RF TEST REPORT

FCC

APPLICANT

SPRINGCARD SAS

MODEL NAME

PUCK One

FCC ID

TYQ-PUCKONE01

REPORT NUMBER

HA191215-SPR-001-R01

TEST REPORT

Date of Issue
October 24, 2020

Test Site
Hyundai C-Tech, Inc. dba HCT America, Inc.
1726 Ringwood Ave, San Jose, CA 95131, USA

Applicant	SPRINGCARD SAS
Applicant Address	2 voie la Cardon Parc Gutenberg 91120 Palaiseau, France
FCC ID	TYQ-PUCKONE01
Model Name	PUCK One
EUT Type	13.56 MHz RFID/NFC USB Coupler
Modulation Type	13.56 MHz (ASK)
FCC Classification	Low Power Communication Device Transmitter
FCC Rule Part(s)	Part 15.225

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures required. The results of testing in this report apply only to the product which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Hyundai C-Tech, Inc. dba HCT America, Inc. certifies that no party to application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 862

Tested By	**Reviewed By**
Billy Kim	Sunwoo Kim
Test Engineer	Technical Manager

REVISION HISTORY

The revision history for this document is shown in table.

TEST REPORT NO.	DATE	DESCRIPTION
HA191215-SPR-001-R01	Oct 24, 2020	Initial Issue

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1. GENERAL INFORMATION

EUT DESCRIPTION

Model	PUCK ONE
S/N	23E9C997
EUT Type	13.56 MHz RFID/NFC USB Coupler
Power Supply	DC 5V
RF Specification	13.56 MHz : ASK
Operating Environment	Indoor
Operating Temperature (1)	-20 °C ~ +70°C

RF SPECIFICATION SUBJECT TO THE REPORT

Operating Frequency Range	13.56 MHz
RF Specification (Modulation)	13.56 MHz (ASK)
Number of Channels	1 channel
Antenna Specification	Loop antenna
Firmware Version (2)	1.15
Hardware Version (2)	FPF20199-AA
Date(s) of Tests	Oct 5, 2020 ~ Oct 23, 2020

Note :
1. Operating temperature is declared by the manufacturer.
2. Firmware and Hardware Version are as received by the client.

2. METHODOLOGY

The measurement procedure described in ANSI C63.10(Version : 2013) 'the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices'.

EUT CONFIGURATION

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

EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.225 under the FCC Rules Part 15 Subpart C.

GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. Also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. To find out the maximum emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

DESCRIPTION OF TEST MODES

The EUT has been tested per test setup instruction provided by the manufacturer under continuous Tx operating condition. Testing was performed at the Tx mode using the key card provided by the manufacturer. 'Springcard diagnostic' software was used to make sure the device is properly connected and recognized by the computer.

3. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment's, which is traceable to recognized national standards. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

4. FACILITIES AND ACCREDITATIONS

FACILITIES

The SAC (Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at 1726 Ringwood Avenue, San Jose, California 95131, USA.
The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Accredited Laboratory

A2LA has accredited

HYUNDAI C-TECH, INC. DBA HCT AMERICA, INC.

San Jose, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 25th day of November 2019.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 4201.01
Valid to July 31, 2021

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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."

(1) The antenna of this E.U.T is permanently attached and there is no provision for connection to an external antenna.
(2) The E.U.T Complies with the requirement of §15.203

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6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	2.55
Radiated Disturbance (9 kHz ~ 30 MHz)	3.20
Radiated Disturbance (30 MHz ~ 1 GHz)	4.73

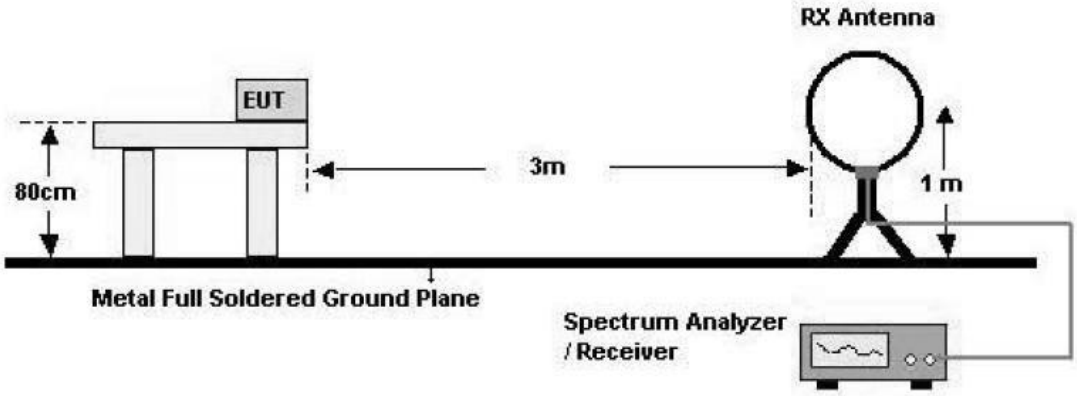
7. DESCRIPTION OF TESTS

7.1. 20 dB Bandwidth

Limit

20 dB bandwidth : According to §15.215(c), the bandwidth at 20 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

Test Configuration



Test Procedure (20 dB Bandwidth)

The Spectrum Analyzer setting :

- RBW = 1 kHz
- VBW ≥ 3 x RBW
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- Allow the trace to stabilize

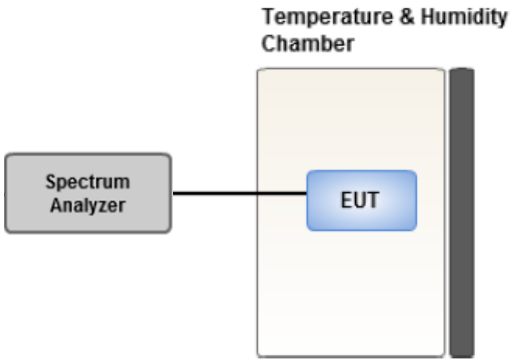
Note :
Bandwidth measurement feature in the spectrum analyzer was used to measure 20 dB bandwidth (X dB bandwidth function).

7.2. Frequency Stability

Limit

§15.225 (e)
The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency.

Test Configuration



Test Procedure

For battery operated equipment, the equipment tests shall be performed using a new battery.

1) Turn the EUT OFF and place it inside the environmental temperature chamber. For devices that have oscillator heaters, energize only the heater circuit.
2) Set the temperature control on the chamber to the highest specified in the regulatory requirements for the type of device and allow the oscillator heater and the chamber temperature to stabilize.
3) While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.
4) Frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency.

