

# ELECTROMAGNETIC EMISSIONS **COMPLIANCE REPORT**



Applicant: Manufacturer:	Quanta Computer Inc. No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City 33377, Taiwan Quanta Computer Inc. No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City 33377, Taiwan
Product Name:	Clover Companion
Brand Name:	Clover
Model No.:	C800
Report Number:	TERF2404000850E2
FCC ID	HFS-C800
Date of EUT Received:	Mar. 29, 2024
Date of Test:	Apr. 01, 2024~May 02, 2024
Issue Date:	May 06, 2024

Approved By HLWO 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.

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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.



Revision History								
Report Number	Revision	Description	Issue Date	Revised By	Remark			
TERF2404000850E2	00	Original	Apr. 26, 2024	Yami Kuo				
TERF2404000850E2	01	Revised chapter 7	May 06, 2024	Yami Kuo	*			

Note:

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

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### **GENERAL INFORMATION** 1

### 1.1 **Product Description**

Product Name:	Clover Companion
Brand Name:	Clover
Model No.:	C800
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	C080UG40940094
Power Supply:	12Vdc
Test Software (Name/Version)	adb.exe

#### 1.2 **RF** specification

Radio Technology:	NFC
Operating Frequency	13.56MHz
Transmit Power	36.23 dBuV/m at 30m; 76.23 dBuV/m at 3m.
Number of Channels	1
Modulation Type	ASK
Antenna Type	Loop

Note: Antenna information is provided by the applicant.

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### 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
		SAC 1		
		SAC 2		
		SAC 3		
	No 124 W/W/War Dood Now Toing	Conduction 1		
	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New	Conducted 1	TW0027	
	Taipei City, Taiwan.	Conducted 2	1 00027	
	Taiper City, Taiwan.	Conducted 3		TW3702
		Conducted 4	-	
		Conducted 5		
SGS Taiwan Ltd.		Conducted 6		
Central RF Lab.	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028	
(TAF code 3702)		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
	hadydan Oity, Talwan 555	Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		

#### 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.

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### SYSTEM TEST CONFIGURATION 2

### 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**

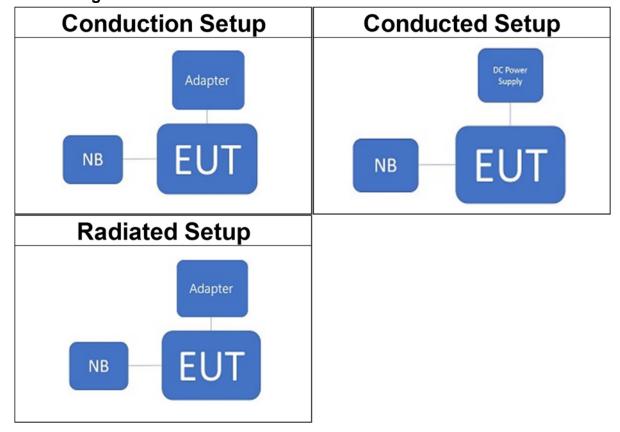
The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission 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.

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### 2.4 Test Configuration



## 2.5 Control Unit(s)

AC Power-Line Conducted Emission Test Site: Conduction C							
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Adapter	clover	S024CEU1200200	N/A	N/A	N/A		
Notebook	Lenovo	L480	P0002332	N/A	N/A		
	Conducted Emission Test Site: Conducted C						
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Adapter	clover	S024CEU1200200	N/A	N/A	N/A		
Notebook	Lenovo	T14	P0003332	N/A	N/A		
	Radiated Emission Test Site: SAC G						
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Adapter	clover	S024CEU1200200	N/A	N/A	N/A		
Notebook	Lenovo	L480	P0002332	N/A	N/A		

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# **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

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### DESCRIPTION OF TEST MODES 4

### 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 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.

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### **MEASUREMENT UNCERTAINTY** 5

Test Items	Unc	ertainty	,
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					
	+/-	1.89	dB	9kHz~30MHz	
Polarization: Vertical	+/-	4.15	dB	30MHz - 1000MHz	
Polalization. Vertical	+/-	3.43	dB	1GHz - 18GHz	
	+/-	3.86	dB	18GHz - 40GHz	
	+/-	1.89	dB	9kHz~30MHz	
Polarization: Horizontal	+/-	4.02	dB	30MHz - 1000MHz	
Polarization: nonzolital	+/-	3.43	dB	1GHz - 18GHz	
	+/-	3.86	dB	18GHz - 40GHz	
	+/-	2	dB	33GHz-50GHz	
	+/-	1.59	dB	50GHz-60GHz	
Radiated Spurious Emission	+/-	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.

