NETZOÖ
Ein Unternehmen der Energie AG

Technischer Bericht

Emissionsmessungen am AMIS-Zähler auf Grund von Anfragen aus Amateurfunker-Kreisen

Andreas Abart

Gmunden im
August 2015

Zusammenfassung

Aus Amateurfunkkreisen wurden Störgeräusche beim Empfang im 2-m Band (144-146 MHz, dieser Bereich beinhaltet auch Amateurfunkfrequenzen) gemeldet, die mit Annäherung an den AMIS-Zähler zunehmen. Eine Messung in der Kundenanlage mit dem Messgerät SRM 3006 ergab deutliche Maxima im angegebenen Frequenzbereich an der Oberfläche des Zählers. Das Ergebnis konnte auch mit einem Referenzzähler am Bürotisch nachvollzogen werden (s. nachfolgend dargestellte Ergebnisse).

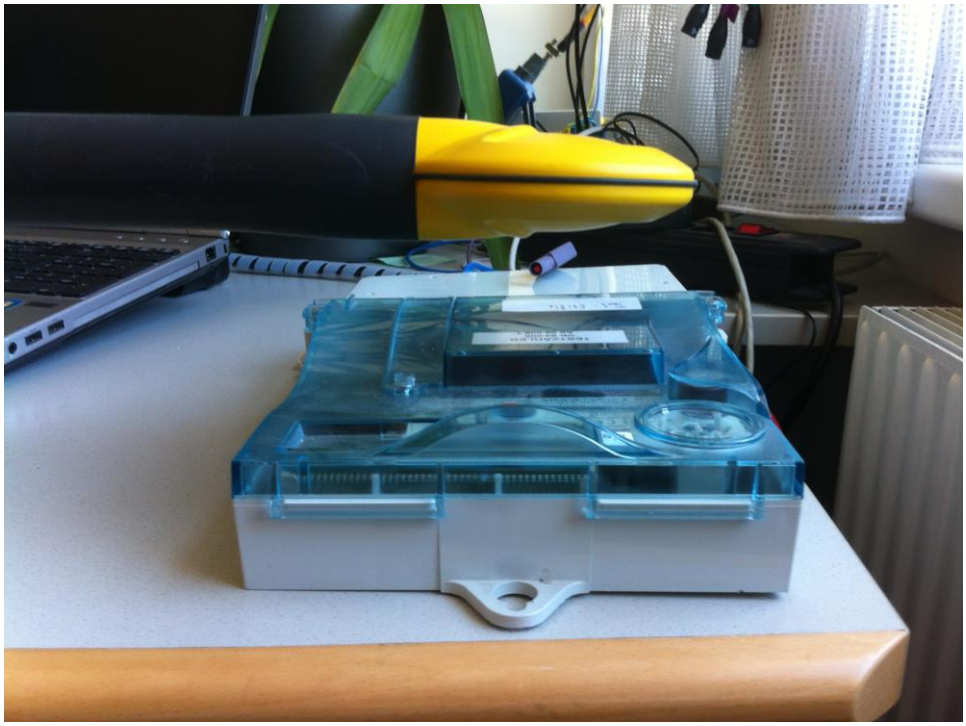
Unabhängig von der Einhaltung einschlägiger Vorschriften (CISPRE) ersuchen die Amateurfunker, die ihnen zugeteilten Bänder möglichst frei zu halten, da es im Amateurfunk untypisch ist Mindestempfangsfeldstärken zusammen mit entsprechenden Signal Störabständen zu verwenden.

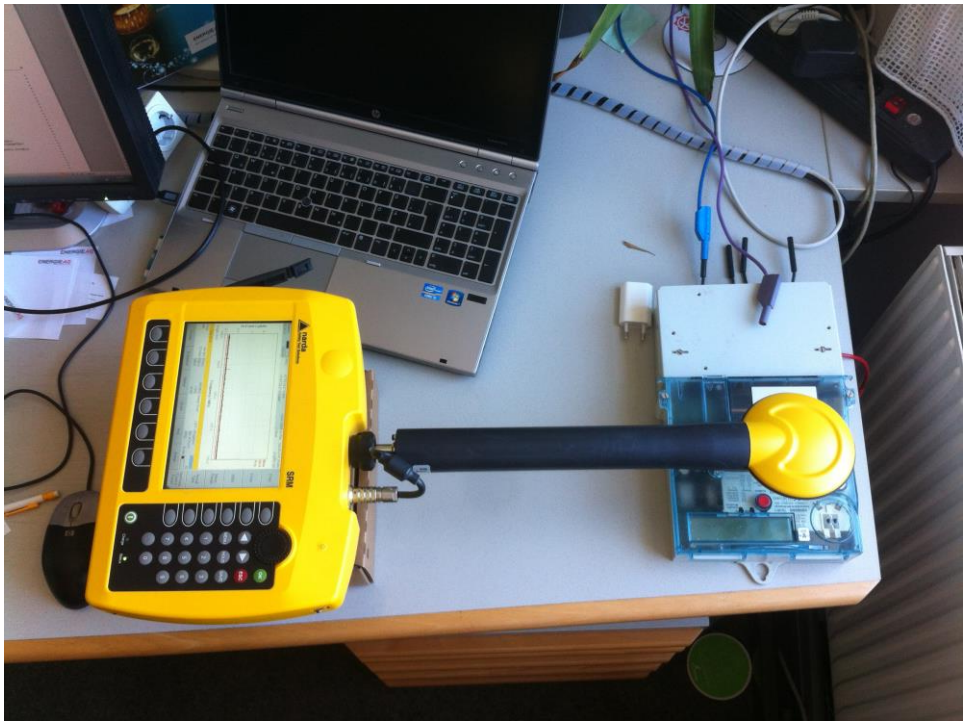
Als Betreiber des Stromverteilernetzes haben wir für dieses Kundenanliegen Verständnis und ersuchen bei künftigen Hardwareanpassungen Taktfrequenzen Elektronischer Schaltungen, möglichst so auszulegen, dass Emissionen in diesem Frequenzbereich vermieden werden.

