FCC Measurement/Technical Report on

GSM gateway
ECOTEL VTMpro

Report Reference: 4_Vierl_0105_ERF_FCCa

Test Laboratory:

7 layers AG
Borsigstrasse 11
40880 Ratingen
Germany
email: info@7Layers.de

Deutscher Akkreditierungs Rat
DAT-P-192/99-01

CTIA Authorized Test Lab
LAB CODE 20011121-00

Note:
The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the testing laboratory.

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0 Summary

0.1 Technical Report Summary

Type of Authorization
Certification for a GSM cellular radiotelephone device

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 0 to 19 and Parts 20 to 69. The following subparts are applicable to the results in this test report.

Part 2
Subpart J - Equipment Authorization Procedures, Certification

§ 2.1053 Measurement required: Field strength of spurious emission

Part 24
Subpart E - Broadband PCS

§ 24.238 Emission limits

Summary Test Results:

The EUT complied with all performed tests as listed in chapter 0.2 Measurement Summary.

The measurements are performed following the requirements of FCC Part 24 but do not cover completely the requirements. The intention of this report is to demonstrate that two radio devices which operate simultaneously do not affect each other and can together fulfil the requirements of FCC Part 24.

The applicant proposed the measurements.

0.2 Measurement Summary

Field strength of spurious radiation			*)
The measurement was performed according to FCC §2.1053			10-01-2004
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_a01	enclosure	passed
op-mode 2	Setup_a01	enclosure	passed

***) Deviation from requirements of FCC Part 24:**
The measurement was performed up to 4 GHz.
This was desired by the applicant.
The measurement was performed when two transmitters were operating. For details please refer to the chapter "operating modes".

Responsible for Accreditation Scope: _____ Responsible for Test Report: _____

7 layers AG, Borsigstr. 11
40880 Ratingen, Germany
Phone +49 (0)2102 749 0

1 Administrative Data

1.1 Testing Laboratory

Company Name:	7 Layers AG
Address	Borsigstr. 11 40880 Ratingen Germany

This facility has been fully described in a report submitted to the FCC and accepted under the registration number 96716 .

The test facility is also accredited by the following accreditation organisation:
- Deutscher Akkreditierungs Rat DAR-Registration no. DAT-P-192/99-01

Responsible for Accreditation Scope:	Dipl.-Ing. Bernhard Retka Dipl.-Ing. Arndt Stöcker Dipl.-Ing. Thomas Hoell
Report Template Version:	2005-05-31

1.2 Project Data

Responsible for testing and report:	Dipl.-Ing. Andreas Petz
Receipt of EUT:	2005-04-05
Date of Test(s):	2005-04-05 to 2005-04-07
Date of Report:	2005-06-29

1.3 Applicant Data

Company Name:	Vierling Communication GmbH
Address:	Pretzfelder Str. 21 91320 Ebermannstadt Germany
Contact Person:	Mr. Friedrich

1.4 Manufacturer Data

Company Name:	please see applicant data
Address:	
Contact Person:	

2 Testobject Data

2.1 General EUT Description

Equipment under	GSM gateway
Type Designation:	ECOTEL VTMpro
Kind of Device:	GSM 850/1800/1900
(optional)	
Voltage Type:	AC 50 Hz / 60 Hz
Voltage level:	100 - 240 V

General product description:

The Equipment Under Test (EUT) is a GSM 850/1800/1900 gateway.
In GSM 850 mode the EUT operates in channel blocks A and B from 824,2 MHz (lowest channel = 128) to 848,8 MHz (highest channel = 251).
In PCS1900 mode the EUT operates in blocks A through F from 1850,2 MHz (lowest channel = 512) to 1909,8 MHz (highest channel = 810).

The EUT provides the following ports:

Ports
antenna connector
enclosure

The main components of the EUT are listed and described in Chapter 2.2

2.2 EUT Main components

Type, S/N, Short Descriptions etc. used in this Test Report

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status	Date of Receipt
EUT A (Code: BN000a01)	GSM gateway	VTMpro	IPC9907702	1.1	0.1.38	2005-04-05
Remark: EUT A is equipped with a permanent antenna connector.						

NOTE: The short description is used to simplify the identification of the EUT in this test report.

2.3 Ancillary Equipment

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	HW Status	SW Status	Serial no.	FCC ID
AE1	external antenna	Kathrein Dual-band Omni Antenna VPol Omni 824–960/1805–2170 360° 2dBi Type No. 800 10147	–	–	–	–

2.4 EUT Setups

This chapter describes the combination of EUT's and ancillary equipment used for testing.

Setup No.	Combination of EUTs	Description
setup_a01	EUT A + AE1	setup for radiated tests (2 GSM modules operating, 2 antennas, distance between antennas: 0.16 meters)

2.5 Operating Modes

This chapter describes the operating modes of the EUT's used for testing.

Op. Mode	Description of Operating Modes	Remarks
op-mode 1	Call established simultaneously on Traffic Channels (TCH) 661 and 664, Carrier Frequency 1880.0 and 1880.6 MHz	661 and 664 are a channels of the full PCS band
op-mode 2	Call established simultaneously on Traffic Channels (TCH) 661 (GSM1900) and 190 (GSM190), Carrier Frequency 836.6 MHz	661 is a mid channel of GSM1900 band, 190 is a mid channel of GSM850 band

3 Test Results

3.1 Field strength of spurious radiation

Standard FCC Part 24, 10-01-2004
Subpart E

The test was performed according to: FCC §2.1053, 10-01-2004

3.1.1 Test Description

1) The EUT was placed inside an anechoic chamber. Refer to chapter "Setup Drawings". The EUT was coupled to the R&S CMD55 / CMU200 Digital Communication Tester which was located outside the chamber via coaxial cable.

2) A speech call was established on a Traffic Channel (TCH) between the EUT and the base station simulator (R&S CMD55 / CMU200 Digital Communication Tester).
Important Settings:
- Discontinuous Transmission: OFF
- Modulation Signal: PSR16-1 (Pseudo Random Sequence)
- Output Power: Maximum
- Channel: see operating modes

3) A pre-calibration procedure is used so that the readings from the spectrum analyser are corrected and represent directly the equivalent radiated power (related to a lamda/2 dipole).

4) All spurious radiation measurements were made with spectrum analyser and the appropriate calibrated antennas for the frequency range of 30 MHz to 4 GHz.

5) Important Analyser Settings
- [Resolution Bandwidth / Video Bandwidth]:
a) [3 kHz / 10 kHz] in the Span of 1 MHz directly below and above the GSM-Band,
b) [10 kHz / 30 kHz] in case the curve of the analyser IF-Filter leads to an exceeding of the limit, in this case a worst case correction factor of 20 dB (1 MHz -> 10 kHz) was used
c) [1 MHz / 3 MHz] otherwise
- Sweep Time: Calculated by using a formula given in the Product Standard "GSM 11.10-1 edition 4" for spurious emissions measurements (depending on the transmitting signal, the span and the resolution bandwidth)

6) The spurious emissions (peak) were measured in both vertical and horizontal antenna polarisation during the call is established.

3.1.2 Test Requirements / Limits

§ 2.1053 Measurements required: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of Sec. 2.1049, as appropriate.

For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.
(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:
(2) All equipment operating on frequencies higher than 25 MHz.

§ 2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in Secs. 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.
(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.
(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

§ 24.238 Emission limits

(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

This is calculated to be -13 dBm (effective radiated power) which corresponds to 84.6 dBµV/m (field strength) in a distance of 3 m.

