

# DNB ENGINEERING, INC.

<p><b>CERTIFICATION FOR INTENTIONAL RADIATOR</b></p>
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per  
Part 15 Subpart C  
(CFR 47, 15.203, 15.231 & 15.209)

**EUT: Security Transmitter Module**  
Model No. M/N 237131-056

PREPARED FOR APPLICANT:  
**Fujitsu Ten Corp. of America**  
19600 S. Vermont  
Torrance, CA 90502

REPORT #96064-1  
Test Date: Feb. 23-24, 1999

Prepared By:  
DNB ENGINEERING, INC.  
1100 East Chalk Creek Rd.  
Coalville, Utah 84017  
Tel: 1(435) 336-4433

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**TRANSMITTAL SUMMARY**

Unit tested: Security Transmitter Module  
Model #: M/N 237131-056  
FCC ID: BAB237131-056

Specifications: ANSI C63.4 (1992) and CFR 47 FCC part 15 Subpart C

Purpose of Report: This report was prepared to document the status of the Security Transmitter Module M/N 237131-056 with requirements of the standards listed above.

Requirements not applicable to EUT Part 15.37 - Not applicable  
Emergency Broadcast System - Not applicable  
Spread Spectrum Exhibit - Not applicable  
Scanning Receiver - Not applicable

Test Summary The EUT's compliance status according to the tests performed is as follows.

REQUIREMENTS	STATUS
FCC part 15 Subpart C per 15.203, 15.231 & 15.209	COMPLIANT

The report shall not be reproduced, except in full, without the written approval of DNB ENGINEERING, INC. Results contained in this report relate only to the item tested.

**CERTIFICATION OF TEST DATA - per 2.911(d)**

This report, containing emissions test data and evaluations, has been prepared by an independent electromagnetic compatibility laboratory, DNB ENGINEERING, in accordance with the applicable specifications and instructions required per the Introduction. DNB Engineering has been evaluated to do these tests by the American Association for Laboratory Accreditation, A2LA.



The data evaluation and equipment configuration presented herein are a true and accurate representation of the measurements of the test emissions characteristics as of the dates and at the times of the test under the conditions herein specified.

Equipment Tested: Security Transmitter Module  
Model #: M/N 237131-056  
FCC ID#: BAB237131-056  
Dates of Test: Feb. 23-24, 1999

Test Performed: \_\_\_\_\_  
Yancey Staples  
Test Technician  
Date

Test Report Reviewed: \_\_\_\_\_  
Rick Linford  
Facility Manager  
Regulatory Engineer  
Date

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## 1. INTRODUCTION

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### 1.1 Administrative Data Per 2.1033(a) and 2.911(c)

#### 1.1.1 REQUEST FOR CERTIFICATION Per 2.1033(b)1:

Applicant: **Fujitsu Ten Corp. of America**  
19600 S. Vermont  
Torrance, CA 90502

Contact: Mark Kubota  
(310)327-2151

Dates of Test: Feb. 23-24, 1999

Equipment Under Test (EUT): Security Transmitter Module M/N 237131-056  
**FCC ID:** BAB237131-056

### 1.2 Related Submittals/Grants

All Peripherals possess grants.

### 1.3 Purpose of Tests

The purpose of this series of tests was to demonstrate the Electromagnetic Compatibility (EMC) characteristics of the EUT. The following tests were performed:

REQUIREMENTS	STATUS
FCC part 15 Subpart C per 15.231 & 15.209	COMPLIANT

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## 2. TEST DESCRIPTION

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### 2.1 Test Configuration

Config-uration	Unit Name - Processor, Monitor, Printer, Cable, etc. (indent for features of a unit)	Style/Model/ Part No.	Serial Number	Obj. of test	Comments/ FCC ID#
A	Security Transmitter Module	M/N 237131-056		■	BAB237131-056

■ - Specific device(s) for which this test is being conducted.

### 2.2 Equipment Description

The Transmitter Module is one component of a vehicle theft deterrent system. It transmits a high frequency digitally encoded signal. Transmission is started manually and will automatically stop after 60 seconds even if the button is held down. The enclosure is plastic and may have a varying number of buttons.

