FCC Test Report

Product Name	TPMS Sensor S5.05 433 MHz
Model No.	TSSRE4Uf
FCC ID.	OYGTSSRE4UF

Applicant	Huf Baolong Electronics Bretten GmbH
Address	Gewerbestr. 40, 75015 Bretten, Germany

Date of Receipt	Jul. 04, 2019
Issued Date	Aug. 13, 2019
Report No.	1970093R-RFUSP14V00
Report Version	V1.0

Testing Laboratory
3023

Test Report

Issued Date : June 15, 2015
Report No. : 1970093R-RFUSP14V00

Product Name	TPMS Sensor S5.05 433 MHz
Applicant	Huf Baolong Electronics Bretten GmbH
Address	Gewerbestr. 40, 75015 Bretten, Germany
Manufacturer	1. Huf Baolong Electronics Bretten GmbH 2. Shanghai Baolong Automotive Corporation
Model No.	TSSRE4Uf
FCC ID.	OYGTSSRE4UF
EUT Rated Voltage	DC 3V(Power by Battery)
EUT Test Voltage	DC 3V(Power by Battery)
Trade Name	HUF and BH SENS
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2016 ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By : Elephant Chen
(Adm. Specialist / Elephant Chen)

Tested By : Boris HSU
(Engineer / Boris Hsu)

Approved By :
(Director / Vincent Lin)

TABLE OF CONTENTS

1. General Information

1.1. EUT Description

Product Name	TPMS Sensor S5.05 433 MHz
Trade Name	HUF and BH SENS
Model No.	TSSRE4Uf
FCC ID	OYGTSSRE4UF
Frequency Range	433.92MHz
Number of Channels	1
Antenna Type	Integral Antenna
Type of Modulation	FSK,ASK

Frequency of Each Channel:

Channel	Frequency
Channel 1:	433.92 MHz

Note:

1. The EUT is a TPMS Sensor S5.05 433 MHz with a built-in 433.92 MHz transmitter.
2. These tests are conducted on a sample for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.231(e).
3. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.
4. In special circumstances ASK modulation is used, but not tested for this report as it does not reflect normal operation.

Test Mode	Mode 1: Transmit

Emission	
Performed Item	Test
Conducted Emission	Not performed (see note)
Radiated Emission	Pass
Transmit time	Pass
Occupied Bandwidth	Pass

Note: Owing to the Battery operation of EUT, this Conducted Emission is not performed.

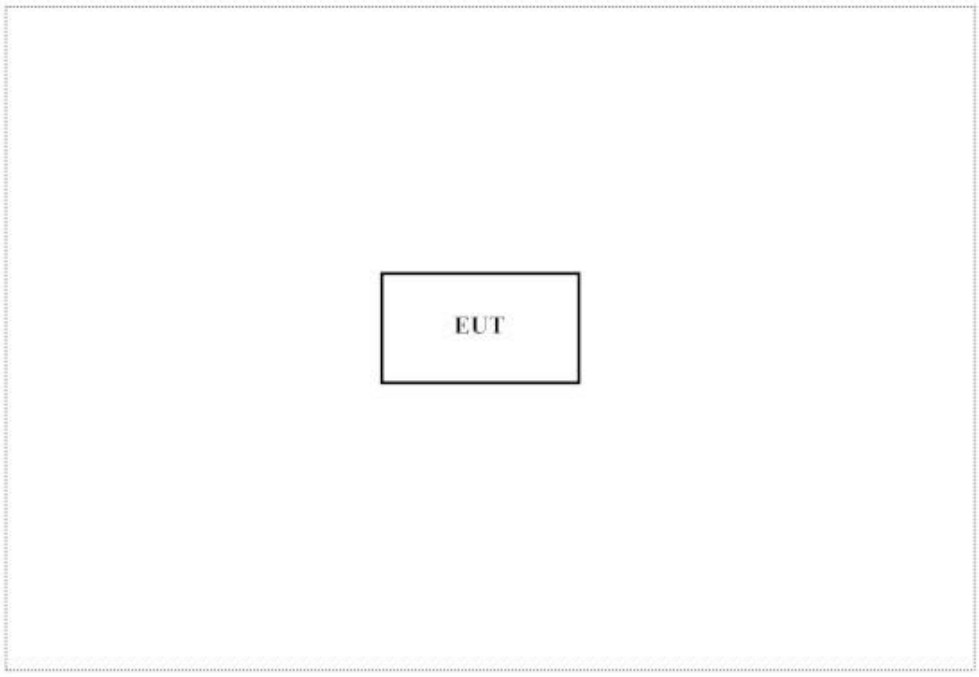
1.3. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	FCC ID	Power Cord
N/A					

Signal Cable Type	Signal cable Description
N/A	

1.4. Configuration of tested System



1.5. EUT Exercise Software

1	Setup the EUT as shown in section 1.4.
2	Plug-in a battery on the EUT.
3	Start transmits continually.
4	Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	30-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:
http://www.dekra.com.tw/english/about/certificates.aspx?bval=5
The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en.aspx

