EVALUATION FOR RF RADIATION EXPOSURE

The worst-case exposure with the new antenna mounted at rear portion of rooftop of a vehicle is expected to be applied to a person standing at right side (or left side) of the vehicle. Since the distance between the person and the antenna is kept more than 20 cm, the transceiver is categorized as a mobile device for which the RF radiation exposure shall be evaluated with MPE (Maximum Permissive Exposure).

1. Method

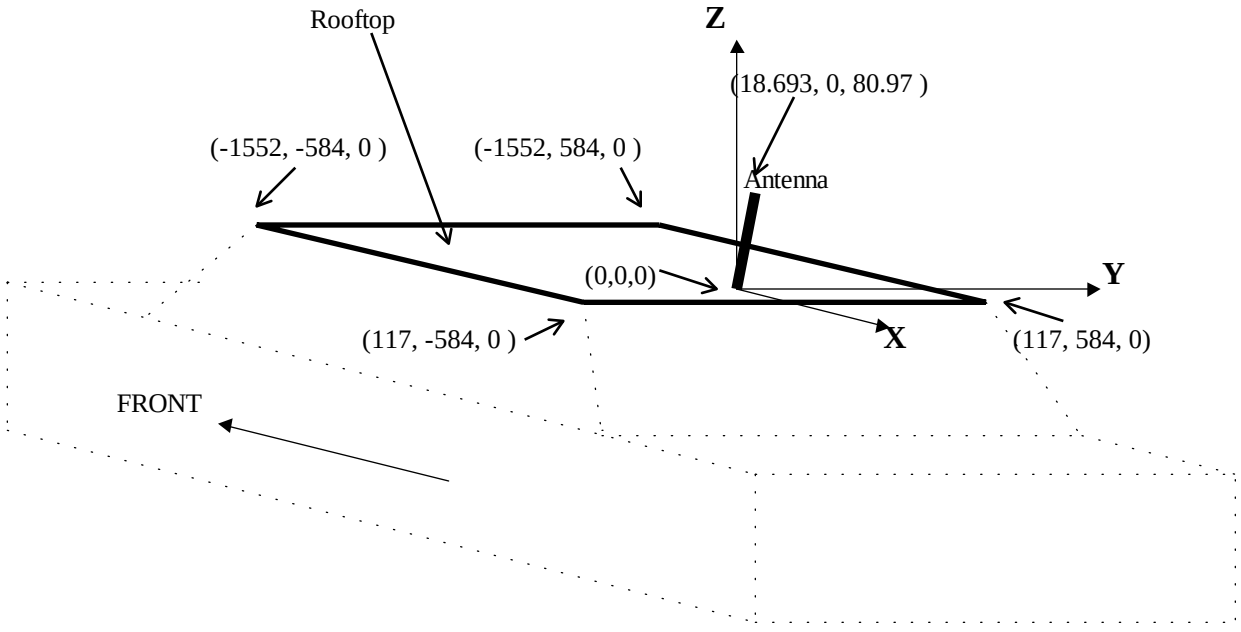
Power Density was calculated by NEC-2 based software for the following condition, which simulates the transceiver (FCC ID: BFYT3017) and the new antenna mounted on vehicle rooftop.

(1) Transceiver
RF Output Power: 3.0 watts (50 ohms) at the antenna terminal of the transceiver unit
Transmit Frequency: 824.04 MHz to 848.97 MHz

(2) Cable connecting Antenna to Transceiver Unit
Cable type: 50 ohms Coaxial cable
Cable loss: 2.49dB

(3) Antenna
Antenna type: Mono pole
Element length: 83.10 mm
RF voltage applied to Antenna : 9.19487 Volts RMS (3W-2.49dB at 50 ohms)

(4) Modeling
The following figure shows the model for the calculation. The rooftop of the vehicle which is simulated by wire grid consisting of 6979 wires works as a ground for the antenna. The radiator of the antenna consists of 40 segments of wire. All dimensions shown in the figure are indicated in mm (millimeter). The worst-case RF exposure is assumed to be occurred at the location of x=0 (mm), and y=834 (mm).



