ETSI EN 300 220-1 V3.1.1 (2017-02)
ETSI EN 300 220-2 V3.1.1 (2017-02)

TEST REPORT

For

Hangzhou Hikvision Digital Technology Co., Ltd.

No. 555 Qianmo Road, Binjiang District, Hangzhou 310052, China

Tested Model: DS-PD1-MC-WWS

Report Type:	**Product Type:**
Amended Report	Wireless Magnetic Contact

Test Engineer:	Alisa Gao
Report Number:	RKSA180727004-01B
Report Date:	2018-08-06
Reviewed By:	Oscar Ye RF Leader
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Issue
1	RKSA180418003-01B	Original Report	2018-05-10
2	RKSA180727004-01B	Amended Report	2018-08-06

Note:

This is an amended report application based on RKSA180418003-01B, the details as below:

1. Add two capacitances on the PCB;

2. Change the LED chip.

For above difference, all the test data except CLAUSE 4.2.2 – UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN refers to the original report RKSA180418003-01B that issued on 2018-05-10.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-12	2018-11-11
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Sonoma Instrunent	Pre-amplifier	310N	171205	2017-08-15	2018-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-7	007	2017-08-15	2018-08-14
Radiated Emission Test（Chamber 2#）					
HP	Signal Generator	HP 8341B	2624A00116	2017-08-29	2018-08-28
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2017-08-27	2018-08-26
ETS-LINDGREN	Horn Antenna	3115	9311-4159	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
Narda	Pre-amplifier	AFS42-00101800	2001270	2017-12-12	2018-12-11
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
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MICRO-COAX	Coaxial Cable	Cable-11	011	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-16	016	2017-08-15	2018-08-14

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.2.2 – UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

Description

Unwanted emissions for a TX mode

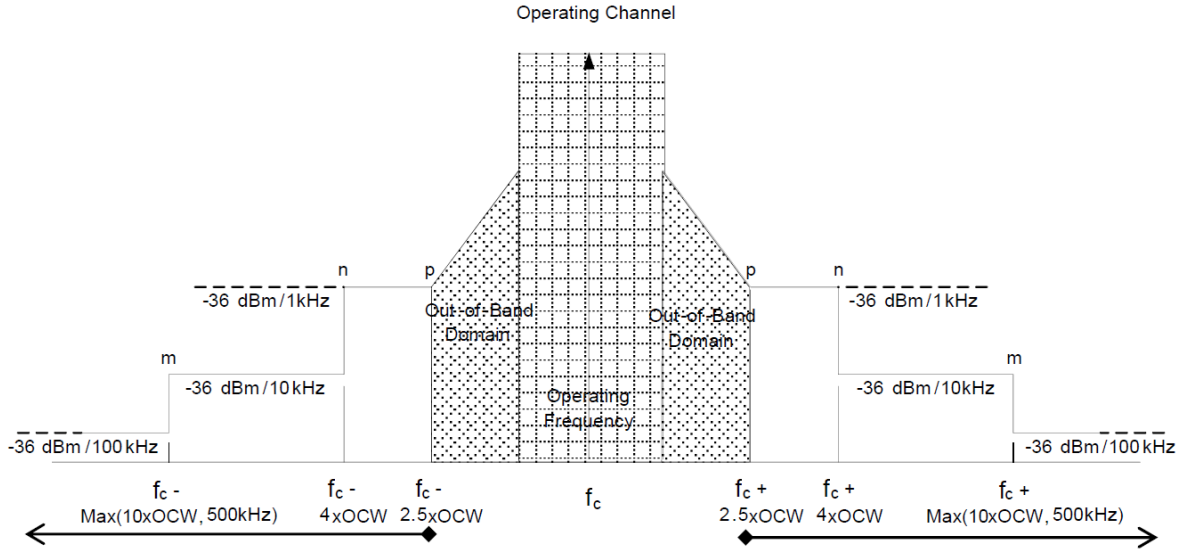


Figure 7: Spectrum Mask for Unwanted Emissions in the Spurious Domain with reference BW

Spurious emissions are unwanted emissions in the spurious domain at frequencies other than those of the Operating Channel and its Out Of Band Domain. The relevant spurious domain is shown in Figure 7.

Unwanted emissions for all other modes

Spurious radiations from the EUT are components, at any frequency, radiated by the equipment and antenna.

Limits

The power of any unwanted emission in the spurious domain shall not exceed the values given in Table 19.

Table 19: Spurious domain emission limits

Frequency / State	47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	-54 dBm	-36 dBm	-30 dBm
RX and all other modes	-57 dBm	-57 dBm	-47 dBm

Conformance

Test conditions for TX mode

The EUT shall be operated in a mode representative of normal operation.
For EUT without an external conventional 50 Ω coaxial antenna connector, the spurious emissions levels shall be established by the radiated measurement procedure in CLAUSE 5.9.3.3.2.
For all other EUT the spurious emissions levels shall be established as both:

- The conducted measurement procedure in CLAUSE 5.9.3.3.1; and
- The radiated measurement procedure in CLAUSE 5.9.3.3.2, with the antenna port terminated in a dummy load.

1) The transmitter shall be performed on the lowest and the highest Operating Frequency declared by the manufacturer. Additional frequencies may be tested.
2) The measurement shall be performed with the EUT operating at its maximum operating power level, as declared by the manufacturer, and also with the EUT in powered-on stand-by mode.
3) The RBW of measuring receiver are shown in Table 20.

Table 20: Parameters for TX Spurious Radiations Measurement

Operating Mode	Frequency Range	RBW_{REF} (see note 2)
Transmit mode	9 kHz ≤ f < 150 kHz	1 kHz
	150 kHz ≤ f < 30 MHz	10 kHz
	30 MHz ≤ f < f_c - m	100 kHz
	f_c - m ≤ f < f_c - n	10 kHz
	f_c - n ≤ f < f_c - p	1 kHz
	f_c + p < f ≤ f_c + n	1 kHz
	f_c + n < f ≤ f_c + m	10 kHz
	f_c + m < f ≤ 1 GHz	100 kHz
	1 GHz < f ≤ 6 GHz	1 MHz
NOTE 1: f is the measurement frequency. f_c is the Operating Frequency. m is 10 x OCW or 500 kHz, whichever is the greater. n is 4 x OCW or 100 kHz, whichever is the greater. p is 2,5 x OCW. NOTE 2: If the value of RBW used for measurement is different from RBW_{REF}, use bandwidth correction from clause 4.3.10.1.		

Test conditions for RX and all other modes

The EUT shall be operated in a mode representative of normal operation.
For EUT without an external conventional 50 Ω coaxial antenna connector, the spurious emissions levels shall be established by the radiated measurement procedure in CLAUSE 5.9.3.3.2.
For all other EUT the spurious emissions levels shall be established as both:

- The conducted measurement procedure in CLAUSE 5.9.3.3.1; and
- The radiated measurement procedure in CLAUSE 5.9.3.3.2, with the antenna port terminated in a dummy load.

Method of measurement

According to ETSI EN 300 220-1 CLAUSE 5.9.3.3

Test Data

Environmental Conditions

Temperature:	24.5 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Alisa Gao on 2018-08-01.

Test result: Compliant.

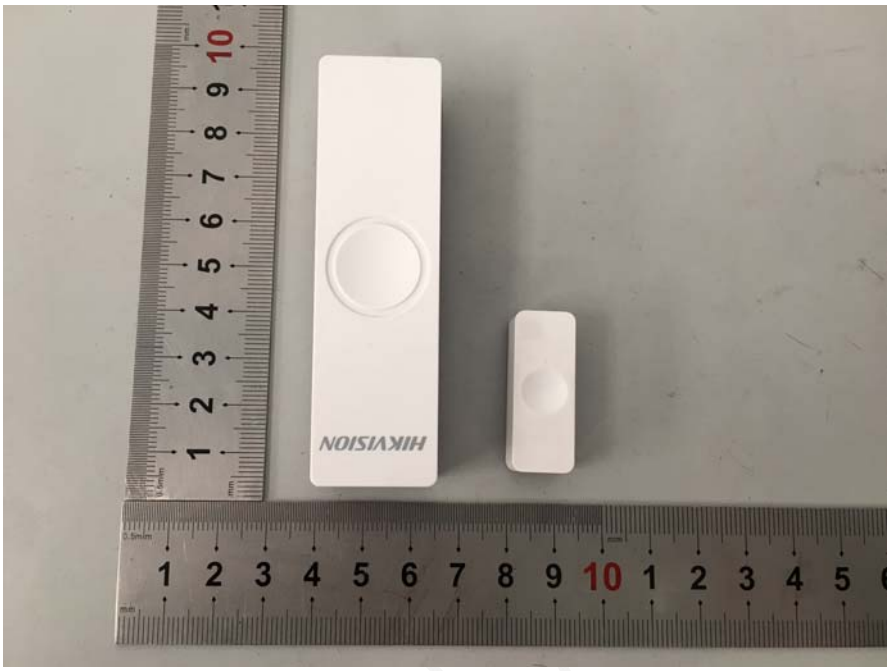
Frequency (MHz)	Receiver Reading (dBµV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
Test mode: TX Mode										
30.08	41.23	17	132	H	-28.57	0.15	-27.67	-56.39	-36	20.39
30.08	38.81	301	220	V	-40.64	0.15	-27.67	-68.46	-36	32.46
867.20	55.71	173	198	H	-39.21	0.63	-1.05	-40.89	-36	4.89
867.20	53.49	202	112	V	-43.84	0.63	-1.05	-45.52	-36	9.52
1300.80	50.83	84	114	H	-61.06	0.81	7.64	-54.23	-30	24.23
1300.80	48.12	80	229	V	-64.20	0.81	7.64	-57.37	-30	27.37
Test mode: RX Mode										
30.08	37.28	49	214	H	-32.52	0.15	-27.67	-60.34	-57	3.34
30.08	34.15	59	146	V	-45.30	0.15	-27.67	-73.12	-57	16.12
1431.22	42.65	158	202	H	-69.42	0.82	8.01	-62.23	-47	15.23
1431.22	39.53	209	225	V	-72.83	0.82	8.01	-65.64	-47	18.64

Note 1: The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

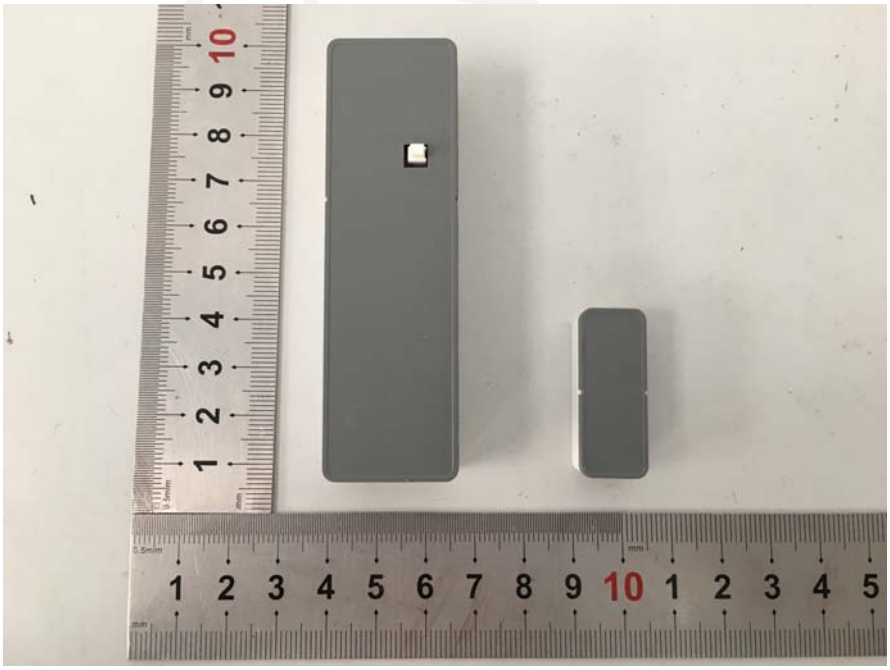
Note 2:
Absolute Level = Submitted Level - Cable loss + Antenna Gain
Margin = Limit – Absolute Level