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd
Site Address: No.5-22, Ruishukeng, Linkou Dist., New Taipei City 24451, Taiwan, R.O.C.
TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : info.tw@dekra.com

FCC Accreditation Number: TW3023

1.7. List of Test Equipment

For Conducted measurements /CB3/SR8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
	Temperature Chamber	WIT GROUP	TH-1S-B	EQ-201-00146	2018/11/28	2019/11/27
X	Spectrum Analyzer	Agilent	N9010A	MY48030495	2019/7/22	2020/7/21
X	Power Meter	Anritsu	ML2495A	6K00003357	2019/6/23	2020/6/22
X	Pulse power sensor	Anritsu	MA2411B	0846193	2019/6/23	2020/6/22
X	EMI Test Receiver	R&S	ESCS 30	100369	2018/10/13	2019/10/12
X	LISN	R&S	ESH3-Z5	836679/017	2019/1/7	2020/1/6
X	LISN	R&S	ENV216	100097	2019/1/7	2020/1/6
X	Coaxial Cable	QTK(Arnist)	RG 400	LC018-RG	2019/6/25	2020/6/24

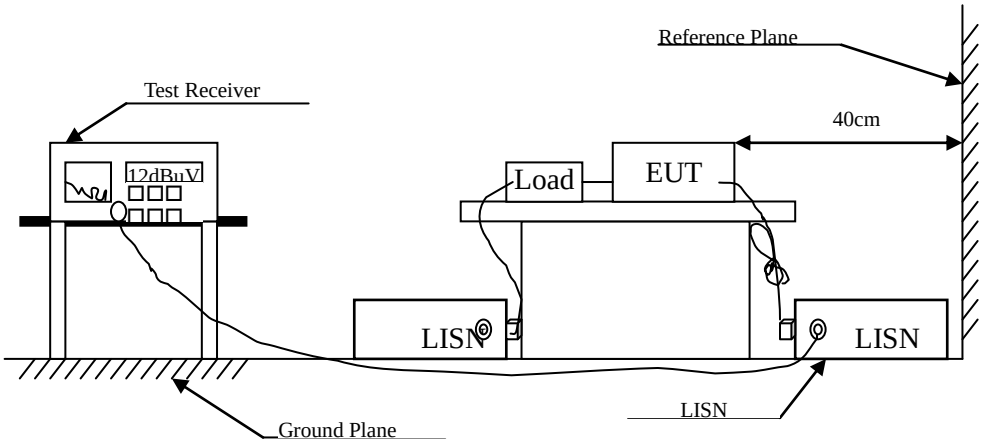
For Radiated measurements /Site3/CB8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSP40	100170	2019/1/5	2020/1/4
X	Loop Antenna	Teseq	HLA6121	37133	2019/3/18	2020/3/17
X	Bi-Log Antenna	Schaffner Chase	CBL6112B	2707	2019/6/11	2020/6/10
X	Horn Antenna	ETS-Lindgren	3117	00135205	2019/4/6	2020/4/5
X	Horn Antenna	Schwarzbeck	BBHA9170	9170430	2019/1/11	2020/1/10
X	Pre-Amplifier	QTK	AP/0100A	CHM/0901069	2019/6/23	2020/6/22
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2019/1/26	2020/1/24
X	Pre-Amplifier	NARDA WE	DBL-1840N506	013	2018/9/30	2019/9/29
X	Filter	MicroTRON	BRM50701	019	2018/11/2	2019/11/1
X	Filter	Microwave Circuits	N0257881	36681	2018/12/7	2019/12/6
X	EMI Test Receiver	R&S	ESR26	101385	2018/9/29	2019/9/28
X	Coaxial Cable	QTK(Arnist)	SUCOFLEX 106	L1606-015C	2019/6/23	2020/6/22
X	EMI Test Receiver	R&S	ESCS 30	838251/001	2019/7/21	2020/7/20
X	Coaxial Cable	QTK(Arnist)	RG 214	LC003-RG	2019/6/16	2020/6/15
X	Coaxial signal switch	Anritsu	MP59B	6201415889	2019/6/16	2020/6/15

Note:
1. All equipments are calibrated every one year.
2. The test instruments marked with “X” are used to measure the final test results.
3. Test Software version :QuieTek EMI 2.0 V2.1.113.

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 Limits (dBuV)		
Frequency MHz	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks : In the above table, the tighter limit applies at the band edges.

