

InterLab®

RF Exposure Evaluation

For

LTE-MBC-NAR2

FCC ID:RK7MBC-NAR2

IC ID:4774A-MBCNAR2

Assessment Reference: MDE_MOLEX_1901_MPEa_rev01

Test Laboratory:

7layers GmbH
Borsigstraße 11
40880 Ratingen
Germany

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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0 Summary

0.1 Technical Report Summary

Type of Report

RF Exposure Assessment for a GSM/UMTS/LTE Compenser.

Applicable FCC and ISED Rules

For RF Exposure:

OET Bulletin 65 Edition 97-01 August 1997 FCC 47 CFR §1.1307

FCC 47 CFR §1.1310

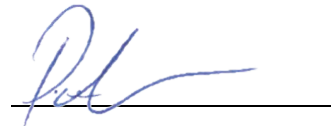
RSS-102 Issue 5 – March 2015

Report version control			
Rev Version	Release date	Changes	Version validity
-	31.01.2020	Initial version	Valid
01	12.03.2020	Included calculation for GSM 50% Duty Cycle	Valid

Reviewer:



Responsible
for Report:



1 Administrative Data

1.1 Testing Laboratory

Company Name: 7layers GmbH

Address: Borsigstr. 11
40880 Ratingen
Germany

The test facility is also accredited by the following accreditation organisation:

Laboratory accreditation no.: DAKKS D-PL-12140-01-01 | D-PL-12140-01-02 | D-PL-12140-01-03

FCC Designation Number: DE0015

FCC Test Firm Registration: 929146

ISED CAB Identifier: DE0007; ISED#: 3699A

Report Template Version: 30.01.2020

1.2 Project Data

Responsible for assessment and report: Mr. Patrick Lomax

Date of Report: 12.03.2020

1.3 Applicant Data

Company Name: Molex CVS Dabendorf GmbH

Address: Märkische Strasse 72
Zossen
Germany

Contact Person: Ines Baufeld

Email: ines.baufeld@molex.com

1.4 Manufacturer Data

Company Name: please see applicant data

Contact Person: Sebastian Dern

Email: Sebastian.Dern@molex.com

2 Test object Data

2.1 General EUT Description

Equipment under Test	LTE-MBC-NAR2
Type Designation:	17400213
Kind of Device:	Multi Band Compenser
FCC ID:	RK7MBC-NAR2
IC Number:	4774A-MBCNAR2

General product description:

The EUT is a Multi Band Compenser for automotive use. See the below section for all variants to which the report shall apply.

2.2 Equipment under test details

Description	Equipment under Test	Type Number	Serial Number	HW Status	SW Status
Multi Band Compenser	LTE-MBC-NAR2	17400213	*0D0FKW-00117.01.20 98210011*	HW004	0003

The below Variant models are declared by the manufacturer as electrically identical but have not been tested.

Product name	Product Type number
LTE-MBC-NAR2	17401213
LTE-MBC-NAR2	17400214
LTE-MBC-NAR2	17402213

2.3 General note

Note 1. Per the KDB 935210 related consumer and industrial signal boosters that operate under Parts 20, 22, 24, 27, and 90 of the FCC rules, the input signaling shall be tested to Pulsed CW (12.5% Duty Cycle) to represent GSM technologies and AWGN (100% Duty Cycle) to represent CDMA technologies (UMS/LTE).

3 Evaluation Results

3.1 RF Exposure Evaluation

Standards
OET Bulletin 65 Edition 97-01 August 1997
RSS-102 Issue 5 – March 2015

3.1.1 Test limits

As specified in Table 1B of 47 CFR 1.1310 – Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure.

Frequency range (MHz)	Power density (mW/cm ²)
300 – 1,500	f/1500
1,500 – 100,000	1.0

Limits specified per RSS-102, Issue 5.

