FCC IC RF Test Report

Report No.:	RF_ FCC_IC_SL20103001-KRO-111 Rev_1.0
FCC ID:	P5W-8610K009
IC:	1416A-8610K009
Models:	InTouch DX with Legic
Part Numbers:	8610000-009, 8610000-109, 8610000-409
Received Date:	11/20/2020
Test Date:	11/25/2020-05/13/2021
Issued Date:	05/13/2021
Applicant name:	Kronos, Inc
Address:	900 Chelmsford Street, Lowell MA 01851
Manufacturer:	Kronos, Inc
Address:	900 Chelmsford Street, Lowell MA 01851
Issued By:	Bureau Veritas Consumer Products Services, Inc.
Lab Address:	775 Montague Expressway, Milpitas, CA 95035
FCC Registration / Designation Number:	540430
ISED# / CAB identifier:	4842D

ACCREDITED
TESTING CERT # 2742-01

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Release Control Record

Issue No.	Description	Date Issued
RF_ FCC_IC_SL20103001-KRO-111	Initial Release	01/13/2021
RF_ FCC_IC_SL20103001-KRO-111 Rev_1.0	Update IC standard to lastest version	03/08/2021
RF_ FCC_IC_SL20103001-KRO-111 Rev_2.0	Update 15.225 (d) RSS Gen test item	05/13/2021

1 Certificate of Conformity

Product:	Legic Card Reader
Test Model:	InTouch DX with Legic
Brand:	Kronos, Inc
Part Numbers:	8610000-009, 8610000-109, 8610000-409
Sample Status:	Kronos, Inc
Applicant:	900 Chelmsford Street, Lowell MA 01851
Test Date:	11/25/2020-05/13/2021
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.225) RSS 210 Issue 10, December 2019 ANSI C63.10:2013 RSS Gen Issue 5, April 2018

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Gary Chou , **Date:** 05/13/2021

Gary Chou / Compliance Engineer

Approved by : Deon , **Date:** 05/13/2021

Deon Dai / Engineer Reviewer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.225 / 15.215) RSS 210 Issue 10, RSS Gen Issue 5			
FCC IC Clause	Test Item	Result	Remarks
15.207 RSS Gen 8.8	AC Power Conducted Emission	Pass	Meet the requirement of limit.
15.225 (a) RSS 210 B.6.a.i	The field strength of any emissions within the band 13.553-13.567 MHz	Pass	Meet the requirement of limit.
15.225 (b) RSS 210 B.6.a.ii	The field strength of any emissions within the bands 13.410-13.553 MHz and 13.567-13.710 MHz	Pass	Meet the requirement of limit.
15.225 (c) RSS 210 B.6.a.iii	The field strength of any emissions within the bands 13.110-13.410 MHz and 13.710-14.010 MHz	Pass	Meet the requirement of limit.
15.225 (d) RSS Gen	The field strength of any emissions appearing outside of the 13.110-14.010 MHz band	Pass	Meet the requirement of limit.
15.225 (e) RSS 210 B.6.b	The frequency tolerance	Pass	Meet the requirement of limit.
15.215 (c) RSS Gen 6.7	20dB Bandwidth & 99% Bandwidth	Pass	Meet the requirement of limit.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Legic Card Reader
Test Model	InTouch DX with Legic
Brand	Kronos, Inc
Part Numbers	8610000-009, 8610000-109, 8610000-409
Status of EUT	Engineering sample
Power Supply Rating	120 Vac
Modulation Type	ASK
Operating Frequency	13.56 MHz (HF)
Antenna Type	PCB loop antenna

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

3.2.1 1 channel is provided to this EUT

Channel	Freq. (MHz)
1	13.56

3.2.2 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE	PLC	FS	EB	
A	√	√	√	√	Continue Transmit

Where **RE**: Radiated Emission **PLC:** Power Line Conducted Emission
FS: Frequency Stability **EB:** 20dB Bandwidth measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.
NOTE: "-" means no effect.

Radiated Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	1	1	ASK

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	1	1	ASK

Frequency Stability:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	1	1	ASK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE	25deg. C, 65%RH	120Vac, 60Hz	Gary Chou
PLC	25deg. C, 65%RH	120Vac, 60Hz	Gary Chou
FS	25deg. C, 68%RH	120Vac, 60Hz	Gary Chou
BW	21deg. C, 60%RH	120Vac, 60Hz	Gary Chou

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	-	-	-	-	-	-
B.						

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	-	-	-	-	0	-

Note: The core(s) is(are) originally attached to the cable(s).

3.3.1 Configuration of System under Test

3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR FCC Part 15, Subpart C (Section 15.225)
47 CFR FCC Part 15, Subpart C (Section 15.215)
RSS 210 Issue 10, December 2019
ANSI C63.10:2013
RSS Gen Issue 5, April 2018

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission Measurement

4.1.1 Limits of Radiated Emission Measurement

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Distance extrapolation factor = 40 log (specific distance / test distance)
   Limit Line (dBuV/m) = 20 log Emission level (uV/m) + Distance extrapolation factor
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
4. The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EMI Test Receiver ROHDE & SCHWARZ	ESW 44	100179	08/30/2020	08/30/2021
Passive Loop Antenna (9k-30MHz)	6512	49120	11/25/2020	11/25/2021
Hybrid Antenna SUNAR	JB6	A111717	03/09/2020	03/09/2021
Preamplifier RF-BAY	LNA-150	12170607	02/16/2020	02/16/2021

