

# Co-Located RF Exposure Condition MPE Report for Mobile Fujitsu Laptops

## Radio Modules:

**WLAN Radio Module: FCC ID: PD9622ANH (IC ID: 1000M-622ANH)**  
**WLAN Radio Module: FCC ID: PPD-AR5B97 (IC ID: 4104A-AR5B97)**  
**Bluetooth Radio Module: FCC ID: PIWBSMAN (IC ID: 5255A-BSMAN)**  
**UMTS/EV-DO Radio Module: FCC ID: N7NGOBI2 (IC ID: 2417C-GOBI2)**

## Introduction:

The intention of this report is to evaluate RF exposure condition and enable the original manufacturer certified Sierra Wireless UMTS/EV-DO (WWAN) radio module Gobi2000 to be co-located with original manufacturer certified WLAN radio modules Intel Puma Peak 622ANH and Atheros HB97 in mobile Fujitsu laptops using the above radio modules. Independent antennas used for each of the Radio modules and simultaneous transmission is possible between the collocated transmitters.

Each laptop will have an option of UMTS function or the EV-DO function and not both simultaneously. Similarly each laptop will have an option of either Intel WLAN or Atheros WLAN and not both WLANs simultaneously.

SAR testing is not required as the WLAN and UMTS/EVDO transmitting antennas are located more than 20 cms from the body of user in a host Fujitsu notebook. This MPE report evaluates the RF Exposure condition of the collocated antennas within 5cms of each other in the case of a WLAN and WWAN.

Antenna location and Antenna Gain details are provided in Appendix A of this document. The Bluetooth antenna is >20cms from other radio antennas and also the output power is low (<4mW) and hence SAR evaluation is not required pursuant to the FCC KDB616217.

## FCC Limits:

In accordance with Section 1.1310, the Maximum Permissible Exposure (MPE) limit for the General Population/Uncontrolled Exposure of  $1\text{mW}/\text{cm}^2$  has been applied.

Friis transmission formula:  $P_d = (P \cdot G) / (4 \cdot \pi \cdot r^2)$

where:  $P_d$  = power density ( $\text{mW}/\text{cm}^2$ )

$P$  = power input to the antenna (mW)

$G$  = antenna gain (numeric)

$r$  = distance to the center of radiation of the antenna (cm)

For frequency dependent limits, the lowest transmitter frequency of UMTS/EV-DO module was used to represent the lowest MPE limit (e.g. 824MHz =  $0.549\text{ mW}/\text{cm}^2$ ).

## Radio Modules:

WLAN = Intel Puma Peak 2x2 model 622ANH / Atheros AR5B97

WWAN = Sierra UMTS/EV-DO model GOBI2000

Bluetooth = CSR BSMAN3

## Antenna Details:

Refer to Appendix A for Antenna details

WLAN Antenna: NISSEI Electric Antenna

WWAN Antenna: NISSEI Electric Antenna

**MPE Calculations:**

WWAN Standalone Configuration (from original Radio manufacturer certification)

Technology	Freq (MHz)	Maximum Conducted Power (dBm)	Maximum Antenna Gain (dBi)	Power Density @ 20cm (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )
EV-DO	824	24.6	2.22	0.096	0.549
UMTS	824	24.2	2.22	0.087	0.549
EV-DO	1850	24.61	4.49	0.162	1.000
UMTS	1850	24.56	4.49	0.160	1.000

Intel WLAN Standalone Configuration (from original Radio manufacturer certification)

Technology	Freq (MHz)	Maximum Conducted Power (dBm)	Maximum Antenna Gain (dBi)	Power Density @ 20cm (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )
802.11b/g/n	2400	29.85	2.46	0.339	1.000
802.11a/n	5150	29.85	3.17	0.398	1.000

Atheros WLAN Standalone Configuration (from original Radio manufacturer certification)

