



TEST REPORT

Applicant Name : Feit Electric Company
Address : 4901 Gregg Road, Pico Rivera, California, United States
Report Number : XMTN2211028-55412E-RF
FCC ID: SYW-BTA19RGB3KRMT

Test Standard (s)

FCC PART 15.231

Sample Description

Product Type: Speaker Bulb Remote
Model No.: BTOM60RGB3KESM/REM
Trade Mark: EcoSmart
Date Received: 2021-10-28
Date of Test: 2021-11-03 to 2021-11-22
Report Date: 2021-11-22

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards above.

Prepared and Checked By:

Ting Lü
EMC Engineer

Approved By:

Candy Li
EMC Engineer

Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Speaker Bulb Remote
Tested Model	BTOM60RGB3KESM/REM
Frequency Range	433.9242MHz
Modulation Technique	OOK
Antenna Specification*	1.5dBi(It is provided by the applicant)
Voltage Range	DC 1.5V from button cell
Sample serial number	XMTN2211028-55412E-RF-S1 (Assigned by ATC)
Sample/EUT Status	Good condition

Objective

All the test measurements were performed according to the measurement procedure described in ANSI C63.10 - 2013.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209, 15.35(c) and 15.231 rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10 - 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters. Each test item follows test standards and with no deviation.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
Unwanted Emission, conducted		1.6dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz- 18GHz	4.98dB
Temperature		1°C
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISED), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing by manufacturer.

Operating frequency: 433.9242MHz

Note: The product has 5 buttons, RF transmitting power is the same, and the maximum duty cycle is tested and recorded.

EUT Exercise Software

No software was used during testing and the power level was default*.

Special Accessories

No special accessories was used

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

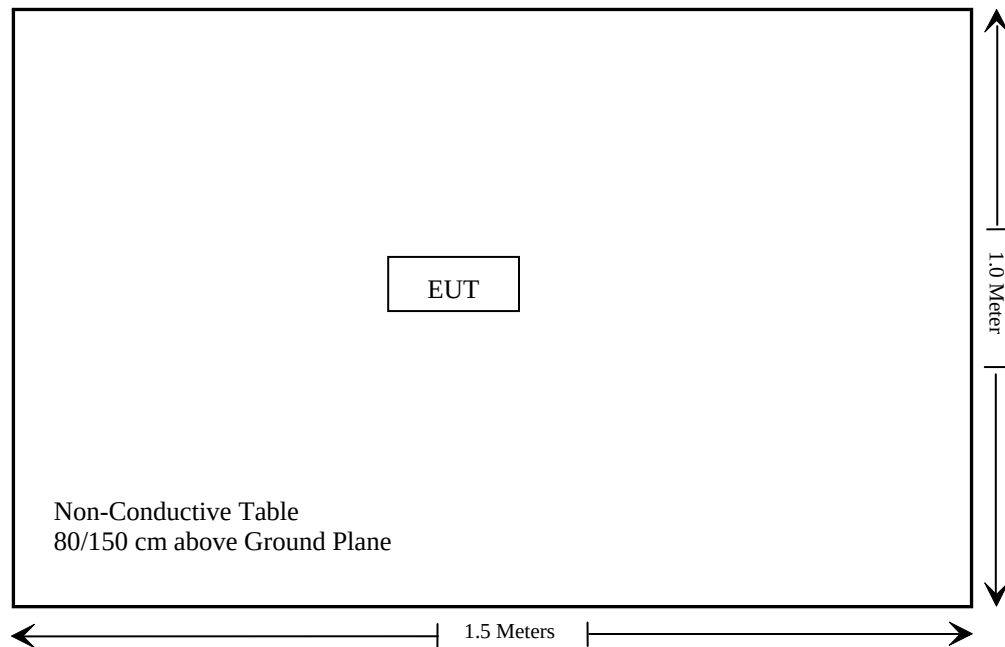
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

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

Block Diagram of Test Setup

For Radiated Emission: Below and Above 1GHz



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207 (a)	Conducted Emissions	Note Applicable
§15.205, §15.209, §15.231(b)	Radiated Emissions	Compliant
§15.231 (c)	20dB Emission Bandwidth	Compliant
§15.231 (a) (1)	Deactivation	Compliant

Note:

Not Applicable: The EUT is powered by button cell.

