China

FCC - TEST REPORT

Report Number	:	**7088819112404-00**	Date of Issue:	October 24, 2019

Model	:	**ZS11E; ZS11MCE3**
Product Type	:	ISMART1.0
FCC ID	:	2AFIXISMART
Applicant	:	Jiangsu Toppower Automotive Electronics Co., Ltd
Address	:	No. 19 Fenghuang Avenue, Xuzhou Economic And Technological Development Zone Xuzhou, 221000 China
Manufacturer	:	Jiangsu Toppower Automotive Electronics Co., Ltd
Address	:	No. 19 Fenghuang Avenue, Xuzhou Economic And Technological Development Zone Xuzhou, 221000 China

Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	36

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1 Table of Contents

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2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
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3 Description of the Equipment under Test

Product:	ISMART1.0
Model no.:	ZS11E; ZS11MCE3
FCC ID:	2AFIXISMART
Options and accessories:	Test harness
Rating:	9~16V DC
RF Transmission Frequency:	2402~2480MHz for Bluetooth For 2.4G & 5G Wi-Fi For 802.11b/g/n-HT20: 2412~2462 MHz For 802.11n-HT40: 2422~2452 MHz 5180~5240MHz 5745~5825MHz
No. of Operated Channel:	79 for Bluetooth 4.1+EDR 40 for Bluetooth 4.1 BLE For 2.4GHz Wi-Fi

Operation Frequency each of channel For 802.11b/g/n(H20)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz		

Operation Frequency each of channel For 802.11n(H40)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
		4	2427MHz	7	2442MHz		
		5	2432MHz	8	2447MHz		
3	2422MHz	6	2437MHz	9	2452MHz		

FOR 5180 ~ 5240MHz

4 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210 MHz

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FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745 MHz	161	5805 MHz
153	5765 MHz	165	5825 MHz
157	5785 MHz		

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755 MHz	159	5795 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775 MHz

Modulation:	Bluetooth 4.0+EDR FHSS: GFSK, 8DPSK, π/4 DQPSK Bluetooth BLE DHSS: QPSK For Wi-Fi: Direct Sequence Spread Spectrum (DSSS) for 802.11b Orthogonal Frequency Division Multiplexing(OFDM) for 802.11g/n
Data speed:	1. Bluetooth: 1Mbps, 2Mbps, 3Mbps 2. Wi-Fi: 11b 1 ~ 11Mbps, 11g/a 6 ~ 54Mbps, 11n HT20 6.5 ~ 65Mbps, 11n HT 40 13.5 ~ 135Mbps, 11ac VHT40 13.5 ~ 180Mbps, 11ac VHT80 29.3 ~ 390Mbps
Duty Cycle:	100%
Antenna Type:	PIFA Antenna
Antenna Gain:	2.4GHz: 2.04dBi 5.2GHz: 4.2dBi 5.8GHz: 5.52dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Car Radio with Bluetooth and WI-FI Module is equipment installed in a car to provide in-car entertainment and information for the vehicle occupants. It consisted of a simple FM/AM/DRM radio, media players and Bluetooth module. User can listen to FM/AM, DRM, USB audio by using the equipment. The EUT support Bluetooth 4.1+EDR and support BLE function and Wi-Fi operated at 5GHz and 2.4GHz. Only 5G Wi-Fi included in this report.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart E, 10-1-2017 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart E - Unlicensed National Information Infrastructure Devices

Test Method:
KDB 789033 D02 General UNII Test Procedures New Rules v02r01
ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices

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5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C						
Test Condition		Pages	Test Site	Test Result		
				Pass	Fail	N/A
§15.207	Conducted emission AC power port	---	---	☐	☐	☒
§15.407(e)	Emission bandwidth	14-15	Site 1	☒	☐	☐
15.407(a)(i)	Maximum Conducted Output Power	16	Site 1	☒	☐	☐
15.407(a)(i)	Maximum Power Spectral Density	17-19	Site 1	☒	☐	☐
§15.407(g)	Frequencies Stability	20	Site 1	☒	☐	☐
§15.407(b)(1), 15.407(b)(2), 15.407(b)(3), 15.407(b)(4), 15.407(b)(5), 15.407(b)(6), 15.407(b)(7), 15.209	Spurious radiated emissions for transmitter	21-32	Site 1	☒	☐	☐
§15.203	Antenna requirement	See note 1		☒	☐	☐

Remark 1: The EUT only operation at 5G Wi-Fi UNII Band4 (5180MHz-5240MHz, 5745MHz-5825MHz).
Remark 2: N/A – Not Applicable. Conducted emission is not apply for battery operated device.

Note 1: The EUT uses a permanently integral antenna, which gain is 2.04dBi for 2.4GHz, 4.2dBi for 5.2GHz, 5.52dBi for 5.8GHz. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

15.203 requirement: 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, 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. 15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2AFIXISMART complies with Section 15.207, 15.209, 15.407 of the FCC Part 15, Subpart E Rules.

This report in only for 5GHz Wi-Fi. The TX and RX range is 5180MHz-5240MHz, 5745MHz-5825MHz.

According to the client's declaration, we chose the ZS11E to perform the conductive RF tests, and chose ZS11E and ZS11MCE3 to perform the radiated emission test.

HARDWARE MODIFICATION	ZS11E	ZS11MCE3
Band	The same	The same
Power Amplifier	The same	The same
Antenna	The same	The same
PCB Layout	The same	The same
Components on PCB	Have DRM components	No DRM
DRM	Yes	No
LCD Structural Bracket	Not connected the AHU	Connected the AHU
LCD Size	8 "	10.1 "
Speaker	The same	The same
Camera	The same	The same
Bluetooth	The same	The same
WIFI	The same	The same

ZS11E and ZS11MCE3 are use same Bluetooth and WIFI module. Main PCB board is same in these 2 models. ZS11E and ZS11MCE3 all need to match LCD use.

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SUMMARY:

All tests according to the regulations cited on page 6 were

■ - Performed

☐ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date:	September 19, 2019
Testing Start Date:	September 26, 2019
Testing End Date:	October 16, 2019

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:	Prepared by:	Tested by:
Hui TONG	Jiaxi XU	Wenqiang LU
Review Engineer	Project Engineer	Test Engineer

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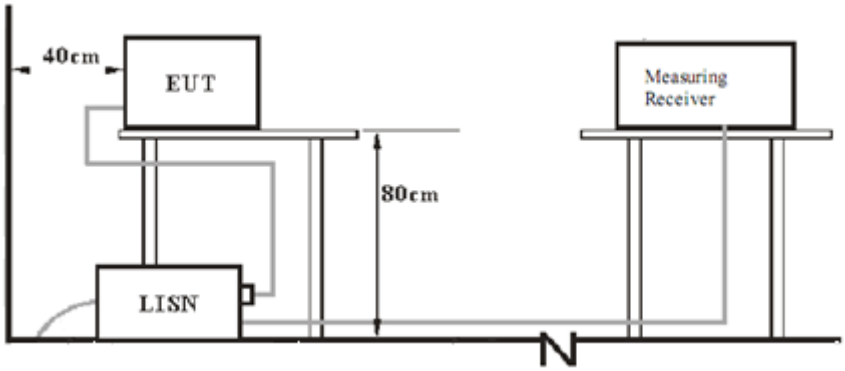
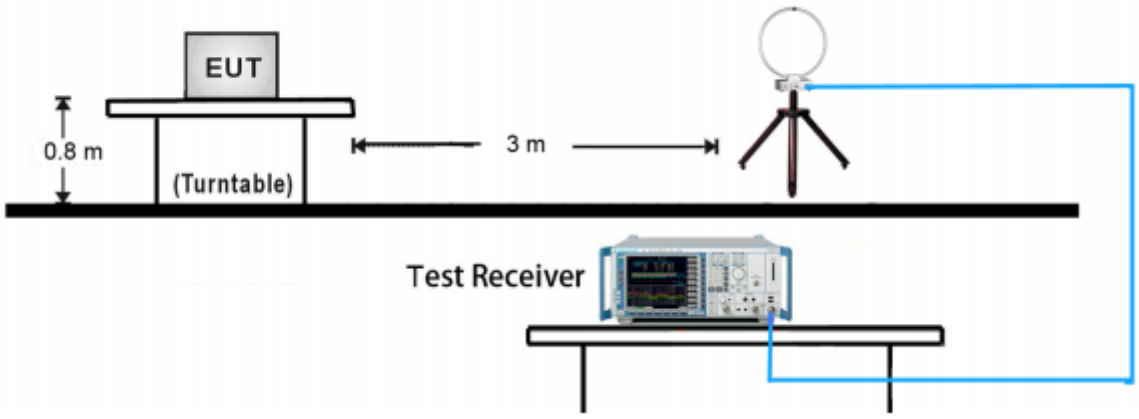
7 Test Setups

7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups

9kHz ~ 30MHz Test Setup:



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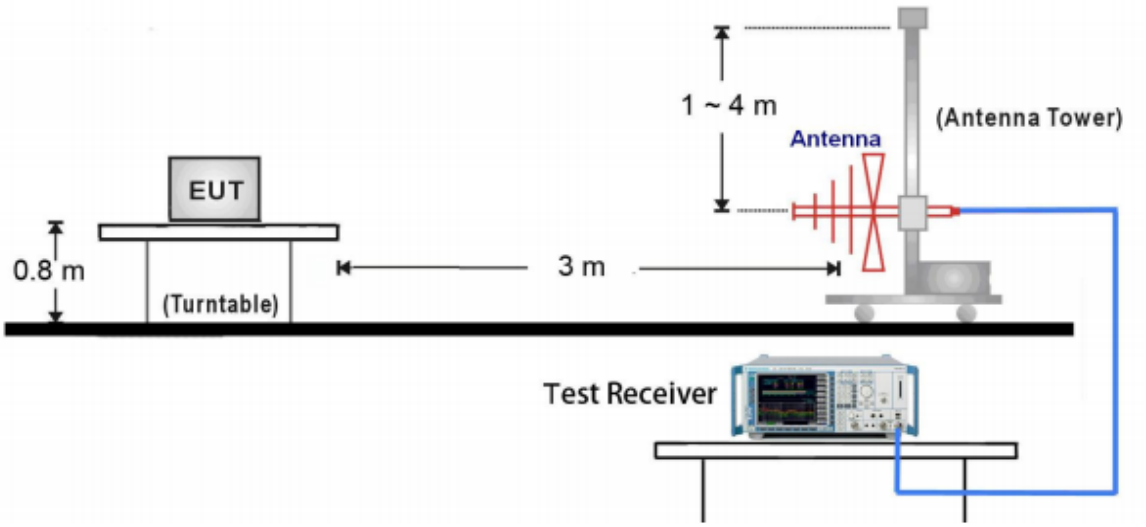
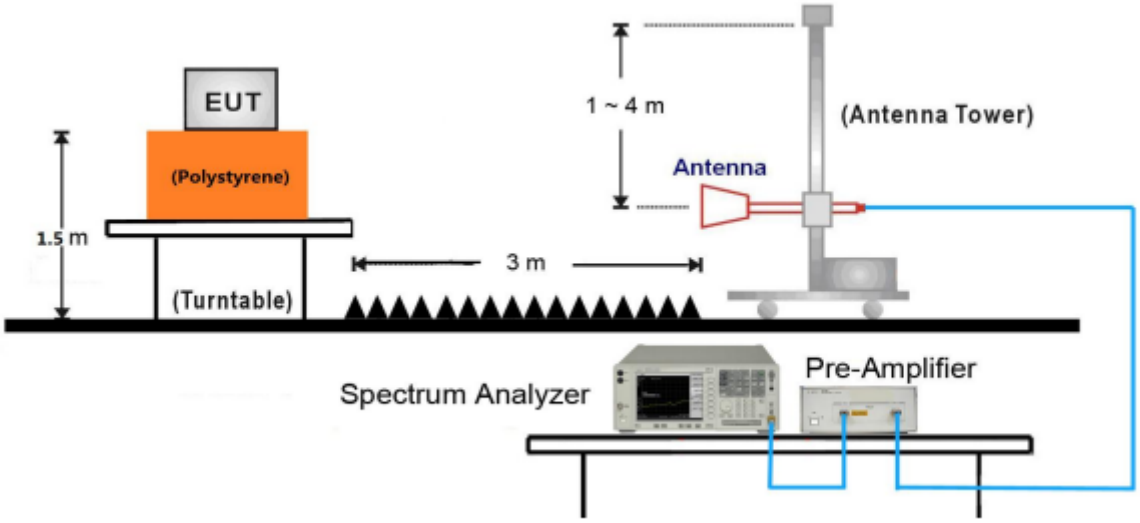
30MHz ~ 1GHz Test Setup:



1GHz ~ 18GHz Test Setup:



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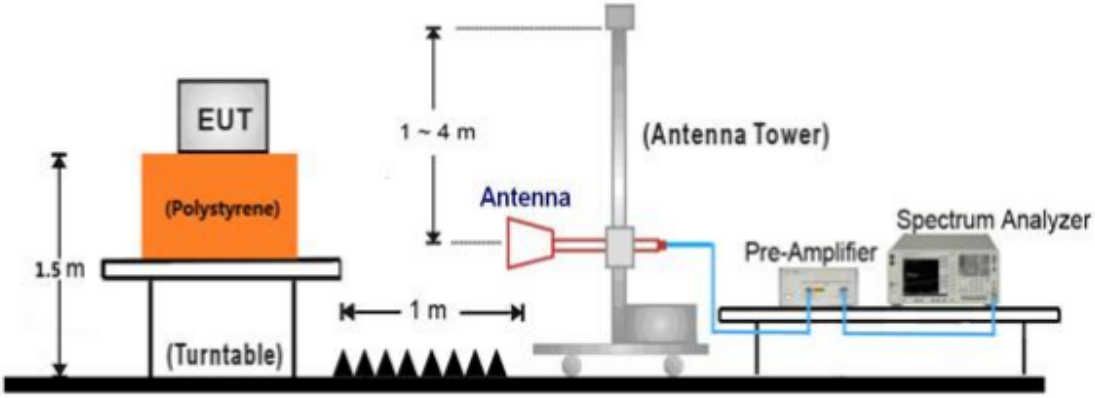
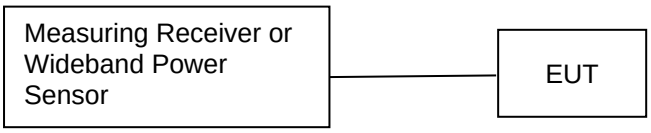
18GHz ~ 40GHz Test Setup:



7.3 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)
Notebook	Lenove	X240

Test channel & mode:
The was Interactive Tablet configured using a proprietary communication interface provided by the client. The interface allows channel control required to support the evaluation.

Test software SecureCRT

The system was configured to channel:

Test Mode	Channel	Frequency (MHz)
802.11a, 802.11n HT20 802.11ac20	36	5180
	44	5220
	48	5240
	149	5745
	157	5785
	165	5825
802.11n HT40 802.11ac40	38	5190
	46	5230
	151	5755
	159	5795
802.11ac80	42	5210
	155	5755

The pre-test has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

Modulation Type	Data Rate
802.11a OFDM	6Mbps
802.11n (HT20): OFDM	MCS0 (6.5Mbps)
802.11n (HT20): OFDM	MCS0 (6.5Mbps)
802.11n (HT40): OFDM	MCS0 (13.5Mbps)
802.11ac (VHT20): OFDM	11ac 6.5Mbps (20MHz)
802.11ac (VHT40): OFDM	11ac13.5Mbps (40MHz)
802.11ac (VHT80): OFDM	11ac 29.3Mbps (80MHz)

Device Capabilities
Duty Cycle: 100%
Note: 2.4GHz WLAN (DTS) operation is possible in 20MHz, and 40MHz channel bandwidths.
5GHz WLAN (DTS) operation is possible in 20MHz, 40MHz and 80MHz channel bandwidths.

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9 Technical Requirement

9.1 Emission bandwidth

1、Test Method of 26dB Bandwidth

According to KDB789033 D02

a) Set RBW = approximately 1% of the emission bandwidth.

b) Set the VBW > RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

Limit: No limit

2、Test Method of 6dB Bandwidth

According to KDB789033 D02

a) Set RBW = 100KHz

b) Set the video bandwidth (VBW) ≥ 3 × RBW

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Limit: ≥500KHz

3、Test Method of 99% Bandwidth

According to KDB789033 D02

a) Set center frequency to the nominal EUT channel center frequency

b) Set span = 1.5 times to 5.0 times the OBW.

c) Set RBW = 1 % to 5 % of the OBW

d) Set VBW ≥ 3 · RBW

e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

f) Use the 99 % power bandwidth function of the instrument (if available).

g) If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total

is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

Limit: No limit

Test result as below table:

Test Mode	Frequency(MHz)	26db EBW [MHz]	6db EBW [MHz]	Limit[MHz]	Verdict
11a	5180	27.704	N/A	---	PASS
	5220	27.704	N/A	---	PASS
	5240	27.568	N/A	---	PASS
	5745	N/A	16.384	---	PASS
	5785	N/A	16.4	---	PASS
	5825	N/A	16.3872	---	PASS
11n HT20	5180	30.984	N/A	---	PASS
	5220	29.6325	N/A	---	PASS
	5240	27.6755	N/A	---	PASS
	5745	N/A	17.76	---	PASS
	5785	N/A	17.76	---	PASS
	5825	N/A	17.76	---	PASS
11ac VHT20	5180	22.869	N/A	---	PASS
	5220	22.876	N/A	---	PASS
	5240	22.95	N/A	---	PASS
	5745	N/A	17.768	---	PASS
	5785	N/A	17.744	---	PASS
	5825	N/A	17.752	---	PASS
11n HT40	5190	47.104	N/A	---	PASS
	5230	46.08	N/A	---	PASS
	5755	N/A	36.512	---	PASS
	5795	N/A	36.52	---	PASS
11ac VHT40	5190	41.024	N/A	---	PASS
	5230	40.892	N/A	---	PASS
	5755	N/A	36.496	---	PASS
	5795	N/A	36.528	---	PASS
11ac VHT80	5210	81.352	N/A	---	PASS
	5775	N/A	75.92	---	PASS

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9.2 Maximum conducted output power

Test Method
According to KDB789033 D02

Limits: The maximum conducted output power over the frequency band of operation shall not exceed 250mW for 5.15-5.25GHz Band, 250mW for 5.25-5.35GHz, 5.47-5.725 GHz Band and 1W for 5.725-5.85GHz Band, provided the maximum antenna gain does not exceed 6dBi.

