



**FCC CFR47 CERTIFICATION**

**PART 24**

**TEST REPORT**

***FOR***

**GSM PCS1900 MHz SELF-CONTAINED GPS DEVICE**

**BRAND NAME: CASH TRACKER**

**MODEL NUMBER: GT69000**

**FCC ID: Q2U-GT69000**

**REPORT NUMBER: 03U1916-1**

**ISSUE DATE: APRIL 9, 2003**

*Prepared for*  
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## 1. TEST RESULT CERTIFICATION

**COMPANY NAME:** GEOTRAX PROTECTION LLC  
16611 E. LASER DRIVE  
FOUNTAIN HILLS, AZ 85268 USA

**CONTACT PERSON:** RICHARD A FULLER

**EUT DESCRIPTION:** GSM PCS1900 MHz SELF-CONTAINED GPS DEVICE

**MODEL NAME:** GT69000

**DATE TESTED:** APRIL 09, 2003

|                       |                                           |
|-----------------------|-------------------------------------------|
| TYPE OF EQUIPMENT     | INTENTIONAL RADIATOR                      |
| EQUIPMENT TYPE        | GSM PCS1900 MHz SELF-CONTAINED GPS DEVICE |
| MEASUREMENT PROCEDURE | ANSI 63.4 / 2001, TIA/EIA 603             |
| PROCEDURE             | CERTIFICATION                             |
| FCC RULE              | CFR 47 PART 24 Subpart E                  |

Compliance Certification Services, Inc. tested the above equipment for compliance with the requirement set forth in CFR 47, PART 24 Subpart E-Broadband PCS. The equipment in the configuration described in this report, shows the measured emission levels emanating from the equipment do not exceed the specified limit.

**Note :** This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Tested By:



VIEN TRAN  
EMC TECHNICIAN  
COMPLIANCE CERTIFICATION SERVICES

Released For CCS By:



THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

## **2. EUT DESCRIPTION**

The EUT is a single mode portable mobile station of which the frequency range is 1850 – 1910 MHz. The EUT has an output power of 32.5 dBm / 1778.28 mW (EIRP) and has an internal antenna with a gain of 2.5 dBi.

## **3. FACILITIES, LABORATORY AND ACCREDITATION**

### **3.1. Facilities**

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 16.

### **3.2. Laboratory Accreditation**

The laboratory and associated test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT (1300F2)).

No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

### 3.3. List of Accreditations

| Country | Agency          | Scope of Accreditation                                                                                                                                                                                                          | Logo                                                                                                         |
|---------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| USA     | NVLAP*          | FCC Part 15, CISPR 22, AS/NZS 3548, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11, CNS 13438                                                                         | <br>200065-0              |
| USA     | FCC             | 3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements                                                                                                                                                          | <br>1300                  |
| Japan   | VCCI            | CISPR 22 Two OATS and one conducted Site                                                                                                                                                                                        | <br>R-1014, R-619, C-640  |
| Norway  | NEMKO           | EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1 |  ELA 117                  |
| Norway  | NEMKO           | EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC                                                                                                           |  ELA-171                |
| Taiwan  | BSMI            | CNS 13438                                                                                                                                                                                                                       | <br>SL2-IN-E-1012       |
| Canada  | Industry Canada | RSS210 Low Power Transmitter and Receiver                                                                                                                                                                                       | <br>IC2324 A,B,C, and F |

\*No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

## 4. CALIBRATION, METHODOLOGY AND UNCERTAINTY

### 4.1. Equipment Calibration

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

### 4.2. Test Methodology

Conducted and radiated testing were performed according to the procedures documented on chapter 13 of ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057.

Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specifications for "Radio Interference Measuring Apparatus and Measurement Methods," Publication 16.

### 4.3. Measurement Uncertainty

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

| <b>Radiated Emission</b>             |             |
|--------------------------------------|-------------|
| 30MHz – 200 MHz                      | +/- 3.3dB   |
| 200MHz – 1000MHz                     | +4.5/-2.9dB |
| 1000MHz – 2000MHz                    | +4.6/-2.2dB |
| <b>Power Line Conducted Emission</b> |             |
| 150kHz – 30MHz                       | +/-2.9      |

Any results falling within the above values are deemed to be marginal.

#### 4.4. Test and Measurement Equipment

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

| TEST EQUIPMENT LIST                  |               |              |             |          |
|--------------------------------------|---------------|--------------|-------------|----------|
| Name of Equipment                    | Manufacturer  | Model No.    | Serial No.  | Due Date |
| SA Display Section 4                 | HP            | 85662A       | 2152A03066  | 6/1/03   |
| SA RF Section, 22 GHz                | HP            | 85660B       | 3014A06685  | 6/1/03   |
| Quasi-Peak Adaptor                   | HP            | 85650A       | 3145A01654  | 6/1/03   |
| Universal Radio Communication Tester | R&S           | CMU200       | 838114/032  | 11/14/03 |
| Antenna, Horn 1 ~ 18 GHz             | EMCO          | 3115         | 6739        | 2/4/04   |
| Antenna, Horn 1 ~ 18 GHz             | EMCO          | 3115         | 2238        | 2/4/04   |
| SA RF Section, 22 GHz                | HP            | 85660B       | 2140A01296  | 5/23/03  |
| Quasi-Peak Adaptor                   | HP            | 85650A       | 2811A01335  | 5/23/03  |
| SA Display Section 1                 | HP            | 85662A       | 3026A19146  | 5/23/03  |
| Preamplifier, 1 ~ 26 GHz             | Miteq         | NSP10023988  | 646456      | 4/26/03  |
| Signal Generator                     | R&S           | SMP04        | DE34210     | 5/2/05   |
| High Pass Filter ( 4.57GHz )         | FSY Microwave | FM-4570-9SS  | 3           | N.C.R    |
| EMI Receiver                         | HP            | 8542E        | 3942A00280  | 11/20/03 |
| RF Filter Section                    | HP            | 8542E        | 3705A00256  | 11/20/03 |
| DC Power Supply                      | HP            | 6235         | 2450A-08312 | N.C.R    |
| Multimeter                           | Fluke         | 26111        | 74380619    | N.C.R    |
| Amplifier Research (.8-4.2GHz)       | AR            | DC 7144a     | CCS# 00983  | N/A      |
| Spectrum Analyzer                    | Agilent       | E4446A       | US 42070220 | 1/13/04  |
| Environmental Chamber                | Thermotron    | SE-600-10-10 | 29800       | 4/26/03  |

## **5. APPLICABLE RULES**

### **5.1. RF POWER OUTPUT §2.1046**

#### **§ 24.232- POWER LIMIT**

§24.232(a) Maximum Peak output power for base station transmitters should not exceed  
100 Watts EIRP (equivalent isotropically radiated power).

§24.232(b) Mobile stations are limited to 2 Watts EIRP.

### **5.2. MODULATION CHARACTERISTICS §2.1047**

Not applicable.

### **5.3. OCCUPIED BANDWIDTH §2.1049**

§2.1049(i) Transmitters designed for other types of modulation – when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied.

## **5.4. SPURIOUS EMISSIONS AT ANTENNA TERMINALS §2.1051**

### **§ 24.238- EMISSION LIMITS**

§24.238(a) The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under conditions specified in the instruction manual and/or alignment procedure, shall not be less than 43+10 log (mean output power in watts) dBc below the mean power output outside a licensee's frequency block (-13dBm).

## **5.5. FIELD STRENGTH OF SPURIOUS RADIATION §2.1053**

### **§ 24.238- EMISSION LIMITS**

§24.238(a) The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under conditions specified in the instruction manual and/or alignment procedure, shall not be less than 43+10 log (mean output power in watts) dBc below the mean power output outside a licensee's frequency block (-13dBm).

## **5.6. FREQUENCY STABILITY §2.1055**

§24.235 The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

## 5.7. FREQUENCY RANGE TO BE INVESTIGATED §2.1057

§2.1057(a) In all of the measurements set forth in §2.1051 and §2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.

§2.1057(b) Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

§2.1057(c) The amplitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be reported.

§2.1057(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

Spec limit: Frequency investigation range from 10 MHz to 20 GHz.

## 5. TEST SETUP, PROCEDURE AND RESULT

### 6.1. SECTION 2.1046: RF POWER OUTPUT

#### INSTRUMENTS LIST

| EQUIPMENT         | MANUFACTURE | MODEL NO.     | CAL. DUE DATE |
|-------------------|-------------|---------------|---------------|
| Spectrum Analyzer | HP          | 8593EM        | 6/11/03       |
| Amplifier         | MITEQ       | NSP2600-44    | 4/26/03       |
| Horn Antenna      | EMCO        | 3115 SN: 6739 | 02/04/04      |
| Horn Antenna      | EMCO        | 3115 SN: 6717 | 02/04/04      |

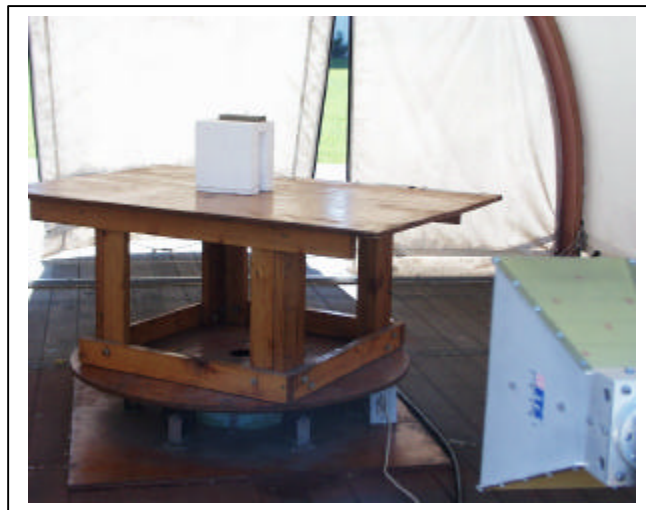
#### MEASUREMENT PROCEDURE

- 1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- 2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the frequency of the transmitter.
- 3). The output of the test antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- 4). The transmitter shall be switched on, if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- 5). The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 6). The transmitter shall than be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- 7). The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 8). The maximum signal level detected by the measuring receiver shall be noted.
- 9). The transmitter shall be replaced by a tuned dipole (substitution antenna).

- 10). The substitution antenna shall be oriented for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
- 11). The substitution antenna shall be connected to a calibrated signal generator.
- 12). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- 13). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- 14). The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- 15). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- 16). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
- 17). The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.

