FCC ID: KR5BTP / IC ID: 7812D-BTP

EMI – TEST REPORT

- FCC Part 15.247, RSS247 -

Type / Model Name : Acura Bidir Fob MDX MY21 / BTP

Product Description : Radio Frequency Bidirectional Key Fob

Applicant : Continental Automotive GmbH

Address : Siemensstraße 12

93055 Regensburg, Germany

Manufacturer : Continental Guadalajara México, S.A. de C.V.

Address : Camino a la Tijera No.3

45640 Tlajomulco de Zuñiga, Jalisco, Mexico

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

Test Report No. :	**T37598-05-00HU**	11. May 2020 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

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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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.

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15 Subpart C - Intentional Radiators (February 28, 2020)

Part 15, Subpart C, Section 15.247	Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz
Part 15, Subpart C, Section 15.35(c)	Correction for Pulse Operation (Duty Cycle)
Part 15, Subpart C, Section 15.207(a)	AC Line conducted emissions
Part 15, Subpart C, Section 15.209(a)	Radiated emissions, general requirements

ANSI C63.10: 2013	Testing Unlicensed Wireless Devices
ANSI C95.1:2005	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
KDB 558074 D01	Guidance for performing compliance measurements on DTS operating under Section 15.247, v03r01 of April 9, 2013.

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.

2 SUMMARY

2.1 Test result summery

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS Gen.	AC power line conducted emissions	not applicable
15.247(a)(2)	RSS 247	-6 dB EBW	passed
15.247(b)(3)	RSS 247	Peak power	passed
15.247(d)	RSS 247	Out-of-band emission, radiated	passed
15.247(d)	RSS Gen	Emissions in restricted bands	passed
15.247(e)	RSS 247	PSD	passed
15.35(c)	RSS Gen	Pulsed operation	not applicable
15.247(i)	RSS 102	MPE	passed
15.247(b)(4)	RSS Gen	Antenna requirement	passed
15.107	RSS Gen	AC power line conducted emissions	passed
15.109(a)	RSS Gen	Receiver spurious emissions, radiated	passed
	RSS Gen	Transmitter frequency stability	not applicable
	RSS Gen	99 % Bandwidth	passed
	RSS 102	Co-location, Co-transmission	not applicable

The mentioned RSS Rule Parts in the above table are related to:
RSS Gen, Issue 5, March 2019
RSS 247, Issue 2, February 2017
RSS 102, Issue 5, March 2015

2.2 General remarks

All radiated tests have been performed on samples which are in original state in a test mode function.
The test mode function is only available by EEPROM settings, which could provided only in specially programmed samples for measuring purpose.

Button functions				
	Button description	**red LED**	**green LED**	**amber LED**
Engine S1	no function			
LOCK S2	no function			
UNLOCK S3	TX Modulated Modes		X	
TRUNK S4	RX Modes		X	x
PANIC S5	TX CW Modes	X		

By pressing the specified button, the previously defined channels are revolving.

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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The EuT has an incorporated antenna and is powered by a primary battery.
All radiated measurements were made with the device in all three orthogonal axis (X, Y, Z).
The test report covers the worst case values which were measured.

Declaration of manufacturer:

- Operation modes:
- DSSS transmissions shall comply with the US / IC regulation as defined in FCC part 15.247 / RSS 247
    - LR CH1: 924.00 MHz
        - Rx mode:
            - 926.00 MHz

- FSK transmissions shall comply with the US / IC regulation as defined in FCC part 15.249 / RSS 210
    - SR CH1: 924.600 MHz
    - SR CH2: 923.625 MHz
        - Rx mode:
            - 926.225 MHz
            - 925.400 MHz

Modulation Scheme:

Range	Scheme	Data Rate	Tolerance	Boud Rate
SR	FSK	7.8125 kbit/s	± 1 %	15.625 kbaud/s
LR	DSSS	1.2 kbit/s	± 1 %	2.4 kbaud/s

FINAL ASSESSMENT:

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

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

Testing commenced on : 04. March 2020

Testing concluded on : 12. March 2020

Checked by:

Klaus Gegenfurtner
I confirm the correctness and integrity of this document
2020.05.11 09:02:59 +02'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Markus Huber
I am the author of this document
2020.05.11 09:00:30 +02'00'

Markus Huber

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3 EQUIPMENT UNDER TEST

3.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

3.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

3.3 Photo documentation of the EuT – See Attachment A

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.

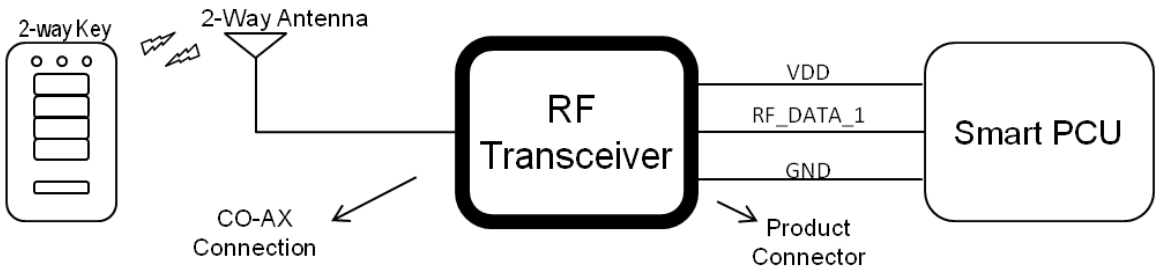
3.4 Power supply system utilised

Power supply voltage: 3.0 V / DC (Battery type: CR2032)

3.5 Short description of the Equipment under Test (EUT)

The EuT is a bidirectional RF key designed to provide remote engine start with feedback, remote keyless entry, passive entry, passive engine start, and immobilization functionality.

Number of tested samples: 1
Serial number: B6A57C4A



3.6 EUT operation mode:

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

- Tx mode at LR1 924.00 MHz
- Rx mode at LR 926.000 MHz
-

3.7 EUT configuration:

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

- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____
- _____ Model : _____

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.

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY

4.2 Statement regarding the usage of logos in test reports

The accreditation and notification body logos displayed in this test report are only valid for standards listed in the accreditation or notification scope of CSA Group Bayern GmbH.

4.3 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

4.4 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k = 2. The true value is located in the corresponding interval with a probability of 95 % 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. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern 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 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.

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Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
20 dB Bandwidth	Center frequency of EuT	95%	± 2.5 x 10^{-7}
99% Occupied Bandwidth	Center frequency of EuT	95%	± 2.5 x 10^{-7}
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	± 3.53 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 3.71 dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	± 2.34 dB
Radiated power of the fundamental wave	Center frequency of EuT	95%	± 3.71 dB
Peak conducted output power	902 MHz to 928 MHz	95%	± 0.35 dB
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	± 2.15 dB

4.5 Measurement Protocol for FCC, VCCI and AUSTEL

4.5.1 GENERAL INFORMATION

4.5.1.1 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.

4.5.1.1 General information

CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011

ISED: DE0009

In compliance with RSS 210 Issue 9 testing for RSS compliance may be achieved by following the procedures set out in ANSI.

4.6 Deviations or Exclusions from the Requirements and Standards

None

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.

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

Frequency range:

Min. limit margin

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

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	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 measurement is not applicable. The EuT has no AC mains connection.

The EuT is separated powered by a 3.0 V battery.

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.

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 – See Attachment B

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 analyser.

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.

