

Maximum Permissible Exposure (MPE)

Related Submittal(s) / Grant (s)

According to \$1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1093 RF exposure is calculated.

This submittal(s) (test report) is intended to comply with Section Part 22, subpart H and Part 24, subpart E and Part27 subpart C & subpart L of the FCC CFR 47 Rules. And RSS-102 issue 4 For 47 CFR 1.1310 Radio frequency Radiation Exposure requirement.

Special Accessories

Not available for this EUT intended for grant.

Equipment Modifications

Not available for this EUT intended for grant.

Limitation

Frequency Range	Electric Field	Magnetic Field	Power Density	Averaging Time
(MHz)	Strength (V/m)	Strength (A/m)	(mW/cm^2)	(minute)
	Limits for General	Population/Uncontr	colled Exposure	
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F =frequency in MHz

* = Plane-wave equipment power density

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Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Averaging Time (minutes)
0.003-1	280	2.19	-	6
1-10	280/f	2.19/f	-	6
10-30	28	2.19/f	-	6
30-300	28	0.073	2*	6
300-1500	$1.585 f^{0.5}$	$0.0042 f^{0.5}$	<i>f</i> /150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/f ^{1.2}
150000-300000	$0.158 f^{0.5}$	$4.21 \ge 10^{-4} f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/f ^{1.2}

Note: f is frequency in MHz.

* Power density limit is applicable at frequencies greater than 100 MHz.

* Please note that R505 supports LTE Multiple Input. But it doesn't support Multiple Output. The "MIMO" only for LTE receive, not for LTE transmit.

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Maximum Permissible Exposure (MPE) Evaluation

802.11b Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	12.91	0.00	12.91	0.0195	1
2437.00	12.95	0.00	12.95	0.0197	1
2462.00	12.91	0.00	12.91	0.0195	1

MPE Prediction (802.11b)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

 $S=PG/4 \pi R^2$

Where: S = Power density

P = Power input to antenna

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

R = Distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	12.95	(dBm)
Maximum peak output power at antenna input terminal:	19.72422736	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.72422736	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2412	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0074636	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0074636 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2412MHz.

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802.11g Power Table

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	12.98	0.00	12.98	0.0199	1
2437.00	12.91	0.00	12.91	0.0195	1
2462.00	12.92	0.00	12.92	0.0196	1

MPE Prediction (802.11g)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

 $S=PG/4 \pi R^2$

Where: S = Power density

- P = Power input to antenna
- G = Power gain of the antenna in the direction of interest relative to an isotropic radiator
- R = Distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	12.98	(dBm)
Maximum peak output power at antenna input terminal:	19.86094917	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.86094917	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0075154	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0075 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2462.

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Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	12.99	0.00	12.99	0.0199	1
2437.00	12.95	0.00	12.95	0.0197	1
2462.00	12.93	0.00	12.93	0.0196	1

802.11n_20M (Main)Power Table

MPE Prediction (802.11n_20M)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

S=PG/4 π R²

Where: S = Power density

 $\mathbf{P} = \mathbf{Power}$ input to antenna

- G = Power gain of the antenna in the direction of interest relative to an isotropic radiator
- R = Distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	12.99	(dBm)
Maximum peak output power at antenna input terminal:	19.90673339	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.90673339	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0075327	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0075 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2462.

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Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	12.95	0.00	12.95	0.0197	1
2437.00	12.92	0.00	12.92	0.0196	1
2462.00	12.95	0.00	12.95	0.0197	1

802.11n_20M(Aux) Power Table

MPE Prediction (802.11n_20M)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

 $S=PG/4 \pi R^2$

Where: S = Power density

- P = Power input to antenna
- G = Power gain of the antenna in the direction of interest relative to an isotropic radiator
- $\mathbf{R} = \mathbf{D}\mathbf{i}\mathbf{s}$ to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	12.95	(dBm)
Maximum peak output power at antenna input terminal:	19.72422736	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.72422736	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0074636	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0074 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2462.

