

TEST REPORT

Reference No..... : WTS15S0831719E
FCC ID : V2V-NFT1N
Applicant..... : LigoWave LLC
Address..... : 138 Mountain Brook Dr Canton, GA 30115 United States
Manufacturer : The same as above
Address..... : The same as above
Product Name..... : Broadband Digital Transmission System
Model No : NFT 1N, NFT 1N AF
Standards : FCC PART15 SUBPART B: 2014
Date of Receipt sample : Aug. 11, 2015
Date of Test : Aug. 12, 2015 ~ Oct. 08, 2015
Date of Issue..... : Oct. 12, 2015
Test Result..... : Pass

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:

Waltek Services (Shenzhen) Co., Ltd.

Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Tel :+86-755-83551033

Fax:+86-755-83552400

Compiled by:



Zero Zhou / Test Engineer

Approved by:



Philo Zhong / Manager

1 Test Summary

Test Item	Test Requirement	Class	Test Method	Test Result
Power Line Conducted Emission (150kHz to 30MHz)	FCC PART 15, SUBPART B: 2014	Class B	ANSI C63.4: 2009	Pass
Radiated Emission 30MHz to 1GHz)	FCC PART 15, SUBPART B: 2014	Class B	ANSI C63.4: 2009	Pass
Radiated Emission (Above 1GHz)	FCC PART 15, SUBPART B: 2014	Class B	ANSI C63.4: 2009	Pass

Remark:

Pass Test item meets the requirement

Fail Test item does not meet the requirement

N/A Test case does not apply to the test object

2 Contents

	Page
COVER PAGE	1
1 TEST SUMMARY	2
2 CONTENTS	3
3 GENERAL INFORMATION	4
3.1 GENERAL DESCRIPTION OF E.U.T.....	4
3.2 DETAILS OF E.U.T.....	4
3.3 STANDARDS APPLICABLE FOR TESTING	4
3.4 TEST FACILITY	4
3.5 SUBCONTRACTED	5
3.6 ABNORMALITIES FROM STANDARD CONDITIONS	5
4 EQUIPMENT USED DURING TEST	7
4.1 EQUIPMENT LIST.....	7
4.2 DESCRIPTION OF SUPPORT UNITS.....	8
4.3 MEASUREMENT UNCERTAINTY.....	8
5 EMISSION TEST RESULTS	9
5.1 POWER LINE CONDUCTED EMISSION, 150KHZ TO 30MHZ	9
5.2 RADIATION EMISSION, 30MHZ TO 1000MHZ.....	16
5.3 RADIATION EMISSION, ABOVE 1000MHZ.....	23
6 PHOTOGRAPHS – TEST SETUP	30
6.1 PHOTOGRAPH –POWER LINE CONDUCTED EMISSION TEST SETUP AT TEST SITE 2#.....	30
6.2 PHOTOGRAPH – RADIATED EMISSION TEST SETUP FOR 30~1000MHZ AT TEST SITE 2#.....	30
6.3 PHOTOGRAPH – RADIATED EMISSION TEST SETUP FOR ABOVE 1GHZ AT TEST SITE 1#.....	31
7 EUT – CONSTRUCTIONAL DETAILS	32

3 General Information

3.1 General Description of E.U.T.

Product Name:	Broadband Digital Transmission System
Model No.:	NFT 1N, NFT 1N AF
Model Description:	Only the Power management circuits and the power supply voltage are different.

3.2 Details of E.U.T.

Technical Data:	
Adapter 1:	Manufacturer: AOYUAN Model No.: AY012E-ZF243 Output: DC 24V 0.5A Input: 100-240V, 50/60Hz, 0.5A
Adapter 2:	Manufacturer: Great Model No.: GRT-240050 Output: DC 24V 0.5A Input: 100-240V, 50/60Hz, 0.5A
	Two adapter for NFN 1N The NFT 1N AF Sale without adapter
Secondary Adapter:	Manufacturer: LEOLINK Model No.: LEF1015 Output: DC 48V 0.5A Input: 100-240V, 50/60Hz, 0.5A

3.3 Standards Applicable for Testing

The tests were performed according to following standards:

FCC PART 15, SUBPART B: Electronic Code of Federal Regulations- Unintentional Radiators. 2014

3.4 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

Waltek Services (Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration 7760A-1, October 15, 2015.

- **FCC Test Site 1#– Registration No.: 880581**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, April 29, 2014.

- **FCC Test Site 2#– Registration No.: 328995**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 328995, December 3, 2014.

3.5 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test Lab: N/A

Lab address: N/A

Test items: N/A

3.6 Abnormalities from Standard Conditions

None.

3.7 Test Mode Description

Conducted Emissions	
TM1*	Data transmission+Adapter+Printer
Radiated Emissions	
TM1*	Data transmission+Adapter+Printer
Voltage Fluctuations and Flicker	
TM1*	Data transmission+Adapter+Printer
Electrostatic Discharge(ESD)	
TM1*	Data transmission+Adapter+Printer
Radiated Immunity(R/S)	
TM1*	Data transmission+Adapter+Printer
Electrical Fast Transients (EFT)	
TM1*	Data transmission+Adapter+Printer
Surge Immunity	
TM1*	Data transmission+Adapter+Printer
Voltage Dips and Interruptions	

TM1*	Data transmission+Adapter+Printer
Conducted Immunity(C/S)	
TM1*	Data transmission+Adapter+Printer
“*” shows the worst case mode which were recorded in this report.	

4 Equipment Used during Test

4.1 Equipment List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	Sep.14,2015	Sep.13,2016
2.	LISN	R&S	ENV216	101215	Sep.14,2015	Sep.13,2016
3.	Cable	Top	TYPE16(3.5M)	-	Sep.14,2015	Sep.13,2016
Conducted Emissions Test Site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	Sep.14,2015	Sep.13,2016
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.14,2015	Sep.13,2016
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.14,2015	Sep.13,2016
4.	Cable	LARGE	RF300	-	Sep.14,2015	Sep.13,2016
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.14,2015	Sep.13,2016
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.14,2015	Sep.13,2016
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2015	Apr.18,2016
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.14,2015	Sep.13,2016
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2015	Apr.18,2016
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2015	Apr.18,2016
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2015	Mar.16,2016
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2015	Apr.09,2016
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	Sep.14,2015	Sep.13,2016
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Sep.14,2015	Sep.13,2016
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.14,2015	Sep.13,2016

4	Cable	HUBER+SUHNER	CBL2	525178	Sep.14,2015	Sep.13,2016
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Sep.14,2015	Sep.13,2016
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.14,2015	Sep.13,2016
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Sep.14,2015	Sep.13,2016

4.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
/	/	/	/

4.3 Measurement Uncertainty

Test Item	Frequency Range	Uncertainty	Note
Conduction disturbance	150kHz~30MHz	±3.64dB	(1)
Radiation Emission	30MHz~1000MHz	±5.03dB	(1)
	1GHz~6GHz	±5.47dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

5 Emission Test Results

5.1 Power Line Conducted Emission, 150kHz to 30MHz

Test Requirement : FCC PART 15, SUBPART B
 Test Method : ANSI C63.4
 Test Result : Pass
 Frequency Range : 150kHz to 30MHz
 Class : Class B
 Limit :

Frequency (MHz)	Limit (dBμ)	
	Quasi-peak	Average
0.15 to 0.5	66 to 6*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

5.1.1 E.U.T. Operation

Operating Environment:

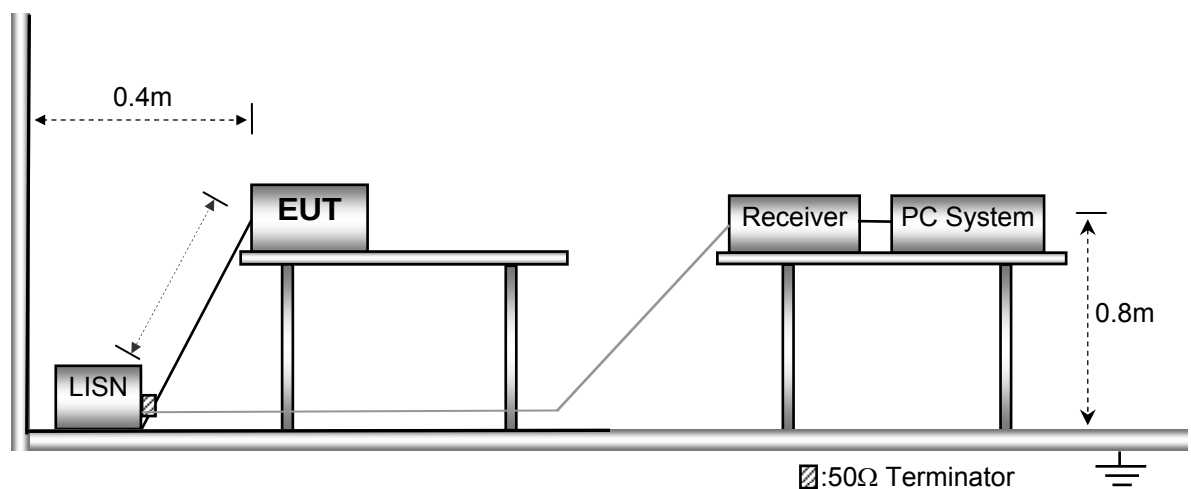
Temperature : 23°C
 Humidity : 53.6%RH
 Atmospheric Pressure : 101kPa

EUT Operation:

Input Voltage : AC 120V/60Hz
 Operating Mode : Transmitting
 Remark : The worst case is Transmitting mode and the data is shown as follow.

5.1.2 Block Diagram of Test Setup

The Mains Terminals Disturbance Voltage tests were performed in accordance with the ANSI C63.4 .



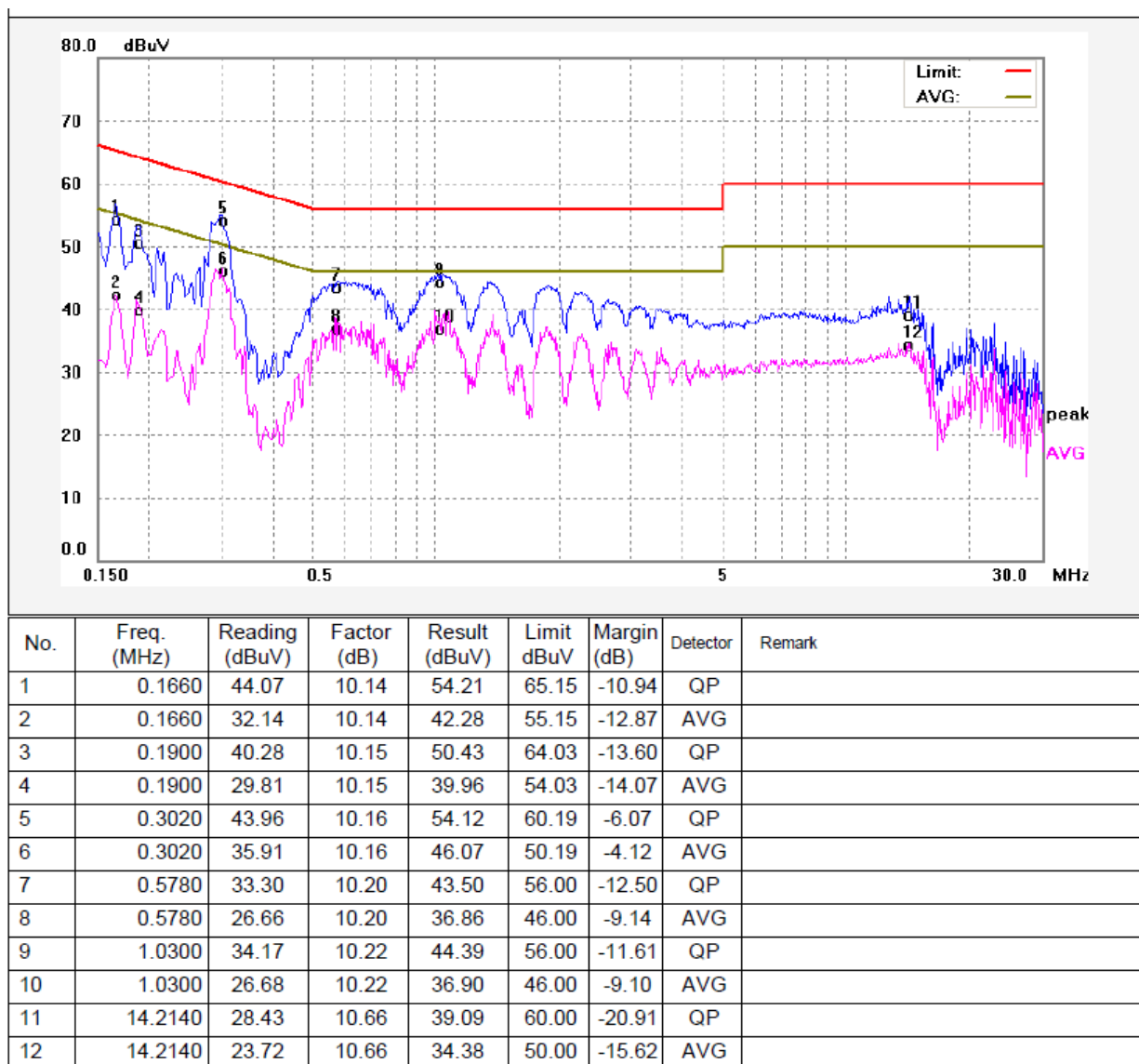
5.1.3 Measurement Data

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line. According to the data in section 5.1.4, the EUT complied with the FCC PART 15, SUBPART B standards.

