# **FCC RF Test Report**

APPLICANT : LC Future Center Limited Taiwan Branch

EQUIPMENT : Notebook
BRAND NAME : Lenovo
MODEL NAME : TP00086B

FCC ID : 2AJN7-TP00086B

STANDARD : FCC 47 CFR Part 2, 22(H), 24(E), 27(L) CLASSIFICATION : PCS Licensed Transmitter (PCB)

Equipment: Fibocom L850-GL tested inside of Lenovo Notebook.

This is a partial report. The product was received on Dec. 21, 2017 and testing was completed on Jan. 18, 2018. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

SPORTON INTERNATIONAL INC.

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SPORTON INTERNATIONAL INC.

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Report Version : Rev. 01

1190

Report No.: FG7O2534-06A

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# **REVISION HISTORY**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG7O2534-06A	Rev. 01	Initial issue of report	Jan. 24, 2018

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## **SUMMARY OF TEST RESULT**

Report Section	FCC Rule	Description Limit		Result	Remark
3.4	§2.1046	Conducted Output Power	Reporting Only	PASS	-
4.4	§2.1053 §22.917(a) §24.238(a) §27.53(h)	Field Strength of Spurious Radiation	< 43+10log10(P[Watts])	PASS	Under limit 39.12 dB at 7520.000 MHz

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# 1 General Description

# 1.1 Applicant

#### LC Future Center Limited Taiwan Branch

7F., No.780, Bei'an Rd., Zhongshan Dist., Taipei City 104, Taiwan (R.O.C.)

#### 1.2 Manufacturer

#### LC Future Center Limited Taiwan Branch

7F., No.780, Bei'an Rd., Zhongshan Dist., Taipei City 104, Taiwan (R.O.C.)

## 1.3 Product Feature of Equipment Under Test

	Product Feature & Specification				
Product Name	Notebook				
Brand Name	Lenovo				
Model Name	TP00086B				
FCC ID	2AJN7-TP00086B				
Sample 1	EUT with Antenna 1				
Sample 2	EUT with Antenna 2				
Integrated WWAN Module	Brand Name: Fibocom Model Name: L850-GL				

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#### Remark:

- 1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
- 2. All test items were performed with Sample 1.
- 3. Equipment: Fibocom L850-GL tested inside of Lenovo Notebook.

L850-GL	3G & LTE			
Antenna 1	Manufacturer	Amphenol	Peak gain	2.99
Antenna i	P/N	LX-8905-16-000-C	Туре	PIFA
Antenna 2	Manufacturer	Speedwire	Peak gain	2.72
Antenna 2	P/N	F.0G.ZV-0006-006-00	Туре	PIFA

### 1.4 Modification of EUT

No modifications are made to the EUT during all test items.

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## 1.5 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW1190 and TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park,
Test Site Location	Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.
Took Site No	Sporton Site No.
Test Site No.	TH05-HY

Test Site SPORTON INTERNATIONAL INC.				
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Dist,			
rest Site Location	Taoyuan City, Taiwan (R.O.C.)			
Test Site No.	Sporton Site No.			
rest site No.	03CH11-HY			

## 1.6 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 2, 22(H), 24(E), 27(L)
- ANSI / TIA-603-E
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03
- FCC KDB 412172 D01 Determining ERP and EIRP v01r01

**Remark:** All test items were verified and recorded according to the standards and without any deviation during the test.

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## 2 Test Configuration of Equipment Under Test

### 2.1 Test Mode

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems v03 with maximum output power.

Radiated emissions were investigated as following frequency range:

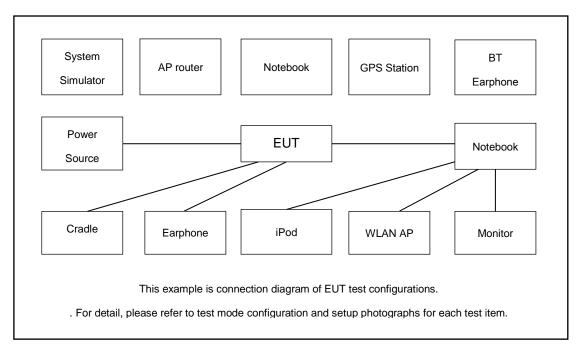
- 1. 30 MHz to 9000 MHz for WCDMA Band V.
- 2. 30 MHz to 18000 MHz for WCDMA Band IV.
- 3. 30 MHz to 19100 MHz for WCDMA Band II.

