

Test Report
Electromagnetic Compatibility

Test Report - Nr.: 07KFE008438-FCC-02

Date: 2008-01-09

Type:	ERT 860, ERT 861
Description:	Access control with tag
Serialnumber:	Test samples

Manufacturer:	Commend International GmbH
Customer:	Commend International GmbH
Address (Customer):	Saalachstrasse 51 A – 5020 Salzburg Austria

Test Laboratory:	Intertek Deutschland GmbH, Innovapark 20, D- 87600 Kaufbeuren
FCC registration number:	90714
Compiled by:	Marek Svoboda Team Leader EMC
Approved by:	R. Dressler Project Engineer

A circular logo for Intertek Deutschland GmbH. The outer ring contains the text "Intertek Deutschland GmbH". Inside the circle is a stylized graphic of a building or bridge structure.

This test report consists of 29 pages. All measurement results exclusively refer to the equipment, which was tested.
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1. General description

1.1. Product description

The device is 4 - Wire Access Reader Module Series ER 800 with built – in antenna. It is activated by approaching the passive tag to reader. In this case the data sent through cable connection to control are evaluated by control unit.

The transmitter which the tag responds has operating frequency $f = 13,56$ MHz. Necessary supply voltage is 13 V – 35 V AC or DC. The device was tested with 230 V 50 Hz AC /24 V AC Adapter delivered by the manufacturer and with 110 V 60 Hz /24 V AC adapter. In both cases the connection from mains adapter was performed with unshielded cable.

There were tested two models of the Series:

Model ERT 860 : without LED's on front panel

Model ERT 861 : with LED's on front panel.

The high frequency part of both models is identical.

Both models are constructed on the same PCB; Model ERT 860 has not filled components marked on the Schematic diagram by \$ sign.

The differences are documented in the Exhibit 2 : Internal photos.

Antenna type : Internal, Integral on PCB

Under normal operating conditions no approach of tag the device transmits 1.6 ms data pulse to check the integrity of system once in 200 ms.

The device is intended to be certified as modular device according to FCC Part 15 unlicenced modular approval.

1.2. Related submittal(s) Grants

This is application for certification of the transmitter.

No related devices are present.

1.3. Test Methodology

- The test setup and test was done according to: **ANSI C63.4: 2003**
American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- The test setup and test was done according to: **CISPR 22: 1998 + Corrigendum: 2003 + A1: 2000 + A2: 2003 and ANSI C63.4: 2003**

This conforms with requirements of FCC Part 15.207(a).

The test results detailed in this report apply only to the Series ERT 860 : Model ERT 860 and ERT861 with the test setup described. Any modification such as a change, addition to or inclusion of another device into this product will require an additional evaluation.

The support equipment listed as part of the emission tests is required to properly exercise and test the device under test.

1.4. Test Facility

The test site was semi-anechoic chamber Intertek Germany (PM KF 1150) and Open Field Test Site Intertek Germany. Radiated measurements were made with measurement distance EUT – Antenna was $d = 3\text{ m}$ and $d = 10\text{ m}$.

1.5. List of Exhibits

Following exhibits are delivered as separate pdf files. The name of file corresponds with description of exhibit with extension **.pdf**

Exhibit 1	External photos
Exhibit 2	Internal photos
Exhibit 3	Test setup photos
Exhibit 4	Installation manual
Exhibit 5	Block diagram
Exhibit 6	Circuit diagram
Exhibit 7	Operational description
Exhibit 8	Product labelling
Exhibit 9	Modular approval requirements

2. Measurements And Test Specifications

Emission - Requirements according to

- FCC, Part 15, Class A, verification
- FCC, Part 15, Class B, DoC
- FCC, Part 15, Class B, certification
- FCC, Part 15, intentional radiator, certification

2.1. Modifications to Test Report 07KFE008438-FCC-01

- Bandwidth measurement removed.
- Corrected text Ch. 5.3.1 : Temperature stability is bellow specified limit of $\pm 0,01 \%$.
- Explanation to test results included : Ch.5.1.
- Text modification Ch.5.2.

3. Description Of EUT

3.1. Configuration / Operating Conditions

☒ table-top EUT

floor-standing EUT

There were two samples of each Model delivered:

Sample 1: was modified by manufacturer to transmit continuously. This sample was used for measurement of bandwidth and field strength ;

Sample 2 : has normal operation as specified by manufacturer . It was used for measurement of the duty cycle.

The equipment under test (EUT) was placed on non-conductive table 0,8 m above ground plane.

Measurements in the frequency range 9 kHz – 30 MHz were performed with shielded loop antenna and measuring receiver ESIB 26 in “Analyzer” mode. The measured values at distance 10 m (sample – antenna) were bellow noise level. The measurement was then repeated at distances 2m, 3m, 4m and 5m (Open area test site).

Measurements in frequency range 30 MHz – 1 GHz were performed with bilog antenna HL 562 and measuring receiver ESIB 26 in “Receiver” mode.

At all interference frequencies the height of the antenna is scanned in the range 1 m to 4 m with horizontal and vertical polarization and the turntable is rotated in the range 0° to 360° to obtain the highest field strength.

