



FCC EMC Test Report

Product Name: LTE USB Rotator

Model Number: K5005

Report No: SYBH(Z-EMC)103032011-2

FCC ID: QISK5005

Reliability Laboratory of Huawei Technologies Co., Ltd.

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Notice 1

1. The laboratory has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS), and accreditation number: L0310.
2. The laboratory has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements. The site recognition number is 97456.
3. The laboratory has been listed by industry Canada to perform electromagnetic emission measurement. The site recognition number is 6369A-2
4. The test report is invalid if not marked with "exclusive stamp for the test report".
5. The test report is invalid if not marked with the stamps or the signatures of the persons responsible for performing, revising and approving the test report.
6. The test report is invalid if there is any evidence of erasure and/or falsification.
7. If there is any dissidence for the test report, please file objection to the test centre within 15 days from the date of receiving the test report.
8. Normally, the test report is only responsible for the samples that have undergone the test.
9. Context of the test report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of the laboratory.



Notice 2

Modification Information:

Table 1 Modification Information

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



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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	LTE USB Rotator
MANUFACTURERS MODEL NUMBER	K5005

1.2 Test Site

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

1.3 Test environment condition

Ambient temperature	20~25°C
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: Wireless Module				
Test Items	Test Configuration & Test Mode	Required Performance Criteria	Result	Site
Radiated Emissions Enclosure Port	TC1 (TM5~TM8)	N/A	Pass	Site1
Conducted Emissions	TC1 (TM1~TM8)	N/A	Pass	Site1
Radiated Spurious Emissions Enclosure Port	TC1 (TM1~TM8)	N/A	Pass	Site1

Note:
1, Measurement taken is within the measurement uncertainty of measurement system.
2, TC = Test configuration



3 Equipment Specification

3.1 General Description

K5005 USB Rotator is subscriber equipment in the LTE/ DC-HSPA+/HSPA+/UMTS/EDGE/GPRS/GSM system. K5005 implements such functions as RF signal receiving/transmitting, LTE/DC-HSPA+/HSPA+/WCDMA and EDGE/GPRS/GSM protocol processing, data service etc. Externally it provides USB interface (to connect to the notebook etc.), USIM card interface and Micro SD card interface. K5005 has 3 internal antennae as default.

3.1.1 Main Equipment Technical Data

Description:	LTE USB Rotator
Models:	K5005
Input Rated Voltage:	5V
Rated Consumption Power:	Max 4.0 W
Maximum Emission Power:	Max 33dBm
Dimensions:	92mm x 31.5mm x 14.4mm
Weight:	about 35.5g

Table 3 Sub-Assembly Identity

Mode		Work Frequency	
		Transmitt Frequency (MHz)	Receive Frequency (MHz)
GSM	GSM850	824-849	869-894
	PCS1900	1850-1910	1930-1990

3.2 Sub-Assembly Identity

Table 4 Sub-Assembly Identity

Board			
Model Name	Qty.	Serial Number	Description
K5005	1	N3Q2A11130100076	Main Board

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 Cable	shielded



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	3608082535	2010-08-04
Notebook	T61	ThinkPad	3108052581	NA
Notebook	D620	DELL	3106085412	NA

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~TM8

TC1: EUT was powered by the USB port of the notebook directly.

4.3.2 Test Mode

There were 8 test Modes. TM1 to TM 8 were shown below:

- TM1: operate in traffic mode GPRS 850;
- TM2: operate in traffic mode EGPRS 850;
- TM3: operate in traffic mode GPRS 1900;
- TM4: operate in traffic mode EGPRS 1900;
- TM5: operate in idle mode GPRS 850;
- TM6: operate in idle mode EGPRS 850;
- TM7: operate in idle mode GPRS 1900;
- TM8: operate in idle mode EGPRS 1900;

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 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.

For GSM850 and PCS1900, the following conditions shall also be met:

- The EUT shall be commanded to operate at maximum transmit power;
- The downlink RXQUAL shall be monitored.

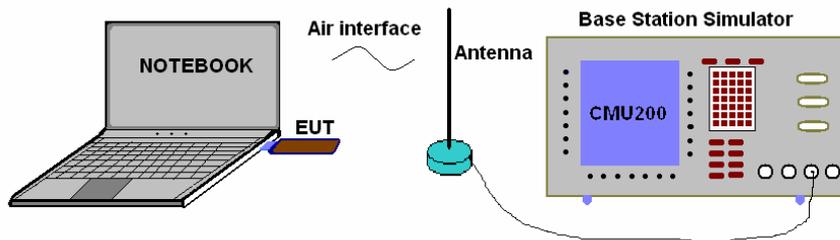


Figure 1.: TC1 (TM1-TM4)

Idle Mode:

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).

The EUT is required to be in the idle mode.

For GSM850 and PCS1900, the following conditions shall be met:

When the EUT is required to be in the idle mode, the test system shall simulate a Base Station (BS) with Broadcast Control Channel/Common Control Channel (BCCH/CCCH) on one carrier. The EUT shall be synchronized to the BCCH, listening to the CCCH and able to respond to paging messages. Periodic Location Updating shall be disabled.

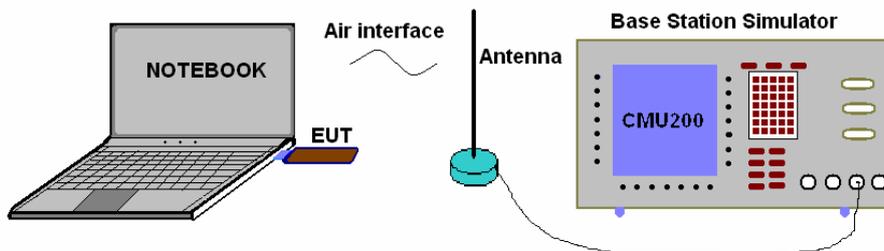


Figure 2. TC1 (TM5-TM8)

5 Electromagnetic Interference (EMI)

5.1 Radiated Disturbance 30MHz to18000MHz

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 (2009). 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 Test Receiver and control software ES-K1.

A preliminary scan and a final scan of the emissions were made from 30 MHz to 18GHz by using test script of software; the emissions were measured using a Quasi-Peak Detector (30MHz~1GHz) and AV detector (1GHz ~18GHz). 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

Measurement bandwidth: 1GHz – 18GHz: 1MHz

Test set up figure:

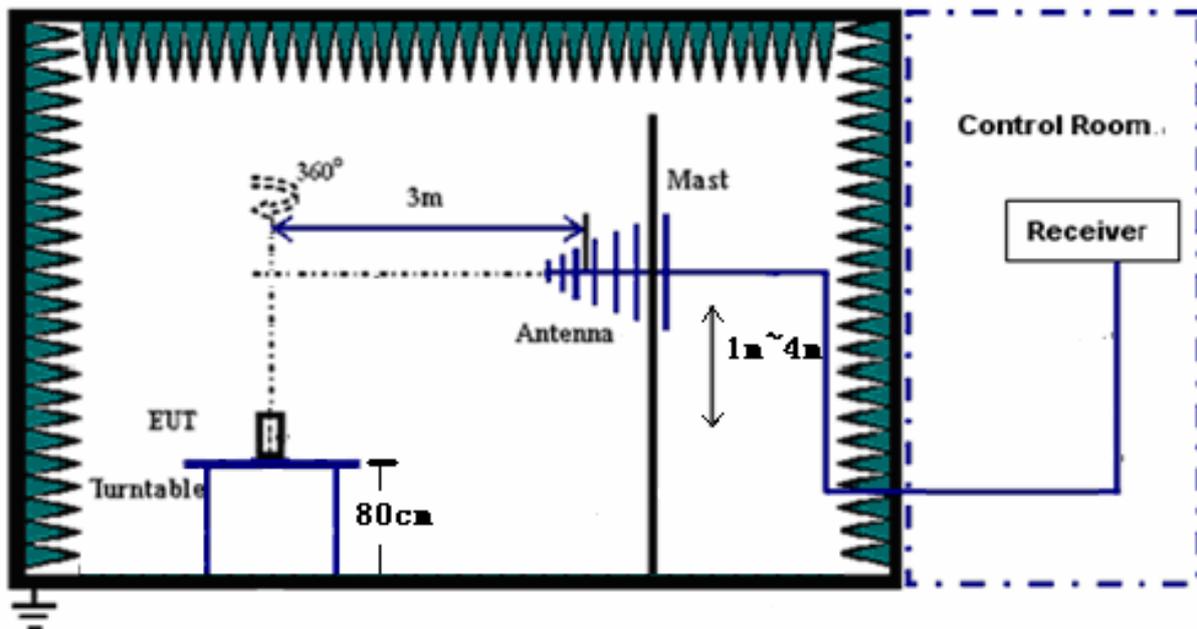


Figure 3. Test set-up

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
Above 960	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.