TEST EQUIPMENT LIST AND DETAILS

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emissions Test					
Rohde&Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/07/08	2022/07/07
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/04	2023/01/03
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Unknown	RF Coaxial Cable (For Below 1GHz)	N-5m	No.3	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable (For Below 1GHz)	N-1m	No.5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable (For Above 1GHz)	N-10m	No.7	2021/11/09	2022/11/08
Unknown	RF Coaxial Cable (For Above 1GHz)	N-2m	No.8	2021/11/09	2022/11/08
Radiated Emission Test Software: e3 19821b(V9)					
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV40	101495	2020/12/24	2021/12/23
WEINSCHTEL	10dB Attenuator	5324	AU 3842	2020/12/25	2021/12/24

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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.

Antenna Connector Construction

The EUT has one internal antenna arrangement which was permanently attached. And the antenna gain is 1.5dBi; fulfill the requirement of this section. Please refer to EUT photos.

Result: Compliant.

FCC §15.205, §15.209, §15.231 (b) - RADIATED EMISSIONS**Applicable Standard**

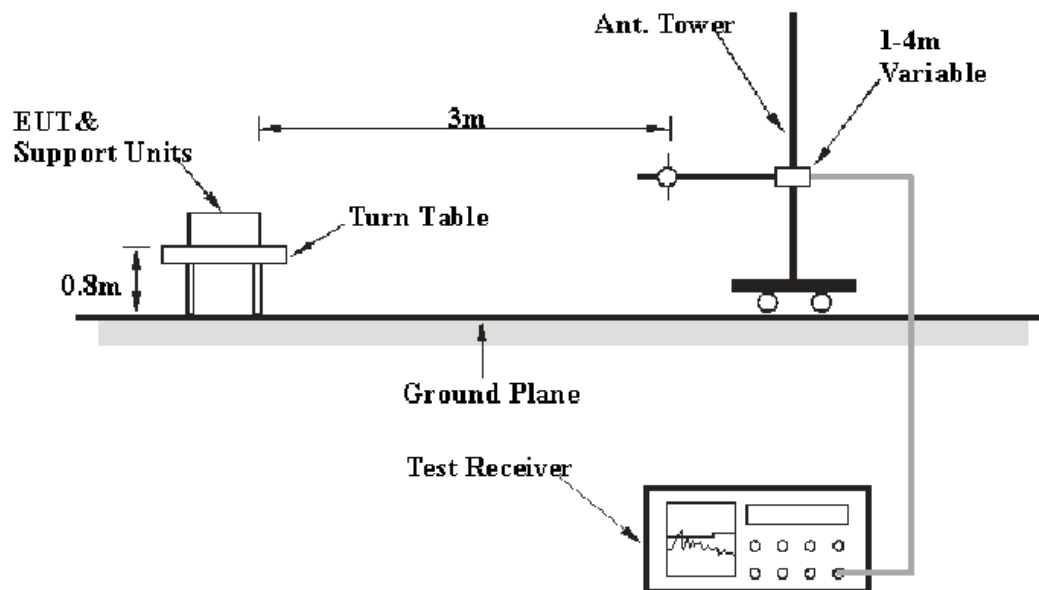
FCC §15.205, §15.209, §15.231 (b)

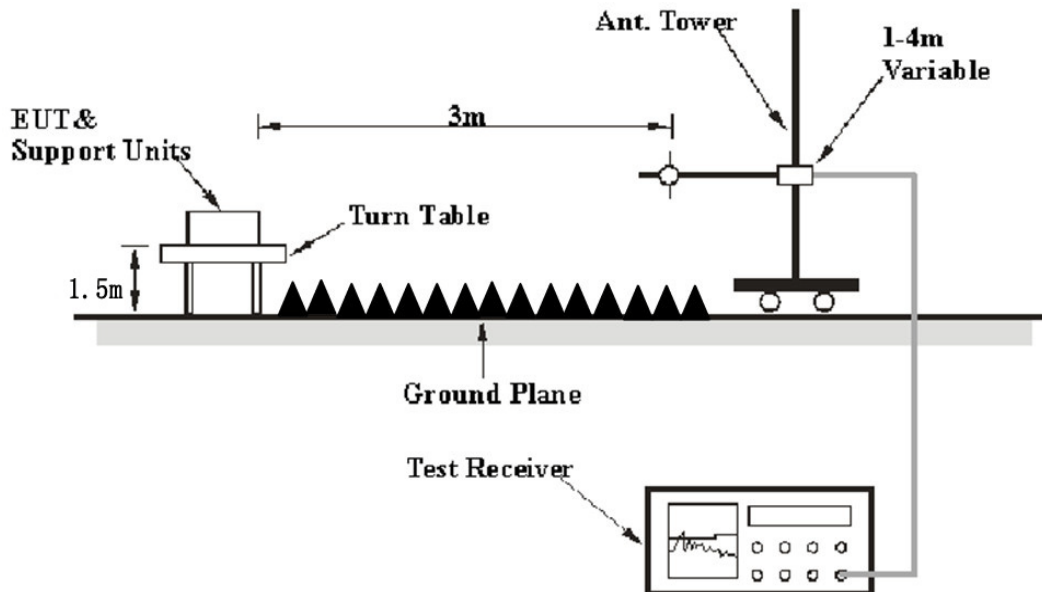
According to FCC §15.231(b), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field Strength of Fundamental (Microvolts /meter)	Field Strength of spurious emissions ((Microvolts /meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250**
Above 470	12500	1250

*Linear interpolations.

