SGS-CSTC Standards Technical Services Co., Ltd.
Guangzhou Branch

198 Kezhu Road, Scientech Park, Guangzhou Economic & Technological Development District, Guangzhou, China 510663
Telephone: +86 (0) 20 82155555
Fax: +86 (0) 20 82075059
Email: ee.guangzhou@sgs.com

TEST REPORT

Application No.:	GZEM1502000657CR
Applicant:	LUDA Elektronik AB
Manufacturer:	Same as the applicant.
FCC ID:	QKC2007
Product Description:	machineCam
Model No.:	2007+3008
Standards:	CFR 47 PART 15 Subpart C: 2014 section 15.249
Date of Receipt:	2015-02-12
Date of Test:	2015-03-07 to 2015-03-24
Date of Issue:	2015-07-16
Test Result :	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Jerry Chan
Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2015-07-16		Original

Authorized for issue by:				
Tested By		**(Jack Liang) / Project Engineer**		2015-03-07 to 2015-03-24 **Date**
Prepared By		**(June Chen) / Clerk**		2015-03-31 **Date**
Checked By		**(Jerry Chan) / Reviewer**		2015-03-31 **Date**

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3 Test Summary

Test	Test Requirement	Test method	Result
Field Strength of Fundamental	FCC PART 15 C section 15.249 (a)	ANSI C63.10: Clause 6.6	PASS
Field Strength of Unwanted Emissions	FCC PART 15 C section 15.249 (a) section 15.249 (d)	ANSI C63.10: Clause 6.4, 6.6 and 6.7	PASS
Band Edges	FCC PART 15 C section 15.249 (d)	ANSI C63.10: Clause 6.9.2	PASS
Occupied Bandwidth	FCC PART 15 C section 15.215(c)	ANSI C63.10: Clause 6.9.1	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207	ANSI C63.10: Clause 6.2	PASS

Remark:
EUT: In this whole report EUT means Equipment Under Test.
Tx: In this whole report Tx (or tx) means Transmitter.
Rx: In this whole report Rx (or rx) means Receiver.
RF: In this whole report RF means Radio Frequency.
ANSI C63.10: the detail version is ANSI C63.10:2013 in the whole report.

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4 Contents

1 Cover Page 1

2 Version 2

3 Test Summary 3

4 Contents 4

5 General Information 5

5.1 Client Information 5
5.2 General Description of E.U.T. 5
5.3 Details of E.U.T. 5
5.4 Description of Support Units 5
5.5 Other Information Requested by the Customer 5
5.6 Deviation from Standards 5
5.7 Test Location 6

6 Equipment List 8

7 Test Results 9

7.1 E.U.T. Operation 9
7.2 Antenna Requirement 11
7.3 Field Strength of Fundamental& Field Strength of Unwanted Emissions& Band Edge 12
7.4 Occupied Bandwidth 27
7.5 Conducted Emissions at Mains Terminals 150 kHz to 30 MHz 29

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5 General Information

5.1 Client Information

Applicant:	LUDA Elektronik AB
Address of Applicant:	Krokslätts Fabriker 30, 431 37 Mölndal, Sweden
Manufacturer:	Same as the applicant.
Address of Manufacturer:	Same as the applicant.

5.2 General Description of E.U.T.

Product Description:	machineCam
Model No.:	2007+3008

5.3 Details of E.U.T.

Operating Frequency	2406 MHz to 2472.5MHz
Type of Modulation:	GFSK
Number of Channels	20
Channel Separation:	3.5MHz
Antenna Type	Integral
Antenna gain:	3.0 dBi
Function:	Farm machine monitoring system which allows the driver to keep an eye on the machine (cultivator, harvester, baler etc.) connected to the tractor while driving.
Power Supply:	DC 24V
Power cord:	N/A

5.4 Description of Support Units

The EUT has been test with DC power supplied by SGS.

5.5 Other Information Requested by the Customer

None.

5.6 Deviation from Standards

Biconical and log periodic antennas were used instead of dipole antennas.

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5.7 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663
Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

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5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **NVLAP (Lab Code: 200611-0)**

  SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

  The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **ACMA**

  SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our NVLAP accreditation.

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

  Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

  SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

- **FCC (Registration No.: 282399)**

  SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 282399, May 31, 2002.

- **Industry Canada (Registration No.: 4620B-1)**

  The 3m/10m Alternate Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Certification and Engineering of Industry Canada for radio equipment testing with Registration No. 4620B-1.

- **VCCI (Registration No.: R-2460, C-2584, G-449 and T-1179)**

  The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co. Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2460, C-2584，G-449 and T-1179 respectively.

- **CBTL (Lab Code: TL129)**

  SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, the Basic Rules, IECEE 01:2006-10 and Rules of procedure IECEE 02:2006-10, and the relevant IECEE CB-Scheme Operational documents.

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6 Equipment List

RE in Chamber						
No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. date (YYYY-MM-DD)	Cal.Due date (YYYY-MM-DD)
EMC0525	Compact Semi-Anechoic Chamber	ChangZhou ZhongYu	N/A	N/A	2014-12-5	2015-12-5
EMC0522	EMI Test Receiver	Rohde & Schwarz	ESIB26	100283	2015-03-02	2016-03-02
EMC0056	EMI Test Receiver	Rohde & Schwarz	ESCI	100236	2015-04-07	2016-04-07
EMC0528	RI High frequency Cable	SGS	20 m	N/A	2014-04-19	2016-04-19
EMC2025	Trilog Broadband Antenna 30-1000MHz	SCHWARZBECK MESS-ELEKTRONIK	VULB 9160	9160-3372	2014-07-14	2017-07-14
EMC0524	Bi-log Type Antenna	Schaffner -Chase	CBL6112B	2966	2013-08-31	2016-08-31
EMC0519	Bilog Type Antenna	Schaffner -Chase	CBL6143	5070	2014-05-04	2017-05-04
EMC2026	Horn Antenna 1-18GHz	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	9120D-841	2013-08-31	2016-08-31
EMC0521	1-26.5 GHz Pre-Amplifier	Agilent	8449B	3008A01649	2015-03-02	2016-03-02
EMC2065	Amplifier	HP	8447F	N/A	2014-08-25	2015-08-25
EMC0075	310N Amplifier	Sonama	310N	272683	2015-03-02	2016-03-02
EMC0523	Active Loop Antenna	EMCO	6502	42963	2014-03-03	2016-03-03
EMC2041	Broad-Band Horn Antenna (14)15-26.5(40)GHz	SCHWARZBECK MESS-ELEKTRONI	BBHA 9170	9170-375	2014-05-26	2017-05-26
EMC2079	High Pass Filter(915MHz)	FSY MICROWAVE	HM1465-9SS	009	2015-03-02	2016-03-02
EMC2069	2.4GHz filter	Micro-Tronics	BRM 50702	149	2015-03-02	2016-03-02
EMC0530	10m Semi-Anechoic Chamber	ETS	N/A	N/A	2014-05-03	2016-05-03

General used equipment						
No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. date (YYYY-MM-DD)	Cal.Due date (YYYY-MM-DD)
EMC0006	DMM	Fluke	73	70681569	2014-09-15	2015-09-15
EMC0007	DMM	Fluke	73	70671122	2014-09-15	2015-09-15

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7 Test Results

7.1 E.U.T. Operation

Test Voltage: DC 24V

Temperature: 20.0 -25.0 °C

Humidity: 38-50 % RH

Atmospheric Pressure: 1000 -1010 mbar

Test frequencies and frequency range: According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

