

# TEST RESULT SUMMARY

## FCC PART 15 SUBPART C Section 15.213

MANUFACTURER'S NAME	Subsite Electronics
NAME OF EQUIPMENT	Cable Locating Transmitter
MODEL NUMBER	<b>300ST</b>
MANUFACTURER'S ADDRESS	1950 West Fir Street Perry OK 73077
TEST REPORT NUMBER	NC200679
TEST DATE	19 February 2002

According to testing performed at TÜV Product Service Inc, the above-mentioned unit is in compliance with the electromagnetic compatibility requirements defined in FCC Part 15.

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

TÜV Product Service Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the requirements of FCC Part 15.

Date: 25 March 2002



Location: Taylors Falls MN  
USA

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R. M. Johnson  
Test Technician

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T. K. Swanson  
Technical Writer

# EMC EMISSION - TEST REPORT

Test Report File No. : **NC200679** Date of issue: 25 March 2002

Model / Serial No. : **300ST**

Product Type : Cable Locating Transmitter

Applicant : Subsite Electronics

Manufacturer : Subsite Electronics

License holder : Subsite Electronics

Address : 1950 West Fir Street

: Perry OK 73077

Test Result : **■ Positive      □ Negative**

Test Project Number  
Reference(s) : **NC200679**

Total pages including  
Appendices : **26**

*TÜV Product Service Inc is a subcontractor to TÜV Product Service, GmbH according to the principles outlined in ISO/IEC Guide 25 and EN 45001.*

*TÜV Product Service Inc reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. TÜV Product Service Inc shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV Product Service Inc issued reports.*

*This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. This report shall not be used by the client to claim product endorsement by NVLAP or any agency of the US government.*

*TÜV Product Service Inc and its professional staff hold government and professional organization certifications and are members of AAMI, ACIL, AEA, ANSI, IEEE, NVLAP, and VCCI*

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## EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to following regulations:

<input type="checkbox"/> - EN 50081-1 / 1991	<input type="checkbox"/> - Group 1	<input type="checkbox"/> - Group 2
<input type="checkbox"/> - EN 55011 / 1991	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B
<input type="checkbox"/> - EN 55013 / 1990	<input type="checkbox"/> - Household appliances and similar	
<input type="checkbox"/> - EN 55014 / 1987	<input type="checkbox"/> - Portable tools	
<input type="checkbox"/> - EN 55014 / A2:1990	<input type="checkbox"/> - Semiconductor devices	
<input type="checkbox"/> - EN 55014 / 1993	<input type="checkbox"/> - Household appliances and similar	
<input type="checkbox"/> - EN 55015 / 1987	<input type="checkbox"/> - Portable tools	
<input type="checkbox"/> - EN 55015 / A1:1990	<input type="checkbox"/> - Semiconductor devices	
<input type="checkbox"/> - EN 55015 / 1993	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B
<input type="checkbox"/> - EN 55022 / 1987	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B
<input type="checkbox"/> - EN 55022 / 1994	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B
<input type="checkbox"/> - BS	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B
<input type="checkbox"/> - VCCI	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B
<input checked="" type="checkbox"/> - FCC Part 15 Subpart C Section 15.213	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B
<input type="checkbox"/> - FCC Part 15 Subpart C Section 15.207 - Conducted	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B
<input type="checkbox"/> - FCC Part 15 Subpart B	<input type="checkbox"/> - Group 1	<input type="checkbox"/> - Group 2
<input type="checkbox"/> - CISPR 11 (1990)	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B
<input type="checkbox"/> - CISPR 22 (1993)	<input type="checkbox"/> - Class A	<input type="checkbox"/> - Class B

**Environmental conditions in the lab:**

	<u>Actual</u>
Temperature	: 15 °C
Relative Humidity	: 46 %
Atmospheric pressure	: 98.6 kPa
Power supply system	: 9 VDC

**Sign Explanations:**

- not applicable
- applicable



## Emissions Test Conditions: CONDUCTED EMISSIONS (15.207)

The **CONDUCTED EMISSIONS (INTERFERENCE VOLTAGE)** measurements were performed at the following test location:

- Test not applicable

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site)
- Oakwood Lab (Open Area Test Site)
- Wild River Lab Screen Room
- New Brighton Lab Shielded Room

## Emissions Test Conditions: RADIATED EMISSIONS (15.213 - 10 kHz to 30 MHz)

The **RADIATED EMISSIONS (MAGNETIC FIELD)** measurements were performed at the following test location:

- Test not applicable

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site) – NSA measurements made 7-01, due 7-02.
- Oakwood Lab (Open Area Test Site)

at a test distance of :

- 0.3 meters
- 1 meter
- 3 meters
- 10 meters
- 30 meters

### Test equipment used:

TUV ID	Model Number	Manufacturer	Description	Serial Number	Cal Due
<input checked="" type="checkbox"/> - 2517	HFH2-Z2	Polarad	Loop Antenna	879285/036	2-11-03
<input checked="" type="checkbox"/> - 2534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	8-22-02

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.

