

Prüfbericht-Nr.: Test Report No.:	50162611 001	Auftrags-Nr.: Order No.:	144189847	Seite 1 von 13 Page 1 of 13	
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	06.07.2018		
Auftraggeber: Client:	TUNG SHING STATIONERY MANUFACTURING LIMITED B6, 27/F, TML TOWER, 3 HOI SHING ROAD, TSUEN WAN, HONG KONG, CHINA				
Prüfgegenstand: Test item:	Short Range Device – EMR Ink Pen				
Bezeichnung / Typ-Nr.: Identification / Type No.:	MDP-0304-C10				
Auftrags-Inhalt: Order content:	FCC Certification				
Prüfgrundlage: Test specification:	FCC Part 15 Subpart C ANSI C63.10-2013				
Wareneingangsdatum: Date of receipt:	10.07.2018				
Prüfmuster-Nr.: Test sample No.:	A000773057				
Prüfzeitraum: Testing period:	18.07.2018 - 15.08.2018				
Ort der Prüfung: Place of testing:	TÜV Rheinland Hong Kong Ltd				
Prüflaboratorium: Testing laboratory:	TÜV Rheinland Hong Kong Ltd				
Prüfergebnis*: Test result*:	Pass				
geprüft von / tested by:		kontrolliert von / reviewed by:			
 04.10.2018 Mika Chan / Project Manager		 04.10.2018 Sharon Li / Unit Senior Manager			
Datum Date	Name / Stellung Name / Position	Unterschrift Signature	Datum Date	Name / Stellung Name / Position	Unterschrift Signature
Sonstiges / Other: FCC ID: 2AQNL-MD1-MDSP					
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:			Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested					
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>					

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Product information

Manufacturers declarations

	Transmitter
Operating frequency range	161 - 174KHz
Type of modulation	Carrier Wave
Number of channels	2
Type of antenna	Intrgral Coil Antenna
Power level	fix
Connection to public utility power line	Yes
Nominal voltage	V _{nor} : 2.4 VDC (Rechargeable battery)

Product function and intended use

The equipment under test (EUT) is a EMR Ink Pen operating at 161KHz and 174KHz. It is powered by battery only.

FCC ID: 2AQNL-MD1-MDSP

Models	Product description
MDP-0304-C10	Short Range Device – EMR Ink Pen

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

Independent Operation Modes

The basic operation modes are:

- Transmitting mode.
- Normal operation mode

For further information refer to User Manual

Related Submittal(s) Grants

This is a single application for certification of the transmitter.

Remark

The test results in this test report are only relevant to the tested sample and does not involve any assessment in the production.

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Test Operation and Test Software

Test operation should refer to test methodology.

- Test mode samples with maximum RF output power and duty cycle provided by the applicant are used for testing.

Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

- AC/DC Adapter Model: A1399 (Provided by TÜV Rheinland Hong Kong Ltd)

Countermeasures to achieve EMC Compliance

- None

Test Methodology

Radiated Emission

The radiated emission measurements of the transmitter part were performed according to the procedures in ANSI C63.10-2013.

For measurement below 1GHz - the equipment under test (EUT) was placed at the middle of the 80 cm height turntable. For measurement above 1GHz - the EUT was placed at the middle of the 1.5 m height turntable and RF absorbing material was placed on ground plane between turntable and measuring antenna. During the testing, the EUT was operated standalone and arranged for maximum emissions. The EUT was tested in three orthogonal planes.

The investigation is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained.

All radiated tests were performed at an antenna to EUT with 3 meters distance, unless stated otherwise in particular parts of this test report.

Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

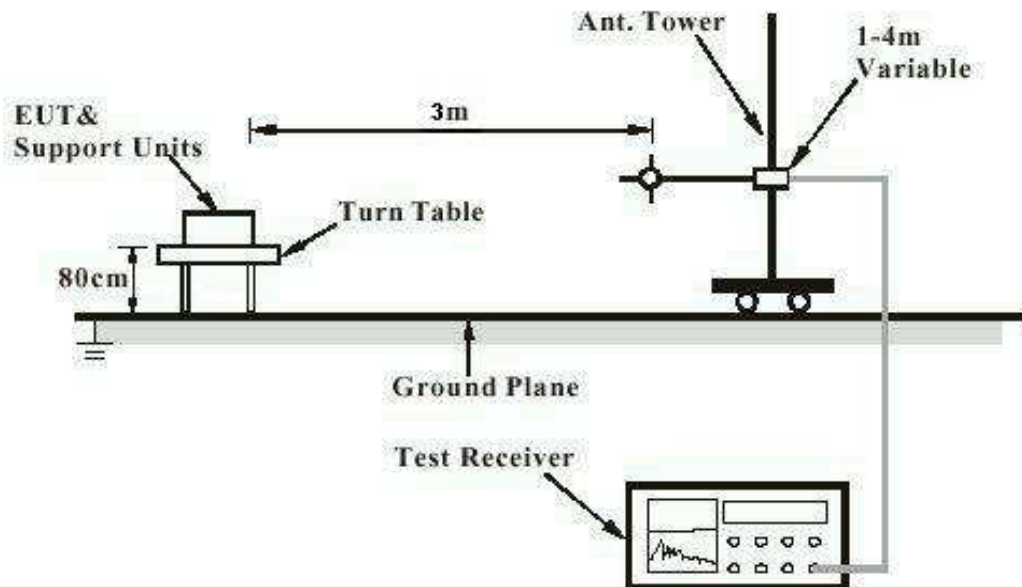
$$FS = R + AF + CF + FA - PA$$

Where FS = Field Strength in dBuV/m at 3 meters.
R = Reading of Spectrum Analyzer in dBuV.
AF = Antenna Factor in dB.
CF = Cable Attenuation Factor in dB.
FA = Filter Attenuation Factor in dB.
PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

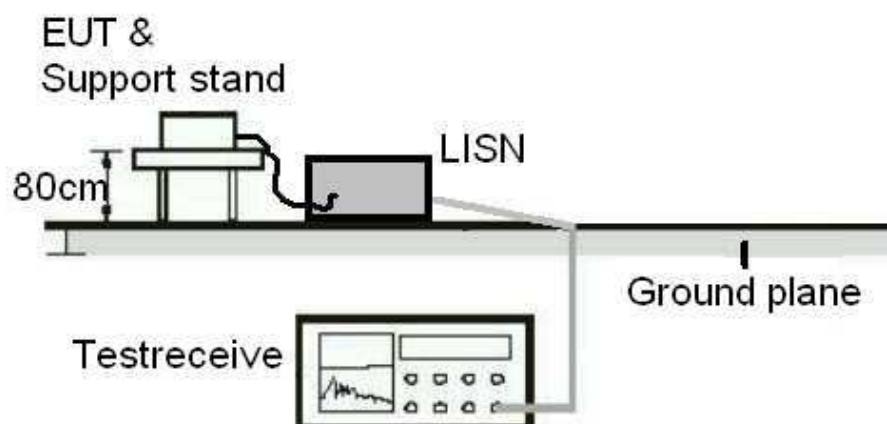
Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)



Test Facility

Test Laboratory Information

TÜV Rheinland Hong Kong Ltd.

Address: 3-4, 11/F., Fou Wah Industrial Building, 10-16 Pun Shan Street, Tsuen Wan, N.T., Hong Kong

Tel.: +852 2192 1000

Fax: +852 2192 1001

Email service-gc@tuv.com

Web: www.tuv.com

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

FCC

Type	: Accredited Test Firm
Designation Number	: HK0013
Test Firm Registration Number	: 371735
Scope	: Intentional Radiators

List of Test and Measurement Instruments

TÜV Rheinland Hong Kong Ltd

Radiated Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Semi-anechoic Chamber	Frankonia	Nil	23-Apr-18	23-Apr-19
Test Receiver	R & S	ESU40	12-Jun-18	12-Jun-19
Bi-conical Antenna	R & S	HK116	21-Mar-18	21-Mar-20
Log Periodic Antenna	R & S	HL223	22-Mar-18	22-Mar-20
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	11-Dec-17	11-Dec-19
Active Loop Antenna	EMCO	6502	30-Oct-17	30-Oct-18
Semi-anechoic Chamber (SiteVSWR)	Frankonia	Nil	17-May-18	17-May-19
Double-Ridged Waveguide Horn	EMCO	3116	17-Jun-17	17-Jun-19
Double-Ridged Waveguide Horn	EMCO	3117	22-Jun-17	22-Jun-19
Cable with I-Joint Conector	Huber+Suhner	CNM-NMCMILX800-473	11-Dec-17	11-Dec-19
Microwave amplifier 0.5-26.5GHz, 25dB gain	HP	83017A	18-Jul-17	18-Jul-19
Preamplifier 18GHz to 40GHz with cable (EMC656)	A.H. Systems, Inc.	PAM-1840VH	29-Jan-18	29-Jan-19
High Pass Filter (cutoff freq. =1000MHz)	Trilithic	23042	30-Oct-17	30-Oct-19

Radio Test

Equipment	Manufacturer	Type	Cal. Date	Due Date
Spectrum Analyzer	R & S	FSP30	03 May 2018	02 May 2019

AC Mains Conducted Emission

Equipment	Manufacturer	Type	Cal. Date	Due Date
Test Receiver	R & S	ESU40	12-Jun-18	12-Jun-19
RF Voltage Probe	Schwarzbeck	TK9416	12-Feb-18	12-Feb-20
LISN	R&S	ENV216	31-Jul-18	31-Jul-19
Double Shield Cable	Huber+ Suhner	RG223/U-01	18-May-17	18-May-19

Measurement Uncertainty

The estimated combined standard uncertainty for power-line conducted emissions measurements is $\pm 2.42\text{dB}$.

