ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant:	LEDGER SAS 106 Rue du Temple, 75003 Paris, France
Manufacturer:	LEDGER SAS 106 Rue du Temple, 75003 Paris, France
Product Name:	LEDGER FLEX
Brand Name:	[L] or [LEDGER]
Model No.:	0908
Report Number:	TERF2405001455E2
FCC ID	2ASAL-0908
Date of EUT Received:	May 20, 2024
Date of Test:	May 23, 2024～May 29, 2024
Issue Date:	July 26, 2024

Approved By Arno Hsieh
Arno Hsieh

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab 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 EUT comply with FCC rule part §15.225.

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

Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TERF2405001455E2	00	Original.	June 26, 2024	Kate Lai	
TERF2405001455E2	01	Revised: Firmware Version	July 19, 2024	Kate Lai	*
TERF2405001455E2	02	Revised: Firmware Version	July 26, 2024	Kate Lai	*

Note:

1、 The remark "*" indicates modification of the report upon requests from certification body.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	LEDGER FLEX
Brand Name:	[L] or [LEDGER]
Model No.:	0908
Hardware Version:	DVT
Firmware Version:	MCU 6.3.0 + SE 1.0.0-rc1
EUT Series No.:	0UF442S01G (Conducted) 0UF442S03A (Conduction、Radiated)
Power Supply:	3.8 Vdc
Test Software (Name/Version)	STM32CubeMonitor-RF V2.10.0

Note: 2nd source EUT is no car kit connector & No change for RF circuit and layout.

1.2 RF specification

Radio Technology:	NFC
Operating Frequency	13.56MHz
Transmit Power	< 12.02 dBuV/m at 30m.
Number of Channels	1
Modulation Type	ASK
Antenna Type	Coil Antenna

Note: Antenna information is provided by the applicant.

1.3 Test Methodology

FCC Part 15, Subpart C §15.225

ANSI C63.10:2013.

1.4 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 2		
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
		Conducted 6		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

1.5 Special Accessories

There is no other accessory attached. This is the worst case condition.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The Tx frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

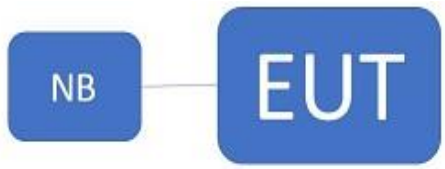
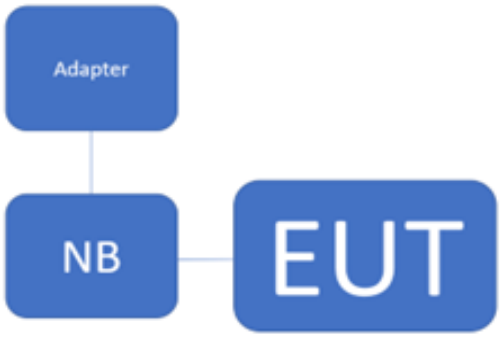
2.3.2 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

2.3.3 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4 Test Configuration

Conducted Setup	Conduction Setup
	

Radiated Setup


2.5 Control Unit(s)

Conducted Emission Test Site: Conducted C					
VIENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
3 Cable	Interplus Industry Co., Ltd	ADV-7570214	N/A	N/A	N/A
tebook	Lenovo	T14	P0003332	N/A	N/A
AC Power-Line Conducted Emission Test Site: Conduction C					
IIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L480	P0002332	N/A	N/A
Radiated Emission Test Site: SAC G					
UIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Notebook	Lenovo	L480	P0002332	N/A	N/A

3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.225 (a)-(d)	Radiated Emission	Compliant
§15.209	Radiated Emission Limits, general requirement	Compliant
§15.225 (e)	Frequency Stability	Compliant
§2.1049 §15.215 (c)	Emission Bandwidth	Compliant
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Bands	Compliant

4 DESCRIPTION OF TEST MODES

4.1 The Worst Test Modes and Channel Details

1. The EUT stay in continuous transmission mode.
2. The frequency 13.56 MHz is the default channel to test, where it is the only manipulative channel as this application supports.
3. Only one configuration is supported/applicable as follows.

RADIATED EMISSION TEST			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK
FREQUENCY STABILITY			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK
20dB and 99% BANDWIDTH			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK

The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.

5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty		
AC Power Line Conducted Emission	+/-	1.54	dB
Frequency Stability	+/-	1.48	Hz
Emission Bandwidth	+/-	1.38	Hz
Temperature	+/-	0.6	°C
Humidity	+/-	3	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty				
Polarization: Vertical	**+/-**	**1.89**	**dB**	9kHz~30MHz
	+/-	**4.15**	**dB**	30MHz - 1000MHz
	+/-	**3.43**	**dB**	1GHz - 18GHz
	+/-	**3.86**	**dB**	18GHz - 40GHz
Polarization: Horizontal	**+/-**	**1.89**	**dB**	9kHz~30MHz
	+/-	**4.02**	**dB**	30MHz - 1000MHz
	+/-	**3.43**	**dB**	1GHz - 18GHz
	+/-	**3.86**	**dB**	18GHz - 40GHz
Radiated Spurious Emission	**+/-**	**2**	**dB**	33GHz-50GHz
	+/-	**1.59**	**dB**	50GHz-60GHz
	+/-	**1.7**	**dB**	60GHz-90GHz
	+/-	**1.64**	**dB**	90GHz-140GHz
	+/-	**3.83**	**dB**	140GHz-220GHz

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

6 MEASUREMENT EQUIPMENT USED

6.1 Emission from AC power line

AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	974	06/19/2023	06/18/2024
EMI Test Receiver	R&S	ESCI	101342	04/29/2024	04/28/2025
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2024	03/26/2025
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2024	03/26/2025
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

6.2 Conducted Measurement

Conducted Emission Test Site: Conducted C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
H-Loop Near Field Antenna	LANGER EMV-Technik	LF-R 400	02-1597	N.C.R	N.C.R
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	04/03/2024	04/02/2025
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/17/2023	06/16/2024
DC Power Supply	Agilent	E3640A	MY53140006	05/17/2024	05/16/2025
DC Block	PASTERNACK	PE8210	RF155	11/15/2023	11/14/2024

6.3 Radiated Measurement

Radiated Emission Test Site: SAC G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWARZBECK	VULB 9168	1208	07/21/2023	07/20/2024
Active Loop Antenna	COM-POWER	AL-130R	10160105	12/04/2023	12/03/2024
3m Site NSA	SGS	966 chamber G	N/A	03/30/2024	03/29/2025
Spectrum Analyzer	KEYSIGHT	N9010B	MY63440390	02/16/2024	02/15/2025
Pre-Amplifier	EMC Instruments	EMC330N	980781	03/13/2024	03/12/2025
Coaxial Cable	EMC Instruments	EMCCFD400-NM-NM-8000-5000-2000	210216、210217、210218	03/13/2024	03/12/2025

NOTE: *N.C.R refers to Not Calibrated Required.*

7 CONDUCTED EMISSIONS TEST

7.1 Standard Applicable

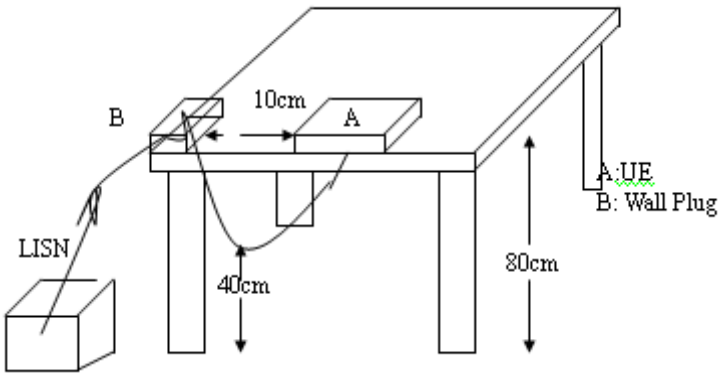
Frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits (dBuV)	
	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
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

