FCC Part 22H & 24E
Measurement and Test Report

For

Shenzhen Handheld-Wireless Technology Co., Ltd

FCC ID: 2AKFLH947

FCC Rules:	FCC Part 22H, FCC Part 24E
Product Description:	Mobile Data Terminal
Tested Model:	H947
Report No.:	BSL180121040860005Y-ER-4
Tested Date:	February 23~28, 2018
Issued Date:	February 28,2018
Tested By:	Lisa. Li / Engineer
Reviewed By:	arno. Liu / EMC Manager
Approved & Authorized By:	Mike mo / PSQ Manager
Prepared By:	

BSL Testing Co.,LTD.
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	Shenzhen Handheld-Wireless Technology Co., Ltd
Address of applicant:	16th Floor, Block B, Dongfangtiande Bldg., Minzhi Street, Longhua New District., Shenzhen, China
Manufacturer:	Shenzhen Handheld-Wireless Technology Co., Ltd
Address of manufacturer:	16th Floor, Block B, Dongfangtiande Bldg., Minzhi Street, Longhua New District., Shenzhen, China

General Description of EUT:	
Product Name:	Mobile Data Terminal
Brand Name:	Handheld-Wireless
Model No.:	H947, H948
Rated Voltage:	DC 5V from adapter
Adapter information:	Model:GDP12AH-0502000-UL INPUT:AC 100~240V, 50/60Hz, 0.45Amax OUTPUT:DC 5V, 2A
Battery:	DC 3.8V, 4750mAh
Device Category:	Portable Device
The EUT Main board support GSM850 /PCS1900, WCDMA Band 2, It is intended for speech, Multimedia Message Service (MMS) transmission. It is equipped with GPRS/EDGE for GSM850/900/DCS1800/PCS1900, Bluetooth and Wi-Fi functions. For more information see the following datasheet.	
Note: The test data is gathered from a production sample provided by the manufacturer. The appearance of others models listed in the report is different from main-test model H947, but the circuit and the electronic construction do not change, declared by the manufacturer.	

Technical Characteristics of EUT:	
2G	
Support Networks:	GSM, GPRS, EDGE
Support Band:	GSM850/PCS1900
Uplink Frequency:	GSM/GPRS/EDGE 850: 824~849MHz GSM/GPRS/EDGE 1900: 1850~1910MHz
Downlink Frequency:	GSM/GPRS/EDGE 850: 869~894MHz GSM/GPRS/EDGE 1900: 1930~1990MHz
Max RF Output Power:	GSM850: 32.19dBm, GSM1900: 28.29dBm EDGE850: 25.36dBm, EDGE1900: 23.18dBm
Type of Emission:	GSM850: 250KGXW, GSM1900: 248KGXW EDGE850: 252KG7W, EDGE1900: 252KG7W
Type of Modulation:	GMSK, 8PSK
Type of Antenna:	Internal Antenna
Antenna Gain:	GSM850: -3.3dBi; GSM1900: 1.9dBi
GPRS/EDGE Class:	Class 12
3G	
Support Networks:	WCDMA, HSDPA, HSUPA
Support Band:	WCDMA Band 2
Uplink Frequency:	WCDMA Band 2: 1850~1910MHz
Downlink Frequency:	WCDMA Band 2: 1930~1990MHz
RF Output Power:	WCDMA Band 2: 22.16dBm,
Type of Emission:	WCDMA Band 2: 4M38F9W
Type of Modulation:	BPSK
Antenna Type:	Integral Antenna
Antenna Gain:	WCDMA Band 2: 1.6dBi,

1.2 Test Standards

The following report is prepared on behalf of the Shenzhen Handheld-Wireless Technology Co., Ltd in accordance with FCC Part 2 subpart J, FCC Part 22 subpart H and FCC Part 24 subpart E of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 2 subpart J, FCC Part 22 subpart H and FCC Part 24 subpart E of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI/TIA-603-D: 2010 and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 971168 D01 Power Meas License Digital Systems v02r02 shall be performed also.

1.4 Test Facility

BSL Testing Co.,LTD.
NO. 24, ZH Park, Nantou, Shenzhen, 518000 China
Designation Number : CN1217
Test Firm Registration Number: 866035
Tel: 86- 755-26508703
Fax: 86- 755-26508703

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	GSM 850	Low, Middle, High Channels
TM2	GPRS 850	Low, Middle, High Channels
TM3	EDGE 850	Low, Middle, High Channels
TM4	GSM 1900	Low, Middle, High Channels
TM5	GPRS 1900	Low, Middle, High Channels
TM6	EDGE 1900	Low, Middle, High Channels
TM13	WCDMA Band 2	Low, Middle, High Channels
TM14	HSDPA Band 2	Low, Middle, High Channels
TM15	HSUPA Band 2	Low, Middle, High Channels

Testing Configure			
Support Band	Support Standard	Channel Frequency	Channel Number
GSM 850	GSM/GPRS/EDGE	824.2 MHz	128
		836.6 MHz	190
		848.8 MHz	251
PCS 1900	GSM/GPRS/EDGE	1850.2 MHz	512
		1880.0 MHz	661
		1909.8 MHz	810
WCDMA Band 2	WCDMA/HSDPA/HSUPA	1852.4 MHz	9262
		1880.0 MHz	9400
		1907.6 MHz	9538
Note: the transmitter has been tested on the communications mode of GSM, GPRS, EDGE, WCDMA, HSDPA, HSUPA compliance test and record the worst case.			

EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
USB Cable	1.0	Unshielded	Without Ferrite

Auxiliary Equipment List and Details

Description	Manufacturer	Model	Serial Number
/	/	/	/

Special Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Frequency Stability	Conducted	2.3%
Transmitter Spurious Emissions	Radiated	±5.1dB
Transmitter Spurious Emissions	Conducted	±0.42dB

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2017-10-21	2018-10-20
Spectrum Analyzer	R&S	FSP40	100550	2017-10-21	2018-10-20
Test Receiver	R&S	ESCI7	US47140102	2017-10-21	2018-10-20
Signal Generator	HP	83630B	3844A01028	2017-10-22	2018-10-21
Test Receiver	R&S	ESPI-3	100180	2017-10-21	2018-10-20
Amplifier	Agilent	8449B	4035A00116	2017-10-22	2018-10-21
Amplifier	HP	8447E	2945A02770	2017-10-22	2018-10-21
Signal Generator	IFR	2023A	202307/242	2017-10-22	2018-10-21
Broadband Antenna	SCHAFFNER	2774	2774	2017-10-17	2018-10-16
Biconical and log periodic antennas	ELECTRO-METRICS	EM-6917B-1	171	2017-10-17	2018-10-16
Horn Antenna	R&S	HF906	100253	2017-10-17	2018-10-16
Horn Antenna	EM	EM-6961	6462	2017-10-17	2018-10-16
LISN	R&S	ESH3-Z5	100196	2017-10-17	2018-10-16
LISN	COM-POWER	LI-115	02027	2017-10-17	2018-10-16
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2017-10-21	2018-10-20
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2017-10-21	2018-10-20

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 1.1307, § 2.1093	RF Exposure	PASS
§ 22.913 (a), § 24.232 (c)	RF Output Power	PASS
§ 24.51	Peak-to-average Ratio (PAR) of Transmitter	PASS
§ 22.917 (b), § 24.238 (b)	Emission Bandwidth	PASS
§ 22.917 (a), § 24.238 (a)	Spurious Emissions at Antenna Terminal	PASS
§ 22.917 (a), § 24.238 (a)	Spurious Radiation Emissions	PASS
§ 22.917 (a), § 24.238 (a)	Out of Band Emissions	PASS
§ 22.355, § 24.235	Frequency Stability	PASS

Note: PASS: applicable, N/A: not applicable.

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the SAR report.

4. RF Output Power

4.1 Standard Applicable

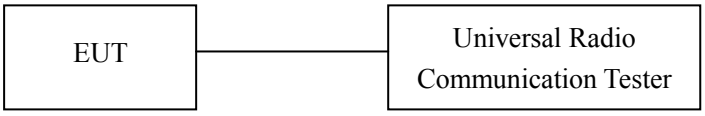
According to §22.913(a)(2), The ERP of mobile and portable stations transmitters and auxiliary test transmitters must not exceed 7 Watts.

According to §24.232 (c), Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to §27.50(d)(4), Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

4.2 Test Procedure

Conducted output power test method:



Radiated power test method:

1.The setup of EUT is according with per ANSI/TIA Standard 603D and ANSI C63.4-2014 measurement procedure.

2. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

3. The frequency range up to tenth harmonic of the fundamental frequency was investigated.

4. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

4.3 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

4.4 Summary of Test Results/Plots

Max. Radiated Power

ERP For GSM Mode GSM850

Frequency	Polar	Result	FCC Part 22H Limit
MHz	H / V	dBm	dBm
Low channel			
824.2	H	31.26	38.45
824.2	V	30.69	38.45
Middle channel			
836.4	H	30.29	38.45
836.4	V	30.05	38.45
High channel			
848.8	H	29.16	38.45
848.8	V	31.89	38.45

EIRP For GSM Mode PCS1900

Frequency	Polar	Result	FCC Part 24E Limit
MHz	H / V	dBm	dBm
Low channel			
1850.2	H	26.96	33.00
1850.2	V	27.85	33.00
Middle channel			
1880.0	H	25.76	33.00
1880.0	V	27.77	33.00
High channel			
1909.8	H	25.16	33.00
1909.8	V	27.06	33.00

ERP For GPRS Mode GSM850

Frequency	Polar	Result	FCC Part 22H Limit
MHz	H / V	dBm	dBm
Low channel			
824.2	H	29.16	38.45
824.2	V	31.27	38.45
Middle channel			
836.6	H	29.32	38.45
836.6	V	31.04	38.45
High channel			
848.8	H	29.15	38.45
848.8	V	31.33	38.45

EIRP For GPRS Mode PCS1900

Frequency	Polar	Result	FCC Part 24E Limit
MHz	H / V	dBm	dBm
Low channel			
1850.2	H	25.87	33.00
1850.2	V	27.14	33.00
Middle channel			
1880.0	H	25.16	33.00
1880.0	V	27.75	33.00
High channel			
1909.8	H	25.34	33.00
1909.8	V	27.10	33.00

ERP For EDGE Mode GSM850

Frequency	Polar	Result	FCC Part 22H Limit
MHz	H / V	dBm	dBm
824.2	H	23.26	38.45
824.2	V	25.31	38.45
836.6	H	23.24	38.45
836.6	V	25.17	38.45
848.8	H	23.30	38.45
848.8	V	25.27	38.45

EIRP For EDGE Mode PCS1900

Frequency	Polar	Result	FCC Part 24E Limit
MHz	H / V	dBm	dBm
1850.2	H	21.14	33.00
1850.2	V	23.02	33.00
1880.0	H	21.64	33.00
1880.0	V	23.05	33.00
1909.8	H	21.14	33.00
1909.8	V	23.11	33.00

EIRP For WCDMA Mode Band 2

Frequency	Polar	Result	FCC Part 24E Limit
MHz	H / V	dBm	dBm
1852.4	H	19.76	33
1852.4	V	21.51	33
1880.0	H	19.53	33
1880.0	V	21.76	33
1907.6	H	20.02	33
1907.6	V	21.78	33

EIRP For HSDPA Mode Band 2

Frequency	Polar	Result	FCC Part 24E Limit
MHz	H / V	dBm	dBm
1852.4	H	18.63	33
1852.4	V	20.34	33
1880.0	H	18.50	33
1880.0	V	20.76	33
1907.6	H	19.08	33
1907.6	V	20.76	33

EIRP For HSUPA Mode Band 2

Frequency	Polar	Result	FCC Part 24E Limit
MHz	H / V	dBm	dBm
1852.4	H	18.64	33
1852.4	V	20.37	33
1880.0	H	18.51	33
1880.0	V	20.72	33
1907.6	H	19.05	33
1907.6	V	20.76	33

Note: Result = Substitude - Cable loss + Antenna Gain

Max. Conducted Output Power

For Cellular Band (GSM850)

Test Mode	Channel	Frequency (MHz)	Average Power (dBm)	FCC Part 22.913 Limit (dBm)
GSM	Low Channel	824.2	32.13	38.45
	Middle Channel	836.6	32.10	38.45
	High Channel	848.8	32.19	38.45
GPRS(1 Slot)	Low Channel	824.2	32.05	38.45
	Middle Channel	836.6	32.06	38.45
	High Channel	848.8	32.01	38.45
EDGE(1 Slot)	Low Channel	824.2	25.36	38.45
	Middle Channel	836.6	25.31	38.45
	High Channel	848.8	25.34	38.45

For PCS Band (GSM1900)

Test Mode	Channel	Frequency (MHz)	Average Power (dBm)	FCC Part 24.232 Limit (dBm)
GSM	Low Channel	1850.2	28.29	33.0
	Middle Channel	1880.0	28.14	33.0
	High Channel	1909.8	28.13	33.0
GPRS(1 Slot)	Low Channel	1850.2	28.21	33.0
	Middle Channel	1880.0	28.26	33.0
	High Channel	1909.8	28.29	33.0
EDGE(1 Slot)	Low Channel	1850.2	23.16	33.0
	Middle Channel	1880.0	23.18	33.0
	High Channel	1909.8	23.10	33.0

For WCDMA Band 2

Test Mode	Channel	Frequency (MHz)	Average Power (dBm)	FCC Part 24.232 Limit (dBm)
WCDMA	Low Channel	1852.4	22.12	33.00
	Middle Channel	1880.0	22.13	33.00
	High Channel	1907.6	22.16	33.00
HSDPA	Low Channel	1852.4	21.01	33.00
	Middle Channel	1880.0	21.28	33.00
	High Channel	1907.6	21.04	33.00
HSUPA	Low Channel	1852.4	20.94	33.00
	Middle Channel	1880.0	20.91	33.00
	High Channel	1907.6	20.97	33.00

5. Peak-to-average Ratio (PAR) of Transmitter

5.1 Standard Applicable

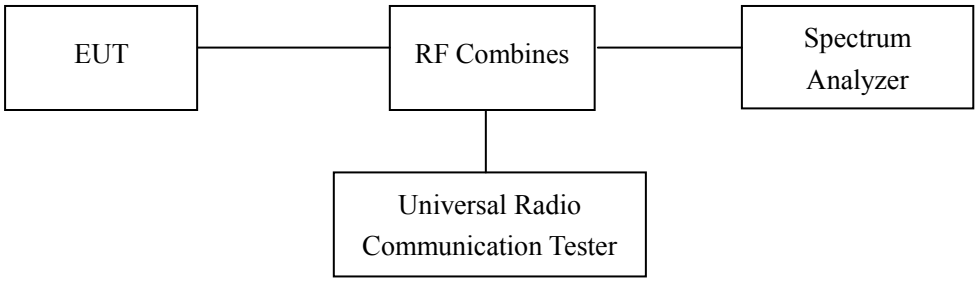
According to §24.232(d), Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

According to §27.50(B), the peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

5.2 Test Procedure

The RF output terminal of the transmitter was connected to the input of the spectrum analyzer via a suitable attenuation. The RBW of the spectrum analyzer was set to 30kHz and the peak-to-average ratio (PAR) of the transmission was recorded. Record the maximum PAPR level associated with a probability of 0.1%.

Test Configuration for the emission bandwidth testing:



5.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

5.4 Summary of Test Results

Only the worst case was selected to record

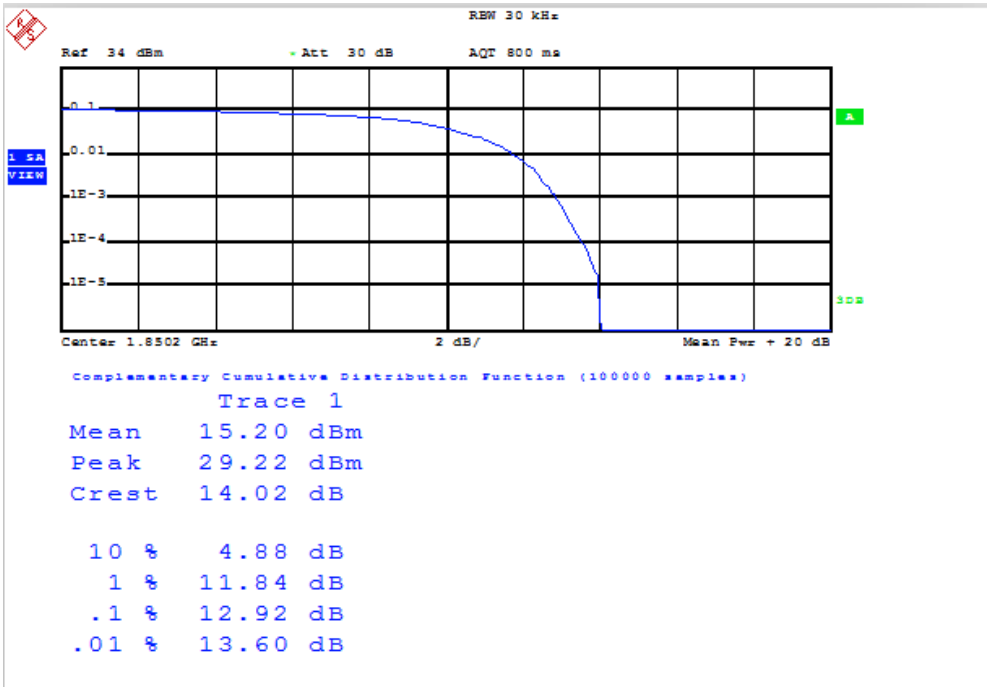
For PCS Band

Test Mode	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)
GSM	512	1850.2	12.92	13
GPRS(1 Slot)	512	1850.2	12.92	13
EDGE(1 Slot)	512	1850.2	12.88	13

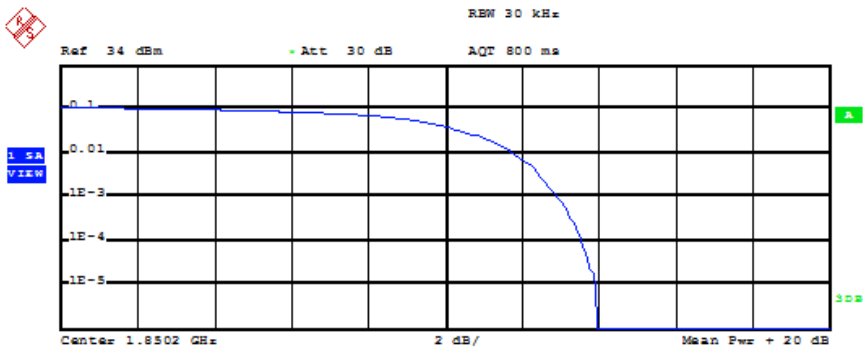
For WCDMA Band 2

Test Mode	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)
WCDMA	9262	1852.4	8.64	13
HSDPA	9400	1880.0	8.60	13
HSUPA	9400	1880.0	8.44	13

GSM Low Channel:



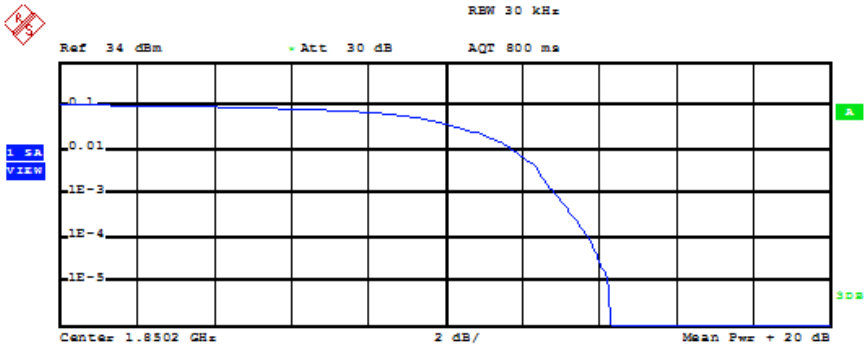
GPRS Low Channel:



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	15.22 dBm
Peak	29.15 dBm
Crest	13.93 dB
10 %	4.92 dB
1 %	11.84 dB
.1 %	12.92 dB
.01 %	13.56 dB

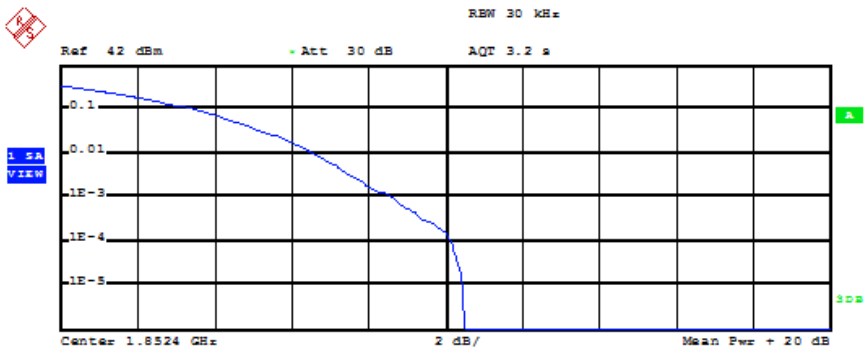
EDGE Low Channel:



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	15.20 dBm
Peak	29.50 dBm
Crest	14.30 dB
10 %	4.92 dB
1 %	11.84 dB
.1 %	12.88 dB
.01 %	13.76 dB

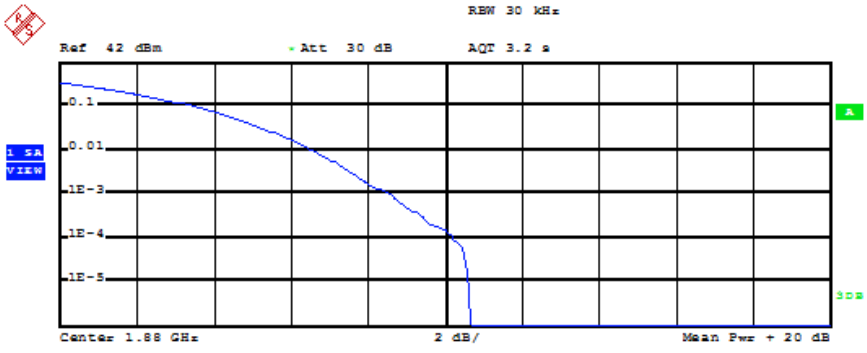
WCDMA Low Channel:



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	11.85 dBm
Peak	22.33 dBm
Crest	10.49 dB
10 %	3.60 dB
1 %	6.64 dB
.1 %	8.64 dB
.01 %	10.16 dB

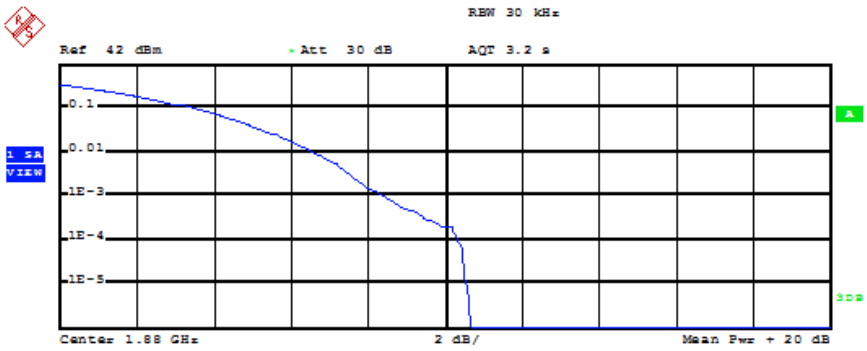
HSDPA Low Channel:



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	11.76 dBm
Peak	22.40 dBm
Crest	10.64 dB
10 %	3.64 dB
1 %	6.64 dB
.1 %	8.60 dB
.01 %	10.24 dB

HSUPA Low Channel:



Complementary Cumulative Distribution Function (100000 samples)

	Trace 1
Mean	11.76 dBm
Peak	22.40 dBm
Crest	10.65 dB
10 %	3.60 dB
1 %	6.68 dB
.1 %	8.44 dB
.01 %	10.36 dB

6. Emission Bandwidth

6.1 Standard Applicable

According to §22.917(b), The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

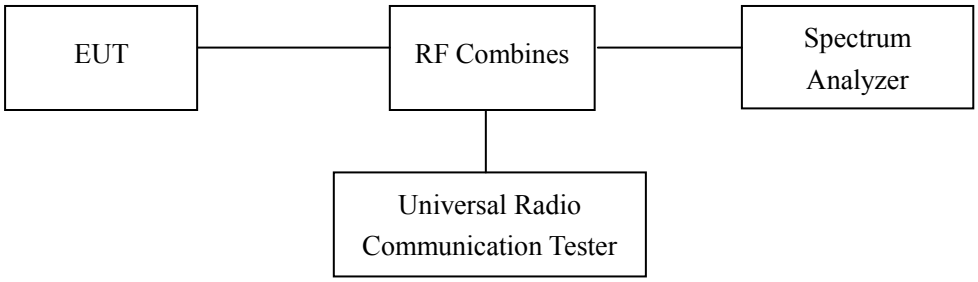
According to §24.238(b), The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

According to §27.53, The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

6.2 Test Procedure

The RF output terminal of the transmitter was connected to the input of the spectrum analyzer via a suitable attenuation. The RBW of the spectrum analyzer was set to 10kHz for GSM mode and 100kHz for WCDMA mode, VBW shall be at least 3 times the RBW, and the 26dB bandwidth was recorded.

