



# FCC/IC Test Report

**FOR:**

**Manufacturer: 3SI Security Systems**

**Model Name: ATM Tracker**

**Product Description: Asset Tracking and Alert Device**

**FCC ID: Q6KGT86000A**

**IC ID: 5043A-GT86000B**

**47 CFR Part 95**

**RSS-210 Issue 8**

**TEST REPORT #: EMC\_3SISE-033-13001\_GT86000\_FCC95**

**DATE: 2013-10-23**



**FCC:  
A2LA Accredited**

**IC recognized #  
3462B-1**

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**1 Assessment**

The following device was tested against the applicable criteria specified in FCC rules Parts 95 of Title 47 of the Code of Federal Regulations and Industry Canada Standards RSS 210 Issue 8 and no deviations were ascertained during the course of the tests performed.

Company	Description	Model #
3SI Security Systems	Asset Tracking and Alert Device	GT86000

This report is reviewed by:

Tunji Yusuf  
(Test Lab Manager)

2013-10-23 Compliance

Date	Section	Name	Signature
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Responsible for the Report:

Danh Le  
(EMC Engineer)

2013-10-23 Compliance

Date	Section	Name	Signature
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The test results of this test report relate exclusively to the test item specified in Section3.

CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

## 2 Administrative Data

### 2.1 Identification of the Testing Laboratory Issuing the Test Report

<b>Company Name:</b>	CETECOM Inc.
<b>Department:</b>	Compliance
<b>Address:</b>	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
<b>Telephone:</b>	+1 (408) 586 6200
<b>Fax:</b>	+1 (408) 586 6299
<b>Test Lab Manager:</b>	Tunji Yusuf
<b>Responsible Project Leader:</b>	Danh Le

### 2.2 Identification of the Client

<b>Applicant's Name:</b>	3SI Security Systems
<b>Street Address:</b>	486 Thomas Jones Way
<b>City/Zip Code</b>	Exton, PA 19341
<b>Country</b>	USA
<b>Contact Person:</b>	Waldemar Sierocinski
<b>Phone No.</b>	954-214-5398
<b>e-mail:</b>	waldemar_sierocinski@3sisecurity.com

### 2.3 Identification of the Manufacturer

<b>Manufacturer's Name:</b>	Same as Client
<b>Manufacturers Address:</b>	
<b>City/Zip Code:</b>	
<b>Country:</b>	

### 2.4 Environmental conditions during Test:

The following environmental conditions were maintained during the course of testing:

Ambient Temperature: 22 - 24°C

Relative humidity: 32%

### 2.5 Dates of Testing:

Sept 5, 2013 - Sept 16, 2013.

### 3 Equipment under Test (EUT)

#### 3.1 Specification of the Equipment under Test

<b>Marketing Name:</b>	ATM Tracker
<b>Model No:</b>	GT86000
<b>Product Type:</b>	Asset Tracking and Alert Device
<b>FCC-ID:</b>	Q6KGT86000A
<b>IC-ID :</b>	5043A-GT86000B
<b>Frequency range of test:</b>	216.475 MHz
<b>Type(s) of Modulation:</b>	None (CW), Pulsed carrier signal with no modulation, 20% duty cycle (200ms/s)
<b>Number of channels:</b>	1
<b>Antenna Info:</b>	Magnetic Loop antenna Gain: -41 dBd $\pm$ 3 dB (manufacturer declared value)
<b>Other radios in the device:</b>	GSM/GPRS 850/900/1800/1900 MHz GPS Receiver: 1575.42 MHz
<b>Rated Operating Voltage Range(DC):</b>	Internal Battery Operated 3.3V (Low) / 3.7V (Nominal) / 4.2V (Max)
<b>Rated Operating Temperature Range:</b>	<b>GT86000:</b> 0°C to +60°C
<b>Test Sample status:</b>	Production

### 3.2 Identification of the Equipment under Test (EUT)

EUT #	IMEI:	HW Version	SW Version	Model	Notes
1	352964051431196DA	1.1	10.08R10085	GT8600	Radiated Sample

### 3.3 Testing notes

1. Full testing was performed on base model **GT86000**.
2. Test sample has integral antennas. All test cases were performed using radiated test method.

#### **4 Subject of Investigation**

The objective of the measurements done by CETECOM, Inc. was to measure the performance of the EUT as specified by requirements listed in the following test standards: FCC rules Part 95 of Title 47 of the Code of Federal Regulations and Industry Canada Standards RSS 210 Issue 8.

- 47 CFR 2: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communication Commission: Frequency allocations and radio treaty matters; general rules and regulations.
- 47 CFR 95: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communication Commission: Personal Radio Services.
- RSS 210 - Issue 8: Spectrum Management and Telecommunications – Radio Standards Specification; License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.

