



MEASUREMENT REPORT

FCC PART 22&24

FCC ID: 2ACS2-M1

APPLICANT: MiiTech LLC

Application Type: Certification

Product: MiiLink

Model No.: M1

FCC Classification: PCS Licensed Transmitter Worn to Body (PCT)

FCC Rule Part(s): Part2, Part22 Subpart H, Part24 Subpart E

Test Procedure(s): ANSI/TIA-603-D-2010, KDB 971168 D01v02r01

Test Date: July 10 ~ July 26, 2014

Reviewed By : Robin Wu
(Robin Wu)

Approved By : Marlin Chen
(Marlin Chen)

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date
1407RSU01604	Rev. 01	Initial report	07-27-2014
1407RSU01604	Rev. 02	Modify the FCC Classification	07-31-2014
1407RSU01604	Rev. 03	Modify the test procedure rule and some output power	08-01-2014
1407RSU01604	Rev. 04	Modify the power of EDGE1900 mode	08-04-2014
1407RSU01604	Rev. 05	Modify the test procedure rule and added some descriptions for band-edge test.	08-11-2014

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§2.1033 General Information

Applicant:	MiiTech LLC
Applicant Address:	46616 Pinehurst Cir. Northville MI.48168, USA
Manufacturer:	MiiTech LLC
Manufacturer Address:	46616 Pinehurst Cir. Northville MI.48168, USA
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT Registration No.:	809388
FCC Rule Part(s):	Part22 Subpart H, Part24 Subpart E
Model No.:	M1
FCC ID:	2ACS2-M1
Test Device Serial No.:	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering
FCC Classification:	PCS Licensed Transmitter Worn to Body (PCT)
Date(s) of Test:	July 10 ~ July 26, 2014
Test Report S/N:	1407RSU01604

1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name	MiiLink
Model No.	M1
GPS Function	Support
Antenna Type	Internal
Antenna Gain	GSM850: -1.0dBi PCS1900: 1.2dBi
Type of Modulation	GSM / GPRS: GMSK; EDGE: 8PSK

2.2. Device Capabilities

This device contains the following capabilities:

850/1900 GPRS/EDGE, GPS

2.3. Test Configuration

The **MiiLink FCC ID: 2ACS2-M1** was tested per the guidance of ANSI/TIA-603-D-2010 and KDB 971168 D01v02r01. See section 3.0 of this report for a description of the radiated and antenna port conducted emissions tests.

2.4. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

3. DESCRIPTION OF TEST

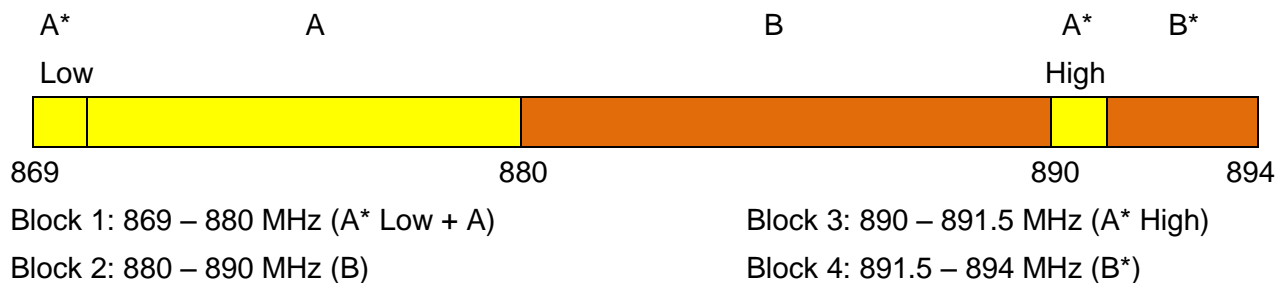
3.1. Evaluation Procedure

The measurement procedures described in the “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI/TIA-603-D-2010) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168) were used in the measurement of the **MiiLink FCC ID: 2ACS2-M1**.

Deviation from measurement procedure.....None

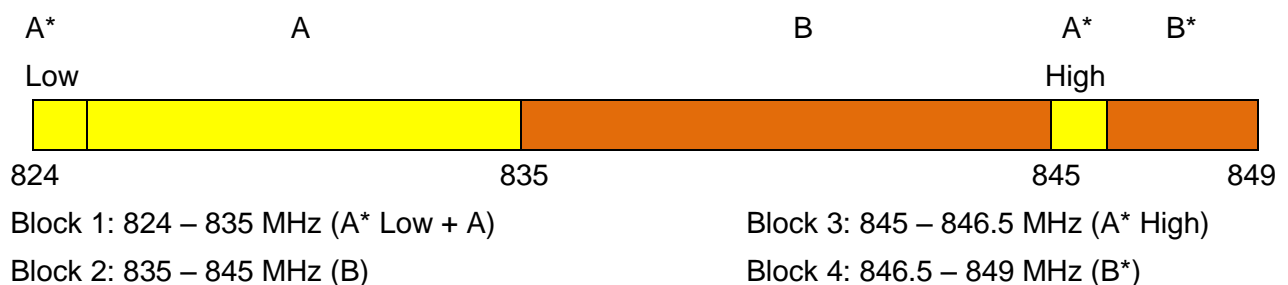
3.2. Cellular – Base Frequency Blocks

§22.905



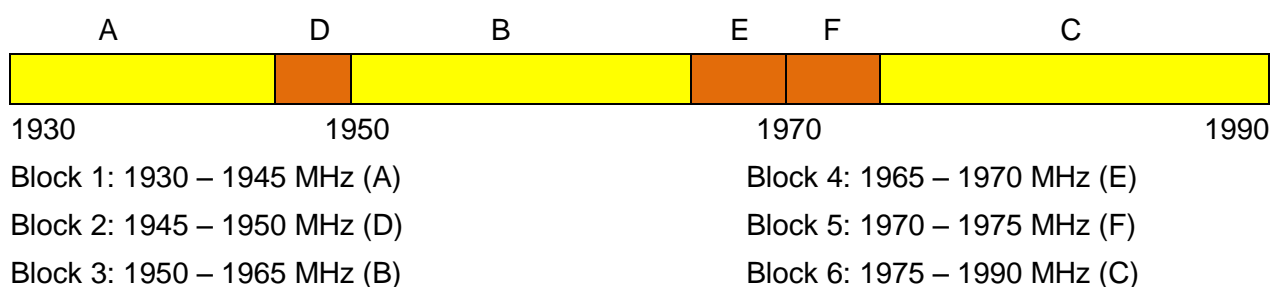
3.3. Cellular – Mobile Frequency Blocks

§22.905



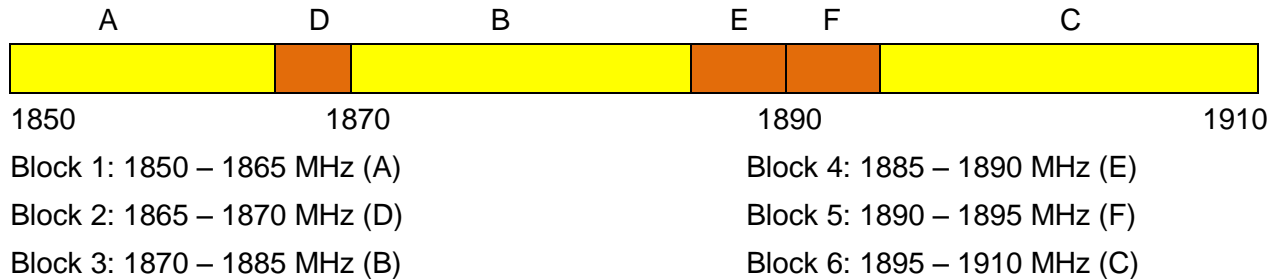
3.4. PCS – Base Frequency Blocks

§24.229



3.5. PCS – Mobile Frequency Blocks

§24.229



3.6. Occupied Bandwidth

§2.1049

The occupied bandwidth, that 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 shall be measured. The spectrum analyzers' "occupied bandwidth" measurement function was used to record the occupied bandwidth in accordance with KDB 971168.

3.7. Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §22.917(a) §24.238(a)

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for Part 22 and 1 MHz or greater for Part 24. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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 emission are attenuated at least 26 dB below the transmitter power.

3.8. Radiated Power and Radiated Spurious Emissions

§2.1053 §22.913(a.2) §22.917(a) §24.232(c) §24.238(a)

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurement and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer "Channel Power" function with the integration band set to the emissions' occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168.

Per the guidance of ANSI/TIA-603-D-2010, a half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_d \text{ [dBm]} = P_g \text{ [dBm]} - \text{cable loss [dB]} + \text{antenna gain [dBd/dBi]}$$

Where, P_d is the dipole equivalent power, P_g is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_g \text{ [dBm]} - \text{cable loss [dB]}$.

The calculated P_d levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of $43 + 10 \cdot \log_{10}(\text{Power [Watts]})$ specified

in 22.917(a) and 24.238(a).

3.9. Peak-Average Ratio

§24.232(d)

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

For pulsed signals, 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 the transmitter is operating at maximum power. For continuous signals, the trigger is set to “free run” in the CCDF measurement mode.

3.10. Frequency Stability / Temperature Variation

§2.1055 §22.355 §22.863 §22.905 §24.229 §24.235

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-D-2010. The frequency stability of the transmitter is measured by:

- a.) Temperature: The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- b.) Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – For Part 22, the frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency. For Part 24, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Time Period and Procedure:

- 1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
- 2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
- 3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

4. TEST EQUIPMENT CALIBRATION DATA

Radiated Emission

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cal. Date
Spectrum Analyzer	Agilent	N9010A	MY5144016A	1 year	2015/01/04
Radio Communication Tester	R&S	CMU 200	117129	1 year	2014/12/14
Preamplifier	MRT	AP01G18	1310002	1 year	2014/12/14
Loop Antenna	Schwarzbeck	FMZB1519	1519-041	1 year	2014/11/24
TRILOG Antenna	Schwarzbeck	VULB9162	9162-047	1 year	2014/11/24
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1167	1 year	2014/11/24
Broadband Horn Antenna	Schwarzbeck	BBHA9170	9170-549	1 year	2014/12/11
Temperature/Humidity Meter	Anymetre	TH101B	AC1-01	1 year	2014/11/15

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	E4447A	MY45300136	1 year	2014/11/08
Radio Communication Tester	R&S	CMU 200	117129	1 year	2014/12/14
DC Power Supply	GWINSTEK	GPS-3030D	EM861052	1 year	2014/11/14
Programmable Temperature & Humidity Chamber	BAOYT	BYH-1500L	1309W043	1 year	2014/11/20
Temperature/Humidity Meter	Anymetre	TH101B	TR3-01	1 year	2014/11/15

5. SAMPLE CALCULATIONS

GSM Emission Designator

Emission Designator = 250KGXW

GSM BW = 250 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 250KG7W

GSM BW = 250 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

Spurious Radiated Emission

Example: Spurious emission at 3700.40 MHz

The receive spectrum analyzer reading at 3 meters with the EUT on the turntable was -81.0dBm.

The gain of the substituted antenna is 8.1dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of -81.0dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3700.40MHz. So 6.1 dB is added to the signal generator reading of -30.9dBm yielding -24.80dBm. The fundamental EIRP was 25.50dBm so this harmonic was $25.50\text{dBm} - (-24.80) = 50.3\text{dBc}$.

