

MEASUREMENT REPORT

FCC PART 15.231(e) / RSS 210

FCC ID: 2AFH7PHT220
IC: 20466-PHT220
APPLICANT: HAMATON AUTOMOTIVE TECHNOLOGY CO. LTD

Application Type: Certification
Product: Dual-Band and Programmable Sensor
Model No.: HTS-2200
FCC Classification: FCC Part 15 Security/Remote Control Transmitter (DSC)
FCC Rule Part(s): Part 15.231(e)
IC Rule(s): RSS-210 Issue 9 - Annex A
Test Procedure(s): ANSI C63.10-2013
Test Date: August 25 ~ 30, 2018

Reviewed By : _____
(Sunny Sun)

Approved By : _____
(Robin Wu)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
1808RSU058-U1	Rev. 01	Draft Report	09-03-2018	

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§2.1033 General Information

Applicant:	HAMATON AUTOMOTIVE TECHNOLOGY CO. LTD
Applicant Address:	12 East Zhengxing Road,Linping, Yuhang, Hangzhou, China
Manufacturer:	HAMATON AUTOMOTIVE TECHNOLOGY CO. LTD
Manufacturer Address:	12 East Zhengxing Road,Linping, Yuhang, Hangzhou, China
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
FCC Registration No.:	893164
Test Device Serial No.:	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 893164) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	Dual-Band and Programmable Sensor
Model No.:	HTS-2200
Frequency Range:	433.92 MHz, 315MHz, 125kHz
Type of modulation:	ASK, FSK
Antenna Type:	Internal Antenna
Accessories	
Battery #1	M/N: CR2050HR SB0-T23 Brand Name: Max-e11 Capacity: 345mAh
Battery #2	M/N: CR-2050A/FCN Brand Name: Panasonic Capacity: 345mAh

Note: For the 125kHz of this device, it's only working on receive mode.

2.2. Test Standards

The following report is prepared on behalf of the **HAMATON AUTOMOTIVE TECHNOLOGY CO. LTD** in accordance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commission rules, and RSS-210 Issue 9 & RSS-Gen Issue 4 rules of IC rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commission rules, and RSS-210 Issue 9 & RSS-Gen Issue 4 rules of IC rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

2.3. Test Methodology

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013).

Deviation from measurement procedure.....None

2.4. EUT Setup and Test Mode

The EUT was operated at continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode	Description	Remark
Mode 1	Transmitting	With modulation

3. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antenna of the **Dual-Band and Programmable Sensor** is permanently attached.
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

4. TEST EQUIPMENT CALIBRATION DATA

Radiated Disturbance, 20dB Bandwidth, Release Time, Duty Cycle - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2019/08/18
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2018/11/17
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2018/11/20
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2018/11/18
Broad Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2018/10/21
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2018/12/14
Amplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2019/06/13
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2019/08/15
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2019/05/02

Software	Version	Function
e3	V8.3.5	EMI Test Software

5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

Radiated Emission Measurement - AC1
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 18GHz: 4.76dB

6. TEST RESULT

6.1. Summary

Company Name: Dual-Band and Programmable Sensor

FCC ID: 2AFH7PHT220

IC: 20466-PHT220

FCC Part Section(s)	IC Part Section(s)	Test Description	Test Condition	Test Result
15.205, 15.231(e)	RSS-210 Annex A.1.4(d)	Radiated Spurious Emissions	Radiated	Pass
15.231(c)	RSS-210 Annex A.1.3	20dB Bandwidth / 99% Bandwidth		Pass
15.231(e)	RSS-210 Annex A.1.4(b)	Transmission Time		Pass
15.231(e)	N/A	Duty Cycle		Pass
15.207	RSS-Gen 7.2	Conducted Emissions Measurement	Conducted	N/A

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 3) The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

6.2. Radiated Emissions

6.2.1. Test Limit

According to §15.231(e), 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	1000	100
70 - 130	500	50
130 - 174	500 to 1500 ¹	50 to 150 ¹
174 - 260	1500	150
260 - 470	1500 to 5000 ¹	150 to 500 ¹
Above 470	5000	500

The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements start below or at the lowest crystal frequency.

Compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

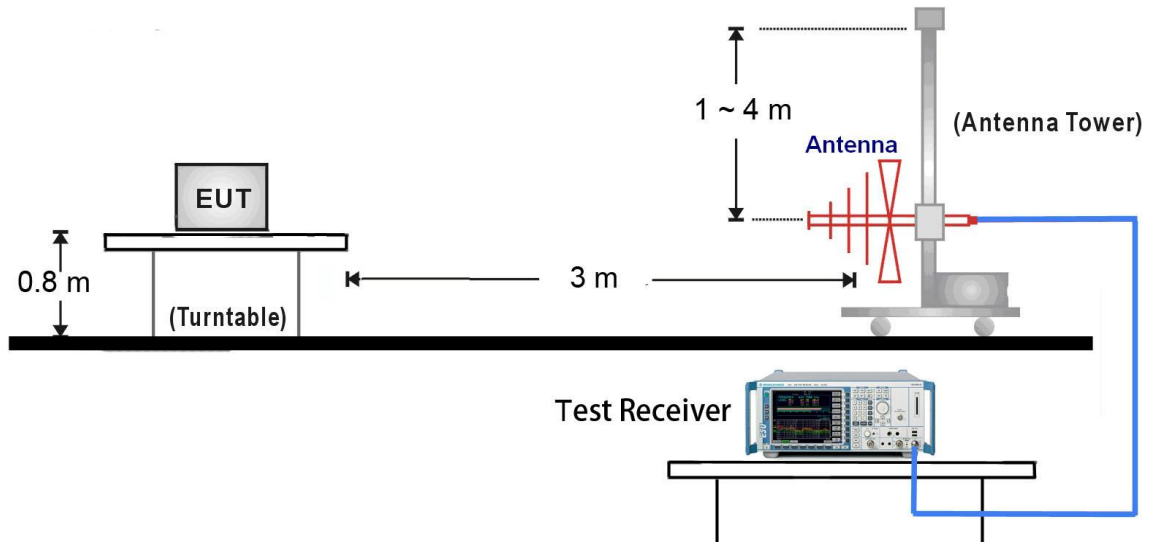
6.2.2. Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.231(e) and FCC Part 15.209 Limit.

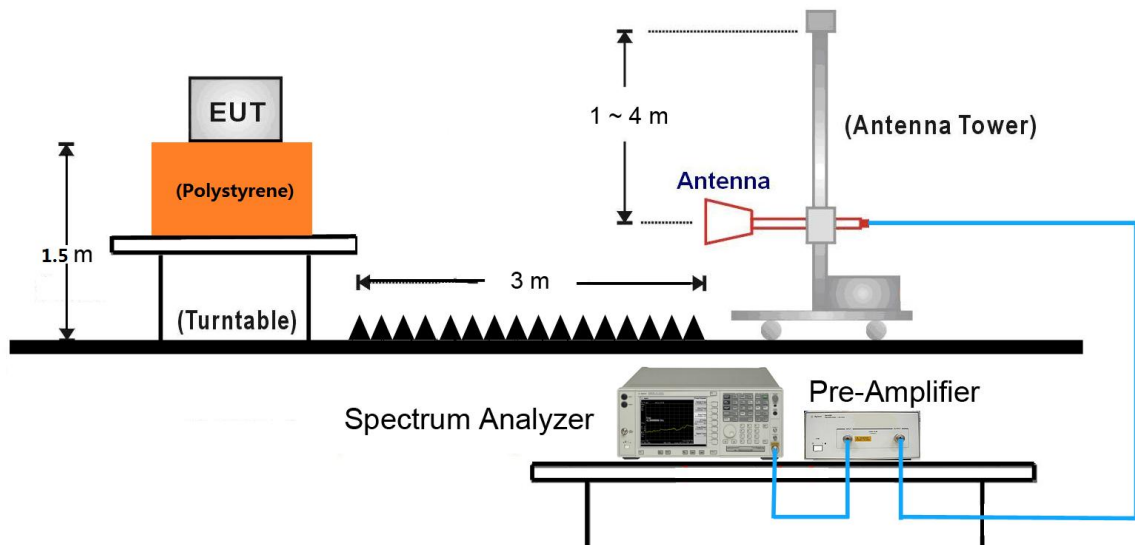
6.2.3. Test Setup

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.231(e) and FCC Part 15.209 Limit.

30MHz ~ 1GHz Test Setup:

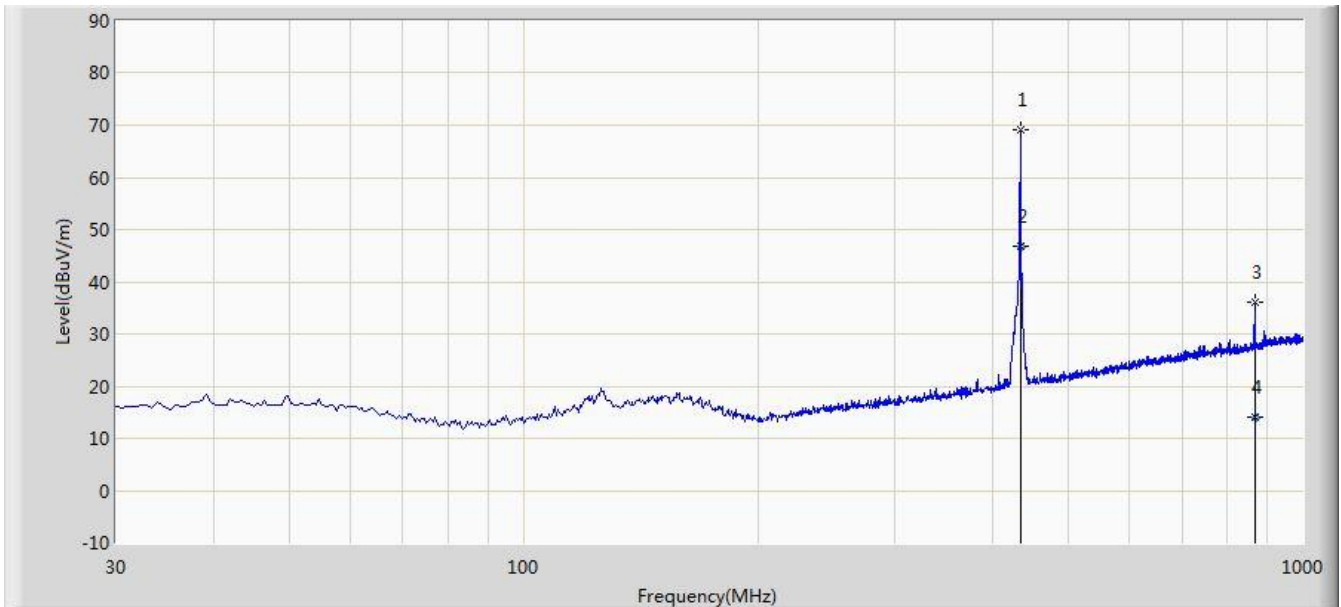


1GHz ~ 5GHz Test Setup:



6.2.4. Test Results

Site: AC1	Time: 2018/08/25 - 12:34
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by ASK mode at Channel 433.92MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	434.005	51.515	17.508	N/A	69.023	92.866	-23.843	PK
2	434.005	29.375	17.508	22.140	46.883	72.866	-25.983	AV
3	867.595	12.124	23.966	N/A	36.089	72.866	-36.797	PK
4	867.595	-10.016	23.966	22.140	13.949	52.866	-38.937	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