This report is to support a request for a Class 2 Permissive Change to add a part 95 frequency to an existing FCC approval under the FCC ID: Q6KGT86000A and to support an application for a new IC approval under IC ID: 5043A-GT86000B including that same frequency;



## 5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Pass	Fail	NA	NP	Models Tested	Result
FCC §95.639 (e) RSS-210 A4.3	RF Output Power	Nominal	■	□	□	□	GT86000	Complies
FCC §95.629 (c) (2) RSS-210 A4.3	Frequency Tolerance	Nominal & Extreme	■	□	□	□	GT86000	Complies
§95.633(d) (3) RSS Gen Sect. 4.6	Occupied Bandwidth	Nominal	■	□	□	□	GT86000	Complies
§95.635 (c) (2) (i) RSS210 A4.3 Mask D (a)	Transmit Spectrum Mask	Nominal	■	□	□	□	GT86000	Complies
§95.635 (c) (2) (ii) RSS210 A4.3 Mask D (b)	Radiated Spurious Emissions	Nominal	■	□	□	□	GT86000	Complies
§95.635 (c) (2) RSS210 A4.3 Mask D	Conducted Spurious Emissions	Nominal	□	□	□	■	GT86000	NA

Note: NA = Not Applicable; NP = Not Performed

## **6 Radiated Peak Output Power**

### **6.1 References**

FCC: 2.1046, 95.639(e)

RSS 210: A4.3

### **6.2 Limits**

FCC: The maximum transmitter output power authorized for LPRS stations is 100 mW (20dBm).

RSS 210: The peak output power shall not exceed 100 mW (20 dBm) or 160 mW (22 dBm) EIRP.

### **6.3 Test Conditions**

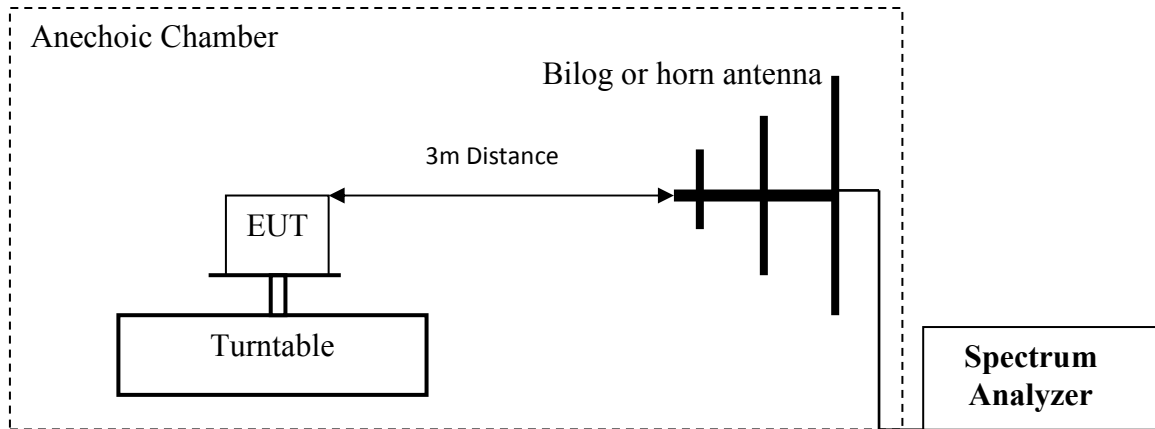
Tnom: 24°C

Vnom: 3.7 V dc

## 6.4 Radiated Measurement Procedure

Ref: ANSI/TIA-603-C-2004 & RSS-Gen Section 4.8

Effective Radiated Power (ERP) or Effective Isotropic Radiated Power (EIRP)



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a vertical orientation.
2. Set the EUT in continuous transmission mode with its maximum power @ 98% - 100% duty cycle.
3. Set the spectrum analyzer to the channel frequency of interest.
4. Maximize the emission amplitude by rotating the turntable 0 - 360°, adjusting the measuring antenna height from 1 – 4 m & changing antenna polarity.
5. Repeat steps 4 with all antennas different polarity and determine the maximized polarity for measurement. Measure and record the peak level of field strength (**LVL**) in dBuV.
6. Adjust correction factors to the measured field strength (**LVL**) and using the field strength approach calculation to convert (**LVL**) from dBuV to transmitter output power (EIRP) in Watts using the following equations:  
Correction factors (**CF**) in dB = Antenna factor (dB) + Cable loss (dB).  
**LVLc** (dBuV) = **LVL** (dBdBuV) + **Correction Factors** (dB)  
**EIRP** (W) = (**LVLc** (V/m) x D)<sup>2</sup> / (30 x G)
8. Convert Watt to dBm (logarithmic), using the following formula:  
**EIRP** (dBm) = 10 log (W x 1000)  
**ERP** (dBm) = **EIRP** (dBm) – 2.15 (dB)
9. Manually peak search, record readings and save data.  
**Note:** Steps 7 above are performed prior to testing and **CF** was entered in the test software. Steps 3, 4, 5, 6 and 8 above are performed and controlled by test software.)

## 6.5 Measurement Settings

RBW  $\geq$  OBW; VBW  $\geq$  RBW or 3 x RBW

Span= 2 x RBW or wide enough to capture bandwidth of emission being measured

Detector = Peak; Trace = Max Hold

Sweep time: Auto.

