FCC 47 CFR PART 24 SUBPART E

TEST REPORT

For

Automated Vehicle Location Device

Model: VITA-350

Trade Name: Advantech

Issued to

Advantech Co. Ltd.
No.1, Alley 20, Lane 26, Rueiguang Road, Neihu District,
Taipei 114, Taiwan, R.O.C.

Issued by

Compliance Certification Services Inc.
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ACCREDITED
TESTING CERT #0824.01

Testing Laboratory
0363

TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION 3
2. EUT DESCRIPTION 4
3. TEST METHODOLOGY 5
3.1 EUT CONFIGURATION 5
3.2 EUT EXERCISE 5
3.3 GENERAL TEST PROCEDURES 5
3.4 DESCRIPTION OF TEST MODES 5
4. INSTRUMENT CALIBRATION 6
4.1 MEASURING INSTRUMENT CALIBRATION 6
4.2 MEASUREMENT EQUIPMENT USED 6
5. FACILITIES AND ACCREDITATIONS 7
5.1 FACILITIES 7
5.2 EQUIPMENT 7
5.3 TABLE OF ACCREDITATIONS AND LISTINGS 8
6. SETUP OF EQUIPMENT UNDER TEST 9
6.1 SETUP CONFIGURATION OF EUT 9
6.2 SUPPORT EQUIPMENT 9
7. FCC PART 24 REQUIREMENTS 10
7.1 AVERAGE POWER 10
7.2 ERP & EIRP MEASUREMENT 11
7.3 OCCUPIED BANDWIDTH MEASUREMENT 13
7.4 OUT OF BAND EMISSION AT ANTENNA TERMINALS 16
7.5 FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT 21
7.6 FREQUENCY STABILITY V.S. TEMPERATURE MEASUREMENT 29
7.7 FREQUENCY STABILITY V.S. VOLTAGE MEASUREMENT 31
7.8 POWERLINE CONDUCTED EMISSIONS 33
APPENDIX I RADIO FREQUENCY EXPOSURE 34

1. TEST RESULT CERTIFICATION

Applicant:	Advantech Co. Ltd. No.1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 114, Taiwan, R.O.C.
Equipment Under Test:	Automated Vehicle Location Device
Trade Name:	Advantech
Model Number:	VITA-350
Date of Test:	October 23 ~ 31, 2007

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR PART 24 SUBPART E	No non-compliance noted

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI/TIA/EIA-603-A-2001 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rule FCC PART 24 Subpart E.

The test results of this report relate only to the tested sample identified in this report.

Approved by:

Rex Lai
Section Manager
Compliance Certification Services Inc.

Reviewed by:

Amanda Wu
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	Automated Vehicle Location Device
Trade Name	Advantech
Model Number	VITA-350
Model Discrepancy	N/A
Power Supply	DC 12V / DC 24 V
Frequency Range	TX: 1850.2 ~ 1909.8 MHz RX: 1930 ~ 1989.8 MHz
Transmit Power (ERP & EIRP Power)	22.16 dBm
Modulation Technique	GMSK
Cellular Phone Protocol	GPRS
Type of Emission	252KGXW--
Antenna Type	Dual Band External Antenna
Antenna Specification	-6 dBi

Remark:

1. *The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: M82-VITA-350 filing to comply with Part 24 of the FCC 47 CFR Rules.*

3. TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures document 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.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.

3.4 DESCRIPTION OF TEST MODES

The EUT (model: VITA-350) had been tested under operating condition.

EUT staying in continuous transmitting mode was programmed.

GPRS 1900: Channel Low (CH512), Channel Mid (CH661) and Channel High (CH810) were chosen for full testing.

4. INSTRUMENT CALIBRATION

4.1MEASURING INSTRUMENT 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.

4.2MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: *Each piece of equipment is scheduled for calibration once a year.*

Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY43360131	01/30/2008
Power Meter	Agilent	E4416A	GB41291611	03/20/2008
Power Sensor	Agilent	E9327A	US40441097	06/07/2008

3M Semi Anechoic Chamber				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510252	09/11/2008
Test Receiver	Rohde&Schwarz	ESCI	100064	11/12/2008
Switch Controller	TRC	Switch Controller	SC94050010	05/04/2008
4 Port Switch	TRC	4 Port Switch	SC94050020	05/04/2008
Horn-Antenna	TRC	HA-0502	06	06/05/2008
Horn-Antenna	TRC	HA-0801	04	06/20/2008
Horn-Antenna	TRC	HA-1201A	01	08/12/2008
Horn-Antenna	TRC	HA-1301A	01	08/12/2008
Bilog- Antenna	Sunol Sciences	JB3	A030205	03/29/2008
Turn Table	Max-Full	MFT-120S	T120S940302	N.C.R.
Antenna Tower	Max-Full	MFA-430	A440940302	N.C.R.
Controller	Max-Full	MF-CM886	CC-C-1F-13	N.C.R.
Site NSA	CCS	N/A	FCC: 965860 IC: IC 6106	09/25/2008
Test S/W	LABVIEW (V 6.1)			

Remark: *The measurement uncertainty is less than +/-2.0065dB (30MHz ~ 1GHz), +/-3.0958dB (Above 1GHz) which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No. No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 TABLE OF ACCREDITATIONS AND LISTINGS

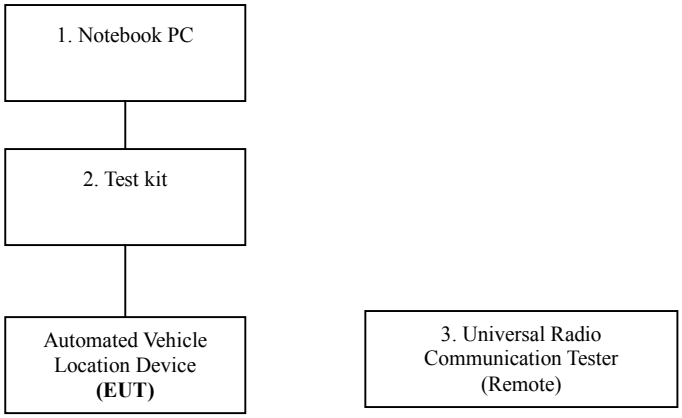
Country	Agency	Scope of Accreditation	Logo
USA	A2LA	EN 55011, EN 55014-1/2, CISPR 11, CISPR 14-1/2, EN 55022, EN 55015, CISPR 22, CISPR 15, AS/NZS 3548, VCCI V3 (2001), CFR 47, FCC Part 15/18, CNS 13783-1, CNS 13439, CNS 13438, CNS 13803, CNS 14115, EN 55024, IEC 801-2, IEC 801-3, IEC 801-4, IEC/EN 61000-3-2, IEC/EN 61000-3-3, IEC/EN 61000-4-2/3/4/5/6/8/11, EN 50081-1/ EN 61000-6-3, EN 50081-2/EN 61000-6-4, EN 50081-2/EN 61000-6-1: 2001	ACCREDITED TESTING CERT #0824.01
USA	FCC	3/10 meter Open Area Test Sites (93105, 90471) / 3M Semi Anechoic Chamber (965860) to perform FCC Part 15/18 measurements	93105, 90471 965860
Japan	VCCI	3/10 meter Open Area Test Sites to perform conducted/radiated measurements	R-393/1066/725/879 C-402/747/912
Norway	NEMKO	EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2, EN 50091-2, EN 50130-4, EN 55011, EN 55013, EN 55014-1/2, EN 55015, EN 55022, EN 55024, EN 61000-3-2/3, EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, EN 60601-1-2, EN 300 328, EN 300 422-2, EN 301 419-1, EN 301 489-01/03/07/08/09/17, EN 301 419-2/3, EN 300 454-2, EN 301 357-2	ELA 124a ELA 124b ELA 124c
Taiwan	TAF	EN 300 328, EN 300 220-1, EN 300 220-2, EN 300 220-3, 47 CFR FCC Part 15 Subpart C, EN 61000-3-2, EN 61000-3-3, CNS 13439, CNS 13783-1, CNS 14115, CNS 13438, AS/NZS CISPR 22, CNS 13022-1, IEC 61000-4-2/3/4/5/6/8/11, CNS 13022-2/3	Testing Laboratory 0363
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS 13439, CNS 14115	SL2-IS-E-0014 SL2-IN-E-0014 SL2-A1-E-0014 SL2-R1-E-0014 SL2-R2-E-0014 SL2-L1-E-0014
Canada	Industry Canada	3/10 meter Open Area Test Sites (IC 2324C-3, IC 2324C-5) / 3M Semi Anechoic Chamber (IC 6106)	IC 2324C-3 IC 2324C-5 IC 6106

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.