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ($U=2U_c(y)$): 9kHz ~ 1GHz: $\pm 4.18\text{dB}$ 1GHz ~ 40GHz: $\pm 4.76\text{dB}$

7. TEST RESULT

7.1. Summary

Company Name: MiiTech LLC
FCC ID: 2ACS2-M1
FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)
Mode(s): GPRS/EDGE

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
<u>Transmitter Mode(TX)</u>					
2.1049	Occupied bandwidth	N/A	Conducted	Pass	Section 7.2
2.1051 22.917(a) 24.238(a)	Band Edge / Conducted Spurious Emissions	> 43 + log10 (P[Watts]) at Band Edge and for all out-of-band emissions		Pass	Section 7.3
24.232(d)	Peak-Average Ratio	< 13 dB		Pass	Section 7.5
2.1046	Transmitter Conducted Output Power	N/A		Pass	RF Exposure Report
22.913(a.2)	Effective Radiated Power	< 7 Watts max. ERP	Radiated	Pass	Section 7.4
24.232(c)	Equivalent Isotropic Radiated Power	< 2 Watts max. EIRP		Pass	Section 7.4
2.1053 22.917(a) 24.238(a)	Undesirable Emissions	> 43 + log10 (P[Watts]) for all out-of-band emissions		Pass	Section 7.4
2.1055 22.355 24.235	Frequency Stability	< 2.5 ppm (Part 22) Emission must remain in band (Part 24)		Pass	Section 7.6

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in Section 4.0 were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.

7.2. Occupied Bandwidth

7.2.1. Test Limit

N/A

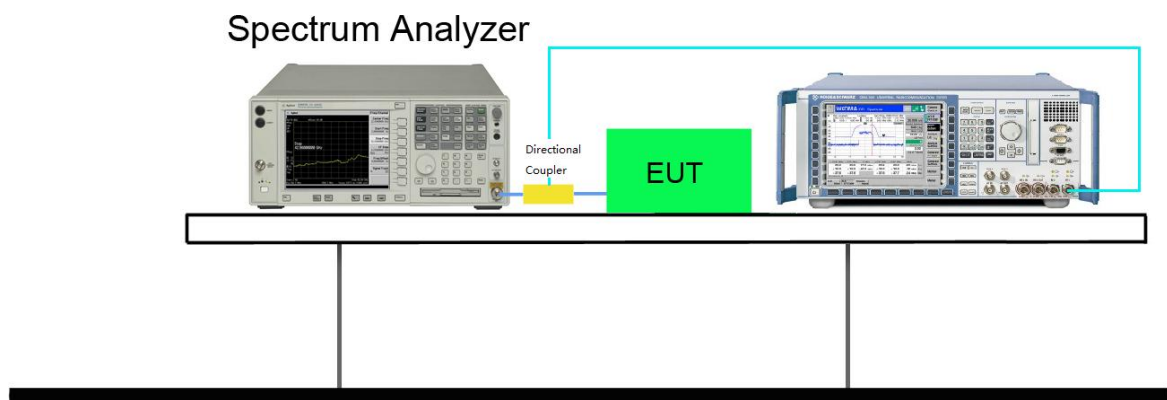
7.2.2. Test Procedure used

KDB 971168 D01v02r01 – Section 4.1 & ANSI/TIA-603-D-2010

7.2.3. Test Setting

1. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency.
The span range for the spectrum analyzer shall be between two and five times the anticipated OBW. RBW = approximately 1% of the emission bandwidth.
2. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
3. Set the detection mode to peak, and the trace mode to max hold.
4. Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.

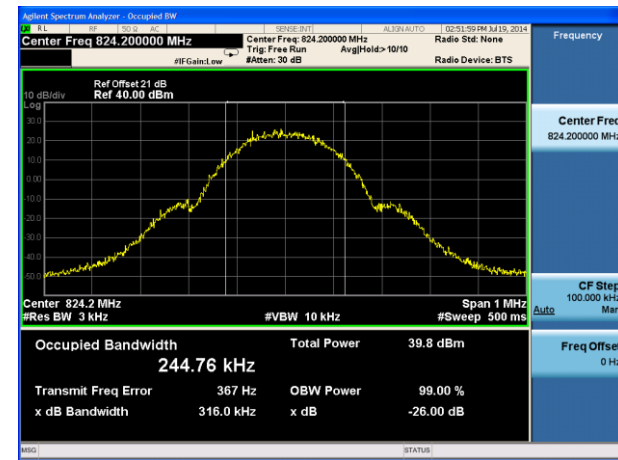
7.2.4. Test Setup



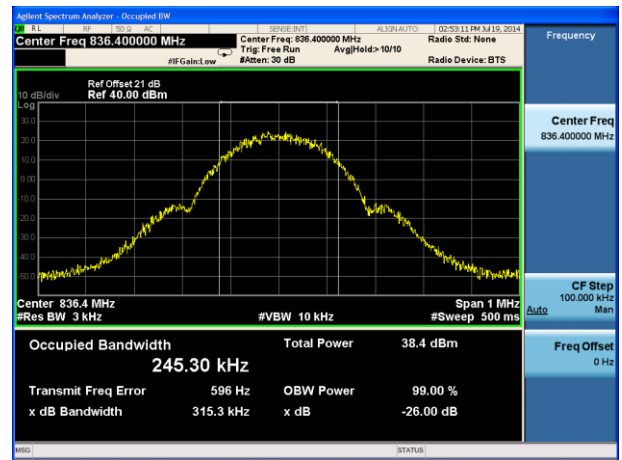
7.2.5. Test Result

Test Mode	Channel No.	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26dB Occupied Bandwidth (kHz)	Result
GSM850	128	824.2	244.76	316.00	Pass
	189	836.4	245.30	315.30	Pass
	251	848.8	241.85	313.40	Pass
PCS1900	512	1850.2	243.60	316.10	Pass
	661	1880.0	246.27	316.70	Pass
	810	1909.8	244.18	314.00	Pass
EDGE850	128	824.2	244.78	319.60	Pass
	189	836.4	243.58	320.50	Pass
	251	848.8	246.11	317.40	Pass
EDGE1900	512	1850.2	242.56	314.90	Pass
	661	1880.0	245.95	319.70	Pass
	810	1909.8	244.63	311.50	Pass

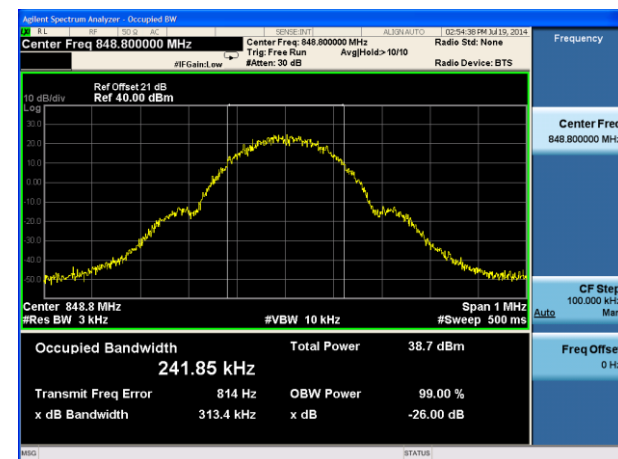
GSM850 Channel 128 (824.2MHz)



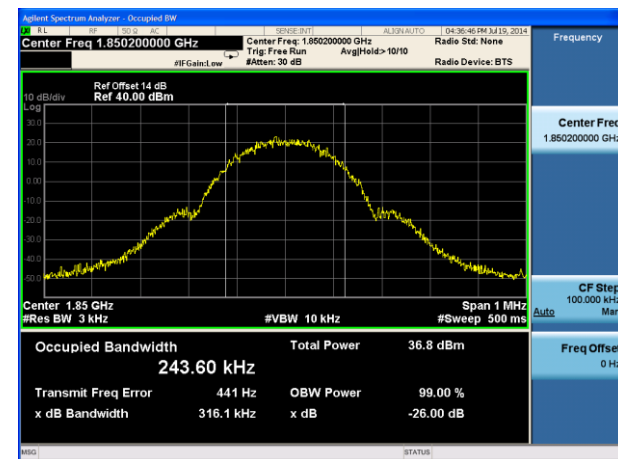
GSM850 Channel 189 (836.4MHz)



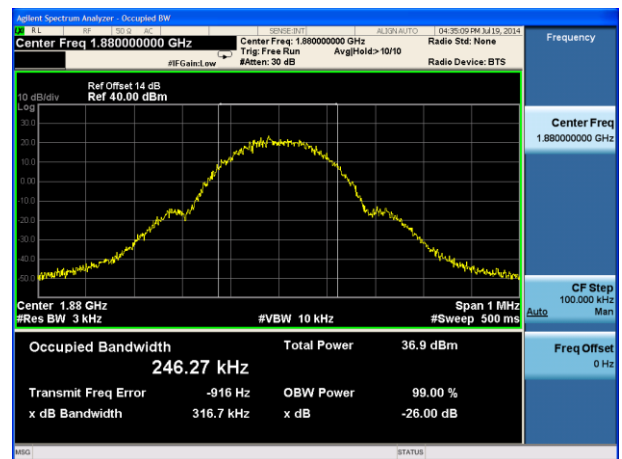
GSM850 Channel 251 (848.8MHz)



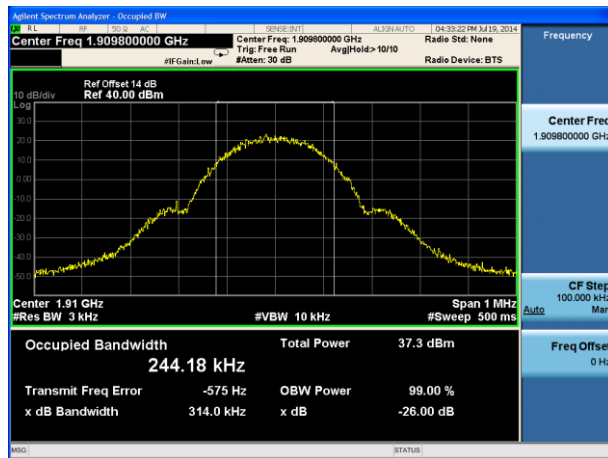
PCS1900 Channel 512 (1850.2MHz)



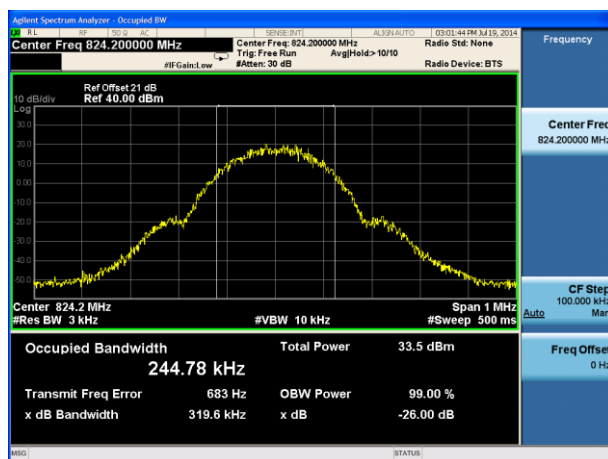
PCS1900 Channel 661 (1880.0MHz)