## 6.6 Measurement Uncertainty

+/- 3 dB

## 6.7 Sample Calculations for Radiated Measurements

When the EUT power is measured by using radiated test method, the EIRP can be directly determined using the field strength (linear) approach calculation by applying the following equations:

$$(1) \quad FS \text{ (dBuV/m)} = \text{Measured FS (dBuV/m)} + CF \text{ (dB)}$$

Where

- CF = Ant. Factor + Cable Loss – Ext. Amp Gain (if required)
- FS = electric field strength in dBuV/m

Then convert from dBuV to V/m by using the equation (2):

$$(2) \quad FS \text{ (V/m)} = 10^{\frac{(\text{dBuV/m}) - 120}{20}}$$

The EIRP (dBm) is calculated by using equation (3):

$$(3) \quad EIRP \text{ (dBm)} = 10 \log \left( \frac{(FS \times D)^2}{30} \times 1000 \right)$$

- FS = electric field strength in V/m
- D = measurement distance in meters (m)
- 30 = basic free space propagation path loss

Frequency (MHz)	Measured Field Strength (FS) (dBuV/m)	Correction Factors (CF) (dB)	Calculated FS FS + CF (dBuV/m)	Calculated FS @ 3m (V/M)	Calculated EIRP (dBm)
1000	40	12	52	0.0004	-43.23

## 6.8 Test Results

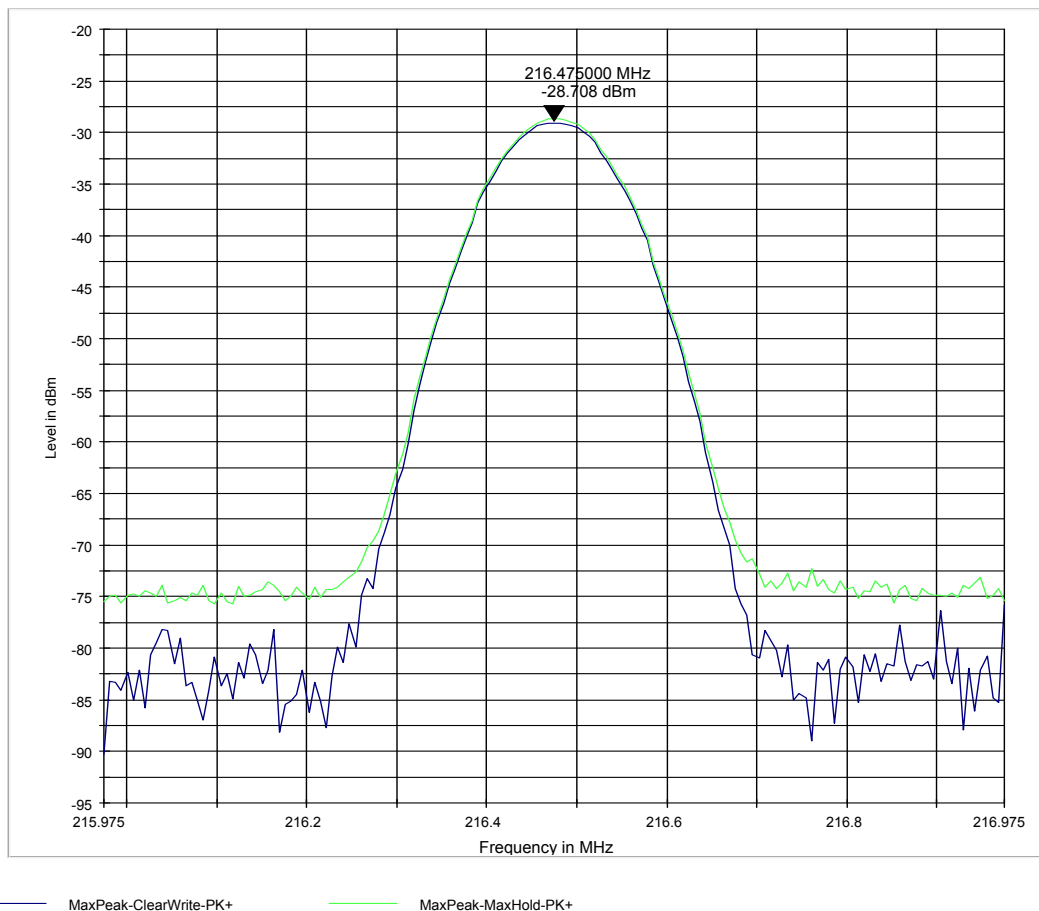
Model: GT86000					
Frequency (MHz)	Antenna Polarity (H/V)	Antenna Height (m)	Angle (°)	ERP (dBm)	Conducted Output Power
					ERP - Ant.G (dBd) (dBm)
216.475	H	1	27	-28.71	12.29

## 6.9 Measurement Verdict

Pass.

## 6.10 Measurement Plot

### Radiated Peak Power – GT86000



## 7 Occupied Bandwidth

### 7.1 References

FCC: 2.1049, 95.633 (d) (3)

RSS Gen Issue 3 section 4.6

### 7.2 Limits

According to CFR 47 section 95.633

(d) For transmitters in the LPRS:

(3) The channel bandwidth for extra band frequencies is 50 kHz.

According to RSS-Gen Issue 3 section 4.6.1

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be 99% emission bandwidth, as calculated or measured.

