TEST REPORT

ETSI EN 300 440 V2.2.1 (2018-07)

Report Reference No. ..... :	**TZ240505696-WLAN3**
Compiled by (position+printed name+signature) . :	File administrators Lena Wen
Supervised by (position+printed name+signature) . :	Technique principal Hugo Chen
Approved by (position+printed name+signature) . :	Manager Andy Zhang
Date of issue ..... :	2024/5/23

Testing Laboratory Name ..... :	Shenzhen Tongzhou Testing Co.,Ltd
Address ..... :	1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang Street, Longhua, Shenzhen, China
Applicant's name ..... :	**Jiangxi Small Walrus Intelligent Technology Co.,LTD**
Address ..... :	Factory No. 1, Hengsi Road, Qianping Industrial Zone, Le 'an Industrial Park, Fuzhou City, Jiangxi Province, China
Test specification..... **:**	
Standard..... :	**ETSI EN 300 440 V2.2.1 (2018-07)**
TRF Originator ..... :	Shenzhen Tongzhou Testing Co.,Ltd
Master TRF ..... :	Dated 2024-01

Test item description..... **:**	**Smart WiFi Dome Camera**
Trade Mark..... :	AI.SWALRUS
Model/Type reference ..... :	XHX-PT09-DW
List Model..... :	XHX-PT10-DW, XHX-PT11-DW, XHX-PT12-DW, XHX-PT13-DW, SC489-DWB2, SC489-DWB3, SC489-DWB4, HHK-5362X, HHK-5368X, HHK-5369X, HHK-5370X, HHK-5371X, HHK-5350X, HHK-5320X, HHK-5362Y, HHK-5368XY, HHK-5369Y, HHK-5370Y, HHK-5371Y, HHK-5350Y, HHK-5320Y, HHK-5362Z, HHK-5368Z, HHK-5369Z, HHK-5370Z, HHK-5371Z, HHK-5350G, HHK-5320G, HHK-5562Y, HHK-5568XY, HHK-5569Y, HHK-5570Y, HHK-5571Y, HHK-5550Y, HHK-5520Y, HHK-5562Z, HHK-5568Z, HHK-5569Z, HHK-5570Z, HHK-5571Z, HHK-5550Z, HHK-5520Z
Hardware Version ..... :	V1.0
Software Version..... :	V3.2.1X
Ratings ..... :	Input:DC 12V
Result ..... :	**PASS**

TEST REPORT

Test Report No. :	TZ240505696-WLAN3	2024/5/23 Date of issue

Equipment under Test	:	Smart WiFi Dome Camera
Model /Type	:	XHX-PT09-DW
Listed Models	:	XHX-PT10-DW, XHX-PT11-DW, XHX-PT12-DW, XHX-PT13-DW, SC489-DWB2, SC489-DWB3, SC489-DWB4, HHK-5362X, HHK-5368X, HHK-5369X, HHK-5370X, HHK-5371X, HHK-5350X, HHK-5320X, HHK-5362Y, HHK-5368XY, HHK-5369Y, HHK-5370Y, HHK-5371Y, HHK-5350Y, HHK-5320Y, HHK-5362Z, HHK-5368Z, HHK-5369Z, HHK-5370Z, HHK-5371Z, HHK-5350G, HHK-5320G, HHK-5562Y, HHK-5568XY, HHK-5569Y, HHK-5570Y, HHK-5571Y, HHK-5550Y, HHK-5520Y, HHK-5562Z, HHK-5568Z, HHK-5569Z, HHK-5570Z, HHK-5571Z, HHK-5550Z, HHK-5520Z
Applicant	:	Jiangxi Small Walrus Intelligent Technology Co.,LTD
Address	:	Factory No. 1, Hengsi Road, Qianping Industrial Zone, Le ‘an Industrial Park, Fuzhou City, Jiangxi Province, China
Manufacturer	:	Jiangxi Small Walrus Intelligent Technology Co.,LTD
Address	:	Factory No. 1, Hengsi Road, Qianping Industrial Zone, Le ‘an Industrial Park, Fuzhou City, Jiangxi Province, China

Test Result:	**PASS**

The test report merely corresponds to the test sample.

** Modifited History **

Revision	Description	Issued Data	Remark
Revision 00	Initial Test Report Release	2024/5/23	Andy Zhang

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

ETSI EN 300 440 V2.2.1 (2018-07)
Short Range Devices (SRD); Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2016/53/EU

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	2024/5/20
Testing commenced on	:	2024/5/20
Testing concluded on	:	2024/5/22

2.2 Product Description

The **Jiangxi Small Walrus Intelligent Technology Co.,LTD**'s Model: XHX-PT09-DW or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Smart WiFi Dome Camera
Model(s) Number	XHX-PT09-DW
List Model	XHX-PT10-DW, XHX-PT11-DW, XHX-PT12-DW, XHX-PT13-DW, SC489-DWB2, SC489-DWB3, SC489-DWB4, HHK-5362X, HHK-5368X, HHK-5369X, HHK-5370X, HHK-5371X, HHK-5350X, HHK-5320X, HHK-5362Y, HHK-5368XY, HHK-5369Y, HHK-5370Y, HHK-5371Y, HHK-5350Y, HHK-5320Y, HHK-5362Z, HHK-5368Z, HHK-5369Z, HHK-5370Z, HHK-5371Z, HHK-5350G, HHK-5320G, HHK-5562Y, HHK-5568XY, HHK-5569Y, HHK-5570Y, HHK-5571Y, HHK-5550Y, HHK-5520Y, HHK-5562Z, HHK-5568Z, HHK-5569Z, HHK-5570Z, HHK-5571Z, HHK-5550Z, HHK-5520Z
Difference description	All the same except for the model name.
Hardware version	V1.0
Software version	V3.2.1X

2.3 Wireless Function Tested in this report

Wireless Type	Working Frequency	Modulation Type
WLAN(5G)	5745MHz to 5825MHz	IEEE 802.11n :OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11a:OFDM (64QAM, 16QAM, QPSK,BPSK)

2.4 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	120V / 60 Hz	○	115V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

Input:DC 12V

2.5 Short description of the Equipment under Test (EUT)

Smart WiFi Dome Camera(M/N: XHX-PT09-DW)

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

2.6 EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides software to control the EUT for staying in continous transmitting and receiving mode for testing.

2.7 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

/	/	/	/
/	/	/	/
/	/	/	/

2.8 Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt	Type of Test
TZ240505696-1#	N/A	V1.0	V3.2.1X	2024/5/20	Radio
TZ240505696-2#	N/A	V1.0	V3.2.1X	2024/5/20	SAR (EMF)
TZ240505696-3#	N/A	V1.0	V3.2.1X	2024/5/20	EMC

2.9 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen Tongzhou Testing Co.,Ltd
1th Floor, Building 1, Haomai High-tech Park, Huating Road 387, Dalang Street, Longhua, Shenzhen, China
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2014) and CISPR Publication 22.

3.2 Environmental conditions

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

Normal Temperature/NT: 25℃
High Temperature/HT: 40℃
Low Temperature/LT: -10℃
Normal Voltage: DC 12V
High Voltage/HV: DC 13.2V
Low Voltage/LV: DC 10.8V
Relative Humidity: 55 %
Air Pressure: 989 hPa

3.3 Test Description

ETSI EN 300 440 requirements		
Test Items	standard	Verdict
Transmitter requirements		
Equivalent isotropically radiated power (e.i.r.p.)	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.2.2	PASS
Permitted range of operating frequencies	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.2.3	PASS
Unwanted emissions in the spurious domain	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.2.4	PASS
Duty cycle	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.2.5	PASS
Additional requirements for FHSS equipment	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.2.6	PASS
Receiver requirements		
Adjacent channel selectivity	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.3.3	N/A
Blocking or desensitization	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.3.4	N/A
Spurious emissions	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.3.5	PASS
Spectrum access techniques		
Listen Before Talk (LBT)	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.4.2	Compliance (note1)
Detect And Avoid techniques (DAA)	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.4.3	Compliance (note1)
Adaptive Frequency Agility (AFA)	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.4.4	Compliance (note1)
2,45 GHz RFID systems		
Effective radiated power	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.5	N/A
GBSAR systems		
Effective radiated power	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.6.1	N/A
Permitted range of operating frequencies	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.6.2	N/A
DAA threshold	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.6.3	N/A
Antenna pattern	ETSI EN 300 440 V2.2.1 (2018-07)) Sub-clause 4.6.4	N/A

Remark: The measurement uncertainty is not included in the test result.

