SENTON

■ EMV-Prüfzentrum ■ EMI/EMC-Testcenter ■

Straubing, 08 July 2003

T E S T - R E P O R T

No. 52209-30278

for

Datatool System 3

Remote Control Transmitter

Applicant:	Liteon Automotive Electronics BV
Test Specification:	FCC Code of Federal Regulations, Part 15 Subpart C, Section 15.231

Table of Contents

1. Administrative Data

Test item (EUT)	
Type designation	Datatool System 3
Serial number(s):	001
Type of equipment:	Remote Control Transmitter
Parts/accessories:	---
FCC-ID:	
Technical data	
Frequency range	M/A
Operational frequency	433.920 MHz
Type of modulation	10K0A1D
Pulse frequency	N/A
Pulse width	N/A
Antenna	Integrated
Power supply	2 x 3 V Lithium Cell
Applicant: (full address)	LiteOn Automotive Electronics Tweelinglaan 57 NL-7324 BK Appeldoorn
Contract identification:	---
Contact person:	Mr. Stefan Rainer / TÜV Automotive GmbH
Manufacturer:	Applicant
Application details	
Receipt of EUT:	14 May 2003
Date of test:	June 2003
Note:	
Responsible for testing:	J. Roidt
Responsible for test report:	J. Roidt

2. Identification of Test Laboratory

DETAILS OF THE TEST LABORATORY	
COMPANY NAME:	Senton GmbH EMI/EMC Test Center
ADDRESS:	Aeussere Fruehlingsstrasse 45 D-94315 Straubing Germany
LABORATORY ACCREDITATION:	DAR-Registration No. TTI-P-G 062/94-40
FCC TEST SITE LISTING	
INDUSTRY CANADA TEST SITE REGISTRATION	IC 3050
NAME FOR CONTACT PURPOSES:	Mr. Johann Roidt
TELEPHONE: (+49) (0)9421 5522-0	FAX: (+49) (0)9421 5522-99

PERSONNEL INVOLVED IN THIS TEST REPORT	
TECHNICAL DIRECTOR:	 Mr. Johann Roidt
RESPONSIBLE FOR TESTING:	Mr. Martin Steindl
RESPONSIBLE FOR TEST REPORT:	Mr. Martin Steindl

SUMMARY OF TEST RESULTS
The tested sample complies with the requirements set forth in the **FCC Code of Federal Regulations** **Part 15, Subpart C, Section 15.231**

3. Operation Mode of EUT

While one button is pressed, the transmitter continuously sends the corresponding datagram. When the button is released, the transmitter stops working instantly.

4. Configuration

Configuration of the EUT
Not applicable

Cables connected to the EUT
Not applicable

Peripheral devices connected to the EUT
Not applicable

5. Measuring Methods

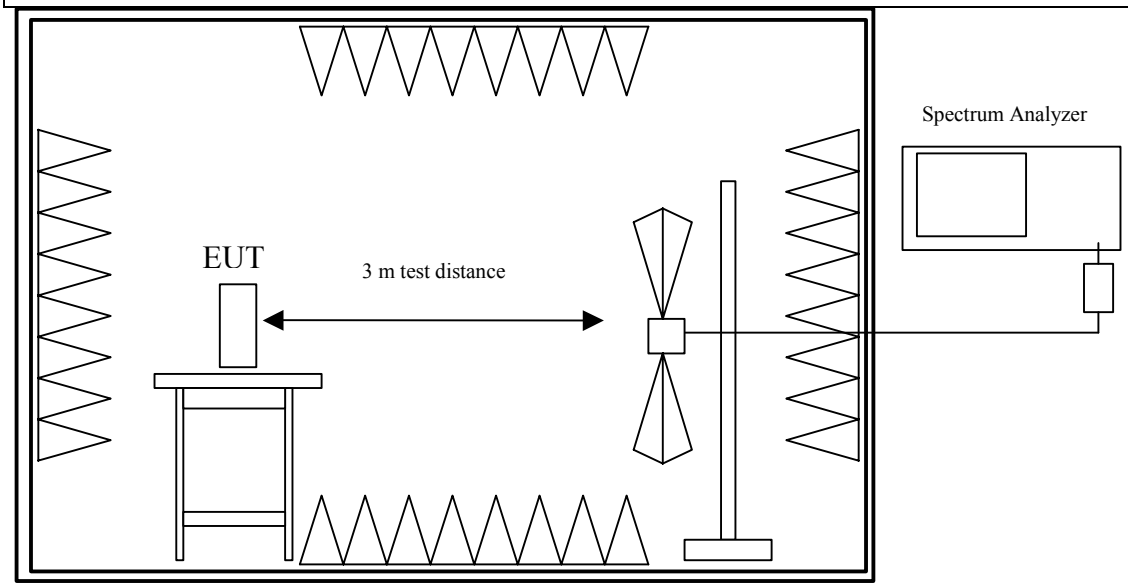
5.1. Field Strength of Emissions, Prescans in a fully-anechoic room (30 MHz – 1 GHz)

Rules and Specifications:	Sections 15.109 & 15.231
Guide:	ANSI C63.4 1997

Measurement Procedure:

Radiated emissions are measured over the frequency range from 30 MHz to 1 GHz.

Measurements were made in both the horizontal and vertical planes of polarization in a fully anechoic room using a spectrum analyzer with the detector function set to peak and resolution bandwidth set to 100 kHz. All tests were performed at a test-distance of 3 meters. Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.



Fully anechoic chamber

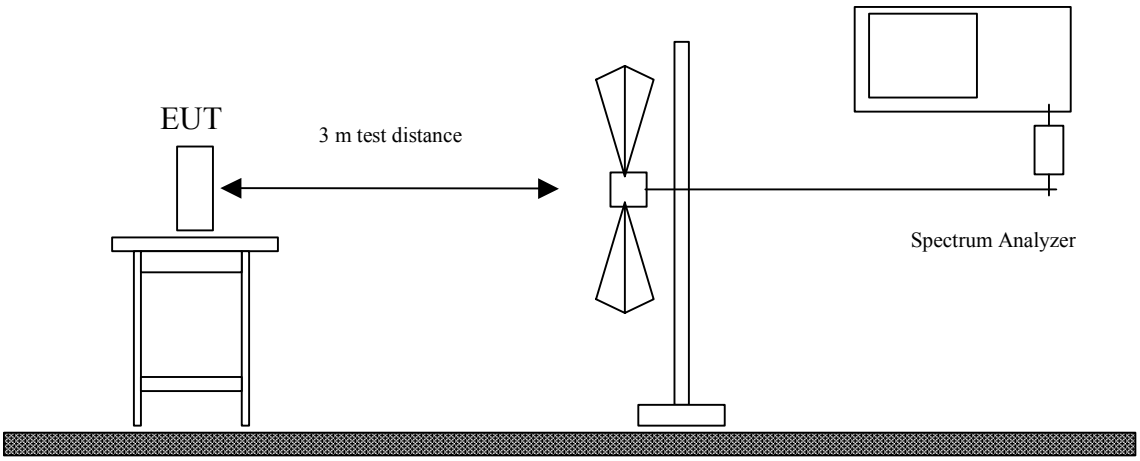
Test instruments used:

No.	Type	Model	Serial Number	Manufacturer
01	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
113	Preamplifier	CPA9231A	3393	Schaffner
141	Biconical antenna	HK 116	829708/006	Rohde & Schwarz
143	Log. periodic antenna	3147	9112-1054	EMCO
003	Fully anechoic room	No. 2	1452	Albatross Projects

5.2. Fieldstrength of Emissions, Measurement at Open Area Test Site (30 MHz – 1 GHz)

Rules and Specifications:	Sections 15.109 & 15.231
Guide:	ANSI C63.4 1997

Measurement Procedure:
Measurement Procedure: For final testing an open-area test-side was used. Radiated emissions are measured over the frequency range from 30 MHz to 1 GHz. Measurements were made in both the horizontal and vertical planes of polarisation at a open area test side using a spectrum analyser with the detector function set to CISPR. All test were performed at a test distance of 3 meters. During the tests the EUT is rotated all around, and the receiving-antenna is rased and lowered from 1m to 4m to find the maximum levels of emissions. The cables and equipment were placed and moved within the range of position likely to find their maximum emissions.



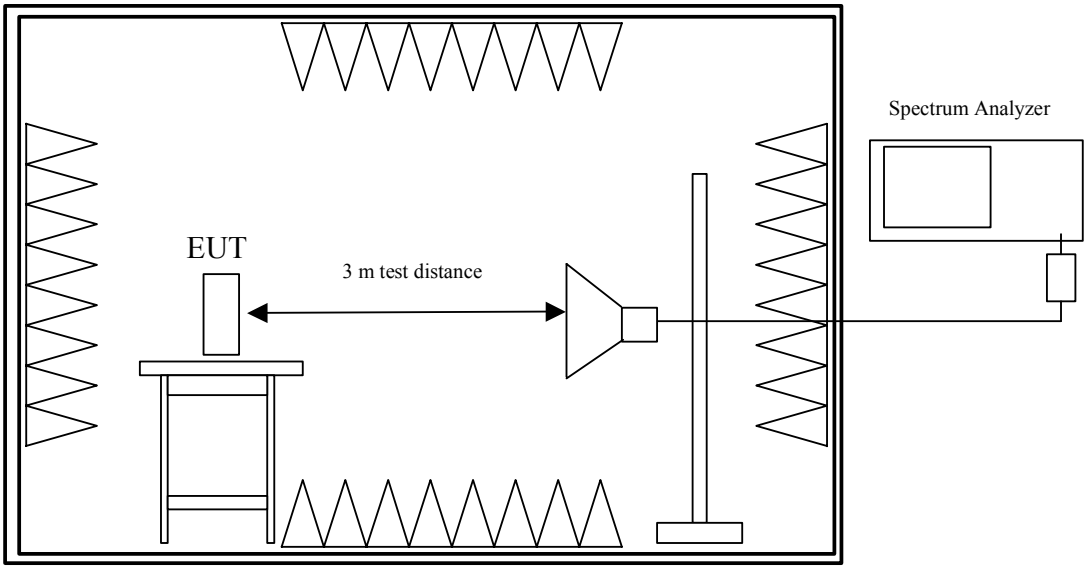
Test instruments used:

No.	Type	Model	Serial Number	Manufacturer
01	EMI Receiver	ESVP	881414/009	Rohde & Schwarz
141	Biconical antenna	HK 116	829708/006	Rohde & Schwarz
143	Log. periodic antenna	3147	9112-1054	EMCO
003	Open Field Test Site	No. 1	N/A	Senton

5.3. Fieldstrength of Emissions above 1 GHz

Rules and Specifications:	Sections 15.109 & 15.209
Guide:	ANSI C63.4 1997

Measurement Procedure:
Radiated emissions are measured in the frequency range 1 GHz to the 10th harmoic of the maximum frequency of the EUT. Resolution and video bandwidth of the spectrum analyzer are set to 1 MHz. Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing. Additional measurements are performed at critical frequencies with reduced span. EUT is rotated all around and receiving antenna is raised and lowered to find the maximum levels of emission. The cables and equipment are placed and moved within the range of position likely to find their maximum emissions. All tests are performed in a fully-anechoic chamber with a test-distance of 3 meters. If required preamplifiers are used for the whole frequency range. Special care is taken to avoid overload in transmit mode (using appropriate attenuators and filters if necessary).



Fully anechoic

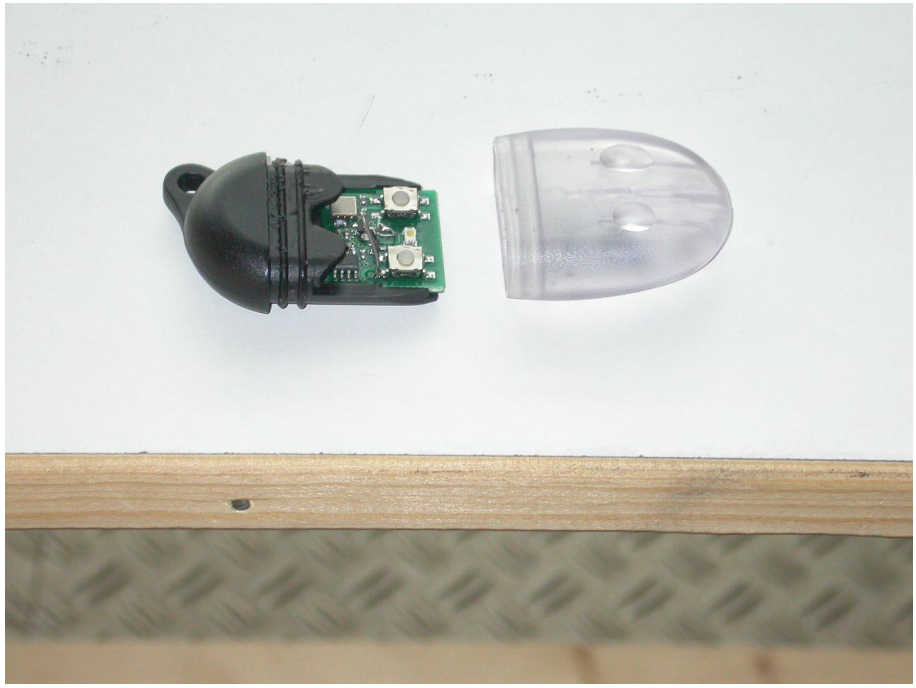
Test instruments used:

No.	Type	Model	Serial Number	Manufacturer
01	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
143	Log. periodic antenna	3147	9112-1054	EMCO
145	Horn antenna	3115	9508-4553	EMCO
146	Horn antenna set	3160-03/-09	9112-1003	EMCO
114	Preamplifier 1-8 GHz	AFS3-00100800-32-LN	847743	Miteq
115	Preamplifier 8-18 GHz	ACO/180-3530	32641	CTT
003	Fully anechoic room	No. 2	1452	Albatross Projects

6. Photographs Taken During Testing

Test setup for radiated emission measurement (fully anechoic room)

Test setup for radiated emission measurement (open-area test-side)



7. List of Measurements

FCC Part 15			
Section(s):	**Test**	**Page(s)**	**Result**
15.205	Restricted Bands	---	Pass
15.207	AC powerline emissions	---	Not applicable
15.231 (a) (1)	Periodic operation	16	Pass
15.231 (b)	Duty Cycle Correction	16	Pass
15.231 (b)	Field strength of emissions	15	Pass
15.231 (c)	Bandwidth of emissions	18	Pass

Field strength of emissions

Rules and Specifications:	15.231 (b) Radiated Emission Limits
Guide:	ANSI C63.4
Limit:	In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under Section 15.231 shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 – 40.70	2.250	225
70 – 130	1.250	125
130 - 174	1.250 to 3.750**	125 to 375 **
174 - 260	3.750	375
260 – 470	3750 to 12.500**	375 to 1250 **
above 470	12.500	1250

** linear interpolations

Test Site:	Open Area Test Site (< 1 GHz), Fully anechoic chamber (> 1 GHz)
Distance:	3 Meter
Note:	3 orthogonal axes tested, test data show maximum

Frequency (MHz)	Detector	Antenna Polarization	Analyzer Reading (dBµV)	Antenna Correction (dB/m)	Duty Cycle Correction (dB/m)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
433.84	PK	Hor	54.7	18.72	-3.88	69.54	80.8	**-11.3**
868.60	PK	Hor	32.05	24.58	-3.88	52.75	60.80	**-8.1**
1301.50	Pk	Hor	18.7	28.17	-3.88	42.99	60.80	**-17.8**
1736.00	Pk	Hor	11.1	32.01	-3.88	39.23	60.80	**-21.6**
								0.0

***** = All emissions showed more than 20 dB margin to the limit**
A negative value for Margin indicates, that the limit is kept.

Sample calculation of erp values:

Field Strength (dBµV/m) = Analyzer Reading (dBµV) + Antenna Correction (dB/m) + Duty Cycle Correction (dB)

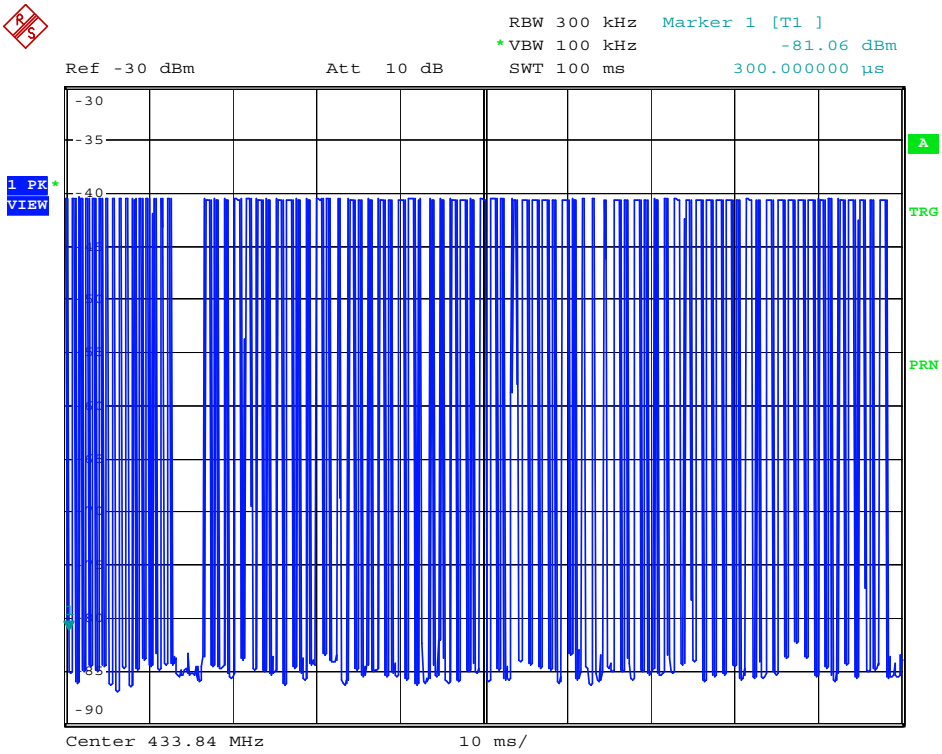
Test Results:	Pass	

Duty Cycle Correction

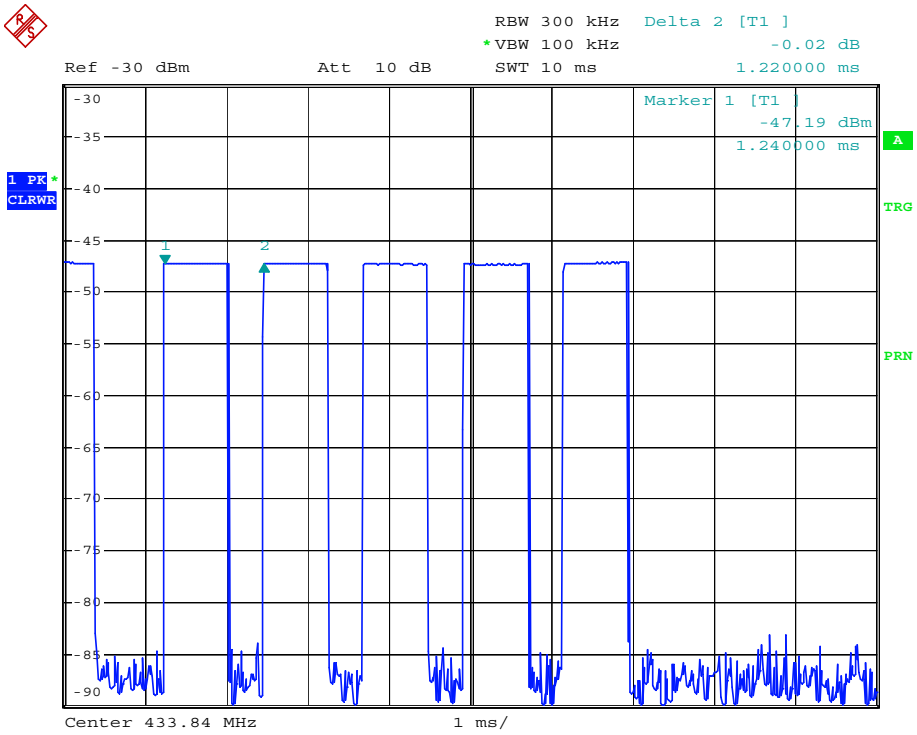
Rules and Specifications:	15.231 (b) (2) Limits on the Field Strength of Emissions
Guide:	ANSI C63.4
ANSI C63.4	When average detector function limits are specified for a pulse modulated transmitter, the average level of emissions may be found by measuring the peak levels of the emissions and correcting them with the duty cycle according to ANSI C64.4, section I4 (10)

$$Duty\ Cycle\ Correction\,[dB] = 20 \cdot \log\left(\frac{Sum\ of\ the\ Pulse\ Widths}{100ms}\right) = -dB$$

