



Test Report No.: FV180928W002



# EMC TEST REPORT

Applicant:	HMD Global Oy
Address:	Bertel Jungin aukio 9, 02600 Espoo, Finland

Manufacturer or Supplier:	HMD Global Oy
Address:	Bertel Jungin aukio 9, 02600 Espoo, Finland
Product:	GSM/WCDMA/LTE Mobile Phone
Brand Name:	Nokia
Model Name:	TA-1123
FCC ID:	2AJOTTA-1123
Date of tests:	Dec. 19, 2018 ~ Jan. 15, 2019

The submitted sample of the above equipment has been tested for according to the requirements of the following standards:

- FCC Part 15, Subpart B, Class B
- ANSI C63.4:2014

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

Issued by Alex Chen  
Engineer / Mobile Department

Approved by Sam Tung  
Manager / Mobile Department

Date: Jan. 16, 2019

Date: Jan. 16, 2019

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**VERITAS**

Test Report No.: FV180928W002

## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
FV180928W002	Original release	Jan. 16, 2019



# 1 GENERAL INFORMATION

## 1.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	GSM/WCDMA/LTE Mobile Phone	
<b>BRAND NAME</b>	Nokia	
<b>MODEL NAME</b>	TA-1123	
<b>NOMINAL VOLTAGE</b>	5.0Vdc (adapter or host equipment) 3.85Vdc (Li-ion, battery)	
<b>MODULATION TYPE</b>	<b>WLAN</b>	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
	<b>BT_LE</b>	BT-LE(GFSK) for DTS
	<b>Bluetooth</b>	GFSK, $\pi/4$ -DQPSK, 8DPSK, LE
	<b>GPS/ GLONASS</b>	C/A code
	<b>FM</b>	FSK
	<b>GSM/GPRS/EDGE</b>	GMSK, 8PSK
	<b>WCDMA</b>	BPSK/QPSK
	<b>LTE</b>	QPSK/16QAM
<b>OPERATING FREQUENCY</b>	<b>WLAN</b>	2412-2462MHz for 11b/g/n(HT20)
	<b>Bluetooth/BT_LE</b>	2402MHz ~ 2480MHz
	<b>GPS</b>	1575.42MHz
	<b>GLONASS</b>	1602MHz
	<b>FM</b>	88MHz ~ 108MHz
	<b>GSM</b>	824.2MHz ~ 848.8MHz (FOR GSM 850) 1850.2MHz ~ 1909.8MHz (FOR GSM 1900)
	<b>WCDMA</b>	1852.4MHz ~ 1907.6MHz(FOR WCDMA Band 2) 1712.4MHz ~ 1752.6MHz(FOR WCDMA Band 4) 826.4MHz ~ 846.6MHz (FOR WCDMA Band 5)
	<b>LTE</b>	1850.7MHz ~ 1909.3MHz (FOR LTE Band2) 1710.7MHz ~ 1754.3MHz (FOR LTE Band4) 824.7MHz ~ 848.3MHz (FOR LTE Band5) 2502.5MHz ~ 2567.5MHz (FOR LTE Band7) 699.7MHz ~ 715.3MHz (FOR LTE Band12) 706.5MHz ~ 713.5MHz (FOR LTE Band17)
<b>HW VERSION</b>	HW0202	
<b>SW VERSION</b>	000C_0_310	
<b>I/O PORTS</b>	Refer to user's manual	



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<b>CABLE SUPPLIED</b>	USB cable: non-shielded, detachable, 1.0meter Earphone cable: non-shielded, detachable, 1.5meter
<b>ACCESSORY DEVICES</b>	Refer to note as below

**NOTE:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

**List of Accessories:**

<b>ACCESSORIES</b>	<b>BRAND</b>	<b>MODEL</b>	<b>Manufacturer</b>	<b>SPECIFICATION</b>
AC Adapter 1	Aohai	AD-5WU(US)	DONGGUAN AOHA TECHNOLOGY CO., LTD.	I/P:100-240Vac, 150mA O/P: 5Vdc, 1A
AC Adapter 2	DVE	AD-5WU(US)	Dee Van Enterprise Co., LTD.	I/P:100-240Vac, 150mA O/P: 5Vdc, 1A
Battery	Lishen	HE365	-	Rating: 3.85Vdc, 2500mAh
USB Cable 1	Nokia	CA-10W	Shenglan Technology Co., Ltd	1.0m shielded cable w/o core
USB Cable 2	Nokia	MICRO USB 5V2A	RongTaiFeng Technology Co.,Ltd	1.0m shielded cable w/o core
Earphone	Nokia	WH-108	OBO	1.5m shielded cable w/o core

## 1.2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart B			
Standard Section	Test Item	Result	Remark
FCC Part 15, Subpart B, Class B ANSI C63.4:2014	Conducted Test	PASS	Meets limits minimum passing margin is -9.03dB at 0.182000MHz.
	Radiated Emission Test (30MHz ~ 1GHz)	PASS	Meets Class B Limit Minimum passing margin is -6.45dB at 383.08MHz
	Radiated Emission Test (Above 1GHz)	PASS	Meets Class B Limit Minimum passing margin is -10.35dB at 3550MHz

## 1.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	150kHz ~ 30MHz	+/-2.66dB
Radiated emissions	30MHz ~ 1GHz	+/-3.26dB
	1GHz ~ 18GHz	+/-4.48dB



### 1.4 DESCRIPTION OF TEST MODES

Test Mode	Test Condition
<b>Radiated emission test</b>	
1	GSM850 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx+ FM RX
2	GSM1900 Idle+ Adapter 2+ Earphone+ USB cable 2+ BT Idle+ WIFI Idle(2.4G)+ GLONESS Rx+ Front camera on
3	WCDMA B2 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx+ Back camera on
4	WCDMA B4 Idle+ Adapter 2+ Earphone+ USB cable 2+ BT Idle+ WIFI Idle(2.4G)+GLONESS Rx+ MPG 4
5	WCDMA B5 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx+ FM RX
6	LTE B2 Idle+ Adapter 2+ Earphone+ USB cable 2+ BT Idle+ WIFI Idle(2.4G)+GLONESS Rx+ Front camera on
7	LTE B4 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx+ Back camera on
8	LTE B5 Idle+ Adapter 2+ Earphone+ USB cable 2+ BT Idle+ WIFI Idle(2.4G)+GLONESS Rx+ MPG 4
9	LTE B7 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+WIFI Idle(2.4G)+GPS Rx+FM RX
10	LTE B12 Idle+ Adapter 2+Earphone+ USB cable 2+ BT Idle+WIFI Idle(2.4G)+GLONESS Rx+ Front camera on
11	LTE B17 Idle+ Adapter 1+ Earphone+USB cable 1+ BT Idle+ WIFI Idle(2.4G)+GPS Rx+ Back camera on
12	USB Cable 1+USB Link+ Data Trasmission(PC to EUT)+Earphone+BT Idle+WIFI Idle(2.4G)+ GLONESS Rx
13	USB Cable 2+USB Link+ Data Trasmission(PC to SD)+Earphone+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx
<b>Conducted emission test</b>	
1	GSM850 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx+ FM RX
2	GSM1900 Idle+ Adapter 2+ Earphone+ USB cable 2+ BT Idle+ WIFI Idle(2.4G)+ GLONESS Rx+ Front camera on
3	WCDMA B2 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx+ Back camera on
4	WCDMA B4 Idle+ Adapter 2+ Earphone+ USB cable 2+ BT Idle+ WIFI Idle(2.4G)+GLONESS Rx+ MPG 4
5	WCDMA B5 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx+ FM RX
6	LTE B2 Idle+ Adapter 2+ Earphone+ USB cable 2+ BT Idle+ WIFI Idle(2.4G)+GLONESS Rx+ Front camera on
7	LTE B4 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx+ Back camera on
8	LTE B5 Idle+ Adapter 2+ Earphone+ USB cable 2+ BT Idle+ WIFI Idle(2.4G)+ GLONESS Rx+



