

TEST REPORT

Report Number: 102083608MIN-001

Project Number: G102083608

Models:

ExP CIC; A4 CIC; Start 1200 CIC; Start 1000 CIC;

ExP ITC; A4 ITC; Start 1200 ITC; Start 1000 ITC;

ExP ITE; A4 ITE; Start 1200 ITE; Start 1000 ITE

FCC ID: EOA-EXPCUSTOM

Industry Canada ID: 6903A-EXPCUSTOM

to

47 CFR Part 15.249:2015

RSS- 210, Issue 8, 2010

RSS-Gen, Issue 4, 2014


47 CFR, Part 15:2015, §15.107 and §15.109, Class / ICES-003, Issue 5:2012


For

Starkey Laboratories, Inc.

Test Performed by:
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Test Authorized by:
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Date of issue: June 4, 2015

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1.0 GENERAL DESCRIPTION

| | |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model tested: | ExP ITE |
| Type of EUT: | Hearing Aid |
| Serial Number: | 2911322072 |
| FCC ID: | EOA-EXPCUSTOM |
| Industry Canada ID: | 6903A-EXPCUSTOM |
| Related Submittal(s) Grants: | None |
| Company: | Starkey Laboratories, Inc. |
| Customer: | Mr. Ken Meyer |
| Address: | 6700 Washington Avenue South Eden Prairie, MN 55344, USA |
| Phone: | (952) 947-4734 |
| Fax: | (952) 828-6972 |
| Test Standards: | <input checked="" type="checkbox"/> 47 CFR, Part 15:2015, §15.249 <input checked="" type="checkbox"/> RSS-210, Issue 8, 2010 <input checked="" type="checkbox"/> RSS-Gen, Issue 4, 2014 <input checked="" type="checkbox"/> 47 CFR, Part 15:2015, §15.107 and §15.109, Class B <input checked="" type="checkbox"/> ICES-003, Issue 5:2012 <input type="checkbox"/> Other [REDACTED] |
| Type of radio: | <input checked="" type="checkbox"/> Stand -alone <input type="checkbox"/> Module <input type="checkbox"/> Hybrid |
| Date Sample Submitted: | May 27, 2015 |
| Test Work Started: | May 27, 2015 |
| Test Work Completed: | May 29, 2015 |
| Test Sample Conditions: | <input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good |



1.1 Product Description; Test Facility

| | |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Description: | Hearing Aid Transceiver |
| Band of Operation: | 902 - 928MHz |
| Operating Frequencies: | 902.6-926.9MHz |
| Modulation: | FSK |
| Emission Designator: | 338KFXD |
| Antenna(s) Info: | Integral |
| Antenna Installation: | <input type="checkbox"/> User <input type="checkbox"/> Professional <input checked="" type="checkbox"/> Factory |
| Transmitter Power Configuration: | <input checked="" type="checkbox"/> Internal battery <input type="checkbox"/> External power source <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"/> <input type="text"/> Amp. <input type="checkbox"/> 50Hz <input type="checkbox"/> 60Hz |
| Test Facility Accreditation: | A2LA (Certificate No. 1427.01) |
| Test Methodology: | Measurements performed according to the procedures in ANSI C63.10-2009 |



1.2 EUT Configuration

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

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

Operating modes of the EUT:

| No. | Description |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | The device was pre-programmed to operate continuously at low (353), middle (393), and upper (433) 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 Notes: The model ExP ITE was tested as a representative model. According to the manufacturer, the models ExP CIC; A4 CIC; Start 1200 CIC; Start 1000 CIC; ExP ITC; A4 ITC; Start 1200 ITC; Start 1000 ITC; ExP ITE; A4 ITE; Start 1200 ITE; Start 1000 ITE are electrically identical; therefore, the only model ExP ITE was tested only

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: ± 4 dB at 10m and ± 5.4 dB at 3m

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(μ V/m)

RA = Receiver Amplitude in dB(μ 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(μ 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(μ 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) / RSS-210 A2.9(a) | Field strength of fundamental | Pass |
| 15.249(a) / RSS-210 A2.9(a) | Field strength of harmonics | Pass |
| 15.249(d) / RSS-210 A2.9(b) | Field strength of spurious emissions | Pass |
| 15.215(c) / RSS- Gen 4.6.1 | Bandwidth of the emission | Pass |
| 15.207/RSS-Gen 7.2.2 | Transmitter Power Line conducted emissions | N/A |
| 15.109/ICES-003 | Receiver/digital device radiated emissions | Pass |
| 15.107/ ICES-003 | Digital device conducted emissions | N/A |



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: 14.3dB below the limits

Notes: None



| | | |
|------------------------|------------------------------|---------------------|
| Date: | May 27-29, 2015 | Result: Pass |
| Standard: | FCC 15.249(a) / RSS-210 A2.9 | |
| Tested by: | Simon Khazon | |
| Test Point: | Enclosure with antenna | |
| Operation mode: | See Page 5 | |
| Note: | None | |

Table 3.1.1

| Frequency MHz | Antenna | | Ant. CF dB1/m | Cable loss dB | Pre-amp Gain (dB) | Reading dBµV | Total @ 3m dBµV/m | Limit dBµV/m | Margin dB | Comments |
|--------------------|----------|---------|------------------|------------------|----------------------|-----------------|----------------------|-----------------|--------------|----------|
| | Polarity | Hts(cm) | | | | | | | | |
| Channel 353 | | | | | | | | | | |
| 902.570 | V | 100 | 21.8 | 3.6 | 0.0 | 54.2 | 79.7 | 94.0 | -14.3 | Pk |
| 902.580 | H | 200 | 21.8 | 3.6 | 0.0 | 49.8 | 75.3 | 94.0 | -18.7 | Pk |
| Channel 393 | | | | | | | | | | |
| 914.712 | V | 100 | 21.8 | 3.6 | 0.0 | 53.8 | 79.2 | 94.0 | -14.8 | Pk |
| 914.837 | H | 200 | 21.8 | 3.6 | 0.0 | 49.9 | 75.3 | 94.0 | -18.7 | Pk |
| Channel 433 | | | | | | | | | | |
| 926.970 | V | 100 | 21.7 | 3.7 | 0.0 | 53.9 | 79.3 | 94.0 | -14.7 | Pk |
| 926.855 | H | 198 | 21.7 | 3.7 | 0.0 | 50.4 | 75.8 | 94.0 | -18.2 | Pk |
| | | | | | | | | | | |



3.2 Field strength of harmonics and spurious emissions

Test location: OATS Anechoic Chamber

Test distance: 10 meters 3 meters

Frequency range of measurements: 30MHz-10GHz

Test result: **Pass**

Max. Emissions margin at Spurious: 8.3 dB below the limits

Max. Emissions margin at Band edge: 8.9 dB below the limits

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



| | | |
|------------------------|--------------------------------------|---------------------|
| Date: | May 27-29, 2015 | Result: Pass |
| Standard: | FCC 15.249(a) and (d) / RSS-210 A2.9 | |
| Tested by: | Simon Khazon | |
| Test Point: | Enclosure with antenna | |
| Operation mode: | See Page 5 | |
| Note: | Spurious Emissions | |

Table 3.2.1

| Frequency MHz | Antenna Polarity | Peak Reading dBμV | Total C.F. dB1/m | Pre-Amp. Gain (dB) | Total at 3m dBμV/m | Limit dBμV/m | Margin dB |
|--------------------|------------------|-------------------|------------------|--------------------|--------------------|--------------|-----------|
| Channel 353 | | | | | | | |
| 1.8067 GHz | V | 53.4 | 29.5 | 43.6 | 39.3 | 54.0 | -14.7 |
| 2.7067 GHz | V | 52.8 | 32.6 | 44.0 | 41.4 | 54.0 | -12.6 |
| 9.6547 GHz | V | 37.4 | 44.4 | 41.0 | 40.8 | 54.0 | -13.2 |
| Channel 393 | | | | | | | |
| 2.7084 GHz | H | 54.9 | 32.4 | 44.0 | 43.3 | 54.0 | -10.7 |
| 3.61 GHz | H | 52.2 | 35.4 | 43.6 | 44.1 | 54.0 | -9.9 |
| 6.3182 GHz | H | 42.4 | 39.1 | 41.8 | 39.7 | 54.0 | -14.3 |
| Channel 393 | | | | | | | |
| 2.746 GHz | V | 52.9 | 32.7 | 44.0 | 41.6 | 54.0 | -12.4 |
| 3.6604 GHz | V | 47.1 | 35.8 | 43.5 | 39.4 | 54.0 | -14.6 |
| 8.5096 GHz | V | 37.8 | 43.2 | 40.3 | 40.7 | 54.0 | -13.3 |
| Channel 433 | | | | | | | |
| 2.746 GHz | H | 56.2 | 32.5 | 44.0 | 44.7 | 54.0 | -9.3 |
| 3.6604 GHz | H | 53.6 | 35.6 | 43.5 | 45.7 | 54.0 | -8.3 |
| 6.4036 GHz | H | 42.4 | 39.2 | 41.9 | 39.8 | 54.0 | -14.2 |
| 8.2324 GHz | H | 39.2 | 42.7 | 40.4 | 41.4 | 54.0 | -12.6 |
| Channel 433 | | | | | | | |
| 2.4515 GHz | V | 54.6 | 31.7 | 43.9 | 42.3 | 54.0 | -11.7 |
| 2.4564 GHz | V | 53.8 | 31.7 | 43.9 | 41.6 | 54.0 | -12.4 |
| 2.7804 GHz | V | 54.3 | 32.9 | 44.0 | 43.1 | 54.0 | -10.9 |
| Channel 433 | | | | | | | |
| 2.7804 GHz | H | 56.5 | 32.7 | 44.0 | 45.2 | 54.0 | -8.8 |
| 3.7082 GHz | H | 49.3 | 35.7 | 43.4 | 41.6 | 54.0 | -12.3 |
| 6.4884 GHz | H | 43.6 | 39.3 | 41.9 | 41.0 | 54.0 | -13.0 |
| 8.4225 GHz | H | 38.3 | 42.9 | 40.3 | 40.9 | 54.0 | -13.1 |



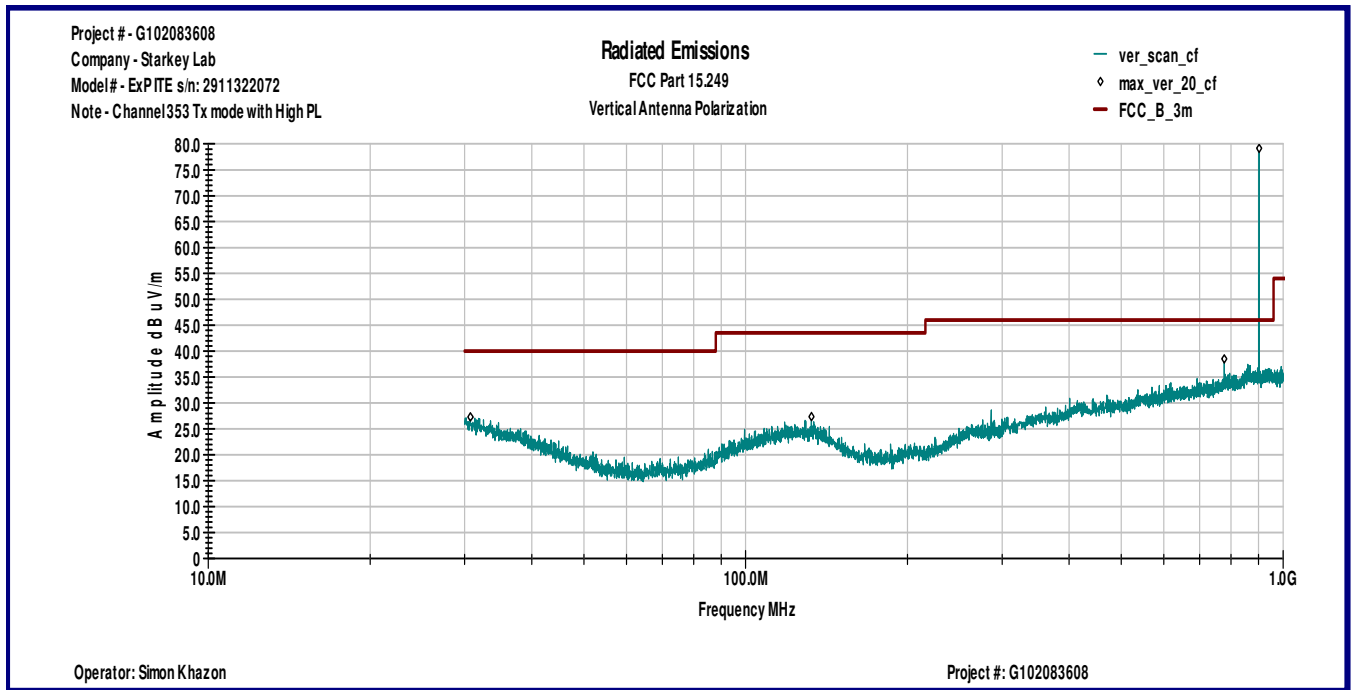
| | | |
|------------------------|--------------------------------------|---------------------|
| Date: | May 27-29, 2015 | Result: Pass |
| Standard: | FCC 15.249(a) and (d) / RSS-210 A2.9 | |
| Tested by: | Simon Khazon | |
| Test Point: | Enclosure with antenna | |
| Operation mode: | See Page 5 | |
| Note: | Band Edge Compliance | |