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 in the measurement of mobile radio equipment characteristics;Part 2 " and is documented in the Shenzhen Tongzhou Testing 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 Tongzhou Testing Co.,Ltd is reported:

Test Items	Measurement Uncertainty	Notes
Frequency error	25 Hz	(1)
Frequency range	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Adjacent and alternate channel power Conducted	1.20 dB	(1)
Conducted spurious emission	1.60 dB	(1)
Radiated spurious emission	2.20 dB	(1)
Intermodulation attenuation	1.00 dB	(1)
Maximum useable receiver sensitivity	2.80 dB	(1)
Co-channel rejection	2.80 dB	(1)
Adjacent channel selectivity	2.80 dB	(1)
Spurious response rejection	2.80 dB	(1)
Intermodulation response rejection	2.80 dB	(1)
Blcking or desensitization	2.80 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

3.5 Equipments Used during the Test

Conducted Method						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2024/1/4	2025/1/3
2	Signal Generator	Keysight	N5182A	MY4620709	2024/1/4	2025/1/3
3	Signal Generator	R&S	SML03	102924/0013	2024/1/4	2025/1/3
4	Power Sensor	Agilent	U2021XA	MY5365004	2024/1/4	2025/1/3
5	Power Meter	Agilent	U2531A	TW53323507	2024/1/4	2025/1/3
6	Climate Chamber	KRUOMR	KRM-1000	KRM16072901	2024/1/4	2025/1/3
7	Wideband Radio Communication Tester	R&S	CMW500	101855	2024/1/4	2025/1/3
8	Test Software	Tonscend	JS1120-3	V3.2.22	--	--

Radiated Method						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	Wideband Antenna	schwarzbeck	VULB 9163	958	2022/11/13	2025/11/12
2	Horn Antenna	schwarzbeck	BBHA 9120D	01989	2022/11/13	2025/11/12
3	EMI Test Receiver	R&S	ESCI	100849/003	2024/1/4	2025/1/3
4	Controller	MF	MF7802	N/A	N/A	N/A
5	Amplifier	schwarzbeck	BBV 9743	209	2024/1/4	2025/1/3
6	Amplifier	Tonscend	TSAMP-0518SE	--	2024/1/4	2025/1/3
7	RF Cable	HUBER+SUHNER	RG214	N/A	2024/1/4	2025/1/3
8	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2024/1/4	2025/1/3
9	Horn Antenna	ETS	3117	00218874	2022/11/13	2025/11/12
10	Wideband Antenna	Sunol	JB3	A020115	2022/7/3	2025/7/2
11	Test Software	Tonscend	JS36-RSE	V5.0.0.0	--	--

4 TEST CONDITIONS AND RESULTS

4.1 Transmitter Requirements

4.1.1 Effective Radiated Power (radiated measurement)

APPLICABILITY

The equivalent isotropically radiated power requirement shall apply to all transmitters.

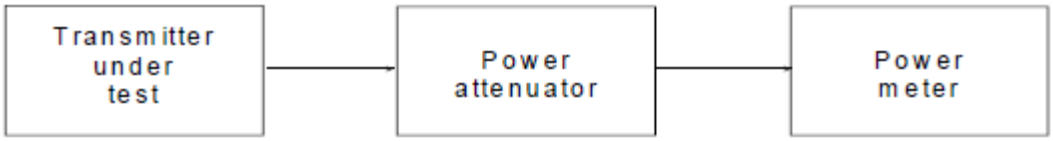
LIMIT

The transmitter maximum e.i.r.p. under normal and extreme test conditions is provided in table 2.

Table 2: Maximum radiated peak power (e.i.r.p.)

Frequency Bands	Power	Application	Notes
2 400 MHz to 2 483,5 MHz	10 mW e.i.r.p.	Non-specific short range devices	
2 400 MHz to 2 483,5 MHz	25 mW e.i.r.p.	Radio determination devices	
(a) 2 446 MHz to 2 454 MHz	500 mW e.i.r.p.	Radio Frequency Identification (RFID) devices	See also table 4 and annex D
(b) 2 446 MHz to 2 454 MHz	4 W e.i.r.p.	Radio Frequency Identification (RFID) devices	See also table 4 and annex D
5 725 MHz to 5 875 MHz	25 mW e.i.r.p.	Non-specific short range devices	
9 200 MHz to 9 500 MHz	25 mW e.i.r.p.	Radio determination devices	
9 500 MHz to 9 975 MHz	25 mW e.i.r.p.	Radio determination devices	
10,5 GHz to 10,6 GHz	500 mW e.i.r.p.	Radio determination devices	
13,4 GHz to 14,0 GHz	25 mW e.i.r.p.	Radio determination devices	
17,1 GHz to 17,3 GHz	400 mW e.i.r.p.	Radio determination devices	See annex F
24,00 GHz to 24,25 GHz	100 mW e.i.r.p.	Non-specific short range devices and Radio determination devices	

TEST CONFIGURATION



TEST PROCEDURE

☐ 4.2.2.3.1 Non spread spectrum transmitters with a -6 dB bandwidth of up to 20 MHz and spread spectrum transmitters with channel bandwidth of up to 1 MHz

☒ 4.2.2.3.2 Transmitters other than those defined in clause 4.2.2.3.1

TEST RESULTS

Pass

Temperature:	22.8° C
Humidity:	56%
Test Engineer:	Allen.Lai

802.11a			
Test Condition	EIRP (dBm)	EIRP (mW)	Limit (mW)
NTC	11.86	15.34	25
HTLV	11.80	15.12	25
HTHV	11.66	14.65	25
LTLV	11.92	15.57	25
LTHV	11.86	15.36	25

802.11n HT40			
Test Condition	EIRP (dBm)	EIRP (mW)	Limit (mW)
NTC	10.86	12.19	25
HTLV	11.00	12.59	25
HTHV	10.90	12.31	25
LTLV	11.27	13.38	25
LTHV	11.23	13.28	25

802.11n HT20			
Test Condition	EIRP (dBm)	EIRP (mW)	Limit (mW)
NTC	10.62	11.54	25
HTLV	10.87	12.21	25
HTHV	10.54	11.33	25
LTLV	10.68	11.69	25
LTHV	10.79	12.00	25

4.1.2 Permitted range of operating frequencies

APPLICABILITY

The Permitted range of operating frequencies shall apply to all transmitters.

LIMIT

According to ETSI EN 300 440 V2.2.1 (2018-07) 4.2.3.5

The width of the power spectrum envelope is fH -fL for a given operating frequency. In equipment that allows adjustment or selection of different operating frequencies, the power envelope takes up different positions in the allowed band. The frequency range is determined by the lowest value of fL and the highest value of fH resulting from the adjustment of the equipment to the lowest and highest operating frequencies.

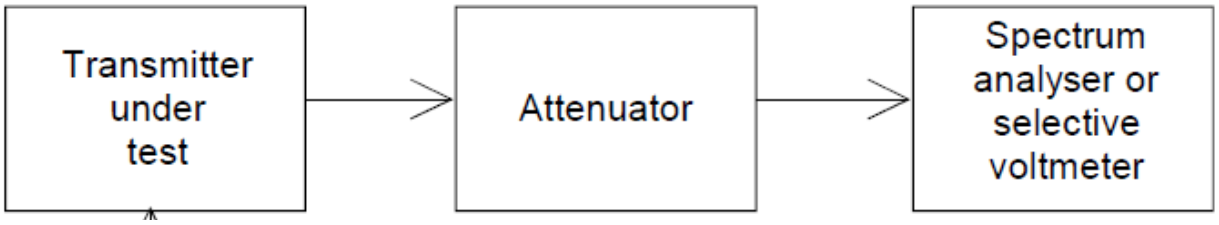
The occupied bandwidth (i.e. the bandwidth in which 99 % of the wanted emission is contained) of the transmitter shall fall within the assigned frequency band.

