SNAS
Reg. No. 029/S-066

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TEST REPORT

No.: 45/17/SL EMK
year: 2017

Applicant: **Vutlan s.r.o.**
Ulica Svornosti 43, 82106 Bratislava, Slovakia

Tested equipment: **Remote monitoring unit**
Type VT335

Approved by:
Assoc. Prof. K. Kováč, PhD.
Head of Test house of FEI STU

Bratislava 24. 10. 2017

Test subject (EUT): **Remote monitoring unit, Type VT335**

Serial number: **Prototype**

Manufacturer: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Test: **Measurement of emissions according to EN 55022:2010 and immunity testing according to EN 55024:2010.**

Applicant: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Date of test sample submission: **18. 10. 2017**

Number of tested samples: **1**

Date of measurement: **18. 10. 2017**

Place of measurement: **EMC Test Laboratory of SFEI STU Bratislava**

Test report contains:	
text pages:	16
tables:	8
appendices:	2
figures:	7

Distribution:	**Number of pcs**
SFEI STU:	1 pc
applicant:	1 pc

Conditions of measurements and tests:

Identification of test equipment is shown in Fig. 1.

EUT set contained:
- monitoring unit VT335,
- LAN cable CAT 6 connected monitoring module to notebook, 2 m long,
- temperature sensor connected to monitoring module by unshielded cable 1.5 m long,
- AC power adapter, model KRE-1201000, 100-240 VAC / 12 VDC, 1 A; connected to monitoring unit by 2 wire unshielded cable, 1.8 m long,
- notebook HP, OS: Windows 10 with monitoring software.

Explanation: If the measured set was modified due to any measurement or test conditions, it is noticed on the page corresponding to the measurement or test.

Power supply:	power adapter	230 V / AC
Atmospheric conditions:	Temperature:	22 °C
	Rel. humidity:	35 %

Test results summary:

Table 1: Results of emission measurements.

No.	Measurement	Method / Configuration of measured set	Limit	Measurement result	Page
1	Conducted emissions	EN 55016-2-1 EN 55022	EN 55022 A	**PASS** **A class**	5
2	Radiated emissions	EN 55016-2-3 EN 55022	EN 55022 B	**PASS** **B class**	6

Caution:
The equipment complies with requirements set by EN 55022, emission class A must contain warning in users manual (EN 55022, chap. 4.2): **RF INTERFERENCE WARNING: This is a Class A product. In a domestic or laboratory environment this product may cause radio frequency interference, in which case the user may be required to take adequate measures.**

Conclusion: **The tested device complies with the requirements set by the standard EN 55022:2010 of electromagnetic interference of information technology equipment within the range shown in the Table 1.**

Table 2: Results of immunity tests.

No.	Immunity test against	Method	Test level / Function criterion		Page
			Request EN 55024	Result	
1	Electrostatic discharges	EN 61000-4-2	±4 kV (contact, indirect) / B ±4 kV (contact, direct) / B ±8 kV (air, direct) / B	**PASS, A**	7
2	Electromagnetic field	EN 61000-4-3	3 V/m (80 – 1000 MHz) / A 3 V/m (1.0 – 2.0 GHz) / A 1 V/m (2.0 – 2.7 GHz) / A	**PASS, A**	8
3	EFT/Burst pulses	EN 61000-4-4	±1 kV (AC power) / B ±0.5 kV (LAN) / B ±0.5 kV (Temp. sensor) / B	**PASS, A**	9
4	SURGE pulses	EN 61000-4-5	±1 kV (L-N power) / B	**PASS, A**	10
5	Conducted interference	EN 61000-4-6	3 V (AC power) / A 3 V (LAN) / A 3 V (Temp. sensor) / A	**PASS, A**	11
6	Power failures	EN 61000-4-11	Drop of 100% (0,5 per.) / B Drop of 30% (25 per.) /C Drop of 100% (250 per.) /C	**PASS, A, B**	12

The behaviour of the equipment, in terms of criteria of function compatibility, was judged on the basis of specifications of the manufacturer.

Criteria used for function compatibility:

Criterion A: During and after the test the EUT shall continue to operate without operator intervention. No degradation of performance or loss of function is allowed below a minimum performance level

specified by the manufacturer when the EUT is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation and by what the user may reasonably expect from the EUT if used as intended.

Criterion B: The EUT must after completion of the test to continue normal operations, which immediately preceding the test without operator intervention. The performance level may be replaced by a permissible loss of performance. During the test degradation of performance is allowed. However no change of operating state or stored data is allowed to persist after the test.

Criterion C: During and after testing temporary loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls. The information stored in non-volatile memory or protected by battery backup should not be lost.

Conclusion: **The tested device complies with the requirements set by the standard EN 55024:2010 for electromagnetic immunity of information technology equipment within the range shown in the Table 2.**

The test laboratory declares that measurement results are valid only for the test subject.

