MEASUREMENT AND TECHNICAL REPORT

LGC Wireless, Inc.
2540 Junction Avenue
San Jose, CA 95134

DATE: 30 August, 2001

This Report Concerns: Original Grant: X Class II Change:

Equipment Type: LGC InterReach Unison EGSM

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes: ____ Defer until: _____ No: X

LCG Wireless Inc., 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.

Transition Rules Request per 15.37? Yes: *No:

(*) FCC Part 2, Paragraphs, 2.1046, 2.1051, 2.1053, 2.1055 and Part 90..

Report Prepared By:

TÜV Product Service
4855 Patrick Henry Drive Bldg. 6
Santa Clara, CA 95054

DIRECTORY

1 . GENERAL INFORMATION

1.1 Product Description

EUT Description:

The system is a distributed in-building antenna system that enables wireless uninterrupted communication. The Main Hub of the system receives an RF signal from either a roof top antenna or a base station. The Main Hub down converts this signal to an IF signal and passes the signal to the Expansion Hub via fiber. The Expansion Hub does some additional filtering and passes the signal via Cat5 cable on to the Remote Antenna Unit, the RAU. The RAU up converts the signal back to an RF signal and rebroadcasts it. The system extends the wireless coverage area by bringing wireless signals into hard to penetrate structures.

EUT Name: LGC InterReach Unison EGSM Model No. UNS-EGSM-1

Product Options: N/A Serial No. Not Serialized

Configurations To Be Tested: LGC InterReach Unison EGSM compromising of Main Hub, Expansion, and Remote Antenna Unit.

Power Requirements

Voltage: 120 VAC (If battery powered, make sure battery life is sufficient to complete testing.)
No. Of Phases: N/A
Current: Amps / Phase (Max): 5 A Current: Amps / Phase (Nominal): N/A

Typical Installation and / or Operating Environment
TELECOM

EUT Power Cable

■ - Permanent or ☐ - Removable ☐ - Shielded or ■ - Unshielded

Length (In Meters): 1.5 ■ **Not Applicable**

EUT I/O Ports and Cables:

CONNECTION:	Signal Generator To Main Hub and RAU to Spectrum Analyzer; RF Cable.
SHIELD:	Yes
CONNECTORS:	Yes
TERMINATION TYPE:	SMA or N
LENGTH:	
REMOVABLE:	Yes
CONNECTION:	Expansion Hub to RAU; Cat5 Cable
SHIELD:	No
CONNECTORS:	Yes
TERMINATION TYPE:	RJ 45
LENGTH:	50 m max
REMOVABLE:	Yes
CONNECTION:	Main Hub to expansion Hub; Fiber
SHIELD:	No

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 test system are:

None.

1.4 STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are accurate. The reader is cautioned that there is some measurement variability due to the tolerances of the test equipment that can contribute to a nominal product measurement uncertainty. Furthermore, component differences and manufacturing process variability of production units similar to that tested may result in additional product uncertainty. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests.

1.5 TEST FACILITY

All measurements and tests were performed by:

TÜV Product Service

4855 Patrick Henry Drive

Building 6

Santa Clara, CA 95054

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

Equipment Specifications

Frequency Range In MHz	Rated RF Power In Watts	Frequency Tolerance %, Hz, ppm	Emission Designator (see CFR §2.201 and § 2.202)	Microprocessor Model Number
880- 915 925- 960	0.01	+/- 5ppm	F8W , DXW, F1D, F9W	

2. SYSTEM TEST CONFIGURATION

2.1 Justification

The LGC InterReach Unison EGSM was tested in the configuration shown in the block diagram.

2.2 EUT Exercise Software

None

2.3 Special Accessories

None.

2.4 Modifications

None.

2.5 Configuration of tested System

See Block Diagram.

RF Power Output – 2.1046

Uplink

Channel	Frequency (MHz)	Peak Power Level (dBm)
Low	880.000	-18.4
Mid	897.500	-14.7
High	915.000	-14.6

Downlink

Channel	Frequency (MHz)	Peak Power Level (dBm)
Low	925.000	9.8
Mid	942.500	14.1
High	960.000	10.7

Test Equipment used:

	Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
■ -	8566B	Spectrum Analyzer	Hewlett Packard	2816A18342	9/25/01
■ -	8656B	Signal Generator	Hewlett Packard	2523A03399	4/9/02
■ -	HP8491B	Attenuator	Hewlett Packard	35958	N/A

Occupied Bandwidth (2.1049)

Minimum Requirement:

Section 2.1049(i); transmitters designed for other types of modulation –when modulated by an appropriate signal of sufficient amplitude to be represented of the type of service in which used. A description of the input signal should be supplied.

Test Procedure

The EUT's Occupied Bandwidth is compared to the input source plot (signal generator) and the output plot (EUT) and checked that the input signal bandwidth is not greater at the output of the EUT.

Test Results

Plots were produced for the output of the EUT and for the signal generator. See following pages.

Test Equipment Used:

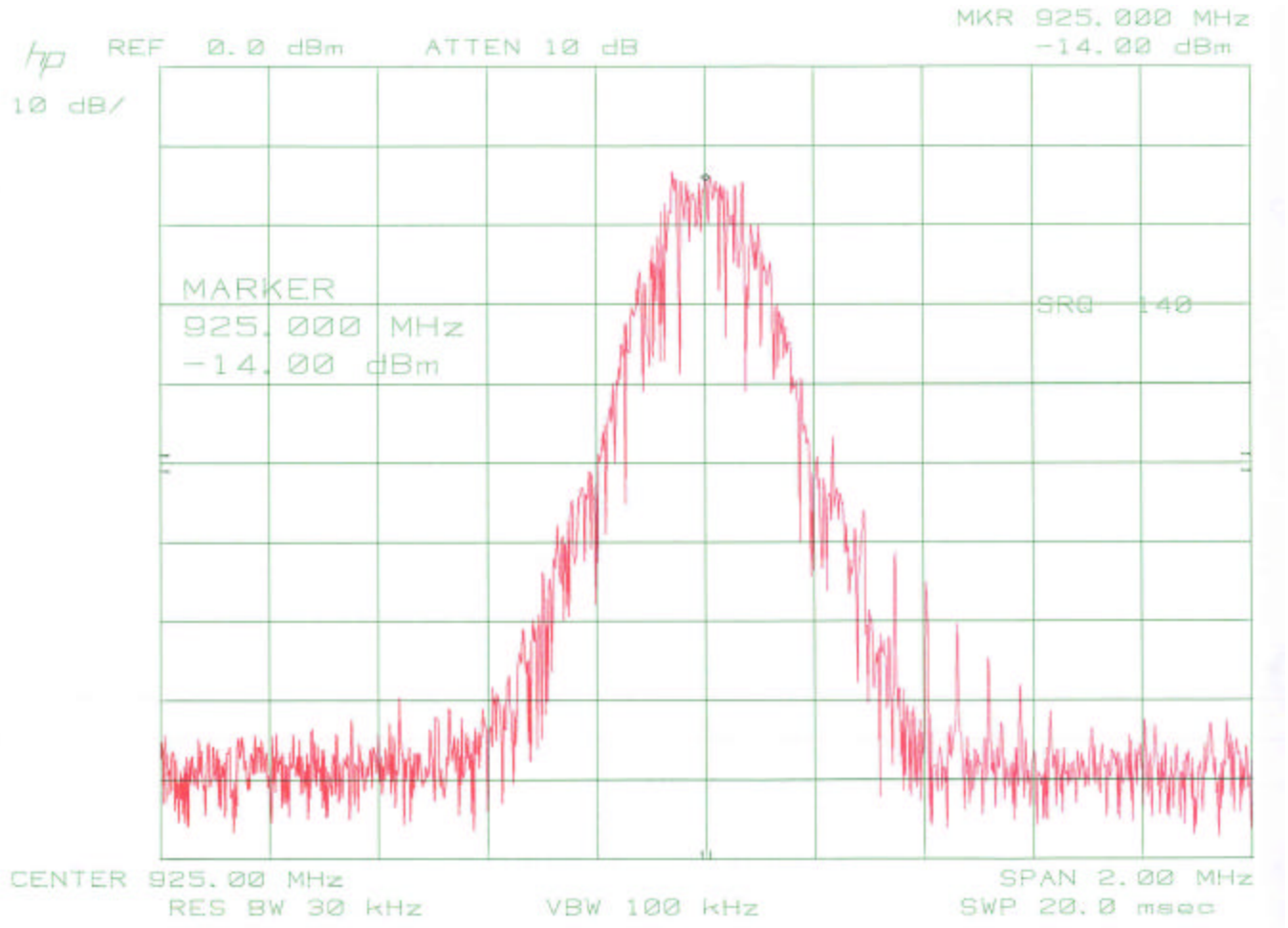
	Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
■ -	8566B	Spectrum Analyzer	Hewlett Packard	2816A18342	9/25/01
■ -	8656B	Signal Generator	Hewlett Packard	2523A03399	4/9/02
■ -	HP8491B	Attenuator	Hewlett Packard	35958	N/A

