



FCC RF Test Report

APPLICANT : Wistron Corporation
EQUIPMENT : Notebook Computer
BRAND NAME : Lenovo
MODEL NAME : TP00076C
FCC ID : PU5-TP00076CUC
STANDARD : FCC 47 CFR Part 2, and 90(S)
CLASSIFICATION : PCS Licensed Transmitter (PCB)

Equipment: Sierra Wireless EM7455 and Intel 8265NGW tested inside of Lenovo Notebook Computer

This is a partial report which is included the radiated test item. The product was received on Nov. 03, 2016 and testing was completed on Nov. 23, 2016. 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-D-2010 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



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FW6N0303-01	Rev. 01	Initial issue of report	Dec. 19, 2016



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	§2.1053 §90.691	Field Strength of Spurious Radiation	$< 43 + 10 \log_{10}(P[\text{Watts}])$	PASS	Under limit 19.48 dB at 2440.000 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 Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00076C
FCC ID	PU5-TP00076CUC
Integrated WWAN Module	Brand Name: Sierra Model Name: EM7455 FCC ID: N7NEM7455
Integrated WLAN Module	Brand Name: Intel Model Name: 8265NGW FCC ID: PD98265NG
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: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



1.4 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx Frequency	814.7 ~ 823.3 MHz
Rx Frequency	859.7 ~ 868.3 MHz
Bandwidth	1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz
Type of Modulation	QPSK / 16QAM

Remark: This test report recorded only product characteristics and test results of PCS Licensed Transmitter (PCB).

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. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

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.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No.
	03CH10-HY

1.7 Applied Standards

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

- ♦ FCC 47 CFR Part 2, 90
- ♦ ANSI / TIA / EIA-603-D-2010
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v02r02
- ♦ Interim Guidance for Equipment Authorization of Devices with Channel Bandwidths Combined Across Two Contiguous Service Rule Allocations OET/Lab/EACB, June 6, 2013

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

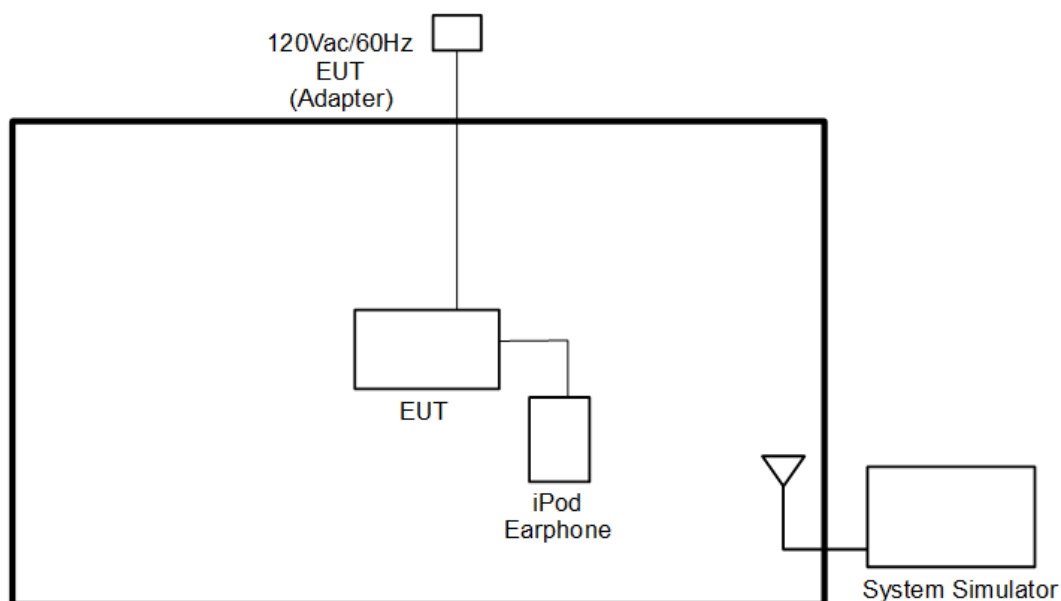
2.1 Test Mode

During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

Frequency range investigated for radiated emission is 30 MHz to 9000 MHz.

Test Items	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
Radiated Spurious Emission	26	v	v	v	v	v	-	v		v			v	v	v
Note	1. The mark "v" means that this configuration is chosen for testing 2. The mark "-" means that this bandwidth is not supported. 3. LTE Band26 transmit frequency for part22 rule is 824MHz-849MHz, for part90 rule is 814MHz-824MHz. ERP over 15MHz bandwidth complies the ERP limit line of part22 rule, therefore ERP of the partial frequency spectrum which falls within part 22 also complies.														

