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## TEST REPORT

Test Report No.: 1-5500/12-01-02



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**Accredited Test Laboratory:**

The test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025

DAR registration number: DGA-PL-176/94-D1

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### Test Standard/s

ICNIRP Guidelines Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)  
FCC OET Bulletin 65 Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields  
AS/NZS 2772.1 Radiofrequency fields, Part 1: Maximum exposure limits - 3 kHz to 300 GHz  
For further applied test standards please refer to section 3 of this test report.

### Test Item

Kind of test item: GSM/UMTS Module  
Device type: mobile device  
**Model name:** **EHS5-US**  
S/N serial number: n.a.  
FCC-ID: QIPEHS5-US  
IC-ID: 7830A-EHS5US  
IMEI-Number: n.a.  
HW hardware status: n.a.  
SW software status: n.a.  
Frequency: see technical details  
Antenna: external antenna  
Exposure category: general population / uncontrolled environment

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

**Test Report authorised:**

**Test performed:**

2012-11-05 Thomas Vogler  
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2012-11-05 Oleksandr Hnatovskiy  
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## 2 General information

### 2.1 Notes

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

### 2.2 Application details

Date of receipt of order:	2012-11-05
Date of receipt of test item:	2012-11-05
Start of test:	2012-11-05
End of test:	2012-11-05
Person(s) present during the test:	

### 2.3 Statement of compliance

The EMF values found for the EHS5-US GSM/UMTS Module are below the maximum allowed levels according to the standards listed in section 3, when used with an antenna with maximum gain as listed in chapter 4.3.

## 2.4 Technical details

Supported frequency bands	Technology	Frequency band	Lowest transmit frequency/MHz	Highest transmit frequency/MHz	Lowest receive Frequency/MHz	Highest receive Frequency/MHz	Kind of modulation	Power Class	Tested power control level	GPRS/EGPRS mobile station class	GPRS/EGPRS multislot class	(E)GPRS voice mode or DTM	Test channel low	Test channel middle	Test channel high	Maximum output power/dBm (from tune-up info) )*
<input checked="" type="checkbox"/>	GSM	cellular	824.2	848.8	869.2	893.8	GMSK	4	5	B	12	no	128	190	251	33.5
<input checked="" type="checkbox"/>	GSM	PCS	1850.2	1909.8	1930.2	1989.8	GMSK	1	0	B	12	no	512	661	810	30.5
<input checked="" type="checkbox"/>	UMTS	FDD II	1852.4	1907.6	1982.4	1987.6	QPSK	3	max	--	--	--	9262	9400	9538	24.5
<input checked="" type="checkbox"/>	UMTS	FDD V	826.4	846.6	871.4	891.6	QPSK	3	max	--	--	--	4132	4182	4233	24.5

)\*: slotted peak power for GSM, averaged max. RMS power for UMTS.

### 3 Test standard/s:

Test Standard	Version	Test Standard Description
ICNIRP Guidelines	1998-04	Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)
FCC OET Bulletin 65	1997-01	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
AS/NZS 2772.1	1998-01	Radiofrequency fields, Part 1: Maximum exposure limits - 3 kHz to 300 GHz
1999/519/EC	1999-07	Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (Official Journal L 197 of 30 July 1999)
RSS-102 Issue 4	2010-03	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

#### 3.1 Purpose of this report

The purpose of this report is to show the compliance of certain simultaneous transmission configurations for use in mobile exposure conditions.

In addition to basic requirements of the standards listed above (including FCC Part 22 H and Part 24 E) the following requirements have been taken into account:

- The module must be categorically excluded by FCC 47 CFR § 2.1091 (c) and the antenna separation distance and MPE compliance boundary requirements that enable all simultaneous transmitting antennas incorporated within the host shall comply with MPE limits as specified in FCC 47 CFR § 1.1310.  
(see chapter 8 of FCC KDB 447498 D01 Mobile Portable RF Exposure)

If these requirements are kept the module can be incorporated in mobile host devices without further testing or certification.