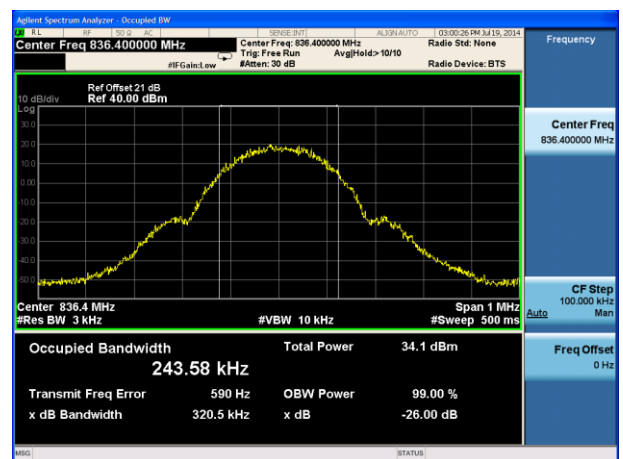
PCS1900 Channel 810 (1909.8MHz)



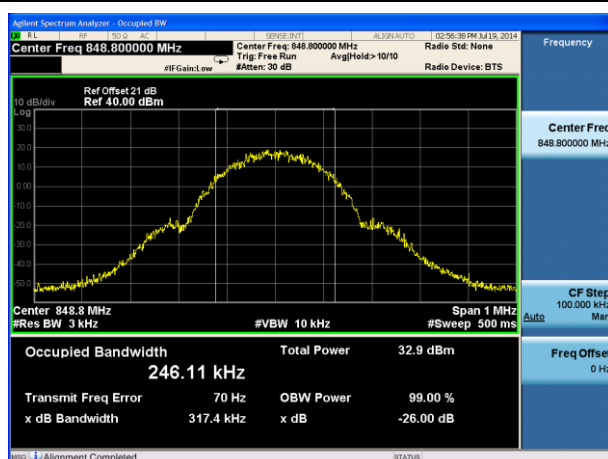
EDGE850 Channel 128 (824.2MHz)



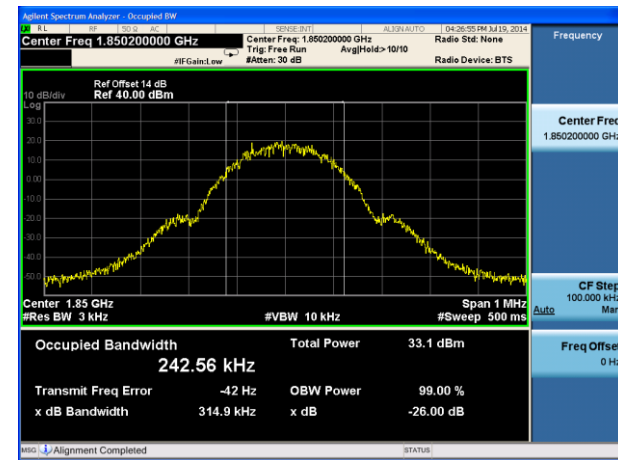
EDGE850 Channel 189 (836.4MHz)



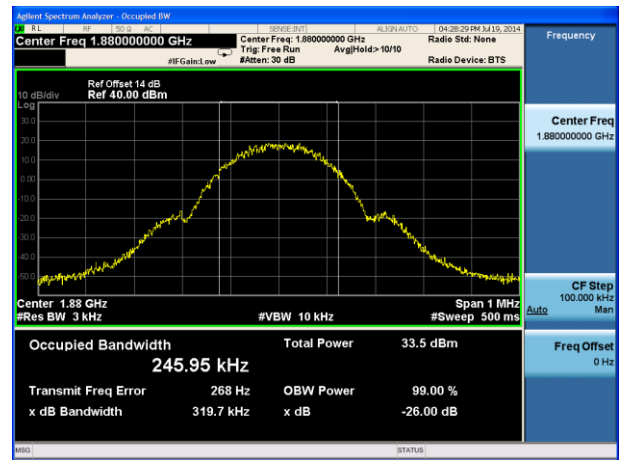
EDGE850 Channel 251 (848.8MHz)



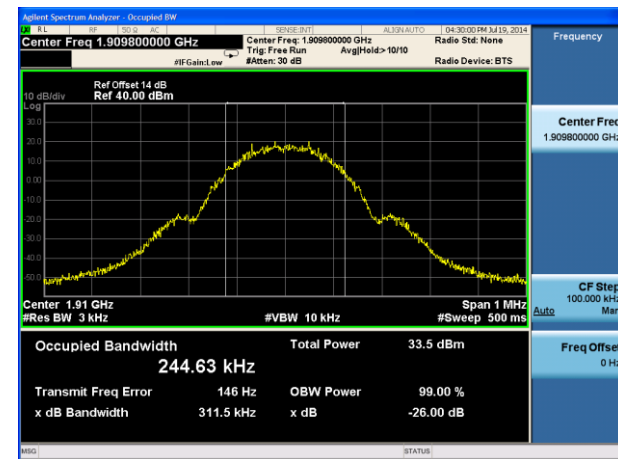
EDGE1900 Channel 512 (1850.2MHz)



EDGE1900 Channel 661 (1880.0MHz)



EDGE1900 Channel 810 (1909.8MHz)



7.3. Spurious and Harmonic Emissions at Antenna Terminal

7.3.1. 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 $43 + 10\log(P)$ dB.

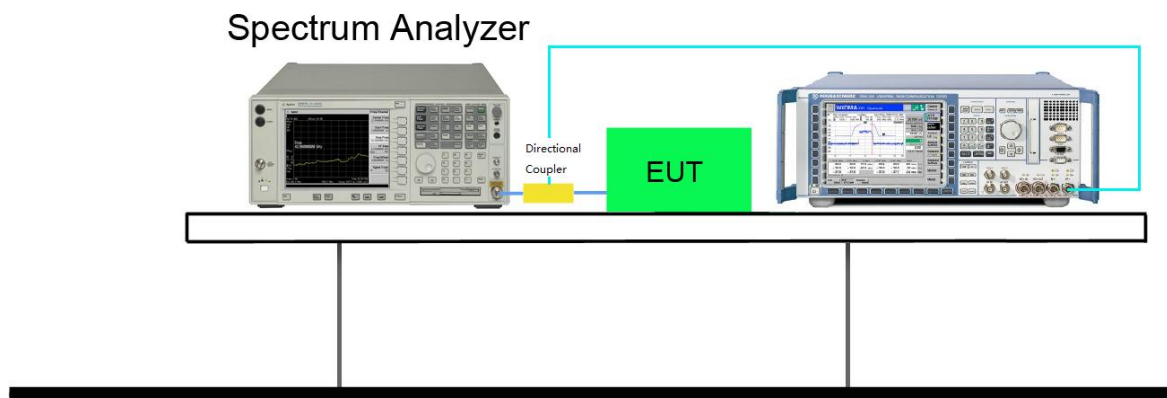
7.3.2. Test Procedure Used

KDB 971168 D01v02r01 – Section 6.0 & ANSI/TIA-603-D-2010

7.3.3. Test Setting

In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions.

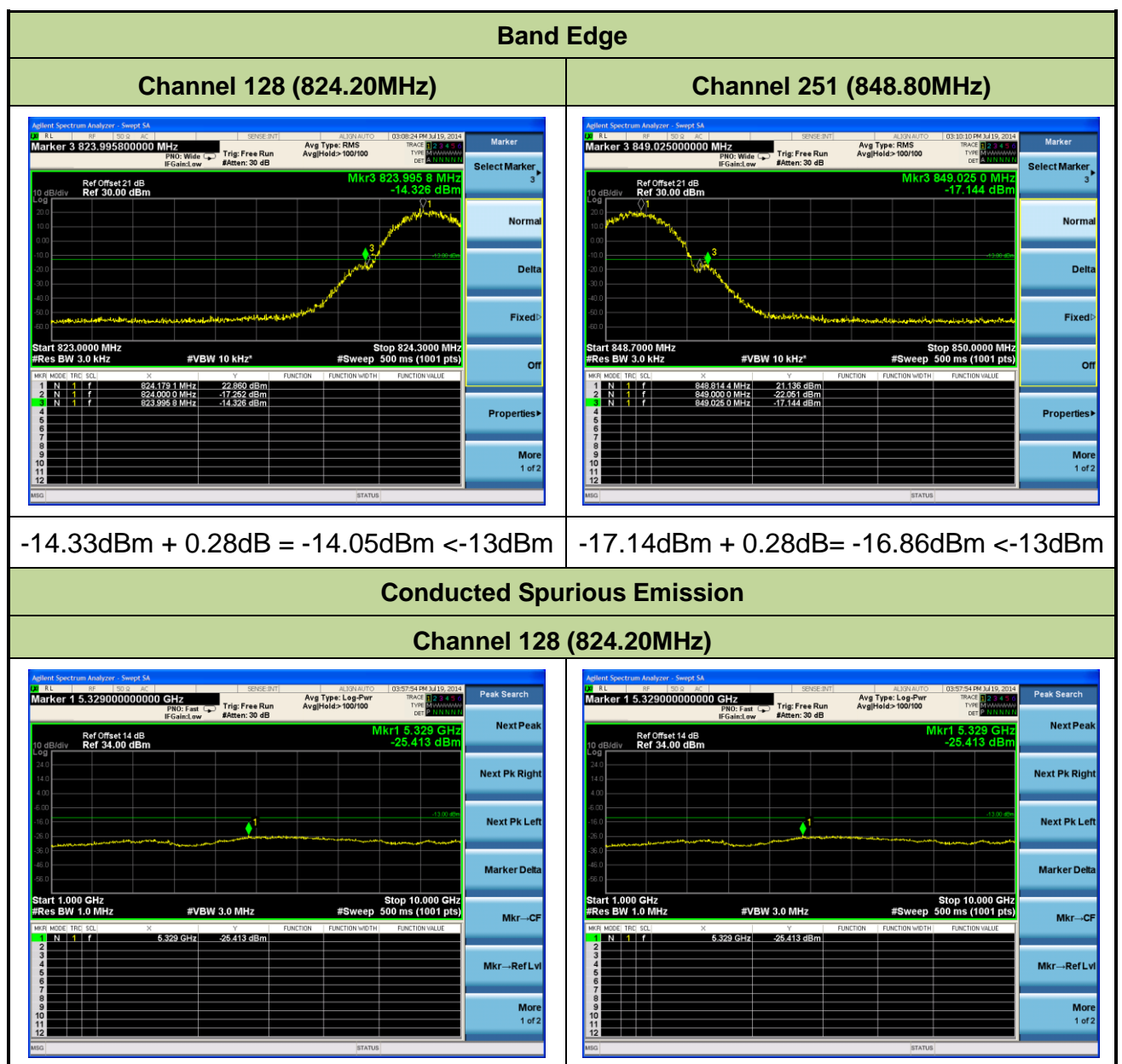
7.3.4. Test Setup



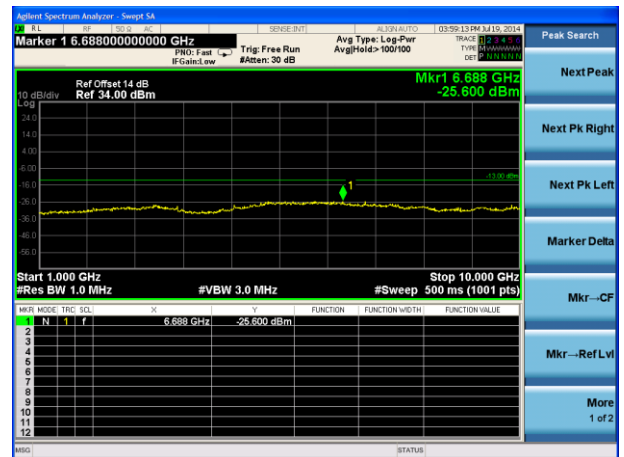
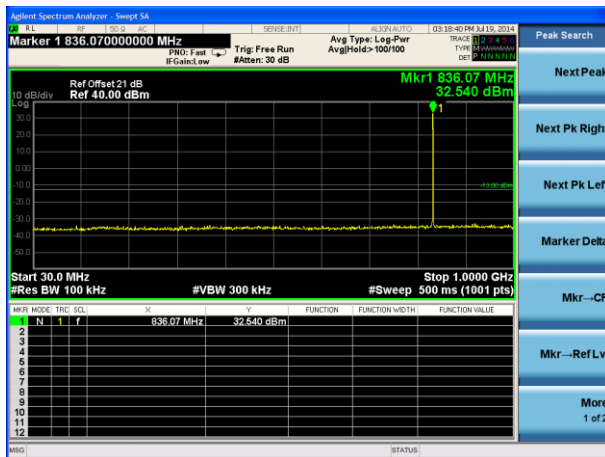
7.3.5. Test Result