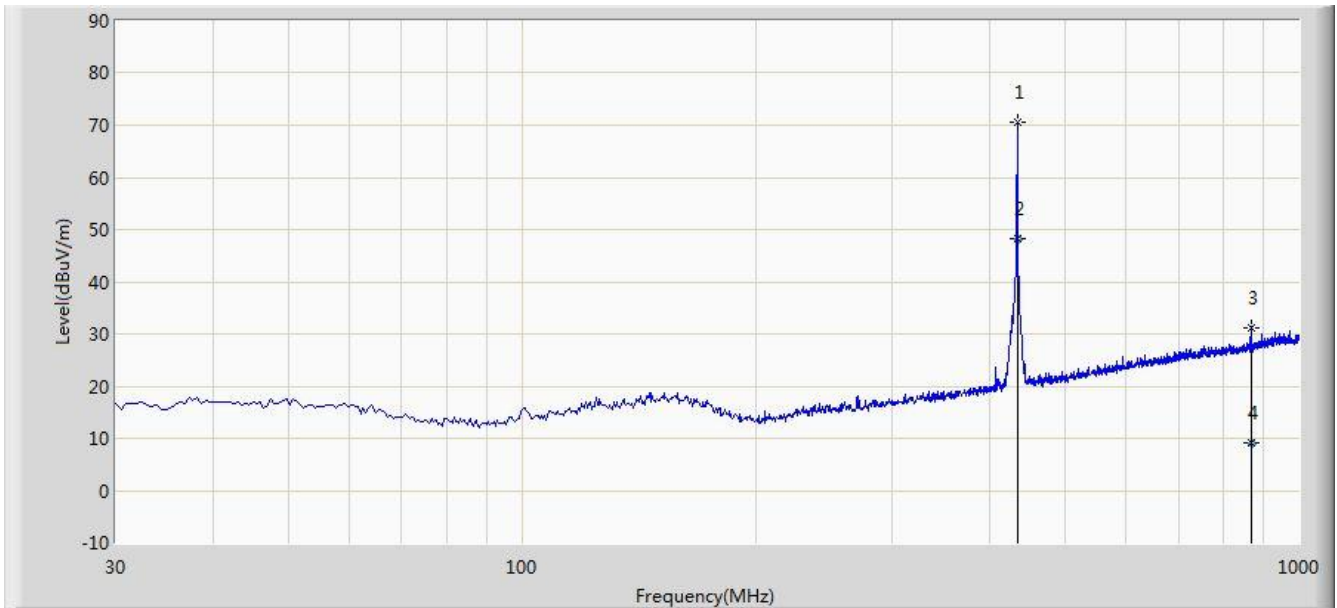
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB).

AV Measure Level = Peak Measure Level + Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2018/08/25 - 12:38
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by ASK mode at Channel 433.92MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	434.005	52.946	17.508	N/A	70.454	92.866	-22.412	PK
2	434.005	30.806	17.508	22.140	48.314	72.866	-24.552	AV
3	867.595	7.330	23.966	N/A	31.295	72.866	-41.571	PK
4	867.595	-14.810	23.966	22.140	9.155	52.866	-43.711	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

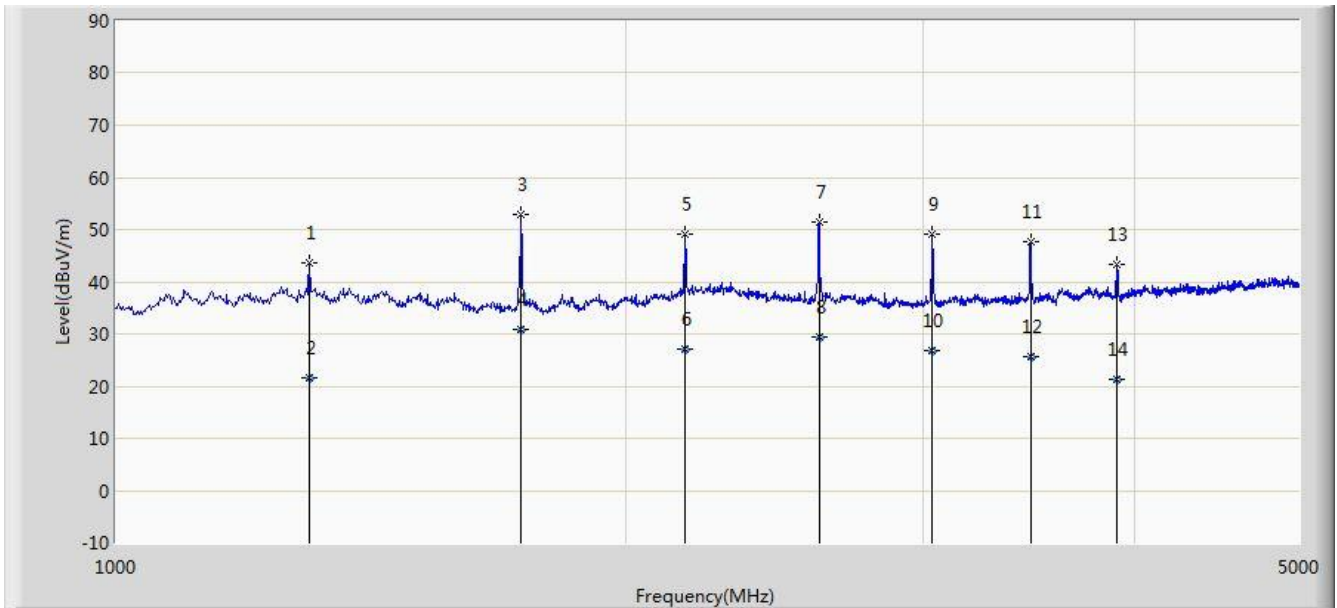
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

AV Measure Level = Peak Measure Level + Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2018/08/25 - 17:02
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by ASK mode at Channel 433.92MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	1302.000	49.127	-5.375	N/A	43.752	72.866	-29.114	PK
2	1302.000	26.987	-5.375	22.140	21.612	52.866	-31.254	AV
3	1736.000	58.987	-6.009	N/A	52.978	72.866	-19.888	PK
4	1736.000	36.847	-6.009	22.140	30.838	52.866	-22.028	AV
5	2170.000	51.778	-2.612	N/A	49.166	72.866	-23.700	PK
6	2170.000	29.638	-2.612	22.140	27.026	52.866	-25.840	AV
7	2604.000	54.295	-2.781	N/A	51.515	72.866	-21.351	PK
8	2604.000	32.155	-2.781	22.140	29.375	52.866	-23.491	AV
9	3038.000	51.920	-2.869	N/A	49.052	72.866	-23.814	PK
10	3038.000	29.780	-2.869	22.140	26.912	52.866	-25.954	AV
11	3472.000	49.334	-1.574	N/A	47.759	72.866	-25.107	PK
12	3472.000	27.194	-1.574	22.140	25.619	52.866	-27.247	AV
13	3906.000	43.982	-0.583	N/A	43.400	72.866	-29.466	PK
14	3906.000	21.842	-0.583	22.140	21.260	52.866	-31.606	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

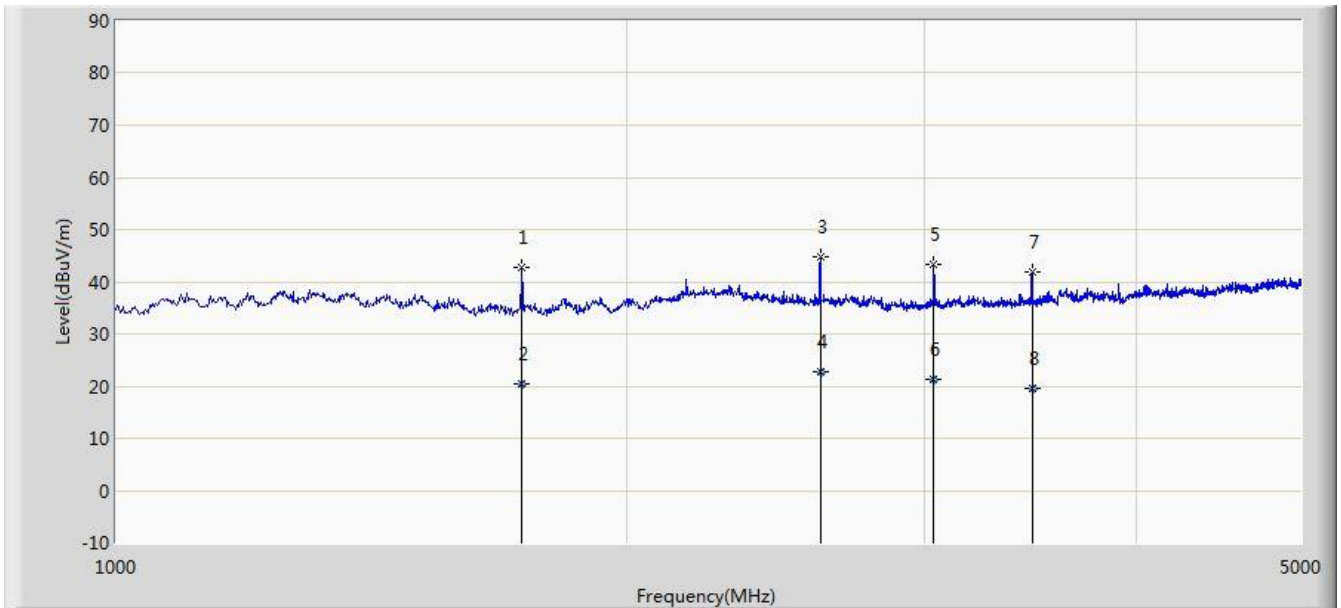
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB).

AV Measure Level = Peak Measure Level - Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

Site: AC1	Time: 2018/08/25 - 17:12
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by ASK mode at Channel 433.92MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	1736.000	48.688	-6.009	N/A	42.679	72.866	-30.187	PK
2	1736.000	26.548	-6.009	22.140	20.539	52.866	-32.327	AV
3	2604.000	47.560	-2.781	N/A	44.780	72.866	-28.086	PK
4	2604.000	25.420	-2.781	22.140	22.640	52.866	-30.226	AV
5	3038.000	46.247	-2.869	N/A	43.379	72.866	-29.487	PK
6	3038.000	24.107	-2.869	22.140	21.239	52.866	-31.627	AV
7	3472.000	43.416	-1.574	N/A	41.841	72.866	-31.025	PK
8	3472.000	21.276	-1.574	22.140	19.701	52.866	-33.165	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

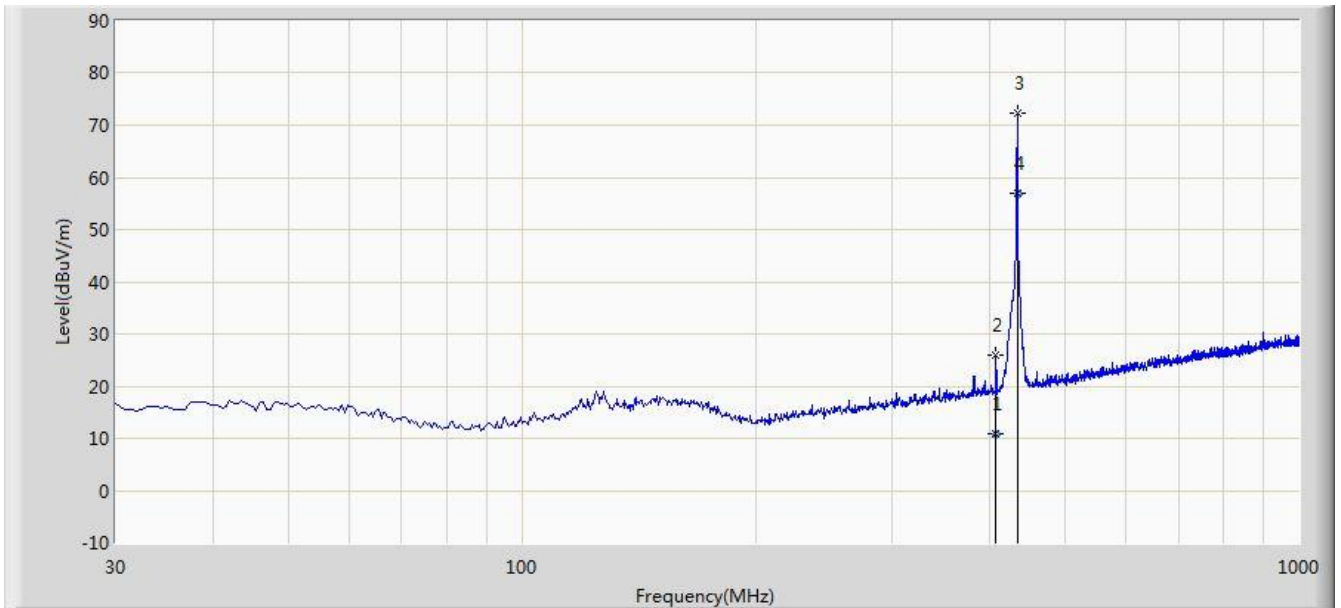
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB).

