FCC/IC Test Report

FOR:

Manufacturer: 3SI Security Systems

Model Name: GT83000

Product Description: Asset Tracking and Alert Device

FCC ID: Q6KGT83000A
IC ID: 5043A-GT83000B

47 CFR Part 95
RSS-210 Issue 8

TEST REPORT #: EMC_3SISE-033-13001_GT83000_FCC95
DATE: 2013-10-23

ilac-MRA

A2LA ACCREDITED
TESTING LABORATORY
Certificate #2135.01

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC:
A2LA Accredited

IC recognized #
3462B-1

***CETECOM* Inc.**
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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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	GT83000

This report is reviewed by:

Date	Section	Name	Signature
2013-10-23	Compliance	Tunji Yusuf (Test Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
2013-10-23	Compliance	Danh Le (EMC Engineer)	

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

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

2.2 Identification of the Client

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

2.3 Identification of the Manufacturer

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

2.4 Environmental conditions during Test:

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

Marketing Name:	Cash Tracker
Model No:	Base Model: GT83000 Variant info contain in Section 3.4
Product Type:	Asset Tracking and Alert Device
FCC-ID:	Q6KGT83000A
IC-ID :	5043A-GT83000B
Frequency range of test:	216.475 MHz
Type(s) of Modulation:	None (CW), Pulsed carrier signal with no modulation, 20% duty cycle (200ms/s)
Number of channels:	1
Antenna Info:	Magnetic Loop antenna Gain: -51 dBd ± 3 dB (manufacturer declared value)
Other radios in the device:	GSM/GPRS 850/900/1800/1900 MHz GPS Receiver: 1575.42 MHz
Rated Operating Voltage Range(DC):	Internal Battery Operated 3.3V (Min) / 3.7V (Nominal) / 4.2V (Max)
Rated Operating Temperature Range:	0^{o}C to + 40^{o}C
Test Sample status:	Production

3.2 Identification of the Equipment under Test (EUT)

EUT #	IMEI:	HW Version	SW Version	Model	Notes
1	352964050038778	1.2	9.09.07	GT83000	Radiated Sample

3.3 Testing notes

1. There are 5 variants of the EUT. **GT83000**, **GT83000VP**, **GT83000R2** and **GT83100**.
2. The manufacturer has provided a product equality declaration that model variants **GT83000VP**, **GT83000R2** and **GT83100** incorporate the same VHF portion (Radio, Antenna and associated circuitry) as the base model **GT83000**.
3. Full testing was performed on base model **GT83000**.
4. All samples have 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: Q6KGT83000A and to support an application for a new IC approval under IC ID: 5043A-GT83000B including that same frequency; as well as an IC Family approvals of the additional models GT83000VP, GT83000R2 and GT83100.

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	■	☐	☐	☐	GT83000	Complies
FCC §95.629 (c) (2) RSS-210 A4.3	Frequency Tolerance	Nominal & Extreme	■	☐	☐	☐	GT83000	Complies
§95.633(d) (3) RSS Gen Sect. 4.6	Occupied Bandwidth	Nominal	■	☐	☐	☐	GT83000	Complies
§95.635 (c) (2) (i) RSS210 A4.3 Mask D (a)	Transmit Spectrum Mask	Nominal	■	☐	☐	☐	GT83000	Complies
§95.635 (c) (2) (ii) RSS210 A4.3 Mask D (b)	Radiated Spurious Emissions	Nominal	■	☐	☐	☐	GT83000	Complies
§95.635 (c) (2) RSS210 A4.3 Mask D	Conducted Spurious Emissions	Nominal	☐	☐	☐	■		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

