



Report on EMC Test of HUAWEI USB Modem M/N: EC228

Report No: SYBH(R)129112007EB-1



Reliability Laboratory of Huawei Technologies Co., Ltd.

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Modification Information:

Table 1 Modification Information

Modification Information	1	
	2	
	3	<i>Not Applicable!</i>
	4	
	5	
	6	
	7	



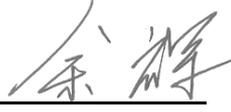
REPORT ON HUAWEI USB Modem
M/N: EC228

REGULATION FCC CFR47 Part 15: Subpart B;

START OF TEST Dec.10, 2007
END OF TEST Dec.20, 2007

Final Judgement: Pass

Approver 2007-12-27 张兴海 
 Date Name Signature

Reviewer 2007-12-27 余辉 
 Date Name Signature

Operator 2007-12-27 张飞 
 Date Name Signature

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1 Status

1.1 Product Information

CLIENT: Huawei Technologies Co., Ltd.
ADDRESS: Bantian Longgang District Shenzhen, P.R. China
MANUFACTURING DESCRIPTION HUAWEI USB Modem
MANUFACTURERS MODEL NUMBER EC228

1.2 Applied Standard

FCC Measurement Specification	FCC Limits Part(s)	Description	Result
-	15.107	Conducted Emission at Power Port	PASS
-	15.109	Radiated Emission of Enclosure in Idle Mode	PASS
2.1051	22.917	Radiated Spurious Emission	PASS
2.1053	24.238	Radiated Spurious Emission	PASS

1.3 Test Site

Site 1:
RELIABILITY LABORATORY OF HUAWEI TECHNOLOGIES CO., LTD

1.4 Test environment condition

Ambient temperature	20~25
Relative humidity	40%~52%
Atmospheric pressure	101kPa

2 Summary of Results

Table 2 below shows a brief summary of the results obtained.

Table 2 Summary of results

EUT Classification : Radio Equipment				
Test Items	Test Configuration & Test Mode	Required Performance Criteria	Result	Site
<u>Radiated Emissions</u> Enclosure Port	TC1 (TM7~TM12)	N/A	Pass	Site1
<u>Conducted Emissions</u>	TC1 (TM1~TM6)	N/A	Pass	Site1
<u>Radiated Spurious Emissions</u> Enclosure Port 9KHz -26.5GHz	TC1 (TM1~TM6)	N/A	Pass	Site1

Note:

- 1, Measurement taken is within the measurement uncertainty of measurement system.
- 2, TC = Test configuration
- 3, NT=no test. Because of not containing devices susceptible to magnetic fields, the EUT has been exempt from immunity test of power frequency magnetic field.

3 Equipment Specification

3.1 General Description

HUAWEI EC228 CDMA2000 1X/EVDO dual mode 2 BAND USB Modem is subscriber equipment in the CDMA2000 system. For cellular 800, the TX frequency is 824MHz-849MHz and the RX frequency is 869MHz-894MHz. For PCS 1900, the TX frequency is 1850MHz-1910MHz and the RX frequency is 1930MHz-1990MHz. EC228 implements such functions as RF signal receiving/transmitting, CDMA2000 protocol processing, data service etc. Externally it provides USB interface (to connect to the notebook etc.), USIM card interface and antenna interface. EC228 has an internal antenna as default.

3.2 Technical Data

3.2.1 Main Equipment Technical Data

Description:	USB MODEM
Models:	EC228
Input Rated Voltage:	5V
Rated Power:	2.5W
Dimensions:	89(depth) × 43(width) × 14.5(height) (mm ³)
Weight:	55g

Table 3 Sub-Assembly Identity

Mode		Work Frequency	
		Transmitt Frequency (MHz)	Receive Frequency (MHz)
CDMA2000 1X	CELLULAR 800	824-849MHz	869MHz-894MHz
	PCS1900	1850-1910MHz	1930MHz-1990MHz
EVDO Release.0	CELLULAR 800	824-849MHz	869MHz-894MHz
	PCS1900	1850-1910MHz	1930MHz-1990MHz
EVDO Release.A	CELLULAR 800	824-849MHz	869MHz-894MHz
	PCS1900	1850-1910MHz	1930MHz-1990MHz



Figure 1. EUT Appearance

3.3 Sub-Assembly Identity

Table 4 Sub-Assembly Identity

Board			
Model Name	Qty.	Serial Number	Description
Huawei EC228	1	KS1AA107B1900193	Main board of data card
Accessory			
Name	Qty.	Serials number	Description

4 System Configuration during EMC Test

The Equipment under Test (EUT) was functioning correctly during all tests. The EUT was installed within the test site and was configured to simulate a typical user installation.

4.1 Cables Used during Test

Table 5 Cable Used during Test

Port	Connector	Type of Cable
USB	USB	USB Cable 80cm

4.2 Associated Equipment Used during Test

Table 6 Associated Equipment Used during Test

Name	Model	Manufacturer	S/N	Cal Date
Radio Communication Tester	CMU200	R&S	108522	2007-03-22
Notebook	D640m	DELL	3106094190	NA
Notebook	T43	IBM	3106093834	N/A

4.3 Test Configurations and Test Mode

4.3.1 Test Configuration.

The EUT will be connected to test system (Base Station Simulator) in order to simulate normal operating conditions (with reference to the guidance given in the standard for this type of equipment).

Table 7 Configuration table

Test configuration	Test mode
TC1	TM1~TM12

TC1: EUT was powered by USB cable connected to the notebook directly.

4.3.2 Test Mode

There was 12 test Modes. TM1 to TM12 were shown below:

TM1: operate in traffic mode CDMA800;
TM2: operate in traffic mode EV-DO800 V.0;
TM3: operate in traffic mode EV-DO800 V.A;
TM4: operate in traffic mode CDMA1900;
TM5: operate in traffic mode EV-DO1900 V.0;
TM6: operate in traffic mode EV-DO 1900 V.A;
TM7: operate in idle mode CDMA800;
TM8: operate in idle mode EV-DO800 V.0;
TM9: operate in idle mode EV-DO800 V.A;
TM10: operate in idle mode CDMA1900;
TM11: operate in idle mode EV-DO1900 V.0;
TM12: operate in idle mode EV-DO 1900 V.A;

4.4 Test conditions and test Connections

4.4.1 Test Conditions

The EUT will be connected to test system (Base Station Simulator) in order to simulate normal operating conditions (with reference to the guidance given in the standard for this type of equipment).

4.4.2 Test Connections

Traffic Mode:

The EC228 will be connected to test system (Base Station Simulator) in order to simulate normal operating conditions (with reference to the guidance given in the standard for this type of equipment).

The EUT is required to be in the traffic mode, a call is set up according to the generic call set up procedure and enter the EUT into loop back test mode.(EVDO see 3GPP2 C.P0033-A v1.0,CDMA see 3GPP2 C.S0011-B).

For CDMA and EVDO, the following conditions shall also be met:
Logical Test Interface for details regarding generic call set-up procedure
- set and send continuously up power control commands to the UE;
- The EUT shall be commanded to operate at maximum transmit power;

Assign channel frequency to an appropriate channel number. Set the ARFCN channel number to 283 (833.49MHz) for CDMA and EV-DO 800 and to 575(1878.75MHz) for CDMA and EV-DO1900.

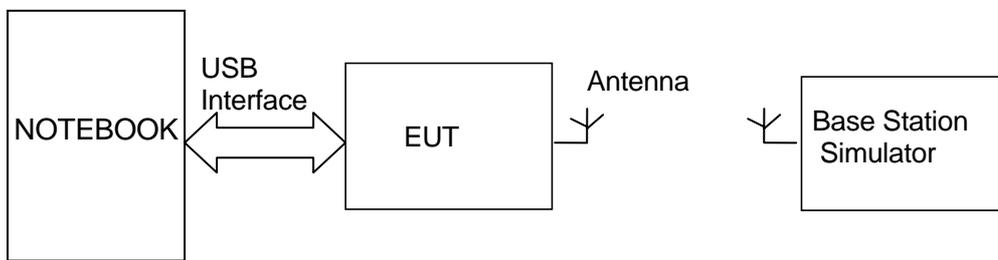


Figure 2. Test Configuration

Idle Mode :

The EC228 will be connected to test system (Base Station Simulator) in order to simulate normal operating conditions (with reference to the guidance given in the standard for this type of equipment).

The EUT is required to be in the idle mode.

For CDMA and EVDO, the following conditions shall be met:

- UE shall be camped on a cell;
- UE shall perform Location Registration (LR) before the test, but not during the test;
- UE's neighbour cell list shall be empty;
- Paging repetition period and DRX cycle shall be set to minimum (shortest possible time interval).

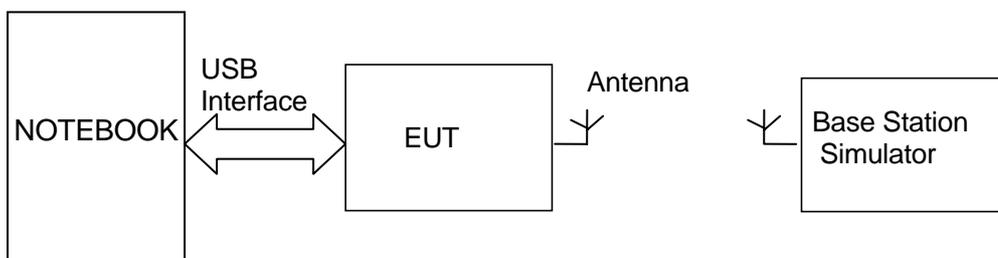


Figure 3. Test Configuration

5 Electromagnetic Interference (EMI)

5.1 Radiated Disturbance 30MHz to 1000MHz

5.1.1 Test Procedure

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2003). The test distance was 3m. The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4. The Radiated Disturbance measurements were made using a Rohde and Schwarz ESMI Test Receiver and control software ES-K1.

A preliminary scan and a final scan of the emissions were made from 30 MHz to 1GHz by using test script of software; the emissions were measured using a Quasi-Peak Detector. The maximal emission value was acquired by adjusting the antenna height, polarisation and turntable azimuth in accordance with the software setup. Normally, the height range of antenna was 1m to 4m, the azimuth range of turntable was 0° to 360°, The receive antenna has two polarizations V and H.

Huawei Mobile Station was communicated with the BTS simulator through Air interface. The Mobile Station operated on the typical channel and the Mobile Station worked in idle mode, transmitter was not work in this test.

