

**ELECTROMAGNETIC EMISSIONS
COMPLIANCE REPORT**

Applicant: Quanta Computer Inc.
No. 188, Wenhua 2nd Road, Guishan District, Taoyuan City
33377, Taiwan

Product Name: Clover Mini

Brand Name: clover

Model No.: C302U

HVIN: C302W

Model Difference: N/A

Report Number: E2/2021/60028

FCC ID HFS-C302W

IC: 1787B-C302W

Issue Date: August 4, 2021

Date of Test: June 17, 2021~July 14, 2021

Date of EUT Received: June 10, 2021

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, ISED RSS-210.

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

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Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/60028	00	Original	August 4, 2021	Susan Lin

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Table of Contents

1	GENERAL INFORMATION	4
2	SYSTEM TEST CONFIGURATION	6
3	SUMMARY OF TEST RESULTS	8
4	DESCRIPTION OF TEST MODES	9
5	MEASUREMENT UNCERTAINTY	10
6	CONDUCTED EMISSIONS TEST	11
7	RADIATED EMISSION TEST	15
8	FREQUENCY STABILITY	28
9	EMISSION BANDWIDTH MEASUREMENT	32
10	ANTENNA REQUIREMENT	34

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Clover Mini
Brand Name:	clover
Model No.:	C302U
HVIN:	C302W
Model Difference:	N/A
Hardware Version:	C302W
Firmware Version:	N/A
EUT Series No.:	PJ216092003
Power Supply:	12V from AC/DC Adapter

1.2 RF specification

Radio Technology:	NFC
Operating Frequency:	13.56MHz
Transmit Power:	< 123dBuV/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
 RSS-210 issue 10 Annex B B.6 Dec. 2019
 RSS-Gen Issue 5
 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 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 A	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.

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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*9m*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.

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2.4 Configuration of Tested System

Fig. 2-1 Conduction (AC Power Line) & Radiated test set up configuration

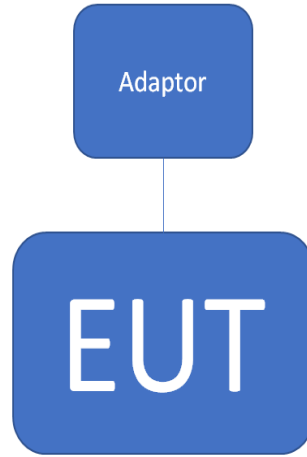


Fig. 2-2 Emission test set up configuration



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	NFC Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L420	S0011721	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	ISED Rules	Description Of Test	Result
§15.207	RSS-Gen § 8.8	AC Power Line Conducted Emission	Compliant
§15.225 (a)-(d)	RSS210 Annex B B.6	Radiated Emission	Compliant
§15.209	RSS-Gen § 8.9	Radiated Emission Limits, general requirement	Compliant
§15.225 (e)	RSS210 Annex B B.6 (b)	Frequency Stability	Compliant
§2.1049 §15.215 (c)	RSS-Gen § 6.7	Emission Bandwidth	Compliant
§15.203	N/A	Antenna Requirement	Compliant

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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 BANDWIDTH			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK

The field strength of radiation emission was measured as EUT three orthogonal planes, E1 / E2 / H, are positioned to pre-scan the emission generating the highest one. The worst position is tested and recorded.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.34 dB
Frequency Stability	+/- 1.53 Hz
Emission Bandwidth	+/- 1.53 Hz
Temperature	+/- 0.4 °C
Humidity	+/- 3.5 %
DC / AC Power Source	+/- 1 %

Radiated Spurious Emission Measurement Uncertainty		
Polarization: Vertical	+/- 2.64 dB	9kHz~30MHz
	+/- 4.93 dB	30MHz - 1000MHz
	+/- 4.81 dB	1GHz - 18GHz
	+/- 4.52 dB	18GHz - 40GHz
Polarization: Horizontal	+/- 2.64 dB	9kHz~30MHz
	+/- 4.45 dB	30MHz - 1000MHz
	+/- 4.81 dB	1GHz - 18GHz
	+/- 4.52 dB	18GHz - 40GHz

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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6 CONDUCTED EMISSIONS TEST

6.1 Standard Applicable

According to §15.207 and 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

- The lower limit shall apply at the transition frequencies
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2 Measurement Equipment Used:

Radiated Emission Test Site: Conduction A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Software	audix	e3	Ver. 6.11-20180419c	N.C.R	N.C.R
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	973	03/25/2021	03/24/2022
EMI Test Receiver	R&S	ESCI	101342	04/27/2021	04/26/2022
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2021	03/26/2022
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2021	03/26/2022

6.3 EUT Setup

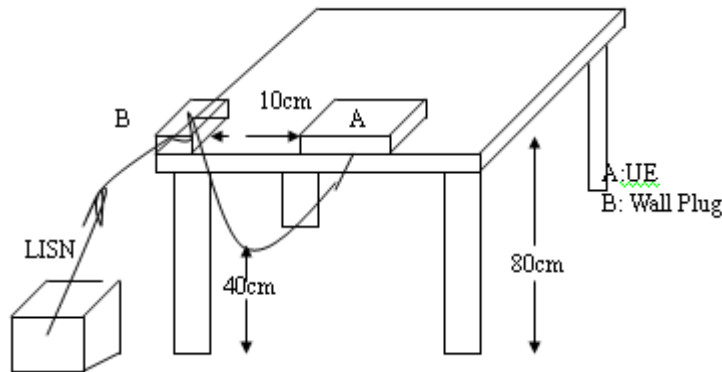
- The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
- The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 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.

6.6 Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit.