EXHIBIT A - EUT PHOTOGRAPHS

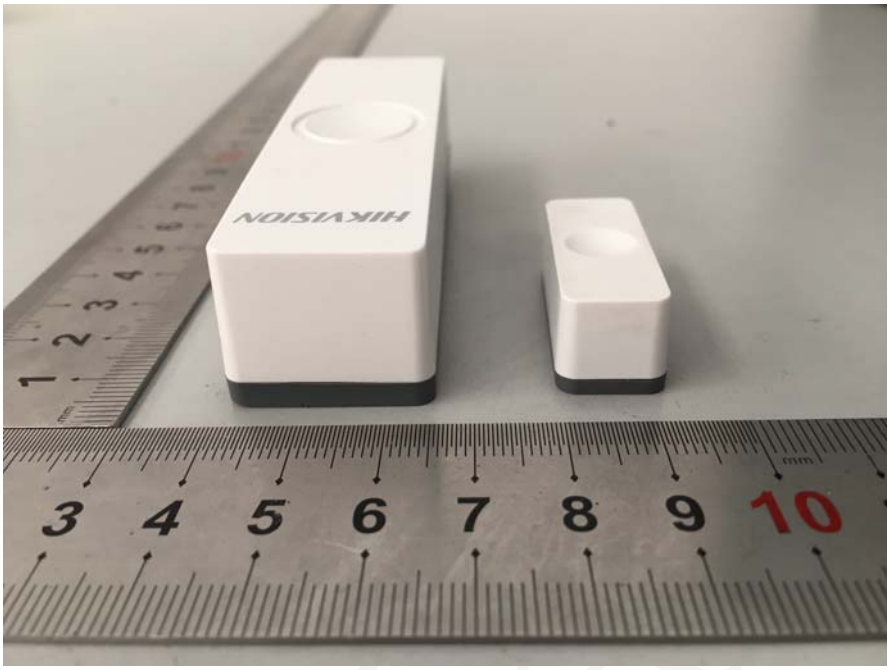
EUT – Top View



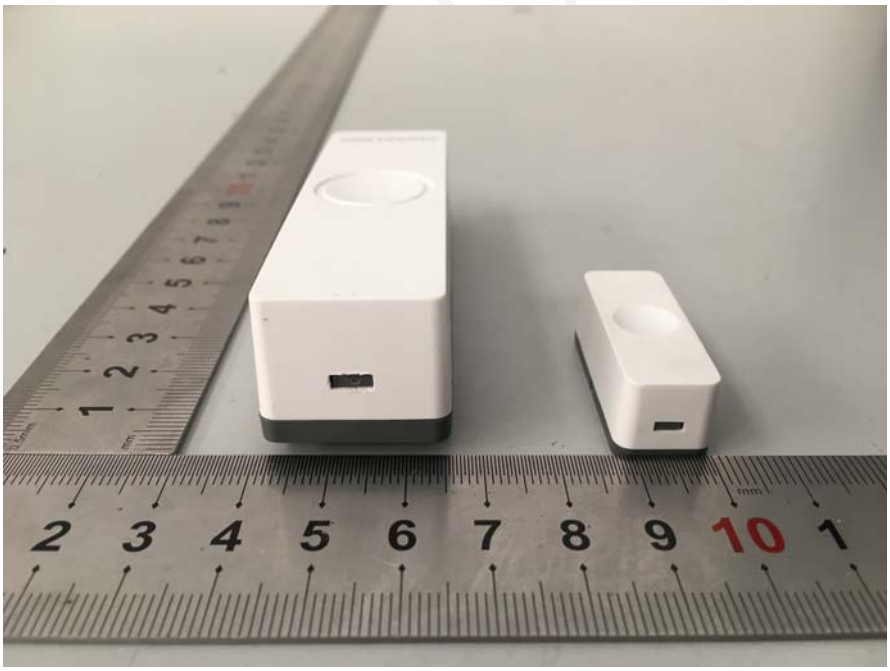
EUT – Bottom View



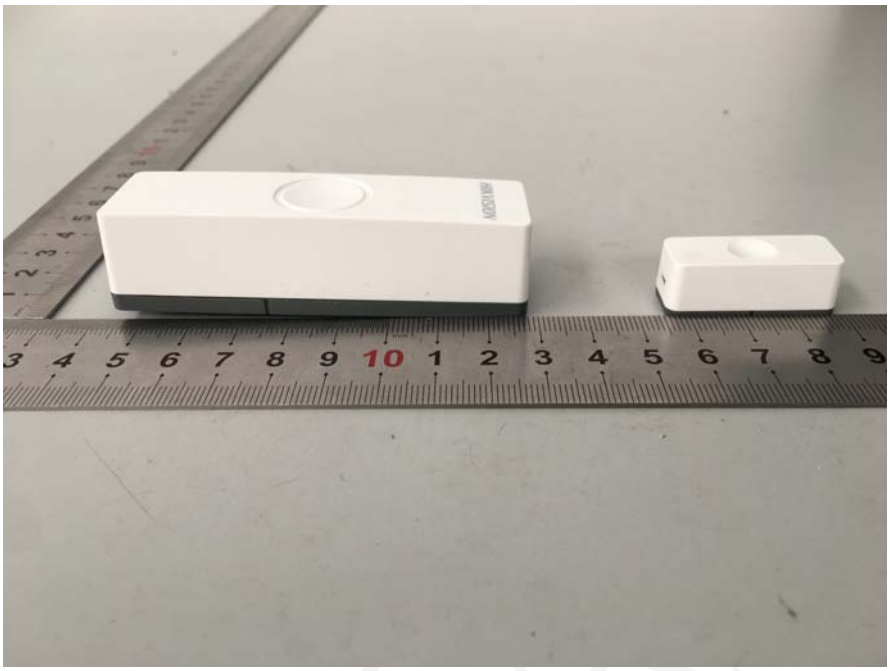
EUT – Front View



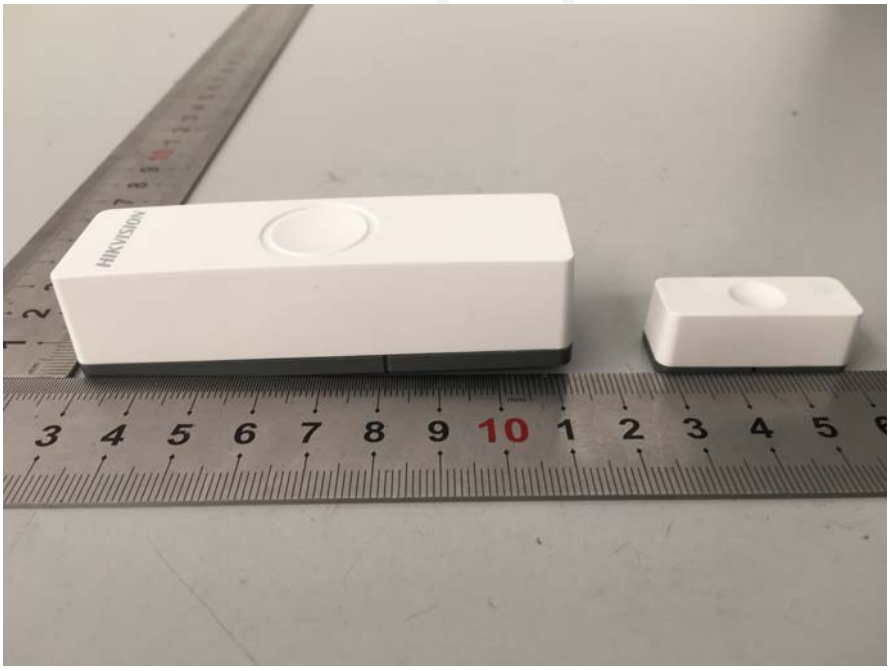
EUT – Rear View



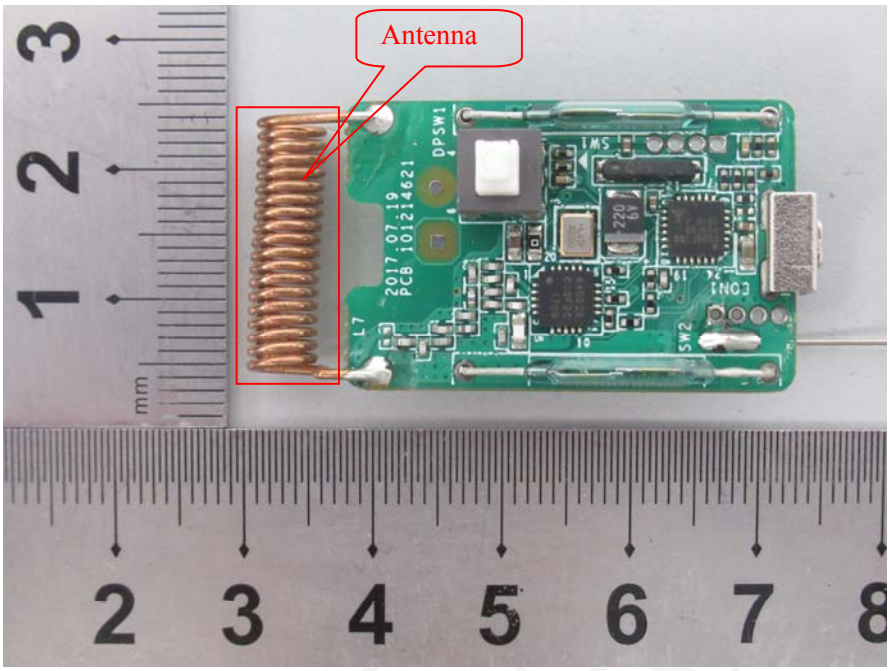
EUT – Left View



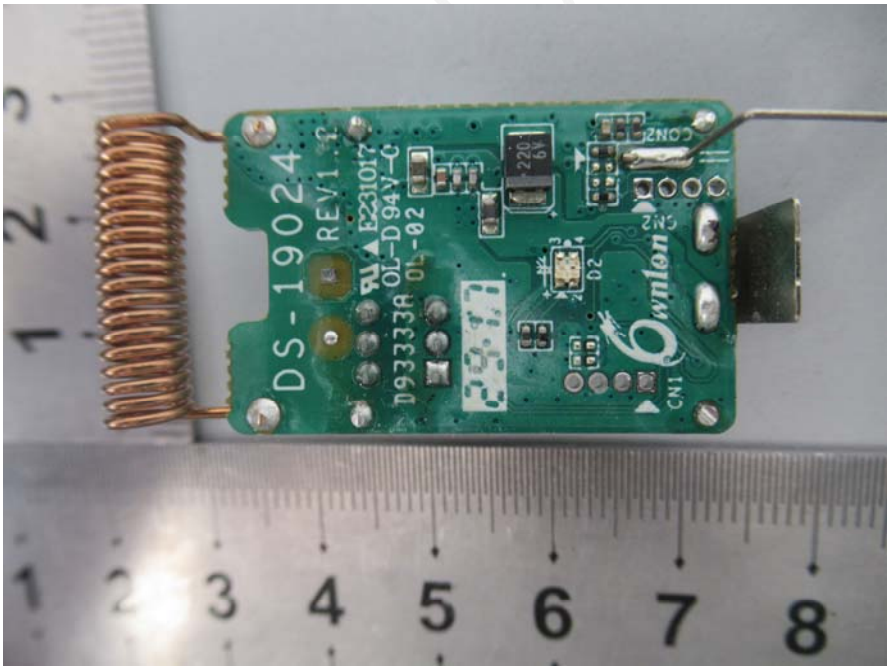
EUT – Right View



EUT – PCB Top View



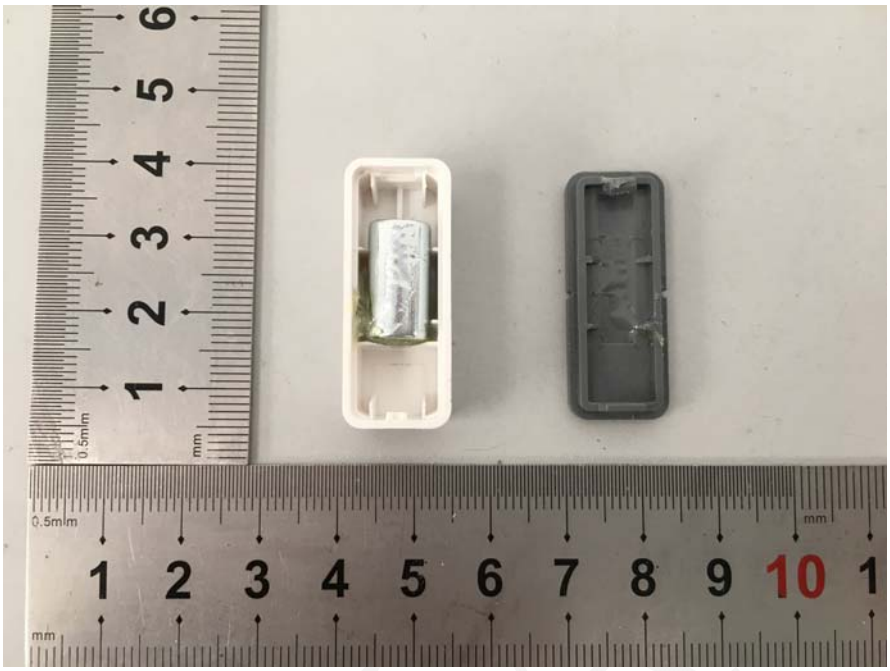
EUT – PCB Bottom View



EUT – Battery Top View

EUT – Battery Bottom View

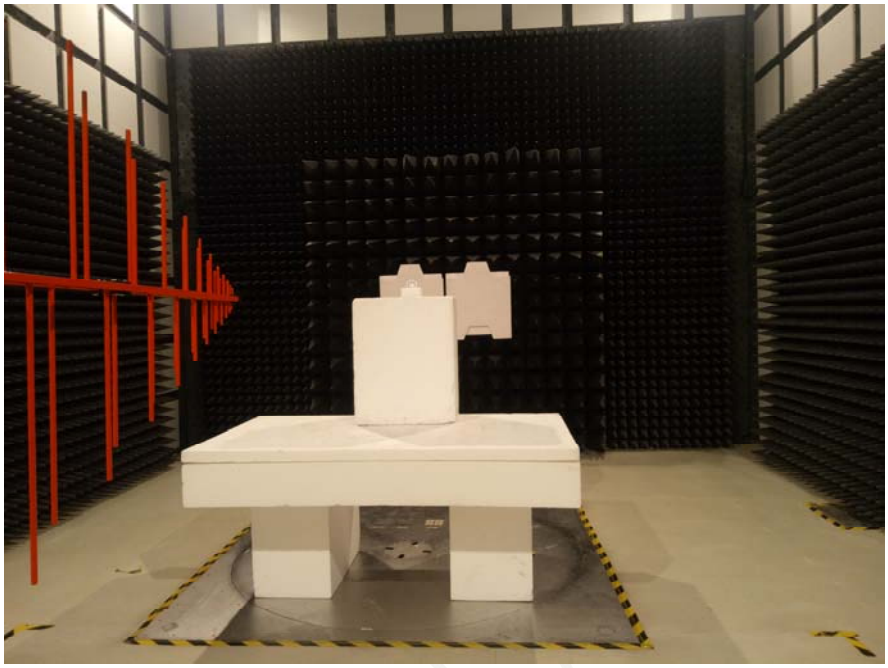
EUT – Cover off View -1



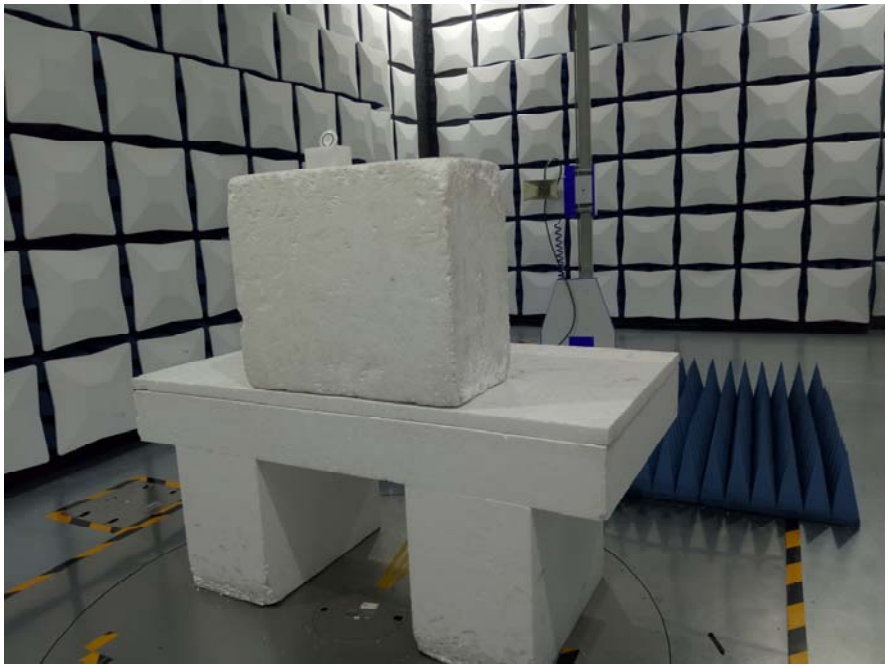
EUT – Cover off View -2

EXHIBIT B - TEST SETUP PHOTOGRAPHS

Spurious Radiation - Below 1GHz View



Spurious Radiation - Above 1GHz View



BELOW IS THE ORIGINAL REPORT

ETSI EN 300 220-1 V3.1.1 (2017-02)
ETSI EN 300 220-2 V3.1.1 (2017-02)
TEST REPORT

For

Hangzhou Hikvision Digital Technology Co., Ltd.

