TÜV PRODUCT SERVICE

MEASUREMENT AND TECHNICAL REPORT

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

DATE: 12 June 1998

This Report Concerns:	Original Grant:	Class II Change: X
Equipment Type:	Base Station, Model SYS1000A Base	
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(a), 15.209(a), and 15.249.

Report Prepared by:

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

TABLE OF CONTENTS

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

1 GENERAL INFORMATION

1.1 Product Description

DESCRIPTION OF EUT:	Tye SYS1000A base is a wireless intercom base station intended primarily for use by Quick Service restaurantes for drive through ordering.

Components of EUT			
Description	Model Number	Serial Number	FCC ID Number
Base station	SYS1000A Base	--	BYMB1K

OPERATING MODE(S):	Normal

I/O CABLES	
CONNECTION	16 Vac
SHIELD	Yes
CONNECTORS	Solder lug
TERMINATION TYPE	Terminal block
LENGTH	10'
REMOVABLE	Yes
CONNECTION	Microphone in
SHIELD	Yes
CONNECTORS	None
TERMINATION TYPE	Terminal block
LENGTH	150'
REMOVABLE	Yes
CONNECTION	Speaker out
SHIELD	Yes
CONNECTORS	None
TERMINATION TYPE	Terminal block
LENGTH	150'
REMOVABLE	Yes
CONNECTION	Ceiling speaker
SHIELD	None
CONNECTORS	None
TERMINATION TYPE	Terminal block
LENGTH	50'
REMOVABLE	Yes
CONNECTION	RS485
SHIELD	Yes
CONNECTORS	None
TERMINATION TYPE	Terminal block
LENGTH	150'
REMOVABLE	Yes
CONNECTION	Gooseneck Microphone
SHIELD	Yes
CONNECTORS	N/A
TERMINATION TYPE	Terminal block
LENGTH	50'
REMOVABLE	Yes
POWER CORDS	N/A

POWER INTERFACE	
FREQUENCY/AC/DC VOLTAGE:	60 Hz / 120 Vac
PHASES/CURRENT:	1 / 1/2

OSCILLATOR FREQUENCIES

FREQUENCY	EUT LOCATION	DESCRIPTION OF USE
10 MHz	Transceiver board	Reference for PLL< TCXO
11.35 MHz (derived 45.4 MHz)	Transceiver board	For YCXO transmitter portion
1.2 MHz	Audio board	Reference for V3
4 MHz (derived 1 MHz)	Audio board	Reference for U14, U17, U18, U24 and U28
24.576 MHz	Audio board	Reference for U33
16.257 MHz	Audio board	Reference for U34
650 kHz	Audio board	Internal reference for switching regulator U6

POWER SUPPLY

DESCRIPTION	MANUFACTURER	MODEL #	SERIAL #	SWITCHING/LINEAR FREQ.
16 Vac Class 2 Transformer	Electro-Mech	N/A	N/A	Linear

POWER LINE FILTERS

MANUFACTURER	MODEL NO.	QTY.	LOCATION ON EUT
N/A			

CRITICAL EMI COMPONENTS

DESCRIPTION	MANUFACTURER	PART # OR VALUE	QTY.	LOCATION ON EUT
N/A				

DESCRIPTION OF ENCLOSURE:	Painted steel. No gaskets or coatings.

INTERFACING AND/OR SIMULATORS PERIPHERAL EQUIPMENT:

DESCRIPTION	MANUFACTURER	MODEL #	SERIAL #	FCC ID
Directional Electret Microphone	HME	DM1	--	N/A
Horn Speaker	HME	SP2000A	--	N/A
Remote Display	HME	R30	--	N/A
Gooseneck Microphone	Astatic	AMC-105-2	N/A	N/A

1 GENERAL INFORMATION (continued)

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, Paragraph 15.207(a)
2. Radiated Emissions, EN55022: 1992 Class B limit, 30 - 1,000 MHz, 10 meters
x 3. Radiated Emission per FCC Part 15, Paragraphs 15.209(a), and 15.249
4. Engineering evaluations

1.5 Test Facility

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

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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 15

Change in Base box - new dimensions: 14¼ W x 3¼D x 8 ¼H.

Theory of Operation for the SYS1000A Base (Audio Board information) (see following pages).

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

Theory of Operation for the SYS1000A Base

1 Audio Board

1.1 Refer to Figure 1 while reading the theory below.

1.2 Inbound audio

1.2.1 Audio from the outside microphone enters the audio board on connector J5, pins 1 and 2. The audio passes through a relay (K1). When the relay is not energized, the audio is connected to a high pass filter network for rejection of radio interference from the long microphone cable. The filtered audio then goes to a balanced preamplifier (U11B) for amplification. An adjustable gain amplifier (U11A) follows the preamplifier for level adjustment. Next, the audio is sent to a Programmable Gain Amplifier (U44), which is under the control of a Digital Signal Processor (U34), and then to a CODEC (U33) where it is converted from an analog signal to a digital signal. The digital signal is sent to the same DSP (U34) for analysis and processing to reduce unwanted noise. The DSP can adjust the signal level using the PGA (U44) to maintain the optimum processing efficiency. The resulting digital signal is sent back to the CODEC (U33) where it is converted back into an analog signal and sent through high pass filter (U19A). Following the high pass filter is the inbound audio gate (U8C). The inbound audio gate is open to allow the signal to pass, and closed to stop the signal and quiet the system. The inbound audio gate is under the control of microprocessor U24. The audio is sent next to a summing amplifier (U19B) where it is combined with audio from a goose neck microphone (U8A), an auxiliary source (J14 pin 10), signaling tones generated by microcontroller U24, and message repeater audio (U42B). After the summer, the signal is sent to compressor (U13B), and summing amplifier (U19C). After the compressor, the audio is summed (U9C) with received audio for retransmit, pre-emphasized (U9D) and summed (U16B) with a sub-audible tone. Lastly, the audio is sent to a Limiter (U15,U16A, and Q1) to keep the signal amplitude limited under high microphone levels and fed to J3 pin 7 to go the transceiver board modulator. After summer U19C, the signal sent out the auxiliary audio (J14 pin 1) and to an adjustable amplifier (U45B), after which is sent out J12 pin 4 for use with a different transceiver board not yet developed.