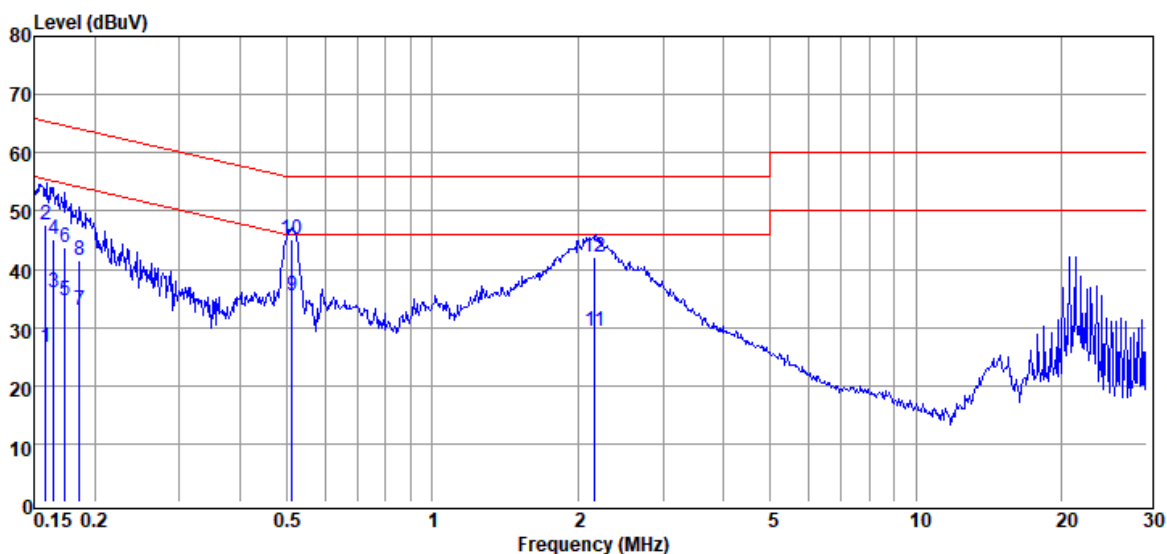
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:E2-2021-60028	Test Site	:Conduction Room C
Test Mode	:NFC	Test Date	:2021-06-28
Power	:120V/60Hz	Temp./Humi.	:25.4/52
Probe	:L1	Engineer	:Jack Tseng
Note:	: Adapter:FSP040-RHBN2		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V	Limit dB μ V	Margin dB
0.16	Average	16.16	10.30	26.46	55.55	-29.09
0.16	QP	37.23	10.30	47.53	65.55	-18.02
0.17	Average	25.65	10.22	35.87	55.21	-19.34
0.17	QP	34.78	10.22	45.00	65.21	-20.21
0.17	Average	24.36	10.22	34.58	54.77	-20.19
0.17	QP	33.51	10.22	43.73	64.77	-21.04
0.19	Average	22.74	10.22	32.96	54.20	-21.24
0.19	QP	31.28	10.22	41.50	64.20	-22.70
0.51	Average	25.12	10.31	35.43	46.00	-10.57
0.51	QP	34.76	10.31	45.07	56.00	-10.93
2.17	Average	18.24	11.11	29.35	46.00	-16.65
2.17	QP	30.83	11.11	41.94	56.00	-14.06

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Report Number :E2-2021-60028

Test Site :Conduction Room C

Test Mode :NFC

Test Date :2021-06-28

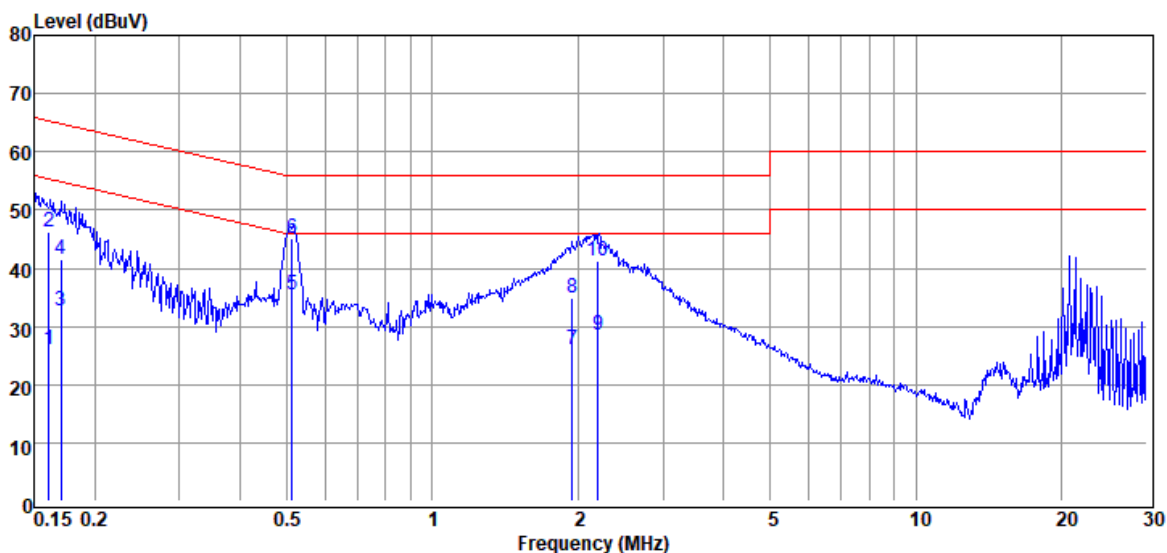
Power :120V/60Hz

Temp./Humi. :25.4/52

Probe :N

Engineer :Jack Tseng

Note: : Adapter:FSP040-RHBN2



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.16	Average	15.82	10.31	26.13	55.42	-29.29
0.16	QP	35.96	10.31	46.27	65.42	-19.15
0.17	Average	22.46	10.21	32.67	54.94	-22.27
0.17	QP	31.25	10.21	41.46	64.94	-23.48
0.51	Average	25.06	10.32	35.38	46.00	-10.62
0.51	QP	34.76	10.32	45.08	56.00	-10.92
1.95	Average	15.68	10.45	26.13	46.00	-19.87
1.95	QP	24.51	10.45	34.96	56.00	-21.04
2.20	Average	17.50	11.12	28.62	46.00	-17.38
2.20	QP	30.19	11.12	41.31	56.00	-14.69