	MPG 4
9	LTE B7 Idle+ Adapter 1+ Earphone+ USB cable 1+ BT Idle+WIFI Idle(2.4G)+GPS Rx+FM RX
10	LTE B12 Idle+ Adapter 2+Earphone+ USB cable 2+ BT Idle+WIFI Idle(2.4G)+GLONESS Rx+ Front camera on
11	LTE B17 Idle+ Adapter 1+ Earphone+USB cable 1+ BT Idle+ WIFI Idle(2.4G)+GPS Rx+ Back camera on
12	USB Cable 1+USB Link+ Data Trasmision(PC to EUT)+Earphone+BT Idle+WIFI Idle(2.4G)+ GLONESS Rx
13	USB Cable 2+USB Link+ Data Trasmision(PC to SD)+Earphone+ BT Idle+ WIFI Idle(2.4G)+ GPS Rx

**NOTE:**

1. For conducted emission test, test mode 3, 12 was the worst case and only this mode was presented in this report.
2. For radiated emission test, test mode 3, 12 was the worst case and only this mode was presented in this report



## 1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

### FOR EMISSION TESTS

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	GPS Simulator +Antenna	TOJOIN	GNSS-5000A	E1-010-010119	N/A
2	Wireless AP	ABOCOM	WR224GR	060500749P	N/A
3	FM signal generator	Rohde & Schwarz	SMB100A	109279	N/A
4	Printer	HP	Hp LaserJet 1300	CNSJF75989	N/A
5	Notebook	Lenovo	Thnikpad X520	SL10H14859JS	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A
2	N/A
3	N/A
4	N/A
5	N/A

## 2 EMISSION TEST

### 2.1 CONDUCTED EMISSION MEASUREMENT

#### 2.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.107)

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

**NOTE:** 1.The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

#### 2.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR3	101900	Mar. 15,18	Mar. 14,19
EMC32 test software	Rohde&Schwarz	EMC32	NA	NA	NA
LISN network	Rohde&Schwarz	ENV216	101922	Mar. 15,18	Mar. 14,19

**NOTE:** 1. The test was performed in CE shielded room.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

### 2.1.3 TEST PROCEDURES

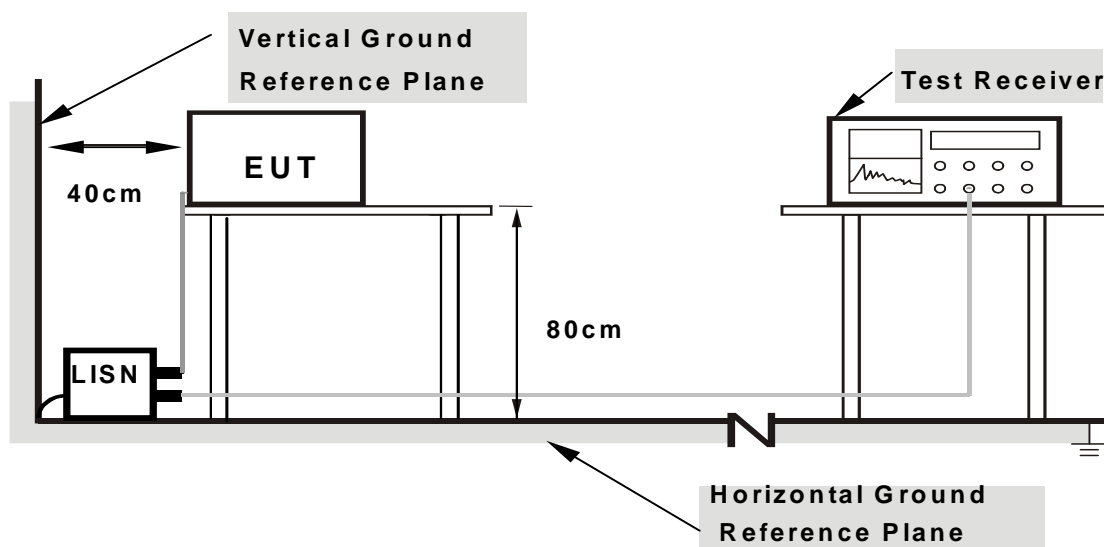
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

**NOTE:** All modes of operation were investigated and the worst-case emissions are reported.

### 2.1.4 DEVIATION FROM TEST STANDARD

No deviation.

## 2.1.5 TEST SETUP



- Note:**
- 1.Support units were connected to second LISN.
  - 2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

## 2.1.6 EUT OPERATING CONDITIONS

- a. Turned on the power and connected of all equipment.
- b. EUT was operated according to the use type described in the manufacturer's specifications or the user's manual.



