



**MEASUREMENT AND TECHNICAL REPORT**

LGC Wireless, Inc.

2540 Junction Avenue

San Jose, CA 95134

DATE: 19 June 2001

This Report Concerns:

Original Grant:  X

Class II Change:

Equipment Type: LGCCell GSM

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:**

TUV Product Service

4855 Patrick Henry Drive Bldg. 6

Santa Clara, CA 95054

## DIRECTORY

		Page No.
1	GENERAL INFORMATION	<u>2</u>
1.1	Product Description	<u>3</u>
1.2	Related Submittal Grant	<u>3</u>
1.3	Tested System Details	<u>3</u>
1.4	Statement of Measurement Uncertainty	<u>3</u>
1.5	Test Facility	<u>3</u>
1.6	Part 2 Requirements	<u>4</u>
2	SYSTEM TEST CONFIGURATION	<u>4</u>
2.1	Justification	<u>4</u>
2.2	EUT Software Exercise	<u>4</u>
2.3	Special Accessories	<u>4</u>
2.4	Equipment Modifications	<u>4</u>
2.5	Configuration of Tested System	<u>4</u>
2.1046	RF Power Output	<u>5</u>
2.1049	Occupied Bandwidth	<u>6</u>
2.1051	Spurious Emissions At The Antenna Terminals	<u>19</u>
2.1053	Field Strength of Spurious Radiation	<u>20</u>
2.1055	Frequency Stability	<u>21</u>
3	RADIATED EMISSION EQUIPMENT DATA Field Strength Calculation	<u>22</u>
4	CONDUCTED EMISSION EQUIPMENT DATA	<u>26</u>
	Photos -Test Setups	<u>34</u>
5	Signature Page	<u>37</u>

**1. GENERAL INFORMATION**

**1.1 Product Description**

EUT Description In Building Repeater

EUT Name LGCell GSM

Model No. DAS9M-2-W Serial No. - Not Serialized

Products Options N/A

Configurations To Be Tested: LGCell GSM comprising of main hub, expansion hub 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 Length (In Meters): 1.5

- Shielded or  - Unshielded  **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:

TUV 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
890- 915 935- 960	0.01	+/- 5ppm	F8W , DXW, F1D, F9W	

## 2. SYSTEM TEST CONFIGURATION

### 2.1 Justification

The LGCell GSM 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 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	890.000	-16.3
Mid	902.500	-14.7
High	915.000	-15.9

Downlink

Channel	Frequency (MHz)	Peak Power Level (dBm)
Low	935.000	2.6
Mid	947.500	5.1
High	960.000	4.0

**Test Equipment Used:**

<b>Model No.</b>	<b>Description</b>	<b>Manufacturer</b>	<b>Serial No.</b>	<b>Due Calib. Date</b>
■ - 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.

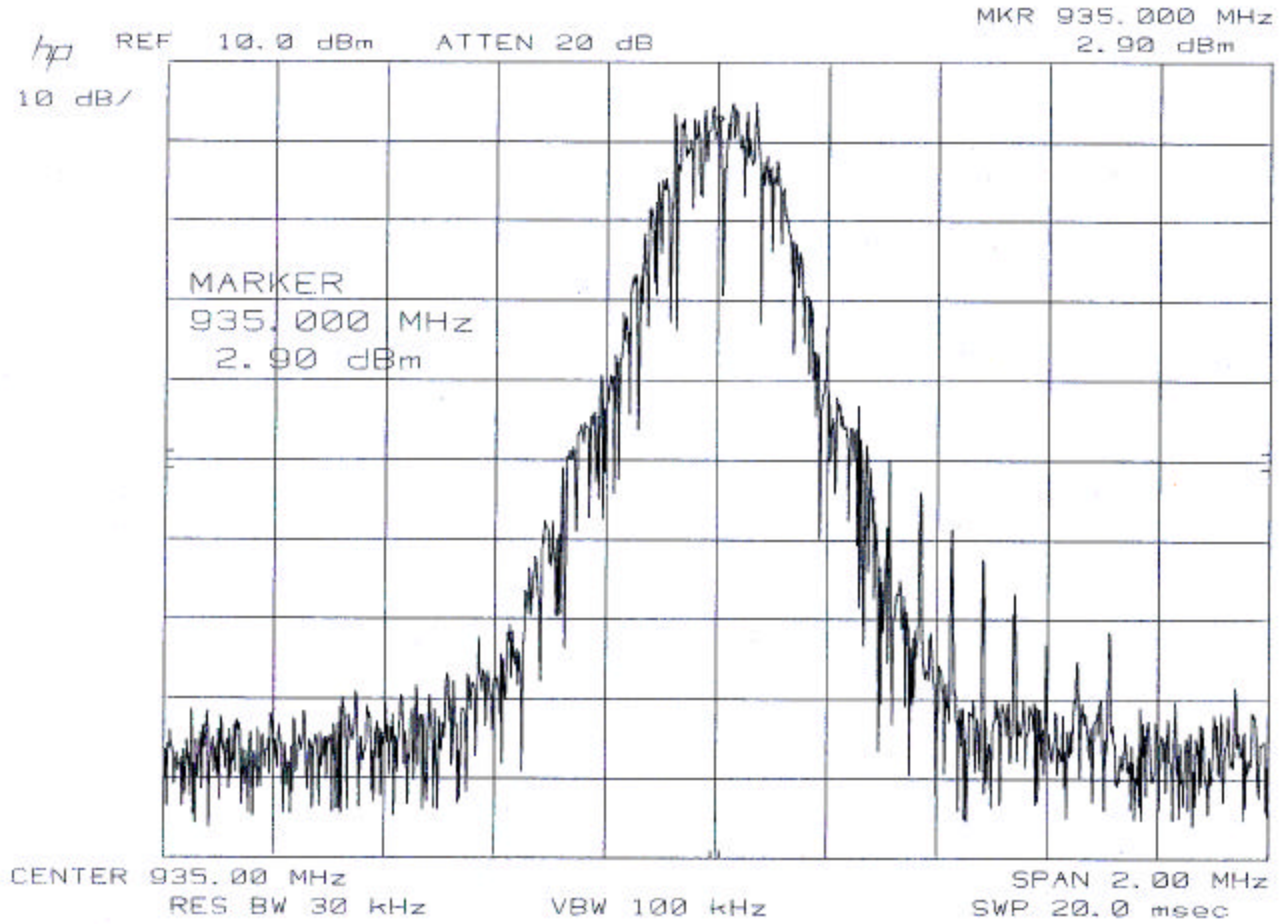
Test Results

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

Test Equipment Used:

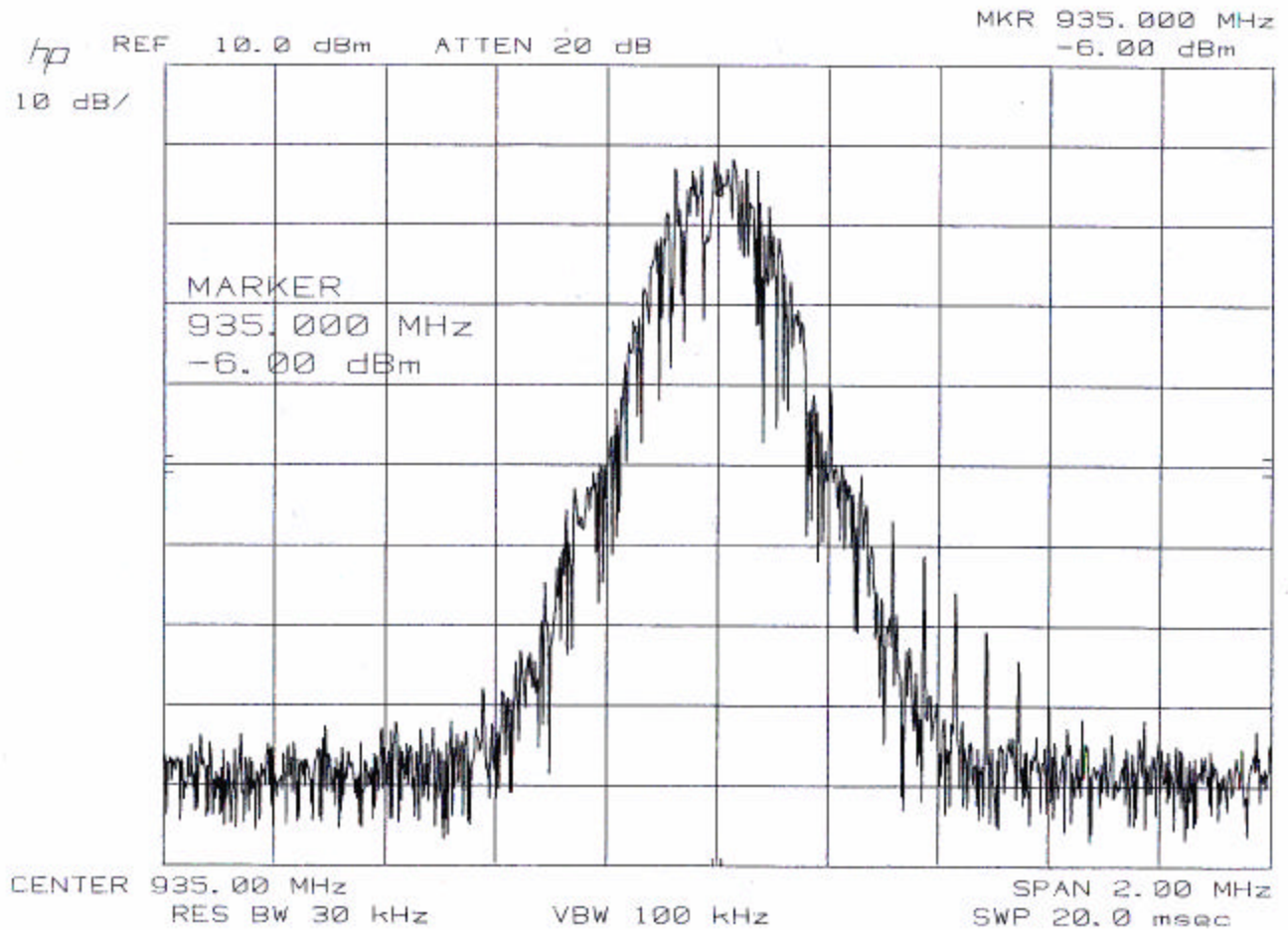
Model No.	Description	Manufacturer	Serial No.	Due Calib. Date
■ - 8566B	Spectrum Analyzer	Hewlett Packard	2816A18342	9/25/01
■ - 8656B	Signal Generator	Hewlett Packard	2523A03399	4/9/02
■ - HP8491B	Attenuator	Hewlett Packard	35958	N/A

