

FCC RF Test Report

(NFC)

Applicant: Inepro BV

Address of Applicant: Pondweg 7, 2153 PK Nieuw-Vennep, The Netherlands

Equipment Under Test (EUT)

Product Name: Red Spider

Model No.: Red Spider HF

Trade Mark: Red Spider

FCC ID: 2AFBFRSHF01

Applicable Standards: FCC CFR Title 47 Part 15C (§15.225)

Date of Sample Receipt: 08 Sep., 2022

Date of Test: 09 Sep., to 02 Nov., 2022

Date of Report Issue: 15 Dec., 2022

Test Result: PASS

Tested by:
_____**Date:**15 Dec., 2022
_____**Reviewed by:**
_____**Date:**15 Dec., 2022
_____**Approved by:**
_____**Date:**15 Dec., 2022

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in above the application standard version. Test results reported herein relate only to the item(s) tested.

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1 Version

Version No.	Date	Description
00	08 Nov., 2022	Original
01	15 Dec., 2022	1. Updated page 1 2. Updated section 3.5, 4.1

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3 General Information

3.1 Client Information

Applicant:	Inepro BV
Address:	Pondweg 7, 2153 PK Nieuw-Vennep, The Netherlands
Manufacturer/Factory:	Inepro BV
Address:	Pondweg 7, 2153 PK Nieuw-Vennep, The Netherlands

3.2 General Description of E.U.T.

Product Name:	Red Spider
Model No.:	Red Spider HF
Operation Frequency:	13.56MHz
Channel Numbers:	1
Modulation Type:	ASK
Antenna Type:	Internal Antenna
Power Supply:	DC 5V
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

3.3 Test Mode and Environment

Test Mode:	
Transmitting mode:	Keep the EUT in transmitting mode with modulation
Remark: Pre-scan The EUT was placed on three different polar directions tested: i.e. X axis, Y axis, Z axis, and found Y axis was worse case, so the report only reflects the worse axis tested data.	
Operating Environment:	
Temperature:	15°C ~ 35°C
Humidity:	20 % ~ 75 % RH
Atmospheric Pressure:	1008 mbar

3.4 Description of Test Auxiliary Equipment

Manufacturer	Description	Model	Serial Number	FCC ID/DoC
N/A	N/A	N/A	N/A	N/A

3.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Conducted Emission for LISN (9kHz ~ 150kHz)	1.9 dB
Conducted Emission for LISN (150kHz ~ 30MHz)	2.6 dB
Radiated Emission (9kHz ~ 30MHz) (3m SAC)	3.2 dB
Radiated Emission (30MHz ~ 1GHz) (3m SAC)	3.8 dB
Radiated Emission (1GHz ~ 18GHz) (3m SAC)	3.6 dB
Note: All the measurement uncertainty value were shown with a coverage k=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.	

3.6 Additions to, Deviations, or Exclusions From the Method

No

3.7 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

● **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

● **CNAS - Registration No.: CNAS L15527**

JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.

● **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <https://portal.a2la.org/scopepdf/4346-01.pdf>

3.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.

Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.

Tel: +86-755-23118282, Fax: +86-755-23116366

Email: info-JYTee@lets.com, Website: <http://jyt.lets.com>

3.9 Test Instruments List

Radiated Emission(3m SAC):					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2024
Loop Antenna	Schwarzbeck	FMZB 1519 B	WXJ002-4	03-07-2022	03-06-2023
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	03-08-2022	03-07-2023
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	01-20-2022	01-19-2023
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	03-05-2022	03-04-2023
Coaxial Cable (9kHz ~ 30MHz)	JYT	JYT3M-1G-BB-5M	WXG001-6	01-20-2022	01-19-2023
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-20-2022	01-19-2023
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		
EMI Test Software	AUDIX	E3	Version: 6.110919b		

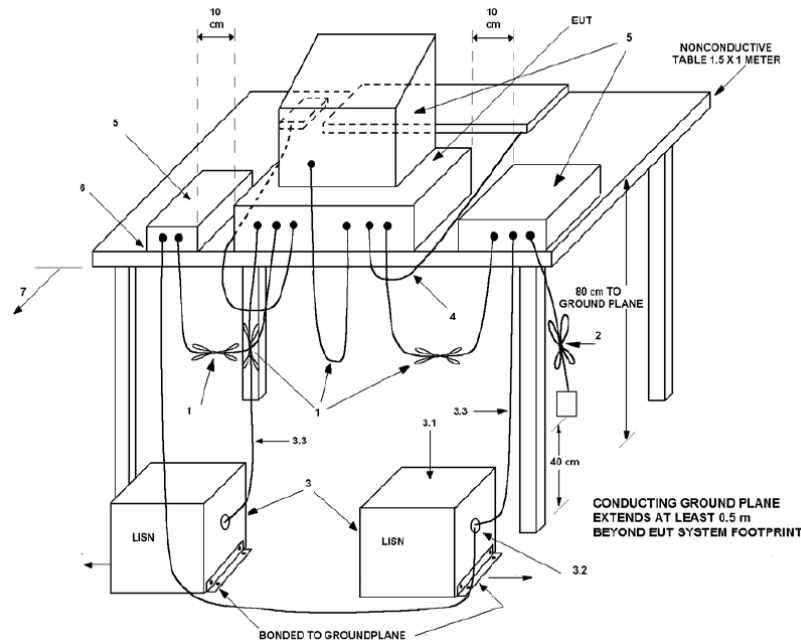
Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESR3	WXJ003-2	07-12-2022	07-11-2023
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	02-24-2022	02-23-2023
LISN	Rohde & Schwarz	ESH3-Z5	WXJ005-1	03-30-2022	03-29-2023
LISN Coaxial Cable (9kHz ~ 30MHz)	JYTSZ	JYTCE-1G-NN-2M	WXG003-1	02-24-2022	02-23-2023
RF Switch	TOP PRECISION	RSU0301	WXG003	N/A	
Test Software	AUDIX	E3	Version: 6.110919b		