3.2. Major Subassemblies Or Internal Peripherals

Device	Manufacturer	Type	SN	FCC ID
none				

3.3. Peripheral Devices Used For Testing

Device	Manufacturer	Type	SN	FCC ID
Voice interface	Commend	ET 861	n/a	n/a
Power supply 110V	Commend	n/a	n/a	n/a
AC/24 V DC	Laboratory sample			

3.4. Supply- And Interconnecting Cables

Line	Length	shielded	non shielded	Shield on GND / PE
Supply cable AC/DC 24V	1.5 m	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Connection cable card reader – audio	0,3 m	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

4. Test Results - Overview

	required	passed	passed with modification	not passed
Conducted emission	FCC 15.207	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Duty cycle	n/a for f = 13.56 MHz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiated Emission				
9 kHz – 30 MHz	FCC 15.225	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30 MHz - 1000 MHz	FCC 15.225	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Measurement results detailed

5.1. Conducted Emission results

The conducted emission measurement was performed in frequency range 150 kHz – 30 MHz according to ANSI C63.4:2003. The EUT was for both models **sample 1** (modified by manufacturer to transmit continuously).

The disturbing voltage was measured at AC input 110 V of the adaptor 110 V 60 Hz AC / 24 V DC with both models ERT 860 and ERT 861.

Displayed curves are merged results (worst case) of L1 and N disturbance voltage measurements.

Blue trace is prescan – peak detector, green trace is prescan – average detector. Final measurements are performed at frequencies where prescan values exceed or are close to limits (PK value vs. QP limit, AV value vs. AV limit).

Scan Setup: Voltage with 2-Line-LISN fin [EMI conducted] : all tests

Hardware Setup: Voltage with 2-Line-LISN
Level Unit: dB μ V

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
150kHz - 30MHz	QuasiPeak; Average	10kHz	1s	ESHS

Conducted disturbance with Adaptor 110V AC 60 Hz/ 24 V AC : Model ERT 860

EMC32 Report

Test information

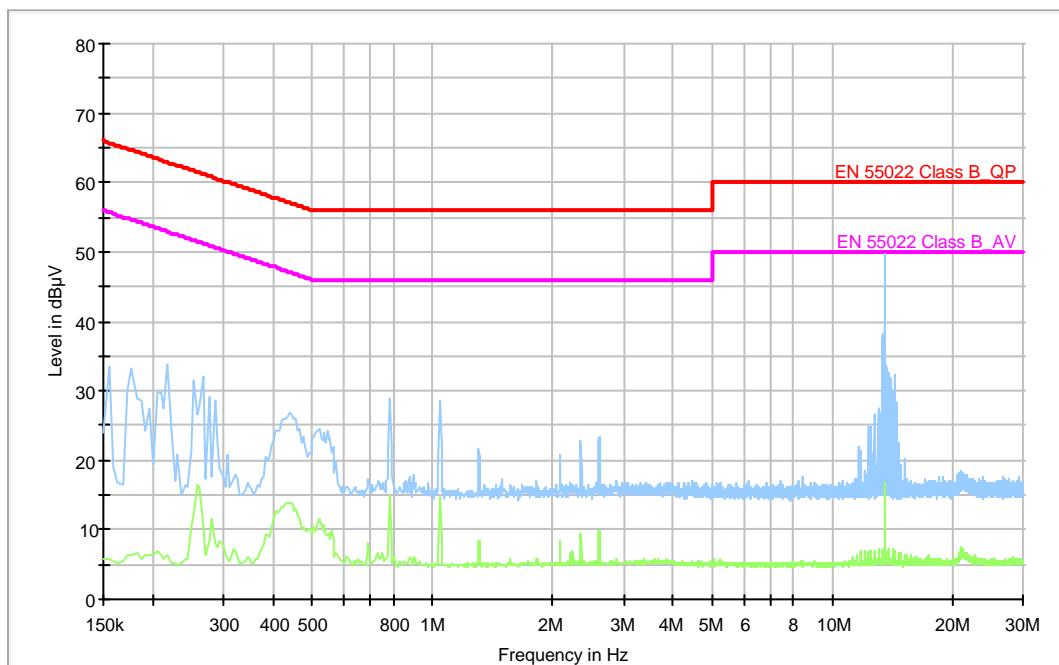
EUT Name: ER 860 (without LED's)
Serial Number: Sample 1
Test Description: 110 V 60 Hz
Operating Conditions:
Operator Name: MSV
Comment:

Scan Setup: Voltage with 2-Line-LISN fin [EMI conducted]

Hardware Setup: Voltage with 2-Line-LISN
Level Unit: dB μ V

Subrange	Detectors	IF Bandwidth	Meas. Time	Receiver
150kHz - 30MHz	QuasiPeak; Average	10kHz	1s	ESHS