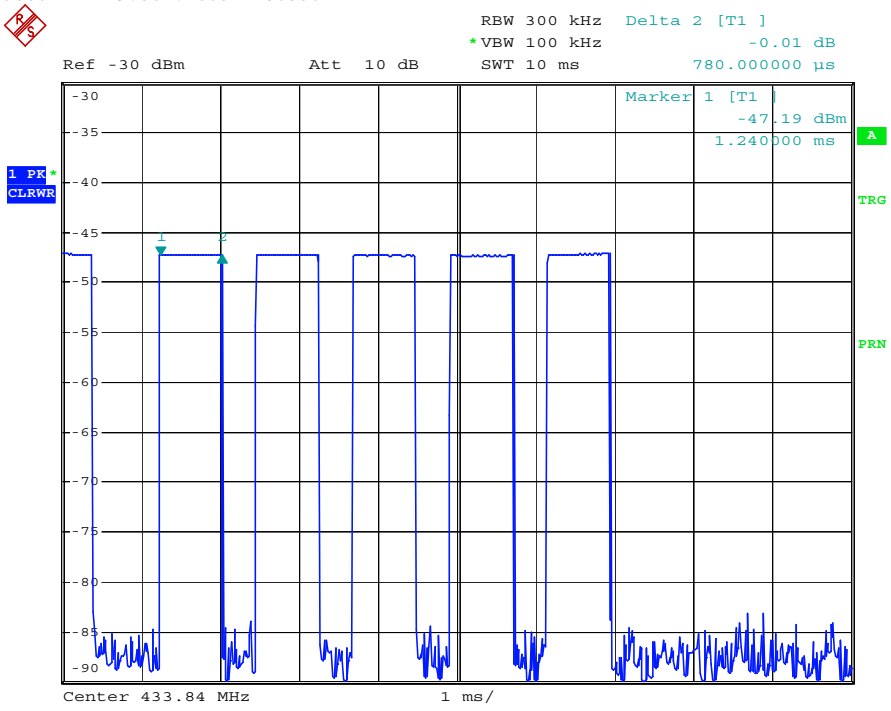
= 20log (64 ms / 100 ms) = -3.88 dB



Comment A: TUV30278 Duty Cycle Correction 1
Date: 9.JUL.2003 18:17:27



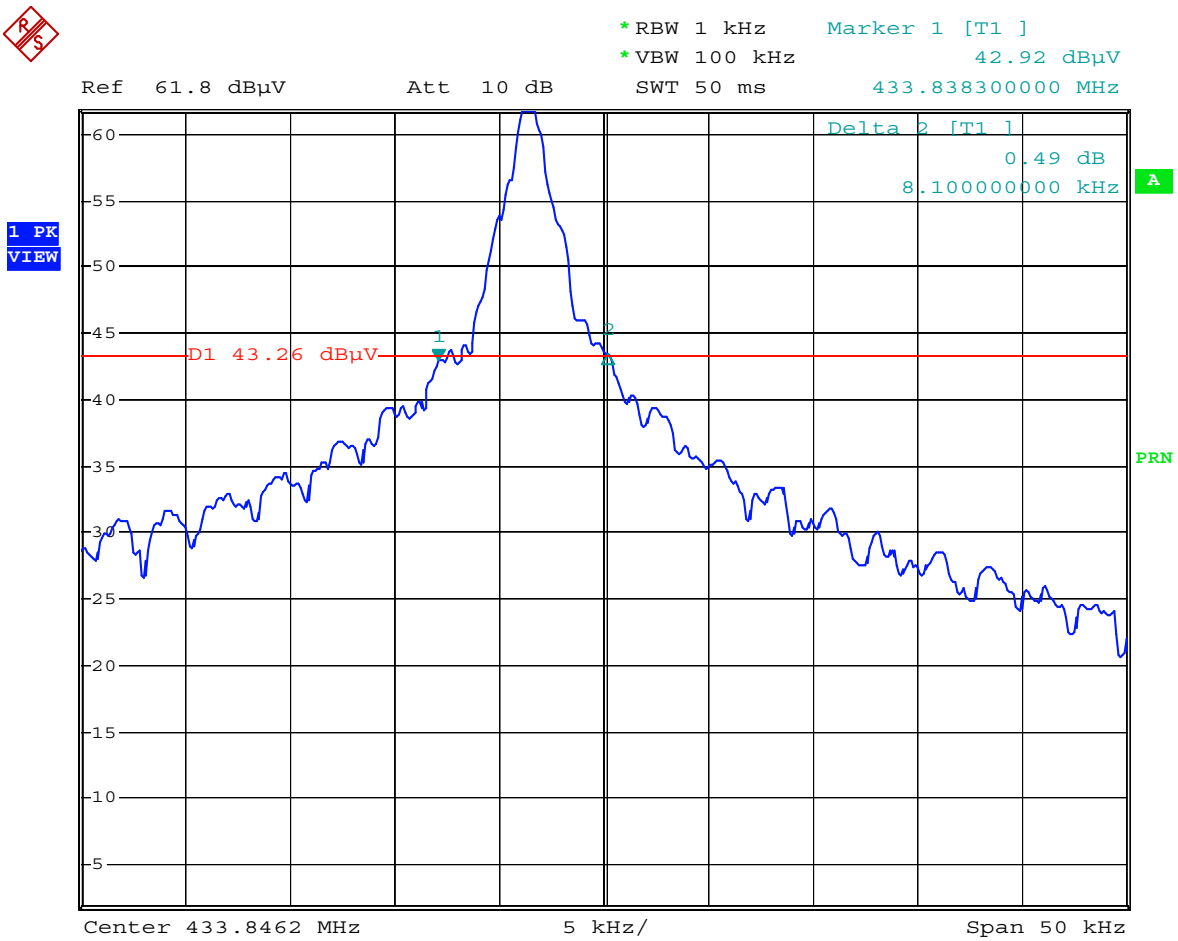
Comment A: TUV30278 Duty Cycle Correction 3
Date: 9.JUL.2003 18:33:22



Comment A: TUV30278 Duty Cycle Correction 4
Date: 9.JUL.2003 18:34:04

Bandwidth of Emission

Rules and Specifications:	15.231 c
Guide:	ANSI C63.4
Limit:	The bandwidth of the emission shall bo no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB from the modulated carrier