Spectrum analyser settings:

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.2.5 Test result

Channel number	Fundamental frequency (MHz)	6 dB Bandwidth (kHz)	Minimum limit (kHz)
Spreading 15			
LR CH1	923.994	684	500
Spreading 31			
LR CH1	923.994	684	500

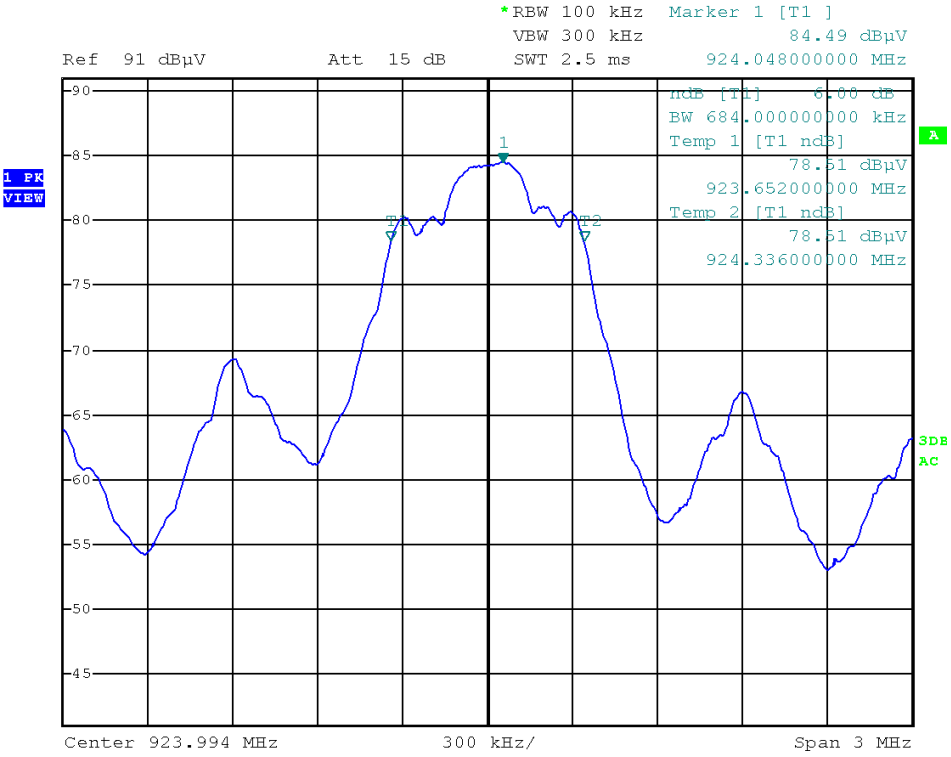
The requirements are **FULFILLED.**

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

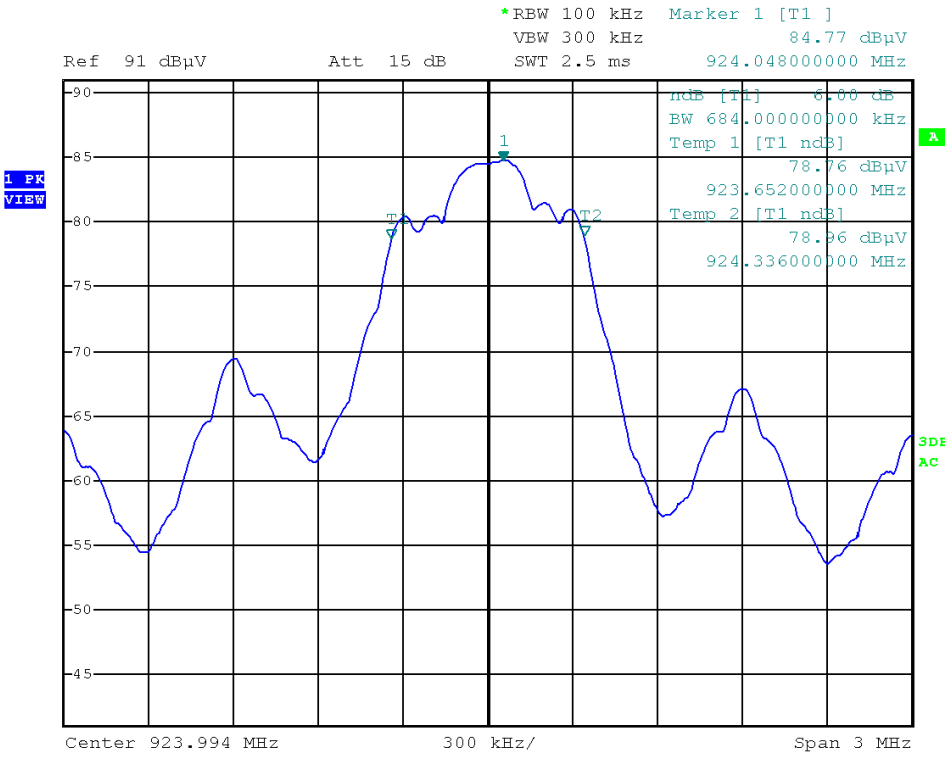
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

5.2.6 Test protocols

Channel LR CH1 – Spreading 15



Channel LR CH1 – Spreading 31



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.

5.3 Occupied bandwidth

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

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 B

5.3.3 Applicable standard

According to RSS-Gen, 4.6.1:
When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99 % emission bandwidth, as calculated or measured.

5.3.4 Description of Measurement

The bandwidth was measured with the function “bandwidth measurement” of the spectrum analyser. The EUT is connected via suitable attenuator at the spectrum analyser. The measurement is repeated for every different modulation standard of the EUT and recorded.

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.

5.3.5 Test result

	Fundamental frequency (MHz)	99 % Bandwidth (MHz)	Limit (MHz)
Spreading 15			
LR CH1	923.994	1.878	4.62
Spreading 31			
LR CH1	923.99955	1.884	4.62

Limit according to RSS 210, Annex 1, section A1.1.3:

The 99% bandwidth shall be no wider than 0.50% of the center frequency for devices operating above 900 MHz.