2.3. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.207(a)

2.5. Uncertainty

± 2.26 dB

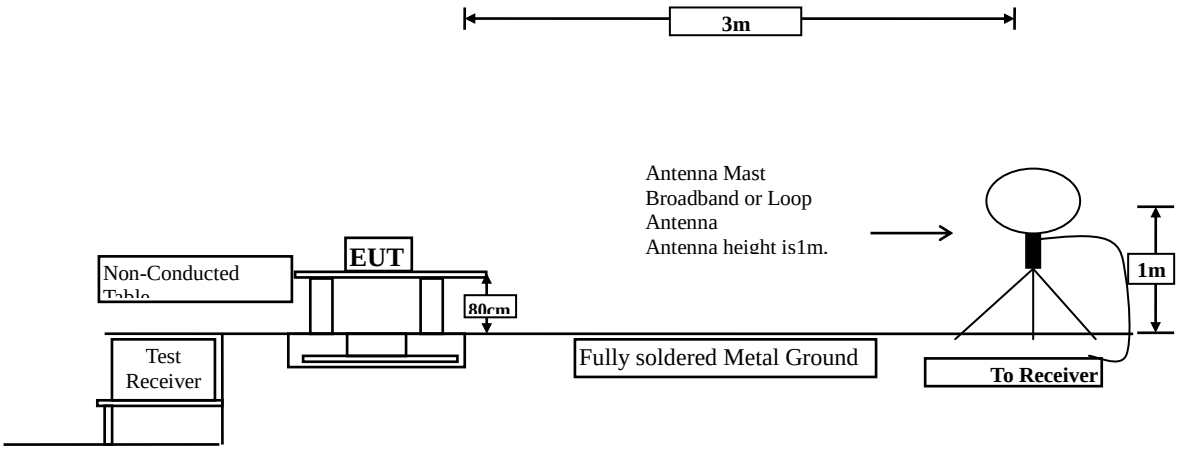
2.6. Test Result

Owing to the DC operation of EUT, this test item is not performed.

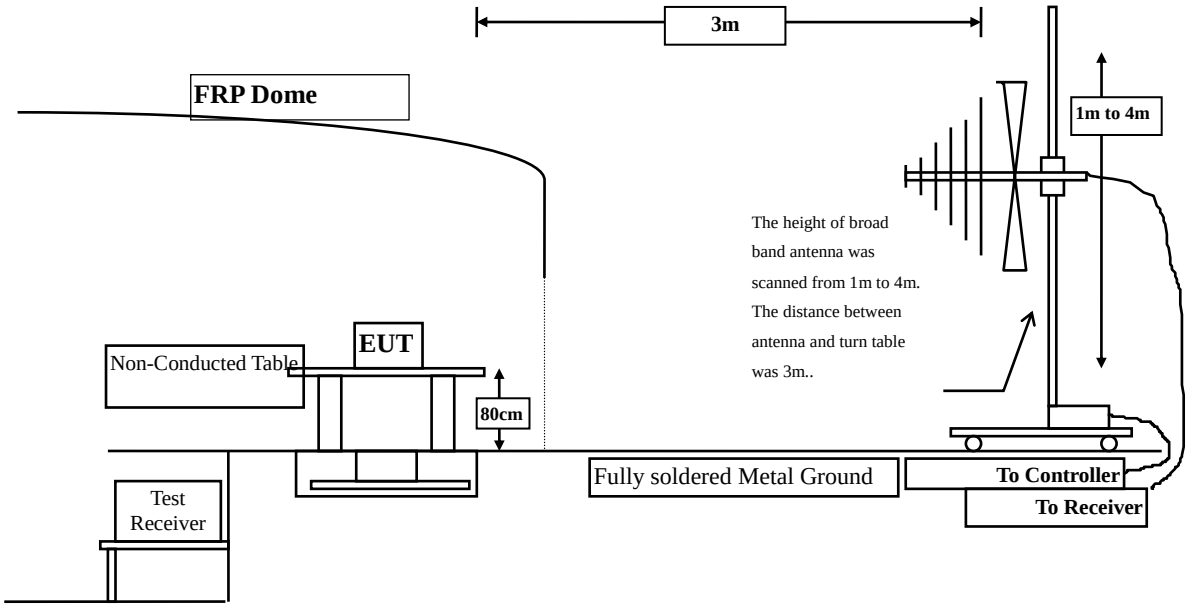
3. Radiated Emission

3.1. Test Setup

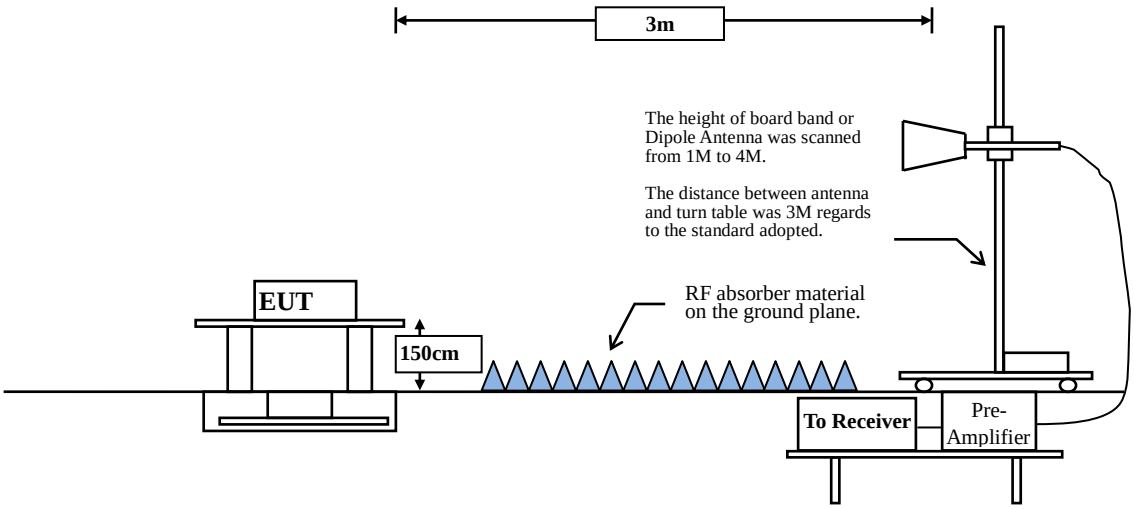
Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



