ETSI EN300 328 RADIO TEST REPORT

For

Zhuhai Gotech Intelligent Technology Co., Ltd.

Door Bell

Model Number: MD7L

Additional Model: MD7LA, MD7LB, MD8L, MD8LA, MD9L

Applicant:	Zhuhai Gotech Intelligent Technology Co., Ltd.
Address:	66 Yongda Road, Hongqi Town, Jinwan District, 519090 Zhuhai, P.R.China
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
Tel: 86-769-83081888-808	

Report Number:	ESTE-R2206044
Date of Test:	May. 17~Jun. 08, 2022
Date of Report:	Jun. 13, 2022

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EST Technology Co., Ltd.

Applicant: **Address:**	Zhuhai Gotech Intelligent Technology Co., Ltd. 66 Yongda Road, Hongqi Town, Jinwan District, 519090 Zhuhai, P.R.China		
Manufacturer: **Address:**	Zhuhai Gotech Intelligent Technology Co., Ltd. 66 Yongda Road, Hongqi Town, Jinwan District, 519090 Zhuhai, P.R.China		
Factory: **Address:**	Zhuhai Gotech Intelligent Technology Co., Ltd. 2 jinliang Road, Hongqi Town, Jinwan District, Zhuhai 519090 P.R. China		
E.U.T:	Door Bell		
Model Number:	MD7L		
Additional Model:	MD7LA, MD7LB, MD8L, MD8LA, MD9L Note: They are identical except model name.		
Power Supply:	DC 3.7V From Battery; DC 5V From Adapter Input AC 100-240V, 50/60Hz		
Trade Name:	STAVIX	Serial No.:	------
Date of Receipt:	May. 17, 2022	Date of Test:	May. 17~Jun. 08, 2022
Test Specification:	ETSI EN 300 328 V2.2.2: 2019-07		
Test Result:	The device described above is tested by EST Technology Co., Ltd.. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the ETSI EN 300 328 requirements. This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd. **Date:** Jun. 13, 2022		

Prepared by:	Reviewed by:	Approved by:
Emily Cai / Assistant	Seven Wang/ Engineer	Iceman Hu / Manager

Other Aspects:
N/A

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Product Name	:	Door Bell
Model Number	:	MD7L
Software Version	:	V1.0.X.XX
Hardware Version	:	SP550C
Operation frequency	:	IEEE 802.11b/g/n HT20:2412MHz~2472MHz
Max EIRP Power	:	IEEE 802.11b: 18.242dBm IEEE 802.11g: 17.569dBm IEEE 802.11n HT20: 17.242dBm
Modulation	:	IEEE 802.11b mode: DSSS(CCK/QPSK/BPSK) IEEE 802.11g/n mode: OFDM (BPSK/QPSK/16QAM/64QAM)
Transmit Data Rate	:	IEEE 802.11b: 1/2/5.5/11Mbps IEEE 802.11g: 6/9/12/18/24/36/48/54Mbps IEEE 802.11n: up to 150Mbps
Receiver Categorization	:	☒Receiver category 1 ☐Receiver category 2 ☐Receiver category 3
Adaptive / non-adaptive	:	☐ non-adaptive Equipment ☒ adaptive Equipment without the possibility to switch to a non-adaptive mode ☐ adaptive Equipment which can also operate in a non-adaptive mode
Operating Temperature Range	:	-10℃~+50℃
Sample Type	:	Prototype production

1.2. Antenna Information

Ant No.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	-	-	Internal	-	2.0

Note: This information is provided by the applicant.

1.3. Information of RF Cable

Cable Loss(dB)	Provided by
1.0	Zhuhai Gotech Intelligent Technology Co., Ltd.
Note: 1.The customer declared the loss value of the RF Cable, and the test results of this report only apply to the sample as received. 2. This information is provided by the applicant.	

2. SUMMARY OF MEASUREMENTS AND RESULTS

Harmonized Standard EN300 328 The following essential requirements and test specifications are relevant to the presumption of conformity under Article 3.2 of the Radio Equipment Directive 2014/53/EU				
No	Test Parameter	Clause No	Condition	Results
1	RF Output Power	4.3.1.2 or 4.3.2.2	Apply all equipment	PASS
2	Power Spectral Density	4.3.2.3	Only for non-FHSS equipment	PASS
3	Duty Cycle ,Tx-Sequence, Tx-gap	4.3.1.3 or 4.3.2.4	Only for non-Adaptive equipment	N/A
4	Accumulated Transmit Time, Frequency Occupation & Hopping Sequence	4.3.1.4	Only for FHSS equipment	N/A
5	Hopping Frequency Separation	4.3.1.5	Only for FHSS equipment	N/A
6	Medium Utilization	4.3.1.6 or 4.3.2.5	Only for non-Adaptive equipment	N/A
7	Adaptivity	4.3.1.7 or 4.3.2.6	Only for Adaptive equipment	PASS
8	Occupied Channel Bandwidth	4.3.1.8 or 4.3.2.7	Apply all equipment	PASS
9	Transmitter unwanted emissions in the OOB domain	4.3.1.9 or 4.3.2.8	Apply all equipment	PASS
10	Transmitter unwanted emissions in the spurious domain	4.3.1.10 or 4.3.2.9	Apply all equipment	PASS
11	Receiver spurious emissions	4.3.1.11 or 4.3.2.10	Apply all equipment	PASS
12	Receiver Blocking	4.3.1.12 or 4.3.2.11	Apply all equipment	PASS
13	Geo-location capability	4.3.1.13 or 4.3.2.12	Only for equipment with geo-location capability	N/A
Note: N/A is an abbreviation for Not Applicable and means this test item is not applicable for this device according to the technology characteristic of device.				

2.1. Test Facilities

EMC Lab : Certificated by CNAS, CHINA
Registration No.: L5288
This Certificate is valid until: November 12, 2023

Certificated by FCC, USA
Designation Number: CN1215
This Certificate is valid until: January 31, 2024

Certificated by A2LA, USA
Registration No.: 4366.01
This Certificate is valid until: January 31, 2024

Certificated by Industry Canada
CAB identifier No.: CN0035
This Certificate is valid until: January 31, 2024

Certificated by VCCI, Japan
Registration No.:C-14103; T-20073; R-13663;
R-20103; G-20097
Date of registration: Apr. 20, 2020
This Certificate is valid until: Apr. 19, 2023

Certificated by TUV Rheinland, Germany
Registration No.: UA 50413872 0001
Date of registration: July 31, 2018

Certificated by Intertek
Registration No.: 2011-RTL-L2-64
Date of registration: November 08, 2018

Name of Firm : EST Technology Co., Ltd.

Site Location : Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China

2.2. Measurement Uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	±3.48dB
Uncertainty for spurious emissions test (30MHz-1GHz)	±4.60 dB(Polarize: H)
	±4.68 dB(Polarize: V)
Uncertainty for spurious emissions test (1GHz to 18GHz)	±4.96dB
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	1.08dB
Uncertainty for Power density test	0.26dB

Note：

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

2.3. Assistant Equipment Used For Test

Item	Equipment	Brand	Model Name/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
-	-	-	-	-

2.4. Block Diagram of Test Setup

For radiated emissions test: EUT was placed on a turn table, which is 1.5 meter high above ground. EUT was beset into 2.4G WIFI test mode by software before test.

EUT

DC 3.7V

(EUT: Door Bell)

2.5. Test Mode

The test mode was selected for the final test as listed below.

Test Item	Test Mode	Date Rate	Test Channel
RF Output Power	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High
Power Spectral Density	IEEE 802.11b	1Mbps	Low/Middle/High
	IEEE 802.11g	6Mbps	Low/Middle/High
	IEEE 802.11n HT20	MCS0	Low/Middle/High
Adaptivity	IEEE 802.11b	11Mbps	Low/High
	IEEE 802.11g	54Mbps	Low/High
	IEEE 802.11n HT20	MCS0	Low/High
Occupied Channel Bandwidth	IEEE 802.11b	1Mbps	Low/ High
	IEEE 802.11g	6Mbps	Low/ High
	IEEE 802.11n HT20	MCS0	Low/ High
Transmitter unwanted emissions in the OOB domain	IEEE 802.11b	1Mbps	Low/ High
	IEEE 802.11g	6Mbps	Low/ High
	IEEE 802.11n HT20	MCS0	Low/ High
Transmitter unwanted emissions in the spurious domain	IEEE 802.11b	1Mbps	Low/ High
	IEEE 802.11g	6Mbps	Low/ High
	IEEE 802.11n HT20	MCS0	Low/ High
Receiver Spurious Emissions	Receive	-	-
Receiver Blocking	IEEE 802.11b	1Mbps	Low/ High

Note:

1. In radiated measurement,the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on **X-plane.**

2.6. Power Setting of Test Software

Software Name	Hi3861-sscom5.13.1		
Frequency(MHz)	2412	2442	2472
IEEE 802.11b Setting	Default	Default	Default
IEEE 802.11g Setting	Default	Default	Default
IEEE 802.11n HT20 Setting	Default	Default	Default

Note: This information is provided by the applicant.

