



**FCC 47 CFR PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 8**

**CERTIFICATION TEST REPORT**

**FOR**

**Urban Active Vehicle Module**

**MODEL NUMBER: 561077**

**FCC ID: 2AJFG561077  
IC: 21819-561077**

**REPORT NUMBER: 11385860C**

**ISSUE DATE: December 1, 2016**

*Prepared for*  
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NVLAP Lab code: 100414-0

Revision History

| Rev. | Issue<br>Date       | Revisions         | Revised By  |
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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Vast Production Services  
307 Robbins Drive  
Troy, MI, 48083

**EUT DESCRIPTION:** Urban Active Vehicle Module

**MODEL:** 561077

**SERIAL NUMBER:** 0059752

**DATE TESTED:** August 8 – September 29, 2016

| APPLICABLE STANDARDS                       |              |
|--------------------------------------------|--------------|
| STANDARD                                   | TEST RESULTS |
| CFR 47 Part 15 Subpart C                   | Pass         |
| INDUSTRY CANADA RSS-210 Issue 8 Annex A1.1 | Pass         |
| INDUSTRY CANADA RSS-GEN Issue 4            | Pass         |

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For  
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## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-210 Issue 8.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 333 Pfingsten Road, Northbrook, IL 60062 USA.

UL NBK is accredited by NVLAP, Laboratory Code 100414-0. The full scope of accreditation can be viewed at <http://ts.nist.gov>

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Sample Calculations

Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) - Gain (dB) + Cable Loss (dB)

Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)

Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Test                | Range       | Equipment         | Uncertainty k=2 |
|---------------------|-------------|-------------------|-----------------|
| Conducted Emissions | 150k-30MHz  | LISN              | 3.65dB          |
| Radiated Emissions  | 9k-30MHz    | H-Field Loop      | 3.15dB          |
| Radiated Emissions  | 30-200MHz   | Bicon 3m Horz     | 3.64dB          |
| Radiated Emissions  | 30-200MHz   | Bicon 3m Vert     | 5.10dB          |
| Radiated Emissions  | 200-1000MHz | LogP 3m Horz      | 4.00dB          |
| Radiated Emissions  | 200-1000MHz | LogP 3m Vert      | 5.36dB          |
| Radiated Emissions  | 30-200MHz   | Bicon 10m Horz    | 4.48dB          |
| Radiated Emissions  | 30-200MHz   | Bicon 10m Vert    | 4.49dB          |
| Radiated Emissions  | 200-1000MHz | LogP 10m Horz     | 3.79dB          |
| Radiated Emissions  | 200-1000MHz | LogP 10m Vert     | 3.84dB          |
| Radiated Emissions  | 1-18GHz     | Horn              | 4.32dB          |
| Conducted Ant Port  | 30MHz-26GHz | Spectrum Analyzer | 2.94dB          |

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a 433.92MHz periodic transmitter. It is powered by a DC vehicle battery. The transmitter is used for electronic access and authorization system of a vehicle. The radio wave signals of ASK and FSK are not transmitted simultaneously. The key fob transmits radio wave signals of ASK and FSK modulations. Either one of ASK or FSK are transmitted by operator's actions. End user cannot control which of ASK and FSK modulation are to be transmitted. The device is manufactured by Vast Production Services

### 5.2. MAXIMUM OUTPUT E-FIELD STRENGTH

The transmitter has a maximum output peak E-field as follows:

| Frequency Range<br>(MHz) | Mode     | Output AV E-field Strength<br>(dBuV/m) |
|--------------------------|----------|----------------------------------------|
| 433.92                   | TX - ASK | 77.21                                  |
| 433.92                   | TX - FSK | 70.78                                  |

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB trace antenna.

### 5.4. WORST-CASE CONFIGURATION AND MODE

The EUT was set in worst axis as found in preliminary testing. The Z-axis was determined to be the worst axis.

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List                                                                                            |                   |              |           |               |             |
|-------------------------------------------------------------------------------------------------------------------|-------------------|--------------|-----------|---------------|-------------|
| Use                                                                                                               | Description       | Manufacturer | Model     | Serial Number | FCC ID      |
| EUT                                                                                                               | CAN/LIN Interface | Vector       | VN1630A   | -             | -           |
| SIM                                                                                                               | Laptop            | DELL         | E6410     | 82563381124   | -           |
| SIM                                                                                                               | Power Supply      | Leader       | LPS-164A  | 9070286       | -           |
| SIM                                                                                                               | Tablet            | Samsung      | SM-T560NU | RS2H60LF76W   | A3LSMT560NU |
| Note: EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test) |                   |              |           |               |             |

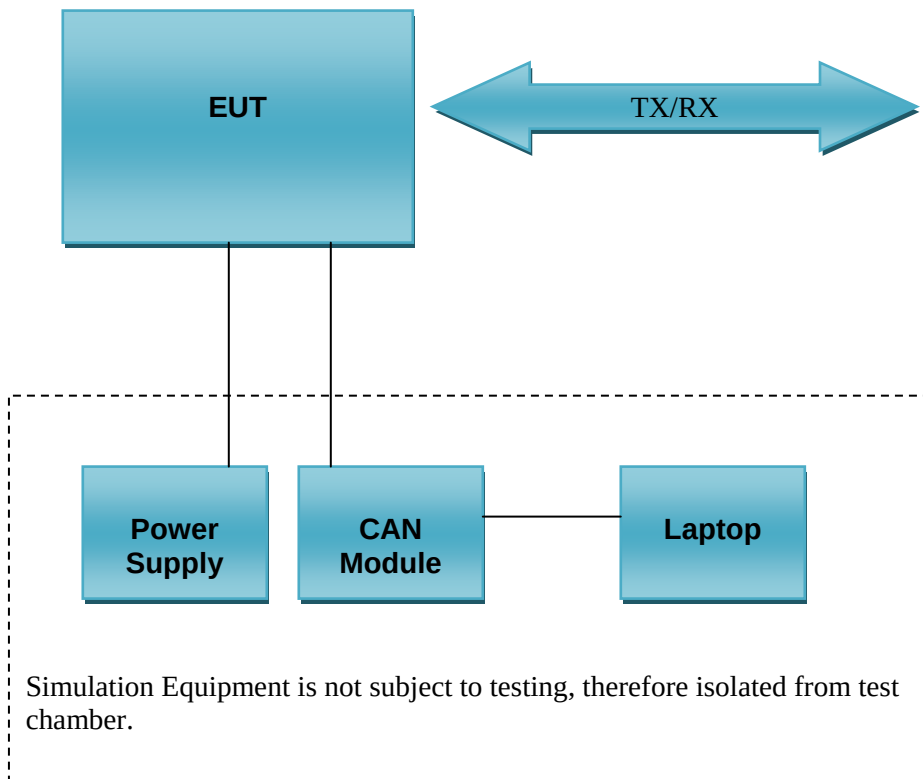
### I/O CABLES

| I/O Cable List |           |                      |                |            |                  |                                                    |
|----------------|-----------|----------------------|----------------|------------|------------------|----------------------------------------------------|
| Cable No       | Port      | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks                                            |
| 0              | Enclosure | -                    | Non-Electrical | -          | -                | None                                               |
| 1              | DC        | 2                    | Wire           | DC         | <3m              | None                                               |
| 2              | CAN       | 1                    | Wire           | I/O        | <3m              | None                                               |
| 3              | USB       | 1                    | Wire           | I/O        | <3m              | Service port only. Not accessible to the end user. |

### TEST SETUP

The EUT is programmed for continuous TX mode for Radiated and Bandwidth measurements. For timing tests, the EUT is programmed for manual TX operation. The EUT was programmed through the USB port. The USB port was left unpopulated during testing, since it is only used for factory programming and the USB port will remain inaccessible by the user after it is installed into the vehicle.

**SETUP DIAGRAM FOR TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Test Equipment List |                 |          |                    |            |            |
|---------------------|-----------------|----------|--------------------|------------|------------|
| Description         | Manufacturer    | Model    | T No.              | Cal Date   | Cal Due    |
| Radiated Software   | UL              | UL EMC   | Ver 9.5, Nov, 2015 |            |            |
| Signal Analyzer     | Agilent         | PXA      | EMC4360            | 1/8/2016   | 1/31/2017  |
| Test Receiver       | Rhode & Schwarz | ESCI     | EMC4328            | 11/18/2015 | 11/30/2016 |
| Log-P Antenna       | Chase           | UPA6109  | EMC4313            | 1/22/2016  | 1/31/2017  |
| Bicon Antenna       | Chase           | UPA6106A | EMC4078            | 12/28/2015 | 12/31/2016 |
| Antenna Array       | UL              | BOMS     | EMC4276            | 12/1/2015  | 12/31/2016 |
| Test Receiver       | Rhode & Schwarz | ESU      | EMC4323            | 1/2/2016   | 1/31/2017  |
| Loop Antenna        | EMCO            | 6502/1   | EMC4026            | 7/22/2016  | 7/31/2017  |

## 7. TEST RESULTS

### 7.1 Configuration Tx 433.92MHz Test Data

#### 7.1.1 Test Conditions and Results – Occupied Bandwidth

|                                                  |                                                                                                                                                                                                                                                                                   |                                       |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Test Description                                 | Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard. |                                       |
| Basic Standard                                   |                                                                                                                                                                                                                                                                                   | 47 CFR Part 15.231(c), RSS-210 A1.1.3 |
| Occupied Bandwidth Limits                        |                                                                                                                                                                                                                                                                                   |                                       |
| 0.25% of Center Frequency (433.92MHz: 1085.8kHz) |                                                                                                                                                                                                                                                                                   |                                       |

**Table 1 Occupied Bandwidth Configuration Settings**

| Power Interface Mode #          | EUT Configurations Mode # | EUT Operation Mode # |
|---------------------------------|---------------------------|----------------------|
| 1                               | 1                         | 1                    |
| Supplementary information: None |                           |                      |

**Table 2 Occupied Bandwidth Spectrum Analyzer Settings**

| Resolution Bandwidth            | Occupied Bandwidth Requirements |       |
|---------------------------------|---------------------------------|-------|
|                                 | dBc                             | % PWR |
| 15kHz                           | -20                             | 99    |
| Supplementary information: None |                                 |       |

**Table 3 Occupied Bandwidth Test Result Summary**

| Center Frequency | Modulation | 20dB BW Measured (kHz) | 99% BW Measured (kHz) |
|------------------|------------|------------------------|-----------------------|
| 433.92MHz        | ASK        | 86.23                  | 370.97                |
| 433.92MHz        | FSK        | 85.03                  | 89.921                |

Figure 1 – Bandwidth Graph 433.92MHz – 20dB (ASK modulation)