### 7.3 Test Conditions

Tnom: 24°C

Vnom: 3.7 V dc

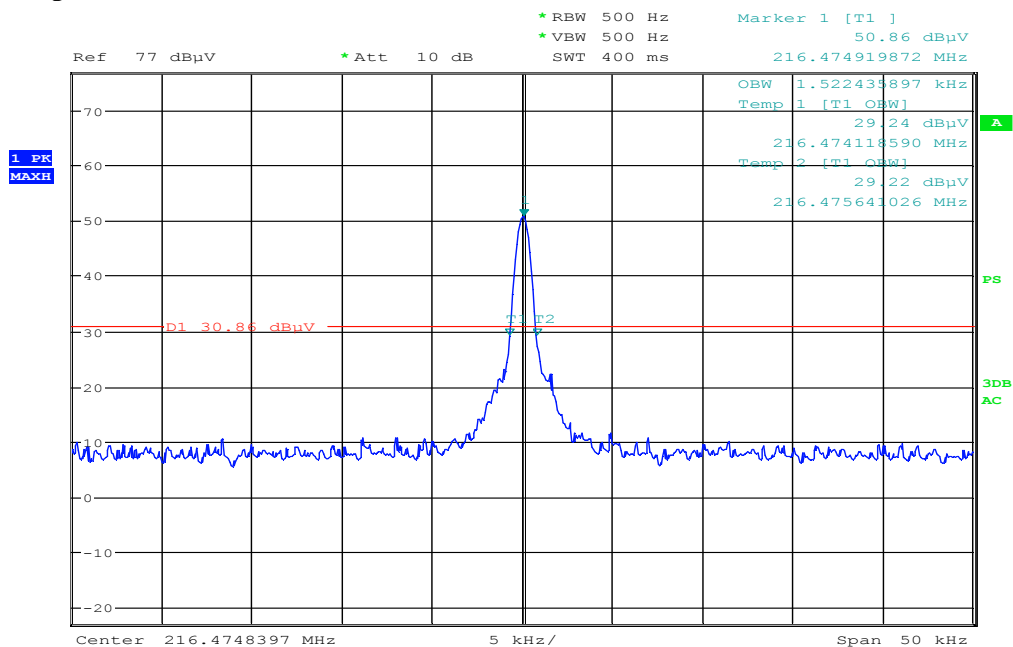
### 7.4 Test Result

Channel	Frequency (MHz)	99% Occupied Bandwidth	20 dB Emission Bandwidth
50	216.475	1.522 kHz	1.522 kHz

### 7.5 Measurement Verdict

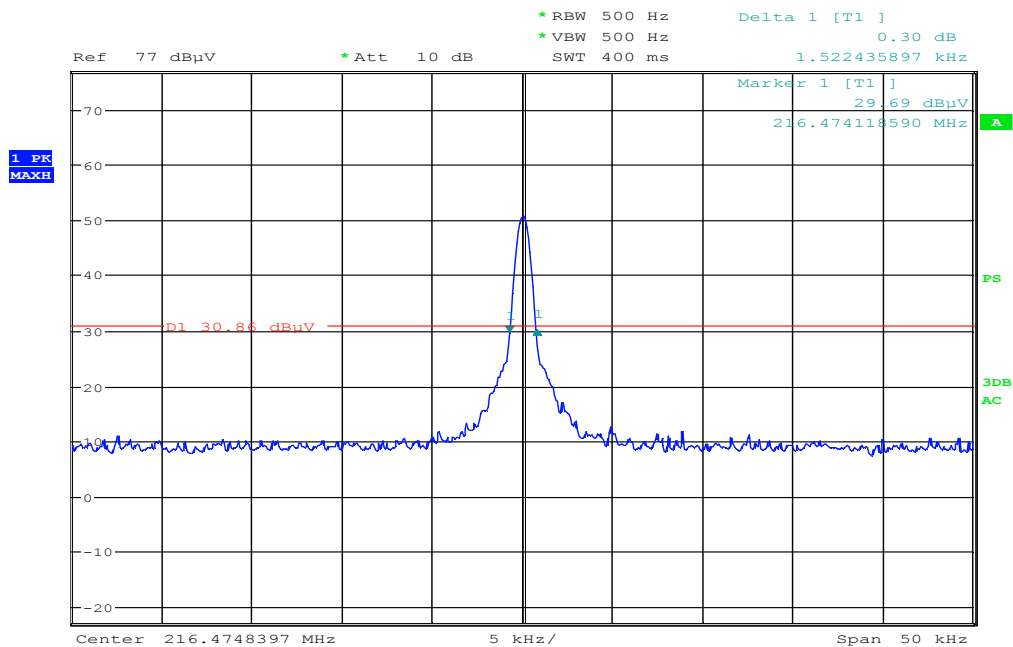
Pass

### 7.5.1 Measurement Plots: 99% Occupied Bandwidth - GT86000



Date: 10.SEP.2013 02:43:24

### 20dB Emission Bandwidth - GT86000



Date: 10.SEP.2013 02:41:26

## **8 Modulation Characteristics**

The transmitter emits a pulsed carrier signal without modulation.



