# FCC 47 CFR PART 15 SUBPART C AND ANSI C63.10:2013

# TEST REPORT
# (Class II Permissive Change Report)

**For**

**Uni TPMS Sensor**

**Model: UNI-SENSOR**

**Data Applies To: Please refer to section 2 (altogether 30 series models)**

**Trade Name: Cub**

**Issued for**

**CUB ELECPARTS INC.**

**No.6, Lane 546, Sec.6, Changlu Road, Fuhsin Hsiang, Changhua County, Taiwan.**

**Issued by**

**Compliance Certification Services Inc.**
**Hsinchu Lab.**
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**Issued Date: July 10, 2017**

# Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|---|---|---|---|---|
| 00 | 07/10/2017 | Initial Issue | All Page 33 | Gloria Chang |
| | | | | |
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| | | | | |

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# 1. TEST REPORT CERTIFICATION

| | | |
|---|---|---|
| **Applicant** | ： | CUB ELECPARTS INC. |
| **Address** | ： | No.6, Lane 546, Sec.6, Changlu Road, Fuhsin Hsiang, Changhua County, Taiwan. |
| **Equipment Under Test** | ： | Uni TPMS Sensor |
| **Model** | ： | UNI-SENSOR |
| **Data Applies To** | ： | Please refer to section 2 (altogether 30 series models) |
| **Trade Name** | ： | Cub |
| **Tested Date** | ： | February 24 ~ July 14, 2015; May 17 ~June 27, 2017 |

| APPLICABLE STANDARD | |
|---|---|
| **Standard** | **Test Result** |
| FCC Part 15 Subpart C AND ANSI C63.10:2013 | PASS |

WE HEREBY CERTIFY THAT: The above equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

***Approved by:***

Sb. Lu
Sr. Engineer

***Reviewed by:***

Gundam Lin
Sr. Engineer

# 2. EUT DESCRIPTION

## 2.1 DESCRIPTION OF EUT & POWER

| | |
|---|---|
| **Product Name** | Uni TPMS Sensor |
| **Model Number** | UNI-SENSOR |
| **Data Applies To** | Please refer to section 2 (altogether 30 series models) |
| **Identify Number** | T170630S01 |
| **Received Date** | February 24, 2015 |
| **Frequency Range** | 433.92 MHz |
| **Transmit Power** | 80.59 dBμV/m @ 3m |
| **Channel Number** | 1 Channel |
| **Type of Modulation** | ASK, FSK |
| **Antenna Type** | PCB Antenna, Antenna Gain -3.6 dBi |
| **Power Rating** | 3Vdc (From Battery) |
| **Test Voltage** | 3Vdc |

**The difference of the series model**

| Model Number | Difference |
|---|---|
| UNI-SENSOR | 1. For the marketing purpose<br>2. Where X may be any alpha character"a" - "z","A" - "Z", or numeric character"0" - "9", or - , ( , ), or blank or combination of alpha and numeric characters. |
| VS-62U009 | |
| VS-62U009-XX | |
| VS-62U009-XXXX | |
| VS-62U009XX | |
| VS-62U009XX-XX | |
| VS-62U009XX-XXXX | |
| VS-69W005 | |
| VS-69W005-XX | |
| VS-69W005-XXXX | |
| VS-69W005XX | |
| VS-69W005XX-XX | |
| VS-69W005XX-XXXX | |
| VS-69W007 | |
| VS-69W007-XX | |
| VS-69W007-XXXX | |
| VS-69W007XX | |
| VS-69W007XX-XX | |
| VS-69W007XX-XXXX | |

| Model Number | Difference |
|---|---|
| VS-62WXXXG | 1. For the marketing purpose<br>2. Where X may be any alpha character"a" - "z","A" - "Z", or numeric character"0" - "9", or - , ( , ), or blank or combination of alpha and numeric characters. |
| VS-62WXXXG-XX | |
| VS-62WXXXG-XXXX | |
| VS-62WXXXGX | |
| VS-62WXXXGX-XX | |
| VS-62WXXXGX-XXXX | |
| VS-62U014 | |
| VS-62U014-XX | |
| VS-62U014-XXXX | |
| VS-62U014XX | |
| VS-62U014XX-XX | |
| VS-62U014XX-XXXX | |

***Remark:***

1. *The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
2. *For more details, please refer to the User's manual of the EUT.*
3. *The device has two different color of housing (Black and Gray), therefore the model VS-62U009 (Black) was considered the main model for testing.*
4. *This submittal(s) (test report) is intended for FCC ID: ZPNVS62U009 filing to comply with Section 15.207, 15.209 and 15.231 of the FCC Part 15, Subpart C Rules.*
5. *This report is modified from T15116S02-RP1.*

## 2.2 DESCRIPTION OF CLASS II CHANGE

The major change filed under this application is:

Due to test for FCC Part 15 Subpart C AND ANSI C63.10:2013 testing standard update.

And renewed test data please refer to section 7.

The original application document reports (Report Number: T151116S02, FCC ID: ZPNVS62U009).

# 3. DESCRIPTION OF TEST MODES

The EUT had been tested under operating condition.

There are one channels have been tested as following :

| Channel | Frequency (MHz) |
|---|---|
| 1 | 433.92 |

**Radiated Emission (Below 1 GHz) Test:**

1. The following test modes were scanned during the preliminary test:

| No. | Pre-Test Mode |
|---|---|
| 1 | TX Mode / ASK |
| 2 | TX Mode / FSK |

2. After the preliminary scan, the following test mode was found to produce the highest emission level.

| Final Test Mode | | |
|---|---|---|
| Emission | Radiated Emission | Mode 1<br>Mode 2 |
| | Conducted Emission | N/A |

***Remark :*** *Then, the above highest emission mode of the configuration of the EUT and cable was chosen for all final test items.*

**Radiated Emission Test (Above 1 GHz) :**

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

TX Mode

***Remark :*** *The field strength of spurious emission was measured in the following position: EUT stand-up position (Y axis), lie-down position(X, Z axis). The worst emission was found in ie-down position(X axis) and the worst case was recorded.*

# 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47, 15.207, 15.209 and 15.231.

# 5. FACILITIES AND ACCREDITATION

## 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.989-1, Wenshan Rd., Shangshan Village,
Qionglin Township, Hsinchu County 30741, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.10:2013 and CISPR 22. All receiving equipment conforms to CISPR 16-1-1, CISPR 16-1-2, CISPR 16-1-3, CISPR 16-1-4, CISPR 16-1-5.

## 5.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

| | |
|---|---|
| **Taiwan** | TAF |

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

| | |
|---|---|
| **Canada** | INDUSTRY CANADA |
| **Japan** | VCCI |
| **Taiwan** | BSMI |
| **USA** | FCC MRA |

Copies of granted accreditation certificates are available for downloading from our web site, http:///www.ccsrf.com

***Remark:*** *FCC Designation Number TW1027.*

## 5.3 MEASUREMENT UNCERTAINTY

The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4-2.

| PARAMETER | UNCERTAINTY |
|---|---|
| Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 30 to 1000 MHz | +/- 3.97 |
| Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 1 to 18GHz | +/- 3.58 |
| Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 18 to 26 GHz | +/- 3.59 |
| Semi Anechoic Chamber (966 Chamber_B) / Radiated Emission, 26 to 40 GHz | +/- 3.81 |
| Conducted Emission (Mains Terminals), 9kHz to 30MHz | +/- 2.48 |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Consistent with industry standard (e.g. CISPR 22, clause 11, Measurement Uncertainty) determining compliance with the limits shall be base on the results of the compliance measurement. Consequently the measure emissions being less than the maximum allowed emission result in this be a compliant test or passing test.

