

FCC PART	15 SUBPART C TEST	REPORT
	FCC PART 15 C (15.225)	
Report Reference No	CTA24050902606	
FCC ID	2A1D3-124P01	
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Date of issue:	May. 11, 2024	
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Applicant's name:	Imin Technology Pte Ltd	
Address:	11 Bishan Street 21, #03-05 Bose	ch Building, Singapore 573943
Test specification:		
Standard:	FCC Part 15 C (15.225)	
TRF Originator: Master TRF	Shenzhen Global Test Service Co Dated 2014-12	o.,Ltd.
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Test item description:	Mobile Data Terminal, Mobile C Terminal, Wireless Handheld Te	omputer, Handheld Data erminal
Trade Mark:	iMiN	
Manufacturer:	Imin Technology Pte Ltd	
Model/Type reference:	I24P01	
List Model:	N/A	
Modulation Type:	ASK	
Operation Frequency	13.56 MHz	
Hardware Version:	N/A	
Software Version:	N/A	
Rating:	DC 3.87V by battery Recharged by DC 9.0V	
Result:	PASS	

Test Report No.:		CTA24050902606	May. 11, 2024 Date of issue
Equipment under Test	:	Mobile Data Terminal, Mobile Co Wireless Handheld Terminal	mputer, Handheld Data Terminal,
Model /Type	:	I24P01	
List Model	:	N/A	
Applicant	:	Imin Technology Pte Ltd	
Address	:	11 Bishan Street 21, #03-05 Bos	ch Building, Singapore 573943
Manufacturer	:	Imin Technology Pte Ltd	
Address	:	11 Bishan Street 21, #03-05 Bos	ch Building, Singapore 573943

TEST REPORT

Test Result:	PASS

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.

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1. TEST STANDARDS

The tests were performed according to following standards:

<u>FCC Rules Part 15.225</u>: RADIO FREQUENCY DEVICES. <u>ANSI C63.10-2020</u>: American National Standard for Testing Unlicensed Wireless Devices

2. <u>SUMMARY</u>

2.1. General Remarks

Date of receipt of test sample	:	Apr. 13, 2024
Testing commenced on	:	Apr. 13, 2024
Testing concluded on	:	May. 10, 2024

2.2. Product Description

Product Name:	Mobile Data Terminal, Mobile Computer, Handheld Data Terminal, Wireless Handheld Terminal
Trade Mark:	imin
Model/Type reference:	I24P01
List Model:	N/A
Model Declaration	N/A
	DC 3 87V by battery
Power supply:	Recharged by DC 9 0V
Hardware Version	N/A
Software Version	N/A
Sample ID	GTS20240329015-1-S0001-1# GTS20240329015-1-S0001-2#
Blueteeth	
	2402MHz 2480MHz
Frequency Range	$2402WHZ \sim 2400WHZ$
Channel Number	40 channels for Bluetooth (DTS)
Channel Specing	1MHz for Bluetooth (DSS)
	2MHz for Bluetooth (DTS)
Modulation Type	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth (DSS)
	GFSK for Bluetooth (DTS)
2.4GWLAN	·
	IEEE 802.11b:2412-2462MHz
WLAN Operation frequency	IEEE 802.11g:2412-2462MHz
	IEEE 802.11n HT20:2412-2462MHz
	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK)
WLAN Modulation Type	IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)
	IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK, BPSK)
Channel number:	11 Channel for IEEE 802.11b/g/n (HT20)
Channel separation:	5MHz
WIFI (5.2G/5.3G/5.7G/5.8G Band	
Frequency Range	5180-5240MHz/ 5260MHz to 5320MHz/ 5500MHz to 5700MHz/
	5745MHz to 5825MHz
	4 Channels for 20MHz bandwidth(5180-5240MHz)
	11 Channels for 20MHz bandwidth(5500-5700MHz)
	5 channels for 20MHz bandwidth(5745-5825MHz)
	2 channels for 40MHz bandwidth(5190~5230MHz)
Ob ann al Nhumh an	2 channels for 40MHz bandwidth(5270~5310MHz)
	5 Channels for 40MHz bandwidth (5510-5670MHz)
	2 channels for 40MHz bandwidth(5755~5795MHz)
	1 channels for 80MHz bandwidth(5210MHz)
	1 channels for 80MHz bandwidth(5290MHz)
	2 Channels for 80MHz bandwidth(5530-5610MHz)
	1 channels for 80MHz bandwidth(5775MHz)
Modulation Type	LEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK)
	IEEE 802.11n H120: OFDM (64QAM, 16QAM, QPSK, BPSK)

	IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac VHT20: OFDM (256QAM,64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac VHT40: OFDM (256QAM,64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac VHT80: OFDM (256QAM,64QAM, 16QAM, QPSK, BPSK)	
Antenna Description	Internal Antenna, -0.18dBi(Max.) for 2.4G Band and 4.01dBi(Max.) for 5G Band	
2G		
Support Band	GPRS850/GPRS1900/EDGE850/EDGE1900	
Release Version	R99	
GPRS Class	Class 12	
EGPRS Class	Class 12	
GPRS/EDGE Multislot Class	GPRS/EDGE: Multi-slot Class 12	
Type Of Modulation	GMSK for GPRS; GMSK/8PSK for EGPRS	
Antenna Description	Internal Antenna -0.82dBi (max.) For GPRS850/EDGE850 -0.77dBi (max.) For GPRS1900/EDGE1900	
3G		
UMTS Operation Frequency Band	UMTS FDD Band 2(1850 MHz -1910MHz) UMTS FDD Band 5(824 MHz -849MHz)	
WCDMA Release Version	R7	
HSDPA Release Version	Release 5	
HSUPA Release Version	Release 6	
HSPA+ Release Version	Release 7	
Modulation Type	QPSK for UMTS	
Antenna Description	Internal Antenna -0.77dBi (max.) For WCDMA Band 2 -0.82dBi (max.) For WCDMA Band 5	
LTE		
LTE Operation Frequency Band	E-UTRA Band 2(1850 MHZ -1910MHZ) E-UTRA Band 4(1710 MHz -1755MHz) E-UTRA Band 5(824 MHz -849MHz) E-UTRA Band 7(2500 MHz -2570MHz) E-UTRA Band 12(699 MHz -716MHz) E-UTRA Band 14(788 MHz -798MHz) E-UTRA Band 17(704 MHz -716MHz) E-UTRA Band 25(1850 MHz -1915MHz) E-UTRA Band 26(814 MHz -824MHz) E-UTRA Band 26(824 MHz -849MHz) E-UTRA Band 41(2496 MHz -2690MHz) E-UTRA Band 66(1710 MHz -1780MHz)	
LTE Release Version	R10	
Type Of Modulation	QPSK/16QAM	
Antenna Description	Internal Antenna; -0.77dBi (max.) For LTE Band 2; -0.8dBi (max.) For LTE Band 4; -0.82dBi (max.) For LTE Band 5; 2.47dBi (max.) For LTE Band 7; -2.7dBi (max.) For LTE Band 12; -2.63dBi (max.) For LTE Band 14; -2.7dBi (max.) For LTE Band 17;	

	-0.77dBi (max.) For LTE Band 25;	
	-0.82dBi (max.) For LTE Band 26;	
	2.51dBi (max.) For LTE Band 41;	
	-0.8dBi (max.) For LTE Band 66;	
RFID(13.56MHz) (Optional)		
Frequency Range	13.56MHz	
Channel Number	1	
Modulation Type	ASK	
Antenna Description	Internal Antenna, 0dBi (Max.)	
GPS(RX)	Support	
Remark:The I24P01 model has 2 versions;		
Version A: With fingerprint recognition function		
Version B: No fingerprint recognition function		

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	0	230V / 50 Hz	0	120V / 60Hz
		0	12 V DC	0	24 V DC
			Other (specified in blank bel	ow	

DC 3.87V

2.4. Short description of the Equipment under Test (EUT)

This is a Mobile Data Terminal, Mobile Computer, Handheld DataTerminal, Wireless Handheld Terminal

For more details, refer to the user's manual of the EUT.

2.5. Block Diagram of Test Setup



2.6. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2AYD5-I24P01 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.7. EUT Exercise Software

N/A.

2.8. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
SHENZHEN TIANYIN ELECTRONICS CO.,LTD.	Adapter	TPD- 203A120167UF0 1		SDOC
/	Charger Base	Lark1 Dock A		SDOC
/	Hand Shank	Lark1 Handle		SDOC

Note: The product accessories are selected by customers to matched product to use.

2.9. External I/O Cable

I/O Port Description	Quantity	Cable
DC IN Port	1	1.0M, Unscreened Cable

2.10. Modifications

No modifications were implemented to meet testing criteria.

3. <u>TEST ENVIRONMENT</u>

3.1. Address of the test laboratory

Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 517856 Designation Number: CN1318

Shenzhen CTA Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6534.01

Shenzhen CTA Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	-20-50 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. 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 TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties radio equipment characteristics; Part 2" and is documented in the Shenzhen CTA Testing Technology Co., Ltd. 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. Hereafter the best measurement capability for Shenzhen CTA Testing Technology Co., Ltd. :

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	9KHz~30MHz	3.02 dB	(1)
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)
Output Peak power	30MHz~18GHz	0.55 dB	(1)
Power spectral density	/	0.57 dB	(1)
Spectrum bandwidth	/	1.1%	(1)
Radiated spurious emission (30MHz-1GHz)	30~1000MHz	4.10 dB	(1)
Radiated spurious emission (1GHz-18GHz)	1~18GHz	4.32 dB	(1)
Radiated spurious emission (18GHz-40GHz)	18-40GHz	5.54 dB	(1)