**Test result:**

| <b>Modulation</b>  | <b>Max Output Power(dBm)</b> | <b>Max Output Power(mW)</b> |
|--------------------|------------------------------|-----------------------------|
| <b>GSM 1900MHz</b> | <b>32.5 (EIRP)</b>           | <b>1778.27</b>              |

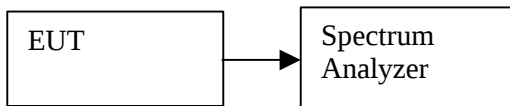


## GSM 1900MHz Output Power (EIRP)

| 04/08/03 <b>FCC Measurement</b><br><b>Compliance Certification Services, Morgan Hill Open Field Site</b><br><br><b>Test Engr: VIEN TRAN</b><br><b>Project #: 03u1916-1</b><br><b>Company: 7Layers inc.</b><br><b>EUT Descrip.: 900/1800/1900MHz Self-Contained GPS Device</b><br><b>EUT M/N: Cash Tracker</b><br><b>Test Target: FCC 24</b><br><b>Mode Oper: Tx / Rx _ 1900MHz_Harmonics, Spurious &amp; Substitution (X Position)</b>                                                                   |                      |                     |            |               |               |               |                |                |                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------|------------|---------------|---------------|---------------|----------------|----------------|--------------------------|
| Frequency<br>(GHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | SA reading<br>(dBuV) | SG reading<br>(dBm) | CL<br>(dB) | Gain<br>(dBi) | Gain<br>(dBd) | EIRP<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) | Notes                    |
| <b>Fundamental (Low, Mid, &amp; High Channels):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |                     |            |               |               |               |                |                |                          |
| 1.850                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 92.5                 | 14.30               | 0.80       | 7.30          | 0.00          | 20.80         | 33.00          | -12.20         | V,X, Orientation, Low ch |
| 1.850                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 100.4                | 25.00               | 0.80       | 7.30          | 0.00          | 31.50         | 33.00          | -1.50          | H                        |
| 1.880                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 88.5                 | 11.90               | 0.80       | 7.30          | 0.00          | 18.40         | 33.00          | -14.60         | V,X, Orientation, Mid ch |
| 1.880                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 103.1                | 25.80               | 0.80       | 7.30          | 0.00          | 32.30         | 33.00          | -0.70          | H                        |
| 1.910                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 90.1                 | 13.10               | 0.80       | 7.30          | 0.00          | 19.60         | 33.00          | -13.40         | V,X, Orientation, Hi ch  |
| 1.910                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 103.0                | 26.00               | 0.80       | 7.30          | 0.00          | 32.50         | 33.00          | -0.50          | H                        |
| <b>EIPR = SG reading - CL + Gain (dBi)</b><br><b>Margin = EIPR - Limit</b><br><br><b>SA:</b> Spectrum Analyzer, HP 8593EM, S/N: 3710A00205 <b>CL:</b> cable loss (5ft), FLEXCO<br><b>SG:</b> Signal Generator, HP 83732B, S/N: US34490599 <b>Pre-Amp:</b> Miteq NSP2600 -44, S/N: 646456<br><b>TX Antenna:</b> Dipole, Compliance Design, Roberts, S/N: 116 <b>RX Antenna:</b> Bicon, Eston 94455-1, S/N: 1214<br>Horn, EMCO 3115, S/N: 6717      LP, EMCO 3146, S/N: 3163<br>Horn, EMCO 3115, S/N: 6739 |                      |                     |            |               |               |               |                |                |                          |

## 6.2. OCCUPIED BANDWIDTH

### TEST SETUP

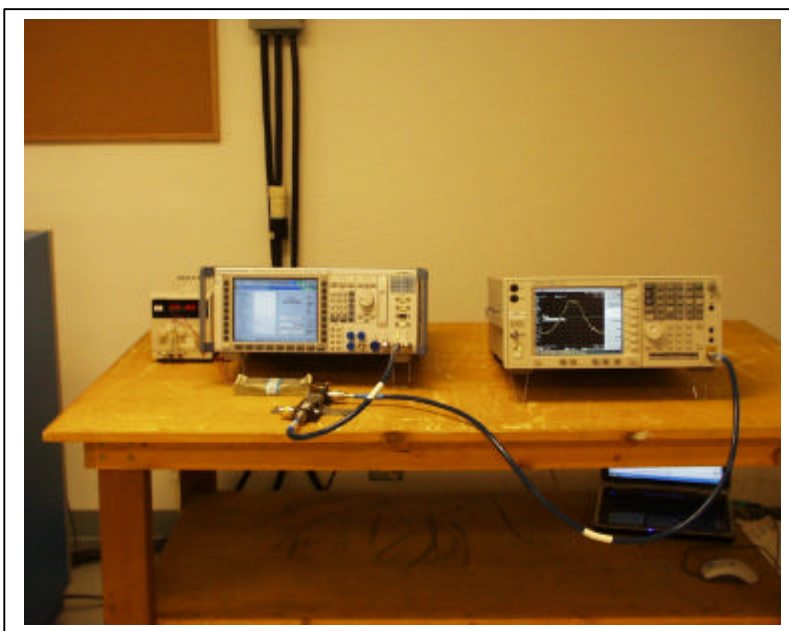


### TEST PROCEDURE

The EUT's output RF connector (made solely for the purpose of the test) was connected with a short cable to the spectrum analyzer, RES BW was set to about 1% of 99 %emission BW , the occupied BW is the delta frequency between the two points.

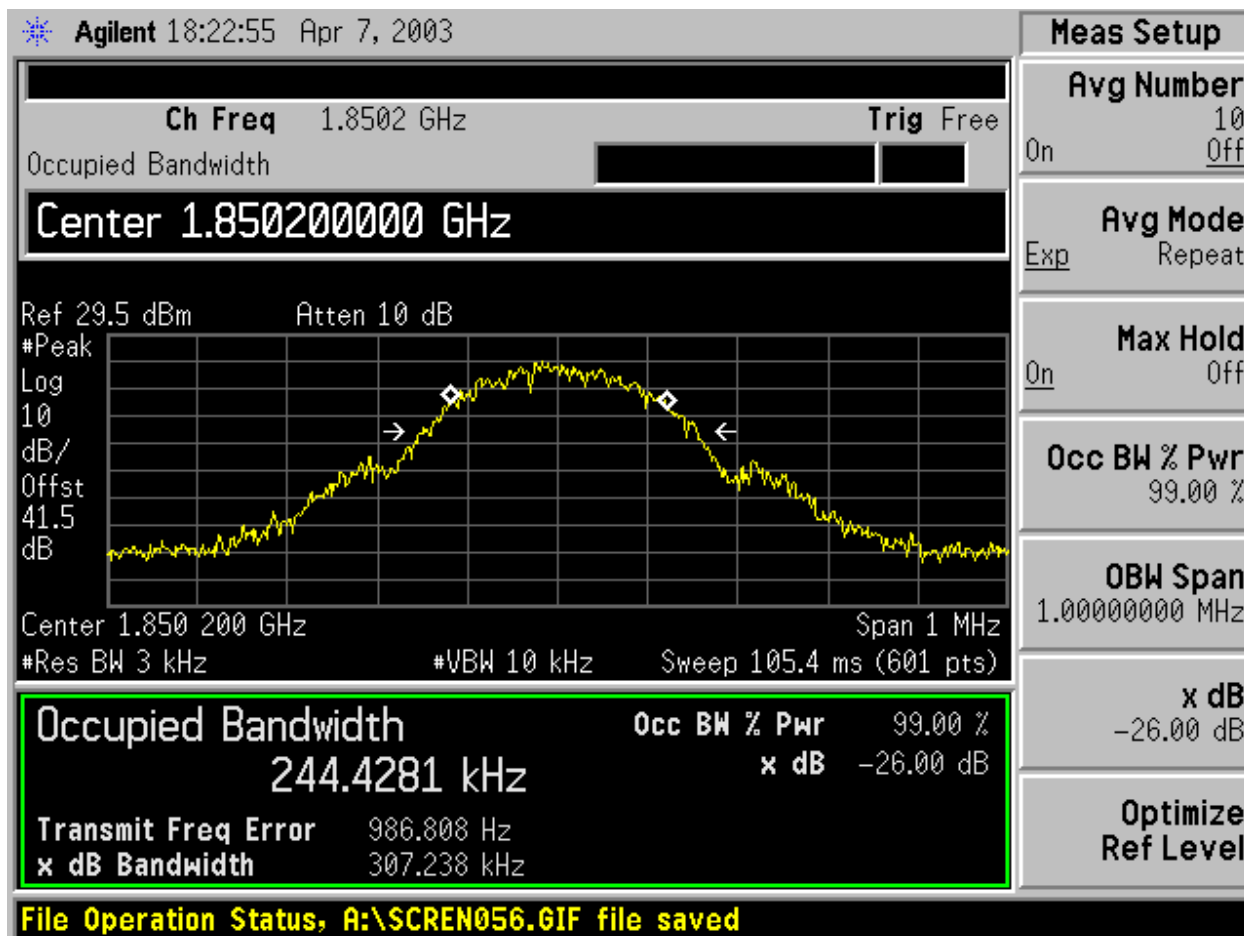
### RESULT

No non-compliance noted.

