TEST REPORT

REPORT NUMBER: I22W00025-GSM RF_Rev2

ON

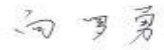
Type of Equipment:	LTE /HSPA/GSM/GNSS MODULE
Type of Designation:	SIM7600SA-H/SIM7600SA-H miniPCIE
Brand Name:	SIMCom
Manufacturer:	SIMCom Wireless Solutions Limited
FCC ID:	2AJYU-8PYA002

ACCORDING TO

FCC CFR Part 2, FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS，e-CFR, 2019
PART 22, PUBLIC MOBILE SERVICES，e-CFR, 2019
PART 24, PERSONAL COMMUNICATIONS SERVICES，e-CFR, 2019
ANSI C63.26-2015

Chongqing Academy of Information and Communications Technology

Month date, year
May, 05, 2022
Signature



Xiang Luoyong
Director

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 Chongqing Academy of Information and Communications Technology.

Revision Version

Report Number	Revision	Date	Memo
I22W00025-GSM RF	00	2022-03-30	Initial creation of test report
I22W00025-GSM RF_Rev1	01	2022-04-26	the second time creation of test report
I22W00025-GSM RF_Rev2	02	2022-05-05	the third time creation of test report

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1. Test Laboratory

1.1. Testing Location

Name:	Chongqing Academy of Information and Communications Technology
FCC Registration Number:	CN1239
Address:	Building C, Technology Innovation Center, No.8, Yuma Road, Chayuan New Area, Nan'an District, Chongqing, People's Republic of China
	No.19 East Road, Xiantao Big-data Valley, Yubei District, Chongqing, People's Republic of China
Postal Code:	401336
Telephone:	0086-23-88069965
Fax:	0086-23-88608777

1.2. Testing Environment

Normal Temperature:	15-35℃
Relative Humidity:	30-60%

1.3. Project data

Testing Start Date:	2022-03-25
Testing End Date:	2022-04-26

1.4. Signature

董俊鑫	2022-05-05
Dong Junxin (Prepared this test report)	**Date**
李 照	2022-05-05
Li Xu (Reviewed this test report)	**Date**
向罗勇	2022-05-05
Xiang Luoyong Director of the laboratory (Approved this test report)	**Date**

2. Client Information

2.1. Applicant Information

Company name:	SIMCom Wireless Solutions Limited
Address /Post:	Building 3,No. 289, Linhong Road, Changning District, Shanghai, P.R.China
City:	Shanghai
Country:	China
Telephone:	15902149520
Fax:	--
Email:	yue.hai@simcom.com
Contact Person:	Haiyue

2.2. Manufacturer Information

Company Name:	SIMCom Wireless Solutions Limited
Address /Post:	Building 3,No. 289, Linhong Road, Changning District, Shanghai, P.R.China
City:	Shanghai
Country:	China
Telephone:	15902149520
Fax:	--
Email:	yue.hai@simcom.com
Contact Person:	Haiyue

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

3.1. About EUT

EUT Description	LTE /HSPA/GSM/GNSS MODULE
Model name	SIM7600SA-H/SIM7600SA-H miniPCIE
Brand name	SIMCom
LTE Frequency Band	2/4/5/28/66
WCDMA Frequency Band	2/5
GSM Frequency Band	2/5
Type of modulation	GMSK/8PSK/QPSK/16QAM
Extreme Temperature	-10/+55℃
Nominal Voltage	3.8
Extreme High Voltage	4.2
Extreme Low Voltage	3.3

Note: Photographs of EUT are shown in ANNEX A of this test report.
Note: High and low voltage values in extreme condition test are given by manufacturer.

3.2. Internal Identification of EUT used during the test

EUT ID	SN or IMEI	HW Version	SW Version	Date of receipt
S1	863427042013020	V1.01	SIM7600M11_A_V2.0.1	2022-03-25
S2	863427042010166	V1.01	SIM7600M11_A_V2.0.1	2022-03-25
S4	863427042009036	V1.01	SIM7600M11_A_V2.0.1	2022-03-25

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

3.3. Outline of Equipment under Test

Technology	Band	UL Freq.(MHz)	DL Freq.(MHz)	Note
GSM	B2	1850.2-1909.8	1930.2-1989.8	--
	B5	824.2-848.8	869.2-893.8	--
WCDMA	B2	1852.4-1907.6	1932.4-1987.6	--
	B5	826.4-846.6	871.4-891.6	--
LTE	B2	1850-1910	1930-1990	--
	B4	1710 – 1755	2110 – 2155	--
	B5	824-849	869-894	--
	B28	703-748	758-803	--
	B66	1710-1780	2110-2200	--

3.4. Internal Identification of AE used during the test

AE ID*	Description	dB*
AE1	--	--

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

4. Reference Documents

4.1. Documents supplied by applicant

PICS/PIXIT, referring to Annex B for detailed information, is supplied by the client or manufacturer, which is the basis of testing.

4.2. Reference Documents for testing

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

Reference	Title	Version
FCC CFR Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS，e-CFR	2019
FCC CFR Part 22	PUBLIC MOBILE SERVICES	2019
FCC CFR Part 24	PERSONAL COMMUNICATIONS SERVICES，e-CFR	2019
ANSI C63.26-2015	--	2015
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016

5. Test Equipments Utilized

5.1. RF Test System

No.	Equipment	Model	SN	HW Version	SW Version	Manufacture	Cal.Due Date
1	spectrum analyzer	FSQ 26	201137/026	--	--	R&S	2022-06-11
2	DC Power Supply	N6705B	MY50000919	--	--	Agilent	2022-06-11
3	Universal Radio Communication Tester	CMW500	152395	--	--	R&S	2022-06-11

5.2. RSE /ERP Test System

No.	Equipment	Model	SN	HW Version	SW Version	Manufacture	Cal.Due Date
1	Test Receiver	ESU26	100367	--	5.1-24-3	R&S	2022-06-11
2	Ultra-wideband Log Periodic Antenna	VULB 9163	01392	--	--	Schwarzbeck	2023-03-04
3	Double Ridged Guide Antenna	HF907	100357	--	--	R&S	2023-02-10
4	Universal Radio Communication Tester	CMW500	152395	--	--	R&S	2021-05-12
5	Generator	SMU 200A	104517	--	--	R&S	2022-06-11
6	Ultra-wideband Log Periodic Antenna	VULB 9163	00995	--	--	R&S	2023-04-03
7	Double Ridged Guide Antenna	HF907	100356	--	--	R&S	2022-07-22

5.3. Climate Chamber

No.	Name	Type	SN	Manufacture	Cal.Due Date
1	Climate chamber	SH-241	92010759	ESPEC	2022-07-25
2	Fully-Anechoic Chamber	FACT3-2	--	ETS	2023-06-25

5.4. Vibration table

No.	Name	Type	SN	Manufacture	Cal.Due Date
--	--	--	--	--	--

Anechoic chamber

Fully anechoic chamber by ETS-LINDGREN.

5.5. Test software

No.	Name	version	SN	Manufacture
1	EMC32	V 8.51.00	--	R&S
2	T-RFS500	V2.0	--	Manufacturer:Beijing Zhiwang Xince Technology Co., Ltd.

6. Test Results

6.1. Summary of Test Results

A brief summary of the tests carried out is shown as following.

FCC Rules	Name of Test	Result
2.1046,22.913(a),24.232(c),27.50,	Conducted RF Power Output	Pass
2.1046,22.913(a),24.232 (c),27.50	ERP and EIRP	Pass
2.1049,22.917(b), 24.238(b)	Occupied Bandwidth	*Note 1
2.1051,24.238,2.1053,22.917, 27.53	Conducted spurious emissions	Pass
2.1051,24.238,2.1053,22.917, 27.53	Radiated Spurious Emission	Pass
2.1051,24.238, 2.1053, 22.917, 27.53	Band Edge	Pass
2.1055, 22.355, 24.235, 27.54	Frequency Stability	Pass
24.232, 27.50	Peak to Average Ratio	Pass

Note 1: No applicable performance criteria.

Note 2：Explanation of worst-case configuration The worst-case scenario for all measurements is based on the conducted output power. Output power was measured on GMSK,8PSK modulations. It was found that GMSK was the worst case. All testing was performed using GMSK modulations to represent the worst case unless otherwise stated. The test results shown in the following sections represent the worst case emission.

6.2. Conducted RF Power Output

Specifications:	FCC Part 2.1046, 22.913(a), 24.232(c), 27.50
DUT Serial Number:	863427042010166
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

According to Part 22.913(a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

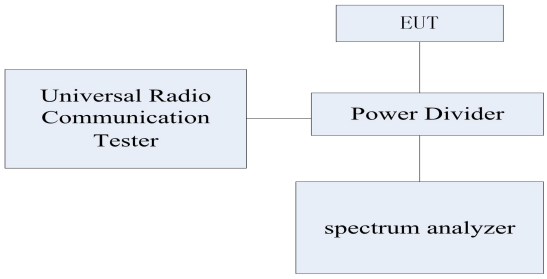
According to Part24.232(c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

Measurement Uncertainty:

Item	Uncertainty
Expanded Uncertainty	0.62 dB (k=2)

Test Setup:

During the test, the EUT was controlled via the Wireless Telecommunications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.



Test Method:

1) The EUT was coupled to the spectrum analyzer and the Wireless Telecommunications Test Set through a power divider. The loss of the RF cables of the test system is calibrated to correct the readings.

2) For RMS power test, the spectrum analyzer was set to RMS Detector function and Maximum hold mode.

3) For Peak power test, the spectrum analyzer was set to Maxpeak Detector function and Maximum hold mode.

4) The resolution Bandwidth of the spectrum analyzer was comparable to the emission Bandwidth.

Note: --

6.2.1 Conducted RF Power Output Results

GSM850

GSM

Frequency (MHz)	Power Step	Slot	Output power (dBm)	Peak power (dBm)
824.2	5	1TS	34.52	34.52
836.6	5	1TS	34.68	34.69
848.8	5	1TS	34.73	34.73

GPRS(GMSK)

Frequency (MHz)	Power Step	Slot	Output power (dBm)	Peak power (dBm)
824.2	3	1TS	34.51	34.54
824.2	3	2TS	33.92	33.95
824.2	3	3TS	31.06	31.11
824.2	3	4TS	29.80	29.83
836.6	3	1TS	34.62	34.66
836.6	3	2TS	33.90	33.89
836.6	3	3TS	30.97	30.99
836.6	3	4TS	29.71	29.79
848.8	3	1TS	34.63	34.66
848.8	3	2TS	33.92	33.92
848.8	3	3TS	31.08	31.13
848.8	3	4TS	29.78	29.87

EGPRS(8PSK)

Frequency (MHz)	Power Step	Slot	Output power (dBm)	Peak power (dBm)
824.2	6	1TS	27.94	27.94
824.2	6	2TS	27.30	27.31
824.2	6	3TS	25.86	25.22
824.2	6	4TS	24.02	27.79
836.6	6	1TS	27.88	27.94
836.6	6	2TS	27.19	27.22
836.6	6	3TS	25.15	25.20
836.6	6	4TS	24.04	24.05
848.8	6	1TS	27.94	27.94
848.8	6	2TS	27.34	27.37
848.8	6	3TS	25.22	25.26
848.8	6	4TS	24.08	24.13

PCS1900

GSM(GMSK)

Frequency (MHz)	Power Step	Slot	Output power (dBm)	Peak power (dBm)
1850.2	0	1TS	30.93	30.93
1880	0	1TS	31.28	31.29
1909.8	0	1TS	31.38	31.38

GPRS(GMSK)

Frequency (MHz)	Power Step	Slot	Output power (dBm)	Peak power (dBm)
1850.2	3	1TS	31.08	31.09
1850.2	3	2TS	29.91	29.80
1850.2	3	3TS	27.45	27.47
1850.2	3	4TS	26.26	26.30
1880	3	1TS	30.89	31.11
1880	3	2TS	29.45	29.47
1880	3	3TS	27.62	27.64
1880	3	4TS	26.44	26.52
1909.8	3	1TS	31.40	31.40
1909.8	3	2TS	30.35	30.46
1909.8	3	3TS	28.01	.28.21
1909.8	3	4TS	26.97	26.98

EGPRS(8PSK)

Frequency (MHz)	Power Step	Slot	Output power (dBm)	Peak power (dBm)
1850.2	5	1TS	26.34	26.42
1850.2	5	2TS	25.69	25.69
1850.2	5	3TS	23.92	23.58
1850.2	5	4TS	22.53	26.20
1880	5	1TS	26.41	26.33
1880	5	2TS	25.75	25.76
1880	5	3TS	23.72	23.88
1880	5	4TS	22.69	22.66
1909.8	5	1TS	26.98	26.98
1909.8	5	2TS	26.42	27.13
1909.8	5	3TS	24.32	24.32
1909.8	5	4TS	23.25	23.26

6.3. ERP and EIRP

Limit Level Construction:

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

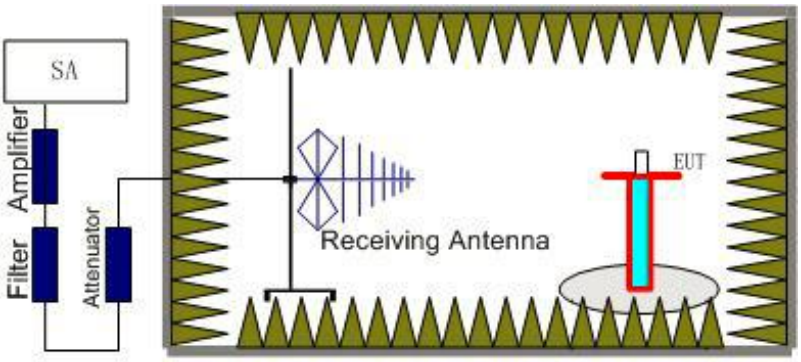
According to Part 24.232(c),"Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power"and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

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

Method of Measurement

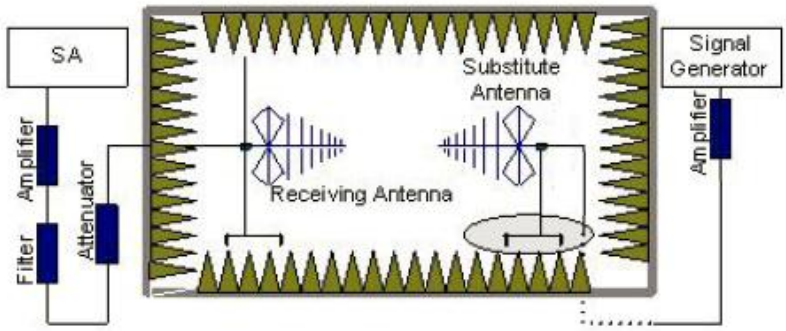
The measurements procedures in TIA-603-E-2016 are used.

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from thereceive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUTfor emission measurements. The height of receiving antenna is 1.5m. The test setup refers tofigure below. Detected emissions were maximized at each frequency by rotating the EUTthrough 360° and adjusting the receiving antenna polarization. The radiated emissionmeasurements of all transmit frequencies in three channels (High, Middle, Low) weremeasured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level duringthe test. And the maximum value of the receiver should be recorded as (Pr).