3.1.3 Test Protocol

Temperature: 25 °C
Air Pressure: 1002 hPa
Humidity: 32 %

Op. Mode	Setup	Port
op-mode 1	setup_a01	enclosure

Frequency MHz	Antenna Polarisation	Bandwidth kHz	Measured Level dBm	Limit dBm
–	–	–	–	-13,0

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Deviation from requirements of FCC Part 24: Measured up to 4 GHz instead of 20 GHz.

Temperature: 25 °C
Air Pressure: 1002 hPa
Humidity: 32 %

Op. Mode	Setup	Port
op-mode 1	setup_a01	enclosure

Frequency MHz	Antenna Polarisation	Bandwidth kHz	Measured Level dBm	Limit dBm
836,0 *)	Vertical	1000	–28,86	-13,0

Remark: No (further) spurious emissions were found in the range 20 dB below the limit.
Deviation from requirements of FCC Part 24: Measured up to 4 GHz instead of 20 GHz.

*) NOTE: GSM850 carrier.
The measurement is performed using a notch filter in order to suppress the GSM850 carrier (fundamental frequency). The frequency response of the notch filter was determined and is documented at the 7 layers test laboratory.

3.1.4 Test result: Field strength of spurious radiation

FCC Part 24, Subpart E	Op. Mode	Result
	op-mode 1	passed
	op-mode 2	passed

4 Test Equipment

EUT Digital Signalling System

Equipment	Type	Serial No.	Manufacturer
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz
Signalling Unit for Bluetooth Spurious Emissions	PTW60	100004	Rohde & Schwarz
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz

EMI Test System

Equipment	Type	Serial No.	Manufacturer
Comparison Noise Emitter	CNE III	99/016	York
EMI Analyzer	ESI 26	830482/004	Rohde & Schwarz
Signal Generator	SMR 20	846834/008	Rohde & Schwarz

EMI Radiated Auxiliary Equipment

Equipment	Type	Serial No.	Manufacturer
Antenna mast 4m	MA 240	240/492	HD GmbH H. Deisel
Biconical dipole	VUBA 9117	9117108	Schwarzbeck
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32	849785	Miteq
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35	896037	Miteq
Broadband Amplifier 45MHz-27GHz	JS4-00102600-42	619368	Miteq
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2 + W38.01-2	Kabel Kusch
Cable "ESI to Horn Antenna"	UFB311A + UFB293C	W18.02-2 + W38.02-2	Rosenberger-Microcoax
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
KUEP pre amplifier	Kuep 00304000	001	7layers
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz
Pyramidal Horn Antenna 26,5 GHz	Model 3160-09	9910-1184	EMCO

EMI Conducted Auxiliary Equipment

Equipment	Type	Serial No.	Manufacturer
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber+Suhner
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz

Auxiliary Test Equipment

Equipment	Type	Serial No.	Manufacturer
Broadband Resist. Power Divider N	1506A / 93459	LM390	Weinschel
Broadband Resist. Power Divider SMA	1515 / 93459	LN673	Weinschel
Digital Multimeter 01	Voltcraft M-3860M	IJ096055	Conrad
Digital Multimeter 02	Voltcraft M-3860M	IJ095955	Conrad
Digital Oscilloscope	TDS 784C	B021311	Tektronix
Fibre optic link Satellite	FO RS232 Link	181-018	Pontis
Fibre optic link Transceiver	FO RS232 Link	182-018	Pontis
I/Q Modulation Generator	AMIQ-B1	832085/018	Rohde & Schwarz
Notch Filter ultra stable	WRCA800/960-6E	24	Wainwright
Spectrum Analyzer 9 kHz to 3 GHz	FSP3	838164/004	Rohde & Schwarz
Temperature Chamber	VT 4002	58566002150010	Vötsch
Temperature Chamber	KWP 120/70	59226012190010	Weiss
ThermoHygro Datalogger 03	Opus10 THI (8152.00)	7482	Lufft Mess- und Regeltechnik GmbH

Anechoic Chamber

Equipment	Type	Serial No.	Manufacturer
Air Compressor (pneumatic)			Atlas Copco
Controller	HD 100	100/603	HD GmbH H. Deisel
EMC Camera	CE-CAM/1		CE-SYS
EMC Camera for observation of EUT	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter telephone systems / modem	B84312-C40-B1		Siemens&Matsushita
Filter Universal 1A	B84312-C30-H3		Siemens&Matsushita
Fully/Semi AE Chamber	10.58x6.38x6		Frankonia
Turntable	DS 420S	420/573/99	HD GmbH, H. Deisel
Valve Control Unit (pneum.)	VE 615P	615/348/99	HD GmbH, H. Deisel

Equipment	Type	Serial No.	Manufacturer
10 MHz Reference	MFS	5489/001	Efratom
Power Meter 832025/059	NRVD	832025/059	Rohde & Schwarz
Power Sensor A 832279/013	NRV-Z1	832279/013	Rohde & Schwarz
Power Sensor B 832279/015	NRV-Z1	832279/015	Rohde & Schwarz
Power Supply	E3632A	MY40003776	Agilent
Power Supply	PS-2403D	-	Conrad
RF Step Attenuator 833695/001	RSP	833695/001	Rohde & Schwarz
Rubidium Frequency Normal	MFS	002	Efratom
Signal Analyzer FSIQ26 832695/007	FSIQ26	832695/007	Rohde & Schwarz
Signal Generator 833680/003	SMP 03	833680/003	Rohde & Schwarz
Signal Generator A 834344/002	SMIQ03B	834344/002	Rohde & Schwarz
Signal Generator B 832870/017	SMIQ03B	832870/017	Rohde & Schwarz
Signal Switching and Conditioning Unit	SSCU	338826/005	Rohde & Schwarz
Signalling Unit PTW60 838312/014	PTW60 for TS8960	838312/014	Rohde & Schwarz
System Controller 829323/008	PSM12	829323/008	Rohde & Schwarz