6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Notebook PC	ASUS	M5200AE	5BN0AG019631	PD9WM3B2100	N/A	AC I/P: Unshielded, 1.8m with a core DC O/P: Unshielded, 1.8m
2.	Test kit	N/A	N/A	N/A	N/A	N/A	N/A
3.	Universal Radio Communication Tester (Remote)	R&S	CMU200	1100.000.8.02	N/A	N/A	Unshielded, 1.8m

Remark:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

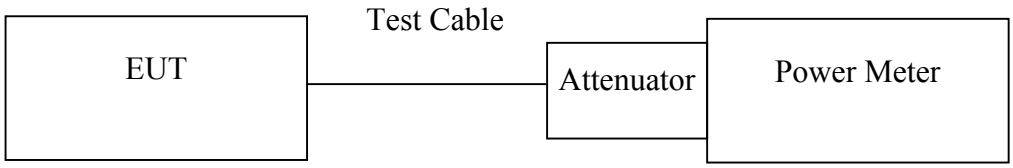
7. FCC PART 24 REQUIREMENTS

7.1 AVERAGE POWER

LIMIT

According to FCC §2.1046.

Test Configuration



Remark: *Measurement setup for testing on Antenna connector*

TEST PROCEDURE

The transmitter output was connected to a calibrated attenuator, the other end of which was connected to a power meter. Transmitter output was read off the power meter in dBm. The power output at the transmitter antenna port was determined by adding the value of the attenuator to the power meter reading.

TEST RESULTS

No non-compliance noted.

Test Data

Test Mode	CH	Frequency (MHz)	Power Meter Reading (dBm)	Attenuator (dB)	Average Power (dBm)
GPRS 1900 (Class 10)	512	1850.20	-5.14	34.80	29.66
	661	1880.00	-4.74		30.06
	810	1910.00	-4.54		30.26

Remark: *The value of factor includes both the loss of cable and external attenuator*

7.2 ERP & EIRP MEASUREMENT

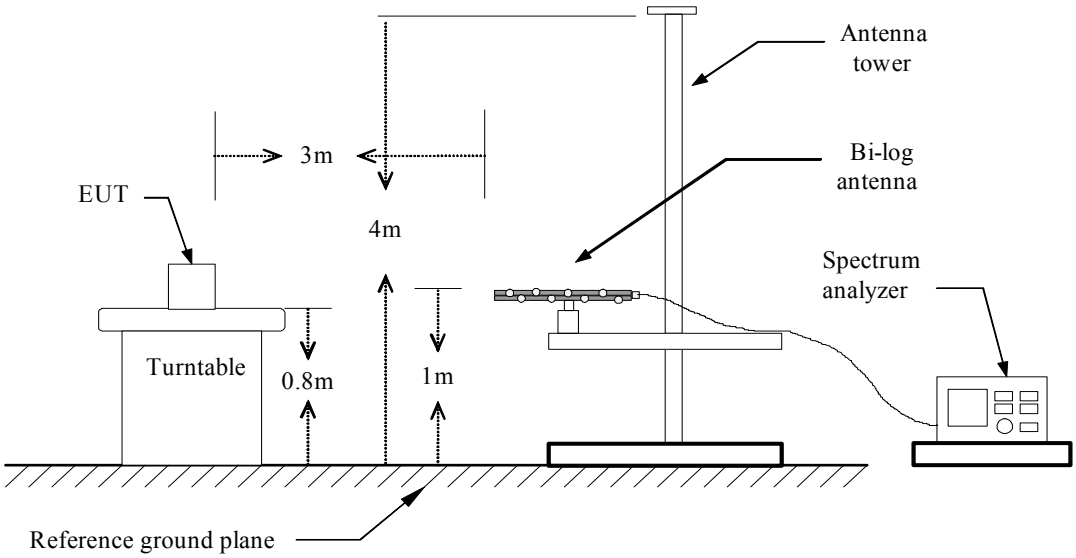
LIMIT

According to FCC §2.1046

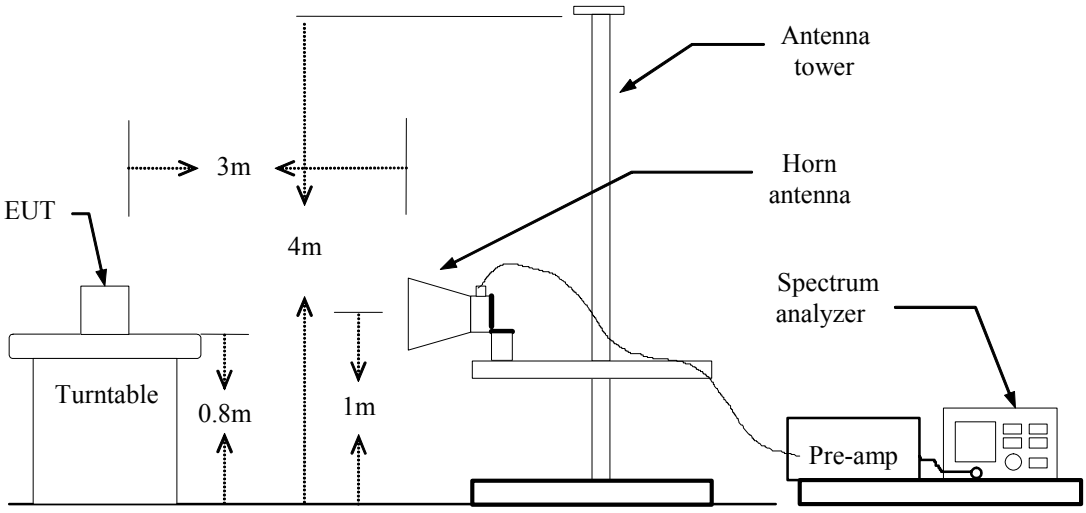
FCC 24.232(b): The equivalent Isotropic Radiated Power (EIRP) must not exceed 2 Watts.