2. Calculation Results

Frequency: 824.04 MHz

Location (x, y, z)			Electric Field	Magnetic Field	Power Density	
x(mm)	y(mm)	z(mm)	(V/m RMS)	(A/m RMS)	W/(m x m)	
0	834	0	8.16348	0.0215953	0.176293	
0	834	50	10.5089	0.0279833	0.294074	
0	834	100	12.6196	0.03383	0.426921	
0	834	150	14.2568	0.0385085	0.549008	
0	834	200	15.2978	0.0415946	0.636306	
0	834	210	15.4308	0.0420027	0.648135	
0	834	220	15.5392	0.0423408	0.657942	
0	834	230	15.6244	0.0426092	0.665743	
0	834	240	15.6846	0.0428091	0.671444	
0	834	250	15.7222	0.0429414	0.675133	
0	834	260	15.7372	0.0430082	0.676829	
0	834	270	15.7291	0.043012	0.676540	
0	834	280	15.7004	0.042954	0.674395	
0	834	290	15.6516	0.0428374	0.670474	
0	834	300	15.5837	0.0426644	0.664869	
0	834	350	14.9934	0.0410585	0.615607	
0	834	400	14.0818	0.0384988	0.542132	
0	834	450	12.9767	0.0353596	0.458851	
0	834	500	11.7906	0.0319722	0.376971	
-350	834	260	11.6679	0.0317784	0.370787	
-300	834	260	12.1108	0.0332122	0.402226	
-250	834	260	12.782	0.0351849	0.449733	
-200	834	260	13.6227	0.0374208	0.509772	
-150	834	260	14.4738	0.0395412	0.572311	
-100	834	260	15.1649	0.0413165	0.626561	
-50	834	260	15.5865	0.0425263	0.662836	
-40	834	260	15.6368	0.0426835	0.667433	
-30	834	260	15.6766	0.0428106	0.671125	
-20	834	260	15.7063	0.0429073	0.673915	
-10	834	260	15.7264	0.042973	0.675811	
0	834	260	15.7372	0.0430082	0.676829	
10	**834**	**260**	**15.7393**	**0.0430138**	**0.677007**	**(Max)**
20	834	260	15.7329	0.0429902	0.676361	
30	834	260	15.7184	0.0429383	0.674921	
40	834	260	15.6961	0.0428593	0.672724	
50	834	260	15.6661	0.0427545	0.669796	
100	834	260	15.4072	0.041899	0.645546	
150	834	260	14.9877	0.0406508	0.609262	
200	834	260	14.4508	0.039199	0.566457	
250	834	260	13.8441	0.0376444	0.521153	
300	834	260	13.2003	0.0360038	0.475261	
350	834	260	12.5357	0.0342623	0.429502	

2. Calculation Results (continued)

Frequency: 836.49 MHz

Location (x, y, z)			Electric Field	Magnetic Field	Power Density	
x(mm)	y(mm)	z(mm)	(V/m RMS)	(A/m RMS)	W/(m x m)	
0	834	0	8.11455	0.0212845	0.172714	
0	834	50	10.3105	0.0274055	0.282564	
0	834	100	12.3127	0.0330124	0.406472	
0	834	150	13.8681	0.0374982	0.520029	
0	834	200	14.8489	0.0404366	0.600439	
0	834	210	14.972	0.0408199	0.611156	
0	834	220	15.0726	0.0411351	0.620013	
0	834	230	15.1482	0.041382	0.626863	
0	834	240	15.201	0.0415623	0.631789	
0	834	250	15.232	0.0416766	0.634818	
0	**834**	**260**	**15.2392**	**0.0417272**	**0.635889**	**(Max)**
0	834	270	15.2258	0.0417157	0.635155	
0	834	280	15.192	0.0416446	0.632665	
0	834	290	15.1388	0.0415163	0.628507	
0	834	300	15.0672	0.0413329	0.622771	
0	834	350	14.4683	0.0397005	0.574399	
0	834	400	13.5641	0.0371547	0.50397	
0	834	450	12.4812	0.0340701	0.425236	
0	834	500	11.3295	0.0307706	0.348616	
-350	834	260	11.0854	0.0303988	0.336983	
-300	834	260	11.577	0.0318239	0.368425	
-250	834	260	12.3633	0.0339469	0.419696	
-200	834	260	13.2884	0.0362984	0.482348	
-150	834	260	14.1509	0.038488	0.54464	
-100	834	260	14.7799	0.0402459	0.59483	
-50	834	260	15.1252	0.0413551	0.625504	
-40	834	260	15.1644	0.0414886	0.62915	
-30	834	260	15.195	0.0415924	0.631997	
-20	834	260	15.2175	0.0416663	0.634057	
-10	834	260	15.2321	0.0417114	0.635352	
0	**834**	**260**	**15.2392**	**0.0417272**	**0.635889**	**(Max)**
10	834	260	15.239	0.0417154	0.635701	
20	834	260	15.2316	0.0416766	0.634801	
30	834	260	15.217	0.0416122	0.633213	
40	834	260	15.1953	0.041524	0.63097	
50	834	260	15.1665	0.0414137	0.628101	
100	834	260	14.92	0.0405853	0.605533	
150	834	260	14.5256	0.0394519	0.573063	
200	834	260	14.027	0.0381483	0.535106	
250	834	260	13.4615	0.0367009	0.494049	
300	834	260	12.8511	0.0350947	0.451005	
350	834	260	12.2105	0.0333353	0.407041	