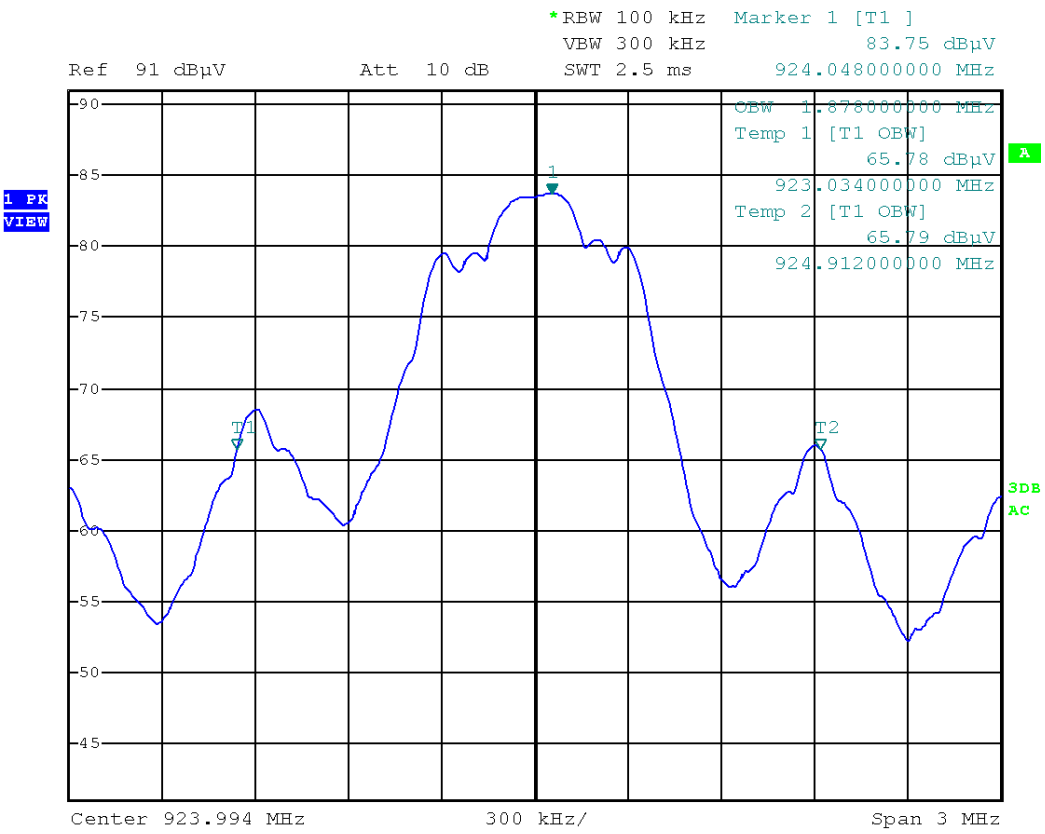
The requirements are **FULFILLED.**

Remarks: For detailed results, please see the test protocol below.

The Rhode & Schwarz analyzer which we used for this measurement calculates automatically the 99 % emission bandwidth.

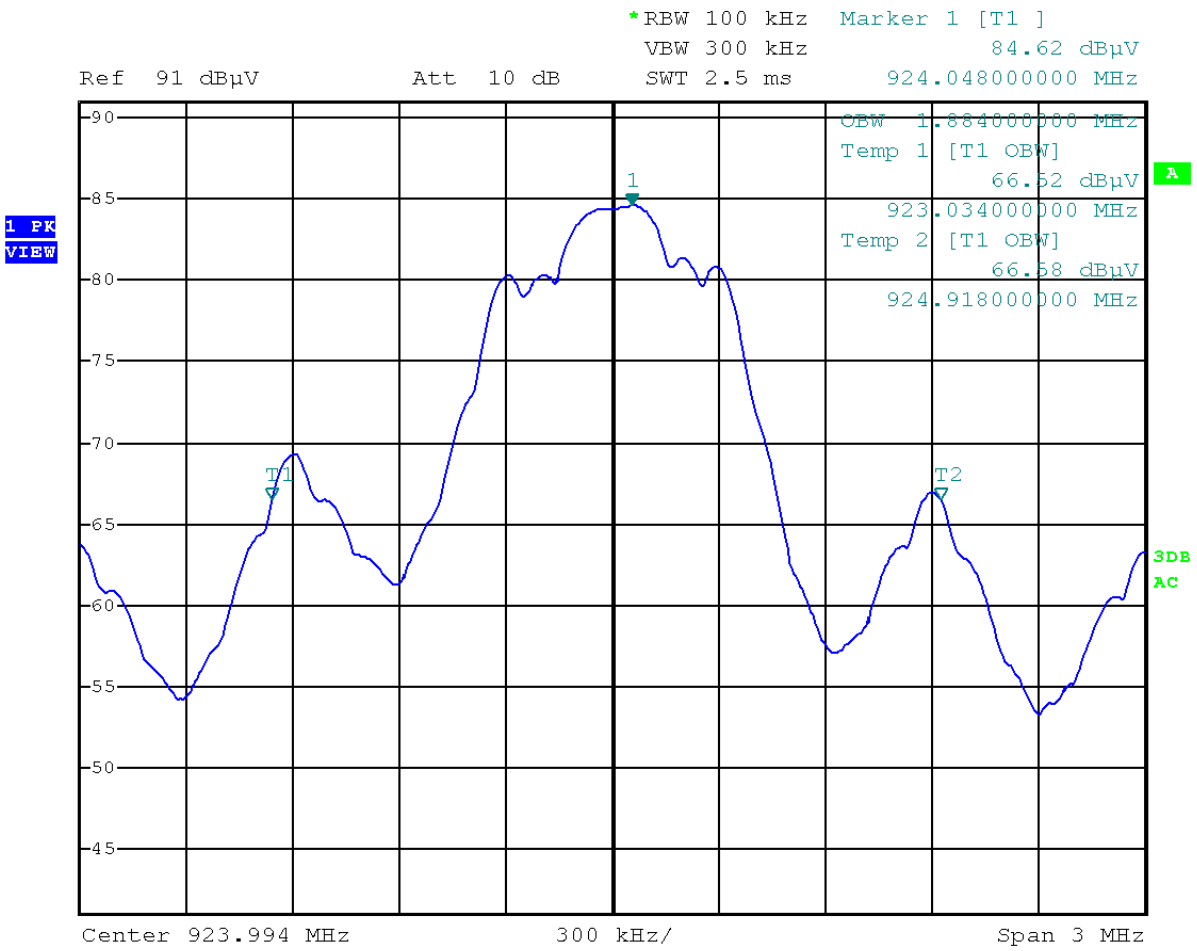
5.3.6 Test protocols

LR CH1, Spreading 15:



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.

LR CH1, Spreading 31:



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5.4 Radiated emission of the fundamental wave

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

5.4.1 Description of the test location

Test location: OATS 1

Test distance: 10 metres

5.4.2 Photo documentation of the test set-up – See Attachment B

5.4.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):
For systems using digital modulation in the 902-298 MHz, 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.

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.

5.4.4 Description of Measurement

The radiated power of the fundamental wave from the EUT is measured in the frequency range of 30 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 150 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.

The resolution bandwidth during the measurement is as follows:
30 MHz – 1000 MHz: ResBW: 120 kHz

5.4.5 Test result

Frequency (MHz)	Reading level QP (dBµV)	Bandwidth (kHz)	Correction factor (dB)	Corrected level QP (dBm)	Limit (dBm)	Delta (dB)
923.994	58.3	120	-61.5	-3.2	30.0	-33.2

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**
2400-2483.5	30	1.0
5725-5850	30	1.0

The requirements are **FULFILLED.**

Remarks: The device has no antenna connector. To find out the max. power this measurement was performed.

The following measurements are based on this result.

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.

5.5 Maximum peak conducted output power

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

5.5.1 Description of the test location

Test location: Shielded Room S4

5.5.2 Photo documentation of the test set-up – See Attachment B

5.5.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):
For systems using digital modulation in the 902 – 928 MHz, 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.

5.5.4 Description of Measurement

The EuT was fixed mounted on the receiving antenna of the spectrum analyzer to find out the maximum power.
An analyzer offset was tried to see the compliance to the measured radiated value.

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.