TEST CONFIGURATION

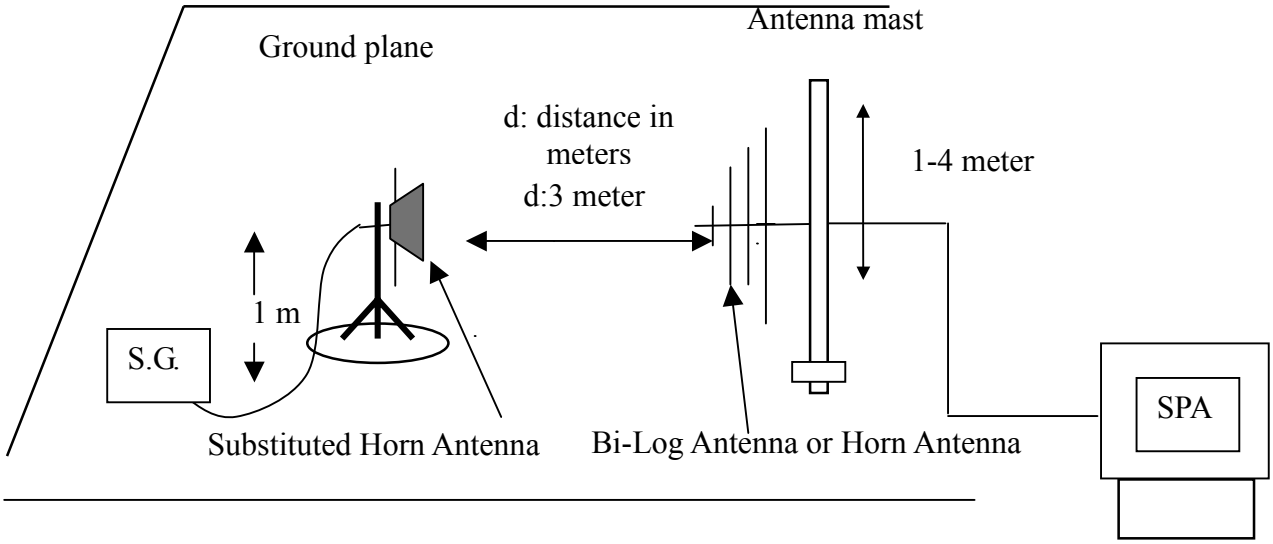
Below 1 GHz



Above 1 GHz



For Substituted Method Test Set-UP



TEST PROCEDURE

The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer.

During the measurement of the EUT, the resolution bandwidth was set to 3MHz and the average bandwidth was set to 3MHz. The highest emission was recorded with the rotation of the turntable and the lowering of the test antenna. The reading was recorded and the field strength (E in dBuV/m) was calculated.

ERP in frequency band 824-849MHz, and EIRP in frequency band 1851.25 –1910MHz were measured using a substitution method. The EUT was replaced by half-wave dipole (824-849MHz) or horn antenna (1851.25-1910MHz) connected to a signal generator. The spectrum analyzer reading was recorded and ERP/EIRP was calculated as follows:

ERP = S.G. output (dBm) + Antenna Gain (dBd) – Cable (dB)
EIRP = S.G. output (dBm) + Antenna Gain (dBi) – Cable (dB)

TEST RESULTS

No non-compliance noted.

GPRS 1900 Test Data (Class 10)

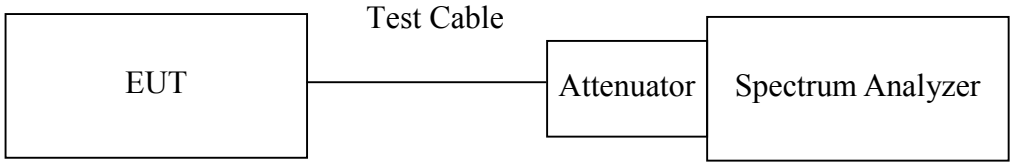
Channel	Frequency (MHz)	Antenna Pol.	Reading level (dBuV)	Correction Factor (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
512	1850.20	V	-14.28	35.61	21.33	33.00	-11.67
	1850.20	H	-13.99	36.15	***22.16**	33.00	-10.84
661	1880.00	V	-13.70	35.54	21.84	33.00	-11.16
	1880.00	H	-14.58	36.37	21.79	33.00	-11.21
810	1909.80	V	-15.17	35.58	20.41	33.00	-12.59
	1909.80	H	-15.05	36.43	21.38	33.00	-11.62

7.3 OCCUPIED BANDWIDTH MEASUREMENT

LIMIT

According to §FCC 2.1049.

Test Configuration



Remark: *Measurement setup for testing on Antenna connector*

TEST PROCEDURE

The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW was set to about 1% of emission BW, VBW is set to 3 times the RBW, -26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

TEST RESULTS

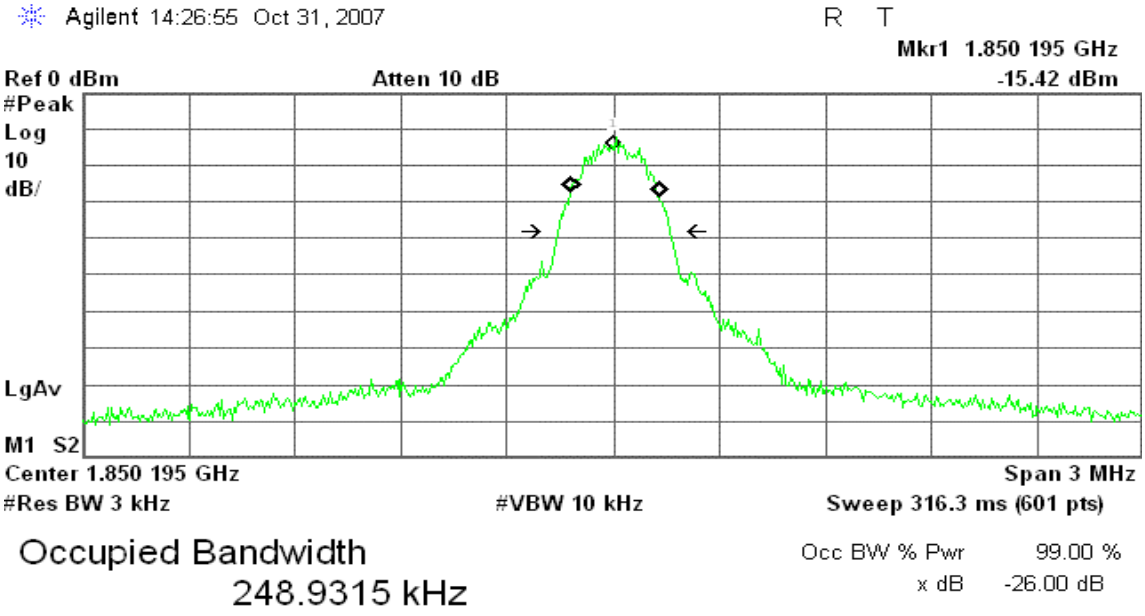
No non-compliance noted.

Test Data

Test Mode	CH	Frequency (MHz)	Bandwidth (kHz)
GPRS 1900 (Class 10)	512	1850.20	248.9315
	661	1880.00	246.1594
	810	1909.80	252.2156

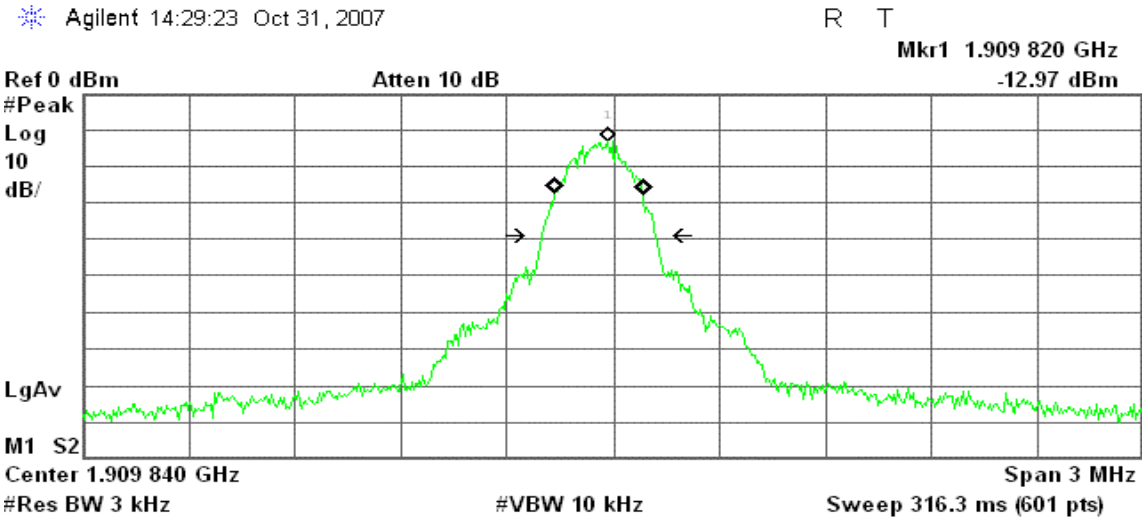
Test Plot

GPRS 1900 (CH Low)