5 Photo Report

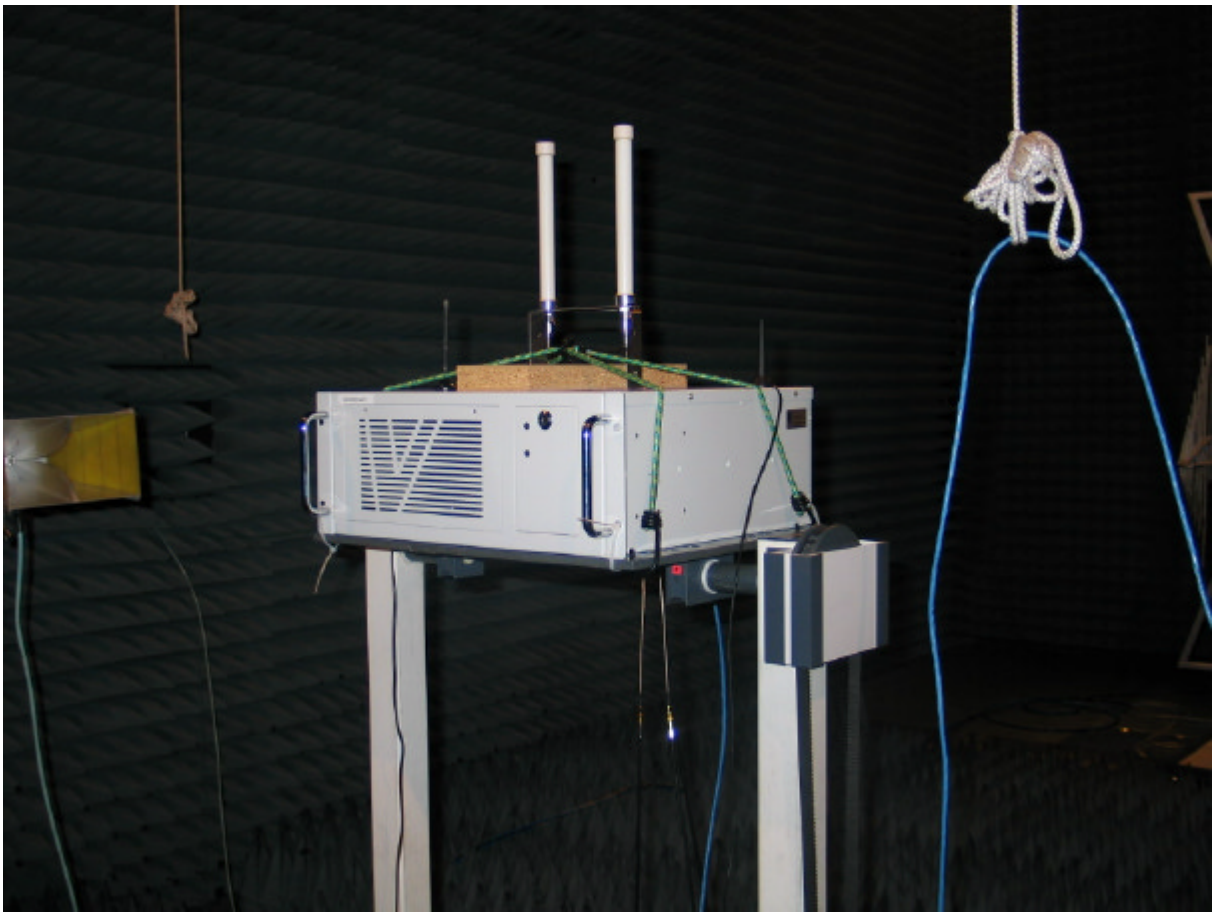


Photo 1: EUT (front and right side, set up together with two antennas AE1)

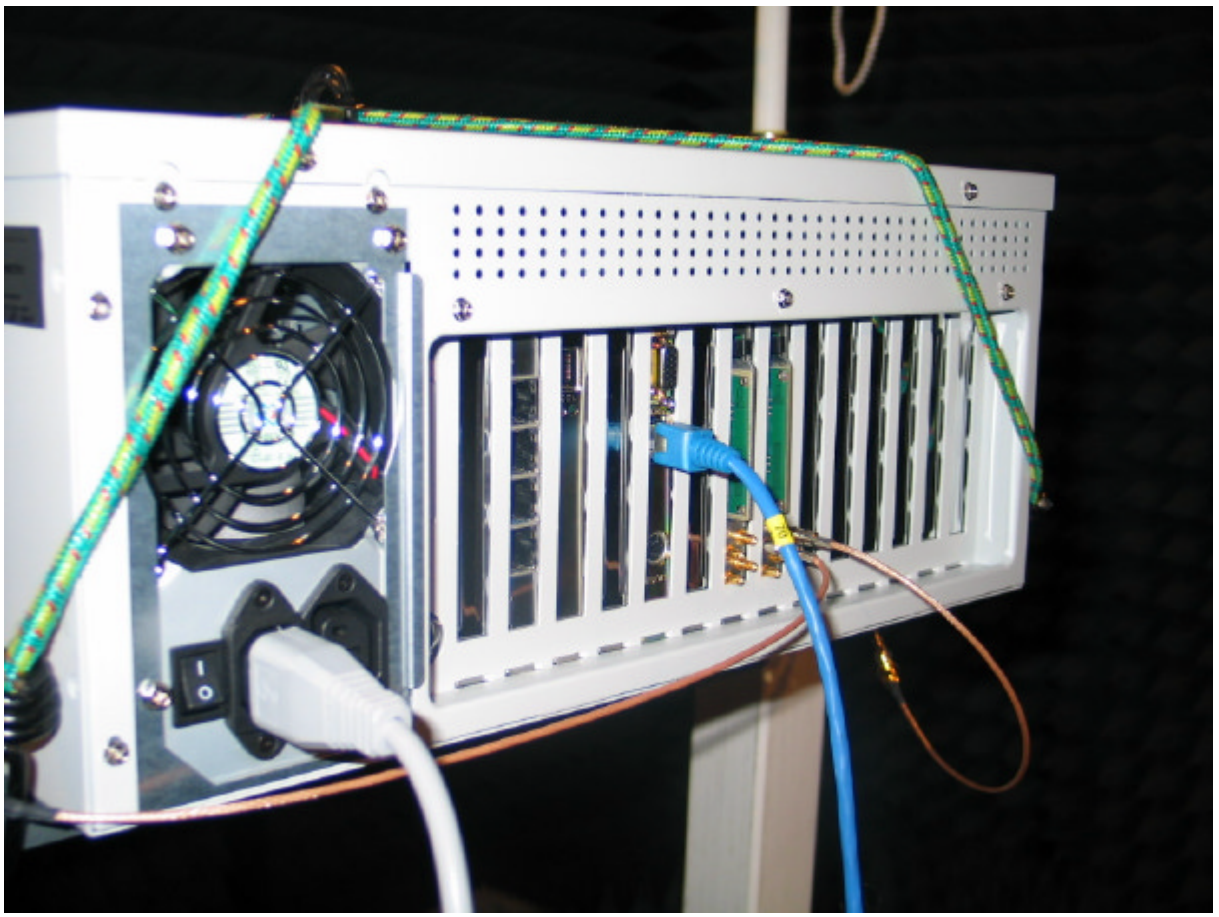
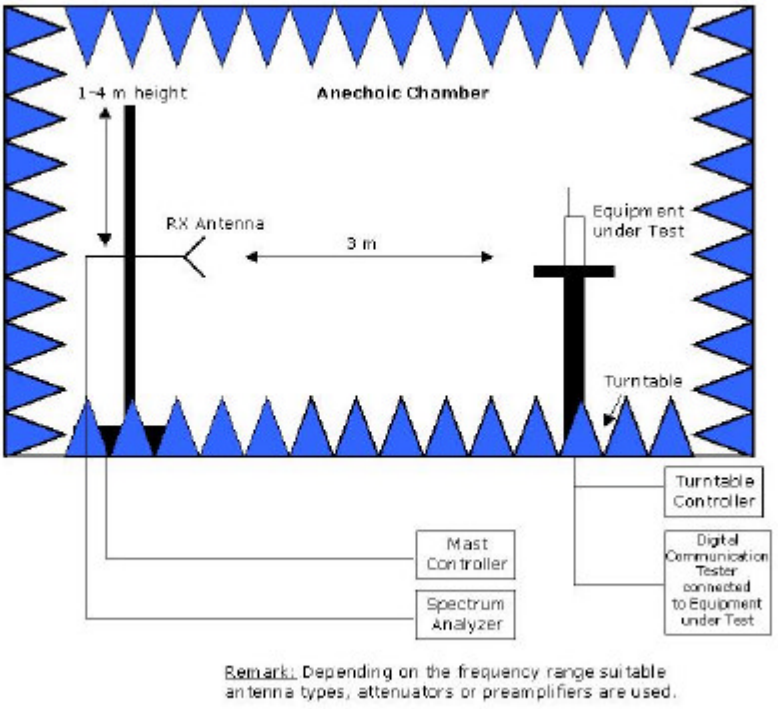


Photo 2: EUT (rear side, two GSM gateway cards inserted, two GSM modules on the same card operating)

6 Setup Drawings



Drawing 1: Principle setup for radiated measurements.