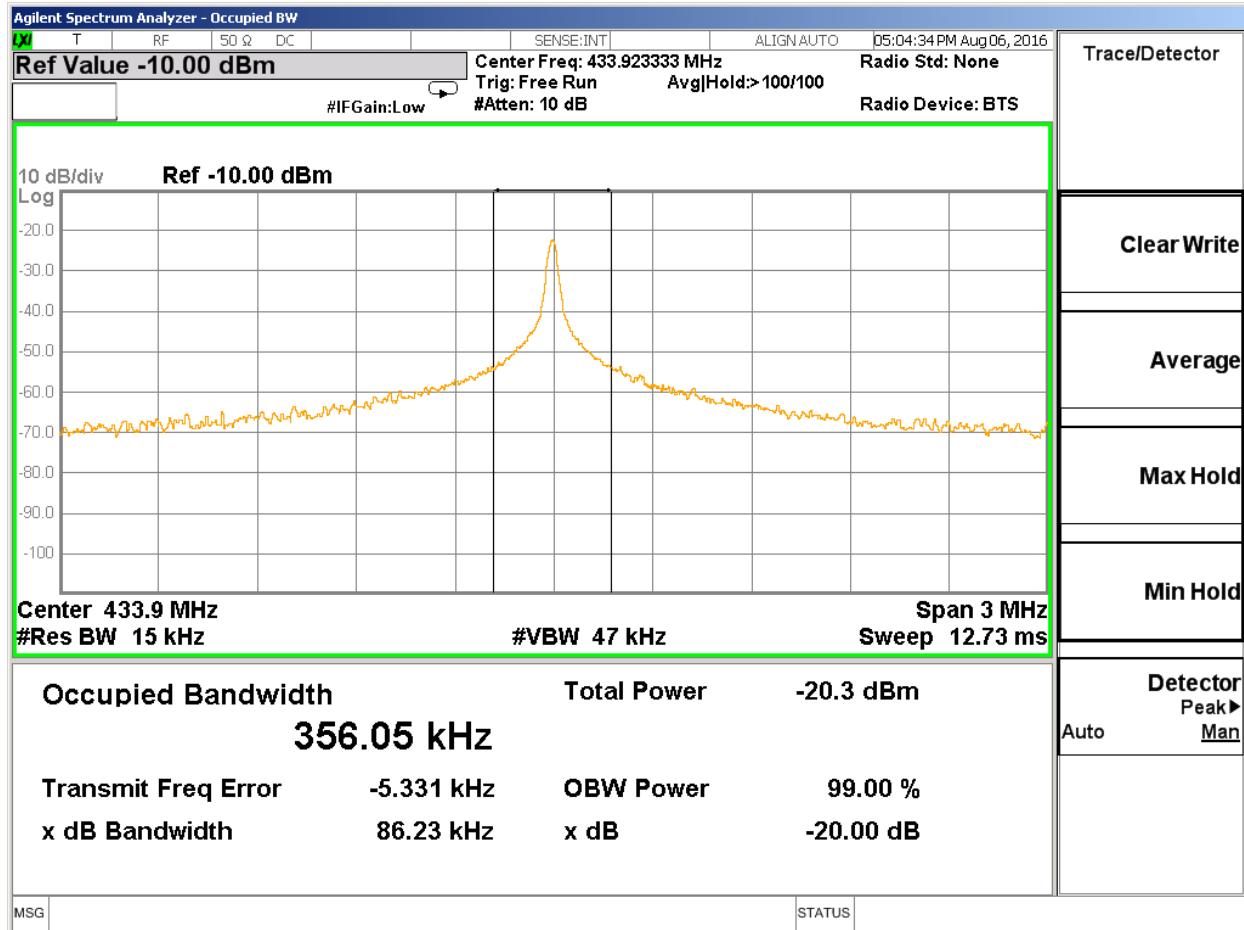


Figure 2 – Bandwidth Graph 433.92MHz – 20dB (FSK modulation)

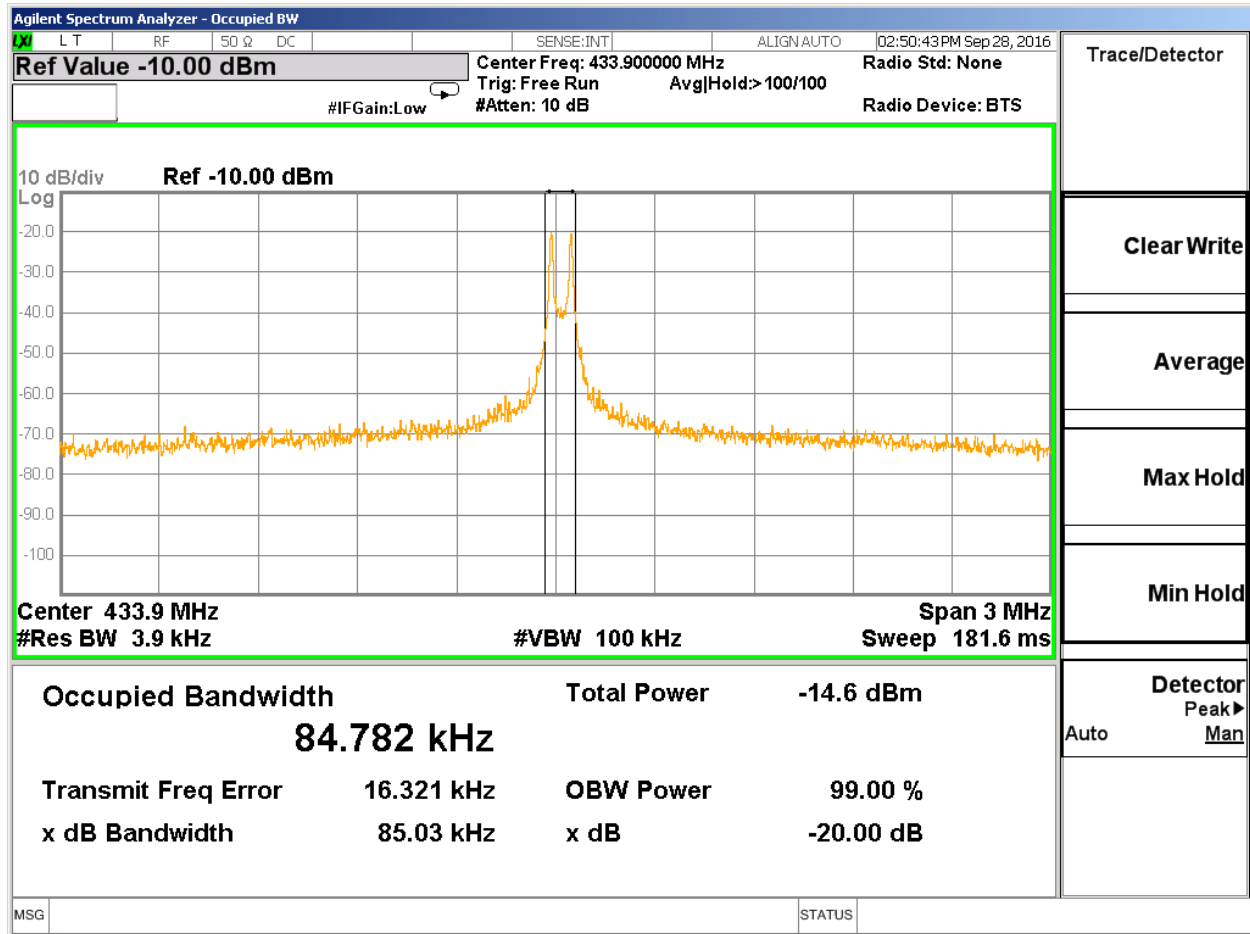


Figure 3 – Bandwidth Graph 433.92MHz – 99% (ASK modulation)

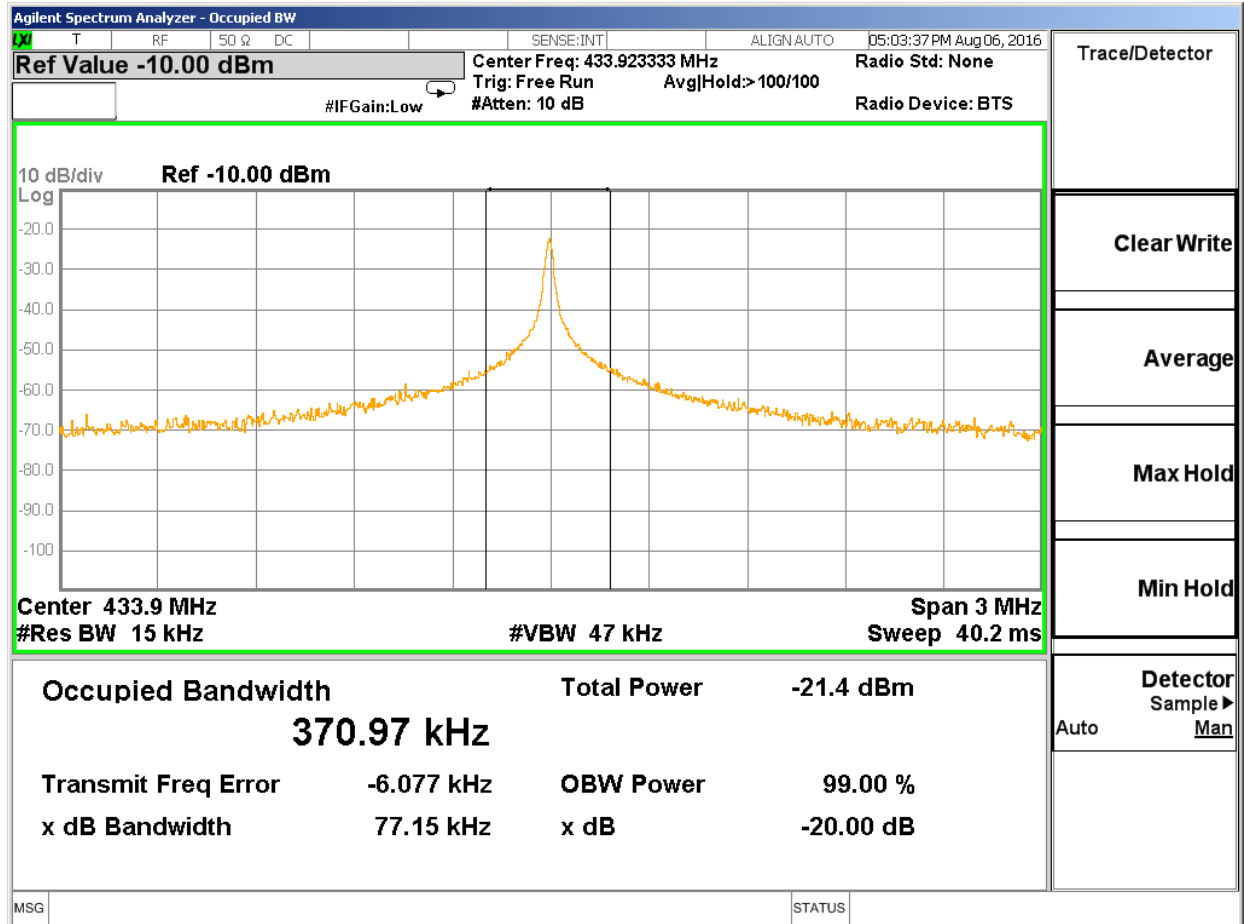
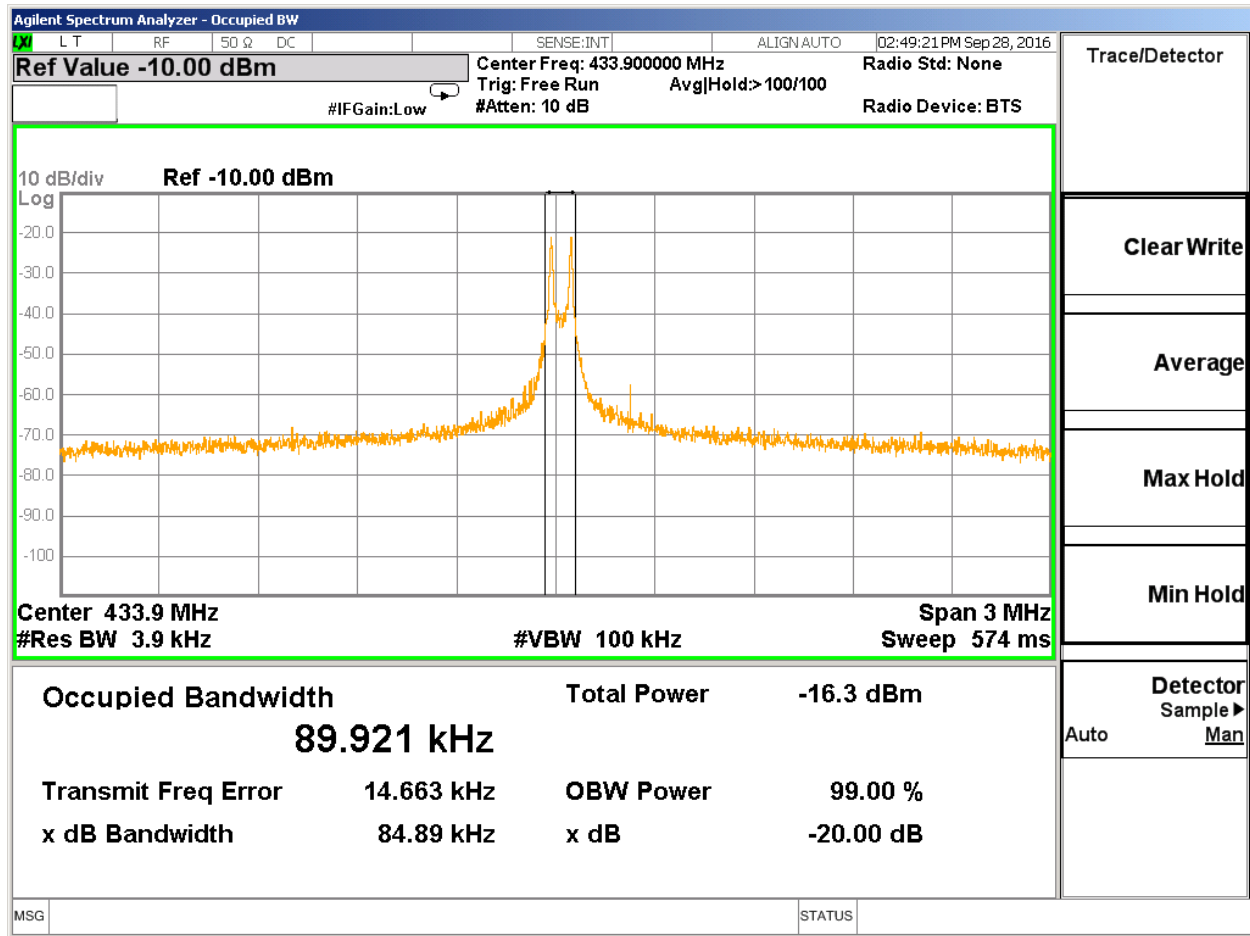