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Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2412.00	15.980	0.00	15.980	0.0396	1
2437.00	15.945	0.00	15.945	0.0393	1
2462.00	15.950	0.00	15.950	0.0394	1

802.11n_20M(MIMO) Power Table

MPE Prediction (802.11n_20M)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

 $S=PG/4 \pi R^2$

Where: S = Power density

P = Power input to antenna

- G = Power gain of the antenna in the direction of interest relative to an isotropic radiator
- R = Distance to the center of radiation of the antenna

MIMO only for multiple input. (Effect on receiving)

Maximum peak output power at antenna input terminal:	15.98	(dBm)
Maximum peak output power at antenna input terminal:	39.62780343	(mW)
Duty cycle:	100	(%)
Maximum Pav :	39.62780343	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2462	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0149951	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.015 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2462.

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Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	12.96	0.00	12.96	0.0198	1
2437.00	12.91	0.00	12.91	0.0195	1
2452.00	12.89	0.00	12.89	0.0195	1

802.11n_40M(Main) Power Table

MPE Prediction (802.11n_40M)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

 $S=PG/4 \pi R^2$

Where: S = Power density

- P = Power input to antenna
- G = Power gain of the antenna in the direction of interest relative to an isotropic radiator
- $\mathbf{R} = \mathbf{D}\mathbf{i}\mathbf{s}$ to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	12.96	(dBm)
Maximum peak output power at antenna input terminal:	19.7696964	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.7696964	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0074808	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0075 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2437.

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Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	12.95	0.00	12.95	0.0197	1
2437.00	12.95	0.00	12.95	0.0197	1
2452.00	12.91	0.00	12.91	0.0195	1

802.11n_40M(Aux) Power Table

MPE Prediction (802.11n_40M)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

 $S=PG/4 \pi R^2$

Where: S = Power density

- P = Power input to antenna
- G = Power gain of the antenna in the direction of interest relative to an isotropic radiator
- $\mathbf{R} = \mathbf{D}\mathbf{i}\mathbf{s}$ to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	12.95	(dBm)
Maximum peak output power at antenna input terminal:	19.72422736	(mW)
Duty cycle:	100	(%)
Maximum Pav :	19.72422736	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0074636	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0075 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2437.

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Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2422.00	15.965	0.00	15.965	0.0395	1
2437.00	15.940	0.00	15.940	0.0393	1
2452.00	15.910	0.00	15.910	0.0390	1

802.11n_40M(MIMO) Power Table

MPE Prediction (802.11n_40M)

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

 $S=PG/4 \pi R^2$

Where: S = Power density

P = Power input to antenna

- G = Power gain of the antenna in the direction of interest relative to an isotropic radiator
- R = Distance to the center of radiation of the antenna

MIMO only for multiple input. (Effect on receiving)

Maximum peak output power at antenna input terminal:	15.965	(dBm)
Maximum peak output power at antenna input terminal:	39.49116993	(mW)
Duty cycle:	100	(%)
Maximum Pav :	39.49116993	(mW)
Antenna gain (typical):	2.79	(dBi)
Maximum antenna gain:	1.90107828	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2437	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0149434	(mW/cm^2)

Measurement Result

The predicted power density level at 20 cm is 0.0149 mW/cm2. This is below the uncontrolled exposure limit of 1 mW/cm2 at 2437.

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Maximum Permissible Exposure (MPE) Evaluation

In this application we seek approval to the LTE/HSPA+ VoIP Router-R505. Based on the FCC OET Bulletin 65 Supplement C and 47 CFR §2.1091, we have concluded that the LTE/HSPA+ VoIP Router will comply with the FCC rules on RF exposure for mobile devices in cellular band and PCS band. The following analysis will demonstrate such compliance. The analysis will be done in two US bands. Operation in cellular band (1852.40–1907.60 MHz)