Mode	Channel No.	Frequency (MHz)	Modulation	Test Result
GSM850	128	824.20	GMSK	Pass
GSM850	189	836.40	GMSK	Pass
GSM850	251	848.80	GMSK	Pass

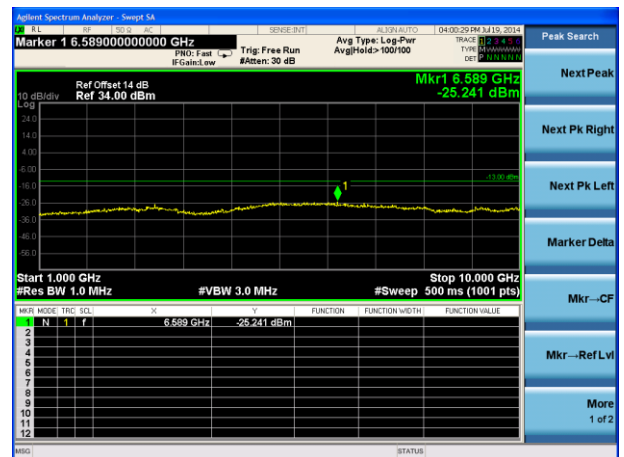
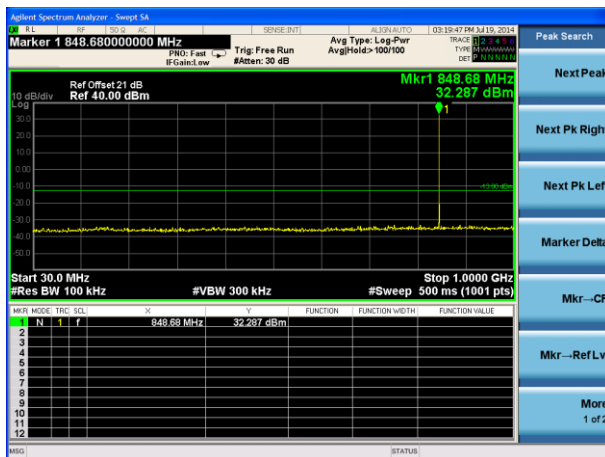
Note: Offset = $10 \cdot \log(3.2\text{kHz}/3\text{kHz}) = 0.28\text{dB}$, if the measured level added this offset, the result can pass.



Channel 189 (836.40MHz)



Channel 251 (848.80MHz)

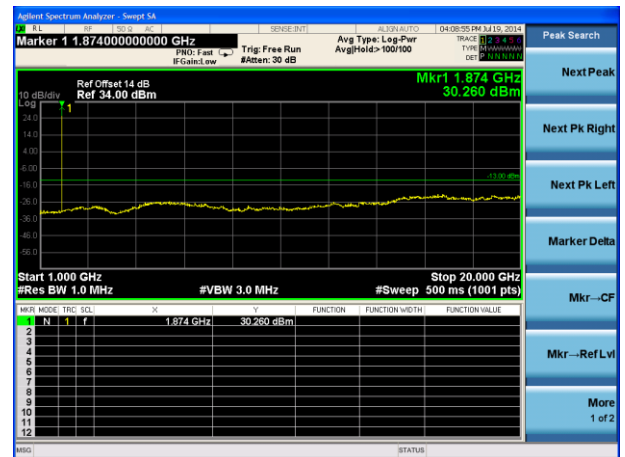
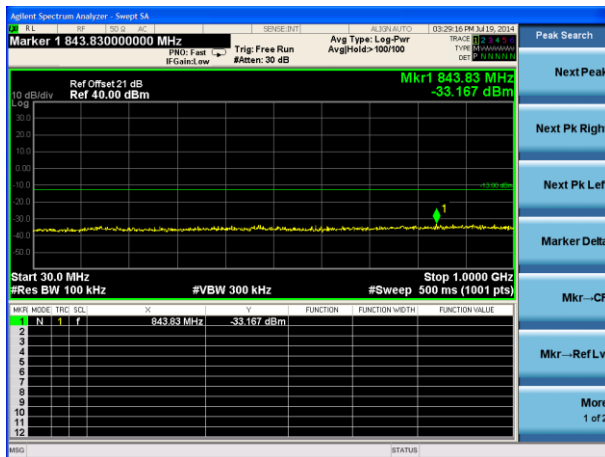


Mode	Channel No.	Frequency (MHz)	Modulation	Test Result
PCS1900	512	1850.20	GMSK	Pass
PCS1900	661	1880.00	GMSK	Pass
PCS1900	810	1909.80	GMSK	Pass

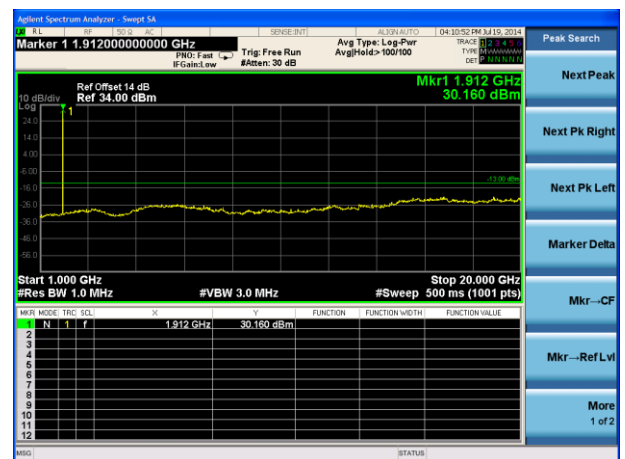
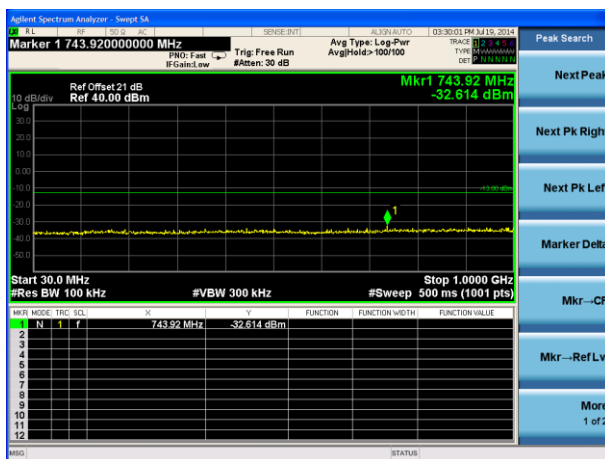
Note: Offset = $10 \cdot \log(3.2\text{kHz}/3\text{kHz}) = 0.28\text{dB}$, if the measured level added this offset, the result can pass.



Channel 661 (1880.00MHz)

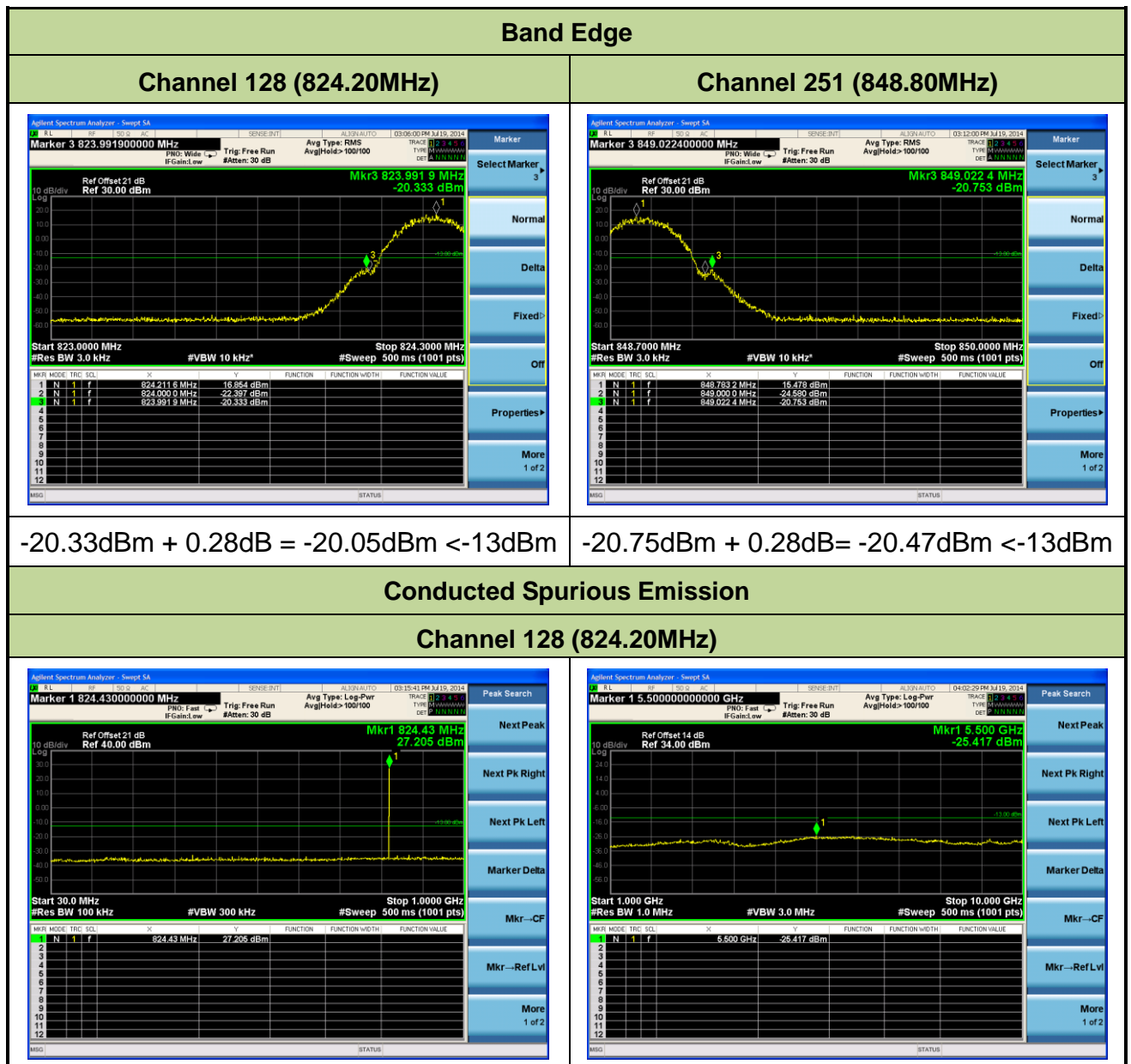


Channel 810 (1909.80MHz)

