FCC ID: R2DTT29X-453 Issue date: 2004-04-05

Test Report
acc. to the relevant standard:
47 CFR Part 15 C – Intentional Radiators
Measurement Procedure:
ANSI C63.4 - 1992
relating to
ASIM Technologies Ltd.
Triple Technology Combination Detector
TT 29X

Measurement of Radio- Noise Emissions
from Low Voltage Electrical and Electronic Equipment
Technical characteristics and test methods for radio equipment
in the frequency range 9 kHz to 40 GHz

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FCC ID: R2DTT29X-453 Issue date: 2004-04-05

Manufacturer's details	
Manufacturer	ASIM Technologies Ltd
Manufacturer's grantee code	**R2D**
Manufacturer's address	Ziegelhof-Strasse 30
	CH-8730 Uznach
	Switzerland
	Phone: +41 – 55 – 285 99 99
	Fax: +41 – 55 – 285 99 00
	e-mail: Arthur Schmucki [aschmucki@asim.ch]
Relevant standard used	47 CFR Part 15C - Intentional Radiators
	ANSI C63.4-1992

Test report prepared by	
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Equipment **U**nder **T**est **(EUT)**		
Equipment category	Field disturbance sensor	
Trade name	ASIM	
Type designation	Triple Technology Combination Detector TT 290 Series	
Serial no.	14292xxx (Prototype)	
Variants (Hardware versions include but are not limited to the following)	TT 29X – ABC - DE	
	With the following definitions:	
	X	Type of classification (e.g. X = 2 for two classes)
	A	Supply voltage (e.g. 4 = 12 V DC)
	B	Output (e.g. 5 = RS 485)
	C	Case Colour (e.g. 3 = grey)
	D	Mechanical orientation (e.g. L = longitudinal standard)
	E	Protocol definition of data exchange (e.g. 0 = standard)

0 Test result

CFR Section	Report Chapter	Requirements Headline	Test result OK		
15.203	10.1	Antenna Requirement	**pass**	~~**fail**~~	~~**n.a.**~~
15.245 (b)	10.2	Field Strength Limits (Fundamental)	**pass**	~~**fail**~~	~~**n.a.**~~
15.205(b) 15.209 15.245(b)(1)(ii) 15.245(b)(3)	10.2	Radiated Spurious Emissions	**pass**	~~**fail**~~	~~**n.a.**~~

Test requirements kept	**yes** ~~**no**~~

Signature test personnel .....
Ralf Trepper

Signature of the company official .....
Manfried Dudde

FCC ID: R2DTT29X-453 Issue date: 2004-04-05

List of contents Page

1 Testing laboratory

Company name:	m.dudde high frequency technology
Street:	Rottland 5a
City:	51429 Bergisch Gladbach
Country:	Germany
Laboratory:	
	FCC Registration Number: 699717 This site has been fully described in a report submitted to the FCC and was accepted with letter dated Registration Number .699717
Phone:	+49-2207-9689-0
Fax:	+49-2207-9689-20
E-mail:	manfred.dudde@t-online.de
Web:	http://www.dudde.com

2 Introduction

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of m. dudde hochfrequenz - technik.

This report contains the result of tests performed by m. dudde hochfrequenz - technik for the purpose of a type approval. The order for carrying out these tests had been placed by:

Manufacturer

Company name	: ASIM Technologies Ltd
Address	: Ziegelhof-Strasse 30
Postcode	: CH-8730
City/town	: Uznach
Country	: Switzerland
Telephone	: +41 – 55 – 285 99 99
Telefax	: +41 – 55 – 285 99 00
Date of order	: 2004-02-25
References	: Herr Schmucki
E-mail	: Arthur Schmucki [aschmucki@asim.ch]
Date of order	:

3 Product

Samples of the following apparatus were submitted for testing:

Type of equipment	: field disturbance sensor
Trademark	: ASIM
Type designation	: Triple Technology Combination Detector TT 290 Series
Hardware version	: TT 292-453-LO
Serial number	: 14292xxx (Prototype)
Software release	: ---
Power used	: 12.0VDC
Frequency range	: 24.000 GHz ... 24.250 GHz
Frequency used	: 24.136 GHz
Generated or used frequencies	:
FCC ID	**: R2DTT29X-453**

4 Test schedule

Tests were carried out in accordance with the specifications detailed in chapter 7 “Summary“ of this report.

