

Partial FCC RF Test Report

APPLICANT : LC Future Center
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

EQUIPMENT : Notebook Computer

BRAND NAME : Lenovo

MODEL NAME : TP00110B

FCC ID : 2AJN7-TP00110B

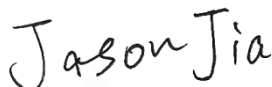
STANDARD : 47 CFR Part 2, and 90(S)

CLASSIFICATION : PCS Licensed Transmitter (PCB)

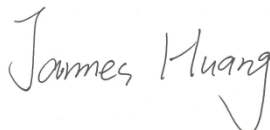
Equipment: Fibocom L850-GL and Intel AX201D2W tested inside of Lenovo Notebook Computer.

This is a data re-used report which is only valid together with the original test report. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.26-2015 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 (Kunshan) Inc., the test report shall not be reproduced except in full.



Reviewed by: Jason Jia / Supervisor



Approved by: James Huang / Manager



Sporton International (Kunshan) Inc.

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FW9D0702	Rev. 01	Initial issue of report	Feb. 14, 2020
FW9D0702	Rev. 02	Revised the Applicant information	Feb. 25, 2020

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	§2.1046	Conducted Output Power and ERP	-	Reporting only	-
3.3	§2.1053 §90.691	Field Strength of Spurious Radiation	$< 43 + 10 \log_{10}(P[\text{Watts}])$	PASS	Under limit 33.29 dB at 2444.00 MHz

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.

1 General Description

1.1 Applicant

LC Future Center

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

1.2 Manufacturer

LC Future Center Limited Taiwan Branch

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

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	TP00110B
FCC ID	2AJN7-TP00110B
Sample 1	EUT with Amphenol Antenna
Sample 2	EUT with SPEEDWIRE Antenna
EUT supports Radios application	WCDMA/ LTE/NFC/GNSS WLAN 2.4GHz 802.11b/g/n WLAN 5GHz 802.11a/n/ac/ax Bluetooth BR/EDR/LE
SW Version	N/A
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. Equipment: Fibocom L850-GL and Intel AX201D2W tested inside of Lenovo Notebook Computer.
3. All test items were performed with Sample 1

WWAN Antenna Information				
Antenna 1	Manufacturer	Amphenol	Peak gain (dBi)	2.3
	Part number	LX9865-16-000-C	Type	PIFA
Antenna 2	Manufacturer	SPEEDWIRE	Peak gain (dBi)	2.07
	Part number	F.0G.ZV-0008-001-00	Type	PIFA

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
Maximum Output Power to Antenna	22.90 dBm
Antenna Gain	1.39 dBi
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 International (Kunshan) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH06-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH06-KS	AUDIX	E3	6.2009-8-24al



1.8 Applied Standards

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

- ♦ 47 CFR Part 2, 90(S)
- ♦ ANSI C63.26-2015
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- ♦ FCC KDB 971168 D02 Misc Rev Approv License Devices v02r01
- ♦ 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.