## 4 Evaluating compliance with requirements for human exposure to EMFs

### 4.1 Maximum permissible exposure (MPE)

Fixed/mobile exposure conditions of multiple transmitters installed in different hosts represent the most difficult situation in terms of the determination of minimum safety distances.

While EMF measurements most often only refer to a single configuration with only one transmitter or with multiple co-located transmitters a general approach is needed to determine a worst case condition under which several transmitters and their antennas can be installed to prevent additional RF exposure evaluation for each host.

This test report illustrates different scenarios how radio modules can be integrated in notebook hosts without the need of further testing.

The target is to determine a maximum EIRP or antenna gain for a WWAN module using GSM and/or UMTS frequencies, which is used stand-alone or collocated with other antennas for WLAN, Bluetooth, WiMAX etc.

The background of the calculation is a minimum distance of 20 cm between antenna(s) and user (mobile exposure condition), and the compliance with the requirements of chapter 3.1.

### 4.2 Limits and normative references

There is a number of international and national regulations, standards and guidelines for exposure to electromagnetic fields. For the evaluations in this report the following reference levels have been applied.

#### 4.2.1 FCC and IC requirements

Frequency range	E-field strength (V/m)	H-field strength (A/m)	B-field strength ( $\mu$ T)	Power density (mW/cm <sup>2</sup> )
300 – 1500 MHz	--	--	--	f(MHz) / 1500
1.5 – 100 GHz	--	--	--	1.0

Categorically exclusion per § 2.1091 (c) : - below 1.5 GHz : avg. ERP < 1.5 W (= 33.9 dBm EIRP)  
- above 1.5 GHz : avg. ERP < 3 W (= 36.9 dBm EIRP)

Part 22 H ERP limit : max. 7 W (38.45 dBm) burst power (= 40.6 dBm EIRP)

Part 24 E EIRP limit : max. 2 W (33.0 dBm) burst power

#### 4.2.2 EN requirements

Frequency range	E-field strength (V/m)	H-field strength (A/m)	B-field strength ( $\mu$ T)	Power density (mW/cm <sup>2</sup> )
400 – 2000 MHz	$1.375 * f(\text{MHz})^{1/2}$	$0.0037 * f(\text{MHz})^{1/2}$	$0.0046 * f(\text{MHz})^{1/2}$	f(MHz) / 2000
2 – 300 GHz	61	0.16	0.2	1.0

#### 4.2.3 Australian requirements

Frequency range	E-field strength (V/m)	H-field strength (A/m)	B-field strength ( $\mu$ T)	Power density (mW/cm <sup>2</sup> )
400 – 2000 MHz	$1.375 * f(\text{MHz})^{1/2}$	$0.0037 * f(\text{MHz})^{1/2}$	$0.0046 * f(\text{MHz})^{1/2}$	f(MHz) / 2000
2 – 300 GHz	61	0.16	0.2	1.0

Reference levels are provided for exposure assessment to determine whether the basic restrictions on exposure of humans to electromagnetic fields are exceeded. The basic restrictions on exposure to electromagnetic fields are based directly on established health effects and biological considerations.

### 4.3 Host platform analysis

The MPE calculation has been performed for different scenarios of stand-alone and co-located operation of the WWAN module described below and generic radio modules with different communication systems.

WWAN module :	WWAN (GSM/UMTS)	Notes :
type :	Cinterion	
model :	EHS5 US	
FCC-ID :	QIPEHS5-US	
IC-ID :	7830A-EHS5US	
Maximum antenna gain < 1 GHz	<b>3.35 dBi (stand-alone)</b>	limitation by FCC §2.1091 (c) )*
Maximum antenna gain < 1 GHz	<b>3.10 dBi (co-located)</b>	limitation by RF exposure limit )*
Maximum antenna gain > 1.7 GHz	<b>2.50 dBi</b>	limitation by FCC Part 24 E EIRP limit )*

)\* FCC limits for maximum E(I)RP are overlaying maximum exposure limits.

The table below lists the calculated maximum EIRP values which represent the worst case condition of all standards and limits listed in chapter 4.2.

