

Produkte
Products

Prüfbericht-Nr.: <i>Test Report No.:</i>	50162610 001	Auftrags-Nr.: <i>Order No.:</i>	144189847	Seite 1 von 17 <i>Page 1 of 17</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	06.07.2018		
Auftraggeber: <i>Client:</i>	TUNG SHING STATIONERY MANUFACTURING LIMITED B6, 27/F, TML TOWER, 3 HOI SHING ROAD, TSUEN WAN, HONG KONG, CHINA				
Prüfgegenstand: <i>Test item:</i>	Short Range Device – Digital Notebook Folio with Bluetooth Connectivity				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	Please refer to "Models" on page 4				
Auftrags-Inhalt: <i>Order content:</i>	FCC Certification				
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C ANSI C63.10-2013				
Wareneingangsdatum: <i>Date of receipt:</i>	16.07.2018				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000775938-002				
Prüfzeitraum: <i>Testing period:</i>	24.07.2018 - 14.08.2018				
Ort der Prüfung: <i>Place of testing:</i>	Hong Kong				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland Hong Kong Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von / tested by:		kontrolliert von / reviewed by:			
					
Datum <i>Date</i>	04.10.2018	Name / Stellung <i>Name / Position</i>	Mika Chan / Project Manager	Datum <i>Date</i>	04.10.2018
		Unterschrift <i>Signature</i>			
				Name / Stellung <i>Name / Position</i>	Sharon Li / Unit Senior Manager
				Unterschrift <i>Signature</i>	
Sonstiges / Other: FCC ID: 2AQNL-MD1-MDNF					
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>			Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* 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

	BLE Transceiver	electro-magnetic resonance Receiver
Operating frequency range	2402 - 2480 MHz	161KHz, 174 KHz
Type of modulation	GFSK	Carrier Wave
Number of channels	40	2
Channel separation	2 MHz	N/A
Type of antenna	Integral Antenna	
Antenna gain (dBi)	1.5 dBi	
Power level	fix	
Type of equipment	stand alone radio device	
Connection to public utility power line	No	
Nominal voltage	V _{nor} : 3.7 VDC	
Independent Operation Modes	Transmitting	

Product function and intended use

The equipment under test (EUT) is a notebook folio with Bluetooth Low Energy connectivity and EMR receiver. The manufacturer declares that the models listed below are all identical in electrical, PCB layout and components used except the model number.

FCC ID: 2AQNL-MD1-MDNF

Models	Product description
MD1-0202, MDx-xxxx-cxx (x=0-9)	Short Range Device – Digital Notebook Folio with Bluetooth Connectivity

Submitted documents

Circuit Diagram
Block Diagram
Technical Description
User manual
Label

Independent Operation Modes

The basic operation modes are:

- Transmitting 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.

- During test, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

Special Accessories and Auxiliary Equipment

- 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 3m 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:

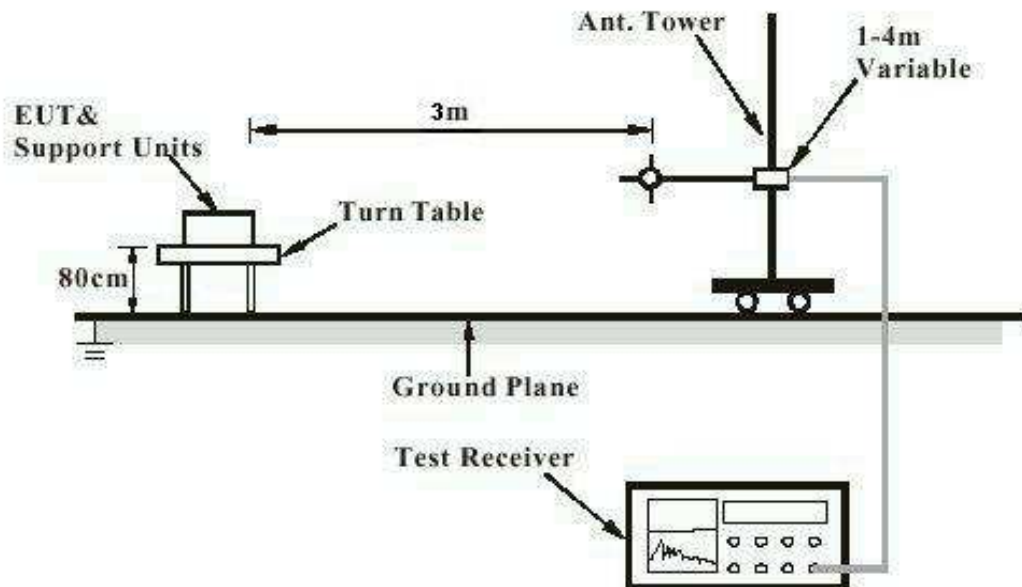
$$FS = R + AF + CF + FA - PA$$

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)