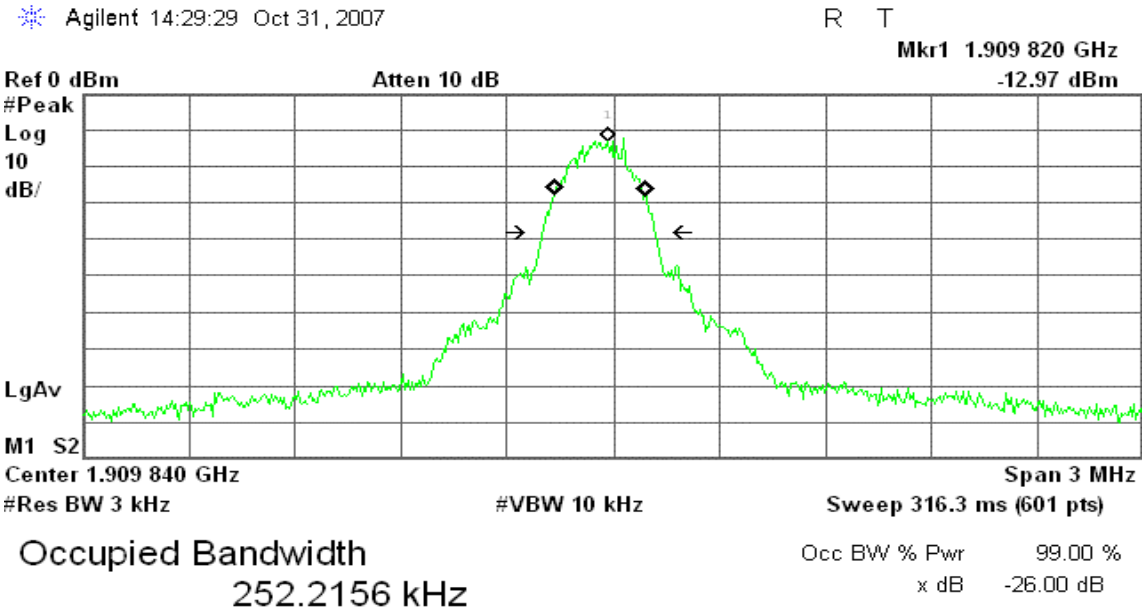
Transmit Freq Error	4.018 kHz
x dB Bandwidth	315.068 kHz

GPRS 1900 (CH Mid)



Transmit Freq Error	-40.514 kHz
x dB Bandwidth	318.540 kHz

GPRS 1900 (CH High)



Transmit Freq Error	-37.933 kHz
x dB Bandwidth	317.339 kHz

7.4 OUT OF BAND EMISSION AT ANTENNA TERMINALS

LIMIT

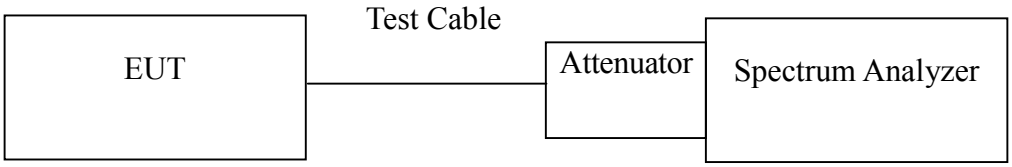
According to FCC §2.1051, FCC §2.2917(f), FCC §24.238(a).

Out of Band Emissions: The mean power of emission must be attenuated below the mean power of the non-modulated carrier (P) on any frequency twice or more than twice the fundamental frequency by at lease 43 + 10 log P dB.

Band Edge Requirements: In the 1MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at lease 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the Out of band Emission

TEST CONFIGURATION

Out of band emission at antenna terminals:



TEST PROCEDURE

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

For the out of band: Set the RBW, VBW = 1MHz, Start=30MHz, Stop= 10 th harmonic. Limit = -13dBm

Band Edge Requirements (1850MHz and 1910MHz): In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions. Limit, -13dBm.

TEST RESULTS

No non-compliance noted.

Test Data

Test Mode	CH	Location	Description
GPRS 1900 (Class 10)	512	Figure 7-1	Conducted spurious emissions, 30MHz - 20GHz
	661	Figure 7-2	Conducted spurious emissions, 30MHz - 20GHz
	810	Figure 7-3	Conducted spurious emissions, 30MHz - 20GHz

Test Mode	CH	Location	Description
GPRS 1900 (Class 10)	512	Figure 8-1	Band Edge emissions
	810	Figure 8-2	Band Edge emissions