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

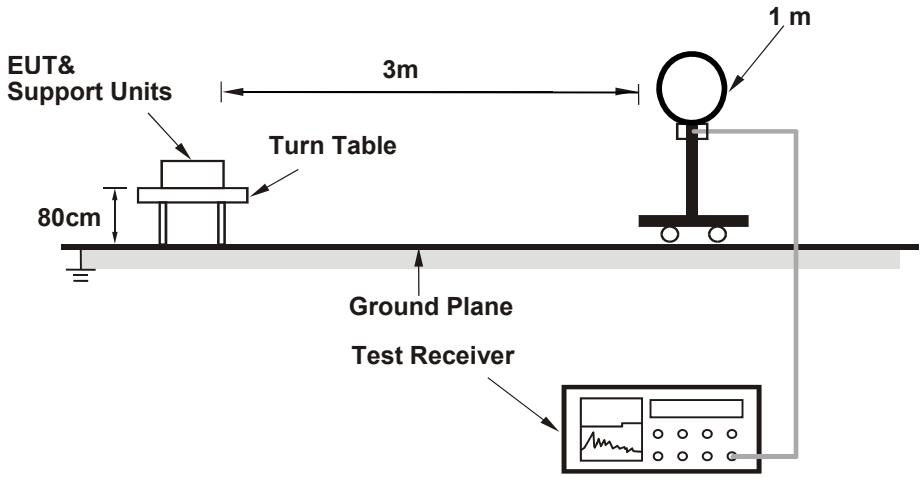
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

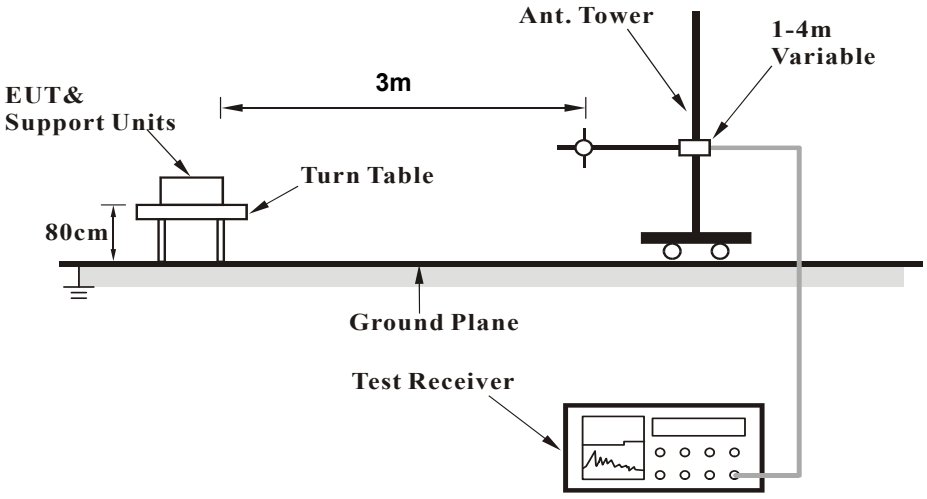
No deviation.

4.1.5 Test Setup

For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



4.1.6 EUT Operating Conditions

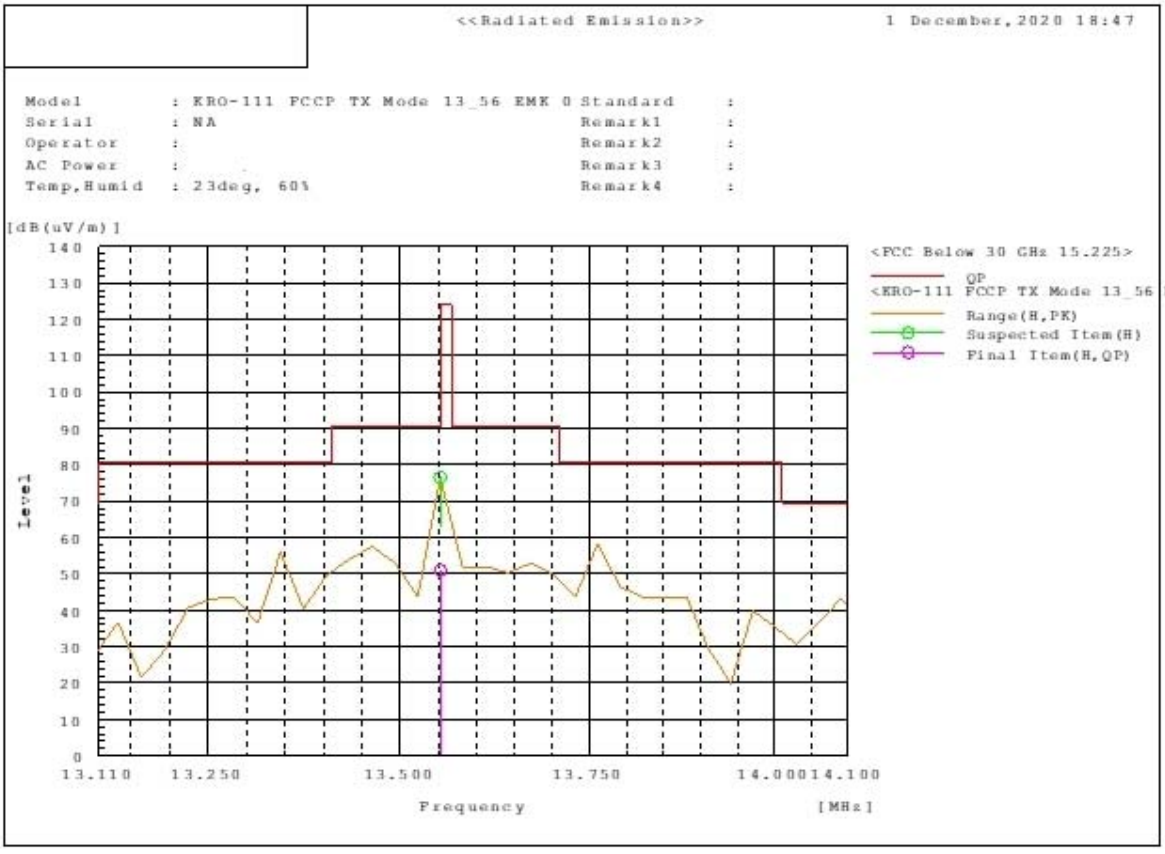
a. Connected the EUT with the Notebook Computer which is placed on remote site.
b. Controlling software has been activated to set the EUT on specific status.