EUT was configured in idle mode and the test performed at worst emission state.

Measurement bandwidth: 30 MHz – 1000 MHz: 120 k Hz

Test set up figure:

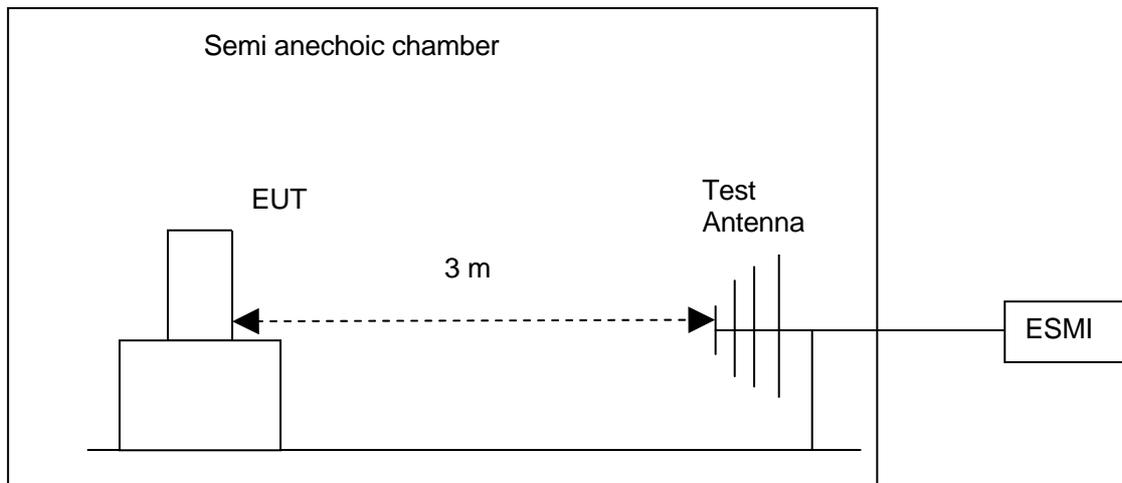


Figure 4. Test set-up

5.1.2 Test Results

The EUT has met the requirements for Radiated Emission of enclosure port.

Table 8 Test Limits

Frequency of Emission (MHz)	Radiated Limit	
	Unit($\mu\text{V}/\text{m}$)	Unit($\text{dB}\mu\text{V}/\text{m}$)
30-88	100	40
88-216	150	43.5
216-960	200	46
960-1000	500	54

5.2 Conducted Disturbance 0.15 MHz to 30MHz

5.2.1 Test Procedure

The Table-top EUT was placed upon a non-metallic table 0.8 m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4: 2003.

Conducted Disturbance at AC Port measurements were undertaken on the L and N Lines. The emissions were measured using a Quasi-Peak Detector and Average Detector.

Huawei Mobile Station was communicated with the BTS simulator through Air interface, the BTS simulator controls the Mobile Station to transmitter the maximum power which defined in specification of product. The Mobile Station operated on the typical channel.

Measurement bandwidth (RBW) for 150kHz to 30 MHz: 9 kHz;

Test Set-up figure:

The Mobile Station was setup in the screened chamber and operated under nominal conditions.

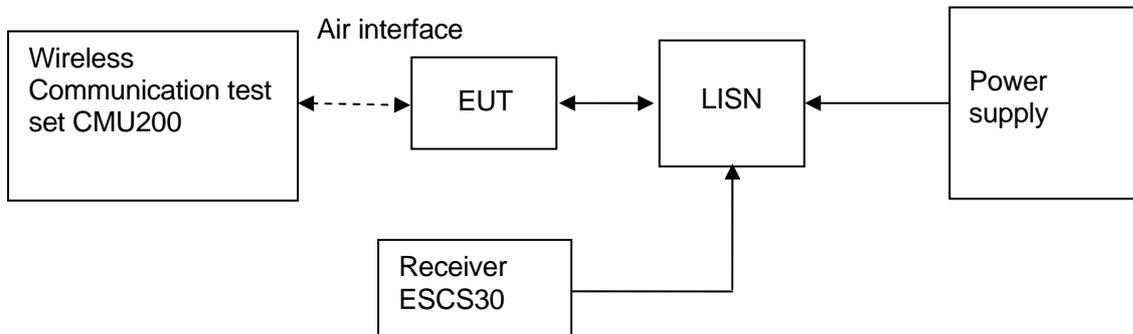


Figure 5. Test Set-up

5.2.2 Test Results

The EUT has met requirements for Conducted disturbance of power lines.

Table 9 Test Limit of DC&AC Power Port

Frequency range	150kHz~ 30MHz	
Classification	Class B	
Limit(Class B)	Voltage limits	
	QP	AV
0.15MHz~0.5MHz	66~56 dB μ V	56~46 dB μ V
0.5MHz~5MHz	56 dB μ V	46 dB μ V
5MHz~30MHz	60 dB μ V	50 dB μ V

5.3 Radiated Spurious Emissions

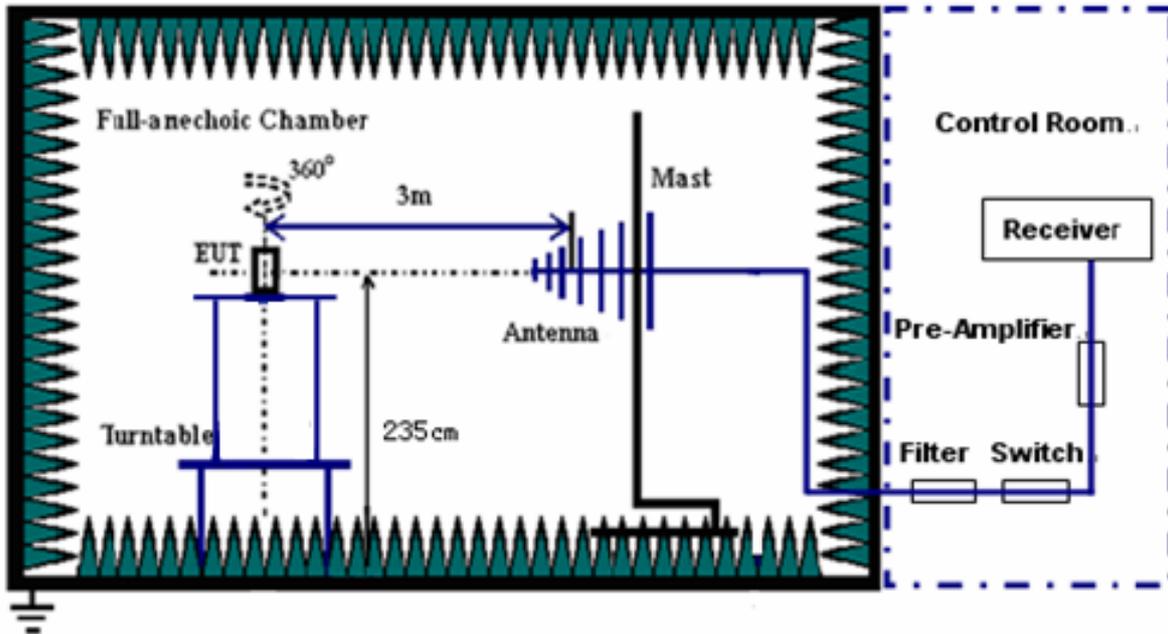
5.3.1 Test Procedure

A test site fulfilling the requirements of ITU-R Recommendation SM329-10 was used. The EUT was placed on a non-conducting support in the anechoic chamber and was operated from a power source via an RF filter to avoid radiation from the power leads.

Step 1:

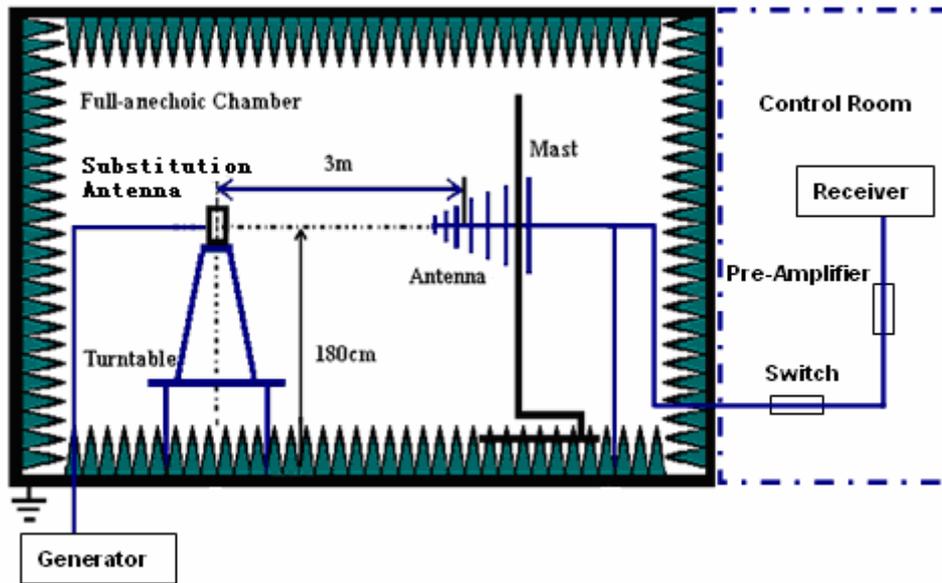
For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, EIRP shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in 2.1033(c)(8). Connect the EUT to the BTS simulator via the air interface.

Test the Radiated maximum output power by the Rohde and Schwarz ESIB26 Test Receiver from test antenna.



Step 2:

Use substitution method to verify the maximum output power. The EUT is substituted by a dipole antenna. The dipole is connected to a signal generator. And then adjust the output level of the signal generator to get the same received power recorded in step1 on ESIB26 Test Receiver, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.



