

Test Report

Radio Frequency Devices – Intentional Radiators

Test Report – No.: 2223020KAU-002

Date of issue: 2015-12-10

Type: RF Board

Description of the EUT: RF tranceiver

Serialnumber: Prototype

Manufacturer and Applicant: TENSATOR S.A.

Address: Rua Dr. Jose Espirito Santo, Lote 1A
PT-1959-001 LISBOA
PORTUGAL

Summary:

Referring to the emission limits and the operating mode during the tests specified in this report the equipment complies with the requirements according to

47 CFR Part 15, Subpart C, Intentional radiators, section 15.231

Test methods according to ANSI C63.10-2009

Test Laboratory:

Intertek Deutschland GmbH, Innovapark 20, 87600 Kaufbeuren

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This test report . All measurement results exclusively refer to the equipment, which was tested.
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Revision History

Edition	Date	Description
1	2015-12-10	First release

Details about Accreditation/ Acceptance

EMC/ Radio National



The Intertek Deutschland EMC- Lab is accredited of the Deutsche Akkreditierungsstelle GmbH (DAkkS)

Registration Number: **D-PL-12085-01-01**

International



The Intertek Deutschland EMC- Lab is accepted of the Worldwide System for Conformity Testing and Certification of Electrotechnical Equipment and Components (IECEE)

CB Test Laboratory: **TL118**



The Intertek Deutschland EMC- Lab is listed at the Federal Communications Commission (FCC)

Registration Number: **498399**



The Intertek Deutschland EMC- Lab is listed at Industry Canada

No. **8882A-1** (OATS) and **8882A-2** (3 m alternative test site)

Automotive



The Intertek Deutschland EMC- Lab is recognized technical Service of the Kraftfahrt-Bundesamtes (KBA)

Registration Number: **KBA-P 00046**

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1 Equipment under test (EUT)

1.1 Identification of the EUT according to the manufacturer/client declaration

Type/ Model:

Description of the EUT:

Transmitter frequency range: 434 MHz

Frequency agile or hopping: ☐ Yes ☒ No

Antenna: ☒ Internal antenna ☐ External antenna

Antenna connector: ☒ None, internal antenna ☐ Yes, type

Temperature range: ☐ Category I (General): -20°C to +55°C
☐ Category II (Portable equipment): -10°C to +55°C
☒ Category III (Equipment for normal indoor use): +5°C to +35°C
☐ Other:

1.2 Test conditions

The radiated emission tests of the EUT were done with CW.

If not additionally specified, the tests were performed under the following environmental conditions:

Parameter	See each single test in this report
Supplying voltage	5 V _{DC}

1.3 Additional hardware information about the EUT

The EUT consists of the following units:

See 2.4

1.4 Peripheral equipment

Peripheral equipment is defined as equipment needed for correct operation of the EUT during the tests, but not included as a part of the testing and evaluation of the EUT.

See 2.4

1.5 Test signals

The radiated emission tests of the EUT were done with CW and with modulation.

1.6 Modification during the tests

No modifications have been made during the tests.

2 Test specifications

2.1 Standards

47 CFR Part 15, Subpart C, Intentional radiators, section 15.231

Test methods in:

ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices

2.2 Additions, deviations and exclusions from standards and accreditation

No additions, deviations or exclusions have been made from standards and accreditation.

2.3 Test site

Measurements were performed at:

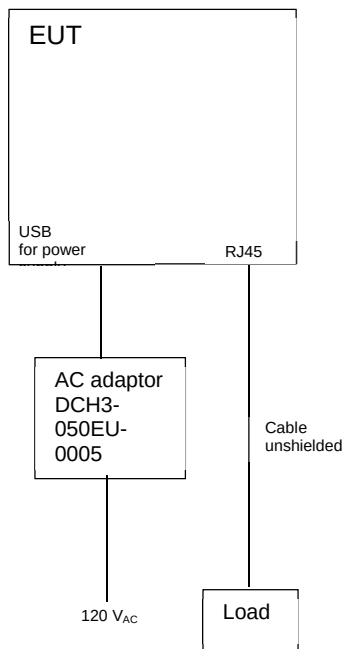
Intertek Deutschland GmbH, Innovapark 20, 87600 Kaufbeuren

Test sites:

Measurement Chamber	Type of chamber	IC Site filing #
OATS	10m	8882A-1
ANECHOIC CHAMBER 1	Semi-anechoic 3m	8882A-2

2.4 Test set-up

This is the principle block diagram.



