

# Test Report

FCC ID: YAV-EL0376

Date of issue: Mar. 09, 2018

Report Number:	MTi180228E058
Sample Description:	Home Automation System Interface
Model(s):	EL03-76
Applicant:	USA Shutter Company LLC dba MaestroShield
Address:	5600 Zip Drive Fort Myers, FL 33905
Date of Test:	Feb. 08, 2018 to Feb. 28, 2018

Shenzhen Microtest Co., Ltd.  
<http://www.mtitest.com>

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## 1 PRODUCT INFORMATION

General	
Applicant's name:	USA Shutter Company LLC dba MaestroShield
Address:	5600 Zip Drive Fort Myers, FL 33905
Manufacture's Name:	USA Shutter Company LLC dba MaestroShield
Address:	5600 Zip Drive Fort Myers, FL 33905
Product description	
Product name:	Home Automation System Interface
Trademark:	Maestroshield
Model name:	EL03-76
Serial Model:	N/A
Standards:	47 CFR Part 15, Subpart C
Test Procedure:	ANSI C63.10:2013

*This device described above has been tested by Shenzhen Microtest Co., Ltd. and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.*

Tested by:

*Amy Lu*

Amy Lu

Feb. 28, 2018

Reviewed by:

*Blue Zheng*

Blue Zheng

Mar. 09, 2018

Approved by:

*Smith Chen*

Smith Chen

Mar. 09, 2018

## 2 Summary of Test Result

Item	FCC Part No.	Description of Test	Result	Remark
1	15.203	Antenna requirement	Pass	
2	15.207	AC power line conducted emission	Pass	
3	15.231(b)	Field strength of fundamental and harmonic emissions	Pass	
4	15.205 and 15.209	Radiated emission and bandedge	Pass	
5	15.215	Occupied Bandwidth	Pass	
6	15.231(a)(2)	Release time	Pass	
The meaning of symbols: "N/A" – Not Applicable				

### 3 General description

#### 3.1 Feature of equipment under test (EUT)

Product name:	Home Automation System Interface
Model name:	EL03-76
Serial Model:	N/A
Tx/Rx frequency range:	Tx:434MHz
Modulation type:	ASK
Power source:	AC120V/60Hz
Adapter information:	Model : BI10-120100-Ad Input: AC 100-240V, 50/60Hz 0.5A Output : DC 12V , 1A
Antenna designation:	External antenna (Antenna Gain: 3dBi)
Hardware version:	1.4
Software version:	1.0

#### 3.2 Operation channel list

Channel	Frequency
1	434MHz

#### 3.3 Frequency Channel Under Test

Channel	Frequency
1	434MHz

#### 3.4 EUT operation mode

During testing, RF test program provided by the manufacture to control the Tx operation followed the test requirement.

#### 3.5 Test conditions

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

- Temperature: 20°C~30°C
- Humidity: 30%~70%
- Atmospheric pressure: 98kPa~101kPa

### 3.6 Ancillary equipment list

Equipment	Model	S/N	Manufacturer
/	/	/	/

### 3.7 Measurement uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %,  $U=2xUc(y)$

RF frequency	$1 \times 10^{-7}$
RF power, conducted	$\pm 1$ dB
Conducted emission(150kHz~30MHz)	$\pm 2.5$ dB
Radiated emission(30MHz~1GHz)	$\pm 4.2$ dB
Radiated emission (above 1GHz)	$\pm 4.3$ dB
Temperature	$\pm 1$ degree
Humidity	$\pm 5$ %

## 4 Testing site for laboratory

Test Site	Shenzhen Microtest Co., Ltd.
Test Site Location	No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China
FCC Registration No.:	448573
CNAS Registration No.:	CNAS L5813