Note:

- Temperature humidity chamber is used to adjust the temperature between -20°C and + 50°C
- The primary supply voltage was adjusted between 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

7.3. Radiated Test

Radiated Emission Limits

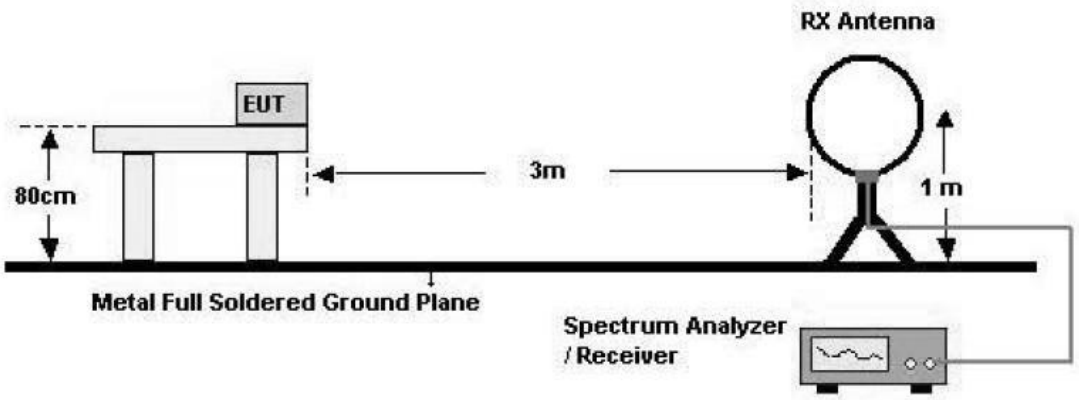
FCC : 47 CFR § 15.209		
Frequency (MHz)	**Field Strength (uV/m)**	**Measurement Distance (m)**
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Operation within the band 13.110 MHz – 14.010 MHz

FCC : 47 CFR § 15.225 (a), (b), (c), (d)		
Frequency (MHz)	**Field Strength (uV/m)**	**Measurement Distance (m)**
13.553 – 13.567	15,848	30
13.410 ≤ f ≤ 13.553 13.567 ≤ f ≤ 13.710	334	30
13.110 ≤ f ≤ 13.410 13.710 ≤ f ≤ 14.010	106	30

Test Configuration

Below 30 MHz



Test Procedure of Radiated spurious emissions (Below 30 MHz)

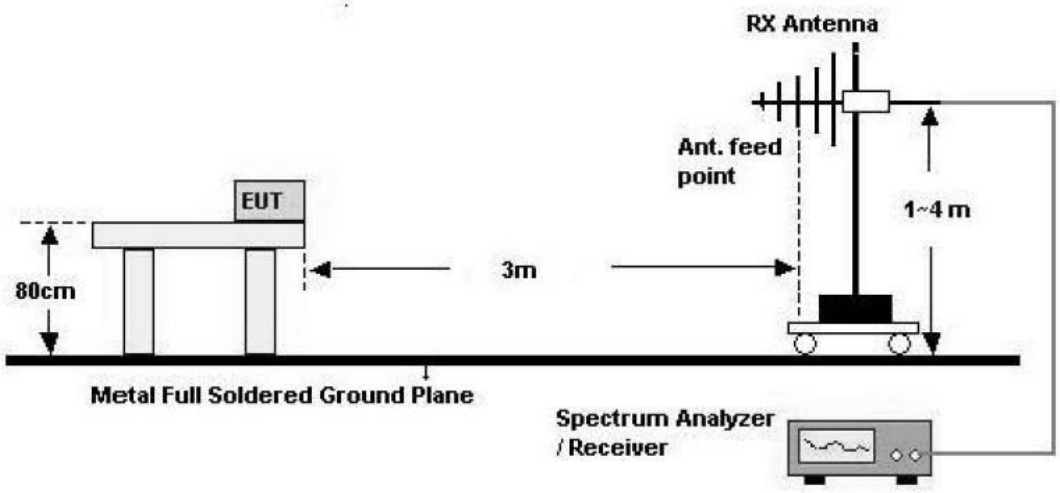
1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor (0.009 MHz – 0.490 MHz) = 40*log(3 m/300 m) = - 80 dB
   Measurement Distance: 3 m
7. Distance Correction Factor (0.490 MHz – 30 MHz) = 40*log(3 m/30 m) = - 40 dB
   Measurement Distance: 3 m
8. Spectrum Setting

   - Frequency Range = 9 kHz ~ 30 MHz
   - Detector = Peak
   - Trace = Max hold
   - RBW = 9 kHz
   - VBW ≥ 3*RBW

9. Total = Reading Value + Antenna Factor (A.F) + Cable Loss (C.L) + Distance Factor (D.F)

Adequate comparison measurements were confirmed against an open field site since the test was performed at alternative site (3m SAC) other than the open area test site. Sufficient test was made to demonstrate that the alternative site produces result that correlate with the one of test made at the open field site based on KDB 414788.

30 MHz - 1 GHz



Test Procedure of Radiated spurious emissions (Below 1GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8m above ground plane.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Spectrum Setting

(1) Measurement Type (Peak):
- Measured Frequency Range: 30 MHz – 1 GHz
- Detector = Peak
- Trace = Max hold
- RBW = 100 kHz
- VBW ≥ 3*RBW

(2) Measurement Type(Quasi-peak):
- Measured Frequency Range: 30 MHz – 1 GHz
- Detector = Quasi-Peak
- RBW = 120 kHz

In general, the method (1) is mainly used

6. Total = Reading Value + Antenna Factor (A.F) + Cable Loss (C.L)

7.4. AC Power Line Conducted Emissions

Limit

47 CFR § 15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dBµV)	
	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

*Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.

According to FCC KDB 174176 D01 Line Conducted FAQ v01r01 :

Devices Operating Above 30 MHz

For a device with a permanent or detachable antenna operating above 30 MHz, measurements must be performed with the antenna connected as specified in clause 6.2 of ANSI C63.10-2013.

Devices Operating Below 30 MHz

For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements performed with a suitable dummy load in lieu of the antenna under the following conditions:

(1) Perform the AC power-line conducted tests with the antenna connected to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band;

(2) 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. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network which simulates the antenna in the fundamental frequency band. All measurements must be performed as specified in clause 6.2 of ANSI C63.10-2013.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

7.5. Worst Case Test Mode

Radiated test

Measurement loop antenna polarization and EUT azimuth were varied to find the maximum level of emissions out of the EUT. In addition, all X, Y, and Z positions were investigated to find the worst-case position.