#### 2.2.1 Mode of Operation

The Transmitter Module was tested in vertical and horizontal positions and laying flat on the table to find the worst case emissions. The vertical position was found to allow the highest emissions relative to the limit and was used for final testing of the transmitter.

### 2.3 Antenna Requirement - per 15.203

The antenna is an internal loop antenna etched on the PCB. It is fixed and non-removable.

### 2.4 Circuit Description - per 2.1033(b)4

The Transmitter Module circuitry consists of an encrypted data encoder circuit, oscillator/modulator circuit, RF power amplifier circuit and a DC power supply circuit. It transmits a high frequency digitally encoded signal. The combination of encoded data has  $2^{40}$  variations.

The transmitter transmits a signal by manual operation and will automatically stop transmitting even if the button is held down.

When the transmitter button is pushed, the IC1 ( $\mu$  PD754144GS) will initiate the EEPROM, that is built-in to the IC1, and read-out a transmitting code from the oscillator/modulator circuit. This will also simultaneously supply power through the DC power supply circuit to the oscillator/modulator circuit as well as the RF amplifier circuit. The integrated transistor Q2 (FH102-1/2) consists of a direct oscillation circuit, which uses a SAW resonator. Q2 is modulated by serial data from IC1. Q2 (FH102-2/2), which consists of an RF amplifier circuit, amplifies the oscillator/modulator and also transmits using the antenna connected to the collector on PC board.

The PC board is built into the molded plastic case and houses a lithium battery (DC 3.0V). Also, the transmitting antenna is etched into the PC board and constitutes part of the PC board pattern.

The enclosure has optional pushbuttons to allow different configurations (one to four button models). All shielding, power supply and data buffering are contained on PCB assembly.