According to part 22.917, the defined measurement bandwidth as following:

22.917(b) Measurement procedure:

- Measurement bandwidth (RBW) for 9 kHz up to 150 kHz: 1 kHz;
- Measurement bandwidth (RBW) for 150 kHz up to 30 MHz: 10 kHz;
- Measurement bandwidth (RBW) for 30 MHz up to 1 GHz: 100 kHz;
- Measurement bandwidth (RBW) for 1GHz up to 18 GHz: 1MHz;

Table 10 Radiated Spurious Emissions Limits

Frequency band	Minimum requirement (E.R.P) traffic mode
30MHz~18GHz	-13dBm

According to part 24.238, the defined measurement bandwidth as following:

24.238 (b) Measurement procedure:

- Measurement bandwidth (RBW) for 9 kHz up to 150 kHz: 1 kHz;
- Measurement bandwidth (RBW) for 150 kHz up to 30 MHz: 10 kHz;
- Measurement bandwidth (RBW) for 30 MHz up to 26.5 GHz: 1 MHz;

Table 11 Radiated Spurious Emissions Limits

Frequency band	Minimum requirement (E.R.P) traffic mode
30MHz~26.5GHz	-13dBm

5.3.2 Test Results

The EUT has met the requirements of FCC Part22/Part24 requirement.

6 Main Test Instruments

Table 12 Main Test Equipments

Test item	Test Instrument	Model	Manufacturer	Cal-Date	Cal Interval (month)
RE	EMI Test receiver	ESMI	R&S	April.23, 2007	12
	Broadband Antenna	CBL 6112B (2536)	SCHAFFNER	Jun.08, 2007	12
CE	EMI Test receiver	ESCS30	R&S	May.29, 2007	12
	Artificial Mains Network	ENV4200	R&S	May.21, 2007	12
RSE	EMI Test receiver	ESIB26	R&S	May.30.2007	12
	Horn Antenna	3117	EMCO	May.20.2007	12
	Broadband Antenna	CBL6112B (2941)	SCHAFFNER	Feb.16.2007	12
	Horn Antenna	3160	EMCO	May.20.2007	12
Software Information					
Test Item	Software Name	Manufacturer	Version		
RE/CE	ES-K1	R&S	1.7.1		
RSE	EMC32	R&S	V5.0		

7 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

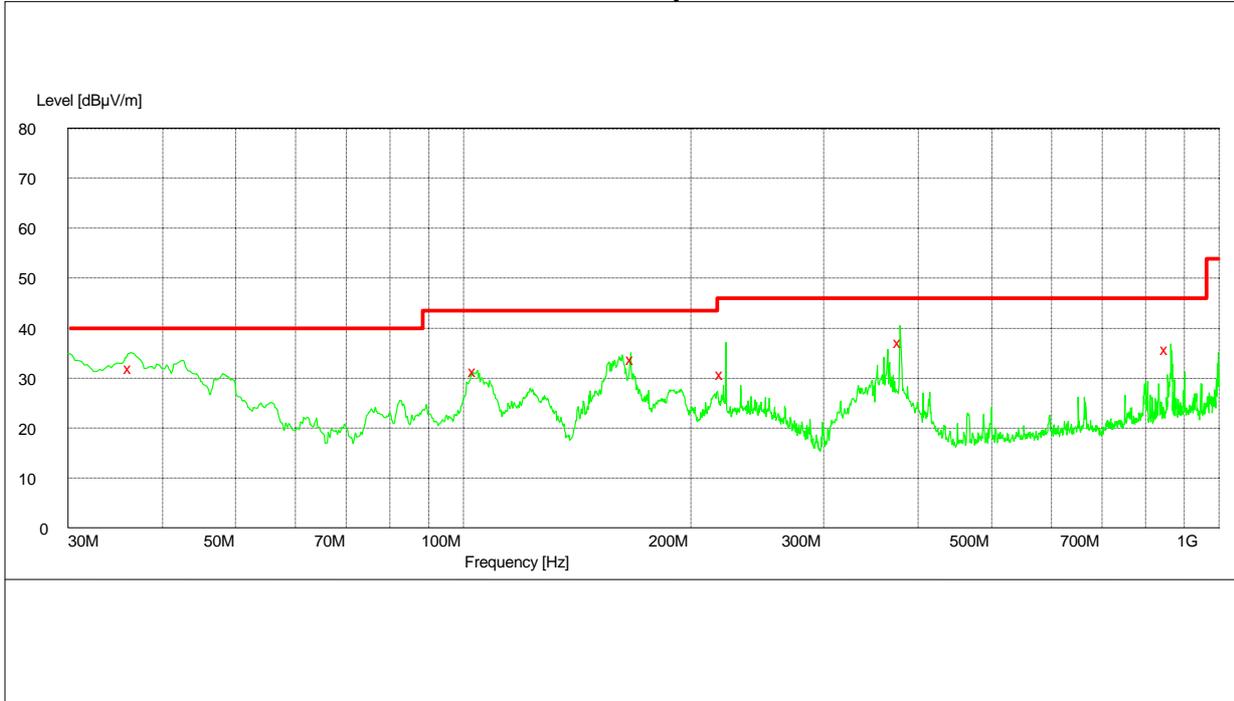
Table 13 System Measurement Uncertainty

	Items	Extended Uncertainty
RE	Field strength (dB μ V/m)	U=4.6dB; k=2(30MHz-1GHz)
RSE	ERP (dBm)	U = 2.2dB ; k = 2
CE	Disturbance Voltage (dB μ V)	U=3.3dB; k=2

8 Graph and Data of Emission Test

8.1 Radiated Disturbance

This test was carried out in all the test modes, Here only the worst test result was shown.



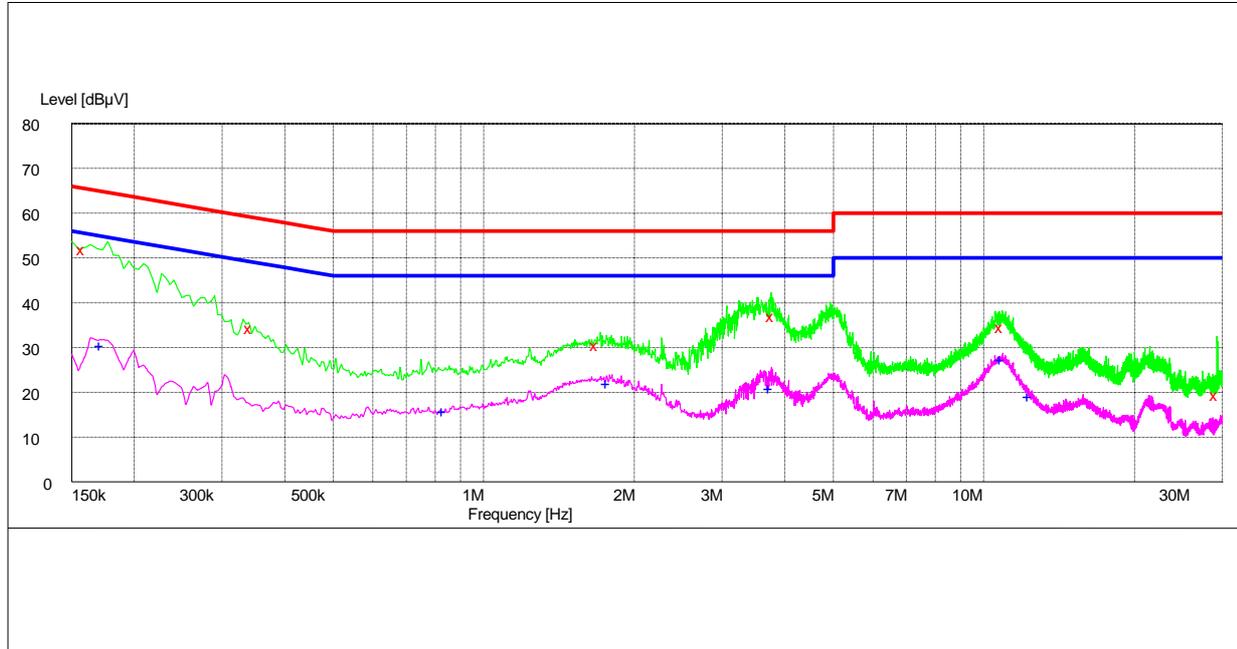
MEASUREMENT RESULT: QP Detector

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
36.360000	31.90	-9.0	40.0	8.1	178.0	39.00	HORIZONTAL
103.980000	31.00	-15.3	43.5	12.5	234.0	40.00	HORIZONTAL
167.760000	33.90	-14.4	43.5	9.6	118.0	296.00	VERTICAL
220.500000	30.90	-12.8	46.0	15.1	217.0	14.00	VERTICAL
379.020000	37.30	-7.4	46.0	8.7	264.0	132.00	HORIZONTAL
855.600000	35.80	0.2	46.0	10.2	210.0	260.00	VERTICAL

8.2 Conducted Disturbance

This test was carried out in all the test modes, Here only the worst test result was shown.

8.2.1 AC Power Port Test Data



MEASUREMENT RESULT: QP Detector

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.159000	50.30	10.9	66	15.7	N	FLO
0.343500	34.10	10.2	59	24.9	N	FLO
1.684500	30.80	9.9	56	25.2	N	FLO
3.795000	37.80	10.1	56	18.2	L3	FLO
10.873500	35.70	11.6	60	24.3	L3	FLO
29.359500	17.90	13.7	60	42.1	L3	FLO

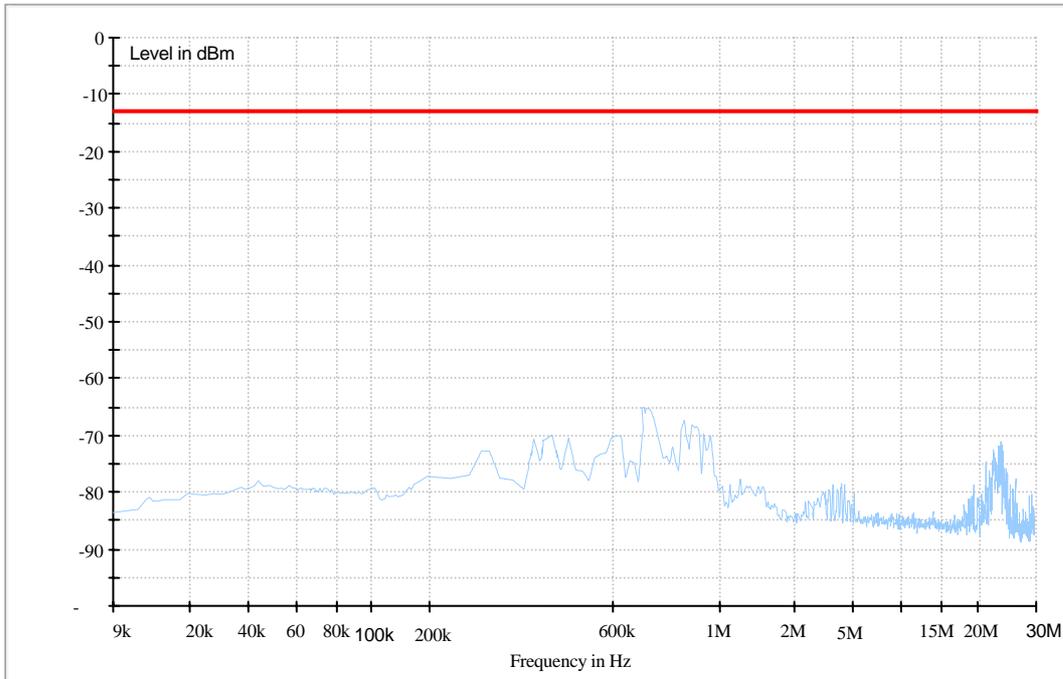
MEASUREMENT RESULT: AV Detector

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.172500	30.90	10.8	55	24.1	L3	FLO
0.834000	16.10	9.9	46	29.9	N	FLO
1.774500	22.30	10.0	46	23.7	N	FLO
3.750000	21.40	10.1	46	24.6	L3	FLO
10.873500	27.80	11.6	50	22.2	L3	FLO
12.376500	19.50	11.7	50	30.5	L3	FLO