Gmunden, am 3.08.2015

Dipl.-Ing. Dr. Andreas Abart

Referenzmessung AMIS-Meter im ausgeschalteten Zustand





Spectrum Analysis Results	
Measurement Type	Spectrum
Date	08/03/2015
Time	13:02:08

Instrument Information		Configuration	
Model	SRM-3006	Antenna	Active magnetic loop 9 kHz- 300 MHz
S/N	H-0004	Cable	

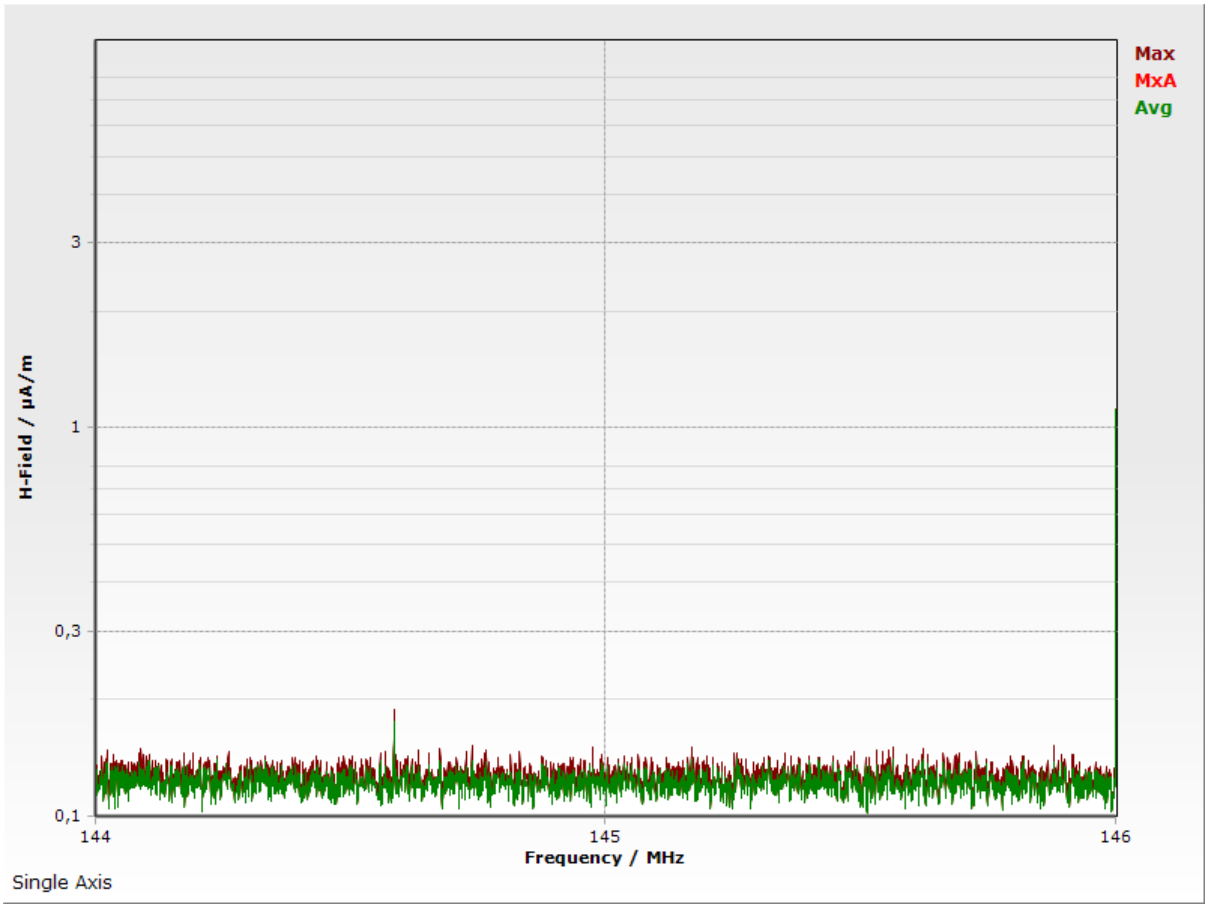
Cable Calibration Date	Antenna Calibration Date
01/01/2001	03/22/2012