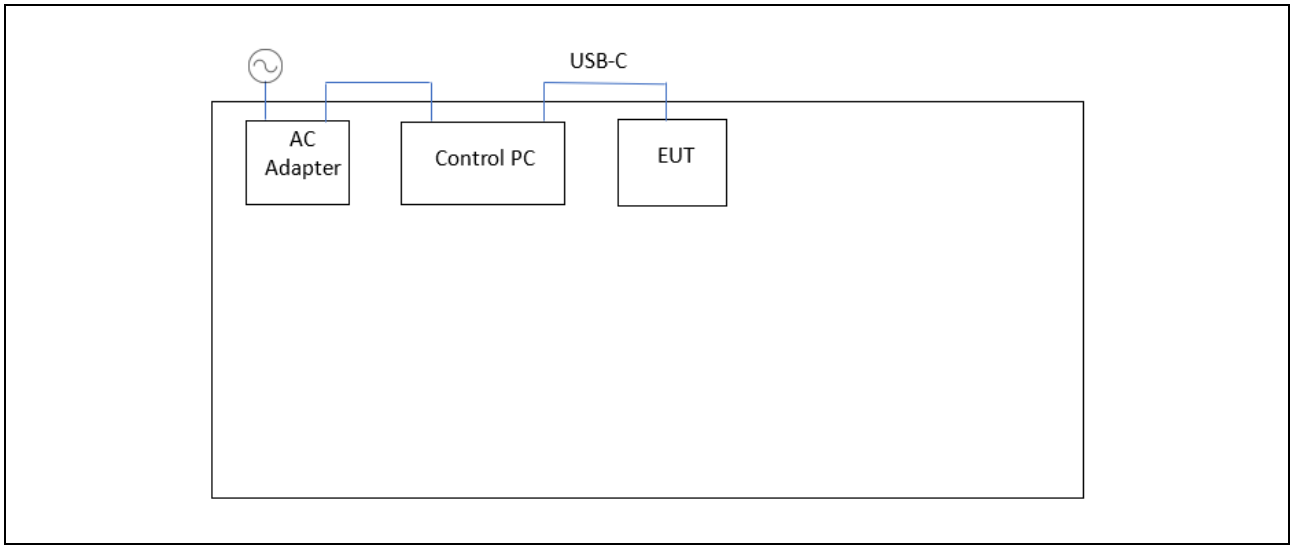
Final test was performed by placing the EUT at the position (Z) which gives the maximum emission.

Conducted test

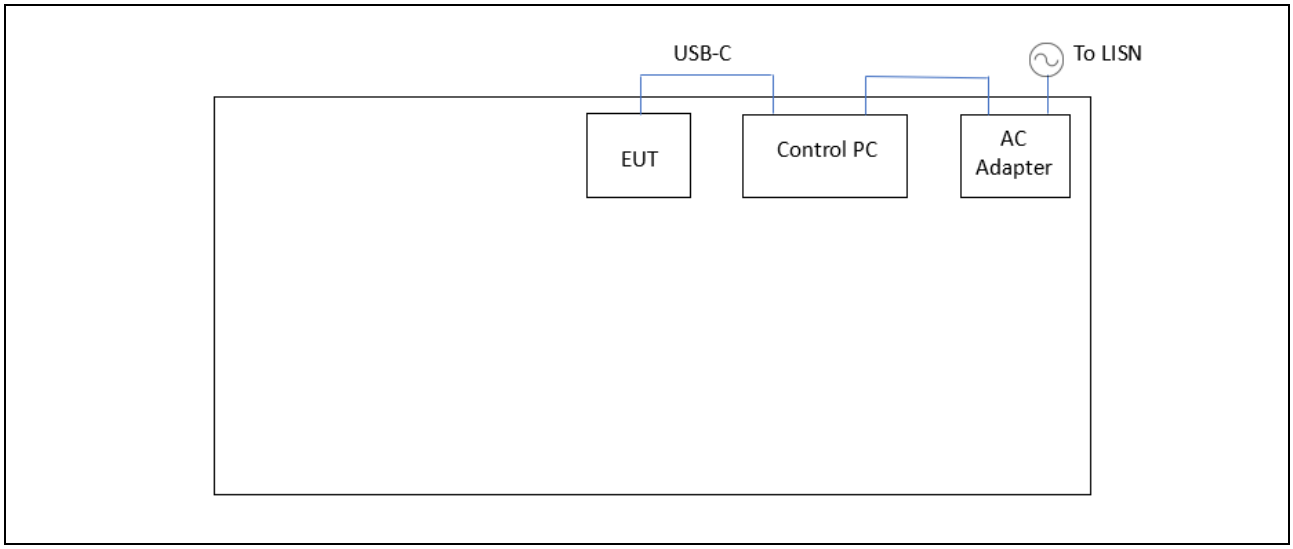
AC Line conducted emission test was performed in two modes because the EUT operates below 30 MHz
(1) EUT with RF output
(2) RF output terminated with dummy load

7.6. Test Configuration

Radiated Emission



Conducted Emission



Note:
RFID keycard was placed next to the EUT for 13.56 MHz RFID transmission during testing.

7.7. List of Support Equipment

Equipment Type	Model No.	Serial Number	Manufacturer	Qty	Note
Laptop	T440	TP00050A	Lenovo	1	-
AC Adapter	ADLX65SDC2A	36200350	Delta	1	100-240 VAC, 1.5A 50-60Hz
USB type C (2m)	-	-	-	1	Not shielded No choke attached

8. SUMMARY OF TEST RESULTS

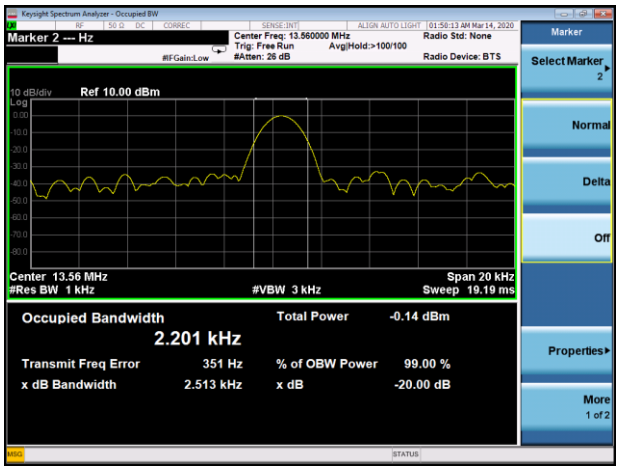
Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
20 dB Bandwidth	§15.215 (c)	N/A	Radiated	PASS
Radiated E-Field Emissions 13.553 MHz - 13.567 MHz	§15.225 (a)	cf. Section 7.3		PASS
Radiated E-Field Emissions 13.410 MHz ≤ f ≤ 13.553 MHz 13.567 MHz ≤ f ≤ 13.710 MHz	§15.225 (b)	cf. Section 7.3		PASS
Radiated E-Field Emissions 13.110 MHz ≤ f ≤ 13.410 MHz 13.710 MHz ≤ f ≤ 14.010 MHz	§15.225 (c)	cf. Section 7.3		PASS
Radiated Spurious Emissions	15.209	cf. Section 7.3		PASS
Frequency Stability	§15.225 (e)	cf. Section 7.2		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 7.4	Conducted	PASS