Conducted Method:					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESCI 3	WXJ003	01-19-2022	01-18-2023
Spectrum analyzer	Rohde & Schwarz	FSP30	WXJ004	01-20-2022	01-19-2023
Spectrum Analyzer	Keysight	N9020B	WXJ081-1	06-29-2022	06-28-2023

4 Measurement Setup and Procedure

4.1 Test Setup

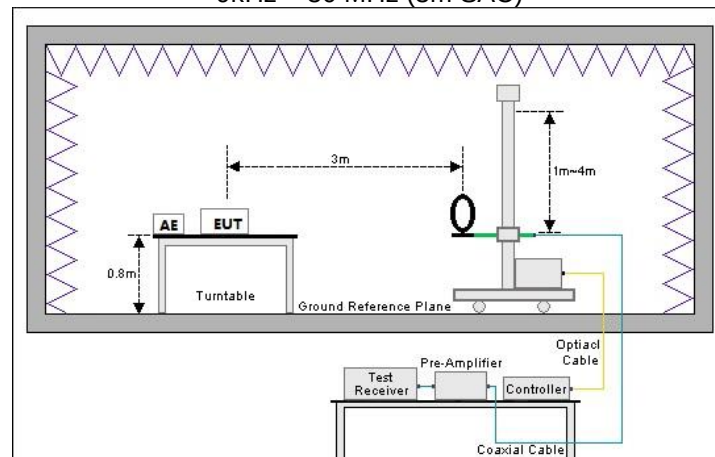
1) Conducted emission measurement:



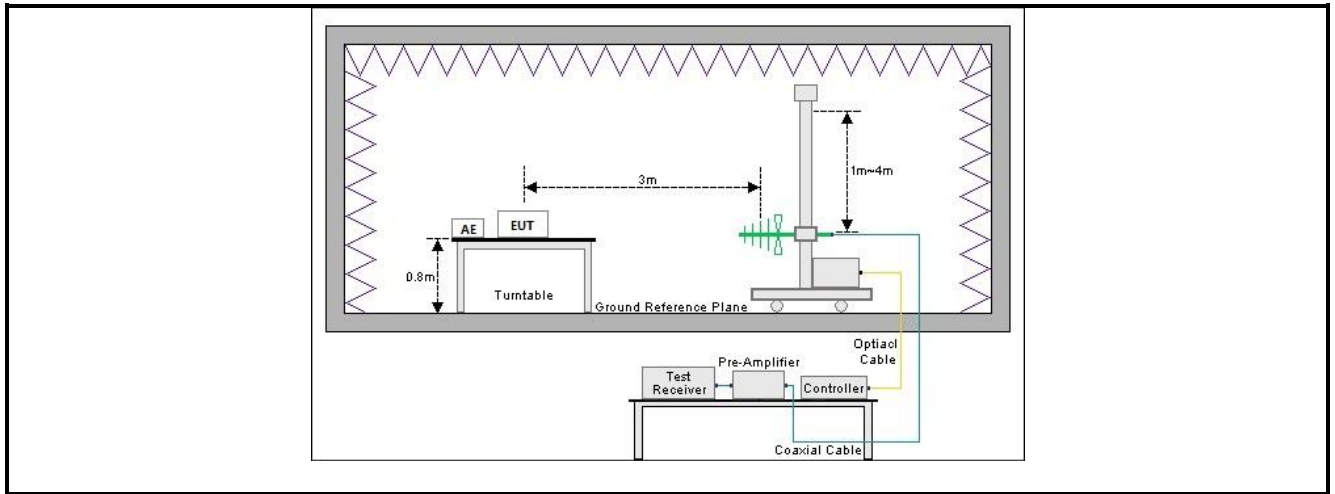
Note: The detailed descriptions please refer to Figure 8 of ANSI C63.4:2014.