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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Spectrum analyser settings:

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

a) Set the RBW ≥ *DTS bandwidth*.
b) Set VBW ≥ 3 × RBW.
c) Set span ≥ 3 x RBW
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

5.5.5 Test result

Channel	Frequency (MHz)	Measured conducted power (dBm)	Peak power limit (dBm)	Delta (dB)
LR CH1	924.019325	11.05	30.0	-18.95

Declaration of manufacturer:

Channel	Max. radiated power ERP (dBm)	Conv. factor ERP – EiRP (dB)	EuT antenna Gain (dBi)	Calculated conducted output power (dBm)
LR CH1	1.0	+2.15	-7.9	11.05

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**
2400-2483.5	30	1.0
5725-5850	30	1.0

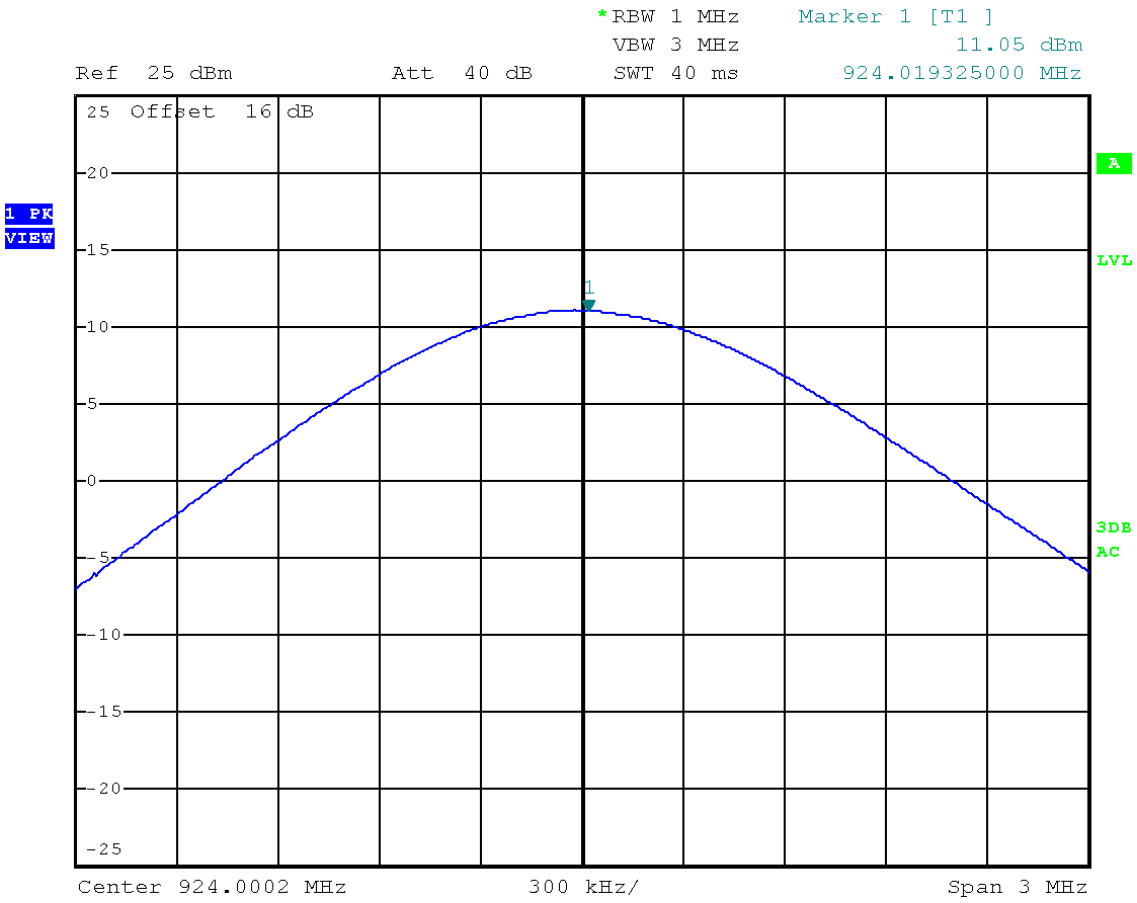
The requirements are **FULFILLED.**

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

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.

5.5.6 Test protocols

LR CH1



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.

5.6 Spurious emissions conducted

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

5.6.1 Description of the test location

Test location: Shielded Room S4

5.6.2 Photo documentation of the test set-up – See Attachment B

5.6.3 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).

5.6.4 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.

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.

5.6.5 Test result

Signal levels which are located in restricted band.

Tx mode @ LR CH1: 924.000 MHz, max. level 11.07 dBm			
Frequency (MHz)	Peak power * (dBm)	Limit (-20 dB) (dBm)	Delta (dB)
14976.0	-50.06	-8.93	-27.30

The requirements are **FULFILLED.**

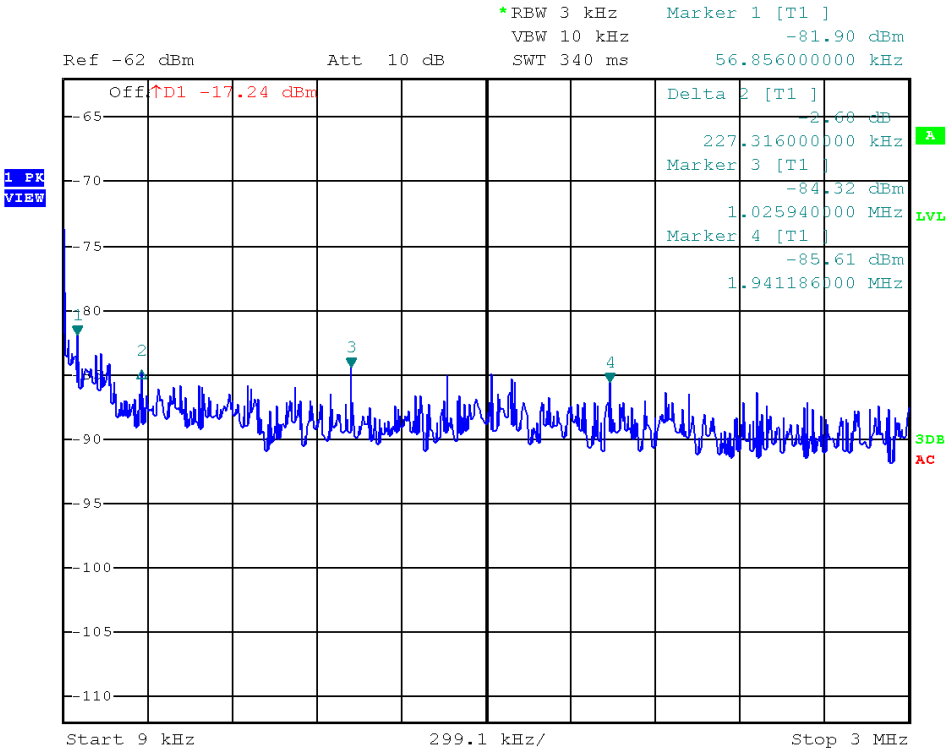
Remarks: All spurious emissions falling in restricted bands have been measured radiated.

