

Project No.: TM-2202000327P  
Report No.: TMWK2202000702KR

FCC ID: WQJ-VP3350

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Rev.: 00

## FCC 47 CFR PART 15 SUBPART C

### TEST REPORT

For

VP3350

Model No.: IDMR-SUR93D, IDMR-SLR93D, IDMR-SUF93D,  
IDMR-SUS93D

Trade Name: ID TECH

Issued to

ID TECH

10721 Walker Street Cypress, CA 90630 United States

Issued by

Compliance Certification Services Inc.  
Wugu Laboratory

No.11, Wugong 6th Rd., Wugu Dist.,  
New Taipei City, Taiwan. (R.O.C.)

Issued Date: April 6, 2022

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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## **Revision History**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	April 6, 2022	Initial Issue	ALL	Allison Chen

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## 1. TEST RESULT CERTIFICATION

**Applicant:** ID TECH  
10721 Walker Street Cypress, CA 90630 United States

**Manufacturer:** ID TECH  
No.16, Ln.22, Gaoqing Rd., Yangmei Dist., Taoyuan City  
32667, Taiwan

**Equipment Under Test:** VP3350

**Trade Name:** ID TECH

**Model No.:** IDMR-SUR93D, IDMR-SLR93D, IDMR-SUF93D,  
IDMR-SUS93D

**Date of Test:** March 1 ~ 8, 2022

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	compliance
Statements of Conformity	
Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.	

### We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample tested as described in this report is in compliance with the requirements of FCC Rules Part 15.225.

The test results of this report relate only to the tested sample identified in this report.

Approved by:



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Shawn Wu  
Supervisor  
Compliance Certification Services Inc.

## 2. EUT DESCRIPTION

<b>Product</b>	VP3350
<b>Model No.</b>	IDMR-SUR93D, IDMR-SLR93D, IDMR-SUF93D, IDMR-SUS93D
<b>Model Discrepancy</b>	Please see remark as below.
<b>Trade</b>	ID TECH
<b>Received Date</b>	February 21, 2022
<b>Power Supply</b>	1. Power from host system. 2. Power from Lithium Battery.
<b>Frequency Range</b>	13.56MHz
<b>Modulation Technique</b>	ASK
<b>Number of Channels</b>	1 Channel
<b>Antenna Requirement</b>	Antenna type: Loop Antenna

**Remark:**

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
3. Disclaimer: The variant model numbers / trademarks are assessed as identical in hardware and software to each other, hence all variants are fully covered by the test results in this test report without further verification test.
4. Model Discrepancy:

<b>Model</b>	IDMR-SUF93D	IDMR-SLR93D	IDMR-SUR93D	IDMR-SUS93D
<b>USB (female connector)</b>	O	O	O	O
<b>USB (male connector)</b>	X	X	O (Rotatable)	O (Fixed)
<b>Lightning (male connector)</b>	X	O (Rotatable)	X	X
<b>Power button</b>	X	X	O	O
<b>Circuit</b>	O	O	O	O
<b>PCB</b>	O	O	O	O
<b>Lithium Battery</b>	X	O	X	X

### 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 Part 15.207, 15.209, 15.225.

The tests documented in this report were performed in accordance with IC RSS-210, IC RSS-Gen, and ANSI C63.10: 2013

#### 3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

#### 3.2 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

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### 3.3 DESCRIPTION OF TEST MODES

The EUT had been tested under engineering test mode condition and the EUT staying in continuous transmitting mode.

All modes and data rates were investigated and it was determined that ISO 14443A/B and ISO 18092 Type y, 106/212/424/848 kbps.

All data rates were investigated and it was determined that 106 Kbps was considered worst-case. Therefore, all testing was performed in 106 Kbps mode.

AC Power Line Conducted Emission	
<b>Test Condition</b>	<b>AC Power line conducted emission for line and neutral</b>
<b>Power supply Mode</b>	<b>Mode 1: EUT power by NB</b>
<b>Worst Mode</b>	<input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4

Radiated Emission Measurement Below 1G	
<b>Test Condition</b>	<b>Radiated Emission Below 1G</b>
<b>Power supply Mode</b>	<b>Mode 1: EUT power by Host System SUF93D</b> <b>Mode 2: EUT power by Host System SUR93D</b> <b>Mode 3: EUT power by Host System SUS93D</b> <b>Mode 4: EUT power by Host System SLR93D</b>
<b>Worst Mode</b>	<input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4

Remark:

1. The worst mode was record in this test report.
2. EUT pre-scanned in axis X and two polarity, for radiated measurement. The worst case(X-Plane) were recorded in this report
3. AC power line conducted emission and for below 1G radiation emission were performed the EUT transmit at the highest output power channel as worse case.

## 4. TEST SUMMARY

FCC Standard Sec.	Chapter	Test Item	Result
15.203	2	Antenna Requirement	Pass
15.215	8.1	Occupied Bandwidth (99%) and 20dB Bandwidth	Pass
15.209	8.2	Radiated Emissions	Pass
15.225	8.3	Frequency Stability	Pass
15.207	8.4	AC Power-line Conducted Emission	Pass

## 5. INSTRUMENT CALIBRATION

### 5.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

### 5.2 MEASUREMENT EQUIPMENT USED

#### Equipment Used for Emissions Measurement

RF Conducted Test Site					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Thermostatic/Humidity Chamber	TAICHY	MHG-150LF	930619	09/17/2021	09/16/2022
EXA Signal Analyzer	KEYSIGHT	N9010B	MY55460167	09/07/2021	09/06/2022
<b>Software</b>	N/A				

3M 966 Chamber Test Site					
Equipment	Manufacturer	Model	S/N	Cal Date	Cal Due
Bilog Antenna	Sunol Sciences	JB3	A030105	07/19/2021	07/18/2022
Coaxial Cable	HUBER SUHNER	SUCOFLEX 104PEA	20995	02/23/2022	02/22/2023
Digital Thermo-Hygro Meter	WISEWIND	1206	D07	12/28/2021	12/27/2022
Loop Ant	COM-POWER	AL-130	121051	04/07/2021	04/06/2022
Pre-Amplifier	EMEC	EM330	060609	02/23/2022	02/22/2023
PSA Series Spectrum Analyzer	Agilent	E4446A	MY46180323	12/06/2021	12/05/2022
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
<b>Software</b>	e3 210616				

Conducted Emission Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
CABLE	EMCI	CFD300-NL	CERF	06/28/2021	06/27/2022
EMI Test Receiver	R&S	ESCI	100064	07/05/2021	07/04/2022
LISN	SCHAFFNER	NNB 41	03/10013	02/15/2022	02/14/2023
<b>Software</b>	EZ-EMC(CCS-3A1-CE-wugu)				