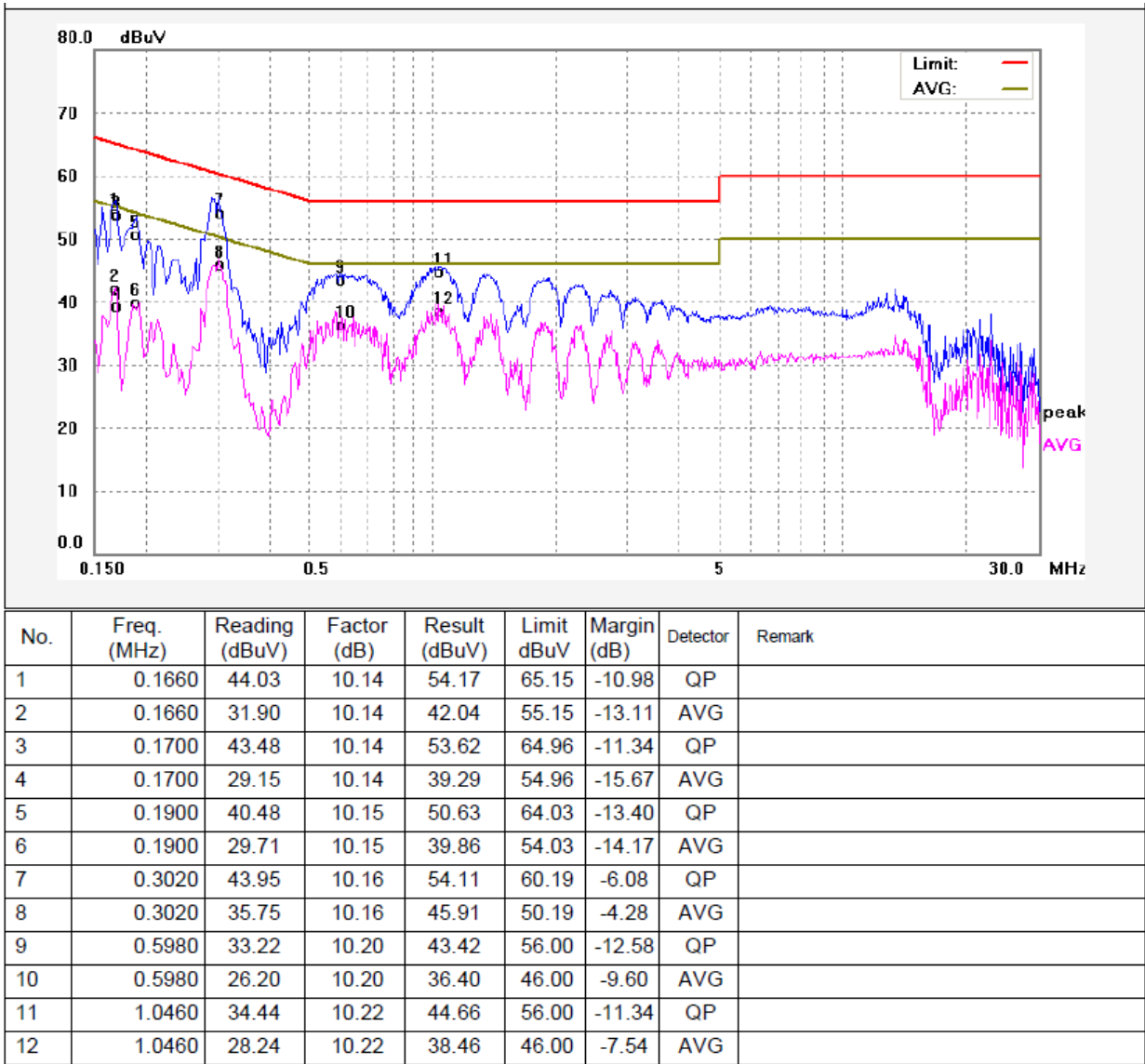
5.1.4 Power Line Conducted Emission Test Data

Model: NFT 1N (AY012E-ZF243)

Live Line:

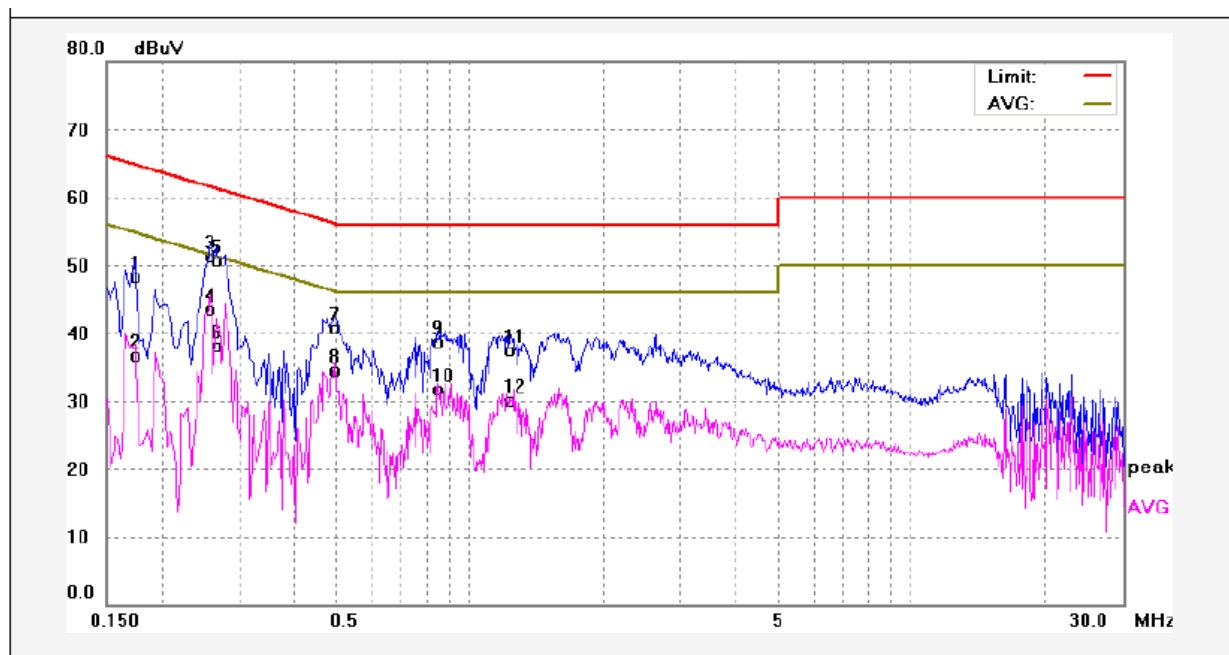


Neutral Line:



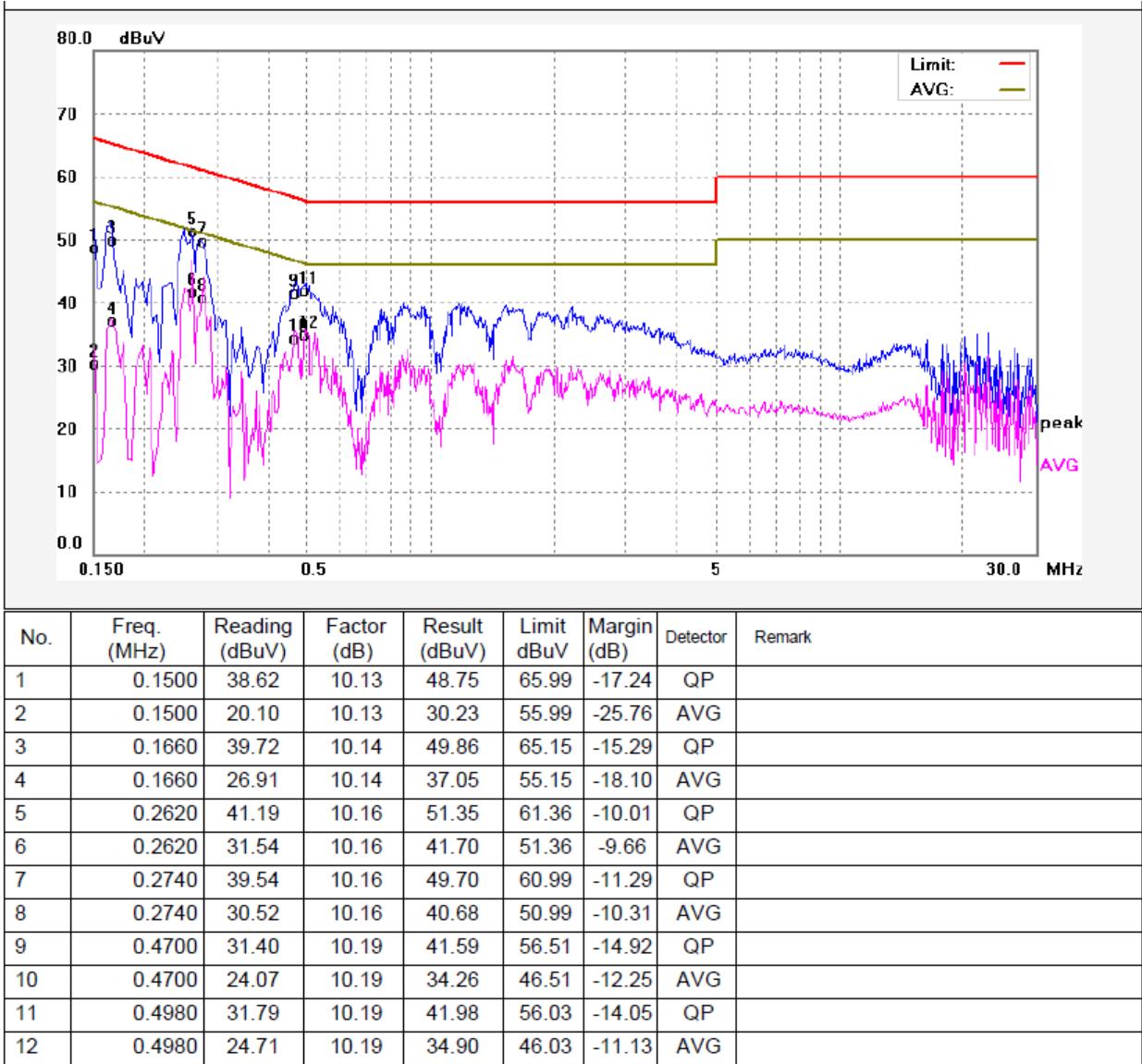
Model: NFT 1N (GRT-240050)

Live Line:

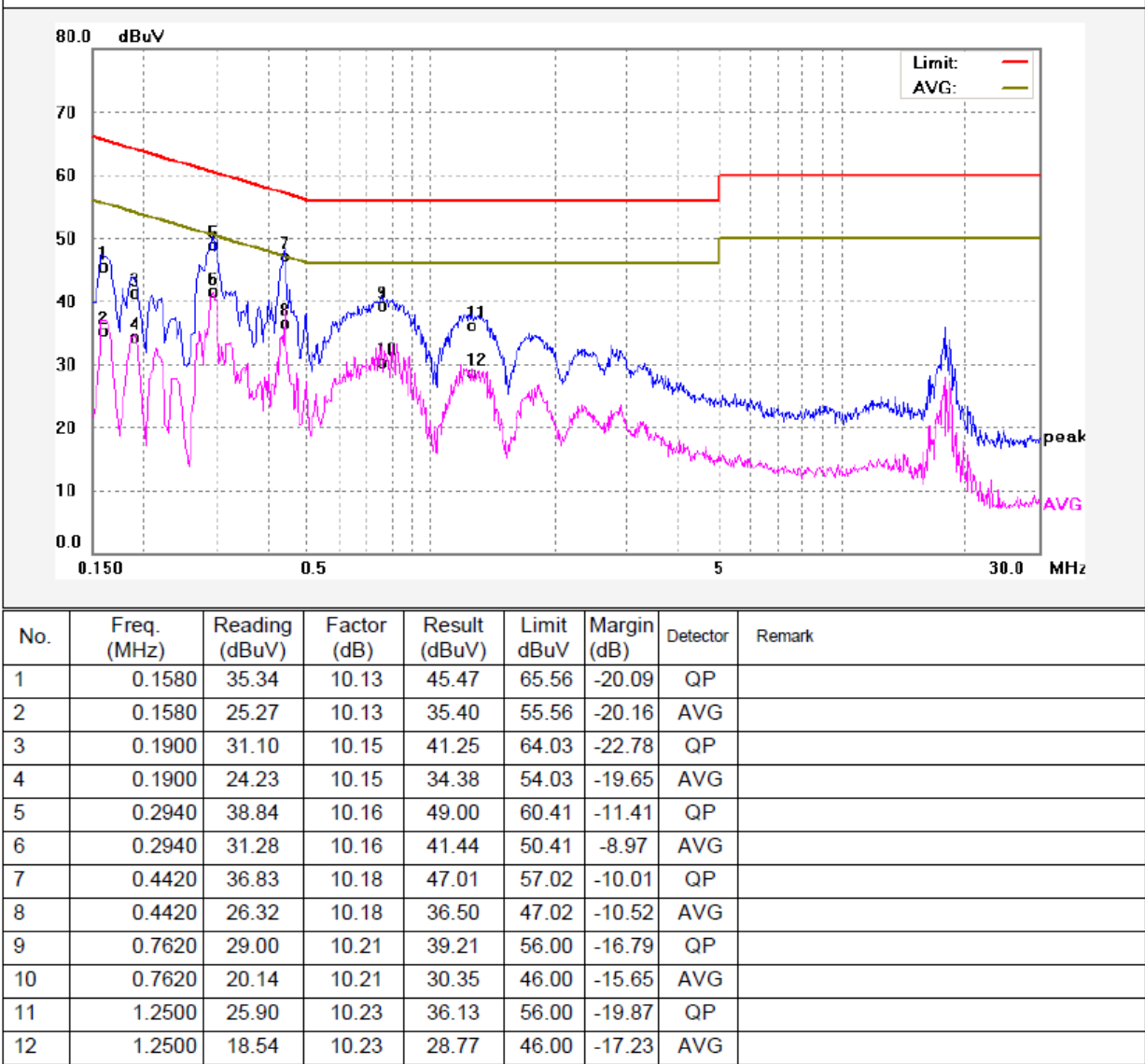


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1740	38.11	10.14	48.25	64.76	-16.51	QP	
2	0.1740	26.49	10.14	36.63	54.76	-18.13	AVG	
3	0.2580	41.11	10.16	51.27	61.49	-10.22	QP	
4	0.2580	33.39	10.16	43.55	51.49	-7.94	AVG	
5	0.2660	40.61	10.16	50.77	61.24	-10.47	QP	
6	0.2660	27.99	10.16	38.15	51.24	-13.09	AVG	
7	0.4940	30.58	10.19	40.77	56.10	-15.33	QP	
8	0.4940	24.38	10.19	34.57	46.10	-11.53	AVG	
9	0.8460	28.57	10.21	38.78	56.00	-17.22	QP	
10	0.8460	21.57	10.21	31.78	46.00	-14.22	AVG	
11	1.2420	27.24	10.23	37.47	56.00	-18.53	QP	
12	1.2420	19.80	10.23	30.03	46.00	-15.97	AVG	

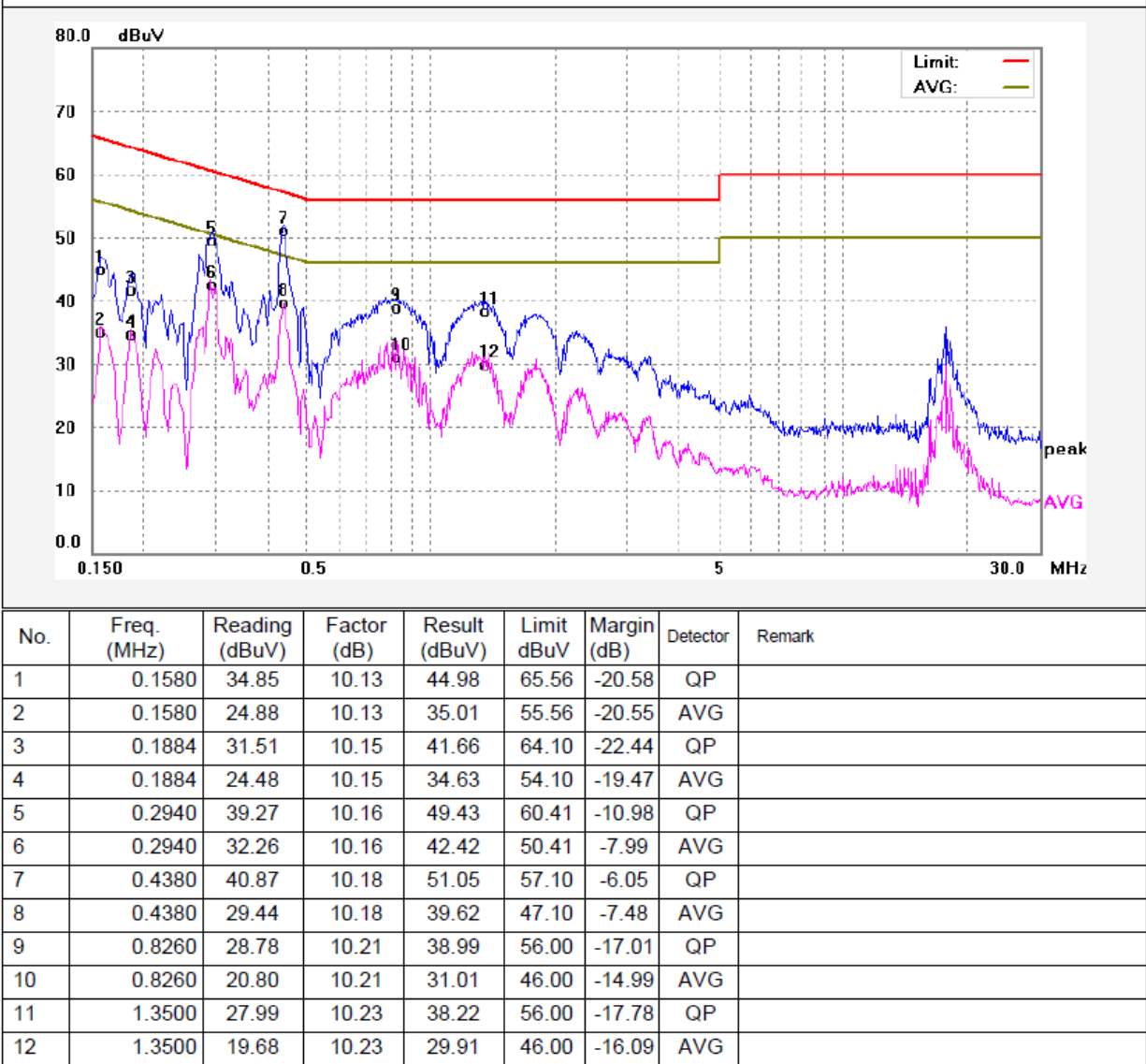
Neutral Line:



Model: NFT 1N AF
Live Line:



Neutral Line:



5.2 Radiation Emission, 30MHz to 1000MHz

Test Requirement : FCC PART 15, SUBPART B
 Test Method : ANSI C63.4
 Test Result : Pass
 Frequency Range : 30MHz to 1000MHz
 Class. : Class B
 Limit..... :

Frequency (MHz)	Distance (Meter)	Limit (dB μ V/m Quasi-pea)
30 to 88	3	40
88 to 216	3	43.5
216 to 960	3	46
960 to 1000	3	54

5.2.1 E.U.T. Operation

Operating Environment:

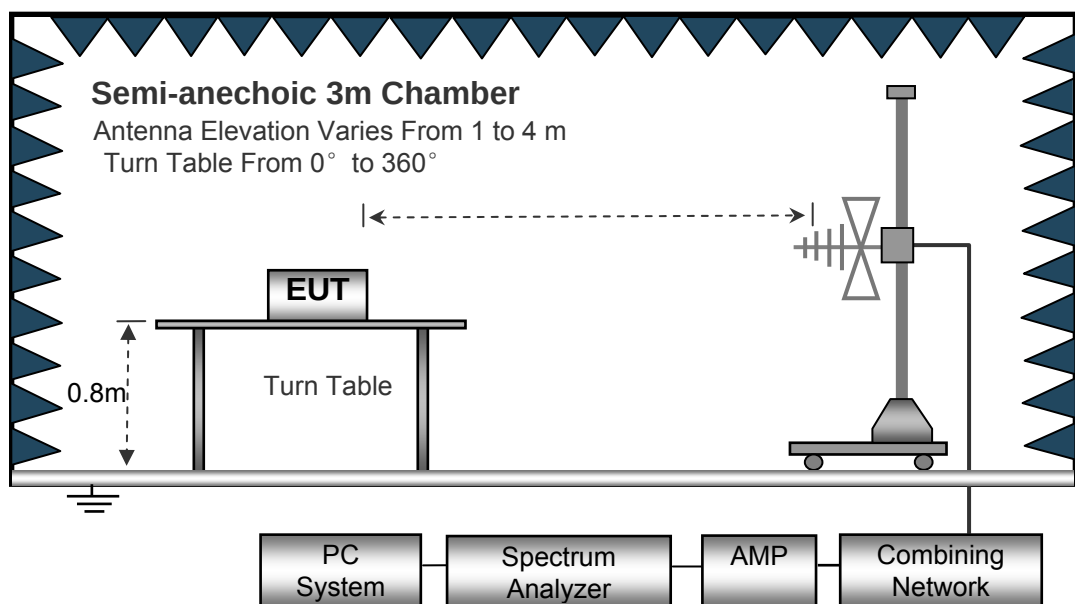
Temperature : 22.5°C
 Humidity : 52.6%RH
 Atmospheric Pressure..... : 101.2kPa

EUT Operation:

Input Voltage..... : AC 120V/60Hz
 Operating Mode : Transmitting
 Remark : The worst case is Transmitting mode and the data is shown as follow.