Figure 4 – Bandwidth Graph 433.92MHz – 99% (FSK modulation)



|                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Description                                                                                                                                                                   | Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency. |
| Basic Standard                                                                                                                                                                     | 47 CFR Part 15.231(a), RSS-210 Annex A1.1.1                                                                                                                                                                                                                                                                   |
| <b>Cease Operation Limits</b>                                                                                                                                                      |                                                                                                                                                                                                                                                                                                               |
| The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin. |                                                                                                                                                                                                                                                                                                               |

| Power Interface Mode #          | EUT Configurations Mode # | EUT Operation Mode # |
|---------------------------------|---------------------------|----------------------|
| 1                               | 1                         | 1                    |
| Supplementary information: None |                           |                      |

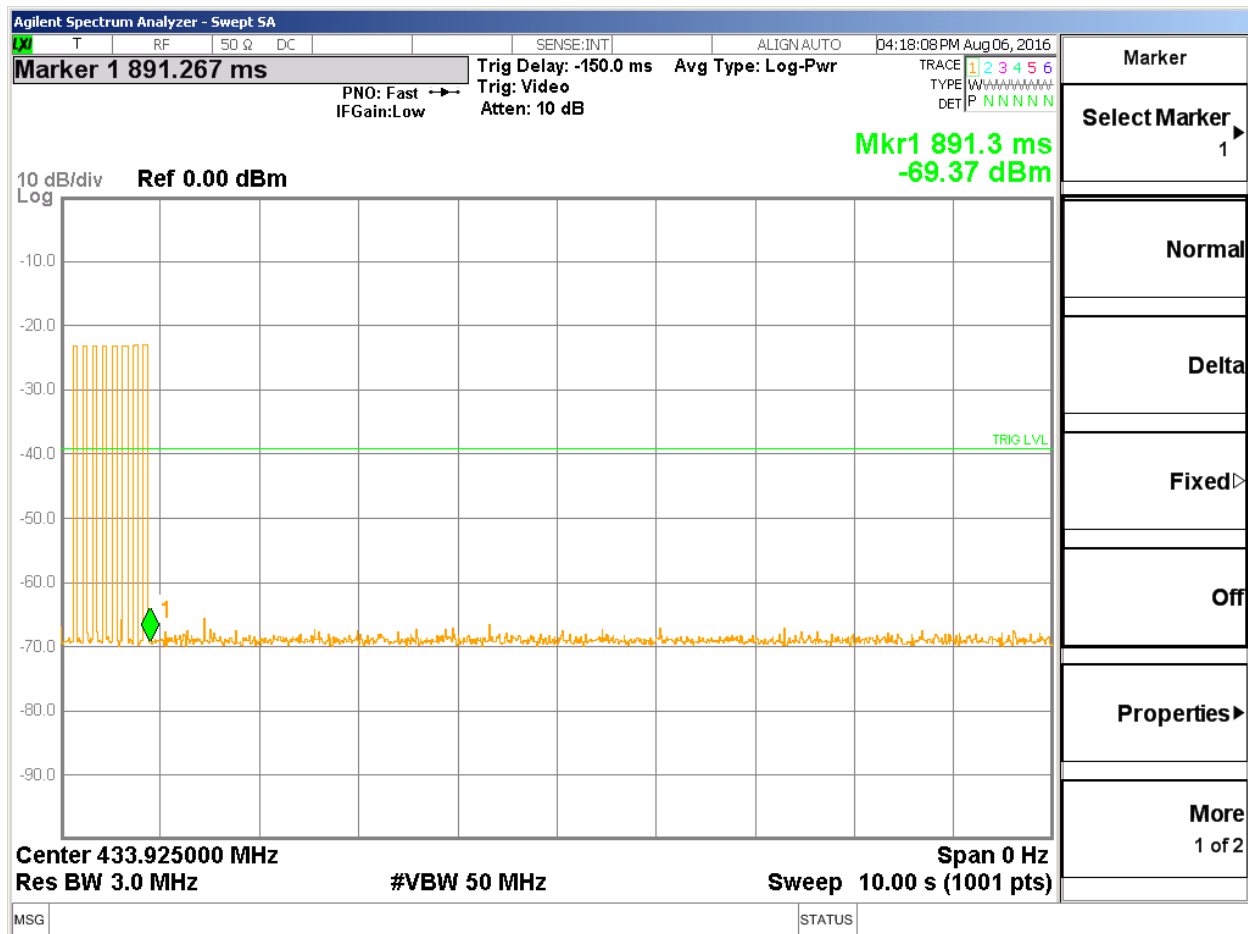
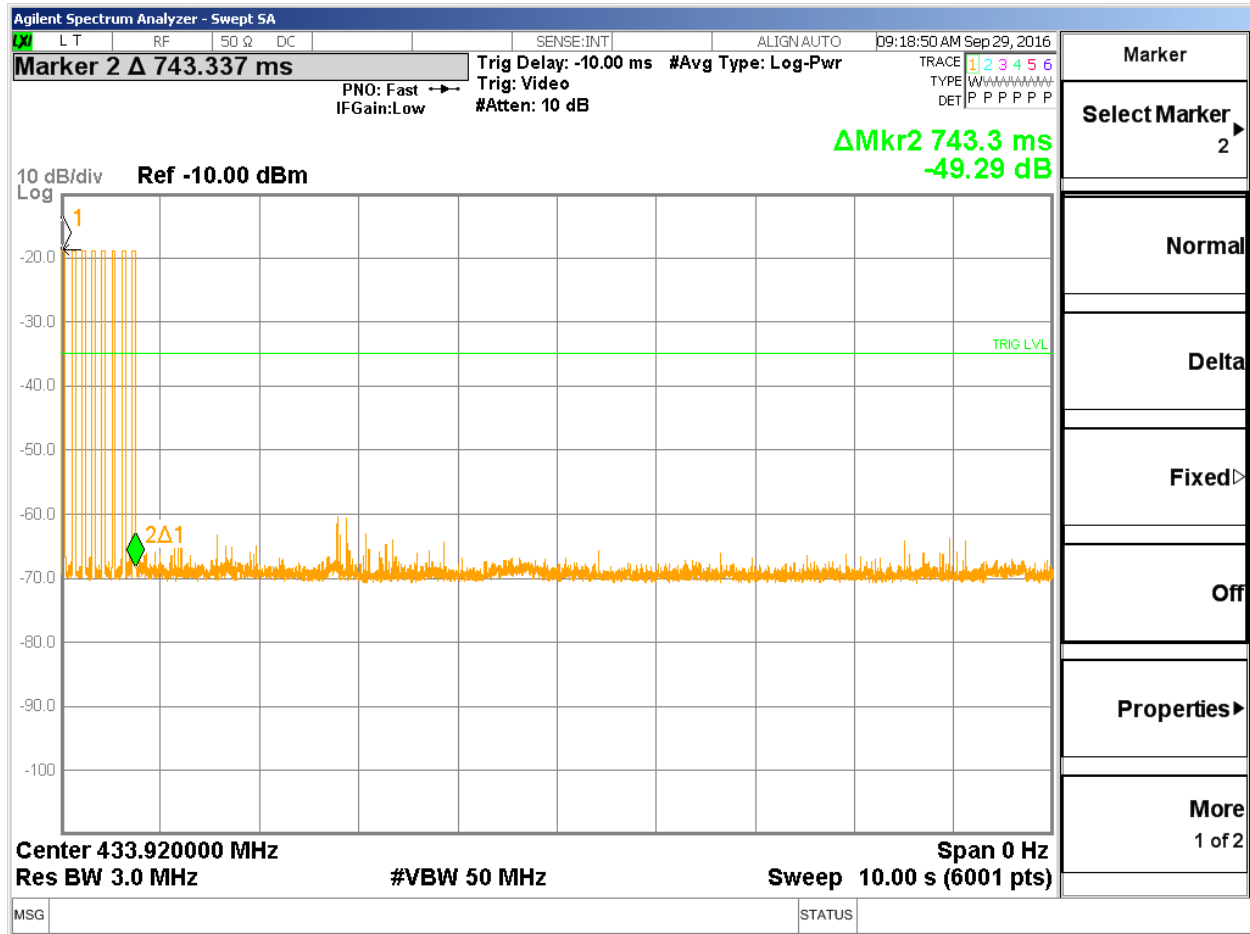


Figure 6 Cease Operation Graph 433.92MHz (FSK modulation)



### 7.1.3 Test Conditions and Results – Pulse Train

|                                                                                                                                                                    |                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Description                                                                                                                                                   | Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency. |
| Basic Standard                                                                                                                                                     | FCC Part 15 Subpart A 15.35, RSS-Gen 6.10                                                                                                                                                                                                                                       |
| <b>Pulse Train Limits</b>                                                                                                                                          |                                                                                                                                                                                                                                                                                 |
| There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results. |                                                                                                                                                                                                                                                                                 |