2.7. Channel List

IEEE 802.11b/802.11g/802.11n HT20					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	6	2437	11	2462
2	2417	7	2442	12	2467
3	2422	8	2447	13	2472
4	2427	9	2452		
5	2432	10	2457		

2.8. Test Equipment List

For Connect EUT Antenna Terminal Test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
TS 8997	Rohde &Schwarz	/	/		/	/
Open Switch and Control Unit	Rohde &Schwarz	OSP-B157WB	EST-E036	LISAI	June 13,21	1 Year
Signal and Spectrum Analyzer	Rohde &Schwarz	FSV	EST-E037	LISAI	June 13,21	1 Year
Signal Generator	Rohde &Schwarz	SMB100A	EST-E038	LISAI	June 13,21	1 Year
Vector Signal Generator	Rohde &Schwarz	SMBV100A	EST-E039	LISAI	June 13,21	1Year
Test Software	Rohde &Schwarz	WMS32	V10.50.00	LISAI	/	/
Wireless Connectivity Tester	Rohde &Schwarz	CMW 270	EST-E050	LISAI	June 13,21	1Year
Temperature controller	GAOXIN	GX-3030-3A	EST-E101	LISAI	June 13,21	1 Year

For Radiated Emissions Test (30MHz-1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	June 13,21	1 Year
Bilog Antenna	Teseq	CBL 6111D	EST-E034	LISAI	June 13,21	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
30-1000MHz Cable	N/A	EST-002	N/A	N/A	N/A	N/A

For Radiated Emission Test(Above 1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
Horn Antenna	SCHWARZBECK	BBHA9120D	EST-E031	LISAI	June 13,21	1 Year
Signal Amplifier	SCHWARZBECK	BBV9718	EST-E032	LISAI	June 13,21	1 Year
Spectrum Analyzer	Rohde &Schwarz	FSV40	EST-E069	LISAI	July 19,21	1 Year
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
Above 1GHz Cable	N/A	EST-003	N/A	N/A	N/A	N/A

3. RF OUTPUT POWER

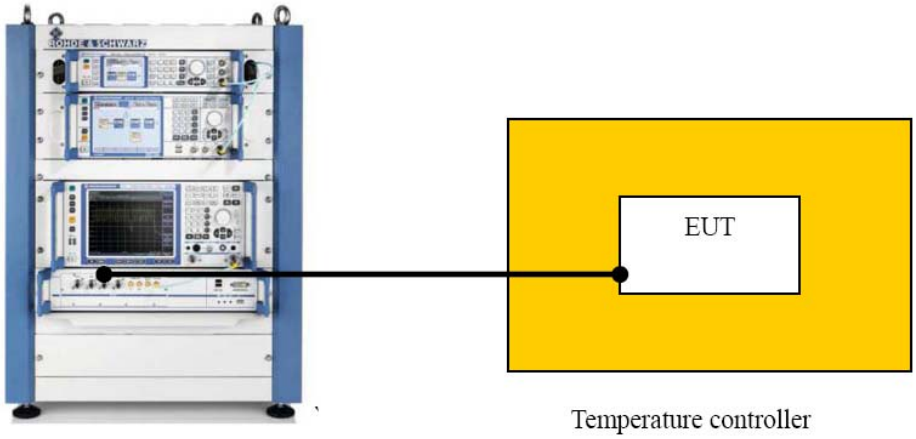
3.1. Applicability

This requirement applies to all types of non-FHSS equipment.

3.2. Limit

The RF output power for non-FHSS equipment shall be equal to or less than 20 dBm.

3.3. Test Setup



3.4. Test Procedure

a. Turn the EUT OFF and place it inside the environmental temperature chamber.
b. Connected antenna port of the EUT to the OSP of TS 8997 system.
c. Set the EUT transmit continuously with maximum output power.
d. The measurement procedure refer to clause 5.4.2.2.1.2 of ETSI EN300 328 V2.2.2.
e. Repeat step a to step c until all modes and channels were measured.
f. Repeat step a to step d until normal environmental conditions and at the extremes of the operating temperature range were measured.
g. Record the results in the test report.

3.5. Test Conditions

Temperature	24.1℃	Relative Humidity	50%	Test Voltage	DC 3.7V

3.6. Test Result

IEEE 802.11b					
Test Conditions		Frequency (MHz)	Max EIRP (dBm)	Limit (dBm)	Result
T_{nor}(℃)	24.1	2412	17.492	20	Pass
		2442	17.730		Pass
		2472	18.242		Pass
T_{min}(℃)	-10.0	2412	17.480		Pass
		2442	17.715		Pass
		2472	18.238		Pass
T_{max}(℃)	50.0	2412	17.454		Pass
		2442	17.711		Pass
		2472	18.216		Pass

IEEE 802.11g					
Test Conditions		Frequency (MHz)	Max EIRP (dBm)	Limit (dBm)	Result
T_{nor}(℃)	24.1	2412	16.366	20	Pass
		2442	17.554		Pass
		2472	17.569		Pass
T_{min}(℃)	-10.0	2412	16.372		Pass
		2442	17.429		Pass
		2472	17.550		Pass
T_{max}(℃)	50.0	2412	16.361		Pass
		2442	17.413		Pass
		2472	17.535		Pass

IEEE 802.11n HT20					
Test Conditions		Frequency (MHz)	Max EIRP (dBm)	Limit (dBm)	Result
T_{nor}(℃)	24.1	2412	16.627	20	Pass
		2442	16.698		Pass
		2472	17.239		Pass
T_{min}(℃)	-10.0	2412	16.631		Pass
		2442	16.700		Pass
		2472	17.242		Pass
T_{max}(℃)	50.0	2412	16.632		Pass
		2442	16.705		Pass
		2472	17.237		Pass

4. POWER SPECTRAL DENSITY

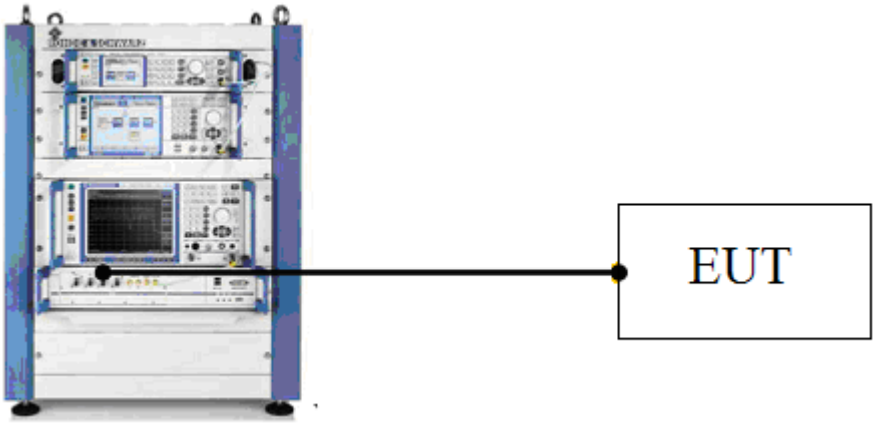
4.1. Applicability

This requirement applies to all types of non-FHSS equipment.

4.2. Limit

The maximum Power Spectral Density for non-FHSS equipment is 10 dBm per MHz.

4.3. Test Setup



4.4. Test Procedure

a. Connected antenna port of the EUT to the OSP of TS 8997 system.
b. Set the EUT transmit continuously with maximum output power.
c. The measurement procedure refer to clause 5.4.3.2.1 of ETSI EN300 328 V2.2.2.
d. Repeat step a to step c until all modes and channels were measured.
e. Record the results in the test report.

4.5. Test Conditions

Temperature	24.1℃	Relative Humidity	50%	Test Voltage	DC 3.7V

4.6. Test Result

Test Mode	Frequency (MHz)	EIRP Spectral Density (dBm/MHz)	EIRP Limit (dBm/MHz)	Result
IEEE 802.11b	2412	8.43	10	Pass
	2442	8.65		Pass
	2472	9.15		Pass
IEEE 802.11g	2412	4.61		Pass
	2442	5.99		Pass
	2472	5.87		Pass
IEEE 802.11n HT20	2412	4.79		Pass
	2442	4.96		Pass
	2472	5.36		Pass

5. ADAPTIVITY

5.1. Applicability

This requirement does not apply to non-adaptive non-FHSS equipment or adaptive non-FHSS equipment operating in a non-adaptive mode.
In addition, this requirement does not apply for non-FHSS equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for non-FHSS equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.
Adaptive non-FHSS equipment uses a mechanism by which it can adapt to its radio environment by identifying other transmissions present within its Occupied Channel Bandwidth.
Adaptive non-FHSS equipment shall implement either of the mechanisms DAA or LBT.
Adaptive non-FHSS equipment is allowed to switch dynamically between different adaptive modes.