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EUT channels and frequencies list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2406	10	2441
1	2409.5	11	2444.5
2	2413	12	2448
3	2416.5	13	2451.5
4	2420	14	2455
5	2423.5	15	2458.5
6	2427	16	2462
7	2430.5	17	2465.5
8	2434	18	2469
9	2437.5	19	2472.5

Test frequencies are the lowest channel: 0 channel(2406 MHz), middle channel: 10 channel(2441 MHz) and highest channel: 19 channel(2472.5 MHz)

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7.2 Antenna Requirement

Standard requirement

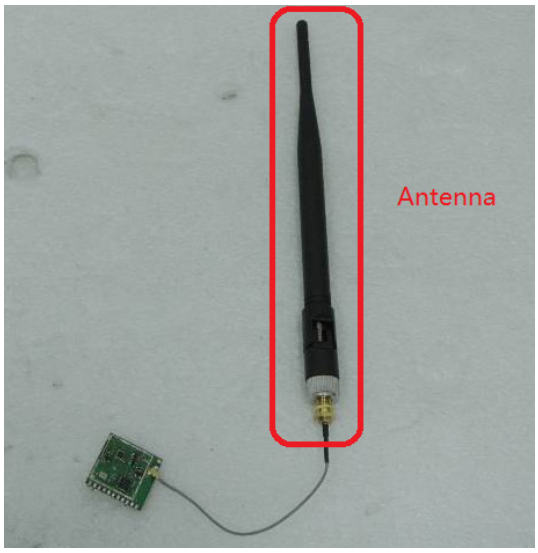
15.203 requirement:

For intentional device. According to 15.203. an intentional radiator shall be designed to

Ensure that no antenna other than that furnished by the responsible party shall be used with the device.

EUT Antenna

The antenna is an ISM Band Planar Chip Antenna integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 3.0 dBi.



Test result: The unit does meet the FCC requirements.

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7.3 Field Strength of Fundamental& Field Strength of Unwanted Emissions& Band Edge

Test Requirement: FCC Part15 C section 15.249

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBμV/m @ 3m)	Field Strength of Harmonics (dBμV/m @ 3m)
902 to 928	94.0	54.0
2400 to 2483.5	94.0	54.0
5725 to 5875	94.0	54.0
24000 to 24250	108.0	68.0

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Limits: The fundamental frequency rang is in the frequency band of the EUT is 2406MHz ~ 2472.5MHz.

The limit for Average field strength dBμV/m for the fundamental frequency = 94.0 dBμV/m.

The limit for Peak field strength dBμV/m for the fundamental frequency = 114.0 dBμV/m.

No fundamental is allowed in the restricted bands.

The limit for average field strength dBμV/m for the harmonics = 54.0 dBμV/m.

The limit for peak field strength dBμV/m for the harmonics = 74.0 dBμV/m.

Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or 54.0 dBμV/m in 15.209. Here the limit for the other emission is 54.0 dBμV/m.

Test Method: ANSI C63.10: Clause 6.4, 6.6 and 6.7 for Field Strength of Fundamental& Field Strength of Unwanted Emissions

Status: Pre-test the EUT in continuous transmitting mode with setup as stand-alone in X, Y, Z threes axes, found the worst case is X axes and report the data.

Measurement Distance: 3m (Semi-Anechoic Chamber)

Frequency range: 9 kHz – 25 GHz for transmitting mode.

Test instrumentation resolution bandwidth
9 kHz (9 kHz - 30 MHz), 120 kHz (30 MHz - 1000 MHz), 1 MHz (1000 MHz – 25 GHz)

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Test Procedure:

1)9 kHz to 30 MHz emissions:

For testing performed with the loop antenna, testing was performed in accordance to ANSI C63.10. The centre of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specified distance from the EUT, During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane.

2)30 MHz to 1 GHz emissions:

For testing performed with the bi-log type antenna, testing was performed in accordance to ANSI C63.10. The measurement is performed with the EUT rotated 360º, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

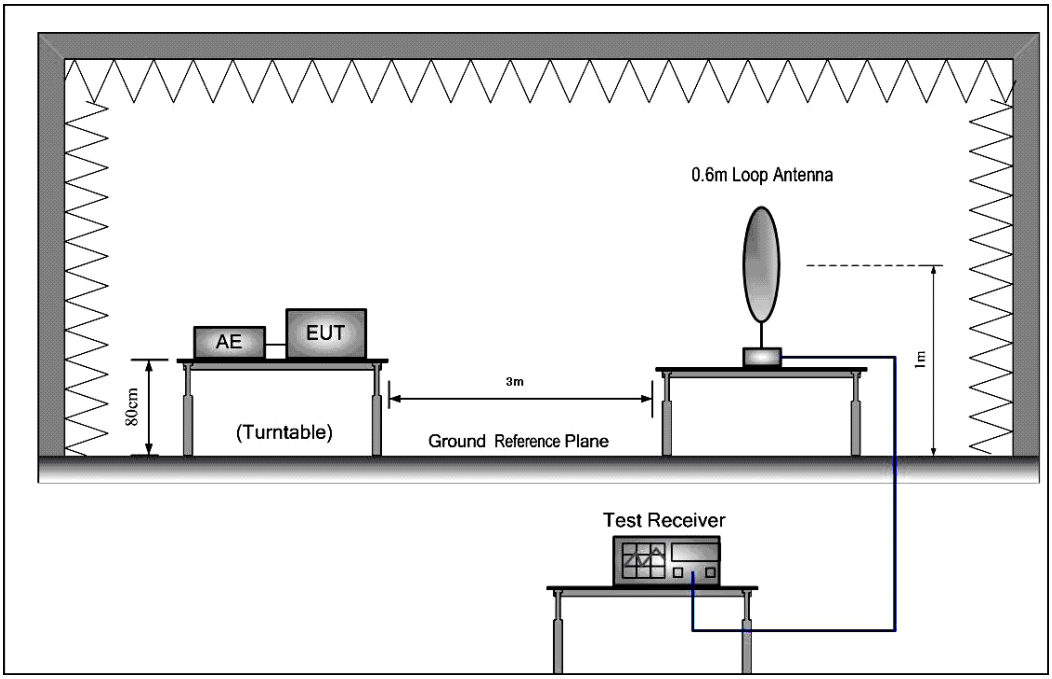
3)1 GHz to 25 GHz emissions:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2007 was used to perform radiated emission test above 1 GHz.

For testing performed with the horn antenna, testing was performed in accordance to ANSI C63.10. The measurement is performed with the EUT rotated 360º, the antenna height scan between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

Test Configuration:

1) 9 kHz to 30 MHz emissions:



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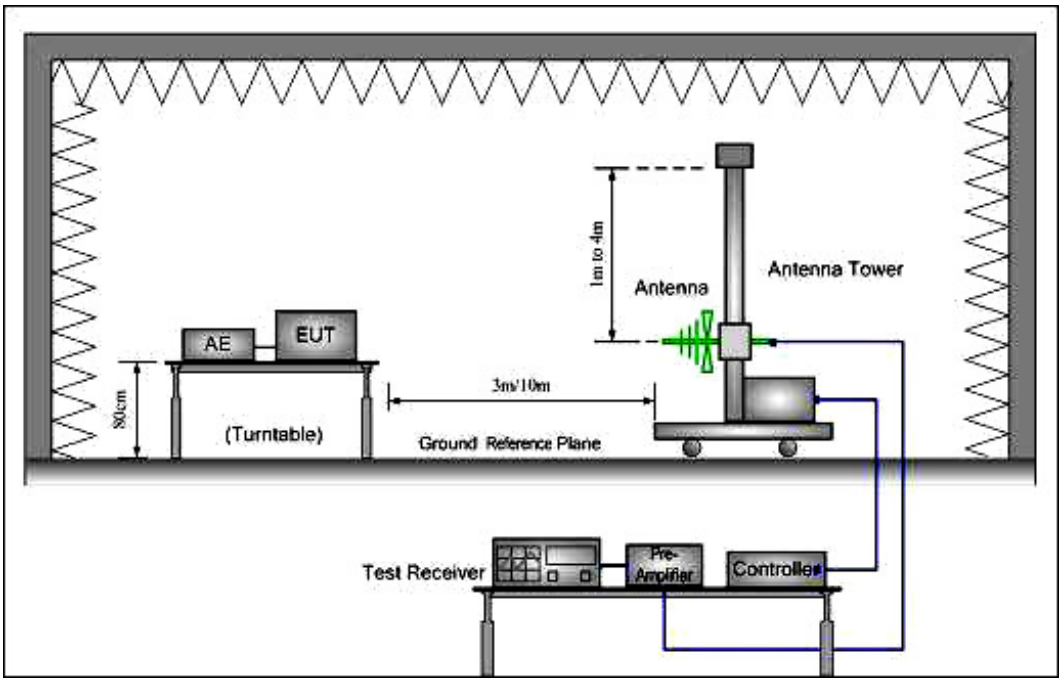
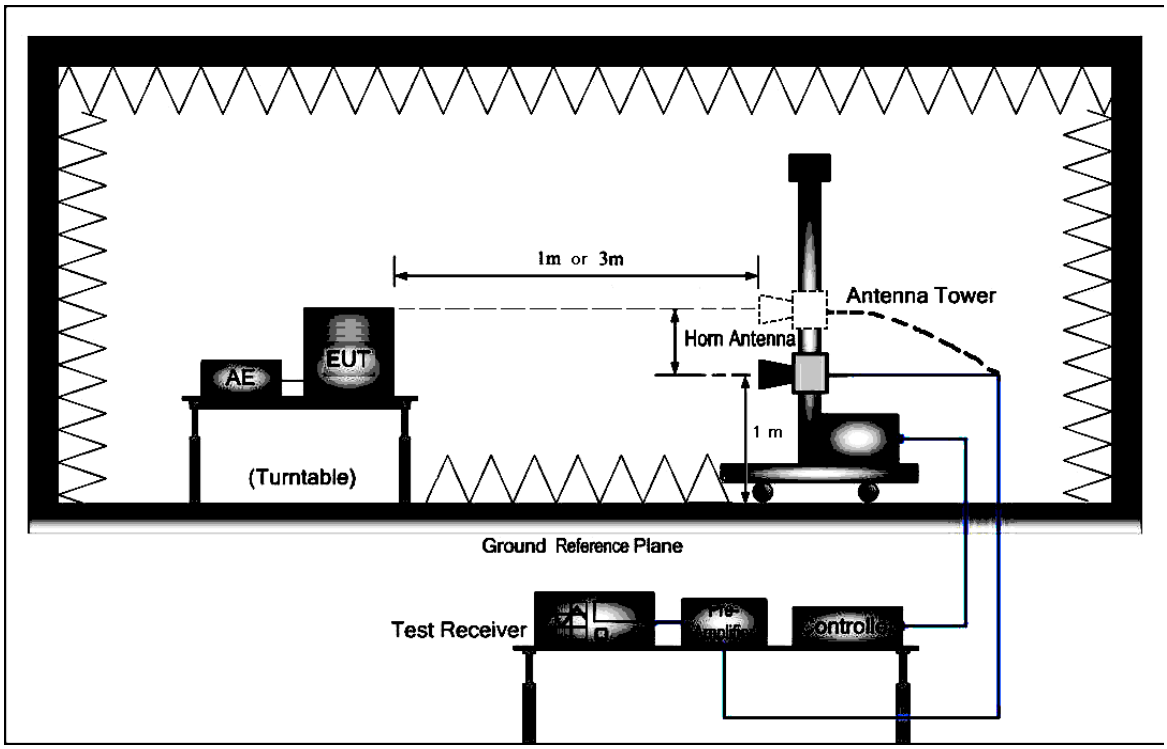
2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 25 GHz emissions:



The field strength is calculated by adding the Antenna Factor, Cable Loss & Per-amplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Loss – Preamplifier Factor

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Test at low Channel in transmitting status

9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

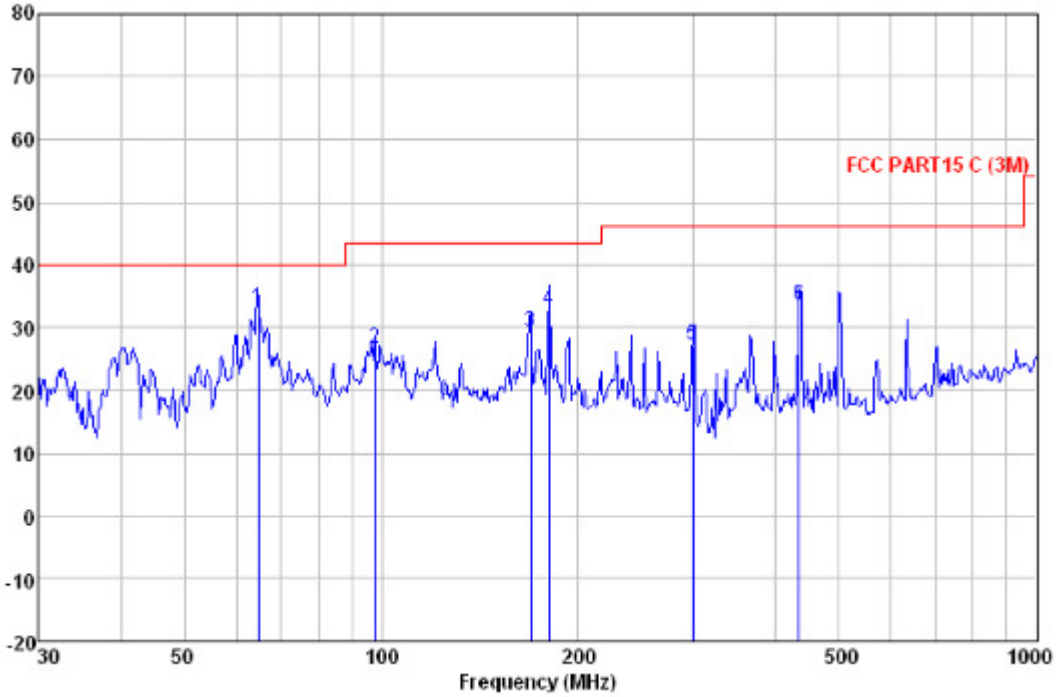
The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Field Strength of Unwanted Emissions.Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
64.887	50.66	12.34	1.15	31.00	33.15	40.00	-6.85	QP
97.798	46.20	10.04	1.38	31.00	26.62	43.50	-16.88	QP
169.005	45.33	13.36	1.80	31.08	29.41	43.50	-14.09	QP
180.017	49.74	12.35	1.85	31.09	32.85	43.50	-10.65	QP
298.268	42.75	13.17	2.40	31.00	27.32	46.00	-18.68	QP
434.065	45.50	16.07	2.87	30.94	33.50	46.00	-12.50	QP