Tests were carried out at:

- m. dudde hochfrequenz - technik, D-51429 Bergisch Gladbach

The test sample was received on:

- 2004-02-25

The tests were carried out in the following period of time:

- 2004-03-17 - 2004-04-05

5 Product and measurement documentation

For issuing this report the following product documentation was used and the following annexes were created:

Description:	Date:	Identifications:
External photographs of the Equipment Under Test (EUT)		Annex no. 1
Internal photographs of the Equipment Under Test (EUT)		Annex no. 2
Occupied bandwidth plot		not applicable
FCC ID label sample		Annex no. 4
Technical description		Annex no. 5
Test setup photos		Annex no. 6
Block diagram		Annex no. 7
Schematics		Annex no. 8

The above mentioned documentation will be filed at m. dudde hochfrequenz - technik for a period of 10 years following the issue of this test report.

6 Observations and comments

All detectors of the TT 290 Series are using the same components and circuits and are equivalent in all respects regarding the electromagnetic properties.

Hardware versions include but are not limited to the following:
TT 29X – ABC - DE

With the following definitions:

X	Type of classification	(e.g. X = 2 for two classes)
A	Supply voltage	(e.g. 4 = 12 V DC)
B	Output	(e.g. 5 = RS 485)
C	Case Colour	(e.g. 3 = grey)
D	Mechanical orientation	(e.g. L = longitudinal standard)
E	Protocol definition of data exchange	(e.g. 0 = standard)

7 Summary

The product is intended for the use in the following areas of application:
Radio- Noise Emissions from Low- Voltage Electrical and Electronic Equipment
in the frequency range 9 kHz to 40 GHz

The samples were tested according to the following specification:

47 CFR Part 15 – Intentional Radiators, ANSI C63.4 - 1992

8 Conclusions

Samples of the apparatus were found to **CONFORM WITH** the specifications stated in chapter 7 "Summary" of this report.

In the opinion of m. dudde hochfrequenz - technik, the samples satisfied all applicable requirements relating to the network interface types specified in chapter 7 "Summary".

The results of the type tests as stated in this report are exclusively applicable to the product item as identified in this report. m. dudde hochfrequenz - technik does not accept any responsibility for the results stated in this report, with respect to the properties of product items not involved in these tests.

This report consists of a main module, modules with test results and annexes listed in chapter 5: "Product documentation". All pages have been numbered consecutively and bear the m. dudde hochfrequenz - technik logo, the report number and sub numbers.
The total number of pages in this report is **19.**

Tester:

Date : 2004-04-05

Name : Ralf Trepper

Signature : 

Technical responsibility for area of testing:

Date : 2004-04-05

Name : Manfried Dudde

Signature : 

9 Operation description

9.1 EUT details

see technical description in Annex No. 5

9.2 EUT configuration

Operation:	:	As soon as the equipment is powered up, TX start operating
Purpose of operation	:	Traffic radar, speed measurement

9.3 EUT measurement description

AS soon as the software was activated and the EUT connected to the power supply it starts, after a short delay, to operate in continuous mode. The maximum radiation will be achieved, if the EUT is adjusted as described by the manufacturer in the manual. The inclination of the test sample will be brought into a prescribed angle to the aerial antenna.