Table 3.2.2

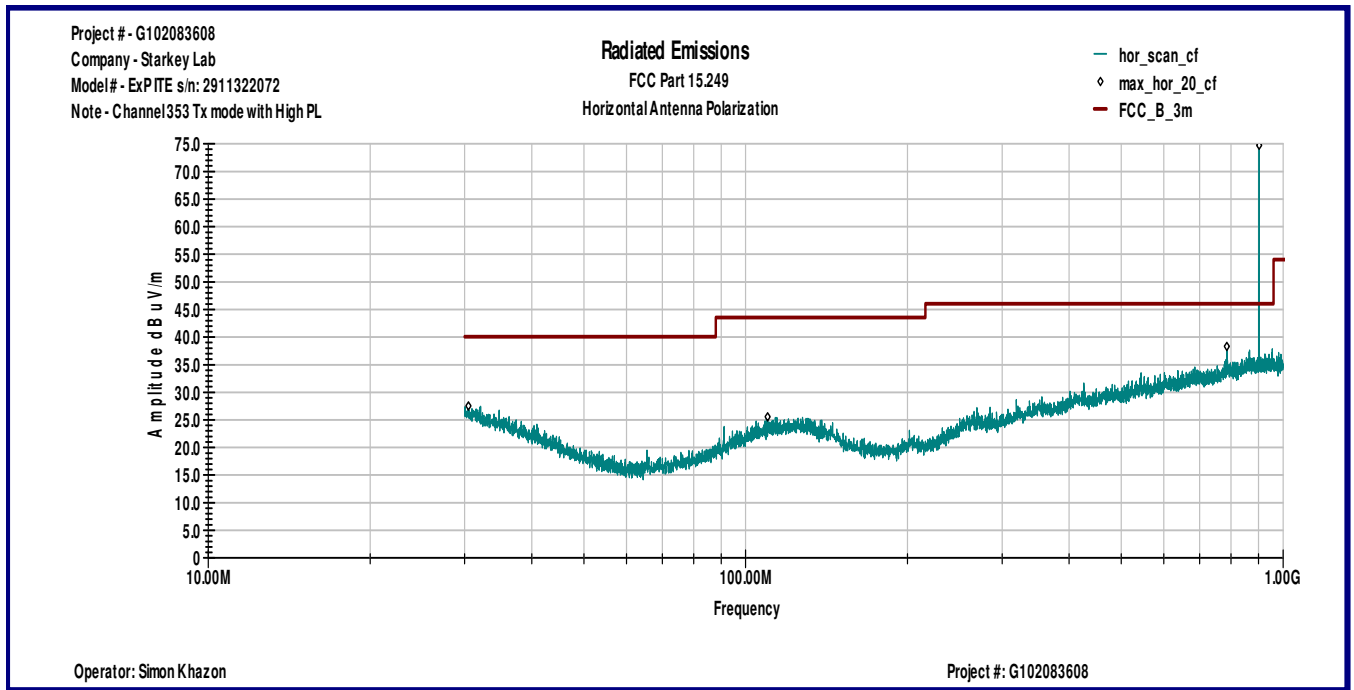
| Frequency MHz | Antenna | | Ant. CF dB1/m | Cable loss dB | Pre-amp Gain (dB) | Reading dBµV | Total @ 3m dBµV/m | Limit dBµV/m | Margin dB | Comments |
|-----------------------------|----------|---------|------------------|------------------|----------------------|-----------------|----------------------|-----------------|--------------|----------|
| | Polarity | Hts(cm) | | | | | | | | |
| Band Edge Compliance | | | | | | | | | | |
| 902.00 | V | 100 | 21.8 | 3.6 | 0.0 | 11.7 | 37.2 | 46.0 | -8.9 | QP |
| 902.00 | H | 199 | 21.8 | 3.6 | 0.0 | 10.0 | 35.5 | 46.0 | -10.6 | QP |
| 928.00 | V | 100 | 21.7 | 3.7 | 0.0 | 8.3 | 33.7 | 46.0 | -12.4 | QP |
| 928.00 | H | 197 | 21.7 | 3.7 | 0.0 | 7.4 | 32.8 | 46.0 | -13.3 | QP |
| | | | | | | | | | | |