TEST PLOTS

Occupied Bandwidth

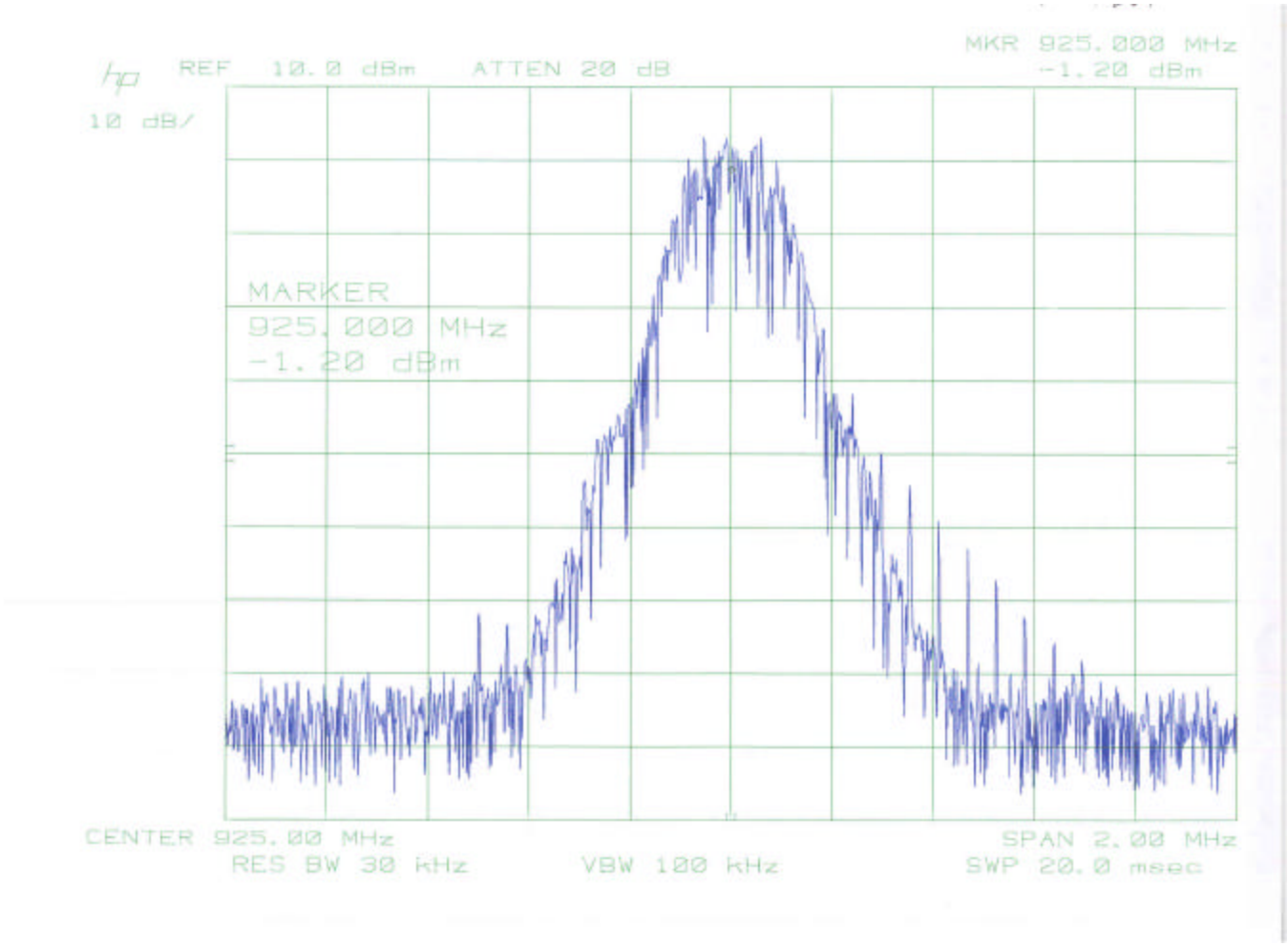
Occupied Bandwidth - Downlink

925.000 MHz – Signal Generator



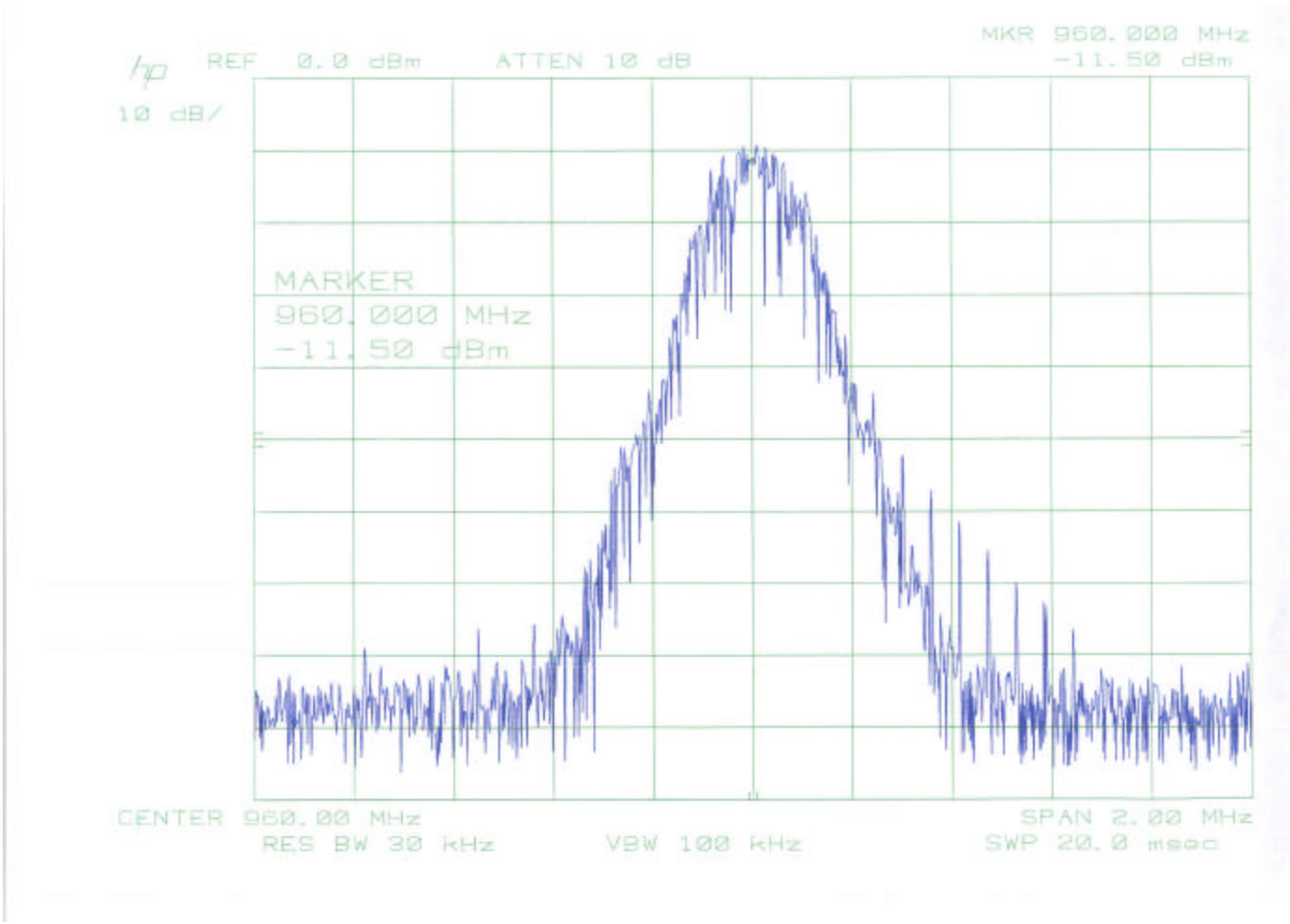
Occupied Bandwidth - Downlink

925.000 MHz



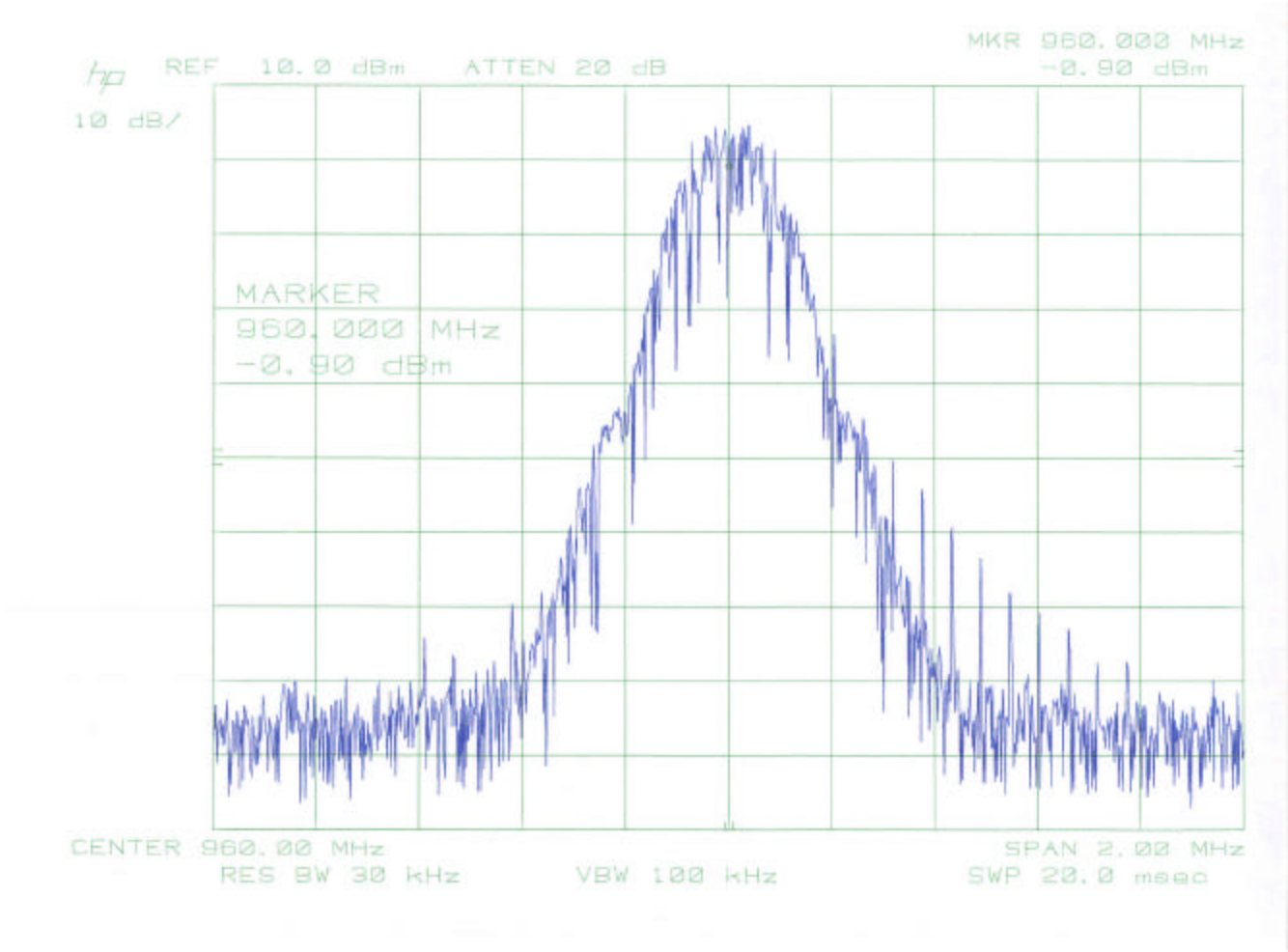
Occupied Bandwidth - Downlink

960.000 MHz – Signal Generator



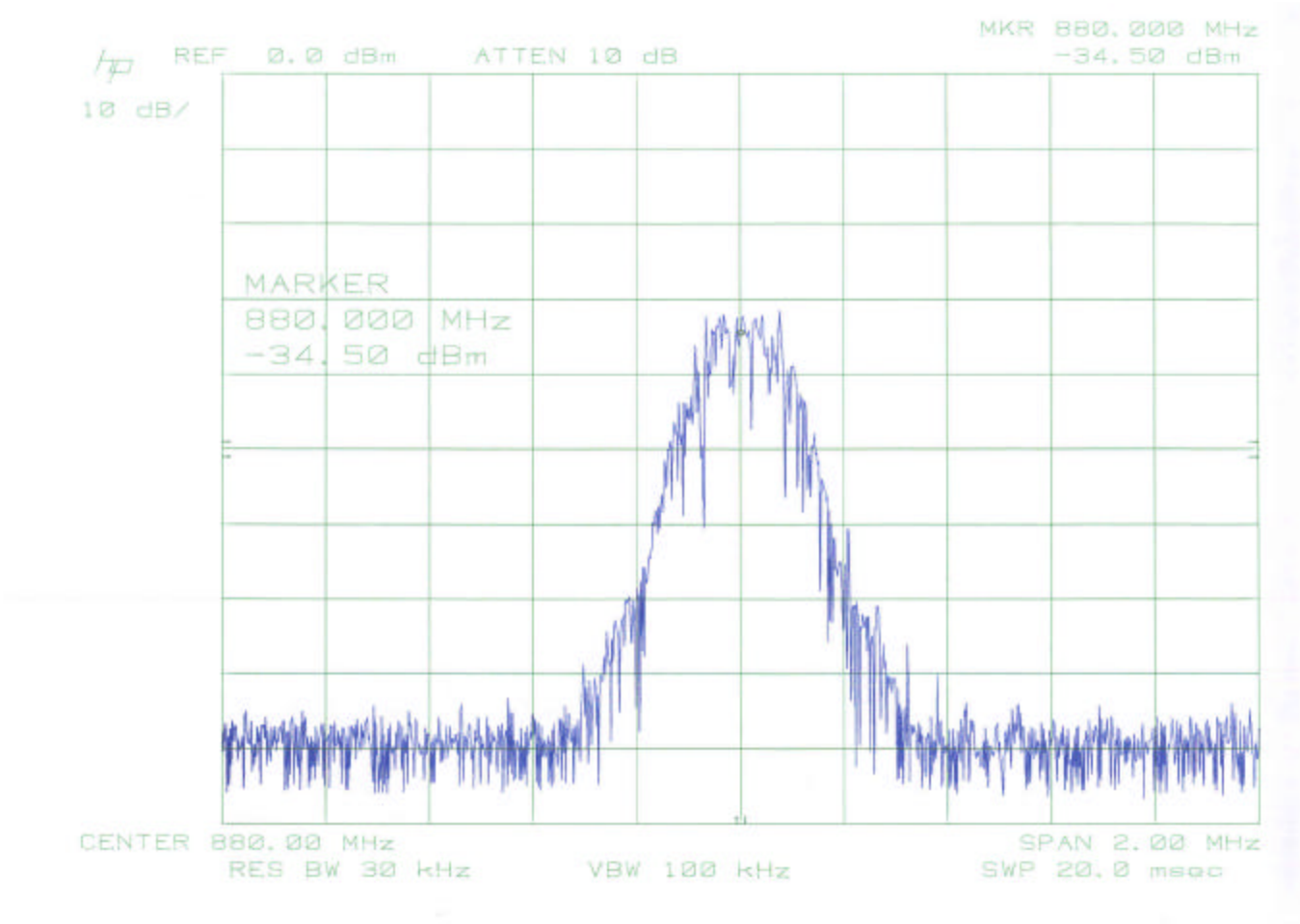
Occupied Bandwidth - Downlink

960.000 MHz



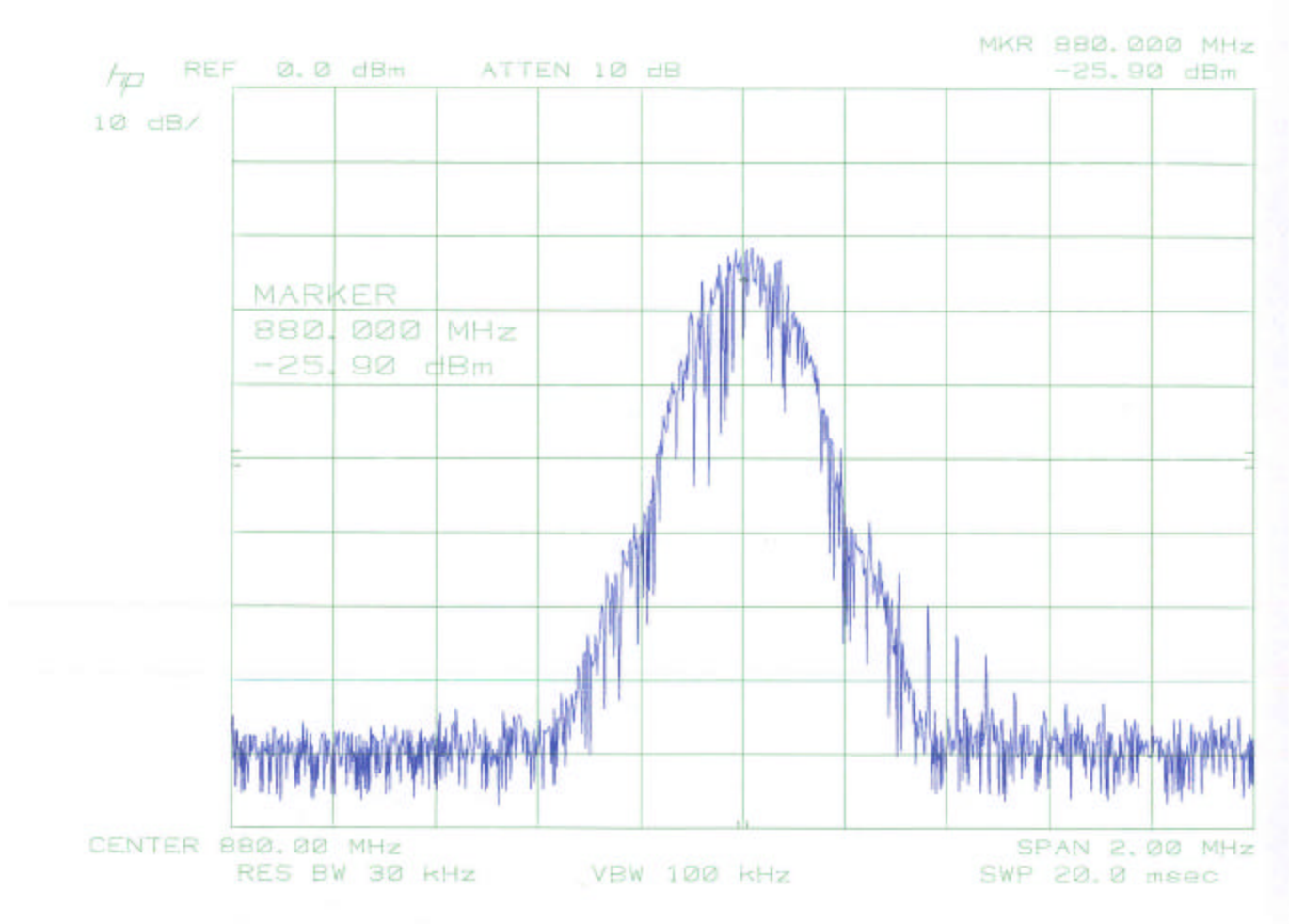
Occupied Bandwidth - Uplink

880.000 MHz – Signal Generator



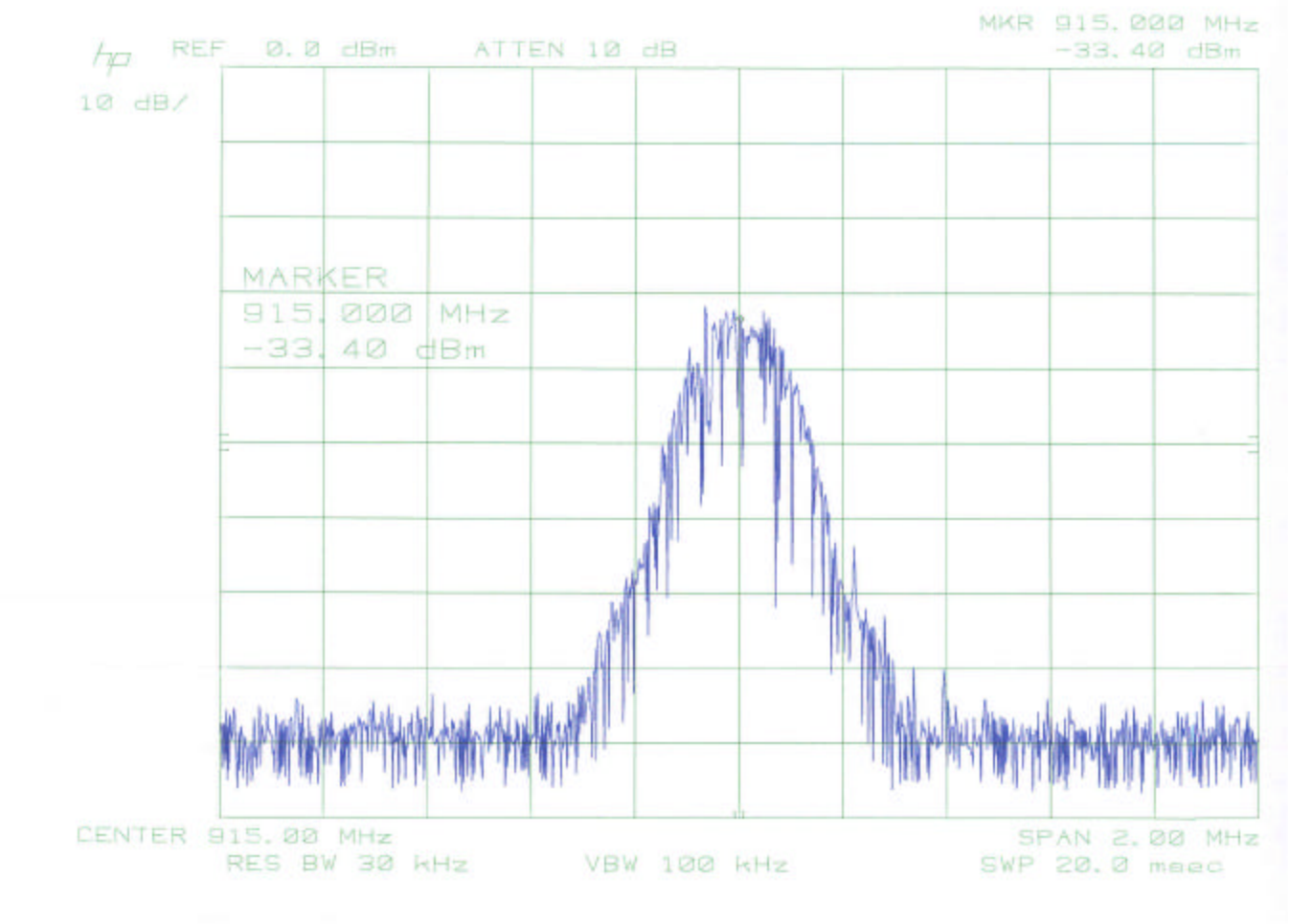
Occupied Bandwidth - Uplink

880.000 MHz



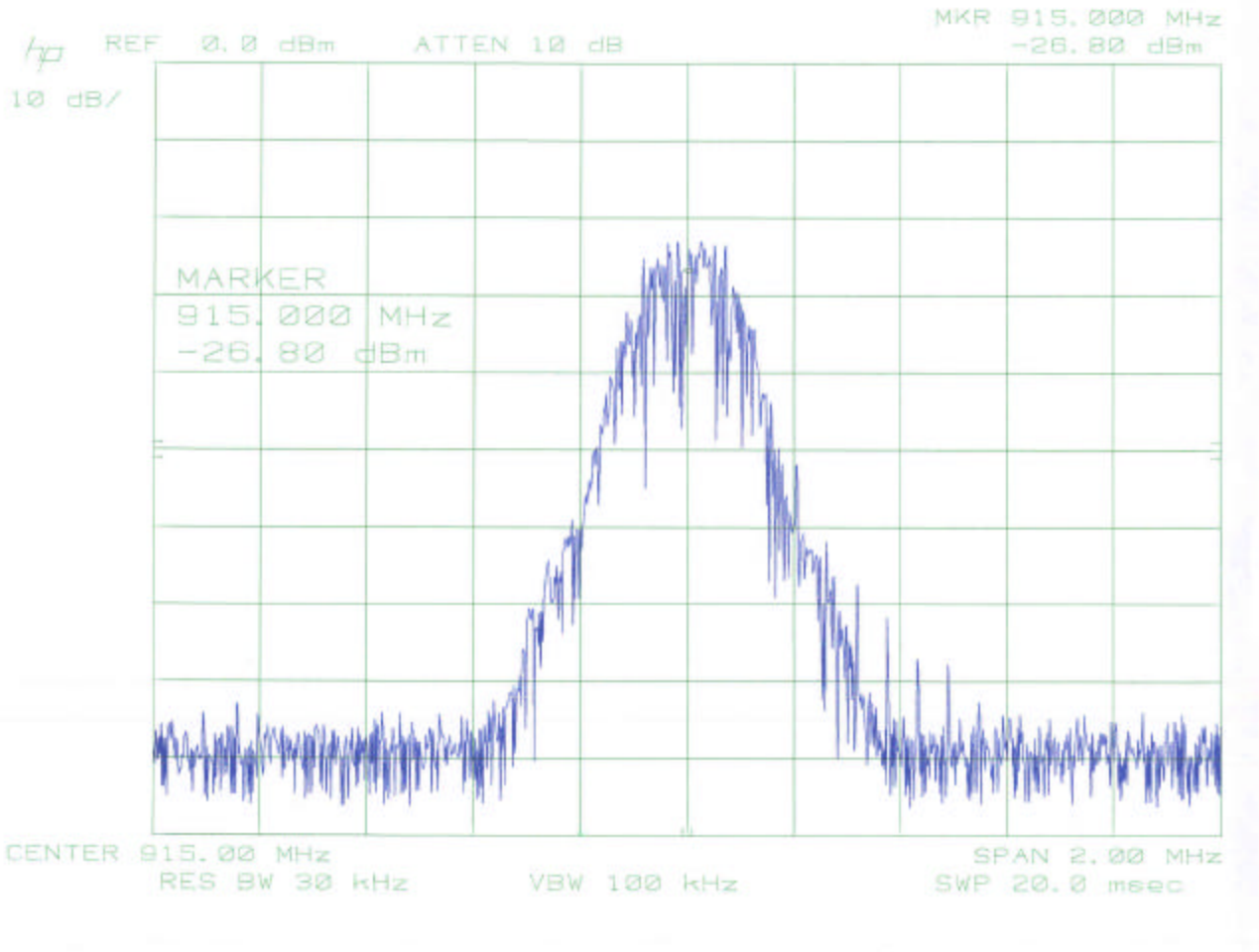
Occupied Bandwidth - Uplink

915.000 MHz – Signal Generator



Occupied Bandwidth - Uplink

915.000 MHz



Spurious Emissions At The Antenna Terminals (2.1051)

Method: Spurious Emissions at the Antenna Terminals.

Measurements shown are corrected to take into account cable losses and correction factors.

Frequency (MHz)	Channel Frequency (MHz)		
	935.000	947.500	960.000
692.5			-43.5 dBm
705.0		-43.5 dBm	
716.5	-44.6 dBm		
852.0	-42.0 dBm	-42.4 dbm	-42.3 dBm

Remarks:

No other emissions were detected at a level greater then 20 dB below the limit.

Test Equipment Used:

	Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
■ -	8566B	Spectrum Analyzer	Hewlett Packard	2816A18342	9/25/01
■ -	8656B	Signal Generator	Hewlett Packard	2523A03399	4/9/02
■ -	HP8491B	Attenuator	Hewlett Packard	35958	N/A

Field Strength Of Spurious Radiation (2.1053)