10.1 Antenna requirement

10.1.1 Regulation

15.203 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

10.1.2 Result

The equipment meets the requirements	**yes**	~~no~~	~~n.a.~~

Further test results are attached	~~yes~~	~~no~~	page no:

n.a [x] see page no. 31

10.2 Radiated emissions

10.2.1 Regulation

Test Requirement: FCC CFR47, Part 15C Test Procedure: ANSI C63.4:1992

Section 15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. lf measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

15.245 (b)The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (millivolts/meter)	Field Strength of Spurious Emissions (millivolts/meter)
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25.0
24075-24175	2500	25.0

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted band below 17.7 GHz ,as specified in § 15.205,shall not exceed the field strength limits shown in §15.209. Harmonic emissions in the restricted band at and above 17.7 GHz shall not exceed the following field strength limits:

(i) For field disturbance sensors designed for use only within a building or to open building doors, 25mV/m.

(ii) For all other field disturbance sensors, 7.5mV/m

(iii)Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted band fully comply with the limits given in Section 15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration.

(2) Field strength limits are specified at a distance of 3 meters.

(3) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

(4) The emission limits shown in the above table are based on measurement instrumentation employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

10.2.2 Test equipment

Type	**Manufacturer/ Model no.**	**Serial no.**	**Last calibration**	**Next calibration**
Receiver (9 kHz –26.5 GHz)	Hewlett Packard Spectrum Analyzer 8593E (171)	3528U00990	2004/02	2006/02
Pre-amplifier (100kHz - 1.3GHz)	Hewlett Packard 8447 E (166a)	1726A00705	2002/04	2006/04
Bilog antenna	CHASE	1517	2002/04	2008/04
(30- 1000 MHz)	CBL611A (167)			
Horn antenna (0,86-8,5 GHz)	Schwarzbeck BBHA 9120 A (284)	236	1998/01	2008/01

10.2.2 Test procedures

The EUT and this peripheral (when additional equipment exist) are placed on a turn table which is 0.8 m above the ground. The turn table would be allowed to rotate 360 degrees to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3m. To find the maximum emission, the polarization of the receiving antenna is changed in horizontal and vertical polarization, the position of the EUT was changed in different orthogonal determinations.
ANSI C63.4: 1992 Section 8 “Radiated Emissions Testing”

Radiated emissions test characteristics	
Frequency range	30 MHz - 24,500 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (1,000 MHz - 24,500 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/horizontal

* According to Section 15.31 (f)(1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

10.2.3 Calculation of the field strength

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of an Pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of an Pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Antenna factor + cable loss

For example:

The receiver reading is 32.7 dBµV. The antenna factor for the measured frequency is +2.5 dB(1/m) and the cable factor for the measured frequency is 0.71 dB, giving a field strength of 35.91dBµV/m.
The 35.91dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm (35.91/20) = 39.8

For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f)(1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurements).

10.2.4 Result

TRANSMITTER SPURIOUS RADIATION (Section 15.245(b))										
f (GHz)	Bandwidth (kHz)/Type of detector	Noted receiver level **dBmV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBmV/m**	Limit **dBmV/m**	Margin	Polarisation EUT / antenna	Antenna height **cm**
24.135367	1000, PK	16.67	3	41.88	0	58.55	67.96	9.41	V / V	152
48.270700	1000, PK	-11.67	3	38.62	0	26.95	27.98	1.03	V / V	152
72.405620	1000, PK	-16.67	1	40.14	-9.54	8.85	27.98	19.13	V / V	150
96.543300	1000, Pk	-17.37	0.25	44.64	-21.58	5.69	27.98	22.29	V / V	150
Measurement uncertainty		4 dB								

* Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 6.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 10 dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 17 dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.a.**~~

Further test results are attached	yes	no	page no:

n.a [x] see page no. 31

TRANSMITTER SPURIOUS RADIATION BELOW 30 MHz (Section 15.205, 15.209)									
f (MHz)	Bandwidth (kHz), Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polarisation EUT / antenna orientation
0.1200	*PK/0.2kHz*	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*Pk46.0- @ 300*	80.90	V, H/0-360°
	AV/0.2kHz	*< 4.0*	*10*	20.2	*-59.1*	-34.90	*AV26.0 @ 300*	80.90	V, H/0-360°
0.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV33.6 @ 30*	28.5	V, H/0-360°
1.5000	*AV/0.2kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV24.1 @ 30*	19.00	V, H/0-360°
3.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
5.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
8.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
10.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
20.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
30.0000	*AV/9.0kHz*	*< 4.0*	*10*	20.2	*-19.1*	5.10	*AV29.5 @ 30*	24.4	V, H/0-360°
No emissions detected									
Measurement uncertainty	4 dB								

Remark: *[1] Noise level of the measuring instrument ≤ 4.0dBµV @ 10m distance (0.009 MHz –30 MHz)
Remark: * Peak Limit according to Section 15.35 (b).