The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

EUT Setup**Below 1 GHz:**

Above 1 GHz:

The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10 - 2013. The specification used was the FCC 15 § 15.209, 15.205 and 15.231.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 5 GHz.

During the radiated emission test, the test receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	PK
Above 1 GHz	1 MHz	3 MHz	/	PK

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All final data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin/Over limit**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin/over limit of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

$$\begin{aligned}\text{Margin / Over Limit} &= \text{Result / Absolute Level} - \text{Limit} \\ \text{Result / Absolute Level} &= \text{Reading} + \text{Factor}\end{aligned}$$

Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.205, §15.209, §15.231 (b).

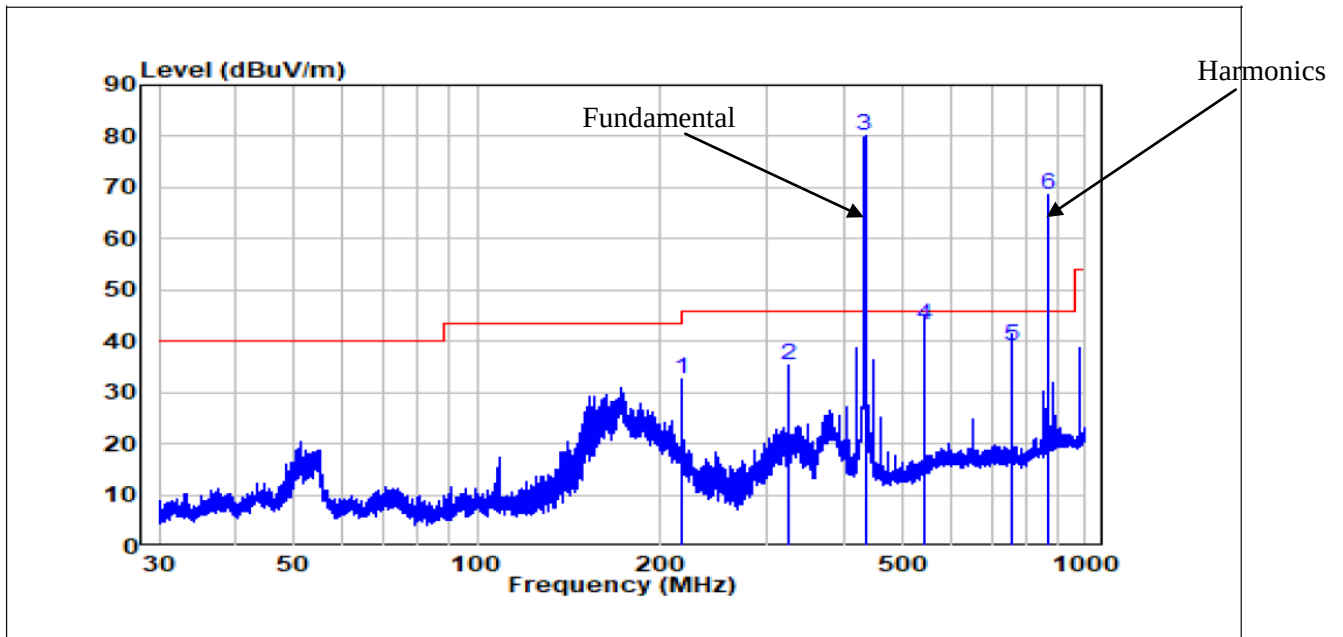
Test Data

Environmental Conditions

Temperature:	25°C
Relative Humidity:	64%
ATM Pressure:	101.0 kPa

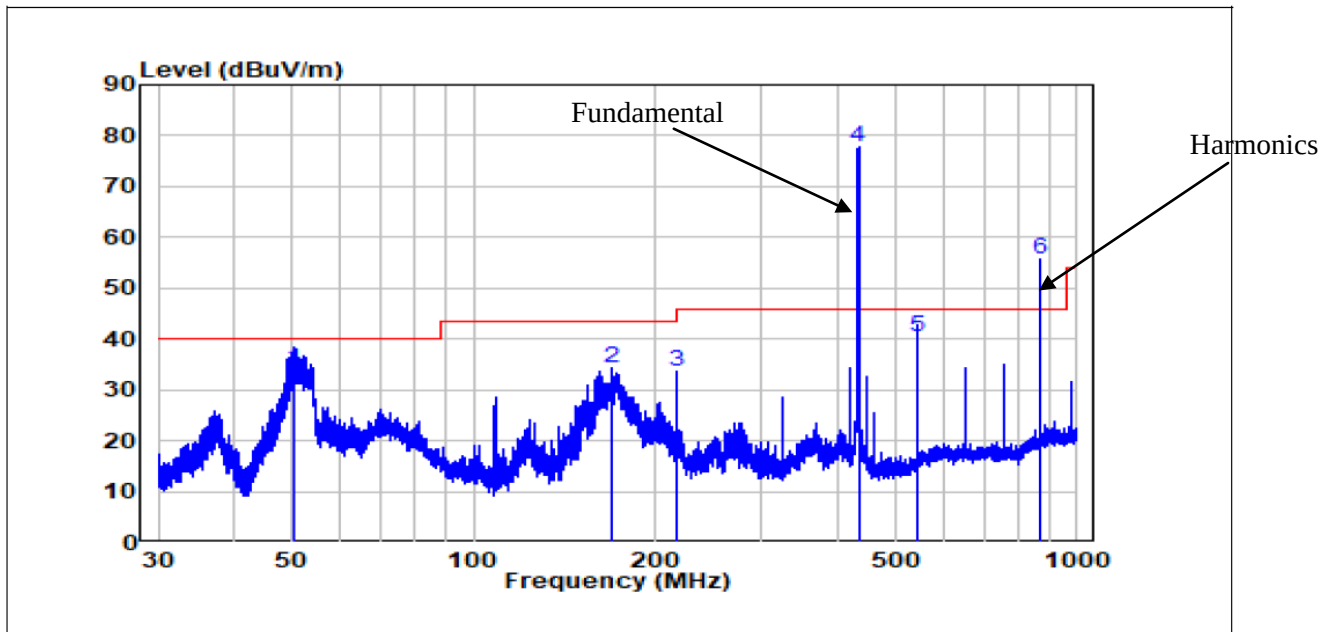
The testing was performed by Ting Lü from 2021-11-03 to 2021-11-22 for below 1GHz, and on 2021-11-18 for above 1GHz.