## Emissions Test Conditions: RADIATED EMISSIONS (Electric Field)

The **RADIATED EMISSIONS (ELECTRIC FIELD)** measurements, in the frequency range of 30 MHz-1000 MHz, were tested in a horizontal and vertical polarization at the following test location :

- Test not applicable

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site) – NSA measurements made 7-01, due 7-02
- Oakwood Lab (Open Area Test Site)

at a test distance of :

- 3 meters
- 10 meters
- 30 meters

Test equipment used :

TUV ID	Model Number	Manufacturer	Description	Serial Number	Cal Due
■ - 2733	11867A	Hewlett-Packard	Limiter	01080	3-18-03
■ -	8566B	Hewlett-Packard	Spectrum Analyzer	2115A00853	6-19-02
■ -	85662A	Hewlett-Packard	Analyzer Display	2112A02220	6-19-02
■ - 2679	85650A	Hewlett-Packard	Quasi-Peak Adapter	2430A00550	12-19-02
■ - 2830	ZHL-1042J	Mini-Circuits	Preamplifier	H081396-16	3-15-03
■ - 3203	EM-6917B	Electro-Metrics	Biconicalog Periodic	106	2-14-03

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.

## Emissions Test Conditions: INTERFERENCE POWER

The **INTERFERENCE POWER** measurements were performed by using the absorbing clamp on the mains and interface cables in the frequency range 30 MHz - 300 MHz at the following test location :

- Test not applicable

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site)
- Oakwood Lab (Open Area Test Site)
- Wild River Lab Screen Room
- New Brighton Lab Shielded Room

## Emissions Test Conditions: RADIATED EMISSIONS (Electric Field)

The **EQUIVALENT RADIATED EMISSIONS** measurements in the frequency range 1 GHz - 100 GHz were performed in a horizontal and vertical polarization at the following test location :

**■ - Test not applicable**

- Wild River Lab Large Test Site (Open Area Test Site)
- Wild River Lab Small Test Site (Open Area Test Site)
- Oakwood Lab (Open Area Test Site)
- Wild River Lab Screen Room

at a test distance of:

- 1 meters
- 3 meters
- 10 meters



## Equipment Under Test (EUT) Test Operation Mode - Emission tests :

**The device under test was operated under the following conditions during emissions testing:**

- Standby
- Test program (H - Pattern)
- Test program (color bar)
- Test program (customer specific)
- Practice operation
- Normal Operating Mode
- \_\_\_\_\_

## Configuration of the device under test:

- - See Constructional Data Form in Appendix B - Page B2
- - See Product Information Form in Appendix B - beginning on Page B3

**The following peripheral devices and interface cables were connected during the measurement:**

## Emission Test Results:

### Conducted emissions 450 kHz - 30 MHz

The requirements are  - MET  - NOT MET  - N/A

Minimum margin of compliance \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Maximum margin of non-compliance \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_

### Radiated emissions (magnetic field) 10 kHz - 30 MHz

The requirements are  - MET  - NOT MET

Minimum limit margin for fundamental 47 dB at 29.4 kHz

Minimum limit margin for spurious/harmonics >10 dB at \_\_\_\_\_ kHz

Remarks: The fundamental was measured to be 68 dBuV/m (2511.886 microvolts/meter or 189uW) in Average mode at 30 meters. The limit is 115 dBuV/m (577,640 microvolts/meter or 10 W) at 30 meters. All other spurious emissions or other harmonics were >10 dB below the FCC 15.209 300 meter limit when measured at 30 meters.

### Radiated emissions (electric field) 30 MHz - 1000 MHz

The requirements are  - MET  - NOT MET

Minimum margin of compliance 9 dB at 148.0 MHz

Minimum limit margin for spurious \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_

### Interference Power at the mains and interface cables 30 MHz - 300 MHz

The requirements are  - MET  - NOT MET  - N/A

Minimum margin of compliance \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Maximum margin of non-compliance \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_

### Equivalent Radiated emissions 1 GHz - 100 GHz

The requirements are  - MET  - NOT MET  - N/A

Minimum margin of compliance \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Maximum margin of non-compliance \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_

## DEVIATIONS FROM STANDARD:

None.

