

FCC RF Test Report

APPLICANT : Wistron Corporation
EQUIPMENT : Notebook Computer
BRAND NAME : Lenovo
MODEL NAME : TP00076D
FCC ID : PU5-TP00076DUC
STANDARD : FCC 47 CFR Part 2, 27
CLASSIFICATION : PCS Licensed Transmitter (PCB)

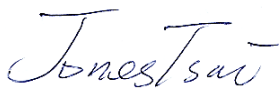
Equipment: Fibocom L850-GL and Intel 8265NGW tested inside of Lenovo Notebook Computer

This is a partial report. The product was received on Dec, 13, 2017 and completely tested on Jan. 16, 2018. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI / TIA / EIA-603-E and shown 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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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG7N0343-03	Rev. 01	Initial issue of report	Feb. 21, 2018



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 §27.53 (a)(4)	Radiated Spurious Emission	$< 70+10\log_{10}(P[\text{Watts}])$	PASS	Under limit 2.24 dB at 9234.000 MHz

1 General Description

1.1 Applicant

Wistron Corporation

21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221, Taiwan R.O.C.

1.2 Manufacturer

Wistron Corporation

21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221, Taiwan R.O.C.

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00076D
FCC ID	PU5-TP00076DUC
Sample 1	EUT with Silver case
Sample 2	EUT with Black case
Integrated WWAN Module	Brand Name: Fibocom Model Name: L850-GL
Integrated WLAN Module	Brand Name: Intel Model Name: 8265NGW
EUT supports Radios application	WCDMA/HSPA/LTE WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
EUT Stage	Production Unit

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 the tests were performed for sample 1.
3. Equipment: Fibocom L850-GL and Intel 8265NGW tested inside of Lenovo Notebook Computer

WWAN			LTE	
Antenna 1	Manufacturer	Jiengtai	Peak gain	2.2
	Part Number	025.90167.0001	Type	PIFA



1.4 Product Specification subjective to this standard

Product Feature	
Tx Frequency	LTE Band 30 : 2307.5 MHz ~2312.5 MHz
Rx Frequency	LTE Band 30 : 2352.5 MHz ~ 2357.5 MHz
Bandwidth	5MHz / 10MHz
Maximum Output Power to Antenna	LTE Band 30 : 22.37 dBm
Type of Modulation	QPSK / 16QAM

1.5 Modification of EUT

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

1.6 Testing Site

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 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.
Test Site No.	Sporton Site No.
	TH05-HY

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Dist, Taoyuan City, Taiwan (R.O.C.)
Test Site No.	Sporton Site No.
	03CH13-HY

1.7 Applied Standards

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

- ♦ 47 CFR Part 2, Part 27(D)
- ♦ ANSI / TIA / EIA-603-E
- ♦ FCC KDB 971168 Power Meas License Digital Systems D01 v02r02

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

2 Test Configuration of Equipment Under Test

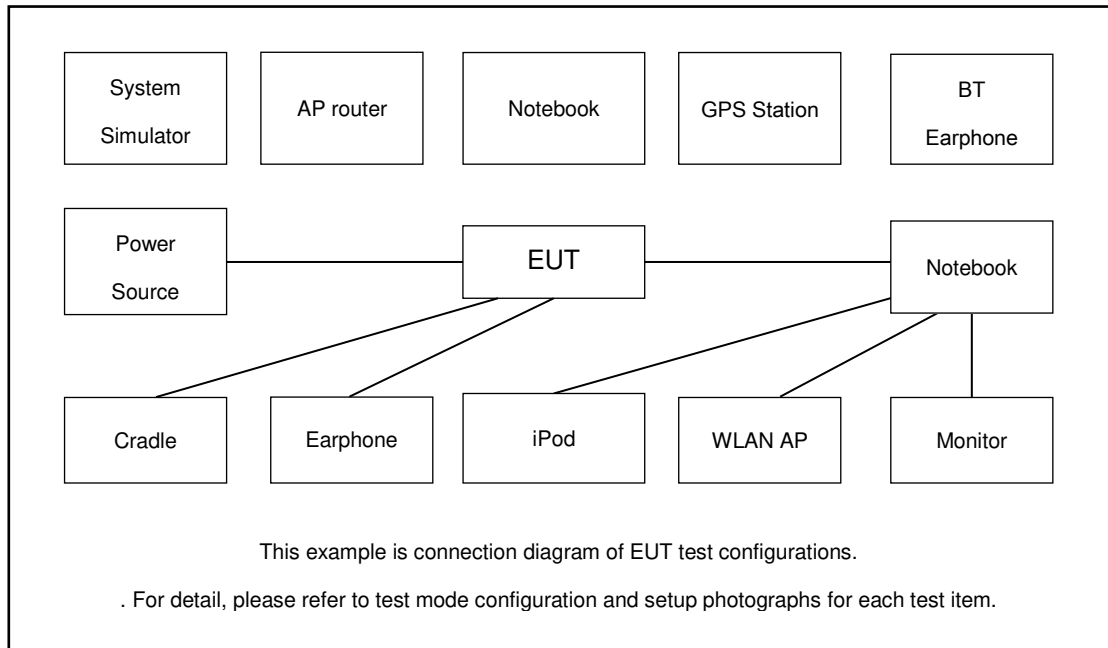
2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v02r02 with maximum output power.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes to find the maximum emission.