Voltage with 2-Line-LISN_EN55022 Class B



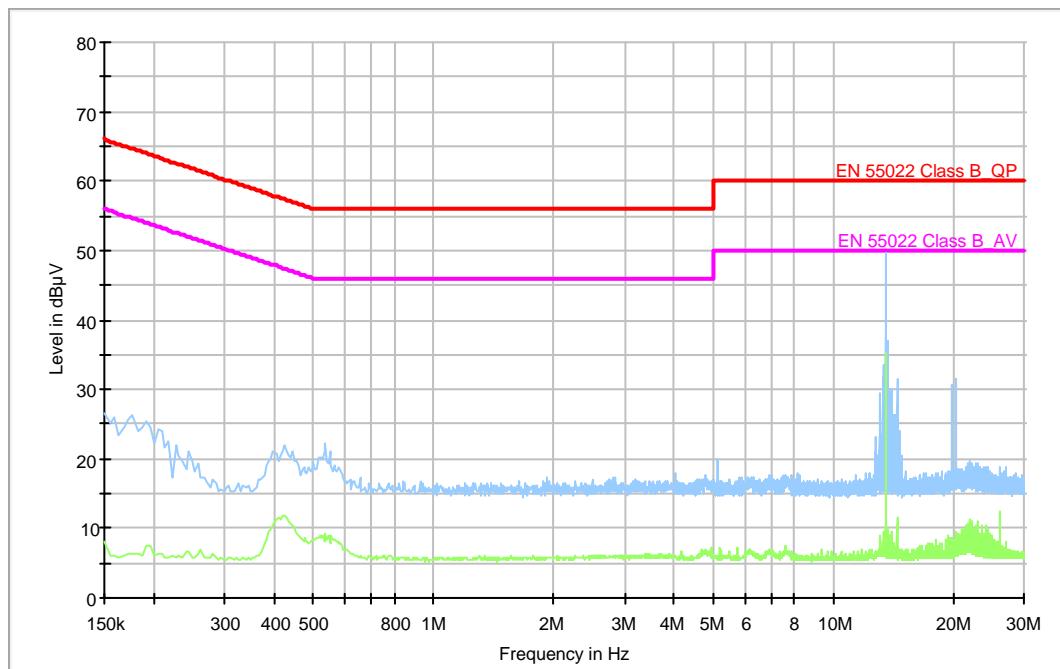
**Conducted disturbance with Adaptor 110V AC 60 Hz/ 24 V AC :
Model ERT 861**

EMC32 Report

Test information

EUT Name: ER 861 (with LED's)
Serial Number: Sample 2
Test Description: 110 V 60 Hz
Operating Conditions:
Operator Name: MSV
Comment:

Voltage with 2-Line-LISN_EN55022 Class B



5.2. Duty cycle

Though not requested, the duty cycle measurement is included for demonstration of transmission periods.

The duty cycle was measured by means of the measuring receiver/spectrum analyzer ESIB 26 in "Analyzer mode".

The measurement was performed with Model ERT 861, sample 2. The Model ERT 860 has identical high frequency part and identical duty cycle.

Fig. 1 shows the length of single data pulse in 10 ms window in absence of tag.

Fig. 2 shows the length of single data pulse in presence of tag

Fig. 3 demonstrates the duty cycle under normal operation in 500 ms window in absence of tag.

Summary of duty cycle measurement (Table 1) :

	Pulse length in absence of tag	Pulse length in presence of tag
Single data pulse length	1.6 ms	7.6 ms
Repetition time	200 ms	200 ms

