FCC CFR47 PART 22 TYPE ACCEPTANCE

TEST REPORT

FOR

AMPS CELLEMETRY RADIO MODULE

FCC ID: D6X1422

REPORT NUMBER: 98E7505

ISSUE DATE: AUGUST 13, 1998

Prepared for

TECOM CO., LTD.
23,. R&D ROAD 2, SCIENCE-BASED INDUSTRIAL PARK, HSIN-SHU, TAIWAN, R.O.C

Prepared by

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LAB CODE:200065-0

TABLE OF CONTENTS PAGE

1. FCC TYPE ACCEPTANCE INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part2, Subpart J, Sections 2.983 – 2.999.

2.983(a) Applicant: TECOM CO., LTD.
23,.R&D ROAD 2, SCIENCE-BASED INDUSTRIAL PARK, HSIN-CHU, TAIWAN, R.O.C.

Contact person: MR. S.Y. LYN

Telephone number: 035-775141

2.983(b) FCC ID: D6X1422

2.983(c) Quantity production is planned

2.983(d) **Technical Description**

The EUT, TECOM AMPS MODULAR TX using Cellular Telephone Frequency (Non-voice), is a radio adapter which only transmits data information to a specific receiving unit. It is designed to use the control channels (834.030 to 839.49 MHz) in AMPS band with no voice operation. The only type of transmission this module is capable of is a reverse control channel "Registration" message containing a MIN and ESN. It cannot operate on voice channels. EUT will be used in monitoring vending machines and copies. The module would be enclosed in a metal box, typically inside of a vending machine, with an external antenna. Another typical application might be for utilities where the module would command, control and report status of remote switching devices. In this situation the device might be enclosed in a sealed NEMA enclosure for mounting outside on a utility pole. A third application monitors cable television backup power supplies, where the transmitter module is enclosed in a metal box, within the larger metal power supply enclosure, with the entire assembly mounted 20-30 feet up on a utility pole. Another application is one in which a GPS vehicle-positioning product (from another manufacturer) encloses the module, along with a GPS receiver, in a paperback-sized metal box for mounting in the trunk of a vehicle. A small combination cellular-GPS antenna is magnetically mounted to the trunk lid outside the vehicle. Monitoring catholic protection sites on natural gas pipeline is another use for the module. Each transmission lasts less than 200mSec. Rate of transmission will depend on the particular application into which the module is designed. In general, the highest rate anticipated would be approximately once each hour (when the device is transmitting GPS coordinates, for example) to once per month (for devices transmitting cathodic corrosion protection status, or copier or vending machine maintenance information). Some devices may be designed to transmit only when there is a power failure and

restoration (possibly as little as one minute between transmissions, but weeks or months between individual occurrences).

1) Type of emissions

36K0FD1 (FM)

2) Frequency Range

Transmitter: 834.03 – 839.49 MHz
Receiver: 869 – 894 MHz

3) Range of Operation Power

There are 7 power levels of AMPS radio module.

Level 0,1,2 : 27dBm
Level 3 : 24dBm
Level 4 : 20dBm ** tolerance –2, +4 dB
Level 5 : 16dBm
Level 6 : 12dBm
Level 7 : 9dBm

The power level is controlled via the PWM on PCB. The values are stored in EPROM. When the module receives the power change command from base station, the module will set the emission power according to the command.

4) Maximum Power Rating

Maximum power output is .553 Watts (27.43 dBm)

5) Applied voltage and currents into the final transistor elements

EUT: 5V @ 600mA DC
TEST BOARD: 8VDC

6) Function of Each Active Device

DESIGNATION	FUNCTION DESCRIPTION	OPERATING FREQUNECY
U4	Dual PLL Circuits	50 MHz to 1.1GHz
TCXO1	TXCO	9.6 MHz
U3	UHF VCO	824 to 849 MHz
U5	UHF VCO	914 to 939 MHz
U2	IF Demodulation Stage	DC to 45 MHz
U1	RF Power Amplifier	824 to 849 MHz
U7	Comparator	DC
Q3	Mixer	809 to 894/914 to 939 MHz
Q2	RF Amplifier	869 to 894 MHz
Q1	RF Amplifier	824 to 849 MHz
Q4	RF Amplifier	914 to 939 MHz
Q5	Switch	DC
D1	Detector Diode	824 to 849 MHz

7) Complete Circuit Diagrams and Functional Diagram

Refer to **Attachment**: Schematics and Parts list. Confidentiality is requested for these items.

8) Instructions/Installation Manual

Refer to **Attachment**: Installation and Service manual.

9) Tune-up/Optimization Procedure

The detector diode monitors the output of RF power amplifier, and transforms the monitored value into DC level. The DC level is compared with the equivalent level of expected output power, the comparator output is then fed back to the power amplifier. The precise output power is then achieved and maintained via the feedback loop.

10) Means for Frequency Stabilization

A) Receiver first local oscillator
The receiver first local oscillator consists of PLL (U4) and TCXO (TXXO1). The frequency band is 914 to 939 MHz.

B) Receiver second local oscillator
The receiver second local oscillator mainly composed by crystal X1 and IF demodulation stage (U2). Its frequency is 44.545MHz.

C) Receiver first mixer

The receiver first mixer is 03. The IF is 45MHz

D) Receiver second mixer
The receiver second mixer is on IF demodulation stage(U2).
The IF is 455 kHz.