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

3.5. Summary of measurement results

Applied Standard: FCC Part 15 Subpart C					
Test Items	FCC Rules	Test Sample	Result		
Line Conducted Emissions	§15.207(a)	GTS20240329015-1- S0001-1#	PASS		
Field Strength of Fundamental Emissions	§15.225(a)(b)(c)	GTS20240329015-1- S0001-1#	PASS		
Radiated Emissions	§15.225(d) & §15.209	GTS20240329015-1- S0001-1# GTS20240329015-1- S0001-2#	PASS		
20dB Bandwidth	§ 15.215	GTS20240329015-1- S0001-1#	PASS		
Frequency Stability	§15.225(e)	GTS20240329015-1- S0001-1#	PASS		
Antenna Requirement	§15.203	GTS20240329015-1- S0001-1#	PASS		

Remark:

- 1. The measurement uncertainty is not included in the test result.
- 2. NA = Not Applicable; NP = Not Performed
- 3. Note 1 Test results inside test report;
- 4. Note 2 Test results in other test report (SAR Report).
- 5. We tested all test mode and recorded worst case in report

3.6. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2023/08/02	2024/08/01
LISN	R&S	ENV216	CTA-314	2023/08/02	2024/08/01
EMI Test Receiver	R&S	ESPI	CTA-307	2023/08/02	2024/08/01
EMI Test Receiver	R&S	ESCI	CTA-306	2023/08/02	2024/08/01
Spectrum Analyzer	Agilent	N9020A	CTA-301	2023/08/02	2024/08/01
Spectrum Analyzer	R&S	FSP	CTA-337	2023/08/02	2024/08/01
Vector Signal generator	Agilent	N5182A	CTA-305	2023/08/02	2024/08/01
Analog Signal Generator	R&S	SML03	CTA-304	2023/08/02	2024/08/01
Universal Radio Communication	CMW500	R&S	CTA-302	2023/08/02	2024/08/01
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2023/08/02	2024/08/01
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2023/10/17	2024/10/16
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2023/10/13	2024/10/12
Loop Antenna	Zhinan	ZN30900C	CTA-311	2023/10/17	2024/10/16
Horn Antenna	Beijing Hangwei Dayang	OBH100400	CTA-336	2021/08/07	2024/08/06
Antenna Tower	Suzhou Keletuo electronic Technology Co., LTD	BK-*AT-BS	N/A	N/A	N/A
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2023/08/02	2024/08/01
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2023/08/02	2024/08/01
Directional coupler	NARDA	4226-10	CTA-303	2023/08/02	2024/08/01
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2023/08/02	2024/08/01
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2023/08/02	2024/08/01
Automated filter bank	Tonscend	JS0806-F	CTA-404	2023/08/02	2024/08/01
Power Sensor	Agilent	U2021XA	CTA-405	2023/08/02	2024/08/01
Amplifier	Schwarzbeck	BBV9719	CTA-406	2023/08/02	2024/08/01

Note: The Cal.Interval was one year.

4. RADIATED MEASUREMENT

4.1. Standard Applicable

According to §15.209/ §15.205

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

\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

4.2. Measuring Instruments and Setting

Please refer to 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/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B 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

4.3. 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 3 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 $(\pm 45^{\circ})$ 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 2.5 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.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Transd=AF +CL-AG

4.4. Test Setup Layout



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1m]) (dB); Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

4.5. Test Results

Temperature	24.5 ℃	Humidity	53.7%
Test Engineer	Lushan Kong	Configurations	NFC

PASS.

The test data please refer to following page:

9 KHz~30MHz

Freq. MHz	Reading dBuV	Factor dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark
0.17	34.28	20.54	54.82	103.07	48.25	QP
0.84	26.34	20.48	46.82	83.07	36.25	QP
1.97	30.44	20.30	50.74	69.54	18.80	QP
5.00	26.15	20.32	46.47	69.54	23.07	QP
13.56	88.12	20.18	108.30	124.00	15.70	QP
14.97	34.75	20.12	54.87	69.54	14.67	QP
22.03	33.85	19.94	53.79	69.54	15.75	QP
25.96	27.89	19.95	47.84	69.54	21.70	QP

*Note: Emission Level= Reading Level + Factor

Factor= Antenna Factor + Cable Loss

Margin = Emission Level Limit – Measured Values

"--" means noise floor.

NOTE: All the modes have been tested and recorded worst mode in the report at Version A.