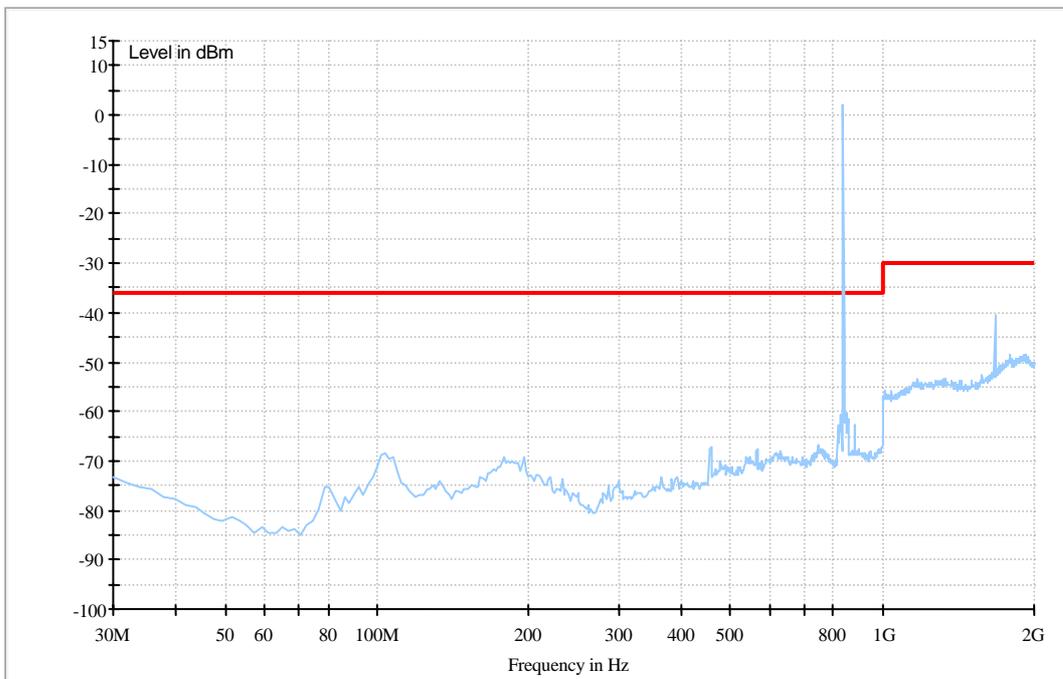
8.3 Radiated Spurious Emission

8.3.1 CDMA800

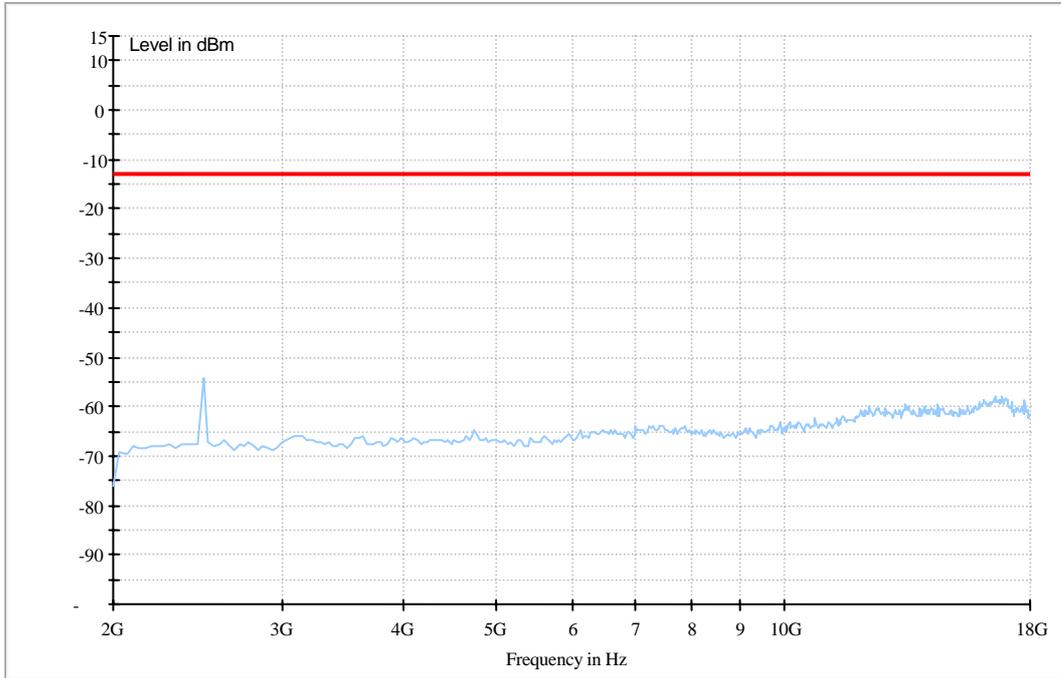
Traffic Mode (9kHz-30MHz)



Traffic Mode (30MHz-2GHz)

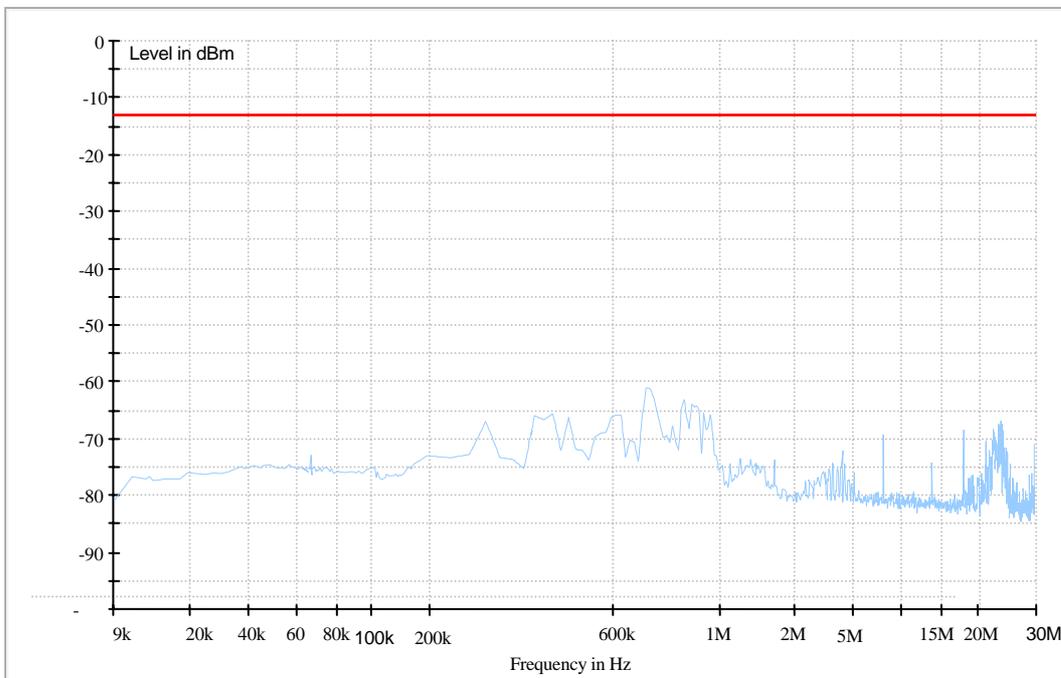


Traffic Mode (2GHz-18GHz)