Test Plot

Figure 7-1: Out of Band emission at antenna terminals–GPRS CH Low

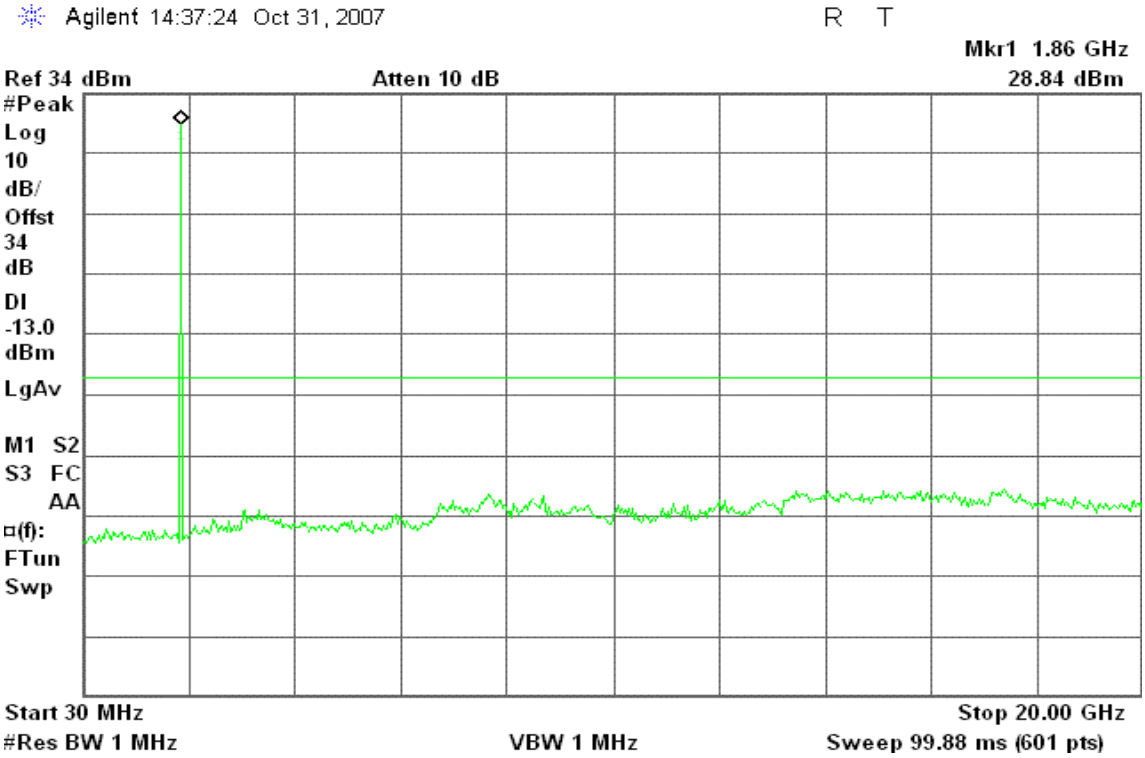


Figure 7-2: Out of Band emission at antenna terminals –GPRS CH Mid

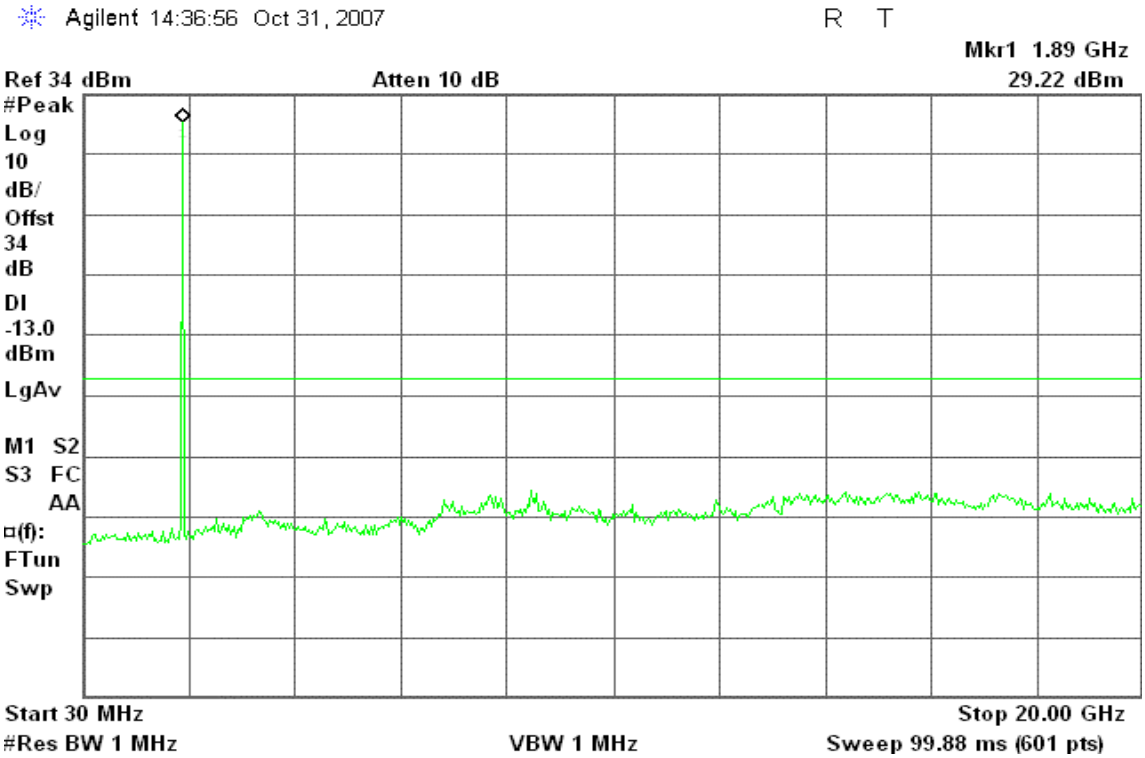


Figure 7-3: Out of Band emission at antenna terminals–GPRS CH High

