

FCC REPORT

Applicant: PS GmbH

Address of Applicant: Melisau 1255, 6863 Egg Austria

Equipment Under Test (EUT)

Product Name: SOLO DUAL

Model No.: DUAL

Trade mark: PS

FCC ID: 2ALMH2

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.225

Date of sample receipt: 08 Mar., 2021

Date of Test: 08 Mar., to 22 Jun., 2021

Date of report issue: 23 Jun, 2021

Test Result: PASS*

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	23 Jun, 2021	Original

Tested by: YT Yang
Test Engineer

Date: 23 Jun, 2021

Reviewed by: Winner Zhang
Project Engineer

Date: 23 Jun, 2021

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	Pass
Field strength of the fundamental signal	15.225 (a)	Pass
Spurious emissions	15.225(d)& 15.209	Pass
20dB Bandwidth	15.215(c)	Pass
Frequency tolerance	15.225 (e)	Pass
Conducted Emission	15.207	N/A
Remark: 1. Pass: The EUT complies with the essential requirements in the standard. 2. The cable insertion loss used by "RF Output Power" and other conduction measurement items is 0.5dB (provided by the customer).		
Test Method:	ANSI C63.4-2014 ANSI C63.10-2013	

5 General Information

5.1 Client Information

Applicant:	PS GmbH
Address:	Melisau 1255, 6863 Egg Austria
Manufacturer/ Factory:	PS GmbH
Address:	Melisau 1255, 6863 Egg Austria

5.2 General Description of E.U.T.

Product Name:	SOLO DUAL
Model No.:	DUAL
Operation Frequency:	13.56MHz
Channel numbers:	1
Modulation type:	ASK
Antenna Type:	Internal Antenna
Power supply:	DC 3.0V
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

5.3 Test mode

Transmitting mode:	Keep the EUT in transmitting mode with modulation		
Pre-Test Mode:			
JYT has verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:			
Axis	X	Y	Z
Field Strength(dBuV/m)	60.31	58.71	59.27
Final Test Mode:			
According to ANSI C63.4 standards, the test results are both the “worst case” and “worst setup”: X axis (see the test setup photo).			

5.4 Description of Support Units

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

5.5 Measurement Uncertainty

Parameters	Expanded Uncertainty
Conducted Emission (9kHz ~ 30MHz)	±1.60 dB (k=2)
Radiated Emission (9kHz ~ 30MHz)	±3.12 dB (k=2)
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB (k=2)

5.6 Additions to, deviations, or exclusions from the method

No

5.7 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 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.

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

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 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>

5.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.

Address: No.110~116, Building B, Jinyuan Business Building, Xixiang Road,
Bao'an District, Shenzhen, Guangdong, China

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

Email: info@ccis-cb.com, Website: <http://www.ccis-cb.com>

5.9 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
3m SAC	SAEMC	9m*6m*6m	966	07-22-2020	07-21-2021
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-07-2020	03-06-2021
Biconical Antenna	SCHWARZBECK	VUBA9117	359	06-22-2020	06-21-2021
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-07-2020	03-06-2021
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-22-2020	06-21-2021
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170582	11-18-2020	11-17-2021
Loop Antenna	SCHWARZBECK	FMZB 1519 B	00044	03-07-2020	03-06-2021
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-07-2020	03-06-2021
Pre-amplifier	CD	PAP-1G18	11804	03-07-2020	03-06-2021
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-07-2020	03-06-2021
Spectrum analyzer	Rohde & Schwarz	FSP40	100363	11-18-2020	11-17-2021
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-07-2020	03-06-2021
Signal Generator	Rohde & Schwarz	SMX	835454/016	03-07-2020	03-06-2021
Signal Generator	R&S	SMR20	1008100050	03-07-2020	03-06-2021
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2020	03-06-2021
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2020	03-06-2021
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-07-2020	03-06-2021