Table 1

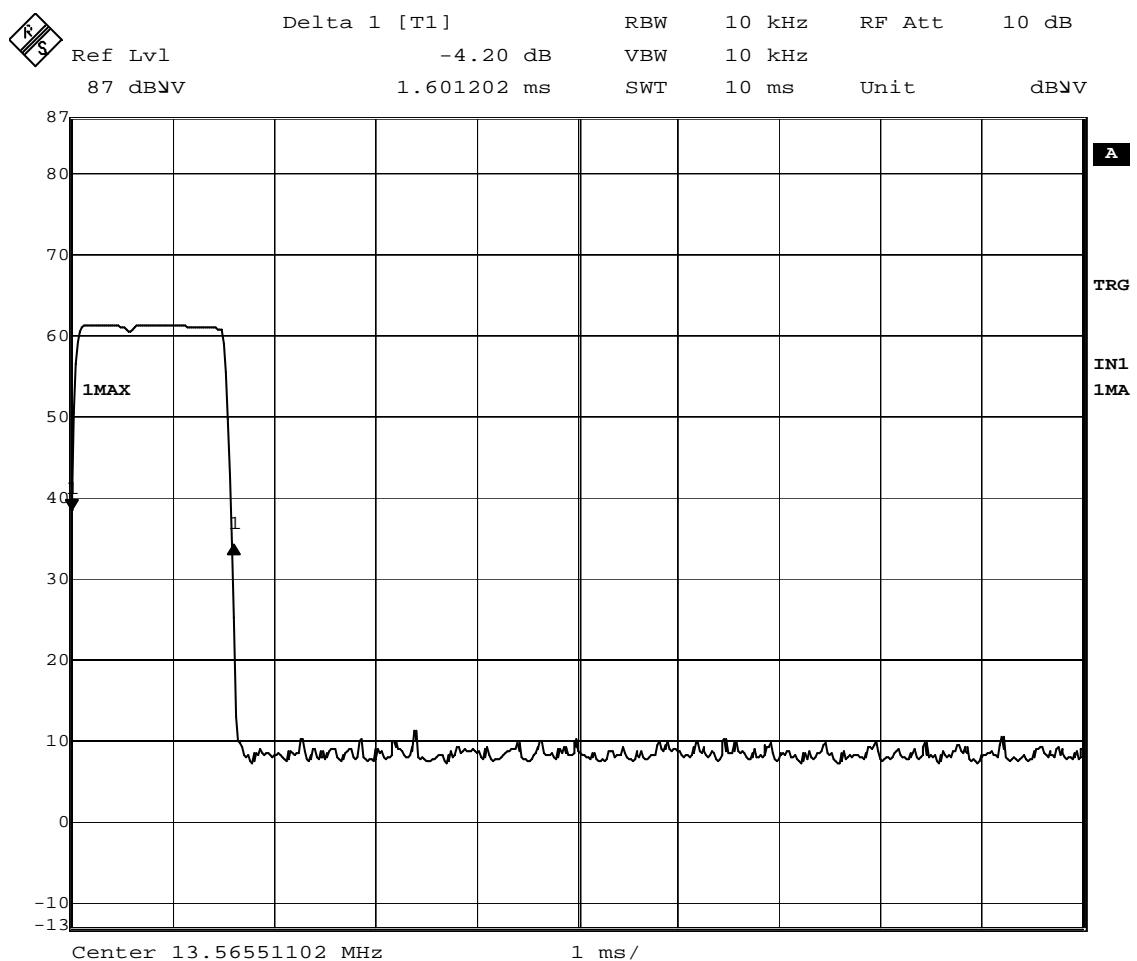


Fig.1

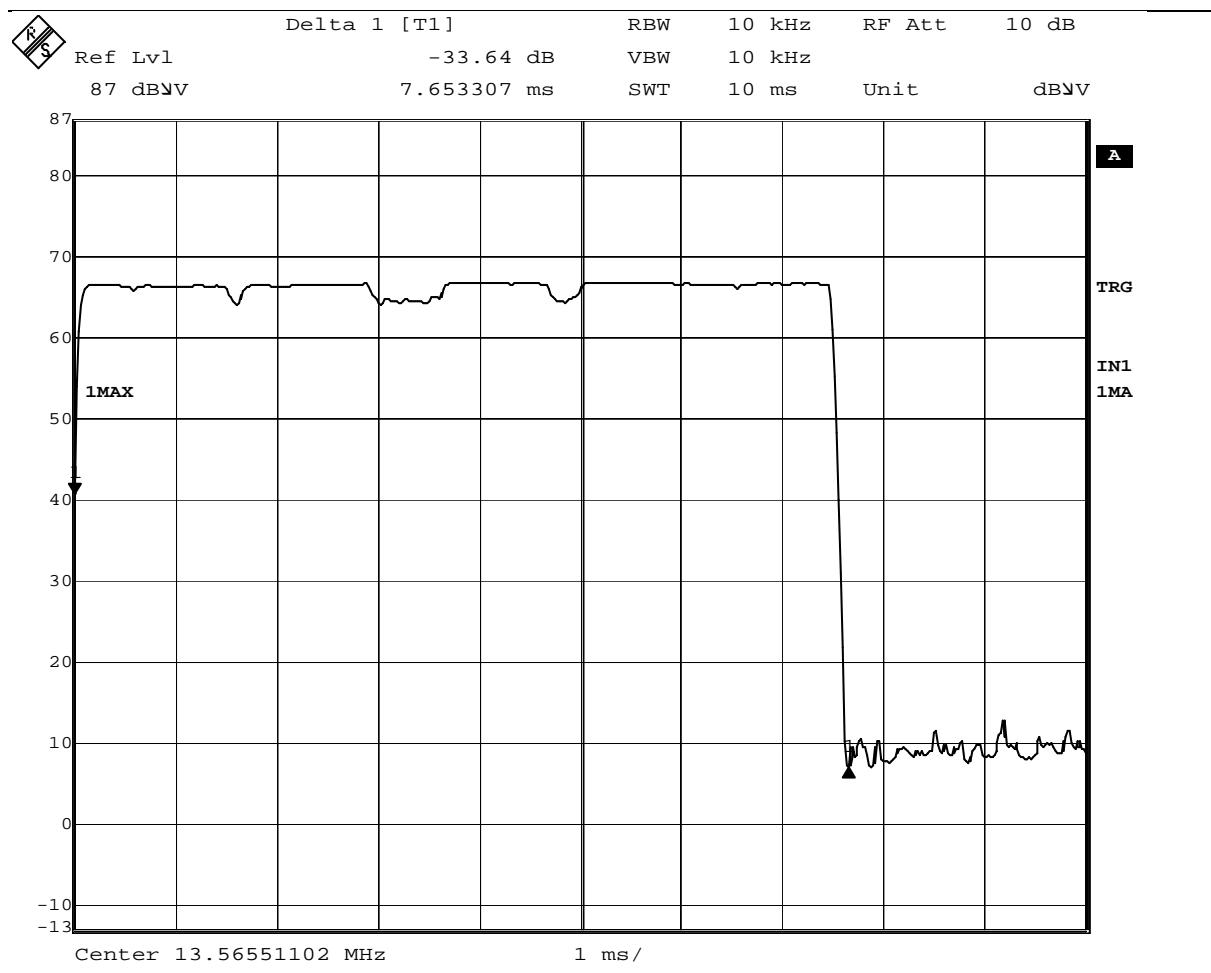


Fig.2

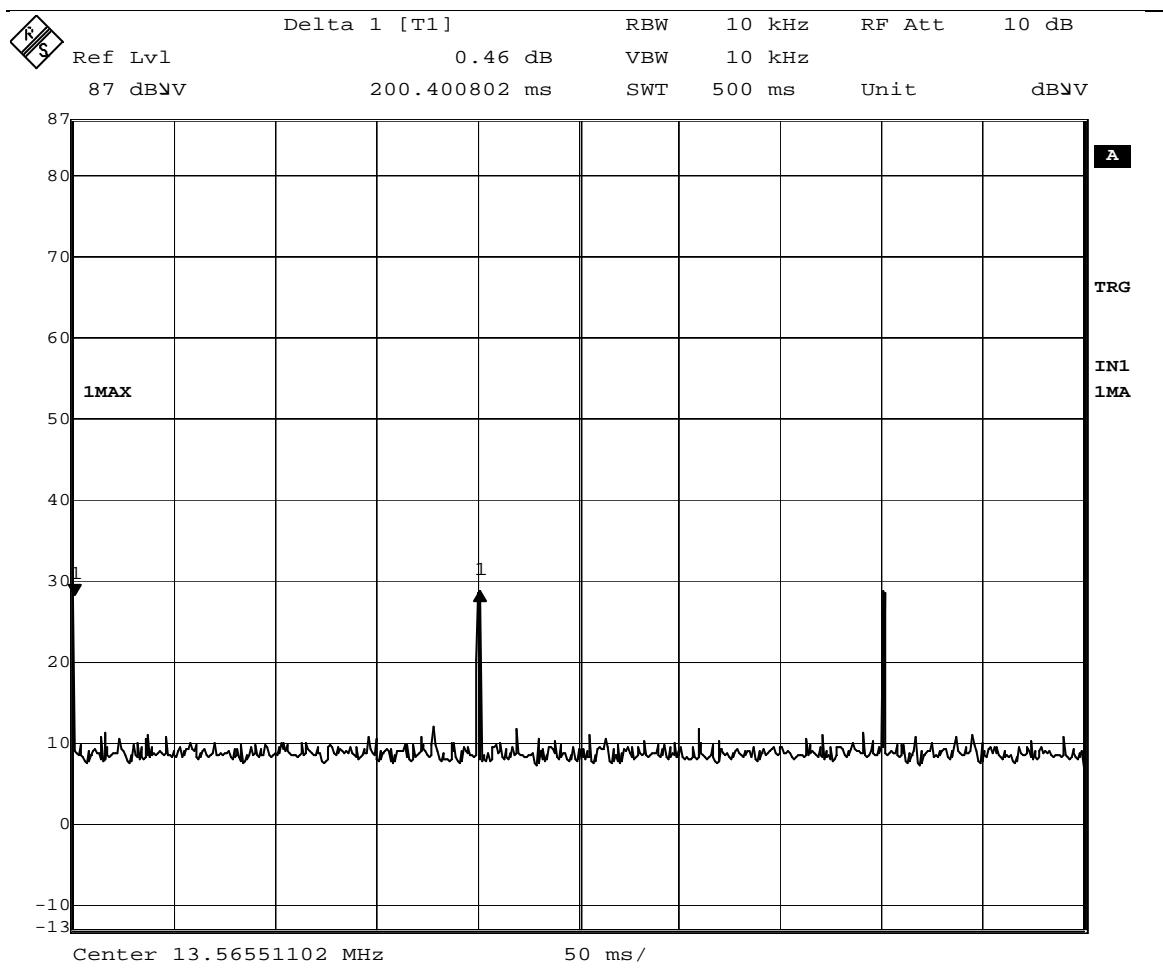


Fig. 3

5.3. Extreme conditions

5.3.1. Temperature

The measurement was performed with Model ERT 861, sample 4. The Model ERT 860 has identical high frequency part.

During the test was recorded center frequency of transmitter and shape of resonance curve.

The frequency stability of the transmitter was tested under extremal operational conditions in climatic chamber :

Results are given in Table 2, deviation from center frequency ($T = 20^{\circ}\text{C}$) is demonstrated in Fig. 5.

Temperature	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C
Center f (MHz)	13,5653	13,5654	13,5653	13,5653	13,5652	13,5652	13,5651	13,5650
Deviation from $f/T = 20^{\circ}\text{C}$ (%)	0,0007%	0,0013%	0,0008%	0,0004%	0,0000%	0,0003%	0,0009%	0,0011%