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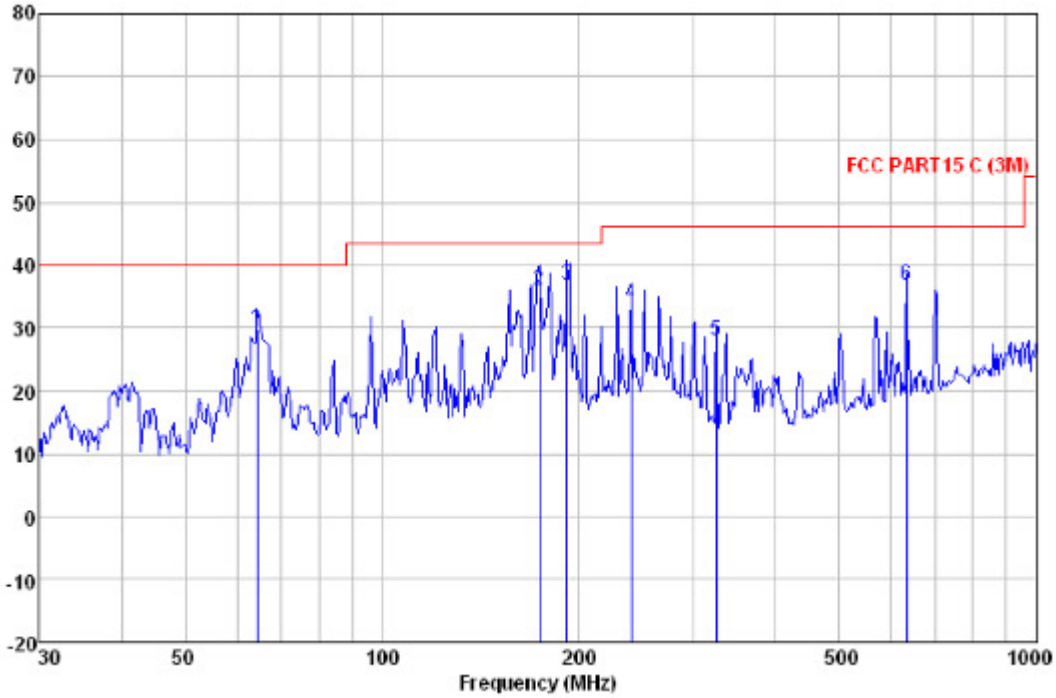
Horizontal:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
64.433	47.27	12.37	1.14	31.00	29.78	40.00	-10.22	QP
173.814	52.21	12.96	1.82	31.09	35.90	43.50	-7.60	QP
191.745	55.14	11.00	1.88	31.10	36.92	43.50	-6.58	QP
239.987	51.24	11.71	2.05	31.05	33.95	46.00	-12.05	QP
324.456	42.91	13.73	2.46	30.98	28.12	46.00	-17.88	QP
633.907	45.10	19.32	3.27	30.90	36.79	46.00	-9.21	QP

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1~25 GHz Field Strength of Fundamental & Field Strength of Unwanted Emissions.

Peak & Average Measurement

Peak Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2406.00	27.58	8.17	38.25	88.28	85.78	114.00	V
4812.00	31.53	11.11	38.57	41.49	45.56	74.00	V
7218.00	36.47	13.34	38.84	36.89	47.86	74.00	V
9624.00	38.08	14.61	39.70	40.15	53.14	74.00	V
2406.00	27.58	8.17	38.25	76.72	74.22	114.00	H
4812.00	31.53	11.11	38.57	42.59	46.66	74.00	H
7218.00	36.47	13.34	38.84	38.29	49.26	74.00	H
9624.00	38.08	14.61	39.70	39.68	52.67	74.00	H
Average Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2406.00	27.58	8.17	38.25	73.17	70.67	94.00	V
4812.00	31.53	11.11	38.57	32.10	36.17	54.00	V
7218.00	36.47	13.34	38.84	29.56	40.53	54.00	V
9624.00	38.08	14.61	39.70	26.48	39.47	54.00	V
2406.00	27.58	8.17	38.25	67.15	64.65	94.00	H
4812.00	31.53	11.11	38.57	34.46	38.53	54.00	H
7218.00	36.47	13.34	38.84	29.81	40.78	54.00	H
9624.00	38.08	14.61	39.70	32.22	45.21	54.00	H

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Band Edge:

Peak Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2400.00	27.63	8.17	38.25	44.86	42.41	74.00	V
2483.50	27.55	8.28	38.26	44.62	42.19	74.00	V
2400.00	27.63	8.17	38.25	47.09	44.64	74.00	H
2483.50	27.55	8.28	38.26	47.90	45.47	74.00	H
verage Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2400.00	27.63	8.17	38.25	39.53	37.08	54.00	V
2483.50	27.55	8.28	38.26	37.01	34.58	54.00	V
2400.00	27.63	8.17	38.25	42.48	40.03	54.00	H
2483.50	27.55	8.28	38.26	39.48	37.05	54.00	H

Measured emission about other frequencies except above frequency points were greater than 20dB below the limit, so the test data was not recorded in the test report.

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Test at middle Channel in transmitting status

9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

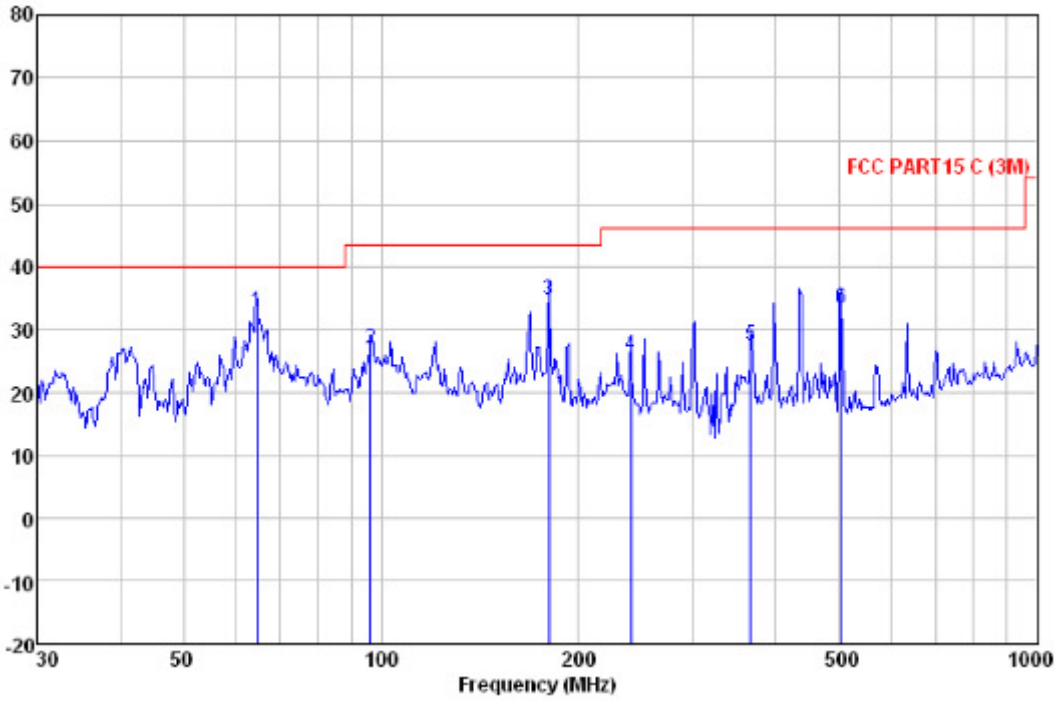
The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Field Strength of Unwanted Emissions.Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
64.887	50.37	12.34	1.15	31.00	32.86	40.00	-7.14	QP
96.436	46.76	9.88	1.36	31.00	27.00	43.50	-16.50	QP
180.017	51.68	12.35	1.85	31.09	34.79	43.50	-8.71	QP
239.987	43.11	11.71	2.05	31.05	25.82	46.00	-20.18	QP
365.539	41.32	14.50	2.71	30.93	27.60	46.00	-18.40	QP
502.940	44.04	17.09	3.10	31.00	33.23	46.00	-12.77	QP