3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at thereference point of the chamber. An RF Signal source for the frequency band of interest isconnected to the substitution antenna with a cable that has been constructed to not interferewith the radiation pattern of the antenna. A power (PMea) is applied to the input of thesubstitution antenna, and adjust the level of the signal generator output until the value of thereceiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. Thetest should be performed by rotating the test item and adjusting the receiving antennapolarization.

4. A amplifier should be connected to the Signal Source output port. And the cable should beconnect between the Amplifier and the Substitution Antenna.

The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAg) should berecorded after test.

The measurement results are obtained as described below:

Power(EIRP)=PMea+ PAg- Pcl+ Ga

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

6. ERP can be calculated from EIRP by subtracting the gain of the dipole,

ERP=S.G output(dBM)-cable loss (dB) + antenna gain (dBd)

EIRP=S.G output(dBM)-cable loss (dB) + antenna gain (dBi)

6.3.1 GSM 850 Measurement result

GSM GMSK Mode

Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dB]	ERP [dBm]	Antenna Polarization [H/V]
824.2	25.8	3.4	8.0	29.4	V
836.6	25.6	3.4	6.6	28.8	V
848.8	25.4	3.4	7.2	29.2	V

GPRS(GMSK)

Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dB]	ERP [dBm]	Antenna Polarization [H/V]
824.2	23.9	3.4	8.0	28.5	V
836.6	23.9	3.4	6.6	27.1	V
848.8	23.5	3.4	7.2	27.3	V

EGPRS(8PSK)

Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dB]	ERP [dBm]	Antenna Polarization [H/V]
824.2	20.4	3.4	8.0	25.0	V
836.6	21.6	3.4	6.6	24.8	V
848.8	21.2	3.4	7.2	25.0	V

6.3.2 PCS 1900 Measurement result

GSM GMSK Mode

Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dB]	EIRP [dBm]	Antenna Polarization [H/V]
1850.2	25.5	5.0	7.2	27.7	V
1880.0	24.9	5.0	7.2	27.1	V

1909.8	25.6	5.1	6.8	27.3	V

GPRS(GMSK)

Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dB]	EIRP [dBm]	Antenna Polarization [H/V]
1850.2	24.6	5.0	7.2	26.8	V
1880.0	24.1	5.0	7.2	26.3	V
1909.8	24.3	5.1	6.8	26.0	V

EGPRS(8PSK)

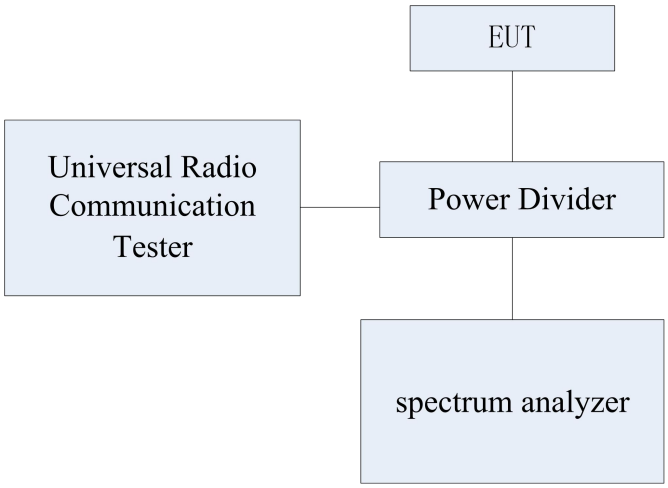
Frequency [MHz]	Generator output power(P_g) [dBm]	Cable loss [dB]	Antenna Gain [dB]	EIRP [dBm]	Antenna Polarization [H/V]
1850.2	22.3	5.0	7.2	24.5	V
1880.0	22.5	5.0	7.2	24.7	V
1909.8	23.1	5.1	6.8	24.8	V

6.4. Occupied Bandwidth

Specifications:	FCC Part 2.1049, 22.917(b), 24.238(b)
DUT Serial Number:	863427042013020
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	--

Test Setup

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.



Measurement Uncertainty:

Item	Uncertainty
Expanded Uncertainty	500 kHz (k=2)

Test Method

The 99% occupied Bandwidth was calculated from the spectrum analyzer. Markers in the spectrum analyzer were then placed between the calculated frequencies to show the calculated 99% power Band. The 26dB Bandwidth was also measured and recorded.

Note: --

6.4.1 occupied bandwidth Results

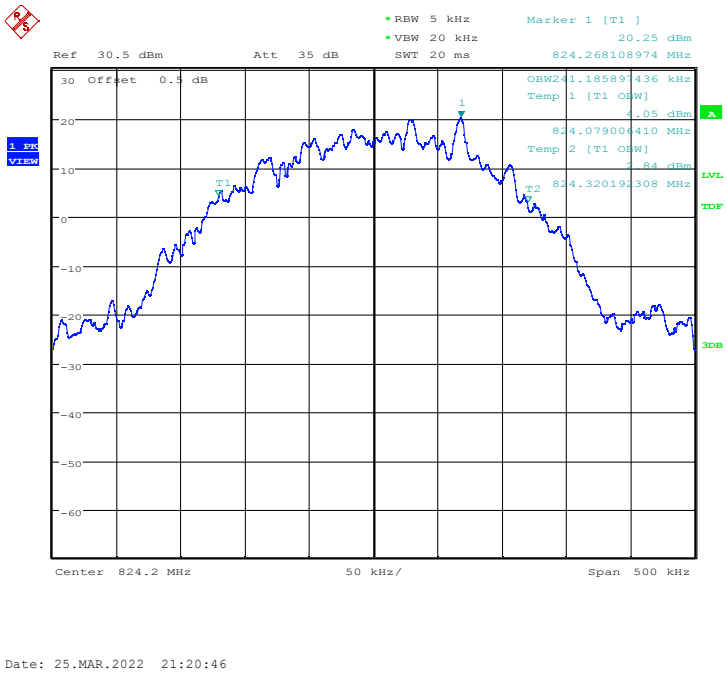
GSM850 (99 %)

GSM

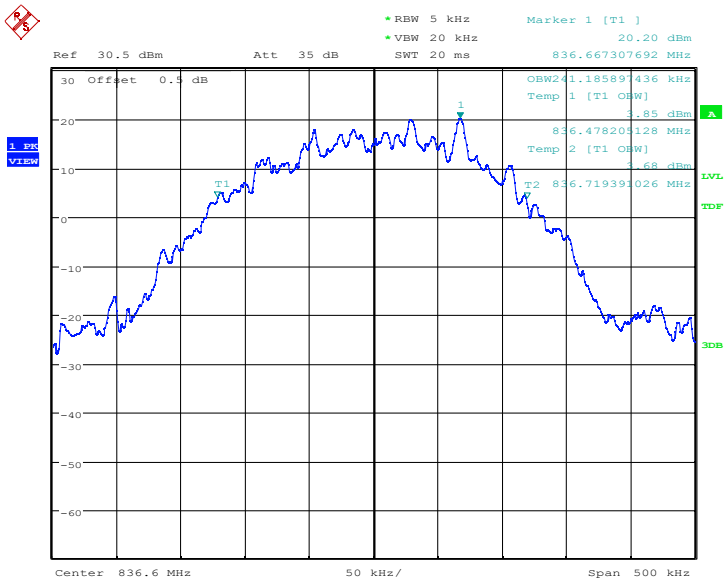
Frequency (MHz)	Occupied Bandwidth (99%) (kHz)
824.2	241.186
836.6	241.186
848.8	241.186

GSM850

Channel 128-Occupied Bandwidth (99% BW)



Channel 190-Occupied Bandwidth (99% BW)



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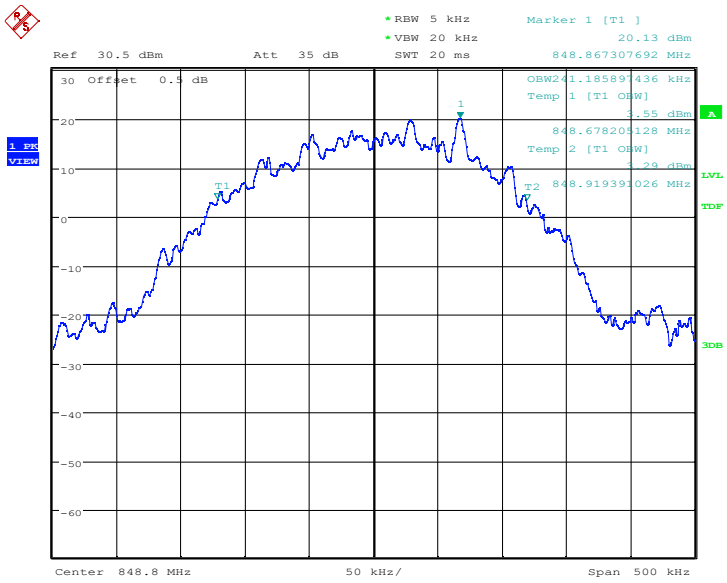
Channel 251-Occupied Bandwidth (99% BW)



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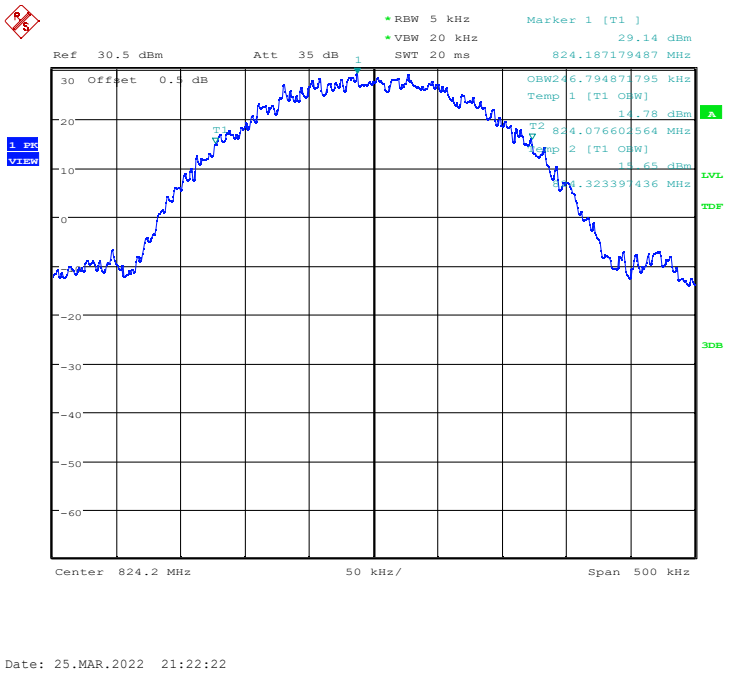
GSM850 (99 %)

GPRS

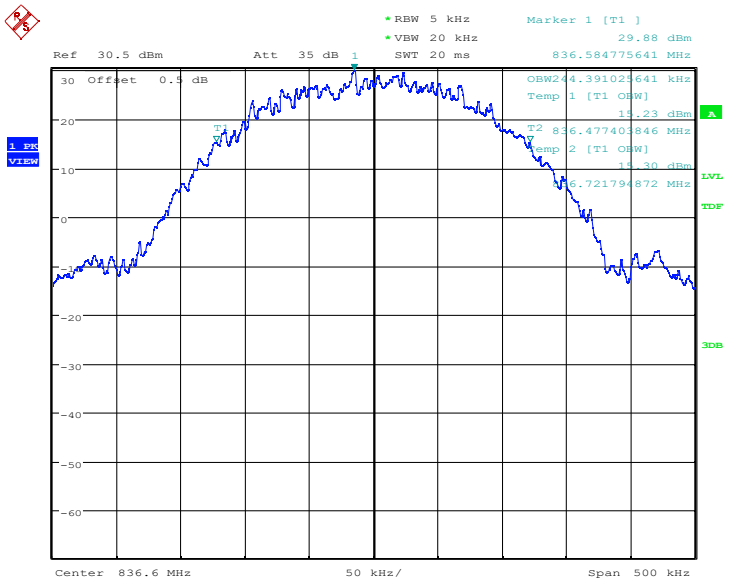
Frequency (MHz)	Occupied Bandwidth (99%) (kHz)
824.2	246.795
836.6	244.391
848.8	245.192

GSM850

Channel 128-Occupied Bandwidth (99% BW)

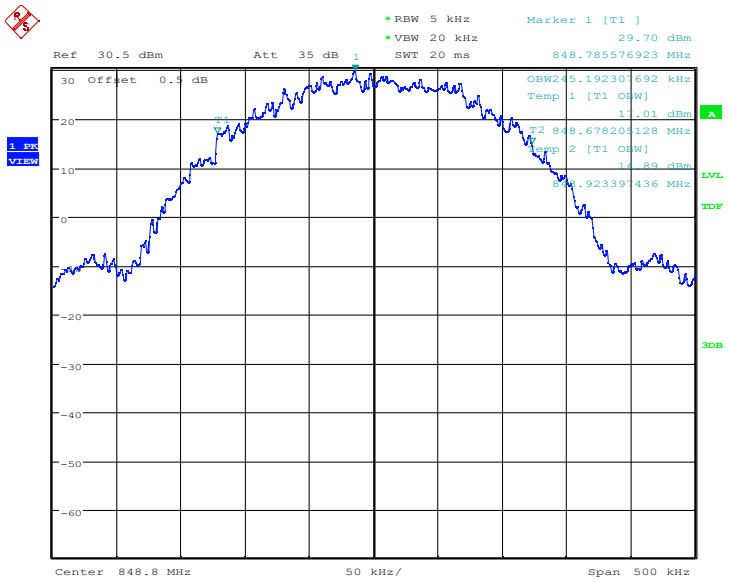


Channel 190-Occupied Bandwidth (99% BW)



Date: 25.MAR.2022 21:23:02

Channel 251-Occupied Bandwidth (99% BW)



Date: 25.MAR.2022 21:23:37

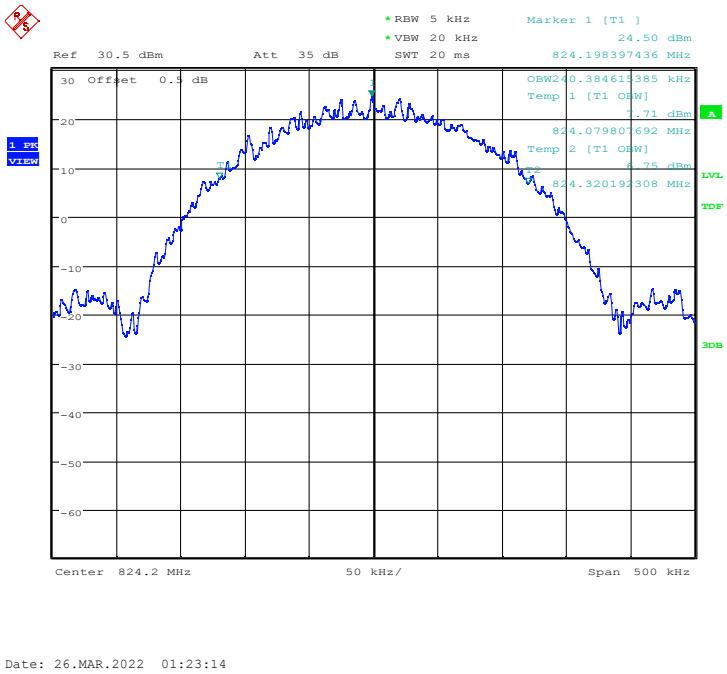
GSM850 (99 %)