Test Configuration for the emission bandwidth testing:



6.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

6.4 Summary of Test Results/Plots

For Cellular Band

Test Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM	128	824.2	248	330
	190	836.6	250	334
	251	848.8	248	330
GPRS	128	824.2	250	336
	190	836.6	248	334
	251	848.8	250	334
EDGE	128	824.2	252	336
	190	836.6	250	334
	251	848.8	250	336

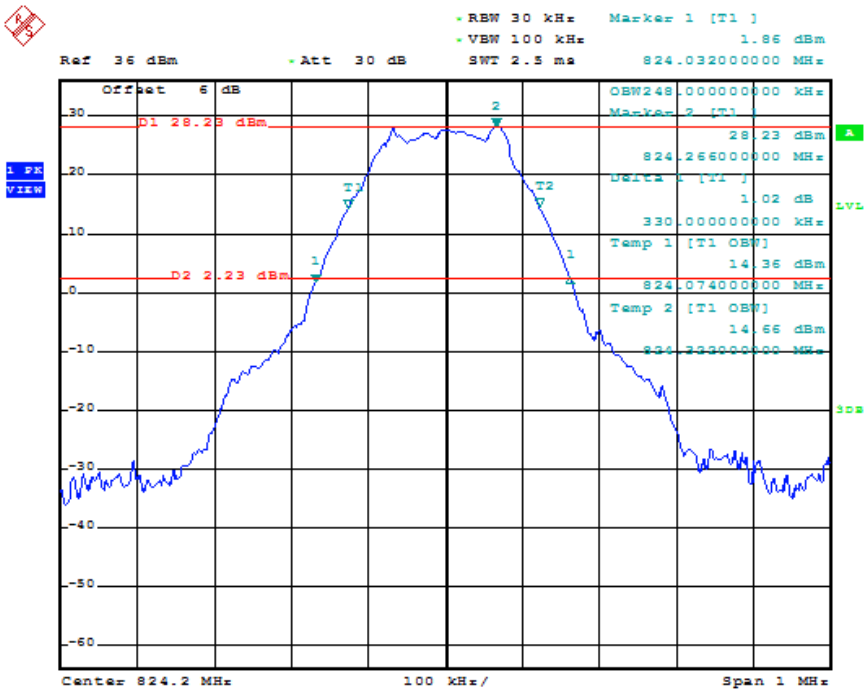
For PCS Band

Test Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM	512	1850.2	248	336
	661	1880.0	248	334
	810	1909.8	246	328
GPRS	512	1850.2	250	332
	661	1880.0	252	334
	810	1909.8	248	334
EDGE	512	1850.2	248	334
	661	1880.0	252	334
	810	1909.8	252	338

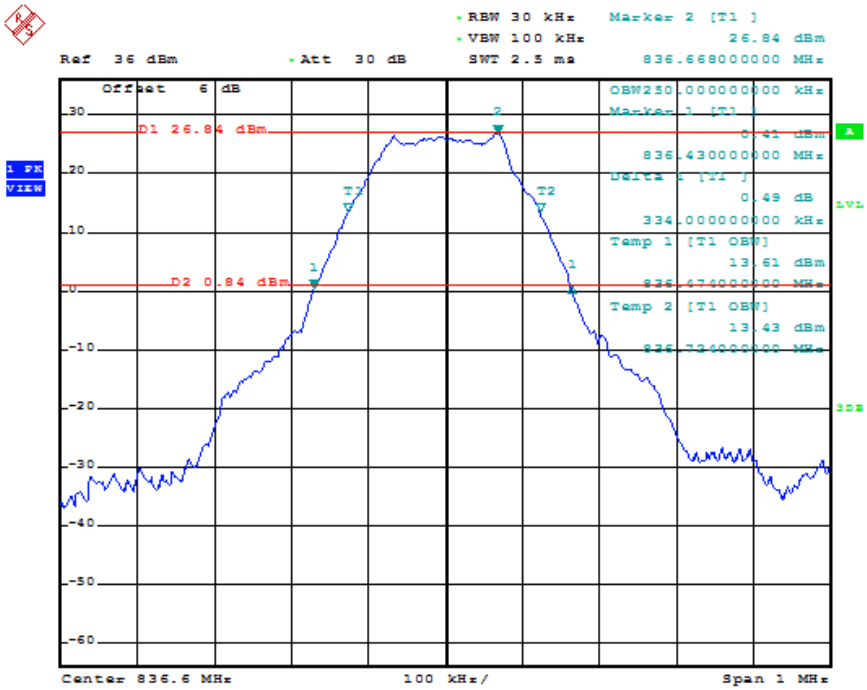
For Band 2

Test Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)
WCDMA	9262	1852.4	4.38	4.98
	9400	1880.0	4.34	4.86
	9538	1907.6	4.26	4.98
HSDPA	9262	1852.4	4.34	4.92
	9400	1880.0	4.33	4.86
	9538	1907.6	4.28	4.98
HSUPA	9262	1852.4	4.34	4.96
	9400	1880.0	4.33	4.90
	9538	1907.6	4.26	4.98

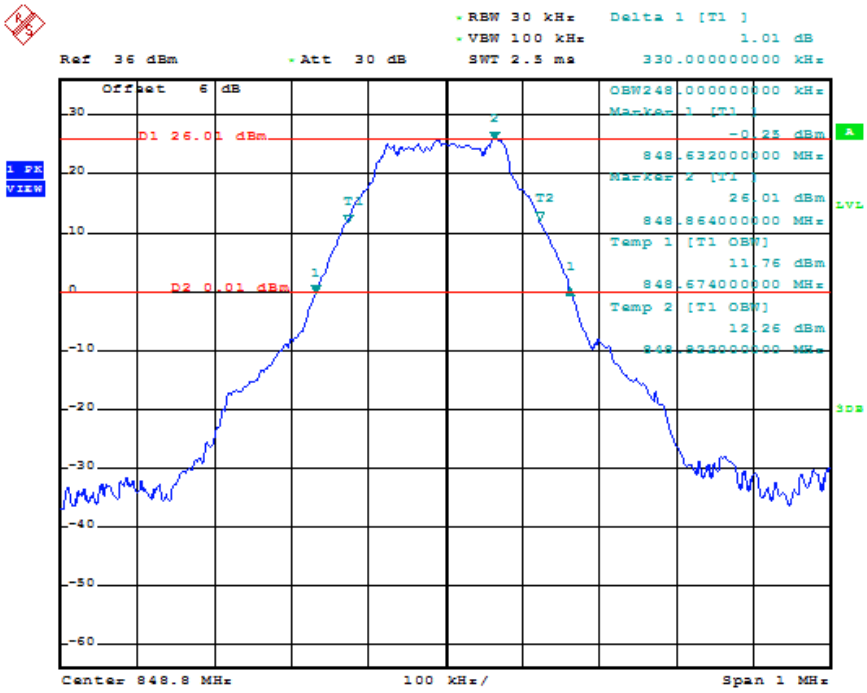
For Cellular Band
GSM Low Channel



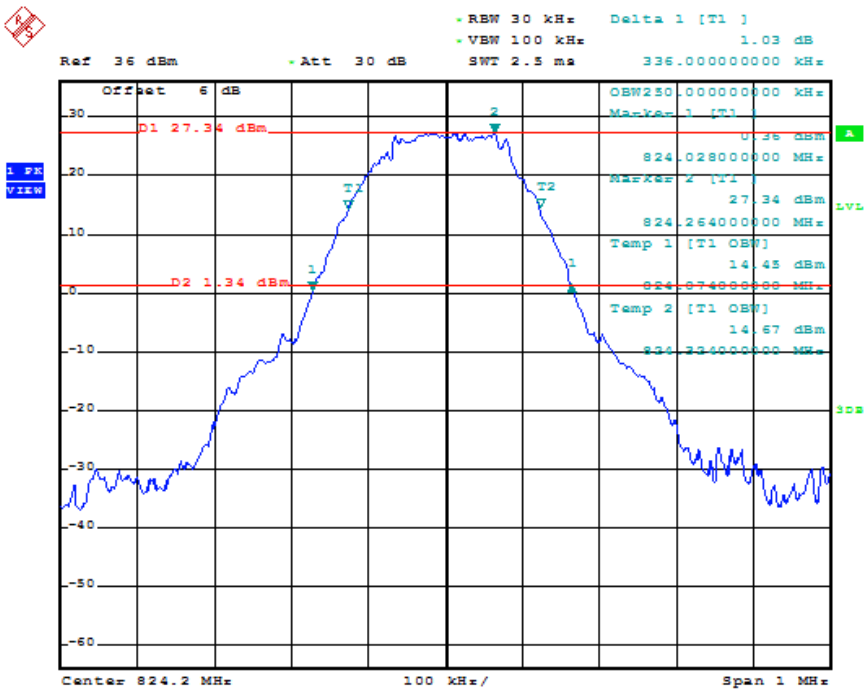
GSM Middle Channel



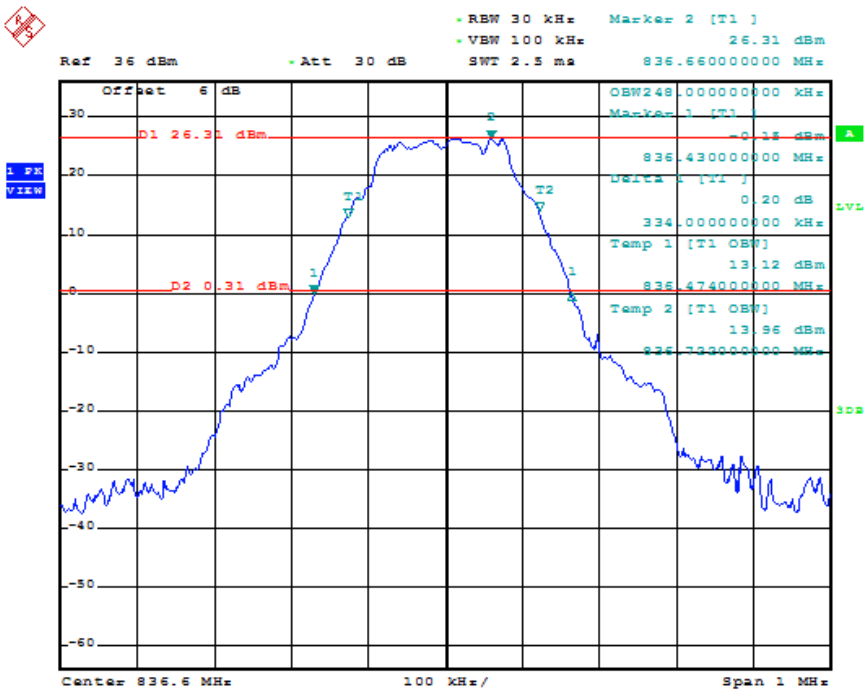
GSM High channel



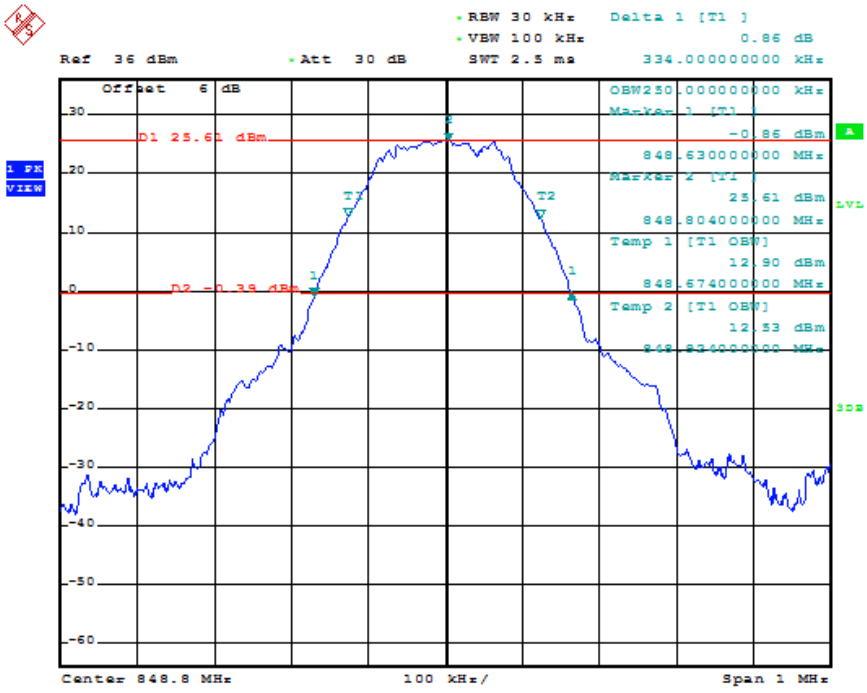
GPRS Low Channel



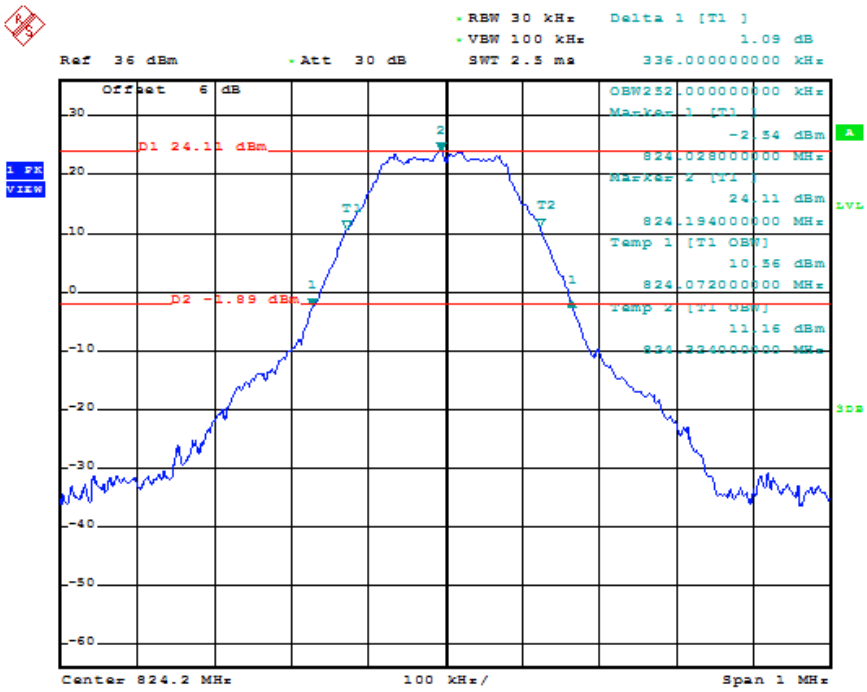
GPRS Middle Channel



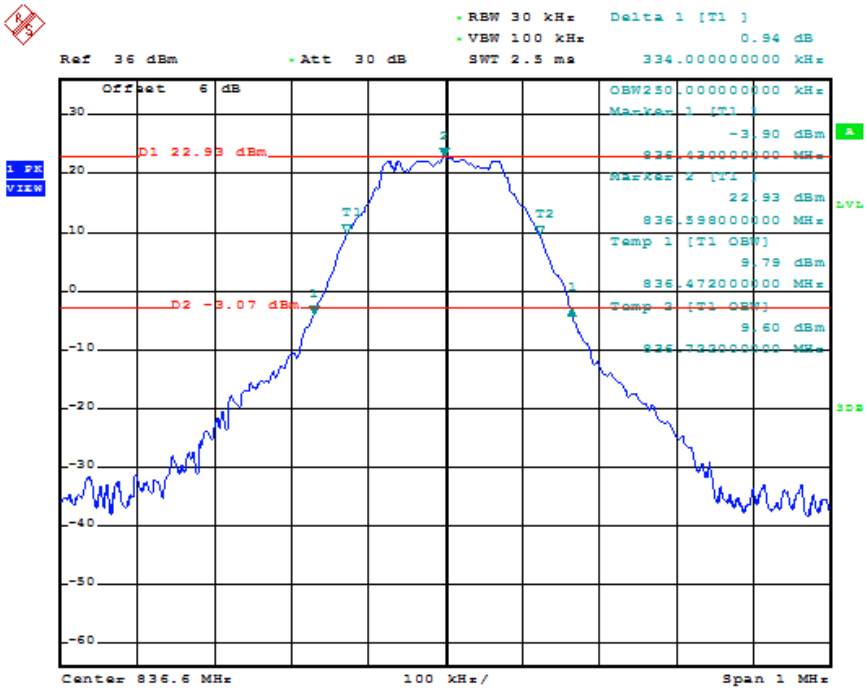
GPRS High Channel



EDGE Low Channel



EDGE Middle Channel



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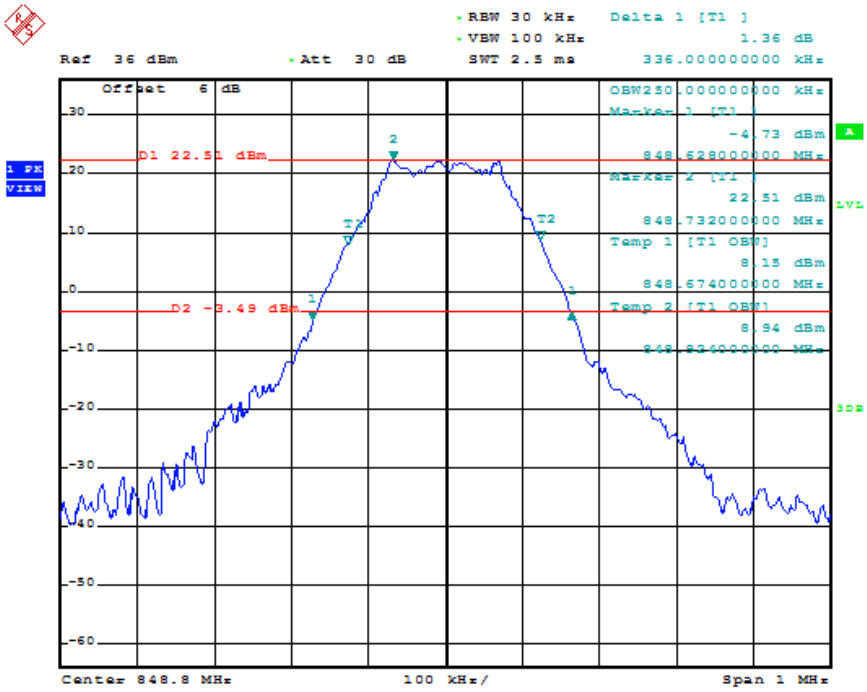
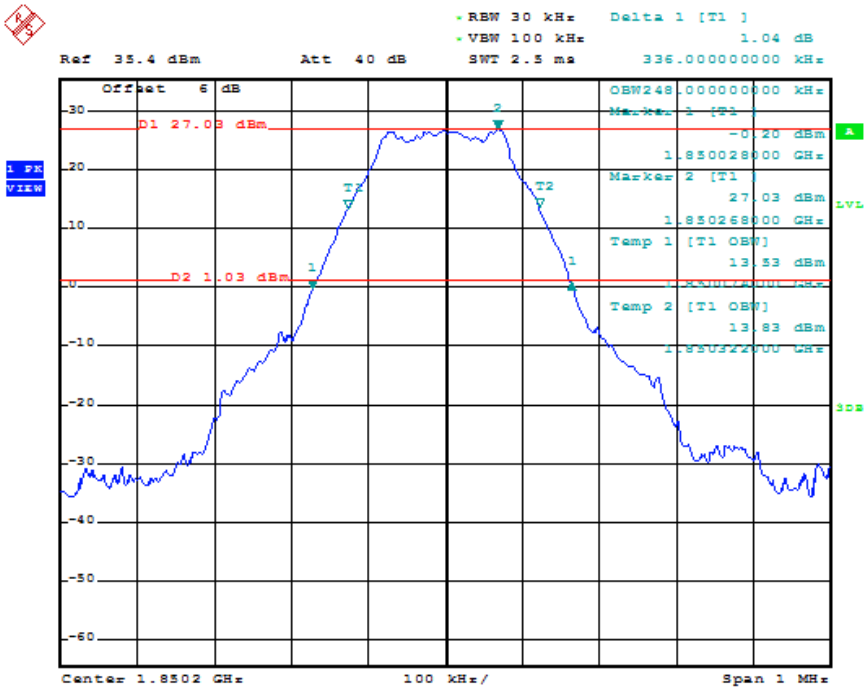
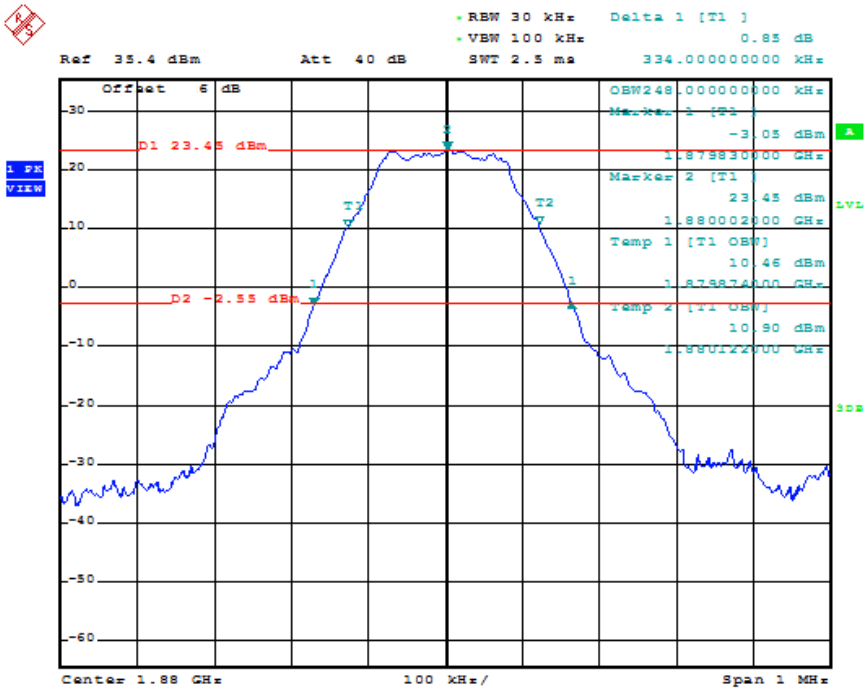