Comment
AMISZ REF

Spectrum Analysis Peak Table

Index	Service	Frequency	Max	MxA	Avg
1		144,585 541 MHz	189,3 nA/m	176,2 nA/m	176,2 nA/m
2		144,738 432 MHz	153,4 nA/m	139,3 nA/m	139,3 nA/m
3		145,879 472 MHz	152,7 nA/m	136,8 nA/m	136,8 nA/m
4		145,564 574 MHz	151,8 nA/m	141,0 nA/m	141,0 nA/m
5		144,975 059 MHz	151,1 nA/m	132,7 nA/m	132,7 nA/m
6		145,168 363 MHz	150,3 nA/m	139,7 nA/m	139,7 nA/m
7		144,675 585 MHz	150,2 nA/m	139,2 nA/m	139,2 nA/m
8		144,022 788 MHz	149,3 nA/m	136,5 nA/m	136,5 nA/m
9		144,089 417 MHz	148,9 nA/m	133,0 nA/m	133,0 nA/m
10		144,766 730 MHz	148,9 nA/m	137,6 nA/m	137,6 nA/m

Spectrum Analysis Graph



Fmin:	144 MHz	Fmax:	146 MHz	RBW:	1 kHz	No. of Runs:	2
Meas. Range:	10,000 mA/m	Sweep Time:	1662 ms	VBW:	10 Hz	AVG:	6 min (0 %)

Spectrum Analysis Measurement Parameters

Data Set Type	Spectrum
Storing Mode	Man
Date	08/03/2015
Time	13:02:08
Overdriven	NO
Frequency Minimum	144 MHz
Frequency Maximum	146 MHz
Resolution Bandwidth (RBW)	1 kHz
Video Bandwidth (VBW)	10 Hz
Mode Video Bandwidth	On
Measurement Range	10,000 mA/m
Unit	A/m
Result Type	Max, MxA, Avg
Number of Result Types used	3
Average Method	Time
Average Time	6 min
Number of Averages	32
Average Progress	0 %
Number of Spatial Averages	0
Sweep Time	1662 ms
No. of Runs	2
Standard Name	ICNIRP 1998 General Public
Service Table Name	Germany Ex. FM Radio Narda Pful.
Cable Name	
Antenna Name	Active magnetic loop 9 kHz- 300 MHz
Axis	Single
Device Serial Number	H-0004
Device Firmware Version	V1.1.2
Cable Serial Number	
Cable Calibration Date	
Antenna Serial Number	AA-0077
Antenna Calibration Date	03/22/2012
GPS Flag	Actual
GPS Quality	GPS
Satellites in use	4
GPS Fix	3D
GPS Altitude	687 m
GPS Latitude	47°55'24,8" N
GPS Longitude	13°47'22,6" E
Voice Comment Available	NO
Comment	AMISZ REF

AMIS-Meter im eingeschalteten Zustand (Position Mitte)

Spectrum Analysis Results	
Measurement Type	Spectrum
Date	08/03/2015
Time	12:42:58

Instrument Information		Configuration	
Model	SRM-3006	Antenna	Active magnetic loop 9 kHz- 300 MHz
S/N	H-0004	Cable	

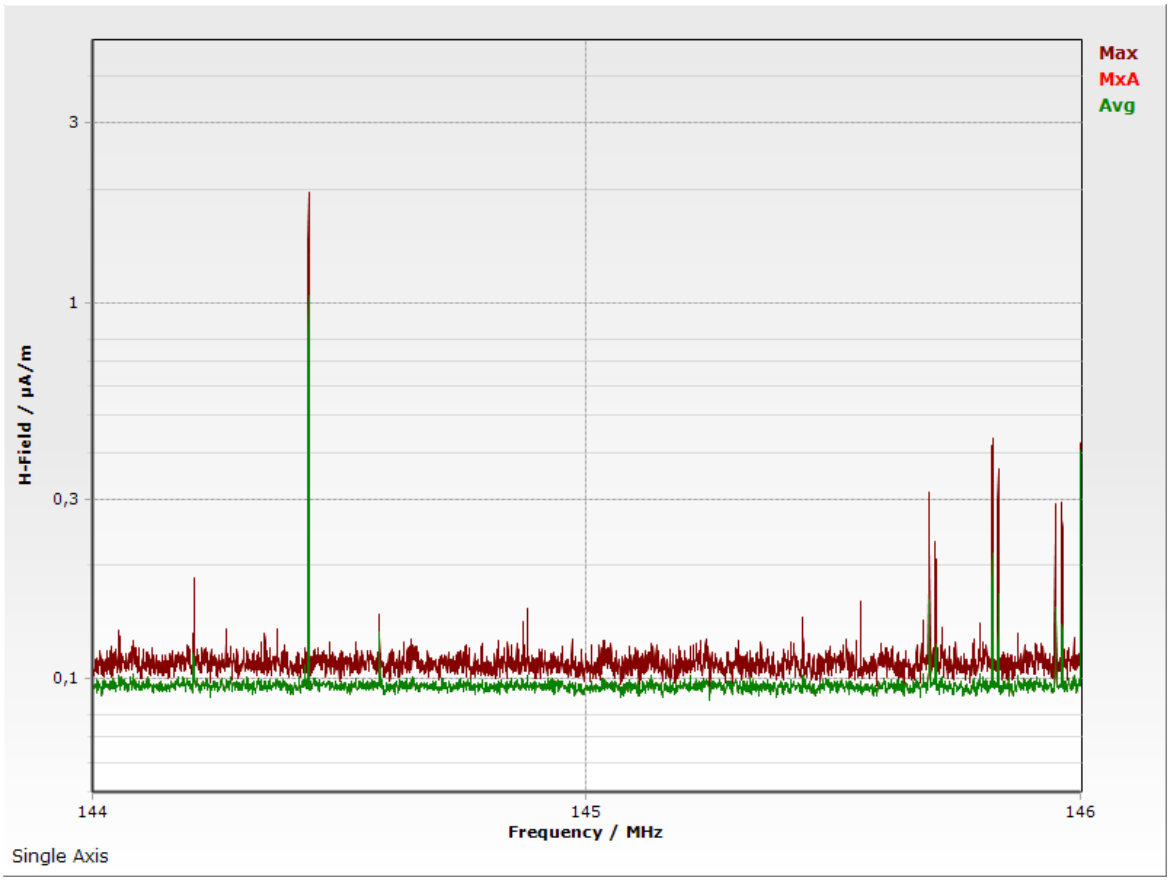
Cable Calibration Date	Antenna Calibration Date
01/01/2001	03/22/2012