AV Measure Level = Peak Measure Level - Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

Site: AC1	Time: 2018/08/25 - 13:56
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by FSK mode at Channel 433.92MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	407.815	9.282	16.803	N/A	26.085	72.866	-46.781	PK
2	407.815	-6.008	16.795	15.290	10.787	52.866	-42.079	AV
3	434.005	54.812	17.508	N/A	72.320	92.866	-20.546	PK
4	434.005	39.522	17.508	15.290	57.030	72.866	-15.836	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

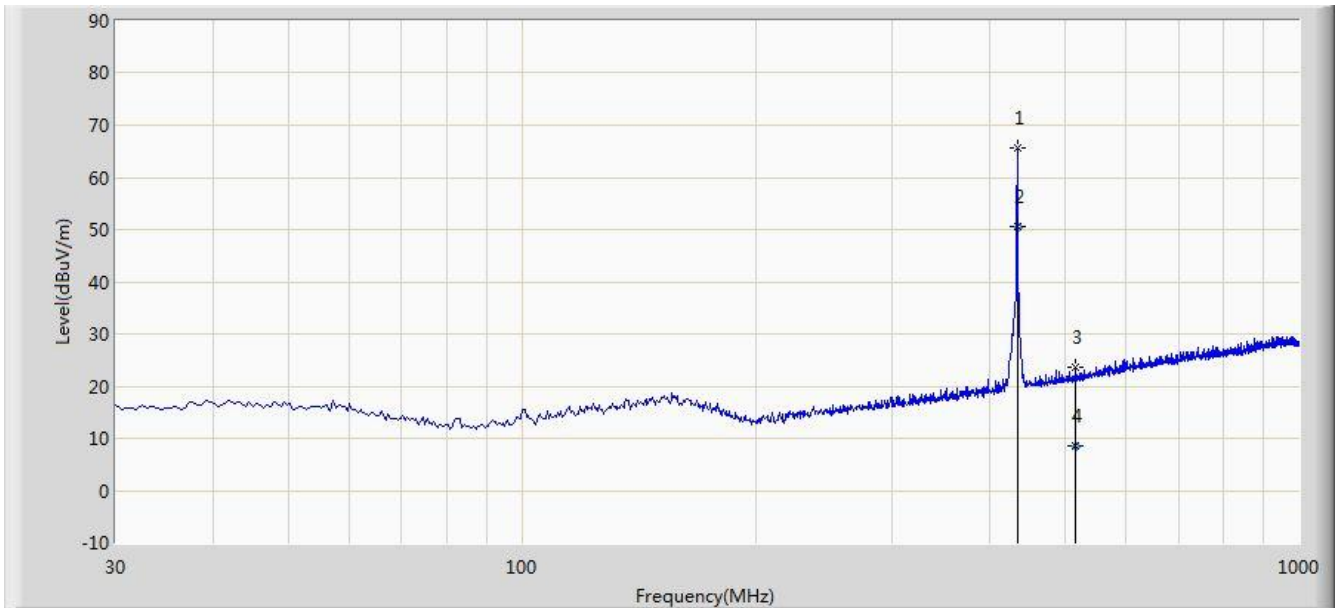
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

AV Measure Level = Peak Measure Level + Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2018/08/25 - 13:57
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by FSK mode at Channel 433.92MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	434.005	48.285	17.508	N/A	65.793	92.866	-27.073	PK
2	434.005	32.995	17.508	15.290	50.503	72.866	-22.363	AV
3	516.940	4.830	18.912	N/A	23.742	72.866	-49.124	PK
4	516.940	-10.460	18.912	15.290	8.452	52.866	-44.414	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

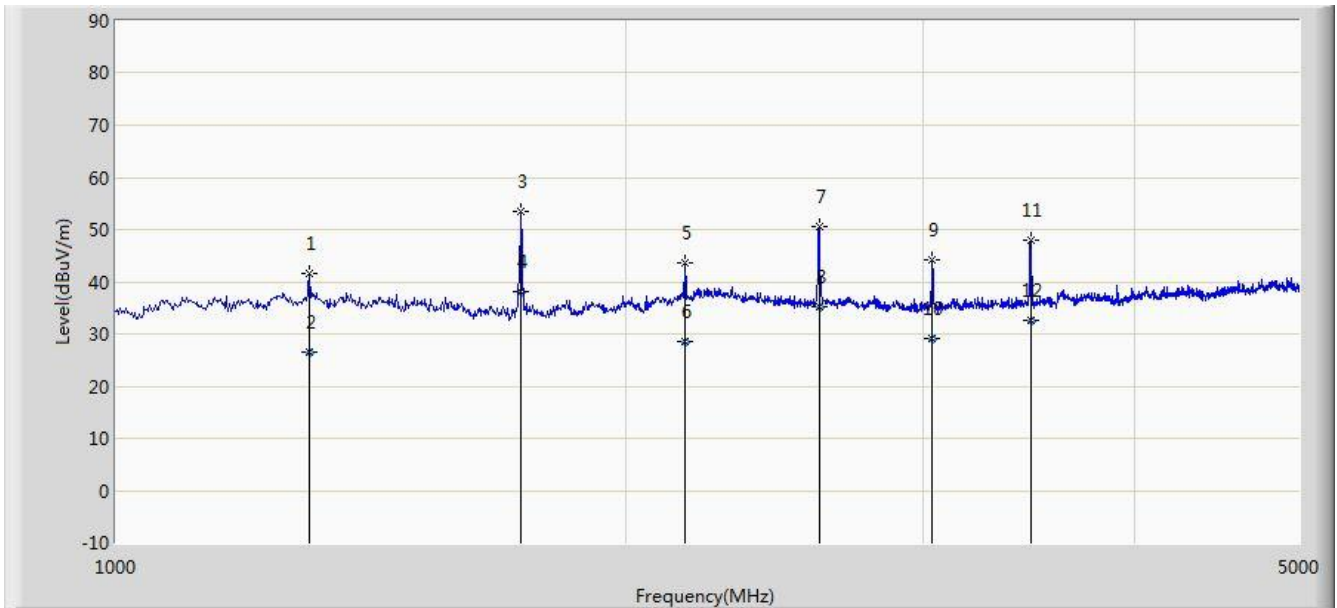
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB).

AV Measure Level = Peak Measure Level + Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2018/08/25 - 17:15
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by FSK mode at Channel 433.92MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	1302.000	47.072	-5.375	N/A	41.697	72.866	-31.169	PK
2	1302.000	31.782	-5.375	15.290	26.407	52.866	-26.459	AV
3	1736.000	59.517	-6.009	N/A	53.508	72.866	-19.358	PK
4	1736.000	44.227	-6.009	15.290	38.218	52.866	-14.648	AV
5	2170.000	46.374	-2.612	N/A	43.762	72.866	-29.104	PK
6	2170.000	31.084	-2.612	15.290	28.472	52.866	-24.394	AV
7	2604.000	53.258	-2.781	N/A	50.478	72.866	-22.388	PK
8	2604.000	37.968	-2.781	15.290	35.188	52.866	-17.678	AV
9	3038.000	47.166	-2.869	N/A	44.298	72.866	-28.568	PK
10	3038.000	31.876	-2.869	15.290	29.008	52.866	-23.858	AV
11	3472.000	49.608	-1.574	N/A	48.033	72.866	-24.833	PK
12	3472.000	34.318	-1.574	15.290	32.743	52.866	-20.123	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

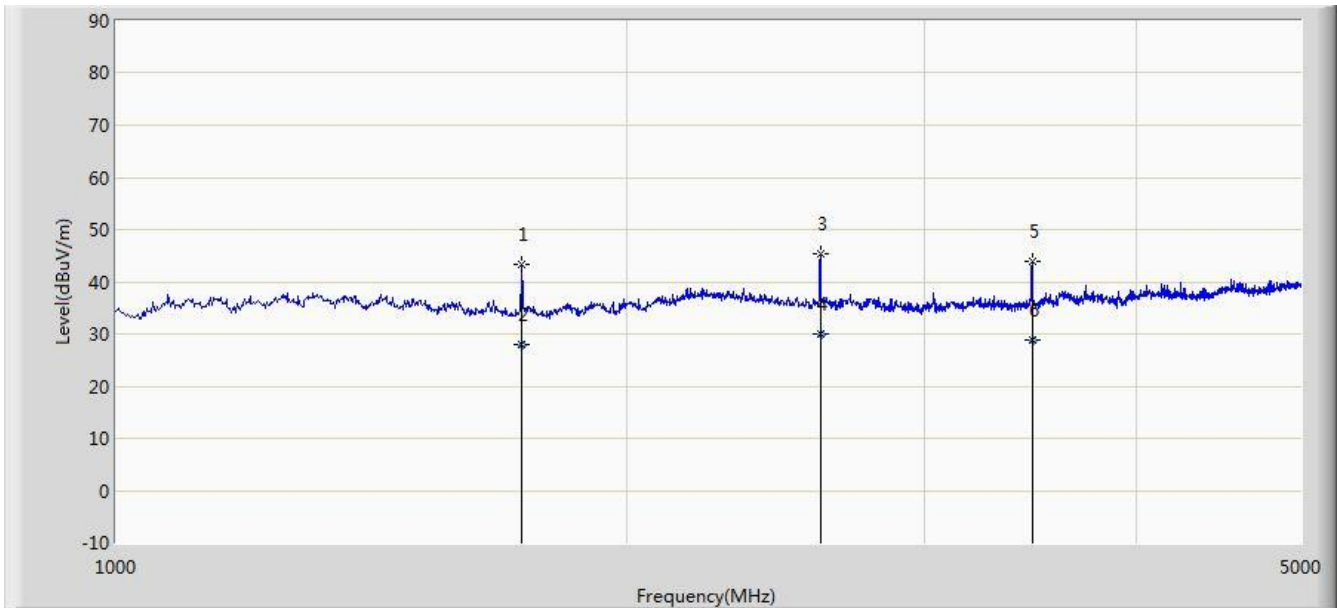
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB).