Conducted Test Cases	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
Max. Output Power	30	-	-	v	v	-	-	v	v	v	v	v	v	v	v
Radiated Spurious Emission	30	Worst case										v	v	v	
Note	<ol style="list-style-type: none"> The mark "v" means that this configuration is chosen for testing The mark "-" means that this bandwidth is not supported. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. 														

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m

2.4 Frequency List of Low/Middle/High Channels

LTE Band 30 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	-	27710	-
	Frequency	-	2310	-
5	Channel	27685	27710	27735
	Frequency	2307.5	2310	2312.5

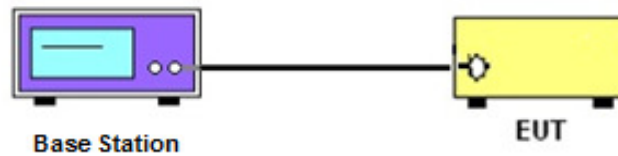
3 Conducted Test Items

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.



3.4 Conducted Output Power Measurement

3.4.1 Description of the Conducted Output Power Measurement

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

3.4.2 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through the system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.

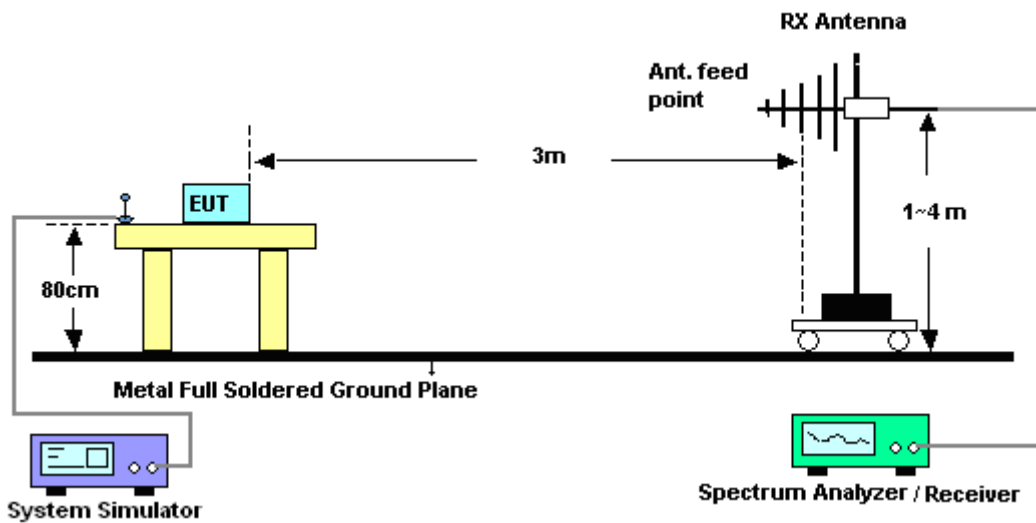
4 Radiated Test Items

4.1 Measuring Instruments

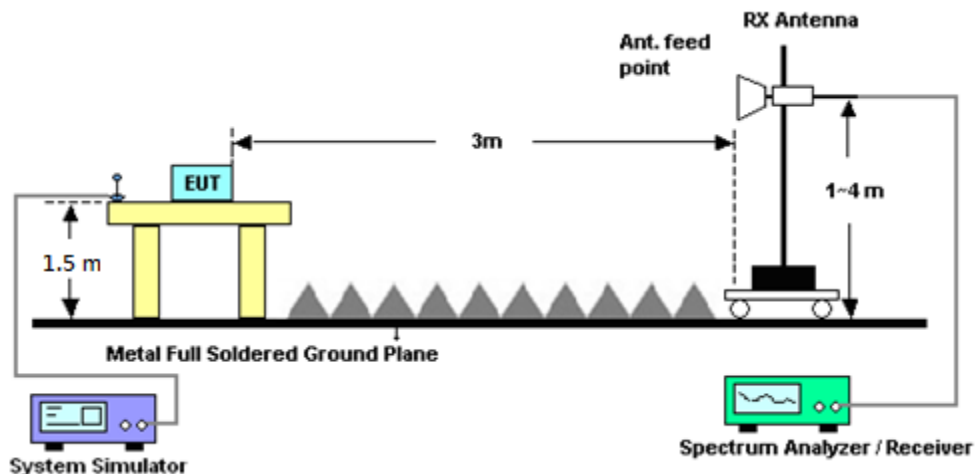
See list of measuring instruments of this test report.

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.

4.4 Radiated Spurious Emission Measurement

4.4.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI / TIA / EIA-603-D-2010. 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 $70 + 10 \log (P)$ dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.4.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 5.8 and ANSI / TIA-603-E Section 2.2.12.
2. The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the receiving antenna 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 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
6. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
7. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
8. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
9. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

$$\text{EIRP (dBm)} = \text{S.G. Power} - \text{Tx Cable Loss} + \text{Tx Antenna Gain}$$

$$\text{ERP (dBm)} = \text{EIRP} - 2.15$$

The limit line is derived from $70 + 10\log(P)$ dB below the transmitter power P(Watts)

$$= P(\text{W}) - [70 + 10\log(P)] (\text{dB})$$

$$= [30 + 10\log(P)] (\text{dBm}) - [70 + 10\log(P)] (\text{dB})$$

$$= -40\text{dBm}.$$



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	Dec. 29, 2017	Oct. 12, 2018	Conducted (TH05-HY)
Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz, VS WR : 2.5:1 max	Jul. 18, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	Jul. 17, 2018	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 14, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	Oct. 13, 2018	Radiation (03CH13-HY)
