792-2	2013-4-12	2014-4-11
Semi-anechoic chamber	-	Albatross project	EC 3048	2013-5-12	2014-5-11
Shielded room	-	Zhongyu	EC 2838	2009-1-12	2014-1-11
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2013-1-9	2014-1-8
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2013-1-9	2014-1-8
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2013-1-9	2014-1-8
Band Reject Filter	WRCGV 2400/2483-2390/2493-35/10SS	Wainwright	EC4297-4	2013-1-9	2014-1-8
Loop Antenna	FMZB 1516	SCHWARZB ECK	/	2012-11-29	2013-11-28
Temperature Camber	SETH-E	tayasaf	EC4315	2013-4-9	2014-4-9

2.2 Test Standard

47CFR Part 15 (2012)
RSS 210 (Issue 8, December 2010)
RSS-Gen (Issue 3, December 2010)
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	IC REFERANCE	RESULT
Fundamental emission	15.225(a) (b) (c)	RSS210 Clause A2.6 (a) (b) (c)	Pass
Spurious emission	15.225(d)	RSS210 Clause A2.6(d)	Pass
Frequency stability	15.225(e)	RSS210 Clause A2.6	Pass
Power line conducted emission	15.207	RSS-Gen Clause 7.2.4	Pass
20dB Bandwidth	15.215(c)	RSS-Gen Clause 4.6.3	Pass

3. Fundamental Emission

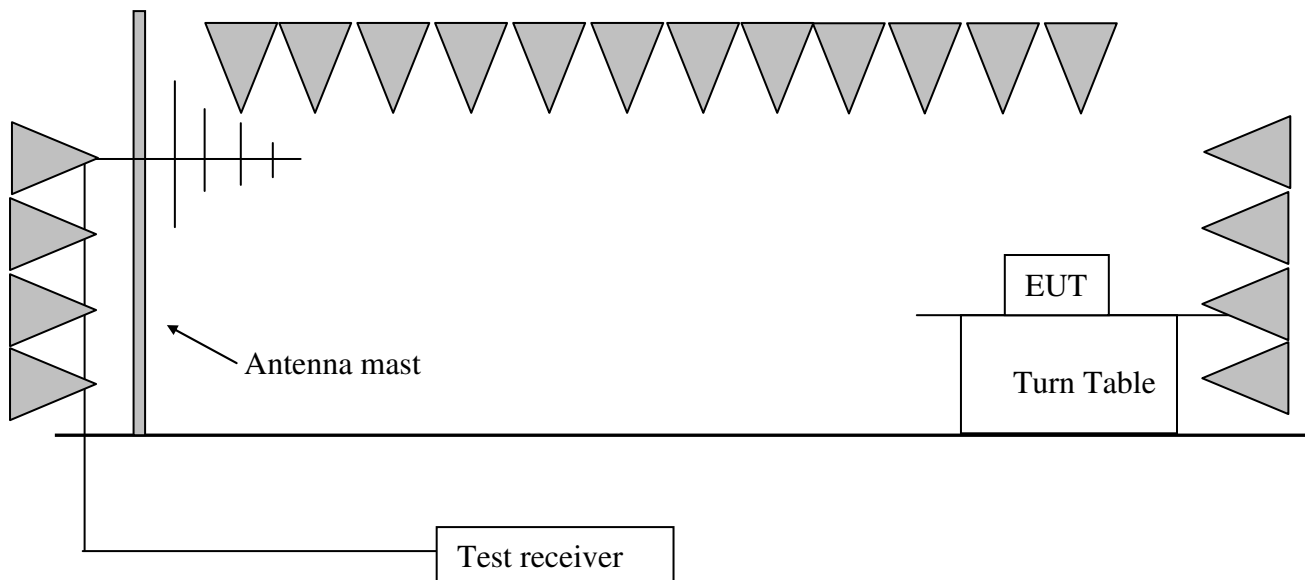
Test result: **PASS**

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 3m (dBuV/m)
13.110 – 13.410	40.50	80.50
13.410 – 13.553	50.50	90.50
13.553 – 13.567	84.00	124.00
13.567 – 13.710	50.50	90.50
13.710 – 14.010	40.50	80.50