7.2 EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

7.3 Test SET-UP (Block Diagram of Configuration)



7.4 Measurement Procedure

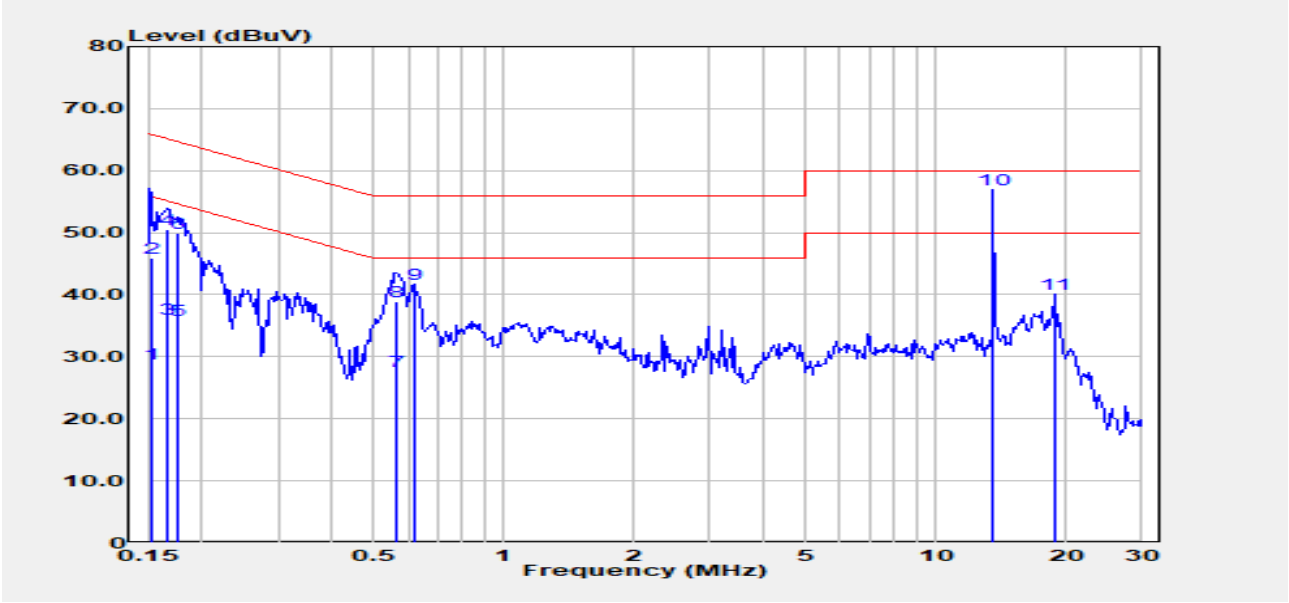
1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

7.5 Measurement Result

Note: Refer to next page for measurement data and plots.
Note2: The * reveals the worst-case results that closest to the limit.

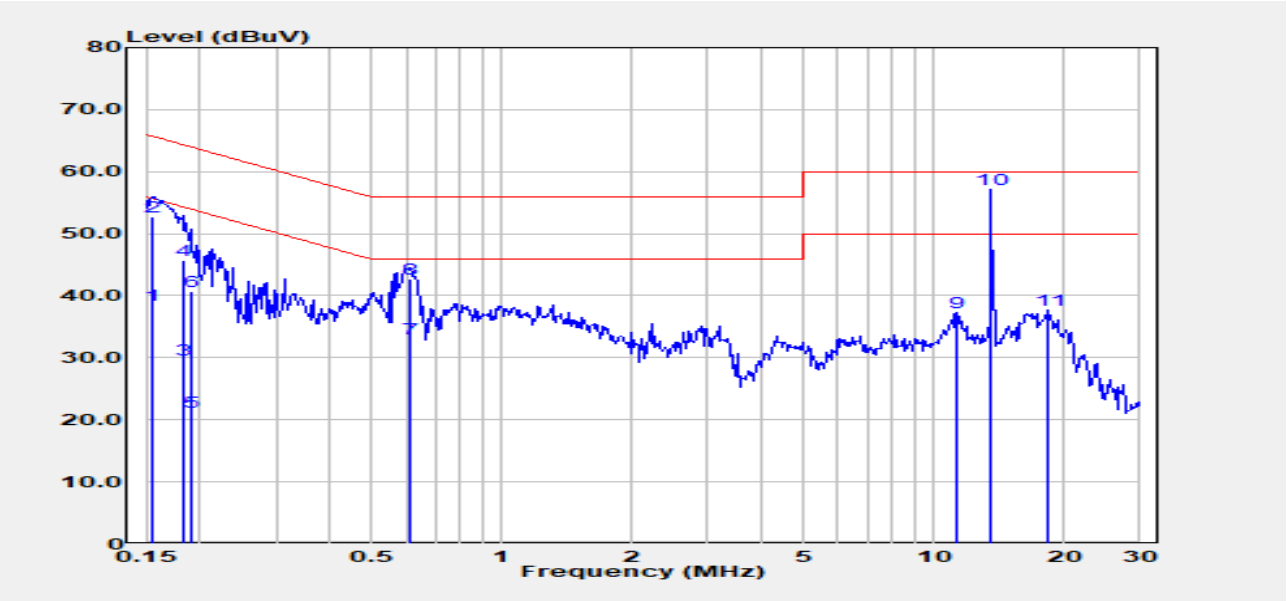
AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:TERF2405001455E2	Test Site	:Conduction C
Test Mode	:NFC	Test Date	:2024-05-23
Power	:120V/60Hz	Temp./Humi.	:23.0℃/55%
Probe	:L1	Engineer	:Jacky Chen
Note	:NFC On		



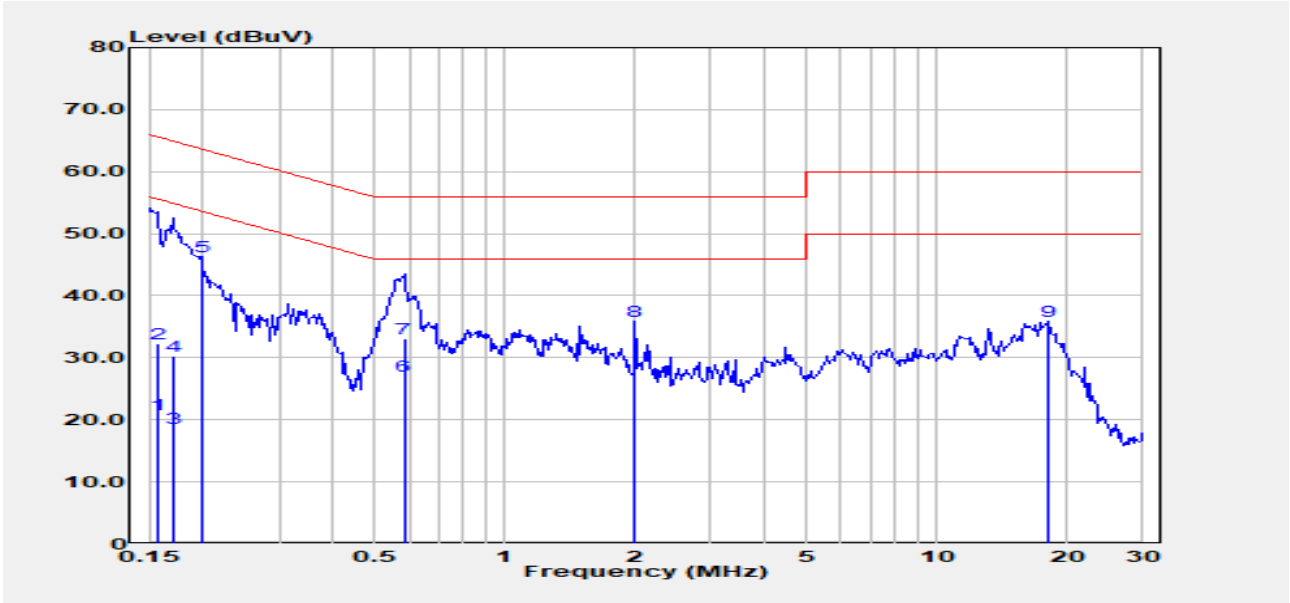
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.153	Average	18.10	10.69	28.79	55.86	-27.07
0.153	QP	35.20	10.69	45.89	65.86	-19.97
0.166	Average	25.50	10.69	36.19	55.15	-18.97
0.166	QP	39.80	10.69	50.49	65.15	-14.67
0.176	Average	25.20	10.68	35.88	54.66	-18.78
0.176	QP	39.30	10.68	49.98	64.66	-14.68
0.564	Average	17.10	10.64	27.74	46.00	-18.26
0.564	QP	28.30	10.64	38.94	56.00	-17.06
0.619	Peak	31.07	10.65	41.73	56.00	-14.27
13.560	Peak	45.95	11.05	57.00	-	-
18.806	Peak	28.89	11.13	40.03	60.00	-19.97