## **2.5 Schematics and Internal Block Diagram**

*Security Transmitter Module M/N 237131-056*

*PDF File. See the attachment that was electronically submitted.*

## **2.6 Photographs of EUT - per 2.1033(b)(7)**

**EUT:** Security Transmitter Module M/N 237131-056

*PDF File. See the attachment that was electronically submitted.*

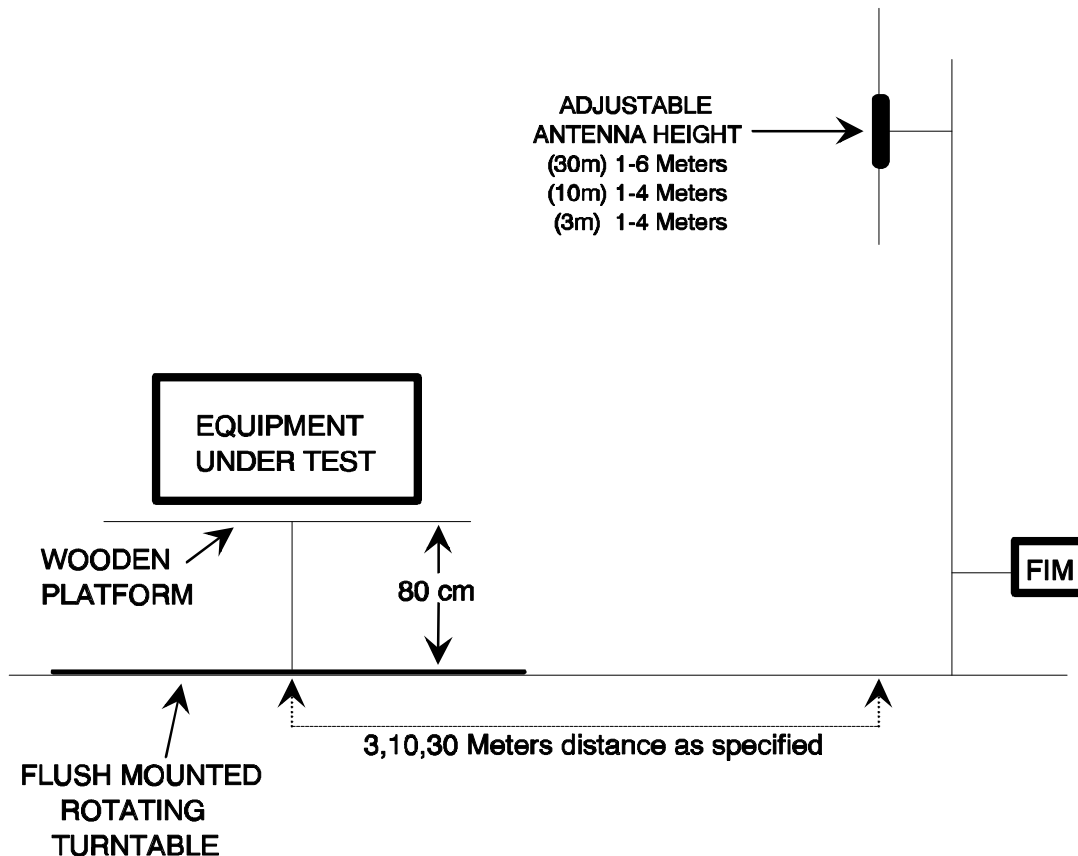
### 3. EMISSIONS FCC PART 15

per FCC part 15 Subpart C

#### 3.1 Radiated Emissions Test Setup and Procedure - Per 2.1033(b)(6) Per 2.947(a)

The EUT was placed on a wooden table 1 meter wide and 1.5 meters long which rests on a flush mounted, steel-top turntable on the open area test site as shown in Section 3.1.1.1. The top of the table is 80 cm above the ground plane. The turntable can be rotated 360 degrees. Measuring antenna is set at the prescribed distance. Measurements are made with broad band antennas that have been correlated with tuned dipole antennas. The mast is 4.5 meters high and is self-supporting. The height of the antenna can be varied from 1 to 4 meters. Positioning of the antenna is controlled remotely.

##### 3.1.1 Spurious Radiation Test Site Per 2.1033(b)6



***Radiated Test Setup and Procedure - cont'd***

The EUT is put into the operational test mode as stated in Section 2.2.1 is then started.

The spectrum analyzer is setup to store the peak emission over the band of the antenna. Peak EUT and ambient emissions are stored while the turntable is rotated 360°. Peak spectrum analyzer trace is then plotted with the addition of antenna and cable correction factors. The limit is plotted on the same graph. A receiver with CISPR Quasi Peak capabilities is then used on the frequencies identified as the highest with respect to the plotted limit. Ambients are noted on the graph along with EUT emissions. The highest EUT frequencies, with respect to the limit, are maximized.

To maximize emissions levels, the turntable is rotated and the antenna is raised and lowered to determine the point of maximum emanations. The cables are then manipulated at that point to maximize emissions. Measurements are made with the antennas in each horizontal and vertical polarization separately. The data obtained from these tests is corrected with the proper cable, preamplifier and antenna factors. The results are then transcribed onto tables that show the maximum emission levels. The highest emissions are listed in a Radiated Emissions Summary table.

If no emissions can be found, the lowest harmonics of the EUT clocks within the bands of the standard are tuned into with the receiver. If no emissions are found, the noise floor will be entered into the table and noted. A minimum of six frequencies will be logged. Summary results will reflect only actual emissions from the EUT.

***Radiated Test Setup and Procedure - cont'd***

The field intensity measurements are made using standard techniques with a spectrum analyzer or EMI receiver as the calibrated Field Intensity Meter (FIM). Preamplifiers and filters are used when required.

When using the Hewlett Packard Model 8568B Spectrum Analyzer as the FIM, the Analyzer is calibrated to read signal level in dBm. Where:

$$0 \text{ dBm (50 ohms)} = 107 \text{ dBuV (50 ohms)}$$

The signal level (dBuV) = indicated signal level (dBm) + 107 dB. To obtain the signal level in dBuV/m it is necessary to add the antenna factor in dB.