3.2 Test Configuration



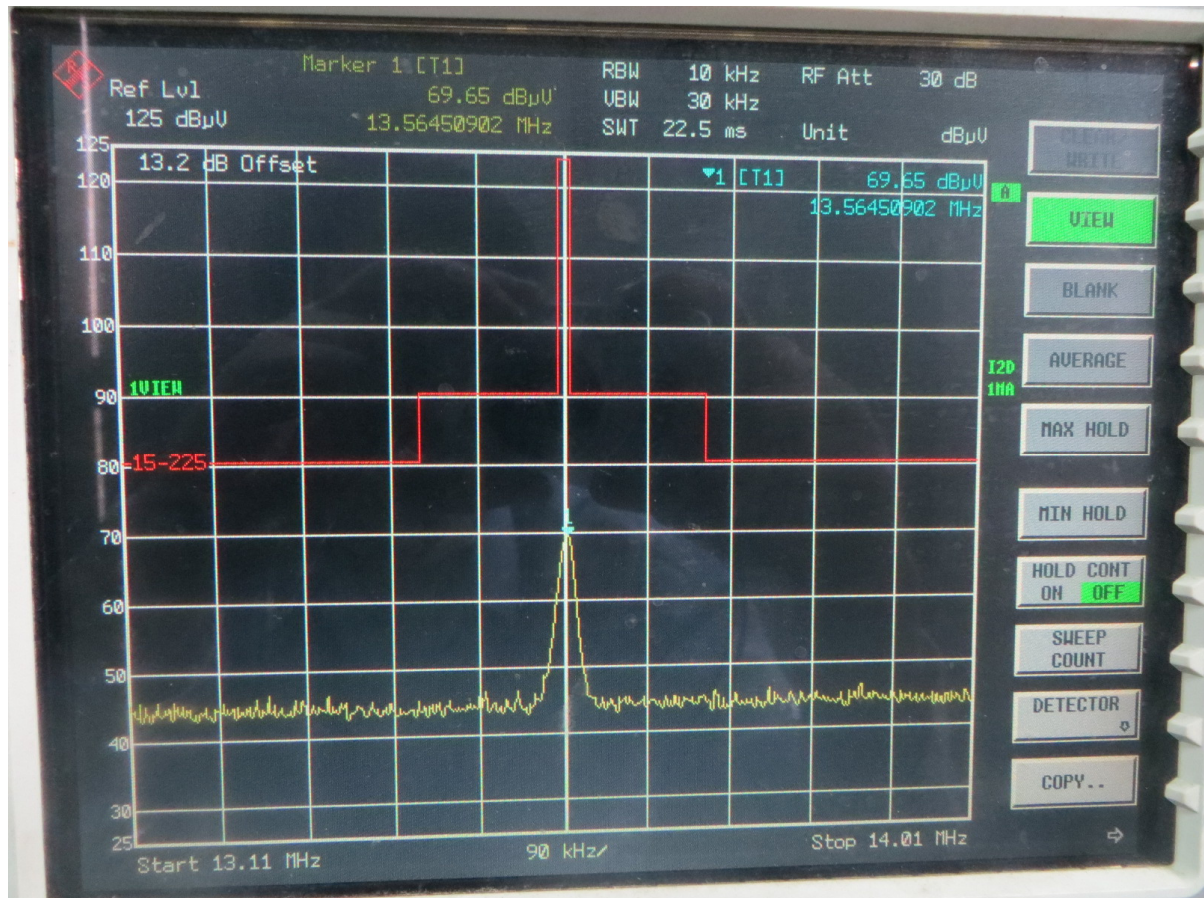
3.3 Test procedure and test setup

The measurement was applied in a 3m 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



Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin	Detector
13.56	13.20	69.65	124.00	54.35	PK

- Remark: 1. Correct Factor = Antenna Factor + Cable Loss
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading

Example: Assuming Antenna Factor = 20.20dB/m, Cable Loss = 2.00dB,
Original Receiver Reading = 10.00dBuV, limit = 40.00dBuV/m.
Then Correct Factor = 20.20 + 2.00 = 22.20dB/m; Corrected Reading = 10dBuV + 22.20dB/m = 32.20dBuV/m; Margin = 40.00dBuV/m - 32.20dBuV/m = 7.80dB.

4. Spurious Emission

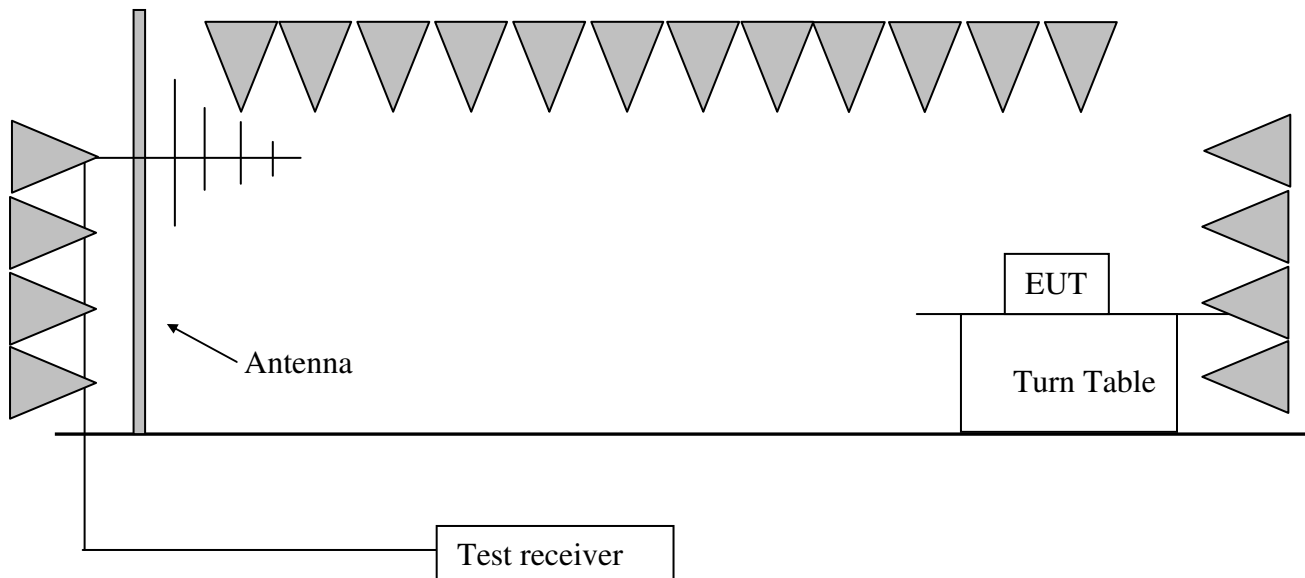
Test result: PASS

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	147.6-20lg (F _{kHz})	3
0.490 – 1.705	127.6-20lg (F _{kHz})	3
1.705 – 30.0	69.5	3
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 3m semi-anechoic chamber.

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)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin	Detector
Z	0.018	10.60	67.20	122.50	55.30	PK
X	0.022	10.50	62.40	120.80	58.40	PK
Z	0.090	10.50	56.10	108.50	52.40	PK
V	53.33	10.00	38.50	40.00	1.50	PK
V	80.54	10.40	30.90	40.00	9.10	PK
V	105.81	15.10	40.80	43.50	2.70	PK
V	162.18	13.50	34.40	43.50	9.10	PK
V	189.40	11.80	37.80	43.50	5.70	PK
H	815.33	23.90	36.30	46.00	9.70	PK

