LXE

125 Technology Parkway
Norcross, Georgia, US 30092

Direct Sequence Spread Spectrum Transmitter

Model:	480628-3700
FCC ID:	KDZ480628-3700
Manufacturer:	LXE Inc.
Scope of Testing:	FCC Part 15, Subpart C
Section/Standard:	47 CFR § 15.247

Issue Date: August 10, 1999

Table of Contents

1.0 GENERAL

1.1 Introduction

The purpose of this report is to demonstrate compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations. Testing was performed by LXE Inc., a division of EMS Technologies, Inc.

1.2 Product Description

The equipment under test(EUT) is the combination of the Huber & Suhner antenna type 9090.16.0001 and the LXE Transceiver model 480628-3700.

The antenna has a gain of 1.8dBi and is designed for 2.4 GHz operation. It is primarily used with radios installed in LXE Hand Held Computer Terminals (HHT). The antenna couples to the radio via a custom designed connector satisfying the requirements of section **15.203** of the FCC rules.

The transceiver is a Direct Sequence Spread Spectrum radio that operates in the band of 2.400-2.4835 GHz at a nominal 42mW.

The combination of the radio, antenna and a suitable host are used in establishing wireless LAN's for applications such as inventory tracking, healthcare and office settings. The radio can only be used in host devices that are equipped with a type 2 PCMCIA interface and the proper software for operation. Selected hosts must be compliant to FCC Part 15, Subpart B rules and regulations among others.

2.0 LOCATION OF TEST FACILITY

The LXE test facility is located at the following address:

LXE, Inc.
An Electromagnetic Sciences Company
125 Technology Parkway
Norcross, GA US 30092-2993
Tel: (770) 447-4224
Fax: (770) 447-6928

Radiated emission tests were conducted at the manufacture's test facility at a location specifically prepared for this testing. The radiated emissions test site meets the characteristics of ANSI C63.4:1992, CISPR 16 and EN 55022:1994. This site has been fully described and submitted to the FCC, and accepted in their letter marked 31040/SIT, 1300F2.

3.0 DESCRIPTION OF OPEN AREA TEST SITE

The open area test site(OATS) is located in the center of the rooftop of the building. The roof is located at a height of approximately 8 meters above the ground. The 3 meters radiated emissions test site is an open, flat area (open area) test site approximately 6.2m x 9.2m in dimension. All reflecting objects including test personnel lie outside the perimeter of the ellipse. The 3 meters test site ground plane is made of a 1/4" metal screen mesh which extends 2 meters past the mast and equipment under test(EUT). Material of the ground plane, comprised of individual 1/4" metal screen mesh rolls, were soldered at the seams with gaps smaller than 1/10 of the wavelength at 1000MHz. The ground plane is connected to the earth ground by ground rods. All wiring is done at floor level around the test site periphery. The radiated emissions test setup is shown in figure 1.

3.1 Radiated Emissions Testing Facility Drawing

All dimensions are in meters(m)