Unless peak burst power is required for evaluation the GSM timeslot configuration with highest time based average power has been used for calculation.

a) Maximum antenna gain determination in stand-alone situation. For details see annex A.1.

Communication system	Mode	Frequency (MHz)	Conducted power (dBm) *	Antenna gain (dBi)	Duty Cycle (%)	PAR (dB)	EIRP (dBm)**	EIRP (mW)**
GSM 850	GSM/GPRS	824.2 - 848.8	33.50	3.35	50	3	33.85	2426.61
	EDGE	824.2 - 848.8	27.50	3.35	50	3	27.85	609.54
FDD V	WCDMA	826.4 - 846.6	24.50	3.35	100	0	27.85	609.54
	HSDPA	826.4 - 846.6	24.50	3.35	100	0	27.85	609.54
	HSUPA	826.4 - 846.6	24.50	3.35	100	0	27.85	609.54
PCS 1900	GSM/GPRS	1850.2 - 1909.8	30.50	2.50	50	3	30.00	1000.00
	EDGE	1850.2 - 1909.8	26.50	2.50	50	3	26.00	398.11
FDD II	WCDMA	1852.4 - 1907.6	24.50	2.50	100	0	27.00	501.19
	HSDPA	1852.4 - 1907.6	24.50	2.50	100	0	27.00	501.19
	HSUPA	1852.4 - 1907.6	24.50	2.50	100	0	27.00	501.19

\*: slotted peak power of 1 time slot for GSM, maximum RMS for all other communication systems

\*\* : time based averaged

b) Maximum antenna gain determination in collocated scenarios. For details see annex A.1 and A.2.

Communication system	Mode	Frequency (MHz)	Conducted power (dBm) *	Antenna gain (dBi)	Duty Cycle (%)	PAR (dB)	EIRP (dBm)**	EIRP (mW)**
GSM 850	GSM/GPRS	824.2 - 848.8	33.50	3.10	50	3	33.60	2290.87
	EDGE	824.2 - 848.8	27.50	3.10	50	3	27.60	575.44
FDD V	WCDMA	826.4 - 846.6	24.50	3.10	100	0	27.60	575.44
	HSDPA	826.4 - 846.6	24.50	3.10	100	0	27.60	575.44
	HSUPA	826.4 - 846.6	24.50	3.10	100	0	27.60	575.44
PCS 1900	GSM/GPRS	1850.2 - 1909.8	30.50	2.50	50	3	30.00	1000.00
	EDGE	1850.2 - 1909.8	26.50	2.50	50	3	26.00	398.11
FDD II	WCDMA	1852.4 - 1907.6	24.50	2.50	100	0	27.00	501.19
	HSDPA	1852.4 - 1907.6	24.50	2.50	100	0	27.00	501.19
	HSUPA	1852.4 - 1907.6	24.50	2.50	100	0	27.00	501.19

For the generic communication systems the following worst case technical data have been assumed.

Communication system	Mode	Frequency (MHz)	Conducted power (dBm) *	Antenna gain (dBi)	Duty Cycle (%)	PAR (dB)	EIRP (dBm)**	EIRP (mW)**
Bluetooth		2,4 GHz Range	20	0.00	76	1.2	18.80	75.86
WLAN		2,4 / 5 GHz Range	23	0.00	100	0	23.00	199.53
WiMAX		various	27	0.00	100	0	27.00	501.19

\*: slotted peak power of 1 time slot for GSM, maximum RMS for all other communication systems