E) Transmitter RF generator.
Transmitter RF signal is generated by PLL circuits composed by PLL (U4), VCO (U3), and TCXO (TCXO1). The transmitter RF frequency band is 824 to 849 MHz.

11) Means for Limiting Modulation

Not applicable

11) Means for Limiting Power.

Not applicable.

11) Means for Attenuating Higher Audio Frequencies

There are two circuits to suppress the spurious radiation. One is a SWA filter (FL1) with the passband 824 to 849 MHz, the other is duplex filter (FL2) to provide further suppression.

12) Description of Modulation Techniques

FM FSK, 0 = Fc – 8kHz low offset; 1 = Fc + 8kHz high offset

The data rate of 10 KBPS and Manchester encoding is used in AMPS radio module.

The data train is input to a Digital to Analog converter to get the analog output. The data train (1010--) is provided to check the maximum rated conditions under which the equipment will be operated.

2.983(e) Standard Test Condition

The transmitter was tested under the following conditions.
Room Temperature: 20 – 30 °C
Relative Humidity: 35 - 50%
TEST BOARD DC Supply Voltage: 9.5V, 6.4V
EUT DC Supply Voltage: 5.75V, 4.75V

The transmitter was aligned and tuned up according to manufacturer's alignment procedure, prior to testing. All data presented represents the worst case parameter being measured.

2.983(f) Equipment Identification

A drawing of the equipment identification nameplate appears under **Exhibits**: PROPOSED FCC ID LABEL FORMAT.

2.983(g) Photographs

Photographs of the equipment, internal and external views, are found in the **Attachment**: Eut Photographs.

2.983 Description of Various Base Station Configuration.

Not Applicable.

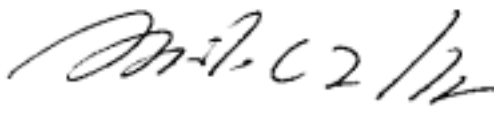
2.983 Use of Various Power Supplies

Normal operation is from 4.75 - 5 Vdc sources (**EUT**)
Normal operation is from 9.5 – 6.4Vdc sources (**TEST BOARD)**

TYPE OF EQUIPMENT:	AMPS CELLEMENTRY RADIO MODULE
MEASUREMENT DISTANCE:	3 METER
TECHNICAL LIMIT:	FCC 22.917, 22.913, 22.915
FCC RULES:	PART 2, 15, AND 22
EQUIPMENT AUTHORIZATION PROCEDURE	TYPE ACCEPTANCE
MODIFICATIONS MADE ON EUT	☐ YES (REFER TO PAGE 8) ☒ NO

The above equipment was tested by Compliance Certification Services for compliance with the requirements set forth in the FCC CFR 47, PART 15 AND 22. The results of testing in this report apply to the product/system, which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved By



MIKE C.I. KUO / VICE - PRESIDENT
COMPLIANCE CERTIFICATION SERVICES

2. TEST FACILITY

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 22.

3. ACCREDITATION AND LISTING

The 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. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT(1300F2))

4. MEASUREMENT INSTRUMENTATION

Radiated emissions were measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, ridged waveguide liner horn. EMI receivers were used for line conducted readings, spectrum analyzers with pre-selectors and quasi-peak detectors were used to perform radiated measurements. Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specification for “Radio Interference Measuring Apparatus and Measurement Methods,” Publication 16.

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

5. MEASURING 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.

6. UNITS OF MEASUREMENT

Measurements of radiated interference are reported in terms of dB(uV/m) at a specified distance. The indicated readings on the spectrum analyzer were converted to dB(uV/m) by

use of appropriate conversion factors. Measurements of conducted interference are reported in terms of dB(uV).

The field strength is calculated by adding the Antenna Factor and Cable Factors, then by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4dB/m and a Cable Factor of 1.1dB is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/m. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m.

FS = 52.5 + 7.4 + 1.1 - 29 = 32 dBuV/m

Level in uV/m = Common Antilogarithm [(32 dBuV/m)/20] = 39.8 uV/m

7. CLASSIFICATION OF DIGITAL DEVICE

Class A includes digital devices that are marketed for use in commercial, industrial or business environments, excluding devices which are marketed for use by the general public or are intended to be used in the home.

Class B includes digital devices that are marketed for use in residential environments, notwithstanding use in commercial, business and industrial environments.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as Class B device, and in fact is encouraged to do so provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

8. RADIATED EMISSION LIMITS

FCC PART 15 CLASS A

MEASURING DISTANCE OF 10 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	90	39.1
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

FCC PART 15 CLASS B

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

9. RADIATED EMISSION TEST PROCEDURE

The EUT and all other support equipment are placed on a wooden table 80 cm above the ground screen. Antenna to EUT distance is 3 meters . During the test, the table is rotated 360 degrees to maximize emissions and the antenna is positioned from 1 to 4 meters above the ground screen to further maximize emissions. The antenna is polarized in both vertical and horizontal positions.

EUT test configuration is according to Section 8 of ANSI C63.4/1992.

