

## TEST REPORT

Report Number: 102254548LEX-002  
Project Number: G102254548

Report Issue Date: 1/10/2016

Product Name: 3M Tracker – CDMA Variant

FCC Standards: Title 47 CFR Parts 15  
Subpart C

Industry Canada Standards: RSS-210 Issue 8

Tested by:  
Intertek Testing Services NA, Inc.  
731 Enterprise Drive  
Lexington, KY 40510

Client:  
3M Traffic Safety and Security Division  
1838 Gunn Highway  
Odessa, FL 55144

Report prepared by



Brian Daffin - Engineer

Report reviewed by



Bryan Taylor – Team Leader

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## 1 Introduction and Conclusion

The tests indicated in section 2 were performed on the product constructed as described in section 3. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test method, a list of the actual test equipment used, documentation photos, results and raw data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complied with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

The INTERTEK-Lexington is located at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1 and ANSI C63.4: 2009. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters. The test site is listed with the FCC under registration number 485103. The test site is listed with Industry Canada under site number IC 2042M-1.

## 2 Test Summary

| Page | Test full name                            | FCC Reference     | IC Reference      | Result          |
|------|-------------------------------------------|-------------------|-------------------|-----------------|
| 8    | Transmission Timing Measurements          | § 15.231(a)       | RSS-210 (A1.1.1)  | Pass            |
| 9    | Duty Cycle Correction Factor              | ANSI C63.10: 2013 | ANSI C63.10: 2013 | ---             |
| 11   | Occupied Bandwidth                        | § 15.231(c)       | RSS-210 (A1.1.3)  | Pass            |
| 12   | Radiated Spurious Emissions (Transmitter) | § 15.231(b)       | RSS-210 (A1.1.2)  | Pass            |
| 23   | Antenna Requirement per FCC Part 15.203   | § 15.203          | RSS-Gen (7.1.2)   | Pass            |
| 24   | Conducted Emission Limits                 | § 15.207          | RSS-Gen (7.2.4)   | NA <sup>1</sup> |

<sup>1</sup> This device is battery powered and will never connect to the AC mains.

**3 Description of Equipment Under Test**

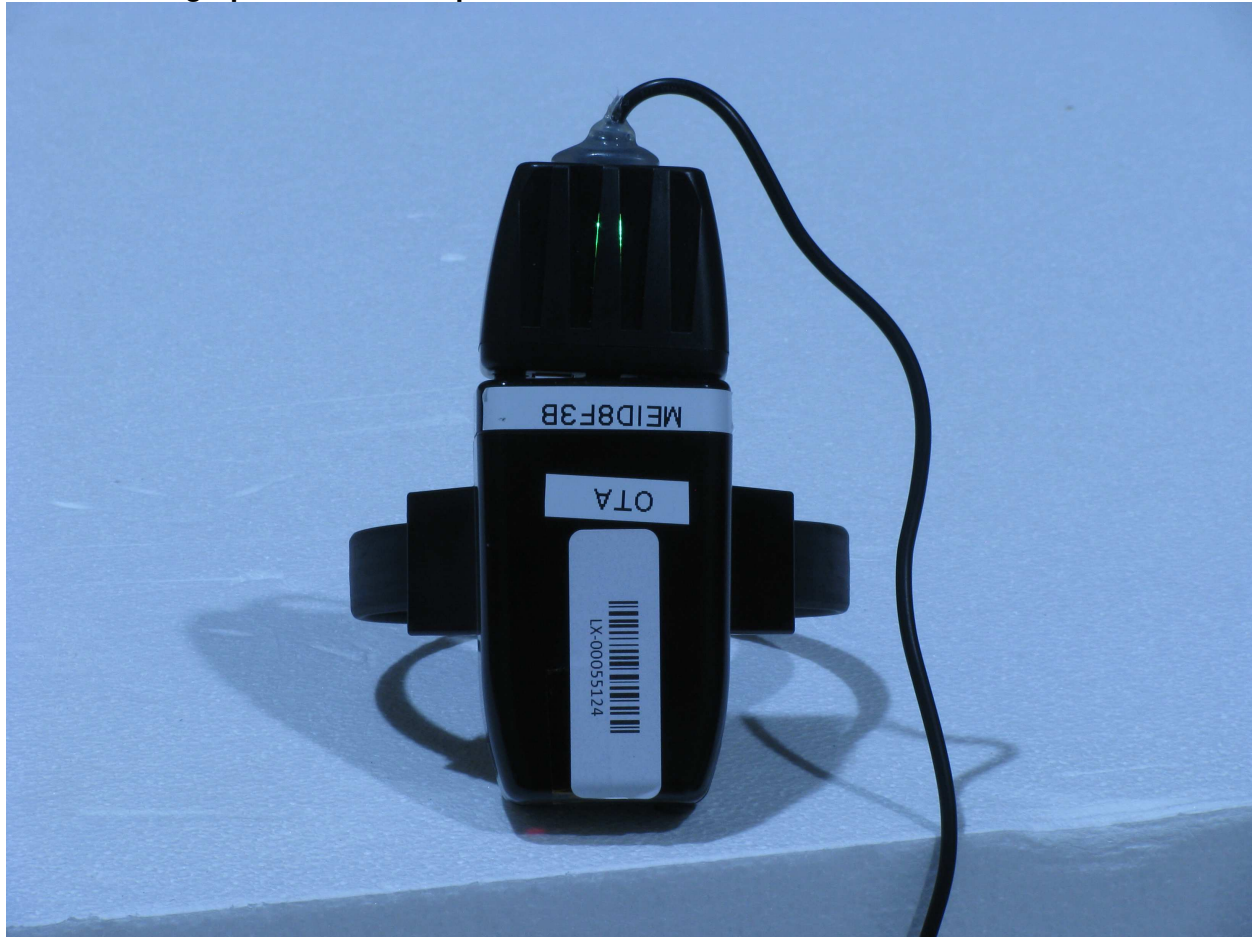
| <b>Equipment Under Test</b>      |                                         |
|----------------------------------|-----------------------------------------|
| <b>Manufacturer</b>              | 3M Traffic Safety and Security Division |
| <b>Model Number</b>              | CDMA Tracker                            |
| <b>Serial Number</b>             | MEID8F3B                                |
| <b>Receive Date</b>              | 9/2/2015                                |
| <b>Test Start Date</b>           | 9/2/2015                                |
| <b>Test End Date</b>             | 10/1/2015                               |
| <b>Device Received Condition</b> | Good                                    |
| <b>Test Sample Type</b>          | Production                              |
| <b>Transmission Control</b>      | Test Commands                           |
| <b>Transmit Frequencies</b>      | 433.92MHz, 418MHz                       |
| <b>Antenna Type (15.203)</b>     | PCB Antenna                             |
| <b>Operating Voltage</b>         | Battery Powered                         |

| <b>Description of Equipment Under Test</b> |
|--------------------------------------------|
| Ankle worn tracking equipment              |

**Operating modes of the EUT:**

| <b>No.</b> | <b>Descriptions of EUT Exercising</b> |
|------------|---------------------------------------|
| 1          | Transmitting on 433.92MHz or 418MHz.  |
| 2          | Receive mode / idle mode              |

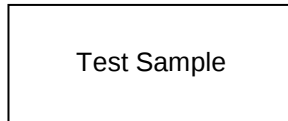
### **3.1 Photographs of Test Sample**



Front



Back

**3.2 System setup including cable interconnection details, support equipment and simplified block diagram****3.3 EUT Block Diagram:****3.4 Cables:**

The only cable included in the test setup was the charger cable which was 6ft long, unshielded, and connected from the charging terminals to the AC wall adapter.

