FCC Radio Test Report

FCC ID: 2AP7K-H100

Original Grant

Report No.	:	TB-FCC160366
Applicant	:	Shenzhen Holloo Technology Co.,Ltd.
Equipment Under Test (EUT)		
EUT Name	:	Vehicle Wireless Terminal(GSM)
Model No.	:	H100A
Series Model No.	:	H100B, H100C
Brand Name	:	Holloo
Receipt Date	:	2018-06-08
Test Date	:	2018-06-09 to 2018-06-14
Issue Date	:	2018-06-15
Standards	:	FCC Part 2 FCC Part 22 Subpart H, FCC Part 24 Subpart E, 2017 ANSI/TIAC63.26: 2015
Conclusions	:	**PASS** In the configuration tested, the EUT complied with the standards specified above, The EUT technically complies with the FCC requirements

Test/WitnessEngineer	:	Jason Xu
Engineer Supervisor		Ivan Su
Engineer Manager	:	Ray Lai

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

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Contents

Revision History

Report No.	Version	Description	Issued Date
TB-FCC160366	Rev.01	Initial issue of report	2018-06-15

1. General Information about EUT

1.1 Client Information

Applicant	:	Shenzhen Holloo Technology Co.,Ltd.
Address	:	103,105, Building6, 1980 Industrial Park, Minzhi Street, Longhua New District, Shenzhen, China
Manufacturer	:	Shenzhen Holloo Technology Co.,Ltd.
Address	:	103,105, Building6, 1980 Industrial Park, Minzhi Street, Longhua New District, Shenzhen, China

1.2 General Description of EUT (Equipment Under Test)

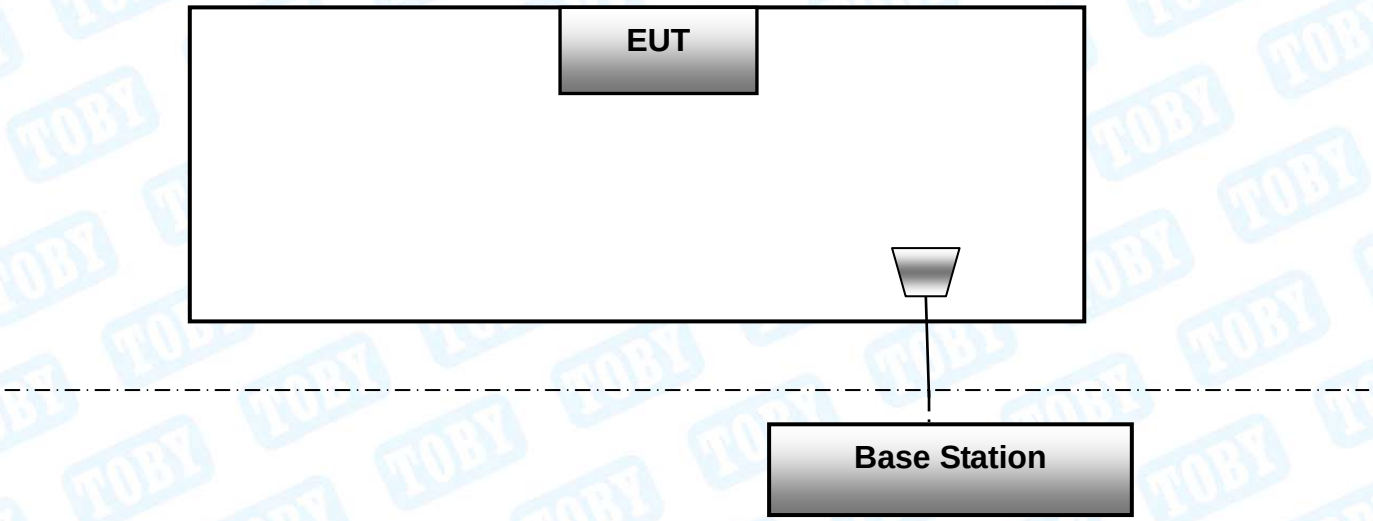
EUT Name	:	Vehicle Wireless Terminal(GSM)	
Models No.	:	H100A, H100B, H100C	
Model Difference	:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is model name for commercial.	
Product Description	:	Frequency Bands: GSM850; PCS1900;	
		GSM 850 Power :	Cond:29.97dBm ERP:28.54dBm
		PCS 1900 Power :	Cond:29.80dBm EIRP:27.97dBm
		Antenna Gain:	3.8 dB Dipole Antenna
		Modulation Type:	GPRS:GMSK
FCC Operating Frequency	:	GSM 850: 824.20MHz-848.80MHz PCS1900: 1850.20MHz-1909.80MHz	
Emission Designator	:	GPRS 850: 248KG7W GPRS 1900: 250KG7W	
Power Rating	:	DC 9~36V	
Software Version	:	N/A	
Hardware Version	:	V1.3	
Connecting I/O Port(S)	:	Please refer to the User's Manual	

Note:

(1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

(2) This test report only product for PCS Licensed Transmitter (PCB).

1.3 Block Diagram Showing the Configuration of System Tested



The above block diagram of setup is the normal mode. And more detail please refer to the test setup of each test item of bellow.

1.4 Description of Support Units

The EUT has been tested as an independent unit.

1.5 Description of Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned follow was evaluated respectively.

During all testing, EUT is link mode with base station at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range.

Frequency range investigated for radiated emission as below：

1. 9kHz~10GHz for GSM850.
2. 9kHz~20GHz for PCS1900.

Test Channel		
Mode	**Channel**	**Frequency(MHz)**
GSM 850	128	824.20
	190	836.60
	251	848.80
PCS 1900	512	1850.20
	661	1880.00
	810	1909.80

Pre-scanning test Mode	Description
GPRS 850	highest , middle, lowest channels
GPRS 1900	highest , middle, lowest channels
Final test Mode	**Description**
GPRS 850	highest , middle, lowest channels
GPRS 1900	highest , middle, lowest channels

Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

(2) During the testing procedure, the EUT is in link mode with base station emulator at maximum power level in each test mode.

(3) The EUT has GPRS functions, and after pre-testing, GSM function is the worst case for all the emission tests.

(4) The EUT is considered a portable unit; it was pre-tested on the positioned of each 3 axis, X-plane, Y-plane and Z-plane. The worst case was found positioned on Z-plane as the normal use. Therefore only the test data of this Z-plane was used for radiated emission measurement test.

1.6 Measurement Uncertainty

Test Item	Parameters	Expanded Uncertainty (U_{Lab})
Conducted Emission	Level Accuracy: 9kHz~150kHz 150kHz to 30MHz	±3.42 dB ±3.42 dB
Radiated Emission	Level Accuracy: 9kHz to 30 MHz	±4.60 dB
Radiated Emission	Level Accuracy: 30MHz to 1000 MHz	±4.40 dB
Radiated Emission	Level Accuracy: Above 1000MHz	±4.20 dB

1.7 Test Facility

The testing was performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at:1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China.
At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)

The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

A2LA Certificate No.: 4750.01

The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025：2005 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01.

IC Registration No.: (11950A-1)

The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A-1.

2. Test Summary

Test Standards and Test Results			
Standard	**Document Title**		
FCC Part 2 (10-1-05 Edition)	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations		
FCC Part 22 (10-1-05 Edition)	Public Mobile Services		
FCC Part 24 (10-1-05 Edition)	Personal Communications Services		
Standard Section	**Test Item**	**Judgment**	**Remark**
2.1046	Conducted RF Output Power	PASS	N/A
24.232(d)	Peak-Average Ratio	PASS	N/A
2.1049; 22.917; 24.238	99% & -26 dB Occupied Bandwidth	PASS	N/A
2.1055; 22.355; 24.235	Frequency Stability	PASS	N/A
2.1051; 2.1057; 22.917; 24.238	Conducted Out of Band Emissions	PASS	N/A
2.1051; 2.1057; 22.917; 24.238	Band Edge	PASS	N/A
22.913; 24.238	Transmitter Radiated Power (EIRP/ERP)	PASS	N/A
2.1053; 2.1057; 22.917; 24.238	Radiated Out of Band Emissions	PASS	N/A
Note: N/A is an abbreviation for Not Applicable.			

3. Test Equipment

Radiation Emission Test					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 20, 2017	Jul. 19, 2018
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 20, 2017	Jul. 19, 2018
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.16, 2018	Mar. 15, 2019
Bilog Antenna	ETS-LINDGREN	3142E	00117542	Mar.16, 2018	Mar. 15, 2019
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar.16, 2018	Mar. 15, 2019
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar.16, 2018	Mar. 15, 2019
Loop Antenna	SCHWARZBECK	FMZB 1519 B	1519B-059	Jul. 03, 2017	Jul. 02, 2018
Pre-amplifier	Sonoma	310N	185903	Mar.17, 2018	Mar. 16, 2019
Pre-amplifier	HP	8449B	3008A00849	Mar.17, 2018	Mar. 16, 2019
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar.17, 2018	Mar. 16, 2019
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
Antenna Conducted Emission					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 20, 2017	Jul. 19, 2018
Spectrum Analyzer	Rohde & Schwarz	ESCI	100010/007	Jul. 20, 2017	Jul. 19, 2018
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Oct. 26, 2017	Oct. 25, 2018
Vector Signal Generator	Agilent	N5182A	MY50141294	Oct. 26, 2017	Oct. 25, 2018
Analog Signal Generator	Agilent	N5181A	MY50141953	Oct. 26, 2017	Oct. 25, 2018
RF Power Sensor	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO26	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO29	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO31	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRPR3006W	17I00015SNO33	Oct. 26, 2017	Oct. 25, 2018
Wideband Radio Comunication Tester	Rohde & Schwarz	CMW500	144382	Oct. 26, 2017	Oct. 25, 2018
Universal Radio Communication Tester	Rohde&Schwarz	CMU200	103903	Jul. 20, 2017	Jul. 19, 2018

4. Frequency Stability

4.1 Test Standard and Requirement

4.1.1 Test Standard

FCC Part 2.1055
FCC Part 22.355
FCC Part 24.235

4.1.2 Requirement

According to FCC section 22.355 and FCC section 24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. According to FCC section 2.1055, the test conditions are:

(1) Temperature:

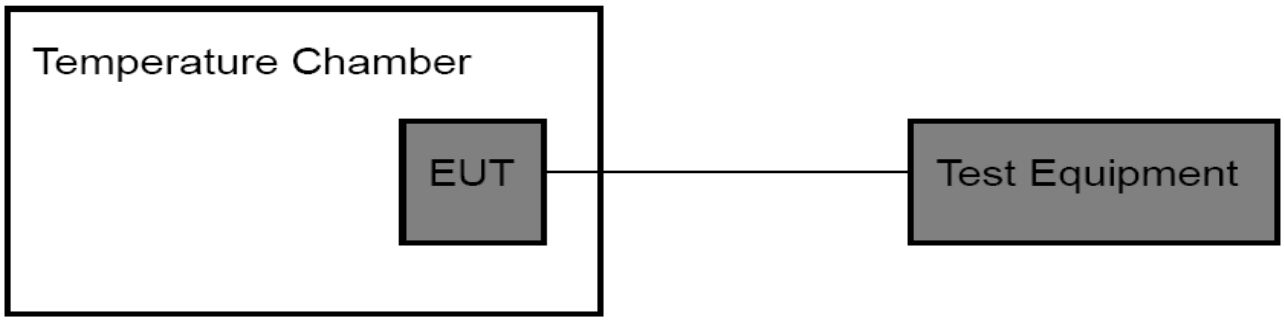
The temperature is varied from -30℃ to +50℃ at intervals of not more than 10℃.

(2) Primary Supply Voltage:

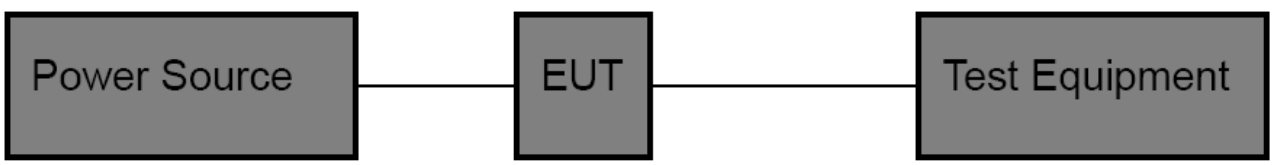
For hand carried battery powered equipment, the primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacture. The supply voltage shall be measured at input to the cable normally provide with the equipment, or at the power supply terminals if cables are not normally provided.

4.2 Test Setup

For Temperature Test:



For Voltage Test:



4.3 Test Procedure

Test Procedures for Temperature Variation:

(1) The EUT was set up in the thermal chamber and connected with the base station.

(2) With power off, the temperature was decreased to -30℃ and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.

(3) With power off, the temperature was raised in 10℃ set up to 50℃ and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.

(4) If the EUT cannot be turned on at -30℃, the testing lowest temperature will be raised in 10℃ step until the EUT can be turned on.

Test Procedures for Voltage Variation:

(1) The EUT was placed in a temperature chamber at 25±5℃ and connected with the base station.

(2) Reduce the input voltage to specify extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.

(3) The variation in frequency was measured for the worst case.

4.4 EUT Operating Condition

The Equipment Under Test was set to Communication with the Base Station.

4.5 Test Data

Please refer to the Attachment A.