Method: The field strength of spurious radiation was measured at a distance of 3 meters in a semi anechoic absorber lined chamber. Frequency range investigated was 900 MHz to the 10th Harmonic.

Frequency (MHz)	Channel Frequency (MHz)		
	935.000	947.500	960.000
1653.600	-28.0dBm	-28.0dBm	-28.0dBm

Remarks:

No other emissions were detected at a level greater than 20 dB below the limit.

Test Equipment Used:

	Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
■ -	8566B	Spectrum Analyzer	Hewlett Packard	2816A18342	9/25/01
■ -	8656B	Signal Generator	Hewlett Packard	2523A03399	4/9/02
■ -	HP8491B	Attenuator	Hewlett Packard	35958	N/A

Section 2.1055: Frequency Stability

Not Applicable. EUT is an Amplifier Type repeater. No RF oscillators or frequency determining circuits in EUT.

3.0 RADIATED EMISSION EQUIPMENT / 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).

See test setup photos for radiated emissions test setup.

Sample Calculations

These calculations are performed automatically by the control software prior to display. For radiated emissions the corrected level is derived by taking into account the antenna gain, antenna mast amplifier and coax cable loss.

For example, assuming a receiver measurement of 50.0dbμV. Allowing for an antenna factor of 10.0dB/m, a mast amplifier gain of 25dB and a cable loss of 0.64dB, the resultant corrected field strength would be calculated as follows:-

Receiver level = field strength - antenna factor + amplifier gain - cable factor