Monitor the frequency range of interest at a fixed antenna height and EUT azimuth. Frequency span should be small enough to easily differentiate between broadcast stations and intermittent ambients. Rotate EUT 360 degrees to maximize emissions received from EUT. If emission increases by more than 1 dB, or if another emission appears that is greater by 1 dB, return to azimuth where maximum occurred and perform additional cable manipulation to further maximize received emission.

Move antenna up and down to further maximize suspected highest amplitude signal. If emission increased by 1 dB or more, or if another emission appears that is greater by 1dB or more, return to antenna height where maximum signal was observed and manipulate cables to produce highest emissions, noting frequency and amplitude.

10. AMBIENT CONDITIONS

The ambient conditions at the time of final tests were as follows:

	Radiated Emission	Conducted Emission
Temperature	**21**^{o}C	**N/A**
Humidity	**61%**	**N/A**

11. SYSTEM TEST CONFIGURATION

The equipment under test was configured and operated in a manner, which tended to maximize its emission characteristics in a typical application. Power and signal distribution, ground, interconnecting cabling and physical placement of equipment simulated the typical application and usage insofar as practicable.

SOFTWARE USED DURING THE TESTS	
Operating System	**WIN95 (DOS MODE)**
File Name	**XCTRL.EXE**
Program Sequence	Communicates with EUT through com1 or 2. Set power level, channel, and modulates carrier signal.

12. EQUIPMENT MODIFICATIONS

To achieve compliance for FCC PART 15/22 requirement, the following change(s) were made during compliance testing:

Mod.# 1 **N/A**

13. TEST EQUIPMENT LIST

Equipment	Manufacturer	Model No.	Serial No.	Site	Cal Date	Due Date
Spectrum Analyzer	**H.P.**	**8593EM**	**3710A00205**	**C**	**05/98**	**05/99**
Spectrum Analyzer	**H.P.**	**8546A**	**3520A00259**	**C**	**03/98**	**03/99**
Pre-Amp	**H.P.(P5)**	**8447D**	**2944A06550**	**C**	**09/98**	**10/99**
Antenna	**Eaton**	**94455-1**	**1214**	**C**	**09/98**	**10/99**
Antenna	**EMCO**	**3146**	**9107-3163**	**C**	**10/98**	**10/99**
Horn Antenna	**EMCO**	**3115**	**9001-3245**	**C**	**12/97**	**12/00**
Pre-Amp	**H.P. (1-26.5GHz)**	**8449B**	**3008A00369**	**C**	**04/98**	**04/99**

B) SUPPORT EQUIPMENT

Device Type	**Manufacturer**	**Model Number**	**Serial No.**	**FCC ID / DoC**
17" MONITOR	PACKAR BELL	1712SL	MEMN52300605	ACJ93312120
PC	COMPAQ	PRESARIO 2240	X803BTTD8802	DOC
KB	COMPAQ	N/A	B0AB30E39FUZ4M	AQ6-71Z15
MOUSE	COMPAQ	MUS9J-N	286231-001	EMJMUSJR
COMMUINCATION SET	H.P.	8920A	3339403248	N/A
POWER SUPPLY	PRECISION REGULATED POWER SUPPLY	N/A	N/A	N/A
DUAL DIRECTIONAL COUPLER	H.P.	778D	17086	N/A

14. EUT SETUP PHOTOS

FREQUENCY Vs VOLTAGE

MODULATION

15. TEST RESULT SUMMARY FOR PART 15

FCC PART 15 Radiated Emission Test was conducted by operating the configuration as indicated below.

AMPS CELLEMENTRY RADIO MODULE							
OATS No: C / 3 Meter		Data Report No. 980821C1		Date 8/21/98		Tested By: JUAN MARTINEZ	
Six Highest Radiated Emission Readings							
Frequency Range Investigated				30 MHz TO 1000 MHz			
Freq. (MHz)	Meter Reading (dBuV)	C.F. (dB/m)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Reading Type (P/Q/A)	Polar (H/V)
57.6	**39.2**	**-19.86**	**19.34**	**40.0**	**-20.66**	**P**	**V**
76.8	**42.9**	**-20.03**	**22.87**	**40.0**	**-17.13**	**P**	**V**
115.2	**42.9**	**-15.70**	**27.2**	**43.5**	**-16.30**	**P**	**V**
124.8	**40.6**	**-14.83**	**25.77**	**43.5**	**-17.73**	**P**	**V**
134.4	**41.0**	**-12.02**	**28.98**	**43.5**	**-14.52**	**P**	**V**
172.8	**38.3**	**-9.60**	**28.7**	**43.5**	**-14.80**	**P**	**V**

C.F.(Correction Factor)=Antenna Factor + Cable Loss-Amplifier Gain
Corrected Reading = Metering Reading + C.F. Margin = Corrected Reading - Limits
P= Peak Reading H= Horizontal Polarization/Antenna
Q= Quasi-peak V= Vertical Polarization/Antenna
A= Average Reading
Comments: N/A

16. TYPE ACCEPTANCE TEST RESULTS.

SECTION 2.985 RF POWER OUTPUT.