5. Conducted RF Output Power

5.1 Test Standard and Limit

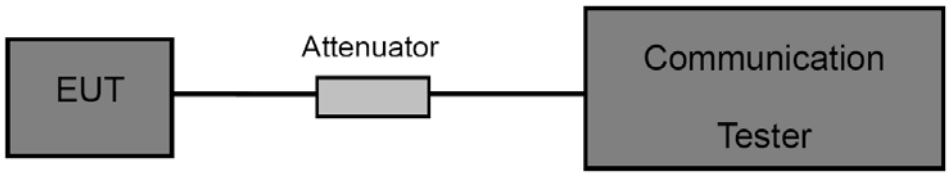
5.1.1 Test Standard

FCC Part 2: 2.1046
FCC Part 22H : 22.913 (a)
FCC Part 24E: 24.232 (c)

5.1.2 Test Limit

GSM850/UMTS Band V	PCS 1900/UMTS Band II
38.5 dBm (ERP)	33 dBm (EIRP)

5.2 Test Setup



5.3 Test Procedure

(1) The EUT is coupled to the Base Station with the suitable Attenuator, the path loss is calibrated to correct the reading.
(2) A call is set up by the Base Station to the generic call set up procedure.
(3) Set EUT at maximum power level through base station by power level command.
(4) Then read record the power value from the Base Station in dBm.

5.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

5.5 Test Data

Please refer to the Attachment B.

6. Peak-Average Ratio

6.1 Test Standard and Limit

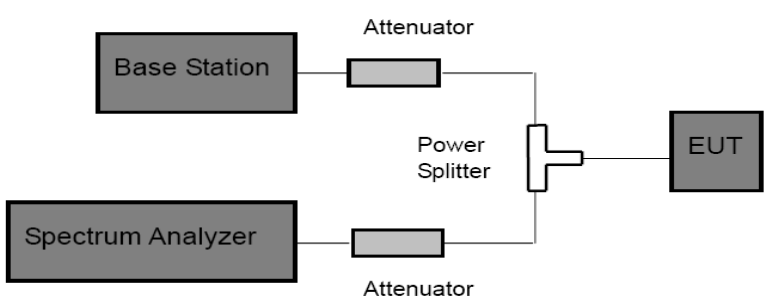
6.1.1 Test Standard

FCC Part 24E: 24.232 (d)

6.1.2 Test Limit

PCS 1900 /UMTS Band II
The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

6.2 Test Setup



6.3 Test Procedure

According with KDB 971168

(1) The signal analyzer's CCDF measurement profile is enabled.
(2) Frequency = carrier center frequency.
(3) Measurement BW>Emission bandwidth of signal.
(4) The signal analyzer was set to collect one million samples to generate the CCDF curve.
(5) The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which of the transmitter is operating at maximum power.

6.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

6.5 Test Data

Please refer to the Attachment C.

7. Radiated Output Power

7.1 Test Standard and Limit

7.1.1 Test Standard

FCC Part 22H : 22.913 (a)

FCC Part 24E: 24.232 (c)

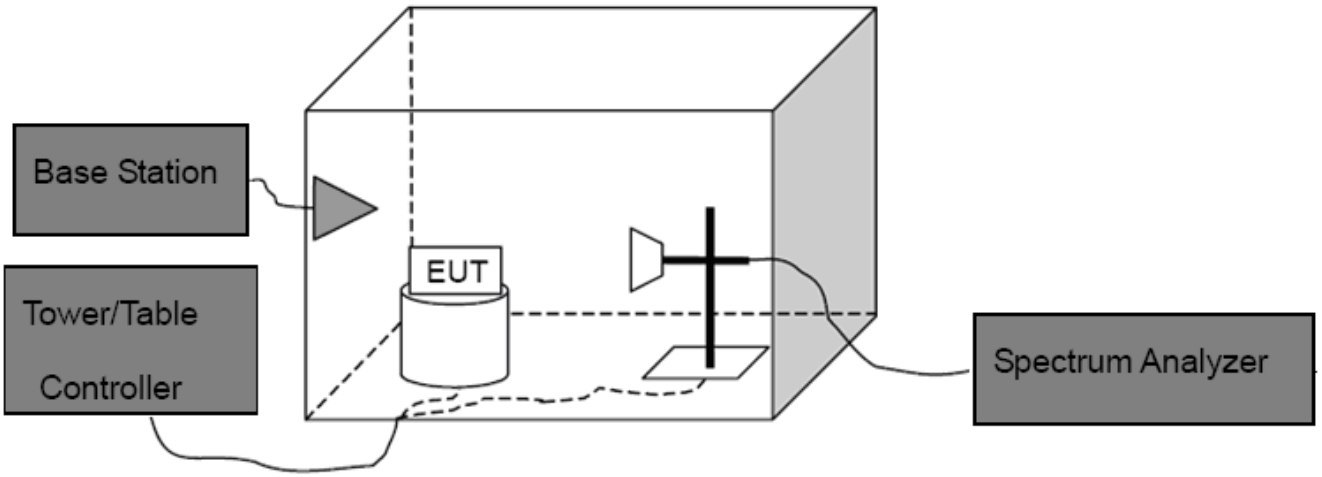
7.1.2 Test Limit

According to FCC Part 22.913 (a), the ERP of Cellular mobile transmitters must not exceed 7 Watts(38.5 dBm).

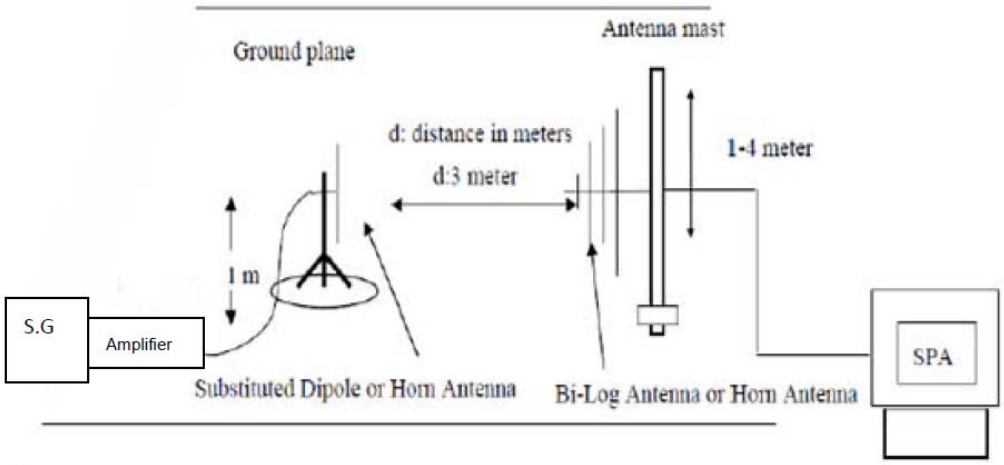
According to FCC Part 24.232 (c), the Mobile/portable stations are limited to 2 Watts(33 dBm) EIRP peak power.

Cellular Band		PCS Band	
GSM850	UMTS Band V	PCS 1900	UMTS Band II
38.5 dBm (ERP)		33 dBm (EIRP)	

7.2 Test Setup



Above 1G



Substituted Method

7.3 Test Procedure

(1) The EUT was placed on an non-conductive rotating platform with 0.8 meter height in an anechoic chamber. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer with RBW=3 MHz, VBW=3 MHz and peak detector settings.

(2) During the measurement, the EUT was enforced in maximum power and linked with the Base Station. The highest was recorded from analyzer power level (LVT) from the 360 degrees rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations.

(3) Effective Isotropic Radiated Power (EIRP) was measured by substitution method according to C63.26. The EUT was replaced by dipole antenna (for frequency below 1 GHz) or Horn antenna (for frequency above 1 GHz) at same location with same polarize of receiver antenna and then a known power of each measure frequency from S.G. was applied into the dipole antenna or Horn antenna through a TX cable, and then recorded the maximum Analyzer reading through raised and lowered the test antenna.

Note: In test, the S.G Connect the Pre-amplifier(Sonoma 310N Pre-amplifier for frequency below 1 GHz, HP 8449B Pre-amplifier for frequency above 1 GHz)

Then the EUT's EIRP and ERP was calculated with the correction factor:

ERP=S.G.Level +Antenna Gain Cord.(dBd)-Cable Loss(dB)

EIRP=S.G.Level+Antenna Gain Cord.(dBi)-Cable Loss(dB)

7.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

7.5 Test Data

Please refer to the Attachment D.

8. Occupied Bandwidth

8.1 Test Standard and Limit

8.1.1 Test Standard

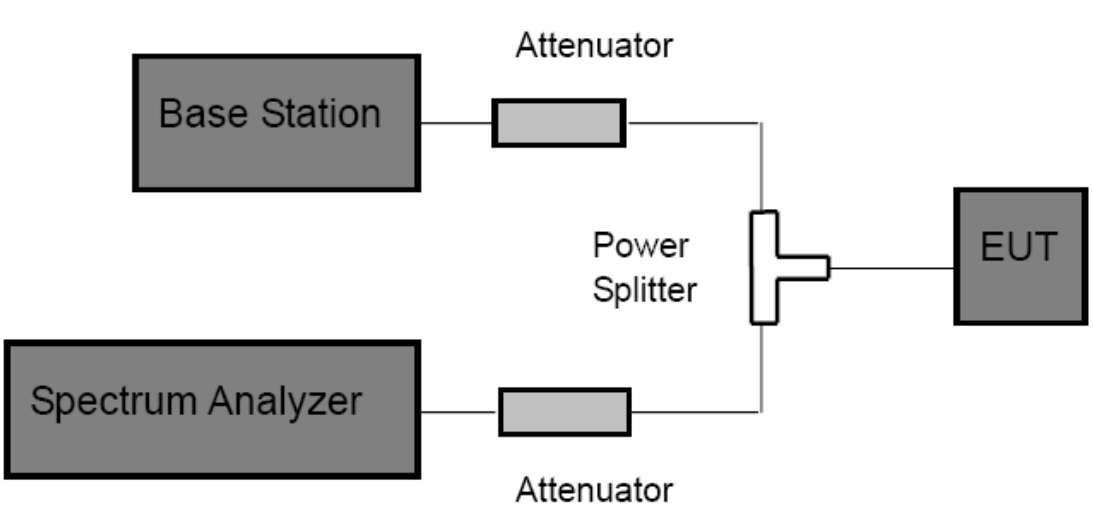
FCC Part 2: 2.1049
FCC Part 22H : 22.913 (a)
FCC Part 24E: 24.232 (c)

8.1.2 Test Requirement

According to FCC section 2.1049, the occupied bandwidth is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Occupied bandwidth is also known as 99% power and -26dBC occupied bandwidths.

8.2 Test Setup



8.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.
(2) The resolution bandwidth of the Spectrum Analyzer is set to at least 1% of the occupied bandwidth.
(3) The low, middle and the high channels are selected to perform tests respectively.
(4) Set the frequency range of the Spectrum Analyzer suitably to capture the waveform; search peak; make a line whose value is 26dB lower than the peak; mark two points which the line intersected the waveform at; finally record the delta of the two points as the occupied bandwidth and the plot.
(5) Set the Spectrum Analyzer Occupied bandwidth function to measure the 99% occupied bandwidth.

8.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

8.5 Test Data

Please refer to the Attachment E.

9. Conducted Out of Band Emissions

9.1 Test Standard and Limit

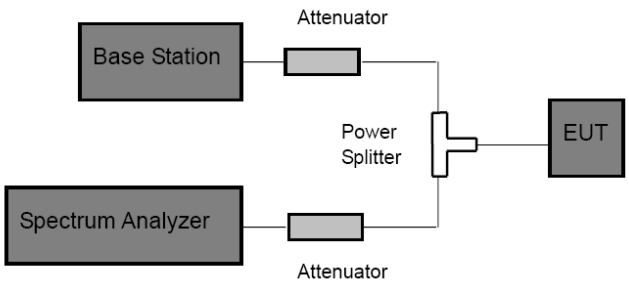
9.1.1 Test Standard

FCC Part 2: 2.1051, 2.1057
FCC Part 22H: 22.917(a)
FCC Part 24E: 24.238(a)

9.1.2 Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power(P) by a factor of at least 43+10log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

9.2 Test Setup



9.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.
(2) Spectrum Setting:
Frequency bellow 1 GHz: RBW=100 kHz, VBW=300 kHz.
Frequency above 1 GHz: RBW=1 MHz, VBW=3 MHz.
(3) The low, middle and high channels of each band and mode's spurious emissions for 30 MHz to 10th Harmonic were measured by Spectrum analyzer.

9.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

9.5 Test Data

Please refer to the Attachment F.

10. Band Edge Test

10.1 Test Standard and Limit

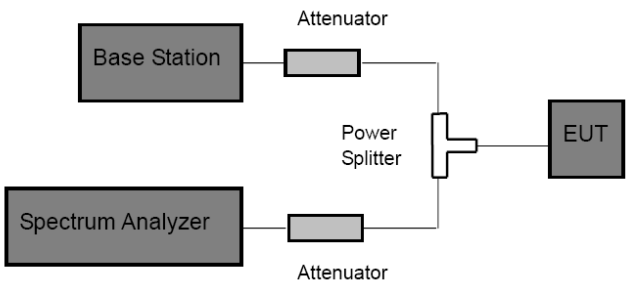
10.1.1 Test Standard

FCC Part 2: 2.1051, 2.1057
FCC Part 22H: 22.917(a)
FCC Part 24E: 24.238(a)

10.1.2 Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power(P) by a factor of at least 43+10log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

10.2 Test Setup



10.3 Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and Base station via power splitter as show in the block diagram above.
(2) Spectrum Setting:
GSM and PCS: RBW≥1% 26db bandwidth, VBW=3 RBW, Span 1 MHz, Detector: Peak Mode.
WCDMA: RBW≥1% 26db bandwidth, VBW=3 RBW, Span 10 MHz, Detector: Peak Mode.
(3) The band edges of low and high channels for the highest RF powers were measured.

10.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

10.5 Test Data

Please refer to the Attachment G.