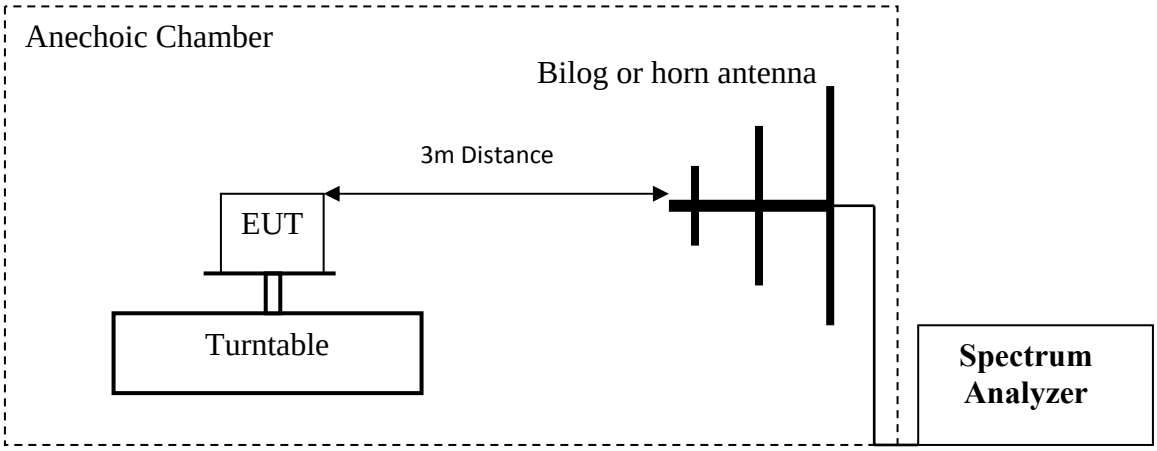
FCC: The maximum transmitter output power authorized for LPRS stations is 100 mW (20dBm).
RSS 210: The peak output power shall not exceed 100 mW (20 dBm) or 160 mW (22 dBm) EIRP.

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 FS from dBuV to transmitter output power (EIRP) in Watts using the following equations:
7. 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)² / (30 x G)
8. Convert Watt to dBm (logarithmic), using the following formula:
   EIRP (dBm) = 10 log (W x 1000)
9. Manually peak search, record readings and save data.
   N**ote:** 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=VBW=1.5 kHz
Span=80 kHz; Detector: Peak- 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) FS (dBuV/m) = Measured FS (dBuV/m) + CF (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) FS (V/m) $= 10^{(\frac{dBuV}{m}-120)/20}$

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

(3) EIRP (dBm) $= 10\,Log\,(\frac{(FS \times D)^2}{30} \times 1000)$

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

Frequency (MHz)	**Measured Field Strength** (FS) (dBµV/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

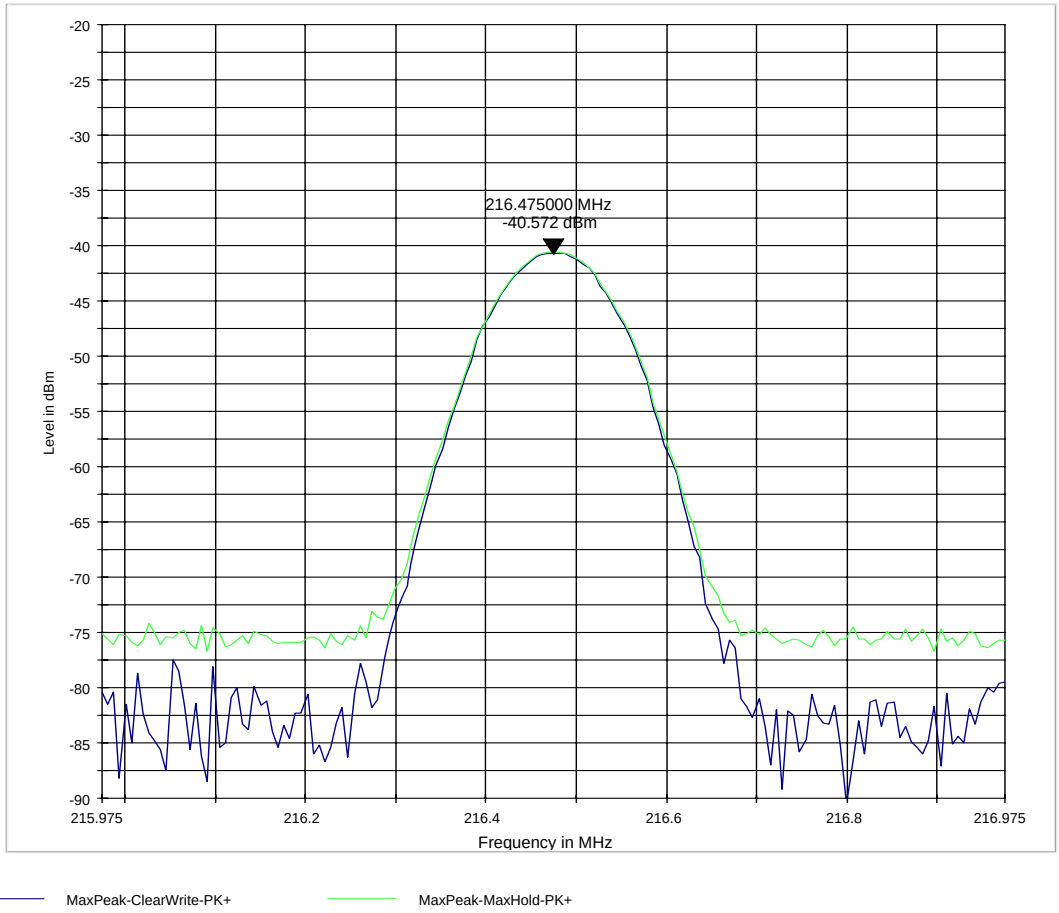
Model: GT83000					
Frequency (MHz)	**Antenna Polarity (H/V)**	**Antenna Height (m)**	**Angle (^{o})**	**ERP (dBm)**	**Conducted Output Power ERP - Ant.G (dBd) (dBm)**
216.475	H	1	27	- 40.57	10.43

