

## **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**



#### **5.1.3 Applicable standard**

According to FCC Part 15C, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency

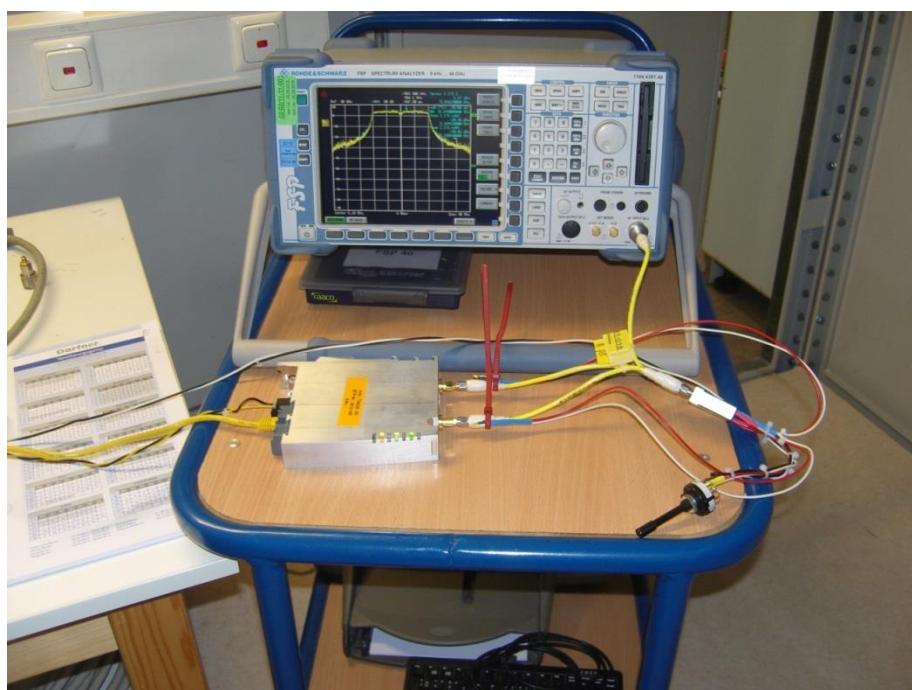
## 5.2 EBW and OBW

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

### 5.2.1 Description of the test location

Test location: AREA 4

### 5.2.2 Photo documentation of the test set-up



### 5.2.3 Applicable standard

According to FCC Part 15E, Section 15.407(a)(1):

For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.

#### 5.2.4 Description of Measurement

The bandwidth is measured conducted using a spectrum analyser and following the procedures according the OET 789033, item C. The spectrum analyser function “n-dB-down” is used to determine the bandwidth. For the OBW the analyser function “OBW” is used to determine the bandwidth. The procedures according the OET 789033, item D are followed in this case.

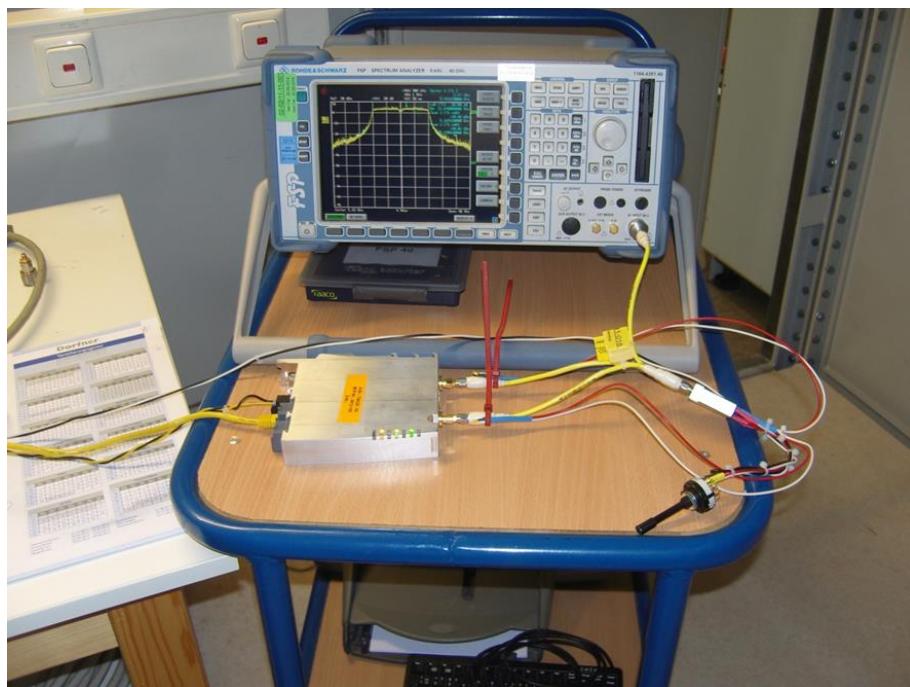
### 5.3 Maximum conducted output power

For test instruments and accessories used see section 6 Part **CPC 3**.