## 2.1.7 TEST RESULTS

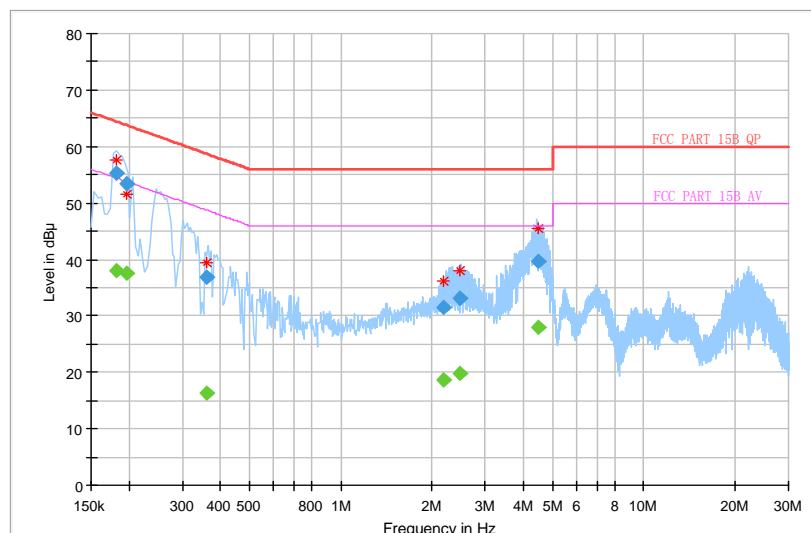
### Mode 3

<b>TEST VOLTAGE</b>	DC 5V From Adapter Input 120 Vac, 60 Hz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9 kHz
<b>ENVIRONMENTAL CONDITIONS</b>	25deg. C, 50RH	<b>TESTED BY</b>	Star Le

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.182000	---	37.91	54.39	-16.48	L1	ON	9.7
<b>0.182000</b>	<b>55.37</b>	---	<b>64.39</b>	<b>-9.03</b>	<b>L1</b>	<b>ON</b>	<b>9.7</b>
0.196000	---	37.52	53.78	-16.26	L1	ON	9.7
0.196000	53.37	---	63.78	-10.41	L1	ON	9.7
0.360000	---	16.36	48.73	-32.37	L1	ON	9.7
0.360000	36.86	---	58.73	-21.87	L1	ON	9.7
2.176000	---	18.69	46.00	-27.31	L1	ON	9.7
2.176000	31.52	---	56.00	-24.48	L1	ON	9.7
2.480000	---	19.88	46.00	-26.12	L1	ON	9.7
2.480000	33.01	---	56.00	-22.99	L1	ON	9.7
4.464000	---	28.02	46.00	-17.98	L1	ON	9.7
4.464000	39.76	---	56.00	-16.24	L1	ON	9.7

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.

Full Spectrum





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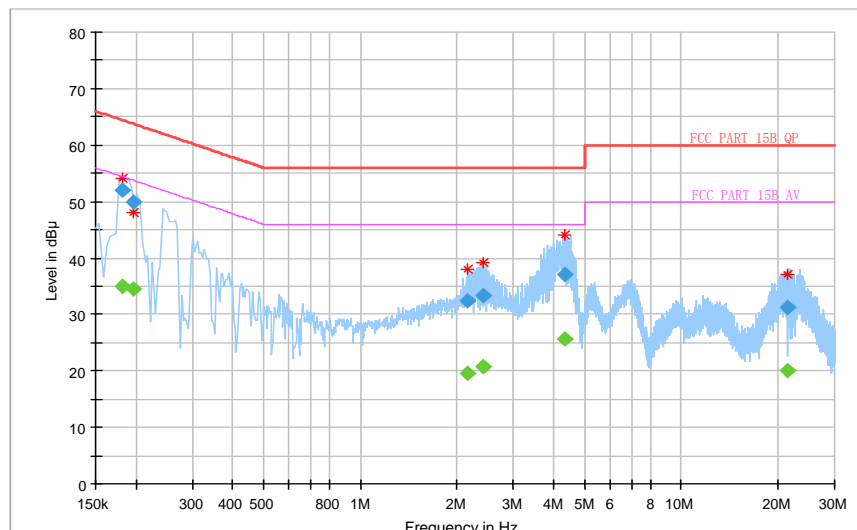
**Test Report No.: FV180928W002**

<b>TEST VOLTAGE</b>	DC 5V From Adapter Input 120 Vac, 60 Hz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9 kHz
<b>ENVIRONMENTAL CONDITIONS</b>	25deg. C, 50RH	<b>TESTED BY</b>	Star Le

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.182000	---	34.99	54.39	-19.41	N	ON	10.2
0.182000	52.04	---	64.39	-12.36	N	ON	10.2
0.196000	---	34.47	53.78	-19.31	N	ON	9.9
0.196000	49.97	---	63.78	-13.81	N	ON	9.9
2.166000	---	19.60	46.00	-26.40	N	ON	9.8
2.166000	32.38	---	56.00	-23.62	N	ON	9.8
2.406000	---	20.85	46.00	-25.15	N	ON	9.8
2.406000	33.33	---	56.00	-22.67	N	ON	9.8
4.336000	---	25.70	46.00	-20.30	N	ON	9.8
4.336000	37.11	---	56.00	-18.89	N	ON	9.8
21.476000	---	20.16	50.00	-29.84	N	ON	10.0
21.476000	31.28	---	60.00	-28.72	N	ON	10.0

- REMARKS:**
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  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.

Full Spectrum





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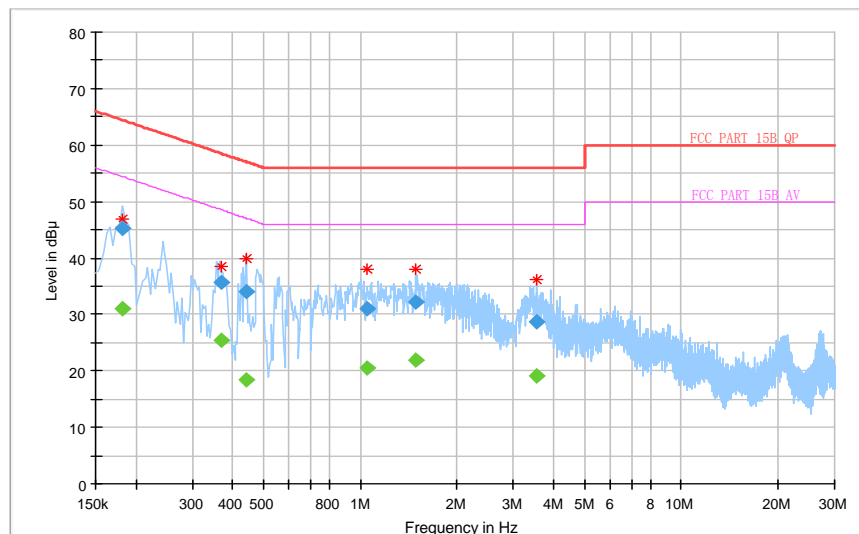
**Mode 12**

<b>TEST VOLTAGE</b>	Data trasmission Input 120 Vac, 60 Hz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9 kHz
<b>ENVIRONMENTAL CONDITIONS</b>	25deg. C, 50RH	<b>TESTED BY</b>	John Wen

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.182000	---	31.02	54.39	-23.37	L1	ON	9.7
0.182000	45.33	---	64.39	-19.06	L1	ON	9.7
0.368000	---	25.34	48.55	-23.21	L1	ON	9.7
0.368000	35.59	---	58.55	-22.95	L1	ON	9.7
0.444000	---	18.42	46.99	-28.57	L1	ON	9.7
0.444000	34.14	---	56.99	-22.84	L1	ON	9.7
1.046000	---	20.48	46.00	-25.52	L1	ON	9.7
1.046000	30.99	---	56.00	-25.01	L1	ON	9.7
1.496000	---	21.97	46.00	-24.03	L1	ON	9.7
1.496000	32.27	---	56.00	-23.73	L1	ON	9.7
3.540000	---	19.18	46.00	-26.82	L1	ON	9.7
3.540000	28.66	---	56.00	-27.34	L1	ON	9.7

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.