Graph 3.2.1

Vertical antenna polarization

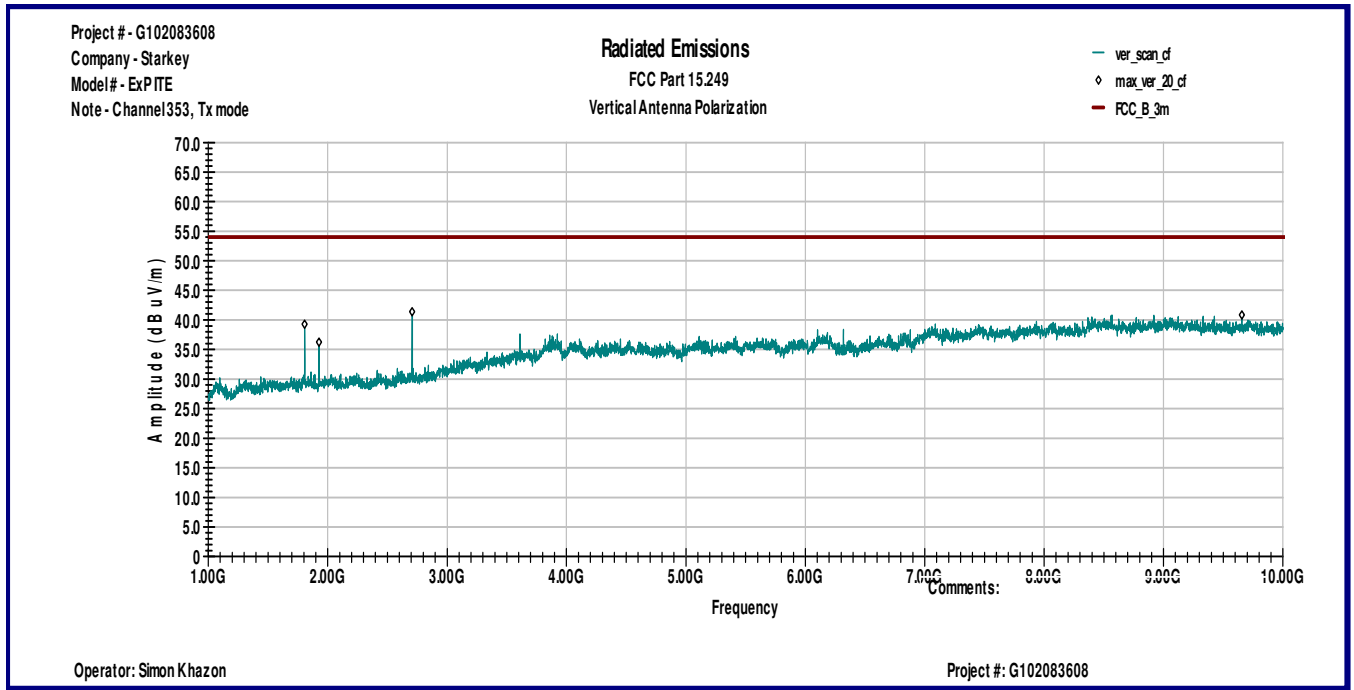


Horizontal antenna polarization

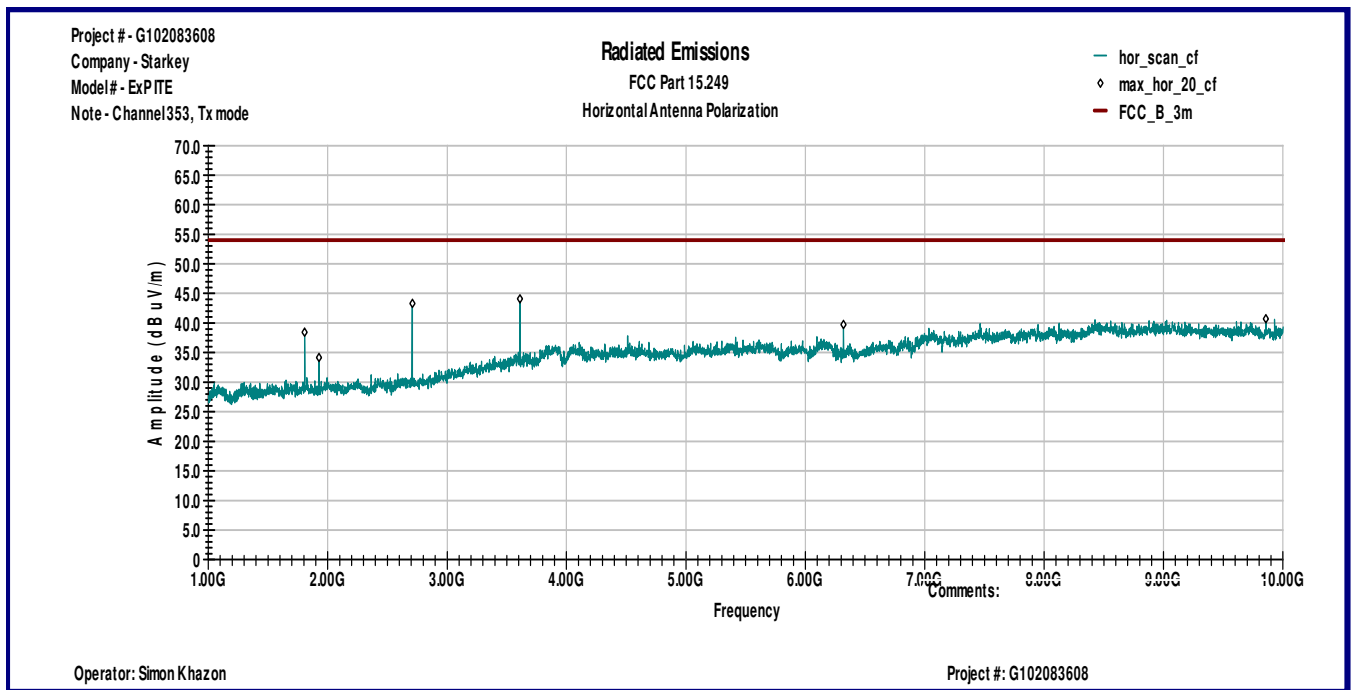


Graph 3.2.2

Vertical antenna polarization



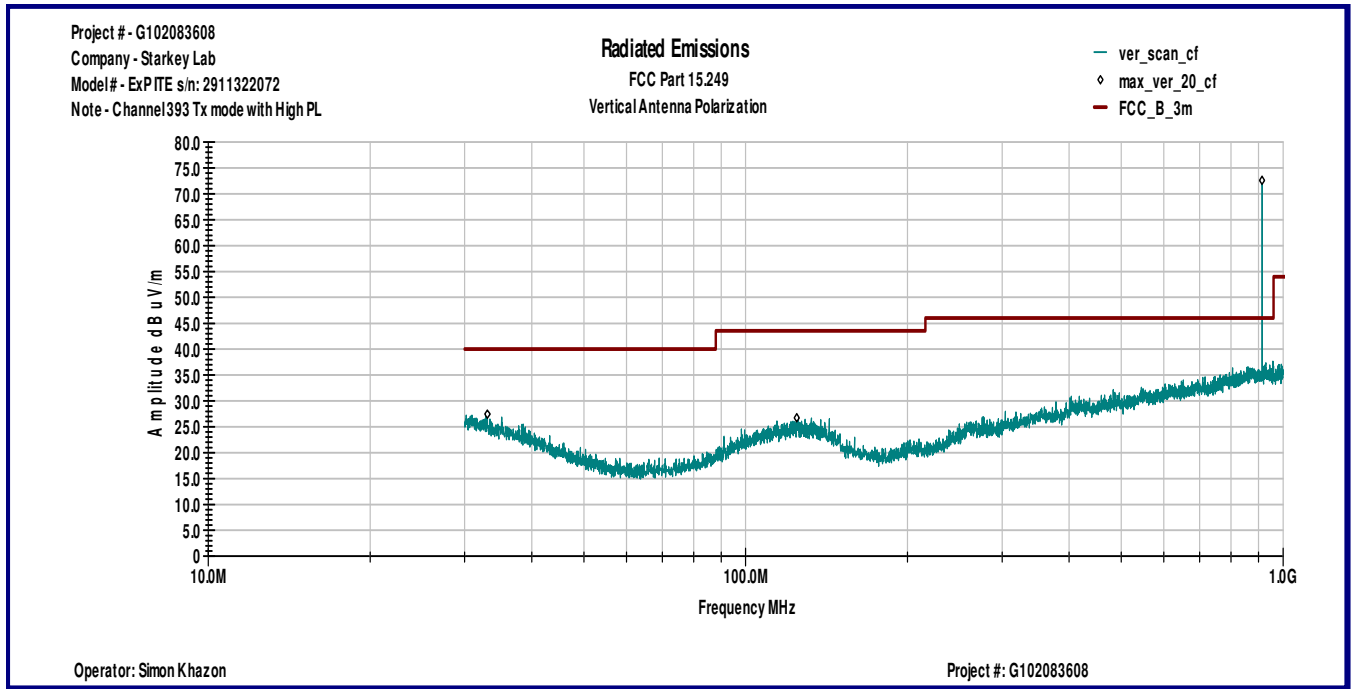
Horizontal antenna polarization



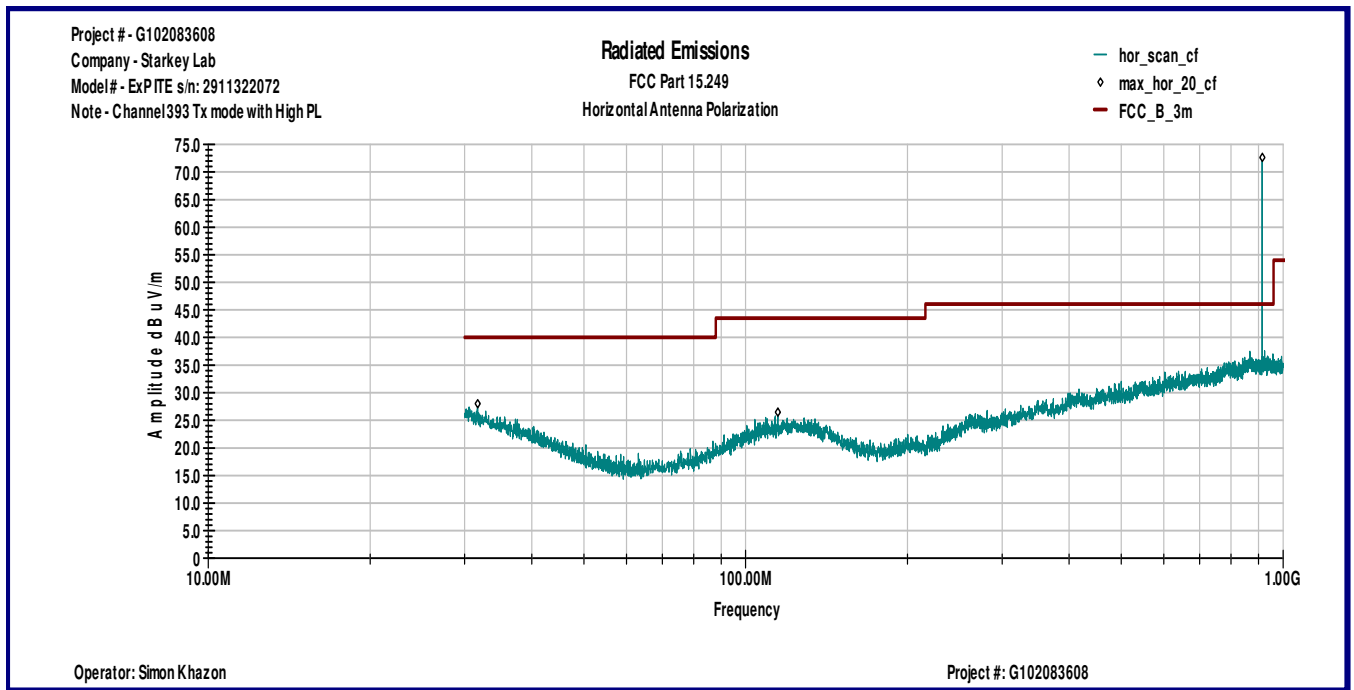


Graph 3.2.3

Vertical antenna polarization

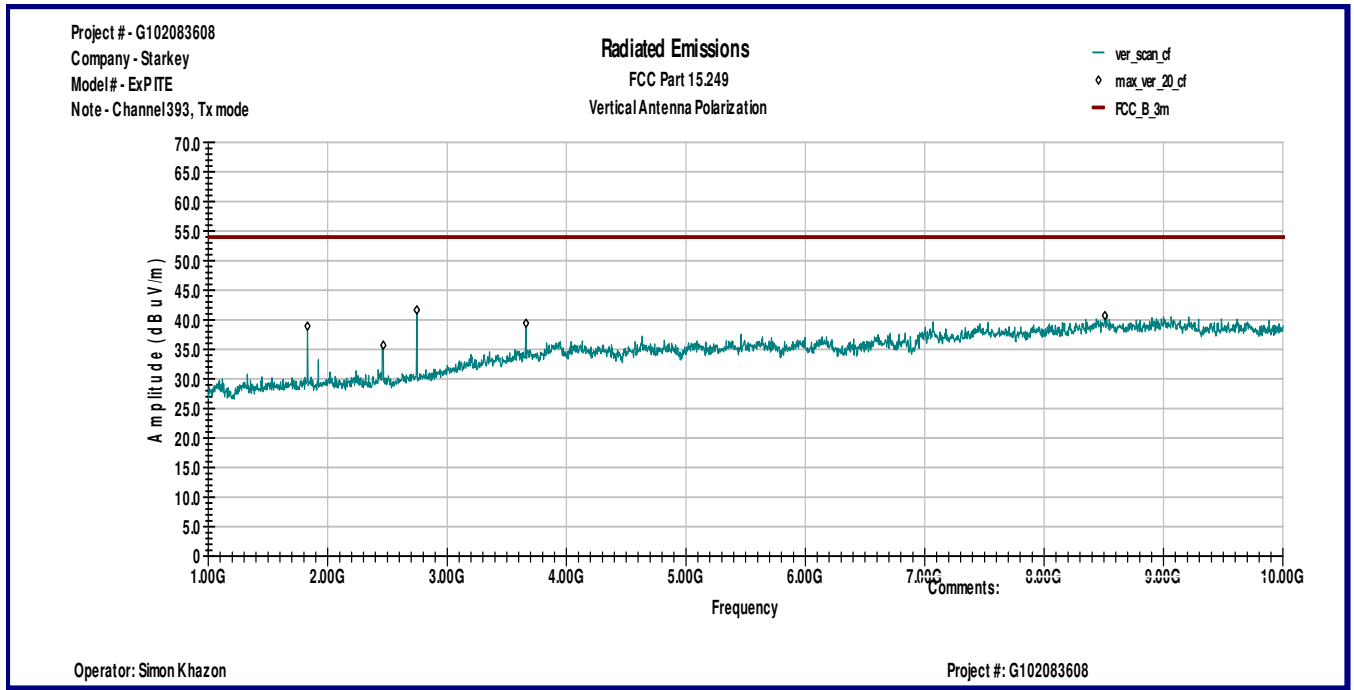


Horizontal antenna polarization

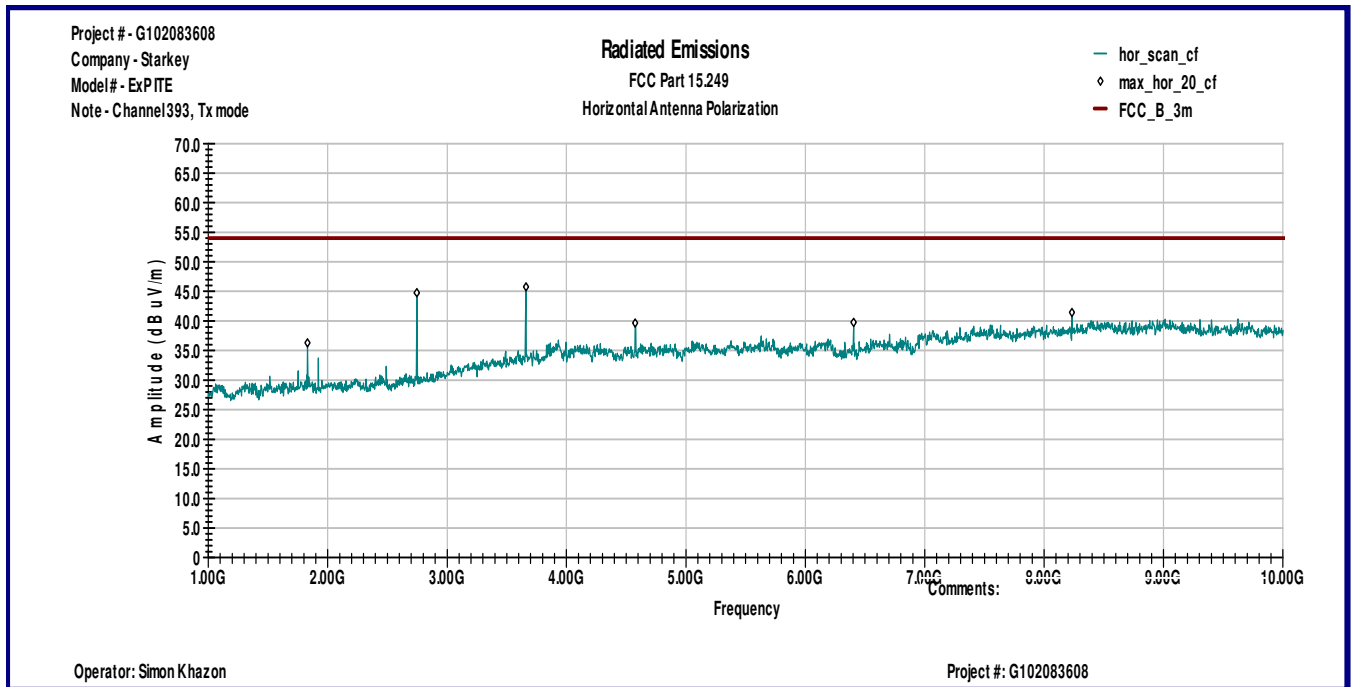


Graph 3.2.4

Vertical antenna polarization



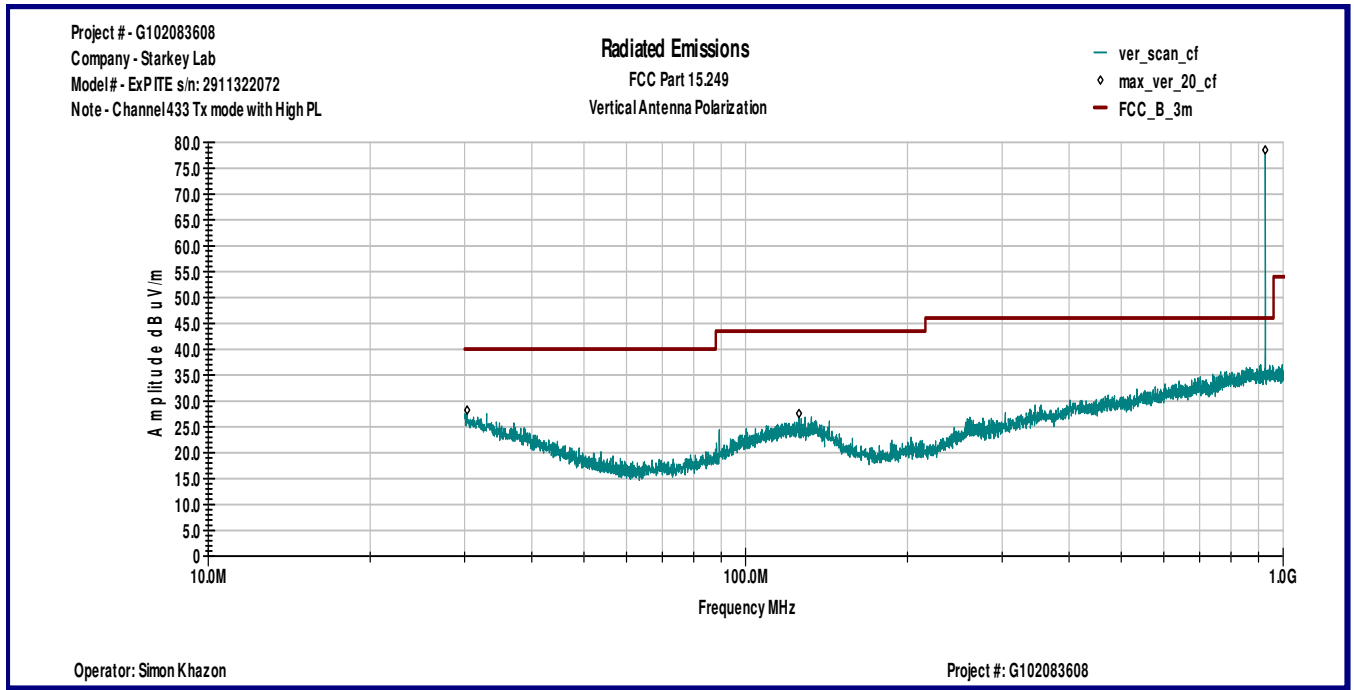
Horizontal antenna polarization



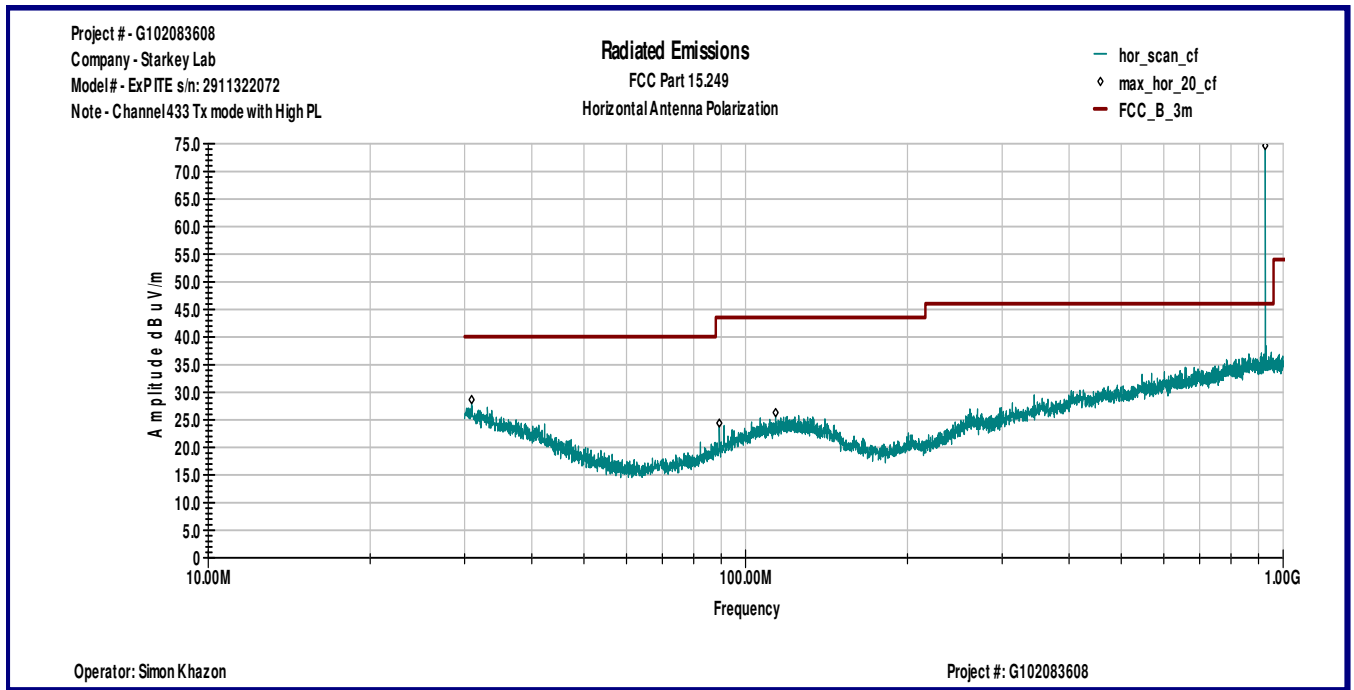


Graph 3.2.5

Vertical antenna polarization

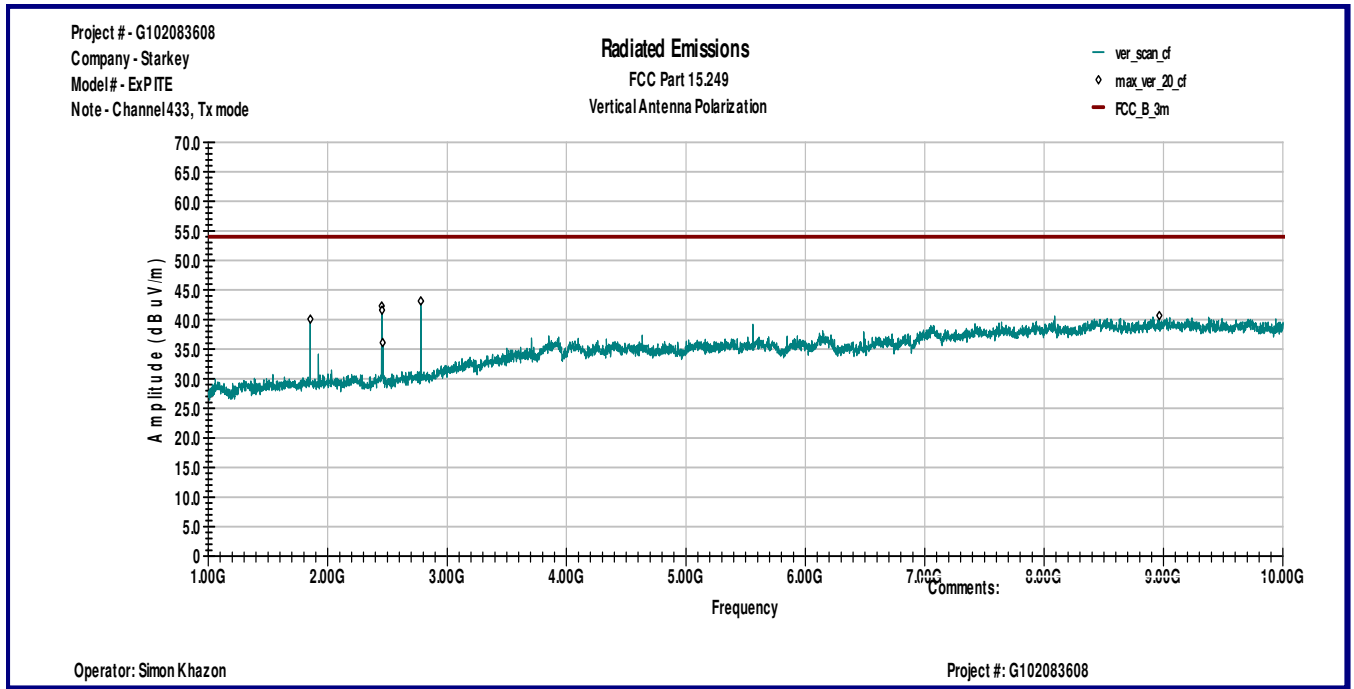