### 5.3.1 Description of the test location

Test location: AREA 4

### 5.3.2 Photo documentation of the test set-up



### 5.3.3 Applicable standard

According to FCC Part 15E, Section 15.407(a):

The maximum conducted output power over the frequency band of operation shall not exceed the effective values. If transmitting antennas of directional gain are greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 5.3.4 Description of Measurement

The output power is measured conducted using a spectrum analyser. The EUT has no constant duty cycle and may be smaller than 98% therefore the procedure according the OET 789033, item E g) Method SA-3 Alternative is followed. The EUT is set while measuring in TX continuous mode with a maximum duty cycle. The total output power is summed over all antenna terminals of the multiple antenna system. The insertion loss of the measurement cable and switch is taken into account with a amplitude offset while measuring.

### Determination of the min VBW:

Transmission duration			
Standard	min puls in TX continuous mode	1/T	min VBW
	(ms)	(Hz)	
801.11a	2.000	500	1 kHz
801.11n, HT20	1.850	541	1 kHz
801.11n, HT40	0.455	2198	3 kHz

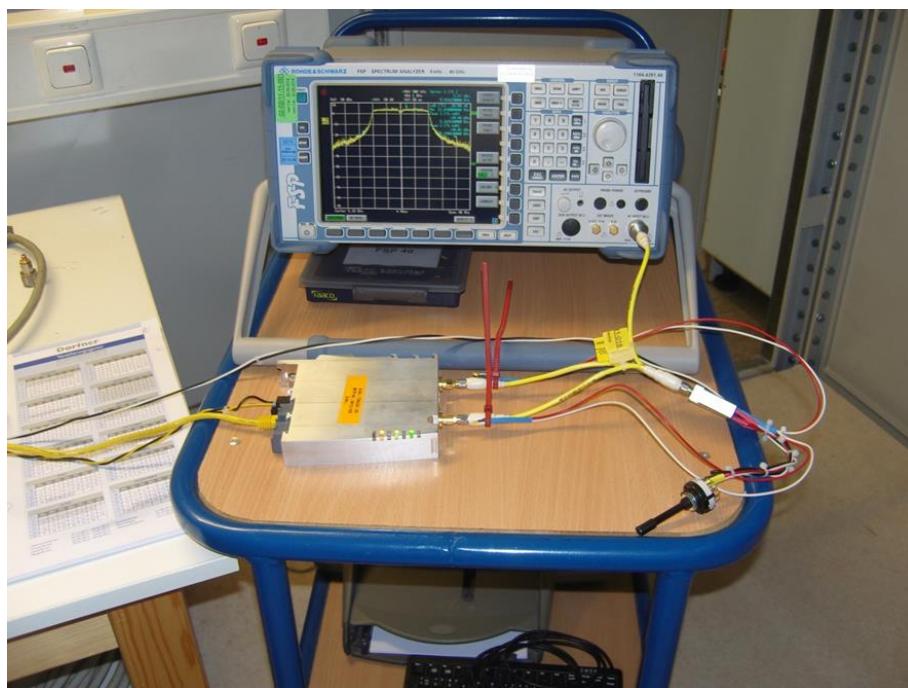
## 5.4 Peak power spectral density

For test instruments and accessories used see section 6 Part **CPC 3**.

#### 5.4.1 Description of the test location

Test location: AREA 4

#### 5.4.2 Photo documentation of the test set-up



### 5.4.3 Applicable standard

According to FCC Part 15E, Section 15.407(a):

For the defined operating bands the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than the appropriate limit in any 1 MHz band during any time interval of continuous transmission.

#### 5.4.4 Description of Measurement

The bandwidth is measured conducted using a spectrum analyser and following the procedures according the OET 789033, item F. Since the method SA-3 alternative was used for channel power the spectrum analyser settings are the same as under item F(g). The marker function “Marker to max” is used to set at peak power spectral density. For this MIMO transmitter the antenna chain 1 and chain 2 is measured and summed in linear terms over all antenna terminals of the multiple antenna system. The insertion loss of the measurement cable and switch is taken into account with a amplitude offset while measuring.