**Remark:**

1. Each piece of equipment is scheduled for calibration once a year.
2. N.C.R. = No Calibration Request.

### 5.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575
Emission bandwidth, 20dB bandwidth	+/- 0.0014
RF output power, conducted	+/- 1.14
Power density, conducted	+/- 1.40
3M Semi Anechoic Chamber / 9K~30M	+/- 2.25
3M Semi Anechoic Chamber / 30M~1G (Horizontally)	+/- 3.91
3M Semi Anechoic Chamber / 30M~1G (Vertically)	+/- 4.57
3M Semi Anechoic Chamber / 1G~6G	+/- 5.20
3M Semi Anechoic Chamber / 6G~18G	+/- 5.18
3M Semi Anechoic Chamber / 18G~40G	+/- 3.68

**Remark:** This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 6. FACILITIES AND ACCREDITATIONS

### 6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

- No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan. (R.O.C.)  
Tel: 886-2-2299-9720 / Fax: 886-2-2299-9721, CAB identifier: TW1309

## 7. SETUP OF EQUIPMENT UNDER TEST

### 7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix A for the actual connections between EUT and support equipment.

### 7.2 SUPPORT EQUIPMENT

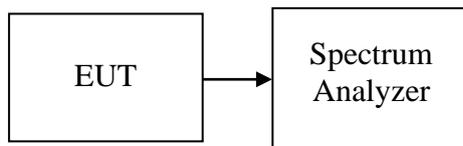
No.	Device Type	Brand	Model	Series No.	FCC ID
1	NB(G)	Lenovo	IBM 1951	N/A	N/A
2	NB	Lenovo	T460P	N/A	N/A
3	NB(E)	Lenovo	IBM 7663	N/A	N/A

**Remark:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

## 8. FCC PART 15.225 REQUIREMENTS

### 8.1 OCCUPIED BANDWIDTH(99%) AND 20 dB BANDWIDTH TEST CONFIGURATION



### TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW & VBW (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth (VBW) shall not be smaller than three times the RBW value.
4. Record the max. reading.

### TEST RESULTS

No non-compliance noted.

**Temperature:** 20.6°C

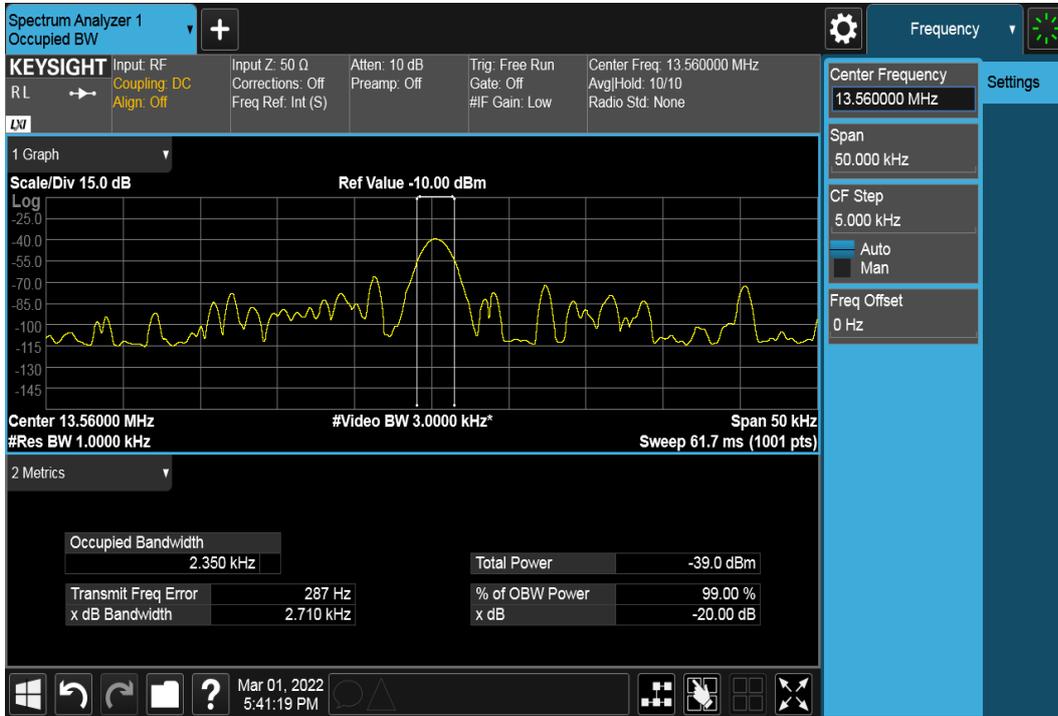
**Test Date:** March 1, 2022

**Humidity:** 66% RH

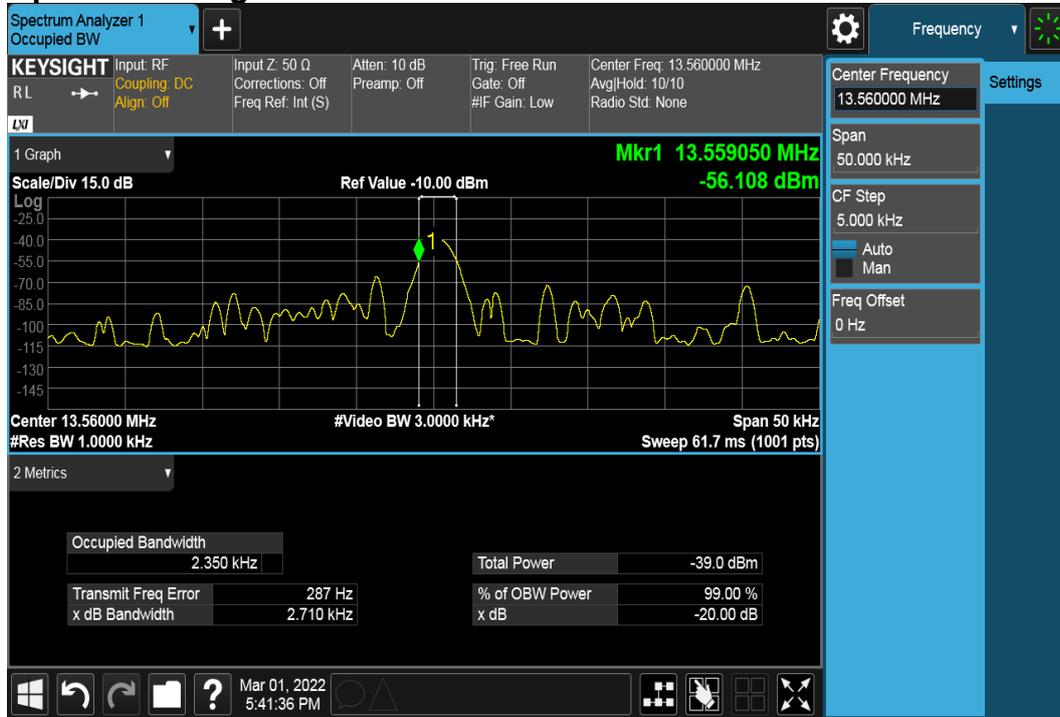
**Tested by:** Marco Chan

Test Condition	Frequency(MHz)	Occupied Bandwidth 99% (kHz)	20 dB Bandwidth (kHz)
NFC	13.56	2.350	2.710