Test Equipment:
HP Spectrum Analyzer/8593EM
COMPAQ PC/Presario 2240
DC power supply
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

TEST SETUP:

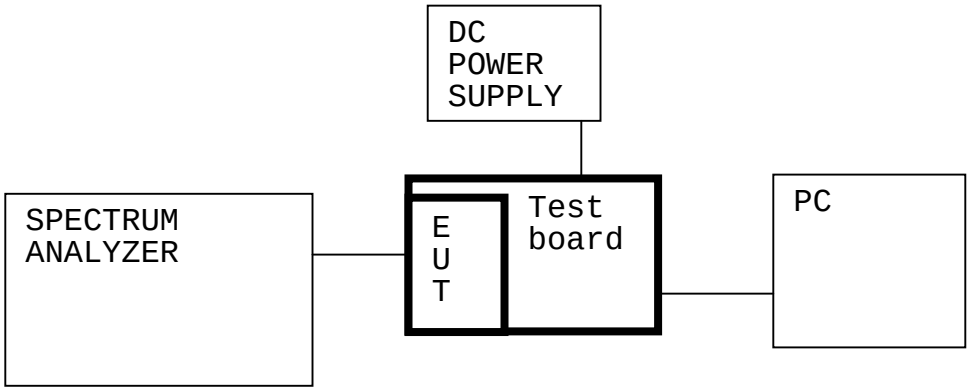


FIGURE 1.

Minimum requirement:
Section 22.913(a); Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

Test procedure:
Position the EUT as shown in figure 1. Turn on the EUT and connected the transmitter antenna output to spectrum analyzer using a low loss cable. RES b/w. was set to 100kHz and adjusted spectrum analyzer to center frequency at the highest amplitude appearing on spectral display. Then set spectrum analyzer frequency span to 20Mhz.

Test result:
Plots were made to show the power output for each level that the EUT can produce (from 0 to 7). 0 being the highest and 7 being the lowest output power. Table shows the order of plots.

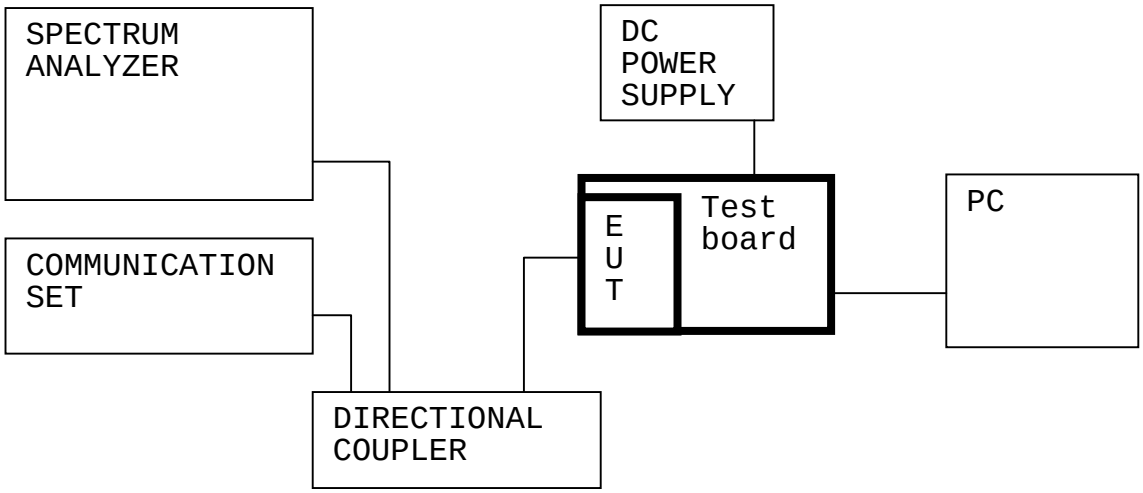
RF POWER OUPUT PLOTS	
POWER LEVELS	**PLOT NUMBER**
0 (27dBm)	**1**
1(27dBm)	**2**
2(27dBm)	**3**
3(24dBm)	**4**
4(20dBm)	**5**
5(16dBm)	**6**
6(12dBm)	**7**
7(9dBm)	**8**

SECTION 2.987 MODULATION CHARACTERISTICS

Test Equipment:

HP Spectrum Analyzer/8593EM
HP Communication set/8920A
HP Directional coupler/778D
COMPAQ PC/Presario 2240
DC power supply

Test setup



Minimum requirement:

Section 2.987 (d), for other type of equipment, a curve or equivalent data which shows that equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

Section 22.915 (b), the levels of the modulation signal must be set to the values specified as follows and must be maintained within ± 10 percent of those values:

4) The instantaneous frequency deviation resulting from wideband data signals must be ± 8kHz.

Test procedure:

For this device, only used control channels in AMPS band for transmitting data and no voice operation, the modulation characteristic is just measured with wideband data and it is not practical to input other external signals to this device, therefore frequency response measurement is no performed.

