

FCC ID: DO4EVLVETZ and DO4WRTZ15

EMI - TEST REPORT

- FCC Part 15.223 and FCC Part 15.247-



Test Report No. : T35577-00-00HU	16. July 2012
	Date of issue

Type / Model Name : P10 UHF RFID Wirama Upgrade Kit

Product Description : Electronic Article Surveillance Detection System
with UHF RFID-Reader

Applicant : Checkpoint Systems, Inc.

Address : 101 Wolf Drive, Thorofare

New Jersey, USA 08086

Manufacturer : See general remarks

Address : _____

Licence holder : Checkpoint Systems, Inc.

Address : 101 Wolf Drive, Thorofare

New Jersey, USA 08086

Test Result according to the standards listed in clause 1 test standards:	POSITIVE
--	-----------------



The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: DO4EVOLVETZ and DO4WRTZ1500

Contents

1	<u>TEST STANDARDS</u>	3
2	<u>SUMMARY</u>	4
3	<u>EQUIPMENT UNDER TEST</u>	6
3.1	PHOTO DOCUMENTATION OF THE EUT – SEE ATTACHMENT A	6
3.2	FERRITE LOCATIONS – SEE ATTACHMENT C	7
3.3	POWER SUPPLY SYSTEM UTILISED	8
3.4	SHORT DESCRIPTION OF THE EQUIPMENT UNDER TEST (EUT)	8
4	<u>TEST ENVIRONMENT</u>	9
4.1	ADDRESS OF THE TEST LABORATORY	9
4.2	ENVIRONMENTAL CONDITIONS	9
4.3	STATEMENT OF THE MEASUREMENT UNCERTAINTY	9
4.4	MEASUREMENT PROTOCOL FOR FCC, VCCI AND AUSTEL	9
4.5	DEVIATIONS OR EXCLUSIONS FROM THE REQUIREMENTS AND STANDARDS	10
4.6	OPERATION IN RESTRICTED BANDS	11
5	<u>TEST CONDITIONS AND RESULTS</u>	12
5.1	CONDUCTED EMISSIONS	12
5.2	FIELD STRENGTH OF THE FUNDAMENTAL WAVE	24
5.3	MAXIMUM PEAK CONDUCTED OUTPUT POWER	26
5.4	SPURIOUS EMISSIONS (MAGNETIC FIELD) 9 KHZ – 30 MHZ	28
5.5	RADIATED EMISSIONS (ELECTRIC FIELD) 30 MHZ – 1 GHZ	30
5.6	SPURIOUS RADIATED EMISSIONS IN RESTRICTED BANDS	32
6	<u>USED TEST EQUIPMENT AND ACCESSORIES</u>	36

FCC ID: DO4EVOLVETZ and DO4WRTZ1500

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (October, 2011)

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart B - Unintentional Radiators (October, 2011)

Part 15, Subpart B, Section 15.107	AC Line conducted emissions,	Class B
Part 15, Subpart B, Section 15.109	Radiated emissions, general requirements,	Class B

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (October, 2011)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.223	Operation in the band 1.705-10 MHz §15.223(a) Radiated emissions, Fundamental & Harmonics
Part 15, Subpart C, Section 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

FCC ID: DO4EVLVETZ and DO4WRTZ1500

2 SUMMARY

GENERAL REMARKS:

Manufacturer of the Evolve P10: Pikatron Feinwerktechnik GmbH & Co. KG
Raiffeisenstrasse 10
D-61250 Usingen

Manufacturer of the WRTZ-1500: RM Gerätebau
Hirschbachstr. 47
64354 Reinheim, Germany

The frequency range was scanned from 9 kHz to 10 GHz.

All emissions not reported in this test report were more than 10 dB below the specified limit.

The P10 UHF RFID Wirama Upgrade Kit consists of following systems:

- WRTZ-1500 (FCCID: DO4WRTZ1500):

The UHF system is a frequency hopping system using 50 channels in the frequency band from 902 to 928 MHz. The device has a maximum of eight external antenna ports for connection of the transmission/reception antennas for communication with RFID tags.

Measurements have been made with power settings of 27.7 dBm.

For detailed information please refer to the user manual.

It is not possible to set the EuT only in receiving mode.