**3.5 Support Equipment:**

None

## 4 Transmission Timing

### § 15.231(a):

The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

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

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition

(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

### 4.1 Test Results

The client provided attestation statements indicating the following:

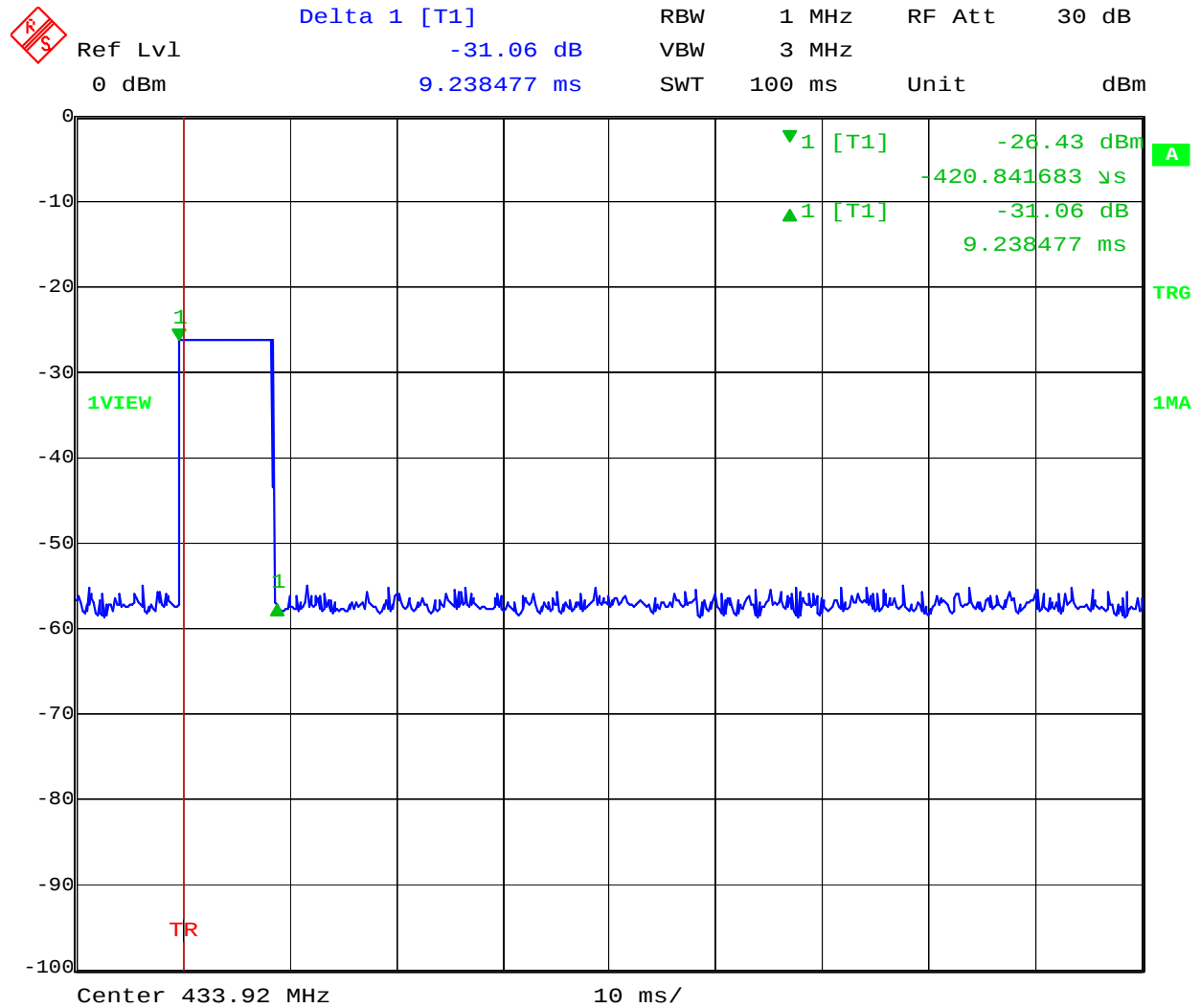
This device does not contain a manually operated transmitter.

The automatically activated transmitter ceases transmission within 5 seconds after activation.

This is a security or safety application. This device transmits at regular predetermined intervals. The total duration of transmissions does not exceed more than two seconds per hour. The total transmission time does not exceed two seconds per hour.



### 5.4 Duty Cycle Correction Factor Results (433.92MHz):



Date: 9.DEC.2015 15:01:31

Pulse "On Time" = 9.2mS

Total Time = 100mS

Duty Cycle =  $(9.2 / 100) \times 100 = 9.2\%$

Duty Cycle Correction Factor =  $20\log (.092) = -20.72\text{dB}$

## 6 Occupied Bandwidth

### 6.1 Test 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.

### 6.2 Test Procedure

ANSI C63.10: 2013

### 6.3 Test Equipment Used:

| Description       | Serial Number | Manufacturer    | Model   | Cal. Date | Cal. Due  |
|-------------------|---------------|-----------------|---------|-----------|-----------|
| Spectrum Analyzer | 3720          | Rohde & Schwarz | FSEK 30 | 9/19/2015 | 9/19/2016 |