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.

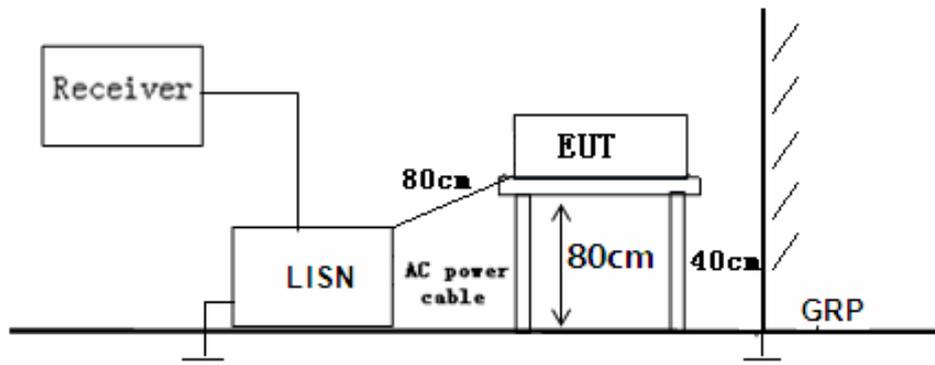


Figure 4. Test Set-up

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

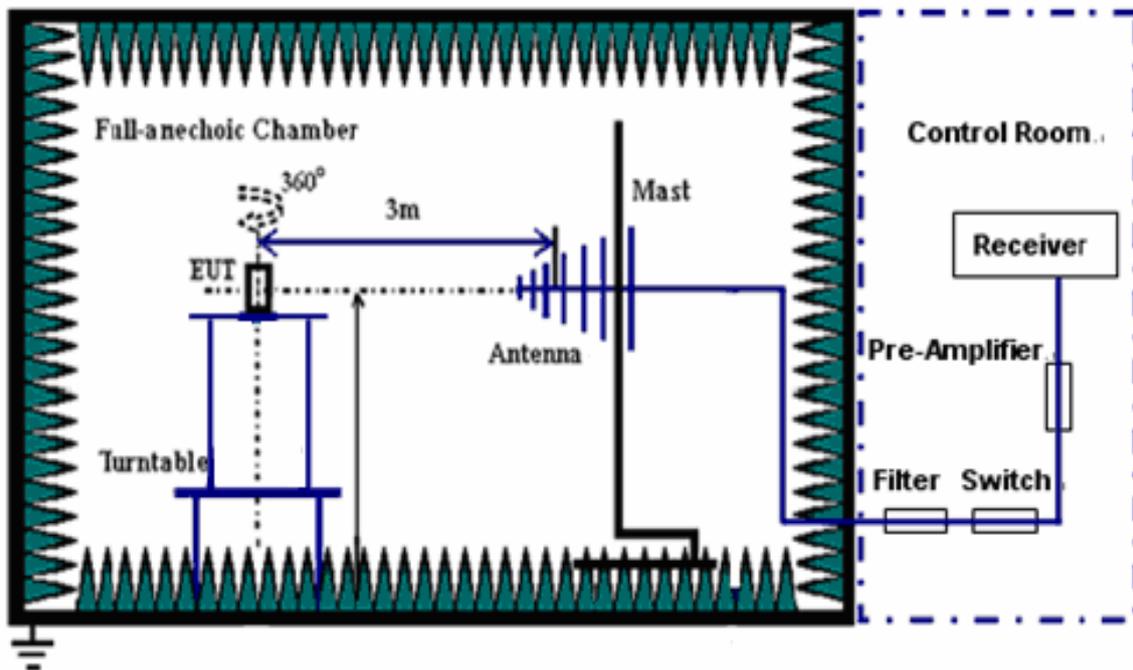
5.3.1 Test Procedure

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:

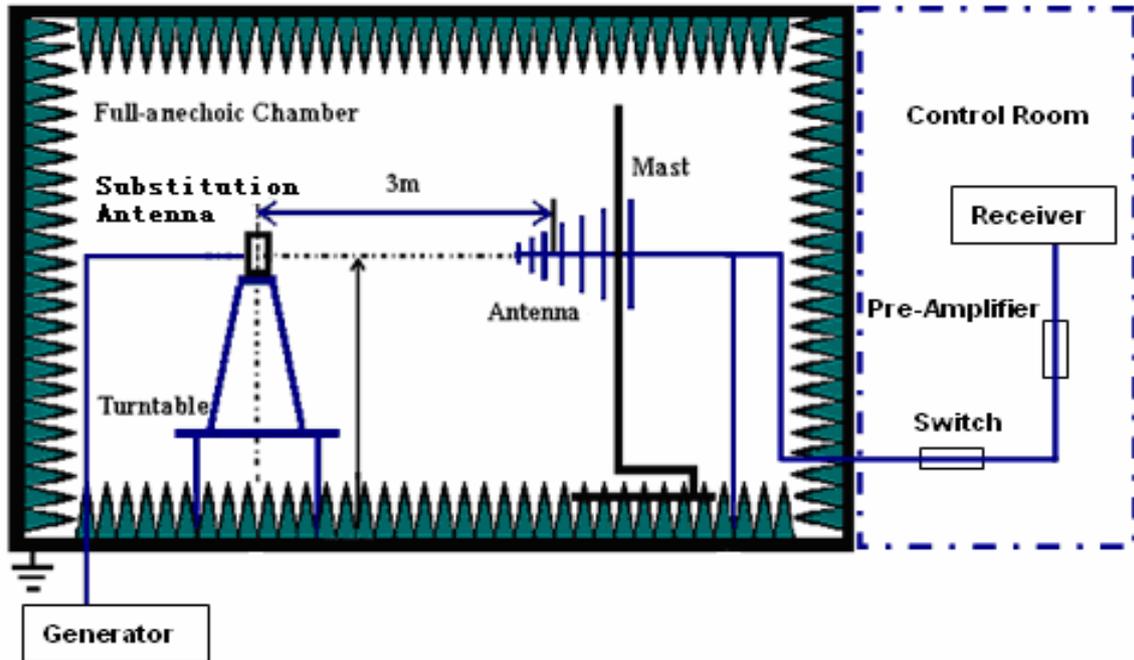
For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, EIRP shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in 2.1033(c)(8). Connect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

Test the Radiated maximum output power by the 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 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: Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater.

- 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
9KHz~18GHz	-13dBm

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

24.238 (b) Measurement procedure: Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater.

- 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
9KHz~26.5GHz	-13dBm

No peak found in pre- test. All frequency points' margin is bigger than 20dB, so the substitution method isn't used.