1.3 Outbound Audio

1.3.1 Received audio from the transceiver board enters the audio board at J3 pin 8. The signal is de-emphasized (U9B) and presented to the "A" and "B" channel decoders (U18 and U14). If the signal contains the correct subaudible tone, the decoder will open and allow the signal to pass through, stripping off the

subaudible tone. This signal is sent to summer (U9C) for re-transmit and to summer (U9A). Following the summer (U9A) the signal is sent to the expandor (U13A), and then to another summer (U21C) where it is combined with the auxiliary audio (J14 pin 10) and the audio from the goose neck microphone (U8B). The audio is then sent to a Programmable Gain Amplifier (U44), which is under the control of a Digital Signal Processor (U34), and then to a CODEC (U33) where it is converted from an analog signal to a digital signal. The digital signal is sent to the same DSP (U34) for analysis and processing to reduce unwanted noise. The DSP can adjust the signal level using the PGA (U44) to maintain the optimum processing efficiency. The resulting digital signal is sent back to the CODEC (U33) where it is converted back into an analog signal and sent through a buffer amplifier (U9A). From the buffer amplifier, the signal is sent to summer (U19C) described above, and to an audio recording IC (U31), the VAA audio gate (U42D), the outside speaker audio gate (U20A) and the ceiling speaker audio gate (U20B). All of these audio gates are under the control of microprocessor U24. The output from the VAA audio gate goes to the VAA circuit (U37, Q2). The VAA circuit causes attenuation of the inbound audio whenever audio is going to the outside speaker.

The play and record functions of the recording IC (U31) are under the control of microcontroller U24, as are the audio gates that route the recorded audio to different parts of the board. Audio gate (U42A) routes the recorded audio to the outside speaker summer (U21A) where it is combined with the receive audio from audio gate U20A. Audio gate (U42B) routes the recorded audio to summer (U19B) for transmit. And audio gate (U42C) routes the recorded audio to the ceiling speaker summer (U21B). The outside speaker summer (U21A) is followed by the AVC circuit (U26,U27,U28 and U29) which automatically adjusts the outside speaker volume based on the audio level present at the outside microphone. The AVC circuit is followed by the outside speaker amplifier (U23), and the signal is sent to J5 pins 9 and 10, and to relay K1. If energized, relay K1 presents the speaker amp output to J5 pins 1 and 2. The ceiling speaker summer (U21B) is followed by the ceiling speaker amplifier (U23). This signal is sent to J2 pins 7 and 8.

1.4 Routing Control

1.4.1 All audio routing, audible tone generation, and RS485 interface are controller by microcontroller U24. Dip switches S6 and S8 are connected to parallel to serial converters (U40 and U41) to read in configuration options. These options are sent to the microcontroller U24. Likewise, the microcontroller sends data out to serial to parallel converters (U38 and U39) for controlling audio routing. The microcontroller also runs the RS485 interface IC (U43), which is currently used to send data to a peripheral numeric display.

1.5 Synthesizer Control

1.5.1 Microcontroller (U3) and dip switch (S1) control the frequency of the synthesizer on the transceiver board.

1.6 Power

1.6.1 Power for the audio board is supplied by a 16VAC adapter that is connected to 120VAC single phase 60Hz power. The 16VAC is connected to J2 pin 1 and 2, and is fed to a full wave bridge rectifier (CR9 and C17). This unregulated power is sent to a +12VDC regulator (U5), a +8VDC regulator (U4), and a +5VDC switching regulator (U6). The +5VDC regulator supplies power to a +3.3VDC regulator (U7).

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The Base Station, Model **SYS1000A Base** was initially tested for FCC emission in the following configuration:

See Block Diagram, paragraph 4.1.

3.2 EUT Exercise Software

None

3.3 Special Accessories

None

3.4 Modification

None

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3.5 Configuration of Tested System

See Block Diagram, paragraph 4.1

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Figure 3.1 Configuration of Tested System

