



FCC RADIO TEST REPORT

FCC ID	: PU5-TP00127BLQ
Equipment	: Notebook Computer
Brand Name	: Lenovo
Model Name	: TP00127B
Applicant	: Wistron Corporation
	21F, No. 88, Sec. 1, Hsin Tai Wu Rd., Hsichih Dist, New Taipei City 221,Taiwan
Manufacturer	: Lenovo PC HK Limited.
	23/F, Lincoln House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong, China
Standard	: FCC 47 CFR Part 2, 90(R)
otaridard	

Equipment: Quectel EM05-G tested inside of Lenovo Notebook Computer.

The product was received on Nov. 18, 2021 and testing was performed from Dec. 17, 2021 and completed on Jan. 19, 2022. We, Sporton International Inc. Wensan 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 test results in this partial report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu Sporton International Inc. Wensan Laboratory



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History of this test report

Report No.	Version	Description	Issued Date
FG1N1847-04C	01	Initial issue of report	Mar. 04, 2022



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	-
-	-	Peak-to-Average Ratio	-	See Note
-	§2.1049	§2.1049 Occupied Bandwidth -		See Note
-	§2.1053 §90.543 (e)(2)	Conducted Band Edge Measurement	-	See Note
-	§2.1051 §90.210 (n)	Emission Mask	-	See Note
-	§2.1053 §90.543 (e)(3)	Conducted Spurious Emission	-	See Note
-	§2.1055 §90.539 (e)	Frequency Stability Temperature & Voltage	-	See Note
-	§90.542 (a)(7)	Effective Radiated Power	-	See Note
4.2	§2.1053 §90.543 (e)(3) §90.543 (f)	Radiated Spurious Emission	Pass	Under limit 11.63 dB at 1577.000 MHz

Summary of Test Result

Note: The module (Model: EM05-G) makes no difference after verifying output power, this report reuses test data from the module report.

Declaration of Conformity:

 The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.

2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sheng Kuo Report Producer: Lucy Wu

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature							
Equipment	Notebook Computer						
Brand Name	Lenovo						
Model Name	TP00127B						
FCC ID	PU5-TP00127BLQ						
	WCDMA/HSPA/LTE/GNSS/NFC						
	WLAN 11a/b/g/n HT20/HT40						
EUT supports Radios application	WLAN 11ac VHT20/VHT40/VHT80/VHT160						
	WLAN 11ax HE20/HE40/HE80/HE160						
	Bluetooth BR/EDR/LE						
EUT Stage	Production Unit						

Remark:

- 1. The above EUT's information was declared by manufacturer.
- 2. Equipment: Quectel EM05-G tested inside of Lenovo Notebook Computer.

Antenna Information								
Main Antonna	Manufacturer	AWAN	Peak gain(dBi)	LTE Band 14 : -2.90				
Main Antenna	Part number	025.901S1.0071	Туре	PIFA				

Remark: The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Product Specification of Equipment Under Test

Product Specification is subject to this standard							
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	24.39 dBm						
Type of Modulation	QPSK / 16QAM						

1.3 Modification of EUT

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



1.4 Testing Site

Test Cite	Charten International Inc. FMC 8 Wireless Communications Laboratory			
Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory			
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333			
Test Site No.	Sporton Site No.			
Test Site No.	TH03-HY (TAF Code: 1190)			
Test Engineer	Benjamin Lin			
Temperature (°C)	23.5~25			
Relative Humidity (%)	49.4~52			
Domork	The Conducted test item subcontracted to Sporton International Inc. EMC			
Remark	& Wireless Communications Laboratory.			
Test Site	Sporton International Inc. Wensan Laboratory			
Test Site Leastian	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist.,			
Test Site Location	Taoyuan City 333010			
Test Site No.	Sporton Site No.			
Test Site No.	03CH15-HY			
Test Engineer	Leo Li, Mancy Chou and Bigshow Wang			
Temperature (°C)	22.5~24.5			
Relative Humidity (%)	45~55			

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

FCC Designation No.: TW1190 and TW3786

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
- FCC 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
- FCC KDB 414788 D01 Radiated Test Site v01r01

Remark:

- **1.** All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

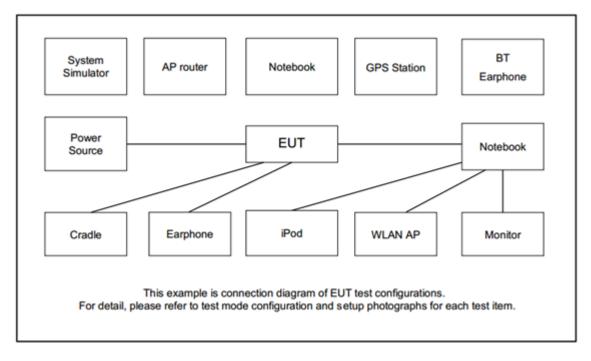
2.1 Test Mode

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.

For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in Tablet Type (three orthogonal axis (X: flat, Y: portrait, Z: landscape)) and Notebook Type, and adjusting the measurement antenna orientation, following C63.26 exploratory test procedures and find Y plane as worst plane.

Conducted	Dand		Ba	andwid	lth (MH	lz)		Modulation				RB #		Tes	t Chai	nnel
Test Cases	Band	1.4	3	5	10	15	20	QPSK	16QAM	64QAM	1	Half	Full	L	М	н
Max. Output Power	14	-	-	v	v	-	-	v	v	-	v	v	v	v	v	v
E.R.P	14	-	-	v	v	-	-	v	v	-		Max. Power				
Radiated																
Spurious	14	-	-	v	v	-	-	v		-	v			v	v	v
Emission																
	1. Tł	ne mark	« " v " m	eans th	nat this	configu	iration i	s chosen	for testin	g						
	2. Tł	ne mark	« "-" me	ans tha	at this b	andwic	lth is no	ot support	ed.							
Remark	3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission							on								
	te	test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case								ase						
	er	nission	s are re	eported												

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

ltem	Equipment	Brand Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	System Simulator	Anritsu	MT8821C	N/A	N/A	Unshielded, 1.8 m
3.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A

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	-					
5	Channel	23305	23330	23355					
	Frequency	790.5	793	795.5					



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



3.1.3 Test Result of Conducted Test

Please refer to Appendix A.



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.

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.



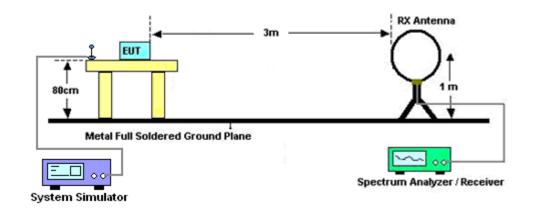
4 Radiated Test Items

4.1 Measuring Instruments

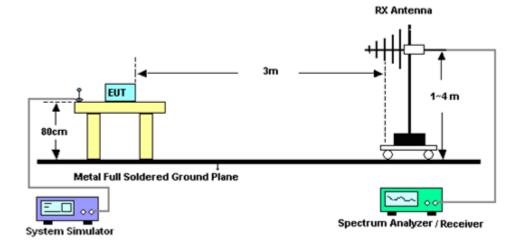
See list of measuring instruments of this test report.

4.1.1 Test Setup

For radiated test below 30MHz

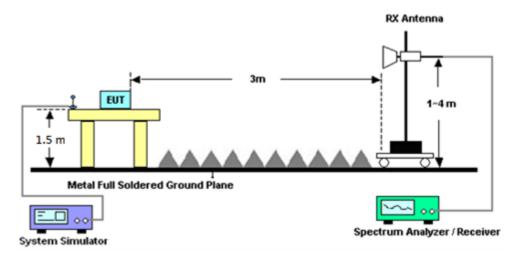


For radiated test from 30MHz to 1GHz





For radiated test above 1GHz



4.1.2 Test Result of Radiated Test

Please refer to Appendix B.

Note:

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.