A) Modulation limit

1. Activated wideband data by computer program and recorded the deviation indicated on the communication set.

Test result:

1) Instantaneous frequency deviation resulting from wideband data:

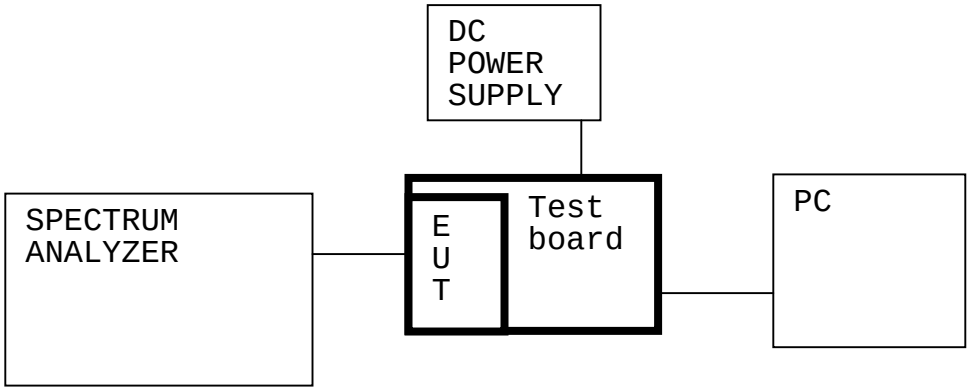
CHANNEL	FREQUENCY DEVIATION
340	**± 8.34 kHz**

SECTION 2.989 OCCUPIED BANDWIDTH

Test Equipment:

HP Spectrum Analyzer/8593EM
COMPAQ PC/Presario 2240
DC power supply
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

Test Setup:



Minimum Requirement:

Section 2.989(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.

22.905; all channels have a bandwidth of 40kHz.

Test procedure:

For this device, only use control channels in AMPS band for transmitting data and no voice operation, the occupied bandwidth is measured with wideband data, only.

Position the EUT as shown in the test setup. Turn on the EUT and set it to one convenient frequency within its operating range. Use the PC test program to produce the wideband data $\pm$ 8kHz deviation in the EUT and measured the frequency of the modulated signal from the EUT where it is 26 below the peak power of frequency. This the occupied bandwidth specified.

Test Result:

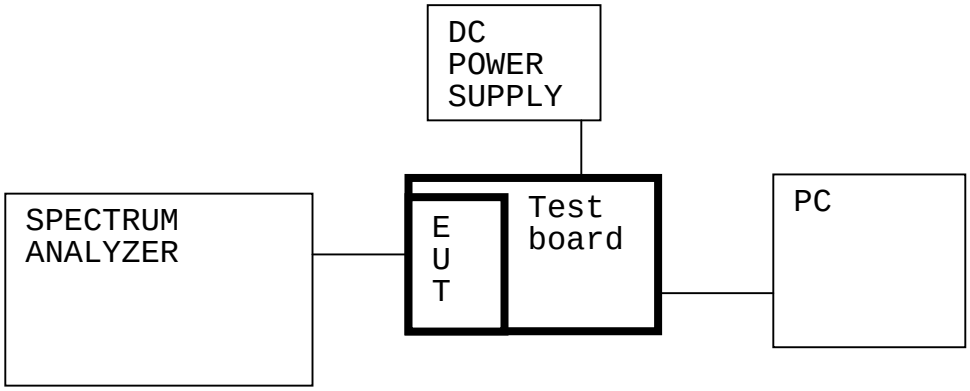
Refer to Spectrum Plots attached #9 and #10.

22.917 EMISSION LIMITATIONS FOR CELLULAR.

Test Equipment:

HP Spectrum Analyzer/8593EM
COMPAQ PC/Presario 2240
DC power supply
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

Test Setup:



Minimum Requirement:

22.917 (d) FD1 emission mask; FD1 emissions, the mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) as follows:

1) On any frequency removed from the carrier frequency by more than 20kHz, but no more than 45kHz: at least 26dB.
2) On any frequency removed from the carrier frequency by more than 45kHz, but no more than 90kHz: at least 45dB.
3) On any frequency removed from the carrier frequency by more than 90kHz, up to the first multiple of the carrier frequency: at least 60dB or 43 + log(P) dB, whichever is the lesser attenuation.

Measurement procedure:

Set resolution bandwidth of spectrum analyzer as follows:

1) When operating in the wideband data mode of the signaling tone mode:

a) for any emissions not more than 60kHz removed from the carrier: 300Hz;

b) for any emissions more than 60kHz removed from the carrier: 30kHz.

Test result:

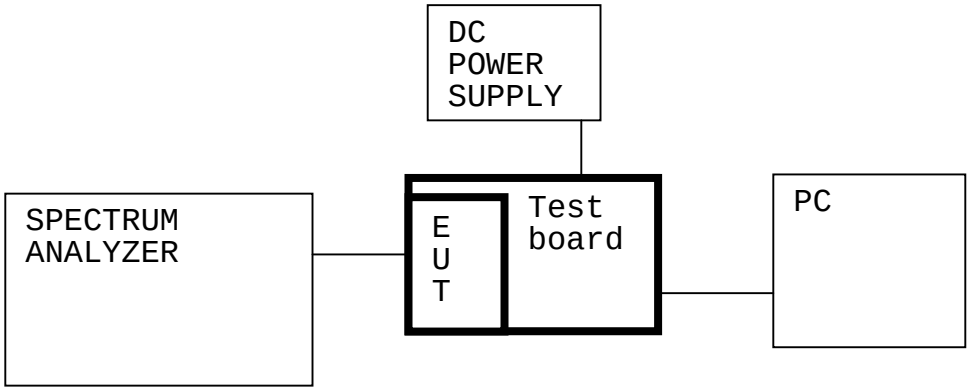
Refer to spectrum plots attached #11, 12, 13, 14,15, and 16.

