



FCC Test Report

Report No: FCS202105008W01

Issued for

Applicant:	Wenzhou sunwolf automotive electronics factory
Address:	No.280 Hebin Middle Road, Xianyan Sub-district, Ouhai District, Wenzhou, China
Product Name:	Tire Pressure Sensor
Brand Name:	SUNWOLF
Model Name:	SW2IN1
Series Model:	N/A
FCC ID:	2A2EH-SW2IN1
Issued By: Flux Compliance Service Laboratory Add: Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan Tel: 769-27280901 Fax:769-27280901 http://www.FCS-lab.com	

TEST RESULT CERTIFICATION

Applicant's Name.....: Wenzhou sunwolf automotive electronics factory
 Address.....: No.280 Hebin Middle Road, Xianyan Sub-district, Ouhai District, Wenzhou, China
 Manufacture's Name.....: Wenzhou sunwolf automotive electronics factory
 Address.....: No.280 Hebin Middle Road, Xianyan Sub-district, Ouhai District, Wenzhou, China

Product Description

Product Name.....: Tire Pressure Sensor
 Brand Name: SUNWOLF
 Model Name.....: SW2IN1
 Series Model.....: N/A
 Test Standards.....: FCC Rules and Regulations Part 15 Subpart C, Section 231
 Test Procedure.....: ANSI C63.10:2013

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

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Date of Test.....:

Date (s) of performance of tests.: 29 Mar. 2021 ~ 21 Jun. 2021

Date of Issue.....: 21 Jun. 2021

Test Result.....: Pass

Tested by

:

Scott Shen

(Scott Shen)

Reviewed by

:

Duke Qian

(Duke Qian)

Approved by

:

Kait Chen

(Kait Chen)

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Revision History

Rev.	Issue Date	Effect Page	Contents
00	21 Jun. 2021	All	Initial Issue

1. SUMMARY OF TEST RESULTS

FCC Part 15.231,Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	--
15.209, 15.231(b)	Radiated Emission	PASS	--
15.231(a) (1)	Transmitter time	PASS	--
15.231(c)	20dB Bandwidth	PASS	
15.231	Duty cycle	PASS	--
15.203	Antenna Requirement	PASS	--

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

(2) All tests are according to ANSI C63.10-2013

1.1 TEST FACTORY

Company Name:	Flux Compliance Service Laboratory
Address:	Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Telephone:	+86-769-27280901
Fax:	+86-769-27280901
FCC Test Firm Registration Number: 514908 Designation number: CN0127 A2LA accreditation number: 5545.01	

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95 %**.

No.	Item	Uncertainty
1	RF output power, conducted	± 0.71 dB
2	Unwanted Emissions, conducted	± 2.98 dB
3	Conducted Emission (9KHz-150KHz)	± 4.13 dB
4	Conducted Emission (150KHz-30MHz)	± 4.74 dB
5	All emissions, radiated (<1G) 30MHz-1000MHz	± 3.2 dB
6	All emissions, radiated (1GHz -18GHz)	± 3.66 dB
7	All emissions, radiated (18GHz -40GHz)	± 4.31 dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Tire Pressure Sensor
Trade Name	SUNWOLF
Model Name	SW2IN1
Series Model	N/A
Model Difference	N/A
Frequency	315MHZ
Modulation	ASK
Antenna type	PCB antenna
Power Supply	DC 3V
Hardware version number	V1.0
Software version number	V1.0
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

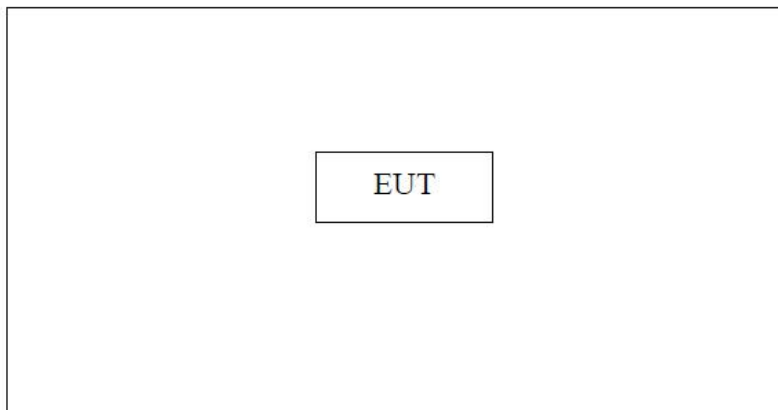
1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	CSGH	integral Antenna	N/A	1.0dBi	Antenna

2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Configuration and peripherals