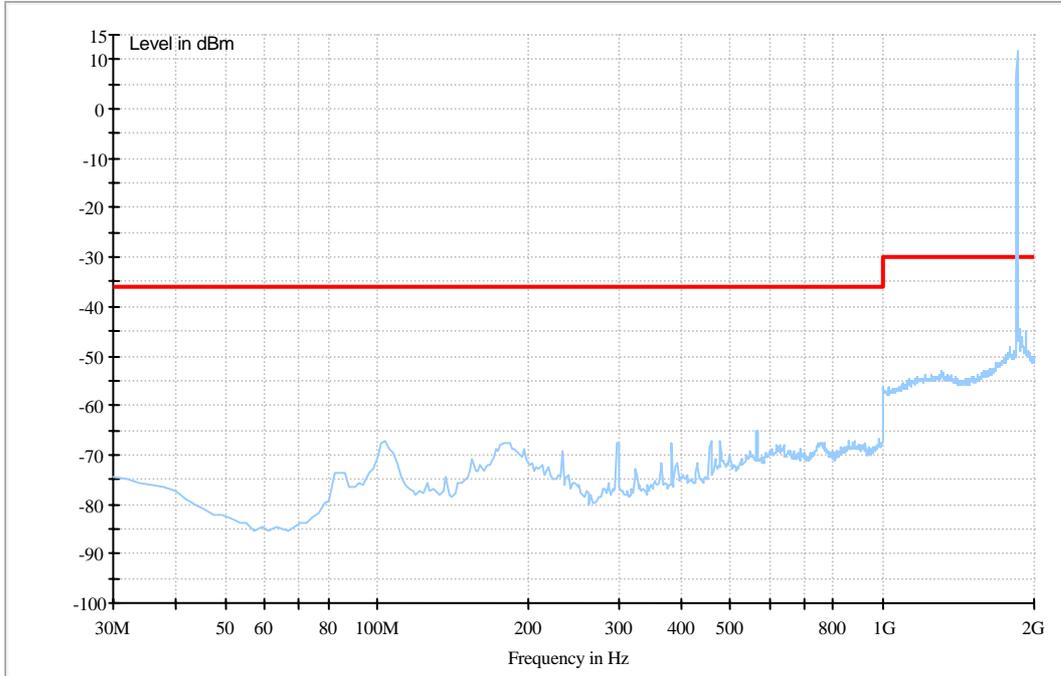


8.3.2 CDMA1900

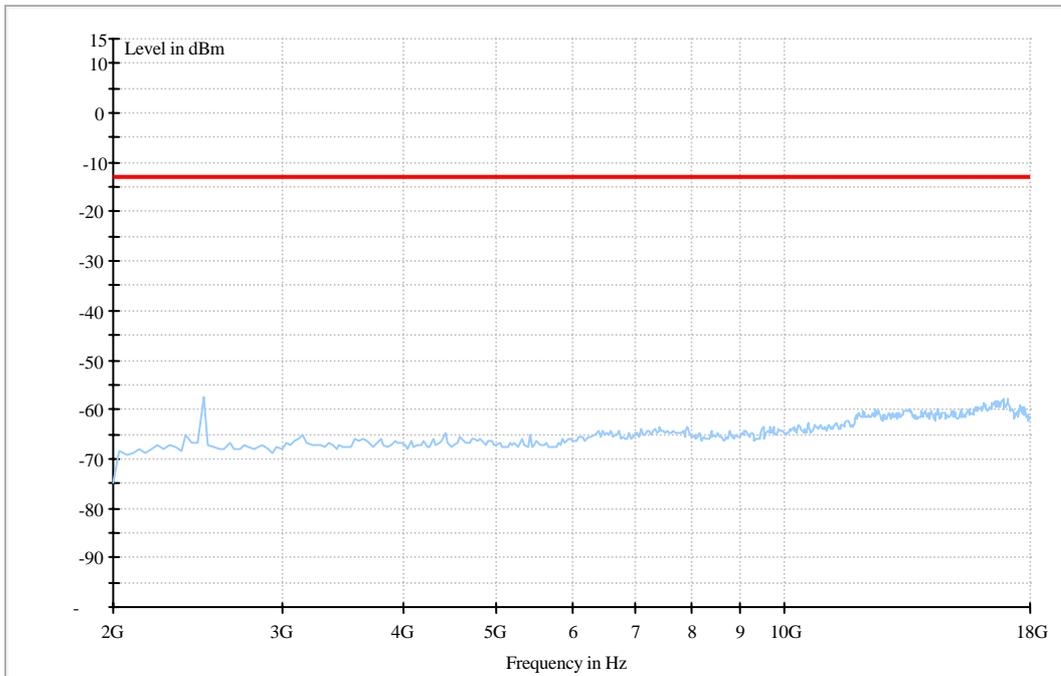
Traffic Mode (9kHz-30MHz)



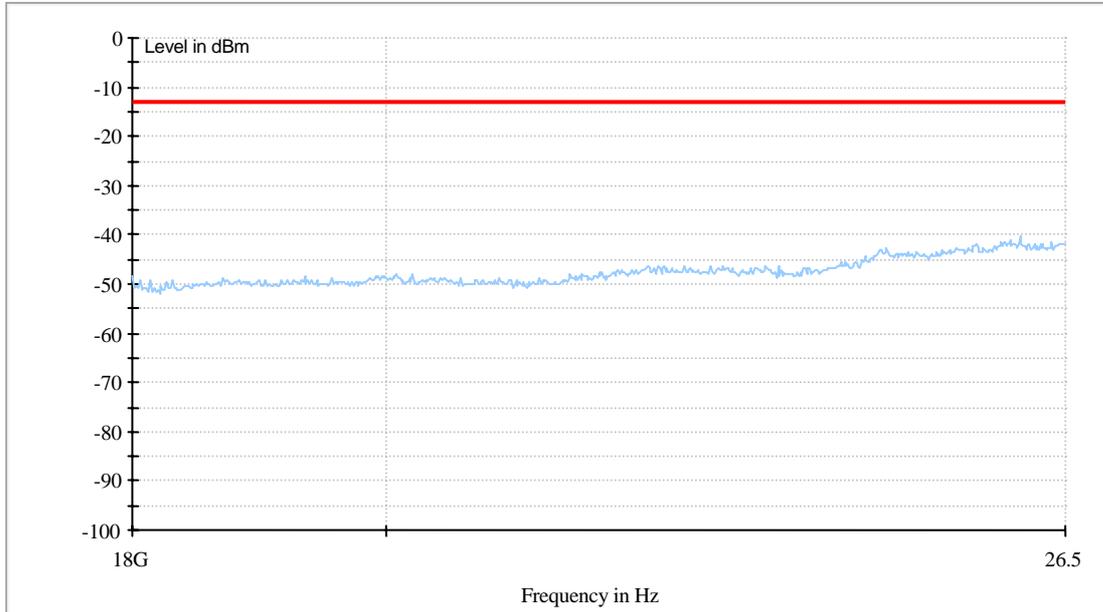
Traffic Mode (30MHz-2GHz)



Traffic Mode (2GHz-18GHz)

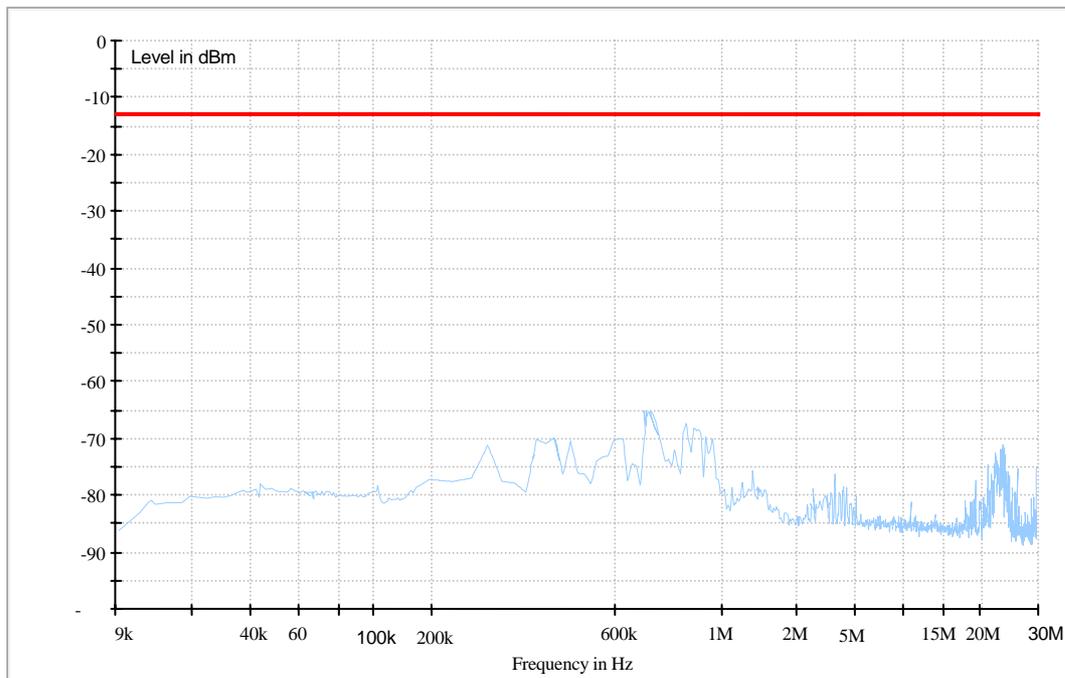


Traffic Mode (18GHz-26.5GHz)