Report Number	:TERF2405001455E2	Test Site	:Conduction C
Test Mode	:NFC	Test Date	:2024-05-23
Power	:120V/60Hz	Temp./Humi.	:23.0℃/55%
Probe	:N	Engineer	:Jacky Chen
Note	:NFC On		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.155	Average	27.80	10.67	38.47	55.72	-17.25
0.155	QP	42.10	10.67	52.77	65.72	-12.95
0.182	Average	19.10	10.67	29.77	54.38	-24.61
0.182	QP	35.10	10.67	45.77	64.38	-18.61
0.190	Average	10.50	10.67	21.17	54.03	-32.86
0.190	QP	30.00	10.67	40.67	64.03	-23.36
0.614	Average	22.40	10.64	33.04	46.00	-12.96
0.614	QP	32.00	10.64	42.64	56.00	-13.36
11.299	Peak	26.26	11.05	37.31	60.00	-22.69
13.560	Peak	45.97	11.11	57.08	-	-
18.490	Peak	26.53	11.21	37.75	60.00	-22.25

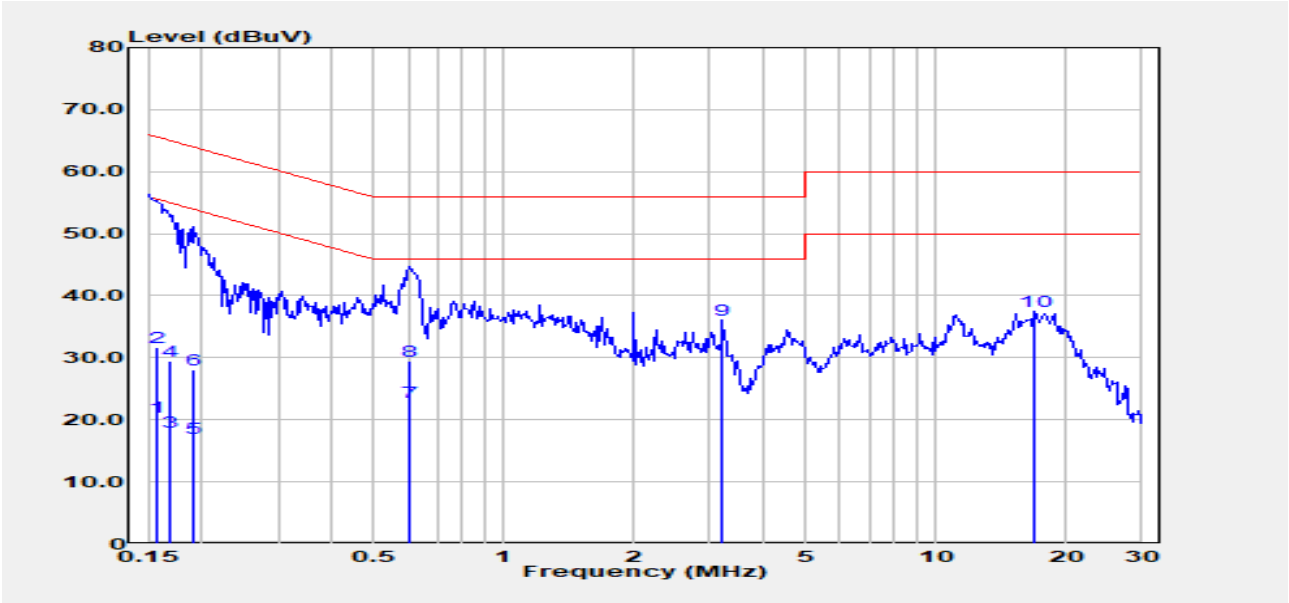
Report Number	:TERF2405001455E2	Test Site	:Conduction C
Test Mode	:NFC	Test Date	:2024-05-23
Power	:120V/60Hz	Temp./Humi.	:23.0℃/55%
Probe	:L1	Engineer	:Jacky Chen
Note	:Standby Mode*		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.158	Average	10.20	10.69	20.89	55.58	-34.69
0.158	QP	21.60	10.69	32.29	65.58	-33.29
0.170	Average	7.90	10.69	18.59	54.94	-36.36
0.170	QP	19.50	10.69	30.19	64.94	-34.76
0.199	Peak	35.62	10.68	46.30	63.67	-17.38
0.584	Average	16.40	10.65	27.05	46.00	-18.95
0.584	QP	22.50	10.65	33.15	56.00	-22.85
1.999	Peak	25.17	10.78	35.95	56.00	-20.05
18.178	Peak	24.74	11.13	35.86	60.00	-24.14

*Terminate the RF output and retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band.

Report Number	:TERF2405001455E2	Test Site	:Conduction C
Test Mode	:NFC	Test Date	:2024-05-23
Power	:120V/60Hz	Temp./Humi.	:23.0℃/55%
Probe	:N	Engineer	:Jacky Chen
Note	:Standby Mode*		



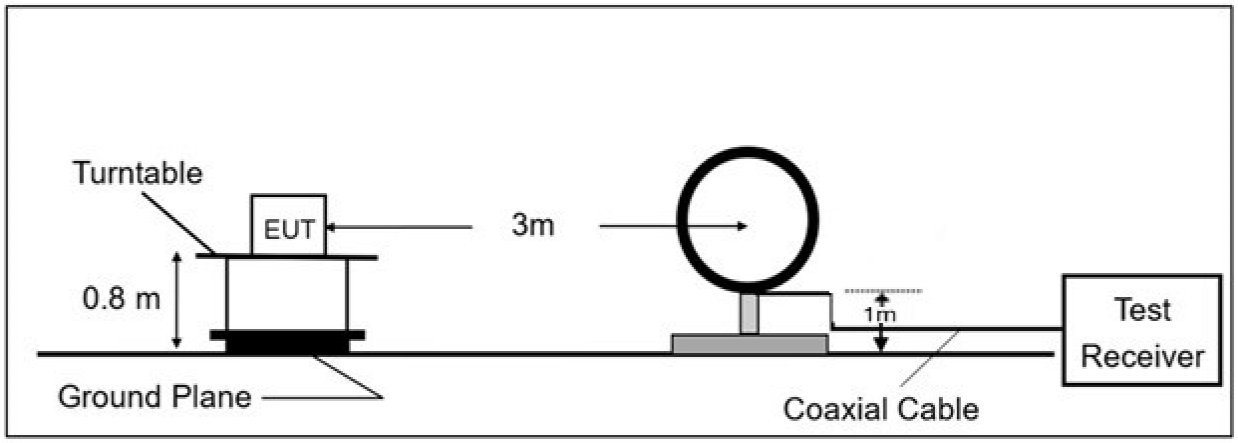
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.158	Average	9.80	10.67	20.47	55.58	-35.11
0.158	QP	21.10	10.67	31.77	65.58	-33.81
0.169	Average	7.40	10.67	18.07	55.01	-36.94
0.169	QP	18.80	10.67	29.47	65.01	-35.54
0.190	Average	6.30	10.67	16.97	54.03	-37.06
0.190	QP	17.30	10.67	27.97	64.03	-36.06
0.604	Average	12.30	10.64	22.94	46.00	-23.06
0.604	QP	18.80	10.64	29.44	56.00	-26.56
3.216	Peak	25.17	10.86	36.04	56.00	-19.96
16.985	Peak	26.39	11.19	37.57	60.00	-22.43

*Terminate the RF output and retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band.