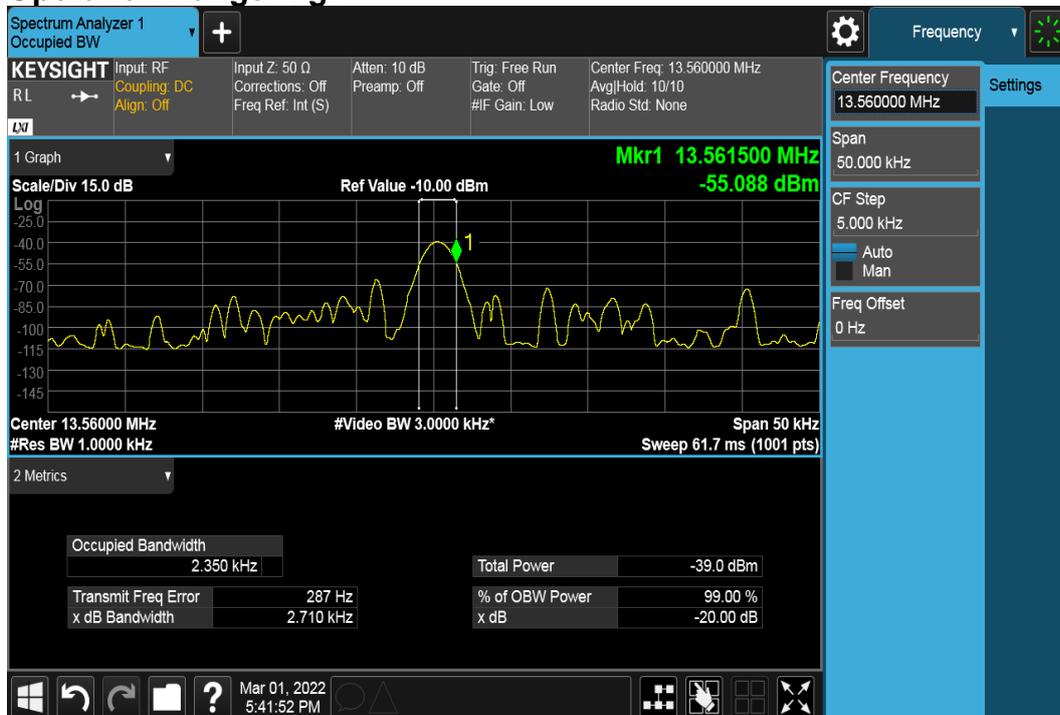
## Test Plot



## Operation Range Low



## Operation Range High



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## 8.2 FUNDAMENTAL AND RADIATED EMISSIONS

### LIMIT

According to §15.225

- (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.
- (b) Within the bands 13.410 – 13.553 MHz and 13.567 -13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts / meter at 30 meters.
- (c) Within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz the field strength of any emissions shall not exceed 106 microvolts / meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz and shall not exceed the general radiated emission limits in §15.209.

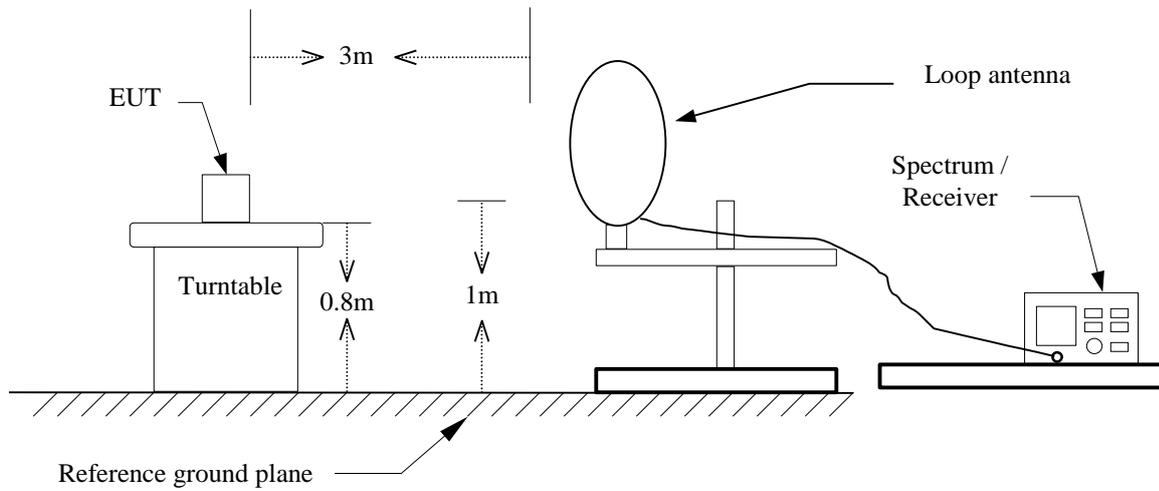
According to §15.225, except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (µV/m at meter)	Measurement Distance (meter)
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