**3.1.2 Example Of Typical Calculation Per 2.1033(b)6**

Measurement Distance = 3 Meter				
Rohde and Schwarz reading @ 60 MHz	_____	49.0	dBuV	
Antenna Factor	+7.5	dBuV		
Cable Loss	+2.0	dBuV		
Preamplifier	-25.5	dBuV		
	_____	-16.0	dBuV	
Field Strength dBuV/m at 3 Meter =	_____	33.0	dBuV	

***The Following FCC limits for acceptance were used:***

***Limit 902 to 928 MHz (At the Carrier Frequency):***

$$50,000 \text{ mV/M} = 20 \log (50,000) \text{ dBmV/M} = 94.0 \text{ dBmV/M @ 3 Meters}$$

***Limit 88 to 216 MHz (Not at the Carrier Frequency):***

$$150 \text{ mV/M} = 20 \log (150) \text{ dBmV/M} = 43.5 \text{ dBmV/M @ 3 Meters}$$

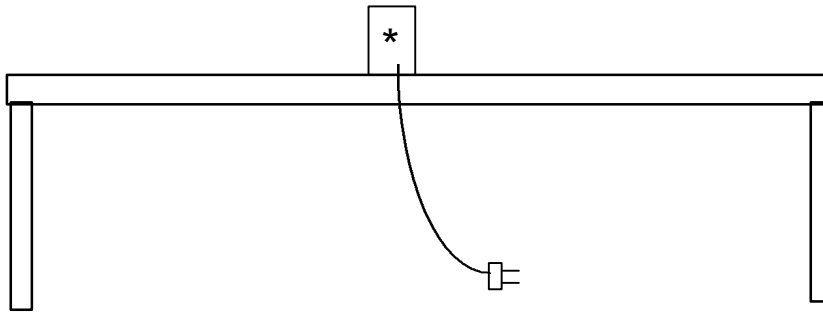
***Limit 30 to 88 MHz:***

$$100 \text{ mV/M} = 20 \log (100) \text{ dBmV/M} = 40.0 \text{ dBmV/M @ 3 Meters}$$

***Limit >960 Mhz:***

$$500 \text{ mV/M} = 20 \log (500) \text{ dBmV/M} = 54.0 \text{ dBmV/M @ 3 Meters}$$

3.1.3 *Diagram of Test Setup - per 2.1033(b)5*



\* - OBJECT OF TEST Vertical

### 3.1.4 Field Strength of Intentional Radiator Inside of Band

The EUT was compliant with CFR 47, 15.231(b) field strength of intentional radiator.

#### Radiated Emissions – Fundamental Frequency Summary Test Data per FCC part 15, Subpart C (15.231) at 3 meters

<b>Fujitsu Ten Corp. of America EUT: Security Transmitter Module M/N 237131-056</b>					
<b>Transmitter Field Strength</b>					
		Frequency MHz	Corrected Measurement (dBuV/m)	Limit (dBuV/m)	Delta (dB)
	<b>VERTICAL</b>	<b>303.88</b>	66.7	74.9	<b>-8.2</b>

<b>Fujitsu Ten Corp. of America EUT: Security Transmitter Module M/N 237131-056</b>					
<b>Transmitter Field Strength</b>					
		Frequency MHz	Corrected Measurement (dBuV/m)	Limit (dBuV/m)	Delta (dB)
	<b>HORIZONTAL</b>	<b>303.88</b>	62.7	74.9	<b>-12.2</b>

- Six highest frequencies relative to the Limit.
- Reference Appendix A for all data taken.
- All measurements are Average. See attached PDF File showing 50% on during 100 ms time = 6 dB correction from peak.

### 3.1.5 Emissions Radiated - Spurious

The EUT was compliant with CFR 47, 15.231(b) radiated emissions requirements.

