



## TEST REPORT

Report Number: 102714365MIN-001

Project Number: G102714365

Testing performed on the  
BTE13  
Class II Permissive Changes

FCC ID: EOA-EXPSTANDARD

to  
47 CFR Part 15.249:2015

For  
Starkey Laboratories, Inc.

Test Performed by:  
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Oakdale, MN 55128 USA

Test Authorized by:  
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Date of issue: September 1, 2016

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## 1.0 GENERAL DESCRIPTION

|                                     |   |
|-------------------------------------|---|
| <b>Model Tested:</b>                | BTE13   |
| <b>Type of EUT:</b>                 | Hearing Aid   |
| <b>Serial Number:</b>               | 161085203   |
| <b>FCC ID:</b>                      | EOA-EXPSTANDARD   |
| <b>Related Submittal(s) Grants:</b> | Class II Permissive Changes   |
| <b>Company:</b>                     | Starkey Laboratories, Inc.  |
| <b>Customer:</b>                    | Mr. Bill Mitchell   |
| <b>Address:</b>                     | 6700 Washington Avenue South<br>Eden Prairie, MN 55344, USA   |
| <b>Phone:</b>                       | (952) 947-4734  |
| <b>Fax:</b>                         | (952) 828-6972  |
| <b>E-mail:</b>                      | <a href="mailto:bill_mitchell@starkey.com">bill_mitchell@starkey.com</a>  |
| <b>Test Standards:</b>              | <input checked="" type="checkbox"/> 47 CFR, Part 15:2015, §15.249<br><input type="checkbox"/> RSS-210, Issue 8, 2010<br><input type="checkbox"/> RSS-Gen, Issue 4, 2014<br><input type="checkbox"/> 47 CFR, Part 15:2015, §15.107 and §15.109, Class [REDACTED], test method: ANSI C63.4-2014<br><input type="checkbox"/> ICES-003, Issue 6:2016<br><input type="checkbox"/> Other [REDACTED] |
| <b>Type of radio:</b>               | <input checked="" type="checkbox"/> Stand -alone <input type="checkbox"/> Module <input type="checkbox"/> Hybrid  |
| <b>Date Sample Submitted:</b>       | August 31, 2016   |
| <b>Test Work Started:</b>           | August 31, 2016   |
| <b>Test Work Completed:</b>         | September 1, 2016   |
| <b>Test Sample Conditions:</b>      | <input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good  |



1.1 Product Description; Test Facility

|   |   |
|---|---|
| <b>Product Description:</b>             | Hearing Aid Transceiver   |
| <b>Band of Operation:</b>               | 902 - 928MHz  |
| <b>Operating Frequencies:</b>           | 902.6-926.9MHz  |
| <b>Modulation:</b>                      | FSK   |
| <b>Antenna(s) Info:</b>                 | Integral  |
| <b>Antenna Installation:</b>            | <input type="checkbox"/> User <input type="checkbox"/> Professional <input checked="" type="checkbox"/> Factory   |
| <b>Transmitter Power Configuration:</b> | <input checked="" type="checkbox"/> Internal battery <input type="checkbox"/> External power source<br><input type="checkbox"/> 120VAC <input type="checkbox"/> 230VAC <input type="checkbox"/> 400VAC <input checked="" type="checkbox"/> 1.45VDC <input type="checkbox"/> Other: <input type="text"/><br><input type="text"/> Amp.<br><input type="checkbox"/> 50Hz <input type="checkbox"/> 60Hz |
| <b>Special Test Arrangement:</b>        | None  |
| <b>Test Facility Accreditation:</b>     | A2LA (Certificate No. 1427.01)  |
| <b>Test Methodology:</b>                | Measurements performed according to the procedures in ANSI C63.10-2013  |



## 1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

- Standby
- Continuous
- Continuous un-modulated
- Test program (customer specific)
- Continuous modulated (see details below)

### Operating modes of the EUT:

| No. | Description  |
|-----|--|
| 1   | The device was pre-programmed to operate continuously at low, middle, and upper frequency channels, one channel being transmitted at a given time. |

### Cables:

| No. | Type | Length | Designation | Note |
|-----|------|--------|-------------|------|
| 1   | None |        |             |      |

### Support equipment/Services:

| No. | Item | Description |
|-----|------|-------------|
| 1   | None |             |

**General Note:** The only RF circuit change that has been made to the design was that antenna tuning capacitor C401 was depopulated. Therefore, Field Strength of Fundamental Emission and Spurious Radiated Emissions were measured.