935.000 MHZ / Downlink

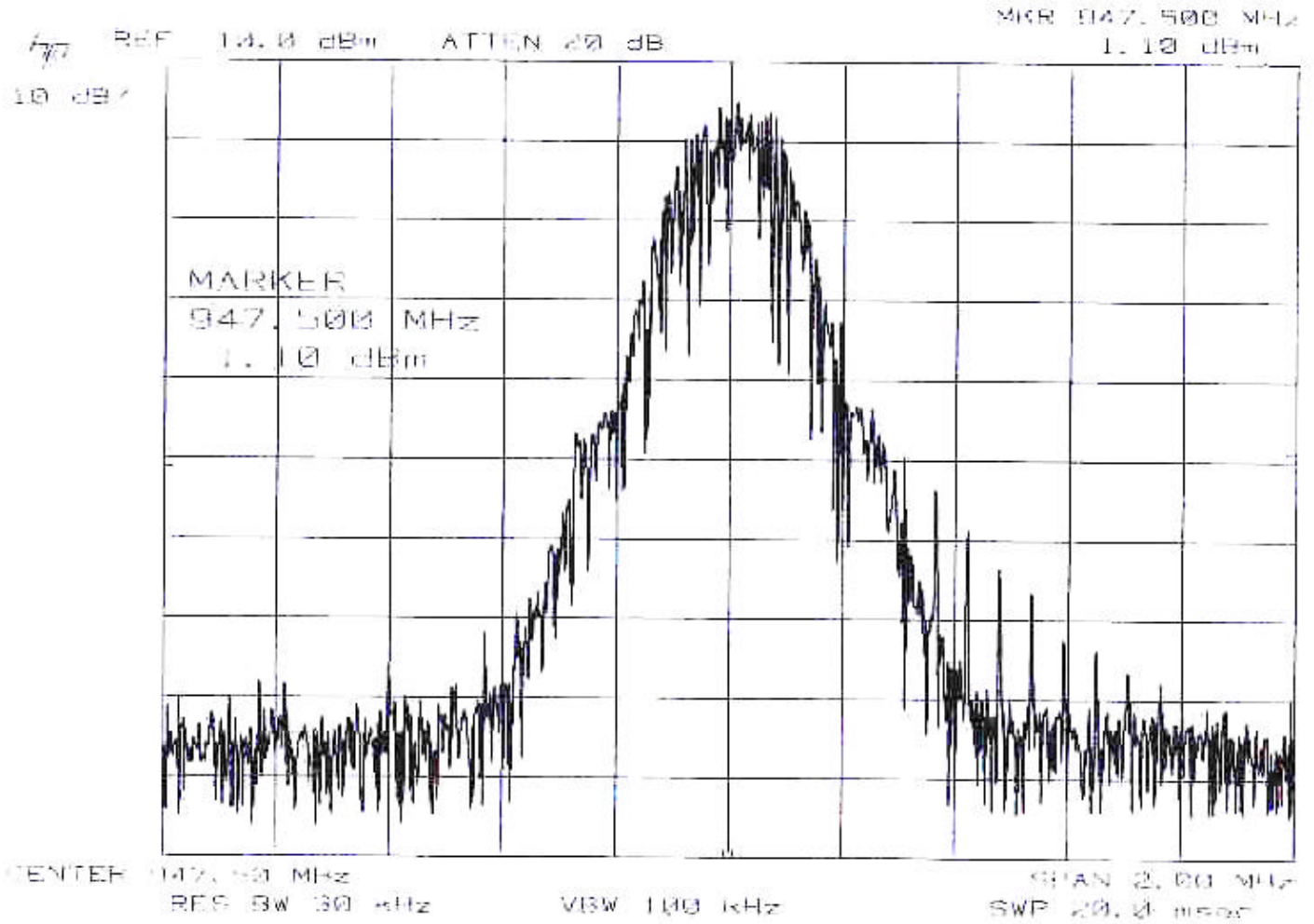




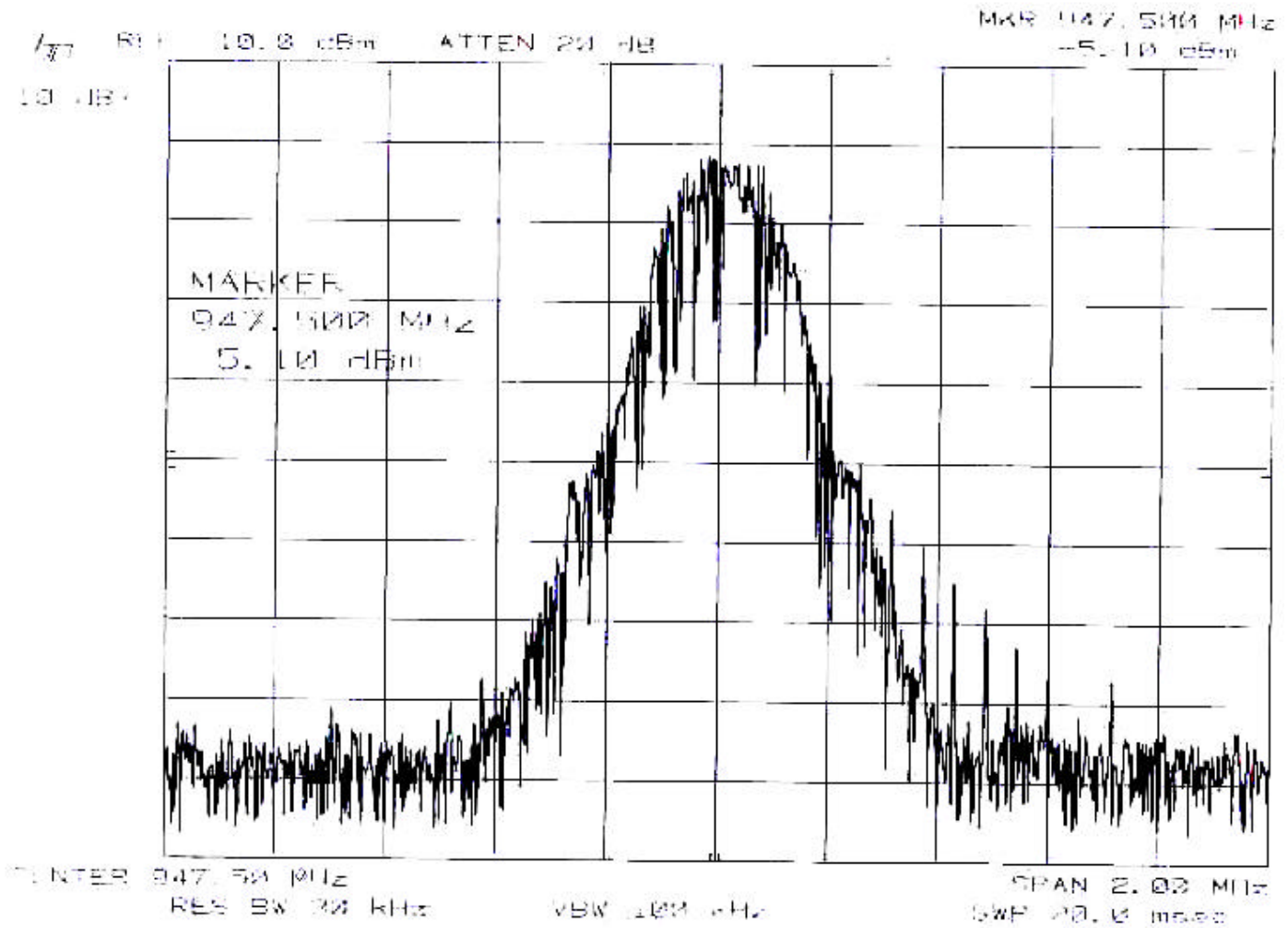
935.000 MHz / Downlink  
Signal Generator