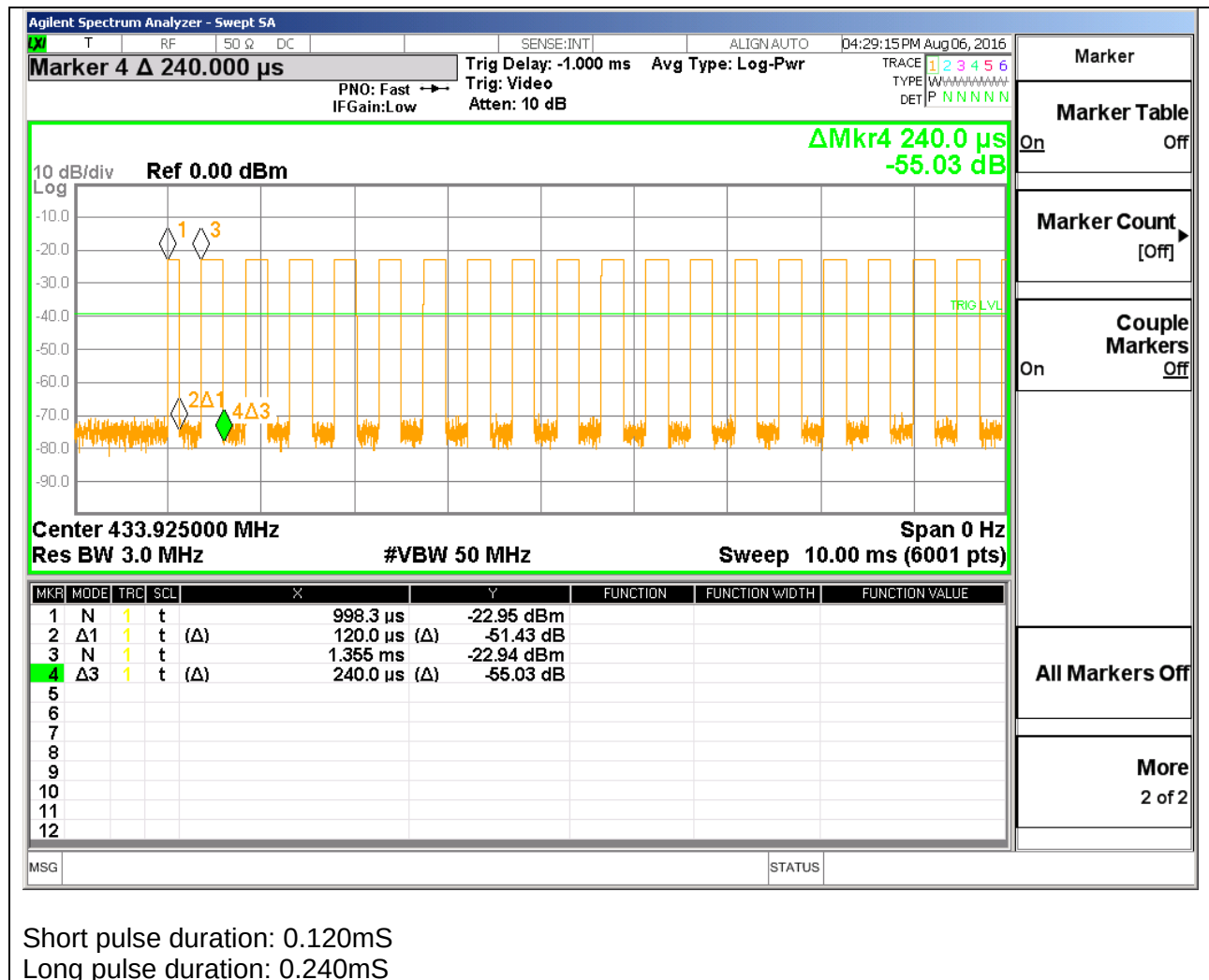
**Table 5 Pulse Train Configuration Settings**

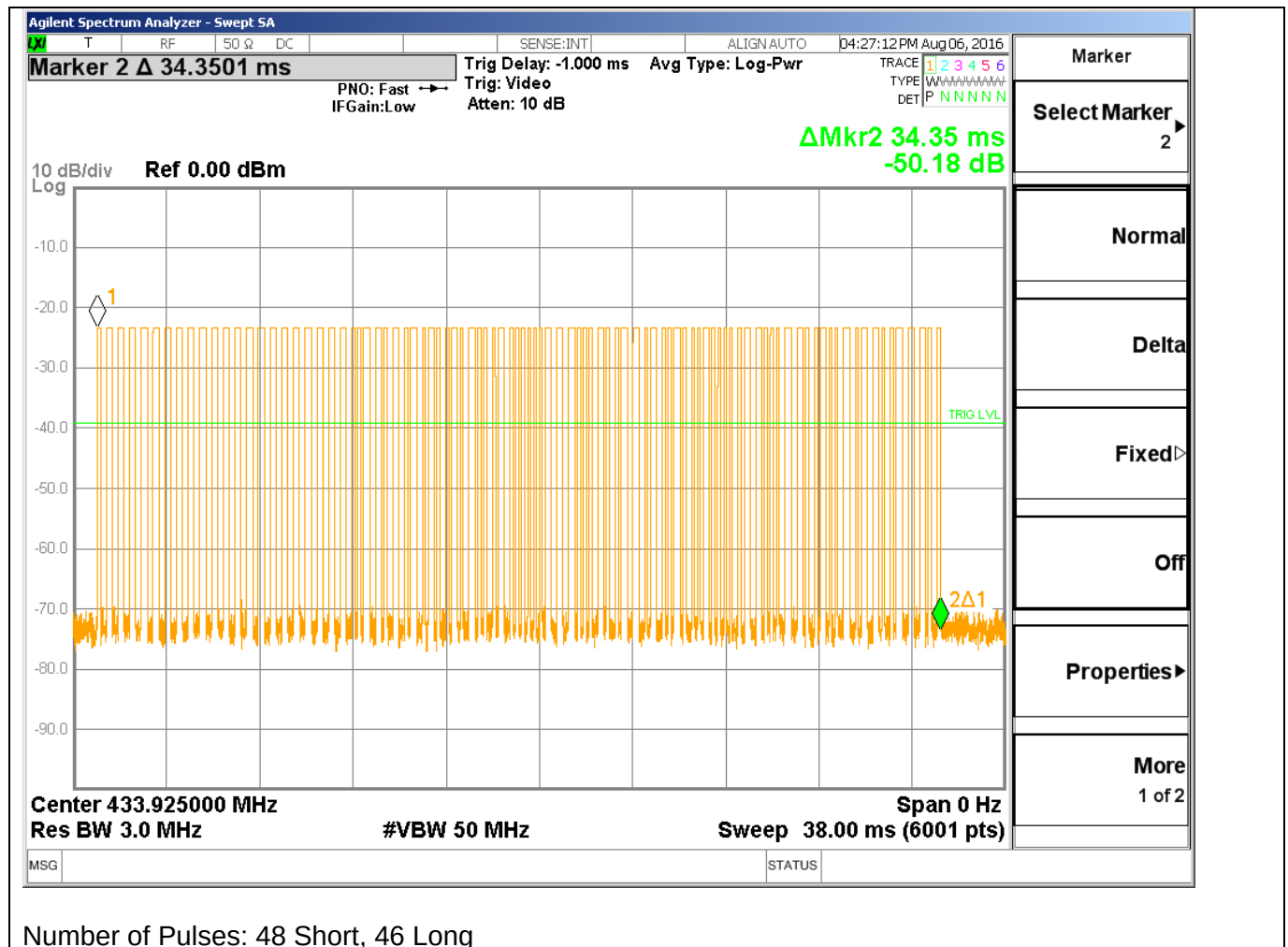
| Power Interface Mode #          | EUT Configurations Mode # | EUT Operation Mode # |
|---------------------------------|---------------------------|----------------------|
| 1                               | 1                         | 1                    |
| Supplementary information: None |                           |                      |

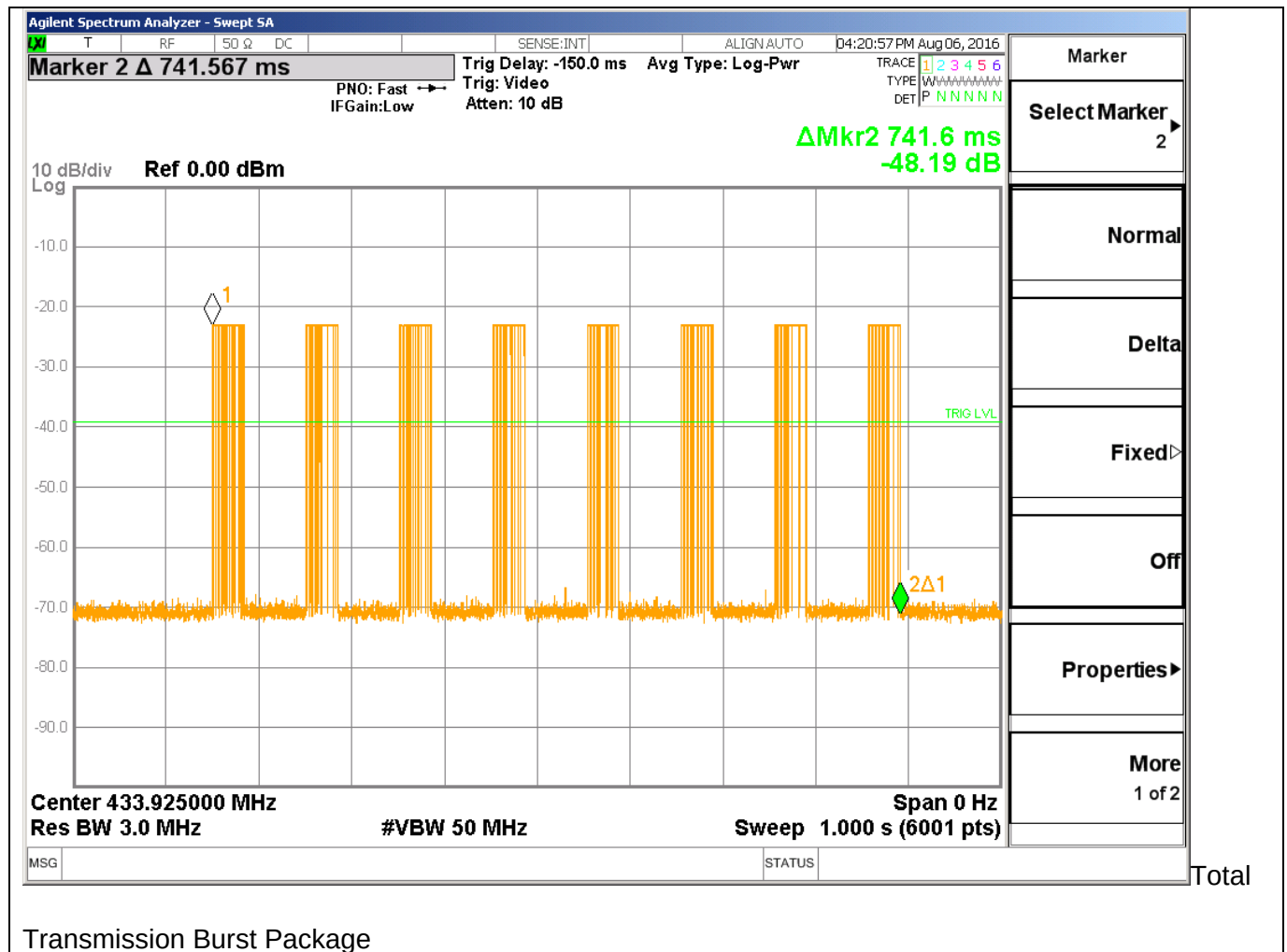
**Table 6 Pulse Train Calculation**

| TX Frequency                                                            | Modulation | Total TX time                                 | Total Transmission period or 100ms whichever is lesser | DC Correction Factor (dB)<br>$20 \log \left( \frac{PulseWidth}{Period} \right)$ |
|-------------------------------------------------------------------------|------------|-----------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------|
|                                                                         |            |                                               |                                                        |                                                                                 |
| 433.92MHz                                                               | ASK        | $(48 \times 0.120) + (46 \times 0.240) = 2mS$ | 100mS                                                  | -15.49dB                                                                        |
|                                                                         | FSK        | 34.43                                         | 100mS                                                  | -9.26                                                                           |
| Worst Case Duty Cycle: Worst case duty cycle was calculated over 100mS. |            |                                               |                                                        |                                                                                 |