11. Radiated Out Band of Emissions

11.1 Test Standard and Limit

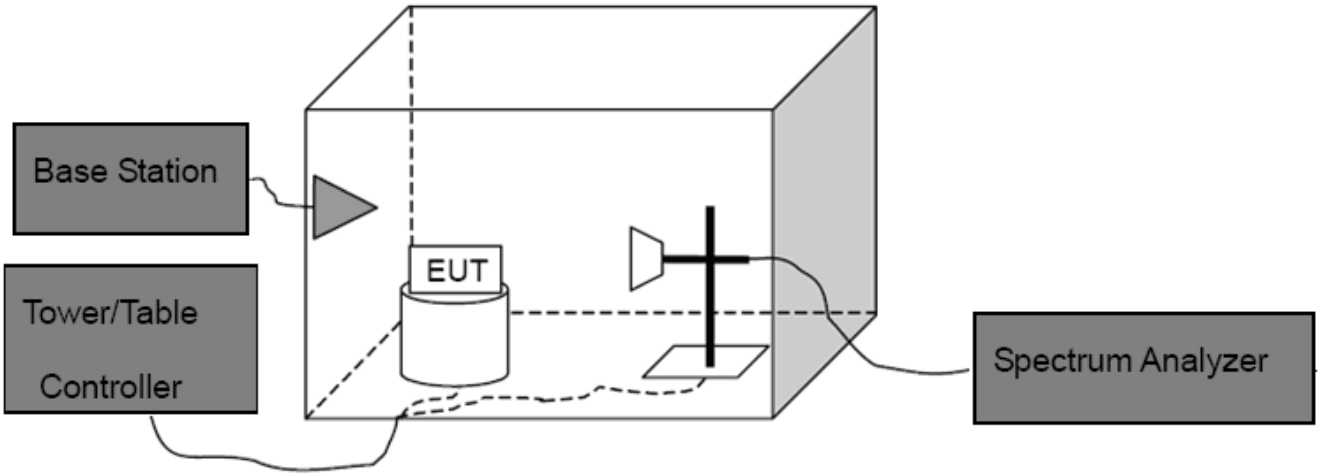
11.1.1 Test Standard

FCC Part 2: 2.1053, 2.1057
FCC Part 22H: 22.917
FCC Part 24E: 24.238

11.1.2 Test Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power(P) by a factor of at least 43+10log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

11.2 Test Setup



11.3 Test Procedure

(1) The test system setup as show in the block diagram above.
(2) The EUT was placed on an non-conductive rotating platform in an anechoic chamber. The radiated spurious emissions from 30MHz to 10th harmonious of fundamental frequency were measured at 3 m with a test antenna and a spectrum analyzer with RBW=1 MHz, VBW=1 MHz, peak detector settings.
(3) During the measurement, the EUT was enforced in maximum power and linked with a base station. All the spurious emissions at 3m were measured by rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations.
(4) When found the maximum level of emissions from the EUT. 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 emissions in dB=10 log(TX power in Watts/0.001)-the absolute level
Spurious attenuation limit in dB=43+10 log(power out in Watts)

11.4 EUT Operating Condition

The EUT was continuously connected with the Base station and transmitting in the max power during the test.

11.5 Test Data

Please refer to the Attachment H.

Attachment A--Frequency Stability

Temperature Variation

Temperature Variation GSM 850 (CH190)		
Temperature (℃)	GPRS	
	Freq. Dev. (Hz)	Deviation (ppm)
-30	13	0.016
-20	12	0.014
-10	10	0.012
0	11	0.013
10	14	0.017
20	12	0.014
30	14	0.017
40	15	0.018
50	9	0.011
60	11	0.013
Limit	2.5 (ppm)	
Result	PASS	

Temperature Variation GSM 1900 (CH661)		
Temperature (℃)	GPRS	
	Freq. Dev. (Hz)	Deviation (ppm)
-30	22	0.033
-20	23	0.035
-10	24	0.036
0	25	0.038
10	23	0.035
20	22	0.033
30	23	0.035
40	24	0.036
50	21	0.032
60	21	0.032
Limit	2.5 (ppm)	
Result	PASS	

Voltage Variation

Voltage Variation GSM 850 (CH190)		
Voltage (V)	GPRS	
	Freq. Dev. (Hz)	Deviation (ppm)
9.0	14	0.017
12.0	13	0.016
36.0	12	0.014
Limit	2.5 (ppm)	
Result	PASS	

Voltage Variation GSM 1900 (CH661)		
Voltage (V)	GPRS	
	Freq. Dev. (Hz)	Deviation (ppm)
9.0	23	0.035
12.0	20	0.030
36.0	19	0.029
Limit	2.5 (ppm)	
Result	PASS	

Attachment B--Conducted RF Output Power

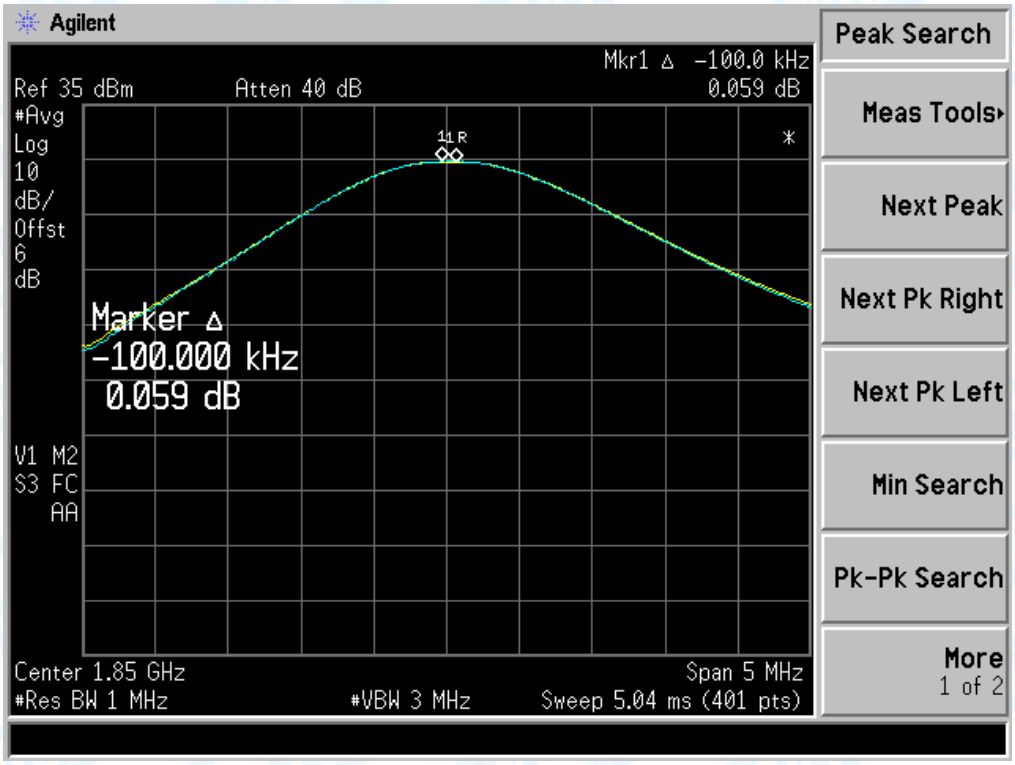
GSM 850				
Mode	Channel	Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)
GPRS 850 (1 Slot)	128	824.2	29.97	0.993
	190	836.6	29.59	0.910
	251	848.8	29.86	0.968
GPRS 850 (2 Slot)	128	824.2	28.23	0.665
	190	836.6	28.42	0.695
	251	848.8	28.52	0.711
GPRS 850 (3 Slot)	128	824.2	28.16	0.655
	190	836.6	28.26	0.670
	251	848.8	28.34	0.682
GPRS 850 (4 Slot)	128	824.2	28.47	0.703
	190	836.6	28.32	0.679
	251	848.8	28.41	0.693

PCS 1900				
Mode	Channel	Frequency (MHz)	Conducted Power (dBm)	Conducted Power (W)
GPRS 1900 (1 Slot)	512	1850.2	29.80	0.955
	661	1880.0	29.78	0.951
	810	1909.8	29.43	0.877
GPRS 1900 (2 Slot)	512	1850.2	28.65	0.733
	661	1880.0	28.88	0.773
	810	1909.8	28.29	0.675
GPRS 1900 (3 Slot)	512	1850.2	28.87	0.771
	661	1880.0	28.68	0.738
	810	1909.8	28.72	0.745
GPRS 1900 (4 Slot)	512	1850.2	28.68	0.738
	661	1880.0	28.75	0.750
	810	1909.8	28.45	0.700

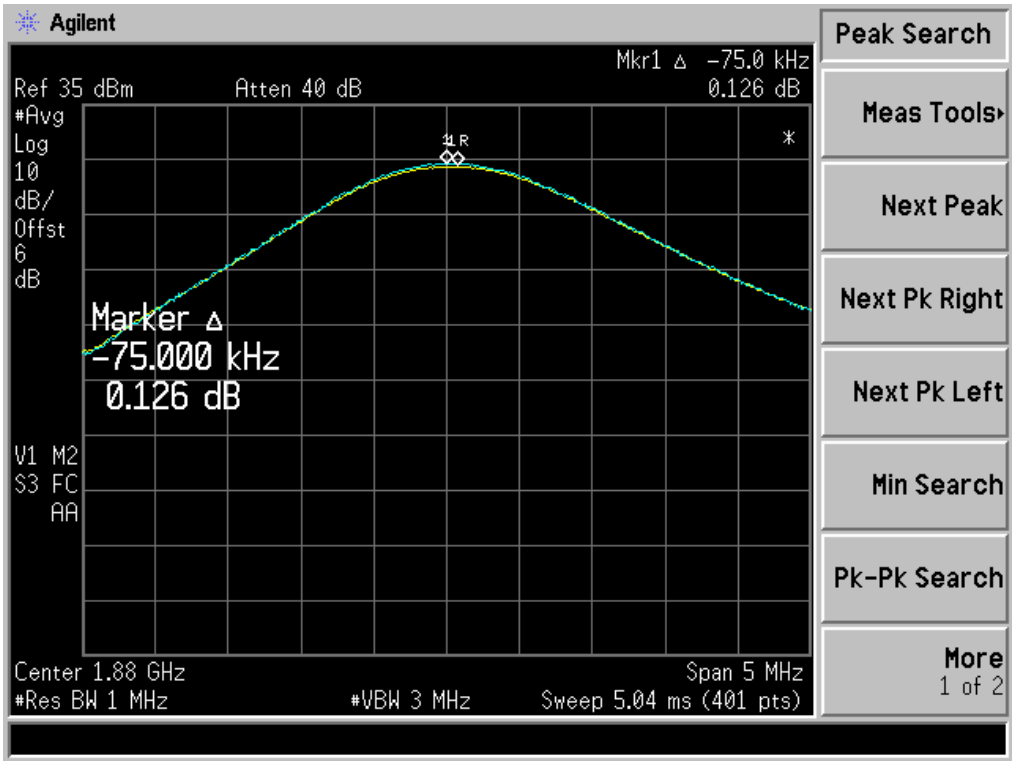
Attachment C--Peak-Average Ratio

PCS 1900			
Mode	Channel	Frequency (MHz)	Peak-Average Ratio (PAR)
PCS 1900	512	1850.2	0.059
	661	1880.0	0.126
	810	1909.8	0.112

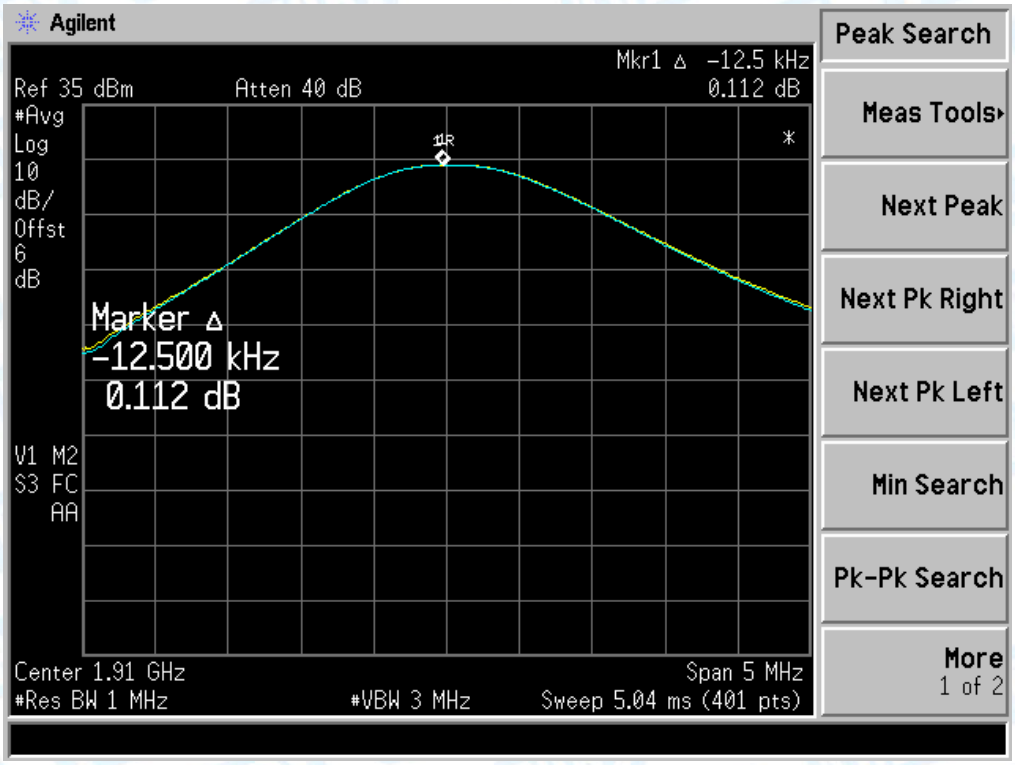
PCS 1900
CH 512



CH 661


Agilent
Mkr1 Δ -75.0 kHz
0.126 dB
Ref 35 dBm
Atten 40 dB
#Avg
Log
10
dB/
Offst
6
dB
Marker Δ
-75.000 kHz
0.126 dB
V1 M2
S3 FC
AA
Center 1.88 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 5 MHz
Sweep 5.04 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

