

## 1 BAND-EDGE-COMPLIANCE (WITH ANTENNAS HAVING A NONUNIQUE ANTENNA CONNECTOR)

## 1.1 METHOD OF MEASUREMENT (BAND-EDGE-COMPLIANCE)

For the methods of measurements please refer to document "F082155E01" chapter 5.4.1.

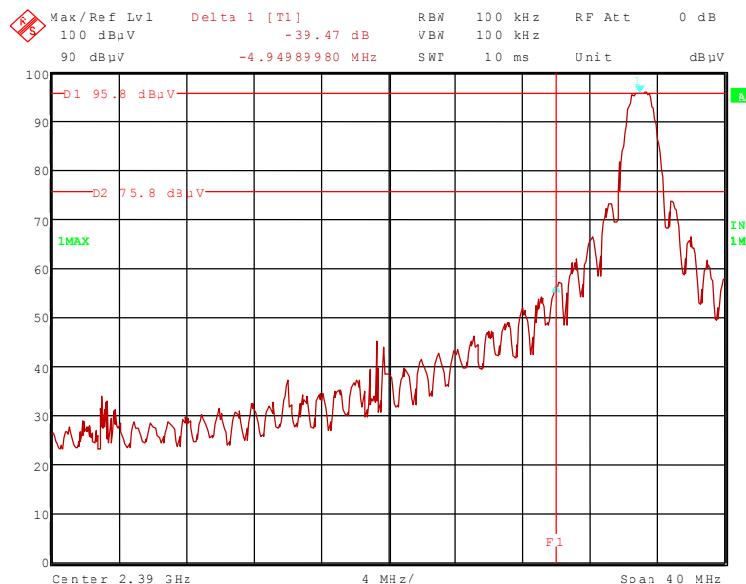
### 1.1.1 TEST RESULT (BAND-EDGE COMPLIANCE) with external patch antenna

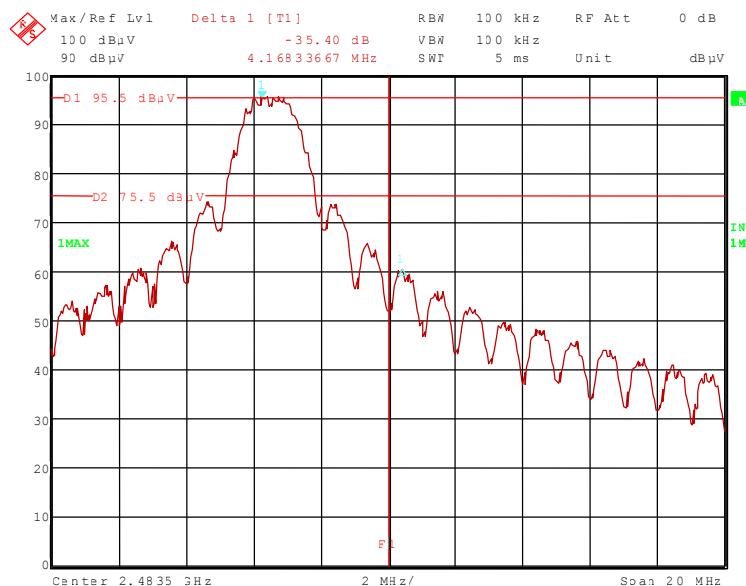
Ambient temperature	21 °C	Relative humidity	52 %
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Remark:

This test was carried out with the SPA 2400/75/8/0/V antenna, because pretests have shown that this antenna causes the highest spurious emissions of all patch antennas in question.

### 82155\_26.wmf (radiated band-edge compliance, lower band edge):



82155\_25.wmf (radiated band-edge compliance, upper band edge):


The plots before are showing the radiated band-edge compliance for the upper and lower band-edge. The display line 1 (D1) in these plots represents the highest level within the assigned frequency band. The display line 2 (D2) represents the 20 dB offset to this highest level and shows the compliance with FCC 47 CFR Part 15.247 (d). The frequency line 1 (F1) shows the edge of the assigned frequency.

Band-edge compliance (lower band edge)										
Result measured with the peak detector:										
Frequency	Corr. value	Limit	Margin	Readings	Antenna factor	Preamp	Cable loss	Height	Pol.	Restr. Band
GHz	dBμV/m	dBμV/m	dB	dBμV	1/m	dB	dB	cm		
2405	106.9	-	-	100.9	28.8	26.5	3.7	150	Vert.	-
2400	67.4	86.9	19.5	61.4	28.8	26.5	3.7	150	Vert.	No
Result measured with the average detector:										
Frequency	Corr. value	Limit	Margin	Readings	Antenna factor	Preamp	Cable loss	Height	Pol.	Restr. Band
GHz	dBμV/m	dBμV/m	dB	dBμV	1/m	dB	dB	cm		
2405	87.5	-	-	81.5	28.8	26.5	3.7	150	Vert.	-
2400	59.1	67.5	8.4	53.1	28.8	26.5	3.7	150	Vert.	No
Measurement uncertainty							+2.2 dB / -3.6 dB			

Band-edge compliance (upper band edge)										
Result measured with the peak detector:										
Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2480	106.2	-	-	99.9	29.0	26.5	3.8	150	Vert.	-
2484	70.8	74.0	3.2	64.5	29.0	26.5	3.8	150	Vert.	Yes
Result measured with the average detector:										
Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2480	86.9	-	-	80.6	29.0	26.5	3.8	150	Vert.	-
2484	51.5	54.0	2.5	45.2	29.0	26.5	3.8	150	Vert.	Yes
Measurement uncertainty								+2.2 dB / -3.6 dB		

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 37, 39, 43, 46, 49 – 51, 54

## 2 RADIATED EMISSIONS (WITH ANTENNAS HAVING A NONUNIQUE ANTENNA CONNECTOR)

### 2.1 METHOD OF MEASUREMENT (RADIATED EMISSIONS)

For the methods of measurements please refer to document "F082155E01" chapter 5.5.1.

#### 2.1.1 PRELIMINARY MEASUREMENT (1 GHz to 25 GHz) WITH EXTERNAL PATCH ANTENNA (SPA 2400/75/8/0/V)

Ambient temperature	21 °C	Relative humidity	52 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

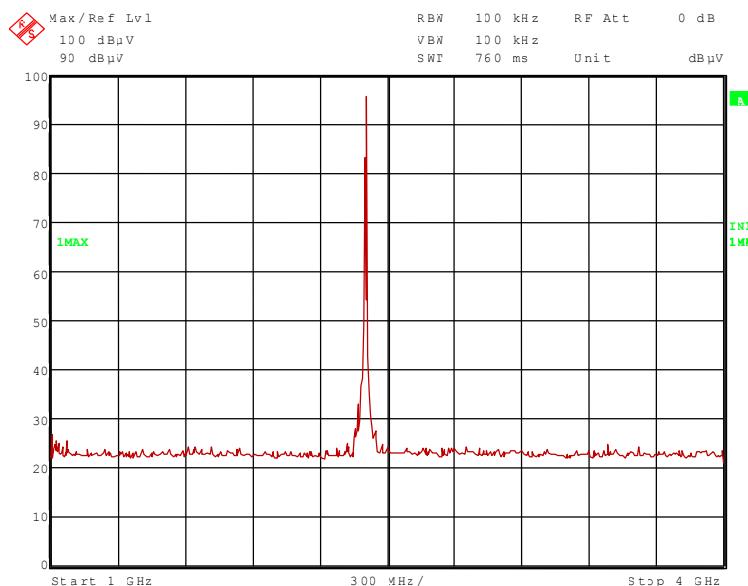
Test record: Where not otherwise stated the test was carried out in test mode 2 of the EUT, because there was no difference to the other test modes. All results are shown in the following.

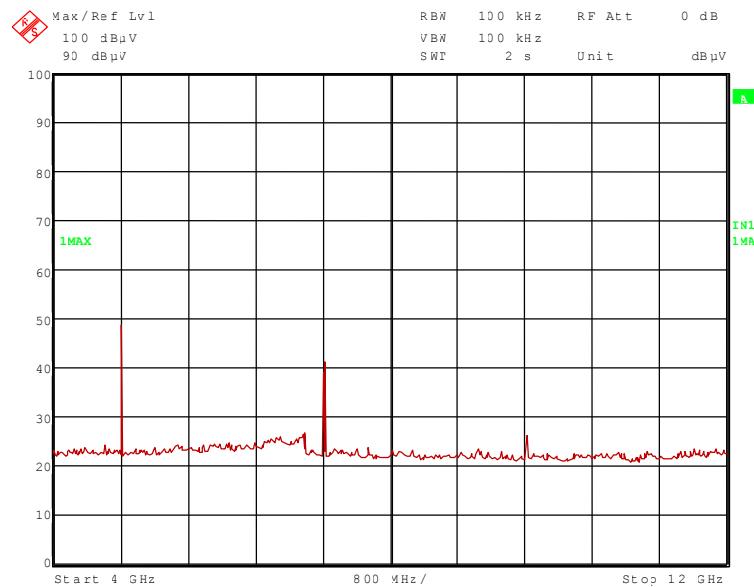
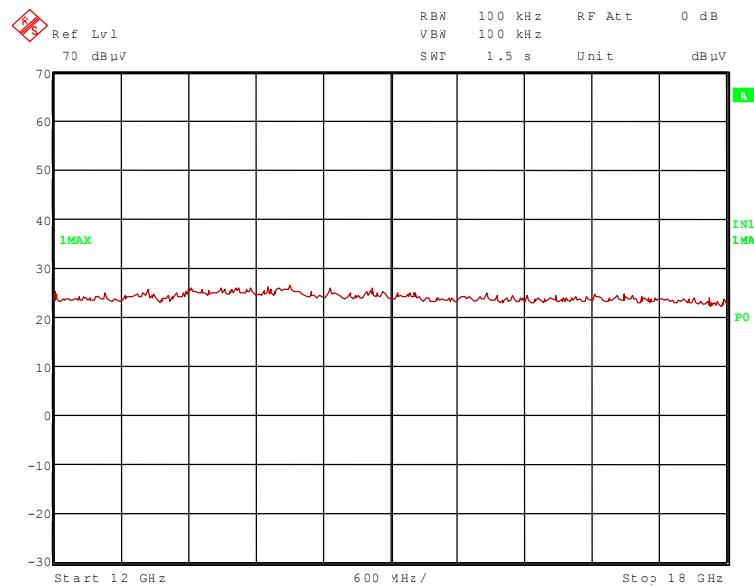
Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Remark: This test was carried out with the SPA2400/75/8/0/V antenna, because additional pretests has shown that this antenna causes the highest spurious emissions of all patch antennas in question.

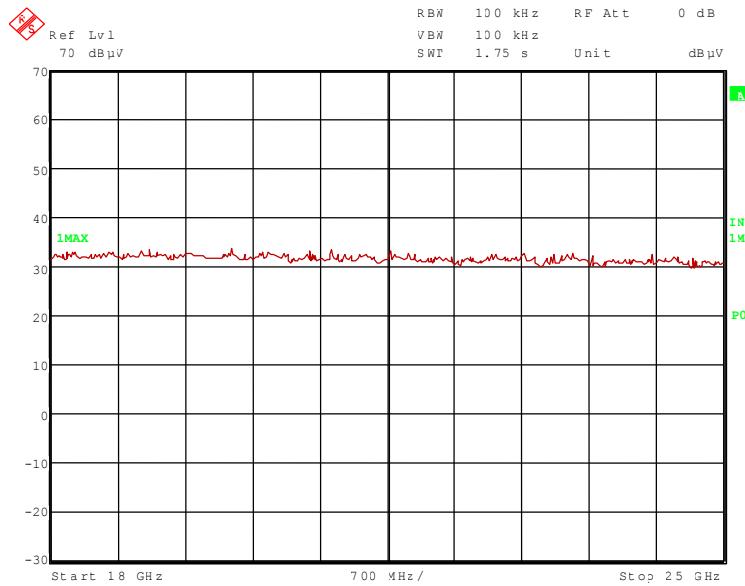
#### Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

#### 82155\_21.wmf (1 GHz to 4 GHz) with SPA 2400/75/8/0/V antenna:



82155\_22.wmf (4 GHz to 12 GHz) with SPA 2400/75/8/0/V antenna:

82155\_64.wmf (12 GHz to 18 GHz) with SPA 2400/75/8/0/V antenna:


82155\_65.wmf (18 GHz to 25 GHz) with SPA 2400/75/8/0/V antenna:



The following frequency was found inside the restricted bands during the preliminary radiated emission test:

- 4.810 GHz.

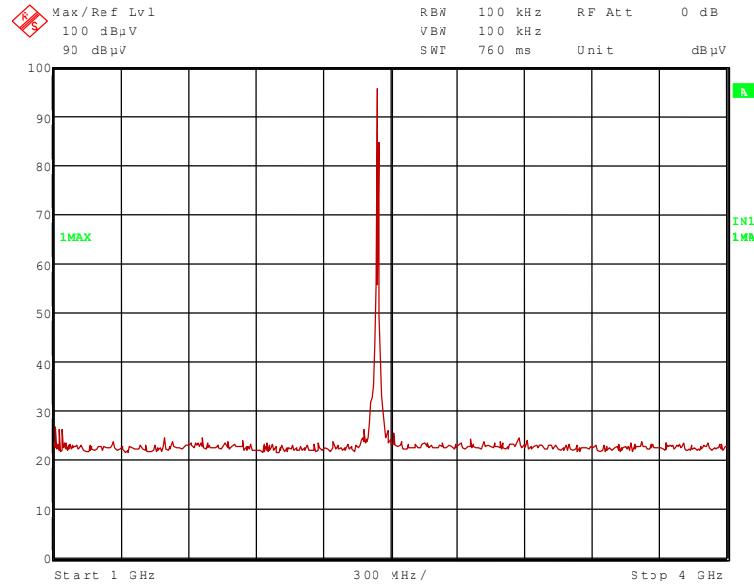
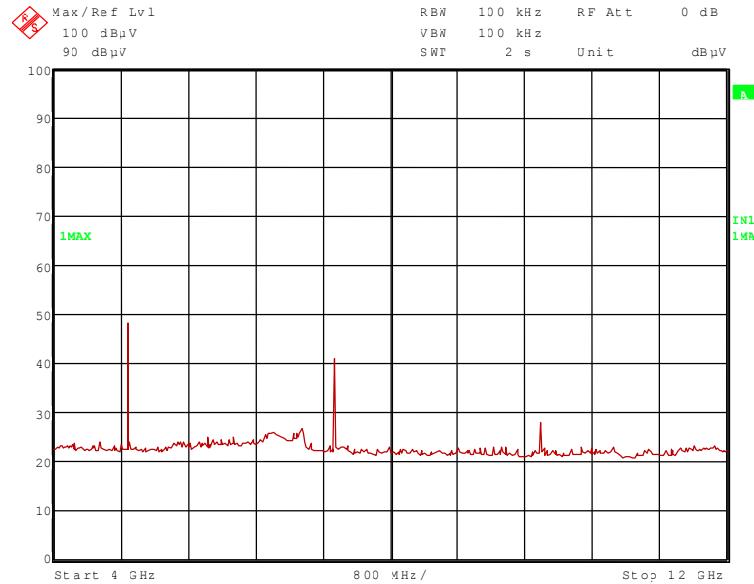
The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

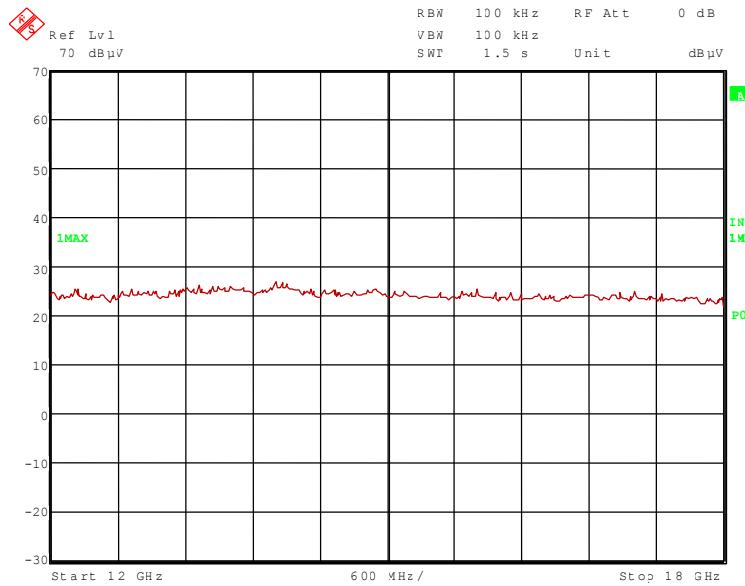
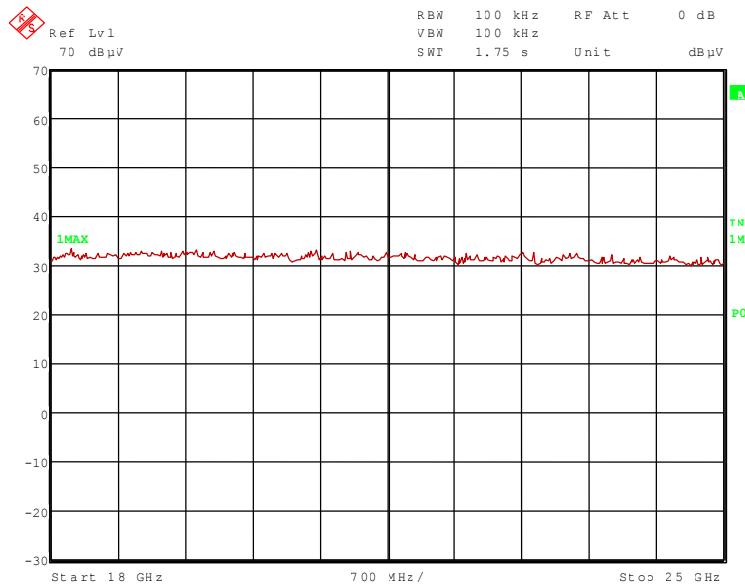
- 2.405 GHz, 7.215 GHz and 9.620 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

**TEST EQUIPMENT USED FOR THE TEST:**

29, 31 – 37, 39, 43, 44, 46, 49 – 51, 54, 58

**Transmitter operates at the middle of the assigned frequency band (operation mode 2)**
82155\_19.wmf (1 GHz to 4 GHz) with SPA 2400/75/8/0/V antenna:

82155\_20.wmf (4 GHz to 12 GHz) with SPA 2400/75/8/0/V antenna:


82155\_63.wmf (12 GHz to 18 GHz) with SPA 2400/75/8/0/V antenna:

82155\_62.wmf (18 GHz to 25 GHz) with SPA 2400/75/8/0/V antenna:


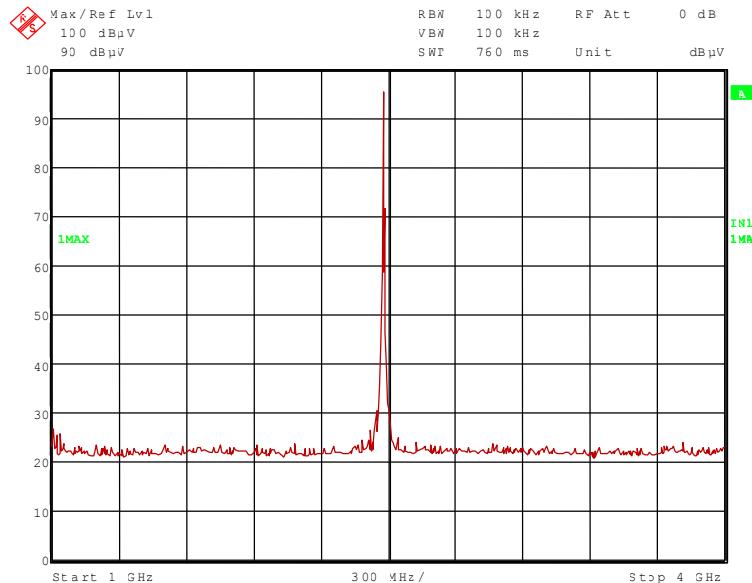
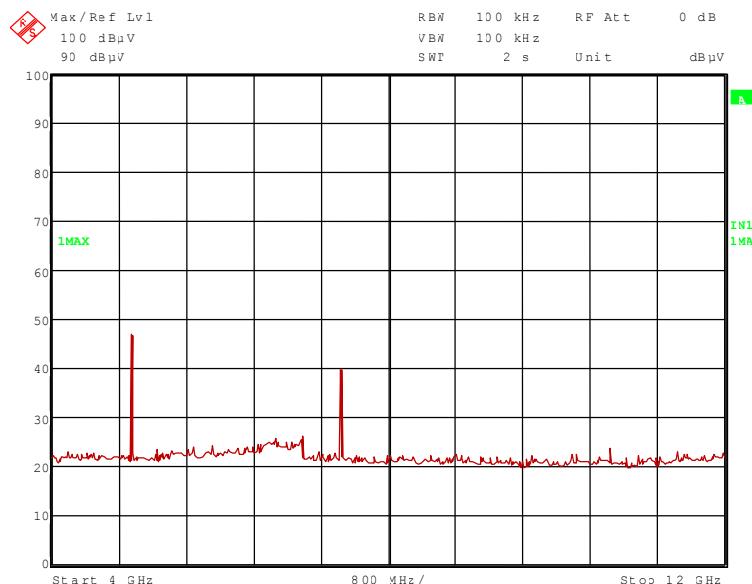
The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

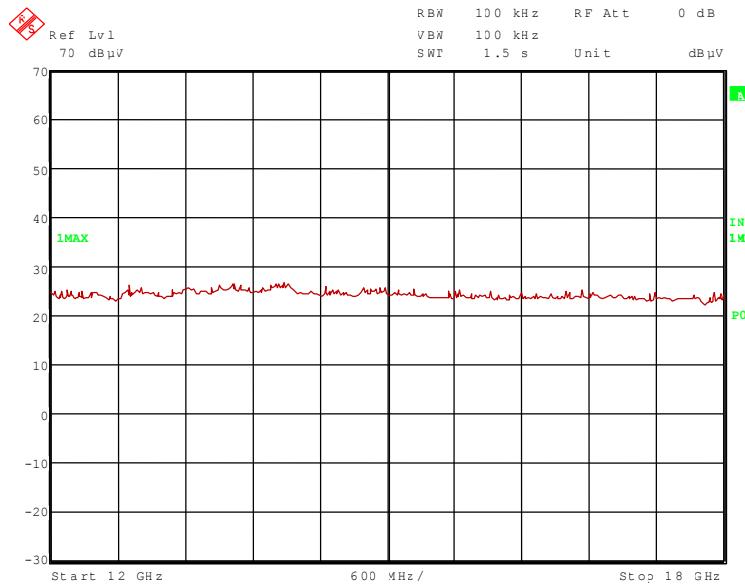
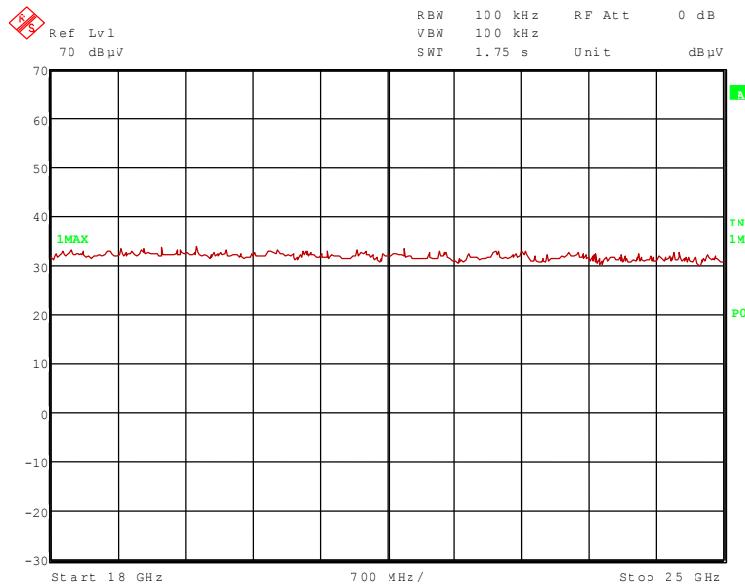
- 4.890 GHz and 7.335 GHz.

The following frequencies were found outside the restricted bands during the preliminary radiated emission test:

- 2.445 GHz and 9.780 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

**Transmitter operates at the upper end of the assigned frequency band (operation mode 3)**
82155\_24.wmf (1 GHz to 4 GHz) with SPA 2400/75/8/0/V antenna:

82155\_23.wmf (4 GHz to 12 GHz) with SPA 2400/75/8/0/V antenna:


82155\_60.wmf (12 GHz to 18 GHz) with SPA 2400/75/8/0/V antenna:

82155\_61.wmf (18 GHz to 25 GHz) with SPA 2400/75/8/0/V antenna:


The following frequencies were found inside the restricted bands during the preliminary radiated emission test:

- 4.960 GHz and 7.440 GHz.

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 2.480 GHz.

These frequencies have to be measured in a final measurement. The results were presented in the following.

## 2.1.2 FINAL MEASUREMENT (1 GHz to 25 GHz) WITH EXTERNAL PATCH ANTENNA (SPA 2400/75/8/0/V)

Ambient temperature	21 °C	Relative humidity	52 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Supply voltage: During all measurements the EUT was supplied with 5.0 V DC via the carrier board.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

### Transmitter operates at the lower end of the assigned frequency band (operation mode 1)

#### **Result measured with the peak detector:**

Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.405	106.9	-	-	100.9	28.8	26.5	3.7	150	Vert.	-
4.810	71.1	74.0	2.9	57.8	33.7	25.7	5.3	150	Vert.	Yes
7.215	68.0	86.9	18.9	48.9	36.9	24.6	6.8	150	Vert.	No
9.620	58.3	86.9	28.6	36.1	38.3	23.9	7.8	150	Vert.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

#### **Result measured with the average detector:**

Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.405	87.5	-	-	81.5	28.8	26.5	3.7	150	Vert.	-
4.810	49.3	54.0	4.7	36	33.7	25.7	5.3	150	Vert.	Yes
7.215	46.8	67.5	20.7	27.7	36.9	24.6	6.8	150	Vert.	No
9.620	41.5	67.5	26.0	19.3	38.3	23.9	7.8	150	Vert.	No
Measurement uncertainty						+2.2 dB / -3.6 dB				

**Transmitter operates at the middle of the assigned frequency band (operation mode 2)**
**Result measured with the peak detector:**

Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height Cm	Pol.	Restr. Band
2.445	106.5	-	-	100.4	28.9	26.5	3.7	150	Vert.	-
4.890	69.7	74.0	4.3	56.2	33.9	25.7	5.3	150	Vert.	Yes
7.335	66.5	74.0	7.5	47.2	37.1	24.6	6.8	150	Vert.	Yes
9.780	54.0	86.5	32.5	31.5	38.4	23.9	8.0	150	Vert.	No
Measurement uncertainty									+2.2 dB / -3.6 dB	

**Result measured with the average detector:**

Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height Cm	Pol.	Restr. Band
2.445	87.4	-	-	81.3	28.9	26.5	3.7	150	Vert.	-
4.890	48.0	54.0	6.0	34.5	33.9	25.7	5.3	150	Vert.	Yes
7.335	45.7	54.0	8.3	26.4	37.1	24.6	6.8	150	Vert.	Yes
9.780	40.7	67.4	26.7	18.2	38.4	23.9	8.0	150	Vert.	No
Measurement uncertainty									+2.2 dB / -3.6 dB	

**Transmitter operates at the upper end of the assigned frequency band (operation mode 3)**
**Result measured with the peak detector:**

Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	106.2	-	-	99.9	29.0	26.5	3.8	150	Vert.	-
4.960	67.5	74.0	6.5	53.8	34.0	25.6	5.3	150	Vert.	Yes
7.440	66.3	74.0	7.7	46.7	37.3	24.5	6.8	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

**Result measured with the average detector:**

Frequency GHz	Corr. value dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Readings dB $\mu$ V	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
2.480	86.9	-	-	80.6	29.0	26.5	3.8	150	Vert.	-
4.960	46.3	54.0	7.7	32.6	34.0	25.6	5.3	150	Vert.	Yes
7.440	45.9	54.0	8.1	26.3	37.3	24.5	6.8	150	Vert.	Yes
Measurement uncertainty						+2.2 dB / -3.6 dB				

Test: Passed

**TEST EQUIPMENT USED FOR THE TEST:**

29, 31 – 37, 39, 43, 44, 46, 49 – 51, 54, 58