The acceptable measurement uncertainty value without requiring revision of the compliance statement is base on conducted and radiated emissions being less than $U_{CISPR}$ which is 3.6dB and 5.2dB respectively. CCS values (called $U_{Lab}$ in CISPR 16-4-2) is less than $U_{CISPR}$ as shown in the table above. Therefore, MU need not be considered for compliance.

# 6. SETUP OF EQUIPMENT UNDER TEST

## SUPPORT EQUIPMENT

N/A

## SETUP DIAGRAM FOR TESTS

EUT & peripherals setup diagram is shown in appendix setup photos.

## EUT OPERATING CONDITION

1. EUT & peripherals setup diagram is shown in appendix setup photos.
2. Power on all equipments.
   TX Mode: Frequency: 433.92MHz.
3. All of the functions are under run.
4. Start test.

# 7. FCC PART 15.231 REQUIREMENTS

## 7.1 20dB BANDWIDTH

**LIMITS**

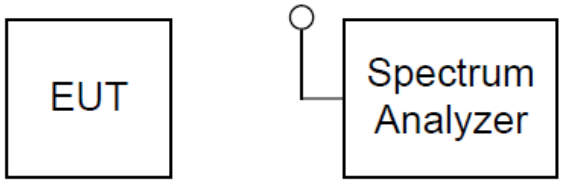
§15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from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

**TEST EQUIPMENT**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4446A | MY43360132 | 06/06/2018 |
| Test S/W | N/A | | | |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

**TEST SETUP**



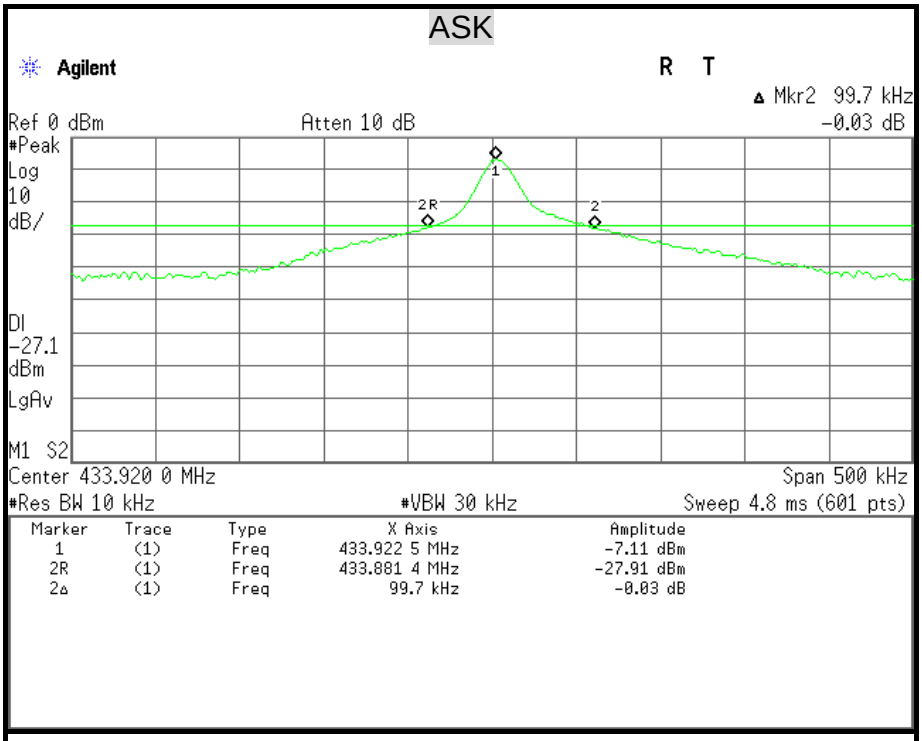

**TEST PROCEDURE**

The 20dB band width was measured with a spectrum analyzer connected to RF antenna while EUT was operating in transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer. Display Line and Marker Delta functions, the 20dB band width of the emission was determined.

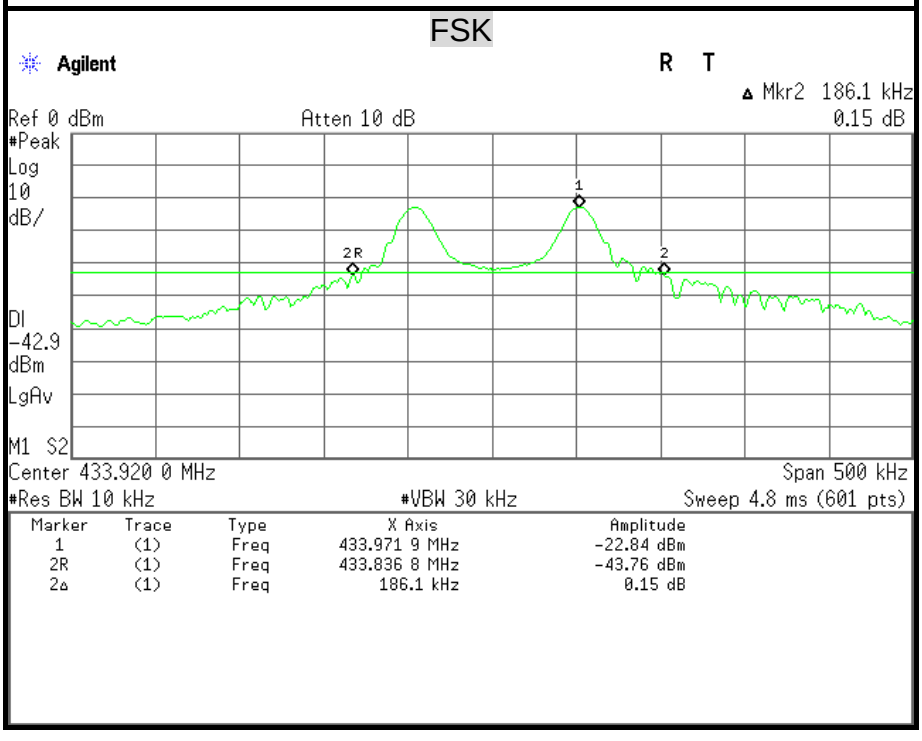
## TEST RESULTS

| Modulation Type | Channel Frequency (MHz) | 20dB Bandwidth (kHz) | Minimum Limit (kHz) | Result |
|---|---|---|---|---|
| ASK | 433.92 | 99.7 | 1084.8 | PASS |
| FSK | 433.92 | 186.1 | 1084.8 | PASS |

ASK




FSK



## 7.2 LIMIT OF TRANSMISSION TIME

**LIMITS**

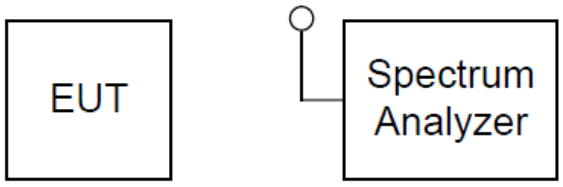
§ 15.231(e) In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the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

**TEST EQUIPMENT**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4446A | MY43360132 | 06/04/2016 |
| Test S/W | N/A | | | |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

**TEST SETUP**




**TEST PROCEDURE**

The spectrum analyzer connected to RF antenna. The spectrum analyzer center frequency is set to the transmitter frequency. The RBW and VBW are set to 100 kHz.