9. TEST RESULT

9.1 20 dB BANDWIDTH

13,56 MHz		20 dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit
Mode	Frequency (MHz)	Result	Result	
13.56 MHz	ASK	2.513	2.201	N/A

▣ TEST PLOTS

HF (ASK) : 20dB BW	
	

9.2 FREQUENCY STABILITY

Operating Frequency	13.56 MHz
Reference Voltage	5 V DC
Limit	100 PPM = 1356 Hz

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency [MHz]	Frequency Dev. (Hz)	Frequency (ppm)
100%	5.0	-20	13.560546	545.5	40.23
100%		-10	13.560536	536.5	39.56
100%		0	13.560529	528.7	38.99
100%		+10	13.560526	525.5	38.76
100%		+20 (Ref.)	13.560525	524.9	38.71
100%		+30	13.560525	525.4	38.75
100%		+40	13.560526	526.4	38.82
100%		+50	13.560533	533.2	39.32
115%	5.75	+20	13.560525	525.0	38.71
85%	4.25	+20	13.560525	525.0	38.71

9.3 RADIATED SPURIOUS EMISSIONS

Radiated Electric Field Emission within band 13.110 – 14.010 MHz

13.553 MHz-13.567 MHz

Frequency (MHz)	Polarization	Reading (dBuV)	Corr.(1) (dB)	Total (dBuV/m)	Limit (2) (dBuV/m)	Margin (dB)	Measurement Type
13.560	H	63.1	14.7	**77.8**	124.0	46.2	QP
13.560	V	58.5	14.7	73.2	124.0	50.8	QP

13.410 MHz-13.553 MHz and 13.567 MHz-13.710 MHz

Frequency (MHz)	Polarization	Reading (dBuV)	Corr.(1) (dB)	Total (dBuV/m)	Limit (2) (dBuV/m)	Margin (dB)	Measurement Type
13.453	H	39.8	14.7	54.5	90.5	36.0	QP
13.453	V	34.6	14.7	49.3	90.5	41.2	QP
13.633	H	35.9	14.7	50.6	90.5	39.9	QP
13.667	V	33.9	14.7	48.6	90.5	41.9	QP

13.110 MHz – 13.410 MHz and 13.710 MHz-14.010 MHz

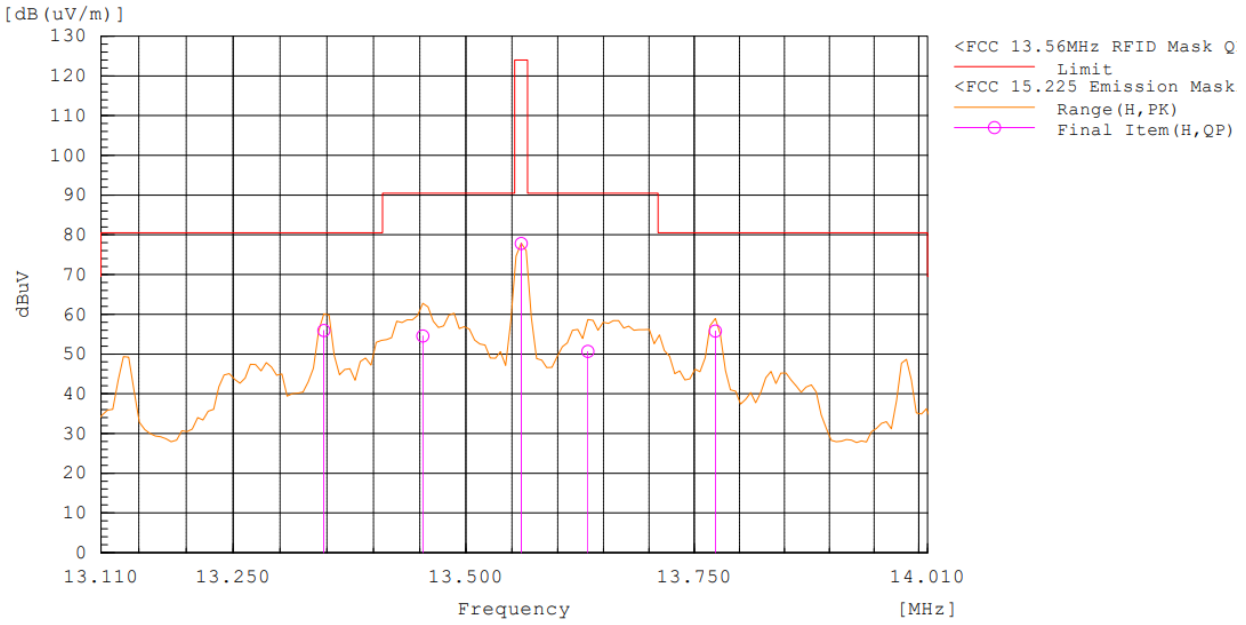
Frequency (MHz)	Polarization	Reading (dBuV)	Corr.(1) (dB)	Total (dBuV/m)	Limit (2) (dBuV/m)	Margin (dB)	Measurement Type
13.347	H	41.2	14.7	55.9	80.5	24.6	QP
13.347	V	36.5	14.7	51.2	80.5	29.3	QP
13.773	H	41.1	14.7	55.8	80.5	24.7	QP
13.773	V	36.0	14.7	50.7	80.5	29.8	QP

Notes:

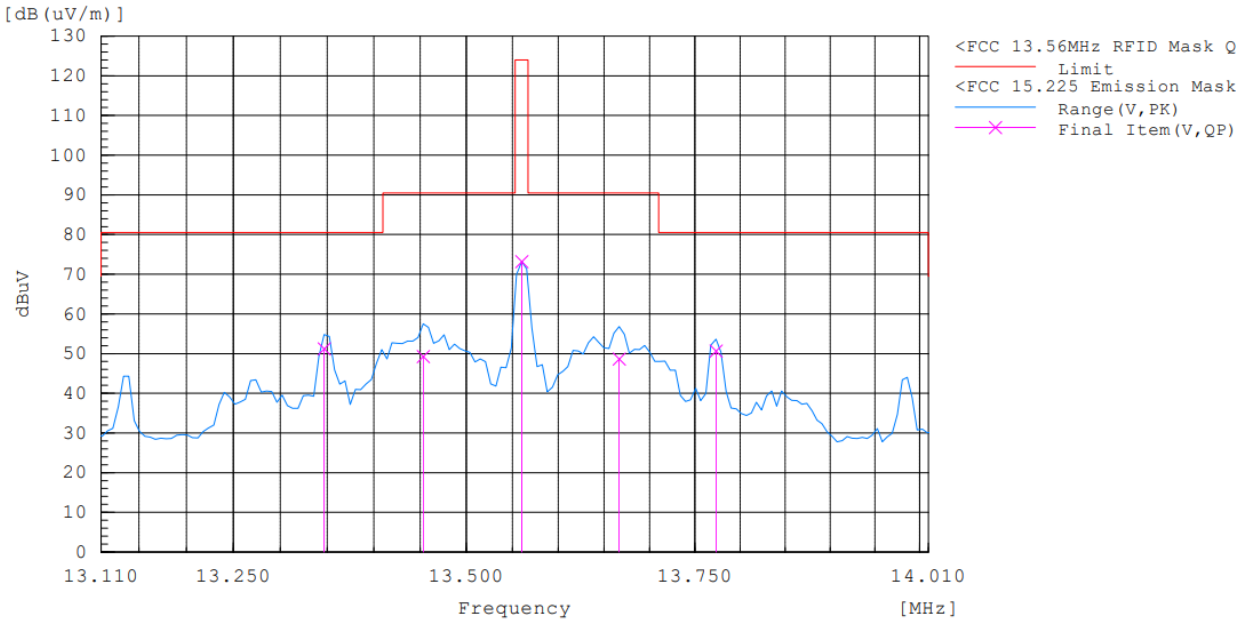
1. Correction Factor: Antenna Factor + Cable loss
2. Limit = specific Limits (dBuV) + Distance extrapolation factor
   - The measurement distance is 3 meters.
   - Distance extrapolation factor = 40 log (specific distance / test distance) (dB)

▣ TEST PLOTS

Radiated E-Field Emission (Antenna Position 180°) : 13.110 – 14.010 MHz



Radiated E-Field Emission (Antenna Position 90°) : 13.110 – 14.010 MHz



Radiated Spurious Emission

HF : ASK

Frequency Range : 9 kHz – 30MHz

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [2] (dB)	Total (dBuV/m)	Limit [3] (dBuV/m)	Margin (dB)	Measurement Type
0.032	V	34.8	14.8	49.6	117.5	67.9	QP
0.032	H	34.7	14.8	49.5	117.5	68.0	QP
11.065	V	17.6	14.9	32.5	69.5	37.0	QP
11.065	H	20.6	14.9	35.5	69.5	34.0	QP
22.114	V	14.1	13.2	27.3	69.5	42.2	QP
22.114	H	17.0	13.2	30.2	69.5	39.3	QP
27.646	V	16.7	11.9	28.6	69.5	40.9	QP

Notes:
1. Correction Factor: Antenna Factor + Cable loss
2. Limit = specific Limits (dBuV) + Distance extrapolation factor
   - The measurement distance is 3 meters.
   - Distance extrapolation factor = 40 log (specific distance / test distance) (dB)

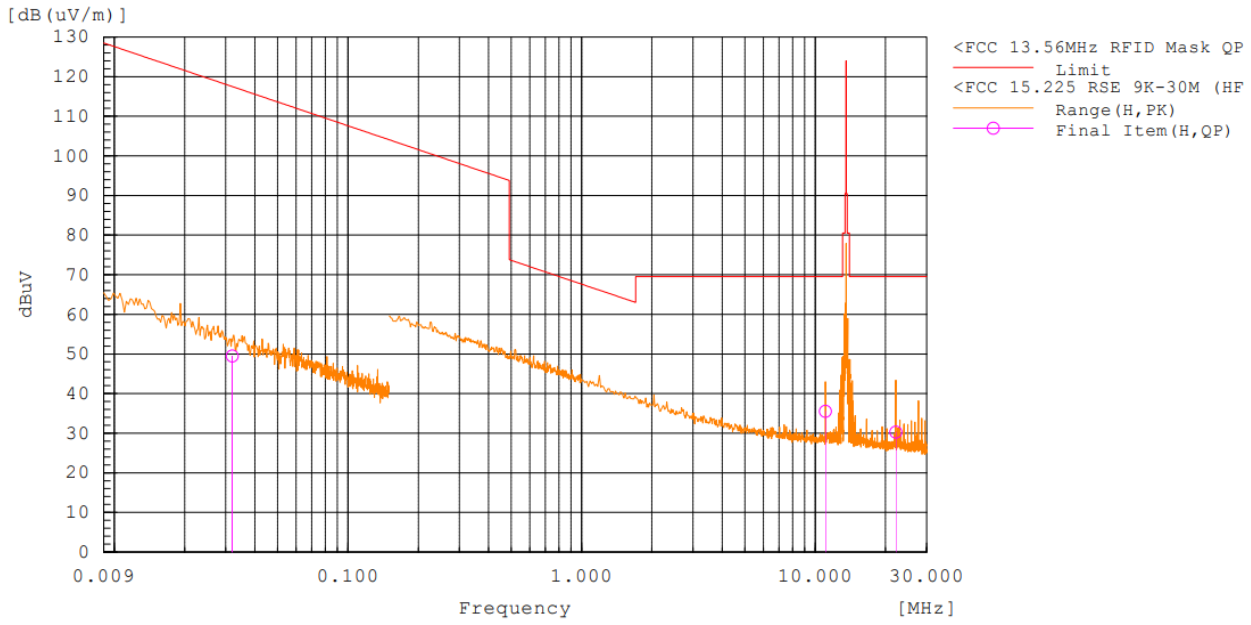
Frequency Range : Below 1 GHz

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. [2] (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Type
40.661	V	44.2	-7.4	36.8	40	3.2	QP
40.692	H	40.2	-7.4	32.8	40	7.2	QP
46.227	V	42.8	-11.3	31.5	40	8.5	QP
50.835	V	49.6	-13.3	36.3	40	3.7	QP
162.732	V	41.7	-8.5	33.2	43.5	10.3	QP
176.292	H	40.8	-9.1	31.7	43.5	11.8	QP