Comment A: TUV30278 Bandwidth of Emission
Date: 9.JUL.2003 18:50:07

Test Results:	Pass	Bandwidth of Emission at –20dBc = 8.1 kHz

8. Referenced Regulations

All tests were performed with reference to the following regulations and standards:

☒	FCC Part 2	Code of Federal Regulations Part 2 Frequency allocationand radio treaty matters; General rules and regulations	October 01, 1999
☐	FCC Part 15 Subpart A	Code of Regulations Part 15 (Radio Frequency Devices), Subpart A (General) of the Federal Communication Commission (FCC)	May 30, 2002
☐	FCC Part 15 Subpart B	Code of Regulations Part 15 (Radio Frequency Devices), Subpart B (Unintentional Radiators) of the Federal Communication Commission (FCC)	May 30, 2002
☒	FCC Part 15 Subpart C	Code of Regulations Part 15 (Radio Frequency Devices), Subpart C (Intentional Radiators) of the Federal Communication Commission (FCC)	May 30, 2002
☐	FCC Part 74 Subpart H	Code of Regulations Part 15 (Radio Frequency Devices), Subpart H (Low Power Auxiliary Stations) of the Federal Communication Commission (FCC)	October 20, 1997
☒	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz - 40 GHz	October, 1992
☐	RSS-210	Radio Standards Specification RSS-210 Issue 2 for Low Power Licence-Exempt Radiocommuniction Devices of Industry Canada	February 24, 1996

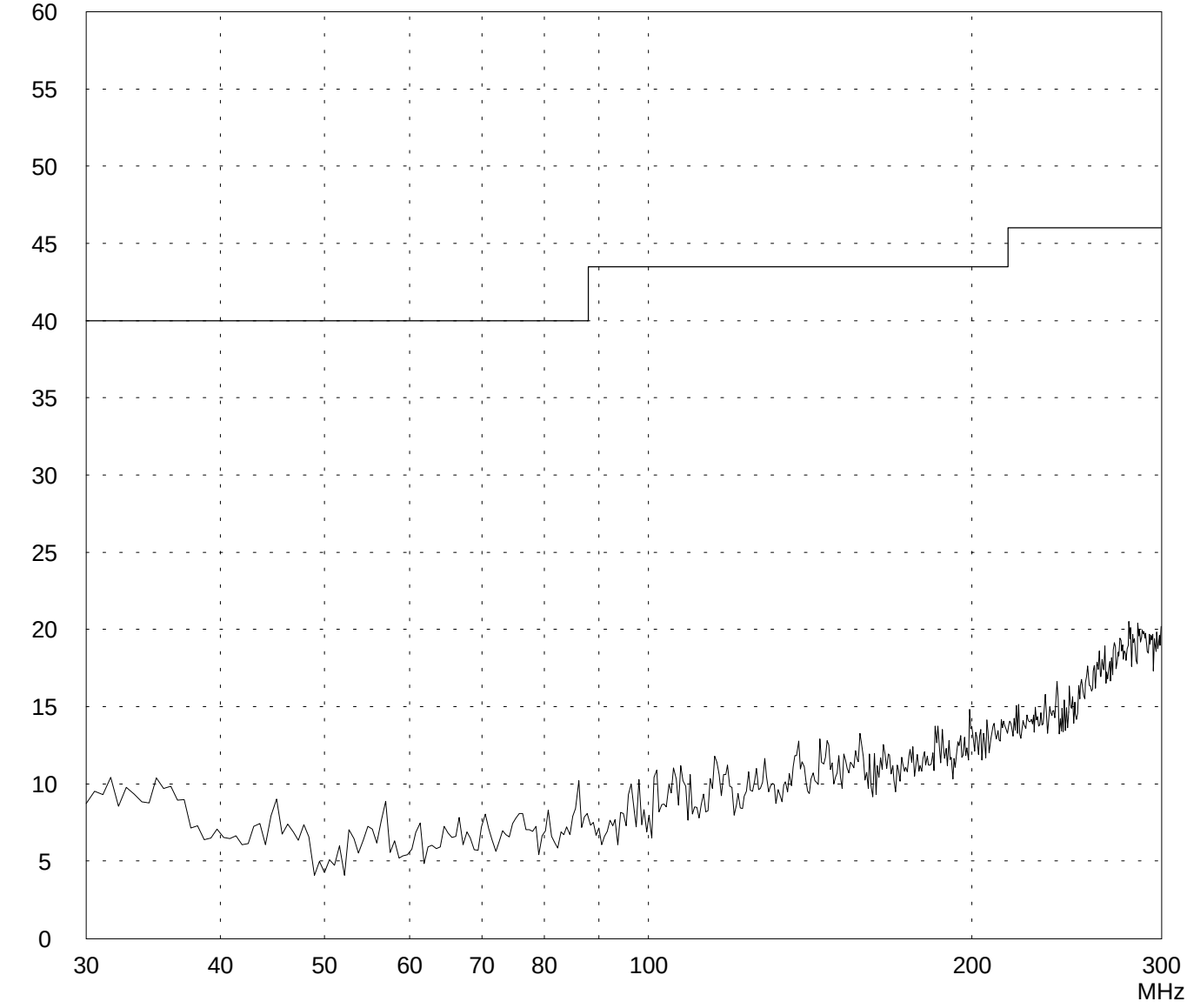
Charts taken during testing

Radiated Emission Test 30 MHz - 300 MHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: Datatool System 3	Comment:
Serial no.: Modified Transmitter	
Applicant: LiteOn Automotive Electronics	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 07/09/2003 / Operator: J. Roidt	
Test performed: by hand / File name: default.emi	

Detector: Peak	List of values: 10 dB Margin / 50 Subranges

dBµV/m — Limit1: FCC Part 15 — Transducer: HK 116 (A-1560)