\*\* : time based averaged



## c) Maximum antenna gain with ERP Limitation by FCC 47 CFR § 2.1091 (c)

Communication system	Mode	Frequency (MHz)	Conducted power (dBm) *	Antenna gain (dBi)	Duty Cycle (%)	PAR (dB)	EIRP (dBm)**	EIRP (mW)**
GSM 850	GSM/GPRS	824.2 - 848.8	33.50	<b>3.35</b>	50	3	33.85	2426.61
	EDGE	824.2 - 848.8	27.50	<b>3.35</b>	50	3	27.85	609.54
FDD V	WCDMA	826.4 - 846.6	24.50	<b>3.35</b>	100	0	27.85	609.54
	HSDPA	826.4 - 846.6	24.50	<b>3.35</b>	100	0	27.85	609.54
	HSUPA	826.4 - 846.6	24.50	<b>3.35</b>	100	0	27.85	609.54
PCS 1900	GSM/GPRS	1850.2 - 1909.8	30.50	2.50	50	3	30.00	1000.00
	EDGE	1850.2 - 1909.8	26.50	2.50	50	3	26.00	398.11
FDD II	WCDMA	1852.4 - 1907.6	24.50	2.50	100	0	27.00	501.19
	HSDPA	1852.4 - 1907.6	24.50	2.50	100	0	27.00	501.19
	HSUPA	1852.4 - 1907.6	24.50	2.50	100	0	27.00	501.19

## d) Maximum antenna gain with E(I)RP Limitation by FCC Part 22 H and Part 24 E

Communication system	Mode	Frequency (MHz)	Conducted power (dBm) *	Antenna gain (dBi)	Duty Cycle (%)	PAR (dB)	EIRP (dBm)**	EIRP (mW)**
GSM 850	GSM/GPRS	824.2 - 848.8	33.50	3.35	50	3	33.85	2426.61
	EDGE	824.2 - 848.8	27.50	3.35	50	3	27.85	609.54
FDD V	WCDMA	826.4 - 846.6	24.50	3.35	100	0	27.85	609.54
	HSDPA	826.4 - 846.6	24.50	3.35	100	0	27.85	609.54
	HSUPA	826.4 - 846.6	24.50	3.35	100	0	27.85	609.54
PCS 1900	GSM/GPRS	1850.2 - 1909.8	30.50	<b>2.50</b>	50	3	30.00	1000.00
	EDGE	1850.2 - 1909.8	26.50	<b>2.50</b>	50	3	26.00	398.11
FDD II	WCDMA	1852.4 - 1907.6	24.50	<b>2.50</b>	100	0	27.00	501.19
	HSDPA	1852.4 - 1907.6	24.50	<b>2.50</b>	100	0	27.00	501.19
	HSUPA	1852.4 - 1907.6	24.50	<b>2.50</b>	100	0	27.00	501.19

\*: slotted peak power for GSM, maximum RMS for all other communication systems

\*\*: time based averaged

**Antenna configuration for all scenarios:**



**Important note** : this notebook configuration is an example. Different applications (e.g. M2M) are also possible as long as the same antenna-to-antenna and antenna-to-user distances are respected.

#### 4.3.0 Scenario 0 : WWAN stand-alone

This scenario covers the following combination of collocated radio modules:

Transmitter	<b>primary</b>
communication system	<b>WWAN (GSM/UMTS)</b>
type	<b>Cinterion</b>
model	<b>EHS5 US</b>
FCC-ID	<b>QIPEHS5-US</b>
IC-ID	<b>7830A-EHS5US</b>
max. EIRP (mW)	<b>see chapter 4.3</b>
max.antenna gain	<b>3.35 dBi/2.5 dBi</b>

This scenario covers the following conditions:

- the antenna-to-user distance of all transmitters listed above is 20 cm or larger
- the maximum antenna gain of the WWAN transmitters does not exceed the values listed above

Note: other antennas for different communication systems may be installed in the host platform as long as they are not collocated to the WWAN antenna (distance > 20 cm)

#### 4.3.1 Scenario 1 : WWAN + BT

This scenario covers the following combination of collocated radio modules:

Transmitter	primary	secondary
communication system	<b>WWAN (GSM/UMTS)</b>	BT
type	<b>Cinterion</b>	any
model	<b>EHS5 US</b>	any
FCC-ID	<b>QIPEHS5-US</b>	any
IC-ID	<b>7830A-EHS5US</b>	any
max. EIRP (mW)	<b>see chapter 4.3</b>	76.43
max.antenna gain	<b>3.1 dBi/2.5 dBi</b>	nn

This scenario covers the following conditions:

- the antenna-to-user distance of all transmitters listed above is 20 cm or larger
- the maximum antenna gain of the WWAN transmitters does not exceed the values listed above
- the averaged EIRP of the BT module does not exceed the value listed above
- the distance between WWAN and BT antennas is 0 cm or larger

Note : other antennas for different communication systems may be installed in the host platform as long as they are not collocated to the WWAN antenna (distance > 20 cm)

#### 4.3.2 Scenario 2 : WWAN + WLAN

This scenario covers the following combination of collocated radio modules:

Transmitter	primary	secondary
communication system	<b>WWAN (GSM/UMTS)</b>	WLAN
type	<b>Cinterion</b>	any
model	<b>EHS5 US</b>	any
FCC-ID	<b>QIPEHS5-US</b>	any
IC-ID	<b>7830A-EHS5US</b>	any
max. EIRP (mW)	<b>see chapter 4.3</b>	200
max.antenna gain	<b>3.1 dBi/2.5 dBi</b>	nn

This scenario covers the following conditions:

- the antenna-to-user distance of all transmitters listed above is 20 cm or larger
- the maximum antenna gain of the WWAN transmitters does not exceed the values listed above
- the averaged EIRP of the WLAN module does not exceed the value listed above
- the distance between WWAN and WLAN antennas is 0 cm or larger

Note : other antennas for different communication systems may be installed in the host platform as long as they are not collocated to the WWAN antenna (distance > 20 cm).

### 4.3.3 Scenario 3 : WWAN + WLAN + BT

This scenario covers the following combination of collocated radio modules:

Transmitter	primary	secondary	
communication system	<b>WWAN (GSM/UMTS)</b>	BT	WLAN
type	<b>Cinterion</b>	any	any
model	<b>EHS5 US</b>	any	any
FCC-ID	<b>QIPEHS5-US</b>	any	any
IC-ID	<b>7830A-EHS5US</b>	any	any
max. EIRP (mW)	<b>see chapter 4.3</b>	76.43	200
max.antenna gain	<b>3.1 dBi/2.5 dBi</b>	nn	nn

This scenario covers the following conditions:

- the antenna-to-user distance of all transmitters listed above is 20 cm or larger
- the maximum antenna gain of the WWAN transmitters does not exceed the values listed above
- the averaged EIRP of the WLAN module does not exceed the value listed above
- the averaged EIRP of the BT module does not exceed the value listed above
- the distance between WWAN, WLAN and BT antennas is 0 cm or larger

Note : other antennas for different communication systems may be installed in the host platform as long as they are not collocated to the WWAN antenna (distance > 20 cm)

### 4.3.4 Scenario 4 : WWAN + WiMAX

This scenario covers the following combination of collocated radio modules:

Transmitter	primary	secondary
communication system	<b>WWAN (GSM/UMTS)</b>	WiMAX
type	<b>Cinterion</b>	any
model	<b>EHS5 US</b>	any
FCC-ID	<b>QIPEHS5-US</b>	any
IC-ID	<b>7830A-EHS5US</b>	any
max. EIRP (mW)	<b>see chapter 4.3</b>	500
max.antenna gain	<b>3.1 dBi/2.5 dBi</b>	nn

This scenario covers the following conditions:

- the antenna-to-user distance of all transmitters listed above is 20 cm or larger
- the maximum antenna gain of the WWAN transmitters does not exceed the values listed above
- the averaged EIRP of the WiMAX module does not exceed the value listed above
- the distance between WWAN and WiMAX antennas is 0 cm or larger

Note : other antennas for different communication systems may be installed in the host platform as long as they are not collocated to the WWAN antenna (distance > 20 cm)

#### 4.3.5 Scenario 5 : WWAN + WiMAX + BT

This scenario covers the following combination of collocated radio modules:

Transmitter	primary	secondary	
communication system	<b>WWAN (GSM/UMTS)</b>	BT	WiMAX
type	<b>Cinterion</b>	any	any
model	<b>EHS5 US</b>	any	any
FCC-ID	<b>QIPEHS5-US</b>	any	any
IC-ID	<b>7830A-EHS5US</b>	any	any
max. EIRP (mW)	<b>see chapter 4.3</b>	76.43	500
max.antenna gain	<b>3.1 dBi/2.5 dBi</b>	nn	nn