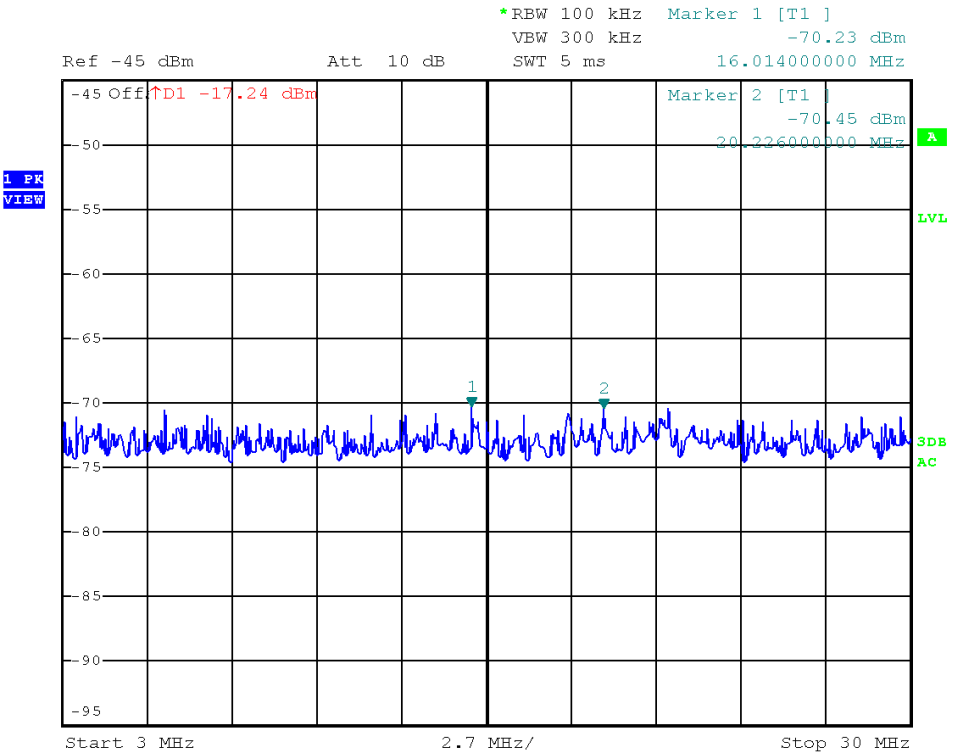
For detailed results please refer to following test protocol.

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.

5.6.6 Test protocols

Conducted RF emission from 9 kHz to 30 MHz

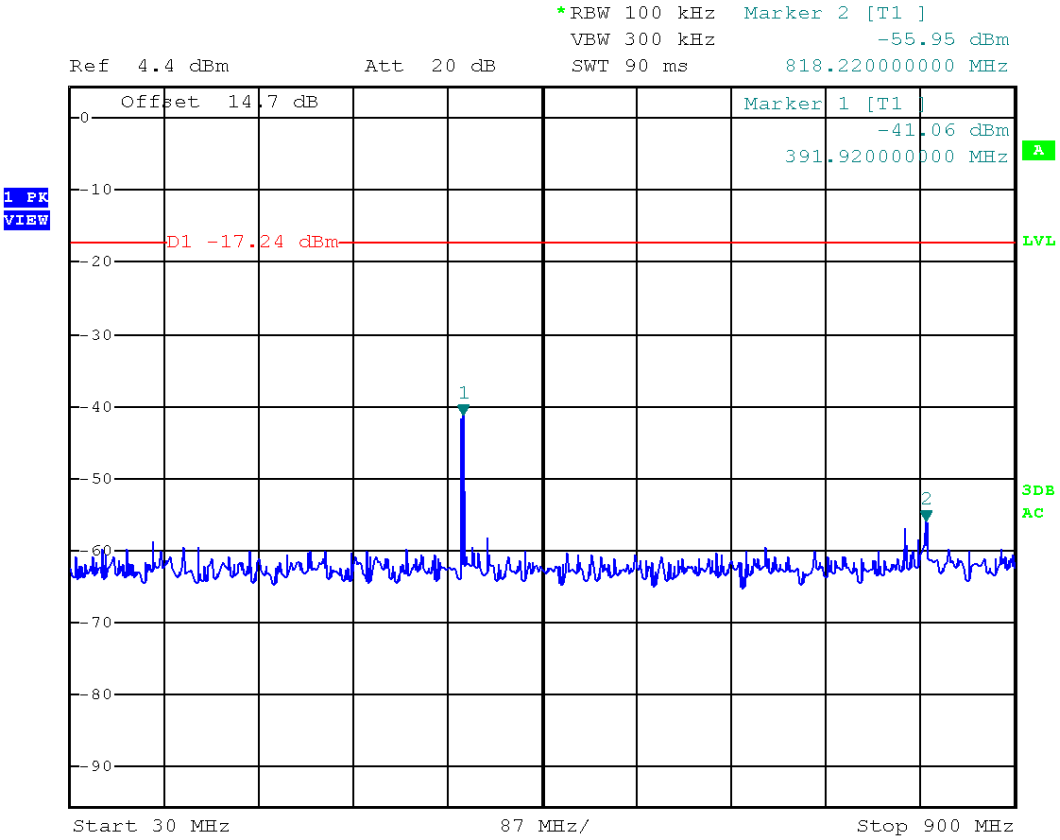




The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: KR5BTP / IC ID: 7812D-BTP

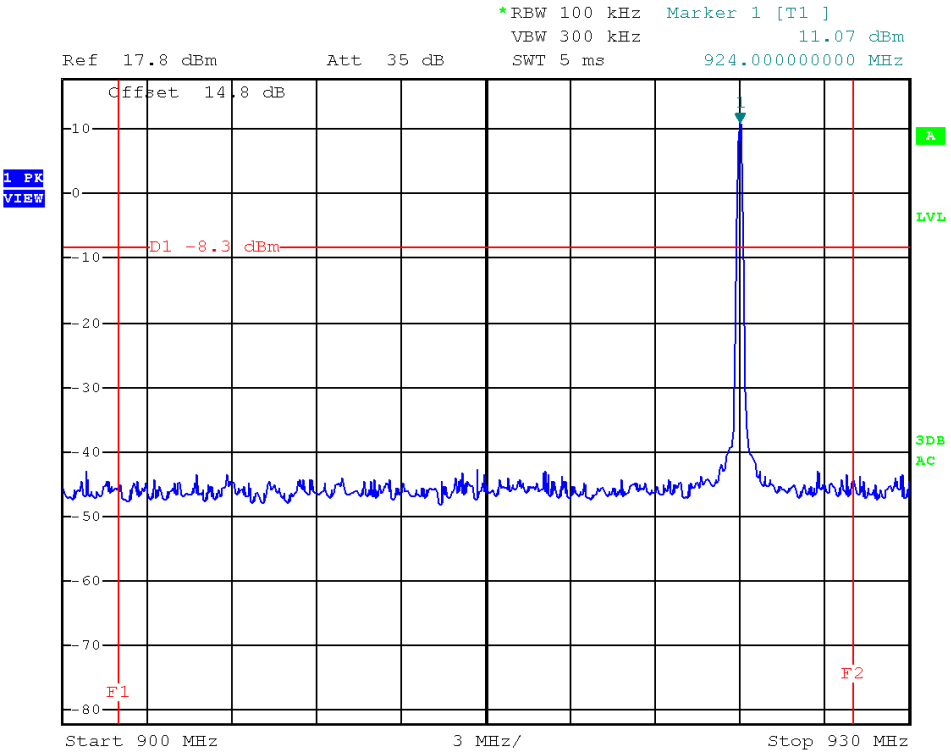
Conducted RF emission from 30 to 1000 MHz