EGPRS

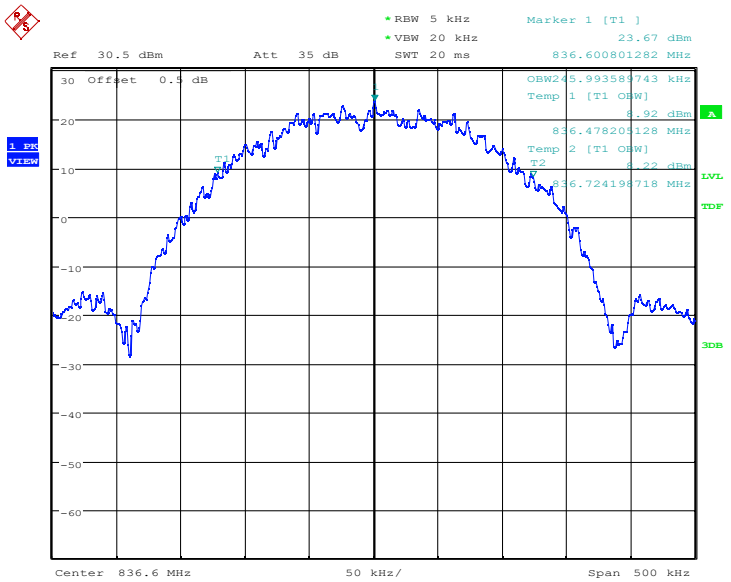
Frequency (MHz)	Occupied Bandwidth (99%) (kHz)
824.2	240.385
836.6	245.994
848.8	245.192

GSM850

Channel 128-Occupied Bandwidth (99% BW)

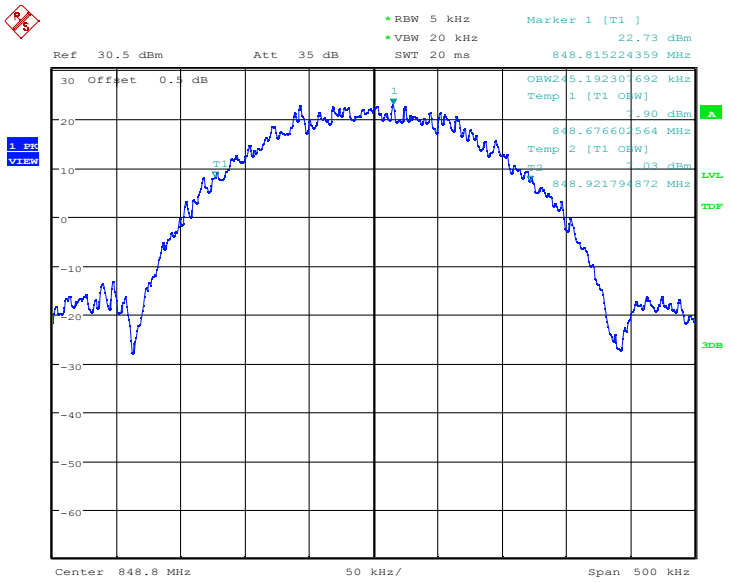


Channel 190-Occupied Bandwidth (99% BW)



Date: 25.MAR.2022 21:25:04

Channel 251-Occupied Bandwidth (99% BW)



Date: 25.MAR.2022 21:25:39

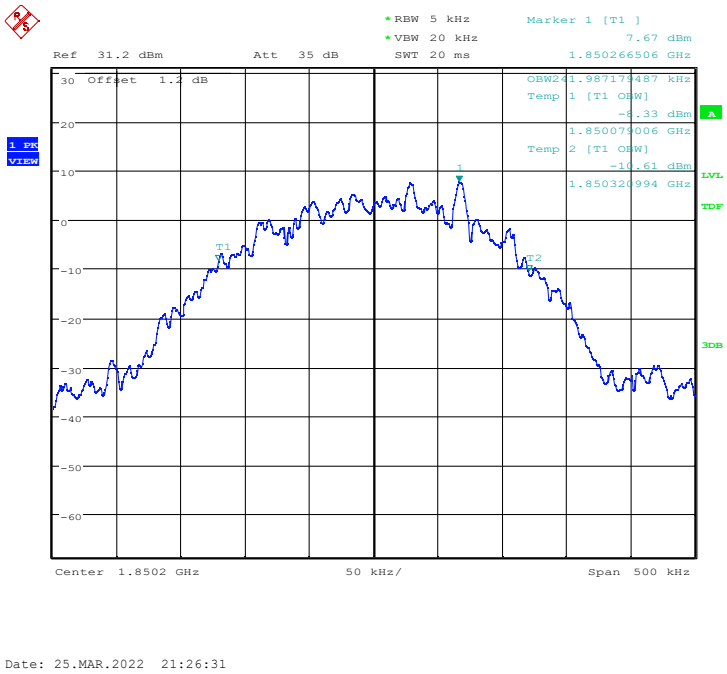
PCS1900 (99 %)

GSM

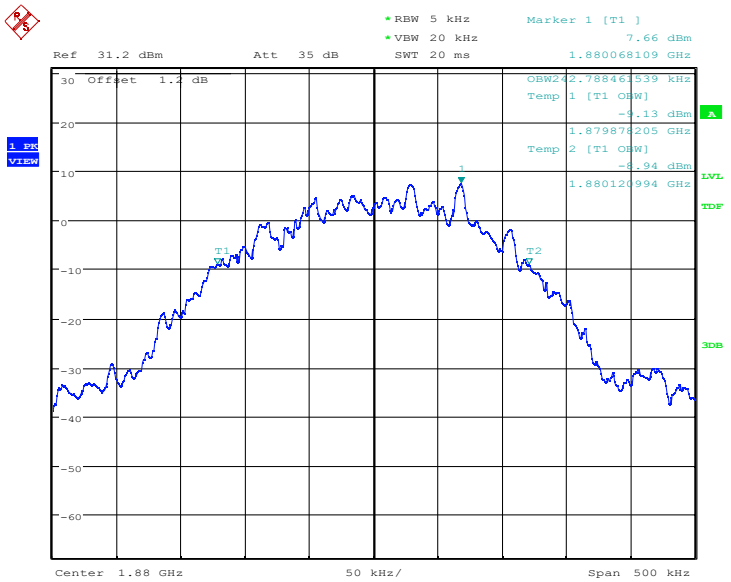
Frequency (MHz)	Occupied Bandwidth (99%) (kHz)
1850.2	241.987
1880	242.788
1909.8	242.788

PCS1900

Channel 512-Occupied Bandwidth (99% BW)

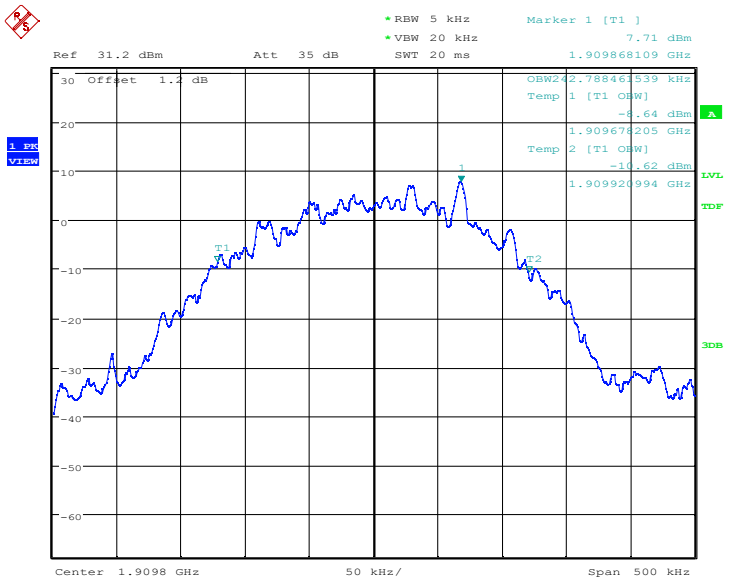


Channel 661-Occupied Bandwidth (99% BW)



Date: 25.MAR.2022 21:27:01

Channel 810-Occupied Bandwidth (99% BW)



Date: 25.MAR.2022 21:27:31

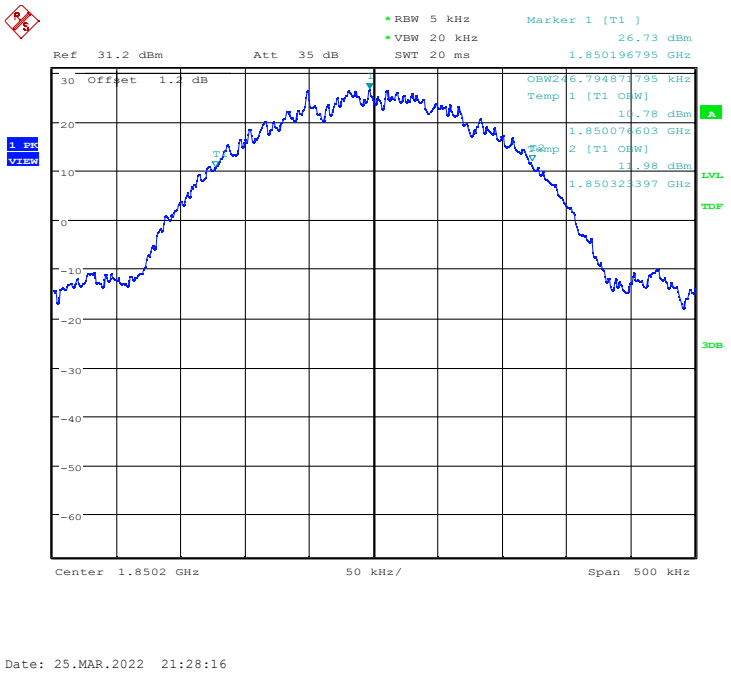
PCS1900 (99 %)

GPRS

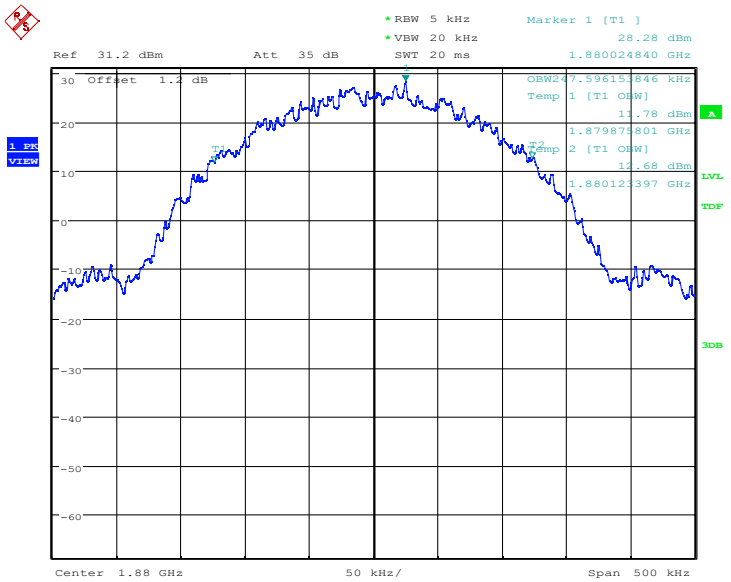
Frequency (MHz)	Occupied Bandwidth (99%) (kHz)
1850.2	246.795
1880	247.596
1909.8	245.994

PCS1900

Channel 512-Occupied Bandwidth (99% BW)

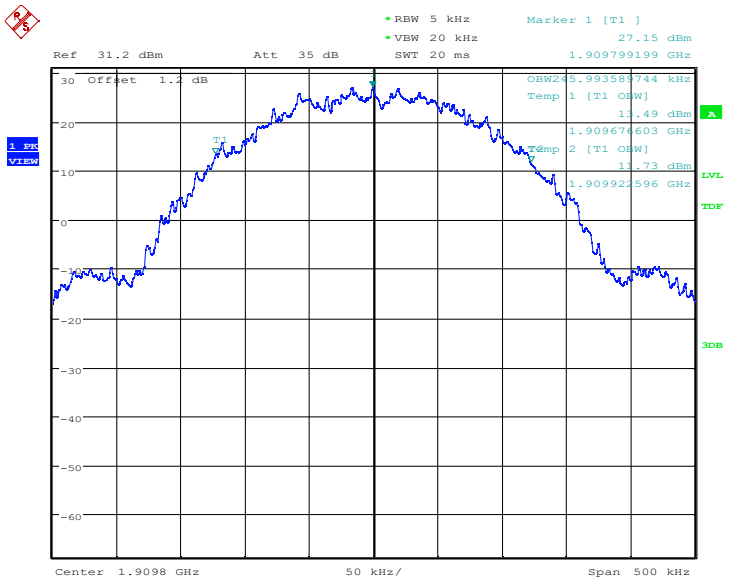


Channel 661-Occupied Bandwidth (99% BW)



Date: 25.MAR.2022 21:28:54

Channel 810-Occupied Bandwidth (99% BW)



Date: 25.MAR.2022 21:29:29

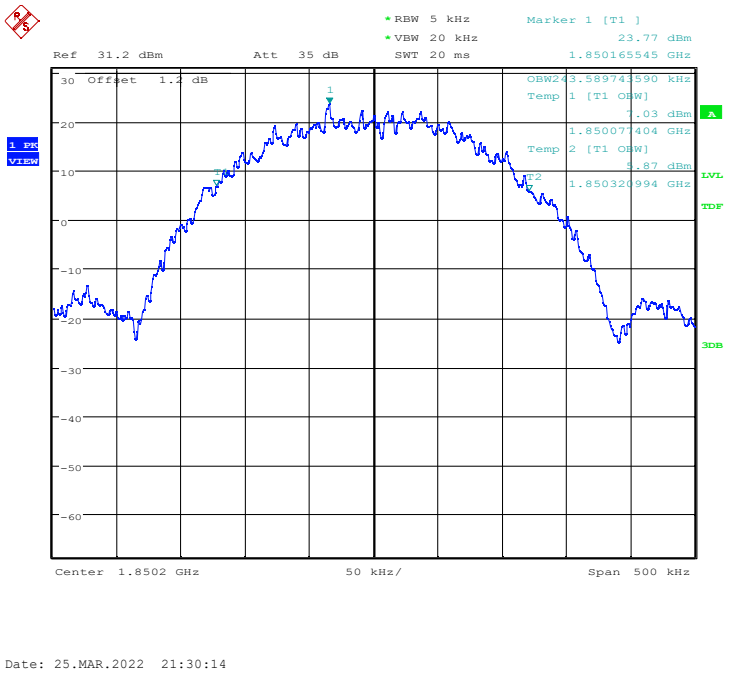
PCS1900 (99 %)