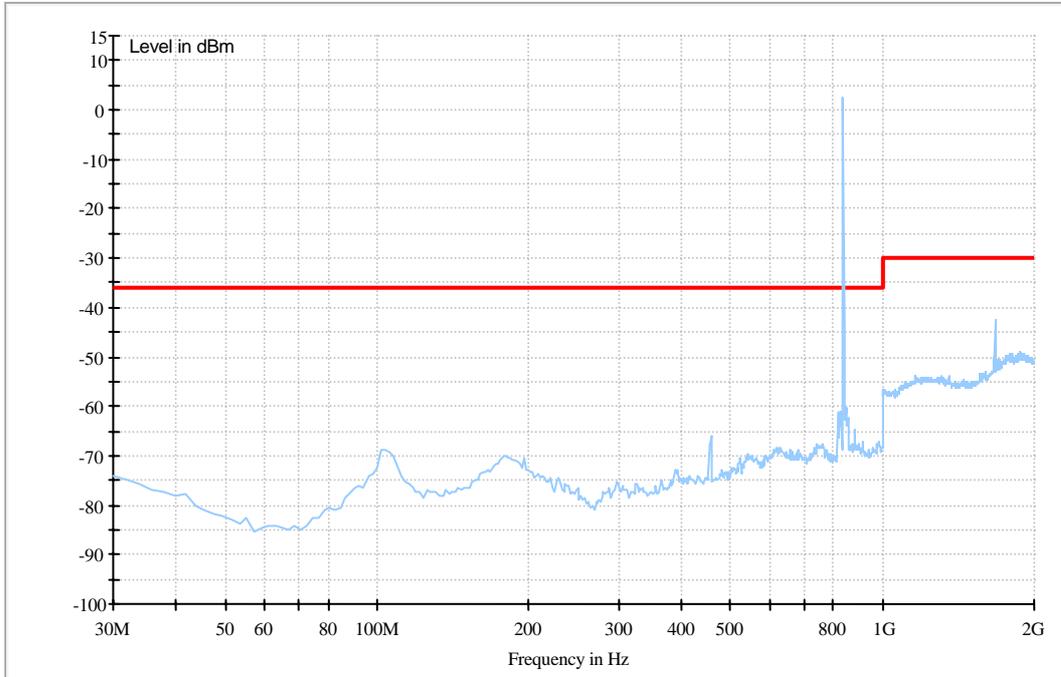


8.3.3 EV-DO800 V.0

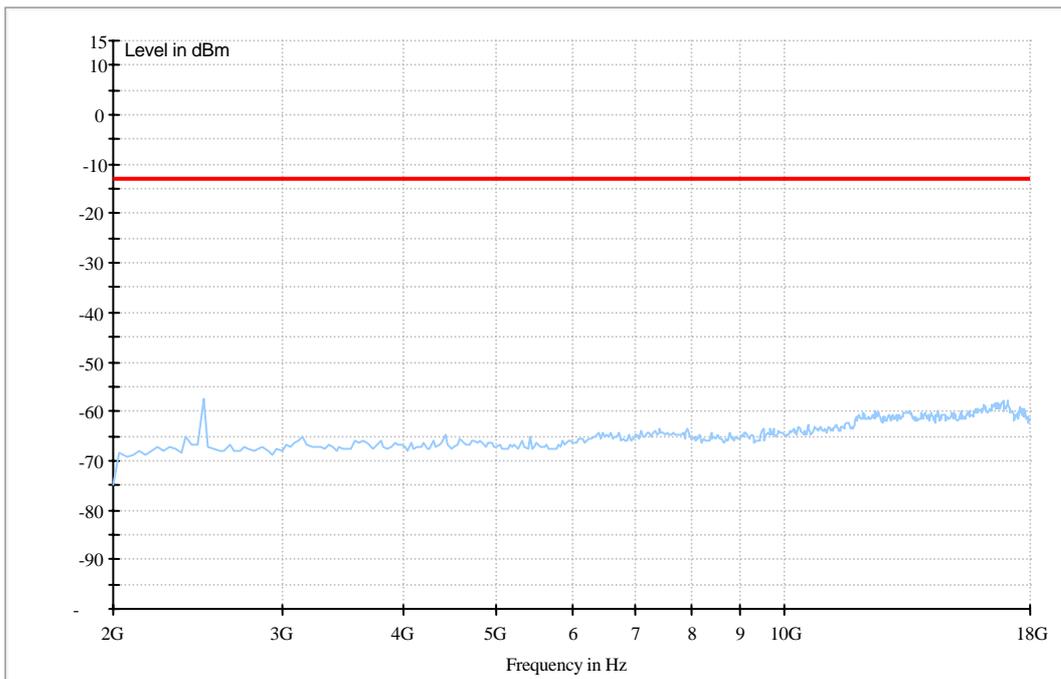
Traffic Mode (9kHz-30MHz)



Traffic Mode (30MHz~2GHz)

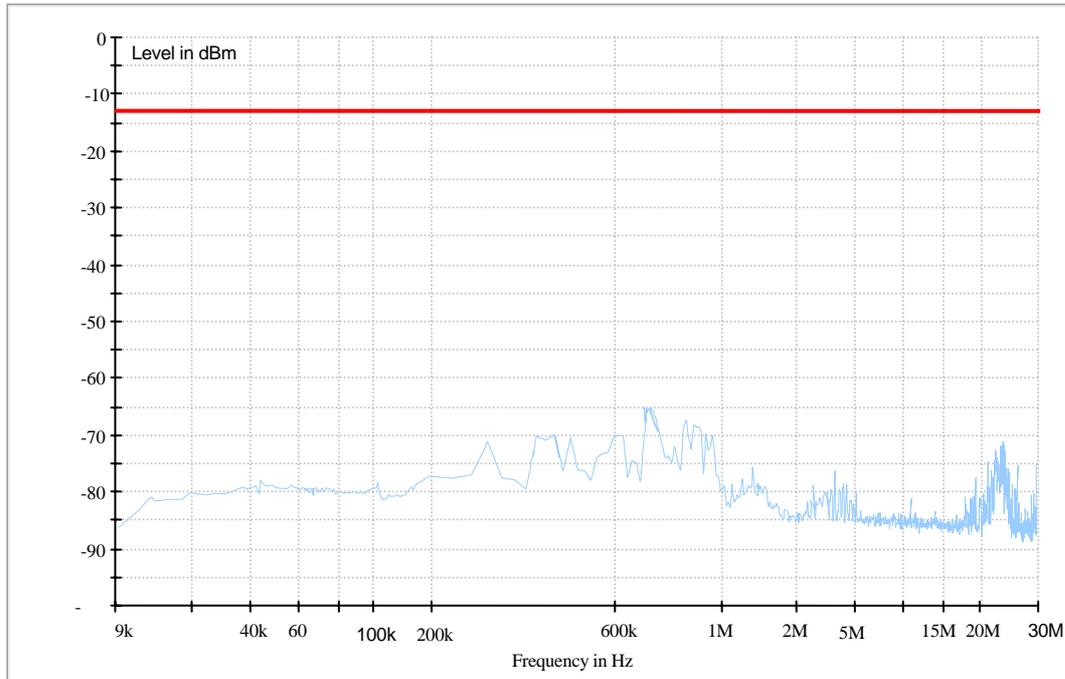


Traffic Mode (2GHz-18GHz)

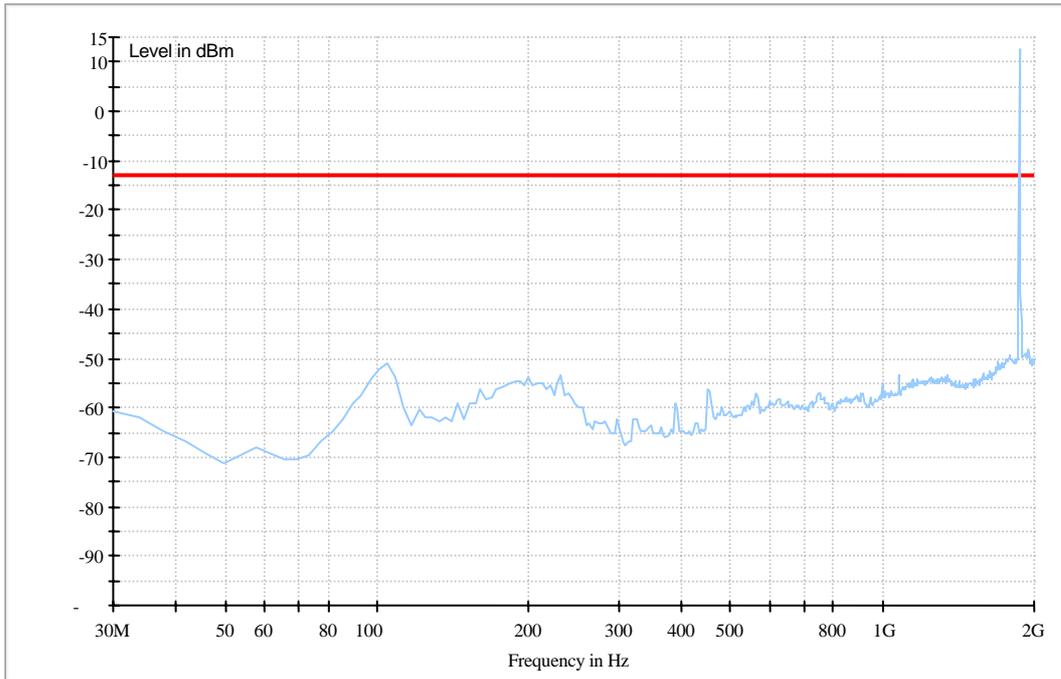


8.3.4 EV-DO1900 V.0

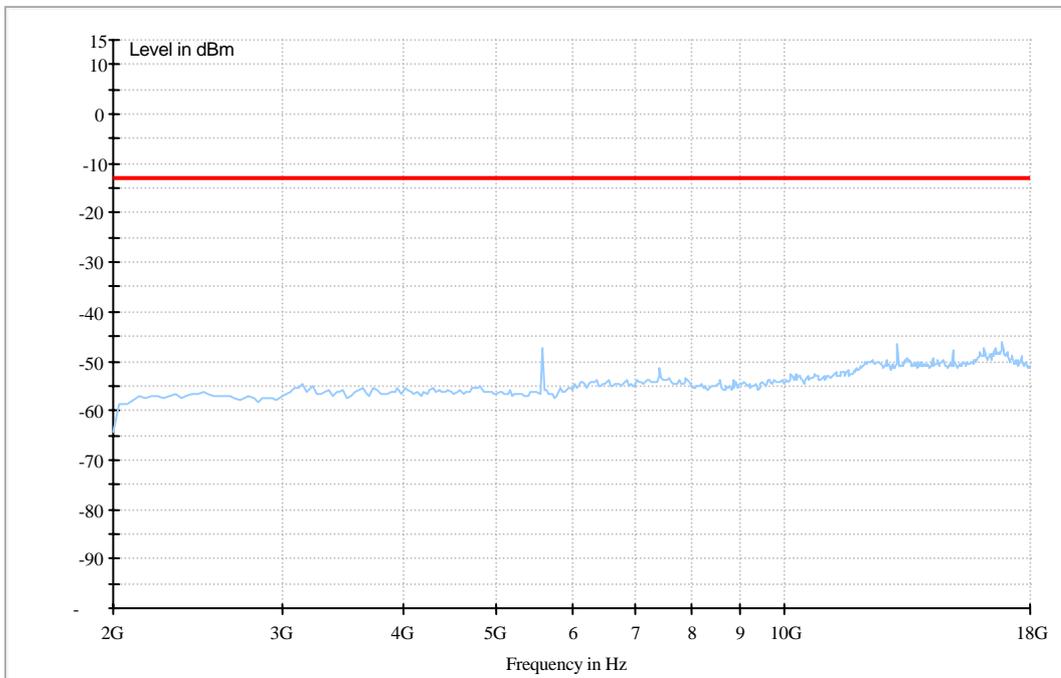
Traffic Mode (9kHz-30MHz)