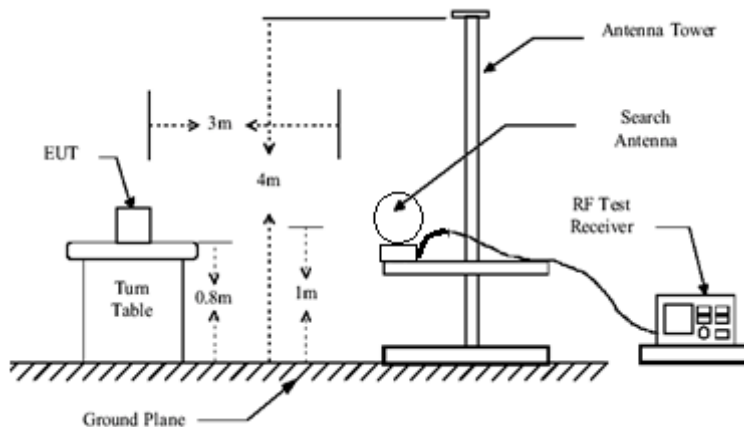
6 Test results and Measurement Data

6.1 Antenna requirement

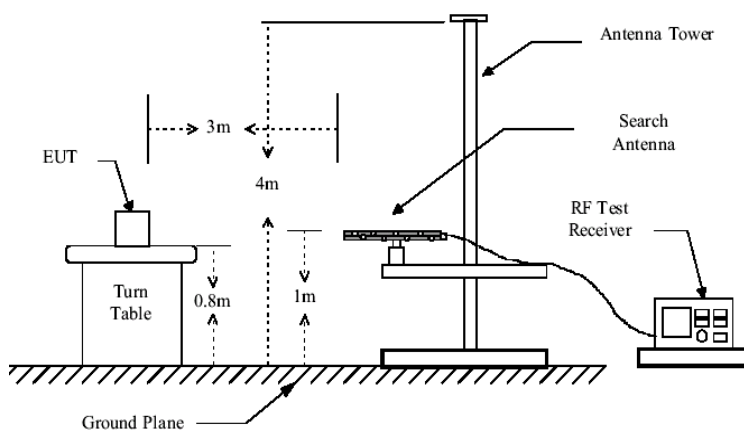
Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling 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.	

6.2 Radiated Emission

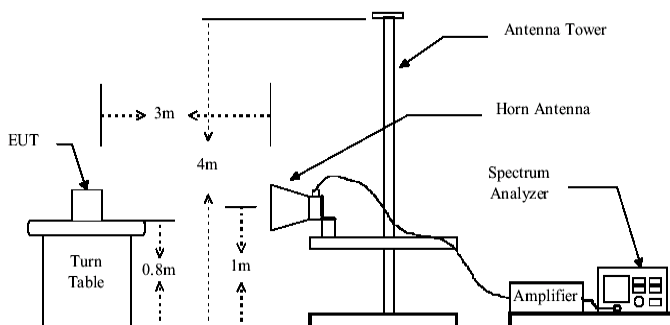
Test Requirement:	FCC Part15 C Section 15.225(a) and 15.209				
Test Frequency Range:	9 kHz to 1000MHz				
Test site:	Measurement Distance: 3m(Semi-Anechoic Chamber)				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	9kHz-150kHz	Quasi-peak	200Hz	600Hz	Quasi-peak Value
	150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	120kHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
Limit: (Field strength of the fundamental signal)	Frequency		Limit (uV/m @30m)		Limit (dBuV/m @3m)
	13.553MHz-13.567MHz		15848		124.0
	13.410MHz-13.553MHz & 13.567MHz-13.710MHz		334		90.5
	13.110MHz-13.410MHz & 13.710MHz-14.010MHz		106		80.5
	Remark: Per FCC part 15.31, when performing measurements at a distance which is closer than specified, the field strength results shall be extrapolated to the specified distance by using the square of an inverse linear distance extrapolation factor (i.e., 40 dB/decade) in conjunction with the slant-range distance defined in §15.3(hh) of this part.				
Limit: (Spurious Emissions)	Frequency (MHz)		Limit (uV/m @3m)		Distance (m)
	0.009-0.490		2400/F(kHz)		300
	0.490-1.705		24000/F(kHz)		30
	1.705-30		30		30
	30-88		100		3
	88-216		150		3
	216-960		200		3
	Above 1GHz		500		3
Test Procedure:	a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. If the emission level of the EUT in peak mode was 10dB lower than the limits pecified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would bere-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.				
Test setup:	9kHz-30MHz				



30MHz-1GHz



Above 1GHz



Test Instruments:

Refer to section 5.9 for details

Test mode:

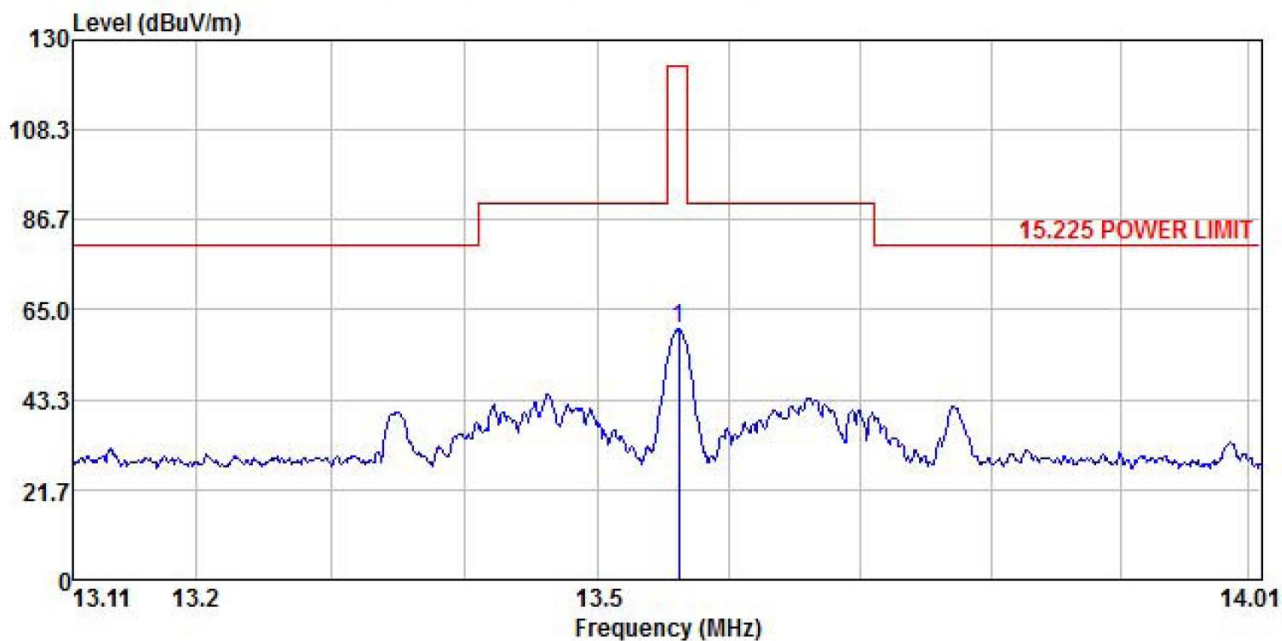
Refer to section 5.3 for details

Test results:

Pass

Measurement Data:
Field Strength of fundamental signal:

Product Name:	SOLO DUAL	Product Model:	DUAL
Test By:	Janet	Test mode:	NFC Tx mode
Test Voltage:	DC 3.7V	Environment:	Temp: 24℃ Humi: 57%



	Freq	ReadAntenna	Cable	Preamp	Limit	Over	
	Level	Factor	Loss	Factor	Level	Line	Limit Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m dB
1	13.562	40.31	19.59	0.41	0.00	60.31	124.00 -63.69

