

Report No.: FG9O1135D



FCC RADIO TEST REPORT

FCC ID : 2AJN7-TP00109B

Equipment : Notebook Computer

Brand Name : Lenovo

Model Name : TP00109B

Applicant : LC Future Center Limited Taiwan Branch

7F., No.780, Bei'an Rd., Zhongshan Dist., Taipei City 104, Taiwan

Manufacturer : LC Future Center Limited Taiwan Branch

7F., No.780, Bei'an Rd., Zhongshan Dist., Taipei City 104, Taiwan

Standard : FCC 47 CFR Part 2, 90(R)

Equipment: Fibocom L860-GL and Intel AX201D2W tested inside of Lenovo Notebook Computer.

The product was received on Oct. 11, 2019 and testing was started from Oct. 23, 2019 and completed on Oct. 29, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, 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 report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

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

Lunis Wu

Approved by: Louis Wu

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

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History of this test report

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Report No.	Version	Description	Issued Date
FG9O1135D	01	Initial issue of report	Nov. 25, 2019

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Summary of Test Result

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Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark	
3.2	§2.1046	Conducted Output Power	Reporting only	-	
3.2	§90.542 (a)(7)	Effective Radiated Power	Pass	-	
4.2	§2.1053 §90.543 (e)(3) §90.543 (f)	Radiated Spurious Emission	Pass	Under limit 3.41 dB at 1576.000 MHz	

Remark: This is a variant report which can be referred Product Equality Declaration. All the test cases were performed on original report which can be referred to Sporton Report Number FG931312E .Based on the original report, the test cases were verified.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

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Report Producer: Dara Chiu

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1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature						
Equipment	Notebook Computer					
Brand Name	Lenovo					
Model Name	TP00109B					
FCC ID	2AJN7-TP00109B					
Sample 1	EUT with Amphenol Antenna					
Sample 2	EUT with SPEEDWIRE Antenna					
EUT supports Radios application	WCDMA/HSPA/LTE/GNSS					
EUT Stage	Production Unit					

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Remark:

- 1. The above EUT's information was declared by manufacturer.
- 2. Equipment: Fibocom L860-GL and Intel AX201D2W tested inside of Lenovo Notebook Computer.

Antenna Information								
WWAN				3G<E (dBi)				
Antonno 4	Manufacturer	Amphenol	Peak gain	1.12				
Antenna 1	Part number	LXA113-16-000-C	Туре	PIFA				
A 1	Manufacturer	SPEEDWIRE	Peak gain	1.63				
Antenna 2	Part number	F.0G.ZV-0009-001-00	Туре	PIFA				

1.2 Product Specification of Equipment Under Test

Product Feature							
Tx Frequency	LTE Band 14 :790.5 MHz ~ 795.5 MHz						
Rx Frequency	LTE Band 14 :760.5 MHz ~ 765.5 MHz						
Bandwidth	5MHz / 10MHz						
Maximum Output Power to Antenna	23.17 dBm						
Type of Modulation	QPSK / 16QAM / 64QAM						

1.3 Modification of EUT

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

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1.4 Testing Site

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory							
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan							
Test Site No.	Sporton Site No.							
rest Site No.	TH05-HY							
Test Engineer	Jacky Wang							
Temperature	23~25°ℂ							
Relative Humidity	52~55%							

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Note: The test site complies with ANSI C63.4 2014 requirement.

Test Site	SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory							
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan							
Test Site No.	Sporton Site No.							
lest Site No.	03CH13-HY							
Test Engineer	JC Liang and Wilson Wu							
Temperature	21.5~23.5							
Relative Humidity	46.9~49.5							

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: TW1190 and TW0007

1.5 Applied Standards

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

- ANSI C63.26-2015
- 47 CFR Part 2, Part 90(R)
- ANSI / TIA-603-E
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- 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

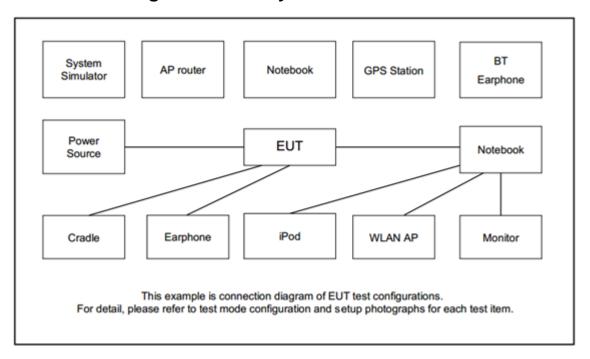
2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