## **9 Transmitter Unwanted Emissions – Radiated**

### **9.1 References**

FCC: 95.635 (c) (2)

RSS 210 A4.3 Mask D

### **9.2 Limits**

According to FCC CFR 47 section 95.635 (c) (2)

Emissions for LPRS transmitters operating on extra band channels (50 kHz) shall be attenuated below the un-modulated carrier in accordance with the followings:

- 1) Emissions more than 25 kHz to 35 kHz from the channel center frequency: at least 30dB; and
- 2) Emissions more than 35 kHz away from the channel center frequency: at least  $43 + 10 \log$  (carrier power in watts) dB.

**FCC: -13 dBm**

According to RSS 210 A4.3

The following unwanted emissions mask shall be measured with the measurement meter in peak mode and a bandwidth of at least 300 Hz. Unwanted emissions shall be attenuated below the peak transmitter output power (P, watts) in accordance with the following mask:

**Mask D**

- i) At least 30dB for emissions 25 kHz to 35 kHz removed from the channel center frequency: and
- ii) At least  $55 + 10 \log$  (carrier power in watts) dB or to the general field strength limits list in RSS-Gen, whichever is less stringent, for emissions more than 35 kHz removed from the channel center frequency.

**IC: -25 dBm**

### **9.3 Measurement Settings**

For emissions measurement 25 kHz to 35 kHz from center frequency:

RBW=500 Hz for measurements

VBW=RBW or 3x RBW

Span= 100 kHz or sufficient to capture the entire frequency range to be investigated

For emissions measurement more than 35 kHz away from the channel center frequency:

RBW=100 kHz for measurements < 1GHz

RBW=1MHz for measurements > 1GHz

VBW=RBW or 3x RBW

Span= Entire range of measuring antenna or in segment

Detector: Peak- Max Hold

Peak- Max Hold

Sweep time: Auto.

### **9.4 Test Conditions**

**Tnom:** 22°C

**Vnom:** 3.7 V dc

**9.5 Radiated test procedure for transmitter unwanted emissions:****Ref: ANSI C63.4:2009 & RSS-Gen Section 4.9****Refer to section 12 for test setup diagrams.**

1. Connect the equipment as shown in the above diagram with the EUT's antenna in a horizontal orientation.
2. The EUT was set to continuous transmission mode with its maximum power @ 100% duty cycle.
3. Set the spectrum analyzer to measure peak hold with the required settings.
4. Rotate the EUT 360°. Raise the measurement antenna up to 4 meters in 0.5 meters increments and rotate the EUT 360° at each height to maximize all emissions. Measure and record all spurious emissions (**LVL**) up to the tenth harmonic of the carrier frequency.
5. Repeat steps 4, 5 and 6 with all antennas vertically polarized and determine the maximized polarity for measurement.
6. Select 6 closest readings or more to the limits for measurements.
7. Determine the level of spurious emissions using the following equation:  

$$\text{LVLc (dBuV)} = \text{Measured LVL (dBuV)} + \text{CF}$$
8. Correction factors in dB (**CF**) = Antenna factor (dB) + Cable loss (dB).
9. Convert the adjusted **LVLc** from dBuV/m to dBm using the following formula:

$$\text{LVLc (dBm)} = 10 \log \left( \frac{(F \times D)^2}{30} \times 1000 \right)$$

10. Manually peak search, record reading in dBm and save data.
11. Measurements are to be performed from 30 MHz to the 6 GHz with the EUT set to the main operating frequency.

(**Note:** Steps 8 above are performed prior to testing and **CF** is entered in test software.  
 Steps 3, 4, 5, 6, 7 and 9 above are performed with test software.)

**Measurement Survey:**

The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3m site. The spectrum is scanned from 30MHz to the 10<sup>th</sup> harmonic of the highest frequency generated by the EUT.

For radiated measurements, all data in this report shows the worst case emissions data between H/V antenna polarizations and for all 3 orthogonal orientations of the EUT.