Remark: 1. Correct Factor = Antenna Factor + Cable Loss

2. Corrected Reading = Original Receiver Reading + Correct Factor

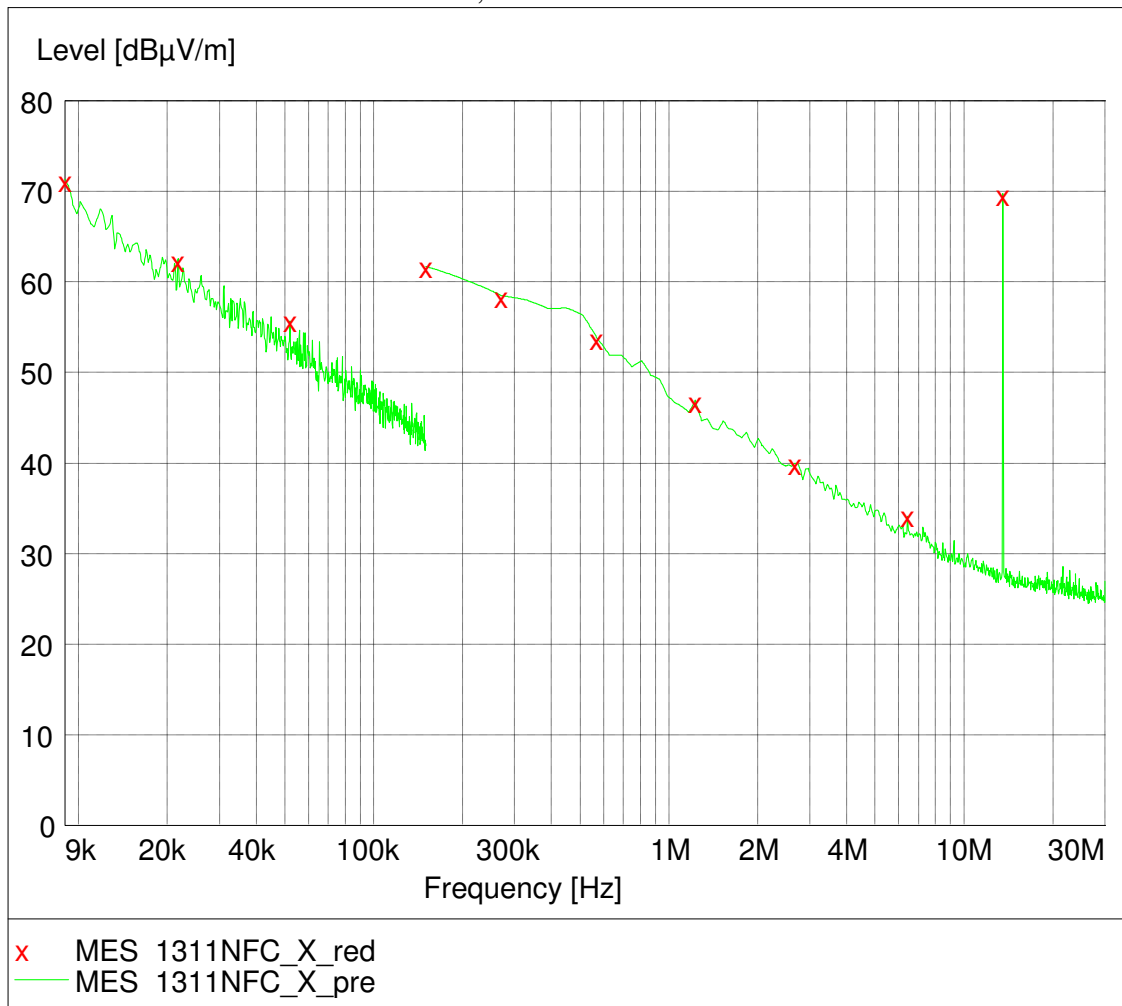
3. Margin = limit - Corrected Reading

Example: Assuming Antenna Factor = 20.20dB/m, Cable Loss = 2.00dB,

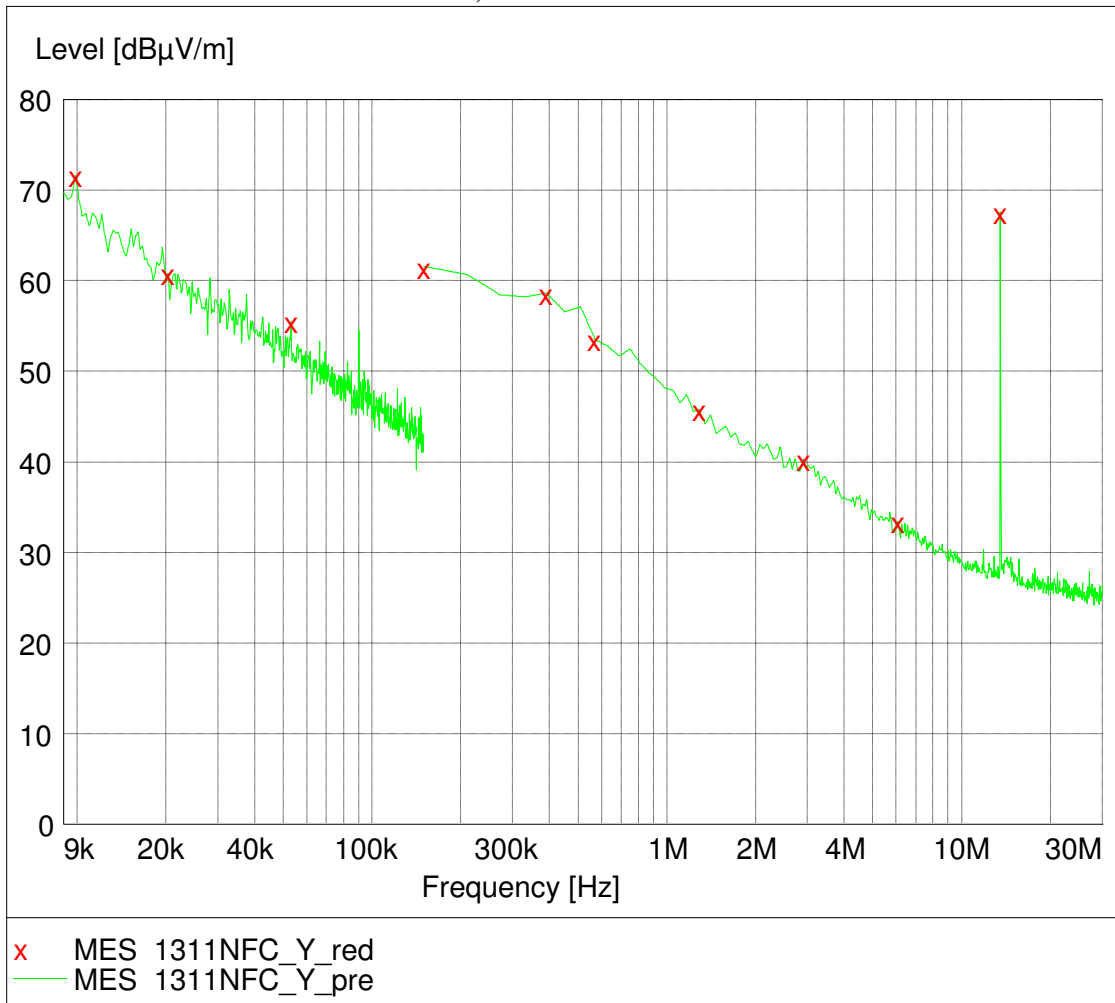
Original Receiver Reading = 10.00dBuV, limit = 40.00dBuV/m.

