TEST REPORT

No. I22Z60641-WMD01

for

Hytera Communications Corporation Limited

PoC mobile radio

Model Name: MNC360

FCC ID: YAMMNC360

with

Hardware Version: V1.0.01.000.01

Software Version: V1.0.06.000.01

Issued Date: 2022-05-25

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S.Government.

Test Laboratory:

CTTL, Telecommunication Technology Labs, CAICT

No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191.

Tel: +86(0)10-62304633-2512, Fax: +86(0)10-62304633-2504

Email: cttl_terminals@caict.ac.cn, website: www.caict.ac.cn

©Copyright. All rights reserved by CTTL.

REPORT HISTORY

Report Number	Revision	Description	Issue Date
I22Z60641-WMD01	Rev.0	1st edition	2022-05-25

Note: the latest revision of the test report supersedes all previous version.

©Copyright. All rights reserved by CTTL.

CONTENTS

1. TEST LABORATORY 4
1.1. INTRODUCTION & ACCREDITATION 4
1.2. TESTING LOCATION 4
1.3. TESTING ENVIRONMENT 5
1.4. PROJECT DATA 5
1.5. SIGNATURE 5
2. CLIENT INFORMATION 6
2.1. APPLICANT INFORMATION 6
2.2. MANUFACTURER INFORMATION 6
3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) 7
3.1. ABOUT EUT 7
3.2. INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST 7
3.3. INTERNAL IDENTIFICATION OF AE USED DURING THE TEST 7
4. REFERENCE DOCUMENTS 8
4.1. DOCUMENTS SUPPLIED BY APPLICANT 8
4.2. REFERENCE DOCUMENTS FOR TESTING 8
5. LABORATORY ENVIRONMENT 9
6. SUMMARY OF TEST RESULT 10
7. TEST EQUIPMENTS UTILIZED 11
ANNEX A: MEASUREMENT RESULTS 12
A.1 OUTPUT POWER 12
A.2 EMISSION LIMIT 20
A.3 FREQUENCY STABILITY 28
A.4 OCCUPIED BANDWIDTH 30
A.5 EMISSION BANDWIDTH 39
A.6 BAND EDGE COMPLIANCE 48
A.7 CONDUCTED SPURIOUS EMISSION 51
A.8 PEAK-TO-AVERAGE POWER RATIO 56
ANNEX B: ACCREDITATION CERTIFICATE 57

©Copyright. All rights reserved by CTTL.

1. Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2017 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0 and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

1.2. Testing Location

Location 1: CTTL (huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191

Location 4: CTTL (BDA)

Address: No.18A, Kangding Street, Beijing Economic-Technology Development Area, Beijing, P. R. China 100176

©Copyright. All rights reserved by CTTL.

1.3. Testing Environment

Normal Temperature: 15-35℃

Relative Humidity: 20-75%

1.4. Project Data

Testing Start Date: 2022-03-28

Testing End Date: 2022-05-18

1.5. Signature

Dong Yuan

(Prepared this test report)

Zhou Yu

(Reviewed this test report)

Zhao Hui Lin

Deputy Director of the laboratory

(Approved this test report)

©Copyright. All rights reserved by CTTL.

2. Client Information

2.1. Applicant Information

Company Name:	Hytera Communications Corporation Limited
Address /Post:	Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, P.R.C., P 518057
Contact:	Ruifen.Huang
Email:	Ruifen.Huang@hytera.com
Telephone:	18925250460
Fax:	/

2.2. Manufacturer Information

Company Name:	Hytera Communications Corporation Limited
Address /Post:	Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen, P.R.C., P 518057
Contact:	Ruifen.Huang
Email:	Ruifen.Huang@hytera.com
Telephone:	18925250460
Fax:	/

©Copyright. All rights reserved by CTTL.

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	PoC mobile radio
Model Name	MNC360
FCC ID	YAMMNC360
Antenna	Integrated
Output power	28.46dBm maximum ERP measured for GSM850
Extreme vol. Limits	10.2VDC to 15.6VDC (nominal: 13.6VDC)
Extreme temp. Tolerance	-20°C to +60°C

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of CTTL.

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
UT06aa	866346040178337	V1.0.01.000.01	V1.0.06.000.01	2022-03-28
UT09aa	866346040178360	V1.0.01.000.01	V1.0.06.000.01	2022-03-28

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE used during the test

AE ID*	Description
AE1	GPS Antenna
AE2	2G/3G/4G Antenna
AE3	DC power supply
AE4	Palm microphone

AE1

Model	DAMA1575AT41
Manufacturer	ZHANGJIAGANG FREE TRADE ZONE CAIQIN TECHNOLOGY CO.,LTD.

AE2

Model	AN1700W01
Manufacturer	/

AE3

Model	ZUP60-14
Manufacturer	/

AE4

Model	SM16A1
Manufacturer	Hytera Communications Corporation Limited

*AE ID: is used to identify the test sample in the lab internally.

©Copyright. All rights reserved by CTTL.

4. Reference Documents

4.1. Documents supplied by applicant

EUT parameters are supplied by the client or manufacturer, which are the bases of testing.

4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-20 Edition
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	10-1-20 Edition
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services	2015
KDB 971168 D01	MEASUREMENT GUIDANCE FOR CERTIFICATION OF LICENSED DIGITAL TRANSMITTERS	v03r01

©Copyright. All rights reserved by CTTL.

5. Laboratory Environment

Shielded room did not exceed following limits along the RF testing:

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz>60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	>2 MΩ
Ground system resistance	< 4 Ω

Fully-anechoic chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio （VSWR）	≤ 6 dB, from 1 to 18 GHz，3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

©Copyright. All rights reserved by CTTL.

6. Summary Of Test Result

GSM850

Items	List	Clause in FCC rules	Verdict
1	Output Power	22.913	P
2	Emission Limit	2.1051/22.917	P
3	Frequency Stability	2.1055	P
4	Occupied Bandwidth	2.1049	P
5	Emission Bandwidth	22.917	P
6	Band Edge Compliance	22.917	P
7	Conducted Spurious Emission	22.917	P

PCS1900

Items	List	Clause in FCC rules	Verdict
1	Output Power	24.232	P
2	Emission Limit	2.1051/24.238	P
3	Frequency Stability	2.1055	P
4	Occupied Bandwidth	2.1049	P
5	Emission Bandwidth	24.238	P
6	Band Edge Compliance	24.238	P
7	Conducted Spurious Emission	24.238	P
8	Peak-to-Average Power Ratio	24.232	P

Terms used in Verdict column

P	Pass. The EUT complies with the essential requirements in the standard.
NP	Not Performed. The test was not performed by CTTL.
NA	Not Applicable. The test was not applicable.
BR	Re-use test data from basic model report.
F	Fail. The EUT does not comply with the essential requirements in the standard.

All the test results are based on normal power.

Explanation of worst-case configuration

The worst-case scenario for all measurements is based on the conducted output power measurement investigation results unless otherwise stated. The test results shown in the following sections represent the worst case emission.

©Copyright. All rights reserved by CTTL.

7. Test Equipments Utilized

NO.	Description	TYPE	Manufacture	series number	CAL DUE DATE
1	Test Receiver	E4440A	Agilent	MY48250642	2023-03-10
2	EMI Antenna	VULB9163	Schwarzbeck	9163-482	2022-11-16
3	EMI Antenna	LB-7180-NF	A-INFO	J203001300005	2023-02-23
4	EMI Antenna	3117	ETS-Lindgren	00058889	2022-11-07
5	Signal Generator	N5183A	Agilent	MY49060052	2022-07-11
6	Universal Radio Communication Tester	CMW500	R&S	143008	2022-12-01
7	Wideband Radio Communication Tester	CMW500	R&S	159082	2023-01-17
8	Signal&Spectrum Analyzer	FSW	R&S	104038	2022-06-24
9	Climate chamber	SH-242	ESPEC	93008556	2023-12-23

©Copyright. All rights reserved by CTTL.

Annex A: Measurement Results

A.1 Output Power

A.1.1 Summary

During the process of testing, the EUT was controlled via communication tester to ensure max power transmission and proper modulation.

In all cases, output power is within the specified limits.

A.1.2 Conducted

A.1.2.1 Method of Measurements

The EUT was set up for the max output power with pseudo random data modulation.

These measurements were done at 3 frequencies (bottom, middle and top of operational frequency range) for each bandwidth.

A.1.2.2 Measurement Result

GSM850

	Power step	Nominal Peak output power (dBm)
GPRS	3	33dBm(2W)
EGPRS	6	27dBm(0.5W)

Measurement result

GPRS(GMSK,1Slot)

Frequency(MHz)	Power Step	Output power(dBm)
824.2	3	32.73
836.6	3	32.41
848.8	3	32.31

EGPRS(8PSK,1Slot)

Frequency(MHz)	Power Step	Output power(dBm)
824.2	6	26.13
836.6	6	25.98
848.8	6	25.75

©Copyright. All rights reserved by CTTL.

PCS1900

	Power step	Nominal Peak output power (dBm)
GPRS	3	30dBm(1W)
EGPRS	5	26dBm(0.4W)

Measurement result

GPRS(GMSK,1Slot)

Frequency(MHz)	Power Step	Output power(dBm)
1850.2	3	28.85
1880.0	3	28.82
1909.8	3	28.78

EGPRS(8PSK,1Slot)

Frequency(MHz)	Power Step	Output power(dBm)
1850.2	5	24.06
1880.0	5	24.11
1909.8	5	24.14

©Copyright. All rights reserved by CTTL.

A.1.3 Radiated

A.1.3.1 Description

This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(c) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

Rule Part 22.913(a) specifies ” The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.”

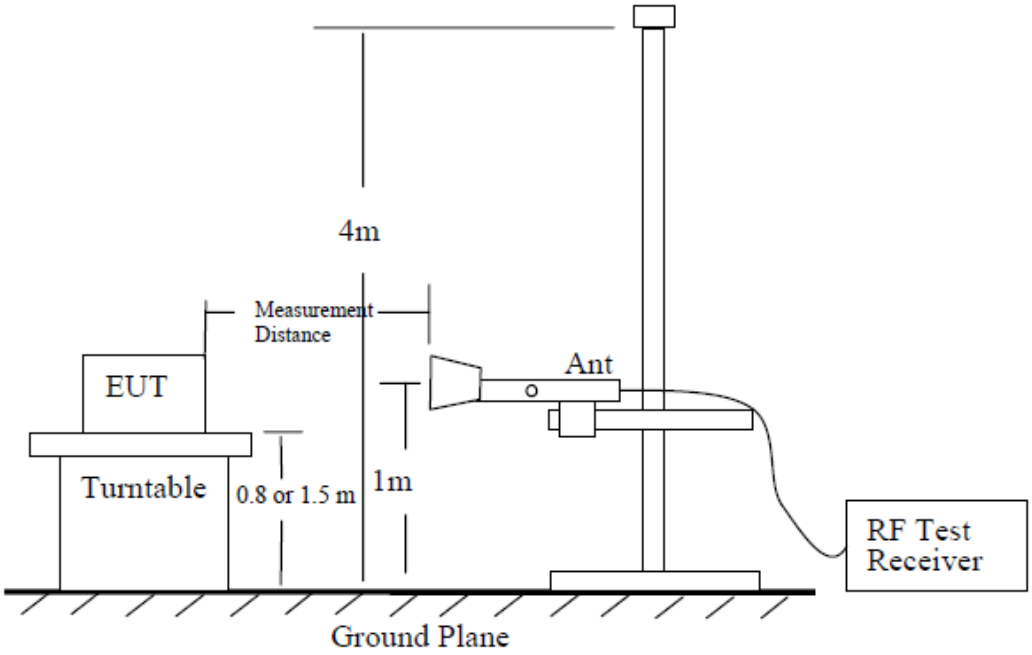
A.1.3.2 Method of Measurement

For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, the EUT shall be placed on a RF-transparent table or support at a nominal height of 80 cm above the reference ground plane.

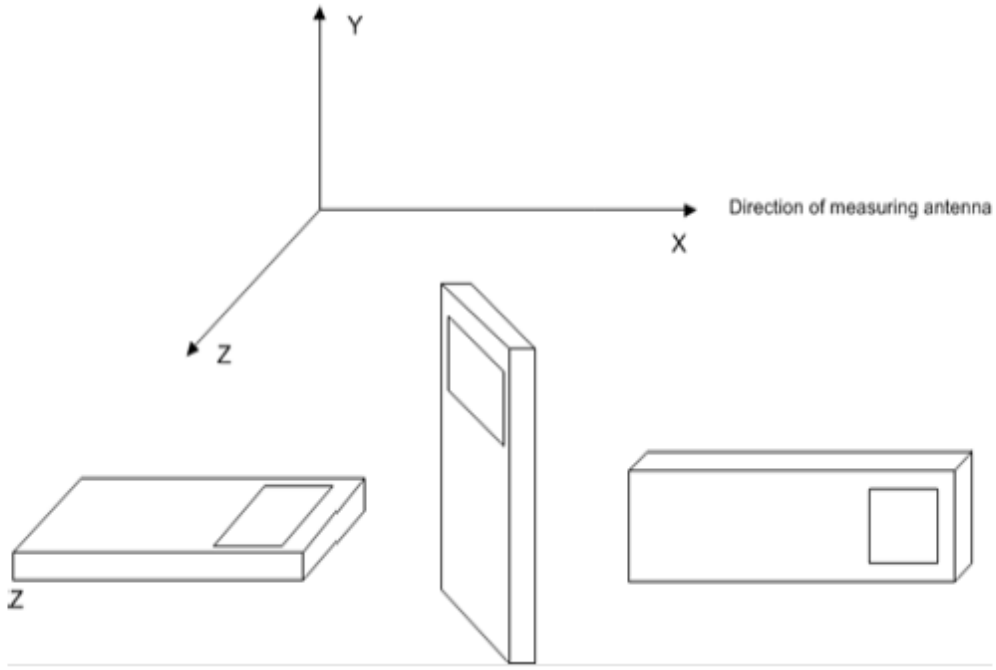
For radiated measurements performed at frequencies above 1 GHz, the EUT shall be placed on an RF transparent table or support at a nominal height of 1.5 m above the ground plane.

Radiated measurements shall be made with the measurement antenna positioned in both horizontal and vertical polarization. The measurement antenna shall be varied from 1 m to 4 m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level (i.e., field strength or received power). When orienting the measurement antenna in vertical polarization, the minimum height of the lowest element of the antenna shall clear the site reference ground plane by at least 25 cm.

The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



©Copyright. All rights reserved by CTTL.