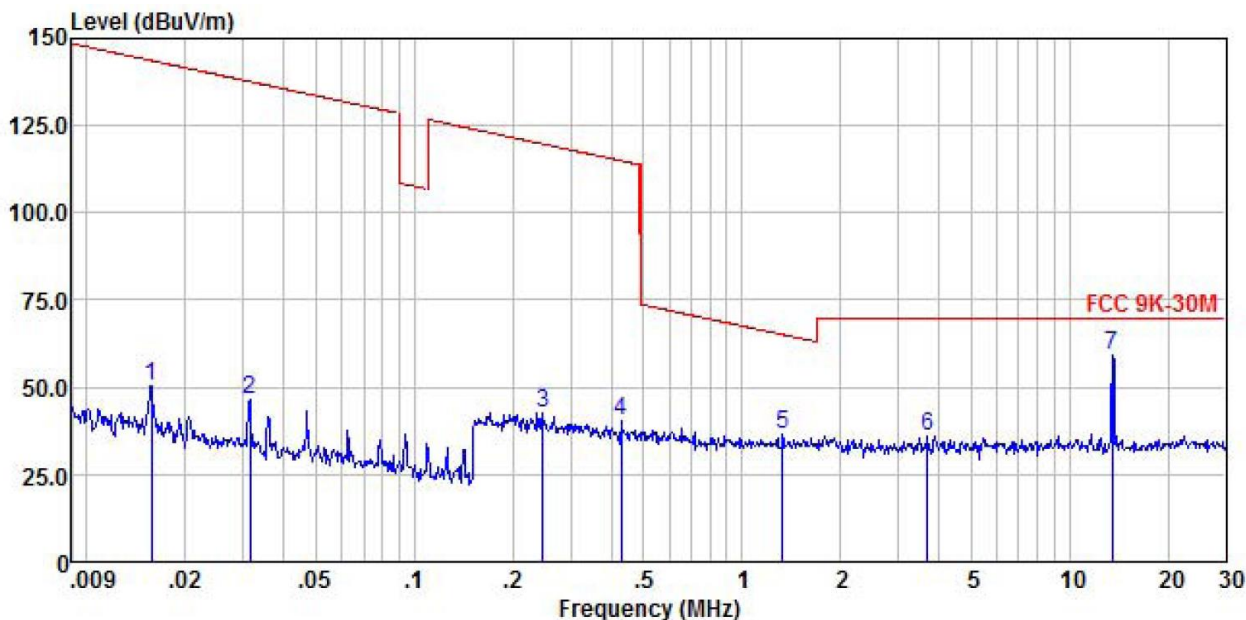
Remark:

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

Spurious Emissions:

Test frequency range: 9 kHz- 30 MHz

Product Name:	SOLO DUAL	Product Model:	DUAL
Test By:	Janet	Test mode:	NCF Tx mode
Test Frequency:	9 kHz ~ 30 MHz	Polarization:	Vertical
Test Voltage:	DC 3.7V	Environment:	Temp: 24°C Humi: 57%