3.2. Limits

➢ Fundamental and Harmonics Emission Limits

FCC Part 15 Subpart C Paragraph 15.231(e) Limits		
Fundamental Frequency MHz	Field Strength of Fundamental	Field Strength of Spurious Emission
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1500	50 to 150
174-260	1500	150
260-470	1500 to 5000	150 to 500
above 470	5000	500

Remarks : 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)

2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector.

➢ Spurious electric field strength limits

FCC Part 15 Subpart C Paragraph 15.209 Limits			
Frequency MHz	uV/m	dBuV/m	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	See Remark[1]	300
0.490-1.705	24000/F(kHz)	See Remark[1]	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Remarks : 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)

2. In the Above Table, the tighter limit applies at the band edges.

3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

3.3. Test Procedure

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground,when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10, 2013 on radiated measurement.

On the field strength of fundamental and harmonics, the limits shown are based on measuring equipment employing a average detector function. As an alternative, compliance with the limits may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

On the field strength of spurious electric, on any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a quasi-peak detector function and on any frequency or frequencies above 1000 MHz the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function.

When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

The bandwidth The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

3.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(e).

3.5. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

3.6. Test Result

Product	TPMS Sensor S5.05 433 MHz		
Test Item	Fundamental Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2019/07/23	Test Site	No.3 OATS

Fundamental Power (X-Line)

Peak Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	5.828	61.010	66.838	-26.032	92.870
Vertical					
433.920	5.828	67.420	73.248	-19.622	92.870

Average Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	5.828	33.900	39.728	-33.142	72.870
Vertical					
433.920	5.828	40.300	46.128	-26.742	72.870

Note:

1. Correct factor = Antenna Factor + Cable Loss – Pre-amplifier Gain
2. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
3. Average Limit=20log(4398uv)=72.87dBuV、Peak Limit=92.87dBuV

Product	TPMS Sensor S5.05 433 MHz		
Test Item	Fundamental Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2019/07/23	Test Site	No.3 OATS

Fundamental Power (Y-Line)

Peak Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	5.828	62.530	68.358	-24.512	92.870
Vertical					
433.920	5.828	65.300	71.128	-21.742	92.870

Average Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	5.828	36.100	41.928	-30.942	72.870
Vertical					
433.920	5.828	39.000	44.828	-28.042	72.870

Note:

1. Correct factor = Antenna Factor + Cable Loss – Pre-amplifier Gain
2. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
3. Average Limit=20log(4398uv)=72.87dBuV、Peak Limit=92.87dBuV

Product	TPMS Sensor S5.05 433 MHz		
Test Item	Fundamental Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2019/07/23	Test Site	No.3 OATS

Fundamental Power (Z-Line)

Peak Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	5.828	63.920	69.748	-23.122	92.870
Vertical					
433.920	5.828	63.670	69.498	-23.372	92.870

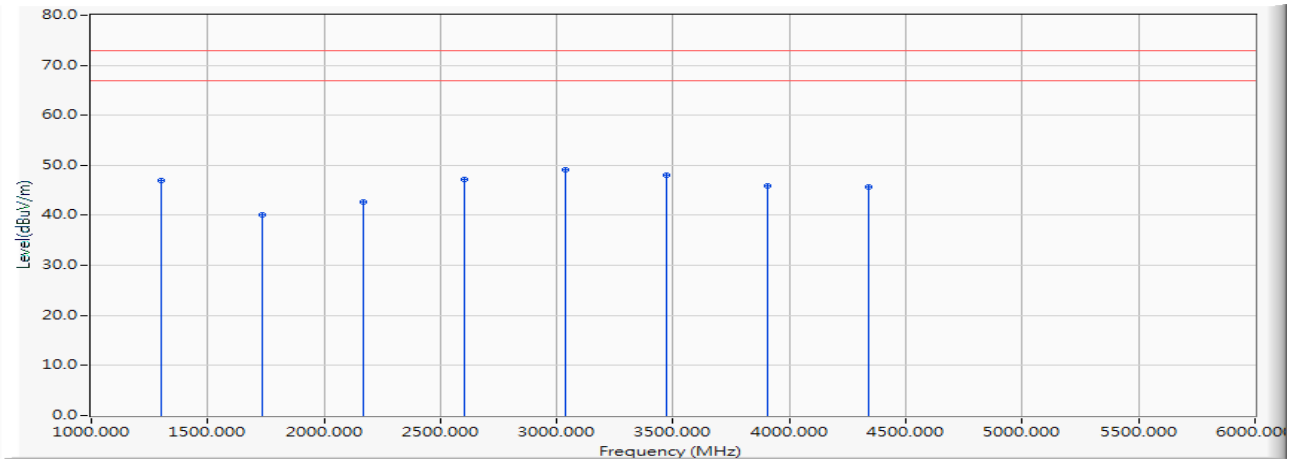
Average Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	5.828	37.600	43.428	-29.442	72.870
Vertical					
433.920	5.828	36.500	42.328	-30.542	72.870