- TX Antenna Best Solution:

915 MHz		Ver. Pol	Hor. Pol
Gain		8,3 dBi	8,2 dBi
Beam width @ -3 dB			
	Vert. Cut	61 deg.	61 deg.
	Hor. Cut	62 deg.	62 deg.

- Evolve P10 (FCCID: DO4EVLVETZ):

The Evolve P10 is a digital swept frequency hopping transmitter. The EUT hops on discrete frequencies. The hop can not stop on one of the frequencies.

In practical use both systems (Evolve P10 and WRTZ-1500) are in continuous sweep mode at the same time (simultaneous transmission) in the two different frequency ranges.

FCC ID: DO4EVLVETZ and DO4WRTZ1500

3 EQUIPMENT UNDER TEST

3.1 Photo documentation of the EuT – See Attachment A

mikes

FCC ID: DO4EVOLVETZ and DO4WRTZ1500

3.2 Ferrite Locations – See Attachment C

mikes

FCC ID: DO4EVOLVETZ and DO4WRTZ1500

3.3 Power supply system utilised

Power supply voltage : 115 V / 60 Hz / 1 ϕ
24 V / DC – Evolve P10
12 V / DC – WRTZ-1500

3.4 Short description of the Equipment under Test (EuT)

The Evolve Antenna with Emerald Electronic are Electronic Article Surveillance System (EAS). The system detects target tags attached to merchandise. The targets resonate in the region of 8.2 MHz or 9.5 MHz. When an article of merchandise is purchased, the target is deactivated which causes it to no longer resonate. The Evolve Antenna's with Emerald Electronic monitors an area 3-feet on either side of the antenna in the 7.4 to 10.0 MHz range and triggers an alarm when a non-deactivated target is detected.

The WRTZ-1500 is a UHF RFID reader. It can read active and passive Tags in the frequency range from 902 to 928 MHz. 8 antenna connectors are available.

Number of tested samples: 1
Serial number: see Photo documentation of the EuT under Point 3 / Equipment Under Test

EuT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- Continuous sweep mode at 8.2 MHz Band
- TAG reading mode supplying 27.7 dBm

EuT configuration:

The following peripheral devices and interface cables were connected during the measurements:

- PSU (Power Supply Unit), EOS Model: ZVC65SG24E, S/N:4535, E01-A-E415
- Standard AC mains cable Model: _____
- PSU (Power Supply Unit), XP Power Model: AEB70US12, S/N: 7012-0002713, #1009
- Standard AC mains cable Model: _____
- Lap Top Model: Supplied by manufacturer
- Test Software Model: Supplied by manufacturer
- customer specific cables

FCC ID: DO4EVOLVETZ and DO4WRTZ1500

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

mikes-testingpartners gmbh
Ohmstrasse 2-4
94342 Strasskirchen
Germany

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 /11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.4 Measurement Protocol for FCC, VCCI and AUSTEL

4.4.1 GENERAL INFORMATION

4.4.1.1 Test Methodology

Conducted and radiated disturbance testing is performed according to the procedures in International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

In compliance with 47 CFR Part 15 Subpart A Section 15.38 testing for FCC compliance may be done following the ANSI C63.4-2003 procedures and using the CISPR 22 Limits.

FCC ID: DO4EVLVETZ and DO4WRTZ1500

4.4.1.2 Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.4.2 DETAILS OF TEST PROCEDURES

General Standard Information

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4-2003 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

4.5 Deviations or Exclusions from the Requirements and Standards

The Evolve P10 is a digital swept frequency hopping transmitter. The EUT hops on discrete frequencies. The hop can not stop on one of the frequencies. It is not possible to find the "true peak" with an measuring receiver by using a average detector.

Following measurement method was used to find the "true peak".

Measurement of the fundamental – 7.4 to 10.0 MHz – was performed by setting a spectrum analyzer to "max-hold", peak detector, a 300 kHz bandwidth and a span from 6.5 MHz to 10 MHz. A resolution bandwidth of 300 kHz was used in performing the "true peak" measurements, because increasing the bandwidth above 300 kHz did not increase the detected peak of the fundamental.