Calculation Sample:

Table 12 Substitution Results

Freq. [MHz]	Measurement Value [dBm]	Substitution Antenna Type	Gain [dBd]	Cable Loss [dB]	Signal Generator Level [dBm]	Substitution Level [dBm]	FCC limit [dBm]	Result

Note: Forget the E.R.P. (Efficient Radiated Power) in substitution method, the following formula should take to calculate it,

$$\text{E.R.P. [dBm]} = \text{SGP [dBm]} - \text{Cable Loss [dB]} + \text{Gain [dBd]}$$

NOTE: SGP- Signal Generator Level

5.3.2 Test Results

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



6 Main Test Instruments

Table 13 Main Test Equipments

Test item	Test Instrument	Model	Manufacturer	Cal-Date	Cal Interval (month)
RE	EMI Test receiver	ESU26	R&S	Jun.25, 2010	12
	Broadband Antenna	VULB9163	SCHWARZBECK	May.15, 2010	12
	Horn Antenna	HF906	R&S	May.15, 2010	12
CE	EMI Test receiver	ESU26	R&S	Jun.25, 2010	12
	Artificial Mains Network	ENV216	R&S	Jun.25, 2010	12
RSE	EMI Test receiver	FSU43	R&S	Jun.24, 2010	12
	Broadband Antenna	VULB 9163	SCHAFFNER	Sep.21, 2010	12
	Horn Antenna	HF906	R&S	Jun.29, 2010	12
	Horn Antenna	3160	ETS-Lindgren	Sep.29.2010	12
Software Information					
Test Item	Software Name	Manufacturer	Version		
RE/CE	ES-K1	R&S	1.7.1		
RSE	EMC32	R&S	V8.10.10		

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 14 System Measurement Uncertainty

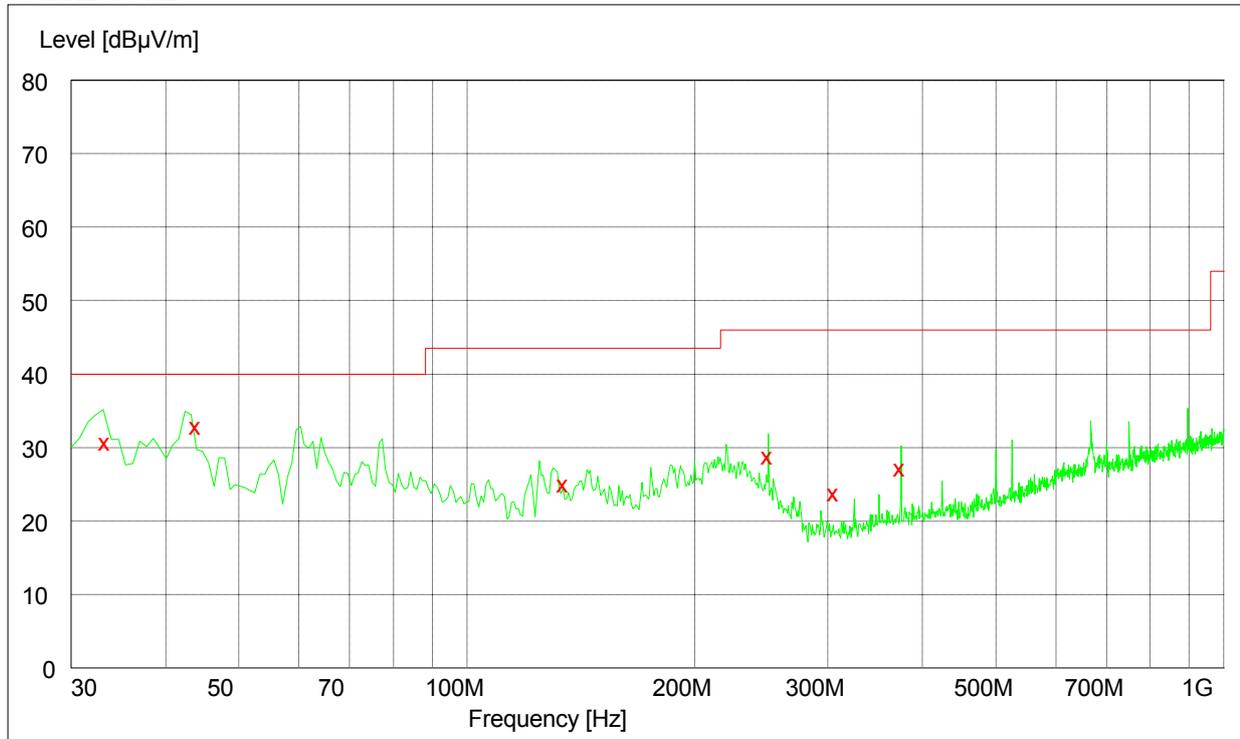
Items		Extended Uncertainty
RE	Field strength (dB μ V/m)	U=4.1dB; k=2(30MHz-1GHz)
RE	Field strength (dB μ V/m)	U=4.1dB; k=2(1GHz-18GHz)
RSE	ERP (dBm)	U=2.8dB; k=2
CE	Disturbance Voltage(dB μ V)	U=3.4dB; k=2

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.

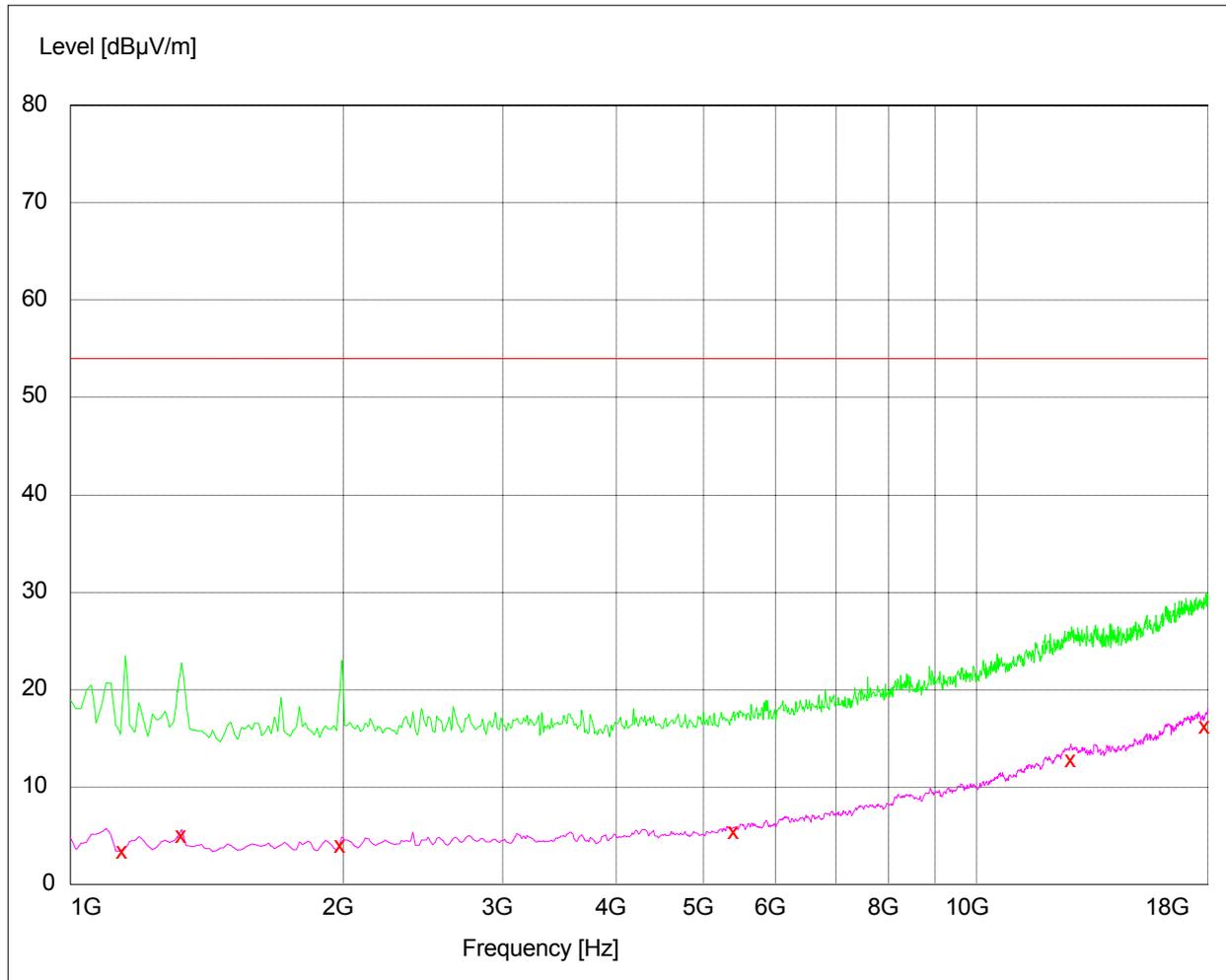
30MHz-1GHz



MEASUREMENT RESULT: QP Detector

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
33.336000	30.90	11.7	40.0	9.1	104.0	309.00	VERTICAL
43.932000	33.10	12.7	40.0	6.9	101.0	107.00	HORIZONTAL
134.404000	25.30	9.0	40.0	14.7	154.0	329.00	VERTICAL
250.276000	29.10	13.8	47.0	17.9	140.0	126.00	HORIZONTAL
306.132000	24.00	15.7	47.0	23.0	125.0	107.00	HORIZONTAL
374.092000	27.40	17.5	47.0	19.6	103.0	219.00	HORIZONTAL