For PCS Band

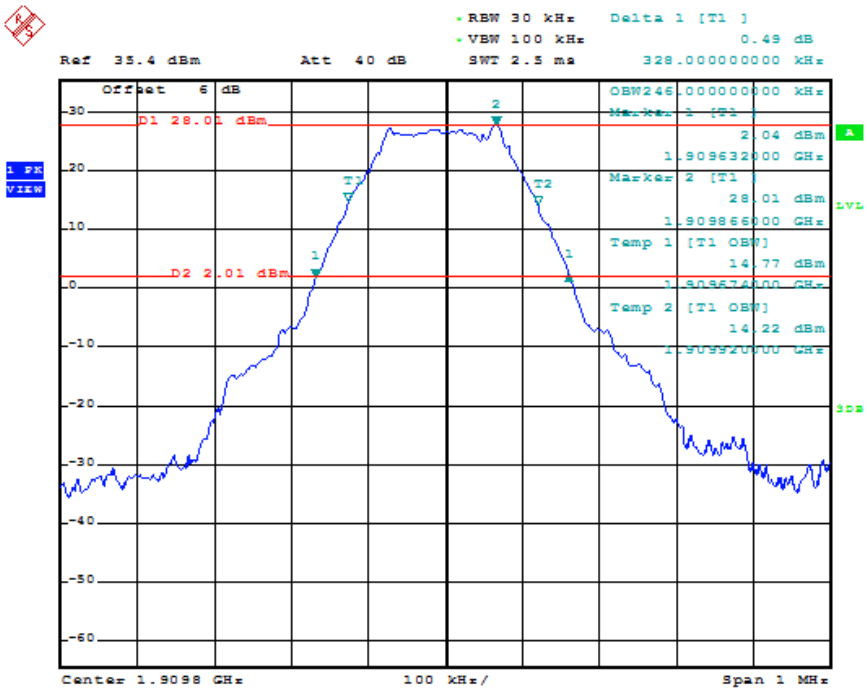
GSM Low Channel



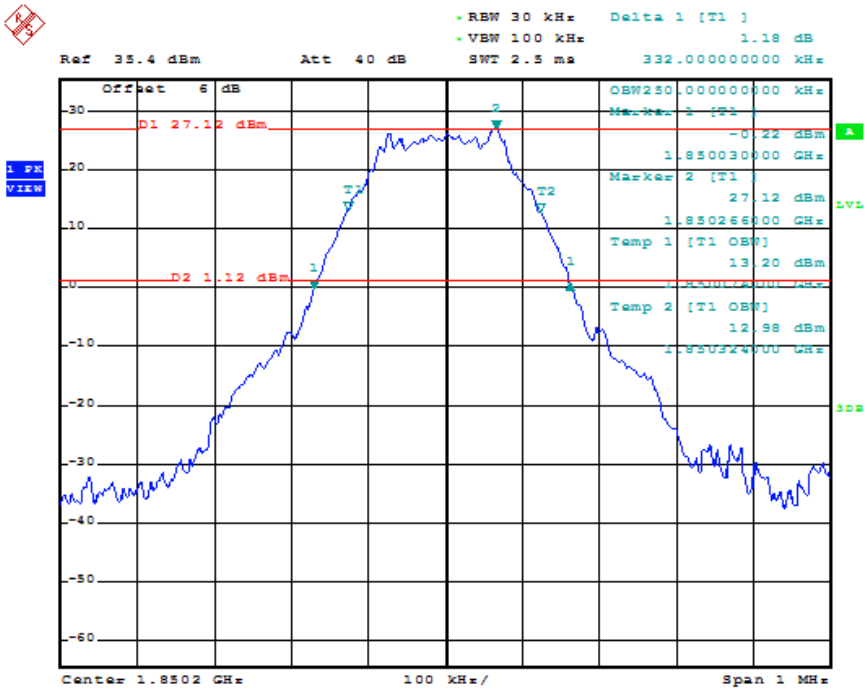
GSM Middle Channel



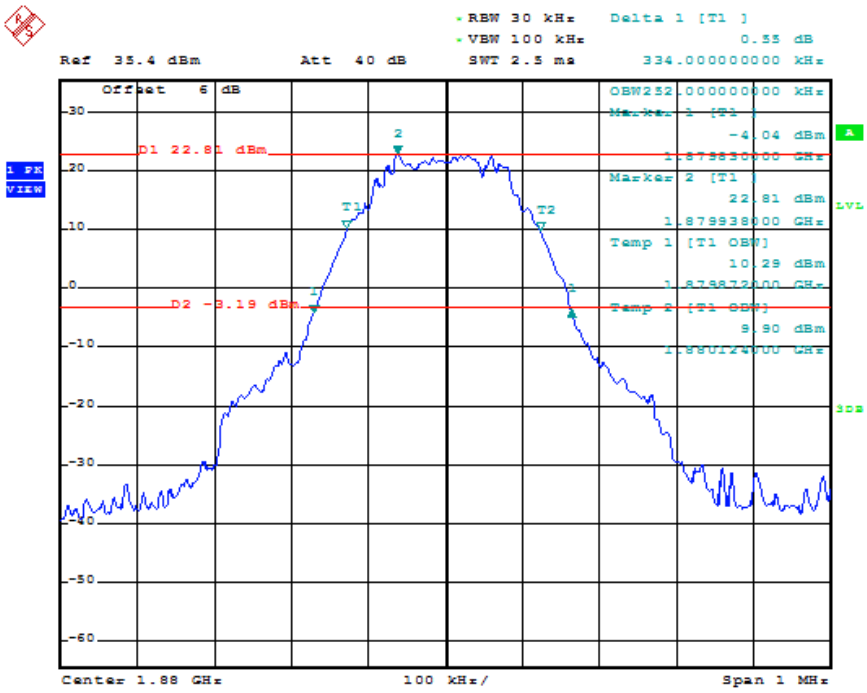
GSM High channel



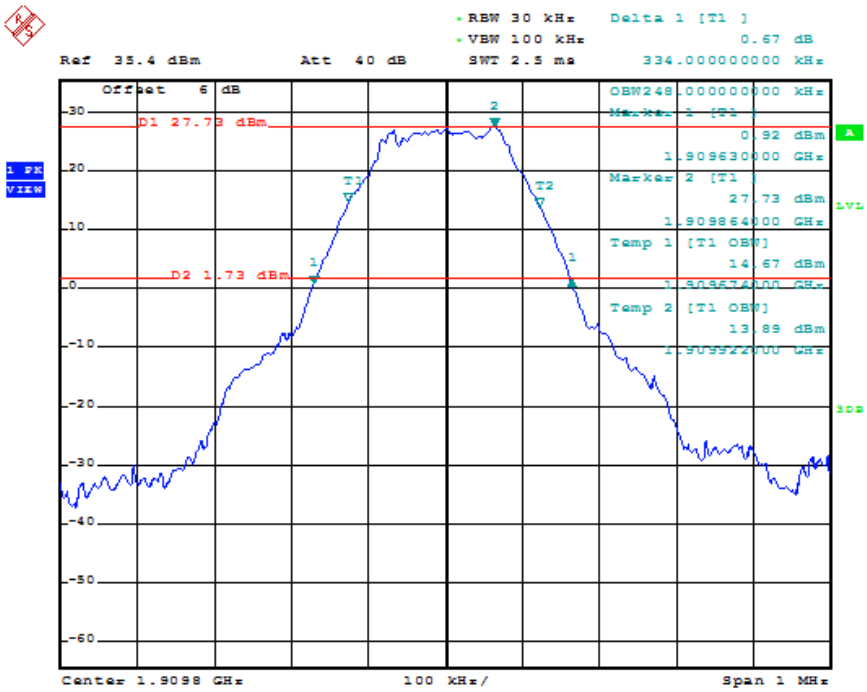
GPRS Low Channel



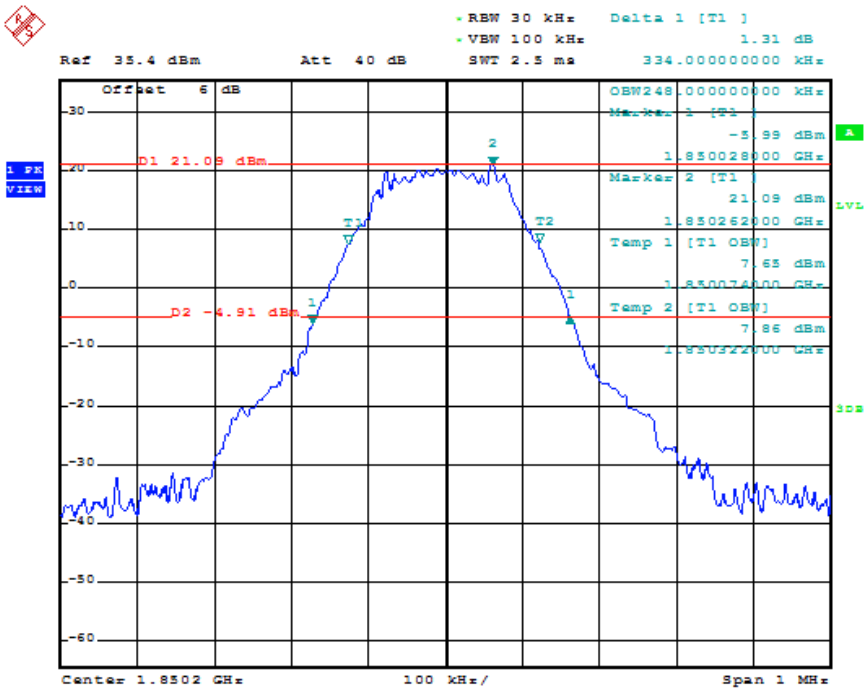
GPRS Middle Channel



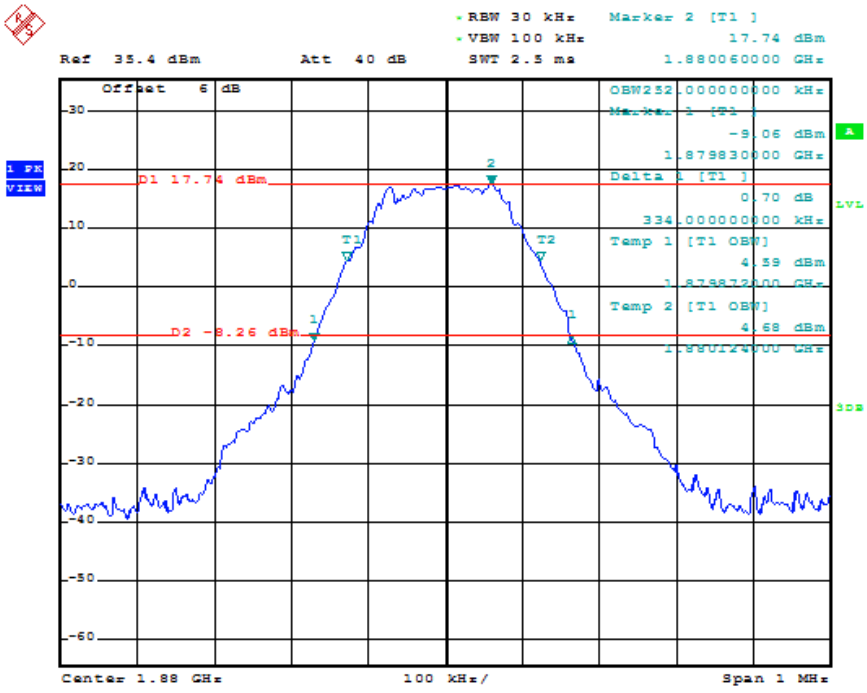
GPRS High Channel



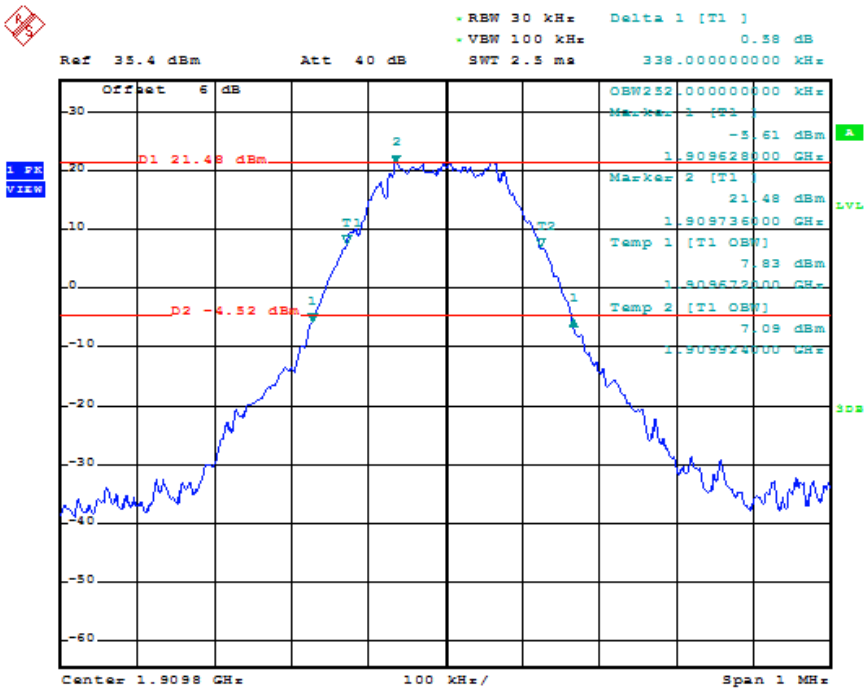
EDGE Low Channel



EDGE Middle Channel

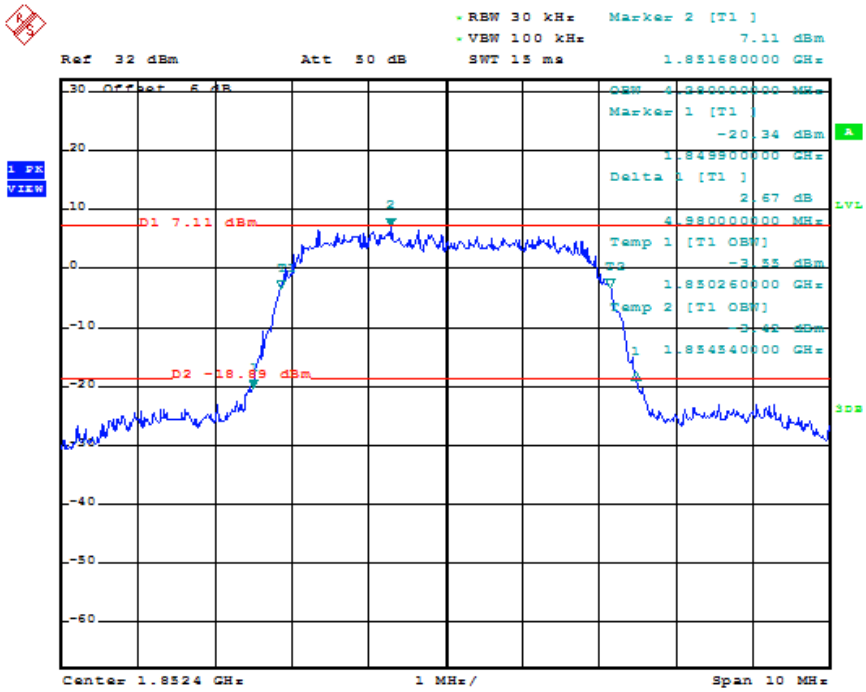


EDGE High Channel

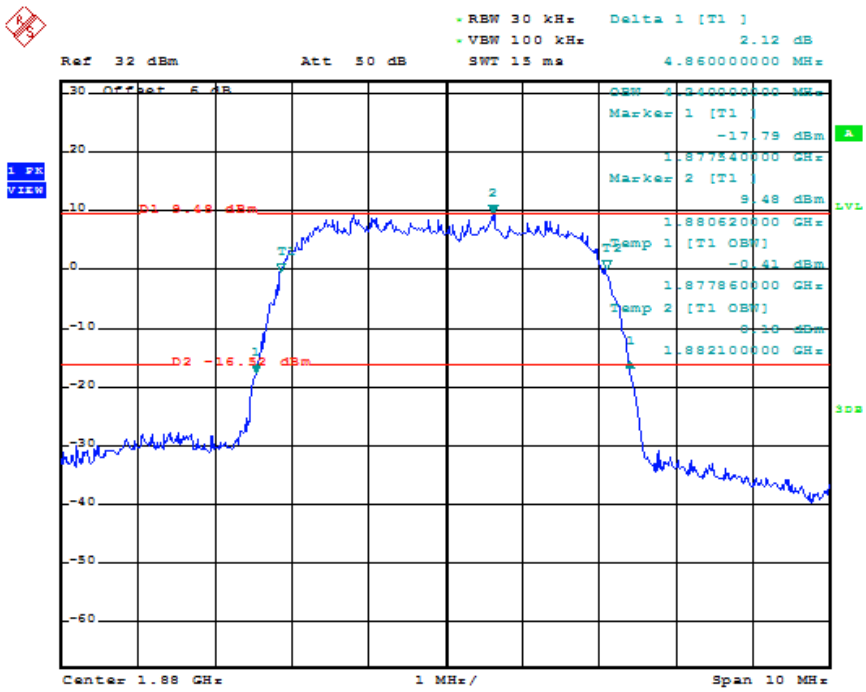


For Band II

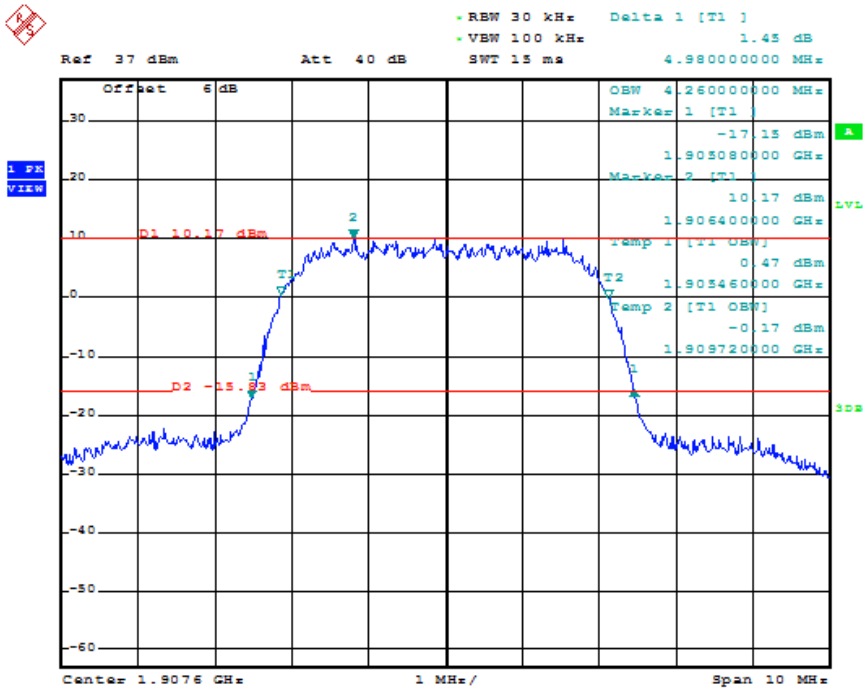
WCDMA Low Channel



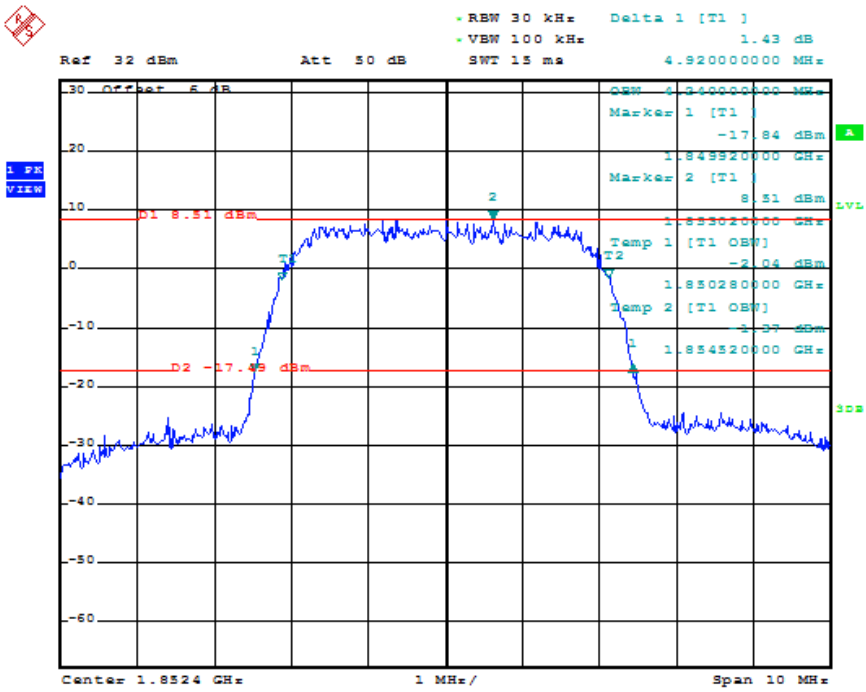
WCDMA Middle Channel



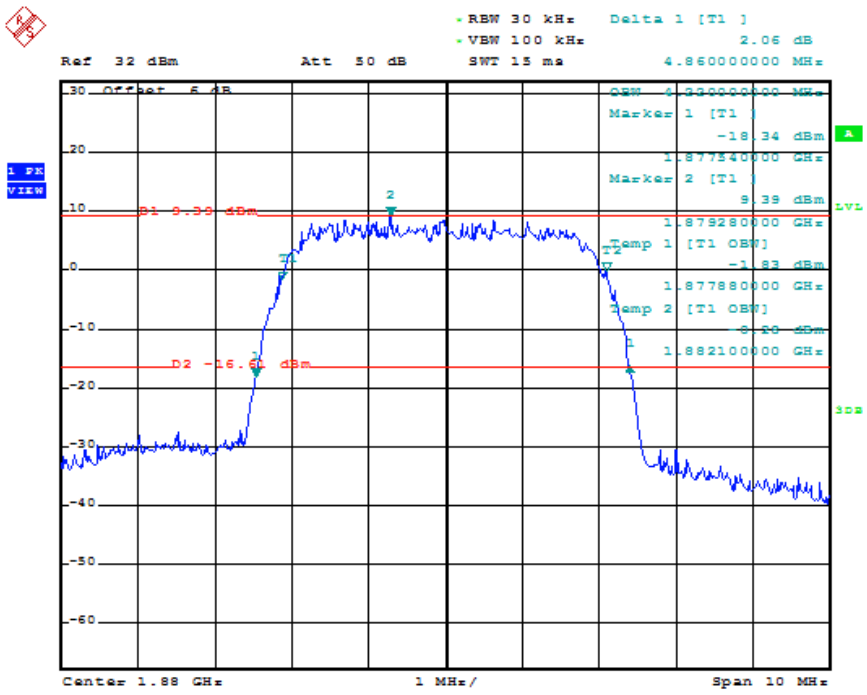
WCDMA High Channel



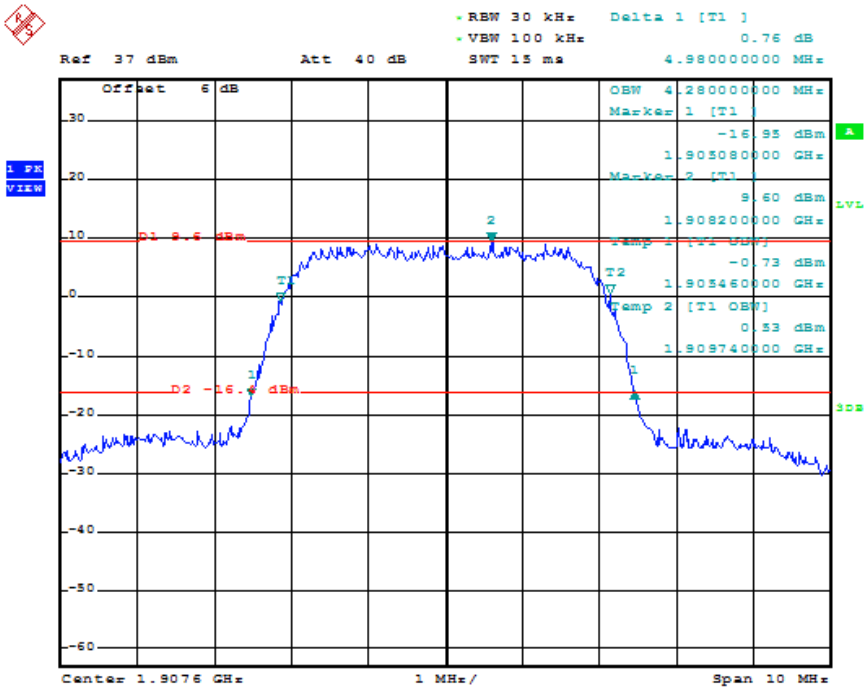
HSDPA Low Channel



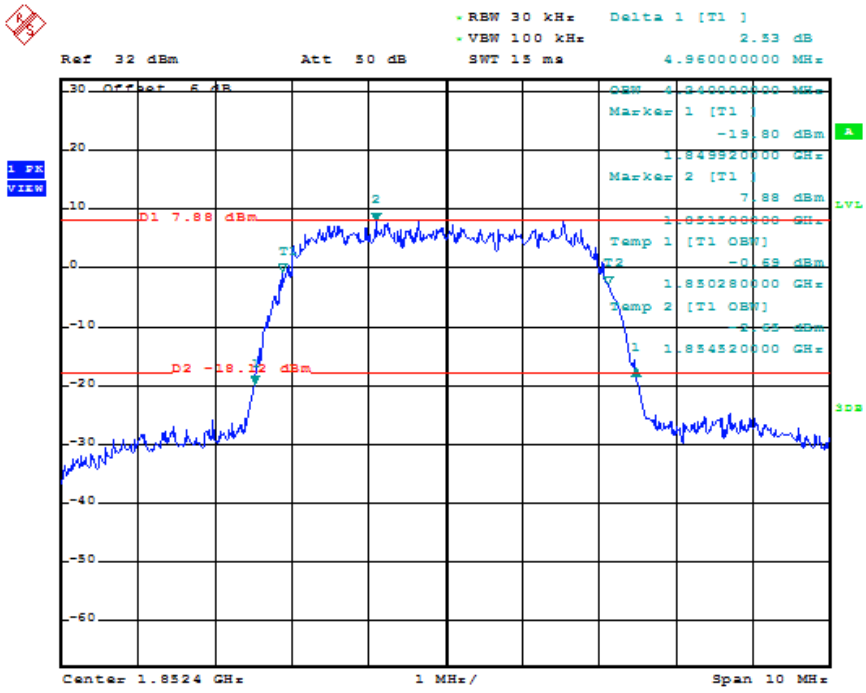
HSDPA Middle Channel



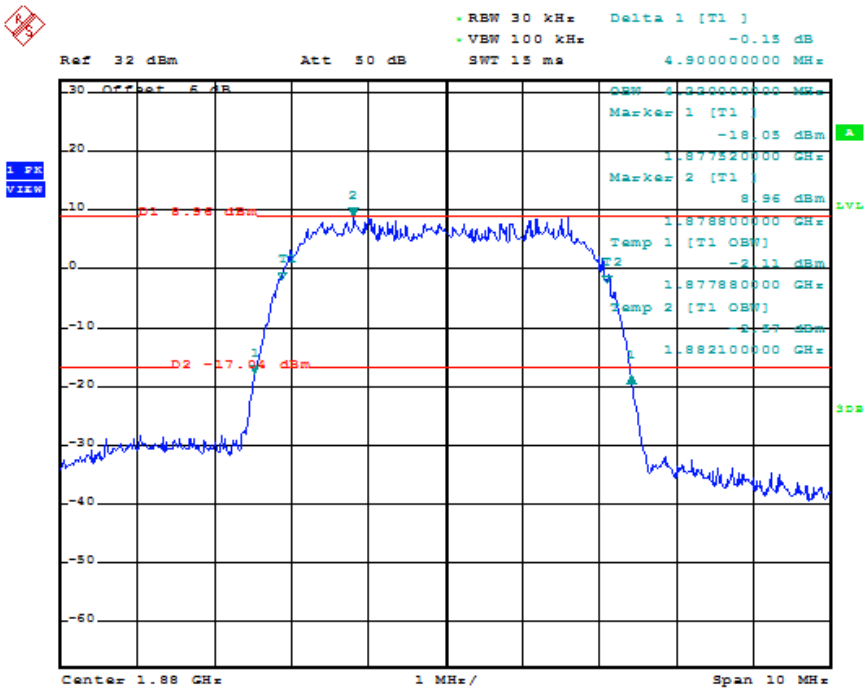