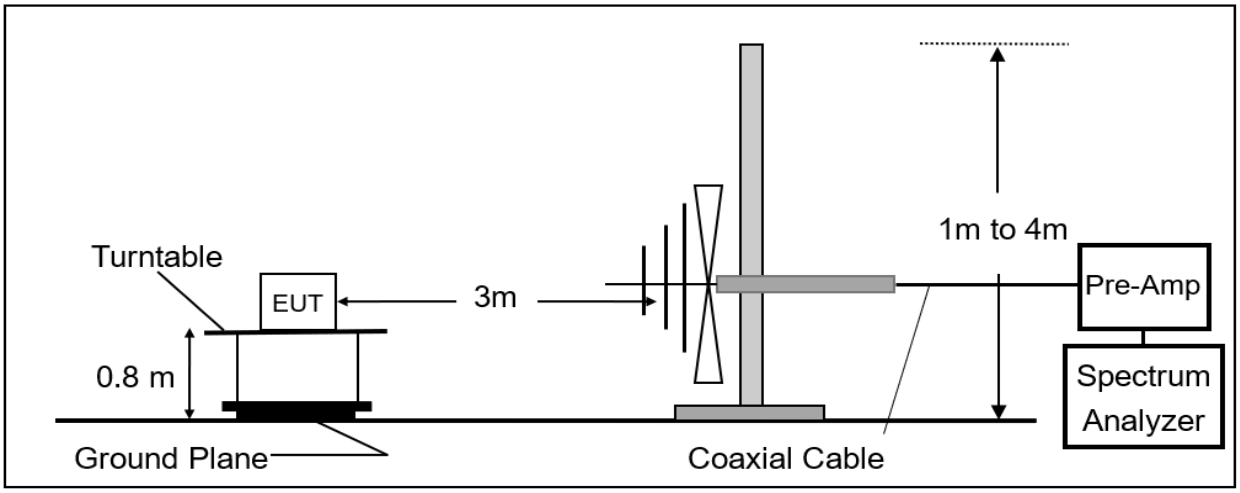
8 RADIATED EMISSION TEST

8.1 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz.



8.2 Measurement Procedure

1. Configure the EUT according to ANSI C63.10.
2. The EUT was placed on a turn table which is 0.8m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all default test channel measured were complete.

8.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

8.4 Field Strength of Fundamental Emission

8.4.1 Applicable standard

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)	
Frequency of Emission (MHz)	Field Strength (μV/m)at 30m	Field Strength (dBμV/m)at 30m
1.705~13.110	30	29.5
13.110~13.410	106	40.5
13.410~13.553	334	50.5
13.553~13.567	15848	84
13.567~13.710	334	50.5
13.710~14.010	106	40.5
14.010~30.00	30	29.5

8.4.2 Distance Extrapolation Factor

30m to 3m

Distance extrapolation = 40 *log (30/3) = 40 dB

30m to 10m

Distance extrapolation = 40 *log (30/10) = 19.08 dB

10m to 3m

Distance extrapolation = 40 *log (10/3) = 20.92 dB

Note:

1. Distance extrapolation factor = 40 log (required distance/ test distance) (dB)
2. The lower limit shall apply at the transition frequencies.
3. KDB 414788 D01 OATS and 3m semi-anechoic chamber Justification:
   Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. OATS and 3m SAC chamber testing had been performed and 3m SAC measured test result is the worst case test result.

Actual FS(dBμV/m) = Spectrum. Reading level(dBμV) + Factor(dB)

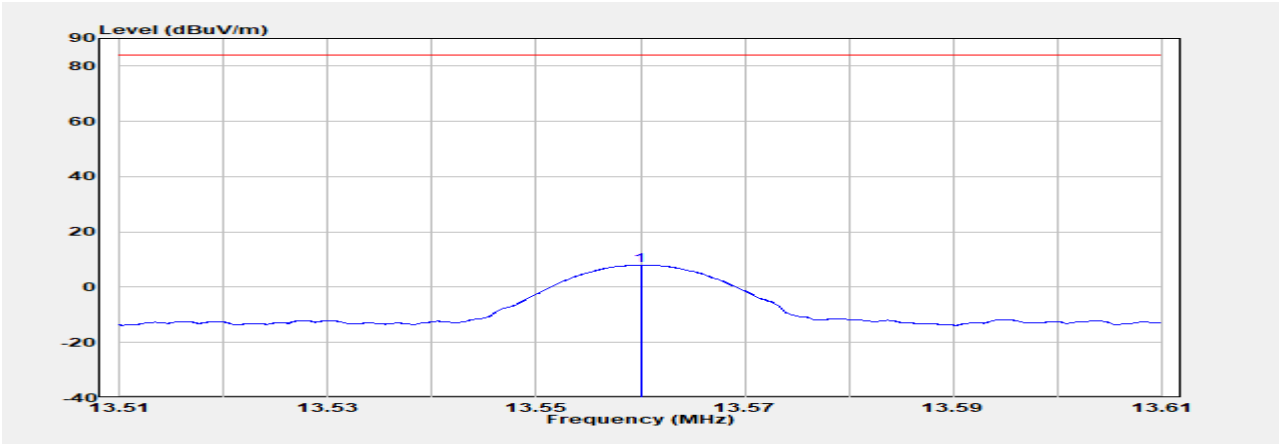
Below 30 MHz of Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Distance Factor (dB)

Above 30 MHz of Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amp Gain (dB)

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

8.4.3 Field Strength of Fundamental Emission Measurement Result

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-23
Test Frequency	:13.56 MHz	Temp./Humi.	:24.3℃/57%
Test Mode	:Main	Antenna Pol.	:Coaxial
EUT Pol	:E1 Plane	Engineer	:Jacky Chen



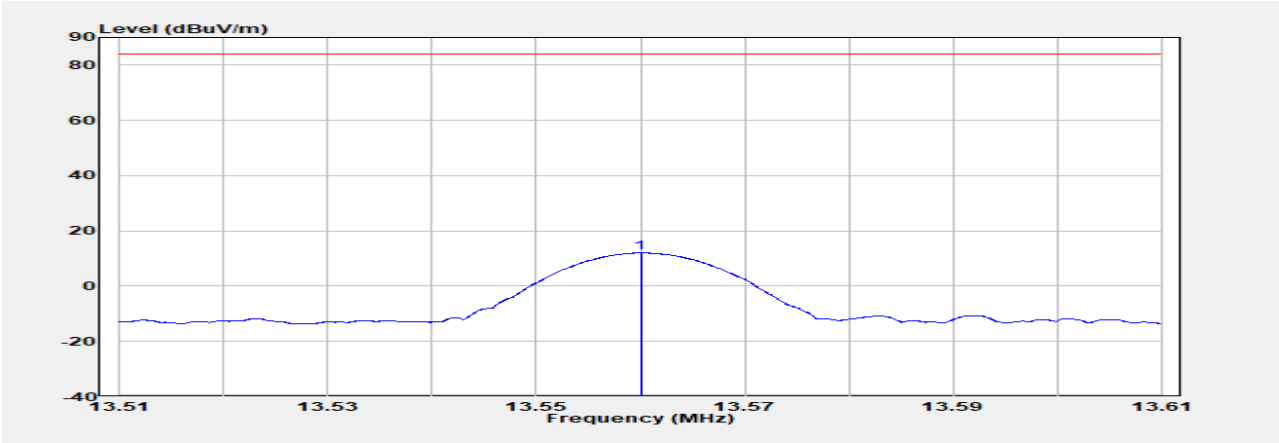
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
13.560	Peak	32.39	-24.43	7.96	84.00	-76.04

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-23
Test Frequency	:13.56 MHz	Temp./Humi.	:24.3℃/57%
Test Mode	:Main	Antenna Pol.	:Coplanar
EUT Pol	:E1 Plane	Engineer	:Jacky Chen



