TEST REPORT

No. I19D00143-SRD04

For

Client: Shanghai Sunmi Technology Co.,Ltd.

Production: Smart POS System

Model Name: T6800

Brand Name: SUNMI

FCC ID : 2AH25T6800

Hardware Version: V1

Software Version: SP2186_769__P2LITELA_patchbuild_20190808165765_DCC

Issued date: 2019-11-15

NOTE

1. The test results in this test report relate only to the devices specified in this report.
2. This report shall not be reproduced except in full without the written approval of China Telecommunication Technology Labs.
3. KDB 971168 D01 has not been accredited by A2LA.
4. For the test results, the uncertainty of measurement is not taken into account when judging the compliance with specification, and the results of measurement or the average value of measurement results are taken as the criterion of the compliance with specification directly.

Test Laboratory:
East China Institute of Telecommunications
Add: 7-8F, G Area, No.668, Beijing East Road, Huangpu District, Shanghai, P. R. China
Tel: +86 21 63843300
FAX: +86 21 63843301
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Revision Version

Report Number	Revision	Date	Memo
I19D00143-SRD04	00	2019-09-18	Initial creation of test report
I19D00143-SRD04	01	2019-11-15	Second creation of test report

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1. Test Laboratory

1.1. Testing Location

Company Name	East China Institute of Telecommunications
Address	7-8/F., Area G, No.668, Beijing East Road, Shanghai, China
Postal Code	200001
Telephone	+86 21 63843300
Fax	+86 21 63843301
FCC registration No	CN1177

1.2. Testing Environment

Normal Temperature	15℃-35℃
Relative Humidity	20%-75%

Project Data

Project Leader	Yu Anlu
Testing Start Date	2019-08-19
Testing End Date	2019-08-22

1.3. Signature

Wang Liang
(Prepared this test report)

Fan Songyan
(Reviewed this test report)

Zheng Zhongbin
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18721763396
Postcode	/

2.2. Manufacturer Information

Company Name	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, KIC Plaza, No.388 Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18721763396
Postcode	/

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

3.1. About EUT

Production	Smart POS System
Model name	T6800
GSM Frequency Band	GSM850/GSM900/GSM1800/GSM1900
UMTS Frequency Band	I/II/IV/V/VIVIII
Extreme Temperature	-10/+45℃
Nominal Voltage	3.80V
Extreme High Voltage	4.35V
Extreme Low Voltage	3.00V
Maximum of Antenna Gain	GSM850: -0.42dBi; PCS1900: 1.65dBi; WCDMA BAND II: 2.57dBi; WCDMA BAND IV: 1.82dBi;WCDMA BAND V: -0.42dBi

Note:

a. Photographs of EUT are shown in ANNEX A of this test report.

b. The value of the antenna gain is provided by the customer. For specific antenna information, please check the antenna specifications of the customer.

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
N01	81256040029551	V1	SP2186_769__P2LITELA_patchbuild_20190808165765_DCC	2019-08-19
N03	81256040030997	V1	SP2186_769__P2LITELA_patchbuild_20190808165765_DCC	2019-08-19
N07	81256040032522	V1	SP2186_769__P2LITELA_patchbuild_20190808165765_DCC	2019-08-19
N08	81256040030922	V1	SP2186_769__P2LITELA_patchbuild_20190808165765_DCC	2019-08-19
N11	/	V1	SP2186_769__P2LITELA_patchbuild_20190808165765_DCC	2019-08-19

*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	Type	Manufacturer
AE1	RF cable	---	AE1

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

4. Reference Documents

4.1. Documents supplied by applicant

All technical documents are 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 Part 24	PERSONAL COMMUNICATIONS SERVICES	2018-10-01
FCC Part 22	PUBLIC MOBILE SERVICES	2018-10-01
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	2018-10-01
ANSI-TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio	2015
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v03r01

5. Test Results

5.1. Summary of Test Results

Measurement Items	Sub-clause of Part15C	Verdict
Output Power	2.1046/22.913(a)/24.232(c)	P
Peak-to-Average Ratio	24.232(d)	P
99%Occupied Bandwidth	2.1049(h)(i)/ 22.917(b)	P
-26dB Emission Bandwidth	22.917(b)/§24.238(b)	P
Band Edge at antenna terminals	22.917(a)/24.238(a)	P
Frequency stability	2.1055/24.235	P
Conducted Spurious mission	2.1053/22.917(a)/24.238(a)	P
Emission Limit	2.1051/22.917/24.238/22.913/24.232	P

Note: please refer to Annex A in this test report for the detailed test results.