HSDPA High Channel



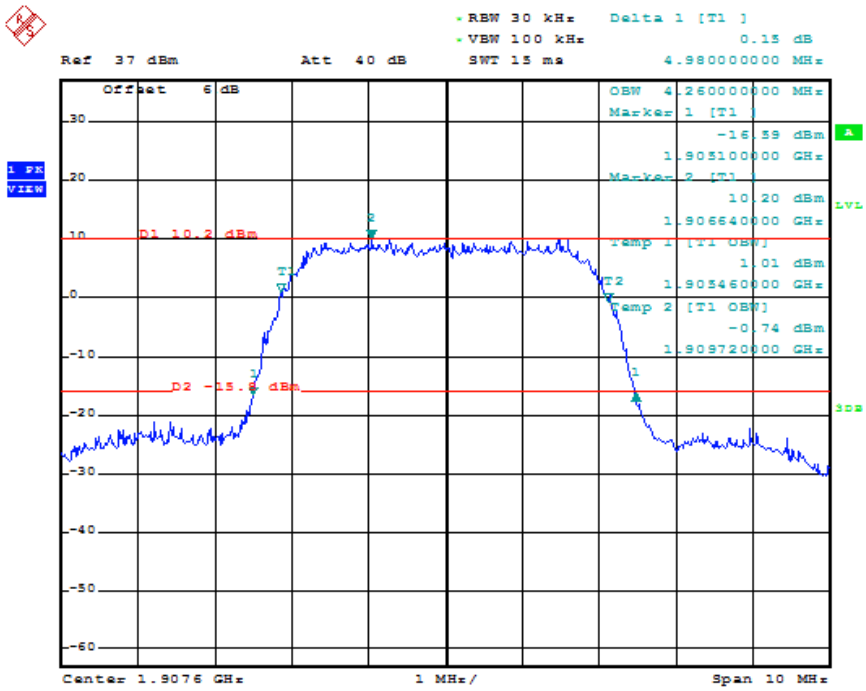
HSUPA Low Channel



HSUPA Middle Channel



HSUPA High Channel



7. Out of Band Emissions at Antenna Terminal

7.1 Standard Applicable

According to §22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

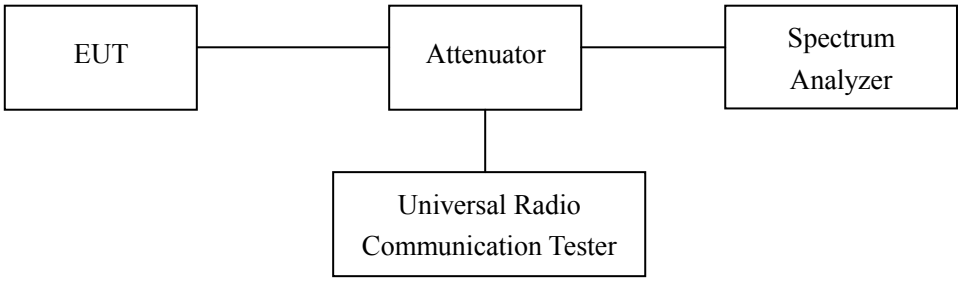
According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

According to §27.53 (h), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

7.2 Test Procedure

The RF output terminal of the transmitter was connected to the input of the spectrum analyzer via a suitable attenuation. The RBW of the spectrum analyzer was set to 100kHz and 1MHz for the scan frequency from 30MHz to 1GHz and the scan frequency from 1GHz to up to 10^{th} harmonic.

Test Configuration for the out of band emissions testing:



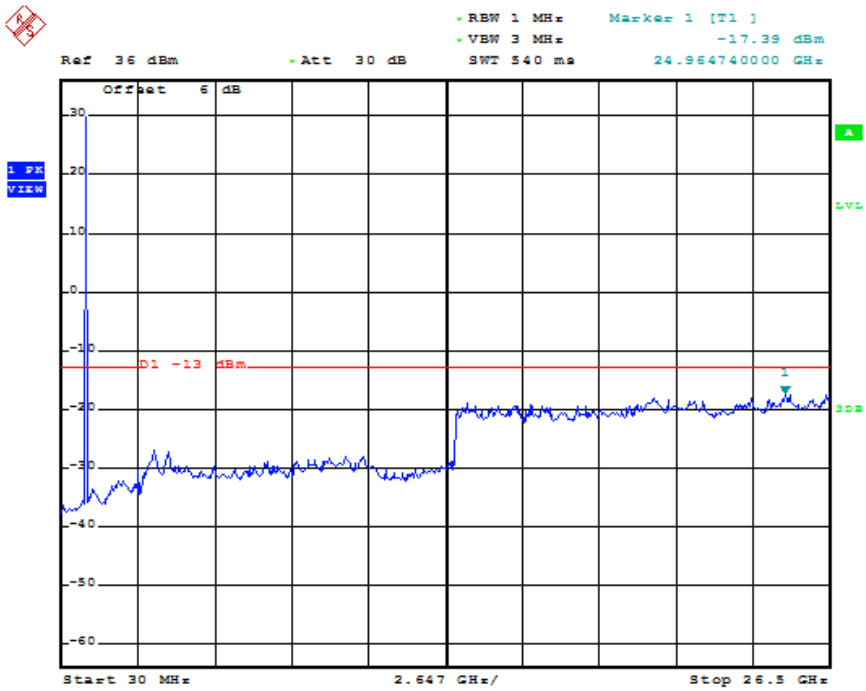
7.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

