FCC Part 22H & 24E
Test Report

FCC ID: 2AV7J-ESSENCE

Product Name:	ESSENCE-Smart Watch
Trademark:	Smartwatcher®
Model Name :	ESSENCE SW20, S99D, S22, S666, S8, S226, S669, S216, S9D, S866, S226D
Prepared For : Address :	Smartwatcher Technologies AG Technopark, Technoparkstrasse 1, 8005 Zurich, Switzerland
Prepared By : Address :	Shenzhen BCTC Testing Co., Ltd. BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China
Test Date:	Jan. 17, 2020 – Apr. 18, 2020
Date of Report :	Apr. 18, 2020
Report No.:	BCTC2001000570-2E

TEST RESULT CERTIFICATION

Applicant's name ..... :	Smartwatcher Technologies AG
Address..... :	Technopark, Technoparkstrasse 1, 8005 Zurich, Switzerland
Manufacture's Name .....:	Shenzhen PGD Digital Technology Co.,Ltd
Address ..... :	5F,3rd Building,Houshan Industrial Area,Shuidou Xinwei Village,Longhua New District,Shenzhen 518000 China
Product description	
Product name .....:	ESSENCE-Smart Watch
Trademark.....:	Smartwatcher®
Model and/or type reference :	ESSENCE SW20, S99D, S22, S666, S8, S226, S669, S216, S9D, S866, S226D
Standards ..... :	FCC Part 22H & 24E

This device described above has been tested by BCTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

General Description of EUT:	
Equipment	ESSENCE-Smart Watch
Trade Name	Smartwatcher®
Model Name	ESSENCE SW20, S99D, S22, S666, S8, S226, S669, S216, S9D, S866, S226D
Model Difference	The product is different for model number and outlook color.
Ratings	DC 4.35V
Connecting I/O Port(s)	Please refer to the User's Manual
hardware version	N/A
Software version	N/A
Note: The test data is gathered from a production sampleprovided by the manufacturer.	

Technical Characteristics of EUT:	
2G	
Support Networks:	GSM, GPRS
Support Band:	GSM850/PCS1900
Uplink Frequency:	GSM/GPRS 850: 824~849MHz GSM/GPRS 1900: 1850~1910MHz
Downlink Frequency:	GSM/GPRS 850: 869~894MHz GSM/GPRS 1900: 1930~1990MHz
MaxRF Output Power:	GSM850: 32.36dBm, GSM1900: 29.35dBm
Type of Emission:	GSM850: 250KGXW, GSM1900: 248KGXW
Type of Modulation:	GMSK
Type of Antenna:	Integral antenna
Antenna Gain:	GSM850: -4dBi; GSM1900: 0.5dBi
GPRS/EDGE Class:	Class 12
3G	
Support Networks:	WCDMA, HSDPA, HSUPA
Support Band:	WCDMA Band 5
Uplink Frequency:	WCDMA Band 5: 824~849MHz
Downlink Frequency:	WCDMA Band 5: 869~894MHz
RF Output Power:	WCDMA Band 5: 24.31dBm
Type of Emission:	WCDMA Band 5: 4M22F9W
Type of Modulation:	BPSK
Antenna Type:	Integral antenna
Antenna Gain:	WCDMA Band 5: -4dBi

1.2 Test Standards

The following report is prepared on behalf of the Michley Electronics Inc.in accordance withFCC Part 2 subpart J, FCC Part 22 subpart H and FCC Part 24 subpart 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 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.

1.3Test Methodology

All measurements contained in this report were conducted withANSI/TIA-603-D: 2010 andANSI 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.

1.4Test Facility

FCC Test Firm Registration Number: 712850
IC Registered No.: 23583
Shenzhen BCTC Testing Co., Ltd.
Add. : BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao’an District, Shenzhen, China

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	GSM 1900	Low, Middle, High Channels
TM4	GPRS 1900	Low, Middle, High Channels
TM5	WCDMA Band 5	Low, Middle, High Channels
TM6	HSDPA Band 5	Low, Middle, High Channels
TM7	HSUPA Band 5	Low, Middle, High Channels

Testing Configure			
Support Band	Support Standard	Channel Frequency	Channel Number
GSM 850	GSM/GPRS	824.2 MHz	128
		836.6 MHz	190
		848.8 MHz	251
PCS 1900	GSM/GPRS	1850.2 MHz	512
		1880.0 MHz	661
		1909.8 MHz	810
WCDMA Band 5	WCDMA/HSDPA/HSUPA	826.4 MHz	4132
		836.6 MHz	4183
		846.6 MHz	4233
Note: the transmitter has been tested on the communications mode of GSM, GPRS, 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
/	/	/	/
/	/	/	/

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

The reported uncertainty of measurement y ± U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %。

No.	Item	Uncertainty
1	3m camber Radiated spurious emission(30MHz-1GHz)	U=4.3dB
2	3m chamber Radiated spurious emission(1GHz-18GHz)	U=4.5dB
3	3m chamber Radiated spurious emission(18GHz-40GHz)	U=3.34dB
4	Conducted Adjacent channel power	U=1.38dB
5	Conducted output power uncertainty Above 1G	U=1.576dB
6	Conducted output power uncertainty below 1G	U=1.28dB
7	humidity uncertainty	U=5.3%
8	Temperature uncertainty	U=0.59℃

1.7 Test Equipment List and Details

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	Agilent	E4407B	MY45109572	Jun. 13, 2019	Jun. 12, 2020
2	Test Receiver (9kHz-7GHz)	R&S	ESR7	101154	Jun. 13, 2019	Jun. 12, 2020
3	Bilog Antenna (30MHz-3GHz)	SCHWARZBECK	VULB9163	VULB9163-942	Jun. 22, 2019	Jun. 21, 2020
4	Horn Antenna (1GHz-18GHz)	SCHWARZBECK	BBHA9120D	1541	Jun. 22, 2019	Jun. 21, 2020
5	Horn Antenna (18GHz-40GHz)	SCHWARZBECK	BBHA9170	822	Jun. 22, 2019	Jun. 21, 2020
6	Amplifier (9KHz-6GHz)	SCHWARZBECK	BBV9744	9744-0037	Jun. 25, 2019	Jun. 24, 2020
7	Amplifier (0.5GHz-18GHz)	SCHWARZBECK	BBV9718	9718-309	Jun. 25, 2019	Jun. 24, 2020
8	Amplifier (18GHz-40GHz)	MITEQ	TTA1840-35-HG	2034381	Jun. 17, 2019	Jun. 16, 2020
9	Loop Antenna (9KHz-30MHz)	SCHWARZBECK	FMZB1519B	014	Jul. 02, 2019	Jul. 01, 2020
10	RF cables1 (9kHz-30MHz)	Huber+Suhnar	9kHz-30MHz	B1702988-0008	Jun. 25, 2019	Jun. 24, 2020
11	RF cables2 (30MHz-1GHz)	Huber+Suhnar	30MHz-1GHz	1486150	Jun. 25, 2019	Jun. 24, 2020
12	RF cables3 (1GHz-40GHz)	Huber+Suhnar	1GHz-40GHz	1607106	Jun. 25, 2019	Jun. 24, 2020
13	Power Metter	Keysight	E4419B	\	Jun. 17, 2019	Jun. 16, 2020
14	Power Sensor (AV)	Keysight	E9 300A	\	Jun. 17, 2019	Jun. 16, 2020
15	Signal Analyzer 20kHz-26.5GHz	KEYSIGHT	N9020A	MY49100060	Jun. 13, 2019	Jun. 12, 2020
16	Spectrum Analyzer 9kHz-40GHz	Aglient	FSP40	100363	Jun. 13, 2019	Jun. 12, 2020
17	Communication test set	R&S	CMU200	119435	Jun. 13, 2019	Jun. 12, 2020
18	D.C. Power Supply	LongWei	TPR-6405D	\	\	\
19	Software	Frad	EZ-EMC	FA-03A2 RE	\	\

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Test Receiver	R&S	ESR3	102075	Jun. 13, 2019	Jun. 12, 2020
2	LISN	SCHWARZBECK	NSLK8127	8127739	Jun. 13, 2019	Jun. 12, 2020
3	LISN	R&S	ENV216	101375	Jun. 13, 2019	Jun. 12, 2020
4	RF cables	Huber+Suhnar	9kHz-30MHz	B1702988-0008	Jun. 25, 2019	Jun. 24, 2020
5	Software	Frad	EZ-EMC	EMC-CON 3A1	\	\

2. SUMMARY OF TEST RESULTS

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

3. RF Output Power

3.1 Standard Applicable

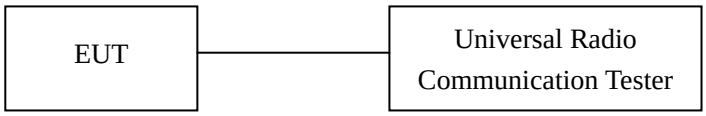
According to §22.913(a)(2),The ERP of mobileand portable stations transmitters and auxiliary test transmitters must not exceed 7 Watts.

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.

3.2Test 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.

3.3Environmental Conditions

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

3.4Summary of Test Results/Plots

Max. Radiated Power

ERP For GSM Mode GSM850

Frequency	Substitude SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
824.2	30.15	1.5	0	H	1.5	0	28.65	38.45
824.2	30.22	1.5	0	V	1.5	0	28.72	38.45
Middle Channel								
836.4	29.71	1.5	0	H	1.5	0	28.21	38.45
836.4	28.55	1.5	0	V	1.5	0	27.05	38.45
High Channel								
848.8	28.71	1.5	0	H	1.5	0	27.21	38.45
848.8	28.65	1.5	0	V	1.5	0	27.15	38.45

EIRP For GSM Mode PCS1900

Frequency	Substitude SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 24E Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
1850.2	22.28	1.5	0	H	1.9	7.7	28.48	33.00
1850.2	22.14	1.5	0	V	1.9	7.7	28.34	33.00
Middle Channel								
1880.0	21.38	1.5	0	H	1.9	7.7	27.58	33.00
1880.0	21.19	1.5	0	V	1.9	7.7	27.39	33.00
High Channel								
1909.8	21.29	1.5	0	H	1.9	7.7	27.49	33.00
1909.8	21.30	1.5	0	V	1.9	7.7	27.50	33.00

ERP For GPRS Mode GSM850

Frequency	Substitude SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
824.2	28.42	1.5	0	H	1.5	0	26.92	38.45
824.2	28.39	1.5	0	V	1.5	0	26.89	38.45
Middle Channel								
836.6	27.85	1.5	0	H	1.5	0	26.35	38.45
836.6	27.64	1.5	0	V	1.5	0	26.14	38.45
High Channel								
848.8	27.81	1.5	0	H	1.5	0	26.31	38.45
848.8	27.97	1.5	0	V	1.5	0	26.47	38.45

EIRP For GPRS Mode PCS1900

Frequency	Substitude SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 24E Limit
MHz	dBm	Meter	Degree	H / V	dB	dB	dBm	dBm
Low Channel								
1850.2	21.98	1.5	0	H	1.9	7.7	28.18	33.00
1850.2	22.17	1.5	0	V	1.9	7.7	28.37	33.00
Middle Channel								
1880.0	21.36	1.5	0	H	1.9	7.7	27.56	33.00
1880.0	22.29	1.5	0	V	1.9	7.7	28.49	33.00
High Channel								
1909.8	21.55	1.5	0	H	1.9	7.7	27.75	33.00
1909.8	20.97	1.5	0	V	1.9	7.7	27.17	33.00

ERP For WCDMA Mode Band 5

Frequency	Substitude SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dBd	dBm	dBm
Low Channel								
826.4	21.35	1.5	0	H	1.5	0	19.85	38.45
826.4	21.45	1.5	0	V	1.5	0	19.95	38.45
Middle Channel								
836.6	21.87	1.5	0	H	1.5	0	20.37	38.45
836.6	22.09	1.5	0	V	1.5	0	20.59	38.45
High Channel								
846.6	21.69	1.5	0	H	1.5	0	20.19	38.45
846.6	22.47	1.5	0	V	1.5	0	20.97	38.45

ERP For HSDPA Mode Band 5

Frequency	Substitude SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dBd	dBm	dBm
Low Channel								
826.4	21.33	1.5	0	H	1.5	0	19.83	38.45
826.4	21.45	1.5	0	V	1.5	0	19.95	38.45
Middle Channel								
836.6	20.69	1.5	0	H	1.5	0	19.19	38.45
836.6	21.74	1.5	0	V	1.5	0	20.24	38.45
High Channel								
846.6	20.39	1.5	0	H	1.5	0	18.89	38.45
846.6	21.25	1.5	0	V	1.5	0	19.75	38.45

ERP For HSUPA Mode Band 5

Frequency	Substitude SG	Height	Table	Polar	Cable loss	Antenna Gain	Result	FCC Part 22H Limit
MHz	dBm	Meter	Degree	H / V	dB	dBd	dBm	dBm
Low Channel								
826.4	21.64	1.5	0	H	1.5	0	20.14	38.45
826.4	21.62	1.5	0	V	1.5	0	20.12	38.45
Middle Channel								
836.6	20.55	1.5	0	H	1.5	0	19.05	38.45
836.6	21.97	1.5	0	V	1.5	0	20.47	38.45
High Channel								
846.6	20.77	1.5	0	H	1.5	0	19.27	38.45
846.6	21.05	1.5	0	V	1.5	0	19.55	38.45

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	31.58	38.45
	Middle Channel	836.6	32.36	38.45
	High Channel	848.8	32.19	38.45
GPRS(1 Slot)	Low Channel	824.2	31.05	38.45
	Middle Channel	836.6	32.05	38.45
	High Channel	848.8	32.12	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	29.35	33.0
	Middle Channel	1880.0	28.58	33.0
	High Channel	1909.8	28.32	33.0
GPRS(1 Slot)	Low Channel	1850.2	29.16	33.0
	Middle Channel	1880.0	28.35	33.0
	High Channel	1909.8	28.07	33.0

For WCDMA Band 5

Test Mode	Channel	Frequency (MHz)	Average Power (dBm)	FCC Part 22.913 Limit (dBm)
WCDMA	Low Channel	826.4	23.58	38.45
	Middle Channel	836.6	24.31	38.45
	High Channel	846.6	23.13	38.45
HSDPA	Low Channel	826.4	22.48	38.45
	Middle Channel	836.6	23.06	38.45
	High Channel	846.6	21.98	38.45
HSUPA	Low Channel	826.4	22.47	38.45
	Middle Channel	836.6	22.46	38.45
	High Channel	846.6	21.96	38.45

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

4.1 Standard Applicable

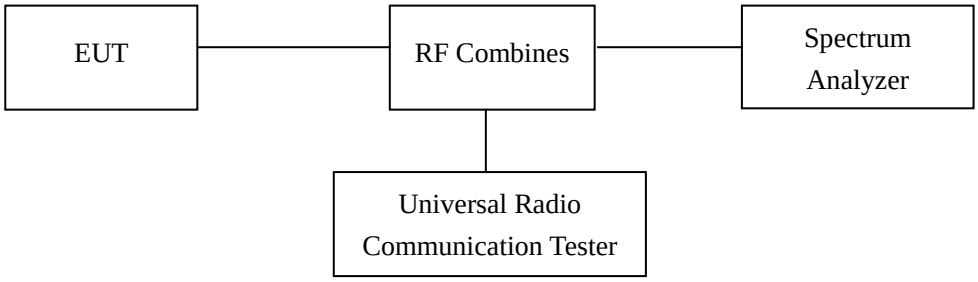
According to §24.232(d), Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in 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.