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### MEASUREMENT EQUIPMENT USED 6

### 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	N9010B	MY59071573	05/23/2023	05/22/2024		
Temperature Chamber	TERCHY	MHK-120LK	1020582	06/17/2023	06/16/2024		
DC Power Supply	HOLA	DP-3003	D7070035	06/12/2023	06/11/2024		

#### **Radiated Measurement** 6.3

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		
Loop Antenna	ETS.LINDGREN	6502	143303	05/23/2023	05/22/2024		
3m Site NSA	SGS	SGS 966 chamber G		03/30/2024	03/29/2025		
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	07/17/2023	07/16/2024		
Test Software	oftware audix e3		E3 20923 SGS Ver.9 ( C )	N.C.R	N.C.R		
Pre-Amplifier	EMC Instruments	EMC330N	980781	03/15/2024	03/14/2025		
Coaxial Cable	EMC Instruments	EMCCFD400-NM- NM-8000-5000- 2000	210216 \ 210217 \ 210218	03/15/2024	03/14/2025		

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

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# 7 CONDUCTED EMISSIONS TEST

# 7.1 Standard Applicable

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

Frequency range	Limits (dBuV)					
MHz	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				
Noto						

Note

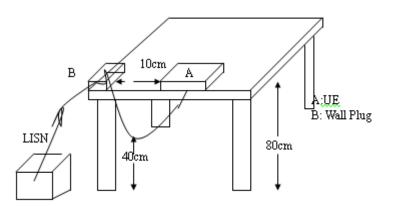
1. The lower limit shall apply at the transition frequencies

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.

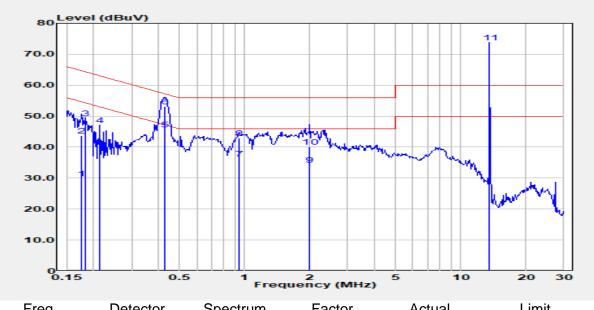
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# **AC POWER LINE CONDUCTED EMISSION TEST DATA**

Report Number	:TERF2404000850E2
Test Mode	:NFC
Power	:120V/60Hz
Probe	:L1
Note	:NFC ON

Test Site :Conduction C Test Date :2024-05-02 :24.3°C/52% Temp./Humi. Engineer :Temo Chen



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBμV	dBµV	dB
0.176	Average	19.30	10.65	29.95	54.66	-24.71
0.176	QP	33.10	10.65	43.75	64.66	-20.91
0.184	Peak	38.75	10.65	49.40	64.31	-14.90
0.214	Peak	36.43	10.65	47.08	63.04	-15.96
0.426	Average	35.10	10.62	45.72	47.33	-1.61
0.426	QP	42.60	10.62	53.22	57.33	-4.11
0.939	Average	25.60	10.68	36.28	46.00	-9.72
0.939	QP	32.30	10.68	42.98	56.00	-13.02
1.999	Average	23.60	10.77	34.37	46.00	-11.63
1.999	QP	29.40	10.77	40.17	56.00	-15.83
13.560	Peak	-	-	-	-	-

