

Prüfbericht-Nr.: <i>Test report no.:</i>	CN21VC66 002	Auftrags-Nr.: <i>Order no.:</i>	168289126	Seite 1 von 20 Page 1 of 20
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2020-11-04	
Auftraggeber: <i>Client:</i>	Nortek Security&Control LLC 5919 Sea Otter Place,Suite 100,Carlsbad,California, United States			
Prüfgegenstand: <i>Test item:</i>	System Controller			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	EL-SC-300 (Trademark: ELAN)			
Auftrags-Inhalt: <i>Order content:</i>	FCC & IC approval			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.407 RSS-247 Issue 2 February 2017 CFR47 FCC Part 15: Subpart C Section 15.207 RSS-Gen Issue 5 March 2019 CFR47 FCC Part 15: Subpart C Section 15.209 RSS-102 Issue 5 March 2015 CFR47 FCC Part 2: Section 2.1091			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2020-12-02	Please refer to Photo Document		
Prüfmuster-Nr.: <i>Test sample no.:</i>	A002957975-005~007			
Prüfzeitraum: <i>Testing period:</i>	2020-12-03 – 2021-01-29			
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>			genehmigt von: <i>authorized by:</i>	
Datum: <i>Date:</i> 2021-01-29	Signed by: Jonathan Li		Ausstellungsdatum: <i>Issue date:</i> 2021-01-29	Signed by: Winnie Hou
Stellung / Position:	Project Manager		Stellung / Position:	Technical Certifier
Sonstiges / Other:	FCC ID: EF400211 IC: 1078A-00211 HVIN: EL-SC-300			
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 P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient 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>				

Test Summary

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 MAXIMUM CONDUCTED OUTPUT POWER

RESULT: Pass

5.1.3 CONDUCTED POWER SPECTRAL DENSITY

RESULT: Pass

5.1.4 FREQUENCY STABILITY

RESULT: Pass

5.1.5 26dB BANDWIDTH, 6dB BANDWIDTH AND 99% BANDWIDTH

RESULT: Pass

5.1.6 RADIATED SPURIOUS EMISSION

RESULT: Pass

5.1.7 CONDUCTED EMISSION ON AC MAINS

RESULT: Pass

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up

Appendix B: Test Results of Wi-Fi operation for U-NII-1 band

Appendix C: Test Results of Wi-Fi operation for U-NII-3 band and Conducted Emission on AC Mains

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

No.362, Huanguan Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District,
Shenzhen, Guangdong, China

FCC Accreditation Designation No.: 694916

ISED wireless device testing laboratory: 25069

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Radio Spectrum Testing (TS8997)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
Signal Analyzer	R&S	FSV 40	101441	2021-08-10
OSP	R&S	OSP 150	101017	2021-12-10
Control PC	DELL	OptiPlex 7050	FTJZ9P2	N/A
Test Software	R&S	WMS32 (V11.00.00)	N/A	N/A
Power Meter	R&S	NRP2	107105	2021-12-10
Wideband Power Sensor	R&S	NRP-Z81	105677	2021-09-10
Shielding Room 8#	Albatross	SR8	APC17151-SR8	2021-07-23
Unwanted Emission Testing (TS9975)				
Equipment	Manufacturer	Model	Serial No.	Cal. until
EMI Test Receiver	R&S	ESR 7	102021	2021-08-11
Signal Analyzer	R&S	FSV 40	101439	2021-08-10
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2021-08-10
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2021-08-10
Amplifier	R&S	SCU-18F	180070	2021-08-10
Amplifier	R&S	SCU40A	100475	2021-09-10
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2022-08-08
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	2022-08-08
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2022-08-08
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2022-09-13
Wideband Ridged Horn Antenna (12-18 GHz)	Steatite	QMS-00208	18313	2021-09-02
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	2021-07-06
Conducted Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R&S	ESR3	102680	2021-05-19
Artificial Mains Network	R&S	ENV216	101445	2021-05-19
EMC32 test software	R&S	EMC32(Ver.10.50.0 1)	N/A	N/A