Then Correct Factor = 20.20 + 2.00 = 22.20dB/m; Corrected Reading = 10dBuV + 22.20dB/m = 32.20dBuV/m; Margin = 40.00dBuV/m - 32.20dBuV/m = 7.80dB.

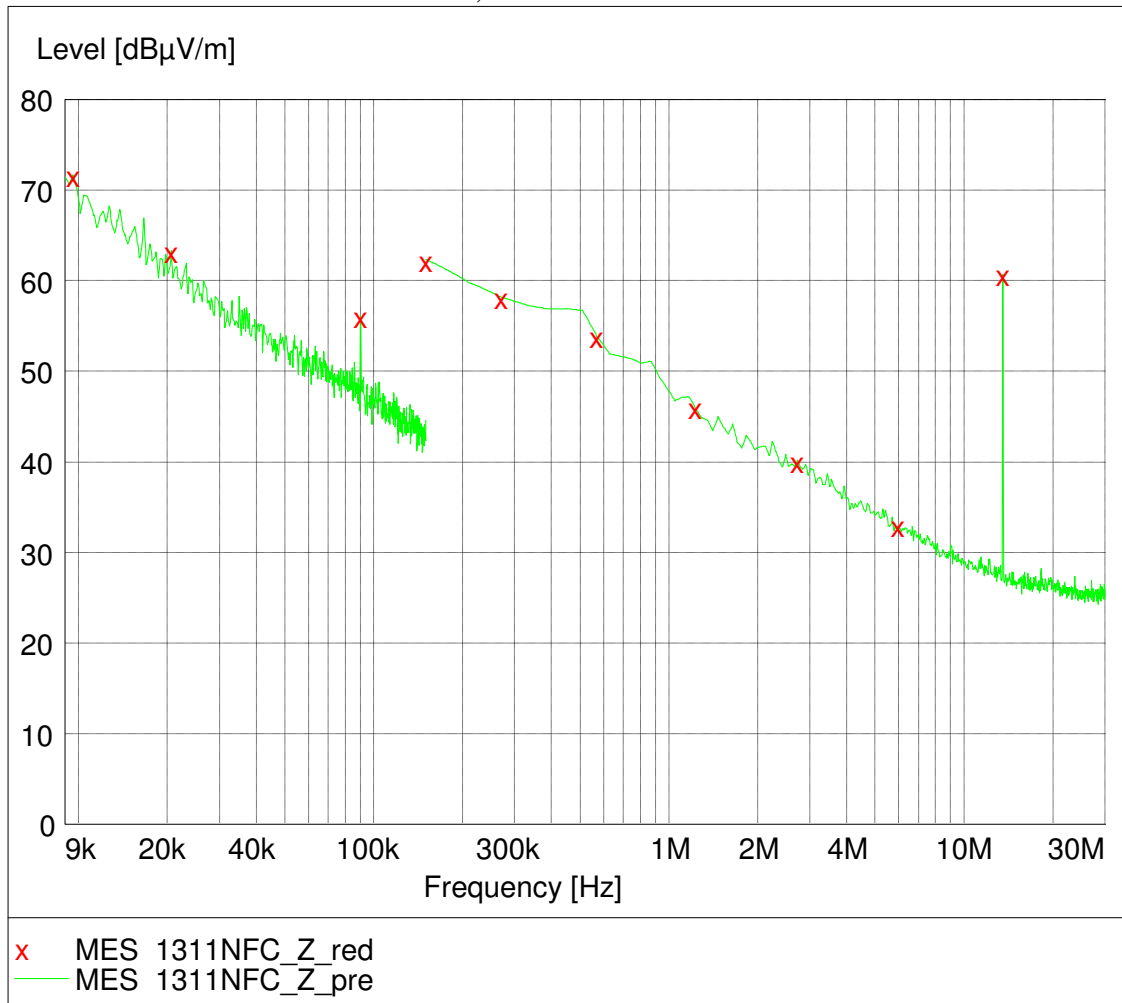
X axis, 0.15MHz - 30MHz



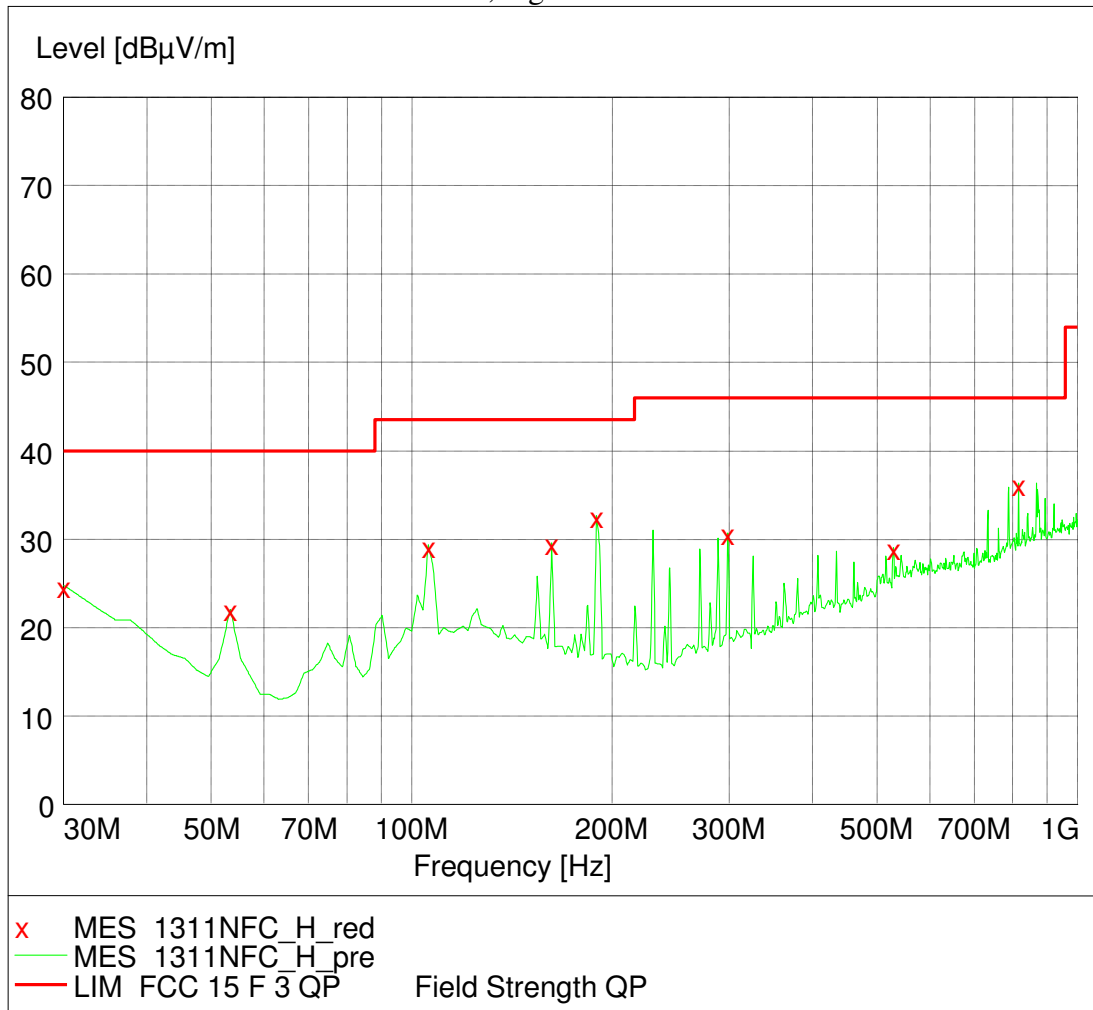
Y axis, 0.15MHz - 30MHz



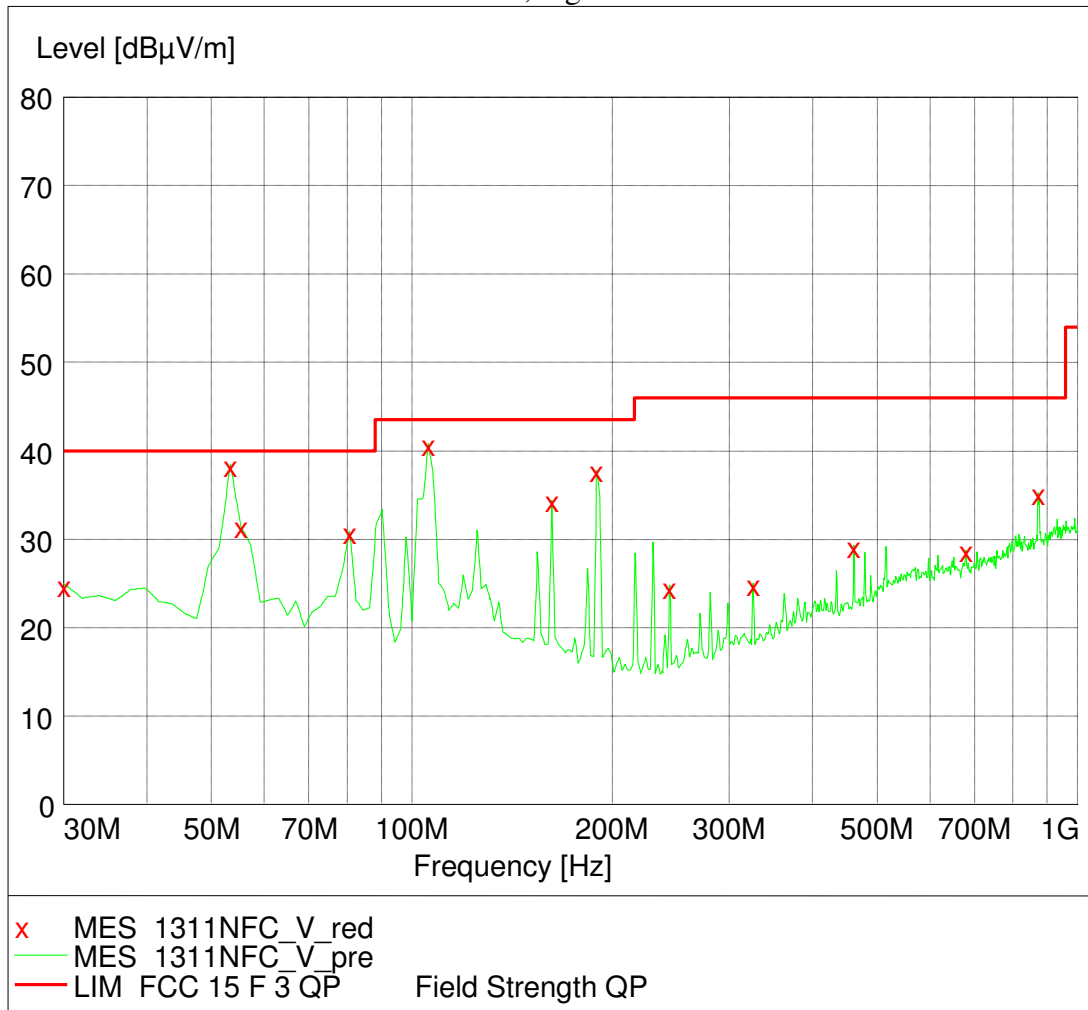