Figure 7 Pulse Train Graphs for 433.92MHz (ASK modulation)







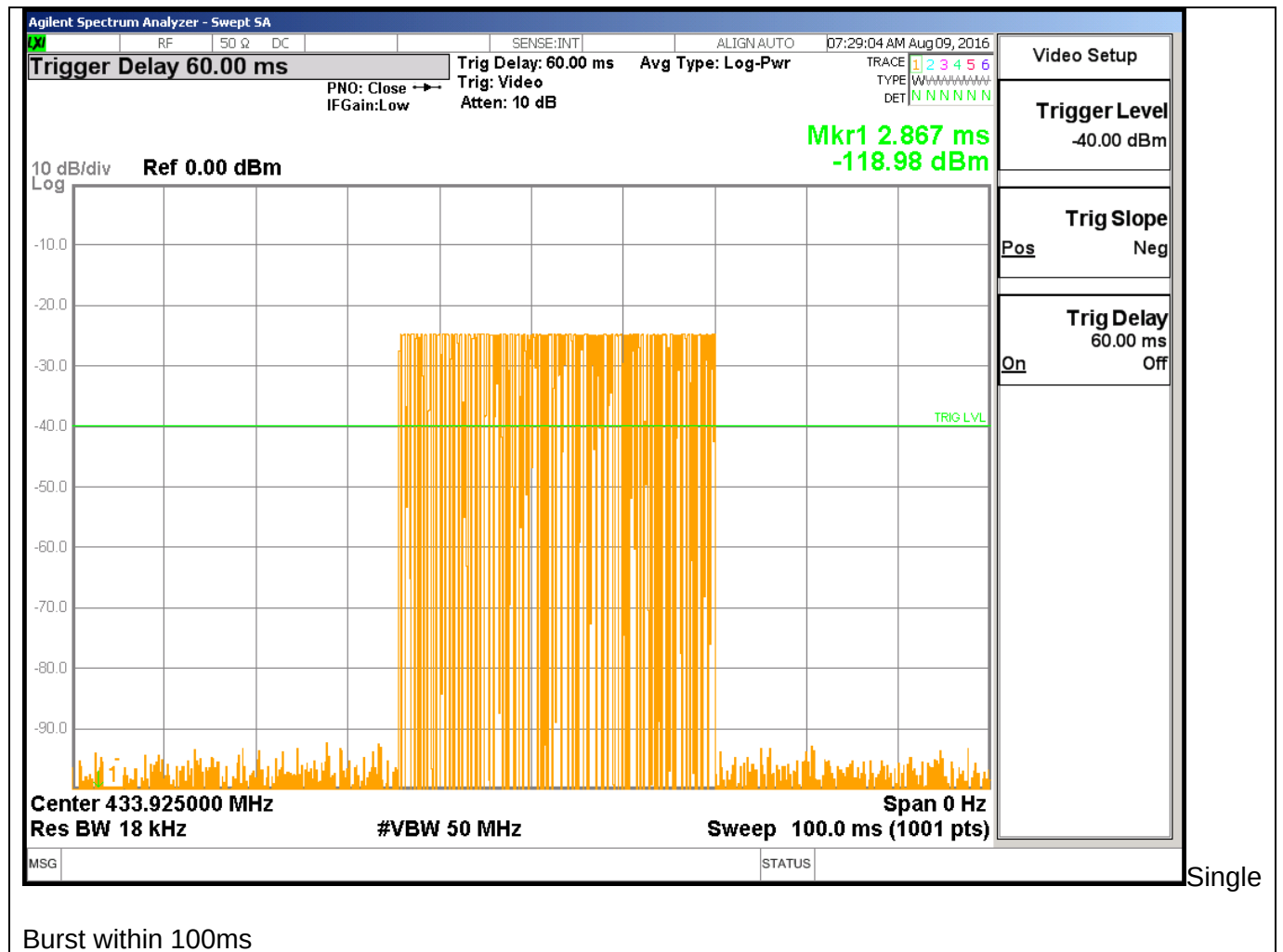
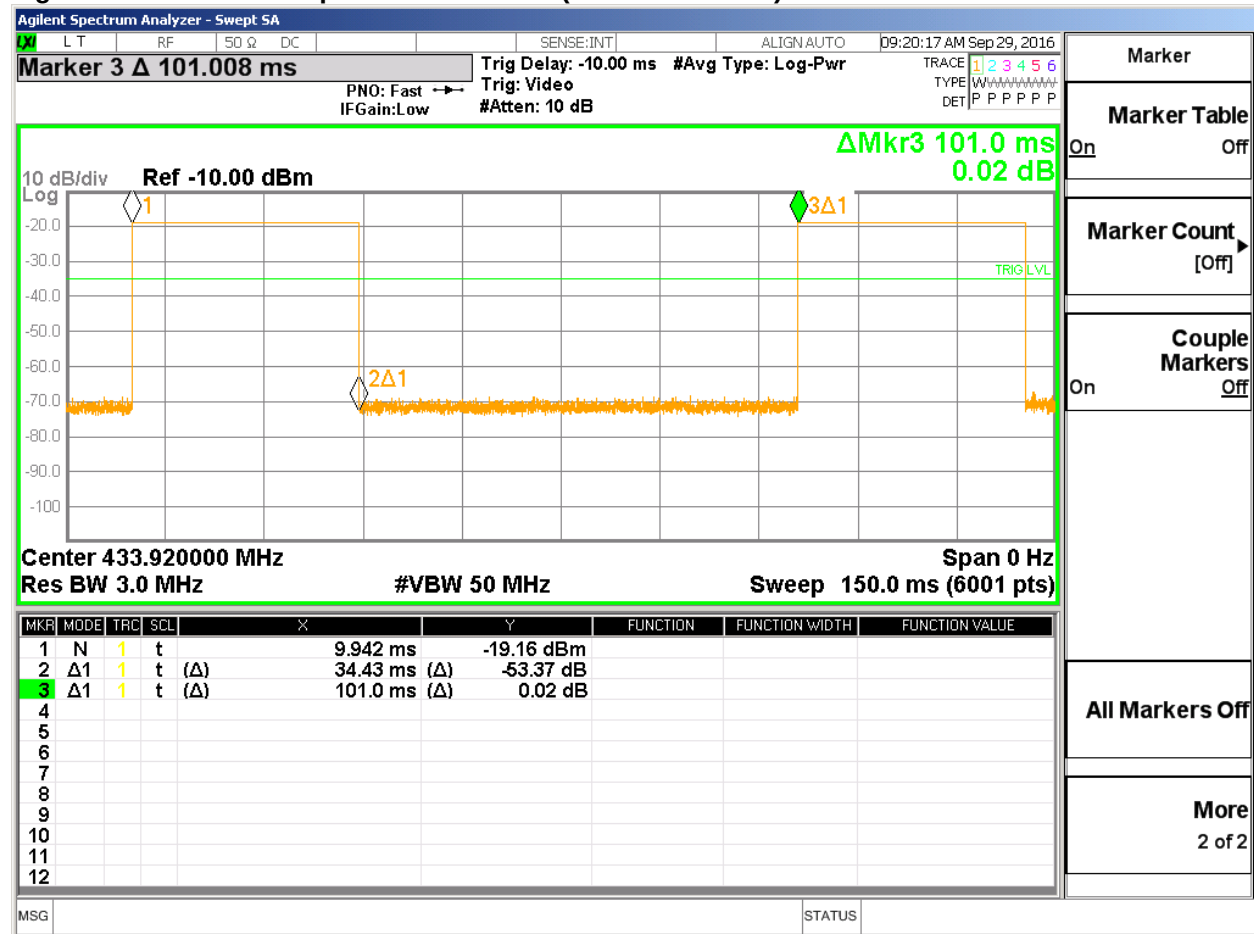


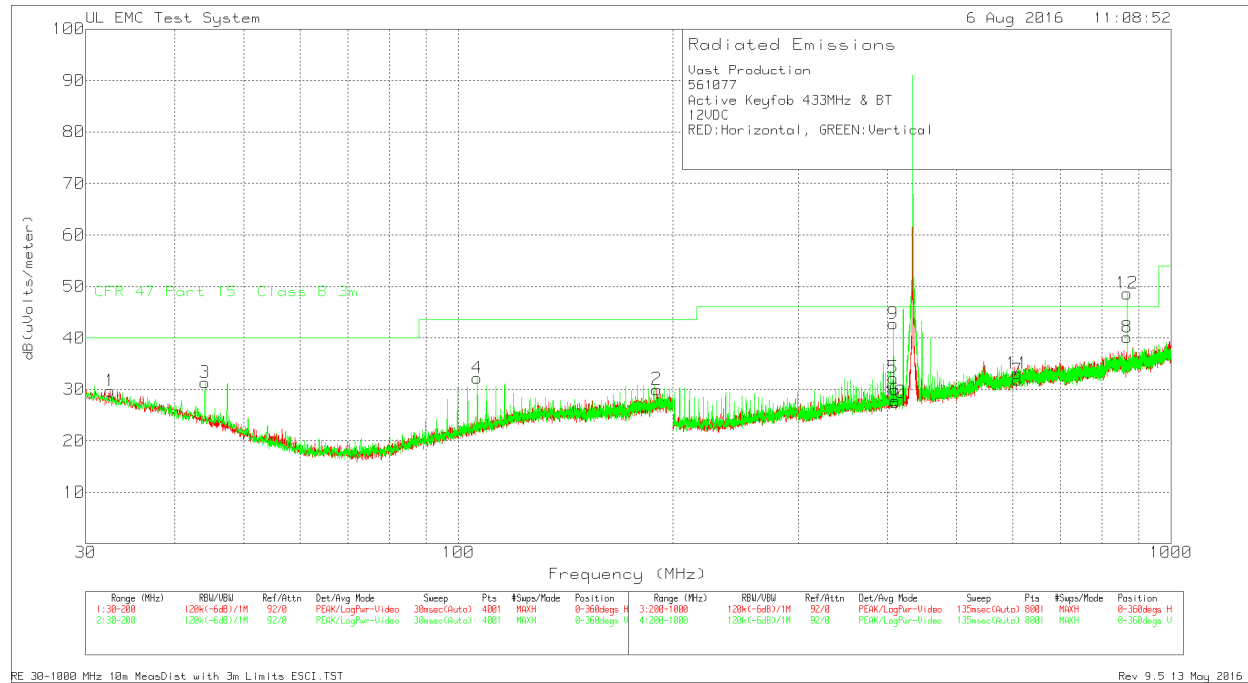
Figure 8 Pulse Train Graphs for 433.92MHz (FSK modulation)