FCC ID: DO4EVLVETZ and DO4WRTZ1500

4.6 Operation in Restricted Bands

The Evolve P10 is a digital swept frequency hopping transmitter. The EUT hops on discrete frequencies. The discrete frequencies that can be transmitted by the EUT are as follows:

Original Emerald frequency tables Vers. 2.79:

/* Center frequency 8.2MHz +/- 410KHz */
8610, 8555, 8500, 8446, 8391, 8337, 8282, 8227, 8173, 8118, 8063, 8009, 7954, 7899, 7845, 7790

/* Center frequency 8.6MHz +/- 430KHz */
9030, 8973, 8915, 8858, 8801, 8743, 8686, 8629, 8571, 8514, 8457, 8399, 8342, 8285, 8227, 8170

/* Center frequency 9.0MHz +/- 450KHz */
9450, 9390, 9330, 9270, 9210, 9150, 9090, 9030, 8970, 8910, 8850, 8790, 8730, 8670, 8610, 8550

/* Center frequency 9.2MHz +/- 460KHz */
9660, 9599, 9537, 9476, 9415, 9353, 9292, 9231, 9169, 9108, 9047, 8985, 8924, 8863, 8801, 8740

/* Center frequency 9.5MHz +/- 480KHz */
9980, 9916, 9852, 9788, 9724, 9660, 9596, 9532, 9468, 9404, 9340, 9276, 9212, 9148, 9084, 9020

/* This table is used for multi band (8.2/9.2) skinny pulse, using PW of 4us JRG_SP */
9325, 9325, 9325, 9325, 9075, 9075, 9075, 9075, 8325, 8325, 8325, 8325, 8075, 8075, 8075, 8075

The restricted frequency bands (per FCC Part 15 Clause 15.205) in the operating frequency band of the EuT are as follows:

8.291 – 8.294 MHz
8.362 – 8.366 MHz
8.37625 – 8.38675 MHz
8.41425 – 8.41475 MHz

The transmitter is not capable of hopping into, or operating, in the restricted frequency bands and therefore complies with the restriction.

FCC ID: DO4EVLVETZ and DO4WRTZ1500

5 TEST CONDITIONS AND RESULTS

5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

5.1.1 Description of the test location

Test location: Shielded Room S2

5.1.2 Photo documentation of the test set-up

See Attachment C

5.1.3 Description of Measurement

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC Limit or to the CISPR limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EuT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

FCC ID: DO4EVOLVETZ and DO4WRTZ1500**5.1.4 Test result**

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 1.6 dB at 8.405 MHz (UHF Reader active – RFID active (Evolve P10))