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)



5 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 07, 2021	Dec. 20, 2021~ Jan. 19, 2022	Sep. 06, 2022	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01 N-06	37059 & 01	30MHz~1GHz	Oct. 09, 2021	Dec. 20, 2021~ Jan. 19, 2022	Oct. 08, 2022	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL6111D&0 0800N1D01N- 06	41912 & 05	30MHz to 1GHz	Feb. 08, 2021	Dec. 20, 2021~ Jan. 19, 2022	Feb. 07, 2022	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	187282	9kHz~1GHz	Dec. 15, 2021	Dec. 20, 2021~ Jan. 19, 2022	Dec. 14, 2022	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-016 20	1-18GHz	Oct. 25, 2021	Dec. 20, 2021~ Jan. 19, 2022	Oct. 24, 2022	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-132 6	1GHz~18GHz	Oct. 25, 2021	Dec. 20, 2021~ Jan. 19, 2022	Oct. 24, 2022	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA0118-55-3 03	171000180 0055006	1GHz~18GHz	May 06, 2021	Dec. 20, 2021~ Jan. 19, 2022	May 05, 2022	Radiation (03CH15-HY)
Amplifier	E-INSTRUME NT TECH LTD	ERA-10M-700 0-MR	EC190024 7	10MHz-7GHz	Dec. 03, 2021	Dec. 20, 2021~ Jan. 19, 2022	Dec. 02, 2022	Radiation (03CH15-HY)
Preamplifier	EM Electronics	EM01G18G	060803	1GHz-18GHz	Dec. 16, 2021	Dec. 20, 2021~ Jan. 19, 2022	Dec. 15, 2022	Radiation (03CH15-HY)
Spectrum Analyzer	Keysight	N9038A	MY541300 85	20MHz~8.4GHz	Oct. 21, 2021	Dec. 20, 2021~ Jan. 19, 2022	Oct. 20, 2022	Radiation (03CH15-HY
Spectrum Analyzer	Keysight	N9010A	MY542004 85	10Hz~44GHz	Mar. 05, 2021	Dec. 20, 2021~ Jan. 19, 2022	Mar. 04, 2022	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Dec. 20, 2021~ Jan. 19, 2022	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Dec. 20, 2021~ Jan. 19, 2022	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24(k 5)	RK-00045 1	N/A	N/A	Dec. 20, 2021~ Jan. 19, 2022	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY36980/ 4,MY9838/ 4PE,50840 5/2E	30MHz~18G	Nov. 15, 2021	Dec. 20, 2021~ Jan. 19, 2022	Nov. 14, 2022	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY36980/ 4,MY9838/ 4PE,50840 5/2E	30MHz~18G	Nov. 15, 2021	Dec. 20, 2021~ Jan. 19, 2022	Nov. 14, 2022	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY36980/ 4,MY9838/ 4PE,50840 5/2E	30MHz~18G	Nov. 15, 2021	Dec. 20, 2021~ Jan. 19, 2022	Nov. 14, 2022	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz-40GHz	Feb. 22, 2021	Dec. 20, 2021~ Jan. 19, 2022	Feb. 21, 2022	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz-40GHz	Feb. 22, 2021	Dec. 20, 2021~ Jan. 19, 2022	Feb. 21, 2022	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	9kHz~30MHz	Mar. 11, 2021	Dec. 20, 2021~ Jan. 19, 2022	Mar. 10, 2022	Radiation (03CH15-HY)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Filter	Wainwright	WLK4-1000-1 530-8000-40S S	SN12	1.53GHz Low Pass Filter	Sep. 14, 2021	Dec. 20, 2021~ Jan. 19, 2022	Sep. 13, 2022	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-935 -1000-15000- 40ST	SN1	1GHz High Pass Filter	Apr. 29, 2021	Dec. 20, 2021~ Jan. 19, 2022	Apr. 28, 2022	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-270 0-3000-18000 -60ST		3GHz High Pass Filter	Sep. 15, 2021	Dec. 20, 2021~ Jan. 19, 2022	Sep. 14, 2022	Radiation (03CH15-HY)
Signal Generator	Anritsu	MG3694C	163401	0.1Hz~40GHz	Jan. 31, 2021	Dec. 20, 2021~ Jan. 19, 2022	Jan. 30, 2022	Radiation (03CH15-HY)
Base Station (Measure)	Anritsu	MT8821C	626202534 1	N/A	Oct. 05, 2021	Dec. 17, 2021	Oct. 04, 2022	Conducted (TH03-HY)



6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of	2.92 dB
Confidence of 95% (U = 2Uc(y))	2.92 UB

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

Measuring Uncertainty for a Level of	3.72 dB
Confidence of 95% (U = 2Uc(y))	5.72 UB

Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power & ERP)