See Block Diagram, paragraph 4.1

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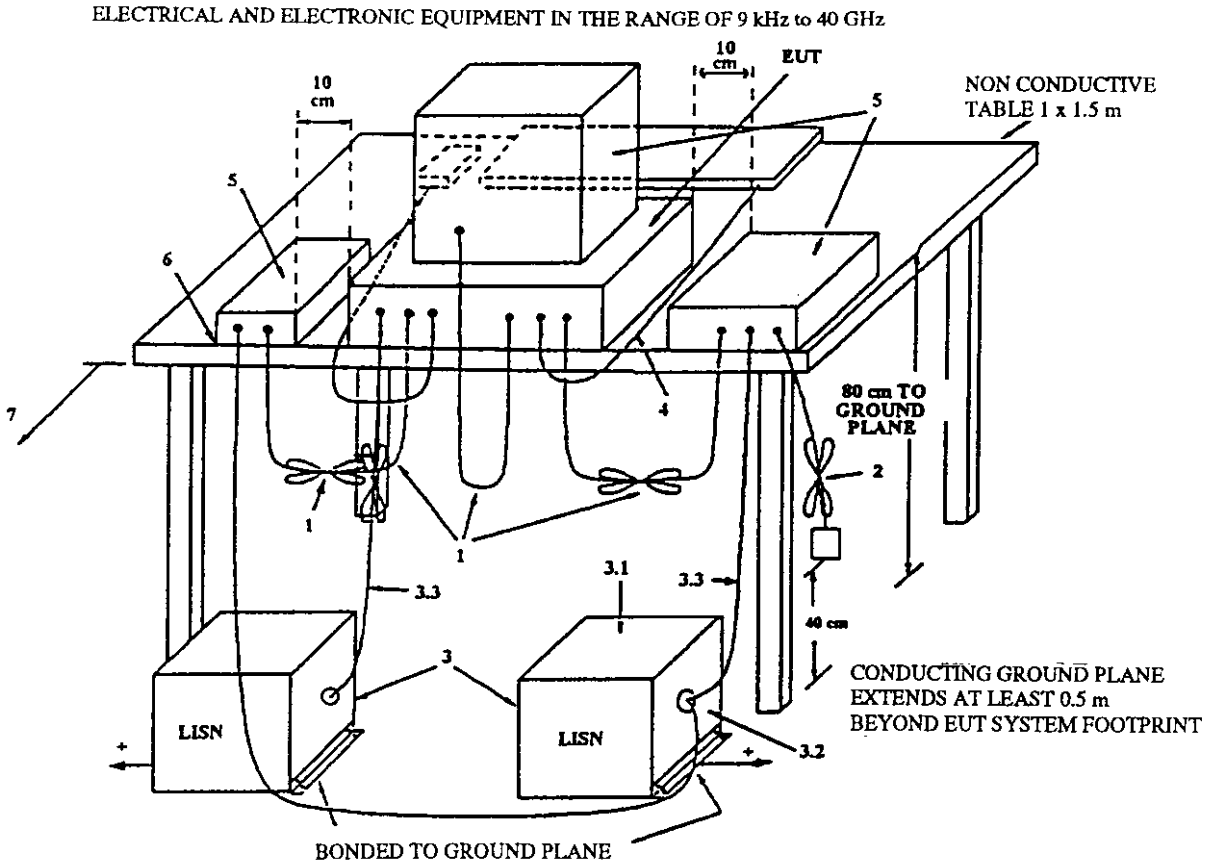
5 CONDUCTED MEASUREMENT SETUP

Conducted Emission Test Setup, 0.15 TO 30 MHz



LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. EUT connected to one LISN. Unused LISN connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, ground plane.
   - 3.1 All other equipment powered from second LISN.
   - 3.2 Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
   - 3.3 LISN at least 80 cm from nearest part of EUT chassis.
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the controller.
5. Non-EUT components being tested.
6. Rear of EUT, including peripherals, shall be all aligned and flush with rear of tabletop.
7. Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the floor ground plane.

Emissions Test Conditions: CONDUCTED EMISSIONS (Interference Voltage)

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

☐ - Test not applicable

☐ - SR-2, Shielded Room, 12' x 24' x 10', Metal Chamber
■ - SR-3, Shielded Room, 12' x 20' x 8', Metal Chamber
☐ - SR-4, Shielded Room, 10' x 17' x 8', Copper Screen Chamber
☐ - SR-5, Shielded Room, 16' x 28' x 15', Metal, Semi-Anechoic Chamber
☐ - CSR-1, Shielded Room, 10' x 7' x 7', Metal Chamber

Test Equipment Used :