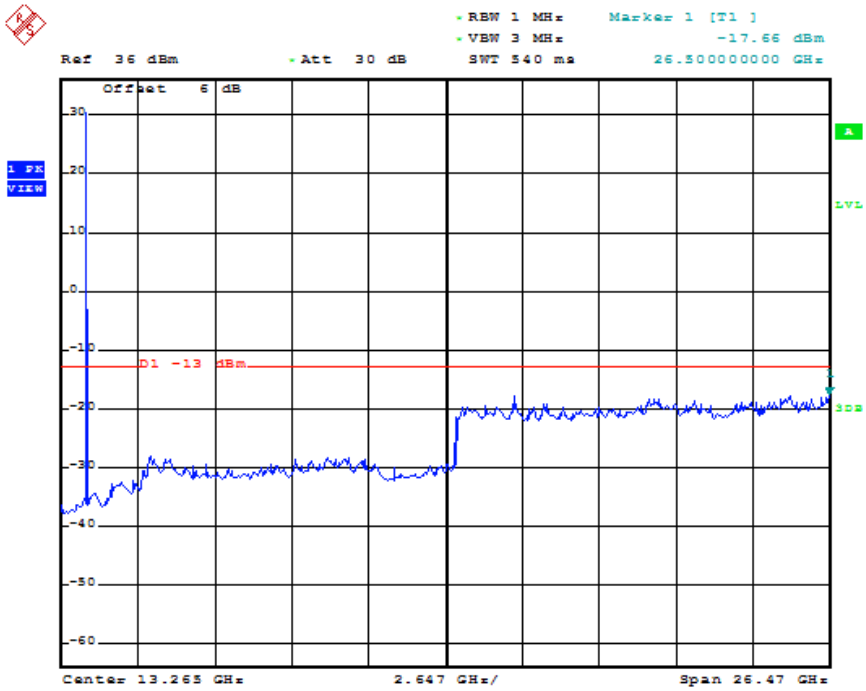
7.4 Summary of Test Results/Plots

Please refer to the following test plots For Cellular Band

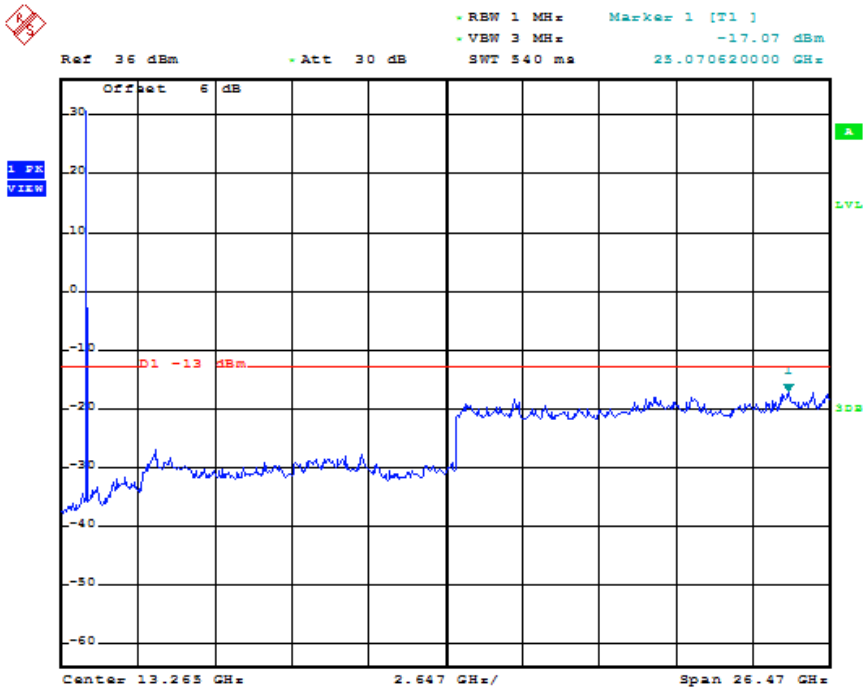
GSM Low Channel



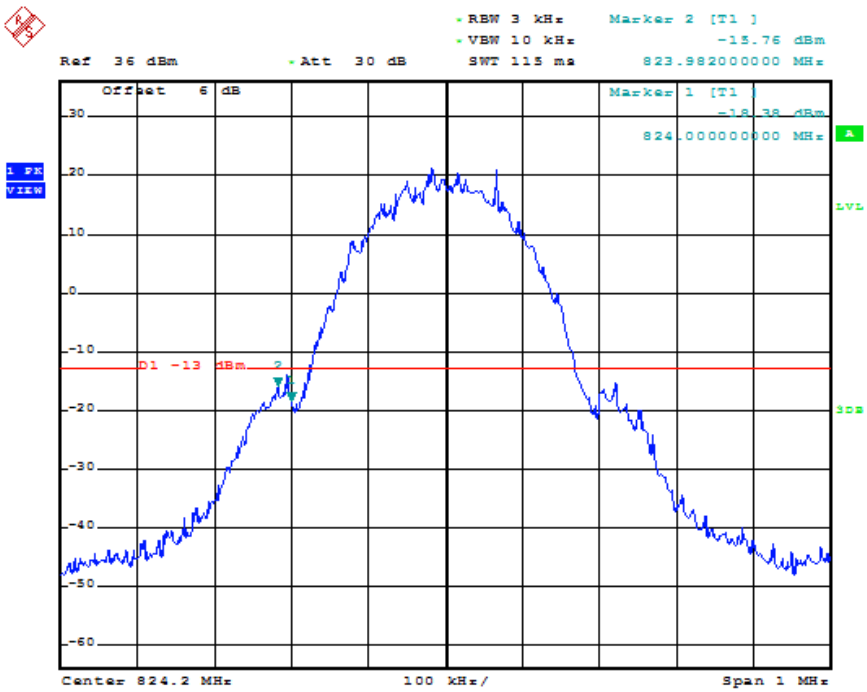
GSM Middle Channel



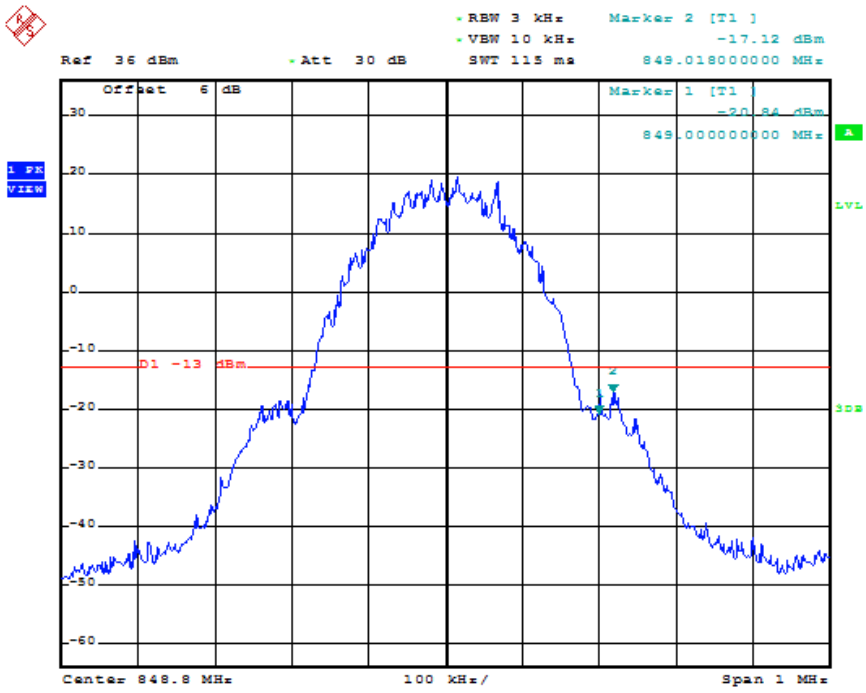
GSM High Channel



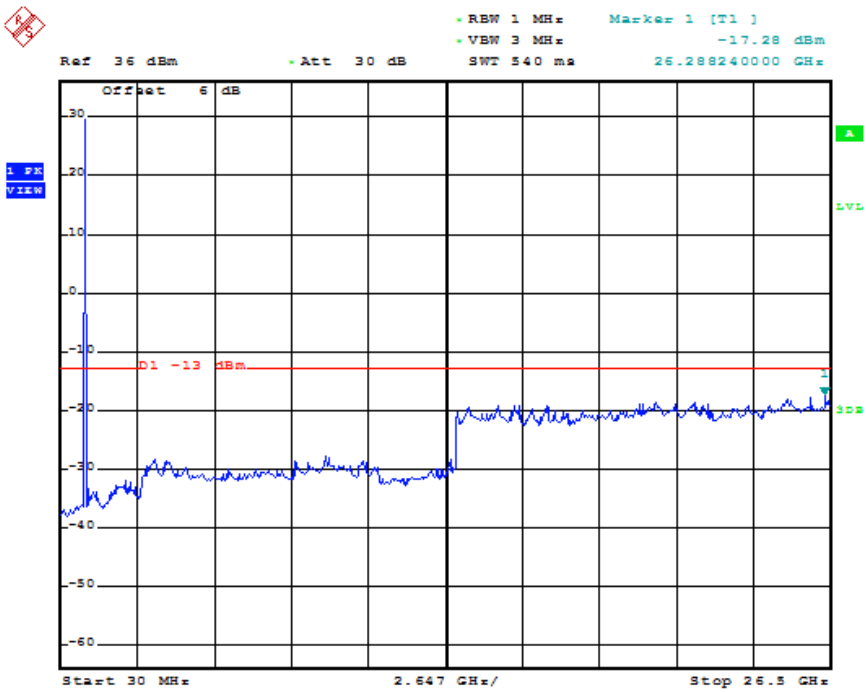
GSM Low Band Emission



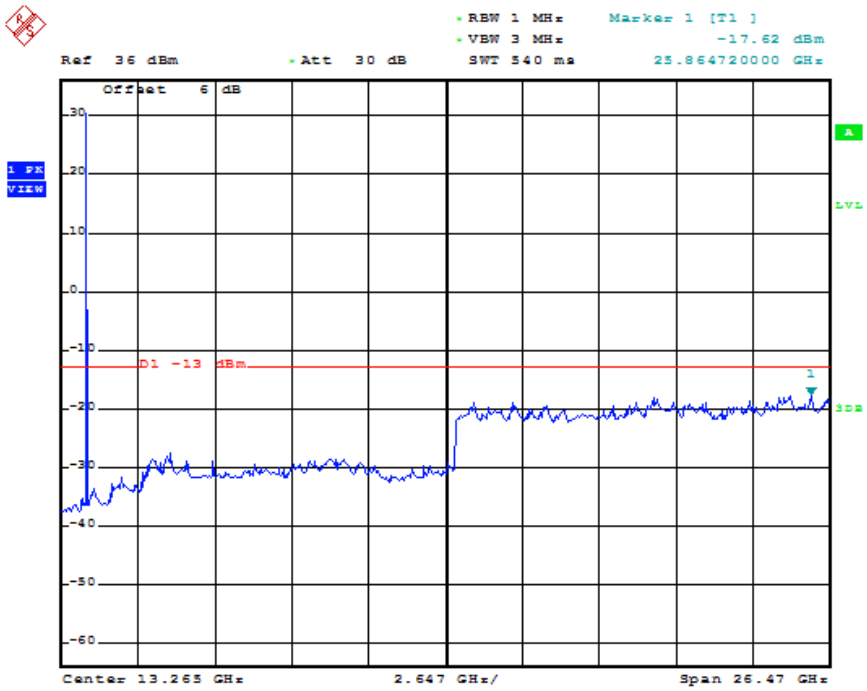
GSM High Band Emission



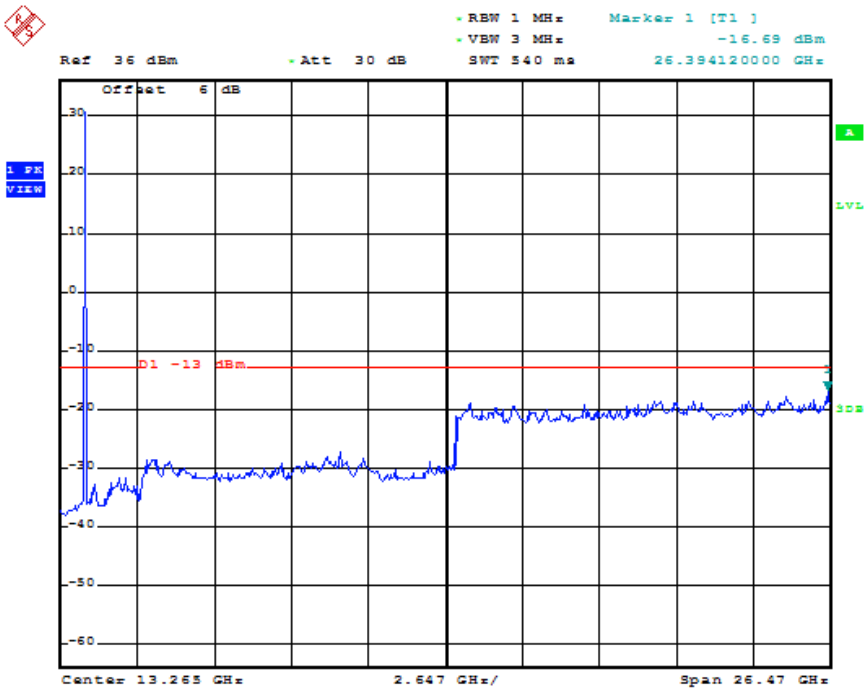
GPRS Low Channel



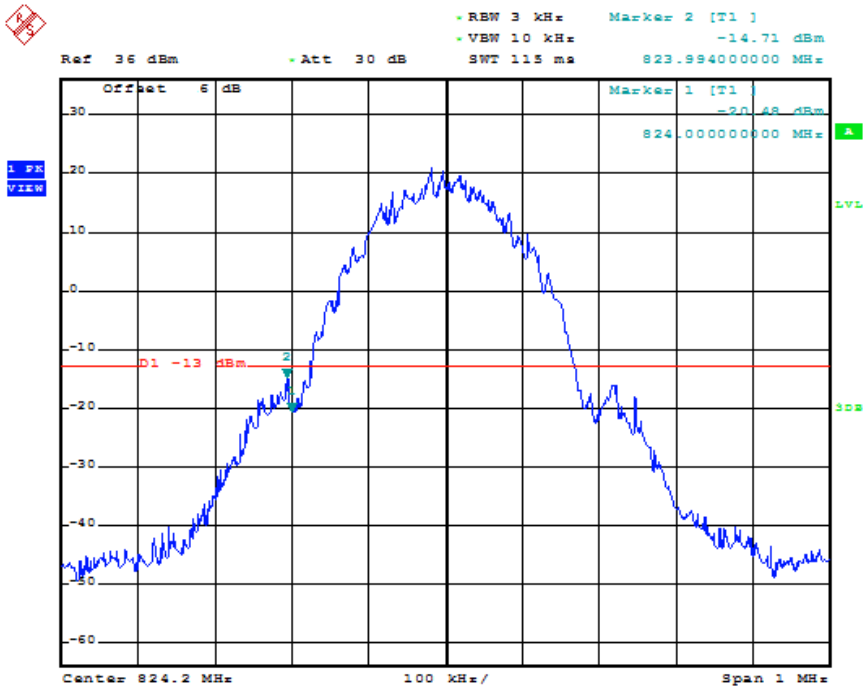
GPRS Middle Channel



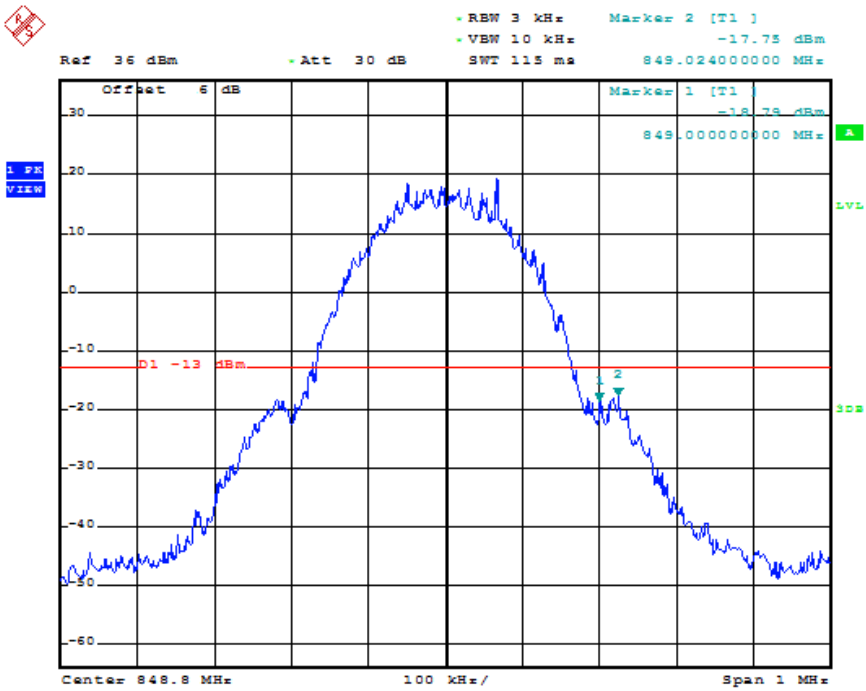
GPRS High Channel



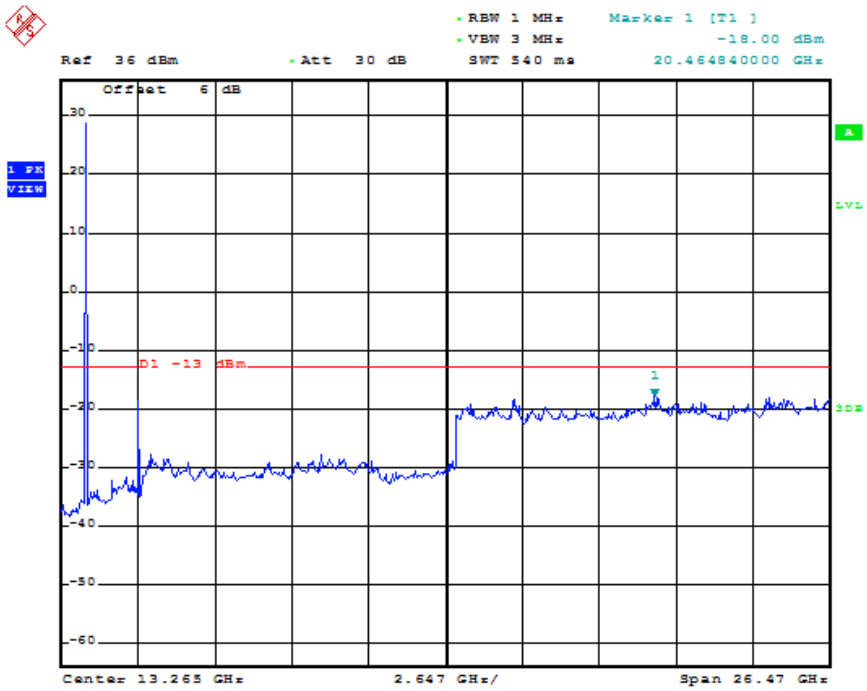
GPRS Low Band Emission



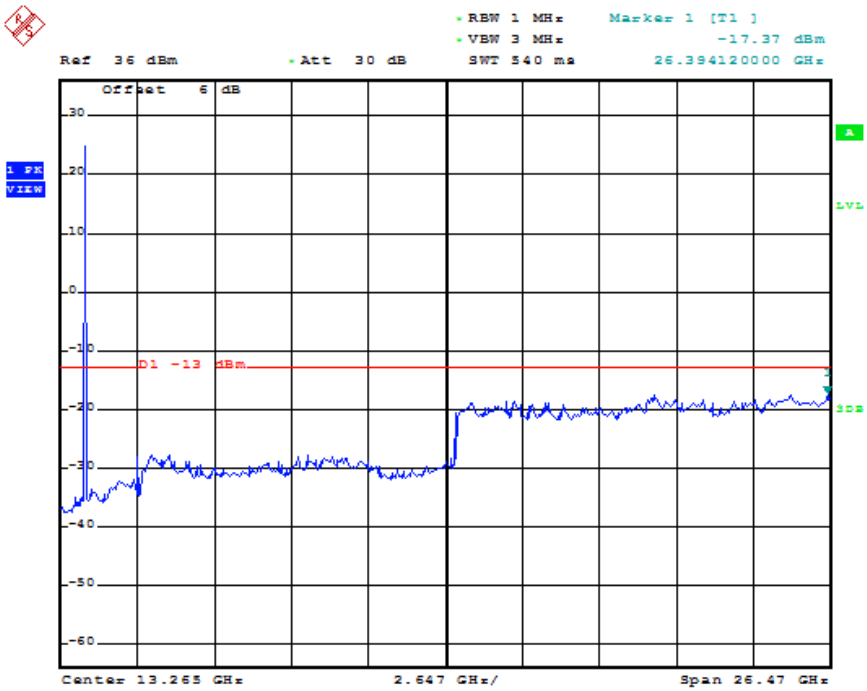
GPRS High Band Emission



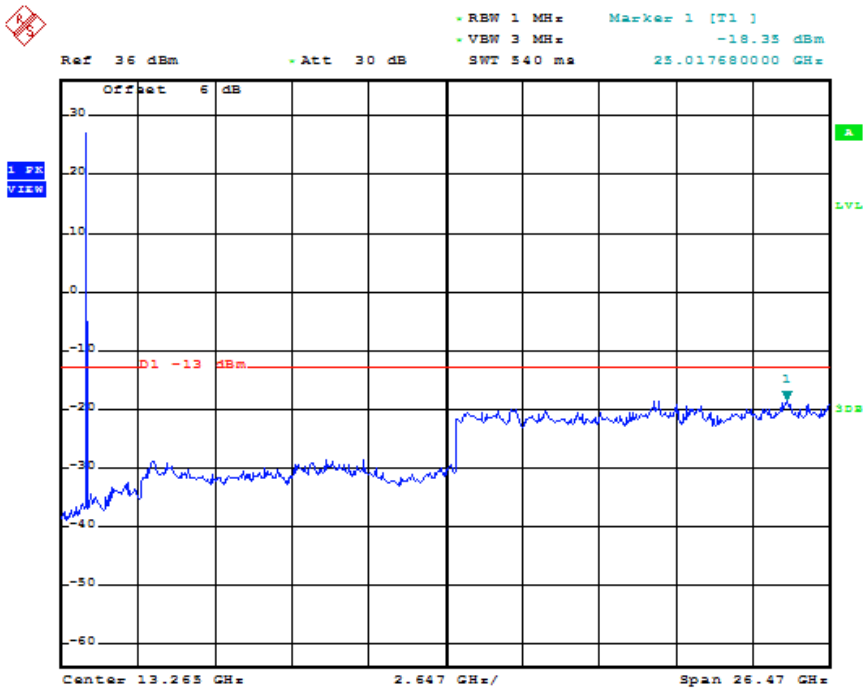
EDGE Low Channel



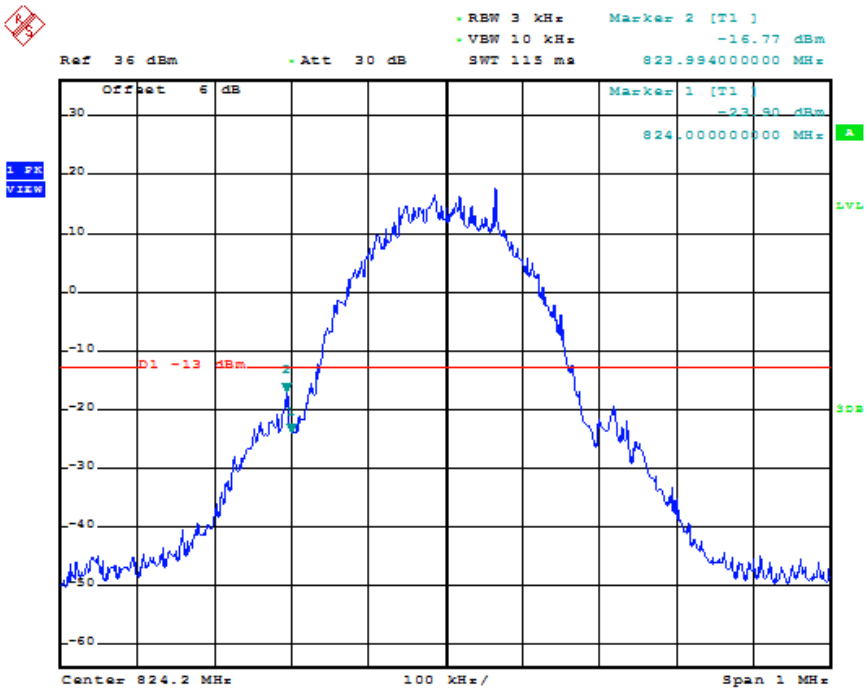
EDGE Middle Channel



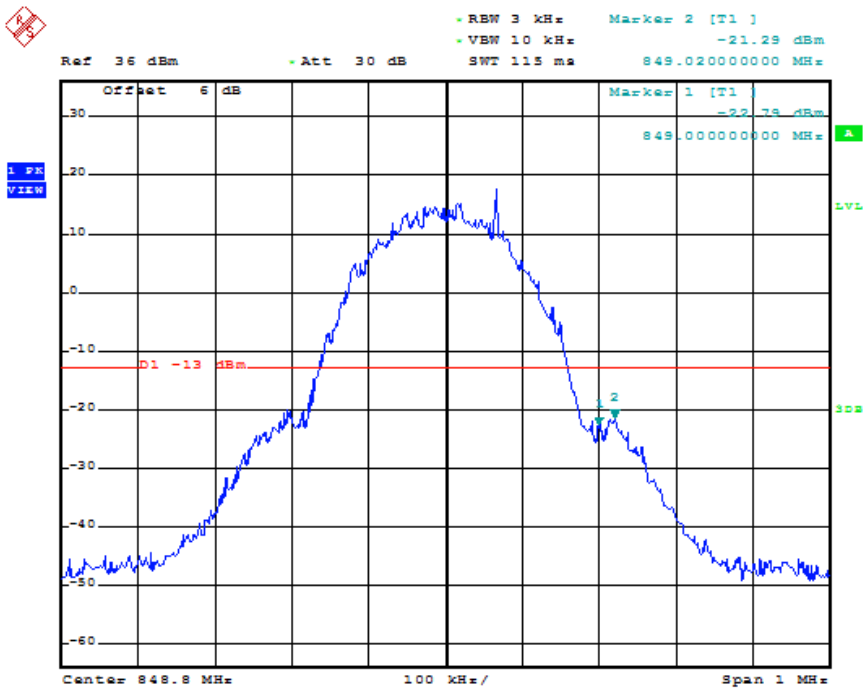
EDGE High Channel



EDGE Low Band Emission

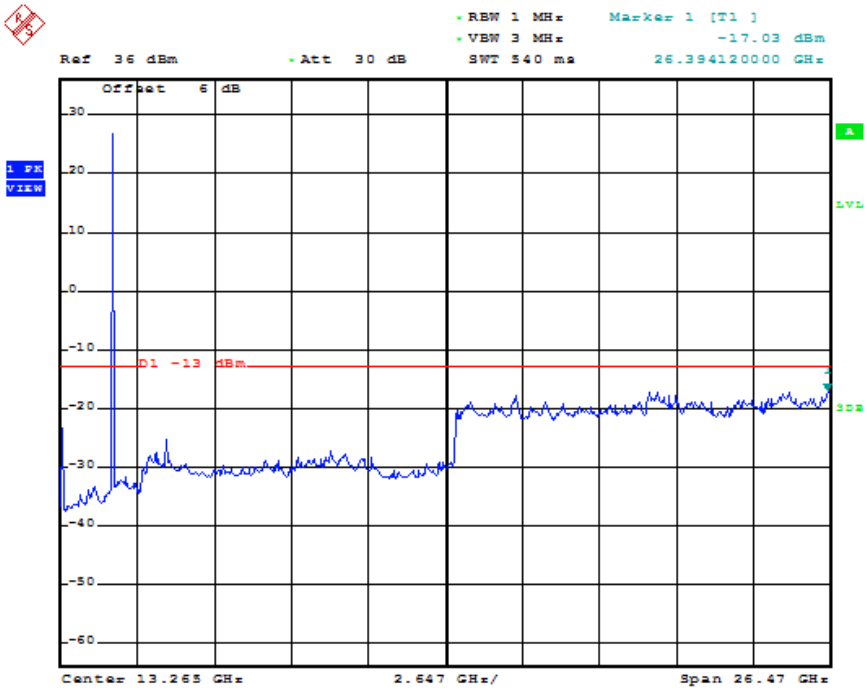


EDGE High Band Emission

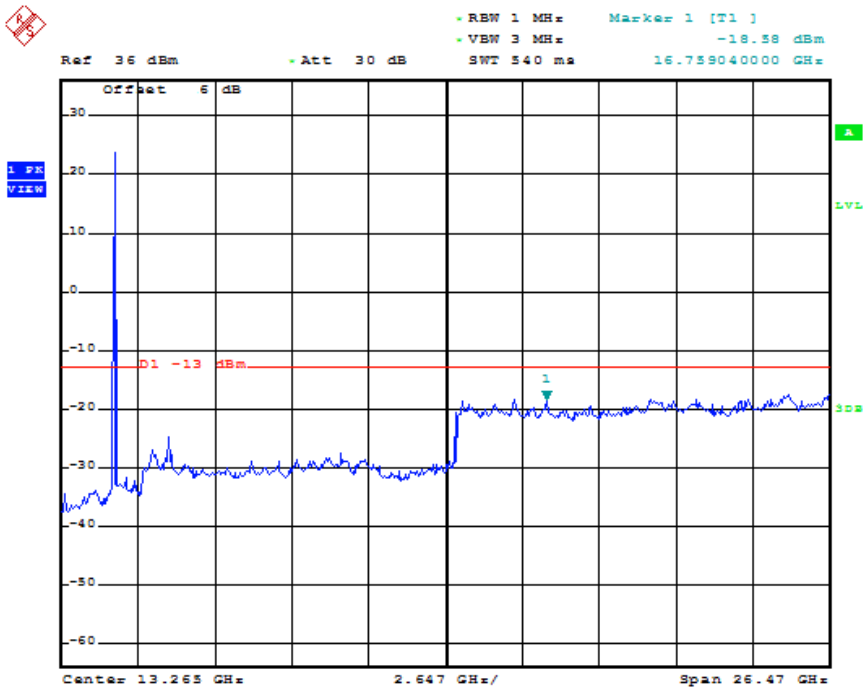


For PCS Band

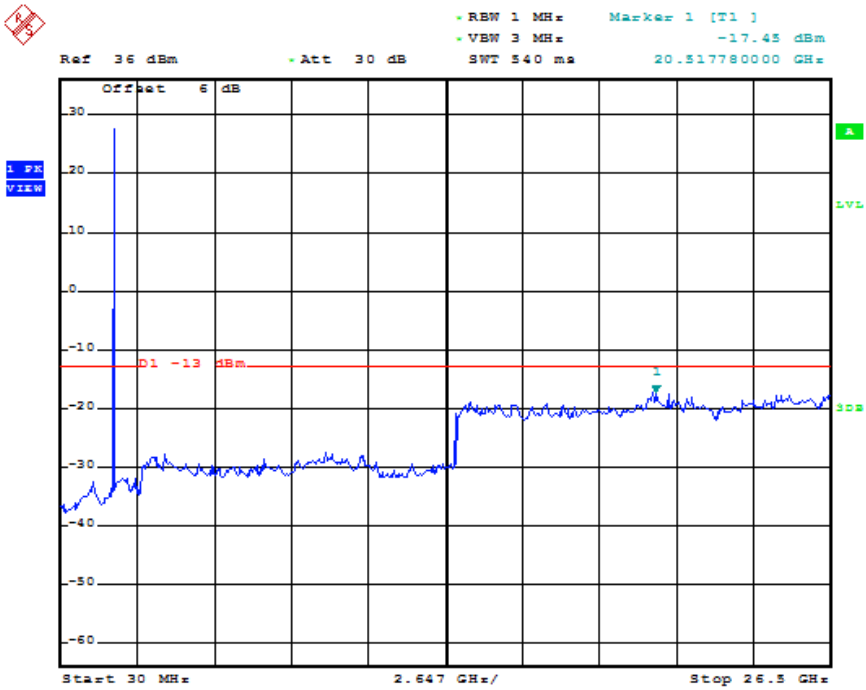
GSM Low Channel



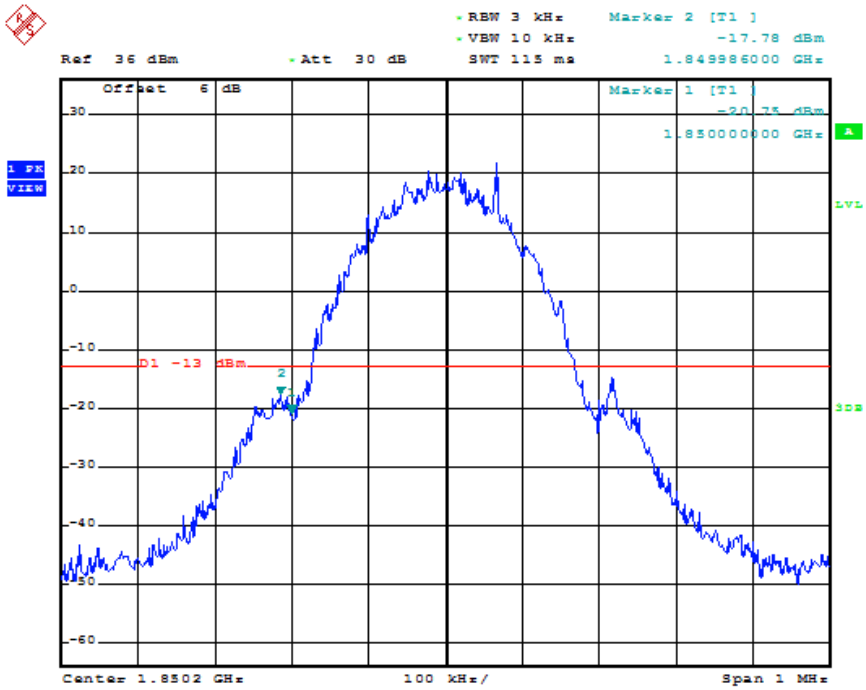
GSM Middle Channel



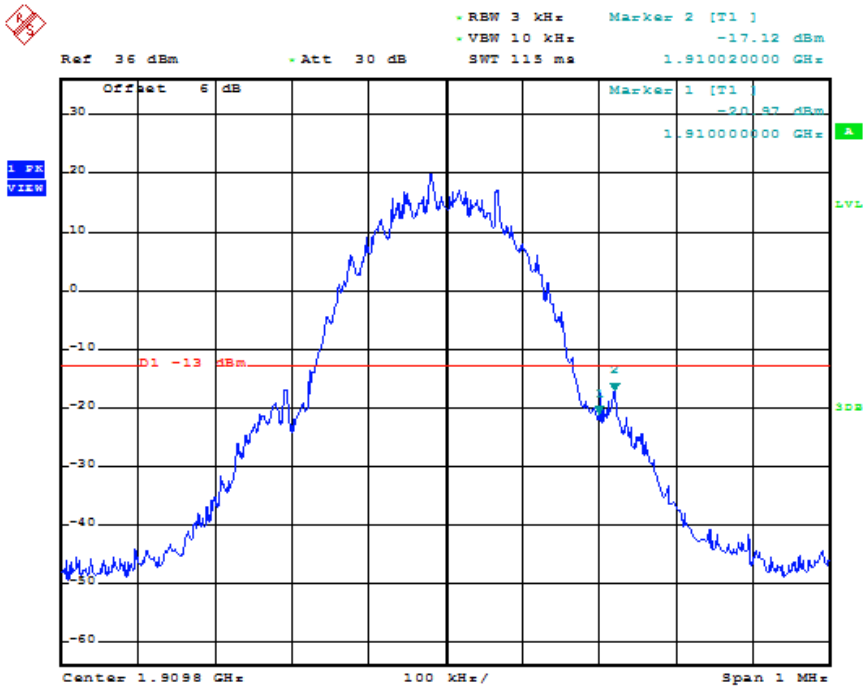
GSM High Channel



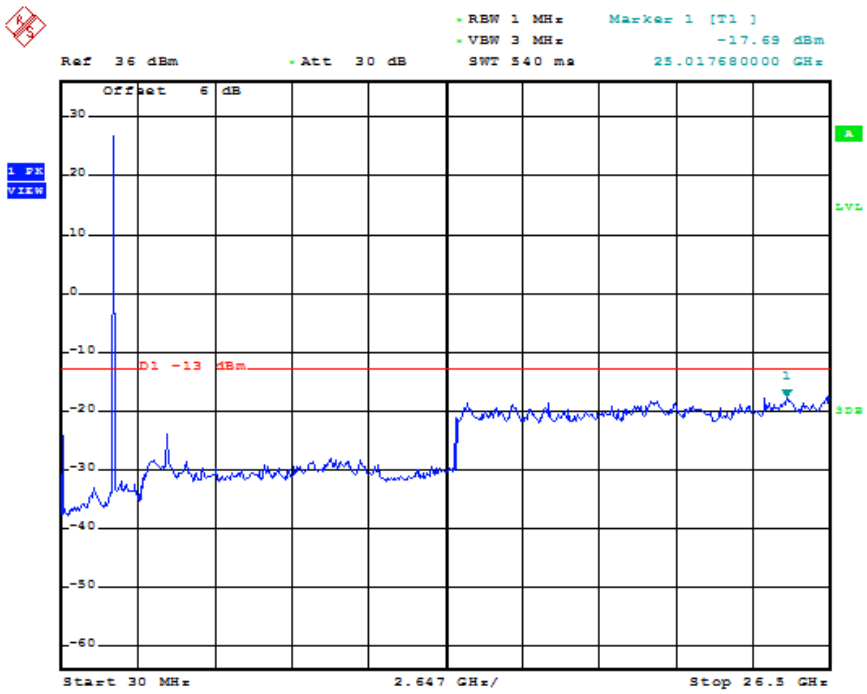
GSM Low Band Emission



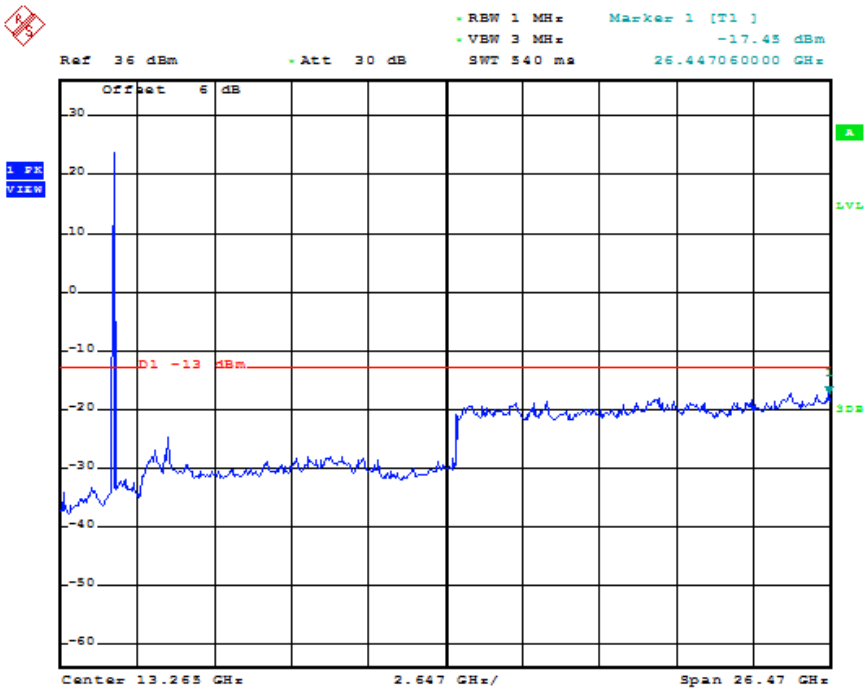
GSM High Band Emission



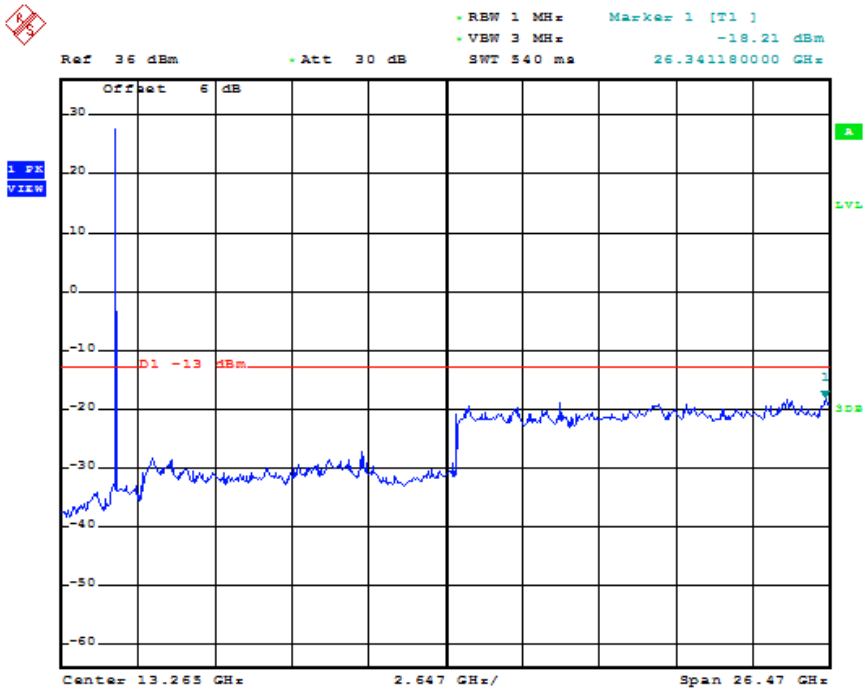
GPRS Low Channel



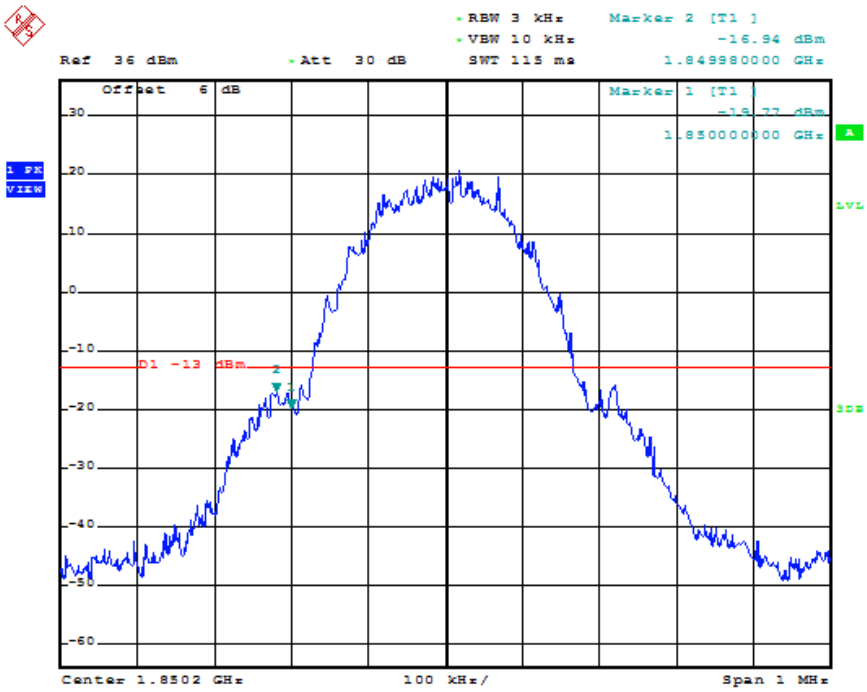
GPRS Middle Channel



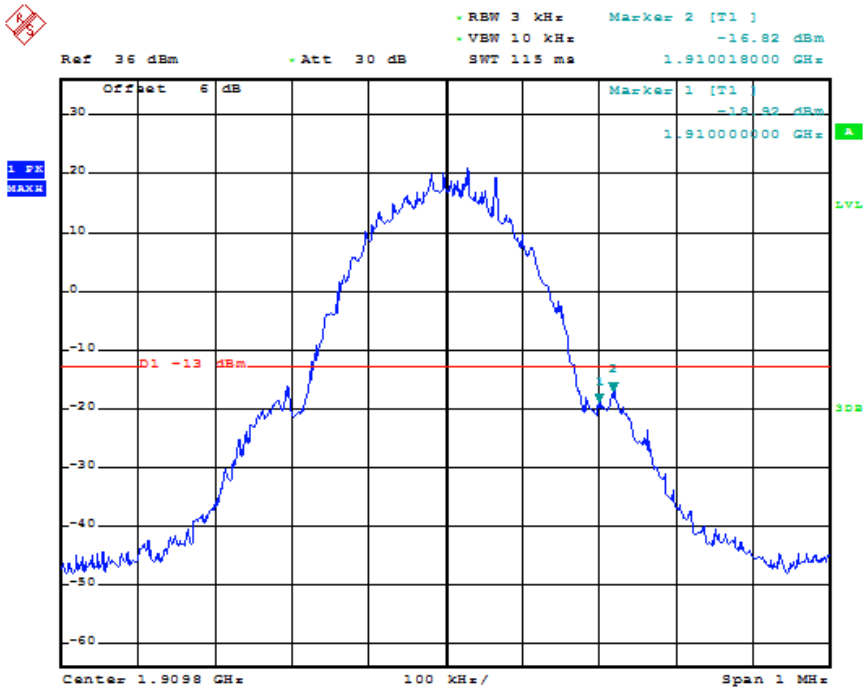
GPRS High Channel



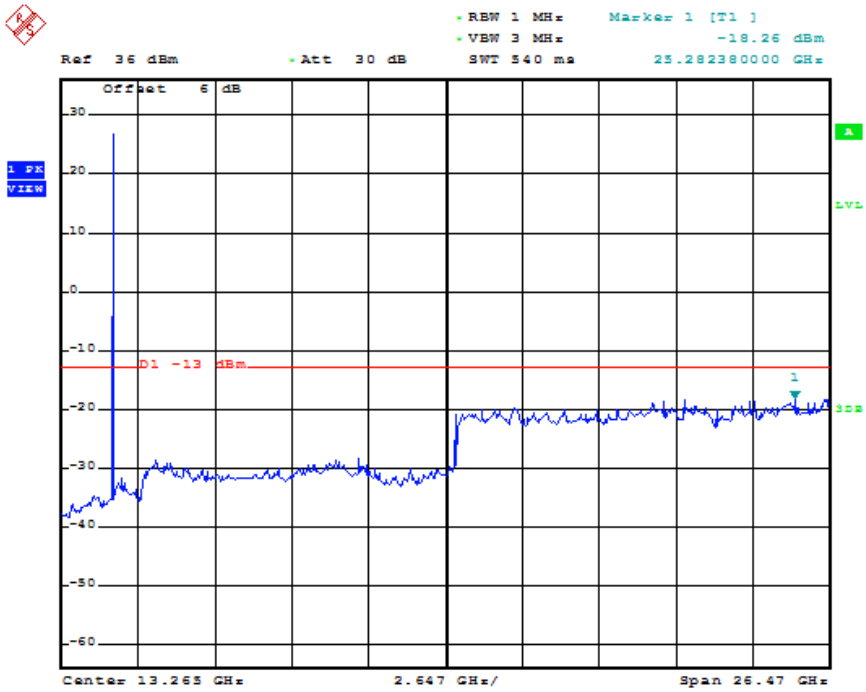
GPRS Low Band Emission



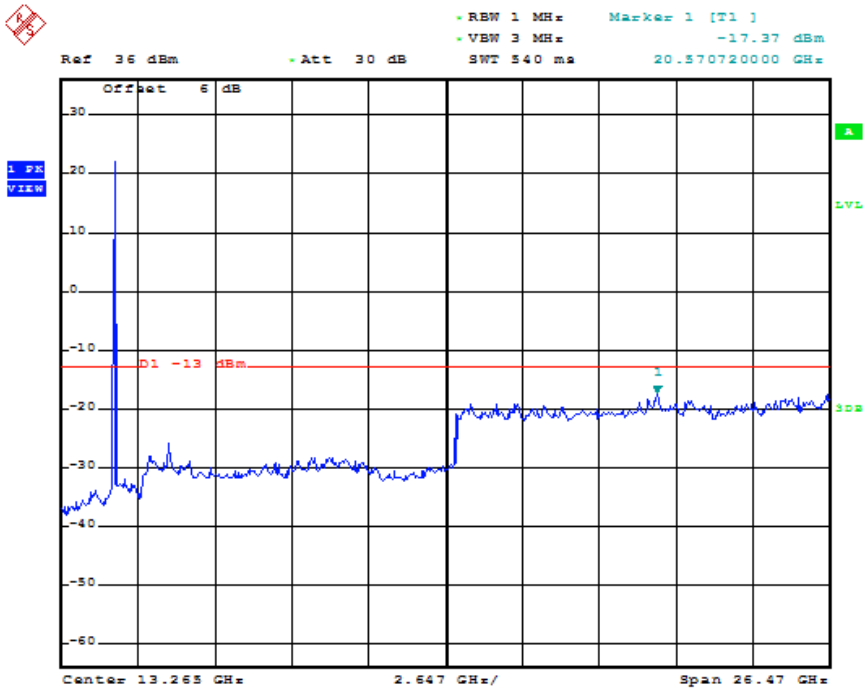
GPRS High Band Emission



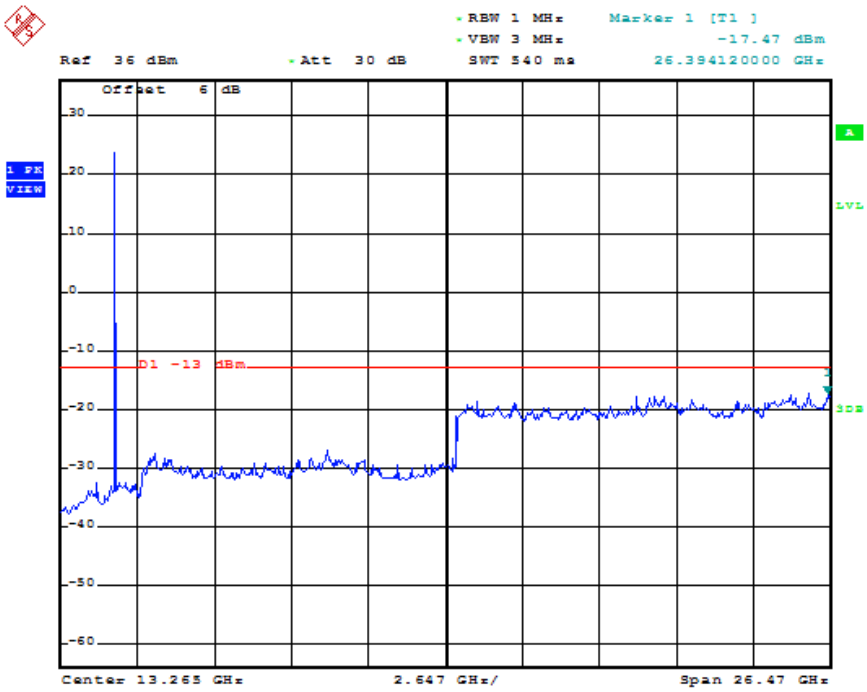
EDGE Low Channel



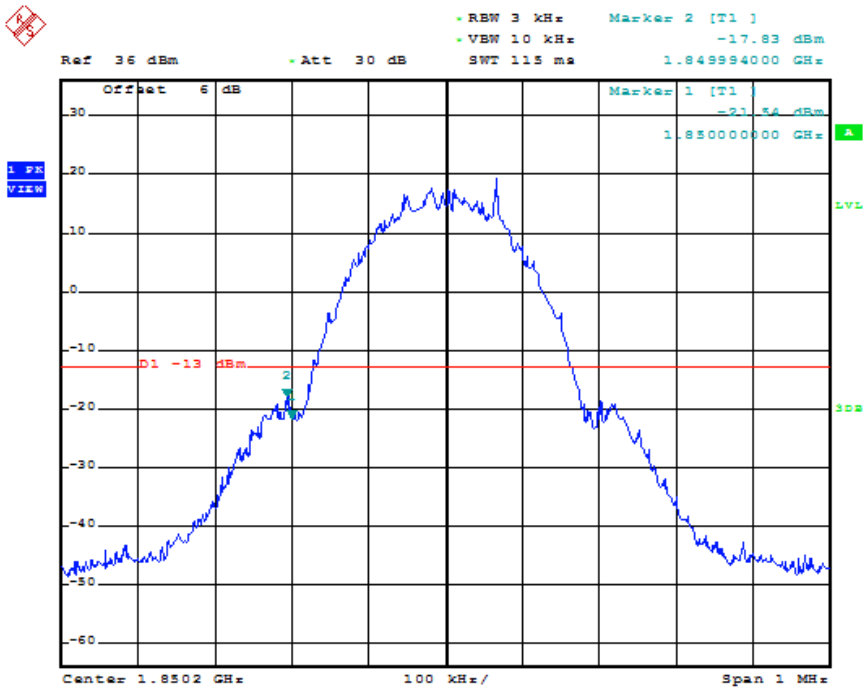
EDGE Middle Channel



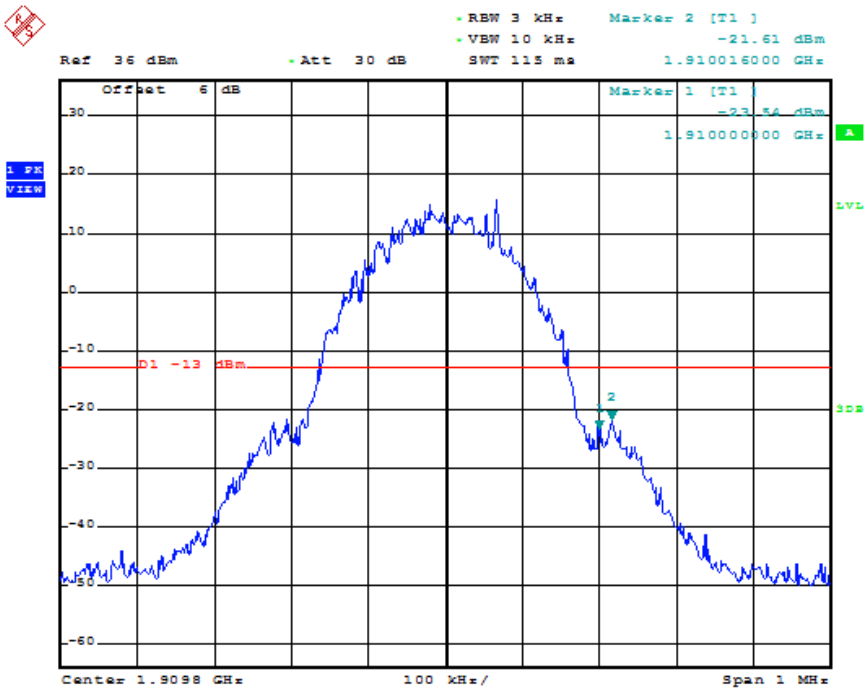
EDGE High Channel



EDGE Low Band Emission

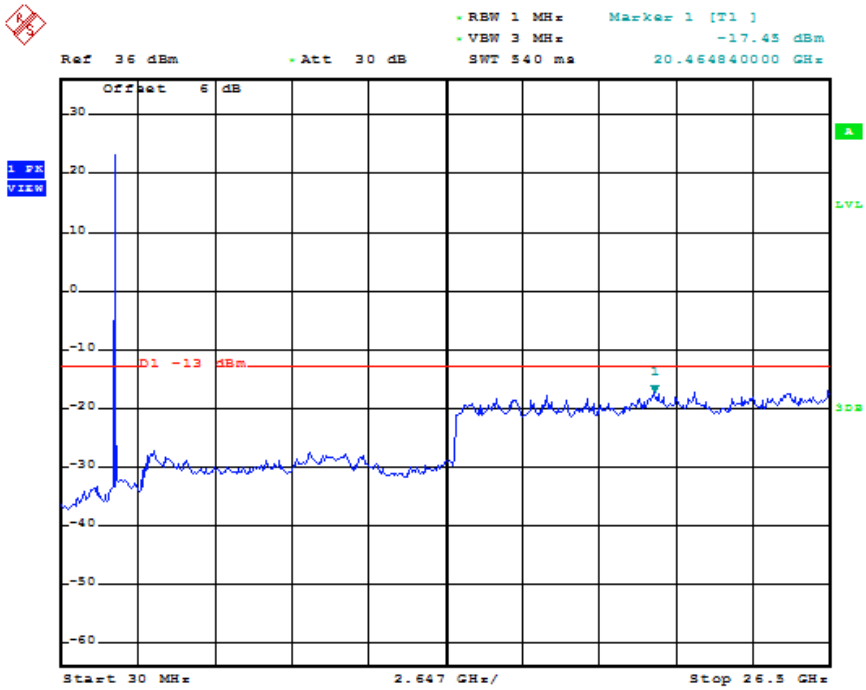


EDGE High Band Emission

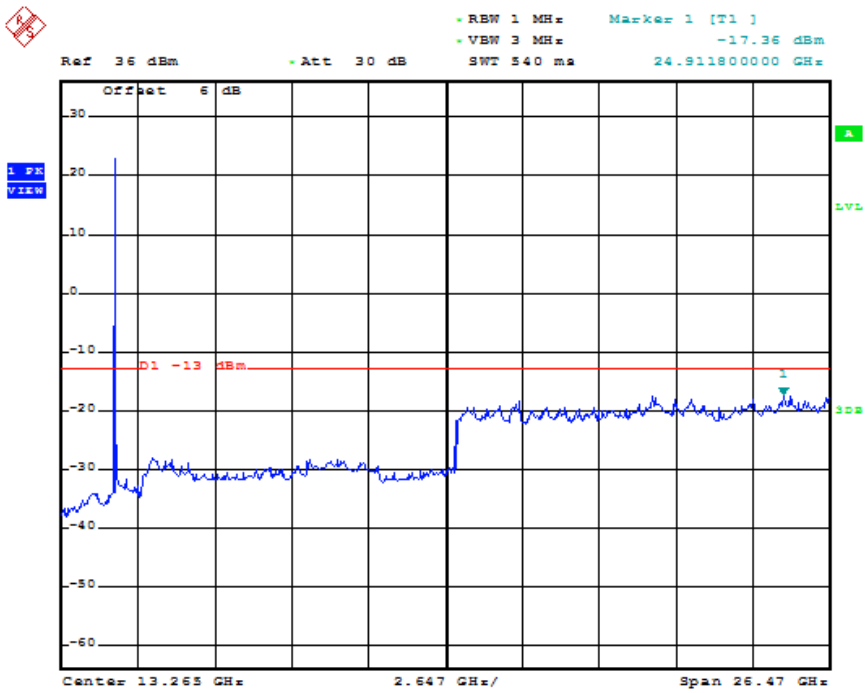


For Band II

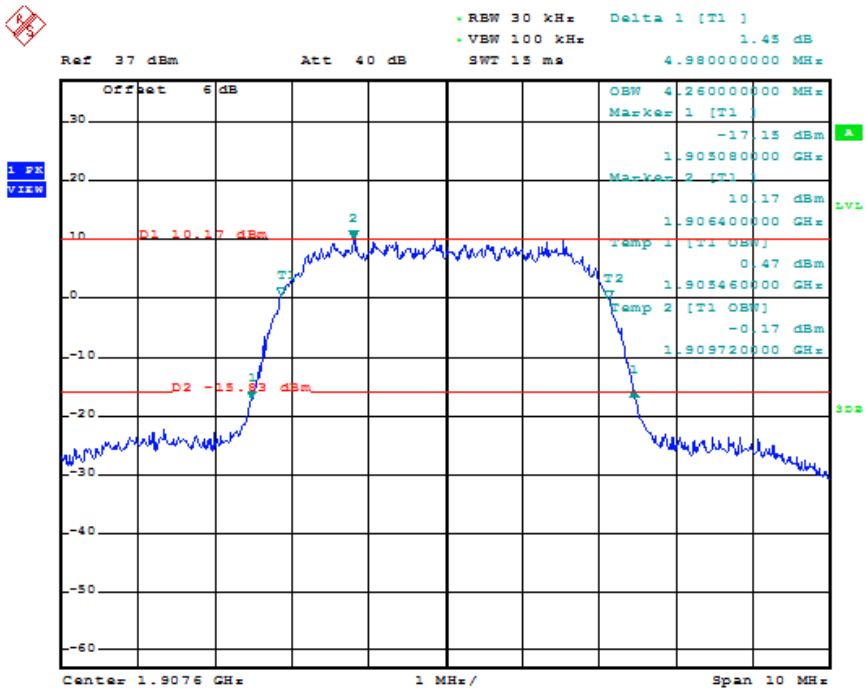
WCDMA Low Channel



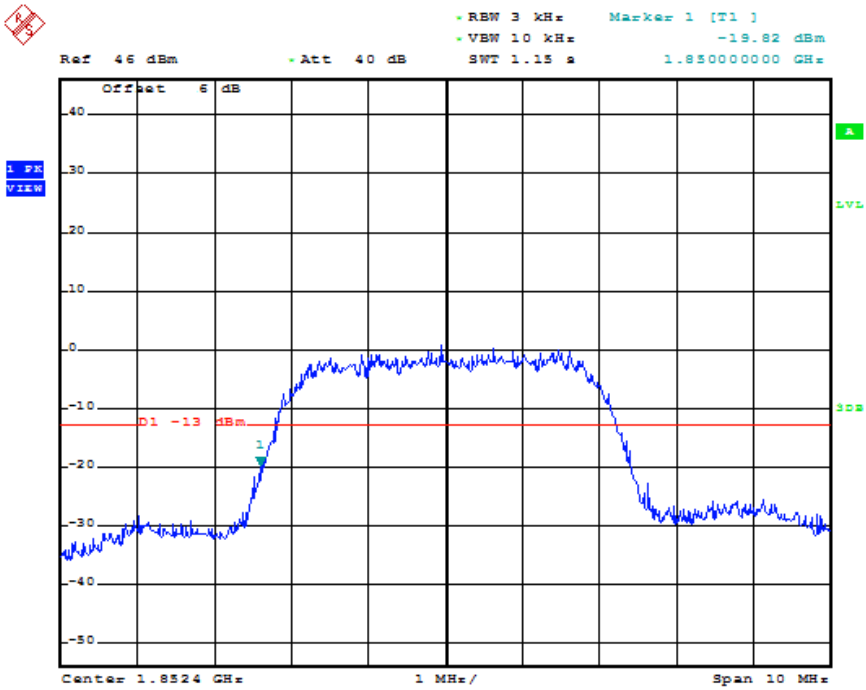
WCDMA Middle Channel



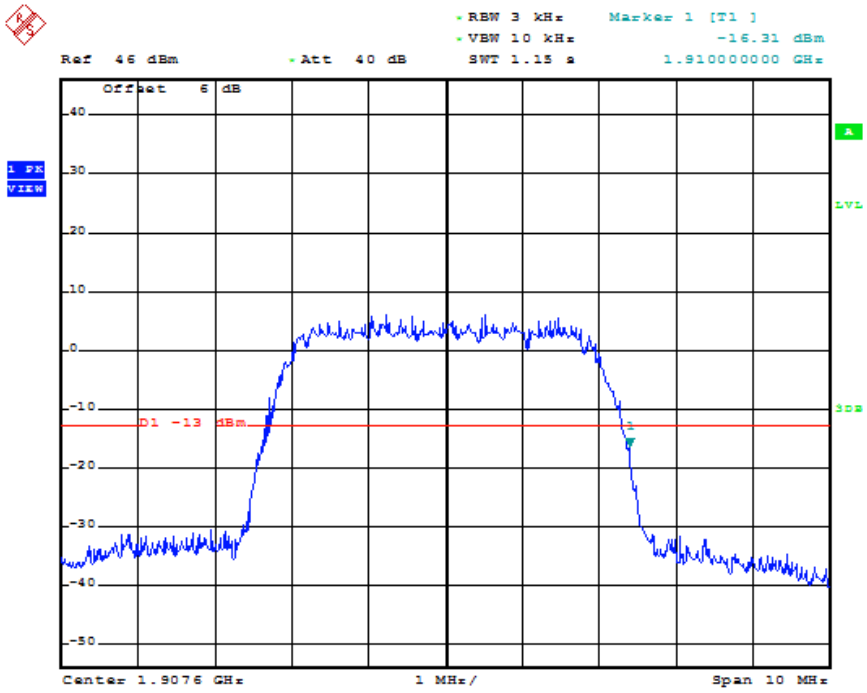
WCDMA High Channel



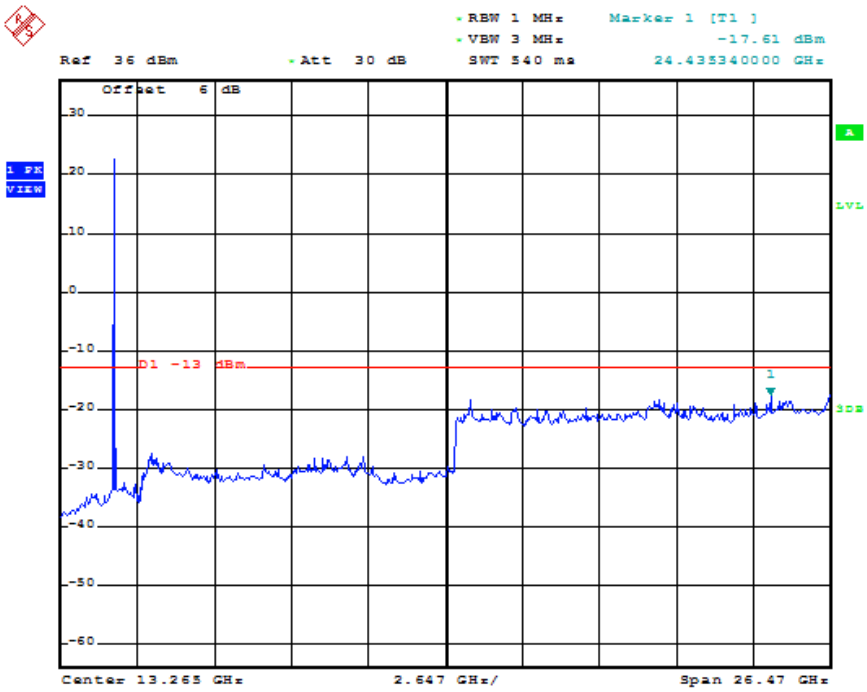
WCDMA Low Band Spurious Emission



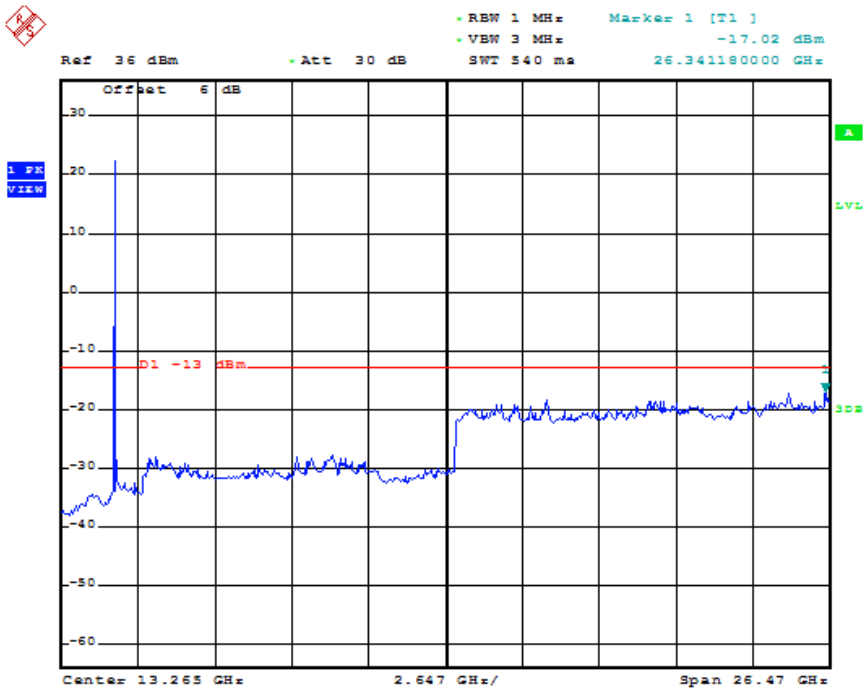
WCDMA High Band Spurious Emission



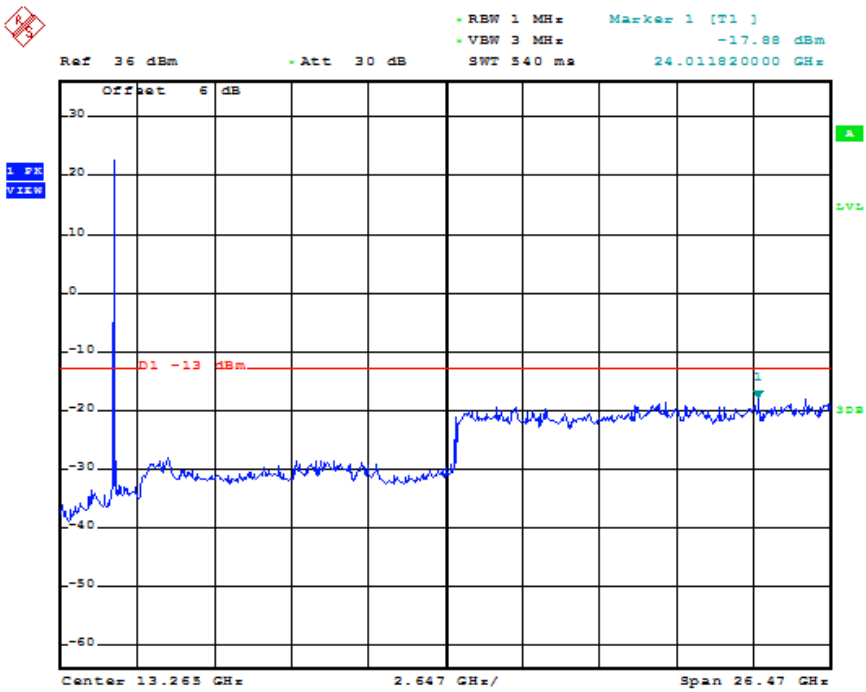
HSDPA Low Channel



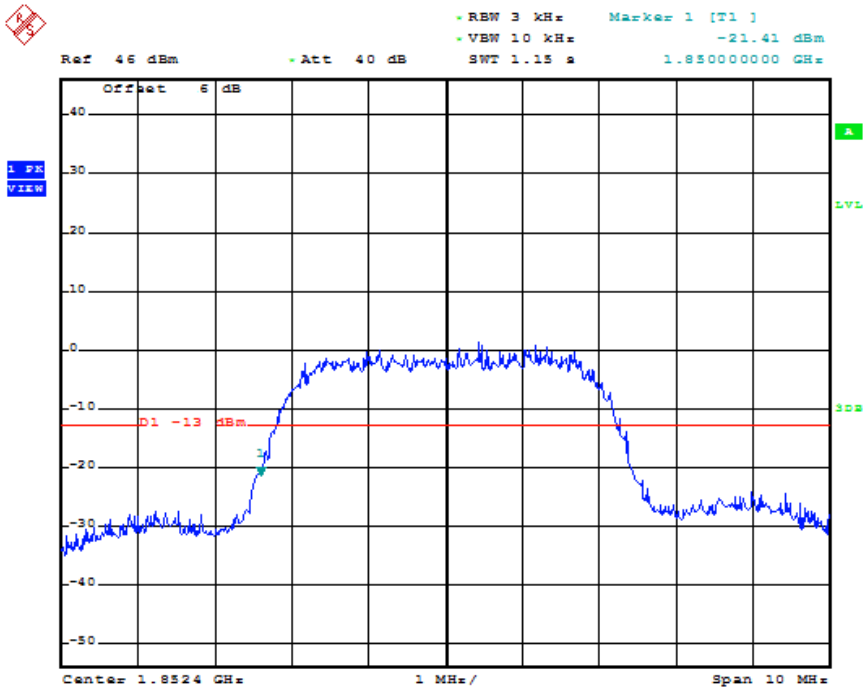
HSDPA Middle Channel



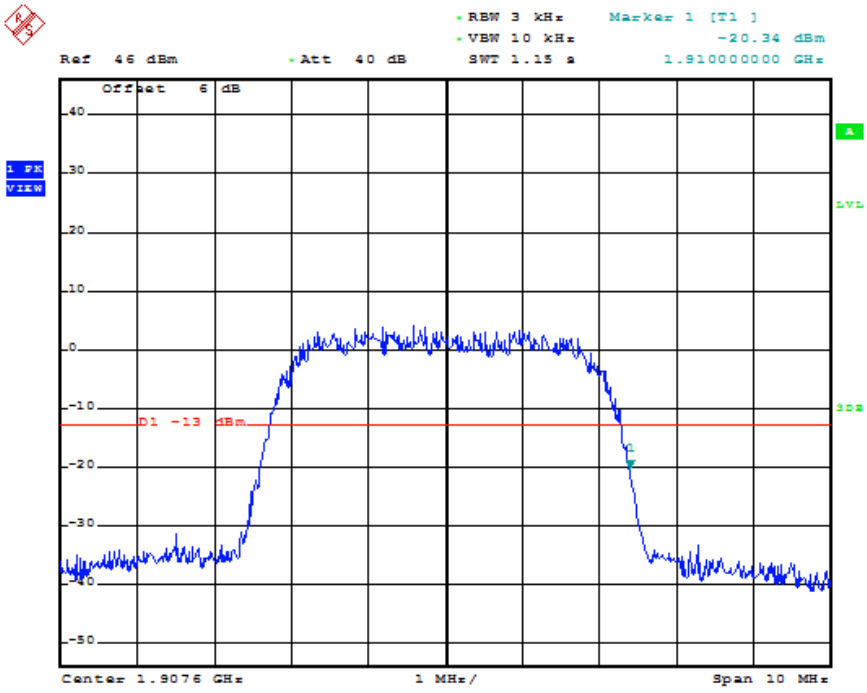
HSDPA High Channel



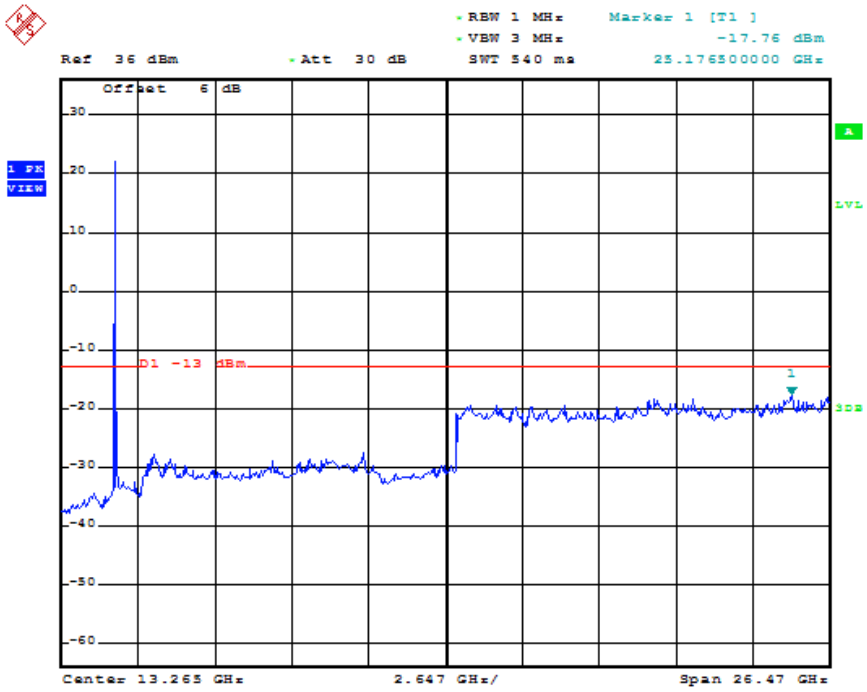
HSDPA Low Band Spurious Emission



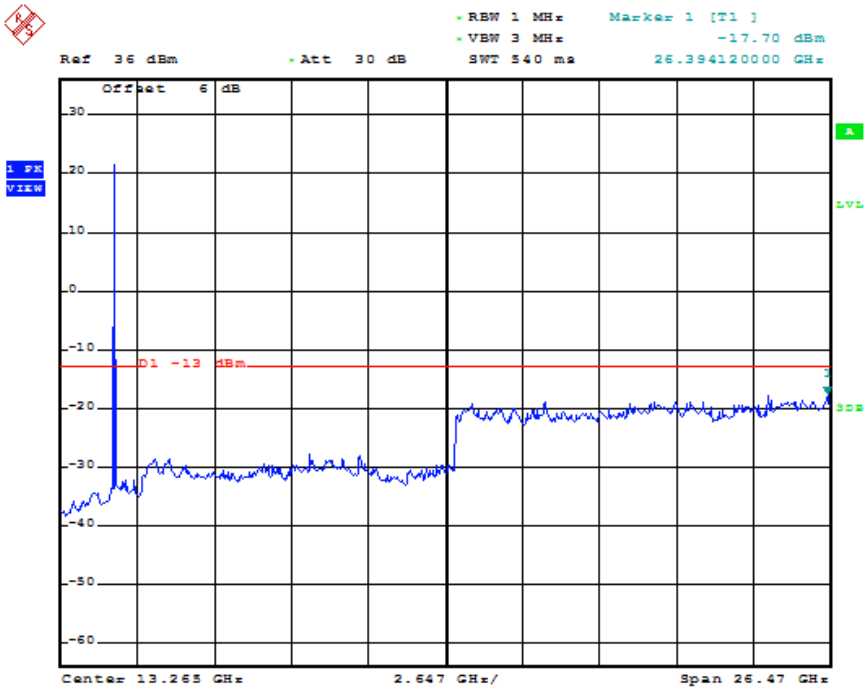
