

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant: HP INC.
1501 PAGE MILL ROAD PALO ALTO, CA 94304, USA

Product Name: Notebook Computer

Brand Name: HP

Model No.: TPN-H101

Model Difference: N/A

Report Number: E2/2021/10093

FCC ID: B94-TNH101QN

FCC Rule Part: Part 15.225

Issue Date: March 23, 2021

Date of Test: February 5, 2021 - March 16, 2021

Date of EUT Received: February 5, 2021

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 tested as described in this report is in compliance with conducted and radiated emission limits.

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

Approved By: _____

Jay Lin
Jay Lin / Asst. Supervisor



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Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/10093	Rev.00	Original.	March 23, 2021	Susan Lin

Note:

- 1、Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Notebook Computer
Brand Name:	HP
Model No.:	TPN-H101
Model Difference:	N/A
Hardware Version:	N/A
Software Version:	N/A
EUT Series No.:	C1L050004L
Power Supply:	7.7Vdc from Rechargeable Li-Polymer Battery or 5 / 9 / 12 / 15Vdc 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
Antenna Type	Loop Antenna
Modulation Type	ASK

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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		FCC Designation number
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	<input type="checkbox"/>	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	TW0027
	<input checked="" type="checkbox"/>	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	TW0028

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 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 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 Emission test set up configuration



Fig. 2-2 Conduction test set up configuration

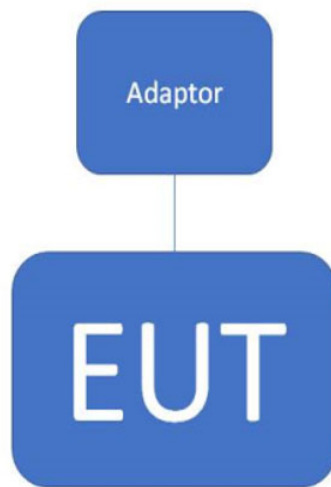


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.
1.	NFC Test software	N/A	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

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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 spurious radiation emission was measured as EUT stand-up position (H, E1 mode) and lie down position (E2 mode) for NFC Transmitter for channel the worst case H position was reported.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.34 dB
Frequency Stability	+/- 1.54 Hz
20 dB OCCUPIED BANDWIDTH	+/- 1.54 Hz
Temperature	+/- 0.4 °C
Humidity	+/- 3.5 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 1%

Radiated Spurious Emission Measurement Uncertainty		
Polarization: Vertical	+/- 2.64 dB	9kHz~30MHz: +/-2.3dB
	+/- 4.93 dB	30MHz - 1000MHz: +/- 3.37dB
	+/- 4.81 dB	1GHz - 18GHz: +/- 4.04dB
	+/- 4.52 dB	18GHz - 40GHz: +/- 4.04dB
Polarization: Horizontal	+/- 2.64 dB	9kHz~30MHz: +/-2.3dB
	+/- 4.45 dB	30MHz - 1000MHz: +/- 4.22dB
	+/- 4.81 dB	1GHz - 18GHz: +/- 4.08dB
	+/- 4.52 dB	18GHz - 40GHz: +/- 4.08dB

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 dB(uV)	
	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.

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	974	03/25/2020	03/24/2021
EMI Test Receiver	R&S	ESCI	101342	04/28/2020	04/27/2021
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2020	03/26/2021
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2020	03/26/2021

6.3 EUT Setup

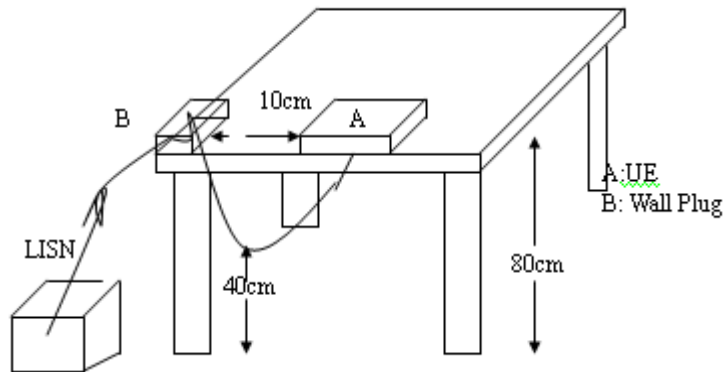
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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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.

