

FCC ID:SRD50010

# EMI - TEST REPORT

- FCC Part 15.247 -



<b>Test Report No. :</b>	<b>T35019-00-06HU</b>	18. May 2011 Date of issue
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**Type / Model Name** : RTR-322

**Product Description** : Wireless Thermo Recorder

**Applicant** : T&D CORPORATION

Address : 817-1 Shimadachi Matsumoto City

NAGANO 390-0852 JAPAN

**Manufacturer** : T&D CORPORATION

Address : 817-1 Shimadachi Matsumoto City

NAGANO 390-0852 JAPAN

**Licence holder** : T&D CORPORATION

Address : 817-1 Shimadachi Matsumoto City

NAGANO 390-0852 JAPAN

<b>Test Result</b> according to the standards listed in clause 1 test standards:	<b>POSITIVE</b>
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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.

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## **1 TEST STANDARDS**

The tests were performed according to following standards:

### **FCC Rules and Regulations Part 15, Subpart A - General (October, 2010)**

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 C - Intentional Radiators (October, 2010)**

Part 15, Subpart C, Section 15.203	Antenna requirement
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 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

### **FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969**

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

### **OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.**

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.
ANSI C95.1:1992	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005 EN 55022: 2006	Information technology equipment

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## 2 SUMMARY

### GENERAL REMARKS:

The EuT is battery powered. After each measurement the battery voltage was checked via Multimeter. After the third measurement the battery was replaced by a new one.

To activate the test mode of the RTR-322 unit it is necessary to hold continually switch 1 and then connecting the power (inserting a battery).

The conducted tests were performed with a modified test sample with antenna connector cable.

The radiated tests were performed with an original sample.

The EuT is declared as Class B digital device.

### FINAL ASSESSMENT:

The equipment under test **fulfills** the EMC requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 07. March 2011

Testing concluded on : 06. April 2011

Checked by:

Tested by:

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Harald Buchwald  
Dipl. Ing.(FH)  
Manager: EMC

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Markus Huber

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### 3 EQUIPMENT UNDER TEST

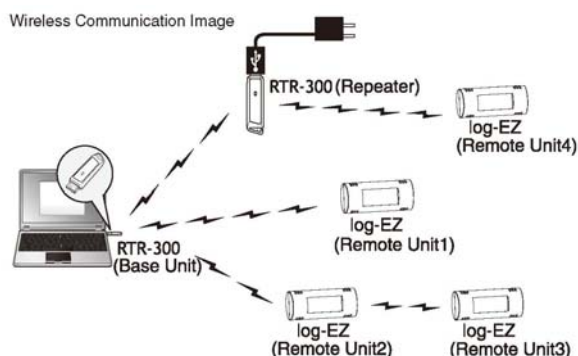
#### 3.1 Photo documentation of the EUT – Detailed photos see attachment A2

#### 3.2 Power supply system utilised

Power supply voltage : 1.5 V / DC (Battery Size AA)

#### 3.3 Short description of the equipment under test (EUT)

The EUT is a wireless thermo recorder. The RTR-322 (log-EZ) measures and records temperature and humidity of the Location where it is placed. The measured datas can be downloaded via RTR-300 unit.



Number of tested samples: 1  
Serial number: Prototype

#### EUT operation mode:

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

- TX mode at CH 0 (2433.00 MHz), CH 123 (2457.593994156MHz), CH 247 (2482.387939484MHz)

- RX mode at CH 0 (2433.00 MHz), CH 123 (2457.593994156MHz), CH 247 (2482.387939484MHz)

- Device Idle (Radio Off)

#### EUT configuration:

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

- \_\_\_\_\_ Model : \_\_\_\_\_
- \_\_\_\_\_ Model : \_\_\_\_\_
- \_\_\_\_\_ Model : \_\_\_\_\_
- \_\_\_\_\_ Model : \_\_\_\_\_
- \_\_\_\_\_ Model : \_\_\_\_\_
- \_\_\_\_\_ Model : \_\_\_\_\_

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## **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 may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production process of devices may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for the specific test. The manufacturer has the sole responsibility of continued compliance of the EUT.

### **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 set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

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**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.

**4.4.1.3 Details of test procedures**

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 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

**4.4.1.4 Conducted emission**

The final level, expressed in dBµV, 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 dBµV and µV, the following conversion formula apply:

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \cdot \log(\mu\text{V}); \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)}; \end{aligned}$$

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 50Ω/50 µH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin of a peak mode measurement appears to be less than 20 dB, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

**4.4.1.5 Radiated emission (electrical field 30 MHz - 1 GHz)**

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 polarised 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 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 cm to the ground plane are bundled in the center in a serpentine fashion so that they are at least 40 cm from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 m horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 m and the EUT is rotated 360 degrees.

The final level in dBµV/m is calculated by add on the reading value from the EMI receiver (level dBµV) the correction factor. The FCC or CISPR limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:

30 MHz – 1000 MHz:            RBW: 120 kHz

Example:

Frequency	Level	+	Factor	=	Level	-	CISPR Limit	=	Delta
(MHz)	(dBµV)		(dB)		(dBµV/m)		(dBµV/m)		(dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

**FCC ID:SRD50010****4.4.1.6 Radiated emission (electrical field 1 GHz - 40 GHz)**

Radiated emissions from the EUT are measured in the frequency range 1 GHz up to the maximum frequency as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyzer and appropriate linearly polarized antennas. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.4. 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 screened room located outside the test area. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyzer set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak and 10 Hz for average measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

mikes



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## **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: None

#### **5.1.2 Photo documentation of the test set-up**

#### **5.1.3 Applicable standard**

According to FCC Part 15, 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 given limits.

#### **5.1.4 Description of Measurement**

The measurements are performed following the procedures set out in ANSI C63.4 described under item 4.4.3. 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.

#### **5.1.5 Test result**

Limit according to FCC Part 15, Section 15.207(a):

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

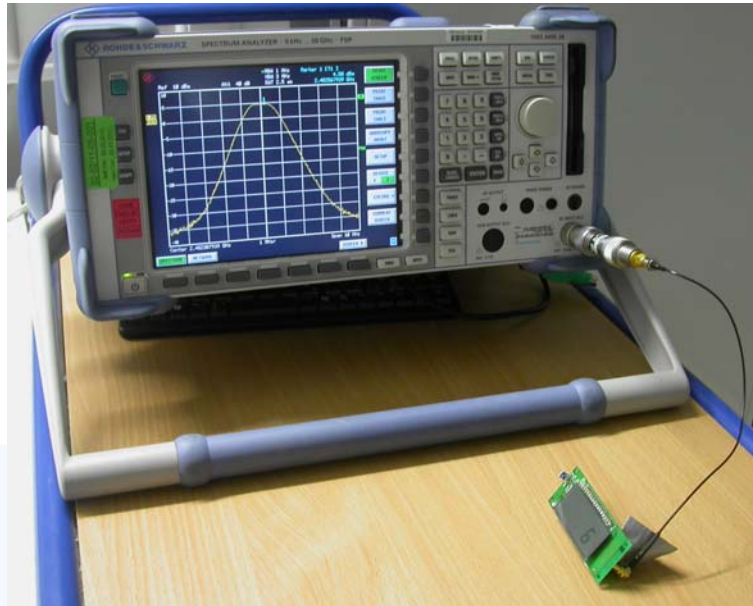
**Remarks:** The test is not applicable.  
The EuT is battery powered.

**FCC ID:SRD50010****5.2 Emission bandwidth**

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

**5.2.1 Description of the test location**

Test location:               Shielded Room S4

**5.2.2 Photo documentation of the test set-up****5.2.3 Applicable standard**

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

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

**5.2.4 Description of Measurement**

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. An alternative is to use the bandwidth measurement of the analyzer.

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The table below shows the settings according to ANSI C63.4:

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

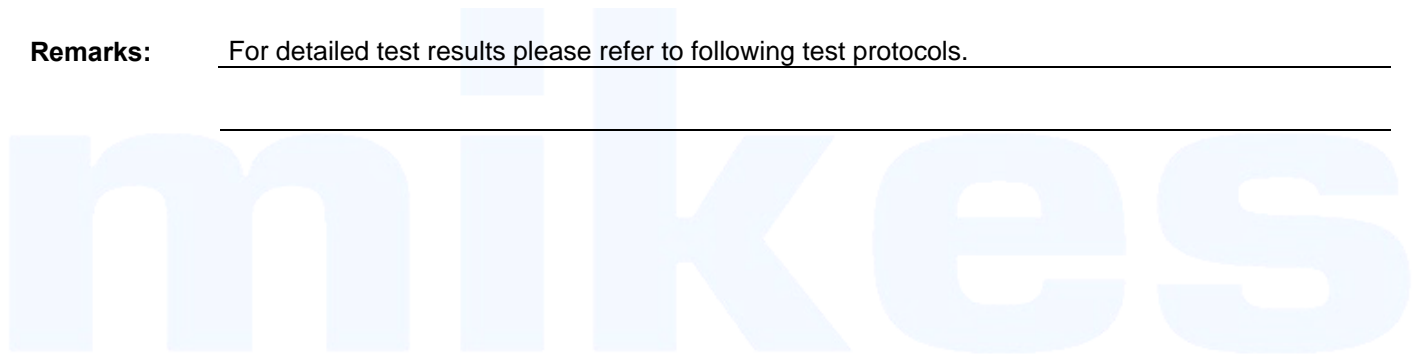
**5.2.5 Test result**

Channel number	Fundamental frequency (MHz)	6 dB Bandwidth (kHz)	Minimum limit (kHz)
0	2433.00	544.0	500
123	2457.59	536.0	500
247	2482.39	576.0	500

The requirements are **FULFILLED**.

**Remarks:** For detailed test results please refer to following test protocols.

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5.2.6 Test protocols

Channel 0

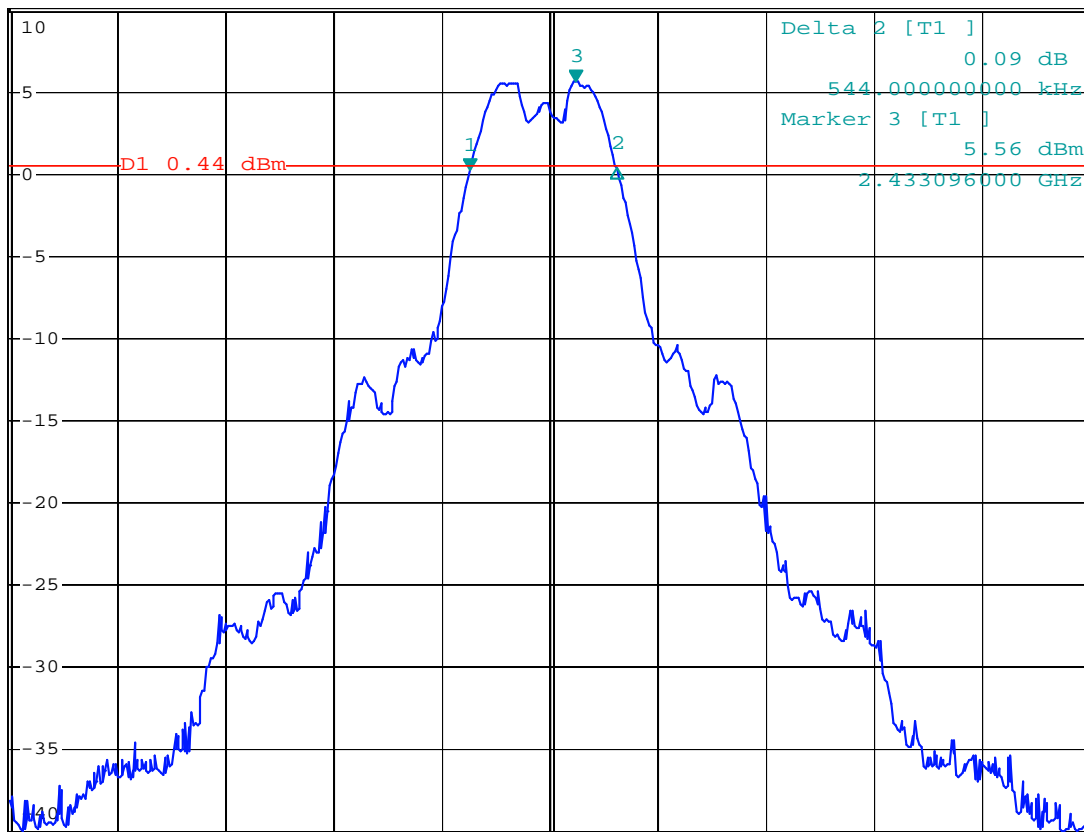


\*RBW 100 kHz Marker 1 [T1 ]  
VBW 300 kHz 0.24 dBm  
SWT 2.5 ms 2.432704000 GHz

Ref 10 dBm

Att 40 dB

1 PK  
VIEW



Center 2.433 GHz

400 kHz/

Span 4 MHz

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Channel 123

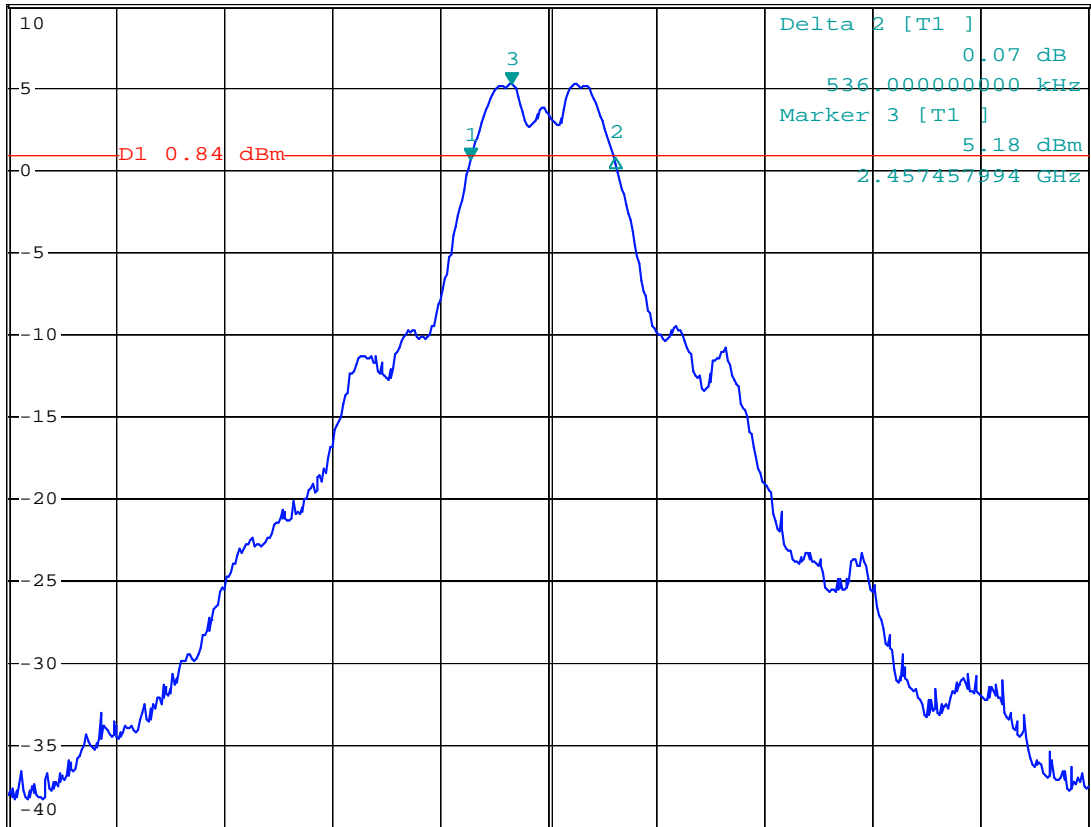


\*RBW 100 kHz    Marker 1 [T1 ]  
 VBW 300 kHz                    0.63 dBm  
 SWT 2.5 ms                        2.457305994 GHz

Ref 10 dBm

Att 40 dB

1 PK  
MAXH



Center 2.457593994 GHz

400 kHz/

Span 4 MHz

**FCC ID:SRD50010**

Channel 247

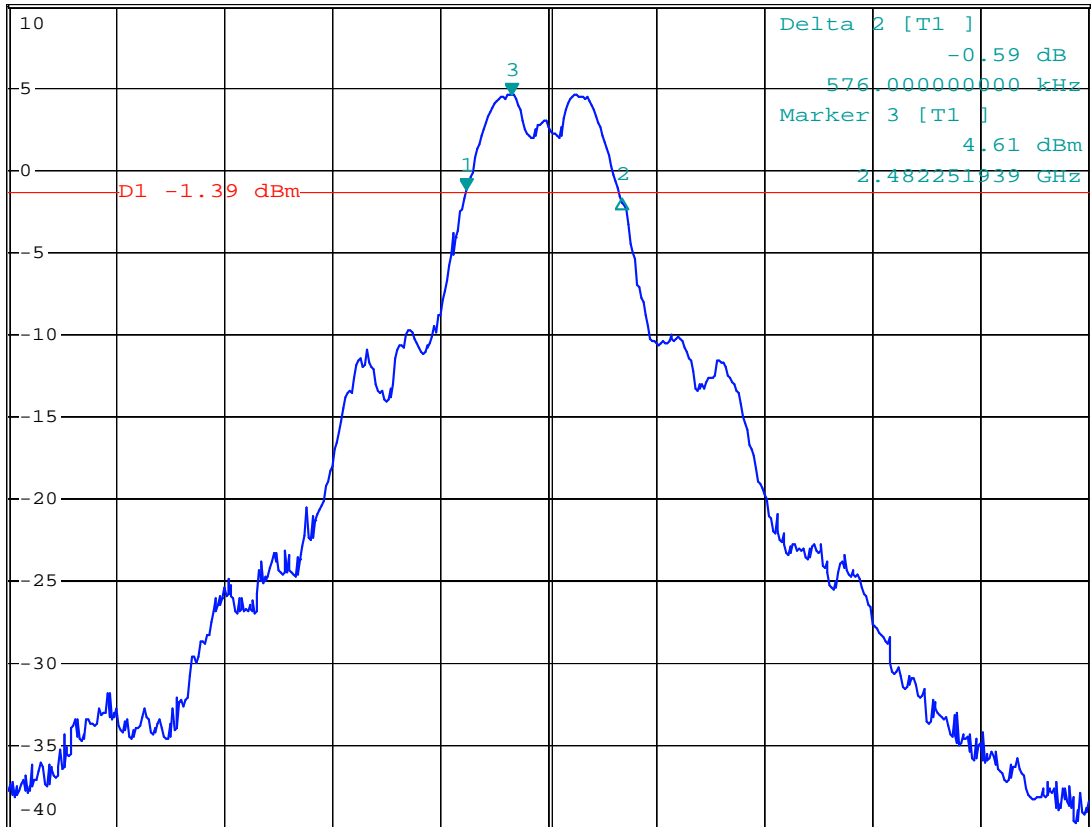


\*RBW 100 kHz    Marker 1 [T1 ]  
 VBW 300 kHz        -1.15 dBm  
 SWT 2.5 ms            2.482083939 GHz

Ref 10 dBm

Att 40 dB

1 PK  
VIEW



Center 2.482387939 GHz

400 kHz/

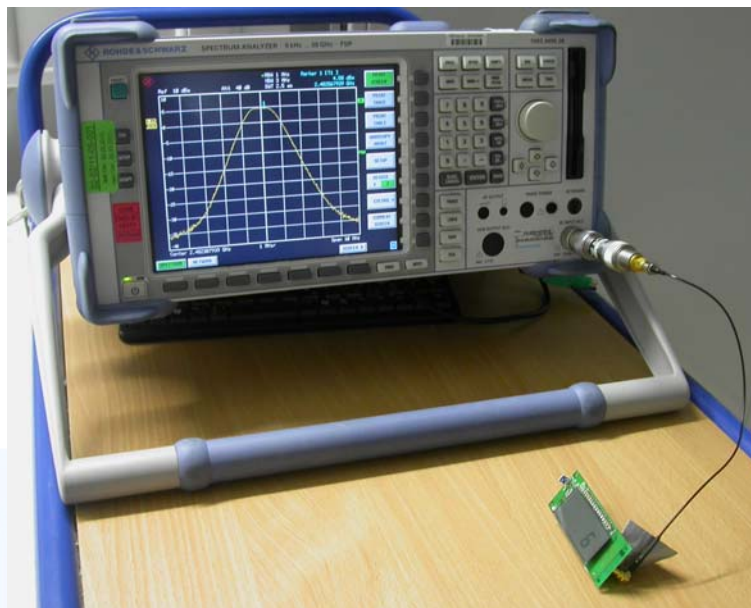
Span 4 MHz

**FCC ID:SRD50010****5.3 Maximum peak 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:                   Shielded Room S4

**5.3.2 Photo documentation of the test set-up****5.3.3 Applicable standard**

According to FCC Part 15, Section 15.247(b)(3):

For systems using digital modulation in the 2400-2483.5 MHz and 5725 – 5850 MHz bands, the maximum peak output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

**5.3.4 Description of Measurement**

The transmitter output was directly connected to the spectrum analyzer . The center frequency of the spectrum analyzer is set to the fundamental frequency. The span of the spectrum analyzer should be larger than the emission bandwidth (EBW). The channel bandwidth has been set to EBW. With peak detector and power mode "Max Hold" the result is the summed maximum output power of the EBW.

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**5.3.5 Test result**

Channel	Frequency (MHz)	Measured power (dBm)	Peak power limit (dBm)	Delta (dB)
0	2433	5.50	30	-24.5
123	2457	5.12	30	-24.9
247	2482	4.58	30	-25.4

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3):

Frequency (MHz)	Peak Power Limit	
	(dBm)	(Watt)
902-928	30	1.0
<b>2400-2483.5</b>	<b>30</b>	<b>1.0</b>
5725-5850	30	1.0

The requirements are **FULFILLED**.

**Remarks:** For detailed test results please refer to following test protocols.

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Channel 0

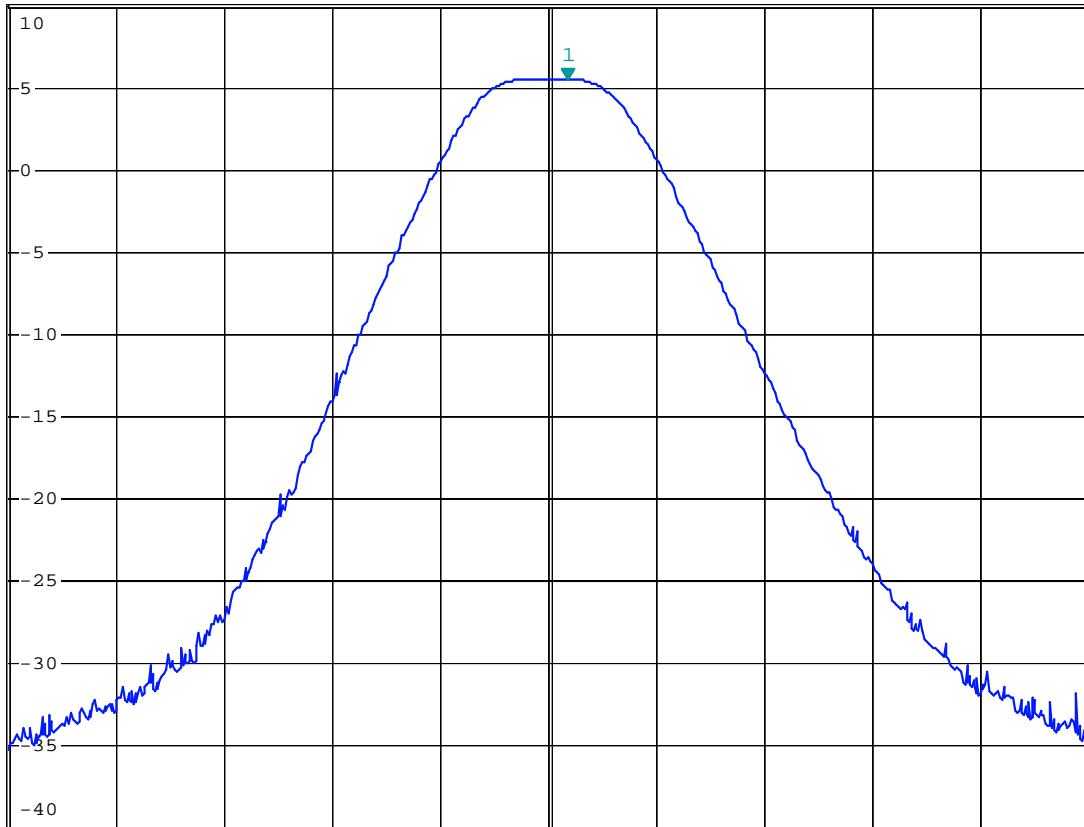


\*RBW 1 MHz    Marker 1 [T1 ]  
VBW 3 MHz        5.50 dBm  
SWT 2.5 ms        2.433180000 GHz

Ref 10 dBm

Att 40 dB

1 PK  
VIEW



A

PRN

FCC ID:SRD50010

Channel 123

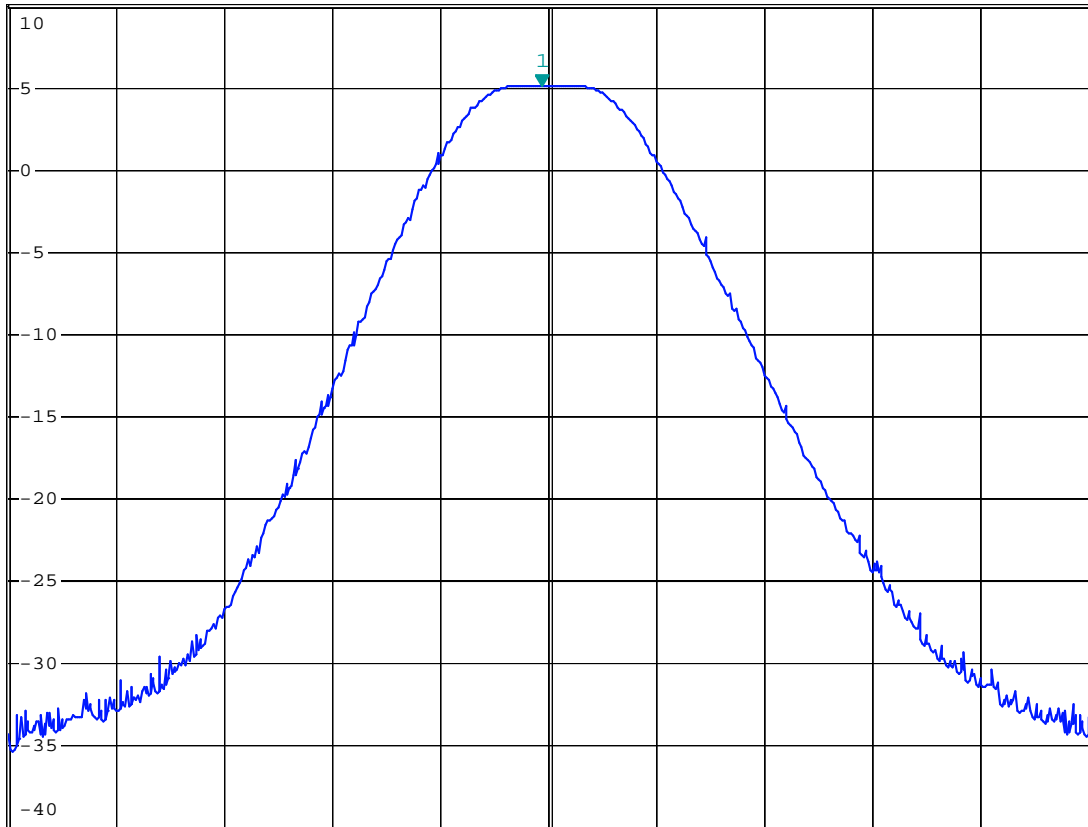


\*RBW 1 MHz    Marker 1 [T1 ]  
 VBW 3 MHz    5.12 dBm  
 SWT 2.5 ms    2.457533994 GHz

Ref 10 dBm

Att 40 dB

1 PK  
VIEW



Center 2.457533994 GHz

1 MHz /

Span 10 MHz

FCC ID:SRD50010

Channel 247

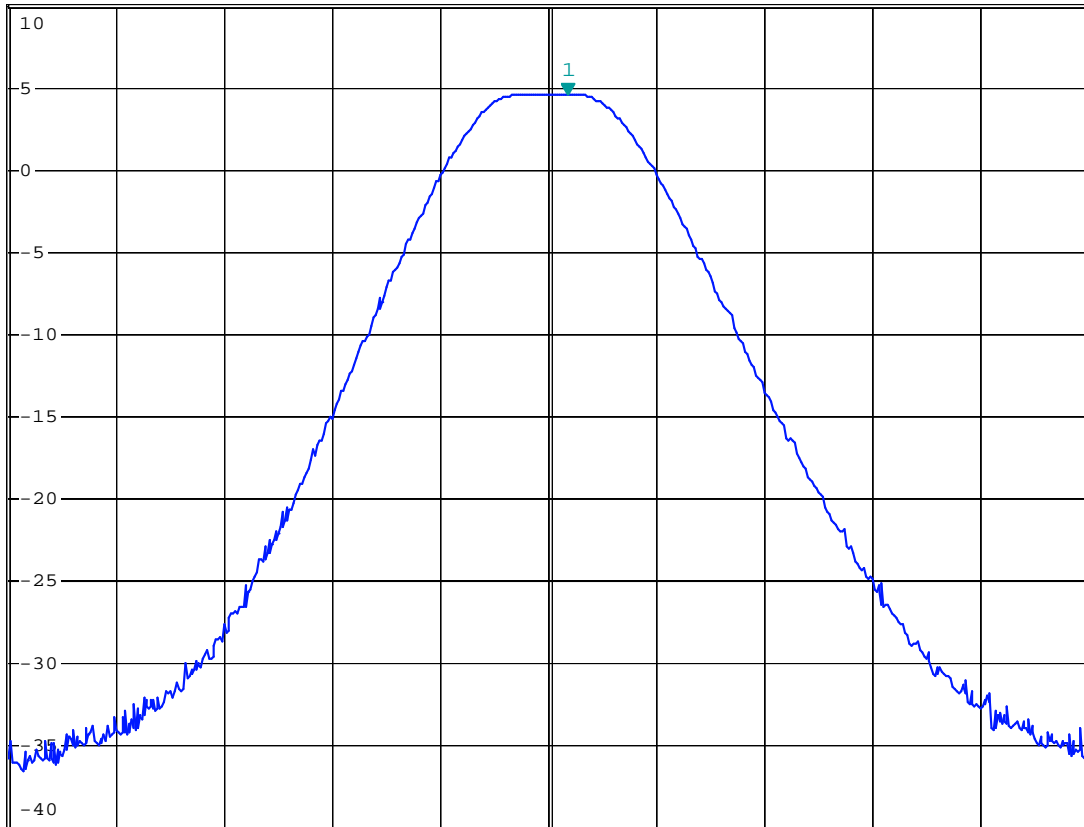


\*RBW 1 MHz    Marker 1 [T1 ]  
VBW 3 MHz        4.58 dBm  
SWT 2.5 ms        2.482567939 GHz

Ref 10 dBm

Att 40 dB

1 PK  
VIEW



Center 2.482387939 GHz

1 MHz/

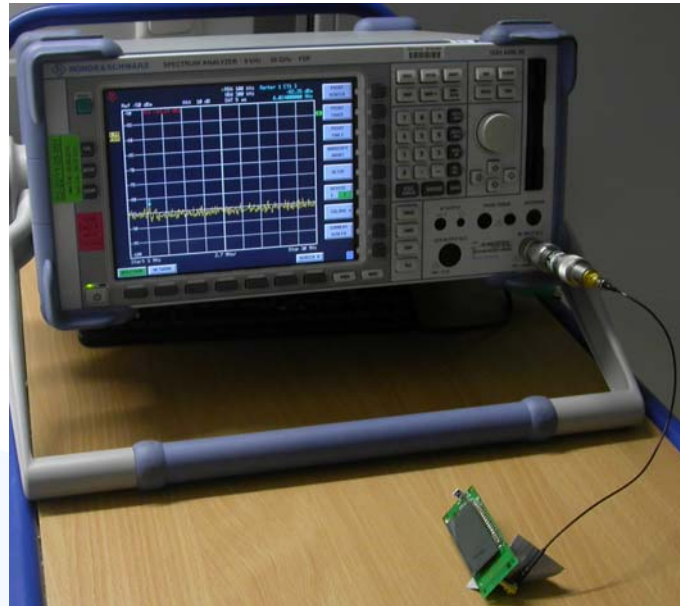
Span 10 MHz

**FCC ID:SRD50010****5.4 Spurious emissions conducted**

For test instruments and accessories used see section 6 Part SEC1, SEC2 and SEC3.

**5.4.1 Description of the test location**

Test location:               Shielded Room S4

**5.4.2 Photo documentation of the test set-up****5.4.3 Applicable standard**

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

In any 100 kHz bandwidth outside the frequency band 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).

**5.4.4 Description of measurement**

A spectrum analyzer is connected to the output of the transmitter while EUT was operating in transmit mode at the assigned frequency.

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**5.4.5 Test result**

Signal levels which are located in restricted band.

Tx mode @ CH0, CH123, CH247, max. level 5.76 dBm			
Frequency (MHz)	Peak power * (dBm)	Limit (-20 dB) (dBm)	Delta (dB)
115.36	-52.30	-14.24	-38.06
163.86	-54.97	-14.24	-40.73
2483.80	-25.95	-14.24	-11.71
2485.80	-40.48	-14.24	-26.24
4862.00	-58.56	-14.24	-44.32
4918.00	-59.34	-14.24	-45.10
4960.00	-58.32	-14.24	-44.08

The requirements are **FULFILLED**.

**Remarks:** All spurious emissions falling in restricted bands have been measured radiated.  
For detailed results please refer to following test protocol.  
In the frequency range from 10 GHz up to 18 GHz no emissions could be measured.

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5.4.6 Test protocols

Conducted RF emission from 9 kHz to 30 MHz

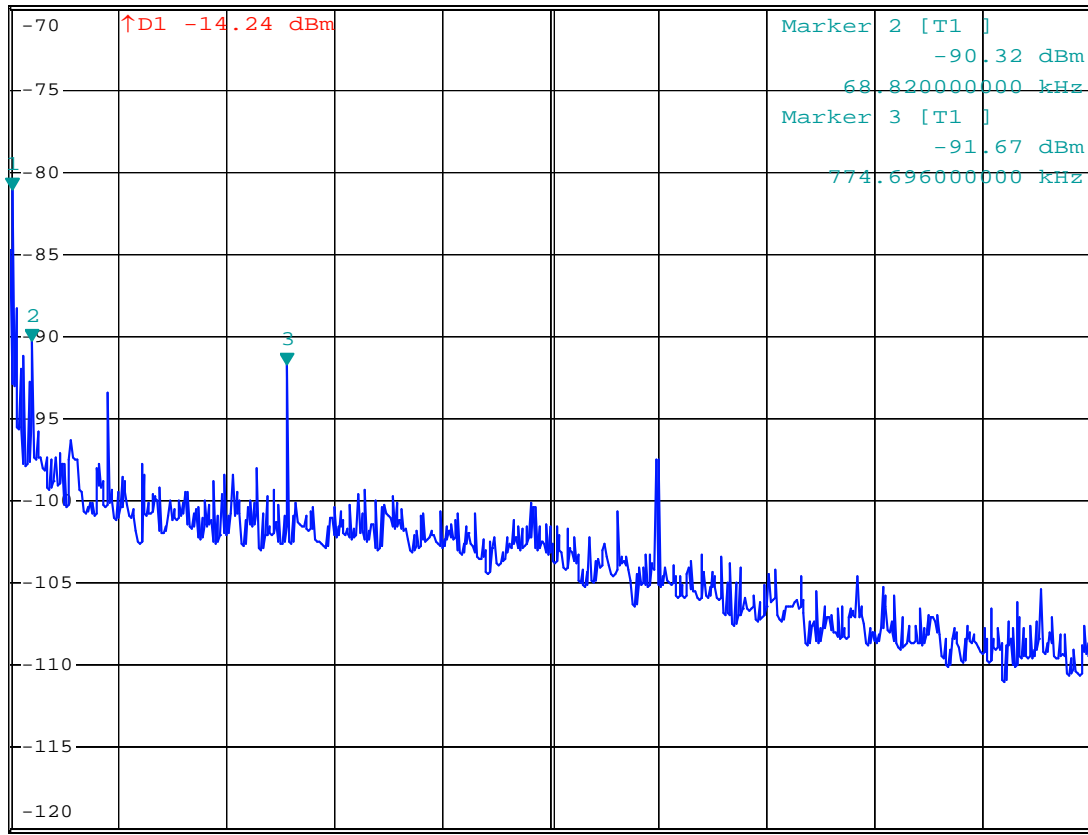


\*RBW 300 Hz    Marker 1 [T1 ]  
VBW 1 kHz                    -81.08 dBm  
SWT 34 s                    14.982000000 kHz

Ref -70 dBm

Att 10 dB

1 PK  
VIEW



Start 9 kHz

299.1 kHz/

Stop 3 MHz

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Conducted RF emission from 3 to 30 MHz

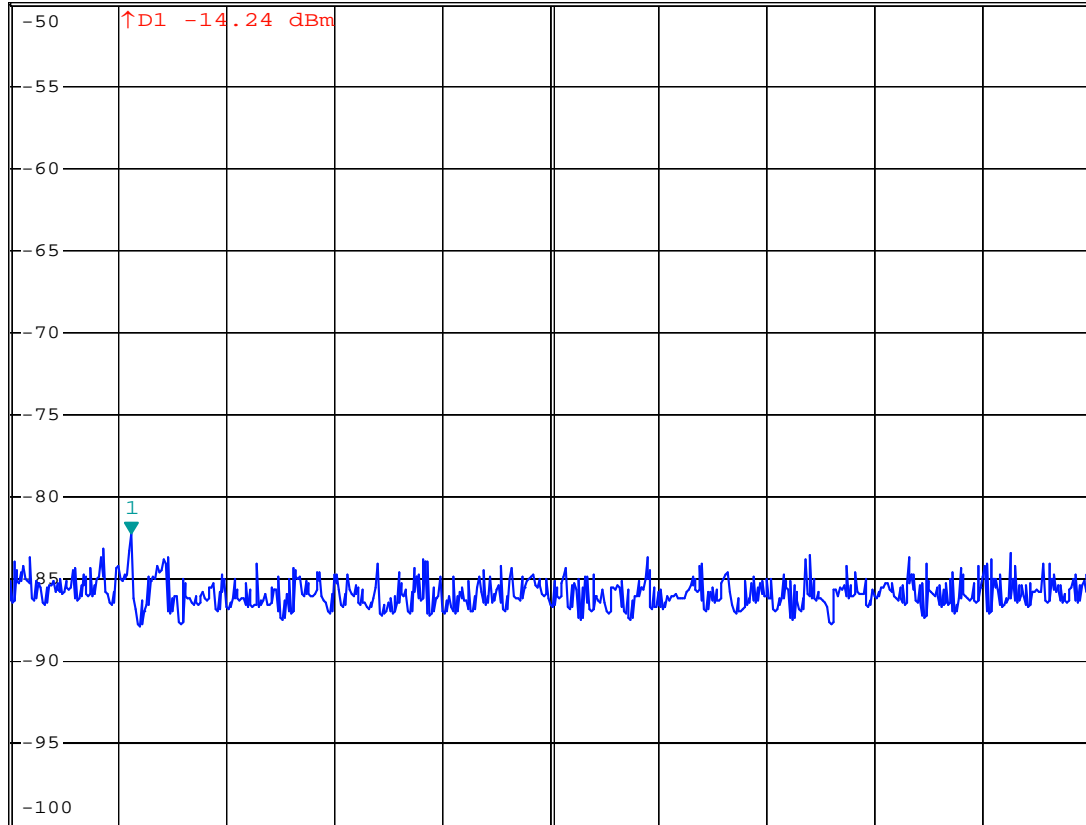


\*RBW 100 kHz Marker 1 [T1 ]  
VBW 300 kHz -82.25 dBm  
SWT 5 ms 6.024000000 MHz

Ref -50 dBm

Att 10 dB

1 PK  
VIEW



Start 3 MHz

2.7 MHz/

Stop 30 MHz

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Conducted RF emission from 30 to 1000 MHz

Note: Signal level no. 1 and no. 3 are located in restricted band.

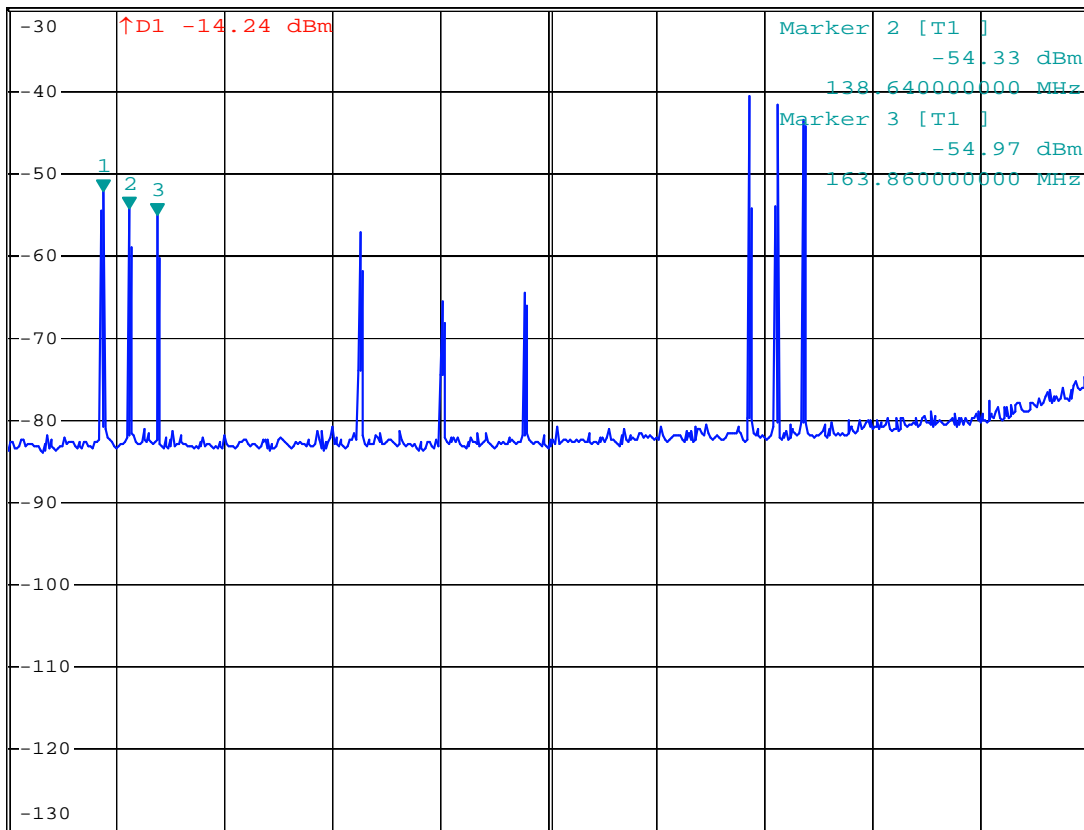


\*RBW 100 kHz    Marker 1 [T1 ]  
VBW 300 kHz        -52.30 dBm  
SWT 100 ms        115.360000000 MHz

Ref -30 dBm

Att 10 dB

1 PK  
VIEW



Start 30 MHz

97 MHz/

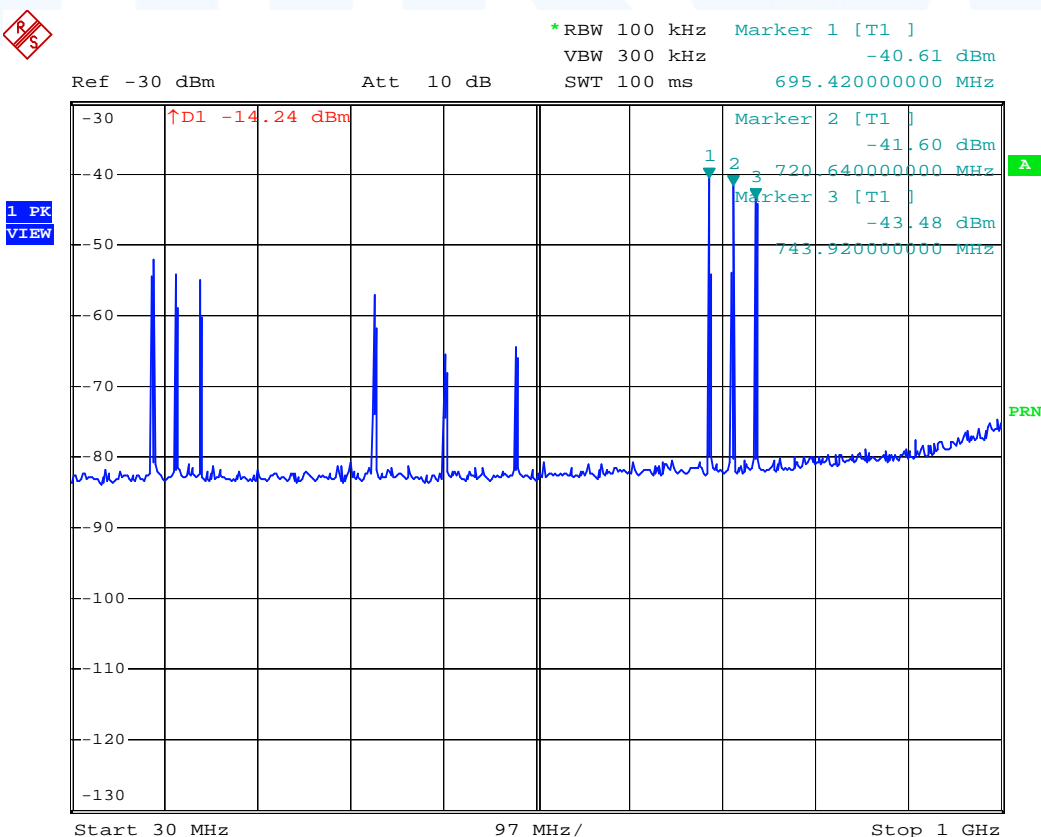
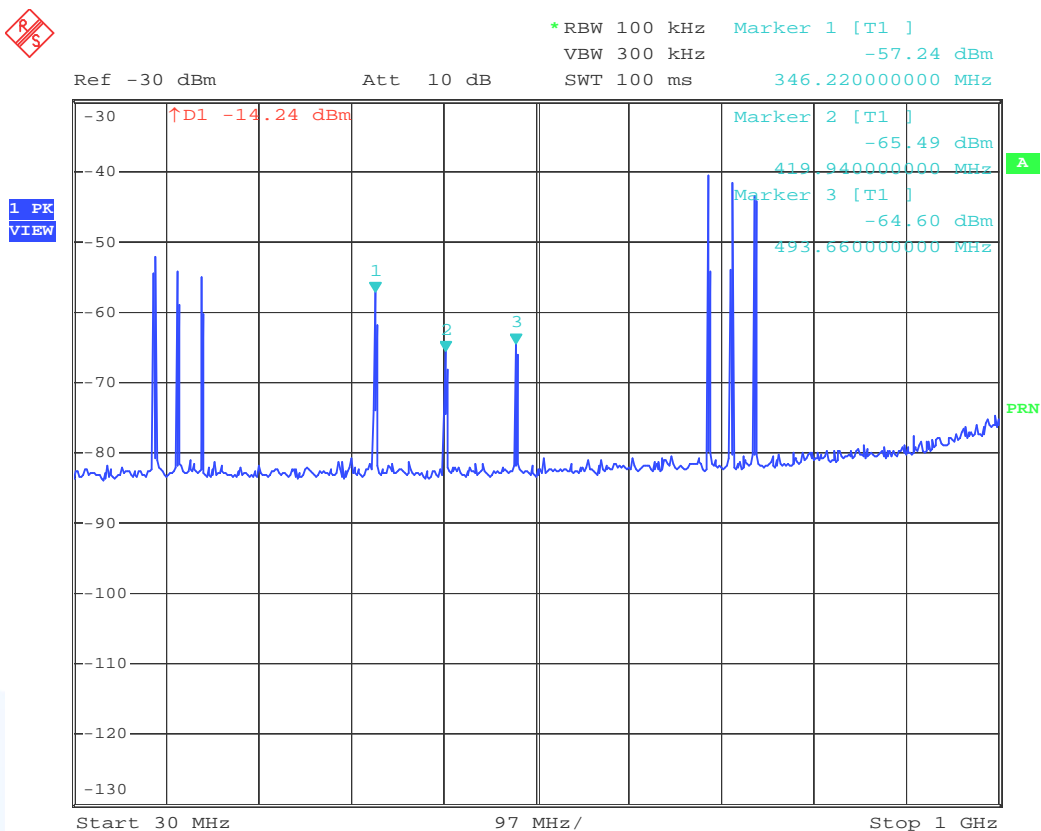
Stop 1 GHz

Note: Signal level no. 1 and no. 3 are located in restricted band.



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Conducted RF emission from 30 to 1000 MHz



**FCC ID:SRD50010**

Conducted RF emission from 1000 to 3000 MHz  
(Band edge)

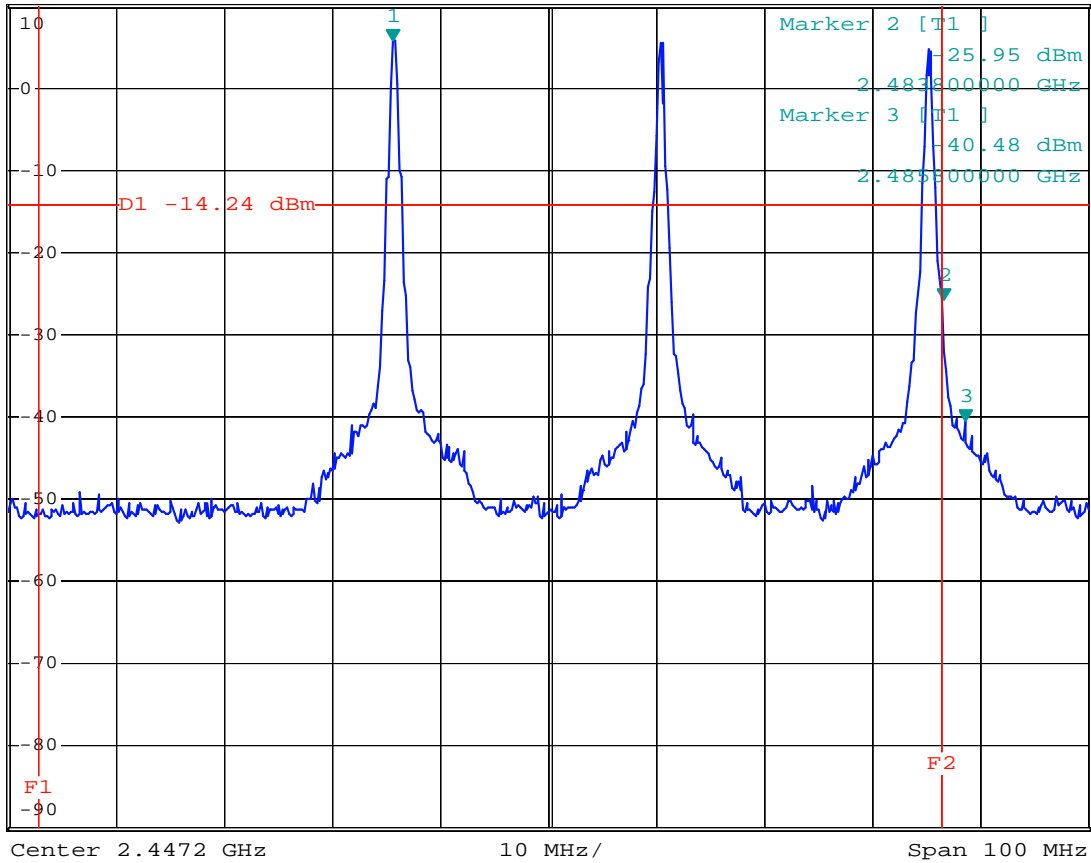


\*RBW 100 kHz    Marker 1 [T1 ]  
VBW 300 kHz        5.76 dBm  
SWT 10 ms            2.432800000 GHz

Ref 10 dBm

Att 40 dB

1 PK  
VIEW



Note: Signal level no. 2 and no. 3 are located in restricted band.

**FCC ID:SRD50010**

**Conducted RF emission from 1 to 10 GHz**

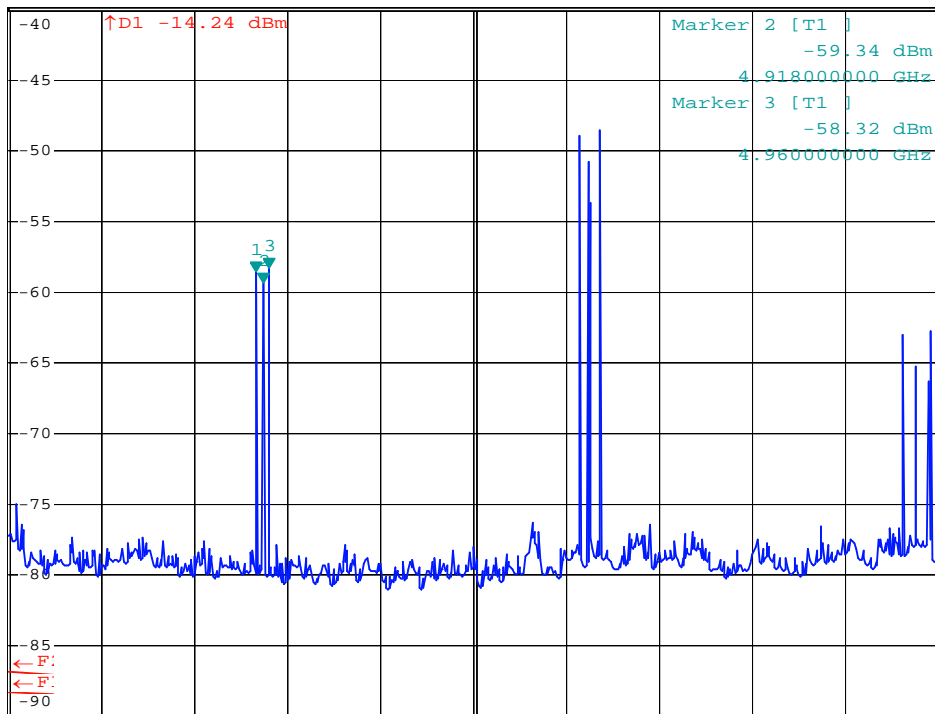


\*RBW 100 kHz Marker 1 [T1 ]  
 VBW 300 kHz -58.56 dBm  
 SWT 700 ms 4.862000000 GHz

Ref -40 dBm

Att 10 dB

1 PK  
VIEW



Start 3 GHz 700 MHz/ Stop 10 GHz

**Note:** Signal level no. 1, no. 2 and no. 3 are located in restricted band.

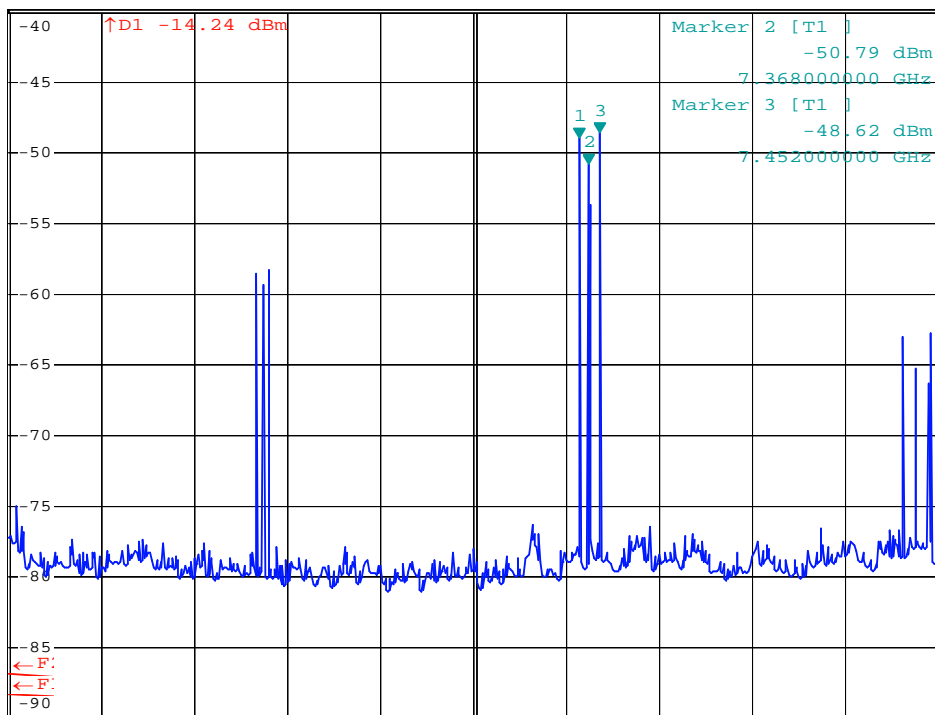


\*RBW 100 kHz Marker 1 [T1 ]  
 VBW 300 kHz -48.96 dBm  
 SWT 700 ms 7.298000000 GHz

Ref -40 dBm

Att 10 dB

1 PK  
VIEW



Start 3 GHz 700 MHz/ Stop 10 GHz

**FCC ID:SRD50010**

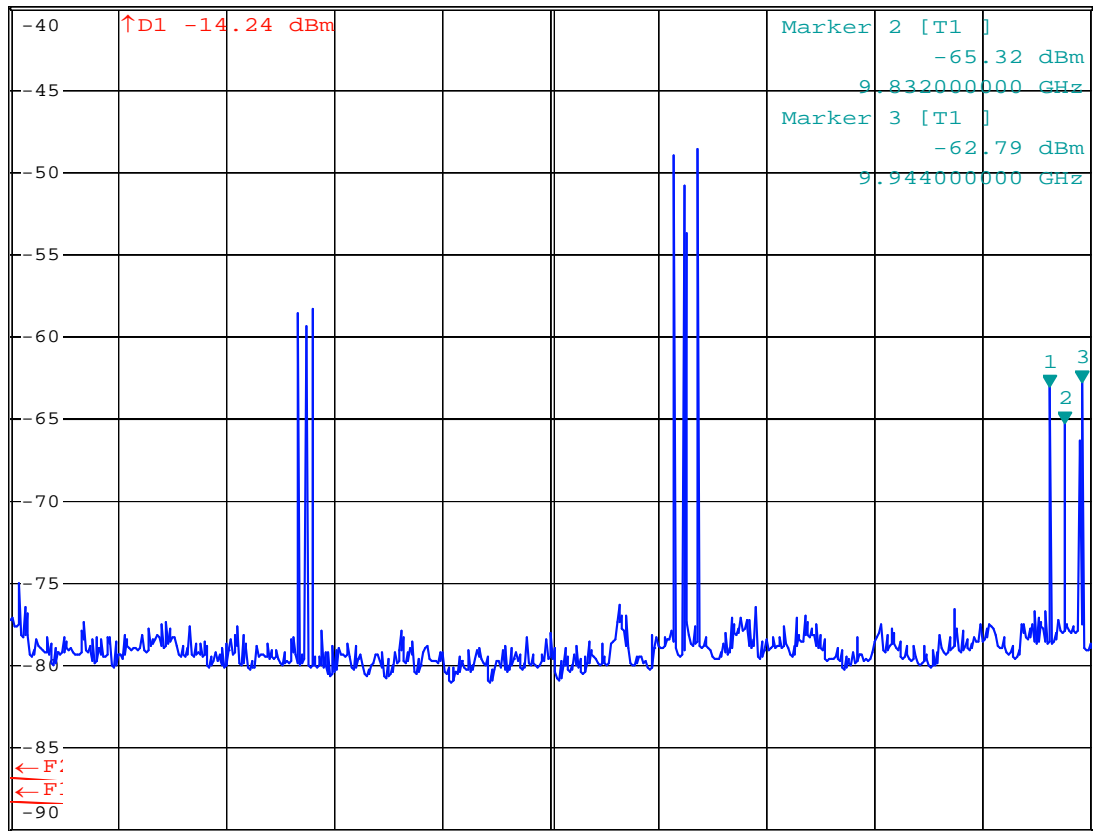


\*RBW 100 kHz    Marker 1 [T1 ]  
 VBW 300 kHz                    -63.08 dBm  
 SWT 700 ms                      9.734000000 GHz

Ref -40 dBm

Att 10 dB

1 PK  
VIEW



Start 3 GHz

700 MHz/

Stop 10 GHz

FCC ID:SRD50010

## 5.5 Spurious emissions

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

### 5.5.1 Description of the test location

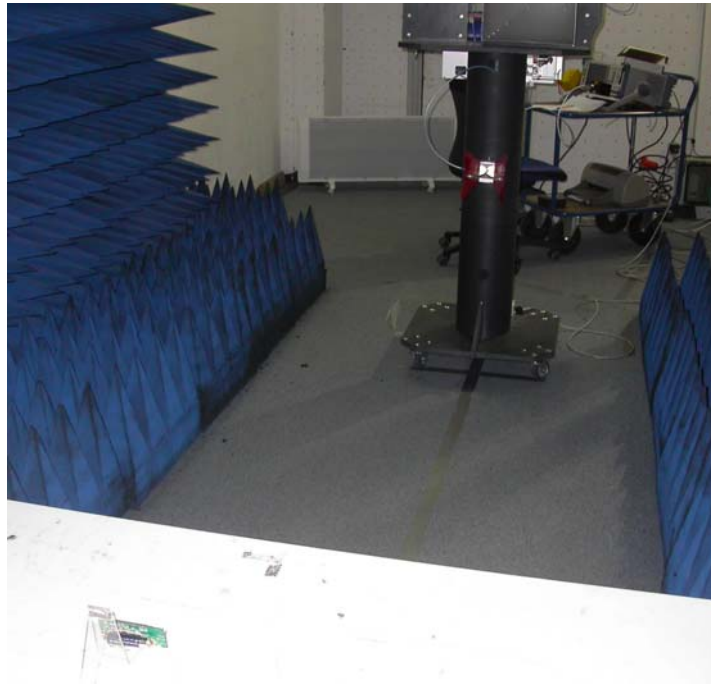
Test location: OATS1  
Test distance: 3 metres

Test location: Anechoic Chamber A2  
Test distance: 3 metres

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



FCC ID:SRD50010



### 5.5.3 Applicable standard

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

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 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)).

### 5.5.4 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. 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.

#### 5.5.4.1 Radiated emission test $f < 1$ GHz

In the frequency range from **9 kHz to 30 MHz** no emissions from the EuT could be measured.

In the frequency range from **30 MHz up to 1 GHz** no emissions from the EuT could be measured.

**FCC ID:SRD50010**

**5.5.4.2 Radiated emission test f > 1GHz**

Tx mode @ CH0

Frequency (GHz)	L: PK (dBµV)	L: AV (dBµV)	Bandwidth (kHz)	Correct. (dB)	L: PK dB(µV/m)	L: AV dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
4.866	57.3	45.9	1000	3.0	60.3	48.9	54.0	-5.1
7.299	44.8	33.5	1000	7.2	52.0	40.7	54.0	-13.3
9.732	34.6	27.3	1000	9.8	44.4	37.1	54.0	-16.9

Tx mode @ CH123

Frequency (GHz)	L: PK (dBµV)	L: AV (dBµV)	Bandwidth (kHz)	Correct. (dB)	L: PK dB(µV/m)	L: AV dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
4.915	58.2	46.7	1000	3.2	61.4	49.9	54.0	-4.1
7.372	45.3	34.6	1000	7.3	52.6	41.9	54.0	-12.1
9.830	35.6	26.8	1000	9.7	45.4	36.5	54.0	-17.5

Tx mode @ CH247

Frequency (GHz)	L: PK (dBµV)	L: AV (dBµV)	Bandwidth (kHz)	Correct. (dB)	L: PK dB(µV/m)	L: AV dB(µV/m)	Limit AV dB(µV/m)	Delta (dB)
4.965	56.4	45.6	1000	3.3	59.6	48.9	54.0	-5.1
7.447	43.3	35.8	1000	7.4	50.7	43.1	54.0	-10.9
9.929	33.9	25.7	1000	9.7	43.5	35.4	54.0	-18.6

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

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(µV/m)	dB(µV/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

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**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:** The measurement was performed up to 18 GHz. All emissions not reported in this test report are more than 20 dB below the specified limit.



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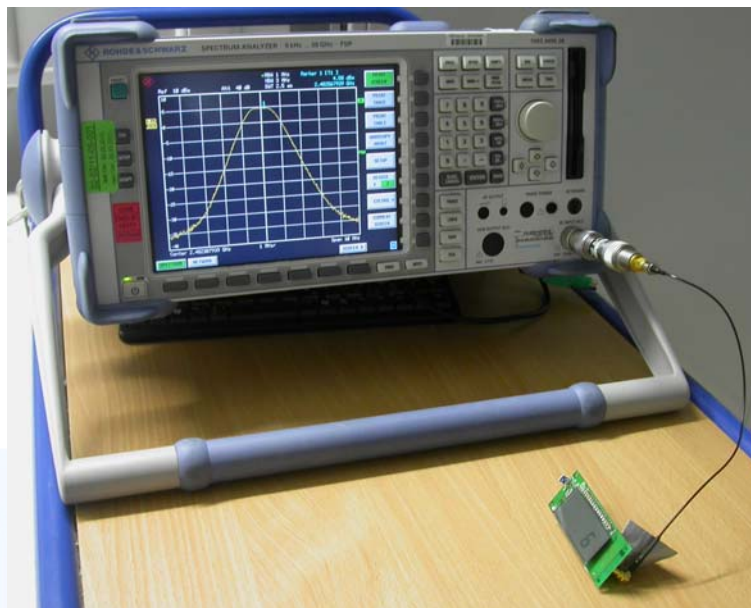
## 5.6 Power spectral density

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

### 5.6.1 Description of the test location

Test location:               Shielded Room S4

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



### 5.6.3 Applicable standard

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

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### 5.6.4 Description of Measurement

The EUT was connected to the spectrum analyser with a suitable attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyser, set sweep time equal to span/3 kHz. The power spectral density was measured using the analyser function "Channel Power" in dBm/Hz. The result is calculated by adding 35 dB (10 log 3000 Hz/Hz) as bandwidth correction factor to the analyser reading.

Spectrum analyzer settings:  
see attached plots

**FCC ID:SRD50010**

**5.6.5 Test result**

Channel	Frequency (MHz)	Reading (dBm/Hz)	Correction to 3 kHz (dB)	PSD (dBm)	Limit (dBm)
0	2433	-56.89	35	-21.89	8
123	2457	-56.45	35	-21.45	8
247	2482	-55.70	35	-20.70	8

Power spectral density limit according to FCC Part 15, Section 15.247(e):

Frequency (MHz)	Power spectral density limit
	(dBm/3kHz)
2400 - 2483.5	8

The requirements are **FULFILLED**.

**Remarks:** For detailed test results please refer to following test protocols.

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**FCC ID:SRD50010**

**Power spectral density plots**

Channel 0



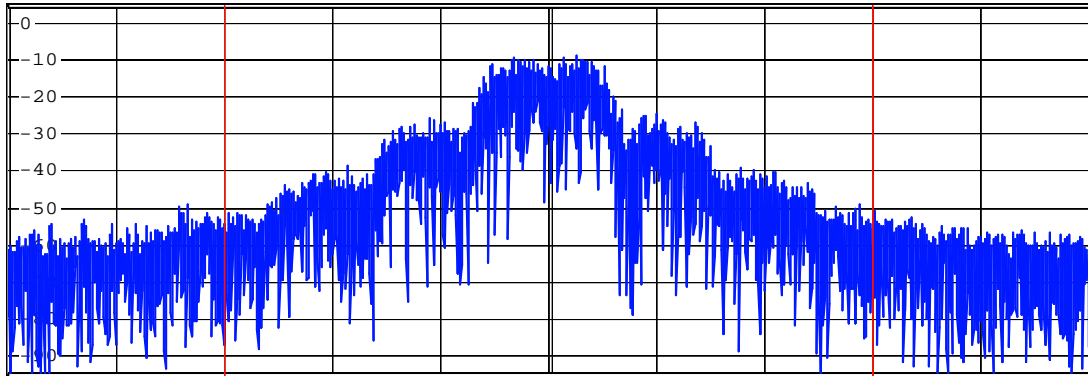
\*RBW 3 kHz  
VBW 10 kHz  
SWT 560 ms

Ref 5 dBm

Att 20 dB

SWT 560 ms

1 AP  
VIEW



PWR  
MAXH

Center 2.433 GHz

500 kHz/

Span 5 MHz PRN

Tx Channel

Bandwidth

3 MHz

Power -56.89 dBm/Hz

Channel 123



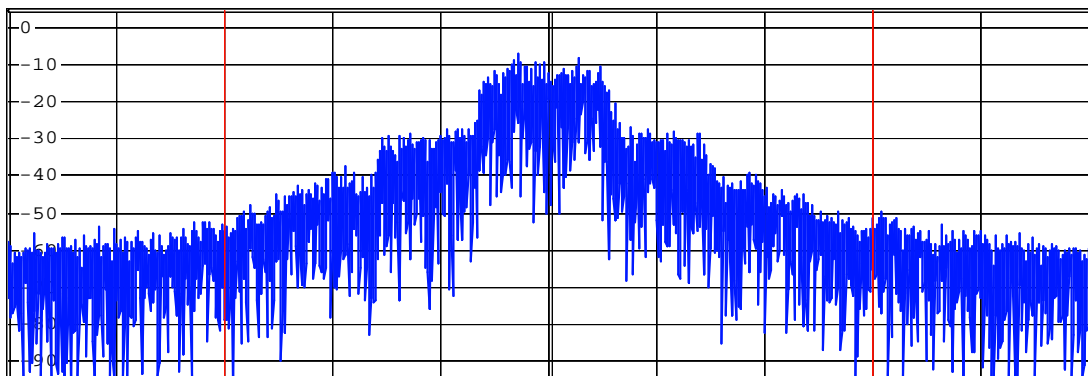
\*RBW 3 kHz  
VBW 10 kHz  
SWT 560 ms

Ref 5 dBm

Att 20 dB

SWT 560 ms

1 AP  
VIEW



PWR  
MAXH

Center 2.457593994 GHz

500 kHz/

Span 5 MHz PRN

Tx Channel

Bandwidth

3 MHz

Power -56.45 dBm/Hz

**FCC ID:SRD50010**

Channel 247

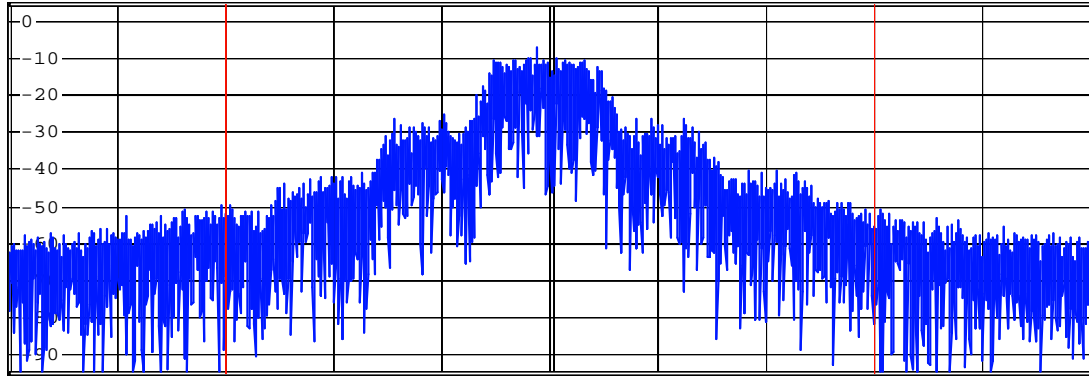


\* RBW 3 kHz  
VBW 10 kHz  
SWT 560 ms

Ref 5 dBm

Att 20 dB

1 AP  
VIEW



PWR  
MAXH

Center 2.482387939 GHz

500 kHz/

Span 5 MHz PRN

Tx Channel

Bandwidth

3 MHz

Power -55.70 dBm/Hz

mikes

**FCC ID:SRD50010**

## **5.7 Receiver radiated emissions**

For test instruments and accessories used see section 6 Part **SER1**, **SER2** and **SER3**.

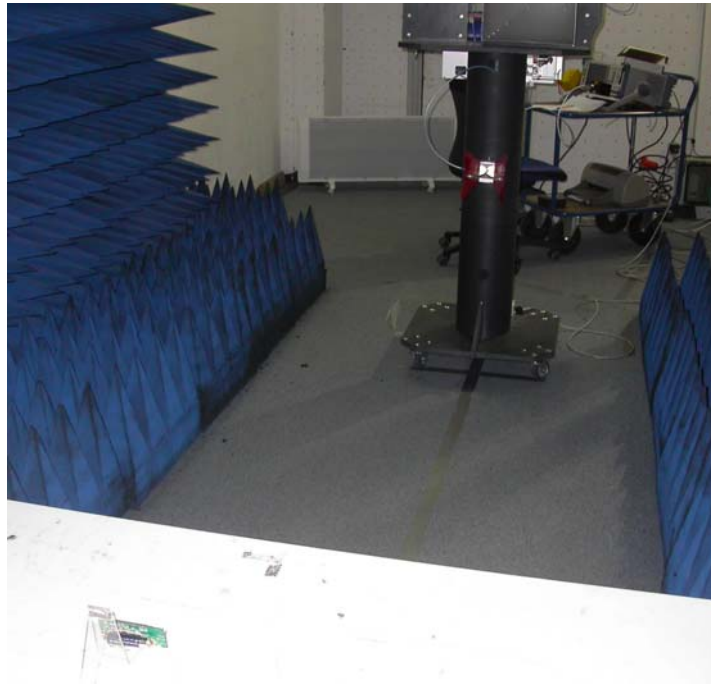
### **5.7.1 Description of the test location**

Test location: OATS 1  
Test location: Anechoic Chamber A2  
Test distance: 3 metres

### **5.7.2 Photo documentation of the test set-up**



FCC ID:SRD50010



### 5.7.3 Applicable standard

According to FCC Part 15, Section 15.109 (a):  
Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 m shall not exceed the given limit.

### 5.7.4 Description of Measurement

The radiated power of the spurious emission from the EUT is measured in a test setup following the procedures set out in ANSI C63.4. 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:SRD50010**

**5.7.5 Test result**

**5.7.5.1 f < 1 GHz)**

In the frequency range from **9 kHz to 30 MHz** no emissions from the EuT could be measured.

In the frequency range from **30 MHz up to 1 GHz** no emissions from the EuT could be measured.

**5.7.5.2 f > 1GHz**

In the frequency range from **1 GHz up to 12.75 GHz** no emissions from the EuT could be measured.

Limit according to FCC Section 15.109(a)

Frequency of emission (MHz)	Field strength limit (µV/m)	Field strength limit dB(µV/m)
0.009-0.490	2400/F(kHz)	
0.490-1.705	24000/F (kHz)	
1.705-30.0	30	
30-88	100	40
88-216	150	44
216-960	200	46
Above 960	500	54

The requirements are **FULFILLED**.

**Remarks:** During the test, the EUT was set into continuous receiving mode.  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**FCC ID:SRD50010****5.8 Maximum permissible exposure (MPE)**

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

**5.8.1 Description of the test location**

Test location: NONE

**5.8.2 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).

**5.8.3 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, can be calculated the MPE 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/cm<sup>2</sup>)

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

$G$  = gain of antenna (linear scale)

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



**FCC ID:SRD50010**

**5.8.4 Test result**

Limits for maximum permissible exposure (MPE):

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(B) Limits for General Population / Uncontrolled Exposure</b>				
0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/ <i>f</i>	2.19/ <i>f</i>	180/ <i>f</i> <sup>2</sup>	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	<i>f</i> /1500	30
<b>1500-100000</b>	---	---	<b>1.0</b>	<b>30</b>

*f* = Frequency in MHz

**Remarks:**     The measurement and calculation is accd. OET Bulletin 65 not necessary. Because the  
antenna of the EuT is an integral part of the device and the max. power is ≤ 0.2 W at all  
3 measured channels. This type of transmitters generally not expected to exceed MPE Limits;  
Special instructions or warnings are normally not necessary to ensure compliance.  
\_\_\_\_\_  
\_\_\_\_\_

**FCC ID:SRD50010****5.9 Antenna application - Detailed photos see attachment A2****5.9.1 Applicable standard**

According to FCC Part 15C, Section 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 this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has a PCB antenna and can not be replaced by the user.  
This type of antenna meet the requirements of part 15.203 and 15.204.

**5.9.2 Antenna requirements**

According to FCC Part 15C, Section 15.247(b)(4):

The conducted output power limit specified in paragraph (b) of 15.247 is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2) and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The gain of the used PCB antenna is  $\leq 2.14$  dBi.

FCC ID:SRD50010

## 6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
CPC 3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
MB	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
SEC 1-3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
SER 1	FMZB 1516 ESCI S10162-B KK-EF393-21N-16 NW-2000-NB	01-02/24-01-018 02-02/03-05-005 02-02/50-05-031 02-02/50-05-033 02-02/50-05-113	19/11/2011	19/11/2010	16/02/2012	16/02/2011
SER 2	ESVS 30 VULB 9168 S10162-B KK-EF393-21N-16 NW-2000-NB	02-02/03-05-006 02-02/24-05-005 02-02/50-05-031 02-02/50-05-033 02-02/50-05-113	11/06/2011 07/03/2012	11/06/2010 07/03/2011	17/09/2011	17/03/2011
SER 3	FSP 30 AFS4-01000400-10-10P-4 AMF-4F-04001200-15-10P AFS5-12001800-18-10P-6 3117 Sucoflex N-1600-SMA Sucoflex N-2000-SMA	02-02/11-05-001 02-02/17-05-003 02-02/17-05-004 02-02/17-06-002 02-02/24-05-009 02-02/50-05-073 02-02/50-05-075	04/05/2011	04/05/2010	11/02/2012	11/02/2011