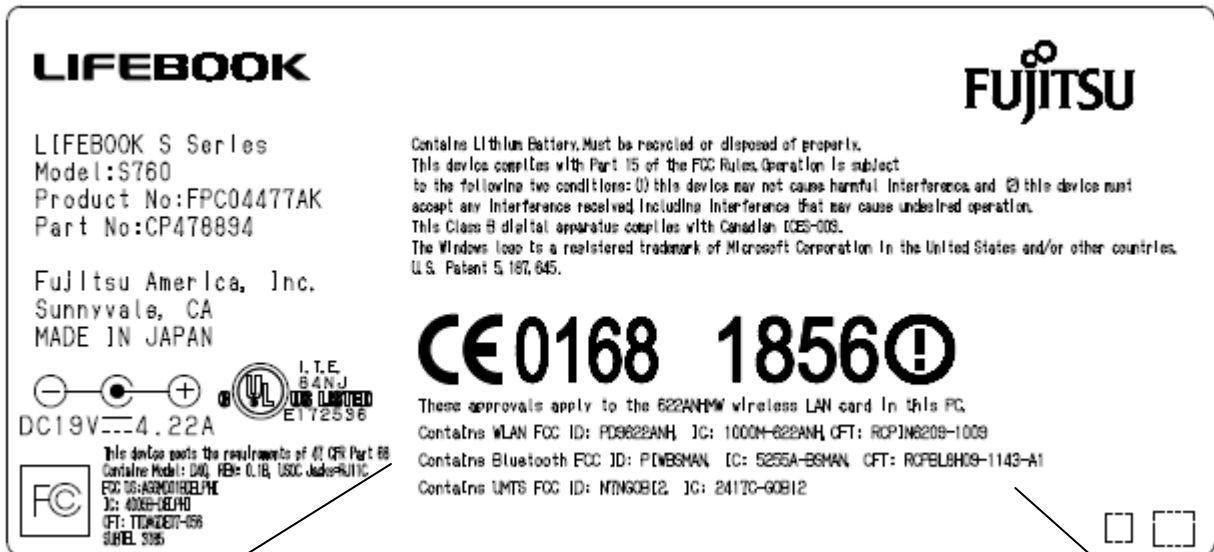
Technology	Freq (MHz)	Maximum Conducted Power (dBm)	Maximum Antenna Gain (dBi)	Power Density @ 20cm (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )
802.11b/g/n	2400	27.1	2.46	0.179	1.000

**Aggregate Collocated MPE Calculations:**

Worst case Power Densities shown for respective frequency bands

Transmitter Modules	FCC ID	Frequency GHz	Antenna Type	Antenna Gain (dBi)	Power Density @ 20 cm mW/cm <sup>2</sup>	MPE Limit mW/cm <sup>2</sup>
WWAN UMTS/EVDO	N7NGOBI2	0.8	Nissei Electric Inverted-F	2.22	0.096	0.55
		1.8		4.49	<b>0.162</b>	1.0
*WLAN (802.11abgn)	P9D622ANH	2.4		2.46	0.339	1.0
		5.0		3.17	<b>0.399</b>	1.0
*WLAN (802.11bgn)	AR5B97	2.4		2.46	0.179	1.0
<b>Sum of Worst Case Power Densities (WWAN 1.8GHz and WLAN 2.4GHz) of Collocated Transmitters</b>					<b>0.561</b>	<b>1.0</b>