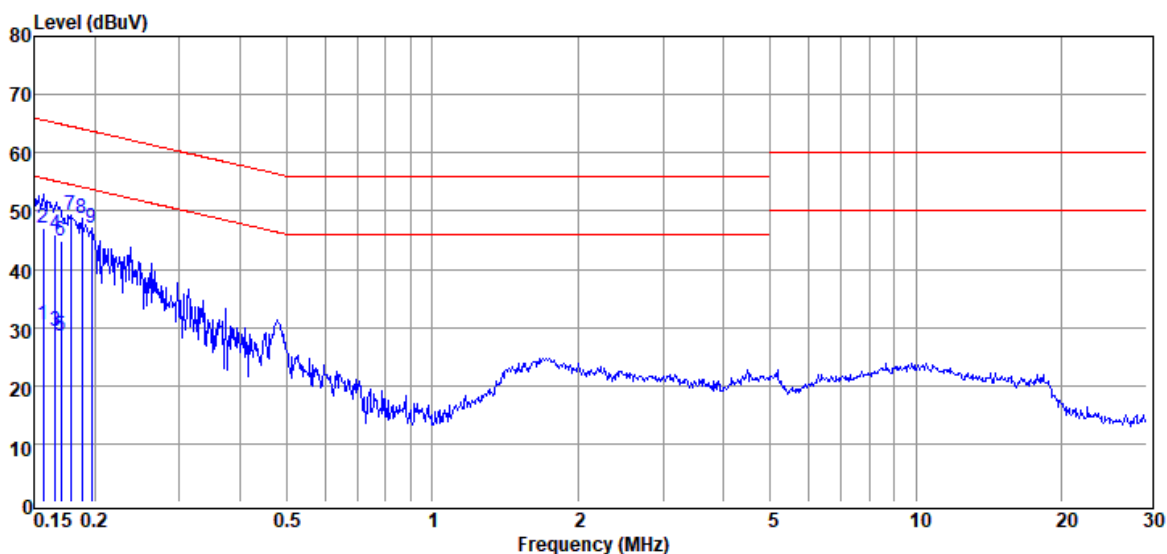
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	: E2/2021/10093	Test Site	:Conduction Room C
Test Mode	:NFC	Test Date	:2021-03-08
Power	:120V/60Hz	Temp./Humi.	:24.5/56
Probe	:L1	Engineer	:Jack Tseng
Note:	: Adapter :TPN-LA19		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV	Limit dBuV	Margin dB
0.16	Average	20.37	10.22	30.59	55.64	-25.05
0.16	QP	36.77	10.22	46.99	65.64	-18.65
0.17	Average	19.16	10.22	29.38	55.16	-25.78
0.17	QP	35.82	10.22	46.04	65.16	-19.12
0.17	Average	18.33	10.22	28.55	54.94	-26.39
0.17	QP	34.55	10.22	44.77	64.94	-20.17
0.18	Peak	39.00	10.22	49.22	64.55	-15.33
0.19	Peak	38.58	10.22	48.80	64.11	-15.31
0.20	Peak	36.73	10.22	46.95	63.71	-16.76

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Report Number : E2/2021/10093

Test Site :Conduction Room C

Test Mode :NFC

Test Date :2021-03-08

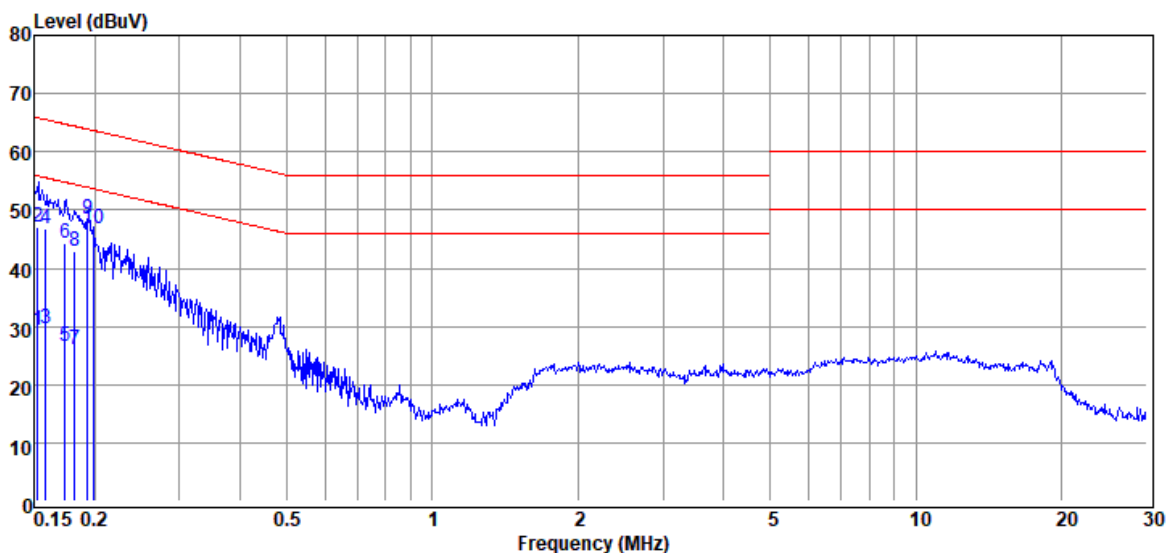
Power :120V/60Hz

Temp./Humi. :24.5/56

Probe :N

Engineer :Jack Tsneg

Note: : Adapter :TPN-LA19



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
0.15	Average	19.21	10.21	29.42	55.85	-26.43
0.15	QP	36.81	10.21	47.02	65.85	-18.83
0.16	Average	19.37	10.21	29.58	55.53	-25.95
0.16	QP	36.62	10.21	46.83	65.53	-18.70
0.17	Average	16.48	10.21	26.69	54.77	-28.08
0.17	QP	33.96	10.21	44.17	64.77	-20.60
0.18	Average	15.90	10.21	26.11	54.38	-28.27
0.18	QP	32.75	10.21	42.96	64.38	-21.42
0.19	Peak	38.21	10.21	48.42	63.89	-15.47
0.20	Peak	36.56	10.21	46.77	63.62	-16.85