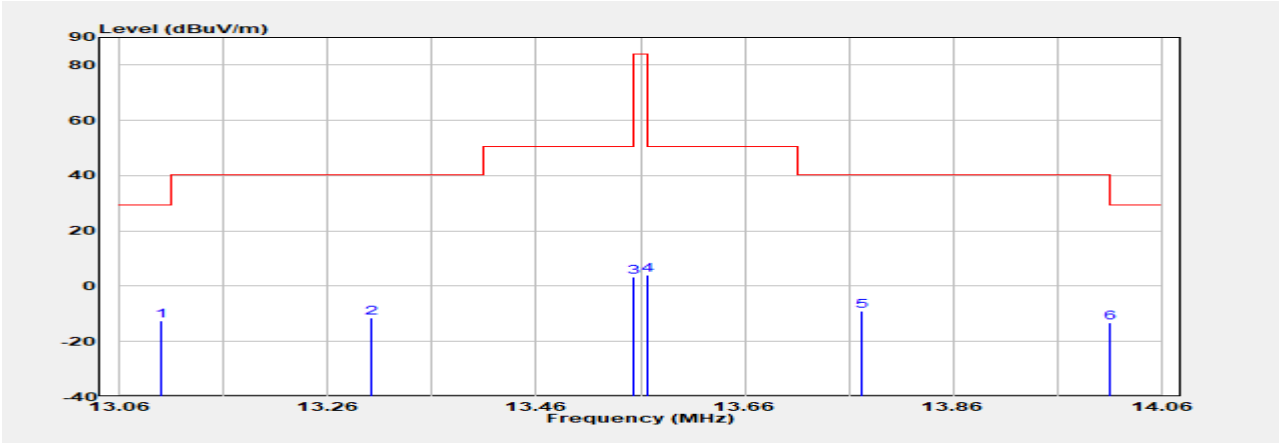
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
13.560	Peak	36.45	-24.43	12.02	84.00	-71.98

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-23
Test Frequency	:13.56 MHz	Temp./Humi.	:24.3℃/57%
Test Mode	:Mask	Antenna Pol.	: Coaxial
EUT Pol	:E1 Plane	Engineer	:Jacky Chen



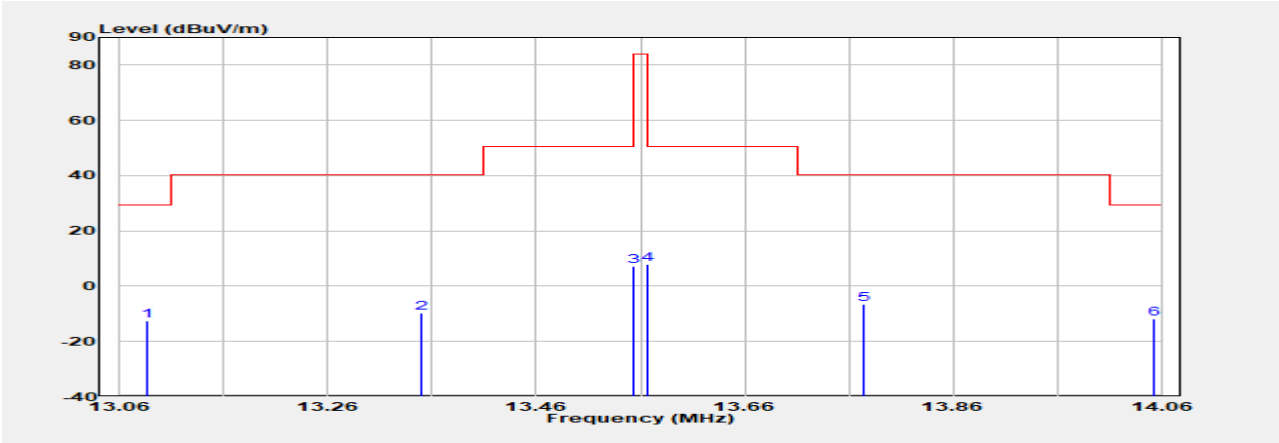
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
13.099	Peak	12.02	-24.43	-12.41	29.54	-41.95
13.302	Peak	13.03	-24.43	-11.40	40.50	-51.90
13.553	Peak	27.64	-24.43	3.21	50.47	-47.26
13.567	Peak	28.60	-24.43	4.17	50.47	-46.30
13.772	Peak	15.35	-24.43	-9.08	40.50	-49.58
14.010	Peak	11.32	-24.43	-13.12	29.54	-42.66

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-23
Test Frequency	:13.56 MHz	Temp./Humi.	:24.3℃/57%
Test Mode	:Mask	Antenna Pol.	: Coplanar
EUT Pol	:E1 Plane	Engineer	:Jacky Chen



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
13.087	Peak	11.99	-24.43	-12.44	29.54	-41.98
13.349	Peak	14.59	-24.43	-9.84	40.50	-50.34
13.553	Peak	31.65	-24.43	7.22	50.47	-43.25
13.567	Peak	32.30	-24.43	7.86	50.47	-42.61
13.774	Peak	17.92	-24.43	-6.51	40.50	-47.01
14.053	Peak	12.55	-24.43	-11.88	29.54	-41.42

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

8.5 Radiated Spurious Emission Measurement

8.5.1 Standard Applicable

The field strength of any emissions appearing outside of the 13.110-14.010 MHz shall not exceed the general radiated emission limits as below.

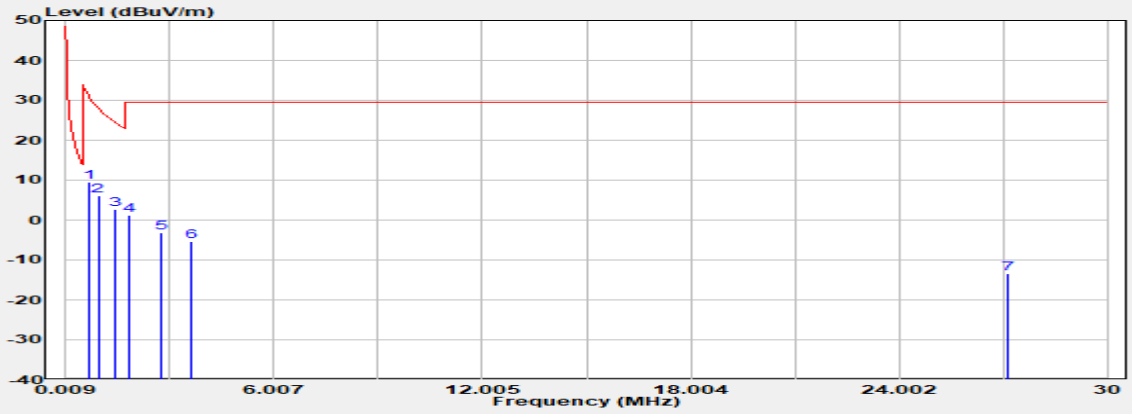
Frequency (MHz)	Field strength (μV/m)	Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. Emission level in dBμV/m=20 log (μV/m)
2. Distance extrapolation factor = 40 log (required distance/ test distance) (dB)
3. 20*log(30uV/m) = 29.54 dBuV/m
4. The lower limit shall apply at the transition frequencies.
5. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
6. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.
7. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

8.5.2 Radiated Spurious Emission Measurement Result

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-23
Test Frequency	:13.56 MHz	Temp./Humi.	:24.3℃/57%
Test Mode	:Tx	Antenna Pol.	: Coaxial
EUT Pol	:E1 Plane	Engineer	:Jacky Chen