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:Conduction C



Report Number :TERF2404000850E2

Test Mode Power Probe Note	:NFC :120V/60 :N :NFC ON		Test D Temp. Engine	/Humi. :24.3	<b>ነ-05-02</b> ℃/52% o Chen	
90 Lev	vel (dBuV)				11	
70.0						
67.5						
56.3	A A					
45.0	New Th	my former	- Phil	10		
33.8	And a	• • •		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
22.5					W	
11.3						
0.15	5 0.	.5 1 Frequ	2 lency (MHz)	5 10	20 30	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBμV	dB
0.170	Peak	38.90	10.66	49.55	64.94	-15.39
0.419	Average	34.80	10.61	45.41	47.47	-2.06
0.419	QP	43.00	10.61	53.61	57.47	-3.86
0.877	Average	24.10	10.66	34.76	46.00	-11.24
0.877	QP	32.40	10.66	43.06	56.00	-12.94
1.485	Average	25.60	10.72	36.32	46.00	-9.68
1.485	QP	31.20	10.72	41.92	56.00	-14.08
1.999 1.999	Average QP	26.60 32.40	10.75 10.75	37.35 43.15	46.00 56.00	-8.65 -12.85
8.045	Peak	29.22	10.75	40.16	60.00	-12.85
0.010	i our	20.22	10.00	10.10	00.00	10.04

Test Site

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.

Peak

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Report Number	:TERF2404000850E2	Test Site	:Conduction C	
Test Mode	:NFC	Test Date	:2024-05-02	
Power	:120V/60Hz	Temp./Humi.	:24.3℃/52%	
Probe	:L1	Engineer	:Temo Chen	
Note	:Standby mode*	9		
11010				
80 Level (	dBuV)		· · · · · · · · · · · · · · · · · · ·	
70.0				
60.0				
<b>50.0</b>				
40.0	Martin	vymm		
30.0			$\sim$	
20.0			1 marine	
10.0				
0.15	0.5 1 Free	2 5 equency (MHz)	10 20 30	
Frog			tual Limit	Morgin
Freq.	Detector Spectrum Mode Reading Leve		S	Margin
MHz F	PK/QP/AV dBµV		βμV dBμV	dB
0.153	Average 21.80		.45 55.86	-23.41
0.153	QP 33.30		.95 65.86	-21.91
0.170	Peak 39.02		.67 64.94	-15.27
0.189	Peak 36.90		.55 64.10	-16.55
0.426	Average 31.40		.02 47.33	-5.31
0.426 1.031	QP 38.70 Peak 28.39		.32 57.33 .08 56.00	-8.01 -16.92
1.965	Peak 28.02		.78 56.00	-10.92
	20102			

\*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.

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Report Number	:TERF240400	0850E2	Test Site	:Conduc	tion C	
Test Mode	:NFC		Test Date	:2024-05	5-02	
Power	:120V/60Hz		Temp./Hu	ımi. :24.3℃/	52%	
Probe	:N		Engineer	:Temo C	hen	
Note	:Standby mod	e*				
	.otanaby moa	0				
80 Level (d	dBuV)					
70.0						
60.0						
50.0 1 2						
40.0		6				
	Mr V Lor	$\gamma   \gamma \gamma \gamma$	and the second second	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
30.0				and a		
20.0				+	and the second second	
10.0				<b>`</b>	A. W. W.	
0.15	0.5	1 2 Frequen	cy (MHz) 5	10	20 30	
Freq.	Detector S		Factor	Actual	Limit	Margin
ricq.		ding Level		FS		margin
MHz F	PK/QP/AV	dBμV	dB	dBμV	dBµV	dB
0.162	Peak	39.78	10.66	50.43	65.37	-14.93
0.187	Peak	38.71	10.65	49.36	64.17	-14.80
0.214	Peak	32.62	10.65	43.27	63.04	-19.77
	Average	31.20	10.61	41.81	47.33	-5.52
0.426	QP	38.60	10.61	49.21	57.33	-8.12
1.031	Peak	29.24	10.67	39.92	56.00	-16.08
7.646	Peak	25.13	10.94	36.07	60.00	-23.93

\*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.