5.2.2 Block Diagram of Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4.



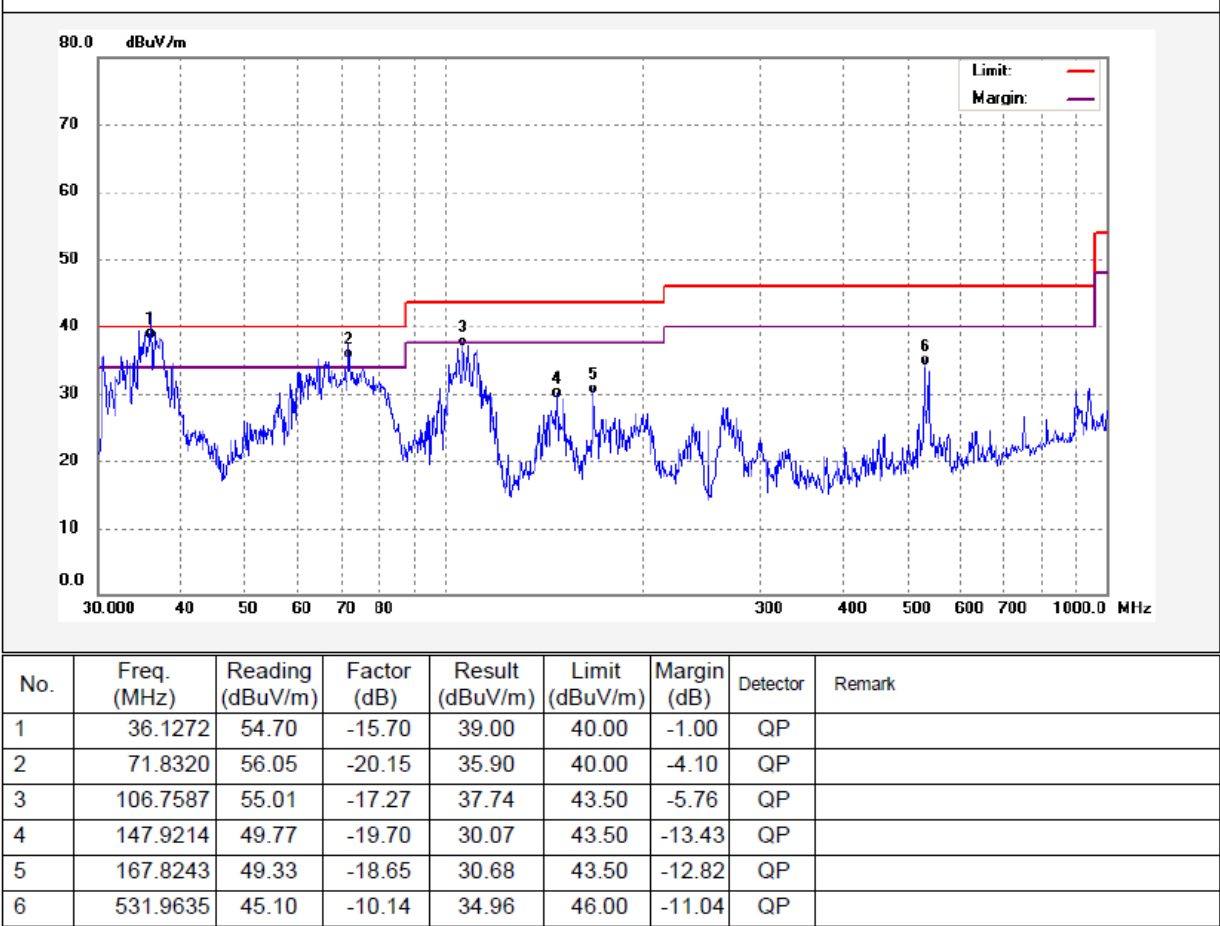
5.2.3 Measurement Data

The maximised peak emissions from the EUT was scanned and measured for both the Antenna Vertical Polarization and Antenna Horizontal Polarization. Quasi-peak measurements were performed if peak emissions were within 6dB of the Quasi-peak limit line.

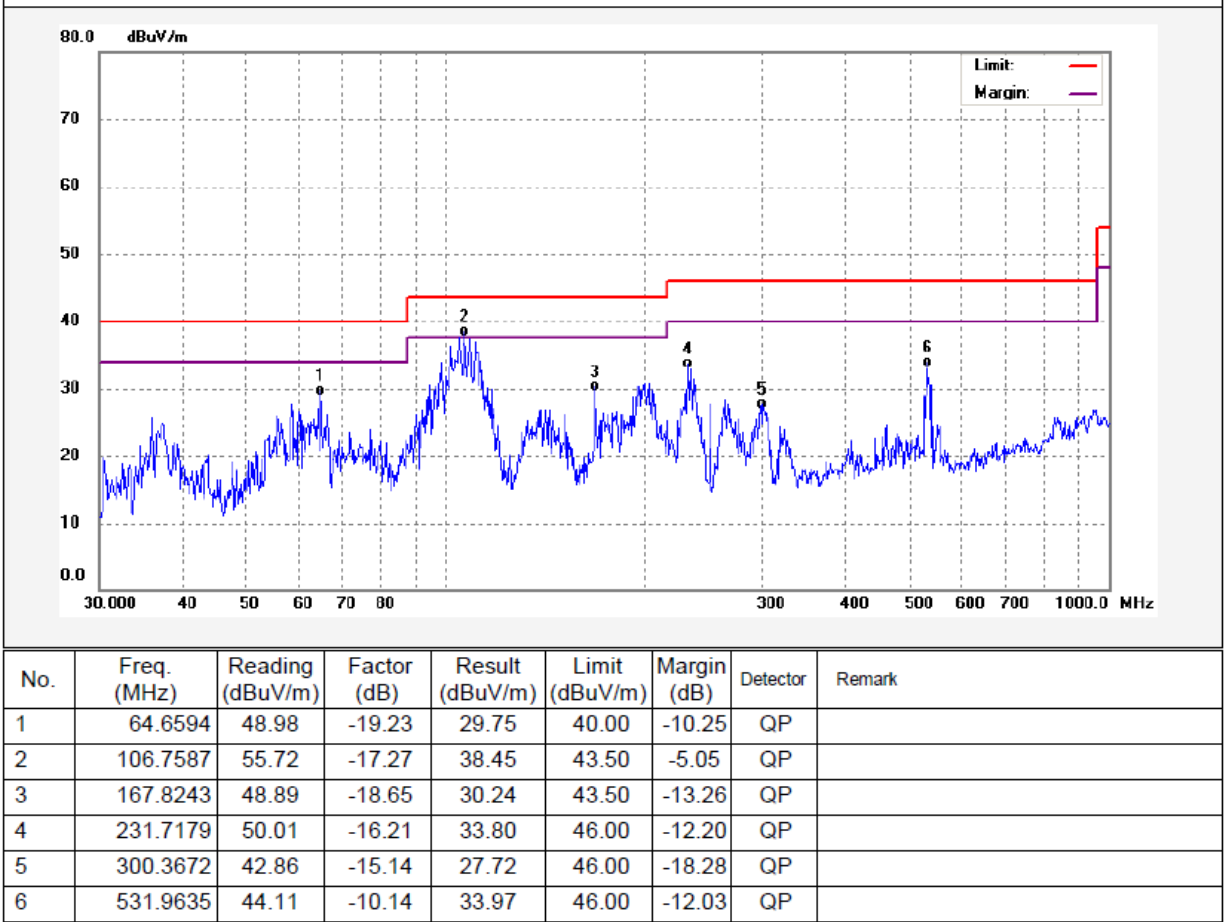
5.2.4 Radiated Emission Test Data, 30MHz to 1000MHz

Model : NFT 1N (AY012E-ZF243)

Antenna Polarization: Vertical

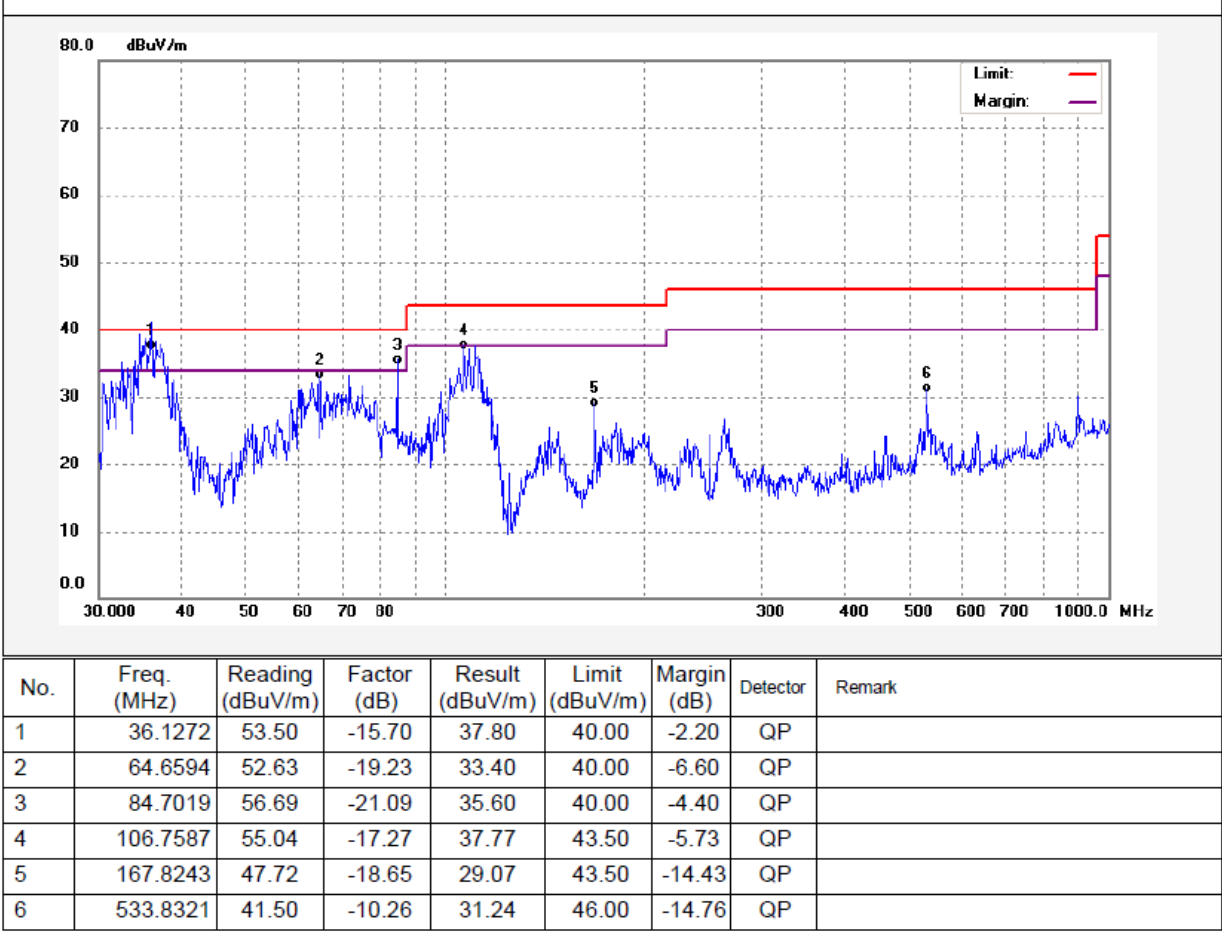


Antenna Polarization: Horizontal

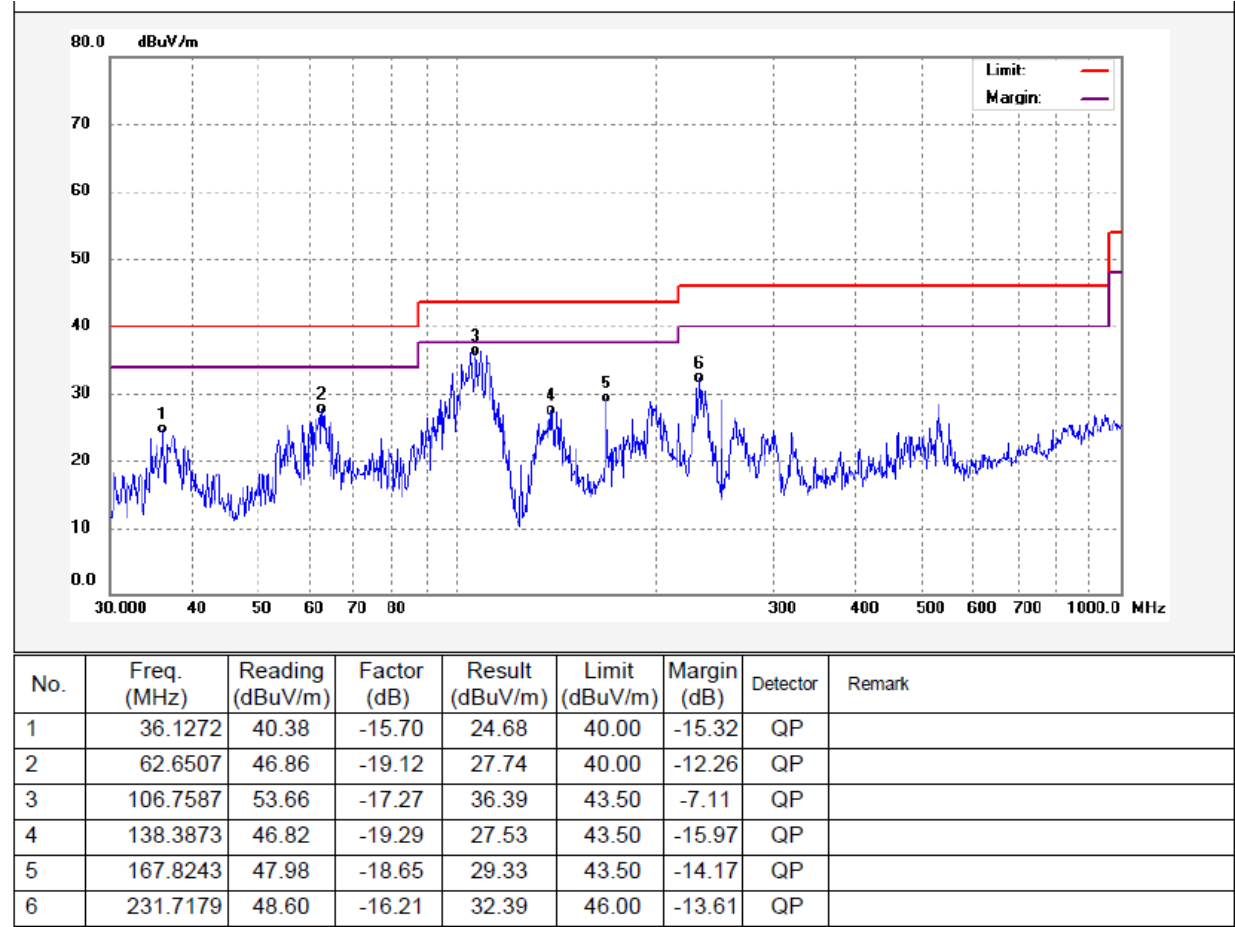


Model : NFT 1N (GRT-240050)