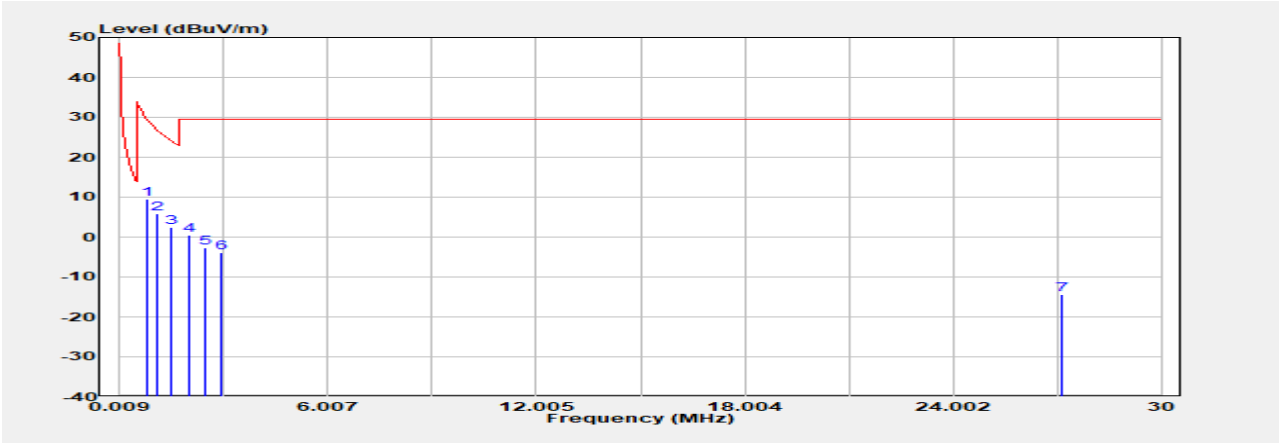
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
0.669	Peak	36.16	-26.57	9.59	31.11	-21.52
0.939	Peak	32.52	-26.43	6.10	28.16	-22.06
1.419	Peak	28.80	-26.21	2.59	24.57	-21.98
1.808	Peak	27.27	-26.05	1.22	29.54	-28.32
2.738	Peak	22.46	-25.73	-3.27	29.54	-32.81
3.608	Peak	20.11	-25.51	-5.39	29.54	-34.93
27.120	Peak	12.76	-26.18	-13.43	29.54	-42.97

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-23
Test Frequency	:13.56 MHz	Temp./Humi.	:24.3℃/57%
Test Mode	:Tx	Antenna Pol.	: Coplanar
EUT Pol	:E1 Plane	Engineer	:Jacky Chen



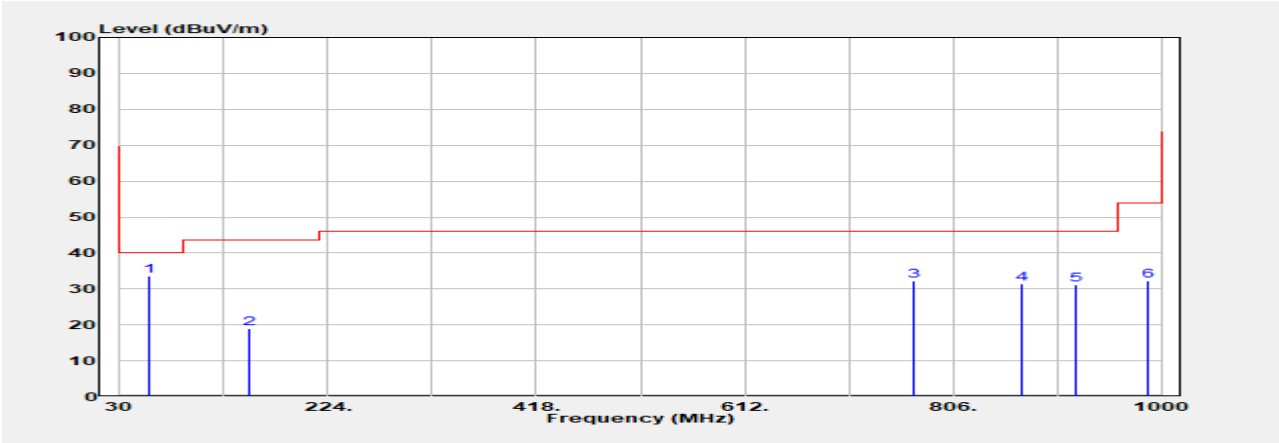
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
0.789	Peak	35.93	-26.51	9.42	29.67	-20.24
1.089	Peak	32.10	-26.35	5.74	26.87	-21.13
1.479	Peak	28.53	-26.19	2.34	24.21	-21.87
1.988	Peak	26.35	-25.98	0.37	29.54	-29.17
2.468	Peak	23.24	-25.82	-2.58	29.54	-32.12
2.948	Peak	21.82	-25.66	-3.84	29.54	-33.38
27.120	Peak	11.83	-26.18	-14.35	29.54	-43.89

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-23
Test Frequency	:13.56 MHz	Temp./Humi.	:24.3℃/57%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E1 Plane	Engineer	:Jacky Chen



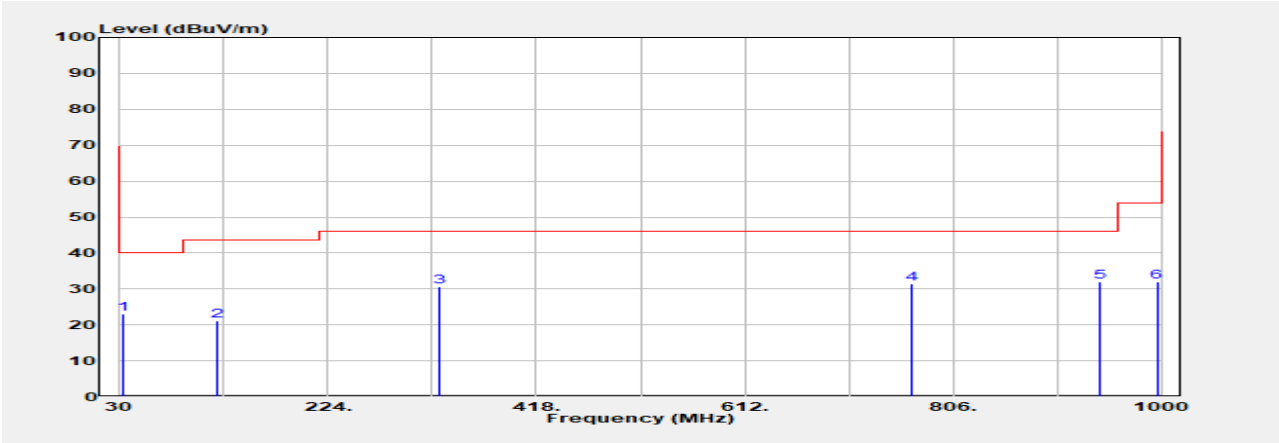
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
58.130	Peak	46.55	-12.95	33.60	40.00	-6.40
151.250	Peak	31.78	-12.72	19.06	43.50	-24.44
769.140	Peak	33.72	-1.57	32.15	46.00	-13.85
870.020	Peak	31.98	-0.45	31.54	46.00	-14.46
920.460	Peak	31.45	-0.41	31.04	46.00	-14.96
987.390	Peak	31.50	0.81	32.32	54.00	-21.68

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-23
Test Frequency	:13.56 MHz	Temp./Humi.	:24.3℃/57%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E1 Plane	Engineer	:Jacky Chen



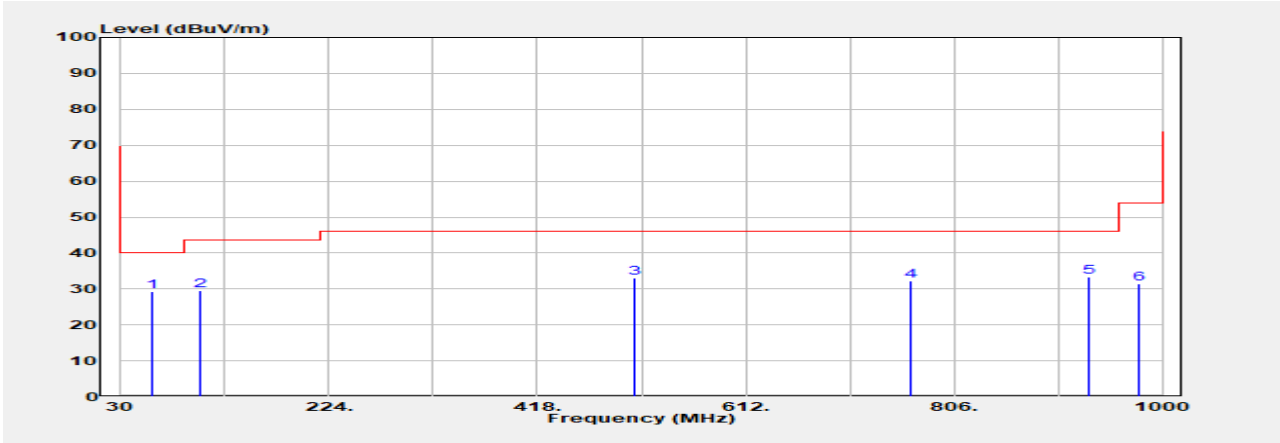
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
33.880	Peak	37.33	-14.23	23.11	40.00	-16.89
120.210	Peak	36.59	-15.56	21.03	43.50	-22.47
327.790	Peak	41.89	-11.16	30.73	46.00	-15.27
768.170	Peak	32.96	-1.58	31.38	46.00	-14.62
943.740	Peak	31.82	0.06	31.89	46.00	-14.11
996.120	Peak	31.34	0.77	32.11	54.00	-21.89