Test Mode	Frequency(MHz)	Maximum Conducted Output Power (dBm)	Power Limit (dBm)	Verdict
11a	5180	21.83	24.00	PASS
	5220	22.13	24.00	PASS
	5240	22.64	24.00	PASS
	5745	12.41	30.00	PASS
	5785	12.75	30.00	PASS
	5825	13.4	30.00	PASS
11n HT20	5180	21.62	24.00	PASS
	5220	21.85	24.00	PASS
	5240	22.54	24.00	PASS
	5745	11.17	30.00	PASS
	5785	11.55	30.00	PASS
	5825	12.35	30.00	PASS
11ac VHT20	5180	20.46	24.00	PASS
	5220	20.63	24.00	PASS
	5240	21.27	24.00	PASS
	5745	8.06	30.00	PASS
	5785	8.46	30.00	PASS
	5825	9.19	30.00	PASS
11n HT40	5190	21.73	24.00	PASS
	5230	22.33	24.00	PASS
	5755	10.4	30.00	PASS
	5795	11.18	30.00	PASS
11ac VHT40	5190	20.52	24.00	PASS
	5230	21	24.00	PASS
	5755	7.22	30.00	PASS
	5795	7.85	30.00	PASS
11ac VHT80	5210	20	24.00	PASS
	5775	6.4	30.00	PASS

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9.3 Maximum power spectral density

Test Method

According to KDB789033 D02

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

Limit: The maximum power spectral density shall not exceed 11dBm for the 5.15-5.25GHz, 5.25-5.35GHz, 5.47-5.725 GHz Band and 30dBm for the 5.8GHz Band in any 1 megahertz band.

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Test Result

Test Mode	Frequency(MHz)	Maximum PSD (dBm/MHz)	PSD Limit (dBm/MHz)	Verdict
11a	5180	10.69	11.00	PASS
	5220	10.98	11.00	PASS
	5240	10.99	11.00	PASS
	5745	10.08	30.00	PASS
	5785	8.97	30.00	PASS
	5825	8.2	30.00	PASS
11n HT20	5180	9.66	11.00	PASS
	5220	9.84	11.00	PASS
	5240	10.3	11.00	PASS
	5745	9.24	30.00	PASS
	5785	8.09	30.00	PASS
	5825	7.21	30.00	PASS
11ac VHT20	5180	6.77	11.00	PASS
	5220	7.26	11.00	PASS
	5240	7.9	11.00	PASS
	5745	6.14	30.00	PASS
	5785	5.01	30.00	PASS
	5825	3.98	30.00	PASS
11n HT40	5190	8.06	11.00	PASS
	5230	8.58	11.00	PASS
	5755	6.49	30.00	PASS
	5795	5.41	30.00	PASS
11ac VHT40	5190	4.93	11.00	PASS
	5230	5.51	11.00	PASS
	5755	4.11	30.00	PASS
	5795	3.06	30.00	PASS
11ac VHT80	5210	2.27	11.00	PASS
	5775	0.11	30.00	PASS

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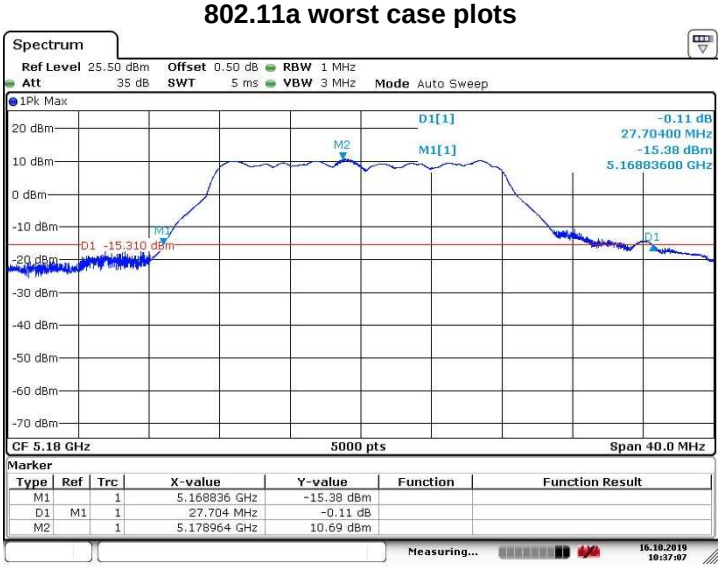
802.11a worst case plots



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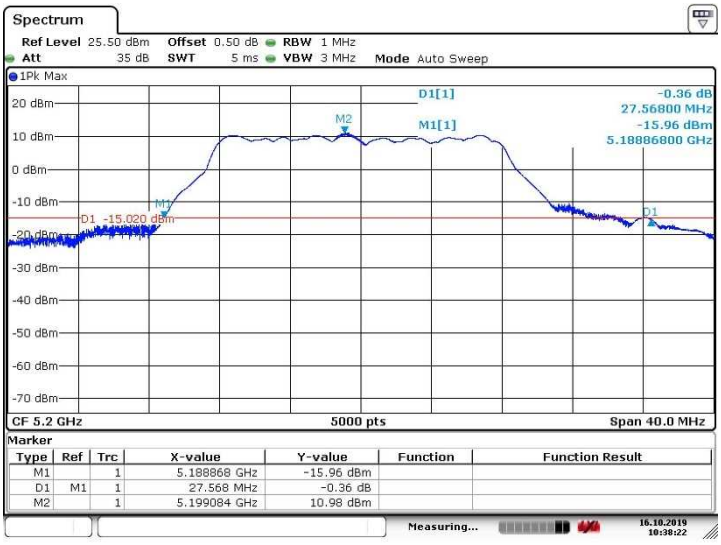

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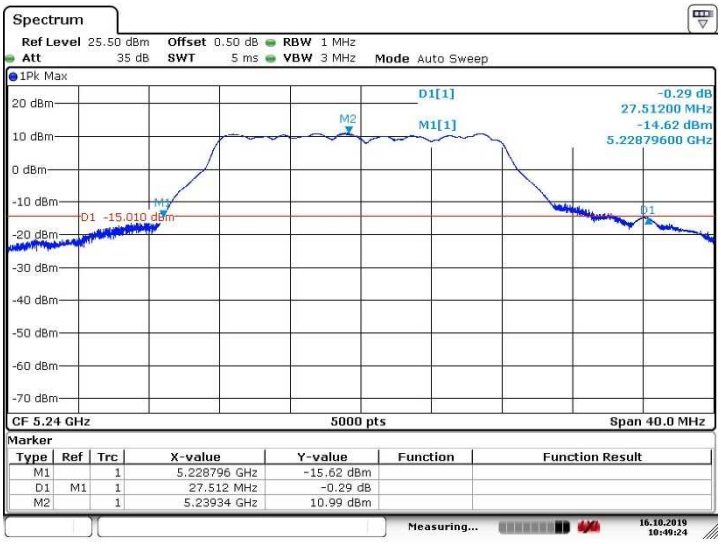

Date: 16.OCT.2019 10:49:25

9.4 Frequencies Stability

Test Method

1. Connect the UUT to the spectrum analyzer
2. Set Centre Frequency of the channel under test.
3. Set Detector PEAK
4. Set RBW: 10KHz, VBW: 3RBW
5. Set Span: Encompass the entire emissions bandwidth (EBW) of the signal.
6. Allow the trace to stabilize, find the peak value of the power envelope and record the frequency, then calculated the frequency drift.

The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.