The following terms are used in the above table.

P	Pass, the EUT complies with the essential requirements in the standard.
NP	Not Perform, the test was not performed by ECIT.
NA	Not Applicable, the test was not applicable.
F	Fail, the EUT does not comply with the essential requirements in the standard.

5.2. Statements

The T6800 is an initial product for testing.

ECIT only performed test cases which identified with P/NP/NA/F results in Annex A.

ECIT has verified that the compliance of the tested device specified in section 3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 4 of this test report.

6. Test Equipments Utilized

6.1. Conducted Test System

Item	Instrument Name	Type	SN	Manufacturer	Cal. Date	Cal. interval
1	Vector Signal Analyzer	FSQ40	200063	R&S	2019-05-10	1 year
2	DC Power Supply	ZUP60-14	LOC-220Z006-0007	TDL-Lambda	2019-05-10	1 year
3	Universal Radio Communication Tester	CMW500	104178	R&S	2019-05-10	1 year

6.2. Radiated Emission Test System

The test equipment and ancillaries used are as follows.

Item	Instrument Name	Type	SN	Manufacturer	Cal. Date	Cal. interval
1	Universal Radio Communication Tester	CMU200	123123	R&S	2019-05-10	1 year
2	EMI Test Receiver	ESU40	100307	R&S	2019-05-10	1 year
3	TRILOG Broadband Antenna	VULB9163	VULB9163-515	Schwarzbeck	2019-05-10	3 years
4	Double- ridged Waveguide Antenna	ETS-3117	00135890	ETS	2019-05-10	3 years
5	2-Line V-Network	ENV216	101380	R&S	2019-05-10	1 year
6	Substitution Antenna	ETS-3117	00135890	ETS	2019-05-10	3 years
7	RF Signal Generator	SMF100A	102314	R&S	2019-05-10	1 year
8	Substitution Antenna	VUBA9117	9117-266	Schwarzbeck	2019-05-10	3 years
9	Amplifier	SCU08	10146	R&S	2019-05-10	1 year

Climate chamber

Item	Instrument Name	Type	SN	Manufacturer	Cal. Date	Cal. interval
1	Climate chamber	SH-641	92012011	ESPEC	2019-05-10	2years

Anechoic chamber

Fully anechoic chamber by ETS

7. Measurement Uncertainty

Measurement uncertainty for all the testing in this report are within the limit specified in ECIT documents .

The detailed measurement uncertainty is defined in ECIT documents.

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Maximum Peak Output Power	30MHz-3600MHz	95%	±0.544dB
EBW and VBW	30MHz-3600MHz	95%	±62.04Hz
Transmitter Spurious Emission-Conducted	30MHz-2GHz	95%	±0.90dB
Transmitter Spurious Emission-Conducted	2GHz-3.6GHz	95%	±0.88dB
Transmitter Spurious Emission-Conducted	3.6GHz-8GHz	95%	±0.96dB
Transmitter Spurious Emission-Conducted	8GHz-20GHz	95%	±0.94dB
Transmitter Spurious Emission-Radiated	9KHz-30MHz	95%	±5.66dB
Transmitter Spurious Emission-Radiated	30MHz-1000MHz	95%	±4.98dB
Transmitter Spurious Emission-Radiated	1000MHz -18000MHz	95%	±5.06dB
Transmitter Spurious Emission-Radiated	18000MHz -40000MHz	95%	±5.20dB
Frequency stability	1MHz-16GHz	95%	±62.04Hz

8. Test Environment

Shielding Room1 (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Ground system resistance	< 0.5 Ω

Control room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ℃, Max. = 35 ℃
Relative humidity	Min. =25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω

Fully-anechoic chamber1 (6.9 meters×10.9 meters×5.4 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω
VSWR	Between 0 and 6 dB, from 1GHz to 18GHz
Site Attenuation Deviation	Between -4 and 4 dB,30MHz to 1GHz
Uniformity of field strength	Between 0 and 6 dB, from 80MHz to 3000 MHz

ANNEX A. Detailed Test Results

ANNEX A.1. OUTPUT POWER

A.1.1. Summary

During the process of testing, the EUT was controlled Rhode & Schwarz Digital Radio. Communication tester (CMU-200) to ensure max power transmission and proper modulation.
This result contains peak output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

A.1.2. Conducted

A.1.2.1. Method of Measurements

Method of measurements please refer to KDB971168 D01 v03 clause 5.
The EUT was set up for the max output power with pseudo random data modulation.
The power was measured with Rhode & Schwarz Spectrum Analyzer FSQ(peak).
These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0MHz and 1909.8MHz for PCS1900 band; 824.2MHz, 836.6MHz and 848.8MHz for GSM850 band. (bottom, middle and top of operational frequency range).
These measurements were done at 3 frequencies, 1852.4 MHz, 1880.0MHz and 1907.6MHz for WCDMA Band II; 1732.6 MHz, 1712.4MHz and 1752.6MHz for WCDMA Band IV; 826.4MHz, 836.6MHz and 846.6MHz for WCDMA Band V. (bottom, middle and top of operational frequency range).

A.1.2.2 Test procedures:

1. The transmitter output port was connected to base station.
2. Set the EUT at maximum power through base station.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure the maximum burst average power for GSM and maximum average power for other modulation signal.

A.1.2.3 Limit:

22.913(a) Mobile stations are limited to 7watts.
24.232(c) Mobile and portable stations are limited to 2 watts.

A.1.2.4 Test Procedure:

The transmitter output power was connected to calibrated attenuator, the other end of which was connected to signal analyzer. Transmitter output power was read off the power in dBm. The power outputs at the transmitter antenna port was determined by adding the value of attenuator to the signal analyzer reading.

A.1.2.5 GSM Test Condition:

RBW	VBW	Sweep time	Span
3MHz	10MHz	Auto	50MHz

A.1.2.6 WCDMA Test Condition:

RBW	VBW	Sweep time	Span
10MHz	30MHz	Auto	50MHz

A.1.2.7 Measurement results:

GSM 850 (GMSK)	
Channel/fc(MHz)	Peak power (dBm)
Mid 189/836.4	29.69
Low 128/824.2	29.75
High 251/848.8	31.03
GPRS 850 (GMSK 1 Slot)	
Channel/fc(MHz)	Peak power (dBm)
Mid 189/836.4	29.8
Low 128/824.2	29.7
High 251/848.8	30
EDGE 850 (8PSK 1 Slot)	
Channel/fc(MHz)	Peak power (dBm)
Mid 189/836.4	23.4
Low 128/824.2	23.55
High 251/848.8	23.55

GSM 1900(GMSK)	
Channel/fc(MHz)	Peak power (dBm)
Mid 661/1880	26.61
Low 512/1850.2	26.5

High 810/1909.8	26.24
GPRS 1900 (GMSK 1 Slot)	
Channel/fc(MHz)	Peak power (dBm)
Mid 661/1880	26.44
Low 512/1850.2	26.6
High 810/1909.8	26.33
EDGE 1900 (8PSK 1 Slot)	
Channel/fc(MHz)	Peak power (dBm)
Mid 661/1880	21.31
Low 512/1850.2	21.44
High 810/1909.8	21.29

WCDMA II	
Channel/fc(MHz)	Peak power (dBm)
Mid 9800 /1880	24.32
Low 9663/1852.6	24.50
High 9937/1907.4	24.27
WCDMA BAND IV	
Channel/fc(MHz)	Peak power (dBm)
Mid 1413 /1732.6	24.43
Low 1312/1712.4	24.00
High 1513/1752.6	24.47
WCDMA BAND V	
Channel/fc(MHz)	Peak power (dBm)
Mid 4400/835	24.27
Low 4358/826.6	23.94
High 4457/846.4	23.53

Conclusion: PASS

ANNEX A.2. Peak-to-Average Power Ratio

Method of test measurements please refer to KDB971168 D01 v03 clause 5.7.