Comment
AMISZ1

Spectrum Analysis Peak Table

Index	Service	Frequency	Max	MxA	Avg
1		144,437 462 MHz	1,962 µA/m	1,045 µA/m	1,045 µA/m
2		145,822 286 MHz	435,6 nA/m	214,5 nA/m	214,5 nA/m
3		145,821 128 MHz	424,8 nA/m	148,0 nA/m	148,0 nA/m
4		145,833 894 MHz	366,6 nA/m	133,5 nA/m	133,5 nA/m
5		145,835 052 MHz	330,4 nA/m	168,0 nA/m	168,0 nA/m
6		145,694 245 MHz	317,2 nA/m	163,7 nA/m	163,7 nA/m
7		145,693 071 MHz	308,8 nA/m	124,7 nA/m	124,7 nA/m
8		145,950 298 MHz	296,3 nA/m	155,4 nA/m	155,4 nA/m
9		145,961 910 MHz	293,5 nA/m	119,9 nA/m	119,9 nA/m
10		145,949 120 MHz	286,4 nA/m	118,3 nA/m	118,3 nA/m

Spectrum Analysis Graph



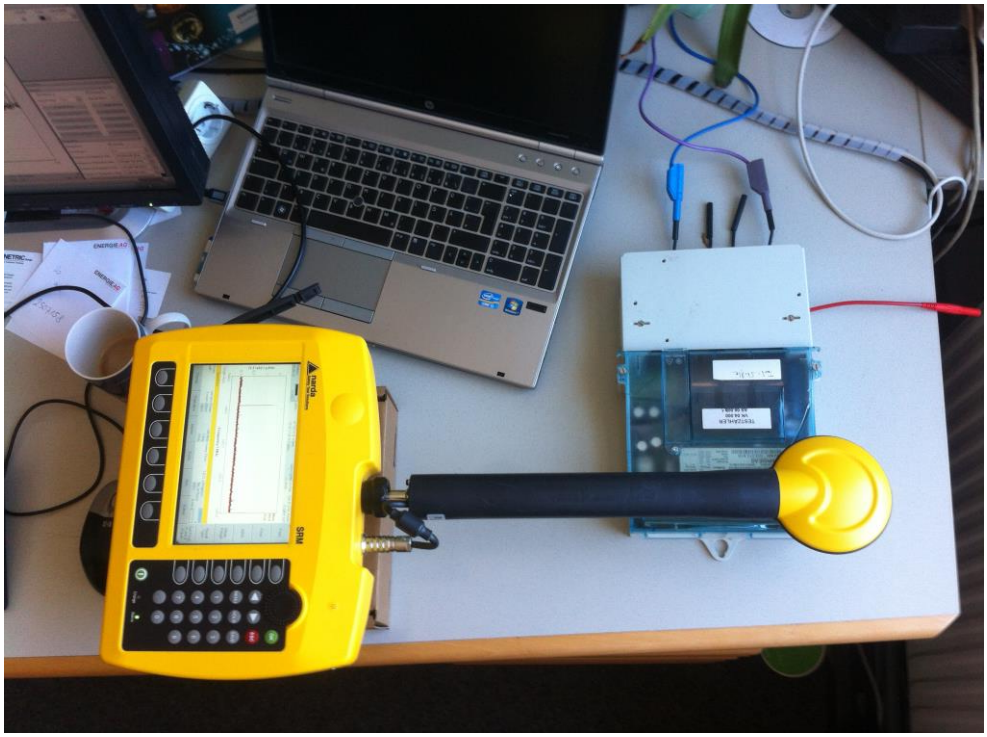
Fmin:	144 MHz	Fmax:	146 MHz	RBW:	1 kHz	No. of Runs:	14
Meas. Range:	5,000 mA/m	Sweep Time:	1679 ms	VBW:	10 Hz	AVG:	6 min (6 %)

Spectrum Analysis Measurement Parameters

Data Set Type	Spectrum
Storing Mode	Man
Date	08/03/2015
Time	12:42:58
Overdriven	NO
Frequency Minimum	144 MHz
Frequency Maximum	146 MHz
Resolution Bandwidth (RBW)	1 kHz
Video Bandwidth (VBW)	10 Hz
Mode Video Bandwidth	On
Measurement Range	5,000 mA/m
Unit	A/m
Result Type	Max, MxA, Avg
Number of Result Types used	3
Average Method	Time
Average Time	6 min
Number of Averages	32
Average Progress	6 %
Number of Spatial Averages	0
Sweep Time	1679 ms
No. of Runs	14