SECTION 2.991 SPURIOUS EMISSION AT ANTENNA TERMINALS

Test Equipment:

HP Spectrum Analyzer/8593EM
COMPAQ PC/Presario 2240
DC power supply
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

Test Setup:



Minimum Requirement:

The magnitude of each spurious and harmonic emissions that can be detected when the equipment is operated under conditions specified in the instruction manual and/or alignment procedure, shall not be more than 43 + log(mean output power) dBc below the mean power output, which is equivalent to –13 dBm.

Test Result:

Refer to spectrum plots attached. Plots were made for modulated and unmodulated signal from 5MHz to 10^{th} harmonic of the carrier frequency. Table shows the order of plots.

OUT OF BAND	
MODULATED SIGNAL	
MODULATION TYPE: WIDEBAND	
FREQUENCY RANGE	**PLOT NUMBER**
5 MHz TO 1GHz	**16**
1GHz TO 2.921MHz	**17**
2.679GHz TO 8.4GHz	**18**
UNMODULATED SIGNAL	
FREQUENCY RANGE	**PLOT NUMBER**
5 MHz TO 1GHz	**19**
1GHz TO 2.921MHz	**20**
2.679GHz TO 8.4GHz	**21**

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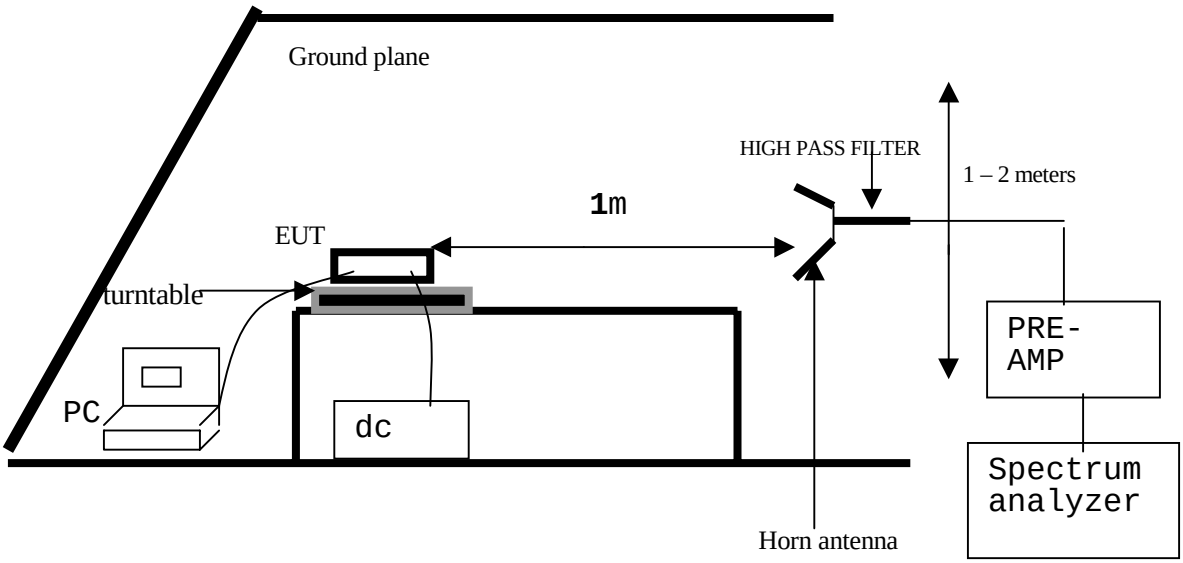
SECTION 2.993 FIELD STRENGTH OF SPURIOUS RADIATION.

Measurement Equipment Used:

Emco Horn Antenna/3146
HP Pre-Amp (1 – 26.5 GHz)/8449B
HP Spectrum Analyzer/8593EM
FSY High Pass Filter(1.802GHz)/001
FLEXCO cable/20761; 19ft. coaxial cable (loss: .9dB/ft @ 26GHz)

Test setup



Radiated Emissions Configuration

Minimum Requirement:

The magnitude of each spurious and harmonic emissions detected as being radiated from the EUT must be at a level no more than 43 + 10 log(mean output power, watts) dB below the mean power output (-13dBm).

Resultant radiated field at 3 meters from –13dBm source feeding isotropic antenna: 82 dBuV/m.

Test procedure:

EUT antenna output was terminated with a 50-ohm terminator. The EUT was placed on a wooden table on the outdoor ground plane. The search antenna was placed 3 ft from the EUT. With the transmitter operating at full power the turntable was slowly rotated to locate the direction of maximum emission once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

Test Result:

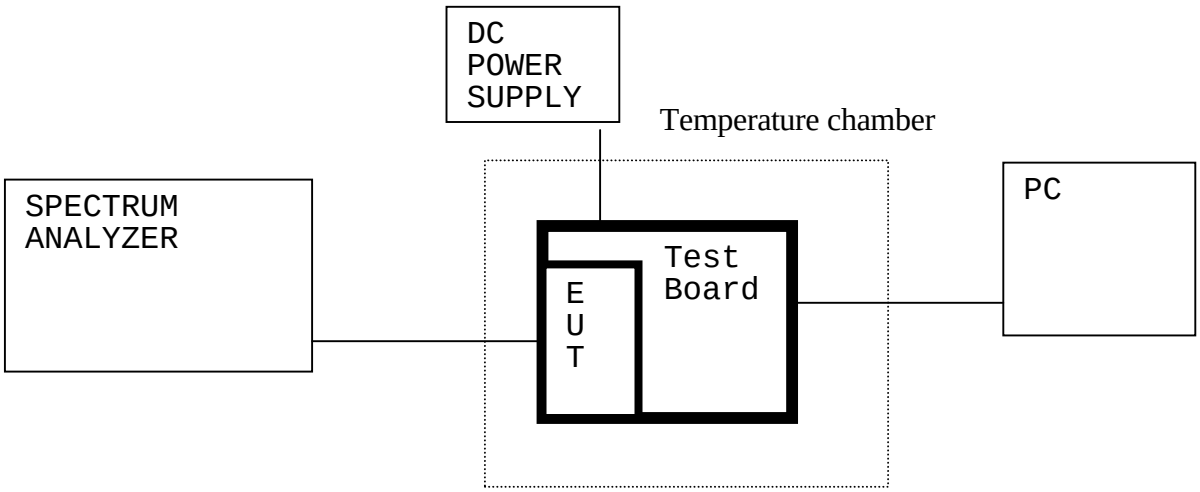
The maximum readings so obtained are recorded in a spreadsheet attached.

SECTION 2.995 (1) FREQUENCY VS. TEMPERATURE
SECTION 22.355 FREQUENCY TOLERANCE.

Test Equipment:

HP Spectrum Analyzer/8593EM
FLEXCO cable; 1ft. coaxial cable (loss: .9dB/ft @ 26GHz)
Wyse PC/Presario 2240
DC power supply

Test Setup:



Minimum Requirement:

Mobile $\leq$ 3 Watts, 821 – 896 MHz: 2.5ppm

Test Procedure:

Temperature: Vary the ambient temperature from –30 to + 50°C, in 10 degrees increments, allowing the EUT to stabilize at each temperature.

Test Result:

Tx Output: 835.199820 2.5ppm: $\pm$ 2088Hz

Temp°C	F(MHz)	Delta (Hz)
+50	835.199443	-377
+40	835.199358	-462
+30	835.199495	-325
+20	835.199720	-100
+10	835.200058	+760
0	835.200133	+313
-10	835.200007	+187
-20	835.199445	-375

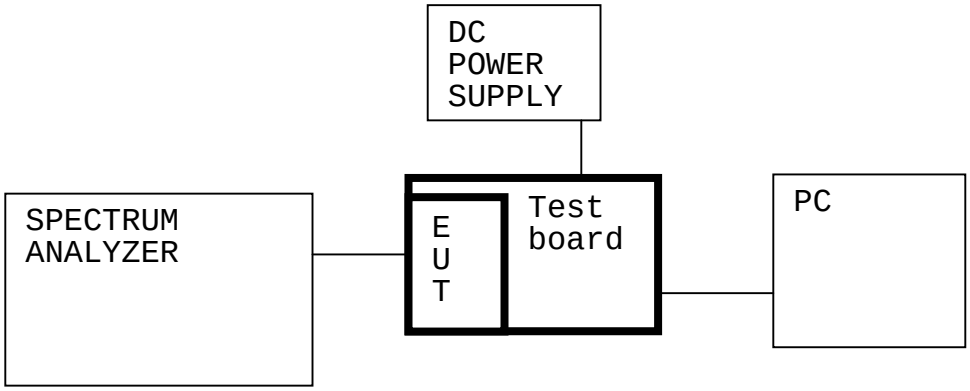
Note: Transmitter stop functioning properly below -24°C. Data was taken from –20 to +50°C, only.

SECTION 2.995 (D) FREQUENCY VS. VOLTAGE
SECTION 22.355 FREQUENCY TOLERANCE.

Test Equipment:

HP Spectrum Analyzer/8593EM
COMPAQ PC/Presario 2240
DC power supply
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

Test Setup:



Minimum Requirement:

Mobile ≤ 3 Watts, 821 – 896 MHz: 2.5ppm

Test procedure:
Primary Supply Voltage: Vary the supply Voltage from 85% to 115% of the nominal operating voltage. Set power supply to 8Vdc(test board, that is use to run the EUT, requires a minimum of 8Vdc). EUT requires 5Vdc, only.

Temperature was 21°C and humidity 50% when test was performed.

Test Result:

Tx output: 835.199505 2.5ppm: ± 2088 Hz

85% Supply: 835.199475
6.8Vdc

115% Supply: 835.199465
9.2Vdc

17. SEC. 22.919 ELECTRONIC SERIAL NUMBERS.

The module is used to provide a wireless telemetry solution over the existing circuit-switched AMPS Cellular network. The ESN is used to convey data between module and device located at MTSO. Cellular phone operator specially assigns the ESNs of module and their contents are different from normal cellular phone. Phone with this special ESNs can not make and receive calls as normal one do.

18. SEC 2.1091 RADIOFREQUENCY RADIATION EXPOSURE EVALUATION: MOBILE DEVICES.

b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term ``fixed location'' means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimeter separation requirement.

d) The limits to be used for evaluation are specified in Sec. 1.1310 of this chapter.

(3) If appropriate, compliance with exposure guidelines for devices in this section can be accomplished by the use of warning labels and by providing users with information concerning minimum separation distances from transmitting structures and proper installation of antennas.