For all equipment the frequency range shall lie within the frequency band given by clause 4.2.2.4, table 2. For non-harmonized frequency bands the available frequency range may differ between national administrations.

Table 2: Maximum radiated peak power (e.i.r.p.)

Frequency Bands	Power	Application	Notes
2 400 MHz to 2 483,5 MHz	10 mW e.i.r.p.	Non-specific short range devices	
2 400 MHz to 2 483,5 MHz	25 mW e.i.r.p.	Radio determination devices	
(a) 2 446 MHz to 2 454 MHz	500 mW e.i.r.p.	Radio Frequency Identification (RFID) devices	See also table 4 and annex D
(b) 2 446 MHz to 2 454 MHz	4 W e.i.r.p.	Radio Frequency Identification (RFID) devices	See also table 4 and annex D
5 725 MHz to 5 875 MHz	25 mW e.i.r.p.	Non-specific short range devices	
9 200 MHz to 9 500 MHz	25 mW e.i.r.p.	Radio determination devices	
9 500 MHz to 9 975 MHz	25 mW e.i.r.p.	Radio determination devices	
10,5 GHz to 10,6 GHz	500 mW e.i.r.p.	Radio determination devices	
13,4 GHz to 14,0 GHz	25 mW e.i.r.p.	Radio determination devices	
17,1 GHz to 17,3 GHz	400 mW e.i.r.p.	Radio determination devices	See annex F
24,00 GHz to 24,25 GHz	100 mW e.i.r.p.	Non-specific short range devices and Radio determination devices	

TEST CONFIGURATION



TEST PROCEDURE

☐ 4.2.2.3.1 Non spread spectrum transmitters with a -6 dB bandwidth of up to 20 MHz and spread spectrum transmitters with channel bandwidth of up to 1 MHz

☒ 4.2.2.3.2 Transmitters other than those defined in clause 4.2.2.3.1

RESULTS

Temperature:	22.8° C
Humidity:	56%
Test Engineer:	Allen.Lai

802.11a				
Test Condition	Lower (MHz)	Highest (MHz)	Limit (MHz)	Result
NTC	5734.98	5835.02	(5725,5875)	Pass
HTLV	5734.95	5834.98	(5725,5876)	Pass
HTHV	5734.99	5835.05	(5725,5877)	Pass
LTLV	5734.95	5835.06	(5725,5878)	Pass
LTHV	5735.03	5835.03	(5725,5879)	Pass

802.11n HT40				
Test Condition	Lower (MHz)	Highest (MHz)	Limit (MHz)	Result
NTC	5734.97	5815.04	(5725,5875)	Pass
HTLV	5735.01	5815.08	(5725,5876)	Pass
HTHV	5734.92	5815.05	(5725,5877)	Pass
LTLV	5734.96	5815.09	(5725,5878)	Pass
LTHV	5734.99	5815.08	(5725,5879)	Pass

802.11n HT20				
Test Condition	Lower (MHz)	Highest (MHz)	Limit (MHz)	Result
NTC	5734.98	5834.96	(5725,5875)	Pass
HTLV	5734.96	5834.93	(5725,5876)	Pass
HTHV	5735.01	5834.97	(5725,5877)	Pass
LTLV	5734.98	5834.97	(5725,5878)	Pass
LTHV	5734.98	5834.93	(5725,5879)	Pass

4.1.3 Unwanted emissions in the spurious domain

APPLICABILITY

The unwanted emissions in the spurious domain requirement shall apply to all transmitters.

LIMIT

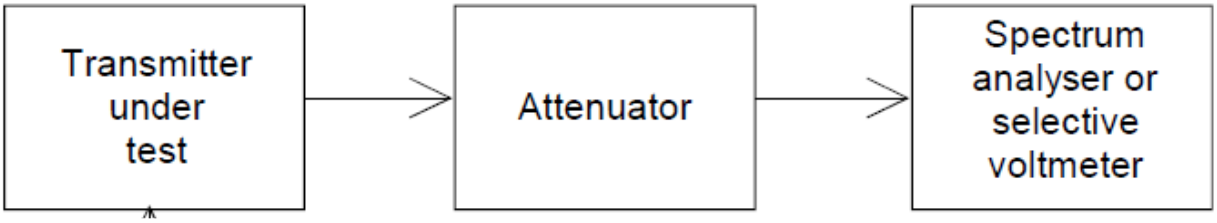
The maximum power limits of any unwanted emissions in the spurious domain are given in table 3.

Table 3: Spurious emissions

Frequency ranges / State	47 MHz to 74 MHz 87,5 MHz to 108 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other frequencies ≤ 1 000 MHz	Frequencies > 1 000 MHz
Operating	4 nW	250 nW	1 µW
Standby	2 nW	2 nW	20 nW

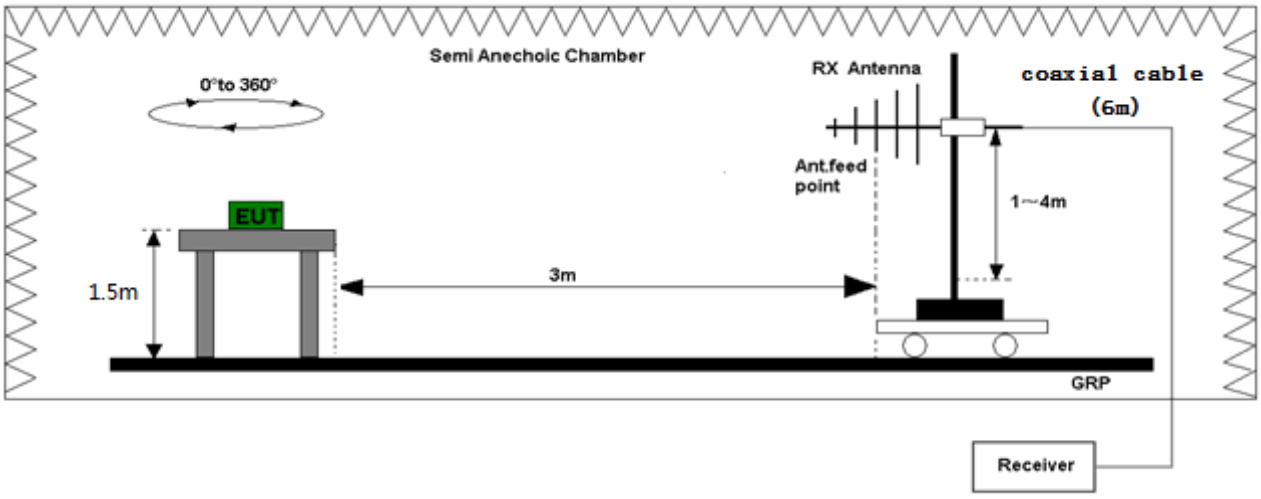
TEST CONFIGURATION

Conducted Method:

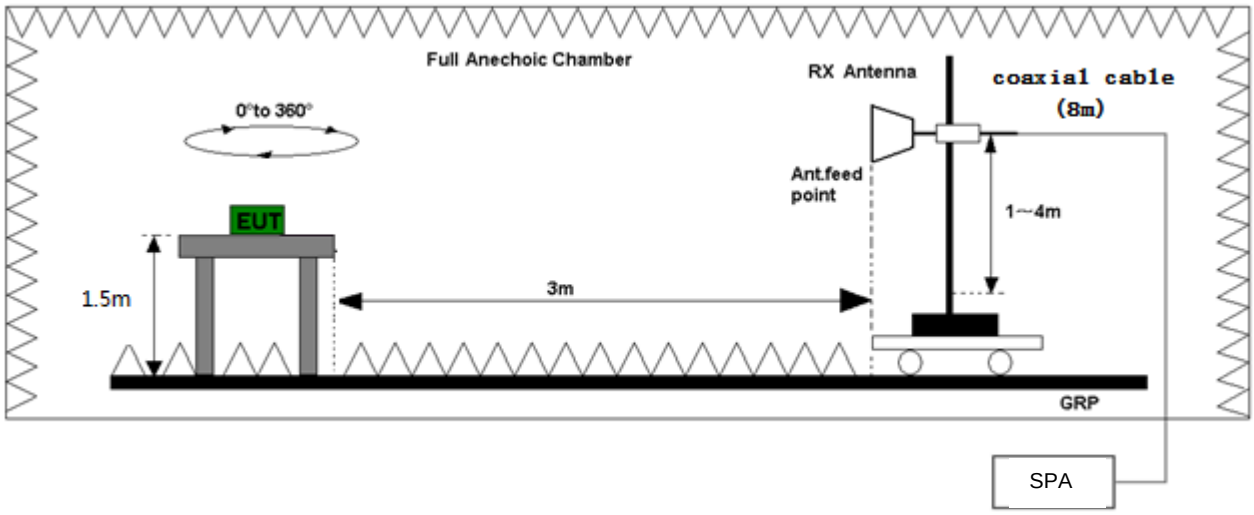


Radiated Method:

Below 1GHz



Above 1GHz



Conformance

☐ 4.2.4.3.1 Conducted spurious emission

☐ 4.2.4.3.2 Method of measurement - cabinet spurious radiation

☒ 4.2.4.3.3 Method of measurement - radiated spurious emission

TEST RESULTS

Temperature:	22.8° C
Humidity:	56%
Test Engineer:	Tony Luo

Note: This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

Fre. (MHz)	ANT. Pol.	Result (dBm)	Limit (dBm)	Margin (dB)	Conclusion
Below 1GHz:					
518.91	V	-60.34	-54	6.34	PASS
513.93	H	-59.23	-54	5.23	PASS
Above 1GHz:					
Test Mode：Low Channel					
11490	H	-43.86	-30	13.86	PASS
11490	V	-43.68	-30	13.68	PASS
17235	H	-44.94	-30	14.94	PASS
17235	V	-46.28	-30	16.28	PASS
22980	H	-45.17	-30	15.17	PASS
22980	V	-49.86	-30	19.86	PASS
Test Mode：High Channel					
11650	H	-45.82	-30	15.82	PASS
11650	V	-43.84	-30	13.84	PASS
17475	H	-46.95	-30	16.95	PASS
17475	V	-47.76	-30	17.76	PASS
23300	H	-47.56	-30	17.56	PASS
23297.3	V	-48.62	-30	18.62	PASS

Note:
1. Cable loss and antenna gain was combined in the calculated result.
2. No record for margin above 20dB.

4.1.4 Duty Cycle

APPLICABILITY

Duty Cycle (DC) shall apply to all transmitting equipment except those which utilize Listen Before Talk (LBT) clause 4.4.2, or Detect And Avoid (DAA), clause 4.4.3. RFID transmitters operating in the 2 446 MHz to 2 454 MHz frequency band that transmit at a maximum radiated peak power level of less than 500 mW e.i.r.p. are also excluded.

LIMIT

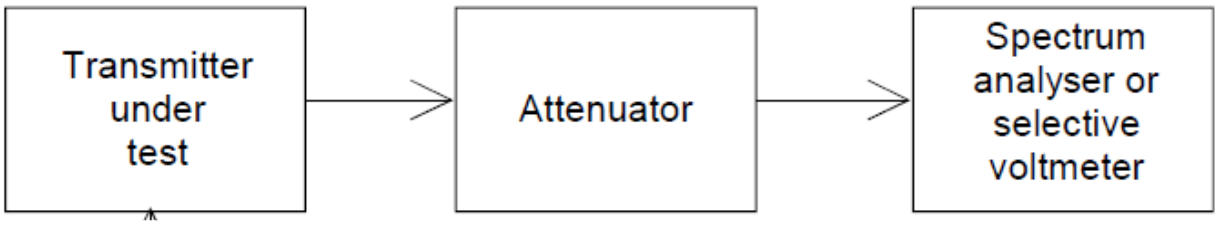
Table 4 defines the maximum duty cycle within a 1 hour period.

Table 4: Duty cycle limits

Frequency Band	Duty cycle	Application	Notes
2 400 MHz to 2 483,5 MHz	No Restriction	Generic use	
2 400 MHz to 2 483,5 MHz	No Restriction	Detection, movement and alert applications	
(a) 2 446 MHz to 2 454 MHz	No Restriction	RFID	Limits shown in annex D shall apply
(b) 2 446 MHz to 2 454 MHz	≤ 15 %	RFID	Limits shown in annex D shall apply
5 725 MHz to 5 875 MHz	No Restriction	Generic use	
9 200 MHz to 9 500 MHz	No Restriction	Radiodetermination: radar, detection, movement and alert applications	
9 500 MHz to 9 975 MHz	No Restriction	Radiodetermination: radar, detection, movement and alert applications	
10,5 GHz to 10,6 GHz	No Restriction	Radiodetermination: radar, detection, movement and alert applications	
13,4 GHz to 14,0 GHz	No Restriction	Radiodetermination: radar, detection, movement and alert applications	
17,1 GHz to 17,3 GHz	DAA or equivalent techniques	Radiodetermination: GBSAR detecting and movement and alert applications	Limits shown in annex F shall apply
24,00 GHz to 24,25 GHz	No Restriction	Generic use and for Radiodetermination: radar, detection, movement and alert applications	

For devices with a 100 % duty cycle transmitting an unmodulated carrier most of the time, a time-out shut-off facility shall be implemented in order to improve the efficient use of spectrum. The method of implementation shall be declared by the manufacturer.

TEST CONFIGURATION



TEST PROCEDURE

☐ 4.2.5.3 Method of measurement

TEST RESULTS

N/A, EUT work in 5725 MHz to 5825 MHz.

4.1.5 Additional requirements for FHSS equipment

APPLICABILITY

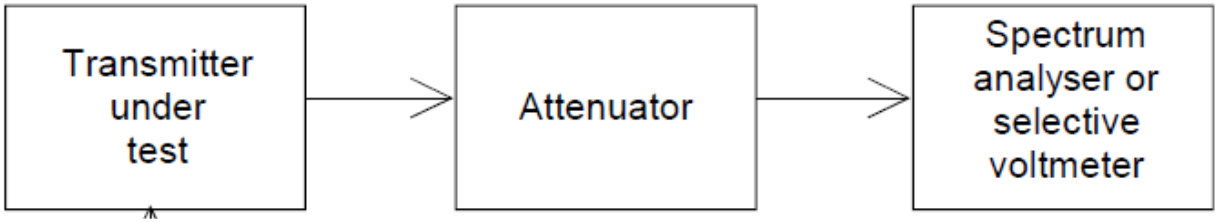
The requirements in this clause apply only to equipment using FHSS modulation.

LIMIT

FHSS modulation shall make use of at least 20 channels hopping over > 90 % of the assigned frequency band.

The dwell time per channel shall not exceed 1 s. While the equipment is operating (transmitting and/or receiving) each channel of the hopping sequence shall be occupied at least once during a period not exceeding four times the product of the dwell time per hop and the number of channels.

TEST CONFIGURATION



Conformance

Hopping Channels:

1) Set SPA as follow:
   Start frequency: MHz, stop frequency: MHz, RBW = 1 MHz, VBW = 3 MHz, Trace = Max Hold, Detector = Peak, Sweep Time = Auto.
2) Set EUT work in a condition which every channel can work, Count the channels(TX_{on}) and record as C_c.

Dwell Time:

Step 1:

1) Set SPA as follow:
   Center frequency = working frequency, sweep time = 1 S.
2) Set EUT work in the specific frequency, and record the TX_{on}(one pluse) time as C_d.

Step 2(only for FHSS):

1) Set SPA as follow: center frequency = evaluate frequency, sweep time = 4*Cc*Cd
2) Count the times of TX_{on}.