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.a.**~~

Further test results are attached	yes	no	page no:

n.a [x] see page no. 31

TRANSMITTER SPURIOUS RADIATION ABOVE 30 MHz (Section 15.205, 15.209)										
f (MHz)	Bandwidth (kHz)/Type of detector	Noted receiver level **dBµV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBµV/m**	Limit **dBµV/m**	Margin **dBµV/m**	Polaris. EUT / antenna	Antenna height **cm**
30.0000	100, AV	≤ 3.5	3	-2.60	0	0.90	40.00	39.10	H,V/H,V	100-400
88.0000	100, AV	≤ 3.5	3	-10.80	0	-7.30	40.00	47.30	H,V/H,V	100-400
216.0000	100, AV	≤ 3.5	3	-10.30	0	-6.80	43.50	50.30	H,V/H,V	100-400
960.0000	100, AV	≤ 3.5	3	8.50	0	12.00	43.50	31.50	H,V/H,V	100-400
1700.0000	1000, AV	≤ 4.5	3	3.80	0	8.30	54.00	45.70	H,V/H,V	100-400
2250.0000	1000, AV	≤ 10	3	8.00	0	18.00	54.00	36.00	H,V/H,V	100-400
4000.0000	1000, AV	≤ 10	3	8.40*[6]	0	18.40	54.00	35.60	H,V/H,V	100-400
5000.0000	1000, AV	≤ 10	3	9.10*[6]	0	19.40	54.00	34.60	H,V/H,V	100-400
7500.0000	1000, AV	≤ 14	3	12.9*[6]0	0	26.90	54.00	27.10	H,V/H,V	100-400
8300.0000	1000, AV	≤ 14	3	14.80*[6]	0	28.80	54.00	25.20	H,V/H,V	100-400
9400.0000	1000, AV	≤ 14	3	16.00*[6]	0	30.00	54.00	24.00	H,V/H,V	100-400
11000.0000	1000, AV	≤ 14	3	18.25*[6]	0	32.25	54.00	21.75	H,V/H,V	100-400
TRANSMITTER SPURIOUS RADIATION ABOVE 17.7 GHz (Section 15.205(e), 15.245(b))										
f (GHz)	Bandwidth (kHz)/Type of detector	Noted receiver level **dBmV**	Test distance **m**	Correction factor **dB**	Distance extrapol. factor **dB**	Level corrected **dBmV/m**	Limit **dBmV/m**	Margin **dBmV/m**	Polaris. EUT / antenna	Antenna height **cm**
17.7 to 21.4	100, AV	≤ -38	3	40.23	0	2.23	27.98	25.75	H,V/H,V	100-400
23.6 to 24.0	100, AV	≤ -38	3	41.88	0	3.88	27.98	24.10	H,V/H,V	100-400
Measurement uncertainty		4 dB								

* Bandwidth = the measuring receiver bandwidth

Remark: *[1] noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *[2] noise floor noise level of the measuring instrument ≤ 4.5 dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *[3] noise floor noise level of the measuring instrument ≤ 10 dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *[4] noise floor noise level of the measuring instrument ≤ 14 dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *[5] for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *[6] for using a pre-amplifier in the range between 4.0 GHz and 18.0 GHz

The equipment meets the requirements	**yes**	~~**no**~~	~~**n.a.**~~

Further test results are attached	~~yes~~	**no**	page no:

n.a [x] see page no. 31

11 Additional information to this test report

Remarks

n.a.[1] not applicable, because antenna is part of the PCB

n.a.[2] not applicable, because EUT is directly battery powered

End of test report