*Radiated Emissions Spurious Summary Test Data*  
*per FCC part 15, Subpart C (15.231) at 3 meters*

**Table 3.1.5(1)**

Fujitsu Ten Corp. of America		EUT: Security Transmitter Module M/N 237131-056						
Freq. (MHz)	Meas'd (dBuV)	Amp Factors (dB)	Cable Factors (dB)	Antenna Factors (dB)	Total Factors (dB)	Corrected signal (dBuV/m)	Limit (dBuV/m)	Delta (dB)
<b>2431.00</b>	46.0	27.5	3.8	28.9	5.2	<b>51.2</b>	54.9	<b>-3.7</b>
<b>2735.00</b>	40.9	27.7	4.1	29.6	6.0	<b>46.9</b>	54.9	<b>-8.0</b>
<b>1823.39</b>	39.2	26.5	3.4	27.4	4.3	<b>43.5</b>	54.9	<b>-11.4</b>
<b>1215.58</b>	38.6	23.8	3.0	24.1	3.3	<b>41.9</b>	54.9	<b>-13.0</b>
<b>2127.28</b>	33.8	26.9	3.6	28.7	5.4	<b>39.2</b>	54.9	<b>-15.7</b>
<b>911.65</b>	27.8	26.4	9.8	23.0	6.4	<b>34.2</b>	54.9	<b>-20.7</b>

- Six highest frequencies relative to the Limit.
- Reference Appendix A for all data taken.
- All measurements are Average. See attached PDF File showing 50% on during 100 ms time = 6 dB correction from peak.



#### 4. OCCUPIED BANDWIDTH

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*The occupied bandwidth at the transceiver's fundamental frequency output was measured using a HP8568B spectrum analyzer*

*The spectrum analyzer was adjusted as follows:*

*Frequency: 303.89 MHz  
Input Attenuation: 0.0 dB  
Scan Width: 1.0 MHz  
Vertical Scale: 5 dB/div*

*Resolution Bandwidth: 10 kHz  
Reference Level: 74.2 dBuV  
Detector: Peak*

*PDF File. See the attached plot that was electronically submitted.*

4.1.1 *Photograph of Radiated Test Setup - per 2.1033(b)(7)*

**EUT:** Security Transmitter Module M/N 237131-056

*PDF File. See the attachment that was electronically submitted.*

## 5. LABELING REQUIREMENTS - PER 2.1033(B)(7)

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Label will be constructed of 0.02 inch plastic attached as shown on the equipment with permanent adhesive.

All information on the label will be etched or screened. All methods will exceed the expected lifetime of the equipment.

The label will be large enough to allow all information to be readily legible.

### 5.1 Additional Label Required

*This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.*

*Shown above is a copy of the label with the Part 15.19 Compliance Statement, Location of required information is checked "below".*

- The label will be placed in a conspicuous location on the device.*
- The device is too small for a compliance label. Therefore the label will be placed in a prominent location in the Instruction Manual or other information supplied to the user.*
- The device is too small for a compliance label. The label will be placed on the container in which the device will be marketed.*

### 5.2 Photograph of Label

*Placement of label on device, Contents of label*

*PDF File. See the attachment that was electronically submitted.*

## 6. OWNERS MANUAL

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*PDF File. See the attachment that was electronically submitted.*

## **7. APPENDIX SECTION**

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## ***7.1 APPENDIX A: TEST DATA***

### **1.0 GHz to 10.0 GHz Emissions**

Using an HP8566B, a HP low noise preamplifier and a high frequency antenna, signals between 1.0 GHz and 10 GHz were analyzed. The Spectrum Analyzer settings were as follows:

Resolution Bandwidth ..... 1.0 MHz  
Video Bandwidth ..... 1.0 MHz  
Sweep Time ..... 450 ms

Average measurements were made by taking peak reading & subtracting 6 dB. The on time over a 100 ms time was measured at 50 ms ( $6 \text{ dB} = 20 \cdot \text{Log} [50/100]$ )

## ***7.2 APPENDIX B: UNCERTAINTY TOLERANCE***

## ***UNCERTAINTY TOLERANCE***

DNB Engineering's Utah Facility is within acceptable uncertainty tolerances per ANSI C63.4 (1992) sections 5.4.6.1 and 5.4.6.2 as well as CISPR 16-1(1993) Annex M, section M.2.

### **ANSI C63.4 (1992)**

5.4.6.1 Site Attenuation. A measurement site shall be considered acceptable for radiated electromagnetic field measurements if the horizontal and vertical NSA derived from measurements, i.e., the "measured NSA," are within  $\pm 4$  dB of the theoretical NSA (5.4.6.3) for an ideal site.