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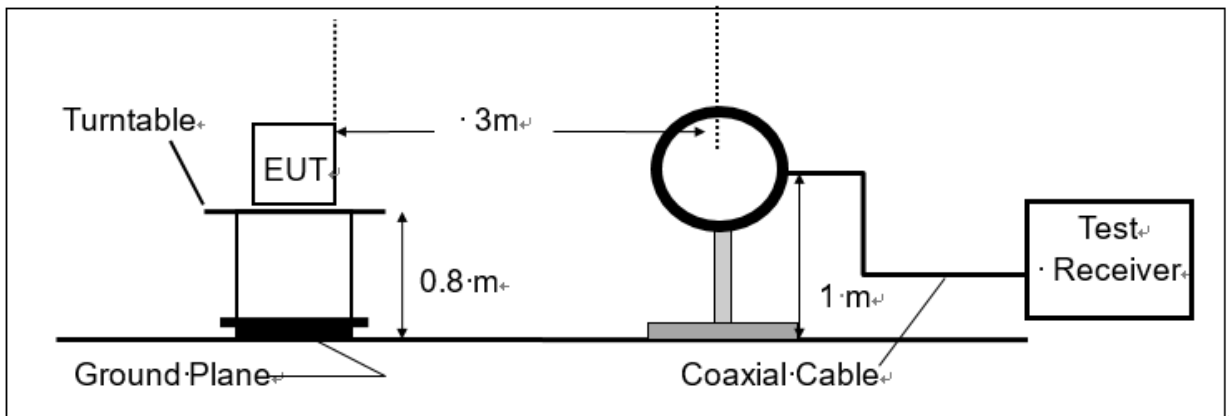
7 RADIATED EMISSION TEST

7.1 Measurement Procedure

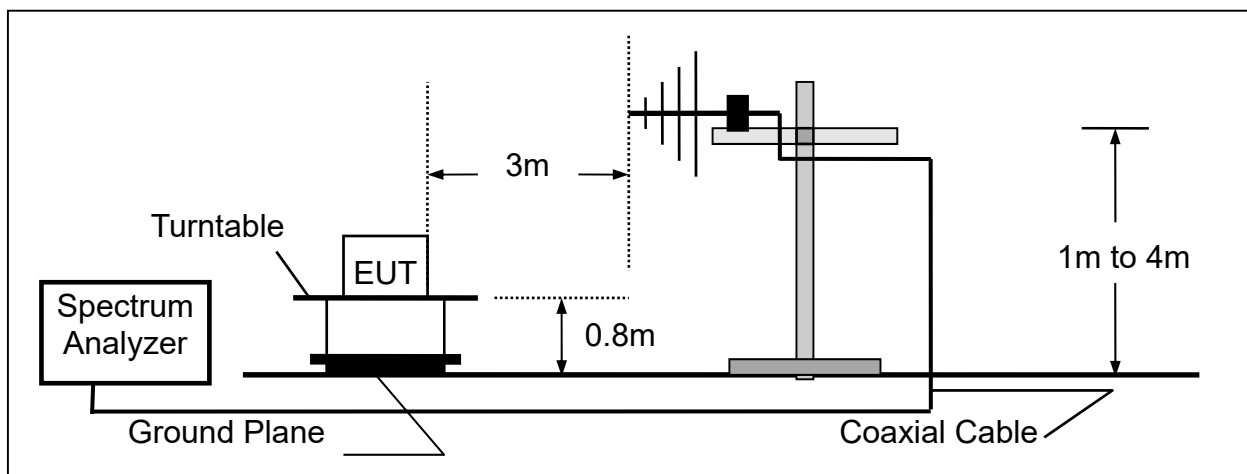
1. Configure the EUT according to ANSI C63.10.
2. The EUT was placed on a turn table which is 0.8m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. 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 form 30MHz to 1000MHz



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7.3 Measurement Equipment Used:

Radiated Emission Test Site: SAC C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	TESEQ	CBL 6112D	35240	09/08/2020	09/07/2021
Loop Antenna	ETS.LINDGREN	6502	143303	04/28/2020	04/27/2021
EMI Test Receiver	R&S	ESU 40	100363	04/29/2020	04/28/2021
Pre-Amplifier	EMC Instruments	EMC330	980096	11/19/2020	11/18/2021
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/19/2020	11/18/2021
Test Software	audix	e3	20923 sgs Ver.9	N.C.R	N.C.R

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	

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 (µV/m)at 30m	Field Strength (dBµV/m)at 30m	Field Strength (dBµV/m)at 3m
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

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7.5.2 Distance Extrapolation Factor

30m to 3m

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

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 = $40 \cdot \log(30/10) = 19.08 \text{ dB}$

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 = $40 \cdot \log(10/3) = 20.92 \text{ dB}$

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. Emission level in dBuV/m = $20 \log(\mu\text{V/m})$
2. Distance extrapolation factor = $40 \log(\text{required distance}/\text{test distance}) \text{ (dB)}$
3. The lower limit shall apply at the transition frequencies.
4. 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)