The EIRP of LTE/HSPA+ VoIP Router-R505 in cellular band is 21.94dBm max at HSDPA Band 2mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)			
	1852.40 926	1952.40	1852 40	1952 40	0262	F 2	V	114.23	9.85	9.90	5.56	14.18	33.00
		9202	E2	Н	121.74	17.56	9.90	5.84	21.62	Bm) (dBm) 4.18 33.00 1.62 33.00 5.33 33.00 1.94 33.00 5.28 33.00			
HSDPA II	1880.00	0.400	0.400	9400	0400	Ea	V	115.31	10.95	9.99	5.61	15.33	33.00
HSDFA II	HSDPA II 1880.00 9	9400	E2	Н	121.71	17.57	9.99	5.61	21.94	33.00			
1907.60	9538	Ба	V	115.20	10.87	10.07	5.66	15.28	33.00				
	1907.00	7550	E2	Н	120.70	16.59	10.07	5.66	21.00	33.00			

EIRP = 21.94dBm = 156.315 mW

Power Density = EIRP*Duty Cycle/($4 \pi R^2$)

=156.315*1/(4* π *20²) = 0.03111 mW/cm²

Where Duty Cycle is 1 for HSDPA Band 2 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in cellular band is compliant with the FCC rules on RF exposure.

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Operation in cellular band (1712.40-1752.60 MHz)

The EIRP of LTE/HSPA+ VoIP Router-R505 in cellular band is 23.87dBm max at HSDPA Band 4 mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
1712.40 1	1312	E2	V	117.27	10.25	9.48	5.17	14.57	33.00	
	1712.40	1312	E2	Н	126.78	19.81	9.90	5.84	23.87	(dBm)
HSDPA IV	1732.60	1413	Ea	V	117.52	10.51	9.54	5.20	14.85	33.00
IISDFATV	HSDPA IV 1/32.60	1413	E2	Н	125.55	18.59	9.54	5.20	22.93	33.00
1752.60	1752.60	1513	Ea	V	118.01	11.01	9.60	5.24	15.38	33.00
	1752.00	1515	E2	Н	125.01	18.06	9.60	5.24	22.43	33.00

EIRP = 23.87dBm = 243.781 mW

Power Density = EIRP*Duty Cycle/ $(4 \pi R^2)$

 $=243.781*1/(4*\pi*20^2) = 0.04852 \text{ mW/cm}^2$

where Duty Cycle is 1 for HSDPA Band 4 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET

Bulletin 65 Supplement C and can be calculated as follows:

MPE limit =1.0 mW/cm²

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in cellular band is compliant with the FCC rules on RF exposure.

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Operation in cellular band (826.40-846.60 MHz)

The ERP of LTE/HSPA+ VoIP Router-R505 in cellular band is 21.02dBm max at HSDPA Band 5 mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	Limit (dBm)		
	826.40 413	1122	E2	V	115.37	29.01	-10.02	3.63	15.36	38.45		
		4132	ĽΖ	Н	120.92	34.66	-10.02	3.63	21.02	(dBm)		
USDDA V	836.60	4192	4102	4183	Ea	V	114.30	28.04	-10.02	3.65	14.37	38.45
	HSDPA V 836.60	4165	E2	Н	120.54	34.31	-10.02	3.65	20.64	38.45		
846.60	4233	Ea	V	114.21	28.06	-10.02	3.67	14.37	38.45			
	4233	E2	Н	120.20	34.00	-10.02	3.67	20.31	38.45			

ERP = 21.02dBm = 126.474 mW

Power Density = EIRP*Duty Cycle/ $(4 \pi R^2)$

$$=126.474*1/(4*\pi *20^2) = 0.02517 \text{ mW/cm}^2$$

where Duty Cycle is 1 for HSDPA Band 5 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET

Bulletin 65 Supplement C and can be calculated as follows:

MPE limit =826.40/1500=0.55093mW/cm²

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in cellular band is compliant with the FCC rules on RF exposure.