Note:

1. Correct factor = Antenna Factor + Cable Loss – Pre-amplifier Gain
2. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
3. Average Limit=20log(4398uv)=72.87dBuV、Peak Limit=92.87dBuV

Product	TPMS Sensor S5.05 433 MHz		
Test Item	Harmonic Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2019/07/19	Test Site	No.3 OATS

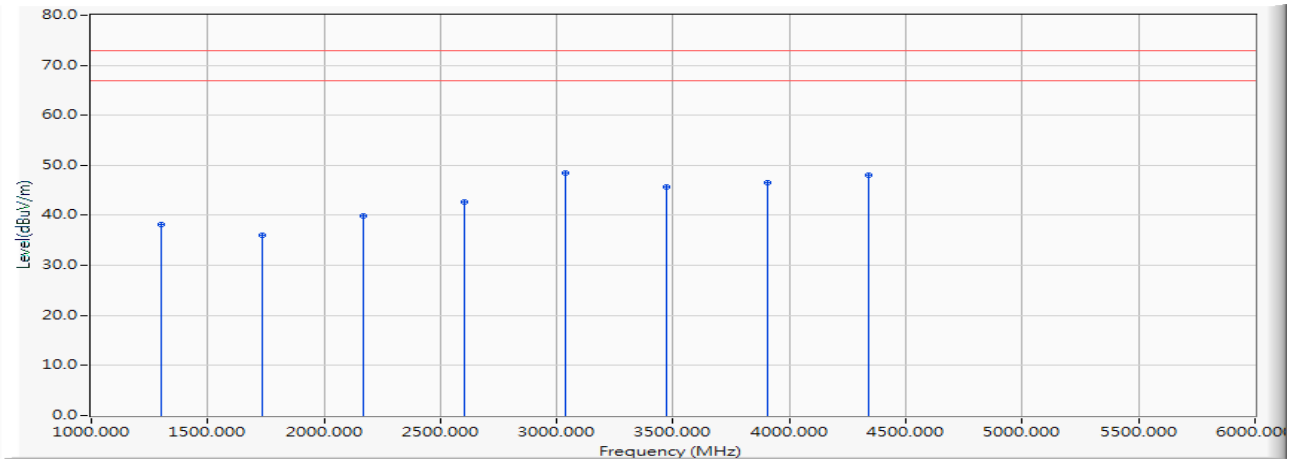


Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Peak Limit	Average Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m	dBuV/m
Harmonic Radiated Emission						
Horizontal						
Peak						
1301.760	-23.263	70.160	46.897	-25.973	72.870	52.870
1735.680	-24.427	64.520	40.093	-32.777	72.870	52.870
2169.600	-20.145	62.720	42.575	-30.295	72.870	52.870
2603.520	-19.479	66.560	47.080	-25.79	72.870	52.870
3037.440	-17.862	66.990	49.128	-23.742	72.870	52.870
3471.360	-17.774	65.810	48.035	-24.835	72.870	52.870
3905.280	-15.621	61.590	45.969	-26.901	72.870	52.870
4339.200	-15.773	61.370	45.597	-27.273	72.870	52.870

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	TPMS Sensor S5.05 433 MHz		
Test Item	Harmonic Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2019/07/19	Test Site	No.3 OATS