2.5 Sample calculation

The radiated test below 30 MHz was performed in a measurement distance of 3 m. In the case of limits with a different measurement distance, the limit conversion is described in the section of the measurement.

For all other measurements, the measurement results can be compared directly with the limits.

3 Test summary

The results in this report apply only to the tested sample:

Test	Result	Section in report	Note
Standard test methods			
AC power-line conducted tests	Pass	See EMC report	Class B
Radiated test below 30 MHz	Pass	4	
Radiated emissions measurements from 30 to 1000 MHz	Pass	5	
Determination of radiated and antenna conducted emissions above 1 GHz	NA		
Frequency Stability Test	NA		
Occupied bandwidth test	Pass	6	
Output Power average symbol envelope power	NA		
Power Spectral Density < 40 GHz	NA		
Power Spectral Density > 40 GHz	NA		
In-situ measurements	NA		
Polar plot, main lobe and variation on radiated emissions test	NA		
Device-specific tests			
Measurement of cable locating equipment	NA		
Determining of cordless telephone handset security code	NA		
Determination of total input power	NA		
Procedure determining compliance for periodic operation [15.231, 15.240(b)]	NA		
Determining the average value of pulsed emissions per 15.35(c)	NA		
Comparison of limits per 15.231(b)(3)	NA		
Procedure to determine compliance of frequency pairing for 47 CFR 15.233(b)(2)	NA		
Determination of frequency hopping compliance per 47 CFR 15.247	NA		
Determination of digital modulation compliance per 47 CFR 15.247	NA		
Determination of peak conducted output unlicensed wireless device power [15.247(b), 15.255]	NA		
Determination of maximum conducted output power (15.247, 15-E)	NA		
Determination of MIMO compliance (2nd edition)	NA		
Determination of Smart antenna compliance (2nd edition)	NA		
Determination of antenna gains, including those emitting in multiple directions (15.247)	NA		
Determination of compliance with RF exposure limits	NA		
Millimeter wave test procedures for systems operating at 54GHz and greater	NA		
Determination of EIRP (15-F)	NA		
Determination Transmitter Etiquette FCC Part 15.255	NA		
Determination of Dynamic Frequency Selection (DFS) including Channel Move Time and In Service Monitoring	NA		
Determination of channel availability	NA		
Determination of Dynamic Frequency Selection including Channel Move Time	NA		
Determination of transmitter power control (TPC) (15-E)	NA		
Peak excursion measurement for UNII devices	NA		
Determination of UWB bandwidth	NA		
Determination of the center frequency, f _C , and highest radiated emissions, f _M (15-F)	NA		

NT = Not Tested, by request of the Client

NA = Not Applicable

4 Radiated test below 30 MHz

Date of test:	2015-04-07	Test location:	Anechoic chamber 1
EUT Serial:	----	Ambient temp.	21.5 °C
Tested by:	UGR	Relative humidity	31.0 %
Test result:	Pass	Margin:	>30 dB

4.1 Requirement

Reference: FCC §15.231 / §15.209

Methods of measurement: ANSI C63.10, Clause 6.4

The limits below 30 MHz are given for different measurement distances. The limits below 30 MHz are converted to 3 m by using the extrapolation factor 40 dB/decade (according to §15.31)

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)	Field strength (dBμV/m) at 3 m
0.009 - 0.490	2400/F(kHz)	67.6 - 20 · log(F(kHz))	300	147.6 - 20 · log(F(kHz))
0.490 - 1.705	24000/F(kHz)	87.6 - 20 · log(F(kHz))	30	107.6 - 20 · log(F(kHz))
1.705 - 13.110	30	29.5	30	69.5
14.010 - 30.000	30	29.5	30	69.5
Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.				