EGPRS

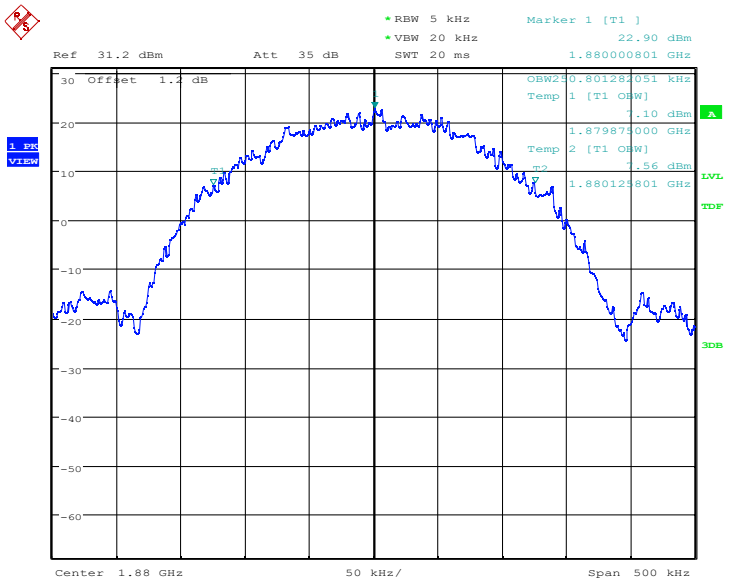
Frequency (MHz)	Occupied Bandwidth (99%) (kHz)
1850.2	243.590
1880	250.801
1909.8	249.199

PCS1900

Channel 512-Occupied Bandwidth (99% BW)

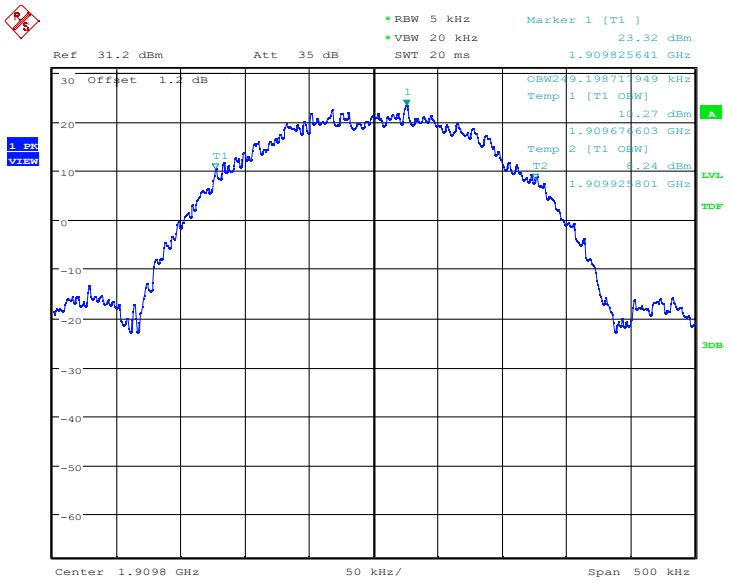


Channel 661-Occupied Bandwidth (99% BW)



Date: 25.MAR.2022 21:30:52

Channel 810-Occupied Bandwidth (99% BW)



Date: 26.MAR.2022 01:24:11

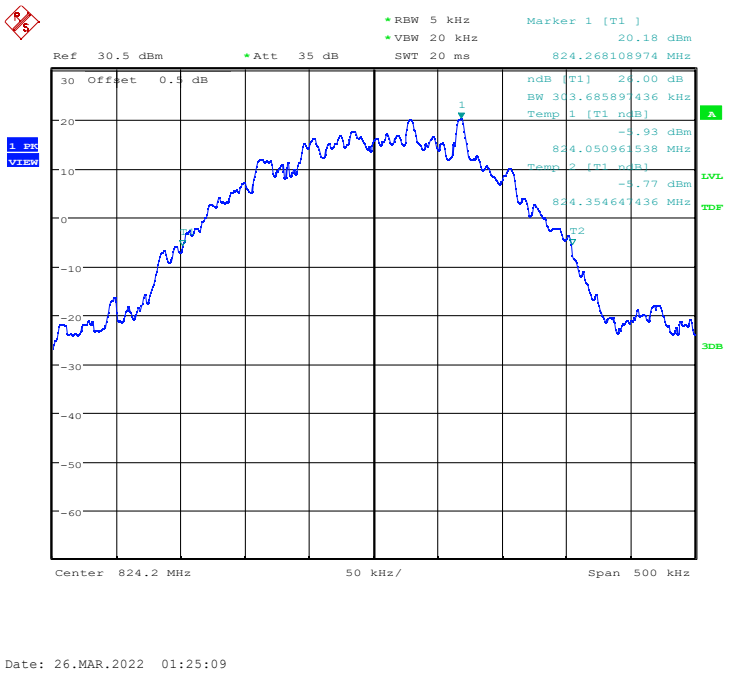
GSM850 (-26dBc)

GSM

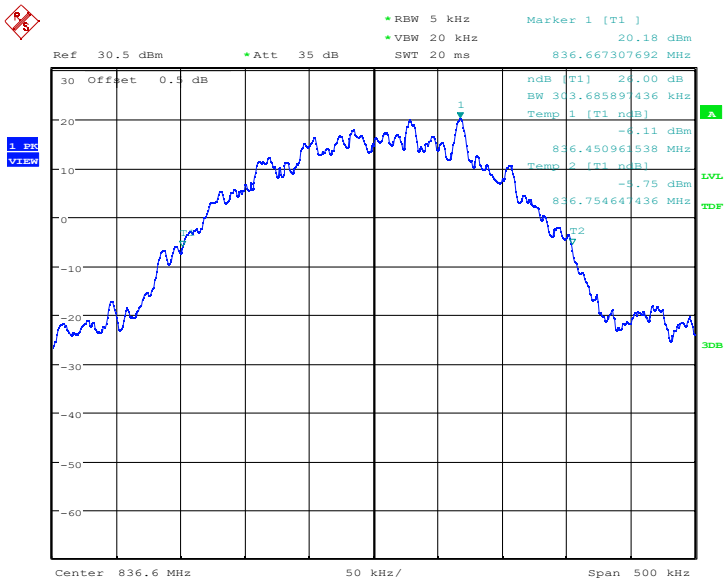
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
824.2	303.686
836.6	303.686
848.8	303.686

GSM850

Channel 128-Emission Bandwidth (-26dBc BW)

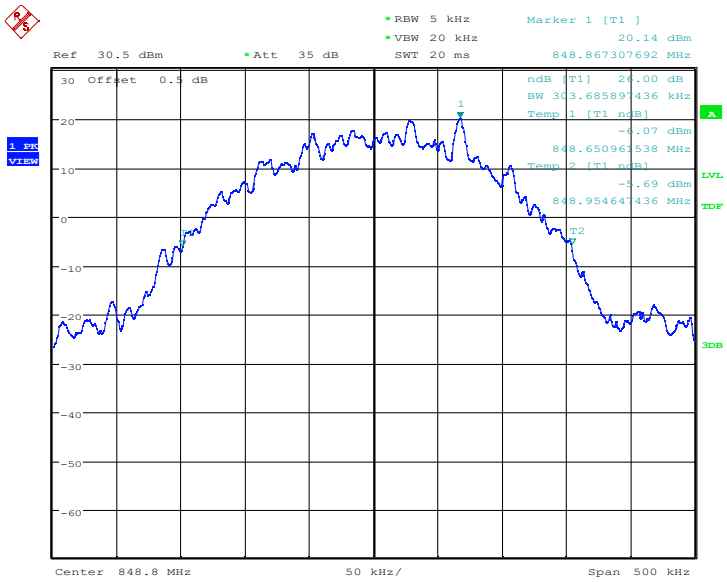


Channel 190-Emission Bandwidth (-26dBc BW)



Date: 26.MAR.2022 01:25:35

Channel 251-Emission Bandwidth (-26dBc BW)



Date: 26.MAR.2022 01:26:03

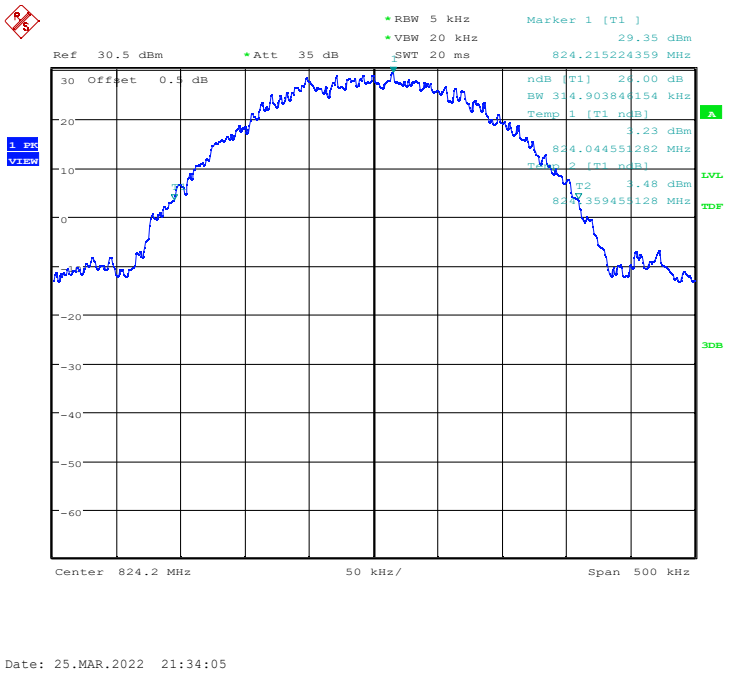
GSM850 (-26dBc)

GPRS

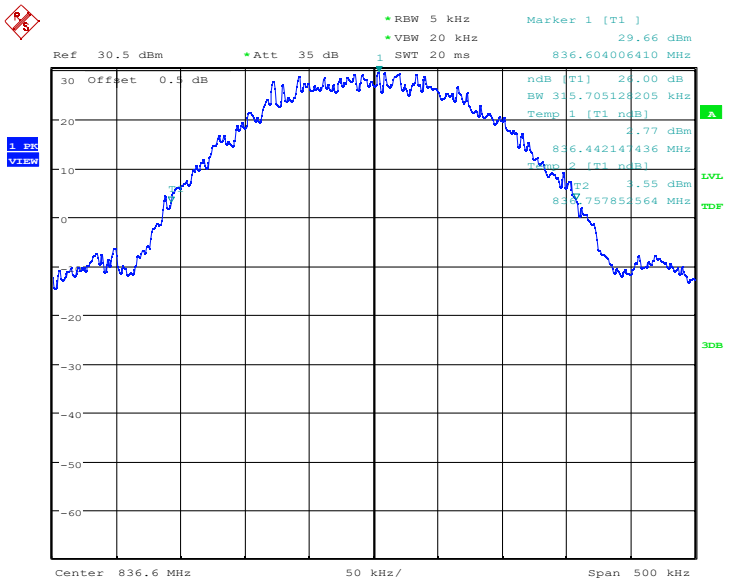
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
824.2	314.904
836.6	315.705
848.8	314.103

GSM850

Channel 128-Emission Bandwidth (-26dBc BW)

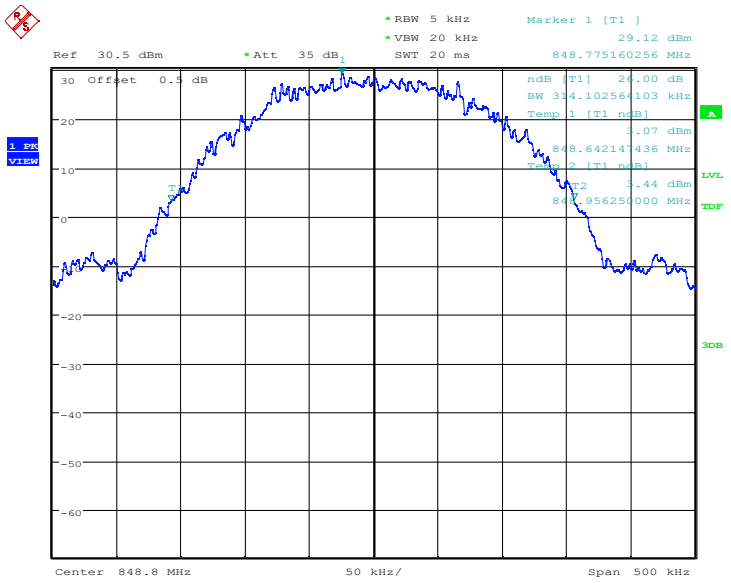


Channel 190-Emission Bandwidth (-26dBc BW)



Date: 25.MAR.2022 21:34:42

Channel 251-Emission Bandwidth (-26dBc BW)



Date: 25.MAR.2022 21:35:28

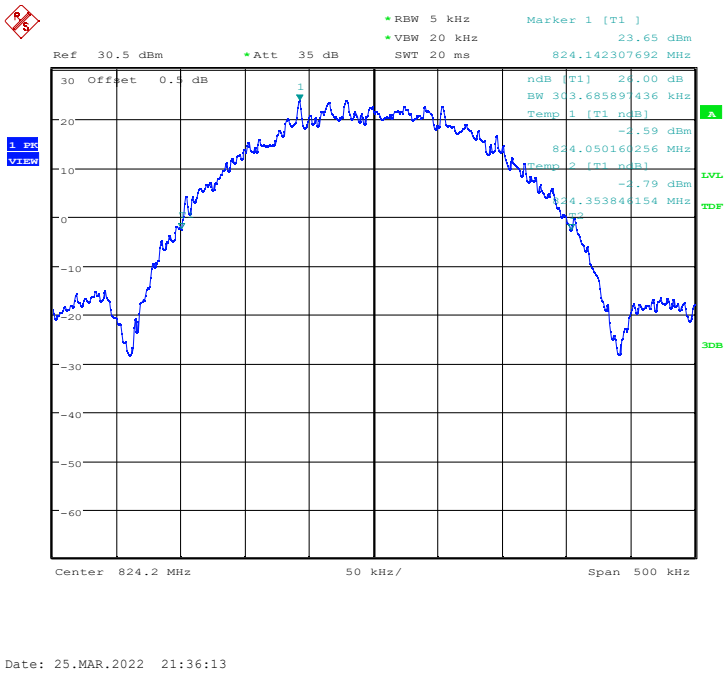
GSM850 (-26dBc)

EGPRS

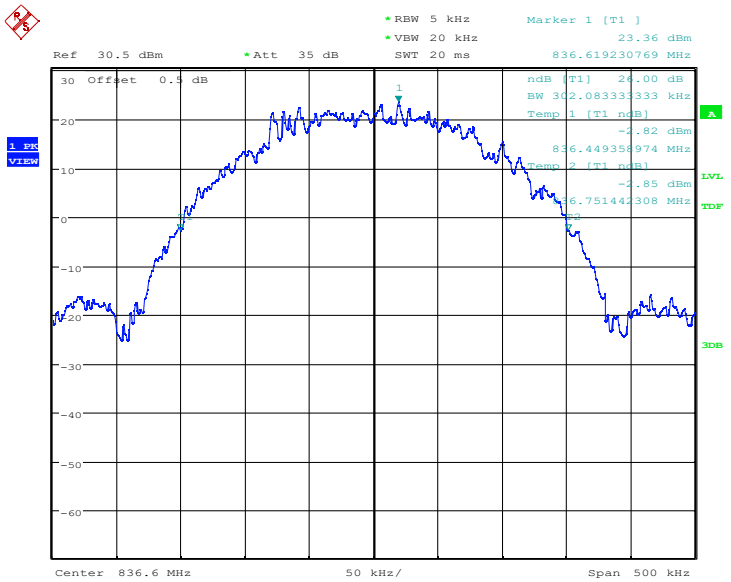
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
824.2	303.686
836.6	302.083
848.8	307.692