No. 555 Qianmo Road, Binjiang District, Hangzhou 310052, China

Tested Model: DS-PD1-MC-WWS

Report Type:	**Product Type:**
Original Report	Wireless Magnetic Contact

Test Engineer:	Alisa Gao
Report Number:	RKSA180418003-01B
Report Date:	2018-05-10
Reviewed By:	Oscar Ye RF Leader
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-0512-86175000 Fax: +86-0512-88934268 www.baclcorp.com.cn

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SPURIOUS RADIATION - BELOW 1GHZ VIEW 42
SPURIOUS RADIATION - ABOVE 1GHZ VIEW 42

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Hangzhou Hikvision Digital Technology Co., Ltd.
Tested Model	DS-PD1-MC-WWS
Product Type	Wireless Magnetic Contact
Dimension	84mm(L)*25mm(W)*21mm(H)
Power Supply	DC 3.0V from Lithium Battery

**All measurement and test data in this report was gathered from production sample serial number: 20180418003 (Assigned by the BACL. The EUT supplied by the applicant was received on 2018-04-18)*

Objective

The test report is prepared on behalf of the *Hangzhou Hikvision Digital Technology Co., Ltd.* in accordance with ETSI EN 300 220-2 V3.1.1 (2017-02), Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for non specific radio equipment.

The objective is to determine the compliance of the EUT with ETSI EN 300 220-2 V3.1.1 (2017-02).

Test Methodology

All measurements contained in this report were conducted with ETSI EN 300 220-1 V 3.1.1 (2017-02).

Measurement Uncertainty

Item		Uncertainty
RF Output Power with Power meter		0.5dB
Power Spectral Density, conducted		0.5dB
Unwanted Emissions, conducted		2.34 dB
Radiated emission	30MHz~1GHz	5.91dB
	1GHz~6GHz	4.68dB
	6 GHz ~18 GHz	4.92dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%
Time		5 %
Supply voltages		0.04%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

Channel list For GFSK Modulation:

Channel	Frequency (MHz)
1	433.60

EUT Exercise Software

No software was used in the test.

Special Accessories

No special accessories.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

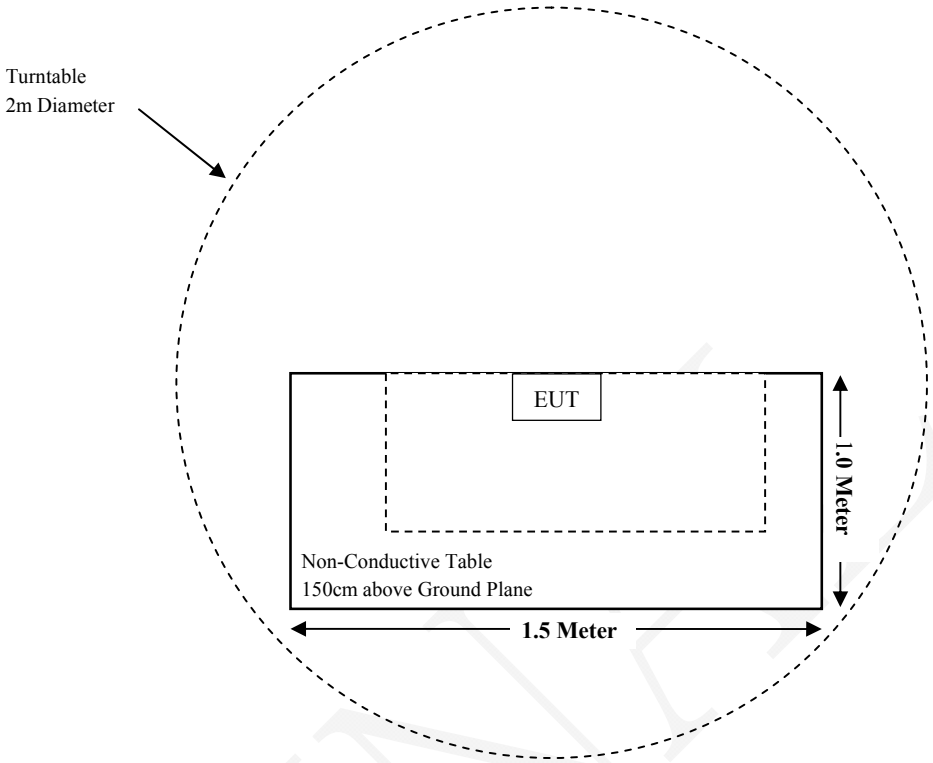
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Shielding Type	Length (m)	From Port	To
/	/	/	/	/

Block Diagram of Test Setup

For Radiated Emissions(Below 1GHz&Above 1GHz):



SUMMARY OF TEST RESULTS

ETSI EN 300 220-2 V3.1.1 (2017-02)

Rules	Description of Test	Result
CLAUSE 4.2.1	Operating Frequency	Compliance
CLAUSE 4.2.2	Unwanted Emissions in the Spurious Domain	Compliance
CLAUSE 4.3.1	Effective Radiated Power	Compliance
CLAUSE 4.3.2	Maximum e.r.p. Spectral Density	Not Applicable (See Note1)
CLAUSE 4.3.3	Duty Cycle	Compliance
CLAUSE 4.3.4	Occupied Bandwidth	Compliance
CLAUSE 4.3.5	TX Out of Band Emissions	Compliance
CLAUSE 4.3.6	Transient Power	Compliance
CLAUSE 4.3.7	Adjacent Channel Power	Not Applicable (See Note2)
CLAUSE 4.3.8	TX Behaviour under Low Voltage Conditions	Compliance
CLAUSE 4.3.9	Adaptive power control	Not Applicable (See Note1)
CLAUSE 4.3.10	FHSS equipment	Not Applicable (See Note3)
CLAUSE 4.3.11	Short Term Behaviour	Not Applicable (See Note1)
CLAUSE 4.4.1	RX Sensitivity	Not Applicable (See Note4)
CLAUSE 4.5.2	Clear Channel Assessment Threshold	Not Applicable (See Note4)
CLAUSE 4.5.3	Polite Spectrum Access Timing Parameters	Not Applicable (See Note4)
CLAUSE 4.4.2	Blocking	Compliance
CLAUSE 4.5.4	Adaptive Frequency Agility	Not Applicable (See Note5)

Note1: The EUT operated in Band H.
Note2: This item applies to EUT with OCW≤25 kHz.
Note3: This item applies to FHSS EUT.
Note4: This item applies to EUT with polite spectrum access.
Note5: This item applies to EUT with AFA.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test（Chamber 1#）					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2017-11-12	2018-11-11
Sunol Sciences	Broadband Antenna	JB3	A090413-1	2016-12-26	2019-12-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Sonoma Instrunent	Pre-amplifier	310N	171205	2017-08-15	2018-08-14
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
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MICRO-COAX	Coaxial Cable	Cable-9	009	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-7	007	2017-08-15	2018-08-14
Radiated Emission Test（Chamber 2#）					
HP	Signal Generator	HP 8341B	2624A00116	2017-08-29	2018-08-28
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2017-08-27	2018-08-26
ETS-LINDGREN	Horn Antenna	3115	9311-4159	2016-01-11	2019-01-10
ETS-LINDGREN	Horn Antenna	3115	6229	2016-01-11	2019-01-10
Narda	Pre-amplifier	AFS42-00101800	2001270	2017-12-12	2018-12-11
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2017-08-15	2018-08-14
MICRO-COAX	Coaxial Cable	Cable-16	016	2017-08-15	2018-08-14
RF Conducted Test					
Rohde & Schwarz	SMBV100A Vector Signal Generator	SMBV100A	261558	2017-07-22	2018-07-21
Rohde & Schwarz	SMB 100A Signal Generator	SMB100A	110390	2017-07-22	2018-07-21
Rohde & Schwarz	FSV40 Signal Analyzer	FSV40	101116	2017-07-22	2018-07-21
BACL	Temperature & Humidity Chamber	BTH-150	30023	2017-09-05	2018-09-04
EAST	Regulated DC Power Supply	MCH-303D-II	14070562	2017-09-05	2018-09-04
Hikvision	RF Cable	/	/	Each Time	/

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.2.1 - OPERATING FREQUENCY

Description

According to ETSI EN 300 220-1 V3.1.1 (2017-02), the nominal operating frequency is the centre of a channel of width OCW.

Limits

The manufacturer may declare either one or more operating frequencies and operating channels.

Operating channel(s) shall be entirely within operational frequency bands allowed by annexes B, C or any NRI in ETSI EN 300 220-2 V3.1.1 (2017-02).

Method of measurement

The information shown in Table 6 shall be recorded in the test report.

Table 6: Information Recorded in the Test Report for Operating Frequency test

Value	Notes
Operational Frequency band or bands	Declared by the manufacturer
Nominal Operating Frequency or Frequencies	Declared by the manufacturer
Operating Channel width(s) - OCW	Declared by the manufacturer

The result

Note: Compliance, which is declared by the manufacturer.

Operating frequency (MHz)	Operating Frequency Band (MHz)	Operating Channel Width (kHz)
433.60	433.050 ~ 434.790	60

ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.2.2 – UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

Description

Unwanted emissions for a TX mode

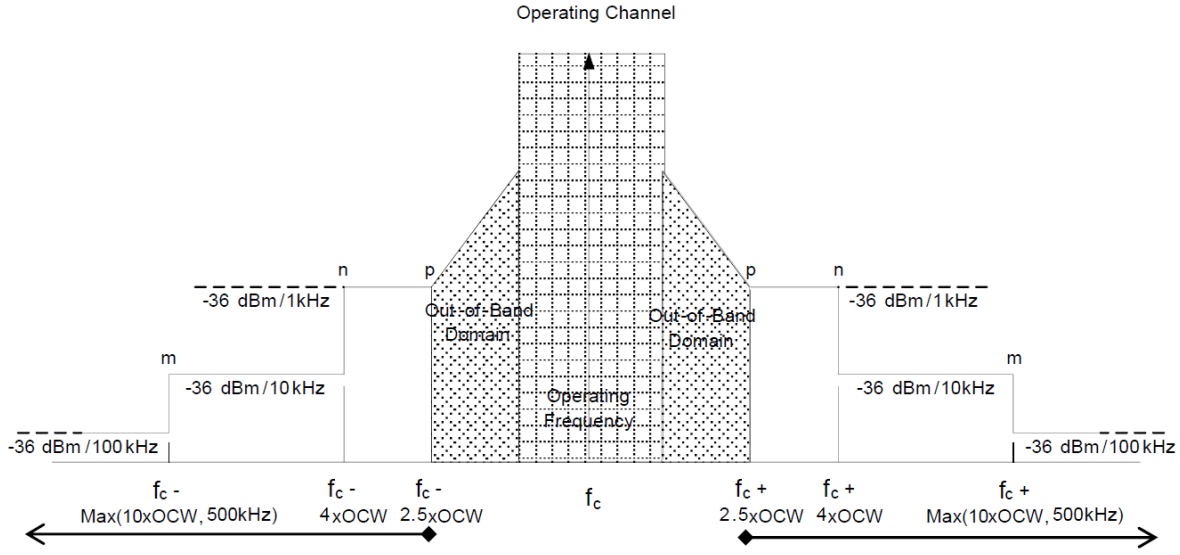


Figure 7: Spectrum Mask for Unwanted Emissions in the Spurious Domain with reference BW

Spurious emissions are unwanted emissions in the spurious domain at frequencies other than those of the Operating Channel and its Out Of Band Domain. The relevant spurious domain is shown in Figure 7.

Unwanted emissions for all other modes

Spurious radiations from the EUT are components, at any frequency, radiated by the equipment and antenna.

Limits

The power of any unwanted emission in the spurious domain shall not exceed the values given in Table 19.

Table 19: Spurious domain emission limits

Frequency / State	47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	-54 dBm	-36 dBm	-30 dBm
RX and all other modes	-57 dBm	-57 dBm	-47 dBm

Conformance

Test conditions for TX mode

The EUT shall be operated in a mode representative of normal operation.
For EUT without an external conventional 50 Ω coaxial antenna connector, the spurious emissions levels shall be established by the radiated measurement procedure in CLAUSE 5.9.3.3.2.
For all other EUT the spurious emissions levels shall be established as both:

- the conducted measurement procedure in CLAUSE 5.9.3.3.1; and
- the radiated measurement procedure in CLAUSE 5.9.3.3.2, with the antenna port terminated in a dummy load.