4.2 Test setup details

see 5.2

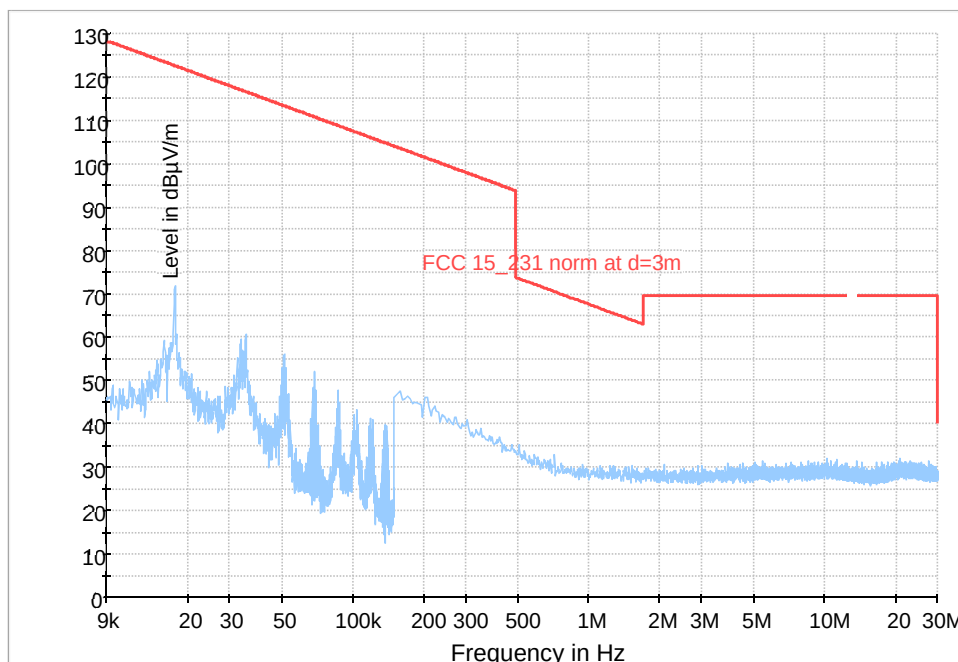
4.3 Test data

EMC32 Report

Common Information

Test Description:	Magnetic field strenght
Operating Conditions:	Test sample 4
Operator Name:	UGR
Date:	2015-04-07

FCC 15.209 9kHz-30MHz



4.4 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Measurement software	Rohde & Schwarz	EMC 32	--	--
Receiver, 10 Hz- 7 GHz	Rohde & Schwarz	ESR 7	PM KF 2441	2015-06
Loop antenna, 9 kHz- 30 MHz	Rohde & Schwarz	HFH2-Z2	PM KF 1401	2016-03

5 Radiated emissions measurements from 30 MHz to 7 GHz

Date of test:	2015-04-02	Test location:	Anechoic chamber 1
EUT Serial:	----	Ambient temp.	22.0 °C
Tested by:	UGR	Relative humidity	35.0 %
Test result:	Pass	Margin:	0,5 dB

5.1 Requirement

Reference: FCC §15.231

Methods of measurement: ANSI C63.10, Clause 6.5, 6.6 and RSS-Gen 6.13 / 8.9

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
30 – 88	100	40.0 (Quasi Peak)	3
88 – 216	150	43.5 (Quasi Peak)	3
216 – 960	200	46.0 (Quasi Peak)	3
Above 960	500	54.0	3
433.92	11000	81.0 (Average) 101 (Peak)	3