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-29
Test Frequency	:13.56 MHz	Temp./Humi.	:23.9℃/56%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E1 Plane	Engineer	:Jacky Chen
Note	:2nd source EUT		



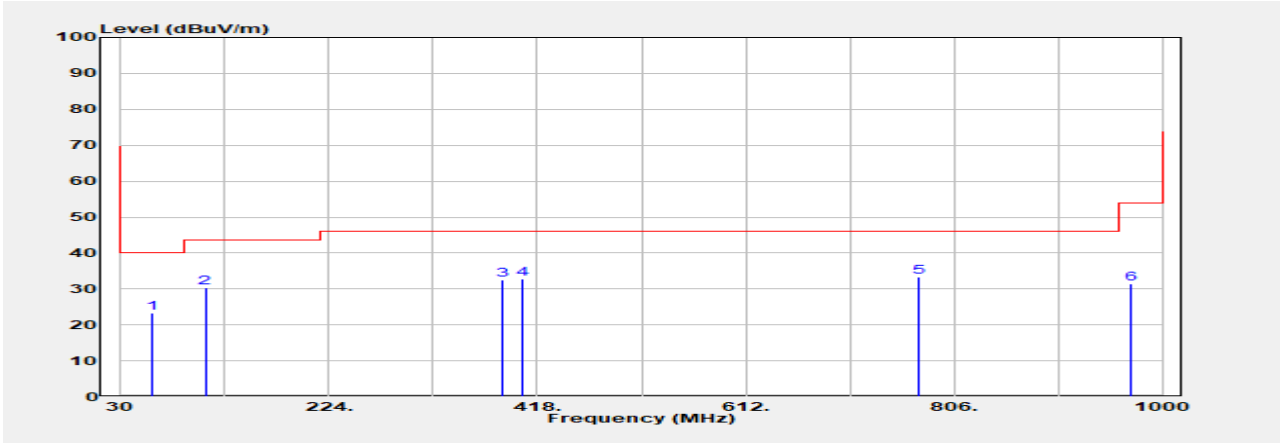
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
59.100	QP	42.20	-13.02	29.18	40.00	-10.82
104.690	Peak	46.29	-16.79	29.50	43.50	-14.00
509.180	Peak	40.27	-7.13	33.14	46.00	-12.86
766.230	Peak	33.98	-1.61	32.37	46.00	-13.63
932.100	Peak	33.53	-0.25	33.28	46.00	-12.72
977.690	Peak	30.47	1.00	31.47	54.00	-22.53

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

Report Number	:TERF2405001455E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-05-29
Test Frequency	:13.56 MHz	Temp./Humi.	:23.9℃/56%
Test Mode	:Tx	Antenna Pol.	:Horizontal
EUT Pol	:E1 Plane	Engineer	:Jacky Chen
Note	:2nd source EUT		



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
59.100	Peak	36.21	-13.02	23.18	40.00	-16.82
108.570	QP	46.70	-16.42	30.28	43.50	-13.22
385.990	Peak	41.97	-9.55	32.43	46.00	-13.57
403.450	Peak	42.15	-9.36	32.79	46.00	-13.21
773.990	Peak	34.79	-1.53	33.26	46.00	-12.74
970.900	Peak	30.26	1.26	31.52	54.00	-22.48

Actual level = Reading level + Factor
Factor = Antenna factor + cable loss – Pre_Amplifier Gain — distance factor

Test distance= 3m

For Actual level and limit:
Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

9 FREQUENCY STABILITY

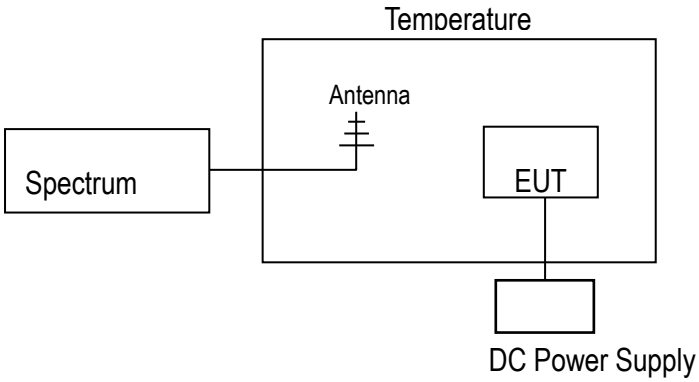
9.1 Applicable Standard

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.

9.2 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.
4. Set SPA Max hold. Mark peak.

9.3 Test SET-UP (Block Diagram of Configuration)



9.4 Measurement Results

Startup

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (℃)	(MHz)		
3.8	-20	13.55943	-0.57000	+/- 1.356
3.8	-10	13.55905	-0.95000	+/- 1.356
3.8	0	13.55976	-0.24000	+/- 1.356
3.8	10	13.55936	-0.64000	+/- 1.356
3.8	20	13.55903	-0.97000	+/- 1.356
3.8	30	13.55917	-0.83000	+/- 1.356
3.8	40	13.55942	-0.58000	+/- 1.356
3.8	50	13.55926	-0.74000	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (℃)	(MHz)		
4.37	20	13.55965	-0.35000	+/- 1.356
3.8	20	13.55903	-0.97000	+/- 1.356
3.23	20	13.55948	-0.52000	+/- 1.356

2 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (℃)	(MHz)		
3.8	-20	13.55987	-0.13000	+/- 1.356
3.8	-10	13.55998	-0.02000	+/- 1.356
3.8	0	13.55929	-0.71000	+/- 1.356
3.8	10	13.55951	-0.49000	+/- 1.356
3.8	20	13.55997	-0.03000	+/- 1.356
3.8	30	13.55997	-0.03000	+/- 1.356
3.8	40	13.55951	-0.49000	+/- 1.356
3.8	50	13.55949	-0.51000	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (℃)	(MHz)		
4.37	20	13.55974	-0.26000	+/- 1.356
3.8	20	13.55997	-0.03000	+/- 1.356
3.23	20	13.55954	-0.46000	+/- 1.356

5 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (℃)	(MHz)		
3.8	-20	13.55955	-0.45000	+/- 1.356
3.8	-10	13.55974	-0.26000	+/- 1.356
3.8	0	13.55932	-0.68000	+/- 1.356
3.8	10	13.55907	-0.93000	+/- 1.356
3.8	20	13.55911	-0.89000	+/- 1.356
3.8	30	13.55939	-0.61000	+/- 1.356
3.8	40	13.55903	-0.97000	+/- 1.356
3.8	50	13.55934	-0.66000	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (℃)	(MHz)		
4.37	20	13.55918	-0.82000	+/- 1.356
3.8	20	13.55911	-0.89000	+/- 1.356
3.23	20	13.55979	-0.21000	+/- 1.356

10 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (℃)	(MHz)		
3.8	-20	13.55983	-0.17000	+/- 1.356
3.8	-10	13.55961	-0.39000	+/- 1.356
3.8	0	13.55924	-0.76000	+/- 1.356
3.8	10	13.55903	-0.97000	+/- 1.356
3.8	20	13.55903	-0.97000	+/- 1.356
3.8	30	13.55927	-0.73000	+/- 1.356
3.8	40	13.55935	-0.65000	+/- 1.356
3.8	50	13.55951	-0.49000	+/- 1.356

B. Supply Voltage Variation

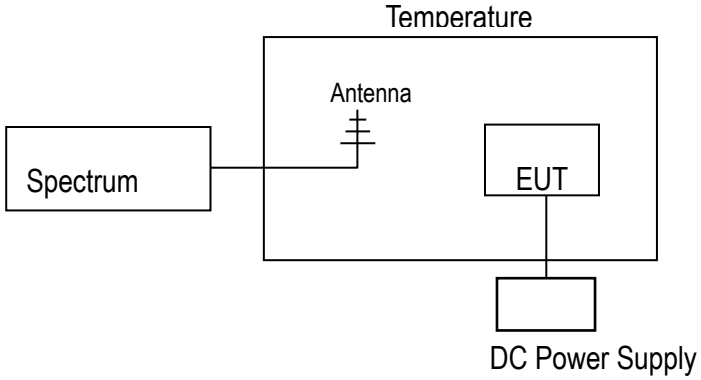
Power Supply	Environment	Frequency	Delta (kHz)	Limit (kHz)
Vdc	Temperature (℃)	(MHz)		
4.37	20	13.55935	-0.65000	+/- 1.356
3.8	20	13.55903	-0.97000	+/- 1.356
3.23	20	13.55959	-0.41000	+/- 1.356

10 EMISSION BANDWIDTH MEASUREMENT

10.1 Applicable Standard:

The 20 dB and 99% bandwidth shall be specified in operating frequency band.