1) The transmitter shall be performed on the lowest and the highest Operating Frequency declared by the manufacturer. Additional frequencies may be tested.
2) The measurement shall be performed with the EUT operating at its maximum operating power level, as declared by the manufacturer, and also with the EUT in powered-on stand-by mode.
3) The RBW of measuring receiver are shown in Table 20.

Table 20: Parameters for TX Spurious Radiations Measurement

Operating Mode	Frequency Range	RBW_{REF} (see note 2)
Transmit mode	9 kHz ≤ f < 150 kHz	1 kHz
	150 kHz ≤ f < 30 MHz	10 kHz
	30 MHz ≤ f < f_c - m	100 kHz
	f_c - m ≤ f < f_c - n	10 kHz
	f_c - n ≤ f < f_c - p	1 kHz
	f_c + p < f ≤ f_c + n	1 kHz
	f_c + n < f ≤ f_c + m	10 kHz
	f_c + m < f ≤ 1 GHz	100 kHz
	1 GHz < f ≤ 6 GHz	1 MHz
NOTE 1: f is the measurement frequency. f_c is the Operating Frequency. m is 10 x OCW or 500 kHz, whichever is the greater. n is 4 x OCW or 100 kHz, whichever is the greater. p is 2,5 x OCW. NOTE 2: If the value of RBW used for measurement is different from RBW_{REF}, use bandwidth correction from clause 4.3.10.1.		

Test conditions for RX and all other modes

The EUT shall be operated in a mode representative of normal operation.
For EUT without an external conventional 50 Ω coaxial antenna connector, the spurious emissions levels shall be established by the radiated measurement procedure in CLAUSE 5.9.3.3.2.
For all other EUT the spurious emissions levels shall be established as both:

- the conducted measurement procedure in CLAUSE 5.9.3.3.1; and
- the radiated measurement procedure in CLAUSE 5.9.3.3.2, with the antenna port terminated in a dummy load.

Method of measurement

According to ETSI EN 300 220-1 CLAUSE 5.9.3.3

Test Data

Environmental Conditions

Temperature:	24.5 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Alisa Gao on 2018-05-03.

Test result: Compliant.

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)			
Test mode: TX Mode										
200.72	41.23	187	159	H	-64.34	0.42	-3.93	-68.69	-54	14.69
200.72	38.81	262	125	V	-66.34	0.42	-3.93	-70.69	-54	16.69
867.20	55.71	285	168	H	-39.21	0.63	-1.05	-40.89	-36	4.89
867.20	53.29	77	236	V	-44.04	0.63	-1.05	-45.72	-36	9.72
1300.80	50.72	258	124	H	-61.17	0.81	7.64	-54.34	-30	24.34
1300.80	48.54	54	180	V	-63.78	0.81	7.64	-56.95	-30	26.95
Test mode: RX/Standby Mode										
206.23	37.13	127	125	H	-67.98	0.42	-3.74	-72.14	-57	15.14
206.23	34.28	231	207	V	-71.38	0.42	-3.74	-75.54	-57	18.54
1431.29	42.89	233	176	H	-69.18	0.82	8.01	-61.99	-47	14.99
1431.29	39.96	220	162	V	-72.4	0.82	8.01	-65.21	-47	18.21

Note 1: The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

Note 2:
Absolute Level = Submitted Level - Cable loss + Antenna Gain
Margin = Limit – Absolute Level

Note 3: RX and Standby Modes are the same.

ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.3.1 – EFFECTIVE RADIATED POWER

Description

The effective radiated power (e.r.p) is the power radiated in the direction of the maximum radiated power under specified conditions of measurements for any condition of modulation. For equipment with a permanent or temporary antenna connection it may be taken as the power delivered from that connector taking into account the antenna gain.

Limits

The effective radiated power shall not be greater than the value allowed in annexes B or C for the chosen operational frequency band(s) in ETSI EN 300 220-2 V3.1.1 (2017-02).

Table B.1: EU wide harmonised national radio interfaces from 25 MHz to 1 000 MHz

Operational Frequency Band		Maximum effective radiated power, e.r.p.	Channel access and occupation rules (e.g. Duty cycle or LBT + AFA)	Maximum occupied bandwidth	Other usage restrictions	Band number from EC Decision 2013/752/ EU [i.3]	Class 1 sub-class number according Commission Decision 2000/299/EU [i.7]
H	433,050 MHz to 434,790 MHz	10 mW	10 %	The whole band	/	44b, 45b	20, 125

Method of measurement

According to ETSI EN 300 220-1 CLAUSE 5.2.2

Test Data

Environmental Conditions

Temperature:	24.5 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Alisa Gao on 2018-05-03.

Test Mode: Transmitting

Test Frequency (MHz)	Test Condition					Result
433.60	N.V. N.T.	L.V. L.T.	L.V. H.T.	H.V. L.T	H.V. H.T	Compliance

Note:

L.V.: Low Voltage 2.7VDC
L.T.: Low Temperature -10℃
N.V.: Normal Voltage 3.0 VDC
N.T.: Normal Temperature +25℃
H.V.: High Voltage 3.3VDC
H.T.: High Temperature +55℃

Normal Condition Test Data as below:

Frequency (MHz)	Reading (dBm)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)
433.6	0.71	-12.00	-11.29	10

Note: 0dBd=2.15dBi

ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.3.3 – DUTY CYCLE

Definition

Duty cycle is the ratio expressed as a percentage, of the cumulative duration of transmissions T_{on_cum} within an observation interval T_{obs}. $DC = \left(\frac{T_{on\_cum}}{T_{obs}}\right)_{Fobs}$ on an observation bandwidth F_{obs}.
Unless otherwise specified, Tobs is 1 hour and the observation bandwidth Fobs is the operational frequency band. Each transmission consists of an RF emission, or sequence of RF emissions separated by intervals < TDis.
An equipment may operate on several bands simultaneously (i.e. multi transmissions), Duty Cycle limit of each individual band applies to each transmission within that band.
In case of a multicarrier modulation in a band, the duty cycle applies to the whole signal used for a transmission (e.g. OFDM).
It has to be noted that on some bands Duty Cycle value may depend on the presence of a primary radio service.
Equipment may be triggered manually, by internal timing or by external stimulus. Depending on the method of triggering the timing may be predictable or random.

Limit

The Duty Cycle at the operating frequency shall not be greater than values in annex B or C for the chosen operational frequency band(s).

Table B.1: EU wide harmonised national radio interfaces from 25 MHz to 1 000 MHz

Operational Frequency Band		Maximum effective radiated power, e.r.p.	Channel access and occupation rules (e.g. Duty cycle or LBT + AFA)	Maximum occupied bandwidth	Other usage restrictions	Band number from EC Decision 2013/752/ EU [i.3]	Class 1 sub-class number according Commission Decision 2000/299/EU [i.7]
H	433,050 MHz to 434,790 MHz	10 mW	10 %	The whole band	/	44b, 45b	20, 125

Method of measurement

An assessment of the overall Duty Cycle shall be made for a representative period of T_{obs} over the observation bandwidth F_{obs}. Unless otherwise specified, T_{obs} is 1 hour and the observation bandwidth Fobs is the operational frequency band.
The representative period shall be the most active one in normal use of the device. As a guide "Normal use" is considered as representing the behaviour of the device during transmission of 99 % of transmissions generated during its operational lifetime.
Procedures such as setup, commissioning and maintenance are not considered part of normal operation.
Where an acknowledgement is used, the additional transmitter on-time from a message responder shall be declared only once whether included in the message initiator Duty Cycle or in the message responder Duty Cycle.

NOTE: The intention of this rule is not to allow EUT to exceed the maximum duty cycle value.

Test Data

Environmental Conditions

Temperature:	24.5 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Alisa Gao on 2018-05-03.

Test result: Compliant.

The duty cycle was not exceeded 1% in a period of 1 hour, which was declared by the manufacturer. EUT was transmitting approximately 0.5s (maximum) at a time when once triggered, and it will be restricted transmitting less than 72 times in a period of 1 hour.

ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.3.4 - OCCUPIED BANDWIDTH

Definition

The occupied bandwidth (OBW) is the Frequency Range in which 99 % of the total mean power of a given emission falls. The residual part of the total power being denoted as β , which, in cases of symmetrical spectra, splits up into β /2 on each side of the spectrum. Unless otherwise specified, β /2 is taken as 0,5 % as described in Figure 3.

*Occupied Bandwidth (OBW):*width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0,5 % of the total mean power of a given emission

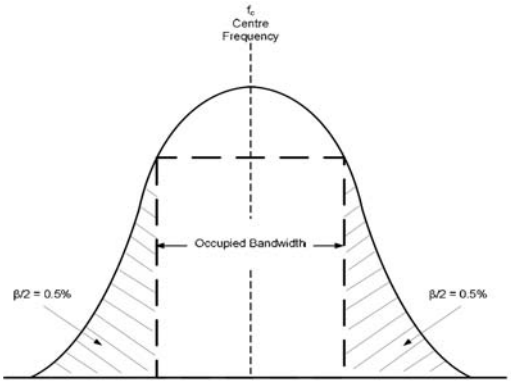


Figure 3: Signal occupied bandwidth

The maximum occupied bandwidth includes all associated side bands above the appropriate emissions level and the frequency error or drift under extreme test conditions.

Limits

The Operating Channel shall be declared and shall reside entirely within the Operational Frequency Band. The Maximum Occupied Bandwidth at 99 % shall reside entirely within the Operating Channel defined by F_{low} and F_{high}.

Method of measurement

The spectrum analyser shall be configured as appropriate for the parameters shown in Table 12.

Table 12: Test Parameters for Max Occupied Bandwidth Measurement

Setting	Value	Notes
Centre frequency	The nominal Operating Frequency	The highest or lowest Operating Frequency as declared by the manufacturer
RBW	1 % to 3 % of OCW without being below 100 Hz	
VBW	3 x RBW	Nearest available analyser setting to 3 x RBW
Span	At least 2 x Operating Channel width	Span should be large enough to include all major components of the signal and its side bands
Detector Mode	RMS	
Trace	Max hold	

All other steps according to ETSI EN 300 220-1 CLAUSE 5.6.3

Test Data

Environmental Conditions

Temperature:	24.5 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

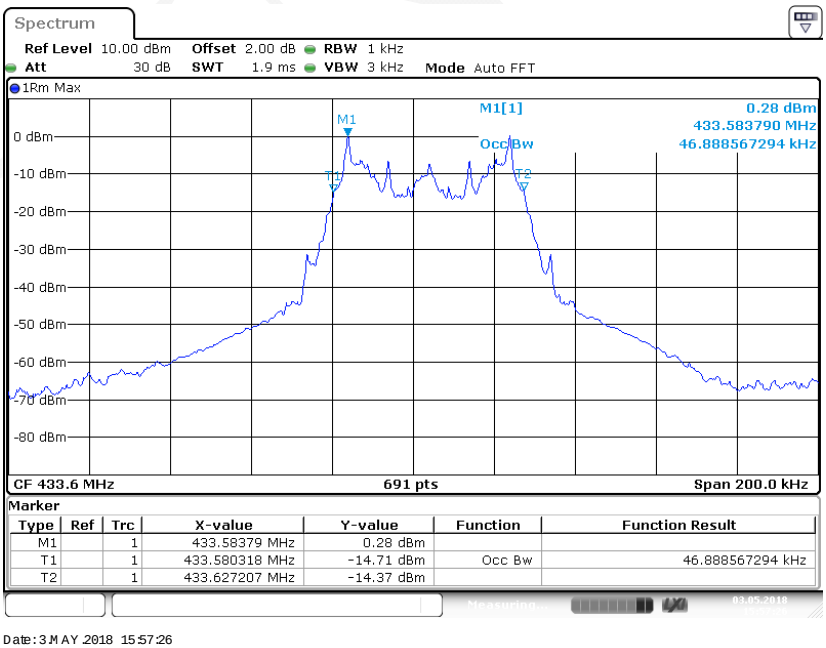
The testing was performed by Alisa Gao on 2018-05-03.

Test Mode: Transmitting

Test Frequency (MHz)	Test Condition					Result
433.60	N.V. N.T.	L.V. L.T.	L.V. H.T.	H.V. L.T	H.V. H.T	Compliance

Normal Condition Test Data as below:

Test Frequency (MHz)	Occupied Bandwidth (kHz)
433.60	46.889



ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.3.5 - TX OUT OF BAND EMISSIONS

Definition

Two OOB domains are defined, one for OC (see Figure 5) and one for Operational Frequency band (see Figure 6). The spectrum masks for these two OOB domains may overlap.

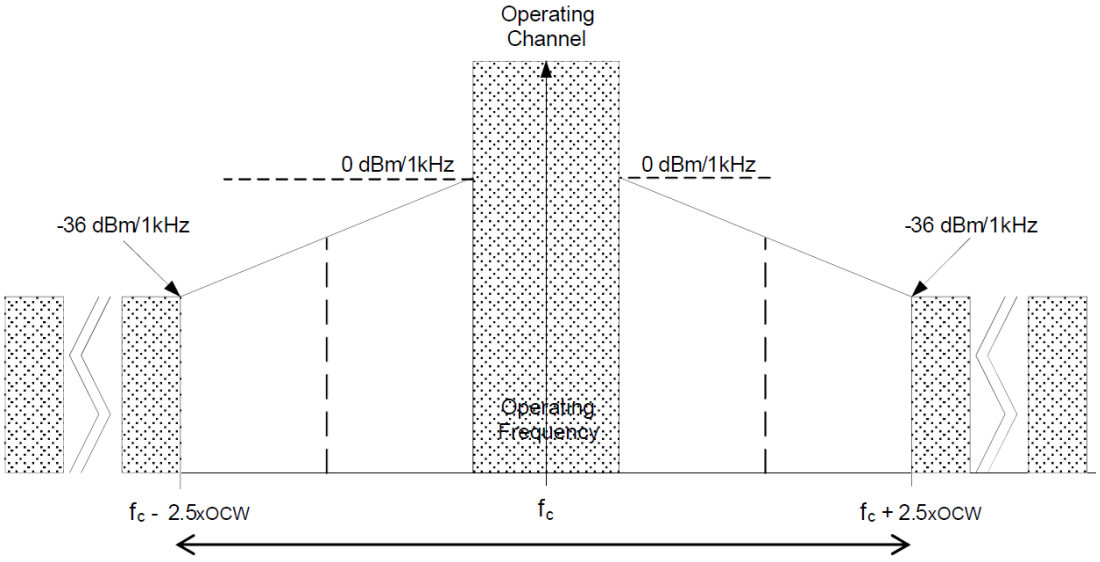


Figure 5: Out Of Band Domain for Operating Channel with reference BW

Unwanted emissions in the Out Of Band domain are those falling in the frequency range immediately below the lower, and above the upper, frequency of the Operating Channel. The OOB domain includes both frequencies outside the Operating Channel within the Operational Frequency Band and frequencies outside the Operational Frequency Band.