The requirements are **FULFILLED**.**Remarks:**



FCC ID: DO4EVLVETZ and DO4WRTZ1500

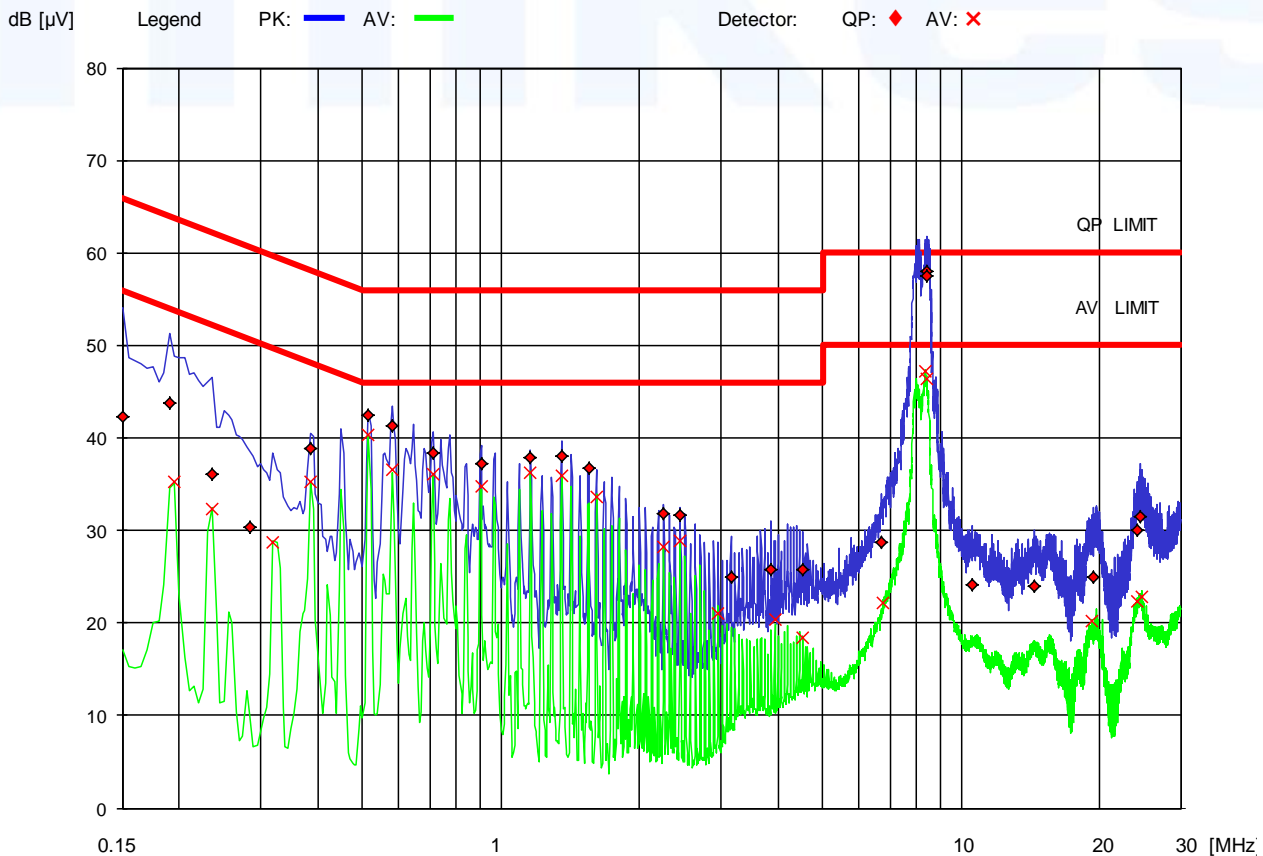
Test point: L1
 Operation mode: UHF Reader active – RFID active
 Remarks: FCC Requirements

Result: passed

Tested by: Josef Knab

Freq kHz	QP-L dB[μV]	D-Limit QP [dB]	Freq kHz	AV-L dB[μV]	D-Limit AV [dB]
150	42,3	23,7	195	35,3	18,5
190	43,7	20,3	235	32,3	20,0
235	36,1	26,2	320	28,7	21,0
285	30,3	30,4	385	35,2	13,0
385	38,8	19,4	515	40,3	5,7
515	42,4	13,6	580	36,6	9,4
580	41,3	14,7	710	36,1	9,9
710	38,3	17,7	905	34,7	11,3
905	37,3	18,7	1160	36,2	9,8
1160	37,8	18,2	1355	35,9	10,1
1355	38,1	17,9	1610	33,7	12,3
1550	36,7	19,3	2260	28,3	17,7
2260	31,9	24,1	2450	28,8	17,2
2450	31,6	24,4	2965	21	25,0
3160	24,9	31,1	3935	20,3	25,7

Freq kHz	QP-L dB[μV]	D-Limit QP [dB]	Freq kHz	AV-L dB[μV]	D-Limit AV [dB]
3870	25,8	30,2	4515	18,4	27,6
4515	25,8	30,2	6755	22,1	27,9
6695	28,7	31,3	8380	47,2	2,8
8405	58	2,0	8440	46,4	3,6
8420	57,5	2,5	19225	20,2	29,8
10575	24,2	35,8	24235	22,4	27,6
14390	23,9	36,1	24705	22,8	27,2
19455	25	35,0			
24235	30,1	29,9			
24560	31,5	28,5			



FCC ID: DO4EVOLVETZ and DO4WRTZ1500

5.2 Field strength of the fundamental wave

For test instruments and accessories used see section 6 Part CPR 1.

5.2.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.2.2 Photo documentation of the test set-up

See Attachment C

5.2.3 Description of Measurement

The magnetic field strength from the EuT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions. In the case where larger measuring distances are required the results will extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with an EMI Receiver set to an average and a peak detector.

The final level, expressed in dB μ V/m, is arrived at by taking the reading from the EMI receiver (Level dB μ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit.

The resolution bandwidth during the measurement was 300 kHz.

