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Date: **August 8, 2013**

RF exposure analysis for the equipment SARA-G310 (FCC ID: XPYSARAG350; IC: 8595A-SARAG350)

The device (FCC ID: XPYSARAG350; IC: 8595A-SARAG350) is a module designed to be installed in other devices. This device is to be used only for fixed and mobile applications. If the final product after integration is intended for portable use, new applications and FCC and IC are required.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter except as under the conditions described in this exhibit and according to KDB 447498 D01 General RF Exposure Guidance.

MPE exposure limits

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1,0	30

The table below is excerpted from RSS-102, Issue 4, 4.2, titled “RF Limits for Devices used by the General Public”:

Frequency Range (MHz)	Power density (W/m ²)	Averaging time (minutes)
300 – 1500	f (MHz) /150	6
1500 – 100.000	10	6

EIRP/ERP limits

For 850 MHz frequency band and according to FCC §22.913 the maximum ERP of the device is 7 W (equivalent to 11,48 W EIRP) while IC SRSP-503 defines an EIRP limit of 11,5 W.

For 1900 MHz frequency band and according to FCC §24.232 and IC SRSP-510, the maximum EIRP of the device should be lower than 2 W.

Using the equation $S = \frac{PG}{4\pi R^2}$ to calculate the exposure to electromagnetic fields

- where:
- S = power density (in appropriate units, e.g. mW/cm²)
 - P = power input to the antenna (in appropriate units, e.g., mW)
 - 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 (appropriate units, e.g., cm)

compliance with FCC/IC MPE and EIRP limits is demonstrated following the calculations shown in the following pages.



1. Standalone operations analysis and maximum antenna gain

Band	Modulation	Test Mode	Channel		Frequency (MHz)	Avg burst Conducted power (dBm)	Duty cycle (%)	FCC/IC MPE limit (mW/cm ²)	FCC ERP limit per §22.913 and §24.232 (W)	IC ERP limit per SRSP-503 and SRSP-510 (W)	Evaluation distance for compliance with MPE limits (cm)	Antenna gain to meet FCC/IC MPE limit (dBi)	Antenna gain to meet FCC ERP limit (dBi)	Antenna gain to meet IC ERP limit (dBi)	Maximum antenna gain to meet all the limits (dBi)	Maximum antenna gain to meet all the limits per frequency band (dBi)
			Lowest	Highest												
GSM 850	GMSK	1 of 8 transmission slot Duty factor 1/8	Lowest	128	824,2	32,20	12,5%	0,55	11,48	11,50	20	11,24	8,39	8,40	8,39	850 MHz frequency band:
			Middle	190	836,6	32,10	12,5%	0,56	11,48	11,50	20	11,40	8,49	8,50	8,49	
			Highest	251	848,8	31,80	12,5%	0,57	11,48	11,50	20	11,77	8,79	8,80	8,79	
GPRS 850	GMSK	2 of 8 transmission slots Duty factor 1/4	Lowest	128	824,2	26,48	25,0%	0,55	11,48	11,50	20	13,95	14,11	14,12	13,95	8,39
			Middle	190	836,6	26,48	25,0%	0,56	11,48	11,50	20	14,01	14,11	14,12	14,01	
			Highest	251	848,8	26,28	25,0%	0,57	11,48	11,50	20	14,28	14,31	14,32	14,28	
GSM 1900	GMSK	1 of 8 transmission slot Duty factor 1/8	Lowest	512	1850,2	29,60	12,5%	1,00	2,00	2,00	20	16,44	3,41	3,41	3,41	1900 MHz frequency band:
			Highest	661	1880,0	29,90	12,5%	1,00	2,00	2,00	20	16,14	3,11	3,11	3,11	
			Highest	810	1909,8	29,60	12,5%	1,00	2,00	2,00	20	16,44	3,41	3,41	3,41	
GPRS 1900	GMSK	2 of 8 transmission slots Duty factor 1/4	Lowest	512	1850,2	24,18	25,0%	1,00	2,00	2,00	20	18,85	8,83	8,83	8,83	3,11
			Highest	661	1880,0	24,08	25,0%	1,00	2,00	2,00	20	18,95	8,93	8,93	8,93	
			Highest	810	1909,8	23,88	25,0%	1,00	2,00	2,00	20	19,15	9,13	9,13	9,13	