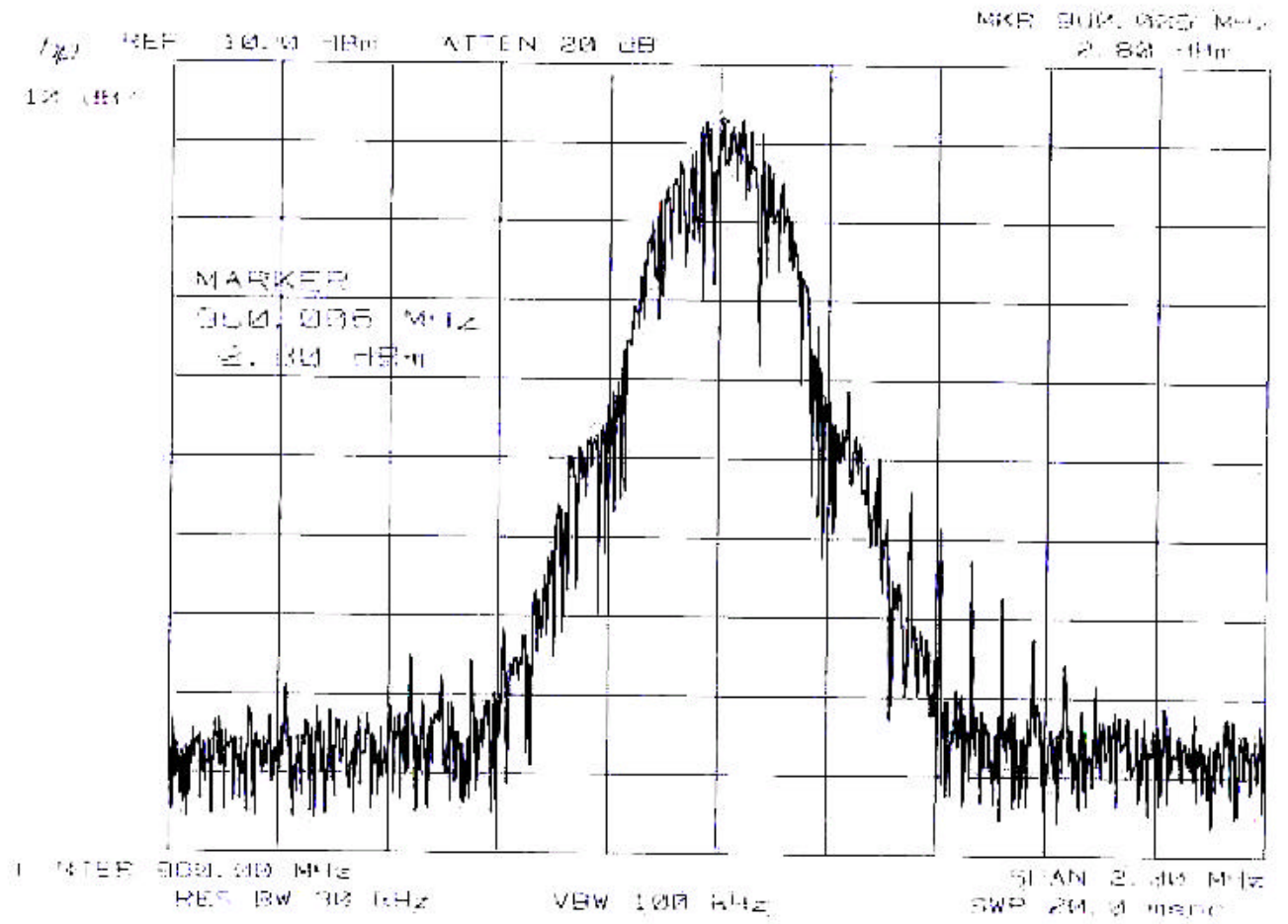
947.500 MHz / Downlink



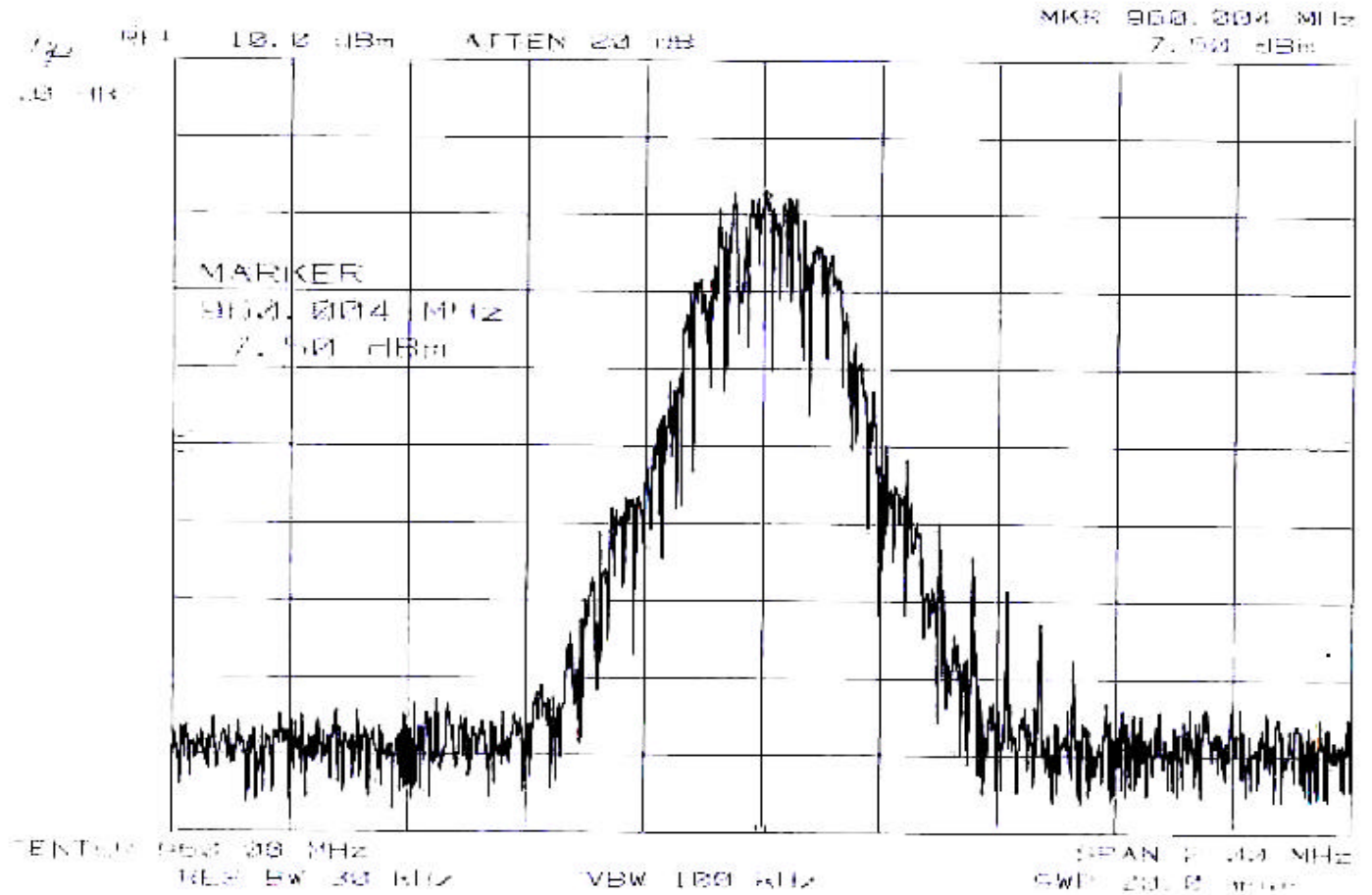
947 MHz / Downlink  
Signal Generator



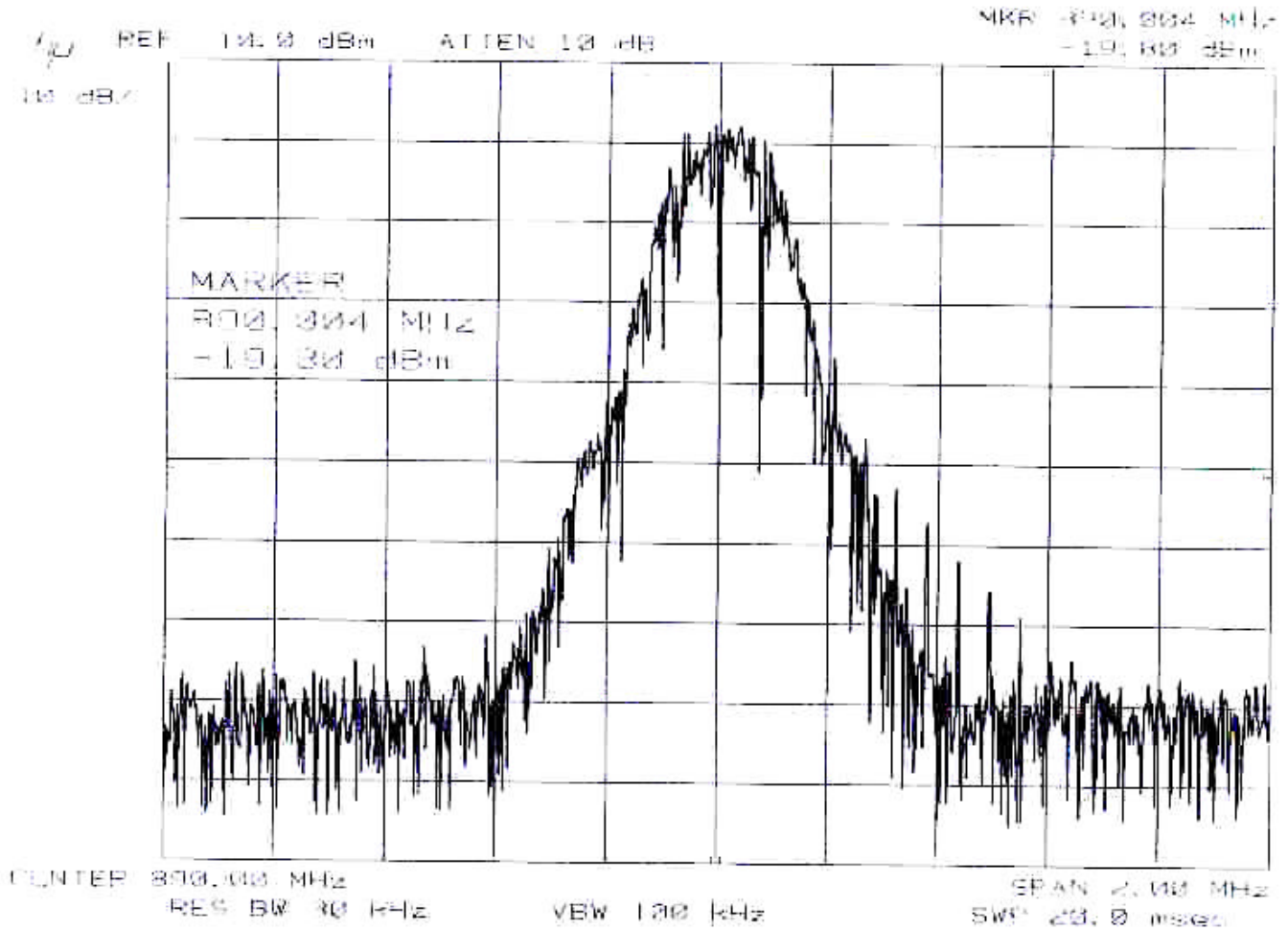
960.000 MHz / Downlink



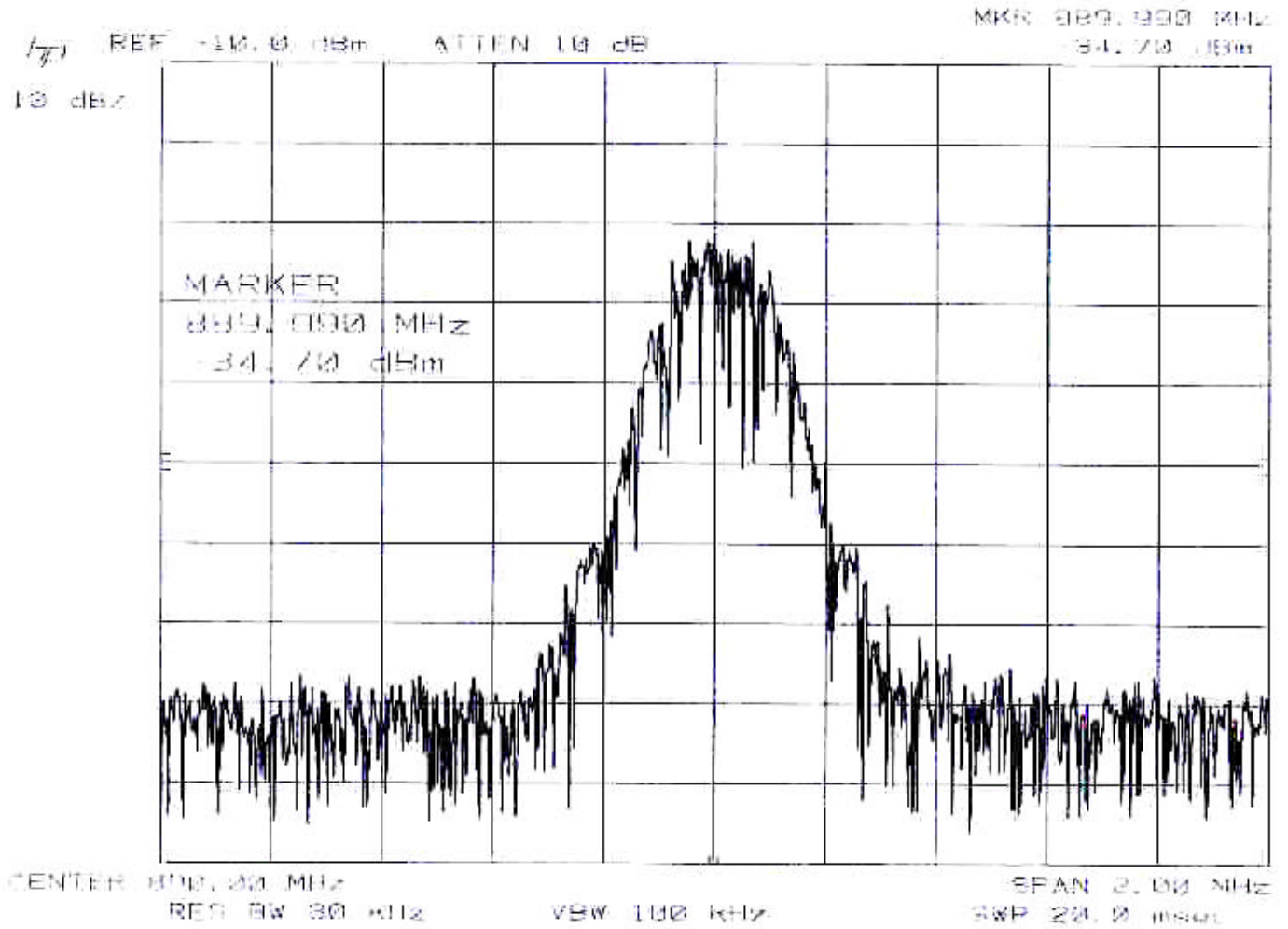
960.000 MHz / Downlink  
Signal Generator