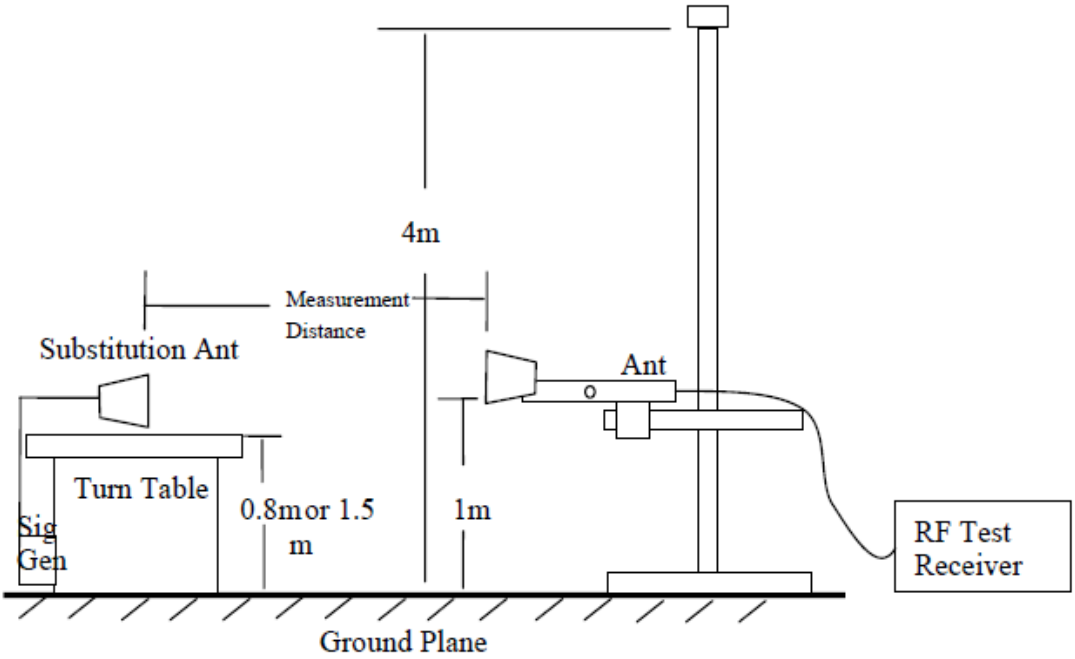
A step-by-step procedure is as follows.

a) Place the EUT in the center of the turntable. The EUT shall be configured to transmit into the standard non-radiating load (for measuring radiated spurious emissions), connected with cables of minimal length unless specified otherwise. If the EUT uses an adjustable antenna, the antenna shall be positioned to the length that produces the worst case emission at the fundamental operating frequency.

b) Each emission under consideration shall be evaluated:
   1) Raise and lower the measurement antenna, as necessary to enable detection of the maximum emission amplitude relative to measurement antenna height.
   2) Rotate the EUT through 360° to determine the maximum emission level relative to the axial position.
   3) Return the turntable to the azimuth where the highest emission amplitude level was observed.
   4) Vary the measurement antenna height again through 1 m to 4 m again to find the height associated with the maximum emission amplitude.
   5) Record the measured emission amplitude level and frequency using the appropriate RBW.

c) Repeat step b) for each emission frequency with the measurement antenna oriented in both the horizontal and vertical polarizations to determine the orientation that gives the maximum emissions amplitude.

©Copyright. All rights reserved by CTTL.



d) Set-up the substitution measurement with the reference point of the substitution antenna located as near as possible to where the center of the EUT radiating element was located during the initial EUT measurement.

e) Maintain the previous measurement instrument settings and test set-up, with the exception that the EUT is removed and replaced by the substitution antenna.

f) Connect a signal generator to the substitution antenna; locate the signal generator so as to minimize any potential influences on the measurement results. Set the signal generator to the frequency where emissions are detected, and set an output power level such that the radiated signal can be detected by the measurement instrument, with sufficient dynamic range relative to the noise floor.

g) For each emission that was detected and measured in the initial test [i.e., in step b) and step c)]:

   1) Vary the measurement antenna height between 1 m to 4 m to maximize the received (measured) signal amplitude.

   2) Adjust the signal generator output power level until the amplitude detected by the measurement instrument equals the amplitude level of the emission previously measured directly in step b) and step c).

   3) Record the output power level of the signal generator when equivalence is achieved in step 2).

h) Repeat step e) through step g) with the measurement antenna oriented in the opposite polarization.

i) Calculate the emission power in dBm referenced to a half-wave dipole using the following equation:

   Pe = Ps(dBm) − cable loss (dB) + antenna gain (dBd)

   where

   Pe = equivalent emission power in dBm

   Ps = source (signal generator) power in dBm

©Copyright. All rights reserved by CTTL.

NOTE—dBd refers to the measured antenna gain in decibels relative to a half-wave dipole.

j) Correct the antenna gain of the substitution antenna if necessary to reference the emission power to a half-wave dipole. When using measurement antennas with the gain specified in dBi, the equivalent dipole-referenced gain can be determined from: gain (dBd) = gain (dBi) − 2.15 dB. If necessary, the antenna gain can be calculated from calibrated antenna factor information.

This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.

ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi.

©Copyright. All rights reserved by CTTL.

GSM 850-ERP 22.913(a)

Limits

	Power Step	Burst Peak ERP (dBm)
GPRS	3	≤38.45dBm (7W)
EGPRS	6	≤38.45dBm (7W)

Measurement result

GPRS

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
824.20	-3.66	-33.60	-0.79	2.15	26.99	38.45	H
836.60	-2.72	-33.50	-0.74	2.15	27.89	38.45	H
848.80	**-2.16**	**-33.50**	**-0.73**	**2.15**	**28.46**	**38.45**	**H**

EGPRS-8PSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	Correction (dB)	ERP(dBm)	Limit(dBm)	Polarization
824.20	-8.69	-33.60	-0.79	2.15	21.97	38.45	V
836.60	-8.55	-33.50	-0.74	2.15	22.06	38.45	V
848.80	-8.47	-33.50	-0.73	2.15	22.15	38.45	V

ANALYZER SETTINGS: RBW = VBW = 3MHz

Note: Both of Vertical and Horizontal polarizations are evaluated, but only the worst case is recorded in this report.

©Copyright. All rights reserved by CTTL.

PCS1900-EIRP 24.232(c)

Limits

	Power Step	Burst Peak EIRP (dBm)
GPRS	3	≤33dBm (2W)
EGPRS	5	≤33dBm (2W)

Measurement result

GPRS

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
1850.20	-10.48	-29.40	8.10	27.02	33.00	H
1880.00	-9.97	-29.30	8.10	27.43	33.00	H
1909.80	**-9.38**	**-29.30**	**8.10**	**28.03**	**33.00**	**H**

EGPRS-8PSK

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)+ P_{Ag}(dB)	Ga Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
1850.20	-17.31	-29.40	8.10	20.20	33.00	H
1880.00	-16.58	-29.30	8.10	20.82	33.00	H
1909.80	-16.15	-29.30	8.10	21.26	33.00	H

Sample: 1850.20MHz

Power(20.20dBm)=P_{Mea} (-17.31dBm)- P_{pl} (-29.40dBm)+ G_a(8.10dBm)

ANALYZER SETTINGS: RBW = VBW = 3MHz

Measurement Uncertainty : k=2

FrequencyRange	Uncertainty(dB) k=2
30MHz-1GHz	5.76
1GHz-18GHz	4.69

Note: Both of Vertical and Horizontal polarizations are evaluated, but only the worst case is recorded in this report.

©Copyright. All rights reserved by CTTL.

A.2 Emission Limit

A.2.1 Measurement Method

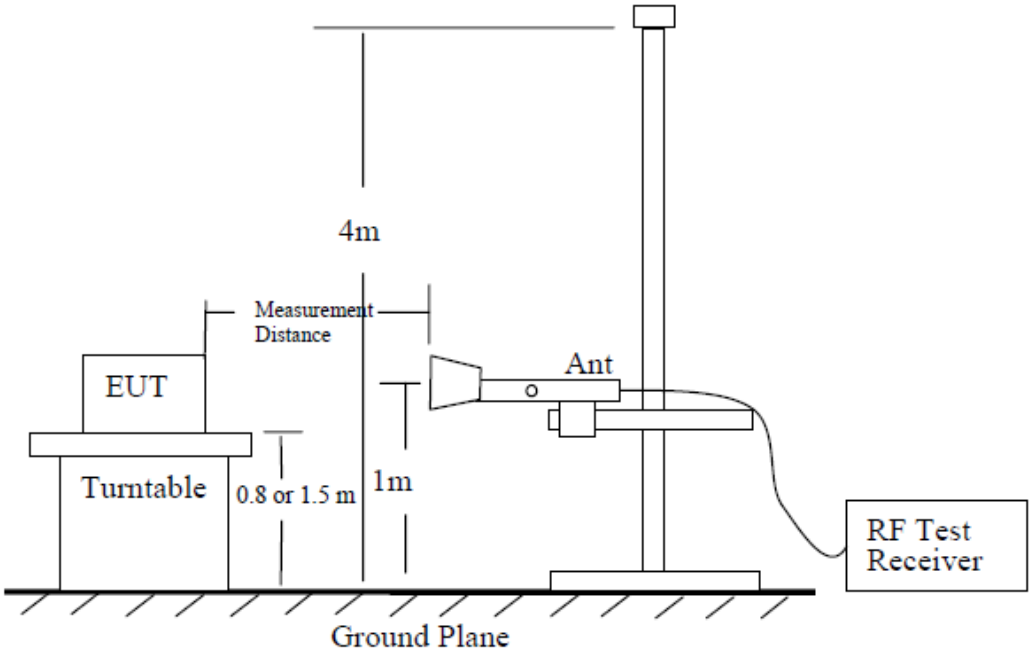
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. The resolution bandwidth is set 1MHz as outlined in Part 24.238 and Part 22.917. The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of PCS1900 and GSM850.

The procedure of radiated spurious emissions is as follows:

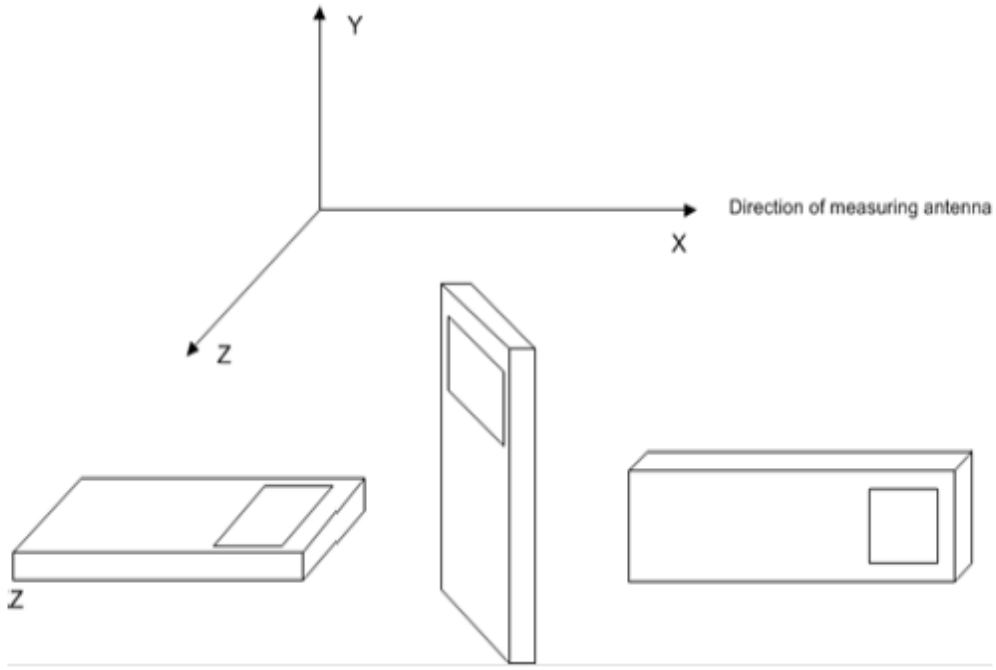
For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, the EUT shall be placed on a RF-transparent table or support at a nominal height of 80 cm above the reference ground plane.

For radiated measurements performed at frequencies above 1 GHz, the EUT shall be placed on an RF transparent table or support at a nominal height of 1.5 m above the ground plane. Radiated measurements shall be made with the measurement antenna positioned in both horizontal and vertical polarization. The measurement antenna shall be varied from 1 m to 4 m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level (i.e., field strength or received power). When orienting the measurement antenna in vertical polarization, the minimum height of the lowest element of the antenna shall clear the site reference ground plane by at least 25 cm.

The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



©Copyright. All rights reserved by CTTL.



A step-by-step procedure is as follows.

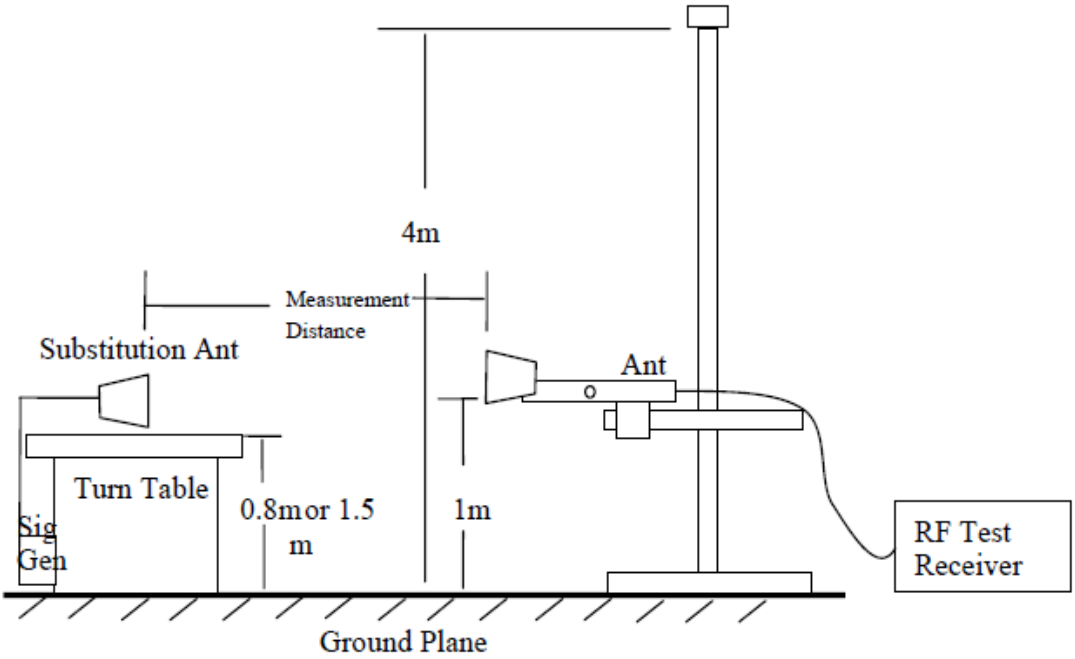
k) Place the EUT in the center of the turntable. The EUT shall be configured to transmit into the standard non-radiating load (for measuring radiated spurious emissions), connected with cables of minimal length unless specified otherwise. If the EUT uses an adjustable antenna, the antenna shall be positioned to the length that produces the worst case emission at the fundamental operating frequency.

l) Each emission under consideration shall be evaluated:

   6) Raise and lower the measurement antenna, as necessary to enable detection of the maximum emission amplitude relative to measurement antenna height.
   7) Rotate the EUT through 360° to determine the maximum emission level relative to the axial position.
   8) Return the turntable to the azimuth where the highest emission amplitude level was observed.
   9) Vary the measurement antenna height again through 1 m to 4 m again to find the height associated with the maximum emission amplitude.
   10) Record the measured emission amplitude level and frequency using the appropriate RBW.

m) Repeat step b) for each emission frequency with the measurement antenna oriented in both the horizontal and vertical polarizations to determine the orientation that gives the maximum emissions amplitude.

©Copyright. All rights reserved by CTTL.



n) Set-up the substitution measurement with the reference point of the substitution antenna located as near as possible to where the center of the EUT radiating element was located during the initial EUT measurement.

o) Maintain the previous measurement instrument settings and test set-up, with the exception that the EUT is removed and replaced by the substitution antenna.

p) Connect a signal generator to the substitution antenna; locate the signal generator so as to minimize any potential influences on the measurement results. Set the signal generator to the frequency where emissions are detected, and set an output power level such that the radiated signal can be detected by the measurement instrument, with sufficient dynamic range relative to the noise floor.

q) For each emission that was detected and measured in the initial test [i.e., in step b) and step c)]:

   4) Vary the measurement antenna height between 1 m to 4 m to maximize the received (measured) signal amplitude.

   5) Adjust the signal generator output power level until the amplitude detected by the measurement instrument equals the amplitude level of the emission previously measured directly in step b) and step c).

   6) Record the output power level of the signal generator when equivalence is achieved in step 2).

r) Repeat step e) through step g) with the measurement antenna oriented in the opposite polarization.

s) Calculate the emission power in dBm referenced to a half-wave dipole using the following equation:

   Pe = Ps(dBm) − cable loss (dB) + antenna gain (dBd)

   where

   Pe = equivalent emission power in dBm

   Ps = source (signal generator) power in dBm

©Copyright. All rights reserved by CTTL.