Corrected field strength = (Receiver level) + (Cable factor) - (Amp gain) + (Antenna factor)

= 50.0 + 10.0 + 0.64 - 25

= 35.64dBμV/m

FCC limits are specified in μV for conducted emissions and μV/m for radiated emissions. These are converted to dbμV and dBμV/m respectively by the control software before results are displayed, limits being converted accordingly. The conversion factor is 20 $\log_{10}$(μV) = dBμV.

Emissions Test Conditions: RADIATED EMISSIONS, FCC Part 2, and Paragraph 2.1053

The *RADIATED EMISSIONS* measurements were performed at the following test location: Santa Clara, CA

☐- Test not applicable

■ - Test area no. 1 – Semi - anechoic absorber – lined chamber (80' x 44' x 28')

☐ - Test area no. 2 – Shielded room (19' x 19' x 8')

☐ - Test area no. 3 – Fully – anechoic ferrite – lined chamber (24' x 16' x 11')

Testing was performed at a test distance of :

■ - 3 meters

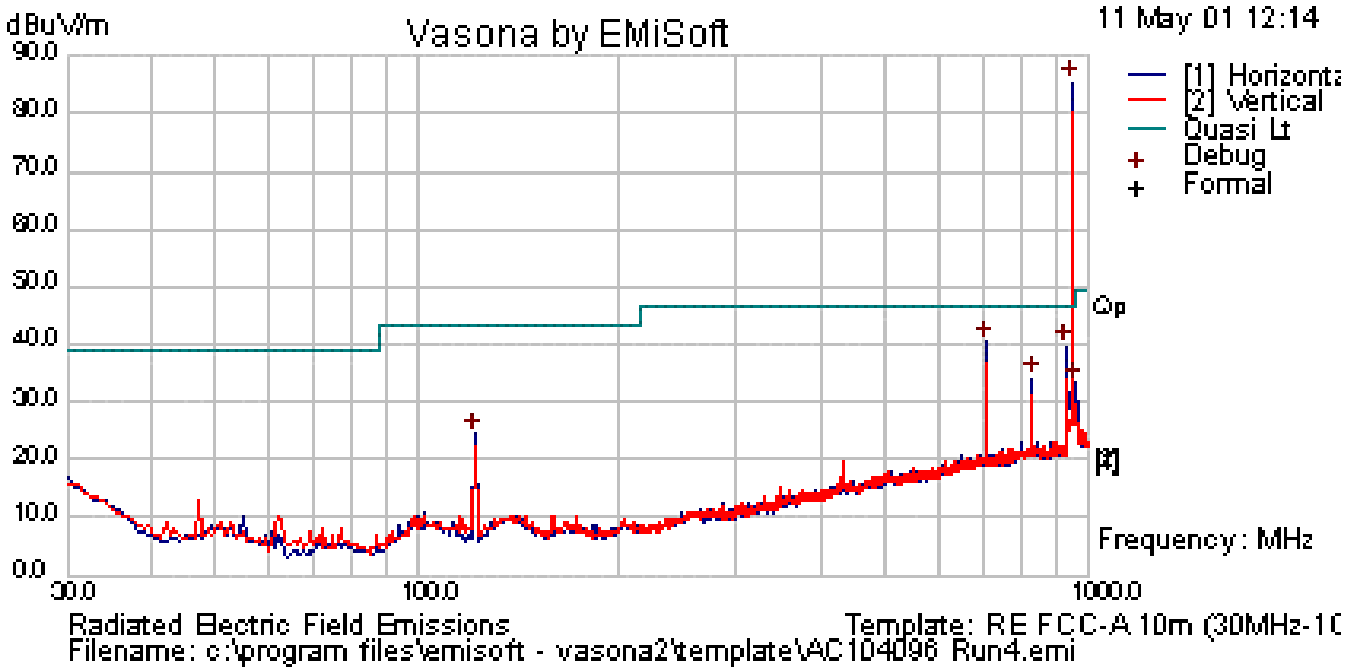
☐ - 10 meters

Test Equipment Used :

	Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
■ -	85462A	Receiver RF Section	Hewlett Packard	3325A00161	5/15/02
■ -	85460A	RF Filter Section	Hewlett Packard	3330A00160	5/15/02
■ -	8566B	Spectrum Analyzer	Hewlett Packard	2421A00443	6/7/02
■ -	85680B	Spectrum Analyzer, RF section	Hewlett Packard	2732A04047	5/15/02
■ -	85662B	Spectrum Analyzer, Display section	Hewlett Packard	2816A16342	5/15/02
■ -	3115	Horn Antenna	EMCO	9902-5686	11/22/01
■ -	CBL6111	Bilog Antenna	Chase	1122	8/15/01
■ -	A-AMF10009046	RF Pre-amplifier	Miteq Inc.	AMF-5D-010180-35-10P	4/10/02