Full Spectrum





**BUREAU  
VERITAS**

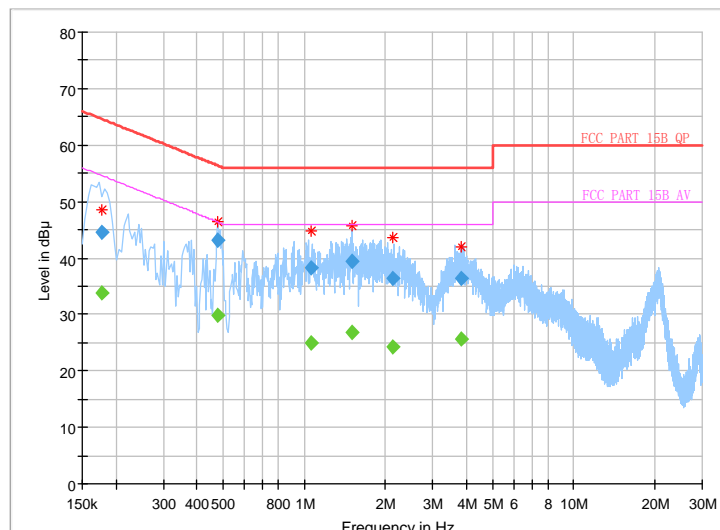
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<b>TEST VOLTAGE</b>	Data trasmission Input 120 Vac, 60 Hz	<b>Detector Function &amp; Resolution Bandwidth</b>	Quasi-Peak (QP) / Average (AV), 9 kHz
<b>ENVIRONMENTAL CONDITIONS</b>	25deg. C, 50RH	<b>TESTED BY</b>	John Wen

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.178000	---	33.89	54.58	-20.69	N	ON	10.2
0.178000	44.64	---	64.58	-19.94	N	ON	10.2
0.476000	---	29.87	46.41	-16.54	N	ON	10.1
<b>0.476000</b>	<b>43.24</b>	---	<b>56.41</b>	<b>-13.17</b>	<b>N</b>	<b>ON</b>	<b>10.1</b>
1.068000	---	25.01	46.00	-20.99	N	ON	9.9
1.068000	38.20	---	56.00	-17.80	N	ON	9.9
1.508000	---	26.78	46.00	-19.22	N	ON	9.9
1.508000	39.48	---	56.00	-16.52	N	ON	9.9
2.144000	---	24.37	46.00	-21.63	N	ON	9.8
2.144000	36.45	---	56.00	-19.55	N	ON	9.8
3.832000	---	25.58	46.00	-20.42	N	ON	9.8
3.832000	36.27	---	56.00	-19.73	N	ON	9.8

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Emission level - Limit value
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.

Full Spectrum





## 2.2 RADIATED EMISSION MEASUREMENT

### 2.2.1. LIMITS OF RADIATED EMISSION MEASUREMENT

#### TEST STANDARD: FCC Part 15, Subpart B (Section: 15.109)

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 10 meters (dB $\mu$ V/m)				
Frequencies (MHz)	FCC 15B/ ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	39	29.5	40	30
88-216	43.5	33.1		
216-230	46.4	35.6		
230-960			47	37
960-1000	49.5	43.5	Not defined	Not defined
1000-3000	Avg: 49.5	Avg: 43.5		
3000+	Peak: 69.5	Peak: 63.5	Not defined	Not defined

Radiated Emissions Limits at 3 meters (dB $\mu$ V/m)				
Frequencies (MHz)	FCC 15B / ICES-003, Class A	FCC 15B / ICES-003, Class B	CISPR 22, Class A	CISPR 22, Class B
30-88	49.5	40	50.5	40.5
88-216	54	43.5		
216-230	56.9	46		
230-960			57.5	47.5
960-1000	60	54	Avg: 56 Peak: 76	Avg: 50 Peak: 70
1000-3000	Avg: 60	Avg: 54		
3000+	Peak: 80	Peak: 74	Avg: 60 Peak: 80	Avg: 54 Peak: 74



Frequency Range (For unintentional radiators)

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5 <sup>th</sup> harmonic of the highest frequency or 40GHz, whichever is lower

- NOTE:**
- The lower limit shall apply at the transition frequencies.
  - Emission level (dBuV/m) = 20 log Emission level (uV/m).
  - As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
  - QP detector shall be applied if not specified.

2.2.2. TEST INSTRUMENTS

Frequency range below 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	Apr. 21,18	Apr. 20,19
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Mar. 15,18	Mar. 14,19
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 16,18	Mar. 15,19
Signal Pre-Amplifier	EMSI	EMC 9135	980249	Jul. 09,18	Jul. 08,19

Frequency range above 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	Apr. 21,18	Apr. 20,19
Horn Antenna	ETS-LINDGREN	3117	00168728	Mar. 15,18	Mar. 14,19
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 16,18	Mar. 15,19
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	Jul. 09,18	Jul. 08,19

- NOTE:**
- The test was performed in 3m chamber.
  - The calibration interval of the above test instruments is 12 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
  - The FCC Site Registration No. is 525120; The Designation No. is CN1171.

## 2.2.3. TEST PROCEDURE

### <Frequency Range below 1GHz>

The basic test procedure was in accordance with ANSI C63.4:2014 (section 12).

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.

#### NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2.  $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
3.  $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$  (if the raw value not contains the amplifier);
4.  $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$  (if the raw value contains the amplifier).
5.  $\text{Margin value} = \text{Emission level} - \text{Limit value}$ .