TEST RESULTS

N/A, EUT is not a FHSS Device

4.2 Receiver Requirements

4.2.1 Adjacent channel selectivity

APPLICABILITY

This requirement applies to Equipment Category 1 receivers, when invoked, as defined in clause 4.3.1.

LIMIT

The adjacent channel selectivity of the equipment under specified conditions shall not be less than the levels of the unwanted signal as stated in table 6.

Table 6: Limit for adjacent channel selectivity

Receiver category	Limit
1	-30 dBm + k
2	No limit
3	No limit

The correction factor, k, is as follows:

$$k = -20\log f - 10\log BW$$

Where:
- f is the frequency in GHz;
- BW is the channel bandwidth in MHz.

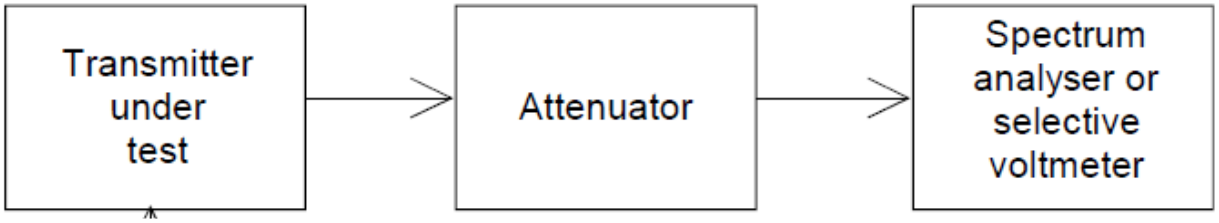
The factor k is limited within the following:
- 0 < k < 40 dB.

The measured adjacent channel selectivity shall be stated in the test report.

Limits at different bandwidths and frequencies:

BW(MHz)	Channel	Frequency (GHz)	k(dB)	Limits (dBm)
20	149	5.745	-28.20	⩾-58.20
	153	5.765	-28.23	⩾-58.23
	157	5.785	-28.26	⩾-58.26
	161	5.805	-28.29	⩾-58.29
	165	5.825	-28.32	⩾-58.32
40	151	5.755	-31.22	⩾-61.22
	159	5.795	-31.28	⩾-61.28
80	155	5.775	-34.26	⩾-64.26
Note: Channel 149 is the worst case for this test.				

TEST CONFIGURATION



Conformance

This measurement shall be conducted under normal conditions.

Two signal generators A and B shall be connected to the receiver via a combining network to the receiver, either:

a) via a test fixture or a test antenna to the receiver integrated, dedicated or test antenna; or

b) directly to the receiver permanent or temporary antenna connector.

The method of coupling to the receiver shall be stated in the test report.

Signal generator A shall be at the nominal frequency of the receiver, with normal modulation of the wanted signal.

Signal generator B shall be unmodulated and shall be adjusted to the adjacent channel centre frequency immediately above that of the wanted signal.

Initially signal generator B shall be switched off and using signal generator A the level that still gives sufficient response shall be established. The output level of generator A shall then be increased by 3 dB.

Signal generator B is then switched on and adjusted until the wanted criteria are met. This level shall be recorded.

The measurements shall be repeated with signal generator B unmodulated and adjusted to the adjacent channel centre immediately below the wanted signal.

The adjacent channel selectivity shall be recorded for the upper and lower adjacent channels as the level in dBm of the unwanted signal.

For tagging systems (e.g. RF identification, anti-theft, access control, location and similar systems) signal generator A may be replaced by a physical tag positioned at 70 % of the measured system range in metres. In this case, the adjacent selectivity shall be recorded as the level in dBm of lowest level of the unwanted signal (generator B) resulting in a non-read of the tag.

TEST RESULTS

Temperature:	22.8° C
Humidity:	56%
Test Engineer:	Allen.Lai

Below is the worst case situation test data.

802.11a Mode

Receiver category: 1						
Test Channel		**The signal of adjacent channel(signal generator B)**				
		Adjacent channel		**Test Value (dBm)**	**Limit(dBm)**	**Verdict**
149	5745MHz	144	5720MHz(lower)	-4	⩾-58.20	PASS
		153	5765MHz(upper)	-3	⩾-58.20	PASS
Note: k=-28.20dB, BW=20MHz						

4.2.2 Blocking or desensitization

APPLICABILITY

This requirement applies to all Category 1, 2, and 3 SRD communication media receivers.

LIMIT

The blocking level, for any frequency within the specified ranges, shall not be less than the values given in table 7, except at frequencies on which spurious responses are found.

Table 6: Limits for blocking or desensitization

Receiver category	Limit
1	-30 dBm + k
2	-45 dBm + k
3	-60 dBm + k

The correction factor, k, is as follows:

$$k = -20\log f - 10\log BW$$

Where:
- f is the frequency in GHz;
- BW is the channel bandwidth in MHz.

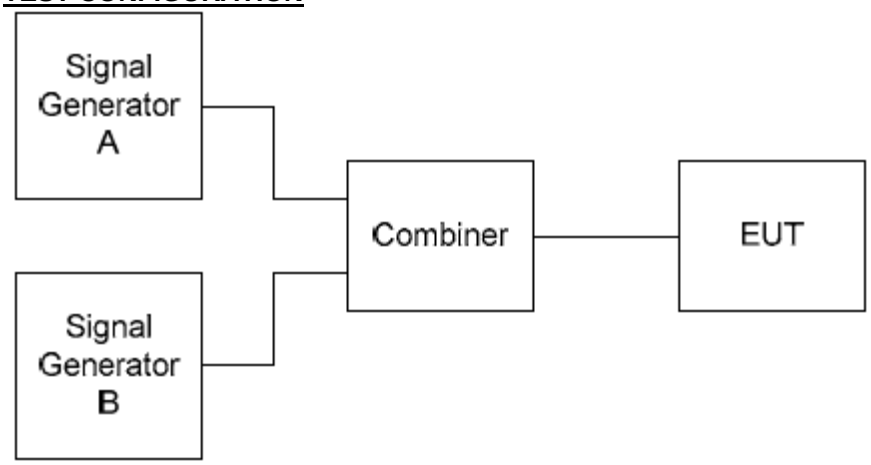
The factor k is limited within the following:
- 0 < k < 40 dB.

The measured adjacent channel selectivity shall be stated in the test report.

Limits at different bandwidths and frequencies:

BW(MHz)	Channel	Frequency (GHz)	k(dB)	Limits (dBm)
20	149	5.745	-28.20	⩾-58.20
	153	5.765	-28.23	⩾-58.23
	157	5.785	-28.26	⩾-58.26
	161	5.805	-28.29	⩾-58.29
	165	5.825	-28.32	⩾-58.32
40	151	5.755	-31.22	⩾-61.22
	159	5.795	-31.28	⩾-61.28
80	155	5.775	-34.26	⩾-64.26
Note: Channel 149 is the worst case for this test.				

TEST CONFIGURATION



Conformance

This measurement shall be conducted under normal conditions.

Two signal generators A and B shall be connected to the receiver via a combining network to the receiver, either:

a) via a test fixture or a test antenna to the receiver integrated, dedicated or test antenna; or
b) directly to the receiver permanent or temporary antenna connector.

The method of coupling to the receiver shall be stated in the test report.

Signal generator A shall be at the nominal frequency of the receiver, with normal modulation of the wanted signal.

Signal generator B shall be unmodulated and shall be adjusted to a test frequency at approximately 10 times, 20 times and 50 times of the receive channel bandwidth above upper band edge of the receive channel.

Initially signal generator B shall be switched off and using signal generator A the level which still gives sufficient response shall be established. The output level of generator A shall then be increased by 3 dB.

Signal generator B is then switched on and adjusted until the wanted criteria are met. This level shall be recorded.

The measurement shall be repeated with the test frequency for signal generator B at approximately 10 times, 20 times and 50 times of the receive channel bandwidth below the lower band edge of the receive channel.

The blocking or desensitization shall be recorded as the level in dBm of lowest level of the unwanted signal (generator B).