All modes and data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

Test Modes							
Band	Radiated TCs	Conducted TCs					
WCDMA Band V	■ RMC 12.2Kbps Link	■ RMC 12.2Kbps Link					
WCDMA Band II	■ RMC 12.2Kbps Link	■ RMC 12.2Kbps Link					
WCDMA Band IV	■ RMC 12.2Kbps Link	■ RMC 12.2Kbps Link					

## 2.2 Connection Diagram of Test System



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# 2.3 Support Unit used in test configuration

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	iPod Earphone	Apple	N/A	Verification	N/A	N/A

# 2.4 Frequency List of Low/Middle/High Channels

Frequency List								
Band	Band Channel/Frequency(MHz) Lowest Middle Highest							
WCDMA	Channel	4132	4182	4233				
Band V	Frequency	826.4	836.4	846.6				
WCDMA	Channel	9262	9400	9538				
Band II	Frequency	1852.4	1880.0	1907.6				
WCDMA	Channel	1312	1413	1513				
Band IV	Frequency	1712.4	1732.6	1752.6				

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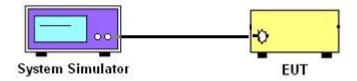
## 3 Conducted Test Result

## 3.1 Measuring Instruments

See list of measuring instruments of this test report.

## 3.2 Test Setup

## 3.2.1 Conducted Output Power



### 3.3 Test Result of Conducted Test

Please refer to Appendix A.

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## 3.4 Conducted Output Power and ERP/EIRP

#### 3.4.1 Description of the Conducted Output Power and ERP/EIRP

A system simulator was used to establish communication with the EUT. Its parameters were set to enforce EUT transmitting at the maximum power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The ERP of mobile transmitters must not exceed 7 Watts for WCDMA Band V.

The EIRP of mobile transmitters must not exceed 2 Watts for WCDMA Band II.

The EIRP of mobile transmitters must not exceed 1 Watts for WCDMA Band IV.

According to KDB 412172 D01 Power Approach,

 $EIRP = P_T + G_T - L_C$ , ERP = EIRP - 2.15, where

 $P_T$  = transmitter output power in dBm

 $G_T$  = gain of the transmitting antenna in dBi

L<sub>C</sub> = signal attenuation in the connecting cable between the transmitter and antenna in dB

#### 3.4.2 Test Procedures

- 1. The transmitter output port was connected to the system simulator.
- 2. Set EUT at maximum power through system simulator.
- 3. Select lowest, middle, and highest channels for each band and different modulation.
- 4. Measure the maximum burst average power for GSM and maximum average power for other modulation signal.

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## 4 Radiated Test Items

## 4.1 Measuring Instruments

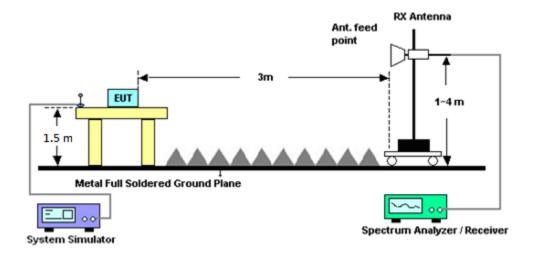
See list of measuring instruments of this test report.

## 4.2 Test Setup

#### 4.2.1 For radiated test from 30MHz to 1GHz



#### 4.2.2 For radiated test above 1GHz



### 4.3 Test Result of Radiated Test

Please refer to Appendix B.

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## 4.4 Field Strength of Spurious Radiation Measurement

#### 4.4.1 Description of Field Strength of Spurious Radiated Measurement

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

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#### 4.4.2 Test Procedures

- 1. The testing follows FCC KDB 971168 D01 v03 Section 5.8 and ANSI / TIA-603-E Section 2.2.12.
- 2. The EUT was placed on a rotatable wooden table 0.8 meters for frequency below 1GHz and 1.5 meter for frequency above 1GHz above the ground.
- 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
- 4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
- 5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations.
- 6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission.
- 7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
- 8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
- 9. Taking the record of output power at antenna port.
- 10. Repeat step 7 to step 8 for another polarization.
- 11. EIRP (dBm) = S.G. Power Tx Cable Loss + Tx Antenna Gain
- 12. ERP (dBm) = EIRP 2.15
- 13. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
- 14. The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)