**Product Label for a typical Fujitsu Laptop (eg S760) with Intel WLAN, Sierra WWAN and CSR Bluetooth radio modules:**



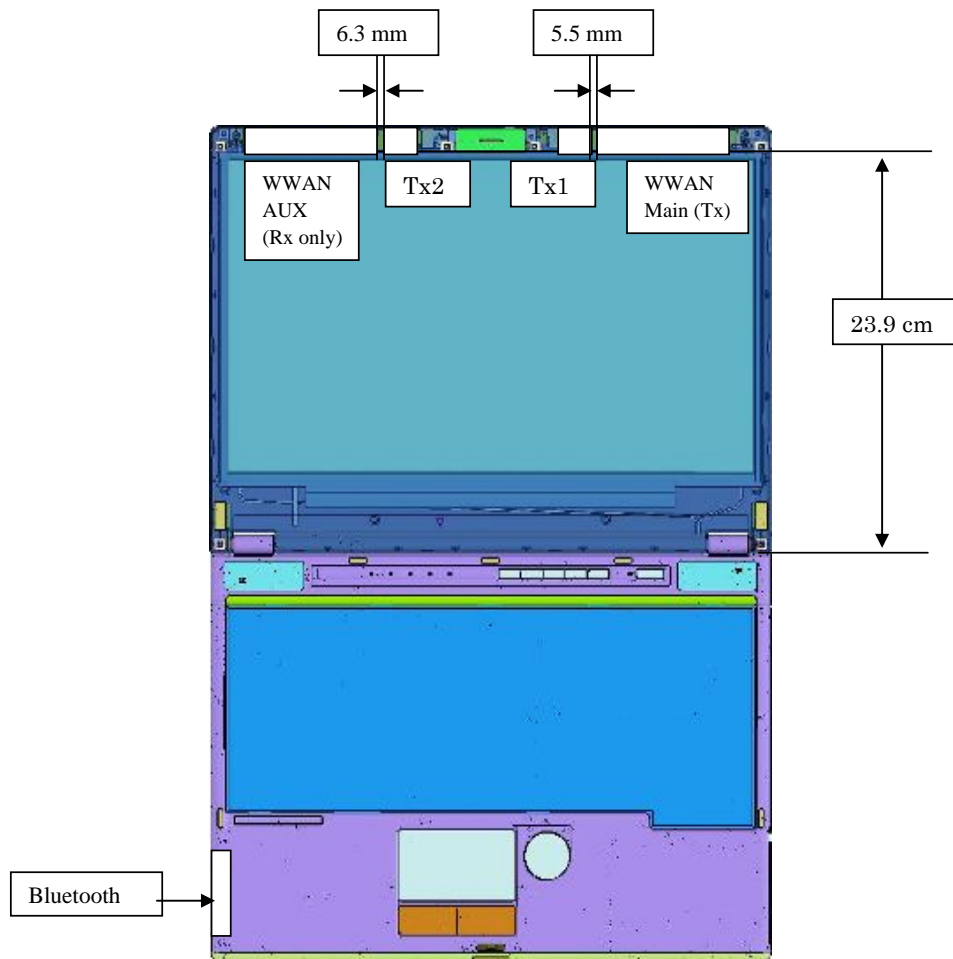
Contains WLAN FCC ID: PD9622ANH, IC: 1000M-622ANH, CF  
Contains Bluetooth FCC ID: PIWBSMAN, IC: 5255A-BSMAN  
Contains EVDO FCC ID: N7NGOB12, IC: 2417C-GOB12

**Conclusion:**

Calculations show that the Fujitsu laptops for the specified radio modules and their antenna gains are less than what is listed in the MPE calculation tables above comply with Maximum Permissible Exposure (MPE) limit for the General Population/Uncontrolled Exposure.

## APPENDIX A

### Antenna Location and Antenna Gain Details



WLAN and WWAN Ant to User >20cms

WLAN(Tx1) - BT Ant. : 345.8mm

WLAN(Tx2) - BT Ant. : 307.1mm

WWAN(Main) - BT Ant. : 364.2mm

BT (Bluetooth) has very low power of 4mW

Note:

Above distances are measured when LCD opened at 90 degree.