This scenario covers the following conditions:

- the antenna-to-user distance of all transmitters listed above is 20 cm or larger
- the maximum antenna gain of the WWAN transmitters does not exceed the values listed above
- the averaged EIRP of the WiMAX module does not exceed the value listed above
- the averaged EIRP of the BT module does not exceed the value listed above
- the distance between WWAN, WiMAX and BT antennas is 0 cm or larger

Note : other antennas for different communication systems may be installed in the host platform as long as they are not collocated to the WWAN antenna (distance > 20 cm)

#### 4.3.6 Scenario 6 : WWAN + WiMAX + WLAN

This scenario covers the following combination of collocated radio modules:

Transmitter	primary	secondary	
communication system	<b>WWAN (GSM/UMTS)</b>	WLAN	WiMAX
type	<b>Cinterion</b>	any	any
model	<b>EHS5 US</b>	any	any
FCC-ID	<b>QIPEHS5-US</b>	any	any
IC-ID	<b>7830A-EHS5US</b>	any	any
max. EIRP (mW)	<b>see chapter 4.3</b>	200	500
max.antenna gain	<b>3.1 dBi/2.5 dBi</b>	nn	nn

This scenario covers the following conditions:

- the antenna-to-user distance of all transmitters listed above is 20 cm or larger
- the maximum antenna gain of the WWAN transmitters does not exceed the values listed above
- the averaged EIRP of the WiMAX module does not exceed the value listed above
- the averaged EIRP of the WLAN module does not exceed the value listed above
- the distance between WWAN, WiMAX and WLAN antennas is 0 cm or larger

Note : other antennas for different communication systems may be installed in the host platform as long as they are not collocated to the WWAN antenna (distance > 20 cm)

#### 4.3.7 Scenario 7 : WWAN + WiMAX + WLAN + BT

This scenario covers the following combination of collocated radio modules:

Transmitter	primary	secondary		
communication system	<b>WWAN (GSM/UMTS)</b>	BT	WLAN	WiMAX
type	<b>Cinterion</b>	any	any	any
model	<b>EHS5 US</b>	any	any	any
FCC-ID	<b>QIPEHS5-US</b>	any	any	any
IC-ID	<b>7830A-EHS5US</b>	any	any	any
max. EIRP (mW)	<b>see chapter 4.3</b>	76.43	200	500
max.antenna gain	<b>3.1 dBi/2.5 dBi</b>	nn	nn	nn

This scenario covers the following conditions:

- the antenna-to-user distance of all transmitters listed above is 20 cm or larger
- the maximum antenna gain of the WWAN transmitters does not exceed the values listed above
- the averaged EIRP of the WiMAX module does not exceed the value listed above
- the averaged EIRP of the WLAN module does not exceed the value listed above
- the averaged EIRP of the BT module does not exceed the value listed above
- the distance between WWAN, WiMAX, WLAN and BT antennas is 0 cm or larger

Note : other antennas for different communication systems may be installed in the host platform as long as they are not collocated to the WWAN antenna (distance > 20 cm)

## Annex A: RF Exposure assessment

### Annex A.1: Individual transmitters

The table on the following page lists all calculated power density values in relation to the limits defined in different standards, calculated for a distance of 20 cm from the antenna(s).

Fundamental data for calculating worst case EIRP of the primary and secondary transmitters are listed in chapter 4.3.

Power density at a distance of 20 cm is calculated by using the following formula:

$$S_{eq} = \frac{P \cdot G}{4\pi \cdot r^2} \text{ with } P \cdot G = \text{EIRP and } r = 20 \text{ cm}$$

Then the ratio  $\frac{S_{eq}}{S_{lim}}$  is calculated for all applied limits.