## GENERAL REMARKS:

The radiated measurements from 10 kHz to 30 MHz are made in quasi-peak detection, except for the levels noted between 9-90kHz, 110-490 kHz, and above 1000 MHz which are made in average detection.

## SUMMARY:

The requirements according to the technical regulations are

- met
- **not** met.

The device under test does

- fulfill the general approval requirements mentioned on page 3.
- **not** fulfill the general approval requirements mentioned on page 3.

Testing Start Date: 19 February 2002

Testing End Date: 19 February 2002

- TÜV PRODUCT SERVICE INC -

*Thomas K. Swanson*

T. K. Swanson  
Technical Writer

*Russ M. Johnson*

Tested By:  
R. M. Johnson

Test-setup photo(s):  
Conducted emission 450 kHz - 30 MHz

**Not Applicable**



Test-setup photo(s):  
Radiated emission 10 kHz - 1000 MHz

**See Test Setup Exhibit**



## **Appendix A**

Test Data Sheets

and

Test Setup Drawing(s)



**TEST SETUP FOR EMISSIONS TESTING**

WILD RIVER LAB  
Small Test Site

**See Test Setup Exhibit**



## Test Data

### FCC 15.213 Radiated Emissions 9 kHz to 30 MHz

MHZ	3m-dbuv/m	10m-dbuv/m	30m-dbuv/m	fcc limit			
0.0294	119	95	68	10 w			
0.0588	69	43	18	<a href="#">32@300m</a>			
0.0883	50		-1				
0.1177	47		-4				
0.1395	50		-1				
0.1471	59	34	8				
0.1767	53		2				
0.2059	55		4				
0.2648	47		-4	<a href="#">19@300m</a>			

15.213 allows 10 w, 68 dbuv/m at 30 meters calculates to 189 uW.

harmonics are >10 dB below 15.209 300 m limit at 30 meters



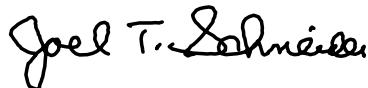
# Radiated Electromagnetic Emissions

Test Report #:	200679 Run 01	Test Area:	STS 10 M
Test Method:	EN55022	Test Date:	19-Feb-2002
EUT Model #:		EUT Power:	BATTERY-POWERED
EUT Serial #:		Temperature:	15 °C
Manufacturer:	DITCHWITCH - SUBSITE ELECTRONICS	Relative Humidity:	46 %
EUT Description:	300 TRANSMITTER	Air Pressure:	98.6 kPa
Notes:	WITH TEST CABLES ATTACHED	Page:	1 of 1

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB/m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 EN55022 B	DELTA2 EN55022 A
120.00	30.9 Qp	2.1 / 11.7 / 27.7	17.0	V / 1.0 / 0.0	-13.0	-23.0
148.00	33.8 Qp	2.3 / 12.6 / 27.8	20.8	V / 1.0 / 0.0	-9.2	-19.2
136.00	31.9 Qp	2.3 / 12.5 / 27.7	19.0	V / 1.0 / 0.0	-11.0	-21.0
140.00	31.8 Qp	2.3 / 12.5 / 27.9	18.7	V / 1.0 / 0.0	-11.3	-21.3
152.00	30.4 Qp	2.3 / 12.6 / 27.8	17.5	V / 1.0 / 0.0	-12.5	-22.5

***** MEASUREMENT SUMMARY *****						
148.00	33.8 Qp	2.3 / 12.6 / 27.8	20.8	V / 1.0 / 0.0	-9.2	-19.2
136.00	31.9 Qp	2.3 / 12.5 / 27.7	19.0	V / 1.0 / 0.0	-11.0	-21.0
140.00	31.8 Qp	2.3 / 12.5 / 27.9	18.7	V / 1.0 / 0.0	-11.3	-21.3
152.00	30.4 Qp	2.3 / 12.6 / 27.8	17.5	V / 1.0 / 0.0	-12.5	-22.5
120.00	30.9 Qp	2.1 / 11.7 / 27.7	17.0	V / 1.0 / 0.0	-13.0	-23.0

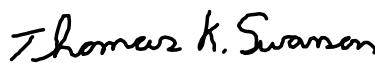
Tested by: JTS



Printed

Signature

Reviewed by: TKS



Printed

Signature

## Appendix B

Constructional Data Form

and

Product Information Form(s)



