FCC TEST REPORT

FOR

Shenzhen Vanch Intelligent Technology Co., Ltd

RFID handheld reader

Test Model: VANCH-VH

Additional Model No.: VH-88R, VH-88S, VH-C77P, VH-76, VH-75T, VH-75, VH-B74, VH-B73, VH-P12

Prepared for	:	Shenzhen Vanch Intelligent Technology Co., Ltd
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Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
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Date of receipt of test sample	:	July 12, 2021
Number of tested samples	:	2
Sample No.	:	210626047A-1, 210626047A-2
Serial number	:	Prototype
Date of Test	:	July 12, 2021 ~ September 23, 2021
Date of Report	:	September 25, 2021

FCC TEST REPORT

FCC CFR 47 PART 15 C (15.247)

Report Reference No.	**:**	**LCS210626047AEB**
Date of Issue.....	:	September 25, 2021
Testing Laboratory Name	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Yabianxueziwei, Shajing Street, Baoan District, Shenzhen, 518000, China
Testing Location/ Procedure	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	**:**	**Shenzhen Vanch Intelligent Technology Co., Ltd**
Address.....	:	Room 401, Building B, FuAnNa CO., Park, Qinghu Village, LongHua Street Qinghu Community, Long Hua District, Shenzhen, Guangdong, China
Test Specification		
Standard	:	FCC CFR 47 PART 15 C (15.247)
Test Report Form No.....	:	LCSEMC-1.0
TRF Originator.....	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	:	Dated 2011-03

Test Item Description.....	**:**	**RFID handheld reader**
Trade Mark.....	:	N/A
Test Model	:	VANCH-VH
Ratings	:	Input: DC 5V, 2A For AC Adapter Input: AC 100-240V, 50/60Hz, MAX 0.45A AC Adapter Output: DC 5V, 2A
**Result ..... **	**:**	**Positive**

Tested by:	**Compiled by:**	**Approved by:**
Jin Wang	Cary Luo	Gavin Liang
Jin Wang/ Administrator	Cary Luo/ Technique principal	Gavin Liang / Manager

FCC -- TEST REPORT

Test Report No. : **LCS210626047AEB**	September 25, 2021 Date of issue

Test Model.....	:	VANCH-VH
EUT.....	:	RFID handheld reader
Applicant.....	**:**	**Shenzhen Vanch Intelligent Technology Co., Ltd**
Address.....	:	Room 401, Building B, FuAnNa CO., Park, Qinghu Village, LongHua Street Qinghu Community, Long Hua District, Shenzhen, Guangdong, China
Telephone.....	:	/
Fax.....	:	/
Manufacturer.....	**:**	**Shenzhen Vanch Intelligent Technology Co., Ltd**
Address.....	:	Room 401, Building B, FuAnNa CO., Park, Qinghu Village, LongHua Street Qinghu Community, Long Hua District, Shenzhen, Guangdong, China
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Factory.....	**:**	**Shenzhen Vanch Intelligent Technology Co., Ltd**
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Telephone.....	:	/
Fax.....	:	/

Test Result	**Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	September 25, 2021	Initial Issue	Gavin Liang

TABLE OF CONTENTS

1.GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	:	RFID handheld reader
Test Model	:	VANCH-VH
Additional Model No.	:	VH-88R, VH-88S, VH-C77P, VH-76, VH-75T, VH-75, VH-B74, VH-B73, VH-P12
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Power Supply	:	Input: DC 5V, 2A For AC Adapter: Input: AC 100-240V, 50/60Hz, MAX 0.45A AC Adapter Output: DC 5V, 2A
Hardware Version	:	Handbluetooth302.01
Software Version	:	APP-v2.2.7
Bluetooth		
Frequency Range	:	2402MHz ~ 2480MHz
Chanel Number	:	40 channels for Bluetooth V5.0(DTS)
Chanel Spacing	:	2MHz for Bluetooth V5.0 (DTS)
Modulation Type	:	GFSK for Bluetooth V5.0(DTS)
Bluetooth Version	:	V5.0
Antenna Description	:	Internal Antenna, 2dBi(Max.)
RF ID		
Frequency Range	:	902.5MHz ~ 927.5MHz
Chanel Number	:	51
Chanel Spacing	:	0.5MHz
Modulation Type	:	FSK
Antenna Description	:	Internal Antenna, 2dBi(Max.)

1.2 Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
--	ADAPTER	TS124X200-0502USE	--	SDOC

1.3 External I/O Cable

I/O Port Description	Quantity	Cable
Micro USB Port	1	USB Cable: 1.0m, unshielded

1.4 Description of Test Facility

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier is CN0071.

CNAS Registration Number is L4595.