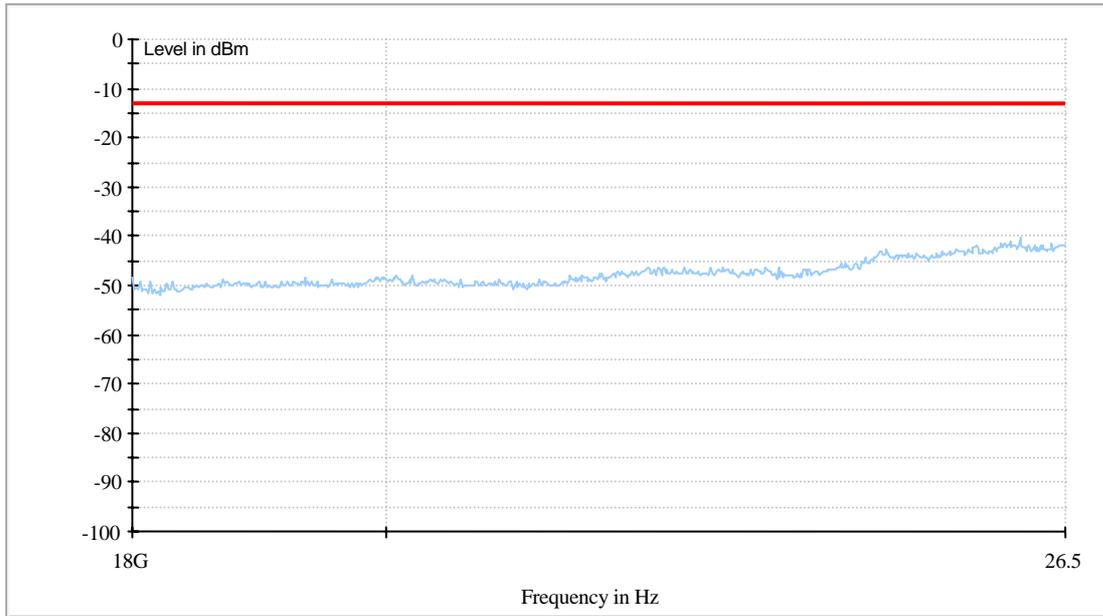
Traffic Mode (30MHz-2GHz)



Traffic Mode (2GHz-18GHz)

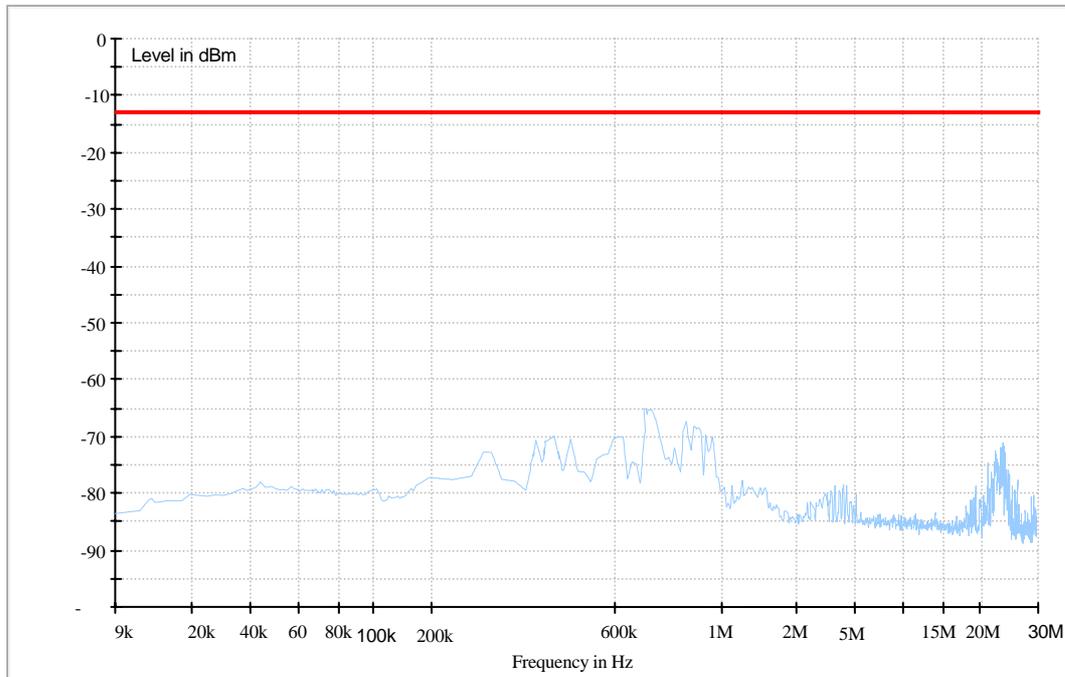


Traffic Mode (18GHz-26.5GHz)

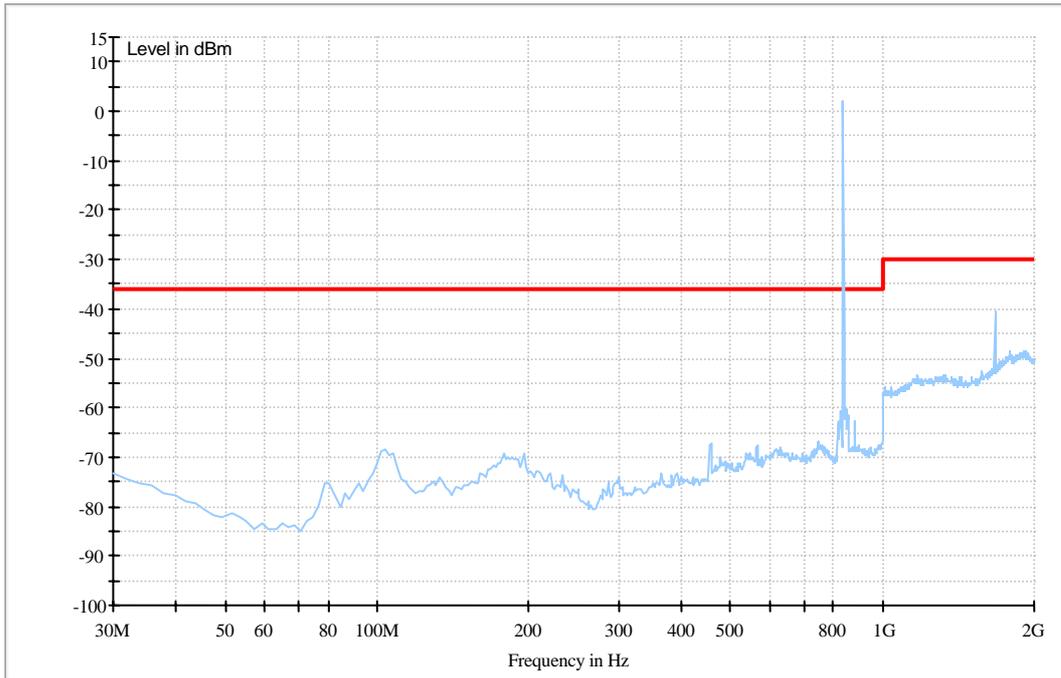


8.3.5 EV-DO800 V.A

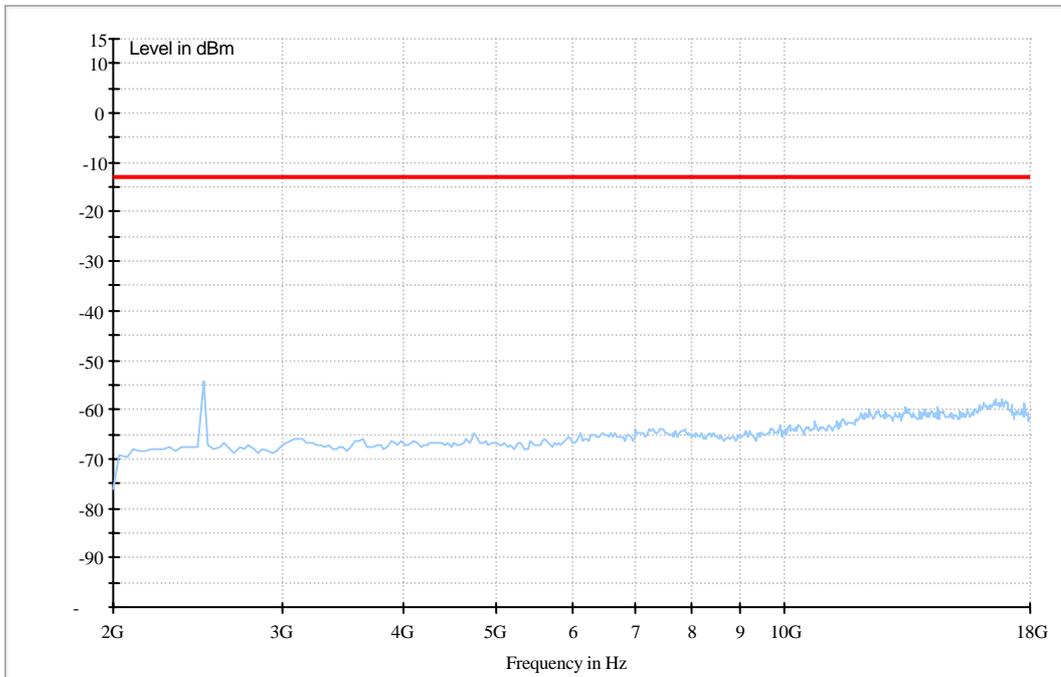
Traffic Mode (9kHz-30MHz)



Traffic Mode (30MHz-2GHz)

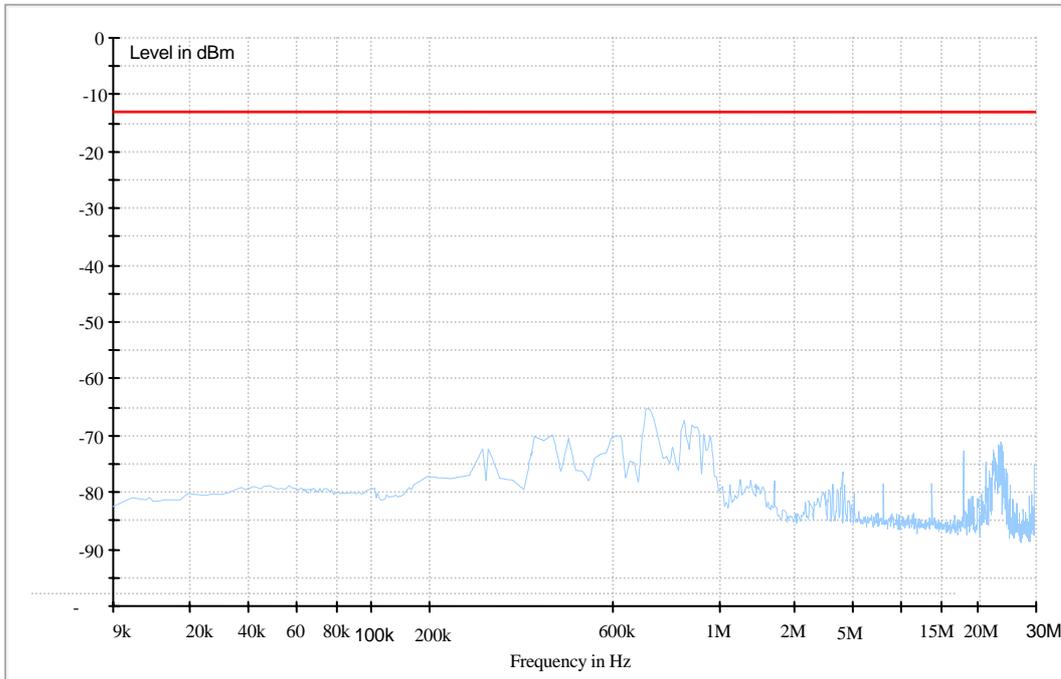


Traffic Mode (2GHz-18GHz)