NOTE—dBd refers to the measured antenna gain in decibels relative to a half-wave dipole.

t) Correct the antenna gain of the substitution antenna if necessary to reference the emission power to a half-wave dipole. When using measurement antennas with the gain specified in dBi, the equivalent dipole-referenced gain can be determined from: gain (dBd) = gain (dBi) − 2.15 dB. If necessary, the antenna gain can be calculated from calibrated antenna factor information.

This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.

ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi.

©Copyright. All rights reserved by CTTL.

A.2.2 Measurement Limit

Part 24.238 and Part 22.917 specify that 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.

The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

A.2.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the PCS1900 band (1850.2 MHz, 1880 MHz and 1909.8 MHz) and GSM850 band (824.2MHz, 836.6MHz, 848.8MHz) . It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the PCS1900 ,GSM850 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

©Copyright. All rights reserved by CTTL.

A.2.4 Measurement Results Table

Frequency	Channel	Frequency Range	Result
GPRS 850MHz	Low	30MHz-10GHz	Pass
	Middle	30MHz-10GHz	Pass
	High	30MHz-10GHz	Pass
GPRS 1900MHz	Low	30MHz-20GHz	Pass
	Middle	30MHz-20GHz	Pass
	High	30MHz-20GHz	Pass

A.2.5 Sweep Table

Working Frequency	Subrange (GHz)	RBW	VBW	Sweep time (s)
850MHz	0.03~1	100KHz	300KHz	10
	1-2	1 MHz	3 MHz	2
	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
	8~10	1 MHz	3 MHz	3
1900MHz	0.03~1	100KHz	300KHz	10
	1-2	1 MHz	3 MHz	2
	2~5	1 MHz	3 MHz	3
	5~8	1 MHz	3 MHz	3
	8~11	1 MHz	3 MHz	3
	11~14	1 MHz	3 MHz	3
	14~18	1 MHz	3 MHz	3
	18~20	1 MHz	3 MHz	2

©Copyright. All rights reserved by CTTL.

GPRS Mode Channel 128/824.2MHz

Frequency(MHz)	P_{Mea}(dBm)	Path loss	Antenna Gain(dBi)	Peak ERP(dBm)	Limit （dBm）	Polarization
2473.00	-48.11	0.90	9.80	-41.36	-13.00	H
9103.25	-51.25	2.20	11.60	-44.00	-13.00	H
9301.75	-50.63	2.00	11.60	-43.18	-13.00	H
9476.00	-51.01	2.10	11.60	-43.66	-13.00	V
9712.00	-51.40	2.20	11.20	-44.55	-13.00	H
9795.38	-51.22	2.30	11.20	-44.47	-13.00	H

GPRS Mode Channel 190/836.6MHz

Frequency(MHz)	P_{Mea}(dBm)	Path loss	Antenna Gain(dBi)	Peak ERP(dBm)	Limit （dBm）	Polarization
2509.50	-36.96	0.90	10.70	-29.31	-13.00	H
4183.13	-44.33	1.20	12.40	-35.28	-13.00	V
5856.00	-52.26	1.40	13.10	-42.71	-13.00	V
9100.13	-51.03	2.20	11.60	-43.78	-13.00	H
9225.25	-50.25	2.10	11.60	-42.90	-13.00	H
9475.00	-51.15	2.10	11.60	-43.80	-13.00	V

GPRS Mode Channel 251/848.8MHz

Frequency(MHz)	P_{Mea}(dBm)	Path loss	Antenna Gain(dBi)	Peak ERP(dBm)	Limit （dBm）	Polarization
2546.50	-49.59	0.90	10.70	-41.94	-13.00	H
5942.25	-50.93	1.50	13.10	-41.48	-13.00	H
9099.25	-51.90	2.20	11.60	-44.65	-13.00	H
9295.63	-50.41	2.00	11.60	-42.96	-13.00	H
9476.38	-51.04	2.10	11.60	-43.69	-13.00	V
9720.00	-50.39	2.20	11.20	-43.54	-13.00	H

©Copyright. All rights reserved by CTTL.

GPRS Mode Channel 512/1850.2MHz

Frequency(MHz)	P_{Mea}(dBm)	Path loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit （dBm）	Polarization
16996.25	-44.58	2.90	16.50	-30.98	-13.00	H
17291.25	-43.24	3.20	14.50	-31.94	-13.00	H
17518.13	-40.39	2.90	12.80	-30.49	-13.00	H
17587.50	-38.79	3.30	12.80	-29.29	-13.00	H
17763.13	-40.31	3.60	12.80	-31.11	-13.00	H
17982.50	-37.86	3.20	12.80	-28.26	-13.00	H

GPRS Mode Channel 661/1880.0MHz

Frequency(MHz)	P_{Mea}(dBm)	Path loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit （dBm）	Polarization
17211.25	-43.88	2.90	14.50	-32.28	-13.00	H
17285.00	-43.17	3.20	14.50	-31.87	-13.00	H
17436.88	-41.47	2.90	14.50	-29.87	-13.00	H
17536.88	-40.08	2.90	12.80	-30.18	-13.00	H
17770.63	-40.73	3.60	12.80	-31.53	-13.00	H
17928.13	-37.16	3.20	12.80	-27.56	-13.00	H

GPRS Mode Channel 810/1909.8MHz

Frequency(MHz)	P_{Mea}(dBm)	Path loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit （dBm）	Polarization
5729.63	-43.69	1.50	13.10	-32.09	-13.00	5729.63
16983.75	-45.26	2.90	16.50	-31.66	-13.00	16983.75
17511.25	-40.10	2.90	12.80	-30.20	-13.00	17511.25
17570.00	-40.20	3.30	12.80	-30.70	-13.00	17570.00
17836.25	-39.71	3.60	12.80	-30.51	-13.00	17836.25
17976.25	-37.88	3.20	12.80	-28.28	-13.00	17976.25

Sample: 5729.63MHz

Power(-32.09dBm)=P_{Mea} (-43.69dBm)- P_{pl} (1.50dBm)+ G_a(13.10dBm)

Measurement Uncertainty : k=2

FrequencyRange	Uncertainty(dB) k=2
30MHz-1GHz	5.76
1GHz-18GHz	4.69

©Copyright. All rights reserved by CTTL.

A.3 Frequency Stability

A.3.1 Method of Measurement

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at +20 °C and rated supply voltage. Two reference points are established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation shall be identified as F_L and F_H respectively.

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a "call mode". This is accomplished with the use of CMU200.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on mid channel of each band, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10℃ increments from +50℃ to -30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of the lower, higher and nominal voltage. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress.

©Copyright. All rights reserved by CTTL.

A.3.2 Measurement results

GPRS 850

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
20	13.6	824.040	848.960		
50				9.94	0.0238
40				11.59	0.0277
30				12.43	0.0297
10				11.07	0.0265
0				11.78	0.0282
-10				11.24	0.0269
-20				11.07	0.0265
-30				11.17	0.0267

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
9.0	20	824.040	848.960	10.69	0.0255
25.0				11.49	0.0275

GPRS 1900

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
20	13.6	1850.044	1909.954		
50				16.30	0.0173
40				16.92	0.0180
30				18.98	0.0202
10				17.89	0.0190
0				16.37	0.0174
-10				16.47	0.0175
-20				17.34	0.0184
-30				16.92	0.0180

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	F_L(MHz)	F_H(MHz)	Offset(Hz)	Frequency error(ppm)
9.0	20	1850.044	1909.954	19.53	0.0208
25.0				15.63	0.0166

©Copyright. All rights reserved by CTTL.

A.4 Occupied Bandwidth

Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequency. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.
The measurement method is from ANSI C63.26:
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts.
b) The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.
d) Set the detection mode to peak, and the trace mode to max-hold.

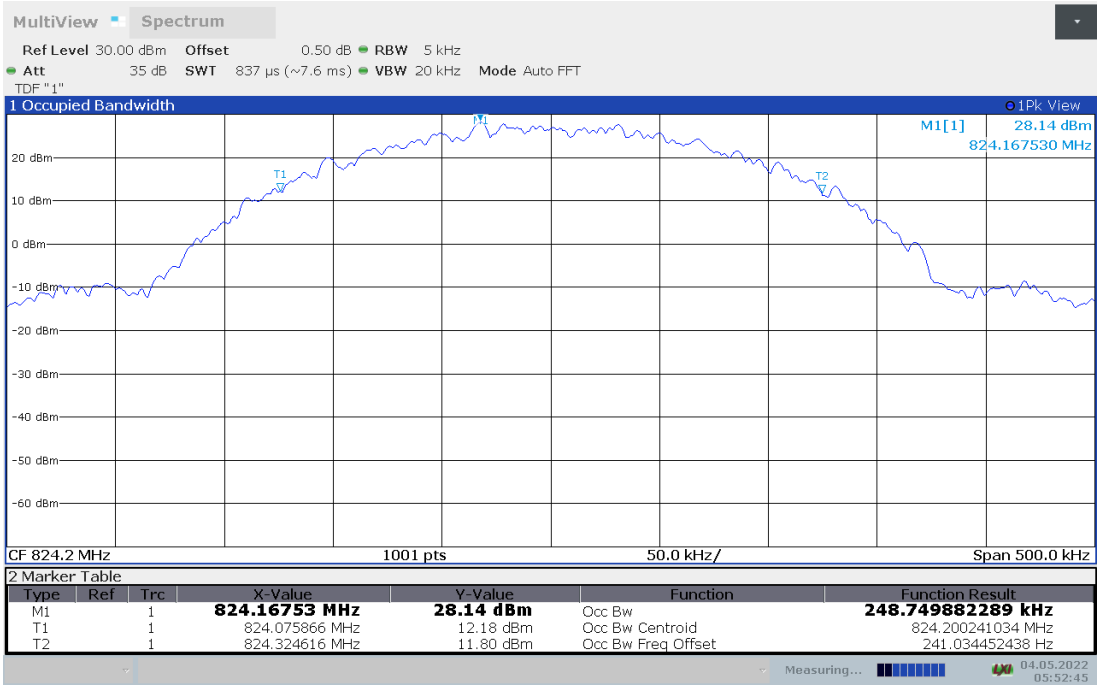
©Copyright. All rights reserved by CTTL.

GPRS 850 (99%)

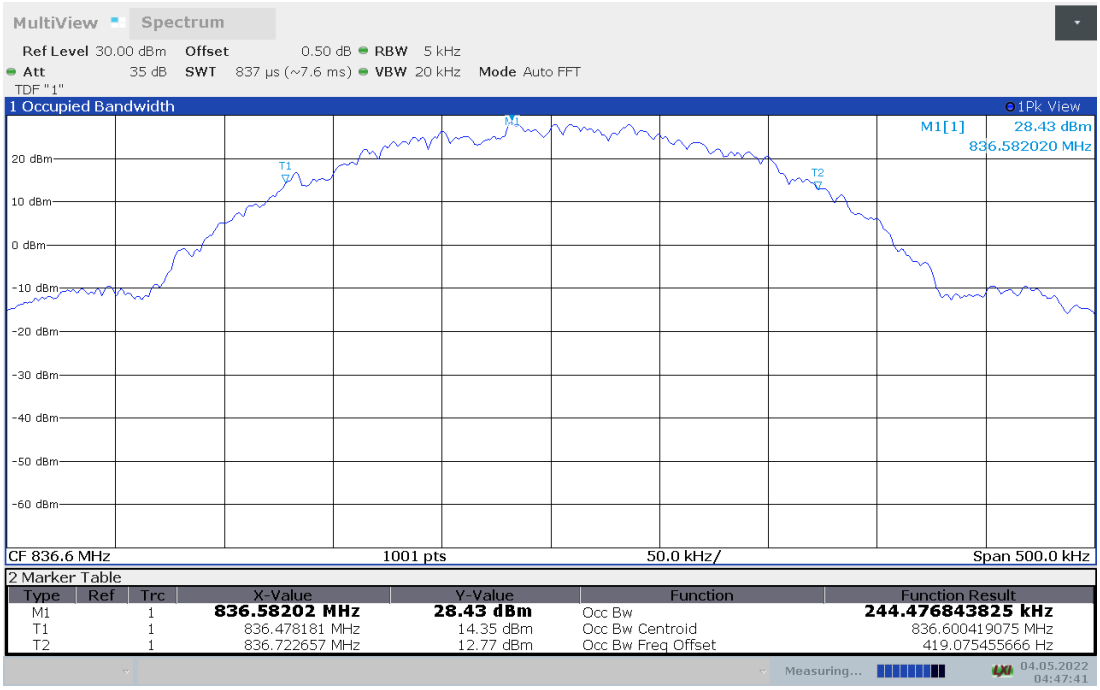
Frequency (MHz)	Occupied Bandwidth (99%)(kHz)
824.2	248.750
836.6	244.477
848.8	244.637

GPRS 850 (99%)

Channel 128-Occupied Bandwidth (99% BW)

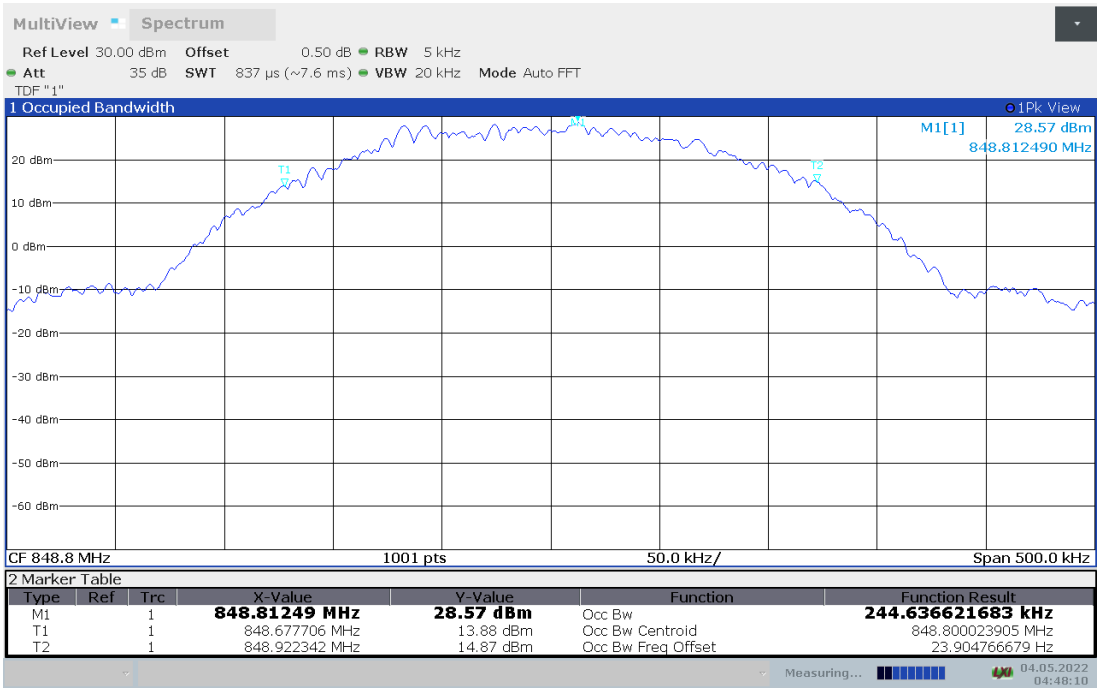


Channel 190-Occupied Bandwidth (99% BW)



©Copyright. All rights reserved by CTTL.