For tagging systems (e.g. RF identification, anti-theft, access control, location and similar systems) signal generator A may be replaced by a physical tag positioned at 70 % of the measured system range in metres. In this case, the blocking or desensitization shall be recorded as the ratio in dB of lowest level of the unwanted signal (generator B) resulting in a non-read of the tag. to the declared sensitivity of the receiver +3 dB.

TEST RESULTS

Temperature:	22.8° C
Humidity:	56%
Test Engineer:	Allen.Lai

Below is the worst case situation test data.

Receiver category: 1							
Test Channel		Blocking Signal(signal generator B)					
		Lower or Upper	Spacing	Frequency (MHz)	Test Value (dBm)	Limit (dBm)	Verdict
149	5745MHz	Lower	10*BW	5545	4	≥-73.20	PASS
			20*BW	5345	8	≥-73.20	PASS
			50*BW	4745	7	≥-73.20	PASS
		Upper	10*BW	5845	4	≥-73.20	PASS
			20*BW	5945	7	≥-73.20	PASS
			50*BW	6745	12	≥-73.20	PASS
Note: k=-28.20dB, BW=20MHz							

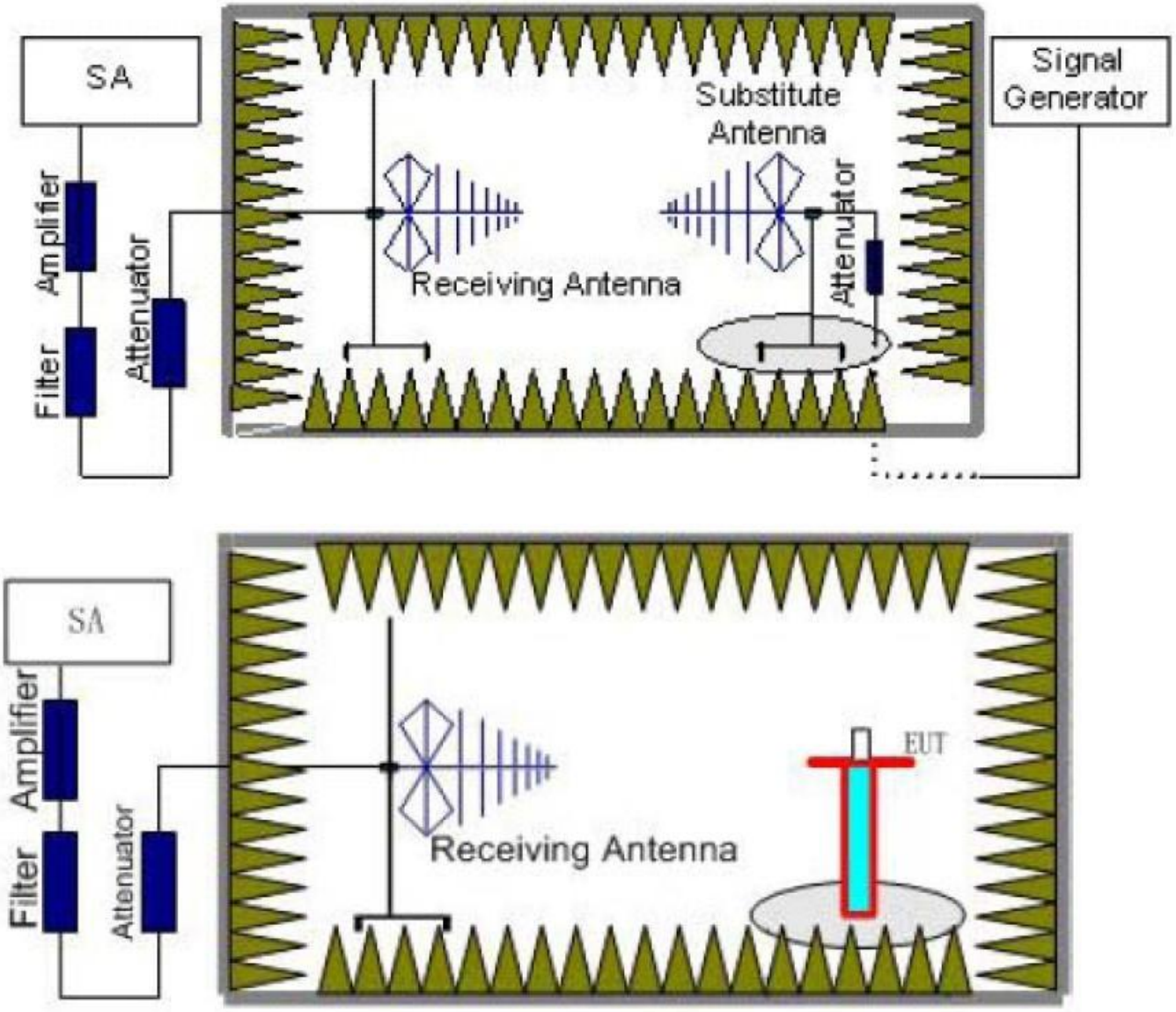
4.2.3 Receiver Spurious emissions

LIMIT

Final Draft ETSI EN 300 440 V2.2.1 (2018-07) Sub-clause 4.2.4.4

The power of any spurious emission shall not exceed 2 nW in the range 25 MHz to 1 GHz and shall not exceed 20 nW on frequencies above 1 GHz.

TEST CONFIGURATION



TEST PROCEDURE

Step 1:
The measurement is carried out in the fully anechoic chamber. EUT was placed on a 1.50 meter high non-conductive table at a 3 meter test distance from the test receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT. The height of receiving antenna is 1.50 m and varies in certain range to find the maximum power value. Connect the EUT to the BTS simulator via the air interface. The measurement is carried out using a spectrum analyzer or receiver. Then the antenna height and turn table rotation is adjusted till the maximum power value is founded on spectrum analyzer or receiver. A filter is necessary in the band near to the carrier frequency. A filter is needed to avoid the distortion of the testing equipment in the band above the carrier frequency.
Step 2:
A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the

level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.

Calculation procedure:

The data of cable loss, antenna gain and air loss has been calibrated in full testing frequency range before the testing.

The power of the Radiated Spurious Emissions is calculated by adding the cable loss, antenna gain and air loss. The basic equation with a sample calculation is as followed:

$P=P_R+L_C+L_A-G$

Where

P: Power of the Radiated Spurious Emissions (dBm)

P_R: reading of the receiver (dBm)

L_C: Cable Lose and power amilifer gain and filter cable loss (dB)

L_A: Air loss (dB)

G: Antenna Gain (dBi)

Assumed the reading of the receiver is -60dBm. A cable lose of 10dB, an air lose of 30dB and an antenna gain of 11dBi are added.

$P=P_R+L_C+L_A-G=-60+10+30-11=-31dBm$

TEST RESULTS

Temperature:	22.8° C
Humidity:	56%
Test Engineer:	Tony Luo

Note: This test was performed with EUT in X, Y, Z position and the worst case was found when EUT in X position.

Fre. (MHz)	ANT. Pol.	Result (dBm)	Limit (dBm)	Margin (dB)	Conclusion
Below 1GHz:					
499.04	V	-64.59	-57	7.59	PASS
785.02	H	-63.44	-57	6.44	PASS
Above 1GHz:					
Test Mode：Lowest frequency					
5358.01	H	-56.99	-47	9.99	PASS
5358.01	V	-55.68	-47	8.68	PASS
10930.62	H	-59.67	-47	12.67	PASS
10930.62	V	-55.66	-47	8.66	PASS
Test Mode： Highest frequency					
5855.54	H	-56.14	-47	9.14	PASS
5855.54	V	-56.40	-47	9.40	PASS
10875.54	H	-55.60	-47	8.60	PASS
10875.54	V	-56.55	-47	9.55	PASS
Note: 1. no record for margin above 20dB. 2. Cable loss and antenna gain was combined in the calculated result.					

4.2.4 Spectrum access techniques

Applicability

For the present document, the following access mechanisms are specified:
• Listen Before Talk (LBT) which is used to share spectrum between SRD transceiver equipment with similar power and bandwidth; or
• 17,1 GHz to 17,3 GHz GBSAR only, Detect And Avoid (DAA) which is used to protect radio communication services.
Receiver Category 2 or better shall be used for all LBT and DAA applications.
For equipment with radiated power of less than 100 µW e.i.r.p., no access technique is specified.
Equipment utilizing LBT or DAA, do not have to comply with the duty cycle conditions stated in clause 4.2.5..