HSDPA High Band Spurious Emission



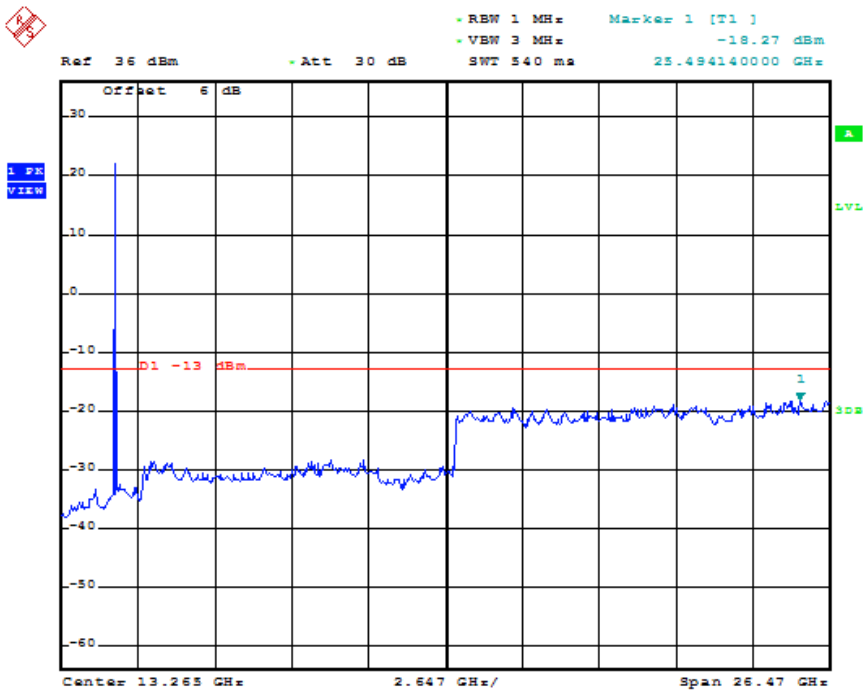
HSUPA Low Channel



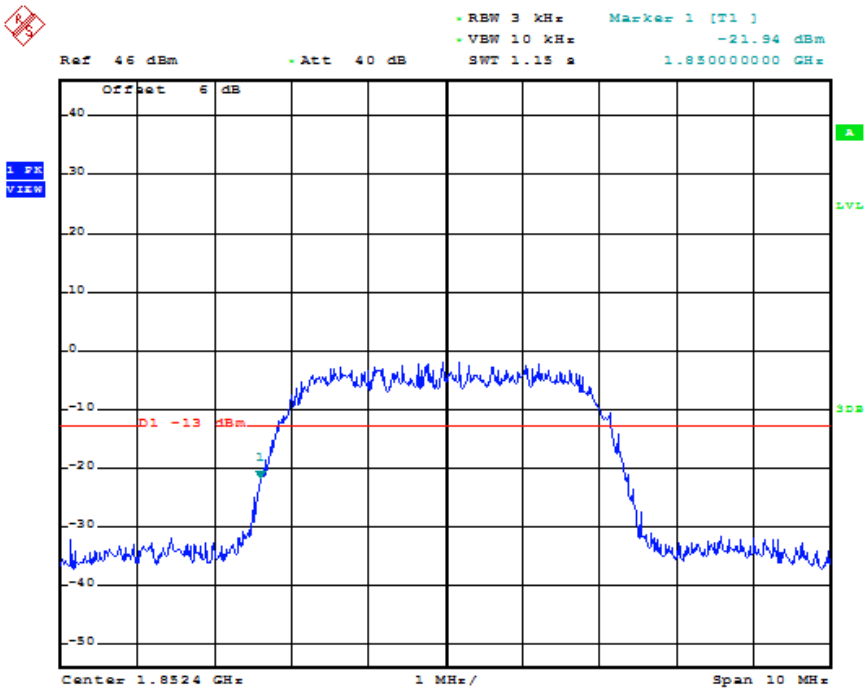
HSUPA Middle Channel



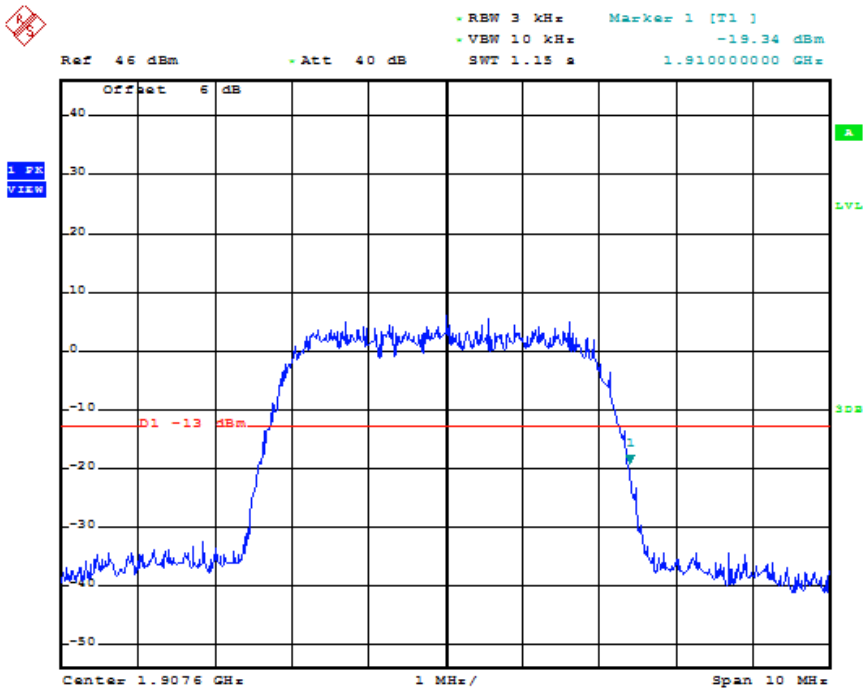
HSUPA High Channel



HSUPA Low Band Spurious Emission



HSUPA High Band Spurious Emission



8. Spurious Radiated Emissions

8.1 Standard Applicable

According to §22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

According to §27.53 (h), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

8.2 Test Procedure

1. The setup of EUT is according with per ANSI/TIA Standard 603D and ANSI C63.4-2014 measurement procedure.
2. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.
3. The frequency range up to tenth harmonic of the fundamental frequency was investigated.
4. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious attenuation limit in dB =43+10 Log_{10} (power out in Watts)

8.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

8.4 Summary of Test Results/Plots

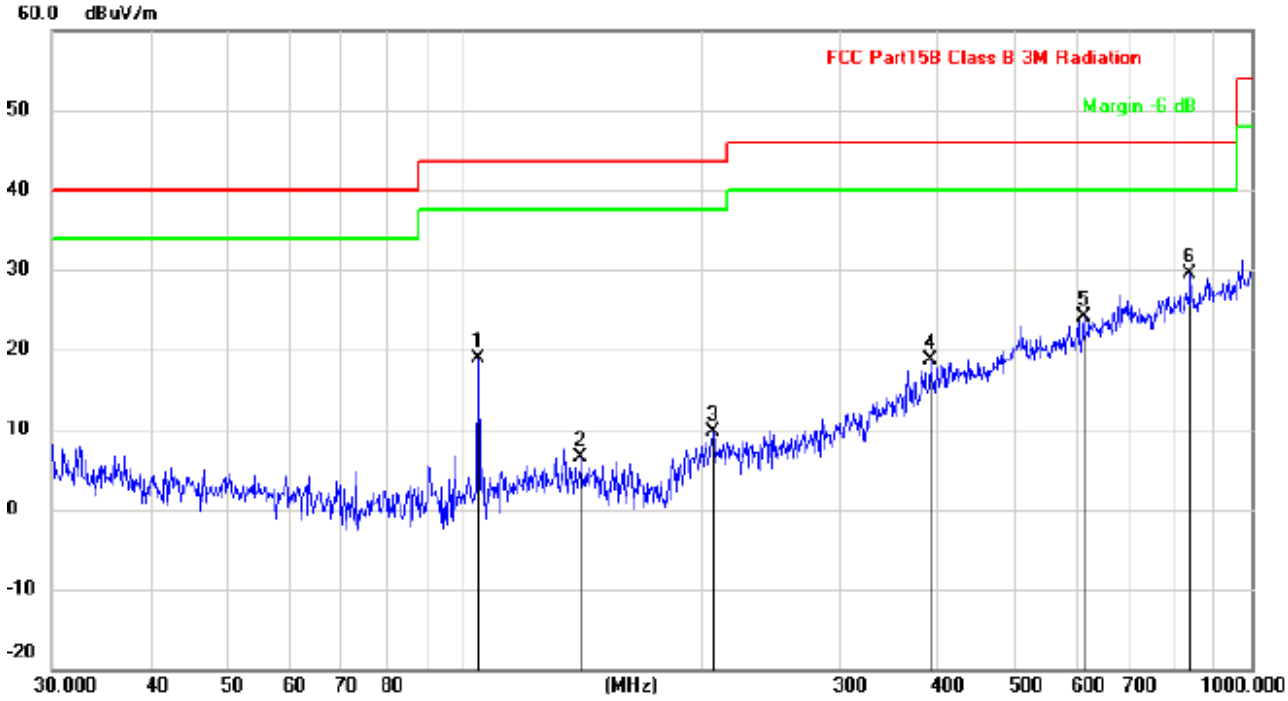
According to the data below, the FCC Part 22.917 and 24.238 standards, and had the worst margin of:

Note:

1. Worst-case radiated emission below 1GHz is GSM850 mode.

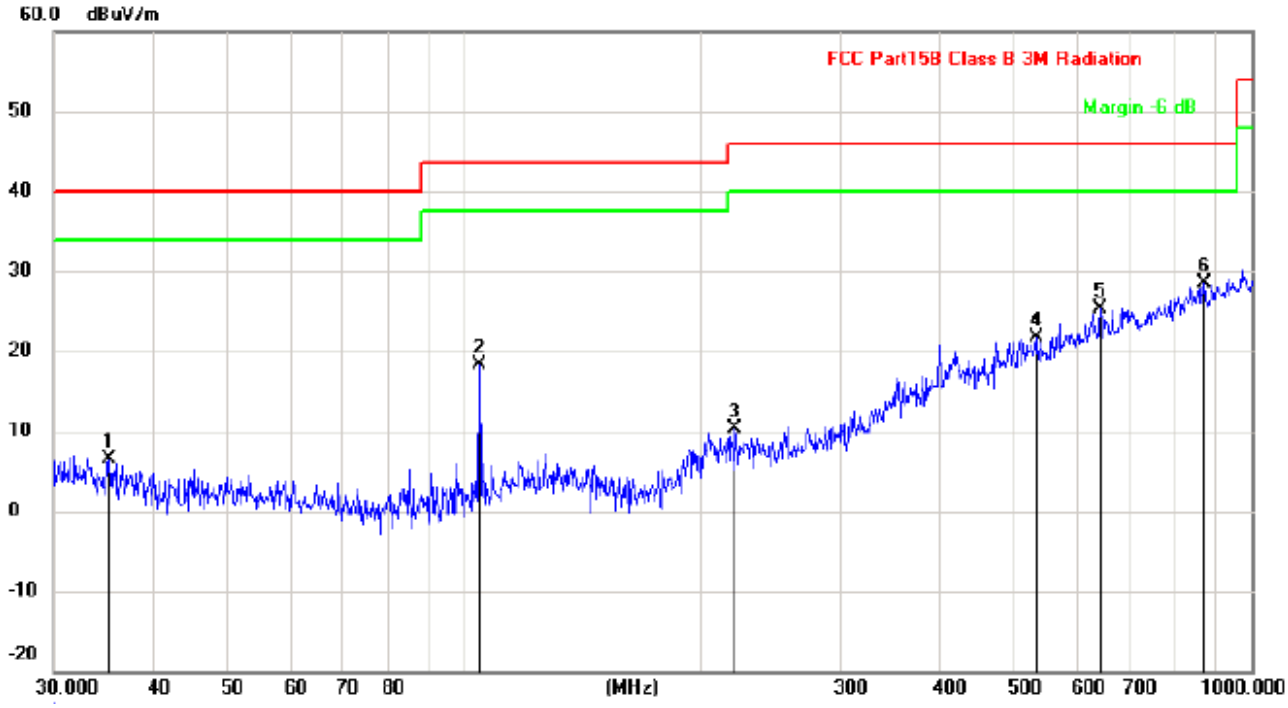
2. Worst-case radiated emission above 1GHz is GSM850/GSM1900/ WCDMA BAND 2 mode.

Spurious Emission From 30MHz to 1GHz
For Cellular Band_ GSM850 Mode
Horizontal:



No.	Mk.	Freq.	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		104.1701	18.88	43.50	-24.62	QP			
2		140.8351	6.43	43.50	-37.07	QP			
3		207.1226	9.64	43.50	-33.86	QP			
4		390.7226	18.61	46.00	-27.39	QP			
5		612.0642	24.03	46.00	-21.97	QP			
6	*	836.2443	29.47	46.00	-16.53	QP			

Vertical:



No.	Mk.	Freq.	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		35.2512	6.51	40.00	-33.49	peak			
2		104.1701	18.27	43.50	-25.23	peak			
3		220.6171	10.31	46.00	-35.69	peak			
4		531.9635	21.70	46.00	-24.30	peak			
5		642.8613	25.39	46.00	-20.61	peak			
6	*	872.1832	28.43	46.00	-17.57	peak			

Spurious Emissions Above 1GHz

For Cellular Band_GSM850 Mode

Frequency	Result	Limit	Margin	Polar
(MHz)	(dBm)	(dBm)	(dB)	H/V
Low channel(824.2MHz)				
1648.4	-46.84	-13	-33.84	H
2472.6	-42.17	-13	-29.17	H
1648.4	-43.06	-13	-30.06	V
2472.6	-40.1	-13	-27.1	V
Middle channel(836.6MHz)				
1673.2	-46.67	-13	-33.67	H
2509.8	-42.09	-13	-29.09	H
1673.2	-42.89	-13	-29.89	V
2509.8	-40.02	-13	-27.02	V
High channel(848.8MHz)				
1697.6	-41.51	-13	-28.51	H
2546.4	-40.58	-13	-27.58	H
1697.6	-41.38	-13	-28.38	V
2546.4	-40.51	-13	-27.51	V

For PCS Band_GSM1900 Mode

Frequency	Result	Limit	Margin	Polar
(MHz)	(dBm)	(dBm)	(dB)	H/V
Low channel(1850.2MHz)				
3700.4	-40.76	-13	-27.76	H
5550.6	-40.65	-13	-27.65	H
3700.4	-39.76	-13	-26.76	V
5550.6	-40.65	-13	-27.65	V