5.2. Limit

5.2.1. Adaptive non-FHSS using DAA

Adaptive non-FHSS equipment using DAA shall comply with the following minimum set of requirements:

1) During normal operation, the equipment shall evaluate the presence of a signal on its current operating channel. If it is determined that a signal is present with a level above the detection threshold defined in step 5 the channel shall be marked as 'unavailable'.
2) The channel shall remain unavailable for a minimum time equal to 1 s after which the channel may be considered again as an 'available' channel.
3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time.
4) The Channel Occupancy Time shall be less than 40 ms. Each such transmission sequence shall be followed by an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Time with a minimum of 100 µs. After this, the procedure as in step 1 needs to be repeated.
5) The detection threshold shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to:

$$TL=-70dBm/MHz+10\times\log10(100mW/Pout)\ (Pout\ in\ mW\ e.i.r.p.)$$

6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in as follow.

Unwanted Signal parameters		
Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
-30	2 395 or 2 488,5 (see note 1)	-35 (see note 2)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. NOTE 2: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

5.2.2. Adaptive non-FHSS using LBT

Frame Based Equipment

Frame Based Equipment shall comply with the following requirements:

1) Before transmission, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.
2) If the equipment finds the channel occupied, it shall not transmit on this channel during the next Fixed Frame Period. The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. See clause 4.3.2.6.1. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.
3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be in the range 1 ms to 10 ms followed by an Idle Period of at least 5 % of the Channel Occupancy Time used in the equipment for the current Fixed Frame Period. See figure 2 below.
4) An equipment, upon correct reception of a packet which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). A consecutive sequence of such transmissions by the equipment without a new CCA shall not exceed the maximum Channel Occupancy Time. For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence.
5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to:

$$TL = -70 \text{ dBm/MHz} + 10 \times \log 10 (100 \text{ mW} / \text{Pout}) \text{ (Pout in mW e.i.r.p.)}$$

6) The equipment shall comply with the requirements defined in step 1 to step 4 in the present clause in the presence of an unwanted CW signal as defined in table as follow.

Unwanted Signal parameters		
Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 2)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

Load Based Equipment

Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect as described in IEEE 802.11™-2012 [i.3], clause 9, clause 10, clause 16, clause 17, clause 19 and clause 20, or in IEEE 802.15.4™-2011 [i.4], clause 4, clause 5 and clause 8 providing the equipment complies with the conformance requirements referred to in clause 4.3.2.6.3.4. Load Based Equipment not using any of the mechanisms referenced above shall comply with the following minimum set of requirements:

1) Before a transmission or a burst of transmissions, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.
2) If the equipment finds the channel occupied, it shall not transmit on this channel (see also the next paragraph). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 µs and at least 160 µs. If the extended CCA check has determined the channel to be no longer occupied, the equipment may resume transmissions on this channel. If the Extended CCA time has determined the channel still to be occupied, it shall perform new Extended CCA checks until the channel is no longer occupied.
   NOTE: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check as there are no transmissions during this period.
   The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.
3) The total time that an equipment makes use of a RF channel is defined as the Channel Occupancy Time. This Channel Occupancy Time shall be less than 13 ms, after which the device shall perform a new CCA as described in step 1 above.
4) The equipment, upon correct reception of a packet which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). A consecutive sequence of transmissions by the equipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3 above.
   For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence.
5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the CCA threshold level may be relaxed to:

   $$TL = -70 \text{ dBm/MHz} + 10 \times \log 10 (100 \text{ mW} / \text{Pout}) \text{ (Pout in mW e.i.r.p.)}$$

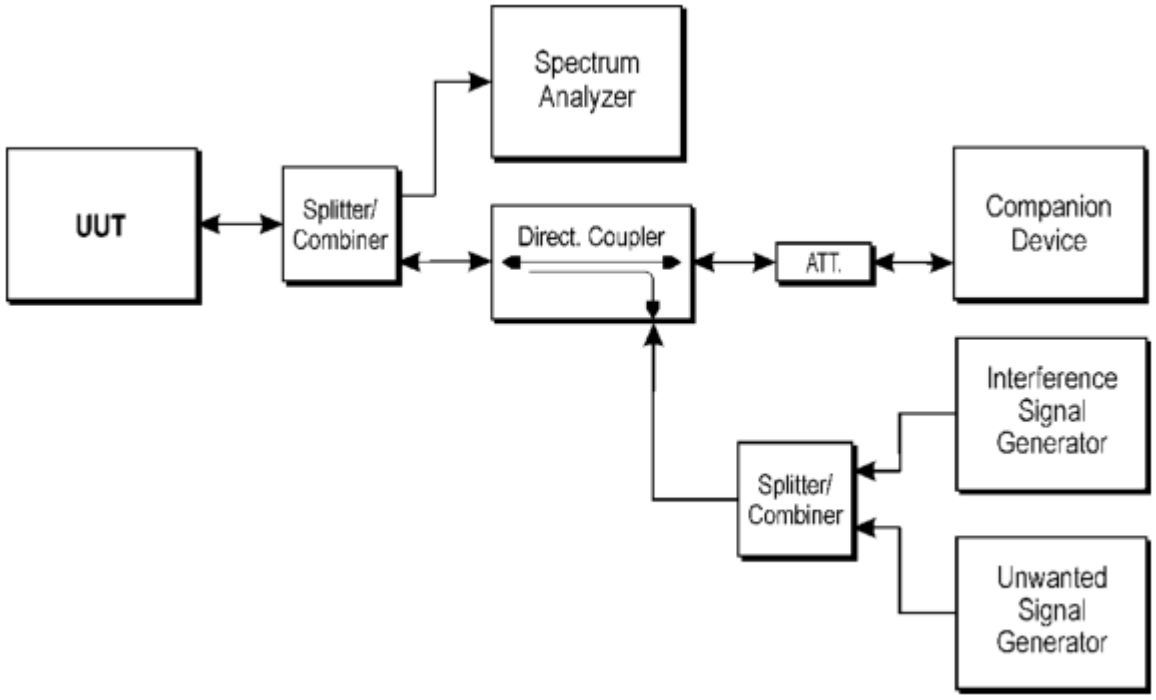
6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in table as follow.

Unwanted Signal parameters		
Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 2)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

5.2.3. Short Control Signalling Transmissions

If implemented, Short Control Signalling Transmissions of adaptive equipment using wide band modulations other than FHSS shall have a maximum TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms.

5.3. Test Setup



5.4. Test Procedure

a. Connected antenna port of the EUT to the OSP of TS 8997 system.
b. The measurement procedure refer to clause 5.4.6.2.1.4 of ETSI EN300 328 V2.2.2.
c. Repeat step a to step c until all modes and channels were measured.
d. Record the results in the test report.

5.5. Test Conditions

Temperature	24.1℃	Relative Humidity	50%	Test Voltage	DC 3.7V

5.6. Test Result

EUT operation Mode	☐ Frame Based Equipment
	☒ Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect
	☐ Load Based Equipment not using any of the mechanisms referenced above

Adaptivity Detection Threshold		
Test Mode	Frequency (MHz)	Detection Threshold Level (dBm/MHz)
IEEE 802.11b	2412	-67.49
	2472	-68.24
IEEE 802.11g	2412	-66.37
	2472	-67.57
IEEE 802.11n HT20	2412	-66.63
	2472	-67.24
TL = -70 dBm/MHz + 10 × log 10 (100 mW / Pout) (Pout in mW e.i.r.p.)		