6.9 Measurement Verdict

Pass.

6.10 Measurement Plot

Radiated Peak Power – GT83000



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

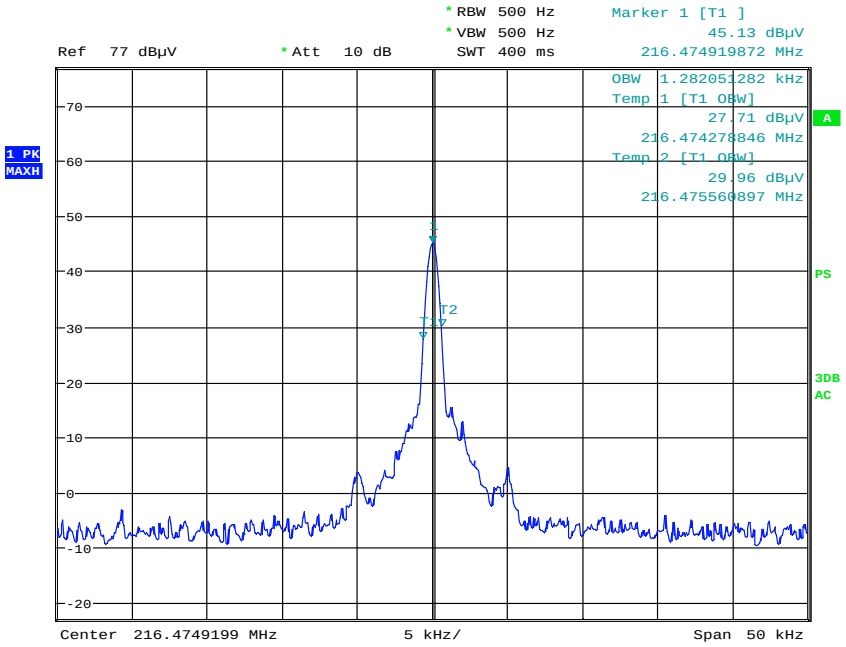
Channel	Frequency (MHz)	99% Occupied Bandwidth	20 dB Emission Bandwidth
50	216.475	1.282 kHz	1.442 kHz