30MHz ~ 1GHz

Version A:



Version B:



2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

5. FIELD STRENGTH OF FUNDAMENTAL EMISSIONS AND MASK MEASUREMENT

5.1. Block Diagram of Test Setup



Below 1GHz

5.2. Field strength of fundamental emissions limit and Mask limit

The field strength of fundamental emissions shall not exceed 15848 microvolts/meter at 30 meters. The emissions limit in this paragraph is based on measurement instrumentation employing a QP detector.

Frequencies	Field Strength	Field Strength	Field Strength
(MHz)	(microvolts/meter)	(dBµV/m) at 10m	(dBµV/m) at 3m
13.553 ~ 13.567MHz	15848 at 30m	103.08 (QP)	124 (QP)

Mask Limit:

Frequency (MHz)	Limit (dBuV/m)	Distance (m)
1.705-13.110	69.5	3
13.110-13.410	80.5	3
13.410-13.553	90.5	3
13.553-13.567	124.0	3
13.567-13.710	90.5	3
13.710-14.010	80.5	3
14.010-30.000	69.5	3

5.3. Test Results

Temperature	24.5 ℃	Humidity	53.7%
Test Engineer	Lushan Kong	Configurations	NFC

PASS.

The test data please refer to following page:

	Freq.(MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin dB	Remark
1	13.16	29.05	20.18	49.23	80.50	31.27	QP
2	13.41	35.34	20.18	55.52	90.50	34.98	QP
3	13.56	88.12	20.18	108.30	124.00	15.70	QP
4	13.61	26.26	20.18	46.44	90.50	44.06	QP
5	13.66	26.54	20.18	46.72	90.50	43.78	QP
6	14.70	32.55	21.18	53.73	81.50	27.77	QP

*Note: Factor= Antenna Factor + Cable Loss

Emission level (dB μ V/m) = 20 log Emission level (μ V/m).

Measured distance is 3m.

All emissions emit from non-NFC function of digital unintentional emissions. All NFC's spurious emissions are below 20dB of limits.

NOTE: All the modes have been tested and recorded worst mode in the report at Version A.

6. BANDWIDTH OF THE OPERATING FREQUENCY

6.1. Standard Applicable

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (13.553 ~ 13.567MHz).

6.2. Test Result

Temperature	24.5 ℃	Humidity	53.7%
Test Engineer	Lushan Kong	Configurations	NFC

Carrier Frequency (MHz)	, 20dB Bandwidth (KHz)	F _L (MHz)	F _н (MHz)
13.56	0.814	13.559593	13.560407

Please refer to the test plot:



7. FREQUENCY STABILITY MEASUREMENT

7.1. Standard Applicable

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% (100ppm) of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a full charged battery.

7.2. Test Result

Temperature	24.5 ℃	Humidity	53.7%
Test Engineer	Lushan Kong	Configurations	NFC

Voltage vs. Frequency Stability

Voltage(V)	Measurement Frequency (MHz)	Deviation (KHz)	Deviation (ppm)	Limit (ppm)
DC 4.3V	13.560021	0.021	1.53	100
DC 3.87V	13.560026	0.026	1.95	100
DC3.5V	13.560042	0.042	3.08	100

Temperature vs. Frequency Stability

Temperature (℃)	Measurement Frequency (MHz)	Deviation (KHz)	Deviation (ppm)	Limit (ppm)
-20	13.560053	0.053	3.87	100
-10	13.560060	0.060	4.42	100
0	13.560036	0.036	2.62	100
10	13.560051	0.051	3.74	100
20	13.560017	0.017	1.23	100
30	13.560032	0.032	2.33	100
40	13.560044	0.044	3.24	100
50	13.560031	0.031	2.28	100

8. LINE CONDUCTED EMISSIONS

8.1. 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 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 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 are listed as follows:

Frequency Range	Limits (dBµV)		
(MHz)	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

DISTURBANCE Calculation

The AC mains conducted disturbance is calculated by adding the 10dB Pulse Limiter and Cable Factor and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

CD (dBuV) = RA (dBuV) + PL (dB) + CL (dB)

Where CD = Conducted Disturbance	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	PL = 10 dB Pulse Limiter Factor

8.2. Block Diagram of Test Setup



8.3. Test Results

Temperature	24.5 ℃	Humidity	53.7%
Test Engineer	Lushan Kong	Configurations	NFC

Version A:



Version B:



9. ANTENNA REQUIREMENTS

9.1. 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.

9.2. Antenna Connected Construction

9.2.1. 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.

9.2.2. Antenna Connector Construction

The gains of antenna used for transmitting is 0dBi, and the antenna is a Loop antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

9.2.3. Results: Compliance.

10. TEST SETUP PHOTOS OF THE EUT



Photo of Radiated Emissions Measurement

Fig. 2



Photo of Conducted Emission Measurement

Fig. 3

11. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the Test Report: CTA24050902601.

.....End of Report.....