Test Mode	Frequency (MHz)	CCA (us)	COT (ms)	CCA Limit (us)	COT Limit (ms)	Result
IEEE 802.11b	2412	18.00	1.89	≥18	≤13	Pass
	2472	18.00	1.89	≥18	≤13	Pass
IEEE 802.11g	2412	18.00	1.89	≥18	≤13	Pass
	2472	18.00	1.89	≥18	≤13	Pass
IEEE 802.11n HT20	2412	18.00	2.70	≥18	≤13	Pass
	2472	18.00	3.36	≥18	≤13	Pass

Adaptivity And Short Control Signalling Transmissions					
Test Mode	Frequency (MHz)	Adaptivity	SCST (%)	SCST Limit (%)	Result
IEEE 802.11b	2412	Pass	3.07	≤10	Pass
	2472	Pass	2.85	≤10	Pass
IEEE 802.11g	2412	Pass	0.61	≤10	Pass
	2472	Pass	2.61	≤10	Pass
IEEE 802.11n HT20	2412	Pass	5.91	≤10	Pass
	2472	Pass	1.88	≤10	Pass

6. OCCUPIED CHANNEL BANDWIDTH

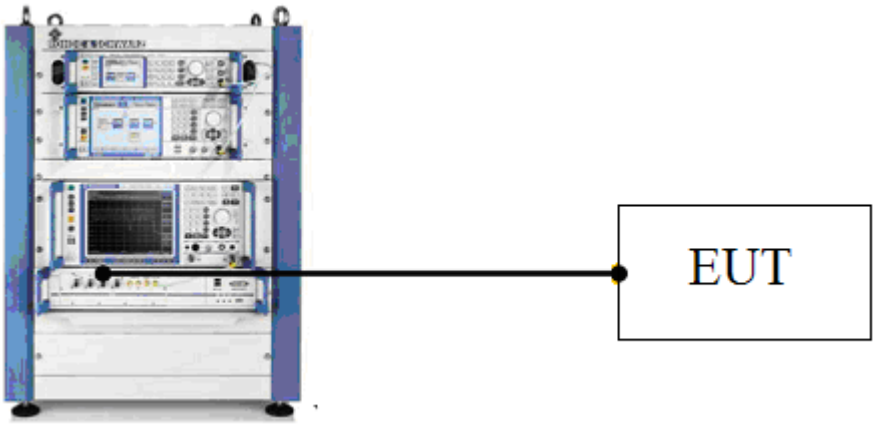
6.1. Applicability

This requirement applies to all types of non-FHSS equipment.

6.2. Limit

The Occupied Channel Bandwidth shall fall completely within 2400MHz to 2483.5MHz. In addition, for non-adaptive non-FHSS equipment with e.i.r.p. greater than 10 dBm, the Occupied Channel Bandwidth shall be equal to or less than 20 MHz.

6.3. Test Setup



6.4. Test Procedure

a. Connected antenna port of the EUT to the OSP of TS 8997 system.
b. Set the EUT transmit continuously with maximum output power.
c. The measurement procedure refer to clause 5.4.7.2.1 of ETSI EN300 328 V2.2.2.
d. Repeat step a to step c until all modes and channels were measured.
e. Record the results in the test report.

6.5. Test Conditions

Temperature	24.1℃	Relative Humidity	50%	Test Voltage	DC 3.7V

6.6. Test Result

Test Mode	Frequency (MHz)	Occupied Channel Bandwidth (MHz)	Lower Band Edge (MHz)	Upper Band Edge (MHz)	Limit (MHz)	Result
IEEE 802.11b	2412	11.43	2406.29	-	F_L＞2400	Pass
	2472	11.43	-	2477.71	F_H＜2483.5	Pass
IEEE 802.11g	2412	16.65	2403.80	-	F_L＞2400	Pass
	2472	16.65	-	2480.45	F_H＜2483.5	Pass
IEEE 802.11n HT20	2412	17.89	2403.06	-	F_L＞2400	Pass
	2472	17.89	-	2480.94	F_H＜2483.5	Pass

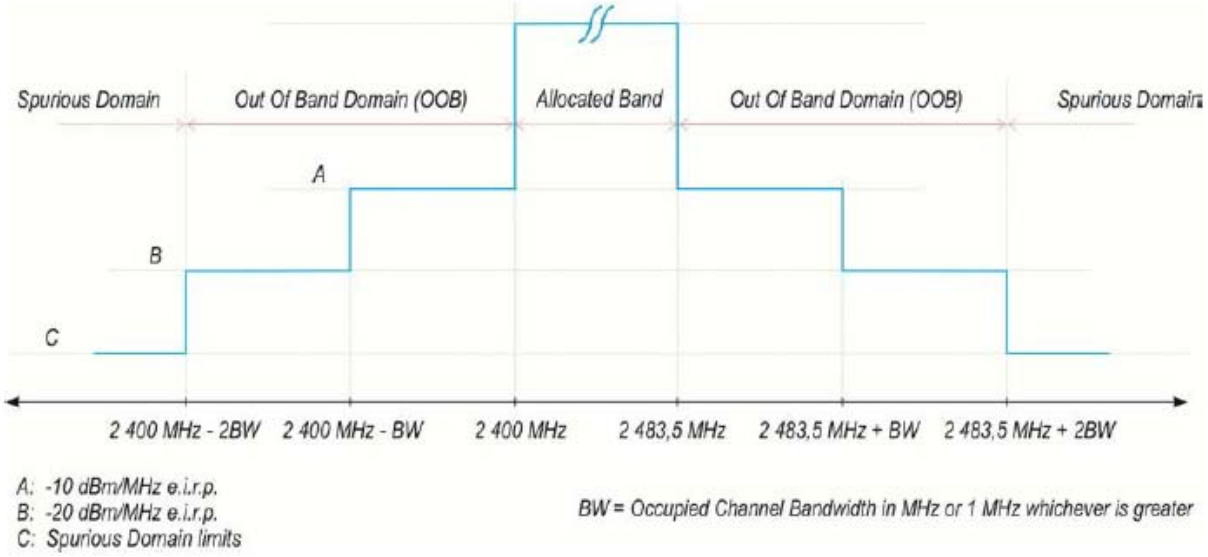
7. TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

7.1. Applicability

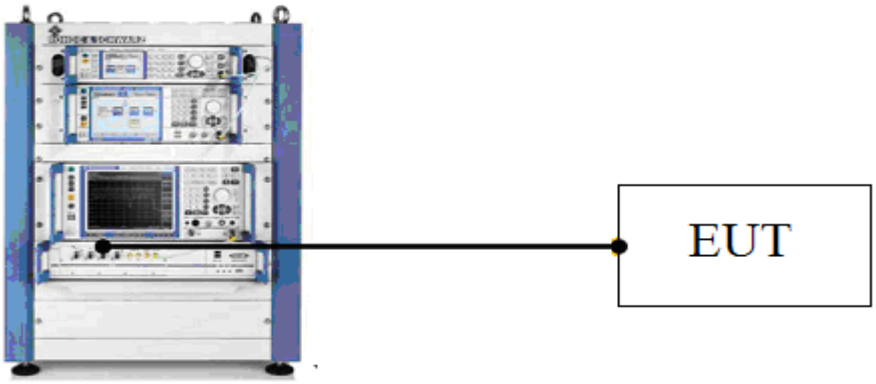
This requirement applies to all types of non-FHSS equipment.

7.2. Limit

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in the following figure.



7.3. Test Setup



7.4. Test Procedure

a. Connected antenna port of the EUT to the OSP of TS 8997 system.
b. Set the EUT transmit continuously with maximum output power.
c. The measurement procedure refer to clause 5.4.8.2.1 of ETSI EN300 328 V2.2.2.
d. Repeat step a to step c until all modes and channels were measured.
e. Record the results in the test report.

7.5. Test Conditions

Temperature	24.1℃	Relative Humidity	50%	Test Voltage	DC 3.7V

7.6. Test Result

Test Mode	Frequency (MHz)	Test Range (MHz)	Emission Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Result
IEEE 802.11b	2412	2400-2×BW~2400-BW	2373.50	-47.10	-20	Pass
		2400-BW~2400	2399.50	-39.30	-10	Pass
		2483.5~2483.5+BW	2492.00	-47.40	-10	Pass
		2483.5+BW~2483.5+2×BW	2508.00	-46.80	-20	Pass
	2472	2400-2×BW~2400-BW	2376.50	-47.90	-20	Pass
		2400-BW~2400	2388.50	-47.90	-10	Pass
		2483.5~2483.5+BW	2484.00	-45.10	-10	Pass
		2483.5+BW~2483.5+2×BW	2510.00	-45.90	-20	Pass

Note：

Only the worst case emission frequency and level in each test range were recorded.

8. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

8.1. Applicability

This requirement applies to all types of non-FHSS equipment.