CH 810


Agilent
Mkr1 Δ -12.5 kHz
0.112 dB
Ref 35 dBm
Atten 40 dB
#Avg
Log
10
dB/
Offst
6
dB
Marker Δ
-12.500 kHz
0.112 dB
V1 M2
S3 FC
AA
Center 1.91 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 5 MHz
Sweep 5.04 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

Attachment D-- Radiated Output Power

Measurement Data (worst case)

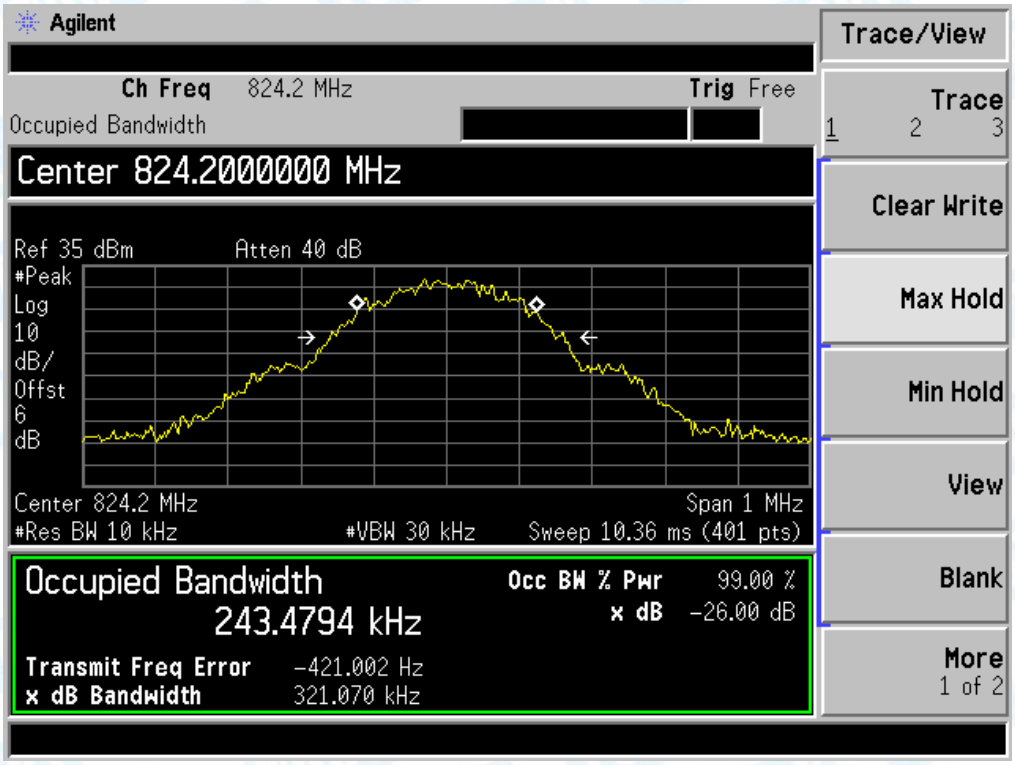
GSM 850								
Mode	Channel	Frequency (MHz)	Antenna (H&V)	SG Level (dBm)	Antenna Factor (dBd)	Cable Loss (dB)	ERP Power (dBm)	ERP Power (W)
GPRS 850 (1 Slot)	128	824.2	H	27.47	3.46	1.26	29.67	0.927
			V	23.11	3.46	1.26	25.31	0.340
	190	836.6	H	27.31	3.82	1.26	29.87	0.971
			V	22.90	3.82	1.26	25.46	0.352
	251	848.8	H	26.46	4.16	1.26	29.36	0.863
			V	22.31	4.16	1.26	25.21	0.332
Limit							38.5	7

PCS 1900								
Mode	Channel	Frequency (MHz)	Antenna (H&V)	SG Level (dBm)	Antenna Factor (dBi)	Cable Loss (dB)	EIRP Power (dBm)	EIRP Power (W)
GPRS 1900 (1 Slot)	512	1850.2	H	25.55	5.01	2.59	27.97	0.627
			V	21.15	5.01	2.59	23.57	0.228
	661	1880.0	H	24.89	4.82	2.59	27.12	0.515
			V	21.90	4.82	2.59	24.13	0.259
	810	1909.8	H	25.26	4.45	2.59	27.12	0.515
			V	21.15	4.45	2.59	23.01	0.200
Limit							33	2

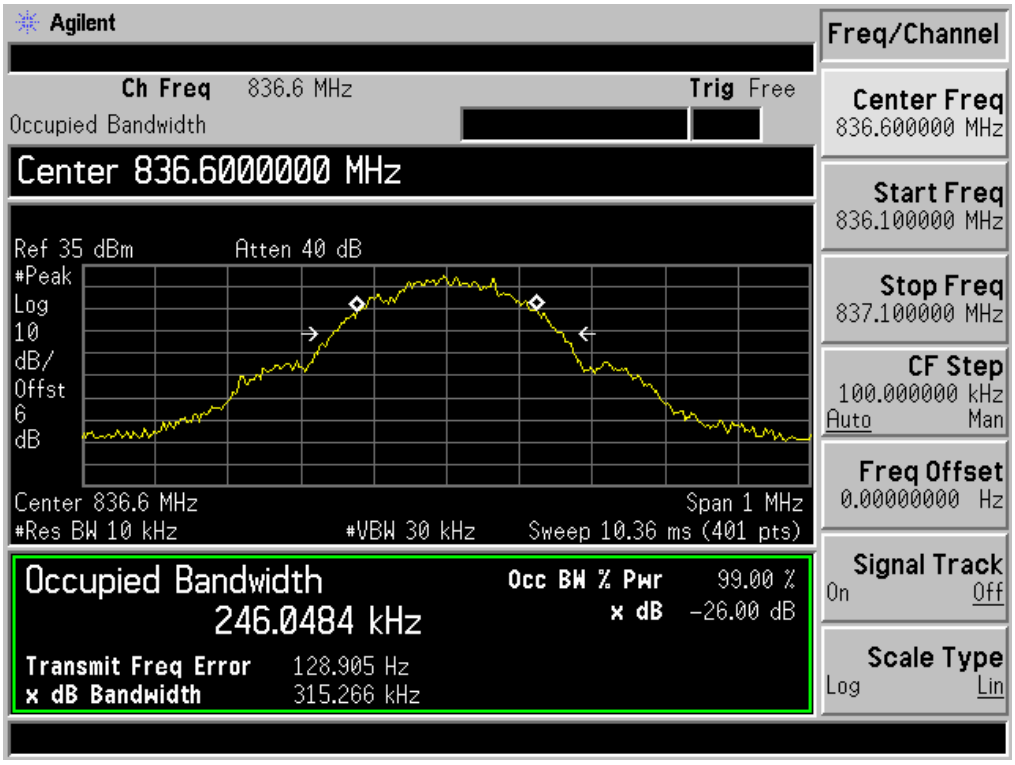
Attachment E--Occupied Bandwidth

GSM 850				
Mode	**Channel**	**Frequency (MHz)**	**99% OBW (MHz)**	**-26dB Bandwidth (kHz)**
GPRS 850 (1 Slot)	128	824.2	243.4794	312.070
	190	836.6	246.0484	315.266
	251	848.8	247.7708	318.542
PCS 1900				
Mode	**Channel**	**Frequency (MHz)**	**99% OBW (MHz)**	**-26dB Bandwidth (kHz)**
GPRS 1900 (1 Slot)	512	1850.2	243.1959	327.791
	661	1880.0	249.7716	319.769
	810	1909.8	244.4867	316.172

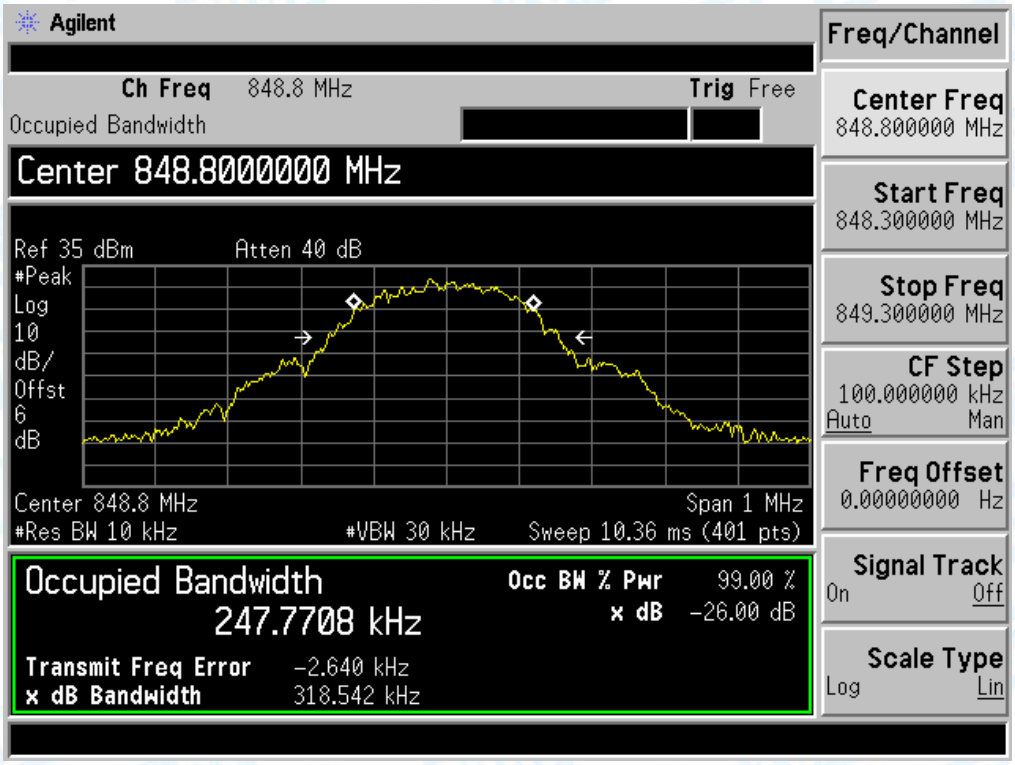
GPRS 850
CH 128



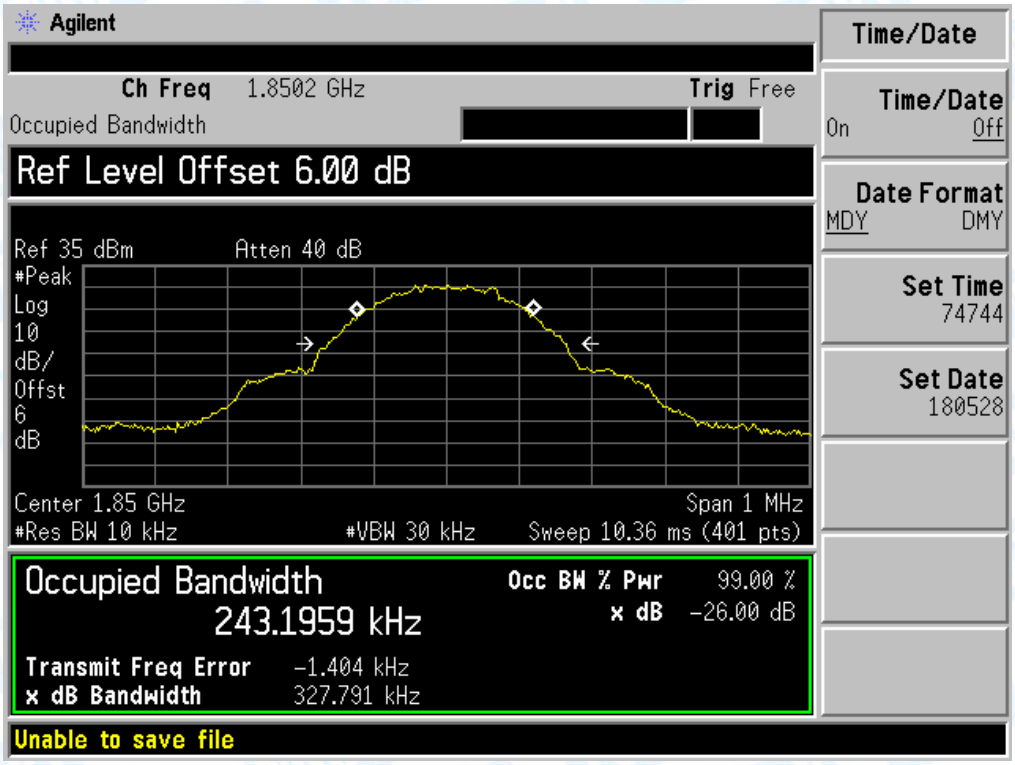
CH 190



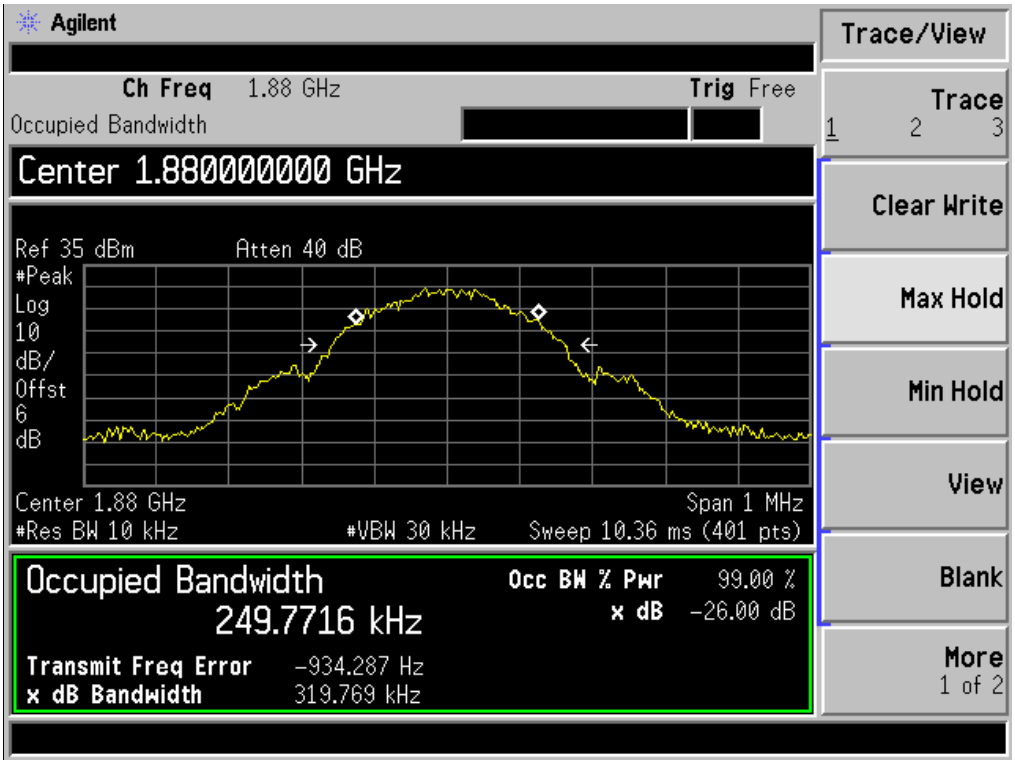
CH 251


Agilent
Ch Freq 848.8 MHz
Trig Free
Occupied Bandwidth
Center 848.8000000 MHz
Ref 35 dBm
Atten 40 dB
#Peak
Log
10
dB/
Offst
6
dB
Center 848.8 MHz
Span 1 MHz
#Res BW 10 kHz
#VBW 30 kHz
Sweep 10.36 ms (401 pts)
Occupied Bandwidth
247.7708 kHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB
Transmit Freq Error -2.640 kHz
x dB Bandwidth 318.542 kHz
Freq/Channel
Center Freq
848.800000 MHz
Start Freq
848.300000 MHz
Stop Freq
849.300000 MHz
CF Step
100.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