7 Annex

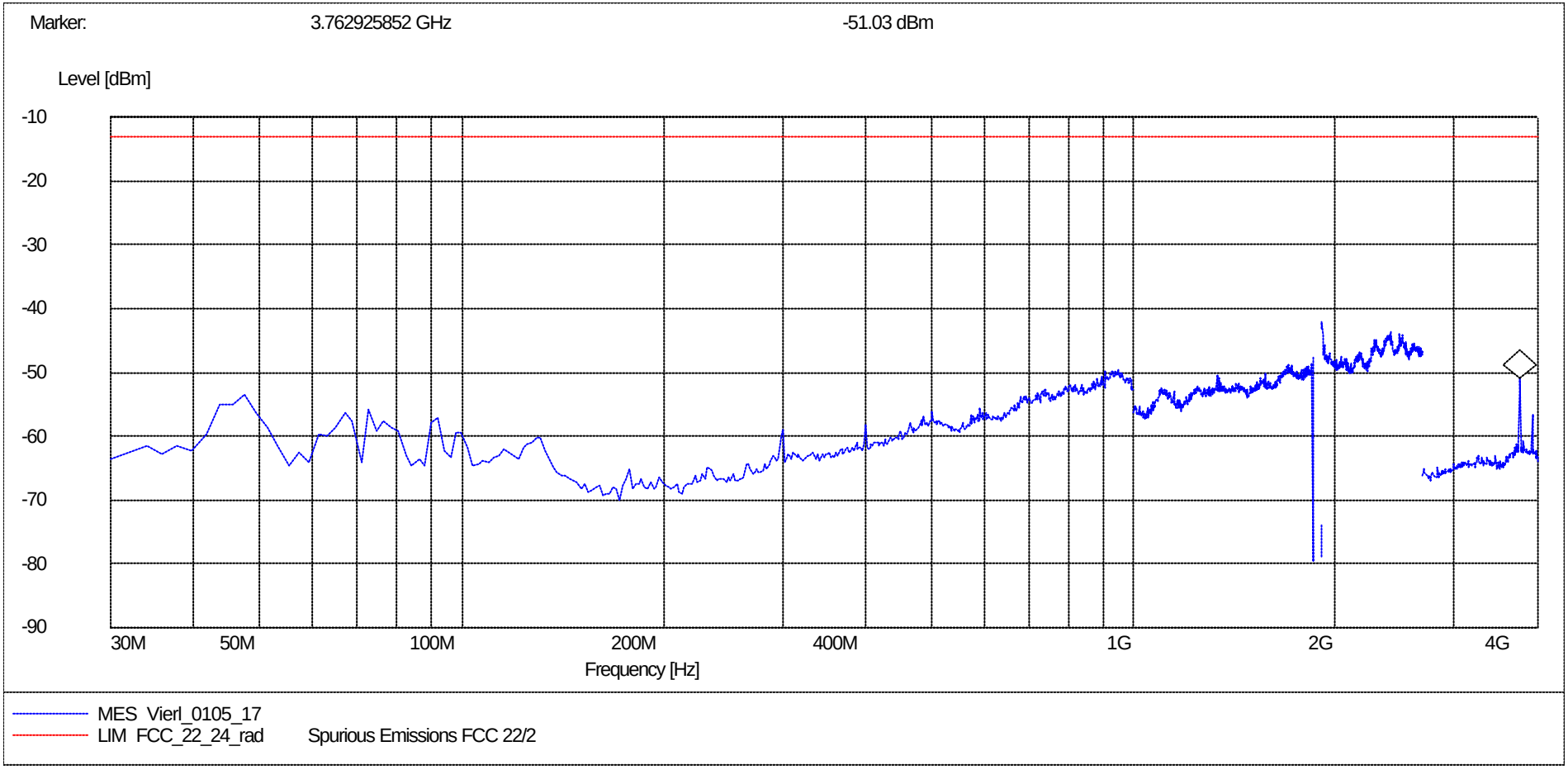
Measurement plots Field strength of spurious radiation

Op. Mode

op-mode 1

SPURIOUS EMISSIONS RADIATED

EUT:	VTMpro (BN000a01) / 06.04.2005
Manufacturer:	Vierling
Operating Condition:	GSM 1900 TCH 661, TCH 664, netz
Test Site:	7Layers, Ratingen
Operator:	Kor
Test Specification:	FCC 24
Comment:	Vertical antenna polarisation Horizontal EUT position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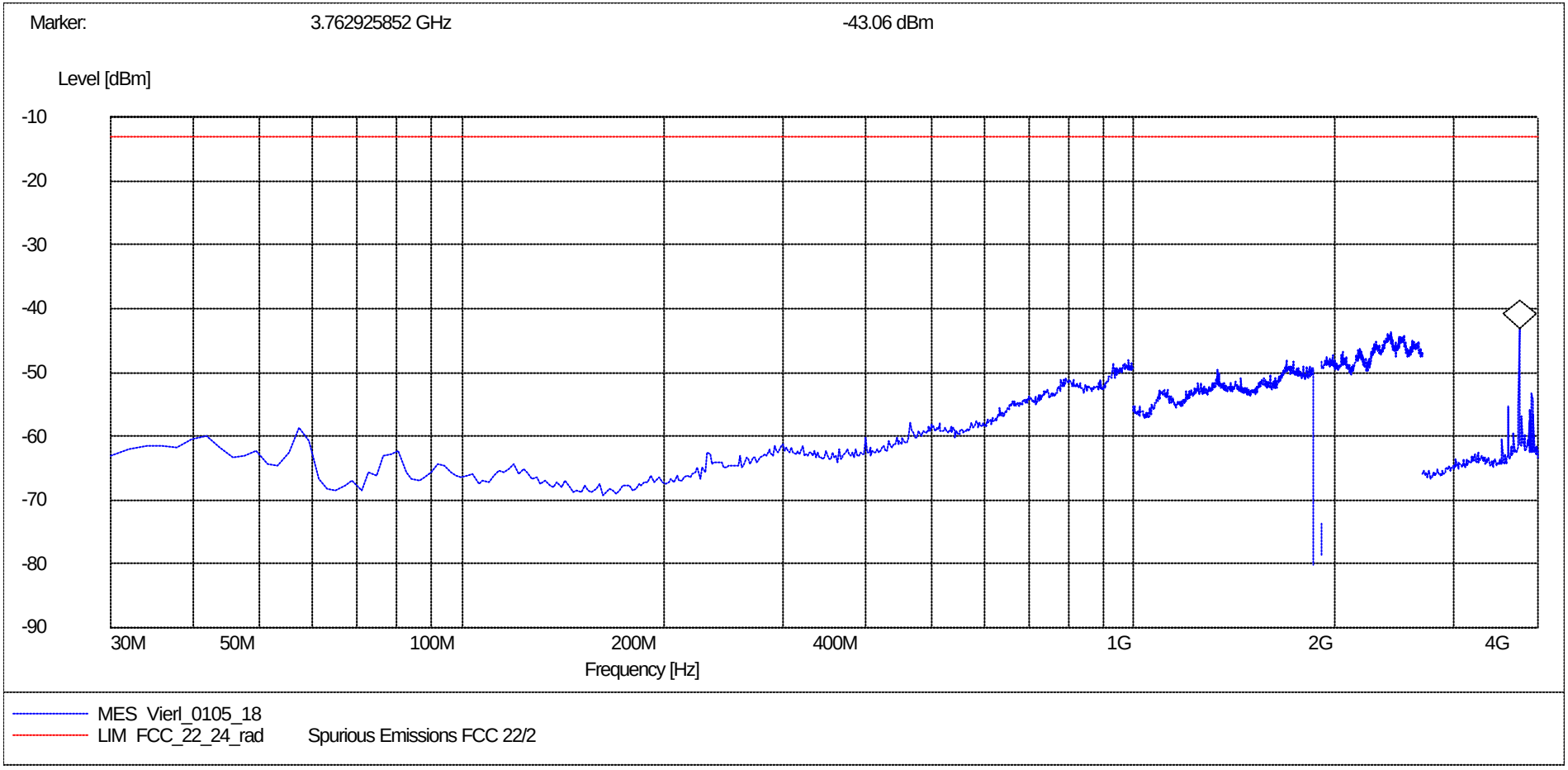
-20
-30
-40
-50
-60
-70
-80
-90
30M
50M
100M
200M
400M
1G
2G
4G
Frequency [Hz]
MES Vierl_0105_17
LIM FCC_22_24_rad
Spurious Emissions FCC 22/2