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Operation in LTE band (1712.5 – 1752.5 MHz)

The EIRP of LTE/HSPA+ VoIP Router in **LTE band 4 5MHz /QPSK/RB 1** is 23.30dBm max at LTE mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	
		100	E2	V	113.82	9.30	9.48	5.33	13.45	30.00	
5MHz BW	1712.5	19975	ΕZ	Н	123.99	19.66	9.48	5.84	23.30	30.00	
LTE-Band 4	1732.5	20175		V	113.78	9.28	9.54	5.37	13.45	30.00	
(QPSK RB	1732.3	20175	20175	E2	Н	122.69	18.38	9.54	5.37	22.56	30.00
1 Offset 24)	/	20375 F2		V	113.91	9.43	9.60	5.40	13.63	30.00	
	1732.3	20373	E2	Н	121.23	16.94	9.60	5.40	21.15	30.00	

EIRP = 23.30dBm = 213.796mW

Power Density = ERP*Duty Cycle/($4 \pi R^2$)

 $=213.796*1/(4*\pi *20^{2}) = 0.04255 \text{ mW/cm}^{2}$

where Duty Cycle is 1 for LTE band 4 5MHz /QPSK/RB 1 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in cellular band is compliant with the FCC rules on RF exposure.

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Operation in LTE band (1712.5 – 1752.5 MHz)

The EIRP of LTE/HSPA+ VoIP Router-R505 in LTE band 4 5MHz /16QAM/RB 1 band is 23.34dBm. max. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
			БЭ	V	114.59	10.07	9.48	5.33	14.22	30.00
5MHz BW	1712.5	19975	E2	Н	124.03	19.70	9.48	5.84	23.34	30.00
LTE-Band 4	1732.5	20175		V	113.85	9.35	9.54	5.37	13.52	30.00
(16QAM RB 1 Offset	1752.5	5 20175	E2	Н	122.80	18.49	9.54	5.37	22.67	30.00
24))	1752 5 2027	20375		V	114.61	10.13	9.60	5.40	14.33	30.00
	1752.5	20373	E2	Н	122.16	17.87	9.60	5.40	22.08	30.00

EIRP = 23.34 dBm = 215.774 mW

Power Density = EIRP*Duty Cycle/ $(4 \pi R^2)$

 $=215.774*1/(4*\pi *20^{2}) = 0.4295 \text{mW/cm}^{2}$

where Duty Cycle is 1 for LTE band 4 5MHz /16QAM/RB 1 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in PCS band is compliant with the FCC rules on RF exposure.

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Operation in LTE band (1715 – 1750 MHz)

The EIRP of LTE/HSPA+ VoIP Router-R505 **LTE band 14 10MHz /QPSK/RB 1** band is 22.41 dBm. max. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
	1715	•••••	E2	V	112.26	7.74	9.49	5.34	11.89	30.00
10MHz BW	1715	20000	Ľ2	Н	120.79	16.46	9.49	5.84	20.11	30.00
LTE-Band 4	1732.5	20175		V	113.34	8.84	9.54	5.37	13.01	30.00
(QPSK RB 1	1752.5	20175	E2	Н	121.61	17.30	9.54	5.37	21.48	30.00
Offset 0)	1750	20250		V	114.71	10.23	9.60	5.40	14.43	30.00
	1750	20350	E2	Н	122.50	18.21	9.60	5.40	22.41	30.00

EIRP = 22.41dBm = 174.181mW

Power Density = ERP*Duty Cycle/ $(4 \pi R^2)$

$$=174.181*1/(4*\pi *20^2) = 0.03467 \text{ mW/cm}^2$$

where Duty Cycle is 1 for LTE band 14 10MHz /QPSK/RB 1 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in LTE band is compliant with the FCC rules on RF exposure.