7.5 Measurement Verdict

Pass

7.6 Measurement Plots

99% Occupied Bandwidth - GT83000



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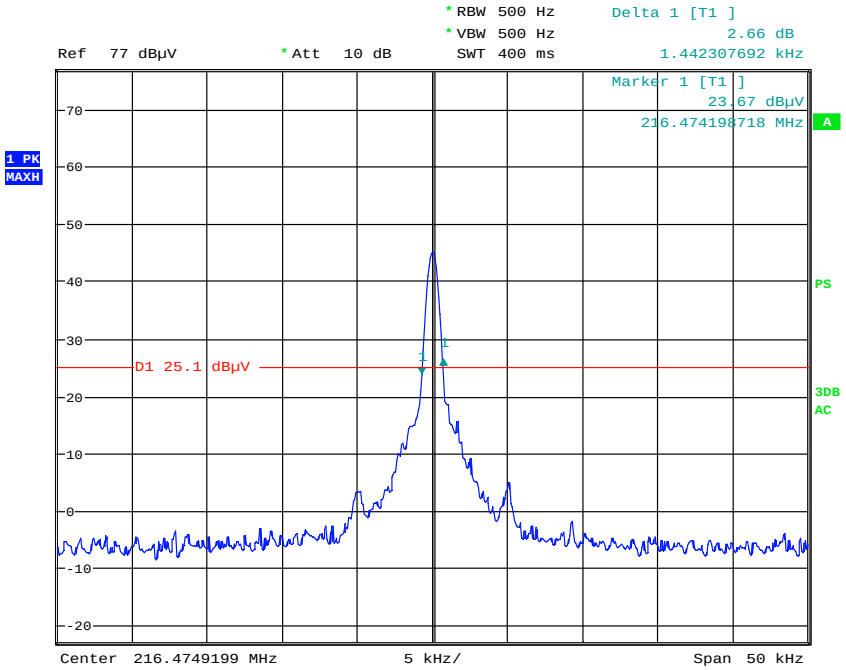
20dB Emission Bandwidth - GT83000



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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:

i) Emissions more than 25 kHz to 35 kHz from the channel center frequency: at least 30dB; and
ii) 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 whole frequency range of interest

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; or quasi-peak (if close to limit) for measurement < 1GHz
Peak- Max Hold; or average (if close to limit) for measurement > 1GHz
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:
   LVLc (dBuV) = Measured **LVL** (dBuV) + **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:

   LVLc (dBm) = $10\,Log\,(\frac{(FS\times D)^2}{30}\times 1000)$

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.

(N**ote:** 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.)

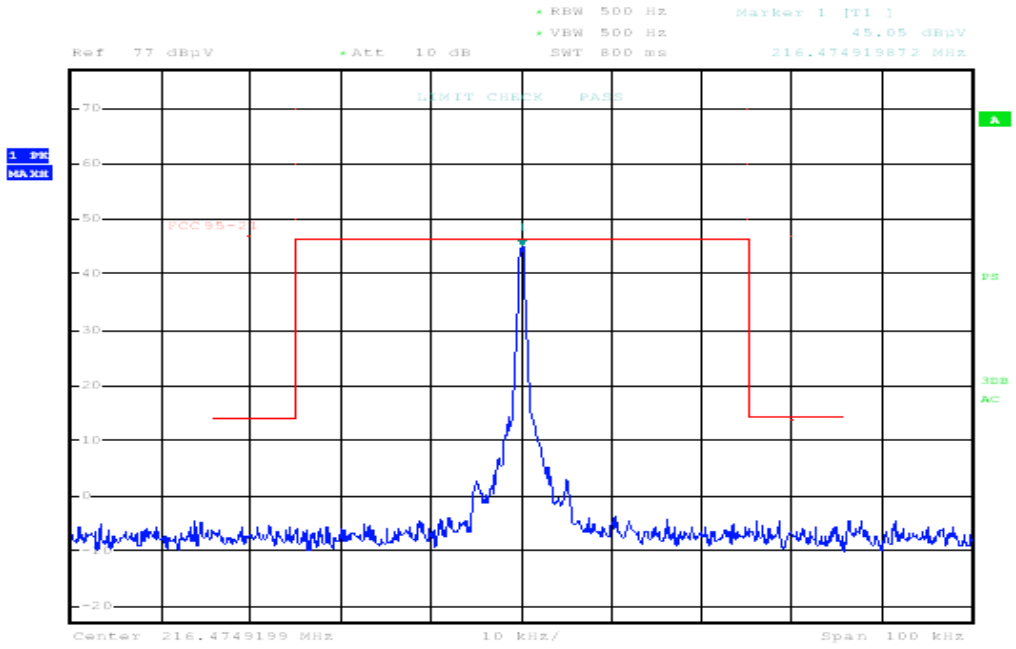
Measurement Survey:
The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3m site. The spectrum is scanned from 30MHz to the 10th harmonic of the highest frequency generated by the EUT.