2) Radiated emission measurement:

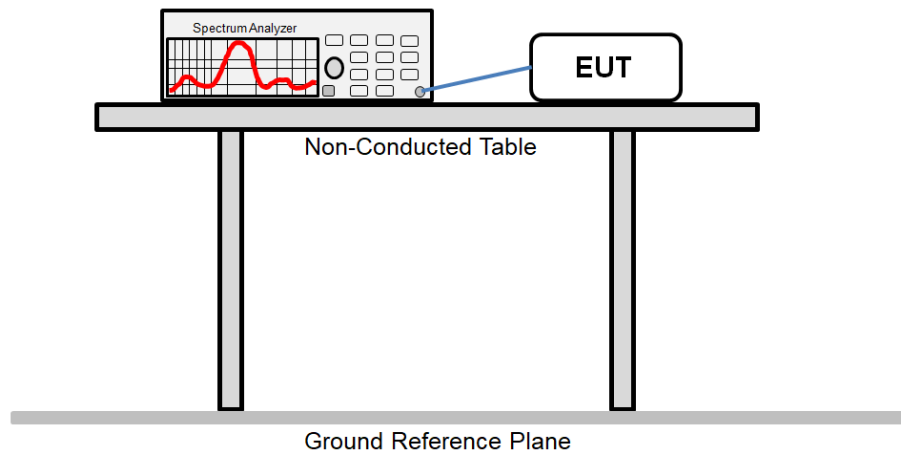
9kHz ~ 30 MHz (3m SAC)



30 MHz ~ 1GHz (3m SAC)



Conducted test method:



4.2 Test Procedure

Test method	Test step
Conducted emission	1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. 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 C63.10 on conducted measurement.
Radiated emission	1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested, and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
Conducted test method	1. The antenna port of EUT was connected to the RF port of the spectrum analyzer through an RF cable. 2. The EUT is keeping in continuous transmission mode and tested in all modulation modes. 3. The test data is saved by the screenshot function of the spectrum analyzer.

5 Test Results

5.1 Summary

5.1.1 Clause and Data Summary

Test items	Standard clause	Test data	Result
Antenna Requirement	15.203	See Section 5.2	Pass
AC Power Line Conducted Emission	15.207	See Section 5.3	Pass
20dB Bandwidth	15.215(c)	See Section 5.4	Pass
Field Strength of Fundamental	15.225 (a)	See Section 5.5	Pass
Field Strength of Spurious Emissions	15.209	See Section 5.6	Pass
Frequency Tolerance	15.225 (e)	See Section 5.7	Pass
Remark: 1. Pass: The EUT complies with the essential requirements in the standard. 2. N/A: Not Applicable.			
Test Method:	ANSI C63.4-2014 ANSI C63.10-2013		

5.1.2 Test Limit

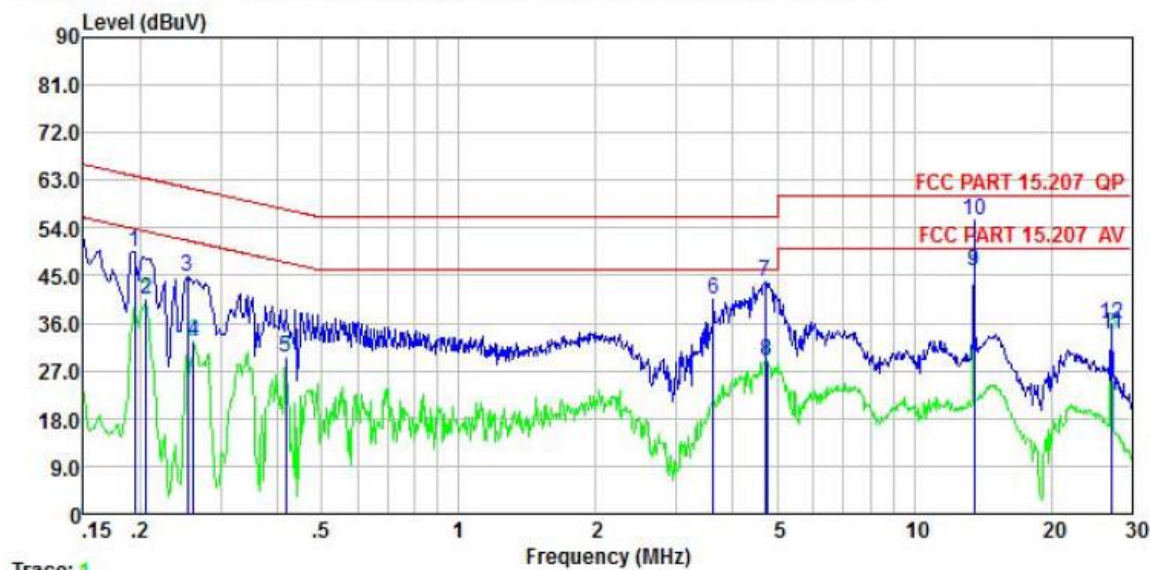
Items	Limit																								
AC Power Line Conducted Emission	<table><tr><th rowspan="2">Frequency (MHz)</th><th colspan="2">Limit (dBµV)</th></tr><tr><th>Quasi-Peak</th><th>Average</th></tr><tr><td>0.15 – 0.5</td><td>66 to 56 ^{Note 1}</td><td>56 to 46 ^{Note 1}</td></tr><tr><td>0.5 – 5</td><td>56</td><td>46</td></tr><tr><td>5 – 30</td><td>60</td><td>50</td></tr></table> Note 1: The limit level in dBµV decreases linearly with the logarithm of frequency. Note 2: The more stringent limit applies at transition frequencies.	Frequency (MHz)	Limit (dBµV)		Quasi-Peak	Average	0.15 – 0.5	66 to 56 ^{Note 1}	56 to 46 ^{Note 1}	0.5 – 5	56	46	5 – 30	60	50										
Frequency (MHz)	Limit (dBµV)																								
	Quasi-Peak	Average																							
0.15 – 0.5	66 to 56 ^{Note 1}	56 to 46 ^{Note 1}																							
0.5 – 5	56	46																							
5 – 30	60	50																							
20dB Bandwidth	N/A																								
Field Strength of Fundamental Field Strength of Spurious Emissions	(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. (d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209. <table><tr><th>Frequency (MHz)</th><th>Field strength (microvolts/meter)</th><th>Measurement distance (meters)</th></tr><tr><td>0.009 – 0.490</td><td>2400/F(kHz)</td><td>300</td></tr><tr><td>0.490 – 1.705</td><td>24000/F(kHz)</td><td>30</td></tr><tr><td>1.705 – 30.0</td><td>30</td><td>30</td></tr><tr><td>30 – 88</td><td>100**</td><td>3</td></tr><tr><td>88 – 216</td><td>150**</td><td>3</td></tr><tr><td>216 – 960</td><td>200**</td><td>3</td></tr><tr><td>Above 960</td><td>500</td><td>3</td></tr></table> ** 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., §§ 15.231 and 15.241.	Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	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
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)																							
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																							
Frequency Tolerance	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.																								

