MEASUREMENT AND TECHNICAL REPORT

HM ELECTRONICS
6675 Mesa Ridge Road
San Diego, CA 92121-2937

DATE: 19 January 2001

This Report Concerns:	Original Grant: X	Class II Change:
Equipment Type:	Vehicle Access Control System, Model VACS2000	
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?	Yes: **Defer until:**	No: X
Company Name **agrees to notify the Commission by:** **of the intended date of announcement of the product so that the grant can be issued on that date.**	N/A	
Transition Rules Request per 15.37?	Yes:	*No:

(*) FCC Part 15, Paragraphs 15.207 and 15.209

Report Prepared by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 619 546 3999
Fax: 619 546 0364

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TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364

1 GENERAL INFORMATION

1.1 Product Description

Vehicle Access Control System, Model VACS2000

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Form

EMC Test Plan and Constructional Data Form

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PLEASE COMPLETE THIS DOCUMENT IN FULL, ENTERING N/A IF THE FIELD IS NOT APPLICABLE.

Applicant -- ***NOTE: This information will be input into your test report as shown below.***
Press the F1 key at any time to get HELP for the current field selected.

Company: HM Electronics

Address: 6675 Mesa Ridge Road
San Diego, CA 92121

Contact: Seth Schlam Position: Sustaining Engineer

Phone: (858) 535-6063 Fax: (858) 535-6029
ATTN: SETH

E-mail Address: SSchlam@hme.com

General Equipment Description -- ***NOTE: This information will be input into your test report as shown below.***

EUT Description: Vehicle Access Control System

EUT Name: VACS2000

Model No.: K23735 Serial No.: None

Product Options:

Configurations to be tested: (1) Normal configuration

Test Objective

- ☐ EMC Directive 89/336/EEC (EMC) ☒ FCC: Class ☐ A ☒ B Part 15
  - Std: ☐ VCCI: Class ☐ A ☐ B
- ☐ Machinery Directive 89/392/EEC (EMC ☐ BCIQ: Class ☐ A ☐ B
  - Std: ☐ Canada: Class ☐ A ☐ B
- ☐ Medical Device Directive 93/42/EEC (EMC) ☐ Australia: Class ☐ A ☐ B
  - Std: ☐ Other:
- ☐ Vehicle Directive 72/245/EEC (EMC)
  - Std:
- ☐ FDA Reviewers Guidance for Premarket Notification Submissions (EMC)

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TÜV Product Service Certification Requested

☐ Attestation of Conformity (AoC) ☐ International EMC Mark (IEM)
☐ Certificate of Conformity (CoC) ☒ Compliance Document → FCC
Protection Class (N/A for vehicles) ☐ Class I ☐ Class II ☐ Class III
(Press **F1** when field is selected to show additional information on Protection Class.)

Attendance

Test will be: ☒ Attended by the customer ☐ Unattended by the customer

Failure - *Complete this section if testing will not be attended by the customer.*

If a failure occurs, TUV Product Service should:
☐ Call contact listed above, if not available then stop testing. (After hrs phone): _____
☒ Continue testing to complete test series.
☐ Continue testing to define corrective action.
☐ Stop testing.

EUT Specifications and Requirements

Length: 16" Width: 14" Height: 6" Weight: _____

Power Requirements

Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)

Voltage: 115 VAC (If battery powered, make sure battery life is sufficient to complete testing.)

# of Phases: 1

Current (Amps/phase(max)): 1A Current (Amps/phase(nominal)): 500mA

Other _____

Other Special Requirements

EXTENSION CORDS

Typical Installation and/or Operating Environment

(ie. Hospital, Small Business, Industrial/Factory, etc.)

ENTRY GATE IN ROAD

Form

EMC Test Plan and Constructional Data Form

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EUT Power Cable

☒ Permanent OR ☐ Removable Length (in meters): AS REQUIRED
☐ Shielded OR ☒ Unshielded
☐ Not Applicable

The VACS2000 uses AC LINE power that is brought into the unit through standard electrical conduit. There is no power cable, as such, that is part of the unit. The power line/power cable is part of the Installation/ building wiring.