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.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

2.4 Frequency List of Low/Middle/High Channels

LTE Band 26 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
15	Channel	26765	-	-
	Frequency	821.5	-	-
10	Channel	-	26740	-
	Frequency	-	819	-
5	Channel	26715	26740	26765
	Frequency	816.5	819	821.5
3	Channel	26705	26740	26775
	Frequency	815.5	819	822.5
1.4	Channel	26697	26740	26783
	Frequency	814.7	819	823.3



3 Test Result

3.1 Field Strength of Spurious Radiation Measurement

3.1.1 Description of Field Strength of Spurious Radiated Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA / EIA-603-D-2010. The power of any emission FCC Part 90.691 on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least $43 + 10 \log (P)$ dB.

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

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 $43 + 10 \log_{10}(P[\text{Watts}])$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

3.1.2 Measuring Instruments

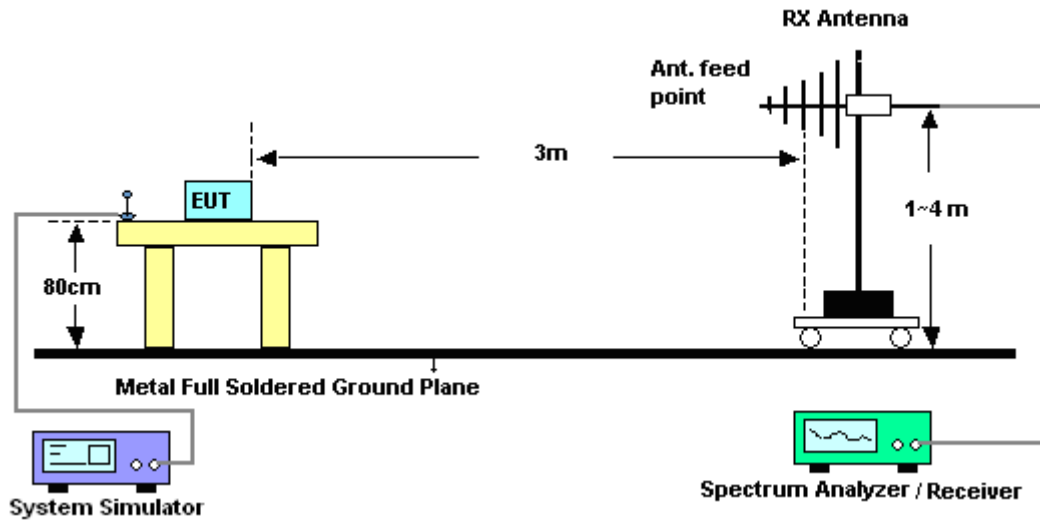
The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

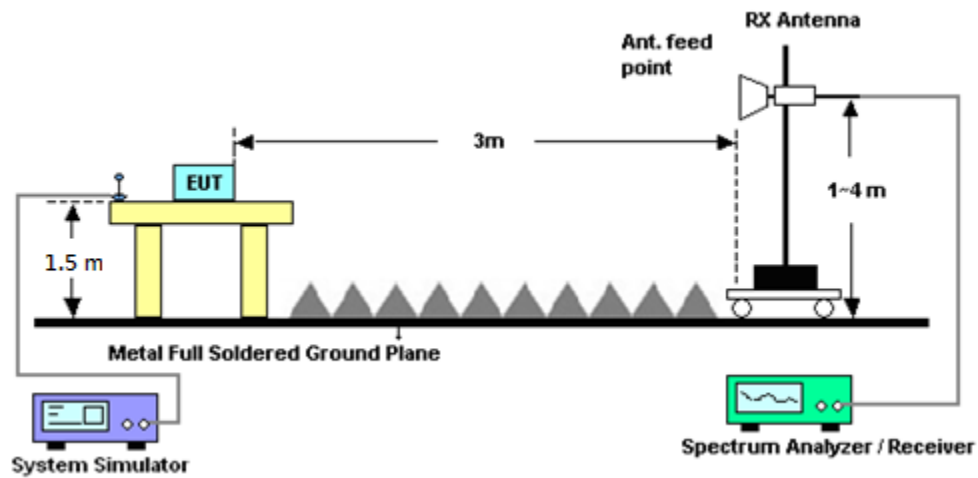
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. $EIRP\ (dBm) = S.G.\ Power - Tx\ Cable\ Loss + Tx\ Antenna\ Gain$
11. $ERP\ (dBm) = EIRP - 2.15$
12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
13. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10\log(P)]\ (dB)$
 $= [30 + 10\log(P)]\ (dBm) - [43 + 10\log(P)]\ (dB)$
 $= -13dBm.$

3.1.4 Test Setup

For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



3.1.5 Test Result of Field Strength of Spurious Radiated

Please refer to Appendix A.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Amplifier	SONOMA	310N	187311	9kHz~1GHz	Oct. 26, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Oct. 25, 2017	Radiation (03CH10-HY)
Bilog Antenna	TESEQ	CBL 6111D&008 00N1D01N- 06	35413&02	30MHz~1GHz	Jan. 13, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Jan. 12, 2017	Radiation (03CH10-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1325	1GHz ~ 18GHz	Sep. 30, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Sep. 29, 2017	Radiation (03CH10-HY)
Preamplifier	Keysight	83017A	MY53270078	1GHz~26.5GHz	Oct. 26, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Oct. 25, 2017	Radiation (03CH10-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz ~ 44GHz	Oct. 17, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Oct. 16, 2017	Radiation (03CH10-HY)
Antenna Mast	EMEC	AM-BS-450 0-B	N/A	1~4m	N/A	Nov. 17, 2016 ~ Nov. 23, 2016	N/A	Radiation (03CH10-HY)
Turn Table	EMEC	TT 2200	N/A	0~360 Degree	N/A	Nov. 17, 2016 ~ Nov. 23, 2016	N/A	Radiation (03CH10-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170576	18GHz - 40GHz	Apr. 15, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Apr. 14, 2017	Radiation (03CH10-HY)
Preamplifier	MITEQ	JS44-18004 000-33-8P	1840917	18GHz- 40GHz	Jun. 14, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Jun. 13, 2017	Radiation (03CH10-HY)
Signal Generator	Anritsu	MG3694C	163401	0.1Hz~40GHz	Aug. 19, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Aug. 18, 2017	Radiation (03CH10-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Nov. 08, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Nov. 07, 2017	Radiation (03CH10-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1522	1G~18GHz	Mar. 31, 2016	Nov. 17, 2016 ~ Nov. 23, 2016	Mar. 30, 2017	Radiation (03CH10-HY)



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.6
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 9 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.9
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Appendix A. Test Results of Radiated Test



Radiated Spurious Emission

**Part 90S LTE Band 26**

Part 90S LTE Band 26 / 1.4MHz / 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	1632	-48.70	-13	-35.70	-58.42	-50.51	0.97	4.93	H
	2440	-39.20	-13	-26.20	-52.73	-41	1.27	5.22	H
	3264	-54.50	-13	-41.50	-70.43	-57.78	1.53	6.96	H
									H
									H
									H
									H
	1632	-45.23	-13	-32.23	-54.89	-47.04	0.97	4.93	V
	2440	-40.52	-13	-27.52	-54.08	-42.32	1.27	5.22	V
	3264	-53.47	-13	-40.47	-69.29	-56.75	1.53	6.96	V
									V
									V
									V
									V
Middle	1640	-45.30	-13	-32.30	-55.07	-47.08	0.97	4.91	H
	2456	-34.57	-13	-21.57	-48.18	-36.41	1.28	5.27	H
	3280	-54.54	-13	-41.54	-70.48	-57.89	1.54	7.03	H
									H
									H
									H
									H
	1640	-42.83	-13	-29.83	-52.54	-44.61	0.97	4.91	V
	2456	-37.40	-13	-24.40	-51.05	-39.24	1.28	5.27	V
	3280	-54.05	-13	-41.05	-69.91	-57.4	1.54	7.03	V
									V
									V
									V
Highest	1648	-44.43	-13	-31.43	-54.2	-46.19	0.98	4.89	H
	2472	-35.36	-13	-22.36	-49.06	-37.24	1.28	5.32	H
	3296	-53.62	-13	-40.62	-69.58	-57.03	1.54	7.10	H
									H
									H
									H
									H
	1648	-42.60	-13	-29.60	-52.31	-44.36	0.98	4.89	V
	2472	-38.24	-13	-25.24	-51.98	-40.12	1.28	5.32	V
	3296	-53.90	-13	-40.90	-69.8	-57.31	1.54	7.10	V
									V
									V
									V

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



Part 90S LTE Band 26 / 3MHz / 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	1632	-47.70	-13	-34.70	-57.42	-49.51	0.97	4.93	H
	2440	-37.21	-13	-24.21	-50.74	-39.01	1.27	5.22	H
	3264	-54.45	-13	-41.45	-70.38	-57.73	1.53	6.96	H
									H
									H
									H
									H
	1632	-46.42	-13	-33.42	-56.08	-48.23	0.97	4.93	V
	2440	-40.72	-13	-27.72	-54.28	-42.52	1.27	5.22	V
	3264	-53.75	-13	-40.75	-69.56	-57.03	1.53	6.96	V
									V
									V
									V
									V
Middle	1632	-42.89	-13	-29.89	-52.61	-44.7	0.97	4.93	H
	2456	-35.01	-13	-22.01	-48.62	-36.85	1.28	5.27	H
	3264	-54.40	-13	-41.40	-70.33	-57.68	1.53	6.96	H
									H
									H
									H
									H
	1632	-43.39	-13	-30.39	-53.05	-45.2	0.97	4.93	V
	2456	-37.97	-13	-24.97	-51.62	-39.81	1.28	5.27	V
	3264	-54.79	-13	-41.79	-70.66	-58.07	1.53	6.96	V
									V
									V
									V
									V
									V
Highest	1640	-42.29	-13	-29.29	-52.06	-44.07	0.97	4.91	H
	2464	-35.22	-13	-22.22	-48.83	-37.08	1.28	5.29	H
	3280	-54.28	-13	-41.28	-70.22	-57.63	1.54	7.03	H
									H
									H
									H
									H
	1640	-42.93	-13	-29.93	-52.64	-44.71	0.97	4.91	V
	2464	-37.78	-13	-24.78	-51.43	-39.64	1.28	5.29	V
	3280	-54.23	-13	-41.23	-70.19	-57.58	1.54	7.03	V
									V
									V
									V
									V
									V

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



Part 90S LTE Band 26 / 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	1632	-47.22	-13	-34.22	-56.94	-49.03	0.97	4.93	H
	2440	-38.15	-13	-25.15	-51.68	-39.95	1.27	5.22	H
	3264	-52.82	-13	-39.82	-68.75	-56.1	1.53	6.96	H
									H
									H
									H
									H
	1632	-46.46	-13	-33.46	-56.12	-48.27	0.97	4.93	V
	2440	-40.32	-13	-27.32	-53.88	-42.12	1.27	5.22	V
	3264	-53.80	-13	-40.80	-69.62	-57.08	1.53	6.96	V
									V
									V
									V
									V
Middle	1632	-46.61	-13	-33.61	-56.34	-48.42	0.97	4.93	H
	2448	-34.94	-13	-21.94	-48.48	-36.76	1.27	5.24	H
	3264	-53.48	-13	-40.48	-69.41	-56.76	1.53	6.96	H
									H
									H
									H
									H
	1632	-46.46	-13	-33.46	-56.12	-48.27	0.97	4.93	V
	2448	-40.32	-13	-27.32	-53.88	-42.14	1.27	5.24	V
	3264	-53.80	-13	-40.80	-69.62	-57.08	1.53	6.96	V
									V
									V
									V
									V
									V
Highest	1640	-44.46	-13	-31.46	-54.23	-46.24	0.97	4.91	H
	2456	-34.21	-13	-21.21	-47.82	-36.05	1.28	5.27	H
	3280	-54.23	-13	-41.23	-70.17	-57.58	1.54	7.03	H
									H
									H
									H
									H
	1640	-44.00	-13	-31.00	-53.71	-45.78	0.97	4.91	V
	2456	-37.86	-13	-24.86	-51.51	-39.7	1.28	5.27	V
	3280	-54.16	-13	-41.16	-70.02	-57.51	1.54	7.03	V
									V
									V
									V
									V
									V

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



Part 90S LTE Band 26 / 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	1632	-48.52	-13	-35.52	-58.24	-50.33	0.97	4.93	H
	2440	-32.48	-13	-19.48	-46.01	-34.28	1.27	5.22	H
	3264	-53.40	-13	-40.40	-69.33	-56.68	1.53	6.96	H
									H
									H
									H
									H
	1632	-47.53	-13	-34.53	-57.19	-49.34	0.97	4.93	V
	2440	-35.93	-13	-22.93	-49.49	-37.73	1.27	5.22	V
	3264	-54.04	-13	-41.04	-69.86	-57.32	1.53	6.96	V
									V
									V
									V
									V

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



Part 90S LTE Band 26 / 15MHz / 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	1632	-47.26	-13	-34.26	-56.98	-49.07	0.97	4.93	H
	2448	-33.09	-13	-20.09	-46.63	-34.91	1.27	5.24	H
	3264	-52.89	-13	-39.89	-68.82	-56.17	1.53	6.96	H
									H
									H
									H
									H
	1632	-47.33	-13	-34.33	-56.99	-49.14	0.97	4.93	V
	2448	-37.78	-13	-24.78	-51.35	-39.6	1.27	5.24	V
	3264	-54.55	-13	-41.55	-70.37	-57.83	1.53	6.96	V
									V
									V
									V
									V

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