SPURIOUS EMISSIONS RADIATED

EUT:	VTMpro (BN000a01) / 06.04.2005
Manufacturer:	Vierling
Operating Condition:	GSM 1900 TCH 661, TCH 664, netz
Test Site:	7Layers, Ratingen
Operator:	Kor
Test Specification:	FCC 24
Comment:	Horizontal antenna polarisation Horizontal EUT position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-30
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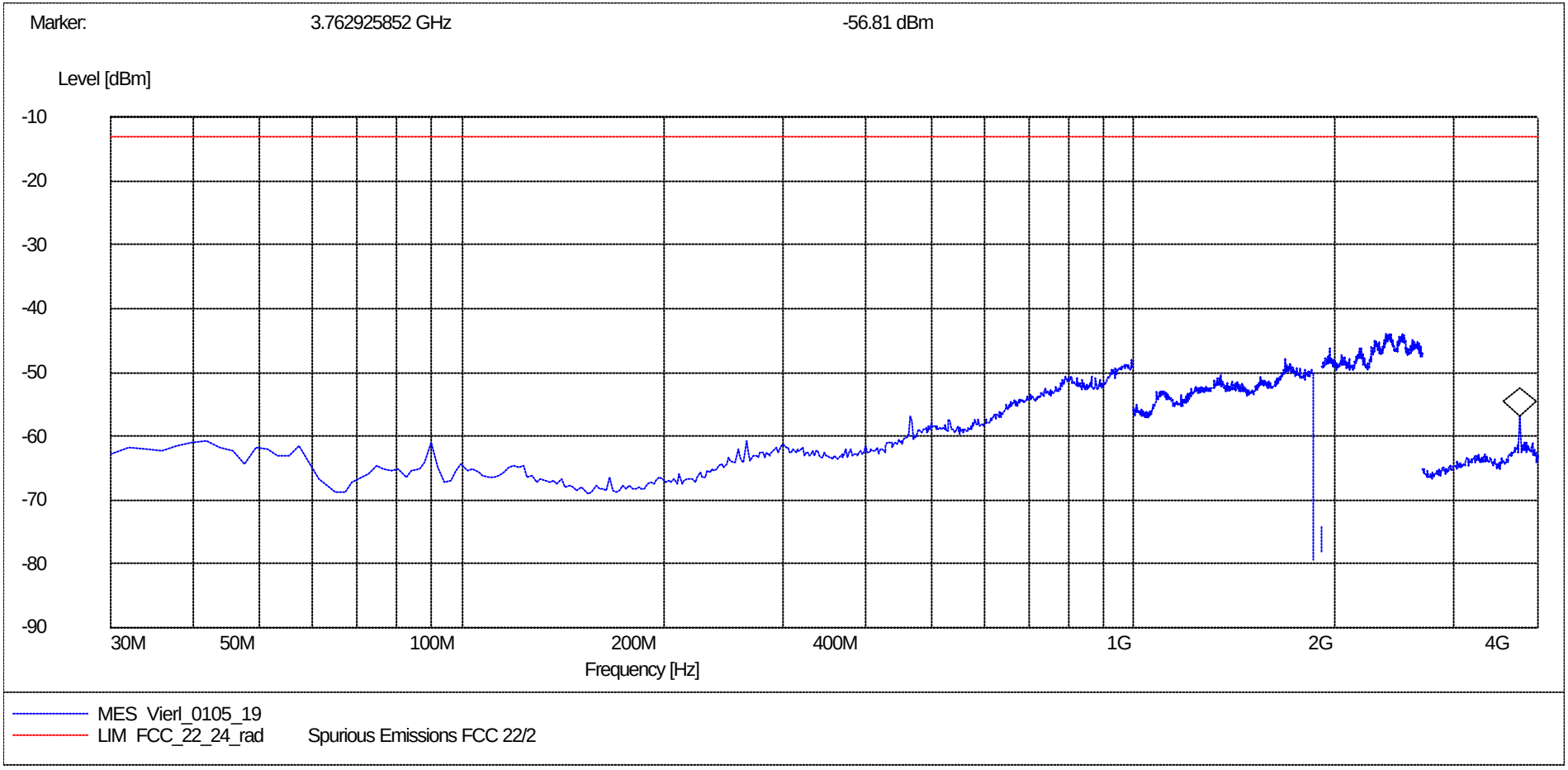
30M
50M
100M
200M
400M
1G
2G
4G
Frequency [Hz]
MES Vierl_0105_18
LIM FCC_22_24_rad
Spurious Emissions FCC 22/2