Test mode: Transmitting (Pre-scan in the X, Y and Z axes of orientation, the worst case X-axis of orientation was recorded)

30MHz – 1 GHz:**Horizontal:**

No.	Frequency	Reading	Correct	Result	Limit	Over Limit	Remark	Phase
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)		
1	216.97	51.53	-18.98	32.55	46.00	-13.45	Peak	HORIZONTAL
2	325.45	51.96	-16.77	35.19	46.00	-10.81	Peak	HORIZONTAL
3	433.9242	94.34	-14.36	79.98	100.83	-20.85	Peak	HORIZONTAL
4	542.56	56.10	-12.87	43.23	46.00	-2.77	QP	HORIZONTAL
5	759.37	50.21	-11.10	39.11	46.00	-6.89	QP	HORIZONTAL
6	867.8484	77.44	-9.26	68.18	80.83	-12.65	Peak	HORIZONTAL

Note: The results which over 6dB below to the limit were not recorded Quasi-peak.

Vertical:

No.	Frequency	Reading	Correct	Result	Limit	Over Limit	Remark	Phase
	(MHz)	(dBUV)	Factor(dB/m)	(dBUV/m)	(dBUV/m)	(dB)		
1	50.34	51.42	-17.32	34.10	40.00	-5.90	QP	VERTICAL
2	169.90	55.39	-20.98	34.41	43.50	-9.09	Peak	VERTICAL
3	216.97	52.67	-18.98	33.69	46.00	-12.31	Peak	VERTICAL
4	433.9242	92.13	-14.36	77.77	100.83	-23.06	Peak	VERTICAL
5	542.56	53.21	-12.87	40.34	46.00	-5.66	QP	VERTICAL
6	867.8484	64.86	-9.26	55.60	80.83	-25.23	Peak	VERTICAL

Note: The results which over 6dB below to the limit were not recorded Quasi-peak.