### <Frequency Range above 1GHz>

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter fully-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. The bore sight should be used during the test above 1GHz.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz

#### NOTE:

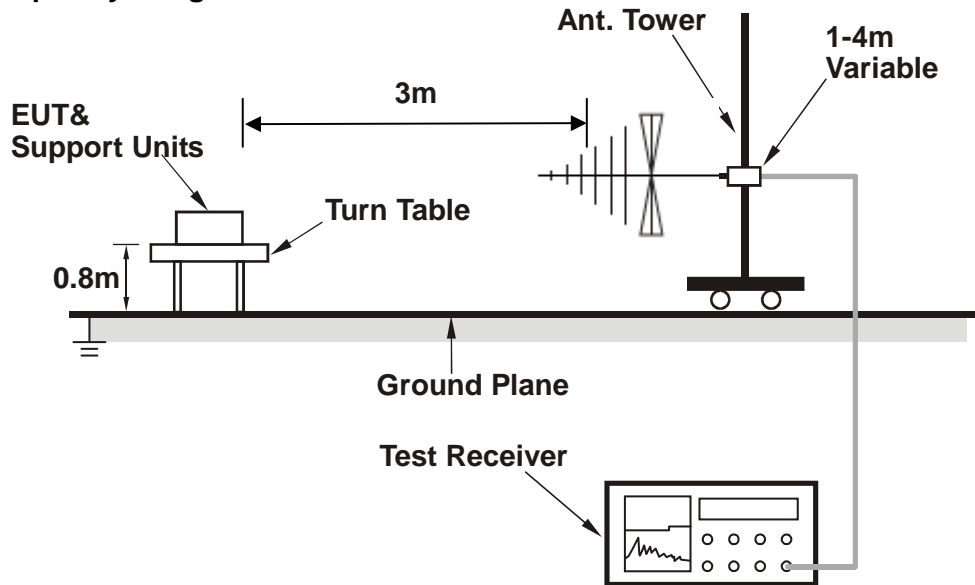
1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth of test receiver/spectrum analyzer is 10Hz for Average detection (AV) at frequency above 1GHz.
3. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
4.  $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
5.  $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$  (if the raw value not contains the amplifier);
6.  $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$  (if the raw value contains the amplifier)
7.  $\text{Margin value} = \text{Emission level} - \text{Limit value}$ .

## 2.2.4. DEVIATION FROM TEST STANDARD

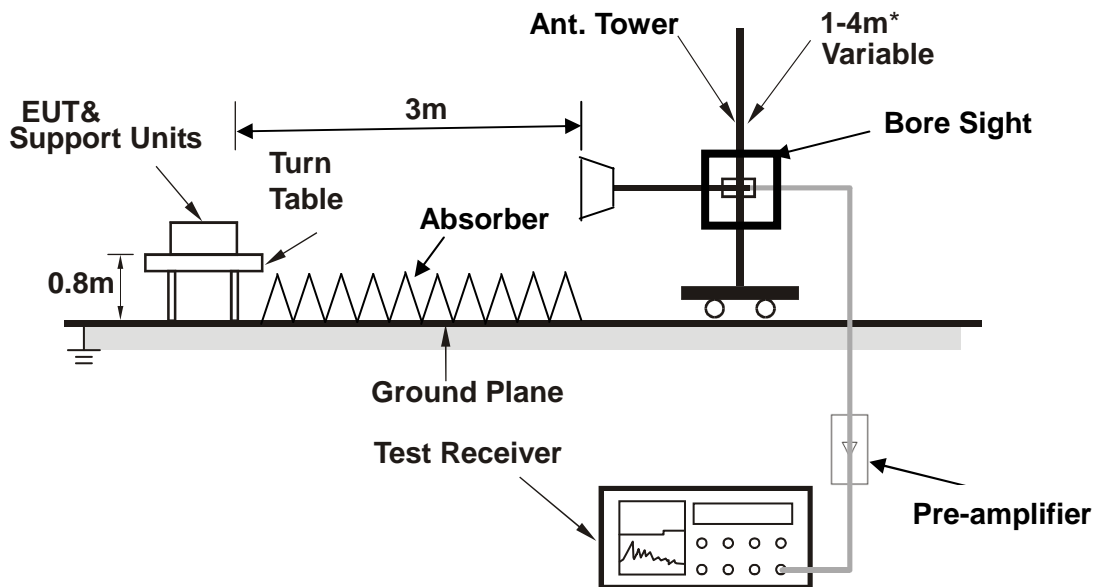
No deviation.

## 2.2.5. TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



\* : depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

## 2.2.6. EUT OPERATING CONDITIONS

Same as item 2.1.6.



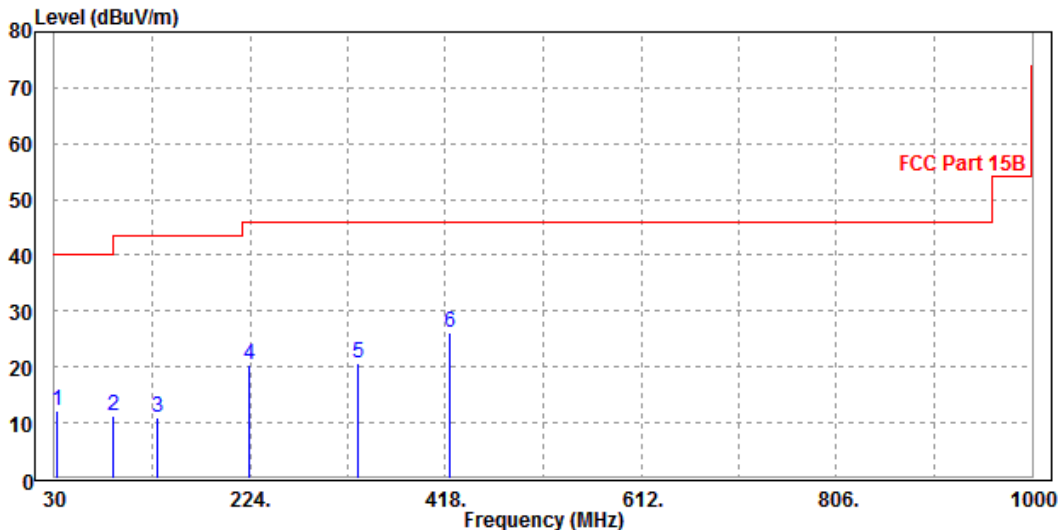
### 2.2.7. TEST RESULTS

#### Mode 3

<b>TEST VOLTAGE</b>	DC 5V From Adapter Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	30-1000 MHz
<b>ENVIRONMENTAL CONDITIONS</b>	23deg. C, 70 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Quasi-Peak, 120 kHz
<b>TESTED BY</b>	Rose Ma		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
32.91	12.17	33.52	40	-27.83	15.37	0.82	37.54	100	148	QP
88.2	11.37	38.83	43.5	-32.13	8.33	1.27	37.06	100	265	QP
131.85	11.02	37.77	43.5	-32.48	8.64	1.49	36.88	100	179	QP
224	20.47	43.48	46	-25.53	11.61	1.91	36.53	100	192	QP
331.67	20.81	40.19	46	-25.19	14.85	2.34	36.57	100	144	QP
<b>422.85</b>	<b>26.2</b>	<b>42.96</b>	<b>46</b>	<b>-19.8</b>	<b>17.31</b>	<b>2.7</b>	<b>36.77</b>	<b>100</b>	<b>193</b>	<b>QP</b>

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.