#### 7.1.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

|                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |
|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Test Description                                                            | Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. |                    |
| Basic Standard                                                              | 47 CFR Part 15 subpart C, and RSS-210 A1.1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |
| UL LPG                                                                      | 80-EM-S0029                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                    |
|                                                                             | Frequency range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Measurement Point  |
| Fully configured sample scanned over the following frequency range          | 30MHz – 1GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3 meter distance   |
|                                                                             | 1GHz – 4GHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 meter distance   |
| <b>Out of band spurious emissions limit</b>                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |
| Frequency (MHz)                                                             | Limit (dBµV/m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |
|                                                                             | Quasi-Peak                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Peak               |
| 30 - 88                                                                     | 40.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | NA                 |
| 88 - 216                                                                    | 43.52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | NA                 |
| 216 - 960                                                                   | 46.02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | NA                 |
| 960 - 1000                                                                  | 54                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | NA                 |
| Above 1000 (FCC)                                                            | NA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 54 (at 3-meter)    |
| <b>Fundamental Frequency Limits and Non-restricted band Harmonic Limits</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |
| Frequency (MHz)                                                             | Limit (dBµV/m) @ 3m distance<br>All harmonics except those in restricted bands must be attenuated by 20dB or more                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |
|                                                                             | Average - Fundamental                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Peak - Fundamental |
| 433.92                                                                      | 80.8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 100.8              |
| Supplementary information: See section 7.1.3 for duty cycle information.    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |

**Figure 9 Radiated Emissions Graph (30MHz to 1GHz) – ASK Modulation**



Besides the fundamental transmit frequency and its harmonics, All visible emissions are at least 6dB below the limit or under the noise floor, therefore no further measurement needed.

**Table 7 - Radiated Emissions Data Points 433.92MHz – 30MHz to 1GHz – ASK Modulation**

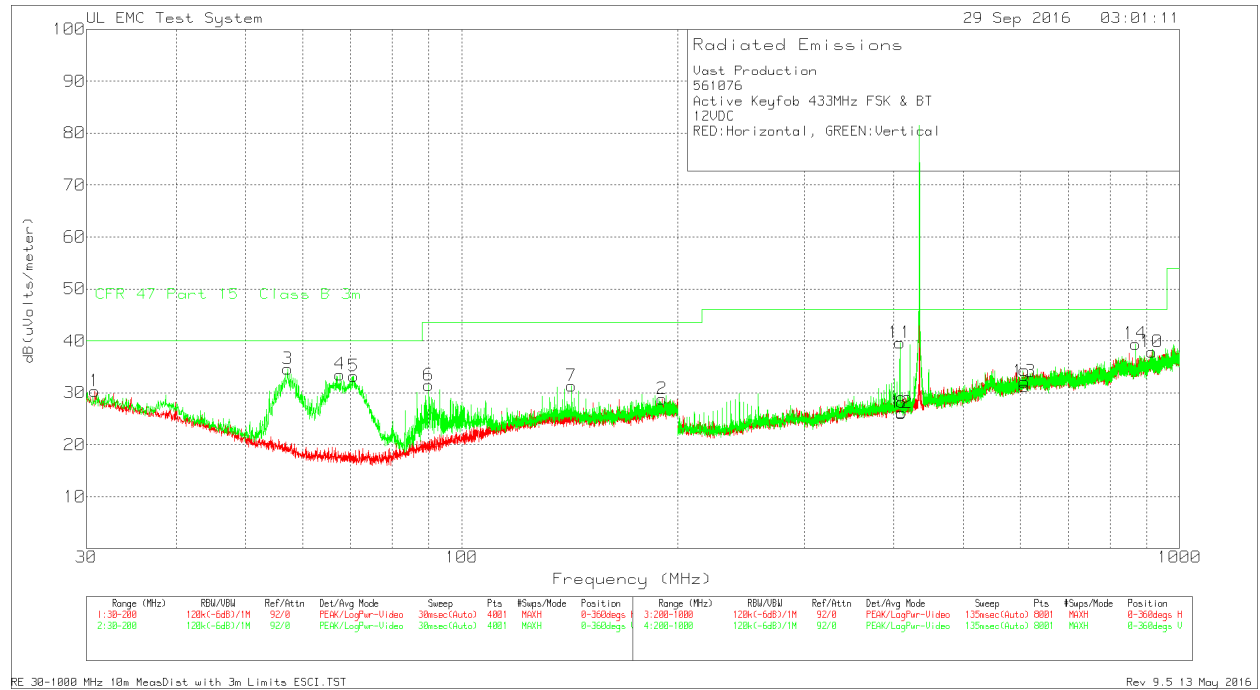
Vast Production  
561076  
Active Keyfob 315MHz & BT  
12VDC

| Test<br>Frequency<br>(MHz) | Meter<br>Reading<br>(dBuV) | Antenna<br>Factor<br>dB/m | Path<br>dB | Peak Level<br>Reading<br>dBuV/m | DC<br>Factor<br>dB | Average    |           | PK<br>Limit | PK<br>Margin<br>(dB) | AV<br>Limit | AV<br>Margin<br>(dB) | Azimuth<br>[Degs] | Height<br>[cm] | Polarity | Notes |
|----------------------------|----------------------------|---------------------------|------------|---------------------------------|--------------------|------------|-----------|-------------|----------------------|-------------|----------------------|-------------------|----------------|----------|-------|
|                            |                            |                           |            |                                 |                    | Level with | DC Factor |             |                      |             |                      |                   |                |          |       |
| 433.9199                   | 67.7 Pk                    | 16.3                      | 8.7        | 92.7                            | -15.49             | 77.21      | 100.8     | 100.8       | -8.1                 | 80.8        | -3.59                | 208               | 128            | V        | 2     |
| 433.9179                   | 55.21 Pk                   | 16.3                      | 8.7        | 80.21                           | -15.49             | 64.72      | 100.8     | 100.8       | -20.59               | 80.8        | -16.08               | 257               | 102            | H        | 2     |
| 867.8373                   | 18.07 Pk                   | 22.1                      | 9.5        | 49.67                           | -15.49             | 34.18      | 80.80     | 80.80       | -31.13               | 60.80       | -26.62               | 148               | 139            | V        | 2     |
| 867.8446                   | 11.17 Pk                   | 22.1                      | 9.5        | 42.77                           | -15.49             | 27.28      | 80.80     | 80.80       | -38.03               | 60.80       | -33.52               | 308               | 105            | H        | 2     |

Pk - Peak detector

Note:  
2 - Y-Axis

Figure 10 Radiated Emissions Graph (30MHz to 1GHz) – FSK Modulation



**Table 8 - Radiated Emissions Data Points 433.92MHz – 30MHz to 1GHz – FSK Modulation**

Vast Production

561076

Active Keyfob 433MHz FSK & BT

12VDC

RED:Horizontal, GREEN:Vertical

| Marker No. | Test Frequency (MHz) | Meter          |          | Antenna    |         | 10M to 3M Factor | Corrected Reading dB(uVolts/meter) | QP Limit | QP Margin (dB) | Azimuth [Degs] | Height [cm] | Polarity |
|------------|----------------------|----------------|----------|------------|---------|------------------|------------------------------------|----------|----------------|----------------|-------------|----------|
|            |                      | Reading (dBuV) | Detector | Factor dBm | Path dB |                  |                                    |          |                |                |             |          |
| 1          | 30.8075              | 31.95          | Pk       | 17.9       | -30     | 10.5             | 30.35                              | 40       | -9.65          | 0-360          | 398         | H        |
| 2          | 190.1825             | 31.34          | Pk       | 16         | -29     | 10.5             | 28.84                              | 43.52    | -14.68         | 0-360          | 99          | H        |
| 3          | 57.2                 | 46.27          | Pk       | 7.8        | -30     | 10.5             | 34.57                              | 40       | -5.43          | 0-360          | 251         | V        |
| 4          | 67.655               | 46.54          | Pk       | 6.5        | -30     | 10.5             | 33.54                              | 40       | -6.46          | 0-360          | 398         | V        |
| 5          | 70.7575              | 46.14          | Pk       | 6.5        | -29.9   | 10.5             | 33.24                              | 40       | -6.76          | 0-360          | 251         | V        |
| 6          | 89.925               | 41.58          | Pk       | 9.3        | -29.9   | 10.5             | 31.48                              | 43.52    | -12.04         | 0-360          | 102         | V        |
| 7          | 142.285              | 36.4           | Pk       | 14.1       | -29.7   | 10.5             | 31.3                               | 43.52    | -12.22         | 0-360          | 102         | V        |
| 8          | 410                  | 28.08          | Pk       | 15.9       | -28.3   | 10.5             | 26.18                              | 46.02    | -19.84         | 0-360          | 199         | H        |
| 9          | 608                  | 28.08          | Pk       | 20         | -27.3   | 10.5             | 31.28                              | 46.02    | -14.74         | 0-360          | 399         | H        |
| 10         | 914.6                | 31.77          | Pk       | 23.4       | -27.8   | 10.5             | 37.87                              | 46.02    | -8.15          | 0-360          | 199         | H        |
| 11         | 407.7                | 41.53          | Pk       | 15.9       | -28.3   | 10.5             | 39.63                              | 46.02    | -6.39          | 0-360          | 99          | V        |
| 12         | 410                  | 28.04          | Pk       | 15.9       | -28.3   | 10.5             | 26.14                              | 46.02    | -19.88         | 0-360          | 299         | V        |
| 13         | 608                  | 28.94          | Pk       | 20         | -27.3   | 10.5             | 32.14                              | 46.02    | -13.88         | 0-360          | 399         | V        |
| 14         | 867.8                | 34.43          | Pk       | 22.1       | -27.6   | 10.5             | 39.43                              | 46.02    | -6.59          | 0-360          | 399         | V        |

Pk - Peak detector

Radiated Emission Data

| Test Frequency (MHz) | Meter          |          | Antenna    |         | 10M to 3M Factor | Corrected Reading dB(uVolts/meter) | QP Limit | QP Margin (dB) | Azimuth [Degs] | Height [cm] | Polarity |
|----------------------|----------------|----------|------------|---------|------------------|------------------------------------|----------|----------------|----------------|-------------|----------|
|                      | Reading (dBuV) | Detector | Factor dBm | Path dB |                  |                                    |          |                |                |             |          |
| 57.2366              | 43.94          | Qp       | 7.8        | -30     | 10.5             | 32.24                              | 40       | -7.76          | 1              | 260         | V        |