5.4.6.1 NSA Tolerance. The  $\pm 4$  dB tolerance in 5.4.6.1 includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies. These errors are analyzed in ANSI C63.6-1988 [3], wherein it is shown that the performance of a well-built site contributes only 1 dB of the total allowable tolerance.

### **CISPR 16-1 (1993)**

#### M.2 Error analysis

. . . The total estimated errors are the basis for the  $\pm 4$  dB site acceptability criterion consisting of approximately 3 dB measurement uncertainty and an additional allowable 1 dB for site imperfections.



***7.3 APPENDIX C: TEST SITE CERTIFICATION, CHALK  
CREEK EMI SITE - per 2.948(a)***

## SITE CHARACTERISTICS, CHALK CREEK EMI TEST SITE

### General:

The DNB Engineering test facility is located in Chalk Creek Canyon near Coalville, Utah. Site characteristics were measured according to the procedures outlined in ANSI C63.4 (1992) "Characteristics of Open Field Test Site". The results of these characterizations indicate that the Chalk Creek site is an outstanding facility to perform accurate and repeatable EMI tests.

This facility has been FCC approved to perform class B certification testing since January, 1986. In October of 1996, according to the FCC requirement to re-apply every three years, the facility was recertified. Certification was granted for the 3, 10, and 30 meter positions for both ranges. Facility approval was granted by the FCC Oct. 15, 1996 under file number 31040/PRV 1300F2.

In July of 1997, **The American Association for Laboratory Accreditation, A2LA**, granted accreditation to this facility. Standards for which accreditation was granted: RF Emissions: ANSI C63.4 - 1992, FCC Part 15 subpart B and C, FCC Part 18 CISPR 11, CISPR 13, CISPR 14, CISPR 22, EN 55011, EN 55013, EN 55014, EN 55022, EN 60601-1-2, EN 50081-1, EN 50081-2, IEC 601-1-2; RF Immunity: EN 50082-1, EN 50082-2, Radiated Susceptibility: EN 61000-4-3, ENV 50140, ENV 50204, IEC 1000-4-3, IEC 801-3, ESD: EN 61000-4-2, IEC 1000-4-2, IEC 801-2, EFT: EN 61000-4-4, IEC 1000-4-4, IEC 801-4, Surge: EN 61000-4-5, ENV 50142, IEC 1000-4-5, IEC 801-5, Injected RF Immunity: EN 61000-4-6, ENV 50141, IEC 1000-4-6, IEC 801-6

In September, 1994 the National Certified Testing/Competent/ Notified Body for Norway and Scandinavian Countries (NEMKO) approved this test facility. DNB now offers the testing required for the CE Mark. **NEMKO EMC Laboratory Authorization No.: ELA 131** Standards for which accreditation was granted: RF Emission: EN 55011, EN 55022, EN 50081-1, EN 50081-2; RF Immunity: EN 50082-1, EN 50082-2

In September, 1994, the New Zealand Ministry of Commerce certified that DNB ENGINEERING, INC. EMC facilities meet their laboratory approval criteria for EMC testing and placed DNB ENGINEERING on their list of Ministry-Approved laboratories.

In August, 1995, VCCI certified that the Chalk Creek facility was acceptable to perform EMI test according to VCCI requirements. The certificate number is 715.

### Ambient Emissions

Ambient emission measurements were made to determine the level of the ambient emanations at the DNB test facility. The results indicate that all ambient signals are below the FCC, and VCCI radiated emission limits or that each can easily be identified as an ambient signal.

## ***7.4 APPENDIX D: EMC INSTRUMENTATION AND MEASUREMENT EQUIPMENT***

All test equipment are calibrated by a certified metrology facility using standards traceable to NIST.

Each instrument is calibrated annually or more frequently if required.