**Mobile Condition  
NOTEBOOK PC (Not a Tablet)**

# LIFEBOOK S760

WLAN module

UMTS module



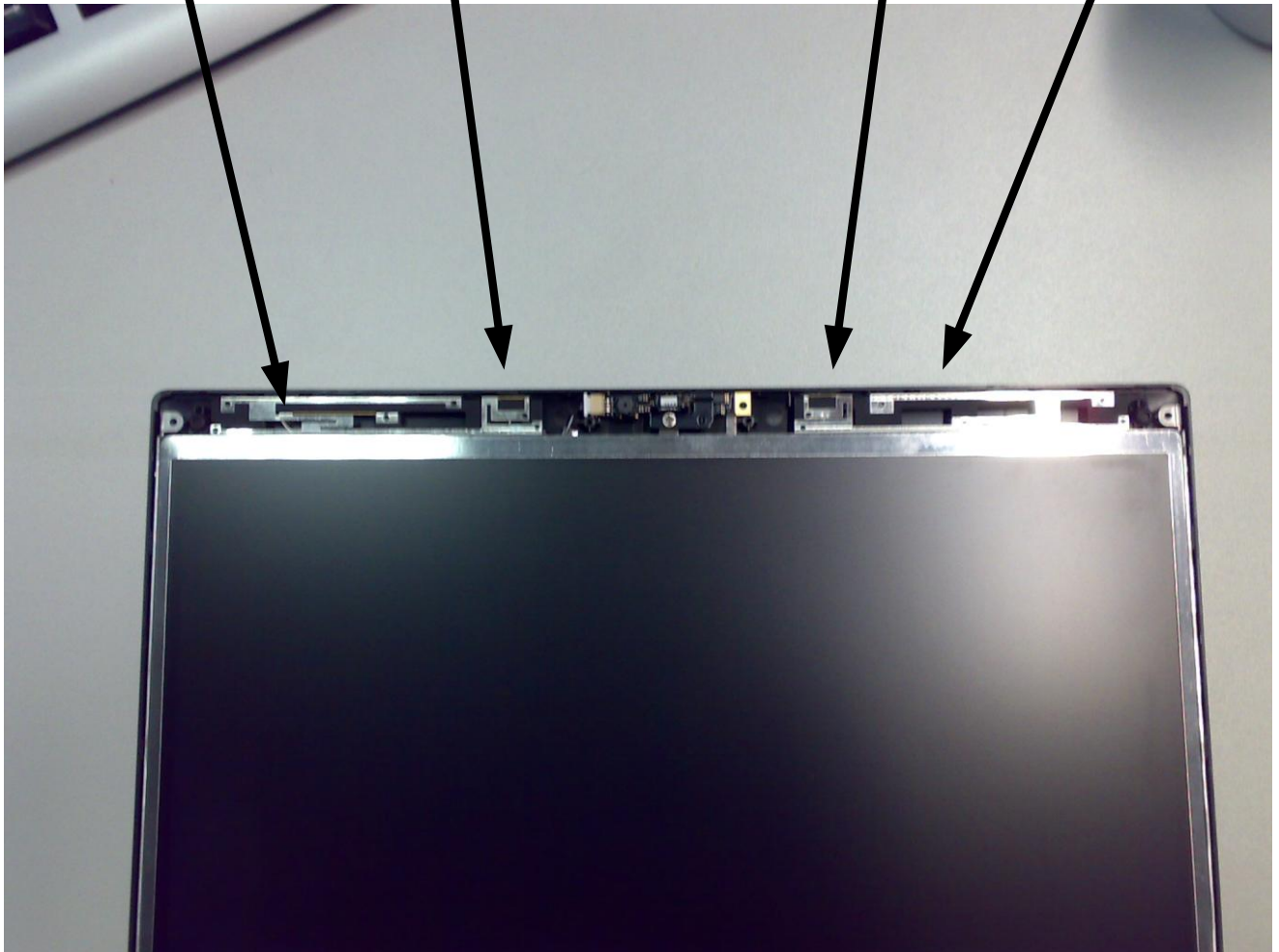
# LIFEBOOK S760

UMTS antenna #1

WLAN antenna #1

WLAN antenna #2

UMTS antenna #2



## Regulatory WLAN Antenna Information

<b>Platform</b>	
Platform Owner	Fujitsu
Brand Name	FMV BIBLO / LIFEBOOK
Model Name	Ginza-UMTS-Mg model
ODM	
Target Launch Date	2010/1/ DD
<b>Antenna</b>	
Brand Name	
Part Number	Tx1 Antenna : CP313631
	Tx2 Antenna : CP313632