Horizontal

Frequency (MHz)	Reading (dB μ V)	Factor Corr.	Average Factor	Result (dB μ V/m)		Limit (dB μ V/m)		Margin (dB)	
	Peak	(dB/m)	(dB)	AV	Peak	AV	Peak	AV	Peak
433.9242	94.34	-14.36	-7.54	72.44	79.98	80.83	100.83	-8.39	-20.85
867.8484	77.44	-9.26	-7.54	60.64	68.18	60.83	80.83	-0.19	-12.65
1301.7726	67.31	-9.05	-7.54	50.72	58.26	54	74	-3.28	-15.74
1735.6968	50.66	-7.03	-7.54	36.09	43.63	60.83	80.83	-24.74	-37.2
2169.6210	52.08	-4.97	-7.54	39.57	47.11	60.83	80.83	-21.26	-33.72
2603.5452	55.54	-4.28	-7.54	43.72	51.26	60.83	80.83	-17.11	-29.57
3037.4694	51.23	-2.94	-7.54	40.75	48.29	60.83	80.83	-20.08	-32.54
3471.3936	48.62	-2.83	-7.54	38.25	45.79	60.83	80.83	-22.58	-35.04

Vertical

Frequency (MHz)	Reading (dB μ V)	Factor Corr.	Average Factor	Result (dB μ V/m)		Limit (dB μ V/m)		Margin (dB)	
	Peak	(dB/m)	(dB)	AV	Peak	AV	Peak	AV	Peak
433.9242	92.13	-14.36	-7.54	70.23	77.77	80.83	100.83	-10.6	-23.06
867.8484	64.86	-9.26	-7.54	48.06	55.6	60.83	80.83	-12.77	-25.23
1301.77261	56.51	-9.05	-7.54	39.92	47.46	54	74	-14.08	-26.54
1735.6968	45.47	-7.03	-7.54	30.90	38.44	60.83	80.83	-29.93	-42.39
2169.6210	46.85	-4.97	-7.54	34.34	41.88	60.83	80.83	-26.49	-38.95
2603.5452	49.66	-4.28	-7.54	37.84	45.38	60.83	80.83	-22.99	-35.45

Note:

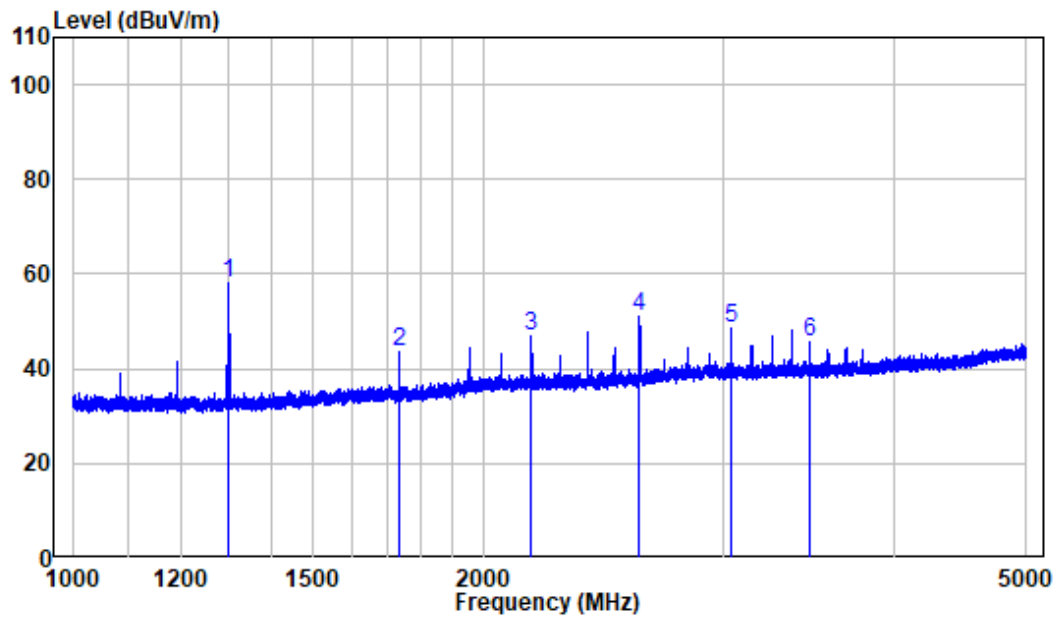
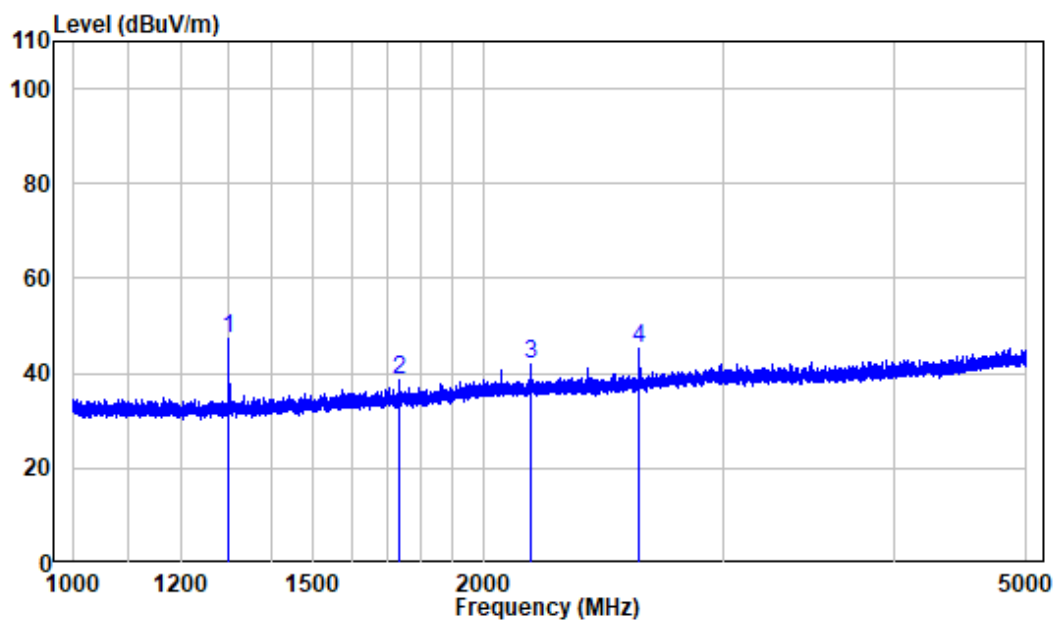
1. Emissions attenuated more than 20 dB below the permissible value are not reported.