## 6.4 Results:



Date: 9.DEC.2015 15:23:55

418MHz 20dB Bandwidth = 142.2kHz

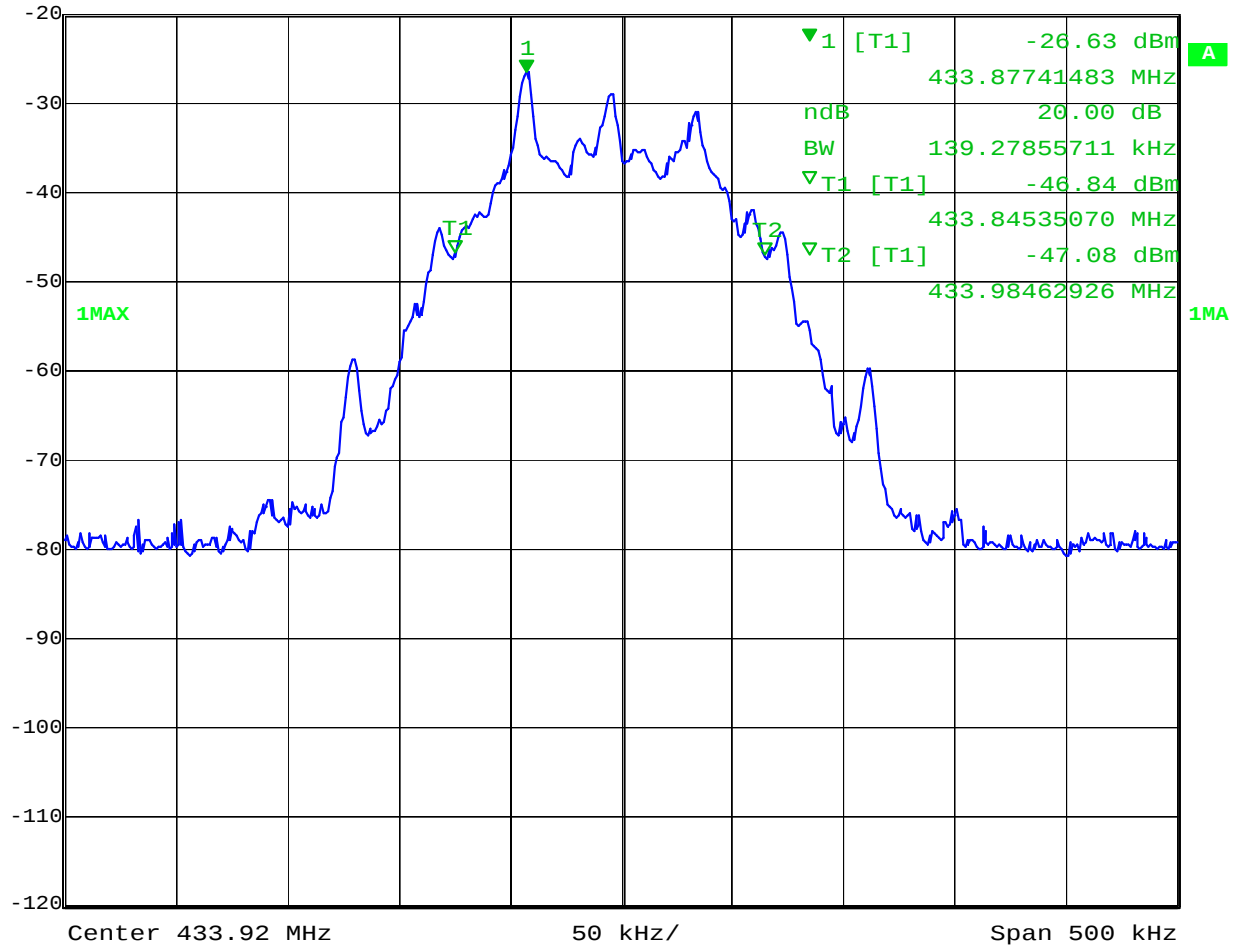


Date: 9.DEC.2015 15:23:06

418MHz 99% Bandwidth = 151.3kHz



Ref Lvl -20 dBm  
 Marker 1 [T1 ndB] 20.00 dB  
 BW 139.27855711 kHz  
 RBW 5 kHz  
 VBW 20 kHz  
 SWT 50 ms  
 RF Att 30 dB  
 Unit dBm



Date: 9.DEC.2015 15:20:47

433.92MHz 20dB Bandwidth = 139.2kHz



Date: 9.DEC.2015 15:21:44

433.92MHz 99% Bandwidth = 151.3kHz

## 7 Radiated Spurious Emissions (Transmitter)

### 7.1 Test Limits

**§ 15.231(a):** The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

(b) In addition to the provisions of §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                 | 2,250                                            | 225                                                     |
| 70-130                      | 1,250                                            | 125                                                     |
| 130-174                     | <sup>1</sup> 1,250 to 3,750                      | <sup>1</sup> 125 to 375                                 |
| 174-260                     | 3,750                                            | 375                                                     |
| 260-470                     | <sup>1</sup> 3,750 to 12,500                     | <sup>1</sup> 375 to 1,250                               |
| Above 470                   | 12,500                                           | 1,250                                                   |

<sup>1</sup>Linear interpolations.

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

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

**Part 15.205(a): Restricted Bands of Operations**

| MHz                            | MHz                 | MHz           | GHz              |
|--------------------------------|---------------------|---------------|------------------|
| 0.090–0.110 .....              | 16.42–16.423        | 399.9–410     | 4.5–5.15         |
| <sup>1</sup> 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             | 3345.8–3358   | 36.43–36.5       |
| 12.57675–12.57725 .....        | 322–335.4           | 3600–4400     | ( <sup>2</sup> ) |
| 13.36–13.41.                   |                     |               |                  |

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

<sup>2</sup> Above 38.6

**Part 15.209(a): Field Strength Limits for Restricted Bands of Operation**

| Frequency (MHz) | Field Strength<br>(microvolts/meter) | Measurement<br>Distance<br>(meters) |
|-----------------|--------------------------------------|-------------------------------------|
| 0.009 - 0.490   | 2,400 / F (kHz)                      | 300                                 |
| 0.490 - 1.705   | 24,000 / 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                                   |

## 7.2 Test Procedure

ANSI C63.10: 2013

### 7.3 Example of Field Strength Calculation Method:

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculations are listed below:

Formula:

$$FS = RA + AF + CF$$

FS = Field Strength in dB $\mu$ V/m

RA = Receiver Amplitude in dB $\mu$ V

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB (Including preamplifier and filter attenuation)

Example Calculation:

RA = 19.48 dB $\mu$ V

AF = 18.52 dB

CF = 0.78 dB

$$FS = 19.48 + 18.52 + 0.78 = 38.78 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(38.78 \text{ dB}\mu\text{V/m})/20] = 86.89 \mu\text{V/m}$$

### 7.1 Test Equipment Used:

| Description        | Serial Number   | Manufacturer    | Model   | Cal. Date   | Cal. Due    |
|--------------------|-----------------|-----------------|---------|-------------|-------------|
| EMI Test Receiver  | 1302.6005.40    | Rohde & Schwarz | ESU40   | 9/19/2015   | 9/19/2016   |
| Preamplifier       | 122005          | Rohde&Schwarz   | TS-PR18 | 11/26/2014  | 11/26/2015  |
| Biconnilog Antenna | 00051864        | ETS             | 3142C   | 1/20/2015   | 1/20/2016   |
| Horn Antenna       | 00154521        | ETS             | 3117    | 11/3/2015   | 11/3/2016   |
| System Controller  | 121701-1        | Sunol Sciences  | SC99V   | Time of Use | Time of Use |
| EMC Software       | Version 9.15.02 | Rohde&Schwarz   | EMC32   | Time of Use | Time of Use |

**7.2 Results:**

All fundamental and spurious emissions not falling into the restricted bands met the limits outlined in FCC Part 15.231(b). Additionally, all emissions falling within restricted bands of operation were found to be below the limit specified in Part 15.209(a). The emissions listed in the following tables are the worst case emissions and were investigated with the sample positioned in three orthogonal axis in order to report the highest possible field strength.