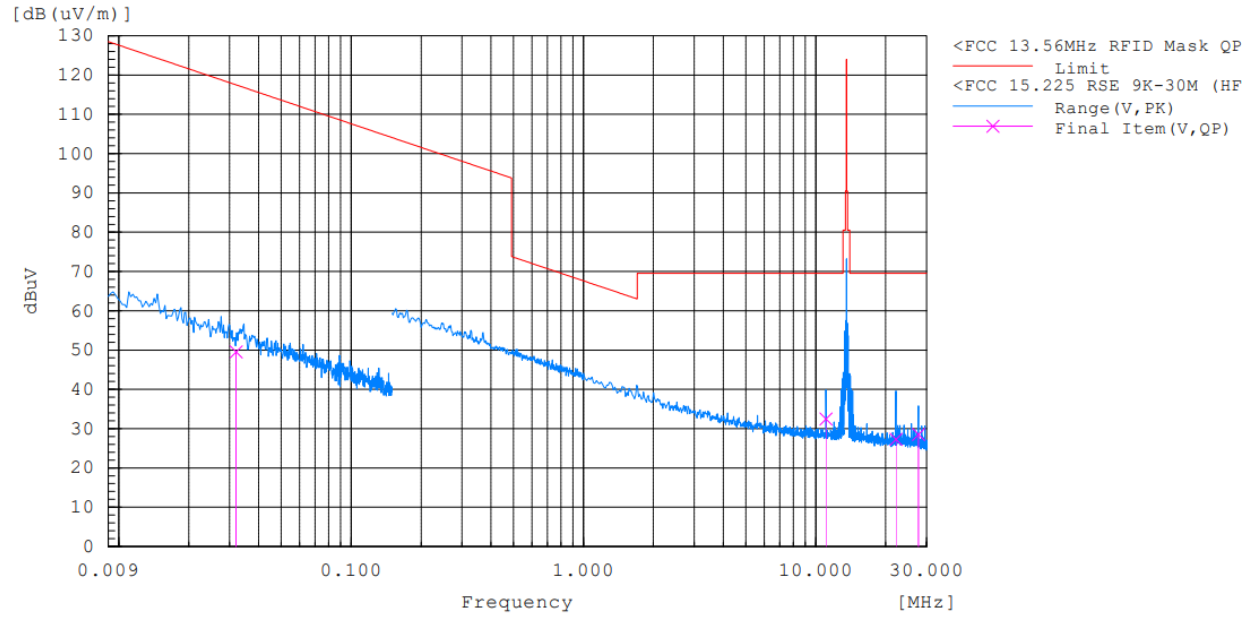
Notes:
1. Correction Factor: Antenna Factor + Cable loss

▣ TEST PLOTS

Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 180°) : HF ASK

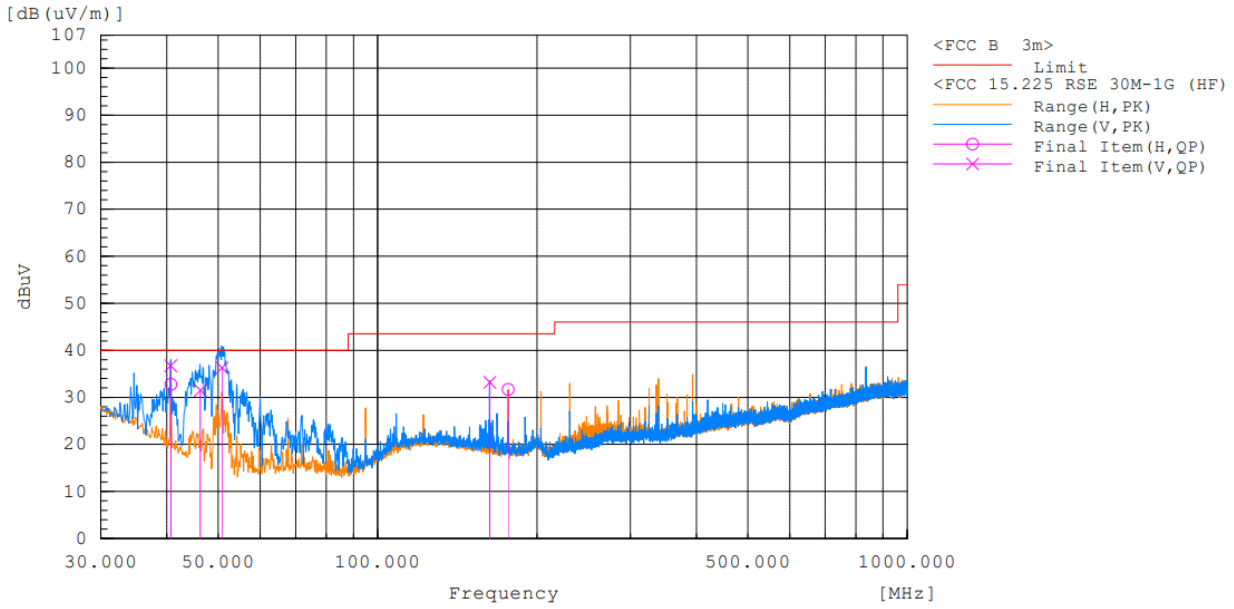


Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 90°) : HF ASK



▣ TEST PLOTS

Radiated Spurious Emission 30 MHz – 1 GHz : HF ASK



9.4. POWERLINE CONDUCTED EMISSIONS

AC Main : Device with antenna connected

Frequency (MHz)	Line	Reading (dBµV)		Corr. [1] (dB)	Level (dBµV)		Limit (dBµV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.154	L1	40.3	16.5	9.8	50.1	26.3	65.8	55.8	15.7	29.5
0.498	L1	29	13.7	9.7	38.7	23.4	56	46	17.3	22.6
0.531	L1	34	23.6	9.7	43.7	33.3	56	46	12.3	12.7
2.543	L1	23.8	12.2	9.8	33.6	22	56	46	22.4	24
5.710	L1	19.1	13.3	9.9	29	23.2	60	50	31	26.8
13.561 [2]	L1	42.3	40.9	10.1	52.4	51	-	-	-	-

Frequency (MHz)	Line	Reading (dBµV)		Corr. [1] (dB)	Level (dBµV)		Limit (dBµV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.150	N	41	20.3	9.8	50.8	30.1	66	56	15.2	25.9
0.496	N	29.2	15	9.7	38.9	24.7	56.1	46.1	17.2	21.4
0.521	N	31.5	16.5	9.7	41.2	26.2	56	46	14.8	19.8
3.239	N	21.8	14.8	9.8	31.6	24.6	56	46	24.4	21.4
13.560 [2]	N	41.4	40	10.1	51.5	50.1	-	-	-	-
15.797	N	24.5	19	10.2	34.7	29.2	60	50	25.3	20.8

Note :
1. Quasi-peak(Final Result) = Reading Value + Correction Factor
2. Fundamental frequency of RFID at 13.56 MHz