The relevant Out Of Band domain is shown in Figure 5 and applies within the Operational Frequency Band.

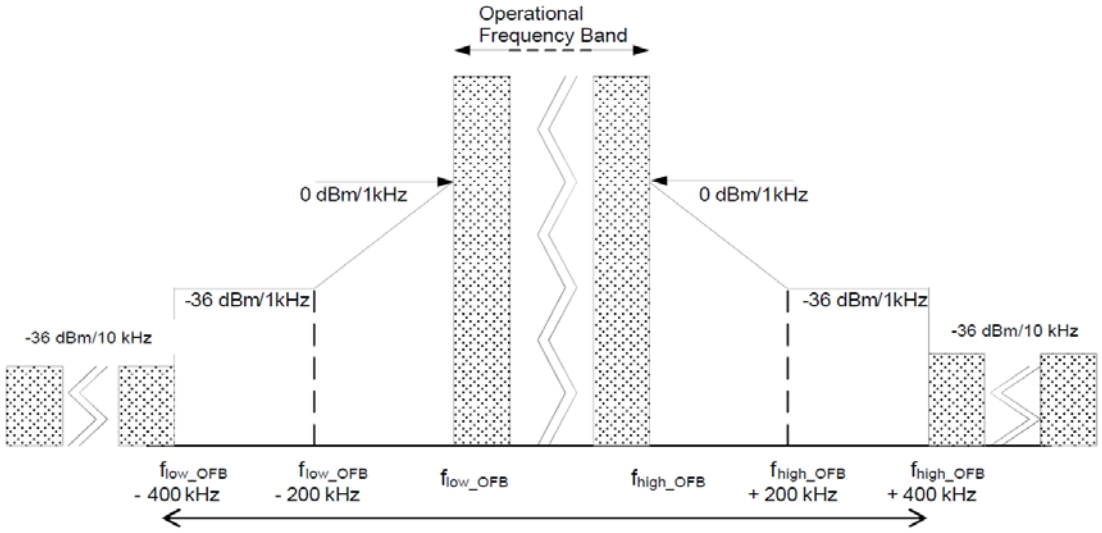


Figure 6: Out Of Band Domain for Operational Frequency Band with reference BW

Specific limits apply at frequencies immediately above and below the Operational Frequency Band as shown in Figure 6.

NOTE: f_{low_OFB} is the lower edge of the Operational Frequency Band.
f_{high_OFB} is the upper edge of the Operational Frequency Band.

Limits

The EUT emissions level in OOB domains for the Operating Channel and the Operational Frequency Band shall be less or equal to Table 15 spectrum mask.

Table 15: Emission limits in the Out Of Band domains

Domain	Frequency Range	RBW_{REF}	Max power limit
OOB limits applicable to Operational Frequency Band (See Figure 6)	$f \le f_{low\_OFB}$ - 400 kHz	10 kHz	-36 dBm
	F_{low_OFB} - 400 kHz ≤ f ≤ f_{low_OFB} - 200 kHz	1 kHz	-36 dBm
	f_{low} - 200 kHz ≤ f < f_{low_OFB}	1 kHz	See Figure 6
	$f = f_{low\_OFB}$	1 kHz	0 dBm
	$f = f_{high\_OFB}$	1 kHz	0 dBm
	F_{high_OFB} < f ≤ f_{high_OFB} + 200 kHz	1 kHz	See Figure 6
	F_{high_OFB} + 200 kHz ≤ f ≤ f_{high_OFB} + 400 kHz	1 kHz	-36 dBm
	F_{high_OFB} + 400 kHz ≤ f	10 kHz	-36 dBm
OOB limits applicable to Operating Channel (See Figure 5)	$f = f_c$ - 2.5 x OCW	1 kHz	-36 dBm
	f_c - 2,5 x OCW ≤ f ≤ f_c - 0,5 x OCW	1 kHz	See Figure 5
	$f = f_c$ - 0,5 x OCW	1 kHz	0 dBm
	$f = f_c$ + 0,5 x OCW	1 kHz	0 dBm
	f_c + 0,5 x OCW ≤ f ≤ f_c + 2,5 x OCW	1 kHz	See Figure 5
	$f = f_c$ + 2,5 x OCW	1 kHz	-36 dBm
NOTE: f is the measurement frequency. f_c is the Operating Frequency. F_{low_OFB} is the lower edge of the Operational Frequency Band. F_{high_OFB} is the upper edge of the Operational Frequency Band. OCW is the operating channel bandwidth.			

Method of measurement

The test equipment shall be configured as appropriate for the parameters shown in Table 16.

Table 16: Test Parameters for Out Of Band for Operating Channel Measurement

Spectrum Analyser Setting	Value	Notes
Centre frequency	Operating Frequency	
Span	6 x Operating Channel width	
RBW	1 kHz (see note)	Resolution bandwidth for Out Of Band domain measurements
Detector Function	RMS	
Trace Mode	Linear AVG	Applies only for EUT generating D-M2 test signal. An appropriate number of samples should be averaged to give a stable reading
	Max Hold	Applies only for EUT generating D-M2a or D-M3 test signal.
NOTE: If the value of RBW used is different from RBW_{REF} in clause 5.8.2, use the bandwidth correction in clause 4.3.10.1.		

All other steps according to ETSI EN 300 220-1 CLAUSE 5.8.3

Test Data

Environmental Conditions

Temperature:	24.5 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Alisa Gao on 2018-05-03.

Test result: Compliant.

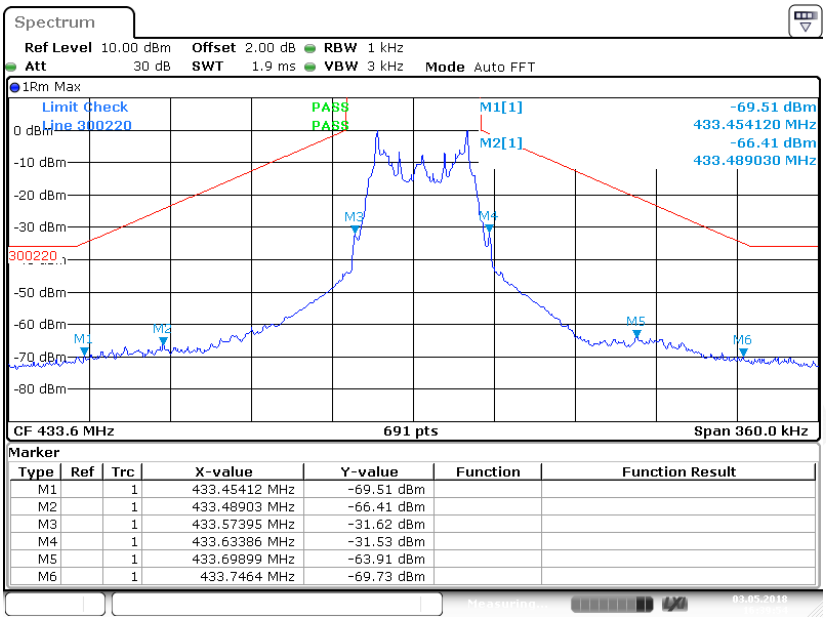
Test Mode: Transmitting

Test Frequency (MHz)	Test Condition					Result
433.60	N.V. N.T.	L.V. L.T.	L.V. H.T.	H.V. L.T	H.V. H.T	Compliance

Normal Condition Test Data as below:

Test with conducted measurement.

OOB

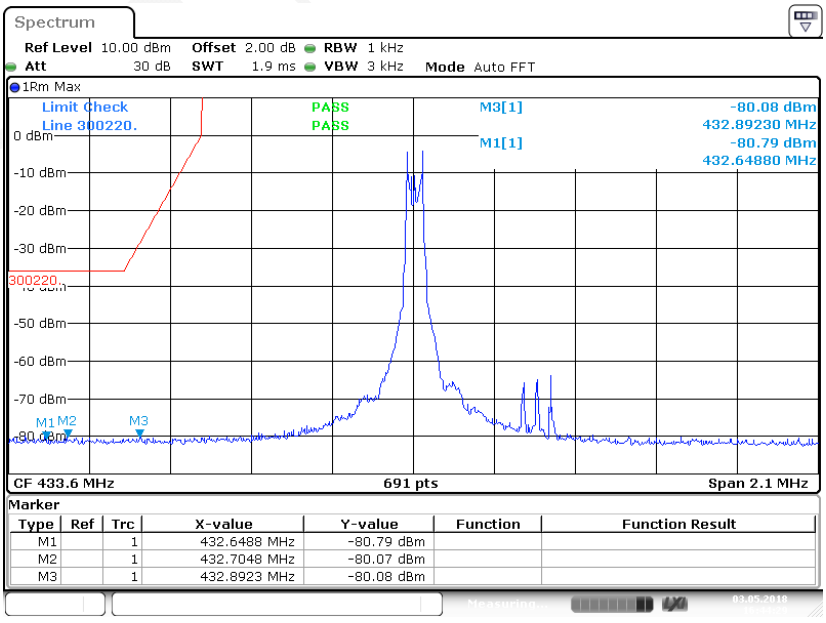


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	433.45412 MHz	-69.51 dBm		
M2		1	433.48903 MHz	-66.41 dBm		
M3		1	433.57395 MHz	-31.62 dBm		
M4		1	433.63386 MHz	-31.53 dBm		
M5		1	433.69899 MHz	-63.91 dBm		
M6		1	433.7464 MHz	-69.73 dBm		

Date: 3.MAY.2018 16:39:55

OFB(F_{low})

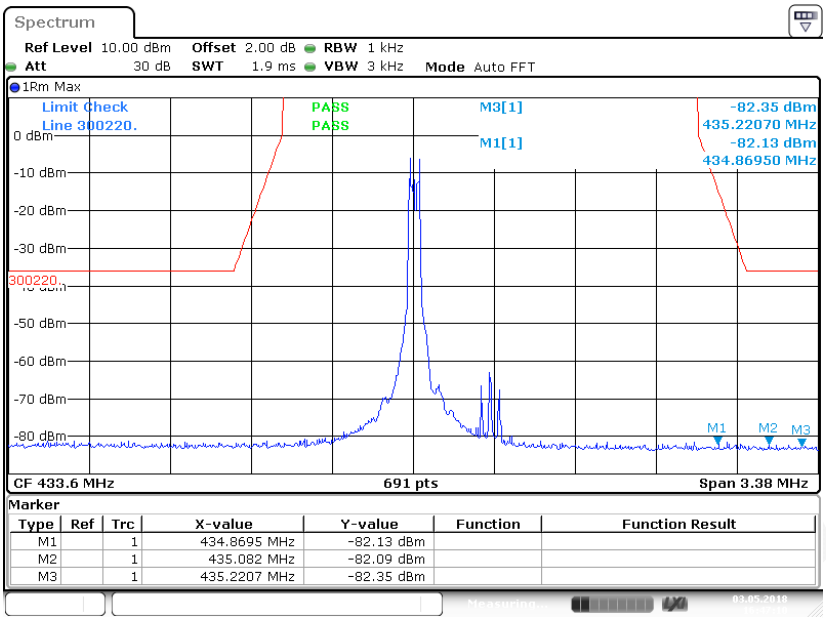


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	432.6488 MHz	-80.79 dBm		
M2		1	432.7048 MHz	-80.07 dBm		
M3		1	432.8923 MHz	-80.08 dBm		

Date: 3.MAY.2018 16:44:29

OFB(F_{high})



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ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.3.6 - TRANSIENT POWER

Definition

Transmitter transient power is power falling into frequencies other than the operating channel as a result of the transmitter being switched on and off.

Limits

The transient power shall not exceed the values given in Table 23.

Table 23: Transmitter Transient Power limits

Absolute offset from centre frequency	RBW_{REF}	Peak power limit applicable at measurement points
≤ 400 kHz	1 kHz	0 dBm
> 400 kHz	1 kHz	-27 dBm

Method of measurement

The output of the EUT shall be connected to a spectrum analyser or equivalent measuring equipment. The measurement shall be undertaken in **zero span** mode. The analyser's centre frequency shall be set to an offset from the operating centre frequency. These offset values and their corresponding RBW configurations are listed in Table 24.

Table 24: RBW for Transient Measurement

Measurement points: offset from centre frequency	Analyser RBW	RBW_{REF}
-0,5 x OCW - 3 kHz 0,5 x OCW + 3 kHz Not applicable for OCW < 25 kHz	1 kHz	1kHz
±12,5 kHz or ±OCW whichever is the greater	Max (RBW pattern 1, 3, 10 kHz) ≤ Offset frequency/6 (see note)	1 kHz
-0,5 x OCW - 400 kHz 0,5 x OCW + 400 kHz	100 kHz	1 kHz
-0,5 x OCW -1 200 kHz 0,5 x OCW + 1 200 kHz	300 kHz	1 kHz
NOTE: Max (RBW pattern 1, 3, 10 kHz) means the maximum bandwidth that falls into the commonly implemented 1, 3, 10 kHz RBW filter bandwidth incremental pattern of spectrum analysers. EXAMPLE: If OCW is 25 kHz then the RBW value corresponding to one OCW offset frequency is 3 kHz. The rest of the analyser settings are listed in Table 25, and if OCW is 250 kHz then the RBW value corresponding to one OCW offset frequency is 30 kHz.		