**Worst Case Spurious Measurements (433.92MHz, Peak Detection)**

EUT Name: 3m Tracker  
 Manufacturer: 3m  
 Test Engineer: Bryan Taylor  
 Date: 12/10/2015  
 Temp/Humidity/Pressure: 21.9C, 54.8%, 983mbar  
 Comment: 433.92MHz Transmitter; 15dBm Power Setting

| Frequency<br>(MHz) | MaxPeak<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) | Bandwidth<br>(kHz) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB) |
|--------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|---------------|
| 433.94             | 98.43               | 100.83            | -2.4           | 120                | 206.5          | H   | 13               | 21.3          |
| 30.44              | 31.06               | 80.83             | -49.77         | 120                | 104.9          | V   | 228              | 18.8          |
| 86.055             | 28.97               | 80.83             | -51.86         | 120                | 104.7          | V   | 340              | 9             |
| 99.44              | 34.6                | 80.83             | -46.23         | 120                | 109.8          | V   | 282              | 10.5          |
| 152.8              | 26.65               | 80.83             | -54.18         | 120                | 110.6          | V   | 340              | 11.6          |
| 434.2              | 49.53               | 80.83             | -31.3          | 120                | 110.4          | V   | 137              | 21.3          |
| 705.81             | 39.4                | 80.83             | -41.43         | 120                | 399.6          | V   | 145              | 27.4          |
| 869.14             | 41.59               | 80.83             | -39.24         | 120                | 398.8          | V   | 90               | 29            |
| 915.32             | 42.99               | 80.83             | -37.84         | 120                | 130.8          | V   | 28               | 30.1          |
| 925.28             | 43.48               | 80.83             | -37.35         | 120                | 100.2          | H   | 237              | 30            |
| 930.06             | 43.13               | 80.83             | -37.7          | 120                | 130.7          | V   | 128              | 30.4          |
| 1301.56            | 56.35               | 80.83             | -24.48         | 1000               | 222            | V   | 272              | -1.2          |
| 1735.48            | 52.97               | 80.83             | -27.86         | 1000               | 200            | V   | 140              | -0.1          |
| 2169.4             | 46.57               | 80.83             | -34.26         | 1000               | 410            | V   | 258              | 3.1           |
| 2603.32            | 55.6                | 80.83             | -25.23         | 1000               | 225            | V   | 318              | 3.9           |
| 3037.24            | 55.36               | 80.83             | -25.47         | 1000               | 227            | H   | 239              | 4.9           |
| 3471.16            | 49.61               | 80.83             | -31.22         | 1000               | 206            | H   | 256              | 5.2           |
| 3905.08            | 50.25               | 80.83             | -30.58         | 1000               | 236            | H   | 260              | 6.1           |
| 4339               | 47.82               | 80.83             | -33.01         | 1000               | 303            | H   | 272              | 6.8           |

**Worst Case Spurious Measurements (433.92MHz, Average Detection)**

EUT Name: 3m Tracker  
 Manufacturer: 3m  
 Test Engineer: Bryan Taylor  
 Date: 12/10/2015  
 Temp/Humidity/Pressure: 21.9C, 54.8%, 983mbar  
 Comment: 433.92MHz Transmitter; 15dBm Power Setting

| Frequency<br>(MHz) | Average<br>Inc DCF<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Bandwidth<br>(kHz) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB) |
|--------------------|--------------------------------|-------------------|----------------|--------------------|----------------|-----|------------------|---------------|
| 433.94             | 77.71                          | 80.83             | -3.12          | 120                | 206.5          | H   | 13               | 21.3          |
| 30.44              | 10.34                          | 60.83             | -50.49         | 120                | 104.9          | V   | 228              | 18.8          |
| 86.055             | 8.25                           | 60.83             | -52.58         | 120                | 104.7          | V   | 340              | 9             |
| 99.44              | 13.88                          | 60.83             | -46.95         | 120                | 109.8          | V   | 282              | 10.5          |
| 152.8              | 5.93                           | 60.83             | -54.9          | 120                | 110.6          | V   | 340              | 11.6          |
| 434.2              | 28.81                          | 60.83             | -32.02         | 120                | 110.4          | V   | 137              | 21.3          |
| 705.81             | 18.68                          | 60.83             | -42.15         | 120                | 399.6          | V   | 145              | 27.4          |
| 869.14             | 20.87                          | 60.83             | -39.96         | 120                | 398.8          | V   | 90               | 29            |
| 915.32             | 22.27                          | 60.83             | -38.56         | 120                | 130.8          | V   | 28               | 30.1          |
| 925.28             | 22.76                          | 60.83             | -38.07         | 120                | 100.2          | H   | 237              | 30            |
| 930.06             | 22.41                          | 60.83             | -38.42         | 120                | 130.7          | V   | 128              | 30.4          |
| 1301.56            | 35.63                          | 60.83             | -25.2          | 1000               | 222            | V   | 272              | -1.2          |
| 1735.48            | 32.25                          | 60.83             | -28.58         | 1000               | 200            | V   | 140              | -0.1          |
| 2169.4             | 25.85                          | 60.83             | -34.98         | 1000               | 410            | V   | 258              | 3.1           |
| 2603.32            | 34.88                          | 60.83             | -25.95         | 1000               | 225            | V   | 318              | 3.9           |
| 3037.24            | 34.64                          | 60.83             | -26.19         | 1000               | 227            | H   | 239              | 4.9           |
| 3471.16            | 28.89                          | 60.83             | -31.94         | 1000               | 206            | H   | 256              | 5.2           |
| 3905.08            | 29.53                          | 60.83             | -31.3          | 1000               | 236            | H   | 260              | 6.1           |
| 4339               | 27.1                           | 60.83             | -33.73         | 1000               | 303            | H   | 272              | 6.8           |

\*Average readings include an additional -20.72dB duty cycle correction factor.

**Worst Case Spurious Measurements (418MHz Peak Detection)**

EUT Name: 3m Tracker  
 Manufacturer: 3m  
 Test Engineer: Bryan Taylor  
 Date: 12/10/2015  
 Temp/Humidity/Pressure: 21.9C, 54.8%, 983mbar  
 Comment: 418MHz Transmitter; 15dBm Power Setting