1GHz-18GHz



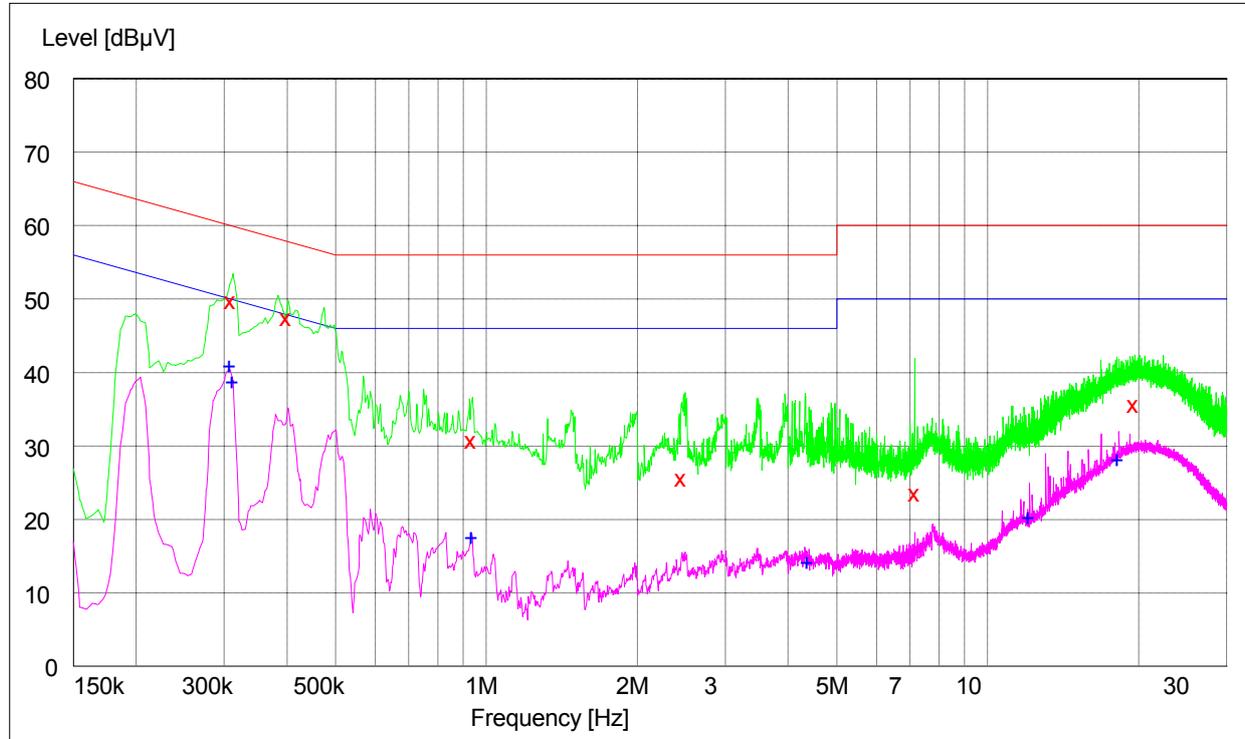
MEASUREMENT RESULT: AV Detector

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
1144.600000	3.20	-27.7	54.0	50.8	100.0	32.00	HORIZONTAL
1330.400000	4.80	-26.5	54.0	49.2	120.0	329.00	HORIZONTAL
1991.300000	3.90	-24.1	54.0	50.1	138.0	16.00	VERTICAL
5416.000000	5.20	-17.6	54.0	48.8	142.0	103.00	VERTICAL
12759.500000	12.60	-5.9	54.0	41.4	119.0	160.00	HORIZONTAL
17918.900000	16.10	-1.0	54.0	37.9	100.0	103.00	HORIZONTAL

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
0.310000	50.00	10.0	60	10	L1	FLO
0.400000	47.70	10.0	58	10.3	N	FLO
0.936000	31.00	10.1	56	25	L1	FLO
2.454000	25.90	10.1	56	30.1	L1	FLO
7.176000	23.90	10.2	60	36.1	L1	FLO
19.618000	35.90	10.3	60	24.1	N	FLO

MEASUREMENT RESULT: AV Detector

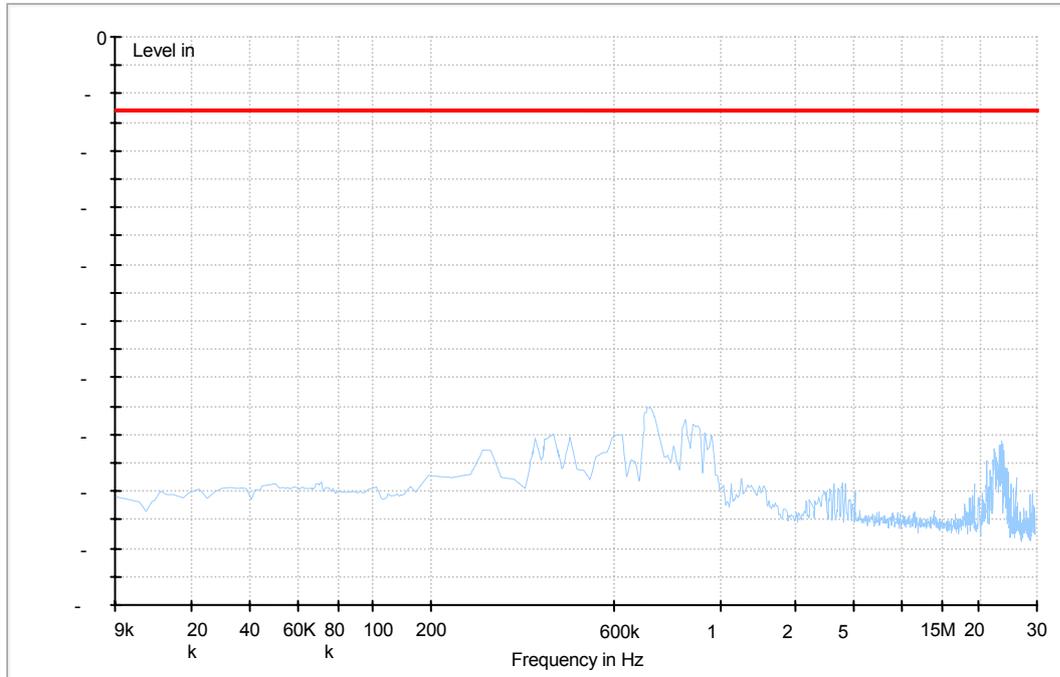
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.308000	41.00	10.0	50	9	L1	FLO
0.312000	38.80	10.0	50	11.2	N	FLO
0.936000	17.70	10.1	46	28.3	L1	FLO
4.376000	14.30	10.2	46	31.7	L1	FLO
12.082000	20.40	10.3	50	29.6	L1	FLO
18.248000	28.20	10.3	50	21.8	N	FLO