AV Measure Level = Peak Measure Level - Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

Site: AC1	Time: 2018/08/25 - 17:17
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by FSK mode at Channel 433.92MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	1736.000	49.242	-6.009	N/A	43.233	72.866	-29.633	PK
2	1736.000	33.952	-6.009	15.290	27.943	52.866	-24.923	AV
3	2604.000	48.163	-2.781	N/A	45.383	72.866	-27.483	PK
4	2604.000	32.873	-2.781	15.290	30.093	52.866	-22.773	AV
5	3472.000	45.601	-1.574	N/A	44.026	72.866	-28.840	PK
6	3472.000	30.311	-1.574	15.290	28.736	52.866	-24.130	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

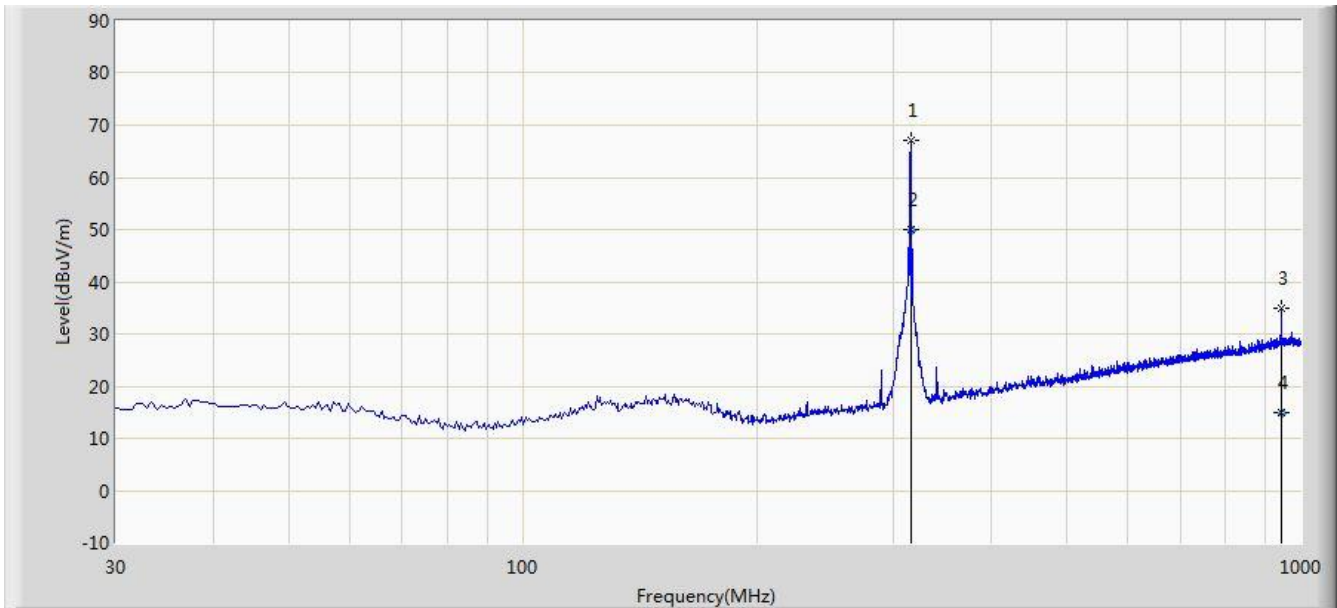
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB).

AV Measure Level = Peak Measure Level - Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

Site: AC1	Time: 2018/08/25 - 15:29
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by ASK mode at Channel 315MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	315.180	52.304	14.809	N/A	67.113	95.623	-28.510	PK
2	315.180	35.324	14.809	16.980	50.133	75.623	-25.490	AV
3	945.195	9.980	24.955	N/A	34.935	75.623	-40.688	PK
4	945.195	-10.000	24.955	16.980	14.955	55.623	-40.668	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

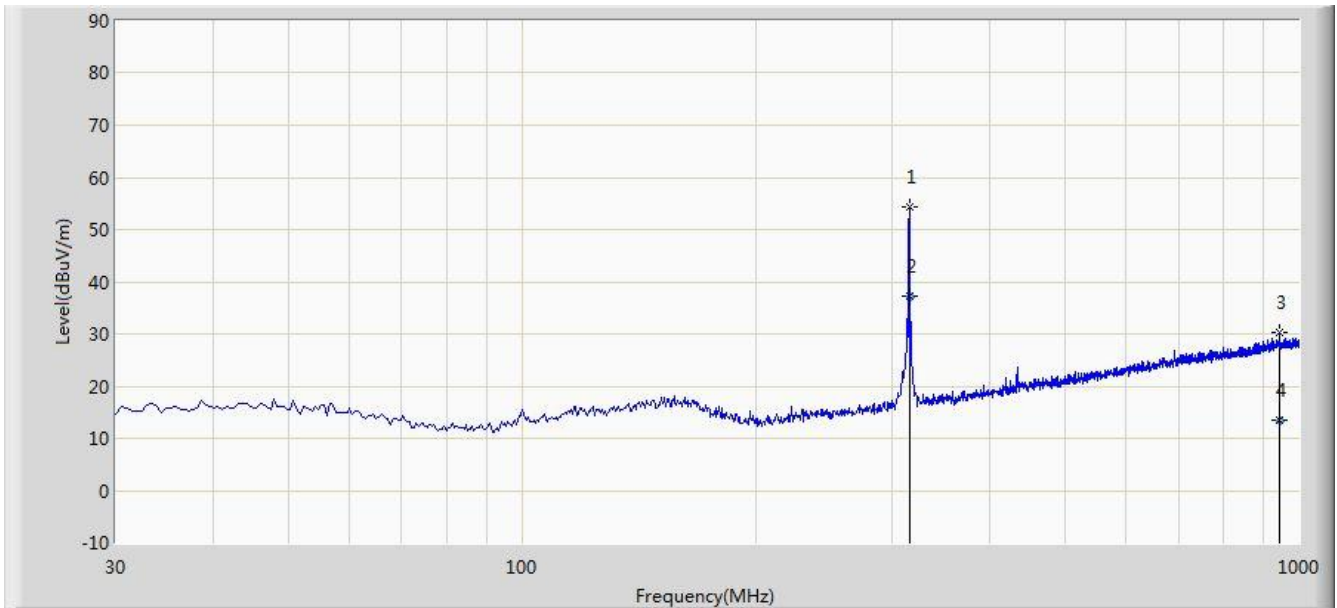
Note 2: The fundamental frequency is 315MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 315MHz.

Note 3: Peak Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB).

AV Measure Level = Peak Measure Level + Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2018/08/25 - 15:30
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by ASK mode at Channel 315MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	315.180	39.510	14.809	N/A	54.319	95.623	-41.304	PK
2	315.180	22.530	14.809	16.980	37.339	75.623	-38.284	AV
3	945.195	5.435	24.955	N/A	30.390	75.623	-45.233	PK
4	945.195	-11.545	24.955	16.980	13.410	55.623	-42.213	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

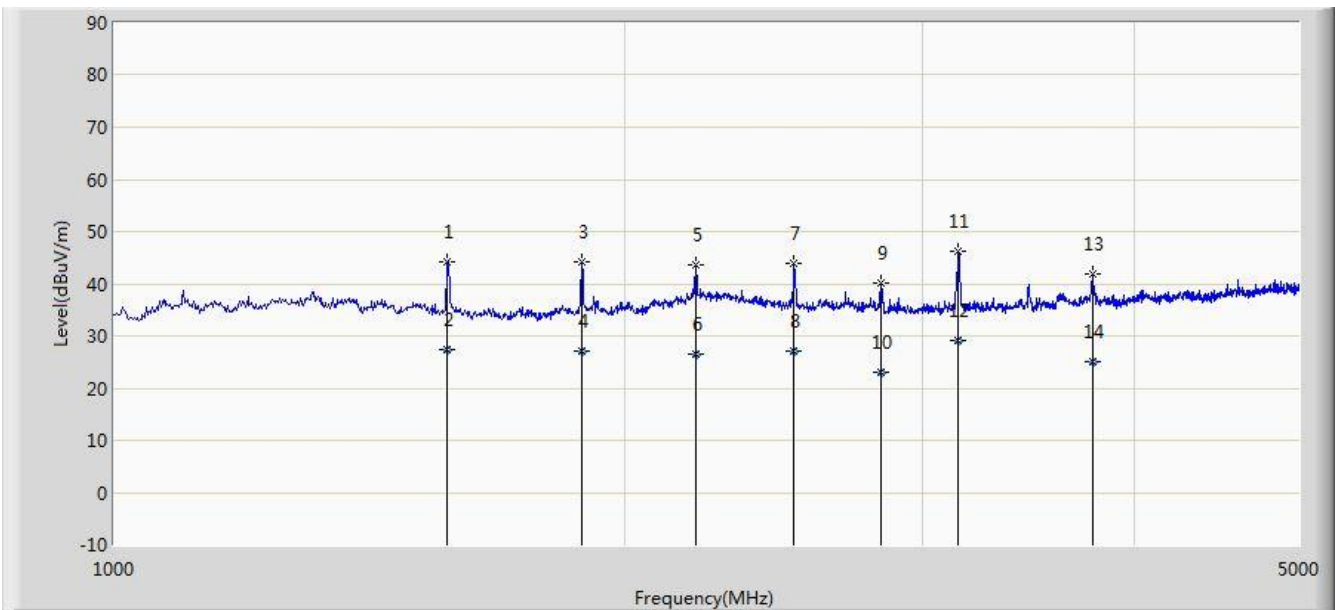
Note 2: The fundamental frequency is 315MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 315MHz.

Note 3: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

AV Measure Level = Peak Measure Level + Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2018/08/25 - 17:18
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by ASK mode at Channel 315MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	1574.000	50.277	-5.966	N/A	44.311	75.623	-31.312	PK
2	1574.000	33.297	-5.966	16.980	27.331	55.623	-28.292	AV
3	1890.000	49.226	-5.108	N/A	44.118	75.623	-31.505	PK
4	1890.000	32.246	-5.108	16.980	27.138	55.623	-28.485	AV
5	2206.000	45.670	-2.181	N/A	43.489	75.623	-32.134	PK
6	2206.000	28.690	-2.181	16.980	26.509	55.623	-29.114	AV
7	2520.000	47.074	-3.099	N/A	43.975	75.623	-31.648	PK
8	2520.000	30.094	-3.099	16.980	26.995	55.623	-28.628	AV
9	2836.000	42.816	-2.684	N/A	40.132	75.623	-35.491	PK
10	2836.000	25.836	-2.684	16.980	23.152	55.623	-32.471	AV
11	3150.000	48.891	-2.671	N/A	46.220	75.623	-29.403	PK
12	3150.000	31.911	-2.671	16.980	29.240	55.623	-26.383	AV
13	3780.000	42.693	-0.714	N/A	41.979	75.623	-33.644	PK
14	3780.000	25.713	-0.714	16.980	24.999	55.623	-30.624	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

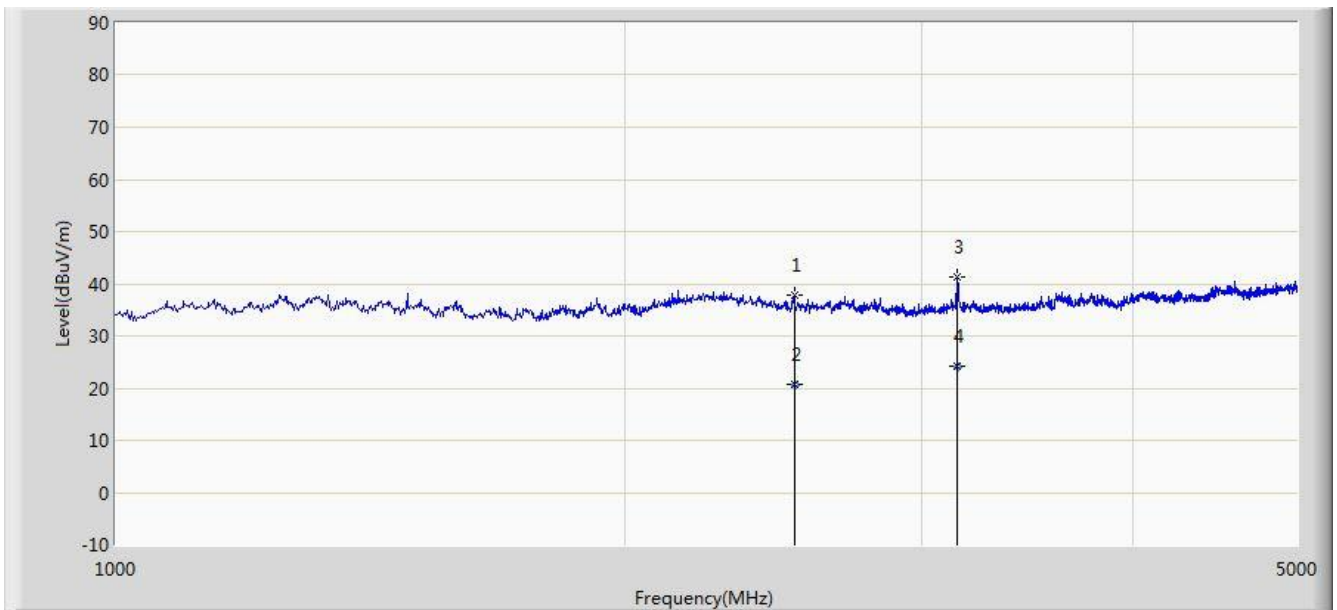
Note 2: The fundamental frequency is 315MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 315MHz.