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Operation in LTE band (1715 – 1750 MHz)

The EIRP of LTE/HSPA+ VoIP Router-R505 in LTE band 4 10MHz /16QAM/RB 1 is 23.73 dBm max at LTE mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)
	1715	•••••	E2	V	113.23	8.71	9.49	5.34	12.86	30.00
10MHz BW	1715	20000	ΕZ	Н	121.55	17.22	9.49	5.84	20.87	30.00
LTE-Band 4	1732.5	20175		V	114.11	9.61	9.54	5.37	13.78	30.00
(16QAM RB	1752.5	20175	E2	Н	121.59	17.28	9.54	5.37	21.46	30.00
1 Offset 0)	1750	20250		V	115.58	11.10	9.60	5.40	15.30	30.00
	1750	20350	E2	Н	123.82	19.53	9.60	5.40	23.73	30.00

EIRP = 23.73 dBm = 187.499 mW

Power Density = ERP*Duty Cycle/($4 \pi R^2$)

 $=187.499*1/(4*\pi *20^{2}) = 0.04698 \text{ mW/cm}^{2}$

where Duty Cycle is 1 for LTE band 4 10MHz /16QAM/RB 1 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit = 1.0 mW/cm^2

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in LTE band is compliant with the FCC rules on RF exposure.

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Operation in LTE band (706.5 – 713.5 MHz)

The ERP of LTE/HSPA+ VoIP Router-R505 in **LTE band 17 5MHz /QPSK/RB 1** is 18.04dBm max at LTE mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	Limit (dBm)
	706 5	00755	E2	V	114.03	24.89	-7.86	3.31	13.72	34.77
5MHz BW	706.5	23755	E2	Н	120.59	31.74	-7.86	5.84	18.04	34.77
LTE-Band 17	710	23790		V	110.67	21.70	-7.86	3.33	10.51	34.77
(QPSK RB 1	/10	23790	E2	Н	117.30	27.80	-7.86	3.33	16.61	34.77
Offset 24)	713.5	713.5 23825		V	112.21	23.40	-7.86	3.34	12.20	34.77
	/15.5	23823	E2	Н	118.90	28.75	-7.86	3.34	17.54	34.77

ERP = 18.04dBm = 63.680mW

Power Density = ERP*Duty Cycle/($4 \pi R^2$)

$$(63.680*1/(4*\pi*20^2) = 0.01268 \text{ mW/cm}^2)$$

where Duty Cycle is 1 for LTE band 17 5MHz /QPSK/RB 1 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit =706.5/1500=0.471 mW/cm²

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in LTE band is compliant with the FCC rules on RF exposure.

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Operation in LTE band (706.5 – 713.5 MHz)

The ERP of LTE/HSPA+ VoIP Router-R505 in LTE band 17 5MHz /16QAM/RB 1 is 20.52dBm max at LTE mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	Limit (dBm)
	706 5	00755	E2	V	114.80	25.66	-7.86	3.31	14.49	34.77
5MHz BW	706.5	23755	E2	Н	121.60	32.75	-7.86	5.84	19.05	34.77
LTE-Band 17	710	23790		V	112.59	23.62	-7.86	3.33	12.43	34.77
(16 QAM RB		23790	E2	Н	120.56	31.06	-7.86	3.33	19.87	34.77
1 Offset 24)	713.5 23825	12015		V	113.61	24.80	-7.86	3.34	13.60	34.77
	/15.5	23825	E2	Н	121.88	31.73	-7.86	3.34	20.52	34.77

ERP = 20.52 dBm = 112.720 mW

Power Density = ERP*Duty Cycle/($4 \pi R^2$)

$$=112.720*1/(4*\pi *20^2) = 0.02244 \text{ mW/cm}^2$$

where Duty Cycle is 1 for LTE band 17 5MHz /16QAM/RB 1 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit =706.5/1500=0.471mW/cm²

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in LTE band is compliant with the FCC rules on RF exposure.