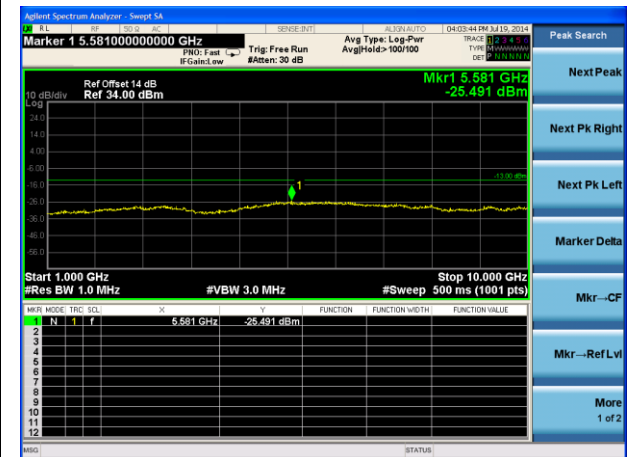
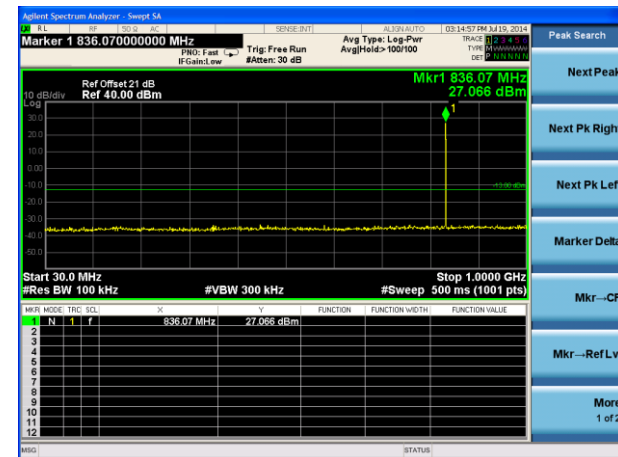


Mode	Channel No.	Frequency (MHz)	Modulation	Test Result
EDGE850	128	824.20	8PSK	Pass
EDGE850	189	836.40	8PSK	Pass
EDGE850	251	848.80	8PSK	Pass

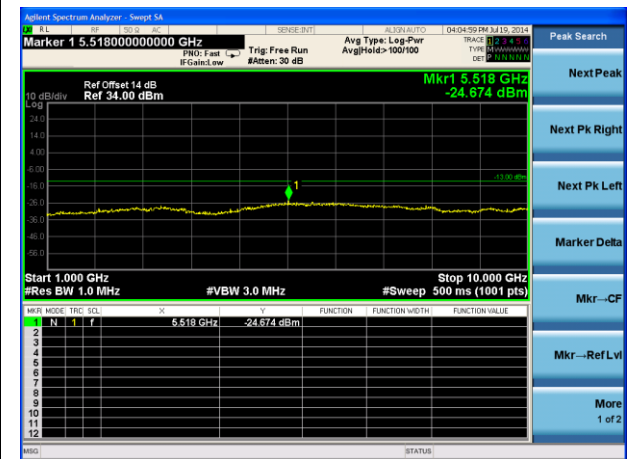
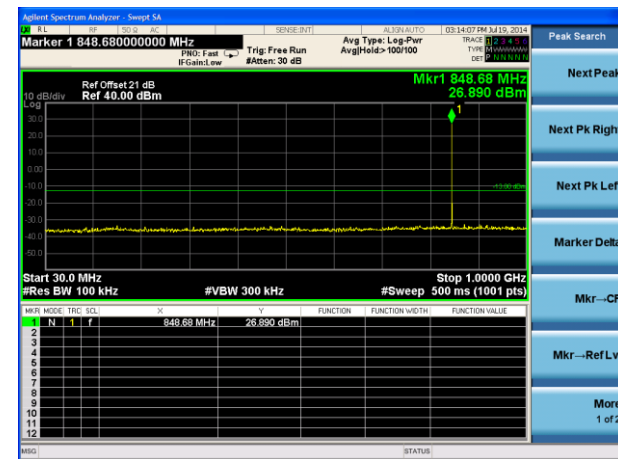
Note: Offset = $10 \cdot \log(3.2\text{kHz}/3\text{kHz}) = 0.28\text{dB}$, if the measured level added this offset, the result can pass.



Channel 189 (836.40MHz)

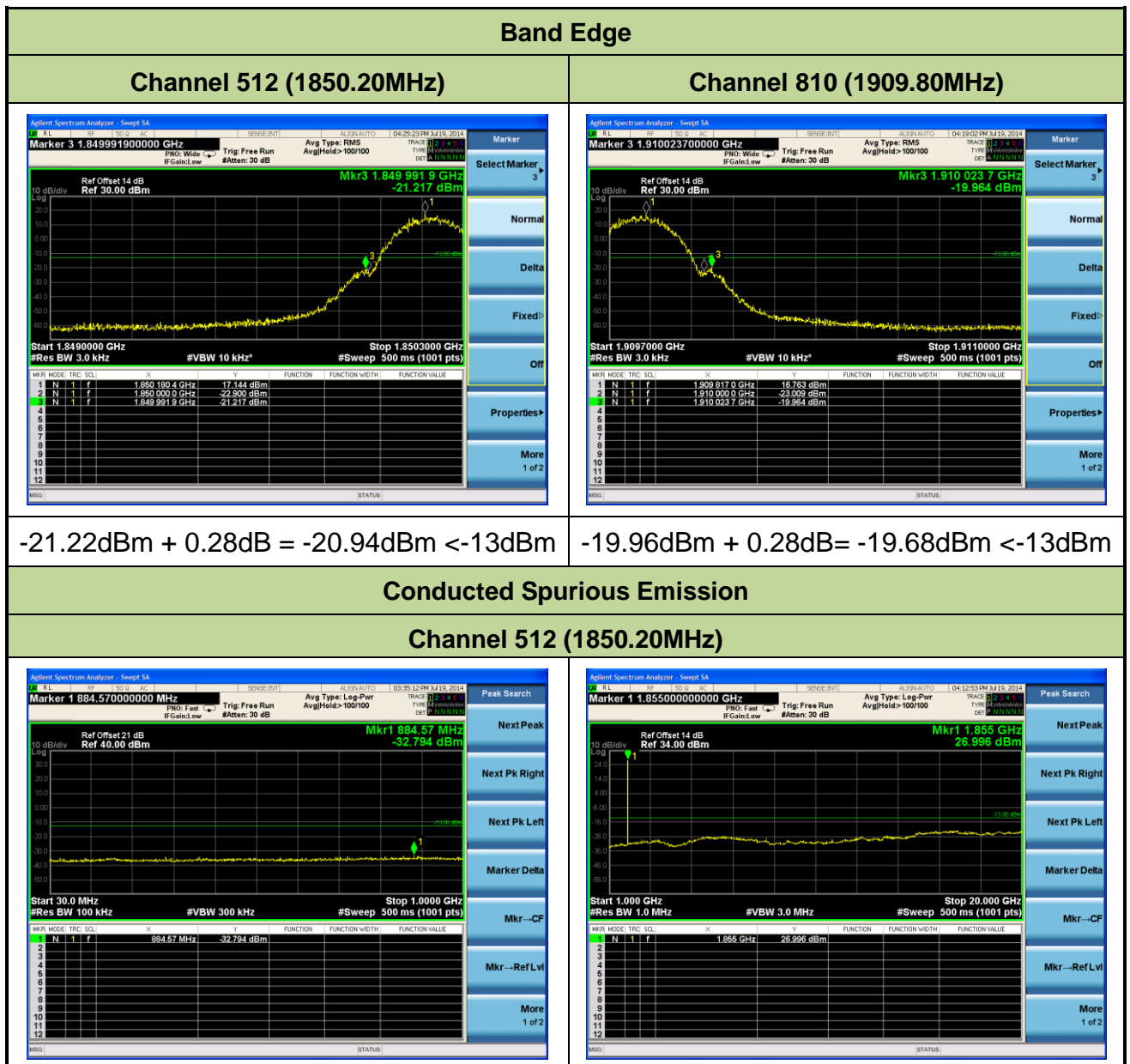


Channel 251 (848.80MHz)

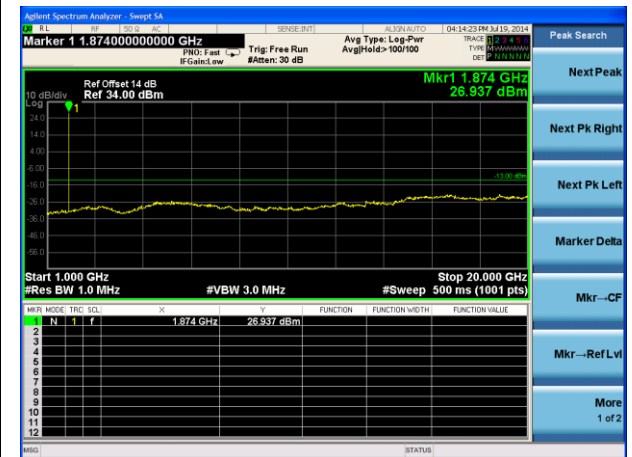
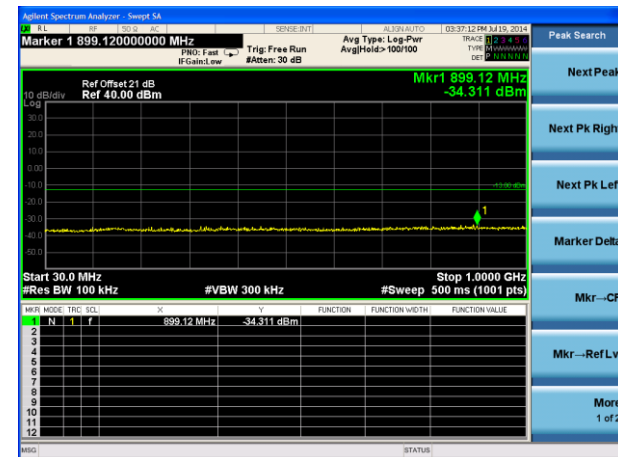


Mode	Channel No.	Frequency (MHz)	Modulation	Test Result
EDGE1900	512	1850.20	8PSK	Pass
EDGE1900	661	1880.00	8PSK	Pass
EDGE1900	810	1909.80	8PSK	Pass