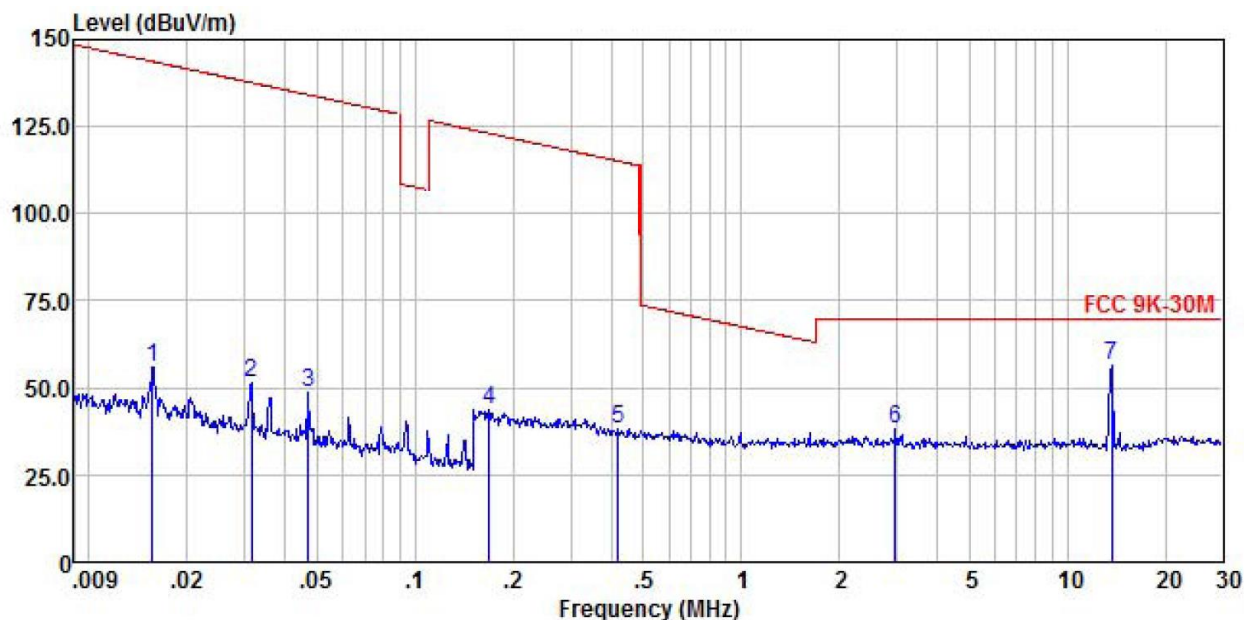


	Freq	Read	Antenna	Cable	Preamp	Level	Limit	Over	
	MHz	Level	Factor	Loss	Factor	dBuV/m	dBuV/m	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	0.016	30.02	20.38	0.01	0.00	50.41	143.64	-93.23	Peak
2	0.031	26.22	20.24	0.02	0.00	46.48	137.65	-91.17	Peak
3	0.246	22.38	20.45	0.05	0.00	42.88	119.78	-76.90	Peak
4	0.428	19.36	20.72	0.07	0.00	40.15	114.98	-74.83	Peak
5	1.331	15.84	20.47	0.17	0.00	36.48	65.14	-28.66	Peak
6	3.700	15.68	20.28	0.25	0.00	36.21	69.50	-33.29	Peak
7	13.548	39.02	19.59	0.41	0.00	59.02	69.50	-10.48	

Remark:

1. Final Level = Receiver 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, not show in test report.

Product Name:	SOLO DUAL	Product Model:	DUAL
Test By:	Janet	Test mode:	NFC Tx mode
Test Frequency:	9 kHz ~ 30 MHz	Polarization:	Horizontal
Test Voltage:	DC 3.7V	Environment:	Temp: 24°C Humi: 57%



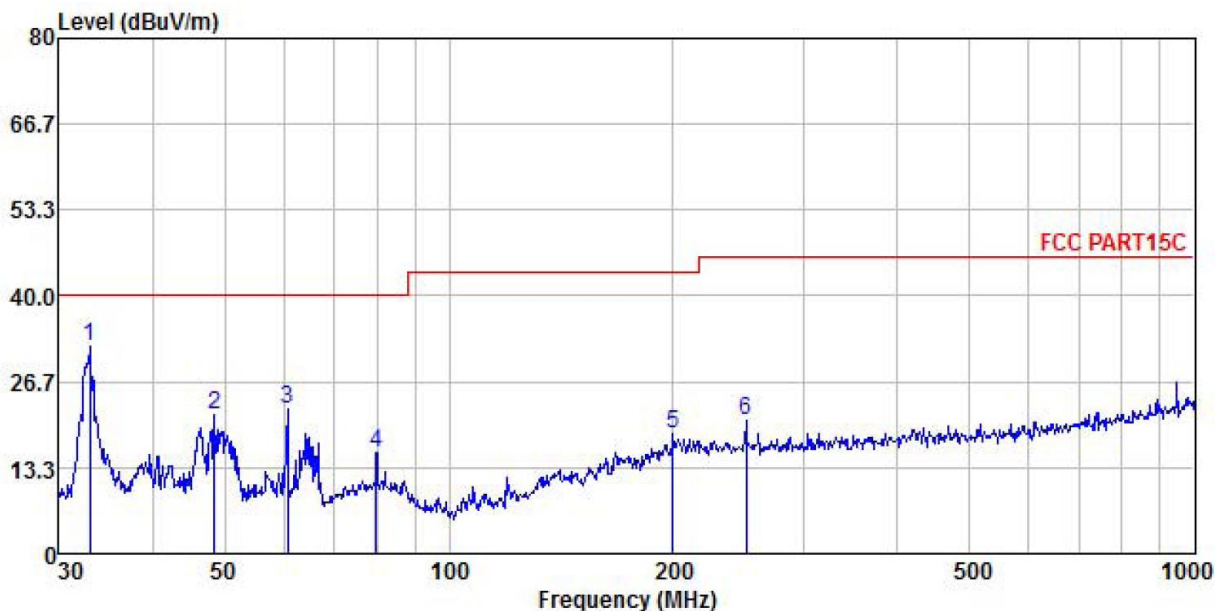
	Read	Antenna	Cable	Preamp	Limit	Over	
Freq	Level	Factor	Loss	Factor	Level	Line	Limit Remark
-----	-----	-----	-----	-----	-----	-----	-----
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	0.016	35.68	20.38	0.01	0.00	56.07	143.71 -87.64 Peak
2	0.031	30.98	20.24	0.02	0.00	51.24	137.65 -86.41 Peak
3	0.047	27.92	20.56	0.02	0.00	48.50	134.13 -85.63 Peak
4	0.168	23.34	20.26	0.03	0.00	43.63	123.10 -79.47 Peak
5	0.421	17.50	20.71	0.06	0.00	38.27	115.12 -76.85 Peak
6	2.972	17.77	20.40	0.23	0.00	38.40	69.50 -31.10 Peak
7	13.658	36.40	19.57	0.42	0.00	56.39	69.50 -13.11