## 1.3 Environmental conditions

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

**Normal**

**Temperature:** 15-35 ° C

**Humidity:** 30-60 %

**Atmospheric pressure:** 86-106 kPa

## 1.4 Measurement uncertainty

The expanded uncertainty ( $k = 2$ ) for radiated emissions from 30 to 1000 MHz has been determined to be:  $\pm 4$  dB at 10m and  $\pm 5.4$  dB at 3m

The expanded uncertainty ( $k = 2$ ) for radiated emissions above 1GHz has been determined to be:  $\pm 6.4$  dB at 3m

The expanded uncertainty ( $k = 2$ ) for conducted emissions from 150 kHz to 30 MHz has been determined to be:  $\pm 2.6$  dB

## 1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength in dB( $\mu$ V/m)

RA = Receiver Amplitude in dB( $\mu$ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB( $m^{-1}$ )

AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB( $\mu$ V) is obtained. The antenna factor of 7.4 dB( $m^{-1}$ ) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB( $\mu$ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/\text{m})$$

**General notes:**



## 2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

| TEST SPECIFICATION | TEST PARAMETERS                      | RESULT |
|--------------------|--------------------------------------|--------|
| 15.249(a)          | Field strength of fundamental        | Pass   |
| 15.249(a)          | Field strength of harmonics          | Pass   |
| 15.249(d)          | Field strength of spurious emissions | Pass   |



### 3.0 TEST CONDITIONS AND RESULTS

#### 3.1 Field strength of fundamental

**Test location:**  OATS  Anechoic Chamber  Other

**Test distance:**  10 meters  3 meters

**Frequency range of measurements:** 902-928MHz

**Test result:** **Pass**

**Max. Emissions margin at fundamental:** 17.1dB below the limits

**Notes:** None

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|                                  |                                     |                     |
|----------------------------------|-------------------------------------|---------------------|
| <b>Date:</b>                     | August 31, 2016                     | <b>Result: Pass</b> |
| <b>Tested by:</b>                | Uri Spector                         |                     |
| <b>Standard:</b>                 | FCC 15.249(a)                       |                     |
| <b>Test Point:</b>               | Enclosure with antenna              |                     |
| <b>Operation mode:</b>           | See page 5                          |                     |
| <b>Environmental Conditions:</b> | 22.9°C; 47.8%(RH); 98.8kPa          |                     |
| <b>Equipment Verification:</b>   | <input checked="" type="checkbox"/> |                     |
| <b>Note:</b>                     | None                                |                     |

**Table 3.1.1**

| Frequency<br>MHz   | Antenna  |         | Ant. CF<br>dB1/m | Cable loss<br>dB | Pre-amp<br>Gain (dB) | Reading<br>dBµV | Total @ 3m<br>dBµV/m | Limit<br>dBµV/m | Margin<br>dB | Comments      |
|--------------------|----------|---------|------------------|------------------|----------------------|-----------------|----------------------|-----------------|--------------|---------------|
|                    | Polarity | Hts(cm) |                  |                  |                      |                 |                      |                 |              |               |
| <b>Channel 353</b> |          |         |                  |                  |                      |                 |                      |                 |              |               |
| 902.58             | V        | 129     | 22.0             | 2.6              | 0.0                  | 52.5            | 77.1                 | 94.0            | -16.9        | Peak Readings |
| 902.58             | H        | 204     | 22.0             | 2.6              | 0.0                  | 48.3            | 72.9                 | 94.0            | -21.1        | Peak Readings |
| <b>Channel 393</b> |          |         |                  |                  |                      |                 |                      |                 |              |               |
| 914.74             | V        | 117     | 22.0             | 2.6              | 0.0                  | 52.3            | 76.9                 | 94.0            | -17.1        | Peak Readings |
| 914.74             | H        | 187     | 22.0             | 2.6              | 0.0                  | 48.4            | 73.0                 | 94.0            | -21.0        | Peak Readings |
| <b>Channel 433</b> |          |         |                  |                  |                      |                 |                      |                 |              |               |
| 926.85             | V        | 110     | 22.0             | 2.6              | 0.0                  | 49.2            | 73.8                 | 94.0            | -20.2        | Peak Readings |
| 926.85             | H        | 190     | 22.0             | 2.6              | 0.0                  | 45.3            | 69.9                 | 94.0            | -24.1        | Peak Readings |



### 3.2 Field strength of harmonics and spurious emissions

**Test location:**  OATS  Anechoic Chamber  Other

**Test distance:**  10 meters  3 meters

**Frequency range of measurements:** 30MHz-10GHz

**Test result:** **Pass**

**Maximum margin of harmonics and spurious emissions:** 5.8dB below the limits

**Notes:** Transmitting fundamental frequencies and frequencies not related with transmitting operation were excluded from the table.

Graphs 3.2.1 and 3.2.2 show spurious and harmonics emissions for Channel 353

Graphs 3.2.3 and 3.2.4 show spurious and harmonics emissions for Channel 393

Graphs 3.2.5 and 3.2.6 show spurious and harmonics emissions for Channel 433

All peak harmonics and spurious emissions are below average limit.



|                                  |                                     |                     |
|----------------------------------|-------------------------------------|---------------------|
| <b>Date:</b>                     | August 31, 2016                     | <b>Result: Pass</b> |
| <b>Tested by:</b>                | Uri Spector                         |                     |
| <b>Standard:</b>                 | FCC 15.249(a)                       |                     |
| <b>Test Point:</b>               | Enclosure with antenna              |                     |
| <b>Operation mode:</b>           | See page 5                          |                     |
| <b>Environmental Conditions:</b> | 22.9°C; 47.8%(RH); 98.8kPa          |                     |
| <b>Equipment Verification:</b>   | <input checked="" type="checkbox"/> |                     |
| <b>Note:</b>                     | None                                |                     |