Horizontal antenna polarization

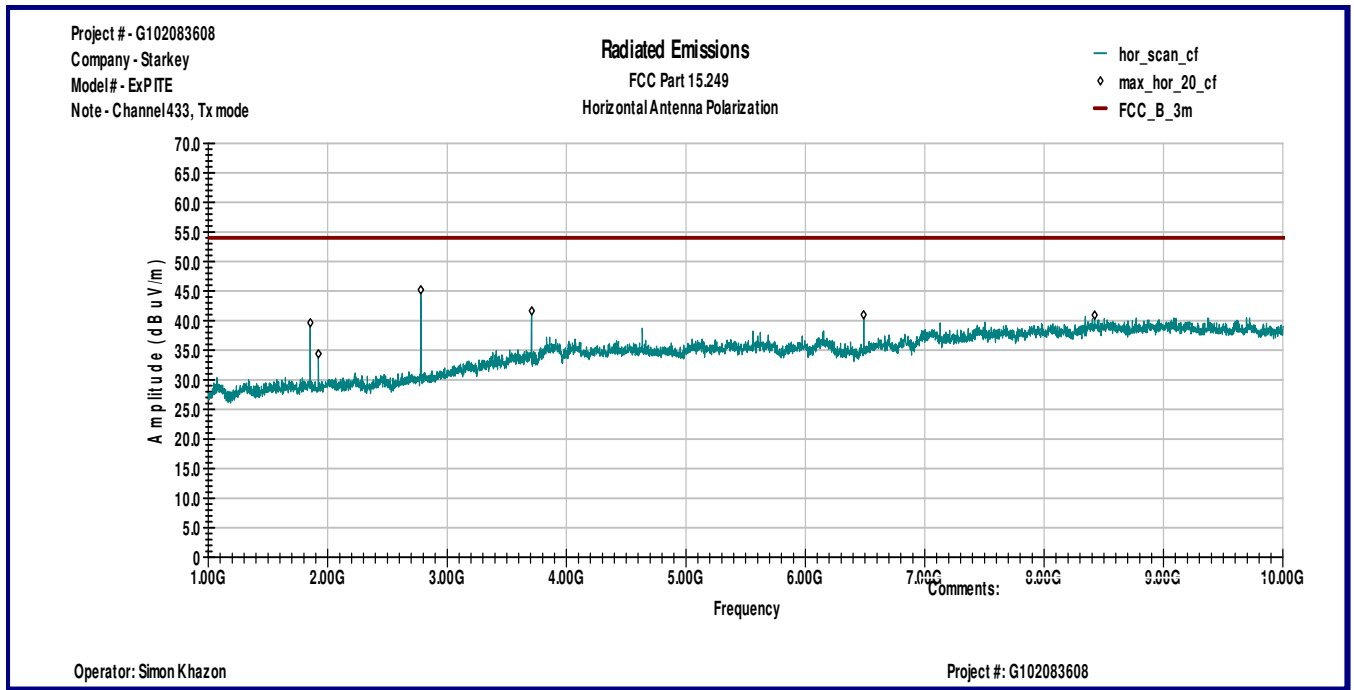


Graph 3.2.6

Vertical antenna polarization



Horizontal antenna polarization





3.2.1 Average correction factor calculation

N/A



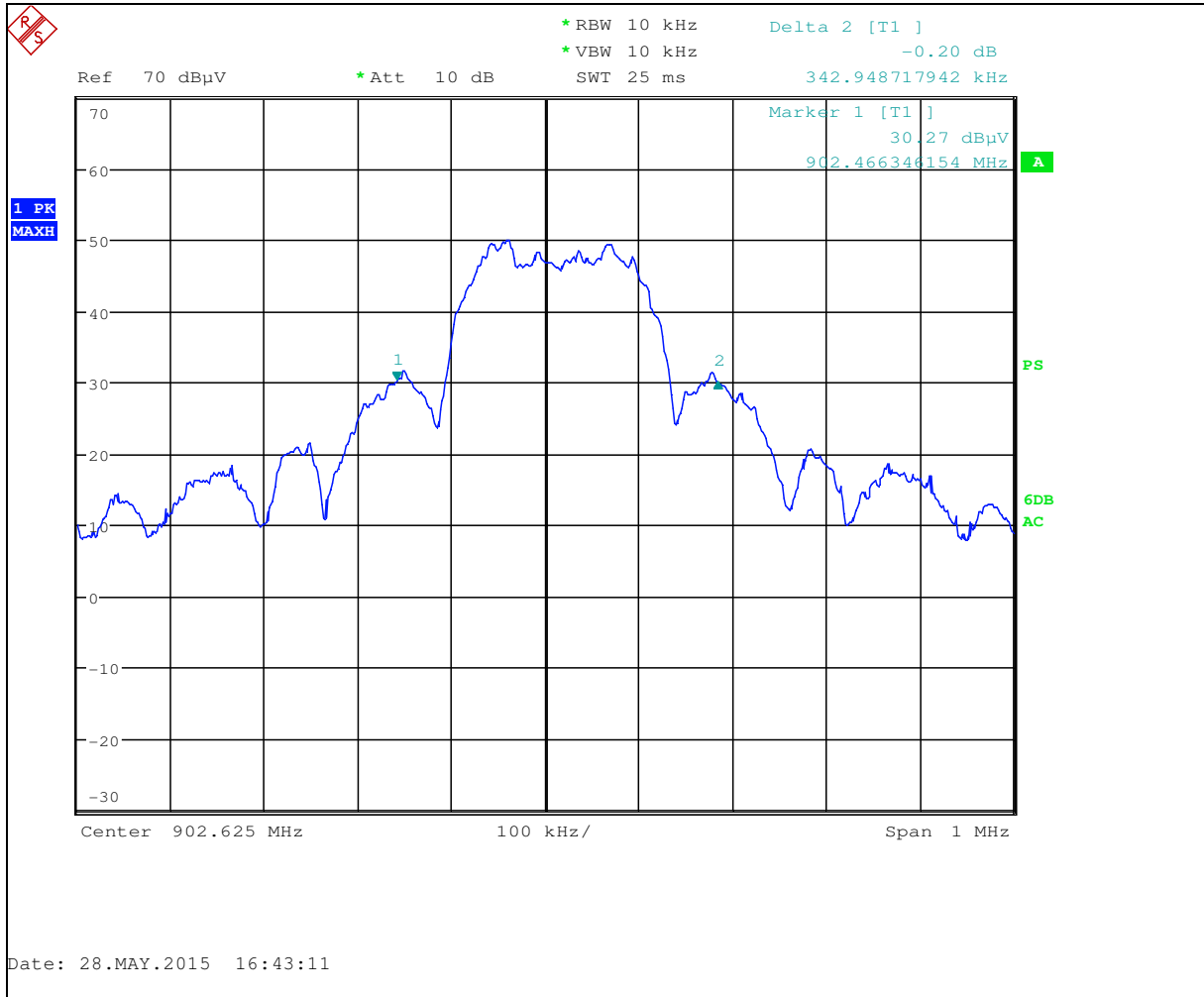
3.3 Bandwidth of Emissions

| Center Frequency of operation MHz | Measured 20dB bandwidth kHz | Measured 99% bandwidth kHz |
|-----------------------------------|-----------------------------|----------------------------|
| 902.62 | 342.9 KHz | 315.7 KHz |
| 914.6 | 349.5 KHz | 328.5 KHz |
| 926.74 | 331.7 KHz | 338.1 KHz |

Graphs 3-3-1, 3-3-2, 3-3-3, 3-3-4, 3-3-5 and 3-3-6 show bandwidth of emissions

Notes: The bandwidth of emissions is contained within the frequency band of operation