Remark:

1. Final Level =Receiver 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, not show in test report.

Test frequency range: 30MHz-1000MHz

Product Name:	SOLO DUAL	Product Model:	DUAL
Test By:	Janet	Test mode:	NFC Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical
Test Voltage:	DC 3.7V	Environment:	Temp: 24°C Humi: 57%

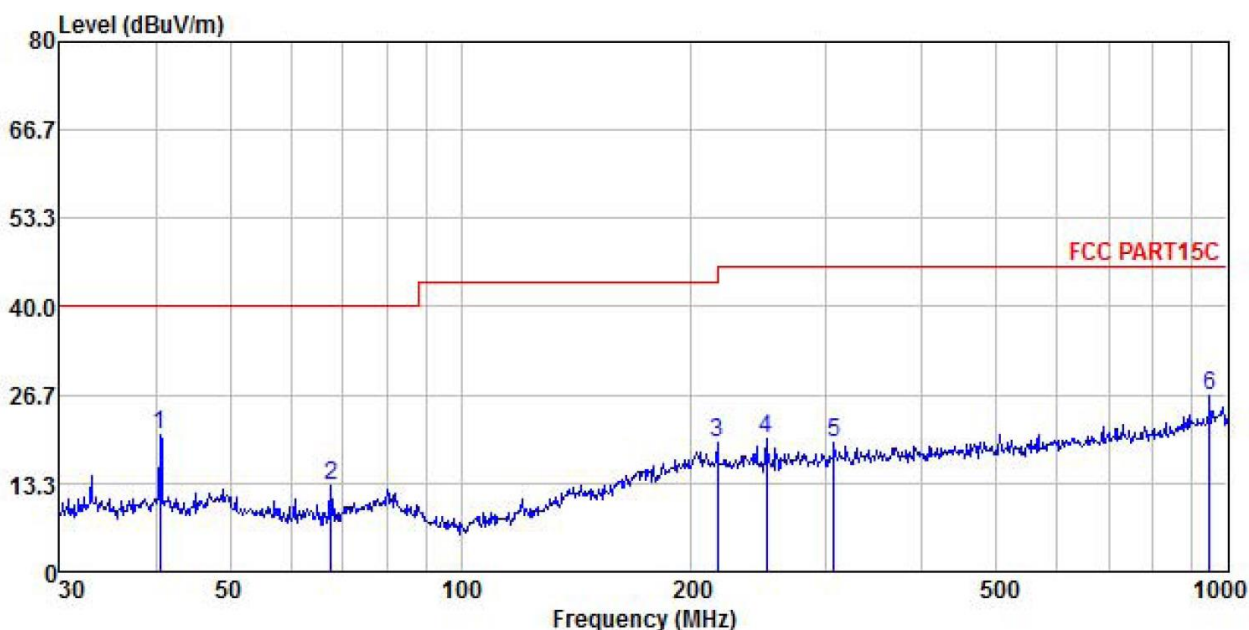


	Freq	ReadAntenna	Cable	Preamp	Limit	Over	
	MHz	Level	Factor	Loss	Factor	Level	Line
		dBuV	dB/m	dB	dB	dBuV/m	dBuV/m
							dB
1	32.979	49.70	12.29	0.00	29.96	32.03	40.00
2	48.502	38.35	13.11	0.00	29.83	21.63	40.00
3	60.704	41.60	10.66	0.00	29.77	22.49	40.00
4	79.800	32.56	12.73	0.00	29.64	15.65	40.00
5	199.986	29.04	18.30	0.00	28.83	18.51	43.60
6	250.301	30.78	18.50	0.00	28.54	20.74	46.00

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. The Aux Factor is a notch filter switch box loss, this item is not used.