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Conducted	Donal		Ва	andwid	lth (MH	lz)		Modulation			RB#			Test Channel		
Test Cases	Band	1.4	3	5	10	15	20	QPSK	16QAM	64QAM	1	Half	Full	L	М	Н
Max. Output Power	14	1	-	٧	٧	1	-	٧	v	v	٧	v	v	٧	٧	v
E.R.P	14		-	v	V	-	-	V	v	v	٧			٧	v	v
Radiated Spurious Emission	Spurious 14 Worst Case										v	v				
Remark	 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 sourious emission. 															

2.2 Connection Diagram of Test System



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2.3 Support Unit used in test configuration and system

Item	Equipment	quipment 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	

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2.4 Frequency List of Low/Middle/High Channels

LTE Band 14 Channel and Frequency List									
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest					
10	Channel	- 23330		-					
10	Frequency	-	793	-					
E	Channel	23305	23330	23355					
5	Frequency	790.5	793	795.5					

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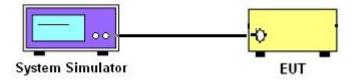
3 Conducted Test Items

3.1 Measuring Instruments

See list of measuring instruments of this test report.

3.1.1 Test Setup

3.1.2 Conducted Output Power



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3.1.3 Test Result of Conducted Test

Please refer to Appendix A.

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3.2 Conducted Output Power Measurement and ERP

3.2.1 Description of the Conducted Output Power Measurement and ERP 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.

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The ERP of mobile transmitters must not exceed 3 Watts for LTE Band 14.

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_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

3.2.2 Test Procedures

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

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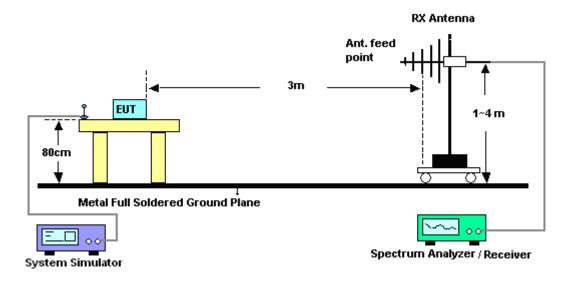
4 Radiated Test Items

4.1 Measuring Instruments

See list of measuring instruments of this test report.

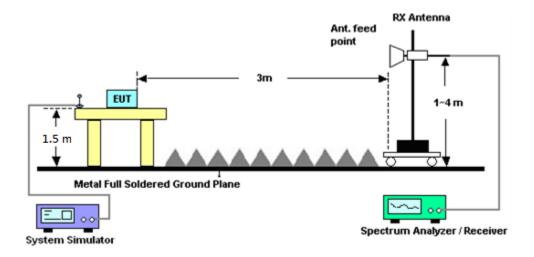
4.1.1 Test Setup

For radiated test from 30MHz to 1GHz



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For radiated test above 1GHz



4.1.2 Test Result of Radiated Test

Please refer to Appendix B.

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4.2 Radiated Spurious Emission

4.2.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E.

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.

For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the

band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP)

for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the

purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative

of the type that will be used with the equipment in normal operation.

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

4.2.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

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. The RF fundamental frequency should be excluded against the limit line in the operating

frequency band.