5.2 Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement:	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, 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.
E.U.T Antenna:	The EUT make use of an Internal Antenna.

5.3 AC Power Line Conducted Emission

Product name:	Red Spider	Product model:	Red Spider HF
Test by:	Mike	Test mode:	NFC mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz		



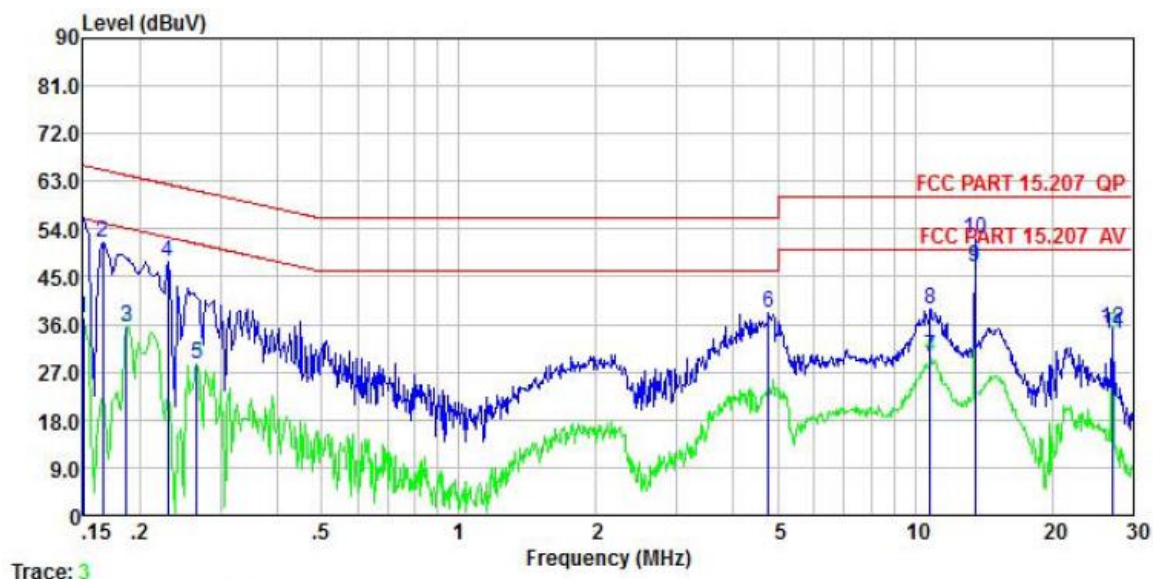
Trace: 1

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.194	49.52	0.05	0.03	49.60	63.84	-14.24	QP
2	0.206	40.30	0.05	0.04	40.39	53.36	-12.97	Average
3	0.253	44.68	0.06	0.01	44.75	61.64	-16.89	QP
4	0.262	32.48	0.06	0.01	32.55	51.38	-18.83	Average
5	0.417	29.34	0.05	0.04	29.43	47.51	-18.08	Average
6	3.623	40.23	0.10	0.08	40.41	56.00	-15.59	QP
7	4.696	43.57	0.12	0.09	43.78	56.00	-12.22	QP
8	4.746	28.71	0.12	0.09	28.92	46.00	-17.08	Average
9	13.551	45.53	0.27	0.12	45.92	50.00	-4.08	Average
10	13.551	54.91	0.27	0.12	55.30	60.00	-4.70	QP
11	27.127	33.38	0.39	0.20	33.97	50.00	-16.03	Average
12	27.127	35.19	0.39	0.20	35.78	60.00	-24.22	QP

Remark:

1. Level = Read level + LISN Factor + Cable Loss.

Product name:	Red Spider	Product model:	Red Spider HF
Test by:	Mike	Test mode:	NFC mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz		