## TEST RESULTS

### Modulation Type : ASK

| Channel Frequency (MHz) | Pulse Width (ms) | Number of Pulse | Transmission Time (ms) | Limit (Second) | Result |
|---|---|---|---|---|---|
| 433.92 | 28.33 | 4 | 113.32 | 1 | PASS |

Transmission Time = Pulse Width × Number of Pulse = 28.33 × 4 = 113.32 (ms)

| Channel Frequency (MHz) | Silent Period (Second) | 30 Times Of The Transmission Time (Times) | Limit (Second) | Result |
|---|---|---|---|---|
| 433.92 | 60.67 | 535 | 10 | PASS |

Times = Silent Period ÷ Transmission Time = 60.67 (s) ÷ 0.11332 (s) = 535

### Modulation Type : FSK

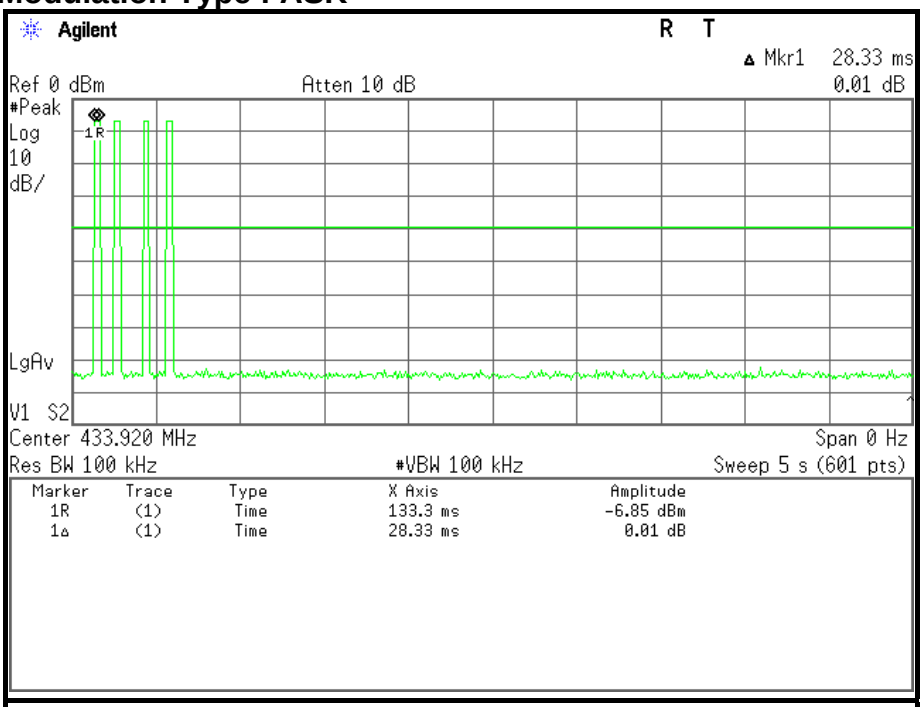
| Channel Frequency (MHz) | Pulse Width (ms) | Number of Pulse | Transmission Time (ms) | Limit (Second) | Result |
|---|---|---|---|---|---|
| 433.92 | 28.70 | 6 | 172.20 | 1 | PASS |

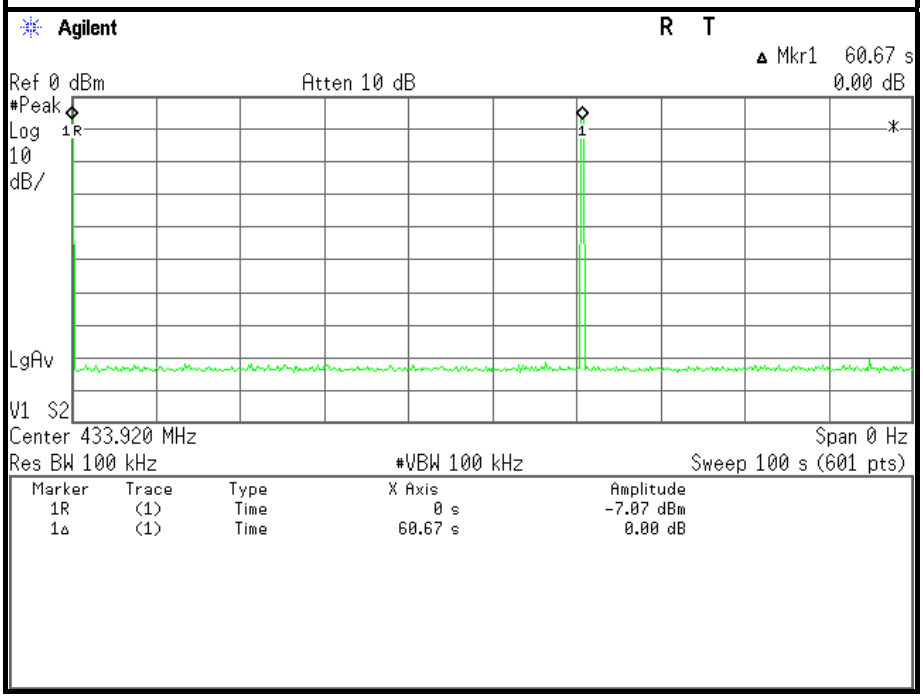
Transmission Time = Pulse Width × Number of Pulse = 28.70 × 6 = 172.20 (ms)

| Channel Frequency (MHz) | Silent Period (Second) | 30 Times Of The Transmission Time (Times) | Limit (Second) | Result |
|---|---|---|---|---|
| 433.92 | 16.38 | 95 | 10 | PASS |