	Model No.	Prop. No.	Description	Manufacturer	Serial No.
☐ -	NM-7A, NM-17/27, NM-37/57, NM-67, CCA-7, & H/P 9836 HP-1B Computer	156, 162-166	Automated RFI Measurement System (ARMS), NO. 1	Eaton/Ailtech	(multiple)
☐ -	NM-17/27, NM-37/57, CA-7, and H/P 9826 Computer	168, 170, 177, 178	Automated RFI Measurement System (ARMS), NO. 2	Eaton/Ailtech	(multiple)
☐ -	H/P Spectrum Analyzer, Model 8568B; Display Section RF Analyzer Section; H/P 85650A, Quasi-Peak Adapter H/P Computer System, Model 310 with HP 85869A Software	187, 188	Automated RFI Measurement System (ARMS)	Various	(multiple)
☐ -	LISN-3, 50 A	262-263	Power Mains Network (LISN), 50 µH/250 µH/50 Ω/0.25 µF	Fischer Custom Communications, Inc.	3-4
☐ -	LISN-3, 50 A	264, 265	Power Mains Network (LISN), 50 µH/250 µH/50 Ω/0.25 µF	Fischer Custom Communications, Inc.	5-6
☐ -	LISN-2, 25 A	413	Power Mains Network (LISN), 50 µH/250 µH/50 Ω/0.25 µF	Fischer Custom Communications, Inc.	7
☐ -	LISN-2, 25 A	--	Power Mains Network (LISN), 50 µH/250 µH/50 Ω/0.25 µF	Fischer Custom Communications, Inc.	7
☐ -	FCC-LISN-50-25-2	553	Power Mains Network (LISN), 50 µH/250 µH/50 Ω/0.25 µF	Fischer Custom Communications, Inc.	112
☐ -	FCC-LISN-50-25-2	552	Power Mains Network (LISN), 50 µH/250 µH/50 Ω/0.25 µF	Fischer Custom Communications, Inc.	113
☐ -	8012-50-R-12-BNC	266	LISN, 50 µH/50 Ω/0.1 µF	Solar Electronics Co.	--
■ -	9252-50-R-24-BNC	458	LISN, 50 µH /250 µH/50 Ω/ 0.25 µF	Solar Electronics Co.	941719
■ -	9252-50-R-24-BNC	457	LISN, 50 µH /250 µH/50 Ω/ 0.25 µF	Solar Electronics Co.	941720
☐ -	MDS-21	277	Absorbing Clamp	Rohde & Schwarz	821023
☐ -	ESHS 20	428	EMI Test Receiver	Rohde & Schwarz	837055/001
■ -	ESHS 30	459	EMI Test Receiver	Rohde & Schwarz	832354/004
■ -	CAT-20	611	20 dB Attenuator	Mini-Circuits	--
■ -	CAT-20	615	20 dB Attenuator	Mini-Circuits	--

Remarks: Tested to Class B; therefore, passes Class A.

6 CONDUCTED EMISSION DATA

HME ELECTRONICS
Base Station, Model SYS1000A Base

See following page(s).

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TUV PRODUCT SERVICE
POWERLINE CONDUCTED RFI

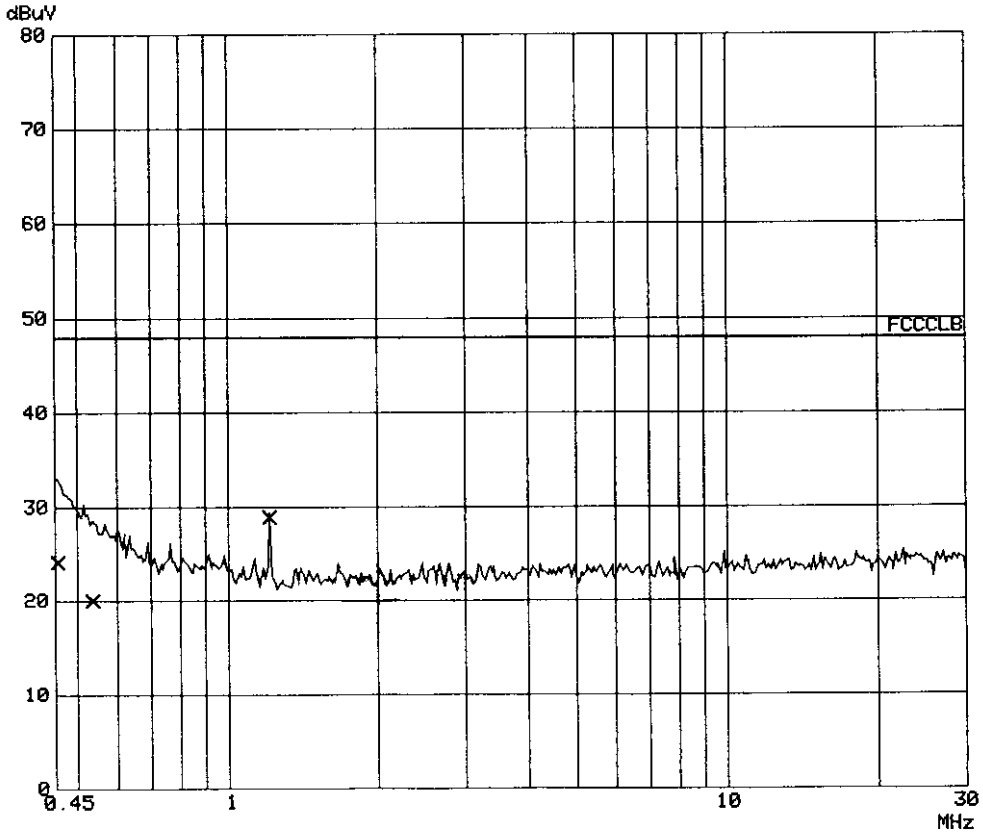
EUT: Base Station, Model Sys1000A Base
Manuf: HM Electronics, Inc.
Op Cond: Normal
Operator: Greg Woelke
Test Spec: FCC Part 15, Paragraph 15.107(a)
120 V 60 Hz Line 1
Date: 27. May 98 09:14

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	1M	5k	10k	PK	50ms	AUTO	LN OFF	60dB
1M	30M	5k	10k	PK	1ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
1	100k	30M	20dBLISN

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 20dB



PAGE 1

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

TUV PRODUCT SERVICE
POWERLINE CONDUCTED RFI

EUT: Base Station, Model Sys1000A Base
Manuf: HM Electronics, Inc.
Op Cond: Normal
Operator: Greg Woelke GW RM
Test Spec: FCC Part 15, Paragraph 15.107(a)
120 V 60 Hz Line 1
Date: 27. May 98 09:14

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
0.45500	24.2 ✓	48.0
0.53500	20.1 ✓	48.0
1.21000	29.0 Ambient	48.0