10.2 Test Set-up



10.3 Measurement Procedure

1. Placed the EUT on the testing table.
2. Set the EUT under transmission condition continuously at specific channel frequency.
3. Set SPA Center Frequency = fundamental frequency, RBW=1% to 5% OBW, VBW=3 x RBW, Span = large enough to capture all products of the modulation process.
4. Measured the spectrum width with power higher than 20dB below carrier.

10.4 Measurement Result

FCC

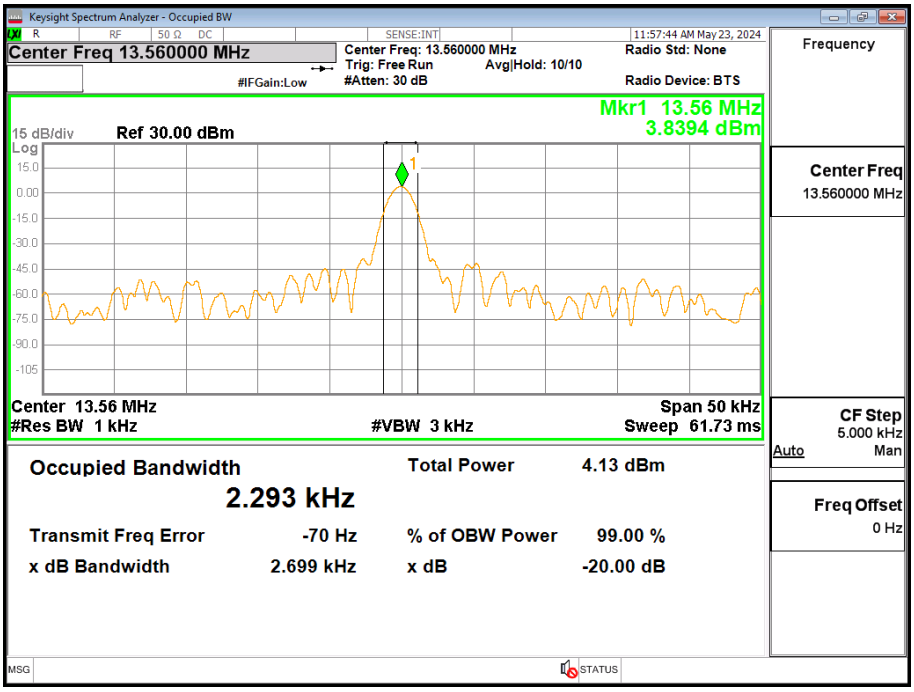
20dB BW (kHz)
2.699

Opration range	Frequency (MHz)	Limit (MHz)
Low	13.55870	>13.11
High	13.56110	<14.01

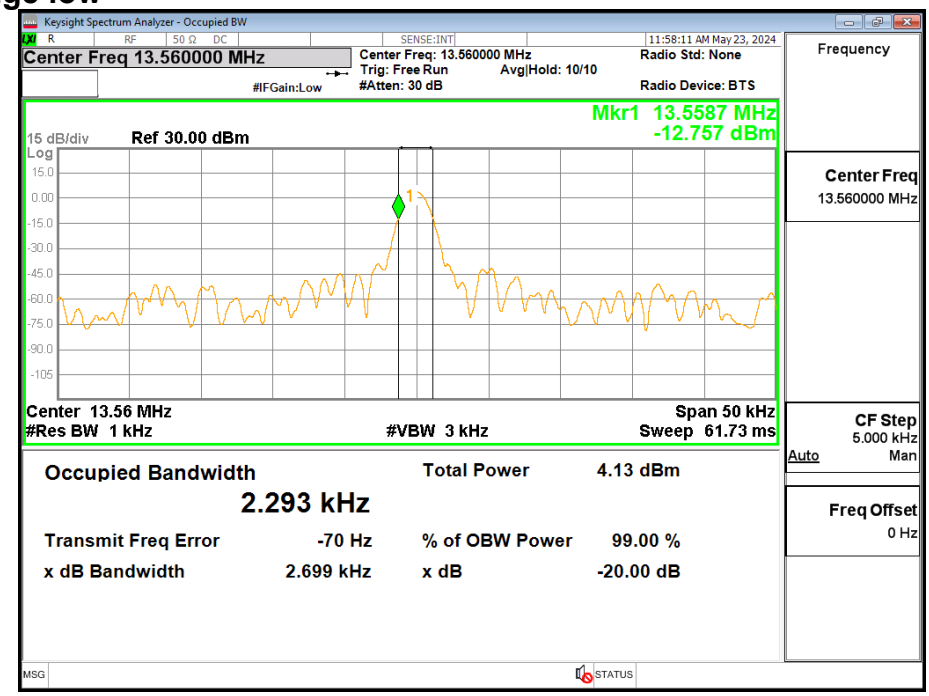
IC

99% BW (kHz)
2.293

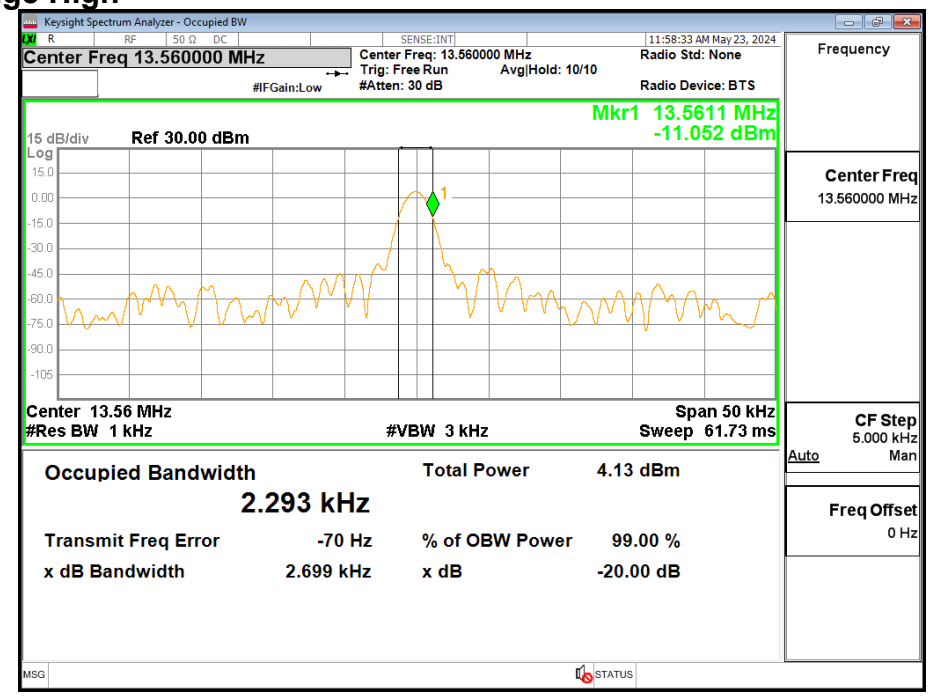
Bandwidth



Operation range low



Operation range High



11 ANTENNA REQUIREMENT

11.1 Standard Applicable:

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 shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

11.2 Antenna Connected Construction:

The antenna complies with this requirement and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~