| Frequency<br>(MHz) | MaxPeak<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Bandwidth<br>(kHz) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB) |
|--------------------|---------------------|-------------------|----------------|--------------------|----------------|-----|------------------|---------------|
| 418                | 90.79               | 100.28            | -9.49          | 120                | 106.7          | V   | 140              | 20.8          |
| 30.88              | 30.94               | 80.28             | -49.34         | 120                | 111.8          | V   | 212              | 18.5          |
| 87.8               | 28.64               | 80.28             | -51.64         | 120                | 114.6          | V   | 264              | 9.2           |
| 97.128             | 35.45               | 80.28             | -44.83         | 120                | 105.1          | V   | 237              | 10.5          |
| 97.857             | 34.45               | 80.28             | -45.83         | 120                | 105.4          | V   | 190              | 10.5          |
| 99.111             | 29.21               | 80.28             | -51.07         | 120                | 265.4          | V   | 266              | 10.6          |
| 150.96             | 28.14               | 80.28             | -52.14         | 120                | 105.2          | V   | 0                | 11.5          |
| 418.54             | 41.05               | 80.28             | -39.23         | 120                | 109.8          | V   | 172              | 20.8          |
| 695.5              | 39.68               | 80.28             | -40.6          | 120                | 224.9          | H   | 61               | 27.1          |
| 836.06             | 55.63               | 80.28             | -24.65         | 120                | 106.5          | V   | 318              | 29            |
| 950.02             | 43.5                | 80.28             | -36.78         | 120                | 378.2          | V   | 312              | 30.3          |
| 1253.8             | 52.94               | 80.28             | -27.34         | 1000               | 208            | V   | 256              | -1            |
| 1671.8             | 48.2                | 80.28             | -32.08         | 1000               | 229            | V   | 144              | -0.6          |
| 2089.8             | 44.11               | 80.28             | -36.17         | 1000               | 200            | V   | 255              | 2.5           |
| 2507.8             | 57.3                | 80.28             | -22.98         | 1000               | 202            | V   | 310              | 3.9           |
| 2925.8             | 52.85               | 80.28             | -27.43         | 1000               | 232            | H   | 260              | 4.6           |
| 3343.8             | 51.04               | 80.28             | -29.24         | 1000               | 237            | H   | 276              | 5.1           |
| 3761.8             | 54.96               | 80.28             | -25.32         | 1000               | 288            | H   | 272              | 5.9           |
| 4179.8             | 54.93               | 80.28             | -25.35         | 1000               | 270            | H   | 261              | 6.4           |

**Worst Case Spurious Measurements (418MHz Average Detection)**

EUT Name: 3m Tracker  
 Manufacturer: 3m  
 Test Engineer: Bryan Taylor  
 Date: 12/10/2015  
 Temp/Humidity/Pressure: 21.9C, 54.8%, 983mbar  
 Comment: 418MHz Transmitter; 15dBm Power Setting

| Frequency<br>(MHz) | Average<br>Inc DCF<br>(dBµV/m) | Limit<br>(dBµV/m) | Margin<br>(dB) | Bandwidth<br>(kHz) | Height<br>(cm) | Pol | Azimuth<br>(deg) | Corr.<br>(dB) |
|--------------------|--------------------------------|-------------------|----------------|--------------------|----------------|-----|------------------|---------------|
| 417.96             | 70.07                          | 80.28             | -10.21         | 120                | 106.7          | V   | 140              | 20.8          |
| 30.88              | 10.22                          | 60.28             | -50.06         | 120                | 111.8          | V   | 212              | 18.5          |
| 87.8               | 7.92                           | 60.28             | -52.36         | 120                | 114.6          | V   | 264              | 9.2           |
| 97.128             | 14.73                          | 60.28             | -45.55         | 120                | 105.1          | V   | 237              | 10.5          |
| 97.857             | 13.73                          | 60.28             | -46.55         | 120                | 105.4          | V   | 190              | 10.5          |
| 99.111             | 8.49                           | 60.28             | -51.79         | 120                | 265.4          | V   | 266              | 10.6          |
| 150.96             | 7.42                           | 60.28             | -52.86         | 120                | 105.2          | V   | 0                | 11.5          |
| 418.54             | 20.33                          | 60.28             | -39.95         | 120                | 109.8          | V   | 172              | 20.8          |
| 695.5              | 18.96                          | 60.28             | -41.32         | 120                | 224.9          | H   | 61               | 27.1          |
| 836.06             | 34.91                          | 60.28             | -25.37         | 120                | 106.5          | V   | 318              | 29            |
| 950.02             | 22.78                          | 60.28             | -37.5          | 120                | 378.2          | V   | 312              | 30.3          |
| 1253.8             | 32.22                          | 60.28             | -28.06         | 1000               | 208            | V   | 256              | -1            |
| 1671.8             | 27.48                          | 60.28             | -32.8          | 1000               | 229            | V   | 144              | -0.6          |
| 2089.8             | 23.39                          | 60.28             | -36.89         | 1000               | 200            | V   | 255              | 2.5           |
| 2507.8             | 36.58                          | 60.28             | -23.7          | 1000               | 202            | V   | 310              | 3.9           |
| 2925.8             | 32.13                          | 60.28             | -28.15         | 1000               | 232            | H   | 260              | 4.6           |
| 3343.8             | 30.32                          | 60.28             | -29.96         | 1000               | 237            | H   | 276              | 5.1           |
| 3761.8             | 34.24                          | 60.28             | -26.04         | 1000               | 288            | H   | 272              | 5.9           |
| 4179.8             | 34.21                          | 60.28             | -26.07         | 1000               | 270            | H   | 261              | 6.4           |

\*Average readings include an additional -20.72dB duty cycle correction factor.

## **8 Antenna Requirement per FCC Part 15.203**

### **8.1 Test Limits**

**§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

### **8.2 Results:**

The sample tested met the antenna requirement. The antenna used was permanently attached and integral to the PCB.

## 9 Power Port Conducted Emissions

### 9.1 Method

The test method used was identical to that described in ANSI C63.4:2014.

### 9.2 Test Location

This test was performed at the Intertek offices located at the following address:

Intertek  
731 Enterprise Drive  
Lexington, KY 40510

### 9.3 Test Equipment Used:

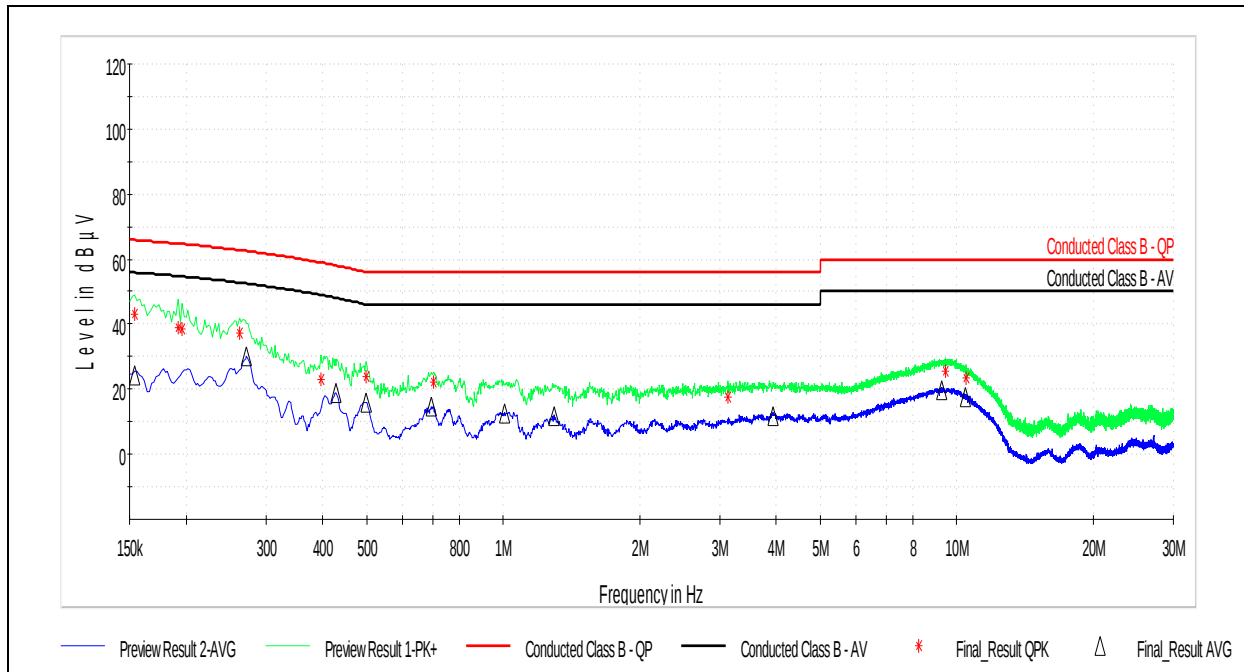
| Description       | Serial Number   | Manufacturer    | Model | Cal. Date   | Cal. Due    |
|-------------------|-----------------|-----------------|-------|-------------|-------------|
| EMI Test Receiver | 10887490.26     | Rohde & Schwarz | ES126 | 9/20/2015   | 9/20/2016   |
| LISN              | 3333            | Teseq           | NNB52 | 5/21/2015   | 5/21/2016   |
| EMC Software      | Version 9.15.02 | Rohde&Schwarz   | EMC32 | Time of Use | Time of Use |