Assoc. Prof. Karol Kováč, PhD.
Head of EMC Laboratory

Test: Measurement of conducted emissions according to EN 55022:2010

Test subject: **Remote monitoring unit, Type VT335**

Serial number: **prototype**

Manufacturer: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Date of measurement: 18. 10. 2017

Test instrumentation:

a. Test receiver R&S ESPI 7 – Ser. No. 101268,
b. V line impedance stabilization network R&S ESH3-Z5 – Ser. No. 846128/015,
c. transient limiter R&S ESH3-Z2 – Ser. No. 102021,
d. semi-anechoic shielded chamber with measurement place according to EN 55012.

Metrological properties:

The measuring place was verified according to CISPR 16-1 on 10. 5. 2017 – report KP-17/01/EMK, ESPI 7 R&S has Certificate of Calibration No.: 201504191 (ZTS Elektronika SKS s.r.o.) from 30. 11. 2015.

Conditions of the measurement:

The measurement place was arranged according to EN 55022 (Fig. 2).

Measured frequency range: 0.15 – 30 MHz

Measurement results:

The measured values of conducted emissions of main input and LAN interface are shown in the appendix **MCE 17 45.**

Caution:

The equipment complies with requirements set by EN 55022, emission class A must contain warning in users manual (EN 55022, chap. 4.2): **RF INTERFERENCE WARNING: This is a Class A product. In a domestic or laboratory environment this product may cause radio frequency interference, in which case the user may be required to take adequate measures.**

Conclusion:

The maximal measured levels of disturbing conducted emissions of the tested device are below the A class limit of the standard EN 55022:2010.

Test: Measurement of radiated emissions according to EN 55022:2010

Test subject: **Remote monitoring unit, Type VT335**

Serial number: **prototype**

Manufacturer: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Date of measurement: 18. 10. 2017

Test instrumentation:

a. test receiver R&S ESPI 7 – Ser. No. 101268,
b. measuring preamplifier Sonoma 352 – Ser. No. 303123,
c. TRILOG measuring antenna Schwarzbeck VULB 9163 – Ser. No. 9163-360,
d. semi-anechoic shielded chamber with measurement place according to EN 55022.

Metrological properties:

The measuring place was verified according to CISPR 16-1 (NSA) on 30. 8. 2011 - report KP-11/05EMK, coefficient of transmission on 21. 5. 2014, KP-14/02/EMK and ESPI 7 R&S has Certificate of Calibration No.: 201504191 (ZTS Elektronika SKS s.r.o.) dated 30. 11. 2015.

Conditions of the measurement:

The measurement place was arranged according to EN 55022 (Fig.3).

Measured frequency range:	30 – 1000 MHz
Measuring distance:	3 m
Height of antenna:	1 – 4 m

Measurements were performed for both polarizations of measuring antenna.

Measurement results:

The measurement results are given in the appendix **MRE 17 45**.

Conclusion:

The maximal measured levels of disturbing radiated emissions of the tested device are below the B class limit of the standard EN 55022:2010.

Test: Test of immunity against electrostatic discharge according to EN 61000-4-2:2009

Test subject: **Remote monitoring unit, Type VT335**

Serial number: **prototype**

Manufacturer: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Date of measurement: 18. 10. 2017

Test instrumentation:

a. ESD simulator Haefely Trench PESD 1600 – Ser. No. H 606 113,
b. test place according to EN 61000-4-2.

Metrological properties:

The test place was verified according to EN 61000-4-2 on 1. 7. 2015, measuring report KP-15/04/EMK.

Conditions of the test:

The test place was arranged according to EN 61000-4-2 (Fig.4). Testing voltage of electrostatic discharge simulator was gradually rising to the nominal value and its polarity was changing. Status of the EUT was checked by employee of manufacturer by monitoring software on notebook.

Test results:

Tab. 3: Result of electrostatic discharge test.

Discharge type	Test level	Request of standard	Test results
Indirect – contact discharge	±4 kV	B	A
Direct – contact discharge	±4 kV	B	A
Direct – air discharge (to plastic parts)	±8 kV	B	A

Note: Explanation of criterions is on the pages 3-4.

Conclusion: ***The immunity level of the tested device complies with the requirements set by EN 55024:2010.***

Test: Test of immunity against hf electromagnetic field according to EN 61000-4-3:2006/A1:2008/A2:2010

Test subject: **Remote monitoring unit, Type VT335**

Serial number: **prototype**

Manufacturer: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Date of measurement: 18. 10. 2017

Test instrumentation:

a. signal generator Agilent E8257D – Ser. No. MY45141271,
b. power amplifier Amplifier Research AR150W1000 – Ser. No. 0333238,
c. power amplifier Milmega AS0840-30/17 – Ser. No. 1030085,
d. TRILOG measuring antenna Schwarzbeck VULB 9163 – Ser. No. 9163-360,
e. test place in anechoic shielded chamber according to EN 61000-4-3.