User manual temperature is -40℃ to 80℃
Limit: 20ppm
Test Results (All conditions and all modes were performed, only list Worst-Case in the report)

Voltage							
Test Mode	Channel	Voltage [Vdc]	Temp (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Verdict
11a	5745	NV	NT	50000	8.72122	20	PASS
	5745	HV	NT	70000	12.17451	20	PASS
	5745	LV	NT	45000	7.846898	20	PASS
	5785	NV	NT	60000	10.36265	20	PASS
	5785	LV	NT	7000	1.195026	20	PASS
	5785	HV	NT	75000	12.94856	20	PASS
	5825	LV	NT	65000	11.1698	20	PASS
	5825	NV	NT	60000	10.29243	20	PASS
	5825	HV	NT	70000	12.00917	20	PASS

Temperature							
Test Mode Antenna	Channel	Voltage [Vdc]	Temp (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Verdict
11a	5745	NV	-40	65000	11.31419	20	PASS
	5745	NV	-20	55000	9.593542	20	PASS
	5745	NV	0	70000	12.17351	20	PASS
	5745	NV	20	55000	9.558542	20	PASS
	5745	NV	80	65000	11.32419	20	PASS
	5785	NV	-40	70000	12.11526	20	PASS
	5785	NV	-20	65000	11.24396	20	PASS
	5785	NV	0	65000	11.24896	20	PASS
	5785	NV	20	55000	9.518347	20	PASS
	5785	NV	80	65000	11.24996	20	PASS
	5825	NV	-40	70000	12.01017	20	PASS
	5825	NV	-20	65000	11.1398	20	PASS
	5825	NV	0	70000	12.01917	20	PASS
	5825	NV	20	75000	12.88154	20	PASS
	5825	NV	80	55000	9.43306	20	PASS

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9.5 Spurious radiated emissions for transmitter

Test Method

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned
5. Use the following spectrum analyzer settings According to C63.10:
   For Above 1GHz
   Span = wide enough to capture the peak level of the in-band emission and all spurious
   RBW = 1MHz, VBW≥RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.
   For Below 1GHz
   Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious
   RBW = 100 KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

Limit

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

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(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

According to part 15.407(b), the radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBμV/m	Detector
30-88	100	40	QP
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

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (which is subject to the maximum EIRP, 802.11a mode) for model ZS11E, ZS11MCE3 are listed in the report.

Transmitting spurious emission worse case test result as below:

Transmitting spurious emission test result as below:
802.11a Modulation 5180MHz Test Result

Frequency Range	Frequency	Emission Level	Polarization	Limit	Margin	Detector	Result
MHz	MHz	dBuV/m		dBμV/m	dB		
1000-7000	--	--	Horizontal	74.00	--	PK	Pass
1000-7000	--	--	Vertical	74.00	--	PK	Pass
7000-40000	10360	44.37	Horizontal	74.00	29.63	PK	Pass
7000-40000	10360	46.29	Vertical	74.00	27.71	PK	Pass

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802.11a Modulation 5220MHz Test Result

Frequency Range	Frequency	Emission Level	Polarization	Limit	Margin	Detector	Result
MHz	MHz	dBuV/m		dBµV/m	dB		
1000-7000	--	--	Horizontal	74.00	--	PK	Pass
1000-7000	--	--	Vertical	74.00	--	PK	Pass
7000-40000	10440	45.26	Horizontal	74.00	28.74	PK	Pass
7000-40000	10440	51.27	Vertical	74.00	22.73	PK	Pass

802.11a Modulation 5240MHz Test Result

Frequency Range	Frequency	Emission Level	Polarization	Limit	Margin	Detector	Result
MHz	MHz	dBuV/m		dBµV/m	dB		
1000-7000	--	--	Horizontal	74.00	--	PK	Pass
1000-7000	--	--	Vertical	74.00	--	PK	Pass
7000-40000	10480	49.86	Horizontal	74.00	24.14	PK	Pass
7000-40000	10480	51.27	Vertical	74.00	22.73	PK	Pass

Transmitting spurious emission test result as below:

802.11a Modulation 5745MHz Test Result

Frequency Range	Frequency	Emission Level	Polarization	Limit	Margin	Detector	Result
MHz	MHz	dBuV/m		dBµV/m	dB		
1000-7000	--	--	Horizontal	74.00	--	PK	Pass
1000-7000	--	--	Vertical	74.00	--	PK	Pass
7000-40000	11490	47.34	Horizontal	74.00	26.66	PK	Pass
7000-40000	11480	50.59	Vertical	74.00	23.41	PK	Pass

802.11a Modulation 5785MHz Test Result

Frequency Range	Frequency	Emission Level	Polarization	Limit	Margin	Detector	Result
MHz	MHz	dBuV/m		dBµV/m	dB		
1000-7000	--	--	Horizontal	74.00	--	PK	Pass
1000-7000	--	--	Vertical	74.00	--	PK	Pass
7000-40000	11570	45.94	Horizontal	74.00	28.06	PK	Pass
7000-40000	11579	51.48	Vertical	74.00	22.52	PK	Pass

802.11a Modulation 5825MHz Test Result

Frequency Range	Frequency	Emission Level	Polarization	Limit	Margin	Detector	Result
MHz	MHz	dBuV/m		dBµV/m	dB		
1000-7000	--	--	Horizontal	74.00	--	PK	Pass
1000-7000	--	--	Vertical	74.00	--	PK	Pass
7000-40000	11650	47.59	Horizontal	74.00	26.41	PK	Pass
7000-40000	11650	52.43	Vertical	74.00	21.57	PK	Pass

Remark:

(1) Above 1GHz Corrector factor= Antenna Factor +Cable Loss - Amp. Factor.
(2) Below 1GHz Corrector factor= Antenna Factor +Cable Loss.
(3) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
(4) We test all modes and only the worst case for each bandwidth recorded in the report.
(5) Testing is carried out with frequency rang 30MHz to 40GHz, which data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
(6) The Low frequency, which start from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

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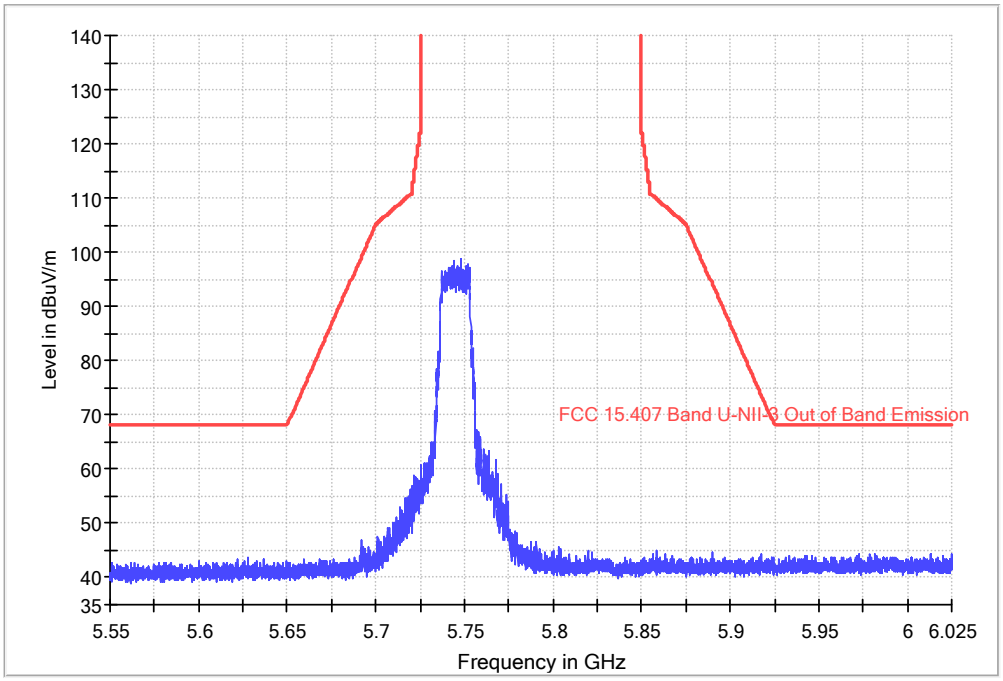
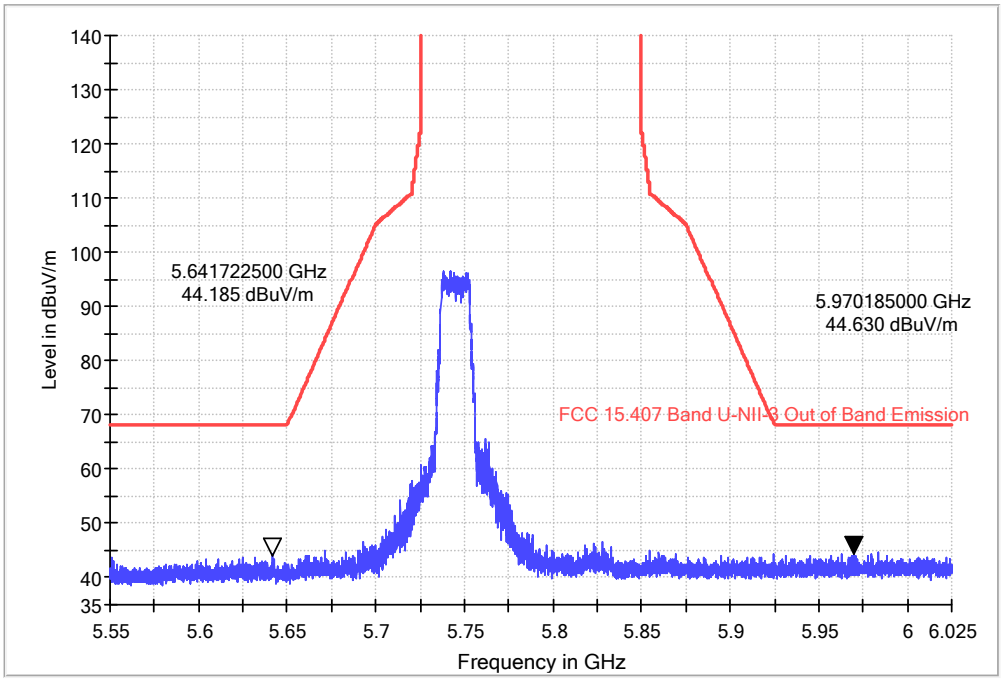
Out of Band Emission
802.11a: CH 5745MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