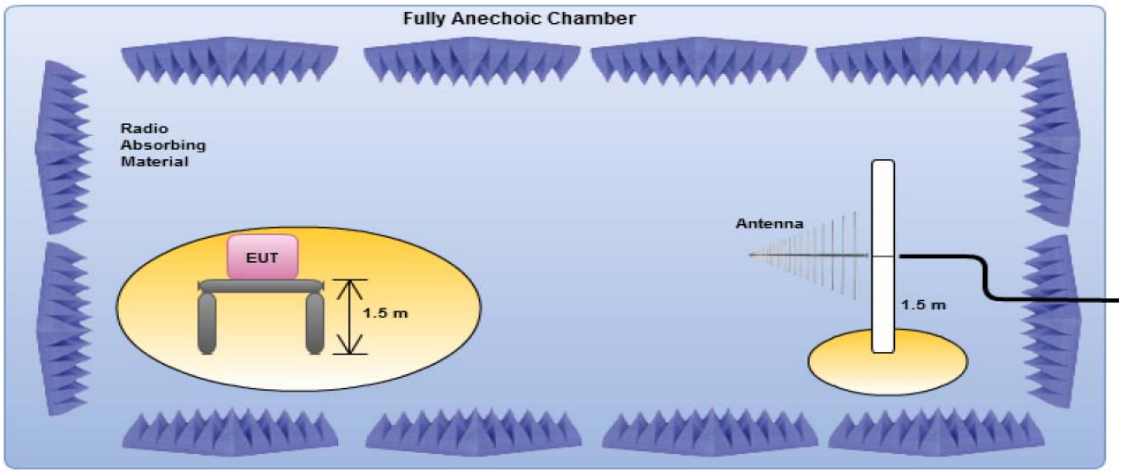
8.2. Limit

Frequency Range	Maximum Power	Bandwidth
30MHz to 47MHz	-36dBm	100kHz
47MHz to 74MHz	-54dBm	100kHz
74MHz to 87,5MHz	-36dBm	100kHz
87,5MHz to 118MHz	-54dBm	100kHz
118MHz to 174MHz	-36dBm	100kHz
174MHz to 230MHz	-54dBm	100kHz
230MHz to 470MHz	-36dBm	100kHz
470MHz to 694MHz	-54dBm	100kHz
694MHz to 1GHz	-36dBm	100kHz
1GHz to 12,75GHz	-30dBm	1MHz

Note:

These limits are e.i.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

8.3. Test Setup



8.4. Test Procedure

a. EUT was placed on a turn table, which is 1.5 meter high above ground.
b. Test Antenna is set 3 meters away from the EUT,which is connect to a spectrum analyzer.
c. Set the EUT transmit continuously with maximum output power.
d. The measurement procedure refer to clause 5.4.9.2.2 of ETSI EN300 328 V2.2.2.
e. Repeat step a to step c until all modes and channels were measured.
f. Record the results in the test report.

8.5. Test Conditions

30MHz to 1GHz					
Temperature	23.1℃	Relative Humidity	52%	Test Voltage	AC 230V/50Hz
Above 1GHz					
Temperature	22.8℃	Relative Humidity	53%	Test Voltage	AC 230V/50Hz

8.6. Test Result

30MHz to 1GHz					
Test Mode	Spurious Emissions Frequency (MHz)	Spurious Emissions Level (dBm)	Limit (dBm)	Result	Antenna Pole (H/V)
TX Mode	105.66	-79.24	-54.00	Pass	H
	100.81	-73.78	-54.00	Pass	V

Note:
1. “H” mean is horizontal direction, “V” mean is vertical direction.
2. The worst case has recorded in the report.

Above 1GHz						
Test Mode	Test Frequency (MHz)	Spurious Emissions Frequency (MHz)	Spurious Emissions Level (dBm)	Limit (dBm)	Result	Antenna Pole (H/V)
IEEE 802.11g	2412	4824.00	-51.27	-30.00	Pass	H
		7236.00	-50.94	-30.00	Pass	H
		4824.00	-54.26	-30.00	Pass	V
		7236.00	-52.40	-30.00	Pass	V
	2472	4944.00	-56.18	-30.00	Pass	H
		7416.00	-51.97	-30.00	Pass	H
		4944.00	-49.85	-30.00	Pass	V
		7416.00	-52.29	-30.00	Pass	V

Note:
1. “H” mean is horizontal direction, “V” mean is vertical direction.
2. The worst case has recorded in the report.

9. RECEIVER SPURIOUS EMISSIONS

9.1. Applicability

This requirement applies to all types of non-FHSS equipment.

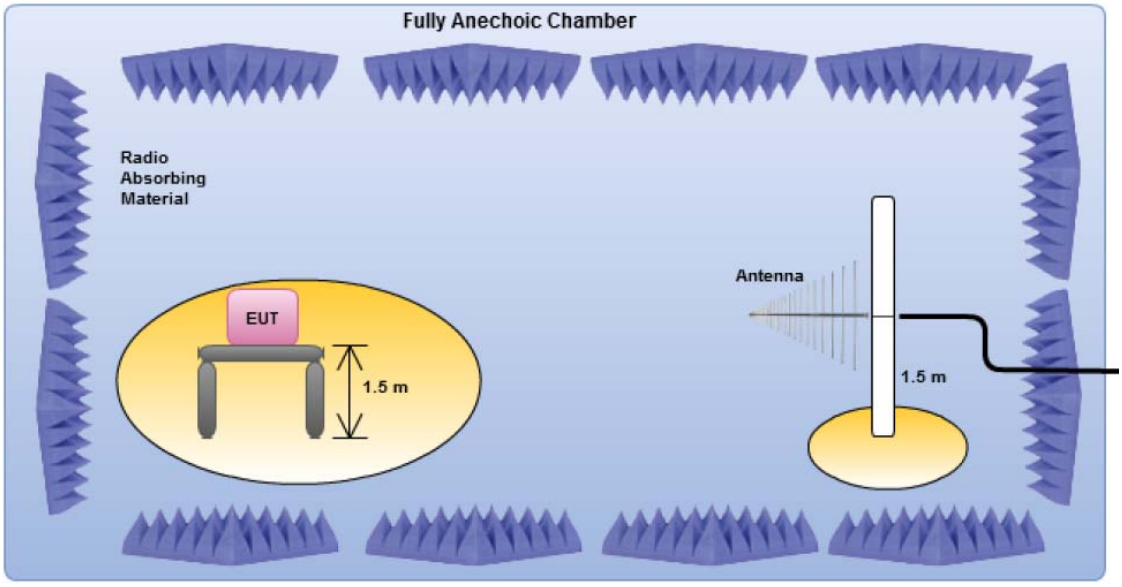
9.2. Limit

Frequency Range	Maximum Power	Bandwidth
30MHz to 1GHz	-57dBm	100kHz
1GHz to 12,75GHz	-47dBm	1MHz

Note:

These limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

9.3. Test Setup



9.4. Test Procedure

a. EUT was placed on a turn table, which is 1.5 meter high above ground.
b. Test Antenna is set 3 meters away from the EUT,which is connect to a spectrum analyzer.
c. Set the EUT transmit to receive mode.
d. The measurement procedure refer to clause 5.4.10.2.2 of ETSI EN300 328 V2.2.2.
e. Repeat above procedures until all modes and channels were measured.
f. Record the results in the test report.

9.5. Test Conditions

30MHz to 1GHz					
Temperature	23.1℃	Relative Humidity	52%	Test Voltage	AC 230V/50Hz
Above 1GHz					
Temperature	22.8℃	Relative Humidity	53%	Test Voltage	AC 230V/50Hz

9.6. Test Result

Test Mode	Spurious Emissions Frequency (MHz)	Spurious Emissions Level (dBm)	Limit (dBm)	Result	Antenna Pole (H/V)
RX Mode	30.00	-70.87	-57	Pass	H
	12515.00	-51.82	-47	Pass	H
	30.00	-68.27	-57	Pass	V
	12526.75	-52.41	-47	Pass	V

Note:

1. “H” mean is horizontal direction, “V” mean is vertical direction.
2. The worst case has recorded in the report.

10. RECEIVER BLOCKING

10.1. Applicability

This requirement applies to all types of non-FHSS equipment.

10.2. Limit

For equipment that supports a PER or FER test to be performed, the minimum performance criterion shall be a PER or FER less than or equal to 10 %.
For equipment that does not support a PER or a FER test to be performed, the minimum performance criterion shall be no loss of the wireless transmission function needed for the intended use of the equipment.
The blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category as follows.

Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	**Blocking Signal frequency (MHz)**	**Blocking signal power (dBm) (see note 4)**	**Type of blocking signal**
(-133dBm+10 × $\log_{10}$(OCBW)) or -68dBm whichever is less (see note 2)	2380 2504	-34	CW
(-139dBm+10 × $\log_{10}$(OCBW)) or -74dBm whichever is less (see note 3)	2300 2330 2360 2524 2584 2674		
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 20 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