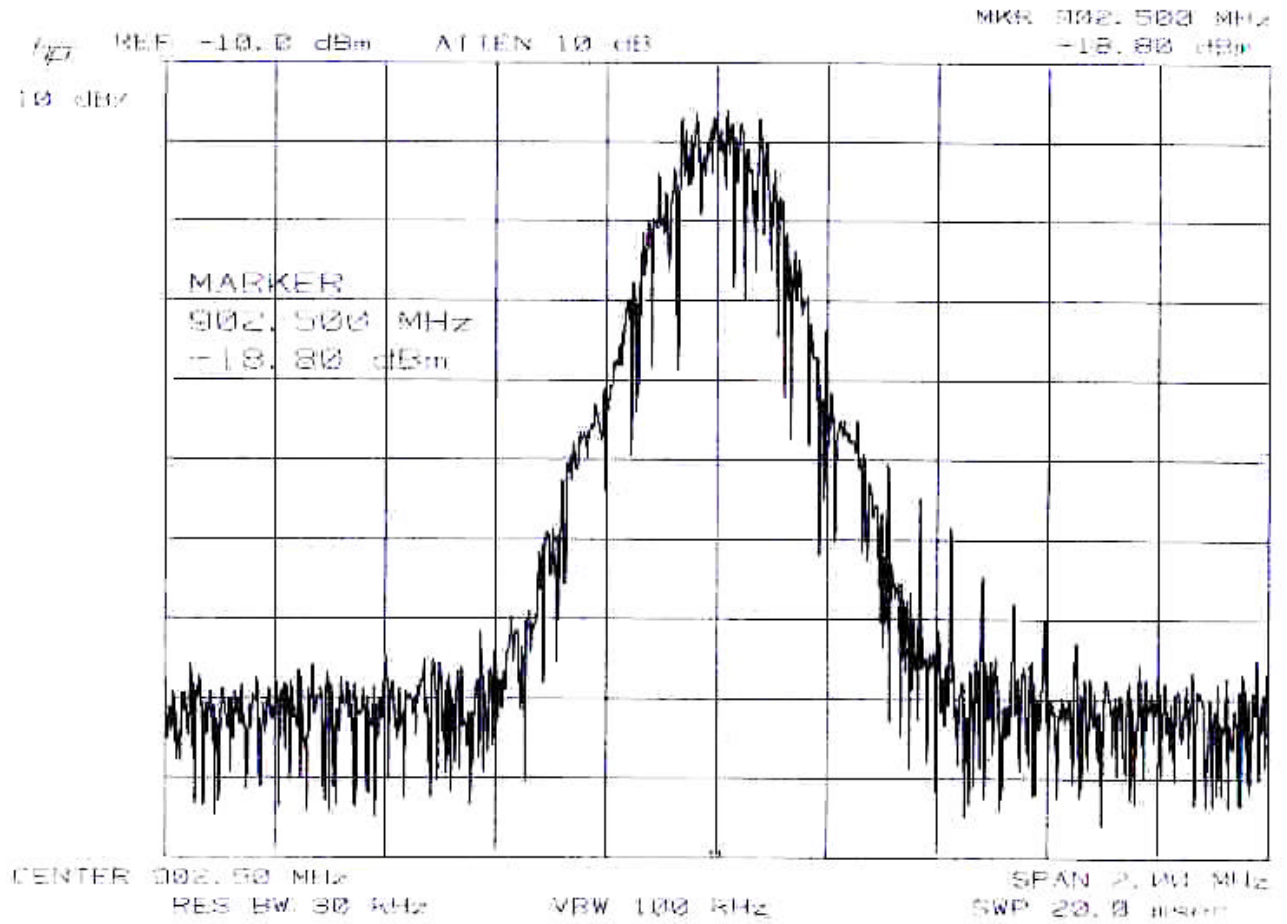
890.000 MHz / Uplink



890.000 MHz / Uplink  
Signal Generator

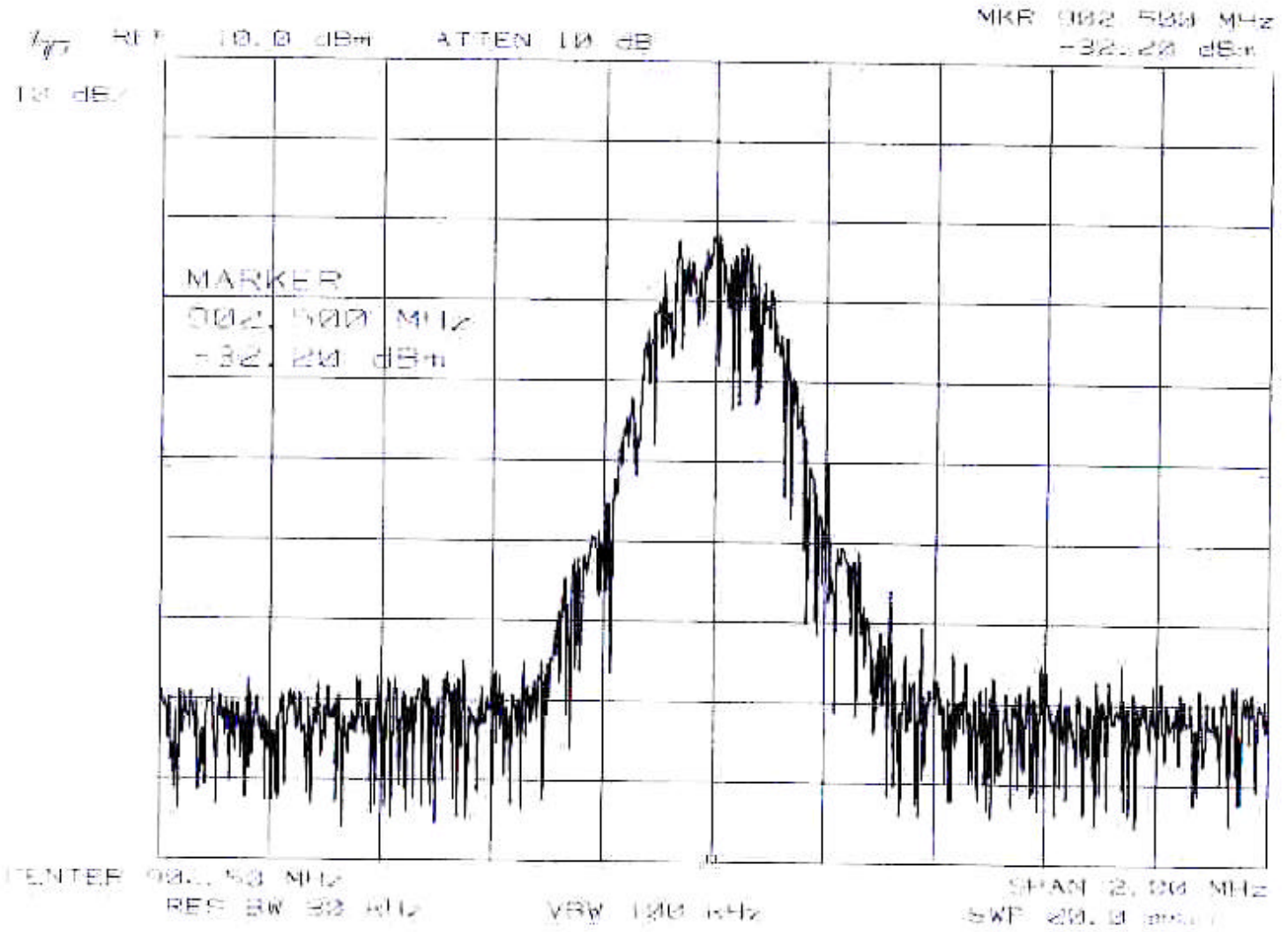


902.500 MHz / Uplink

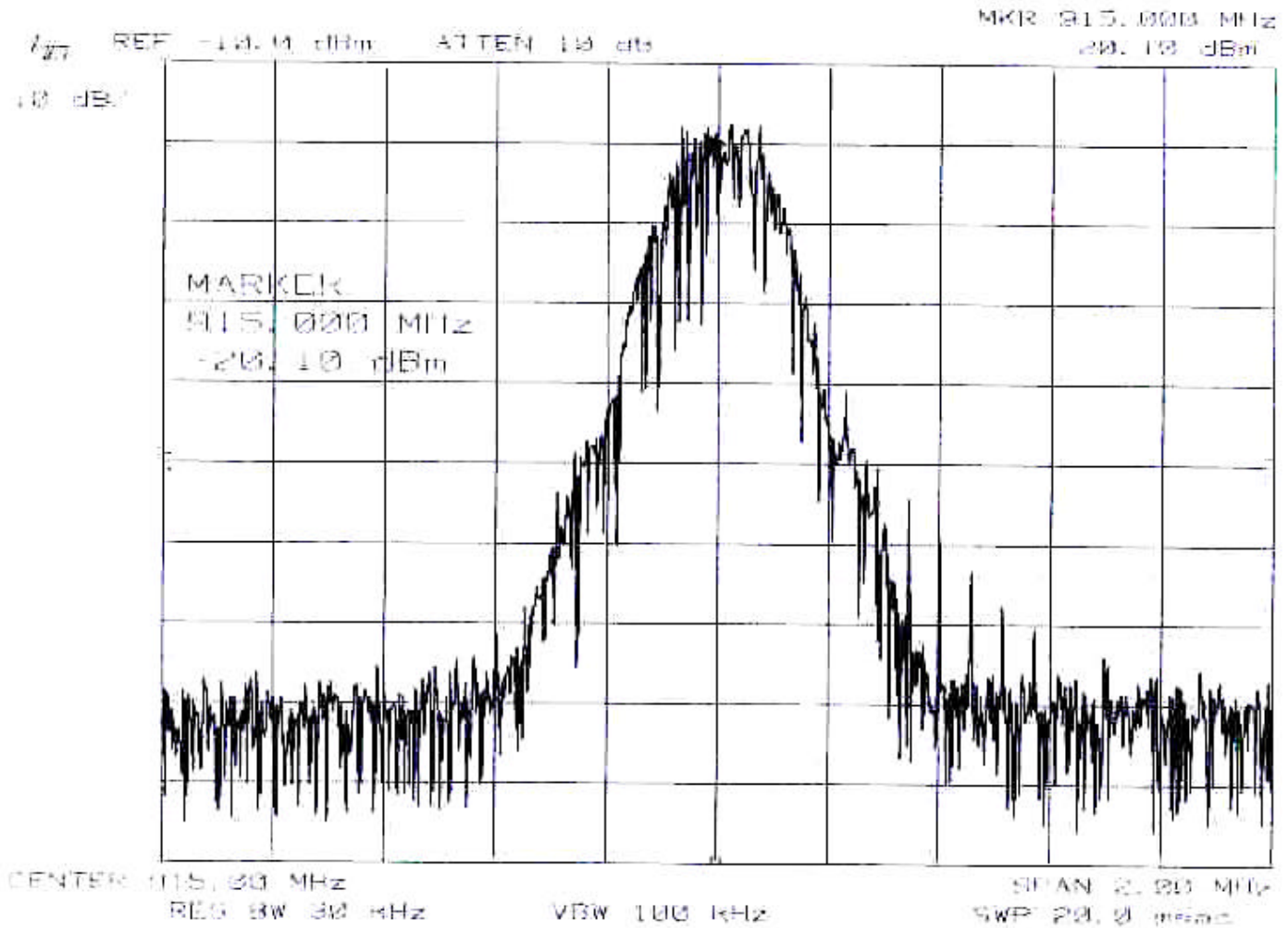




902.500 MHz / Uplink  
Signal Generator



915.000 MHz / Uplink

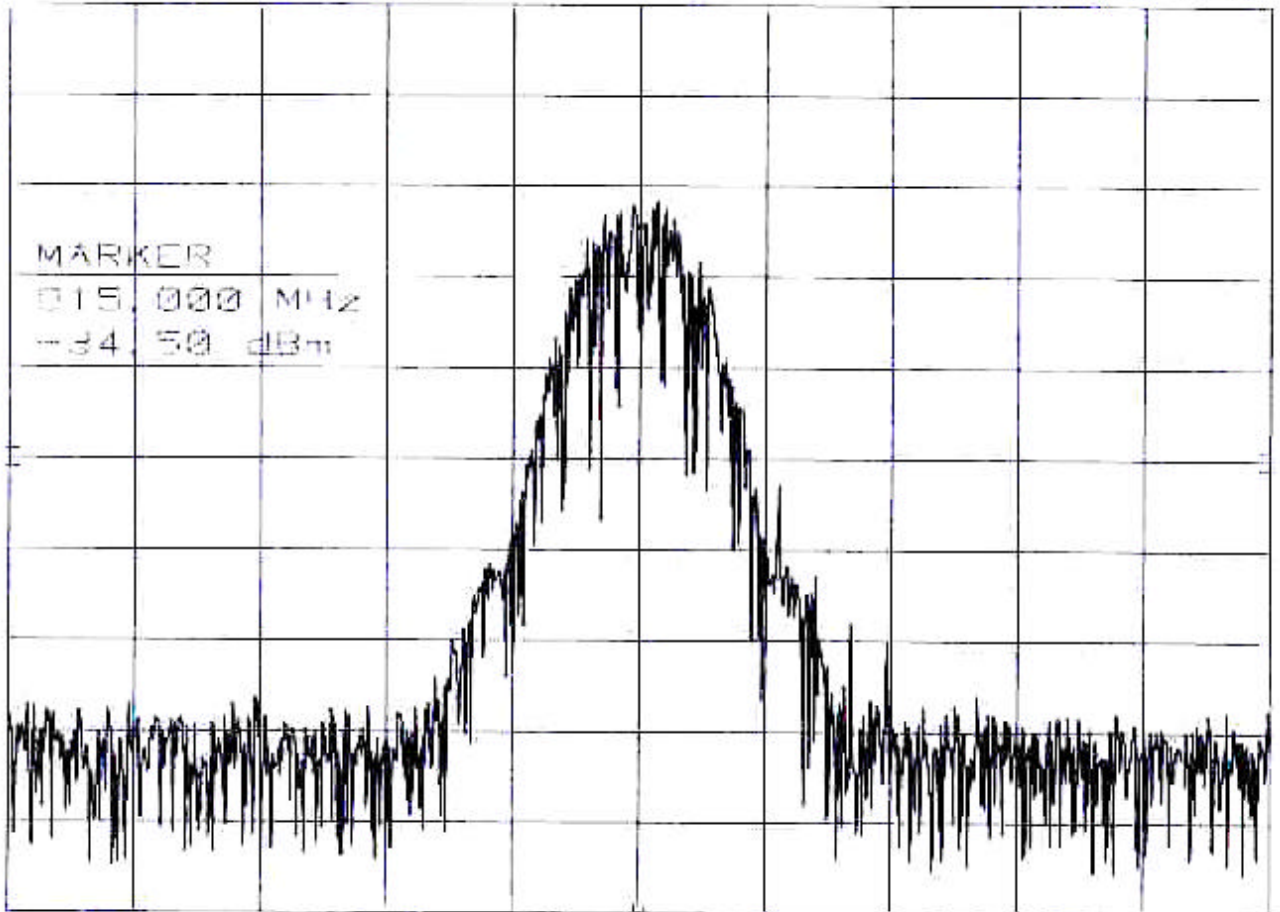


915.000 MHz / Uplink  
Signal Generator

MARK 915.000 MHz  
-34.50 dBm

REF 14.4 dBm    ATTEN 10 dB

10 dB



CENTER 915.00 MHz

RES BW 30 kHz

VBW 100 kHz

SPAN 2.00 MHz

SWP 20.0 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 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

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 10<sup>th</sup> 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

Frequency Stability (2.1055)

Not Applicable – EUT is an amplifier type repeater. No RF oscillators, no 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.