Z axis, 0.15MHz - 30MHz



Horizontal, higher than 30MHz



Vertical, higher than 30MHz



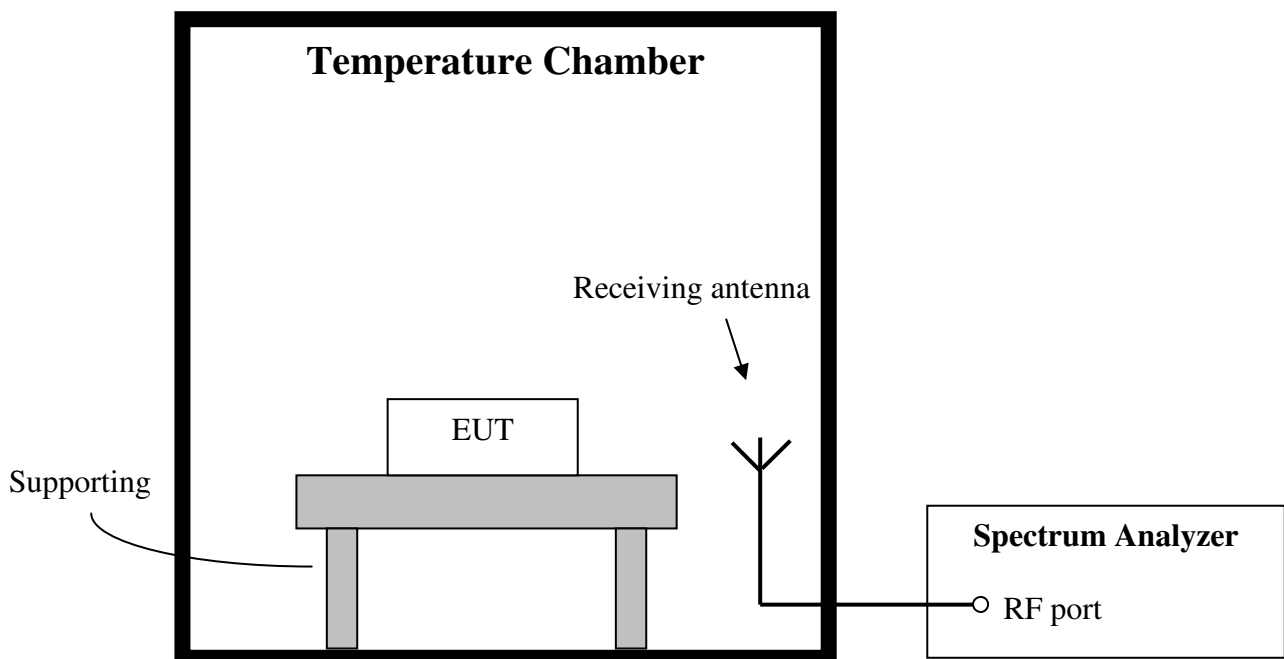
5. Frequency Stability (Temperature Variation)

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 (%)
120	-20	13.56003	13.560	0.0002	0.01
	-10	13.56003		0.0002	
	0	13.56003		0.0002	