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF Power (conducted)	± 2.5 dB
Radiated Emission of Transmitter, valid up to 26.5 GHz	± 6 dB
Radiated Emission of Receiver, valid up to 26.5 GHz	± 6 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB
Radiated Emission (3m SAC), 30MHz to 1000MHz	± 4.52 dB
Radiated Emission (3m SAC), above 1000MHz	± 4.37 dB
Temperature	± 1 °C
Humidity	± 5 %
Voltage (DC)	± 1 %
Voltage (AC, <10kHz)	± 2 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B & C of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. File for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at No.362, Huanguan Middle Road, Songyuansha Community, Guanhu Subdistrict, Longhua District, Shenzhen, Guangdong, China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUT is a System Controller, which supports Wi-Fi 802.11 a/b/g/n/ac wireless technologies. The EUT supports the following functions: Wireless access in the 2.4GHz band or 5GHz band.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	System Controller
Type Designation	EL-SC-300
Trade Mark	ELAN
FCC ID	EF400211
IC	1078A-00211
HVIN	EL-SC-300
Operating Voltage	DC 12.0V@2.5A input via AC/DC adapter DC 48V@600mA via POE
Testing Voltage	AC 120V@60Hz
Antenna Type	Integral Antenna
Antenna Gain	3.0 dBi for 2.4G/5G Wi-Fi
Power Adapter	Model: SRB1202500P Input: AC 100-240V~50/60Hz, 1.0A Output: DC 12.0V@2.5A
Technical Specification of Wi-Fi 802.11 a/n/ac	
Operating Frequency	U-NII-1 Band: 5180-5240 MHz U-NII-3 Band: 5745-5825 MHz
Type of Modulation	OFDM(BPSK/QPSK/16QAM/64QAM/256QAM)
Channel Number:	U-NII-1 Band: 4 channels for 20MHz bandwidth 2 channels for 40MHz bandwidth 1 channels for 80MHz bandwidth U-NII-3 Band: 5 channels for 20MHz bandwidth 2 channels for 40MHz bandwidth 1 channels for 80MHz bandwidth
Channel Separation	5 MHz

Table 3: RF Channel and Frequency of Wi-Fi 802.11 a/n/ac

U-NII-1 Band					
RF Channel	20MHz	RF Channel	40MHz	RF Channel	80MHz
	Frequency (MHz)		Frequency (MHz)		Frequency (MHz)
36	5180.00	38	5190.00	42	5210.00
40	5200.00	46	5230.00	/	/
44	5220.00	/	/	/	/
48	5240.00	/	/	/	/

U-NII-3 Band					
RF Channel	20MHz	RF Channel	40MHz	RF Channel	80MHz
	Frequency (MHz)		Frequency (MHz)		Frequency (MHz)
149	5745.00	151	5755.00	155	5775.00
153	5765.00	159	5795.00	/	/
157	5785.00	/	/	/	/
161	5805.00	/	/	/	/
165	5825.00	/	/	/	/

Test Channel:

CH36, CH40, CH48, CH149, CH157, CH165 for 20MHz;

CH38, CH46, CH151, CH159 for 40MHz

CH 42, CH155 for 80MHz

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Wi-Fi 802.11 a/n/ac wireless transmitting mode
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. On, Wi-Fi 802.11 a/n/ac connecting mode
- C. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- FCC/IC Label and Location Info
- User Manual
- Schematics
- PCB Layout

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

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.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013.

According to clause 3.1, all tests were performed on model EL-SC-300 in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 4: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N	Rating
Laptop	Lenovo	T480	PF-16A6N8	N/A
Portable Laptop	Lenovo	ThinkPad T480	10Q67059	N/A