* limit exceeded

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TUV PRODUCT SERVICE
POWERLINE CONDUCTED RFI

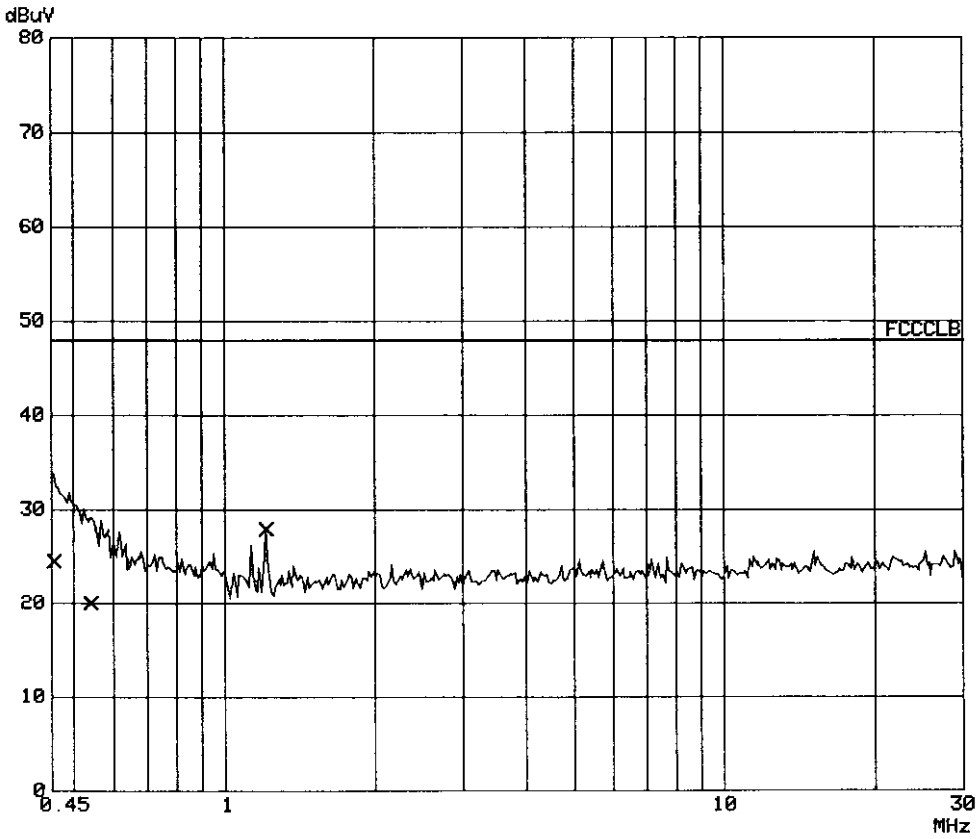
EUT: Base Station, Model Sys1000A Base
Manuf: HM Electronics, Inc.
Op Cond: Normal
Operator: Greg Woelke
Test Spec: FCC Part 15, Paragraph 15.107(a)
120 V 60 Hz Line 2
Date: 27. May 98 09:22

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	1M	5k	10k	PK	50ms	AUTO	LN OFF	60dB
1M	30M	5k	10k	PK	1ms	AUTO	LN OFF	60dB

Transducer No.	Start	Stop	Name
1	100k	30M	20dBLISN

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 20dB



PAGE 1

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

TUV PRODUCT SERVICE
POWERLINE CONDUCTED RFI

EUT: Base Station, Model Sys1000A Base
Manuf: HM Electronics, Inc.
Op Cond: Normal
Operator: Greg Woelke GW
Test Spec: FCC Part 15, Paragraph 15.107(a)
120 V 60 Hz Line 2
Date: 27. May 98 09:22

Final Measurement Results:

Frequency MHz	QP Level dBuV	QP Limit dBuV
0.45500	24.6 ✓	48.0
0.54000	20.0 ✓	48.0
1.21000	27.9 Ambient	48.0