AC Main : RF output terminated with dummy load

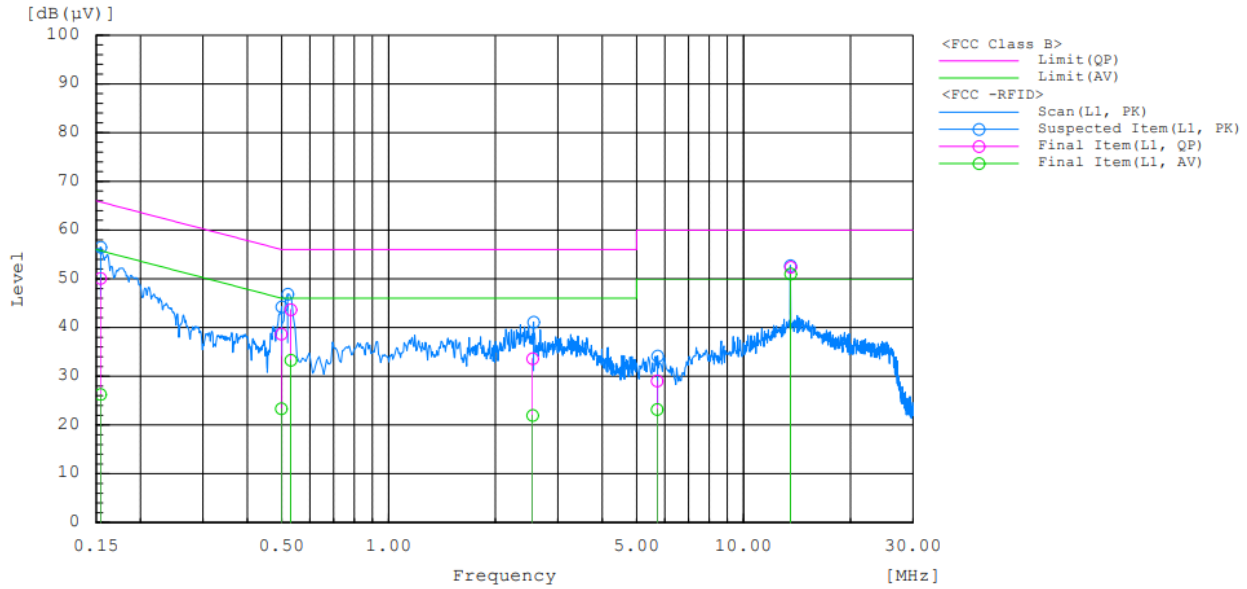
Frequency (MHz)	Line	Reading (dBµV)		Corr. [1] (dB)	Level (dBµV)		Limit (dBµV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.170	L1	44.1	25.2	9.8	53.9	35	65	55	11.1	20
0.225	L1	36	18.2	9.7	45.7	27.9	62.6	52.6	16.9	24.7
0.564	L1	26.5	12.9	9.7	36.2	22.6	56	46	19.8	23.4
2.562	L1	25.6	13.5	9.8	35.4	23.3	56	46	20.6	22.7
6.558	L1	20.9	14.5	9.9	30.8	24.4	60	50	29.2	25.6
13.560	L1	35.7	33.2	10.1	45.8	43.3	60	50	14.2	6.7

Frequency (MHz)	Line	Reading (dBµV)		Corr. [1] (dB)	Level (dBµV)		Limit (dBµV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.171	N	46.1	26.1	9.7	55.8	35.8	64.9	54.9	9.1	19.1
0.227	N	36.5	16.5	9.7	46.2	26.2	62.6	52.6	16.4	26.4
0.515	N	29.1	14.1	9.7	38.8	23.8	56	46	17.2	22.2
3.594	N	23.7	17	9.8	33.5	26.8	56	46	22.5	19.2
6.253	N	23.1	17.6	9.9	33	27.5	60	50	27	22.5
13.561	N	35.1	32.4	10.1	45.2	42.5	60	50	14.8	7.5

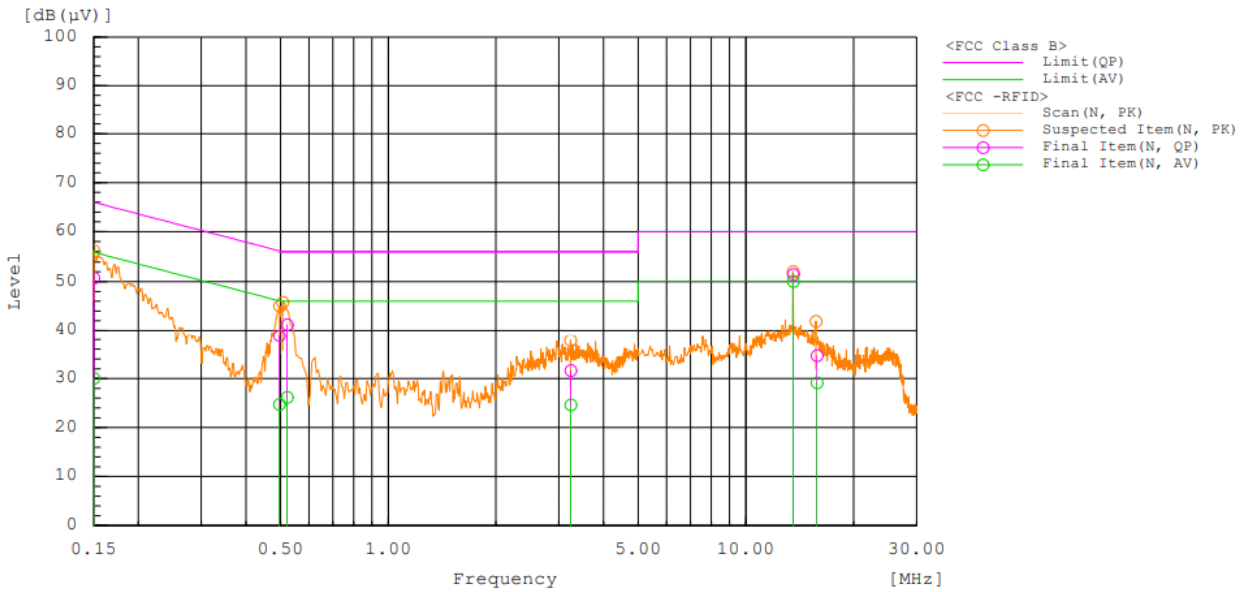
Note :
1. Quasi-peak(Final Result) = Reading Value + Correction Factor

▣ TEST PLOTS

AC Line Conducted Emission (L1)



AC Line Conducted Emission (N)