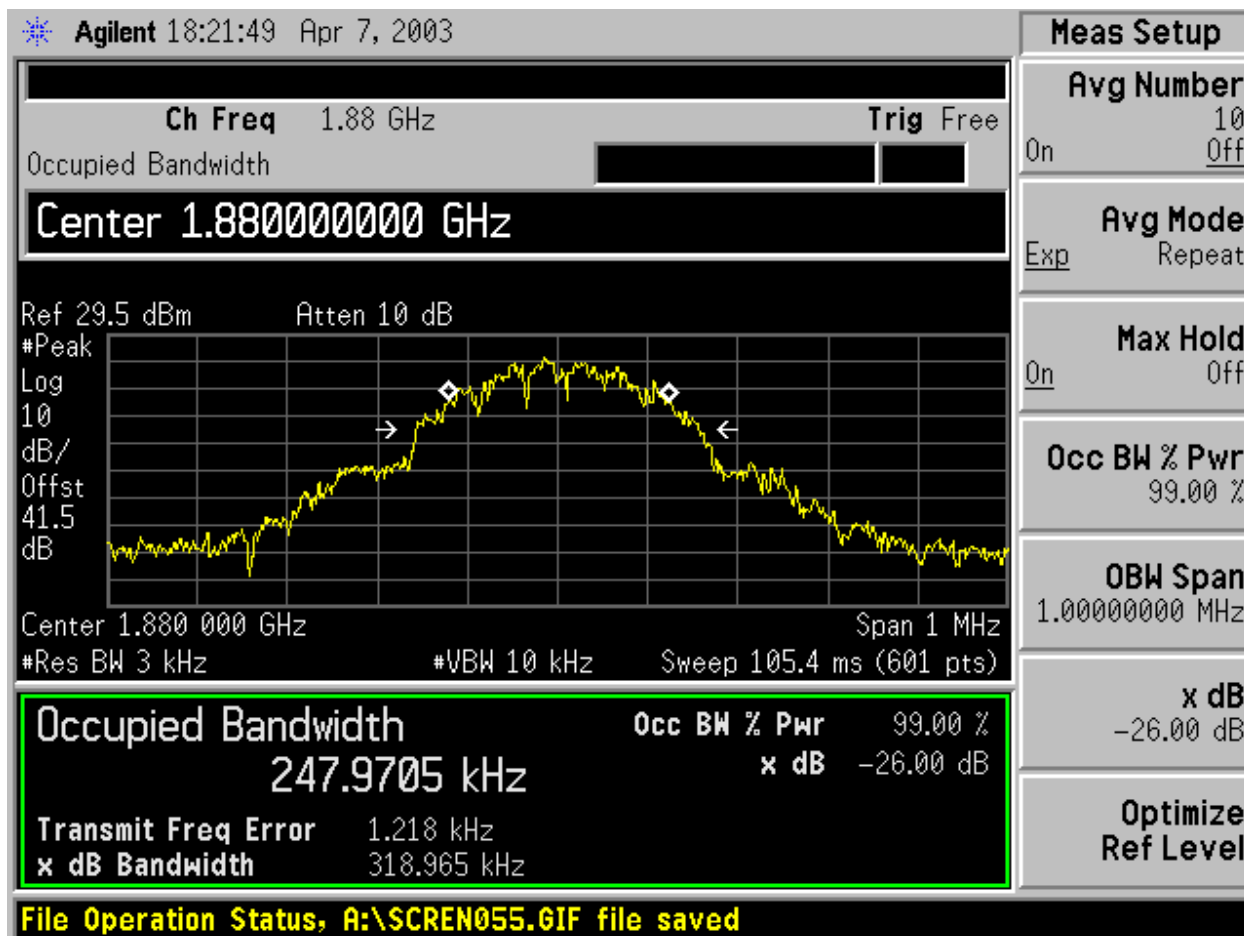


| FREQUENCY | BANDWIDTH |
|-----------|-----------|
| (GHz)     | (KHz)     |
| 1.850     | 244.430   |
| 1.880     | 247.970   |
| 1.910     | 246.010   |