* limit exceeded

PAGE 2

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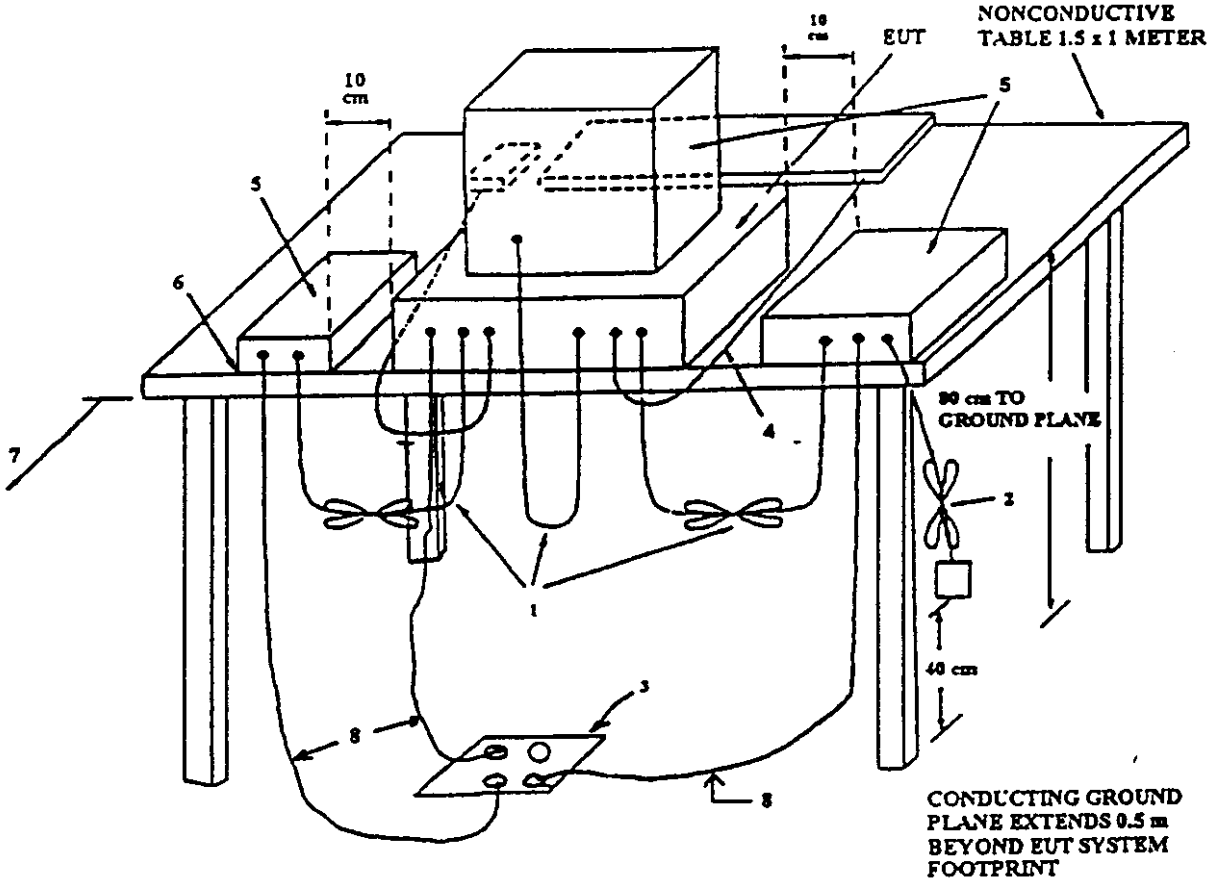
7 RADIATED MEASUREMENT SETUP

Radiated Emission Test Setup, 30 to 1,000 MHz



LEGEND:

1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.
3. If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground plane with the receptacle flush with the ground plane.
4. Cables of hand-operated devices, such as keyboards, mouses, etc., have to be placed as close as possible to the controller.
5. Non-EUT components of EUT system being tested.
6. The rear of all components of the system under test shall be located flush with the rear of the table.
7. No vertical conducting wall used.
8. Power cords drape to the floor and are routed over to receptacle.

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7.1 RADIATED MEASUREMENT PHOTOS (209(a)

HM ELECTRONICS
Base Station, Model SYS1000A Base

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Emissions Test Conditions: RADIATED EMISSIONS (Electric Field) (209(a))

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**

☐ - Roof (Small Open Area Test Site)
☐ - Canyon #1 (10- and 30-Meter Open Area Test Site), Carroll Canyon, San Diego
■ - Canyon #2 (3- and 10-Meter Open Area Test Site), Carroll Canyon, San Diego

Testing was performed at a test distance of :

☐ - 3 meters
■ - 10 meters
☐ - 30 meters

Test Equipment Used :

	Model No.	Prop. No.	Description	Manufacturer	Serial No.
☐ -	NM-37/57A	420	OATS measurement set (Roof)	Eaton/Ailtech	0561-09261
	CCA-7	373			0773-03117
☐ -	NM-37/57	171	OATS measurement set (Canyon)	Eaton/Ailtech	0709-82078
	CCA-7	172			0187-0322
☐ -	HFH 2-Z2	208	Antenna, Loop	Rohde & Schwarz	880
☐ -	3104	235	Antenna, Biconical	EMCO	3031
☐ -	3110	451	Antenna, Biconical	EMCO	1378
☐ -	94455-1	231	Antenna, Biconical	Eaton/Ailtech	0811
■ -	3110B	491	Antenna, Biconical	EMCO	9508-2
☐ -	CBL6111	460	Antenna, Bilog	Chase	1013
☐ -	CBL6111	461	Antenna, Bilog	Chase	1291
☐ -	3146	242	Antenna, Log Periodic Dipole	EMCO	1597
☐ -	3146	243	Antenna, Log Periodic Dipole	EMCO	106X
■ -	3146	244	Antenna, Log Periodic Dipole	EMCO	1063
☐ -	7405	570	Loop Probes	EMCO	9104-1959
☐ -	8566B	404	Spectrum Analyzer	Hewlett Packard	2311A02209
☐ -	85662B	406	Spectrum Analyzer Display	Hewlett Packard	2309A04682
☐ -	ESVS 30	427	EMI Test Receiver	Rohde & Schwarz	830350/006
■ -	ESVS 30	466	EMI Test Receiver	Rohde & Schwarz	833825/003