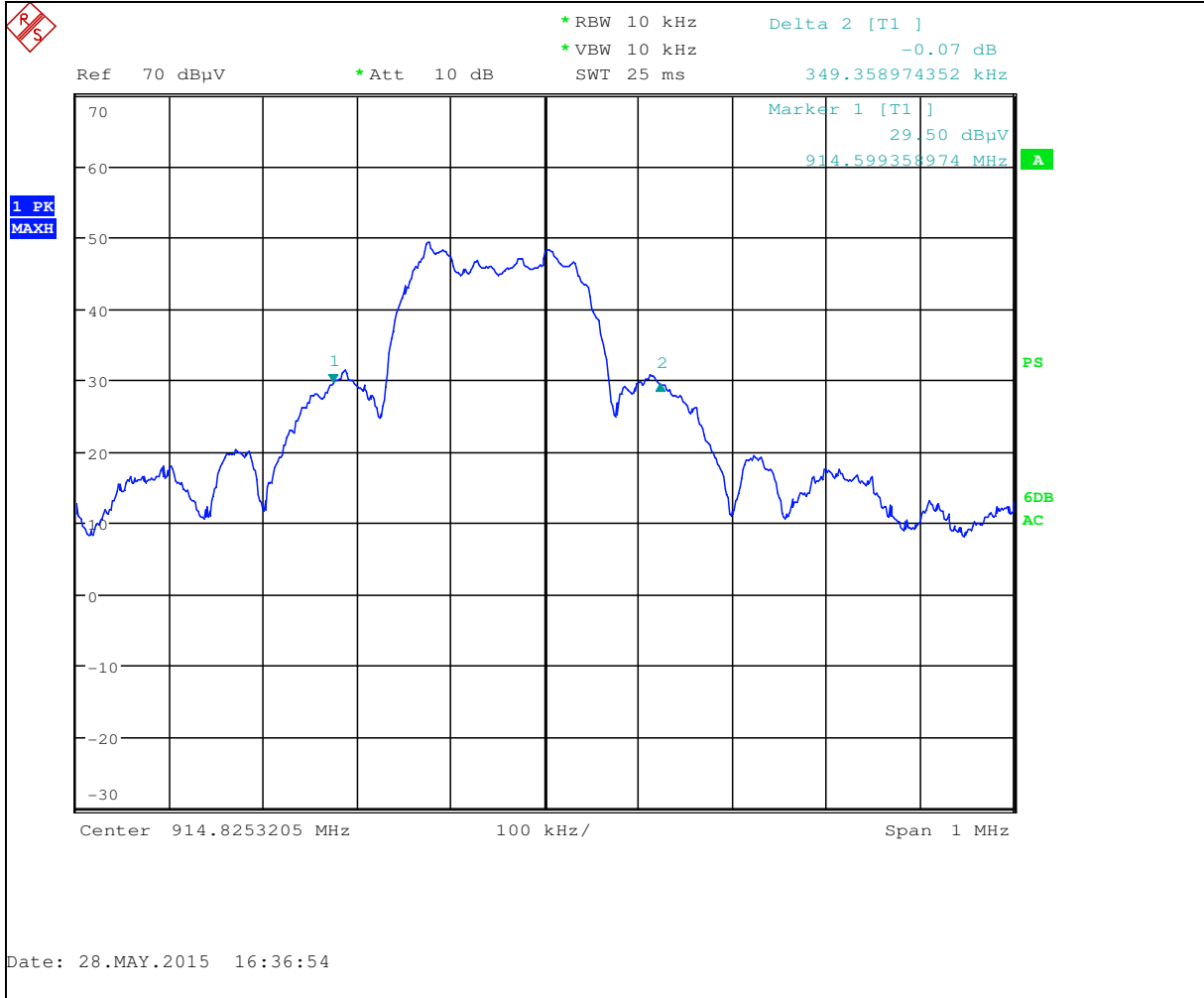
Graph 3.3.1



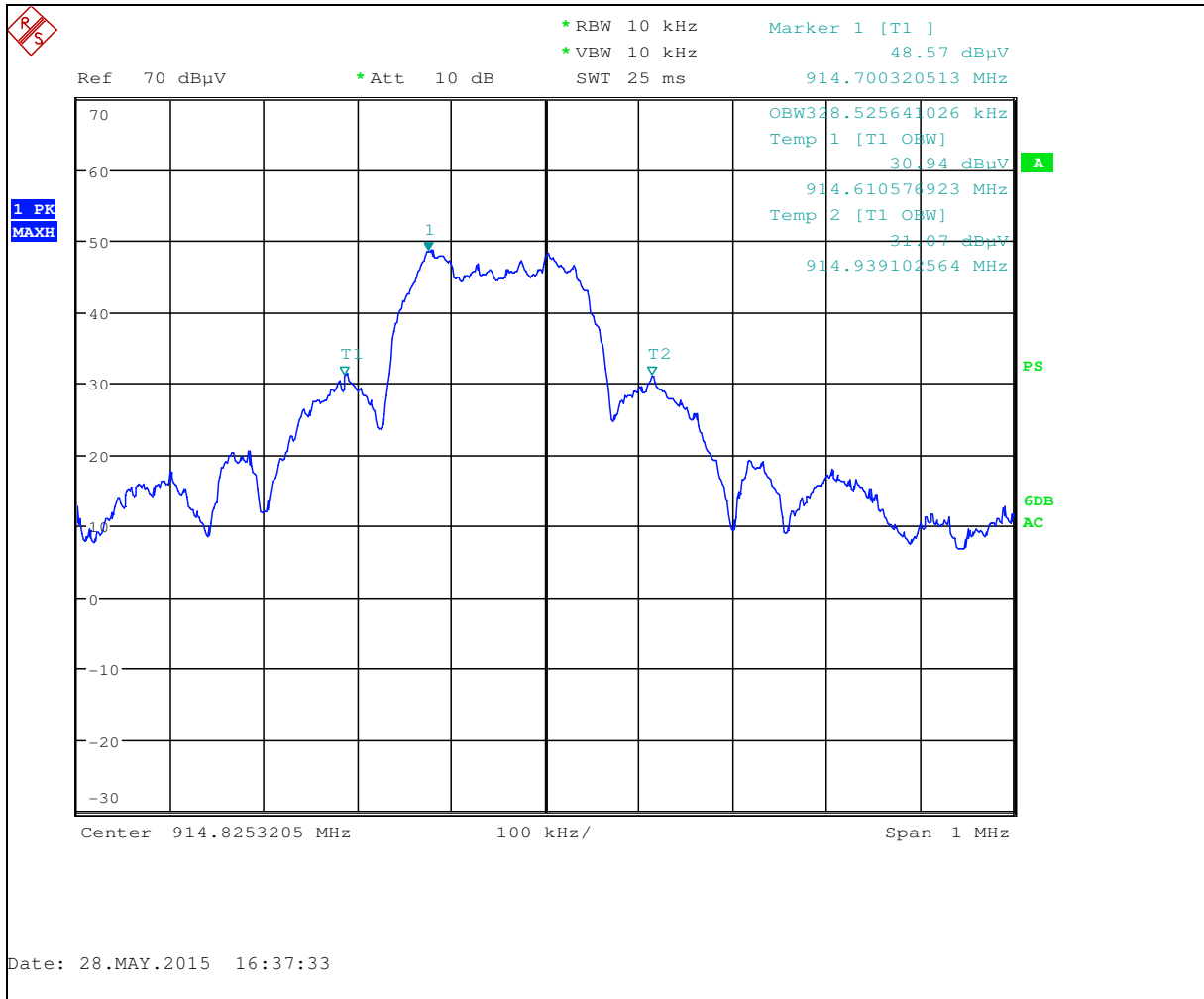
Graph 3.3.2



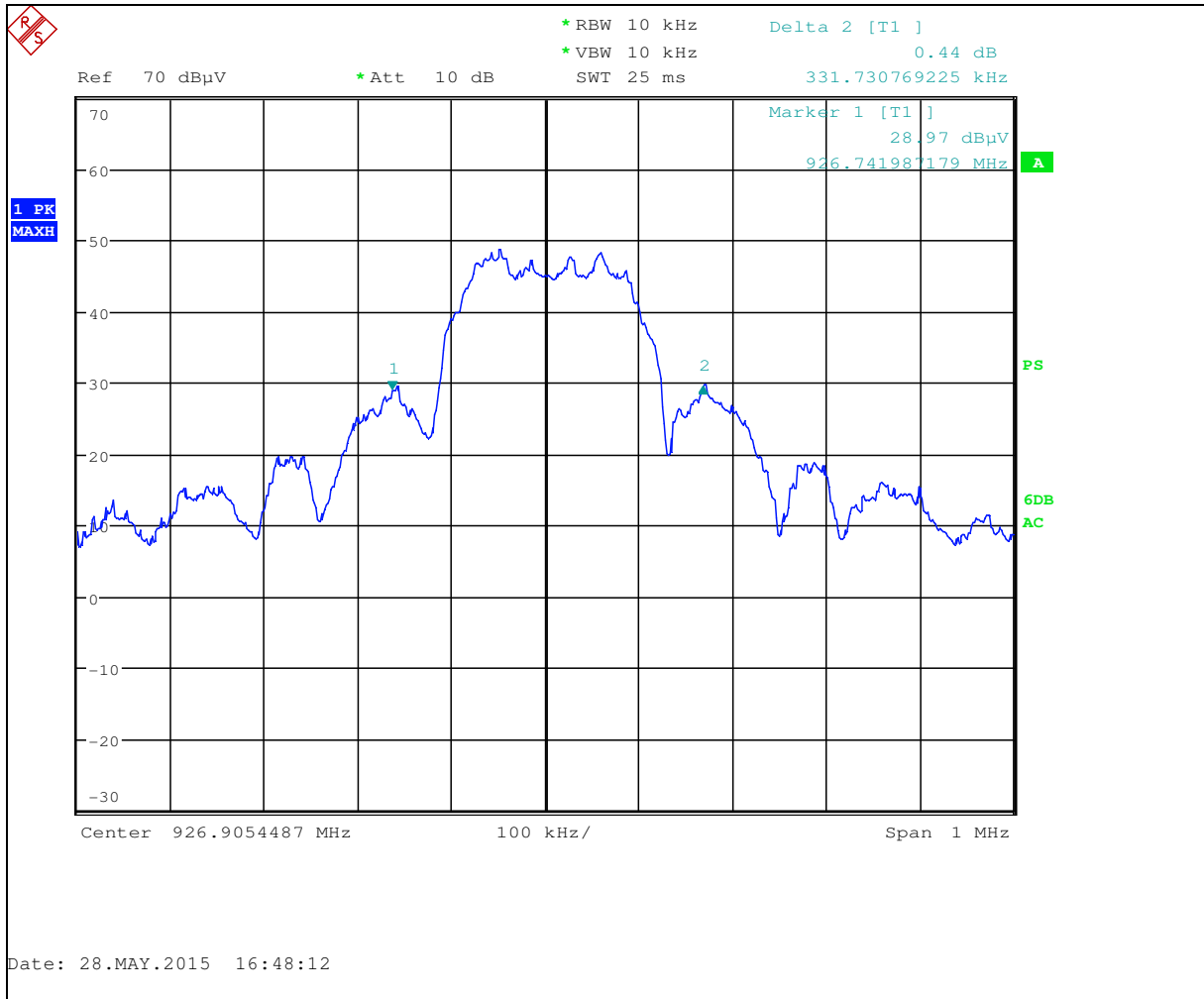
Graph 3.3.3



Graph 3.3.4



Graph 3.3.5



Graph 3.3.6





3.4 Transmitter power line conducted emissions

Test location: OATS Anechoic Chamber Other

Test result: N/A

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: [redacted] dB below the limits

Notes: It was determined from consideration of the electrical characteristics and usage of particular apparatus that Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).