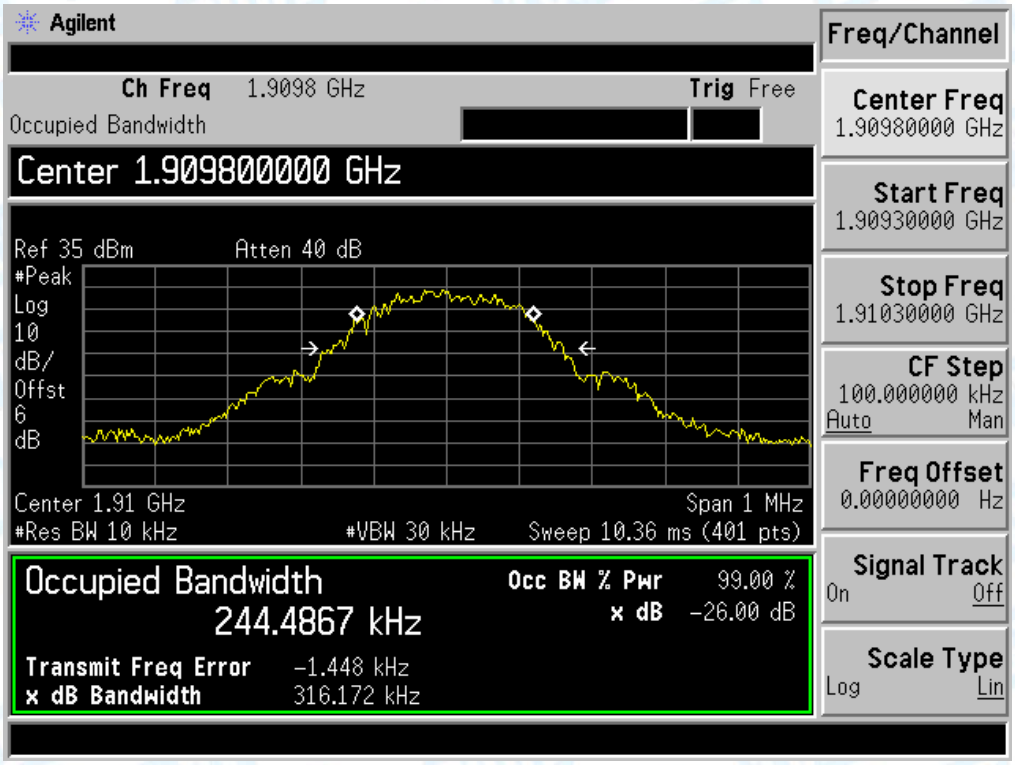
GPRS 1900
CH 512



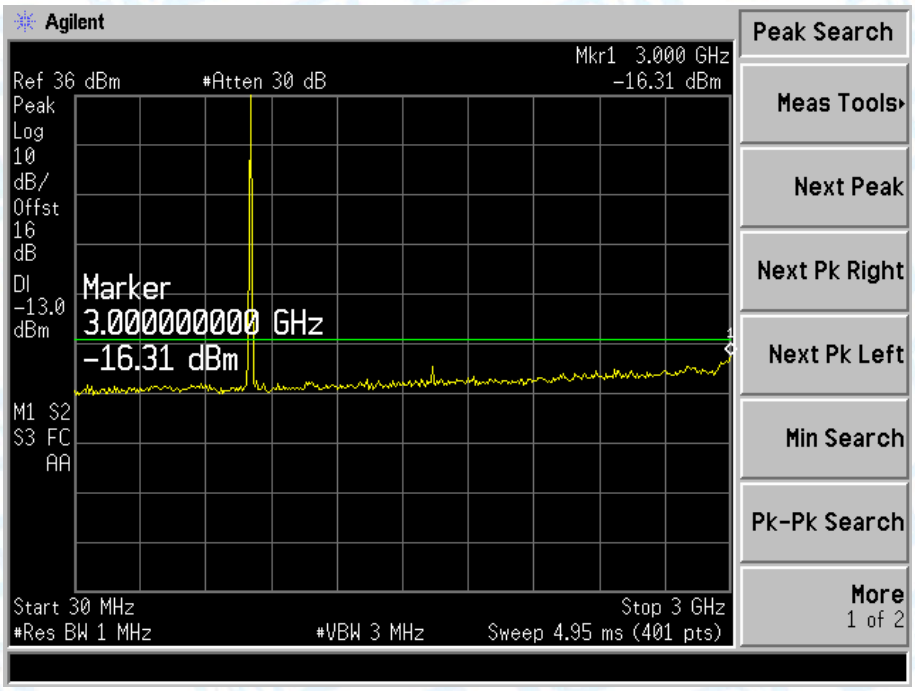
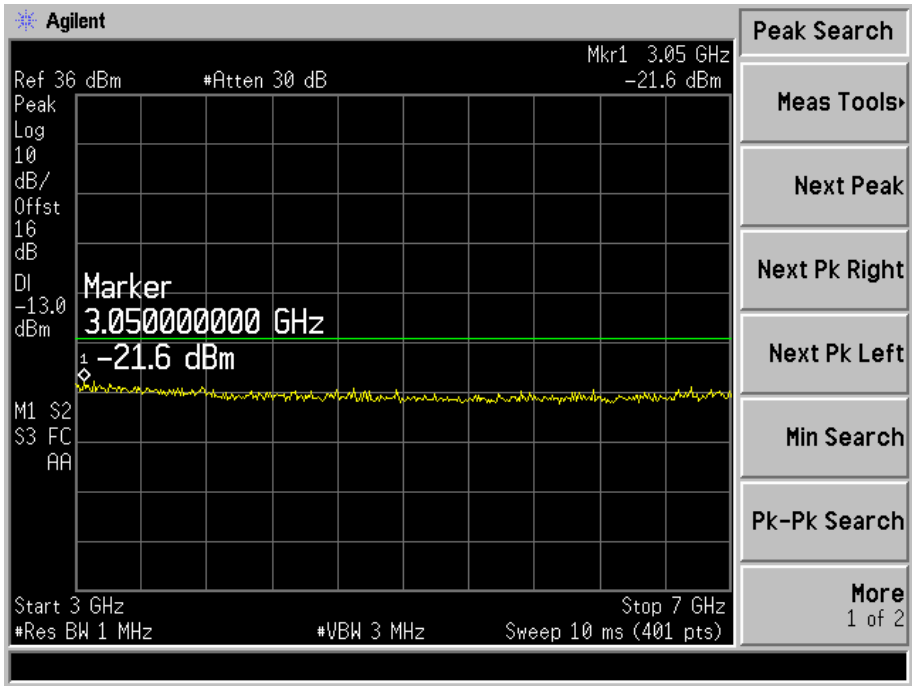
CH 661

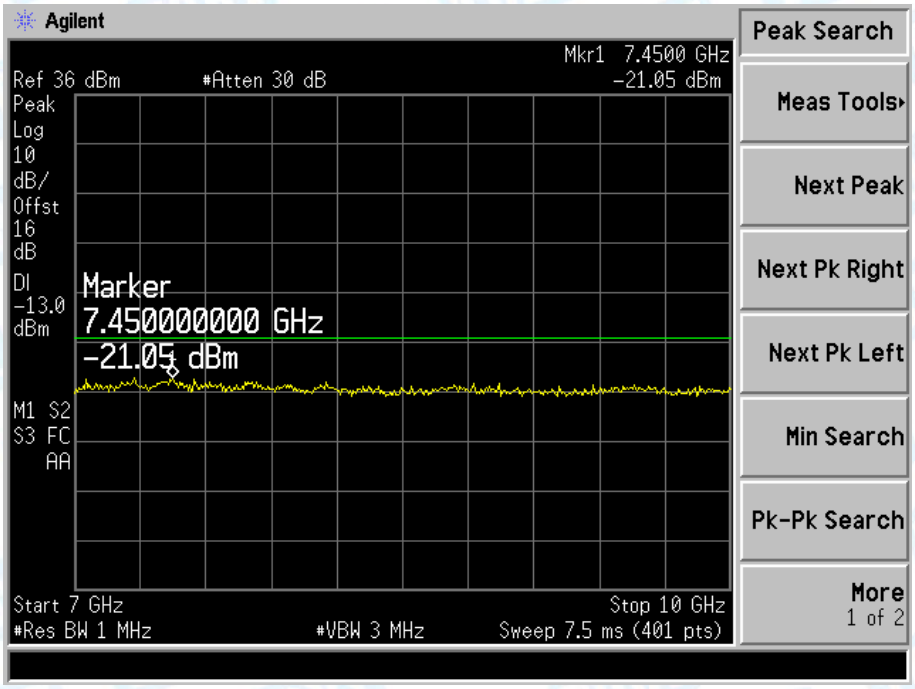


CH 810


Agilent
Ch Freq 1.9098 GHz
Trig Free
Occupied Bandwidth
Center 1.909800000 GHz
Ref 35 dBm
Atten 40 dB
#Peak
Log
10
dB/
Offst
6
dB
Center 1.91 GHz
Span 1 MHz
#Res BW 10 kHz
#VBW 30 kHz
Sweep 10.36 ms (401 pts)
Occupied Bandwidth
244.4867 kHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB
Transmit Freq Error -1.448 kHz
x dB Bandwidth 316.172 kHz
Freq/Channel
Center Freq
1.90980000 GHz
Start Freq
1.90930000 GHz
Stop Freq
1.91030000 GHz
CF Step
100.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

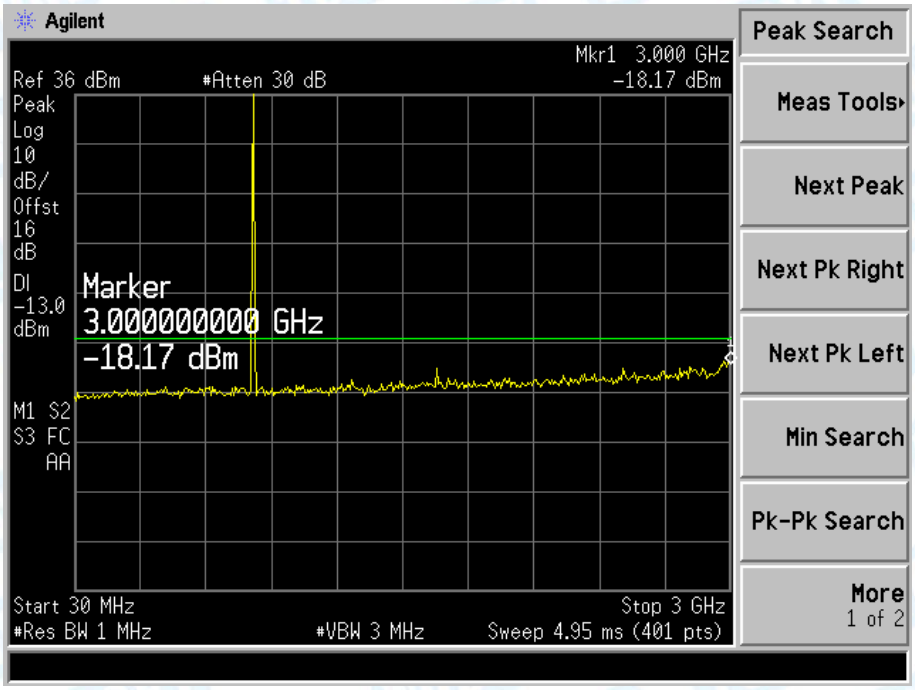
Attachment F--Conducted Out of Band Emissions