Test Firm Registration Number: 254912

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10:2013 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5 Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for PDA disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6 Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	3.10dB	(1)
		30MHz~200MHz	2.96dB	(1)
		200MHz~1000MHz	3.10dB	(1)
		1GHz~26.5GHz	3.80dB	(1)
		26.5GHz~40GHz	3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	1.63dB	(1)
Power disturbance	:	30MHz~300MHz	1.60dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7 Description of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

Worst-case mode and channel used for 150 KHz-30 MHz power line conducted emissions was the mode and channel with the highest output power, which was determined to be Middle Channel.

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be Middle Channel.

Pre-test AC conducted emission at both voltage AC 120V/60Hz and AC 240V/60Hz, recorded worst case.

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.5	18	911	35	919.5
2	903	19	911.5	36	920
3	903.5	20	912	37	920.5
4	904	21	912.5	38	921
5	904.5	22	913	39	921.5
6	905	23	913.5	40	922
7	905.5	24	914	41	922.5
8	906	25	914.5	42	923
9	906.5	26	915	43	923.5
10	907	27	915.5	44	924
11	907.5	28	916	45	924.5
12	908	29	916.5	46	925
13	908.5	30	917	47	925.5
14	909	31	917.5	48	926
15	909.5	32	918	49	926.5
16	910	33	918.5	50	927
17	910.5	34	919	51	927.5

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR PART 15C 15.207, 15.209 and 15.247.

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 that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT was operated in the normal operating mode for Hopping Numbers and Dwell Time test and a continuous transmits mode for other tests.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209, 15.247 under the FCC Rules Part 15 Subpart C.

2.3 General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz and 1.5 m above ground plane above 1GHz. The turntable 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 maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

2.4. Test Sample

The application provides 2 samples to meet requirement;

Sample Number	Description
Sample 1(210626047A-1)	Engineer sample – continuous transmit
Sample 2(210626047A-2)	Normal sample – Intermittent transmit

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a continuous transmits condition.

3.2 EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software (RFID-assistant_release_v2.2.7.apk) provided by application.

3.3 Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
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3.4 Block Diagram/Schematics

Please refer to the related document.

3.5 Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6 Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C				
FCC Rules	Description of Test	Test Sample	Result	Remark
§15.247(b)(2)	Maximum Conducted Output Power	Sample 1	Compliant	Appendix B.1
§15.247(a)(1)	20dB Bandwidth	Sample 1	Compliant	Appendix B.2
§15.247(a)(1)	Frequency Separation	Sample 1	Compliant	Appendix B.3
§15.247(a)(1)(i)	Number Of Hopping Frequency	Sample 1	Compliant	Appendix B.4
§15.247(a)(1)(i)	Time Of Occupancy (Dwell Time)	Sample 1	Compliant	Appendix B.5
§15.209, §15.247(d)	Radiated Spurious Emissions	Sample 1 Sample 2	Compliant	Note 1
§15.209, §15.247(d)	Conducted Spurious Emissions	Sample 2	Compliant	Appendix B.6 Appendix B.7
§15.205, §15.247(d)	Emissions at Restricted Band	Sample 1	Compliant	N/A
§15.207(a)	AC Mains Conducted Emissions	Sample 1	Compliant	Note 1
§15.203	Antenna Requirements	Sample 1	Compliant	Note 1
§15.247(i)§2.1093	RF Exposure	Sample 1	Compliant	Note 2

Remark:
1. Note 1 – Test results inside test report;
2. Note 2 – Test results in other test report (RF Exposure report);
3. N/A –An abbreviation for Not Applicable.

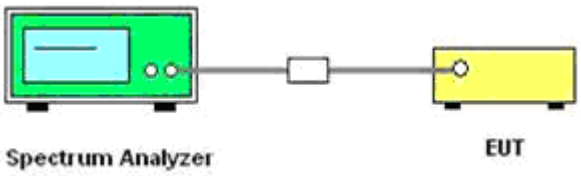
5. SUMMARY OF TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Power Meter	R&S	NRVS	100444	2021-06-21	2022-06-20
2	Power Sensor	R&S	NRV-Z81	100458	2021-06-21	2022-06-20
3	Power Sensor	R&S	NRV-Z32	10057	2021-06-21	2022-06-20
4	Test Software	Tonscend	JS1120-2	/	N/A	N/A
5	RF Control Unit	Tonscend	JS0806-2	N/A	2020-11-17	2021-11-16
6	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2020-11-17	2021-11-16
7	DC Power Supply	Agilent	E3642A	N/A	2020-11-26	2021-11-25
8	EMI Test Software	Farad	EZ	/	N/A	N/A
9	3m Full Anechoic Chamber	MRDIANZI	FAC-3M	MR009	2020-09-26	2021-09-25
10	Positioning Controller	MF	MF7082	MF78020803	2021-06-21	2022-06-20
11	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2021-07-25	2024-07-24
12	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2021-07-25	2024-07-24
13	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2021-07-01	2024-06-30
14	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2020-09-20	2023-09-19
15	Broadband Preamplifier	SCHWARZBECK	BBV9745	9719-025	2021-06-21	2022-06-20
16	EMI Test Receiver	R&S	ESR 7	101181	2021-06-21	2022-06-20
17	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2020-11-17	2021-11-16
18	Broadband Preamplifier	/	BP-01M18G	P190501	2021-06-21	2022-06-20
19	6dB Attenuator	/	100W/6dB	1172040	2021-06-21	2022-06-20
20	3dB Attenuator	/	2N-3dB	/	2020-11-17	2021-11-16
21	EMI Test Receiver	R&S	ESPI	101840	2021-06-21	2022-06-20
22	Artificial Mains	R&S	ENV216	101288	2021-06-21	2022-06-20
23	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2021-06-21	2022-06-20
24	EMI Test Software	Farad	EZ	/	N/A	N/A