4.1.7 Test Results

Field strength of Fundermantal Emissions

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Transmit Frequency	13.56 MHz
Input Power	120 Vac	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Gary Chou

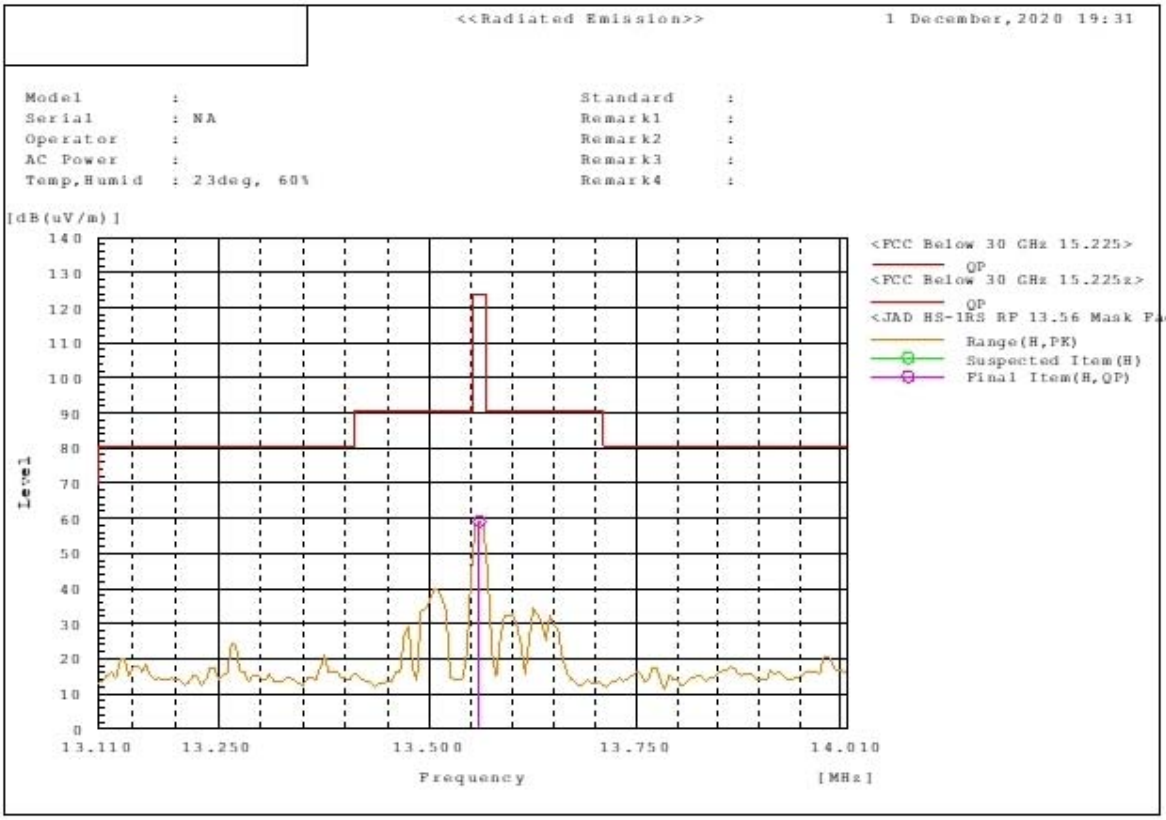
Antenna Polarity & Test Distance: Loop Antenna 0 degree At 3m



Antenna Polarity & Test Distance: Loop Antenna 0 degree At 3m

No.	Frequency (MHz)	Polarization	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	13.553	0	74.8	1.8	76.6	124	-47.4	100	359.5	Pass

Antenna Polarity & Test Distance: Loop Antenna 90 degree At 3m



Antenna Polarity & Test Distance: Loop Antenna 90 degree At 3m										
No.	Frequency (MHz)	Polarization	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	13.553	90	57.3	1.8	59.1	124	-64.9	100	38	Pass