During calculation the maximum EIRP of the primary transmitter is optimized so that the ratio  $S_{eq} / S_{lim}$  does not exceed a value of 1 for all applied limits for a comprehensive coverage of all relevant standards.

The calculation of  $S_{eq} / S_{lim}$  with reference to a certain standard is limited to those frequency bands that are generally used in regions where this standard is applied.

standard region	EN Europe	FCC USA,Canada	AUS/NZ Australia New Zealand
GSM 850		x	
UMTS FDD V		x	x
(E)GSM 900	x		x
UMTS FDD VIII	x		
DCS 1800	x		x
UMTS FDD IV		x	
PCS 1900		x	
UMTS FDD II		x	
UMTS FDD I	x		x
ISM (WLAN/BT)	x	x	x
WiMAX	x	x	x

**Note:**

For frequencies above 2 GHz the limit is constant for all standards.

Therefore no frequency dependent differentiation is needed for radio technologies in this frequency band.



Stand-alone power density overview and limit reference of WWAN communication systems:

Comm. System	Mode	Reference Frequency	EIRP (mW)	Distance (cm)	Power Density Seq (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> ) FCC	S <sub>eq</sub> / S <sub>Lim</sub> FCC	MPE Limit (mW/cm <sup>2</sup> ) AUS	S <sub>eq</sub> / S <sub>Lim</sub> AUS
GSM 850	GSM/GPRS	824.2	2426.61	20	0.4828	0.5495	0.8786	0.4121	
	EDGE	824.2	609.5369	20	0.1213	0.5495	0.2207	0.4121	
FDD V	WCDMA	826.4	609.5369	20	0.1213	0.5509	0.2201	0.4132	0.2935
	HSDPA	826.4	609.5369	20	0.1213	0.5509	0.2201	0.4132	0.2935
	HSUPA	826.4	609.5369	20	0.1213	0.5509	0.2201	0.4132	0.2935
PCS 1900	GSM/GPRS	1850.2	1000	20	0.1989	1.0000	0.1989	0.9251	
	EDGE	1850.2	398.1072	20	0.0792	1.0000	0.0792	0.9251	
FDD II	WCDMA	1852.4	501.1872	20	0.0997	1.0000	0.0997	0.9262	
	HSDPA	1852.4	501.1872	20	0.0997	1.0000	0.0997	0.9262	
	HSUPA	1852.4	501.1872	20	0.0997	1.0000	0.0997	0.9262	
<b>worst case S<sub>eq</sub> / S<sub>Lim</sub></b>						<b>FCC</b>	<b>0.8786</b>	<b>AUS</b>	<b>0.2935</b>

Stand-alone power density overview and limit reference of WWAN communication systems and possible collocated transmitters:

Comm. System	Mode	Reference Frequency	EIRP (mW)	Distance (cm)	Power Density Seq (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> ) FCC	S <sub>eq</sub> / S <sub>Lim</sub> FCC	MPE Limit (mW/cm <sup>2</sup> ) AUS	S <sub>eq</sub> / S <sub>Lim</sub> AUS
<b>GSM 850</b>	GSM/GPRS	824.2	2290.868	20	0.4558	0.5495	0.8294	0.4121	
	EDGE	824.2	575.4399	20	0.1145	0.5495	0.2083	0.4121	
<b>FDD V</b>	WCDMA	826.4	575.4399	20	0.1145	0.5509	0.2078	0.4132	0.2771
	HSDPA	826.4	575.4399	20	0.1145	0.5509	0.2078	0.4132	0.2771
	HSUPA	826.4	575.4399	20	0.1145	0.5509	0.2078	0.4132	0.2771
<b>PCS 1900</b>	GSM/GPRS	1850.2	1000	20	0.1989	1.0000	0.1989	0.9251	
	EDGE	1850.2	398.1072	20	0.0792	1.0000	0.0792	0.9251	
<b>FDD II</b>	WCDMA	1852.4	501.1872	20	0.0997	1.0000	0.0997	0.9262	
	HSDPA	1852.4	501.1872	20	0.0997	1.0000	0.0997	0.9262	
	HSUPA	1852.4	501.1872	20	0.0997	1.0000	0.0997	0.9262	
<b>worst case S<sub>eq</sub> / S<sub>Lim</sub></b>						<b>FCC</b>	<b>0.8294</b>	<b>AUS</b>	<b>0.2771</b>
<b>Collocated transmitters</b>									
:									
<b>Bluetooth</b>		2450	131.83	20	0.0262	1	0.0262	1	0.0262
<b>WLAN</b>		2450	199.53	20	0.0397	1	0.0397	1	0.0397
<b>WiMax</b>		2300	501.19	20	0.0997	1	0.0997	1	0.0997