Middle channel(1880MHz)				
3760.0	-38.76	-13	-25.76	H
5640.0	-40.65	-13	-27.65	H
3760.0	-38.76	-13	-25.76	V
5640.0	-40.65	-13	-27.65	V
High channel(1909.8MHz)				
3819.6	-40.06	-13	-27.06	H
5729.4	-40.62	-13	-27.62	H
3819.6	-40.76	-13	-27.76	V
5729.4	-40.12	-13	-27.12	V

For WCDMA Band 2 Mode

Frequency	Result	Limit	Margin	Polar
(MHz)	(dBm)	(dBm)	(dB)	H/V
Low channel(1850.2MHz)				
3704.8	-45.04	-13	-32.04	H
5557.2	-41.08	-13	-28.08	H
3704.8	-46.1	-13	-33.1	V
5557.2	-41.81	-13	-28.81	V
Middle channel(1880MHz)				
3760.8	-45.43	-13	-32.43	H
5640.0	-40.76	-13	-27.76	H
3760.8	-45	-13	-32	V
5640.0	-41.03	-13	-28.03	V
High channel(1909.8MHz)				
3815.2	-45.11	-13	-32.11	H
5722.8	-40.71	-13	-27.71	H
3815.2	-45.41	-13	-32.41	V
5722.8	-40.3	-13	-27.3	H

Note:

1. Calculation of result is: Result (dBm) = Reading (dBm) + Correction Factor (dB).
2. Correction Factor (dB)=Ant. Factor + Cable Loss – Ampl. Gain.
3. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

9. Frequency Stability

9.1 Standard Applicable

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Cellular Band

Frequency range (MHz)	Base, fixed (ppm)	Mobile >3 watts (ppm)	Mobile ≤3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	N/A	N/A
929 to 960	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

According to §27.54 The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

9.2 Test Procedure

According to §2.1055, the following test procedure was performed.
The Frequency Stability is measured directly with a Frequency Domain Analyzer. Frequency Deviation in ppm is calculated from the measured peak to peak value.
The Carrier Frequency Stability over Power Supply Voltage and over Temperature is measured with a Frequency Domain Analyzer in histogram mode

Temperature:	Supply Voltage
20°C	DC 3.3-4.2V declared by manufacturer
-30°C to +50°C	Normal

9.3 Environmental Conditions

Temperature:	20°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

9.4 Summary of Test Results/Plots

For Cellular Band GSM Mode

Reference Frequency(Middle Channel): 836.6 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.8	79	0.0944
40	3.8	75	0.0896
30	3.8	70	0.0837
20	3.8	68	0.0813
10	3.8	73	0.0873
0	3.8	67	0.0801
-10	3.8	52	0.0622
-20	3.8	63	0.0753
-30	3.8	60	0.0717

For PCS Band GSM Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.8	50	0.0266
40	3.8	47	0.0250
30	3.8	43	0.0229
20	3.8	52	0.0277
10	3.8	48	0.0255
0	3.8	52	0.0277
-10	3.8	63	0.0335
-20	3.8	58	0.0309
-30	3.8	65	0.0346

For Cellular Band GPRS Mode

Reference Frequency(Middle Channel): 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	65	0.0777
40	3.7	61	0.0729
30	3.7	56	0.0669
20	3.7	54	0.0645
10	3.7	59	0.0705
0	3.7	53	0.0634
-10	3.7	38	0.0454
-20	3.7	49	0.0586
-30	3.7	46	0.0550