	10	13.56003		0.0002	
	20	13.56003		0.0002	
	30	13.56003		0.0002	
	40	13.56004		0.0003	
	50	13.56004		0.0003	

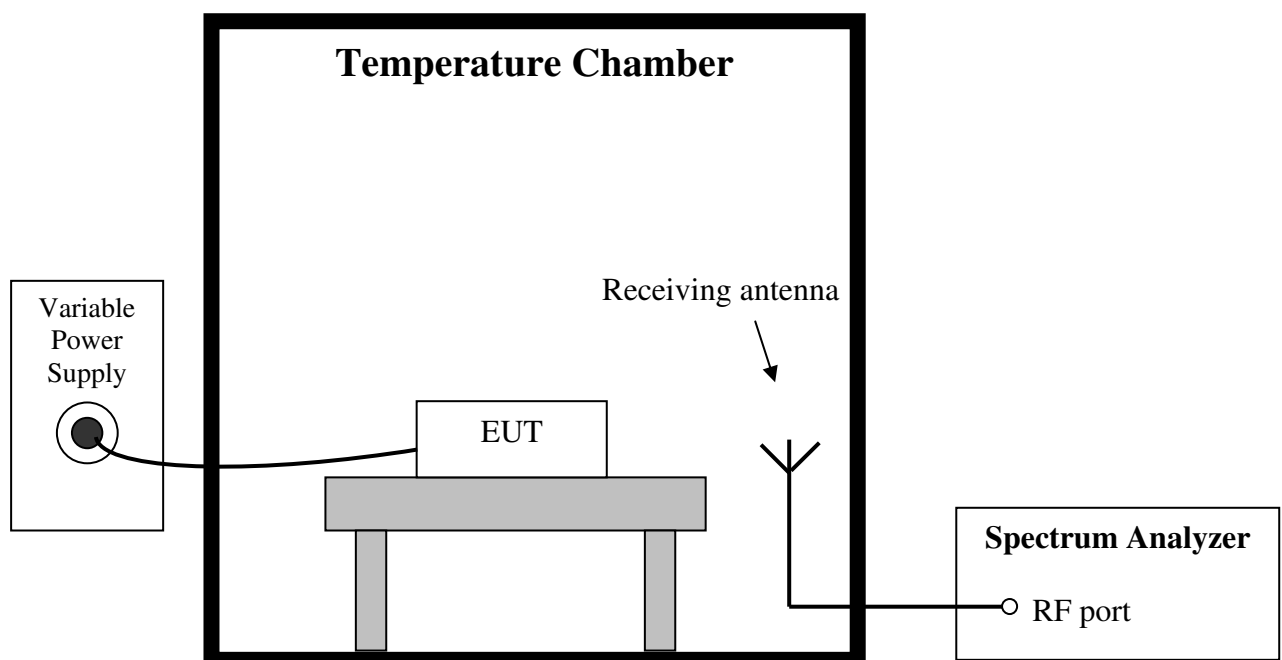
6. Frequency Stability (Voltage Variation)

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	120	13.56003	13.560	0.0002	0.01
	85	13.56003		0.0002	
	276	13.56003		0.0002	