Remarks: _____

8 RADIATED EMISSION DATA (209(a)

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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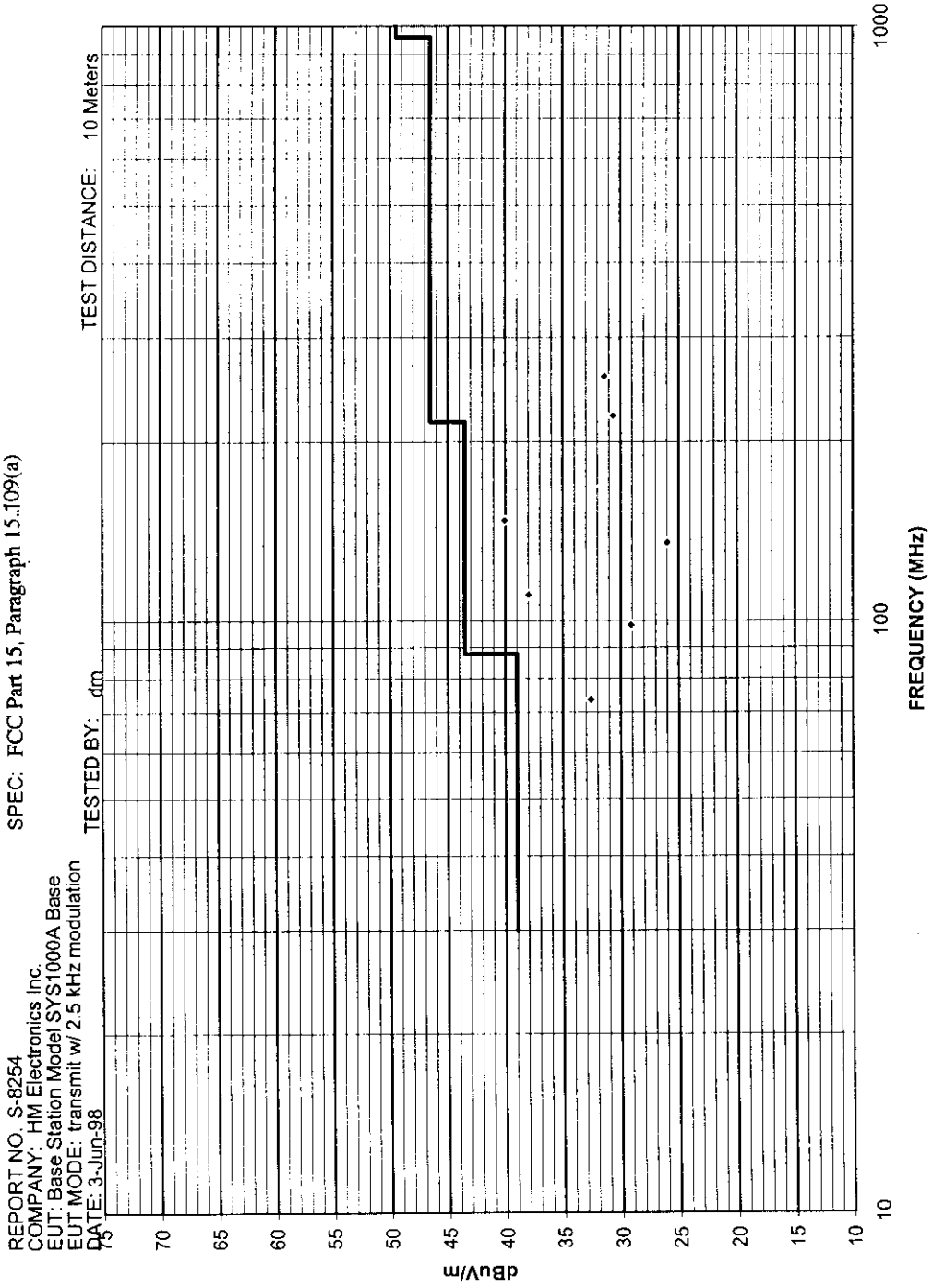
REPORT NO. S-8254
COMPANY: HM Electronics Inc.
EUT: Base Station Model SYS1000A Base
EUT MODE: transmit w/ 2.5 kHz modulation
DATE: 3-Jun-98
SPEC: FCC Part 15, Paragraph 15.109(a)
TESTED BY: dm
TEST DISTANCE: 10 Meters
dBuV/m
FREQUENCY (MHz)
75
70
65
60
55
50
45
40
35
30
25
20
15
10
1000
100
10

TÜV PRODUCT SERVICE

REPORT No: S-8254 SPEC: FCC Part 15, Paragraph 15.109(a)

CUSTOMER: HM Electronics Inc. TEST DIST: 10 Meters

E U T: Base Station Model SYS1000A Base TEST SITE: 2

EUT MODE: transmit w/ 2.5 kHz modulation BICONICAL: 491

DATE: 3-Jun-98 TESTED BY: dm LOG PERIODIC: 244

NOTES: Quasi-Peak with 120 KHz measurement bandwidth. RCVR: 466

EUT MARGIN -3.5 dB at 147.46 MHz ver 1.6

FREQUENCY (MHz)	VERTICAL measured (dBuv)	HORIZONTAL measured (dBuV)	CORRECTION FACTOR (dB/m)	MAXIMUM CORRECTED (dBuV/m)	SPECIFIED LIMIT (dBuV/m)	EUT MARGIN (dB)	EUT ROTATION (degrees)	ANTENNA HEIGHT (meters)
73.73	21	16	11.6	**32.6**	39	-6.4	0	1
98.30	16.5	11	12.6	**29.1**	43.5	-14.4		
110.59	24	16	14.0	**38.0**	43.5	-5.5	180	1.5
135.17	10	6	16.0	**26.0**	43.5	-17.5		
147.46	21	23.5	16.5	**40.0**	43.5	-3.5	180	1.5
221.19	15	12	15.7	**30.7**	46.5	-15.8		
258.06	14	12	17.4	**31.4**	46.5	-15.1		

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8.1 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.