6. MEASUREMENT RESULTS

6.1 Peak Power

6.1.1 Block Diagram of Test Setup



6.1.2 Limit

According to §15.247(b)(2), For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

6.1.3 Test Procedure

The transmitter output is connected to the spectrum.

6.1.4. Test Procedures

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
2) RBW > 20 dB bandwidth of the emission being measured.
3) VBW ≥ RBW.
4) Sweep: Auto.
5) Detector function: Peak.
6) Trace: Max hold.

6.1.5 Test Results

PASS

Please refer to Appendix B.1

Remark:

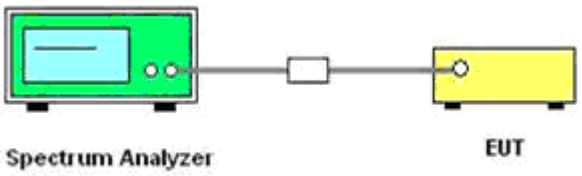
1. *Test results including cable loss;*
2. *Measured output power at difference Packet Type for each mode and recorded worst case for each mode.*

6.2 Frequency Separation and 20 dB Bandwidth

6.2.1 Limit

According to §15.247(a) (1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

6.2.2 Block Diagram of Test Setup



6.2.3 Test Procedure

Frequency separation test procedure：

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set center frequency of Spectrum Analyzer = middle of hopping channel.

4). Set the Spectrum Analyzer as RBW = 100 kHz, VBW = 300 kHz, Span = wide enough to capture the peaks of two adjacent channels, Sweep = auto.

5). Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

20dB bandwidth test procedure：

1). Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel.

2). RBW ≥1% of the 20 dB bandwidth, VBW ≥RBW.

3). Detector function = peak.

4). Trace = max hold.

6.2.4 Test Results

6.2.4.1 20dB Bandwidth

PASS

Please refer to Appendix B.2

Remark:Test results including cable loss;

6.2.4.2 Frequency Separation

PASS

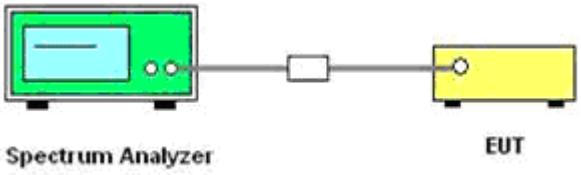
Please refer to Appendix B.3

6.3 Number of Hopping Frequency

6.3.1 Limit

According to §15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

6.3.2 Block Diagram of Test Setup



6.3.3 Test Procedure

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set Spectrum Analyzer Start=900MHz, Stop = 930MHz, Sweep = auto.

4). Set the Spectrum Analyzer as RBW=100KHz, VBW=300KHz.

5). Max hold, view and count how many channel in the band.

6.3.4 Test Results

PASS

Please refer to Appendix B.4

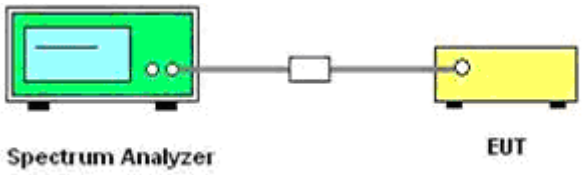
Remark: Test results including cable loss;

6.4 Time of Occupancy (Dwell Time)

6.4.1 Limit

According to §15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

6.4.2 Block Diagram of Test Setup



6.4.3 Test Procedure

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set center frequency of Spectrum Analyzer = operating frequency.

4). Set the Spectrum Analyzer as RBW=1MHz, VBW=3MHz, Span = 0Hz.

5). Repeat above procedures until all frequency measured was complete.

6.4.4 Test Results

PASS

Please refer to Appendix B.5

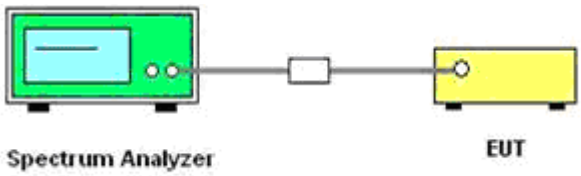
Remark: Test results including cable loss;

6.5 Conducted Spurious Emissions and Band Edges Test

6.5.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the RFID handheld reader frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

6.5.2 Block Diagram of Test Setup



6.5.3 Test Procedure

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 300 KHz.