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EUT Interface Ports and Cables

Interface				Shielding								
Type	Analog	Digital	Qty	Yes	No	Type	Termination	Connector Type	Port Termination	Length (in meters)	Removable	Permanent
EXAMPLE: *RS232*	☐	☒	2	☒	☐	*Foil over braid*	*Coaxial*	*Metallized 9-pin D-Sub*	*Characteristic Impedance*	*6*	☒	☐
RS232	☐	☒	1	☒	☐	Foil shielded CABLE		WECO CONNECTOR PART OF S251B READER			☐	☐
	☐	☐		☐	☐						☐	☐
ANTENNA Connector	☒	☐		☐	☒	ANTENNA CABLE	TERMINAL BLOCK P/O S251B	SPADE LUG			☐	☐
	☐	☐		☐	☐						☐	☐
DC power Input	☒	☐	1	☐	☒	AC power cable	Terminal Block	spade lug			☐	☐
	☐	☐		☐	☐						☐	☐
Relay output OC1, OC2 Open Collector	☒	☐		☐	☒	WIRE TO RELAYS		WECO CONNECTOR PART OF S251B READER			☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐

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Form

EMC Test Plan and Constructional Data Form

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EUT Software. ✳

Revision Level: HME P/N 685Ø13

Description: GATE SMART operating software for VACS 2000

✳ Note; the software is loaded on an IBM PC, which is not part of the EUT, but rather is a peripheral component. The PC is connected to the EUT via an RS232 serial communications link

EUT Operating Modes to be Tested -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing. Consult with your TÜV Product Service Representative if additional assistance is required.

1. w/ 4' loop antenna
2.
3.

EUT System Components -- List and describe all components which are part of the EUT. For FCC testing a minimum configuration is required. (ie. Mouse, Printer, Monitor, External Disk Drive, Motherboard, etc.)

Description	Model #	Serial #	FCC ID #
ENCLOSURE, HME P/N 1140Ø3		NONE	NONE
READER, S251B, HME P/N 4560Ø3			
CKT BREAKER(3A), HME P/N 1820Ø7		NONE	NONE
DIODE, IN4001 50V, HME P/N 2050Ø3		"	"
FAN, 24VDC, HME P/N 2300Ø13		"	"
FILTER, LINE 3A, HME P/N 2410Ø5		"	"
POWER SUPPLY, 24VDC HME P/N 4530Ø5		"	"
RELAY, DPDT, HME P/N 4820Ø18		"	"

~~Note: A complete BOM (Bill of materials) for the VACS2000 Reader (the EUT) is attached. The major components are listed in the above table~~

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Critical EMI Components (Capacitors, ferrites, etc.)

	Description	Manufacturer	Part # or Value	Qty	Component # / Location
1)	EMI LINE FILTER	CII CORCOM	3EP1	1	IMMEDIATELY FOLLOWING AC LINE CIRCUIT BREAKER
2)	FERRITE BEAD		HMEP/N 106010	1	OUTPUT LINE FROM 24VDC POWER SUPPLY

EMC Critical Detail -- Describe other EMC Design details used to reduce high frequency noise.

(PLEASE INSERT "**ELECTRONIC SIGNATURE**" BELOW IF POSSIBLE)

Authorization Signatures

Seth Schlam
Customer authorization to perform tests according to this test plan. — Date

Seth Schlam
Test Plan/CDF Prepared By (please print) — Date

Reviewed by TÜV Product Service Associate — Date

Tests were performed NOV 2000
Additional Info per TUV Request JAN 2001
LS

1.2 Related Submittal/Grant

None

1.3 Tested System Details

The FCC IDs for all equipment, plus descriptions of all cables used in the tested system are:

None

1.4 Test Methodology

Purpose of Test: To demonstrate compliance with the ANSI C63.4 setup.