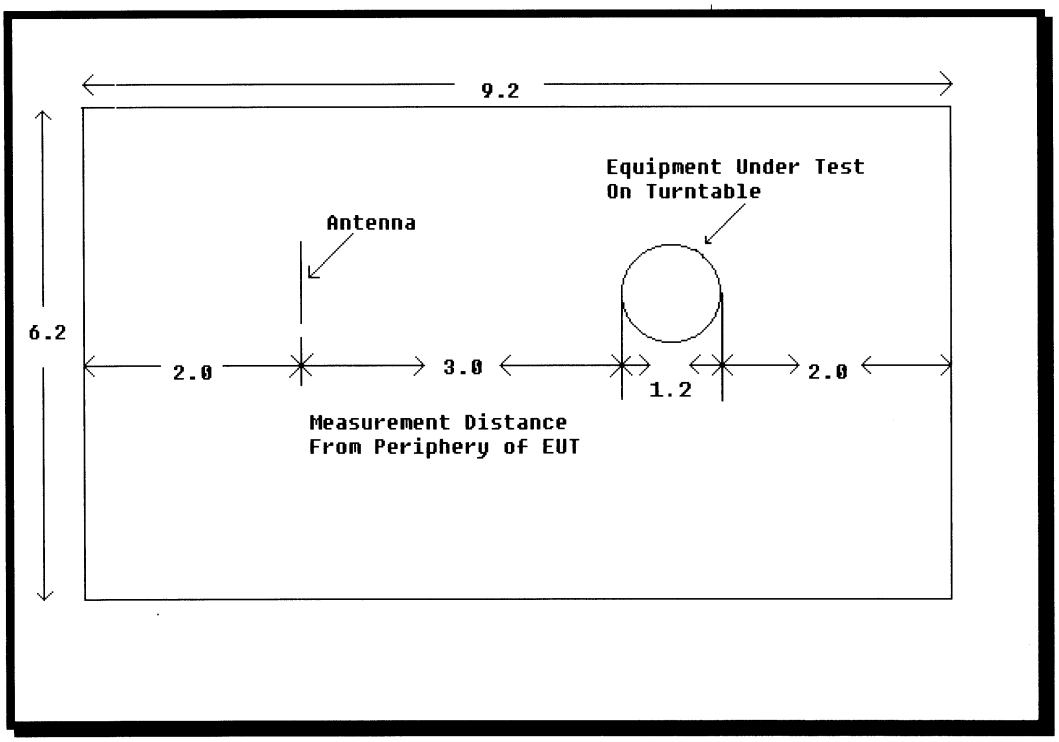


Figure 1: Open Area Test Site(OATS)

4.0 APPLICABLE STANDARD REFERENCES

The following standards were used for this test:

1 - ANSI C63.4-1992: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz

2 - US Code of Federal Regulations (CRF): Title 47, Part 15, Radio Frequency Devices, Subpart C, Intentional Radiators (October 1997)

3 - FCC OET Bulletin 65 Edition 97-01, August 1997 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

5.0 LIST OF TEST EQUIPMENT

Radiated field strength measurements are taken with a spectrum analyzer. For peak measurements the spectrum analyzer was set with both the VBW and the RBW at 1MHz. Average measurements were taken with the RBW at 1MHz and the VBW at 10Hz. The sweep rate was set to auto to optimize the measurement. Adequate attenuation was used to protect the analyzer from damage.

Table 1: Test and Support Equipment

Description	Manufacturer	Model/Part #	Serial #	Calibration Due Date
Spectrum Analyzer	Hewlett Packard	HP 8591A	3131A02254	05/10/00
Spectrum Analyzer	Hewlett Packard	HP 8563E	3304A00657	05/05/00
Preamplifier	LXE	20-1000 MHz	001	04/12/00
Preamplifier	Hewlett Packard	83006A	3116A01317	10/05/99
HI-Pass Filter	MiniCircuits	SHP-1000		02/26/00
HI-Pass Filter	MicroWave Circuits	H3G020G2	0001	01/05/00
LISN	EMCO	3810/2NM	9505-1024	05/07/00
Biconical Antenna	EMCO	3104C	9012-4360	05/06/00
Biconical Antenna	Electro-Metric	BIA-25	1165	07/10/00
Log Periodic	EMCO	3146	3011-2946	04/01/00
Horn Antenna	ElectroMetric	RGA-60	6166	04/05/00
Horn Antenna	ElectroMetric	RGA-60	6165	08/20/99
Dipole Antenna Set	CDI	Roberts Dipole	265	04/03/00
RF Cable			NSN	10/05/99
RF Cable			7015	10/05/99
RF Cable			6986	10/05/99
Antenna Mast	CDI	CDI	N/A	N/A
Turntable	CDI	CDI	N/A	N/A
RF Enclosure	Lindgren Enclosure	14-2/2-0	8147	N/A

6.0 TEST METHODOLOGY

For the radiated emissions tests, measurements were made over the frequency range of 30MHz to 10 times the highest fundamental frequency. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test(EUT)and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. A nonconductive remotely controlled turntable approximately 0.91m x 1.2m x 0.8m was used to measure radiated emissions from all sides of the EUT. The turntable has a center opening that allows cabling to be routed directly down to the conducting ground plane.

Due to high ambient noise levels and small EUT size, radiated emission measurements may be made at a distance of 1 meter. An inverse proportionality factor of 20 dB per decade is used to normalize the measured data to the specified distance to determine compliance. The formula used to calculate an inverse proportionality factor is 20 log (D1/D2), where D1 is the distance used and D2 is the specified distance.

Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120KHz for measurements above 30MHz and below 1000MHz, and 1MHz for measurements above 1000 MHz.

7.0 SUPPORT EQUIPMENT

Table 2: Support Equipment

Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
WinBook XP	LapTop Computer	ANL-4	10AUA01756	JRUANL-4M66
DELL	AC/DC Power Adapter	ADP-45GB	N6745067248	NONE