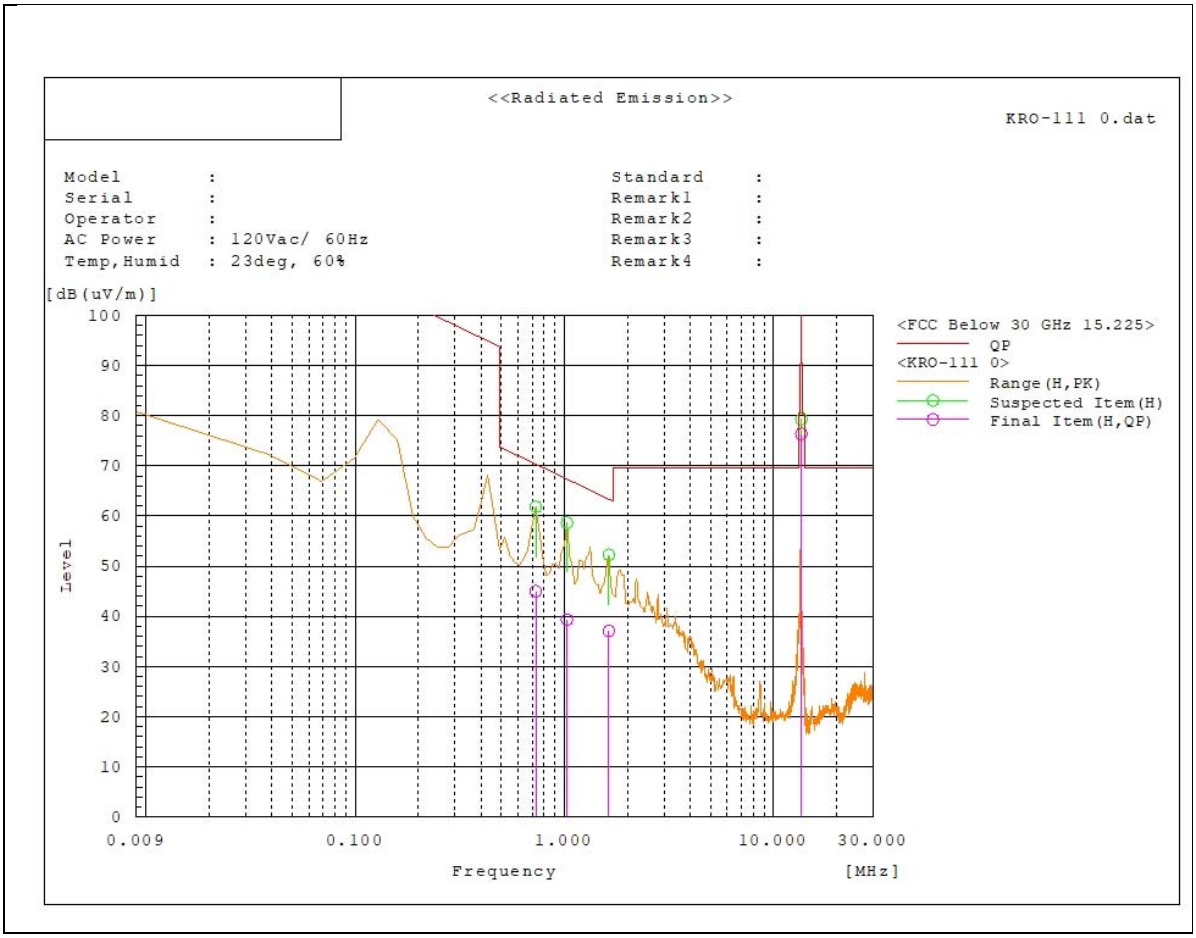
Radiated Emissions (9 kHz~30 MHz)

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Transmit Frequency	13.56 MHz
Input Power	120 Vac	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Gary Chou

Antenna Polarity & Test Distance: Loop Antenna 0 degree At 3m										
No.	Frequency (MHz)	Polarization	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	0.729	0	29.6	15.4	45	70.4	-25.4	100	255	Pass
2	1.029	0	26.6	12.7	39.3	67.4	-22.4	100	241.9	Pass
3	1.629	0	27.8	9.3	37.1	63.4	-18.4	100	187.3	Pass
4	13.553	0	74.6	1.8	76.4	124	-47.6	100	69.2	Pass