## 5 List of test equipment

Equipment No.	Equipment Name	Manufacturer	Model	Serial No.	Calibration date	Due date
MTI-E001	Spectrum Analyzer	Agilent	E4407B	MY41441082	2017/09/18	2018/09/17
MTI-E002	CMU 200 universal radio communication tester	Rohde&schwarz	CMU 200	114587	2017/09/18	2018/09/17
MTI-E004	EMI Test Receiver	Rohde&schwarz	ESPI	1000314	2017/09/18	2018/09/17
MTI-E006	Broadband antenna	schwarabeck	VULB9163	872	2017/09/18	2018/09/17
MTI-E007	Horn antenna	schwarabeck	BBHA9120D	1201	2017/09/18	2018/09/17
MTI-E014	amplifier	America	8447D	3113A06150	2017/09/18	2018/09/17
MTI-E015	Conduction Immunity Signal Generator	Schloder	CDG6000	126A1343/2015	2017/09/18	2018/09/17
MTI-E016	Coupled decoupling network	Schloder	CDA M2/M3	A2210332/2015	2017/09/18	2018/09/17
MTI-E032	Comprehensive test instrument	Rohde&schwarz	CMW500	124192	2017/04/13	2018/04/12
MTI-E034	amplifier	Agilent	8449B	3008A02400	2017/08/22	2018/08/21
MTI-E040	Spectrum analyzer	Agilent	N9020A	MY49100060	2017/03/04	2018/03/04
MTI-E041	Signal generator	Agilent	N5182A	MY49060455	2017/02/22	2018/02/22
MTI-E042	Analog signal generator	Agilent	E4421B	GB40051240	2017/02/22	2018/02/22
MTI-E043	Power probe	Dare Instruments	RPR3006W	16I00054SN016	2017/02/28	2018/02/28
MTI-E047	10dB attenuator	Mini-Circuits	UNAT-10+	15542	2017/05/23	2018/05/23
MTI-E049	spectrum analyzer	Rohde&schwarz	FSP-38	100019	2017/09/18	2018/09/17
MTI-E050	PSG Signal generator	Agilent	E8257D	MY46520873	2017/04/24	2018/04/23
MTI-E051	Active Loop Antenna 9kHz - 30MHz	Schwarzbeek	FMZB1519B	00044	2017//2/26	2018/02/25
MTI-E052	18-40GHz amplifier	Chengdu step Micro Technology	ZLNA-18-40G-21	1608001	2017/09/18	2018/09/17
MTI-E053	15-40G Antenna	Schwarzbeek	BBHA9170	BBHA9170582	2017/09/18	2018/09/17

Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

## 6 Test Result

### 6.1 Antenna requirement

#### 6.1.1 Requirement defined in FCC 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

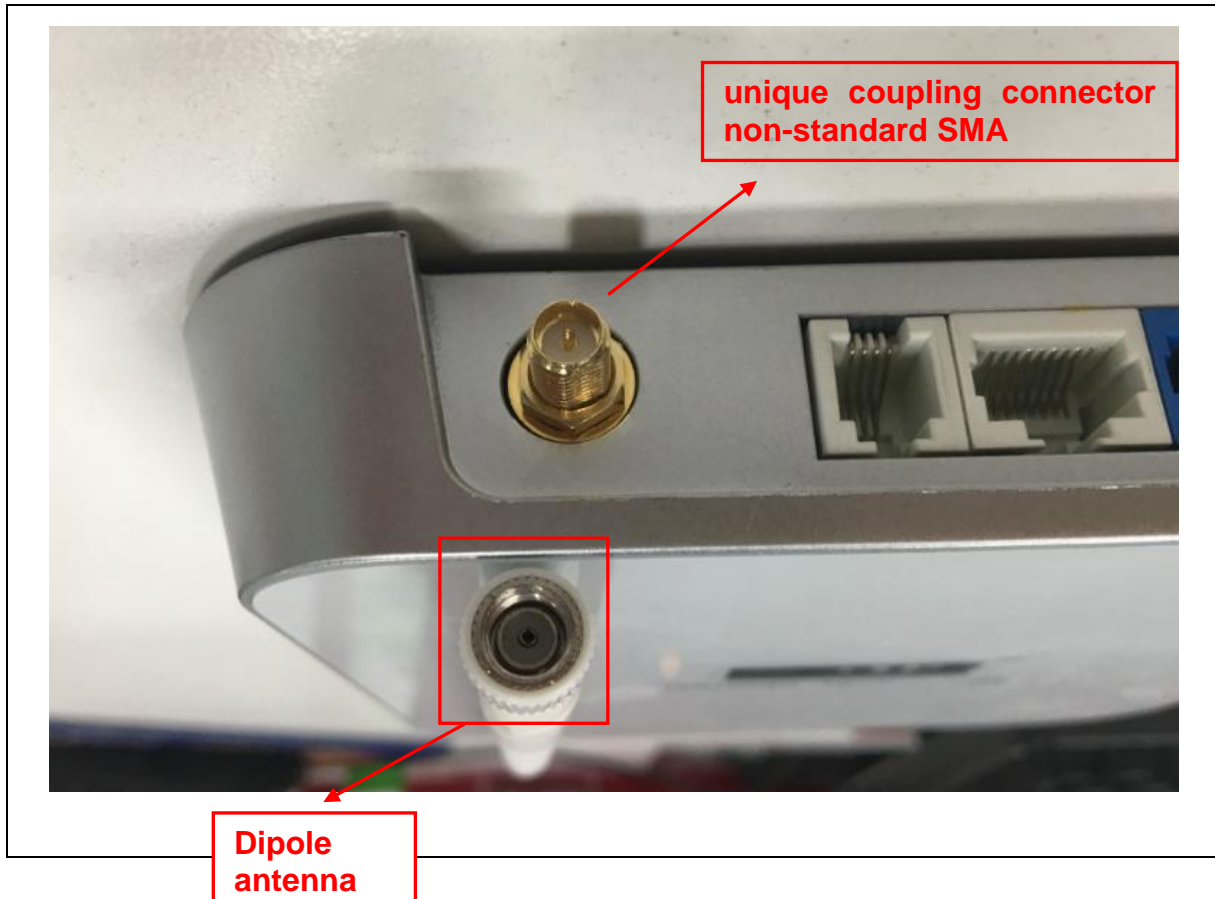
#### 6.1.2 EUT antenna description

The radio antenna of EUT is external antenna(dipole antenna), with unique coupling connector non-standard SMA, the maximum gain is 3dBi. So the antenna meets the requirement of this part.

External antenna:

Model Type:	JYHG-433-SMA	Gain:	3dBi
Max Diameter:	10mm	Min Diameter:	6mm