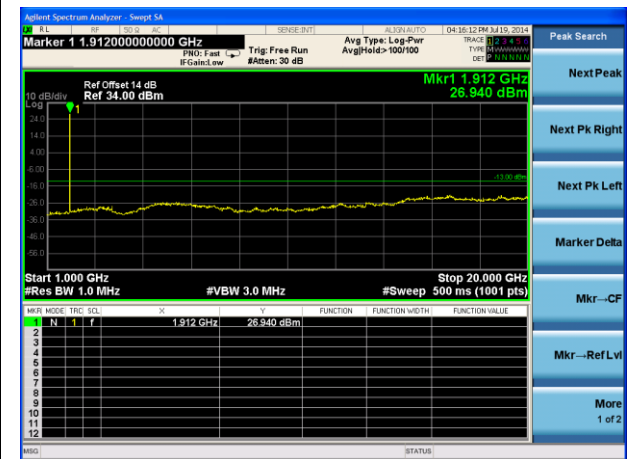
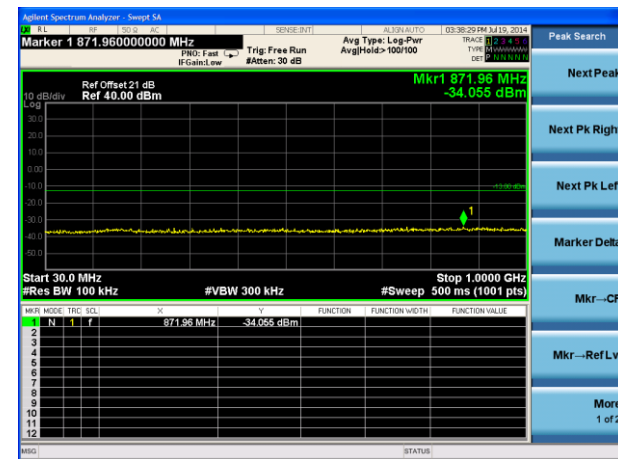
Note: Offset = $10 \cdot \log(3.2\text{kHz}/3\text{kHz}) = 0.28\text{dB}$, if the measured level added this offset, the result can pass.



Channel 661 (1880.00MHz)



Channel 810 (1909.80MHz)



7.4. Conducted & Radiated Power and Radiated Spurious Emissions

7.4.1. Test Limit

Radiated Power

For FCC Part 22.913(a)(2):

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

For FCC Part 24.232(b):

The EIRP of mobile transmitters and auxiliary test transmitters must not exceed 2 Watts.

Radiated Spurious Emissions

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 $43 + 10\log(P)$ dB.

7.4.2. Test Procedure Used

KDB 971168 D01v02r01 - Section 7.0 & ANSI/TIA-603-D-2010

7.4.3. Test Setting

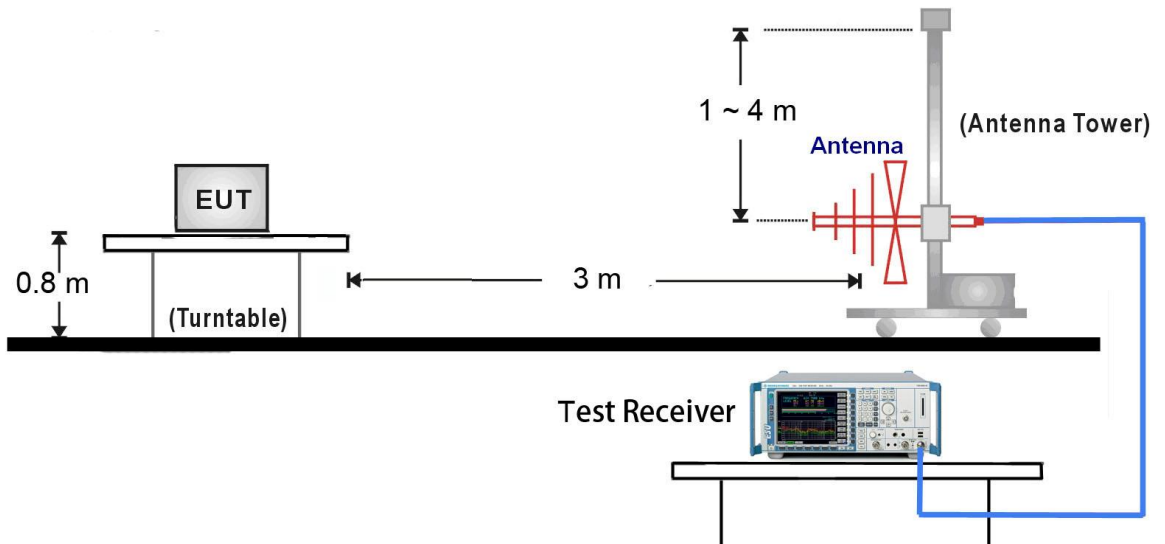
1. The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter
3. The output of the test antenna shall be connected to the measuring receiver.
4. The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height

until a maximum signal level is detected by the measuring receiver.

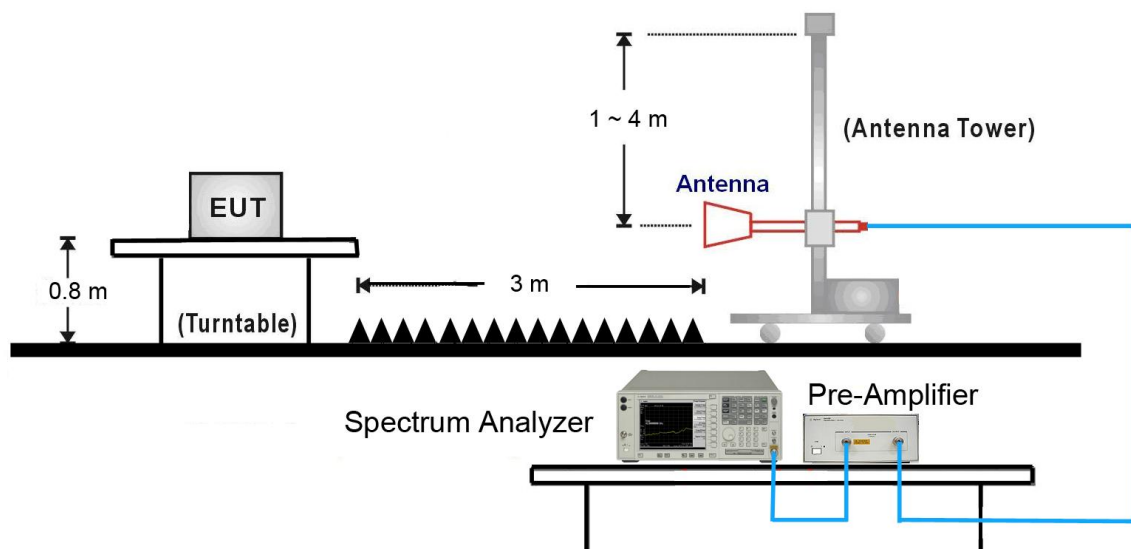
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a substitution antenna.
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
16. The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
17. Test site anechoic chamber refer to ANSI C63.4: 2009.

7.4.4. Test Setup

30MHz ~ 1GHz Test Setup:



1GHz ~ 20GHz Test Setup:



7.4.5. Test Result

Conducted Power

Mode	Frequency (MHz)	Avg. Burst Power (dBm)	Duty Cycle Factor (dB)	Scaling Factor
GPRS850(1 Slot)	824.2	32.13	-9	1.089
	836.4	32.23	-9	1.064
	848.8	32.27	-9	1.054
GPRS850(2 Slot)	824.2	31.35	-6	1.059
	836.4	31.49	-6	1.026
	848.8	31.58	-6	1.005
GPRS850(3 Slot)	824.2	29.40	-4.25	1.175
	836.4	29.92	-4.25	1.042
	848.8	30.01	-4.25	1.021
GPRS850(4 Slot)	824.2	29.20	-3	1.072
	836.4	29.37	-3	1.030
	848.8	29.46	-3	1.009
EDGE850(1 Slot)	824.2	27.74	-9	1.191
	836.4	28.07	-9	1.104
	848.8	28.27	-9	1.054
EDGE850(2 Slot)	824.2	27.26	-6	1.186
	836.4	27.51	-6	1.119
	848.8	27.79	-6	1.050
EDGE850(3 Slot)	824.2	26.12	-4.25	1.091
	836.4	26.28	-4.25	1.052
	848.8	26.35	-4.25	1.035
EDGE850(4 Slot)	824.2	25.27	-3	1.183
	836.4	25.38	-3	1.153
	848.8	25.52	-3	1.117
GPRS1900(1 Slot)	1850.2	29.79	-9	1.050
	1880.0	29.44	-9	1.138
	1909.8	29.25	-9	1.189
GPRS1900(2 Slot)	1850.2	29.10	-6	1.023
	1880.0	28.91	-6	1.069
	1909.8	28.83	-6	1.089
GPRS1900(3 Slot)	1850.2	27.20	-4.25	1.122
	1880.0	27.44	-4.25	1.062

	1909.8	27.63	-4.25	1.016
GPRS1900(4 Slot)	1850.2	26.25	-3	1.161
	1880.0	26.59	-3	1.074
	1909.8	26.83	-3	1.016
EDGE1900(1 Slot)	1850.2	25.03	-9	1.089
	1880.0	24.87	-9	1.130
	1909.8	24.55	-9	1.216
EDGE1900(2 Slot)	1850.2	23.44	-6	1.014
	1880.0	23.05	-6	1.109
	1909.8	22.88	-6	1.153
EDGE1900(3 Slot)	1850.2	21.35	-4.25	1.035
	1880.0	21.12	-4.25	1.091
	1909.8	20.91	-4.25	1.146
EDGE1900(4 Slot)	1850.2	19.61	-3	1.094
	1880.0	19.55	-3	1.109
	1909.8	19.37	-3	1.156

Note:

1. Scaling Factor = Max Power (mW) / Avg. Burst Power (mW); Max Power is the tune-up power.
2. This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v05.
3. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged powers were calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
4. The bolded GPRS modes were selected for SAR testing according to the highest frame-averaged output power table per KDB 941225 D03v01.