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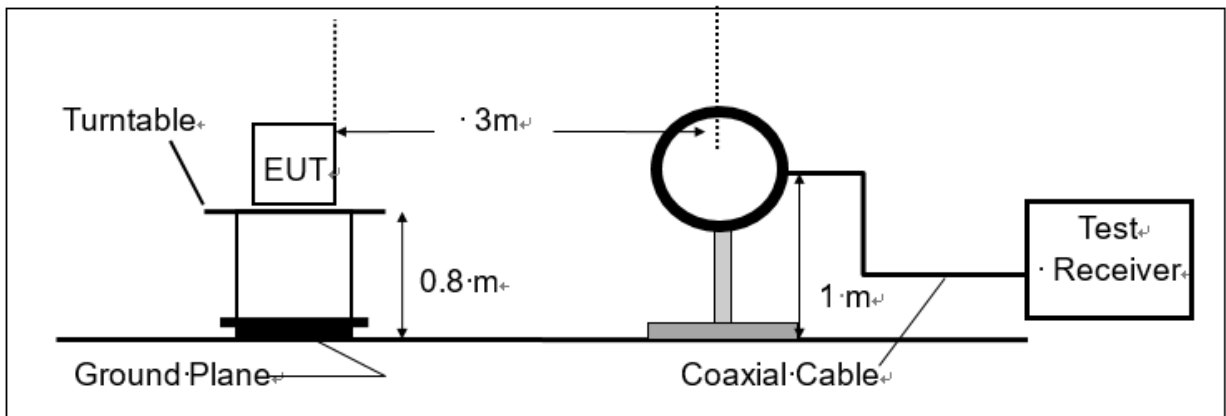
7 RADIATED EMISSION TEST

7.1 Measurement Procedure

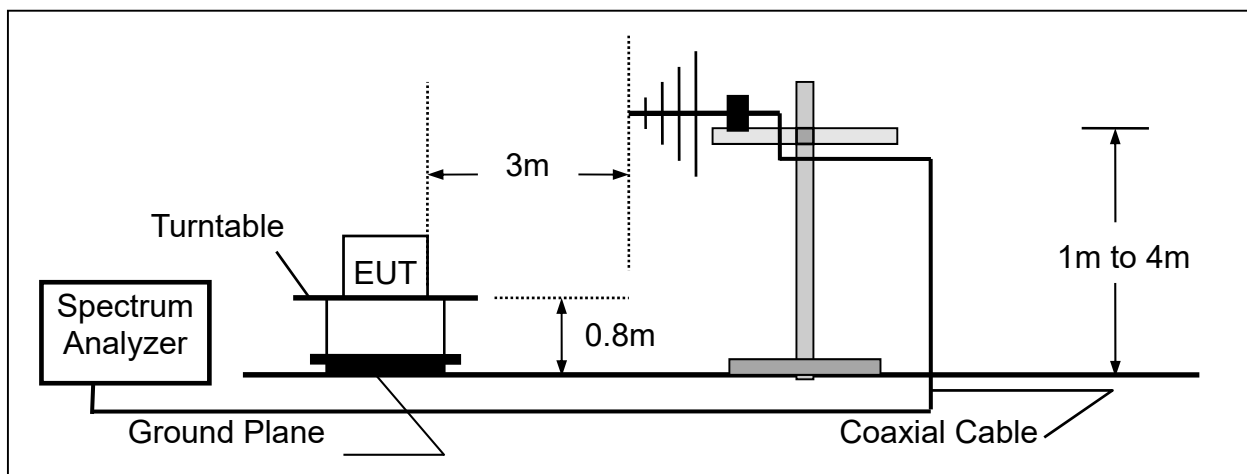
1. Configure the EUT according to ANSI C63.10.
2. The EUT was placed on a turn table which is 0.8m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. 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.

7.2 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



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7.3 Measurement Equipment Used:

Radiated Emission Test Site: SAC G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	SCHWAZBECK	VULB 9168	1206	02/22/2021	02/21/2022
Horn Antenna	Schwarzbeck	DRH18-E	210105A18E	04/09/2021	04/08/2022
Horn Antenna	Schwarzbeck	BBHA9170	185	07/30/2020	07/29/2021
Loop Antenna	ETS.LINDGREN	6502	143303	05/07/2021	05/06/2022
3m Site NSA	SGS	966 chamber G	N/A	03/30/2021	03/29/2022
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120290	04/06/2021	04/05/2022
Pre-Amplifier	EMC Instruments	EMC0011830	980199	11/19/2020	11/18/2021
Pre-Amplifier	EMC Instruments	EMC330N	980781	03/15/2021	03/14/2022
Pre-Amplifier	EMC Instruments	EMC118A45SE	980815	03/15/2021	03/14/2022
Attenuator	Marvelous	MVE2213-30	RF04	11/19/2020	11/18/2021
High Pass Filter	R&S	F13 HPF 3GHz	RF175	11/19/2020	11/18/2021
Lowpass Filter	Woken	EWT-56-0019	RF173	11/19/2020	11/18/2021
High Pass Filter	R&S	HPF7.0	RF176	11/19/2020	11/18/2021
Notch Filter	Woken	EWT-54-0037	RF204	11/19/2020	11/18/2021
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	11/19/2020	11/18/2021
Coaxial Cable	EMC Instruments	EMC104-SM-SM-8000-5000-5000	210219、 210220、 210221	03/15/2021	03/14/2022
Test Software	audix	e3	20923 sgs Ver.9	N.C.R	N.C.R

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

7.4 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	

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7.5 Field Strength of Fundamental Emission

7.5.1 Applicable standard

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)		
	Frequency of Emission (MHz)	Field Strength ($\mu\text{V/m}$) at 30m	Field Strength (dB $\mu\text{V/m}$) at 30m
1.705~13.110	30	29.5	69.5
13.110~13.410	106	40.5	80.5
13.410~13.553	334	50.5	90.47
13.553~13.567	15848	84	124
13.567~13.710	334	50.5	90.47
13.710~14.010	106	40.5	80.5
14.010~30.00	30	29.5	69.5

Radiated Mask per ISED RSS 210 Annex B B6

- (a) 15.848 millivolts/m (84 dB $\mu\text{V/m}$) at 30 m, within the band 13.553-13.567 MHz.
- (b) 334 microvolts/m (50.5 dB $\mu\text{V/m}$) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz.
- (c) 106 microvolts/m (40.5 dB $\mu\text{V/m}$) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz.
- (d) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz

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7.5.2 Distance Extrapolation Factor

30m to 3m

Distance extrapolation = $40 \cdot \log(30/3) = 40$ dB

Limit is re-adjusted in terms of limit taken in 3m = $20 \cdot \log(15848 \text{ uV/m}) + 40 = 124.00\text{dBuV/m}$