Note 3: Peak Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB).

AV Measure Level = Peak Measure Level - Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

Site: AC1	Time: 2018/08/25 - 17:20
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by ASK mode at Channel 315MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	2522.000	40.799	-3.097	N/A	37.702	75.623	-37.921	PK
2	2522.000	23.819	-3.097	16.980	20.722	55.623	-34.901	AV
3	3148.000	43.882	-2.671	N/A	41.211	75.623	-34.412	PK
4	3148.000	26.902	-2.671	16.980	24.231	55.623	-31.392	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

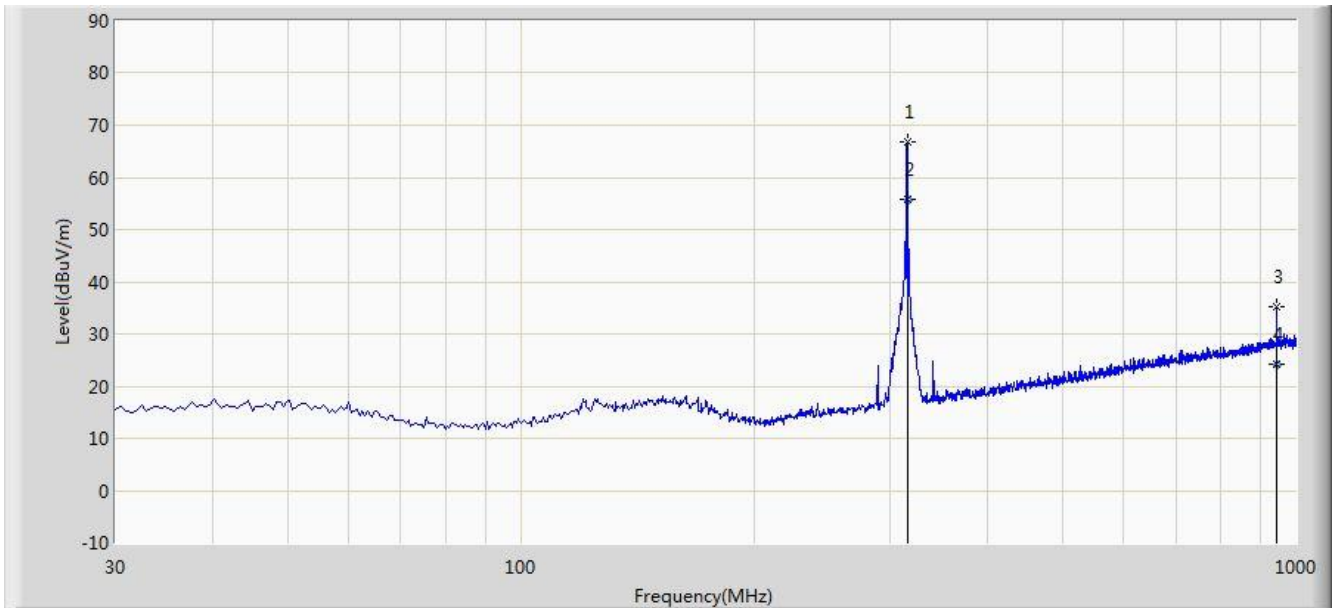
Note 2: The fundamental frequency is 315MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 315MHz.

Note 3: Peak Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB).

AV Measure Level = Peak Measure Level - Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

Site: AC1	Time: 2018/08/25 - 15:08
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by FSK mode at Channel 315MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	315.180	52.063	14.809	N/A	66.872	95.623	-28.751	PK
2	315.180	41.083	14.809	10.980	55.892	75.623	-19.731	AV
3	945.195	10.249	24.955	N/A	35.204	75.623	-40.419	PK
4	945.195	-0.731	24.955	10.980	24.224	55.623	-31.399	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

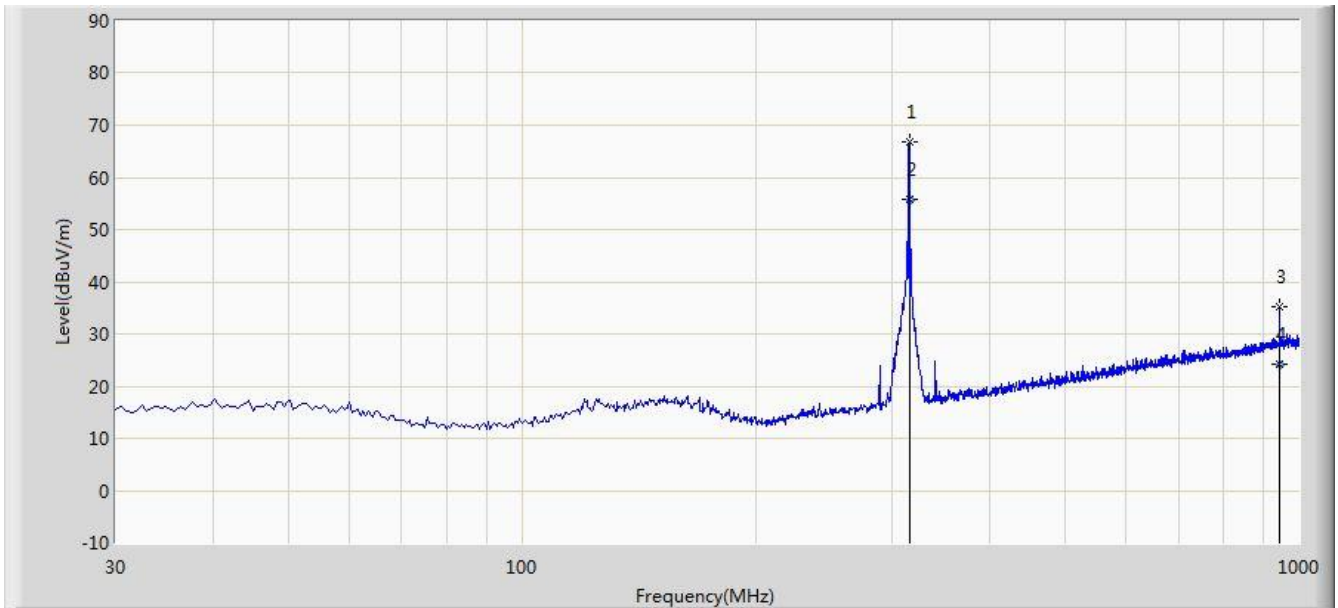
Note 2: The fundamental frequency is 315MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 315MHz.

Note 3: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

AV Measure Level = Peak Measure Level + Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2018/08/25 - 15:10
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by FSK mode at Channel 315MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	315.180	52.063	14.809	N/A	66.872	95.623	-28.751	PK
2	315.180	41.083	14.809	16.980	55.892	75.623	-19.731	AV
3	945.195	10.249	24.955	N/A	35.204	75.623	-40.419	PK
4	945.195	-0.731	24.955	16.980	24.224	55.623	-31.399	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

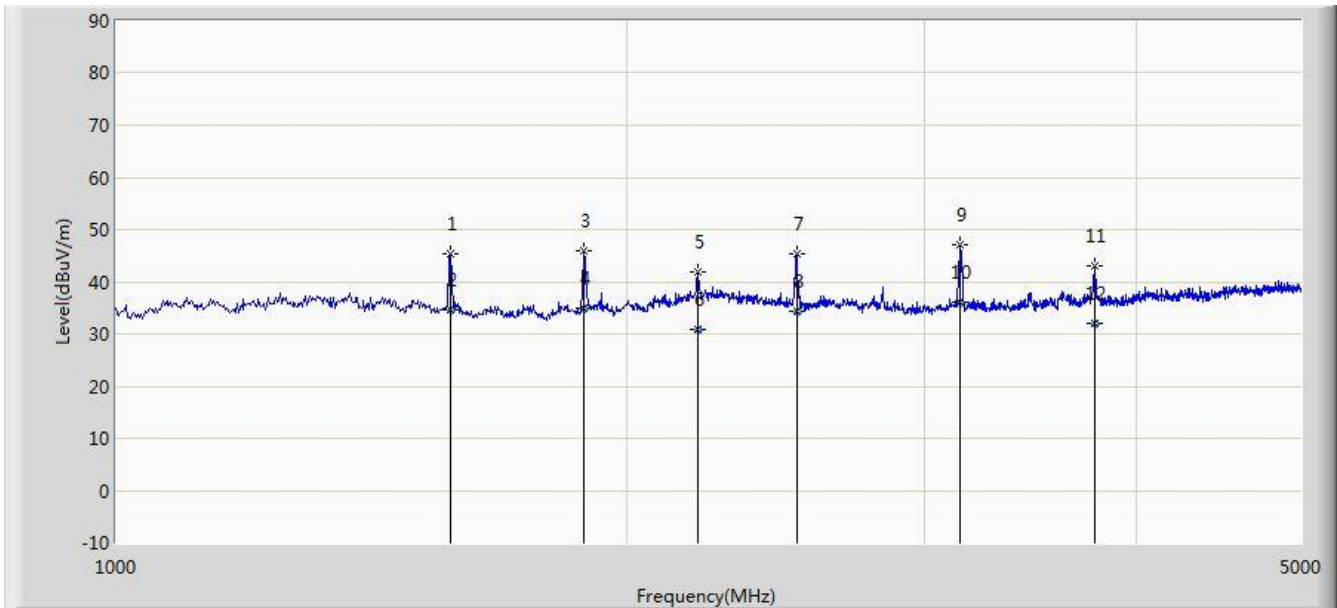
Note 2: The fundamental frequency is 315MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 315MHz.