8.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

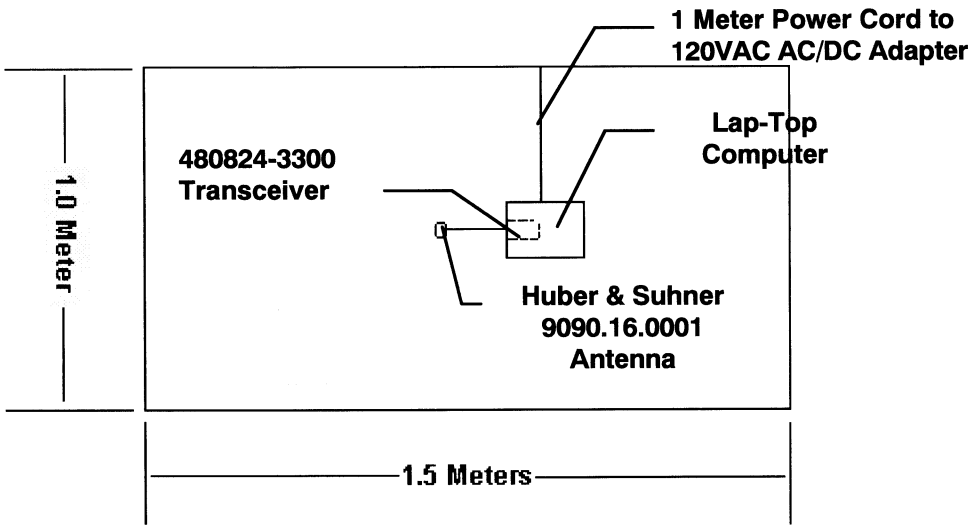


Figure 2: Test Setup Block Diagram

9.0 TEST SETUP PHOTOGRAPHS

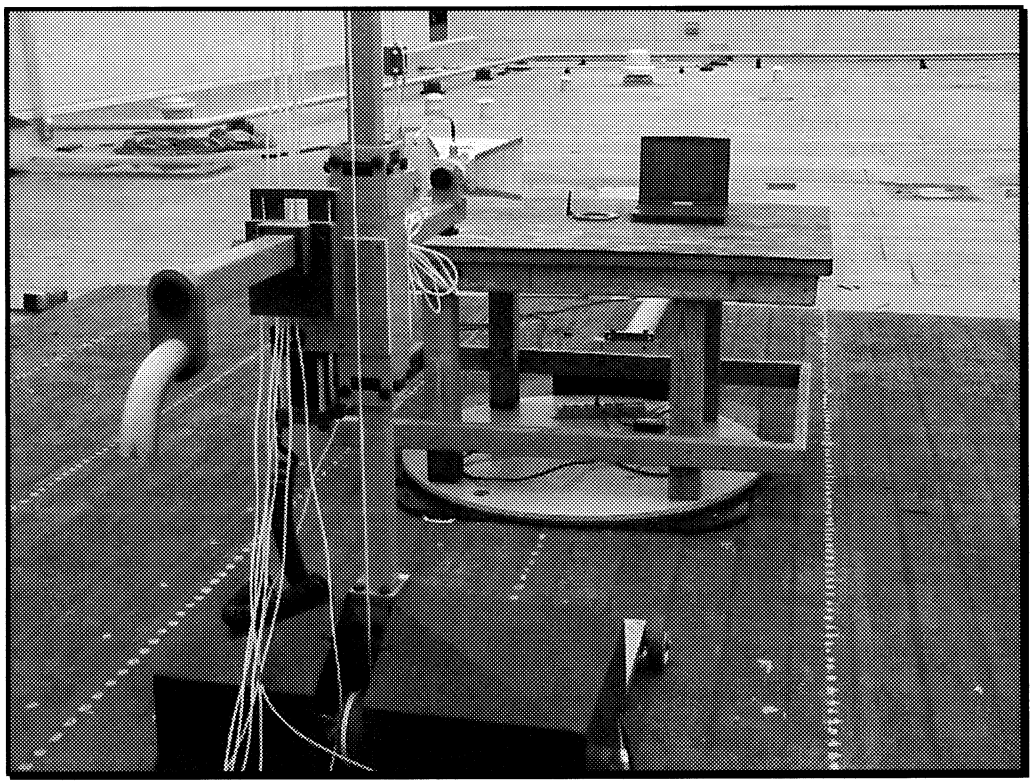


Figure 3: Front View

9.0 TEST SETUP PHOTOGRAPHS(cont.)

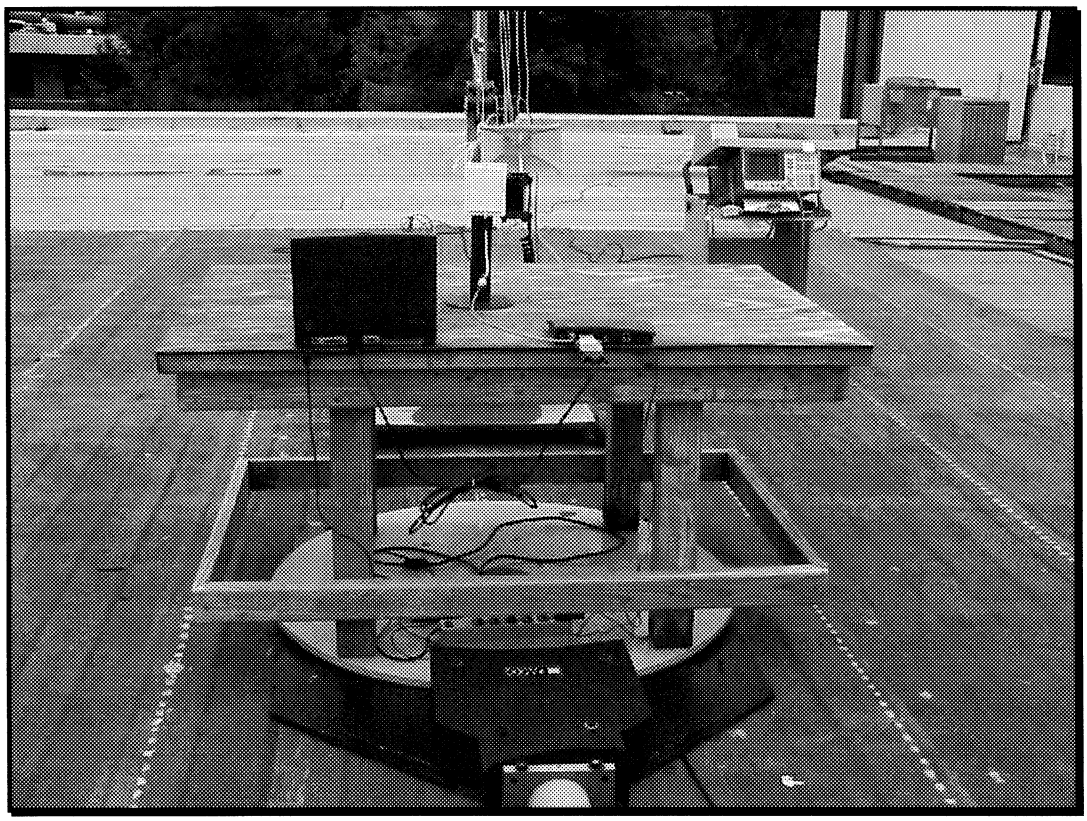


Figure 4: Back View

10.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were also taken of all signals deemed important enough to document. The tables below make reference to plot numbers that can be found following each section.

10.1 Antenna Requirement - FCC Section 15.203

The antenna is equipped with a unique and proprietary connector. Substitution of the antenna would require electrical modifications of the transceiver.

10.2 Radiated Spurious Emissions(Restricted Bands)

Peak radiated spurious emissions found in the restricted bands are reported below in table 4. Average measurements are shown in table 5. Plots of this data will be submitted as an addendum to this report.

Table 4: Radiated Spurious Emissions - Peak Measurements

Frequency (MHz)	Antenna Distance (m)	Level (dBm)	Detector Function (P/A)	Correction Factors (dB)	Corrected Level (dBm)	Corrected Level (uV/m)	Limit (uV/m)	Margin (dB)	Final Result (Pass/Fail)
Low Channel									
4824	1	-67.83*	p	3.61	-64.22	137.71	5000	4862.29	**PASS**