### Spectrum analyser settings:

Channel power measurement function, TX channel bandwidth equal to OBW;

Channel power measurement function, 1X channel bandwidth square 300V, RBW: 1 MHz, VBW: 1 kHz, Sweep time: auto, Detector: PK, Trace: max hold;

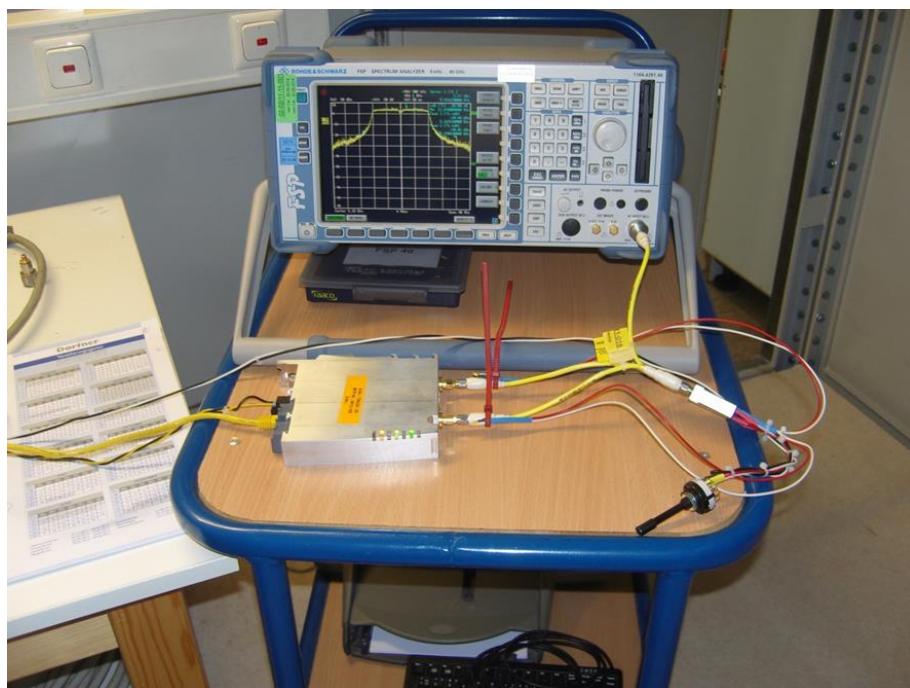
## 5.5 Peak excursion

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

### 5.5.1 Description of the test location

Test location: AREA 4

### 5.5.2 Photo documentation of the test set-up



### 5.5.3 Applicable standard

According to FCC Part 15E, Section 15.407(a)(6):

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured like before) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

#### 5.5.4 Description of Measurement

Peak excursion is measured using a spectrum analyser and following the procedures according the OET 789033, item G. The peak max spectrum is determined with the analyser setting mentioned below. The ratio between peak-max-hold spectrum and average spectrum is calculated and listed as PEX in the tables below.

### Spectrum analyser settings:

Spectrum analyser settings:  
RBW: 1 MHz VBW: 3 MHz

Sweep time: auto

## Detector: PK

Trace: max hold:

## 5.6 Undesirable emissions

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

### 5.6.1 Description of the test location

Test location:                    OATS 1  
Test location:                    Anechoic chamber 2  
Test distance:                    3 m