GSM850 CH 128
30 MHz~ 3 GHz

3 GHz~7 GHz


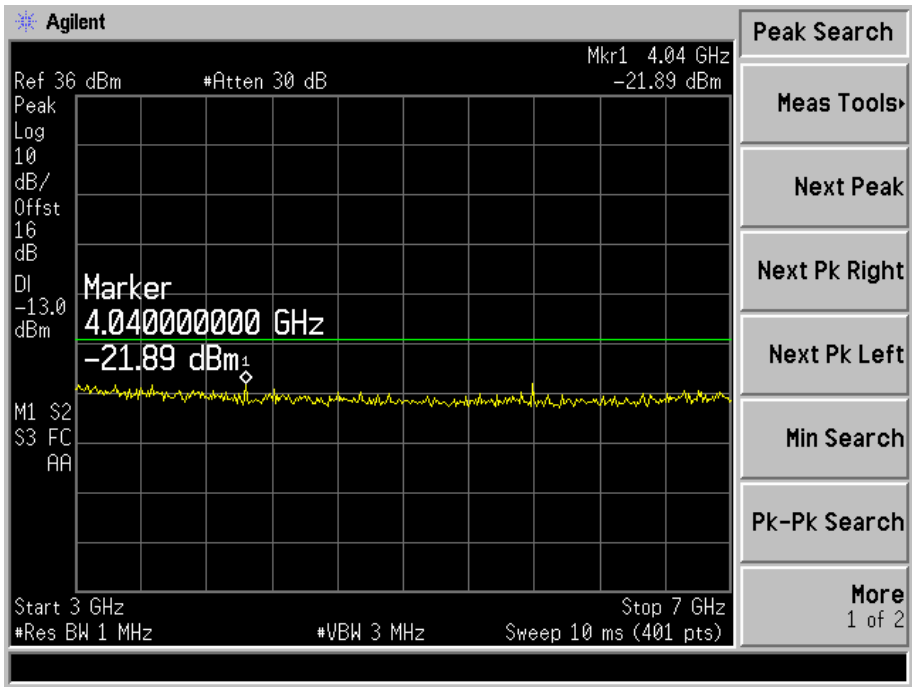
7 GHz~10 GHz


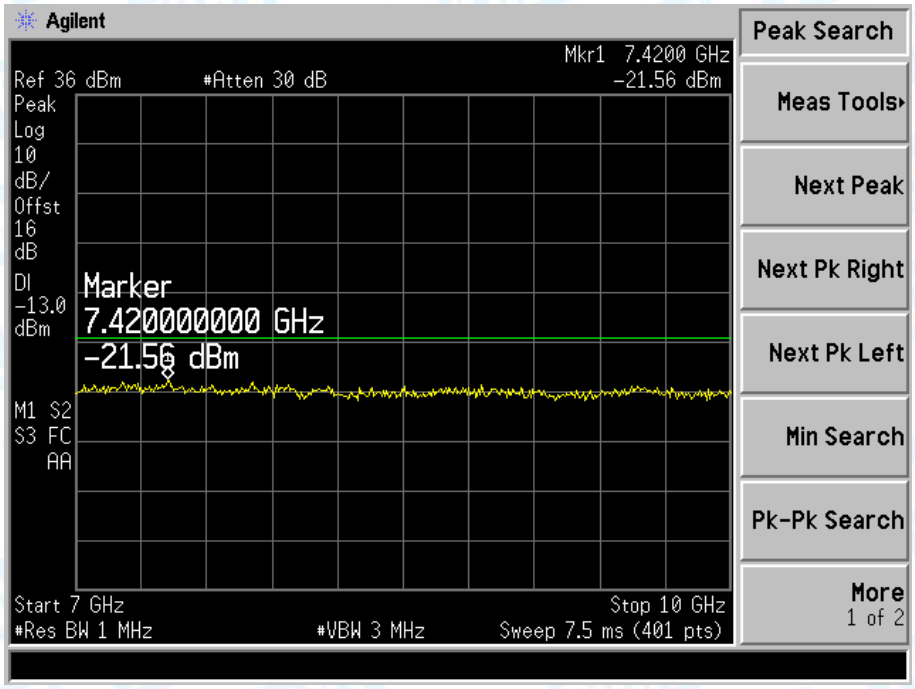
Agilent
Mkr1 7.4500 GHz
Ref 36 dBm
#Atten 30 dB
-21.05 dBm
Peak
Log
10
dB/
Offst
16
dB
Dl
-13.0
dBm
Marker
7.450000000 GHz
-21.05 dBm
M1 S2
S3 FC
AA
Start 7 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 10 GHz
Sweep 7.5 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

GSM850 CH 190
30 MHz~ 3 GHz



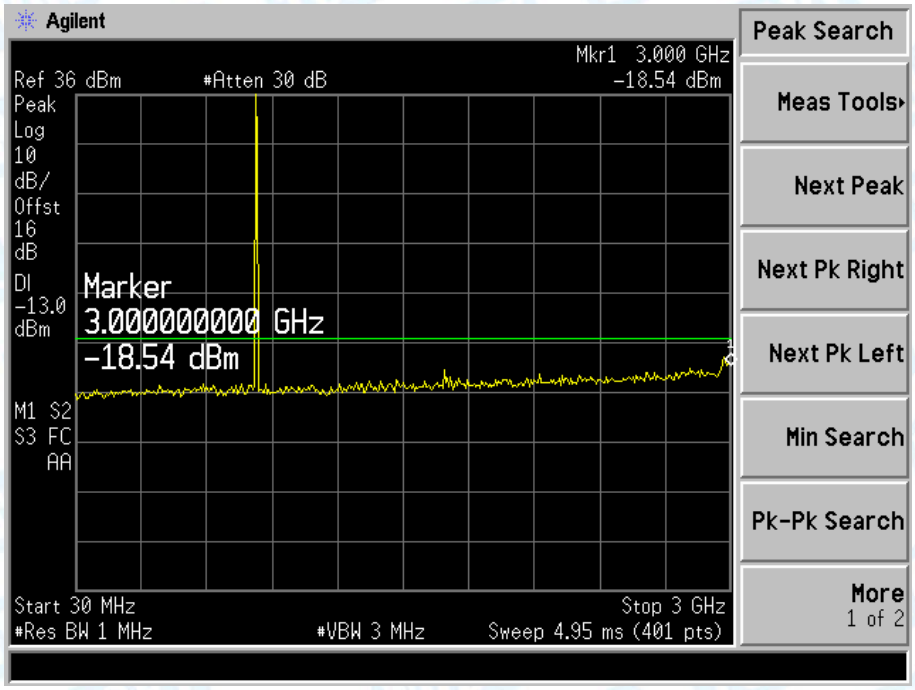
3 GHz~7 GHz



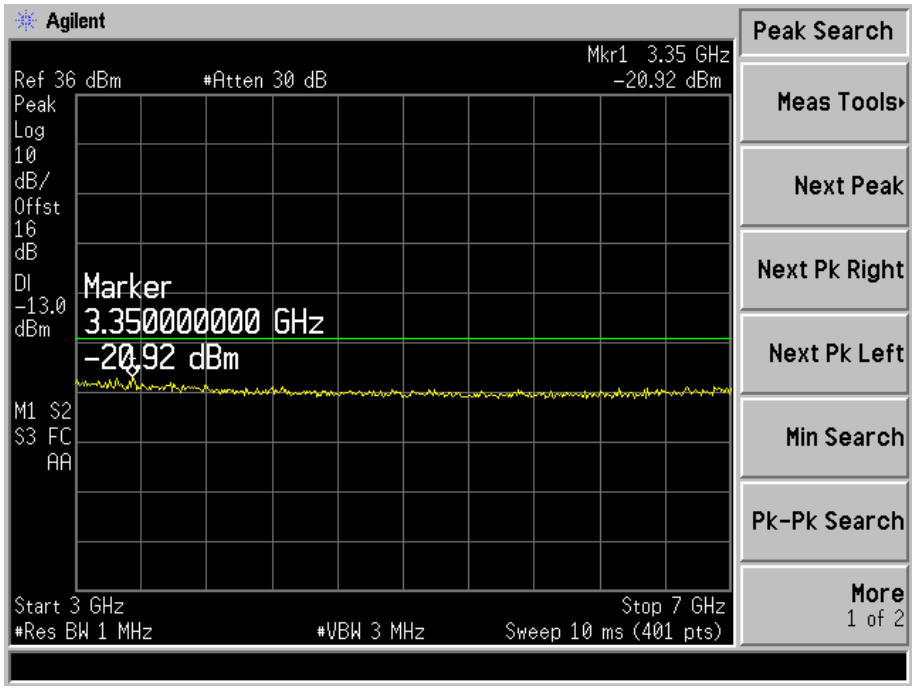
7 GHz~10 GHz


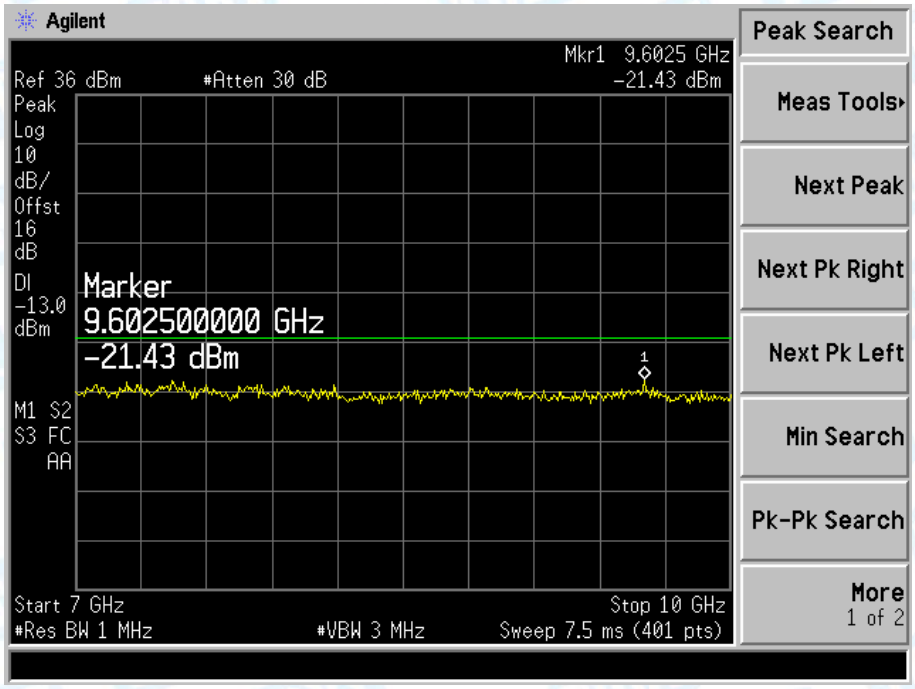
Agilent
Mkr1 7.4200 GHz
Ref 36 dBm
#Atten 30 dB
-21.56 dBm
Peak
Log
10
dB/
Offst
16
dB
Dl
-13.0
dBm
Marker
7.420000000 GHz
-21.56 dBm
M1 S2
S3 FC
AA
Start 7 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 10 GHz
Sweep 7.5 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

GSM850 CH 251
30 MHz~ 3 GHz



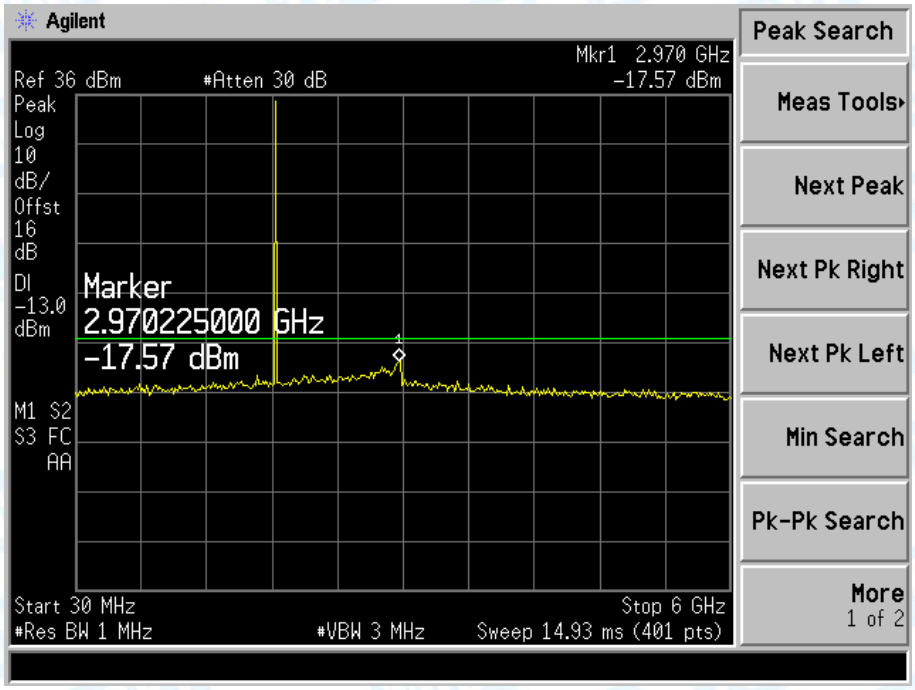
3 GHz~7 GHz



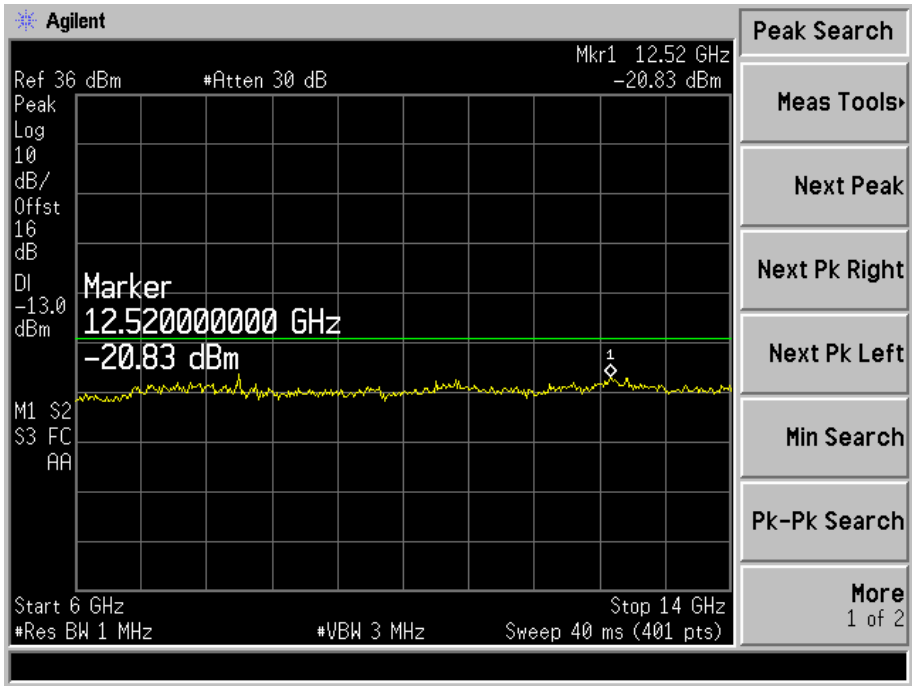
7 GHz~10 GHz


Agilent
Mkr1 9.6025 GHz
Ref 36 dBm
#Atten 30 dB
-21.43 dBm
Peak
Log
10
dB/
Offst
16
dB
Dl
-13.0
dBm
Marker
9.602500000 GHz
-21.43 dBm
M1 S2
S3 FC
AA
Start 7 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 10 GHz
Sweep 7.5 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