7236	1	-73.00*	p	9.45	-63.55	148.71	5000	4851.29	**PASS**
Mid Channel									
4884	1	-65.83*	p	3.76	-62.07	176.46	5000	4823.54	**PASS**
7326	1	-74.17*	p	9.69	-64.48	133.71	5000	4866.29	**PASS**
High Channel									
4924	1	-63.5*	p	3.87	-59.63	233.49	5000	4766.51	**PASS**
7386	1	-71.3*	p	9.86	-61.44	189.62	5000	4810.38	**PASS**

* Measurement was of the noise floor and no plots taken.
** If emissions could not be detected at a distance of 3 meters. Antenna was moved up to one meter and the appropriate correction factor applied.

Correction Factors

= Antenna Factors + Cable Attenuation + High Pass Filter Loss - Amp Gain - Range Correction

Range Correction = 20Log(D1/D2) Where D1 is the specified distance used and D2 is the distance used to make measurements = [20Log(3/1)] = 9.54 dB

Sample Calculations

Corrected Level(dBm) = Receiver Level + Correction Factors
Conversion from dBm to uV/m = Antilog(dBm + 107)/20)

10.3 Radiated Spurious Emissions(Restricted Bands)(cont.)

Table 5: Radiated Spurious Emissions - Average Measurements

Frequency (GHz)	Level (dBm)	Correction Factors	Range Correction	Corrected Level(dBm)	Corrected Level(uV/m)	Limit (uV/m)	Margin (uV/m)	Pass/Fail
ALL PEAK MEASUREMENTS MET THE AVERAGE LIMITS, THEREFORE AVERAGE MEASUREMENTS WERE DEEMED UNECESSARY								

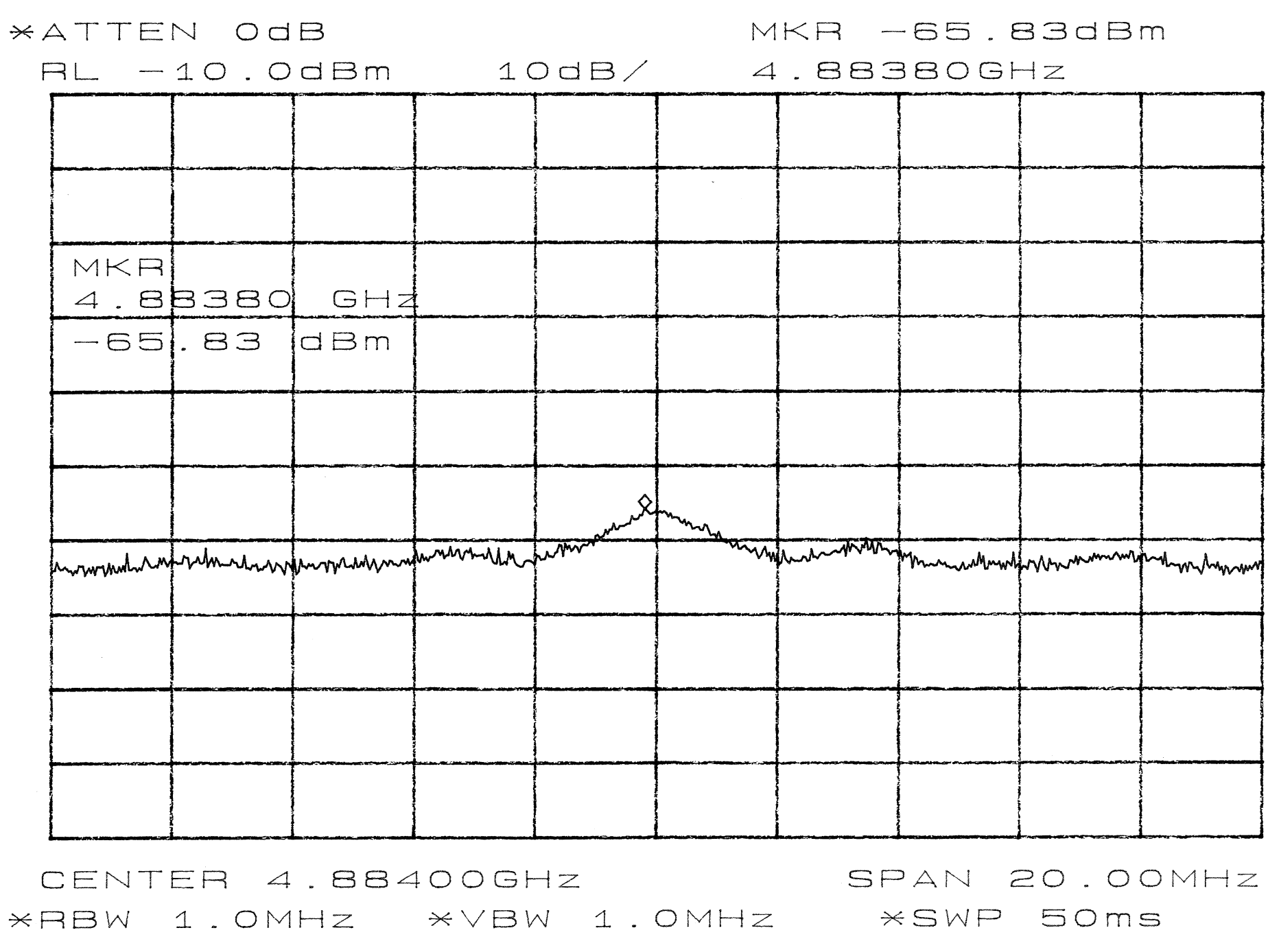
Correction Factors
= Antenna Factors + Cable Attenuation + High Pass Filter Loss - Amp Gain - Range Correction

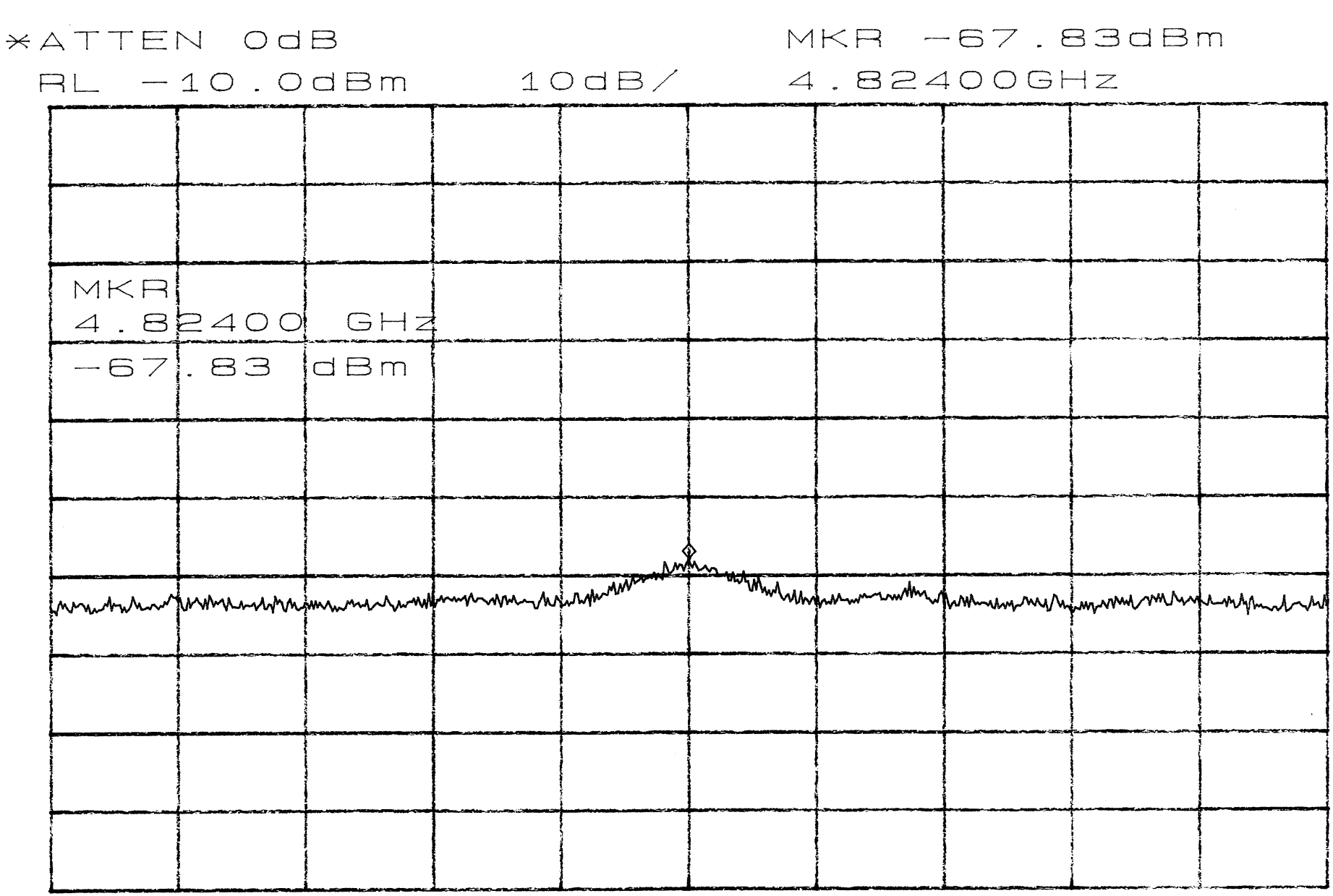
Range Correction = 20Log(D1/D2) Where D1 is the specified distance used and D2 is the distance used to make measurements = [20Log(3/1)] = 9.54 dB

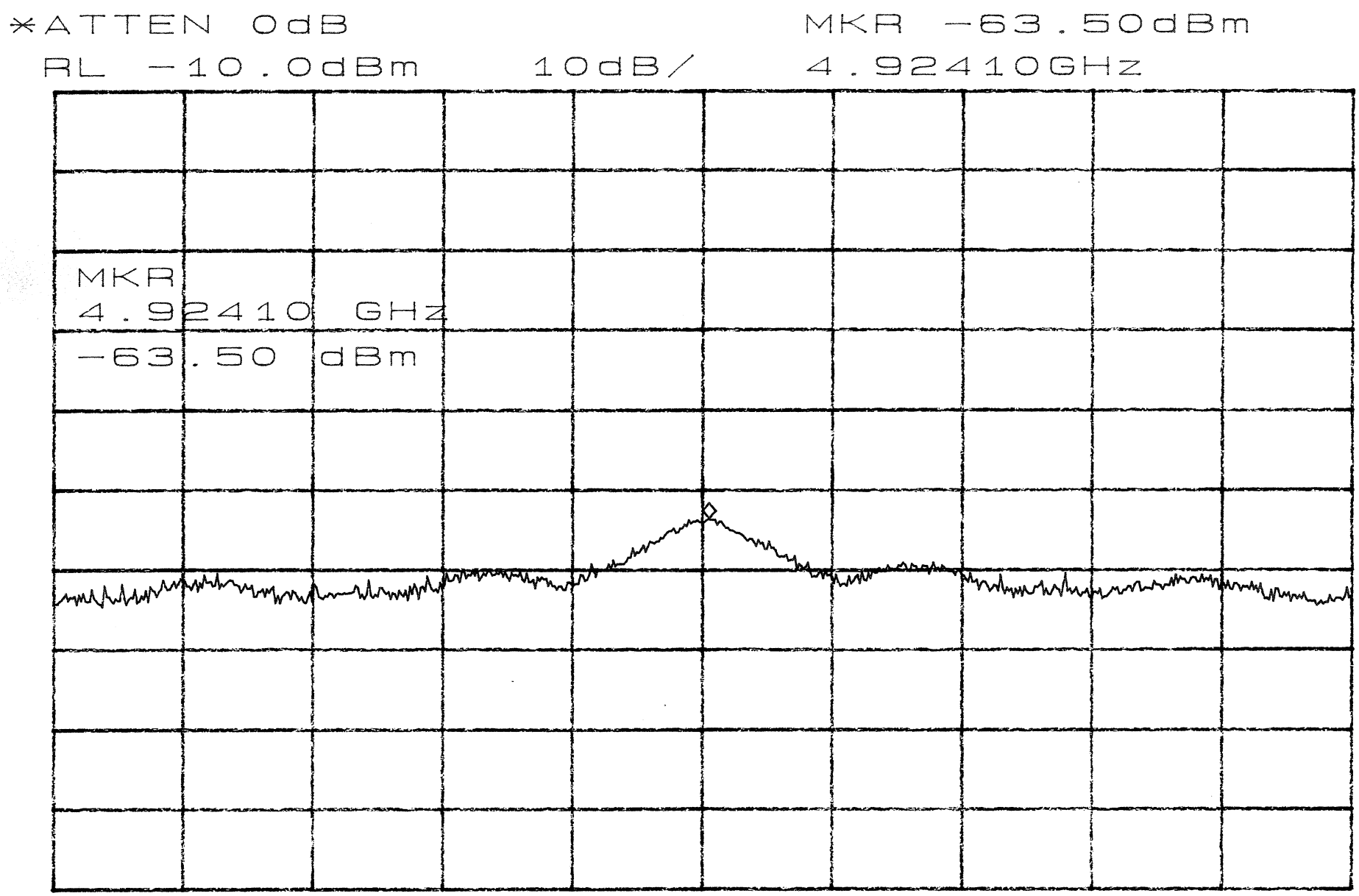
Sample Calculations
Corrected Level(dBm) = Receiver Level + Correction Factors
Conversion from dBm to uV/m = Antilog(dBm + 107)/20)

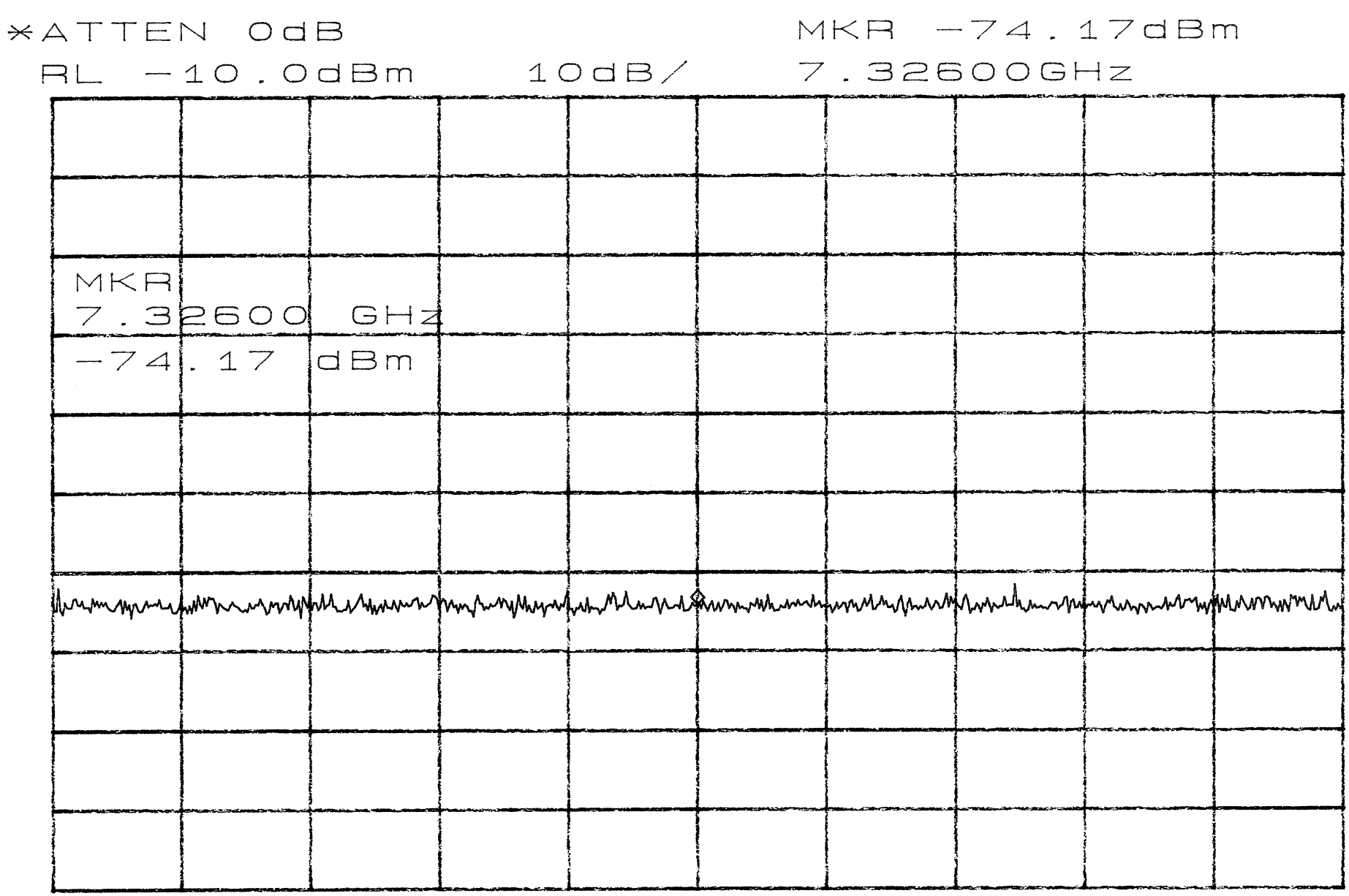
11.0 RF Safety - FCC Section 15.247(b)(4)
As described throughout this report, the Huber & Suhner antenna will be used with the LXE Model 480628-3700 radio. The combination will be integrated into an LXE hand-held terminal, a portable device that is intended to be used less than 20cm from the body. In this application, according to section 1.1310 of the rules, the MPE requirements do not apply.