Emissions Test Conditions: RADIATED EMISSIONS (FCC Part 15, 15.249)

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

☐ - **Test not applicable**

■ - Roof (Small Open Area Test Site)
☐ - Canyon #1 (10- and 30-Meter Open Area Test Site), Carroll Canyon, San Diego
☐ - Canyon #2 (3- and 10-Meter Open Area Test Site), Carroll Canyon, San Diego

Testing was performed at a test distance of :

■ - 3 meters
☐ - 10 meters
☐ - 30 meters

Test Equipment Used :

	Model No.	Prop. No.	Description	Manufacturer	Serial No.
☐ -	NM-37/57A	420	OATS measurement set (Roof)	Eaton/Ailtech	0561-09261
	CCA-7	373			0773-03117
☐ -	NM-37/57	171	OATS measurement set (Canyon)	Eaton/Ailtech	0709-82078
	CCA-7	172			0187-0322
☐ -	HFH 2-Z2	208	Antenna, Loop	Rohde & Schwarz	880
■ -	3115	251	Antenna, Double Ridge Guide	EMCO	2495
☐ -	3110	451	Antenna, Biconical	EMCO	1378
☐ -	94455-1	231	Antenna, Biconical	Eaton/Ailtech	0811
☐ -	3110B	491	Antenna, Biconical	EMCO	9508-2
☐ -	CBL6111	460	Antenna, Bilog	Chase	1013
☐ -	CBL6111	461	Antenna, Bilog	Chase	1291
■ -	3146	418	Antenna, Log Periodic Dipole	EMCO	1597
☐ -	3146	243	Antenna, Log Periodic Dipole	EMCO	106X
☐ -	3146	244	Antenna, Log Periodic Dipole	EMCO	1063
☐ -	7405	570	Loop Probes	EMCO	9104-1959
■ -	8566B	404	Spectrum Analyzer	Hewlett Packard	2311A02209
■ -	85662B	406	Spectrum Analyzer Display	Hewlett Packard	2309A04682
☐ -	ESVS 30	427	EMI Test Receiver	Rohde & Schwarz	830350/006
■ -	AFD3-0208-40-ST	367	Pre-Amplifier (2-8 GHz)	Miteq, Inc.	155382

Remarks: _____

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9.1 RADIATED EMISSION DATA

HME ELECTRONICS
Base Station, Model SYS1000A Base

See following page(s).

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TÜV PRODUCT SERVICE

REPORT No: S-8254 TESTED BY: dm SPEC: FCC Part 15 para 15.249

CUSTOMER: HME TEST DIST: 3 Meters ✓

E U T: Base Station Model 1000A Base TEST SITE: 3

EUT MODE: transmit w/ modulation (2.5kHz) BICONICAL: N/A

DATE: 3-Jun-98 LOG PERIODIC: 418

NOTES: Data is peak ↓ 100% ✓ OTHER: 251

RBW & VBW = 1MHz ✓

FREQ (MHz)	VERTICAL (dBuv) pk	av	HORIZONTAL (dBuv) pk	av	CORRECTION FACTOR (dB/m)	MAX LEVEL (dBuV/m) pk	av	SPEC LIMIT (dBuV/m) pk	av	MARGIN (dB) pk	av	EUT Rotatio	Antenna Height	
902.3	63.1		60.6		27.7	**90.8**		94		-3.18		0	1.75	
1804.6	10		8.8		32.4	**42.4**		54		-11.6		90	1	
2706.8	10.4		9.1		36.3	**46.7**		54		-7.26		95	1	
3609.3	-1.8		0.5		39.1	**39.6**		54		-14.4		180	1	
903	64.5		60.6		27.7	**92.2**		94		-1.77		90	1.5	
1806	11.2		8.8		32.4	**43.6**		54		-10.4		80	1	
2709	8.4		8.3		36.3	**44.7**		54		-9.26		180	1.75	
3612	-0.3		-0.6		39.1	**38.8**		54		-15.2		180	1	
903.8	63.5		62.8		27.7	**91.2**		94		-2.76		45	1.5	
1807.6	7.7		5.1		32.4	**40.1**		54		-13.9		80	1	
2711.4	5.8		6.4		36.3	**42.7**		54		-11.3		90	1	
3615.2	-1.5		-0.6		39.1	**38.5**		54		-15.5		180	1	

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10 SUMMARY:

All tests according to the regulations cited on page 1 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements cited on page 1.

☐ - **Does not** fulfill the general approval requirements cited on page 1.

- TÜV PRODUCT SERVICE, INC. -

Responsible Engineer:

Mary Washington
(EMC Engineer)

Responsible Engineer:

Dave Marshall
(EMC Test Engineer)

Appendix A

Test Setups
(Photographs)

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PHOTOS OF TESTED EUT

The following photos are attached:

Figure A1	SYS1000A Base Top
Figure A2	SYS1000A Base Bottom
Figure A3	SYS1000A Base Back
Figure A4	SYS1000A Base Front
Figure A5	SYS1000A Base Interior with boards in place
Figure A6	SYS1000A Base Audio Board Front
Figure A7	SYS1000A Base Audio Board Back
Figure A8	SYS1000A Base Right Side
Figure A9	SYS1000A Base Back

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