Measurements are made over the 30 MHz to 25GHz range with the transmitter set to the lowest, middle, and highest channels

6.5.4 Test Results of Conducted Spurious Emissions

No non-compliance noted. Only record the worst test result in this report. The test data refer to the following page.

PASS

Please refer to Appendix B.6 for conducted spurious emission.

Please refer to Appendix B.7 for conducted band edge.

Remark: Test results including cable loss;

6.6 Restricted Band Emission Limit

6.6.1. Standard Applicable

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

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

6.6.2. Measuring Instruments and Setting

Please refer to of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10^{th} carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/T kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/T kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

6.6.3. Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0 °to 315 °using 45 °steps.

--- The antenna height is 1.0 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0 ° to 360 °) and by rotating the elevation axes (0 °to 360 °).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0 °to 315 °using 45 °steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 4 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (±45 °) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0 °to 315 °using 45 °steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 4 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (±45 °) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

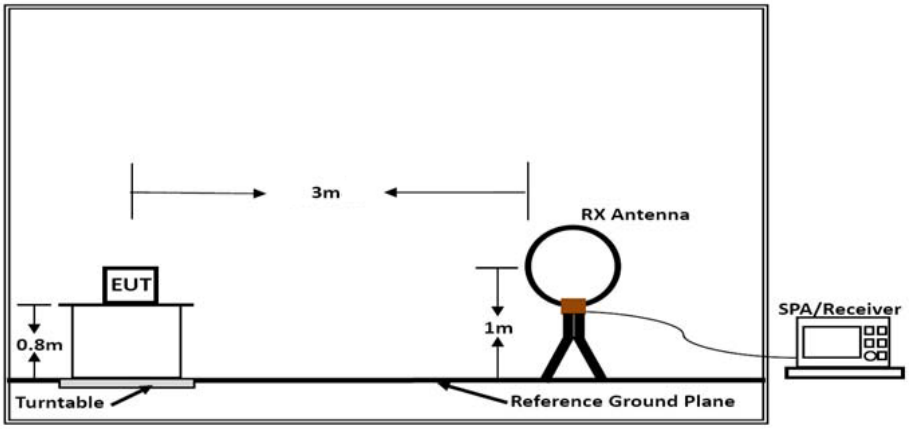
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

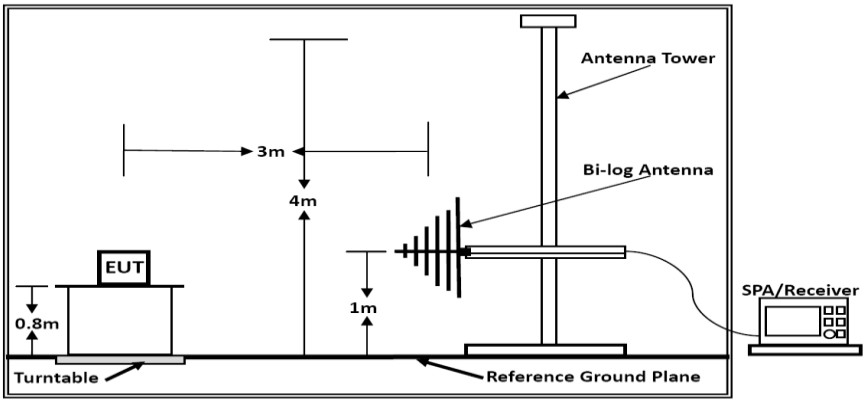
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

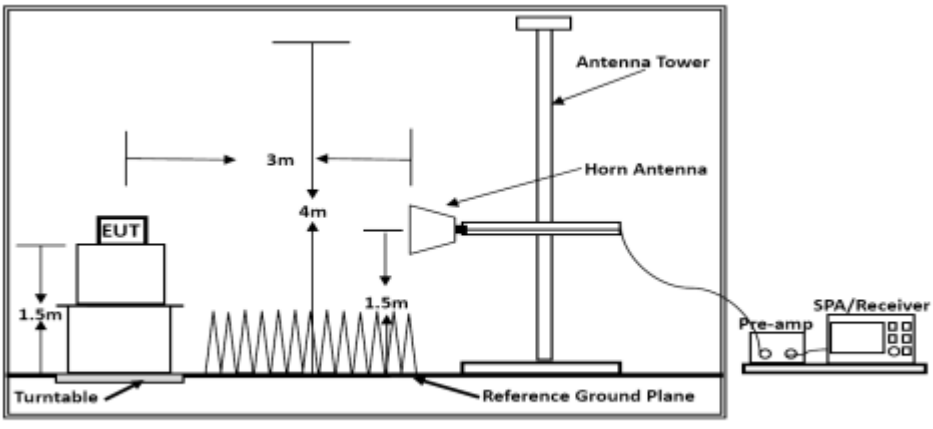
6.6.4. Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1.5m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