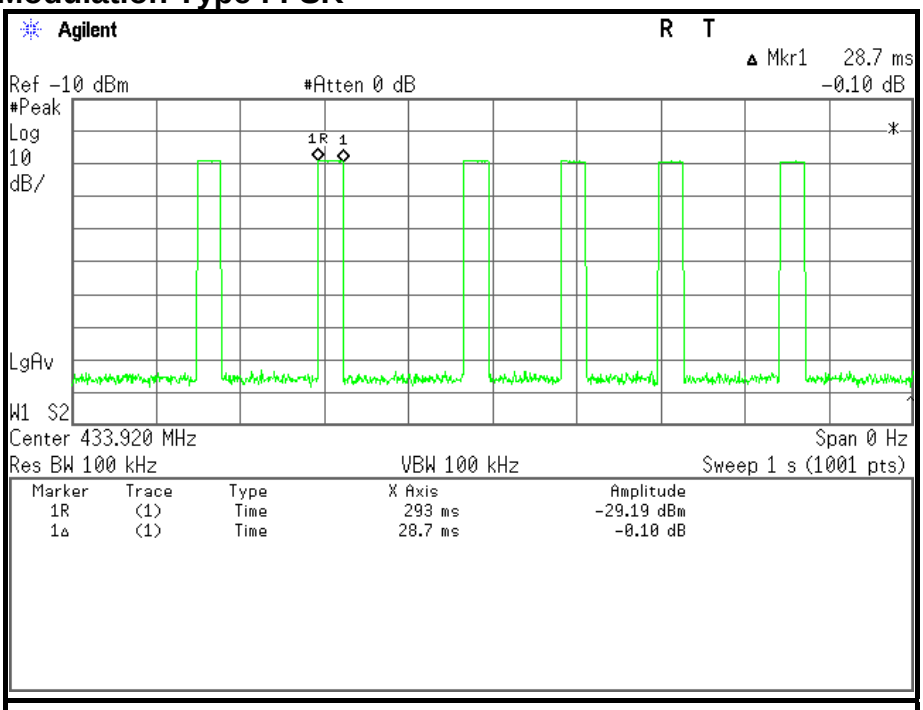
Times = Silent Period ÷ Transmission Time = 16.38 (s) ÷ 0.1722 (s) = 95

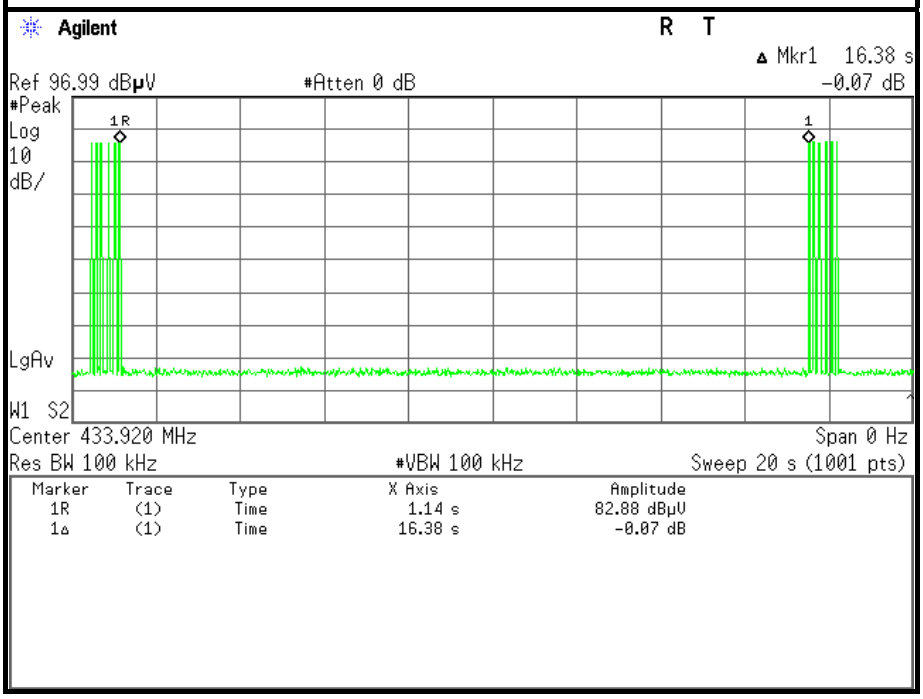
## Modulation Type : ASK



## Modulation Type : FSK



## 7.3 DUTY CYCLE CORRECTION FACTOR

**LIMITS**

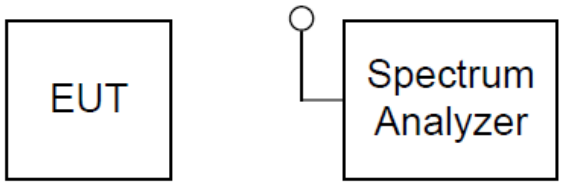
Nil (No dedicated limit specified in the Rules).

**TEST EQUIPMENT**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4446A | MY43360132 | 06/06/2018 |
| Test S/W | N/A | | | |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

**TEST SETUP**




**TEST PROCEDURE**

1. Place the EUT on the table and set it in transmitting mode.
2. The spectrum analyzer connected to RF antenna.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100 kHz, Span = 0Hz.
5. Repeat above procedures until all frequency measured were complete.

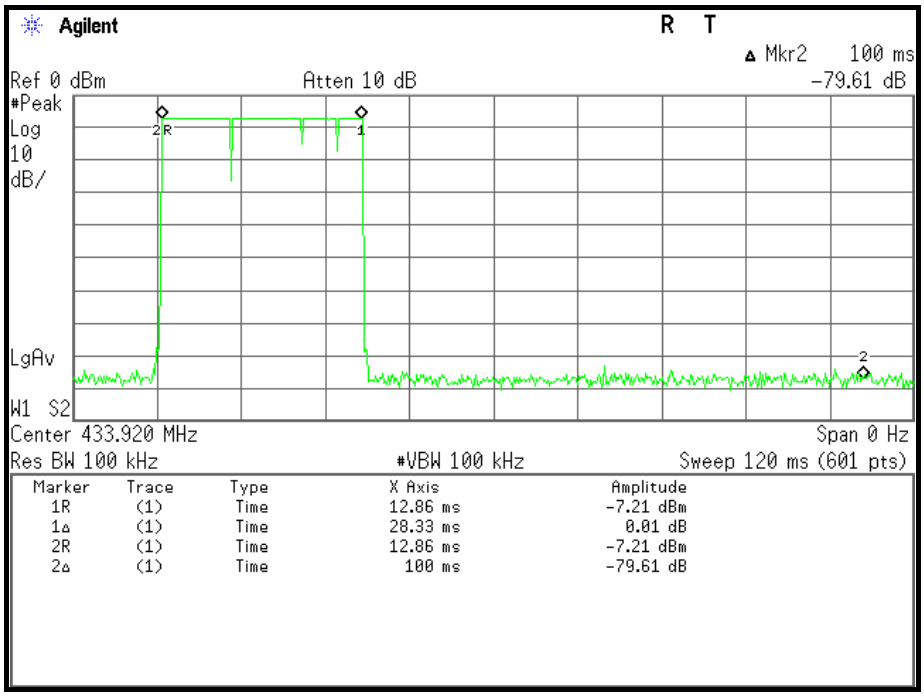
## TEST RESULTS

ASK

Tp = 100ms

Ton = 28.33 (ms)

Duty Cycle Correction Factor= 20 × log (Ton / Tp) = 20 × log (28.33/100) = -10.96 dB