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

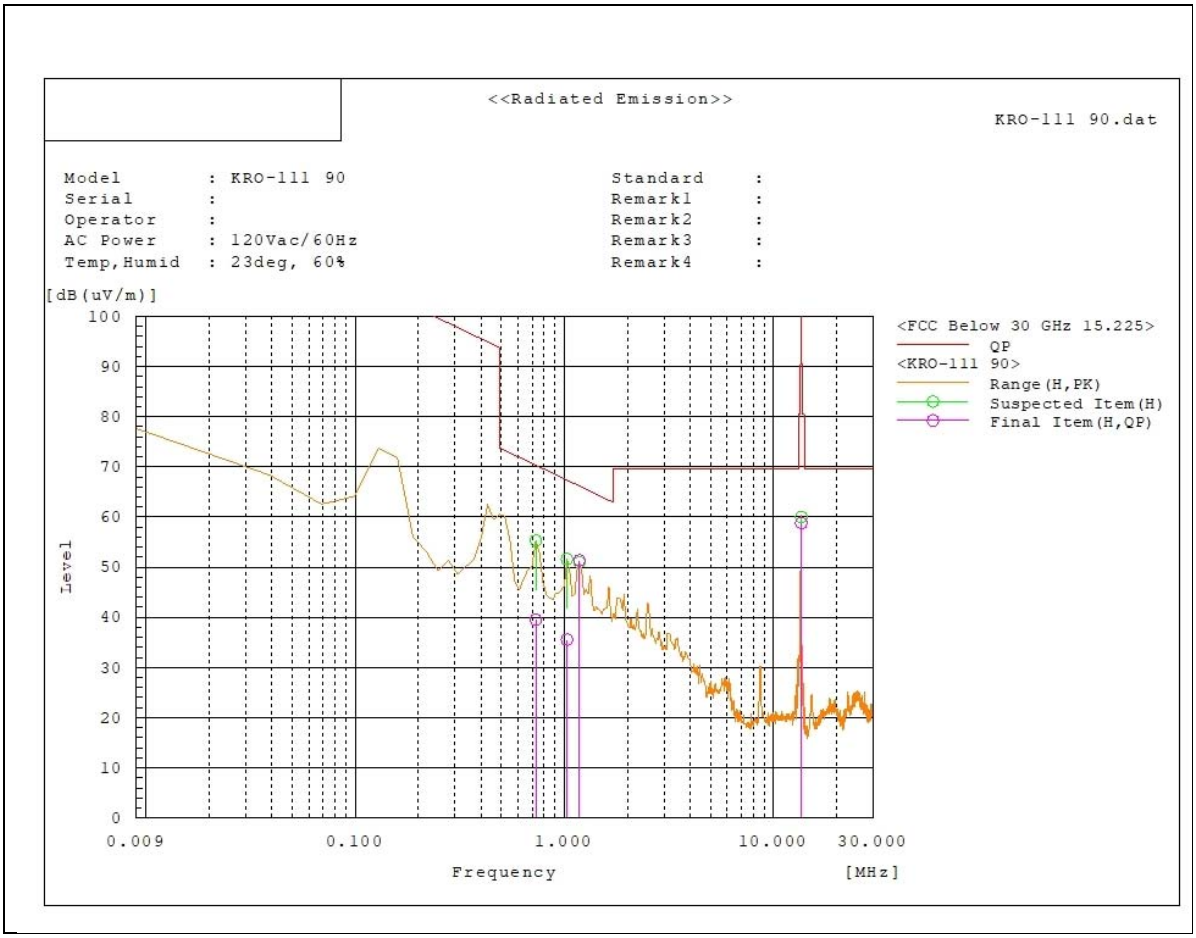

<<Radiated Emission>>
KRO-111 0.dat
Model :
Serial :
Operator :
AC Power : 120Vac/ 60Hz
Temp,Humid : 23deg, 60%
Standard :
Remark1 :
Remark2 :
Remark3 :
Remark4 :
[dB(uV/m)]
Level
100
90
80
70
60
50
40
30
20
10
0
0.009
0.100
1.000
10.000
30.000
Frequency
[MHz]
<FCC Below 30 GHz 15.225>
QP
<KRO-111 0>
Range(H,PK)
Suspected Item(H)
Final Item(H,QP)

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	Below 30MHz
Input Power	120 Vac	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Gary Chou

Antenna Polarity & Test Distance: Loop Antenna 90 degree At 3m										
No.	Frequency (MHz)	Polarization	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	0.729	90	24.1	15.4	39.5	70.4	-30.9	100	213.2	Pass
2	1.029	90	22.9	12.7	35.6	67.4	-31.8	100	223.7	Pass
3	1.179	90	39.7	11.7	51.4	66.2	-14.8	100	207.7	Pass
4	13.553	90	57	1.8	58.8	124	-65.2	100	359.9	Pass

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.



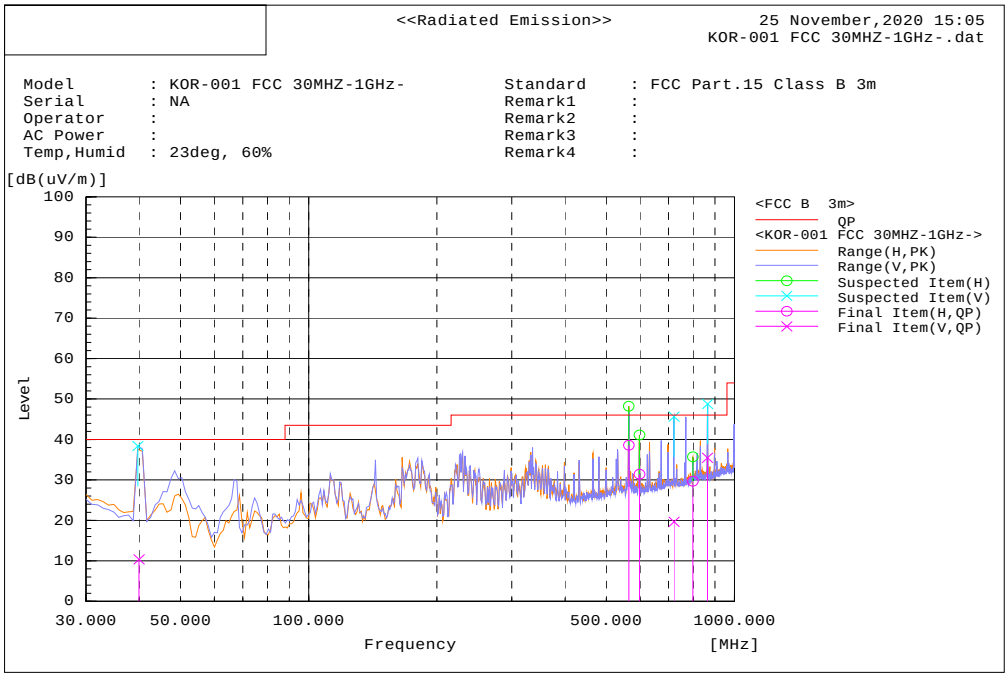
Radiated Emissions (30 MHz~1000 MHz)

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	Below 30MHz
Input Power	120 Vac	Detector Function	Quasi-Peak
Environmental Conditions	25 deg. C, 70% RH	Tested By	Gary Chou

Antenna Polarity & Test Distance: Horizontal & Vertical at 3 m										
No.	Frequency (MHz)	Polarization	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	39.969	V	-8.1	18.5	10.4	40	29.6	100	50.8	Pass
2	564.912	H	12.8	25.8	38.6	46	7.4	266	335.5	Pass
3	598.09	H	4.6	26.8	31.4	46	14.6	247	335	Pass
4	720.708	V	-8.5	28.2	19.7	46	26.3	143	256	Pass
5	797.986	H	0	29.7	29.7	46	16.3	218	324.4	Pass
6	863.773	V	5.9	29.6	35.5	46	10.5	100	359.6	Pass

