RF Exposure Evaluation declaration

Product Name ： Repeater
Model No. ： ST-9116D
FCC ID. ： M38-ST-9116D

Applicant : RANGER COMMUNICATIONS (M) SDN, BHD.
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Date of Receipt ： 2014/09/26
Issued Date ： 2015/06/10
Report No. ： 14A0006R-RF-US-Exp
Report Version ： V1.0

1. RF Exposure Evaluation

1.1. Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Friis transmission formula: $Pd = (Pout*G)/(4*pi*r^2)$

Where
Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
Pi = 3.1416
r= distance between observation point and center of the radiator in cm

EUT's MPE limit is f/300 mW/cm^2 . If we know the maximum gain of the antenna and the tota l power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

1.2. Test Procedure

Software provided by client enabled the EUT to transmit data at lowest, middle and highest channel individually.

Refer to Sections 1.1310, 2.1091
In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

(1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
(2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement.
(3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits.
(4) Any other RF exposure related issues that may affect MPE compliance.

1.3. Test Result of RF Exposure Evaluation

Product	Repeater
Test Mode	Mode 1: Transmit
Test Condition	RF Exposure Evaluation

Evaluation of RF Exposure Compliance Requirements

RF Exposure Requirements	Compliance with FCC Rules
Minimum calculated separation distance between antenna and persons required: 104.5 cm	Manufacturer' instruction for separation distance between antenna and persons required: 105 cm
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Antenna installation and device operating instructions shall be provided to installers to maintain and ensure compliance with RF exposure requirements
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Refer to User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None

Antenna Gain:

The EUT was tested with the antenna port terminated to a 50 Ohm RF Load(0dBi or 1 linear scale.)

RF Exposure Limit = f/300 = 450.1 / 300 = 1.5 mW/cm^2 (worst case)

Max. EIRP = 46.15 dBm + 0 dBi = 46.15 dBm =41209.75 mWatts(worst case)

$0.30030 = (Pout*G)/(4*pi*r^2)=(41209.75*1)/(4*3.14*r^2)$; r = 104.5 cm

Output Power into Antenna & RF Exposure Evaluation Distance:

Channel	Channel Frequency (MHz)	Output Power to Antenna (mW)	Power Density at r = 105 cm (mW/cm^2)	Limit(mW/cm^2)
Low	450.1	41209.75	0.30030	1.500
Middle	481.1	41114.97	0.29961	1.604
High	511.9	41209.75	0.30030	1.706

The power density Pd (4th column) at a distance of 105 cm calculated from the Friis transmission formula is far below the limit of 1.5 mW/cm^2.