3.5 Receiver/digital device radiated emissions

Test location: OATS Anechoic Chamber

Test distance: 10 meters 3 meters

Test result: **Pass**

Frequency range: 30MHz-5000MHz

Max. Emissions margin: 9.1 dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Table 3.5.1 and Graphs 3.5.1 - 3.5.6).



| | | |
|------------------------|--------------------------|---------------------|
| Date: | May 27-29, 2015 | Result: Pass |
| Standard: | FCC Part 15.109, Class B | |
| Tested by: | Simon Khazon | |
| Test Point: | Enclosure | |
| Operation mode: | Receiving/standby | |
| Note: | None | |

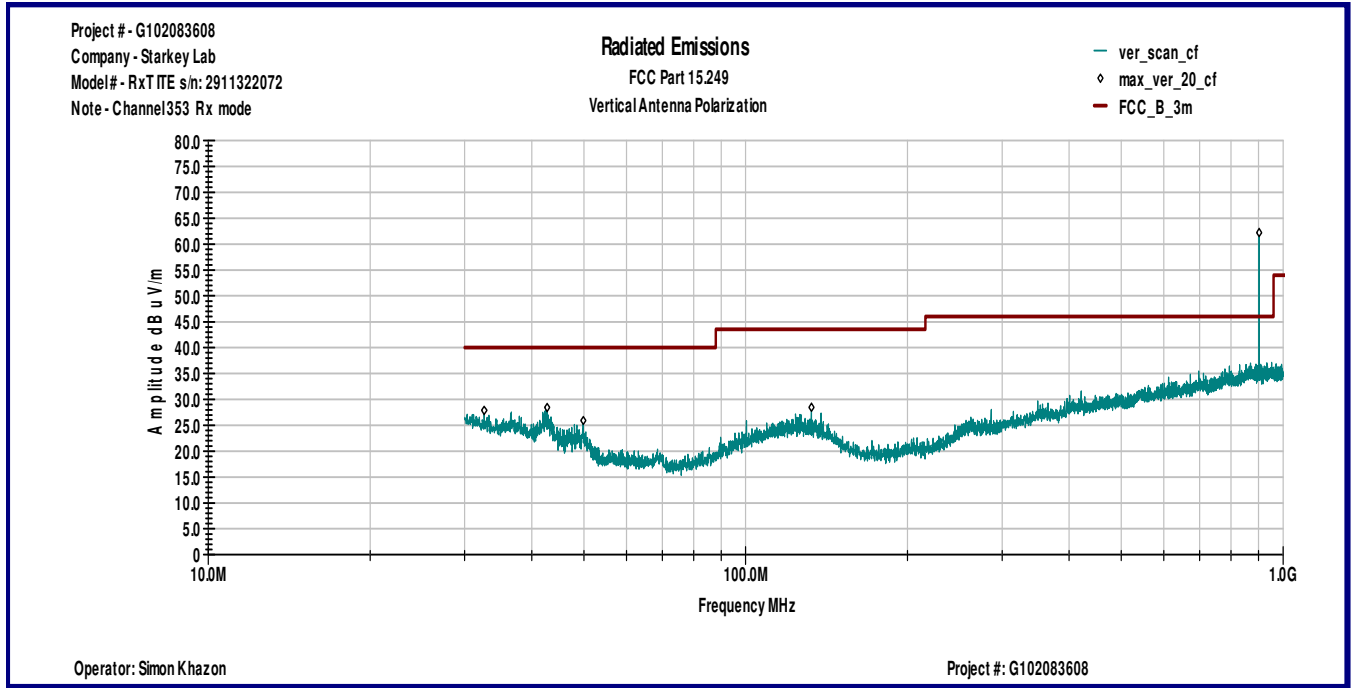
Table 3.5.1

| Frequency | Ant. Polarity | Peak Reading dB μ V | Total C.F. dB1/m | Total at 3m dB μ V/m | Limit dB μ V/m | Margin dB |
|------------|---------------|-------------------------|--------------------|--------------------------|--------------------|-----------|
| | | | Channel 353 | | | |
| 32.632 MHz | V | 9.2 | 18.7 | 27.9 | 40.0 | -12.1 |
| 42.745 MHz | V | 15.4 | 13.1 | 28.4 | 40.0 | -11.6 |
| 132.53 MHz | V | 14.7 | 13.8 | 28.4 | 43.5 | -15.1 |
| 30.208 MHz | H | 8.9 | 20.1 | 29.0 | 40.0 | -11.0 |
| 117.76 MHz | H | 12.5 | 13.9 | 26.4 | 43.5 | -17.2 |
| | | | Channel 393 | | | |
| 31.212 MHz | V | 8.2 | 19.5 | 27.7 | 40.0 | -12.3 |
| 121.34 MHz | V | 13.1 | 14.0 | 27.0 | 43.5 | -16.5 |
| 30.069 MHz | H | 9.1 | 20.2 | 29.3 | 40.0 | -10.8 |
| 119.92 MHz | H | 11.8 | 13.9 | 25.8 | 43.5 | -17.7 |
| 664.01 MHz | H | 14.0 | 23.0 | 36.9 | 46.0 | -9.1 |
| 667.9 MHz | H | 14.5 | 22.9 | 37.4 | 46.0 | -8.6 |
| | | | Channel 433 | | | |
| 31.143 MHz | V | 8.2 | 19.5 | 27.7 | 40.0 | -12.3 |
| 116.71 MHz | V | 12.8 | 13.8 | 26.6 | 43.5 | -16.9 |
| 30.381 MHz | H | 7.5 | 20.0 | 27.4 | 40.0 | -12.6 |
| 130.29 MHz | H | 12.0 | 13.8 | 25.9 | 43.5 | -17.7 |