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
EMI Test Receiver ROHDE & SCHWARZ	ESIB 40	100179	08/28/2020	08/28/2021
Transient Limiter ELECTRO-METRICS	EM-7600-5	106	12/31/2020	12/31/2021
LISN EMCO	3816/2NM	214372	04/10/2020	04/10/2021

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

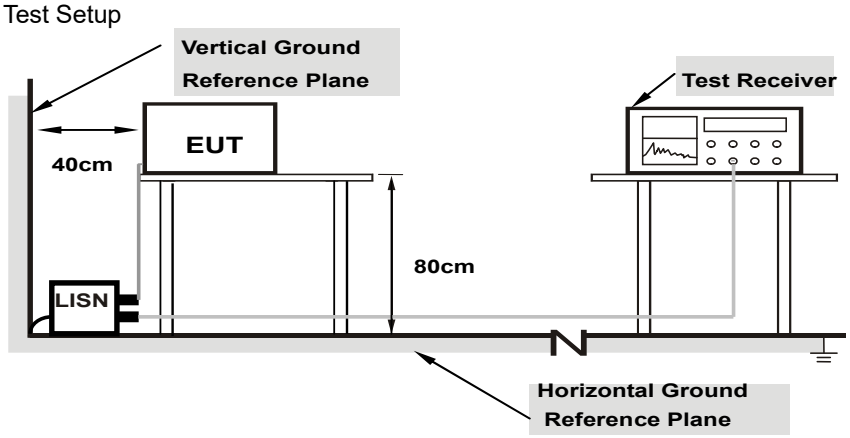
c. The frequency range from 150 kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

Same as 4.1.6.

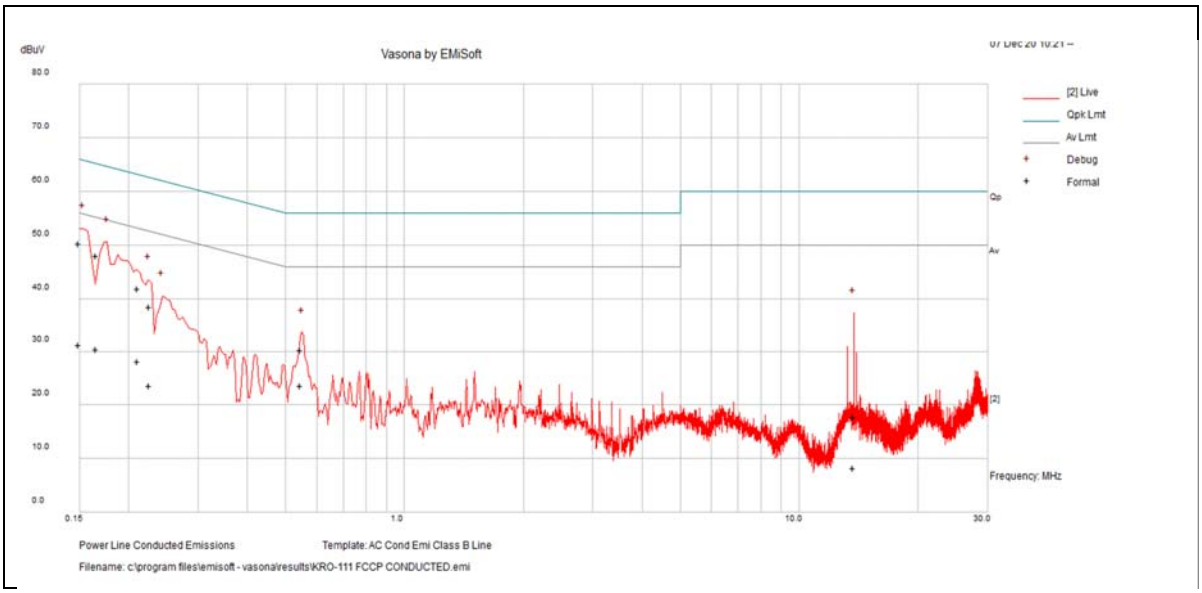
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak / Average

No	Freq.	Raw	Cale Loss	Factors	Level	Measurement Type	Line	Limit	Margin	Pass /Fail
	[MHz]	(dBuV)	(dB)	(dB)	(dBuV)			(dBuV)	(dB)	
1	0.15	40.97	9.29	0.04	50.3	Quasi Peak	Line	66	-15.7	Pass
2	0.165968	38.63	9.32	0.04	47.99	Quasi Peak	Line	65.16	-17.17	Pass
3	0.21083	32.4	9.39	0.04	41.83	Quasi Peak	Line	63.17	-21.35	Pass
4	0.225487	29.1	9.4	0.04	38.55	Quasi Peak	Line	62.61	-24.07	Pass
5	0.544966	20.81	9.45	0.04	30.3	Quasi Peak	Line	56	-25.7	Pass
6	13.759749	7.88	9.69	0.29	17.86	Quasi Peak	Line	60	-42.14	Pass
7	0.15	21.81	9.29	0.04	31.14	Average	Line	56	-24.86	Pass
8	0.165968	20.98	9.32	0.04	30.34	Average	Line	55.16	-24.82	Pass
9	0.21083	18.69	9.39	0.04	28.11	Average	Line	53.17	-25.06	Pass
10	0.225487	14.14	9.4	0.04	23.58	Average	Line	52.61	-29.03	Pass
11	0.544966	14.11	9.45	0.04	23.61	Average	Line	46	-22.39	Pass
12	13.759749	-1.7	9.69	0.29	8.28	Average	Line	50	-41.72	Pass

REMARKS:

1. The emission levels of other frequencies were very low against the limit.
2. Margin value = Emission level - Limit value
3. Emission Level = Correction Factor + Raw Value + Factors Value.