FCC 15.407 U-NII Out of Band Emission



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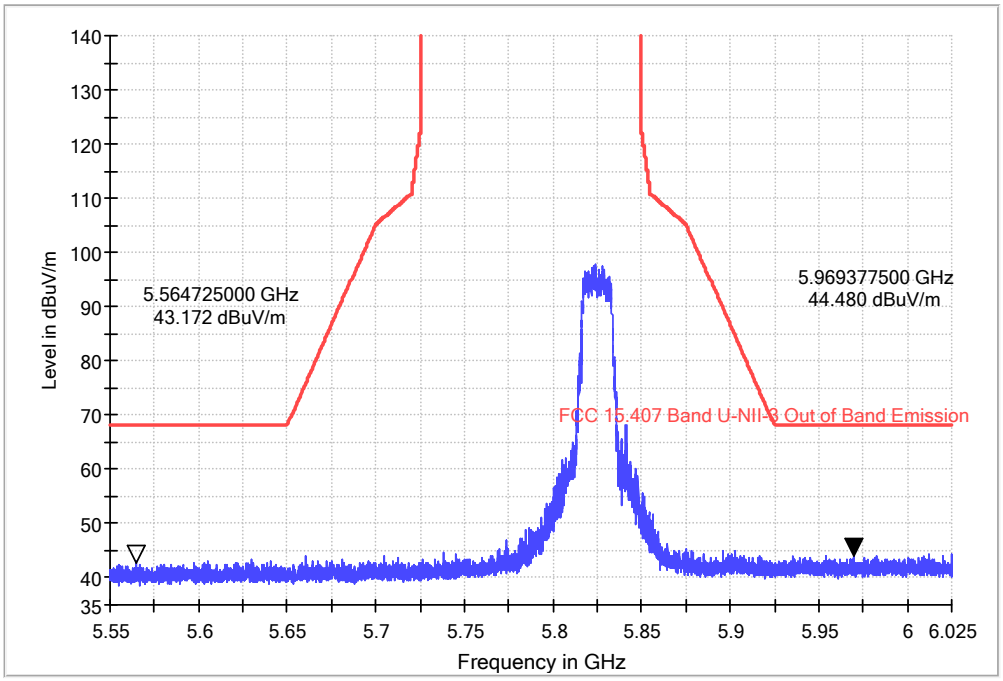
China

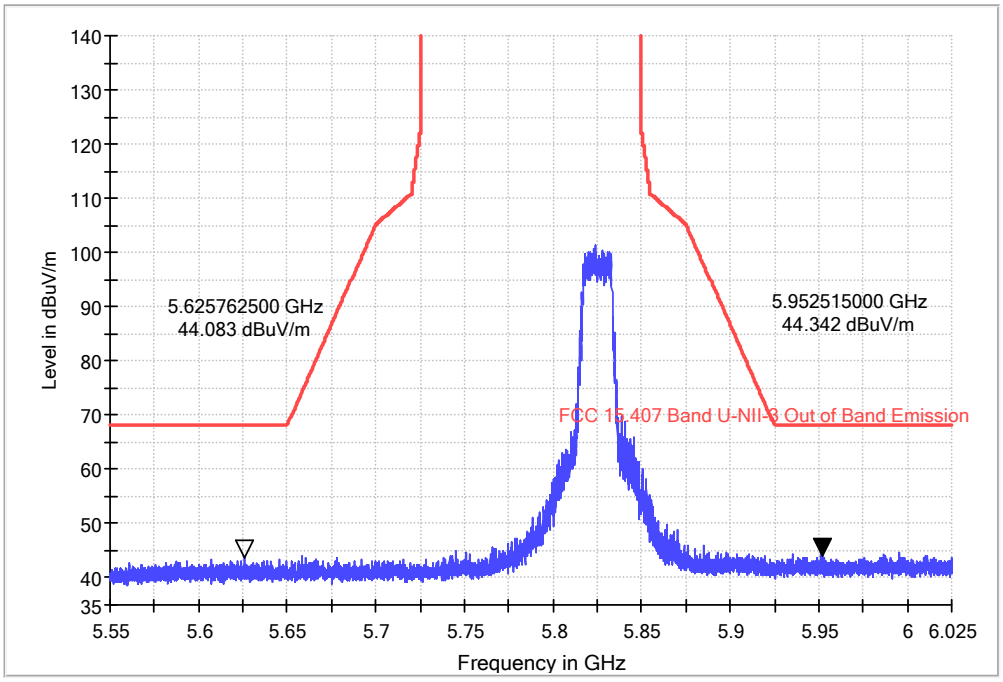
802.11a: CH 5825MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

FCC 15.407 U-NII Out of Band Emission



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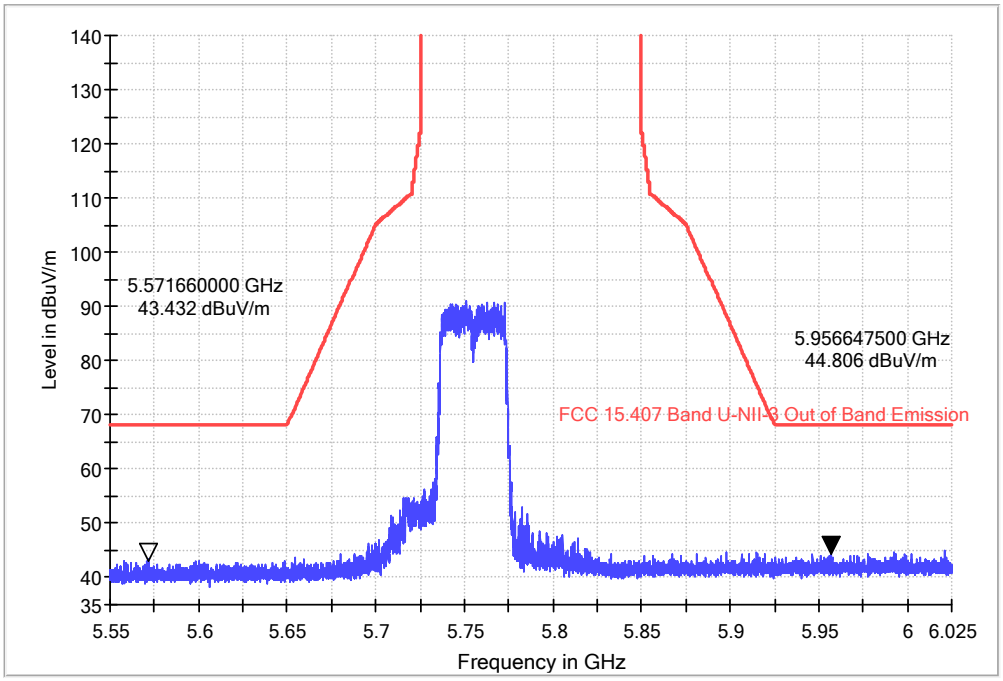
China