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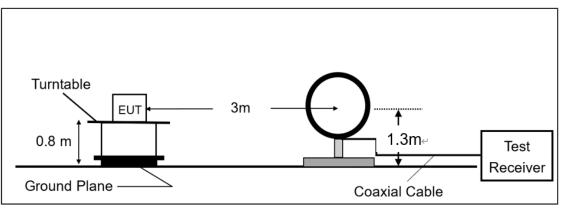
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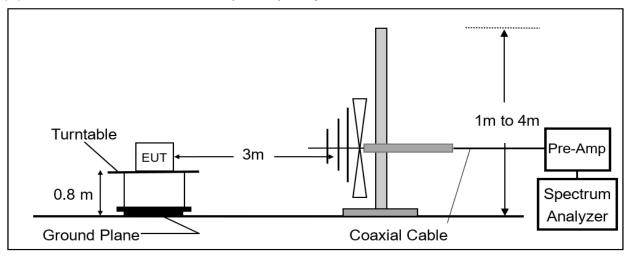
# 8 RADIATED EMISSION TEST

# 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.

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#### 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	

### **Field Strength of Fundamental Emission** 8.4

#### 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		

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### 8.4.2 **Distance Extrapolation Factor**

# 30m to 3m

Distance extrapolation = 40 \*log (30/3) = 40 dB30m to 10m Distance extrapolation = 40 \*log (30/10) = 19.08 dB10m to 3m Distance extrapolation = 40 \*log (10/3) = 20.92 dBNote:

- 1. Distance extrapolation factor = 40 log (required distance/ test distance) (dB)
- 2. The lower limit shall apply at the transition frequencies.
- 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(dB $\mu$ V/m) = Spectrum. Reading level(dB $\mu$ V) + 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)

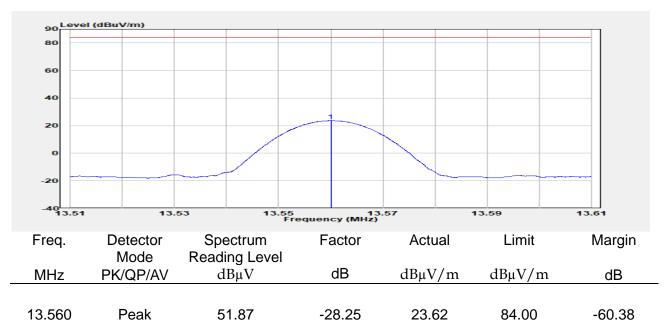
The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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### Field Strength of Fundamental Emission Measurement Result 8.4.3



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.

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.



Report Num Operation M Test Freque Test Mode EUT Pol	Node :NF0 ency :13.4 :Mai	:TERF2404000850E2 :NFC :13.56 MHz :Main :E2 Plane		Test Site Test Date Temp./Humi. Antenna Pol. Engineer		:SAC G Chamber :2024-04-11 :23.0℃/50% :Horizontal :Temo Chen				
90 Level	(dBuV/m)									
80										
60										
40										
20				1						
0										
		1								
-20										
-40										
-40 13.51	13.	.53	13	.55 Frequen	13. cy (MHz)	.57	13	.59	13.61	
Freq.	Detector	Spe	ectrum	F	actor	Actu	ual	Limit	Ма	argin
•	Mode	•	ing Leve	el						U
MHz	PK/QP/AV	d	BμV		dB	dBµV	/m	dBµV/1	n (	βB
13.560	Peak	6	4.47	-2	28.25	36.2	23	84.00	-4	7.77
		Ŭ		-				0		

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.

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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:TERF2404000850E :NFC :13.56 MHz :Mask :E2 Plane	Test Da Temp./ł Antenn	ite Humi. a Pol.	:2024 :23.0° :Vertic	G Chamber -04-11 C/50% cal o Chen
			13.86	14.06
ctor Spectrum	Factor	Actual	Limit	Margin
P/AV dBµV	dB	dBµV/m	dBµV/m	dB
ak 12.07 ak 47.00 ak 48.78 ak 12.96	-28.21 -28.22 -28.25 -28.25 -28.26 -28.26	-16.52 -16.15 18.75 20.53 -15.30	29.54 40.50 50.47 84.00 40.50 29.54	-46.06 -56.65 -31.72 -63.47 -55.80 -48.12
	:NFC :13.56 MHz :Mask :E2 Plane	$\begin{array}{cccc} \text{Intractive Enclosed of CE2} \\ \text{:NFC} & \text{Test Date of Coord of CE2} \\ \text{:Mask} & \text{Temp./k} \\ \text{:Mask} & Antennal Engined of Cease o$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	:NFC   Test Date   :2024     :13.56 MHz   Temp./Humi.   :23.0°     :Mask   Antenna Pol.   :Vertic     :E2 Plane   Engineer   :Temo