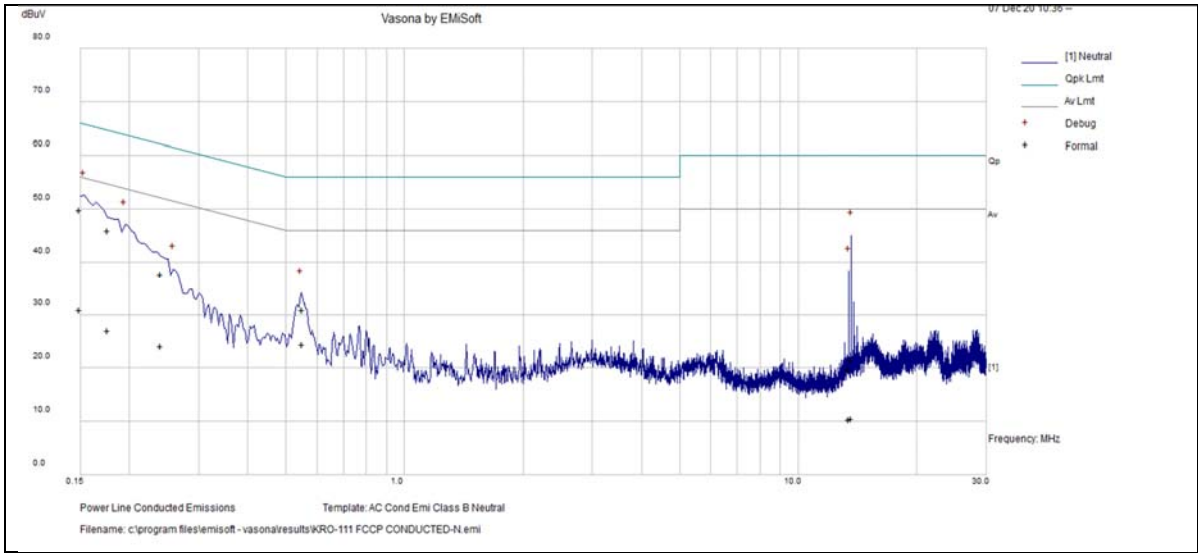


Phase	Neutral (N)	Detector Function	Quasi-Peak / Average

No	Freq.	Raw	Cale Loss	Factors	Level	Measurement Type	Line	Limit	Margin	Pass /Fail
	[MHz]	(dBuV)	(dB)	(dB)	(dBuV)			(dBuV)	(dB)	
1	0.15	40.48	9.29	0.03	49.81	Quasi Peak	Neutral	66	-16.19	Pass
2	13.654166	11.57	9.68	0.3	21.55	Quasi Peak	Neutral	60	-38.45	Pass
3	0.176874	36.58	9.34	0.03	45.94	Quasi Peak	Neutral	64.63	-18.69	Pass
4	13.461469	9.82	9.67	0.3	19.8	Quasi Peak	Neutral	60	-40.2	Pass
5	0.551471	21.38	9.45	0.03	30.86	Quasi Peak	Neutral	56	-25.14	Pass
6	0.240878	28.27	9.42	0.03	37.73	Quasi Peak	Neutral	62.07	-24.34	Pass
7	0.15	21.53	9.29	0.03	30.86	Average	Neutral	56	-25.14	Pass
8	13.654166	0.44	9.68	0.3	10.43	Average	Neutral	50	-39.57	Pass
9	0.176874	17.58	9.34	0.03	26.95	Average	Neutral	54.63	-27.68	Pass
10	13.461469	0.43	9.67	0.3	10.4	Average	Neutral	50	-39.6	Pass
11	0.551471	14.96	9.45	0.03	24.44	Average	Neutral	46	-21.56	Pass
12	0.240878	14.56	9.42	0.03	24.01	Average	Neutral	52.07	-28.06	Pass

REMARKS:

1. The emission levels of other frequencies were very low against the limit.
2. Margin value = Emission level - Limit value
3. Emission Level = Correction Factor + Raw Value + Factors Value.