Antenna Polarization: Vertical

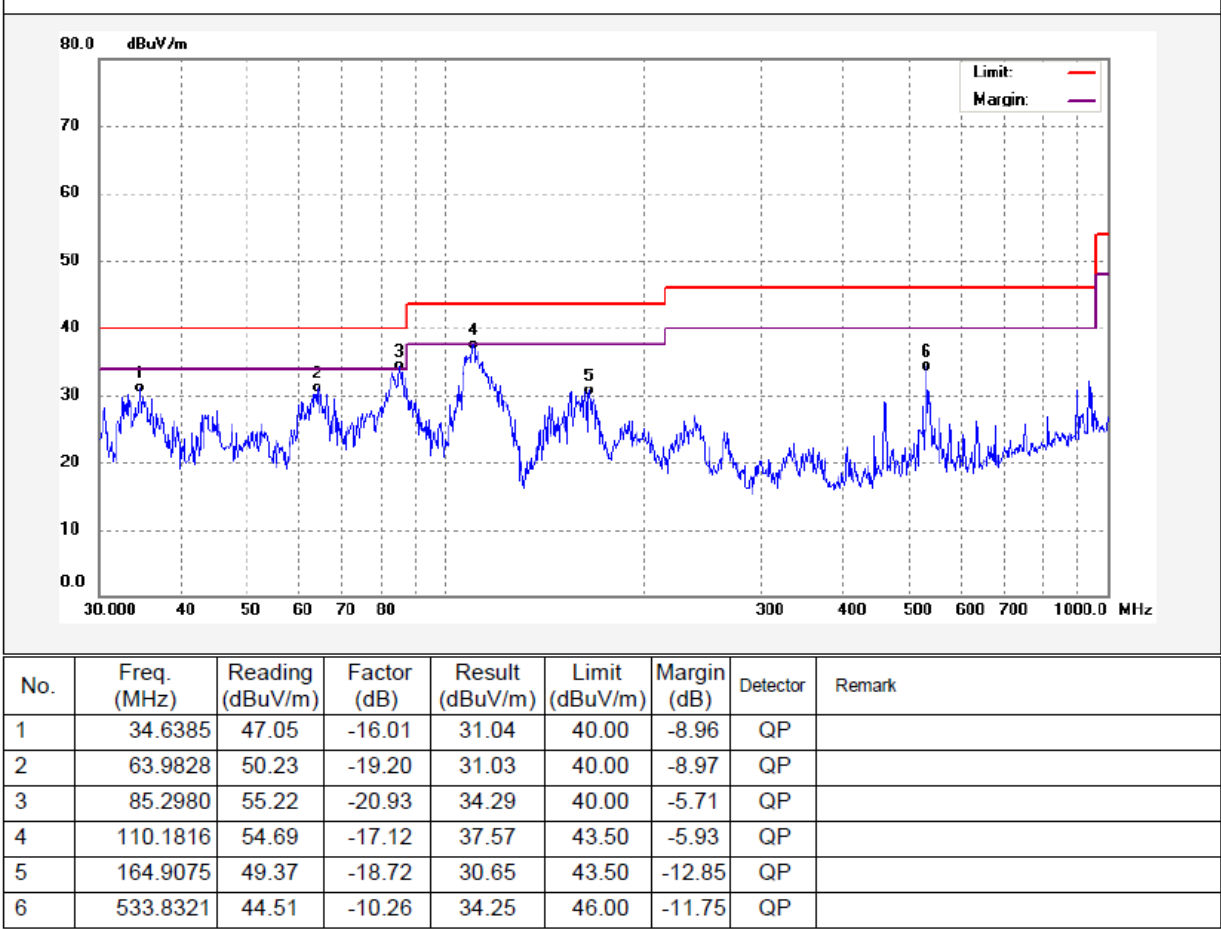


Antenna Polarization: Horizontal

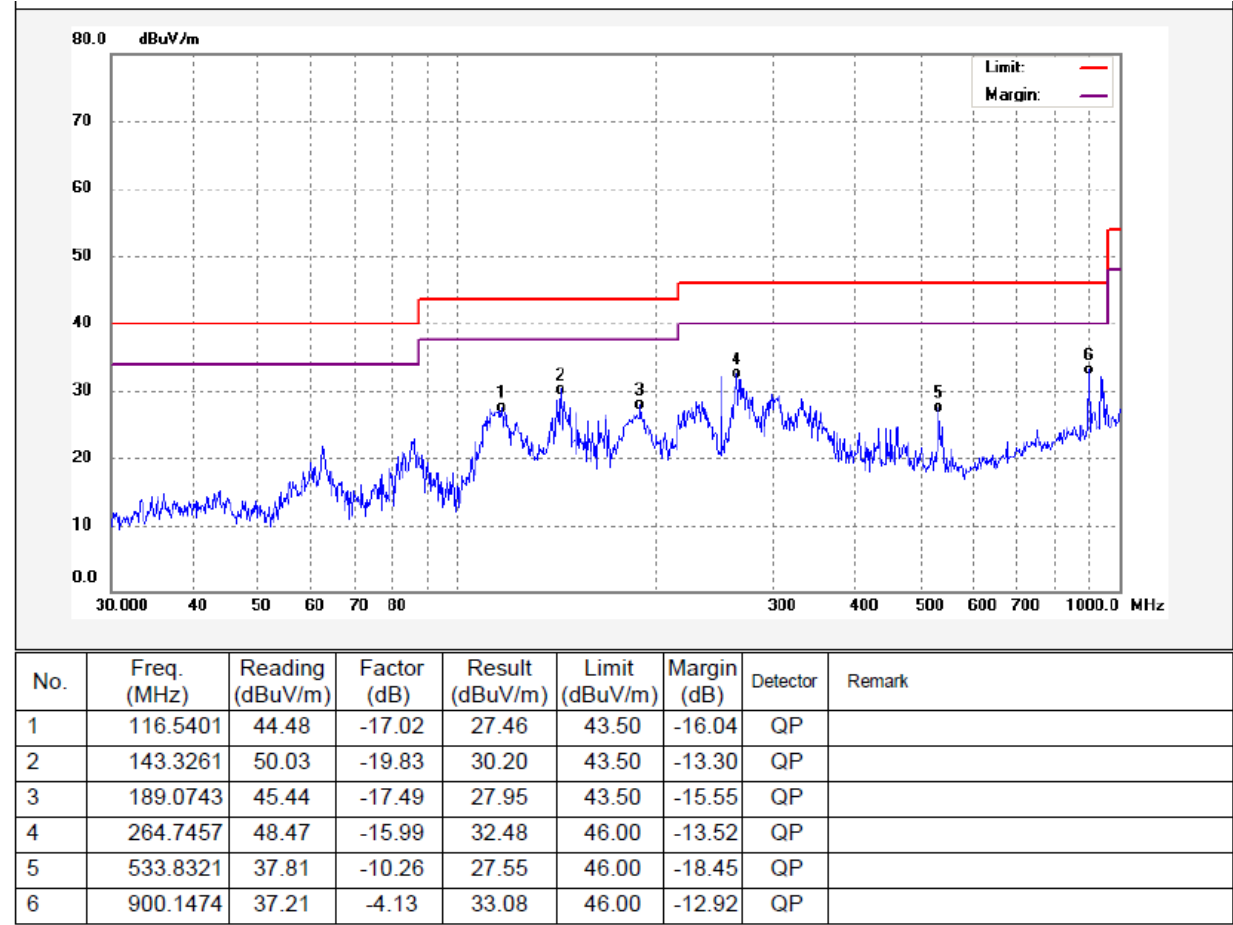


Model : NFT 1N AF

Antenna Polarization: Vertical



Antenna Polarization: Horizontal



5.3 Radiation Emission, Above 1000MHz

Test Requirement : FCC PART 15, SUBPART B
 Test Method : ANSI C63.4
 Test Result..... : Pass
 Frequency Range : 1GHz~6GHz
 Class. : Class B
 Limit. :

Frequency Range (MHz)	Distance (Meter)	Average Limit dB(uV/m)	Peak Limit (dBUV/m)
Above 1GHz	3	54	74

5.3.1 E.U.T. Operation

Operating Environment:

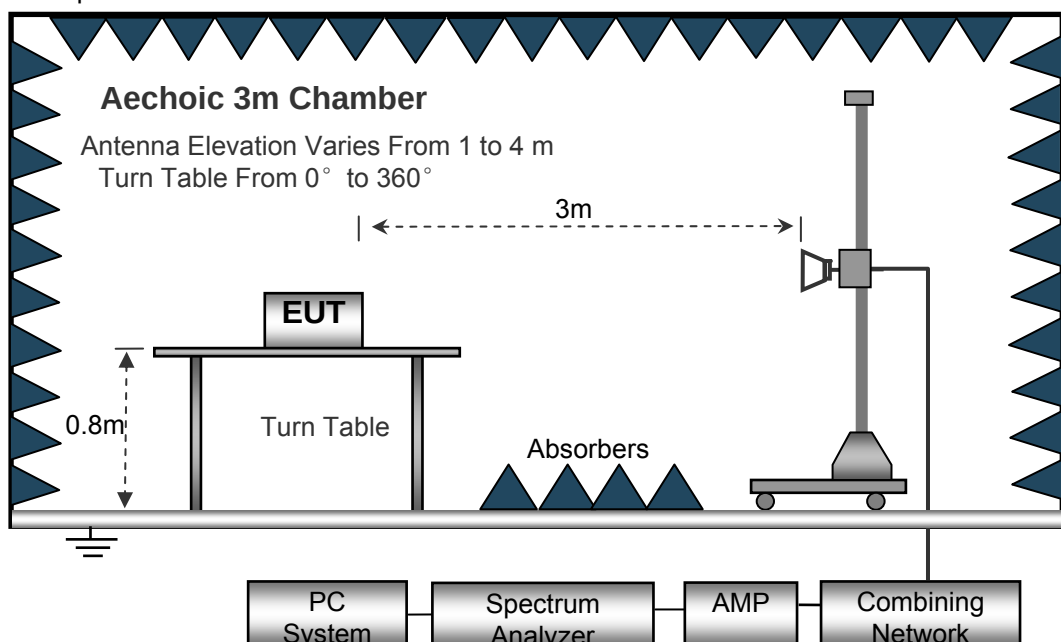
Temperature..... : 22.4°C
 Humidity : 52.3%RH
 Atmospheric Pressure..... : 101.3kPa

EUT Operation:

Input Voltage : AC 120V/60Hz
 Operating Mode : Transmitting
 Remark..... : The worst case is Transmitting mode and the data is shown as follow.