Table 2

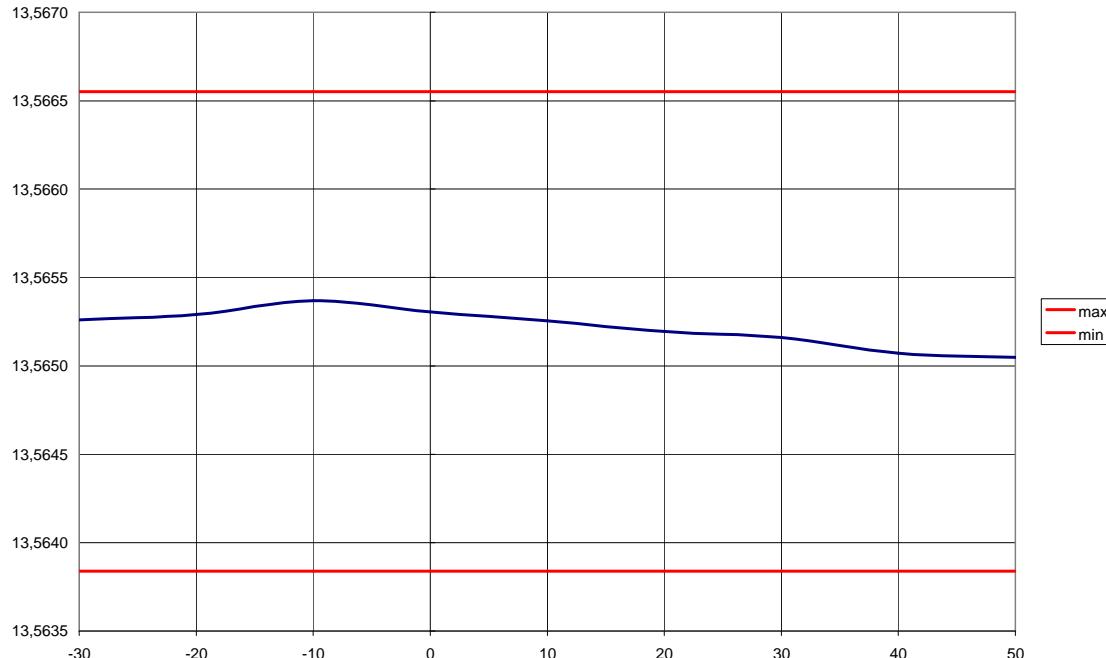


Fig. 5

Temperature stability is below specified limit of $\pm 0,01\%$.

5.4.2 Feeding voltage

Voltage : 12V , 24 V , 35 V both AC and DC

The measurement was performed with Model ERT 861, sample 1. The Model ERT 861 has identical high frequency part.

The feeding voltage was applied directly on device supply input without using AC/AC or AC/DC adaptor. Results are given in Table 3 and Table 4.

Input voltage (V) AC	12	24	35
Center f (MHz)	13,565	13.565	13,565

Table 3

Input voltage (V) DC	12	24	35
Center f (MHz)	13,565	13.565	13,565

Table 4

There was found no dependence of transmitter frequency on feeding voltage.

5.4. Radiated Emission 9 kHz – 30 MHz

The measurement was performed with Model ERT 861, sample 1 (continuous transmission). Model ERT 860 has identical high frequency part.

In the frequency range $9 \text{ kHz} < f < 30 \text{ MHz}$ was used shielded loop antenna and the receiver ESIB 26 in "Analyzer mode". Data was measured for worst case configuration which resulted in highest emission level.

Measured values performed at distance $d = 10 \text{ m}$ (shielded loop antenna – EUT) , were bellow the noise level.

Therefore measurement was performed at closer distances and values calculated to $d = 30 \text{ m}$.

5.4.2 Field strength calculation

The field strength is calculated by adding the reading on the measuring receiver to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when the specified limit is related to average detector and measurements are made with peak detector).

A sample of calculation is included below :

$$E = RR + AF + CF - AG + PD + AV$$

Where

- E field strength in $\text{dB}\mu\text{V/m}$
- RR receiver reading including preamplifier in $\text{dB}\mu\text{V}$
- CF cable attenuation factor in dB
- AF antenna factor in dB/m
- AG amplifier gain in dB

Calculated values :

Factors are as follows :

- CF = 0,2 dB
- AF = 37,5 dB/m – amplifier included
- PD = 0 dB

Then, as example the measured field strength is:
 $f = 13,566 \text{ MHz}$

d	2 m
RR (dB μ V)	32,67
CF (dB)	0,2
AF (dB/m)	37,5
E (dB μ V/m)	70,37

However, the above mentioned calculations are performed by the measurement software EMC 32 (produced by Rohde&Schwarz).

Measured values are as follows :

$$f = 13,565 \text{ MHz}$$

d	2 m	3 m	4 m	5 m
E dB μ V	70,5	68,9	61,2	58,3

The detector used was PEAK

To compare with limits the 40 dB/decade extrapolation was used.

Extrapolated field strength at distance $d = 30 \text{ m}$ calculated from measuring distances 2 m, 3 m, 4 m and 5 m is :

E (dB μ V/m)	23,46	28,90	26,20	27,17

Limit according to FCC part 15.225 is at $f = 13,566 \text{ MHz}$: $E = 15,848 \mu\text{V/m}$, corresponding to $84 \text{ dB}\mu\text{V/m}$.

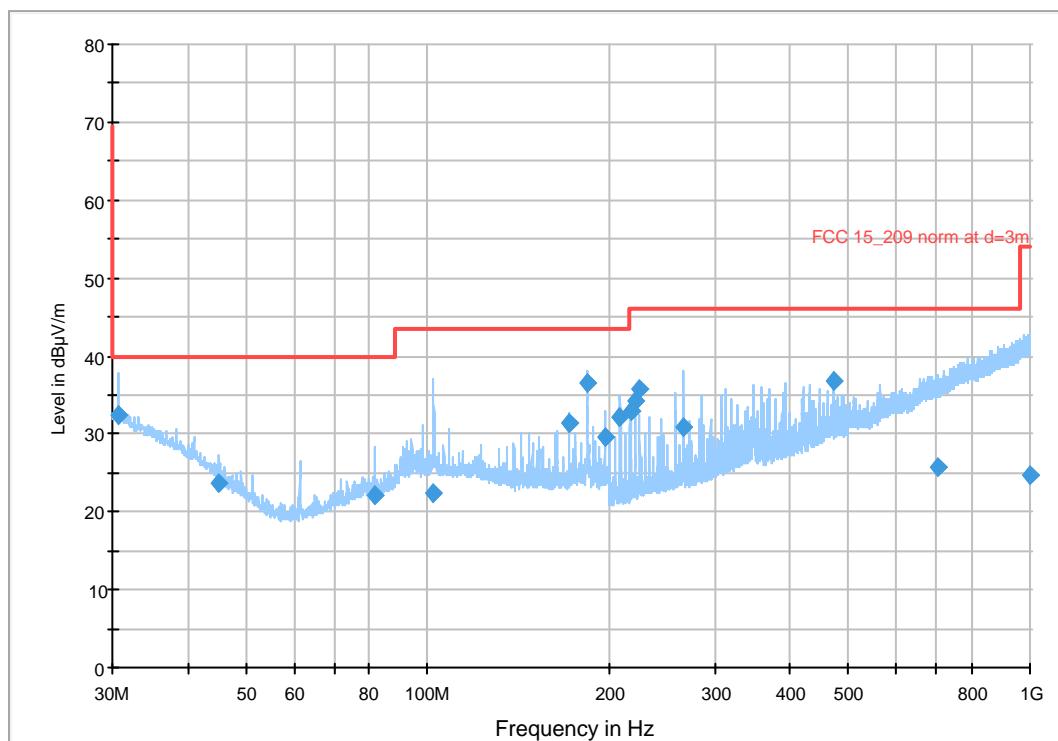
Margin to limit (extrapolated from result at $d = 3 \text{ m}$) is : **55.1 dB**