### 5.6.2 Photo documentation of the test set-up

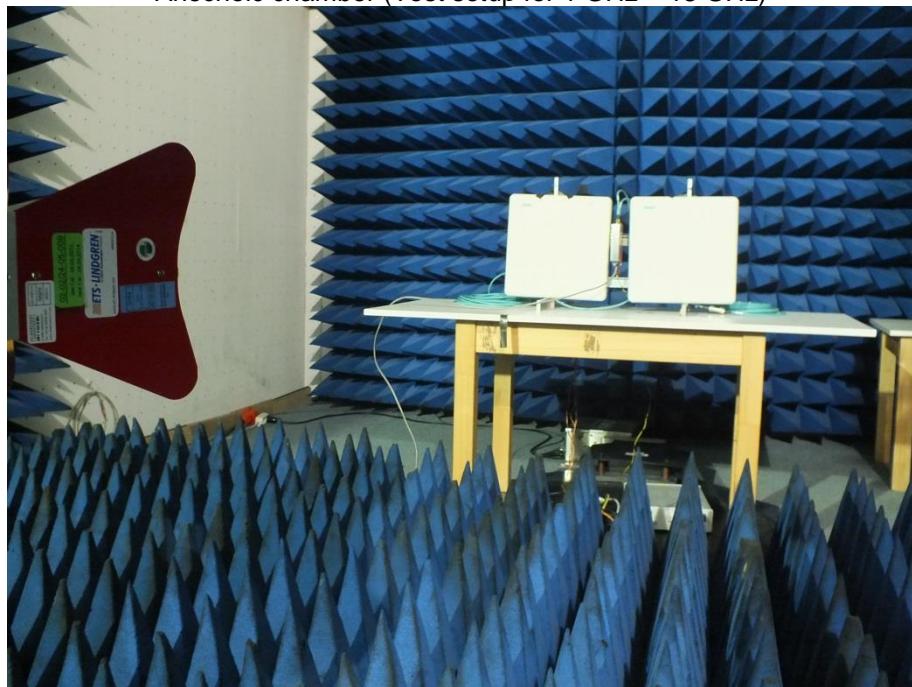
Open area test site (Test setup for 9 kHz – 30 MHz)



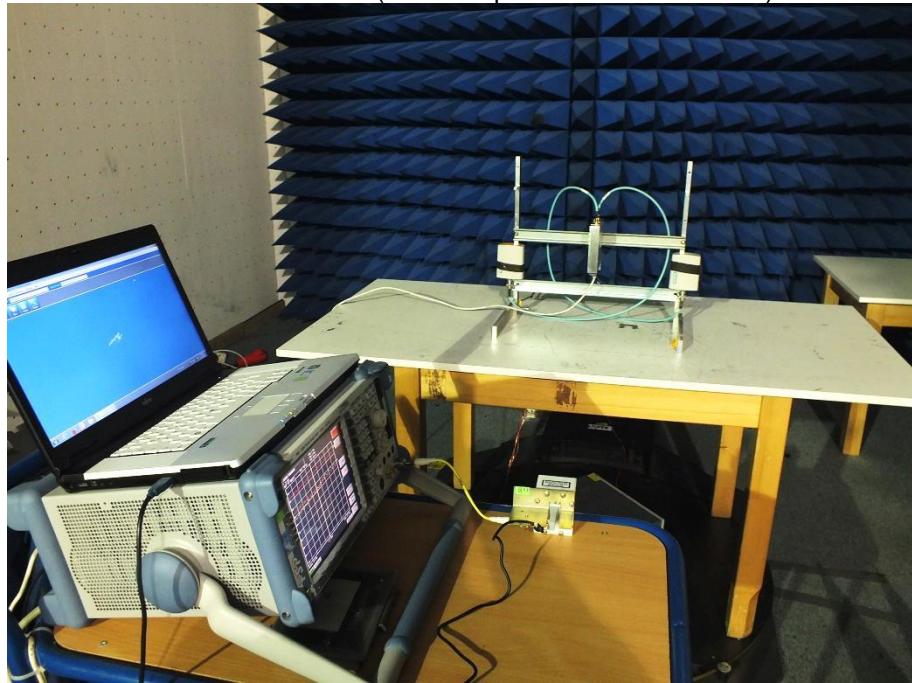
Open area test site (Test setup for 30 MHz – 1000 MHz)



Anechoic chamber (Test setup for 1 GHz – 18 GHz)



Anechoic chamber (Test setup for 18 GHz – 40 GHz)



### 5.6.3 Applicable standard

According to FCC Part 15E, Section 15.407(b):

For transmitters operating in the defined bands shall not exceed the appropriate emission limit outside of the operating bands.

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)).

## 5.7 Frequency stability

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

### 5.7.1 Description of the test location

Test location:                    AREA4

### 5.7.2 Photo documentation of the test setup



### 5.7.3 Applicable standard

According to FCC Part 15, Subpart E, Section 15.407 (g):

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

### 5.7.4 Description of Measurement

This test is performed over variations in temperature and voltage. The lowest and the highest channel in the operating frequency bands are measured at the 20 dB bandwidth under following conditions:

1. Supply voltage from 100 VAC to 120 VAC at normal temperature
2. Extreme temperature from -40°C to 60 °C at nominal voltage.