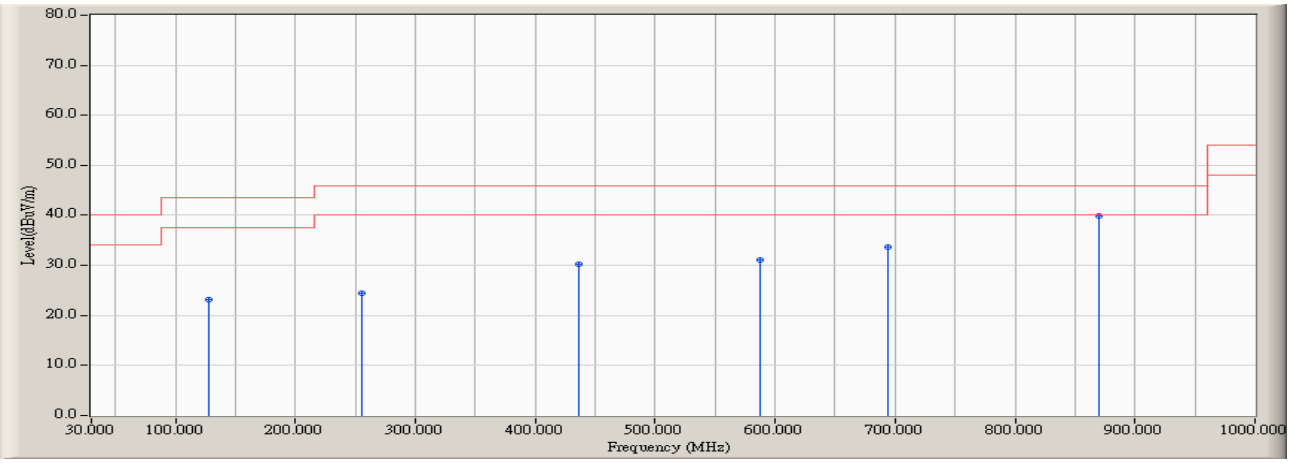


Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Peak Limit	Average Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m	dBuV/m
Harmonic Radiated Emission						
Vertical						
Peak						
1301.760	-23.263	61.450	38.187	-34.683	72.870	52.870
1735.680	-24.427	60.550	36.123	-36.747	72.870	52.870
2169.600	-20.145	60.030	39.885	-32.985	72.870	52.870
2603.520	-19.479	62.080	42.600	-30.270	72.870	52.870
3037.440	-17.862	66.350	48.488	-24.382	72.870	52.870
3471.360	-17.774	63.390	45.615	-27.255	72.870	52.870
3905.280	-15.621	62.140	46.519	-26.351	72.870	52.870
4339.200	-15.773	63.770	47.997	-24.873	72.870	52.870

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	TPMS Sensor S5.05 433 MHz		
Test Item	General Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2019/07/23	Test Site	No.3 OATS

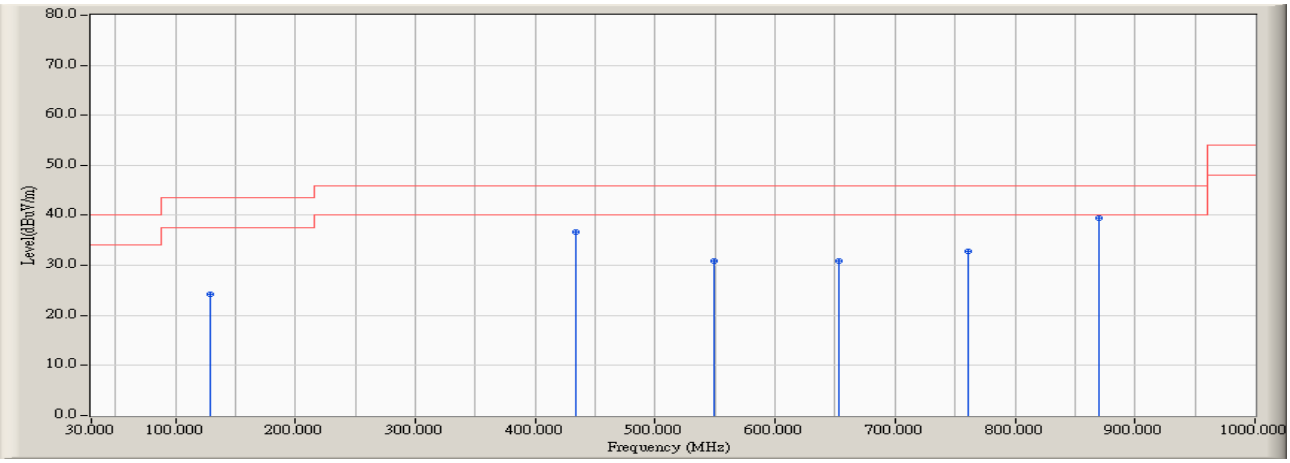


Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Quasi-Peak					
127.933	-0.332	23.506	23.174	-20.326	43.500
255.401	1.381	22.977	24.358	-21.642	46.000
435.721	5.842	24.491	30.333	-15.667	46.000
588.061	8.562	22.522	31.084	-14.916	46.000
693.766	9.864	23.898	33.762	-12.238	46.000
869.423	12.421	27.396	39.817	-6.183	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

Product	TPMS Sensor S5.05 433 MHz		
Test Item	General Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2019/07/23	Test Site	No.3 OATS



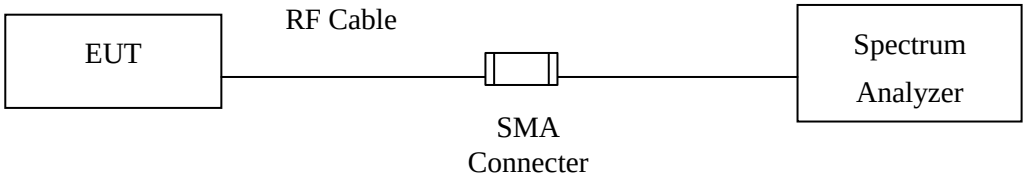
Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Vertical					
Quasi-Peak					
129.487	-0.359	24.621	24.262	-19.238	43.500
434.167	5.832	30.793	36.624	-9.376	46.000
549.199	8.180	22.666	30.846	-15.154	46.000
653.349	9.528	21.370	30.898	-15.102	46.000
760.609	10.795	22.123	32.918	-13.082	46.000
869.423	12.421	27.088	39.509	-6.491	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
9. The emission levels of other frequencies are very lower than the limit and not show in test report.
10. No emission found between lowest internal used/generated frequency to 30MHz.