30m to 10m

Distance extrapolation = $40 \cdot \log(30/10) = 19.08$ dB

Limit is re-adjusted in terms of limit taken in 3m = $20 \cdot \log(15848 \text{ uV/m}) + 19.08 = 103.08\text{dBuV/m}$

10m to 3m

Distance extrapolation = $40 \cdot \log(10/3) = 20.92$ dB

Limit is re-adjusted in terms of limit taken in 3m = $20 \cdot \log(15848 \text{ uV/m}) + 20.92 = 104.92\text{dBuV/m}$

Note:

1. Distance extrapolation factor = $40 \log(\text{required distance}/\text{test distance})$ (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(dB μ V/m) = Spectrum. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

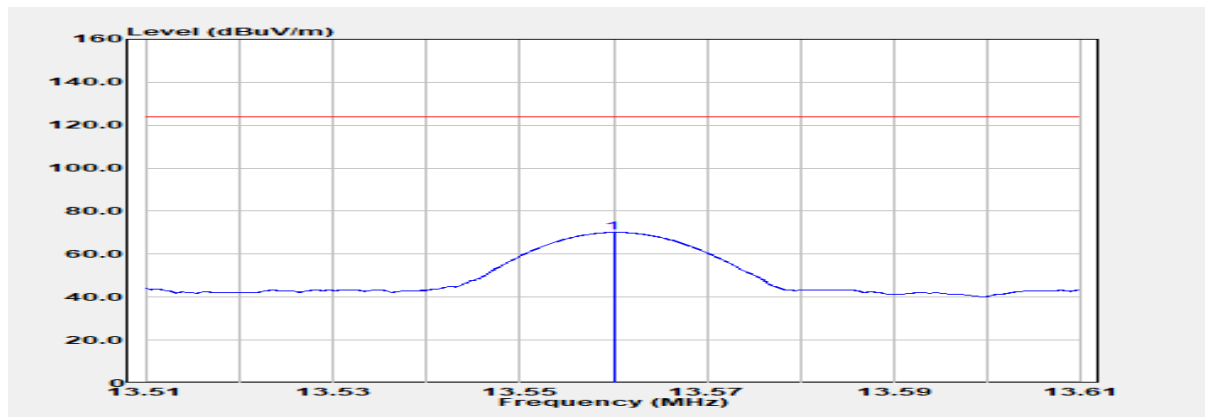
The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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7.5.3 Field Strength of Fundamental Emission Measurement Result

Report Number	:E2/2021/60028	Test Site	:966 Chamber G
Operation Mode	:NFC	Test Date	:2021-06-25
Test Frequency	:13.56 MHz	Temp./Humi.	:23.3/58
Test Mode	:Main	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Jack Tseng



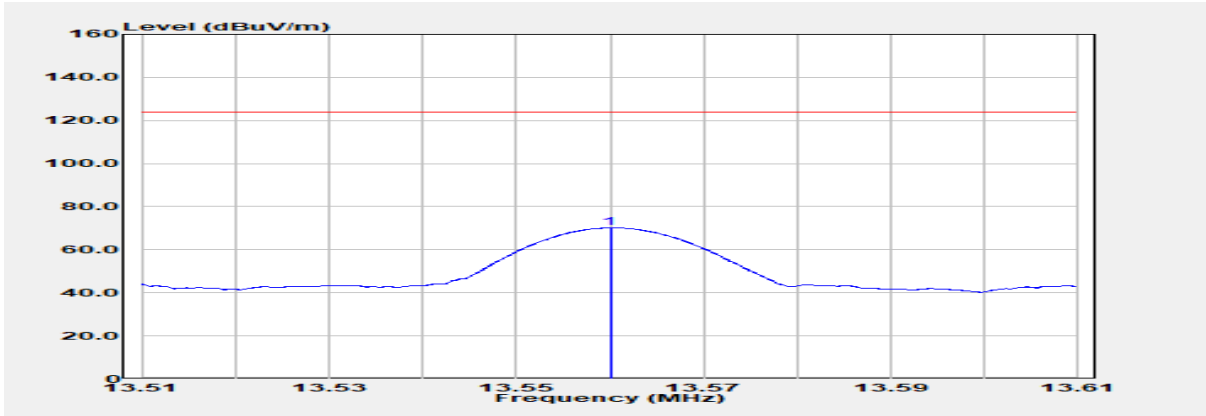
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
13.560	Peak	59.22	10.89	70.11	124.00	-53.89

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Report Number :E2/2021/60028
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Main
 EUT Pol :H Plane

Test Site :966 Chamber G
 Test Date :2021-06-25
 Temp./Humi. :23.3/58
 Antenna Pol. :Horizontal
 Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
13.560	Peak	59.24	10.89	70.14	124.00	-53.86

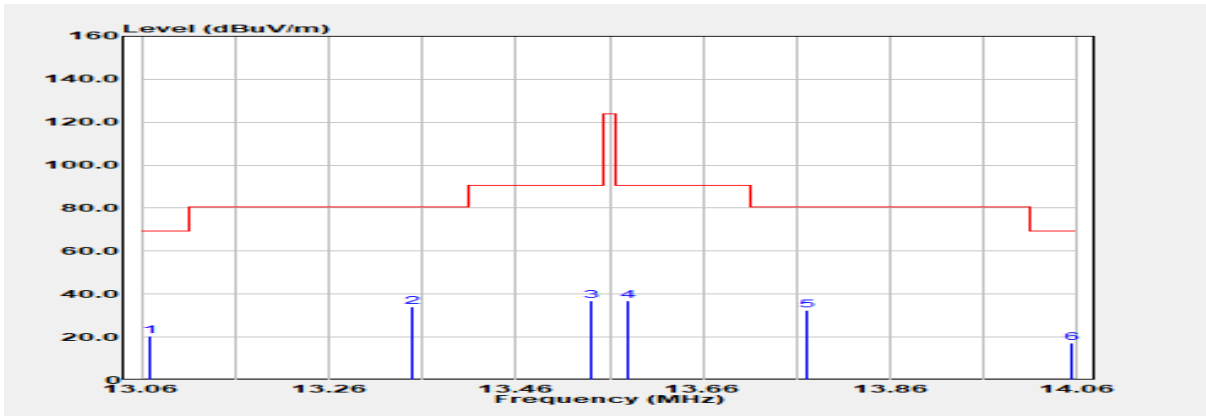
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Report Number :E2/2021/60028
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :H Plane