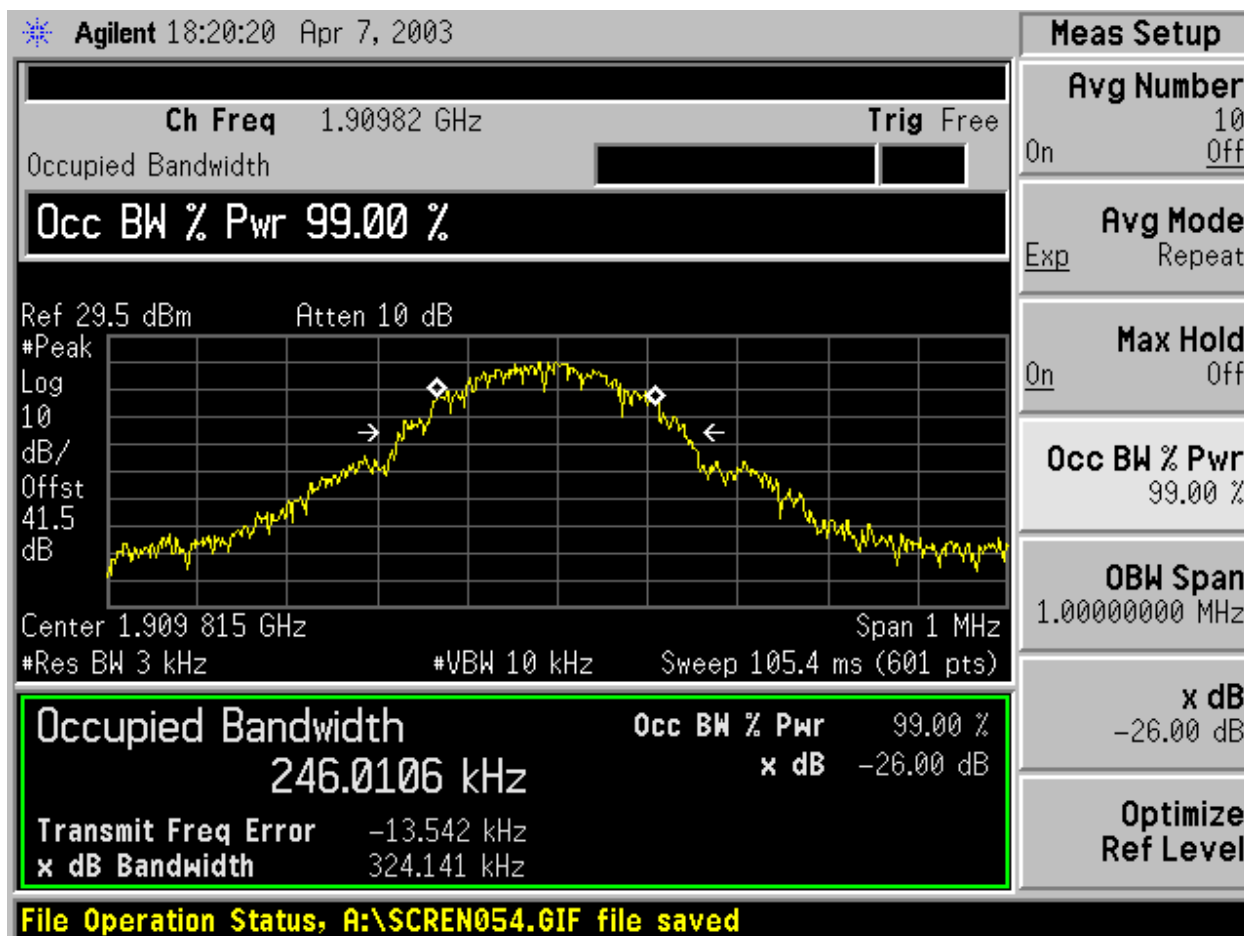
## LOW CHANNEL



**MIDDLE CHANNEL**

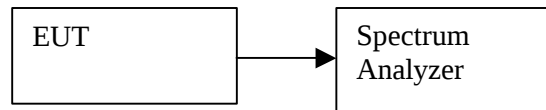


## HIGH CHANNEL



### 6.3. SPURIOUS EMISSION AT ANTENNA TERMINAL

#### TEST SETUP



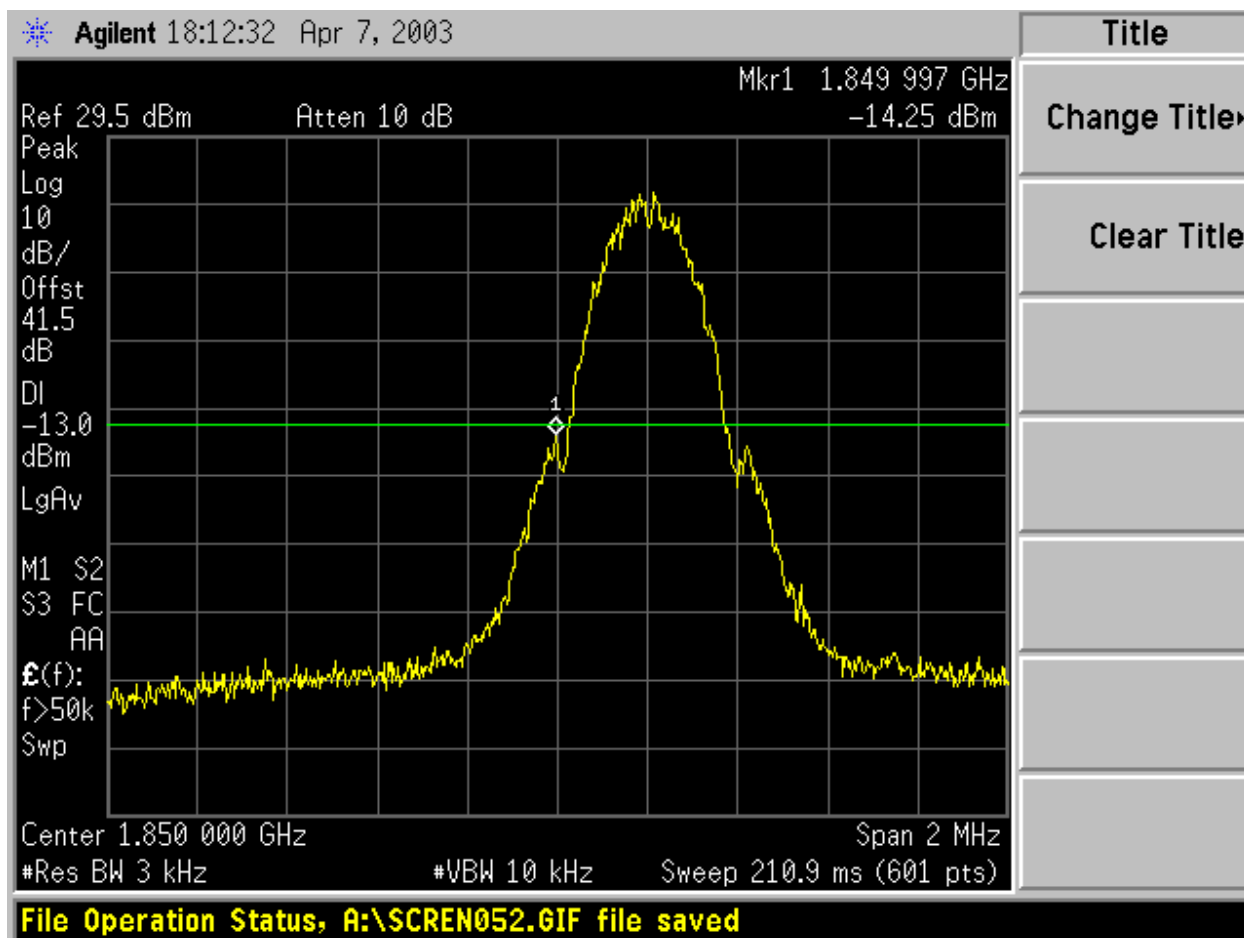
#### TEST PROCEDURE

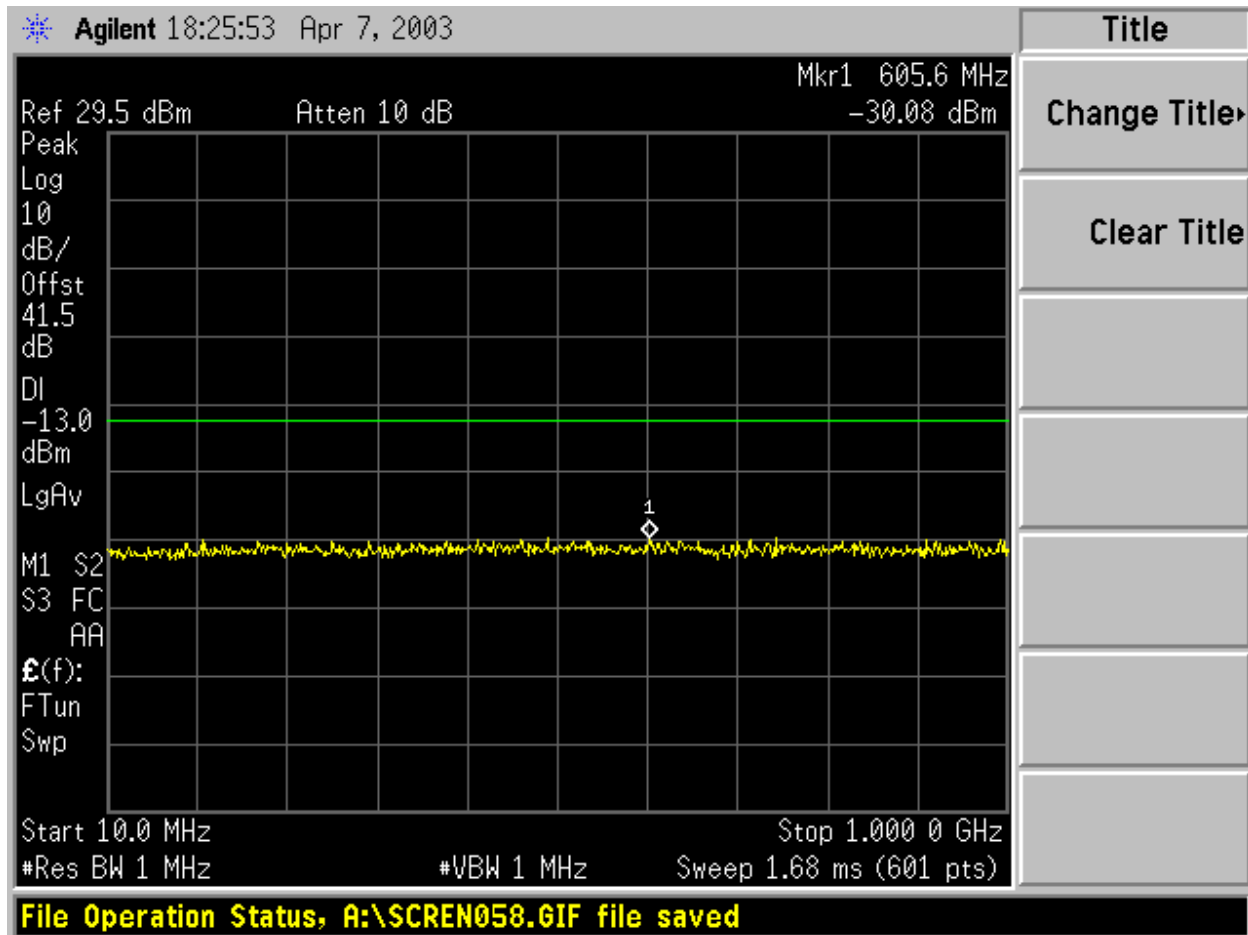
EUT's RF output connector (made solely for the purpose of the test) is connected to the spectrum analyzer, RBW was set to 1MHz and VBW to 1MHz, the spectrum of 10MHz to 20GHz was investigated for any spurious emissions, a close up investigation for band edges for the low and high channels was also investigated with RBW=3KHz and VBW RBW.

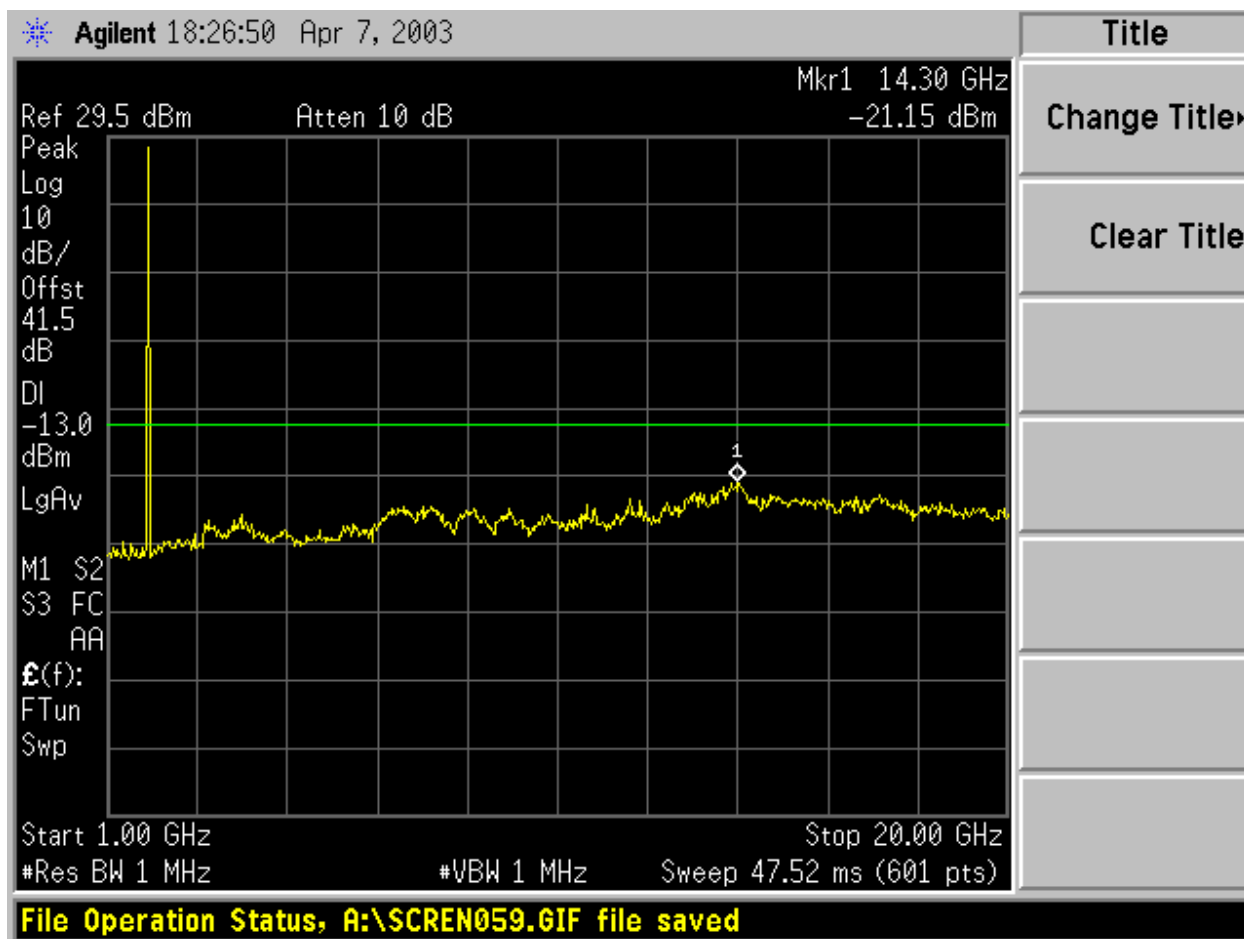
#### RESULT

No non-compliance noted.