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# 5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
LTE Base Station	Anritsu	MT8820C	6201432821	GSM/GPRS /WCDMA/LTE	Oct. 13, 2017	Jan. 02, 2018	Oct. 12, 2018	Conducted (TH05-HY)
Amplifier	MITEQ	TTA1840-35 -HG	1871923	18GHz~40GHz,VS WR : 2.5:1 max	Jul. 18, 2017	Jan. 10, 2018~ Jan. 18, 2018	Jul. 17, 2018	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 10, 2016	Jan. 10, 2018~ Jan. 18, 2018.	Nov. 09, 2018	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6- 06	35414&AT-N0 602	30MHz~1GHz	Oct. 14, 2017	Jan. 10, 2018~ Jan. 18, 2018	Oct. 13, 2018	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBEC K	BBHA 9120 D	9120D-1326	1GHz ~ 18GHz	Oct. 16, 2017	Jan. 10, 2018~ Jan. 18, 2018	Oct. 15, 2018	Radiation (03CH11-HY)
Horn Antenna	SCHWARZBEC K	BBHA 9120 D	9120D-1522	1GHz ~ 18GHz	Mar. 17, 2017	Jan. 10, 2018~ Jan. 18, 2018	Mar. 16, 2018	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Jan. 10, 2018~ Jan. 18, 2018	Nov. 22, 2019	Radiation (03CH11-HY)
Preamplifier	Keysight	83017A	MY53270080	1GHz~26.5GHz	Nov. 10, 2016	Jan. 10, 2018~ Jan. 18, 2018	Nov. 09, 2018	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 19, 2017	Jan. 10, 2018~ Jan. 18, 2018	Oct. 18, 2018	Radiation (03CH11-HY)
Filter	Wainwright	WHKX12-10 80-1200-150 0-60SS	SN2	1.2G High Pass	Sep. 18, 2017	Jan. 10, 2018~ Jan. 18, 2018	Sep. 17, 2018	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-450 0-B	N/A	1~4m	N/A	Jan. 10, 2018~ Jan. 18, 2018	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Jan. 10, 2018~ Jan. 18, 2018	N/A	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MX E)	MY57290111	3Hz~26.5GHz	Nov. 02, 2017	Jan. 10, 2018~ Jan. 18, 2018	Nov. 01, 2018	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBEC K	BBHA 9170	BBHA917057 6	18GHz- 40GHz	Apr. 27, 2017	Jan. 10, 2018~ Jan. 18, 2018	Apr. 26, 2018	Radiation (03CH11-HY)
SHF-EHF Horn Antenna	SCHWARZBEC K	BBHA 9170	BBHA917058 4	18GHz- 40GHz	Nov. 27, 2017	Jan. 10, 2018~ Jan. 18, 2018	Nov. 26, 2018	Radiation (03CH11-HY)
Preamplifier	MITEQ	AMF-7D-00 101800-30-1	1590074	1GHz~18GHz	May 22, 2017	Jan. 10, 2018~ Jan. 18, 2018	May 21, 2018	Radiation (03CH11-HY)

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# 6 Uncertainty of Evaluation

#### **Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)**

	T
Measuring Uncertainty for a Level of	2.27
_	3.37
Confidence of 95% (U = 2Uc(y))	

### **Uncertainty of Radiated Emission Measurement (1 GMHz ~ 18 GHz)**

Measuring Uncertainty for a Level of	3.67
Confidence of 95% (U = 2Uc(y))	0.0.

#### <u>Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)</u>

Measuring Uncertainty for a Level of	4.03
Confidence of 95% (U = 2Uc(y))	4.03

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# **Appendix A. Test Results of Conducted Test**

## Conducted Output Power(Average power)

		Conducted	Power (*Unit:	dBm)		
Band	V	CDMA Band	V	٧	VCDMA Band	II
Channel	4132	4182	4233	9262	9400	9538
Frequency	826.4	836.4	846.6	1852.4	1880	1907.6
RMC 12.2K	23.57	23.55	23.76	23.38	23.43	23.18
HSDPA Subtest-1	23.04	23.06	23.20	23.23	23.31	23.06
HSDPA Subtest-2	22.08	22.52	22.15	22.37	22.37	22.07
HSDPA Subtest-3	21.57	22.07	21.67	21.88	21.89	21.58
HSDPA Subtest-4	21.35	21.83	21.46	21.57	21.65	21.32
HSUPA Subtest-1	22.08	22.54	22.05	22.31	22.36	22.12
HSUPA Subtest-2	19.87	20.30	19.82	20.07	20.15	19.87
HSUPA Subtest-3	20.63	21.03	20.56	20.85	20.84	20.56
HSUPA Subtest-4	20.08	20.58	20.17	20.40	20.39	20.11
HSUPA Subtest-5	22.10	22.60	22.20	22.40	22.40	22.20