2. The field strength is calculated by adding the antenna factor, high pass filter loss(if used) and cable loss, and subtracting the amplifier gain(if any)from the measured reading. The basic equation calculation is as follows:

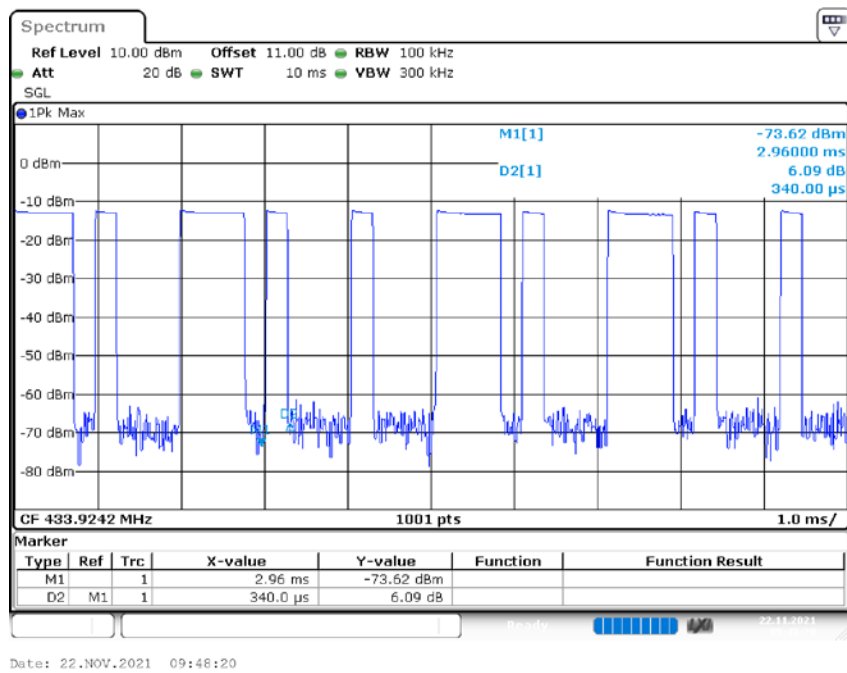
Result = Reading + Corrected Factor

Where Corrected Factor = Antenna Factor + Cable Loss + High Pass Filter Loss – Amplifier Gain