(4) In some cases, e.g., modular or desktop transmitters, the potential conditions of use of a device may not allow easy classification of that device as either mobile or portable (also see Sec. 2.1093). In such cases, applicants are responsible for determining minimum distances for compliance for the intended use and installation of the device based on evaluation of either specific absorption rate (SAR), field strength or power density, whichever is most appropriate.

§ 1.1310 Radiofrequency radiation ex-posure

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field Strength (V/m)	Magnetic field Strength (A/m)	Power density (mW/cm 2)	Averaging time (minutes)
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f 2)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

Comment regarding EUT: (Regarding antenna proximity to humans): This would depend on the particular application design using the particular module. All are machine status monitoring – no applications of any sort are contemplated where the device would be “body worn”. The location of the antenna for GPS would be mounted outside of the vehicle, in much the same way a normal cellular antenna would be. For many of the electric-utility industry needs, the device and antenna will be pole mounted, above the reach of vandals. For the office applications, antennas might be mounted on the top of beverage or snack vending machines, or behind copiers. Each individual application applying to FCC Type acceptance will contain information

as to the typical installation for human susceptibility analysis. The antenna will be typically be 0dBi (quarter-wave whip) type, with an SMA male connector attached directly to the module. In some desings, short lengths of coax may be connected between the antenna connector of the module and the antenna.

Test result:
ALTERNATE MEASUREMENT METHOD:

TABLE 1 (B) LIMITS FOR GENERAL POPULATION/UNCONTROLLED EXPOSURE

F(MHz)	**(POWER DENSITY (mW/cm^2)**
300 – 1500	f / 1500

Calculation:

835 / 1500 = .556 mW/cm^2

$P = E^2 / 3770$

$\sqrt{E^2} = \sqrt{.556 mW/cm^2 * 3770}$

$E = 45.78$ v/m

$$E = \frac{\sqrt{30 * P * G}}{D}$$

$$D = \frac{\sqrt{30 * .55 * 2}}{45.78}$$

D = .125m or D = 1.25cm

A distance of 1.25cm was calculated, showing that it meets the 20-centimeter separation requirement.

19. SEC. 2.202 BANDWIDTHS.

(b**) Necessary bandwidth**. For a given class of emission, the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed, under specified conditions. Emissions useful for the good functioning of the receiving equipment as, for example, the emission corresponding to the carrier of reduced carrier systems, shall be included in the necessary bandwidth.

III–A. FREQUENCY MODULATION

1. Signal With Quantized or Digital Information

3. Sound Broadcasting

Description of emission	Formula
Sound broadcasting	Bn=2M+2DK, K=1 (typically

Necessary bandwidth calculation:

Bn=2M+2DK

Bn = Necessary bandwidth in hertz
B = Modulation rate in bauds
D = Peak frequency deviation, i.e., half the difference between the maximum and minimum values of the instantaneous frequency. The instantaneous frequency in hertz is the time rate of change in phase in radians divided by 2.

Bn = 2(10) + 2 (8) (1)

Bn = 36khZ

Emission Designator: 36K0FD1

20. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION

CABLE NO:1	
I/O Port: : Mouse	Number of I/O ports of this type:1
Number of Conductors: 6	**Connector Type: PS/2**
Capture Type: PUSH-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: MOLDED	**Cable Length: 2M**
Bundled During Tests: NO	**Data Traffic Generated: YES**
Remark: N/A	

CABLE NO: 2	
I/O Port:: KB	Number of I/O ports of this type:1
Number of Conductors: 6	**Connector Type: PS/2**
Capture Type: PUSH-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: MOLDED	**Cable Length:2.0M**
Bundled During Tests: NO	**Data Traffic Generated: YES**
Remark: N/A	

CABLE NO: 3	
I/O Port: PRINTER	Number of I/O ports of this type:1
Number of Conductors: 25	**Connector Type: DB25**
Capture Type: SCREW-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: METAL	**Cable Length: 2.5M**
Bundled During Tests: YES	**Data Traffic Generated: NO**
Remark: N/A	

CABLE NO: 4	
I/O Port: DC INPUT TO EUT	Number of I/O ports of this type:1
Number of Conductors: 2	**Connector Type: 5.0mm DC PLUG**
Capture Type: PUSH-IN	**Type of Cable used: UNSHIELDED**
Cable Connector Type: METAL	**Cable Length:1.5M**
Bundled During Tests: NO	**Data Traffic Generated: NO**
Remark: N/A	

CABLE NO: 5	
I/O Port: SERIAL PORT (COM 1 OR 2)	Number of I/O ports of this type:1
Number of Conductors: 9	**Connector Type: DB9**
Capture Type: SCREW-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: MOLDED	**Cable Length: 4M**
Bundled During Tests: YES	**Data Traffic Generated: YES**
Remark: N/A	
CABLE NO: 6	
I/O Port: VGA	Number of I/O ports of this type:1
Number of Conductors: 14	**Connector Type: D-SUB 15**
Capture Type: SCREW-IN	**Type of Cable used: SHIELDED**

Cable Connector Type: MOLDED	**Cable Length: 1.5M**
Bundled During Tests: YES	**Data Traffic Generated: YES**
Remark: FERRITES AT BOTH ENDS OF CABLE.	

21. CONFIGURATION BLOCK DIAGRAM