Listen Before Talk (LBT)

In order to make maximum use of the available channels intelligent or polite equipment may use a Listen Before Talk (LBT) protocol with a preferred option of Adaptive Frequency Agility (AFA). AFA is defined as the capability of equipment to dynamically change channel within its available frequencies for proper operation.
For LBT equipment, the device shall listen on the next intended frequency before transmitting. If it is intended to move to a different channel then this channel can be monitored whilst still transmitting at its first channel. If it is not intended to move to a different channel then it should be treated as a single frequency device waiting for a free channel.
The channel occupancy timings refer to the maximum time a device can transmit on a channel, in any one period, and the minimum "listening" period before the device can retransmit either on the same or, for frequency agile equipment, on another channel.
For a device with LBT some of the receiver parameters become essential requirements under the RE-D [i.1]. The receiver requirements are the following:
LBT threshold, for further details, see clause 4.4.2.2.
Blocking or desensitization, for further details, see clause 4.3.4.
Adjacent channel selectivity, see clause 4.3.3, is not a mandatory requirement for equipment using LBT. However, it shall be noted that insufficient adjacent channel selectivity may reduce the apparent channel availability.
For spread spectrum systems, LBT may be used if the required timing and threshold limits can be met; if not, then a duty cycle requirement applies, see clause 4.2.5.
It shall be noted that the use of LBT may be restricted by the dwell time for Frequency Hopping Spread Spectrum systems. In case of fast frequency hopping where the dwell time is shorter than the LBT minimum listening time then a duty cycle requirement applies, see clause 4.2.5.

➢ **LBT timing parameters:**

Minimum transmitter off-time:
The minimum TX off-time allows other users with LBT facility to get access to a channel.
The minimum TX-off time is defined as the period where a specific transmitter shall remain off after a transmission or a communication dialogue between units or a polling sequence of other units.
Limit:
The limit for the minimum TX-off time is > 25 ms.
The TX-off time shall be declared in the test report by the equipment manufacturer

➢ **LBT minimum listening time:**

The minimum listening time is defined as the minimum time that the equipment listens for a received signal at or above the LBT threshold level (see clause 4.4.3) immediately prior to transmission to determine whether the intended channel is available for use.
The listening time shall consist of the "minimum fixed listening time" and an additional pseudo random part. If during the listening mode another user is detected on the intended channel, the listening time shall commence from the instant that the intended channel is free again. Alternatively, the equipment may select another channel and again start the listen time before transmission.
Limit for minimum listening time:
The total listen time, tL, consists of a fixed part, tF, and a pseudo random part, tPS, as the following:
tL=tF+tPS
a) The fixed part of the minimum listening time, tF, shall be 5 ms.
b) The pseudo random listening time tPS shall be randomly varied between 0 ms and a value of 5 ms or more in equal steps of approximately 0,5 ms as the following:
- If the channel is free from traffic at the beginning of the listen time, tL, and remains free throughout the fixed part of the listen time, tF, then the pseudo random part, tPS, is automatically set to zero by the equipment itself.

- If the channel is occupied by traffic when the equipment either starts to listen or during the listen period, then the listen time commences from the instant that the intended channel is free. In this situation the total listen time tL shall comprise tF and the pseudo random part, tPS.
The limit for total listen time for the receiver consists of the sum of a) and b) together.
Algorithmic details and values for a) and b) shall be declared by the manufacturer of the equipment.

- **Acknowledge transmissions**

An acknowledge transmission is defined as a receipt for a received message.
There is no requirement for a listen time before an acknowledge can be performed. However, it shall be noted that if the start of an acknowledge is not received before the end of normal fixed part of the listen time (5 ms) then the channel might be taken by another transmitter.

- **Maximum transmitter on-time**

A transmitter shall only be allowed to transmit continuously for a maximum specified period. This will prevent a transmitter from occupying a channel for an extended period.

The maximum on-time shall always be as short as possible for the application since SRD applications are often battery operated.
The maximum transmitter on-time is defined as the maximum time the transmitter can be on during:
a) A single transmission.
b) Multiple transmissions and acknowledgements for a communication dialogue or polling sequence of other units under the condition that the channel is free.
An equipment intended for very long messages shall be capable of switching to a "free" channel before the maximum transmitter on-time is reached for each channel of operation
Limit
The limit for a single transmission TX on-time is 2 s.
For further information on measurements of maximum transmitter on-time, see clause 4.4.2.2.
The time for the transmission dialogue or a polling sequence shall be less than 10 s.
In the case of the above timing, t, reaches the limit then the minimum TX-off time limit shall apply Automatically

- **Declaration of LBT parameters**

For automatic operated LBT devices, either software controlled or pre-programmed devices, the manufacturer shall declare all the channel LBT timings for the equipment under test.
2.8.2.6 Equipment with or without LBT using transmitter time-out-timer
For manual operated or event dependant devices, with or without software controlled functions, the manufacturer shall declare whether the transmission once triggered, follows a pre-programmed time-out-timer, or whether the transmitter
remains on until the trigger is released or the device is manually reset.
The manufacturer shall also give a description of the application for the device and include a typical usage pattern. The typical usage pattern as declared by the manufacturer shall be used to determine the channel occupancy timings

Receiver LBT threshold and transmitter max on-time

- **Applicability**

The measurements and limits apply to a transceiver that facilitates a receiver with a LBT protocol.

- **Descriptions**

The LBT threshold is defined as the received signal level above which the equipment can determine that the channel is not available for use. If the received signal is below the LBT threshold then the equipment can determine that the channel is available for use.
The definition of the maximum transmitter on-time for equipment with an LBT facility is defined in clause 4.4.2.1.4.1.

- **Method of measurements**

A signal generator and a power meter are each combined via appropriate attenuators into the equipment antenna connector. The test set-up in figure 3 shall be used.

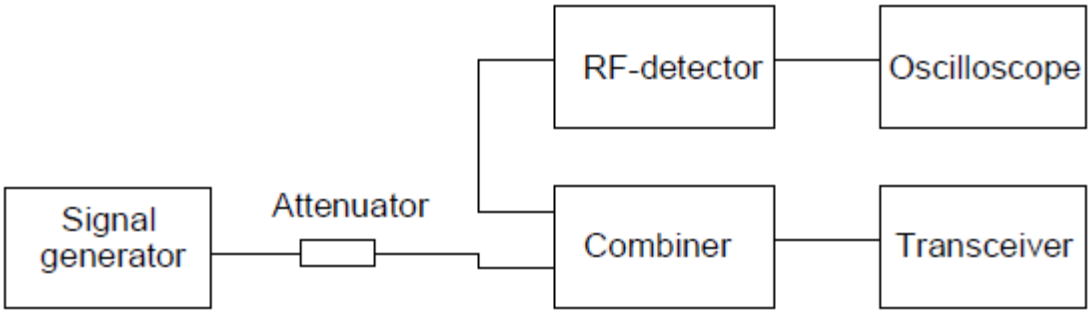


Figure 3: Measurement arrangement

For equipment with integral antenna the connection to the equipment is made either to a temporary 50 Ω antenna connector, see clause 4.2.3.1, or via a calibrated test fixture, see clause 5.8.3:
a) the LBT function of the transceiver shall be active;
b) the attenuator shall provide sufficient attenuation to protect the signal generator from burn-out by the transmitter of the transceiver;
c) the signal generator with normal test modulation is adjusted to the receiving frequency. The level is increased to approximately 20 dB above the receiver sensitivity;
d) the equipment is switched to an intended transmit mode. The equipment shall not be transmitting as the transceiver recognizes a busy channel from the signal generator;
e) the level of the signal generator is reduced in steps of 1 dB until the equipment starts to transmit. This specific signal generator level present at the receiver input of the transceiver is the LBT threshold.
The level of the received LBT threshold shall be recorded in the test report.
f) the steps c) and d) shall be repeated; and
g) the level of the signal generator is reduced in steps of 1 dB until the equipment starts to transmit and the duration of the transmit on-time is measured at the oscilloscope.
The transmit on-time is recorded in the test report.