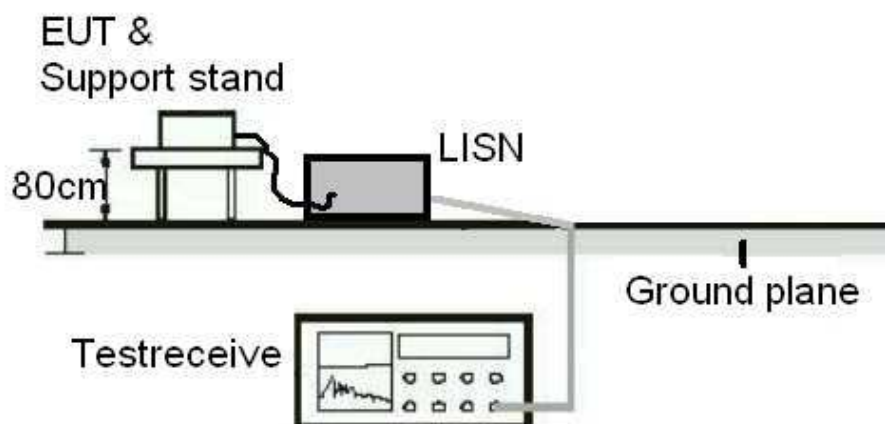
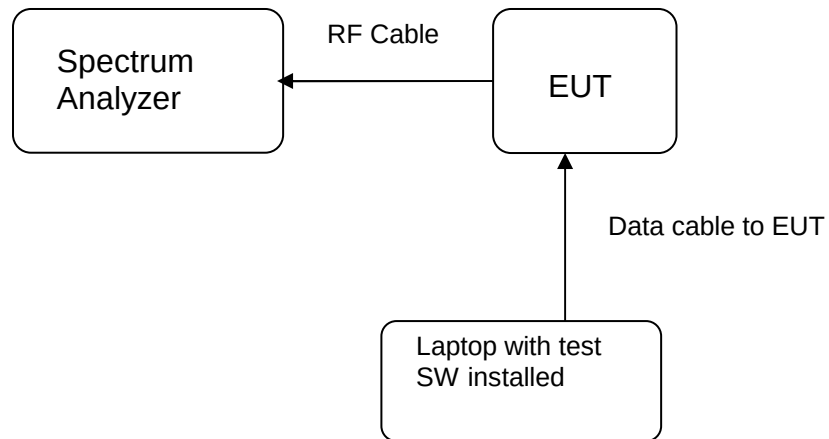


Diagram of Equipment Configuration for Antenna-port Conducted Measurement (if applicable)



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

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Email service-gc@tuv.com

Web: www.tuv.com

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

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 estimated combined standard uncertainty for antenna conducted emission is $\pm 2.1\text{dB}$

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						
a) Antenna type: Integral PCB antenna						
b) Manufacturer and model no: N/A						
c) Peak Gain: 1.5 dBi						
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						
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	0.574	28.0	18.9	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	No peak found	---	---	66 - 56	56 - 46	Pass
> 0,5 - 5	No peak found	---	---	56	46	Pass
> 5 - 30	29.518	30.5	11.1	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.

FCC 15.247 (a)(2) – 6dB Bandwidth Measurement
Pass

FCC Requirement: Systems using digital modulation techniques may operate in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500kHz.