GSM850

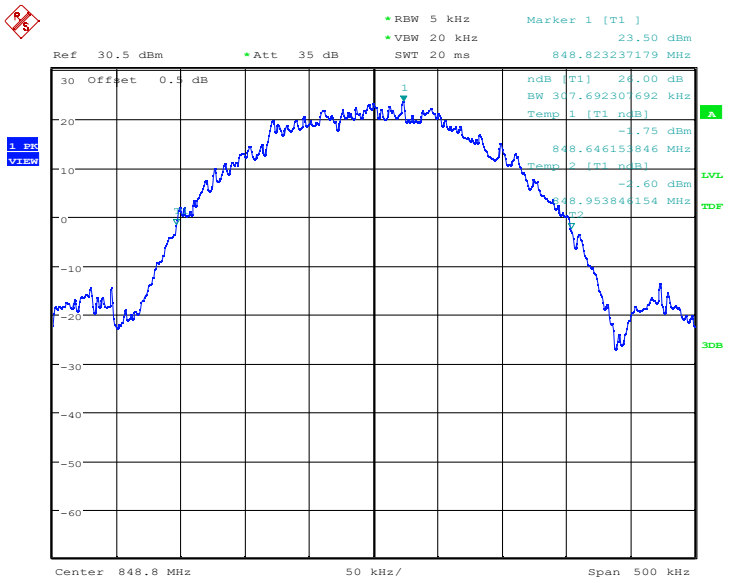
Channel 128-Emission Bandwidth (-26dBc BW)



Channel 190-Emission Bandwidth (-26dBc BW)



Channel 251-Emission Bandwidth (-26dBc BW)



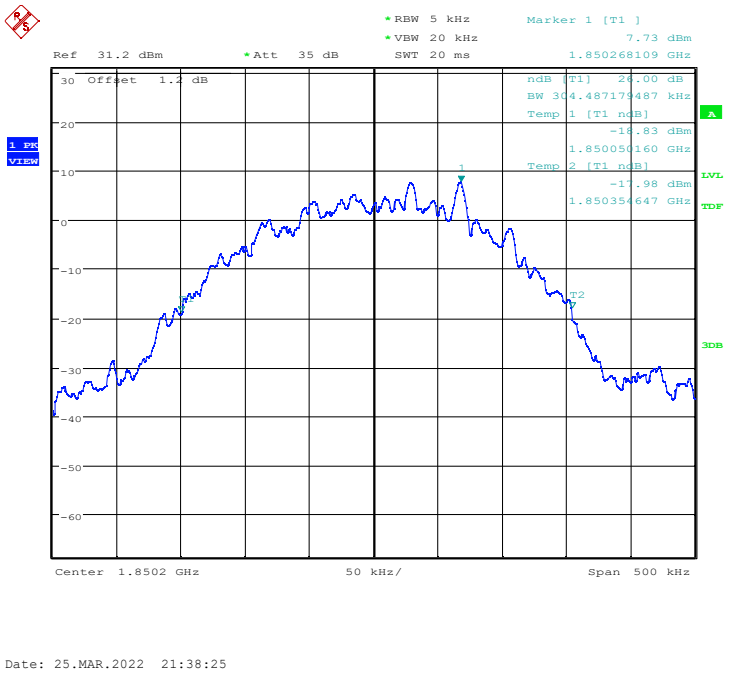
PCS1900 (-26dBc)

GSM

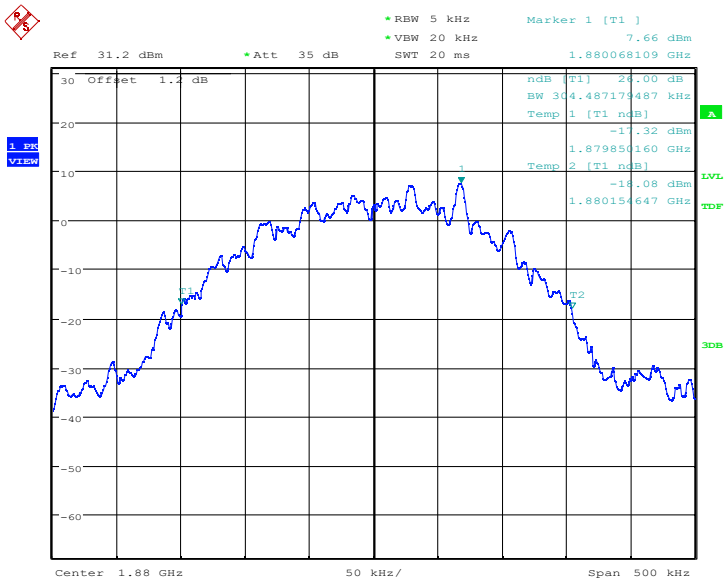
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
1850.2	304.487
1880	304.487
1909.8	303.686

PCS1900

Channel 512-Emission Bandwidth (-26dBc BW)

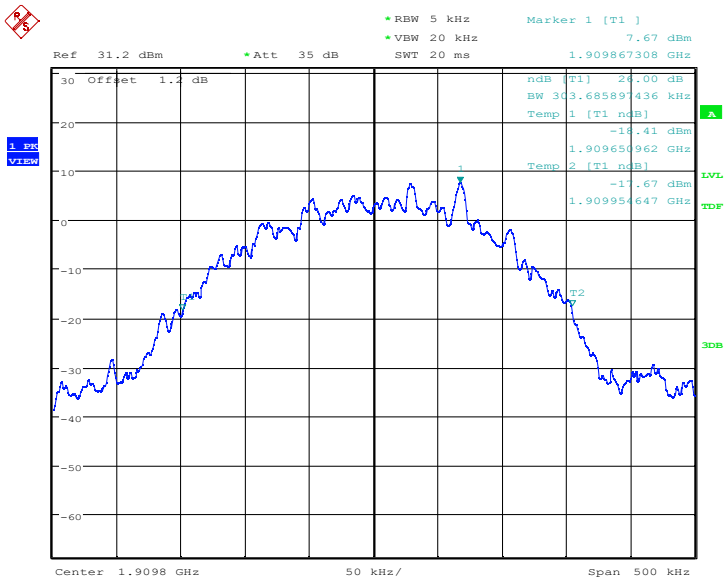


Channel 661-Emission Bandwidth (-26dBc BW)



Date: 25.MAR.2022 21:38:59

Channel 810-Emission Bandwidth (-26dBc BW)



Date: 25.MAR.2022 21:39:33

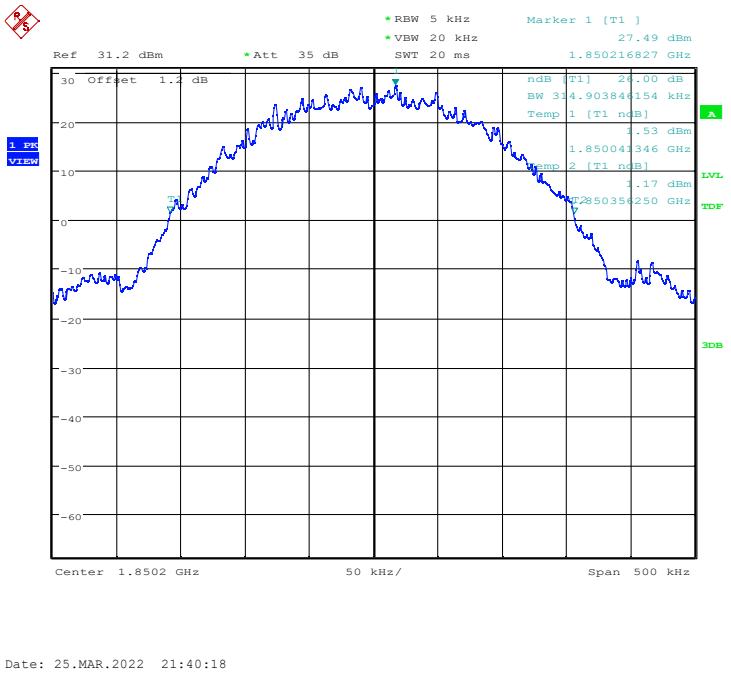
PCS1900 (-26dBc)

GPRS

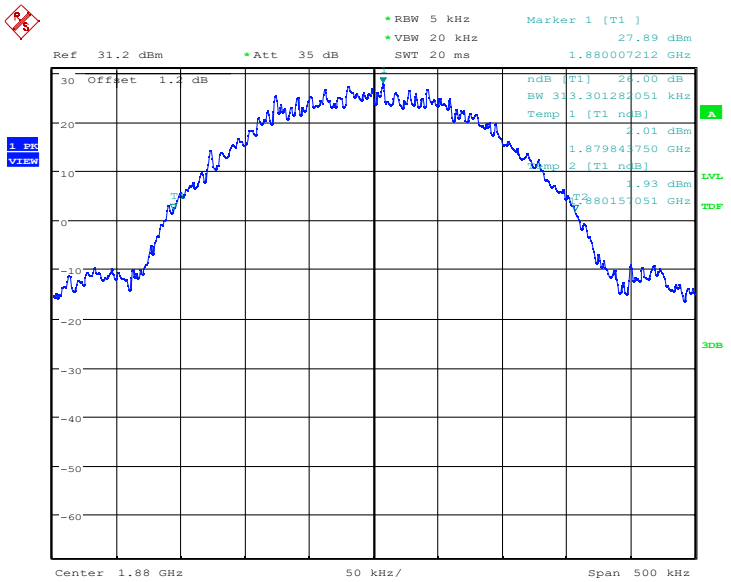
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
1850.2	314.904
1880	313.301
1909.8	310.897

PCS1900

Channel 512-Emission Bandwidth (-26dBc BW)

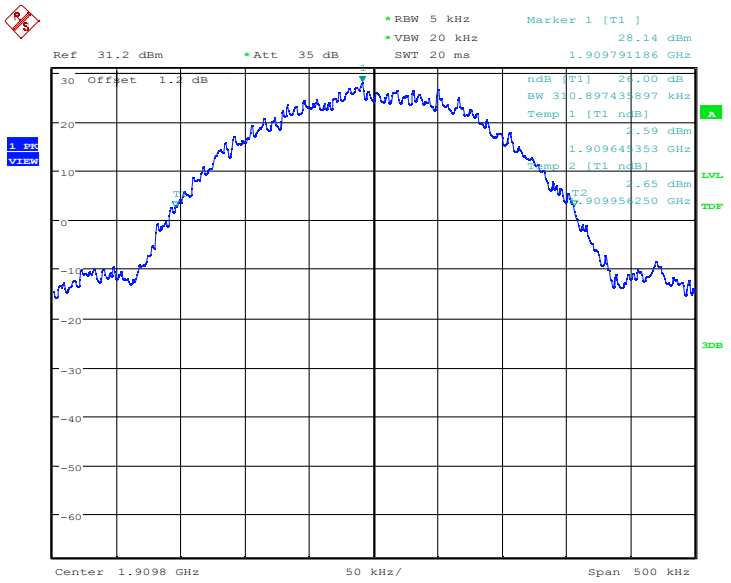


Channel 661-Emission Bandwidth (-26dBc BW)



Date: 25.MAR.2022 21:41:00

Channel 810-Emission Bandwidth (-26dBc BW)



Date: 25.MAR.2022 21:41:42

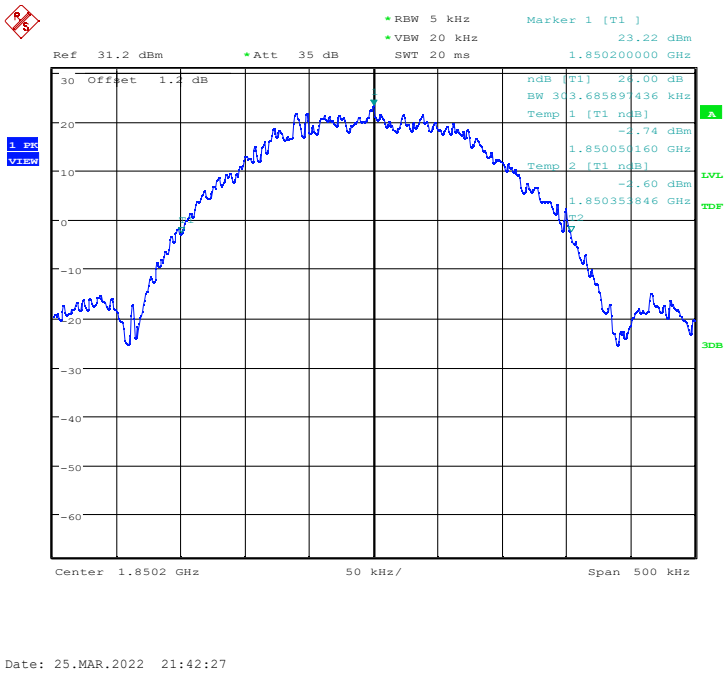
PCS1900 (-26dBc)

EGPRS

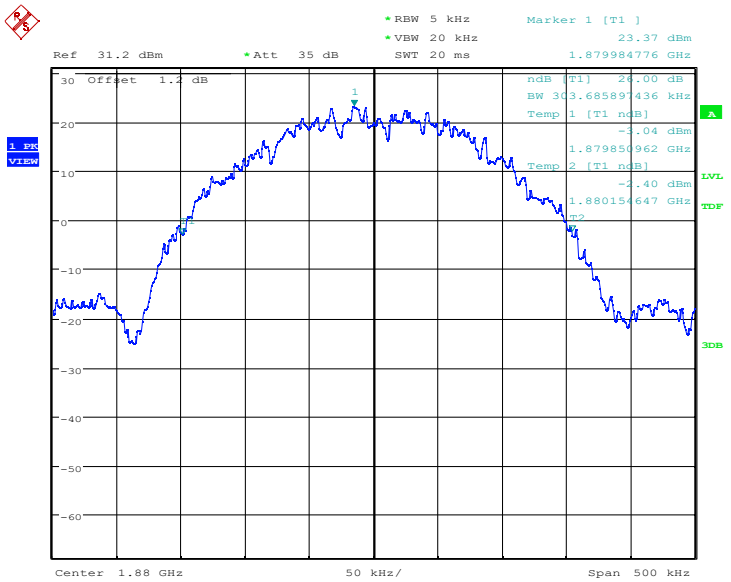
Frequency (MHz)	Emission Bandwidth (-26dBc)(kHz)
1850.2	303.686
1880	303.686
1909.8	316.506

PCS1900

Channel 512-Emission Bandwidth (-26dBc BW)

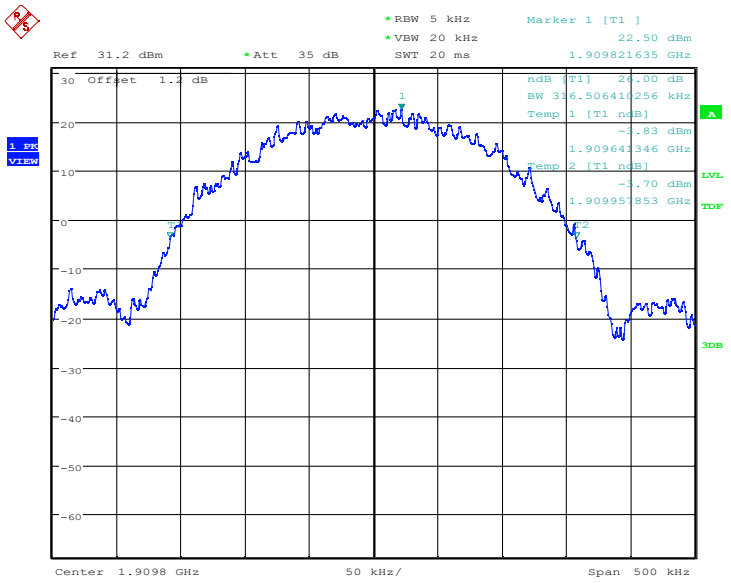


Channel 661-Emission Bandwidth (-26dBc BW)



Date: 25.MAR.2022 21:43:05

Channel 810-Emission Bandwidth (-26dBc BW)



Date: 25.MAR.2022 21:43:48

6.5. Conducted spurious emissions

Specifications:	FCC Part 2.1051, 24.238, 2.1053, 22.917, 27.53
DUT Serial Number:	863427042013020
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

According to Part 22.917 (a), i.e., Out of Band 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.