Product Name:	SOLO DUAL	Product Model:	DUAL
Test By:	Janet	Test mode:	NFC Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	DC 3.7V	Environment:	Temp: 24°C Humi: 57%

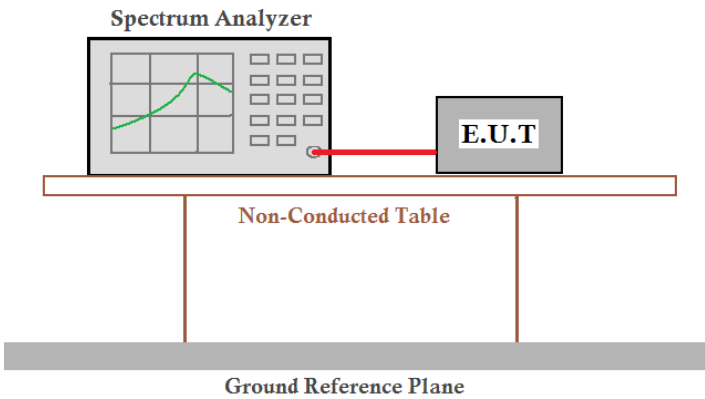


	Freq	ReadAntenna	Cable	Preamp		Limit	Over	
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit
		dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	40.559	37.82	12.81	0.00	29.90	20.73	40.00	-19.27 QP
2	67.675	32.88	9.96	0.00	29.74	13.10	40.00	-26.90 QP
3	216.024	29.79	18.37	0.00	28.73	19.43	46.00	-26.57 QP
4	250.301	30.00	18.50	0.00	28.54	19.96	46.00	-26.04 QP
5	306.754	29.11	18.71	0.00	28.47	19.35	46.00	-26.65 QP
6	948.761	31.54	22.80	0.00	27.73	26.61	46.00	-19.39 QP

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. The Aux Factor is a notch filter switch box loss, this item is not used.