Channel 251-Occupied Bandwidth (99% BW)



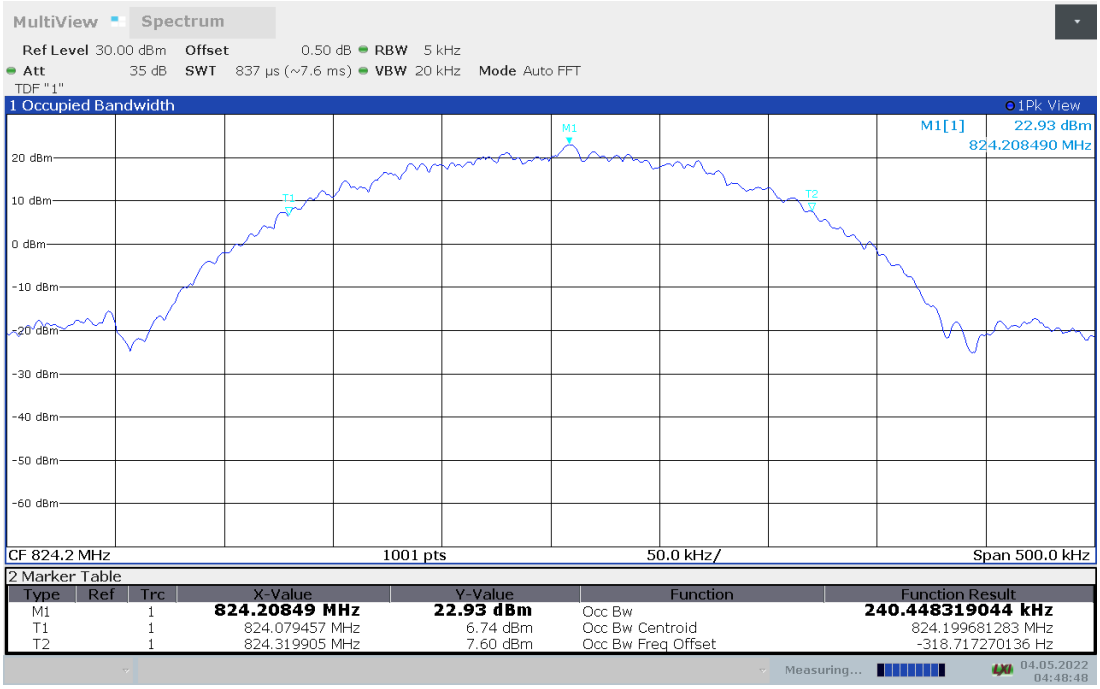
©Copyright. All rights reserved by CTTL.

EGPRS 850-8PSK (99%)

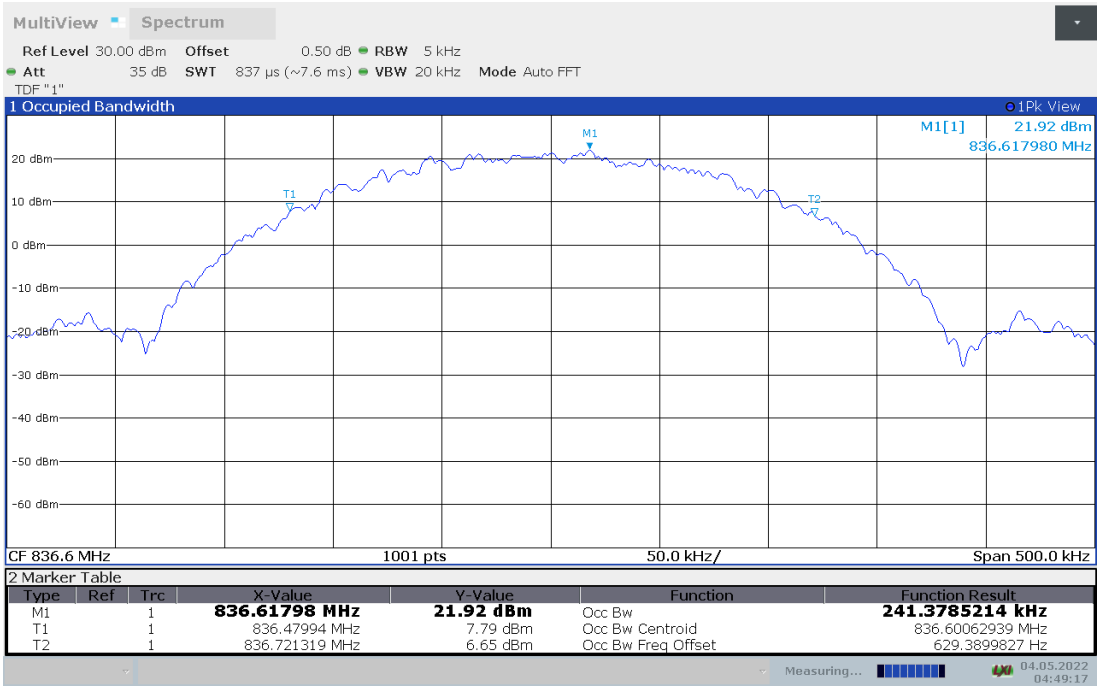
Frequency (MHz)	Occupied Bandwidth (99%)(kHz)
824.2	240.448
836.6	241.379
848.8	245.183

EGPRS 850-8PSK (99%)

Channel 128-Occupied Bandwidth (99% BW)

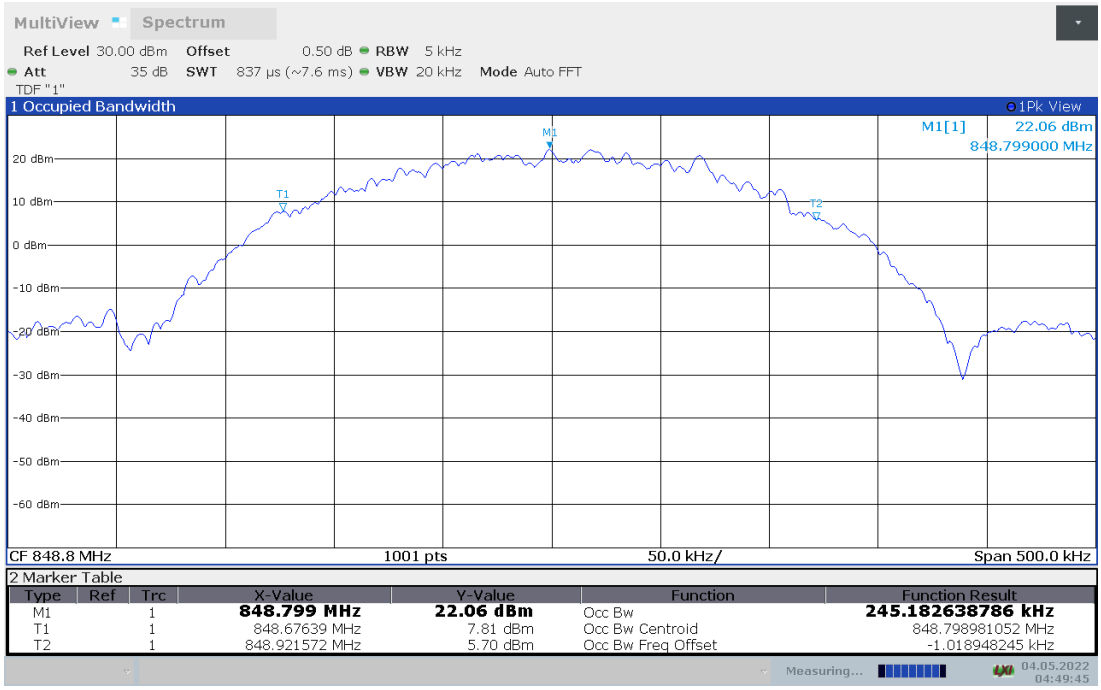


Channel 190-Occupied Bandwidth (99% BW)



©Copyright. All rights reserved by CTTL.

Channel 251-Occupied Bandwidth (99% BW)



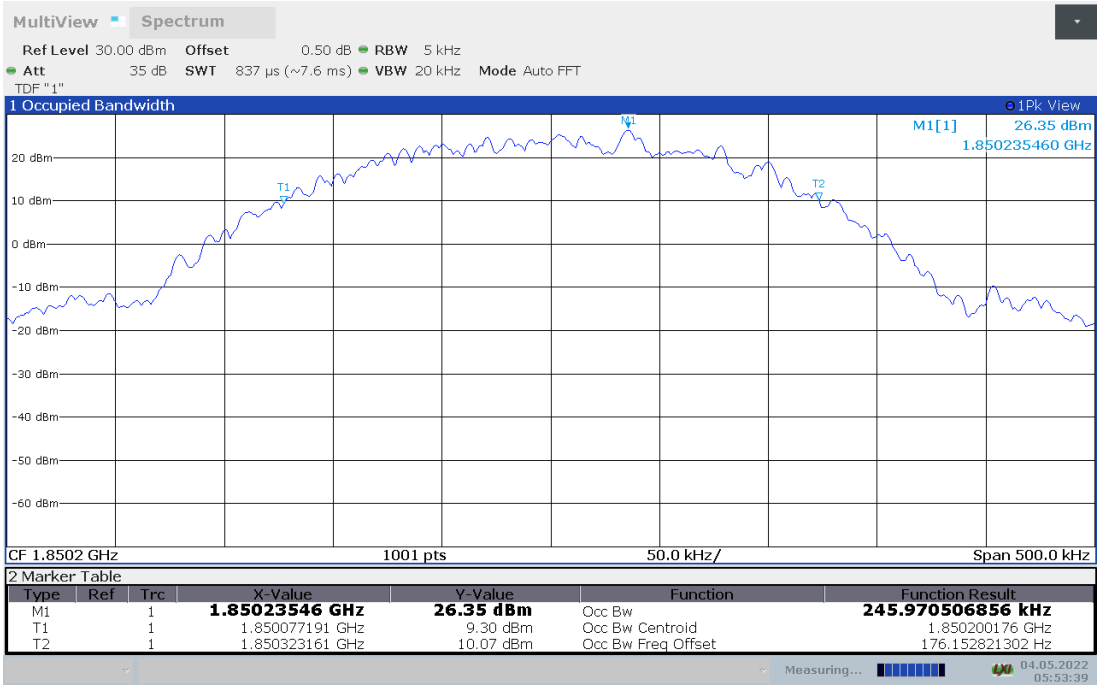
©Copyright. All rights reserved by CTTL.

GPRS 1900 (99%)

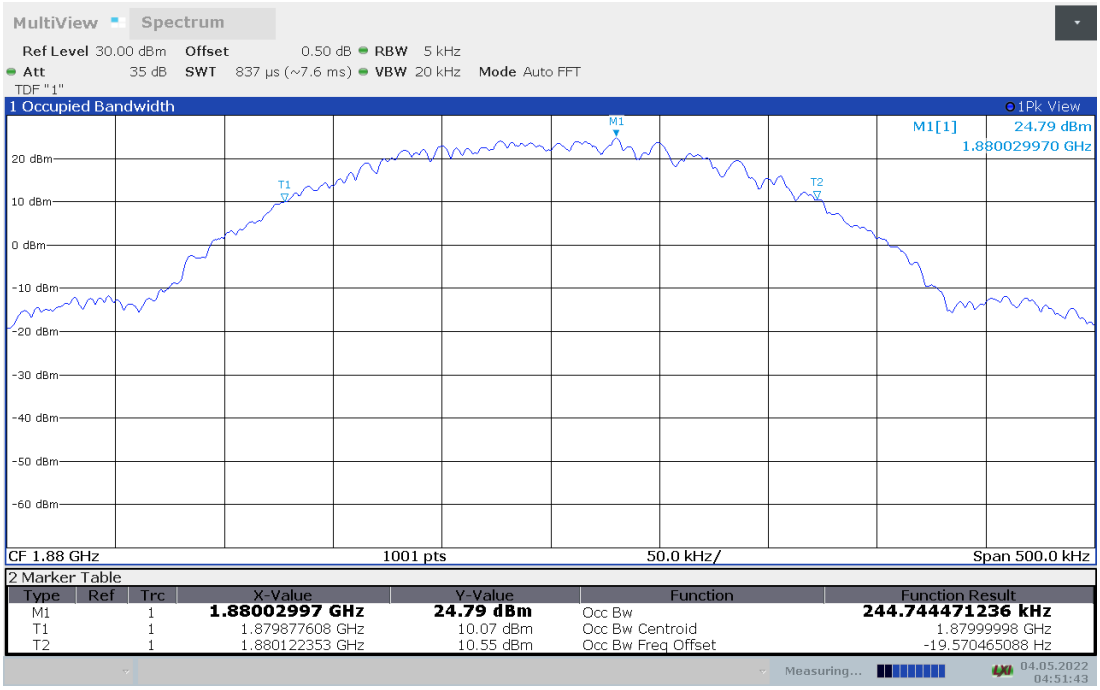
Frequency (MHz)	Occupied Bandwidth (99%)(kHz)
1850.2	245.971
1880.0	244.744
1909.8	243.647

GPRS 1900 (99%)

Channel 512-Occupied Bandwidth (99% BW)

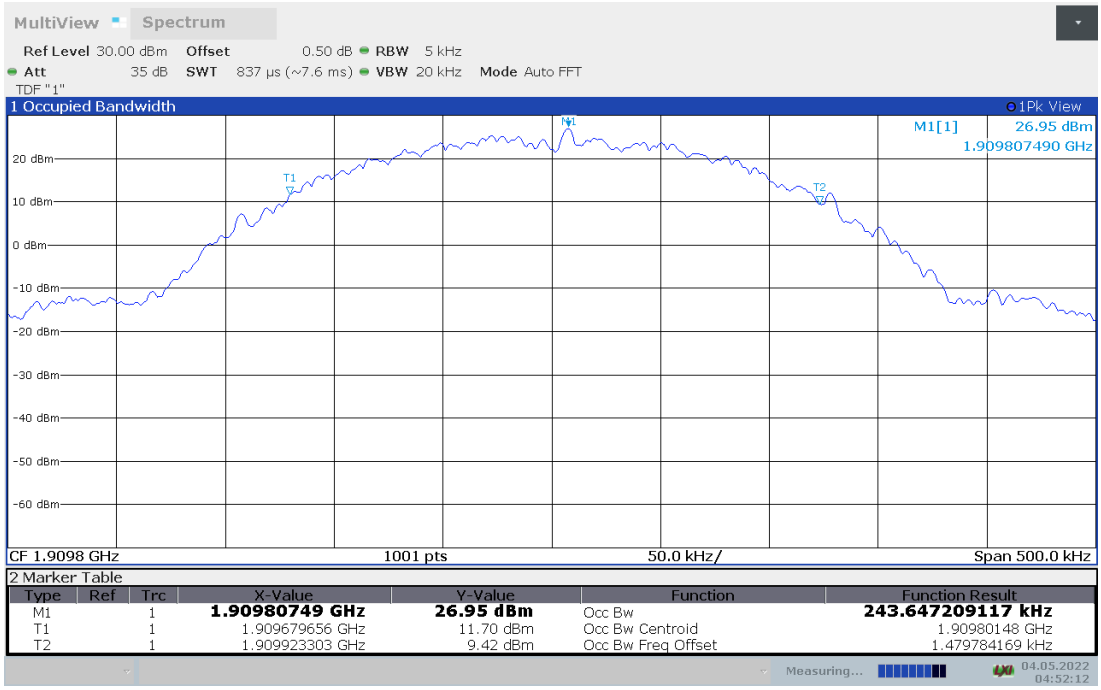


Channel 661-Occupied Bandwidth (99% BW)



©Copyright. All rights reserved by CTTL.