Test Specification : ANSI C63.10 – 2013
 Test date : 14.08.2018
 Mode of operation : Tx mode
 Port of testing : Temporary antenna port
 Supply voltage : 3.7VDC
 Temperature : 23°C
 Humidity : 50%

Results: For test protocols please refer to Appendix 1

Channel frequency (MHz)	6 dB left (MHz)	6 dB right (MHz)	6dB bandwidth (kHz)
2402	2401.628	2402.366	738.000
2440	2439.628	2440.366	738.000
2480	2479.634	2480.366	732.000

FCC 15.247(b)(3) – Maximum Peak Conducted Output Power
Pass

FCC Requirement: For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850MHz bands: 1 Watt (30dBm)

Test Specification : ANSI C63.10 – 2013
 Test date : 14.08.2018
 Mode of operation : Tx mode
 Port of testing : Temporary antenna port
 Supply voltage : 3.7VDC
 Temperature : 23°C
 Humidity : 50%

Results: For test protocols please refer to Appendix 1

Frequency (MHz)	Measured Output Power (dBm)	Limit (W/dBm)	Verdict
2402	3.23	1 / 30.0	Pass
2440	3.99	1 / 30.0	Pass
2480	3.49	1 / 30.0	Pass

FCC 15.247(e) – Power Spectral Density			Pass
FCC Requirement: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.			
Test Specification : ANSI C63.10 – 2013 Test date : 14.08.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.7VDC Temperature : 23°C Humidity : 50%			
Results: For test protocols please refer to Appendix 1.			
Operating frequency (MHz)	Power density (dBm)	Limit (dBm)	Verdict
2402	2.62	8.0	Pass
2440	3.32	8.0	Pass
2480	2.83	8.0	Pass

FCC 15.247(d) – Spurious Conducted Emissions				Pass	
Test Specification : ANSI C63.10 – 2013 Test date : 14.08.2018 Mode of operation : Tx mode Port of testing : Temporary antenna port Supply voltage : 3.7VDC Temperature : 23°C Humidity : 50%					
FCC Requirement: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio 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.					
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Only the worst cases is shown below. For test protocols refer to Appendix 1					
Operating frequency (MHz)	Spurious frequency (MHz)	Spurious Level (dBm)	Reference value (dBm)	Delta (dB)	Verdict
2402	1440.0	-42.85	2.62	45.47	Pass
2440	1464.0	-43.21	3.32	46.53	Pass
2480	1488.0	-43.42	2.83	46.25	Pass

FCC 15.205 – Radiated Emissions in Restricted Frequency Bands			Pass
Test Specification : ANSI C63.10 – 2013 Test Specification : 22.07.2018 Mode of operation : Tx mode Port of testing : Enclosure Frequency range : 9kHz – 25GHz Supply voltage : 3.7VDC Temperature : 23°C Humidity : 50%			
FCC Requirement: In any 100kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.205(c).			
Results: Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and data rate. Simultaneous transmission was investigated and no new emissions were found. All three transmit frequency modes comply with the field strength within the restricted bands. There is no spurious found below 30MHz.			
Mode: 2402MHz TX		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2400.000	43.7	74.0 / PK	
2400.000	24.2	54.0 / AV	
4804.000	38.0	74.0 / PK	
4804.000	24.6	54.0 / AV	
7206.809	43.0	74.0 / PK	
7206.809	29.7	54.0 / AV	
Mode: 2402 MHz TX		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
2400.000	47.4	74.0 / PK	
2400.000	29.3	54.0 / AV	
4803.980	38.4	74.0 / PK	
4803.980	25.1	54.0 / AV	
7205.971	42.8	74.0 / PK	
7205.971	29.2	54.0 / AV	
Mode: 2440 MHz TX		Vertical Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4879.500	37.9	74.0 / PK	
4879.500	24.2	54.0 / AV	
7319.250	44.2	74.0 / PK	
7319.250	30.2	54.0 / AV	
Mode: 2440 MHz TX		Horizontal Polarization	
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m	
4879.987	40.3	74.0 / PK	

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4879.987	29.4	54.0 / AV
7319.980	43.0	74.0 / PK
7319.980	29.5	54.0 / AV
Mode: 2480MHz TX Vertical Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2483.500	34.2	74.0 / PK
2483.500	19.7	54.0 / AV
4959.980	37.8	74.0 / PK
4959.980	24.4	54.0 / AV
7439.971	43.1	74.0 / PK
7439.971	29.8	54.0 / AV
Mode: 2480 MHz TX Horizontal Polarization		
Freq MHz	Level dBuV/m	Limit/ Detector dBuV/m
2483.500	35.4	74.0 / PK
2483.500	20.1	54.0 / AV
4959.660	39.4	74.0 / PK
4959.660	26.7	54.0 / AV
7439.490	43.4	74.0 / PK
7439.490	30.0	54.0 / AV