Band	Modulation	Test Mode	Channel		Frequency (MHz)	Avg burst Conducted power (dBm)	Antenna gain		Duty cycle (%)	Evaluation distance for compliance with MPE limits (cm)	Power density (mW/cm ²)	FCC/IC MPE limit (mW/cm ²)	MPE RATIO	MAX MPE RATIO
			Lowest	Highest			Antenna gain (dBi)	Antenna gain (numerical)						
GSM 850	GMSK	1 of 8 transmission slot Duty factor 1/8	Lowest	128	824,2	32,20	8,39	6,90	12,5%	20	0,285	0,549	0,519	0,519
			Middle	190	836,6	32,10	8,39	6,90	12,5%	20	0,278	0,558	0,500	
			Highest	251	848,8	31,80	8,39	6,90	12,5%	20	0,260	0,566	0,460	
GPRS 850	GMSK	2 of 8 transmission slots Duty factor 1/4	Lowest	128	824,2	26,48	8,39	6,90	25,0%	20	0,153	0,549	0,278	0,519
			Middle	190	836,6	26,48	8,39	6,90	25,0%	20	0,153	0,558	0,274	
			Highest	251	848,8	26,28	8,39	6,90	25,0%	20	0,146	0,566	0,258	
GSM 1900	GMSK	1 of 8 transmission slot Duty factor 1/8	Lowest	512	1850,2	29,60	3,11	2,05	12,5%	20	0,046	1,000	0,047	0,519
			Highest	661	1880,0	29,90	3,11	2,05	12,5%	20	0,050	1,000	0,050	
			Highest	810	1909,8	29,60	3,11	2,05	12,5%	20	0,046	1,000	0,047	
GPRS 1900	GMSK	2 of 8 transmission slots Duty factor 1/4	Lowest	512	1850,2	24,18	3,11	2,05	25,0%	20	0,027	1,000	0,027	0,519
			Highest	661	1880,0	24,08	3,11	2,05	25,0%	20	0,026	1,000	0,027	
			Highest	810	1909,8	23,88	3,11	2,05	25,0%	20	0,025	1,000	0,025	



2. Co-location analysis

2.1. Co-location with other transmitter in mobile exposure conditions

According to KDB 447498 D01 General RF Exposure Guidance v05, 7.2:

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0 .

As the maximum calculated MPE ratio for the device is **0,519**, the product can be co-located with other antennas providing that the sum of the MPE ratios for all the other simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density is $\leq 1.0 - 0,519 = \mathbf{0,481}$.

2.2. Co-location with other transmitter in mixed mobile and portable host platform exposure conditions

According to KDB 447498 D01 General RF Exposure Guidance v05, 7.2:

When one of the following test exclusion conditions is satisfied for all combinations of simultaneous transmission configurations, further equipment approval is not required to incorporate transmitter modules in host devices that operate in the mixed mobile and portable host platform exposure conditions. The grantee is responsible for documenting this according to Class I permissive change requirements. Antennas that qualify for standalone SAR test exclusion must apply the estimated standalone SAR to determine simultaneous transmission test exclusion.

- *The $[\sum \text{ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg} + [\sum \text{ of MPE ratios}]]$ is ≤ 1.0 .*
- *The SAR to peak location separation ratios of all simultaneous transmitting antenna pairs operating in portable exposure conditions are all ≤ 0.04 and the $[\sum \text{ of MPE ratios}]$ is ≤ 1.0 .*

As the maximum calculated MPE ratio for the device is **0,519**, the equipment can be co-located with other transmitters in a mixed mobile and portable conditions providing that the exposure of the co-located transmitter complies with:

- The $[\sum \text{ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg} + [\sum \text{ of MPE ratios}]]$ is $\leq 1.0 - 0,519 = \mathbf{0,481}$
- OR**
- The SAR to peak location separation ratios of all simultaneous transmitting antenna pairs operating in portable exposure conditions are all $\leq \mathbf{0.04}$ and the $[\sum \text{ of MPE ratios}]$ is $\leq 1.0 - 0,519 = \mathbf{0,481}$

Sincerely,

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