4.2 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:



4.3 Environmental Conditions

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

4.4Summary of Test Results

Only the worst case was selected to record

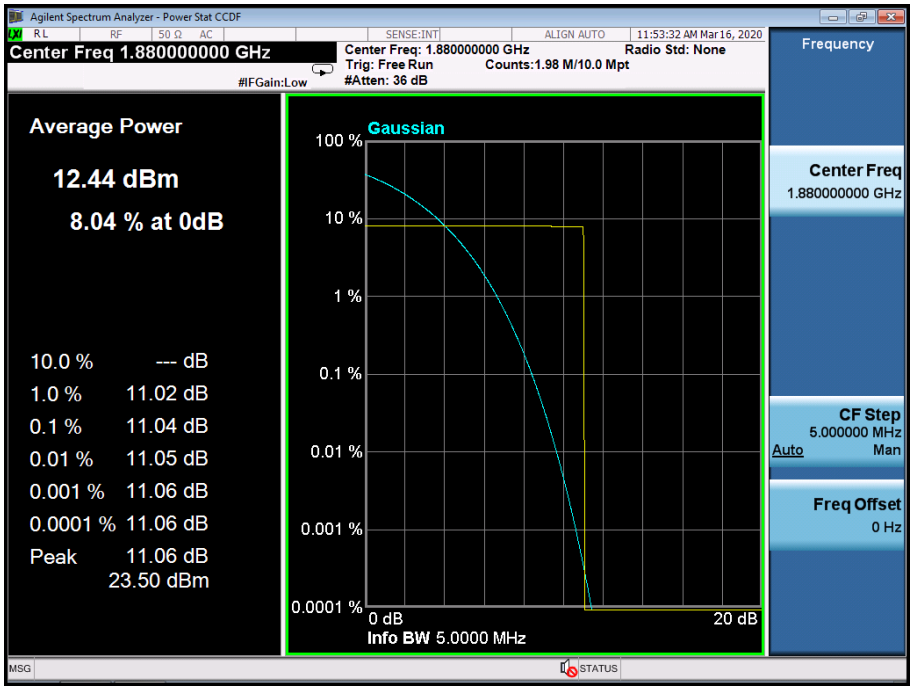
For PCS Band

Test Mode	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)
GSM	661	1880	11.04	13
GPRS(1 Slot)	661	1880	11.04	13

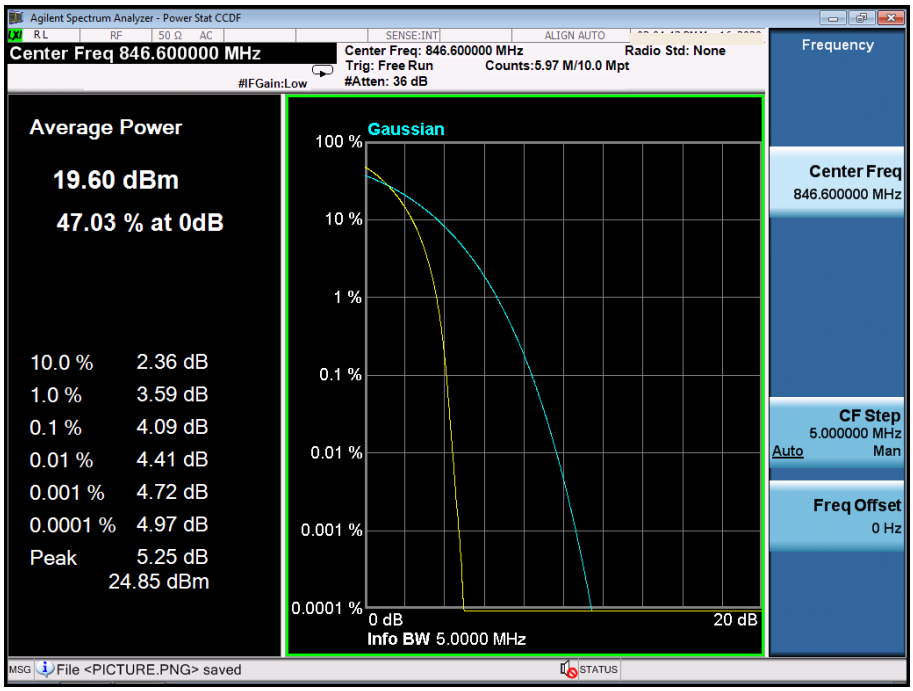
For WCDMA Band 5

Test Mode	Channel	Frequency (MHz)	PAR (dB)	Limit (dB)
WCDMA	4233	846.6	3.23	13
HSDPA	4233	846.6	4.09	13
HSUPA	4233	846.6	4.04	13

GSM 1900 Middle Channel:



WCDMA Band 5 High Channel:



5. Emission Bandwidth

5.1 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.

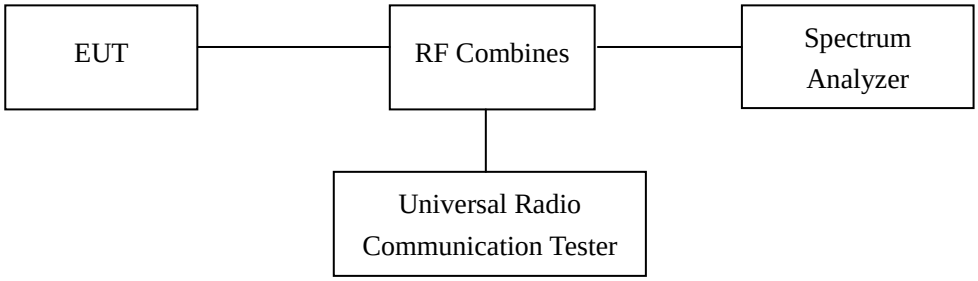
According to §24.238(b), The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

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.

5.2Test 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:



5.3Environmental Conditions

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

6.4Summary 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	247.81	317.1
	190	836.6	249.58	317.6
	251	848.8	246.78	324.0
GPRS	128	824.2	236.31	316.6
	190	836.6	235.86	290.6
	251	848.8	234.05	316.3

For PCS Band

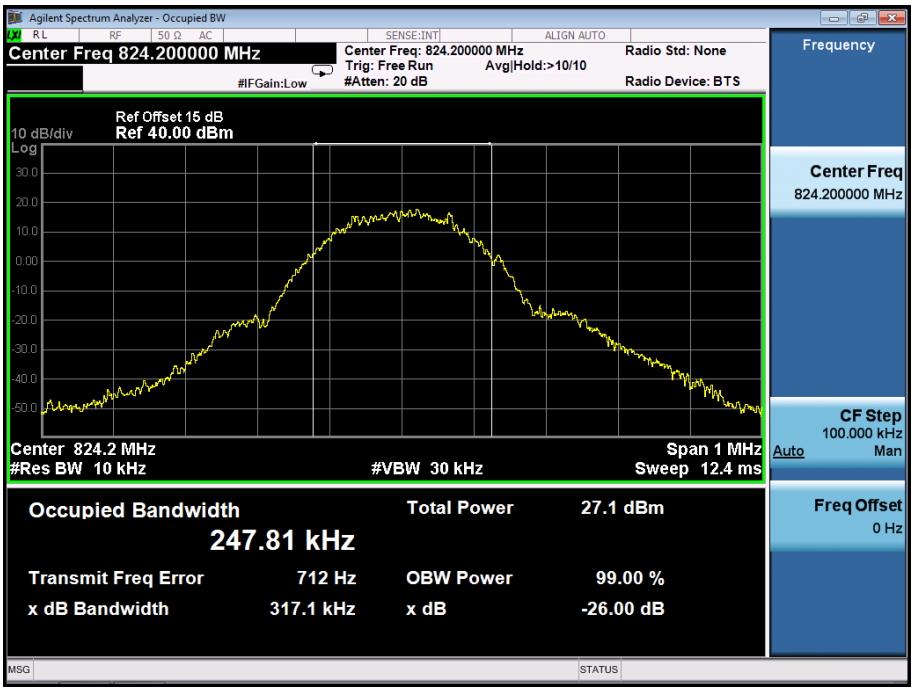
Test Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (kHz)	26 dB Emission Bandwidth (kHz)
GSM	512	1850.2	246.11	320.0
	661	1880.0	248.00	323.5
	810	1909.8	246.63	317.2
GPRS	512	1850.2	245.89	320.2
	661	1880.0	246.19	319.5
	810	1909.8	247.17	322.6

For Band 5

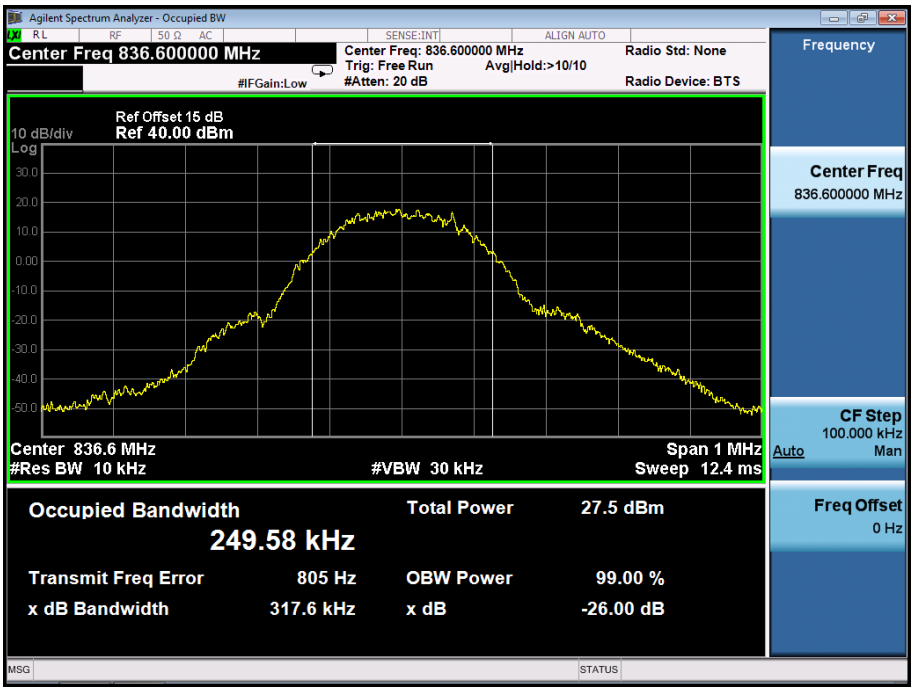
Test Mode	Channel	Frequency (MHz)	99% Emission Bandwidth (MHz)	26 dB Emission Bandwidth (MHz)
WCDMA	4132	826.4	4.171	4.724
	4183	836.6	4.167	4.710
	4233	846.6	4.162	4.685
HSDPA	4132	826.4	4.164	4.659
	4183	836.6	4.166	4.672
	4233	846.6	4.165	4.693
HSUPA	4132	826.4	4.156	4.685
	4183	836.6	4.168	4.682
	4233	846.6	4.157	4.682