# Antenna Information

## Section 1. Antenna Assembly Specifications

### Antenna Assembly Summary:

1A Antenna Part Number	1B Manufacture	1C Antenna Type	1D Cable Assembly Part Number and Information	1E *Peak Gain W/ Cable loss (dBi)	1F Peak Gain w/o Cable Loss (dBi)	1G VSWR	1H Cable Loss (dBi)
(P/N:CP313631) Tx1 antenna	NISSEI ELECTRIC CO., LTD.	PIFA	(P/N: U.FL-LP-068) 50 ohm Coaxial. length: 35cm diameter: 1.09mm Connector: U.FL	2400-2500MHz 0.70dBi (peak)	2400-2500MHz ___ dBi (peak)	2400-2500MHz ___ max	2400-2500MHz ___ dBi (peak)
				2496-2690MHz -0.61dBi (peak)	2496-2690MHz ___ dBi (peak)	2496-2690MHz ___ max	2496-2690MHz ___ dBi (peak)
				5150-5350MHz 2.18dBi (peak)	5150-5350MHz ___ dBi (peak)	5150-5350MHz ___ max	5150-5350MHz ___ dBi (peak)
				5470-5725MHz 1.09dBi (peak)	5470-5725MHz ___ dBi (peak)	5470-5725MHz ___ max	5470-5725MHz ___ dBi (peak)
				5725-5850MHz 0.61dBi (peak)	5725-5850MHz ___ dBi (peak)	5725-5850MHz ___ max	5725-5850MHz ___ dBi (peak)
(P/N: CP313632) Tx2 (or Rx2)	NISSEI ELECTRIC CO., LTD.	PIFA	(P/N: U.FL-LP-068) 50 ohm Coaxial. length: 40cm diameter: 1.09mm Connector: U.FL	2400-2500MHz 1.50dBi (peak) *	2400-2500MHz ___ dBi (peak) *	2400-2500MHz ___ max *	2400-2500MHz ___ dBi (peak) *
				2496-2690MHz -0.75dBi (peak) *	2496-2690MHz ___ dBi (peak) *	2496-2690MHz ___ max *	2496-2690MHz ___ dBi (peak) *
				5150-5350MHz 0.02dBi (peak) *	5150-5350MHz ___ dBi (peak) *	5150-5350MHz ___ max *	5150-5350MHz ___ dBi (peak) *
				5470-5725MHz 1.80dBi (peak) *	5470-5725MHz ___ dBi (peak) *	5470-5725MHz ___ max *	5470-5725MHz ___ dBi (peak) *
				5725-5850MHz 1.66dBi (peak) *	5725-5850MHz ___ dBi (peak) *	5725-5850MHz ___ max *	5725-5850MHz ___ dBi (peak) *

### Antenna Peak Gain Table:

Frequency (MHz)	Tx1 antenna		Tx2 (or Rx2) Antenna		Tx3 (or Rx3) Antenna	
	Horizontal (dBi)	Vertical (dBi)	Horizontal (dBi)	Vertical (dBi)	Horizontal (dBi)	Vertical (dBi)
2400	0.43	-2.30	0.90	-2.33		
2450	0.70	-2.11	1.50	-2.06		
2500	0.49	-1.89	1.17	-1.32		
2501						
2593	-0.61	-1.83	-0.75	-0.81		
2685	-0.72	-1.62	-0.75	-0.76		
5150	2.18	-1.17	-0.08	-1.17		
5250	1.56	-1.49	0.02	-1.47		
5350	1.28	-1.75	-0.36	-1.56		
5470	0.80	-2.06	-0.11	-1.07		
5600	1.09	-2.09	0.56	-1.17		
5725	0.48	-1.94	1.80	-0.44		
5785	0.61	-1.52	0.89	-1.18		
5850	0.56	-1.34	1.66	-1.58		

- Antenna Peak Gain required being test in system basis.
- 1E frame contend absolutely peak antenna gain include H/V

## Regulatory WLAN Antenna Information

### Platform

Platform Owner Fujitsu  
Brand Name FMV BIBLO / LIFEBOOK

Model Name	Ginza-UMTS
ODM	
Target Launch Date	2010/1/ DD
<b>Antenna</b>	
Brand Name	
Part Number	<input checked="" type="checkbox"/> Tx1 Antenna : CP313631
	<input checked="" type="checkbox"/> Tx2 Antenna : CP313632
	<input type="checkbox"/> Tx3 Antenna :
<b>Module</b>	
With WLAN Module	<input type="checkbox"/> 533ANX Family
(Check Box)	<input type="checkbox"/> 512ANX Family
	<input type="checkbox"/> 533AN Family
	<input type="checkbox"/> 512AN Family
	<input type="checkbox"/> 112BN Family
	<input checked="" type="checkbox"/> 622ANHMW
	<input type="checkbox"/> 633ANHMW
	<input type="checkbox"/> 622ANXHMW