Qp - Quasi-Peak detector

**Table 9 - Radiated Emissions Data Points 433.92MHz – 30MHz to 1GHz – FSK Modulation**

**Fundamamental and Harmonics Measurements**

Vast Production

561077

Active Keyfob FSK 433MHz & BT

12VDC

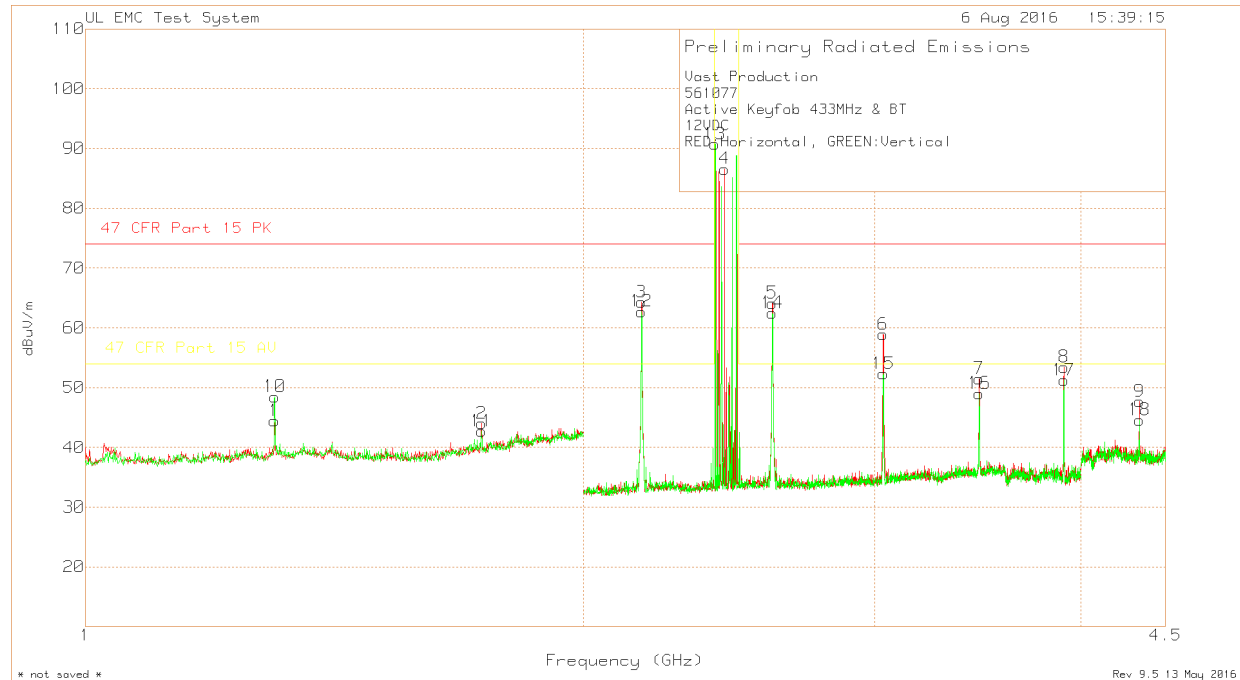
RED:Horizontal, GREEN:Vertical

| Test<br>Frequency<br>(MHz) | Meter<br>Reading<br>(dBuV) | Antenna<br>Factor<br>dBm | Path<br>dB | Peak Level<br>dBuV/m | DC<br>Factor<br>dB | Average<br>Level with<br>DC factor<br>dBuV/m | Peak<br>Limit | Peak<br>Margin<br>(dB) | Average<br>Limit | Average<br>margin | Azimuth<br>[Degs] | Height<br>[cm] | Polarity |
|----------------------------|----------------------------|--------------------------|------------|----------------------|--------------------|----------------------------------------------|---------------|------------------------|------------------|-------------------|-------------------|----------------|----------|
|                            |                            |                          |            |                      |                    |                                              |               |                        |                  |                   |                   |                |          |
| 433.9465                   | 43.49 Pk                   | 16.3                     | 8.4        | 68.19                | -9.26              | 58.93                                        | 100.8         | -32.61                 | 80.8             | -21.87            | 264               | 347            | H        |
| 433.8864                   | 55.34 Pk                   | 16.3                     | 8.4        | 80.04                | -9.26              | 70.78                                        | 100.8         | -20.76                 | 80.8             | -10.02            | 1                 | 138            | V        |
| 867.7738                   | 9.76 Pk                    | 22.1                     | 9.5        | 41.36                | -9.26              | 32.1                                         | 80.8          | -39.44                 | 60.8             | -28.7             | 348               | 133            | V        |
| 867.7732                   | 5.52 Pk                    | 22.1                     | 9.5        | 37.12                | -9.26              | 27.86                                        | 80.8          | -43.68                 | 60.8             | -32.94            | 302               | 259            | H        |

Pk - Peak detector

Text File: Funda Harmonic 1-3 HV FSK 433.TXT

**Figure 11 Radiated Emissions Graph (Above 1GHz) ASK Modulation**

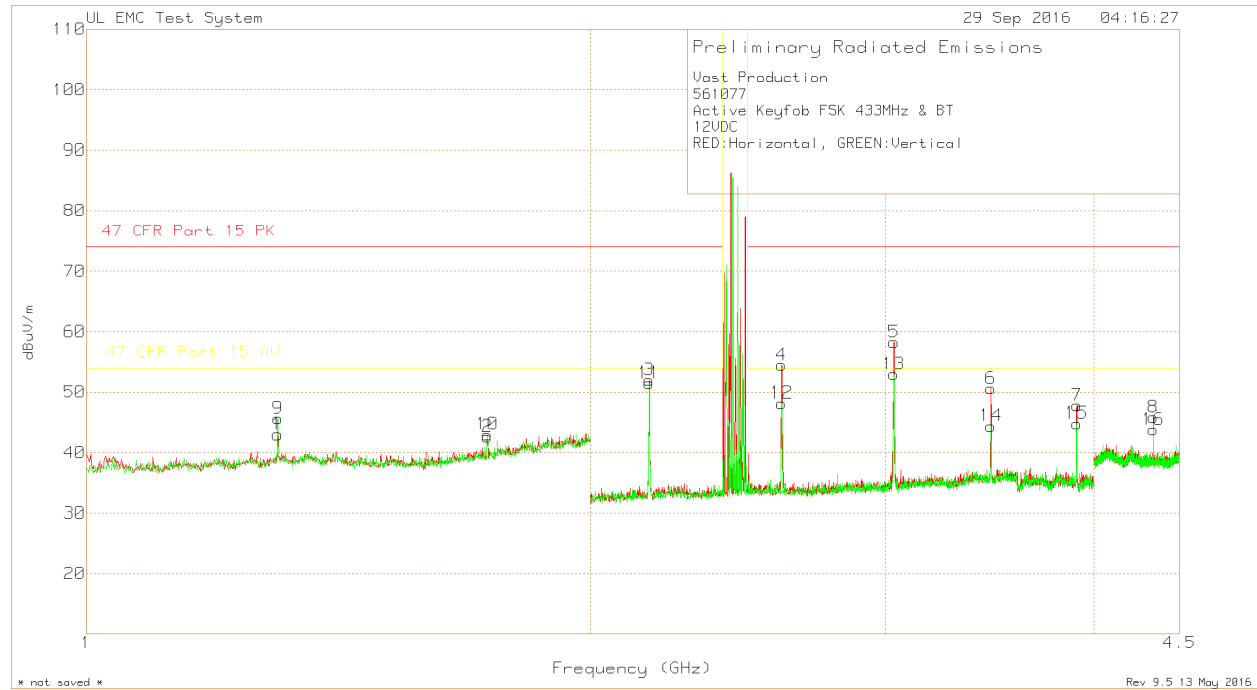


Emissions visible at 2.4GHz are the product of the modular certified Bluetooth transmitter. Besides the transmit frequency harmonics, All visible emissions are at least 6dB below the limit or under the noise floor, therefore no further measurement needed.

**Table 10 - Radiated Emissions Data Points 433.92MHz – Above 1GHz – ASK Modulation**

| Vast Production           |                      |          |                     |           |                   |              |                                     |          |                |          |                |                |             |          |  |
|---------------------------|----------------------|----------|---------------------|-----------|-------------------|--------------|-------------------------------------|----------|----------------|----------|----------------|----------------|-------------|----------|--|
| 561076                    |                      |          |                     |           |                   |              |                                     |          |                |          |                |                |             |          |  |
| Active Keyfob 315MHz & BT |                      |          |                     |           |                   |              |                                     |          |                |          |                |                |             |          |  |
| 12VDC                     |                      |          |                     |           |                   |              |                                     |          |                |          |                |                |             |          |  |
| Test Frequency (GHz)      | Meter Reading (dBuV) | Detector | Antenna Factor dB/m | Path (dB) | Peak Level dBuV/m | DC Factor dB | Average Level with DC Factor dBuV/m | PK Limit | PK Margin (dB) | AV Limit | AV Margin (dB) | Azimuth [Degs] | Height [cm] | Polarity |  |
| 1.3016                    | 73.1                 | Pk       | 28.9                | -57.01    | 44.99             | -15.49       | 29.5                                | 74       | -29.01         | 54       | -24.5          | 11             | 108         | H        |  |
| 1.3018                    | 78.72                | Pk       | 28.9                | -57.01    | 50.61             | -15.49       | 35.12                               | 74       | -23.39         | 54       | -18.88         | 278            | 212         | V        |  |
| 1.7357                    | 69.52                | Pk       | 29.6                | -55.42    | 43.7              | -15.49       | 28.21                               | 74       | -30.3          | 54       | -25.79         | 149            | 157         | V        |  |
| 1.7359                    | 69.42                | Pk       | 29.6                | -55.42    | 43.6              | -15.49       | 28.11                               | 74       | -30.4          | 54       | -25.89         | 296            | 153         | H        |  |
| 2.1696                    | 93.55                | Pk       | 21.7                | -52.18    | 63.07             | -15.49       | 47.58                               | 74       | -10.93         | 54       | -6.42          | 301            | 226         | H        |  |
| 2.1696                    | 95.05                | Pk       | 21.7                | -52.18    | 64.57             | -15.49       | 49.08                               | 74       | -9.43          | 54       | -4.92          | 85             | 101         | V        |  |
| 2.6035                    | 91.95                | Pk       | 22.3                | -51.19    | 63.06             | -15.49       | 47.57                               | 74       | -10.94         | 54       | -6.43          | 111            | 119         | V        |  |
| 2.6035                    | 92.59                | Pk       | 22.3                | -51.19    | 63.7              | -15.49       | 48.21                               | 74       | -10.3          | 54       | -5.79          | 78             | 100         | H        |  |
| 3.0373                    | 86.23                | Pk       | 22.5                | -50.24    | 58.49             | -15.49       | 43                                  | 74       | -15.51         | 54       | -11            | 84             | 105         | H        |  |
| 3.0374                    | 79.21                | Pk       | 22.5                | -50.23    | 51.48             | -15.49       | 35.99                               | 74       | -22.52         | 54       | -18.01         | 71             | 150         | V        |  |
| 3.4713                    | 76.29                | Pk       | 23.5                | -50.59    | 49.2              | -15.49       | 33.71                               | 74       | -24.8          | 54       | -20.29         | 308            | 115         | V        |  |
| 3.4715                    | 78.81                | Pk       | 23.5                | -50.59    | 51.72             | -15.49       | 36.23                               | 74       | -22.28         | 54       | -17.77         | 77             | 162         | H        |  |
| 3.9053                    | 79.74                | Pk       | 23.8                | -51       | 52.54             | -15.49       | 37.05                               | 74       | -21.46         | 54       | -16.95         | 248            | 100         | H        |  |
| 3.9052                    | 77.48                | Pk       | 23.8                | -51       | 50.28             | -15.49       | 34.79                               | 74       | -23.72         | 54       | -19.21         | 135            | 156         | V        |  |
| 4.3393                    | 70.36                | Pk       | 28.1                | -52.09    | 46.37             | -15.49       | 30.88                               | 74       | -27.63         | 54       | -23.12         | 330            | 103         | V        |  |
| 4.3392                    | 73.56                | Pk       | 28.1                | -52.09    | 49.57             | -15.49       | 34.08                               | 74       | -24.43         | 54       | -19.92         | 47             | 208         | H        |  |
| Pk - Peak detector        |                      |          |                     |           |                   |              |                                     |          |                |          |                |                |             |          |  |

**Figure 12 Radiated Emissions Graph (Above 1GHz) FSK Modulation**



Emissions visible at 2.4GHz are the product of the modular certified Bluetooth transmitter. Besides the transmit frequency harmonics, All visible emissions are at least 6dB below the limit or under the noise floor, therefore no further measurement needed.