Remarks: _____

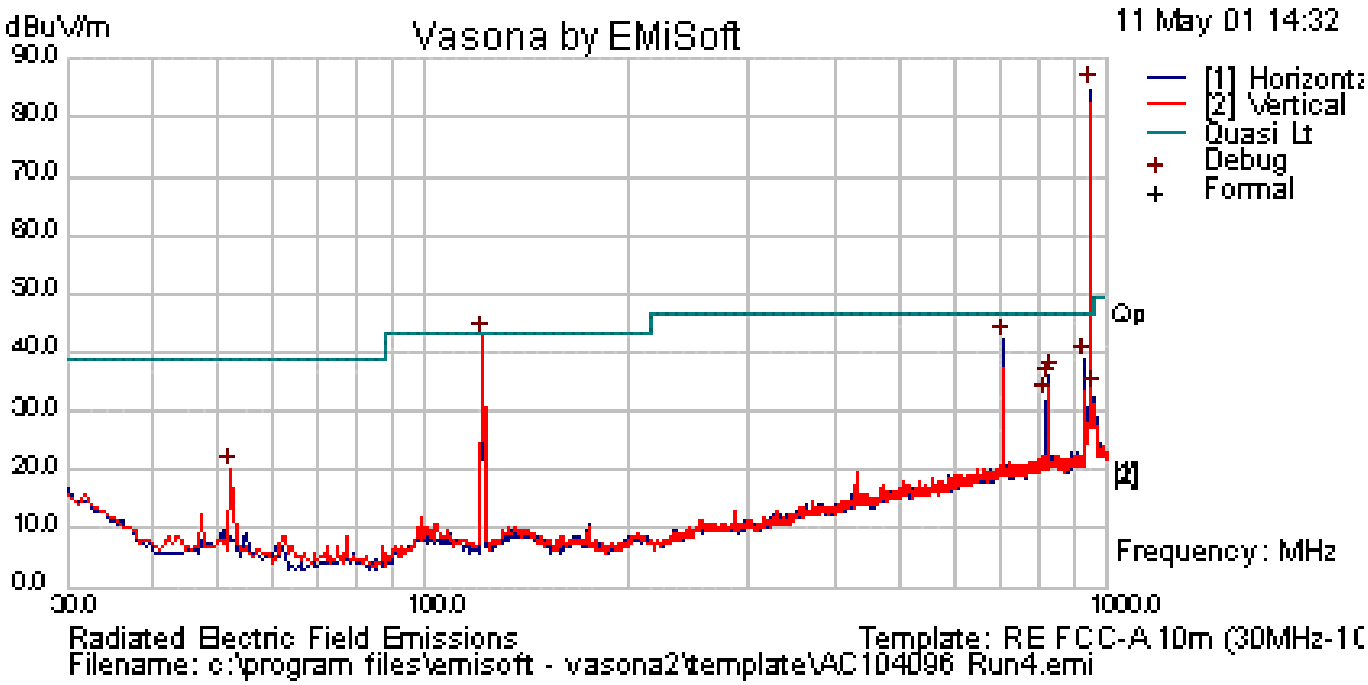
Company : LGC Wireless, AC105086. May-11-2001
EUT: 900 MHz EGSM system, Fc=942.5 MHz, +6.4 dBm signal at the forward simplex port, 50 meters of Cat5 STP cable, fiber jumper between MH and EH
Config : FCC-A, 30-1000MHz, Final 1 (Shielded cables)
Operator : Giap Kim Nguyen



Frequency MHz	Raw dBuV	Cable Loss dB	AF dB	Level dBuV/m	Emission Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
948.469	82.4	3.9	-1	85.35	Preview	H	100	55	46.4	39	N/A
706.575	40.6	3.5	-3.7	40.36	Preview	H	100	325	46.4	-6	Pass
930.888	37.5	3.9	-1.9	39.55	Preview	H	100	280	46.4	-6.9	Pass
827.219	32.4	3.7	-1.9	34.14	Preview	H	100	325	46.4	-12.3	Pass
958.775	29.3	4	-0.1	33.14	Preview	H	100	55	46.4	-13.3	Pass
122.15	37.19	1.23	-13.84	24.58	Preview	H	400	252	43.5	-18.92	Pass

Company : LGC Wireless, AC105086. May-11-2001
EUT : 900 MHz EGSM system, Fc=942.5 MHz, +6.4 dBm signal at the forward simplex port, 50 meters of Cat5 UTP cable, fiber jumper between MH and EH
Config : FCC-A, 30-1000MHz, Final 2 (Unshielded cables)

Operator : Giap Kim Nguyen



Frequency MHz	Raw dBuV	Cable Loss dB	AF dB	Level dBuV/m	Emission Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
948.469	81.8	3.94	-0.97	84.77	Preview	H	100	50	46.4	38.37	N/A
120.701	41.45	1.22	-13.89	28.79	Quasi Peak	H	98	189	43.5	-14.71	Pass
706.575	42.36	3.5	-3.72	42.14	Preview	H	100	320	46.4	-4.26	Pass
930.888	36.79	3.93	-1.93	38.79	Preview	H	100	50	46.4	-7.61	Pass
827.219	34.38	3.67	-1.93	36.13	Preview	H	100	320	46.4	-10.27	Pass
820.55	33.18	3.65	-2.09	34.75	Preview	V	400	190	46.4	-11.65	Pass
952.713	29.7	3.95	-0.6	33.05	Preview	H	100	50	46.4	-13.35	Pass
815.7	30.51	3.64	-2.14	32.01	Preview	H	100	200	46.4	-14.39	Pass
51.825	35.86	0.81	-16.57	20.1	Preview	V	250	220	39.1	-19	Pass

4. CONDUCTED EMISSION EQUIPMENT / DATA

See following page(s).

Emissions Test Conditions: CONDUCTED EMISSIONS, FCC PART 2, 2.1046 AND 2.1051 and Part 90.

The *RADIATED EMISSIONS* measurements were performed at the following test location: Santa Clara, CA

☐ - Test not applicable

■ - Test area no. 1 – Semi - anechoic absorber – lined chamber (80' x 44' x 28')

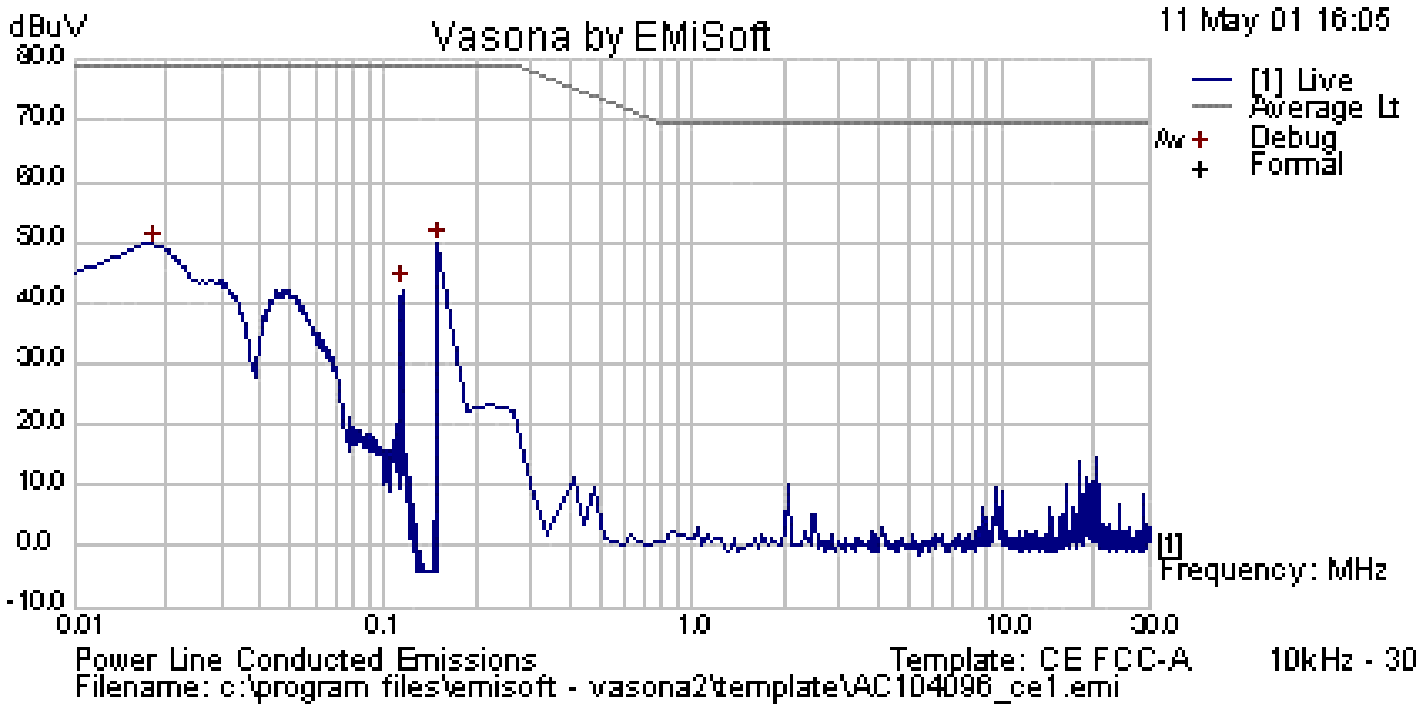
☐ - Test area no. 2 – Shielded room (19' x 19' x 8')

☐ - Test area no. 3 – Fully – anechoic ferrite – lined chamber (24' x 16' x 11')

	Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
■ -	85462A	Receiver RF Section	Hewlett Packard	3325A00161	5/15/02
■ -	85460A	RF Filter Section	Hewlett Packard	3330A00160	5/15/02
☐ -	AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	6A,6B	5/26/02
☐ -	AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	3A,3B	5/26/02
■ -	AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	2A,2B,2C,2D	5/26/02