Spurious emissions of the fundamental frequency in the frequency range up to 30 MHz were not found.

5.5. Radiated Emission 30 MHz – 1 GHz

The measurement was performed with Model ERT 861, sample 1. The Model ERT 860 has identical high frequency part and no LED's. The measurement setup was ERT 861 + ET 860 voice interface. The reason for this setup to measure the "worst case radiation" because the both components can be mounted in close proximity and supplied by common line.

Radiated emissions in the frequency range $30 \text{ MHz} < f < 1000 \text{ MHz}$



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas, Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr, (dB)	Limit (dB μ V/m)	Margin (dB)
30,75	32,3	1000	120	100	V	108	20	40	-7,7
45,05	23,7	1000	120	100	V	244	12,1	40	-16,3
81,9	22,2	1000	120	300	H	86	9,4	40	-17,8
102,4	22,4	1000	120	338	H	0	10,8	40	-17,6
172,05	31,5	1000	120	100	V	86	9,4	40	-8,5
184,35	36,4	1000	120	100	V	-49	9,3	40	-3,6
196,6	29,7	1000	120	100	V	-2	9,1	40	-10,3
208,9	32,2	1000	120	100	V	-2	9,8	40	-7,8
217,1	32,8	1000	120	100	V	132	10,1	40	-7,2
221,2	34,2	1000	120	100	V	157	10,5	40	-5,8
225,3	35,7	1000	120	100	V	195	10,8	40	-4,3
266,25	30,8	1000	120	100	V	85	12,2	47	-16,2
471,05	36,9	1000	120	100	V	157	18	47	-10,1
704,5	25,8	1000	120	100	V	134	21,7	47	-21,2
997,45	24,7	1000	120	200	H	109	25,1	47	-22,3

Normative references

Limits equivalent:	FCC, Part 15.225, Part 15.209 where appropriate
Methods of Measurement equivalent:	ANSI C63.4

Test requirement

Class	B
Distance Antenna – EUT	3 m
Frequency range	30 MHz - 1000 MHz

Place of measurement

- Semi anechoic chamber Intertek Germany PM KF 1150.
- Open Area Test Site

Measurement devices

Measurement device	Manufacturer	Type	SN	Asset No.	Last Calibr. at	Inter-val
<input checked="" type="checkbox"/> Test receiver, 20Hz-26GHz	ESIB26	Rohde & Schwarz	100150	PM KF 0948	07-03	1
<input checked="" type="checkbox"/> Antenna, 9 kHz-30 MHz	MessTec	RA 30.1	960101	PM KF	07-10	2

				0875		
<input checked="" type="checkbox"/> Antenna, 30-3000 MHz	HL562	Rohde & Schwarz	100354	PM KF 1123	07-03	2
<input type="checkbox"/> Horn antenna, 1-18 GHz	Rohde & Schwarz	HF906	100188	PM KF 0947	07-04	2
<input type="checkbox"/> Horn antenna preamp.	Bonn	BLMA0118 -4A	35352	PM KF 0946	07-04	2

Emission Test results

Test requirements

passed

passed with modification

not passed

Comment:

The radiated emissions between 30 MHz and 1000 MHz are under the limit specified in FCC 15.209.

6. Test setup Photo documentation



Fig. 4 Test setup (9 kHz – 30 MHz)