2 Test Configuration of Equipment Under Test

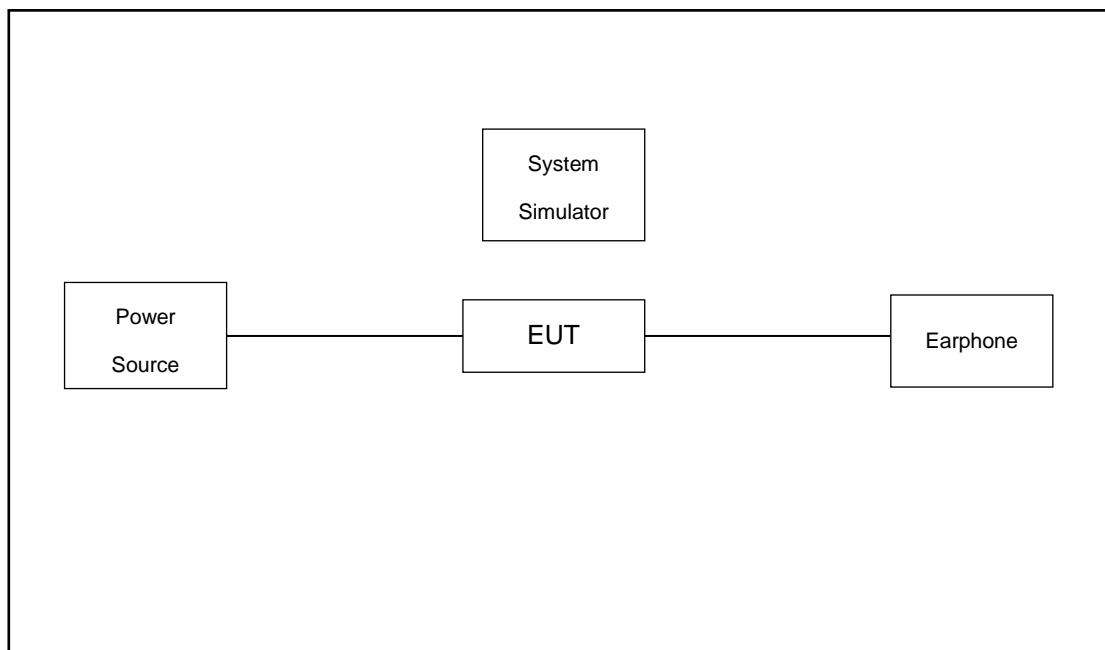
2.1 Test Mode

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 10th harmonic

Test Items	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	26	v	v	v	v	v	-	v	v	v	v	v	v	v	v
E.R.P.	26					v	-	v	v	v	v	v	v		
Radiated Spurious Emission	26	Worst case											-	v	-
Note	1. The mark “v ” means that this configuration is chosen for testing 2. The mark “- ” means that this bandwidth is not supported.														

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 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 Conducted Output Power Measurement

3.1.1 Description of the Conducted Output Power Measurement

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.

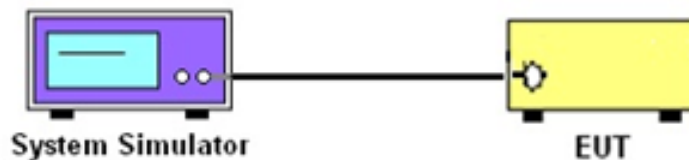
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The 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.

3.1.4 Test Setup



3.1.5 Test Result of Conducted Output Power

Please refer to Appendix A.



3.2 Conducted Output Power and ERP

3.2.1 Description of the Conducted Output Power Measurement and ERP Measurement

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

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

3.3 Field Strength of Spurious Radiation Measurement

3.3.1 Description of Field Strength of Spurious Radiated Measurement

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

3.3.2 Measuring Instruments

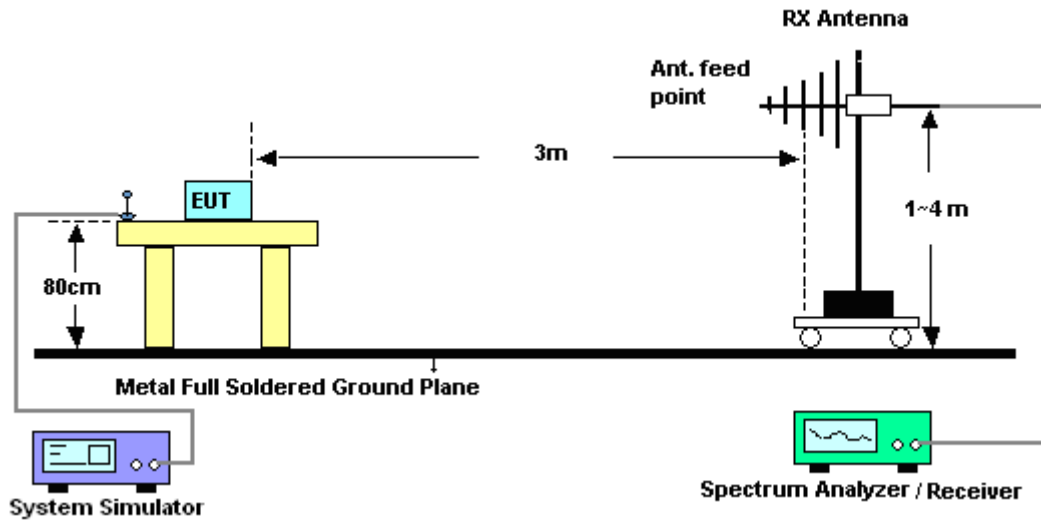
The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