Metrological properties:

The test place was verified according to EN 61000-4-3 on 20. 11. 2015, measuring report KP-15/07/EMK.

Conditions of the test:

The test place was arranged according to EN 61000-4-3 (Fig.5). Device cables were shorted to 1 m active irradiated length. Status of the EUT was checked by employee of manufacturer by monitoring software on notebook located outside of chamber.

Frequency range: 80 – 2700 MHz
Modulation: AM, 80 %, 1 kHz in whole frequency range

Test results:

Tab. 4: Result of immunity test against electromagnetic field.

Frequency range	Polarization	Test level	Request of standard	Test result
80 – 1000 MHz	horizontal	3 V/m	A	A
1000 – 2000 MHz	horizontal	3 V/m	A	A
2000 – 2700 MHz	horizontal	1 V/m	A	A
80 – 1000 MHz	vertical	3 V/m	A	A
1000 – 2000 MHz	vertical	3 V/m	A	A
2000 – 2700 MHz	vertical	1 V/m	A	A

Note: Explanation of criterions is on the pages 3-4.

Conclusion: ***The immunity level of the tested device complies with the requirements set by EN 55024:2010.***

Test: Test of immunity against EFT/Burst according to EN 61000-4-4:2012

Test subject: **Remote monitoring unit, Type VT335**

Serial number: **prototype**

Manufacturer: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Date of measurement: 18. 10. 2017

Test instrumentation:

a. EFT/Burst simulator EM TEST EFT500N5 – Ser. No. V0947105565,
b. capacitive clamp according to EN 61000-4-4,
c. absorbing clamp Lüthi FTC101 – Ser. No. 9851,
d. test place for immunity against EFT/Burst testing according to EN 61000-4-4.

Metrological properties:

The test generator was verified according to EN 61000-4-4 on 15. 5. 2017, measuring report KP-17/02/EMK.

Conditions of the test:

The test place was arranged according to EN 61000-4-4 (Fig. 6). The cables of EUT were shortened according to the requirements of the standard. Testing voltage of simulator was gradually rising to the nominal value and its polarity was changing. Status of the EUT was checked by employee of manufacturer by monitoring software on notebook.

Test results:

Tab. 5: Result of immunity test against EFT/Burst f = 5 kHz, 15/300 ms.

Cable	Coupling	Test level	Request of standard	Test result
AC power adapter	CDN	±1 kV	B	A
LAN	Capacitive clamp	±0.5 kV	B	A
Temperature sensor	Capacitive clamp	±0.5 kV	B	A

Note: Explanation of criterions is on the pages 3-4.

Conclusion: ***The immunity level of the tested device complies with the requirements set by EN 55024:2010.***

Test: Test of immunity against SURGE pulses according to EN 61000-4-5:2014

Test subject: **Remote monitoring unit, Type VT335**

Serial number: **prototype**

Manufacturer: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Date of measurement: 18. 10. 2017

Test instrumentation:

a. surge simulator EM TEST VCS 500-M – Ser. No. V0548100910,
b. test place according to EN 61000-4-5.

Metrological properties:

The test simulator was verified according to EN 61000-4-5 on 18. 5. 2017 - report KP-17/03/EMK.

Conditions of the test:

The test place was arranged according to EN 61000-4-5. Five pulses of both polarities were applied with repetition time of 1 minute. Status of the EUT was checked by employee of manufacturer by monitoring software on notebook.

Test results:

Table 6: Result of immunity test against SURGE pulses.

Tested port	Coupling impedance	Test level	Request of standard	Test result
L - N (power adapter)	2 Ω	± 1 kV	B	A

Note: Explanation of criterions is on the pages 3-4.

Conclusion: ***The immunity level of the tested device complies with the requirements set by EN 55024:2010.***

Test: Test of immunity against conducted interference according to EN 61000-4-6:2014

Test subject: **Remote monitoring unit, Type VT335**

Serial number: **prototype**

Manufacturer: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Date of measurement: 18. 10. 2017

Test instrumentation:

a. signal generator Agilent E8257D – Ser. No. MY45141271,
b. power amplifier Prana AP32DT150 – Ser. No. 0511-0697,
c. set of coupling/decoupling networks (CDN) according to EN 61000-4-6,
d. injection clamp Lüthi EM101 – Ser. No. 35639,
e. absorbing clamp Lüthi FTC101 – Ser. No. 9851,
f. test place according to EN 61000-4-6.

Metrological properties:

The test place and CDNs were verified according to EN 61000-4-6 on 13. 1. 2015, measuring report KP-15/02/EMK.