Note 3: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

AV Measure Level = Peak Measure Level + Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2018/08/25 - 17:22
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by FSK mode at Channel 315MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	1576.000	51.478	-5.976	N/A	45.503	75.623	-30.120	PK
2	1576.000	40.498	-5.976	10.980	34.523	55.623	-21.100	AV
3	1890.000	50.917	-5.108	N/A	45.809	75.623	-29.814	PK
4	1890.000	39.937	-5.108	10.980	34.829	55.623	-20.794	AV
5	2204.000	44.179	-2.204	N/A	41.975	75.623	-33.648	PK
6	2204.000	33.199	-2.204	10.980	30.995	55.623	-24.628	AV
7	2522.000	48.403	-3.097	N/A	45.306	75.623	-30.317	PK
8	2522.000	37.423	-3.097	10.980	34.326	55.623	-21.297	AV
9	3150.000	49.805	-2.671	N/A	47.134	75.623	-28.489	PK
10	3150.000	38.825	-2.671	10.980	36.154	55.623	-19.469	AV
11	3780.000	43.782	-0.714	N/A	43.068	75.623	-32.555	PK
12	3780.000	32.802	-0.714	10.980	32.088	55.623	-23.535	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

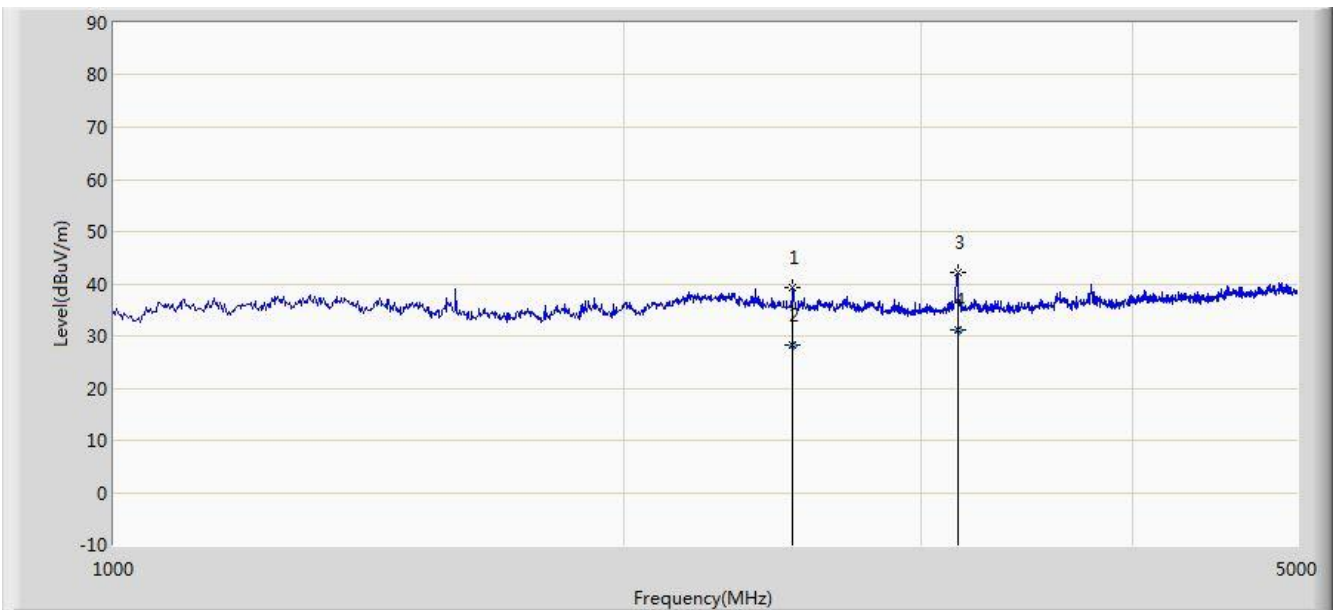
Note 2: The fundamental frequency is 315MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 315MHz.

Note 3: Peak Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB).

AV Measure Level = Peak Measure Level - Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

Site: AC1	Time: 2018/08/25 - 17:24
Limit: FCC_Part15. 231(e)_RE(3m)	Engineer: Snake Ni
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Dual-Band and Programmable Sensor	Power: By Battery
Test Mode: Transmit by FSK mode at Channel 315MHz	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Type
1	2520.000	42.326	-3.099	N/A	39.227	75.623	-36.396	PK
2	2520.000	31.346	-3.099	10.980	28.247	55.623	-27.376	AV
3	3152.000	44.935	-2.670	N/A	42.265	75.623	-33.358	PK
4	3152.000	33.955	-2.670	10.980	31.285	55.623	-24.338	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

Note 2: The fundamental frequency is 315MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 315MHz.

Note 3: Peak Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB).

AV Measure Level = Peak Measure Level - Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

6.3. 20dB Bandwidth

6.3.1. Test Limit

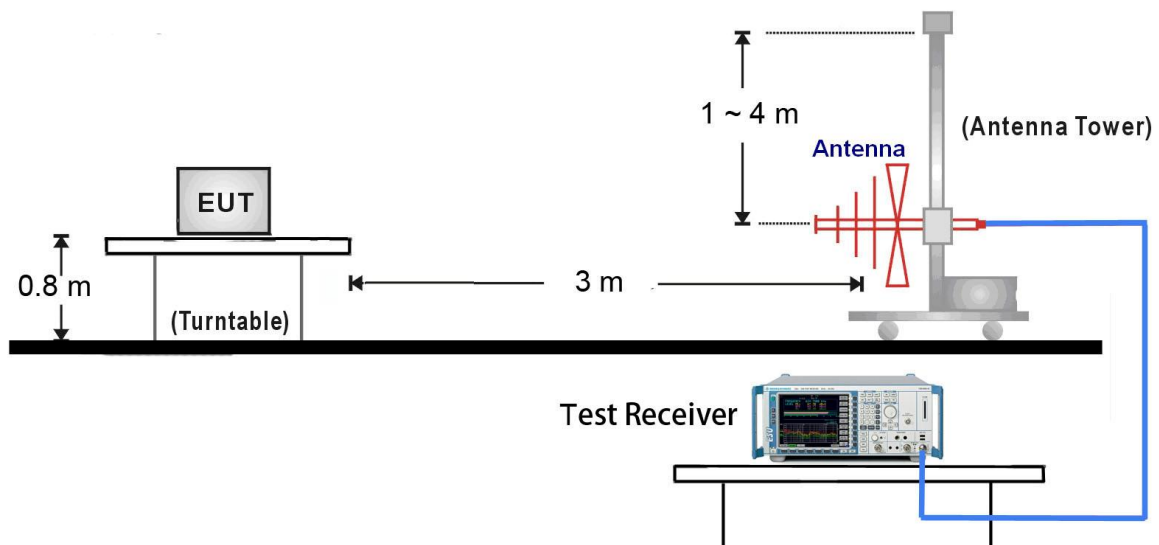
According to FCC Part 15.231(c), the bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

According RSS-210, A1.3, the 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the centre frequency.

6.3.2. Test Procedure

With the EUT's antenna attached, the EUT's 20dB Bandwidth power was received by the test antenna, which was connected to the spectrum analyzer with the START, and STOP frequencies set to the EUT's operation band.

6.3.3. Test Setup



6.3.4. Test Result

Product	Dual-Band and Programmable Sensor	Temperature	24°C
Test Engineer	Snake Ni	Relative Humidity	45%
Test Site	AC1	Test Date	2018/08/25

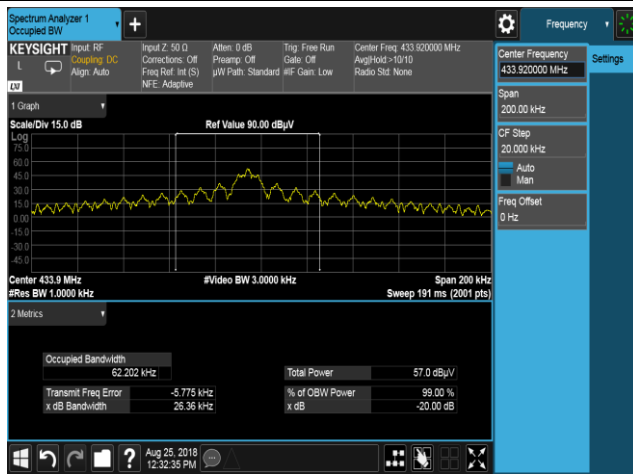
Test Frequency (MHz)	Modulation	20dB Bandwidth (kHz)	Limit (kHz)	Result
433.92	ASK	62.20	≤ 1084.80	Pass
	FSK	112.84	≤ 1084.80	Pass
315.00	ASK	59.78	≤ 787.50	Pass
	FSK	13.73	≤ 787.50	Pass

Limit = Fundamental Frequency * 0.25% = 433.92 MHz * 0.25% = 1084.80 kHz

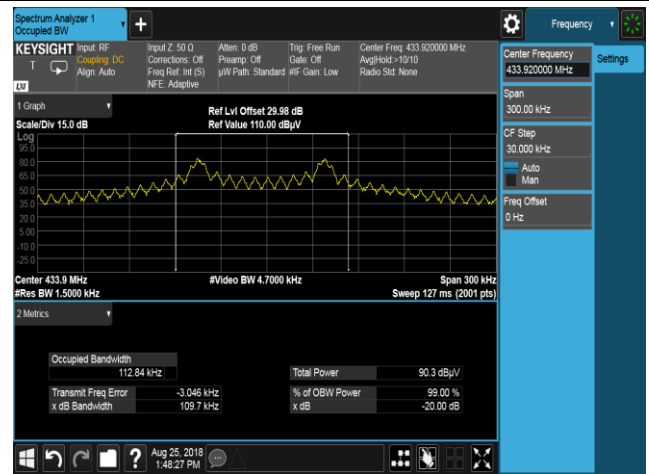
Limit = Fundamental Frequency * 0.25% = 315 MHz * 0.25% = 787.50 kHz

20dB Bandwidth

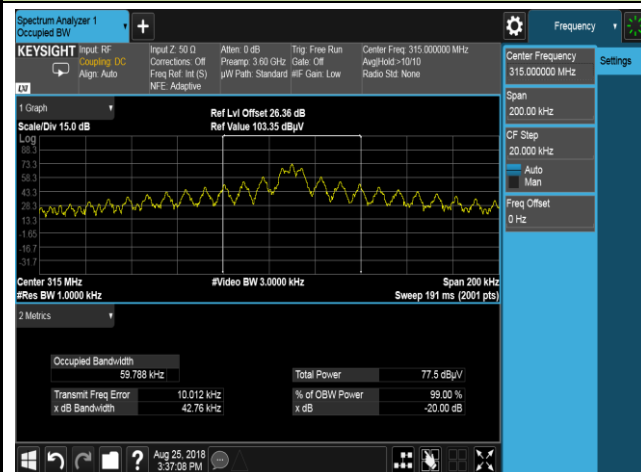
433.92MHz - ASK



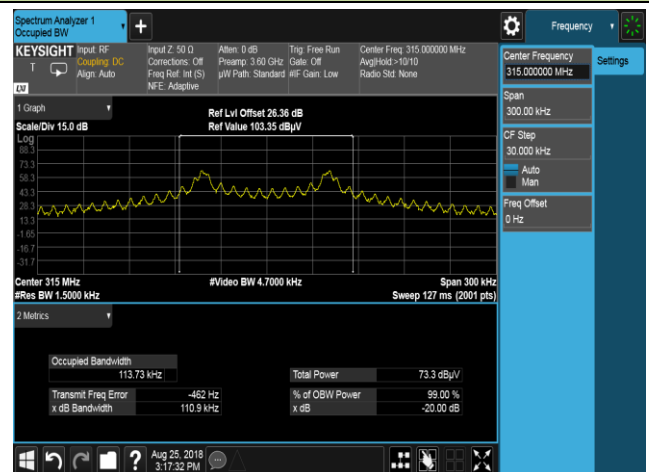
433.92MHz - FSK



315MHz - ASK



315MHz - FSK



6.4. Transmission Time

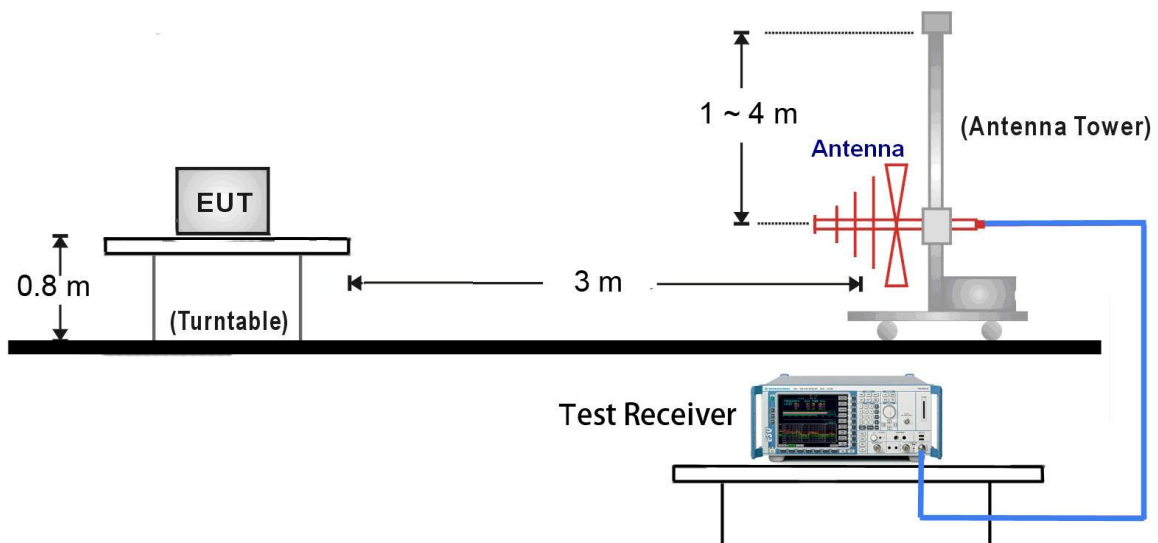
6.4.1. Test Limit

According to FCC 15.231(e), devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