### 9.4 Results:

The sample tested was found to Comply.

**9.5 Data (Line 1):**

EUT Name: 3m Tracker  
 Manufacturer: 3m  
 Test Engineer: Bryan Taylor  
 Date: 10/30/2015  
 Temp/Humidity/Pressure: 21.9C, 54.8%, 983mbar  
 Comment: L1 Transmitting 418 MHz

**Final\_Result\_QPK**

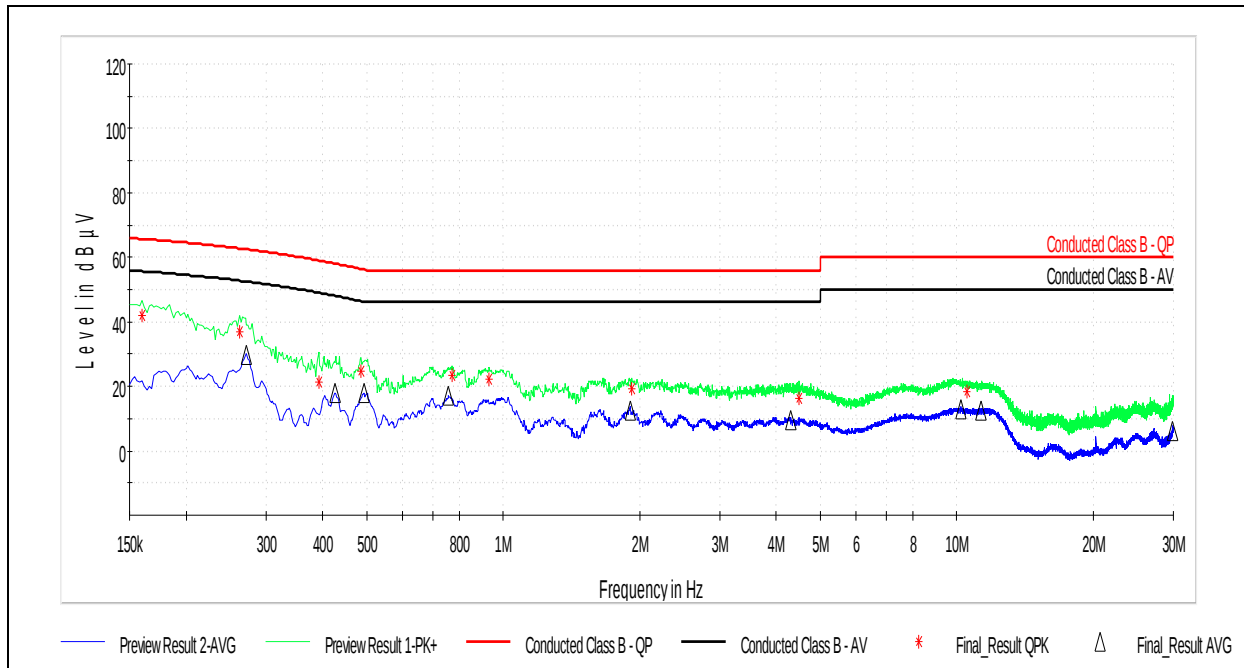
| Frequency (MHz) | QuasiPeak (dBµV) | Limit (dBµV) | Margin (dB) | Bandwidth (kHz) | Corr. (dB) |
|-----------------|------------------|--------------|-------------|-----------------|------------|
| 0.154000        | 42.98            | 65.89        | 22.91       | 9.000           | 0.3        |
| 0.192000        | 39.01            | 64.80        | 25.79       | 9.000           | 0.3        |
| 0.196000        | 38.43            | 64.69        | 26.26       | 9.000           | 0.3        |
| 0.262000        | 37.26            | 62.80        | 25.54       | 9.000           | 0.3        |
| 0.396000        | 22.95            | 58.97        | 36.02       | 9.000           | 0.3        |
| 0.498000        | 23.71            | 56.06        | 32.35       | 9.000           | 0.4        |
| 0.702000        | 22.09            | 56.00        | 33.91       | 9.000           | 0.4        |
| 3.124000        | 17.48            | 56.00        | 38.52       | 9.000           | 0.9        |
| 9.420000        | 25.56            | 60.00        | 34.44       | 9.000           | 1.3        |
| 10.468000       | 23.43            | 60.00        | 36.57       | 9.000           | 1.4        |

**Final\_Result\_AVG**

| Frequency (MHz) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Bandwidth (kHz) | Corr. (dB) |
|-----------------|----------------|--------------|-------------|-----------------|------------|
| 0.154000        | 24.45          | 55.89        | 31.44       | 9.000           | 0.3        |
| 0.272000        | 30.13          | 52.51        | 22.38       | 9.000           | 0.3        |
| 0.428000        | 18.69          | 48.06        | 29.37       | 9.000           | 0.3        |
| 0.498000        | 15.87          | 46.06        | 30.19       | 9.000           | 0.4        |
| 0.694000        | 14.75          | 46.00        | 31.25       | 9.000           | 0.4        |
| 1.008000        | 12.52          | 46.00        | 33.48       | 9.000           | 0.5        |
| 1.296000        | 11.69          | 46.00        | 34.31       | 9.000           | 0.5        |
| 3.928000        | 11.76          | 46.00        | 34.24       | 9.000           | 1.1        |
| 9.268000        | 19.83          | 50.00        | 30.17       | 9.000           | 1.3        |
| 10.440000       | 17.77          | 50.00        | 32.23       | 9.000           | 1.4        |