Standard Name	ICNIRP 1998 General Public
Service Table Name	Germany Ex. FM Radio Narda Pful.
Cable Name	
Antenna Name	Active magnetic loop 9 kHz- 300 MHz
Axis	Single
Device Serial Number	H-0004
Device Firmware Version	V1.1.2
Cable Serial Number	
Cable Calibration Date	
Antenna Serial Number	AA-0077
Antenna Calibration Date	03/22/2012
GPS Flag	Actual
GPS Quality	GPS
Satellites in use	5
GPS Fix	3D
GPS Altitude	635 m
GPS Latitude	47°55'25,8" N
GPS Longitude	13°47'18,7" E
Voice Comment Available	NO
Comment	AMISZ1

AMIS-Meter im eingeschalteten Zustand (Position seitlich rechts)



Spectrum Analysis Results	
Measurement Type	Spectrum
Date	08/03/2015
Time	12:43:38

Instrument Information		Configuration	
Model	SRM-3006	Antenna	Active magnetic loop 9 kHz- 300 MHz
S/N	H-0004	Cable	

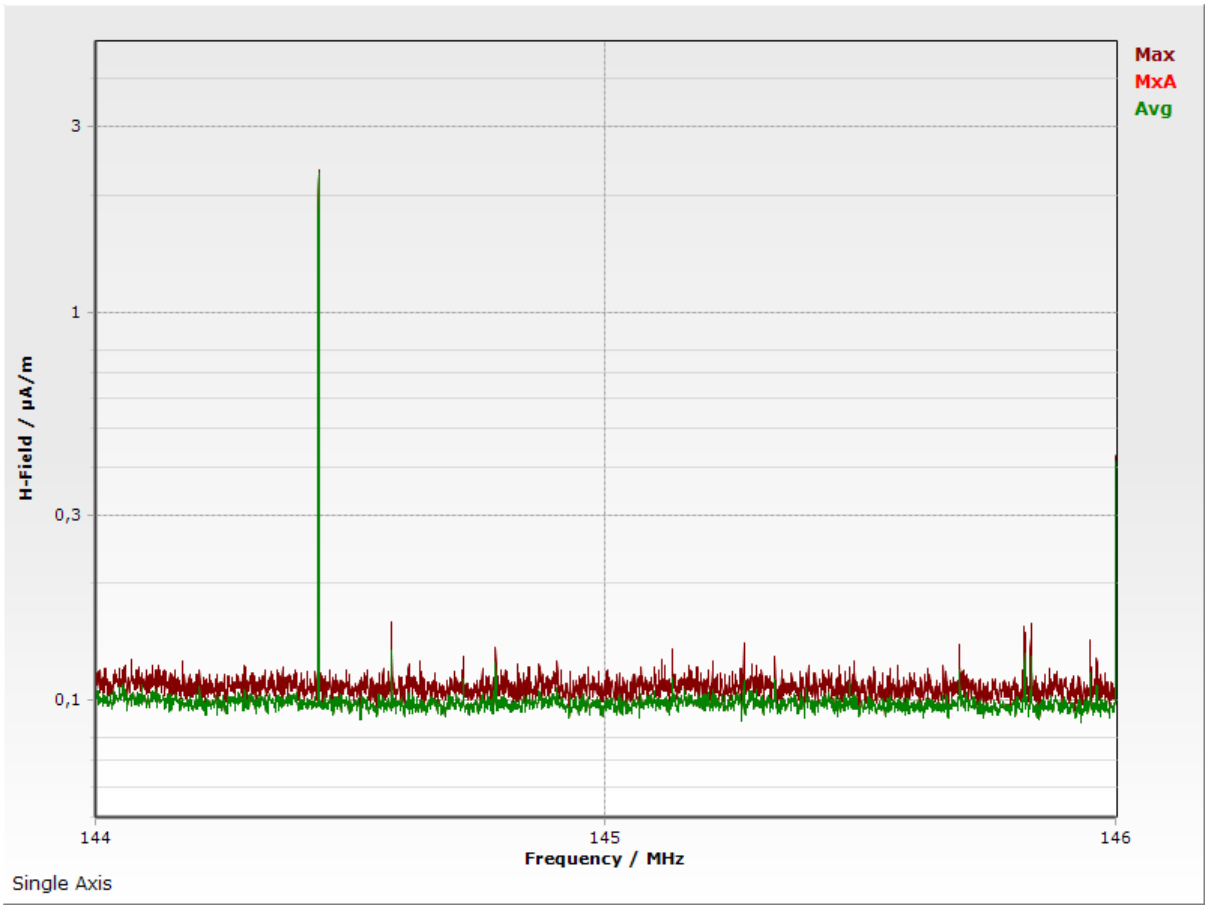
Cable Calibration Date	Antenna Calibration Date
01/01/2001	03/22/2012