Conditions of the test:

The test place was arranged according to EN 61000-4-6 (Fig.7). The cables of EUT were shortened according to the requirements of the standard. Status of the EUT was checked by employee of manufacturer by monitoring software on notebook located outside of chamber.

Frequency range: 0.15 – 80 MHz
Modulation: AM 80 % 1 kHz in whole frequency range

Test results:

Tab. 7: Result of immunity test against conducted interference.

Cable	Coupling	Test level	Request of standard	Test result
AC power adapter	M-2	3 V	A	A
LAN	T8-RJ45	3 V	A	A
Temperature sensor	EM101	3 V	A	A

Note: Explanation of criterions is on the pages 3-4.

Conclusion: ***The immunity level of the tested device complies with the requirements set by EN 55024:2010.***

Test: Test of immunity against voltage dips, short interruptions and voltage fluctuations according to EN 61000-4-11:2004

Test subject: **Remote monitoring unit, Type VT335**

Serial number: **prototype**

Manufacturer: **Vutlan s.r.o., Ulica Svornosti 43, 82106 Bratislava, Slovakia**

Date of measurement: 18. 10. 2017

Test instrumentation:

a. programmable AC source Chroma 61503 – Ser. No. 00000253,
b. test place according to EN 61000-4-11.

Metrological properties:

The test place was verified according to EN 61000-4-11 on 23. 5. 2017 - report KP-17/04/EMK.

Conditions of the test:

The test place was arranged according to EN 61000-4-11. Fluctuations and dips of voltage were generated by programmable AC source. Status of the EUT was checked by employee of manufacturer by monitoring software on notebook.

Test results:

Table 8: Result of immunity test against voltage dips and short interruptions.

Type	Duration	Status	Request of standard	Test result
Drop of 100 %	0.5 period	Normal status	B	A
Drop of 30 %	25 periods	Normal status	C	A
Drop of 100 %	250 periods	Short time dysfunction	C	B

Note: Explanation of criterions is on page 3.

Conclusion: ***The immunity level of the tested device complies with the requirements set by EN 55024:2010.***

Fig.1: Identification of the equipment.