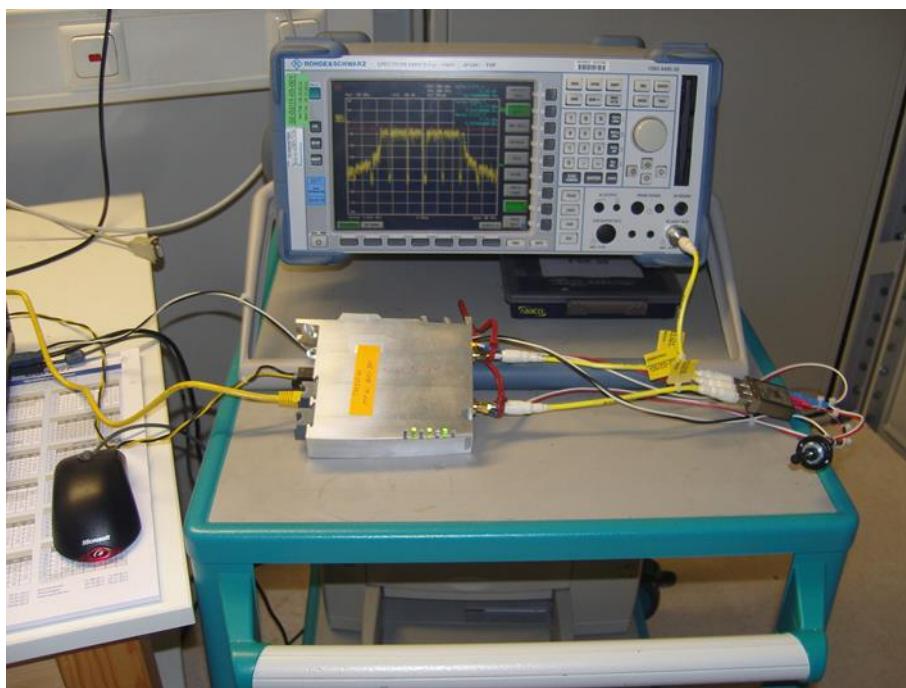
## 5.8 CDD functionality

For test instruments and accessories used see section 6 Part **CPC 3**.

### 5.8.1 Description of the test location

Test location: AREA 4

### 5.8.2 Photo documentation of the test set-up



### 5.8.3 Applicable standard

According to FCC KDB 662911 D01, accounting for directional and array gain.

#### 5.8.4 Description of Measurement

### 5.8.5 Test result

### Array gain:

The only correlated signal is sent in legacy mode. The spurious emission measurement is made radiated. Therefore it is accounted for the array gain.

### Directional gain:

The directional gain calculation for in-band measurements:

The directional gain calculation for in-band measurement. If any transmit signals are correlated with each other,

Directional gain =  $G_{ANT} + 10 \log (N_{ANT})$  dBi

If all transmit signals are completely uncorrelated with each other,

Directional gain =  $G_{\text{ANT}}$

The directional gain appears when the transmission rate fall back from dual stream transmission to one stream or legacy mode. In this case the EUT reduce the output power 3 dB in order to be at the same as before.

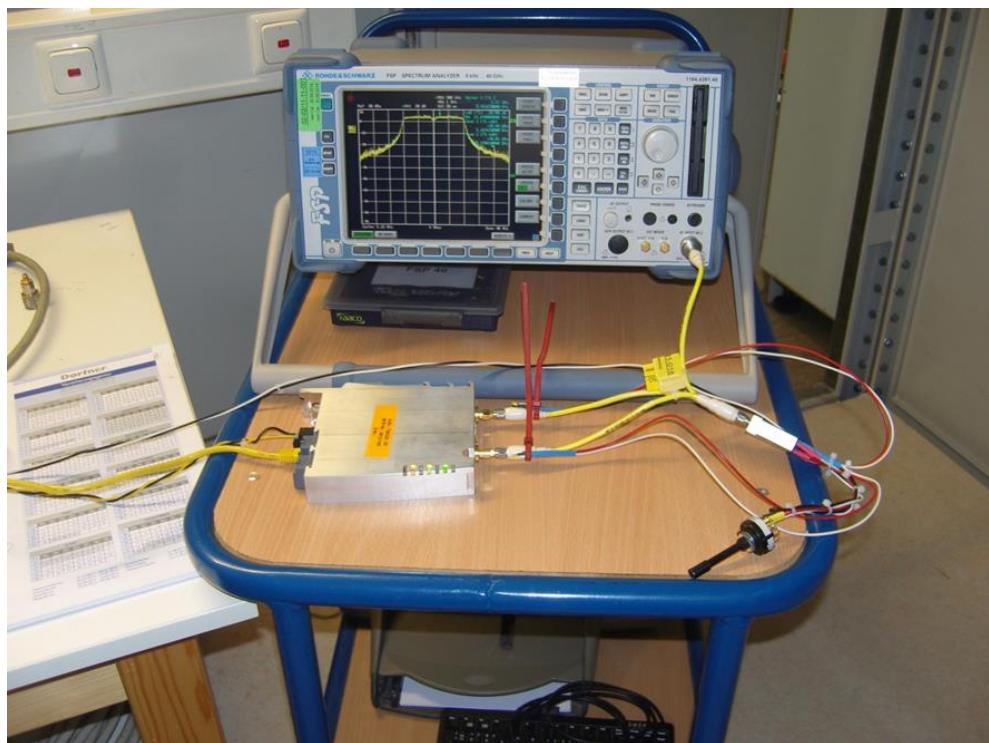
## 5.9 Maximum permissible exposure (MPE)