For Cellular Band

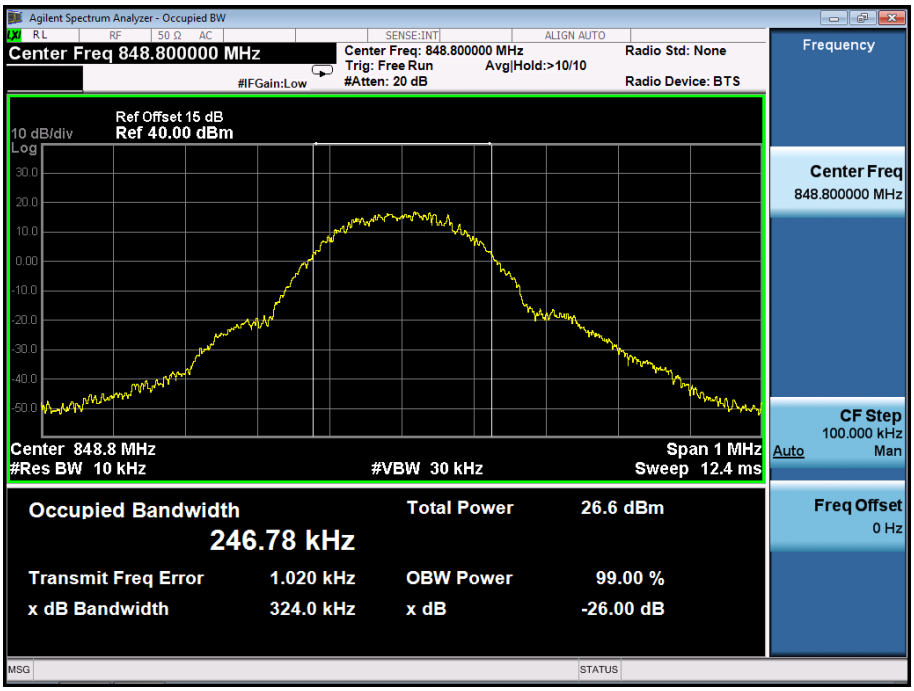
GSM Low Channel



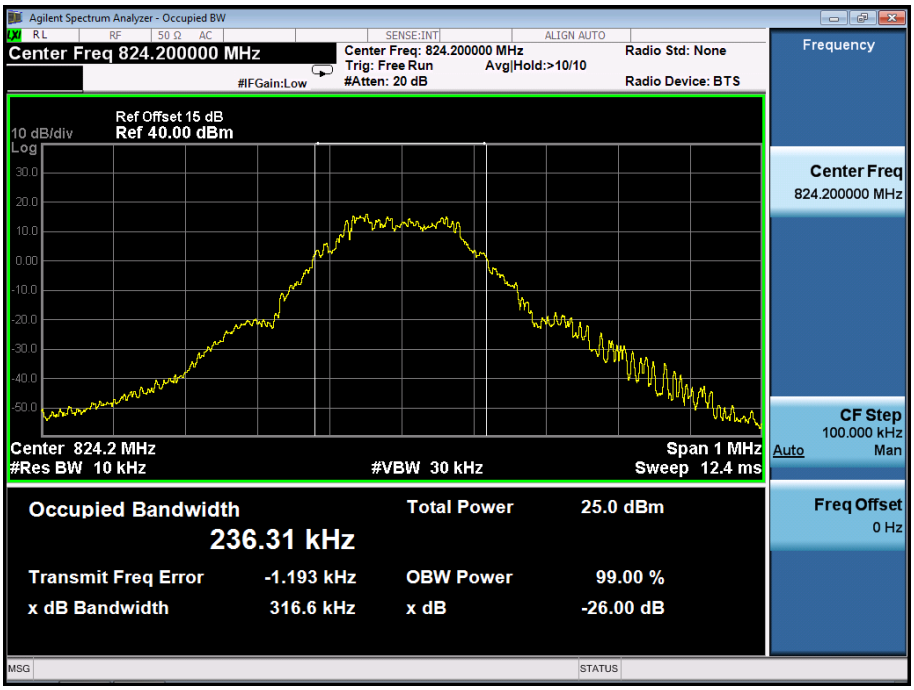
GSM Middle Channel



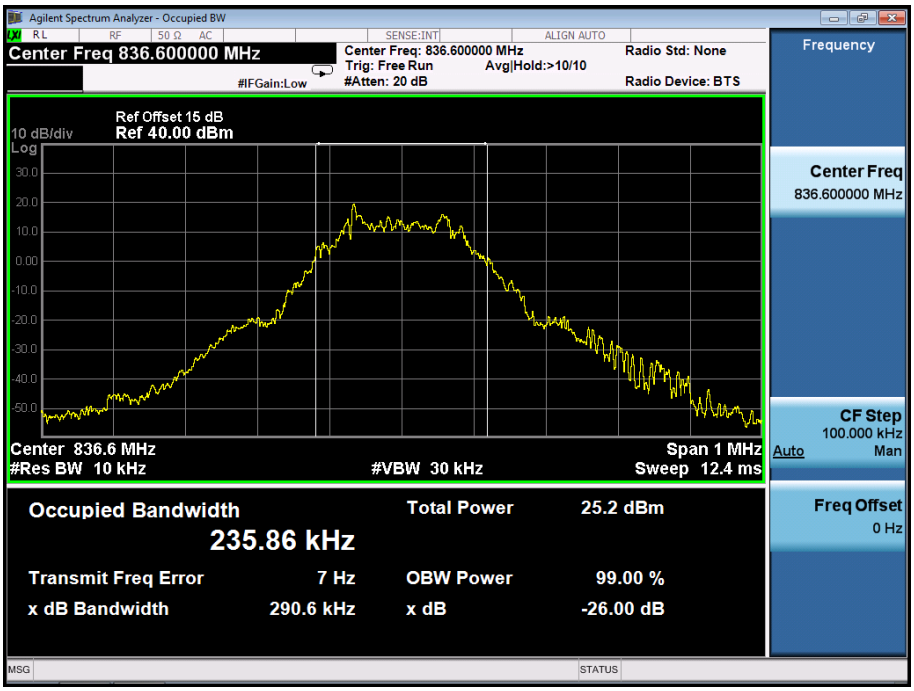
GSM High channel



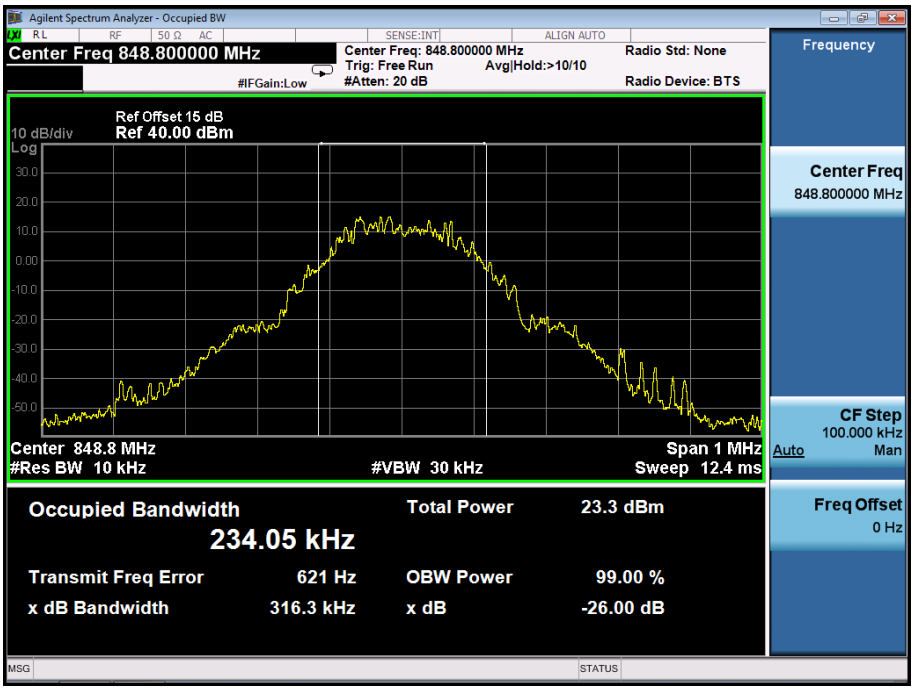
GPRS Low Channel



GPRS Middle Channel

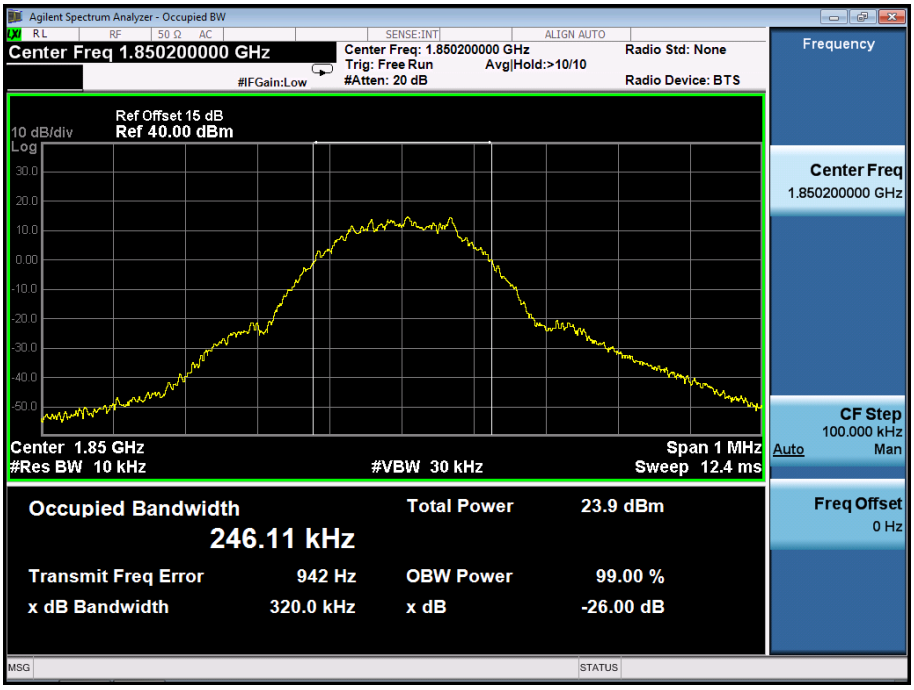


GPRS High Channel

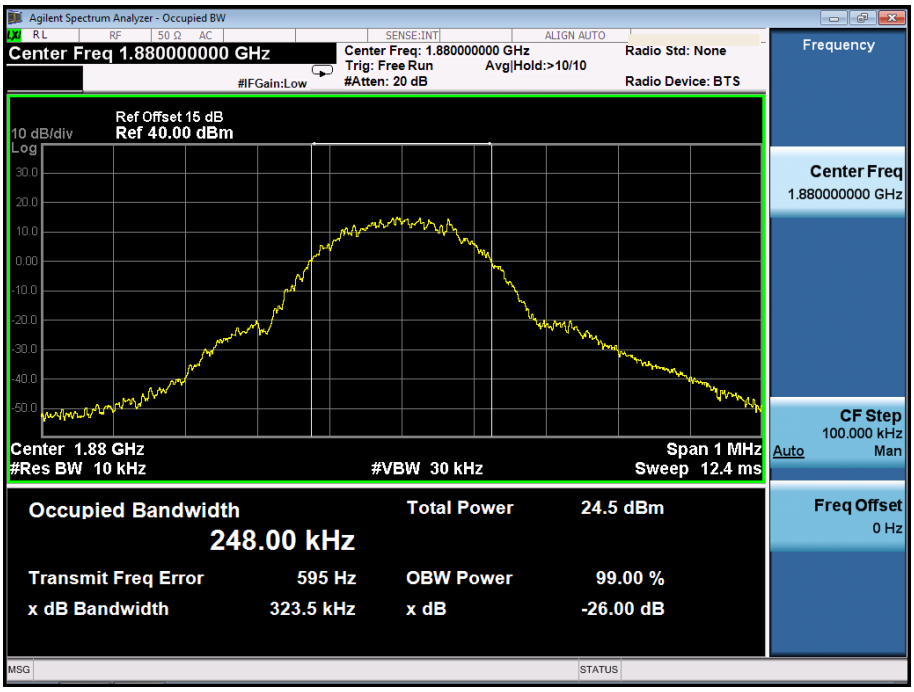


For PCS Band

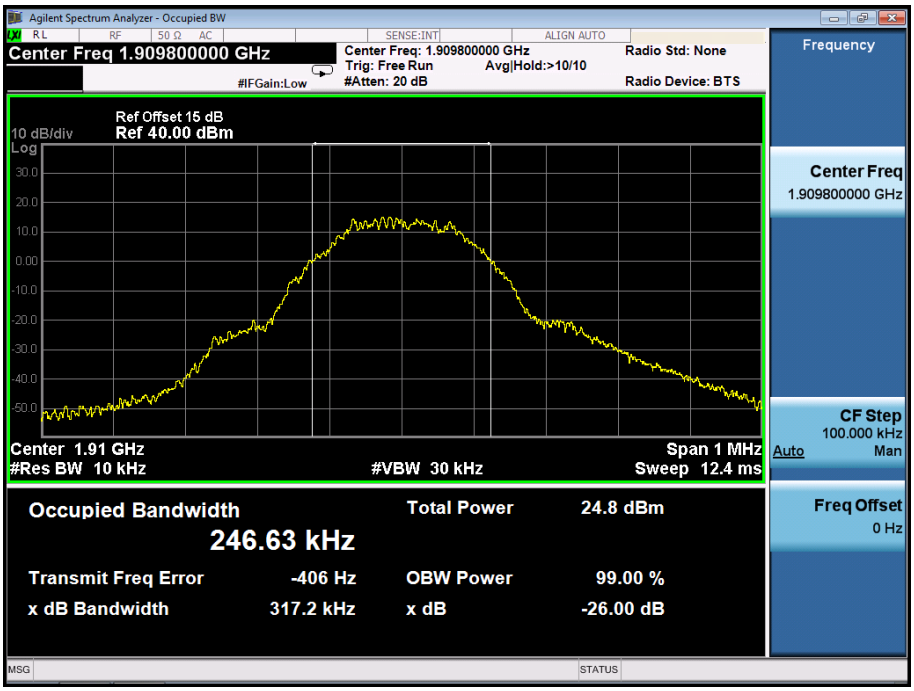
GSM Low Channel



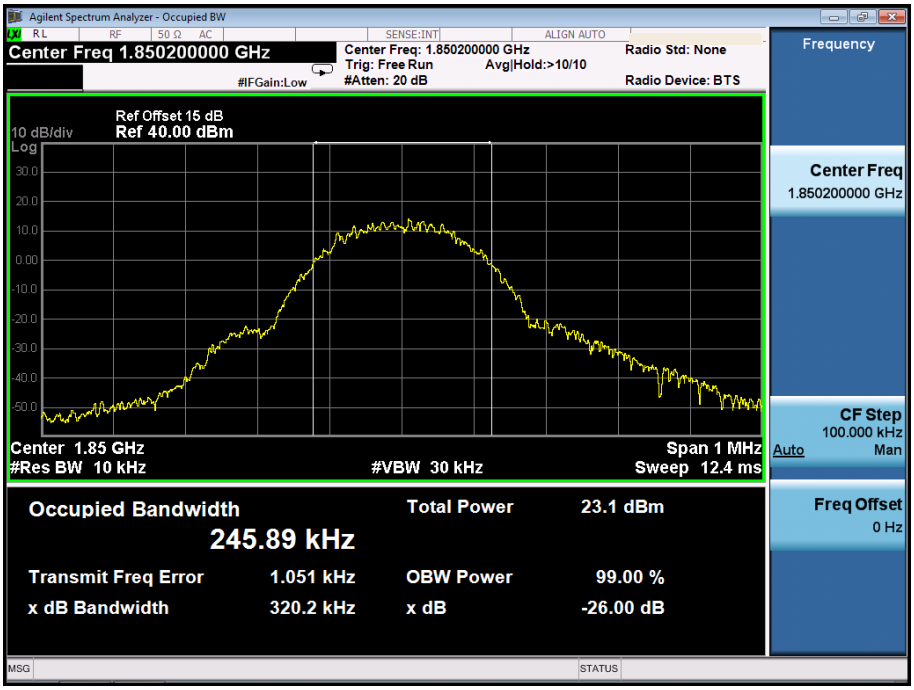
GSM Middle Channel



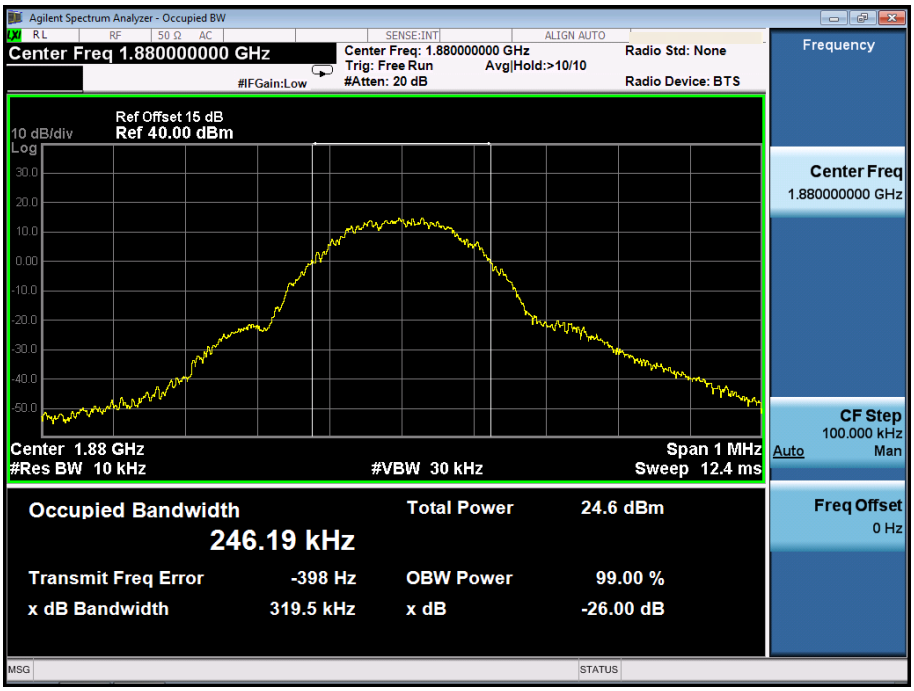
GSM High channel



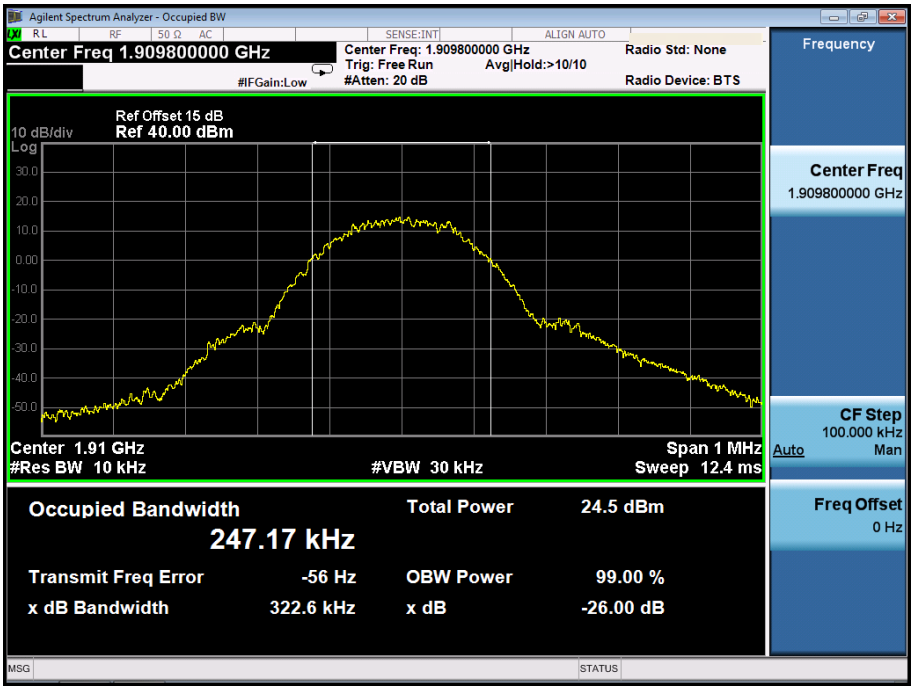
GPRS Low Channel



GPRS Middle Channel

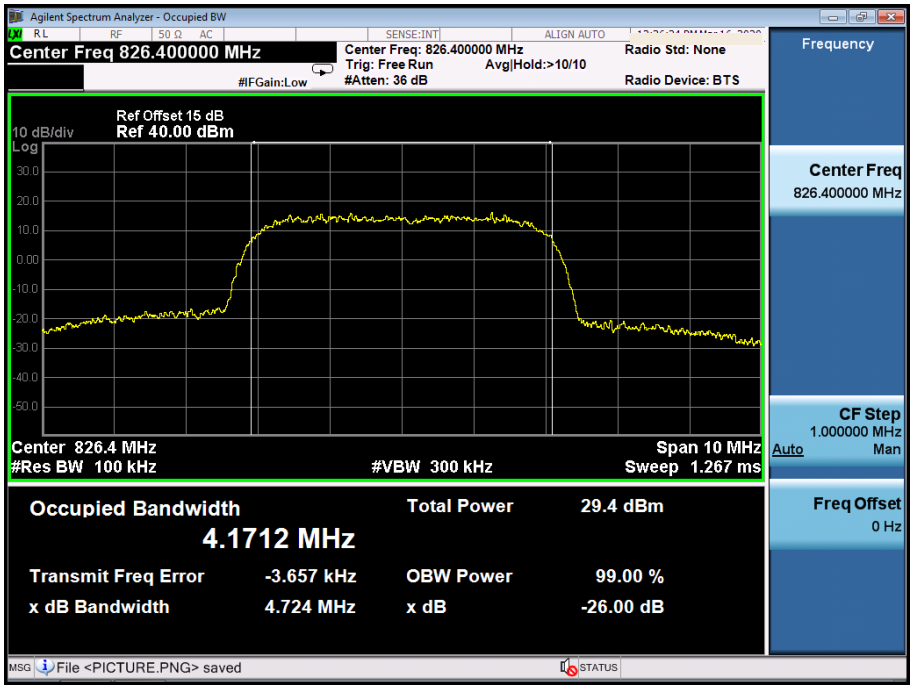


GPRS High Channel

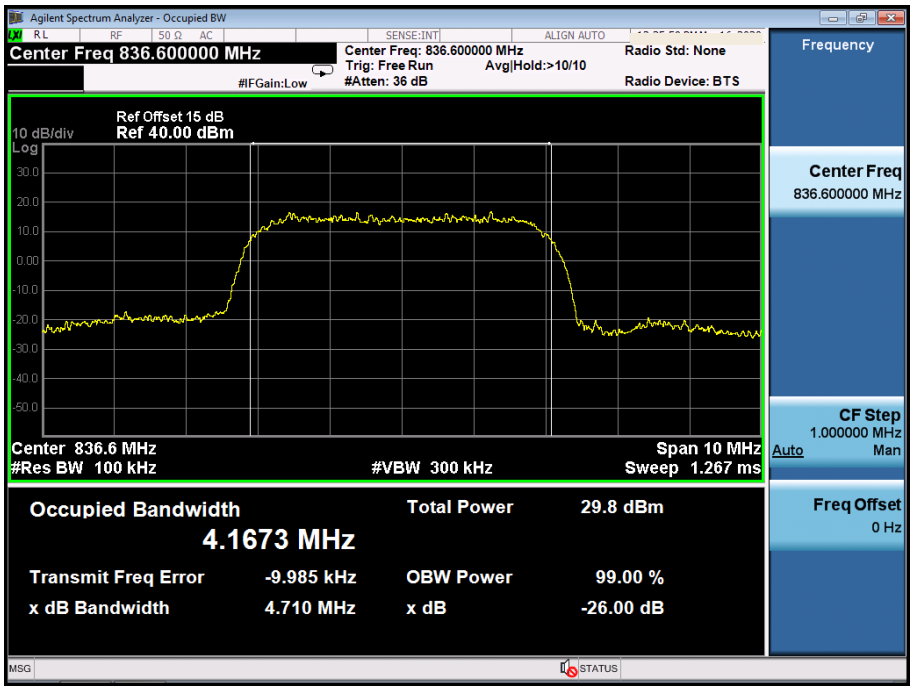


For Band V

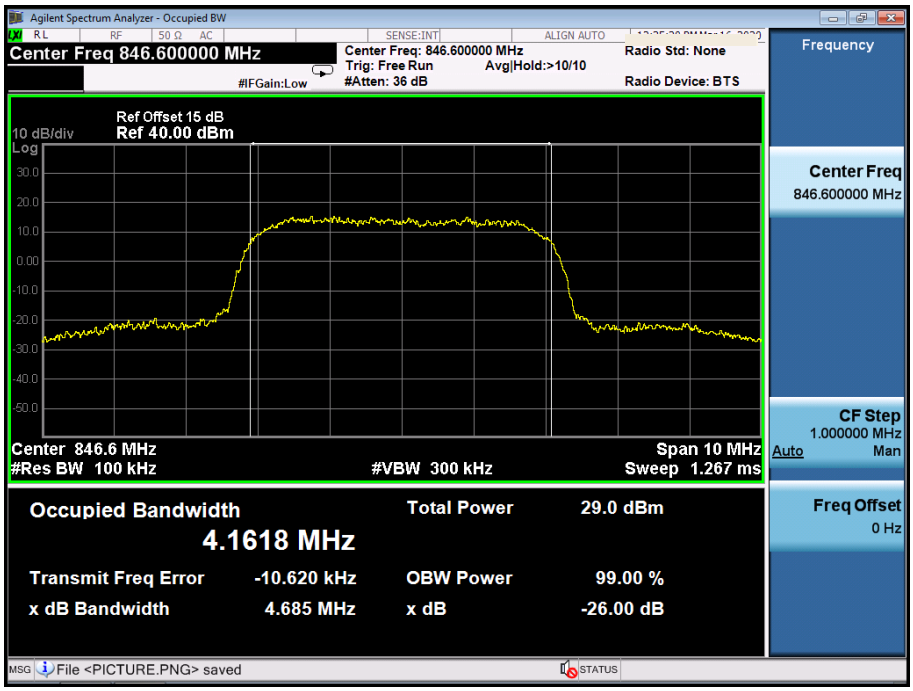
WCDMA Low Channel