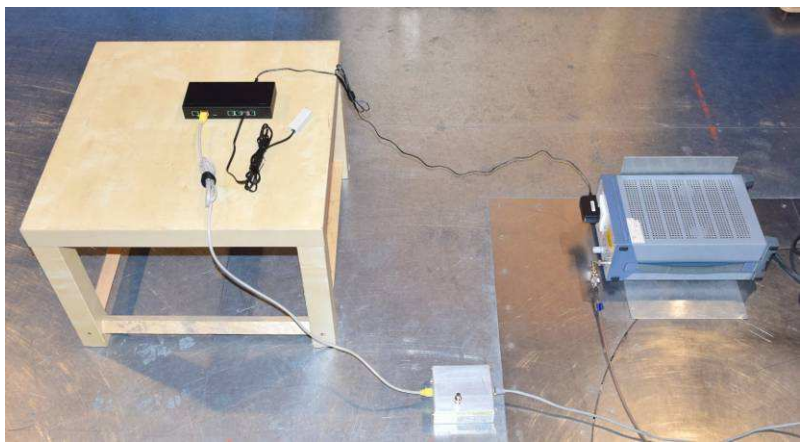


Fig.2: Arrangement of measured sample during conducted emission measurement

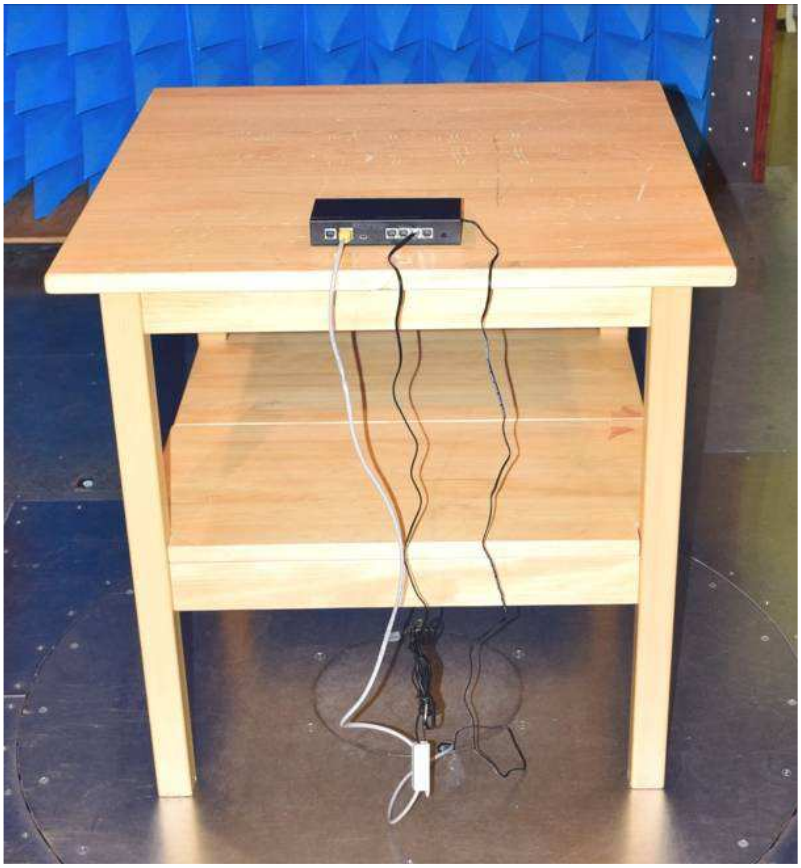


Fig.3: Arrangement of measured sample during radiated emission measurement.

Fig.4: Arrangement of tested sample during the test according to EN 61000-4-2.

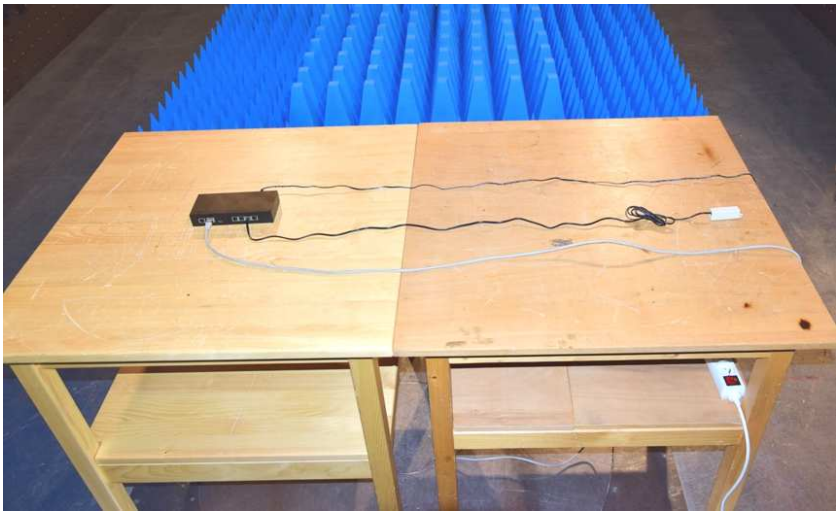


Fig.5: Arrangement of tested sample during the test according to EN 61000-4-3.

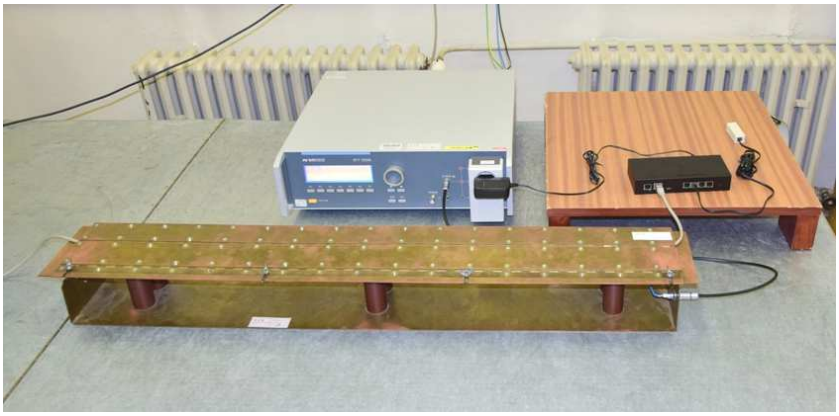


Fig.6: Arrangement of tested sample during the test according to EN 61000-4-4.

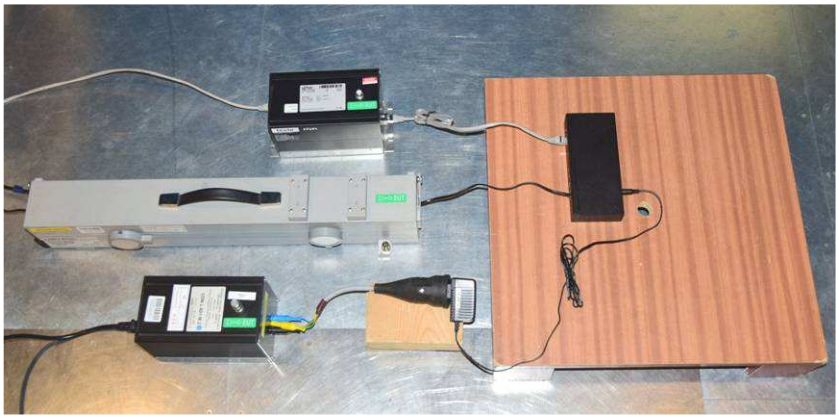


Fig.7: Arrangement of tested sample during the test according to EN 61000-4-6.