A.2.1 PAPR Limit

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

A.2.2 Test procedures

1. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
2.
   1) Select the spectrum analyzer CCDF function.
   2) Set RBW⩾signal's occupied bandwidth.
   3) Set the number of counts to a value that stabilizes the measured CCDF cure;
   4) Sweep time ⩾ 1s.
3. Record the maximum PAPR level associated with a probability of 0.1%.

A.2.3 Test results:

GSM850			
Channel	128	189	251
Frequency (MHz)	824.2	836.4	848.8
PAPR(dB)	8.46	8.33	8.37
GPRS850			
Channel	128	189	251
Frequency (MHz)	824.2	836.4	848.8
PAPR(dB)	8.49	8.43	8.49
EDGE850			
Channel	128	189	251
Frequency (MHz)	824.2	836.4	848.8
PAPR(dB)	8.33	8.37	8.33

GSM1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	8.46	8.46	8.33

GPRS1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	8.37	8.4	8.4
EDGE1900			
Channel	512	661	810
Frequency (MHz)	1850.2	1880	1909.8
PAPR(dB)	8.4	8.46	8.46

WCDMA Band II			
Channel	9262	9400	9538
Frequency (MHz)	1852.4	1880	1907.6
PAPR(dB)	8.4	8.4	8.46
WCDMA Band IV			
Channel	1312	1413	1513
Frequency (MHz)	1712.4	1732.6	1752.6
PAPR(dB)	8.4	8.46	8.46
WCDMA Band V			
Channel	4132	4183	4233
Frequency (MHz)	826.4	836.4	846.6
PAPR(dB)	8.37	8.56	8.37

Conclusion: PASS

ANNEX A.3. Occupied Bandwidth

Method of test please refer to KDB971168 D01 v03 clause 4.0.

A.3.1. Occupied Bandwidth

Similar to conducted emissions; 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 frequencies of GSM850, PCS1900, WCDMA BANDII, WCDMA BANDIV and WCDMA BANDV.

A.3.2 Test Procedure:

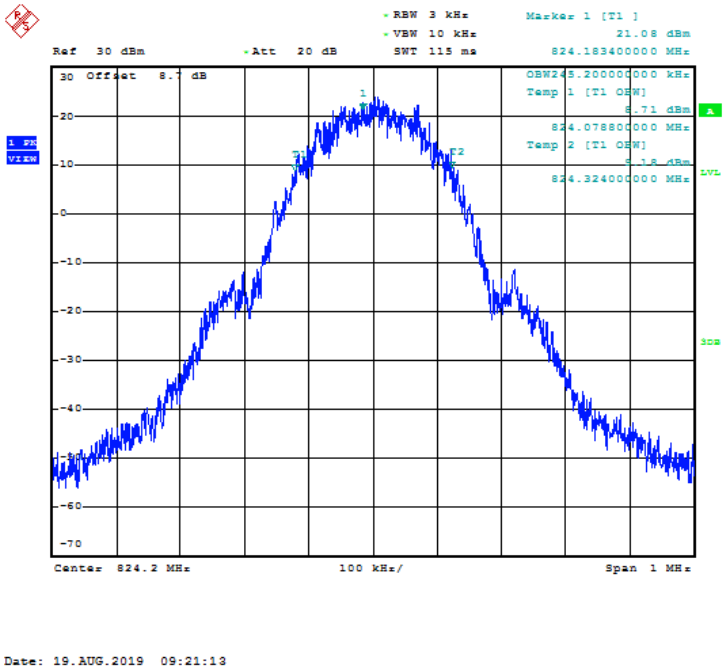
1. The EUT output RF connector was connected with a short cable to the signal analyzer.
2. RBW was set to about 1% of emission BW, VBW >= 3 times RBW,.
3. 99% bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

A.3.3 Test result:

GSM850		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 189	836.4	245.20
Low 128	824.2	247.00
High 251	848.8	239.60
GPRS850		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 189	836.4	246.20
Low 128	824.2	241.30
High 251	848.8	246.70
EDGE850		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 189	836.4	244.30
Low 128	824.2	243.20
High 251	848.8	243.50