FCC ID: DO4EVOLVETZ and DO4WRTZ1500

5.2.4 Test result

Evolve P10:

3m Distance measured:

Frequency [MHz]	L: PK [dB μ V]	Correct. [dB]	L: PK [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]	Tx1 & Tx2:
8.2	73.63	20	93.6	100.0	-6.4	31

30m Distance calculated:

Frequency [MHz]	L: PK [dB μ V]	Correct. [dB]	L: PK [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
8.2	33.63	20	53.6	60.0	-6.4

Limit according to FCC Part 15 Subpart 15.223, 15.35(b)

Frequency (MHz)	Field strength of fundamental – Average Detector	
	(μ V/m)	dB (μ V/m)
1.705-10.0	100*	40*

Frequency (MHz)	Field strength of fundamental – Peak Detector	
	(μ V/m)	dB (μ V/m)
1.705-10.0	1000*	60*

* At a test distance of 30 metres

The requirements are **FULFILLED**.

Remarks:

FCC ID: DO4EVLVETZ and DO4WRTZ1500**5.3 Maximum peak conducted output power**

For test instruments and accessories used see section 6 Part CPC 2.

5.3.1 Description of the test location

Test location: Shielded Room S4

5.3.2 Photo documentation of the test set-up

See Attachment C

5.3.3 Applicable standard

According to FCC Part 15C, Section 15.247(b)(2):

For frequency hopping systems operating in the 902-928 MHz band the maximum peak conducted output power shall not exceed the limit of 1 watt for systems employing at least 50 hopping channels.

5.3.4 Description of Measurement

A spectrum analyzer is connected to the output of the transmitter via a suitable attenuator while EUT was operating in transmit mode using the assigned frequency.

Spectrum analyser settings:

RBW	300 kHz	Sweep time	5 ms (Auto)
VBW	1 MHz	Power Mode	Max. hold
Detector	Peak	Span	500 kHz

FCC ID: DO4EVLVETZ and DO4WRTZ1500
5.3.5 Test result

- a) Power setting 30.0 dBm
Antenna Best Solution: antenna gain: 8.3 dBi

Channel	Frequency (MHz)	Peak Power (dBm)	Correction (dB)	Corr. Peak power (dBm)	Limit (dBm)	Delta (dB)
1	902.75	7.05	20	27.05	27.7	- 0.65
25	914.75	7.00	20	27.00	27.7	- 0.70
50	927.25	6.98	20	26.98	27.7	- 0.72

Note: Correction means fixed attenuation of 20 dB.
Test cable loss is included in the analyzer reading (Transducer factor).

Peak Power Limit according to FCC Part 15C, Section 15.247(b)(2):

Frequency (MHz)	Hopping channels	Hop. CH carrier frequ. separation	Peak Power Limit	
			(dBm)	(W)
902-928	≥ 50		30	1.0

The requirements are **FULFILLED**.

Remarks: The conducted output power has been reduced by the amount in dB that the directional gain of the antenna (8.3 dBi) exceeds 6 dBi. Refer to 5.3.5 a) above.

FCC ID: DO4EVOLVETZ and DO4WRTZ1500**5.4 Spurious emissions (Magnetic field) 9 kHz – 30 MHz**

For test instruments and accessories used see section 6 Part SER 1.

5.4.1 Description of the test location

Test location: OATS1

Test distance: 10 metres

5.4.2 Photo documentation of the test set-up

See Attachment C

5.4.3 Description of Measurement

The spurious emissions from the EuT will be measured on an open area test site in the frequency range of 9 kHz to 30 MHz using a tuned receiver and a shielded loop antenna. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. Measurements have been made in all three orthogonal axes and the shielded loop antenna was rotated to locate the maximum of the emissions. In the case where larger measuring distances are required the results will extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with an EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 to 490 kHz where an average detector will be used according to Section 15.209 (d) [2].

FCC ID: DO4EVLVETZ and DO4WRTZ1500

The final level, expressed in dB μ V/m, is arrived at by taking the reading from the EMI receiver (Level dB μ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has to be compared with the relevant FCC limit.