	Conducted	Power (*Unit: dBm)	
Band		WCDMA Band IV	
Channel	1312	1413	1513
Frequency	1712.4	1732.6	1752.6
RMC 12.2K	23.10	23.13	23.07
HSDPA Subtest-1	22.84	23.02	23.05
HSDPA Subtest-2	21.89	22.04	22.19
HSDPA Subtest-3	21.41	21.53	21.68
HSDPA Subtest-4	21.14	21.29	21.42
HSUPA Subtest-1	21.99	22.09	22.15
HSUPA Subtest-2	19.73	19.86	19.96
HSUPA Subtest-3	20.53	20.62	20.67
HSUPA Subtest-4	19.97	20.06	20.19
HSUPA Subtest-5	22.00	22.10	22.20

# **Appendix B. Test Results of ERP/EIRP and Radiated Test**

# **ERP/EIRP**

Channel	Mode	Cond	ucted	ERP		
Chamilei	Wiode	Power (dBm)	Power (Watts)	ERP(dBm)	ERP(W)	
Lowest	WCDMA Band V	23.57	0.2275	19.83	0.0962	
Middle	RMC 12.2Kbps	23.55	0.2265	19.81	0.0957	
Highest	GT - LC = -1.59 dB	23.76	0.2377	20.02	0.1005	
Limit	ERP < 7W	Re	sult	PA	SS	

Channel	Mode	Cond	ucted	EIRP		
Chamilei	Wiode	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)	
Lowest	WCDMA Band II	23.38	0.2178	26.37	0.4335	
Middle	RMC 12.2Kbps	23.43	0.2203	26.42	0.4385	
Highest	(GT - LC = 2.99 dB)	23.18	0.2080	26.17	0.4140	
Limit	EIRP < 2W	Re	sult	PA	SS	

Channel	Mode	Cond	ucted	EIRP		
	Wiode	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)	
Lowest	WCDMA Band IV	23.10	0.2042	26.02	0.3999	
Middle	RMC 12.2Kbps	23.13	0.2056	26.05	0.4027	
Highest	(GT - LC = 2.92 dB)	GT - LC = 2.92 dB) 23.07 0.2028		25.99	0.3972	
Limit	EIRP < 1W	Re	sult	PA	SS	

# **Radiated Spurious Emission**

# **WCDMA 850**

				WCD	MA 850				
Channel	Frequency ( MHz )	ERP (dBm)	Limit ( dBm )	Over Limit ( dB )	SPA Reading (dBm)	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)
	1656	-56.63	-13	-43.63	-66.53	-63.6	0.53	9.64	Н
	2479	-60.82	-13	-47.82	-74.07	-68.8	0.65	10.78	Н
	3306	-58.69	-13	-45.69	-74.56	-67.8	0.76	12.02	Н
									Н
Louiset									Н
Lowest	1656	-59.33	-13	-46.33	-68.81	-66.3	0.53	9.64	V
	2479	-60.32	-13	-47.32	-74.06	-68.3	0.65	10.78	V
	3306	-58.99	-13	-45.99	-74.88	-68.1	0.76	12.02	V
									V
									V
	1672	-56.60	-13	-43.60	-66.5	-63.6	0.53	9.68	Н
	2510	-60.40	-13	-47.40	-73.79	-68.4	0.66	10.81	Н
	3345	-58.68	-13	-45.68	-74.43	-67.9	0.76	12.14	Н
									Н
Middle									Н
ivildale	1672	-58.50	-13	-45.50	-67.97	-65.5	0.53	9.68	V
	2510	-60.30	-13	-47.30	-74.04	-68.3	0.66	10.81	V
	3345	-58.78	-13	-45.78	-74.49	-68	0.76	12.14	V
									V
									V

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					1			ı	Т
	1693	-58.76	-13	-45.76	-68.26	-65.8	0.53	9.72	Н
	2540	-60.69	-13	-47.69	-73.57	-68.7	0.67	10.82	Н
	3386	-58.76	-13	-45.76	-74.91	-68.1	0.77	12.26	Н
									Н
									Н
									Н
Liberant									Н
Highest	1693	-59.06	-13	-46.06	-68.4	-66.1	0.53	9.72	V
	2540	-60.79	-13	-47.79	-73.97	-68.8	0.67	10.82	V
	3386	-58.96	-13	-45.96	-74.7	-68.3	0.77	12.26	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