#### 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 50.0dB $\mu$ V. 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)

$$= 50.0 + 10.0 + 0.64 - 25$$

$$= 35.64\text{dB}\mu\text{V/m}$$

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

See following page (s).



**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: \_\_\_\_\_

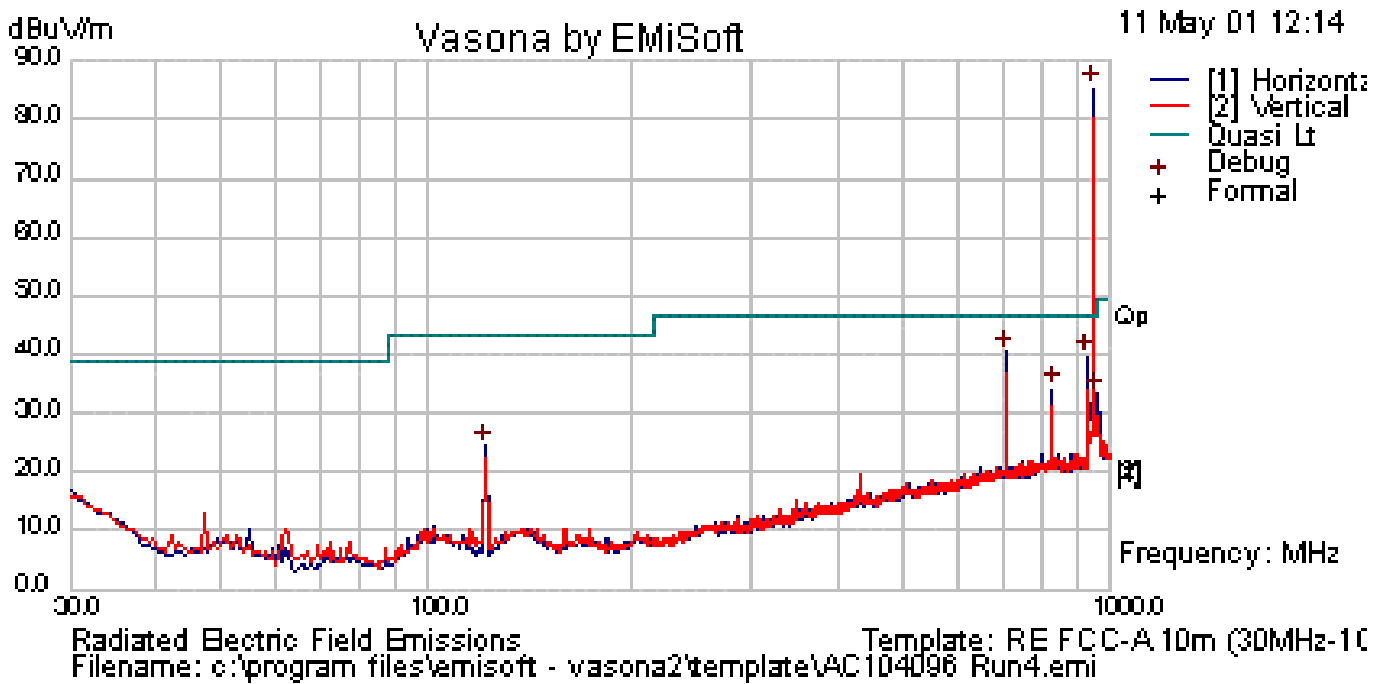


Company : LGC Wireless, AC104096. May-11-2001

EUT: 900 MHz GSM 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

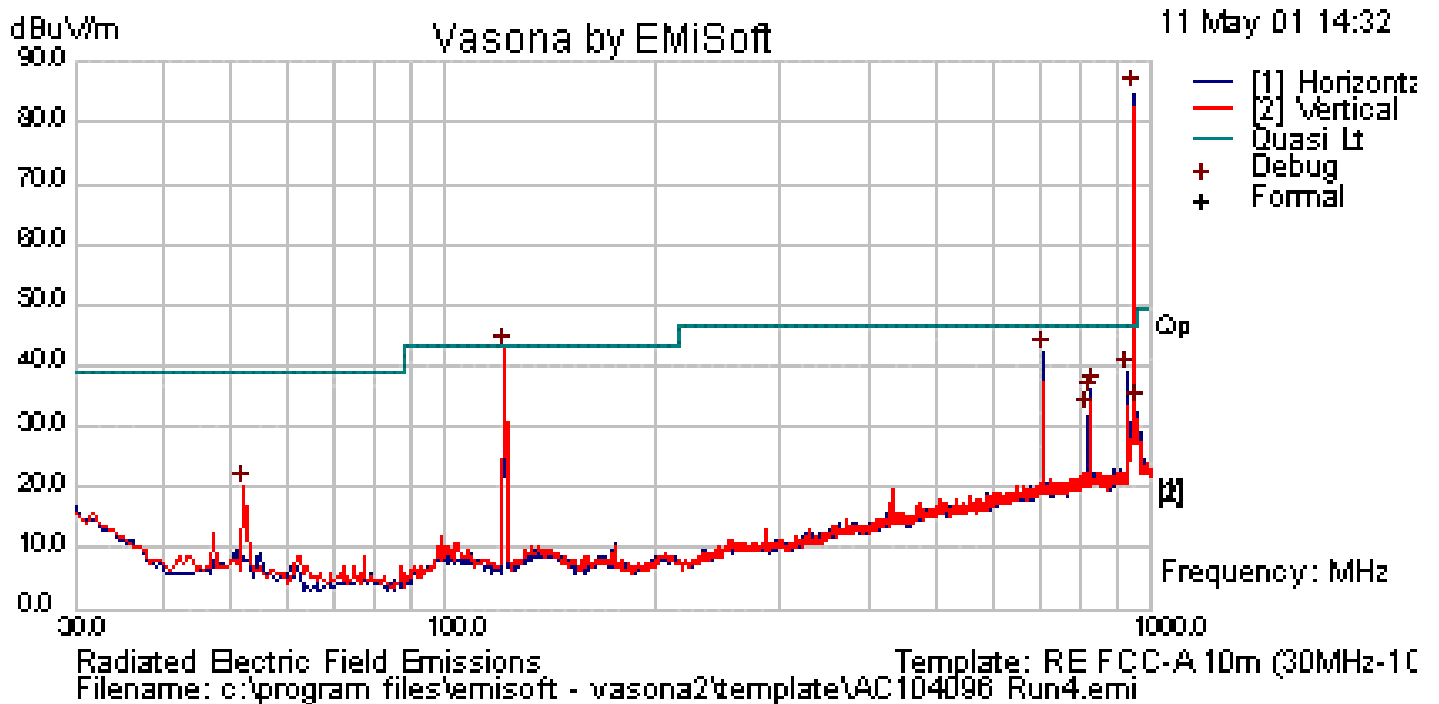


Company : LGC Wireless, AC104096. May-11-2001

EUT : 900 MHz GSM 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



#### 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
<input type="checkbox"/> - AC LISN	Line Impedance Stabilization Network	Fischer Custom Communications	6A,6B	5/26/02
<input type="checkbox"/> - 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: \_\_\_\_\_