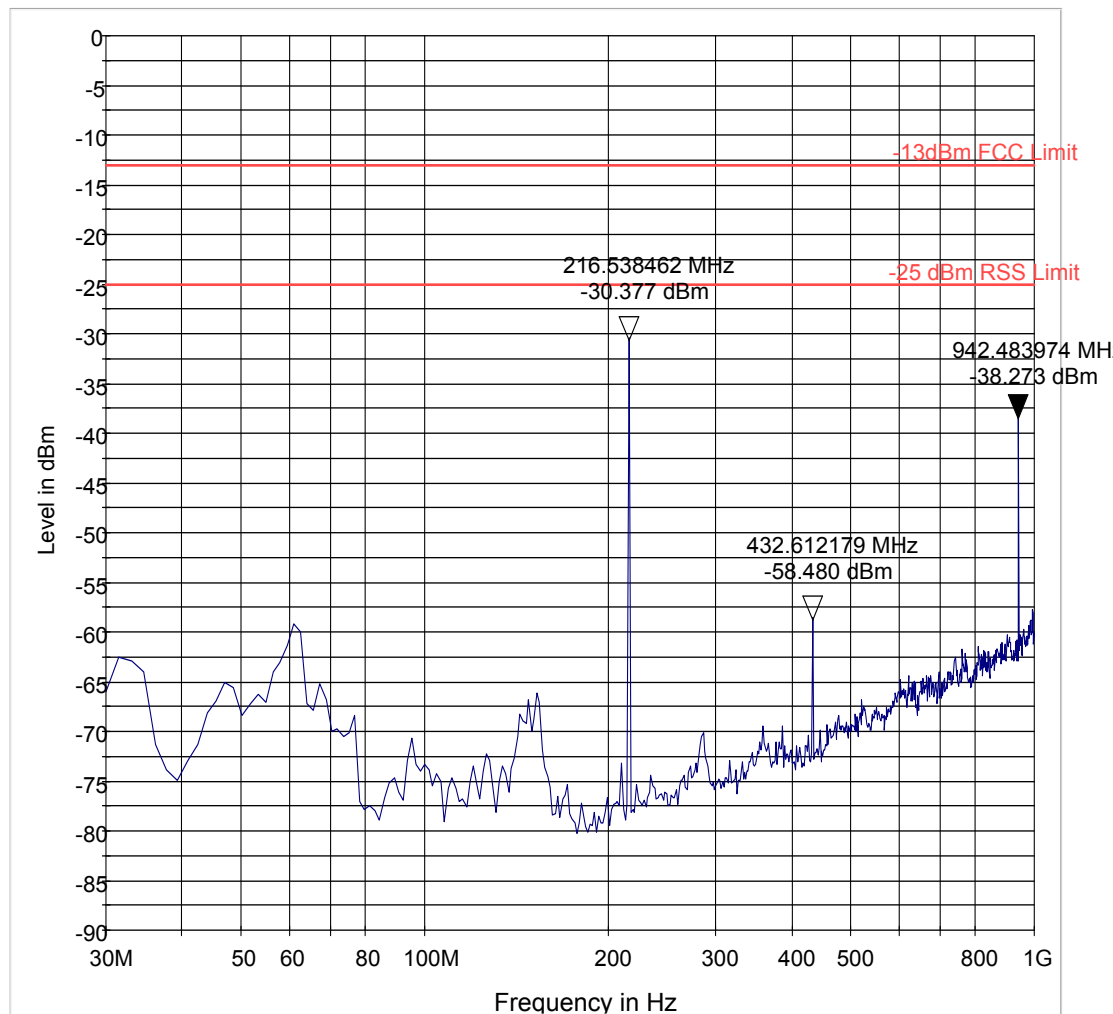
**9.6 Measurement Uncertainty**

+/- 3dB



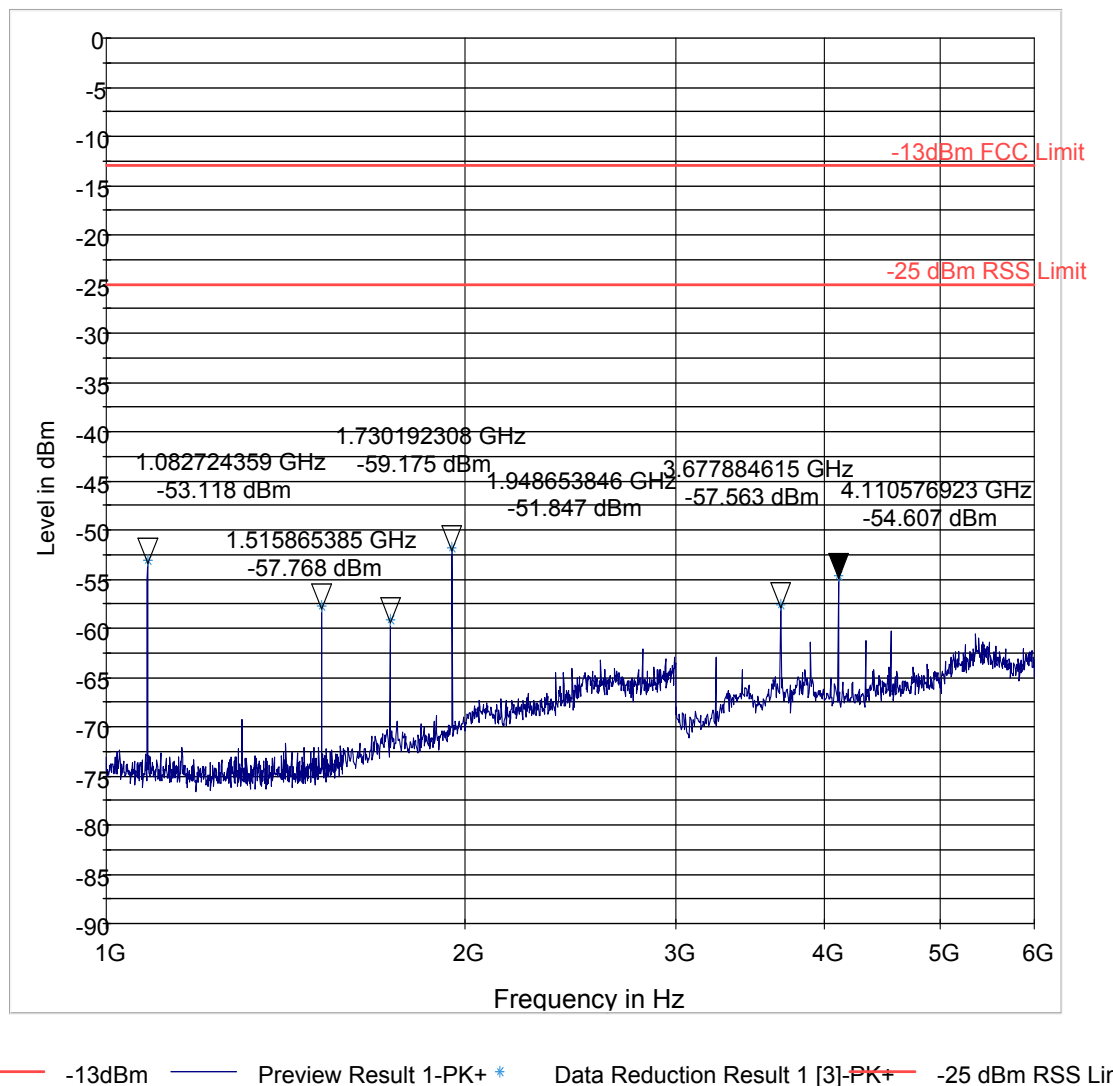
## 9.9 Measurement Plots

### Spurious Emissions: 1GHz – 6GHz – GT86000



— -13dBm — Preview Result 1-PK+ — -25 dBm RSS Limit

## Spurious Emissions: 1GHz – 6GHz – GT86000



### 9.10 Measurement Verdict

Pass.

**10 Frequency Tolerance****10.1 References**

FCC: 2.1055, 95.629 (c) (2)

RSS 210: A6.16

**10.2 Limits**

FCC: +/- 50.0 ppm

RSS: +/- 5.0 ppm

**10.3 Test Conditions****Tnom:** 24°C**Vnom:** 3.7 V dc**10.4 Test Results**

Expected Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)
<b>216.475</b>	216.47502787	27.87	0.13
<b>Vmax 4.2 VDC</b>	216.47492987	-70.13	-0.32
<b>Vmin 3.3 VDC</b>	216.47492788	-72.12	-0.33

Temperature °C	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)
<b>50</b>	216.47483171	-168	-0.78
<b>40</b>	216.47481795	-182	-0.84
<b>30</b>	216.47491186	-88.0	-0.41
<b>20</b>	216.47499199	-8.01	-0.04
<b>10</b>	216.47501603	16.1	0.07
<b>0</b>	216.47504808	48.0	0.22
<b>-10</b>	216.47509615	96.1	0.44
<b>-20</b>	216.47506410	64.1	0.30
<b>-30</b>	216.47507212	72.1	0.33