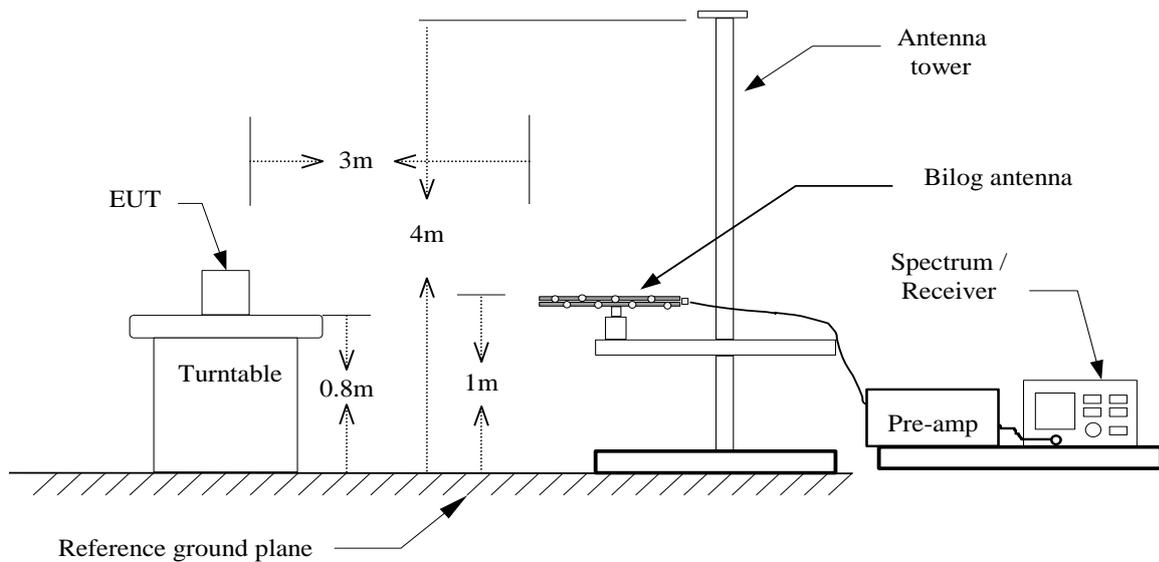
\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

## Test Configuration

### 9kHz ~ 30MHz



### 30MHz ~ 1GHz



## **TEST PROCEDURE**

### **For 9kHz ~ 30MHz**

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, The center of the loop shall be 1 m above the ground then to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Set the spectrum analyzer in the following setting as:  
9KHz-490KHz : RBW=200Hz / VBW=1kHz / Sweep=AUTO  
490KHz-30MHz : RBW=10kHz / VBW=30kHz / Sweep=AUTO
6. Repeat above procedures until the measurements for all frequencies are complete.

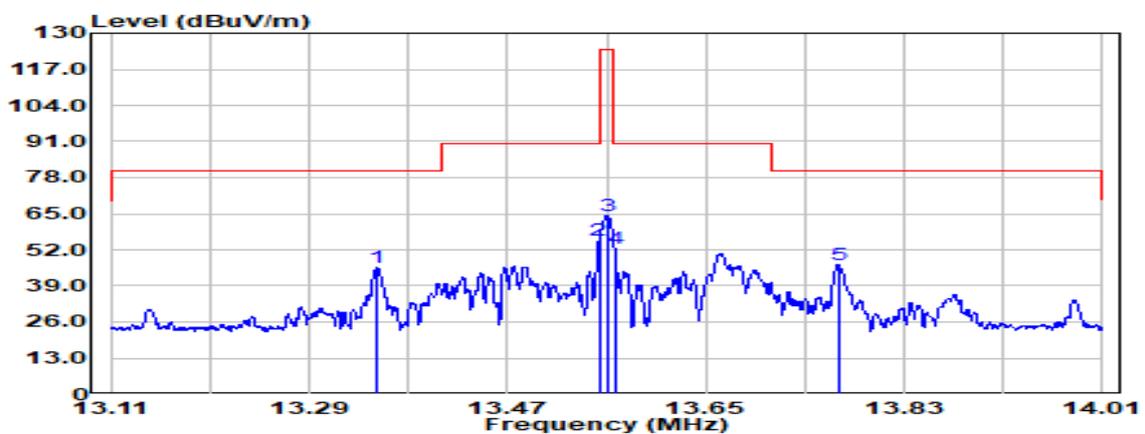
### **For 30MHz ~ 1GHz**

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:  
RBW=100kHz / VBW=300kHz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

### **Remark :**

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

<b>Operation Mode:</b>	TX mode	<b>Polarity:</b>	Horizontal
<b>Temperature:</b>	19.4°C	<b>Test Date:</b>	March 8, 2022
<b>Humidity:</b>	57% RH	<b>Tested by:</b>	Ray Li
<b>Setting:</b>	Ground		

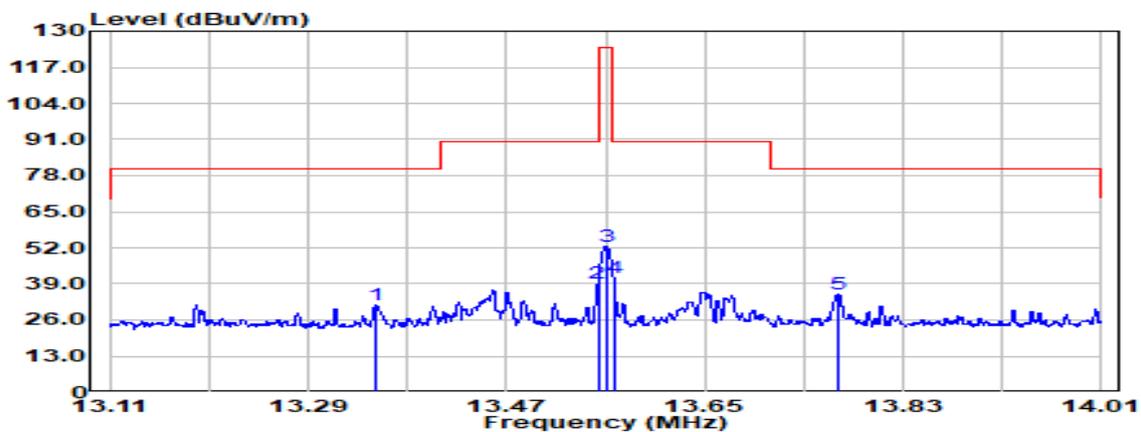


Freq. (MHz)	Detector Mode (PK/QP/AV)	Spectrum Reading Level (dBµV)	Factor (dB)	Actual FS (dBµV/m)	Limit @3m (dBµV/m)	Margin (dB)
13.352	Peak	30.14	15.31	45.45	80.51	-35.06
13.553	Peak	40.13	15.31	55.44	90.47	-35.03
13.560	Peak	48.96	15.31	64.27	124.00	-59.73
13.567	Peak	37.23	15.31	52.54	90.47	-37.93
13.771	Peak	31.28	15.30	46.58	80.51	-33.93