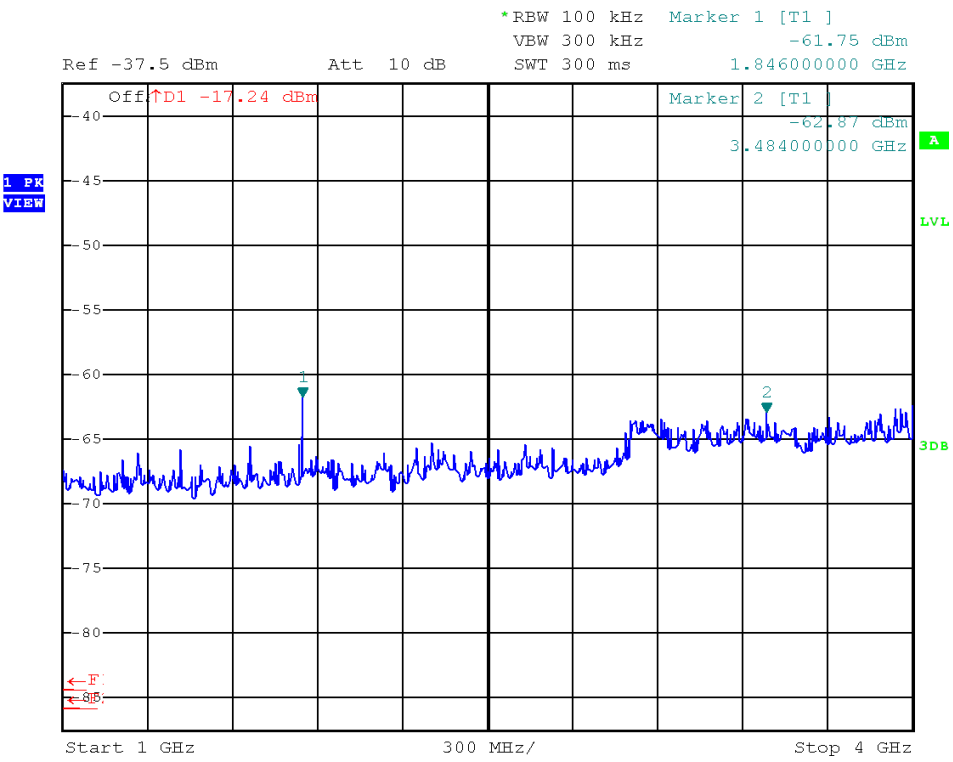
The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

FCC ID: KR5BTP / IC ID: 7812D-BTP

Conducted RF emission from 902 to 928 MHz
(Band edge)

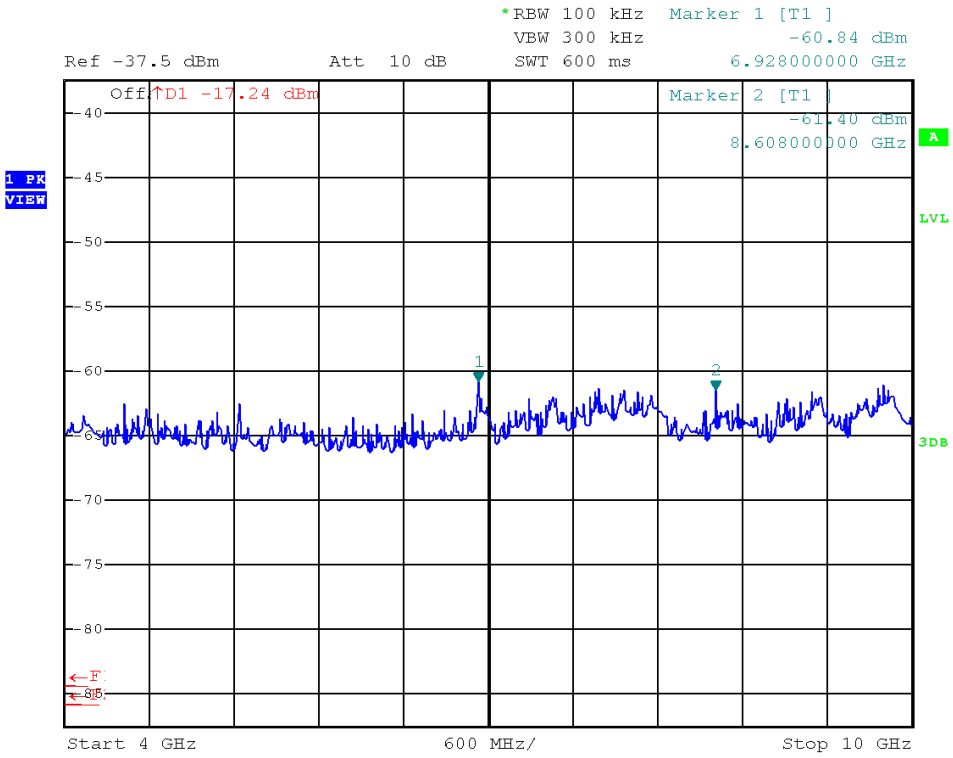


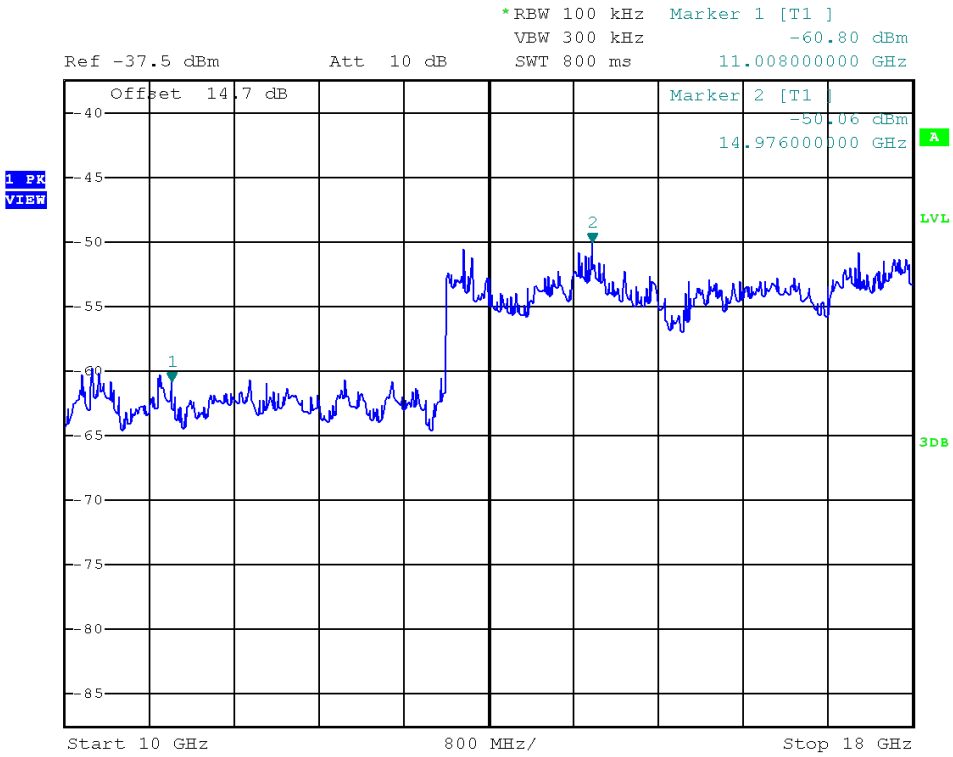
Conducted RF emission from 1 to 10 GHz



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: KR5BTP / IC ID: 7812D-BTP





Note: Signal level no. 1 is located in restricted band.

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.

5.8 Spurious emissions radiated

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

5.8.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 2

Test distance: 3 m

5.8.2 Photo documentation of the test set-up – See Attachment B

5.8.3 Applicable standard

According to FCC Part 15, Section 15.247(d):
In any 100 kHz bandwidth outside the frequency bands 902 – 928 MHz, 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)).

5.8.4 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.

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.