Test environment conditions

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

Temperature range: 21-25°C

Humidity range: 40-75%

Pressure range: 86-106kPa

2.3 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.4 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESRP 3	FCS-E001	2020. 06.26	2021. 06.25
Signal Analyzer	R&S	FSV40-N	FCS-E012	2020.06.05	2021.06.04
Active loop Antenna	ZHINAN	ZN30900C	FCS-E013	2020.08.09	2021.08.10
Bilog Antenna	SCHWARZBECK	VULB 9168	FCS-E002	2020.08.26	2021.08.25
Horn Antenna	SCHWARZBECK	BBHA 9120D	FCS-E003	2020.08.26	2021.08.25
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	FCS-E018	2020.06.26	2021.06.25
Pre-Amplifier(0.1M-3G Hz)	EMCI	EM330N	FCS-E004	2020.06.26	2021.06.25
Pre-Amplifier (1G-18GHz)	N/A	TSAMP-0518SE	FCS-E014	2020.06.03	2021.06.02
Pre-Amplifier (18G-40GHz)	TERA-MW	TRLA-0400	FCS-E019	2020.08.08	2021.08.07
Temperature & Humidity	HTC-1	victor	FCS-E005	2020.08.26	2021.08.25

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESPI	FCS-E020	2020.06.03	2021.06.02
LISN	R&S	ENV216	FCS-E007	2020.08.08	2021.08.07
LISN	ETS	3810/2NM	FCS-E009	2020.06.03	2021.06.02
Temperature & Humidity	HTC-1	victor	FCS-E008	2020.08.08	2021.08.07

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
Spectrum Analyzer	Keysight	N9020A	FCS-E015	2020.06.03	2021.06.02
Spectrum Analyzer	Agilent	E4447A	MY50180039	2020.08.08	2021.08.07
Spectrum Analyzer	R&S	FSV-40	101499	2020.08.26	2021.08.25

3. RADIATED EMISSION MEASUREMENT

3.1 LIMIT

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009mhz - 1000mhz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

LIMITS OF FIELD STRENGTH OF THE FUNDAMENTAL SIGNAL

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
315	100.83	80.83

Note: (1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector

(2) At frequencies below 30MHz, measurement may be performed at a distance closer then that specified, and the limit at closer measurement distance can be extrapolated by below formula:
 $\text{Limit3m(dBuV/m)} = \text{Limit300m(dBuV/m)} + 40\text{Log}(300\text{m}/3\text{m}) = \text{Limit300m(dBuV/m)} + 80$
 $\text{Limit3m(dBuV/m)} = \text{Limit30m(dBuV/m)} + 40\text{Log}(30\text{m}/3\text{m}) = \text{Limit30m(dBuV/m)} + 40$

(3) Limit for this EUT

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions include fundamental emission shall not exceed FCC 15.231 section (b) limit of comply with FCC 15.209 limit which permit higher emission level.

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

3.2 TEST PROCEDURE

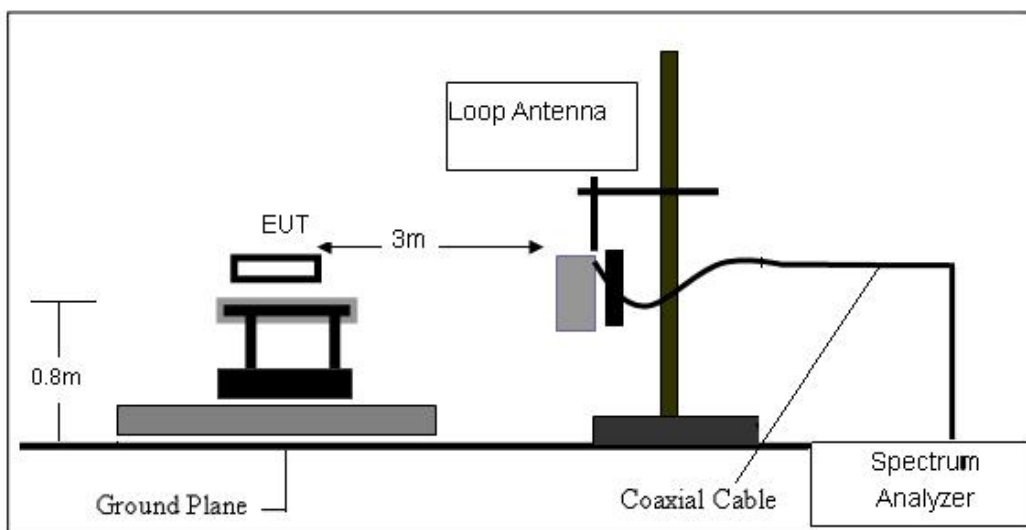
- a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- b. The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then QuasiPeak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