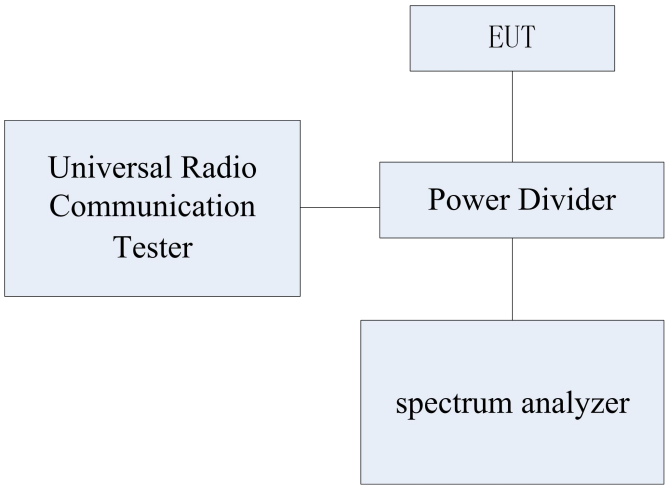
According to Part 24.238 (a), i.e., Out of Band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB, so the limit level is: P(dBm)– (43 + 10 log(P)) dB= -13dBm.

Measurement Uncertainty:

Item	Uncertainty	
Expanded Uncertainty	9kHz < f≤4GHz	0.71 dB (k=2)
	4GHz≤f < 12.75GHz	0.74 dB (k=2)
	12.75GHz≤f < 26GHz	2.70 dB (k=2)

Test Setup:

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.



Test Method:

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-Band emissions, if any, up to 10th harmonic. The EUT was scanned for spurious emissions from 30MHz to 20GHz with sufficient Bandwidth and video resolution. The spectrum analyzer was set to Maximum hold mode to ensure that the worst-case emissions were captured.

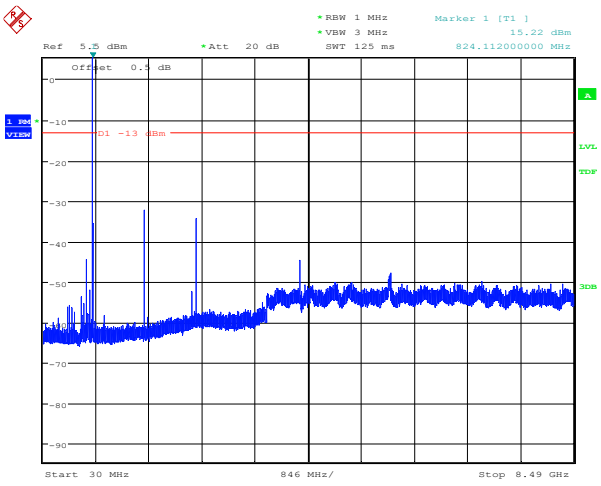
Note: --

6.5.1 Conducted Spurious Emission Results

GSM850

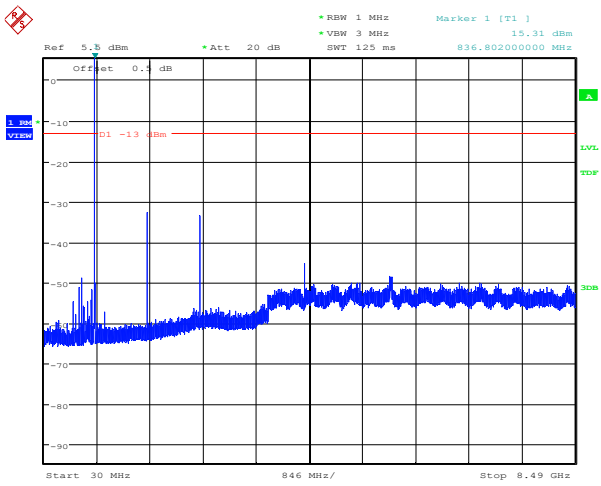
Channel 128:30MHZ - 8490MHZ

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



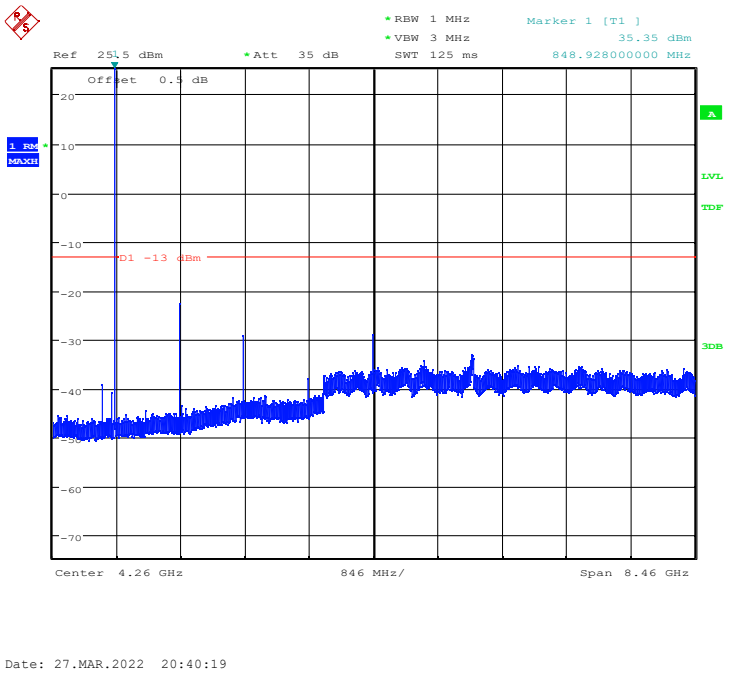
Channel 190:30MHZ - 8490MHZ

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



Channel 251:30MHZ - 8490MHZ

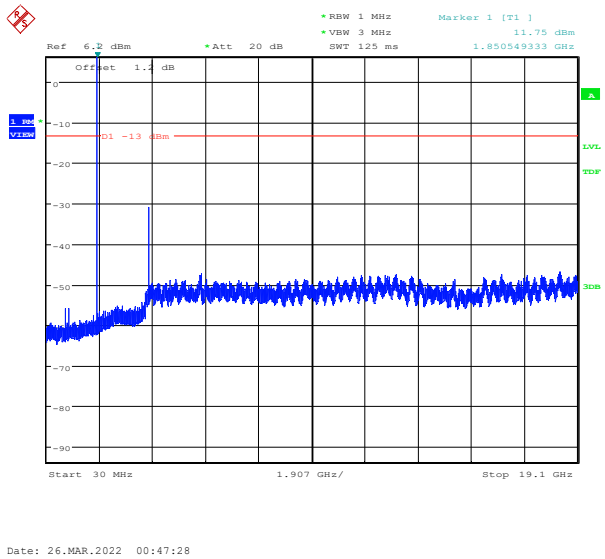
NOTE: peak above the limit line is the carrier frequency.



PCS1900

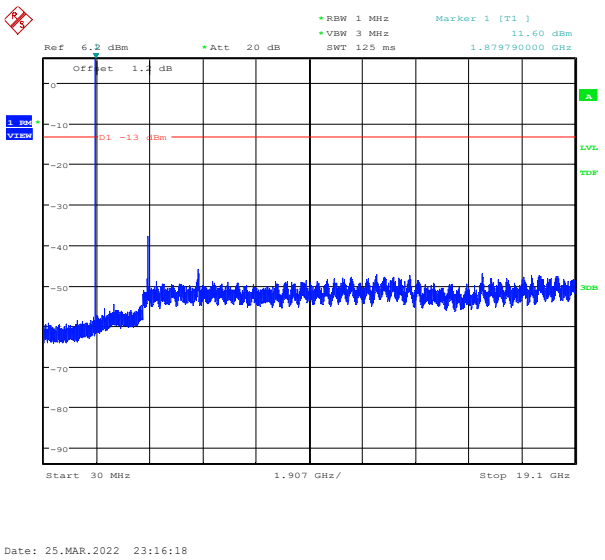
Channel 512:30MHZ - 19100MHZ

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



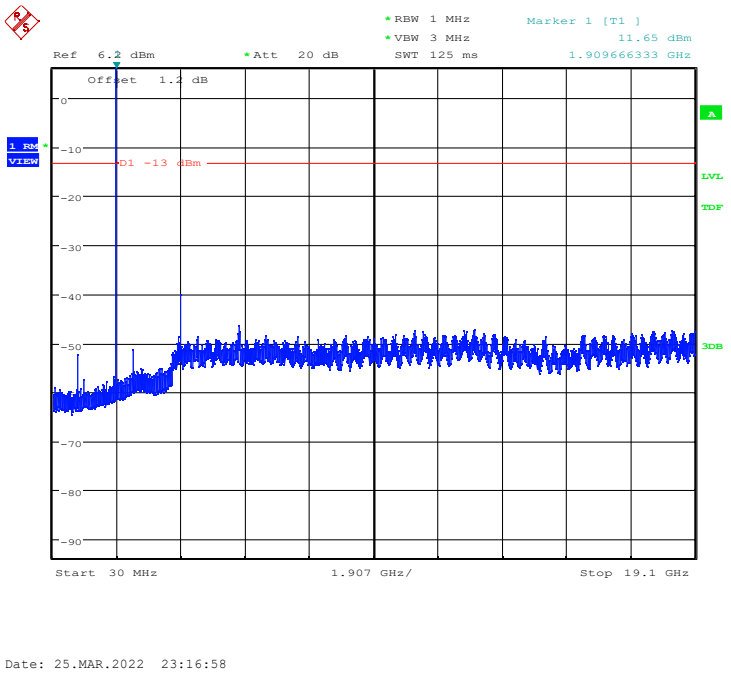
Channel 661:30MHZ - 19100MHZ

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



Channel 810:30MHZ - 19100MHZ

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



6.6. Radiated Spurious Emission

Specifications:	FCC Part 2.1051, 2.1053, 24.238, 22.917, 27.53
DUT Serial Number:	863427042009036
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

According to Part 22.917 (a), i.e., Out of Band 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.

According to Part 24.238 (a), i.e., Out of Band 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, so the limit level is: P(dBm)– (43 + 10 log(P)) dB= -13dBm.

Measurement Uncertainty:

Item	Uncertainty
Expanded Uncertainty（30MHz-150MHz）	5.15 dB (k=2)
Expanded Uncertainty（150MHz-1GHz）	4.09dB (k=2)
Expanded Uncertainty（1GHz-3GHz）	2.92dB (k=2)
Expanded Uncertainty（3GHz-6GHz）	2.93dB (k=2)
Expanded Uncertainty（3GHz-12.75GHz）	2.69dB (k=2)

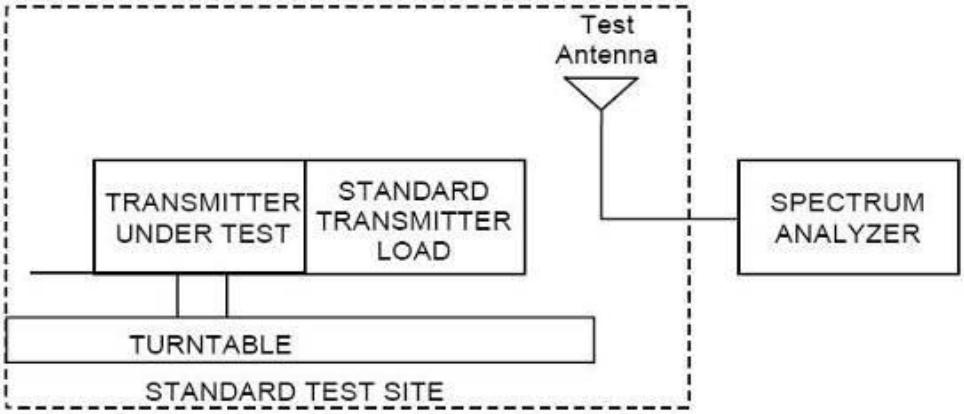
Test Setup:

The EUT was placed in an anechoic chamber. The Wireless Communications Test Set was used to set the TX channel and power level and modulate the TX signal with different bit patterns.

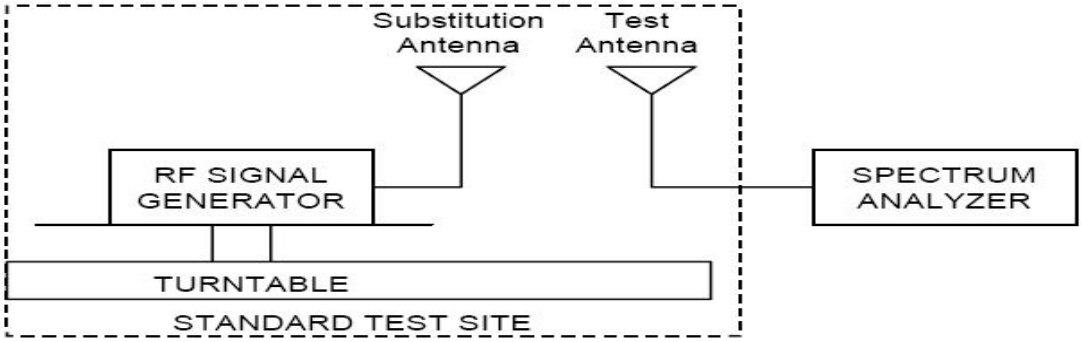
Test Method:

The measurement method is substitution method accordance with section 2.2.12 of ANSI/TIA-603-E: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

(a) Connect the equipment as illustrated and measure the spurious emissions as the method as above. The distance from the device to the antenna is 3 m .



(b) Reconnect the equipment as illustrated.