5.8.5 Test result radiated emissions

5.8.5.1 Radiated emission test f < 1 GHz

Frequency [kHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
536.8	24.1	19.7	9.0	20	44.1	39.7	73.0	-33.3
1073.6	23.4	18.0	9.0	20	43.4	38.0	67.0	-29.0
1342.0	21.6	15.9	9.0	20	41.6	35.9	65.0	-29.1

Frequency [MHz]	L: QP [dBµV]	Correct. [dB]	L: QP [dBµV/m]	Limit [dBµV/m]	Delta [dB]
73.50	2.8	12.0	14.8	40.0	-22.9
162.20	6.9	14.6	21.5	43.5	-21.3

In both frequency ranges only ambient noises could be detected.

5.8.5.2 Radiated emission test f > 1GHz

Tx mode @ LR CH1:

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)
14.784	31.8	--	1000	4.2	36.0	--	54.0	-18.0

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: KR5BTP / IC ID: 7812D-BTP

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

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

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 the 10th harmonic (10.0 GHz).

All emissions not reported in this test report are more than 20 dB below the specified limit.

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.

5.9 Power spectral density

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

5.9.1 Description of the test location

Test location: Shielded Room S4

5.9.2 Photo documentation of the test set-up – See Attachment B

5.9.3 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.

5.9.4 Description of Measurement

The measurement is performed using the procedure set out in KDB-558074. This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

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.

Spectrum analyser settings:

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the *DTS bandwidth*.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 × RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.9.5 Test result

Channel LR CH 1	Frequency (MHz)	Reading (dBm)	Limit (dBm)
Spreading 15	924.0002	-9.38	8
Spreading 31	924.0002	-7.82	8

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

Frequency (MHz)	Power spectral density limit (dBm/3 kHz)
902 - 928	8

The requirements are **FULFILLED.**

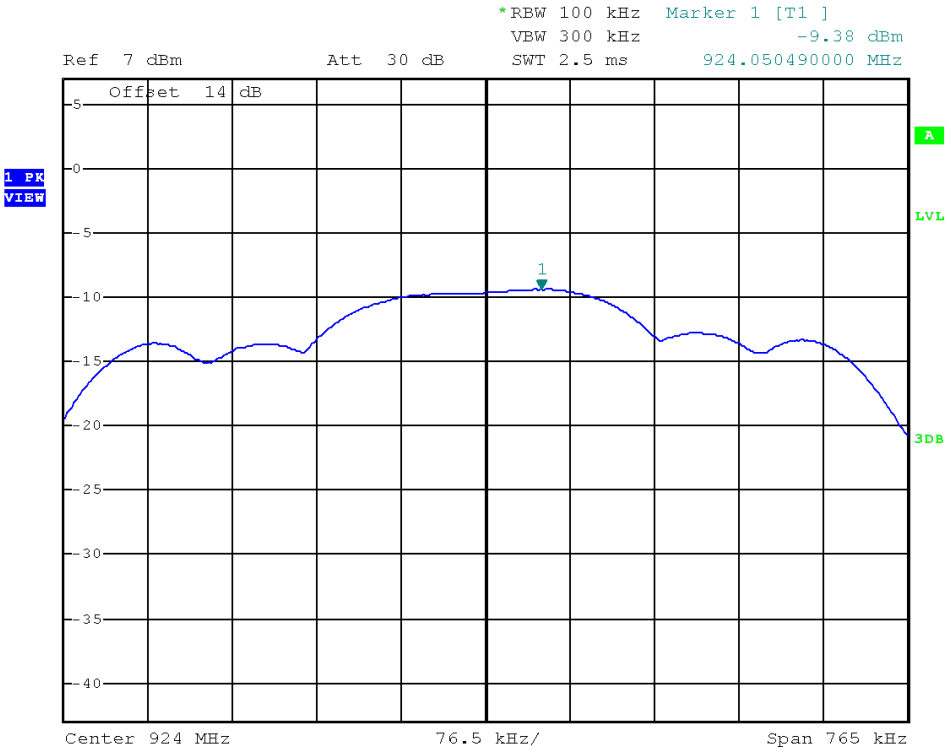
Remarks: For detailed test results please refer to following test protocols.

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.

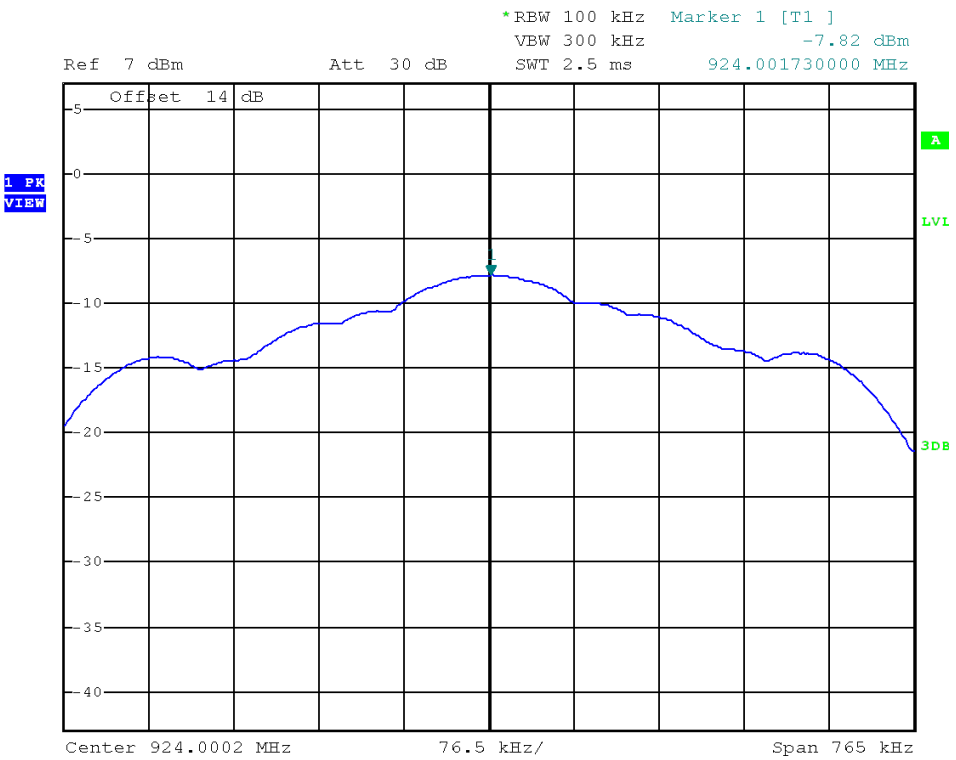
FCC ID: KR5BTP / IC ID: 7812D-BTP

Power spectral density plots

Channel LR CH1 – Spreading 15



Channel LR CH1 – Spreading 31



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.

5.10 Maximum permissible exposure (MPE)

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

5.10.1 Description of the test location

Test location: AREA4

5.10.2 Applicable standard

According to KDB 447498 D01 General Exposure Guidance v05r01:
- Section 4.3. General SAR test reduction and exclusion guidance
- Section 4.3.1. Standalone SAR test exclusion considerations

5.10.3 Description of Measurement

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[24] where

   - $f_{(GHz)}$ is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation[25]
   - The result is rounded to one decimal place for comparison
   - 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

   The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

2) At 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B:[26]

   a) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·($f_{(MHz)}$/150)] mW, at 100 MHz to 1500 MHz

   b) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

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.