Place and date of test report edition: **Bratislava, 24. 10. 2017**

Test executed by: **A. Krammer, MSc.** . . . . . .

Report created by: **J. Hallon, PhD.** . . . . . .

Test results verified by: **Assoc. Prof. K. Kováč, PhD.** . . . . . .

——————— End of test report ———————

EMI Measurement Test Report
Conducted Emission

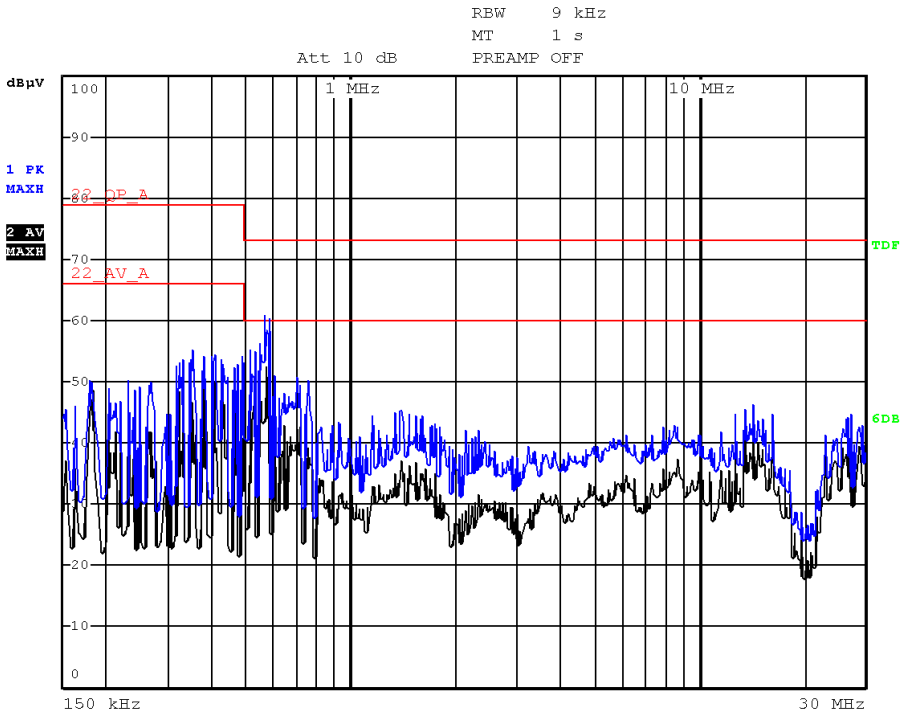
Equipment Under:	**Remote monitoring unit, Type VT335**
Operating Conditions:	normal
Operator:	A. Krammer
Test Specification:	EN 55016-2-1, EN 55022
Limit:	EN 55022, A class
Date:	18. 10. 2017

Measurement 1: V1

Scan Settings (1 Range)

Frequencies			Receiver Settings		Detectors			
Start	**Stop**	**Step**	**Res BW**	**M-Time**	**Pre-measurement**		**Final-measurement**	
150 kHz	30 MHz	4 kHz	9 kHz	1 ms	PK+	AV	QP	AV

Pre-measurement Graph



Final Measurement Results

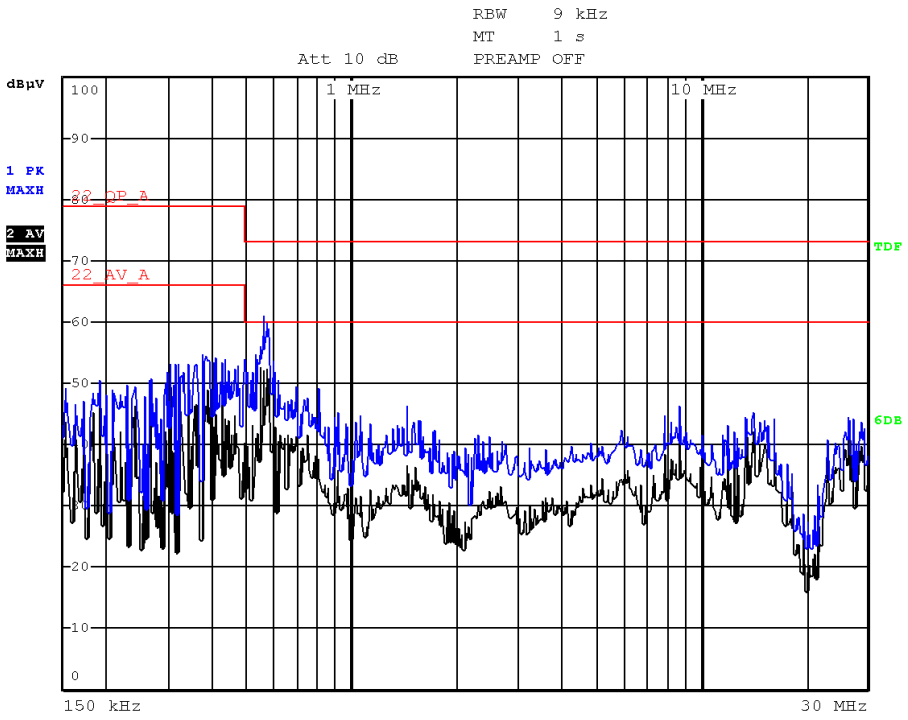
Explanation: As the peak detector values were more than 6 dB below limit, the quasi-peak values were not measured.