Frequency range (MHz)	Power density (W/m ²)	Power density (mW/cm ²)
300 – 6000	$0.02619 f^{0.6834}$	$\text{mW/cm}^2 = \text{W/m}^2 * 0.1$

Equation OET bulletin 65, page 18, edition 97-01:
$$S = \frac{PG}{4\pi R^2} = \frac{EIRP}{4\pi R^2}$$

Where:

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the centre of radiation of the antenna

3.1.2 Test Protocol

Maximum antenna gain to comply with MPE limits for Industry Canada

Band	Mode	Duty Cycle	Frequency (MHZ)	Maximum Conducted output power (dBm)	Maximum Conducted output power (mW)	Equivalent conducted output power (mW)	MPE Limit (mW/cm ²)	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
850	GSM	12.5%	834.0	22.0	158.49	19.82	0.2597	18.2	20
1900	GSM	12.5%	1865.0	21.5	141.25	17.66	0.4501	21.1	20
850	GPRS	50.0%	834.0	22.0	158.49	79.25	0.2597	12.2	20
1900	GPRS	50.0%	1865.0	21.5	141.25	70.63	0.4501	15.1	20
FDD 2	UMTS	100%	1865.0	19.8	95.50	95.50	0.4501	13.7	20
FDD 4	UMTS	100%	1719.0	20.0	100.00	100.00	0.4257	13.3	20
FDD 5	UMTS	100%	834.0	19.9	97.72	97.72	0.2597	11.3	20
eFDD 2	LTE	100%	1865.0	19.8	95.50	95.50	0.4501	13.7	20
eFDD 4	LTE	100%	1719.0	20.0	100.00	100.00	0.4257	13.3	20
eFDD 5	LTE	100%	834.0	19.9	97.72	97.72	0.2597	11.3	20
eFDD 13	LTE	100%	780.0	19.7	93.33	93.33	0.2481	11.3	20
eFDD 17	LTE	100%	709.0	20.0	100.00	100.00	0.2324	10.7	20
eFDD 12	LTE	100%	709.0	20.0	100.00	100.00	0.2324	10.7	20

Maximum antenna gain to comply with MPE limits for FCC

Band	Mode	Duty Cycle	Frequency (MHZ)	Maximum Conducted output power (dBm)	Maximum Conducted output power (mW)	Equivalent conducted output power (mW)	MPE Limit (mW/cm ²)	Maximum antenna gain to meet MPE Limit (dBi)	Separation distance (cm)
850	GSM	12.5%	834.0	22	158.49	19.82	0.5560	21.5	20
1900	GSM	12.5%	1865.0	21.5	141.25	17.66	1.0000	24.5	20
850	GPRS	50.0%	834.0	22	158.49	79.25	0.5560	15.5	20
1900	GPRS	50.0%	1865.0	21.5	141.25	70.63	1.0000	18.5	20
FDD 2	UMTS	100.0%	1865.0	19.8	95.50	95.50	1.0000	17.2	20
FDD 4	UMTS	100.0%	1719.0	20	100.00	100.00	1.0000	17.0	20
FDD 5	UMTS	100.0%	834.0	19.9	97.72	97.72	0.5560	14.6	20
eFDD 2	LTE	100.0%	1865.0	19.8	95.50	95.50	1.0000	17.2	20
eFDD 4	LTE	100.0%	1719.0	20	100.00	100.00	1.0000	17.0	20
eFDD 5	LTE	100.0%	834.0	19.9	97.72	97.72	0.5560	14.6	20
eFDD 13	LTE	100.0%	777.0	19.7	93.33	93.33	0.5200	14.5	20
eFDD 17	LTE	100.0%	709.0	20	100.00	100.00	0.4727	13.8	20
eFDD 12	LTE	100.0%	709.0	20	100.00	100.00	0.4727	13.8	20

3.1.3 Conclusion

Band	Max gain for FCC MPE Limits	Max gain for Industry Canada MPE Limits	Maximum gain to be compliant with all limits
850 GSM	21.5	18.2	18.2
1900 GSM	24.5	21.1	21.1
850 GPRS	15.5	12.2	12.2
1900 GPRS	18.5	15.1	15.1
FDD 2	17.2	13.7	13.7
FDD 4	17.0	13.3	13.3
FDD 5	14.6	11.3	11.3
eFDD 2	17.2	13.7	13.7
eFDD 4	17.0	13.3	13.3
eFDD 5	14.6	11.3	11.3
eFDD 13	14.5	11.3	11.3
eFDD 17	13.8	10.7	10.7
eFDD 12	13.8	10.7	10.7

Gain expressed in dBi

END OF TEST REPORT