## 9.6 Data (Line 2):

EUT Name: 3m Tracker  
 Manufacturer: 3m  
 Test Engineer: Bryan Taylor  
 Date: 10/30/2015  
 Temp/Humidity/Pressure: 21.9C, 54.8%, 983mbar  
 Comment: N Transmitting 418 MHz



### Final\_Result\_QPK

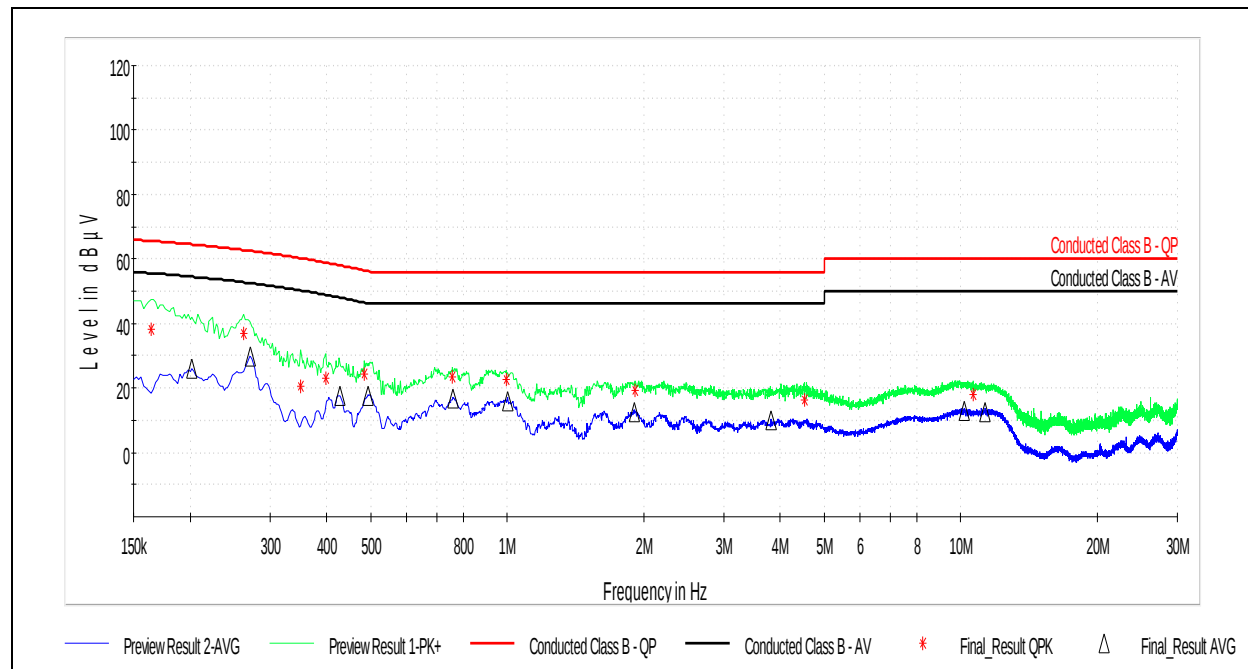
| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Bandwidth (kHz) | Corr. (dB) |
|-----------------|------------------------|--------------------|-------------|-----------------|------------|
| 0.160000        | 41.79                  | 65.71              | 23.92       | 9.000           | 0.3        |
| 0.262000        | 36.91                  | 62.80              | 25.89       | 9.000           | 0.3        |
| 0.392000        | 21.31                  | 59.09              | 37.78       | 9.000           | 0.3        |
| 0.486000        | 24.73                  | 56.40              | 31.67       | 9.000           | 0.4        |
| 0.770000        | 23.50                  | 56.00              | 32.50       | 9.000           | 0.5        |
| 0.932000        | 22.26                  | 56.00              | 33.74       | 9.000           | 0.5        |
| 1.924000        | 19.27                  | 56.00              | 36.73       | 9.000           | 0.6        |
| 4.492000        | 16.46                  | 56.00              | 39.54       | 9.000           | 1.1        |
| 10.508000       | 18.21                  | 60.00              | 41.79       | 9.000           | 1.4        |

### Final\_Result\_AVG

| Frequency (MHz) | Average (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Bandwidth (kHz) | Corr. (dB) |
|-----------------|----------------------|--------------------|-------------|-----------------|------------|
| 0.272000        | 29.81                | 52.51              | 22.70       | 9.000           | 0.3        |
| 0.426000        | 17.75                | 48.11              | 30.36       | 9.000           | 0.3        |
| 0.494000        | 17.76                | 46.17              | 28.41       | 9.000           | 0.4        |
| 0.758000        | 16.90                | 46.00              | 29.10       | 9.000           | 0.5        |
| 1.904000        | 12.58                | 46.00              | 33.42       | 9.000           | 0.6        |
| 4.312000        | 9.41                 | 46.00              | 36.59       | 9.000           | 1.1        |
| 10.204000       | 12.88                | 50.00              | 37.12       | 9.000           | 1.4        |
| 11.304000       | 12.48                | 50.00              | 37.52       | 9.000           | 1.4        |
| 29.940000       | 6.28                 | 50.00              | 43.72       | 9.000           | 3.5        |

**9.1 Data (Line 1):**

EUT Name: 3m Tracker  
 Manufacturer: 3m  
 Test Engineer: Bryan Taylor  
 Date: 10/30/2015  
 Temp/Humidity/Pressure: 21.9C, 54.8%, 983mbar  
 Comment: N Transmitting 433.92 MHz