For test instruments and accessories used see section 6 Part **CPC 3**.

### 5.9.1 Description of the test location

Test location:                    AREA4

### 5.9.2 Photo documentation of the test set-up



### 5.9.3 Applicable standard

According to FCC Part 15, Section 15.407(f):

U-NII devices are subject to the radio frequency radiation exposure requirements specified in Section 1.1307(b), 2.1091 and 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. The test methods used comply with ANSI/IEEE C95.1-2005, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".

### 5.9.4 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, which is a far field assumption and the known maximum gain of the antenna, the maximum MPE at a defined distance away from the product, can be calculated.

Friis transmission formula:

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

Where:

$P_d$  = power density in  $\text{mW/cm}^2$

$P_{out}$  = output power to antenna in mW

$G$  = gain of antenna (linear scale)

$r$  = distance between antenna and observation point (cm)

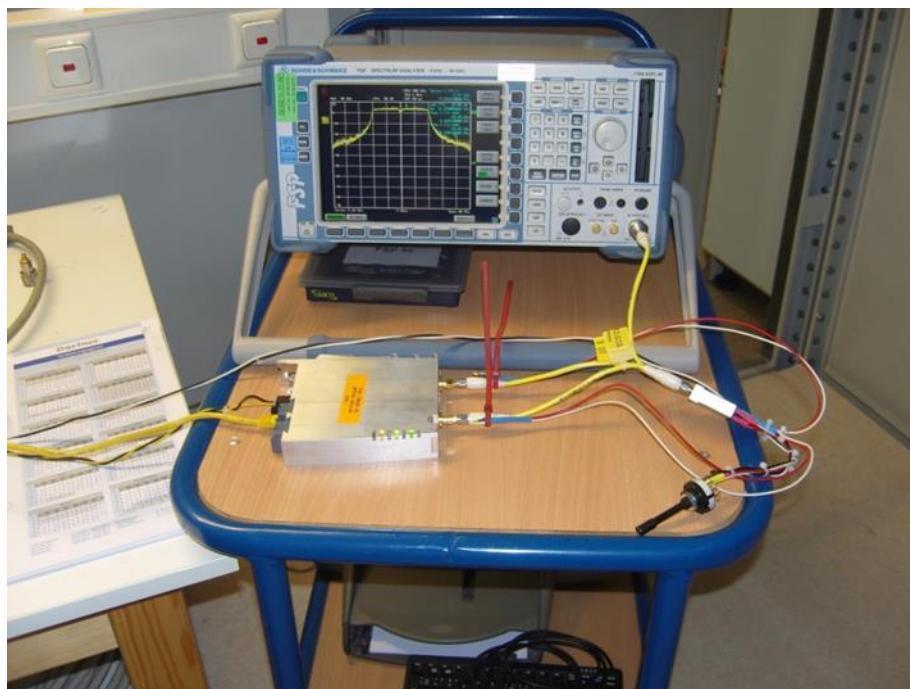
## 5.12 Band requirement 5150 – 5250 MHz

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

### 5.12.1 Description of the test location

Test location:                    AREA4

### 5.12.2 Photo documentation of the test setup



### 5.12.3 Applicable standard

According to FCC Part 15, Subpart C, Section 15.215 (c):

Devices must be designed to ensure that the 20 dB bandwidth of the emission is fully contained within the frequency band designated.

### 5.12.4 Description of Measurement

The spectrum analyser function “n-dB-down” is used to determine the 20 dB EBW.

Spectrum analyser settings:

RBW: 100 kHz,    VBW: 300 kHz,    Sweep: Auto,    Detector: max peak,    Trace mode: max hold;