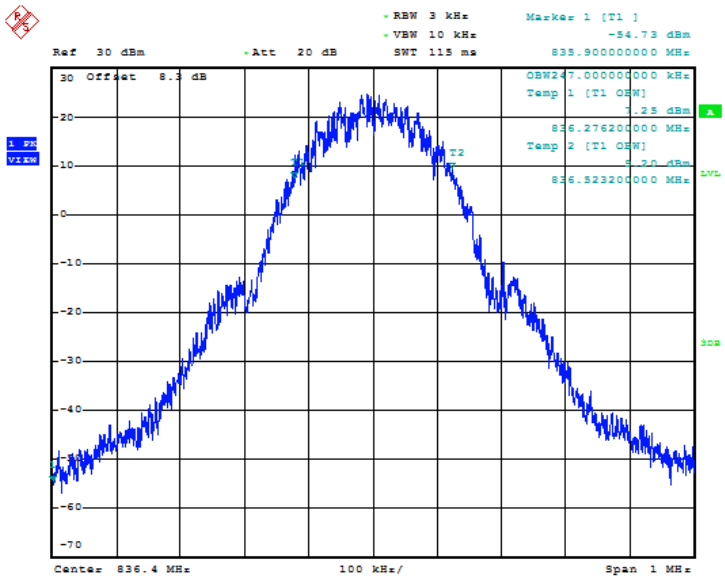
Conclusion: PASS

GSM 850



Date: 19.AUG.2019 09:21:13

Fig.1 Channel 189-Occupied Bandwidth (99%)



Date: 19.AUG.2019 09:22:19

Fig.2 Channel 128-Occupied Bandwidth (99%)

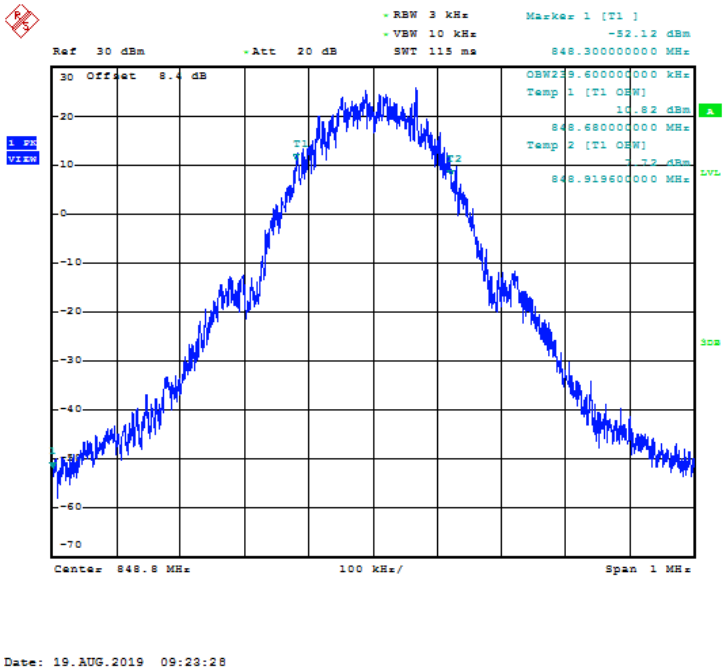


Fig.3 Channel 251-Occupied Bandwidth (99%)