802.11ac(VHT40): CH 5755MHz

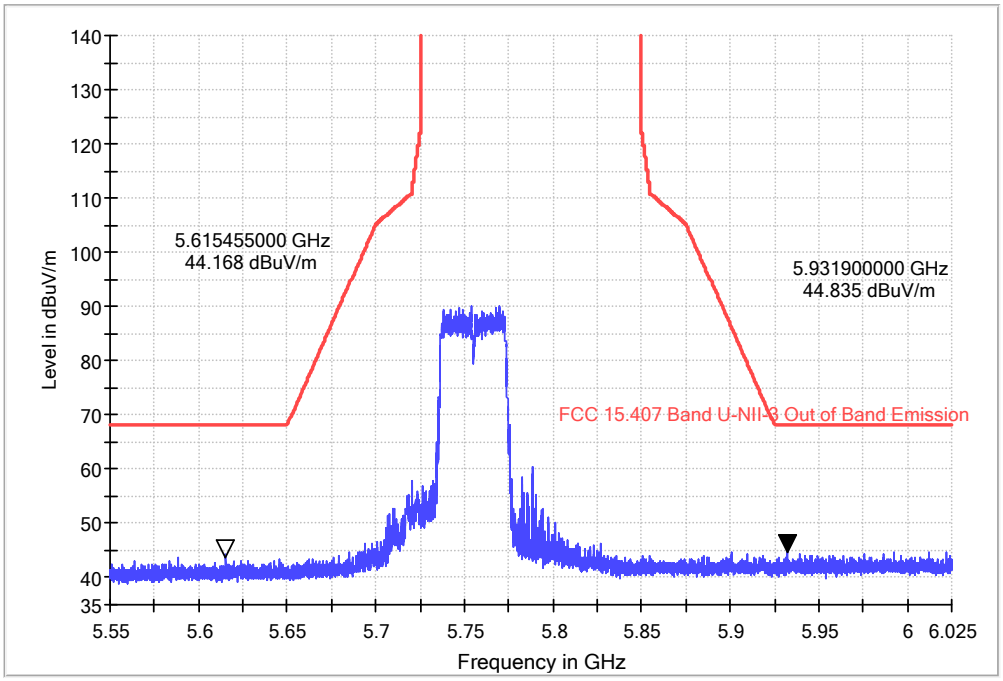
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

FCC 15.407 U-NII Out of Band Emission



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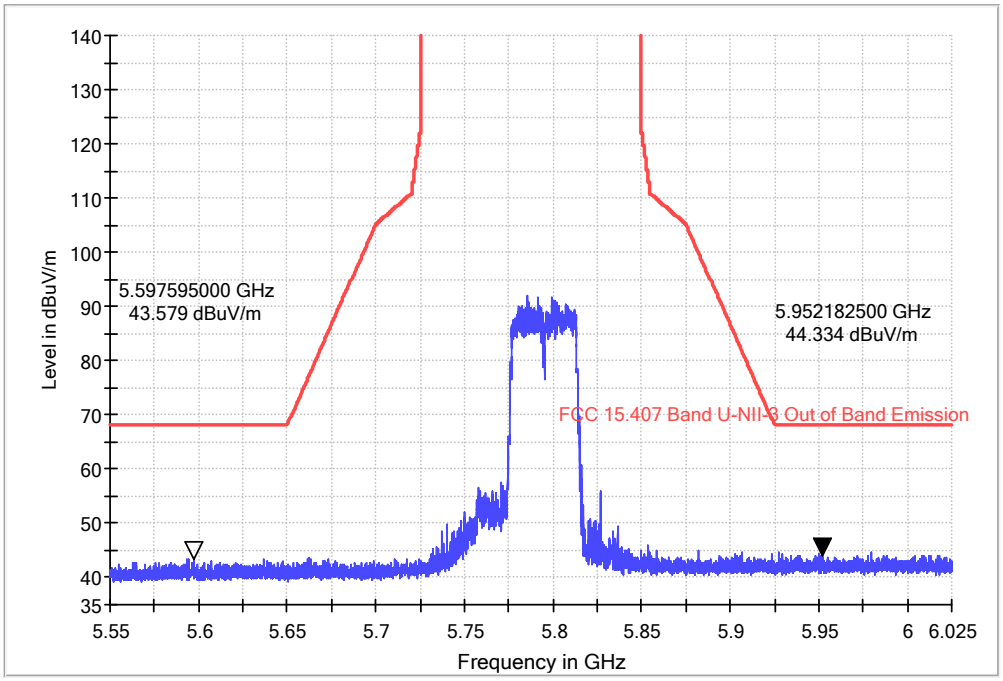
China

802.11ac(VHT40): CH 5795MHz

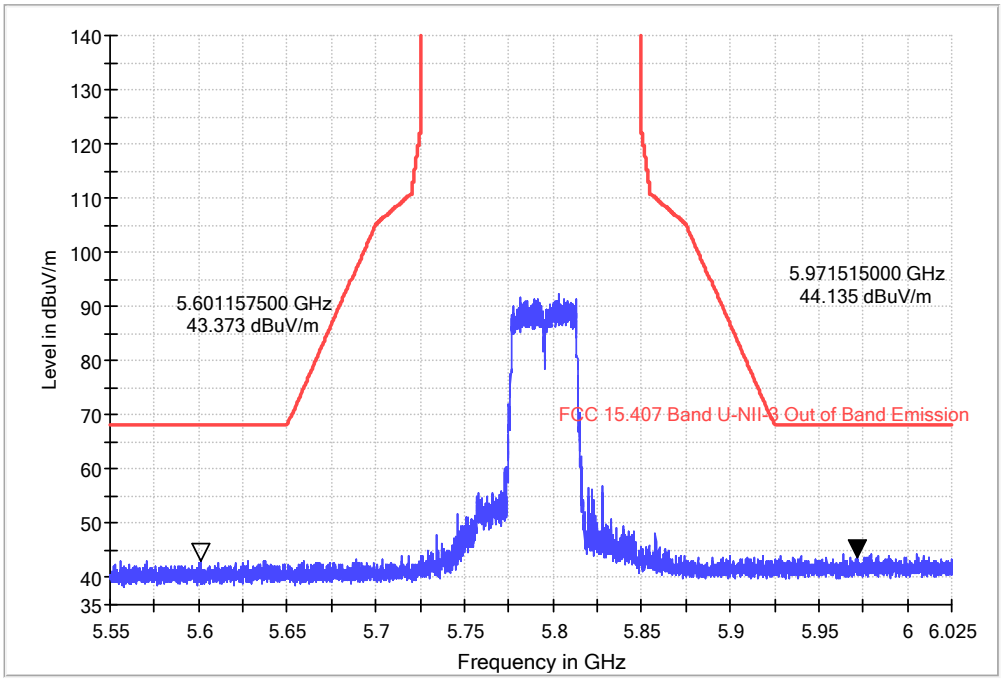
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

FCC 15.407 U-NII Out of Band Emission



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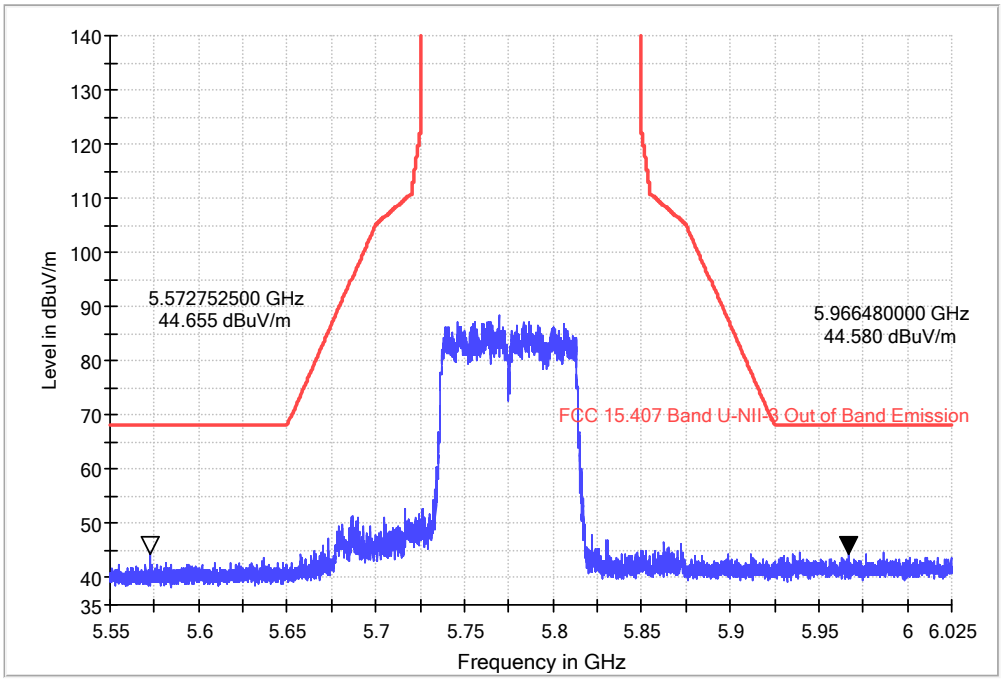
China