8.3 Radiated Spurious Emission

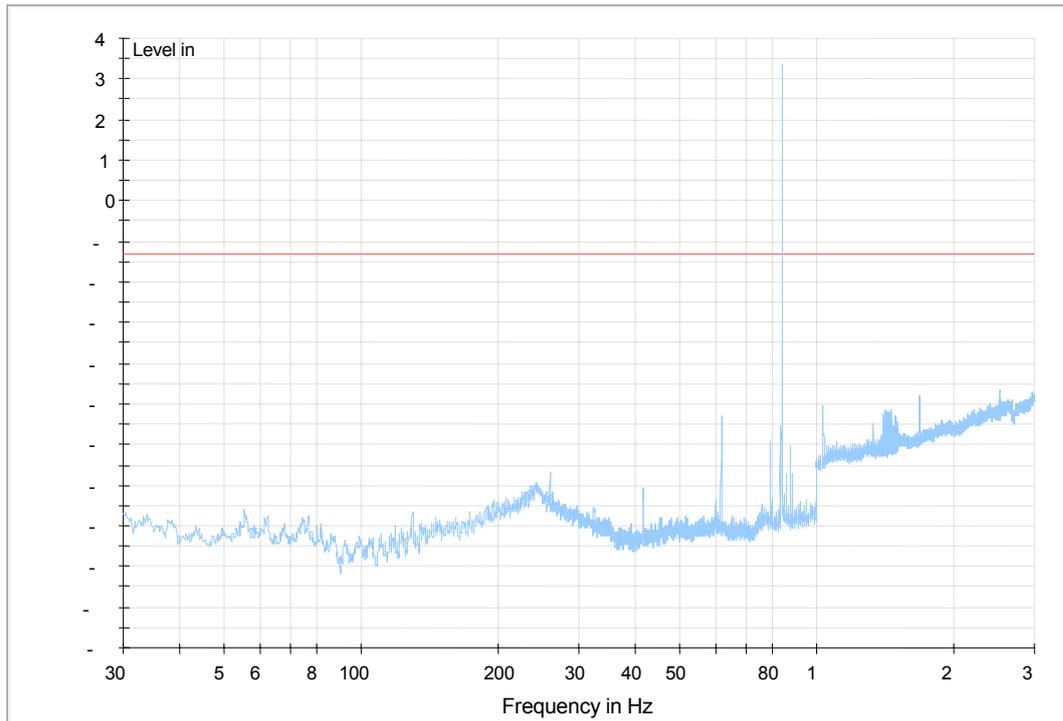
This test results are the maximum level of radiated spurious emissions in vertical and horizontal polarity. The peak exceeds the limit line is carrier frequency.

8.3.1 For GPRS 850

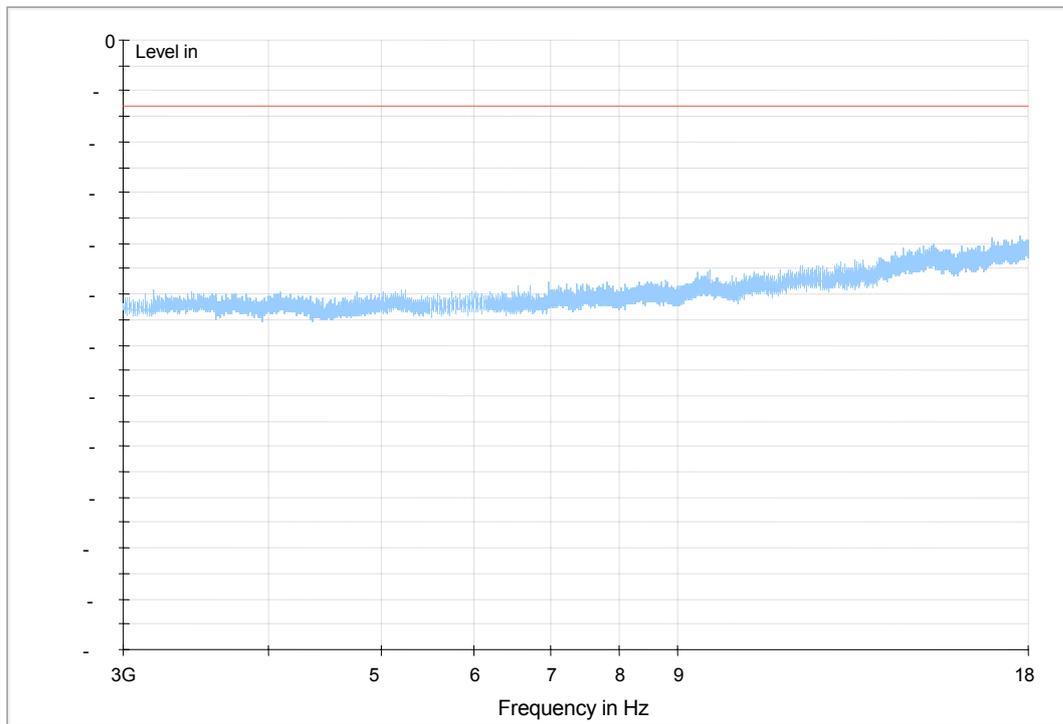
Traffic Mode (9kHz-30MHz)



Traffic Mode (30MHz-3GHz)

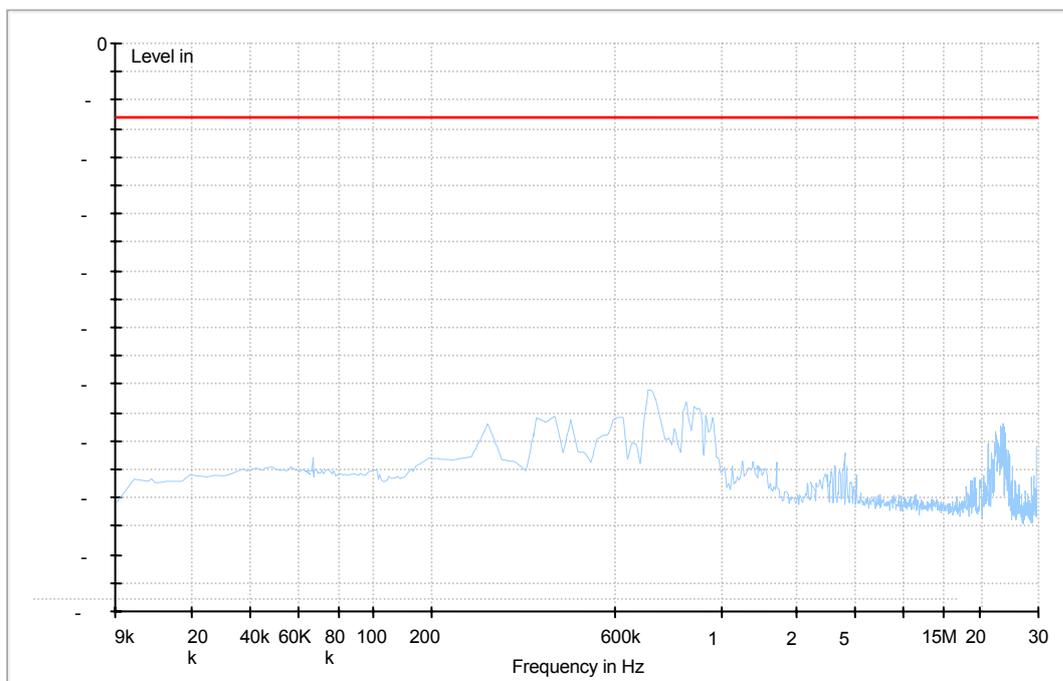


Traffic Mode (3GHz-18GHz)