### 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.

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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·CAC C Chambar



Depart Number

·TEDE2404000050E2

Report Numb		F2404000850E				G Chamber
Operation Mo	de :NFC	,	Test I	Jate	:2024	-04-11
Test Frequen	cy :13.5	6 MHz	Temp	./Humi.	:23.0	°C/ <b>50%</b>
Test Mode	:Mas	k	Anter	nna Pol.	:Horiz	zontal
EUT Pol	:E2 F	Plane	Engir	neer	:Temo	o Chen
90 Level (df	BuV/m)					
80						
60						
40						
20						
0						
	2					6
-20		and a second		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		
-40 13.06	13.2	26 13.46 Fi	13. requency (MHz)	66	13.86	14.06
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz F	Mode PK/QP/AV	Reading Level dBµV	dB	dBµV/m	dBµV/m	dB
		αυμν	40	αυμ γ μι	ασμνγιι	
13.109	Peak	11.78	-28.21	-16.43	29.54	-45.97
13.134	Peak	12.63	-28.21	-15.58	40.50	-56.08
13.553	Peak	59.64	-28.25	31.39	50.47	-19.08
13.566	Peak	61.40	-28.25	33.15	84.00	-50.85
13.939	Peak	12.47	-28.27	-15.81	40.50	-56.31
14.060	Peak	11.34	-28.28	-16.95	29.54	-46.49

Test Site

### 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.

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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### 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  $dB\mu V/m=20 \log (\mu V/m)$
- Distance extrapolation factor = 40 log (required distance/ test distance) (dB) 2.
- 3. 20\*log(30uV/m) = 29.54 dBuV/m
- The lower limit shall apply at the transition frequencies. 4.
- The measurement was undertaken in closer distance at 3m, where extrapolation 5. 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.

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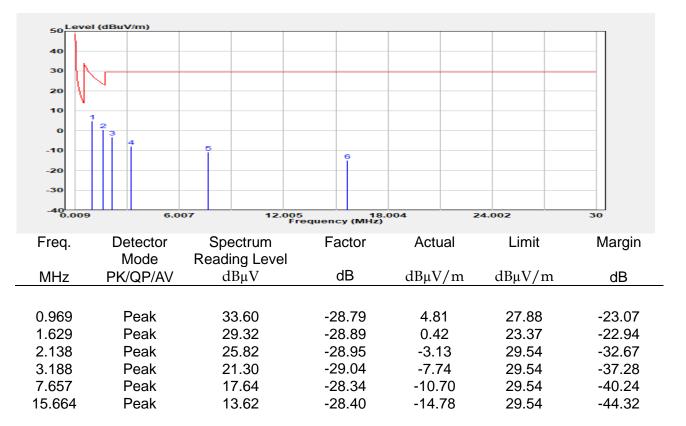
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### 8.5.2 **Radiated Spurious Emission Measurement Result**

Report Number	:TERF2404000850E2	Test Site	:SAC G Chamber
Operation Mode	:NFC	Test Date	:2024-04-11
Test Frequency	:13.56 MHz	Temp./Humi.	:23.0°℃/50%
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Temo Chen



### 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.

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.