Table 25: Parameters for Transient Measurement

Spectrum Analyser Setting	Value	Notes
VBW/RBW	10	At higher RBW values VBW may be clipped to its maximum value
Sweep time	500 ms	
RBW filter	Gaussian	
Trace Detector Function	RMS	
Trace Mode	Max hold	
Sweep points	501	
Measurement mode	Continuous sweep	
NOTE: The ratio between the number of sweep points and the sweep time shall be the same ratio as above if different number of sweep points is used.		

The used modulation shall be D-M3. The analyser shall be set to the settings of Table 25 and a measurement shall be started for each offset frequency. The EUT shall transmit at least five D-M3 test signal. The peak value shall be recorded and the measurement shall be repeated at each offset frequency mentioned in Table 24.
The recorded power values shall be converted to power values measured in RBW_{REF} by the formula in CLAUSE 4.3.10.1.

Test Data

Environmental Conditions

Temperature:	24.3 ℃
Relative Humidity:	50 %
ATM Pressure:	101.2 kPa

The testing was performed by Alisa Gao on 2018-05-03.

Test result: Compliant.

Test Mode: switched on and off

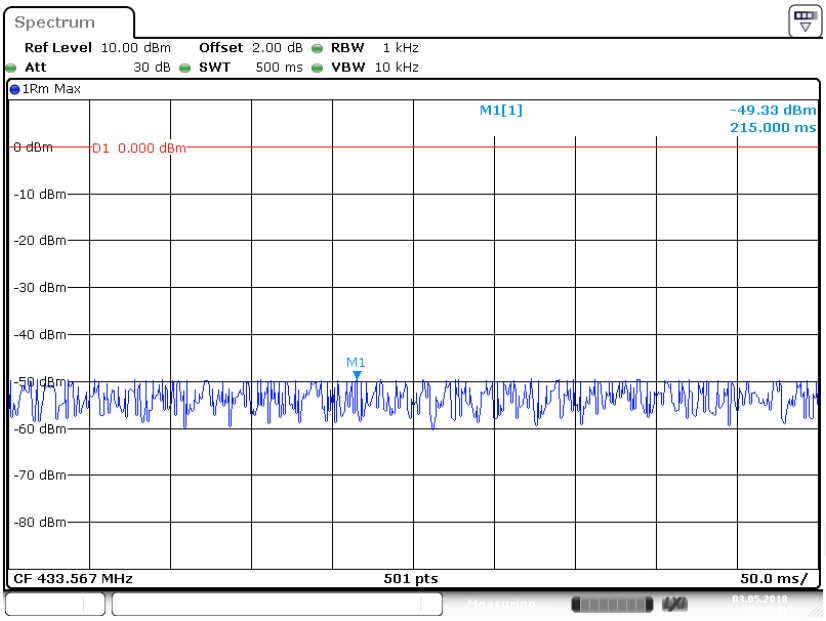
Test with conducted measurement.

Center Frequency (MHz)	Measurement Points: Offset from centre frequency	Analyzer RBW (kHz)	A (dBm)	B (dBm)	Limit (dBm)	Result
433.60	Fc-0.5*OCW-3kHz	1	-49.33	-49.33	0	Pass
	Fc-OCW	10	-53.35	-63.35	0	Pass
	Fc-0.5*OCW-400kHz	100	-67.06	-87.06	-27	Pass
	Fc-0.5*OCW-1200kHz	300	-64.02	-88.79	-27	Pass
	Fc+0.5*OCW+3kHz	1	-37.48	-37.48	0	Pass
	Fc+OCW	10	-49.23	-59.23	0	Pass
	Fc+0.5*OCW+400kHz	100	-66.22	-86.22	-27	Pass
	Fc+0.5*OCW+1200kHz	300	-63.86	-88.63	-27	Pass

Note:

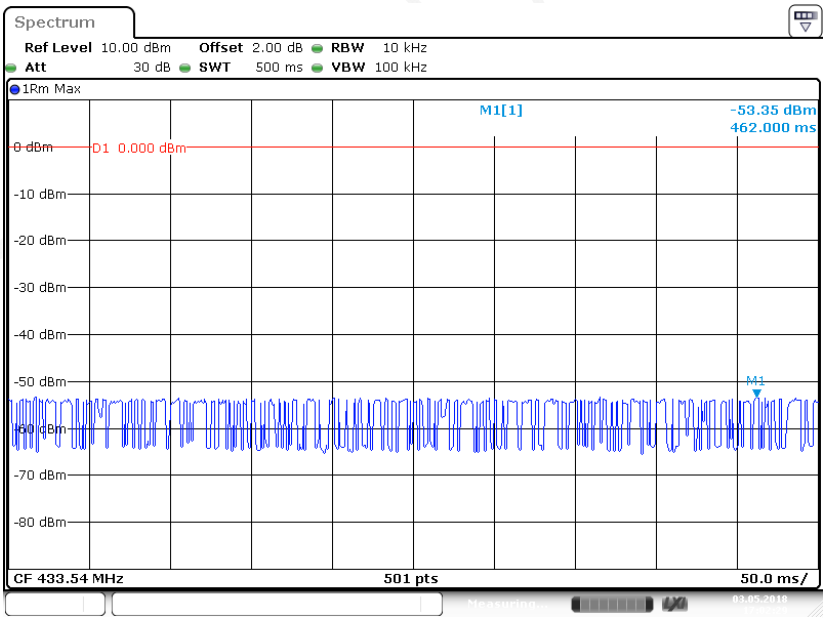
A is the Measure Transient Power at the wider measurement bandwidth $RBW_{measured}$;
B is the corresponding value at RBW_{REF}.

Offset *1



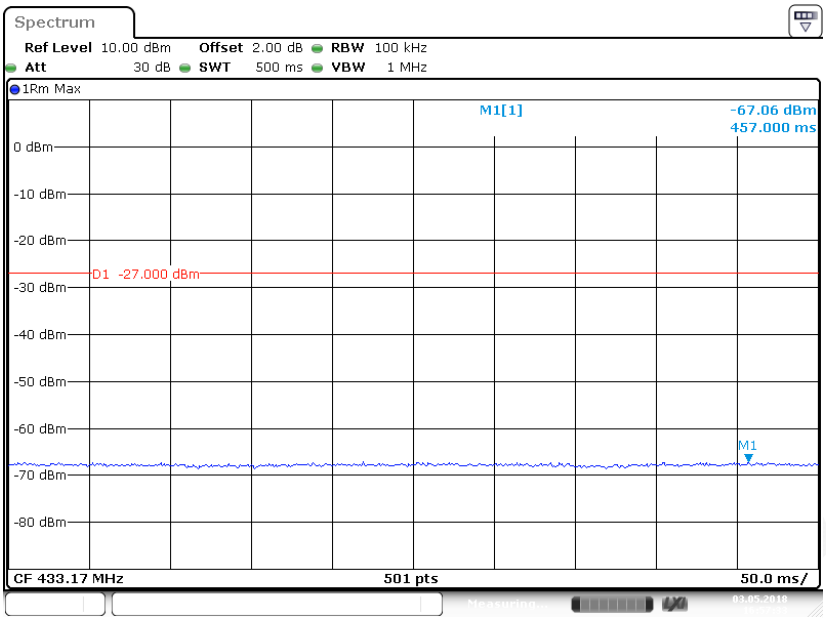
Date: 3.MAY.2018 17:05:41

Offset *2



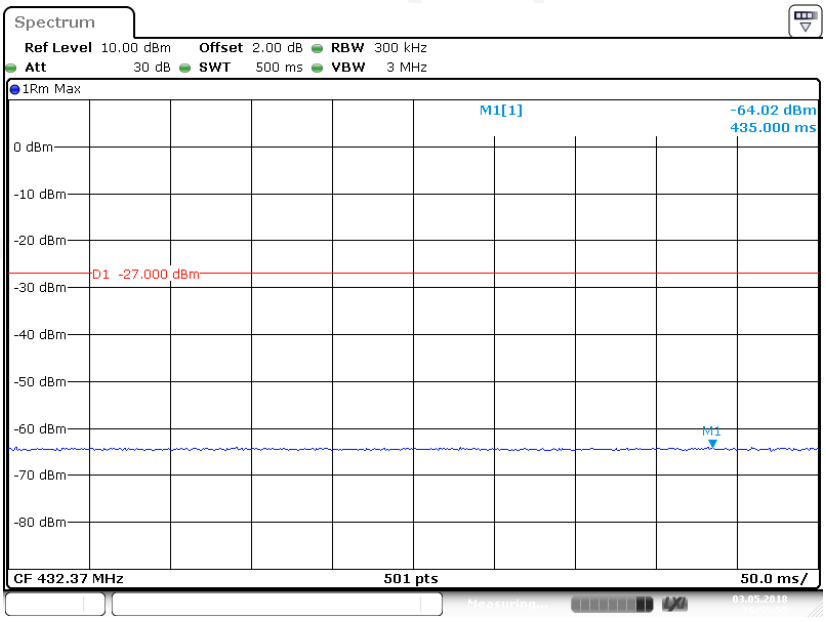
Date: 3.MAY.2018 17:02:30

Offset *3



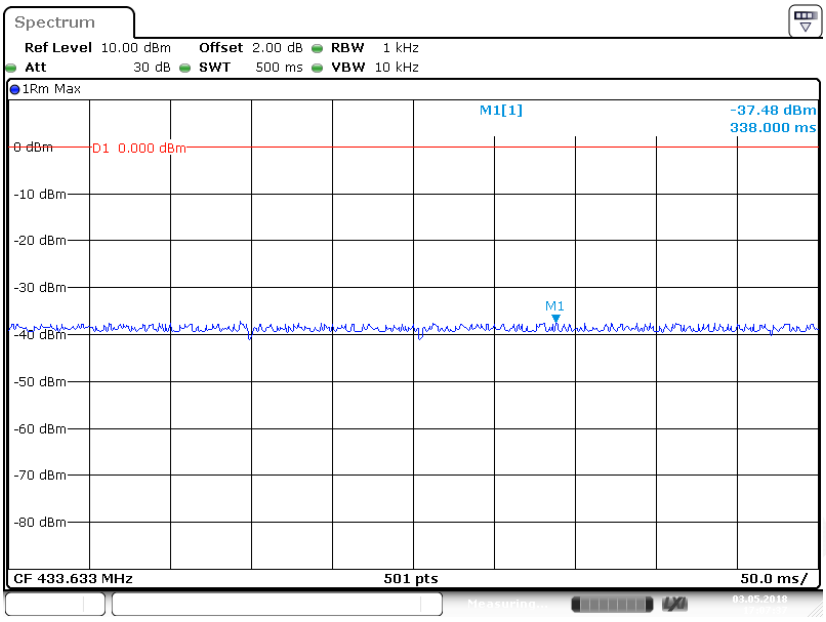
Date: 3.MAY.2018 16:57:33

Offset *4



Date: 3.MAY.2018 16:55:55

Offset *5



Date: 3.MAY.2018 17:07:38

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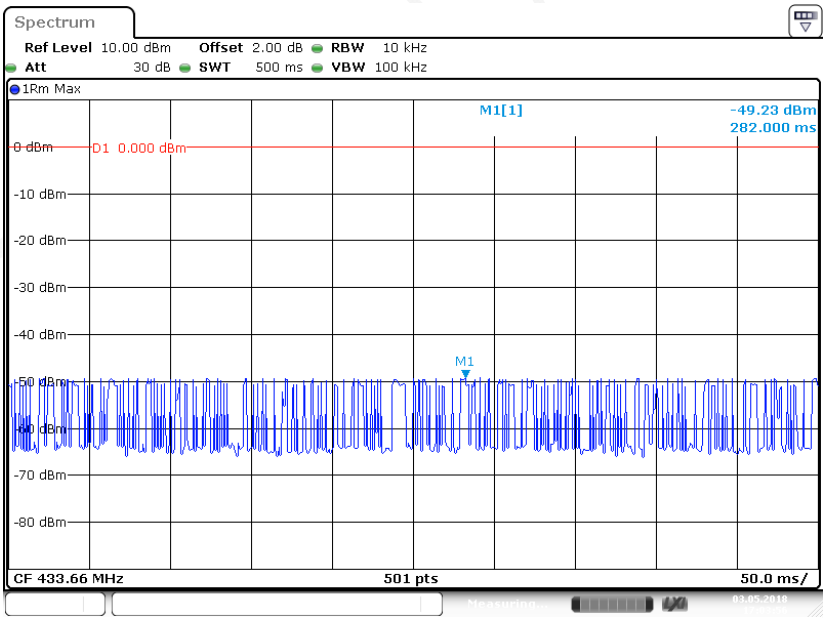

Date: 3.MAY.2018 17:03:57

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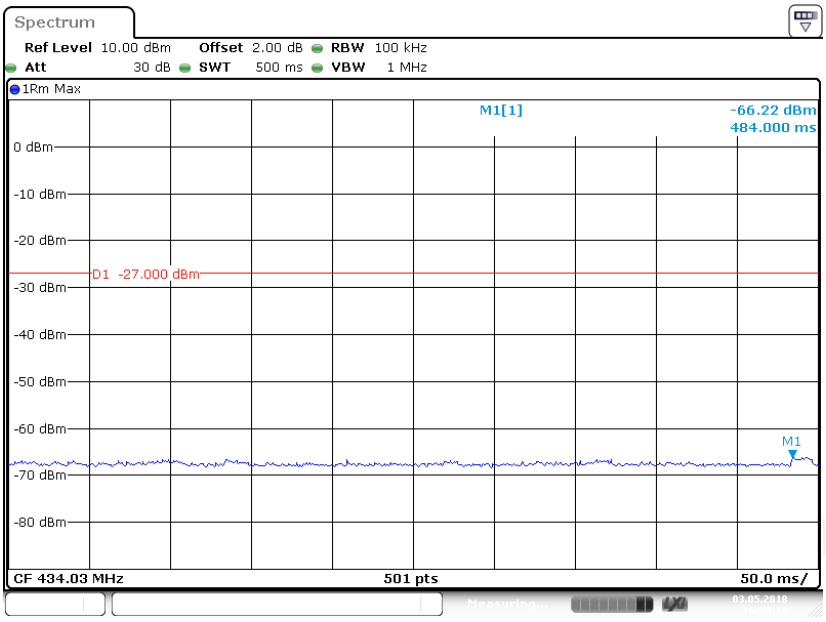