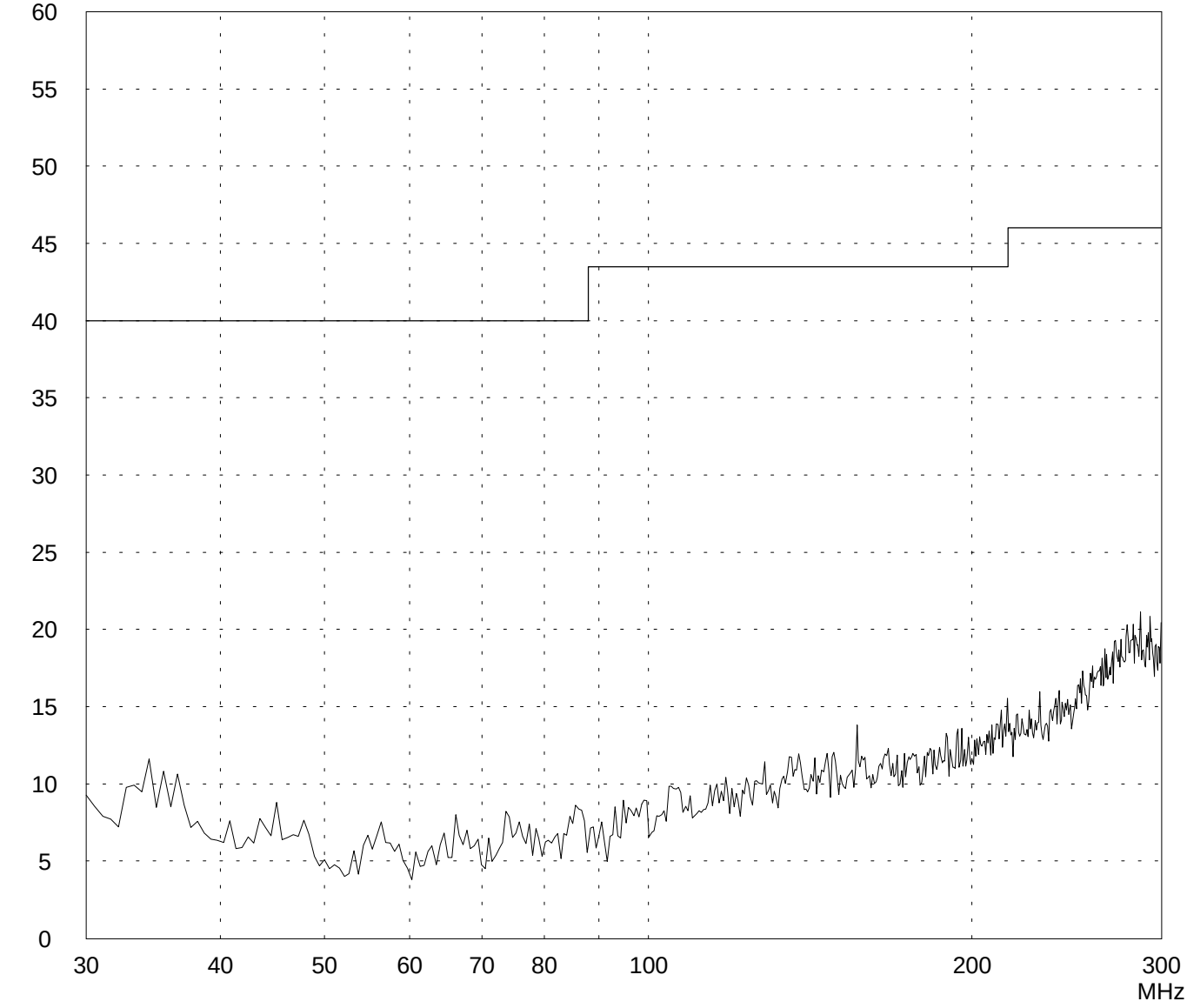
Result: Limit kept	Project file: 52209-30278 Page of Pages

Radiated Emission Test 30 MHz - 300 MHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: Datatool System 3	Comment:
Serial no.: Modified Transmitter	
Applicant: LiteOn Automotive Electronics	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 07/09/2003 / Operator: J. Roidt	
Test performed: by hand / File name: default.emi	

Detector: Peak	List of values: 10 dB Margin / 50 Subranges

dBµV/m — Limit1: FCC Part 15 — Transducer: HK 116 (A-1560)



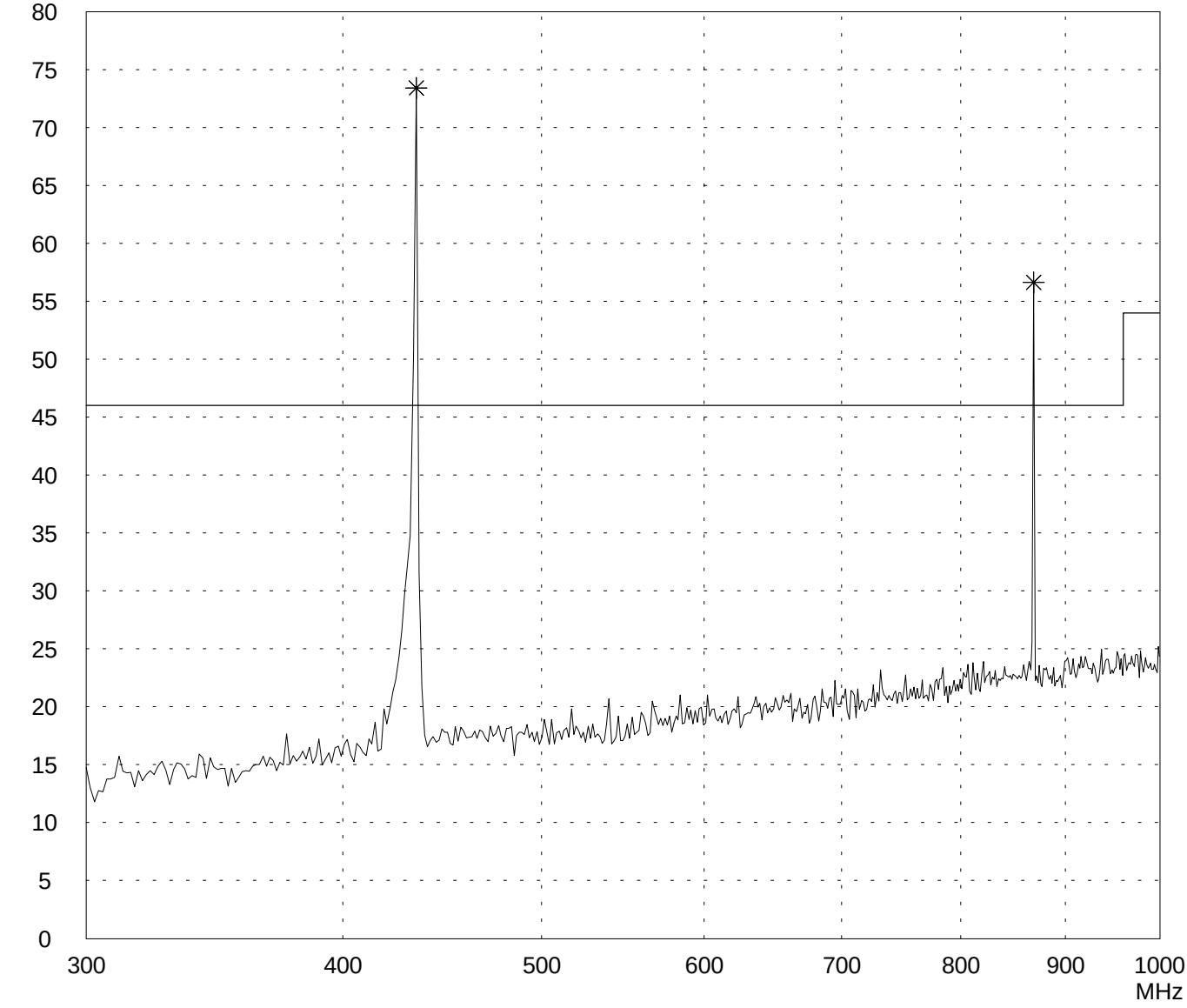
Result: Limit kept	Project file: 52209-30278 Page of Pages