**Remark:**

1. Radiated emissions measured were made with an instrument using peak/quasi-peak/average detector mode.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Margin (dB) = Result (dBUV/m) – Limit (dBUV/m).
4. 9kHz to 490kHz Limit(@3m) = 2400(F/kHz)+ 40\*Log (300 meters/3 meters)  
 490kHz to 1.705MHz Limit (@3m) = 2400(F/kHz)+ 40\*Log (30 meters/3 meters)  
 1.705MHz to 30MHz Limit (@3m) = 30 + 40\*Log (30 meters/3 meters)

<b>Operation Mode:</b>	TX mode	<b>Polarity:</b>	Vertical
<b>Temperature:</b>	19.4°C	<b>Test Date:</b>	March 8, 2022
<b>Humidity:</b>	57% RH	<b>Tested by:</b>	Ray Li

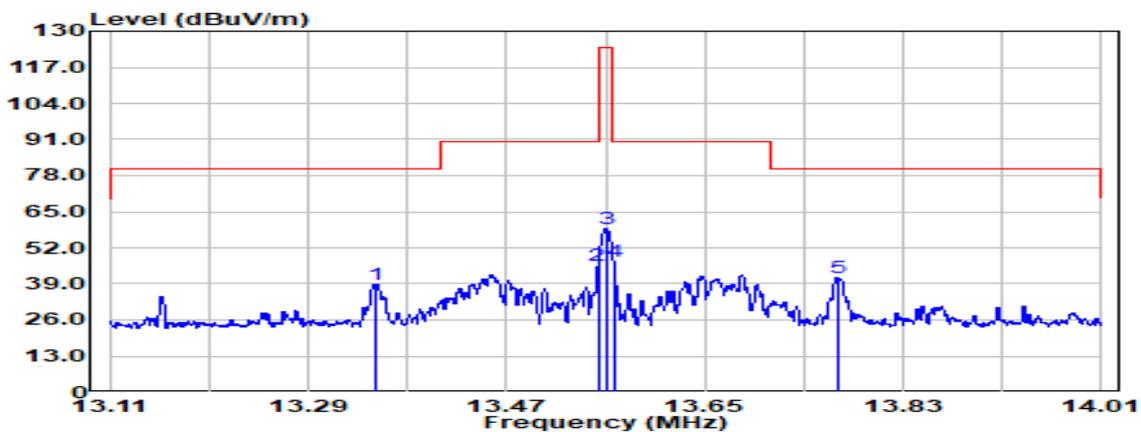


Freq. (MHz)	Detector Mode (PK/QP/AV)	Spectrum Reading Level (dBµV)	Factor (dB)	Actual FS (dBµV/m)	Limit @3m (dBµV/m)	Margin (dB)
13.352	Peak	16.20	15.31	31.52	80.51	-48.99
13.553	Peak	24.09	15.31	39.40	90.47	-51.07
13.560	Peak	36.99	15.31	52.30	124.00	-71.70
13.567	Peak	26.13	15.31	41.43	90.47	-49.04
13.771	Peak	20.19	15.30	35.49	80.51	-45.01

**Remark:**

1. Radiated emissions measured were made with an instrument using peak/quasi-peak/average detector mode.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Margin (dB) = Result (dBuV/m) – Limit (dBuV/m).
4. 9kHz to 490kHz Limit(@3m) = 2400(F/kHz)+ 40\*Log (300 meters/3 meters)  
490kHz to 1.705MHz Limit (@3m) = 2400(F/kHz)+ 40\*Log (30 meters/3 meters)  
1.705MHz to 30MHz Limit (@3m) = 30 + 40\*Log (30 meters/3 meters)

**Operation Mode:** TX mode                      **Polarity:** Horizontal  
**Temperature:** 19.4°C                      **Test Date:** March 8, 2022  
**Humidity:** 57% RH                      **Tested by:** Ray Li



Freq. (MHz)	Detector Mode (PK/QP/AV)	Spectrum Reading Level (dBµV)	Factor (dB)	Actual FS (dBµV/m)	Limit @3m (dBµV/m)	Margin (dB)
13.351	Peak	23.68	15.31	38.99	80.51	-41.52
13.553	Peak	30.39	15.31	45.70	90.47	-44.77
13.560	Peak	43.53	15.31	58.84	124.00	-65.16
13.567	Peak	31.81	15.31	47.12	90.47	-43.35
13.770	Peak	25.96	15.30	41.26	80.51	-39.24

**Remark:**

1. Radiated emissions measured were made with an instrument using peak/quasi-peak/average detector mode.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Margin (dB) = Result (dBuV/m) – Limit (dBuV/m).
4. 9kHz to 490kHz Limit(@3m) = 2400(F/kHz)+ 40\*Log (300 meters/3 meters)  
 490kHz to 1.705MHz Limit (@3m) = 2400(F/kHz)+ 40\*Log (30 meters/3 meters)  
 1.705MHz to 30MHz Limit (@3m) = 30 + 40\*Log (30 meters/3 meters)

### 9kHz ~ 30MHz

**Operation Mode:** TX mode

**Polarity:** Hor.

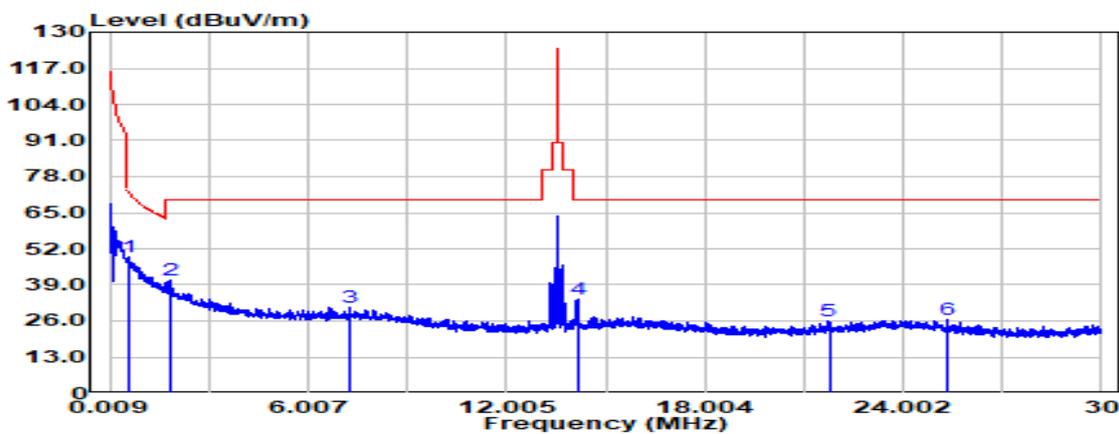
**Temperature:** 19.4°C

**Test Date:** March 8, 2022

**Humidity:** 57% RH

**Tested by:** Ray Li

**Setting:** Ground



Freq. (MHz)	Detector Mode (PK/QP/AV)	Spectrum Reading Level (dBμV)	Factor (dB)	Actual FS (dBμV/m)	Limit @3m (dBμV/m)	Margin (dB)
0.608	Peak	35.44	13.37	48.81	71.93	-23.12
1.812	Peak	27.14	13.79	40.92	69.54	-28.62
7.234	Peak	15.86	14.98	30.83	69.54	-38.71
14.199	Peak	18.35	15.30	33.65	69.54	-35.89
21.761	Peak	11.03	14.88	25.91	69.54	-43.63
25.363	Peak	12.08	14.20	26.28	69.54	-43.26