Date:3.MAY.2018 16:59:11

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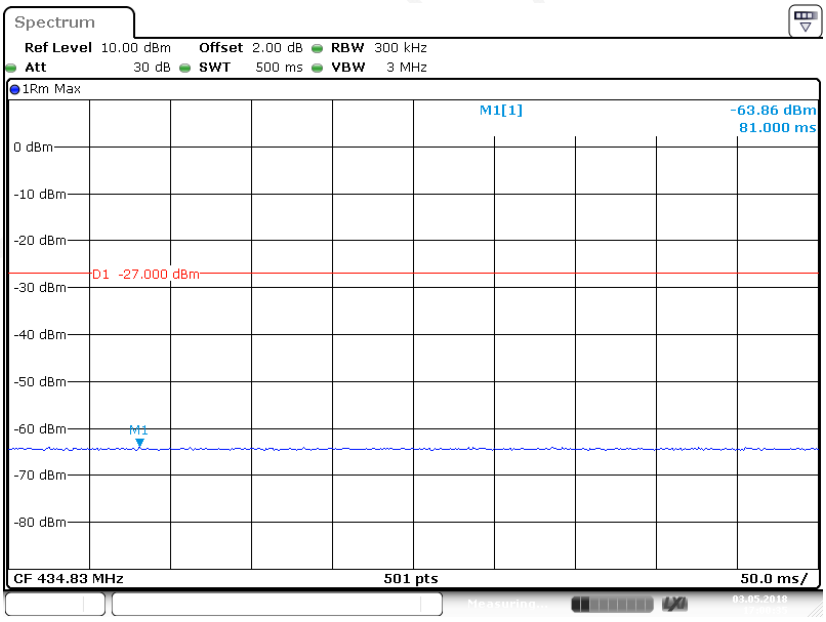


Date:3.MAY.2018 17:00:35

ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.3.8 - TX BEHAVIOUR UNDER LOW VOLTAGE CONDITIONS

Definition

The TX behaviour under low voltage condition is the ability of the equipment to maintain its operating frequency and not produce emissions which exceed any relevant limit when the battery voltage falls below the lower extreme voltage level.

Limits:

The TX behaviour under low voltage condition is the ability of the equipment to maintain its operating frequency and not produce emissions which exceed any relevant limit when the battery voltage falls below the lower extreme voltage level.

The equipment shall either:
a) remain in the Operating Channel OC without exceeding any applicable limits (e.g. Duty Cycle); or
b) reduce its effective radiated power below the Spurious Emission limits without exceeding any applicable limits(e.g. Duty Cycle); or
c) shut down, (ceasing function);
as the voltage falls below the manufacturers declared operating voltage.

Method of measurement

Step 1:
Operation of the EUT shall be started, on Operating Frequency as declared by the manufacturer, with the appropriate test signal and with the EUT operating at nominal operating voltage.
The centre frequency of the transmitted signal shall be measured and noted.
Step 2:
The operating voltage shall be reduced by appropriate steps until the voltage reaches zero.
The centre frequency of the transmitted signal shall be measured and noted.
Any abnormal behaviour shall be noted.

Test Data

Environmental Conditions

Temperature:	24.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

The testing was performed by Alisa Gao on 2018-05-03.

Test result: Compliant.

Test Condition		Frequency of Lower point (MHz)	Frequency of Upper point (MHz)	Result
Frequency (MHz)	Voltage (V_{DC})			
433.60	V_{nom}	433.5803	433.6272	Within Operating frequency band and without exceeding any applicable limits
	V_{nom}-10%	433.5786	433.6254	Within Operating frequency band and without exceeding any applicable limits
	V_{nom}-20%	433.5765	433.6241	Within Operating frequency band and without exceeding any applicable limits
	V_{nom}-30%	/		Shut down

ETSI EN 300 220-2 V3.1.1 (2017-02) CLAUSE 4.3.5 – BLOCKING

Description

Blocking is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the spurious responses or the adjacent channels or bands.

Limit

The blocking levels at the specified frequency offsets shall be equal to or greater than the limits Table 40&41&42&43, except at frequencies where spurious responses are found.

Table 1: Receiver categories

Receiver category	Description
1	Category 1 is a high performance level of receiver. In particular to be used where the operation of a SRD may have inherent safety of human life implications.
1.5	Category 1.5 is an improved performance level of receiver category 2.
2	Category 2 is standard performance level of receiver.
3	Category 3 is a low performance level of receiver. Manufacturers have to be aware that category 3 receivers are not able to work properly in case of coexistence with some services such as a mobile radio service in adjacent bands. The manufacturer shall provide another mean to overcome the weakness of the radio link or accept the failure.

Table 40: Blocking level parameters for RX category 3

Requirement	Limits
	Receiver category 3
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -80 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -60 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -60 dBm

Table 41: Blocking level parameters for RX category 2

Requirement	Limits
	Receiver category 2
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -69 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -44 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -44 dBm

Table 42: Blocking level parameters for RX category 1.5

Requirement	Limits
	Receiver category 1.5
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -43 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -33 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -33 dBm

Table 43: Blocking level parameters for RX category 1

Requirement	Limits
	Receiver category 1
Blocking at ±2 MHz from Centre Frequency	≥ -20 dBm
Blocking at ±10 MHz from Centre Frequency	≥ -20 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -20 dBm

Additionally it is necessary to perform steps 1 to 4 with a +40 dB increased level for signal generator A in CLAUSE 5.18.6.4.

Method of measurement

According to ETSI EN 300 220-1 CLAUSE 5.18.6

Test Data

Environmental Conditions

Temperature:	24.3 ℃
Relative Humidity:	51 %
ATM Pressure:	101.2 kPa

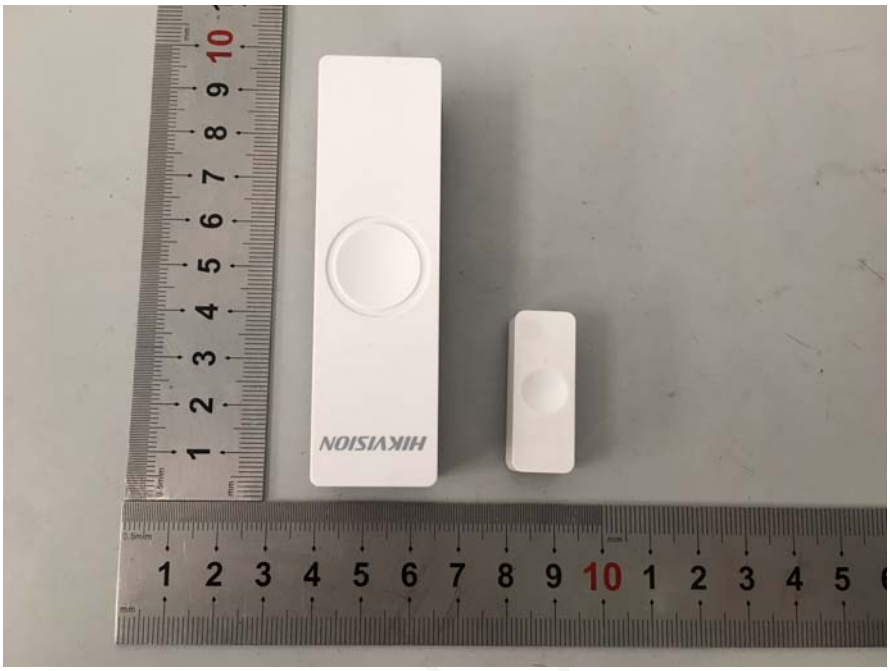
The testing was performed by Alisa Gao on 2018-05-03.

Test result: Compliant.

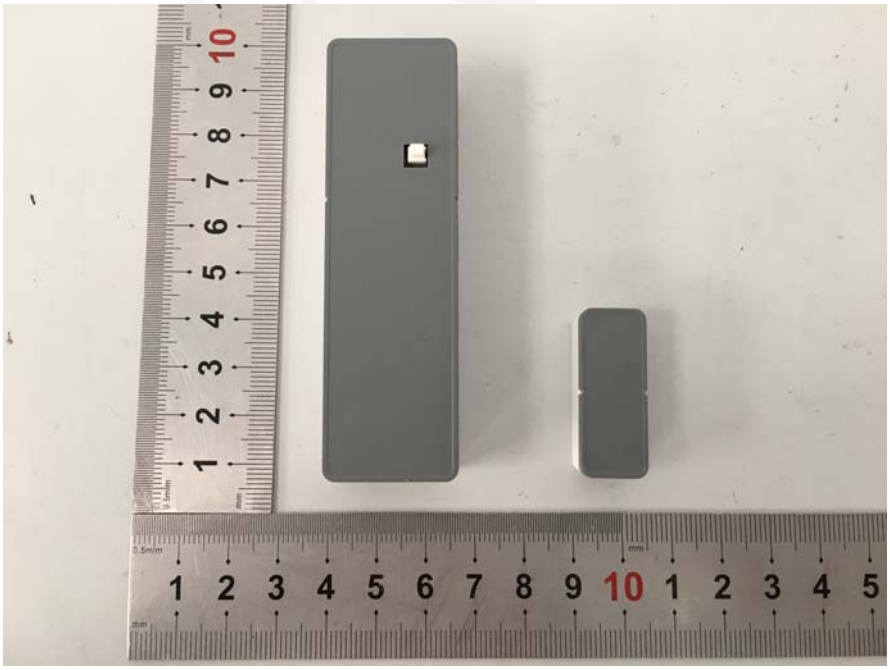
Receiver category	Wanted signal Frequency (MHz)	Blocking signal Frequency (MHz)	Frequency offset (MHz)	Blocking Level (dBm)	Limit (dBm)
2	433.60	431.57	F_{low}-2	-59	≥-69
		435.63	F_{high}+2	-60	≥-69
		423.57	F_{low}-10	-41	≥-44
		443.63	F_{high}+10	-41	≥-44
		455.28	+5%F_{centre} or F_{centre}+15MHz, whichever is the greater	-40	≥-44
		411.92	-5%F_{centre} or F_{centre} -15MHz, whichever is the greater	-38	≥-44