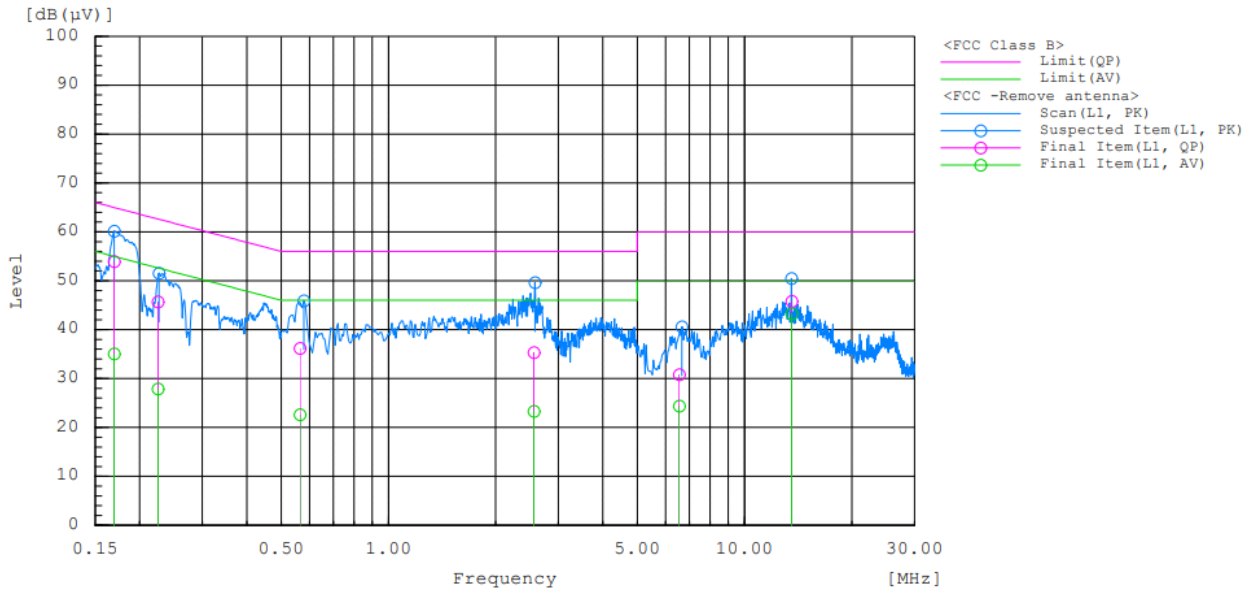


Note :

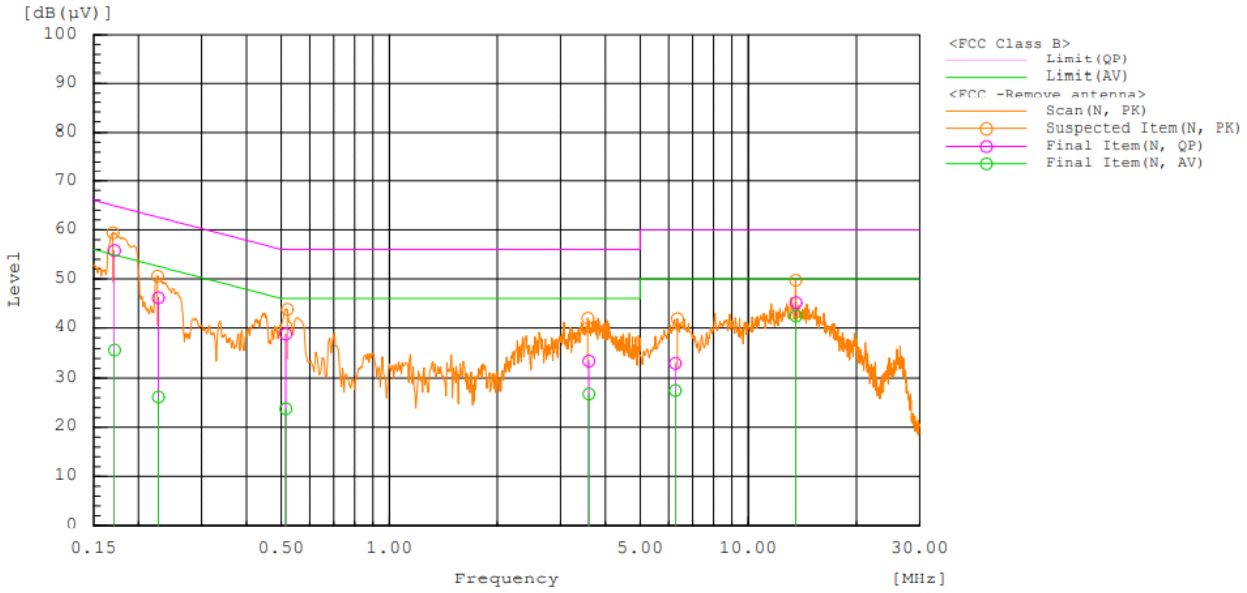
1. Peak at 13.56 MHz is a fundamental frequency HF.

▣ TEST PLOTS

AC Line Conducted Emission (L1) : RF output terminated with dummy load



AC Line Conducted Emission (N) : RF output terminated with dummy load



10. LIST OF TEST EQUIPMENT

No.	Instrument	Model No.	Calibration Due (mm/dd/yy)	Manufacture	Serial No.
☒	Signal Analyzer (20 Hz ~ 40.0 GHz)	ESU40	12/20/2020	ROHDE & SCHWARZ	100529
☒	Signal Analyzer (10 Hz ~ 40.0 GHz)	ESR40	03/23/2021	ROHDE & SCHWARZ	101424
☒	Signal Analyzer (10 Hz ~ 26.5 GHz)	N9020A	11/08/2020	Keysight	MY52091291
☒	BI-LOG Antenna (30 MHz ~ 1 GHz)	JB1	03/27/2021	Sunol	A061416
☐	Attenuator (20 dB, DC ~ 26.5 GHz)	8493C	12/13/2020	HP	09072
☒	POWER AMP (0.3GHz ~ 1GHz)	8447D	08/06/2021	HP	2443A03587
☒	Loop Antenna (0.009 ~ 30 MHz)	AL-130R	04/05/2021	Com-Power	121082
☒	EMI Test Receiver	ESR3	12/20/2020	Rohde & Schwarz	102363
☐	LISN	3816/2SH	01/19/2021	EMCO	00205729
☒	LISN	ENV216	01/19/2021	Rohde & Schwarz	101349
☒	Temp & Humidity Chamber	SH-641	08/05/2021	ESPEC	92002929
☒	Frequency Counter	53181A	08/03/2021	Agilent	MY40002090

Note:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date

APPENDIX A. TEST SETUP PHOTOS

The setup photos are provided as a separate document

Hyundai C-Tech, Inc. dba HCT America, Inc., 1726 Ringwood Avenue, San Jose, CA 95131, USA TEL: +1-510-933-8848 FAX: +1-510-933-8849

APPENDIX B. PHOTOGRAPHS OF EUT

B.1. EXTERNAL PHOTOS

The setup photos are provided as a separate document

B.2. INTERNAL PHOTOS

The setup photos are provided as a separate document

Hyundai C-Tech, Inc. dba HCT America, Inc., 1726 Ringwood Avenue, San Jose, CA 95131, USA TEL: +1-510-933-8848 FAX: +1-510-933-8849

END OF TEST REPORT

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