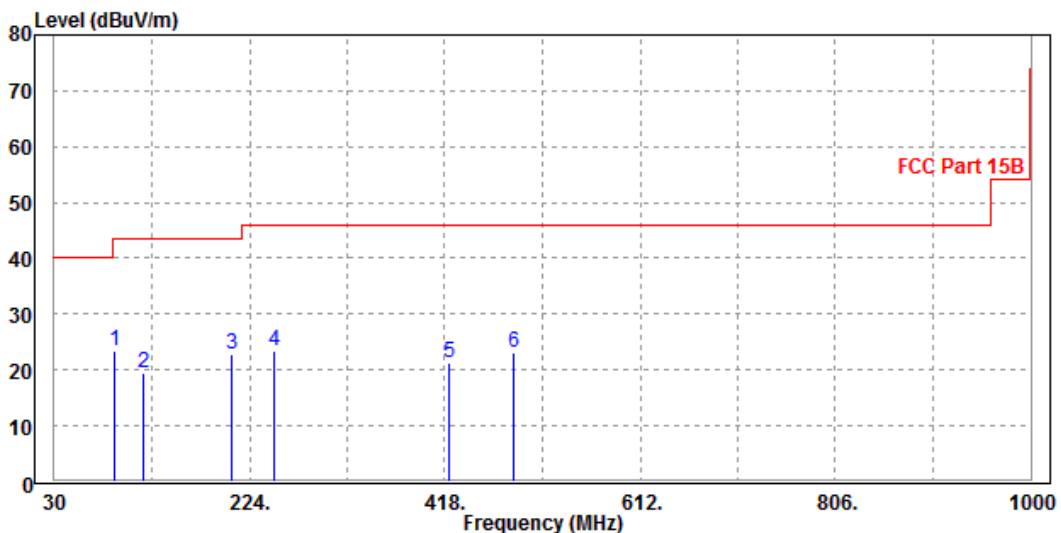
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VERITAS**

**Test Report No.: FV180928W002**

<b>TEST VOLTAGE</b>	DC 5V From Adapter Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	30-1000 MHz
<b>ENVIRONMENTAL CONDITIONS</b>	23deg. C, 70 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Quasi-Peak, 120 kHz
<b>TESTED BY</b>	Rose Ma		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
89.17	23.31	50.72	43.5	-20.19	8.37	1.27	37.05	100	180	QP
118.27	19.58	46.61	43.5	-23.92	8.47	1.44	36.94	100	123	QP
205.57	22.96	46.85	43.5	-20.54	10.83	1.82	36.54	100	114	QP
249.22	23.47	45.28	46	-22.53	12.67	2.04	36.52	100	233	QP
422.85	21.35	38.11	46	-24.65	17.31	2.7	36.77	100	285	QP
486.87	23.17	39.28	46	-22.83	17.88	2.94	36.93	100	246	QP

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.





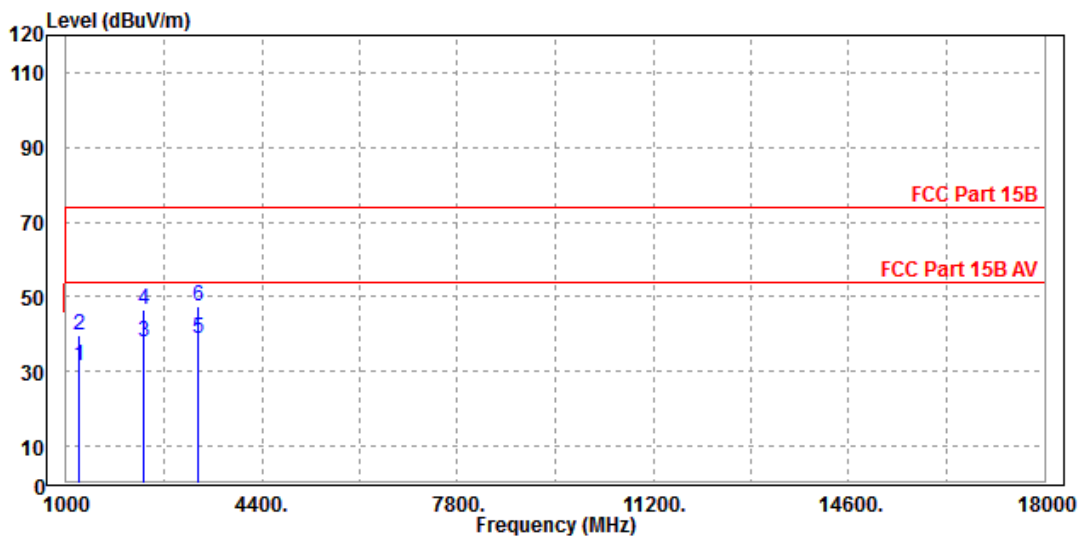
**BUREAU  
VERITAS**

**Test Report No.: FV180928W002**

<b>TEST VOLTAGE</b>	DC 5V From Adapter Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	1-18 GHz
<b>ENVIRONMENTAL CONDITIONS</b>	23deg. C, 70 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Peak/Average, 1 MHz
<b>TESTED BY</b>	Rose Ma		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1220	31.56	45.28	54	-22.44	28.98	5.66	48.36	100	169	Average
1220	39.8	53.52	74	-34.2	28.98	5.66	48.36	100	169	Peak
2360	37.9	45.85	54	-16.1	32.26	8.1	48.31	150	260	Average
2360	46.33	54.28	74	-27.67	32.26	8.1	48.31	150	260	Peak
3280	38.6	44.39	54	-15.4	32.96	9.62	48.37	100	240	Average
3280	47.32	53.11	74	-26.68	32.96	9.62	48.37	100	240	Peak

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 1GHz to 18GHz.
  4. Only emissions significantly above equipment noise floor are reported.