Comment
AMISZ2

Spectrum Analysis Peak Table

Index	Service	Frequency	Max	MxA	Avg
1		144,437 442 MHz	2,330 µA/m	2,295 µA/m	2,295 µA/m
2		144,580 838 MHz	162,9 nA/m	136,3 nA/m	136,3 nA/m
3		145,835 050 MHz	158,2 nA/m	129,8 nA/m	129,8 nA/m
4		145,820 887 MHz	156,1 nA/m	115,4 nA/m	115,4 nA/m
5		145,822 257 MHz	149,7 nA/m	132,2 nA/m	132,2 nA/m
6		145,833 873 MHz	146,5 nA/m	106,5 nA/m	106,5 nA/m
7		145,950 298 MHz	144,4 nA/m	117,9 nA/m	117,9 nA/m
8		145,271 198 MHz	143,6 nA/m	113,2 nA/m	113,2 nA/m
9		145,823 380 MHz	143,1 nA/m	98,92 nA/m	98,92 nA/m
10		145,694 266 MHz	140,1 nA/m	120,1 nA/m	120,1 nA/m

Spectrum Analysis Graph



Fmin:	144 MHz	Fmax:	146 MHz	RBW:	1 kHz	No. of Runs:	8
Meas. Range:	5,000 mA/m	Sweep Time:	1675 ms	VBW:	10 Hz	AVG:	6 min (3 %)

Spectrum Analysis Measurement Parameters

Data Set Type	Spectrum
Storing Mode	Man
Date	08/03/2015
Time	12:43:38
Overdriven	NO
Frequency Minimum	144 MHz
Frequency Maximum	146 MHz
Resolution Bandwidth (RBW)	1 kHz
Video Bandwidth (VBW)	10 Hz
Mode Video Bandwidth	On
Measurement Range	5,000 mA/m
Unit	A/m
Result Type	Max, MxA, Avg
Number of Result Types used	3
Average Method	Time
Average Time	6 min
Number of Averages	32
Average Progress	3 %
Number of Spatial Averages	0
Sweep Time	1675 ms
No. of Runs	8
Standard Name	ICNIRP 1998 General Public
Service Table Name	Germany Ex. FM Radio Narda Pful.
Cable Name	
Antenna Name	Active magnetic loop 9 kHz- 300 MHz

Axis	Single
Device Serial Number	H-0004
Device Firmware Version	V1.1.2
Cable Serial Number	
Cable Calibration Date	
Antenna Serial Number	AA-0077
Antenna Calibration Date	03/22/2012
GPS Flag	Actual
GPS Quality	GPS
Satellites in use	4
GPS Fix	3D
GPS Altitude	607 m
GPS Latitude	47°55'26,0" N
GPS Longitude	13°47'17,2" E
Voice Comment Available	NO
Comment	AMISZ2

AMIS-Meter im eingeschalteten Zustand (Position seitlich rechts)

Spectrum Analysis Results	
Measurement Type	Spectrum
Date	08/03/2015
Time	12:45:25

Instrument Information		Configuration	
Model	SRM-3006	Antenna	Active magnetic loop 9 kHz- 300 MHz
S/N	H-0004	Cable	

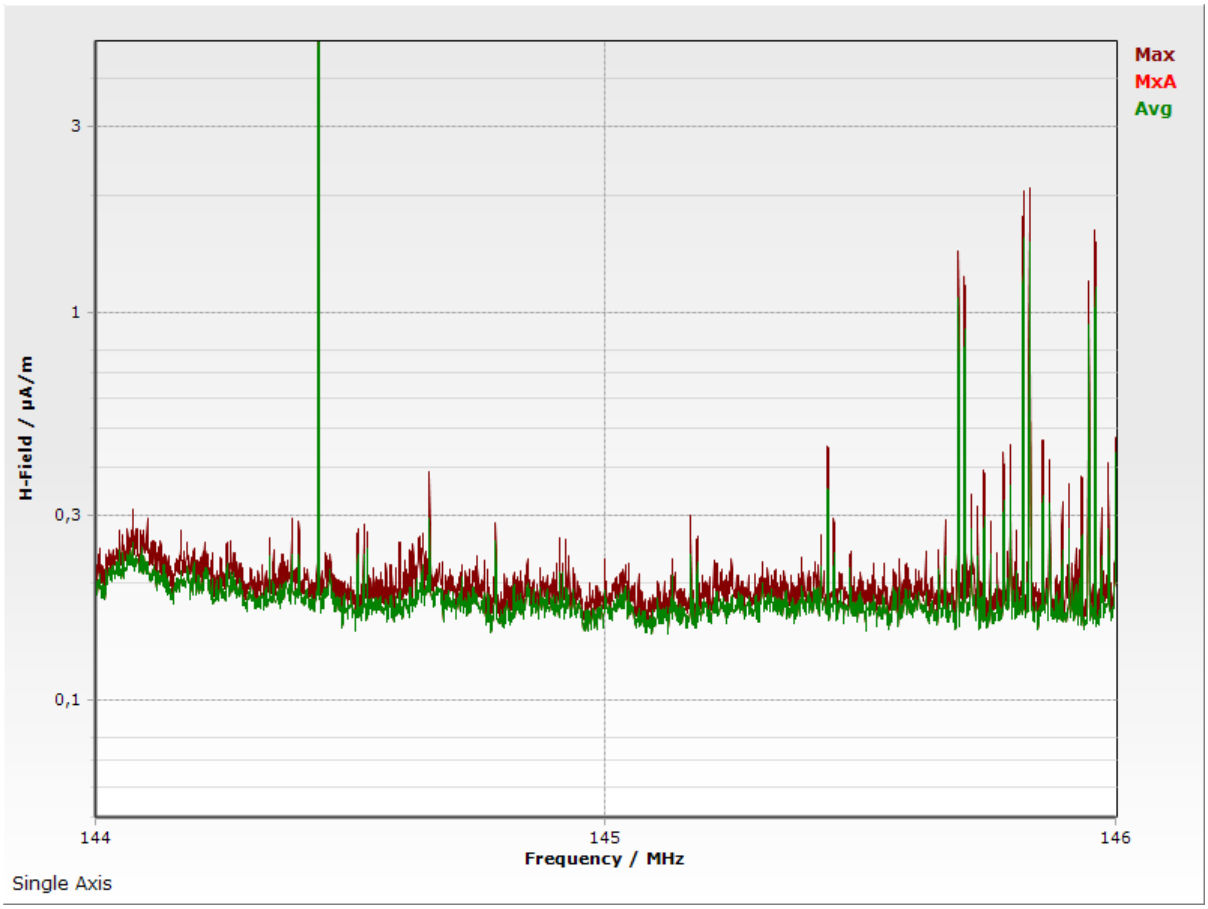
Cable Calibration Date	Antenna Calibration Date
01/01/2001	03/22/2012