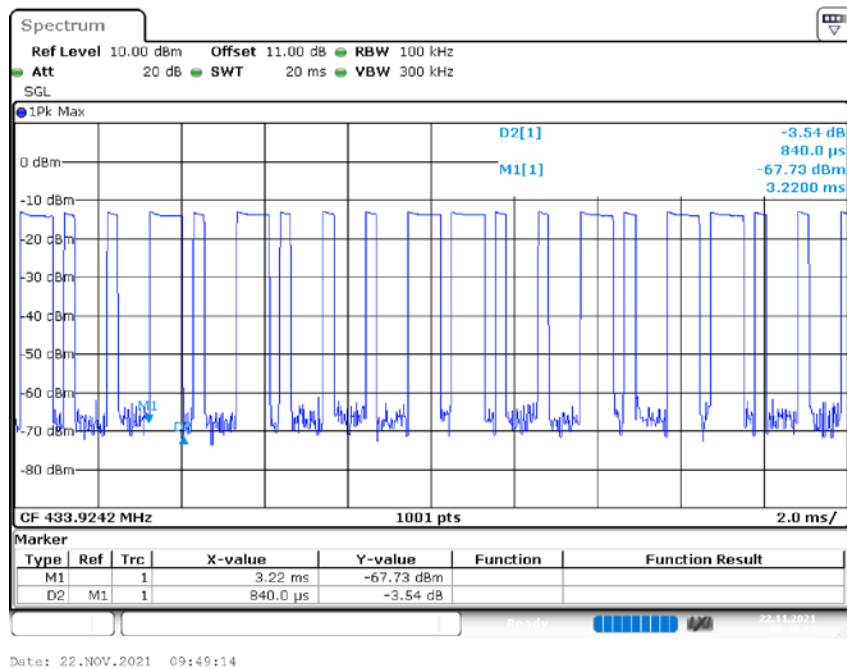
3. Average value= PK value + Average Factor (duty factor)

Pre-scan-Horizontal**Pre-scan – Vertical**

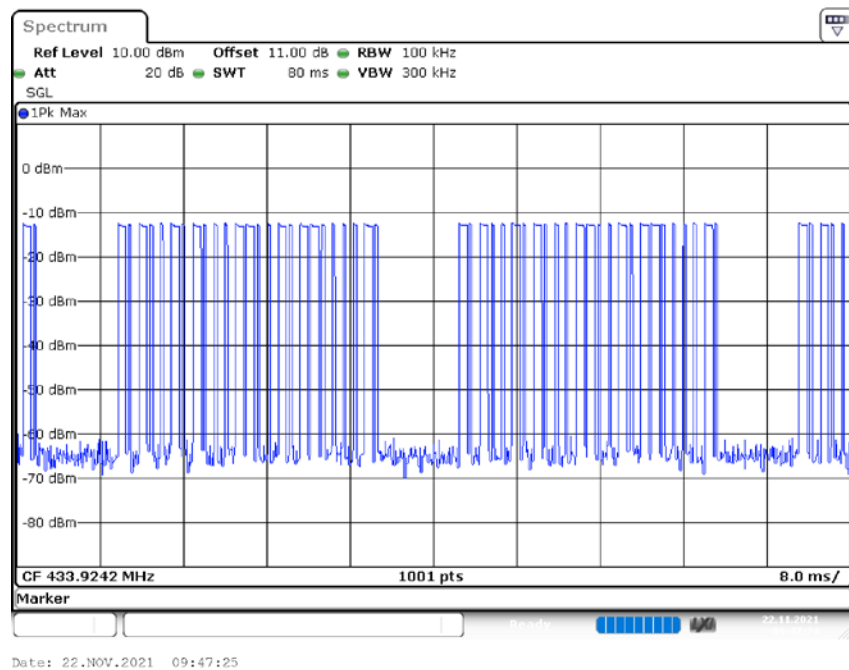
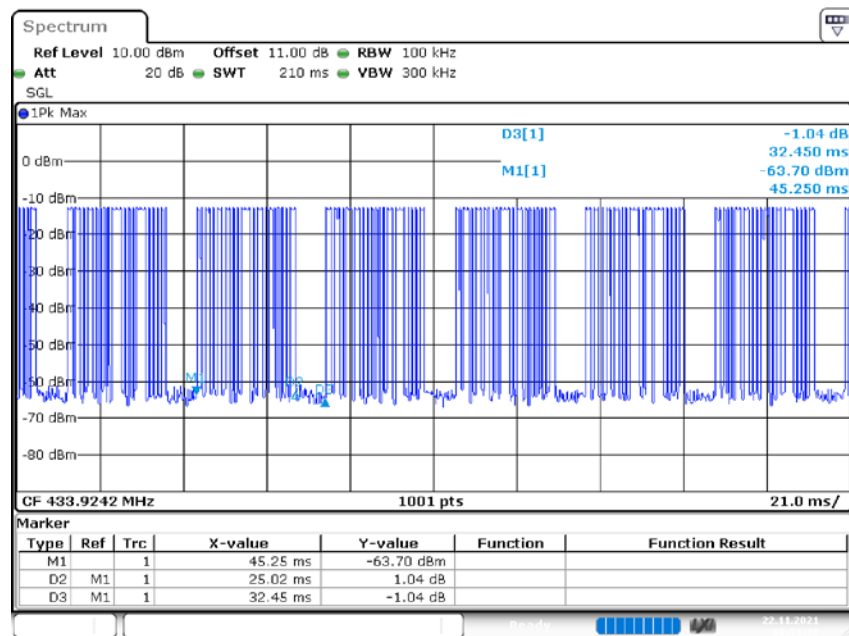
Note: All spurious emissions are compliant to the limit.