4. Transmit time

4.1. Test Setup



4.2. Limits

In addition, 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.

4.3. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(e).

4.4. Uncertainty

± 2.31ms

4.5. Test Result

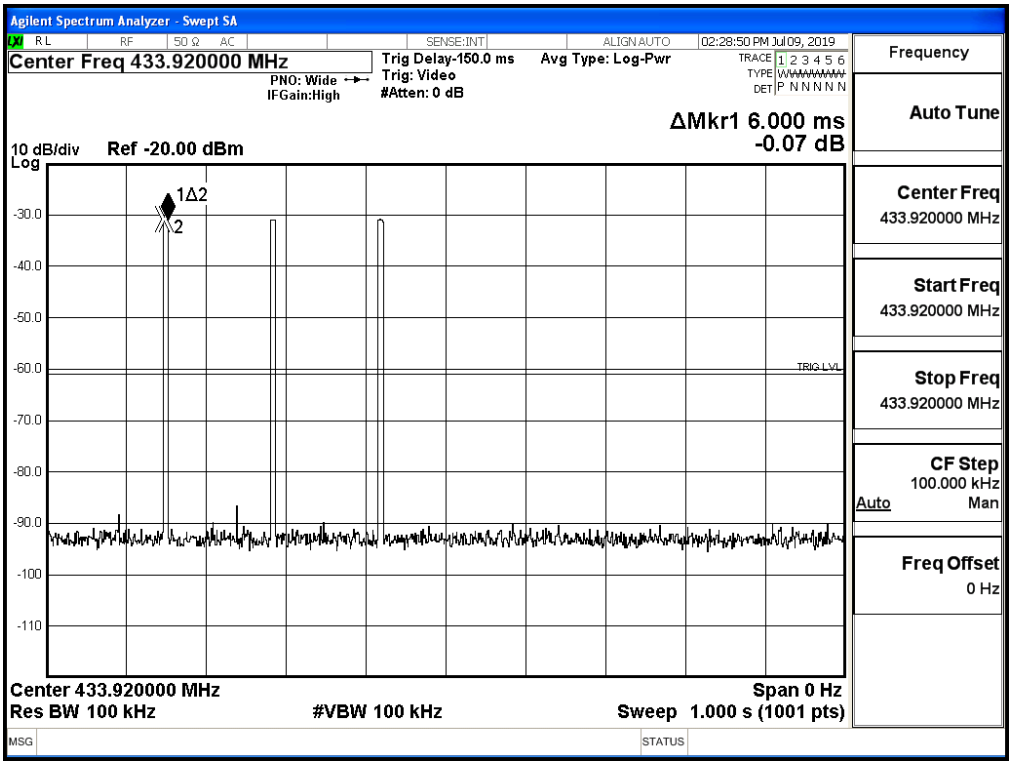
Product TPMS Sensor S5.05 433 MHz
Test Item Transmit time
Test Site No.3 OATS
Test Mode Mode 1: Transmit

Channel No.	Frequency (MHz)	Measurement Value (Sec)	Limit (Sec)	Result
1 (Transmit time)	433.92	0.018	< 1	Pass
1 (Silent period time)	433.92	30.96	> 10	Pass
1 (Silent period time)	433.92	30.96	> 10	Pass