SPURIOUS EMISSIONS RADIATED

EUT:	VTMpro (BN000a01) / 06.04.2005
Manufacturer:	Vierling
Operating Condition:	GSM 1900 TCH 661, TCH 664, netz
Test Site:	7Layers, Ratingen
Operator:	Kor
Test Specification:	FCC 24
Comment:	Horizontal antenna polarisation Vertical EUT position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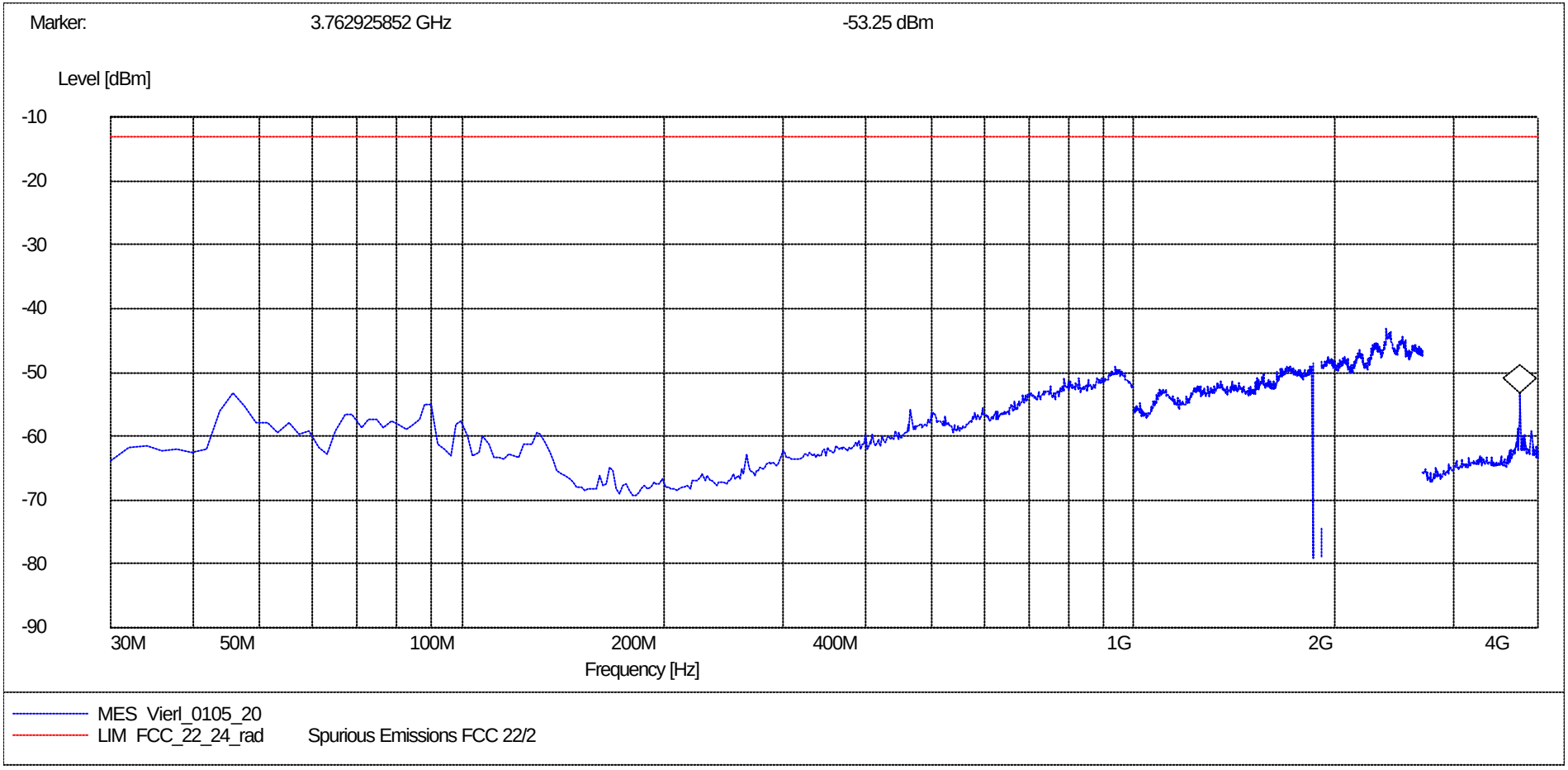
50M
100M
200M
400M
1G
2G
4G
Frequency [Hz]
MES Vierl_0105_19
LIM FCC_22_24_rad
Spurious Emissions FCC 22/2

SPURIOUS EMISSIONS RADIATED

EUT:	VTMpro (BN000a01) / 06.04.2005
Manufacturer:	Vierling
Operating Condition:	GSM 1900 TCH 661, TCH 664, netz
Test Site:	7Layers, Ratingen
Operator:	Kor
Test Specification:	FCC 24
Comment:	Vertical antenna polarisation Vertical EUT position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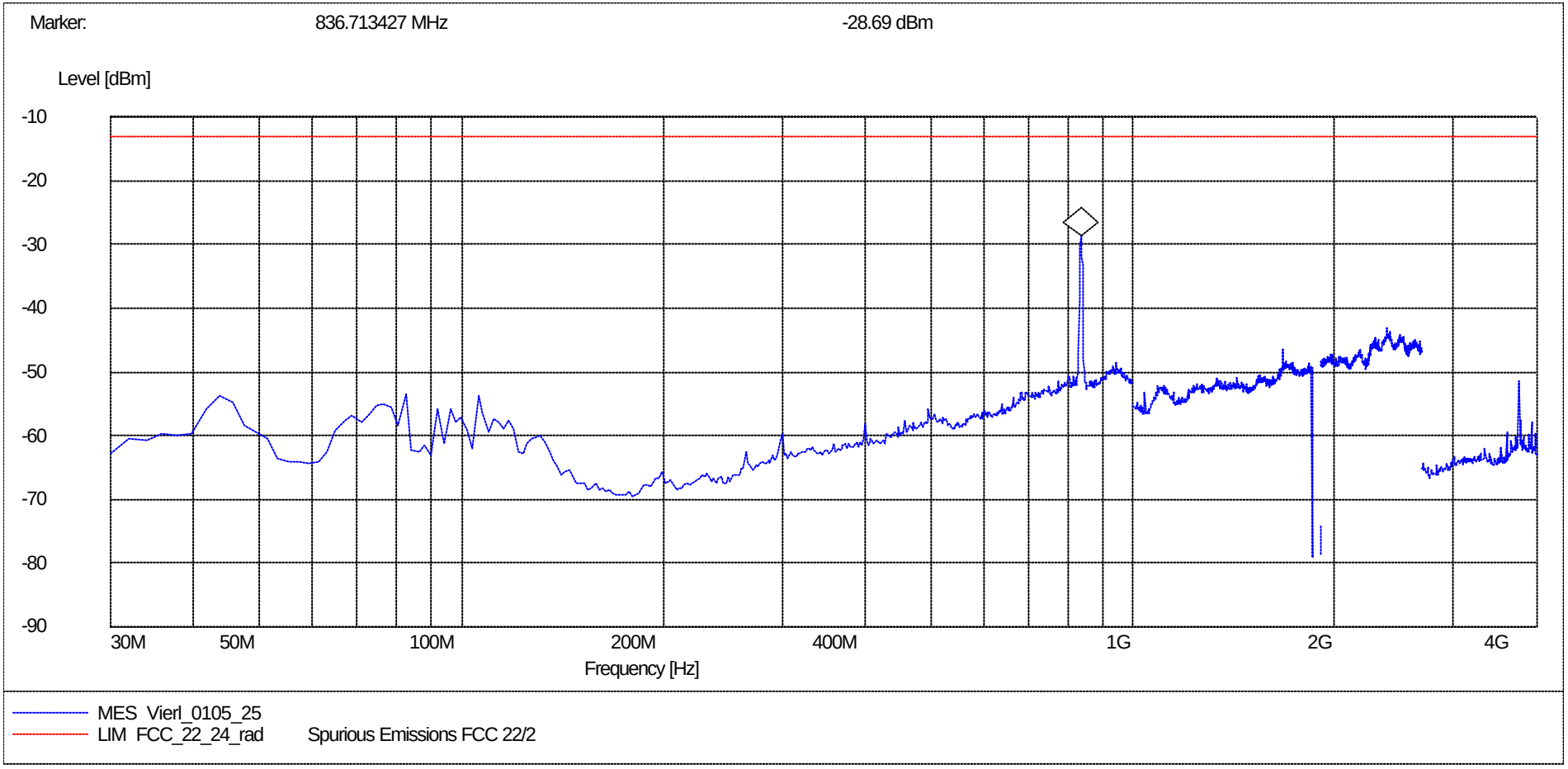
-30
-40
-50
-60
-70
-80
-90
30M
50M
100M
200M
400M
1G
2G
4G
Frequency [Hz]
MES Vierl_0105_20
LIM FCC_22_24_rad
Spurious Emissions FCC 22/2