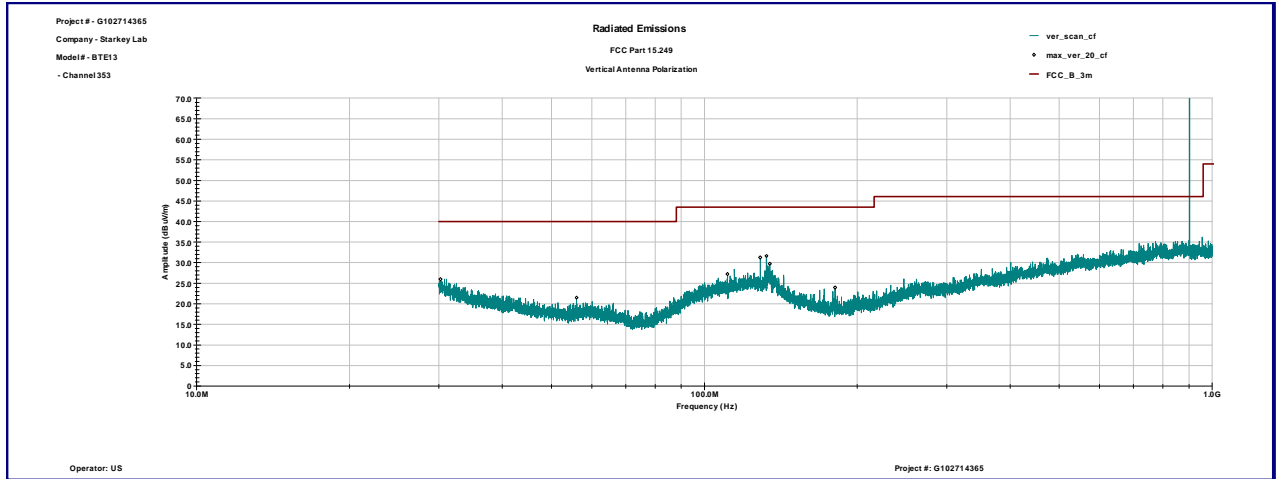
**Table 3.2.1**

| Frequency<br>MHz   | Antenna<br>Polarity | Peak Reading<br>dBμV | Total C.F.<br>dB1/m | Pre-Amp.<br>Gain (dB) | Total at 3m<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB |
|--------------------|---------------------|----------------------|---------------------|-----------------------|-----------------------|-----------------|--------------|
| <b>Channel 353</b> |                     |                      |                     |                       |                       |                 |              |
| 1.738 GHz          | V                   | 48.1                 | 28.6                | 43.0                  | 33.6                  | 54.0            | -20.4        |
| 1.807 GHz          | V                   | 54.8                 | 29.0                | 43.1                  | 40.6                  | 54.0            | -13.4        |
| 1.924 GHz          | V                   | 49.1                 | 29.8                | 43.2                  | 35.7                  | 54.0            | -18.3        |
| 2.707 GHz          | V                   | 55.1                 | 31.8                | 43.6                  | 43.4                  | 54.0            | -10.6        |
| 1.807 GHz          | H                   | 51.7                 | 29.0                | 43.1                  | 37.6                  | 54.0            | -16.4        |
| 2.707 GHz          | H                   | 48.8                 | 31.8                | 43.6                  | 37.1                  | 54.0            | -16.9        |
| <b>Channel 393</b> |                     |                      |                     |                       |                       |                 |              |
| 1.831 GHz          | V                   | 56.9                 | 29.2                | 43.1                  | 43.0                  | 54.0            | -11.0        |
| 1.924 GHz          | V                   | 51.9                 | 29.8                | 43.2                  | 38.5                  | 54.0            | -15.4        |
| 2.743 GHz          | V                   | 55.5                 | 31.9                | 43.6                  | 43.8                  | 54.0            | -10.2        |
| 1.831 GHz          | H                   | 52.2                 | 29.2                | 43.1                  | 38.3                  | 54.0            | -15.7        |
| 2.743 GHz          | H                   | 50.3                 | 31.9                | 43.6                  | 38.6                  | 54.0            | -15.4        |
| <b>Channel 433</b> |                     |                      |                     |                       |                       |                 |              |
| 1.855 GHz          | V                   | 55.4                 | 29.4                | 43.1                  | 41.7                  | 54.0            | -12.3        |
| 1.924 GHz          | V                   | 47.9                 | 29.8                | 43.2                  | 34.5                  | 54.0            | -19.5        |
| 2.779 GHz          | V                   | 59.9                 | 31.9                | 43.6                  | 48.2                  | 54.0            | -5.8         |
| 1.855 GHz          | H                   | 52.2                 | 29.5                | 43.1                  | 38.6                  | 54.0            | -15.4        |
| 2.779 GHz          | H                   | 54.4                 | 32.0                | 43.6                  | 42.8                  | 54.0            | -11.2        |