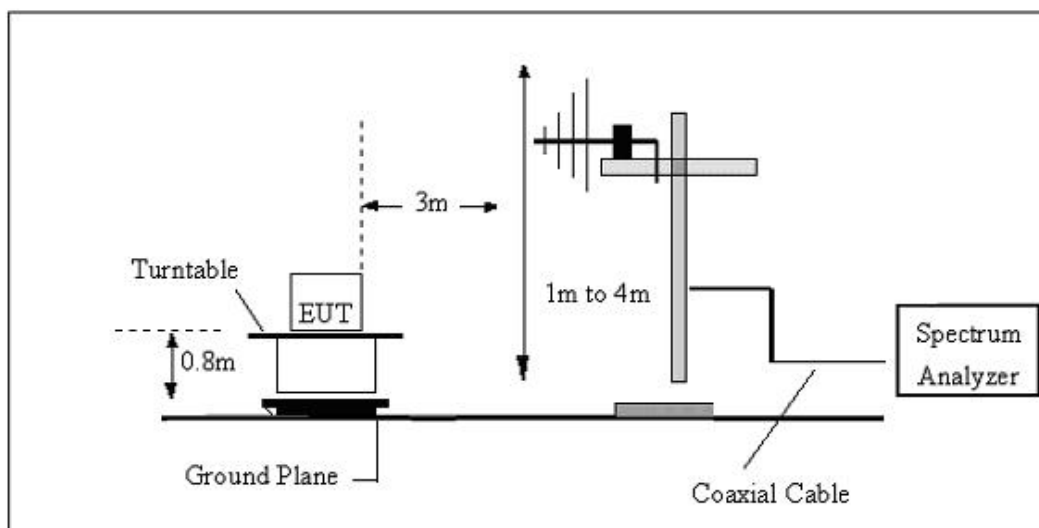
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.3 TEST SETUP

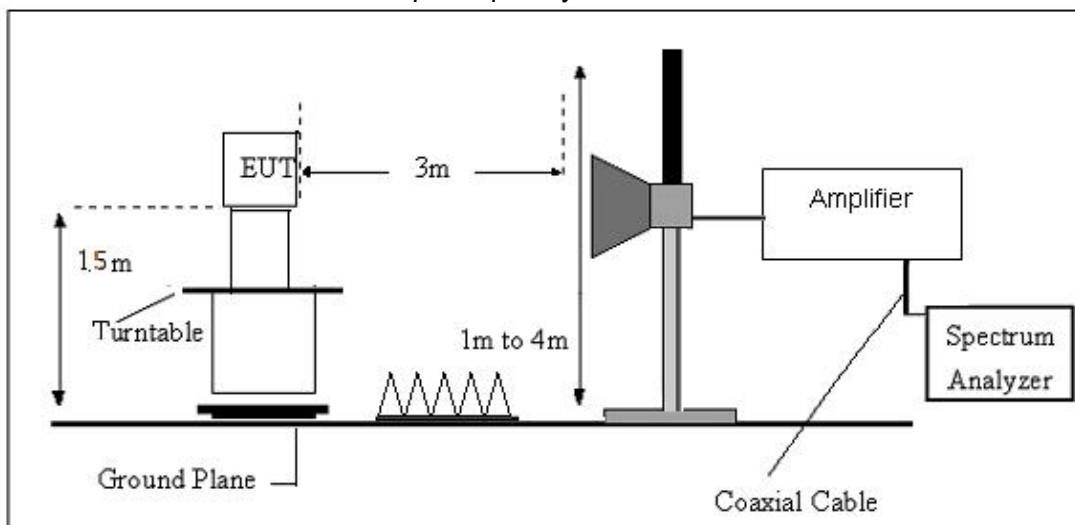
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.4 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Mode:	ASK	Test Voltage:	DC 3V

FIELD STRENGTH OF THE FUNDAMENTAL

ANTENNA POLARITY & TEST DISTANCE: PEAK AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	POLARIZATION
315.18	60.31	80.27	80.83	-20.52	14.3	2.27	36.53	100	0	Horizontal
315.18	62.9	82.86	80.83	-17.93	14.3	2.27	36.53	100	0	Vertical
ANTENNA POLARITY & TEST DISTANCE: AVERAGE AT 3 M										
FREQ. (MHz)	PEAK LEVEL (dBuV/m)	AVERAGE FACTOR	AVERAGE VALUE	LIMIT LINE(dBuV/m)	MARGIN (dB)	POLARIZATION				
315.18	60.31	-14.11	46.2	80.83	-34.63	Horizontal				
315.18	62.9	-14.11	48.79	80.83	-32.04	Vertical				

REMARK:

Average value=Peak value + Duty cycle factor

For spurious emission

(9KHz-30MHz)

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State P/F	Test Result
--	--	--	--	--	PASS
--	--	--	--	--	PASS

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

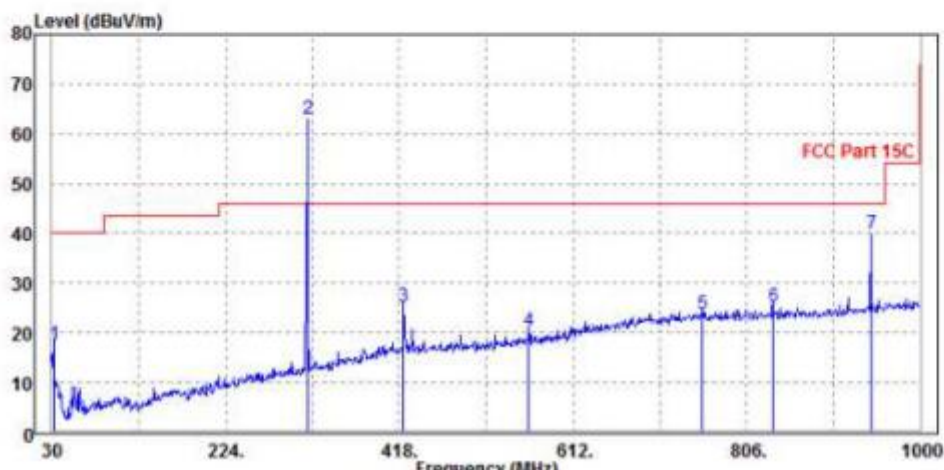
(30MHZ-1000MHZ)

Temperature:	23.7°C	Relative Humidity:	61%
Test Voltage:	DC 3V	Phase:	Horizontal
Test Mode:	ASK		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
31.94	17.73	38.56	40	-22.27	15.91	0.8	37.54	200	154	QP
422.85	25.34	42.1	46	-20.66	17.31	2.7	36.77	100	287	QP
562.53	20.31	35.1	46	-25.69	19.25	3.1	37.14	100	247	QP
756.53	23.62	34.53	46	-22.38	22.87	3.73	37.51	115	156	QP
835.1	25.12	35.66	46	-20.88	23.14	3.94	37.62	100	178	QP
944.71	39.96	49.44	46	-6.04	23.8	4.23	37.51	100	54	QP

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
2. 315MHz: Fundamental frequency.

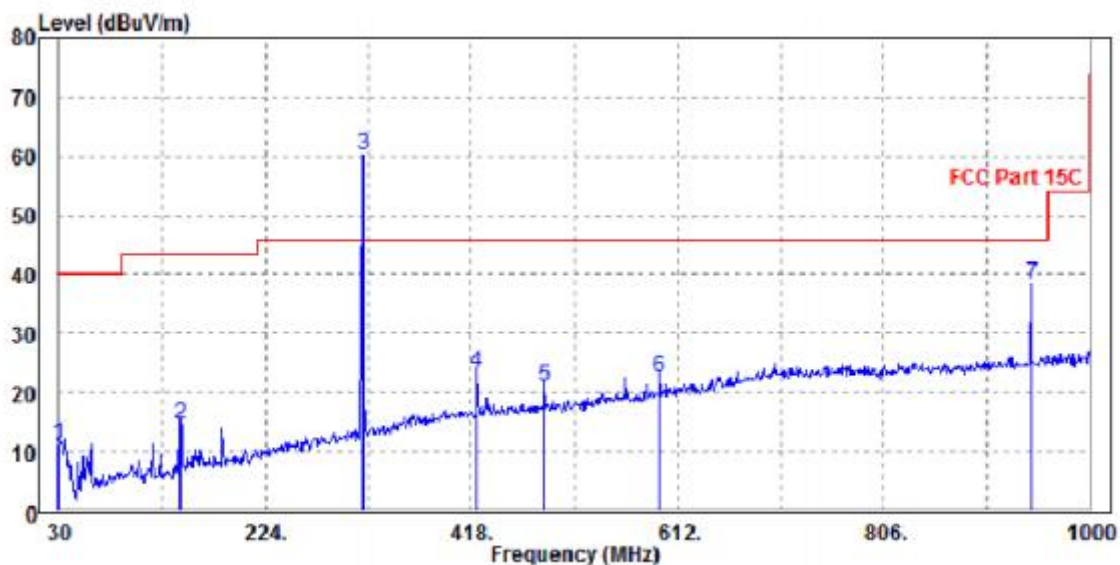


Temperature:	22.7°C	Relative Humidity:	61%
Test Voltage:	DC 3V	Phase:	Vertical
Test Mode:	ASK		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
30	11.36	31.15	40	-28.64	17	0.77	37.56	200	360	QP
144.46	14.46	40.52	43.5	-29.04	9.2	1.56	36.82	200	306	QP
422.85	23.42	40.18	46	-22.58	17.31	2.7	36.77	100	360	QP
486.87	20.92	37.03	46	-25.08	17.88	2.94	36.93	177	296	QP
594.54	22.44	36.63	46	-23.56	19.89	3.15	37.23	107	274	QP
944.71	38.33	47.81	46	-7.67	23.8	4.23	37.51	104	259	QP

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.
2. 315MHz: Fundamental frequency.



(ABOVE ~ 1GHZ)

ANTENNA POLARITY & TEST DISTANCE: PEAK AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	POLARIZATION
1261	35.21	49.67	74	-38.79	28.91	3.36	46.73	108	0	Horizontal
1575	37.03	50.12	74	-36.97	29.68	3.8	46.57	108	0	Horizontal
1890	39.11	49.54	74	-34.89	31.7	4.29	46.42	108	0	Horizontal
2205	39.47	48.5	74	-34.53	32.65	4.68	46.36	108	0	Horizontal
--										Horizontal
1260	36.52	50.98	74	-37.48	28.91	3.36	46.73	108	360	Vertical
1575	37.26	50.35	74	-36.74	29.68	3.8	46.57	108	360	Vertical
1890	39.17	49.6	74	-34.83	31.7	4.29	46.42	108	360	Vertical
2205	40.66	49.69	74	-33.34	32.65	4.68	46.36	108	360	Vertical
--										Vertical
ANTENNA POLARITY & TEST DISTANCE: AVERAGE AT 3 M										
FREQ. (MHz)	PEAK LEVEL (dBuV/m)	AVERAGE FACTOR	AVERAGE VALUE	LIMIT LINE(dBuV/m)	MARGIN (dB)	POLARIZATION				
1261	35.21	-14.11	21.1	54	-32.9	Horizontal				
1575	37.03	-14.11	22.92	54	-31.08	Horizontal				
1890	39.11	-14.11	25	54	-29	Horizontal				
2205	39.47	-14.11	25.36	54	-28.64	Horizontal				
--						Horizontal				
1260	36.52	-14.11	22.41	54	-31.59	Vertical				
1575	37.26	-14.11	23.15	54	-30.85	Vertical				
1890	39.17	-14.11	25.06	54	-28.94	Vertical				
2205	40.66	-14.11	26.55	54	-27.45	Vertical				
--						Vertical				

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
Margin value = Emission level – Limit value.

4. TRANSMITTER TIME

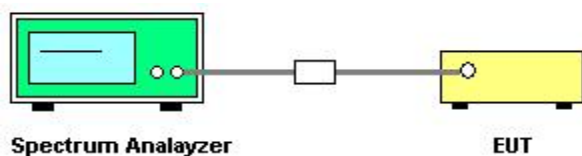
4.1 LIMIT

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released

4.2 TEST PROCEDURE

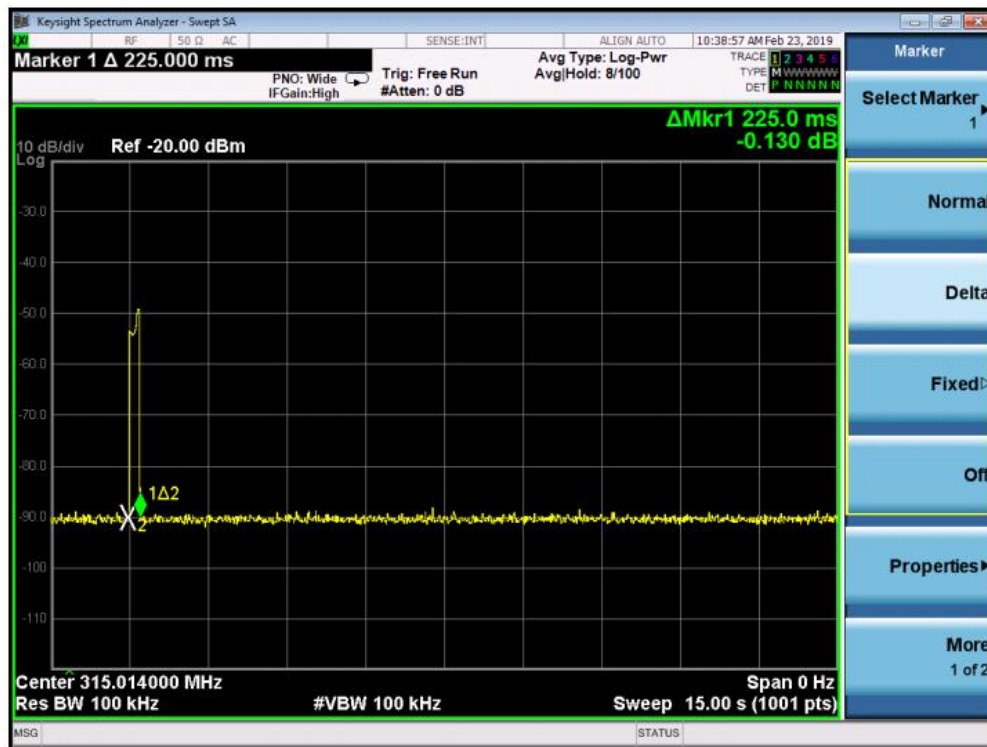
- a. The EUT' s RF signal was coupled to spectrum analyzer by antenna connected to spectrum analyzer.
- b. Set the spectrum to zero span mode, and centered of EUT frequency.
- c. Measure the stop transmitting time after release EUT button

4.3 TEST SETUP



4.4 TEST RESULTS

Frequency(MHz)	Limit	Result
315	$\leq 5s$	Pass



5. 20 DB BANDWIDTH TEST

5.1 LIMIT

The bandwidth of the emission shall be no wider than 0.25% of the center frequency of devices operation above 70MHz and below 900MHz.

5.2 TEST PROCEDURE

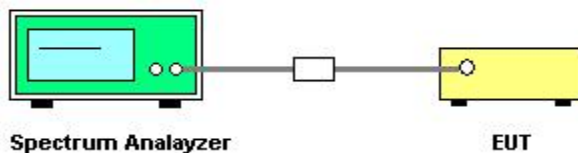
Connect EUT' s antenna output to spectrum analyzer by RF cable.

a.

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 300Hz RBW and 1kHz VBW. The 20dB bandwidth is defined as the total spectrum the

b. power of which is higher than peak power minus 20dB

5.3 TEST SETUP



5.4 TEST RESULTS

Temperature:	25°C	Relative Humidity:	50%
Test Mode:	ASK	Test Voltage:	DC 3V

Frequency	20dB Bandwidth (KHz)	Limt (KHz)	Result
315 MHz	484.5	787.5	PASS



6. DUTY CYCLE

6.1 LIMIT

None: for reporting purposes only.

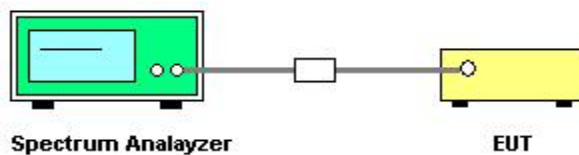
6.2 TEST PROCEDURE

Set the Centre frequency of the spectrum analyzer to the transmitting frequency;

- a. Set the span=0MHz, RBW=1MHz, VBW=1MHz, Sweep time=300ms;

Trace mode = Single hold

6.3 TEST SETUP



6.4 TEST RESULTS

Frequency	Duty Cycle
315 MHz	19.7%

Calculate Formula: Duty cycle factor= $20 \log(\text{Duty cycle})$

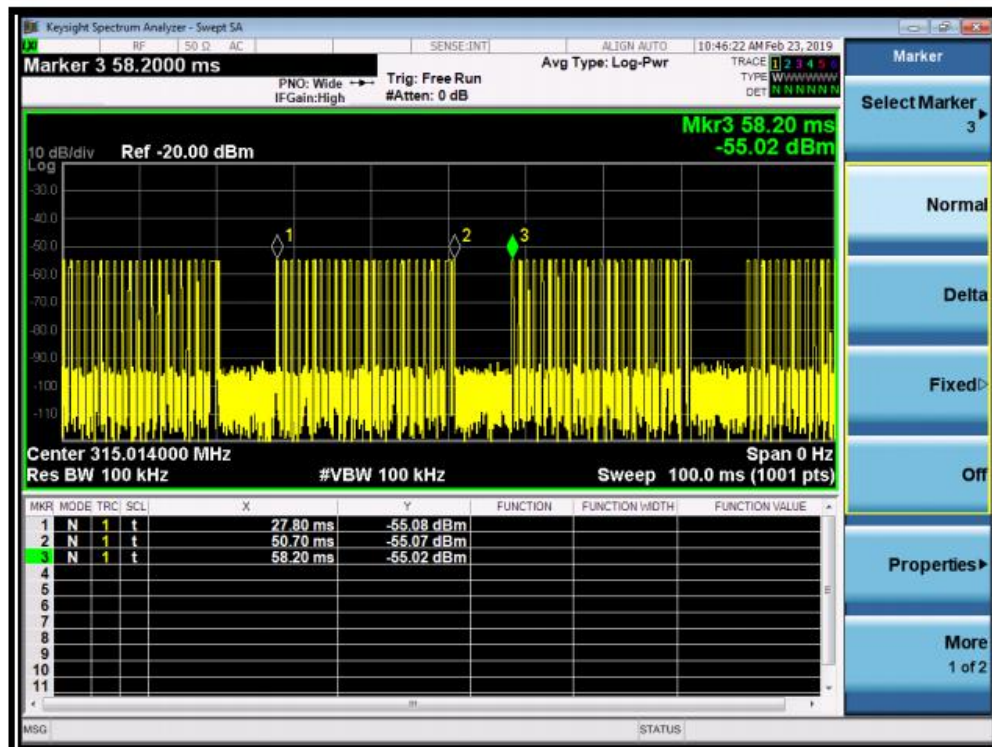
Duty cycle=on time/0.1 seconds or period, whichever is le

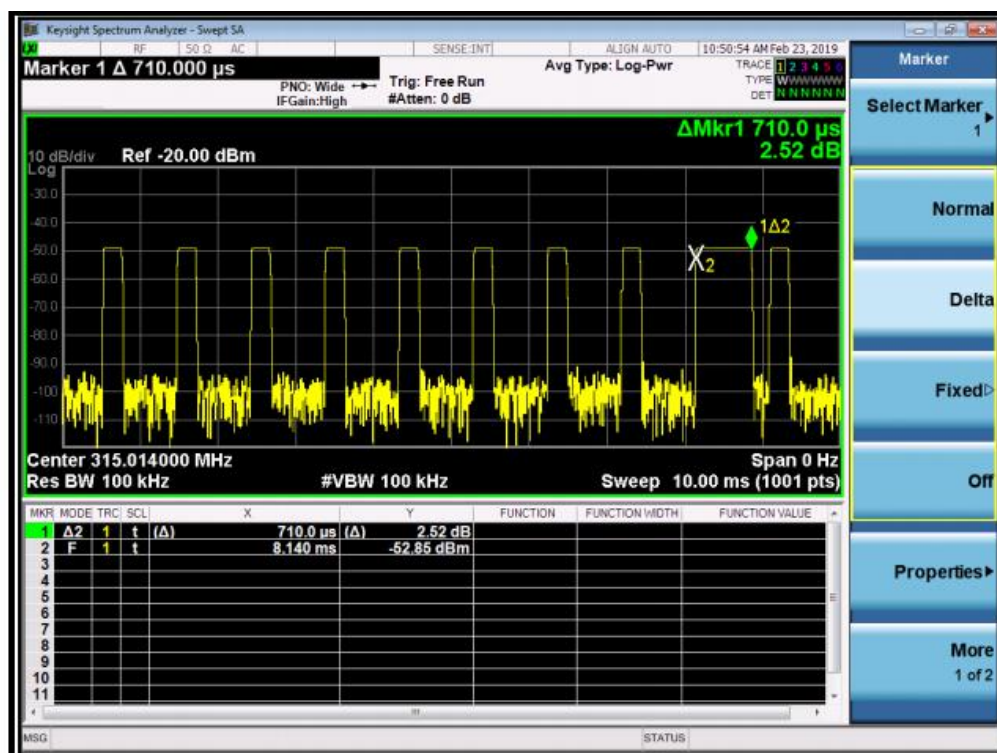
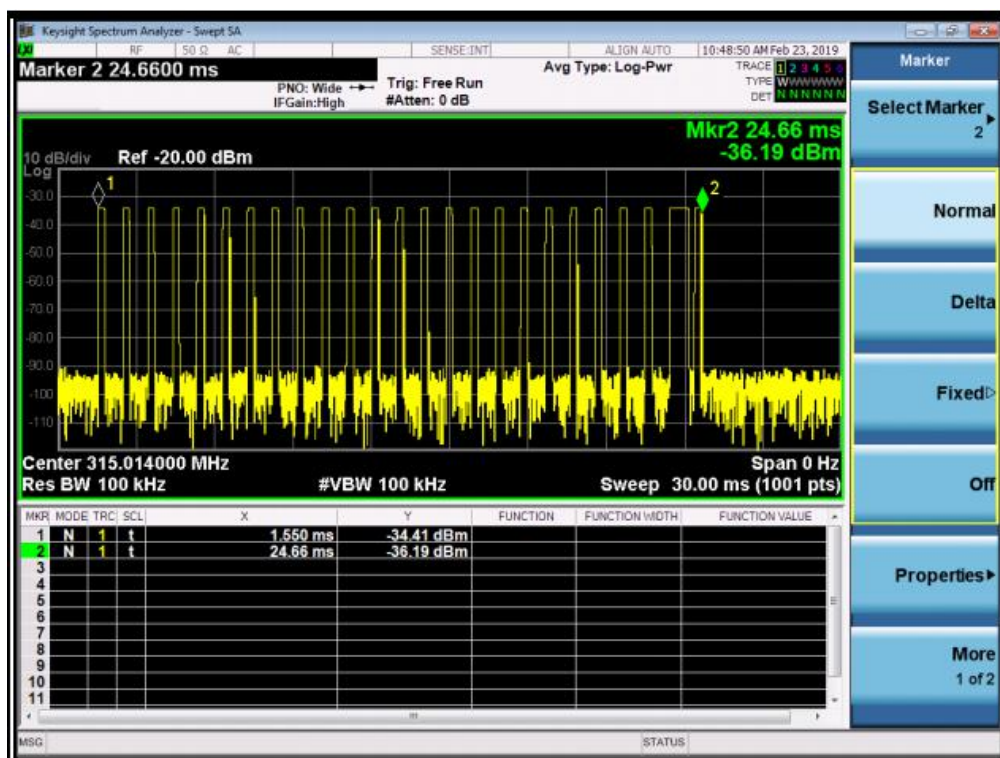
Test data: T on time= $0.71+0.22 \times 24=5.99\text{ms}=0.00599\text{ms}$

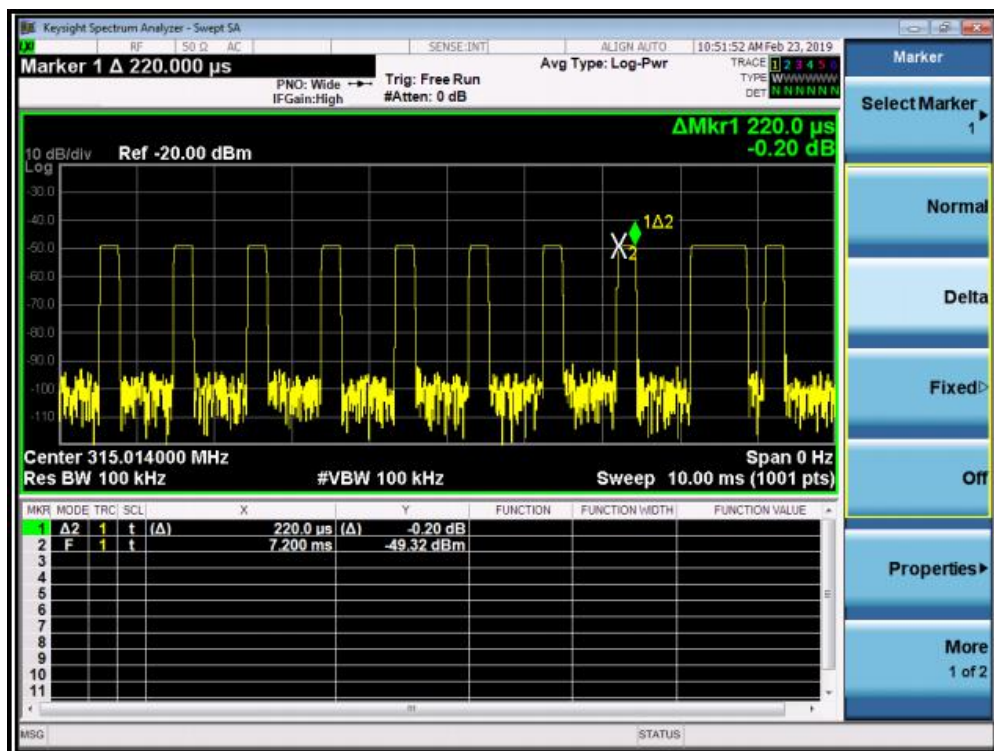
T period= 0.0304s

Duty cycle factor = $20\log(0.00599/0.0304)=-14.11$

Original test data







7 ANTENNA REQUIREMENT

7.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

7.2 EUT ANTENNA

The antennas used for this product are integral antenna and other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 1.0dBi.

XXXXXXXXEND OF THE REPORTXXXXXXXX