7. Power line conducted emission

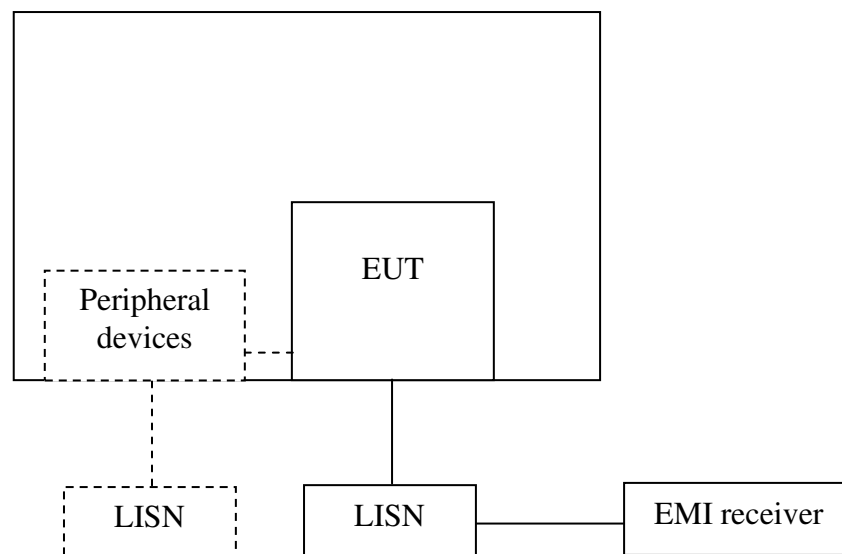
Test result: **Pass**

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

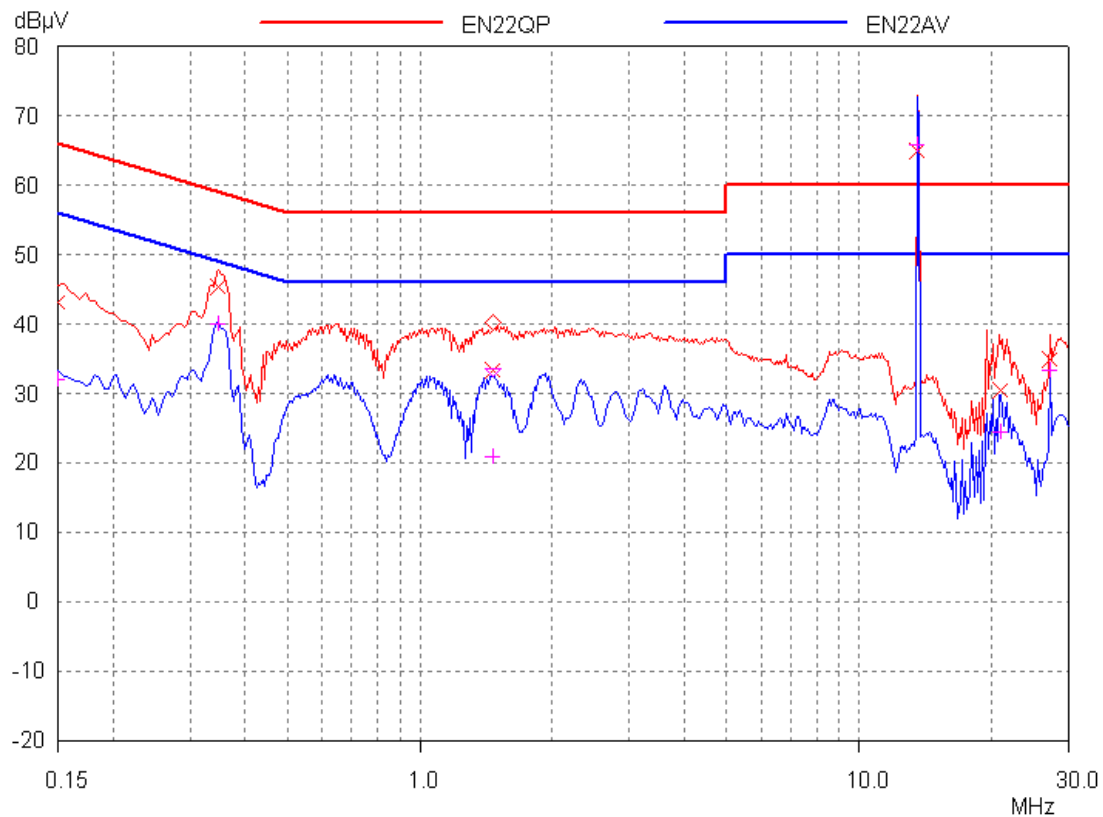
The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 Ω /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 Ω /50uH coupling impedance with 50 Ω 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.

☒ Dummy load is applied according to KDB 174176.