Report Numl Operation M Test Frequer Test Mode EUT Pol	ode :NFC ncy :13.5 :Tx	RF2404000850E C 56 MHz Plane	Tes Ter Ant	at Site at Date np./Humi. tenna Pol. gineer	:202 :23.( :Hor	C G Chamber 4-04-11 D°C/50% izontal no Chen
50 Level (0 40 30 20 10 -10 -20 -30 -40 0.009	dBuV/m)	07 12.0p	6 5 requency (MH	8.004	24.002	30
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m	dBµV/m	dB
1.119 1.629 2.168 2.708	Peak Peak Peak Peak	36.55 34.52 26.68 24.44	-28.81 -28.89 -28.95 -29.02	7.74 5.63 -2.27 -4.58	26.63 23.37 29.54 29.54	-18.89 -17.74 -31.81 -34.12
3.218 16.684	Peak Peak	24.45 12.50	-29.04 -28.46	-4.58 -15.96	29.54 29.54	-34.12 -45.50

### 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.

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.



Report Number Operation Mode	:TERF2404000850E2 Test Site :NFC Test Date			G Chamber I-04-11	
Test Frequency	:13.56 MHz	Tem	p./Humi.	:23.0	°C <b>/50%</b>
Test Mode	:Tx	Ante	enna Pol.	:Verti	cal
EUT Pol	:E2 Plane	Engi	neer	:Temo	o Chen
100 Level (dBuV/n	n)				
90					
80					
70					
60					
50					}
40			6		
30 2	3 4		5		
10					
0 30	224.		12.	806.	1000
30	224.	418. 6 Frequency (MHz)	12.	806.	1000
Freq. Dete			Actual	Limit	Margin
Mo			10.17/		
MHz PK/Q	P/AV dBµV	dB	dBµV/m	dBµV/m	dB
49.400 Pe		-12.68	29.85	40.00	-10.15
105.660 Pe		-16.73	25.80	43.50	-17.70
199.750 Pe 325.850 Pe		-15.78 -11.18	24.99 26.59	43.50 46.00	-18.51 -19.41
672.140 Pe		-3.37	28.15	46.00	-17.85
776.900 Pe		-1.51	32.66	46.00	-13.34

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.

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Report Number Operation Mode Test Frequency Test Mode EUT Pol	:TERF2404000850 :NFC :13.56 MHz :Tx :E2 Plane	Test I Temp	Date D./Humi. Inna Pol.	:2024 :23.0° :Horiz	G Chamber -04-11 C/50% contal o Chen
100 Level (dBuV/n 90 80 70 60 50 40 30 10 0 30		8. 61 Frequency (MHz)	2.	806.	1000
Freq. Dete Mo	ector Spectrum ode Reading Level	Factor	Actual	Limit	Margin
MHz PK/Q	P/AV dBµV	dB	dBµV/m	dBµV/m	dB
186.170 Pe 296.750 Pe	ak 42.32	-17.96 -14.97 -12.06 -11.18 -9.41	21.50 24.26 29.30 31.14 30.49	43.50 43.50 46.00 46.00 46.00	-22.00 -19.24 -16.70 -14.86 -15.51

-1.51

32.85

Actual level = Reading level + Factor

Peak

Factor = Antenna factor + cable loss – Pre\_Amplifier Gain - distance factor

Test distance= 3m

776.900

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.

34.36

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46.00

-13.15



### FREQUENCY STABILITY 9

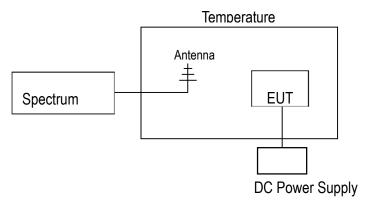
### 9.1 **Applicable Standard**

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
- Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.
- 4. Set SPA Max hold. Mark peak.

### Test SET-UP (Block Diagram of Configuration) 9.3



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#### 9.4 **Measurement Results**

Startup

A. Temperature Variation					
Power Supply	Environment	Frequency			
Vdc	Temperature		Delta (kHz)	Limit (kHz)	
Vuc	(°C)	(MHz)			
12	-20	13.5594	-0.60000	+/- 1.356	
12	-10	13.55935	-0.65000	+/- 1.356	
12	0	13.55948	-0.52000	+/- 1.356	
12	10	13.55999	-0.01000	+/- 1.356	
12	20	13.55912	-0.88000	+/- 1.356	
12	30	13.55933	-0.67000	+/- 1.356	
12	40	13.55936	-0.64000	+/- 1.356	
12	50	13.55981	-0.19000	+/- 1.356	
B. Supply Voltage Variation					