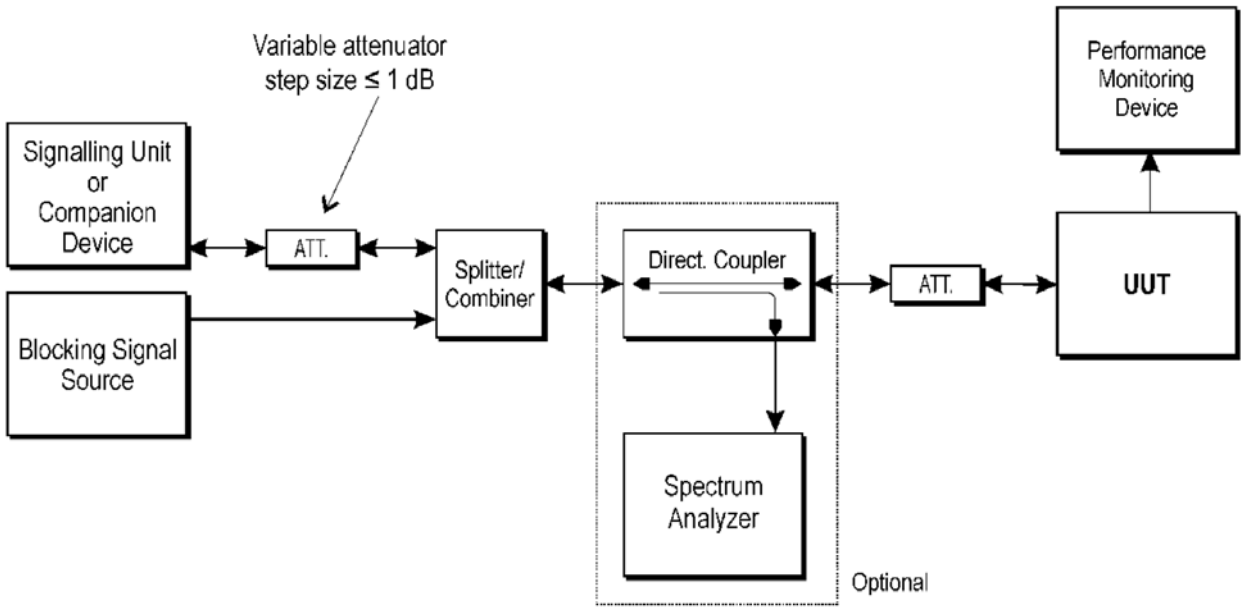
Receiver Blocking parameters for Receiver Category 2 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking Signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139dBm+10 × $\log_{10}$(OCBW)+10dBm) or (-74dBm+10dBm) whichever is less (see note 2)	2380 2504 2300 2584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

Receiver Blocking parameters for Receiver Category 3 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking Signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139dBm+10 × $\log_{10}$(OCBW)+20dBm) or (-74dBm+20dBm) whichever is less (see note 2)	2380 2504 2300 2584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 30 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

10.3. Test Setup



10.4. Test Procedure

a. Connected antenna port of the EUT to the OSP of TS 8997 system.
b. The measurement procedure refer to clause 5.4.11.2 of ETSI EN300 328 V2.2.2.
c. Repeat step b with the EUT operating at the lowest and highest channel on normal mode,record the result.

10.5. Test Conditions

Temperature	24.1℃	Relative Humidity	50%	Test Voltage	DC 3.7V

10.6. Test Result

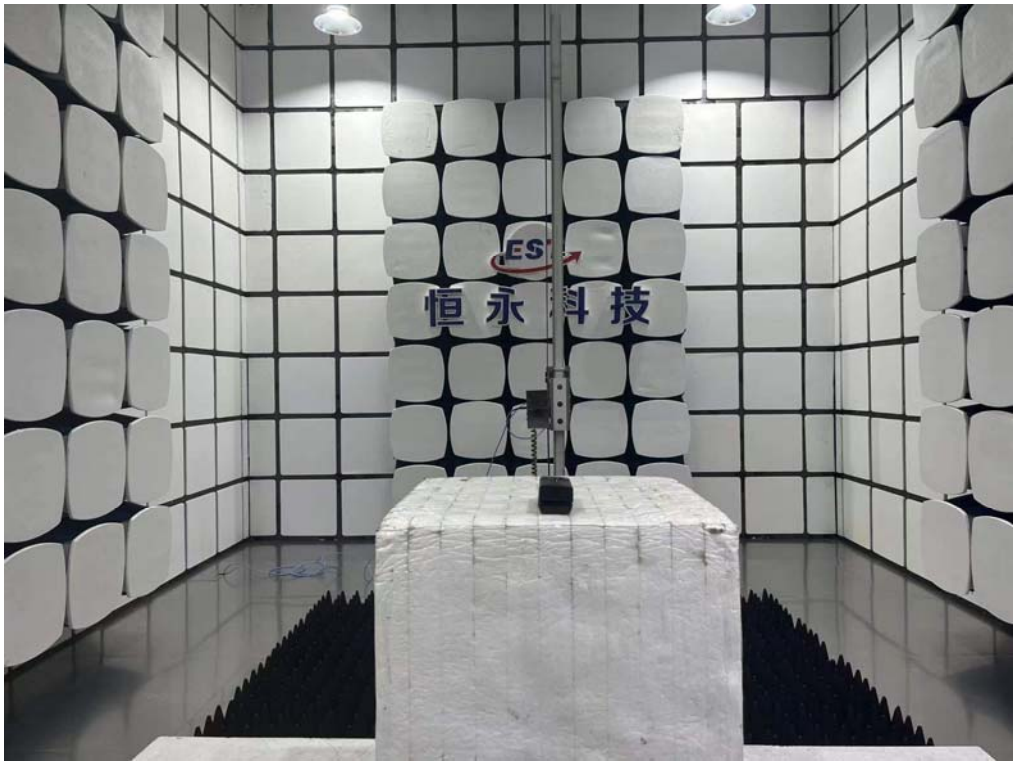
Recevier Category 1							
Test Mode	Frequency (MHz)	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	PER (%)	Limit (%)	Result
IEEE 802.11b	2412	-68	2380	-34	2.40	10.00	Pass
		-74	2300		3.40	10.00	Pass
			2330		2.70	10.00	Pass
			2360		1.80	10.00	Pass
	2472	-68	2504		6.50	10.00	Pass
		-74	2524		4.30	10.00	Pass
			2584		3.30	10.00	Pass
			2674		5.40	10.00	Pass