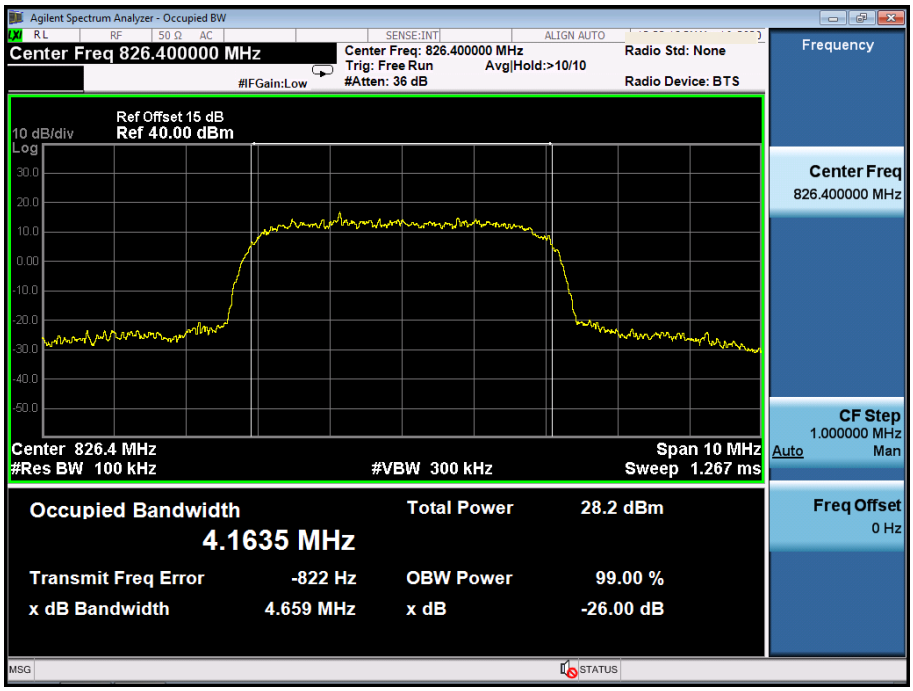
WCDMA Middle Channel



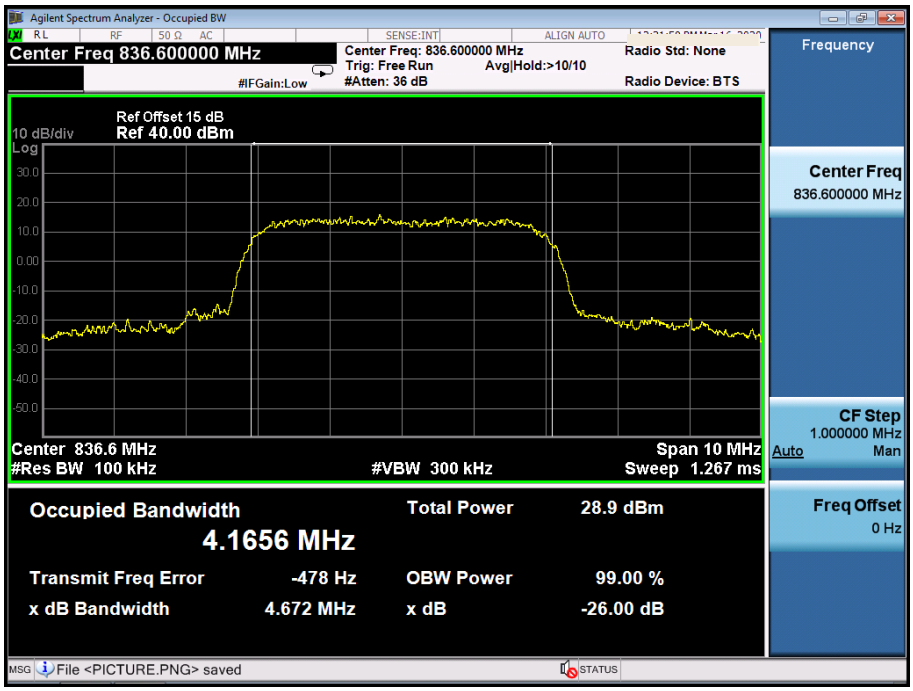
WCDMA High Channel



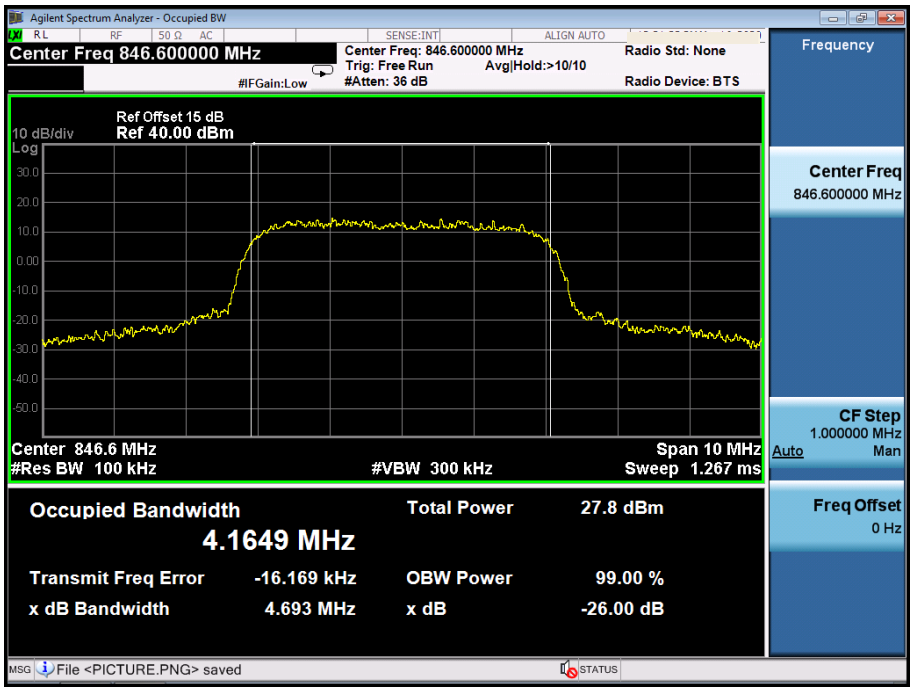
HSDPA Low Channel



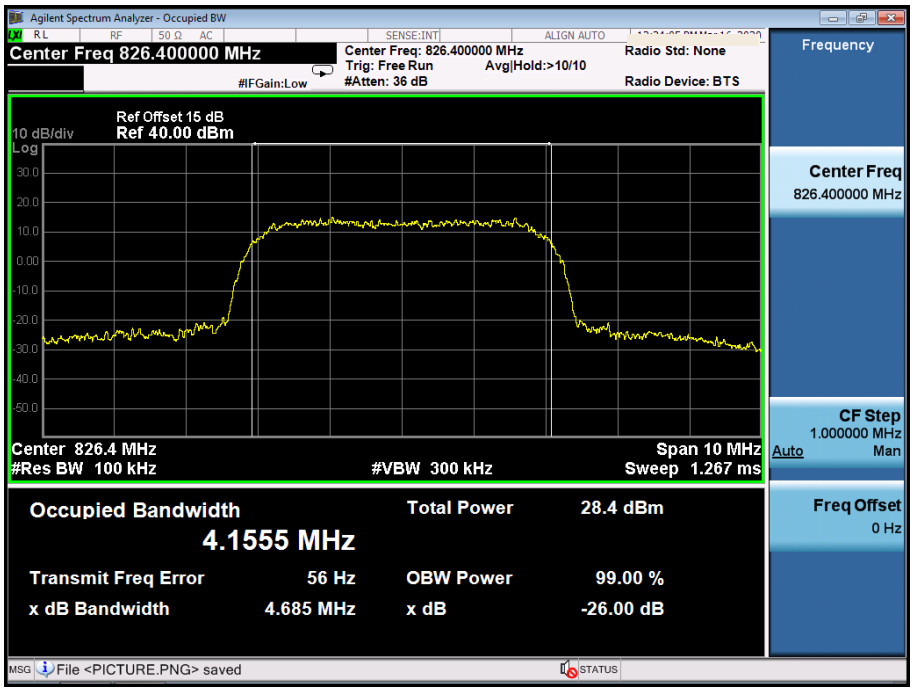
HSDPA Middle Channel



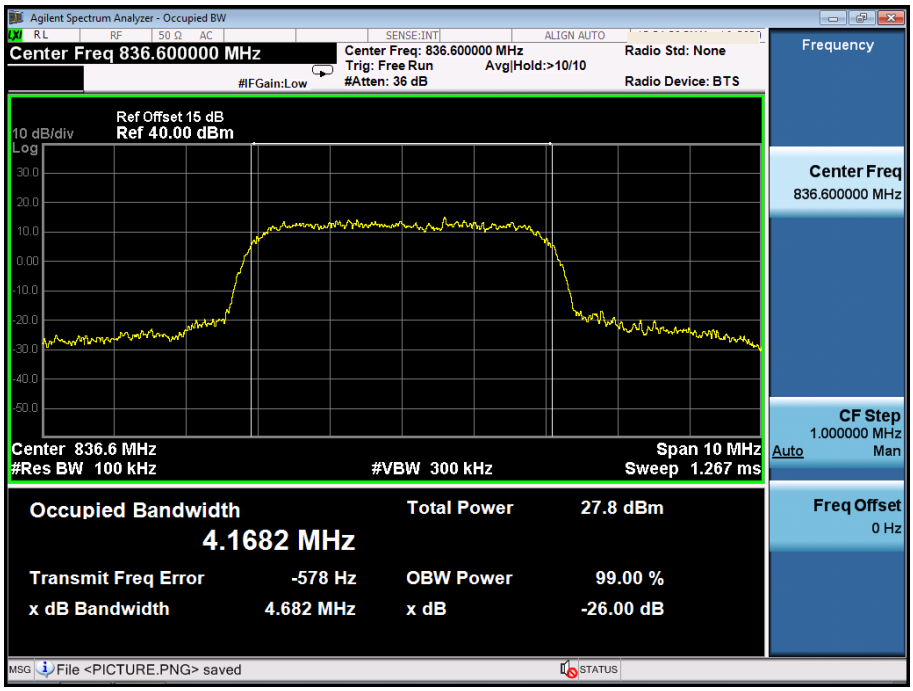
HSDPA High Channel



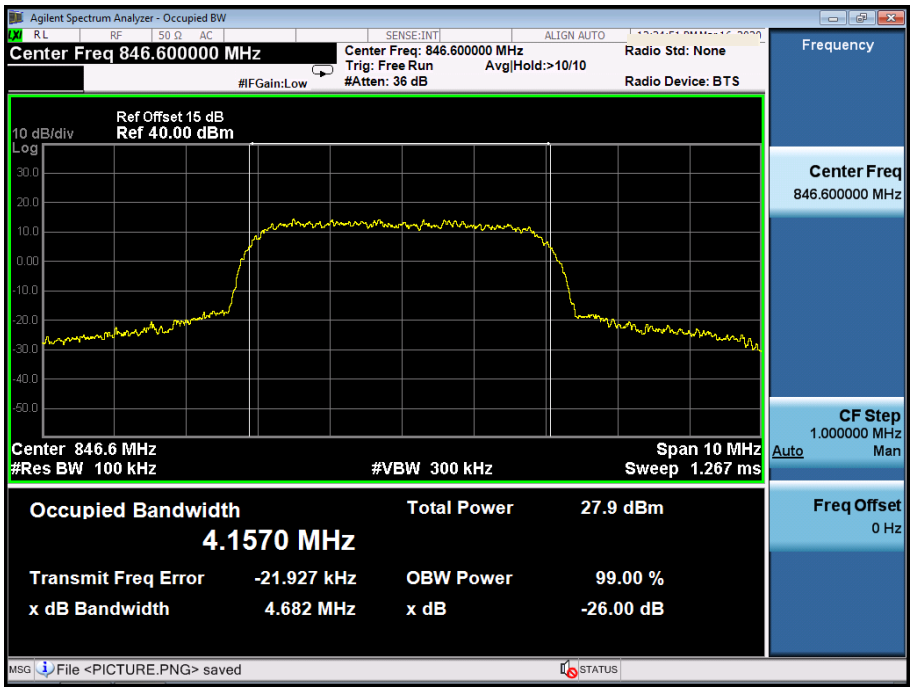
HSUPA Low Channel



HSUPA Middle Channel



HSUPA High Channel



6. Out of Band Emissions at Antenna Terminal

6.1 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.

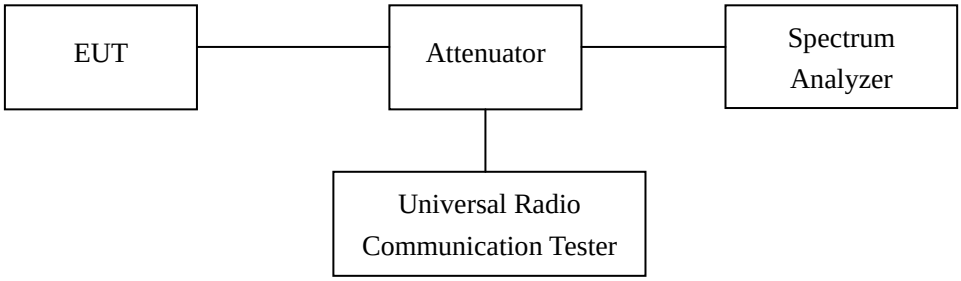
According to §24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

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.

6.2Test 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 10th harmonic.

Test Configuration for the out of band emissions testing:



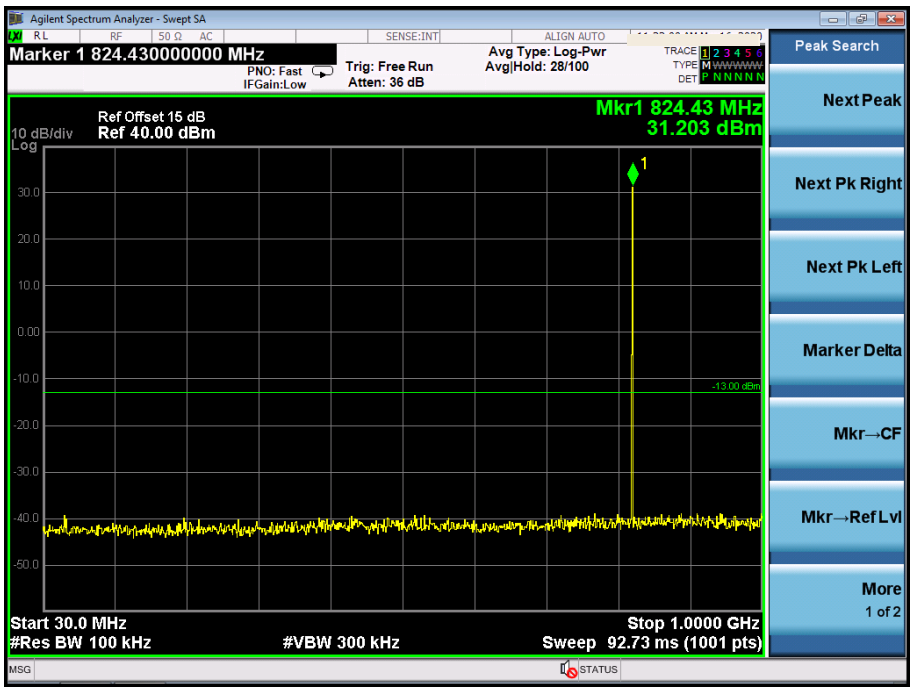
6.3Environmental Conditions

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

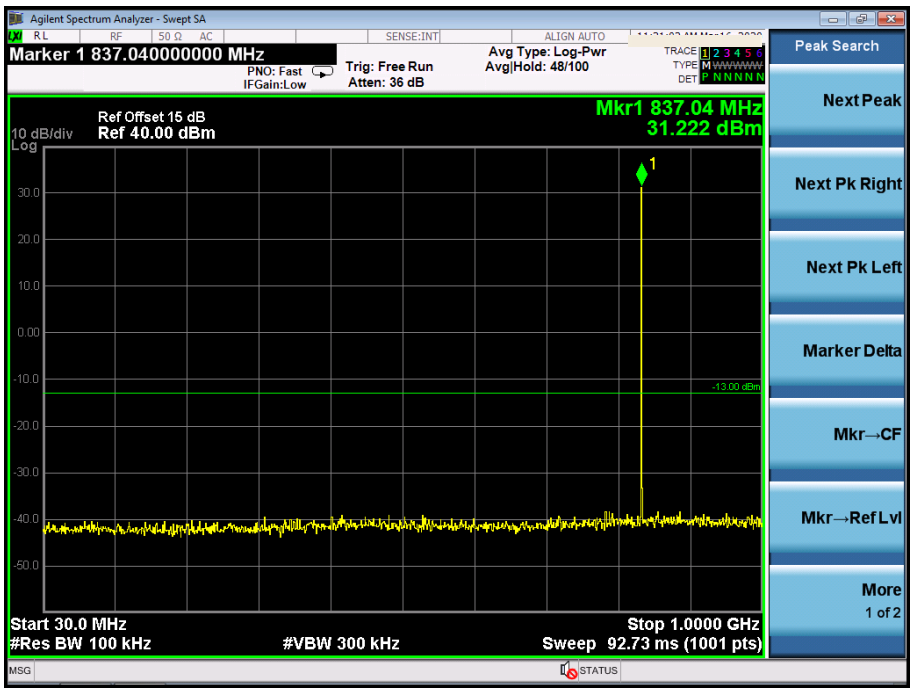
6.4Summary of Test Results/Plots

*Please refer to the following test plots*For Cellular Band

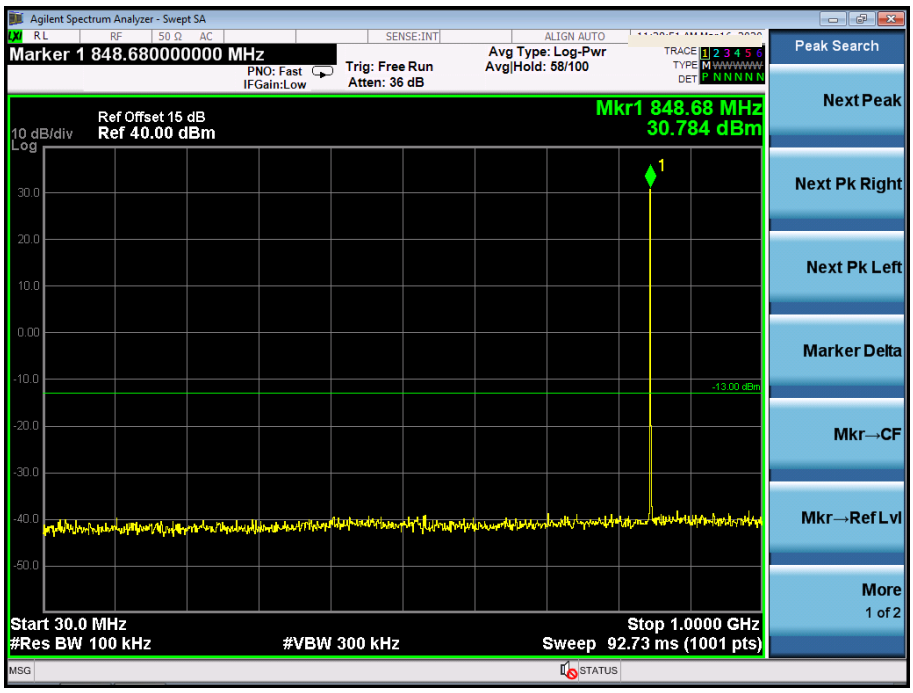
GSM Low Channel



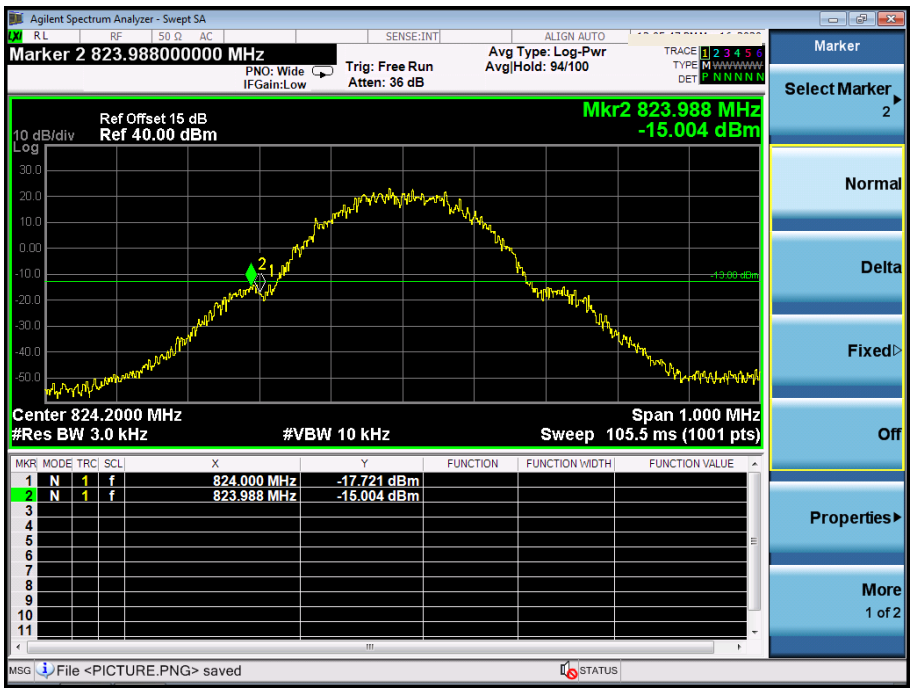
GSM Middle Channel



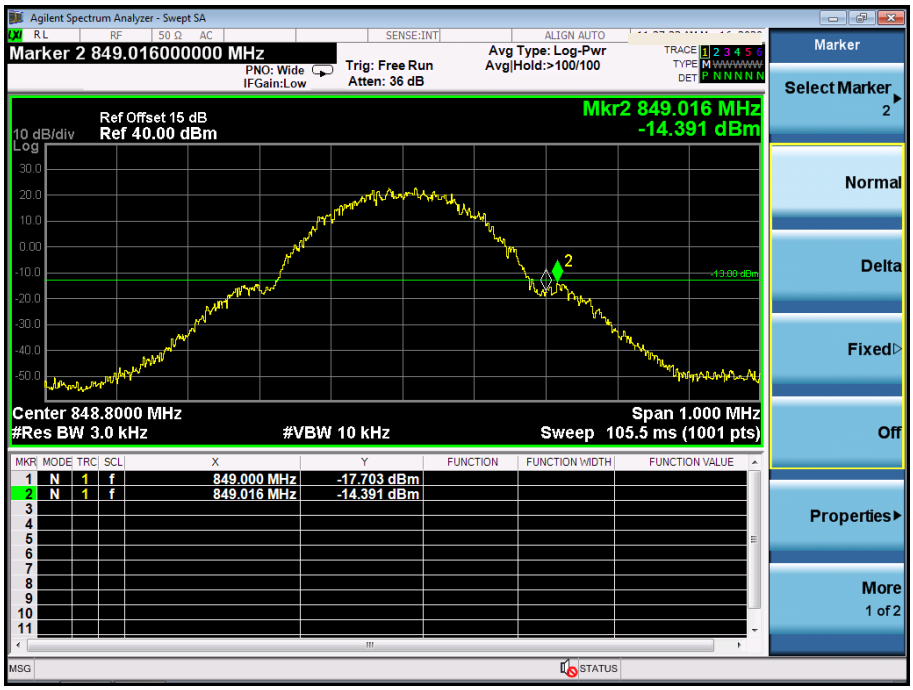
GSM High Channel



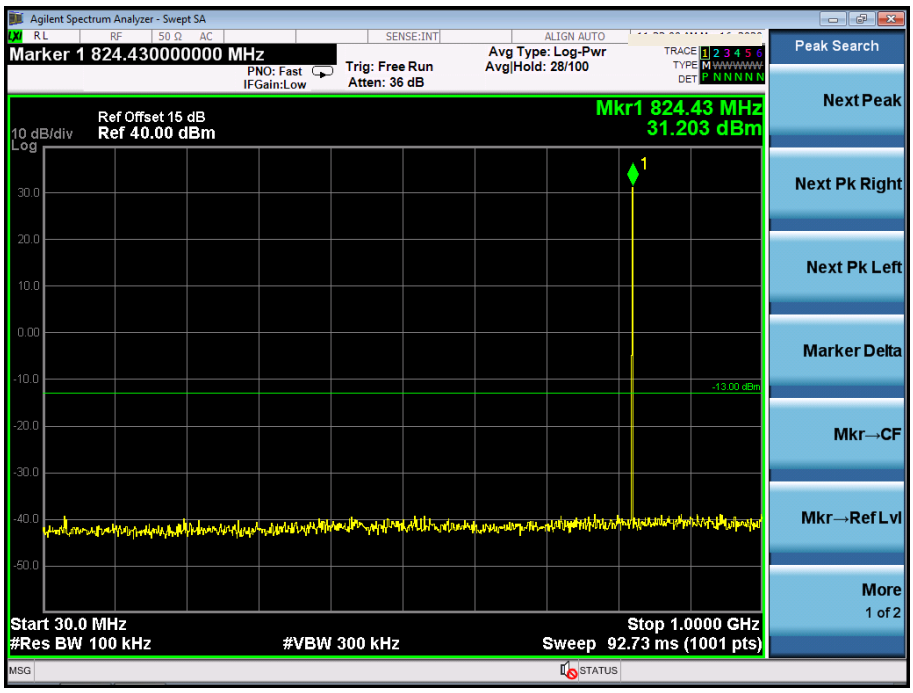
GSM Low Band Emission



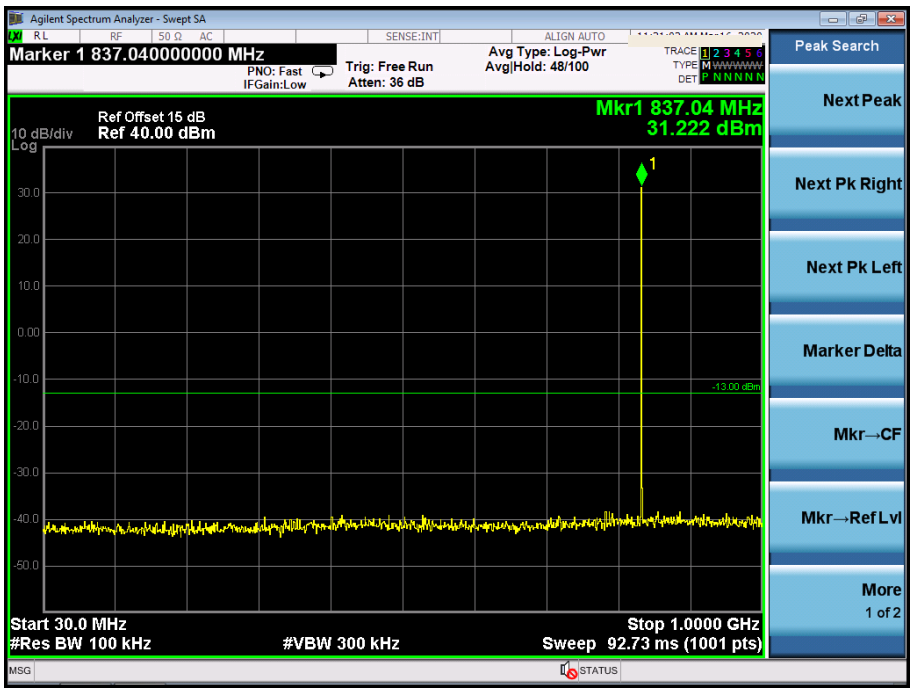
GSM High Band Emission



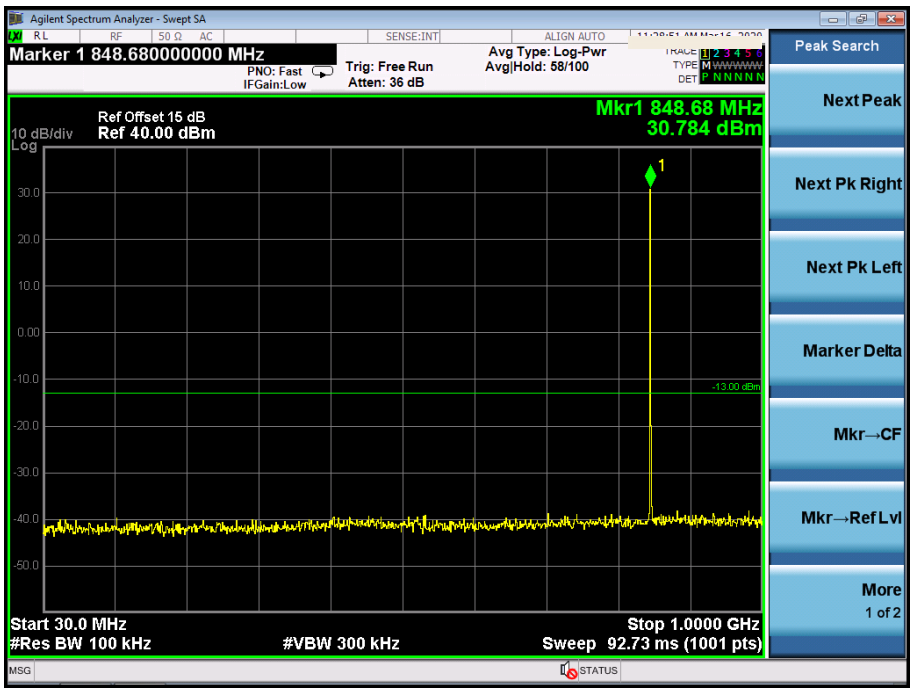
GPRS Low Channel



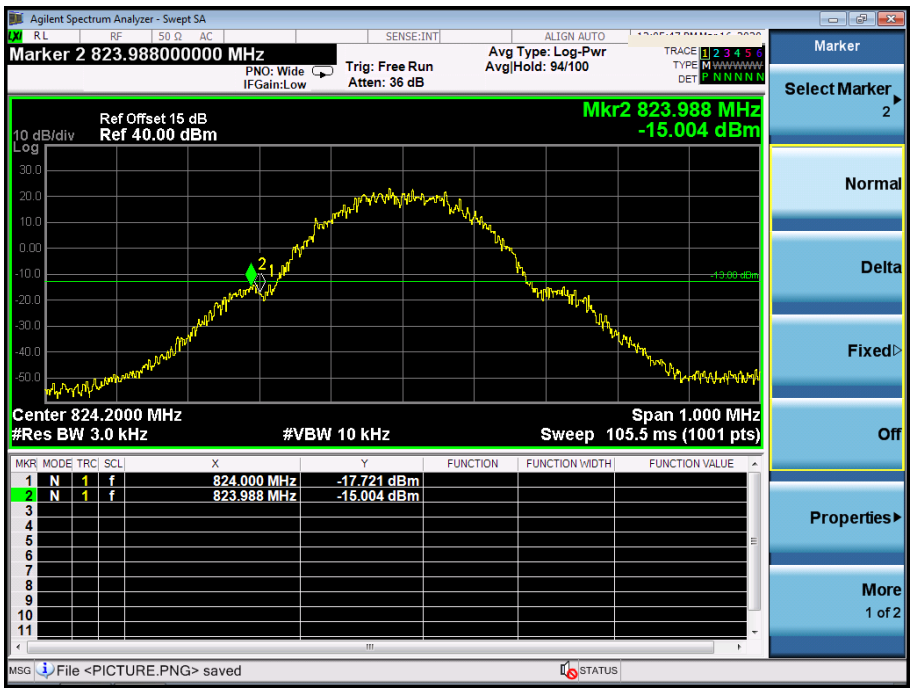
GPRS Middle Channel



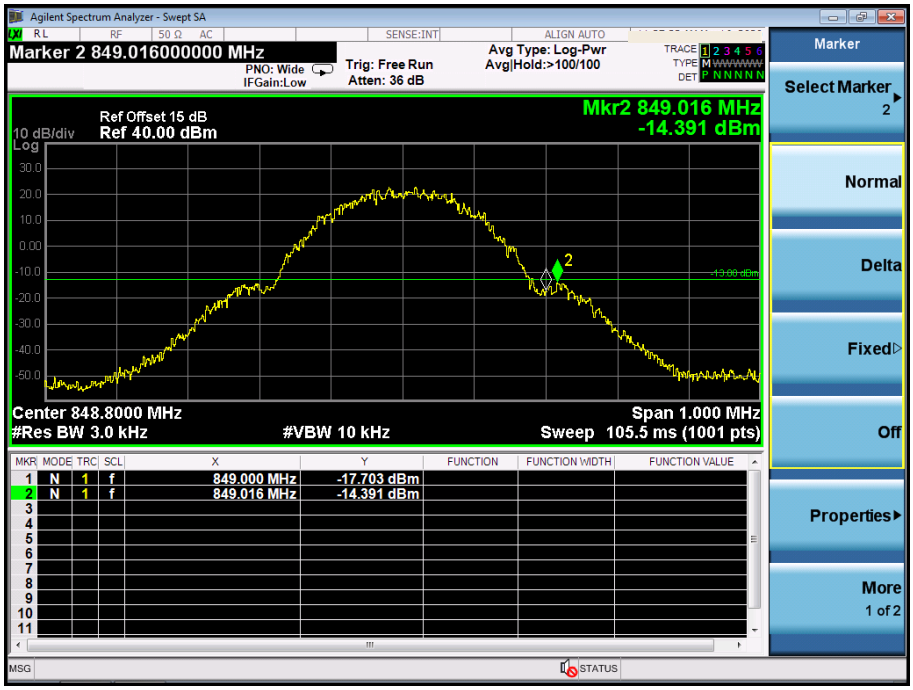
GPRS High Channel



GPRS Low Band Emission

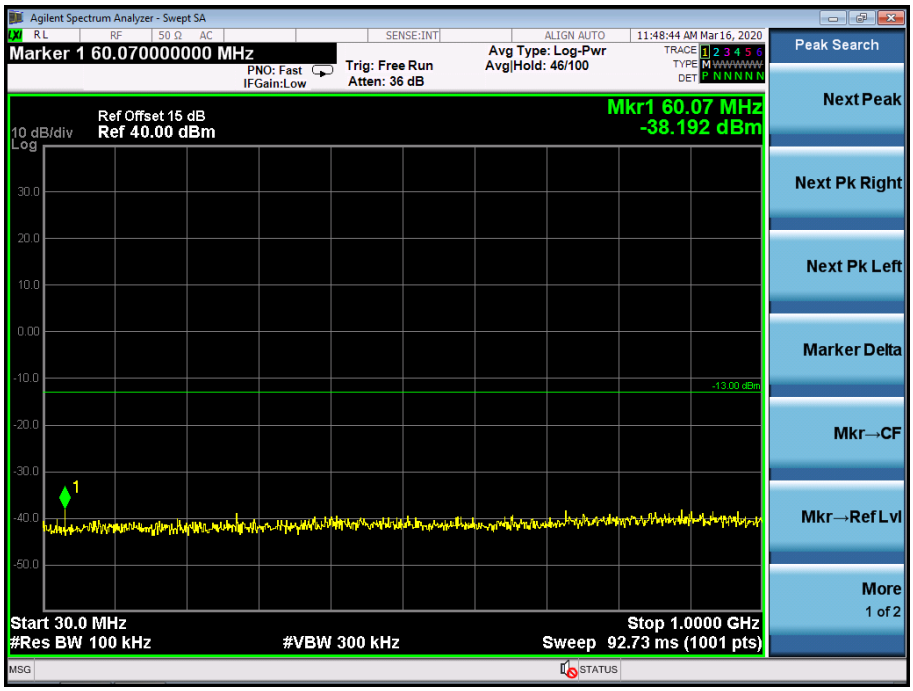


GPRS High Band Emission

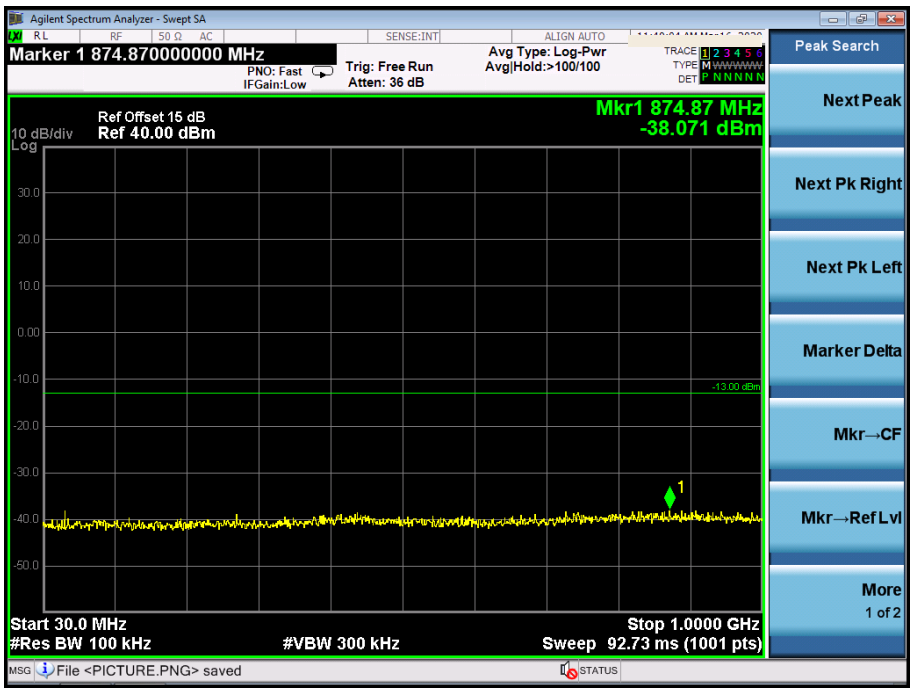


For PCS Band

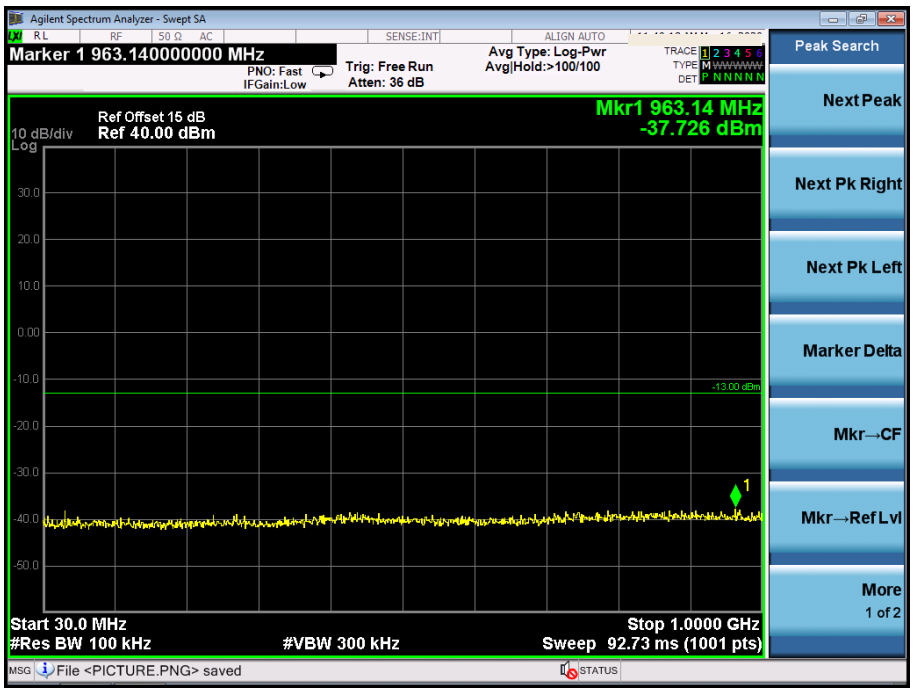
GSM Low Channel



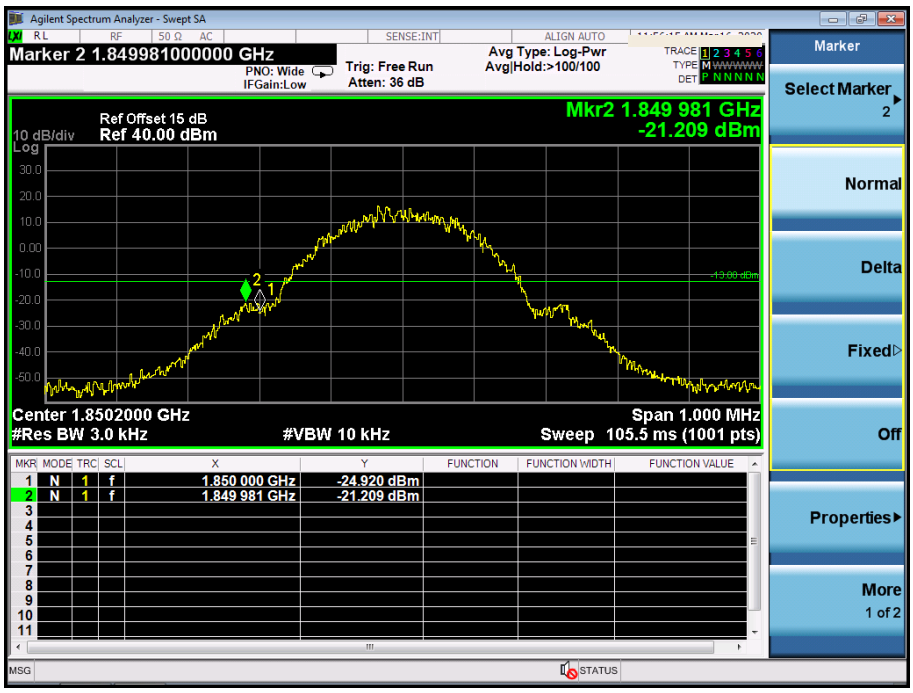
GSM Middle Channel



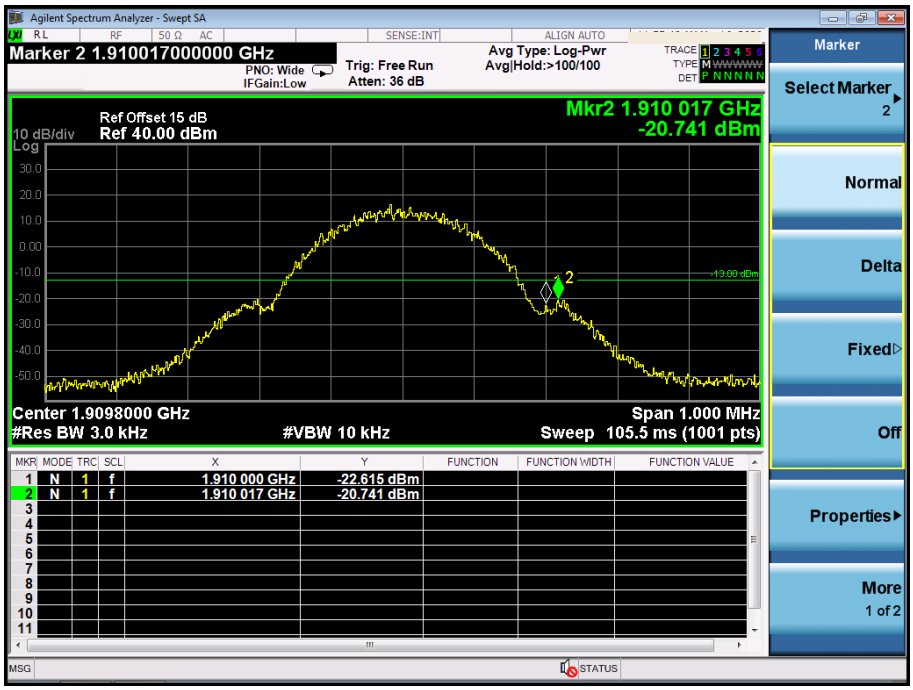
GSM High Channel



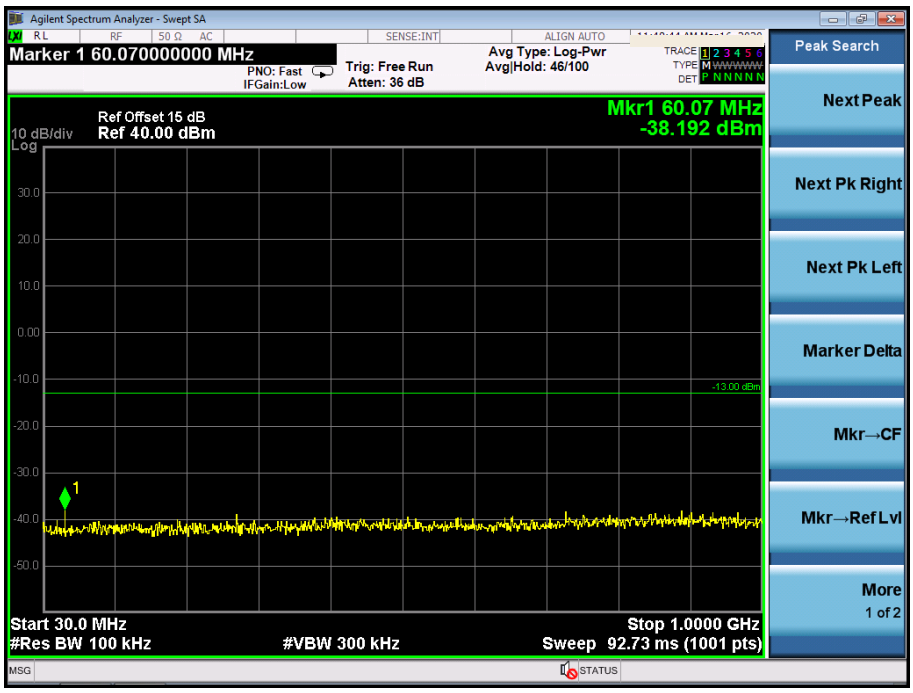
GSM Low Band Emission



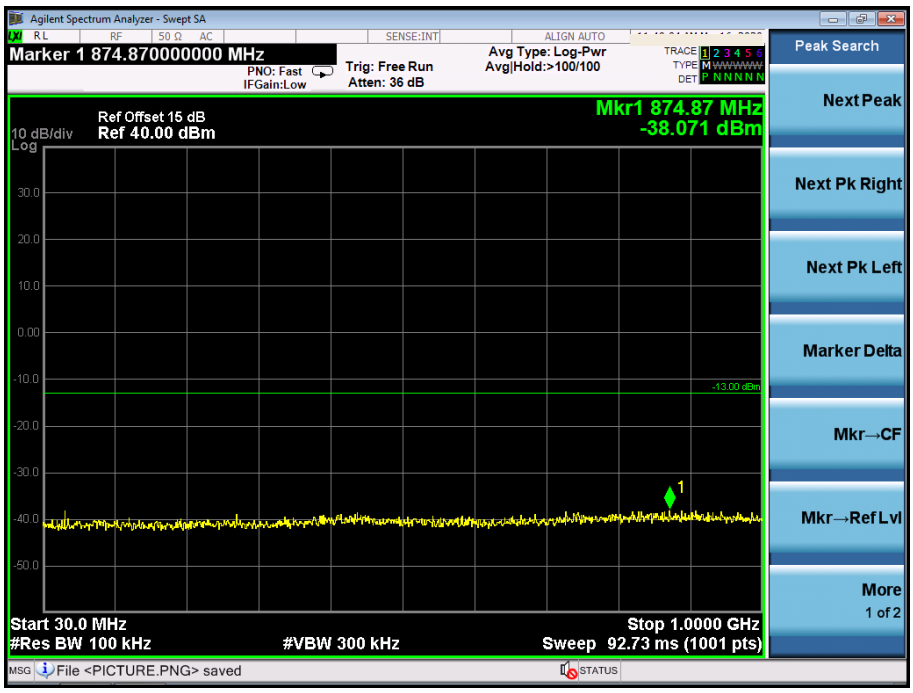
GSM High Band Emission



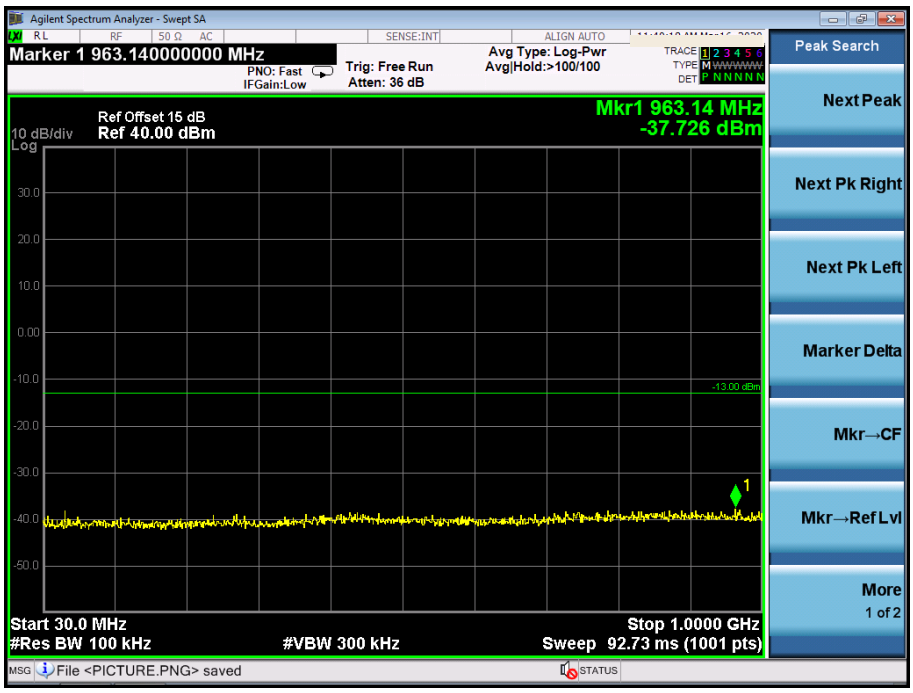
GPRS Low Channel



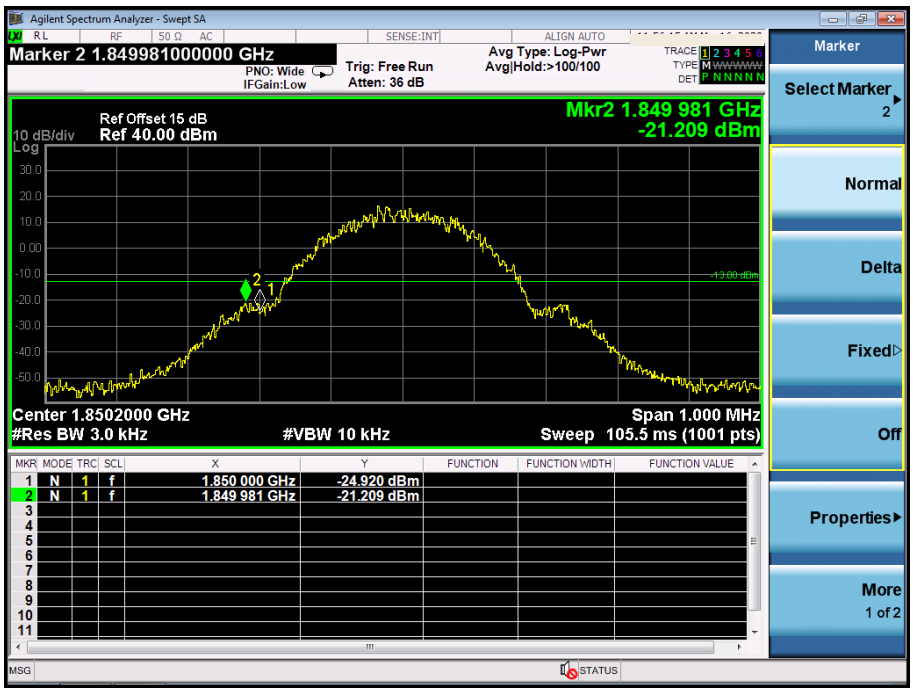
GPRS Middle Channel



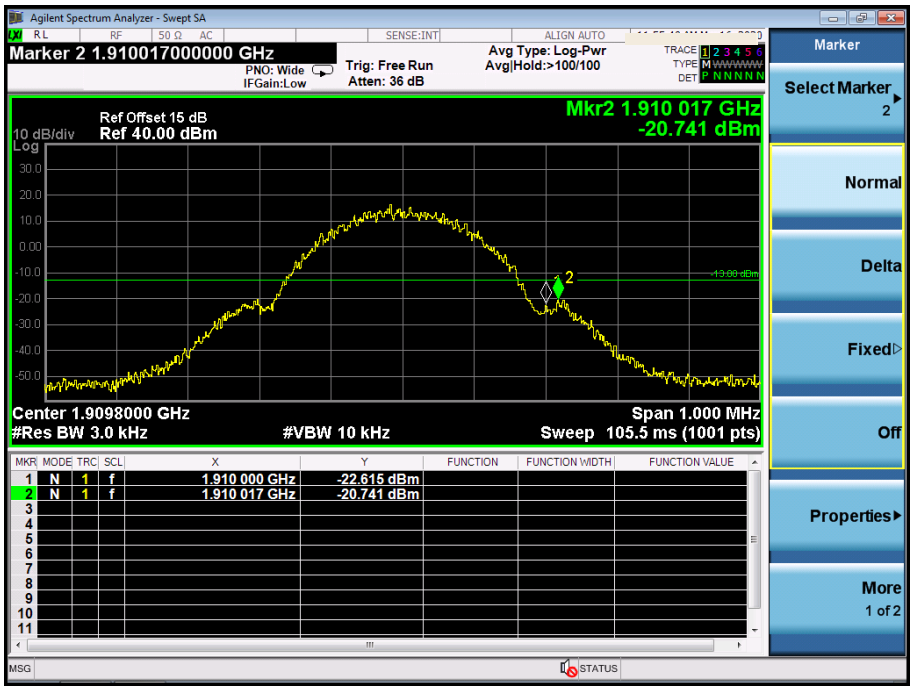
GPRS High Channel



GPRS Low Band Emission

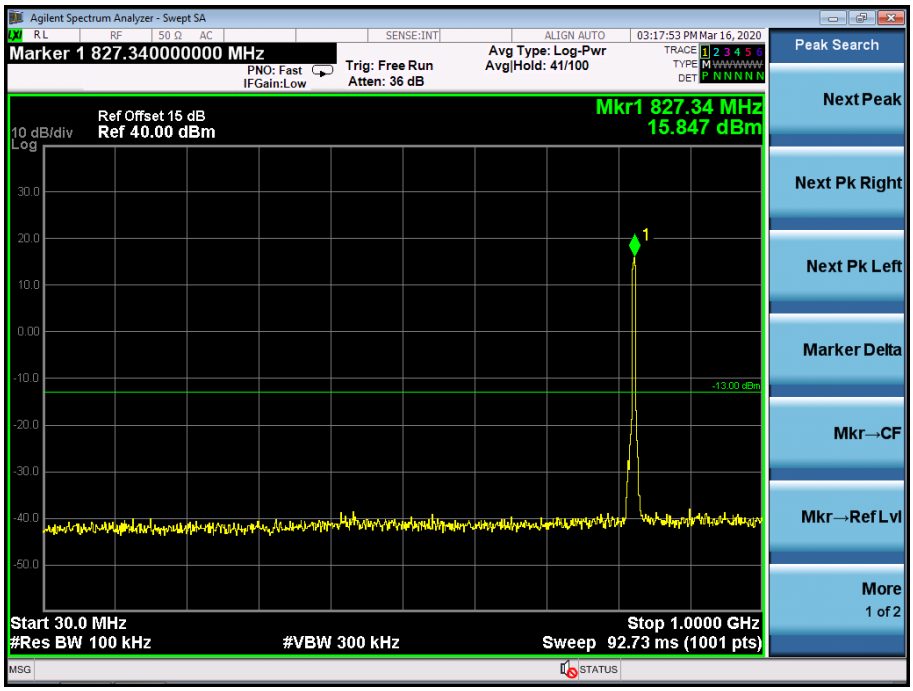


GPRS High Band Emission

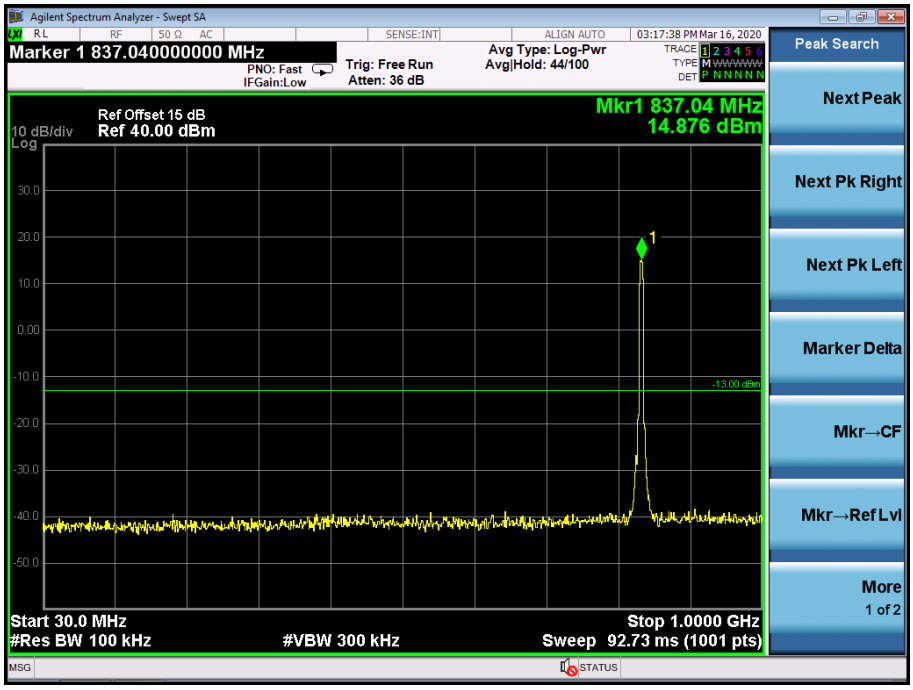


For Band V

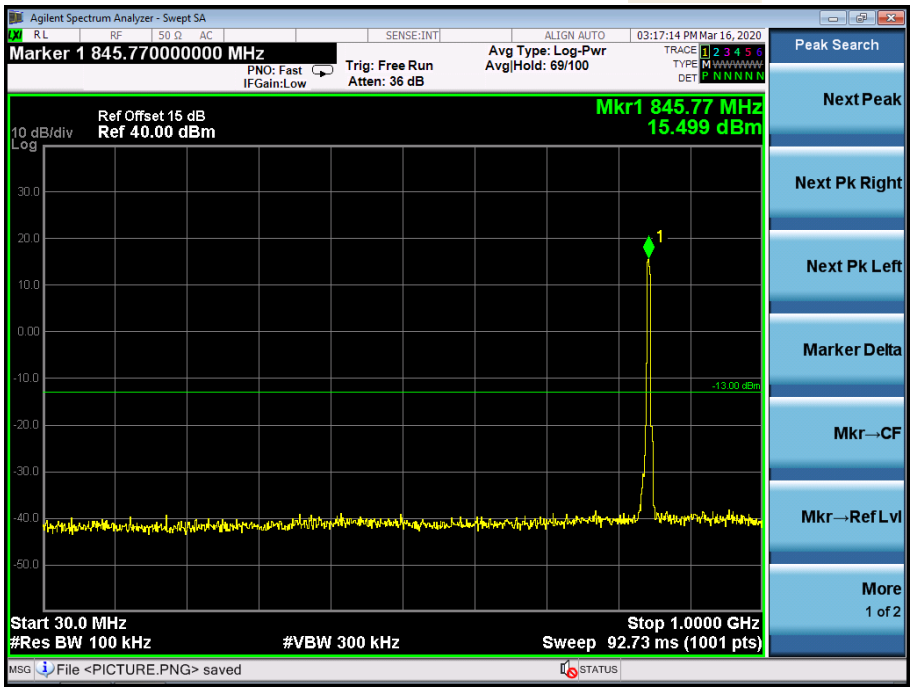
WCDMA Low Channel



WCDMA Middle Channel



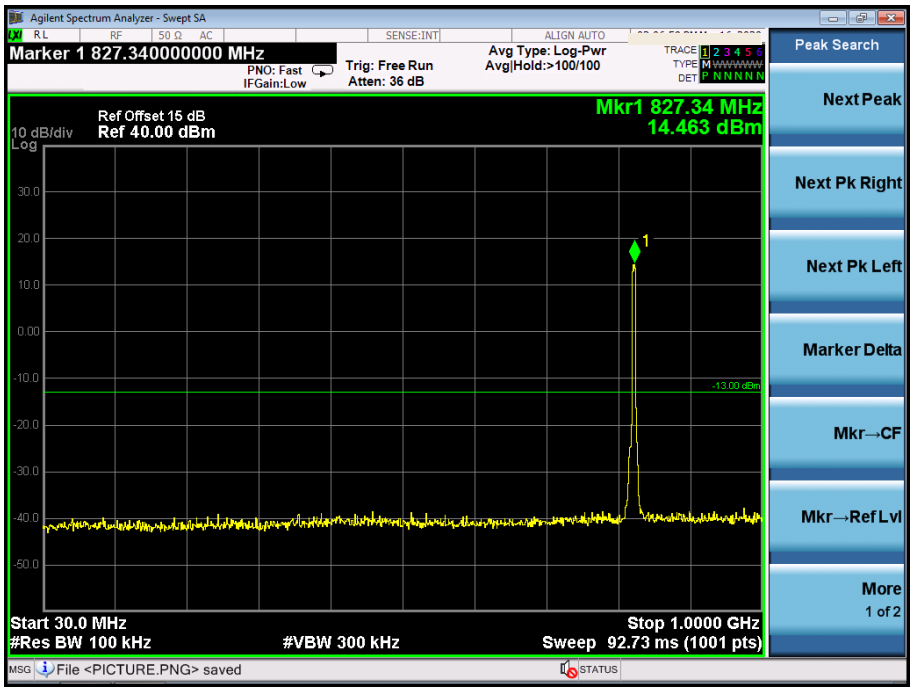
WCDMA High Channel



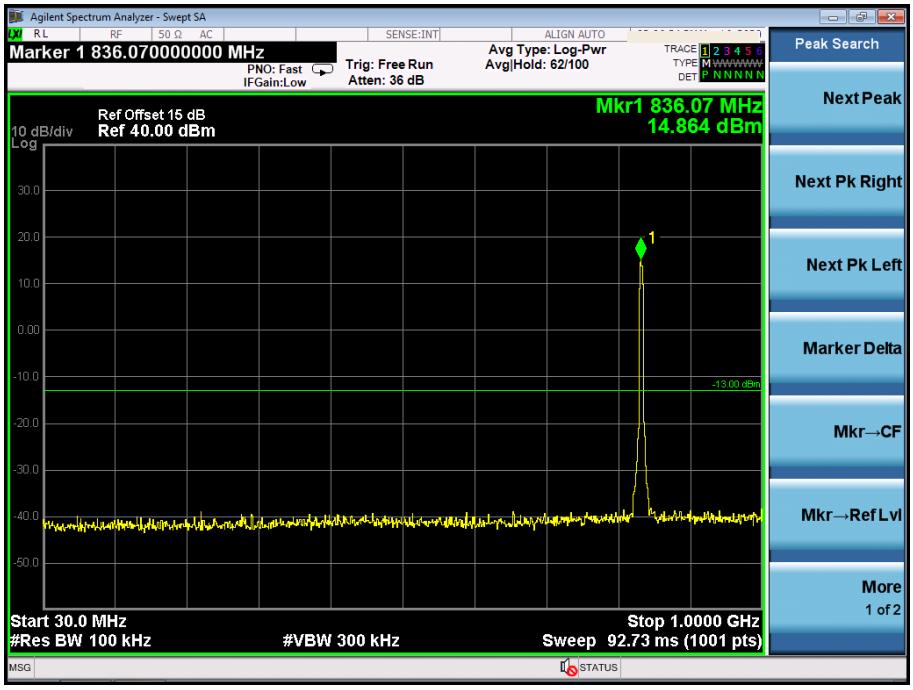
WCDMA Low Band Spurious Emission

WCDMA High Band Spurious Emission

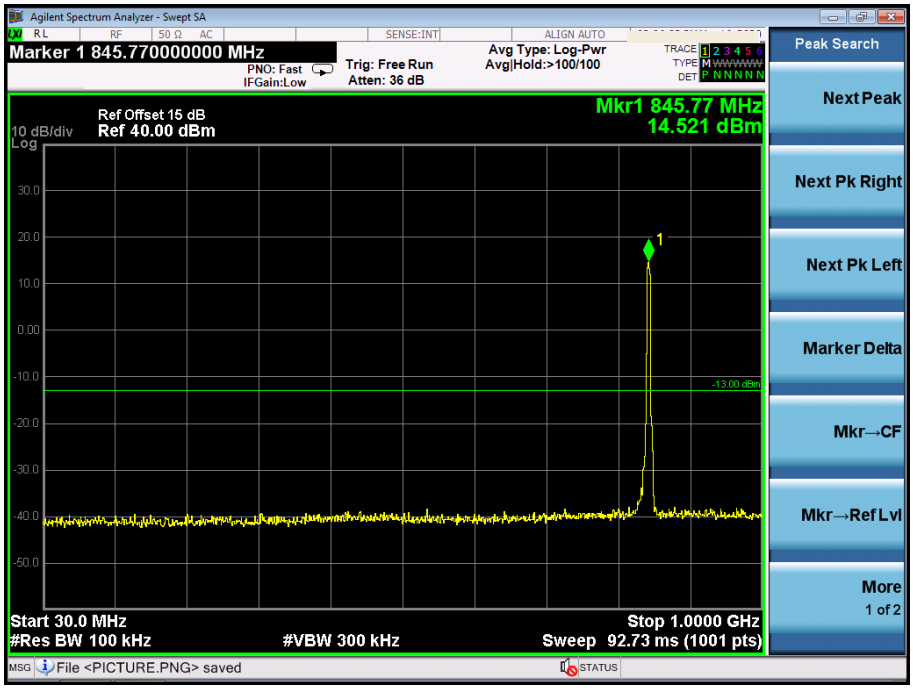
HSDPALow Channel



HSDPA Middle Channel



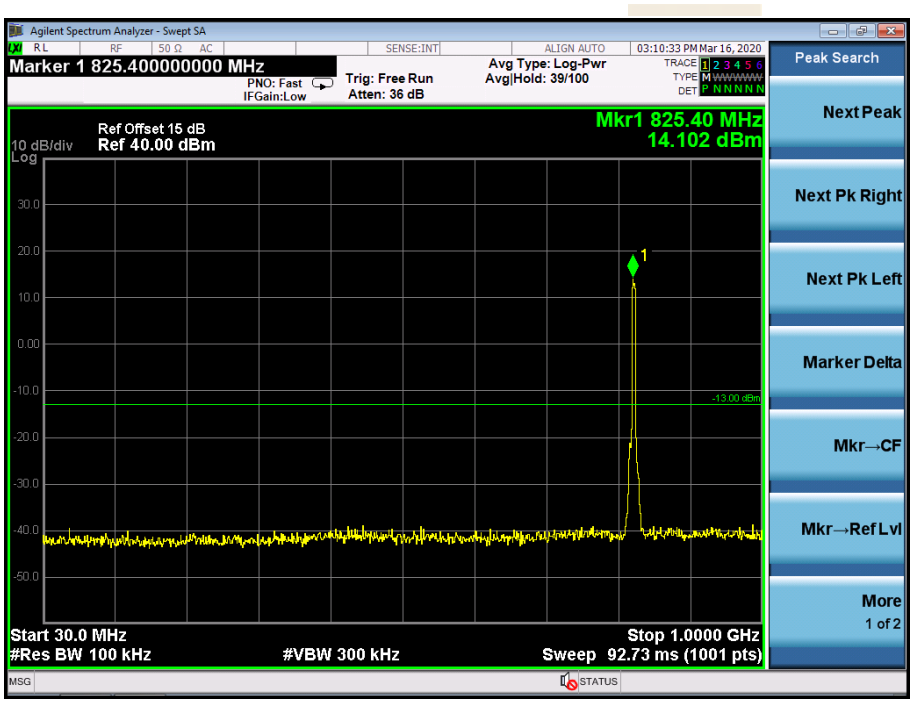
HSDPA High Channel



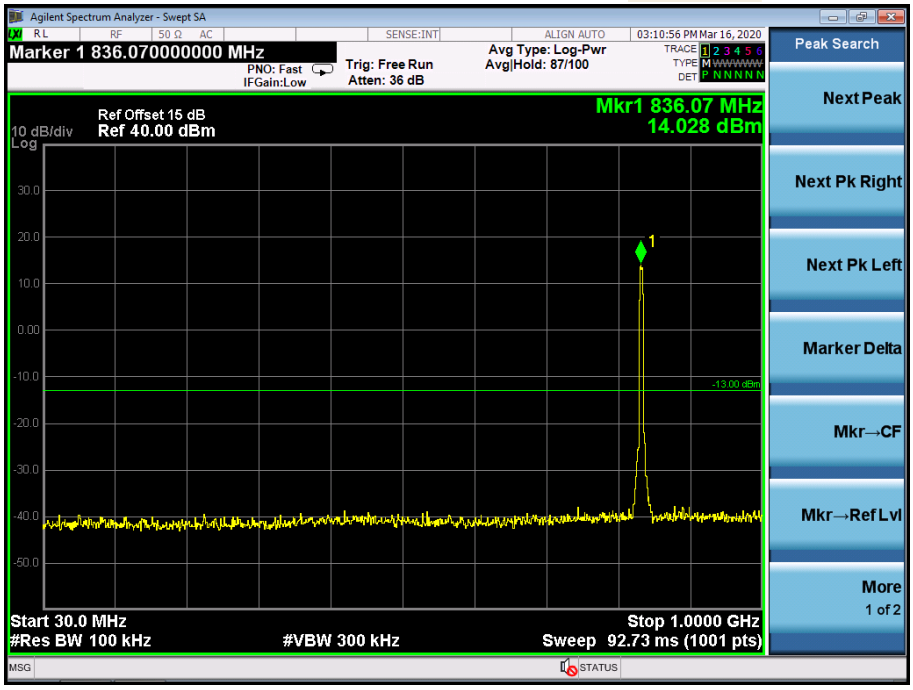
HSDPA Low Band Spurious Emission

HSDPA High Band Spurious Emission

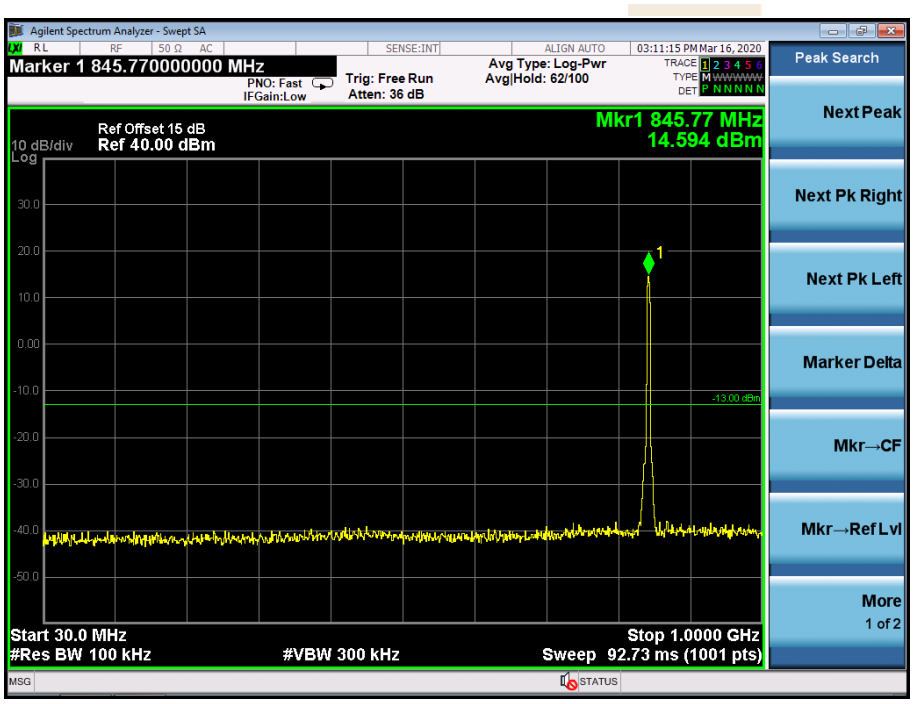
HSUPALow Channel



HSUPA Middle Channel

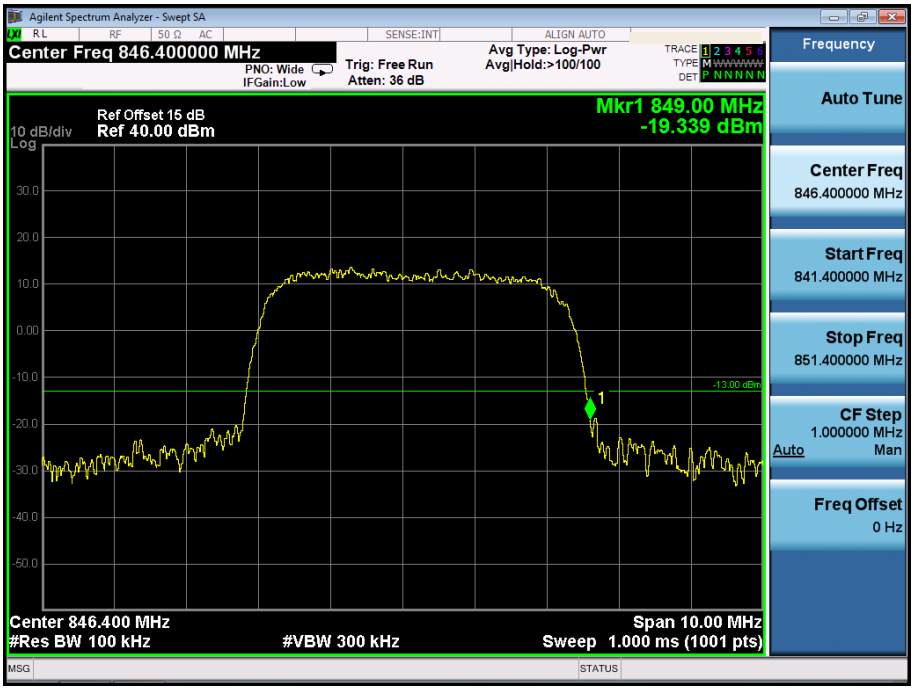


HSUPA High Channel