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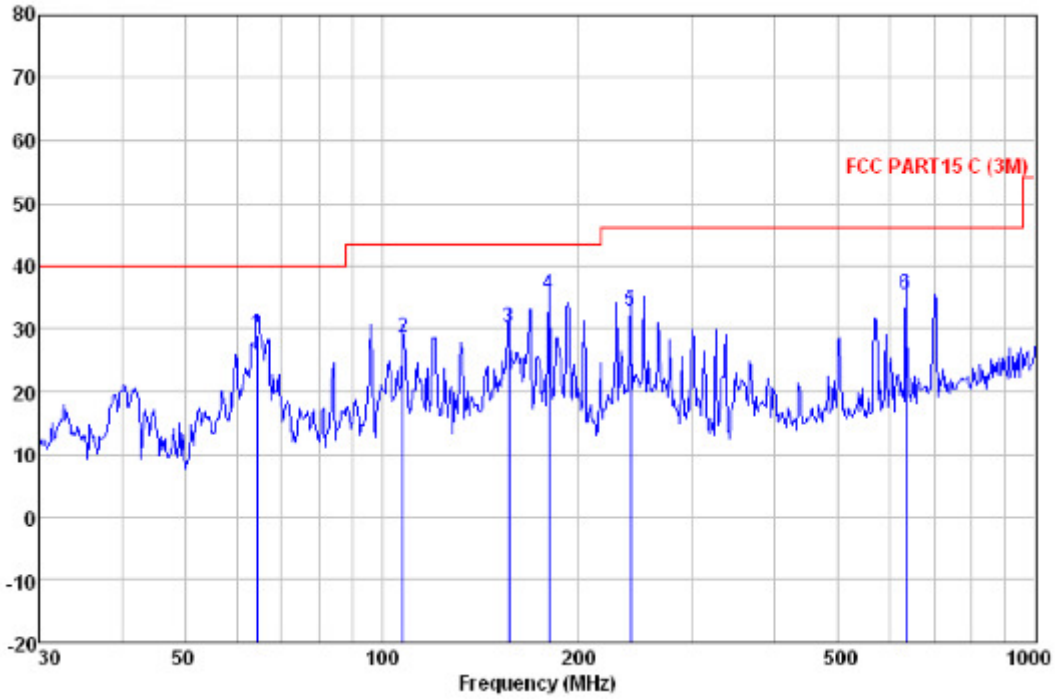
Horizontal:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
64.433	46.67	12.37	1.14	31.00	29.18	40.00	-10.82	QP
107.888	47.22	10.95	1.42	31.01	28.58	43.50	-14.92	QP
156.458	45.55	13.89	1.71	31.07	30.08	43.50	-13.42	QP
180.017	52.42	12.35	1.85	31.09	35.53	43.50	-7.97	QP
239.987	50.17	11.71	2.05	31.05	32.88	46.00	-13.12	QP
633.907	43.71	19.32	3.27	30.90	35.40	46.00	-10.60	QP

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1~25 GHz Field Strength of Fundamental & Field Strength of Unwanted Emissions.

Peak & Average Measurement

Peak Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2441.00	27.56	8.24	38.26	84.11	81.65	114.00	V
4882.00	31.59	11.21	38.56	43.23	47.47	74.00	V
7323.00	36.51	13.39	38.89	38.34	49.35	74.00	V
9764.00	38.61	14.79	39.76	41.24	54.88	74.00	V
2441.00	27.56	8.24	38.26	87.66	85.20	114.00	H
4882.00	31.59	11.21	38.56	43.86	48.10	74.00	H
7323.00	36.51	13.39	38.89	40.13	51.14	74.00	H
9764.00	38.61	14.79	39.76	38.52	52.16	74.00	H
Average Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2441.00	27.56	8.24	38.26	67.40	64.94	94.00	V
4882.00	31.59	11.21	38.56	35.65	39.89	54.00	V
7323.00	36.51	13.39	38.89	32.31	43.32	54.00	V
9764.00	38.61	14.79	39.76	32.05	45.69	54.00	V
2441.00	27.56	8.24	38.26	68.45	65.99	94.00	H
4882.00	31.59	11.21	38.56	35.40	39.64	54.00	H
7323.00	36.51	13.39	38.89	30.80	41.81	54.00	H
9764.00	38.61	14.79	39.76	29.77	43.41	54.00	H

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Band Edge:

Peak Measurement:							
Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
2400.00	27.63	8.17	38.25	45.71	43.26	74.00	V
2483.50	27.55	8.28	38.26	46.34	43.91	74.00	V
2400.00	27.63	8.17	38.25	44.36	41.91	74.00	H
2483.50	27.55	8.28	38.26	45.24	42.81	74.00	H
Average Measurement:							
Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
2400.00	27.63	8.17	38.25	37.93	35.48	54.00	V
2483.50	27.55	8.28	38.26	40.32	37.89	54.00	V
2400.00	27.63	8.17	38.25	36.14	33.69	54.00	H
2483.50	27.55	8.28	38.26	33.72	31.29	54.00	H

Measured emission about other frequencies except above frequency points were greater than 20dB below the limit, so the test data was not recorded in the test report.

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Test at high Channel in transmitting status

9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

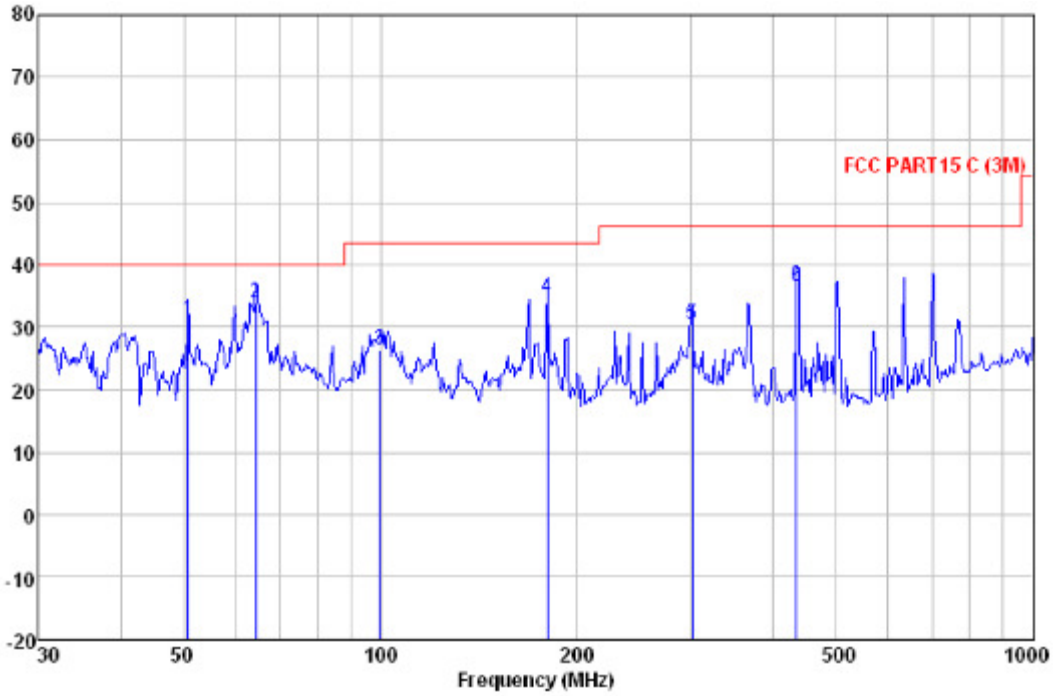
The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~1 GHz Field Strength of Unwanted Emissions.Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
50.764	48.54	12.55	1.10	31.00	31.19	40.00	-8.81	QP
64.433	51.49	12.37	1.14	31.00	34.00	40.00	-6.00	QP
99.878	45.77	10.24	1.40	31.00	26.41	43.50	-17.09	QP
180.017	51.44	12.35	1.85	31.09	34.55	43.50	-8.95	QP
300.367	45.92	13.19	2.40	31.00	30.51	46.00	-15.49	QP
434.065	48.60	16.07	2.87	30.94	36.60	46.00	-9.40	QP