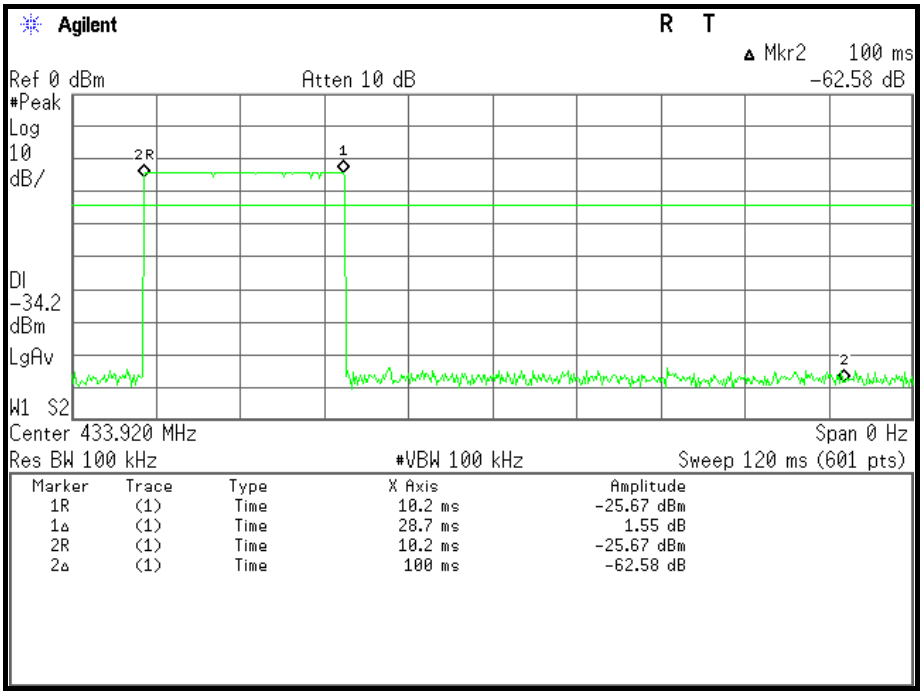


FSK

Tp = 100ms

Ton = 28.70 (ms)

Duty Cycle Correction Factor= 20 × log (Ton / Tp) = 20 × log (28.70/100) = -10.84 dB



## 7.4 RADIATED EMISSION

**LIMITS**

(1) According to § 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| [1]0.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 37.5 - 38.25 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1660 -1710 | 10.6 -12.7 |
| 6.26775 - 6.26825 | 108 -121.94 | 1718.8 - 1722.2 | 13.25 -13.4 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 – 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2310 - 2390 | 15.35 -16.2 |
| 8.362 - 8.366 | 156.52475 - 156.52525 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.17 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345.8 - 3338 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 322 -335.4 | 3600 - 4400 | ([2]) |
| 13.36 - 13.41 | | | |

***Remark:***
*1. [1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.*
*2. [2] Above 38.6*

(2) According to § 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown is Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(3) According to §15.231(b), In addition to the provisions of Section 15.205, 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 ** | 50 to 150 ** |
| 174 – 260 | 1500 | 150 |
| 260 – 470 | 1500 to 5000 ** | 150 to 500 ** |
| Above 470 | 5000 | 500 |

***Remark:*** *** linear interpolations*

(4) According to § 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

| Frequency (MHz) | Field Strength (microvolts/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 |

***Remark:*** ***Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

(5) According to § 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

## TEST EQUIPMENT

**Radiated Emission / 966Chamber_B**

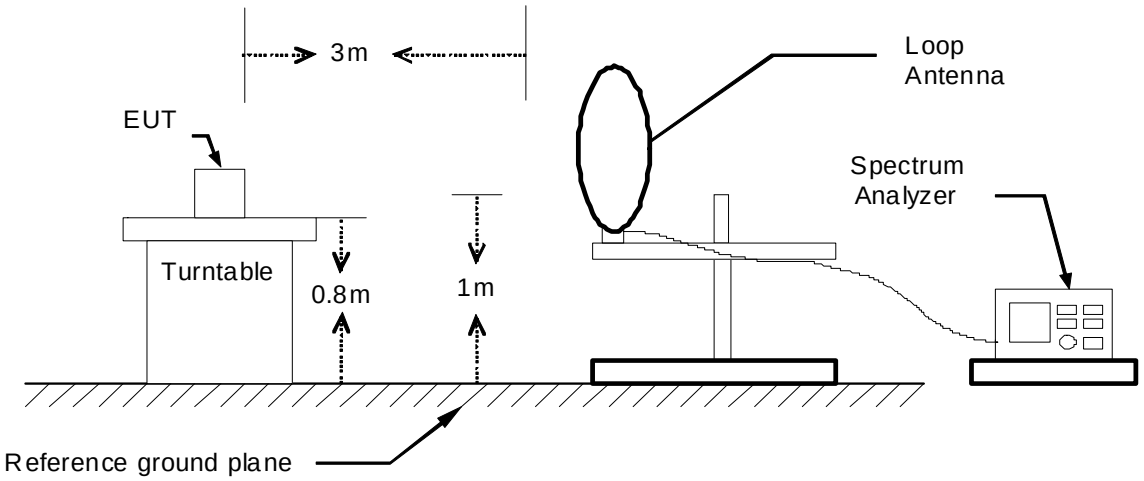
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| Spectrum Analyzer | Agilent | E4446A | MY46180323 | 03/16/2018 |
| EMI Test Receiver | Rohde & Schwarz | ESCI | 101131 | 03/09/2018 |
| Bi-log Antenna | TESEQ | CBL 6112D | 35403 | 07/02/2017 |
| Broad-Band Horn Antenna | Schwarzbeck | BBHA 9120 D | 9120D-778 | 07/14/2017 |
| Double-Ridged Waveguide Horn | ETS-LINDGREN | 3117 | 00078733 | 11/16/2017 |
| Horn Antenna | COM-POWER | AH-840 | 03077 | 12/01/2017 |
| Pre-Amplifier | Agilent | 8447D | 2944A10052 | 07/12/2017 |
| Pre-Amplifier | Agilent | 8449B | 3008A01916 | 07/12/2017 |
| LOOP Antenna | COM-POWER | AL-130 | 121060 | 05/14/2018 |
| Test S/W | E3.815206a | | | |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

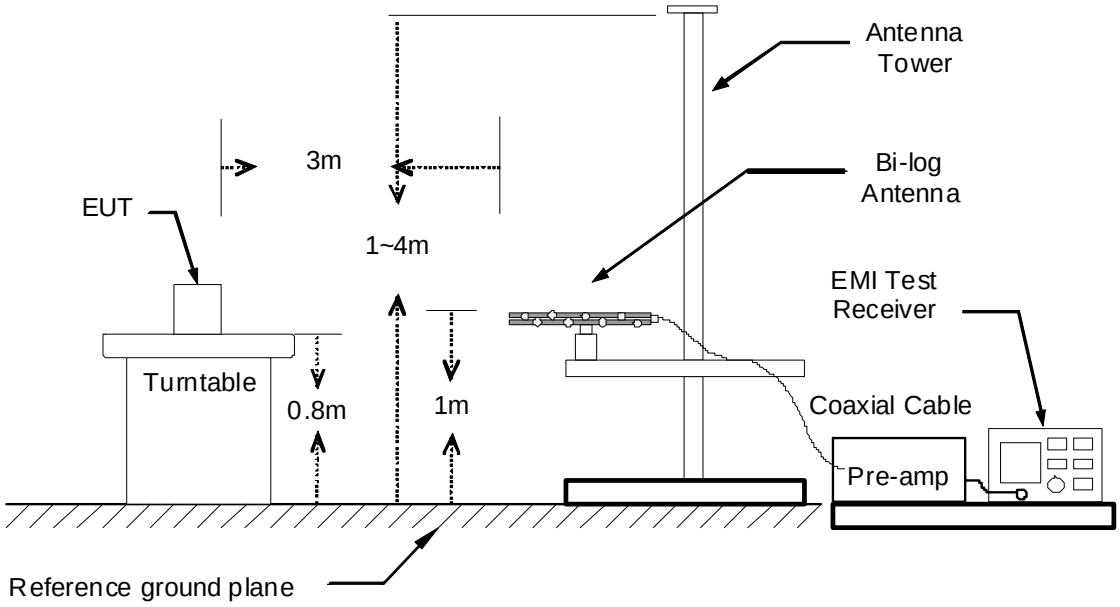
## TEST SETUP

The diagram below shows the test setup that is utilized to make the measurements for emission from below 1GHz.