**Remark:**

- 9kHz to 490kHz Limit(@3m) =  $2400(F/kHz) + 40 \cdot \text{Log}(300 \text{ meters}/3 \text{ meters})$   
 490kHz to 1.705MHz Limit (@3m) =  $2400(F/kHz) + 40 \cdot \text{Log}(30 \text{ meters}/3 \text{ meters})$   
 1.705MHz to 30MHz Limit (@3m) =  $30 + 40 \cdot \text{Log}(30 \text{ meters}/3 \text{ meters})$

**30MHz ~ 1GHz**

**Operation Mode:** TX mode

**Polarity:** Ver. / Hor.

**Temperature:** 19.4°C

**Test Date:** March 8, 2022

**Humidity:** 57% RH

**Tested by:** Ray Li

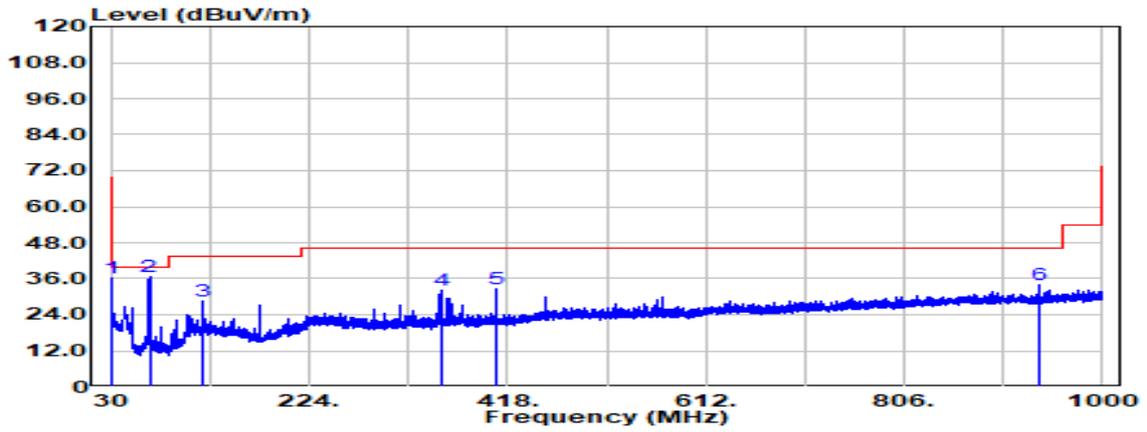
**Setting:** Mode 1: SUF93D

Freq. (MHz)	Detector Mode (PK/QP/AV)	Spectrum Reading Level (dBμV)	Factor (dB)	Actual FS (dBμV/m)	Limit @3m (dBμV/m)	Margin (dB)
31.091	Peak	39.73	-3.40	36.33	40.00	-3.67
67.830	Peak	52.18	-15.39	36.78	40.00	-3.22
119.968	Peak	37.79	-9.39	28.40	43.50	-15.10
352.646	Peak	40.03	-7.66	32.38	46.00	-13.62
408.058	Peak	38.64	-5.81	32.82	46.00	-13.18
937.435	Peak	30.55	3.19	33.74	46.00	-12.26
67.830	Peak	51.17	-15.39	35.78	40.00	-4.22
176.228	Peak	46.25	-11.70	34.55	43.50	-8.95
311.906	Peak	43.99	-8.63	35.36	46.00	-10.64
325.486	Peak	40.72	-8.35	32.37	46.00	-13.63
652.013	Peak	30.43	-0.82	29.61	46.00	-16.39
918.884	Peak	32.14	3.14	35.28	46.00	-10.72

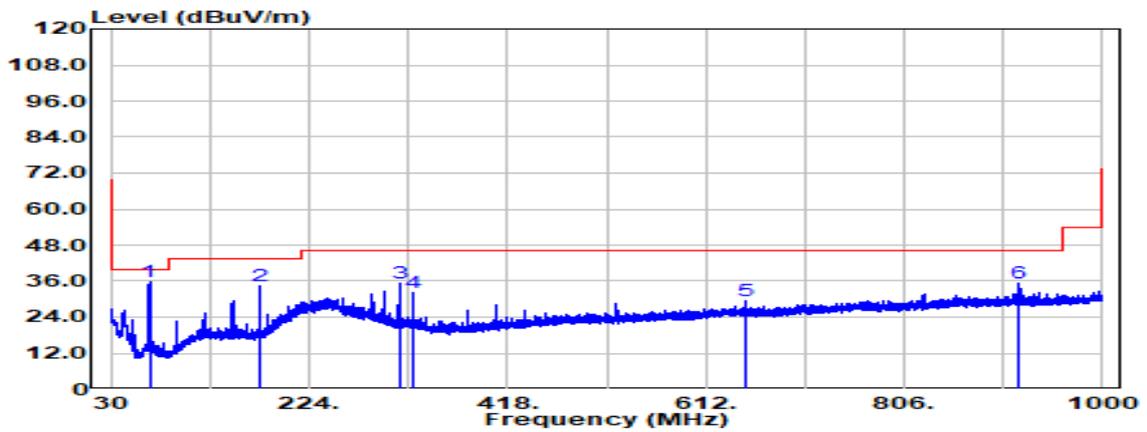
**Remark:**

- 9kHz to 490kHz Limit(@3m) = 2400(F/kHz)+ 40\*Log (300 meters/3 meters)
- 490kHz to 1.705MHz Limit (@3m) = 2400(F/kHz)+ 40\*Log (30 meters/3 meters)
- 1.705MHz to 30MHz Limit (@3m) = 30 + 40\*Log (30 meters/3 meters)