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

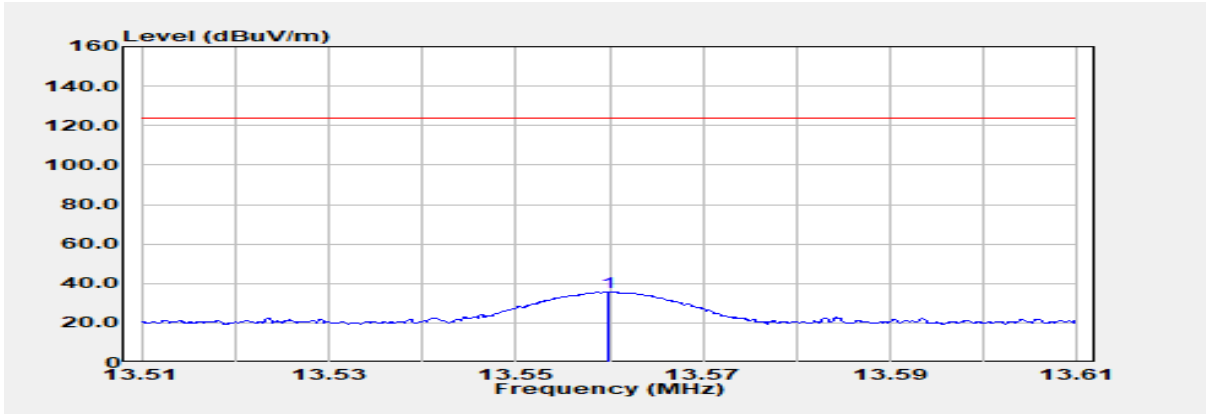
The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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7.5.3 Field Strength of Fundamental Emission Measurement Result

Report Number	:E2/2021/10093	Test Site	:966 Chamber C
Operation Mode	:NFC	Test Date	:2021-03-02
Test Frequency	:13.56 MHz	Temp./Humi.	:22.5/56
Test Mode	:Main	Antenna Pol.	:Vertical
EUT Pol	:H Plan	Engineer	:Ashton Chiu



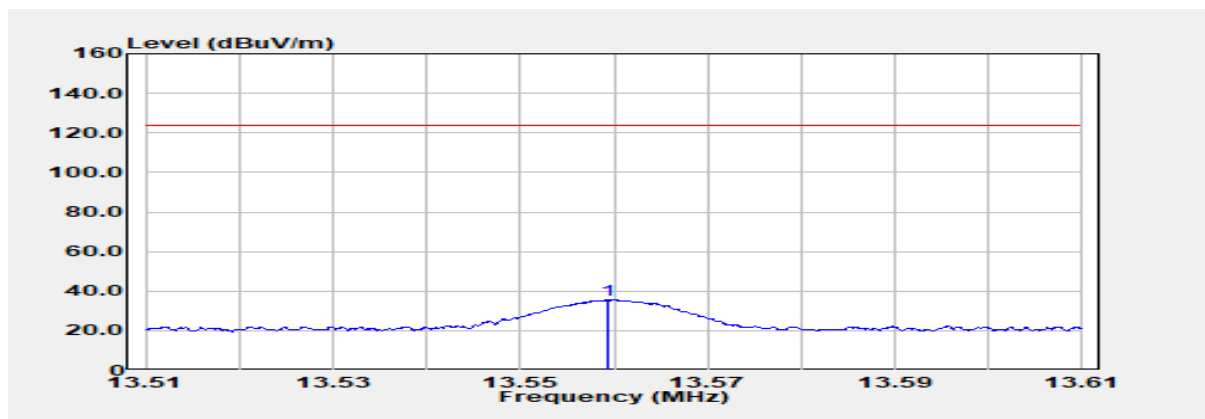
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @3m dB μ V/m	Margin dB
13.560	Peak	24.14	11.33	35.47	124.00	-88.53

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Report Number :E2/2021/10093
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Main
 EUT Pol :H Plan

Test Site :966 Chamber C
 Test Date :2021-03-02
 Temp./Humi. :22.5/56
 Antenna Pol. :Horizontal
 Engineer :Ashton Chiu



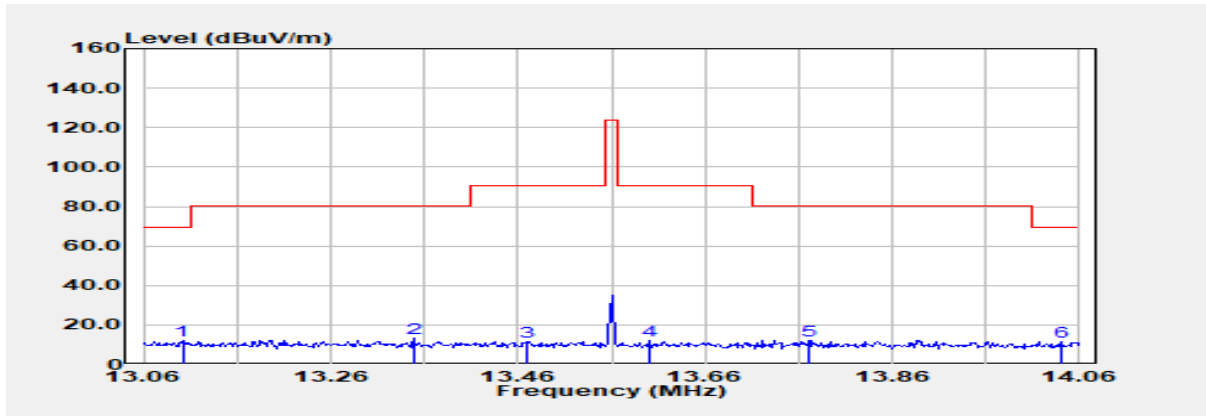
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
13.559	Peak	24.09	11.33	35.42	124.00	-88.58