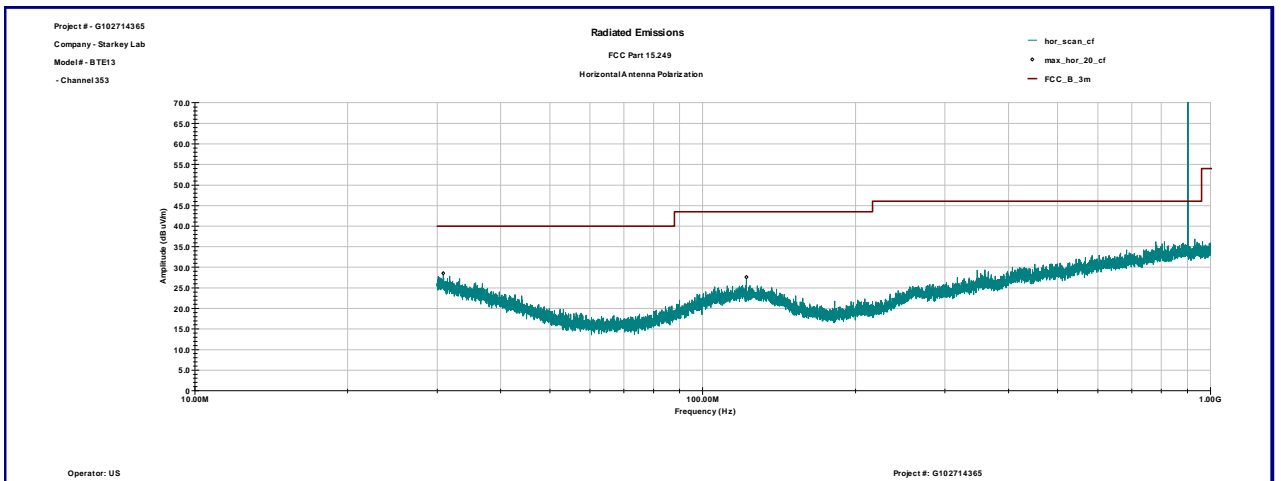


Graph 3.2.1

### Vertical antenna polarization



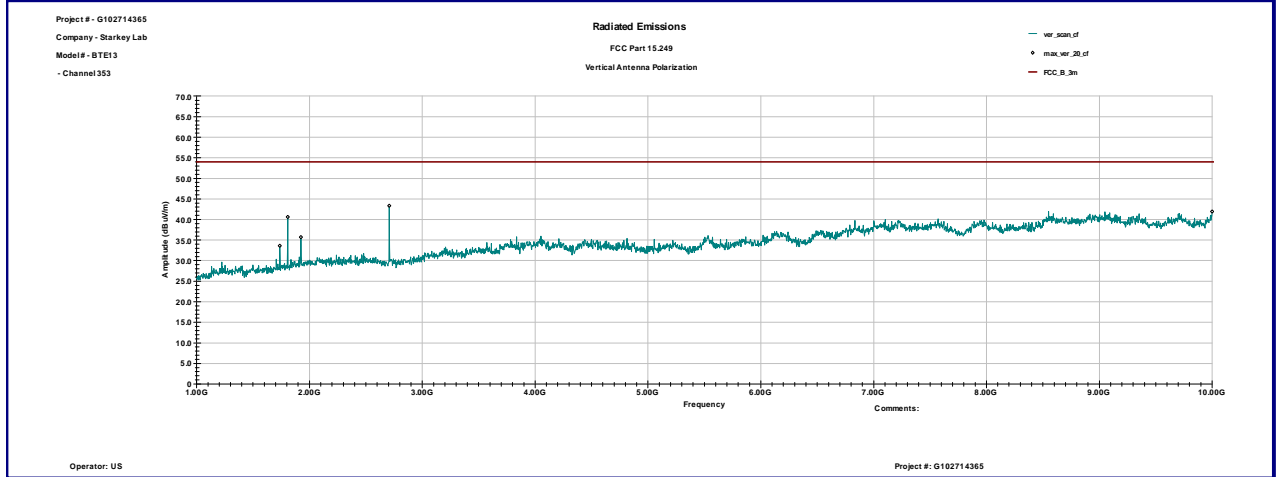
### Horizontal antenna polarization



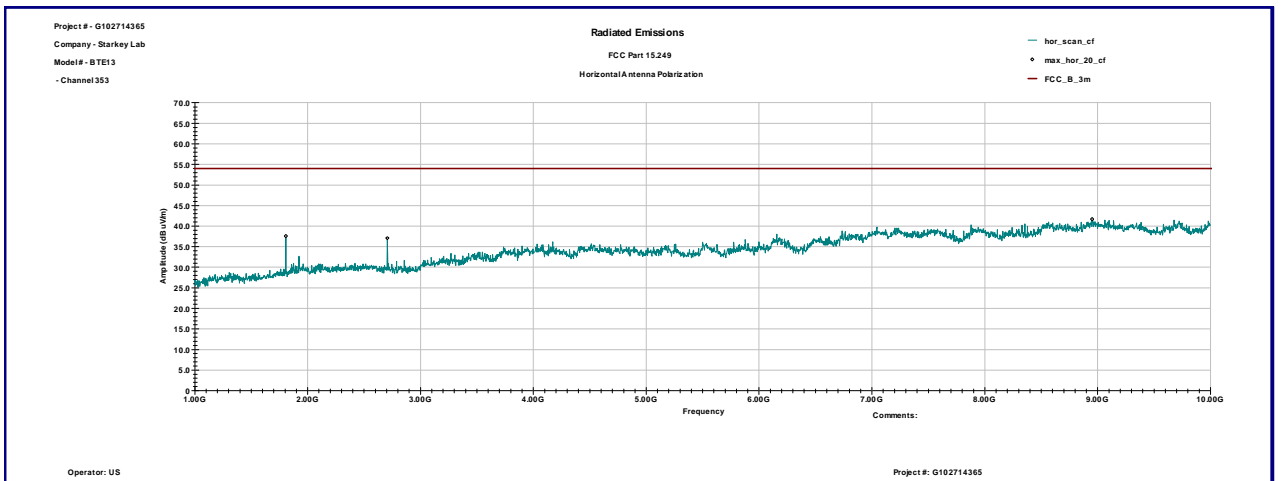


Graph 3.2.2

### Vertical antenna polarization



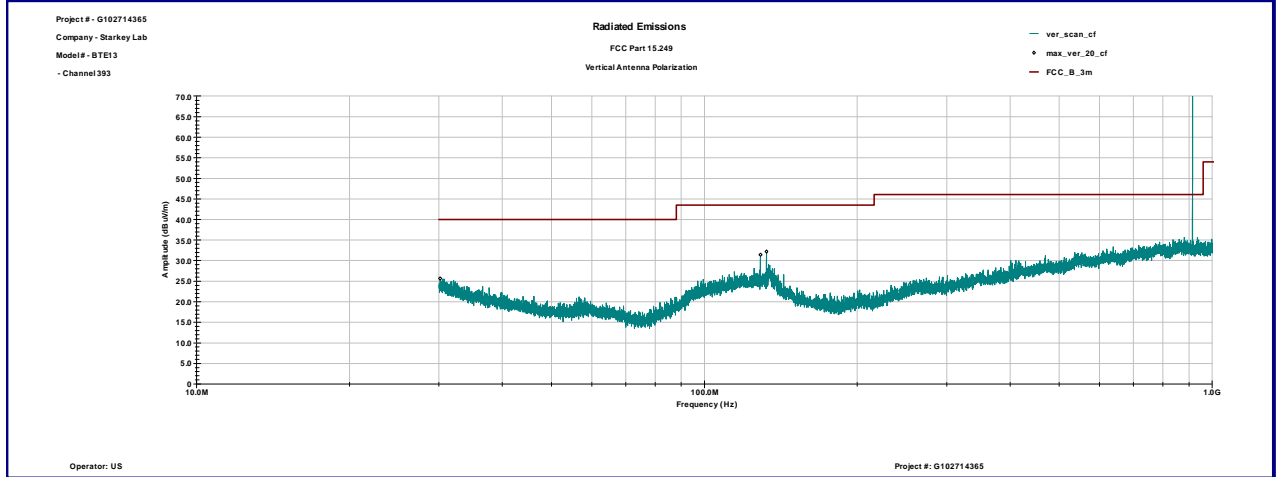
### Horizontal antenna polarization



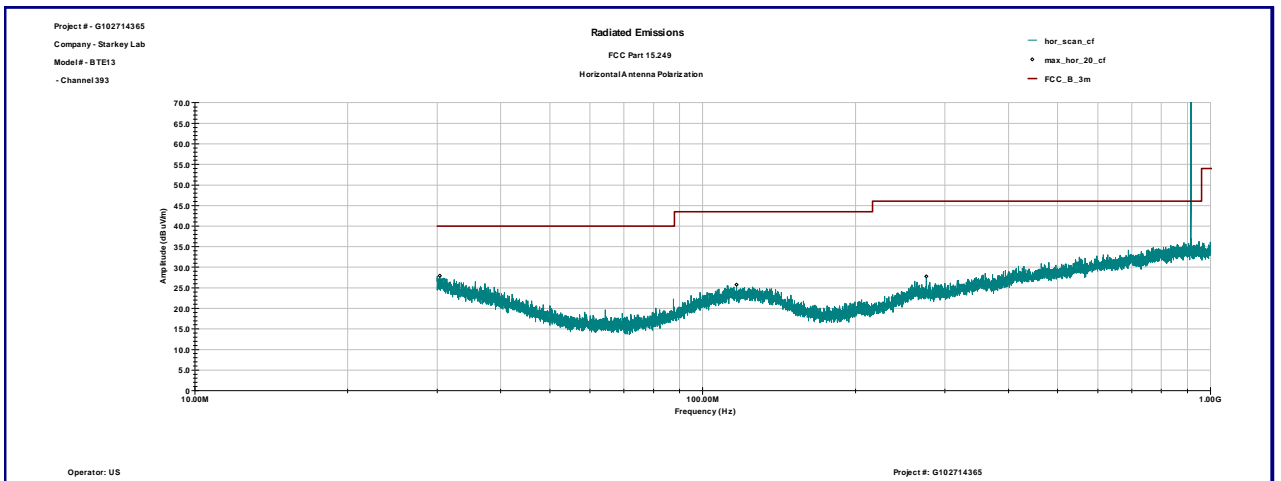


Graph 3.2.3

### Vertical antenna polarization



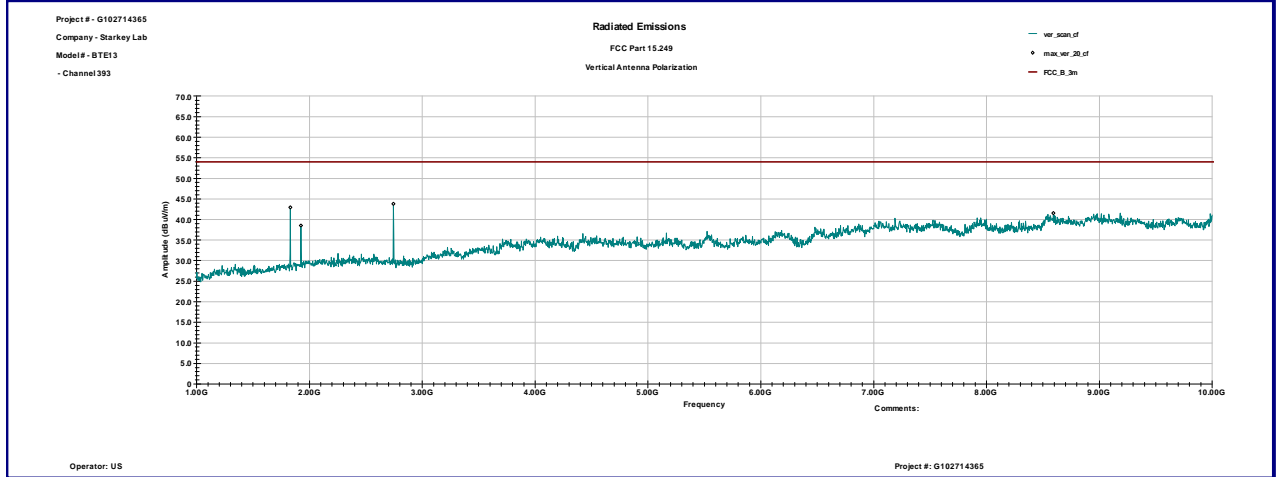
### Horizontal antenna polarization



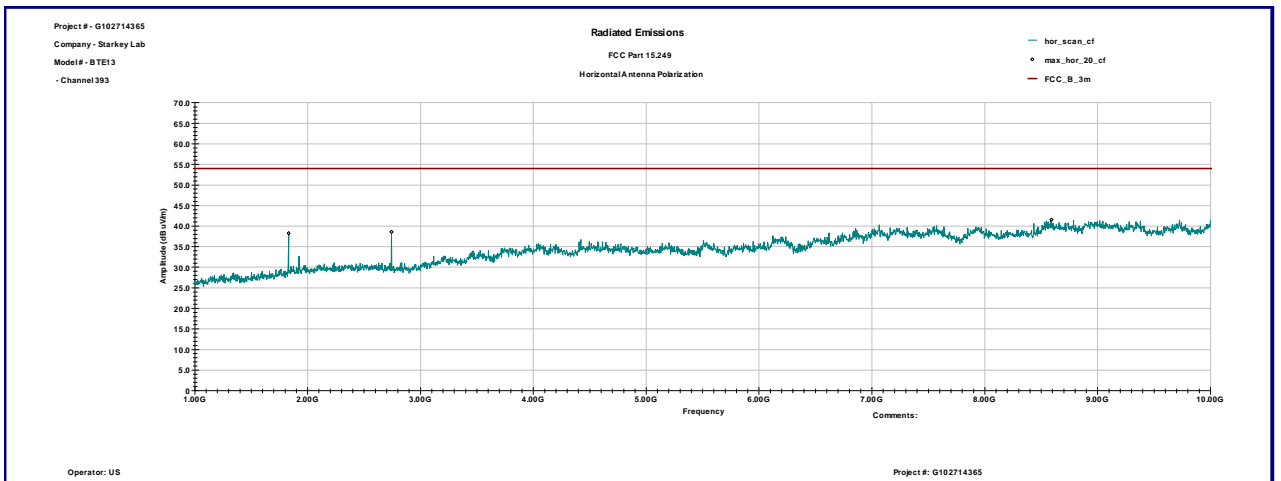


Graph 3.2.4