HSUPA Low Band Spurious Emission

HSUPA High Band Spurious Emission



7. Spurious Radiated Emissions

7.1Standard 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.

7.2Test 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)

7.3Environmental Conditions

Temperature:	26 °C
Relative Humidity:	54%
ATM Pressure:	101 kPa
Test Voltage	DC 4.35V

7.4Summary of Test Results/Plots

According to the data below, the FCC Part22.917 and 24.238 standards, and had the worst margin of:

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

All test modes are performed, but only the worst case is recorded in this report.

For Cellular Band_GSM850 Mode

Frequency	Reading	Correct	Result	Limit	Margin	Polar
(MHz)	(dBm)	dB	(dBm)	(dBm)	(dB)	H/V
Low Channel (824.2MHz)						
46.34	-69.54	4.34	-65.2	-13.00	-52.2	H
1648.4	-53.42	4.94	-48.48	-13.00	-35.48	H
2472.6	-53.21	8.46	-44.75	-13.00	-31.75	H
46.34	-69.19	4.34	-64.85	-13.00	-51.85	V
1648.4	-50.65	4.94	-45.71	-13.00	-32.71	V
2472.6	-50.51	8.46	-42.05	-13.00	-29.05	V
Middle Channel (836.6MHz)						
46.34	-68.52	4.34	-64.18	-13.00	-51.18	H
1673.2	-53.41	5.11	-48.3	-13.00	-35.3	H
2509.8	-52.68	8.54	-44.14	-13.00	-31.14	H
46.34	-68.68	4.34	-64.34	-13.00	-51.34	V
1673.2	-50.12	5.11	-45.01	-13.00	-32.01	V
2509.8	-50.42	8.54	-41.88	-13.00	-28.88	V
High Channel (848.8MHz)						
46.34	-69.21	4.34	-64.87	-13.00	-51.87	H
1697.6	-49.28	5.29	-43.99	-13.00	-30.99	H
2546.4	-51.32	8.59	-42.73	-13.00	-29.73	H
46.34	-69.26	4.34	-64.92	-13.00	-51.92	V
1697.6	-50.06	5.29	-44.77	-13.00	-31.77	V
2546.4	-51.88	8.59	-43.29	-13.00	-30.29	V

For PCS Band_GSM1900 Mode

Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Polar H/V
Low Channel (1850.2MHz)						
46.34	-69.25	4.34	-64.91	-13.00	-51.91	H
3700.4	-53.22	10.54	-42.68	-13.00	-29.68	H
5550.6	-55.43	13.37	-42.06	-13.00	-29.06	H
46.34	-68.51	4.34	-64.17	-13.00	-51.17	V
3700.4	-51.53	10.54	-40.99	-13.00	-27.99	V
5550.6	-55.92	13.37	-42.55	-13.00	-29.55	V
Middle Channel (1880MHz)						
46.34	-68.78	4.34	-64.44	-13.00	-51.44	H
3760	-52.62	10.64	-41.98	-13.00	-28.98	H
5640	-55.62	13.54	-42.08	-13.00	-29.08	H
46.34	-69.17	4.34	-64.83	-13.00	-51.83	V
3760	-52.43	10.64	-41.79	-13.00	-28.79	V
5640	-54.21	13.54	-40.67	-13.00	-27.67	V
High Channel (1909.8MHz)						