(c) Remove the transmitter and replace it with a substitution antenna. The center of the substitution antenna should be approximately at the same location as the center of the transmitter.

(d) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.

(e) Repeat step d) with both antennas vertically polarized for each spurious frequency.

(f) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps d) and e) by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

P_d(dBm) = P_g(dBm) – cable loss (dB) + antenna gain (dB)

where:

Pd is the dipole equivalent power and Pg is the generator output power into the substitution antenna.

Note: The evaluation of radiated spurious emission under the simultaneous transmission of WWAN & WLAN.

6.6.1 GSM 850 Radiated Spurious Emission Results

Test Data （GSM GMSK Mode CH128）

Frequency [MHz]	Generator output power(Pg) [dBm]	Cable loss [dB]	Antenna Gain [dB]	Spurious Emission Power (Pd) [dBm]	Antenna Polarization [H/V]
1652.8	-45.6	4.7	7.9	-42.4	V
2479.2	-46.2	5.9	6.9	-45.2	V
3305.6	-53.6	6.9	8.9	-51.6	V
4132.0	-54.4	7.8	9.2	-53.0	V
4958.4	-56.2	6.8	9.9	-53.1	V
5784.8	-61.4	1.4	10.9	-51.9	V

Test Data （GSM GMSK Mode CH190）

Frequency [MHz]	Generator output power(Pg) [dBm]	Cable loss [dB]	Antenna Gain [dB]	Spurious Emission Power (Pd) [dBm]	Antenna Polarization [H/V]
1673.2	-45.5	4.8	7.9	-42.4	V
2509.8	-46.2	5.9	6.9	-45.2	V
3346.4	-53.5	7.0	8.9	-51.6	V
4183.0	-56.2	7.8	9.2	-54.8	V
5019.6	-53.2	6.8	9.9	-50.1	V
5856.2	-56.8	7.4	10.9	-53.3	V

Test Data （GSM GMSK Mode CH251）

Frequency [MHz]	Generator output power(Pg) [dBm]	Cable loss [dB]	Antenna Gain [dB]	Spurious Emission Power (Pd) [dBm]	Antenna Polarization [H/V]
1693.2	-48.9	4.7	7.9	-45.7	V
2539.8	-47.2	5.9	6.9	-46.2	V
3386.4	-55.1	6.9	8.9	-53.1	V

4233.0	-51.8	7.8	9.2	-50.4	V
5079.6	-56.7	6.8	9.9	-53.6	V
5926.2	-61.5	1.4	10.9	-52.0	V

6.6.2 PCS 1900 Radiated Spurious Emission Results

Test Data （GSM GMSK Mode CH512）

Frequency [MHz]	Generator output power(Pg) [dBm]	Cable loss [dB]	Antenna Gain [dB]	Spurious Emission Power (Pd) [dBm]	Antenna Polarization [H/V]
3704.8	-53.6	7.2	8.9	-51.9	V
5557.2	-57.0	8.0	10.5	-54.5	V
7409.6	-54.2	7.9	11.9	-50.2	V
9262.0	-48.8	8.0	11.5	-45.3	V
11114.4	-53.1	8.4	12.1	-49.4	V
12966.8	-52.7	8.9	12.4	-49.2	V

Test Data （RMC bandwidth 9400 QPSK Mode）

Frequency [MHz]	Generator output power(Pg) [dBm]	Cable loss [dB]	Antenna Gain [dB]	Spurious Emission Power (Pd) [dBm]	Antenna Polarization [H/V]
3760.0	-52.0	7.2	8.9	-50.3	V
5640.0	-55.8	8.2	10.5	-53.5	V
7520.0	-56.6	7.9	11.9	-52.6	V
9400.0	-49.0	8.0	11.5	-45.5	V
11280.0	-53.2	8.5	12.1	-49.6	V
13160.0	-52.8	9.1	12.4	-49.5	V

Test Data （RMC bandwidth 9538 QPSK Mode）

Frequency [MHz]	Generator output power(Pg) [dBm]	Cable loss [dB]	Antenna Gain [dB]	Spurious Emission Power (Pd) [dBm]	Antenna Polarization [H/V]
3815.2	-55.3	7.2	8.9	-53.6	V

5722.8	-55.8	8.0	10.5	-53.3	V
7630.4	-55.9	8.3	11.9	-52.3	V
9538.0	-48.6	8.5	11.5	-45.6	V
11445.6	-54.0	8.4	12.1	-50.3	V
13353.2	-52.1	9.2	12.4	-48.9	V

6.7. Band Edge

Specifications:	FCC Part 2.1051, 24.238, 2.1053, 22.917, 27.53
DUT Serial Number:	863427042013020
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit Level Construction:

According to Part 22.917 (a), i.e., Out of Band 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.

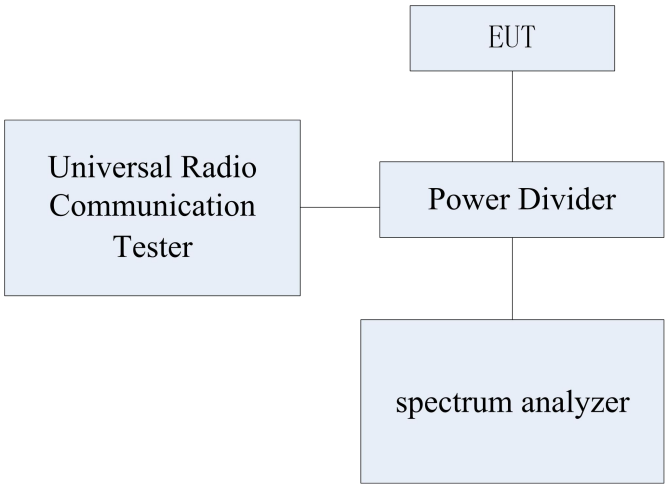
According to Part 24.238 (a), i.e., Out of Band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB, so the limit level is: P(dBm)– (43 + 10 log(P)) dB= -13dBm.

Measurement Uncertainty:

Item	Uncertainty	
Expanded Uncertainty	9kHz < f≤4GHz	0.71 dB (k=2)
	4GHz≤f < 12.75GHz	0.74 dB (k=2)
	12.75GHz≤f < 26GHz	2.70 dB (k=2)

Test Setup:

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.



Test Method:

1) The EUT was coupled to the EMI test receiver analyzer mode and the base station simulator through a power divider. The lost of the cables the test system is calibrated to correct the readings.

2) The spectrum analyzer was set to Average Detector function and Maximum hold mode.

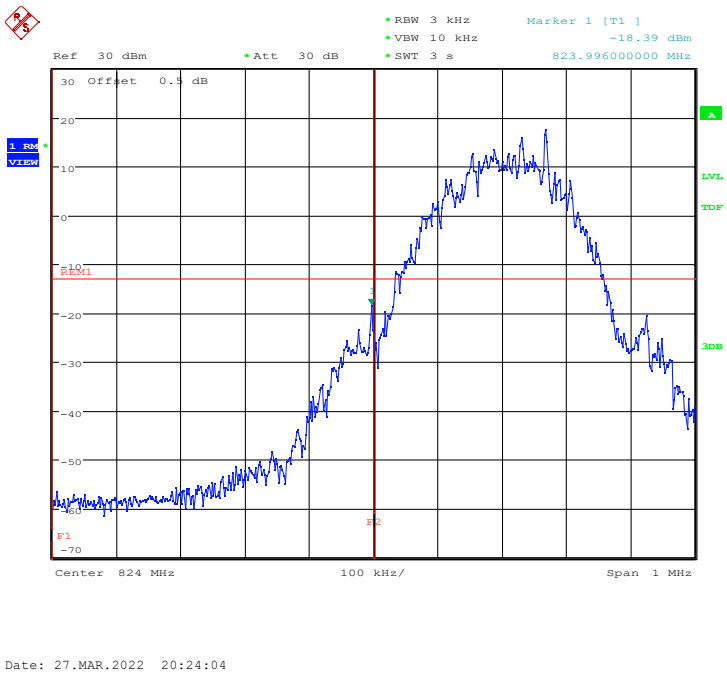
3) The resolution Bandwidth of the spectrum analyzer was a little greater than 1% of the 26dB emission Bandwidth.

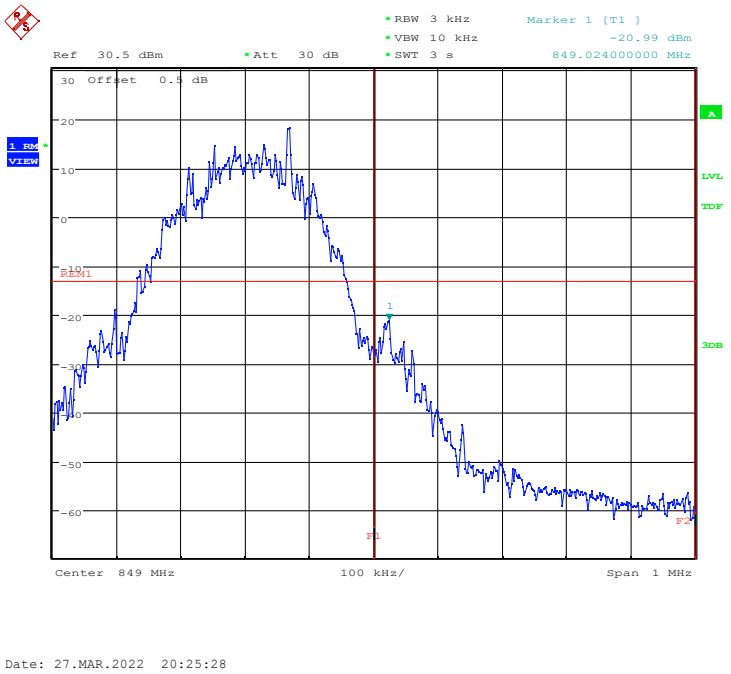
Note: In the graphical result description (X, Y), X represents the number of RB, Y represents the RB offset.

6.7.1 Band Edge Results

GSM850

GSM

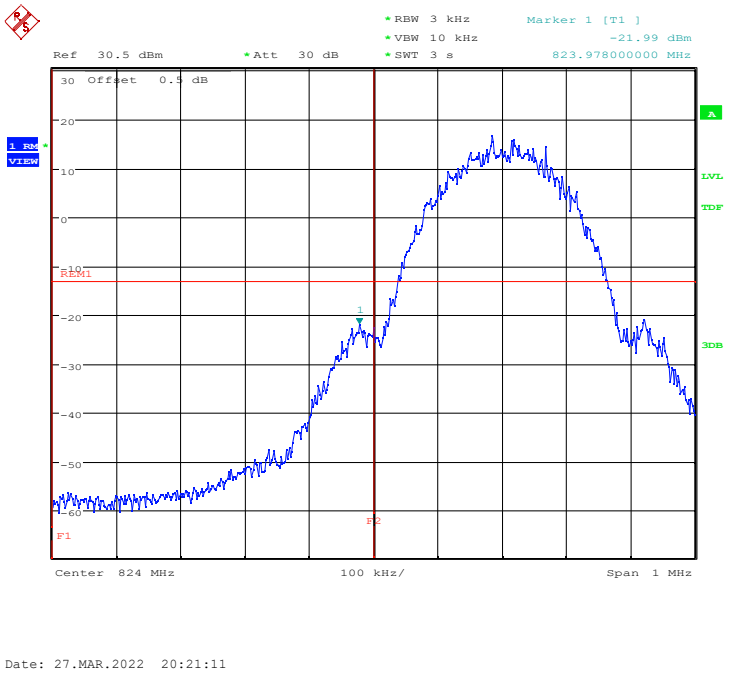
Channel 128

Channel 251


RBW 3 kHz
VBW 10 kHz
SWT 3 s
Marker 1 [T1]
-20.99 dBm
849.024000000 MHz
Ref 30.5 dBm
Att 30 dB
Offset 0.5 dB
1 RM
VIEW
A
LVL
TDF
3DB
REM1
Center 849 MHz
100 kHz/
Span 1 MHz
Date: 27.MAR.2022 20:25:28