11. PHOTOGRAPHS OF TEST SETUP

11.1. Setup for Transmitter & Receiver Spurious Emissions

Below 1GHz

Above 1GHz



11.2. Setup for Radio Spectrum Testing

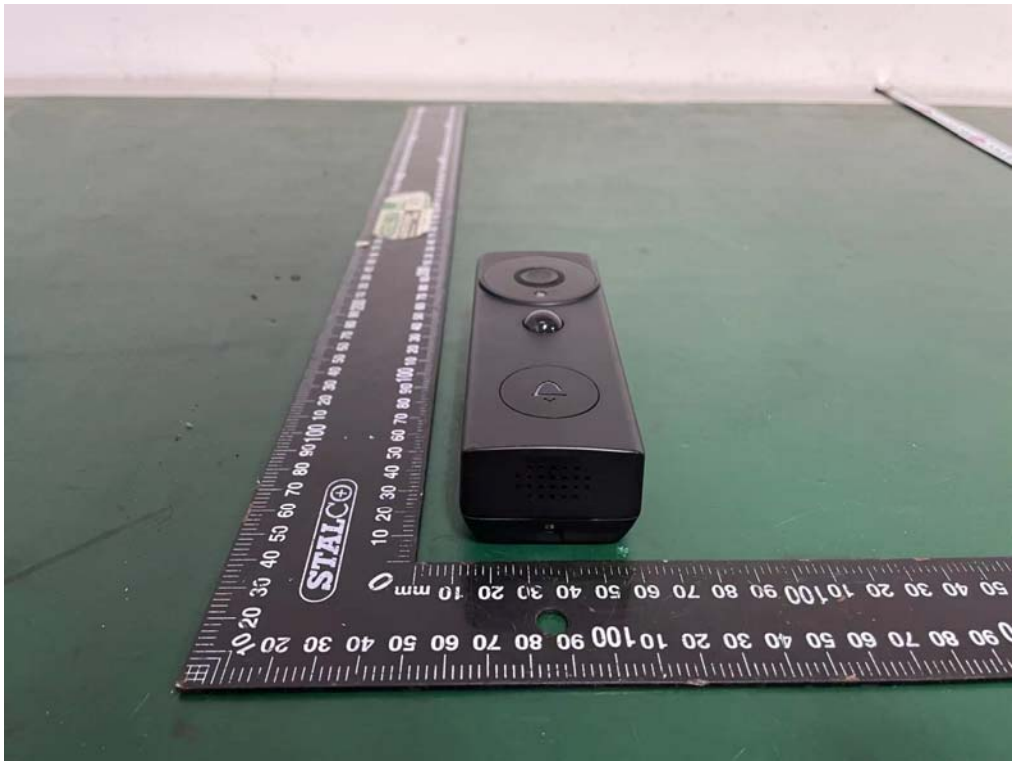
12. EUT PHOTO

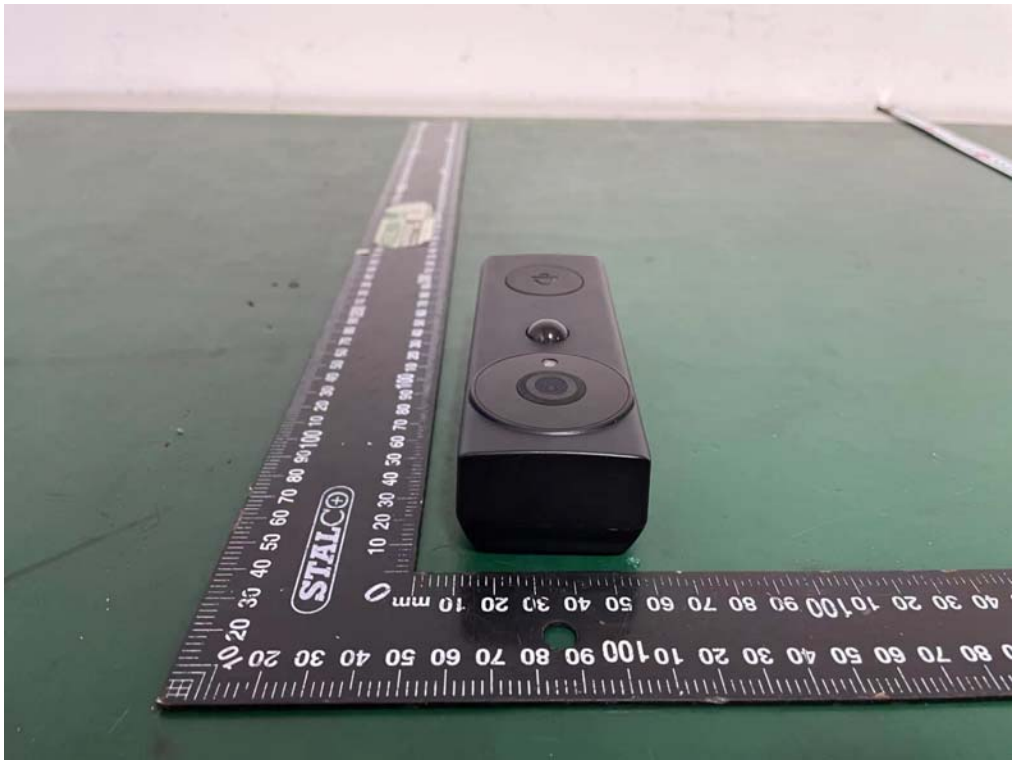
External Photos

M/N: MD7L

External Photos

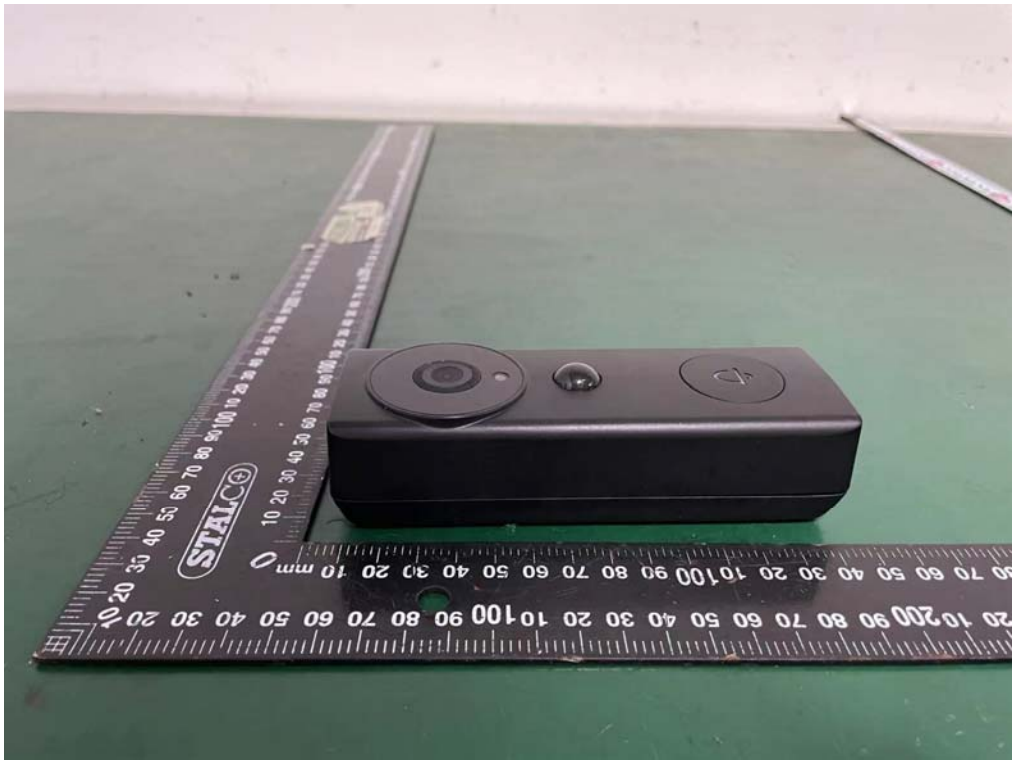
M/N: MD7L





External Photos

M/N: MD7L



External Photos