The resolution bandwidth during the measurement is as follows:

9 kHz – 150 kHz: ResBW: 200 Hz

150 kHz – 30 MHz: ResBW: 300 kHz

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor (dB)	=	Level (dB μ V/m)	Limit (dB μ V/m)	=	Delta (dB)
1.705	5	+	20	=	25	30	=	5

5.4.4 Test result

Evolve P10

Tx Frequency: 8.2 MHz Band

Frequency [MHz]	L: PK [dB μ V]	L: AV [dB μ V]	L: QP [dB μ V]	Correct. [dB]	L: PK [dB μ V/m]	L: AV [dB μ V/m]	L: QP [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
0.009 – 30.0				20				40.0	> 20

Limit according to FCC Part 15 Subpart 15.209(a), Subpart 15.223(a)

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	(μ V/m)	dB (μ V/m)	
0.009-0.490	2400/F(kHz)	--	300
0.490-1.705	24000/F (kHz)	--	30
1.705-10.0	100	40	30

The requirements are **FULFILLED**.

Remarks:

FCC ID: DO4EVLVETZ and DO4WRTZ1500**5.5 Radiated emissions (electric field) 30 MHz – 1 GHz**

For test instruments and accessories used see section 6 Part SER 2.

5.5.1 Description of the test location

Test location: OATS1

Test distance: 3 metres

5.5.2 Photo documentation of the test set-up

See Attachment C

5.5.3 Description of Measurement

Spurious emissions from the EuT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003. The Interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna was positioned 3, 10 or 30 meters horizontally from the EuT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarization's and the EuT are rotated 360 degrees.

FCC ID: DO4EVLVETZ and DO4WRTZ1500

The final level, expressed in dB μ V/m, is arrived by taking the reading from the EMI receiver (Level dB μ V) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored. This result then has the FCC or CISPR limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets at page.

The resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz: ResBW: 120 kHz

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor (dB)	=	Level (dB μ V/m)	Limit (dB μ V/m)	=	Delta (dB)
719	75	+	32.6	=	107.6	110	=	-2.4

5.5.4 Test result

Extract of the critical values:

**Evolve P10, Tx Frequency: 8.2 MHz Dual Band, Tx1&Tx2:31
WRTZ-1500, Power setting 27.7 dBm**

Frequency [MHz]	L: QP [dB μ V]	Correct. [dB]	L: QP [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
33.81	24.7	13.4	38.4	40.0	-1.9
42.28	23.1	14.3	37.4	40.0	-2.6
66.68	22.8	14.1	36.9	40.0	-3.1
230.59	21.5	14.9	36.4	46.0	-9.6
373.59	21.6	18.6	40.2	46.0	-5.8
412.91	22.3	19.4	41.7	46.0	-4.3
395.72	24.1	19.0	43.1	46.0	-2.9
424.62	23.9	19.7	43.6	46.0	-2.4
462.95	24.1	20.6	44.7	46.0	-1.3
469.13	22.0	20.8	42.8	46.0	-3.2

Limit according to FCC Part 15 Subpart 15.209(a)

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	(μ V/m)	dB (μ V/m)	
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
960-1000	500	54	3

The requirements are **FULFILLED**.

Remarks: The table shows an extract of the critical values.

FCC ID: DO4EVLVETZ and DO4WRTZ1500

5.6 Spurious radiated emissions in restricted bands

For test instruments and accessories used see section 6 Part **SER 1**, **SER 2**, **SER 3**.

5.6.1 Description of the test location

Test location: OATS1
Test distance: 3 metres

Test location: Anechoic Chamber A2
Test distance: 3 metres

5.6.2 Photo documentation of the test set-up

See Attachment C

5.6.3 Applicable standard

According to FCC Part 15, Section 15.247(d):

In any 100 kHz bandwidth outside the frequency bands 902 to 928 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

5.6.4 Description of Measurement

Radiated spurious emissions from the EUT are measured in the frequency range of 9 kHz to 1000 MHz using a tuned receiver and appropriate broadband linear polarized antennas. The measurements are made with 120 kHz bandwidth and quasi-peak detection (200 Hz, 9 kHz up to 30 MHz). The EUT was placed on a 1.0 X 1.5 metres non-conducting table 80 centimetres above the ground plane. The set up of the equipment under test will be in accordance to ANSI C63.4. The antenna was positioned 3 metres horizontally from the EUT. To locate maximum emissions from the EUT the antenna is shifted in height from 1 to 4 metres, after the EUT is rotated 360 degrees. The measurement scan is made in horizontal and vertical polarization of the antenna. The correction factors for antenna gain and cable loss are stored in the EMI receiver and automatically added to a measurement data to display the final level in dB μ V/m.