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Operation in LTE band (709 – 711 MHz)

The ERP of LTE/HSPA+ VoIP Router-R505 in LTE band 17 10MHz /QPSK/RB 1 is 15.40dBm max at LTE mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	Limit (dBm)
	700	00700	E2	V	109.44	20.42	-7.86	3.32	9.24	34.77
10MHz BW	709	23780	EZ	Н	115.46	26.15	-7.86	5.84	12.45	34.77
LTE-Band 17	710	23790		v	109.44	20.47	-7.86	3.33	9.28	34.77
(QPSK RB 25		23790	E2	Н	116.09	26.59	-7.86	3.33	15.40	34.77
Offset 12)	711	23800		V	108.01	19.08	-7.86	3.33	7.89	34.77
	/11	23800	E2	Н	114.64	24.95	-7.86	3.33	13.76	34.77

ERP = 15.40dBm = 34.674mW

Power Density = ERP*Duty Cycle/($4 \pi R^2$)

 $=34.674*1/(4*\pi*20^2) = 0.00690 \text{ mW/cm}^2$

where Duty Cycle is 1 for LTE band 17 10MHz /QPSK/RB 1 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit =709/1500=0.473mW/cm²

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in LTE band is compliant with the FCC rules on RF exposure.

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Operation in LTE band (709 – 711 MHz)

The ERP of LTE/HSPA+ VoIP Router-R505 in LTE band 17 10MHz /16QAM/RB 1 is 16.99dBm max at LTE mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	СН	EUT Pol.	Antenna Pol.	SPA Reading (dBuV)	S.G. Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	ERP (dBm)	Limit (dBm)
	700	00700	E2	V	111.96	22.94	-7.86	3.32	11.76	34.77
10MHz BW	709	23780	EZ	Н	118.55	29.24	-7.86	5.84	15.54	34.77
LTE-Band 17	710	23790		V	110.86	21.89	-7.86	3.33	10.70	34.77
(16 QAM RB	/10	23790	E2	Н	117.59	28.09	-7.86	3.33	16.90	34.77
1 Offset 0)	711	711 23800		V	110.90	21.97	-7.86	3.33	10.78	34.77
	/11	23800	E2	Н	117.87	28.18	-7.86	3.33	16.99	34.77

ERP = 16.99dBm = 50.003mW

Power Density = ERP*Duty Cycle/($4 \pi R^2$)

$$50.003*1/(4*\pi*20^2) = 0.00995 \text{ mW/cm}^2$$

where Duty Cycle is 1 for LTE band 17 10MHz /16QAM/RB 1 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

MPE limit =709/1500=0.473 mW/cm²

As we can see the resulted power density is below the MPE limit, therefore LTE/HSPA+ VoIP Router-R505 in LTE band is compliant with the FCC rules on RF exposure.

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Operation if simultaneous transmission is applicable

As per KDB 447498, if transmitter of usage in mobile exposure conditions that allow simultaneous transmission, then the following combinational table of calculation in determination for simultaneous transmission of MPE compliance are needed to be presented as required by FCC.

HSDPA II + IEEE 802.11g										
Antenna No.		Total	1	2						
Tx Status			On	On						
Frequency	MHz		1880	2412						
MPE Limit	mW/cm ²		1.00	1.00						
Max % MPE	%	3.3	2.6	0.8						
Power	(W)	0.176	0.156	0.020						
Antenna Gain	dBi		0.77	2.79						
EIRP	(W)	0.17	0.131	0.038						
x	(cm)		4.0	0.0						
Y	(cm)		0.0	1.7						
Sector			FALSE	FALSE						
Arc			FALSE	FALSE						
θ1			-120	-120						
θ_2		input	60	60						
θ_1	degs		-120	-120						
θ₂		actual	60	60						

HSDPA II + IEEE 802.11g

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HSDPA IX + IEEE 802.11g									
Antenna No.		Total	1	2					
Tx Status			On	On					
Frequency	MHz		1712.4	2412					
MPE Limit	mW/cm ²		1.00	1.00					
Max % MPE	%	6.1	5.5	0.8					
Power	(W)	0.264	0.244	0.020					
Antenna Gain	dBi		0.51	2.79					
EIRP	(W)	0.31	0.274	0.038					
х	(cm)		4.0	0.0					
Y	(cm)		0.0	1.7					
Sector			FALSE	FALSE					
Arc			FALSE	FALSE					
Θ_1			-120	-120					
θ_2		input	60	60					
θ_1	degs		-120	-120					
θ₂		actual	60	60					