## Form



# EMC Test Plan and Constructional Data Form

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.**

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

EUT Description: Cable locating transmitter  
EUT Name: 300ST  
Model No.: 300ST Serial No.: 001  
Product Options: \_\_\_\_\_  
Configurations to be tested: \_\_\_\_\_

## Test Objective

<input checked="" type="checkbox"/> EMC Directive 89/336/EEC (EMC) Std: _____	<input checked="" type="checkbox"/> FCC: Class	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	Part _____
<input type="checkbox"/> Machinery Directive 89/392/EEC (EMC) Std: _____	<input type="checkbox"/> VCCI: Class	<input type="checkbox"/> A	<input type="checkbox"/> B	
<input type="checkbox"/> Medical Device Directive 93/42/EEC (EMC) Std: _____	<input type="checkbox"/> BSMI: Class	<input type="checkbox"/> A	<input type="checkbox"/> B	
<input type="checkbox"/> Vehicle Directive 72/245/EEC (EMC) Std: _____	<input type="checkbox"/> Canada: Class	<input type="checkbox"/> A	<input type="checkbox"/> B	
<input type="checkbox"/> FDA Reviewers Guidance for Premarket Notification Submissions (EMC)	<input type="checkbox"/> Australia: Class	<input type="checkbox"/> A	<input type="checkbox"/> B	
	<input type="checkbox"/> Other: _____			

## **TÜV Product Service Certification Requested**

<input checked="" type="checkbox"/> Attestation of Conformity (AoC)	<input checked="" type="checkbox"/> EMC Certification (used with Octagon Mark)
<input type="checkbox"/> Certificate of Conformity (CoC)	<input type="checkbox"/> Compliance Document
Protection Class (N/A for vehicles)	<input type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> 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

## EMC Test Plan and Constructional Data Form

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

If a failure occurs, TÜV 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: 12.25 in      Width: 9.25 in      Height: 4.35 in      Weight: 5.0LBS

### 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: 9V dc (If battery powered, make sure battery life is sufficient to complete testing.)

# of Phases: \_\_\_\_\_

Current  
(Amps/phase(max)): \_\_\_\_\_      Current  
(Amps/phase(nominal)): \_\_\_\_\_

Other \_\_\_\_\_

### Other Special Requirements

### Typical Installation and/or Operating Environment

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

### EUT Power Cable

<input type="checkbox"/> Permanent	OR	<input type="checkbox"/> Removable	Length (in meters): _____
<input type="checkbox"/> Shielded	OR	<input type="checkbox"/> Unshielded	
<input checked="" type="checkbox"/> Not Applicable			

## EMC Test Plan and Constructional Data Form

EUT Interface Ports and Cables											
Interface			Shielding								
Type	Analog	Digital	Qty	Yes	No	Type	Termination	Connector Type	Port Termination	Length (in meters)	Removable Permanent
<b>EXAMPLE:</b> RS232	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Foil over braid	Coaxial	Metallized 9-pin D-Sub	Characteristic Impedance	6	<input checked="" type="checkbox"/> <input type="checkbox"/>
Direct connect cable	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>						<input type="checkbox"/> <input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/> <input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/> <input type="checkbox"/>
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	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/> <input type="checkbox"/>
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	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/> <input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/> <input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/> <input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/> <input type="checkbox"/>

## EMC Test Plan and Constructional Data Form

### EUT Software.

Revision Level: 1.1

Description: Standard issue of unit software.

**Equipment Under Test (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.

2.

3.

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

Description	Model #	Serial #	FCC ID #

# EMC Test Plan and Constructional Data Form

**Support Equipment** -- List and describe all support equipment which is not part of the EUT. (i.e. peripherals, simulators, etc)

<i>Description</i>	<i>Model #</i>	<i>Serial #</i>	<i>FCC ID #</i>

## Oscillator Frequencies

Frequency	Derived Frequency	Component # / Location	Description of Use
4.0 MHz	29.43KHz	U4/SMD Oscillator	Provides system clock

## Power Supply

Manufacturer	Model #	Serial #	Type
N/A			<input type="checkbox"/> Switched-mode: (Frequency) _____ <input checked="" type="checkbox"/> Linear <input type="checkbox"/> Other: _____
N/A			<input checked="" type="checkbox"/> Switched-mode: (Frequency) < <u>300KHZ</u> <input type="checkbox"/> Linear <input type="checkbox"/> Other: _____