Op. Mode

op-mode 2

SPURIOUS EMISSIONS RADIATED

EUT:	VTMpro (BN000a01) / 07.04.05
Manufacturer:	Vierling
Operating Condition:	GSM 850 TCH 190, 1900 TCH 661, netz
Test Site:	7Layers, Ratingen
Operator:	Bou/Ngu
Test Specification:	FCC24
Comment:	Vertical antenna polarisation Vertical EUT position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836.713427 MHz
-28.69 dBm
Level [dBm]
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-20
-30
-40
-50
-60
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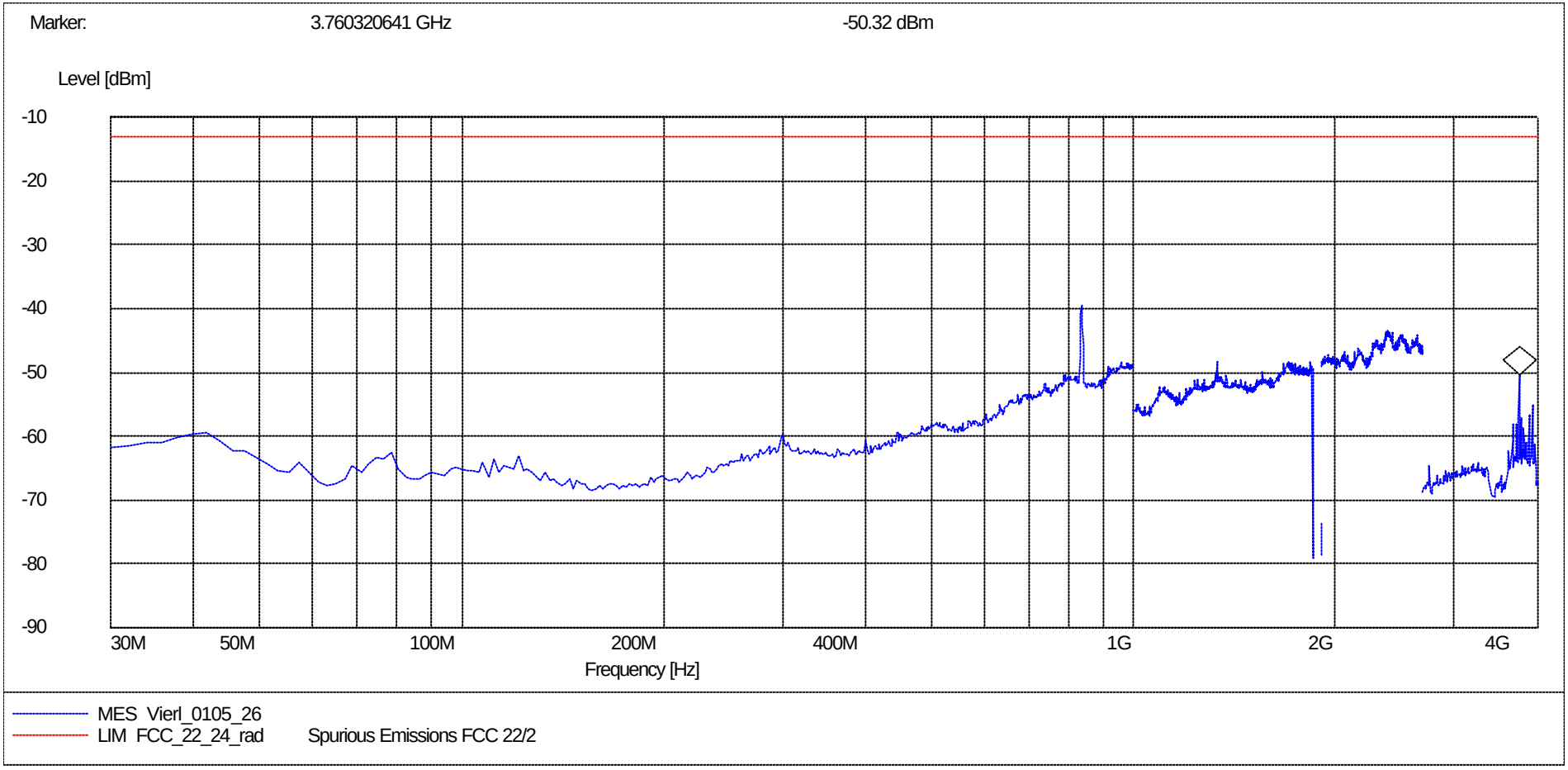
-90
30M
50M
100M
200M
400M
1G
2G
4G
Frequency [Hz]
MES Vierl_0105_25
LIM FCC_22_24_rad
Spurious Emissions FCC 22/2

SPURIOUS EMISSIONS RADIATED

EUT:	VTMpro (BN000a01) / 07.04.05
Manufacturer:	Vierling
Operating Condition:	GSM 850 TCH 190, 1900 TCH 661, netz
Test Site:	7Layers, Ratingen
Operator:	Bou/Ngu
Test Specification:	FCC24
Comment:	Horizontal antenna polarisation Vertical EUT position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Level [dBm]
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-30
-40
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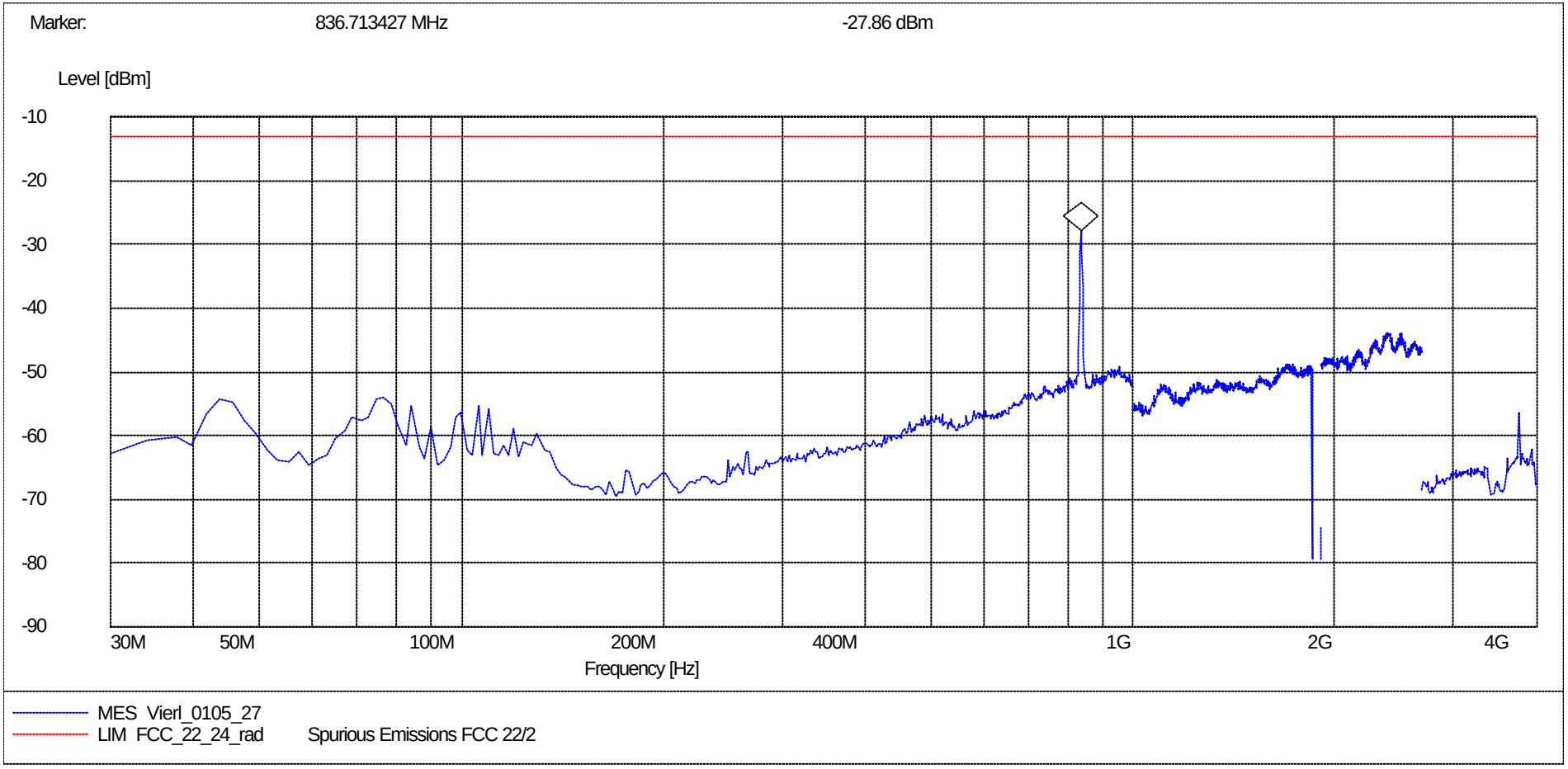
-60
-70
-80
-90
30M
50M
100M
200M
400M
1G
2G
4G
Frequency [Hz]
MES Vierl_0105_26
LIM FCC_22_24_rad
Spurious Emissions FCC 22/2