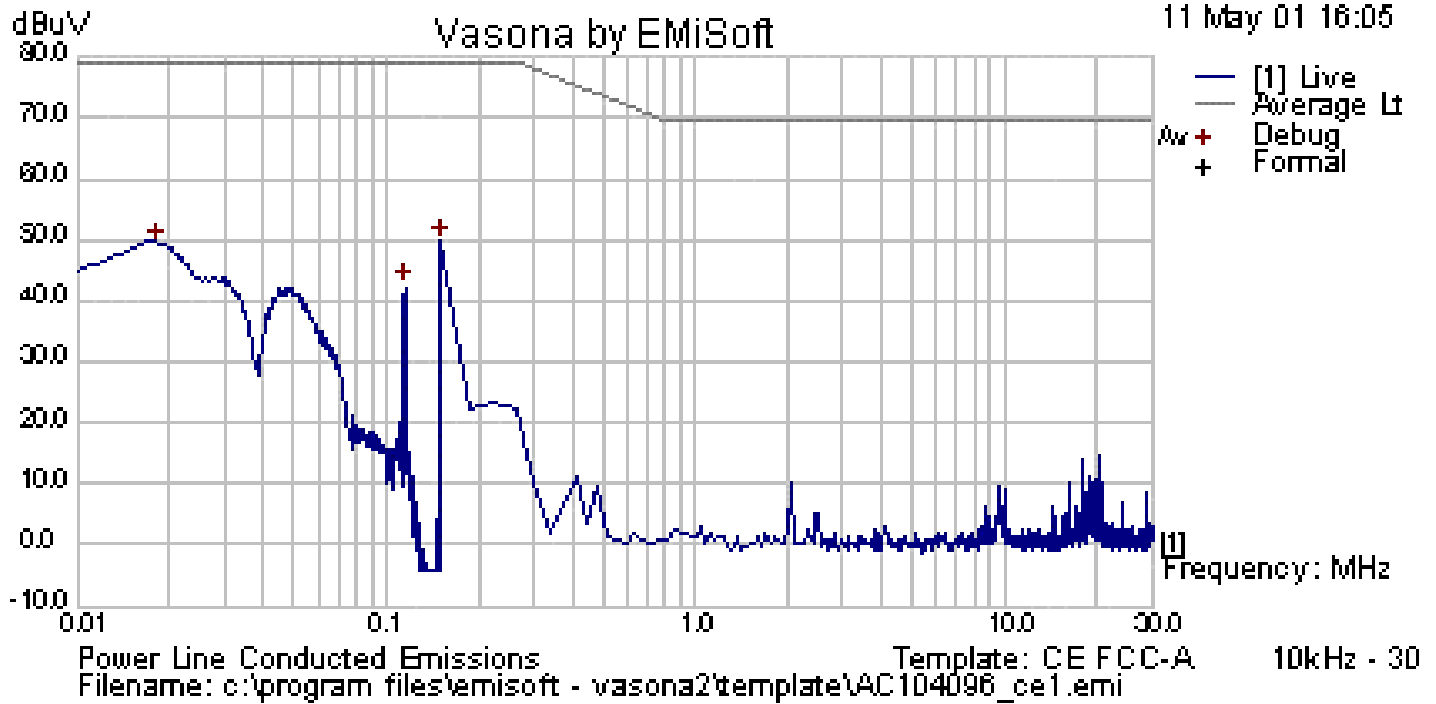
---

Company : LGC Wireless, AC104096. May-11-2001

EUT : 900 MHz GSM 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

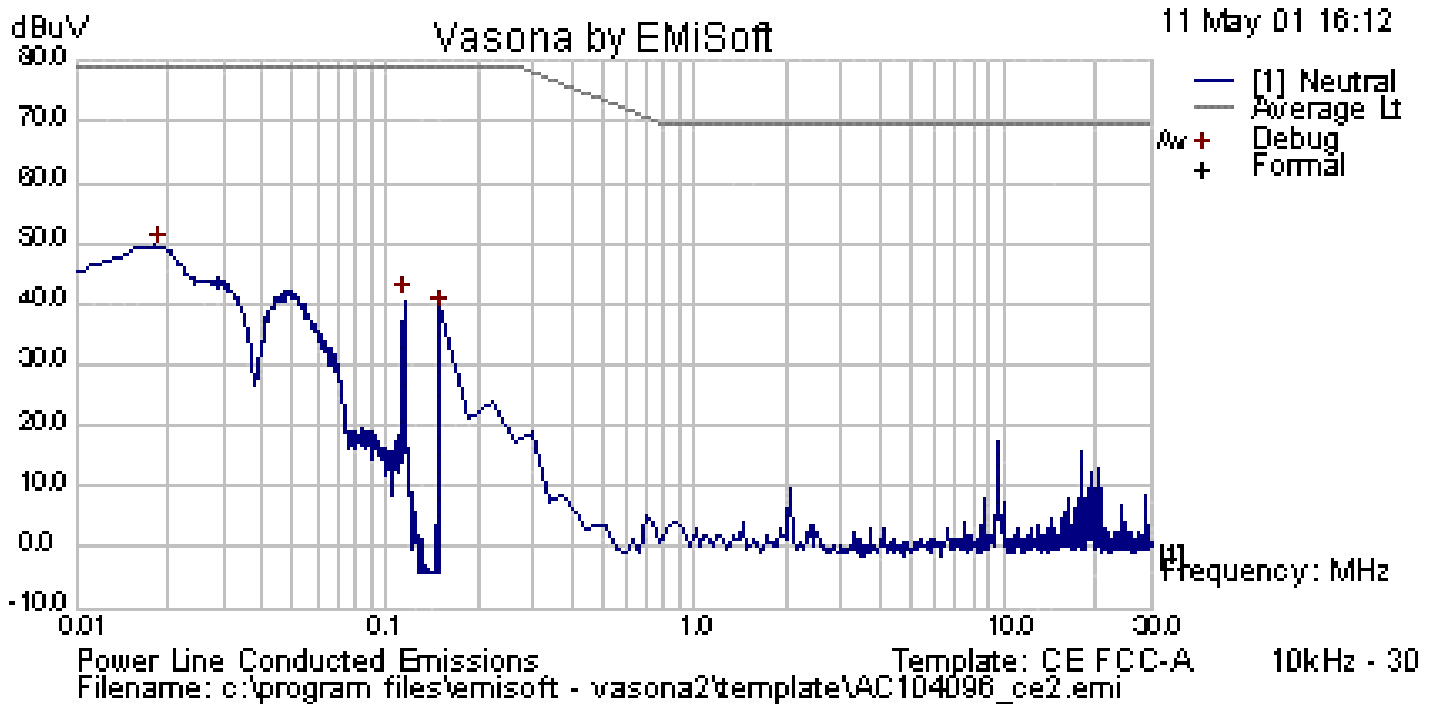
Company : LGC Wireless, AC104096. May-11-2001

EUT : 900 MHz GSM 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

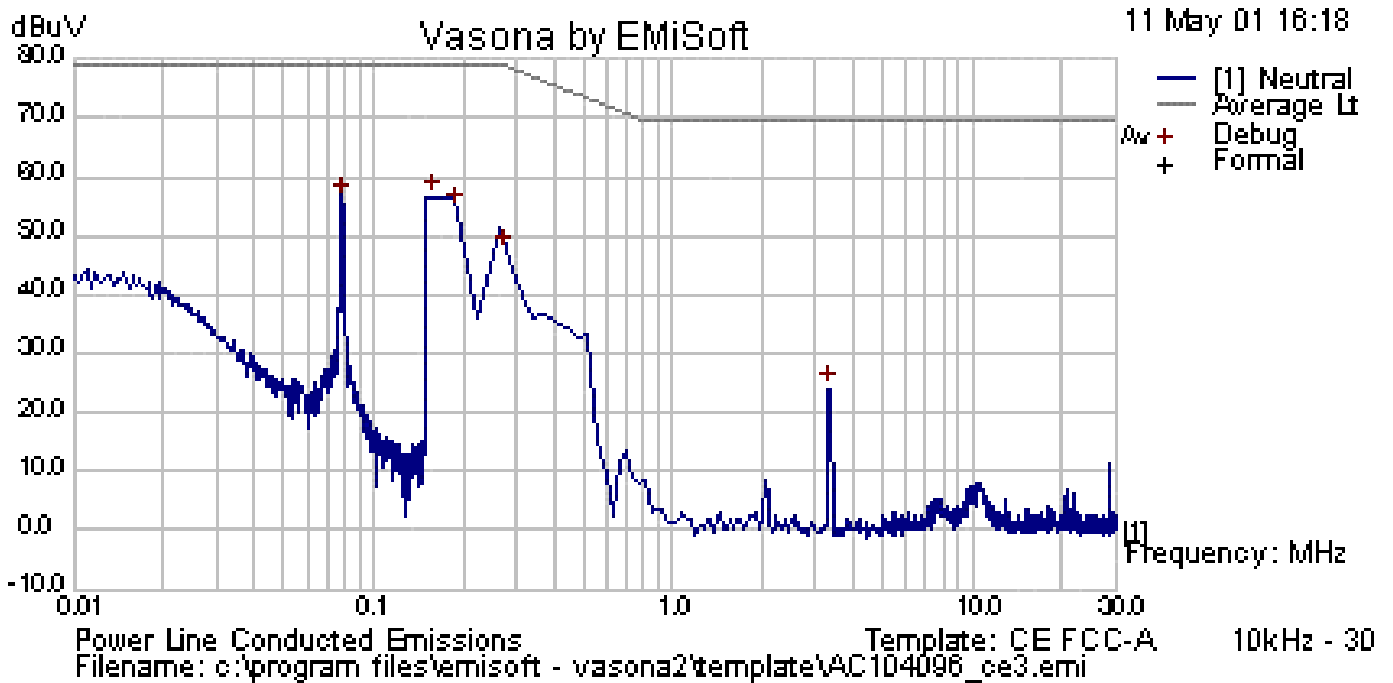
Company : LGC Wireless, AC104096. May-11-2001

EUT : 900 MHz GSM 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

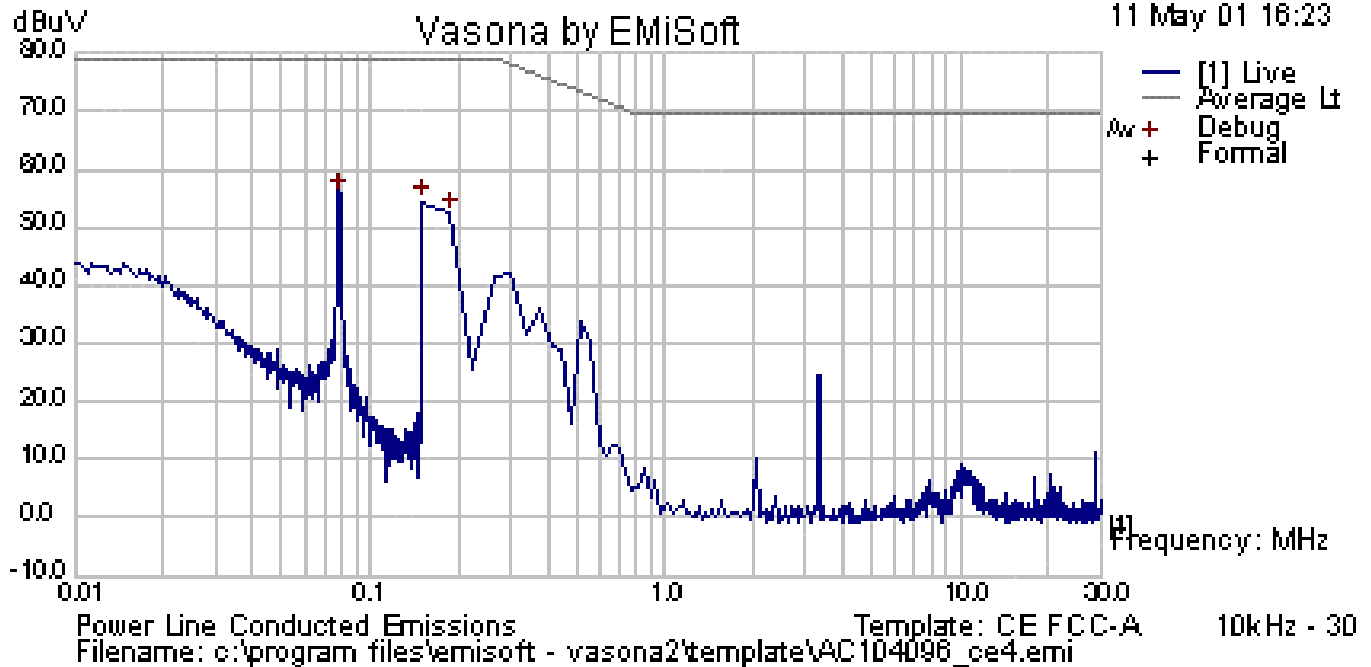
Company : LGC Wireless, AC104096. May-11-2001