11. 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	6201107509	-	Jul. 03, 2019	Oct. 23, 2019	Jul. 02, 2020	Conducted (TH05-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	40103 & 07	30MHz~1GHz	Apr. 30, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	Apr. 29, 2020	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D&00802 N1D01N-06	54682 & AT-N0603	30MHz~1GHz	Sep. 26, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	Sep. 25, 2020	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1241	1GHz~18GHz	Jul. 02, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	Jul. 01, 2020	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1212	1GHz~18GHz	May 14, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	May 13, 2020	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA917057 6	18GHz~40GHz	May 14, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	May 13, 2020	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA917058 4	18GHz~40GHz	Dec. 05, 2018	Oct. 23, 2019 ~ Oct. 29, 2019	Dec. 04, 2019	Radiation (03CH13-HY)
Amplifier	SONOMA	310N	187282	9kHz~1GHz	Dec. 18, 2018	Oct. 23, 2019 ~ Oct. 29, 2019	Dec. 17, 2019	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590074	1GHz~18GHz	May 20, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	May 19, 2020	Radiation (03CH13-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 06, 2018	Oct. 23, 2019 ~ Oct. 29, 2019	Dec. 05, 2019	Radiation (03CH13-HY)
Preamplifier	Agilent	8449B	3008A02375	1GHz~26.5GHz	May 27, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	May 26, 2020	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY55370526	10Hz~44GHz	Mar. 19, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	Mar. 18, 2020	Radiation (03CH13-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Oct. 23, 2019 ~ Oct. 29, 2019	N/A	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Oct. 23, 2019 ~ Oct. 29, 2019	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Oct. 23, 2019 ~ Oct. 29, 2019	N/A	Radiation (03CH13-HY)
Software	Audix	E3 6.2009-8-24	RK-000992	N/A	N/A	Oct. 23, 2019 ~ Oct. 29, 2019	N/A	Radiation (03CH13-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	Aug. 27, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	Aug. 26, 2020	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SF102/2*11SK 252	MY4278/2	9kHz~40GHz	May 16, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	May 15, 2020	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24961/4	30M-18G	Feb. 13, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	Feb. 12, 2020	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30M~40GHz	Mar. 13, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	Mar. 12, 2020	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 0SS	SN2	3GHz High Pass Filter	Jul. 14, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	Jul. 13, 2020	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-1080 -1200-15000-6 0SS	SN3	1.2GHz High Pass Filter	Jul. 03, 2019	Oct. 23, 2019 ~ Oct. 29, 2019	Jul. 02, 2020	Radiation (03CH13-HY)

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6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of	3.07
Confidence of 95% (U = 2Uc(y))	

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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of	2.49
Confidence of 95% (U = 2Uc(y))	3.48

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of	3.92
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 14 Maximum Average Power [dBm]									
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest			
10	1	0			23.17				
10	1	25			22.98				
10	1	49			23.09]			
10	25	0	QPSK		22.11]			
10	25	12			22.01	1			
10	25	25			22.10	1			
10	50	0			22.05	1			
10	1	0			22.35	1			
10	1	25			22.24	1			
10	1	49			22.53	1			
10	25	0	16-QAM	-	21.20	1 -			
10	25	12			21.05	1			
10	25	25			21.21	1			
10	50	0			21.13	1			
10	1	0			21.38	1			
10	1	25			21.23	1			
10	1	49			21.49	1			
10	25	0	64-QAM		20.18	1			
10	25	12			20.07	1			
10	25	25			20.21	1			
10	50	0			20.18				
5	1	0		22.99	23.09	23.04			
5	1	12		22.95	22.97	22.98			
5	1	24		23.07	23.12	23.07			
5	12	0	QPSK	22.02	22.04	22.03			
5	12	7		21.96	21.95	21.99			
5	12	13		22.06	22.00	22.04			
5	25	0		21.96	21.97	21.96			
5	1	0		22.34	22.29	22.34			
5	1	12		22.19	22.16	22.17			
5	1	24		22.43	22.47	22.44			
5	12	0	16-QAM	21.13	21.14	21.13			
5	12	7		20.96	21.00	20.95			
5	12	13		21.12	21.14	21.18			
5	25	0		21.11	21.05	21.06			
5	1	0		21.36	21.30	21.38			
5	1	12		21.15	21.23	21.18			
5	1	24		21.44	21.41	21.42			
5	12	0	64-QAM	20.18	20.09	20.12			
5	12	7		20.07	20.01	20.06			
5	12	13		20.19	20.15	20.21			
5	25	0		20.10	20.15	20.15			

Appendix B. Test Results of ERP and Radiated Test

ERP

	LTE Band 14 / 5MHz (Average) (GT - LC = 1 dB)										
Channel	Mode	RB		Cond	lucted	ERP					
Chamilei	Wode	Size	Offset	Power (dBm)	Power (Watts)	ERP(dBm)	ERP(W)				
Lowest		1	24	23.07	0.2028	21.92	0.1556				
Middle	QPSK	1	24	23.12	0.2051	21.97	0.1574				
Highest		1	24	23.07	0.2028	21.92	0.1556				
Lowest	16QAM	1	24	22.43	0.1750	21.28	0.1343				
Middle		1	24	22.47	0.1766	21.32	0.1355				
Highest		1	24	22.44	0.1754	21.29	0.1346				
Lowest		1	24	21.44	0.1393	20.29	0.1069				
Middle	64QAM	1	24	21.41	0.1384	20.26	0.1062				
Highest		1	24	21.42	0.1387	20.27	0.1064				
Limit	ERP <	3W		Re	sult	PA	SS				

LTE Band 14 / 10MHz (Average) (GT - LC = 1 dB)										
Channel	Mode	R	В	Cond	ucted	ERP				
Channel	Wode	Size	Offset	Power (dBm)	Power (Watts)	ERP(dBm)	ERP(W)			
Lowest		-	-	-	-	-	-			
Middle	QPSK	1	0	23.17	0.2075	22.02	0.1592			
Highest		-	-	-	-	-	-			
Lowest		-	-	-	-	-	-			
Middle	16QAM	1	49	22.53	0.1791	21.38	0.1374			
Highest		-	-	-	-	-	-			
Lowest		-	-	-	-	-	-			
Middle	64QAM	1	49	21.49	0.1409	20.34	0.1081			
Highest		-	-	-	-	-	-			
Limit	ERP <	3W		Re	sult	PA	SS			

Radiated Spurious Emission

LTE Band 14

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	LTE Band 14 / 5MHz / QPSK										
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)		
	1584	-45.85	-42.15	-3.70	-58.9	-51.02	1.20	8.52	Н		
	2376	-41.09	-13	-28.09	-58.27	-47.92	1.42	10.40	Н		
	3168	-52.72	-13	-39.72	-71.75	-60.38	1.60	11.40	Н		
									Н		
Laurant									Н		
Lowest	1584	-49.14	-42.15	-6.99	-62	-54.31	1.20	8.52	V		
	2376	-43.58	-13	-30.58	-61.3	-50.41	1.42	10.40	V		
	3168	-48.28	-13	-35.28	-67.5	-55.94	1.60	11.40	V		
									V		
									V		
	1592	-46.45	-42.15	-4.30	-59.43	-51.64	1.20	8.55	Н		
	2384	-39.66	-13	-26.66	-56.77	-46.50	1.42	10.41	Н		
	3184	-51.78	-13	-38.78	-70.9	-59.47	1.61	11.45	Н		
									Н		
N 4" 1 11									Н		
Middle	1592	-47.04	-42.15	-4.89	-59.84	-52.23	1.20	8.55	V		
	2384	-42.04	-13	-29.04	-59.7	-48.88	1.42	10.41	V		
	3184	-47.08	-13	-34.08	-66.35	-54.77	1.61	11.45	V		
									V		
									V		

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		LTE Band 14 / 5MHz / QPSK										
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)			
	1592	-47.13	-42.15	-4.98	-60.11	-52.32	1.20	8.55	Н			
	2392	-37.83	-13	-24.83	-54.89	-44.67	1.42	10.41	Н			
	3192	-51.53	-13	-38.53	-70.67	-59.24	1.62	11.48	Н			
									Н			
l limb and									Н			
Highest	1592	-48.54	-42.15	-6.39	-61.34	-53.73	1.20	8.55	V			
	2392	-42.15	-13	-29.15	-59.75	-48.99	1.42	10.41	V			
	3192	-48.32	-13	-35.32	-67.61	-56.03	1.62	11.48	V			
									V			
									V			

Report No.: FG9O1135D

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

	LTE Band 14 / 10MHz / QPSK										
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)		
	1576	-45.56	-42.15	-3.41	-58.7	-50.70	1.20	8.49	Н		
	2368	-42.11	-13	-29.11	-59.35	-48.94	1.42	10.39	Н		
	3152	-53.39	-13	-40.39	-72.36	-61.01	1.58	11.36	Н		
									Н		
N 42 1 11									Н		
Middle	1576	-47.02	-42.15	-4.87	-59.96	-52.16	1.20	8.49	V		
	2368	-46.67	-13	-33.67	-64.45	-53.50	1.42	10.39	V		
	3152	-50.18	-13	-37.18	-69.36	-57.80	1.58	11.36	V		
									V		
									V		

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

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