### Annex A.2: Collocated transmitters

When transmitters with collocated antennas are active simultaneously a worst case assessment is necessary which takes additive effects into account.

In this case it must be insured that the sum of all worst case power densities of all active transmitters (according to the different scenarios) do not exceed the limits even if they are far below the limits for the single transmitter.

$$\sum_1^n \frac{S_{eqn}}{S_{limn}} = \frac{S_{eq1}}{S_{lim1}} + \frac{S_{eq2}}{S_{lim2}} + \dots + \frac{S_{eqn}}{S_{limn}} \leq 1$$

The following tables show the results separated for different limits according to the standards listed in chapter 4.2.

The sum that comes closest to 1 represents the worst case and limits the antenna gain that is allowed for the WWAN module.

a) Simultaneous Exposure according to FCC limits

Scenario	Combination		worst case Seq / SLim	Sum	Compliance
Scenario 1	Primary Tx	WWAN	0.8294	0.8557	PASS
	Secondary Tx	Bluetooth	0.0262		
Scenario 2	Primary Tx	WWAN	0.8294	0.8691	PASS
	Secondary Tx	WLAN	0.0397		
Scenario 3	Primary Tx	WWAN	0.8294	0.8954	PASS
	Secondary Tx	WLAN	0.0397		
	Secondary Tx	Bluetooth	0.0262		
Scenario 4	Primary Tx	WWAN	0.8294	0.9292	PASS
	Secondary Tx	WiMAX	0.0997		
Scenario 5	Primary Tx	WWAN	0.8294	0.9554	PASS
	Secondary Tx	WiMAX	0.0997		
	Secondary Tx	Bluetooth	0.0262		
Scenario 6	Primary Tx	WWAN	0.8294	0.9689	PASS
	Secondary Tx	WLAN	0.0397		
	Secondary Tx	WiMAX	0.0997		
Scenario 7	Primary Tx	WWAN	0.8294	0.9951	PASS
	Secondary Tx	WLAN	0.0397		
	Secondary Tx	WiMAX	0.0997		
	Secondary Tx	Bluetooth	0.0262		

## b) Simultaneous Exposure according to AUS/NZ limits

Scenario	Combination		worst case Seq / SLim	Sum	Compliance
Scenario 1	Primary Tx	WWAN	0.2771	0.3033	PASS
	Secondary Tx	Bluetooth	0.0262		
Scenario 2	Primary Tx	WWAN	0.2771	0.3168	PASS
	Secondary Tx	WLAN	0.0397		
Scenario 3	Primary Tx	WWAN	0.2771	0.3430	PASS
	Secondary Tx	WLAN	0.0397		
	Secondary Tx	Bluetooth	0.0262		
Scenario 4	Primary Tx	WWAN	0.2771	0.3768	PASS
	Secondary Tx	WiMAX	0.0997		
Scenario 5	Primary Tx	WWAN	0.2771	0.4030	PASS
	Secondary Tx	WiMAX	0.0997		
	Secondary Tx	Bluetooth	0.0262		
Scenario 6	Primary Tx	WWAN	0.2771	0.4165	PASS
	Secondary Tx	WLAN	0.0397		
	Secondary Tx	WiMAX	0.0997		
Scenario 7	Primary Tx	WWAN	0.2771	0.4427	PASS
	Secondary Tx	WLAN	0.0397		
	Secondary Tx	WiMAX	0.0997		
	Secondary Tx	Bluetooth	0.0262		