46.34	-69.56	4.34	-65.22	-13.00	-52.22	H
3819.6	-52.32	10.74	-41.58	-13.00	-28.58	H
5729.4	-55.78	13.71	-42.07	-13.00	-29.07	H
46.34	-68.82	4.34	-64.48	-13.00	-51.48	V
3819.6	-53.64	10.74	-42.90	-13.00	-29.90	V
5729.4	-55.11	13.71	-41.40	-13.00	-28.40	V

For Band 5 Mode

Frequency (MHz)	Reading (dBm)	Correct dB	Result (dBm)	Limit (dBm)	Margin (dB)	Polar H/V
Low Channel (826.4MHz)						
46.34	-69.34	4.34	-65.00	-13.00	-52.00	H
1652.8	-58.25	4.94	-53.31	-13.00	-40.31	H
2479.2	-58.67	8.46	-50.21	-13.00	-37.21	H
46.34	-69.22	4.34	-64.88	-13.00	-51.88	V
1652.8	-57.34	4.94	-52.40	-13.00	-39.40	V
2479.2	-57.92	8.46	-49.46	-13.00	-36.46	V
Middle Channel (836.6MHz)						
46.34	-69.34	4.34	-65.00	-13.00	-52.00	H
1672.8	-56.56	5.11	-51.45	-13.00	-38.45	H
2509.2	-58.04	8.54	-49.50	-13.00	-36.50	H
46.34	-69.12	4.34	-64.78	-13.00	-51.78	V
1672.8	-57.64	5.11	-52.53	-13.00	-39.53	V
2509.2	-58.64	8.54	-50.10	-13.00	-37.10	V
High Channel (846.6MHz)						
46.34	-69.43	4.34	-65.09	-13.00	-52.09	H
1693.2	-58.76	5.29	-53.47	-13.00	-40.47	H
2539.8	-59.13	8.59	-50.54	-13.00	-37.54	H
46.34	-68.45	4.34	-64.11	-13.00	-51.11	V
1693.2	-58.03	5.29	-52.74	-13.00	-39.74	V
2539.8	-58.11	8.59	-49.52	-13.00	-36.52	V

Note: Result=Reading+ Correct, Margin= Result- Limit

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listedin the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

8. Frequency Stability

8.1 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.

8.2Test 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

8.3Environmental Conditions

Temperature:	26°C
Relative Humidity:	54%
ATM Pressure:	101kPa

8.4Summary 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	4.35	73	0.087
40	4.35	71	0.085
30	4.35	68	0.081
20	4.35	82	0.098
10	4.35	54	0.065
0	4.35	63	0.075
-10	4.35	61	0.073
-20	4.35	68	0.081
-30	4.35	62	0.074

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	4.35	62	0.033
40	4.35	62	0.033
30	4.35	54	0.029
20	4.35	72	0.038
10	4.35	45	0.024
0	4.35	43	0.023
-10	4.35	55	0.029
-20	4.35	52	0.028
-30	4.35	61	0.032

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	4.35	63	0.075
40	4.35	52	0.062
30	4.35	45	0.054
20	4.35	82	0.098
10	4.35	82	0.098
0	4.35	42	0.050
-10	4.35	63	0.075
-20	4.35	45	0.054