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	37.11	0.06	0.01	37.18	56.00	-18.82	Average
2	0.166	51.43	0.06	0.01	51.50	65.16	-13.66	QP
3	0.186	35.60	0.05	0.02	35.67	54.20	-18.53	Average
4	0.230	47.84	0.05	0.02	47.91	62.44	-14.53	QP
5	0.266	28.43	0.05	0.02	28.50	51.25	-22.75	Average
6	4.772	38.07	0.11	0.09	38.27	56.00	-17.73	QP
7	10.790	29.59	0.22	0.12	29.93	50.00	-20.07	Average
8	10.790	38.57	0.22	0.12	38.91	60.00	-21.09	QP
9	13.551	46.36	0.25	0.12	46.73	50.00	-3.27	Average
10	13.551	51.76	0.25	0.12	52.13	60.00	-7.87	QP
11	27.127	33.45	0.43	0.20	34.08	50.00	-15.92	Average
12	27.127	34.61	0.43	0.20	35.24	60.00	-24.76	QP

Remark:

1. Level = Read level + LISN Factor + Cable Loss.

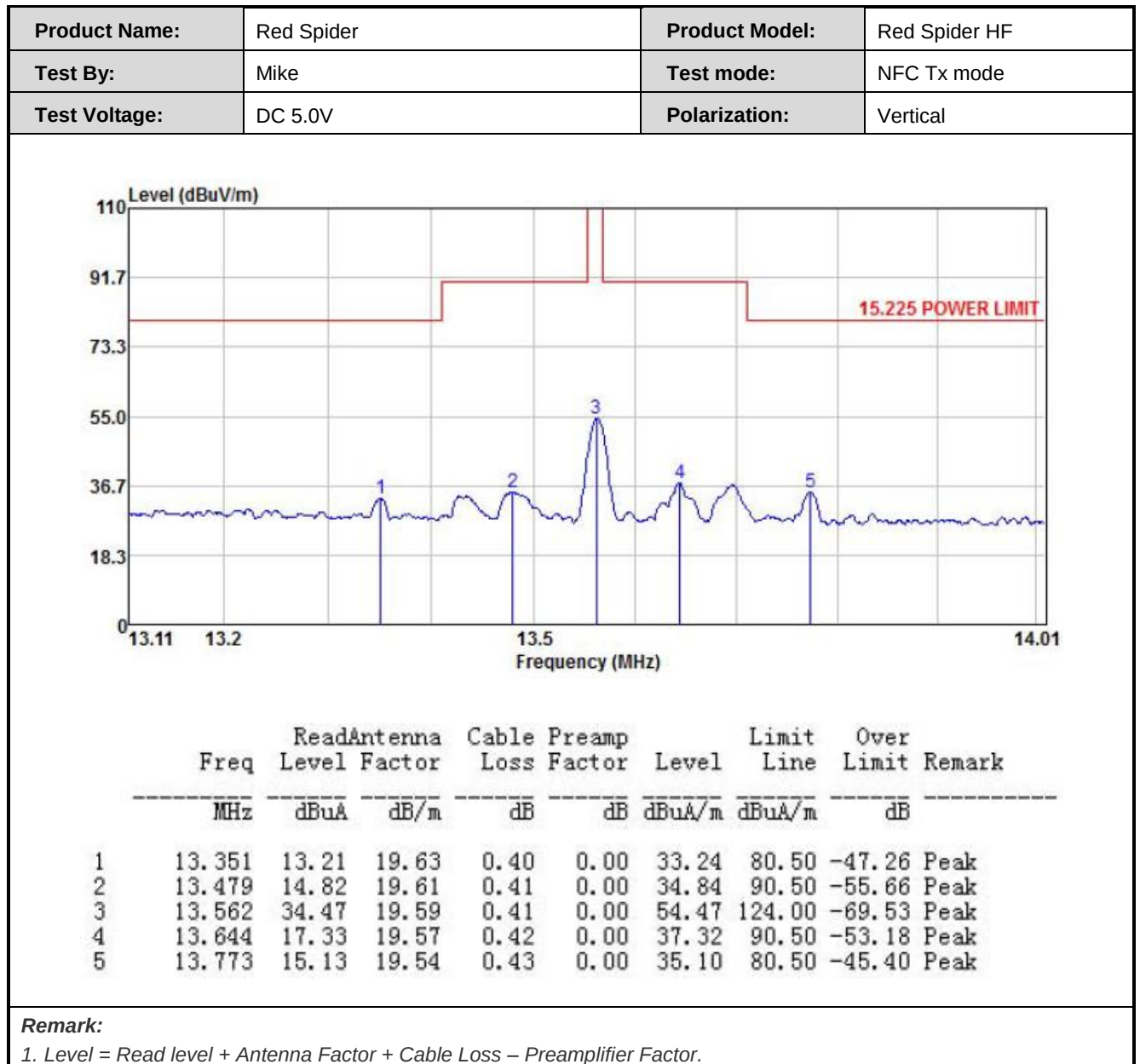
5.4 20dB Bandwidth

20dB bandwidth (kHz)	Limit (kHz)	Results
0.496	11.2	Passed
Note: For 13.56MHz, permitted Band is 14 kHz, so the Limit is 11.2 kHz.		