For PCS Band GPRS Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	74	0.0394
40	3.7	71	0.0378
30	3.7	67	0.0356
20	3.7	76	0.0404
10	3.7	72	0.0383
0	3.7	76	0.0404
-10	3.7	77	0.0410
-20	3.7	62	0.0330
-30	3.7	66	0.0351

For Cellular Band EDGE Mode

Reference Frequency(Middle Channel): 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	67	0.0801
40	3.7	63	0.0753
30	3.7	58	0.0693
20	3.7	56	0.0669
10	3.7	61	0.0729
0	3.7	55	0.0657
-10	3.7	40	0.0478
-20	3.7	51	0.0610
-30	3.7	48	0.0574

For PCS Band EDGE Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	69	0.0367
40	3.7	66	0.0351
30	3.7	62	0.0330
20	3.7	71	0.0378
10	3.7	67	0.0356
0	3.7	71	0.0378
-10	3.7	72	0.0383
-20	3.7	57	0.0303
-30	3.7	61	0.0324

For WCDMA Band 2 Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	61	0.0324
40	3.7	48	0.0255
30	3.7	44	0.0234
20	3.7	53	0.0282
10	3.7	39	0.0207
0	3.7	28	0.0149
-10	3.7	74	0.0394
-20	3.7	57	0.0303
-30	3.7	44	0.0234

For HSDPA Band 2 Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	61	0.0324
40	3.7	48	0.0255
30	3.7	44	0.0234
20	3.7	53	0.0282
10	3.7	39	0.0207
0	3.7	28	0.0149
-10	3.7	74	0.0394
-20	3.7	57	0.0303
-30	3.7	44	0.0234

For HSUPA Band 2 Mode

Reference Frequency(Middle Channel): 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF (Hz)	Error (ppm)
50	3.7	73	0.0388
40	3.7	60	0.0319
30	3.7	56	0.0298
20	3.7	65	0.0346
10	3.7	51	0.0271
0	3.7	40	0.0213
-10	3.7	86	0.0457
-20	3.7	69	0.0367
-30	3.7	56	0.0298

So, Frequency Stability Versus Input Voltage is:

Reference Frequency(Middle Channel): GSM 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	68	0.0813
	3.7	65	0.0777
	4.3	66	0.0789
Reference Frequency(Middle Channel): GSM 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	49	0.0261
	3.7	48	0.0255
	4.3	50	0.0266
Reference Frequency(Middle Channel): GPRS 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	46	0.0550
	3.7	51	0.0610
	4.3	52	0.0622
Reference Frequency(Middle Channel): GPRS 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	71	0.0378
	3.7	72	0.0383
	4.3	72	0.0383

Reference Frequency(Middle Channel): EDGE 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	51	0.0610
	3.7	53	0.0634
	4.2	52	0.0622
Reference Frequency(Middle Channel): EDGE 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	64	0.0340
	3.7	67	0.0356
	4.3	69	0.0367
Reference Frequency(Middle Channel): WCDMA 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	52	0.0277
	3.7	54	0.0287
	4.3	56	0.0298

Reference Frequency(Middle Channel): HSDPA 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	51	0.0271
	3.7	49	0.0261
	4.3	46	0.0245
Reference Frequency(Middle Channel): HSUPA 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	3.3	62	0.0330
	3.7	61	0.0324
	4.3	63	0.0335

******* END OF REPORT *******