6.6.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.6.6. Results of Radiated Emissions (9 KHz~30MHz)

Temperature	21.2℃	Humidity	52.1%
Test Engineer	Kay Hu	Configurations	RF ID

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

6.6.7. Results of Radiated Emissions (30 MHz~1000 MHz)

Temperature	21.2℃	Humidity	52.1%
Test Engineer	Kay Hu	Configurations	RF ID

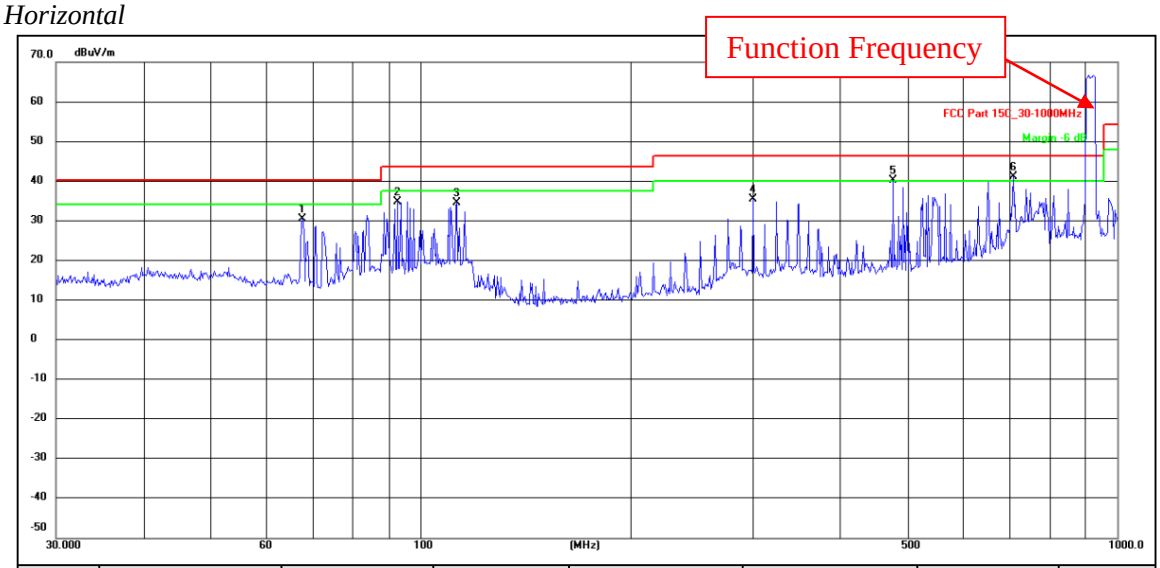
PASS.

Only record the worst test result in this report.

The test data please refer to following page.