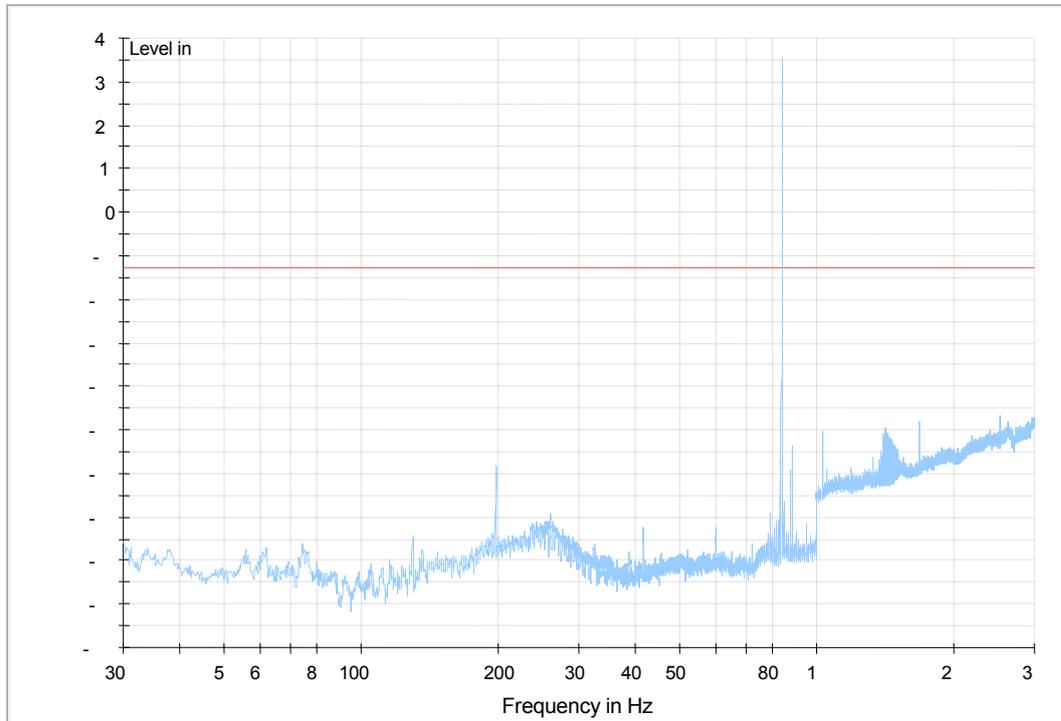


8.3.2 For EGPRS 850

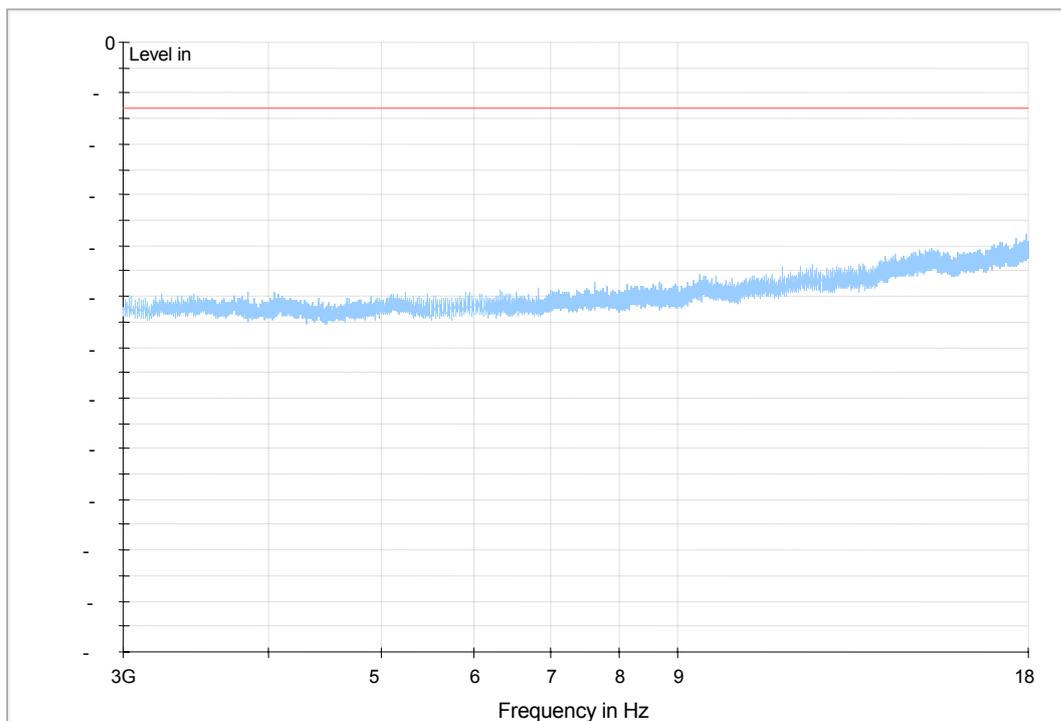
Traffic Mode (9kHz-30MHz)



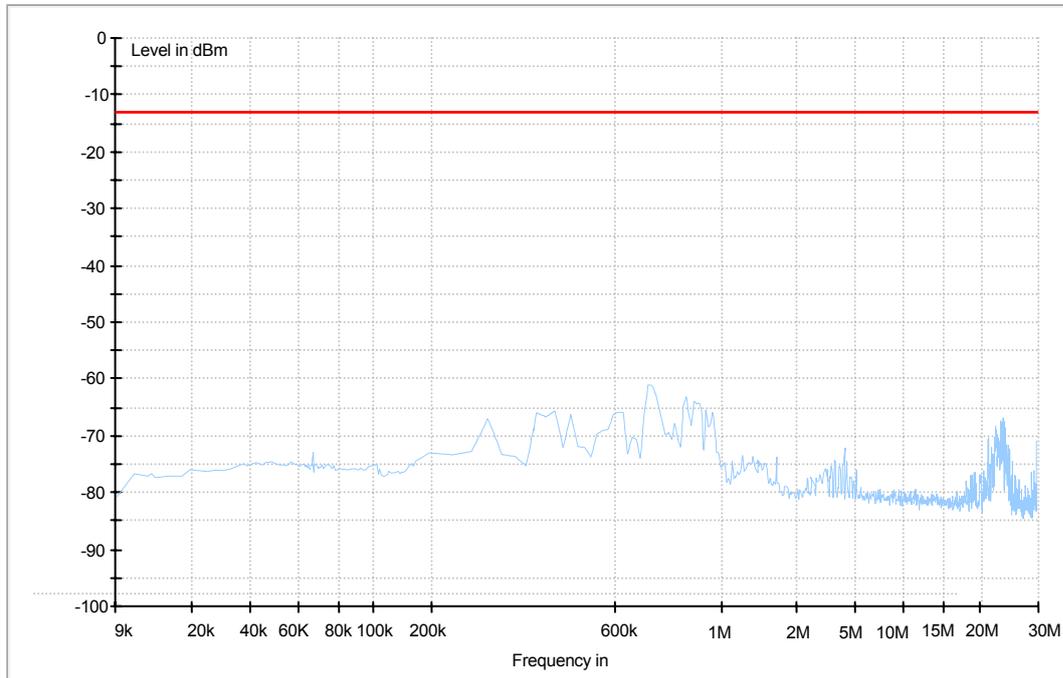
Traffic Mode (30MHz-3GHz)



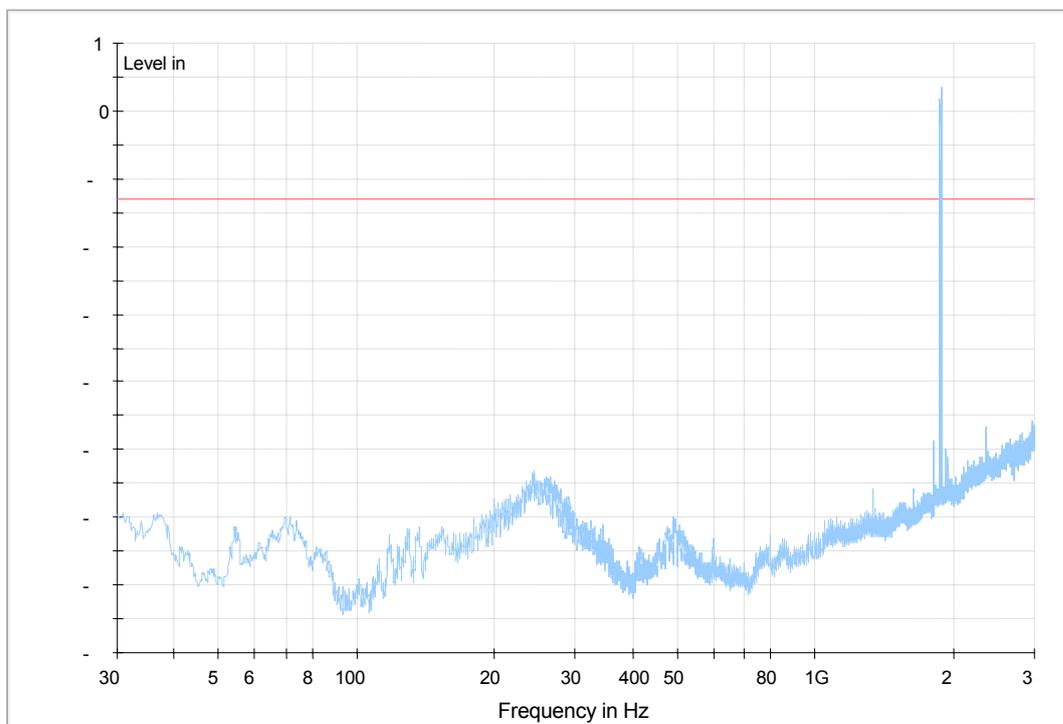
Traffic Mode (3GHz-18GHz)