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

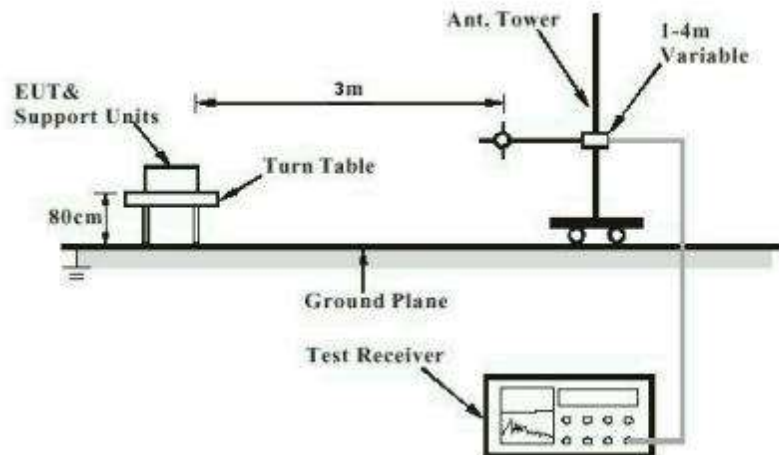


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

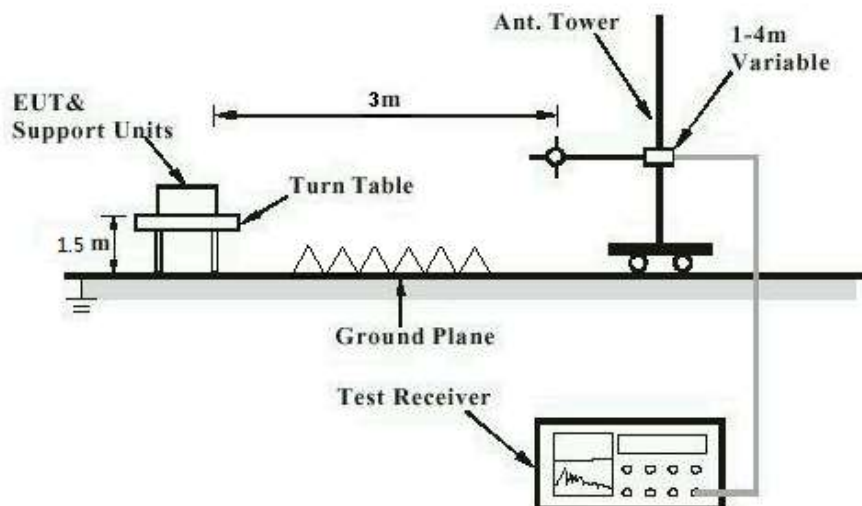


Diagram of Measurement Configuration for Mains Conduction Measurement

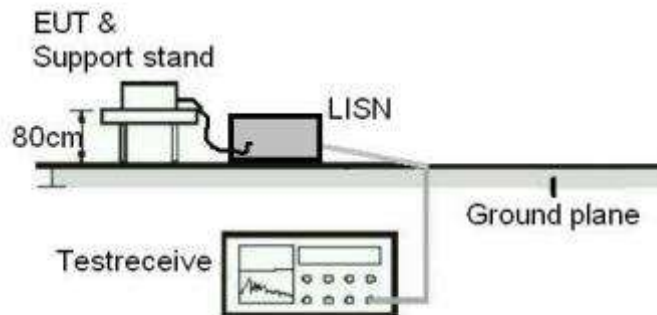
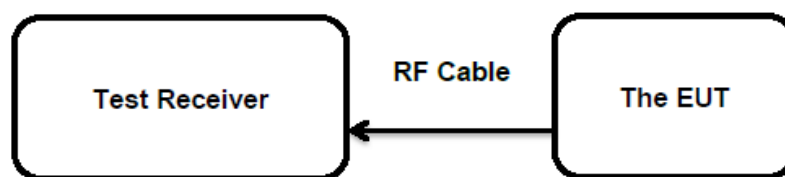


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Pass****Test Specification**

Test standard : FCC Part 15.203

According to the manufacturer declared, the EUT has an external antenna, the directional gain of antenna is 3.0 dBi and this device must be professionally installed, which does not permit use of any antenna with the transmitter; the permitted types of antenna must be specified, refer to user manual for the detail.

Therefore, the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

5.1.2 Maximum Conducted Output Power

RESULT:

Pass

Test Specification

Test standard	: FCC Part 15.407(a)(1)&(2)&(4) RSS-247 clause 6.2
Basic standard	: ANSI C63.10: 2013 FCC:
Limits	: <250mW (24dBm) (5150-5250MHz) <1W (30dBm) (5725-5850MHz) IC: * Max e.i.r.p.<200mW (23dBm) (5150-5250MHz) *200 mW (23dBm) or 10 dBm + 10 logB, where B is the 99% emission bandwidth in MHz, where is lesser. Max conducted output power <1W (30dBm) (5725-5850MHz)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-01-18 ~ 2021-01-29
Input voltage	: AC 120V@60Hz
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.9 °C
Relative humidity	: 51 %
Atmospheric pressure	: 101 kPa

For details refer to following test result.