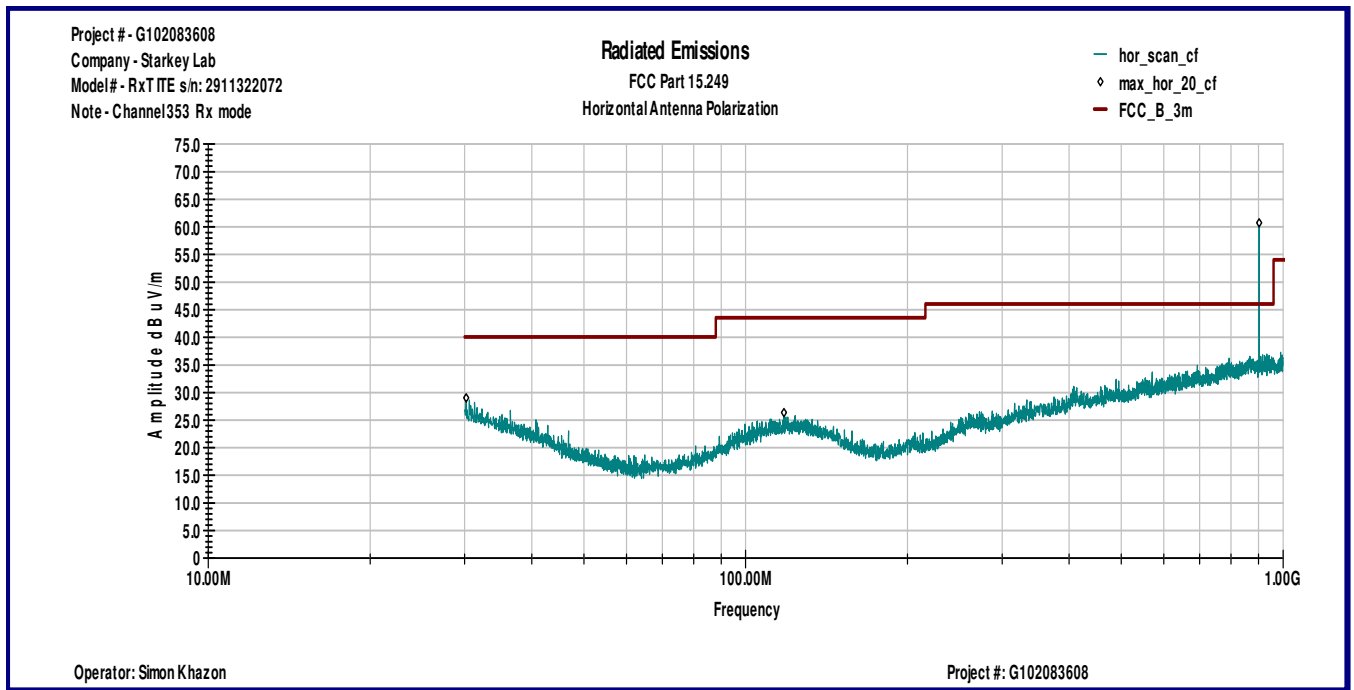


Graph 3.5.1

Vertical antenna polarization



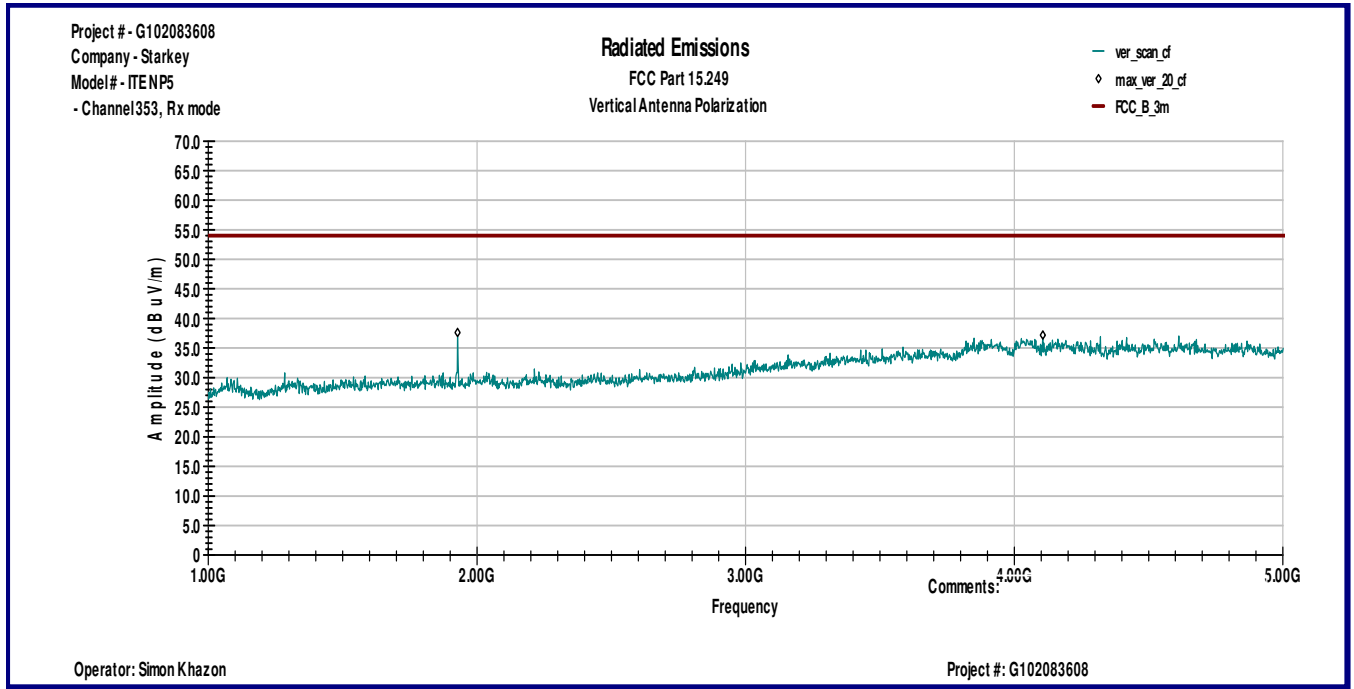
Horizontal antenna polarization



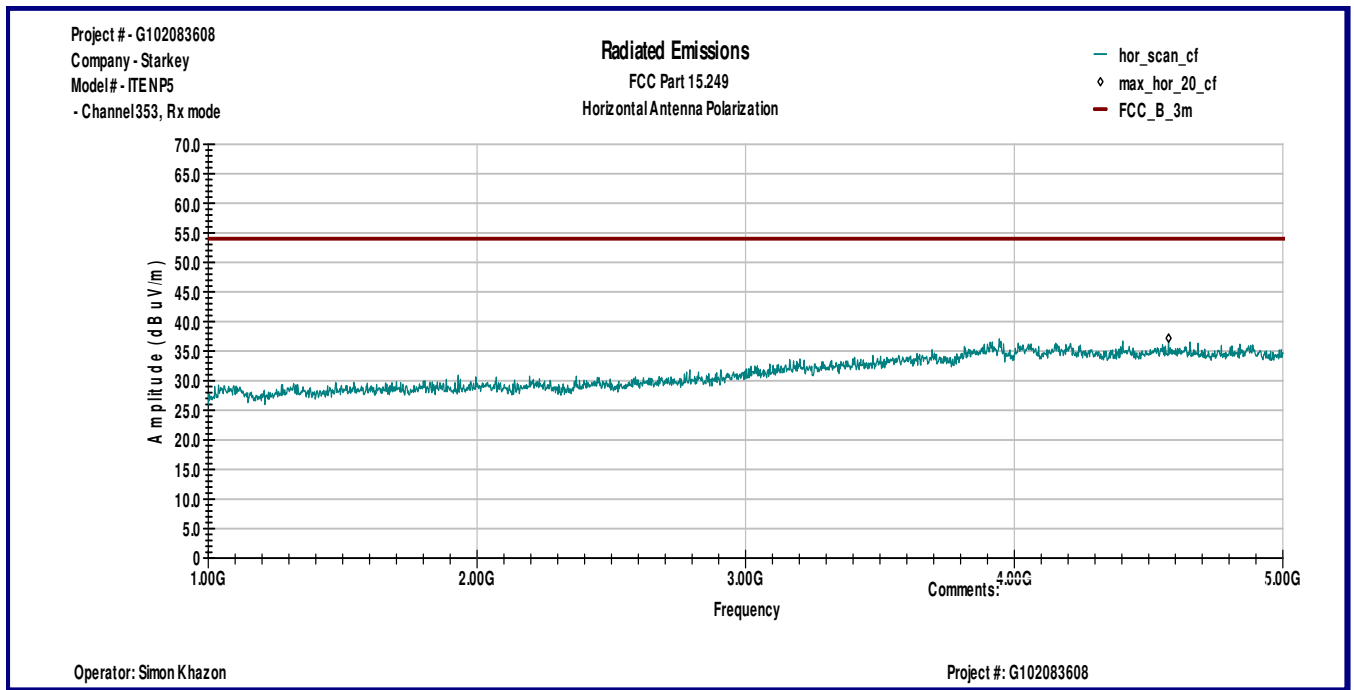


Graph 3.5.2

Vertical antenna polarization



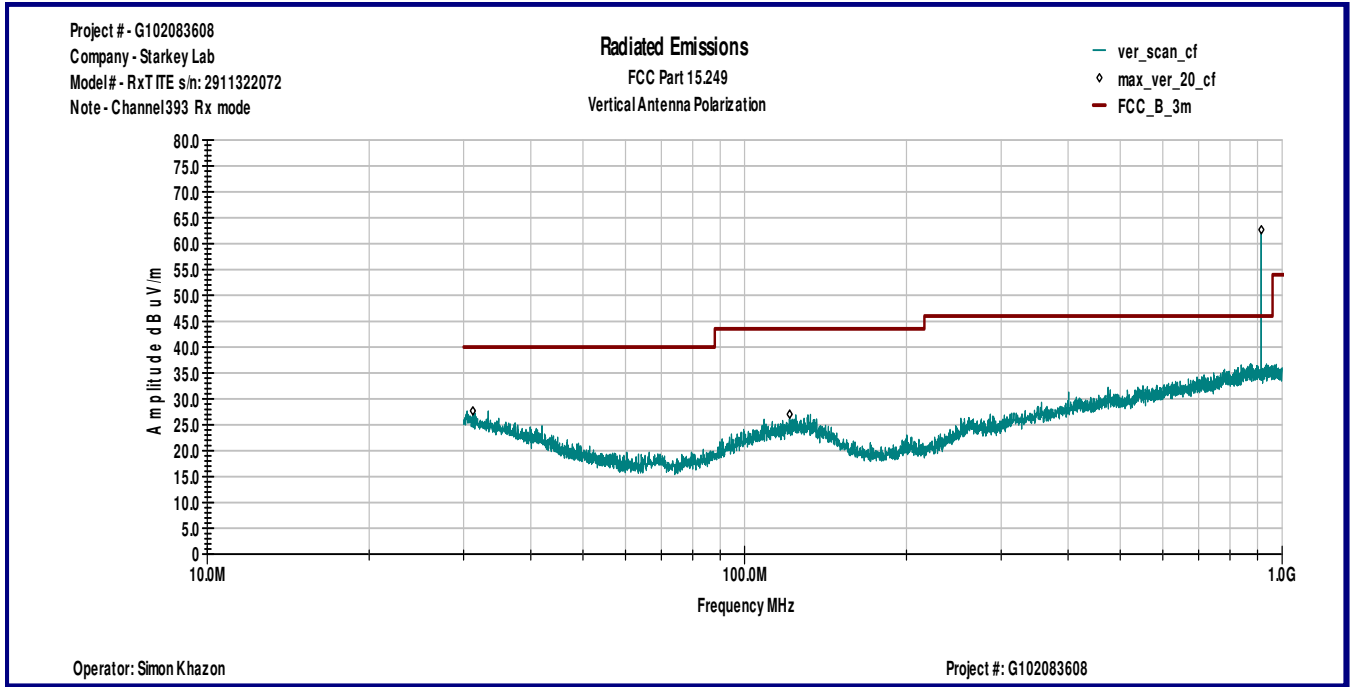
Horizontal antenna polarization



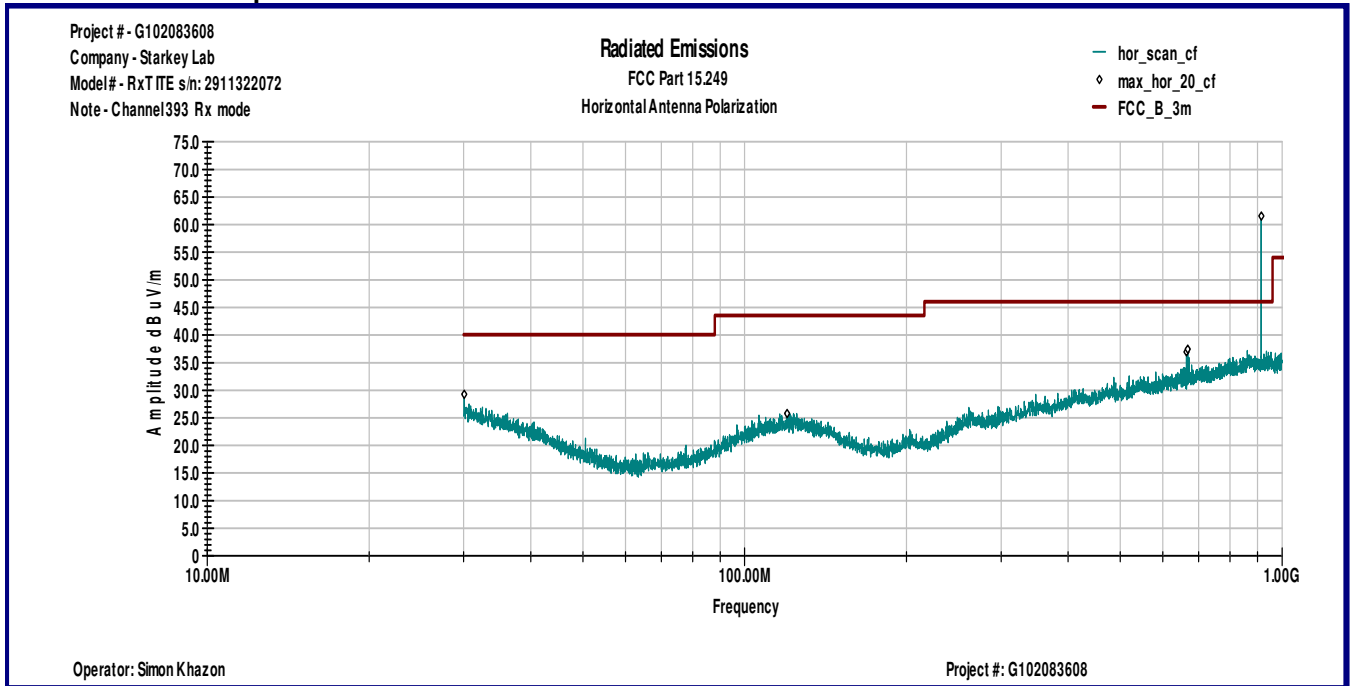


Graph 3.5.3

Vertical antenna polarization



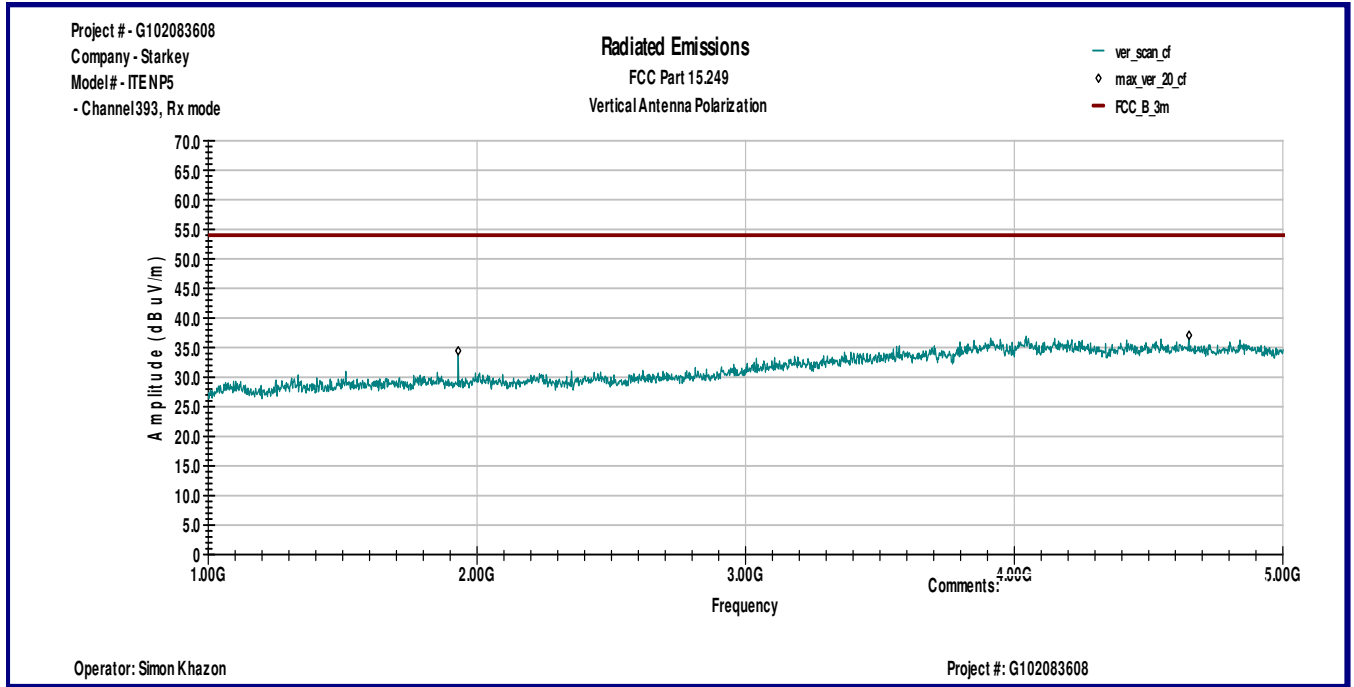
Horizontal antenna polarization



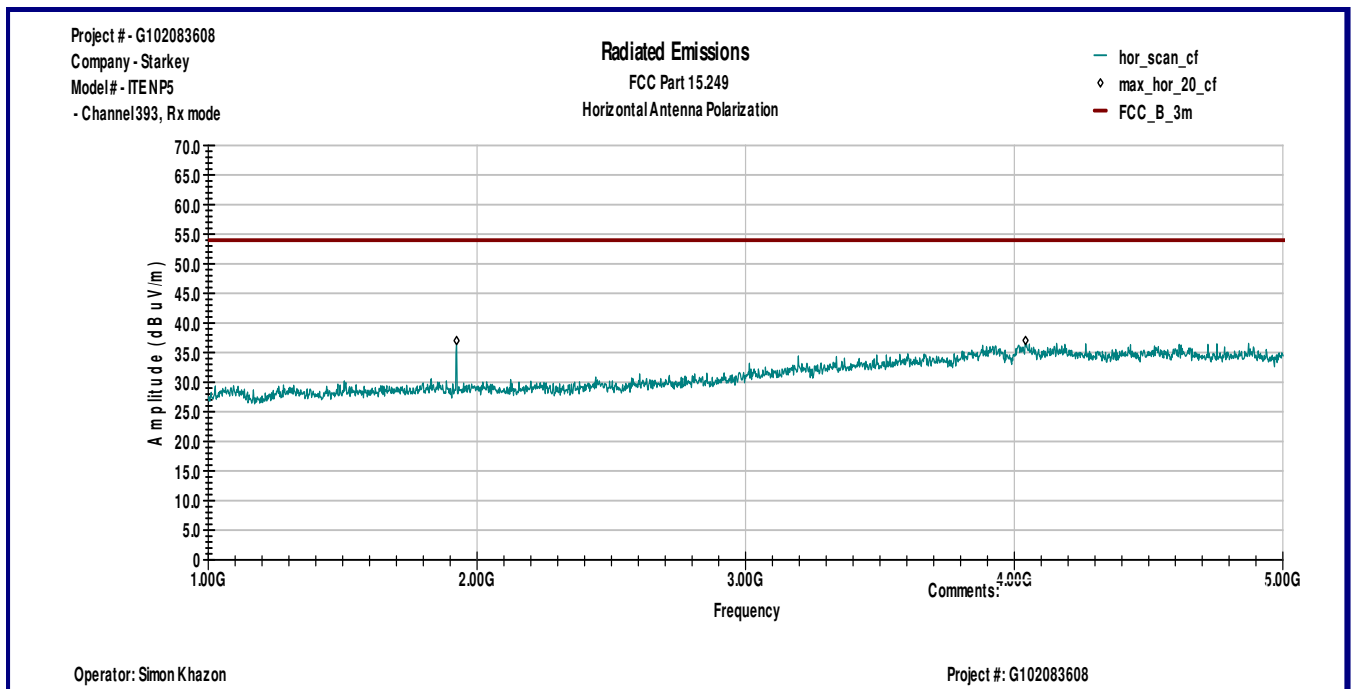


Graph 3.5.4

Vertical antenna polarization



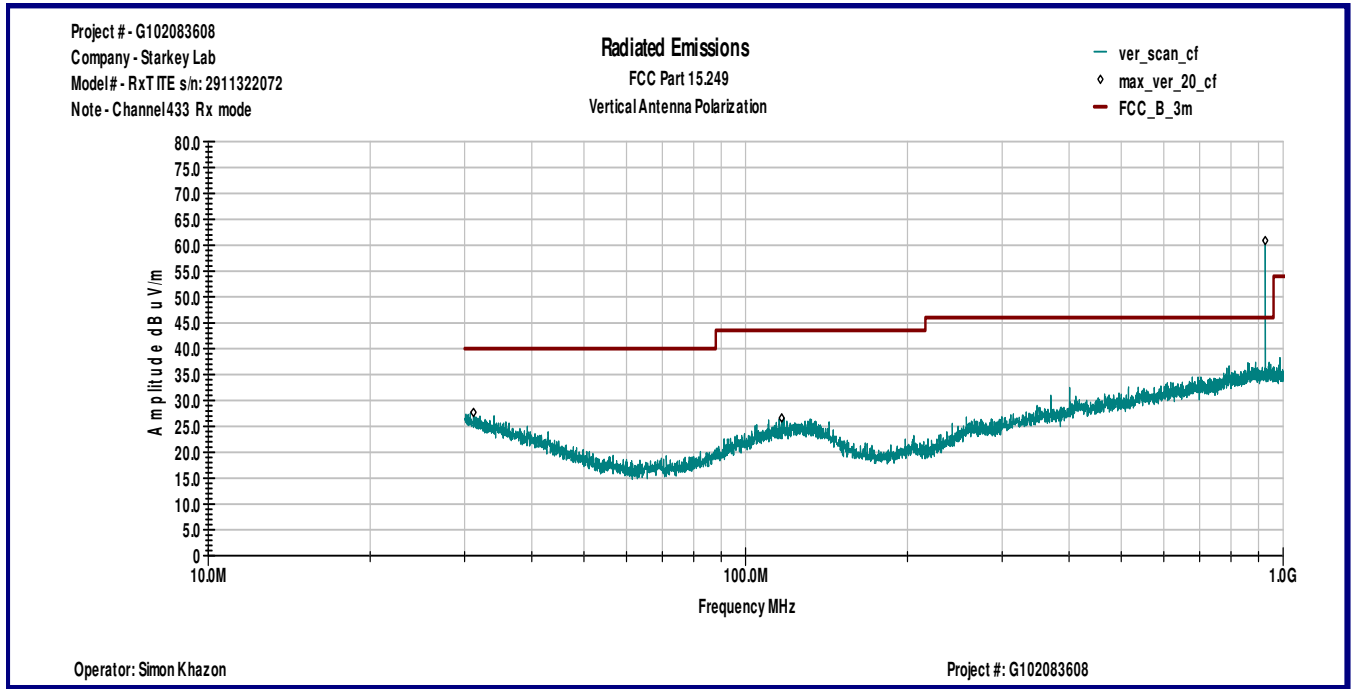
Horizontal antenna polarization



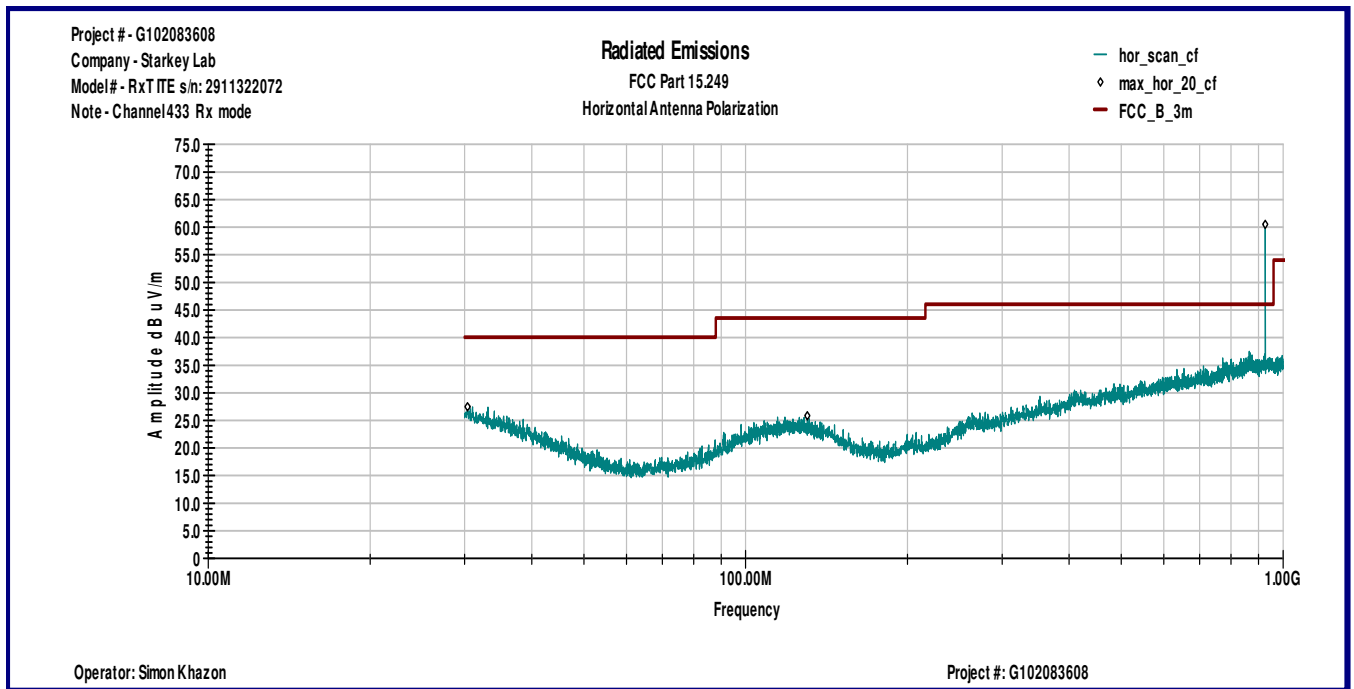


Graph 3.5.5

Vertical antenna polarization



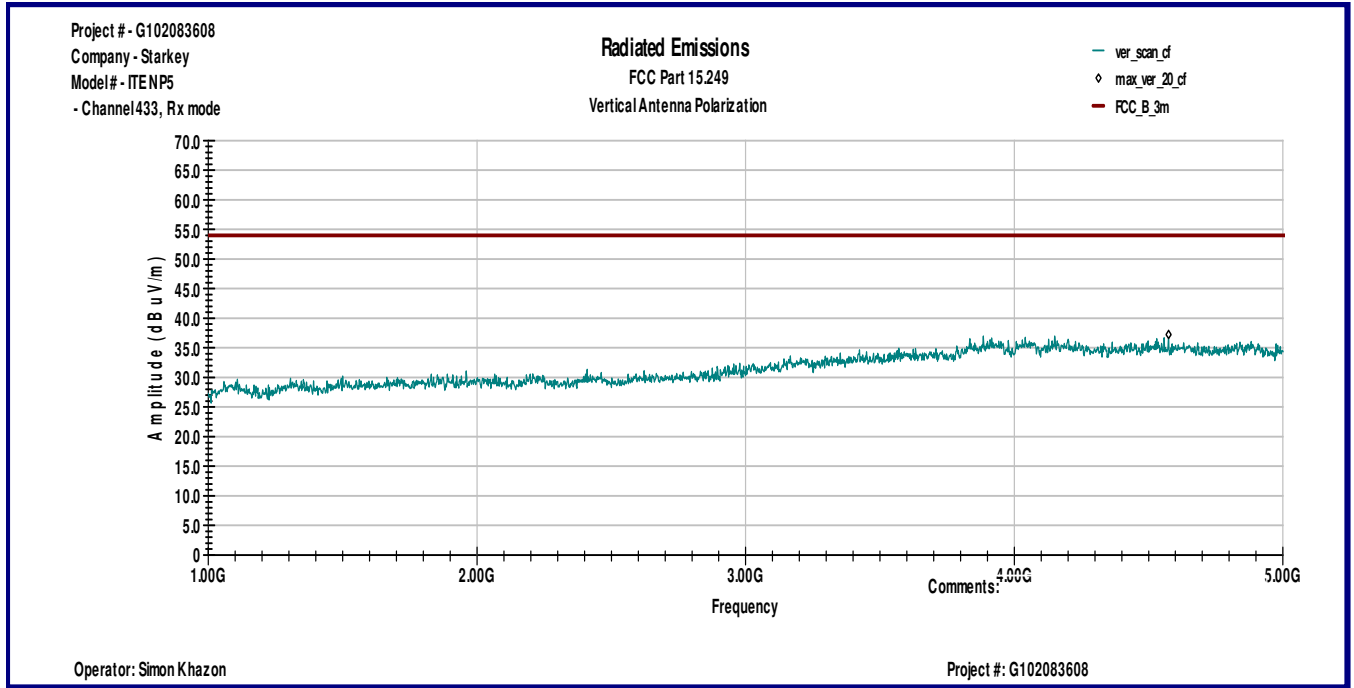
Horizontal antenna polarization



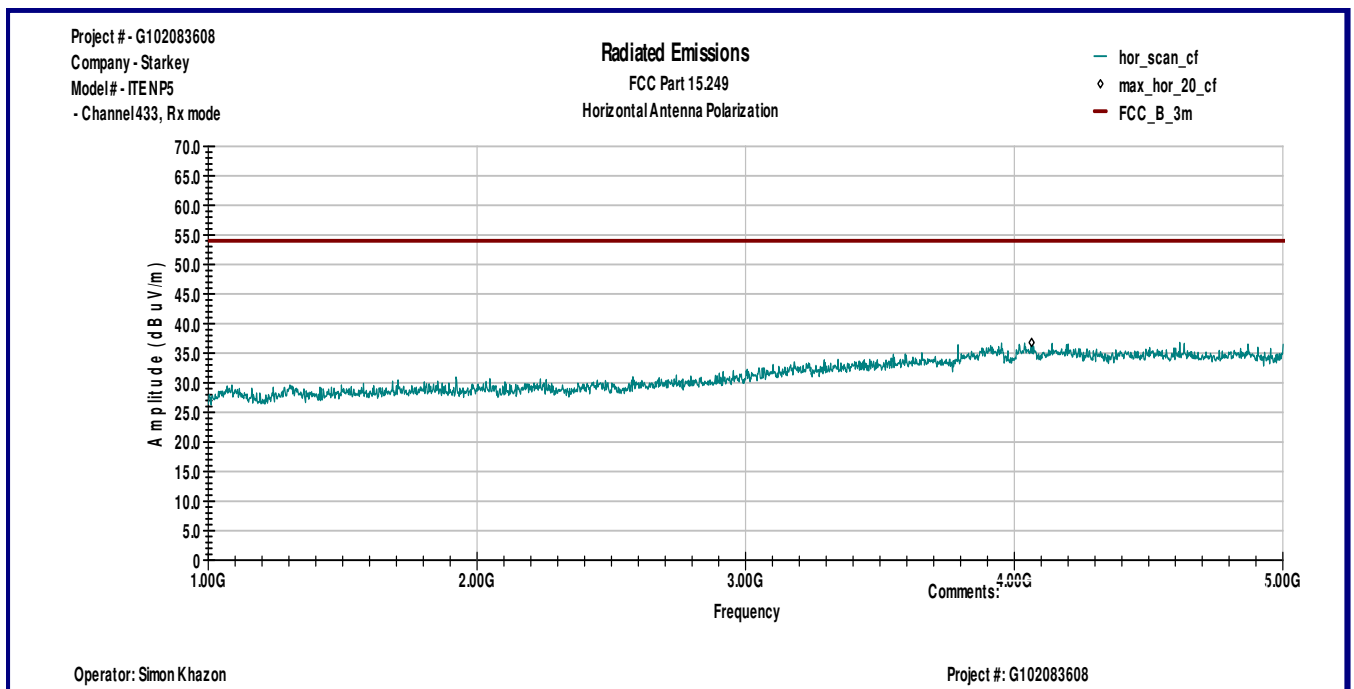


Graph 3.5.6

Vertical antenna polarization



Horizontal antenna polarization





3.6 Digital device conducted emissions

Test location: OATS Anechoic Chamber Other

Test result: **N/A**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: dB below the limits

Notes: It was determined from consideration of the electrical characteristics and usage of particular apparatus that Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).