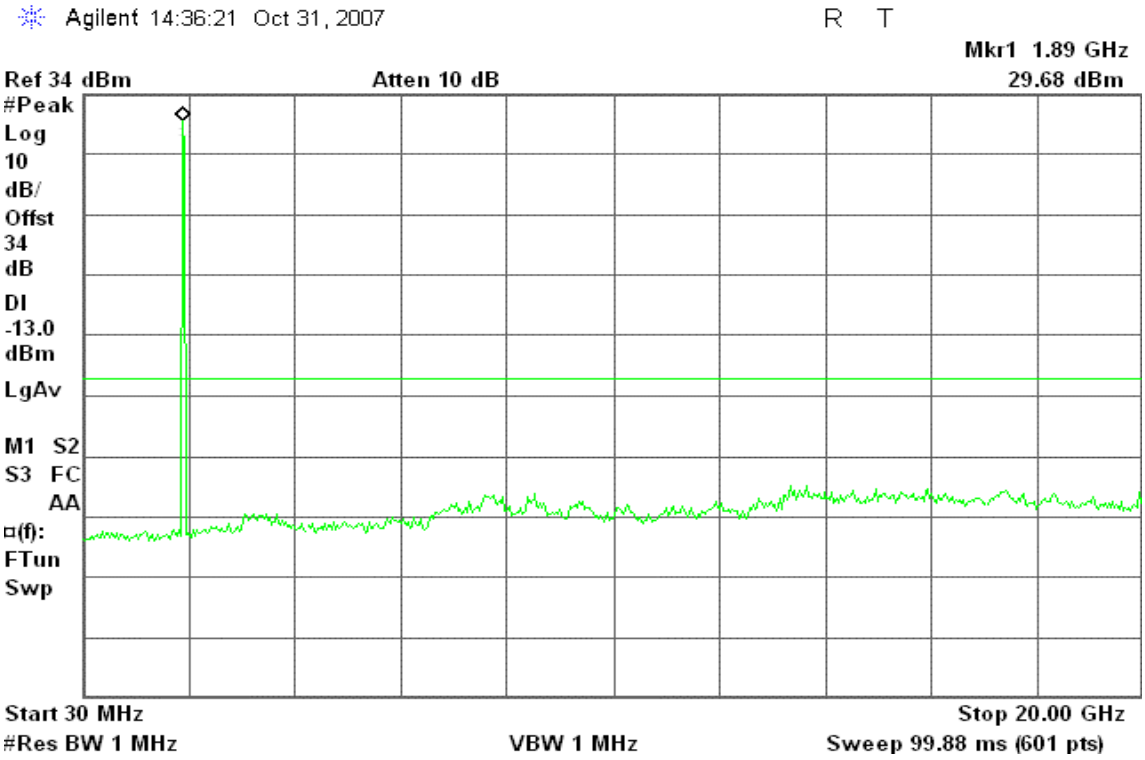


Figure 8-1: Band Edge emissions– GPRS CH Low

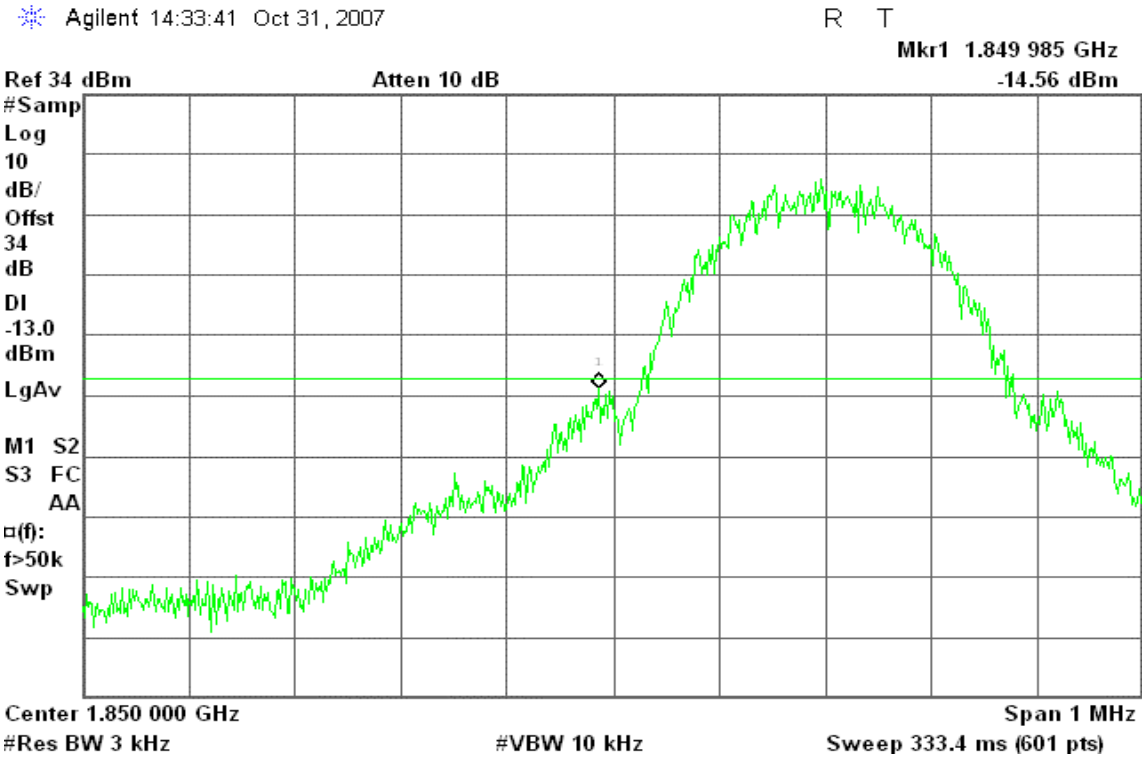
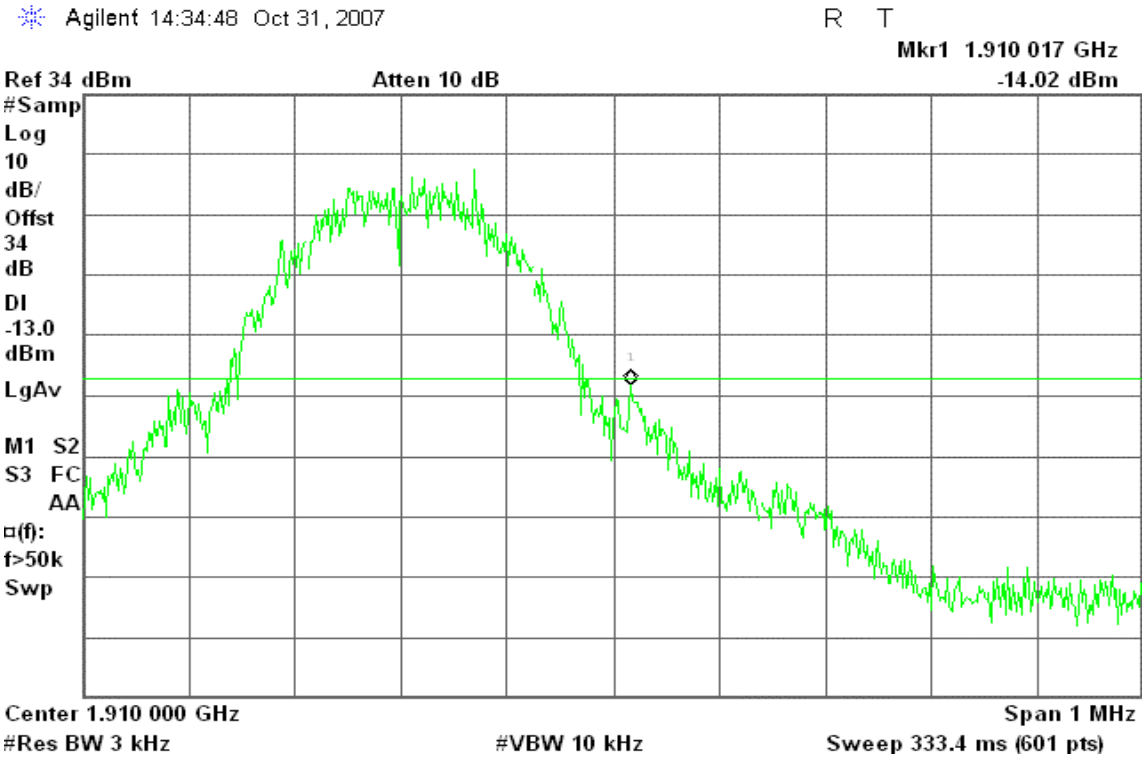


Figure 8-2: Band Edge emissions–GPRS CH High



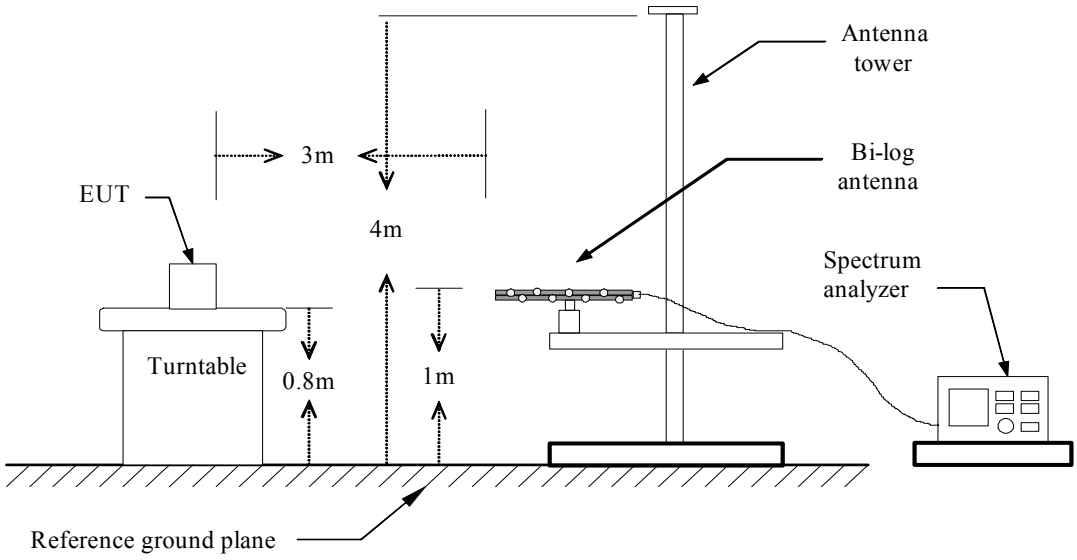
7.5 FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT

LIMIT

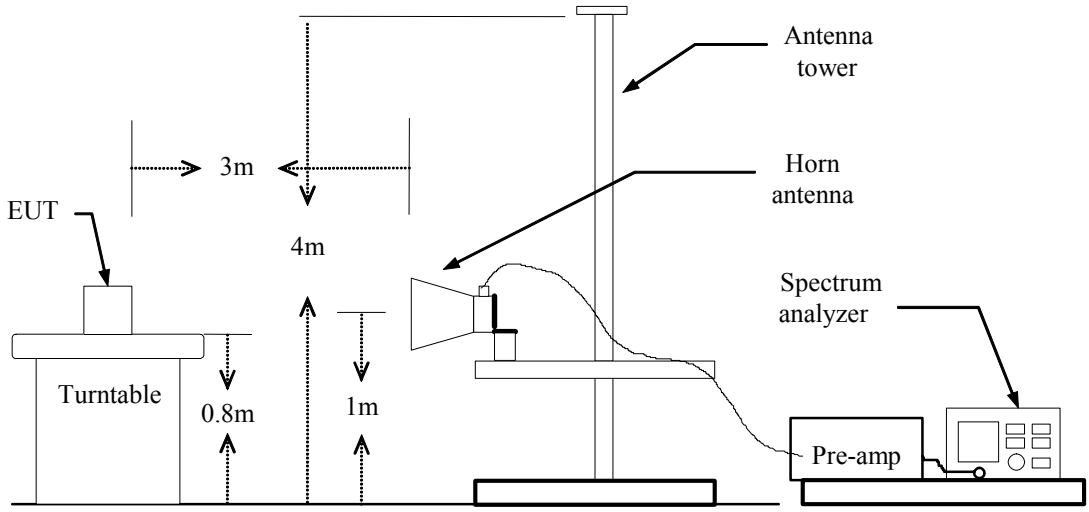
According to FCC §2.1053

Test Configuration

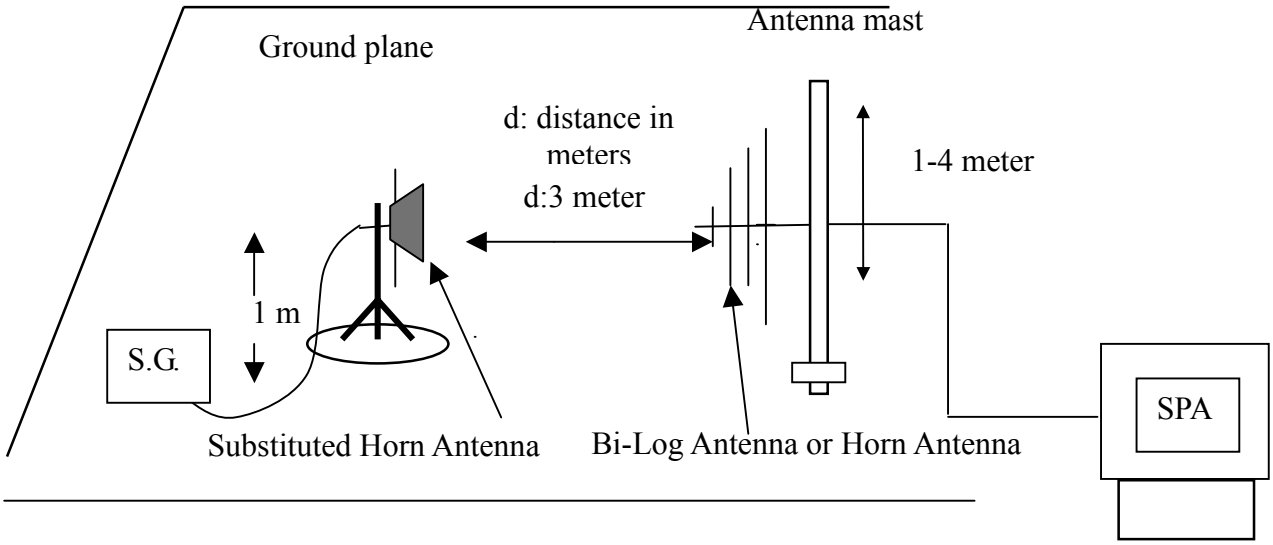
Below 1 GHz



Above 1 GHz



Substituted Method Test Set-up



TEST PROCEDURE

The EUT was placed on a non-conductive, the measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

The frequency range up to tenth harmonic was investigated for each of three fundamental frequency (low, middle and high channels). Once spurious emission were identified, the power of the emission was determined using the substitution method.

The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency.

ERP = S.G. output (dBm) + Antenna Gain (dBd) – Cable (dB)

EIRP = S.G. output (dBm) + Antenna Gain (dBi) – Cable (dB)

TEST RESULTS

Refer to the attached tabular data sheets.

Radiated Spurious Emission Measurement Result

Below 1GHz

Operation Mode: GPRS 1900 / TX / CH 512 **Test Date:** October 23, 2007

Temperature: 25°C **Tested by:** Mimic Young

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Antenna Polarization	Reading level (dBuV)	Correction Factor (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
39.70	V	-52.77	-9.13	-61.90	-13.00	-48.90
199.75	V	-43.52	-17.52	-61.04	-13.00	-48.04
348.16	V	-49.85	-13.15	-63.01	-13.00	-50.01
497.54	V	-53.54	-8.46	-62.00	-13.00	-49.00
565.44	V	-55.57	-7.67	-63.24	-13.00	-50.24
N/A						
39.70	H	-51.44	-3.96	-55.39	-13.00	-42.39
130.88	H	-38.35	-17.33	-55.67	-13.00	-42.67
166.77	H	-37.07	-18.55	-55.62	-13.00	-42.62
264.74	H	-45.06	-14.96	-60.02	-13.00	-47.02
467.47	H	-49.35	-9.00	-58.35	-13.00	-45.35
612.97	H	-53.62	-6.60	-60.21	-13.00	-47.21

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*

Operation Mode: GPRS 1900 / TX / CH 661 **Test Date:** October 23, 2007

Temperature: 25°C **Tested by:** Mimic Young

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Antenna Polarization	Reading level (dBuV)	Correction Factor (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
40.67	V	-53.98	-8.80	-62.77	-13.00	-49.77
134.76	V	-43.52	-18.69	-62.21	-13.00	-49.21
200.72	V	-44.18	-17.44	-61.62	-13.00	-48.62
350.10	V	-50.49	-13.11	-63.60	-13.00	-50.60
498.51	V	-54.41	-8.44	-62.85	-13.00	-49.85
566.41	V	-55.45	-7.66	-63.11	-13.00	-50.11
39.70	H	-50.54	-3.96	-54.50	-13.00	-41.50
131.85	H	-38.10	-17.32	-55.42	-13.00	-42.42
165.80	H	-37.24	-18.59	-55.82	-13.00	-42.82
468.44	H	-49.40	-8.98	-58.39	-13.00	-45.39
646.92	H	-50.87	-6.63	-57.50	-13.00	-44.50
696.39	H	-52.90	-5.44	-58.34	-13.00	-45.34

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*

Operation Mode: GPRS 1900 / TX / CH 810 **Test Date:** October 23, 2007

Temperature: 25°C **Tested by:** Mimic Young

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Antenna Polarization	Reading level (dBuV)	Correction Factor (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
39.70	V	-51.58	-9.13	-60.71	-13.00	-47.71
136.70	V	-43.37	-18.20	-61.57	-13.00	-48.57
200.72	V	-44.07	-17.44	-61.51	-13.00	-48.51
498.51	V	-54.12	-8.44	-62.56	-13.00	-49.56
646.92	V	-52.11	-6.85	-58.97	-13.00	-45.97
696.39	V	-56.77	-5.90	-62.66	-13.00	-49.66
39.70	H	-49.98	-3.96	-53.94	-13.00	-40.94
130.88	H	-38.00	-17.33	-55.32	-13.00	-42.32
165.80	H	-37.54	-18.59	-56.13	-13.00	-43.13
353.01	H	-45.75	-12.90	-58.66	-13.00	-45.66
468.44	H	-48.53	-8.98	-57.52	-13.00	-44.52
N/A						

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*

Above 1GHz

Operation Mode: GPRS 1900 / TX / CH 512 **Test Date:** October 23, 2007

Temperature: 25°C **Tested by:** Mimic Young

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Antenna Polarization	Reading level (dBuV)	Correction Factor (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
1854.00	V	-48.67	0.88	-47.79	-13.00	-34.79
3702.00	V	-44.02	5.44	-38.59	-13.00	-25.59
7398.00	V	-54.01	12.76	-41.25	-13.00	-28.25
N/A						
1854.00	H	-48.81	1.41	-47.40	-13.00	-34.40
3702.00	H	-43.72	5.83	-37.89	-13.00	-24.89
7398.00	H	-58.26	13.17	-45.08	-13.00	-32.08
N/A						

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*

Operation Mode: GPRS 1900 / TX / CH 661 **Test Date:** October 23, 2007

Temperature: 25°C **Tested by:** Mimic Young

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Antenna Polarization	Reading level (dBuV)	Correction Factor (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
1882.00	V	-48.14	0.90	-47.24	-13.00	-34.24
3758.00	V	-45.76	5.55	-40.21	-13.00	-27.21
7524.00	V	-57.49	13.20	-44.28	-13.00	-31.28
N/A						
1882.00	H	-46.90	1.42	-45.48	-13.00	-32.48
3758.00	H	-44.77	5.93	-38.83	-13.00	-25.83
7524.00	H	-58.90	13.63	-45.27	-13.00	-32.27
N/A						

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*

Operation Mode: GPRS 1900 / TX / CH 810 **Test Date:** October 23, 2007

Temperature: 25°C **Tested by:** Mimic Young

Humidity: 50 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Antenna Polarization	Reading level (dBuV)	Correction Factor (dB)	Emission level (dBm)	Limit (dBm)	Margin (dB)
1910.00	V	-52.12	0.91	-51.21	-13.00	-38.21
3821.00	V	-56.75	5.67	-51.08	-13.00	-38.08
5914.00	V	-62.04	7.23	-54.81	-13.00	-41.81
N/A						
1868.00	H	-48.85	1.41	-47.43	-13.00	-34.43
3737.00	H	-46.52	5.90	-40.62	-13.00	-27.62
5732.00	H	-58.83	7.33	-51.50	-13.00	-38.50
7482.00	H	-58.76	13.51	-45.25	-13.00	-32.25
N/A						