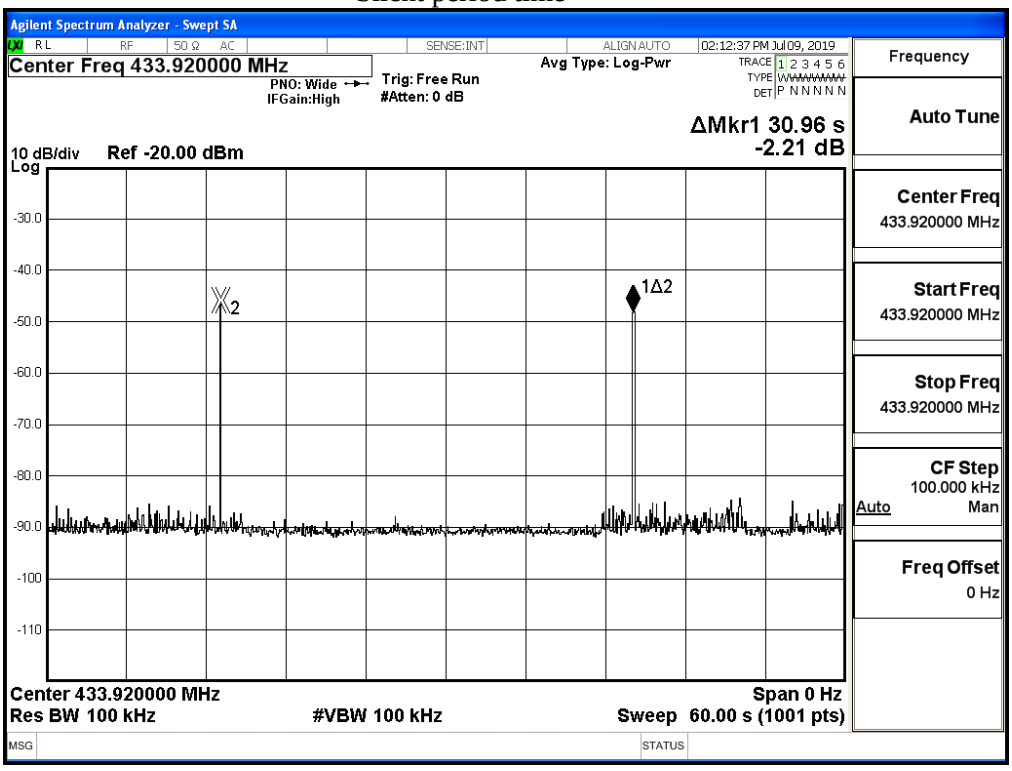
Note: Transmit time = 6ms*3=18ms(0.018s)

Silent period time= 10s and Transmissions * 30 times =0.018s * 30 =0.54s

Transmit time

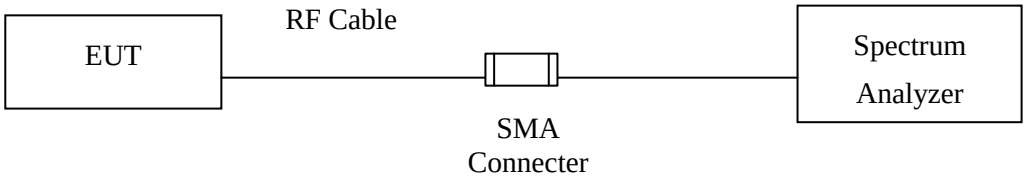


Silent period time



5. Occupied Bandwidth

5.1. Test Setup



5.2. Limits

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier

5.3. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(c).

5.4. Uncertainty

± 283Hz

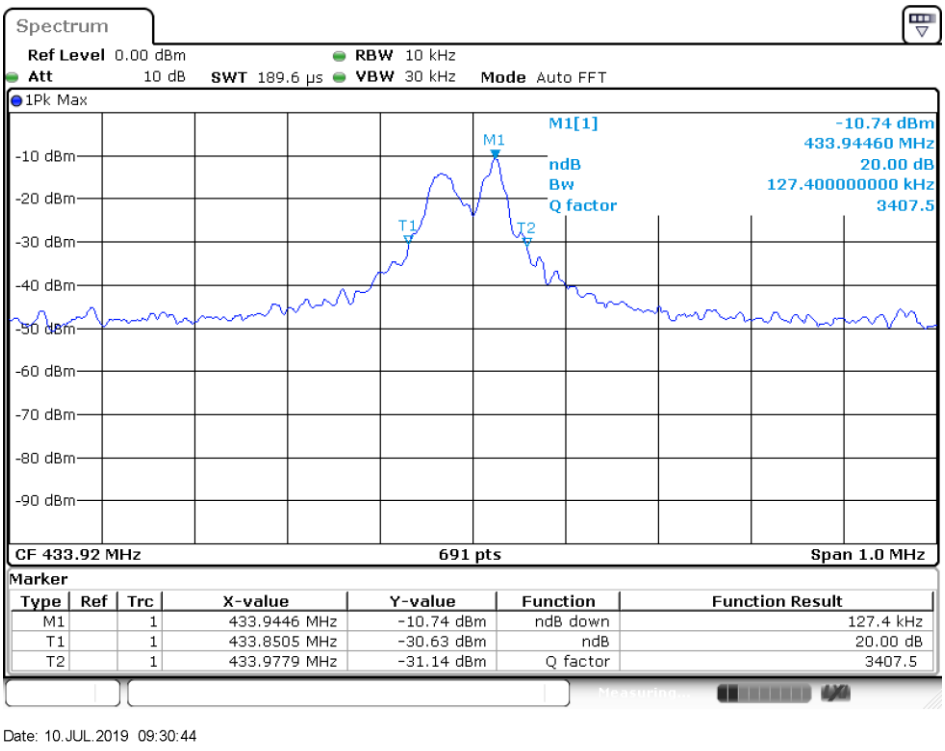
5.5. Test Result

Product TPMS Sensor S5.05 433 MHz
Test Item Occupied Bandwidth
Test Site No.3 OATS
Test Mode Mode 1: Transmit

Channel No.	Frequency (MHz)	Measurement Value (MHz)	Limit (MHz)	Result
1	433.92	0.127	1.0848	Pass

Note: Limit = 433.92MHz * 0.25%= 1.0848MHz

Figure Channel 1:



Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs