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Title

EMC Test, X3M/Easy Locator MID with 350 MHz Shielded antenna

Document

Test Report

Date

September 3, 2002

Prepared

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EMC Test Engineer

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Page

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Equipment under test (EUT):

Description: Ground Penetrating Radar System

Manufacturer: Malå Geoscience

Model name: X3M/Easy Locator Mid with 350 MHz Shielded antenna

Summary:

The EUT complied with the requirement of radiated emissions given in FCC 15.209, measured in the frequency range 30 – 960 MHz

Approved:

Petter Gärdin

Ass. Laboratory Technical Manager

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1 Introduction

The object of the test is to show compliance with the emission standard FCC Part 15.

Date of test: August 13, 2002

Location: Malå Geoscience, Malå Sweden

Test performed by: Henrik Olsson, AerotechTelub / FBM

Client: Malå Geoscience
Skolgatan 11
SE-93070 Malå
Sweden

Client's observers: Lars Lundmark, Malå Geoscience
Bernt Johansson, Malå Geoscience

2 Test methods and results

2.1 Results

The test results in this report apply only for the tested specimen.

EMISSION REQUIREMENTS ACCORDING TO FCC 15.209					
Environmental phenomena	Test method	Requirement	Result	Comments	Test order
Radiated emission	ANSI C63.4	FCC 15.209	Pass		1

3 Applicable documents

Measurements		
ANSI C63.4	1992-07-17	Radio noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.
FCC Part 15	2002-07-22	Radio Frequency Devices
FCC 02-42	2002-04-22	Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems

4 Equipment under test (EUT)

4.1 Identification of equipment under test

Equipment under test (EUT):

Description:	Ground Penetrating Radar System.
Manufacturer:	Malå Geoscience
Model name:	X3M/Easy Locator Mid with 350 MHz Shielded antenna
Build state:	Production sample
Serial no:	X3M/ Easy Locator Mid, 002465 350 MHz antenna, first of production

4.2 Test site

4.2.1 Description

The test site was located outside the Malå Geoscience's facilities in Malå at about 50 m distance from the nearest building. According to the measurement procedures 51 cm (20") of dry sand was placed in the ground, under the EUT. A ground plane, made by sheet metal, was formed around the EUT and protruding under the measurement antenna. The EUT was placed directly on the dry sand with no ground plane under it.



Picture 1: Test Site

The measurement distance antenna – EUT was 3 m. The measurement system and related equipment were placed in a van located 15 m behind the antenna.

4.2.2 Ambient signals

Mobile telephones: 460 – 470 MHz, 937 – 945 MHz
FM broadcasts: 89 – 102 MHz
Television: 174 – 181 MHz, 216 – 224 MHz, 494 – 501 MHz

In addition many signals of short-term duration were found. Each measurement signal close to or above the limit was examined if ambient or related to the EUT.

4.3 General configuration of EUT

The EUT was powered by its internal battery pack.

An X3M control unit was attached to a 350 MHz shielded antenna unit.

No cables were connected to the EUT.

4.4 Operation of EUT during tests

The EUT was gathering data like in normal operation.

5 Emission

5.1 Measurement of radiated emission, ANSI C63.4

5.1.1 Requirements according to FCC 15.209

Radiated emission from the EUT in the frequency range 30 to 960 MHz shall not exceed the limit as specified below.

Frequency range	Limit
30 - 88 MHz	40 dB μ V/m
88 – 216 MHz	43.5 dB μ V/m
216 – 960 MHz	46 dB μ V/m

5.1.2 Procedures

The radiated emission was measured on an Open Area Test Site (OATS) with 3 meters measuring distance. A tent, made entirety of non-metallic material, protected the site.



Picture 2

The EUT was configured and the test was performed in accordance with ANSI C63.4.

The test was initiated with a pre-scan in the frequency range 30 - 960 MHz, where the emission level was measured in 16 different combinations of 8 EUT angle positions and vertical/horizontal polarisation. For each position the EUT was turned manually and the ground plane was adjusted to follow the EUT outlines.

A composite trace of the peak measurements was drawn.

Subsequently, frequencies with the highest emission were selected. EUT position, antenna height and polarisation were adjusted in order to find the position with the highest emission level. Quasi peak values were measured in the maximised positions.

The diagrams are shown with the quasi peak limit according to FCC 15.209.

5.1.3 Deviations from the standard

The ground plane was arranged according to FCC 02-42.

5.1.4 Climatic conditions

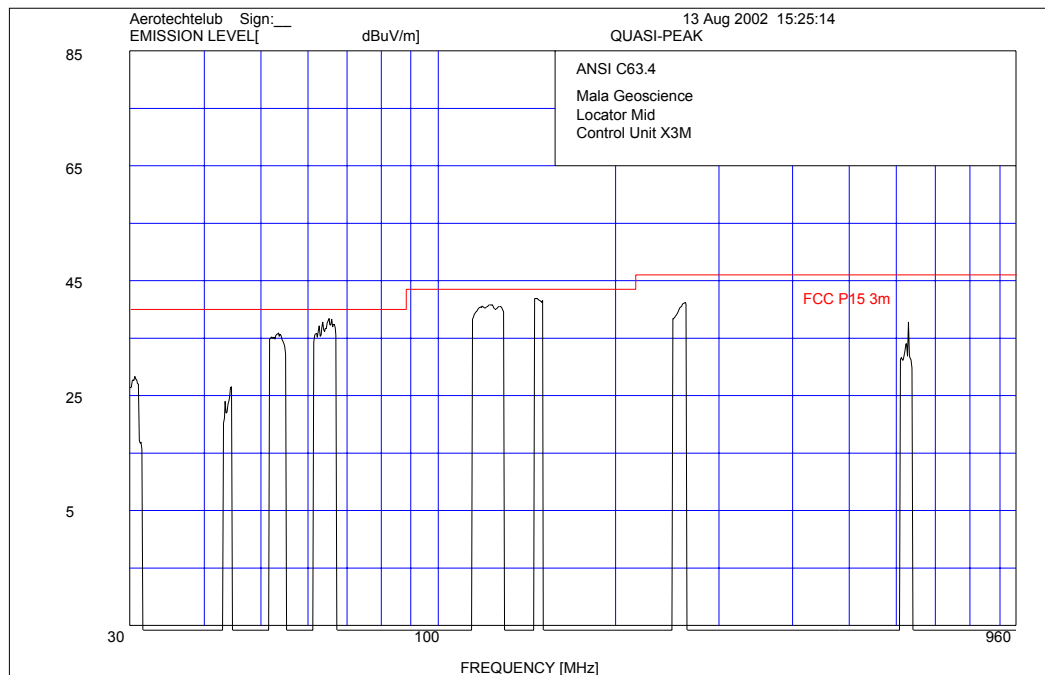
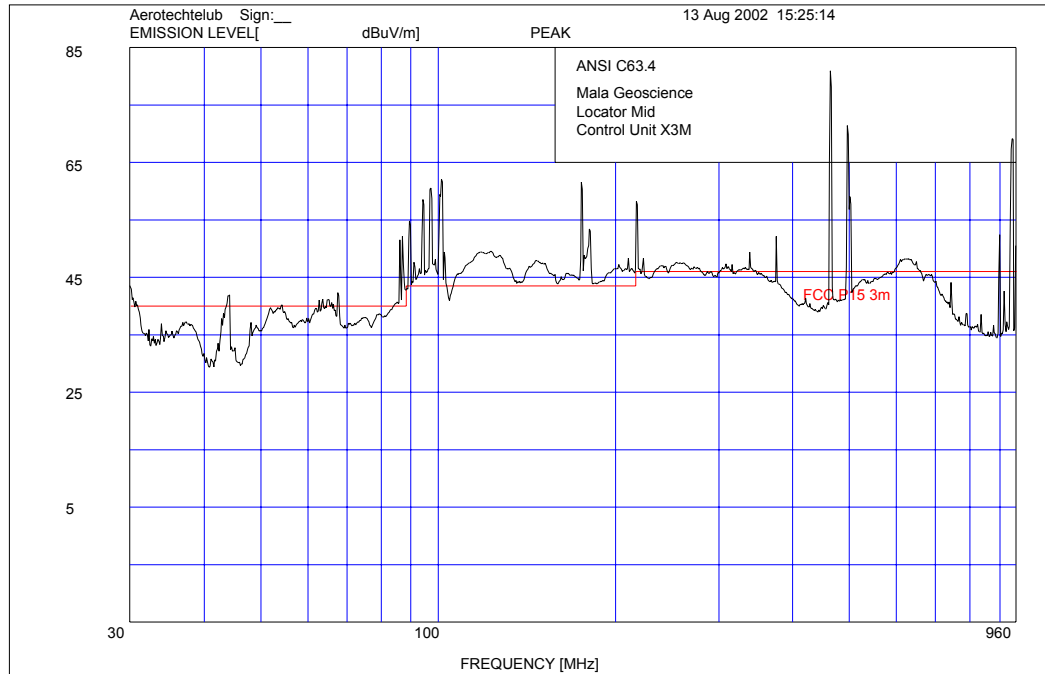
	Requirement according to standard	Climatic conditions during the test
Temperature	-	20 – 25 °C
Relative humidity	-	Not measured

5.1.5 Results

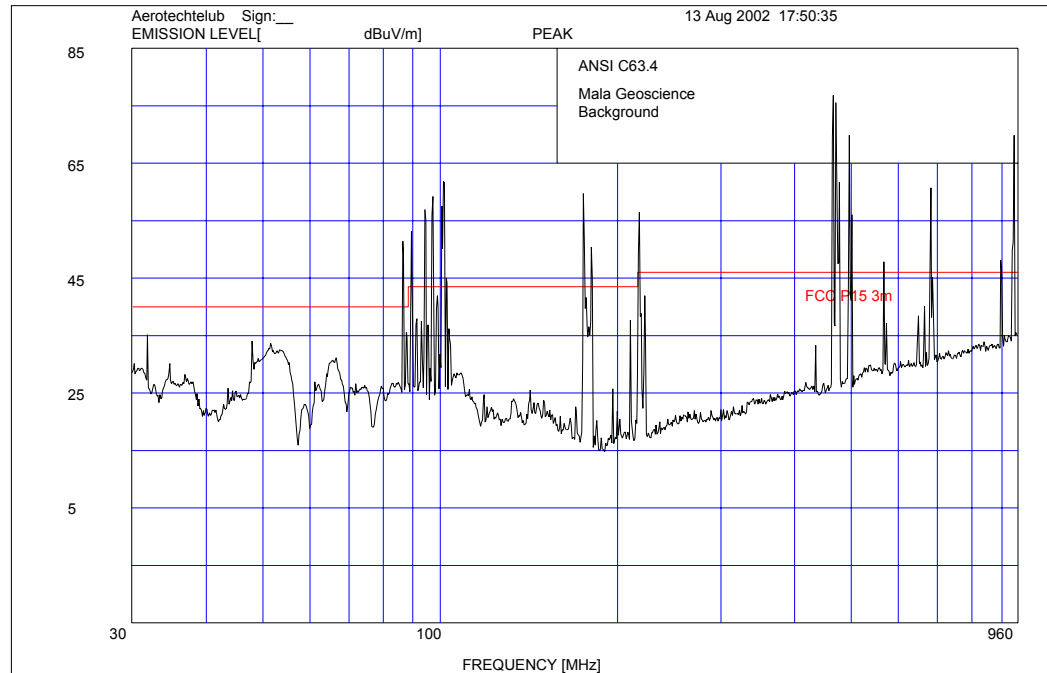
Given measured values are valid for the described arrangement and operation of the EUT.

The EUT complied with the requirement of radiated emission specified in FCC 15.209 in the frequency range 30 – 960 MHz. No signals above the limit line were related to the EUT.

Quasi-peak measurements were not made in the entire frequency range. In order to preserve time measurements were taken in certain ranges only. The characteristics of the signal were the same in the entire range.



Background



5.1.6 Signal List

Frequency (MHz)	Amplitude quasi-peak (dBμV/m)	Antenna polarisation	Delta to limit (dB) ⁽¹⁾
44,5	26,5	Vertical	-13,5
53,7	35,9	Vertical	-4,1
65,4	38,4	Vertical	-1,6
122,4	40,8	Vertical	-2,7
146,0	41,9	Vertical	-1,6
263,0	41,2	Vertical	-4,8
629,3	26,5	Vertical	-8,2

⁽¹⁾ Negative value means below limit.

5.1.7 Measurement uncertainty

For the test site used no calculations exists.

5.1.8 Instrumentation

Hewlett Packard Spectrum analyser	8568B	100 Hz - 1.5 GHz	2648A13535 / 2634A02996
Hewlett Packard RF Preselector	85685A	20 Hz - 2 GHz	2510A00145
Hewlett Packard Quasi-Peak Adapter	85650A		2430A00465
Chase Bilog antenna	CBL6111A	30 - 1000 MHz	1164