6.4.2. Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz or 315MHz, then set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

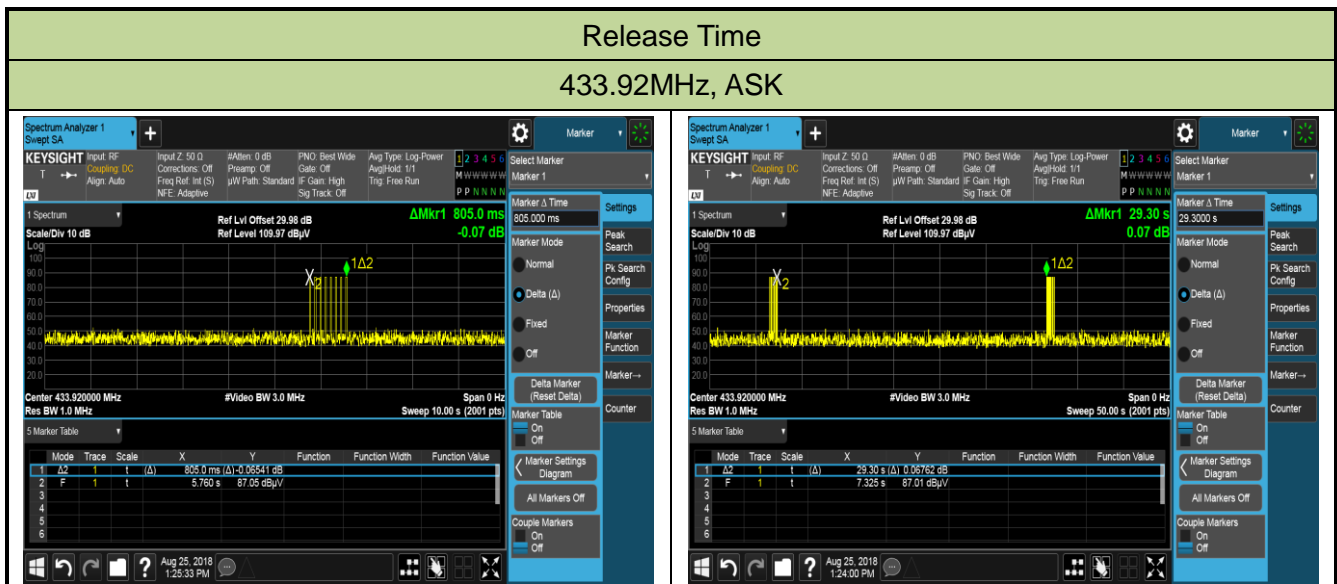
6.4.3. Test Setup



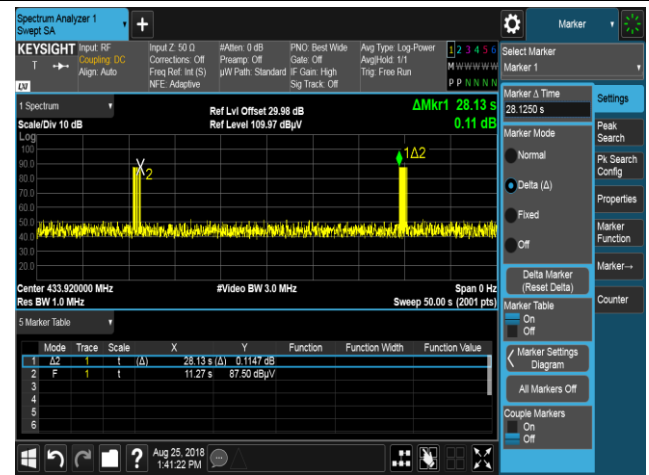
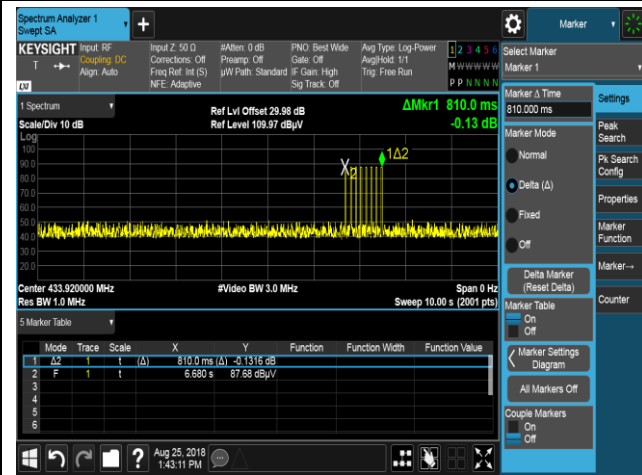
6.4.4. Test Result

Product	Dual-Band and Programmable Sensor	Temperature	24°C
Test Engineer	Snake Ni	Relative Humidity	45%
Test Site	AC1	Test Date	2018/08/25

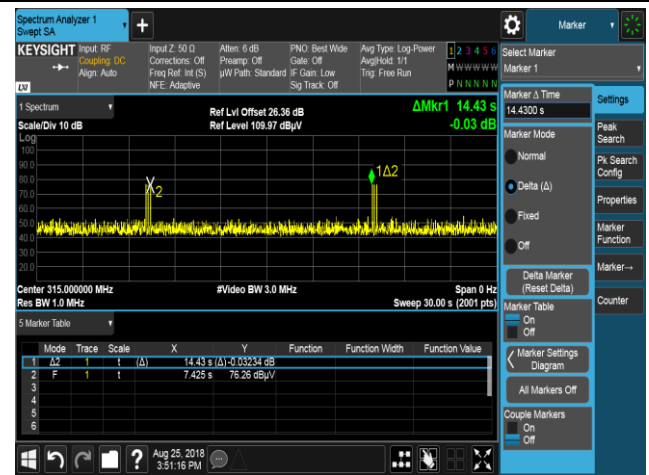
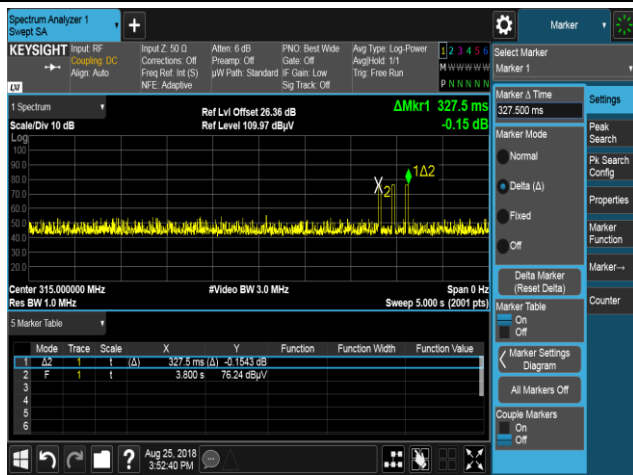
Mode	Test Item	Measured Value	Limit	Result
433.92MHz ASK	Transmission Time(T_{on})	805.0 ms	≤ 1 s	Pass
	Silent Time	29.30 s	≥ 10 s	Pass
	Silent Time/Transmission Time	36.40	≥ 30 times	Pass
433.92MHz FSK	Transmission Time(T_{on})	810.0 ms	≤ 1 s	Pass
	Silent Time	28.13 s	≥ 10 s	Pass
	Silent Time/Transmission Time	34.73	≥ 30 times	Pass
315MHz ASK	Transmission Time(T_{on})	327.5 ms	≤ 1 s	Pass
	Silent Time	14.43 s	≥ 10 s	Pass
	Silent Time/Transmission Time	44.01	≥ 30 times	Pass
315MHz FSK	Transmission Time(T_{on})	327.5 ms	≤ 1 s	Pass
	Silent Time	16.01 s	≥ 10 s	Pass
	Silent Time/Transmission Time	48.89	≥ 30 times	Pass



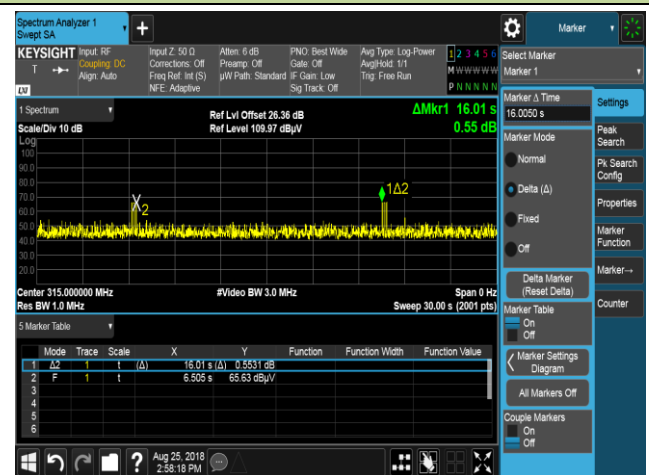
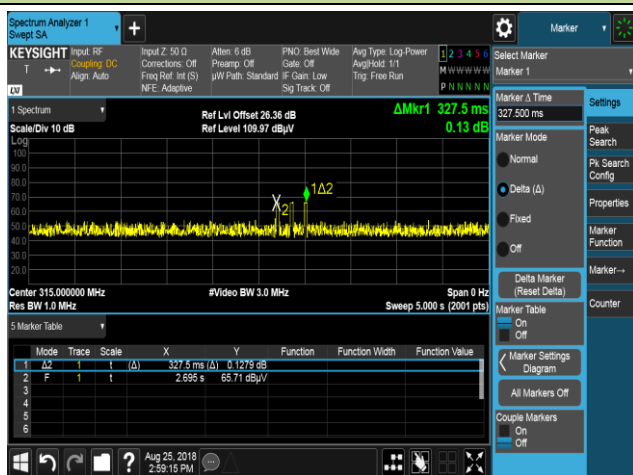
433.92MHz, FSK