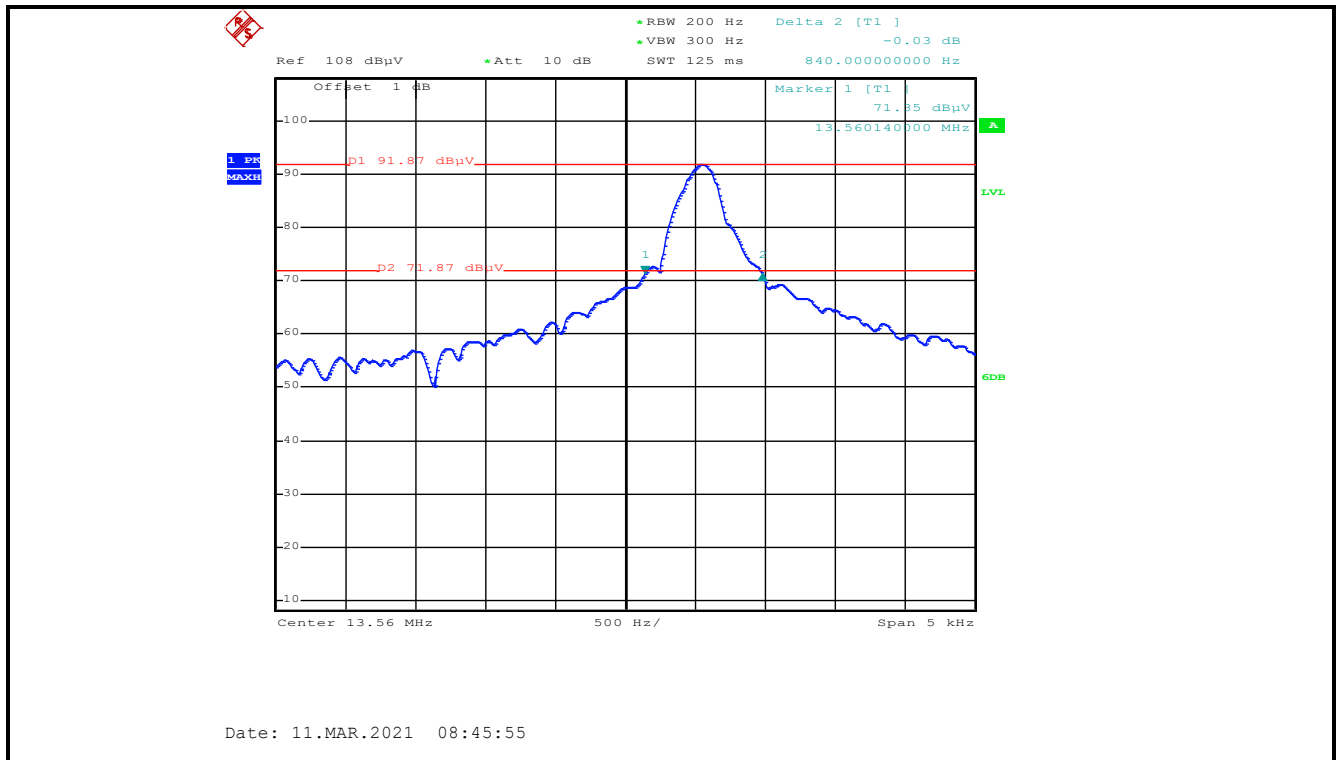
6.3 20dB Bandwidth

Test Requirement:	FCC Part15 C Section 15.215 (c)
Receiver setup:	RBW=200Hz, VBW=300Hz, detector: Peak
Limit:	The fundamental emission be kept within at least the central 80% of the permitted band
Test Procedure:	1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set the EUT to proper test channel. 3. Max hold the radiated emissions, mark the peak power frequency point and the -20dB upper and lower frequency points. 4. Read 20dB bandwidth.
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

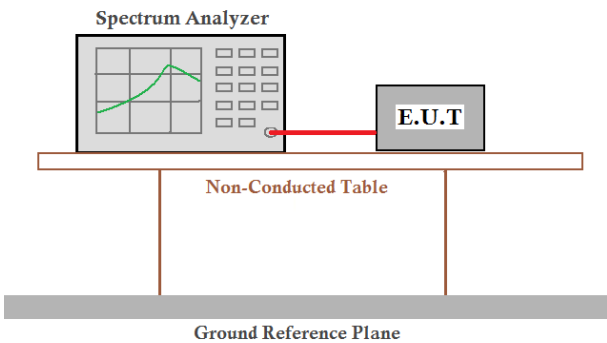
Measurement Data

20dB bandwidth (kHz)	Limit (kHz)	Results
0.84	11.2	Passed
Note: For 13.56MHz, permitted Band is 14 kHz, so the Limit is 11.2 kHz.		

Test plot as follows:



6.4 Frequency Tolerance

Test Requirement:	FCC Part15 C Section 15.225 (e)
Receiver setup:	RBW=200Hz, VBW=300Hz, span=14kHz, detector: Peak
Limit:	±0.01% of the operating frequency
Test mode:	Transmitting mode
Test Procedure:	Frequency stability V.S. Temperature measurement 1. The equipment under test was powered by a fresh battery. 2. RF output was connected to spectrum analyzer via feed through attenuators. 3. The EUT was placed inside the temperature chamber. 4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. 5. Turn EUT off and set the chamber temperature to –20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. 6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached Frequency stability V.S. Voltage measurement 1. Set chamber temperature to 25°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage. 2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency. Reduce the input voltage to specify extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:
a) Frequency stability V.S. Temperature measurement

Voltage (Vdc)	Temperature (°C)	Frequency Tolerance (MHz)	Frequency Error (%)	Limit (%)	Results
3.7	-20	0.071	0.0052	±0.01	Pass
	-10	0.016	0.0012	±0.01	Pass
	0	-0.082	-0.0061	±0.01	Pass
	+10	0.057	0.0042	±0.01	Pass
	+20	0.055	0.0041	±0.01	Pass
	+30	-0.017	-0.0013	±0.01	Pass
	+40	0.056	0.0041	±0.01	Pass
	+50	0.048	0.0035	±0.01	Pass

b) Frequency stability V.S. Voltage measurement

Temperature (°C)	Voltage (Vdc)	Frequency Tolerance (MHz)	Frequency Error (%)	Limit (%)	Results
25.0	3.5	-0.063	-0.0047	±0.01	Pass
	3.7	0.044	0.0032	±0.01	Pass
	4.2	-0.053	-0.0039	±0.01	Pass

8 EUT Constructional Details

Reference to the test report No.: JYTSZB-R01-2100111

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