## Power Line Filters

<i>Manufacturer</i>	<i>Model #</i>	<i>Location in EUT</i>

## EMC Test Plan and Constructional Data Form

### Critical EMI Components (Capacitors, ferrites, etc.)

Description	Manufacturer	Part # or Value	Qty	Component # / Location
Capacitor	Any	39pF	1	C13
Resistor	Any	680 R	1	R19
Inductor	Coilcraft	100uH	1	L2

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

(PLEASE INSERT "ELECTRONIC SIGNATURE" BELOW IF POSSIBLE)

### Authorization Signatures

K. Lloyd

2-18-00

Customer authorization to perform tests  
according to this test plan.

Date

Test Plan/CDF Prepared By (please print)

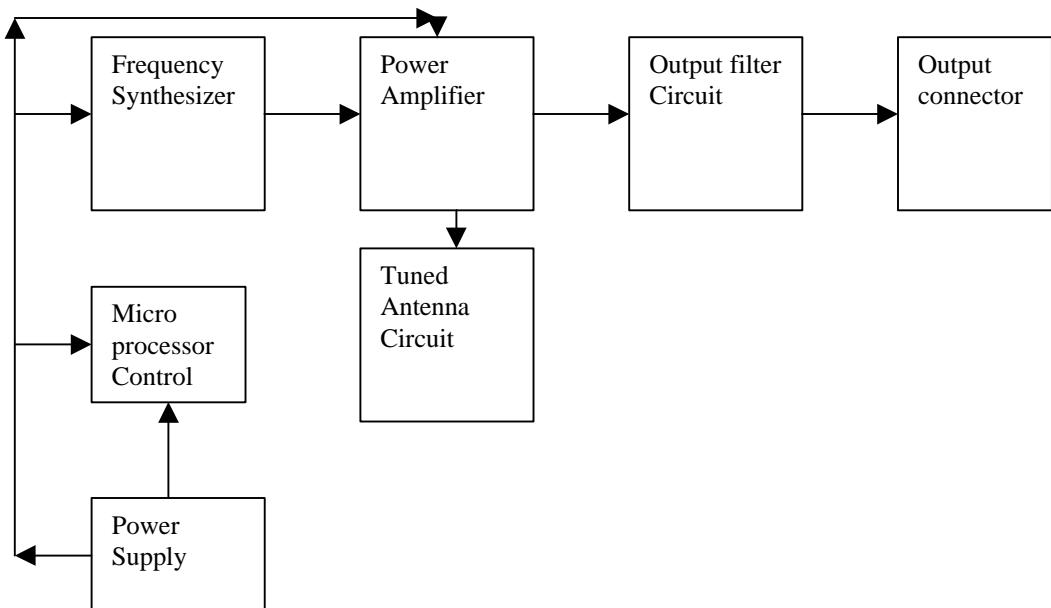
Date

Reviewed by TÜV Product Service Associate

Date

**EMC Block Diagram Form**

**System Configuration Block Diagram** -- Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.

**Authorization Signatures**

K. Lloyd

02/18/02

Customer authorization to perform tests  
according to this test plan.

Date

Test Plan/CDF Prepared By (please print)

Date

Reviewed by TÜV Product Service Associate

Date

## Appendix C

# MEASUREMENT PROTOCOL FOR FCC

### GENERAL INFORMATION

#### Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of  $\pm 4.5$  dB. The equipment comprising the test systems are calibrated on an annual basis.

#### Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

### CONDUCTED EMISSIONS

The final level, expressed in dB $\mu$ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dB $\mu$ V and  $\mu$ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

### RADIATED EMISSIONS

The final level, expressed in dB $\mu$ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB $\mu$ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example:

FREQ (MHz)	LEVEL (dB $\mu$ V)	CABLE/ANT/PREAMP (dB)	FINAL (dB $\mu$ V/m)	POL/HGT/AZ (m) (deg)	DELTA1 FCC B
60.80	42.5Qp	+ 1.2 + 10.9 - 25.5 =	29.1	V 1.0 0.0 -	-10.9

## DETAILS OF TEST PROCEDURES

### General Standard Information

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

### Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 450 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with  $50\ \Omega/50\ \mu\text{H}$  (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

### Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 1000 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.

In the frequency range of 9 kHz to 30 MHz, measurements are made with quasi-peak or average detection with a loop antenna. The antenna is positioned 1 meter above the ground plane and rotated about its vertical axis for maximum response at each azimuth about the EUT. The antenna is also positioned horizontally at the specified distances.