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Report Number :E2/2021/10093
Operation Mode :NFC
Test Frequency :13.56 MHz
Test Mode :Mask
EUT Pol :H Plan

Test Site :966 Chamber C
Test Date :2021-03-02
Temp./Humi. :22.5/56
Antenna Pol. :Vertical
Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
13.102	Peak	0.80	11.36	12.16	69.54	-57.38
13.348	Peak	1.82	11.34	13.16	80.50	-67.34
13.470	Peak	0.32	11.34	11.65	90.47	-78.82
13.602	Peak	0.76	11.33	12.08	90.47	-78.39
13.772	Peak	0.95	11.31	12.26	80.50	-68.24
14.041	Peak	0.03	11.30	11.32	69.54	-58.22

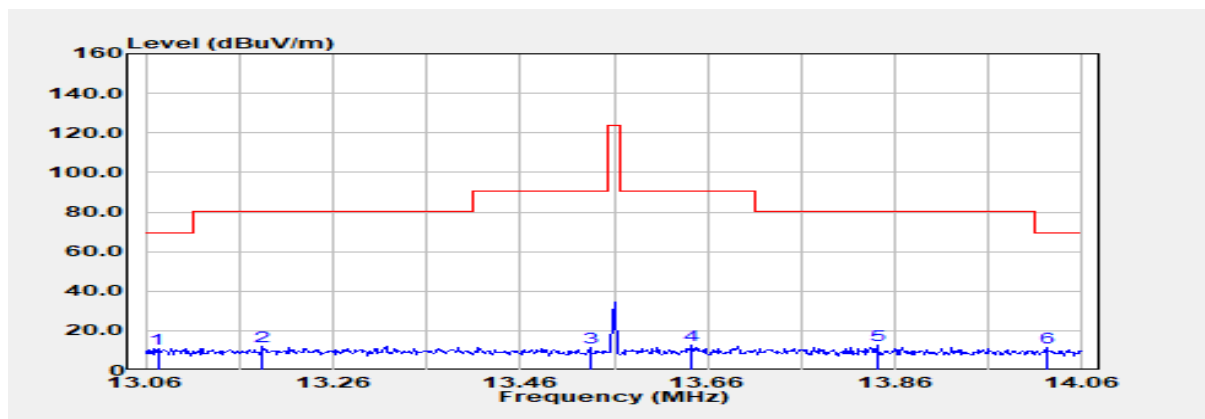
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Report Number :E2/2021/10093
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Mask
 EUT Pol :H Plan

Test Site :966 Chamber C
 Test Date :2021-03-02
 Temp./Humi. :22.5/56
 Antenna Pol. :Horizontal
 Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
13.073	Peak	-0.23	11.36	11.13	69.54	-58.41
13.185	Peak	0.64	11.36	12.00	80.50	-68.50
13.534	Peak	0.32	11.33	11.65	90.47	-78.82
13.643	Peak	1.36	11.32	12.68	90.47	-77.79
13.840	Peak	1.29	11.31	12.60	80.50	-67.90
14.022	Peak	0.11	11.30	11.41	69.54	-58.13

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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.
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.

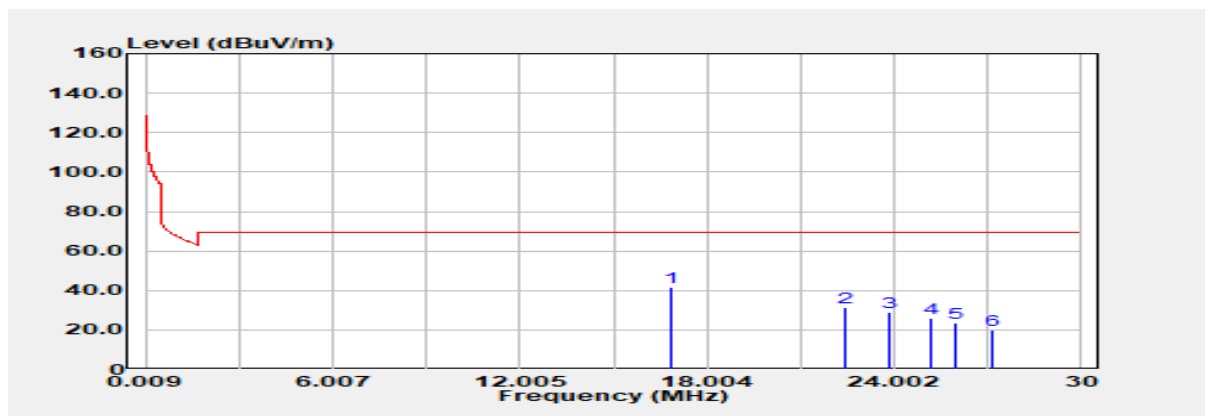
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7.6.2 Radiated Spurious Emission Measurement Result

Report Number	:E2/2021/10093	Test Site	:966 Chamber C
Operation Mode	:NFC	Test Date	:2021-03-02
Test Frequency	:13.56 MHz	Temp./Humi.	:22.5/56
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:H Plan	Engineer	:Ashton Chiu