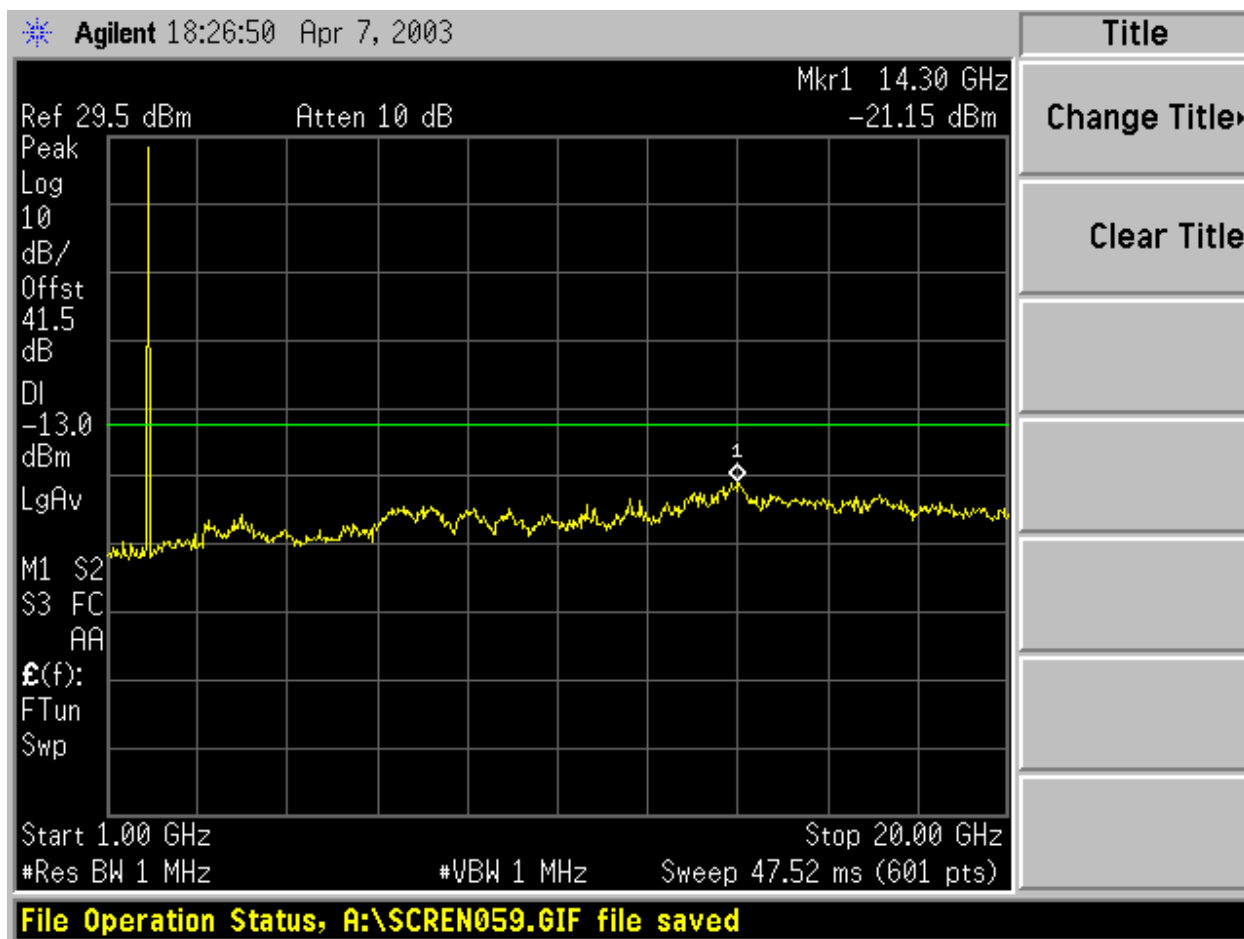
## LOW CHANNEL



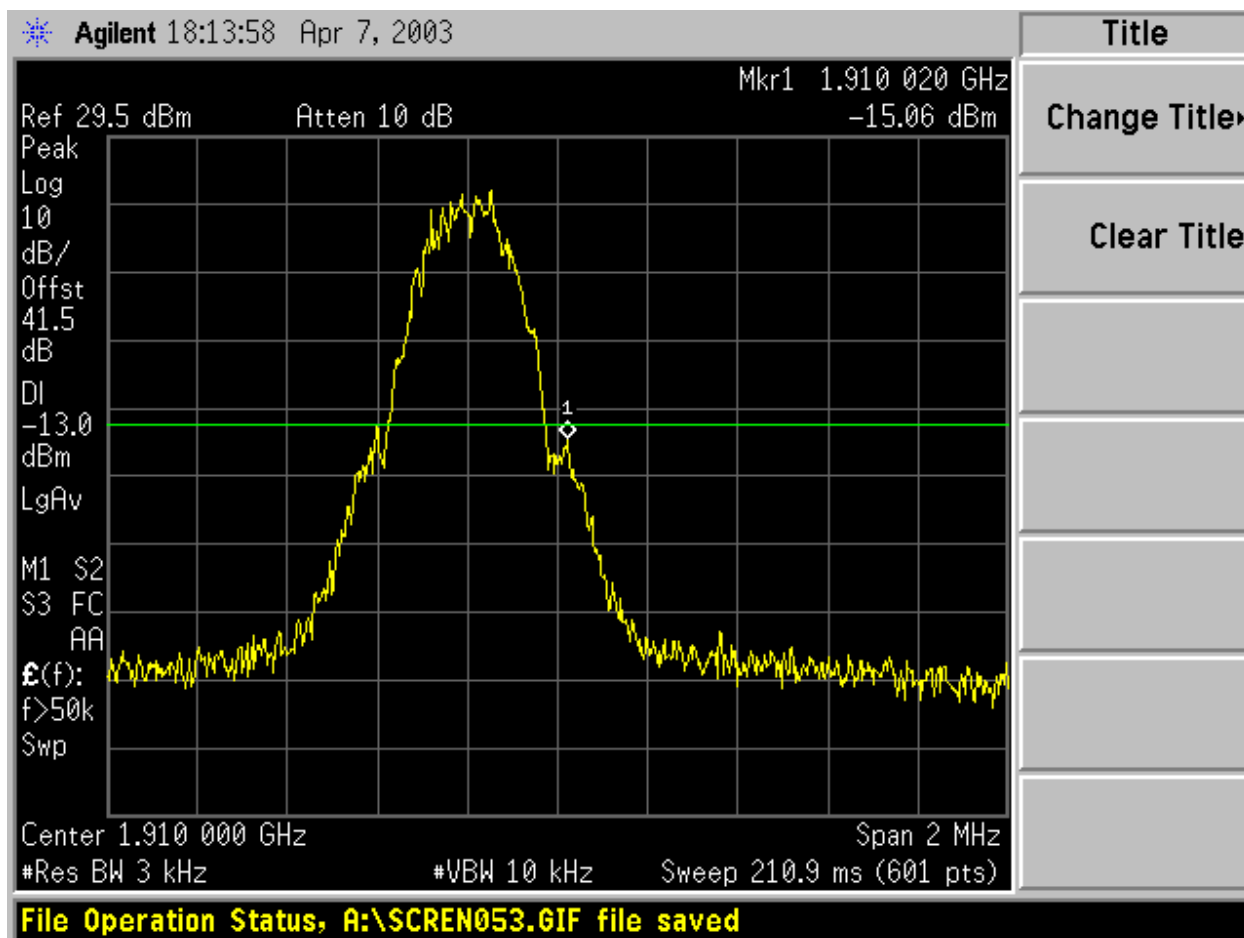


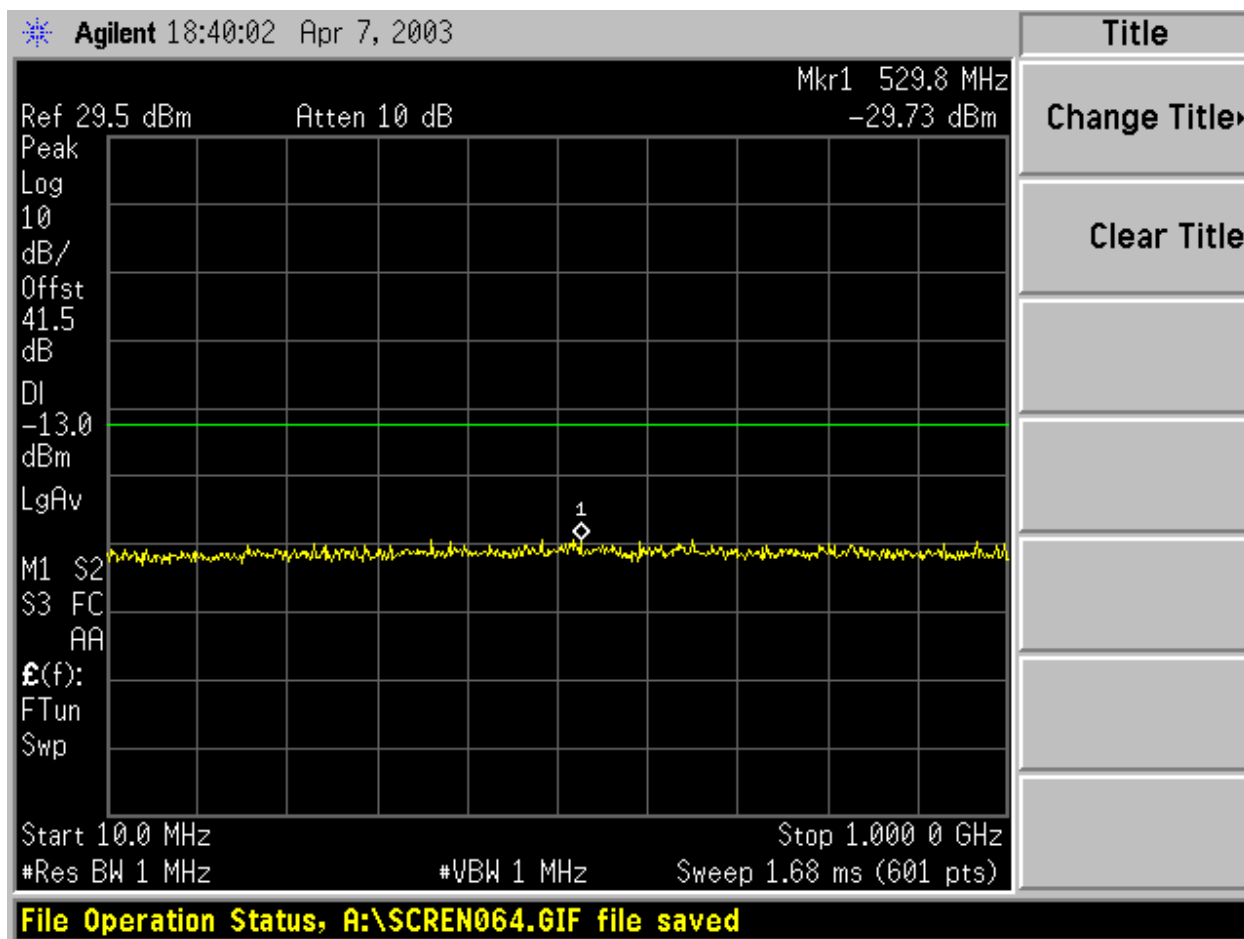


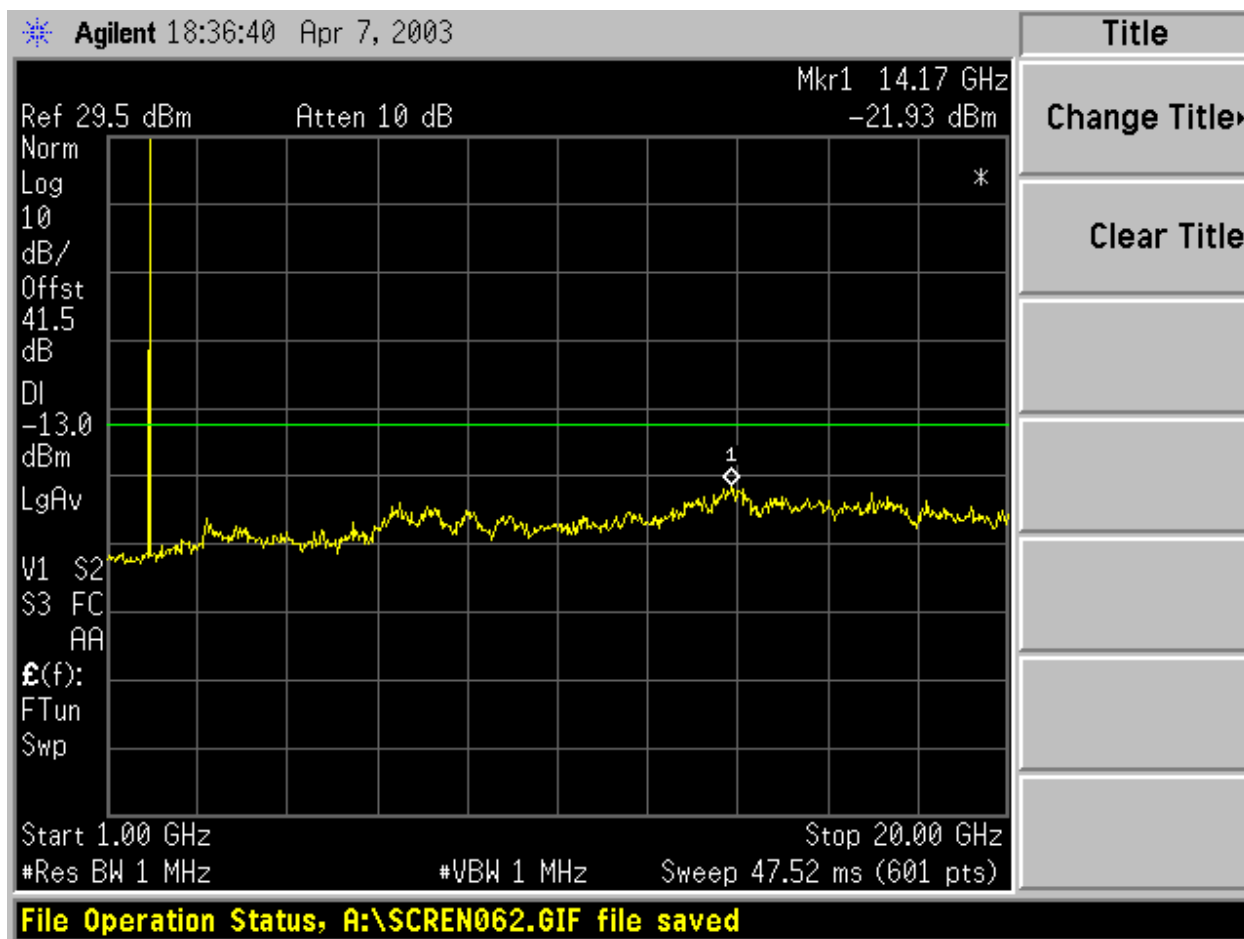




## HIGH CHANNEL







## 6.4. FIELD STRENGTH OF SPURIOUS RADIATION

Detector Function Setting of Test Receiver

| Frequency Range (MHz) | Detector Function                                                            | Resolution Bandwidth                                                        | Video Bandwidth                                                             |
|-----------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Above 1000            | <input checked="" type="checkbox"/> Peak<br><input type="checkbox"/> Average | <input checked="" type="checkbox"/> 1 MHz<br><input type="checkbox"/> 1 MHz | <input checked="" type="checkbox"/> 1 MHz<br><input type="checkbox"/> 10 Hz |

### TEST SETUP

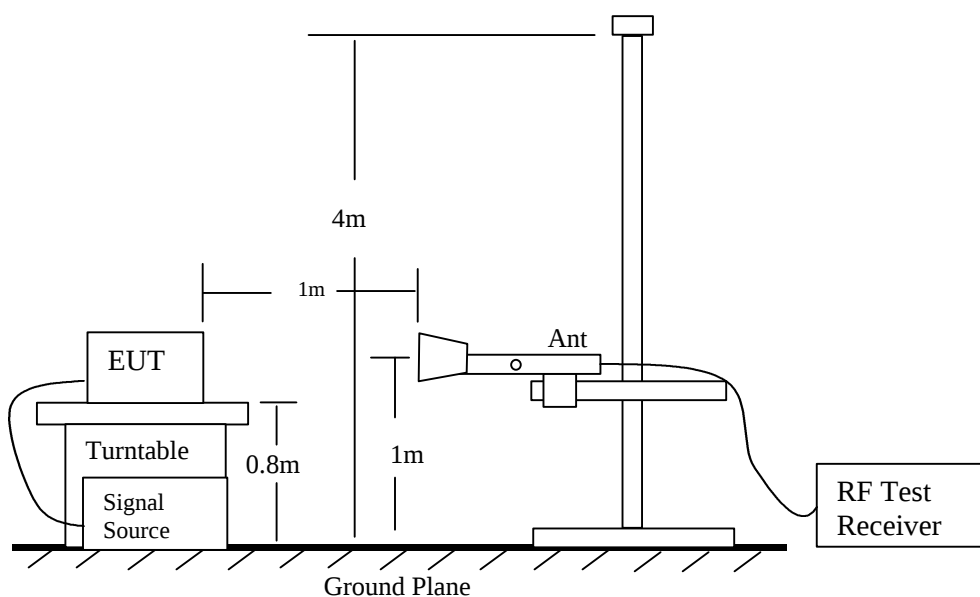


Fig 1: Radiated Emission Measurement

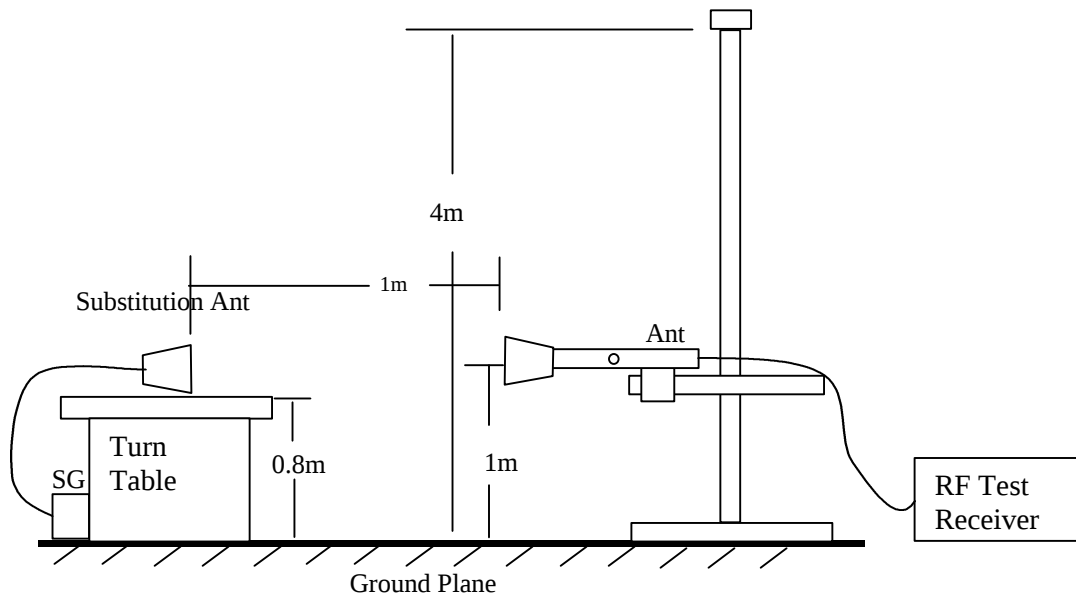


Fig 2: Radiated Emission – Substitution Method set-up

### **TEST PROCEDURE**

- 1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- 2). The test antenna shall be oriented initially for vertical polarization located 1m from the EUT to correspond to the frequency of the transmitter.
- 3). The output of the test antenna shall be connected to the measuring receiver and either a peak or average detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- 4). The transmitter shall be switched on, if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- 5). The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 6). The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- 7). The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 8). The maximum signal level detected by the measuring receiver shall be noted.
- 9). The transmitter shall be replaced by a substitution antenna.
- 10). The substitution antenna shall be oriented for vertical polarization.
- 11). The substitution antenna shall be connected to a calibrated signal generator.
- 12). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- 13). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- 14). The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- 15). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- 16). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

- 17). The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.

## **RESULT**

No non-compliance noted:

| 04/08/03 FCC Measurement                                                                                                                                                                                                                                                                                                                                                                                              |            |            |      |       |       |        |        |        |                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------|-------|-------|--------|--------|--------|-----------------------------|
| Compliance Certification Services, Morgan Hill Open Field Site                                                                                                                                                                                                                                                                                                                                                        |            |            |      |       |       |        |        |        |                             |
| Test Engr: VIEN TRAN                                                                                                                                                                                                                                                                                                                                                                                                  |            |            |      |       |       |        |        |        |                             |
| Project #: 03u1916-1                                                                                                                                                                                                                                                                                                                                                                                                  |            |            |      |       |       |        |        |        |                             |
| Company: 7Layers inc.                                                                                                                                                                                                                                                                                                                                                                                                 |            |            |      |       |       |        |        |        |                             |
| EUT Descrip.: 900/1800/1900MHz Self-Contained GPS Device                                                                                                                                                                                                                                                                                                                                                              |            |            |      |       |       |        |        |        |                             |
| EUT M/N: Cash Tracker                                                                                                                                                                                                                                                                                                                                                                                                 |            |            |      |       |       |        |        |        |                             |
| Test Target: FCC 24                                                                                                                                                                                                                                                                                                                                                                                                   |            |            |      |       |       |        |        |        |                             |
| Mode Oper: Tx / Rx _ 1900MHz_Harmonics, Spurious & Substitution (X Position)                                                                                                                                                                                                                                                                                                                                          |            |            |      |       |       |        |        |        |                             |
| Frequency                                                                                                                                                                                                                                                                                                                                                                                                             | SA reading | SG reading | CL   | Gain  | Gain  | EIRP   | Limit  | Margin | Notes                       |
| (GHz)                                                                                                                                                                                                                                                                                                                                                                                                                 | (dBuV)     | (dBm)      | (dB) | (dBi) | (dBd) | (dBm)  | (dBm)  | (dB)   |                             |
| <b>Bandedge Low</b>                                                                                                                                                                                                                                                                                                                                                                                                   |            |            |      |       |       |        |        |        |                             |
| 1.8502                                                                                                                                                                                                                                                                                                                                                                                                                | 64.80      | -23.00     | 0.7  | 7.90  | 0.00  | -15.80 | -13.00 | -2.80  | H, (30K,30K) - Low Channel  |
| <b>Bandedge High</b>                                                                                                                                                                                                                                                                                                                                                                                                  |            |            |      |       |       |        |        |        |                             |
| 1.9098                                                                                                                                                                                                                                                                                                                                                                                                                | 62.90      | -23.50     | 0.7  | 7.90  | 0.00  | -16.30 | -13.00 | -3.30  | H, (30k/30k) - High Channel |
| <b>Spurious Emissions</b>                                                                                                                                                                                                                                                                                                                                                                                             |            |            |      |       |       |        |        |        |                             |
| <b>Lo Channel:</b>                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |      |       |       |        |        |        |                             |
| 3.70                                                                                                                                                                                                                                                                                                                                                                                                                  | 57.2       | -48.00     | 1.66 | 8.90  | 0.00  | -40.76 | -13.00 | -27.76 | V, X, 2nd Har               |
| 5.55                                                                                                                                                                                                                                                                                                                                                                                                                  | 51.0       | -53.20     | 2.15 | 10.30 | 0.00  | -45.05 | -13.00 | -32.05 | V                           |
| 7.40                                                                                                                                                                                                                                                                                                                                                                                                                  | 51.9       | -49.50     | 2.50 | 10.30 | 0.00  | -41.70 | -13.00 | -28.70 | V                           |
| 9.25                                                                                                                                                                                                                                                                                                                                                                                                                  | 49.7       | -50.50     | 2.84 | 10.10 | 0.00  | -43.24 | -13.00 | -30.24 | V                           |
| 11.10                                                                                                                                                                                                                                                                                                                                                                                                                 | 48.9       | -50.10     | 3.10 | 10.10 | 0.00  | -43.10 | -13.00 | -30.10 | V, NF                       |
| 3.70                                                                                                                                                                                                                                                                                                                                                                                                                  | 56.7       | -50.20     | 1.66 | 8.90  | 0.00  | -42.96 | -13.00 | -29.96 | H, X, 2nd, Har              |
| 5.55                                                                                                                                                                                                                                                                                                                                                                                                                  | 48.9       | -55.50     | 2.15 | 10.30 | 0.00  | -47.35 | -13.00 | -34.35 | H                           |
| 7.40                                                                                                                                                                                                                                                                                                                                                                                                                  | 49.5       | -51.50     | 2.50 | 10.30 | 0.00  | -43.70 | -13.00 | -30.70 | H                           |
| 9.25                                                                                                                                                                                                                                                                                                                                                                                                                  | 48.0       | -51.30     | 2.84 | 10.10 | 0.00  | -44.04 | -13.00 | -31.04 | H                           |
| 11.10                                                                                                                                                                                                                                                                                                                                                                                                                 | 47.2       | -51.80     | 3.10 | 10.10 | 0.00  | -44.80 | -13.00 | -31.80 | H, NF                       |
| <b>Mid Channel</b>                                                                                                                                                                                                                                                                                                                                                                                                    |            |            |      |       |       |        |        |        |                             |
| 3.76                                                                                                                                                                                                                                                                                                                                                                                                                  | 58.4       | -46.30     | 1.66 | 8.90  | 0.00  | -39.06 | -13.00 | -26.06 | V, X, 2nd Har               |
| 5.64                                                                                                                                                                                                                                                                                                                                                                                                                  | 50.0       | -54.80     | 2.15 | 10.30 | 0.00  | -46.65 | -13.00 | -33.65 | V                           |
| 7.52                                                                                                                                                                                                                                                                                                                                                                                                                  | 55.9       | -45.70     | 2.50 | 10.30 | 0.00  | -37.90 | -13.00 | -24.90 | V                           |
| 9.40                                                                                                                                                                                                                                                                                                                                                                                                                  | 49.0       | -51.00     | 2.84 | 10.10 | 0.00  | -43.74 | -13.00 | -30.74 | V                           |
| 11.28                                                                                                                                                                                                                                                                                                                                                                                                                 | 48.0       | -51.50     | 3.10 | 10.10 | 0.00  | -44.50 | -13.00 | -31.50 | V, NF                       |
| 3.76                                                                                                                                                                                                                                                                                                                                                                                                                  | 57.4       | -48.20     | 1.66 | 8.90  | 0.00  | -40.96 | -13.00 | -27.96 | H, X, 2nd Har               |
| 5.64                                                                                                                                                                                                                                                                                                                                                                                                                  | 49.7       | -54.30     | 2.15 | 10.30 | 0.00  | -46.15 | -13.00 | -33.15 | H                           |
| 7.52                                                                                                                                                                                                                                                                                                                                                                                                                  | 52.5       | -47.30     | 2.50 | 10.30 | 0.00  | -39.50 | -13.00 | -26.50 | H                           |
| 9.40                                                                                                                                                                                                                                                                                                                                                                                                                  | 48.7       | -49.80     | 2.84 | 10.10 | 0.00  | -42.54 | -13.00 | -29.54 | H                           |
| 11.28                                                                                                                                                                                                                                                                                                                                                                                                                 | 47.5       | -50.50     | 3.10 | 10.10 | 0.00  | -43.50 | -13.00 | -30.50 | H, NF                       |
| <b>High Channel</b>                                                                                                                                                                                                                                                                                                                                                                                                   |            |            |      |       |       |        |        |        |                             |
| 3.82                                                                                                                                                                                                                                                                                                                                                                                                                  | 62.7       | -40.00     | 1.66 | 8.90  | 0.00  | -32.76 | -13.00 | -19.76 | V, X, 2nd Har               |
| 5.73                                                                                                                                                                                                                                                                                                                                                                                                                  | 52.3       | -53.20     | 2.15 | 10.30 | 0.00  | -45.05 | -13.00 | -32.05 | V                           |
| 7.64                                                                                                                                                                                                                                                                                                                                                                                                                  | 56.0       | -46.30     | 2.50 | 10.30 | 0.00  | -38.50 | -13.00 | -25.50 | V                           |
| 9.55                                                                                                                                                                                                                                                                                                                                                                                                                  | 49.5       | -50.30     | 2.84 | 10.10 | 0.00  | -43.04 | -13.00 | -30.04 | V                           |
| 11.46                                                                                                                                                                                                                                                                                                                                                                                                                 | 48.6       | -48.90     | 3.10 | 10.10 | 0.00  | -41.90 | -13.00 | -28.90 | V, Noise Floor              |
| 3.82                                                                                                                                                                                                                                                                                                                                                                                                                  | 54.5       | -50.70     | 1.66 | 8.90  | 0.00  | -43.46 | -13.00 | -30.46 | H, X, 2nd, Har              |
| 5.73                                                                                                                                                                                                                                                                                                                                                                                                                  | 50.2       | -54.10     | 2.15 | 10.30 | 0.00  | -45.95 | -13.00 | -32.95 | H                           |
| 7.64                                                                                                                                                                                                                                                                                                                                                                                                                  | 55.1       | -45.10     | 2.50 | 10.30 | 0.00  | -37.30 | -13.00 | -24.30 | H                           |
| 9.55                                                                                                                                                                                                                                                                                                                                                                                                                  | 48.5       | -49.40     | 2.84 | 10.10 | 0.00  | -42.14 | -13.00 | -29.14 | H                           |
| 11.46                                                                                                                                                                                                                                                                                                                                                                                                                 | 47.0       | -49.00     | 3.10 | 10.10 | 0.00  | -42.00 | -13.00 | -29.00 | H, NF                       |
| Note: Completed scan from 30MHz to 20 GHz.                                                                                                                                                                                                                                                                                                                                                                            |            |            |      |       |       |        |        |        |                             |
| <b>EIRP</b> = SG reading - CL + Gain (dBi)                                                                                                                                                                                                                                                                                                                                                                            |            |            |      |       |       |        |        |        |                             |
| <b>Margin</b> = EIRP - Limit                                                                                                                                                                                                                                                                                                                                                                                          |            |            |      |       |       |        |        |        |                             |
| <b>SA:</b> Spectrum Analyzer, HP 8593EM, S/N: 3710A00205 <b>CL:</b> cable loss (5ft), FLEXCO<br><b>SG:</b> Signal Generator, HP 83732B, S/N: US34490599 <b>Pre-Amp:</b> Miteq NSP2600 -44, S/N: 646456<br><b>TX Antenna:</b> Dipole, Compliance Design, Roberts, S/N: 1: <b>RX Antenna:</b> Bicon, Eston 94455-1, S/N: 1214<br>Horn, EMCO 3115, S/N: 6717      LP, EMCO 3146, S/N: 3163<br>Horn, EMCO 3115, S/N: 6739 |            |            |      |       |       |        |        |        |                             |

## 6.5. FREQUENCY STABILITY

### TEST SETUP

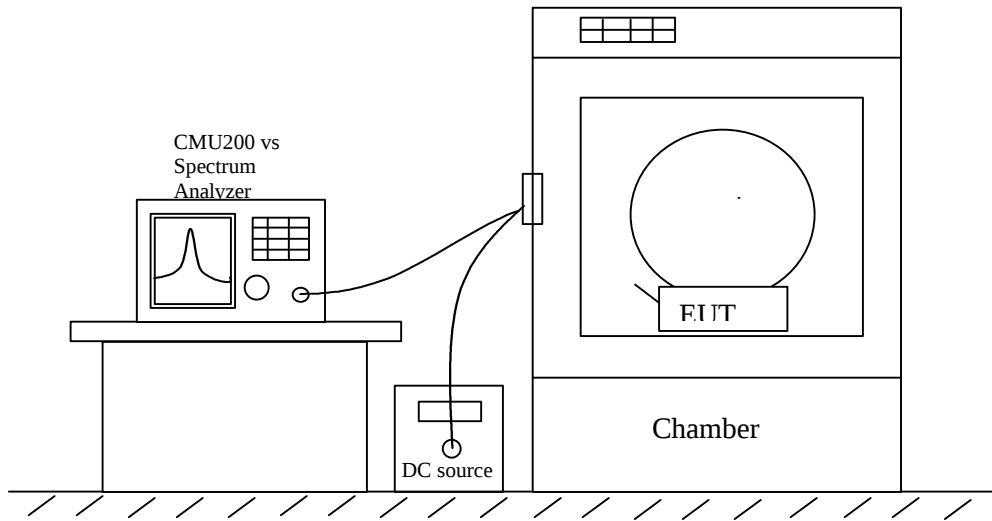


Fig. 3: Frequency Stability Setup

## **TEST PROCEDURE**

### **Frequency stability versus environmental temperature**

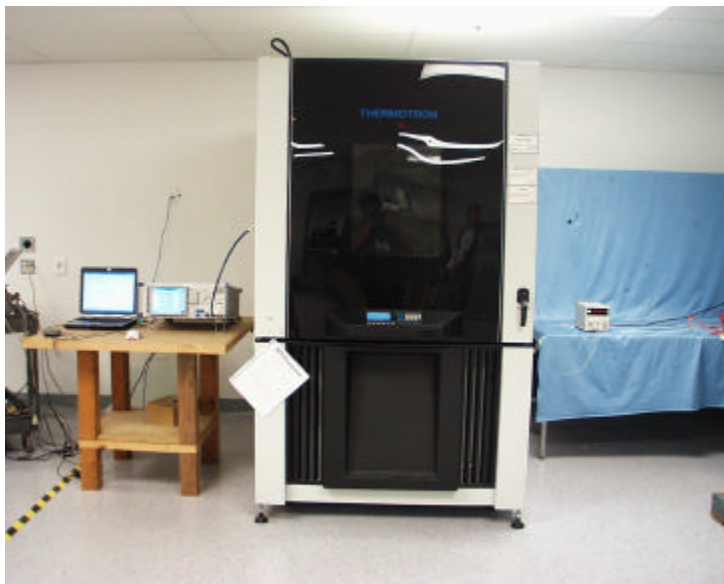
- 1). Setup the configuration per figure 6 for frequencies measurement inside the environmental chamber. Set the temperature of the chamber to 25°C. Set SA Resolution Bandwidth low enough to obtain the desired frequency resolution and measure the EUT 25°C operating frequency as reference frequency.
- 2). Turn EUT off and set Chamber temperature to -30°C.
- 3). Allow sufficient time (approximately 20 to 30 minus after chamber reach the assigned temperature) for EUT to stabilize. Turn on EUT and measure the EUT operating frequency. Turn off EUT after the measurement.
- 4). Repeat step 3 with a 10°C increased per stage until the highest temperature of +50°C reached, record all measured frequencies on each temperature step.