Connector:	non-standard SMA	Frequency Range:	433MHz±10MHz





## 6.2 Conducted emission

### 6.2.1 Limit

Frequency (MHz)	Limit	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Note: Decreases with the logarithm of the frequency from 0.15MHz to 0.5MHz.

### 6.2.2 Test method

1. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/50uH of coupling impedance for the measuring instrument.

2. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

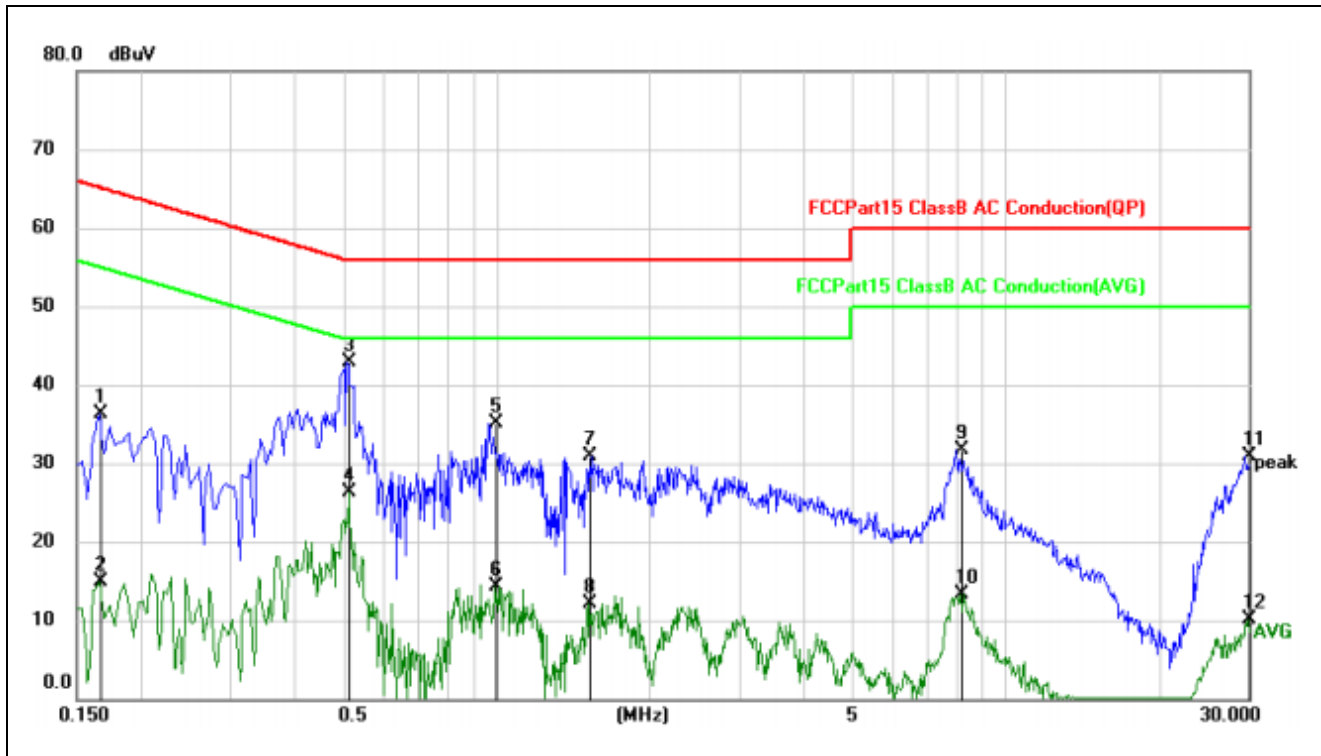
3. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