Channel 810-Occupied Bandwidth (99% BW)



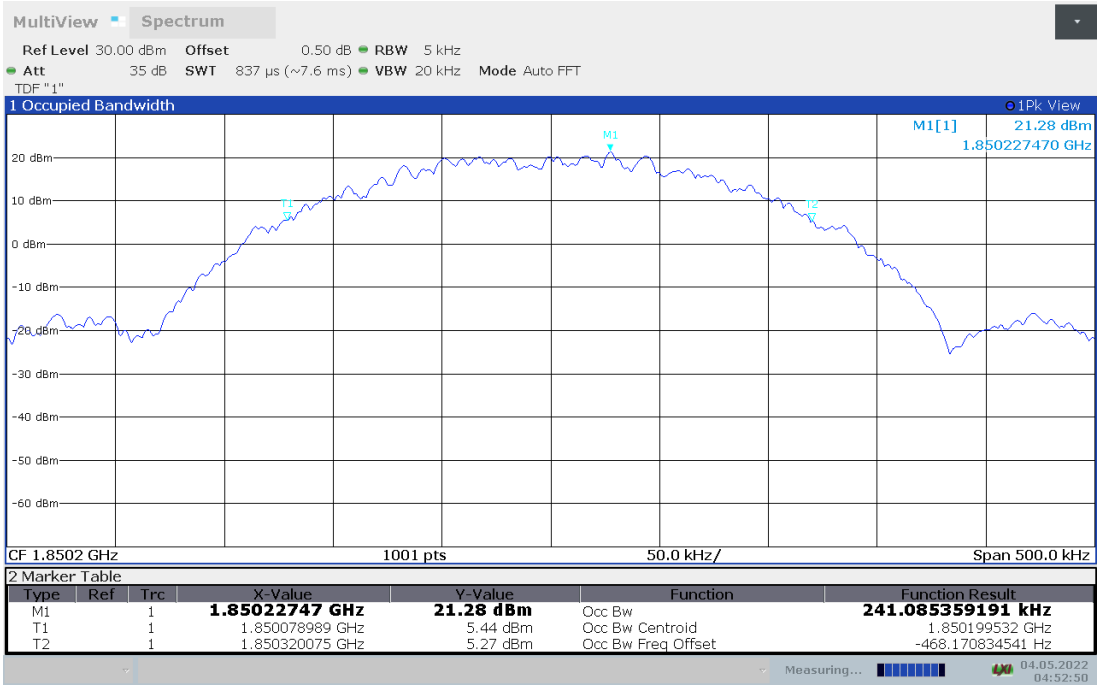
©Copyright. All rights reserved by CTTL.

EGPRS 1900-8PSK (99%)

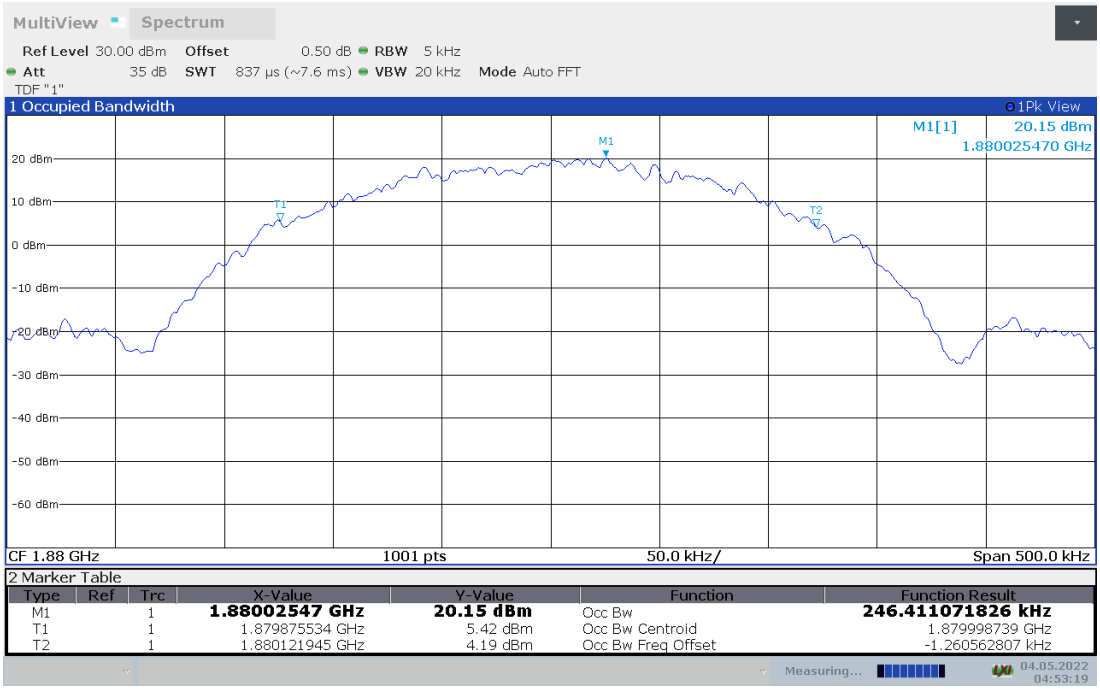
Frequency (MHz)	Occupied Bandwidth (99%)(kHz)
1850.2	241.085
1880.0	246.411
1909.8	243.631

EGPRS 1900-8PSK (99%)

Channel 512-Occupied Bandwidth (99% BW)

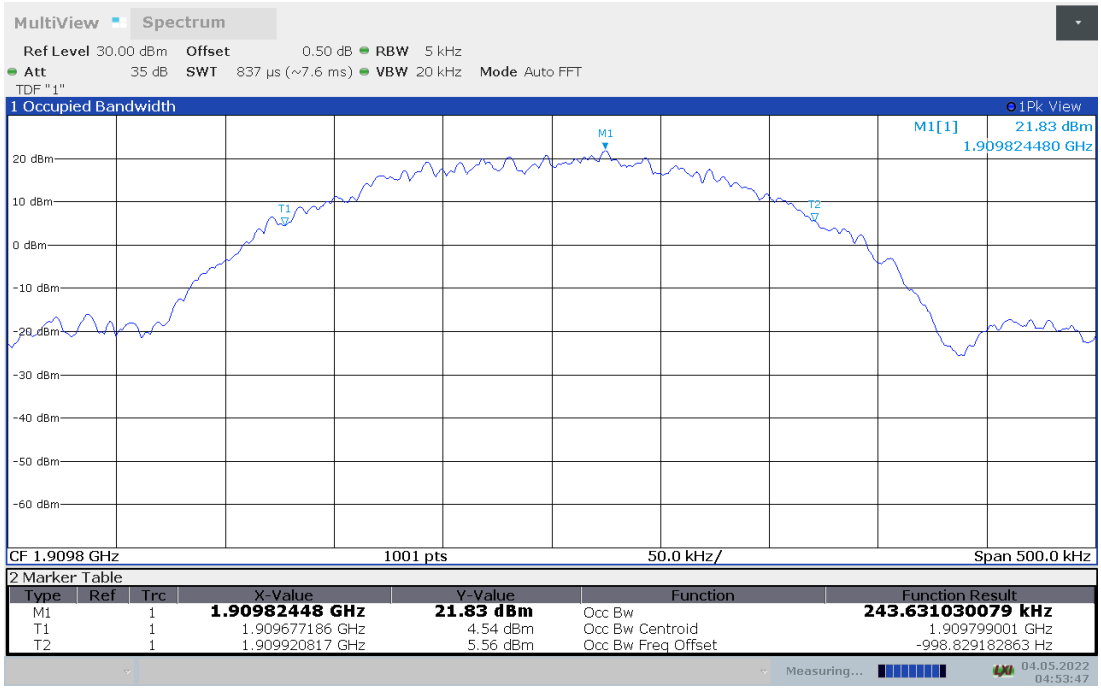


Channel 661-Occupied Bandwidth (99% BW)



©Copyright. All rights reserved by CTTL.

Channel 810-Occupied Bandwidth (99% BW)



©Copyright. All rights reserved by CTTL.

A.5 Emission Bandwidth

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.
The measurement method is from ANSI C63.26:
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
b) The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set ≥ 3 × RBW.
c) Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.
d) The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target "−X dB" requirement, i.e., if the requirement calls for measuring the −26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
e) Set spectrum analyzer detection mode to peak, and the trace mode to max hold.

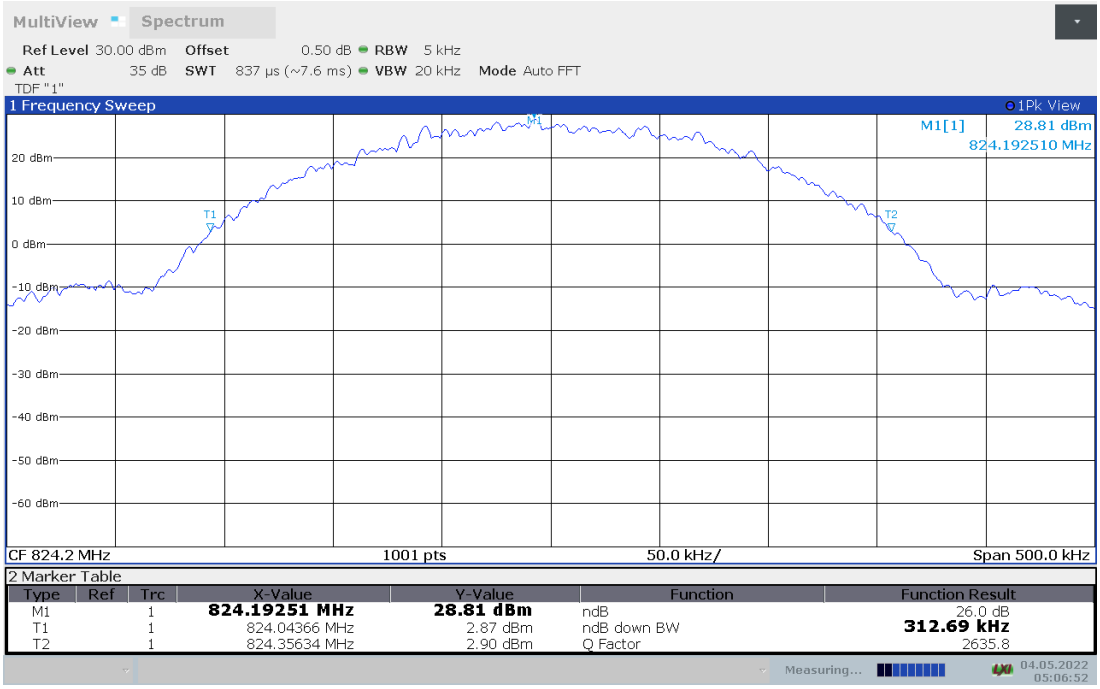
©Copyright. All rights reserved by CTTL.

GPRS 850 (-26dBc)

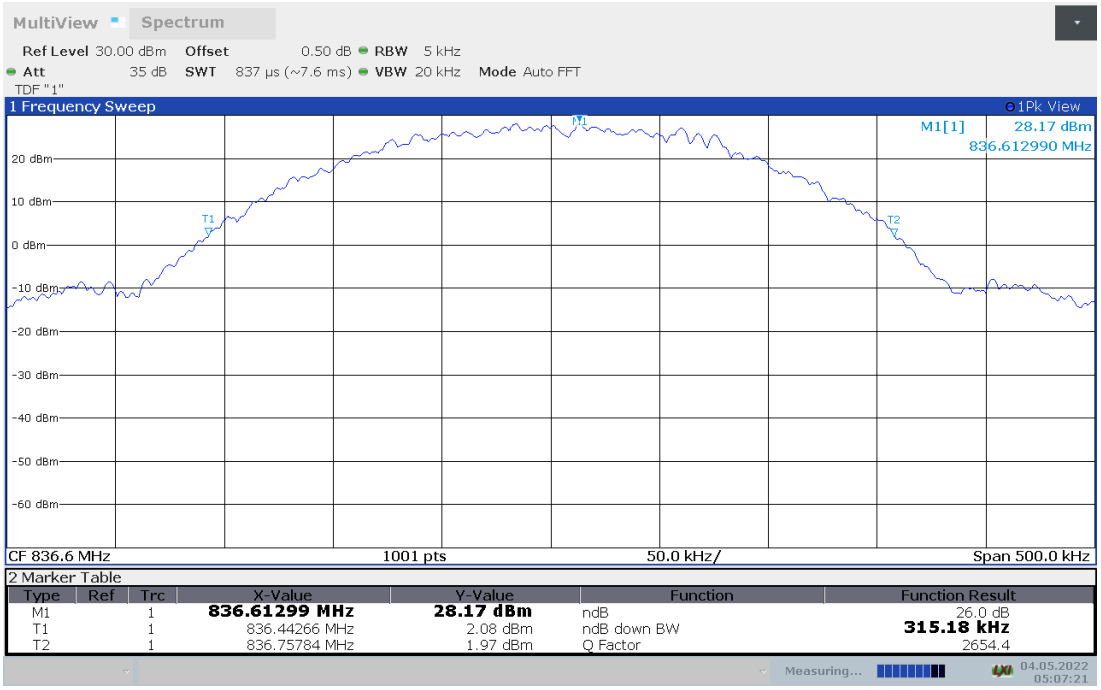
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
824.2	312.69
836.6	315.18
848.8	317.18

GPRS 850 (-26dBc)

Channel 128-Emission Bandwidth (-26dBc BW)

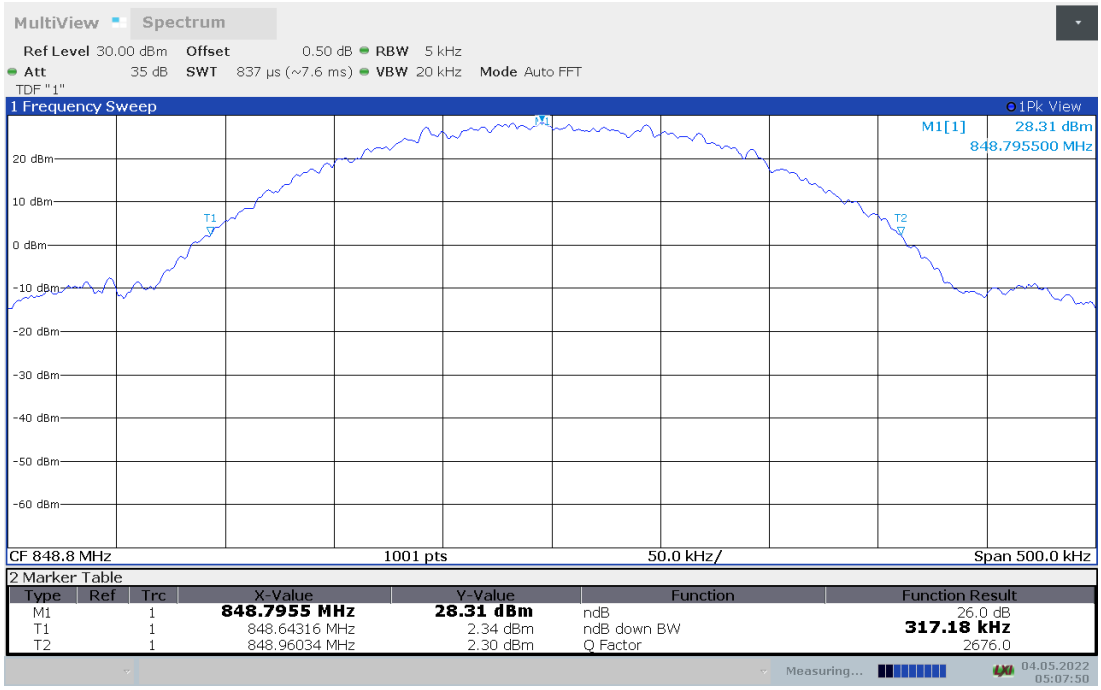


Channel 190-Emission Bandwidth (-26dBc BW)



©Copyright. All rights reserved by CTTL.