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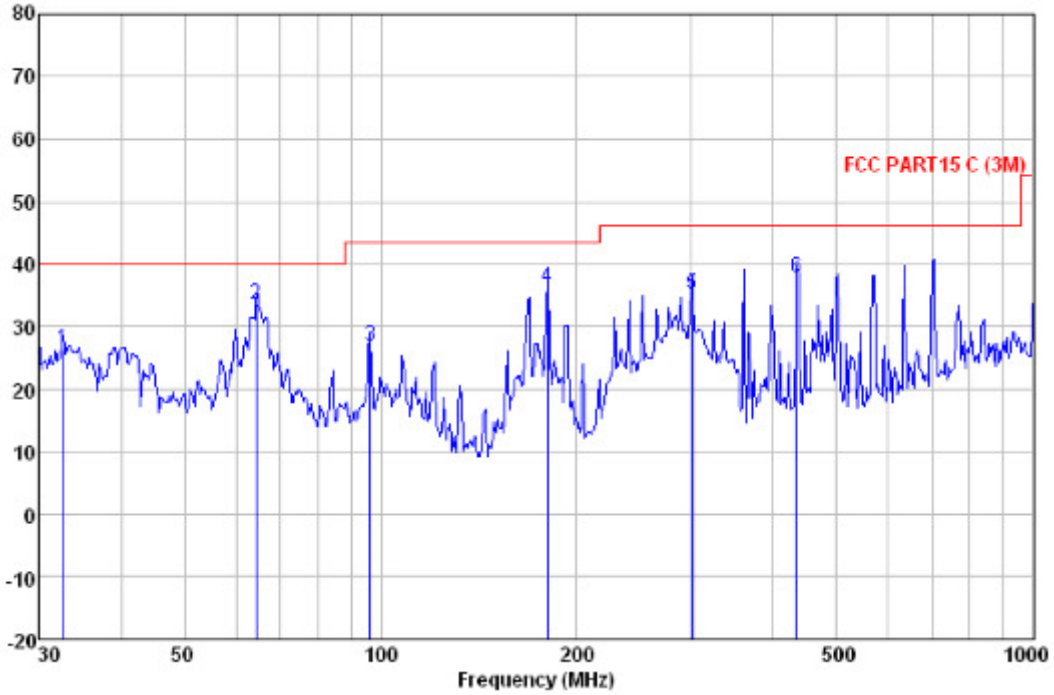
Horizontal:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
32.634	44.37	12.23	0.86	31.02	26.44	40.00	-13.56	QP
64.433	51.08	12.37	1.14	31.00	33.59	40.00	-6.41	QP
96.436	46.56	9.88	1.36	31.00	26.80	43.50	-16.70	QP
180.017	53.13	12.35	1.85	31.09	36.24	43.50	-7.26	QP
300.367	50.71	13.19	2.40	31.00	35.30	46.00	-10.70	QP
434.065	49.81	16.07	2.87	30.94	37.81	46.00	-8.19	QP

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1~25 GHz Field Strength of Fundamental & Field Strength of Unwanted Emissions.

Peak & Average Measurement

Peak Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2472.50	27.56	8.28	38.26	89.28	86.86	114.00	V
4945.00	31.70	11.27	38.56	42.55	46.96	74.00	V
7417.50	36.60	13.42	38.91	38.31	49.42	74.00	V
9890.00	38.65	14.86	39.78	40.18	53.91	74.00	V
2472.50	27.56	8.28	38.26	87.04	84.62	114.00	H
4945.00	31.70	11.27	38.56	39.75	44.16	74.00	H
7417.50	36.60	13.42	38.91	36.51	47.62	74.00	H
9890.00	38.65	14.86	39.78	38.51	52.24	74.00	H
Average Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2472.50	27.56	8.28	38.26	68.01	65.59	94.00	V
4945.00	31.70	11.27	38.56	33.71	38.12	54.00	V
7417.50	36.60	13.42	38.91	27.24	38.35	54.00	V
9890.00	38.65	14.86	39.78	33.71	47.44	54.00	V
2472.50	27.56	8.28	38.26	69.07	66.65	94.00	H
4945.00	31.70	11.27	38.56	30.23	34.64	54.00	H
7417.50	36.60	13.42	38.91	27.21	38.32	54.00	H
9890.00	38.65	14.86	39.78	27.21	40.94	54.00	H

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Band Edge:

Peak Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2400.00	27.63	8.17	38.25	46.36	43.91	74.00	V
2483.50	27.55	8.28	38.26	46.52	44.09	74.00	V
2400.00	27.63	8.17	38.25	42.95	40.50	74.00	H
2483.50	27.55	8.28	38.26	45.82	43.39	74.00	H
Average Measurement:							
Frequency (MHz)	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Reading Level (dBμV)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Antenna polarization**
2400.00	27.63	8.17	38.25	36.38	33.93	54.00	V
2483.50	27.55	8.28	38.26	36.85	34.42	54.00	V
2400.00	27.63	8.17	38.25	36.30	33.85	54.00	H
2483.50	27.55	8.28	38.26	35.90	33.47	54.00	H

Measured emission about other frequencies except above frequency points were greater than 20dB below the limit, so the test data was not recorded in the test report.

Remark:

1). The field strength is calculated by adding the Antenna Factor. Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Loss –Preamplifier Factor.

2). As shown in Section, for frequencies above 1000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

3). The test only perform the EUT in transmitting status since the test frequencies were over 1GHz only required transmitting status.

4). For Radiated Emissions fall in the restricted bands (2400MHz is worse case than 2390MHz and report it as above), which set out in Section 15.205 Restricted bands.

Also there is not any other emission which falls in restricted bands can be detected and reported.

Test result: The unit does meet the FCC requirements.

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7.4 Occupied Bandwidth

Test Requirement: FCC Part 15 C section 15.249

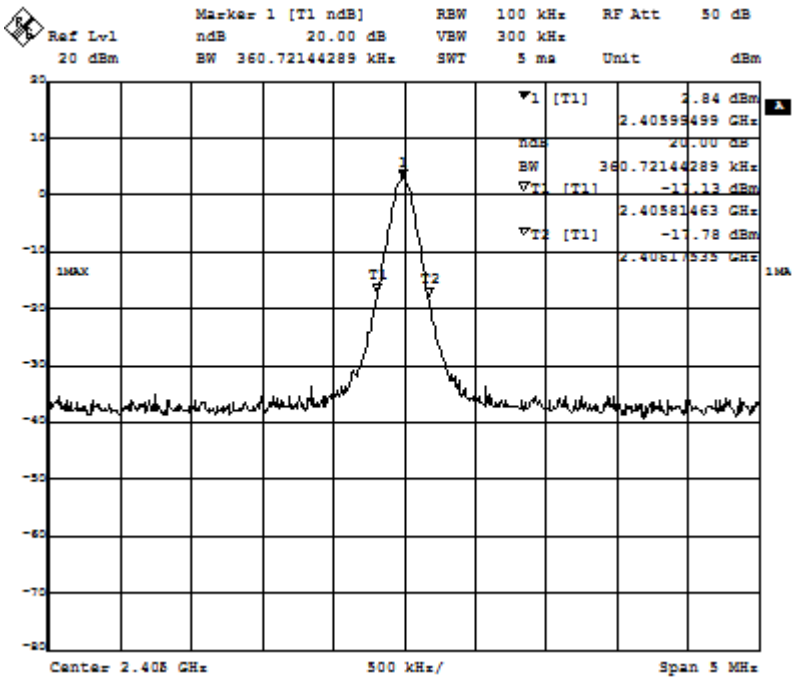
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Test Method: ANSI C63.10: Clause 6.9.1

Operation within the band 2.400 to 2.4835 GHz

Method of measurement: A small sample of the transmitter output was fed into the Spectrum Analyzer and the attached plot was taken.