Table 5: Test Result of Maximum Conducted Output Power, Wi-Fi 802.11 a/n/ac

Test Mode	Frequency Range (MHz)	Test Channel (MHz)	Measured Avg. Power		Limit (dBm)
			(dBm)	(W)	
802.11a	5150-5250	5180	13.84	0.0242	U-NII-1: FCC: Max conducted output power 250Mw IC: * Max e.i.r.p. 200 mW (23dBm) or 10 dBm + 10 logB, where B is the 99% emission bandwidth in MHz, where is lesser. U-NII-3: FCC& IC Max conducted output power 1W
		5200	13.11	0.0205	
		5240	14.25	0.0266	
	5725-5850	5745	9.56	0.0090	
		5785	9.41	0.0087	
		5825	9.16	0.0082	
802.11n (HT20)	5150-5250	5180	13.51	0.0224	
		5200	12.68	0.0185	
		5240	14.12	0.0258	
	5725-5850	5745	8.96	0.0079	
		5785	9.04	0.0080	
		5825	9.13	0.0082	
802.11n (HT40)	5150-5250	5190	9.95	0.0099	
		5230	12.26	0.0168	
		5755	8.89	0.0077	
	5725-5850	5795	8.96	0.0079	
		5180	12.56	0.0180	
		5200	11.85	0.0153	
802.11ac (HT20)	5150-5250	5240	13.07	0.0203	
		5745	9.31	0.0085	
		5785	9.39	0.0087	
	5725-5850	5825	9.47	0.0089	
		5190	9.94	0.0099	
		5230	12.36	0.0172	
802.11ac (HT40)	5150-5250	5755	8.86	0.0077	
		5795	8.79	0.0076	
	5725-5850	5210	9.14	0.0082	
802.11ac (HT80)	5150-5250	5775	8.58	0.0072	
Maximum Measured Value			14.25	0.0266	-

Note:

- 1) The cable loss taken into account in results.
- 2) Antenna gain(G) : **3.0** dBi.

5.1.3 Conducted Power Spectral Density

RESULT:

Pass

Test Specification

Test standard	: FCC part 15.407(a) RSS-247 clause 6.2
Basic standard	: ANSI C63.10: 2013 KDB 789033 D02 v01r03
Limits	FCC: : <11dBm/MHz (5150-5250MHz) : <30dBm/500KHz (5725-5850MHz) IC: e.i.r.p. spectral density <10dBm/MHz (5150-5250MHz) : <30dBm/500KHz (5725-5850MHz)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: Refer to test result
Input voltage	: AC 120V@60Hz
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.9 °C
Relative humidity	: 51 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B & C.

5.1.4 Frequency Stability

RESULT:**Pass****Test Specification**

Test standard : FCC Part 15.407(g)
RSS-Gen Clause 6.11
Basic standard : ANSI C63.10: 2013
Limits : Within assigned bands
Kind of test site : Shielded Room

Test Setup

Date of testing : 2021-01-18 ~ 2021-01-20
Input voltage : AC 120V@60Hz
Operation mode : A
Test channel : Low / Middle / High
Ambient temperature : 24.9 °C
Relative humidity : 51 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B & C.

5.1.5 26dB Bandwidth, 6dB Bandwidth and 99% Bandwidth**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.407(e) RSS-Gen Clause 6.6
Basic standard	: ANSI C63.10: 2013 KDB 789033 D02 v01r03
Limits	: No requirement for U-NII-1 band at least 500kHz for U-NII-3 band
Kind of test site	: Shielded Room

Test Setup

Date of testing	: Refer to test result
Input voltage	: AC 120V@60Hz
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 24.9 °C
Relative humidity	: 51 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B & C.

5.1.6 Radiated Spurious Emission

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.407(b) & FCC Part 15.205 & FCC Part 15.209 RSS-247 clause 6.2 & RSS-GEN clause 8.9 and 8.10
Basic standard	: ANSI C63.10: 2013 KDB 789033 D02 v01r03
Limits	: FCC Part 15.209(a) FCC Part 15.407(b)(7) RSS-GEN
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2020-12-12 ~ 2021-01-21
Input voltage	: AC 120V@60Hz
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: Refer to test result
Relative humidity	: Refer to test result
Atmospheric pressure	: 101 kPa

Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B & C.

5.1.7 Conducted Emission on AC Mains

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.207(a) RSS-GEN clause 8.8
Basic standard	: ANSI C63.10: 2013
Frequency range	: 0.15 – 30MHz
Limits	: FCC Part 15.207(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2021-01-19
Input voltage	: AC 120V@60Hz
Operation mode	: B
Earthing	: Not connected
Ambient temperature	: 23.1 °C
Relative humidity	: 52 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix C.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

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