*Test Equipment for Emissions*

Description	Manufacturer	Model	Serial	Cal. Due
Antenna Mast, site 2 (30m)	AH Systems	AMSC-6	2159-4C	
Plotter	HP	7475A	2517A20261	
Printer	HP	2671G	2520A31080	
PRE Amp (30m)	HP	8447D	2727A06182	3/1/2000
PRE Amp (3,10m)	HP	8447D	2727A06180	6/17/99
CISPR Adapter site 2	HP	85650A	2043A00277	9/25/99
Computer desk top site 1	HP	9826A	2439A09175	
Spectrum Analyzer site 2	HP	8568B	1721A00113	9/23/99
Receiver site 2	R&S	ESH3	872842/045	5/13/99
Receiver site 2	R&S	ESVP	882402/005	10/23/99
Spectrum Monitor site 2	R&S site 1	EZM(3)	880 087/038	
Log Periodic Antenna site 2	SCH	UHAL09107	91071004(L10)	7/24/99
Biconical Antenna site 2	SCH	BBA9106	11	7/20/99
LISN	SCH	NSLK 8126	142	11/6/99
LISN	SCH	NNLA 8120	301	11/6/99
Bicon Antenna	AH SYS	SAS-200/543	183	7/20/99
Log Periodic Antenna	AH SYS	SAS-200/512	322	7/24/99
Horn Antenna, Double Rdg Gd	AH SYS	SAS-200/571	222	6/24/99
Horn Antenna	AR	AT4000	10801	
Antenna Mast, site 1(30m outside)	DNB	2159-2	AMS6	
Antenna Mast, site 1(10m inside)	EMCO 1	1050*	1236a	
Antenna Mast, site 1(3m inside)	EMCO1	1050*	1236b	
Printer	HP	2671G	2520A31883	
Computer desk top	HP	9826A	231A05633	
PRE Amp (3m)	HP	8447D	2727A06191	6/18/99
PRE Amp (30m) site 1	HP	8447D	2727A06181	6/17/99
CISPR Adapter site 1 (ref. only)	HP	85650A	2043A00124	10/27/99
Plotter	HP	7475A	2325A64445	
Spectrum Analyzer site 1	HP	8566B	2421A00516	10/27/99
RF/Preselector site 1 (ref. only)	HP	85685A	2724A00659	10/27/99
PRE Amp. (10m)	HP	8447D	2727A06184	6/17/99
Amplifier	Mini-Circuits	ZHL-1042J	N111496-6	
Amplifier (2-20 GHz, 22dB gain)	MITEQ	AFS6-02002000-18O-MP	428738	6/17/99
Receiver site 1	R&S	ESH3	882399/025	3-19-2000
Spectrum Monitor site 1	R&S	EZM(3)	880 487/037	
Receiver site 1	R&S	ESVP	879807/048	6/19/99
LISN	SCH	NNLK 8121	218	11/6/99
Log Periodic Antenna	SCH	UJALP9107	2C	7/24/99
LISN	SCH	NNLK 8121	156	11/6/99
Antenna Mast site 1 port. (10m outside)	Unisys	U-258	CC-300-5023	

***7.5 APPENDIX E: INFORMATION SUPPLIED TO APPLICANT***

## INFORMATION PERTAINING TO EQUIPMENT MANUFACTURED AFTER COMPLIANCE TESTING

It is prudent that manufacturers have an established Quality Assurance program to spot check their products on a periodic basis, either based upon time or quantities produced. Obviously, a change in the engineering design should be sufficient justification for a re-test.

The Quality assurance test need not be formal Verification or Certification such as required during the initial production of the product. However, it should be sufficient in scope to assure that the EMI characteristics of the product have not changed to the degree that the product exceeds the FCC limits. If a new model of a product is produced, it must undergo full Verification or Certification testing and, in case of Certification, be filed with the FCC.

It is expected that the FCC will place greater emphasis and resources in spot checking commercially available products. If a product is found not to be compliant with the Limits specified in Part 15, Subpart B, the manufacturer will be subject to the appropriate penalties imposed by the Commission. The initial Certification or Verification is sufficient to justify initial production. The additional quality assurance testing performed is the manufacturer's responsibility to assure continued compliance.