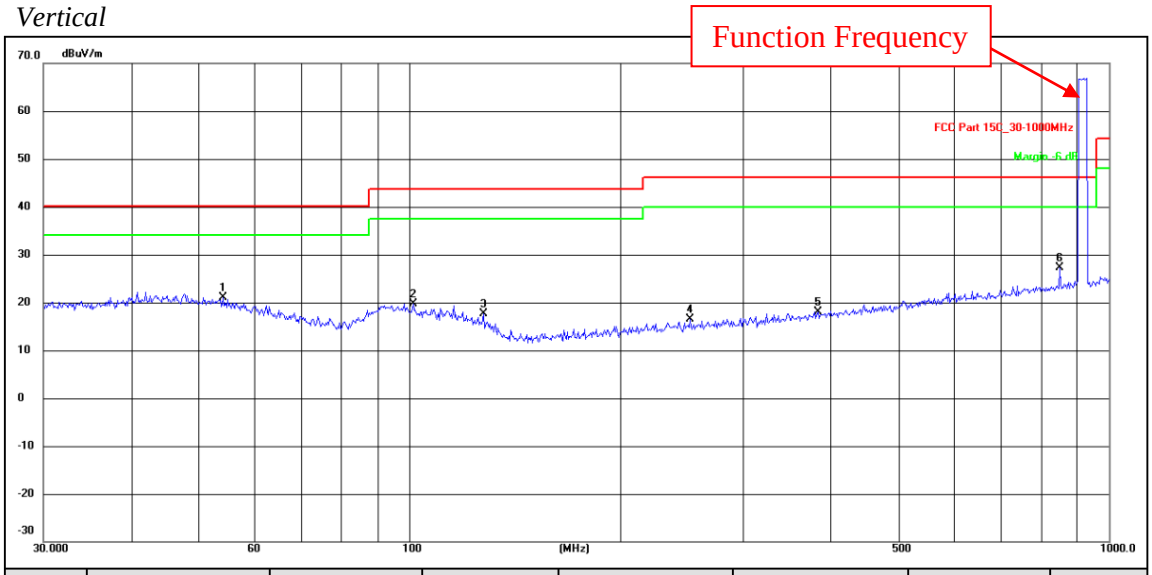
Below 1GHz

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	67.6751	62.12	-31.53	30.59	40.00	-9.41	QP
2	92.7871	63.17	-28.44	34.73	43.50	-8.77	QP
3	112.9196	62.71	-28.20	34.51	43.50	-8.99	QP
4	300.3672	63.79	-28.21	35.58	46.00	-10.42	QP
5 !	477.1693	64.57	-24.43	40.14	46.00	-5.86	QP
6 *	709.1821	61.77	-20.73	41.04	46.00	-4.96	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	54.2609	50.31	-29.36	20.95	40.00	-19.05	QP
2	101.2885	47.24	-27.44	19.80	43.50	-23.70	QP
3	127.6645	48.91	-31.34	17.57	43.50	-25.93	QP
4	252.0627	45.77	-29.27	16.50	46.00	-29.50	QP
5	383.9318	44.25	-26.23	18.02	46.00	-27.98	QP
6 *	851.0353	46.23	-18.91	27.32	46.00	-18.68	QP

Note:

1). The frequency from 902MHz to 928MHz is fundamental frequency.

2). Pre-scan all modes and recorded the worst case results in this report.

3). Emission level (dBuV/m) = 20 log Emission level (uV/m).

4). Level = Reading + Factor, Margin = Level – Limit, Factor = Antenna Factor + Cable Loss - Preamp Factor.

6.6.8. Results of Radiated Emissions (1 GHz~26 GHz)

Note: All the modes have been tested and recorded worst mode in the report.

The worst test result for ASK, Channel 1 / 902.5 MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
1805	55.70	33.06	35.04	3.94	57.66	74.00	-16.34	Peak	Horizontal
1805	41.58	33.06	35.04	3.94	43.54	54.00	-10.46	Average	Horizontal
1805	56.49	33.06	35.04	3.94	58.45	74.00	-15.55	Peak	Vertical
1805	42.46	33.06	35.04	3.94	44.42	54.00	-9.58	Average	Vertical

The worst test result for ASK, Channel 26 / 915MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
1830	56.56	33.16	35.15	3.96	58.53	74.00	-15.47	Peak	Horizontal
1830	42.99	33.16	35.15	3.96	44.96	54.00	-9.04	Average	Horizontal
1830	58.62	33.16	35.15	3.96	60.59	74.00	-13.41	Peak	Vertical
1830	42.88	33.16	35.15	3.96	44.85	54.00	-9.15	Average	Vertical

The worst test result for ASK, Channel 51 / 927.5MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
1855	56.63	33.26	35.14	3.98	58.73	74.00	-15.27	Peak	Horizontal
1855	40.09	33.26	35.14	3.98	42.19	54.00	-11.81	Average	Horizontal
1855	57.20	33.26	35.14	3.98	59.30	74.00	-14.70	Peak	Vertical
1855	45.73	33.26	35.14	3.98	47.83	54.00	-6.17	Average	Vertical

Notes:

1). Measuring frequencies from 9 KHz~10th harmonic (ex. 10GHz), at least have 20dB margin found between lowest internal used/generated frequency to 30 MHz.

2). Radiated emissions measured in frequency range from 9 KHz~10th harmonic (ex. 10GHz) were made with an instrument using Peak detector mode.

3).Measured Level = Reading Level + Factor, Margin = Level – Limit, Factor = Antenna Factor + Cable Loss - Preamp Factor

6.7. AC Power Line Conducted Emissions

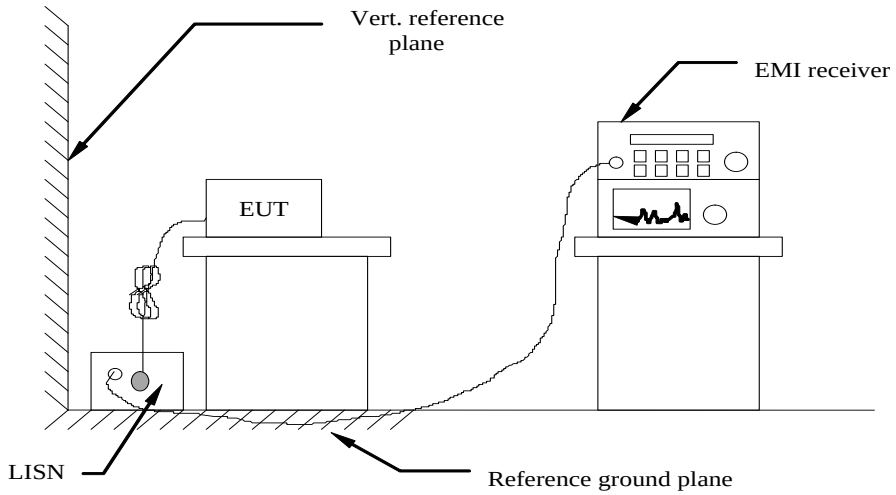
6.7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the RFID handheld reader 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