Test Performed:
- x 1. Conducted Emissions, FCC Part 15.207
- 2. Radiated Emissions, EN55022: 1992 Class B limit, 30 - 1,000 MHz, 10 meters
- x 3. Radiated Emission per FCC Part 15.209
- 4. Engineering evaluations

1.5 Test Facility

The open area test site and conducted measurement data were tested by:

TÜV PRODUCT SERVICE
10040 Mesa Rim Road
San Diego, CA 92121-2912
Phone: 619 546 3999
Fax: 619 546 0364

The Test Site Data and performance comply with ANSI 63.4 and are registered with the FCC, 7435 Oakland Mills Rd, Columbia Maryland 21046. All Measurement Data is acquired according to the content of FCC Measurement Procedure and ANSI C63.4, unless supplemented with additional requirements as noted in the test report.

1.6 Part 2 Requirements

Direct sequence spread spectrum transmitters under Part 15 - not applicable.
Frequency hopping transmitters under Part 15 - not applicable.
Certification of scanning receivers - not applicable.
Certification of transmitters operating within the 59 to 64 GHz band - not applicable.

2. SYSTEM TEST CONFIGURATION

2.1 Justification

The was initially tested for FCC emission in the following configuration:

See Block Diagram.

2.2 EUT Exercise Software

None

2.3 Special Accessories

None

2.4 Modification

None

2.5 Configuration of Tested System

See Block Diagram.

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3 CONDUCTED MEASUREMENT TEST EQUIPMENT

Emissions Test Conditions: CONDUCTED EMISSIONS

The *EQUIVALENT CONDUCTED EMISSIONS* measurements were performed in the following test location :

☐ - Test not applicable

SR-3, Shielded Room, 12' x 20' x 8', Metal Chamber

Test Equipment Used :

Model Number	Prop. No.	Description	Manufacturer	Serial No.	Cal Date
9252-50-R-24-BNC	457	LISN, 50 µH /250 µH/50 Ω/0.25 µF	Solar Electronics Co.	941720	05/01
ESHS 30	459	EMI Test Receiver	Rohde & Schwarz	832354/004	11/01
CAT-20	616	20 dB Attenuator	Mini-Circuits	--	*

Remarks: (*) Verified internally.

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4 CONDUCTED EMISSION DATA

HME ELECTRONICS

See following page(s).