Channel 251-Emission Bandwidth (-26dBc BW)



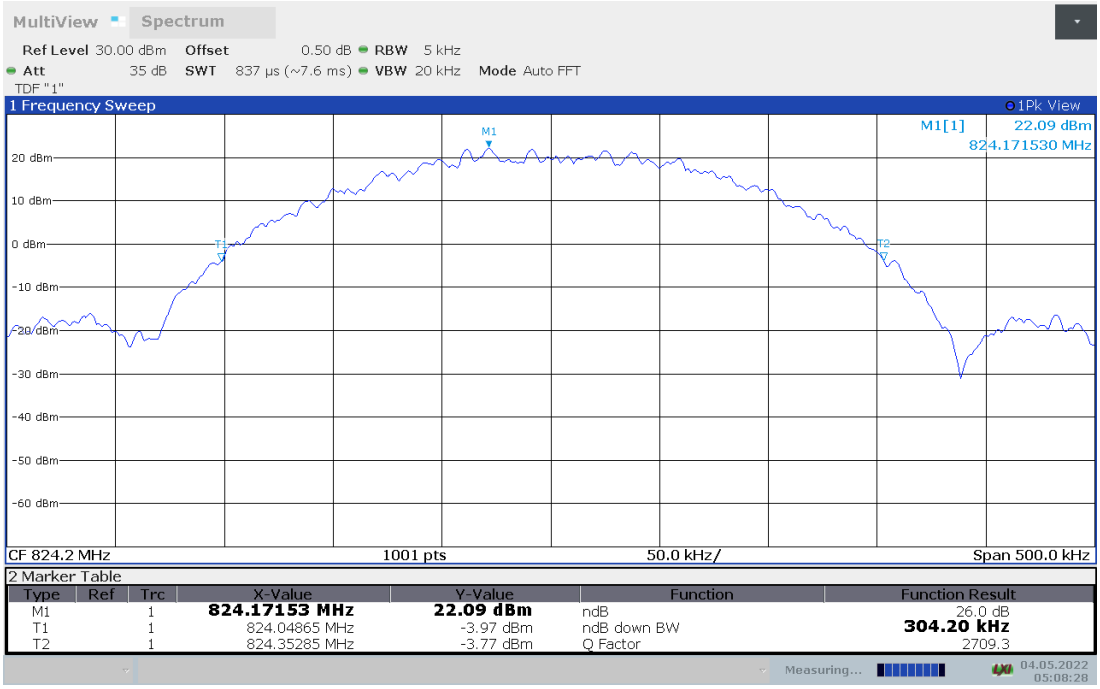
©Copyright. All rights reserved by CTTL.

EGPRS 850-8PSK (-26dBc)

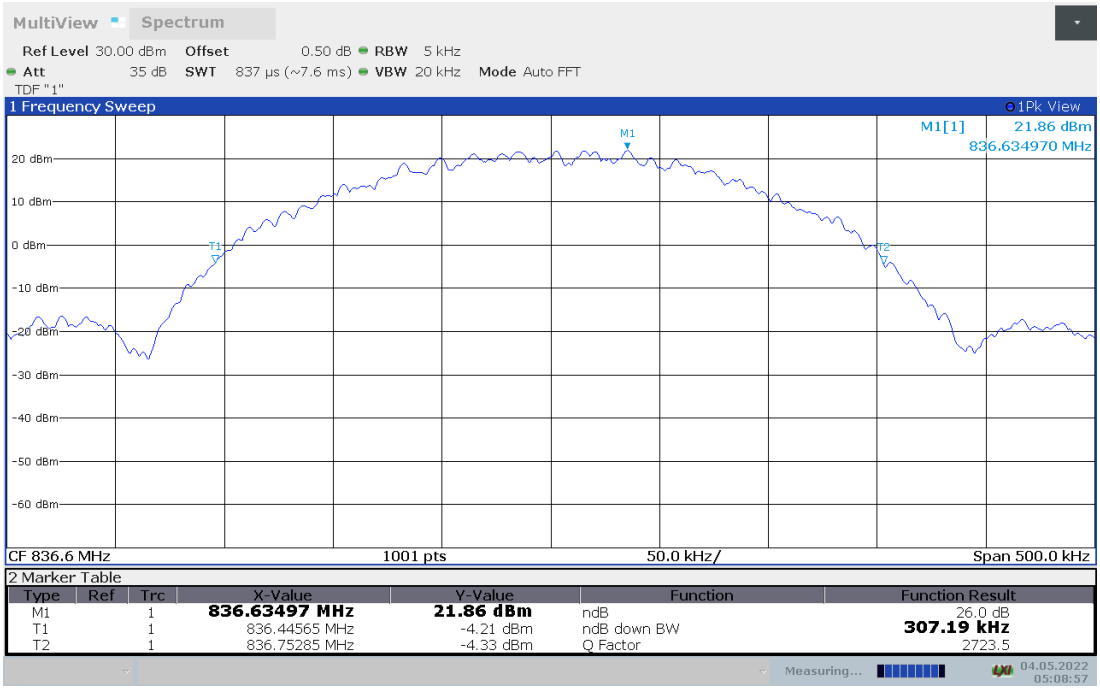
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
824.2	304.20
836.6	307.19
848.8	301.70

EGPRS 850-8PSK (-26dBc)

Channel 128-Emission Bandwidth (-26dBc BW)

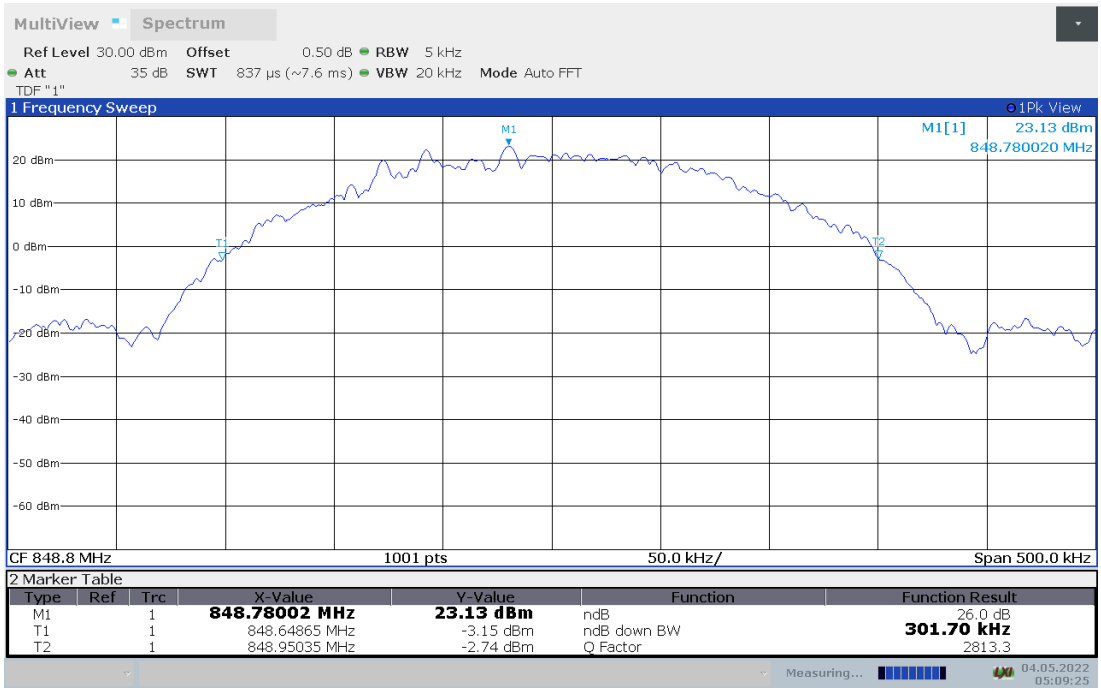


Channel 190-Emission Bandwidth (-26dBc BW)



©Copyright. All rights reserved by CTTL.

Channel 251-Emission Bandwidth (-26dBc BW)



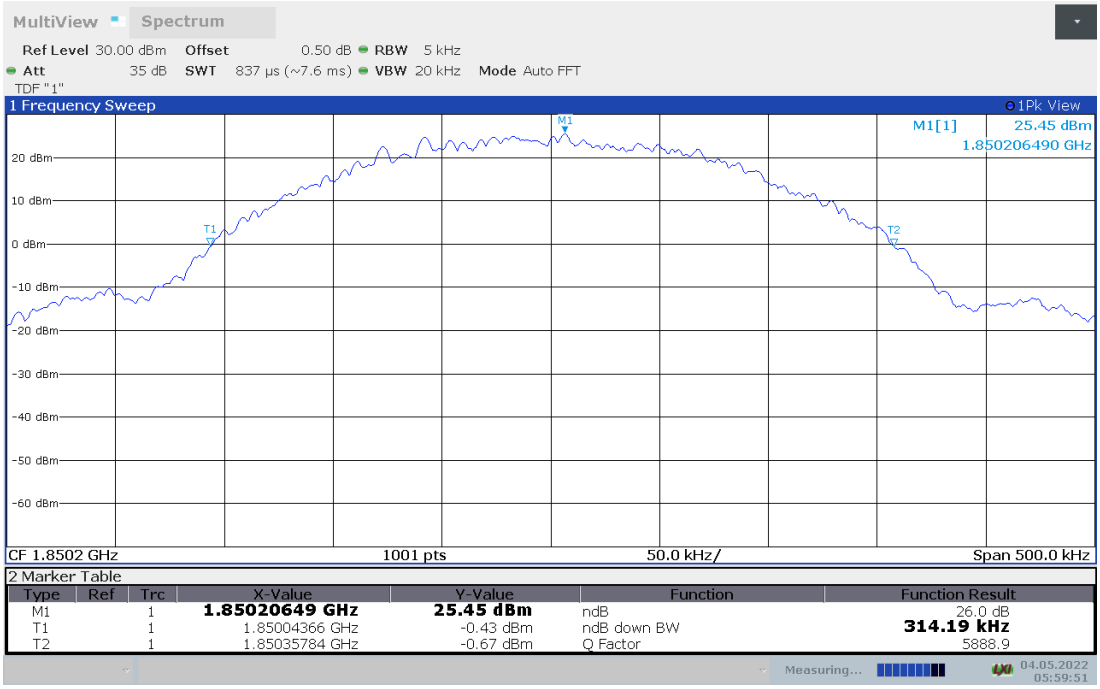
©Copyright. All rights reserved by CTTL.

GPRS 1900 (-26dBc)

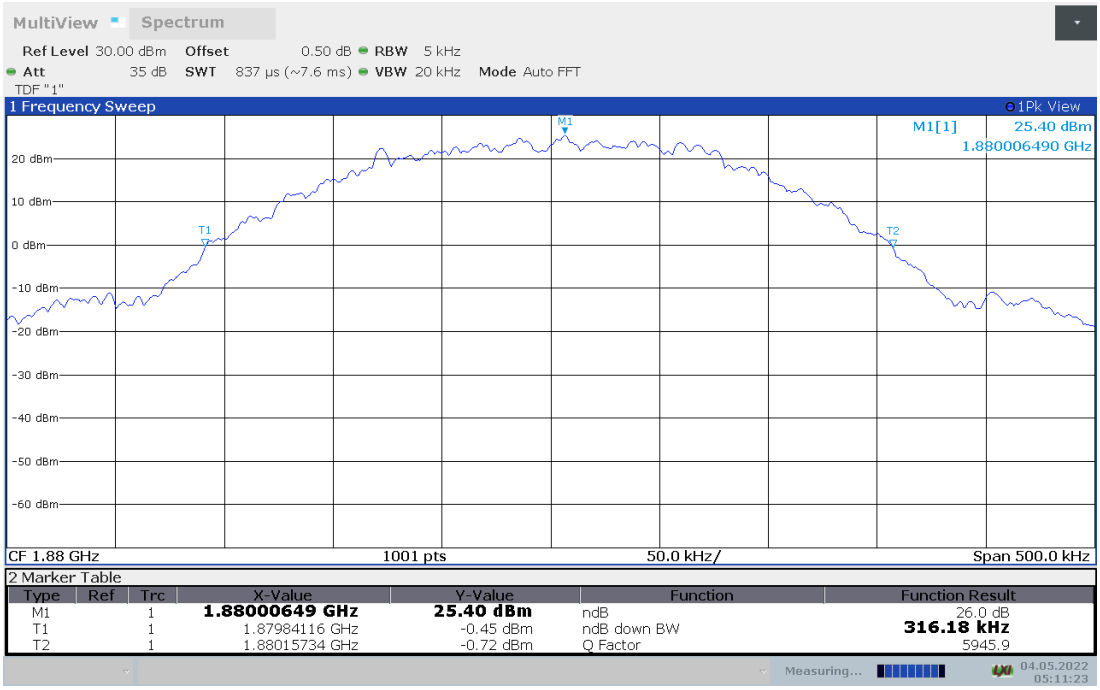
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
1850.2	314.19
1880.0	316.18
1909.8	319.18

GPRS 1900 (-26dBc)

Channel 512-Emission Bandwidth (-26dBc BW)

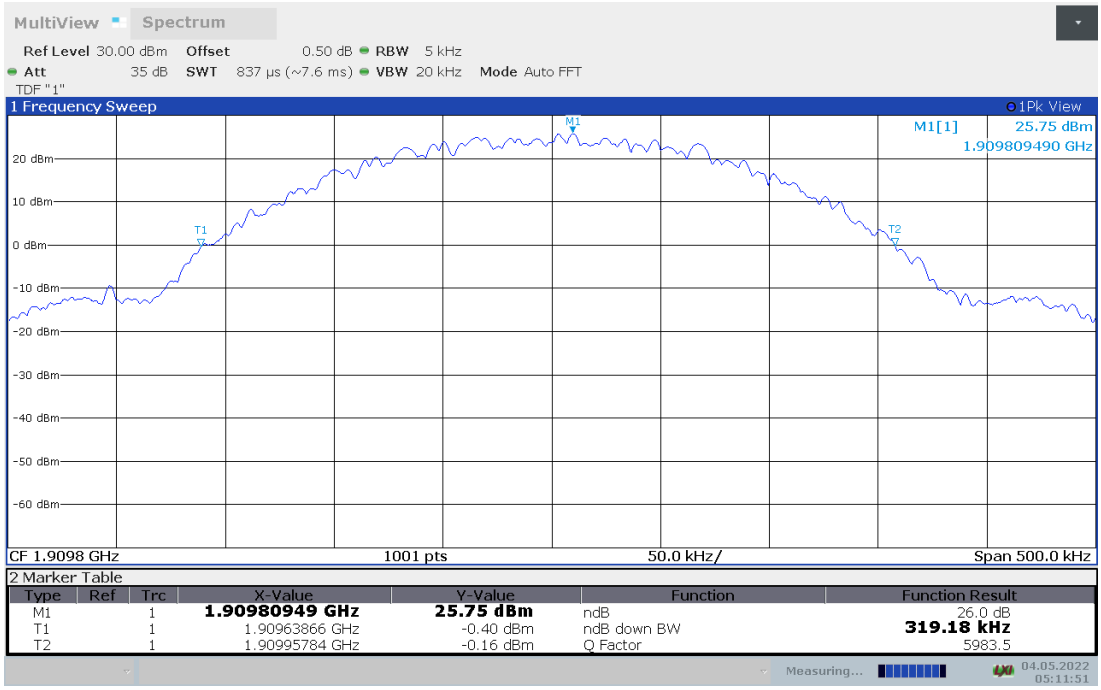


Channel 661-Emission Bandwidth (-26dBc BW)



©Copyright. All rights reserved by CTTL.