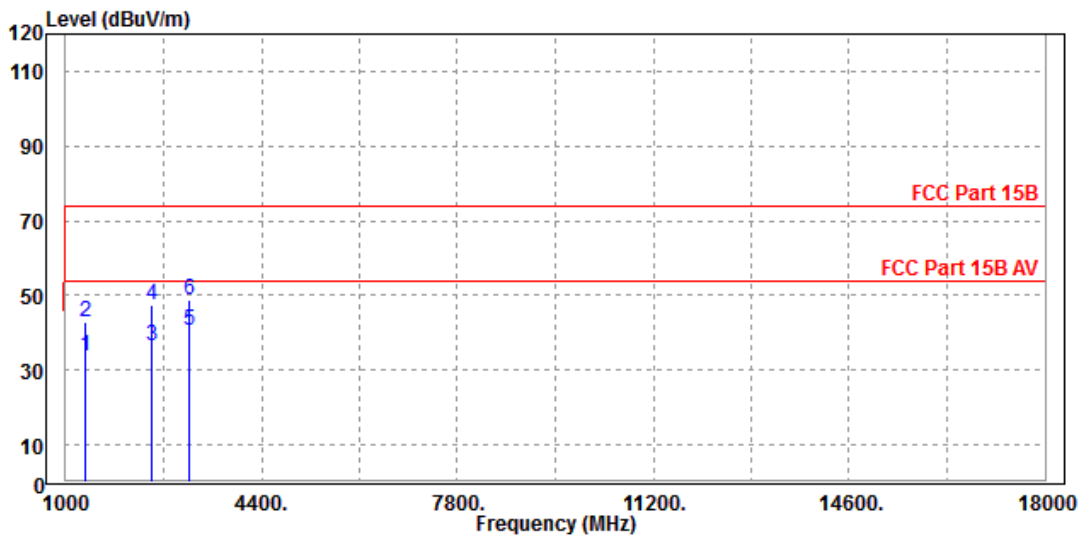
**BUREAU  
VERITAS**

**Test Report No.: FV180928W002**

<b>TEST VOLTAGE</b>	DC 5V From Adapter Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	1-18 GHz
<b>ENVIRONMENTAL CONDITIONS</b>	23deg. C, 70 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Peak/Average, 1 MHz
<b>TESTED BY</b>	Rose Ma		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1340	33.57	47.12	54	-20.43	28.86	5.95	48.36	100	145	Average
1340	42.92	56.47	74	-31.08	28.86	5.95	48.36	100	145	Peak
2485	36.3	43.89	54	-17.7	32.39	8.32	48.3	100	122	Average
2485	47.65	55.24	74	-26.35	32.39	8.32	48.3	100	122	Peak
<b>3150</b>	<b>40.58</b>	<b>46.57</b>	<b>54</b>	<b>-13.42</b>	<b>32.93</b>	<b>9.43</b>	<b>48.35</b>	<b>100</b>	<b>284</b>	<b>Average</b>
3150	48.79	54.78	74	-25.21	32.93	9.43	48.35	100	284	Peak

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 1GHz to 18GHz.
  4. Only emissions significantly above equipment noise floor are reported.



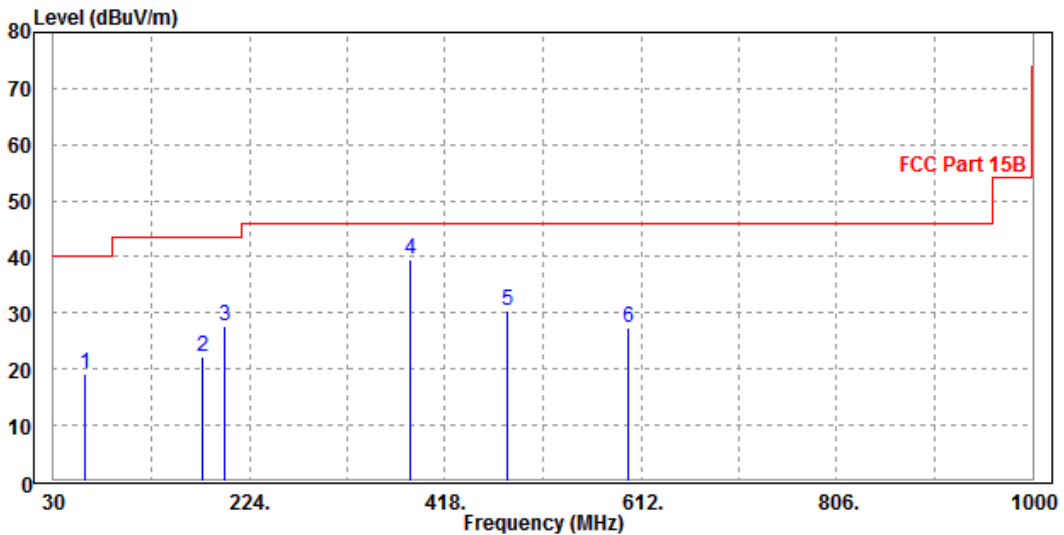


Mode 12

<b>TEST VOLTAGE</b>	Data trasmission Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	30-1000 MHz
<b>ENVIRONMENTAL CONDITIONS</b>	23deg. C, 70 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Quasi-Peak, 120 kHz
<b>TESTED BY</b>	Rose Ma		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
61.04	19.28	48.63	40	-20.72	6.88	1.08	37.31	100	176	QP
177.44	22.35	47.2	43.5	-21.15	10.16	1.69	36.7	100	152	QP
198.78	27.56	51.76	43.5	-15.94	10.57	1.78	36.55	100	166	QP
<b>383.08</b>	<b>39.55</b>	<b>57.14</b>	<b>46</b>	<b>-6.45</b>	<b>16.54</b>	<b>2.55</b>	<b>36.68</b>	<b>100</b>	<b>187</b>	<b>QP</b>
480.08	30.46	46.63	46	-15.54	17.82	2.92	36.91	100	248	QP
599.39	27.41	41.51	46	-18.59	19.99	3.16	37.25	100	174	QP

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.

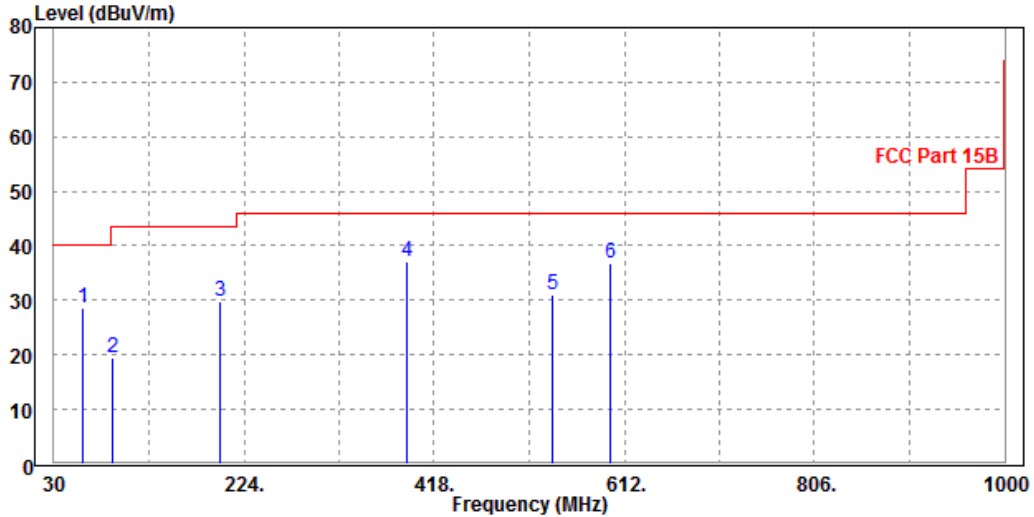




<b>TEST VOLTAGE</b>	Data trasmission Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	30-1000 MHz
<b>ENVIRONMENTAL CONDITIONS</b>	23deg. C, 70 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Quasi-Peak, 120 kHz
<b>TESTED BY</b>	Rose Ma		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
60.07	28.47	57.91	40	-11.53	6.81	1.07	37.32	100	176	QP
90.14	19.47	46.82	43.5	-24.03	8.41	1.28	37.04	100	287	QP
199.75	29.87	54.03	43.5	-13.63	10.59	1.79	36.54	100	144	QP
389.87	37.23	54.58	46	-8.77	16.77	2.58	36.7	100	66	QP
539.25	30.93	46.16	46	-15.07	18.78	3.06	37.07	100	190	QP
598.42	36.87	50.99	46	-9.13	19.97	3.16	37.25	100	77	QP

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.