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
16.831	Peak	30.44	11.12	41.57	69.54	-27.97
22.406	Peak	21.00	10.40	31.40	69.54	-38.14
23.848	Peak	18.75	10.10	28.85	69.54	-40.69
25.146	Peak	16.09	9.84	25.93	69.54	-43.61
25.963	Peak	13.73	9.69	23.42	69.54	-46.12
27.120	Peak	10.52	9.49	20.01	69.54	-49.53

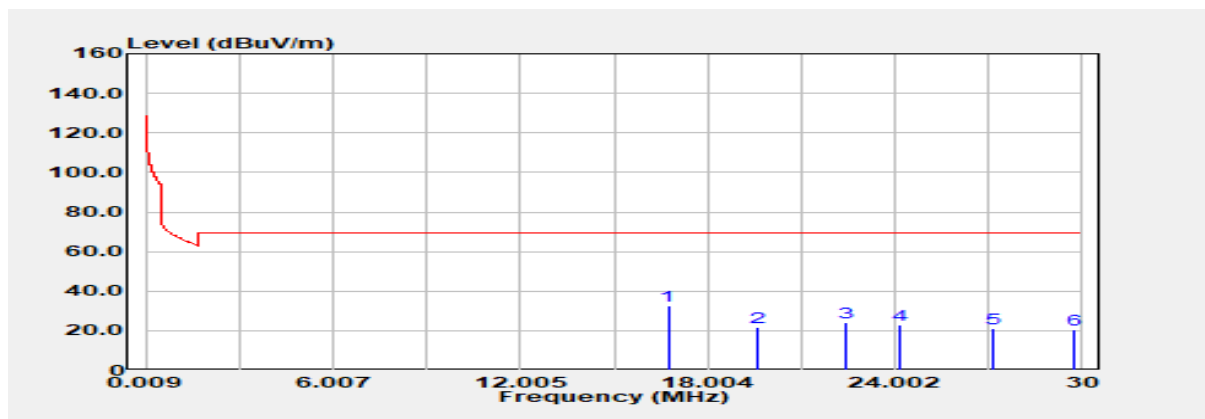
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Report Number :E2/2021/10093
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Tx
 EUT Pol :H Plan

Test Site :966 Chamber C
 Test Date :2021-03-02
 Temp./Humi. :22.5/56
 Antenna Pol. :Horizontal
 Engineer :Ashton Chiu



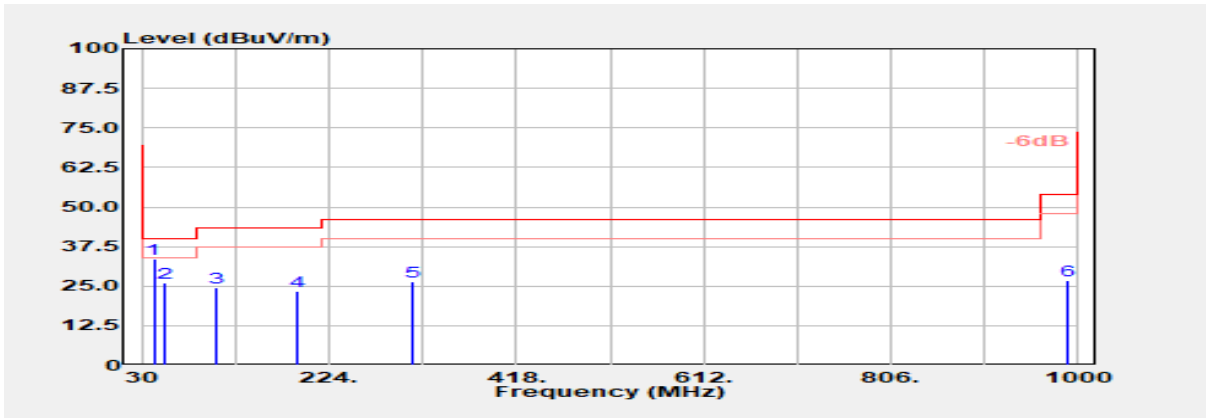
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
16.735	Peak	21.54	11.13	32.66	69.54	-36.88
19.619	Peak	10.84	10.98	21.82	69.54	-47.72
22.406	Peak	13.54	10.40	23.95	69.54	-45.59
24.184	Peak	12.88	10.03	22.91	69.54	-46.63
27.120	Peak	11.61	9.49	21.10	69.54	-48.44
29.760	Peak	11.52	9.06	20.58	69.54	-48.96

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Report Number :E2/2021/10093
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Tx
 EUT Pol :H Plan

Test Site :966 Chamber C
 Test Date :2021-03-02
 Temp./Humi. :22.5/56
 Antenna Pol. :Vertical
 Engineer :Ashton Chiu