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# **WCDMA 1700**

				WCDI	MA 1700				
Channel	Frequency (MHz)	EIRP (dBm)	Limit ( dBm )	Over Limit ( dB )	SPA Reading (dBm)	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)
	3425	-58.10	-13	-45.10	-74.75	-69.7	0.77	12.38	Н
	5137	-57.00	-13	-44.00	-77.51	-68.5	0.97	12.47	Н
	6850	-54.30	-13	-41.30	-77.75	-65.1	0.83	11.63	Н
									Н
Lowest									Н
Lowest	3725	-57.80	-13	-44.80	-74.53	-69.6	0.71	12.51	V
	5137	-56.70	-13	-43.70	-77.32	-68.2	0.97	12.47	V
	6850	-54.20	-13	-41.20	-77.83	-65	0.83	11.63	V
									V
									V
	3465	-57.88	-13	-44.88	-74.65	-69.6	0.78	12.50	Н
	5198	-55.99	-13	-42.99	-76.27	-67.6	0.99	12.60	Н
	6930	-52.85	-13	-39.85	-76.28	-63.3	1.01	11.45	Н
									Н
Middle									Н
ivildale	3465	-56.68	-13	-43.68	-73.86	-68.4	0.78	12.50	V
	5198	-56.19	-13	-43.19	-76.67	-67.8	0.99	12.60	V
	6930	-52.15	-13	-39.15	-76.24	-62.6	1.01	11.45	V
									V
									V

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					I				
	3505	-58.08	-13	-45.08	-74.99	-69.9	0.78	12.60	Н
	5258	-57.50	-13	-44.50	-78.02	-69.2	1.01	12.72	Н
	7010	-52.58	-13	-39.58	-76.28	-62.7	1.17	11.28	Н
									Н
Highoot									Н
Highest	3505	-56.88	-13	-43.88	-74.54	-68.7	0.78	12.60	V
	5258	-57.00	-13	-44.00	-78.03	-68.7	1.01	12.72	V
	7010	-52.48	-13	-39.48	-76.58	-62.6	1.17	11.28	V
									V
									V

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# **WCDMA 1900**

				WCDI	MA 1900				
Channel	Frequency ( MHz )	EIRP (dBm)	Limit ( dBm )	Over Limit ( dB )	SPA Reading (dBm)	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)
	3705	-58.01	-13	-45.01	-74.35	-69.8	0.72	12.52	Н
	5557	-55.73	-13	-42.73	-76.85	-67.9	1.00	13.17	Н
	7410	-53.02	-13	-40.02	-77.92	-62.4	1.18	10.56	Н
									Н
Louiset									Н
Lowest	3705	-57.11	-13	-44.11	-74.57	-68.9	0.72	12.52	V
	5557	-55.03	-13	-42.03	-76.67	-67.2	1.00	13.17	V
	7410	-53.42	-13	-40.42	-77.85	-62.8	1.18	10.56	V
									V
									V
	3760	-56.79	-13	-43.79	-74.02	-68.6	0.69	12.50	Н
	5640	-55.07	-13	-42.07	-76.48	-67.2	0.98	13.12	Н
	7520	-52.12	-13	-39.12	-76.91	-61.4	1.18	10.46	Н
									Н
Middle									Н
ivilaale	3760	-56.09	-13	-43.09	-74.21	-67.9	0.69	12.50	V
	5640	-54.97	-13	-41.97	-76.48	-67.1	0.98	13.12	V
	7520	-52.82	-13	-39.82	-77.7	-62.1	1.18	10.46	V
									V
									V

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Highest	3815	-58.01	-13	-45.01	-74.84	-69.8	0.68	12.47	Н
	5723	-56.03	-13	-43.03	-77.2	-68.1	0.99	13.07	Н
	7630	-52.62	-13	-39.62	-77.32	-62.2	1.18	10.76	Н
		02.02		00.02	77102	02.2		10170	H
									Н
									Н
	0045	-0.44		40.44		00.0		40.4-	H
	3815	-56.41	-13	-43.41	-74.71	-68.2	0.68	12.47	V
	5723	-55.73	-13	-42.73	-76.99	-67.8	0.99	13.07	V
	7630	-52.62	-13	-39.62	-77.12	-62.2	1.18	10.76	V
									V
									V
									V
									V

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