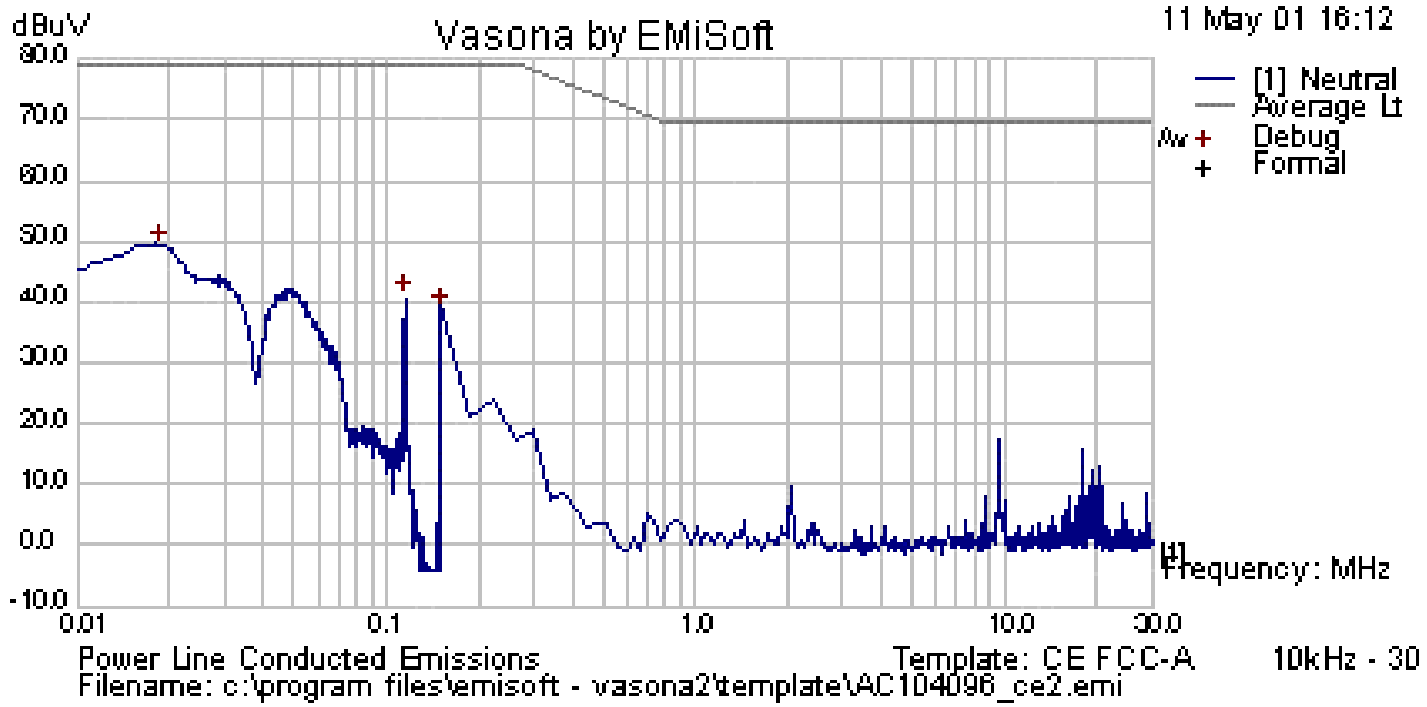
Remarks: _____

Company : LGC Wireless, AC105086. May-11-2001
EUT : 900 MHz EGSM system, Fc=942.5 MHz, +6.4 dBm signal at the forward simplex port, 50 meters of Cat5 UTP cable, fiber jumper between MH and EH
Config : FCC-A, Conducted Emissions, with DAS9M-2W unit, Live (Unshielded cables)
Operator : Dao Le



Frequency MHz	Raw dBuV	Cable Loss dB	Factors dB	Level dBuV	Emission Type	Line	Limit dBuV	Margin dB	Pass /Fail
0.15	49.22	0.57	0	49.79	Debug	Live	79	-29.21	Pass
0.115	41.77	0.56	0	42.33	Debug	Live	79	-36.67	Pass
0.01838	48.56	0.52	0	49.08	Debug	Live	79	-29.92	Pass

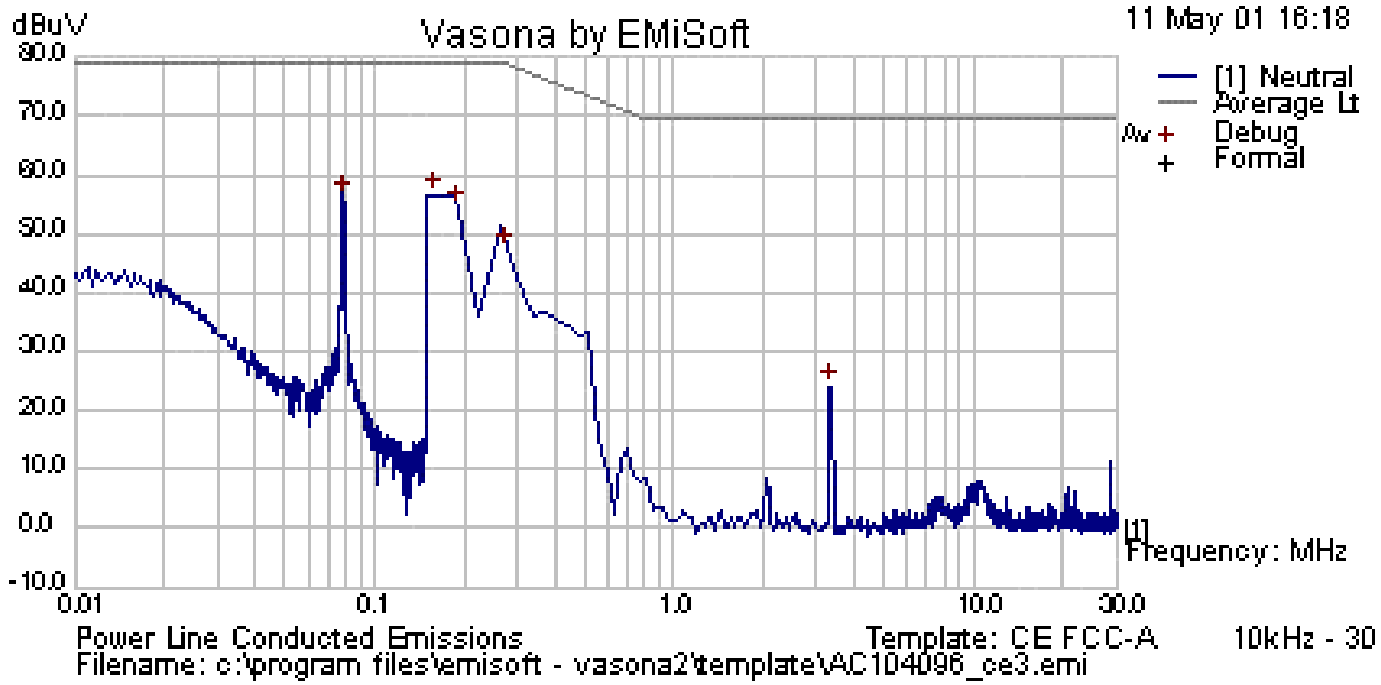
Company : LGC Wireless, AC105086. May-11-2001
EUT : 900 MHz EGSM system, Fc=942.5 MHz, +6.4 dBm signal at the forward simplex port, 50 meters of Cat5 UTP cable, fiber jumper between MH and EH
Config : FCC-A, Conducted Emissions, with DAS9M-2W unit, Neutral (Unshielded cables)
Operator : Dao Le



Frequency MHz	Raw dBuV	Cable Loss dB	Factors dB	Level dBuV	Emission Type	Line	Limit dBuV	Margin dB	Pass /Fail
0.152	38.3	0.57	0	38.87	Debug	Neutral	79	-40.13	Pass
0.115	40.16	0.56	0	40.72	Debug	Neutral	79	-38.28	Pass
0.01882	48.74	0.52	0	49.26	Debug	Neutral	79	-29.74	Pass

Company : LGC Wireless, AC105086. May-11-2001
EUT : 900 MHz EGSM system, Fc=942.5 MHz, +6.4 dBm signal at the forward simplex port, 50 meters of Cat5 UTP

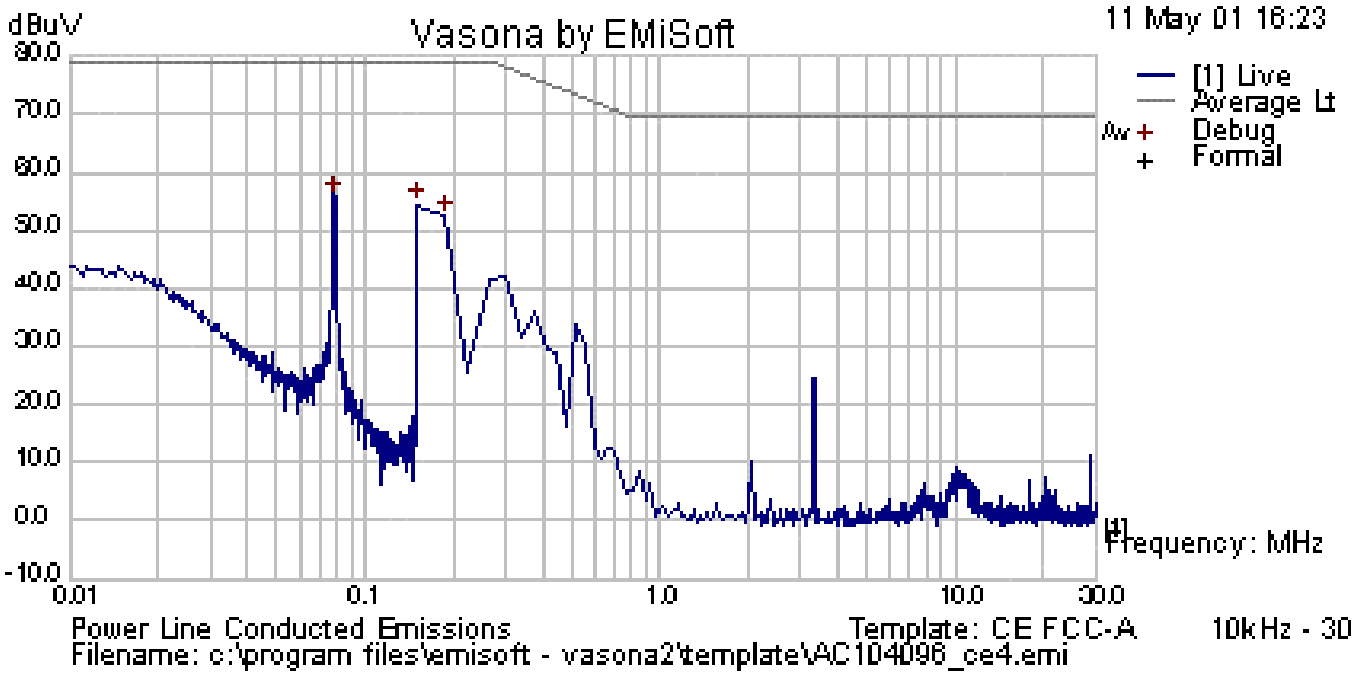
cable, fiber jumper between MH and EH
Config : FCC-A, Conducted Emissions, with DAS9E-2 unit, Neutral (Unshielded cables)
Operator : Dao Le



Frequency MHz	Raw dBuV	Cable Loss dB	Factors dB	Level dBuV	Emission Type	Line	Limit dBuV	Margin dB	Pass /Fail
0.07874	55.65	0.55	0	56.2	Debug	Neutral	79	-22.8	Pass
0.16	56.07	0.57	0	56.64	Debug	Neutral	79	-22.36	Pass
0.278	46.67	0.54	0	47.21	Debug	Neutral	78.74	-31.53	Pass
3.33	23.59	0.57	0	24.16	Debug	Neutral	69.5	-45.34	Pass
0.191	53.84	0.56	0	54.4	Debug	Neutral	79	-24.6	Pass