Comment
AMISZ3

Spectrum Analysis Peak Table

Index	Service	Frequency	Max	MxA	Avg
1		144,437 395 MHz	5,888 µA/m	5,809 µA/m	5,809 µA/m
2		145,831 418 MHz	2,141 µA/m	1,329 µA/m	1,329 µA/m
3		145,819 817 MHz	2,045 µA/m	1,552 µA/m	1,552 µA/m
4		145,832 615 MHz	2,005 µA/m	1,497 µA/m	1,497 µA/m
5		145,818 660 MHz	1,784 µA/m	1,146 µA/m	1,146 µA/m
6		145,959 409 MHz	1,635 µA/m	1,009 µA/m	1,009 µA/m
7		145,960 581 MHz	1,540 µA/m	1,164 µA/m	1,164 µA/m
8		145,691 813 MHz	1,454 µA/m	1,106 µA/m	1,106 µA/m
9		145,690 632 MHz	1,318 µA/m	862,2 nA/m	862,2 nA/m
10		145,703 448 MHz	1,269 µA/m	798,6 nA/m	798,6 nA/m

Spectrum Analysis Graph



Fmin:	144 MHz	Fmax:	146 MHz	RBW:	1 kHz	No. of Runs:	5
Meas. Range:	5,000 mA/m	Sweep Time:	1677 ms	VBW:	10 Hz	AVG:	6 min (1 %)

Spectrum Analysis Measurement Parameters

Data Set Type	Spectrum
Storing Mode	Man
Date	08/03/2015
Time	12:45:25
Overdriven	NO
Frequency Minimum	144 MHz
Frequency Maximum	146 MHz
Resolution Bandwidth (RBW)	1 kHz
Video Bandwidth (VBW)	10 Hz
Mode Video Bandwidth	On
Measurement Range	5,000 mA/m
Unit	A/m
Result Type	Max, MxA, Avg
Number of Result Types used	3
Average Method	Time
Average Time	6 min
Number of Averages	32
Average Progress	1 %
Number of Spatial Averages	0
Sweep Time	1677 ms
No. of Runs	5
Standard Name	ICNIRP 1998 General Public
Service Table Name	Germany Ex. FM Radio Narda Pful.

Cable Name	
Antenna Name	Active magnetic loop 9 kHz- 300 MHz
Axis	Single
Device Serial Number	H-0004
Device Firmware Version	V1.1.2
Cable Serial Number	
Cable Calibration Date	
Antenna Serial Number	AA-0077
Antenna Calibration Date	03/22/2012
GPS Flag	Actual
GPS Quality	GPS
Satellites in use	5
GPS Fix	3D
GPS Altitude	643 m
GPS Latitude	47°55'25,6" N
GPS Longitude	13°47'19,6" E
Voice Comment Available	NO
Comment	AMISZ3

AMIS-Meter im eingeschalteten Zustand (Position mittig Feld oberflächenparalell)

Spectrum Analysis Results	
Measurement Type	Spectrum
Date	08/03/2015
Time	12:46:25

Instrument Information		Configuration	
Model	SRM-3006	Antenna	Active magnetic loop 9 kHz- 300 MHz
S/N	H-0004	Cable	