HSDPA IX \pm IFFF 802 11 σ

HSDPA V + IEEE 802.11g

1100			8	
Antenna No.		Total	1	2
Tx Status			On	On
Frequency	MHz		826.4	2412
MPE Limit	mW/cm ²		0.55	1.00
Max % MPE	%	4.0	3.3	0.8
Power	(W)	0.146	0.127	0.020
Antenna Gain	dBi		1.42	2.79
EIRP	(W)	0.13	0.091	0.038
х	(cm)		4.0	0.0
Y	(cm)		0.0	1.7
Sector			FALSE	FALSE
Arc			FALSE	FALSE
θ_1		_	-120	-120
θ₂		input	60	60
Θ_1	degs		-120	-120
θ_2		actual	60	60

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LTE Band 4 5MHz (QPSK RB 1 / Offset 24) + WIFI 802.11g

Antenna No.		Total	1	2
Tx Status			On	On
Frequency	MHz		1750	2412
MPE Limit	mW/cm ²		1.00	1.00
Max % MPE	%	5.7	5.0	0.8
Power	(W)	0.234	0.214	0.020
Antenna Gain	dBi		0.71	2.79
EIRP	(W)	0.29	0.252	0.038
Х	(cm)		4.0	0.0
Y	(cm)		0.0	1.7
Sector			FALSE	FALSE
Arc			FALSE	FALSE
Θ_1			-120	-120
θ₂		input	60	60
θ_1	degs		-120	-120
θ_2		actual	60	60

LTE Band 4 10MHz (16QAM RB1 Offset 0) + WIFI 802.11g

Antenna No.		Total	1	2
Antenna No.		TULAI	I	2
Tx Status			On	On
Frequency	MHz		1750	2412
MPE Limit	mW/cm ²		1.00	1.00
Max % MPE	%	5.4	4.7	0.8
Power	(W)	0.202	0.182	0.020
Antenna Gain	dBi		1.14	2.79
EIRP	(W)	0.27	0.236	0.038
х	(cm)		4.0	0.0
Y	(cm)		0.0	1.7
Sector			FALSE	FALSE
Arc			FALSE	FALSE
Θ_1			-120	-120
θ_2	_	input	60	60
θ_1	degs		-120	-120
θ_2		actual	60	60

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Antenna No.		Total	1	2
Tx Status			On	On
Frequency	MHz		713.5	2412
MPE Limit	mW/cm ²		0.48	1.00
Max % MPE	%	5.4	4.7	0.8
Power	(W)	0.175	0.155	0.020
Antenna Gain	dBi		1.39	2.79
EIRP	(W)	0.15	0.113	0.038
х	(cm)		4.0	0.0
Y	(cm)		0.0	1.7
Sector			FALSE	FALSE
Arc			FALSE	FALSE
θ_1	degs	input	-120	-120
θ_2			60	60
θ_1		actual	-120	-120
θ_2			60	60

LTE Band 17(5MHz QPSK RB 1 Offset24) + WIFI 802.11g

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Antenna No.		Total	1	2
Tx Status			On	On
Frequency	MHz		713.5	2412
MPE Limit	mW/cm ²		0.48	1.00
Max % MPE	%	2.8	2.1	0.8
Power	(W)	0.181	0.161	0.020
Antenna Gain	dBi		5.09	2.79
EIRP	(W)	0.09	0.050	0.038
Х	(cm)		4.0	0.0
Y	(cm)		0.0	1.7
Sector			FALSE	FALSE
Arc			FALSE	FALSE
θ_1	degs	input	-120	-120
θ_2			60	60
θ_1		actual	-120	-120
θ_2			60	60

LTE Band 17(10MHz 16QAM RB1 Offset 24)+ WIFI 802.11g

* Please note that the table of calculation only present the combination that yield the worst-case scenario.

- End of Report -

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