EUT : 900 MHz GSM 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)

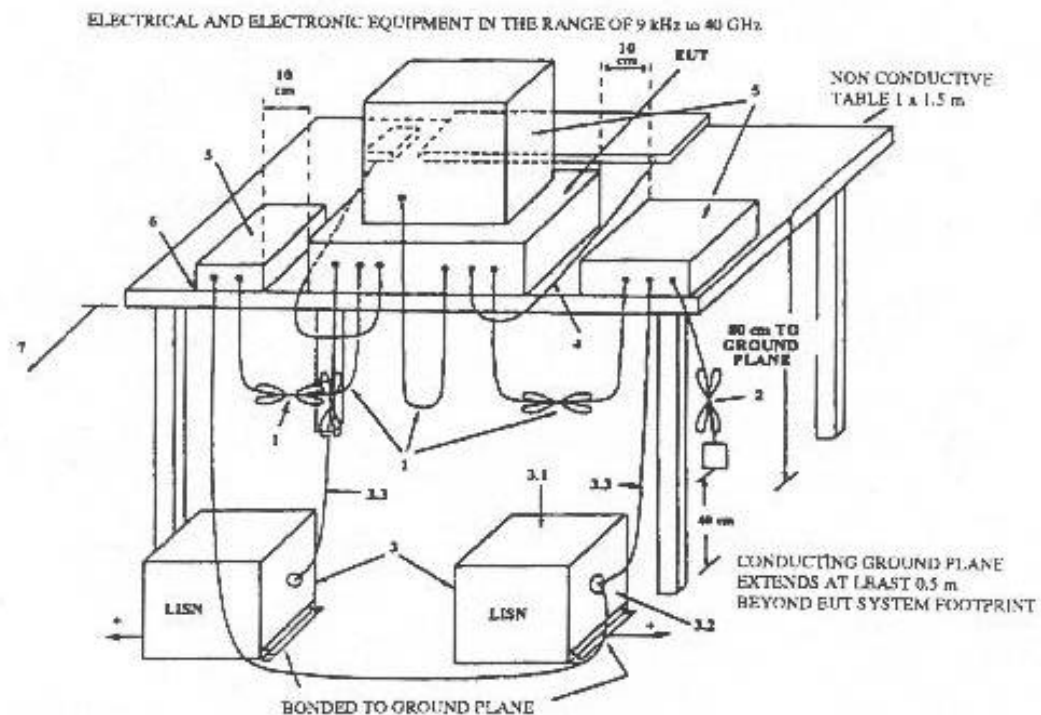
Operator : Dao Le



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



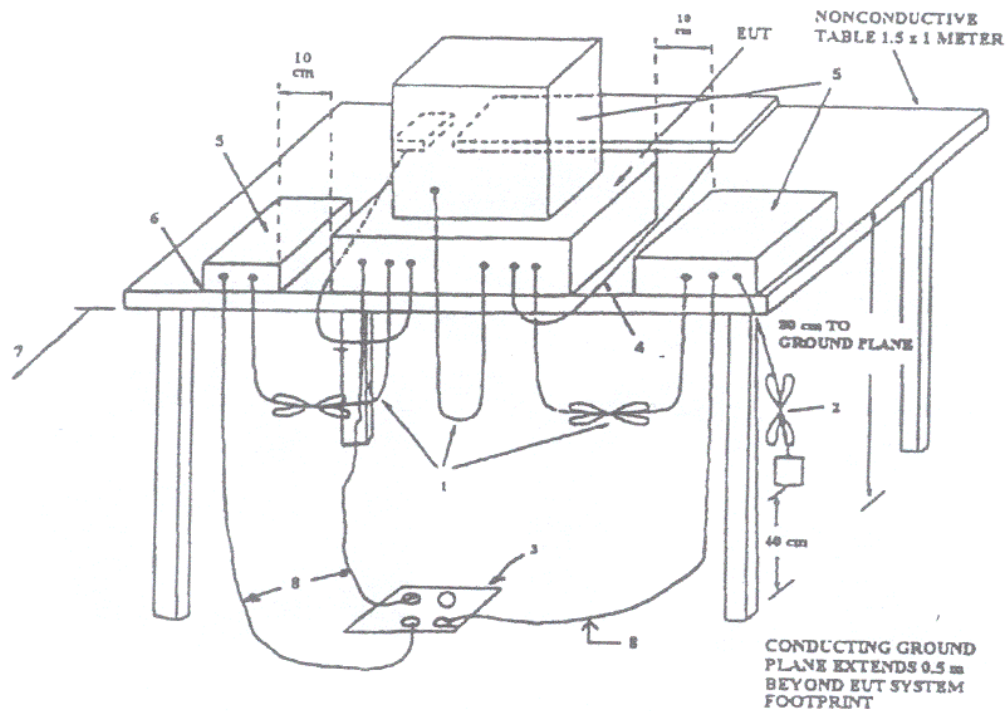
### Conducted Emission Test Setup, 0.15 TO 30 MHz



**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  $\Omega$ . 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, mice, 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

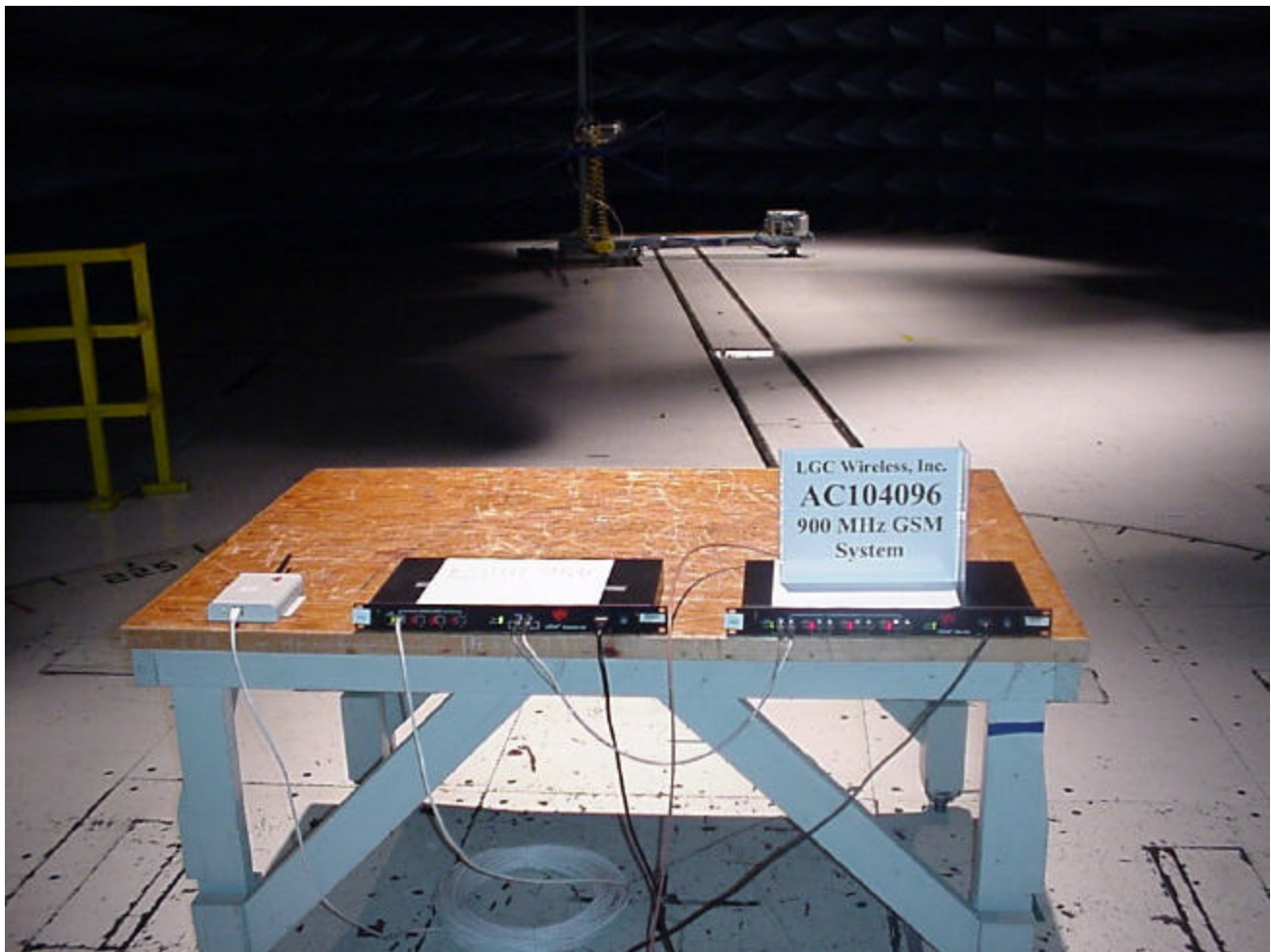


**LEGEND:**

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, mice, 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:  
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 / TUV Product Service

Responsible Engineer:



Srini Chandrasekaran

Lead EMC Engineer