Channel 810-Emission Bandwidth (-26dBc BW)



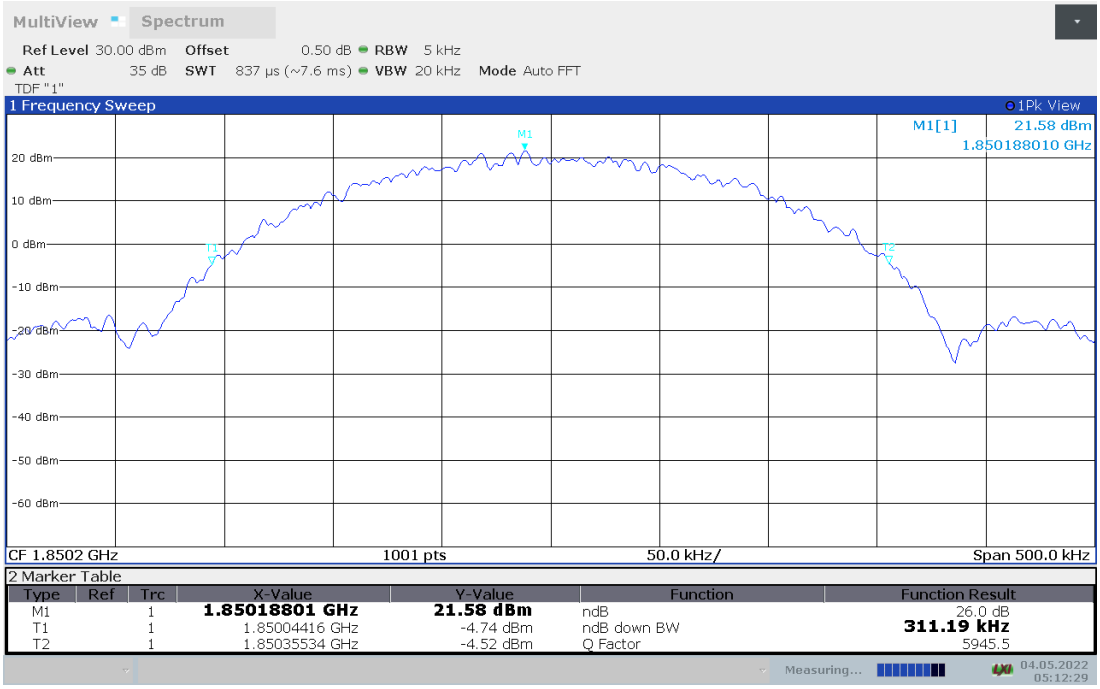
©Copyright. All rights reserved by CTTL.

EGPRS 1900-8PSK (-26dBc)

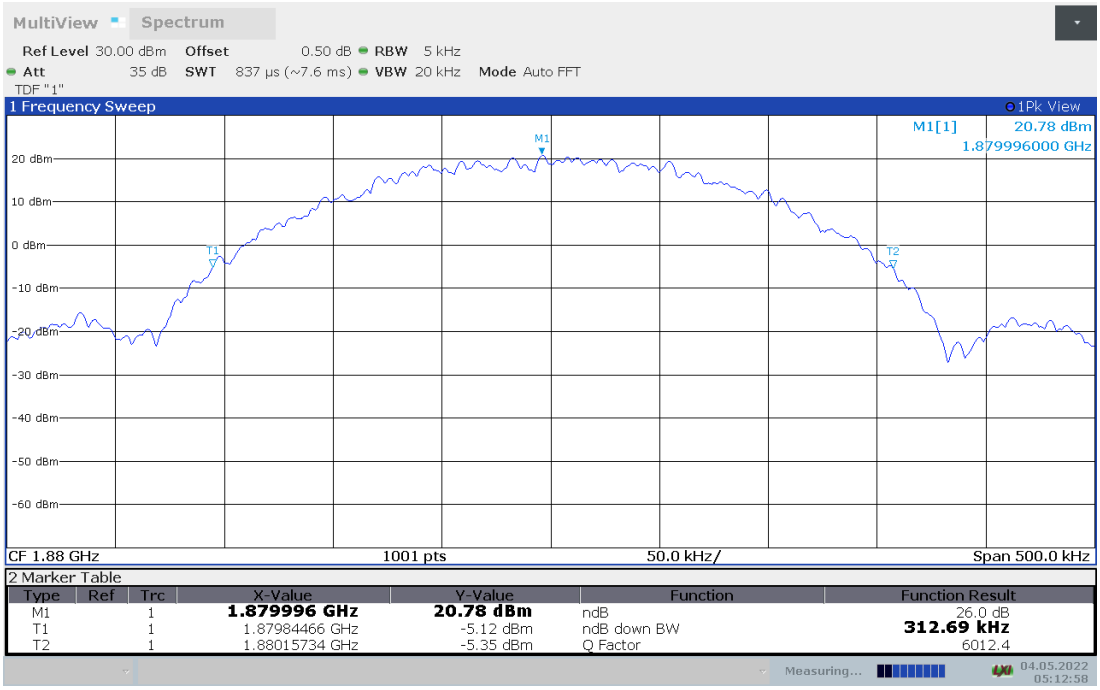
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
1850.2	311.19
1880.0	312.69
1909.8	309.19

EGPRS 1900-8PSK (-26dBc)

Channel 512-Emission Bandwidth (-26dBc BW)

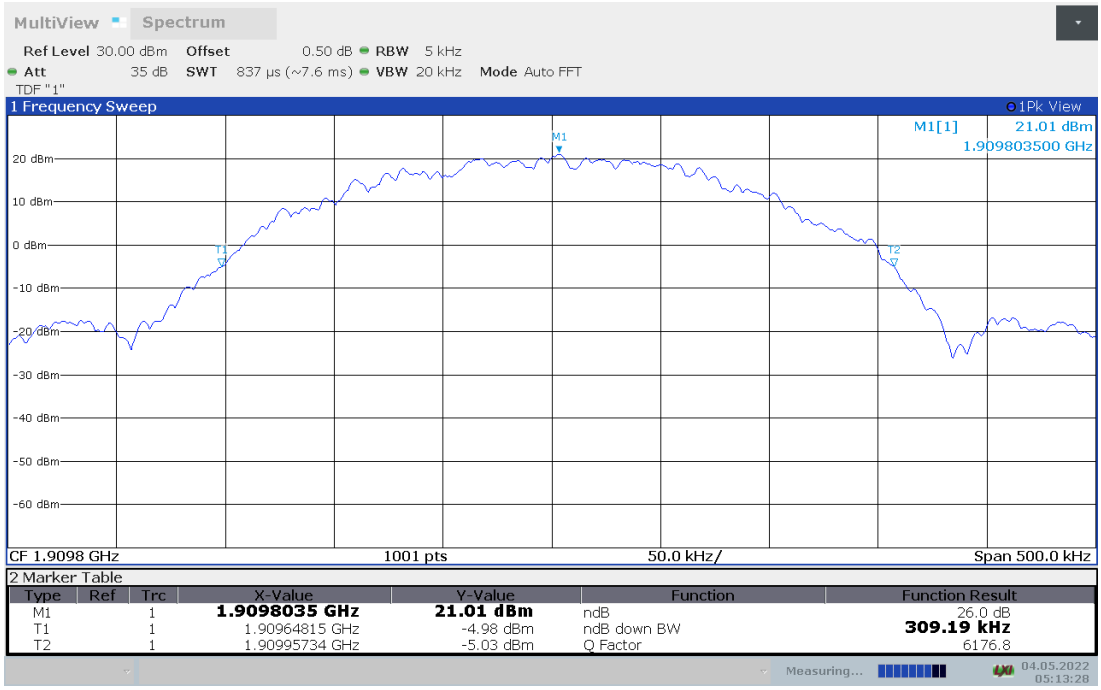


Channel 661-Emission Bandwidth (-26dBc BW)



©Copyright. All rights reserved by CTTL.

Channel 810-Emission Bandwidth (-26dBc BW)



©Copyright. All rights reserved by CTTL.

A.6 Band Edge Compliance

A.6.1 Measurement limit

Part 22.917 and Part 24.238 specify that 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.

According to KDB 971168, a relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

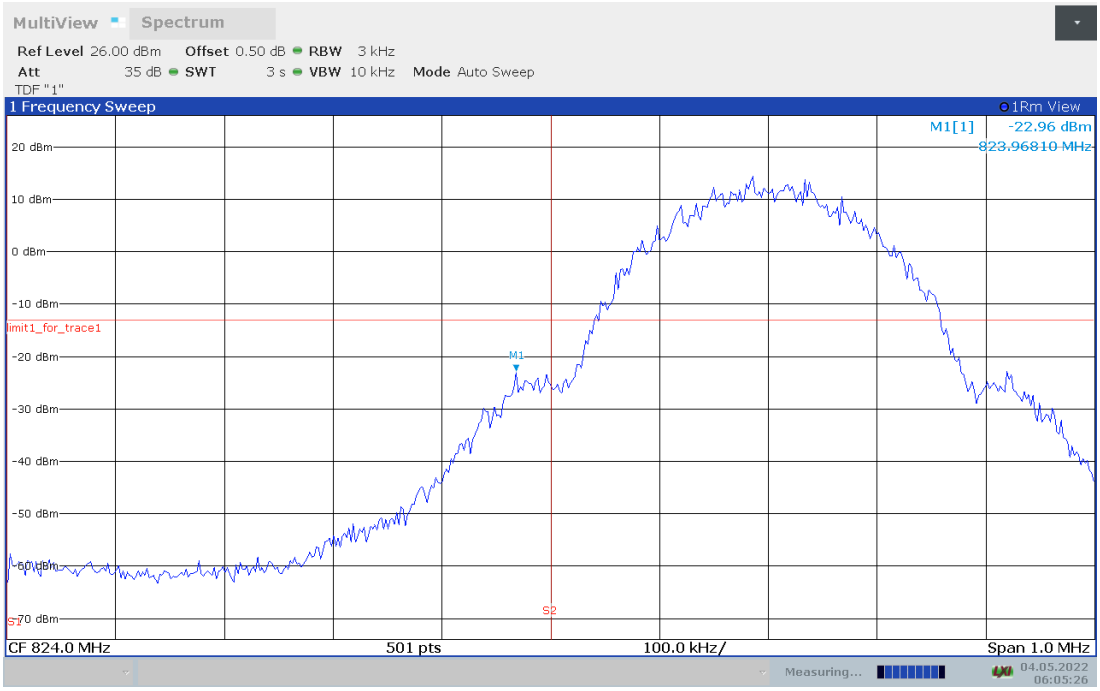
The spectrum analyzer readings are corrected by [10 log (1/duty cycle)] for the non-continuous transmitting scenario.

©Copyright. All rights reserved by CTTL.

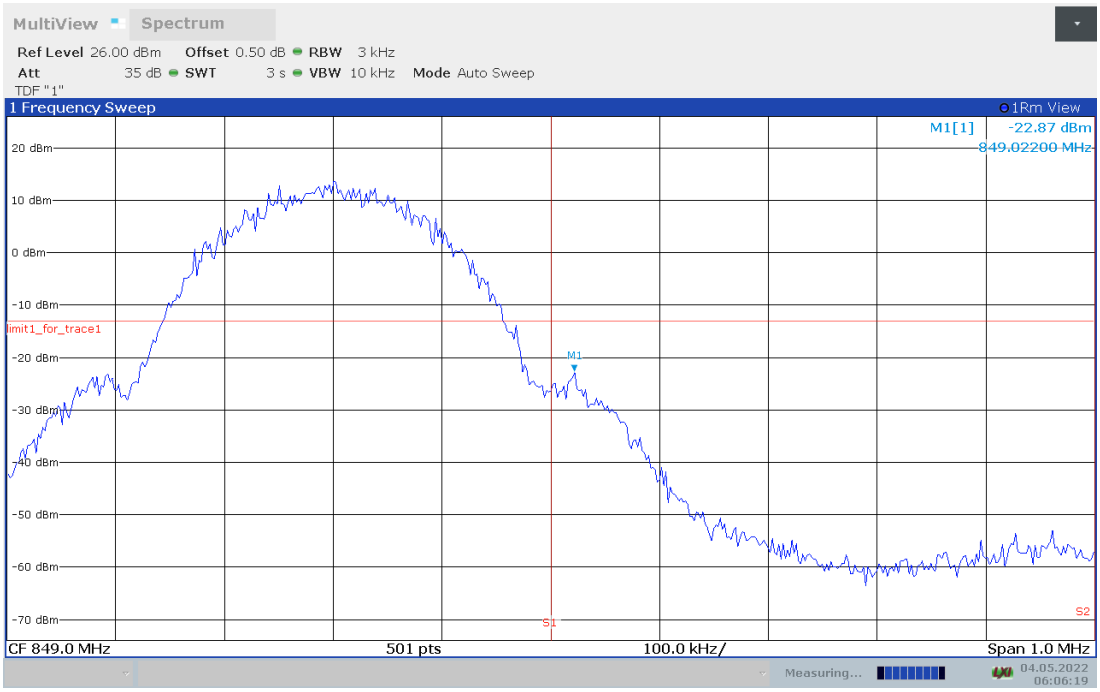
A.6.2 Measurement result

GPRS 850

Channel 128



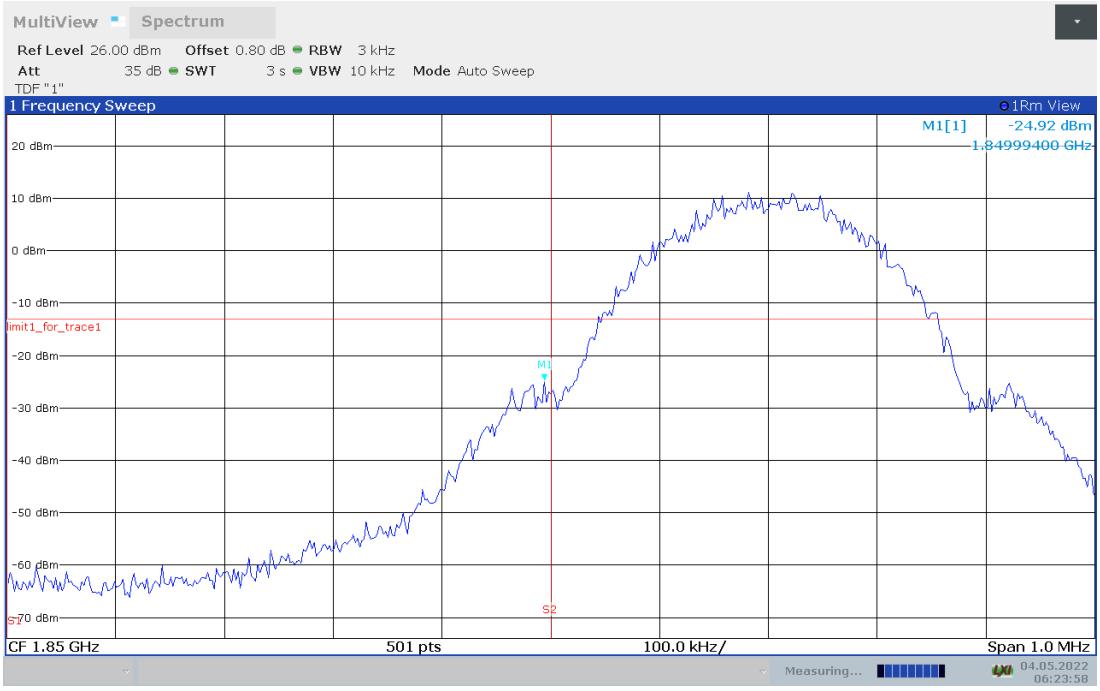
Channel 251



©Copyright. All rights reserved by CTTL.

GPRS 1900

Channel 512



Channel 810

©Copyright. All rights reserved by CTTL.

A.7 Conducted Spurious Emission

A.7.1 Measurement Method

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given below:
   (a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
   (b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.
3. The number of sweep points of spectrum analyzer is greater than 2×span/RBW.

A. 7.2 Measurement Limit

Part 22.917 and Part 24.238 specify that 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.