2. Calculation Results (continued)

Frequency: 848.97 MHz

Location (x, y, z)			Electric Field	Magnetic Field	Power Density	
x(mm)	y(mm)	z(mm)	(V/m RMS)	(A/m RMS)	W/(m x m)	
0	834	0	7.8476	0.0204237	0.160277	
0	834	50	9.84958	0.0261434	0.257502	
0	834	100	11.7077	0.0314077	0.367712	
0	834	150	13.1555	0.0356217	0.468621	
0	834	200	14.059	0.0383582	0.539278	
0	834	210	14.1712	0.0387096	0.548561	
0	834	220	14.2593	0.0389947	0.556037	
0	834	230	14.3245	0.0392143	0.561725	
0	834	240	14.3689	0.0393696	0.565698	
0	834	250	14.3897	0.0394613	0.567836	
0	834	260	14.3898	0.0394916	0.568276	
0	834	270	14.3697	0.0394626	0.567066	
0	834	280	14.3301	0.0393763	0.564266	
0	834	290	14.2721	0.0392345	0.559959	
0	834	300	14.1965	0.0390412	0.554248	
0	834	350	13.5899	0.037389	0.508113	
0	834	400	12.698	0.034878	0.442881	
0	834	450	11.6458	0.0318775	0.371239	
0	834	500	10.5404	0.0287056	0.302569	
-350	834	260	10.347	0.0284264	0.294128	
-300	834	260	10.9491	0.0299471	0.327894	
-250	834	260	11.7994	0.0321442	0.379282	
-200	834	260	12.703	0.0344719	0.437897	
-150	834	260	13.4654	0.0365623	0.492326	
-100	834	260	13.974	0.038171	0.533402	
-50	834	260	14.2616	0.0391621	0.558514	
-40	834	260	14.2992	0.0392808	0.561684	
-30	834	260	14.3308	0.0393729	0.564245	
-20	834	260	14.3565	0.0394381	0.566193	
-10	834	260	14.3763	0.0394779	0.567546	
0	834	260	14.3898	0.0394916	0.568276	
10	**834**	**260**	**14.397**	**0.0394814**	**0.568414**	**(Max)**
20	834	260	14.3975	0.0394479	0.567951	
30	834	260	14.3914	0.0393929	0.566919	
40	834	260	14.3784	0.0393175	0.565323	
50	834	260	14.3585	0.0392235	0.563191	
100	834	260	14.1586	0.0385315	0.545552	
150	834	260	13.8137	0.0375741	0.519037	
200	834	260	13.3599	0.0363972	0.486263	
250	834	260	12.8266	0.0349882	0.44878	
300	834	260	12.2376	0.0333609	0.408257	
350	834	260	11.6169	0.0315817	0.366881	

3. Conclusion

The worst-case RF radiation exposure is summarized as follows.

Frequency f (MHz)	Location (mm)	Power Density W/(m x m)	Power Density mW/(cm x cm)	MPE Limit (*) mW/(cm x cm)
824.04	(10, 834, 260)	0.677007	0.0677007	0.54936
836.49	(0, 834, 260)	0.635889	0.0635889	0.55766
848.97	(10, 834, 260)	0.568414	0.0568414	0.56598

(*) f /1500, Limit for General Population / Uncontrolled Exposure

As shown in the above summary, the worst-case RF exposure is expected to be less than the MPE limit. Therefore, the transceiver with the new antenna is considered to comply with the Section 2.1091 of FCC rule.