Measurement 2: V2

Scan Settings (1 Range)

Frequencies			Receiver Settings		Detectors			
Start	Stop	Step	Res BW	M-Time	Pre-measurement		Final-measurement	
150 kHz	30 MHz	4 kHz	9 kHz	1 ms	PK+	AV	QP	AV

Pre-measurement Graph



Final Measurement Results

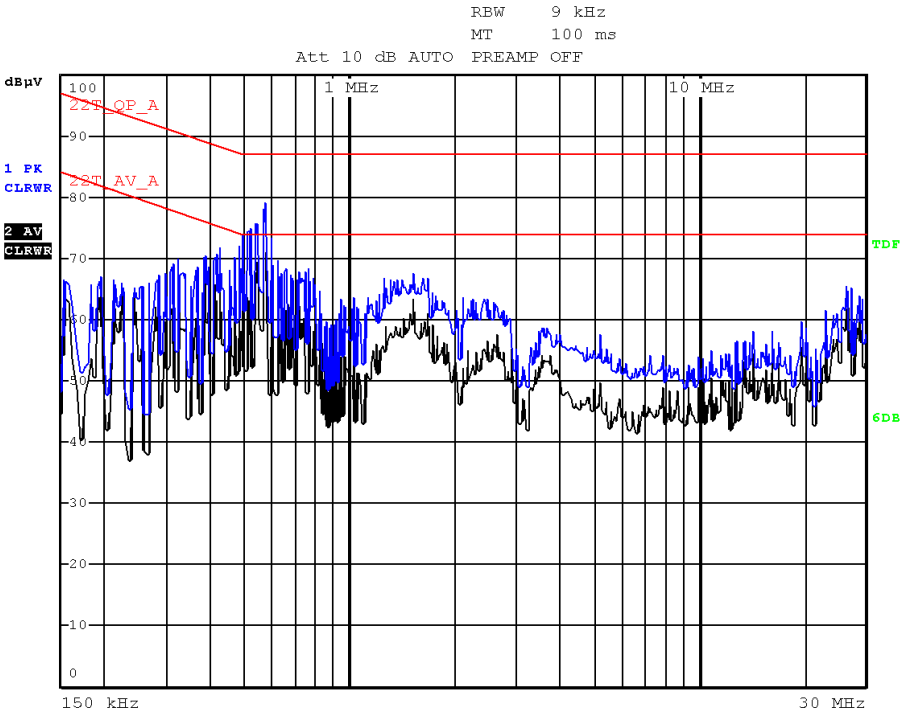
Explanation: As the peak detector values were more than 6 dB below limit, the quasi-peak values were not measured.

Measurement 3: LAN

Scan Settings (1 Range)

Frequencies			Receiver Settings		Detectors			
Start	Stop	Step	Res BW	M-Time	Pre-measurement		Final-measurement	
150 kHz	30 MHz	4 kHz	9 kHz	1 ms	PK+	AV	QP	AV

Pre-measurement Graph



Final Measurement Results

Explanation: As the peak detector values were more than 6 dB below limit, the quasi-peak values were not measured.