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

9.7 Measurement Plot

30 dB down Emission Mask - GT83000

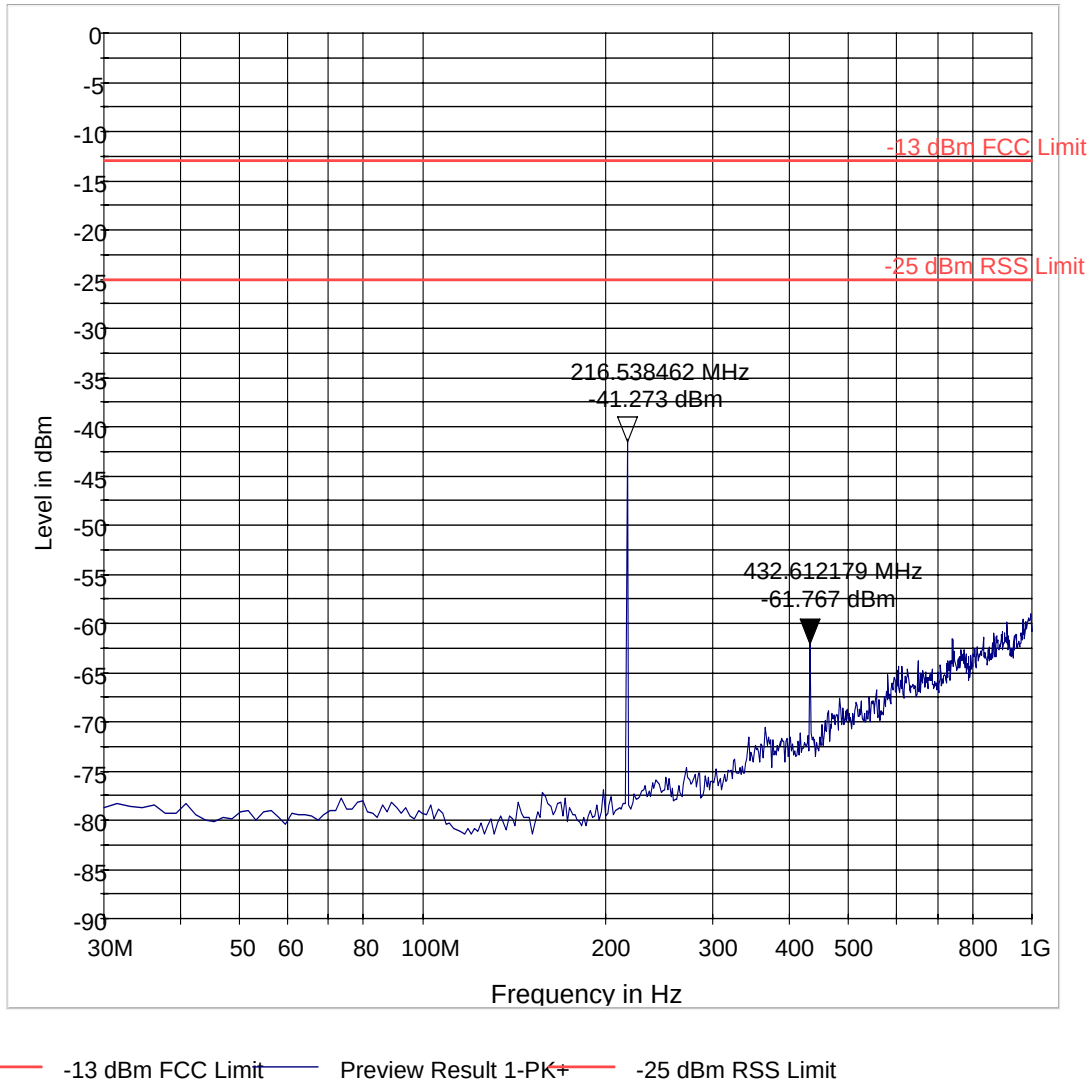


9.8 Measurement Verdict

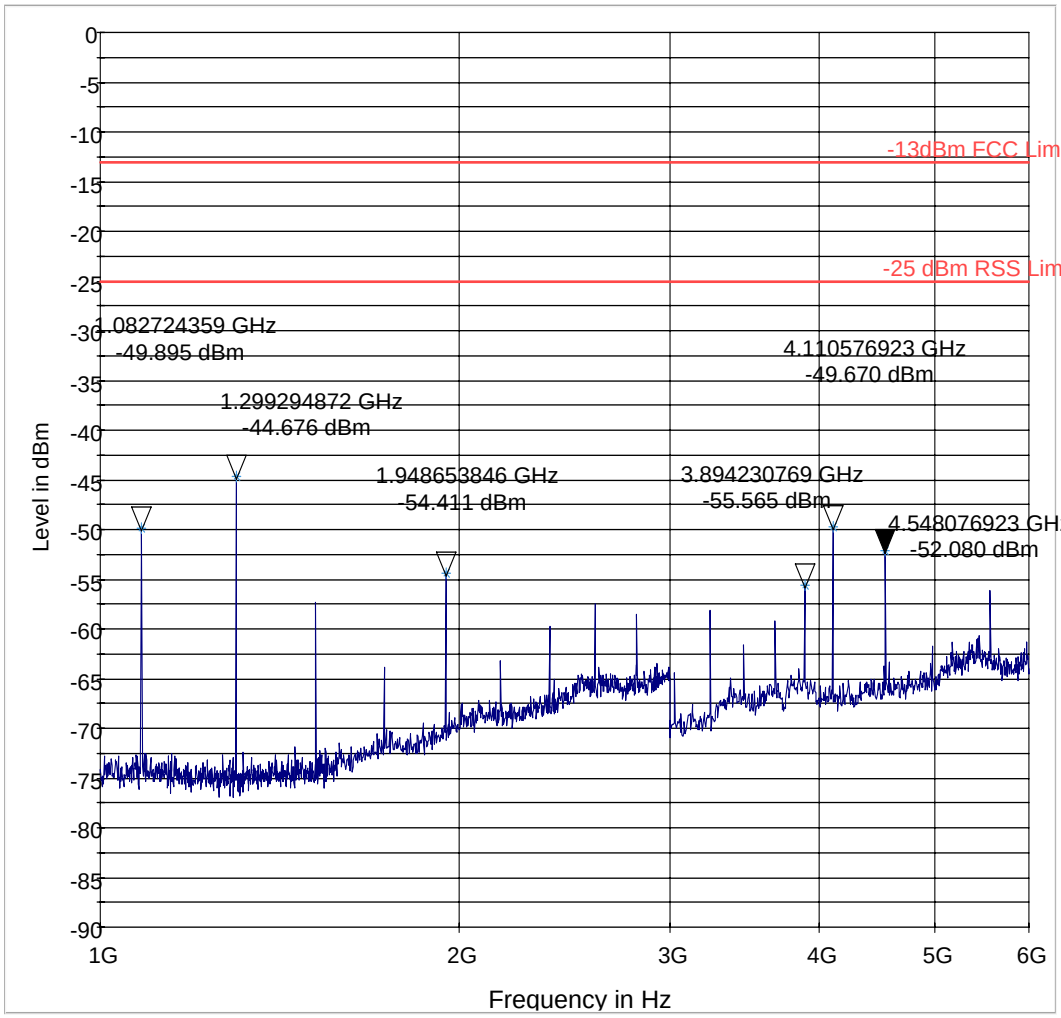
Pass.

9.9 Measurement Plots

Spurious Emissions: 30MHz – 1000MHz – GT83000



Spurious Emissions 1GHz – 6GHz – GT83000



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 @ Normal Temp (MHz)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)
216.475	216.47491987	-80.0	-0.37
Vnom (+10%) 4.1 VDC	216.47491987	-80.1	-037
Vnom (-10%) 3.3 VDC	216.47492786	-72.14	-0.33