5.3.2 Block Diagram of Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4.



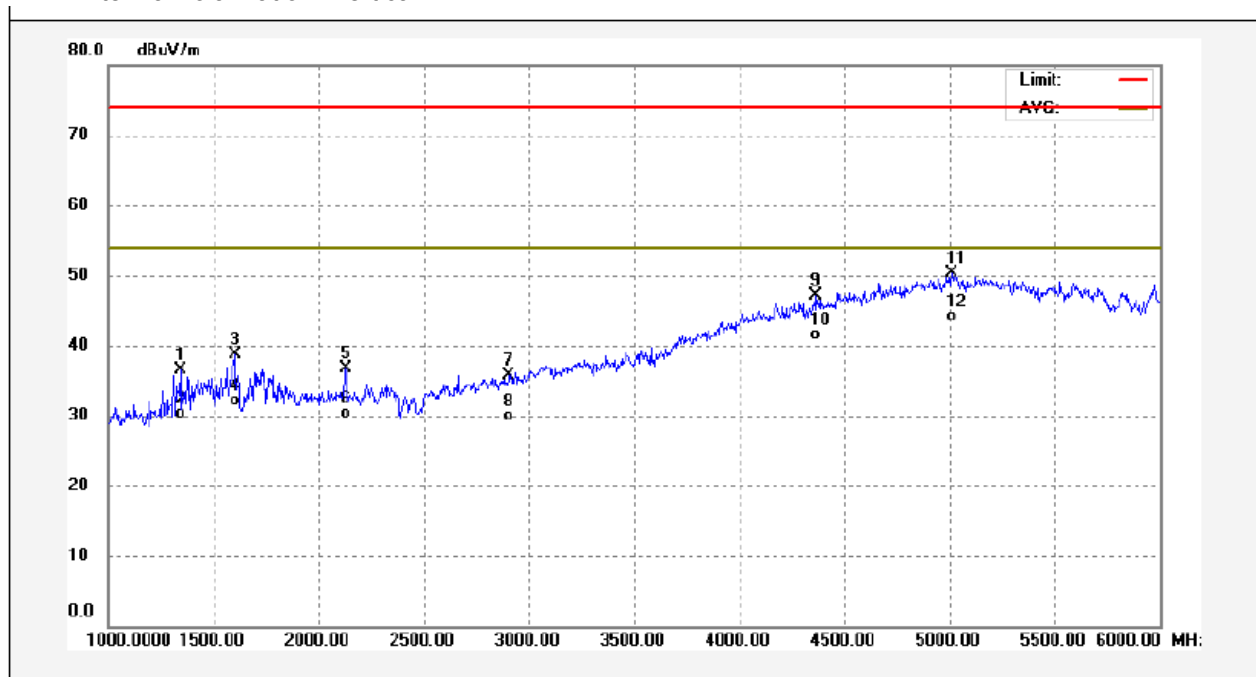
5.3.3 Measurement Data

The maximised peak emissions from the EUT was scanned and measured for both the Antenna Vertical Polarization and Antenna Horizontal Polarization. Average measurements were performed if peak emissions were within 6dB of the average limit line

5.3.4 Radiated Emission Test Data, Above 1000MHz

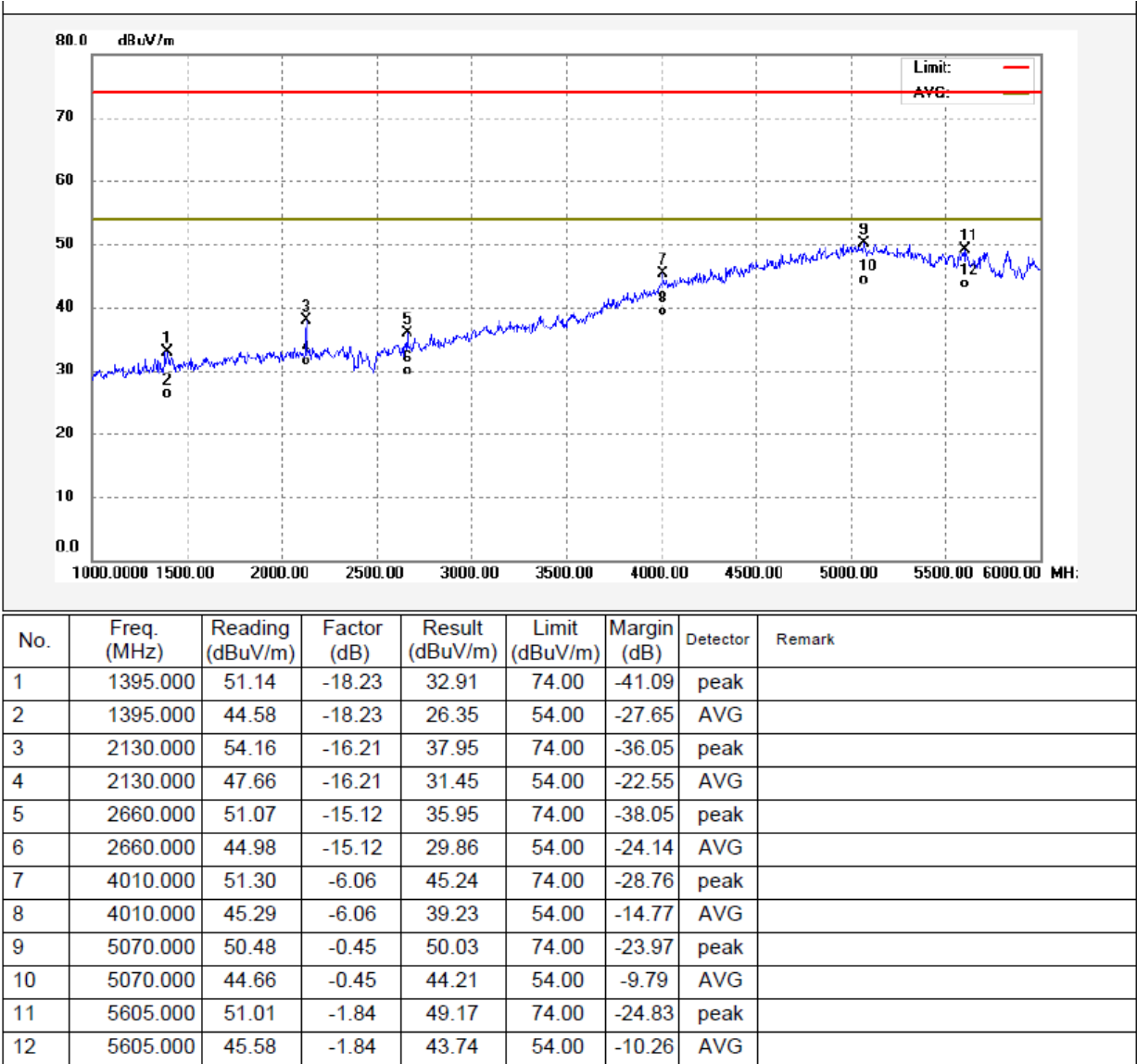
Model: NFT 1N (AY012E-ZF243)

Antenna Polarization: Vertical



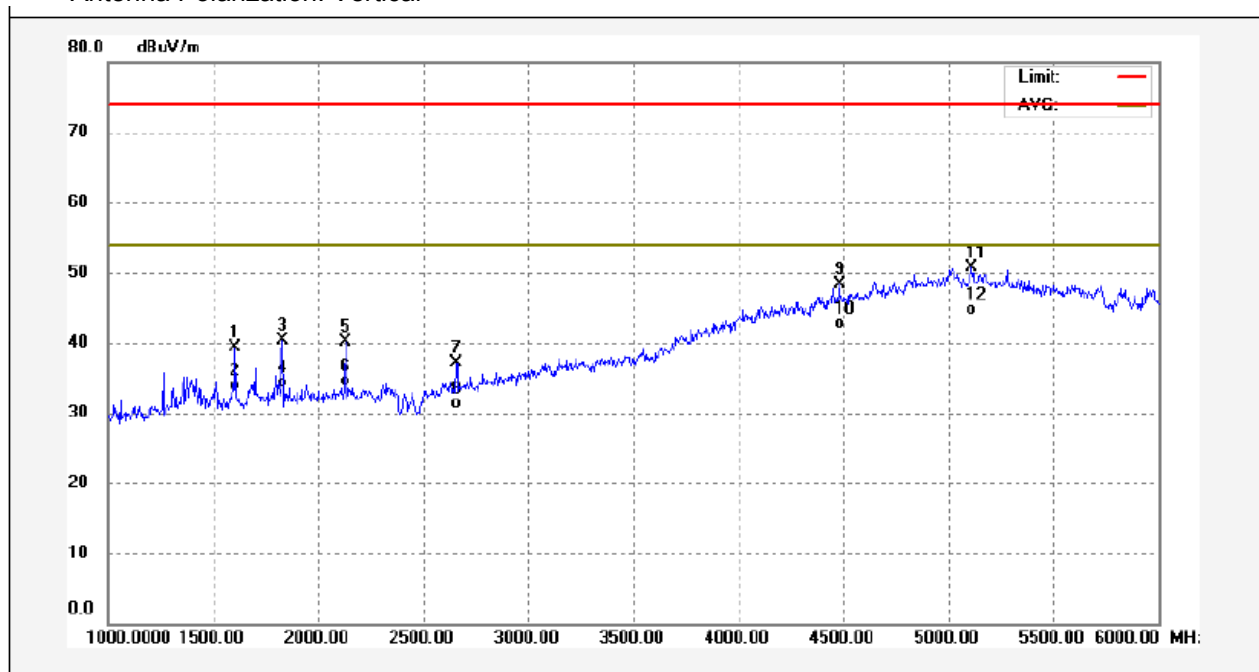
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1340.000	54.98	-18.42	36.56	74.00	-37.44	peak	
2	1340.000	48.68	-18.42	30.26	54.00	-23.74	AVG	
3	1600.000	56.34	-17.57	38.77	74.00	-35.23	peak	
4	1600.000	49.59	-17.57	32.02	54.00	-21.98	AVG	
5	2130.000	52.93	-16.21	36.72	74.00	-37.28	peak	
6	2130.000	46.46	-16.21	30.25	54.00	-23.75	AVG	
7	2905.000	49.64	-13.89	35.75	74.00	-38.25	peak	
8	2905.000	43.87	-13.89	29.98	54.00	-24.02	AVG	
9	4365.000	50.97	-3.94	47.03	74.00	-26.97	peak	
10	4365.000	45.41	-3.94	41.47	54.00	-12.53	AVG	
11	5010.000	50.59	-0.28	50.31	74.00	-23.69	peak	
12	5010.000	44.31	-0.28	44.03	54.00	-9.97	AVG	

Antenna Polarization: Horizontal



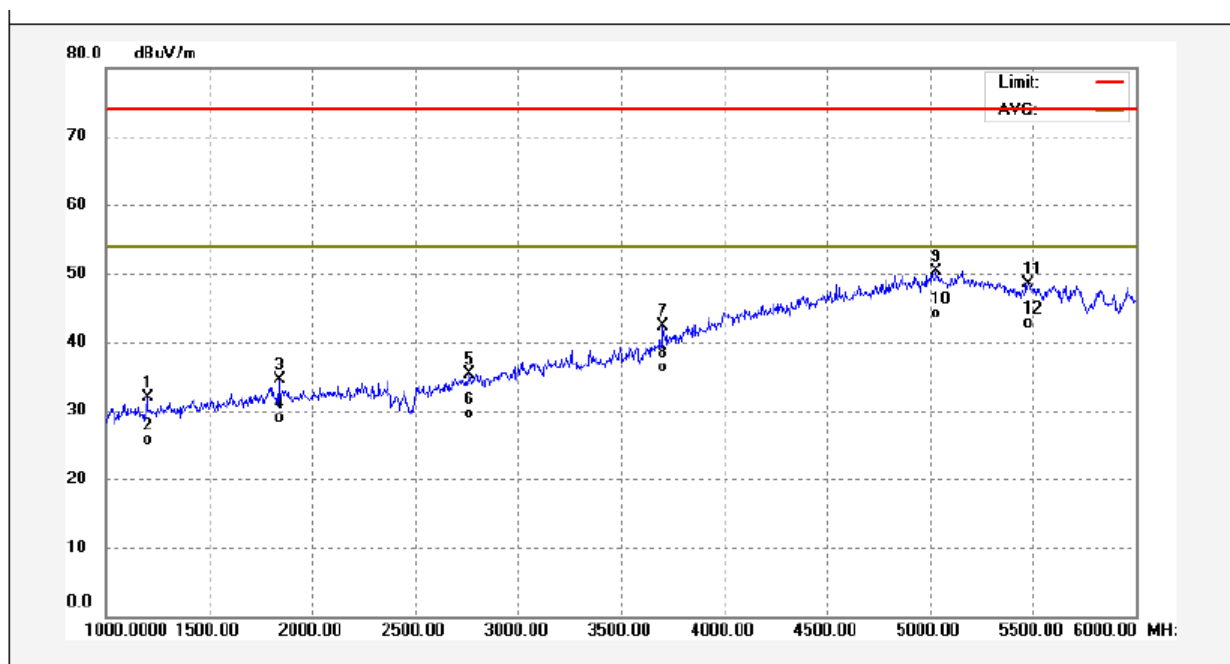
Model: NFT 1N (GRT-240050)

Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1605.000	56.88	-17.56	39.32	74.00	-34.68	peak	
2	1605.000	51.45	-17.56	33.89	54.00	-20.11	AVG	
3	1830.000	57.16	-16.85	40.31	74.00	-33.69	peak	
4	1830.000	51.06	-16.85	34.21	54.00	-19.79	AVG	
5	2130.000	56.36	-16.21	40.15	74.00	-33.85	peak	
6	2130.000	50.77	-16.21	34.56	54.00	-19.44	AVG	
7	2655.000	52.20	-15.14	37.06	74.00	-36.94	peak	
8	2655.000	46.42	-15.14	31.28	54.00	-22.72	AVG	
9	4480.000	51.65	-3.26	48.39	74.00	-25.61	peak	
10	4480.000	45.89	-3.26	42.63	54.00	-11.37	AVG	
11	5110.000	51.38	-0.58	50.80	74.00	-23.20	peak	
12	5110.000	45.27	-0.58	44.69	54.00	-9.31	AVG	

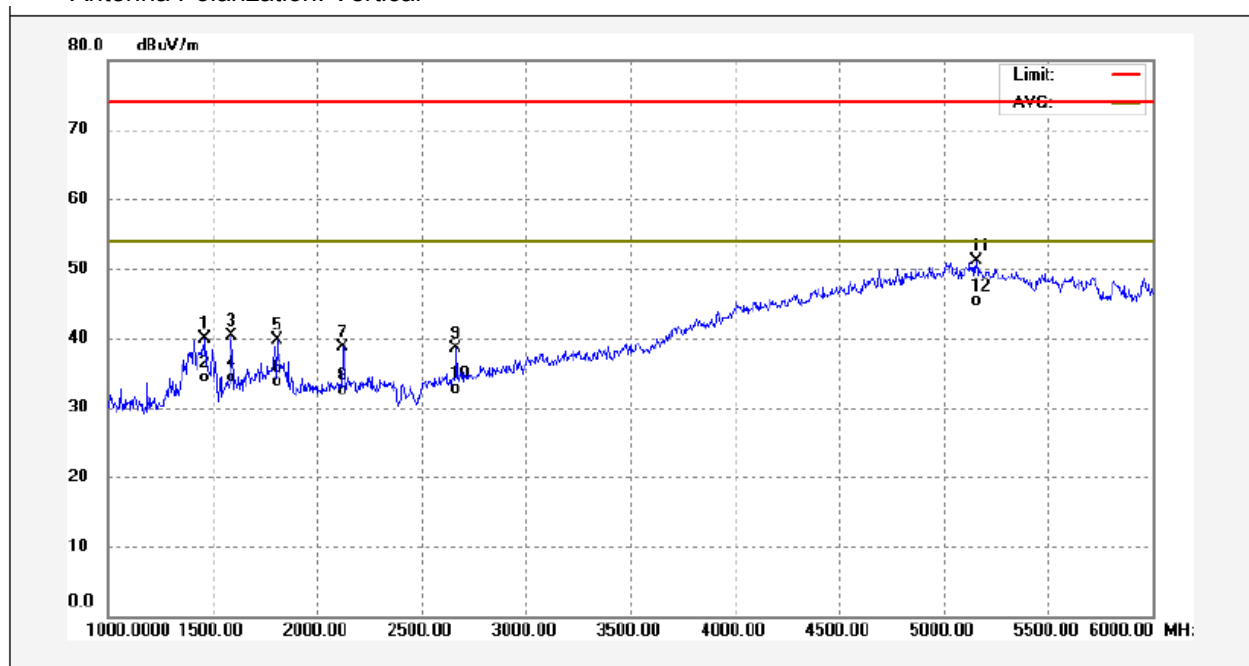
Antenna Polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1200.000	50.79	-18.88	31.91	74.00	-42.09	peak	
2	1200.000	44.50	-18.88	25.62	54.00	-28.38	AVG	
3	1840.000	51.36	-16.82	34.54	74.00	-39.46	peak	
4	1840.000	45.78	-16.82	28.96	54.00	-25.04	AVG	
5	2765.000	49.95	-14.58	35.37	74.00	-38.63	peak	
6	2765.000	44.05	-14.58	29.47	54.00	-24.53	AVG	
7	3705.000	51.51	-9.30	42.21	74.00	-31.79	peak	
8	3705.000	45.62	-9.30	36.32	54.00	-17.68	AVG	
9	5030.000	50.69	-0.33	50.36	74.00	-23.64	peak	
10	5030.000	44.38	-0.33	44.05	54.00	-9.95	AVG	
11	5475.000	50.23	-1.67	48.56	74.00	-25.44	peak	
12	5475.000	44.30	-1.67	42.63	54.00	-11.37	AVG	

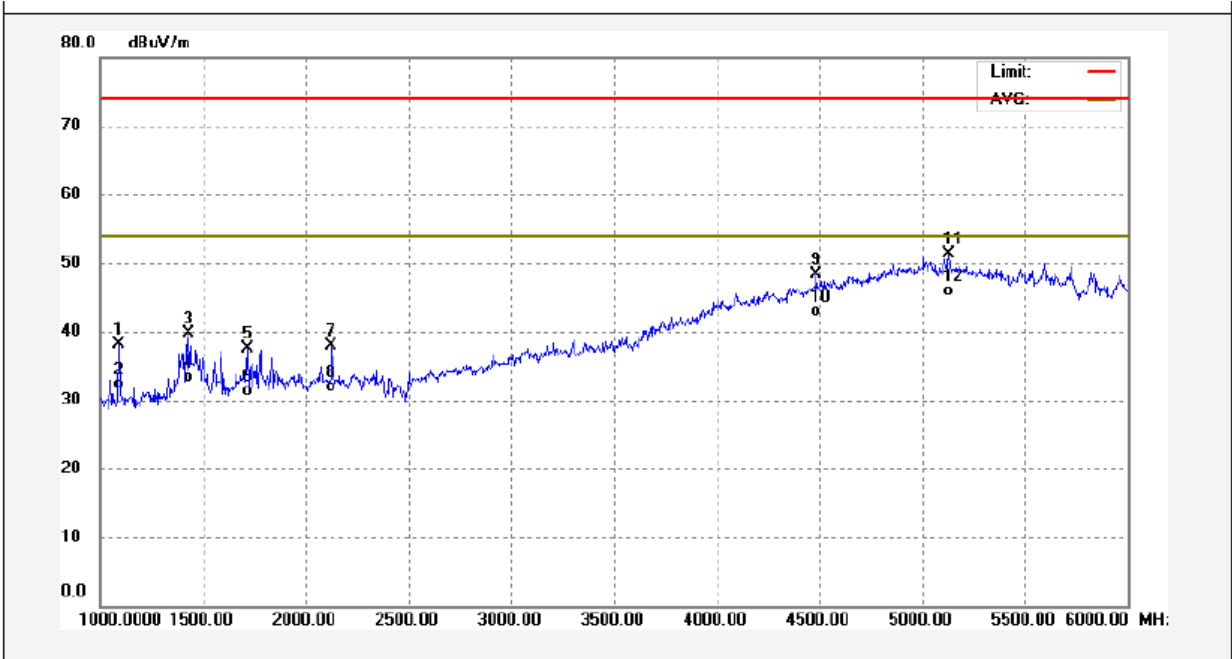
Model: NFT 1N AF

Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1465.000	58.00	-18.00	40.00	74.00	-34.00	peak	
2	1465.000	52.25	-18.00	34.25	54.00	-19.75	AVG	
3	1590.000	57.99	-17.60	40.39	74.00	-33.61	peak	
4	1590.000	51.88	-17.60	34.28	54.00	-19.72	AVG	
5	1810.000	56.57	-16.92	39.65	74.00	-34.35	peak	
6	1810.000	50.53	-16.92	33.61	54.00	-20.39	AVG	
7	2125.000	54.97	-16.22	38.75	74.00	-35.25	peak	
8	2125.000	48.80	-16.22	32.58	54.00	-21.42	AVG	
9	2665.000	53.58	-15.08	38.50	74.00	-35.50	peak	
10	2665.000	47.77	-15.08	32.69	54.00	-21.31	AVG	
11	5155.000	51.73	-0.71	51.02	74.00	-22.98	peak	
12	5155.000	45.92	-0.71	45.21	54.00	-8.79	AVG	

Antenna Polarization: Horizontal



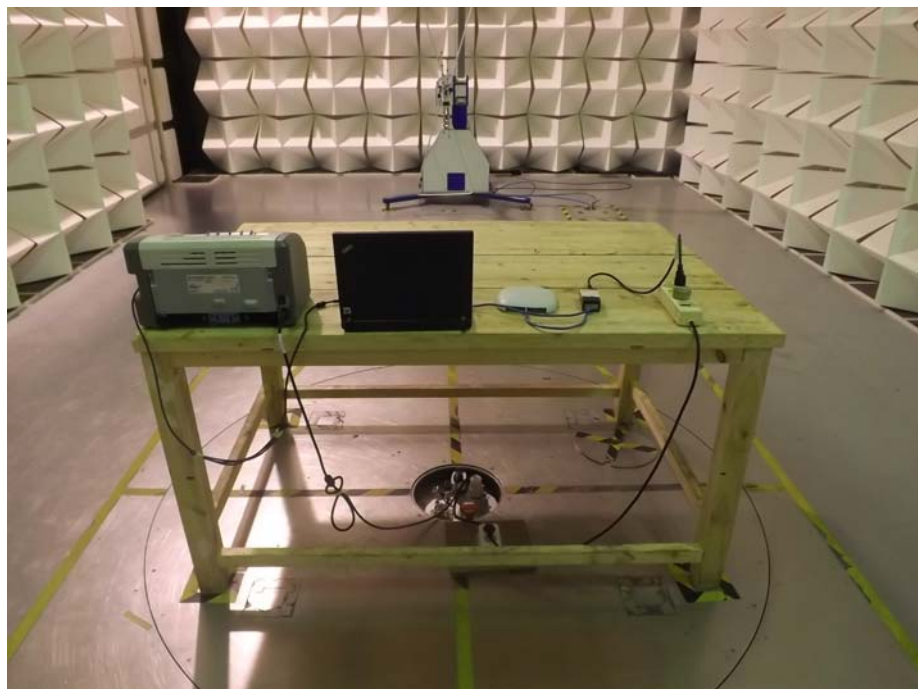
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	1090.000	57.40	-19.26	38.14	74.00	-35.86	peak	
2	1090.000	51.50	-19.26	32.24	54.00	-21.76	AVG	
3	1430.000	57.78	-18.12	39.66	74.00	-34.34	peak	
4	1430.000	51.48	-18.12	33.36	54.00	-20.64	AVG	
5	1715.000	54.81	-17.22	37.59	74.00	-36.41	peak	
6	1715.000	48.50	-17.22	31.28	54.00	-22.72	AVG	
7	2125.000	54.12	-16.22	37.90	74.00	-36.10	peak	
8	2125.000	48.09	-16.22	31.87	54.00	-22.13	AVG	
9	4485.000	51.53	-3.22	48.31	74.00	-25.69	peak	
10	4485.000	46.18	-3.22	42.96	54.00	-11.04	AVG	
11	5130.000	51.93	-0.63	51.30	74.00	-22.70	peak	
12	5130.000	46.50	-0.63	45.87	54.00	-8.13	AVG	