### Vertical antenna polarization



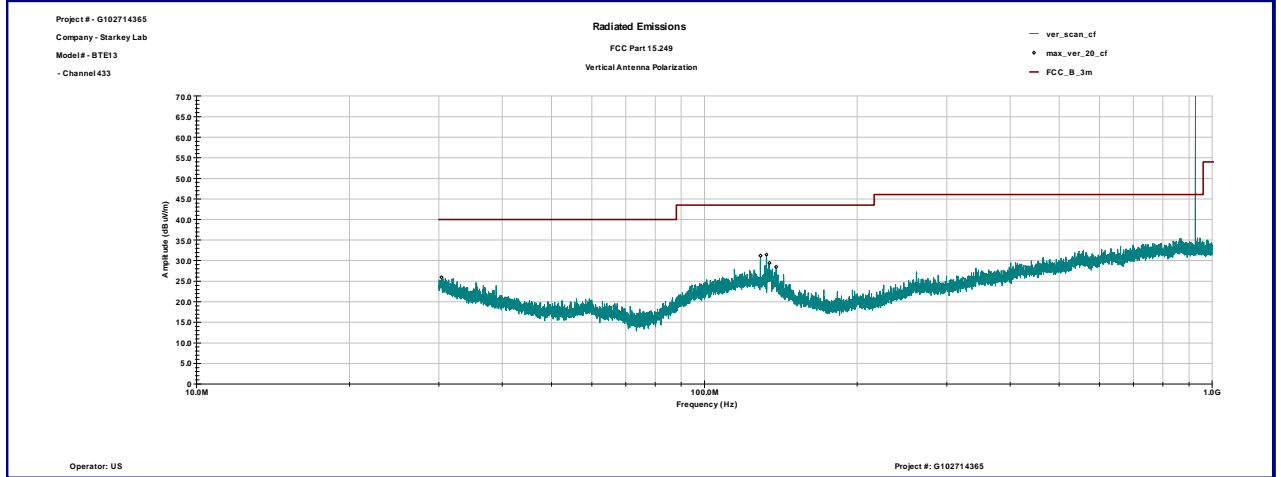
### Horizontal antenna polarization



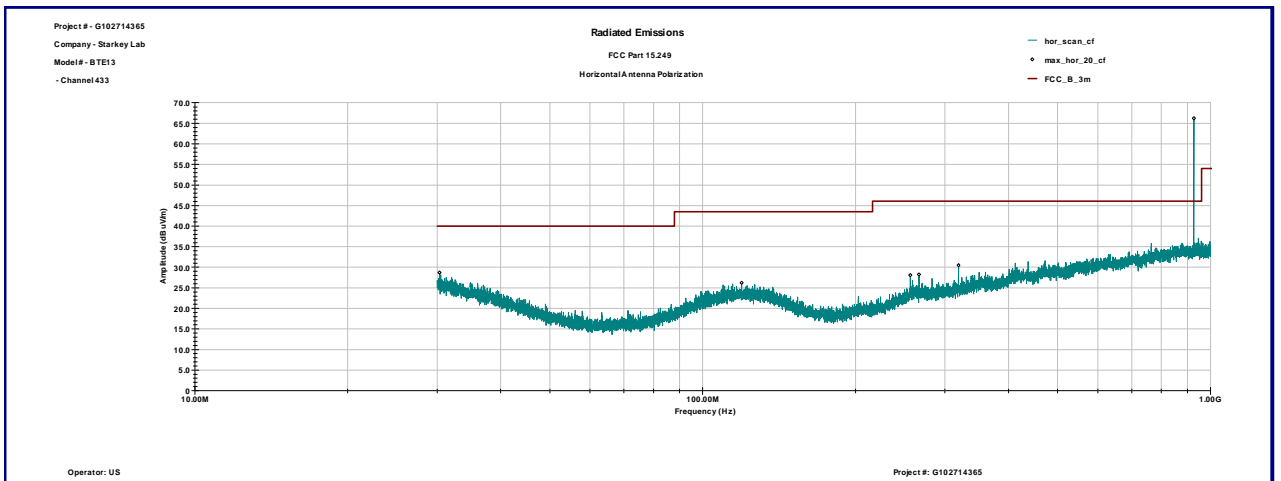


Graph 3.2.5

### Vertical antenna polarization



### Horizontal antenna polarization

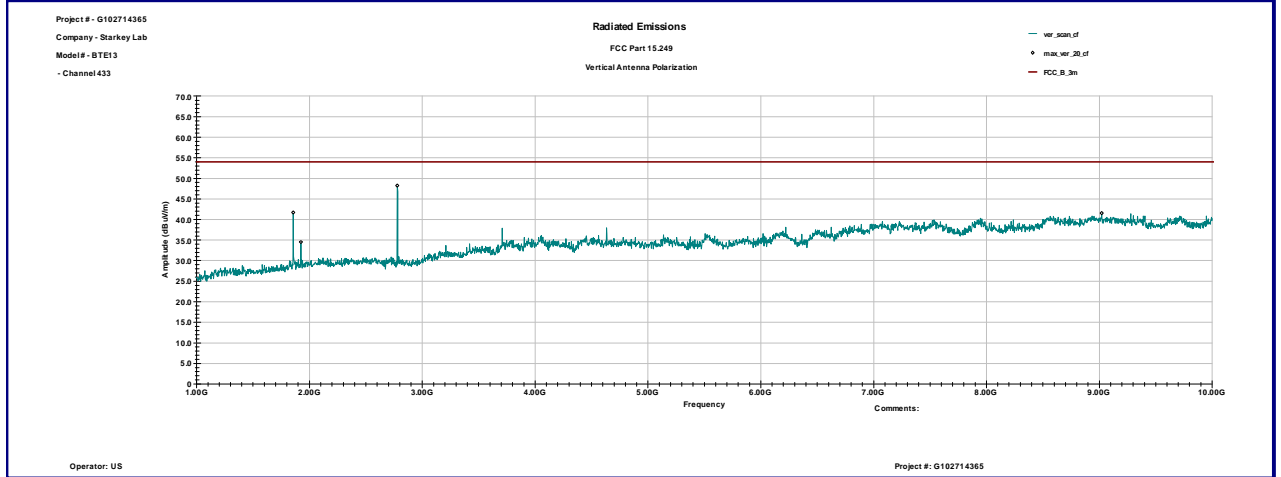




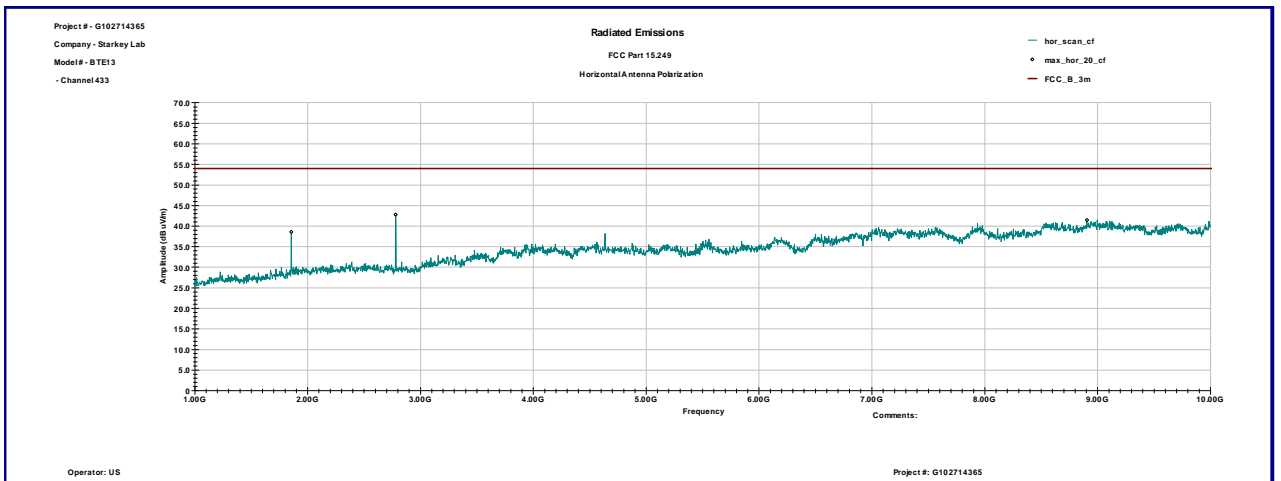
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## Graph 3.2.6

### Vertical antenna polarization



### Horizontal antenna polarization





#### 4.0 TEST EQUIPMENT

| DESCRIPTION        | MANUFACTURER   | MODEL                    | SERIAL NO.    | INTERTEK ID | CAL DUE    | USED                                |