### B. Supply Voltage Variation

Power Supply	Environment	Frequency		
Vdc	Temperature (°C)	(MHz)	Delta (kHz)	Limit (kHz)
13.8	20	13.55969	-0.31000	+/- 1.356
12	20	13.55912	-0.88000	+/- 1.356
10.2	20	13.55942	-0.58000	+/- 1.356

### 2 minutes

### A. Temperature Variation

Power Supply	Environment	Frequency		
Vdc	Temperature	(MHz)	Delta (kHz)	Limit (kHz)
vuc	(°C)	(IVI TTZ)		
12	-20	13.55957	-0.43000	+/- 1.356
12	-10	13.55982	-0.18000	+/- 1.356
12	0	13.55973	-0.27000	+/- 1.356
12	10	13.55971	-0.29000	+/- 1.356
12	20	13.55914	-0.86000	+/- 1.356
12	30	13.55921	-0.79000	+/- 1.356
12	40	13.55985	-0.15000	+/- 1.356
12	50	13.55912	-0.88000	+/- 1.356

### **B** Supply Voltage Variation

Power Supply	Environment	Frequency			
Vdc	Temperature	(MHz)	Delta (kHz)	Limit (kHz)	
	(°C)	()			
13.8	20	13.55939	-0.61000	+/- 1.356	
12	20	13.55914	-0.86000	+/- 1.356	
10.2	20	13.55907	-0.93000	+/- 1.356	

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### 5 minutes

A. Temperature Variation					
Power Supply	Environment	Frequency			
Vdc	Temperature	(MHz)	Delta (kHz)	Limit (kHz)	
Vuc	(°C)	(101112)			
12	-20	13.55971	-0.29000	+/- 1.356	
12	-10	13.55918	-0.82000	+/- 1.356	
12	0	13.55961	-0.39000	+/- 1.356	
12	10	13.55979	-0.21000	+/- 1.356	
12	20	13.56002	0.02000	+/- 1.356	
12	30	13.55908	-0.92000	+/- 1.356	
12	40	13.55948	-0.52000	+/- 1.356	
12	50	13.55932	-0.68000	+/- 1.356	
B. Supply Voltage Variation					

Power Supply	Environment	Frequency		
Vdc	Temperature (°C)	(MHz)	Delta (kHz)	Limit (kHz)
13.8	20	13.55994	-0.06000	+/- 1.356
12	20	13.56002	0.02000	+/- 1.356
10.2	20	13.55959	-0.41000	+/- 1.356

### 10 minutes

### A. Temperature Variation

Power Supply	Environment	Frequency		
Vdc	Temperature (°C)	(MHz)	Delta (kHz)	Limit (kHz)
12	-20	13.55941	-0.59000	+/- 1.356
12	-10	13.55937	-0.63000	+/- 1.356
12	0	13.55946	-0.54000	+/- 1.356
12	10	13.55918	-0.82000	+/- 1.356
12	20	13.55928	-0.72000	+/- 1.356
12	30	13.55908	-0.92000	+/- 1.356
12	40	13.55935	-0.65000	+/- 1.356
12	50	13.55908	-0.92000	+/- 1.356

### B. Supply Voltage Variation

Power Supply	Environment	Frequency		
Vdc	Temperature (°C)	(MHz)	Delta (kHz)	Limit (kHz)
13.8	20	13.55984	-0.16000	+/- 1.356
12	20	13.55928	-0.72000	+/- 1.356
10.2	20	13.55973	-0.27000	+/- 1.356

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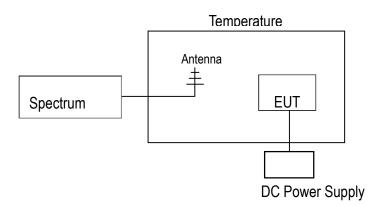


# **10 EMISSION BANDWIDTH MEASUREMENT**

### 10.1 **Applicable Standard:**

The 20 dB 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.
- 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.