Radiated Power

GSM850

Frequency (MHz)	Ant. Pol. (H/V)	SG Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 128 (824.20MHz)							
824.2	H	25.28	1.78	6.52	30.02	38.50	-10.48
824.2	V	16.86	1.78	6.38	21.46	38.50	-18.04
Middle Channel 189 (836.40MHz)							
836.4	H	25.84	1.80	6.63	30.67	38.50	-9.83
836.4	V	18.72	1.80	6.15	23.07	38.50	-17.43
High Channel 251 (848.80MHz)							
848.8	H	25.82	1.82	6.80	30.80	38.50	-9.70
848.8	V	19.12	1.82	6.54	23.84	38.50	-16.66

PCS1900

Frequency (MHz)	Ant. Pol. (H/V)	SG Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 512 (1850.20MHz)							
1850.2	H	27.79	2.70	4.64	29.73	33.00	-7.27
1850.2	V	16.43	2.70	4.64	18.37	33.00	-18.63
Middle Channel 661 (1880.00MHz)							
1880.0	H	27.27	2.72	4.59	29.14	33.00	-8.86
1880.0	V	15.96	2.72	4.59	17.83	33.00	-19.17
High Channel 810 (1909.80MHz)							
1909.8	H	27.70	2.75	4.54	29.49	33.00	-8.51
1909.8	V	17.62	2.75	4.54	19.41	33.00	-18.59

EDGE850

Frequency (MHz)	Ant. Pol. (H/V)	SG Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 128 (824.20MHz)							
824.2	H	20.46	1.78	6.52	25.20	38.50	-14.30
824.2	V	12.86	1.78	6.38	17.46	38.50	-22.04
Middle Channel 189 (836.40MHz)							
836.4	H	20.83	1.80	6.63	25.66	38.50	-13.84
836.4	V	13.72	1.80	6.15	18.07	38.50	-21.43
High Channel 251 (848.80MHz)							
848.8	H	20.86	1.82	6.80	25.84	38.50	-13.66
848.8	V	14.11	1.82	6.54	18.83	38.50	-20.67

EDGE1900

Frequency (MHz)	Ant. Pol. (H/V)	SG Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 512 (1850.20MHz)							
1850.2	H	22.83	2.70	4.64	24.77	33.00	-11.23
1850.2	V	11.43	2.70	4.64	13.37	33.00	-22.63
Middle Channel 661 (1880.00MHz)							
1880.0	H	22.27	2.72	4.59	24.14	33.00	-11.86
1880.0	V	11.96	2.72	4.59	13.83	33.00	-22.17
High Channel 810 (1909.80MHz)							
1909.8	H	21.70	2.75	4.54	23.49	33.00	-11.51
1909.8	V	11.62	2.75	4.54	13.41	33.00	-21.59

NOTES:

- ERP (dBm) / EIRP (dBm)= SG Reading (dBm) - Cable Loss (dB) + Substitute Antenna Gain (dBd)
- This device was tested under all configurations and the highest power is reported in GSM mode.
- The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The "H" positioning is defined with the EUT lying flat on the test surface, the "H2" positioning is defined with the EUT standing up on its side, and the "V" positioning is defined

with the EUT standing upright. The worst case test configuration was found in the EUT in the V positioning. The data reported in the table above was measured in this test setup.

Radiated Spurious Emission

GSM850

Frequency (MHz)	Ant. Pol. (H/V)	SG Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 128 (824.20MHz)							
1646.0	V	-45.44	2.55	5.13	-42.86	-13.0	-29.86
2470.5	V	-48.06	3.14	5.54	-45.66	-13.0	-32.66
1646.0	H	-43.14	2.55	5.13	-40.56	-13.0	-27.56
2470.5	H	-47.84	3.14	5.54	-45.44	-13.0	-32.44
Middle Channel 189 (836.40MHz)							
1671.5	V	-46.14	2.57	5.05	-43.66	-13.0	-30.66
2513.0	V	-49.74	3.18	5.64	-47.28	-13.0	-34.28
1671.5	H	-48.99	2.57	5.05	-46.51	-13.0	-33.51
2513.0	H	-47.04	3.18	5.64	-44.58	-13.0	-31.58
High Channel 251 (848.80MHz)							
1697.0	V	-48.67	2.59	4.97	-46.29	-13.0	-33.29
2547.0	V	-49.19	3.20	5.73	-46.66	-13.0	-33.66
1697.0	H	-52.02	2.59	4.97	-49.64	-13.0	-36.64
2547.0	H	-45.93	3.20	5.73	-43.40	-13.0	-30.40

Note:

1. Spurious emissions within 30-1000MHz were found more than 20dB below limit line.
2. $ERP\ (dBm) = SG\ Reading\ (dBm) - Cable\ Loss\ (dB) + Substitute\ Antenna\ Gain\ (dBd)$

PCS1900

Frequency (MHz)	Ant. Pol. (H/V)	SG Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 512 (1850.20MHz)							
3703.0	V	-28.06	3.90	7.88	-24.08	-13.0	-11.08
5547.5	V	-44.98	4.85	10.10	-39.73	-13.0	-26.73
3703.0	H	-30.37	3.90	7.88	-26.39	-13.0	-13.39
5547.5	H	-44.40	4.85	10.10	-39.15	-13.0	-26.15
Middle Channel 661 (1880.00MHz)							
3762.5	V	-29.68	3.94	7.93	-25.69	-13.0	-12.69
5641.0	V	-46.73	4.90	10.10	-41.53	-13.0	-28.53
3762.5	H	-29.88	3.94	7.93	-25.89	-13.0	-12.89
5641.0	H	-43.63	4.90	10.10	-38.43	-13.0	-25.43
High Channel 810 (1909.80MHz)							
3822.0	V	-25.29	3.98	8.07	-21.20	-13.0	-8.20
5726.0	V	-40.07	5.00	10.10	-34.97	-13.0	-21.97
3822.0	H	-27.91	3.98	8.07	-23.82	-13.0	-10.82
5726.0	H	-43.25	5.00	10.10	-38.15	-13.0	-25.15

Note:

1. Spurious emissions within 30-1000MHz were found more than 20dB below limit line.
2. $EIRP (dBm) = SG \text{ Reading (dBm)} - Cable \text{ Loss (dB)} + Substitute \text{ Antenna Gain (dBd)}$

EDGE850

Frequency (MHz)	Ant. Pol. (H/V)	SG Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 128 (824.20MHz)							
1646.0	V	-48.16	2.55	5.13	-45.58	-13.0	-32.58
2470.5	V	-52.56	3.14	5.54	-50.16	-13.0	-37.16
1646.0	H	-47.73	2.55	5.13	-45.15	-13.0	-32.15
2470.5	H	-51.71	3.14	5.54	-49.31	-13.0	-36.31
Middle Channel 189 (836.40MHz)							
1671.5	V	-50.42	2.57	5.05	-47.94	-13.0	-34.94
2513.0	V	-52.22	3.18	5.64	-49.76	-13.0	-36.76
1671.5	H	-51.87	2.57	5.05	-49.39	-13.0	-36.39
2513.0	H	-51.02	3.18	5.64	-48.56	-13.0	-35.56
High Channel 251 (848.80MHz)							
1697.0	V	-52.57	2.59	4.97	-50.19	-13.0	-37.19
2547.0	V	-52.65	3.20	5.73	-50.12	-13.0	-37.12
1697.0	H	-53.36	2.59	4.97	-50.98	-13.0	-37.98
2547.0	H	-49.64	3.20	5.73	-47.11	-13.0	-34.11

Note:

- Spurious emissions within 30-1000MHz were found more than 20dB below limit line.
- $ERP\ (dBm) = SG\ Reading\ (dBm) - Cable\ Loss\ (dB) + Substitute\ Antenna\ Gain\ (dBd)$

EDGE1900

Frequency (MHz)	Ant. Pol. (H/V)	SG Reading (dBm)	Cable Loss (dB)	Substitute Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
Low Channel 512 (1850.20MHz)							
3703.0	V	-35.19	3.90	7.88	-31.21	-13.0	-18.21
5547.5	V	-40.97	4.85	10.10	-35.72	-13.0	-22.72
3703.0	H	-40.82	3.90	7.88	-36.84	-13.0	-23.84
5547.5	H	-41.50	4.85	10.10	-36.25	-13.0	-23.25
Middle Channel 661 (1880.00MHz)							
3762.5	V	-32.26	3.94	7.93	-28.27	-13.0	-15.27
5641.0	V	-40.24	4.90	10.10	-35.04	-13.0	-22.04
3762.5	H	-35.12	3.94	7.93	-31.13	-13.0	-18.13
5641.0	H	-45.00	4.90	10.10	-39.8	-13.0	-26.80
High Channel 810 (1909.80MHz)							
3822.0	V	-33.07	3.98	8.07	-28.98	-13.0	-15.98
5726.0	V	-45.93	5.00	10.10	-40.83	-13.0	-27.83
3822.0	H	-30.58	3.98	8.07	-26.49	-13.0	-13.49
5726.0	H	-43.48	5.00	10.10	-38.38	-13.0	-25.38

Note:

- Spurious emissions within 30-1000MHz were found more than 20dB below limit line.
- $EIRP (dBm) = SG \text{ Reading (dBm)} - Cable \text{ Loss (dB)} + Substitute \text{ Antenna Gain (dBd)}$.