EXHIBIT B - EUT PHOTOGRAPHS

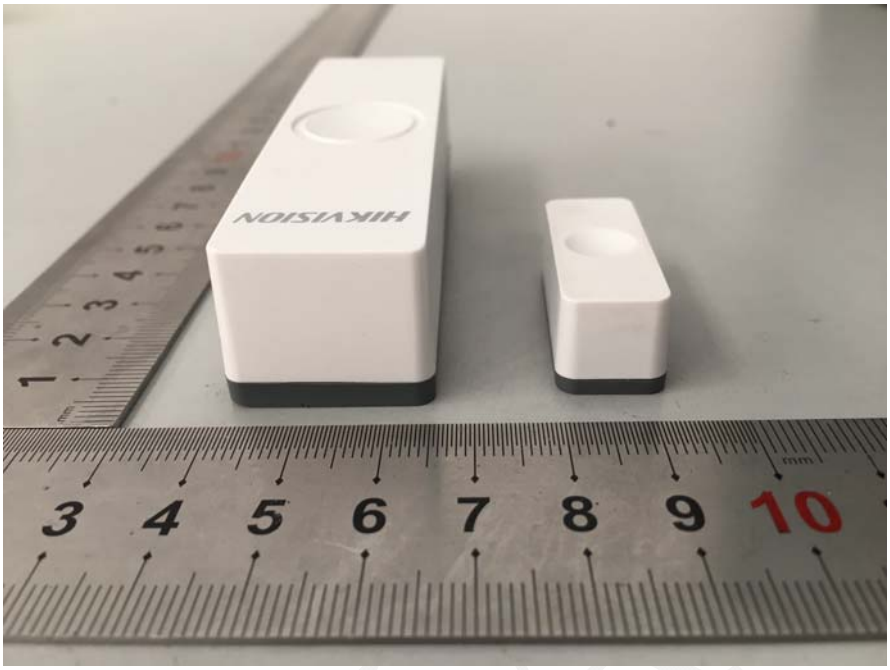
EUT–Top View



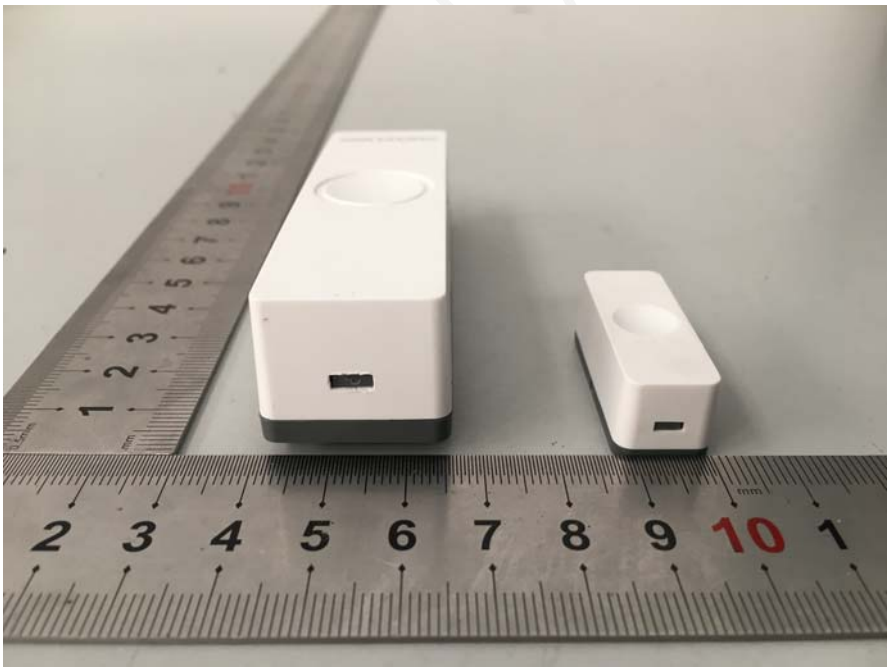
EUT–Bottom View



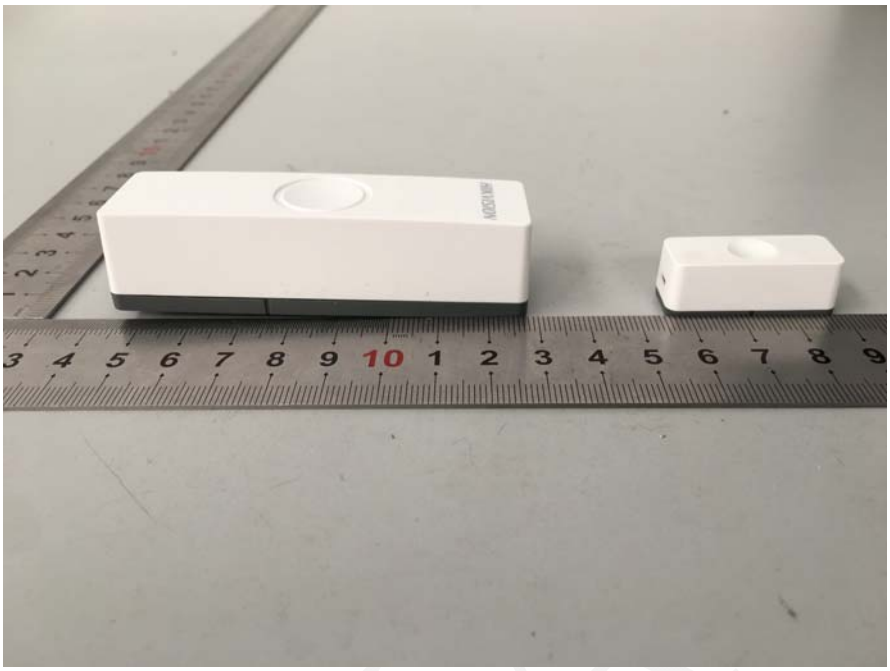
EUT–Front View



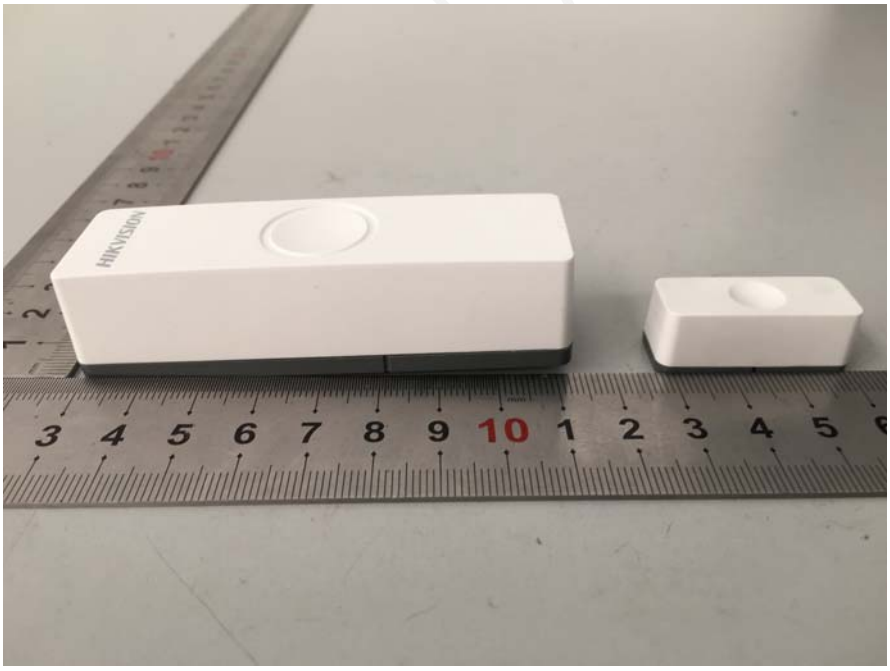
EUT–Rear View



EUT–Left View



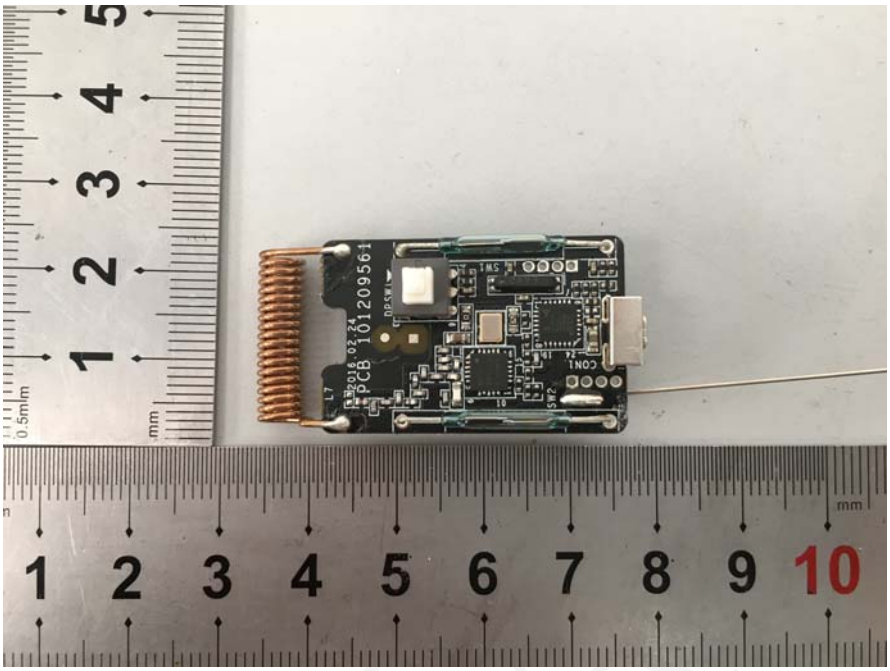
EUT–Right View



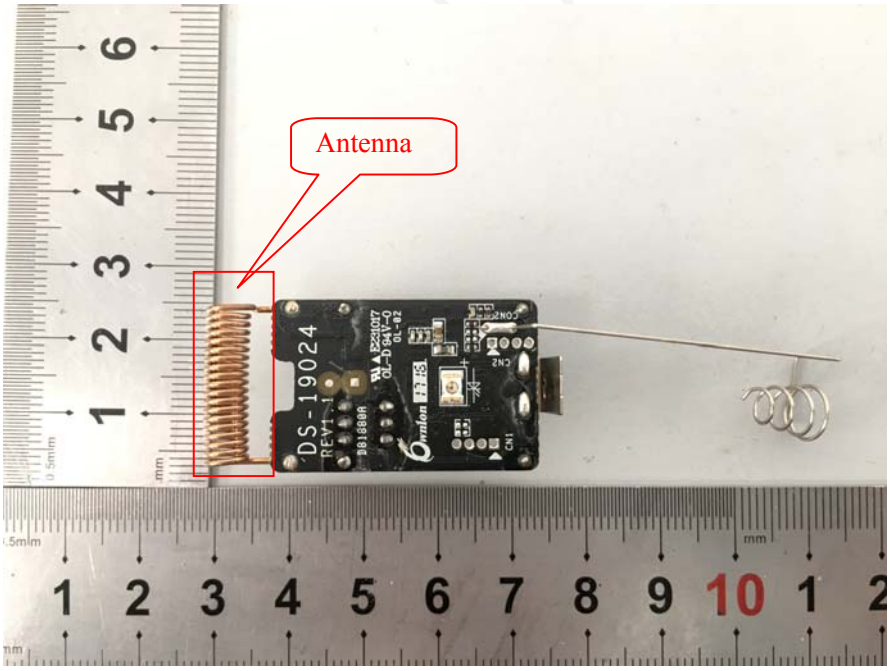
EUT –Cover off View -1

EUT –Cover off View -2

EUT –PCB Top View



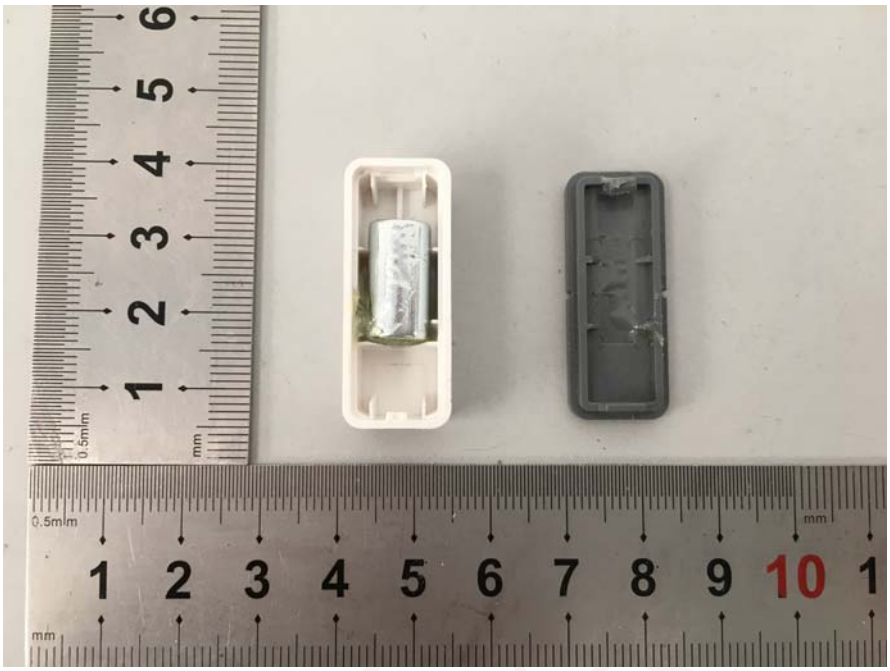
EUT –PCB Bottom View



EUT –Battery Top View

EUT –Battery Bottom View

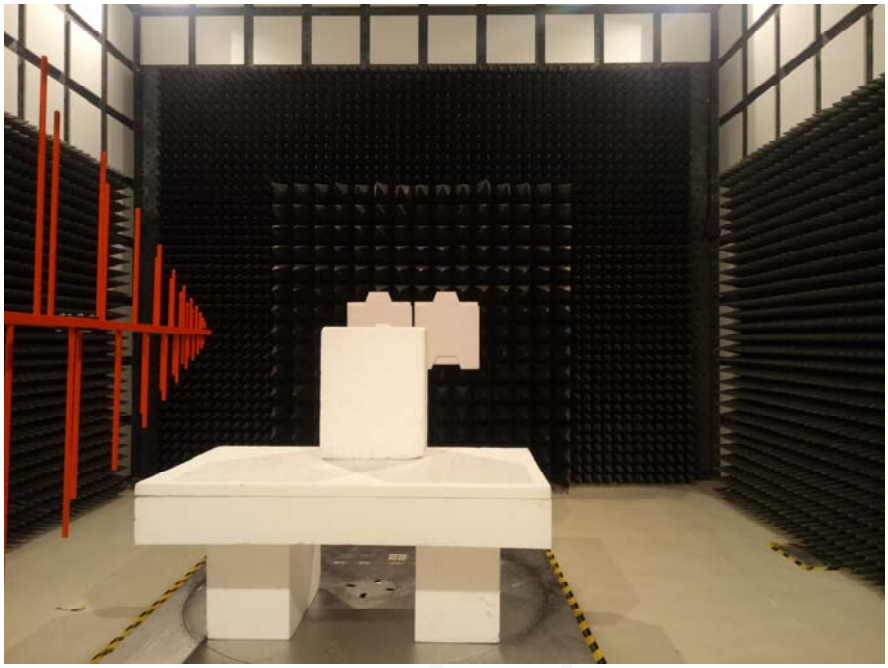
EUT –Cover off View -3



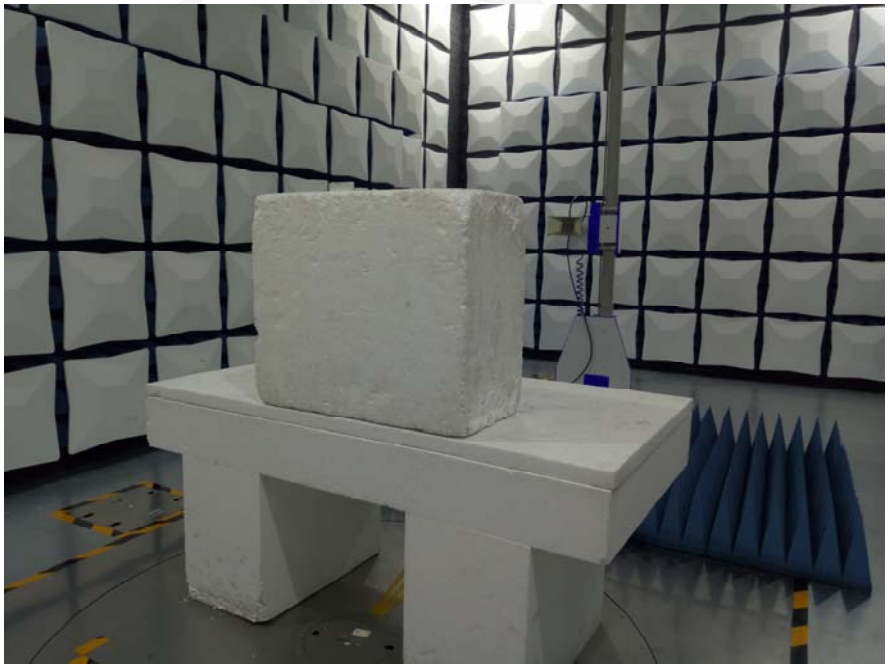
EUT –Cover off View -4

EXHIBIT C - TEST SETUP PHOTOGRAPHS

Spurious Radiation - Below 1GHz View



Spurious Radiation - Above 1GHz View



*******END OF REPORT*******