# Antenna Information

## Section 1. Antenna Assembly Specifications

### Antenna Assembly Summary:

1A Antenna Part Number	1B Manufacture	1C Antenna Type	1D Cable Assembly Part Number and Information	1E *Peak Gain W/ Cable loss (dBi)	1F Peak Gain w/o Cable Loss (dBi)	1G VSWR	1H Cable Loss (dBi)
(P/N:CP313631) Tx1 antenna	NISSEI ELECTRIC CO., LTD.	PIFA	(P/N: U.FL-LP-068) 50 ohm Coaxial. length: 35cm diameter: 1.09mm Connector: U.FL	2400-2500MHz 2.35dBi (peak)	2400-2500MHz ___ dBi (peak)	2400-2500MHz ___ max	2400-2500MHz ___ dBi (peak)
				2496-2690MHz 1.31dBi (peak)	2496-2690MHz ___ dBi (peak)	2496-2690MHz ___ max	2496-2690MHz ___ dBi (peak)
				5150-5350MHz 2.99dBi (peak)	5150-5350MHz ___ dBi (peak)	5150-5350MHz ___ max	5150-5350MHz ___ dBi (peak)
				5470-5725MHz 1.78dBi (peak)	5470-5725MHz ___ dBi (peak)	5470-5725MHz ___ max	5470-5725MHz ___ dBi (peak)
				5725-5850MHz 0.83dBi (peak)	5725-5850MHz ___ dBi (peak)	5725-5850MHz ___ max	5725-5850MHz ___ dBi (peak)
(P/N: CP313632) Tx2 (or Rx2 for 512 family) antenna	NISSEI ELECTRIC CO., LTD.	PIFA	(P/N: U.FL-LP-068) 50 ohm Coaxial. length: 40cm diameter: 1.09mm Connector: U.FL	2400-2500MHz 1.67dBi (peak) *	2400-2500MHz ___ dBi (peak) *	2400-2500MHz ___ max *	2400-2500MHz ___ dBi (peak) *
				2496-2690MHz 1.95dBi (peak) *	2496-2690MHz ___ dBi (peak) *	2496-2690MHz ___ max *	2496-2690MHz ___ dBi (peak) *
				5150-5350MHz 1.16dBi (peak) *	5150-5350MHz ___ dBi (peak) *	5150-5350MHz ___ max *	5150-5350MHz ___ dBi (peak) *
				5470-5725MHz 1.79dBi (peak) *	5470-5725MHz ___ dBi (peak) *	5470-5725MHz ___ max *	5470-5725MHz ___ dBi (peak) *
				5725-5850MHz 2.34dBi (peak) *	5725-5850MHz ___ dBi (peak) *	5725-5850MHz ___ max *	5725-5850MHz ___ dBi (peak) *

**Antenna Peak Gain Table:**

Frequency (MHz)	Tx1 antenna		Tx2 (or Rx2) Antenna		Tx3 (or Rx3) Antenna	
	Horizontal (dBi)	Vertical (dBi)	Horizontal (dBi)	Vertical (dBi)	Horizontal (dBi)	Vertical (dBi)
2400	2.35	2.29	1.35	0.96		
2450	2.20	2.12	0.37	1.62		
2500	2.09	1.61	1.28	1.67		
2501						
2593	1.31	-0.14	1.09	1.95		
2685	0.05	-1.78	-0.46	0.97		
5150	2.99	-0.84	0.02	-0.91		
5250	1.60	-1.16	0.23	0.17		
5350	1.13	-0.47	0.16	1.16		
5470	0.91	-0.15	-0.07	-0.63		
5600	1.78	-1.63	0.15	-0.78		
5725	1.01	-0.51	1.79	-0.06		
5785	0.83	-1.06	1.76	0.15		
5850	0.51	-1.37	2.34	0.08		