➢ **Limits**

The LBT maximum thresholds for the receiver in listen mode are given in table 8.
Table 8: Receiver LBT threshold limit versus transmit power and channel spacing

TX power	< 100 mW	500 mW
LBT threshold	-80 dBm + c	-87 dBm + c
NOTE 1: The limit is independent of the receiver category, see clause 4.1.1. NOTE 2: The limits are based on an antenna gain of +2 dBi maximum. For other antenna gains greater than +2 dBi the limits shall be adjusted accordingly.		

The correction factor, c, is given by the following formula: c =10*logBW
Where:
- BW is the bandwidth in MHz.

➢ **Conformance**

The measured LBT threshold shall be less than the limits given table 8 and stated in the test report

Detect and Avoid techniques (DAA)

➢ **General requirements**

DAA is specified for use with Ground Based Synthetic Aperture Radar (GBSAR) systems. It provides protection to other radio communication services by utilizing the following parameters:
a) Receiver minimum listen time before the transmitter can be switched on, immediately prior to any intended transmission.
b) Receiver detect and avoid threshold.
c) An appropriate long listen-time after detection of a service to be protected is detected.
d) Maximum transmitter on-time without interruption.
e) Minimum transmitter off-time after a transmitter on-time period.
It shall be noted that DAA can only be applied if the SRD equipment is using a common antenna for both receive and transmit, or the same antenna type is used for both receive and transmit with both antennas pointing in the same direction.
The DAA function and limits are depending of the services to be protected. Requirements for the implementation of Detect And Avoid (DAA) technique for Ground Based Synthetic Aperture Radar (GBSAR) systems operating in the frequency range 17,1 GHz to 17,3 GHz are given in annex F.

Adaptive Frequency Agility (AFA)

➢ **General requirements**

SRD equipment with LBT or DAA may also employ an Adaptive Frequency Agility (AFA) function to:

• avoid co-channel operation with other systems after detection of interference from these other systems;

• where possible, provide on aggregate a uniform loading of the spectrum across all devices.

The equipment shall only use the channels dedicated for the application.

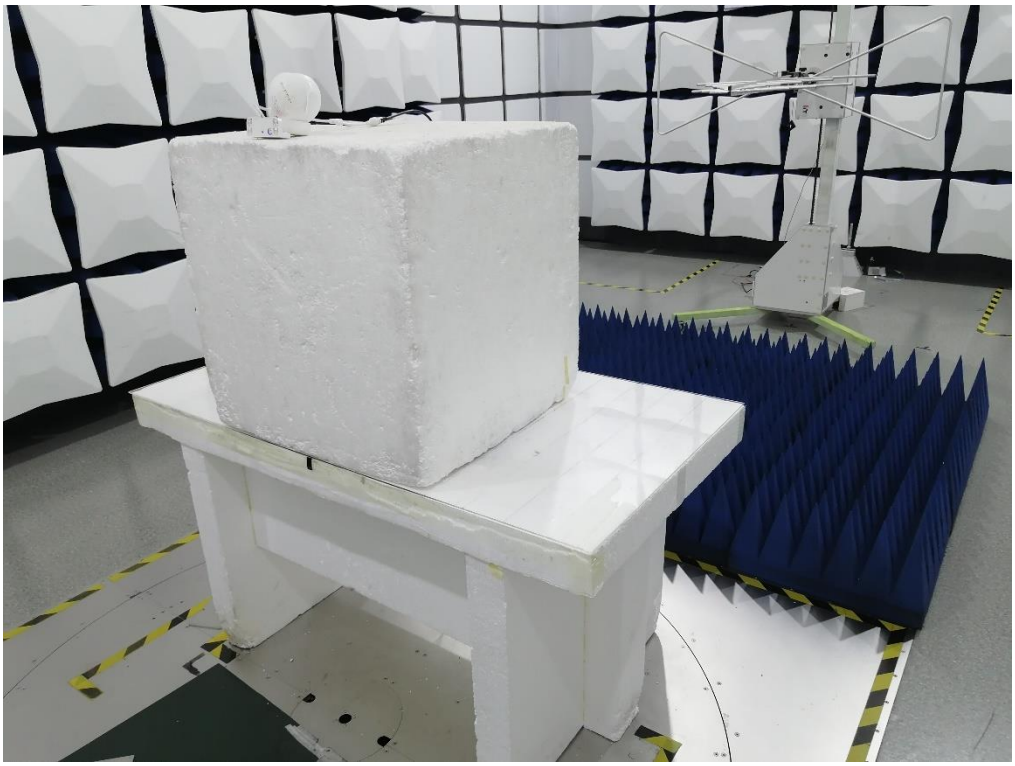
Additionally, the equipment shall either follow the restrictions for LBT given in clause 4.4.2 or the restrictions for DAA as appropriate.

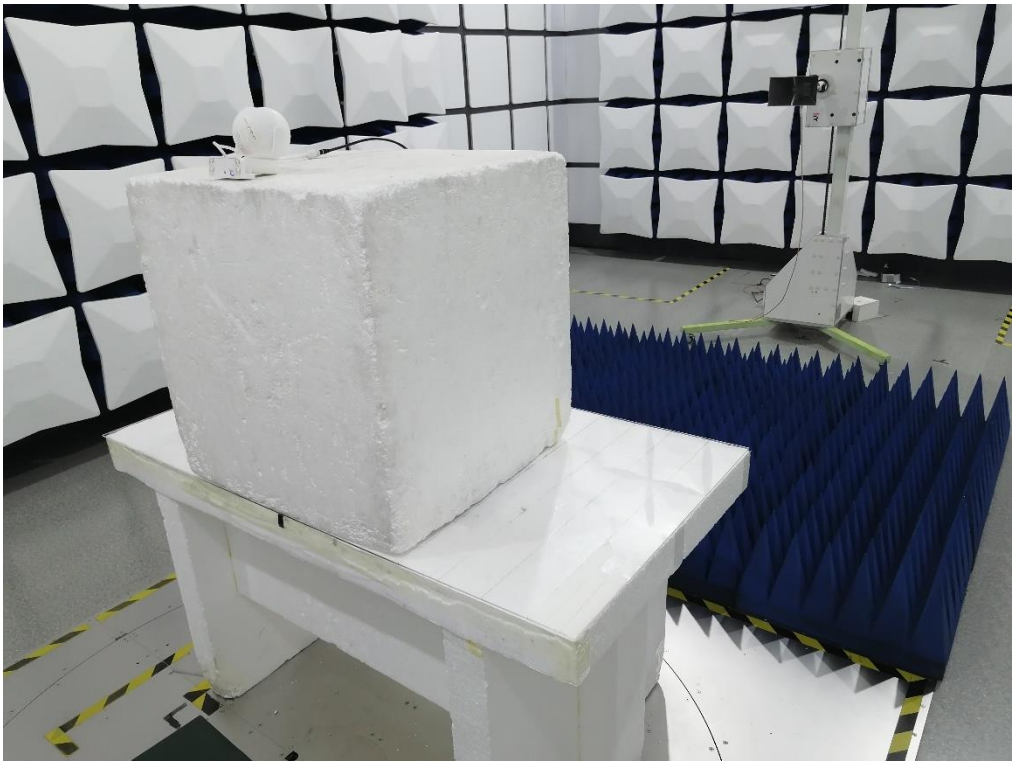
Test Result

Temperature:	22.8° C
Humidity:	56%
Test Engineer:	Allen.Lai

Test Mode	Test Frequency (MHz)	Receiver LBT threshold		Maximum transmitter on-time		Verdict
		Test Value (dBm)	Limit (dBm)	Test Value (s)	Limit (s)	
802.11a	5745	-86	≤-67.0	0.00706	≤2	PASS

5 Test Setup Photos of the EUT





6 External and Internal Photos of the EUT

Reference to the test report No. TZ240505696-RE

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