## Vertical



## Horizontal



## 8.3 FREQUENCY STABILITY

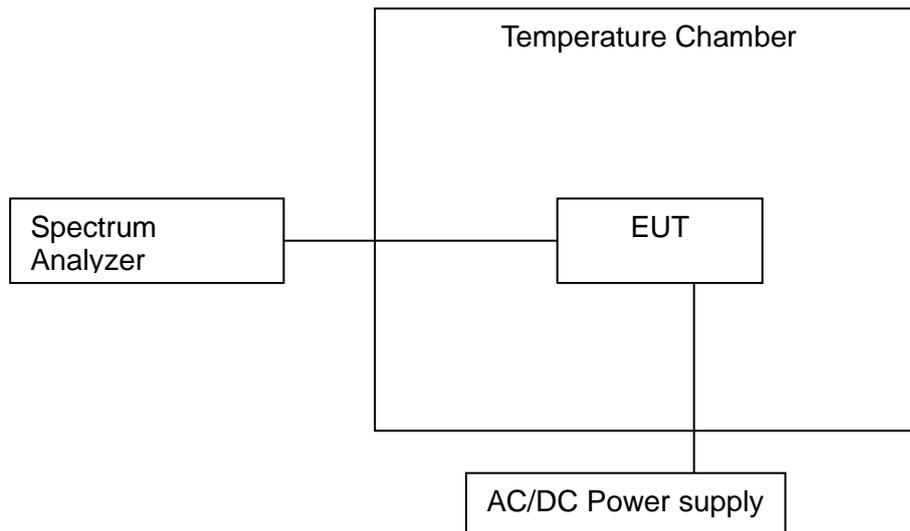
### LIMIT

According to §15.225(e),

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.

### Test Configuration

**Temperature and Voltage Measurement (under normal and extreme test conditions)**



### TEST PROCEDURE

1. Turn the EUT off, and place it inside the environmental temperature chamber.
2. Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.
3. Set the spectrum analyzer as RBW=1kHz, VBW = RBW, Span = 200kHz, Sweep = auto.
4. Turn the EUT on and record the operating frequency at startup and two, five, and ten minutes after the EUT is energized.
5. Switch off the EUT and Lower the chamber temperature by not more than 10 °C and allow the temperature inside the chamber to stabilize.
6. Mark the peak frequency and measure the frequency tolerance using frequency counter function.
7. Repeat step 4 through step 6 down to the lowest specified temperature.

## TEST RESULTS

No non-compliance noted.

**Temperature:** 20.6°C

**Tested by:** Marco Chan

**Humidity:** 66% RH

**Test Date:** March 1, 2022

## TEST DATA

### Startup

Power Supply	Environment	Frequency	Delta (Hz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599915	-8.50	+/- 1.356
5	-10	13.5599945	-5.50	+/- 1.356
5	0	13.5599993	-0.70	+/- 1.356
5	10	13.5600011	1.10	+/- 1.356
5	20	13.5600023	2.30	+/- 1.356
5	30	13.5600080	8.00	+/- 1.356
5	40	13.5600093	9.30	+/- 1.356
5	50	13.5600082	8.20	+/- 1.356

Power Supply	Environment	Frequency	Delta (Hz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5600040	4.00	+/- 1.356
5	20	13.5600023	2.30	+/- 1.356
4.25	20	13.5599969	-3.10	+/- 1.356

### Remark:

- EUT Vnom: 5Vdc, Vmax: 5.75Vdc, Vmin: 4.25Vdc
- EUT Tnom: 25°C, Tmax: 55°C, Tmin: 0°C

**2 minutes**

Power Supply	Environment	Frequency	Delta (Hz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599994	-0.60	+/- 1.356
5	-10	13.5599982	-1.80	+/- 1.356
5	0	13.5600019	1.90	+/- 1.356
5	10	13.5600057	5.70	+/- 1.356
5	20	13.5600020	2.00	+/- 1.356
5	30	13.5600029	2.90	+/- 1.356
5	40	13.5600060	6.00	+/- 1.356
5	50	13.5600083	8.30	+/- 1.356

Power Supply	Environment	Frequency	Delta (Hz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5600042	4.20	+/- 1.356
5	20	13.5600023	2.30	+/- 1.356
4.25	20	13.5599992	-0.80	+/- 1.356

**5 minutes**

Power Supply	Environment	Frequency	Delta (Hz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.5599952	-4.80	+/- 1.356
5	-10	13.5599974	-2.60	+/- 1.356
5	0	13.5599984	-1.60	+/- 1.356
5	10	13.5600066	6.60	+/- 1.356
5	20	13.5600097	9.70	+/- 1.356
5	30	<b>13.5600096</b>	9.60	+/- 1.356
5	40	13.5600083	8.30	+/- 1.356
5	50	13.5600086	8.60	+/- 1.356

Power Supply	Environment	Frequency	Delta (Hz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5600069	6.90	+/- 1.356
5	20	13.5600023	2.30	+/- 1.356
4.25	20	13.5599981	-1.90	+/- 1.356

**Remark:**

1. EUT Vnom: 5Vdc, Vmax: 5.75Vdc, Vmin: 4.25Vdc
2. EUT Tnom: 25°C, Tmax: 55°C, Tmin: 0°C

**10 minutes**

Power Supply	Environment	Frequency	Delta (Hz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5	-20	13.560	-5.40	+/- 1.356
5	-10	13.5599995	-0.50	+/- 1.356
5	0	13.5600018	1.80	+/- 1.356
5	10	13.5600044	4.40	+/- 1.356
5	20	13.5600020	2.00	+/- 1.356
5	30	13.5600043	4.30	+/- 1.356
5	40	13.5600076	7.60	+/- 1.356
5	50	13.5600089	8.90	+/- 1.356

Power Supply	Environment	Frequency	Delta (Hz)	Limit (kHz)
Vdc	Temperature (°C)	(MHz)		
5.75	20	13.5600022	2.20	+/- 1.356
5	20	13.5600023	2.30	+/- 1.356
4.25	20	13.5599944	-5.60	+/- 1.356

**Remark:**

1. EUT Vnom: 5Vdc, Vmax: 5.75Vdc, Vmin: 4.25Vdc
2. EUT Tnom: 25°C, Tmax: 55°C, Tmin: 0°C

## 8.4 POWERLINE CONDUCTED EMISSIONS

### LIMIT

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

\* Decreases with the logarithm of the frequency.

### TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

## TEST RESULTS

**Operation Mode:** Mode 1

**Test Date:** March 2, 2022

**Temperature:** 23.9°C

**Tested by:** Jack Chen

**Humidity:** 56% RH

Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1620	37.29	27.18	10.17	47.46	37.35	65.36	55.36	-17.90	-18.01	L1
0.1780	34.65	17.75	10.18	44.83	27.93	64.58	54.58	-19.75	-26.65	L1
0.2260	26.24	13.33	10.18	36.42	23.51	62.60	52.60	-26.18	-29.09	L1
2.4420	20.35	15.22	10.25	30.60	25.47	56.00	46.00	-25.40	-20.53	L1
3.2660	18.91	12.71	10.27	29.18	22.98	56.00	46.00	-26.82	-23.02	L1
3.3780	18.46	11.90	10.27	28.73	22.17	56.00	46.00	-27.27	-23.83	L1
0.1580	38.48	26.93	10.17	48.65	37.10	65.57	55.57	-16.92	-18.47	N
0.1700	36.08	21.62	10.17	46.25	31.79	64.96	54.96	-18.71	-23.17	N
0.1860	32.51	17.54	10.17	42.68	27.71	64.21	54.21	-21.53	-26.50	N
0.1940	32.11	17.73	10.17	42.28	27.90	63.86	53.86	-21.58	-25.96	N
2.4060	19.31	13.87	10.23	29.54	24.10	56.00	46.00	-26.46	-21.90	N
2.5660	17.89	12.98	10.25	28.14	23.23	56.00	46.00	-27.86	-22.77	N

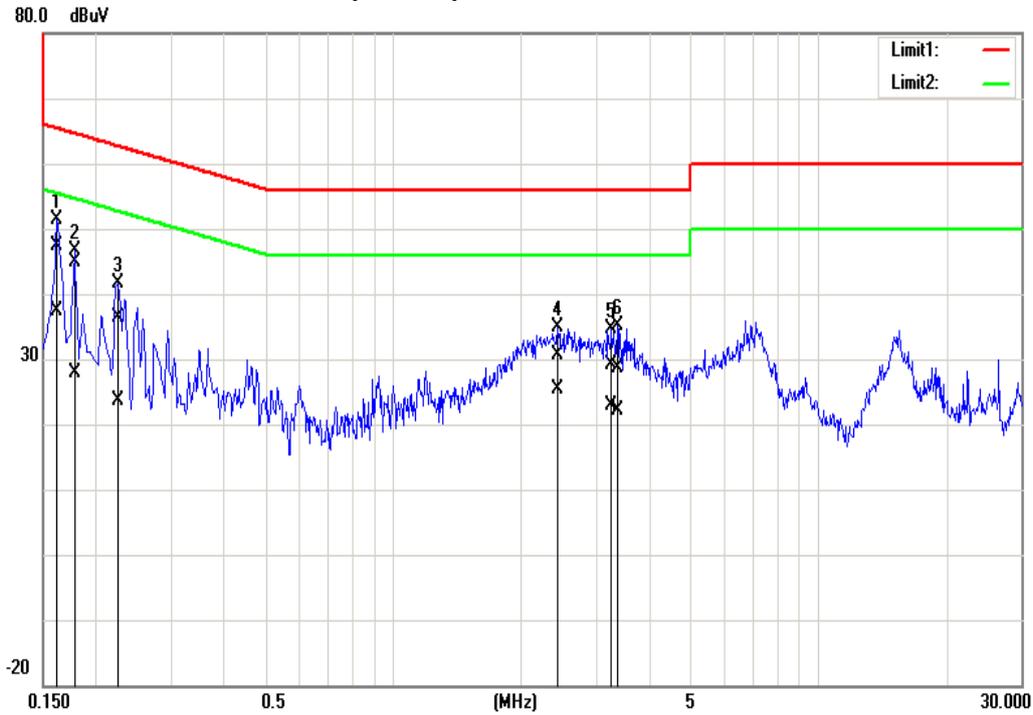
### Remark:

1. The measuring frequencies range between 0.15 MHz and 30 MHz.
2. The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.
3. The IF bandwidth of SPA between 0.15MHz and 30MHz was 10kHz. The IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz.
4. L1 = Line One (Live Line) / N = Line Two (Neutral Line)
5. "-" means Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.

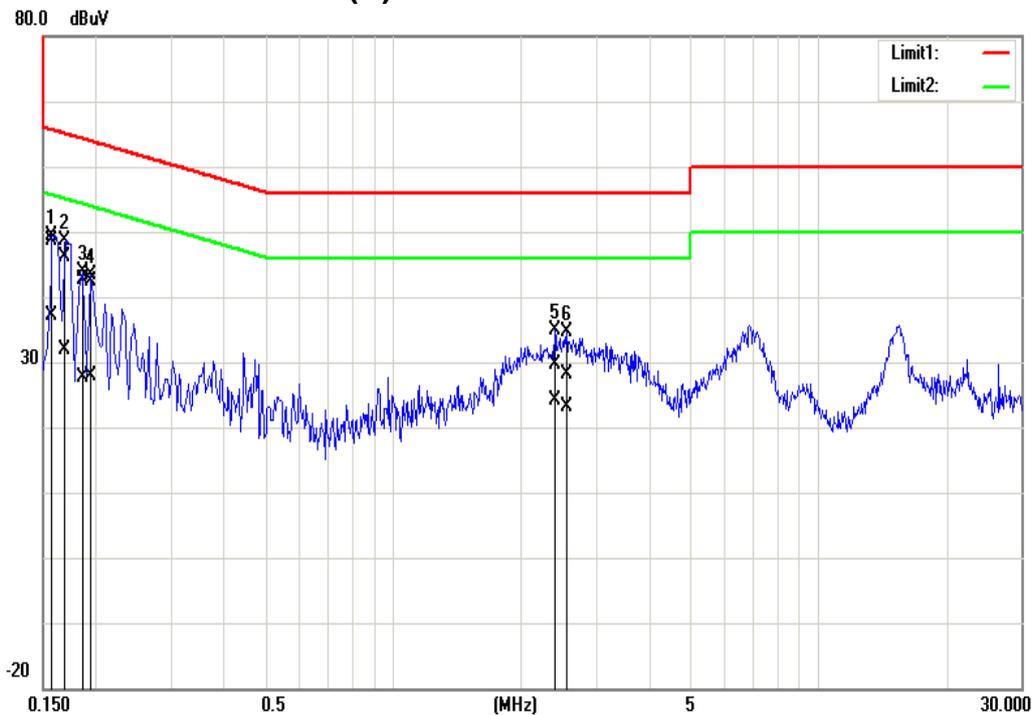
Report No.: TMWK2202000702KR

### Test Plots

#### Conducted emissions (Line 1)



#### Conducted emissions (N)



- End of Test Report -