5.2 Test setup details

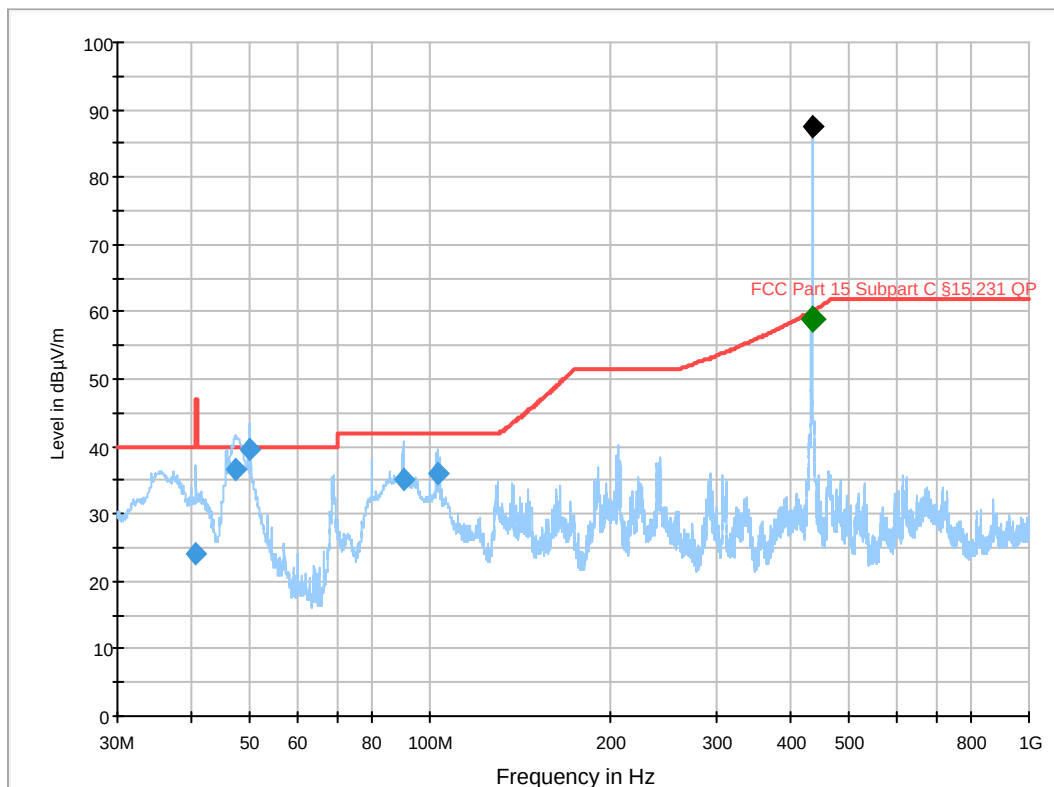
The EUT is a table-top EUT and was standing on a table made of Styrodur with a Pertinax plate on top and the dimensions 1.6 m x 1.0 m x 0.8 m (Length x Width x Height).

5.3 Test data

EMC32 Emission Report

Common Information

Test Description: Radiated emission
 Test standard: FCC Part 15 Subpart C §15.231
 Operating Conditions: Sample 4
 Operator Name: UGR
 Test date: 2015-04-02
 Overview sweeps performed with peak detectors and final measurement with quasi-peak detectors.



Final Result 1 (Quasi peak detector)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
40.590000	24.0	1000.0	120.000	120.0	V	0.0	15.7	16.0	40.0
47.310000	36.5	1000.0	120.000	120.0	V	0.0	11.5	3.5	40.0
50.010000	39.5	1000.0	120.000	120.0	V	0.0	9.7	0.5	40.0
90.000000	35.1	1000.0	120.000	120.0	V	180.0	11.0	6.8	41.9
102.870000	36.0	1000.0	120.000	120.0	V	270.0	11.6	5.9	41.9

(continuation of the "Final Result 1" table from column 10 ...)

Frequency (MHz)	Comment
40.590000	
47.310000	
50.010000	
90.000000	
102.870000	

Final Result 2 (Average detector)

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
433.920000	58.8	1000.0	120.000	120.0	V	90.0	16.3	23.4	81.0

(continuation of the "Final Result 2" table from column 10 ...)