4. LISN is at least 80 cm from nearest part of EUT chassis.

5. The resolution bandwidth of EMI test receiver is set at 9kHz.

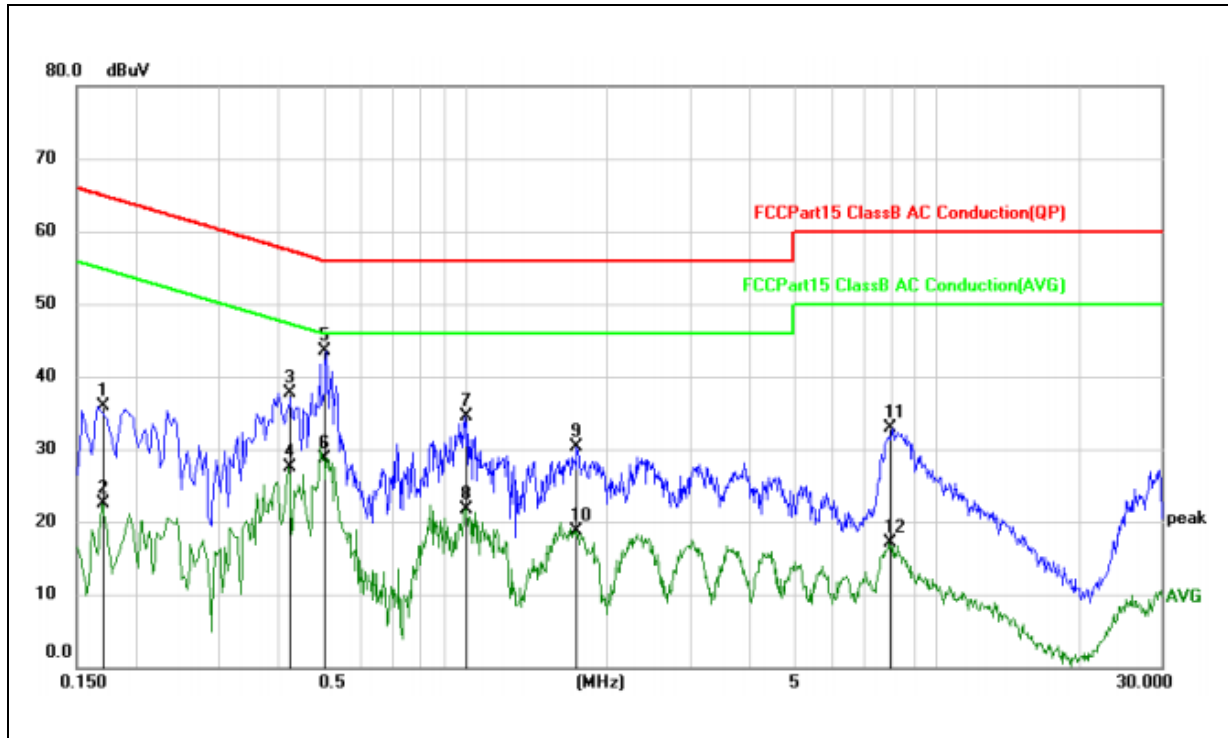
### 6.2.3 Test Result

EUT:	Home Automation System Interface	Model Name. :	EL03-76
Temperature:	26 °C	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	N
Test Voltage :	DC 12V from AC Adapter 230V/50Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1660	34.75	1.57	36.32	65.16	-28.84	QP	
2		0.1660	13.24	1.57	14.81	55.16	-40.35	AVG	
3	*	0.5140	41.31	1.57	42.88	56.00	-13.12	QP	
4		0.5140	24.73	1.57	26.30	46.00	-19.70	AVG	
5		0.9980	33.47	1.58	35.05	56.00	-20.95	QP	
6		0.9980	12.73	1.58	14.31	46.00	-31.69	AVG	
7		1.5220	29.35	1.58	30.93	56.00	-25.07	QP	
8		1.5220	10.52	1.58	12.10	46.00	-33.90	AVG	
9		8.1540	31.37	0.38	31.75	60.00	-28.25	QP	
10		8.1540	12.93	0.38	13.31	50.00	-36.69	AVG	
11		29.9860	30.44	0.37	30.81	60.00	-29.19	QP	

EUT:	Home Automation System Interface	Model Name. :	EL03-76
Temperature:	26 °C	Relative Humidity:	54%
Pressure:	1010hPa	Phase :	N
Test Voltage :	DC 12V from AC Adapter 230V/50Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1700	34.41	1.57	35.98	64.96	-28.98	QP	
2		0.1700	20.99	1.57	22.56	54.96	-32.40	AVG	
3		0.4220	36.06	1.57	37.63	57.41	-19.78	QP	
4		0.4220	26.02	1.57	27.59	47.41	-19.82	AVG	
5	*	0.4994	41.99	1.57	43.56	56.01	-12.45	QP	
6		0.4994	27.20	1.57	28.77	46.01	-17.24	AVG	
7		1.0020	32.98	1.58	34.56	56.00	-21.44	QP	
8		1.0020	20.10	1.58	21.68	46.00	-24.32	AVG	
9		1.7140	28.71	1.58	30.29	56.00	-25.71	QP	
10		1.7140	17.22	1.58	18.80	46.00	-27.20	AVG	
11		7.9380	32.51	0.38	32.89	60.00	-27.11	QP	
12		7.9380	16.81	0.38	17.19	50.00	-32.81	AVG	

### 6.3 Field strength of fundamental and harmonic emissions

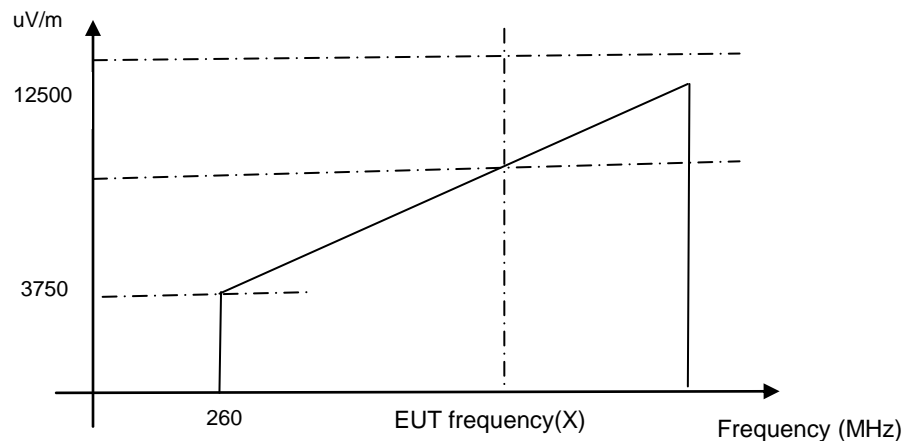
#### 6.3.1 Limits

Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2.250	225
70-130	1.250	125
130-174	<sup>1</sup> 1250 to 3750	<sup>1</sup> 125 to 375
174-260	3.750	375
260-470	<sup>1</sup> 3750 to 12500	<sup>1</sup> 375 to 1250
Above 470	12500	1250

<sup>1</sup>Linear interpolations.