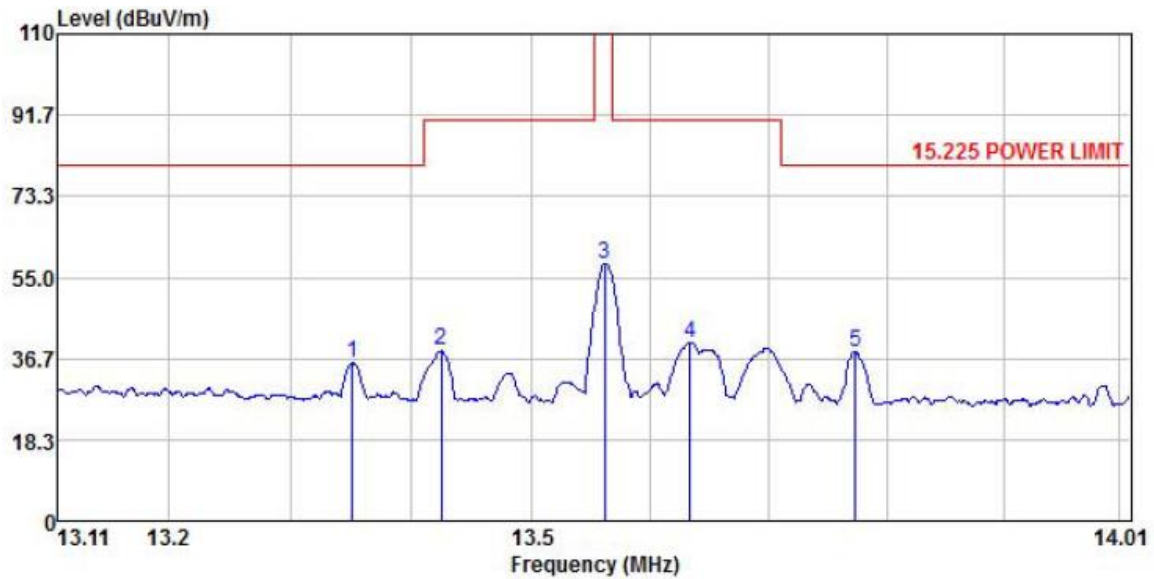
Test plot as follows:



5.5 Field Strength of Fundamental



Product Name:	Red Spider	Product Model:	Red Spider HF
Test By:	Mike	Test mode:	NFC Tx mode
Test Voltage:	DC 5.0V	Polarization:	Horizontal



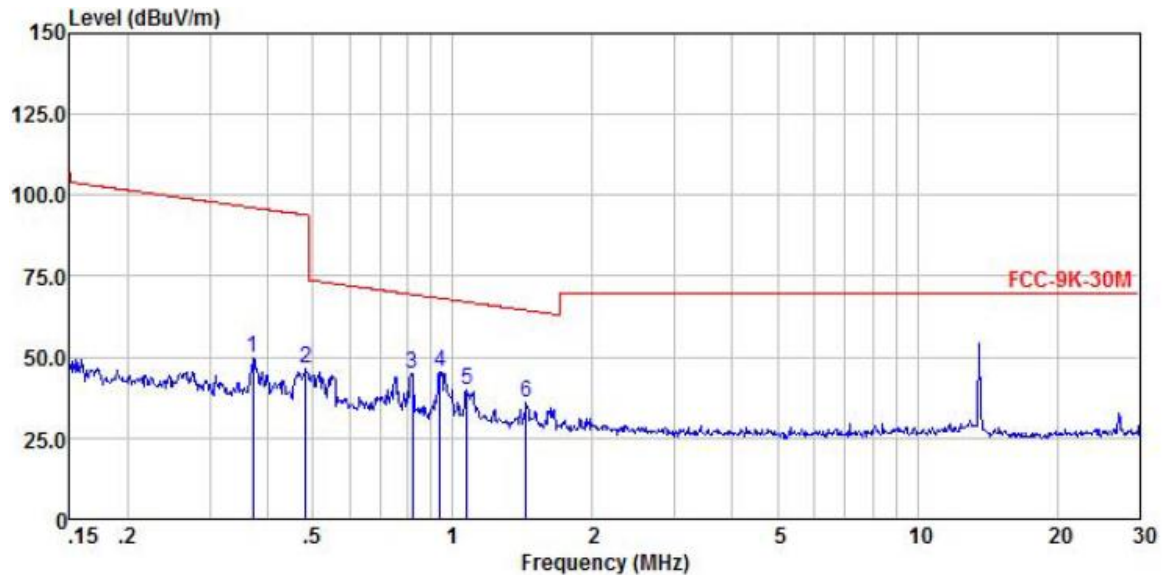
	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit	Over	Remark
	MHz	dBuA	dB/m	dB	dB	dBuA/m	dBuA/m	dB	
1	13.351	15.61	19.63	0.40	0.00	35.64	80.50	-44.86	Peak
2	13.424	18.38	19.61	0.41	0.00	38.40	90.50	-52.10	Peak
3	13.562	38.24	19.59	0.41	0.00	58.24	124.00	-65.76	Peak
4	13.633	20.36	19.57	0.42	0.00	40.35	90.50	-50.15	Peak
5	13.773	18.23	19.54	0.43	0.00	38.20	80.50	-42.30	Peak

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

5.6 Field Strength of Spurious Emissions

Product Name:	Red Spider	Product Model:	Red Spider HF
Test By:	Mike	Test mode:	NFC Tx mode
Test Frequency:	150 kHz – 30 MHz	Polarization:	Coxial
Test Voltage:	DC 5.0V		