EMI Measurement Test Report
Radiated Emission

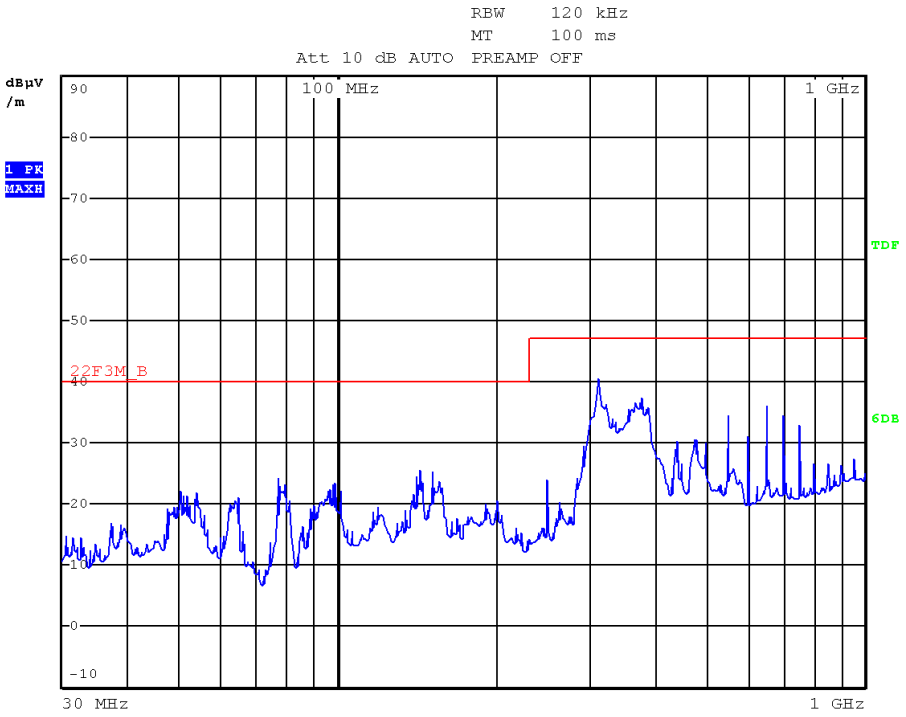
Equipment Under Test:	**Remote monitoring unit, Type VT335**
Operating Conditions:	normal
Operator:	A. Krammer
Test Specification:	EN 55016-2-3, EN 55022
Limit:	EN 55022, B class
Date:	18. 10. 2017

Measurement 1: Horizontal

Scan Settings (1 Ranges)

Frequencies			Receiver Settings		Detectors	
Start	**Stop**	**Step**	**Res BW**	**M-Time**	**Pre-measurement**	**Final-measurement**
30 MHz	1000 MHz	40 kHz	120 kHz	1 ms	PK+	QP

Pre-measurement Graph



Final Measurement Results:

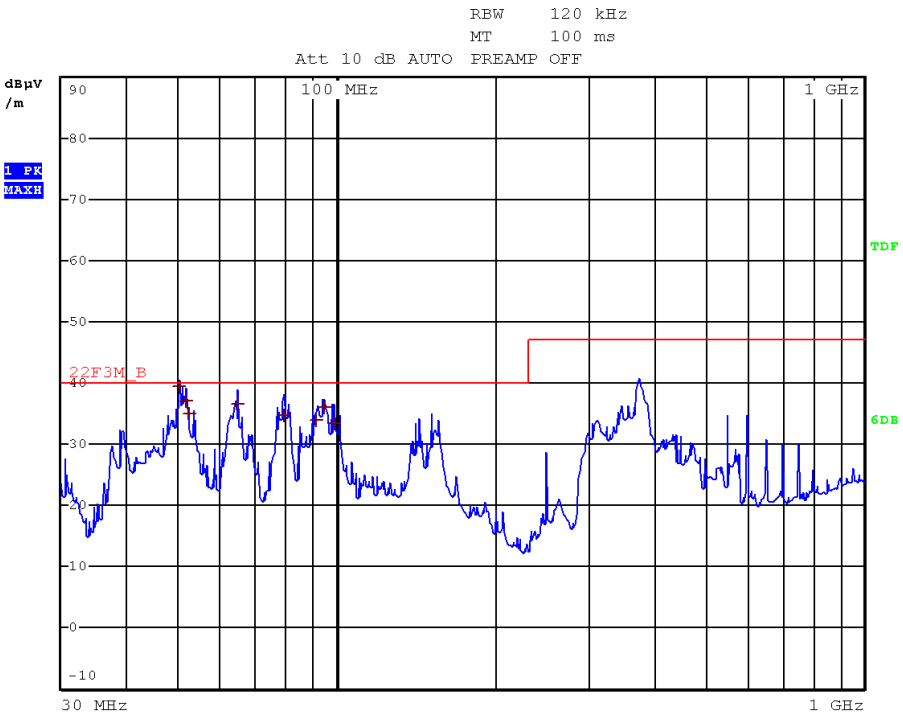
Explanation: As the peak detector values were more than 6 dB below limit, the quasi-peak values were not measured.

Measurement 2: Vertical

Scan Settings (1 Ranges)

Frequencies			Receiver Settings		Detectors	
Start	Stop	Step	Res BW	M-Time	Pre-measurement	Final-measurement
30 MHz	1000 MHz	40 kHz	120 kHz	1 ms	PK+	QP

Pre-measurement Graph



Final Measurement Results

Trace	Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
QP	50.44	39.86	40.00	0.14
QP	51.84	37.09	40.00	2.91
QP	52.60	34.91	40.00	5.09
QP	64.80	36.68	40.00	3.32
QP	79.76	34.78	40.00	5.22
QP	91.84	33.97	40.00	6.03
QP	94.40	35.96	40.00	4.04
QP	98.48	33.50	40.00	6.50

* = limit exceeded