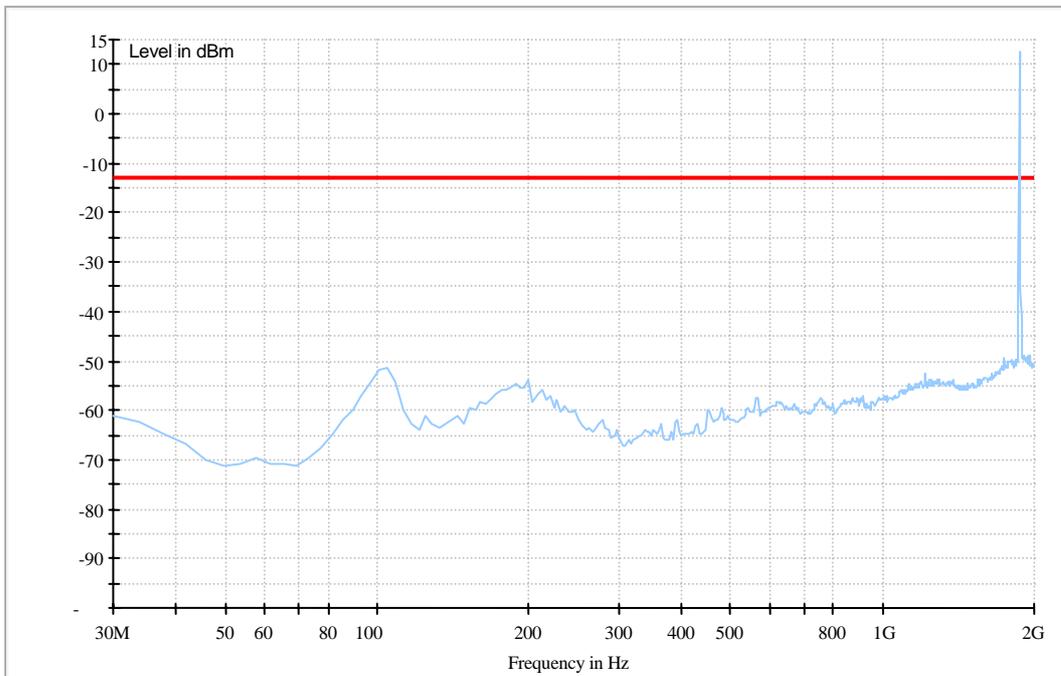


8.3.6 EV-DO1900 V.A

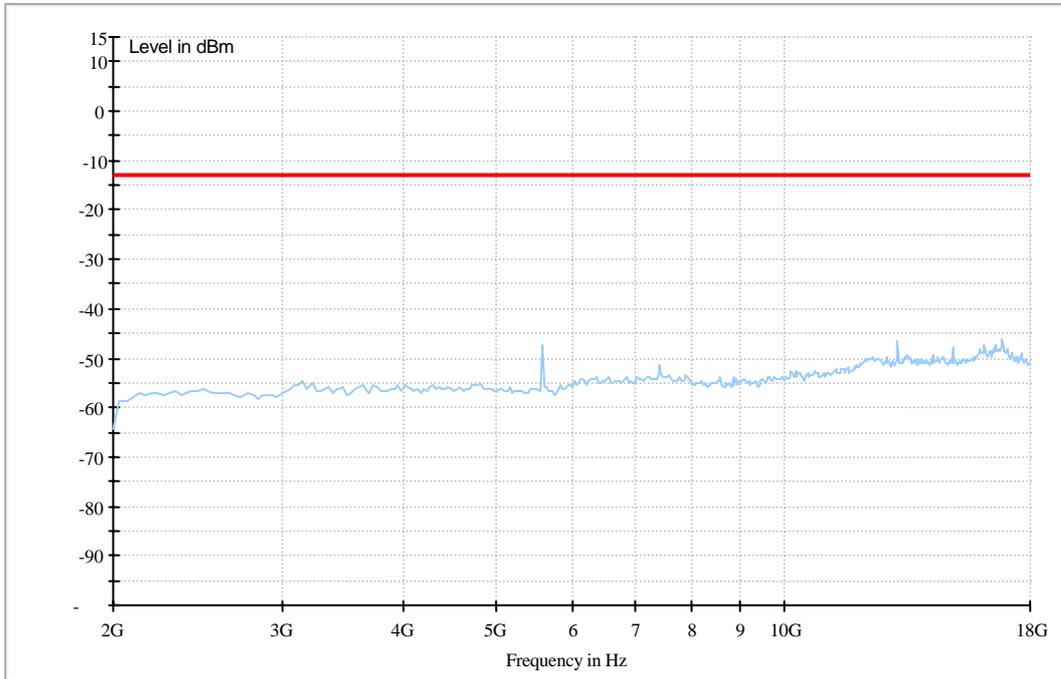
Traffic Mode (9kHz-30MHz)



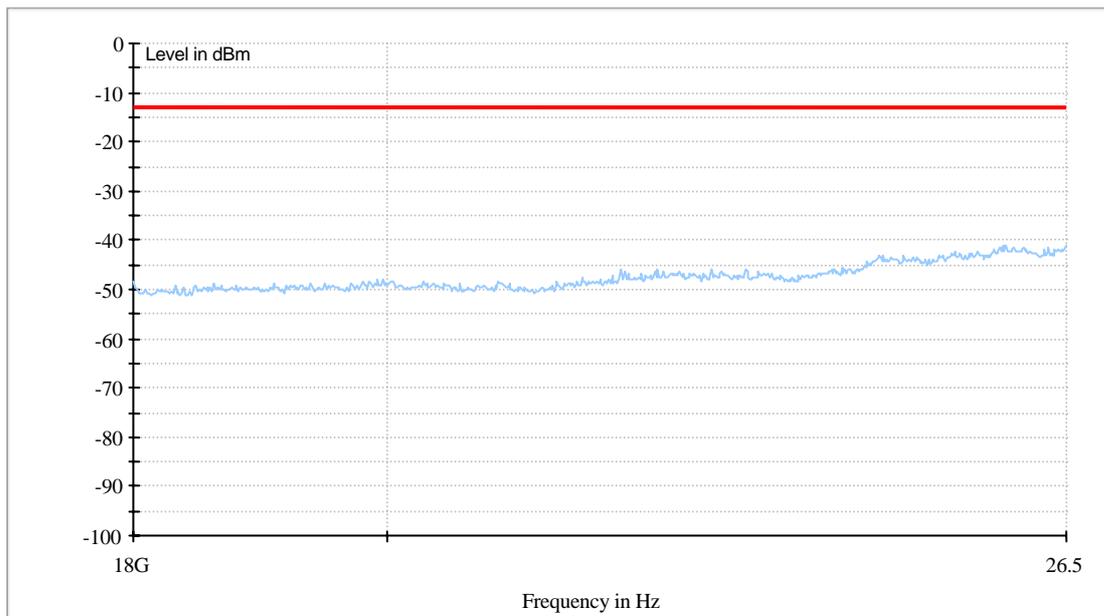
Traffic Mode (30MHz-2GHz)



Traffic Mode (2GHz-18GHz)



Traffic Mode (18GHz-26.5GHz)





9 Photographs of Test Set-ups

9.1 Radiated Emissions



Radiated Disturbance Emissions

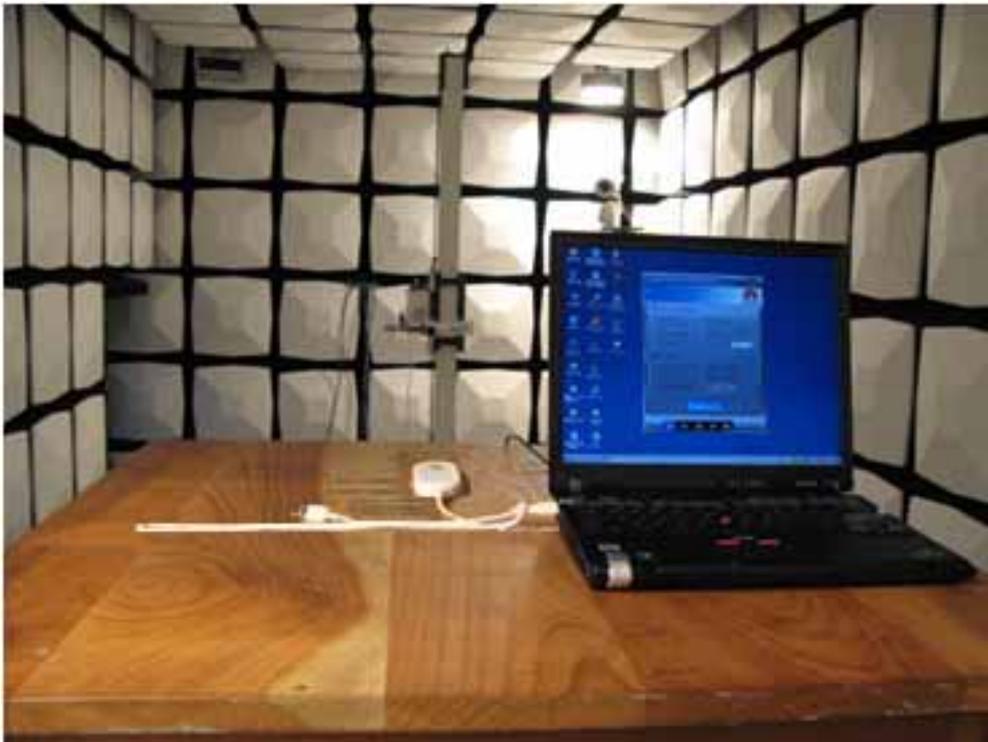
9.2 Radiated Spurious Emissions



Radiated Spurious Emission 30M~2GHz



Radiated Spurious Emission 2G~18GHz



Radiated Spurious Emission 18G~26.5GHz

9.3 Conducted Emissions



Conducted Emissions of AC Power Port

END