|--------------------|----------------|--------------------------|---------------|-------------|------------|-------------------------------------|
| Spectrum Analyzer  | R & S          | FSP 40                   | 100024        | 12559       | 01/20/2017 | <input checked="" type="checkbox"/> |
| Spectrum Analyzer  | R & S          | ESU                      | 100398        | 25283       | 02/11/2017 | <input checked="" type="checkbox"/> |
| Bicono-Log Antenna | Teseq          | CBL6112D                 | 32859         | 25289       | 09/24/2016 | <input checked="" type="checkbox"/> |
| Horn Antenna       | EMCO           | 3115                     | 9507-4513     | 9936        | 07/12/2017 | <input checked="" type="checkbox"/> |
| Pre-Amplifier      | MITEQ          | AMF-5D-00501800-28-13P   | 1402232       | 172081      | 11/19/2016 | <input checked="" type="checkbox"/> |
| System             | Quantum Change | TILE! Instrument Control | Ver. 3.4.K.29 | 15259       | VBU        | <input checked="" type="checkbox"/> |
| High pass filter   | Reactel        | 7HS-1G-S12               | SN02-1        | 6015275     | VBU        | <input checked="" type="checkbox"/> |



## 5.0 Revision History

| REVISION LEVEL | DATE       | REPORT NUMBER    | PREPARED | REVIEWED | NOTES          |
|----------------|------------|------------------|----------|----------|----------------|
| 0              | 09-01-2016 | 102714365MIN-001 | US       | NS       | Original Issue |
|                |            |                  |          |          |                |
|                |            |                  |          |          |                |