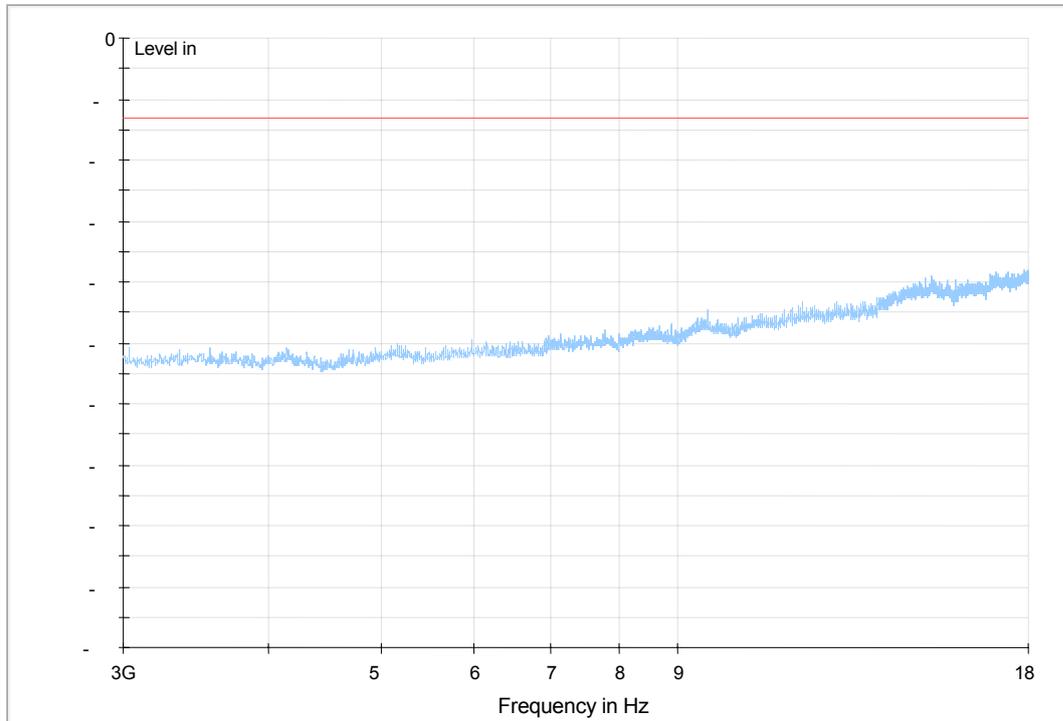
8.3.3 For GPRS 1900 Traffic Mode (9kHz-30MHz)



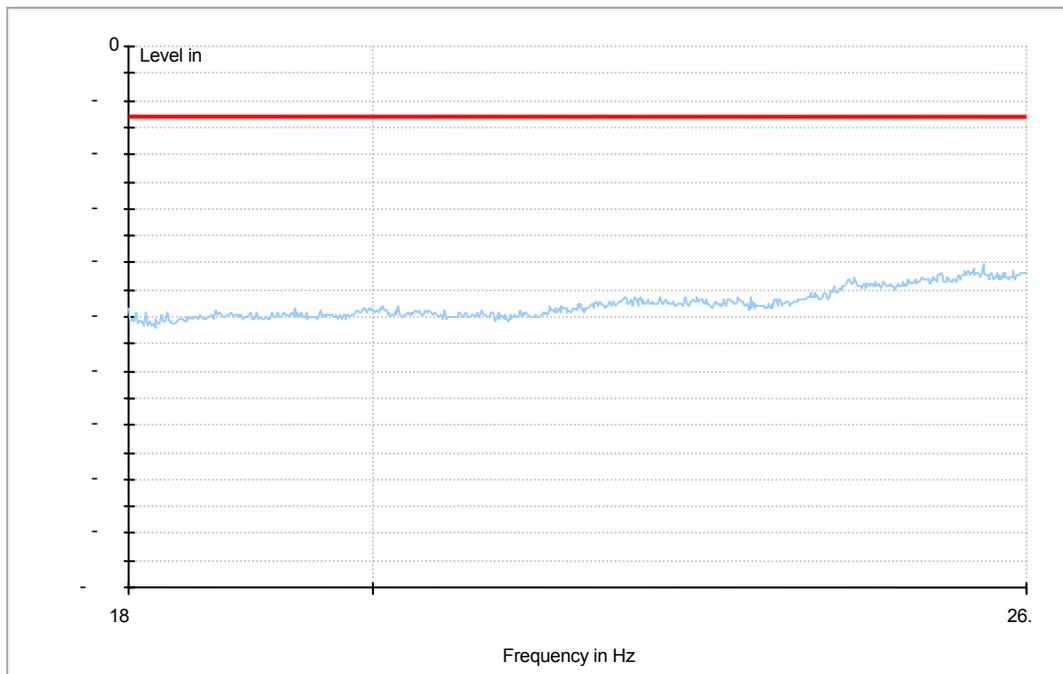
Traffic Mode (30MHz-3GHz)



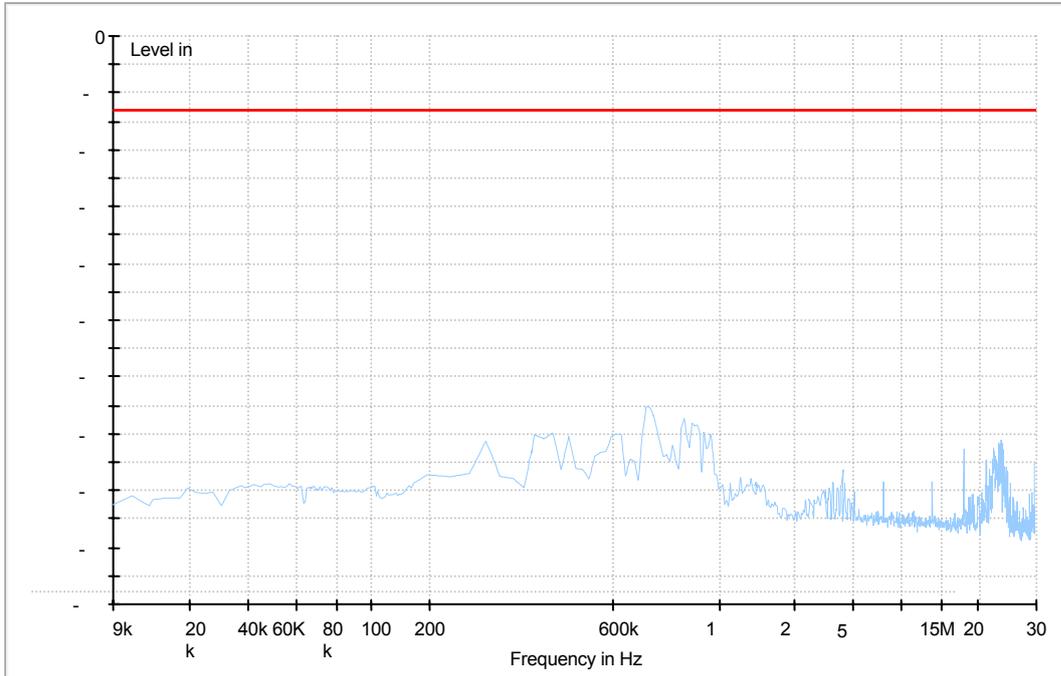
Traffic Mode (3GHz-18GHz)