Test Site :966 Chamber G
 Test Date :2021-06-25
 Temp./Humi. :23.3/58
 Antenna Pol. :Vertical
 Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
13.070	Peak	9.62	10.93	20.55	69.54	-48.99
13.348	Peak	23.21	10.91	34.11	80.50	-46.39
13.540	Peak	26.08	10.89	36.98	90.47	-53.49
13.580	Peak	25.89	10.89	36.78	90.47	-53.69
13.772	Peak	21.53	10.88	32.41	80.50	-48.09
14.053	Peak	6.52	10.86	17.38	69.54	-52.16

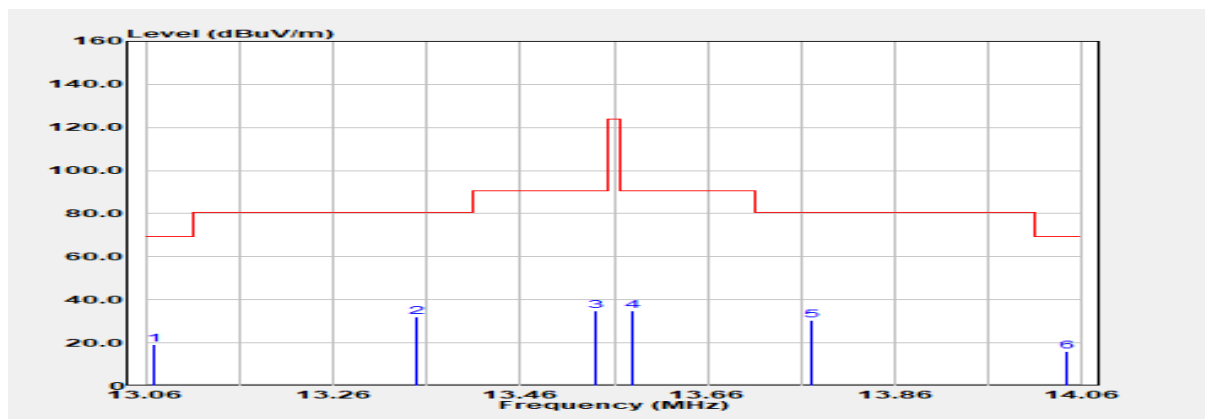
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Report Number :E2/2021/60028
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :H Plane

Test Site :966 Chamber G
 Test Date :2021-06-25
 Temp./Humi. :23.3/58
 Antenna Pol. :Horizontal
 Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
13.070	Peak	8.36	10.93	19.29	69.54	-50.25
13.349	Peak	21.35	10.91	32.26	80.50	-48.24
13.540	Peak	23.96	10.89	34.85	90.47	-55.62
13.580	Peak	24.15	10.89	35.04	90.47	-55.43
13.772	Peak	19.58	10.88	30.46	80.50	-50.04
14.043	Peak	5.23	10.86	16.08	69.54	-53.46

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7.6 Radiated Spurious Emission Measurement

7.6.1 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 in section 15.209 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) + 40dB = 69.54 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 and RSS-Gen §8.10.
7. The general radiated emission limits in §15.209 and RSS-Gen §8.9 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

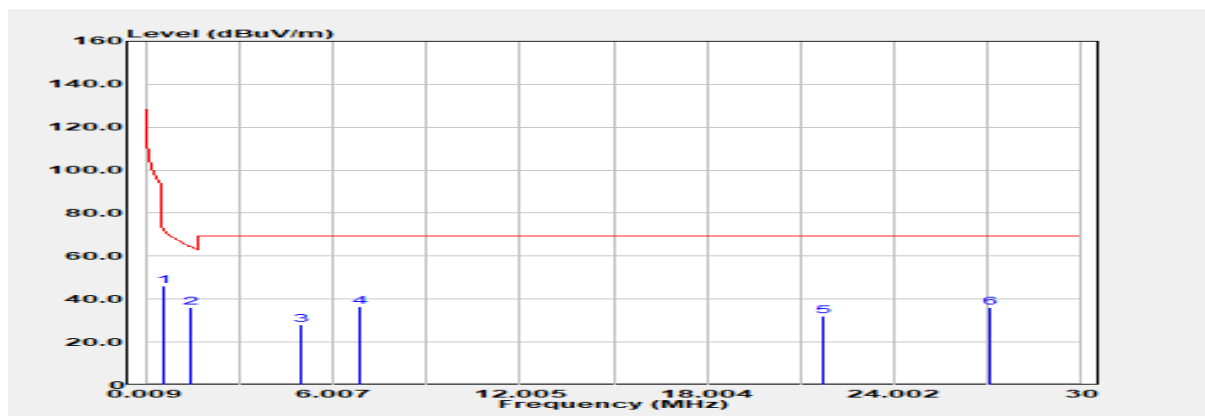
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7.6.2 Radiated Spurious Emission Measurement Result

Report Number	:E2/2021/60028	Test Site	:966 Chamber G
Operation Mode	:NFC	Test Date	:2021-06-25
Test Frequency	:13.56 MHz	Temp./Humi.	:23.3/58
Test Mode	:TX CH MID	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Jack Tseng



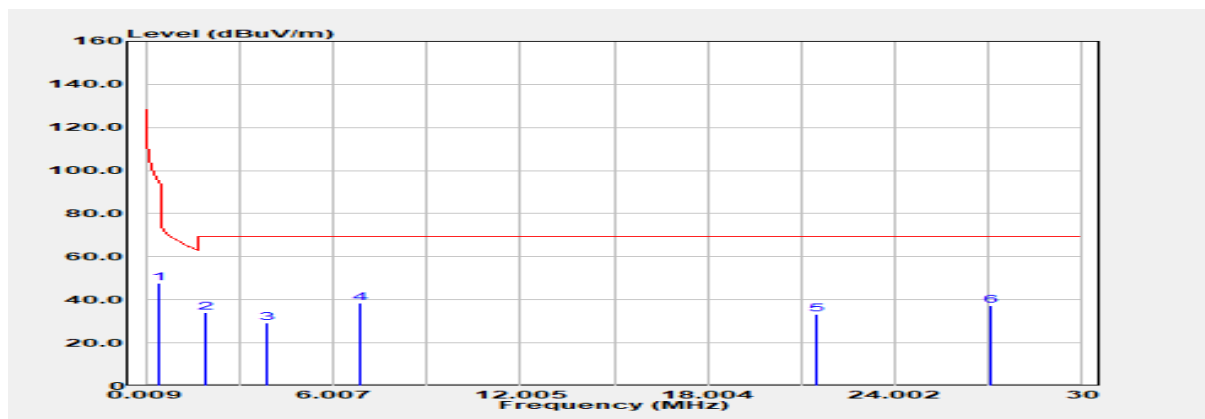
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
0.579	Peak	34.97	10.98	45.95	72.36	-26.41
1.419	Peak	25.22	10.71	35.93	64.57	-28.64
5.017	Peak	17.42	10.80	28.22	69.54	-41.32
6.877	Peak	25.44	10.98	36.42	69.54	-33.12
21.752	Peak	21.91	10.09	32.00	69.54	-37.54
27.031	Peak	27.26	9.01	36.27	69.54	-33.27

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Report Number :E2/2021/60028
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :TX CH MID
 EUT Pol :H Plane

Test Site :966 Chamber G
 Test Date :2021-06-25
 Temp./Humi. :23.3/58
 Antenna Pol. :Horizontal
 Engineer :Jack Tseng



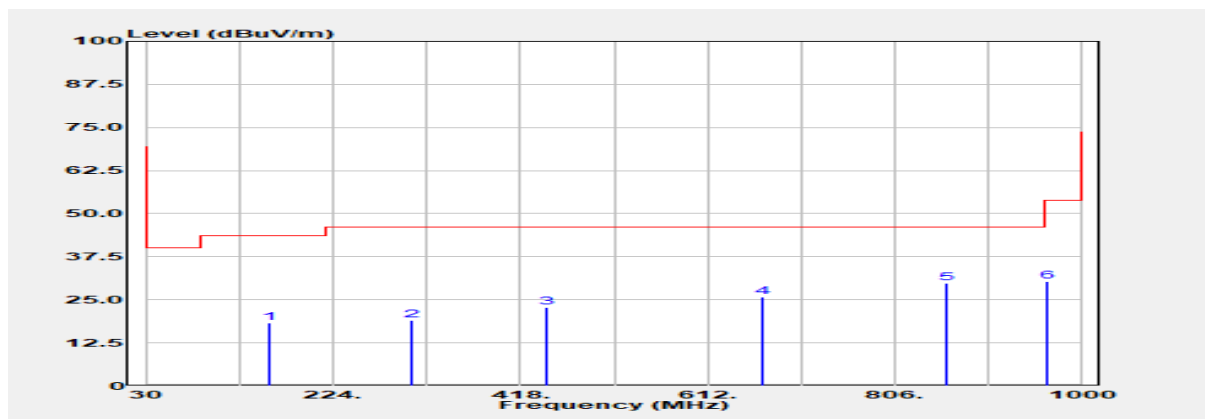
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
0.459	Peak	36.59	11.00	47.59	94.37	-46.78
1.958	Peak	23.56	10.53	34.09	69.54	-35.45
3.908	Peak	18.77	10.56	29.33	69.54	-40.21
6.847	Peak	27.36	10.98	38.34	69.54	-31.20
21.483	Peak	23.05	10.15	33.20	69.54	-36.34
27.031	Peak	28.12	9.01	37.14	69.54	-32.40

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 Engineer :Jack Tseng



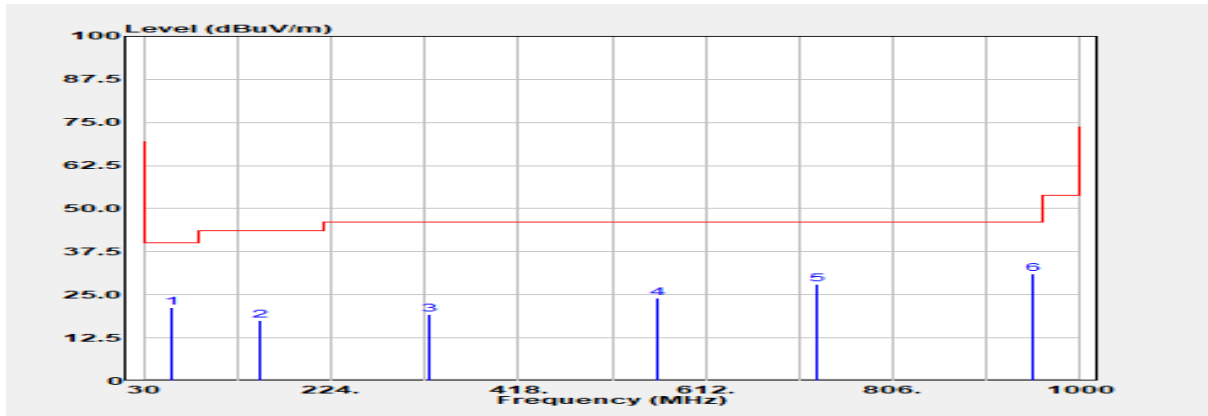
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
158.040	Peak	31.39	-13.08	18.31	43.50	-25.19
306.450	Peak	31.27	-12.24	19.03	46.00	-26.97
445.160	Peak	31.40	-8.47	22.93	46.00	-23.07
669.230	Peak	30.05	-4.33	25.72	46.00	-20.28
859.350	Peak	30.96	-1.04	29.91	46.00	-16.09
963.140	Peak	29.82	0.50	30.32	54.00	-23.68

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Test Date :2021-06-25
Temp./Humi. :23.3/58
Antenna Pol. :Horizontal
Engineer :Jack Tseng



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
58.130	Peak	34.77	-13.44	21.33	40.00	-18.67
151.250	Peak	30.57	-13.05	17.52	43.50	-25.98
324.880	Peak	31.02	-11.75	19.27	46.00	-26.73
562.530	Peak	30.59	-6.43	24.17	46.00	-21.83
726.460	Peak	30.61	-2.59	28.03	46.00	-17.97
951.500	Peak	30.81	0.37	31.19	46.00	-14.81

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8 FREQUENCY STABILITY

8.1 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.

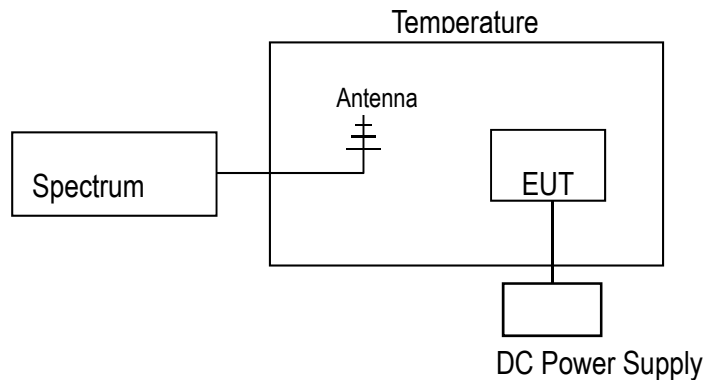
Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm).

For licence-exempt radio apparatus, the frequency stability shall be measured at temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F).

8.2 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.

8.3 Test SET-UP (Block Diagram of Configuration)



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8.4 Measurement Equipment Used:

Conducted Emission Test Site: Conducted G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Loop Antenna	ETS.LINDGREN	6502	143303	05/07/2021	05/06/2022
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071574	06/24/2020	06/23/2021
Temperature Chamber	TERCHY	MHK-120LK	1020582	07/08/2020	07/07/2021
Attenuator	Marvelous	MVE2213-10	RF06	11/19/2020	11/18/2021
DC Block	PASTERNAK	PE8210	RF154	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F2A196C	RF60	11/19/2020	11/18/2021

8.5 Measurement Results

Startup

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
12	-20	13.5600038	0.14620	+/- 1.356
12	-10	13.5599981	0.15190	+/- 1.356
12	0	13.5599971	0.15290	+/- 1.356
12	10	13.5600021	0.14790	+/- 1.356
12	20	13.56015	0.00000	+/- 1.356
12	30	13.5600018	0.14820	+/- 1.356
12	40	13.5599983	0.15170	+/- 1.356
12	50	13.5600016	0.14840	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
13.8	20	13.5599952	0.15480	+/- 1.356
12	20	13.56015	0.00000	+/- 1.356
10.2	20	13.5600021	0.14790	+/- 1.356

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2 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
12	-20	13.5600003	0.14970	+/- 1.356
12	-10	13.5600019	0.14810	+/- 1.356
12	0	13.5599997	0.15030	+/- 1.356
12	10	13.5600013	0.14870	+/- 1.356
12	20	13.56015	0.00000	+/- 1.356
12	30	13.5600035	0.14650	+/- 1.356
12	40	13.5599959	0.15410	+/- 1.356
12	50	13.5600004	0.14960	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
13.8	20	13.5600001	0.14990	+/- 1.356
12	20	13.56015	0.00000	+/- 1.356
10.2	20	13.5599958	0.15420	+/- 1.356

5 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
12	-20	13.5600019	0.14810	+/- 1.356
12	-10	13.5599983	0.15170	+/- 1.356
12	0	13.5600036	0.14640	+/- 1.356
12	10	13.5600038	0.14620	+/- 1.356
12	20	13.56015	0.00000	+/- 1.356
12	30	13.5599968	0.15320	+/- 1.356
12	40	13.5600004	0.14960	+/- 1.356
12	50	13.5600003	0.14970	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
13.8	20	13.5599964	0.15360	+/- 1.356
12	20	13.56015	0.00000	+/- 1.356
10.2	20	13.5599997	0.15030	+/- 1.356

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10 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
12	-20	13.5600016	0.14840	+/- 1.356
12	-10	13.5600014	0.14860	+/- 1.356
12	0	13.5600028	0.14720	+/- 1.356
12	10	13.559995	0.15500	+/- 1.356
12	20	13.56015	0.00000	+/- 1.356
12	30	13.5599982	0.15180	+/- 1.356
12	40	13.5600005	0.14950	+/- 1.356
12	50	13.5600014	0.14860	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
13.8	20	13.5599955	0.15450	+/- 1.356
12	20	13.56015	0.00000	+/- 1.356
10.2	20	13.5600002	0.14980	+/- 1.356

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9 EMISSION BANDWIDTH MEASUREMENT

9.1 Applicable Standard:

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

9.2 Limit:

None

9.3 Test Set-up

Refer to section 8.3 in this report

9.4 Measurement Equipment Used:

Refer to section 8.4 in this report

9.5 Measurement Procedure

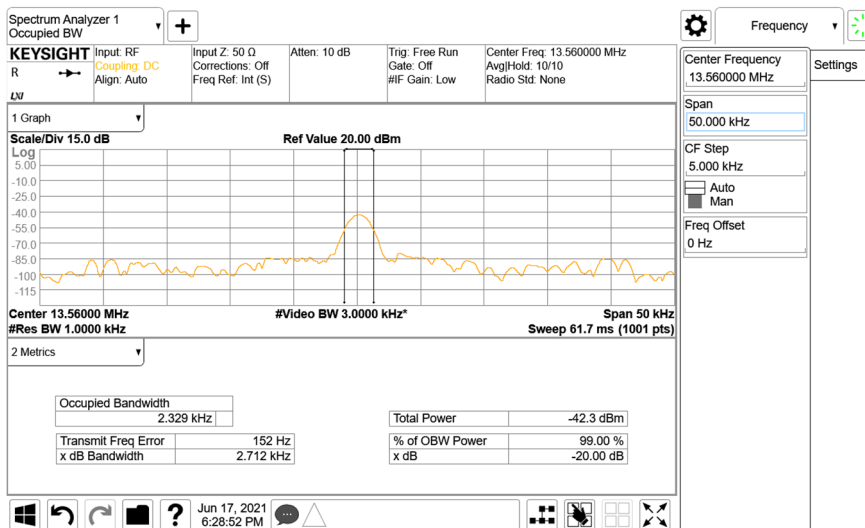
1. Placed the EUT on the testing table.
2. Set the EUT under transmission condition continuously at specific channel frequency.
3. The resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
4. Measured the spectrum width with power higher than 20dB below carrier.