Additionally, the SAR requirements as defined in section 2.1093 do not apply as part 15 devices are excluded from these devices, unless otherwise required by the FCC. However, to satisfy the requirements of 15.247(b)(4) a condition of grant was placed on this radio that restricted the gain of antennas for use on portable devices to 2.5 dBi or less. The Huber and Suhner antenna described herein has a gain of 1.8dBi and is in accordance with this condition of grant.


*ATTEN 0dB
MKR -65.83dBm
RL -10.0dBm
10dB/
4.88380GHz
MKR
4.88380 GHz
-65.83 dBm
CENTER 4.88400GHz
SPAN 20.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
*SWP 50ms


*ATTEN 0dB
MKR -67.83dBm
RL -10.0dBm
10dB/
4.82400GHz
MKR
4.82400 GHz
-67.83 dBm
CENTER 4.82400GHz
SPAN 20.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
*SWP 50ms


*ATTEN 0dB
MKR -63.50dBm
RL -10.0dBm
10dB/
4.92410GHz
MKR
4.92410 GHz
-63.50 dBm
CENTER 4.92400GHz
SPAN 20.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
*SWP 50ms


*ATTEN 0dB
MKR -74.17dBm
RL -10.0dBm
10dB/
7.32600GHz
MKR
7.32600 GHz
-74.17 dBm
CENTER 7.32600GHz
SPAN 20.00MHz
*RBW 1.0MHz
*VBW 1.0MHz
*SWP 50ms

SUHNER
DIPOLE ANTENNA 2.45 GHZ
FOR WIRELESS COMMUNICATION

Type No. 9090.16.0001

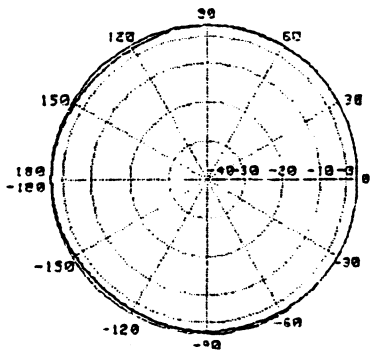
mmcx adapter

Technical Data

Electrical properties	
Frequency range	2.4 – 2.5 GHz
Impedance	50 Ω
VSWR	≤ 2.0
Polarisation	vertical
Gain	1.8 dBi
Pattern	Omni
Permitted power on entrance	1 W (CW) at 25 °C
Standard connector	right angle MCX–male

Mechanical properties	
Length	79 mm
Connector case	ABS
Antenna case	ELVAX 550
Color	Pantone cool grey 11c
Operating temperature range	– 20 °C to + 65 °C

Radiation Pattern



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Data Sheet 02.95/Edition 1, 231GHA/st

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