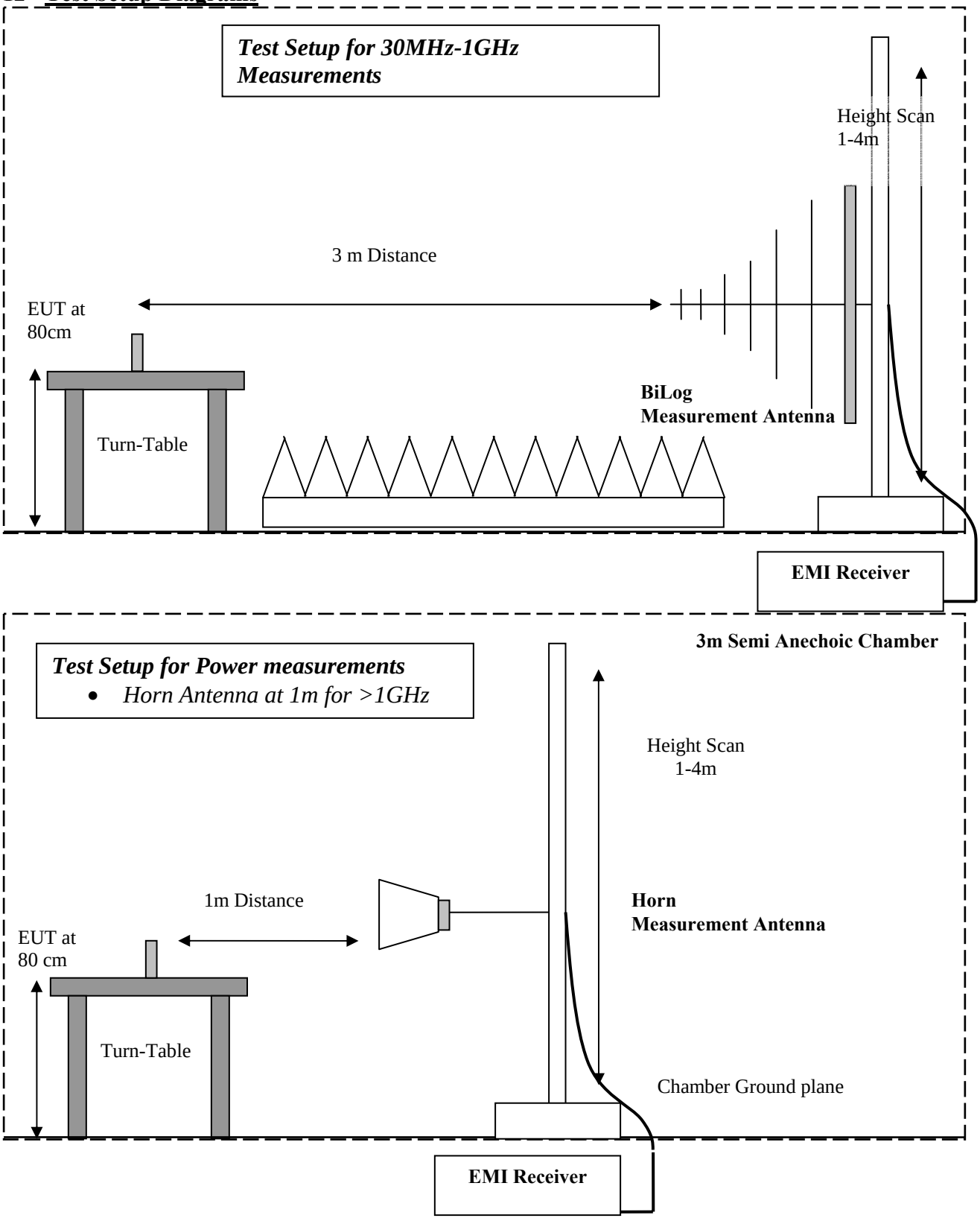
Temperature ºC	Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)
50	216.47516026	160	0.74
40	216.47508013	80.0	0.37
30	216.47491987	-80.0	-0.37
20	216.47491987	-80.0	-0.37
10	216.47487981	-120	-0.56
0	216.47481570	-184	-085
-10	216.47479968	-200	-0.92
-20	216.47478365	-216	-1.00
-30	216.47479167	-208	-0.96

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 2012	1 Year
Climatic Chamber	Votsch	VT4004	G1115	N/A	N/A

12 Test Setup Diagrams



13 Revision History

Date	Report Name	Changes to report	Report prepared by
2013-10-23	EMC_3SISE-033-13001_GT83000_FCC95	First Version	Danh Le