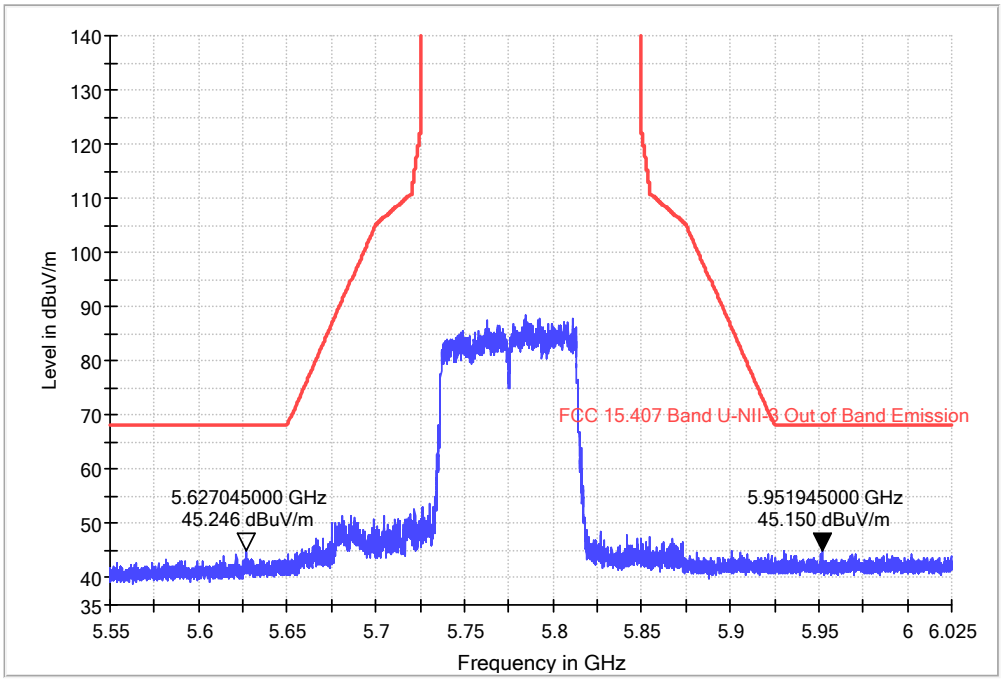
802.11ac(VHT80): CH 5775MHz
Horizontal

FCC 15.407 U-NII Out of Band Emission



Vertical

FCC 15.407 U-NII Out of Band Emission



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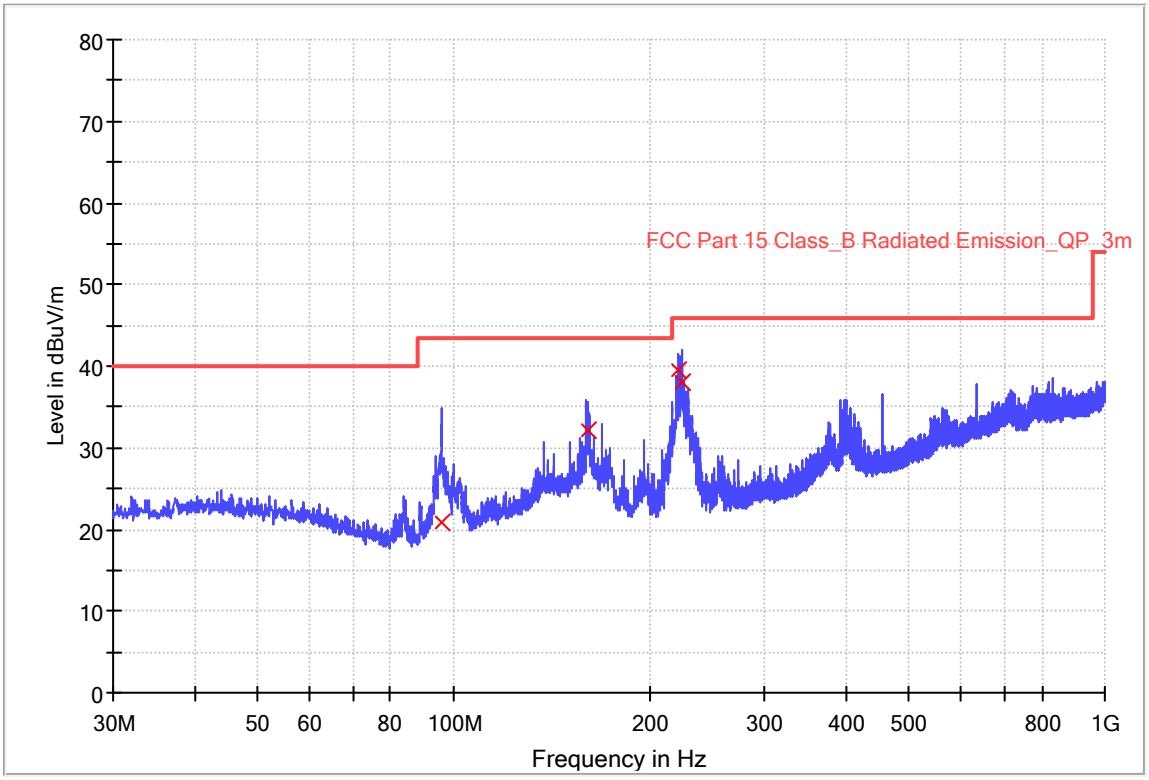
China

ZS11E Transmitting spurious emission test result as below:

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2019/09/28 - 17:21
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Horizontal
EUT: ISMART1.0, Model no: ZS11E	Power: 12VDC
Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_EN 55014_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
95.960000	20.8	1000.0	120.000	100.0	H	1.0	11.0	22.7	43.5
161.240000	32.1	1000.0	120.000	100.0	H	358.0	15.5	11.4	43.5
221.920000	39.5	1000.0	120.000	100.0	H	1.0	12.6	6.5	46.0
224.320000	37.9	1000.0	120.000	100.0	H	359.0	12.7	8.1	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

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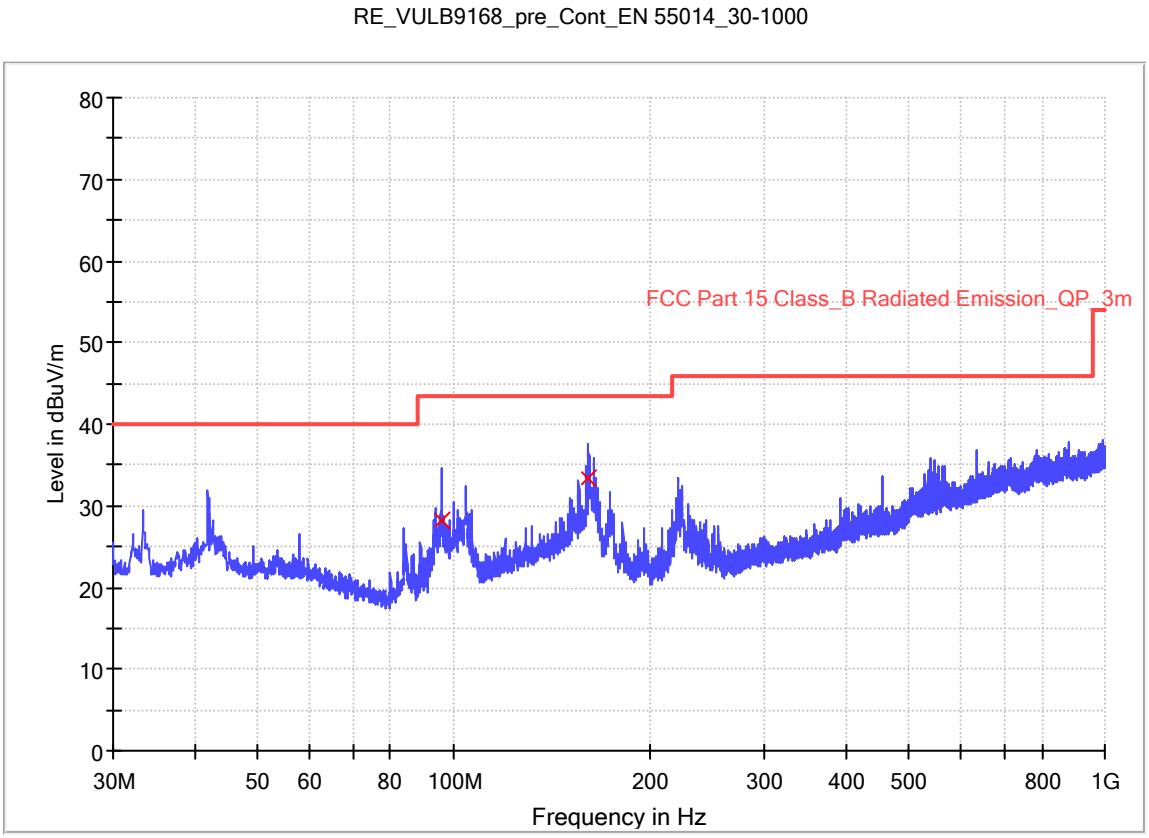
The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2019/09/28 - 17:40
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Vertical
EUT: ISMART1.0, Model no: ZS11E	Power: 12VDC
Note: There is the worst case within frequency range 30MHz~1GHz.	