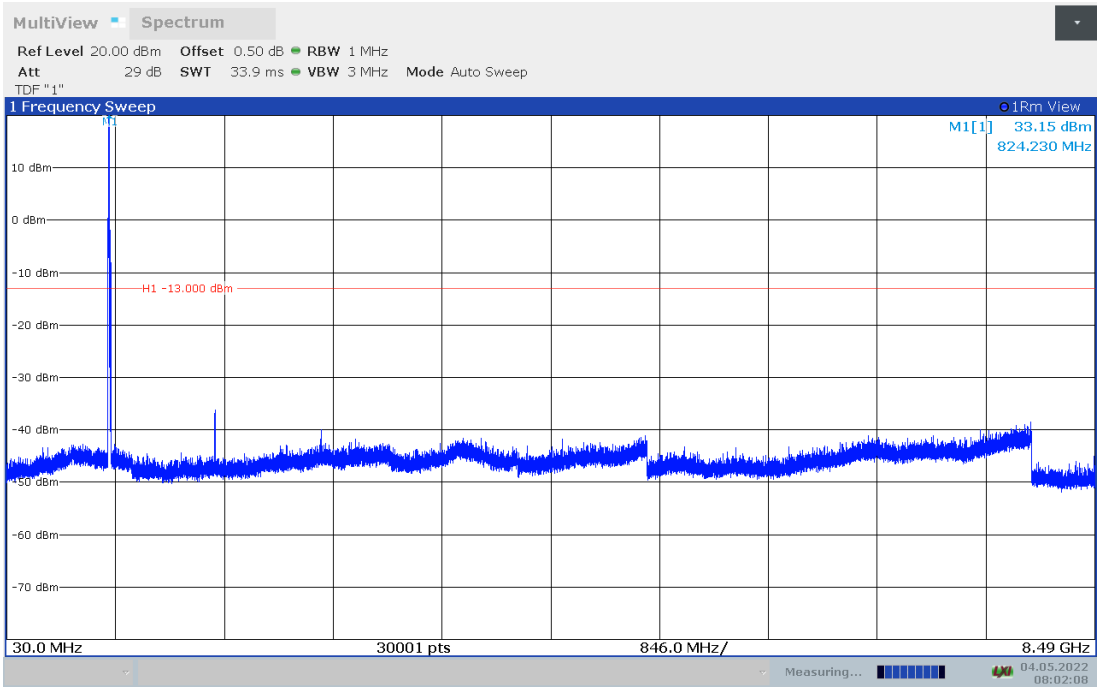
©Copyright. All rights reserved by CTTL.

A.7.3 Measurement result

GPRS 850

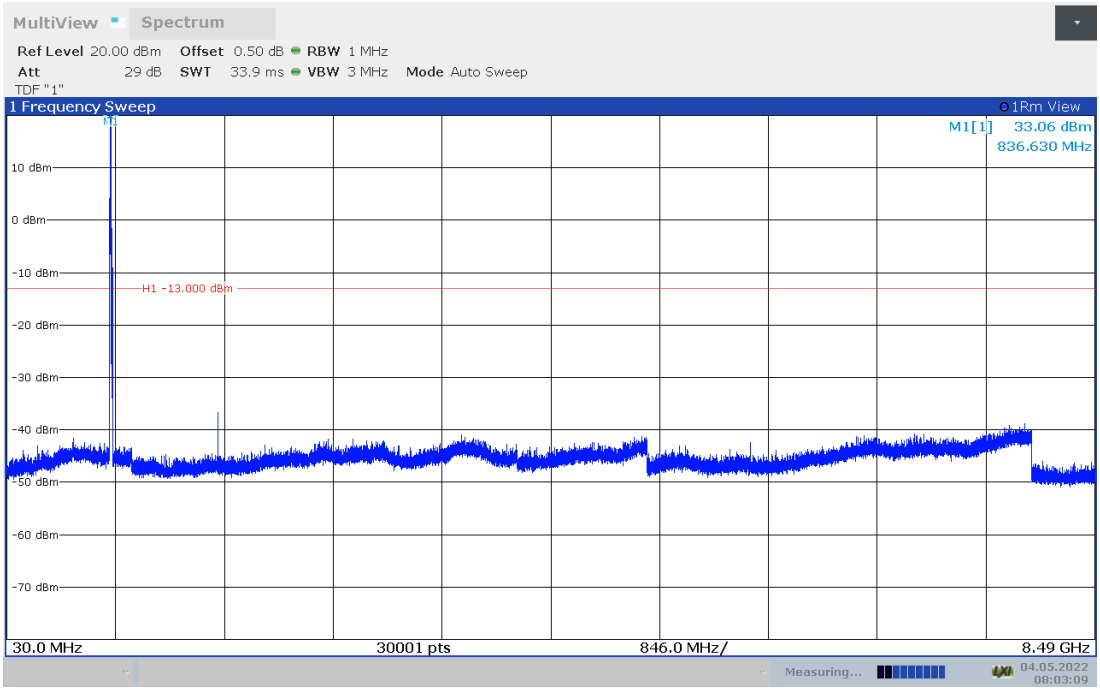
Channel 128: 30MHz – 8.49GHz

NOTE: peak above the limit line is the carrier frequency.



Channel 190: 30MHz – 8.49GHz

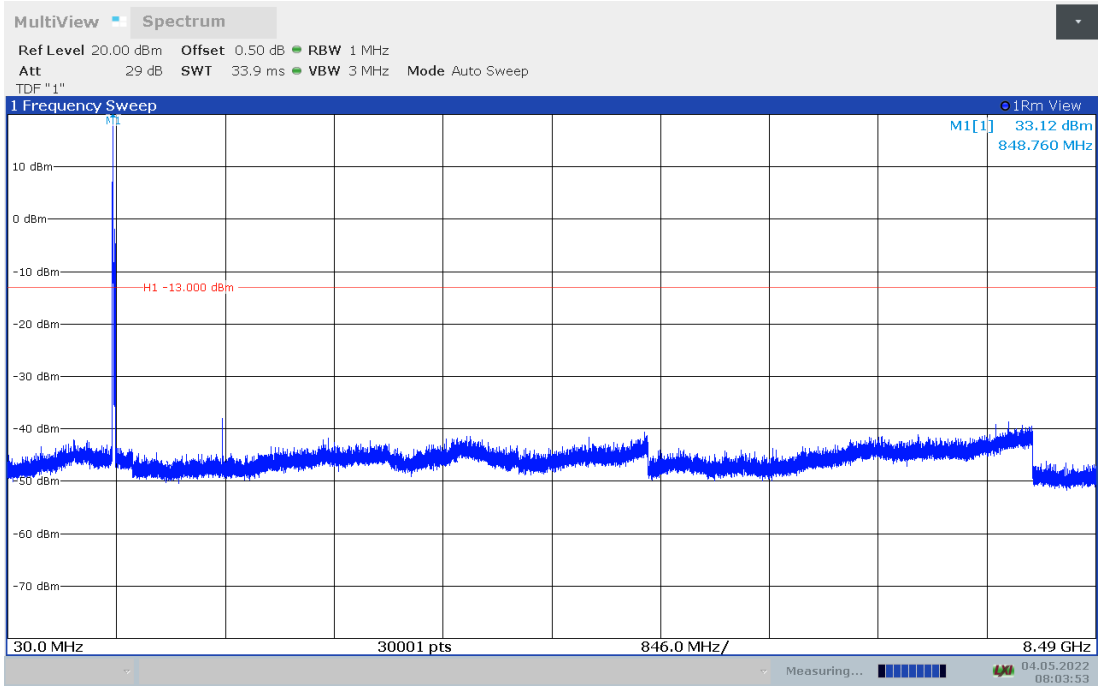
NOTE: peak above the limit line is the carrier frequency.



©Copyright. All rights reserved by CTTL.

Channel 251: 30MHz – 8.49GMHz

NOTE: peak above the limit line is the carrier frequency.

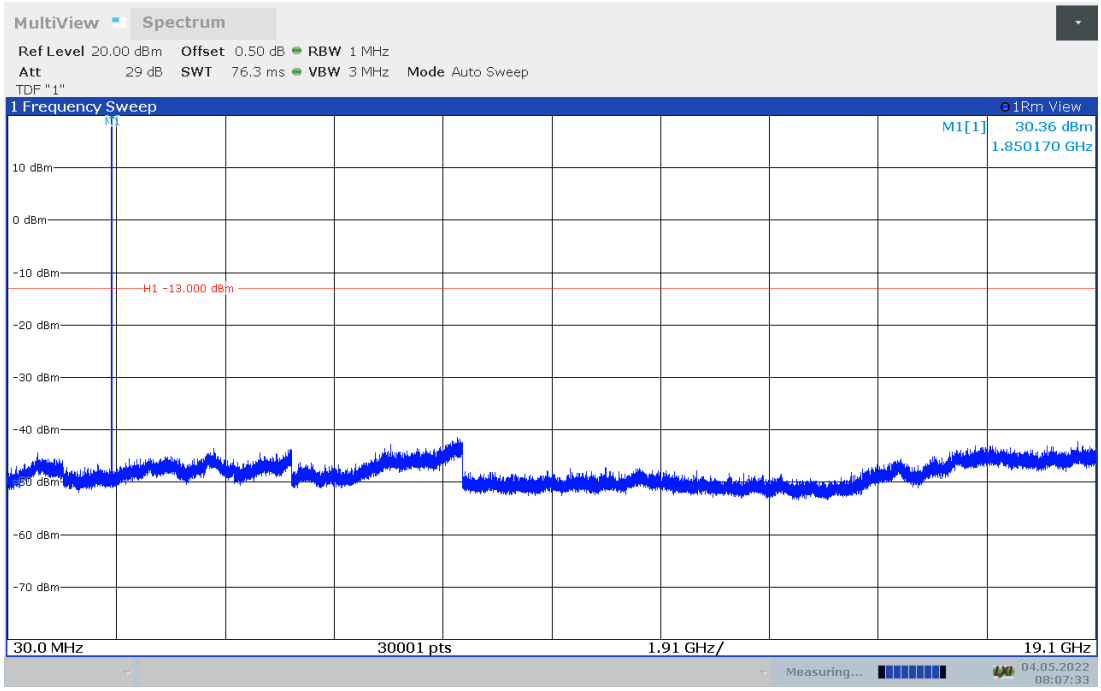


©Copyright. All rights reserved by CTTL.

GPRS 1900

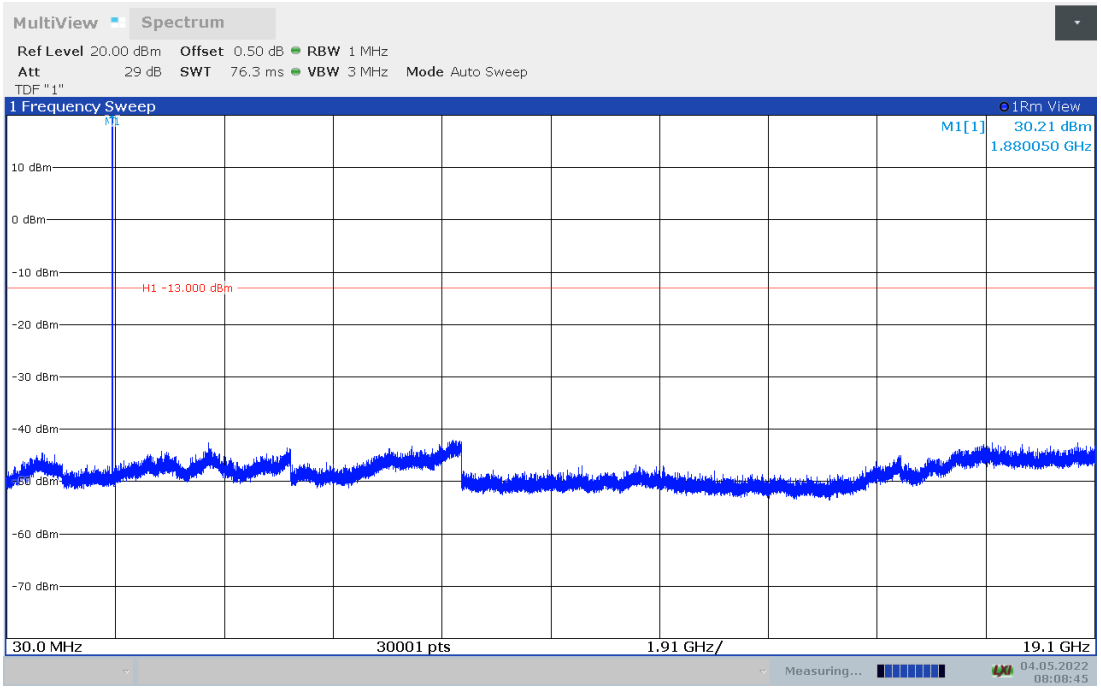
Channel 512: 30MHz – 19.10GHz

NOTE: peak above the limit line is the carrier frequency.



Channel 661: 30MHz – 19.10GHz

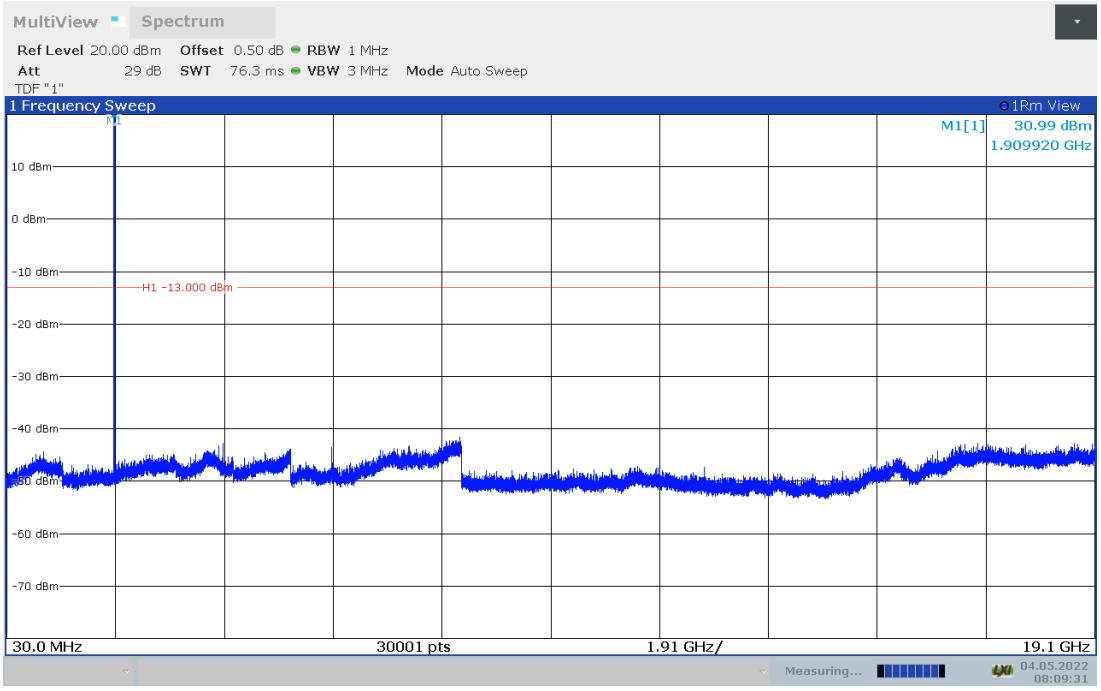
NOTE: peak above the limit line is the carrier frequency.



©Copyright. All rights reserved by CTTL.

Channel 810: 30MHz – 19.10GHz

NOTE: peak above the limit line is the carrier frequency.



©Copyright. All rights reserved by CTTL.

A.8 Peak-to-Average Power Ratio

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB

a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;

b) Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;

c) Set the number of counts to a value that stabilizes the measured CCDF curve;

d) Record the maximum PAPR level associated with a probability of 0.1%.

Measurement results

	Frequency (MHz)	PAPR (dB)
GPRS1900	1880.0	8.22
EGPRS1900(8PSK)	1880.0	11.32

©Copyright. All rights reserved by CTTL.

Annex B: Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ilac-MRA

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2021-09-29 through 2022-09-30
Effective Dates

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

For the National Voluntary Laboratory Accreditation Program

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

©Copyright. All rights reserved by CTTL.