5.10.4 Test result

Channel No.	Frequency	Max rated output power to antenna		Test separation Distance accd. Annex A	SAR Test Exclusion Threshold
	(MHz)	(dBm)	(mW)	(mm)	(mW)
LR 1	923.994	11.05	12.74	5.0	16

Limits for maximum permissible exposure (MPE), KDB 447498, Annex A:

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table. The equation and threshold in section 4.3.1 must be applied to determine SAR test exclusion.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

MHz	30	35	40	45	50	mm
150	232	271	310	349	387	SAR Test Exclusion Threshold (mW)
300	164	192	219	246	274	
450	134	157	179	201	224	
835	98	115	131	148	164	
900	95	111	126	142	158	
1500	73	86	98	110	122	
1900	65	76	87	98	109	
2450	57	67	77	86	96	
3600	47	55	63	71	79	
5200	39	46	53	59	66	
5400	39	45	52	58	65	
5800	37	44	50	56	62	

Note: 10-g Extremity SAR Test Exclusion Power Thresholds are 2.5 times higher than the 1-g SAR Test Exclusion Thresholds indicated above. These thresholds do not apply, by extrapolation or other means, to occupational exposure limits.

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: KR5BTP / IC ID: 7812D-BTP

Limits for maximum permissible exposure (MPE), KDB 447498, Annex B:

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and > 50 mm

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table. The equation and threshold in section 4.3.1 must be applied to determine SAR test exclusion.

MHz	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
100	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567	
150	387	397	407	417	427	437	447	457	467	477	487	497	507	517	527	
300	274	294	314	334	354	374	394	414	434	454	474	494	514	534	554	
450	224	254	284	314	344	374	404	434	464	494	524	554	584	614	644	
835	164	220	275	331	387	442	498	554	609	665	721	776	832	888	943	
900	158	218	278	338	398	458	518	578	638	698	758	818	878	938	998	
1500	122	222	322	422	522	622	722	822	922	1022	1122	1222	1322	1422	1522	mW
1900	109	209	309	409	509	609	709	809	909	1009	1109	1209	1309	1409	1509	
2450	96	196	296	396	496	596	696	796	896	996	1096	1196	1296	1396	1496	
3600	79	179	279	379	479	579	679	779	879	979	1079	1179	1279	1379	1479	
5200	66	166	266	366	466	566	666	766	866	966	1066	1166	1266	1366	1466	
5400	65	165	265	365	465	565	665	765	865	965	1065	1165	1265	1365	1465	
5800	62	162	262	362	462	562	662	762	862	962	1062	1162	1262	1362	1462	

The requirements are **FULFILLED.**

Remarks: _____

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.

5.12 Antenna application

5.12.1 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.

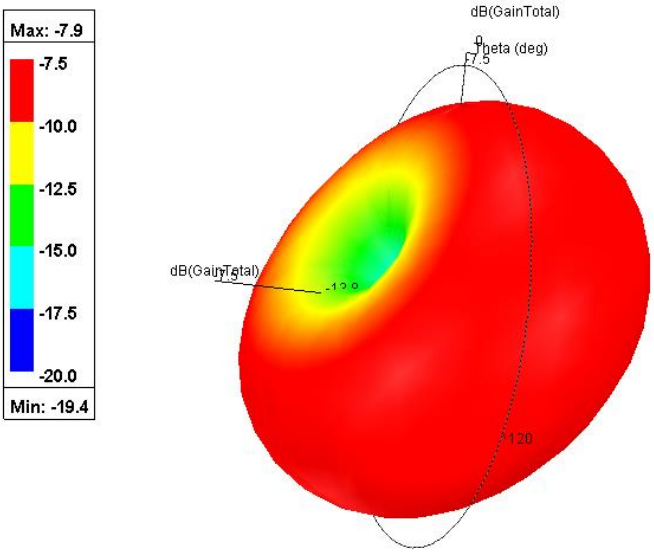
The EUT has an external antenna connector. Only the delivered antenna type should be used.
For detailed information please refer to the user manual.

All supplied antennas meet the requirements of part 15.203 and 15.204.

5.12.2 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.

- Antenna characteristics:



Gain [dBi]		
Min	Avg	Max
-19.4	**-10.3**	**-7.9**

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.

5.14 Receiver radiated emissions

For test instruments and accessories used see section 6 Part **SER 1, SER2** and **SER3**.

5.14.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 2

Test distance: 3 m

5.14.2 Photo documentation of the test set-up – See Attachment B

5.14.3 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.

5.14.4 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.

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: KR5BTP / IC ID: 7812D-BTP

5.14.5 Test result

5.14.5.1 f < 1 GHz)

Frequency [kHz]	L: QP [dBµV]	L: AV [dBµV]	Bandwidth [kHz]	Correct. [dB]	L: QP [dBµV/m]	L: AV [dBµV/m]	Limit [dBµV/m]	Delta [dB]
536.8	24.1	19.7	9.0	20	44.1	39.7	73.0	-33.3
1073.6	23.4	18.0	9.0	20	43.4	38.0	67.0	-29.0
1342.0	21.6	15.9	9.0	20	41.6	35.9	65.0	-29.1

Frequency [MHz]	L: QP [dBµV]	Correct. [dB]	L: QP [dBµV/m]	Limit [dBµV/m]	Delta [dB]
33.78	3.7	13.4	17.1	40.0	-22.9
118.54	9.3	12.9	22.2	43.5	-21.3
517.43	4.8	21.9	26.7	46.0	-19.3

In both frequency ranges only ambient noises could be detected.

5.14.5.2 f > 1GHz

Rx mode

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)
3761.0	26.2		1000	3.3	29.5		54.0	-24.5
8536.0	23.2		1000	7.5	30.7		54.0	-23.3

In the frequency range from 1 GHz up to 25 GHz only ambient noises could be detected.

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.

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.

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	ESCI	02-02/03-05-005	04/12/2020	04/12/2019		
	FSP 40	02-02/11-11-001	07/10/2020	07/10/2019		
	RF Antenna	02-02/24-05-032				
	METRAHIT WORLD	02-02/32-15-001	16/12/2020	16/12/2019		
CPR 2	ESVS 30	02-02/03-05-006	19/08/2020	19/08/2019		
	VULB 9168	02-02/24-05-005	19/07/2020	19/07/2019		
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
MB	ESCI	02-02/03-05-005	04/12/2020	04/12/2019		
	FSP 40	02-02/11-11-001	07/10/2020	07/10/2019		
	RF Antenna	02-02/24-05-032				
	METRAHIT WORLD	02-02/32-15-001	16/12/2020	16/12/2019		
SEC 1-3	FSP 40	02-02/11-11-001	07/10/2020	07/10/2019		
	RF Antenna	02-02/24-05-032				
	METRAHIT WORLD	02-02/32-15-001	16/12/2020	16/12/2019		
	WHJS 1000-10EE	02-02/50-05-070				
SER 1	ESCI	02-02/03-05-005	04/12/2020	04/12/2019		
	HFH 2 - Z 2	02-02/24-15-001	28/03/2020	28/03/2019		
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 2	ESVS 30	02-02/03-05-006	19/08/2020	19/08/2019		
	VULB 9168	02-02/24-05-005	19/07/2020	19/07/2019		
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 3	FSP 40	02-02/11-11-001	07/10/2020	07/10/2019		
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	AFS4-01000400-10-10P-4	02-02/17-13-002				
	AMF-4F-04001200-15-10P	02-02/17-13-003				
	3117	02-02/24-05-009	06/06/2020	06/06/2019		
	Sucoflex N-2000-SMA	02-02/50-05-075				

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