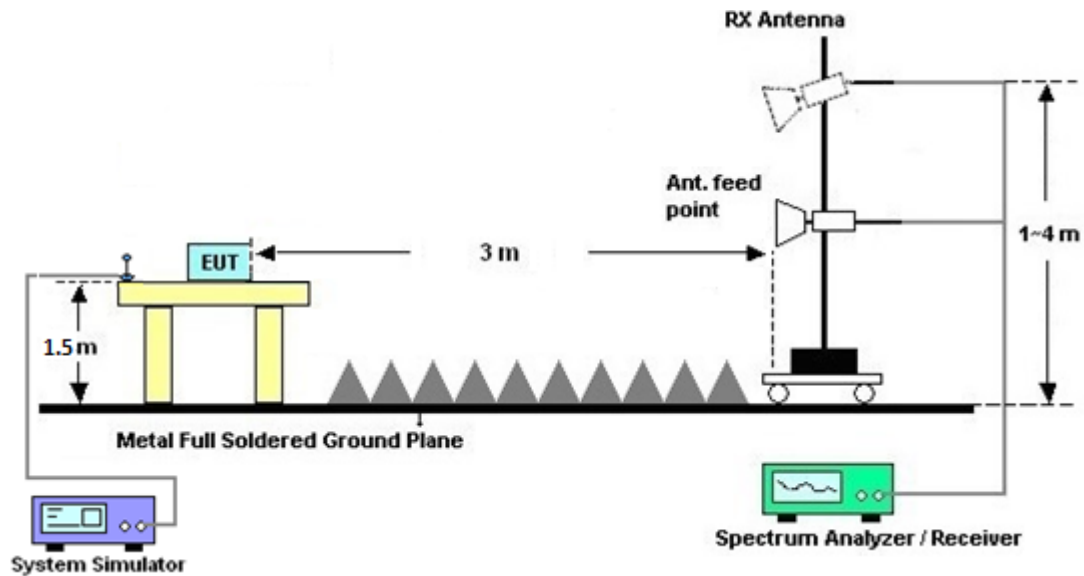
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position 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. $EIRP \text{ (dBm)} = S.G. \text{ Power} - Tx \text{ Cable Loss} + Tx \text{ Antenna Gain}$
11. $ERP \text{ (dBm)} = EIRP - 2.15$
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)

3.3.4 Test Setup

For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



3.3.5 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
Radio communication analyzer	Anritsu	MT8820C	6201432830	LTE_FDD full band	Jan. 14, 2019	Dec. 26, 2019	Jan. 13, 2020	Conducted (TH01-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz-44GHz	Apr. 16, 2019	Dec. 17, 2019	Apr. 15, 2020	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	44483	30MHz-1GHz	Dec. 28, 2018	Dec. 17, 2019	Dec. 27, 2019	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75959	1GHz~18GHz	Jan. 27, 2019	Dec. 17, 2019	Jan. 26, 2020	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Aug. 06, 2019	Dec. 17, 2019	Aug. 05, 2020	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-00 101800-30-1 0P	2025788	1Ghz-18Ghz	Apr. 17, 2019	Dec. 17, 2019	Apr. 16, 2020	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Dec. 17, 2019	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Dec. 17, 2019	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Dec. 17, 2019	NCR	Radiation (03CH06-KS)

NCR: No Calibration Required

5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.26-2015. All the measurement uncertainty value were shown with a coverage $K=2$ to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.5dB
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.1dB
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Appendix A. Test Results of Conducted Test

Conducted Output Power (Average power)