**Final\_Result\_QPK**

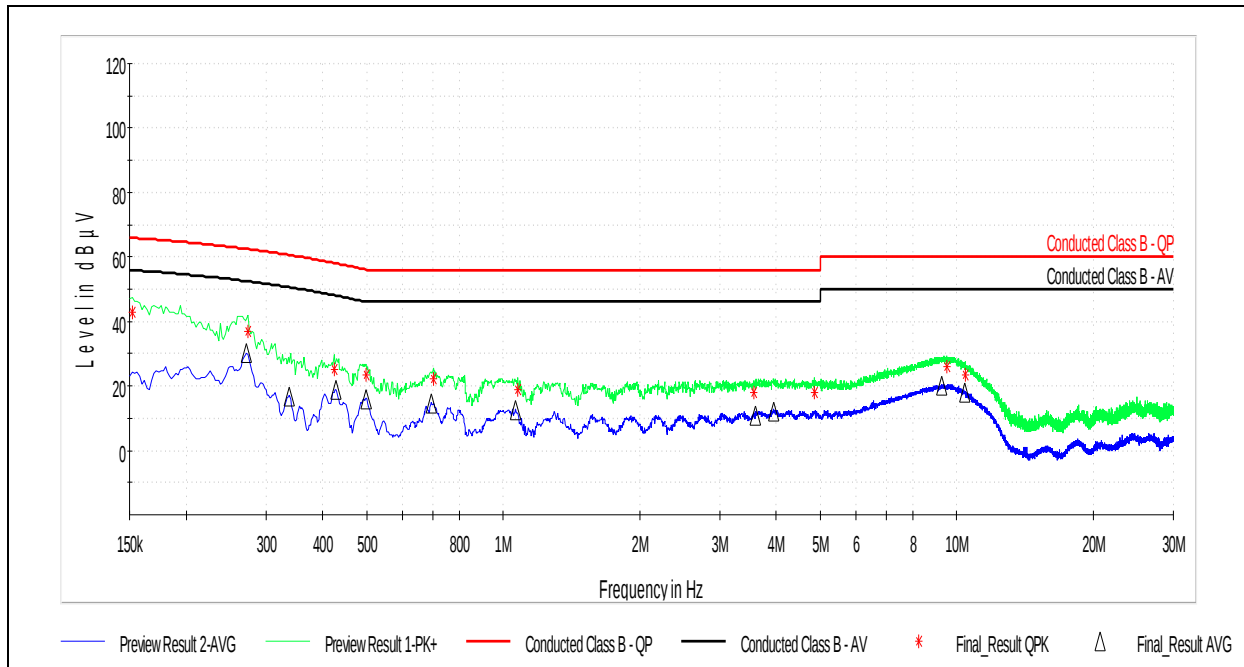
| Frequency (MHz) | QuasiPeak (dBµV) | Limit (dBµV) | Margin (dB) | Bandwidth (kHz) | Corr. (dB) |
|-----------------|------------------|--------------|-------------|-----------------|------------|
| 0.164000        | 38.22            | 65.60        | 27.38       | 9.000           | 0.3        |
| 0.262000        | 36.92            | 62.80        | 25.88       | 9.000           | 0.3        |
| 0.350000        | 20.29            | 60.29        | 40.00       | 9.000           | 0.3        |
| 0.398000        | 23.10            | 58.91        | 35.81       | 9.000           | 0.3        |
| 0.484000        | 24.33            | 56.46        | 32.13       | 9.000           | 0.4        |
| 0.758000        | 23.51            | 56.00        | 32.49       | 9.000           | 0.5        |
| 0.994000        | 22.65            | 56.00        | 33.35       | 9.000           | 0.5        |
| 1.916000        | 19.09            | 56.00        | 36.91       | 9.000           | 0.6        |
| 4.520000        | 16.40            | 56.00        | 39.60       | 9.000           | 1.2        |
| 10.656000       | 18.14            | 60.00        | 41.86       | 9.000           | 1.4        |

**Final\_Result\_AVG**

| Frequency (MHz) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Bandwidth (kHz) | Corr. (dB) |
|-----------------|----------------|--------------|-------------|-----------------|------------|
| 0.202000        | 25.89          | 54.51        | 28.62       | 9.000           | 0.3        |
| 0.272000        | 29.78          | 52.51        | 22.73       | 9.000           | 0.3        |
| 0.428000        | 17.61          | 48.06        | 30.45       | 9.000           | 0.3        |
| 0.494000        | 17.68          | 46.17        | 28.49       | 9.000           | 0.4        |
| 0.760000        | 16.73          | 46.00        | 29.27       | 9.000           | 0.5        |
| 1.004000        | 15.95          | 46.00        | 30.05       | 9.000           | 0.5        |
| 1.904000        | 12.59          | 46.00        | 33.41       | 9.000           | 0.6        |
| 3.816000        | 9.82           | 46.00        | 36.18       | 9.000           | 1.1        |
| 10.168000       | 12.74          | 50.00        | 37.26       | 9.000           | 1.4        |
| 11.304000       | 12.48          | 50.00        | 37.52       | 9.000           | 1.4        |

## 9.1 Data (Line 2):

EUT Name: 3m Tracker  
 Manufacturer: 3m  
 Test Engineer: Bryan Taylor  
 Date: 10/30/2015  
 Temp/Humidity/Pressure: 21.9C, 54.8%, 983mbar  
 Comment: N Transmitting 433.92 MHz



### Final\_Result\_QPK

| Frequency (MHz) | QuasiPeak (dBµV) | Limit (dBµV) | Margin (dB) | Bandwidth (kHz) | Corr. (dB) |
|-----------------|------------------|--------------|-------------|-----------------|------------|
| 0.152000        | 42.65            | 65.94        | 23.29       | 9.000           | 0.3        |
| 0.274000        | 36.73            | 62.46        | 25.73       | 9.000           | 0.3        |
| 0.424000        | 25.20            | 58.17        | 32.97       | 9.000           | 0.3        |
| 0.498000        | 23.61            | 56.06        | 32.45       | 9.000           | 0.4        |
| 0.702000        | 22.19            | 56.00        | 33.81       | 9.000           | 0.4        |
| 1.076000        | 18.74            | 56.00        | 37.26       | 9.000           | 0.5        |
| 3.572000        | 17.75            | 56.00        | 38.25       | 9.000           | 1.0        |
| 4.860000        | 17.81            | 56.00        | 38.19       | 9.000           | 1.4        |
| 9.492000        | 25.77            | 60.00        | 34.23       | 9.000           | 1.3        |
| 10.428000       | 23.57            | 60.00        | 36.43       | 9.000           | 1.4        |

### Final\_Result\_AVG

| Frequency (MHz) | Average (dBµV) | Limit (dBµV) | Margin (dB) | Bandwidth (kHz) | Corr. (dB) |
|-----------------|----------------|--------------|-------------|-----------------|------------|
| 0.272000        | 30.05          | 52.51        | 22.46       | 9.000           | 0.3        |
| 0.338000        | 16.88          | 50.63        | 33.75       | 9.000           | 0.3        |
| 0.428000        | 18.73          | 48.06        | 29.33       | 9.000           | 0.3        |
| 0.498000        | 15.76          | 46.06        | 30.30       | 9.000           | 0.4        |
| 0.694000        | 14.78          | 46.00        | 31.22       | 9.000           | 0.4        |
| 1.064000        | 12.41          | 46.00        | 33.59       | 9.000           | 0.5        |
| 3.592000        | 10.98          | 46.00        | 35.02       | 9.000           | 1.0        |
| 3.944000        | 11.98          | 46.00        | 34.02       | 9.000           | 1.1        |
| 9.268000        | 19.90          | 50.00        | 30.10       | 9.000           | 1.3        |
| 10.412000       | 17.83          | 50.00        | 32.17       | 9.000           | 1.4        |

## 10 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements.

The measurement uncertainty figures were calculated and correspond to a coverage factor of  $k = 2$ , providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Measurement uncertainty Table

| Parameter                                        | Uncertainty | Notes |
|--------------------------------------------------|-------------|-------|
| Radiated emissions, 30 to 1000 MHz               | +3.9dB      |       |
| Radiated emissions, 1 to 18 GHz                  | +4.2dB      |       |
| Radiated emissions, 18 to 40 GHz                 | +4.3dB      |       |
| Power Port Conducted emissions, 150kHz to 30 MHz | +2.8dB      |       |

## 11 Revision History

| Revision Level | Date      | Report Number    | Notes          |
|----------------|-----------|------------------|----------------|
| 0              | 1/10/2016 | 102254548LEX-002 | Original Issue |
|                |           |                  |                |
|                |           |                  |                |
|                |           |                  |                |
|                |           |                  |                |
|                |           |                  |                |