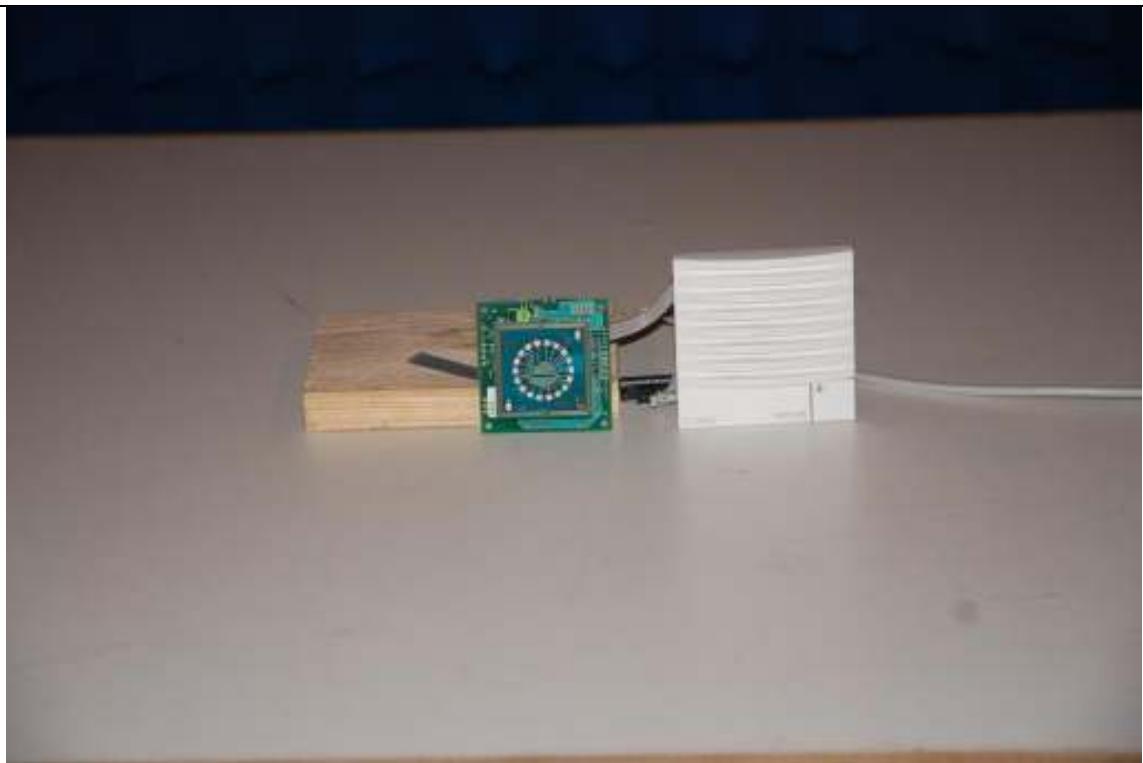


Fig. 5 Test setup front side (30 MHz – 1 GHz)

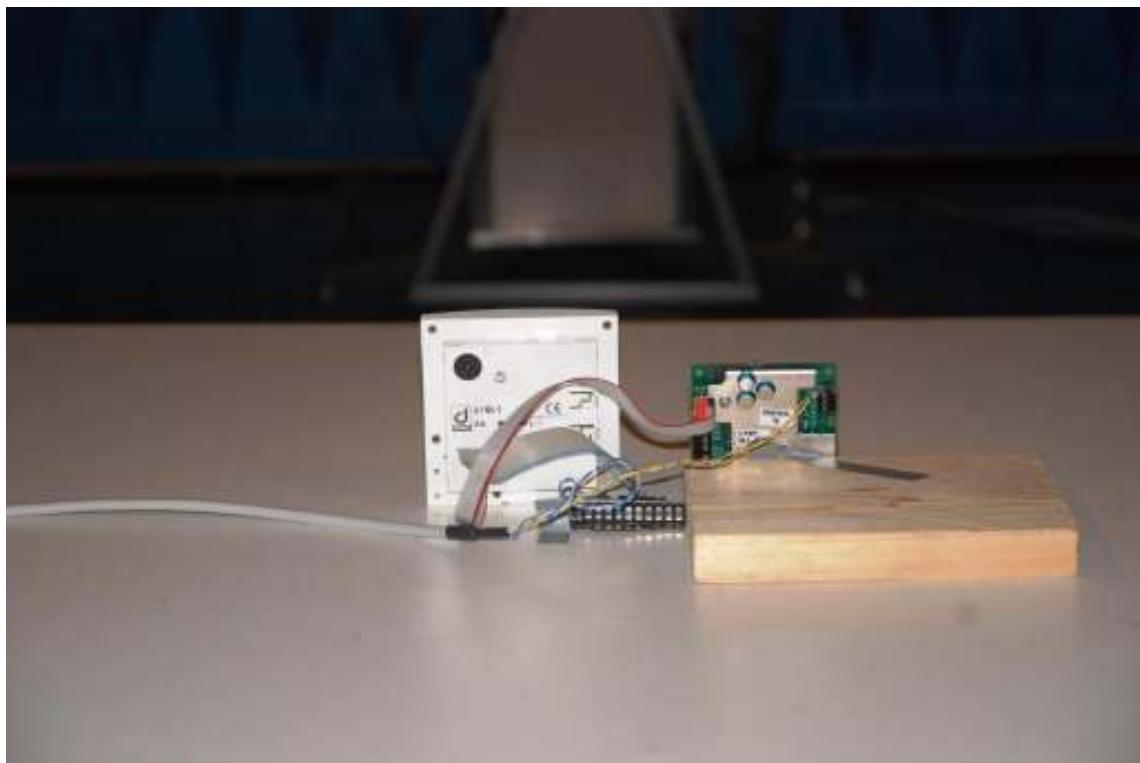


Fig. 6 Test setup rear side (30 MHz – 1 GHz)

7. Technical specification

7.1. External photos

Exhibit 1

7.2. Internal photos

Exhibit 2

7.3. Block Diagram Of The EUT

Exhibit 5

7.4. Circuit Diagram Of The layout

Exhibit 6

7.5. Installation manual

Exhibit 4

7.6. Operational description

Exhibit 7

7.7. Product Labelling

Exhibit 8

8. Modular approval requirements

Exhibit 9