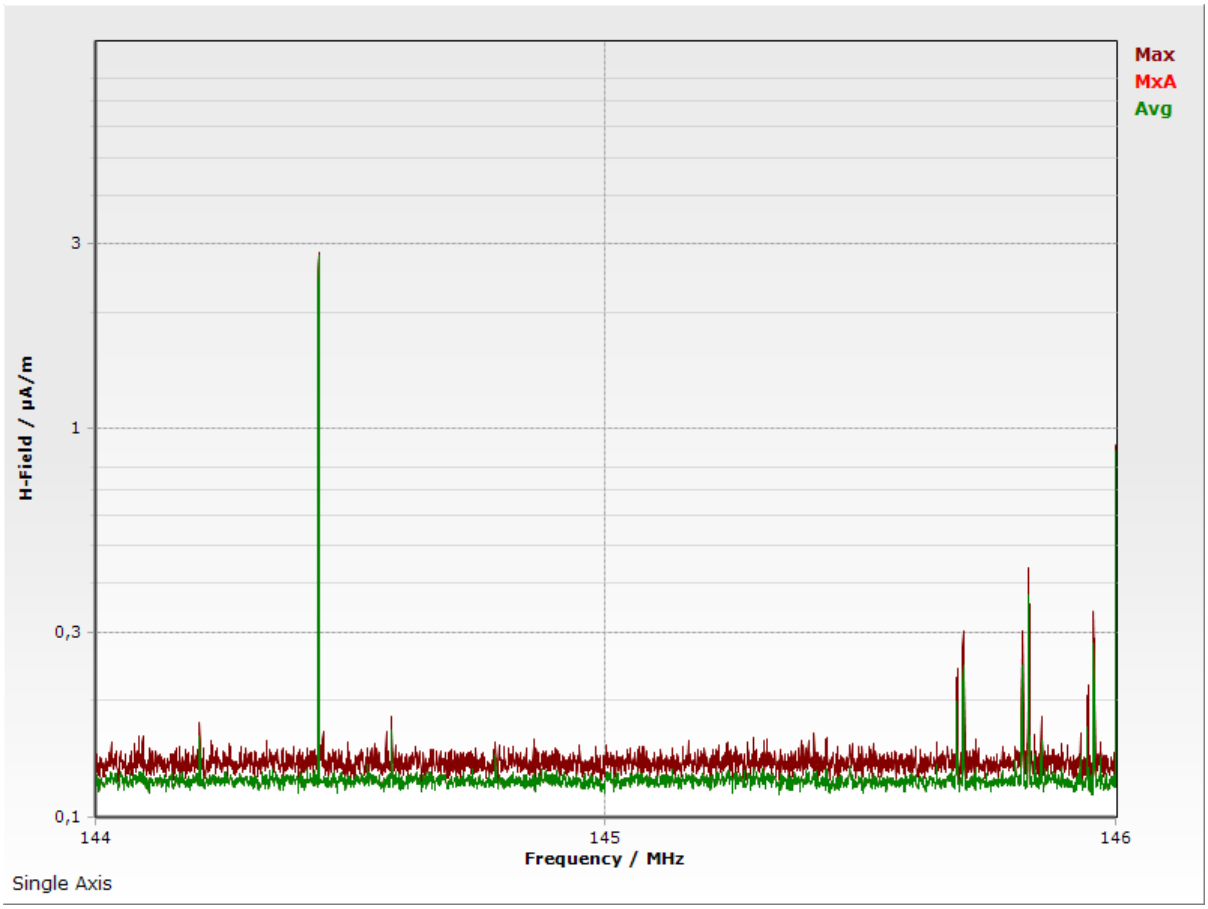
Cable Calibration Date	Antenna Calibration Date
01/01/2001	03/22/2012

Comment
AMISZ4

Spectrum Analysis Peak Table

Index	Service	Frequency	Max	MxA	Avg
1		144,437 375 MHz	2,907 µA/m	2,870 µA/m	2,870 µA/m
2		145,828 995 MHz	446,3 nA/m	377,2 nA/m	377,2 nA/m
3		145,830 165 MHz	404,4 nA/m	177,4 nA/m	177,4 nA/m
4		145,831 398 MHz	364,1 nA/m	163,9 nA/m	163,9 nA/m
5		145,956 946 MHz	342,7 nA/m	280,7 nA/m	280,7 nA/m
6		145,818 612 MHz	312,8 nA/m	151,8 nA/m	151,8 nA/m
7		145,701 017 MHz	308,8 nA/m	248,9 nA/m	248,9 nA/m
8		145,817 383 MHz	300,4 nA/m	153,3 nA/m	153,3 nA/m
9		145,958 093 MHz	290,6 nA/m	155,0 nA/m	155,0 nA/m
10		145,816 235 MHz	282,2 nA/m	252,3 nA/m	252,3 nA/m

Spectrum Analysis Graph



Fmin:	144 MHz	Fmax:	146 MHz	RBW:	1 kHz	No. of Runs:	10
Meas. Range:	10,000 mA/m	Sweep Time:	1673 ms	VBW:	10 Hz	AVG:	6 min (4 %)

Spectrum Analysis Measurement Parameters

Data Set Type	Spectrum
Storing Mode	Man
Date	08/03/2015
Time	12:46:25
Overdriven	NO
Frequency Minimum	144 MHz
Frequency Maximum	146 MHz
Resolution Bandwidth (RBW)	1 kHz
Video Bandwidth (VBW)	10 Hz
Mode Video Bandwidth	On
Measurement Range	10,000 mA/m
Unit	A/m
Result Type	Max, MxA, Avg
Number of Result Types used	3
Average Method	Time
Average Time	6 min
Number of Averages	32
Average Progress	4 %
Number of Spatial Averages	0
Sweep Time	1673 ms
No. of Runs	10
Standard Name	ICNIRP 1998 General Public
Service Table Name	Germany Ex. FM Radio Narda Pful.
Cable Name	
Antenna Name	Active magnetic loop 9 kHz- 300 MHz
Axis	Single
Device Serial Number	H-0004
Device Firmware Version	V1.1.2
Cable Serial Number	
Cable Calibration Date	
Antenna Serial Number	AA-0077
Antenna Calibration Date	03/22/2012
GPS Flag	Actual
GPS Quality	GPS
Satellites in use	5
GPS Fix	3D
GPS Altitude	599 m
GPS Latitude	47°55'25,6" N
GPS Longitude	13°47'17,3" E
Voice Comment Available	NO
Comment	AMISZ4