For example for 434..0650MHz



The Field Strength of Fundamental Emissions (Operating Frequency) is:

$$3750 \text{ uV/m} = 20 \cdot \log(3750) \text{ dBuV/m} = 71.48 \text{ dBuV/m}$$

$$12500 \text{ uV/m} = 20 \cdot \log(12500) \text{ dBuV/m} = 81.94 \text{ dBuV/m}$$

For example the Fundamental emission is 433.925MHz, the limit is X.

$$(433.925-260)/(470-260)=(X-3750)/(12500-3750)$$

$$173.925/210 =(X-3750)/8750$$

$$X = 10996.875 \text{ uV/m}$$

$$\text{AV Limit} = 20 \cdot \log(10996.875) \text{ dBuV/m} = 80.83 \text{ dBuV/m}$$

$$\text{PK Limit} = 100.83 \text{ dBuV/m}$$

### 6.3.2 Test Method

1. The EUT is placed on a turntable, which is 0.8m above ground plane for test frequency range below 1GHz, and 1.5m above ground plane for test frequency range above 1GHz.

2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.

3. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1\text{GHz}$

RBW = 100 kHz for  $f < 1\text{GHz}$

VBW  $\geq$  RBW

Sweep = Auto

Detector function = Peak

Trace = max hold

4. Follow the guidelines in ANSI C63.4-2014 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

5. The peak level, once corrected, must comply with the limit specified in Section 15.209. Set the spectrum to

RBW = 1MHz

VBW = 10Hz

Detector = PK for AV value, while maintaining all of the other instrument settings

6.3.3 Test Result

Test modulation: ASK

Field Strength of Fundamental Emissions and Field strength of spurious emissions Value					
Operating Frequency (MHz)	Field Strength (dBuV/m)	Detector	Limit @3m (dBuV/m)	Margin (dB)	Antenna
434.0650	79.13	Peak	96.46	17.33	Vertical
	77.75	Peak	96.46	18.71	Horizontal
869.1301	64.35	Peak	76.46	12.11	Vertical
	61.41	Peak	76.46	15.05	Horizontal

Note: If the PK measured values lower than average mode limit, the EUT shall be deemed to meet average limits and then no additional average mode measurement performed.

## 6.4 Occupied Bandwidth

### 6.4.1 Test method

Use the following spectrum analyzer settings:

- Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- RBW  $\geq 1\%$  of the 20 dB bandwidth
- VBW  $\geq$  RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold

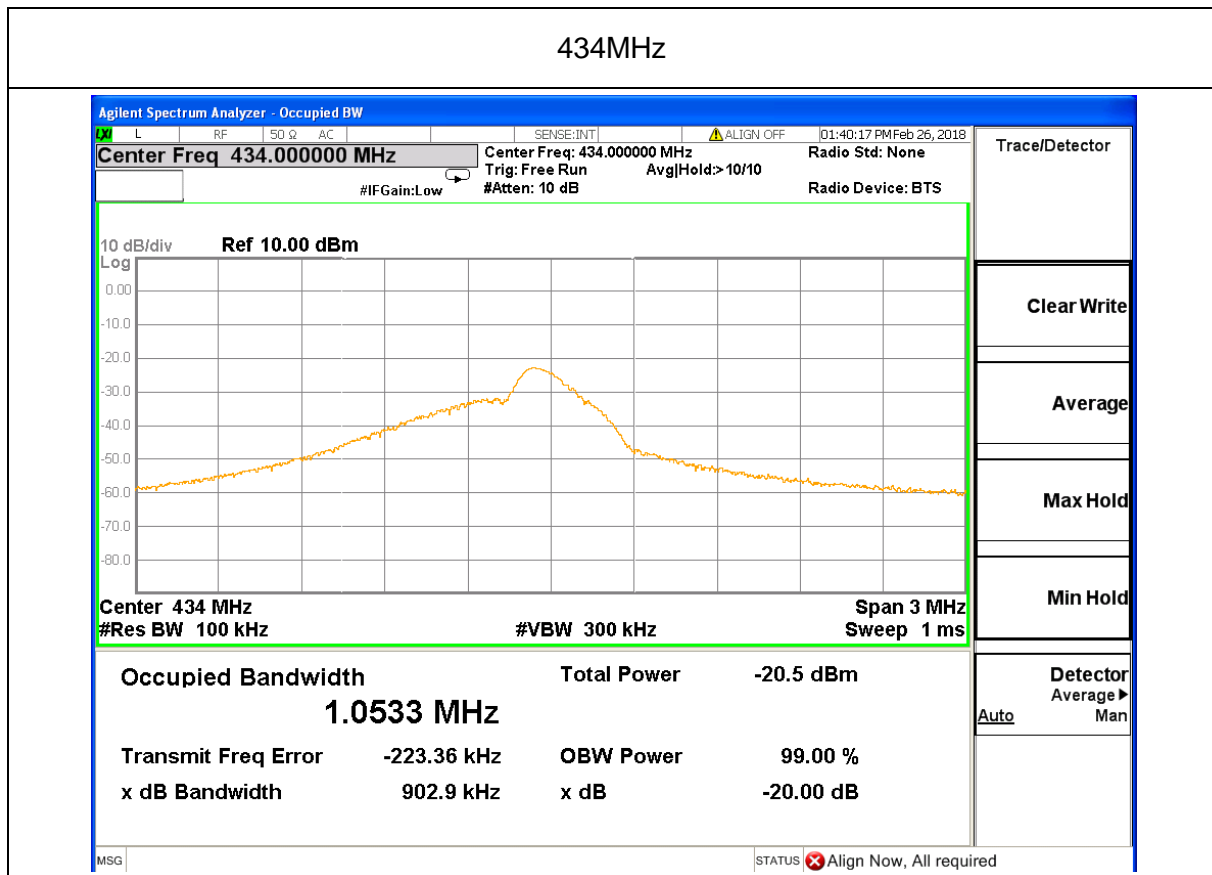
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth and 99% occupied bandwidth of the emission.

### 6.4.2 Test result

Test modulation: ASK

Frequency (MHz)	20dB emission bandwidth (MHz)	99% occupied bandwidth (MHz)
434	0.903	1.0533

Test plots as below





## 6.5 Radiated emission & Band edge spurious emission

### 6.5.1 Limit

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, (b) shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Frequency (MHz)	Field strength $\mu\text{V}/\text{m}$	Field strength $\text{dB}\mu\text{V}/\text{m}$	Detector	Measurement distance
30-88	100	40	QP	3m
88-216	150	43.5	QP	
216-960	200	46	QP	
960-1000	500	54	QP	
Above 1000	500	54	AV	
Above 1000	5000	74	PK	

### 6.5.2 Test method

1. The EUT is placed on a turntable, which is 0.8m above ground plane for test frequency range below 1GHz, and 1.5m above ground plane for test frequency range above 1GHz.

2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.

3. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1\text{GHz}$

100 kHz for  $f < 1\text{GHz}$ , VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

4. Follow the guidelines in ANSI C63.4-2014 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

5. The peak level, once corrected, must comply with the limit specified in Section 15.209. Set the RBW = 1MHz, VBW = 10Hz, Detector = PK for AV value, while maintaining all of the other instrument settings.

### 6.5.3 Test Result

Remark:

If the PK measured values lower than average mode limit, the EUT shall be deemed to meet average limits and then no additional average mode measurement performed.

Radiated emission (ASK mode)

Transmitter channel: 434MHz					
Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dB $\mu$ V/m	dB $\mu$ V/m		
46.0162	V	30.40	40.00	QP	Pass
78.1389	H	20.20	40.00	QP	
120.6991	V	27.60	43.50	QP	
118.6014	H	23.90	43.50	QP	
1411.000	V	29.80	74	PK	
1840.000	H	34.27	74	PK	

## 6.6 Release time

### 6.6.1 Limit

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

### 6.6.2 Test method

Setup the EUT as show in the block diagram above.