	LTE	Band 14 M	laximum A	verage Po	wer [dBm]	(GT - LC =	= -2.9 dB)	
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
10	1	0			24.39			
10	1	25			23.81			
10	1	49			24.05			
10	25	0	QPSK		23.06		19.34	0.0859
10	25	12			22.88			
10	25	25			22.97			
10	50	0			22.87			
10	1	0		-	22.66	-		
10	1	25			22.90			
10	1	49			22.83			
10	25	0	16-QAM		21.98		17.85	0.0610
10	25	12			22.08			
10	25	25			22.07			
10	50	0			22.04			
Limit		ERP < 3W			Result		Pa	ISS

	LTE	Band 14 M	laximum A	verage Po	wer [dBm]	(GT - LC =	= -2.9 dB)	
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP (W)
5	1	0		24.35	24.30	24.31		
5	1	12		23.71	23.81	23.81		
5	1	24		24.00	24.00	24.00	19.30	
5	12	0	QPSK	22.98	23.05	23.04		0.0851
5	12	7		22.86	22.79	22.78		
5	12	13		22.96	22.97	22.89		
5	25	0		22.77	22.87	22.85		
5	1	0		22.59	22.60	22.58		
5	1	12		22.86	22.90	22.86		
5	1	24		22.77	22.75	22.79		
5	12	0	16-QAM	21.97	21.93	21.95	17.85	0.0610
5	12	7		22.08	21.98	22.08		
5	12	13		22.01	22.04	22.07		
5	25	0		21.96	21.95	21.96		
Limit		ERP < 3W			Result		Pa	ass



Appendix B. Test Results of Radiated Test

	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)			
	1577	-55.18	-42.15	-13.03	-61.73	-60.00	1.79	8.76	Н			
	2365	-47.99	-13	-34.99	-58.05	-53.59	2.20	9.95	Н			
	3153	-59.45	-13	-46.45	-72.04	-66.16	2.55	11.41	Н			
									Н			
									Н			
Lowest									Н			
Lowest	1577	-53.78	-42.15	-11.63	-60.60	-58.60	1.79	8.76	V			
	2365	-51.73	-13	-38.73	-62.50	-57.33	2.20	9.95	V			
	3153	-60.02	-13	-47.02	-73.10	-66.73	2.55	11.41	V			
									V			
									V			
									V			
	1582	-58.23	-42.15	-16.08	-64.72	-63.08	1.80	8.79	н			
	2373	-52.81	-13	-39.81	-62.88	-58.49	2.20	10.03	Н			
	3163	-60.20	-13	-47.20	-72.85	-66.94	2.56	11.45	н			
									н			
									н			
NAL II.									Н			
Middle	1582	-55.71	-42.15	-13.56	-62.51	-60.56	1.80	8.79	V			
	2373	-56.29	-13	-43.29	-67.08	-61.97	2.20	10.03	V			
	3163	-59.93	-13	-46.93	-73.06	-66.67	2.56	11.45	V			
									V			
									V			
									V			

LTE Band 14



	1587	-55.31	-42.15	-13.16	-61.76	-60.18	1.80	8.82	Н
	2380	-51.87	-13	-38.87	-61.95	-57.62	2.20	10.10	Н
	3173	-57.90	-13	-44.90	-70.61	-64.68	2.56	11.49	Н
									Н
									Н
Llighoot									Н
Highest	1587	-53.86	-42.15	-11.71	-60.65	-58.73	1.80	8.82	V
	2380	-53.49	-13	-40.49	-64.29	-59.24	2.20	10.10	V
	3173	-58.98	-13	-45.98	-72.16	-65.76	2.56	11.49	V
									V
									V
									V

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)			
	1577	-55.65	-42.15	-13.50	-62.2	-60.47	1.79	8.76	н			
	2366	-51.71	-13	-38.71	-61.77	-57.32	2.20	9.96	н			
	3154	-60.50	-13	-47.50	-73.09	-67.21	2.55	11.42	н			
									н			
									н			
Mistalia									н			
Middle	1577	-56.25	-42.15	-14.10	-63.07	-61.07	1.79	8.76	V			
	2366	-47.84	-13	-34.84	-58.61	-53.45	2.20	9.96	V			
	3154	-60.31	-13	-47.31	-73.4	-67.02	2.55	11.42	V			
									V			
									V			
									V			

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