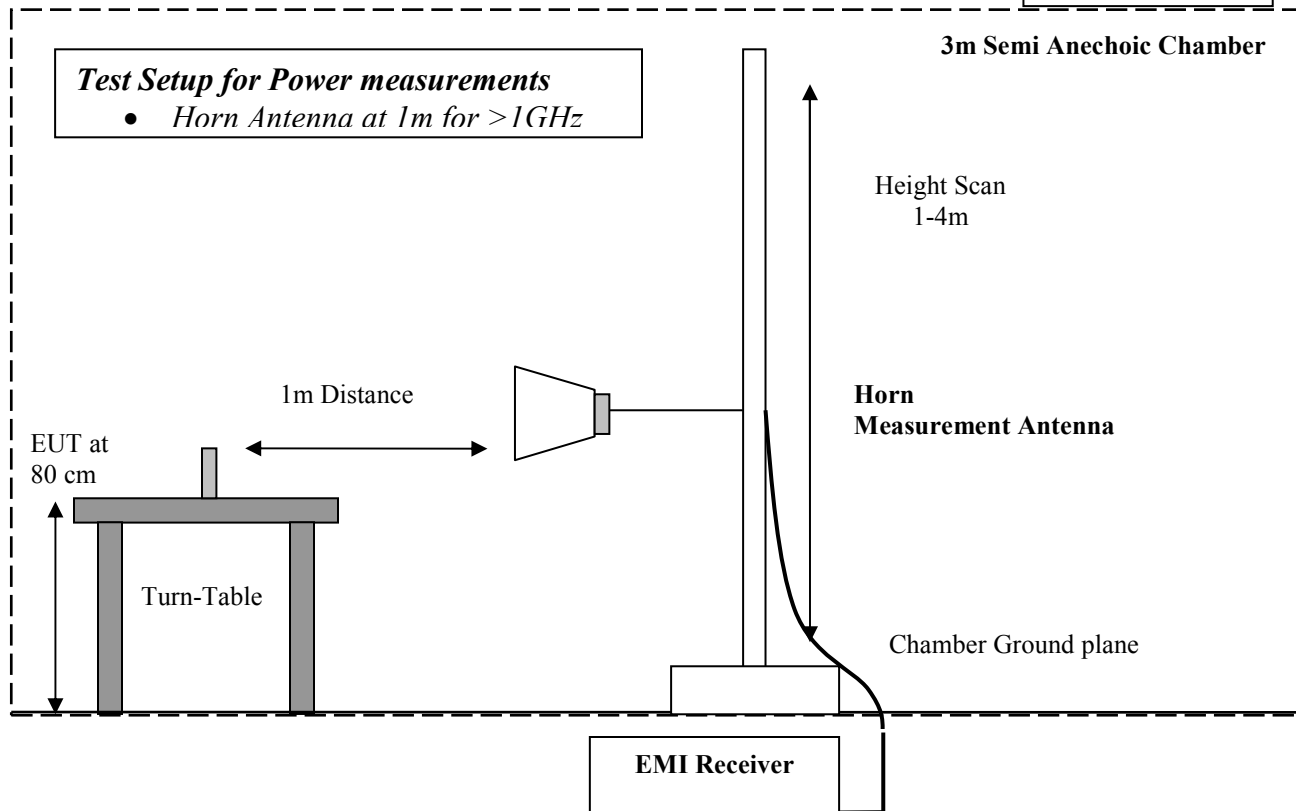
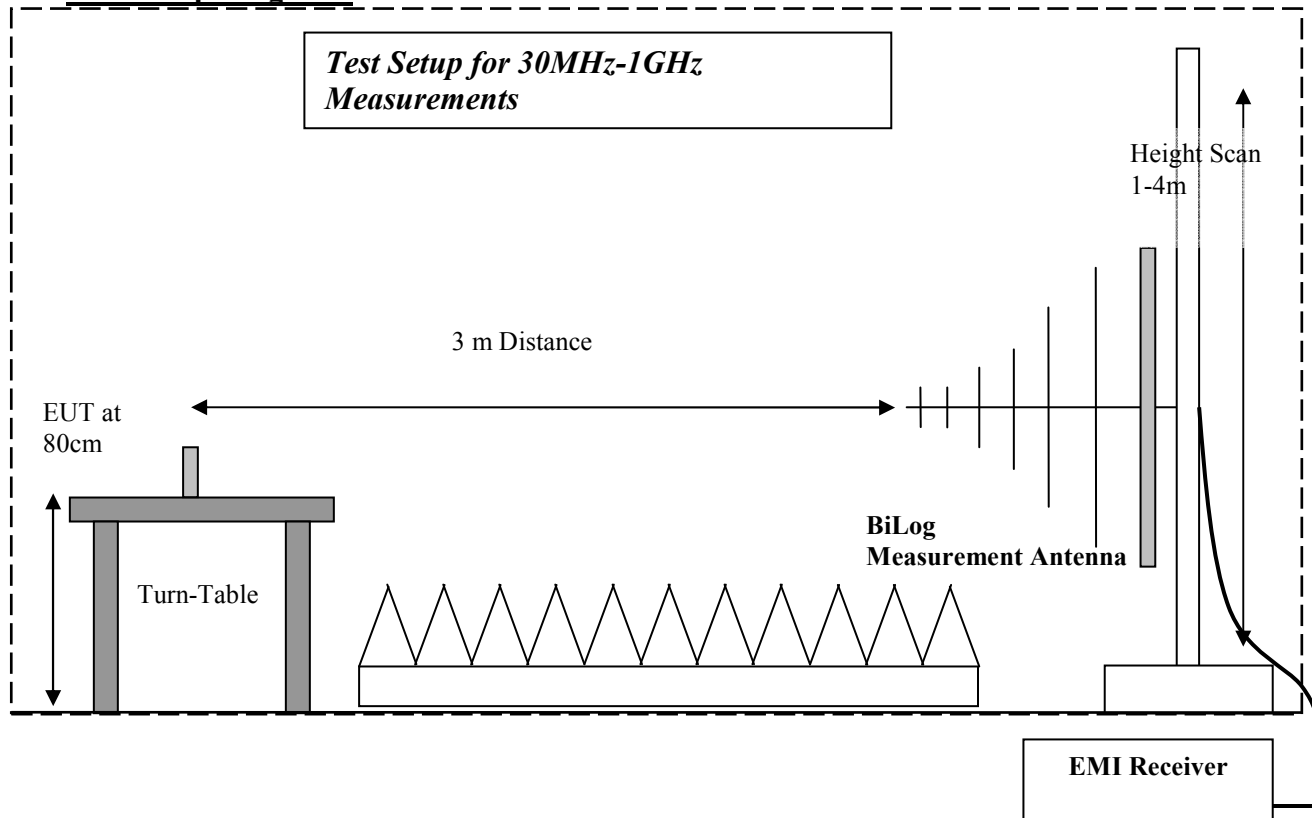
**10.5 Measurement Verdict**

Pass.

**11 Test Equipment**

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
EMI Receiver/Analyzer	ESU 40	Rohde & Schwarz	100251	Aug 2012	2 Years
Loop Antenna	6512	EMCO	00049838	Apr 2012	3 years
Biconilog Antenna	3141	EMCO	0005-1186	Mar 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Mar 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035114	Apr 2012	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
Temp Hum Logger	TM325	Dickson	5285354	Feb 2013	1 Year
Climatic Chamber	Votsch	VT4004	G1115	N/A	N/A

## 12 Test Setup Diagrams





Test Report #: **EMC\_3SISE-033-13001\_GT86000\_FCC95** FCC ID: Q6KGT86000A

Date of Report : 2013-10-23

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### 13 Revision History

Date	Report Name	Changes to report	Report prepared by
2013-10-23	EMC_3SISE-033-13001_GT86000_FCC95	First Version	Danh Le