1.Test in the lowest frequency 2.406 GHz



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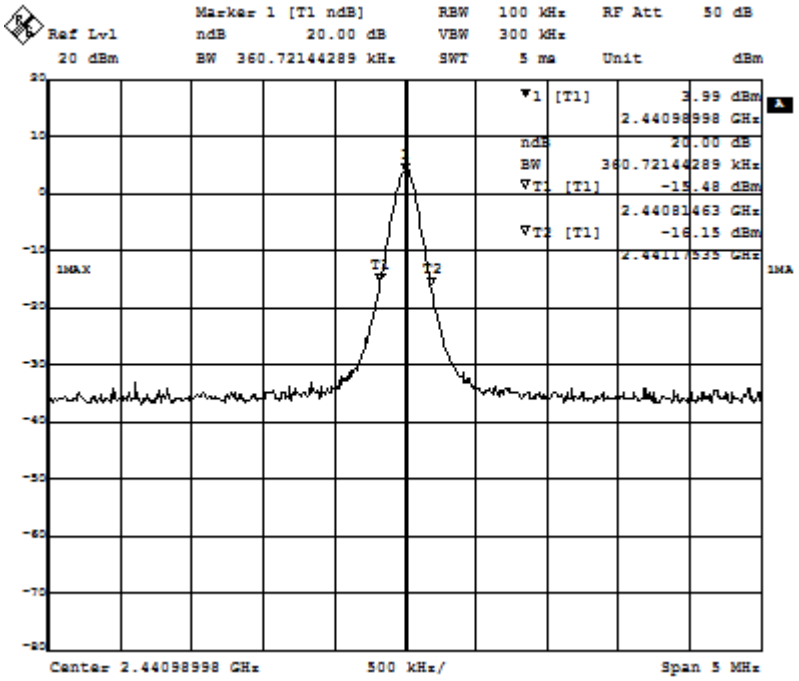
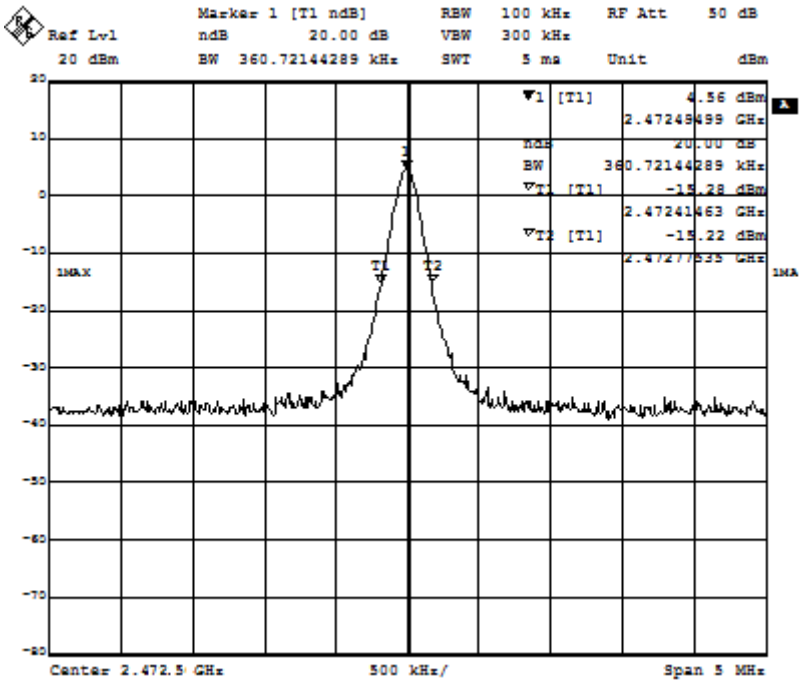
2.Test in the middle frequency 2.441 GHz



3.Test in the highest frequency 2.472.5 GHz



The results: The unit does meet the FCC requirements.

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7.5 Conducted Emissions at Mains Terminals 150 kHz to 30 MHz

Test Requirement: FCC Part 15 C section 15.207

Test Method: ANSI C63.10: Clause 6.2

Frequency Range: 150 kHz to 30 MHz

Detector: Peak for pre-scan (9 kHz Resolution Bandwidth)

Test Limit

Limits for conducted disturbance at the mains ports of class B

Frequency Range (MHz)	Class B Limit dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
NOTE 1 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

EUT Operation: Test in normal operating mode. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

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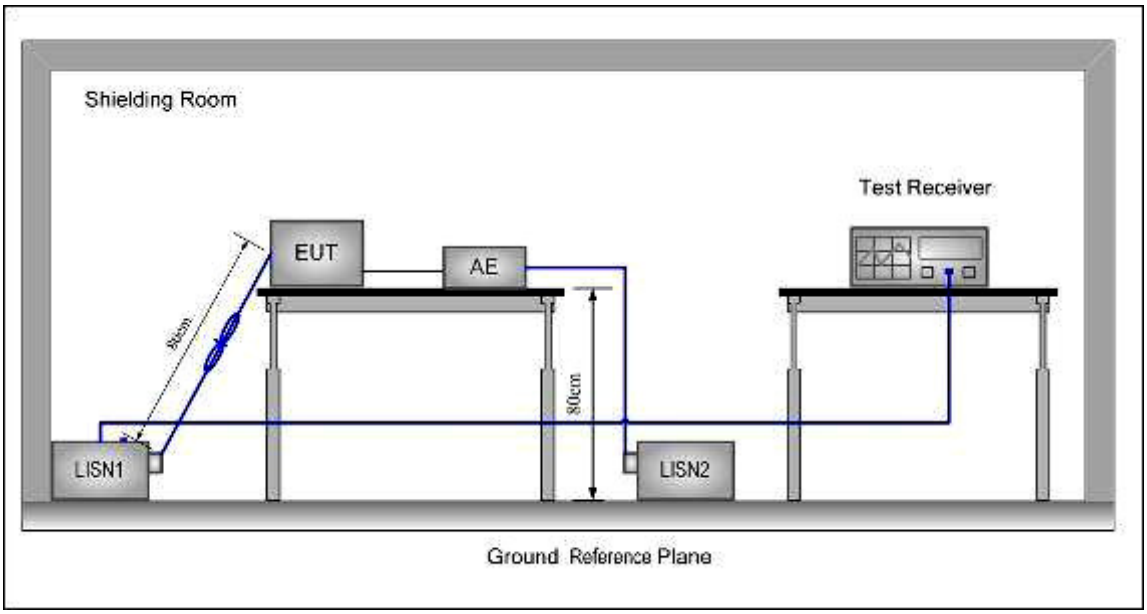
Test Configuration:



Test procedure:

1. The mains terminal disturbance voltage test was conducted in a shielded room.

2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

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Measurement Data

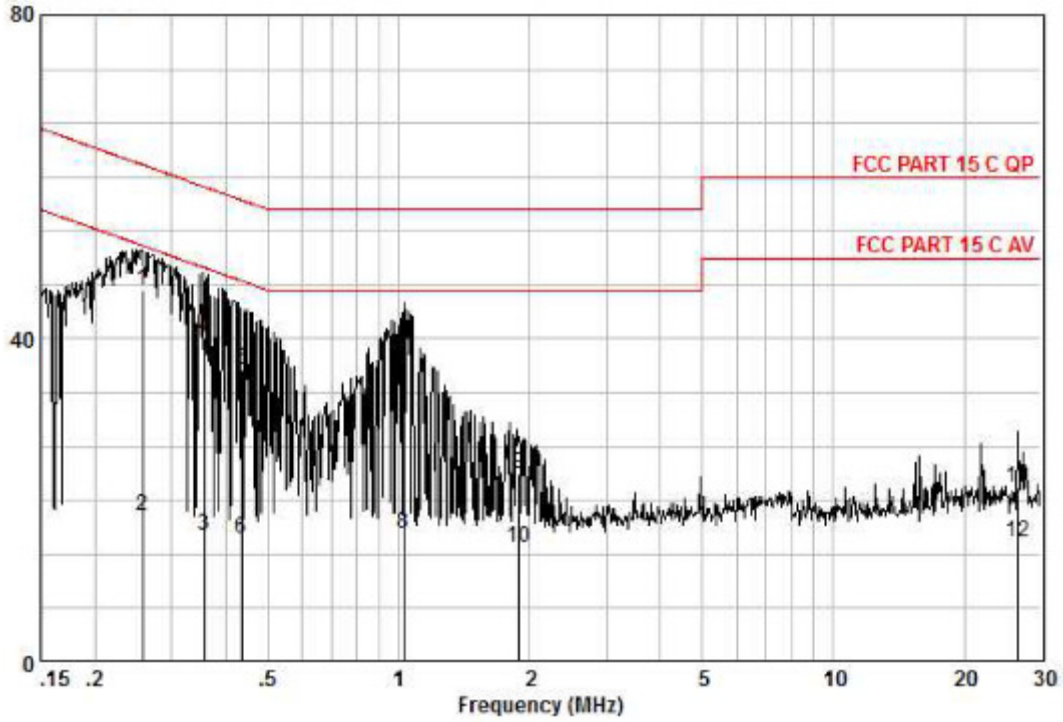
An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected. For EUT the communicating was worst case mode.

The following Quasi-Peak and Average measurements were performed on the EUT:

Neutral Line

Level(dB μ V)



Measure data:

Freq	Read Level	Cable Loss	LISN Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB	dB	dBuV	dBuV	dB	
0,258	36,33	0,07	9,66	46,06	61,51	-15,45	QP
0,258	8,27	0,07	9,66	18,00	51,51	-33,51	AVERAGE
0,358	6,03	0,05	9,66	15,74	48,78	-33,04	AVERAGE
0,358	30,37	0,05	9,66	40,08	58,78	-18,70	QP
0,435	26,50	0,04	9,66	36,20	57,15	-20,95	QP
0,435	5,63	0,04	9,66	15,33	47,15	-31,82	AVERAGE
1,027	25,77	0,00	9,68	35,45	56,00	-20,55	QP
1,027	6,18	0,00	9,68	15,86	46,00	-30,14	AVERAGE
1,888	13,55	0,08	9,69	23,32	56,00	-32,68	QP
1,888	4,41	0,08	9,69	14,18	46,00	-31,82	AVERAGE
26,558	10,58	0,47	10,52	21,57	60,00	-38,43	QP
26,558	3,92	0,47	10,52	14,91	50,00	-35,09	AVERAGE

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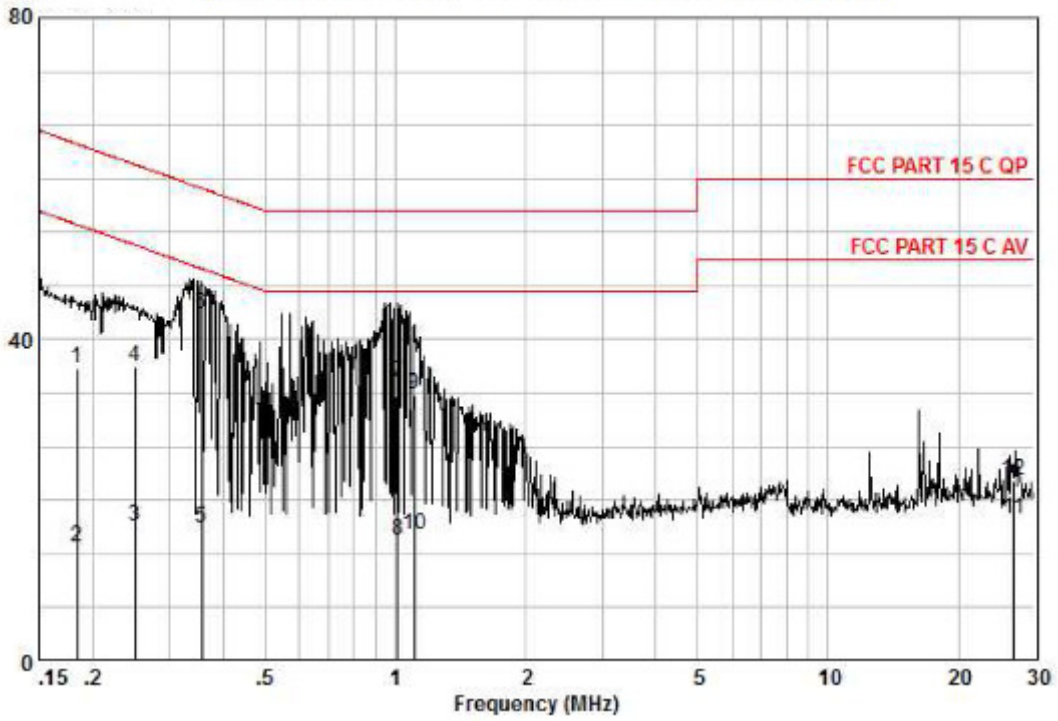
Live Line
Level(dBμV)



Measure result:

Freq	Read Level	Cable Loss	LISN Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB	dB	dBuV	dBuV	dB	
0,183	26,63	0,09	9,60	36,32	64,33	-28,01	QP
0,183	4,57	0,09	9,60	14,26	54,33	-40,07	AVERAGE
0,251	7,03	0,07	9,60	16,70	51,73	-35,03	AVERAGE
0,251	26,95	0,07	9,60	36,62	61,73	-25,11	QP
0,358	6,88	0,05	9,68	16,62	48,78	-32,17	AVERAGE
0,358	33,39	0,05	9,68	43,13	58,78	-15,66	QP
1,010	25,00	0,00	9,70	34,70	56,00	-21,30	QP
1,010	5,44	0,00	9,70	15,14	46,00	-30,86	AVERAGE
1,106	23,47	0,01	9,70	33,18	56,00	-22,82	QP
1,106	5,88	0,01	9,70	15,59	46,00	-30,41	AVERAGE
26,841	6,87	0,47	10,42	17,76	50,00	-32,24	AVERAGE
26,841	11,60	0,47	10,42	22,49	60,00	-37,51	QP

--End of the report--

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