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*

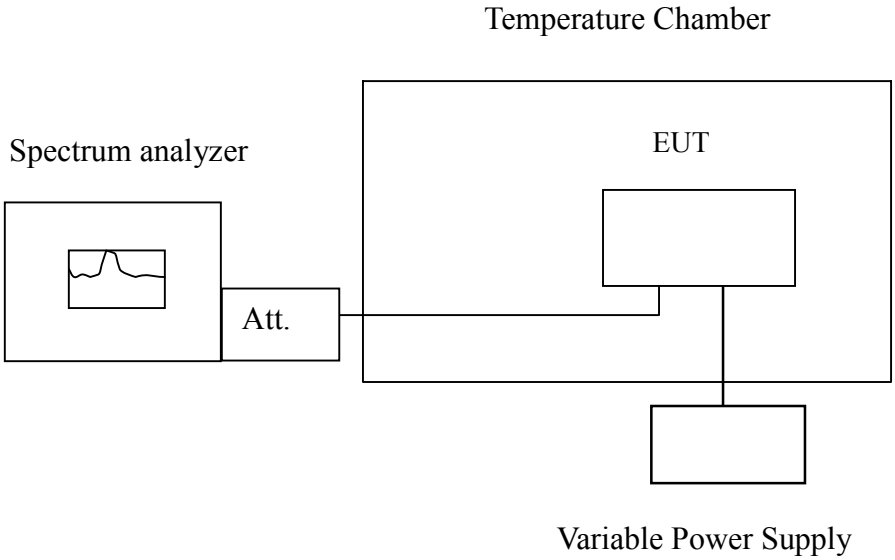
7.6 FREQUENCY STABILITY V.S. TEMPERATURE MEASUREMENT

LIMIT

According to FCC §2.1055, FCC §24.235.

Frequency Tolerance: 2.5 ppm

Test Configuration



Remark: *Measurement setup for testing on Antenna connector*

TEST PROCEDURE

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to –30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

TEST RESULTS

No non-compliance noted.

Reference Frequency: GPRS Mid Channel 1880 MHz @ 20°C				
Limit: ± 2.5 ppm = 4700 Hz				
Power Supply Vdc	**Environment Temperature (°C)**	**Frequency (Hz)**	**Delta (Hz)**	**Limit (Hz)**
12	50	1880000026	57	4700
	40	1880000028	59	
	30	1880000034	65	
	20	1879999969	0	
	10	1880000017	48	
	0	1880000016	47	
	-10	1880000021	52	
	-20	1880000025	56	
	-30	1880000029	60	

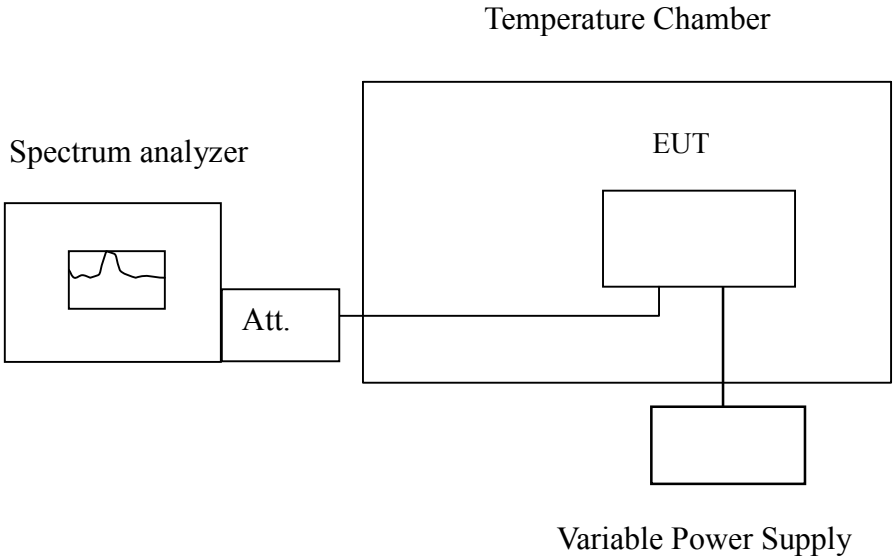
Reference Frequency: GPRS Mid Channel 1880 MHz @ 20°C				
Limit: ± 2.5 ppm = 4700 Hz				
Power Supply Vdc	**Environment Temperature (°C)**	**Frequency (Hz)**	**Delta (Hz)**	**Limit (Hz)**
24	50	1880000012	37	4700
	40	1880000011	36	
	30	1880000008	33	
	20	1879999975	0	
	10	1880000006	31	
	0	1880000012	37	
	-10	1880000010	35	
	-20	1880000013	38	
	-30	1880000018	43	

7.7 FREQUENCY STABILITY V.S. VOLTAGE MEASUREMENT

LIMIT

According to FCC §2.1055, FCC §24.235,
Frequency Tolerance: 2.5 ppm.

Test Configuration



Remark: *Measurement setup for testing on Antenna connector.*

TEST PROCEDURE

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (± 15%) and endpoint, record the maximum frequency change.

TEST RESULTS

No non-compliance noted.

Reference Frequency: GPRS Mid Channel 1880 MHz @ 20°C				
Limit: ± 2.5 ppm = 4700 Hz				
Power Supply Vdc	**Environment Temperature (°C)**	**Frequency (Hz)**	**Delta (Hz)**	**Limit (Hz)**
10.2	20	1879999974	5	4700
12		1879999969	0	
13.8		1879999986	17	
9.8		1879999862	-107	

Reference Frequency: GPRS Mid Channel 1880 MHz @ 20°C				
Limit: ± 2.5 ppm = 4700 Hz				
Power Supply Vdc	**Environment Temperature (°C)**	**Frequency (Hz)**	**Delta (Hz)**	**Limit (Hz)**
21.6	20	1879999967	-8	4700
24		1879999975	0	
26.4		1879999969	-6	
10		1879999905	-70	

7.8 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

** Decreases with the logarithm of the frequency.*

Test Configuration

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete..

TEST RESULTS

Not applicable, because EUT no connect to AC Main Source.

APPENDIX I
RADIO FREQUENCY EXPOSURE

LIMIT

EUT Specification

EUT	Automated Vehicle Location Device
Frequency band (Operating)	☐ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz ☐ WLAN: 5.745GHz ~ 5.825GHz ☒ Others: 1850.2 ~ 1909.8 MHz
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm^2) ☒ General Population/Uncontrolled exposure (S=1mW/cm^2)
Antenna diversity	☒ Single antenna ☐ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☐ Tx/Rx diversity
Max. output power	22.16 dBm (164.44mW)
Antenna gain (Max)	-6 dBi (Numeric gain: 0.25)
Evaluation applied	☒ MPE Evaluation ☐ SAR Evaluation

Remark:
1. *The maximum output power is 22.16dBm (164.44mW) at 1850.20MHz (with 0.25 numeric antenna gain.)*
2. *DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.*
3. *For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm^2 even if the calculation indicates that the power density would be larger.*

TEST RESULTS

No non-compliance noted.

Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

Where *E = Field strength in Volts / meter*
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) = d(m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ ***Equation 1***

Where *d = Distance in cm*
P = Power in mW
G = Numeric antenna gain
S = Power density in mW / cm^2

Maximum Permissible Exposure

EUT output power = 164.44mW

Numeric Antenna gain = 0.25

Substituting the MPE safe distance using d = 20 cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

Where *P = Power in mW*
G = Numeric antenna gain
S = Power density in mW / cm^2

→ Power density = 0.0082 mW / cm^2

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm^2 even if the calculation indicates that the power density would be larger.)