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Dec. 21, 2016	Jan. 12, 2018 ~ Jan. 16, 2018	Dec. 20, 2018	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1241	1GHz ~ 18GHz	Jun. 15, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	Jun. 14, 2018	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-00 101800-30-10P	1590074	1GHz~18GHz	May 22, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	May 21, 2018	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY55370526	10Hz~44GHz	Mar. 15, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	Mar. 14, 2018	Radiation (03CH13-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Jan. 12, 2018 ~ Jan. 16, 2018	N/A	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-450 0-B	N/A	1m~4m	N/A	Jan. 12, 2018 ~ Jan. 16, 2018	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jan. 12, 2018 ~ Jan. 16, 2018	N/A	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz- 40GHz	Nov. 10, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	Nov. 09, 2018	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 27, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	Nov. 26, 2018	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1522	1G~18GHz	Mar. 17, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	Mar. 16, 2018	Radiation (03CH13-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	May 22, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	May 21, 2018	Radiation (03CH13-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz ~ 26.5GHz	Dec. 05, 2017	Jan. 12, 2018 ~ Jan. 16, 2018	Dec. 04, 2018	Radiation (03CH13-HY)

6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.07
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.48
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Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.92
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Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power)

LTE Band 30 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	1	0	QPSK		22.37	
10	1	25			22.28	
10	1	49			22.27	
10	25	0			21.40	
10	25	12			21.36	
10	25	25			21.38	
10	50	0			21.42	
10	1	0	16-QAM		21.53	
10	1	25			21.58	
10	1	49			21.54	
10	25	0			20.37	
10	25	12			20.44	
10	25	25			20.49	
10	50	0			20.52	
5	1	0	QPSK	22.35	22.27	22.36
5	1	12		22.27	22.31	22.34
5	1	24		22.35	22.34	22.28
5	12	0		21.32	21.36	21.35
5	12	7		21.30	21.31	21.35
5	12	13		21.41	21.36	21.30
5	25	0		21.34	21.35	21.39
5	1	0	16-QAM	21.58	21.59	21.54
5	1	12		21.54	21.59	21.50
5	1	24		21.60	21.59	21.46
5	12	0		20.37	20.41	20.39
5	12	7		20.33	20.35	20.34
5	12	13		20.42	20.37	20.29
5	25	0		20.29	20.33	20.41