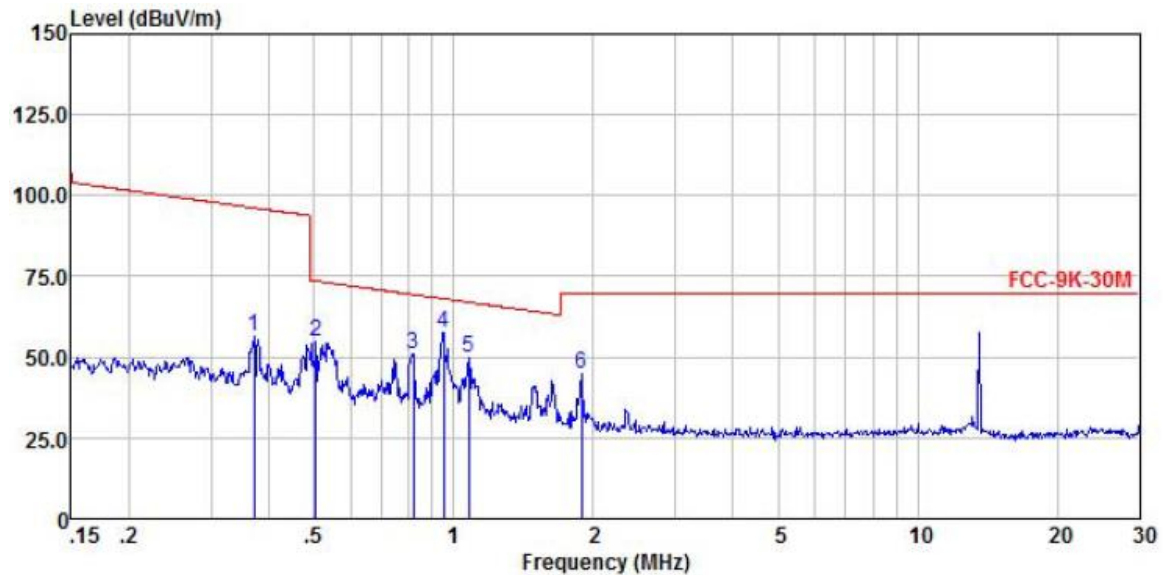


	Read	Antenna	Cable	Preamp		Limit	Over	
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	0.371	29.26	20.65	0.06	0.00	49.97	96.22	-46.25 Peak
2	0.484	25.39	20.78	0.07	0.00	46.24	93.91	-47.67 Peak
3	0.817	23.96	20.59	0.09	0.00	44.64	69.37	-24.73 Peak
4	0.938	24.97	20.53	0.11	0.00	45.61	68.17	-22.56 Peak
5	1.071	19.30	20.49	0.17	0.00	39.96	67.03	-27.07 Peak
6	1.441	15.31	20.47	0.17	0.00	35.95	64.46	-28.51 Peak

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of 9 kHz~150 kHz are background noise and very lower than the limit, so not show in test report.

Product Name:	Red Spider	Product Model:	Red Spider HF
Test By:	Mike	Test mode:	NFC Tx mode
Test Frequency:	150 kHz – 30 MHz	Polarization:	Coplanar
Test Voltage:	DC 5.0V		

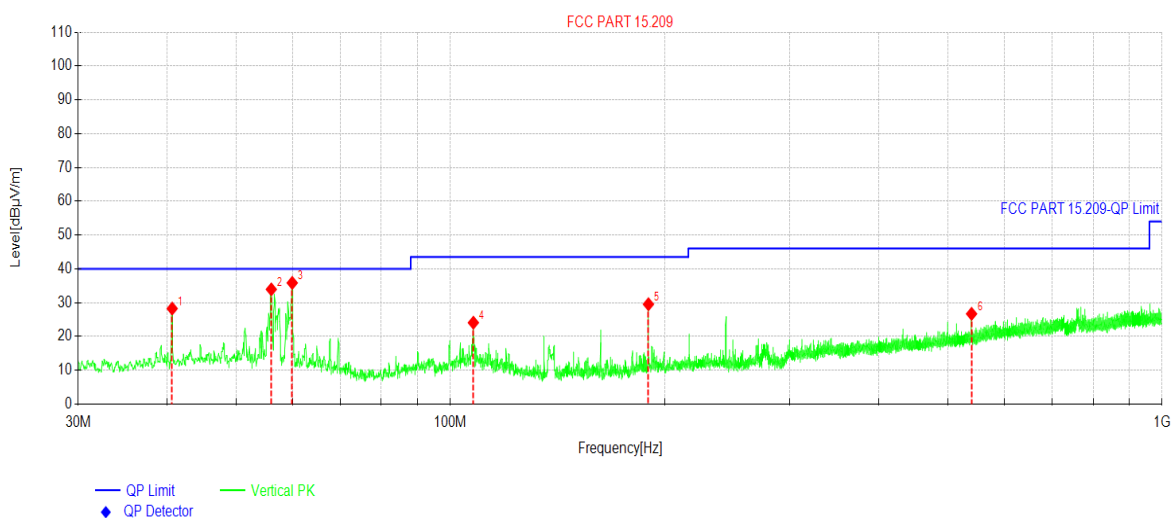


	Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit	Over	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	0.371	35.95	20.65	0.06	0.00	56.66	96.22	-39.56	Peak
2	0.505	34.19	20.80	0.07	0.00	55.06	73.54	-18.48	Peak
3	0.817	30.46	20.59	0.09	0.00	51.14	69.37	-18.23	Peak
4	0.953	36.86	20.52	0.12	0.00	57.50	68.04	-10.54	Peak
5	1.077	28.92	20.49	0.17	0.00	49.58	66.98	-17.40	Peak
6	1.888	24.02	20.44	0.17	0.00	44.63	69.50	-24.87	Peak

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of 9 kHz~150 kHz are background noise and very lower than the limit, so not show in test report.