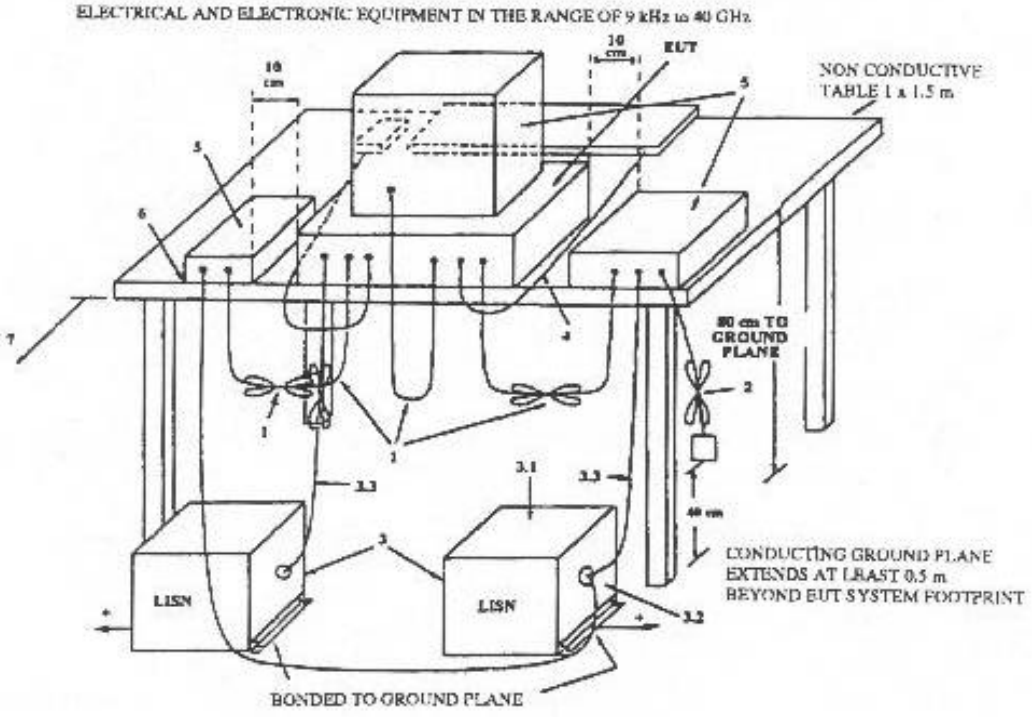
Company : LGC Wireless, AC105086. May-11-2001
EUT : 900 MHz EGSM system, Fc=942.5 MHz, +6.4 dBm signal at the forward simplex port, 50 meters of Cat5 UTP

cable, fiber jumper between MH and EH
Config : FCC-A, Conducted Emissions, with DAS9E-2 unit, Live (Unshielded cables)
Operator : Dao Le



Frequency MHz	Raw dBuV	Cable Loss dB	Factors dB	Level dBuV	Emission Type	Line	Limit dBuV	Margin dB	Pass /Fail
0.15	53.84	0.57	0	54.41	Debug	Live	79	-24.59	Pass
0.188	51.63	0.56	0	52.19	Debug	Live	79	-26.81	Pass
0.07885	55.12	0.55	0	55.67	Debug	Live	79	-23.33	Pass

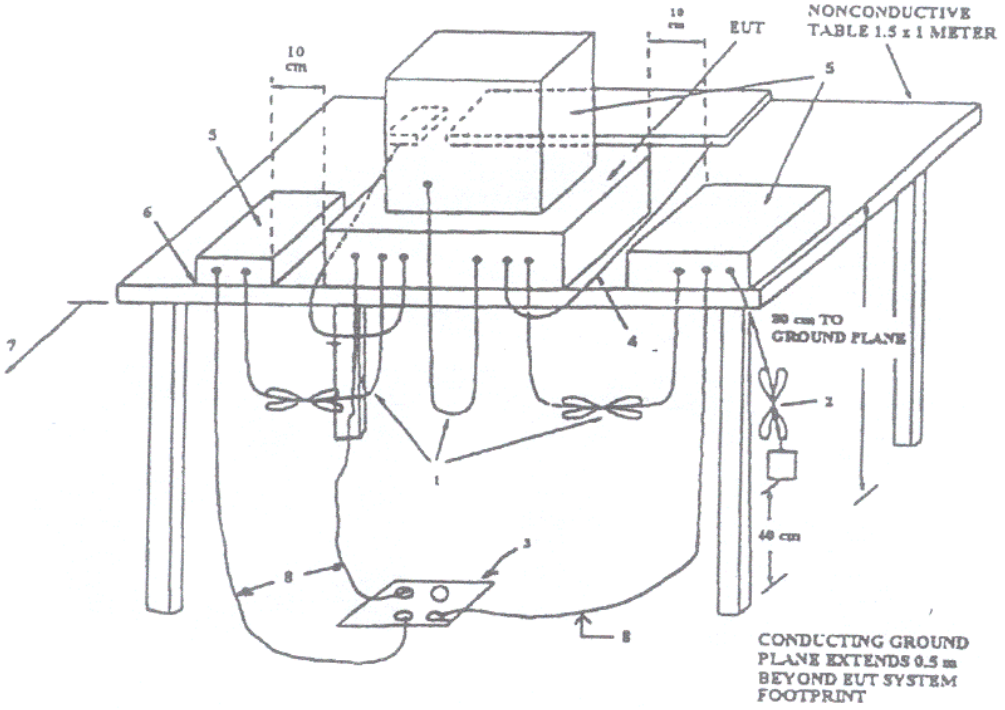
Conducted Emission Test Setup, 0.15 TO 30 MHz



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.

Radiated Emission Test Setup, 30 to 1,000 MHz

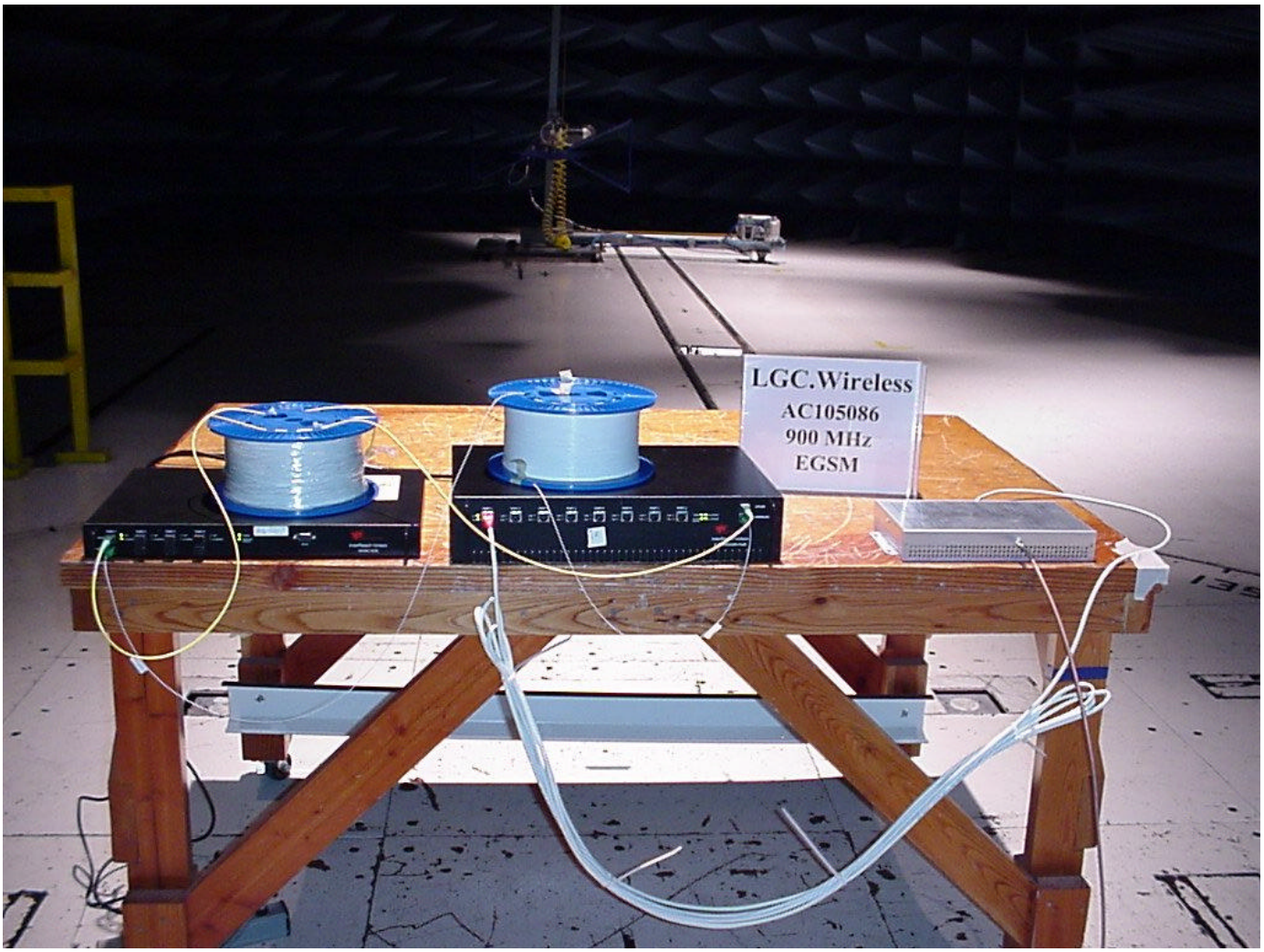


LEGEND:

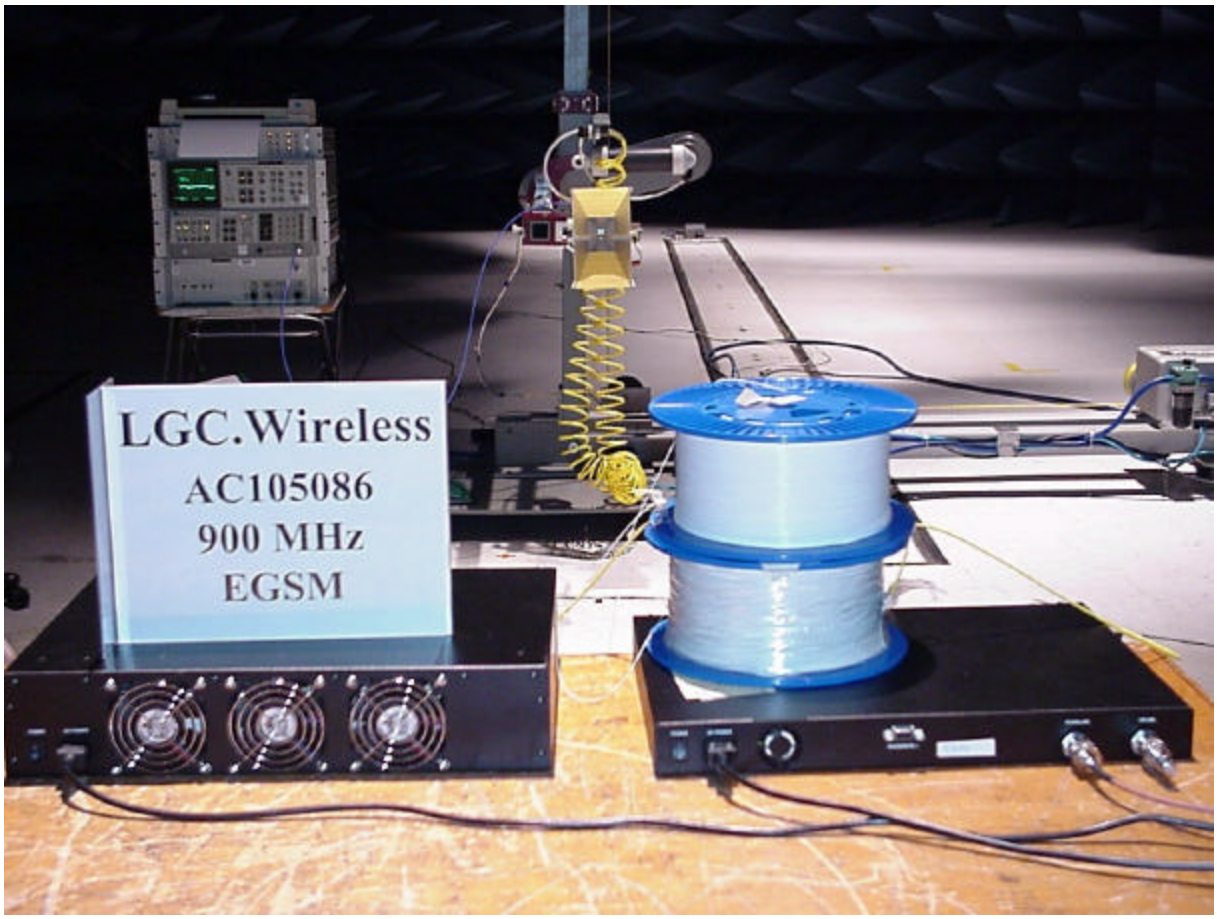
1. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between ground plane and table.
2. I/O cables that are connected to a peripheral shall be bundled in center. The end of the cable 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.

Test Setups
(Photographs)

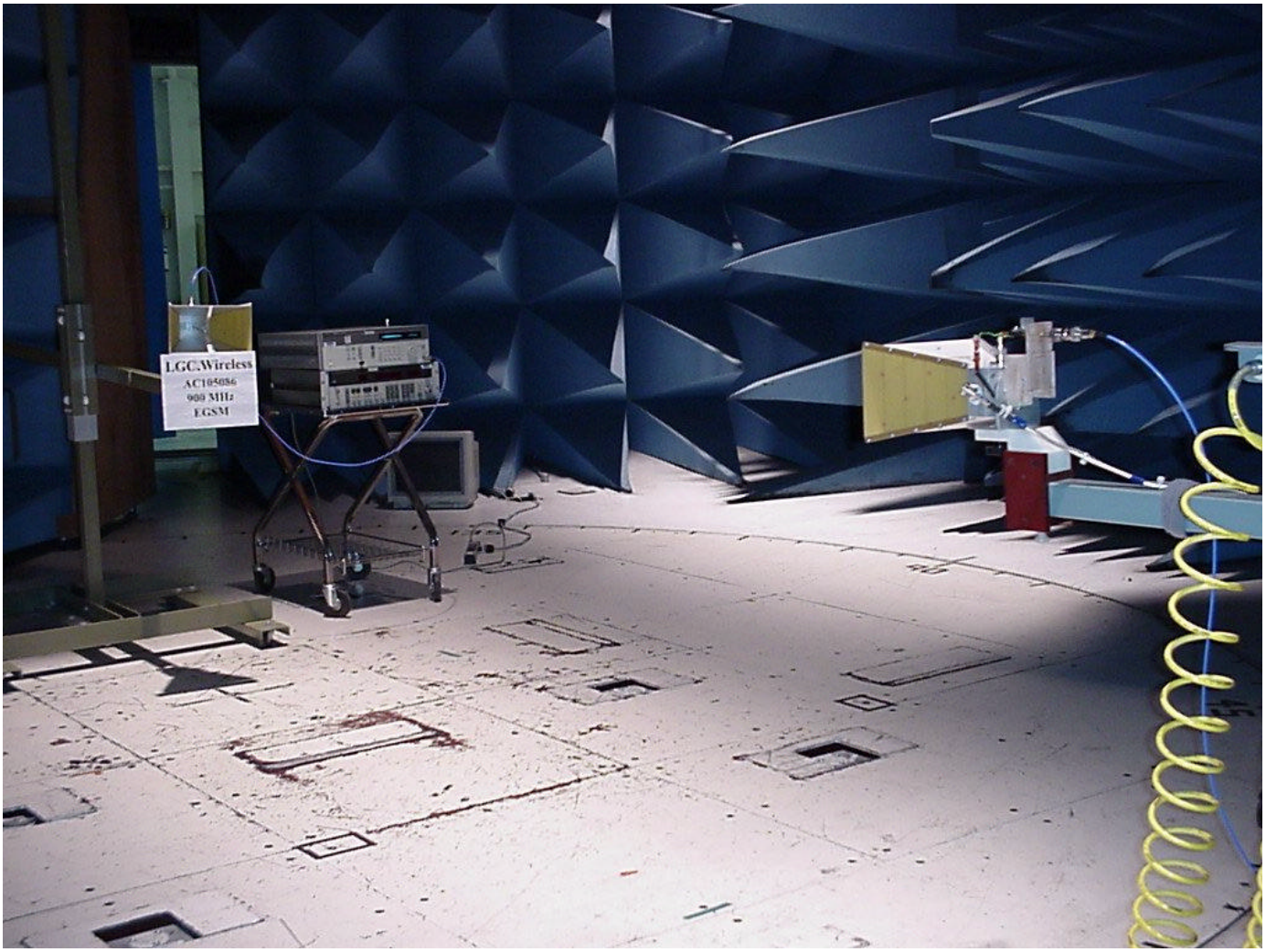
Photograph of Test Setup:
Radiated Emissions 30 MHz - 1000 MHz



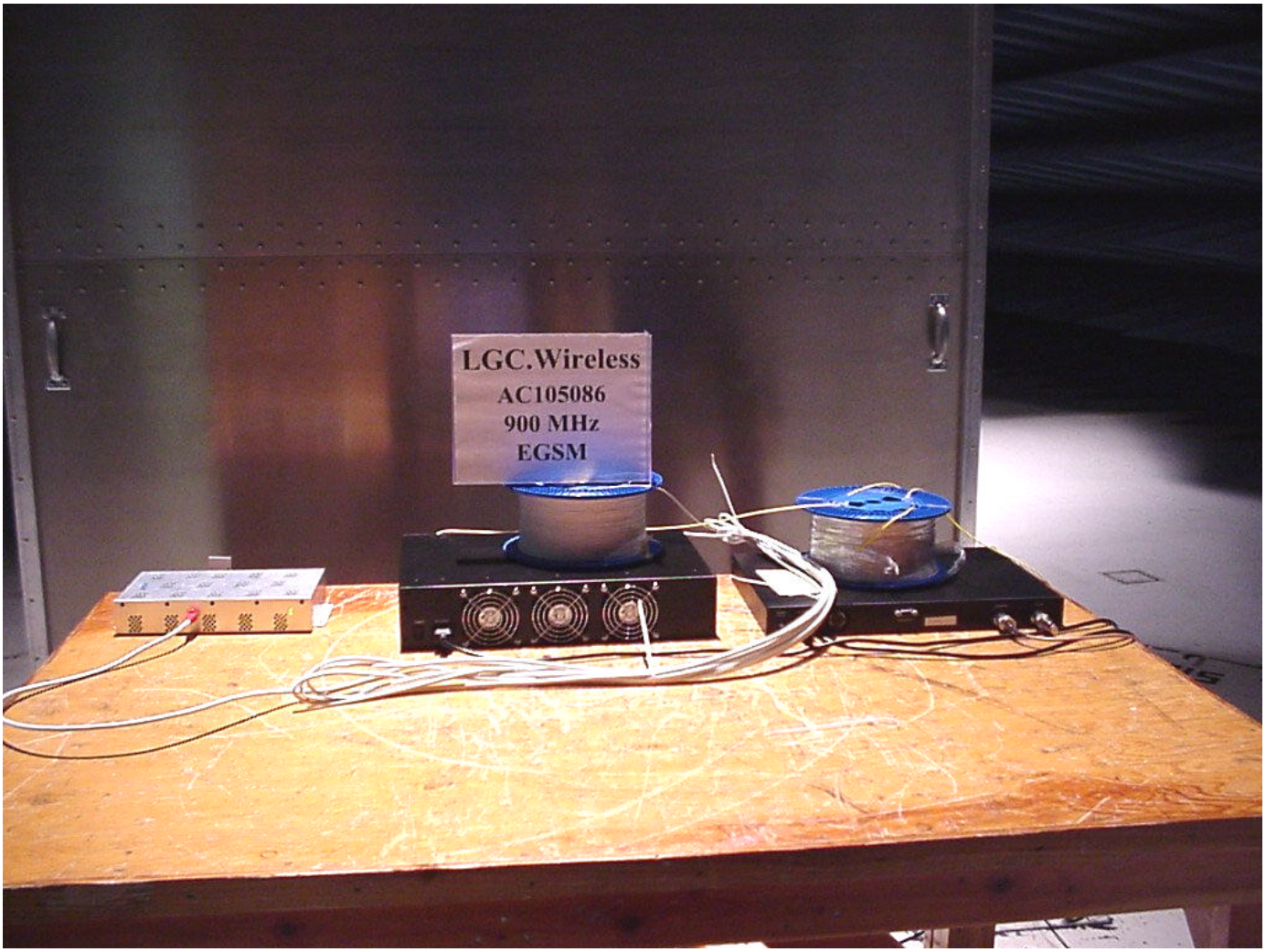
Photograph of Test Setup:
Radiated Emissions 30 MHz - 1000 MHz



Photograph of Test Setup:
Radiated Emissions 30 MHz - 1000 MHz



Photograph of Test Setup:
Conducted Emissions 10/150/450 kHz - 30 MHz



5. ATTESTATION STATEMENT

GENERAL REMARKS:

SUMMARY:

All tests according to FCC Part 2, Paragraphs, 2.1046, 2.1051, 2.1053, 2.1055 and Part 90:

■ - Performed

☐ - Not Performed

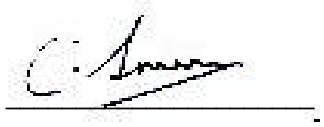
The Equipment Under Test

■ - Fulfills the requirements of FCC Part 2, Paragraphs, 2.1046, 2.1051, 2.1053, 2.1055 and Part 90:

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

BABT / TÜV Product Service

Responsible Engineer:



Srini Chandrasekaran

Lead EMC Engineer