6 Photographs – Test Setup

6.1 Photograph –Power Line Conducted Emission Test Setup at Test Site 2#



6.2 Photograph – Radiated Emission Test Setup for 30~1000MHz at Test Site 2#



6.3 Photograph – Radiated Emission Test Setup for Above 1GHz at Test Site 1#

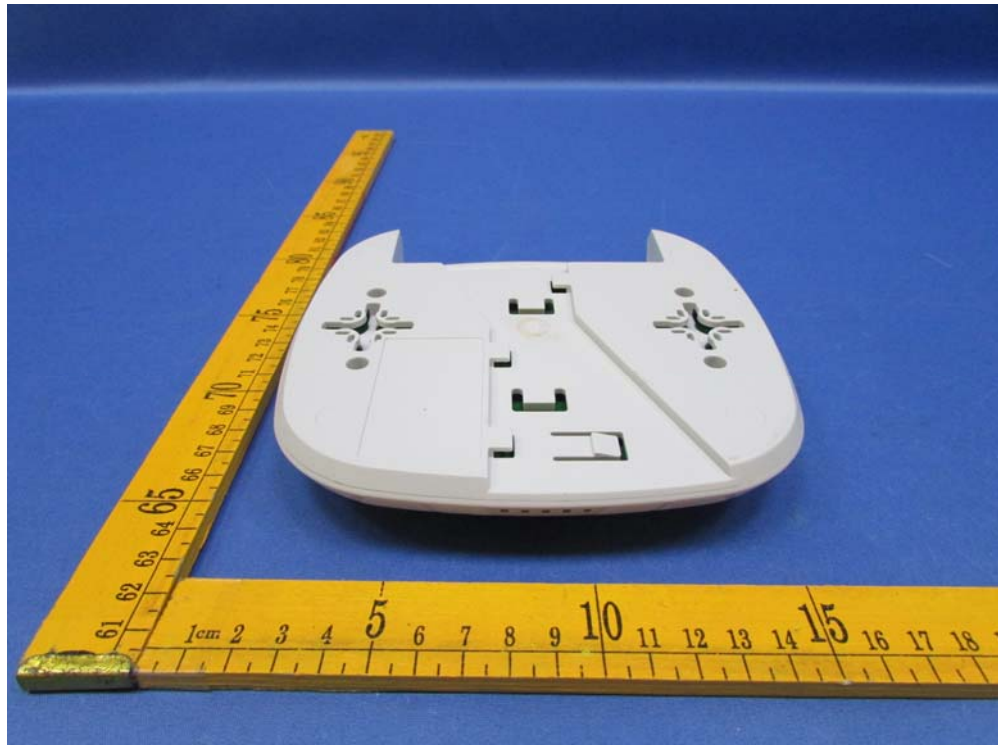


7 EUT – Constructional Details

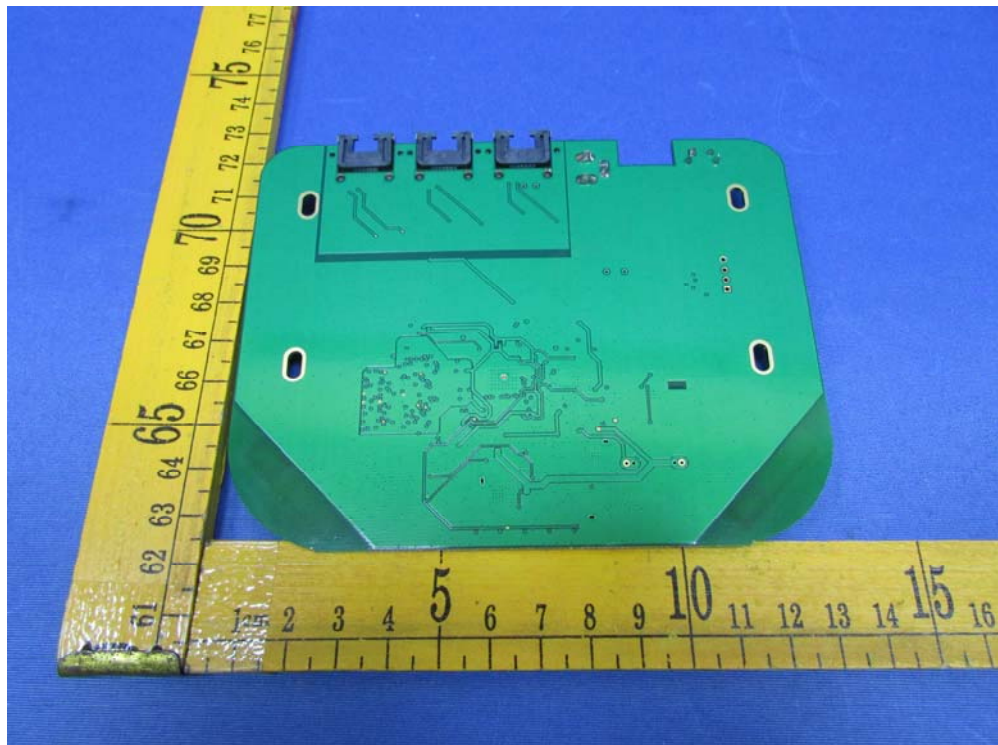
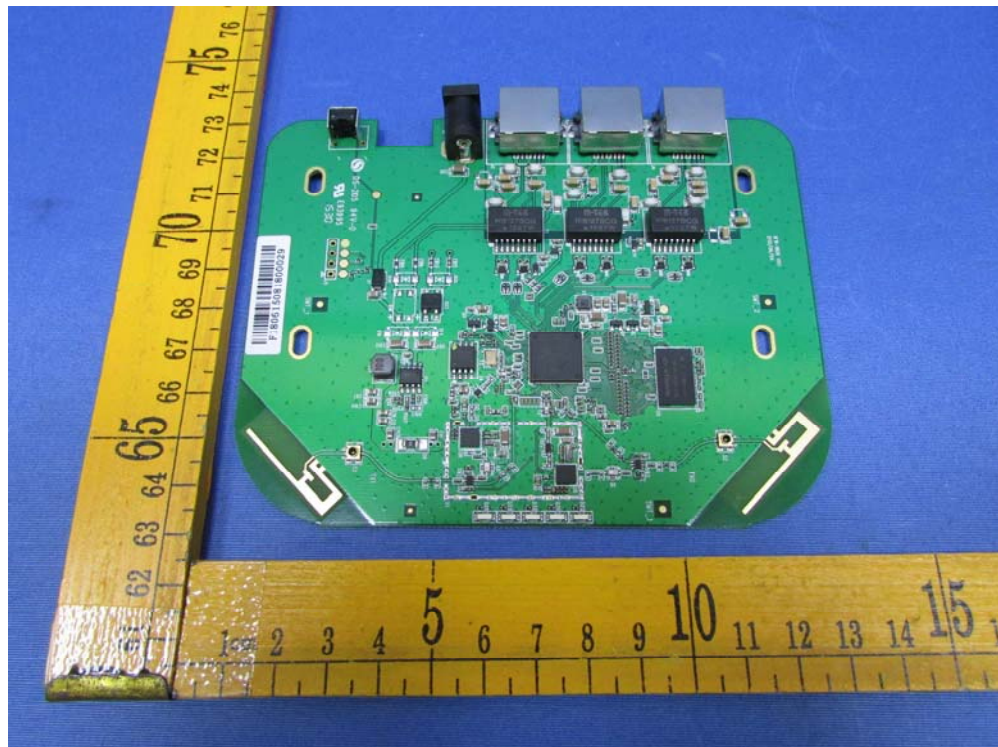






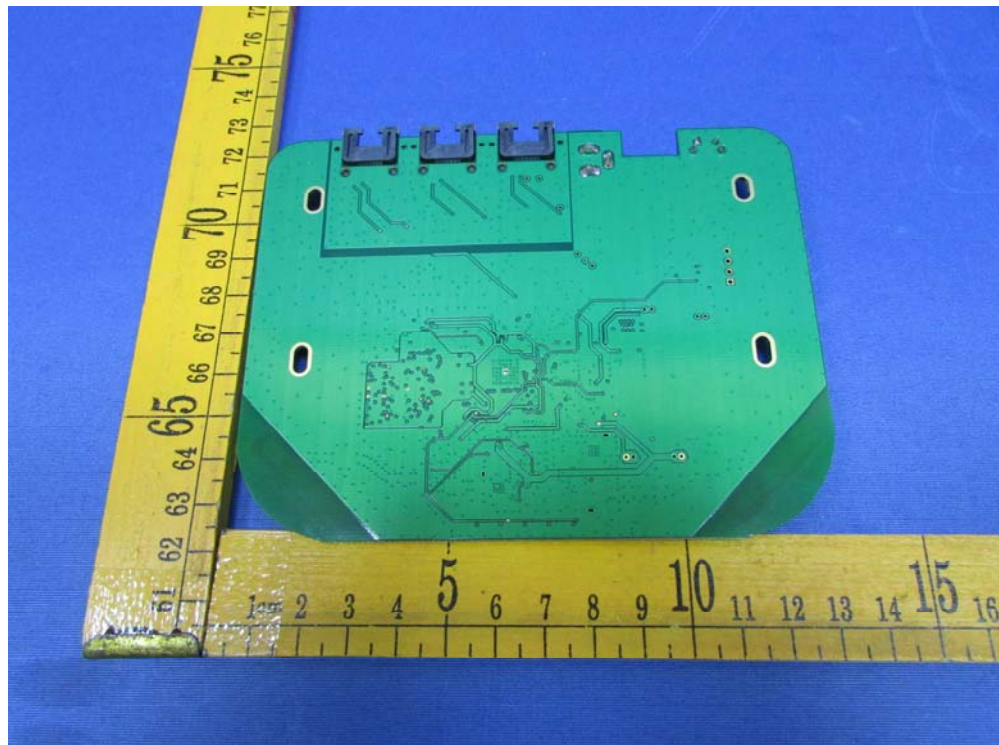
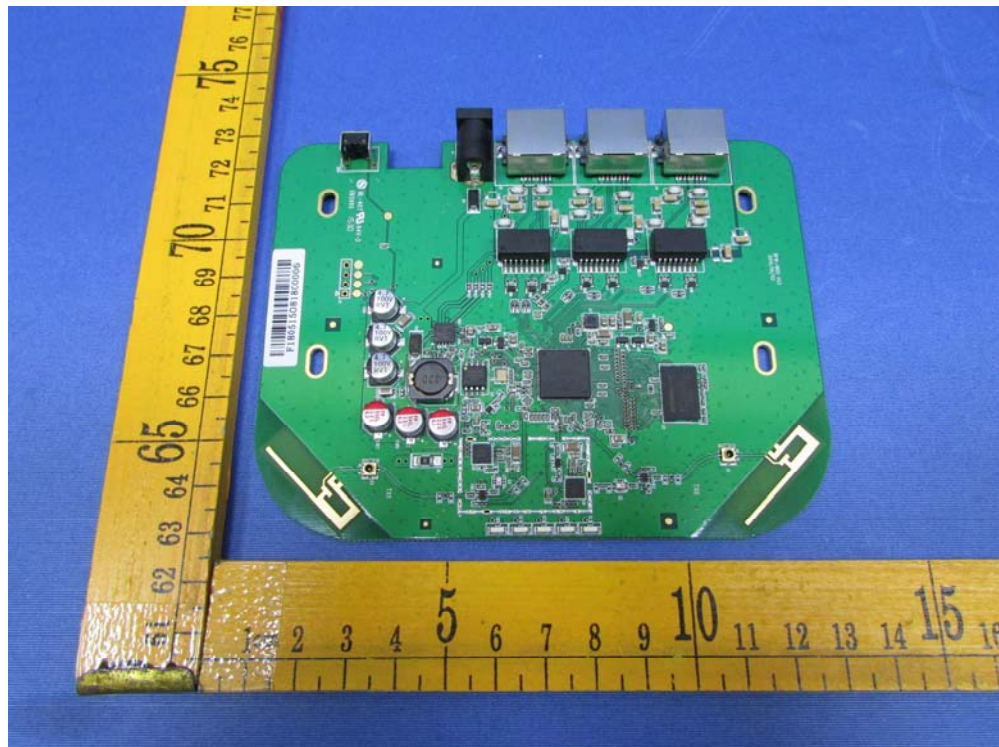


NFT 1N:





NFT 1N AF:



=====End of Report=====