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

* Decreasing linearly with the logarithm of the frequency

6.7.2 Block Diagram of Test Setup



6.7.3 Test Results

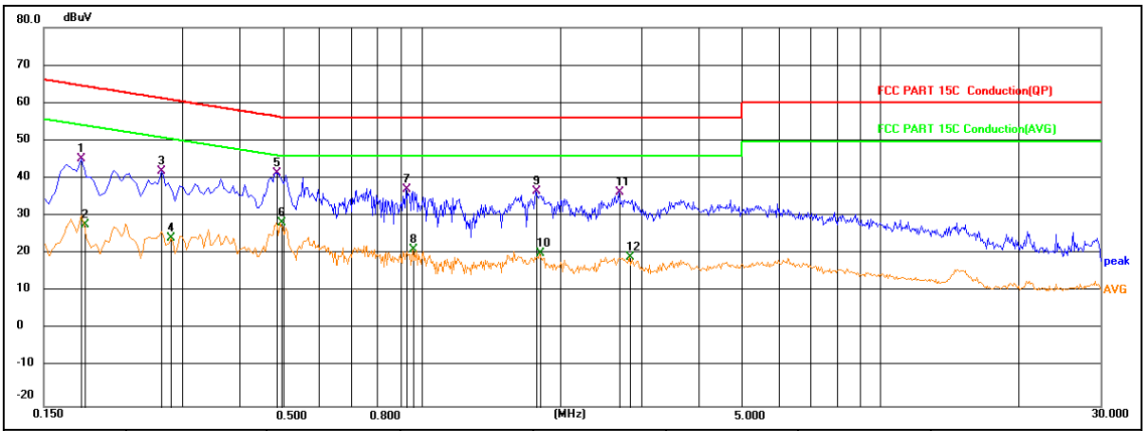
Temperature	23.3℃	Humidity	53.7%
Test Engineer	Kay Hu	Configurations	RF ID

PASS.

The test data please refer to following page.

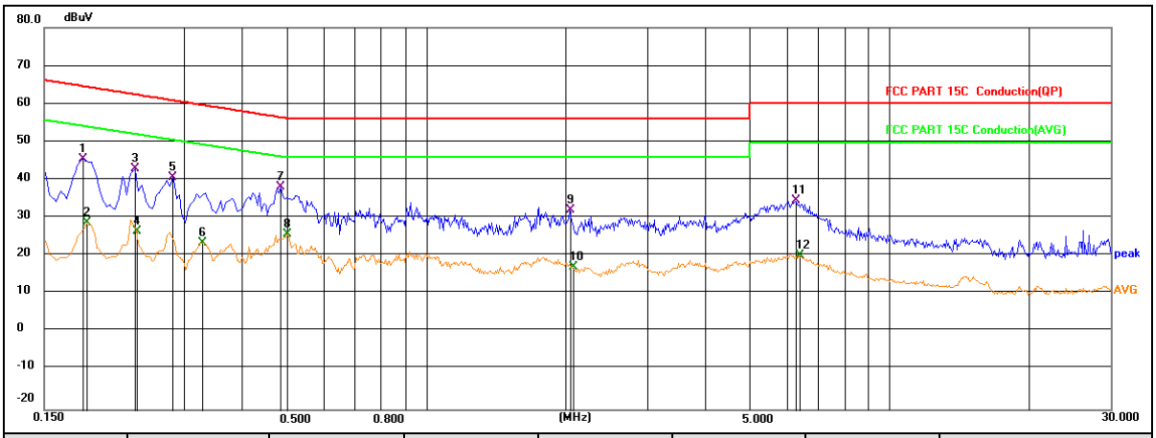
AC Conducted Emission of charge from power adapter mode @ AC 120V/60Hz (worst case)

Line



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1816	25.52	19.76	45.28	64.41	-19.13	QP
2	0.1835	8.30	19.76	28.06	54.33	-26.27	AVG
3	0.2716	22.24	19.75	41.99	61.07	-19.08	QP
4	0.2850	4.73	19.75	24.48	50.67	-26.19	AVG
5	0.4831	21.94	19.76	41.70	56.29	-14.59	QP
6	0.4921	8.64	19.76	28.40	46.13	-17.73	AVG
7	0.9241	17.40	19.78	37.18	56.00	-18.82	QP
8	0.9556	1.76	19.78	21.54	46.00	-24.46	AVG
9	1.7746	16.91	19.82	36.73	56.00	-19.27	QP
10	1.8016	0.49	19.82	20.31	46.00	-25.69	AVG
11	2.6881	16.59	19.84	36.43	56.00	-19.57	QP
12	2.8276	-0.40	19.86	19.46	46.00	-26.54	AVG