M/N: MD7L

External Photos

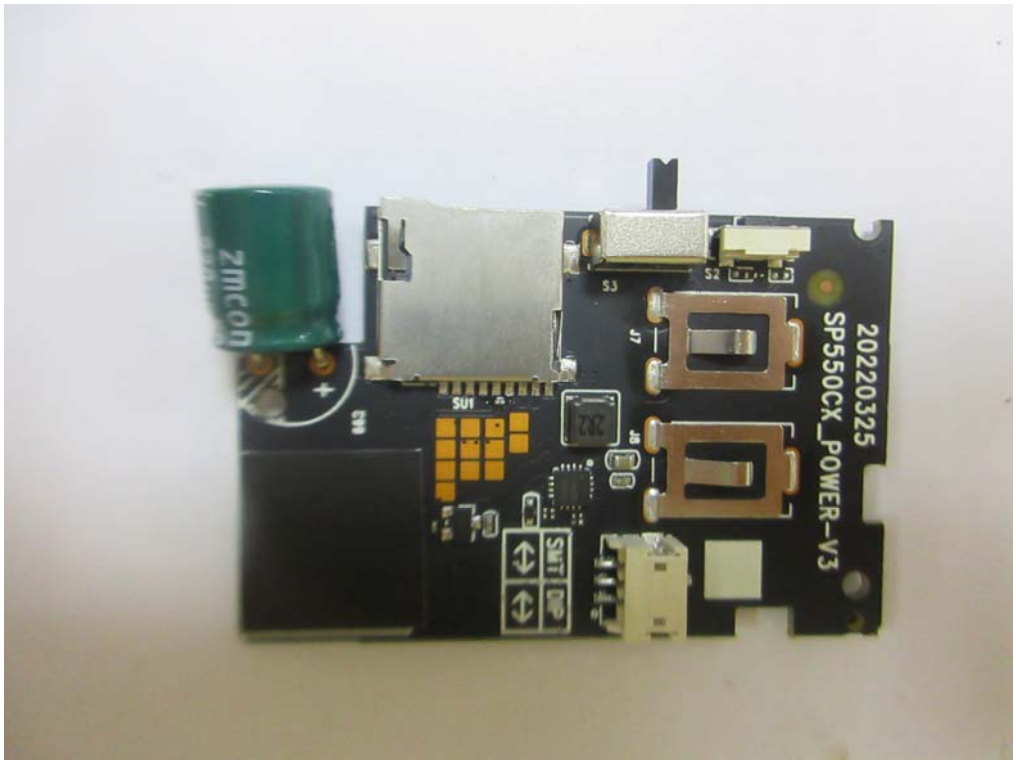
M/N: MD7L

Internal Photos

M/N: MD7L

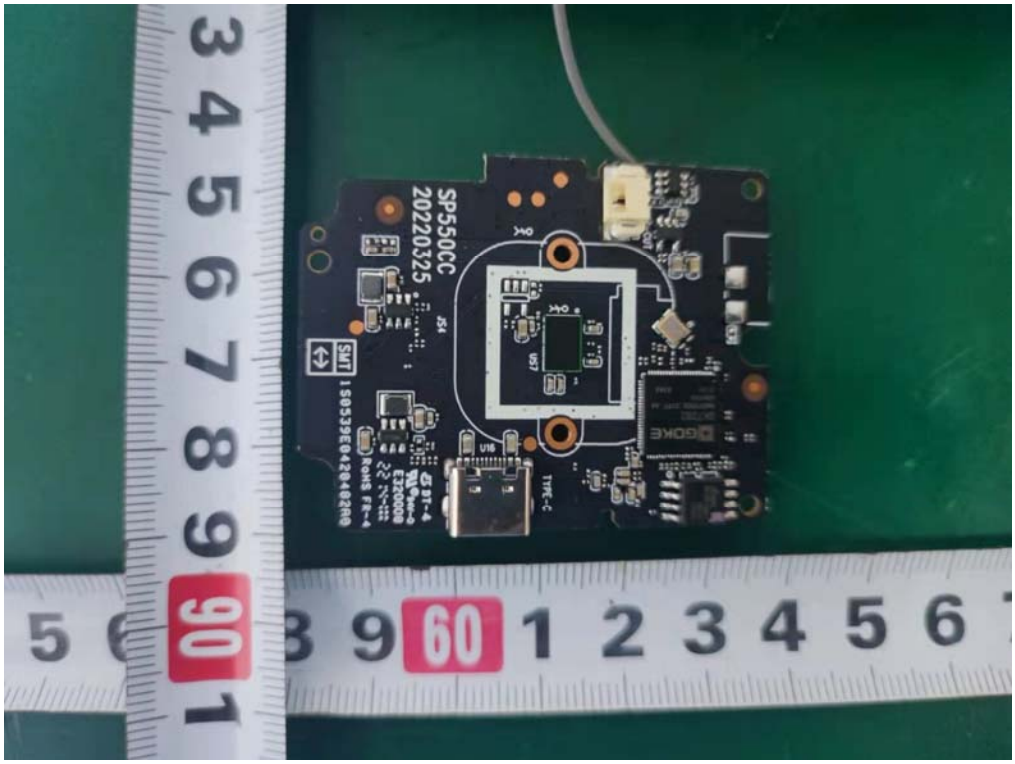
Internal Photos

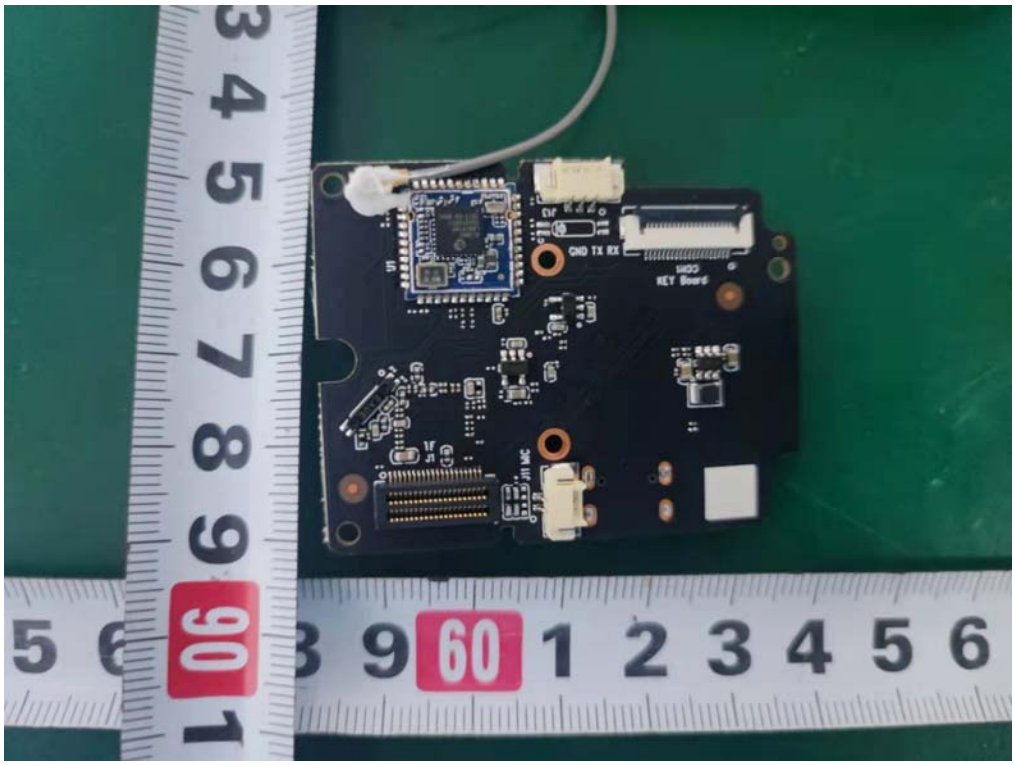
M/N: MD7L



Internal Photos

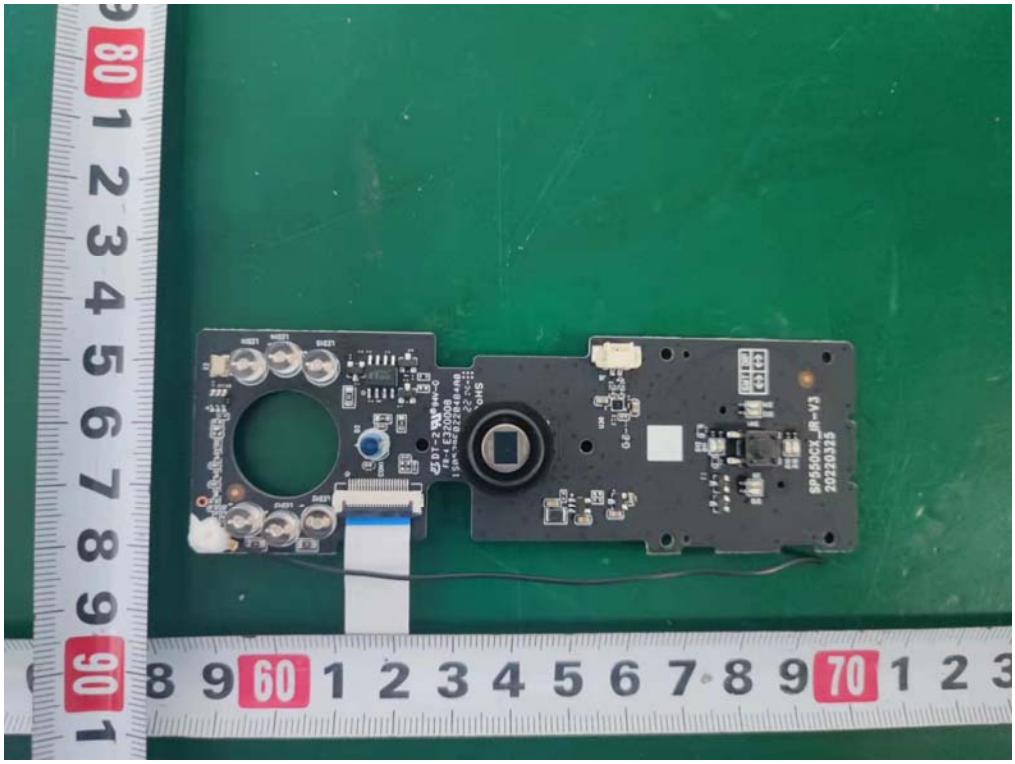
M/N: MD7L





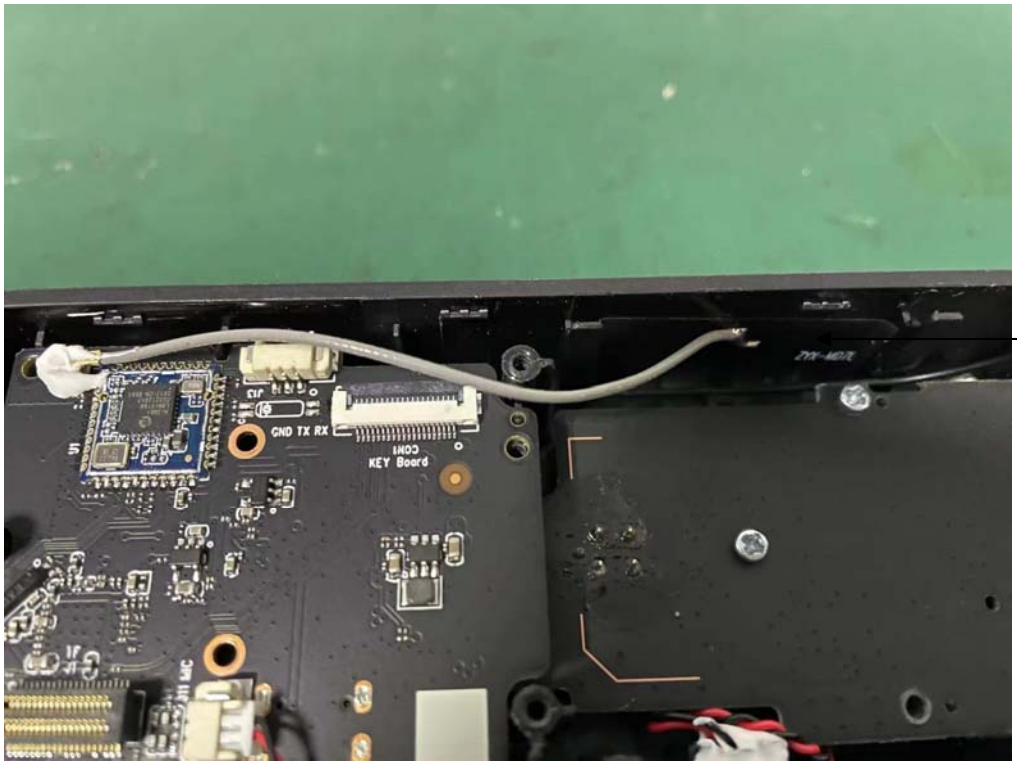
Internal Photos

M/N: MD7L



Internal Photos

M/N: MD7L



End of Test Report