Frequency (MHz)	Comment
433.920000	Fundamental with modulation

Final Result 3 (Peak detector)

Frequency (MHz)	Peak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
433.920000	87.4	1000.0	120.000	120.0	V	90.0	16.3	13.6	101.0

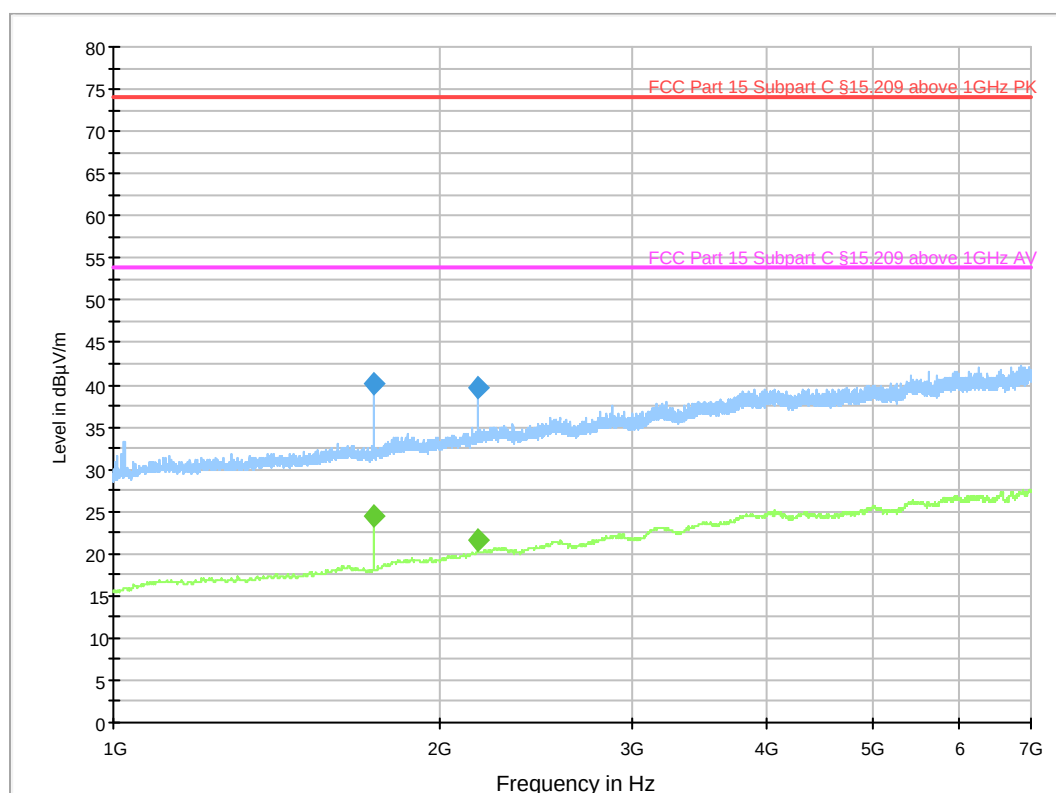
(continuation of the "Final Result 3" table from column 10 ...)

Frequency (MHz)	Comment
433.920000	Fundamental with modulation

EMC32 Emission Report

Common Information

Test Description: Radiated emission
 Test Standard: FCC Part 15 Subpart C §15.231
 Operating Conditions: Sample 4
 Operator Name: UGR
 Test date: 2015-04-07



Final Result 1

Frequency (MHz)	MaxPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1736.000000	40.0	1000.0	1000.000	240.0	H	0.0	-20.7	34.0	74.0
2169.750000	39.6	1000.0	1000.000	120.0	V	180.0	-19.2	34.4	74.0

Final Result 2

Frequency (MHz)	Average (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
1736.000000	24.5	1000.0	1000.000	240.0	H	0.0	-20.7	29.5	54.0
2170.000000	21.7	1000.0	1000.000	240.0	H	0.0	-19.2	32.3	54.0