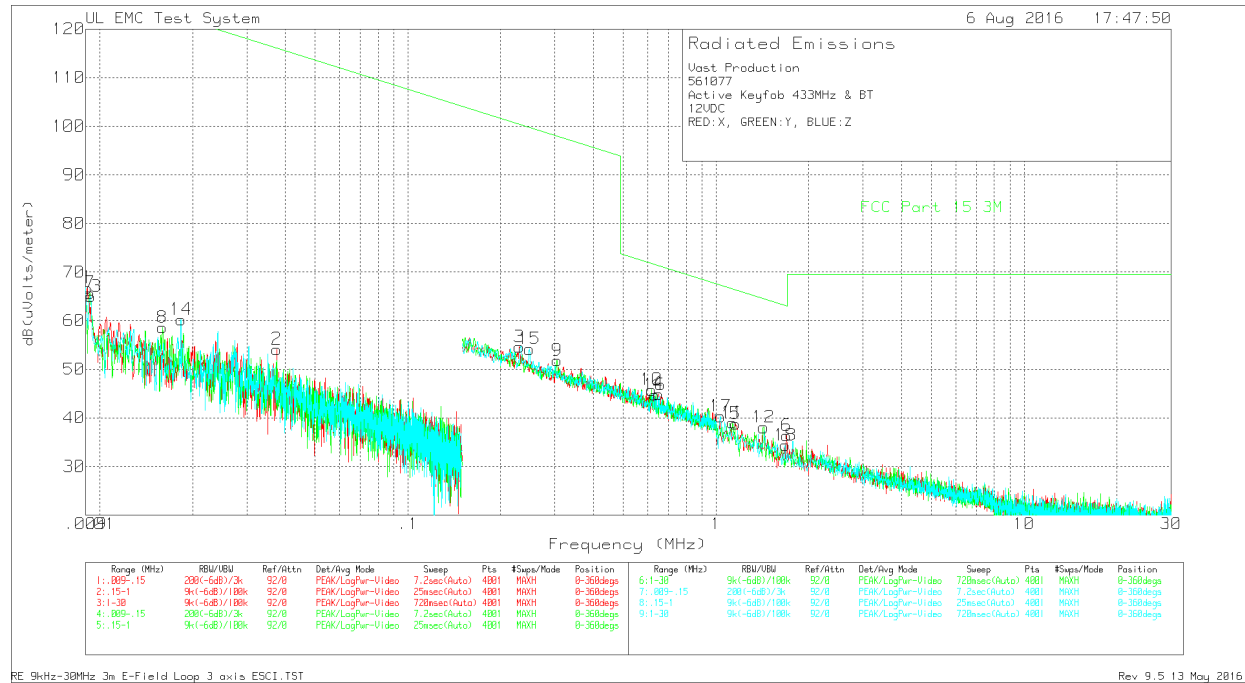
**Table 11 - Radiated Emissions Data Points 433.92MHz – Above 1GHz – FSK Modulation**

Vast Production  
561077  
Active Keyfob FSK 433MHz & BT  
12VDC  
RED:Horizontal, GREEN:Vertical

| Test Frequency (GHz) | Meter Reading (dBuV) Detector | Antenna Factor dBm | Path (dB) | Peak Level dBuV/m | DC Factor dB | Average Level with DC dBuV/m | Peak Limit (dB) | Margin (dB) | Average Limit (dB) | Average Margin (dB) | Azimuth [Degs] | Height [cm] | Polarity |
|----------------------|-------------------------------|--------------------|-----------|-------------------|--------------|------------------------------|-----------------|-------------|--------------------|---------------------|----------------|-------------|----------|
| 1.3017               | 72.39 Pk                      | 28.9               | -57.01    | 44.28             | -9.26        | 35.02                        | 74              | -29.72      | 54                 | -18.98              | 82             | 109         | H        |
| 1.7355               | 70.15 Pk                      | 29.6               | -55.42    | 44.33             | -9.26        | 35.07                        | 74              | -29.67      | 54                 | -18.93              | 61             | 221         | H        |
| 2.1694               | 84.35 Pk                      | 21.7               | -52.18    | 53.87             | -9.26        | 44.61                        | 74              | -20.13      | 54                 | -9.39               | 96             | 226         | H        |
| 2.6033               | 83.27 Pk                      | 22.3               | -51.19    | 54.38             | -9.26        | 45.12                        | 74              | -19.62      | 54                 | -8.88               | 109            | 210         | H        |
| 3.0372               | 85.84 Pk                      | 22.5               | -50.24    | 58.1              | -9.26        | 48.84                        | 74              | -15.9       | 54                 | -5.16               | 101            | 251         | H        |
| 3.4715               | 77.15 Pk                      | 23.5               | -50.59    | 50.06             | -9.26        | 40.8                         | 74              | -23.94      | 54                 | -13.2               | 104            | 159         | H        |
| 3.905                | 75.23 Pk                      | 23.8               | -51       | 48.03             | -9.26        | 38.77                        | 74              | -25.97      | 54                 | -15.23              | 93             | 100         | H        |
| 4.3393               | 70.76 Pk                      | 28.1               | -52.09    | 46.77             | -9.26        | 37.51                        | 74              | -27.23      | 54                 | -16.49              | 146            | 100         | H        |
| 1.3018               | 74.5 Pk                       | 28.9               | -57.01    | 46.39             | -9.26        | 37.13                        | 74              | -27.61      | 54                 | -16.87              | 117            | 125         | V        |
| 1.7357               | 67.19 Pk                      | 29.6               | -55.42    | 41.37             | -9.26        | 32.11                        | 74              | -32.63      | 54                 | -21.89              | 174            | 147         | V        |
| 2.1697               | 82.88 Pk                      | 21.7               | -52.18    | 52.4              | -9.26        | 43.14                        | 74              | -21.6       | 54                 | -10.86              | 193            | 173         | V        |
| 2.6036               | 76.91 Pk                      | 22.3               | -51.19    | 48.02             | -9.26        | 38.76                        | 74              | -25.98      | 54                 | -15.24              | 282            | 106         | V        |
| 3.0372               | 80.08 Pk                      | 22.5               | -50.24    | 52.34             | -9.26        | 43.08                        | 74              | -21.66      | 54                 | -10.92              | 99             | 105         | V        |
| 3.4711               | 71.41 Pk                      | 23.5               | -50.59    | 44.32             | -9.26        | 35.06                        | 74              | -29.68      | 54                 | -18.94              | 180            | 220         | V        |
| 3.9055               | 72.71 Pk                      | 23.8               | -51       | 45.51             | -9.26        | 36.25                        | 74              | -28.49      | 54                 | -17.75              | 27             | 100         | V        |
| 4.3395               | 67.5 Pk                       | 28.1               | -52.09    | 43.51             | -9.26        | 34.25                        | 74              | -30.49      | 54                 | -19.75              | 358            | 105         | V        |

Pk - Peak detector

**Figure 13 Radiated Emissions Graph (9kHz to 30MHz) – ASK Modulation**



Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 3 m open area test site. Therefore sufficient tests weremade to demonstrate that the alternative site produces results that correlate with the ones oftests made in an open field based on KDB 937606.

All visible emissions are at least 6dB below the limit or under the noise floor, therefore no further measurement needed.

**Table 12 - Radiated Emissions Data Points 433.92MHz – 9kHz to 30MHz – ASK Modulation**

| Vast Production           |                      |                      |          |                     |         |                                     |          |                |                |                  |
|---------------------------|----------------------|----------------------|----------|---------------------|---------|-------------------------------------|----------|----------------|----------------|------------------|
| 561077                    |                      |                      |          |                     |         |                                     |          |                |                |                  |
| Active Keyfob 433MHz & BT |                      |                      |          |                     |         |                                     |          |                |                |                  |
| 12VDC                     |                      |                      |          |                     |         |                                     |          |                |                |                  |
| Marker No.                | Test Frequency (MHz) | Meter Reading (dBuV) | Detector | Antenna Factor dB/m | Path dB | Corrected Reading dB(uVolts /meter) | AV Limit | AV Margin (dB) | Azimuth [Degs] | Antenna Polarity |
| 1                         | 0.009105             | 44.44                | Pk       | 22.3                | 0       | 66.74                               | 128.4    | -61.66         | 0-360          | X                |
| 2                         | 0.03756              | 39.21                | Pk       | 14.9                | 0       | 54.11                               | 116.1    | -61.99         | 0-360          | X                |
| 3                         | 0.23009              | 42.58                | Pk       | 12                  | 0       | 54.58                               | 100.36   | -45.78         | 0-360          | X                |
| 4                         | 0.65257              | 32.91                | Pk       | 12                  | 0       | 44.91                               | 71.31    | -26.4          | 0-360          | X                |
| 5                         | 1.1595               | 26.09                | Pk       | 12.6                | 0.1     | 38.79                               | 66.32    | -27.53         | 0-360          | X                |
| 6                         | 1.696                | 23.82                | Pk       | 12.4                | 0.1     | 36.32                               | 63.02    | -26.7          | 0-360          | X                |
| 7                         | 0.00928              | 43.7                 | Pk       | 22                  | 0       | 65.7                                | 128.23   | -62.53         | 0-360          | Y                |
| 8                         | 0.016                | 40.1                 | Pk       | 18.5                | 0       | 58.6                                | 123.51   | -64.91         | 0-360          | Y                |
| 9                         | 0.30485              | 39.9                 | Pk       | 11.9                | 0       | 51.8                                | 97.92    | -46.12         | 0-360          | Y                |
| 10                        | 0.61796              | 33.75                | Pk       | 12                  | 0       | 45.75                               | 71.78    | -26.03         | 0-360          | Y                |
| 11                        | 1.1305               | 26.28                | Pk       | 12.6                | 0.1     | 38.98                               | 66.54    | -27.56         | 0-360          | Y                |
| 12                        | 1.42775              | 25.44                | Pk       | 12.5                | 0.1     | 38.04                               | 64.51    | -26.47         | 0-360          | Y                |
| 13                        | 0.00935              | 43.03                | Pk       | 21.9                | 0       | 64.93                               | 128.17   | -63.24         | 0-360          | Z                |
| 14                        | 0.018345             | 42.82                | Pk       | 17.4                | 0       | 60.22                               | 122.32   | -62.1          | 0-360          | Z                |
| 15                        | 0.24777              | 42.14                | Pk       | 12                  | 0       | 54.14                               | 99.72    | -45.58         | 0-360          | Z                |
| 16                        | 0.63202              | 32.75                | Pk       | 12                  | 0       | 44.75                               | 71.59    | -26.84         | 0-360          | Z                |
| 17                        | 1.03625              | 27.59                | Pk       | 12.6                | 0.1     | 40.29                               | 67.29    | -27            | 0-360          | Z                |
| 18                        | 1.6815               | 21.83                | Pk       | 12.4                | 0.1     | 34.33                               | 63.09    | -28.76         | 0-360          | Z                |
| Pk - Peak detector        |                      |                      |          |                     |         |                                     |          |                |                |                  |