Neutral



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1815	25.97	19.76	45.73	64.42	-18.69	QP
2	0.1853	9.22	19.75	28.97	54.24	-25.27	AVG
3	0.2353	23.27	19.75	43.02	62.26	-19.24	QP
4	0.2366	7.10	19.75	26.85	52.21	-25.36	AVG
5	0.2847	21.17	19.75	40.92	60.68	-19.76	QP
6	0.3286	3.94	19.76	23.70	49.49	-25.79	AVG
7	0.4863	18.55	19.76	38.31	56.23	-17.92	QP
8	0.4994	6.32	19.76	26.08	46.01	-19.93	AVG
9	2.0441	12.37	19.83	32.20	56.00	-23.80	QP
10	2.0659	-2.36	19.83	17.47	46.00	-28.53	AVG
11	6.2520	14.71	19.95	34.66	60.00	-25.34	QP
12	6.3859	0.45	19.96	20.41	50.00	-29.59	AVG

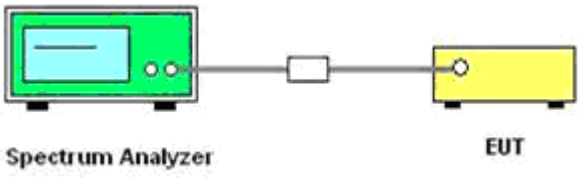
****Note: Pre-scan all modes and recorded the worst case results in this report.*
Result = Reading + Correct, Margin = Result – Limit.

6.8. Emissions at Restricted Band

6.8.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the PDA frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

6.8.2. Test Setup Layout



6.8.3. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of Spectrum Analyzer.

6.8.4. Test Procedures

According to KDB 412172 section 1.1 Field Strength Approach (linear terms):

$eirp = p_t \times g_t = (E \times d)^2/30$

Where:

p_t = transmitter output power in watts,

g_t = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m,

d = measurement distance in meters (m).

$erp = eirp/1.64 = (E \times d)^2/(30 \times 1.64)$

Where all terms are as previously defined.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Middle Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=1/T for Peak detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)

8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Compare the resultant electric field strength level to the applicable regulatory limit.
11. Perform radiated spurious emission test duress until all measured frequencies were complete.

6.8.5. Test Results

Not Applicable, the function frequency is far away from the restricted band.

6.9. Pseudorandom Frequency Hopping Sequence

6.9.1 Standard Applicable

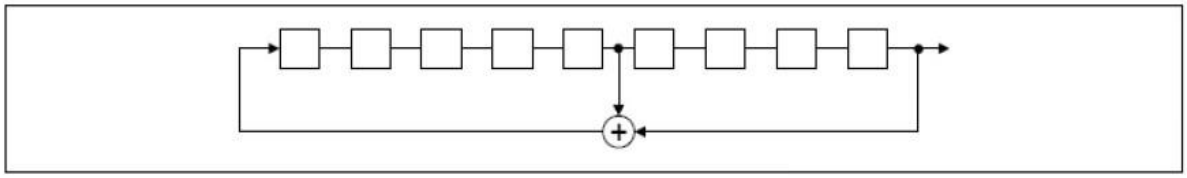
For 47 CFR Part 15C sections 15.247 (a) (1) requirement:

According to §15.247(a)(1)(i), For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

6.9.2 EUT Pseudorandom Frequency Hopping Sequence Requirement

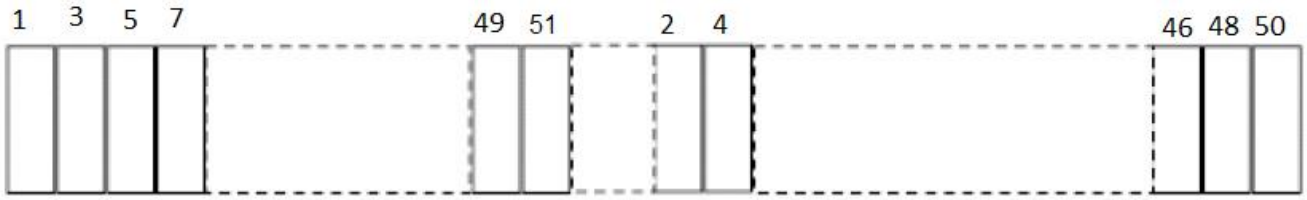
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

6.10. Antenna Requirement

6.10.1 Standard Applicable

According to antenna requirement of §15.203.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.10.2 Antenna Connected Construction

6.10.2.1. Standard Applicable

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

6.10.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 2dBi(Max), and the antenna is an Internal Antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

6.10.2.3. Results: Compliance.

7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

----------THE END OF TEST REPORT----------