5.4 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Measurement software	Rohde & Schwarz	EMC 32	--	--
Receiver, 10 Hz- 7 GHz	Rohde & Schwarz	ESR 7	PM KF 2441	2015-06
Antenna, 30-3000 MHz	Rohde & Schwarz	HL 562	PM KF 1123	2016-01
Antenna 1 – 18 GHz	EMCO	HF906	PM-KF-0947	2016-02
RF amplifier	Bonn	BLMA 0118-4A	PM-KF-0946	2015-06

6 Occupied Bandwidth

Date of test:	2015-12-02	Test location:	Anechoic chamber 1
EUT Serial:	---	Ambient temp.	22.1 °C
Tested by:	UGR	Relative humidity	42.9 %
Test result:	Pass		

6.1 Requirement

Reference: FCC §15.231

Methods of measurement: ANSI C63.10, Clause 6.9

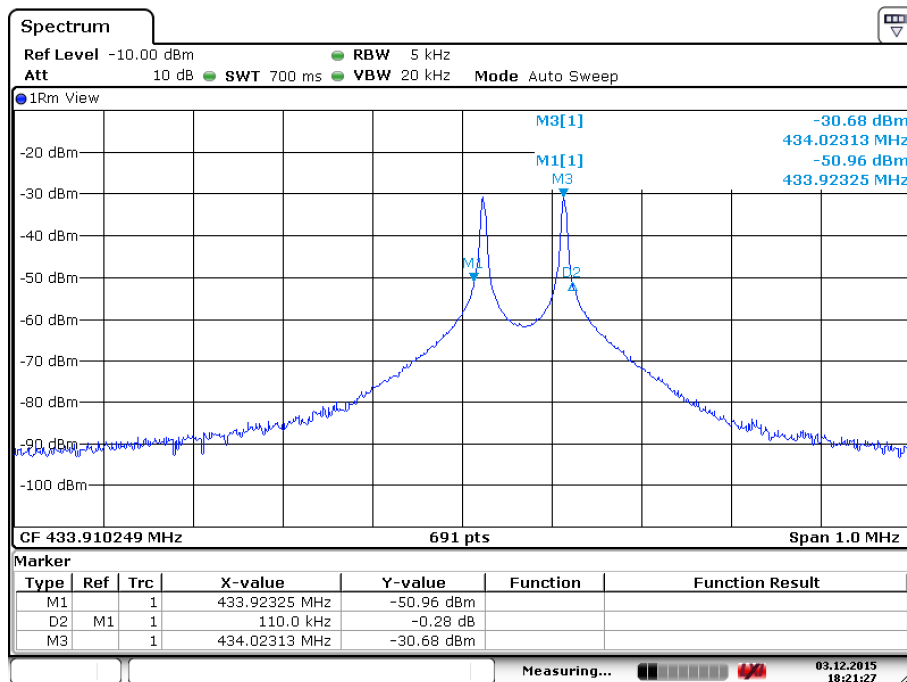
Frequency (fundamental) (MHz)	Bandwidth
433.92	0,25% of fundamental

6.2 Test setup details

The test setup was identical to the test setup at the radiated tests in the frequency range 30 MHz.to 7 GHz

6.3 Test data

Occupied bandwidth (20 dB)



Date: 3.DEC.2015 18:21:26

Test result: The occupied bandwidth is 110 kHz / 0,025% of fundamental frequency

6.4 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Measurement software	Rohde & Schwarz	EMC 32	--	--
Receiver, 10 Hz- 7 GHz	Rohde & Schwarz	ESR 7	PM KF 2441	2016-07
Antenna, 30-3000 MHz	Rohde & Schwarz	HL 562	PM KF 1123	2016-01
Antenna 1 – 18 GHz	EMCO	HF906	PM-KF-0947	2016-02
RF amplifier	Bonn	BLMA 0118-4A	PM-KF-0946	2017-07

7 Photos of the EUT



Photo 1: Front side



Photo 2: Rear side

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