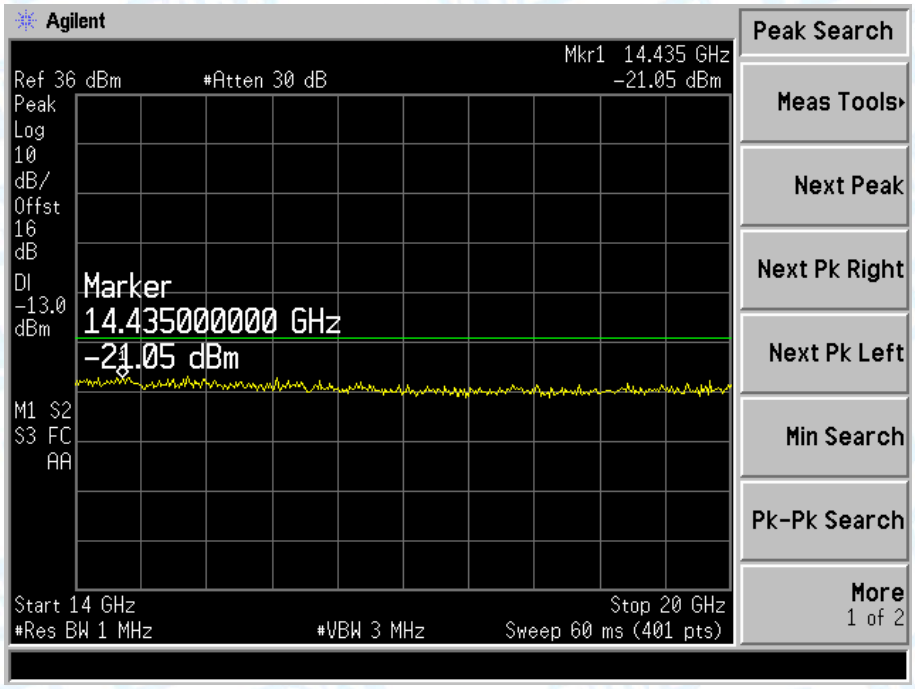
PCS 1900 CH 512
30 MHz~ 6 GHz



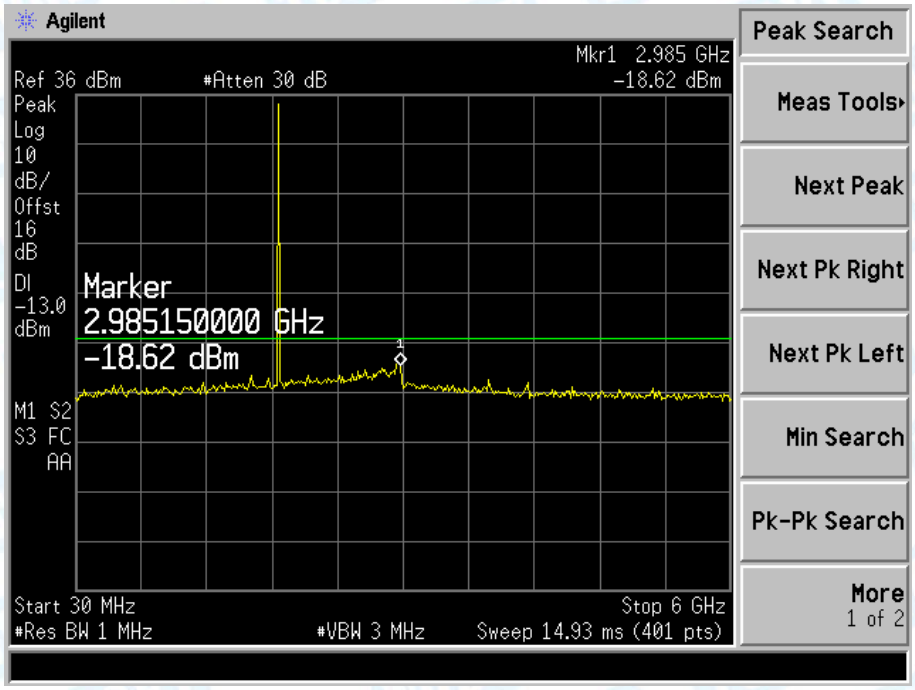
6 GHz~14 GHz



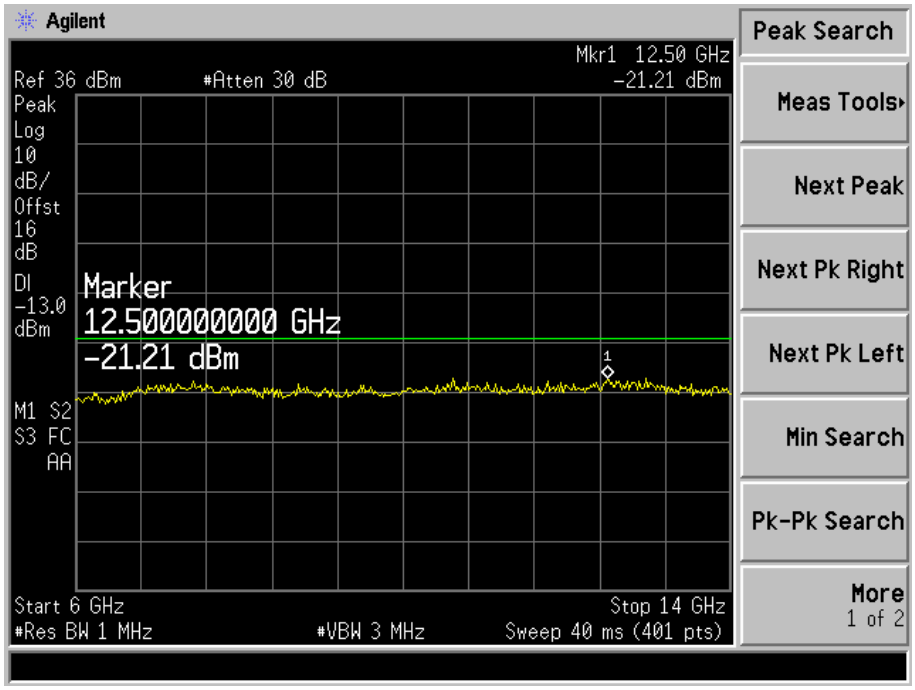
14 GHz~20 GHz


Agilent
Mkr1 14.435 GHz
Ref 36 dBm
#Atten 30 dB
-21.05 dBm
Peak
Log
10
dB/
Offst
16
dB
Dl
-13.0
dBm
Marker
14.435000000 GHz
-21.05 dBm
M1 S2
S3 FC
AA
Start 14 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 20 GHz
Sweep 60 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

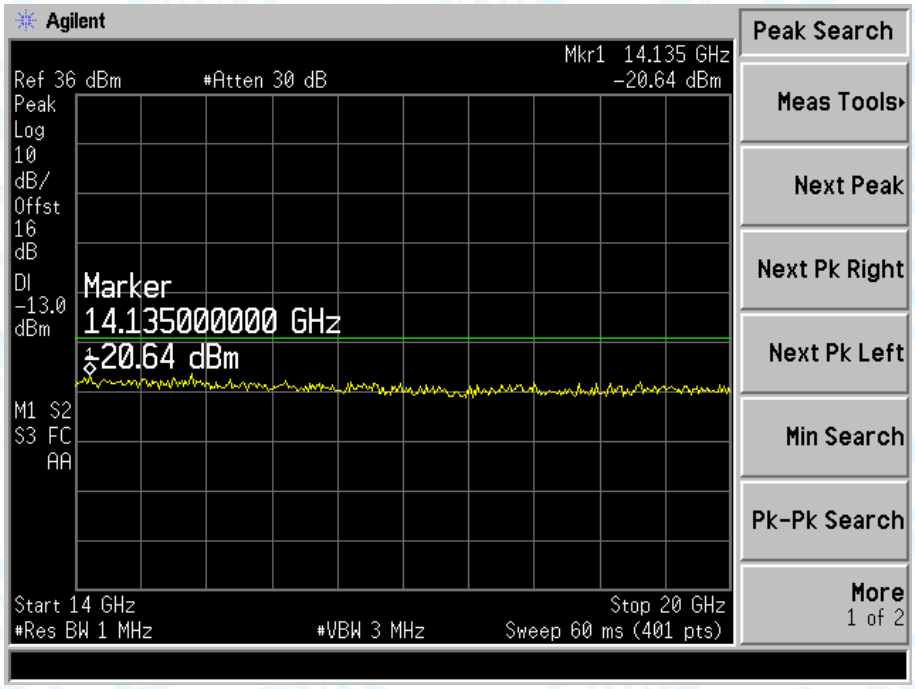
PCS 1900 CH 661
30 MHz~ 6 GHz

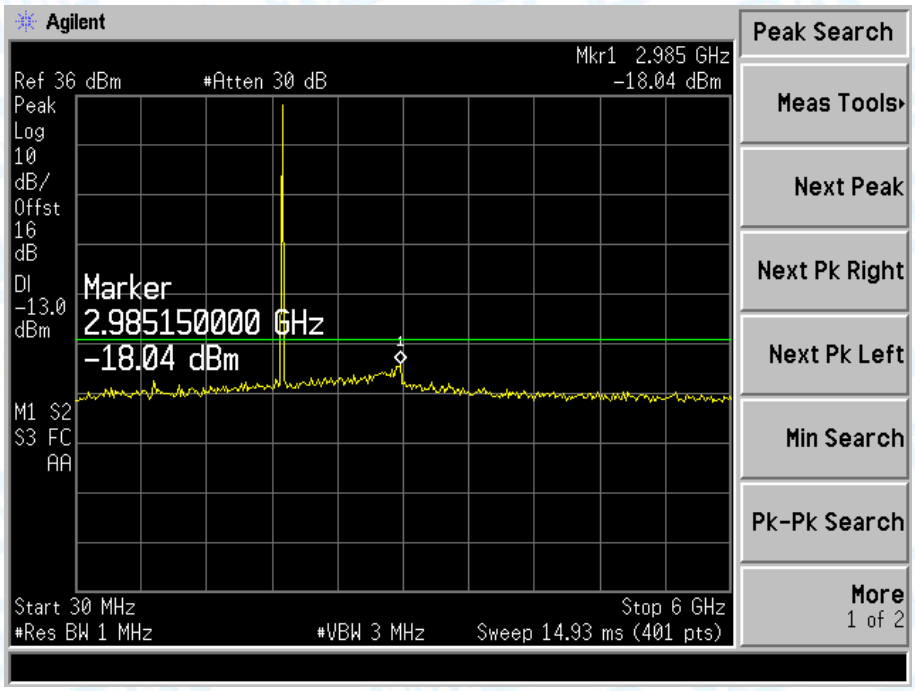
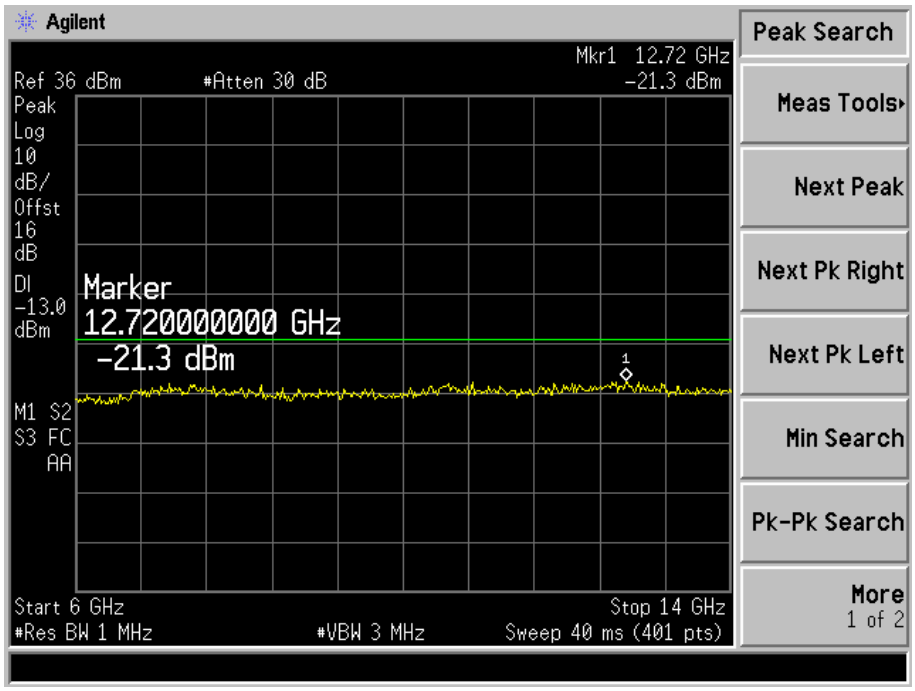