-30	4.35	41	0.049

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	4.35	75	0.040
40	4.35	72	0.038
30	4.35	83	0.044
20	4.35	85	0.045
10	4.35	55	0.029
0	4.35	63	0.034
-10	4.35	82	0.044
-20	4.35	33	0.018
-30	4.35	56	0.030

For WCDMA Band 5 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	4.35	70	0.084
40	4.35	72	0.086
30	4.35	71	0.085
20	4.35	86	0.010
10	4.35	71	0.085
0	4.35	73	0.087
-10	4.35	73	0.087
-20	4.35	75	0.090
-30	4.35	72	0.086

For HSDPA Band 5 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	4.35	53	0.063
40	4.35	51	0.061
30	4.35	52	0.062
20	4.35	56	0.067
10	4.35	64	0.077
0	4.35	62	0.074
-10	4.35	61	0.073
-20	4.35	55	0.066
-30	4.35	49	0.059

For HSUPA Band 5 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	4.35	69	0.082
40	4.35	64	0.077
30	4.35	62	0.074
20	4.35	82	0.098
10	4.35	64	0.077
0	4.35	62	0.074
-10	4.35	63	0.075
-20	4.35	64	0.077
-30	4.35	61	0.073

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	4.57	75	0.090
	4.35	83	0.099
	3.92	71	0.085
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	4.57	63	0.034
	4.35	73	0.039
	3.92	61	0.032
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	4.57	83	0.099
	4.35	86	0.10
	3.92	65	0.078
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	4.57	75	0.040
	4.35	83	0.044
	3.92	71	0.038

Reference Frequency(Middle Channel): WCDMA 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.57	63	0.075
	4.35	92	0.11
	3.92	76	0.091

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	4.57	60	0.032
	4.35	72	0.039
	3.92	55	0.029

Reference Frequency(Middle Channel): HSDPA 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.57	43	0.051
	4.35	53	0.063
	3.92	54	0.065

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	4.57	60	0.032
	4.35	72	0.038
	3.92	55	0.029

Reference Frequency(Middle Channel): HSUPA 836.6MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency (Hz)	Error (ppm)
20	4.57	57	0.068
	4.35	83	0.099
	3.92	62	0.074

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	4.57	56	0.030
	4.35	73	0.039
	3.92	61	0.032

9. EUT PHOTO

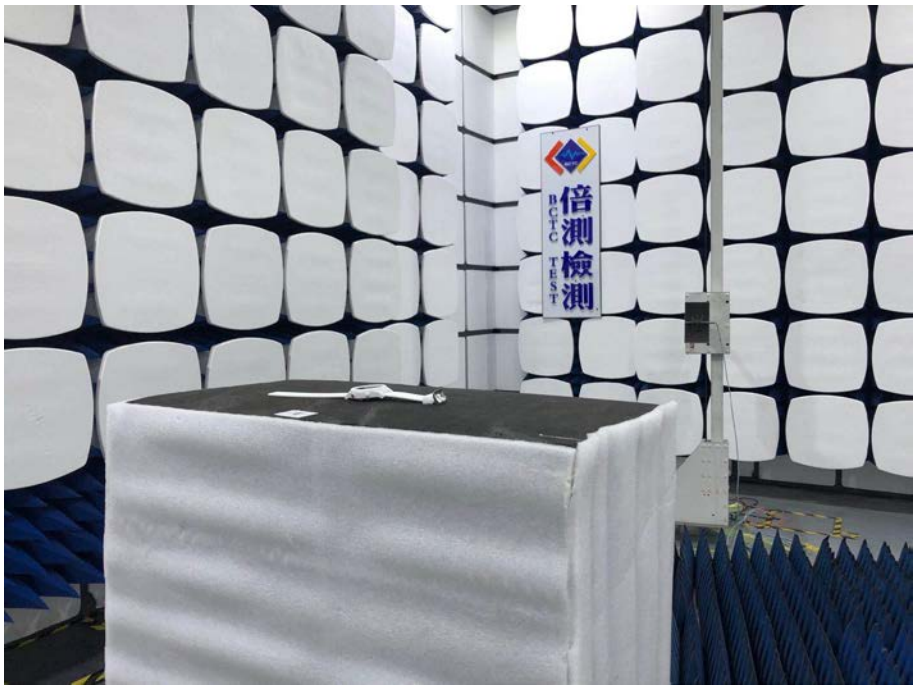
EUT Photo 1

EUT Photo 2

EUT Photo 3

10. EUT TEST PHOTO

Radiated Measurement Photos



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