4.0 TEST EQUIPMENT

| DESCRIPTION | MANUFACTURER | MODEL | SERIAL NO. | INTERTEK ID | CAL DUE | USED |
|------------------------|----------------|--------------------------|---------------|-------------|------------|-------------------------------------|
| Spectrum Analyzer | R & S | FSP 40 | 100024 | 12559 | 01/07/2016 | <input type="checkbox"/> |
| Spectrum Analyzer | R & S | ESU | 100398 | 25283 | 01/26/2016 | <input type="checkbox"/> |
| Bicono-Log Antenna | Teseq | CBL6112D | 32859 | 25289 | 09/10/2015 | <input checked="" type="checkbox"/> |
| Horn Antenna | EMCO | 3115 | 6579 | 15580 | 07/29/2015 | <input checked="" type="checkbox"/> |
| Pre-Amplifier | MITEQ | AMF-5D-00501800-28-13P | 1402232 | 172081 | 11/19/2015 | <input checked="" type="checkbox"/> |
| System | Quantum Change | TILE! Instrument Control | Ver. 3.4.K.29 | 15259 | VBU | <input checked="" type="checkbox"/> |
| 1 GHZ high pass filter | Beactel | 7HS-1G-S12 | SN02-1 | 6015275 | VBU | <input checked="" type="checkbox"/> |



5.0 Revision History

| REVISION LEVEL | DATE | REPORT NUMBER | PREPARED | REVIEWED | NOTES |
|----------------|------------|------------------|----------|----------|----------------|
| 0 | 06-01-2015 | 102083608MIN-001 | SK | US | Original Issue |
| | | | | | |
| | | | | | |