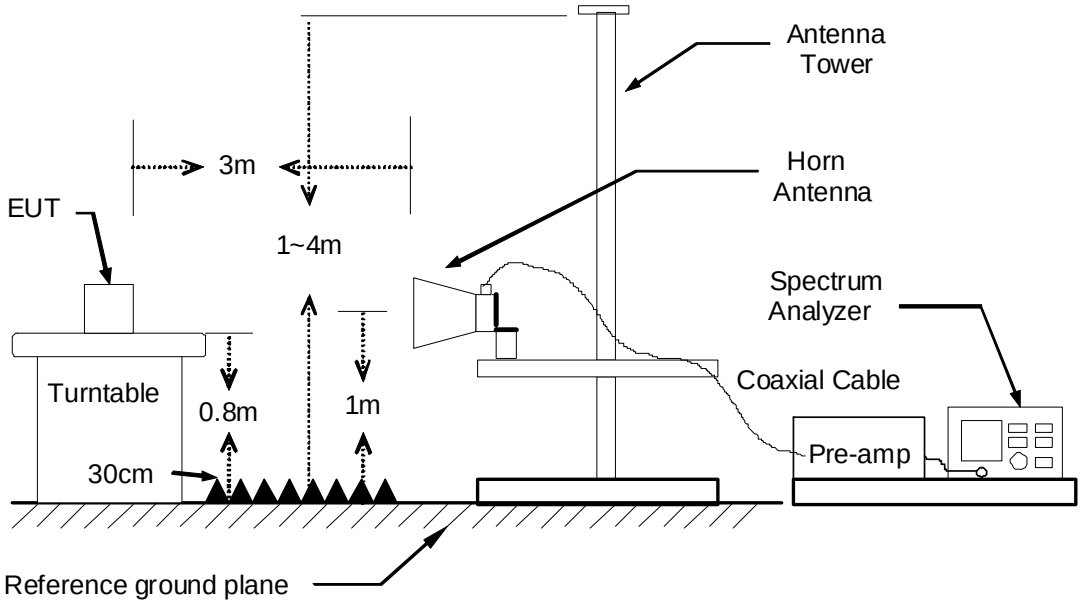
**9kHz ~ 30MHz**



**30MHz ~ 1GHz**




The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.



**TEST PROCEDURE**

1. The EUT was placed on the top of a rotating table 0.8 and 1.5 meters above the ground. The table was rotated 360 degrees to determine the position of the highest radiation.
2. While measuring the radiated emission below 1GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. While measuring the radiated emission above 1GHz, the EUT was set 3 meters away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

***Remark：***

*1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.*
*2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.*
*3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.*

## TEST RESULTS

### Below 1 GHz (9kHz ~ 30MHz)

No emission found between lowest internal used/generated frequency to 30MHz.

### Below 1 GHz (30MHz ~ 1GHz)

| Product Name | Uni TPMS Sensor | Test By | Waternil Guan |
|---|---|---|---|
| Test Model | VS-62U009 | Test Date | 2017/06/27 |
| Test Mode | Mode 1 | Temp. & Humidity | 25°C, 50% |

**966Chamber_B at 3Meter / Horizontal**

| Freq. MHz | Reading dBuV | C.F. dB/m | duty cycle dB | Result dBuV/m | Limit dBuV/m | Margin dB | Azimuth deg | Height cm | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 123.12 | 34.37 | -10.75 | | 23.62 | 43.50 | -19.88 | 146 | 300 | Peak |
| 278.32 | 35.35 | -8.65 | | 26.70 | 46.00 | -19.30 | 64 | 100 | Peak |
| 410.24 | 34.19 | -5.74 | | 28.45 | 46.00 | -17.55 | 50 | 300 | Peak |
| 433.92 | 69.38 | -5.51 | 10 | 63.87 | 72.87 | -9.00 | 100 | 100 | Average |
| 433.92 | 79.38 | -5.51 | | 73.87 | 92.87 | -19.00 | 100 | 100 | Peak |
| 484.93 | 34.08 | -4.83 | | 29.25 | 46.00 | -16.75 | 277 | 100 | Peak |
| 646.92 | 35.65 | -2.86 | | 32.79 | 46.00 | -13.21 | 219 | 200 | Peak |
| 730.34 | 35.56 | -2.29 | | 33.27 | 46.00 | -12.73 | 339 | 200 | Peak |
| 868.08 | 40.13 | -0.48 | | 39.65 | 46.00 | -6.35 | 73 | 100 | Peak |

**966Chamber_B at 3Meter / Vertical**

| Freq. MHz | Reading dBuV | C.F. dB/m | duty cycle dB | Result dBuV/m | Limit dBuV/m | Margin dB | Azimuth deg | Height cm | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 50.37 | 38.85 | -15.50 | | 23.35 | 40.00 | -16.65 | 360 | 400 | Peak |
| 133.79 | 35.45 | -11.10 | | 24.35 | 43.50 | -19.15 | 100 | 200 | Peak |
| 410.24 | 33.98 | -5.74 | | 28.24 | 46.00 | -17.76 | 214 | 100 | Peak |
| 433.92 | 76.10 | -5.51 | 10 | 70.59 | 72.87 | -2.28 | 332 | 100 | Average |
| 433.92 | 86.10 | -5.51 | | 80.59 | 92.87 | -12.28 | 332 | 100 | Peak |
| 484.93 | 33.93 | -4.83 | | 29.10 | 46.00 | -16.90 | 152 | 400 | Peak |
| 682.81 | 35.45 | -2.74 | | 32.71 | 46.00 | -13.29 | 24 | 200 | Peak |
| 803.09 | 35.17 | -1.27 | | 33.90 | 46.00 | -12.10 | 241 | 400 | Peak |
| 868.08 | 41.12 | -0.48 | | 40.64 | 46.00 | -5.36 | 247 | 200 | Peak |

***Remark:***

1. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit.*
2. *Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) – PreAmp.Gain (dB)*
3. *Result (dBuV/m) = Reading (dBuV) + Correction Factor (dB/m)*
4. *Margin (dB) = Remark result (dBuV/m) - Quasi-peak limit (dBuV/m).*
5. *For Fundamental & Harmonics: Result(AVG) = Result(PK) – Duty Cycle Correction Factor.*

| Product Name | Uni TPMS Sensor | Test By | Waternil Guan |
|---|---|---|---|
| Test Model | VS-62U009 | Test Date | 2017/06/27 |
| Test Mode | Mode 2 | Temp. & Humidity | 25°C, 50% |