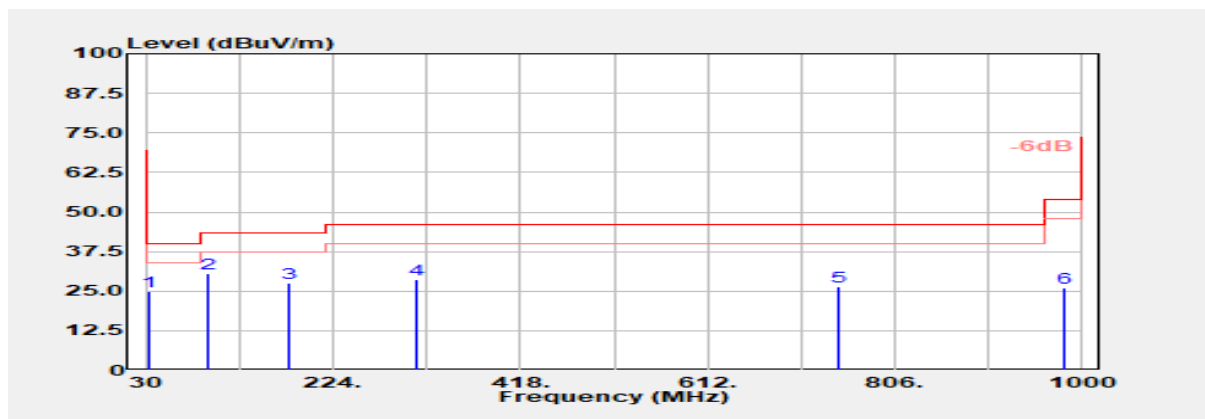
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @3m dBUV/m	Margin dB
42.436	Peak	47.14	-13.64	33.50	40.00	-6.50
53.317	Peak	48.27	-22.16	26.11	40.00	-13.89
107.724	Peak	43.17	-18.50	24.67	43.50	-18.83
191.667	Peak	43.66	-20.09	23.57	43.50	-19.93
311.362	Peak	41.85	-15.33	26.52	46.00	-19.48
989.119	Peak	31.75	-4.85	26.90	54.00	-27.10

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Report Number :E2/2021/10093
 Operation Mode :NFC
 Test Frequency :13.56 MHz
 Test Mode :Tx
 EUT Pol :H Plan

Test Site :966 Chamber C
 Test Date :2021-03-02
 Temp./Humi. :22.5/56
 Antenna Pol. :Horizontal
 Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB
33.109	Peak	33.32	-8.39	24.93	40.00	-15.07
93.734	Peak	51.59	-20.85	30.73	43.50	-12.77
179.231	Peak	47.52	-20.05	27.47	43.50	-16.03
311.362	Peak	43.84	-15.33	28.52	46.00	-17.48
748.173	Peak	33.92	-7.54	26.38	46.00	-19.62
981.346	Peak	31.00	-4.87	26.12	54.00	-27.88

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8 FREQUENCY STABILITY

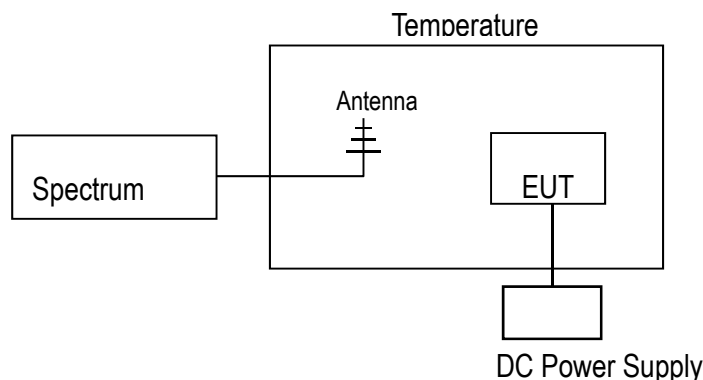
8.1 Applicable Standard

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.

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)



8.4 Measurement Equipment Used:

Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Loop Antenna	ETS.LINDGREN	6502	143303	04/28/2020	04/27/2021
Spectrum Analyzer	KEYSIGHT	N9010B	MY59071570	06/25/2020	06/24/2021
Temperature Chamber	TERCHY	MHK-120LK	1020582	07/08/2020	07/07/2021
DC Block	PASTERNAK	PE8210	RF156	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F1A185C	RF71	11/19/2020	11/18/2021

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8.5 Measurement Results

Startup

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
7.7	-20	13.55997	0.03000	+/- 1.356
7.7	-10	13.55998	0.02000	+/- 1.356
7.7	0	13.55997	0.03000	+/- 1.356
7.7	10	13.55999	0.01000	+/- 1.356
7.7	20	13.56	0.00000	+/- 1.356
7.7	30	13.55999	0.01000	+/- 1.356
7.7	40	13.55997	0.03000	+/- 1.356
7.7	50	13.55996	0.04000	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
8.8	20	13.55999	0.01000	+/- 1.356
7.7	20	13.56	0.00000	+/- 1.356
6.5	20	13.55998	0.02000	+/- 1.356

2 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
7.7	-20	13.55996	0.04000	+/- 1.356
7.7	-10	13.55997	0.03000	+/- 1.356
7.7	0	13.55999	0.01000	+/- 1.356
7.7	10	13.55997	0.03000	+/- 1.356
7.7	20	13.56	0.00000	+/- 1.356
7.7	30	13.55998	0.02000	+/- 1.356
7.7	40	13.55997	0.03000	+/- 1.356
7.7	50	13.55995	0.05000	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
8.8	20	13.55999	0.01000	+/- 1.356
7.7	20	13.56	0.00000	+/- 1.356
6.5	20	13.55997	0.03000	+/- 1.356

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5 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
7.7	-20	13.55998	0.02000	+/- 1.356
7.7	-10	13.55998	0.02000	+/- 1.356
7.7	0	13.55997	0.03000	+/- 1.356
7.7	10	13.55998	0.02000	+/- 1.356
7.7	20	13.56	0.00000	+/- 1.356
7.7	30	13.55998	0.02000	+/- 1.356
7.7	40	13.55997	0.03000	+/- 1.356
7.7	50	13.55996	0.04000	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
8.8	20	13.55997	0.03000	+/- 1.356
7.7	20	13.56	0.00000	+/- 1.356
6.5	20	13.55996	0.04000	+/- 1.356

10 minutes

A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
7.7	-20	13.55998	0.02000	+/- 1.356
7.7	-10	13.55997	0.03000	+/- 1.356
7.7	0	13.55997	0.03000	+/- 1.356
7.7	10	13.55998	0.02000	+/- 1.356
7.7	20	13.56	0.00000	+/- 1.356
7.7	30	13.55999	0.01000	+/- 1.356
7.7	40	13.55994	0.06000	+/- 1.356
7.7	50	13.55991	0.09000	+/- 1.356

B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
8.8	20	13.55997	0.03000	+/- 1.356
7.7	20	13.56	0.00000	+/- 1.356
6.5	20	13.55997	0.03000	+/- 1.356

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9 EMISSION BANDWIDTH MEASUREMENT

9.1 Applicable Standard:

The 20 dB 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

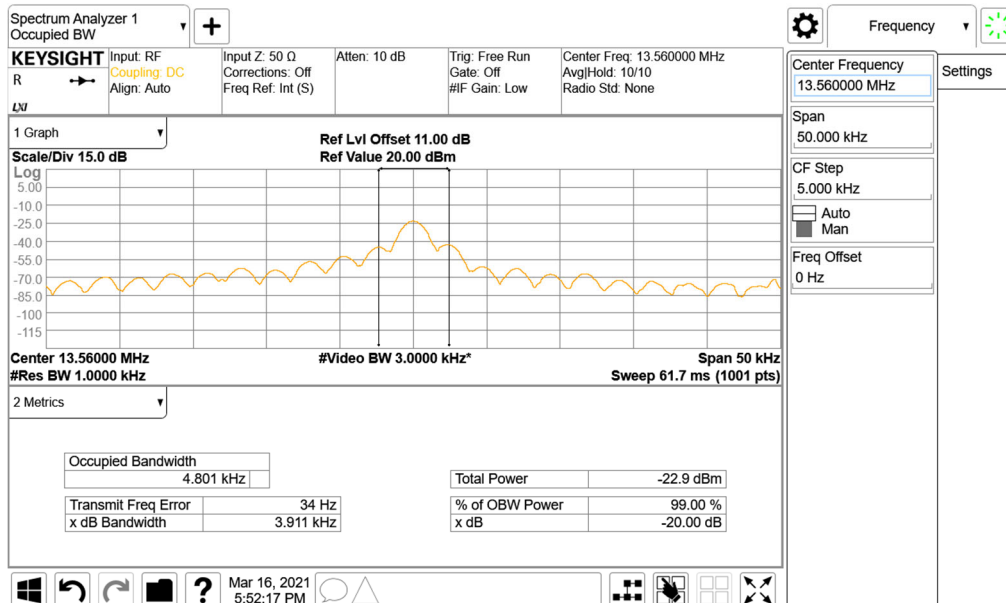
9.5 Measurement Procedure

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)
3.911	Low	13.55765	>13.11
	High	13.56245	<14.01

Bandwidth



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Operation range Left

Spectrum Analyzer 1
Occupied BW

Frequency

Settings

KEYSIGHT R

Input: RF
Coupling: DC
Align: Auto

Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)

Atten: 10 dB

Trig: Free Run
Gate: Off
#F Gain: Low

Center Freq: 13.560000 MHz
Avg/Hold: 10/10
Radio Std: None

1 Graph

Ref Lvl Offset 11.00 dB
Ref Value 20.00 dBm

Mkr1 13.557650 MHz
-44.923 dBm

Scale/Div 15.0 dB

Center 13.56000 MHz
#Res BW 1.0000 kHz

#Video BW 3.0000 kHz*

Span 50 kHz
Sweep 61.7 ms (1001 pts)

2 Metrics

Occupied Bandwidth	4.801 kHz	Total Power	-22.9 dBm
Transmit Freq Error	34 Hz	% of OBW Power	99.00 %
x dB Bandwidth	3.911 kHz	x dB	-20.00 dB

Mar 16, 2021
5:52:52 PM

?

Operation range Right

Spectrum Analyzer 1
Occupied BW

Frequency

Settings

KEYSIGHT R

Input: RF
Coupling: DC
Align: Auto

Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)

Atten: 10 dB

Trig: Free Run
Gate: Off
#F Gain: Low

Center Freq: 13.560000 MHz
Avg/Hold: 10/10
Radio Std: None

1 Graph

Ref Lvl Offset 11.00 dB
Ref Value 20.00 dBm

Mkr1 13.562450 MHz
-42.822 dBm

Scale/Div 15.0 dB

Center 13.56000 MHz
#Res BW 1.0000 kHz

#Video BW 3.0000 kHz*

Span 50 kHz
Sweep 61.7 ms (1001 pts)

2 Metrics

Occupied Bandwidth	4.801 kHz	Total Power	-22.9 dBm
Transmit Freq Error	34 Hz	% of OBW Power	99.00 %
x dB Bandwidth	3.911 kHz	x dB	-20.00 dB

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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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