7.4 Test protocol

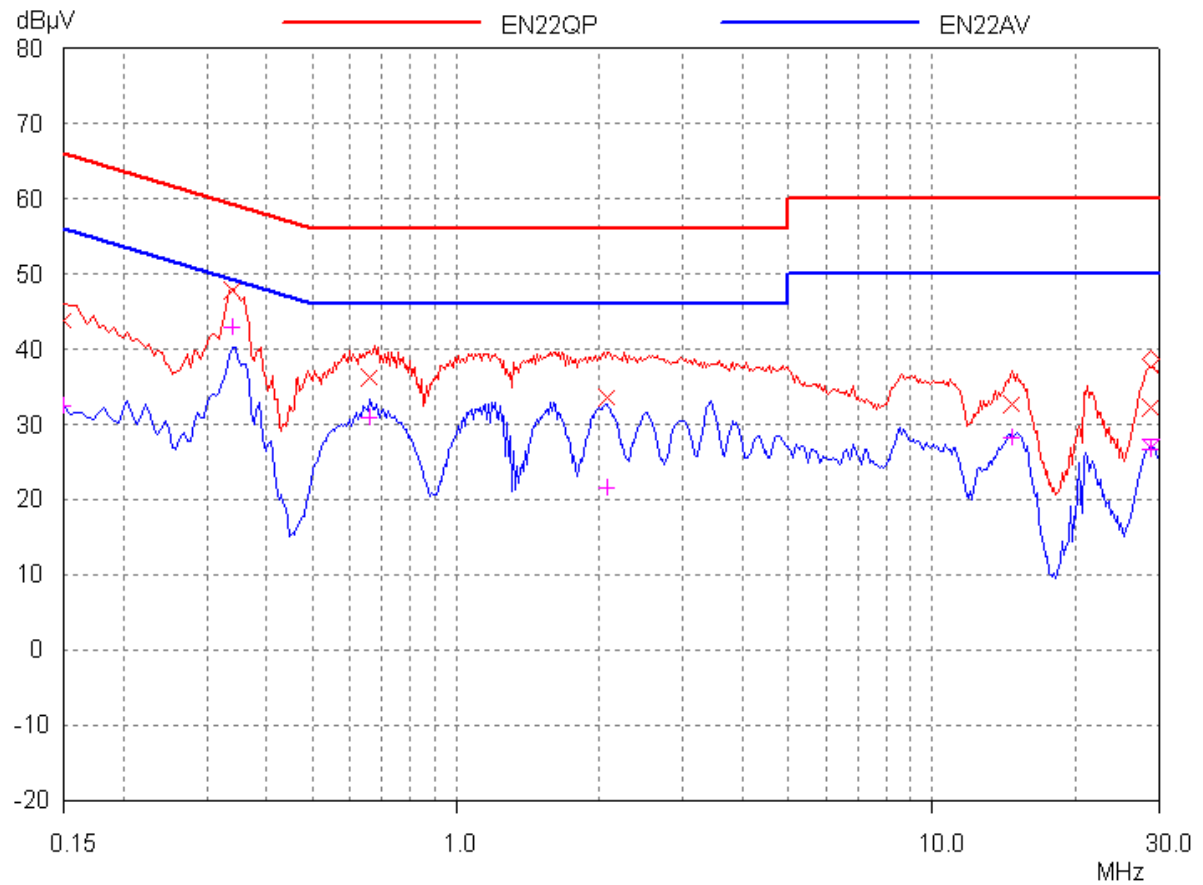
Tested with antenna installed



Frequency (MHz)	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
0.15 (L)	3.00	43.07	31.91	66.00	56.00	22.93	24.09
0.35 (L)	3.00	45.46	40.01	59.01	49.01	13.55	9.00
1.47 (L)	3.00	33.30	20.84	56.00	46.00	22.70	25.16
13.56 (N)	3.00	64.87	65.81	60.00	50.00	-4.87	-15.81
20.87 (N)	3.00	30.37	24.36	60.00	50.00	29.63	25.64
27.12 (L)	3.00	34.89	33.44	60.00	50.00	25.11	16.56

Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB).
2. Margin (dB) = Limit - Corrected Reading.
3. The bolded row falls in the fundamental emission band and is exempted.

Tested with dummy load



Frequency (MHz)	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
0.15 (N)	3.00	43.83	32.28	66.00	56.00	22.17	23.62
0.34 (L)	3.00	47.87	42.90	59.23	49.23	11.36	6.33
0.66 (L)	3.00	36.28	30.87	56.00	46.00	19.72	15.13
2.07 (L)	3.00	33.54	21.45	56.00	46.00	22.46	24.55
14.64 (L)	3.00	32.70	28.14	60.00	50.00	27.30	21.86
28.65 (N)	3.00	32.27	26.63	60.00	50.00	27.73	23.37
Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB). 2. Margin (dB) = Limit - Corrected Reading.							

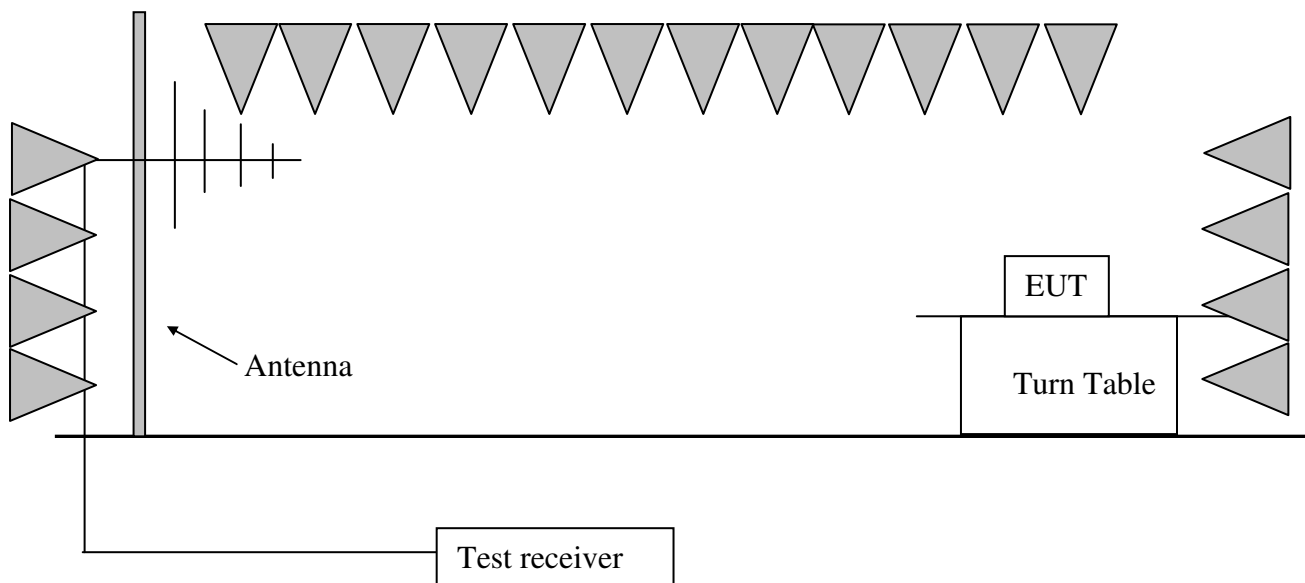
8. 20dB Bandwidth

Test result: **Pass**

8.1 Limit

The 20 bandwidth should be fallen in the allocated operating frequency range.

8.2 Test configuration



8.3 Test procedure and test set up

The measurement was applied in a 3m semi-anechoic chamber.

The center of the loop antenna shall be 1 m above the horizontal metal ground plane.

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

RBW = 1kHz, VBW = 3kHz

8.4 Test protocol

Lower point (MHz)	Higher point (MHz)	Bandwidth (kHz)	Allocated bandwidth (MHz)
13.558998	13.562442	3.44	13.553 ~ 13.567