**966Chamber_B at 3Meter / Horizontal**

| Freq. MHz | Reading dBuV | C.F. dB/m | duty cycle dB | Result dBuV/m | Limit dBuV/m | Margin dB | Azimuth deg | Height cm | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 127.97 | 34.52 | -10.84 | | 23.68 | 43.50 | -19.82 | 245 | 100 | Peak |
| 288.99 | 35.31 | -8.49 | | 26.82 | 46.00 | -19.18 | 274 | 400 | Peak |
| 410.24 | 34.09 | -5.74 | | 28.35 | 46.00 | -17.65 | 224 | 200 | Peak |
| 433.92 | 68.68 | -5.51 | 10 | 63.17 | 72.87 | -9.70 | 84 | 100 | Average |
| 433.92 | 78.68 | -5.51 | | 73.17 | 92.87 | -19.70 | 84 | 100 | Peak |
| 484.93 | 33.39 | -4.83 | | 28.56 | 46.00 | -17.44 | 306 | 200 | Peak |
| 606.18 | 36.44 | -3.29 | | 33.15 | 46.00 | -12.85 | 270 | 400 | Peak |
| 812.79 | 34.87 | -1.24 | | 33.63 | 46.00 | -12.37 | 211 | 200 | Peak |
| 868.08 | 41.50 | -0.48 | | 41.02 | 46.00 | -4.98 | 66 | 100 | Peak |

**966Chamber_B at 3Meter / Vertical**

| Freq. MHz | Reading dBuV | C.F. dB/m | duty cycle dB | Result dBuV/m | Limit dBuV/m | Margin dB | Azimuth deg | Height cm | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 122.15 | 34.94 | -10.74 | | 24.20 | 43.50 | -19.30 | 263 | 100 | Peak |
| 259.89 | 34.26 | -8.06 | | 26.20 | 46.00 | -19.80 | 218 | 100 | Peak |
| 359.80 | 34.92 | -6.94 | | 27.98 | 46.00 | -18.02 | 216 | 300 | Peak |
| 410.24 | 33.70 | -5.74 | | 27.96 | 46.00 | -18.04 | 328 | 400 | Peak |
| 433.92 | 74.41 | -5.51 | 10 | 68.90 | 72.87 | -3.97 | 305 | 100 | Average |
| 433.92 | 84.41 | -5.51 | | 78.90 | 92.87 | -13.97 | 305 | 100 | Peak |
| 484.93 | 33.75 | -4.83 | | 28.92 | 46.00 | -17.08 | 56 | 200 | Peak |
| 868.08 | 42.83 | -0.48 | | 42.35 | 46.00 | -3.65 | 193 | 200 | Peak |
| 925.31 | 35.68 | 0.10 | | 35.78 | 46.00 | -10.22 | 287 | 100 | Peak |

***Remark:***

1. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit.*
2. *Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) – PreAmp.Gain (dB)*
3. *Result (dBuV/m) = Reading (dBuV) + Correction Factor (dB/m)*
4. *Margin (dB) = Remark result (dBuV/m) - Quasi-peak limit (dBuV/m).*
5. *For Fundamental & Harmonics: Result(AVG) = Result(PK) – Duty Cycle Correction Factor.*

**Above 1 GHz**

| Product Name | Uni TPMS Sensor | Test By | Waternil Guan |
|---|---|---|---|
| Test Model | VS-62U009 | Test Date | 2017/06/27 |
| Test Mode | Mode 1 | Temp. & Humidity | 25°C, 50% |

**966Chamber_B at 3Meter / Horizontal**

| Freq. MHz | Reading dBuV | C.F. dB/m | duty cycle dB | Result dBuV/m | Limit dBuV/m | Margin dB | Azimuth deg | Height cm | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 2605.00 | 42.77 | -1.89 | | 40.88 | 74.00 | -33.12 | 106 | 200 | Peak |
| 3035.00 | 42.99 | -0.66 | | 42.33 | 74.00 | -31.67 | 110 | 150 | Peak |
| 3470.00 | 42.08 | 0.50 | 10 | 42.58 | 54.00 | -11.42 | 124 | 150 | Average |
| 3470.00 | 52.08 | 0.50 | | 52.58 | 74.00 | -21.42 | 124 | 150 | Peak |
| 3905.00 | 42.96 | 2.20 | | 45.16 | 74.00 | -28.84 | 116 | 100 | Peak |
| 4340.00 | 39.93 | 3.82 | | 43.75 | 74.00 | -30.25 | 61 | 200 | Peak |
| 5795.00 | 38.38 | 7.40 | | 45.78 | 74.00 | -28.22 | 9 | 100 | Peak |

**966Chamber_B at 3Meter / Vertical**

| Freq. MHz | Reading dBuV | C.F. dB/m | duty cycle dB | Result dBuV/m | Limit dBuV/m | Margin dB | Azimuth deg | Height cm | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1300.00 | 50.36 | -7.38 | | 42.98 | 74.00 | -31.02 | 215 | 100 | Peak |
| 2605.00 | 43.54 | -1.89 | | 41.65 | 74.00 | -32.35 | 183 | 100 | Peak |
| 3035.00 | 45.94 | -0.66 | | 45.28 | 74.00 | -28.72 | 5 | 200 | Peak |
| 3470.00 | 46.74 | 0.50 | 10 | 47.24 | 54.00 | -6.76 | 146 | 100 | Average |
| 3470.00 | 56.74 | 0.50 | | 57.24 | 74.00 | -16.76 | 146 | 100 | Peak |
| 3905.00 | 48.03 | 2.20 | | 50.23 | 74.00 | -23.77 | 139 | 100 | Peak |
| 4340.00 | 45.83 | 3.82 | | 49.65 | 74.00 | -24.35 | 68 | 150 | Peak |

***Remark:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
4. *Result = Reading + Correction Factor*
   *Margin = Result – Limit*
   *Remark Peak = Result(PK) – Limit(PK)*
   *Remark AVG = Result(AV) – Limit(AV)*
5. *For Fundamental & Harmonics: Result(AVG) = Result(PK) – Duty Cycle Correction Factor.*

| Product Name | Uni TPMS Sensor | Test By | Waternil Guan |
|---|---|---|---|
| Test Model | VS-62U009 | Test Date | 2017/06/27 |
| Test Mode | Mode 2 | Temp. & Humidity | 25°C, 50% |

**966Chamber_B at 3Meter / Horizontal**

| Freq. MHz | Reading dBuV | C.F. dB/m | duty cycle dB | Result dBuV/m | Limit dBuV/m | Margin dB | Azimuth deg | Height cm | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 2605.00 | 44.21 | -1.89 | | 42.32 | 74.00 | -31.68 | 249 | 100 | Peak |
| 3035.00 | 42.45 | -0.66 | | 41.79 | 74.00 | -32.21 | 278 | 200 | Peak |
| 3470.00 | 43.33 | 0.50 | 10 | 43.83 | 54.00 | -10.17 | 280 | 200 | Average |
| 3470.00 | 53.33 | 0.50 | | 53.83 | 74.00 | -20.17 | 280 | 200 | Peak |
| 3905.00 | 45.81 | 2.20 | | 48.01 | 74.00 | -25.99 | 284 | 200 | Peak |
| 4340.00 | 41.22 | 3.82 | | 45.04 | 74.00 | -28.96 | 260 | 200 | Peak |
| 4720.00 | 38.98 | 4.97 | | 43.95 | 74.00 | -30.05 | 358 | 200 | Peak |