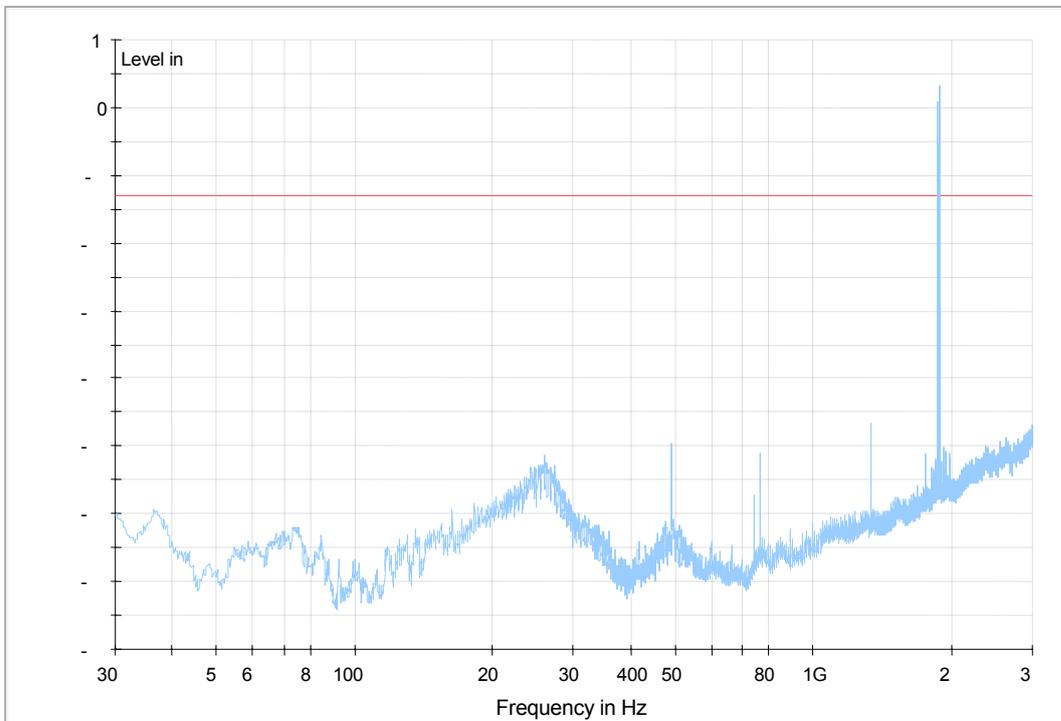
Traffic Mode (18GHz-26.5GHz)



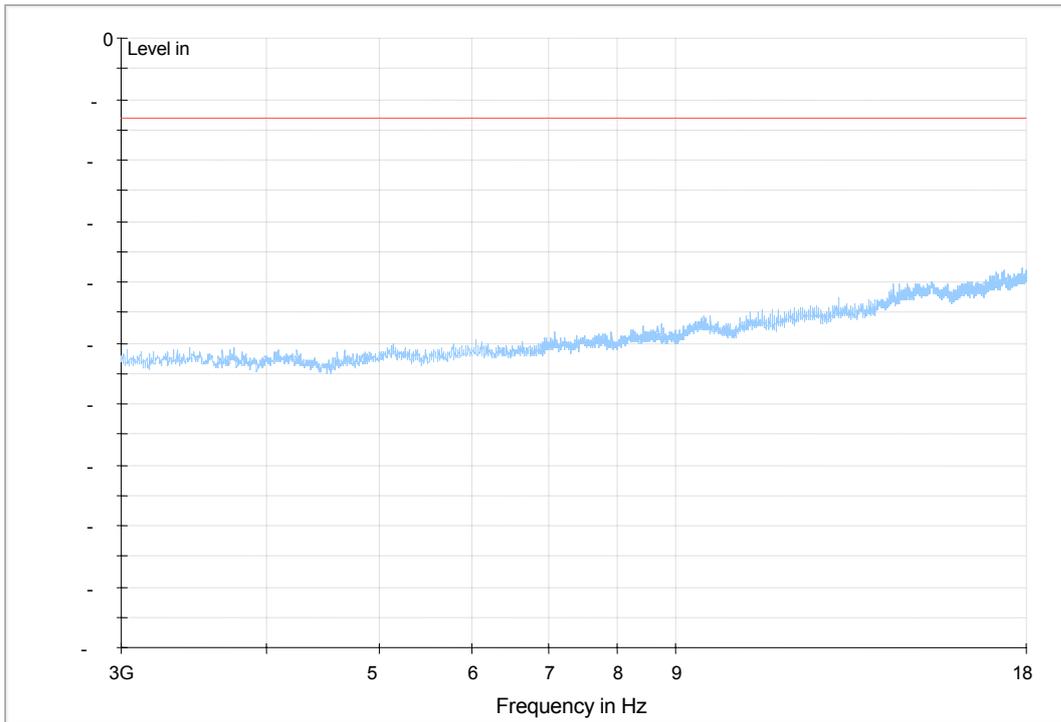
8.3.4 For EGPRS 1900 Traffic Mode (9kHz-30MHz)



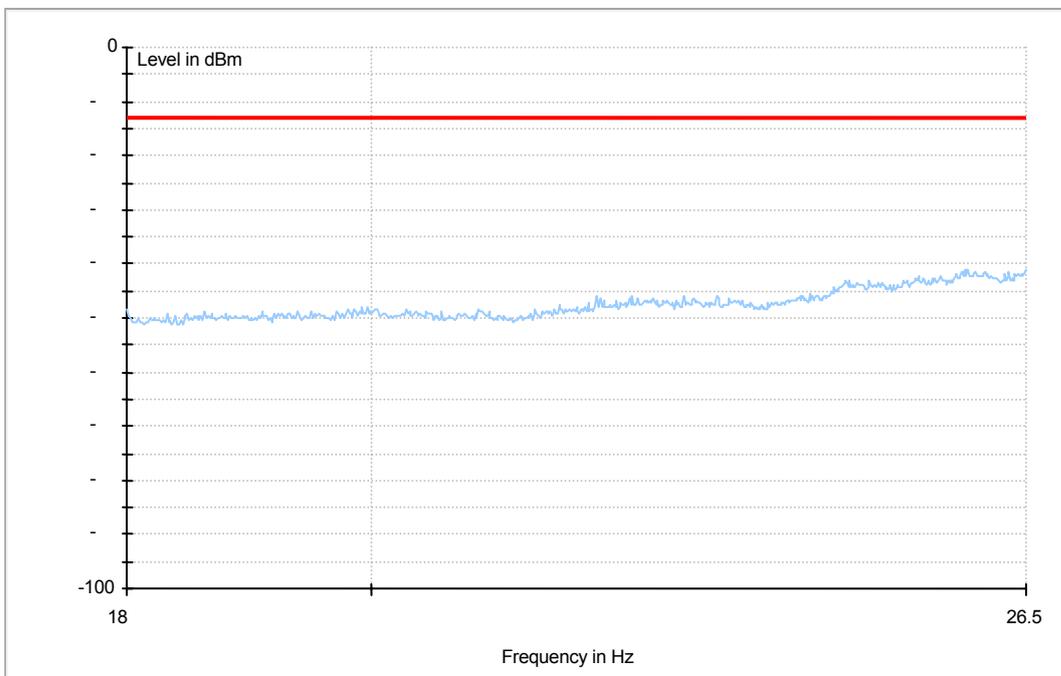
Traffic Mode (30MHz-3GHz)



Traffic Mode (3GHz-18GHz)



Traffic Mode (18GHz-26.5GHz)





END