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### 10.4 Measurement Result

FCC			
20dB BW (kHz)	Opration range	Frequency (MHz)	Limit (MHz)
2.701	Low	13.55880	>13.11
	High	13.56110	<14.01

### **Bandwidth**

	IGHT In	iput: RF oupling: DC	Input Z: 50 Ω Corrections: Off	Atten: 30 dB	Trig: Free Run Gate: Off	Center Freq: 1 Avg Hold: 10/1	3.560000 MHz	Center Frequency	settings
2		lign: Auto	Freq Ref: Int (S)		#IF Gain: Low	Radio Std: Nor	ne	13.560000 MHz	
Graph								Span	
	iv 15.0 dl	- '		Ref Value 30.00	dBm			50.000 kHz	
og	14 15.0 0							CF Step	
15.0								5.000 kHz	
0.00								Auto Man	
30.0									_
45.0								Freq Offset	
60.0 75.0					m			0 Hz	_
90.0						-			
-105								_	
enter	13.56000	MHz	#	Video BW 3.00	00 kHz*		Span 50 kl	łz	
Res B	W 1.0000	kHz				Swee	ep 61.7 ms (1001 p	s)	
2 Metrics	5	•							
	Occupie	d Bandwidth							
	Cocapio		89 kHz		Total Power		7.71 dBm		
	Transmi	t Freg Error	-69 H	łz	% of OBW Pov	wer	99.00 %		
	x dB Ba	ndwidth	2.701 kH	łz	x dB		-20.00 dB		
			Apr 09, 2024						
	5) (7	a 17	Apr 09, 2024 11:44:20 AM	··· ) / \					

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## **Operation range low**

Spectrum Analyzer 1 Occupied BW	F					Ö FI	requency 🔹
KEYSIGHT Input: RF   R Input: RF   Align: Auto	Input Z: 50 Ω Corrections: Off Freq Ref: Int (S)	Atten: 30 dB	Trig: Free Run Gate: Off #IF Gain: Low	Center Freq: 1 Avg Hold: 10/1 Radio Std: No		Center Freque 13.560000 M	Joeungs
1 Graph				Mkr1	13.558800 MHz	30.000 KHZ	
Scale/Div 15.0 dB		Ref Value 30.00 d	1Bm		-6.588 dBm	CF Step	
15.0		1				5.000 kHz	
-15.0						Auto Man	
-30.0 -45.0 -60.0						Freq Offset 0 Hz	
-75.0			m				
-90.0							
Center 13.56000 MHz #Res BW 1.0000 kHz	#\	/ideo BW 3.0000	kHz*		Span 50 kHz ep 61.7 ms (1001 pts)		
2 Metrics				Swe			
Occupied Bandwidth							
2.28	9 kHz		Total Power		7.71 dBm		
Transmit Freq Error	-69 H		% of OBW Pow	ver	99.00 %		
x dB Bandwidth	2.701 kH	Z	x dB		-20.00 dB		
	Apr 09, 2024					1	
€ ^ ⊂ ∎ ?	11:44:53 AM						

## **Operation range High**

	Coupling: DC	Input Z: 50 Ω Corrections: Off Freq Ref: Int (S)	Atten: 30 dB	Trig: Free Run Gate: Off #IF Gain: Low	Center Freq: Avg Hold: 10 Radio Std: N		Center Frequency 13.560000 MHz	Settings
1 Graph	v .		B-614-1 00.00		Mkr1	13.561100 MHz	00.000 KI 12	-
cale/Div 15 _og 15.0	.0 dB		Ref Value 30.00	1Bm		-7.542 dBm	CF Step 5.000 kHz	
0.00							Auto Man	
-45.0				h			Freq Offset 0 Hz	
-75.0 -90.0 -105								_
Center 13.56 #Res BW 1.0		#	Video BW 3.0000	kHz*	Swe	Span 50 kHz eep 61.7 ms (1001 pts)		
2 Metrics	T							
Occ	upied Bandwidth	89 kHz		Total Power		7.71 dBm		
	nsmit Freq Error Bandwidth	-69 H 2.701 kH		% of OBW Pow	wer	99.00 % -20.00 dB		
<b>4</b> N		Apr 09, 2024 11:45:14 AM						

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# **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.

### Antenna Connected Construction: 11.2

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

~ End of Report ~

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