9.6 Measurement Result

FCC				
20dB BW (kHz)		Operation range	Frequency (MHz)	Limit (MHz)
2.712		Low	13.55895	>13.11
		High	13.56145	<14.01

IC	
99% BW (kHz)	2.329

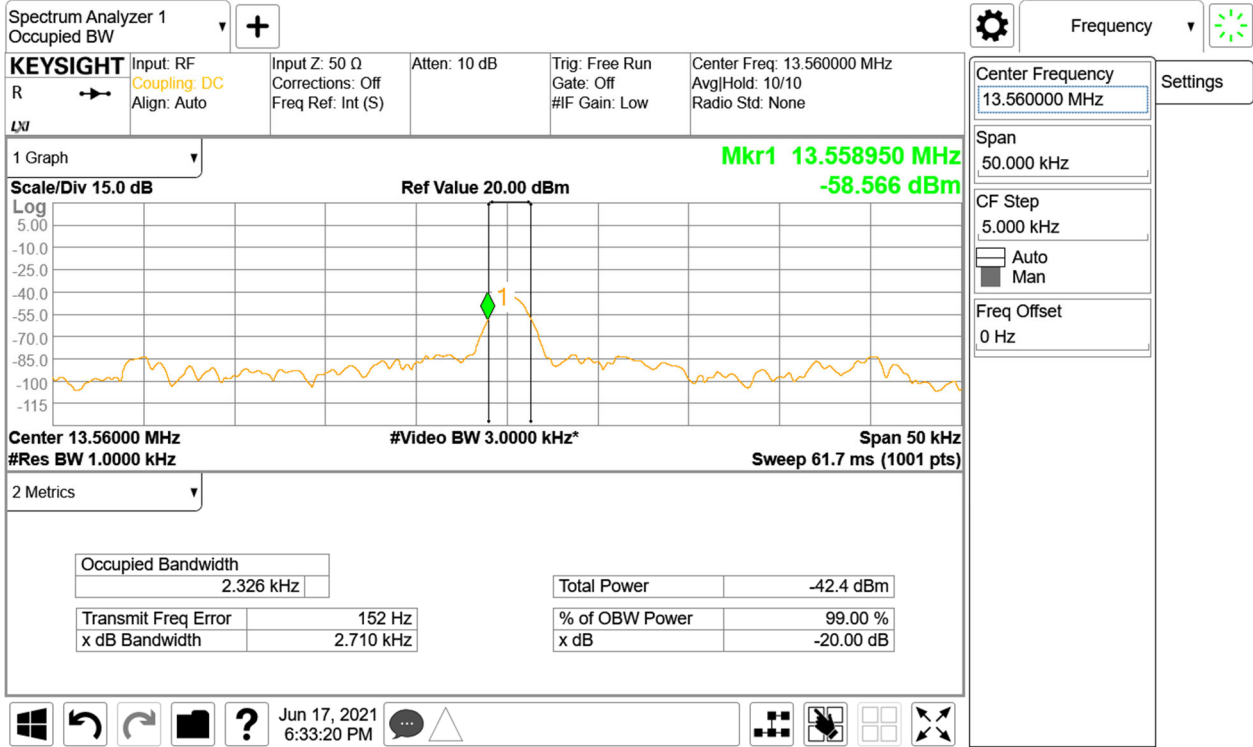
Bandwidth



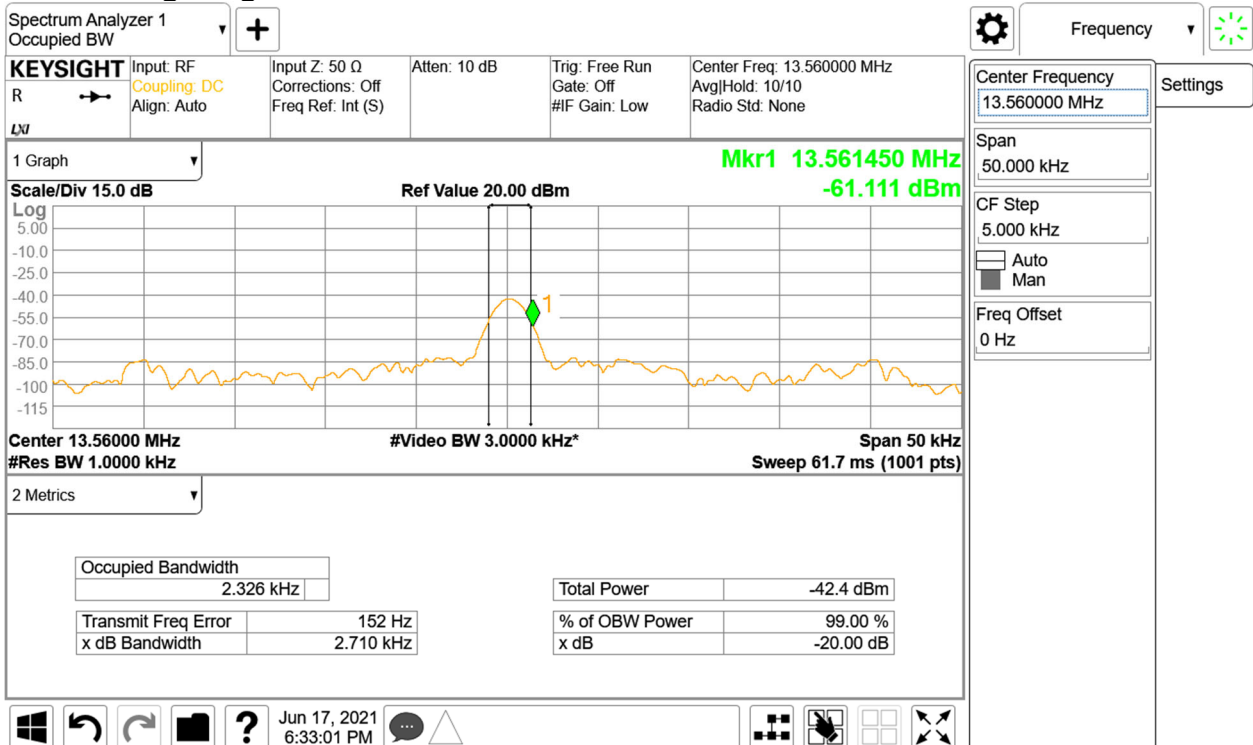
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Operation range Low



Operation range High



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10 ANTENNA REQUIREMENT

10.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

10.2 Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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