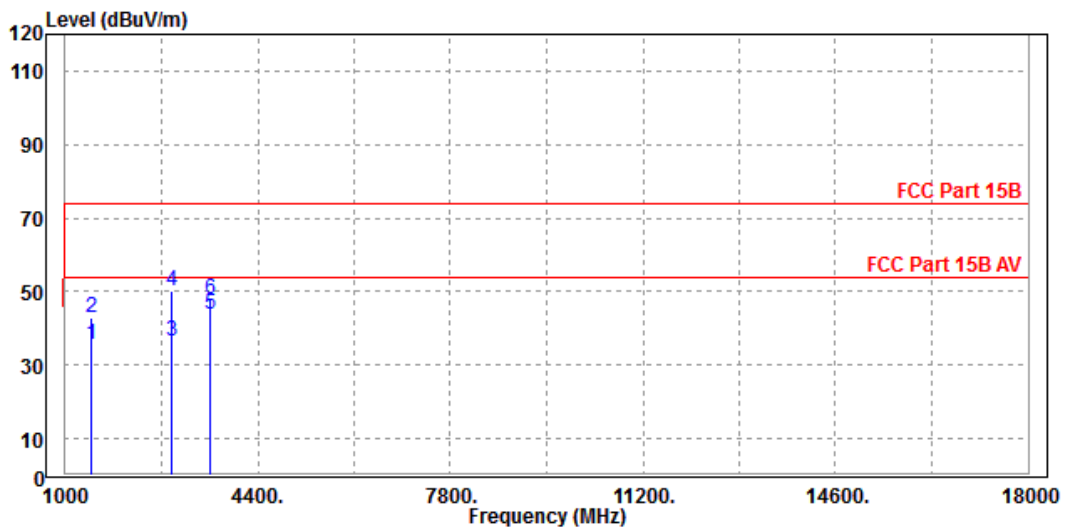




<b>TEST VOLTAGE</b>	Data transmission Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	1-18 GHz
<b>ENVIRONMENTAL CONDITIONS</b>	23deg. C, 70 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Peak/Average, 1 MHz
<b>TESTED BY</b>	Rose Ma		

<b>ANTENNA POLARITY &amp; TEST DISTANCE: HORIZONTAL AT 3 M</b>										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1450	35.36	48.77	54	-18.64	28.75	6.2	48.36	100	162	Average
1450	42.93	56.34	74	-31.07	28.75	6.2	48.36	100	162	Peak
2880	36.67	43.21	54	-17.33	32.78	9	48.32	134	278	Average
2880	50.19	56.73	74	-23.81	32.78	9	48.32	134	278	Peak
<b>3550</b>	<b>43.65</b>	<b>48.96</b>	<b>54</b>	<b>-10.35</b>	<b>33.08</b>	<b>10.04</b>	<b>48.43</b>	<b>120</b>	<b>300</b>	<b>Average</b>
3550	48.01	53.32	74	-25.99	33.08	10.04	48.43	120	300	Peak

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.





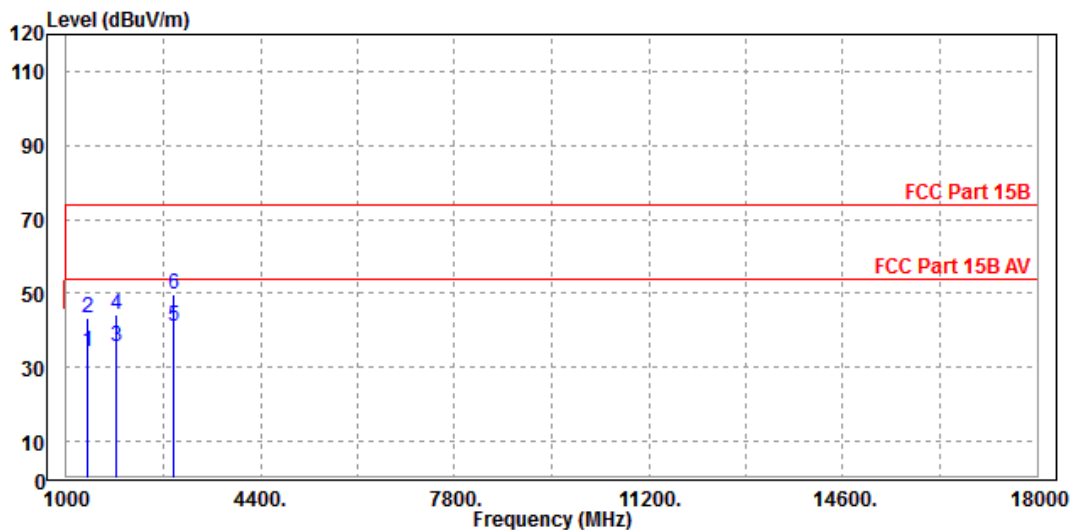
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VERITAS**

**Test Report No.: FV180928W002**

<b>TEST VOLTAGE</b>	Data trasmission Input 120 Vac, 60 Hz	<b>FREQUENCY RANGE</b>	1-18 GHz
<b>ENVIRONMENTAL CONDITIONS</b>	23deg. C, 70 %RH	<b>DETECTOR FUNCTION &amp; RESOLUTION BANDWIDTH</b>	Peak/Average, 1 MHz
<b>TESTED BY</b>	Rose Ma		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
1380	34.38	47.88	54	-19.62	28.82	6.04	48.36	100	120	Average
1380	43.24	56.74	74	-30.76	28.82	6.04	48.36	100	120	Peak
1880	35.73	45.77	54	-18.27	31.13	7.18	48.35	100	278	Average
1880	44.27	54.31	74	-29.73	31.13	7.18	48.35	100	278	Peak
2890	41.05	47.56	54	-12.95	32.79	9.02	48.32	100	0	Average
2890	49.82	56.33	74	-24.18	32.79	9.02	48.32	100	0	Peak

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
  2. Negative sign (-) in the margin column signify levels below the limit.
  3. Frequency range scanned: 30MHz to 1000MHz.
  4. Only emissions significantly above equipment noise floor are reported.





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Test Report No.: FV180928W002

### **3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications were made to the EUT by the lab during the test.

**---END---**