Product Name:	Red Spider	Product Model:	Red Spider HF
Test By:	Mike	Test mode:	NFC Tx mode
Test Frequency:	30 MHz – 1000 MHz	Polarization:	Vertical
Test Voltage:	DC 5.0V		



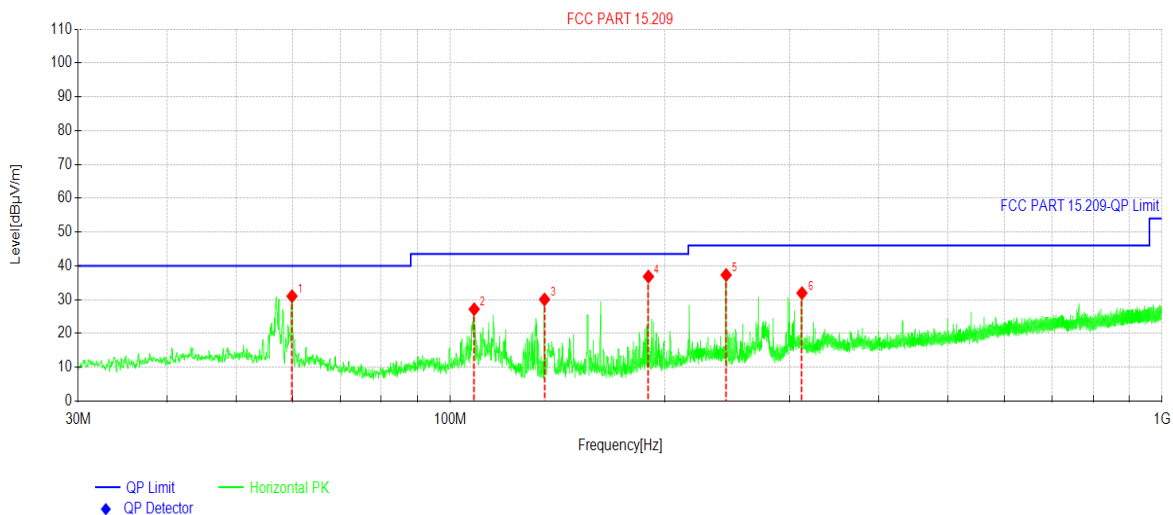
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	40.6700	41.89	28.25	-13.64	40.00	11.75	PK	Vertical
2	56.0445	47.39	33.95	-13.44	40.00	6.05	PK	Vertical
3	59.9730	50.22	35.85	-14.37	40.00	4.15	PK	Vertical
4	107.745	38.79	24.08	-14.71	43.50	19.42	PK	Vertical
5	189.856	45.49	29.54	-15.95	43.50	13.96	PK	Vertical
6	540.026	34.83	26.70	-8.13	46.00	19.30	PK	Vertical

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Red Spider	Product Model:	Red Spider HF
Test By:	Mike	Test mode:	NFC Tx mode
Test Frequency:	30 MHz – 1000 MHz	Polarization:	Horizontal
Test Voltage:	DC 5.0V		



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	59.9245	45.40	31.04	-14.36	40.00	8.96	PK	Horizontal
2	108.036	41.92	27.19	-14.73	43.50	16.31	PK	Horizontal
3	135.633	48.29	30.06	-18.23	43.50	13.44	PK	Horizontal
4	189.856	52.79	36.84	-15.95	43.50	6.66	PK	Horizontal
5	244.127	51.43	37.31	-14.12	46.00	8.69	PK	Horizontal
6	311.979	44.65	31.96	-12.69	46.00	14.04	PK	Horizontal

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

5.7 Frequency Tolerance

Frequency Stability V.S. Temperature Measurement:

Voltage (Vdc)	Temperature (°C)	Frequency Tolerance (kHz)	Frequency Error (%)	Limit (%)	Results
5.0	-20	0.43	0.003	±0.01	Pass
	-10	0.78	0.006	±0.01	Pass
	0	0.62	0.005	±0.01	Pass
	+10	0.53	0.004	±0.01	Pass
	+20	0.21	0.002	±0.01	Pass
	+30	1.07	0.008	±0.01	Pass
	+40	0.36	0.003	±0.01	Pass
	+50	0.24	0.002	±0.01	Pass

Frequency Stability V.S. Voltage Measurement:

Temperature (°C)	Voltage (Vdc)	Frequency Tolerance (kHz)	Frequency Error (%)	Limit (%)	Results
25.0	4.25	0.31	0.002	±0.01	Pass
	5.0	0.94	0.007	±0.01	Pass
	5.75	0.33	0.002	±0.01	Pass

-----End of report-----