Set Spectrum Analyzer

Centre Frequency = Fundamental Frequency

RBW=100 kHz, VBW= 300 kHz

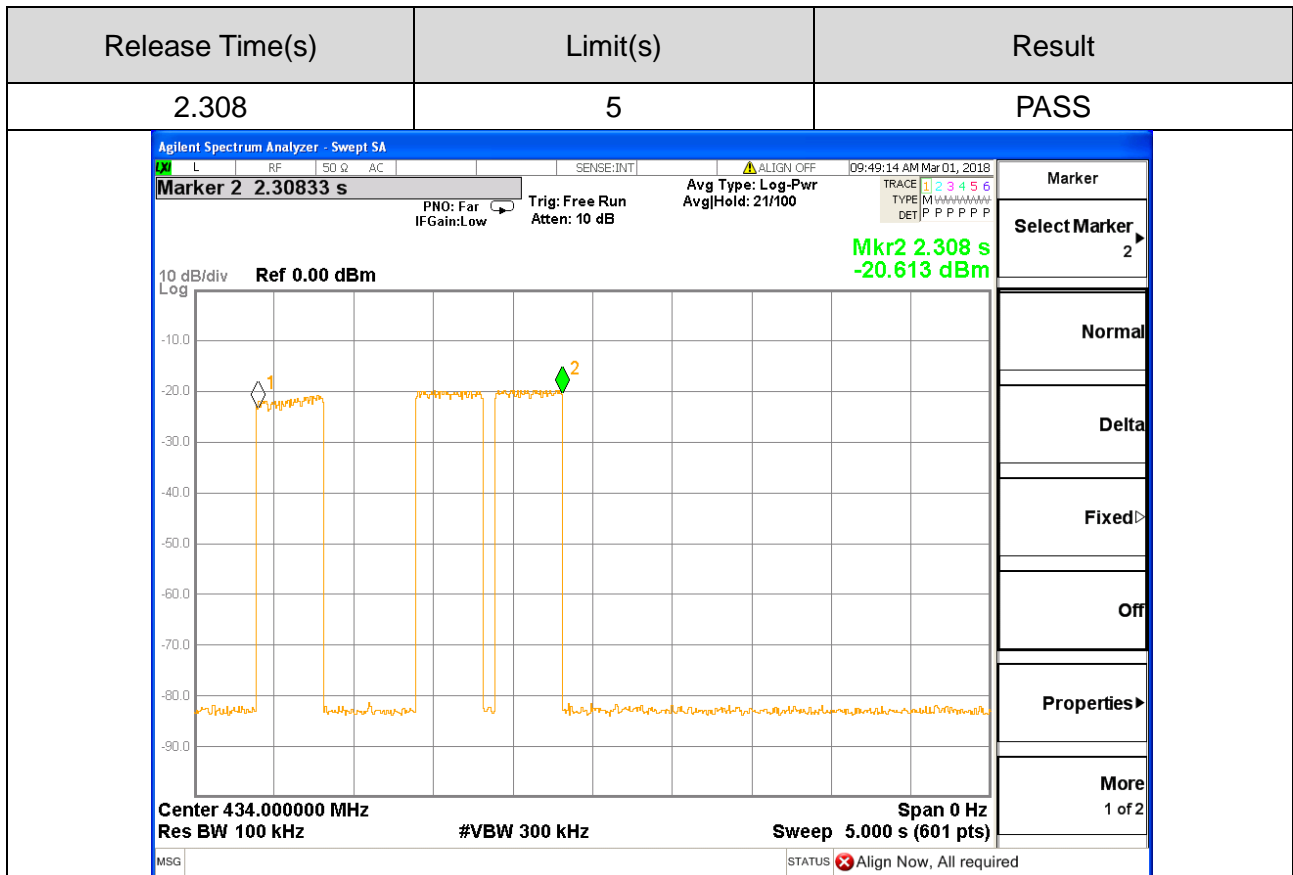
Span= 0 Hz

Sweep Time= 5 Seconds.

Setup the EUT as normal operation and press Transmitter button

Release the button, use Delta Mark function to test the time.

### 6.6.3 Test Result



----END OF REPORT----