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TÜV PRODUCT SERVICE

TUV Product Service, San Diego
POWERLINE CONDUCTED EMISSIONS

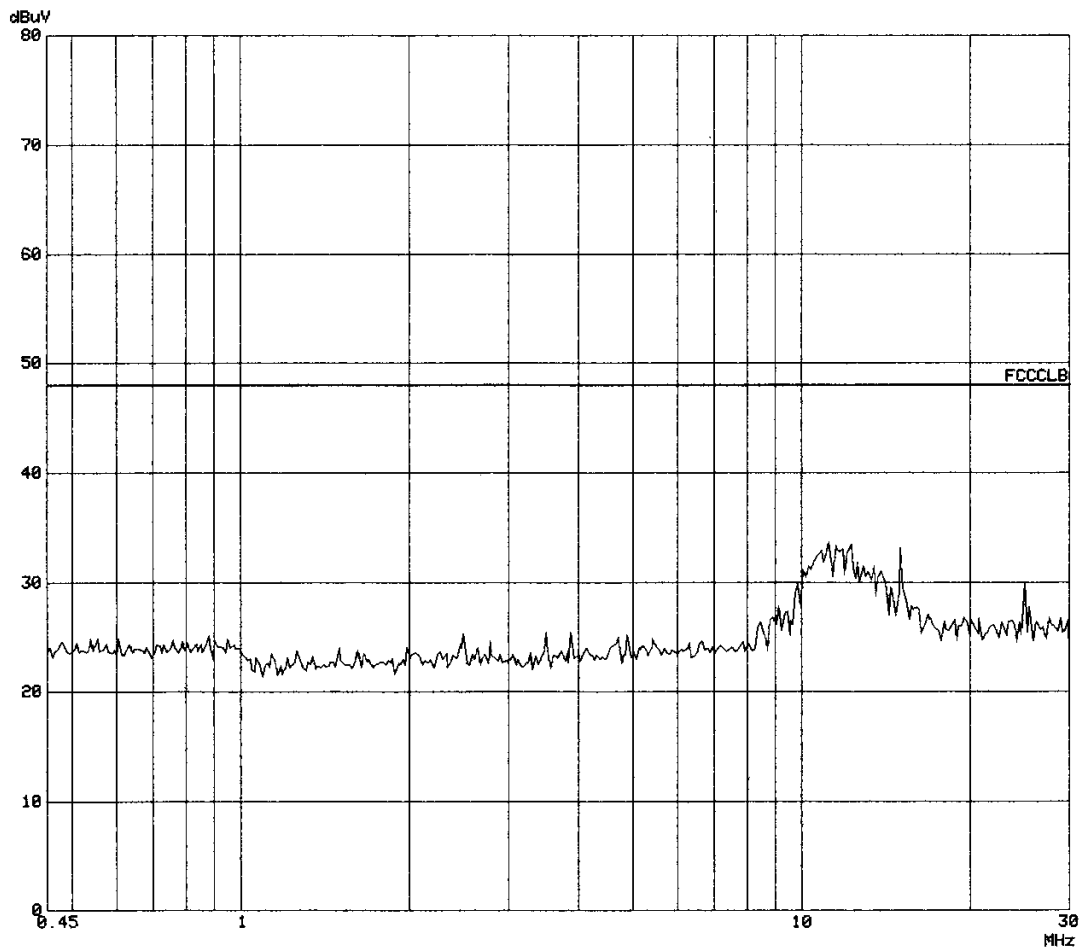
EUT: VACS 2000
Manuf: HM Electronics
Op Cond: 18 uH load / transmit at 134.5 kHz
Operator: Jim Owen
Test Spec: FCC 15.207
Comment: 115 Vac 60 Hz Line 2add torroid on dc line to transceiver
S0466
Date: 07. Nov 00 11:17

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	1M	5k	10k	PK	100ms	AUTO	LN OFF	60dB
1M	30M	5k	10k	PK	2ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
1	10k	30M	20dBLISN

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 10dB



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TÜV PRODUCT SERVICE

TUV Product Service, San Diego
POWERLINE CONDUCTED EMISSIONS

EUT:	VACS 2000
Manuf:	HM Electronics
Op Cond:	18 uH load / transmit at 134.5 kHz
Operator:	Jim Owen
Test Spec:	FCC 15.207
Comment:	115 Vac 60 Hz Line 2add torroid on dc line to transceiver S0466
Date:	07. Nov 00 11:17

Final Measurement Results:

no Results

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PRODUCT SERVICE

TUV Product Service, San Diego
POWERLINE CONDUCTED EMISSIONS

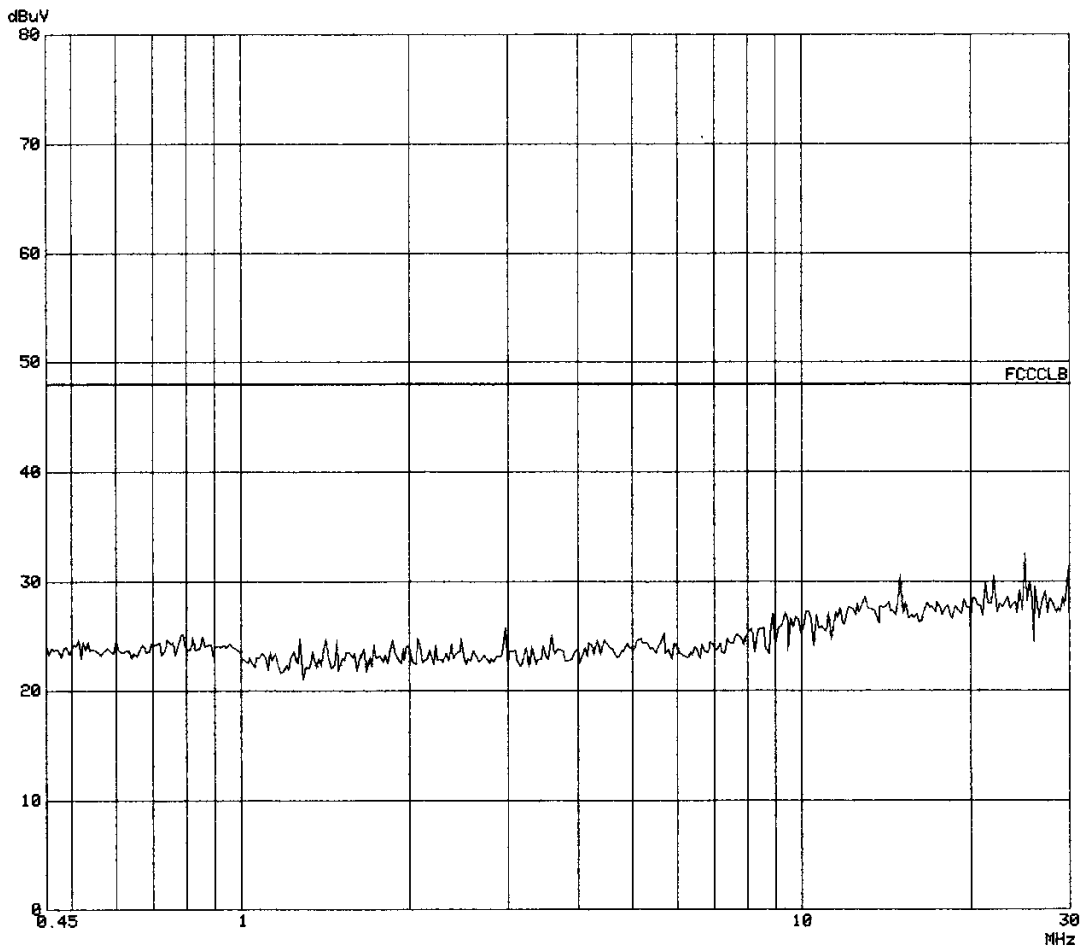
EUT: VACS 2000
Manuf: HM Electronics
Op Cond: 18 uH load / transmit at 134.5 kHz
Operator: Jim Owen
Test Spec: FCC 15.207 (9kHz)
Comment: 115 Vac 60 Hz Line 1add torroid on dc line to transceiver S0466
Date: 07. Nov 00 11:11

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	1M	5k	10k	PK	100ms	AUTO	LN OFF	60dB
1M	30M	5k	10k	PK	2ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
1	10k	30M	20dBLISN

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 10dB



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TÜV PRODUCT SERVICE

TUV Product Service, San Diego
POWERLINE CONDUCTED EMISSIONS

EUT:	VACS 2000
Manuf:	HM Electronics
Op Cond:	18 uH load / transmit at 134.5 kHz
Operator:	Jim Owen
Test Spec:	FCC 15.207
Comment:	115 Vac 60 Hz Line 1add torroid on dc line to transceiver S0466
Date:	07. Nov 00 11:11

Final Measurement Results:

no Results

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5 RADIATED MEASUREMENT EQUIPMENT LIST

Emissions Test Conditions: RADIATED EMISSIONS (Electric Field)

The *EQUIVALENT RADIATED EMISSIONS* measurements were performed at the following test location :

☐ - Test not applicable

Test Site:

Canyon Site Parking Lot, Carroll Canyon, San Diego

Test Equipment Used :

Model No.	Property No.	Description	Manufacturer	Serial Number	Cal Date
ESHS 30	459	EMI Test Receiver	Rohde & Schwarz	832354/004	11/01
HFH2-Z2	208	Loop Antenna	Rohde & Schwarz	880	*

Remarks: (*) Verified prior to use.

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6 RADIATED EMISSION DATA

The following data lists the significant emission frequencies, measured levels, correction factor (which includes cable and antenna corrections), the corrected reading, and the limit.

See following page(s).