The estimated combined standard uncertainty for radiated emissions measurements is $\pm 4.81\text{dB}$ (9kHz to 30MHz) and $\pm 4.62\text{dB}$ (30MHz to 200MHz) and $\pm 5.67\text{dB}$ (200MHz to 1000MHz) and is $\pm 5.07\text{dB}$ (1GHz to 8.2GHz) and $\pm 4.58\text{dB}$ (8.2GHz to 12.4GHz) and $\pm 4.78\text{dB}$ (12.4GHz to 18GHz)

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor of $k=2$, which for the level of confidence is approximately 95%.

Results FCC Part 15 – Subpart C

FCC 15.203 – Antenna Requirement 1		Pass
FCC Requirement:	No antenna other than that furnished by the responsible party shall be used with the device	
Results:	a) Antenna type: Integral Coil antenna b) Manufacturer and model no: N/A c) Peak Gain: N/A	
Verdict:	Pass	

FCC 15.204 – Antenna Requirement 2		Pass
FCC Requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.	
Results:	Only one integral antenna can be used.	
Verdict:	N/A	

FCC 15.207 – Conducted Emission on AC Mains						Pass
Test Specification : ANSI C63.10-2013 Test date : 27.07.2018 Port of Testing : AC Mains input port of power supply Mode of operation : TX Mode + Battery Charging Mode Supply voltage : 120Vac 60Hz Temperature : 23°C Humidity : 50%						
Requirement: 15.207(a)						
Results: Pass						
Live measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	No peak found	---	---	66 - 56	56 - 46	Pass
> 0,5 - 5	0.588	33.3	23.3	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass
Neutral measurement						
Frequency range (MHz)	Frequency (MHz)	Quasi-peak dBµV	Average dBµV	Limit QP (dBµV)	Limit AV (dBµV)	Verdict
0,15 – 0,5	0.286	46.1	46.8	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	No peak found	---	---	60	50	Pass

Results:	Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz does not exceed the limits. For test Results plots refer to Appendix 1, page 2.
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Subclause 15.209 – Radiated Emissions		Pass
Test Specification : ANSI C63.10 – 2013 Test Specification : 27.07.2018 Mode of operation : Tx mode + Battery Charging mode Port of testing : Enclosure Frequency range : 9kHz – 1GHz Supply voltage : 2.4VDC Temperature : 23°C Humidity : 50%		
Requirement:	The emissions from an intentional radiator shall not exceed the field strength levels specified in the table mentioned in section 15.209.	
Results:	PASS.	
Frequency 161 KHz Vertical Polarization		
Freq KHz	Level dBuV/m	Limit/ Detector dBuV/m
161.7308	63.9	123.4 / PK
161.7308	58.2	103.4 / AV
Frequency 161 KHz Horizontal Polarization		
Freq KHz	Level dBuV/m	Limit/ Detector dBuV/m
161.8109	62.5	123.4 / PK
161.8109	55.2	103.4 / AV
Frequency 174 KHz Vertical Polarization		
Freq KHz	Level dBuV/m	Limit/ Detector dBuV/m
173.0609	63.1	122.8 / PK
173.0609	58.3	102.98/ AV
Frequency 174 KHz Horizontal Polarization		
Freq KHz	Level dBuV/m	Limit/ Detector dBuV/m
172.9808	61.9	122.8 / PK
172.9808	55.3	102.98/ AV
Remark: There is no spurious found between 9KHz and 1GHz. All fundamental carrier emission level were below the limit of FCC15.209		

FCC 15.217 (a) – Total Input Power		Pass
FCC Requirement:	The total input power to the final radio frequency stage (exclusive of filament or heater power) shall not exceed one watt.	
Results:	EUT was powered by 2.4V/45mAh battery, maximum current drain is 3.33mA. Power= $2.4 \times 0.00333 = 0.007992\text{W}$	
Verdict:	Pass	

FCC 15.217 (b) – Total length of the transmission line, Antenna and ground lead		Pass
FCC Requirement:	The total length of the transmission line, antenna, and ground lead (if used) shall not exceed 15 meters.	
Results:	Refer to EUT external photos section, the total length of EUT is less than 16cm.	
Verdict:	Pass	

FCC 15.217 (c) – 20 dB Attenuation		Pass
FCC Requirement:	All emissions below 510 kHz or above 1705 kHz shall be attenuated at least 20 dB below the level of the unmodulated carrier. Determination of compliance with the 20 dB attenuation specification may be based on measurements at the intentional radiator's antenna output terminal unless the intentional radiator uses a permanently attached antenna, in which case compliance shall be demonstrated by measuring the radiated emissions.	
Results:	All spurious and fundamental carrier emission level are below the limit of FCC 15.209.	
Verdict:	Pass	