Appendix B. Test Results of EIRP and Radiated Test

EIRP

LTE Band 30 / 5MHz (Average) (GT - LC = 2.2 dB)							
Channel	Mode	RB		Conducted		EIRP	
		Size	Offset	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)
Lowest	QPSK	1	0	22.35	0.1718	24.55	0.2851
Middle		1	0	22.27	0.1687	24.47	0.2799
Highest		1	0	22.36	0.1722	24.56	0.2858
Lowest	16QAM	1	24	21.60	0.1445	23.80	0.2399
Middle		1	24	21.59	0.1442	23.79	0.2393
Highest		1	24	21.46	0.1400	23.66	0.2323
Limit	EIRP < 2W			Result		PASS	

LTE Band 30 / 10MHz (Average) (GT - LC = 2.2 dB)							
Channel	Mode	RB		Conducted		EIRP	
		Size	Offset	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)
Lowest	QPSK	-	-	-	-	-	-
Middle		1	0	22.37	0.1726	24.57	0.2864
Highest		-	-	-	-	-	-
Lowest	16QAM	-	-	-	-	-	-
Middle		1	25	21.58	0.1439	23.78	0.2388
Highest		-	-	-	-	-	-
Limit	EIRP < 2W			Result		PASS	



Radiated Spurious Emission

Part27D LTE Band 30

LTE Band 30 / 5MHz / QPSK									
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)
Lowest	4608	-52.23	-40	-12.23	-77.15	-63.58	0.85	12.20	H
	6918	-46.82	-40	-6.82	-80.57	-57.32	0.98	11.48	H
	9216	-42.54	-40	-2.54	-81.35	-53.16	1.37	12.00	H
									H
									H
	4608	-50.75	-40	-10.75	-75.67	-62.1	0.85	12.20	V
	6918	-45.79	-40	-5.79	-79.51	-56.29	0.98	11.48	V
	9216	-42.34	-40	-2.34	-81.15	-52.96	1.37	12.00	V
									V
									V
Middle	4614	-49.63	-40	-9.63	-74.62	-61.01	0.82	12.20	H
	6924	-46.58	-40	-6.58	-80.3	-57.05	0.99	11.47	H
	9234	-42.24	-40	-2.24	-81.15	-52.81	1.38	11.94	H
									H
									H
									H
									H
	4614	-49.14	-40	-9.14	-74.14	-60.52	0.82	12.20	V
	6924	-45.48	-40	-5.48	-79.2	-55.95	0.99	11.47	V
	9234	-42.33	-40	-2.33	-81.24	-52.9	1.38	11.94	V
									V
									V
									V
								V	



Highest	4620	-51.38	-40	-11.38	-76.38	-62.79	0.79	12.20	H
	6930	-46.49	-40	-6.49	-80.25	-56.94	1.01	11.45	H
	9234	-42.31	-40	-2.31	-81.22	-52.88	1.38	11.94	H
									H
									H
									H
									H
	4620	-48.73	-40	-8.73	-73.73	-60.14	0.79	12.20	V
	6930	-44.83	-40	-4.83	-78.59	-55.28	1.01	11.45	V
	9234	-42.25	-40	-2.25	-81.16	-52.82	1.38	11.94	V
									V
									V
									V
									V

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



LTE Band 30 / 10MHz / QPSK									
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)
Middle	4614	-52.29	-40	-12.29	-77.3	-63.67	0.82	12.20	H
	6918	-45.38	-40	-5.38	-79.11	-55.88	0.98	11.48	H
	9216	-42.71	-40	-2.71	-81.53	-53.33	1.37	12.00	H
									H
									H
									H
									H
	4614	-49.03	-40	-9.03	-74.04	-60.41	0.82	12.20	V
	6918	-44.96	-40	-4.96	-78.69	-55.46	0.98	11.48	V
	9216	-42.59	-40	-2.59	-81.41	-53.21	1.37	12.00	V
									V
									V
									V
									V

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