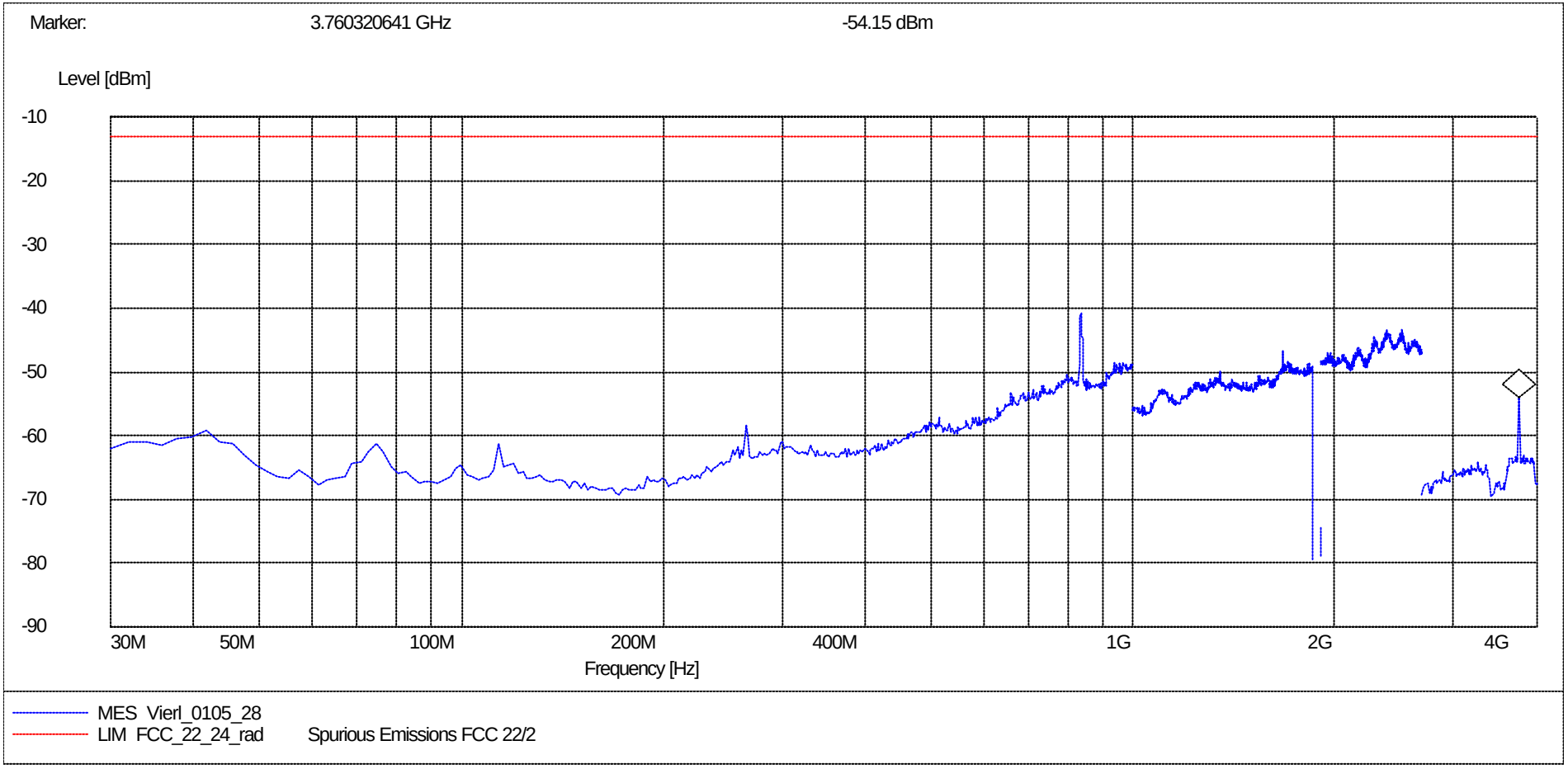
SPURIOUS EMISSIONS RADIATED

EUT:	VTMpro (BN000a01) / 07.04.05
Manufacturer:	Vierling
Operating Condition:	GSM 850 TCH 190, 1900 TCH 661, netz
Test Site:	7Layers, Ratingen
Operator:	Bou/Ngu
Test Specification:	FCC24
Comment:	Vertical antenna polarisation Horizontal EUT position


Marker:
836.713427 MHz
-27.86 dBm
Level [dBm]
-10
-20
-30
-40
-50
-60
-70
-80
-90
30M
50M
100M
200M
400M
1G
2G
4G
Frequency [Hz]
MES Vierl_0105_27
LIM FCC_22_24_rad
Spurious Emissions FCC 22/2

SPURIOUS EMISSIONS RADIATED

EUT:	VTMpro (BN000a01) / 07.04.05
Manufacturer:	Vierling
Operating Condition:	GSM 850 TCH 190, 1900 TCH 661, netz
Test Site:	7Layers, Ratingen
Operator:	Bou/Ngu
Test Specification:	FCC24
Comment:	Horizontal antenna polarisation Horizontal EUT position


Marker: 3.760320641 GHz -54.15 dBm
Level [dBm]
-10
-20
-30
-40
-50
-60
-70
-80
-90
30M
50M
100M
200M
400M
1G
2G
4G
Frequency [Hz]
MES Vierl_0105_28
LIM FCC_22_24_rad
Spurious Emissions FCC 22/2