315MHz, ASK



315MHz, FSK



6.5. Duty Cycle

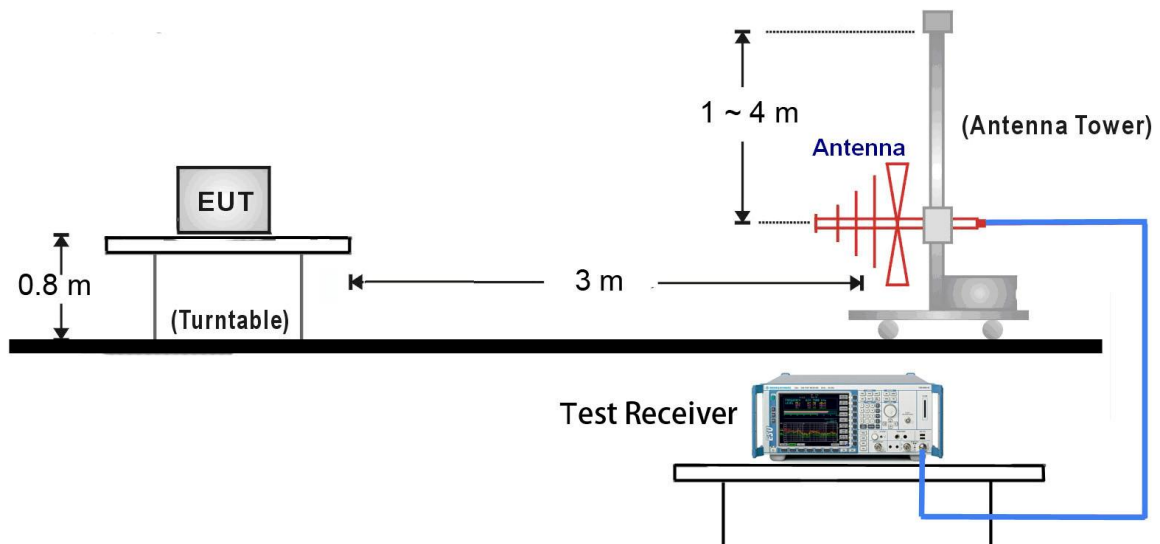
6.5.1. Test Limit

According to FCC Part 15.231(b) and 15.35(c), for pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

6.5.2. Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz or 315MHz, then set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

6.5.3. Test Setup



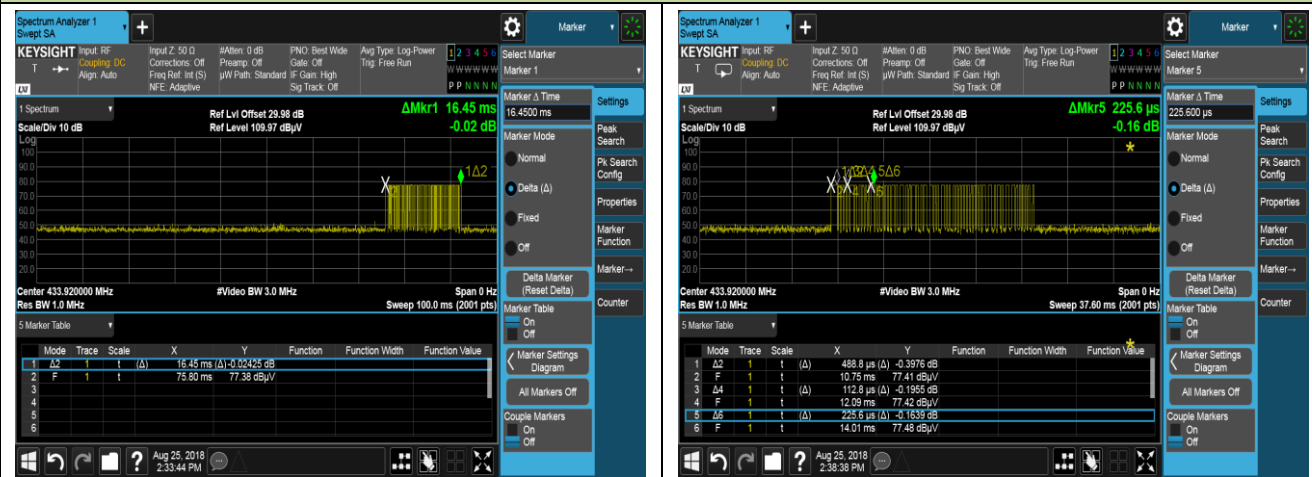
6.5.4. Test Result

Product	Dual-Band and Programmable Sensor	Temperature	24°C
Test Engineer	Snake Ni	Relative Humidity	45%
Test Site	AC1	Test Date	2018/08/25

Test Mode	Total Time (Ton) (ms)	The duration of one cycle (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
433.92 MHz ASK	7.82	100	7.82	22.14
433.92 MHz FSK	17.20	100	17.20	15.29
315 MHz ASK	14.88	100	14.88	16.98
315 MHz FSK	28.55	100	28.55	10.98

Duty Cycle

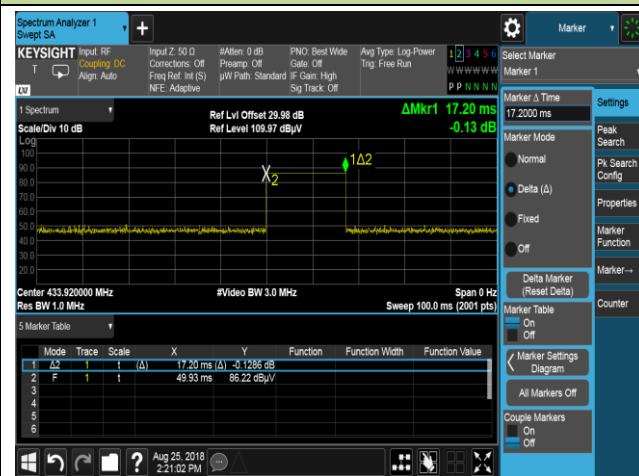
433.92MHz - ASK



Note 1: Total Time (Ton)(ms) / 100 ms = 0.488*1+0.1128*39+0.2256*13 =7.82(ms)

Note 2: Note: Duty Cycle Factor = 20*Log(1/Duty Cycle).

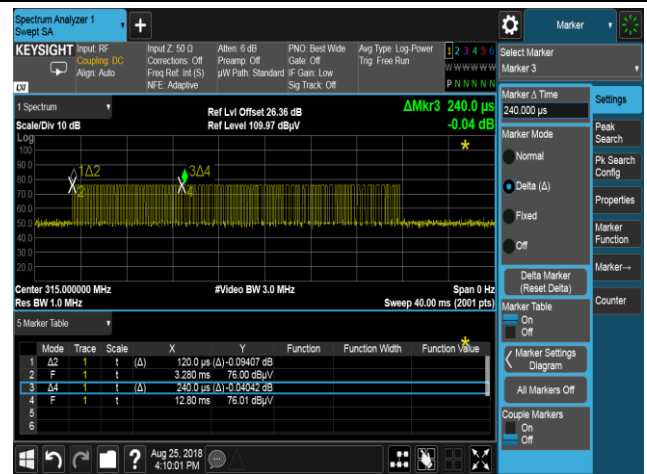
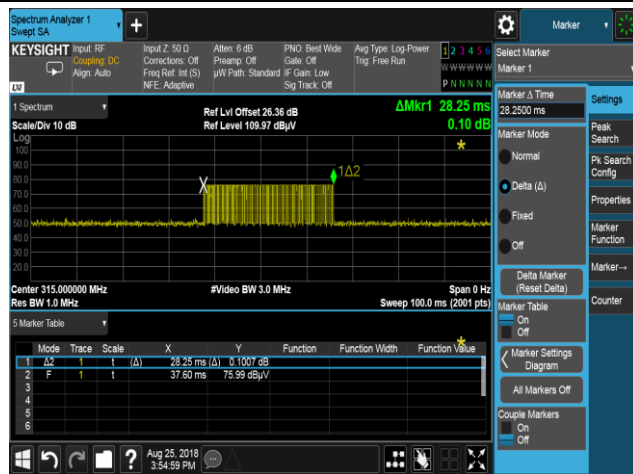
433.92MHz - FSK



Note 1: Total Time (Ton)(ms) / 100 ms = 17.20(ms)

Note 2: Note: Duty Cycle Factor = 20*Log(1/Duty Cycle).

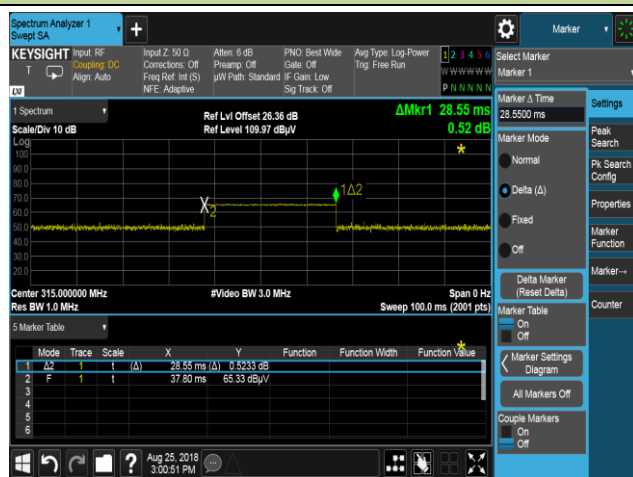
315MHz - ASK



Note 1: Total Time (Ton)(ms) / 100 ms = 0.12*84+0.24*17 =14.88(ms)

Note 2: Note: Duty Cycle Factor = 20*Log(1/Duty Cycle).

315MHz,FSK



Note 1: Total Time (Ton)(ms) / 100 ms =28.55(ms)

Note 2: Note: Duty Cycle Factor = 20*Log(1/Duty Cycle).

6.6. AC Conducted Emissions Measurement

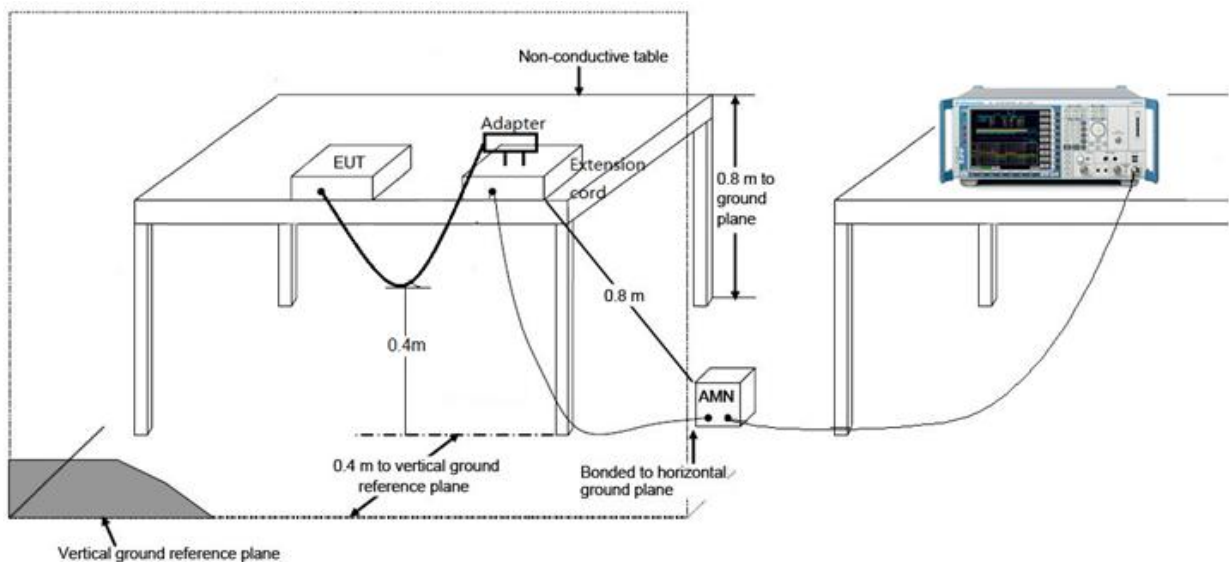
6.6.1. Test Limit

FCC 15.207 Limits & RSS-Gen Issue 5		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

6.6.2. Test Setup



6.6.3. Test Result

The device powered by battery, so this test item is not applicable.

7. CONCLUSION

The data collected relate only the item(s) tested and show that the **Dual-Band and Programmable Sensor FCC ID: 2AFH7PHT220** is in compliance with FCC Part 15.231 of the FCC Rules and ISSED Rules.

The End

Appendix A – Test Setup Photograph

Refer to “1808RSU058-UT” file.

Appendix B – EUT Photograph

Refer to “1808RSU058-UE” file.