**966Chamber_B at 3Meter / Vertical**

| Freq. MHz | Reading dBuV | C.F. dB/m | duty cycle dB | Result dBuV/m | Limit dBuV/m | Margin dB | Azimuth deg | Height cm | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1300.00 | 50.65 | -7.38 | | 43.27 | 74.00 | -30.73 | 85 | 150 | Peak |
| 2605.00 | 44.73 | -1.89 | | 42.84 | 74.00 | -31.16 | 346 | 150 | Peak |
| 3035.00 | 43.81 | -0.66 | | 43.15 | 74.00 | -30.85 | 173 | 150 | Peak |
| 3470.00 | 47.56 | 0.50 | 10 | 48.06 | 54.00 | -5.94 | 318 | 100 | Average |
| 3470.00 | 57.56 | 0.50 | | 58.06 | 74.00 | -15.94 | 318 | 100 | Peak |
| 3905.00 | 48.58 | 2.20 | | 50.78 | 74.00 | -23.22 | 319 | 150 | Peak |
| 4340.00 | 44.04 | 3.82 | | 47.86 | 74.00 | -26.14 | 283 | 150 | Peak |

***Remark:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Average test would be performed if the peak result were greater than the average limit.*
3. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
4. *Result = Reading + Correction Factor*
   *Margin = Result – Limit*
   *Remark Peak = Result(PK) – Limit(PK)*
   *Remark AVG = Result(AV) – Limit(AV)*
5. *For Fundamental & Harmonics: Result(AVG) = Result(PK) – Duty Cycle Correction Factor.*

## 7.5 CONDUCTED EMISSION

**LIMITS**

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

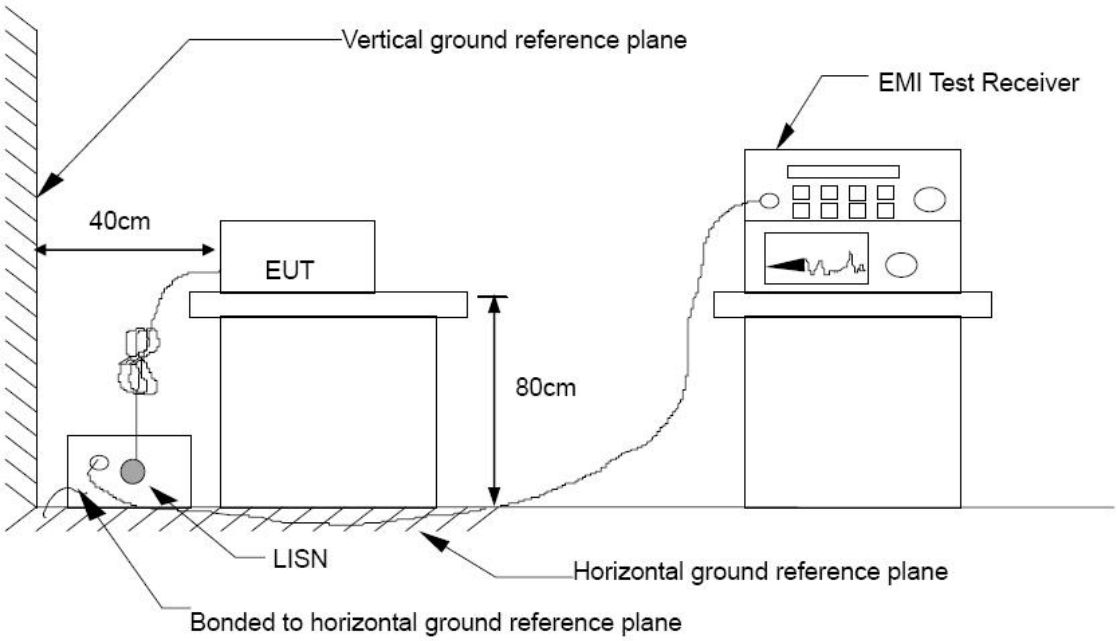
| Frequency Range (MHz) | Conducted Limit (dBμv) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 - 0.50 | 66 to 56 | 56 to 46 |
| 0.50 - 5.00 | 56 | 46 |
| 5.00 - 30.0 | 60 | 50 |

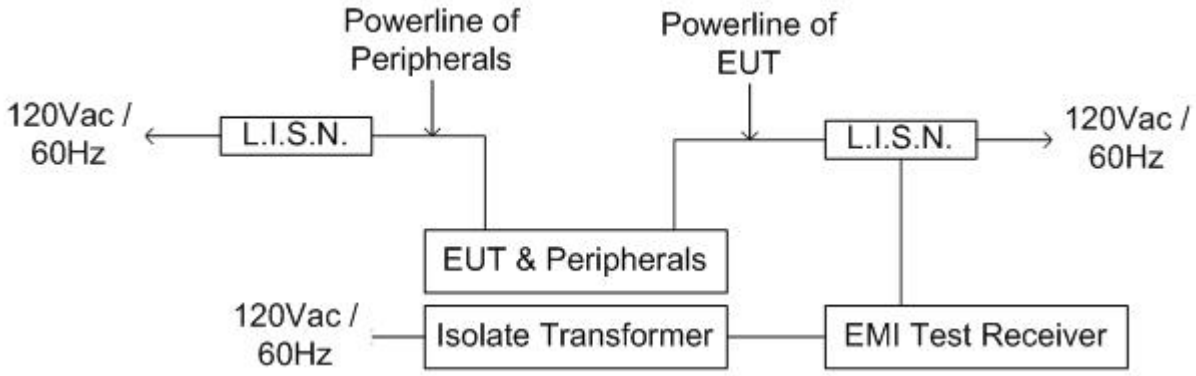
**TEST EQUIPMENT**

| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due |
|---|---|---|---|---|
| L.I.S.N | Schwarzbeck | NSLK 8127 | 8127 465 | 07/28/2017 |
| L.I.S.N | Schwarzbeck | NSLK 8127 | 8127 473 | 03/12/2018 |
| EMI Test Receiver | Rohde & Schwarz | ESHS 30 | 838550/003 | 10/25/2017 |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100111 | 06/27/2017 |
| Test S/W | E3.815206a | | | |

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

## TEST SETUP



## TEST PROCEDURE

The basic test procedure was in accordance with ANSI C63.10:2013.

The test procedure is performed in a 4m × 3m × 2.4m (L×W×H) shielded room.

The EUT along with its peripherals were placed on a 1.0m (W) × 1.5m (L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.

The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.

The EUT was located so that the distance between the boundary of the EUT and the closest surface of the LISN is 0.8 m. Where a mains flexible cord was provided by the manufacturer shall be 1 m long, or if in excess of 1 m, the excess cable was folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

## TEST RESULTS

Since the EUT is powered by battery powered, this test item is not applicable.