Radiated Emission Test 300 MHz - 1 GHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: Datatool System 3	Comment:
Serial no.: Modified Transmitter	
Applicant: LiteOn Automotive Electronics	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 07/09/2003 / Operator: J. Roidt	
Test performed: by hand / File name: default.emi	

Detector: Peak	List of values: 10 dB Margin / 50 Subranges

dBµV/m — Limit1: FCC Part 15 — Transducer: EMCO 3147 (A-1009)

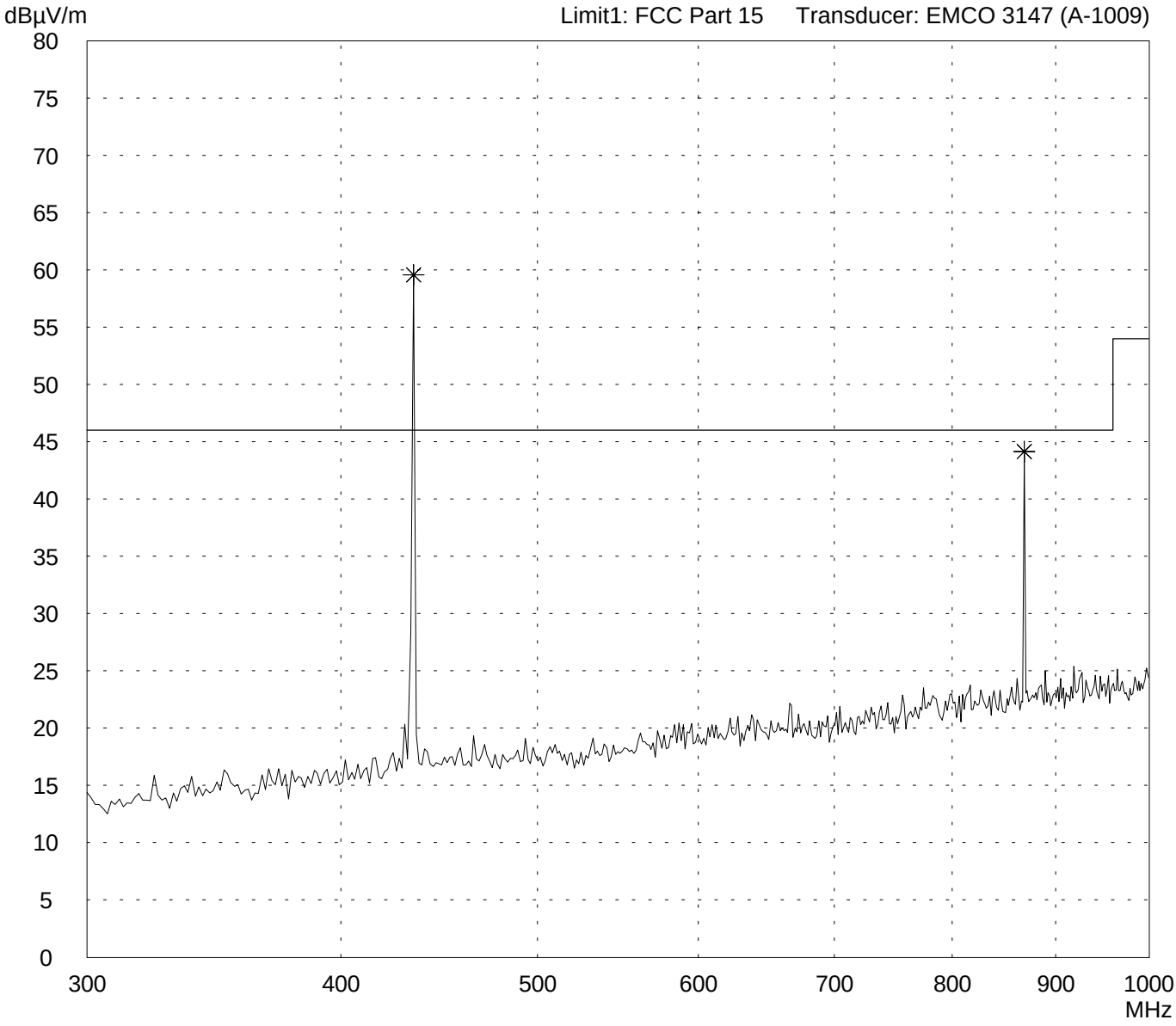


Result: Limit kept	Project file: 52209-30278 Page of Pages

Radiated Emission Test 300 MHz - 1 GHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: Datatool System 3	Comment:
Serial no.: Modified Transmitter	
Applicant: LiteOn Automotive Electronics	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 07/09/2003 / Operator: J. Roidt	
Test performed: by hand / File name: default.emi	

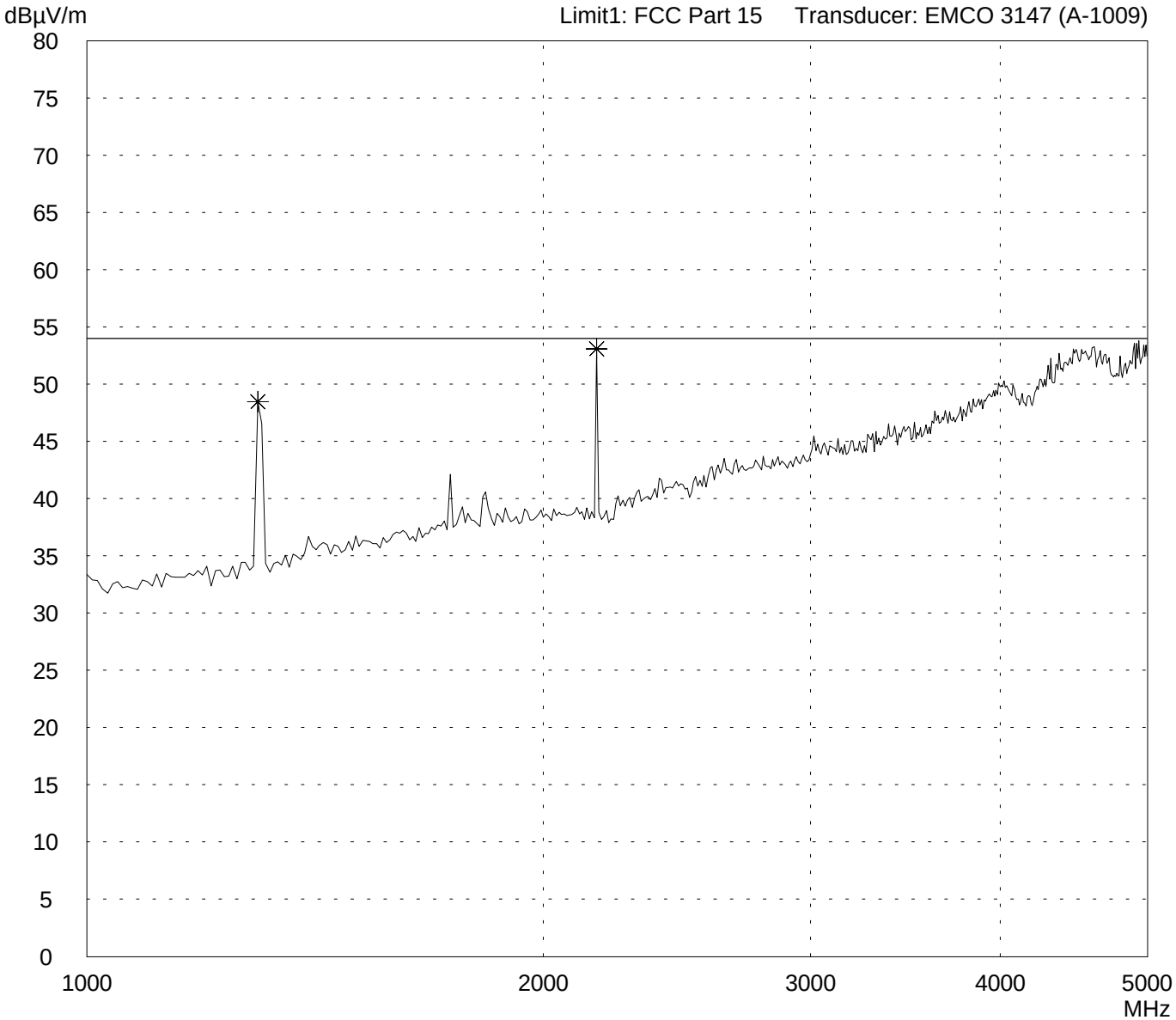
Detector: Peak	List of values: 10 dB Margin / 50 Subranges



Result: Limit kept	Project file: 52209-30278 Page of Pages

Radiated Emission Test 1 GHz - 5 GHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

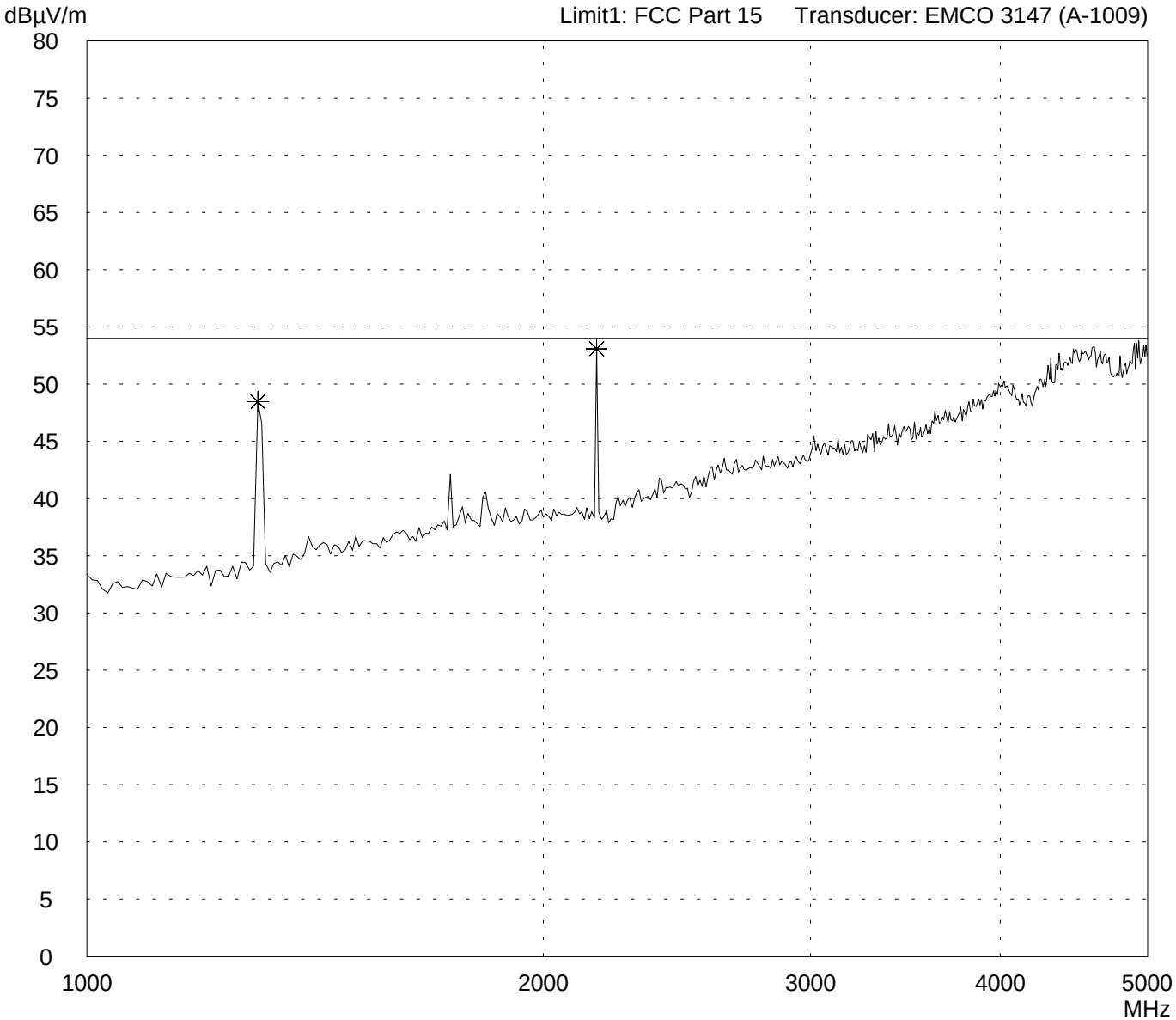
Model: Datatool System 3	Comment:
Serial no.: Modified Transmitter	
Applicant: LiteOn Automotive Electronics	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 07/09/2003 / Operator: J. Roidt	
Test performed: by hand / File name: default.emi	
Detector: Peak	List of values: Selected by hand



Result: Limit kept	Project file: 52209-30278 Page of Pages

Radiated Emission Test 1 GHz - 5 GHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: Datatool System 3	Comment:
Serial no.: Modified Transmitter	
Applicant: LiteOn Automotive Electronics	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 07/09/2003 / Operator: J. Roidt	
Test performed: by hand / File name: default.emi	
Detector: Peak	List of values: Selected by hand



Result: Limit kept	Project file: 52209-30278 Page of Pages