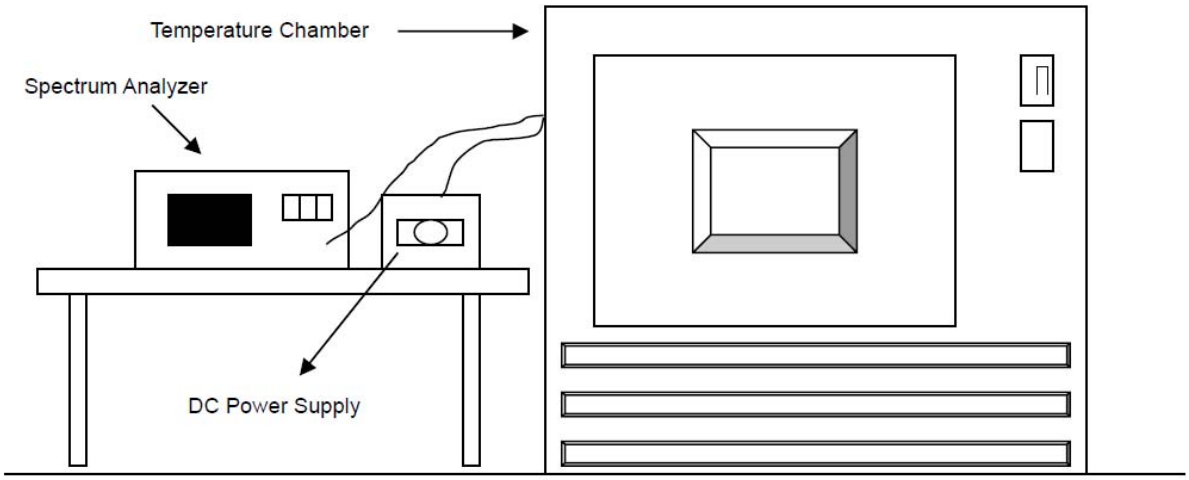


4.3 Frequency Stability

4.3.1 Limits of Frequency Stability Measurement

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.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
b. Turned the EUT on and coupled its output to a spectrum analyzer.
c. Turned the EUT off and set the chamber to the highest temperature specified.
d. Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency after 2, 5, and 10 minutes.
e. Repeat step (d) with the temperature chamber set to the next desired temperature until measurements down to the lowest specified temperature have been completed.
f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.3.5 Deviation fromTest Standard

No deviation.

4.3.6 EUT Operating Conditions

Same as Item 4.1.6.

4.3.7 Test Result

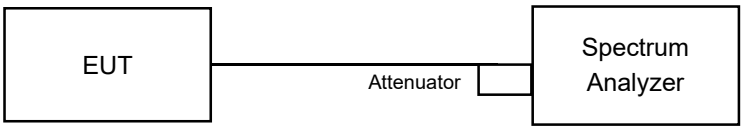
Frequency Stability Versus Temp.				
TEMP. (℃)	Power Supply (Vac)	Measured Frequency (MHz)	Frequency Dev. (Hz)	Deviation (%)
50	120	13.56004	40	0.000297
40		13.55998	-20	-0.000145
30		13.55997	-30	-0.000219
20		13.56005	50	0.000371
10		13.56005	50	0.000371
0		13.56002	20	0.000149
-10		13.55997	-30	-0.000219
-20		13.56005	50	0.000371
20	102	13.55997	-30	-0.000219
	138	13.56003	30	0.000223

4.4 20dB Bandwidth

4.4.1 Limits of 20dB Bandwidth Measurement

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1kHz RBW and 3kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.4.5 Deviation from Test Standard

No deviation.

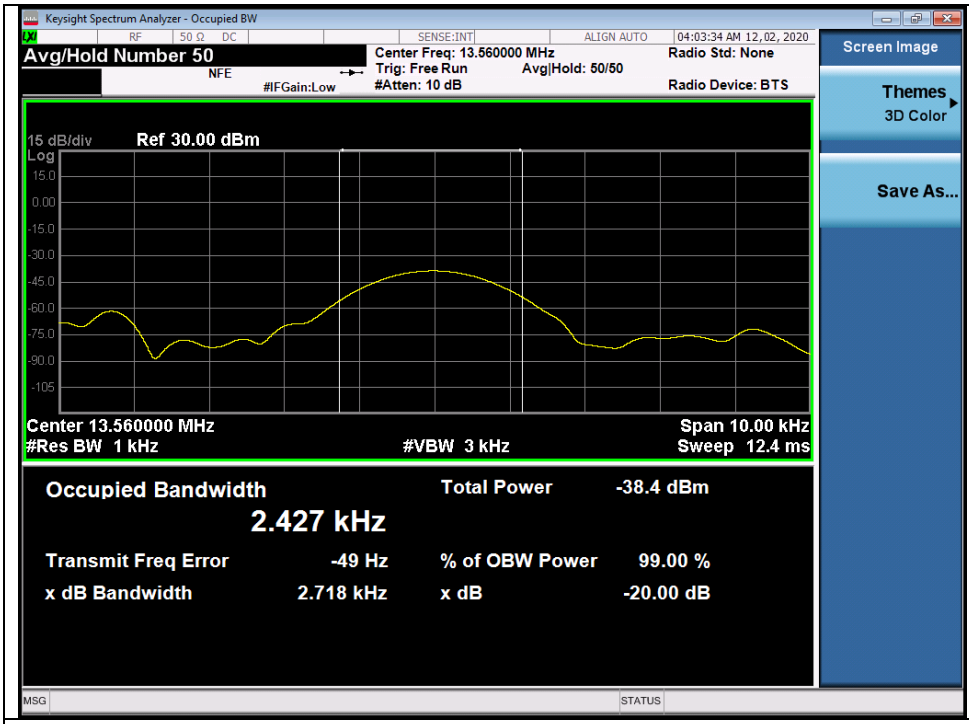
4.4.6 EUT Operating Conditions

Same as Item 4.1.6.

4.4.7 Test Results

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
13.56	2.718	2.427

Test Plots:



20dB Bandwidth

5 Pictures of Test Arrangements

Please see setup photo file.

Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

Milpitas EMC/RF/Safety/Telecom Lab
775 Montague Expressway, Milpitas, CA 95035
Tel: +1 408 526 1188

Sunnyvale OTA/Bluetooth Lab
1293 Anvilwood Avenue, Sunnyvale, CA 94089
Tel: +1 669 600 5293

Littleton EMC/RF/Safety/Environmental Lab
1 Distribution Center Cir #1, Littleton, MA 01460
Tel: +1 978 486 8880

Email: sales.eaw@us.bureauveritas.com
Web Site: www.cpsusa-bureauveritas.com

The address and road map of all our labs can be found in our web site also.

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