7.5. Peak-Average Ratio

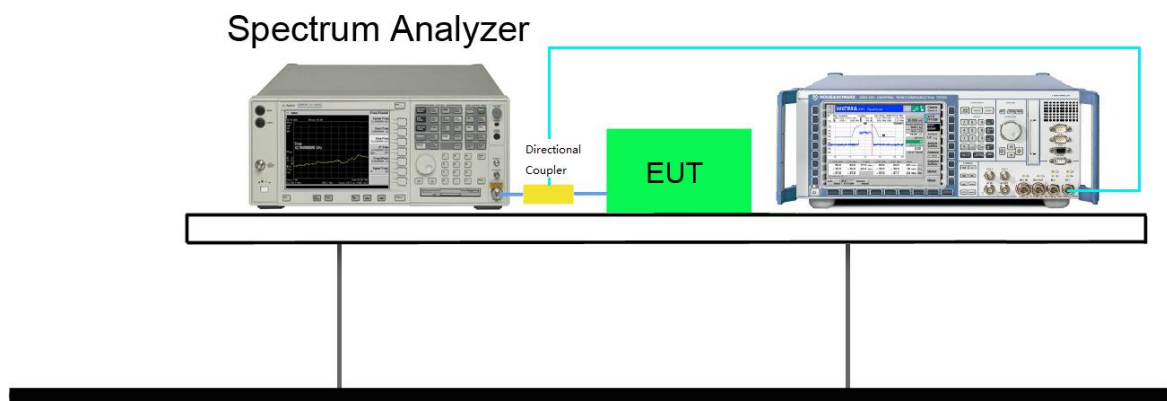
7.5.1. Test Limit

The transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

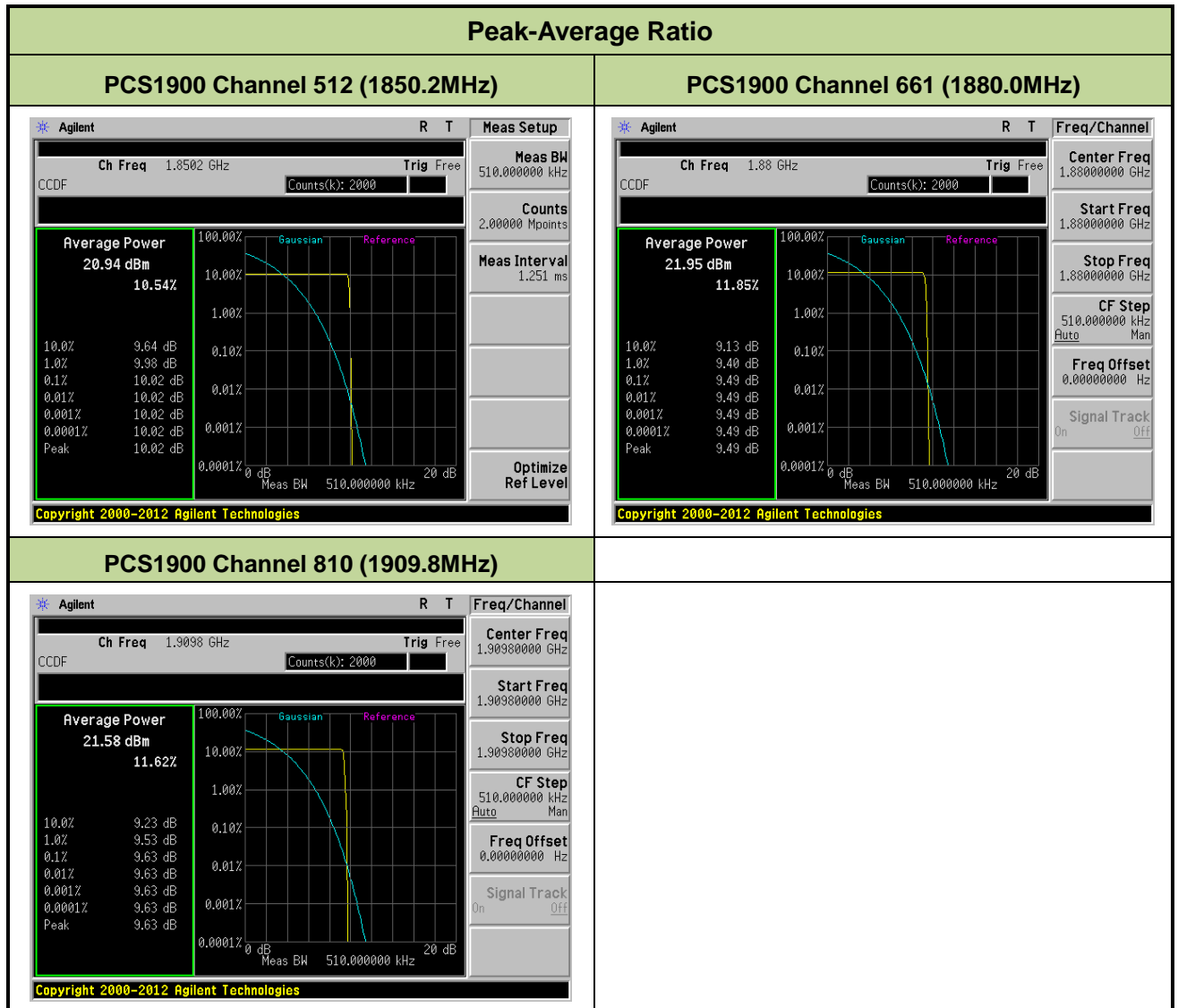
7.5.2. Test Procedure

KDB 971168 D01v02r01 - Section 5.7 & ANSI/TIA-603-D-2010

7.5.3. Test Setup

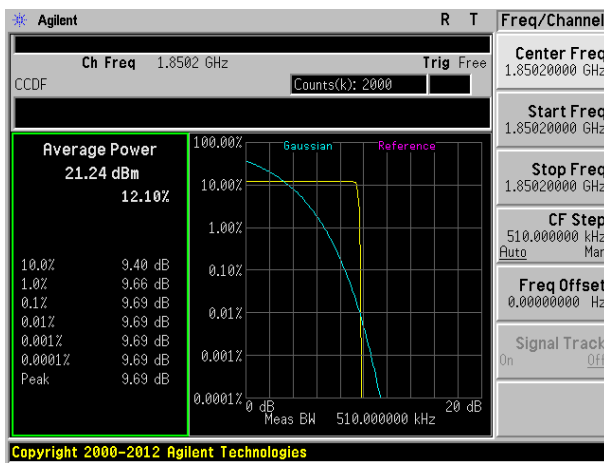


7.5.4. Test Result

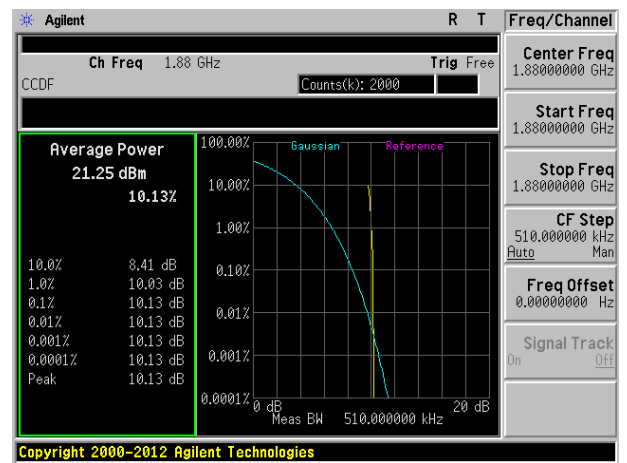


Peak-Average Ratio

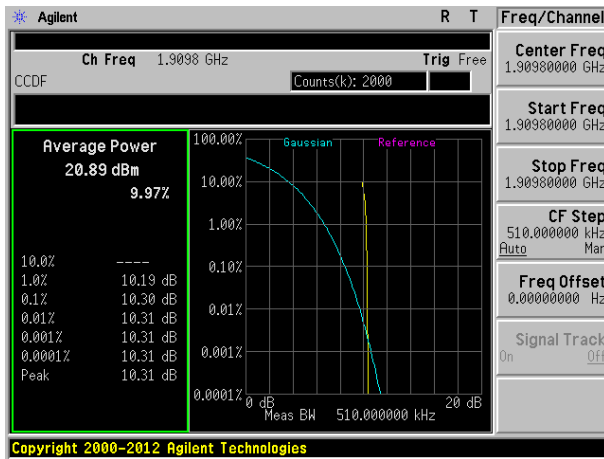
EDGE1900 Channel 512 (1850.2MHz)



EDGE1900 Channel 661 (1880.0MHz)



EDGE1900 Channel 810 (1909.8MHz)



7.6. Frequency Stability Under Temperature & Voltage Variations

7.6.1. Test Limit

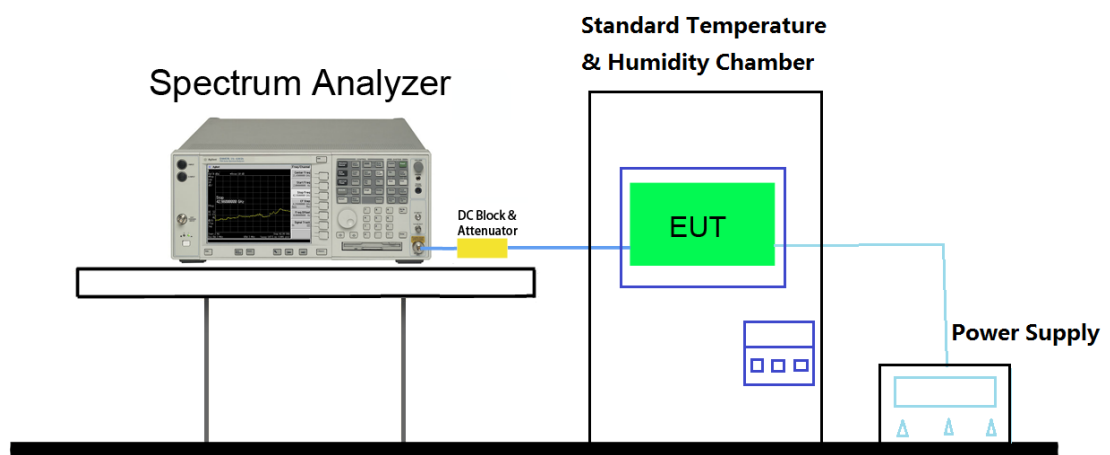
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Limit	$< \pm 2.5$ ppm
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7.6.2. Test Procedure

KDB 971168 D01v02r01 - Section 9.0 & ANSI/TIA-603-D-2010

7.6.3. Test Setup



7.6.4. Test Result

Operating Frequency	836,400,000 Hz
Channel	189
Test Mode	GPRS850
Reference Voltage	3.7 VDC
Deviation Limit	±0.00025% or 2.5ppm

Voltage (%)	Power (VDC)	TEMP (%)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	3.7	+20(Ref)	836,400,000	37	0.00000442
100%		-30	836,400,000	29	0.00000347
100%		-20	836,400,000	-78	-0.00000933
100%		-10	836,400,000	48	0.00000574
100%		0	836,400,000	-40	-0.00000478
100%		+10	836,400,000	31	0.00000368
100%		+20	836,400,000	38	0.00000454
100%		+30	836,400,000	-40	-0.00000477
100%		+40	836,400,000	58	0.00000693
100%		+50	836,400,000	-46	-0.00000550
115%	4.2	+20	836,400,000	31	0.00000371
BAT.ENDPOINT	3.6	+20	836,400,000	-11	-0.00000132

Operating Frequency	1,880,000,000 Hz
Channel	661
Test Mode	GPRS1900
Reference Voltage	3.7 VDC
Deviation Limit	±0.00025% or 2.5ppm

Voltage (%)	Power (VDC)	TEMP (%)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	3.7	+20(Ref)	1,880,000,000	-27	-0.00000144
100%		-30	1,880,000,000	66	0.00000351
100%		-20	1,880,000,000	-66	-0.00000351
100%		-10	1,880,000,000	-54	-0.00000287
100%		0	1,880,000,000	33	0.00000175
100%		+10	1,880,000,000	-47	-0.00000250
100%		+20	1,880,000,000	63	0.00000335
100%		+30	1,880,000,000	54	0.00000287
100%		+40	1,880,000,000	34	0.00000183
100%		+50	1,880,000,000	-34	-0.00000181
115%	4.2	+20	1,880,000,000	39	0.00000207
BAT.ENDPOINT	3.6	+20	1,880,000,000	67	0.00000356

Operating Frequency	836,400,000 Hz
Channel	189
Test Mode	EDGE850
Reference Voltage	3.7 VDC
Deviation Limit	±0.00025% or 2.5ppm

Voltage (%)	Power (VDC)	TEMP (%)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	3.7	+20(Ref)	836,400,000	39	0.00000466
100%		-30	836,400,000	51	0.00000610
100%		-20	836,400,000	70	0.00000837
100%		-10	836,400,000	-34	-0.00000407
100%		0	836,400,000	44	0.00000526
100%		+10	836,400,000	56	0.00000670
100%		+20	836,400,000	38	0.00000454
100%		+30	836,400,000	8	0.00000096
100%		+40	836,400,000	-46	-0.00000555
100%		+50	836,400,000	52	0.00000622
115%	4.2	+20	836,400,000	-43	-0.00000514
BAT.ENDPOINT	3.6	+20	836,400,000	65	0.00000777

Operating Frequency	1,880,000,000 Hz
Channel	661
Test Mode	EDGE1900
Reference Voltage	3.7 VDC
Deviation Limit	±0.00025% or 2.5ppm

Voltage (%)	Power (VDC)	TEMP (%)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	3.7	+20(Ref)	1,880,000,000	43	0.00000229
100%		-30	1,880,000,000	94	0.00000500
100%		-20	1,880,000,000	-36	-0.00000191
100%		-10	1,880,000,000	-54	-0.00000287
100%		0	1,880,000,000	33	0.00000176
100%		+10	1,880,000,000	31	0.00000165
100%		+20	1,880,000,000	-17	-0.00000090
100%		+30	1,880,000,000	64	0.00000340
100%		+40	1,880,000,000	31	0.00000165
100%		+50	1,880,000,000	-29	-0.00000154
115%	4.2	+20	1,880,000,000	43	0.00000229
BAT.ENDPOINT	3.6	+20	1,880,000,000	88	0.00000468

8. CONCLUSION

The data collected relate only the item(s) tested and show that the **MiiLink FCC ID: 2ACS2-M1** compliance with all the requirements of Parts 2, 22, 24 of the FCC Rules.

The End