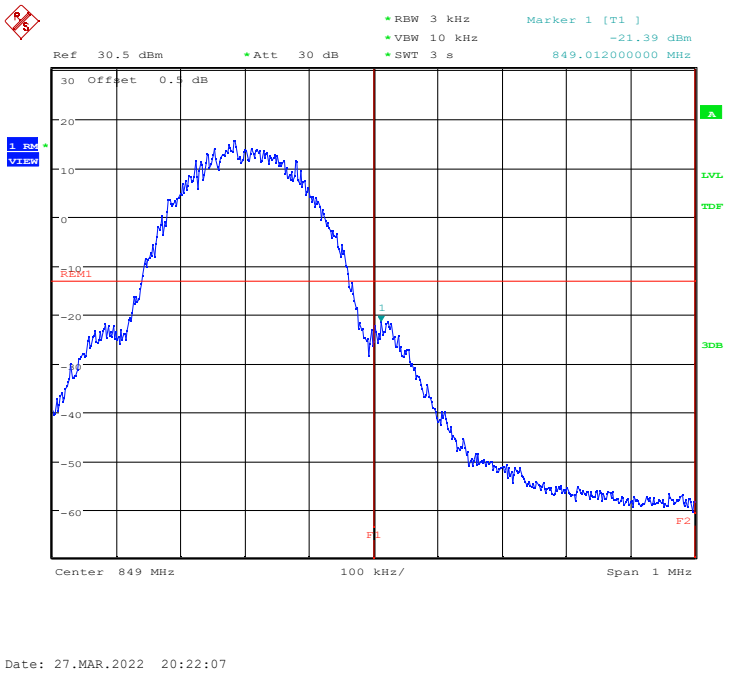
GSM850

GPRS

Channel 128



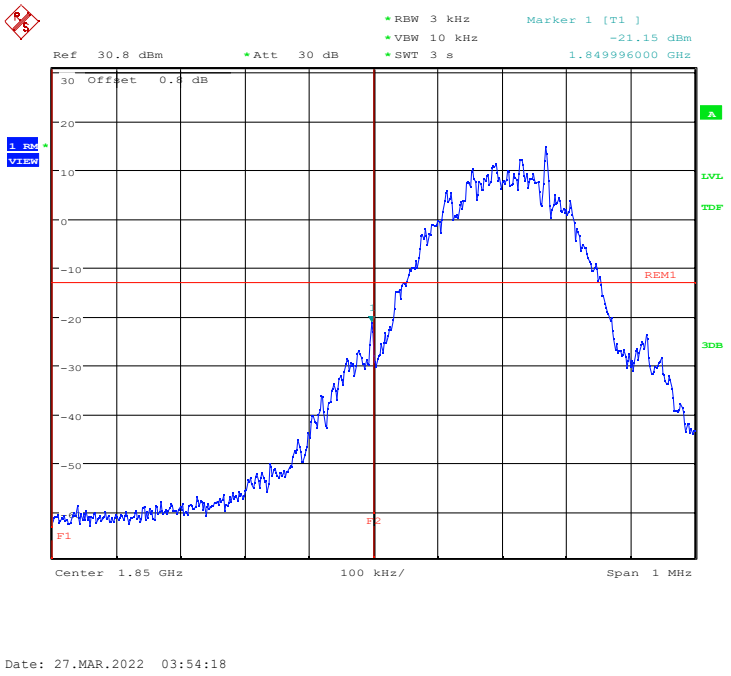
Channel 251



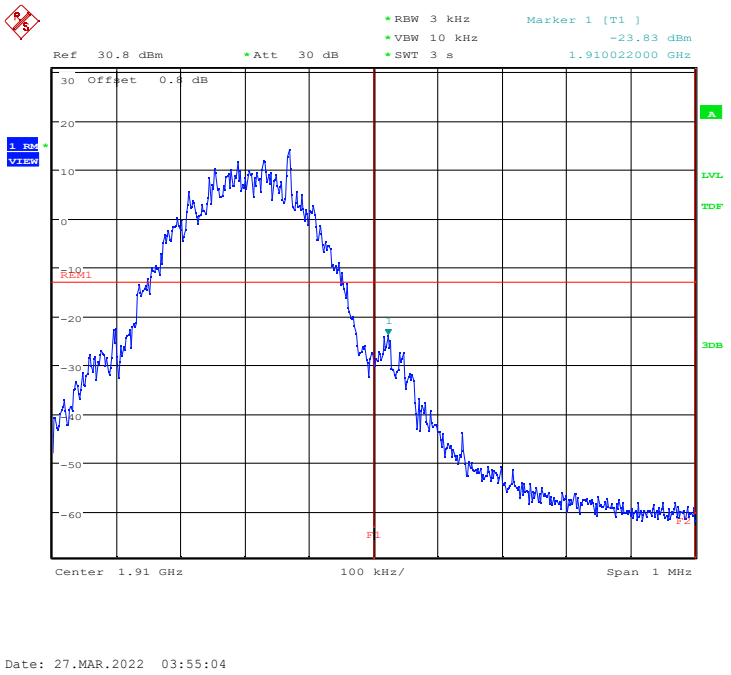
PCS1900

GSM

Channel 512



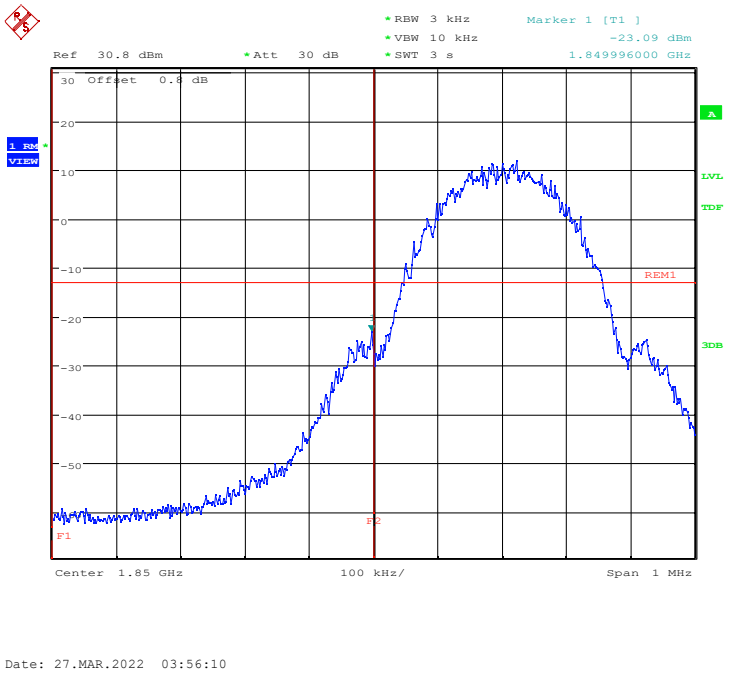
Channel 810



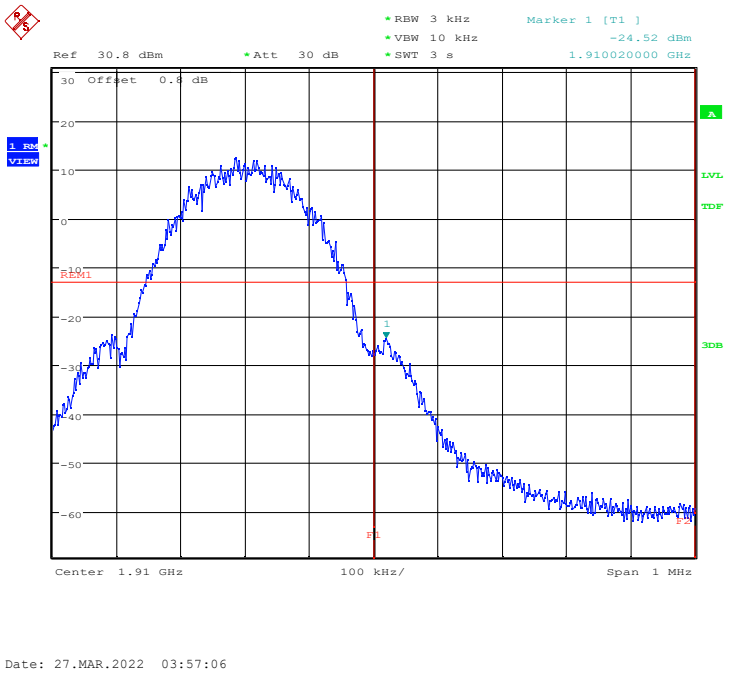
PCS1900

GPRS

Channel 512



Channel 810



6.8. Frequency Stability

Specifications:	FCC Part 2.1055, 22.355, 24.235, 27.54
DUT Serial Number:	863427042013020
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit	
Frequency deviation [ppm]	±2.5

Measurement Uncertainty:

Item	Uncertainty
Expanded Uncertainty	1.54 Hz (k=2)

Test Method

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 FL and FH 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 CMW500.

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 CMW500, and in a simulated call on middle channel for each LTE 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. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring 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 CMW500 and in a simulated call on the center 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.

6.8.1 Frequency Stability over Temperature Variation Results

GSM850

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.8	824.030	848.968		
50				-6.75	0.0161
40				-6.75	0.0161
30				-5.26	0.0126
10				-7.94	0.0190
0				-3.94	0.0094
-10				-7.04	0.0168
-20				-6.01	0.0144
-30				-7.46	0.0178

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.3	20	824.030	848.968	-5.20	0.0124
4.2				-5.07	0.0121

PCS1900

Frequency Error vs Temperature

Temperature(℃)	Voltage(V)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
20	3.8	1850.366	1909.966		
50				-9.59	0.0102
40				-13.85	0.0147
30				-12.20	0.0130
10				-13.11	0.0139
0				-7.01	0.0075
-10				-13.17	0.0140
-20				-14.66	0.0156
-30				-22.37	0.0238

Frequency Error vs Voltage

Voltage(V)	Temperature(℃)	FL(MHz)	FH(MHz)	Offset(Hz)	Frequency error(ppm)
3.3	20	1850.366	1909.966	-16.66	0.0177
4.2				-14.95	0.0159

6.9. Peak to Average Ratio

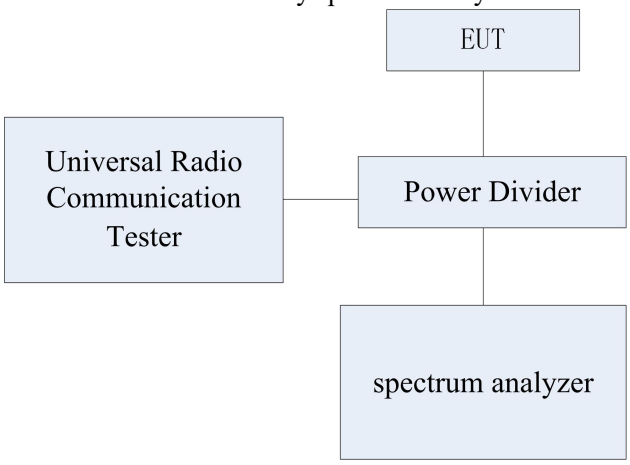
Specifications:	FCC Part 24.232, 27.50,
DUT Serial Number:	863427042013020
Test conditions:	Ambient Temperature:15℃-35℃ Relative Humidity:30%-60% Air pressure: 86-106kPa
Test Results:	Pass

Limit

The EUT meets the requirement of having a peak to average ratio of less than 13dB.

Test Setup

During the test, the EUT was controlled via the Wireless Communications Test Set to ensure max power transmission and proper modulation and measured by spectrum analyzer.



Measurement Uncertainty:

Item	Uncertainty
Expanded Uncertainty	0.62 dB (k=2)

Test Method

The transmitter output was connected to a CMW500 through a coaxial RF cable and directional coupler, and configured to operate at maximum power. The peak to average ratio was measured at the required operating frequencies in each Band on the Spectrum Analyzer.

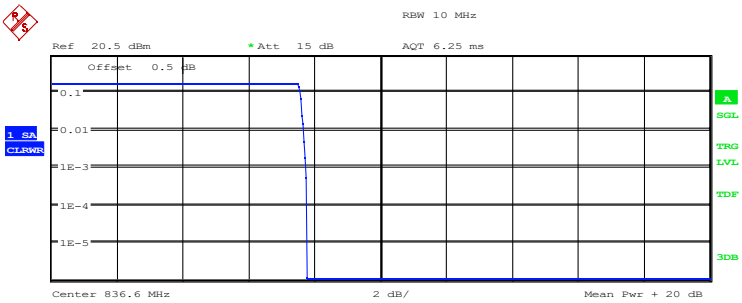
6.9.1 Peak to Average Ratio Results

GSM850

Measurement result

GSM850	Frequency (MHz)	PAPR (dB)
GSM	836.6	7.76
GPRS	836.6	7.95
EGPRS	836.6	10.64

Channel GSM-836.6MHz

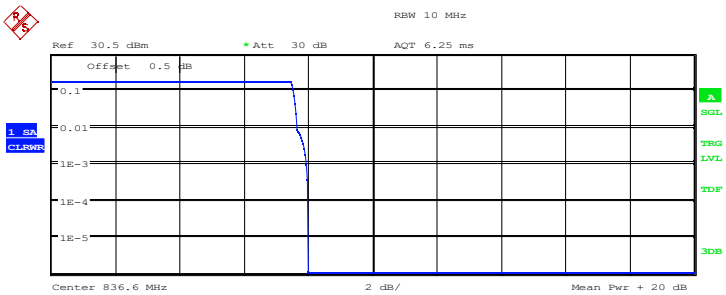


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	16.57 dBm
Peak	24.33 dBm
Crest	7.76 dB
10 %	7.56 dB
1 %	7.66 dB
.1 %	7.76 dB
.01 %	7.79 dB

Date: 25.MAR.2022 23:17:47

Channel GPRS-836.6MHz

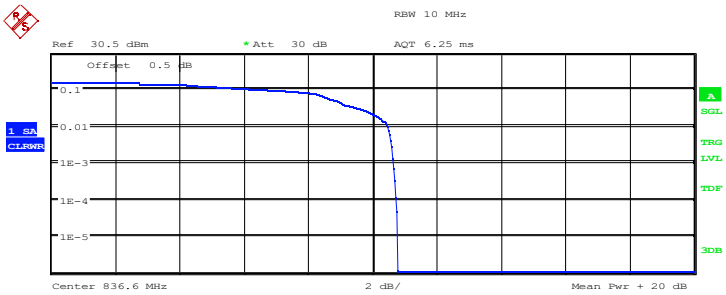


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	27.08 dBm
Peak	35.07 dBm
Crest	7.99 dB
10 %	7.53 dB
1 %	7.66 dB
.1 %	7.95 dB
.01 %	8.01 dB

Date: 27.MAR.2022 22:37:44

Channel EGPRS-836.6MHz



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	18.93 dBm
Peak	29.71 dBm
Crest	10.77 dB
10 %	6.99 dB
1 %	10.48 dB
.1 %	10.64 dB
.01 %	10.74 dB

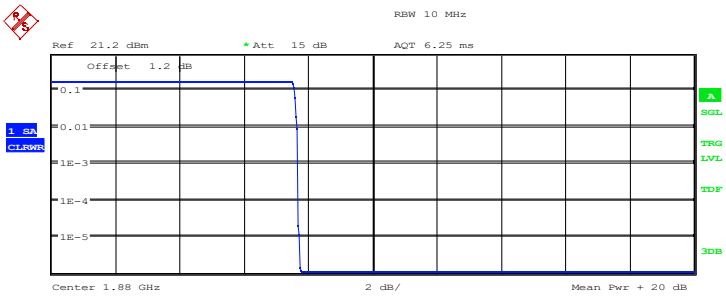
Date: 27.MAR.2022 20:43:44

PCS1900

Measurement result

PCS1900	Frequency (MHz)	PAPR (dB)
GSM	1880	7.69
GPRS	1880	7.79
EGPRS	1880	10.71

Channel GSM-1880MHz

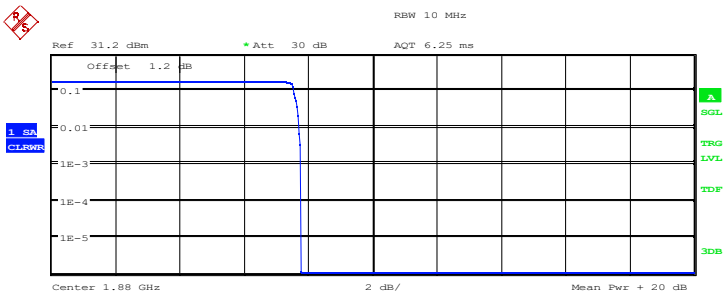


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	4.29 dBm
Peak	12.04 dBm
Crest	7.75 dB
10 %	7.56 dB
1 %	7.66 dB
.1 %	7.69 dB
.01 %	7.69 dB

Date: 25.MAR.2022 23:19:42

Channel GPRS-1880MHz

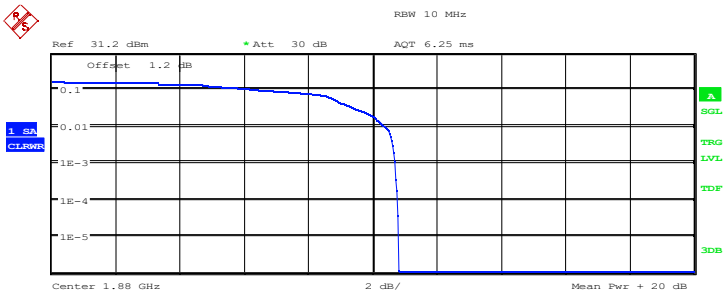


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	24.71 dBm
Peak	32.48 dBm
Crest	7.77 dB
10 %	7.56 dB
1 %	7.72 dB
.1 %	7.79 dB
.01 %	7.79 dB

Date: 27.MAR.2022 22:31:10

Channel EGPRS-1880MHz



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	20.28 dBm
Peak	31.07 dBm
Crest	10.79 dB
10 %	6.67 dB
1 %	10.38 dB
.1 %	10.71 dB
.01 %	10.77 dB

Date: 27.MAR.2022 22:31:48

Annex A EUT Photos

See the document" I22W00025-External Photos".
See the document" I22W00025-Internal Photos ".

ANNEX B Deviations from Prescribed Test Methods

No deviation from Prescribed Test Methods.

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