6 GHz~14 GHz

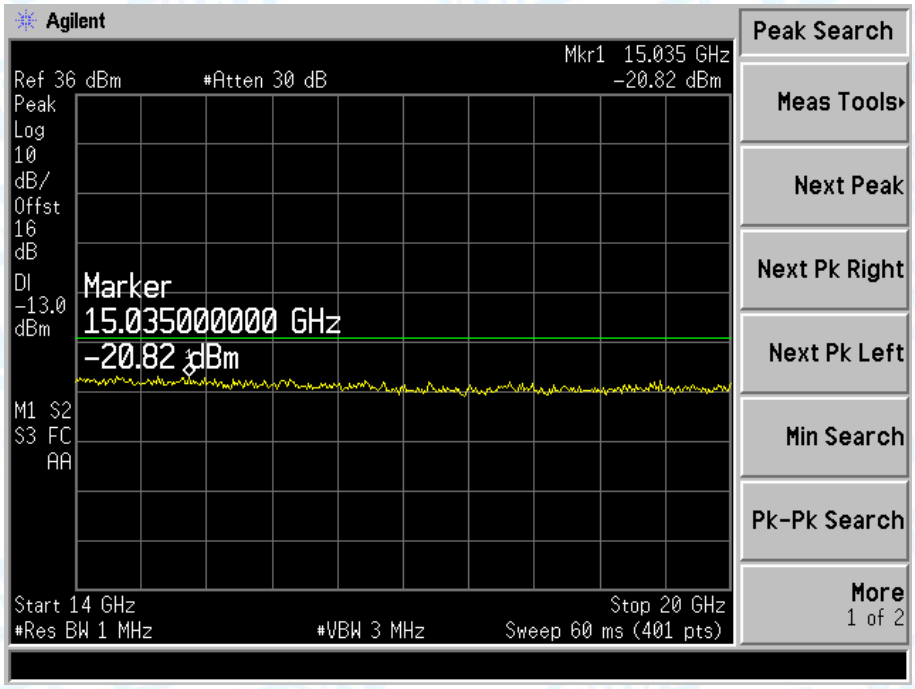


14 GHz~20 GHz


Agilent
Mkr1 14.135 GHz
Ref 36 dBm
#Atten 30 dB
-20.64 dBm
Peak
Log
10
dB/
Offst
16
dB
Dl
-13.0
dBm
Marker
14.135000000 GHz
20.64 dBm
M1 S2
S3 FC
AA
Start 14 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 20 GHz
Sweep 60 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

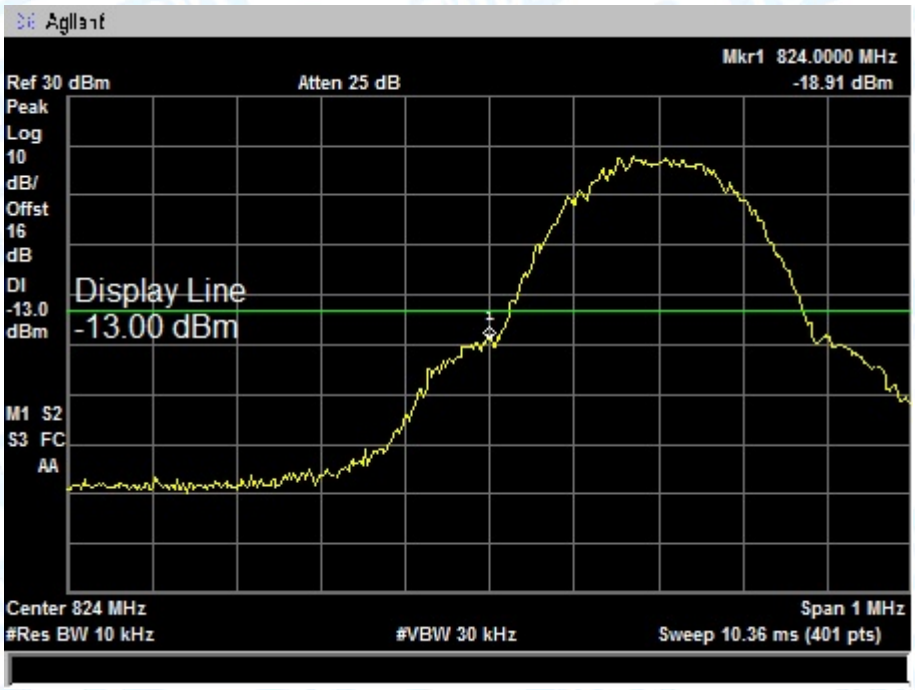
PCS 1900 CH 810
30 MHz~ 6 GHz

6 GHz~14 GHz


14 GHz~20 GHz

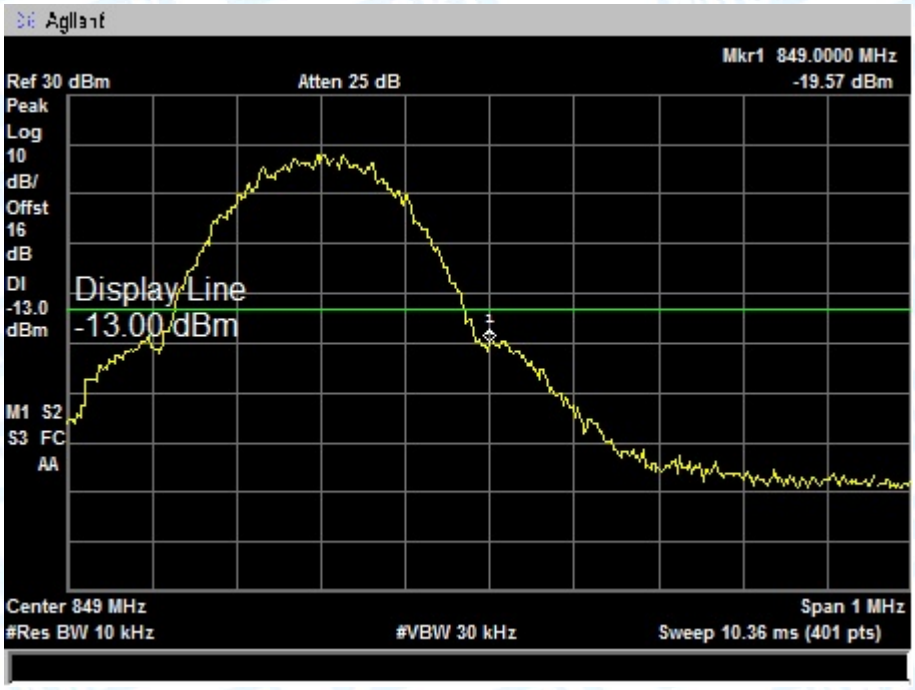

Agilent
Mkr1 15.035 GHz
Ref 36 dBm
#Atten 30 dB
-20.82 dBm
Peak
Log
10
dB/
Offst
16
dB
Dl
-13.0
dBm
Marker
15.035000000 GHz
-20.82 dBm
M1 S2
S3 FC
AA
Start 14 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 20 GHz
Sweep 60 ms (401 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

Attachment G-- Band Edge Test

Test Mode:	GPRS850

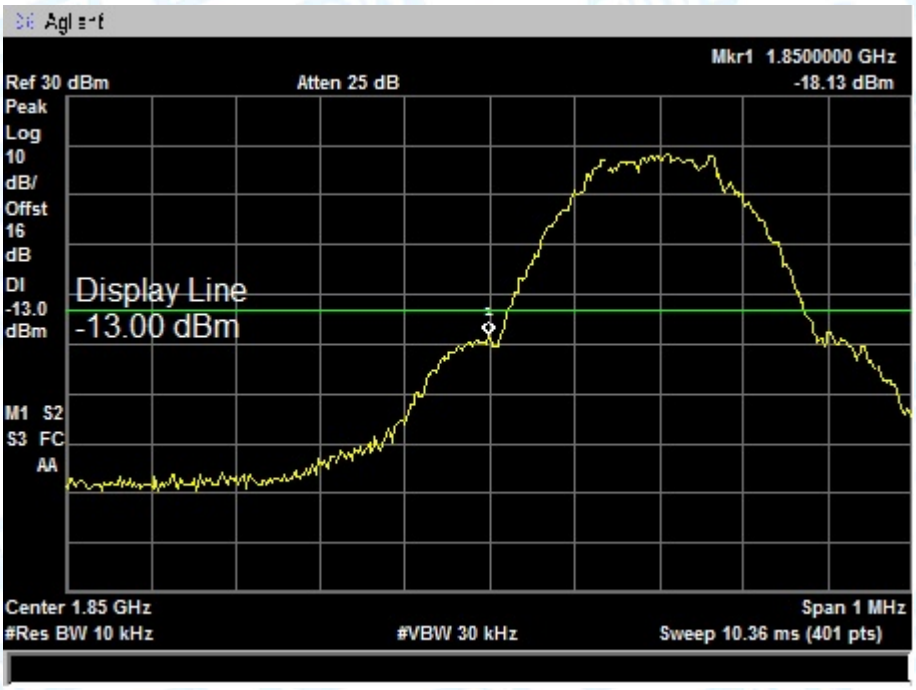


Lowest channel

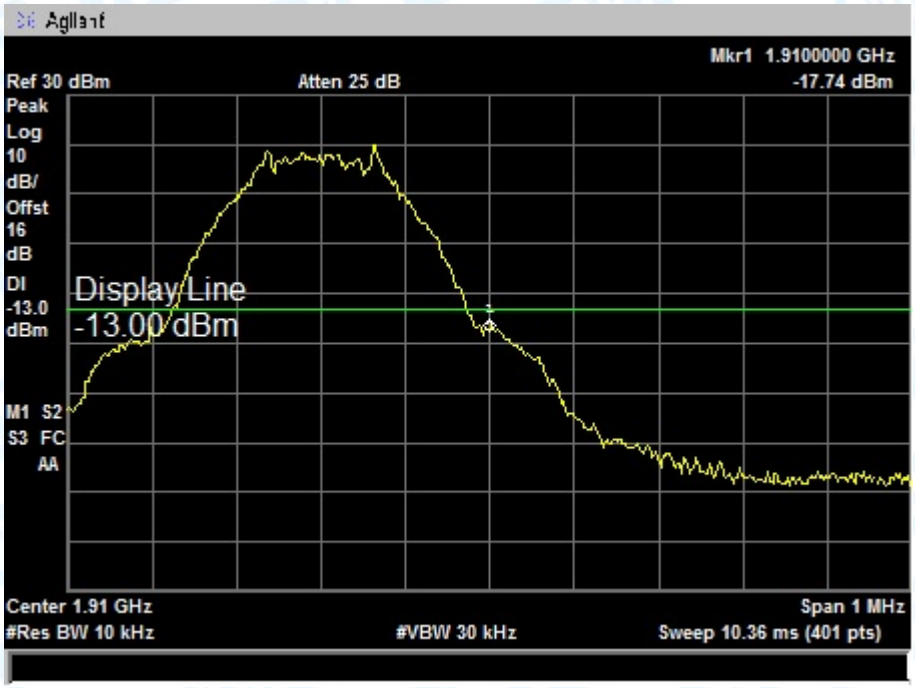


Highest channel

Test Mode:	GPRS1900



Lowest channel



Highest channel

Attachment H--Radiated Out Band of Emissions

Measurement Data (worst case)

Test mode:	**GPRS 850**						
Channel:	**Middle**			**Date of Test:**	**2018-06-12**		
Frequency (MHz)	Spurious Emission					Limit (dBm)	Result
	Polarization (H&V)	Read Level (dBm)	Antenna Correct Factor (dBi)	Cable Loss (dB)	Emission Level (dBm)		
1673.20	Horizontal	-34.68	7.49	3.97	-23.68	-13.00	Pass
2509.80	H	-43.28	7.03	5.05	-25.75		
3346.40	H	-47.99	12.48	5.98	-29.53		
4183.00	H		---	---	---		
5019.60	H	---	---	---	---		
5856.20	H	---	---	---	---		
1673.20	Vertical	-38.25	8.02	3.97	-23.81	-13.00	Pass
2509.80	V	-47.68	10.47	5.05	-25.71		
3346.40	V	-50.40	16.92	5.98	-29.38		
4183.00	V	---	---	---	---		
5019.60	V	---	---	---	---		
5856.20	V	---	---	---	---		

Remark: 1, The testing has been conformed to 10*836.6MHz=8,366MHz.
2, All other emissions more than 30 dB below the limit.
3, Emission Level= Read Level+ Antenna Correct Factor +Cable Loss

Test mode:	GPRS 1900						
Channel:	Middle			Date of Test:	2018-06-12		
Frequency (MHz)	Spurious Emission					Limit (dBm)	Result
	Polarization (H&V)	Read Level (dBm)	Antenna Correct Factor (dBi)	Cable Loss (dB)	Emission Level (dBm)		
3760.00	Horizontal	-36.41	14.70	6.12	-19.68	-13.00	Pass
5640.00	H	-45.26	13.67	7.86	-22.74		
7520.00	H	-47.86	14.27	9.54	-26.56		
9400.00	H	---	---	---	---		
11280.00	H	---	---	---	---		
13160.00	H	---	---	---	---		
3760.00	Vertical	-42.24	15.81	6.12	-20.31	-13.00	Pass
5640.00	V	-45.18	13.80	7.86	-23.52		
7520.00	V	-49.42	13.40	9.54	-26.48		
9400.00	V	---	---	---	---		
11280.00	V	---	---	---	---		
13160.00	V	---	---	---	---		
Remark: 1, The testing has been conformed to 10*1880.0MHz=18,800MHz. 2, All other emissions more than 30 dB below the limit. 3, Emission Level= Read Level+ Antenna Correct Factor +Cable Loss							

------End of the Report------