LTE Band 26 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
15	1	0	QPSK	22.85	-	-
15	1	37		22.75		
15	1	74		22.57		
15	36	0		21.79		
15	36	20		21.76		
15	36	39		21.76		
15	75	0		21.73		
15	1	0	16-QAM	21.95		
15	1	37		22.03		
15	1	74		21.90		
15	36	0		20.95		
15	36	20		20.97		
15	36	39		20.88		
15	75	0		21.03		



LTE Band 26 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	1	0	QPSK		22.82	
10	1	25			22.69	
10	1	49			22.73	
10	25	0			21.81	
10	25	12			21.77	
10	25	25			21.79	
10	50	0			21.79	
10	1	0	16-QAM		21.98	
10	1	25			21.96	
10	1	49			22.04	
10	25	0			20.87	
10	25	12			20.83	
10	25	25			20.86	
10	50	0			20.89	
5	1	0	QPSK	22.76	22.80	22.75
5	1	12		22.75	22.76	22.71
5	1	24		22.66	22.64	22.48
5	12	0		21.85	21.82	21.57
5	12	7		21.89	21.85	21.68
5	12	13		21.94	21.86	21.55
5	25	0		21.86	21.72	21.70
5	1	0	16-QAM	22.04	21.98	21.99
5	1	12		21.99	21.94	21.94
5	1	24		21.98	21.95	21.95
5	12	0		21.01	20.85	20.73
5	12	7		20.96	20.88	20.63
5	12	13		21.03	20.83	20.72
5	25	0		21.01	20.83	20.80



LTE Band 26 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
3	1	0	QPSK	22.76	22.90	22.63
3	1	8		22.68	22.60	22.66
3	1	14		22.65	22.71	22.65
3	8	0		21.85	21.90	21.55
3	8	4		21.89	21.86	21.57
3	8	7		21.94	21.69	21.62
3	15	0		21.86	21.83	21.77
3	1	0	16-QAM	22.04	22.03	21.95
3	1	8		21.95	22.02	21.96
3	1	14		21.98	21.99	21.96
3	8	0		21.01	20.82	20.64
3	8	4		20.96	20.86	20.63
3	8	7		21.03	20.92	20.75
3	15	0		21.01	20.82	20.73
1.4	1	0	QPSK	22.76	22.75	22.68
1.4	1	3		22.65	22.67	22.65
1.4	1	5		22.66	22.82	22.59
1.4	3	0		22.45	22.39	22.57
1.4	3	1		22.49	22.55	22.58
1.4	3	3		22.54	22.59	22.64
1.4	6	0		21.86	21.85	21.79
1.4	1	0	16-QAM	22.04	22.03	22.04
1.4	1	3		21.95	21.98	21.80
1.4	1	5		21.98	22.02	21.90
1.4	3	0		22.01	21.95	21.69
1.4	3	1		21.96	21.86	21.62
1.4	3	3		22.03	21.83	21.65
1.4	6	0		21.01	20.91	20.69



Appendix B. Test Results of ERP and Radiated Test

ERP

<Report Only>

LTE Band 26 / 15MHz (Channel 26765) (GT - LC = 1.39 dB)							
Channel	Mode	RB		Conducted		ERP	
		Size	Offset	Power (dBm)	Power (Watts)	ERP(dBm)	ERP(W)
Lowest	QPSK	1	0	22.85	0.19	22.09	0.16
Middle		-	-	-	-	-	-
Highest		-	-	-	-	-	-
Lowest	16QAM	1	37	22.03	0.16	21.27	0.13
Middle		-	-	-	-	-	-
Highest		-	-	-	-	-	-
Limit	ERP < 7W			Result		PASS	

Radiated Spurious Emission

LTE Band 26 / 10MHz / QPSK								
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	1629.18	-53.58	-13	-40.58	-60.55	1.58	10.70	H
	2444.00	-46.29	-13	-33.29	-54.54	2.102	12.50	H
	3258.00	-54.27	-13	-41.27	-63.16	2.856	13.90	H
	1630.00	-50.09	-13	-37.09	-57.06	1.58	10.70	V
	2443.77	-46.77	-13	-33.77	-55.02	2.10	12.50	V
	3258.00	-58.57	-13	-45.57	-67.46	2.86	13.90	V

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