The graph shows the duration of 'on' signal. From Marker 1 to Delta 2, duration is 0.34ms.



The graph shows the duration of 'on' signal. From Marker 1 to Delta 2, duration is 0.84ms.



The duty cycle is simply the on time divided by the period:

Effective period of one cycle = $(15 \times 0.34) + (10 \times 0.84)$ ms = 13.5 ms

One cycle = 32.45ms

Duty cycle = $13.5\text{ms} / 32.45\text{ms} = 0.42$

Therefore, the average factor is found by $20 \times \log(0.42) = -7.54\text{dB}$

FCC §15.231(a) (1) - DEACTIVATION TESTING

Applicable Standard

Per FCC §15.231(a) (1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer=operating frequency.
3. Set the spectrum analyzer as RBW=100kHz/ VBW=300kHz/ Span=0Hz.
4. Repeat above procedures until all frequency measured was complete.

Test Data

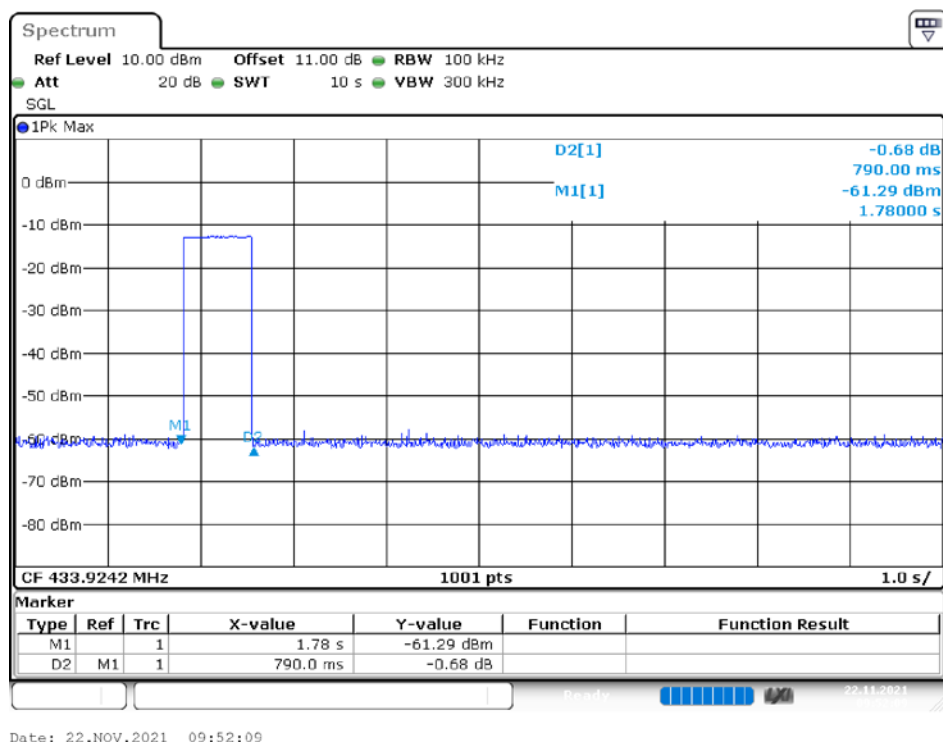
Environmental Conditions

Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Ting Lü on 2021-11-22.

Test mode: Transmitting

Test Result: Compliant. Transmitting time is Less than 5s.



FCC §15.231(c) – 20 dB EMISSION BANDWIDTH TESTING

Applicable Standard

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Procedure

The EUT is setting to the transmit mode, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Data

Environmental Conditions

Temperature:	26°C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Ting Lü on 2021-11-22.

Test Mode: Transmitting

Please refer to following table and plots.

Channel Frequency (MHz)	20 dB Emission Bandwidth (kHz)	Limit (kHz)	Result
433.9242	10.07	<1084.8	Pass

20 dB Emission Bandwidth



Date: 22.NOV.2021 09:35:01

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