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
95.920000	28.1	1000.0	120.000	100.1	V	358.0	11.0	15.4	43.5
161.160000	33.3	1000.0	120.000	100.1	V	1.0	15.6	10.2	43.5

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

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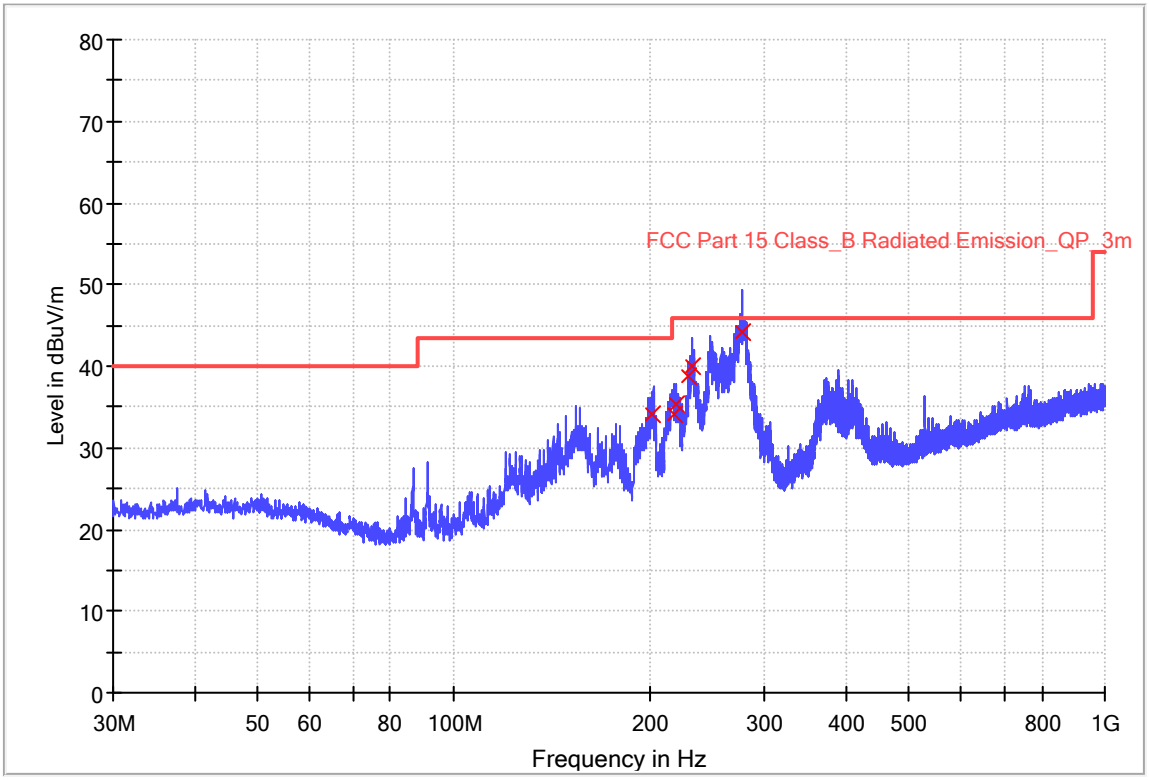
ZS11MCE3 Transmitting spurious emission test result as below:

The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2019/09/28 - 17:21
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Horizontal
EUT: ISMART1.0, Model no: ZS11MCE3	Power: 12VDC
Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_EN 55014_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
202.400000	34.0	1000.0	120.000	100.0	H	6.0	11.7	9.5	43.5
217.640000	34.2	1000.0	120.000	100.0	H	359.0	12.4	11.9	46.0
220.200000	35.2	1000.0	120.000	100.0	H	1.0	12.5	10.8	46.0
229.800000	38.7	1000.0	120.000	100.0	H	2.0	12.9	7.3	46.0
232.200000	39.9	1000.0	120.000	100.0	H	358.0	13.0	6.1	46.0
277.720000	44.2	1000.0	120.000	100.0	H	358.0	14.4	1.8	46.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

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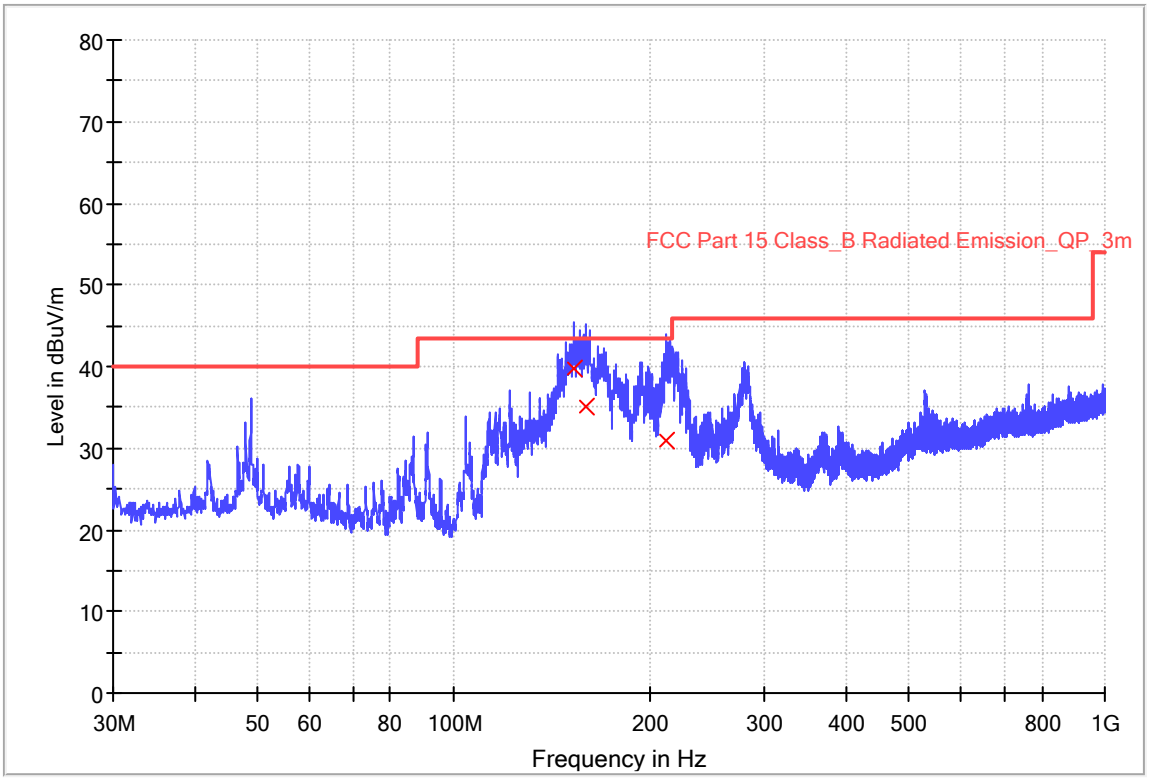
The worst case of Radiated Emission below 1GHz:

Site: 3 meter chamber	Time: 2019/09/28 - 17:40
Limit: FCC_Part15.109_RE(3m)_ClassB	Engineer: Wenqiang LU
Probe: VULB9168	Polarity: Vertical
EUT: ISMART1.0, Model no: ZS11MCE3	Power: 12VDC
Note: There is the worst case within frequency range 30MHz~1GHz.	

RE_VULB9168_pre_Cont_EN 55014_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
153.320000	39.8	1000.0	120.000	100.0	V	255.0	15.7	3.7	43.5
159.960000	35.2	1000.0	120.000	100.0	V	1.0	15.7	8.3	43.5
212.120000	30.9	1000.0	120.000	100.0	V	358.0	12.2	12.6	43.5

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)
Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

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10 Test Equipment List

List of Test Instruments
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4
	Wideband power sensor	Rohde & Schwarz	NRP-Z81	104782	2019-12-27
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2020-8-4
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2022-3-15
	Horn Antenna	Rohde & Schwarz	HF907	102393	2021-4-1
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2020-8-4
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2020-6-27
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	E326	2021-1-28
	3m Semi-anechoic chamber	TDK	9X6X6	----	2021-5-10
CE	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2020-8-4
	LISN	Rohde & Schwarz	ENV216	101924	2020-8-4

Measurement Software Information			
Test Item	Software	Manufacturer	Version
RE	EMC 32	Rohde & Schwarz	V9.15.00
CE	EMC 32	Rohde & Schwarz	V9.15.03

C - Conducted RF tests

- Conducted peak output power
- Occupied Bandwidth
- Power spectral density*

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11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, ±3.16dB
Radiated Disturbance	30MHz to 1GHz, ±5.03dB (Horizontal) ±5.12dB (Vertical) 1GHz to 18GHz, ±5.15dB (Horizontal) ±5.12dB (Vertical) 18GHz to 25GHz, ±4.76dB

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12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

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13 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END

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