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TÜV PRODUCT SERVICE

REPORT NO: SQ466 **DATE:** 11-7-00

TEST: Radiated Emissions - Fcc Part 15.209

CUSTOMER: HM Electronics

EUT: VACS 2000 w/ 4 Ft. loop ant. at max. xmt level

SPECIFICATION: Fcc Part 15.209

Frequency MHz	Average Vertical dBµV	Average Horizontal dBµV	Distance Factor dB	Correction Factor dB/m	Emission Level dBµV/m	Limit dBµV/m	EUT Margin dB
.13442	33.2	52.0	59	20	13.0	17.85	-4.85
.26884	19.9	26.4	59	20	-12.6	8.90	-21.5
.40326	18.6	25.6	59	20	-13.4	5.95	-19.35
* No Other Detectable Emissions Noted *							

NOTES:
1. RBW = _____; VBW = _____
2. Receive antenna = R+S Loop Ant
3. ~~Amplifier~~
4. 200Hz BW 9kHz → 150kHz; 10kHz BW 150kHz → 30MHz

Avg Detector

Geo

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TÜV PRODUCT SERVICE

REPORT NO: SQ466 **DATE:** 11-7-00

TEST: Radiated Emissions

CUSTOMER: H M Electronics

EUT: VACS 2000 w/8ft loop ant. at min. xmt level

SPECIFICATION: FCC Part 15.209

Frequency MHz	Average Vertical dBµV	Average Horizontal dBµV	Distance Factor dB	Correction Factor dB/m	Emission Level dBµV/m	Limit dBµV/m	EUT Margin dB
.13442	25.4	53.9	59	20	14.9	17.85	-2.95
.26884	16.6	18.9	59	20	-20.1	8.90	-29.0
.40326	19.3	37.9	59	20	-1.1	5.95	-7.05
* No Other Detectable Emissions Noted *							

NOTES:
1. RBW = _____; VBW = _____
2. Receive antenna = R+S Loop Ant.
3. ~~Amplifier~~
4. 200Hz BW 9kHz → 150kHz; 10kHz BW 150kHz → 30MHz

Avg Detector

QPO

6.1 Field Strength Calculation

If a preamplifier was used during the Radiated Emission Testing, it is required that the amplifier gain must be subtracted from the Spectrum Analyzer (Meter) Reading. In addition, a correction factor for the antenna , cable used and a distance factor, if any, must be applied to the Meter Reading before a true field strength reading can be obtained. In the automatic measurement, these considerations are automatically presented as a part of the print out. In the case of manual measurements and for greater efficiency and convenience, instead of using these correlation factors for each meter reading, the specification limit was modified to reflect these correlation factors at each frequency value so that the meter readings can be compared directly to the modified specification limit. This modified specification limit is referred to as the "Corrected Meter Reading Limit" or simply the CMRL, which is the actual field strength present at the antenna. The quantity can be derived in the following manner:

Corrected Meter Reading Limit (CMRL) = SAR + AF + CL - AG - DC

Where, SAR = Spectrum Analyzer Reading
AF = Antenna Factor
CL = Cable Loss
AG = Amplifier Gain (if any)
DC = Distance Correction (if any)

Assume the following situation: A meter reading of 29.4 dBuV was obtained from a Class A computing device measured at 83 MHz. Assume an antenna factor of 9.2 dB, a cable loss of 1.4 dB and amplifier gain of 20.0 dB at 83 MHz. The final field strength would be determined as follows:

CMRL = 29.4 dBuV + 9.2dB = 1.4 dB - 20 dB/M - 0.0 dB

CMRL = 20.0 dBuV/M

This result is well below the FCC and CSA Class A limit of 29.5 dbuV/m at 83 MHz.

For the manual mode of measurement, a table of corrected meter reading limit was used to permit immediate comparison of the meter reading to determine if the measure emission amplitude exceeded the specification limit at that specific frequency.

7 SUMMARY:

All tests according to *CFR 47, Part 15, Paragraphs 15.207 and 15.209* were

■ - Performed

The Equipment Under Test

■ - **Fulfills** the general requirements of *CFR 47, Part 15, Paragraphs 15.207 and 15.209.*

- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:

Jim Owen
(EMC Engineer)

TÜV PRODUCT SERVICE 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone 858 546 3999 FAX 858 546 0364