For the radiated measurement up from 1 GHz to maximum frequency as specified in Section 15.33, a spectrum analyzer and appropriate linear polarized antennas are used. The EUT is placed on a 1.0 X 1.5 metres non-conducting table 80 centimetres above the ground plane. The set up of the EUT will be in accordance to ANSI C63.4. The antenna was positioned 3 m horizontally from the EUT. To locate maximum emissions the EUT was rotated 360 degrees in the fully anechoic chamber. The measurement scan is made in horizontal and vertical polarization of the antenna. For testing above 1 GHz, if the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.

FCC ID: DO4EVLVETZ and DO4WRTZ1500

5.6.5 Test result

5.6.5.1 Radiated emission test $f < 1$ GHz

In the frequency range from 9 kHz to 30 MHz no emissions in the restricted bands could be measured.

In the frequency range from 30 MHz up to 1 GHz no emissions in the restricted bands could be measured.

5.6.5.2 Radiated emission test $f > 1$ GHz

Power setting 27.7 dBm

Antenna Best Solution: antenna gain 8.3 dBi

Frequency (GHz)	L: PK (dB μ V)	L: AV (dB μ V)	Bandwidth (kHz)	Correct. (dB)	L: PK dB(μ V/m)	L: AV dB(μ V/m)	Limit AV dB(μ V/m)	Delta (dB)
3.610	40.73	31.42	1000	-8.0	32.7	23.4	54.0	- 26.6
7.264	45.98	39.81	1000	7.5	53.5	47.3	54.0	- 6.7

Radiated limits according to FCC Part 15C, Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μ V/m)	dB(μ V/m)	
0.009 - 0.490	2400/F(kHz)		300
0.490 - 1.705	24000/F(kHz)		30
1.705 - 30	30	29,5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

FCC ID: DO4EVLVETZ and DO4WRTZ1500

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED**.

Remarks: During the test the EUT was set into TX continuous mode with normal modulation.

The measurement was performed up to the 10th harmonic (10000 MHz).

FCC ID: DO4EVOLVETZ and DO4WRTZ1500

5.7 Maximum permissible exposure (MPE) – See Attachment B

For test instruments and accessories used see section 6 Part **CPC 2**.

5.7.1 Description of the test location

Test location: None

5.7.2 Applicable standard

According to FCC Part 15, Section 15.247(i):

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission’s guidelines.

The test methods used comply with ANSI/IEEE C95.1, “IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”.

This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

5.7.3 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. Through the Friis transmission formula, the known maximum gain of the antenna and the maximum power, the MPE can be calculated in a defined distance away from the product.

Friis transmission formula:
$$P_d = \frac{P_{out} * G}{4 * \pi * r^2}$$

where

P_d = power density (mW/cm²)

P_{out} = output power to antenna (mW)

G = gain of antenna (linear scale)

r = distance between antenna and observation point (cm)

Remarks: For detailed test result please refer Attachment B.

FCC ID: DO4EVLVETZ and DO4WRTZ1500
6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	30/06/2012	30/06/2011		
	ESH 2 - Z 5	02-02/20-05-004	12/05/2013	12/05/2011	12/11/2011	12/05/2011
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2	02-02/50-05-155			05/04/2012	05/10/2011
	SP 103 /3.5-60	02-02/50-05-182				
CPC 2	FSP40	02-02/11-11-001	02/09/2012	02/09/2011		
CPR 1	FMZB 1516	01-02/24-01-018			16/02/2012	16/02/2011
	ESCI	02-02/03-05-005	19/11/2011	19/11/2010		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 1	FMZB 1516	01-02/24-01-018			16/02/2012	16/02/2011
	ESCI	02-02/03-05-005	19/11/2011	19/11/2010		
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 2	ESVS 30	02-02/03-05-006	20/06/2012	20/06/2011		
	VULB 9168	02-02/24-05-005	07/03/2012	07/03/2011	06/04/2012	06/10/2011
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
SER 3	FSP 30	02-02/11-05-001	05/10/2012	05/10/2011		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	11/02/2012	11/02/2011		
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				