### **Frequency stability Ac Voltage**

- 1). Setup the configuration per figure 6 and set chamber temperature to 25°C. Use a variable DC power supply to power the EUT and set DC output voltage to EUT nominal input DC voltage. Set SA Resolution Bandwidth low enough to obtain the desired frequency resolution and measure the EUT 25°C operating frequency as reference frequency.
- 2). Slowly reduce the EUT input voltage to specified extreme voltage variation and record the maximum frequency change.

## **RESULT**

No non-compliance noted.



| Reference Frequency: GSM Mid Channel 1880.00000MHz @ 25°C<br>Limit: to stay $\pm 2.5$ ppm = 4700.000 Hz |                                 |                                               |             |             |
|---------------------------------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------|-------------|-------------|
| Power Supply<br>(Vdc)                                                                                   | Environment<br>Temperature (°C) | Frequency Deviation Measured with Time Elapse |             |             |
|                                                                                                         |                                 | (MHz)                                         | Delta (ppm) | Limit (ppm) |
| 3.60                                                                                                    | 60                              | 1879.999722                                   | 0.116       | $\pm 2.5$   |
| 3.60                                                                                                    | 50                              | 1879.999861                                   | 0.042       | $\pm 2.5$   |
| 3.60                                                                                                    | 40                              | 1879.999851                                   | 0.047       | $\pm 2.5$   |
| 3.60                                                                                                    | 30                              | 1879.999876                                   | 0.034       | $\pm 2.5$   |
| <b>3.60</b>                                                                                             | <b>25</b>                       | <b>1879.999940</b>                            | <b>0</b>    |             |
| 3.60                                                                                                    | 20                              | 1879.999867                                   | 0.039       | $\pm 2.5$   |
| 3.60                                                                                                    | 10                              | 1879.999826                                   | 0.061       | $\pm 2.5$   |
| 3.60                                                                                                    | 0                               | 1879.999896                                   | 0.023       | $\pm 2.5$   |
| 3.60                                                                                                    | -10                             | 1879.999875                                   | 0.035       | $\pm 2.5$   |
| 3.60                                                                                                    | -20                             | 1879.999882                                   | 0.031       | $\pm 2.5$   |
| 3.60                                                                                                    | -30                             | 1879.999898                                   | 0.022       | $\pm 2.5$   |
| 3.0 (end point)                                                                                         | 25                              | 1879.999535                                   | 0.215       | $\pm 2.5$   |
| 4.2                                                                                                     | 25                              | 1879.999932                                   | 0.004       | $\pm 2.5$   |

## 7. EUT SETUP PHOTOS



**Front (Closed Cover)**



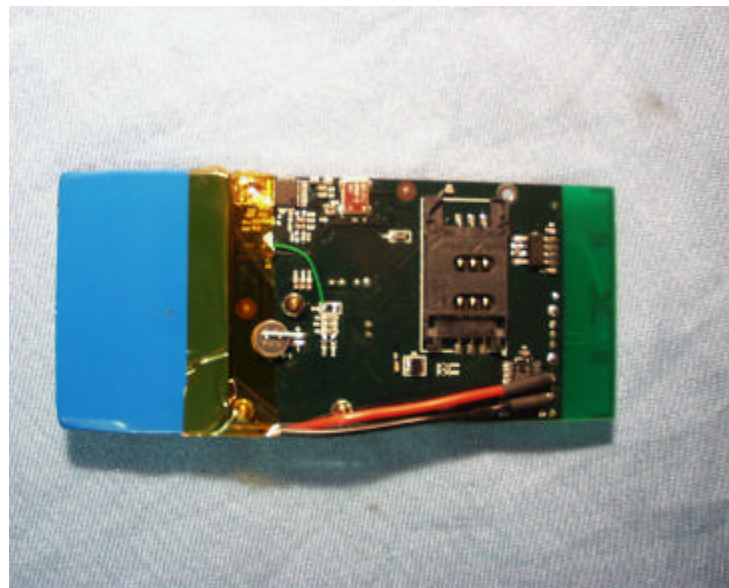
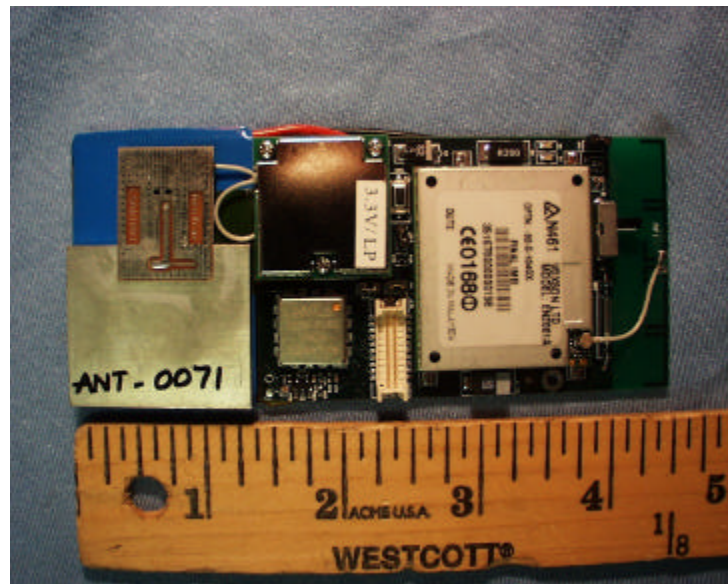
**Back (Closed Cover)**

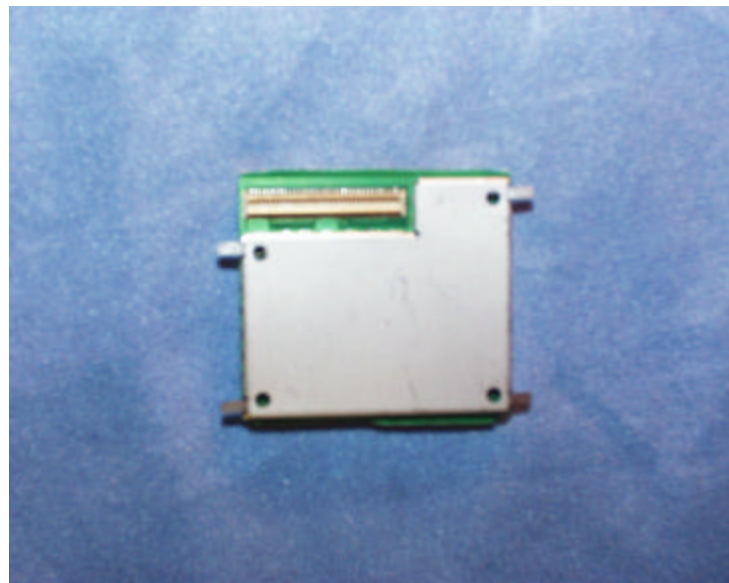
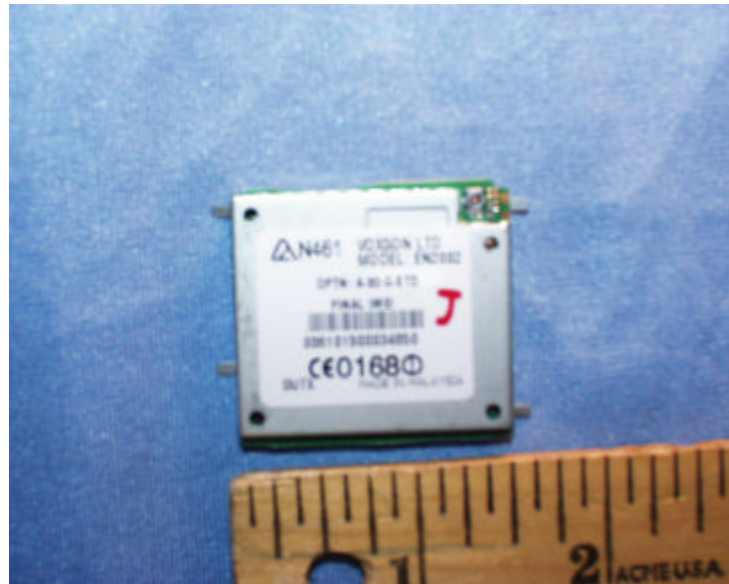


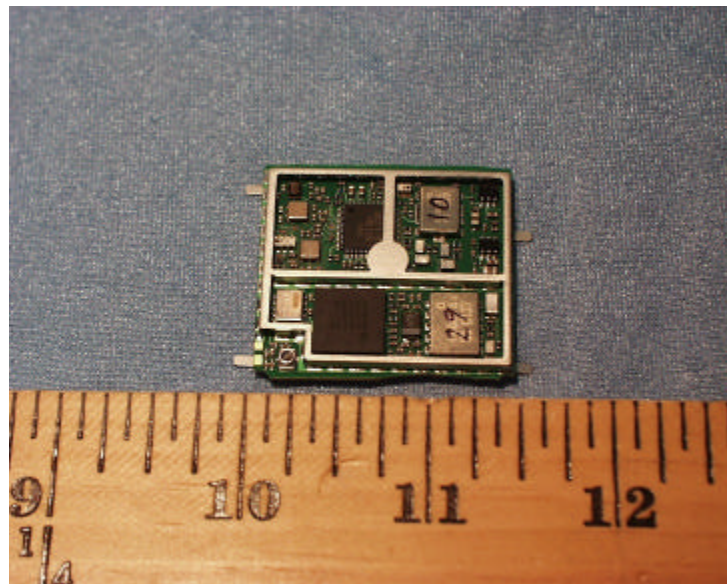
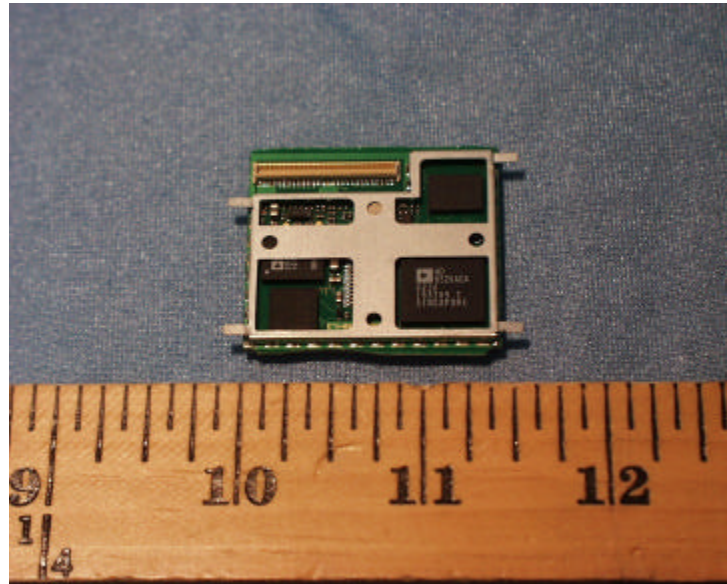
**Front (Open)**



**Back (Open)**







**END OF REPORT**