GPRS 850

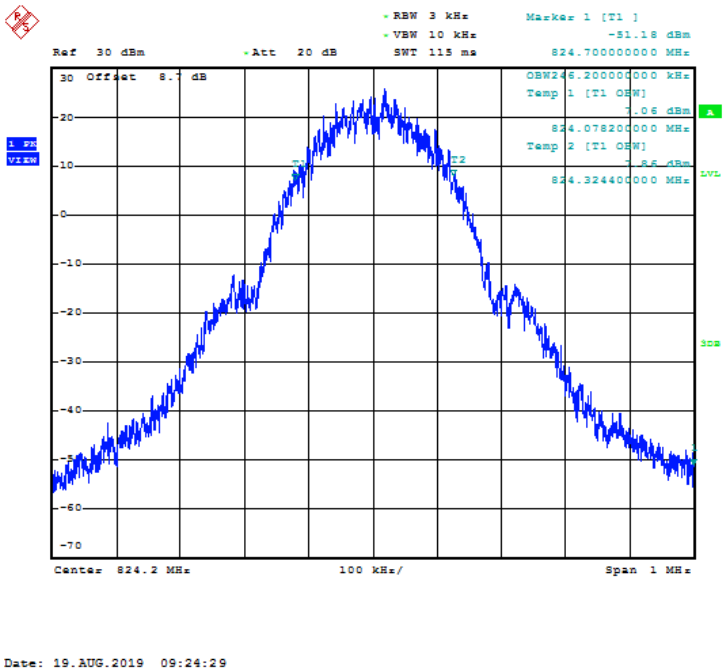


Fig.4 Channel 189-Occupied Bandwidth (99%)

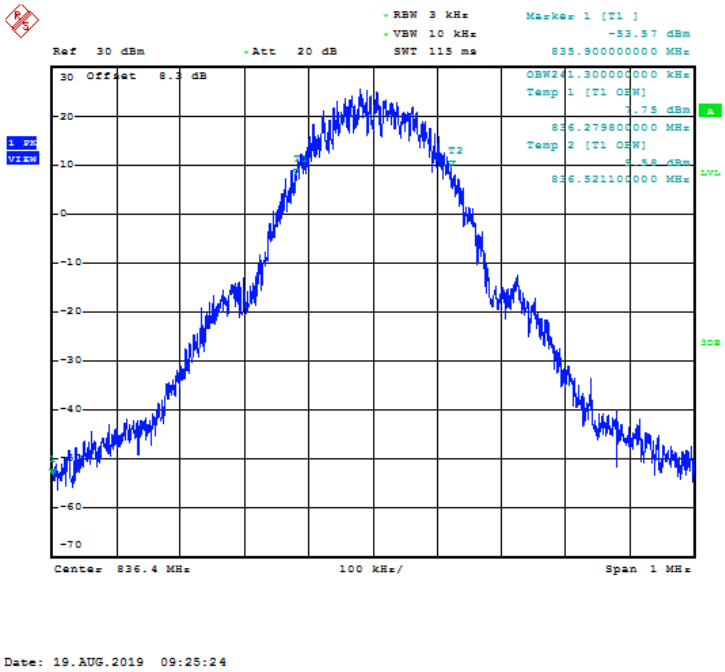


Fig.5 Channel 128-Occupied Bandwidth (99%)

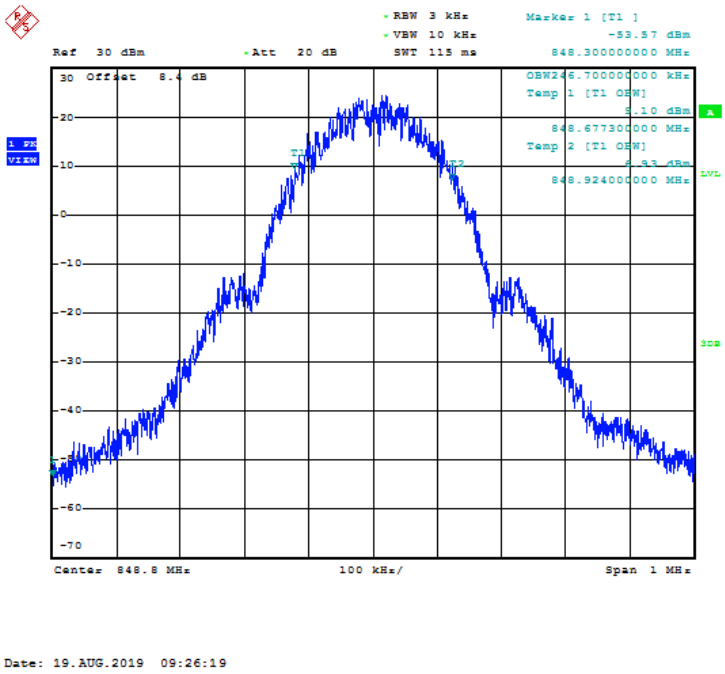


Fig.6 Channel 251-Occupied Bandwidth (99%)

EDGE 850

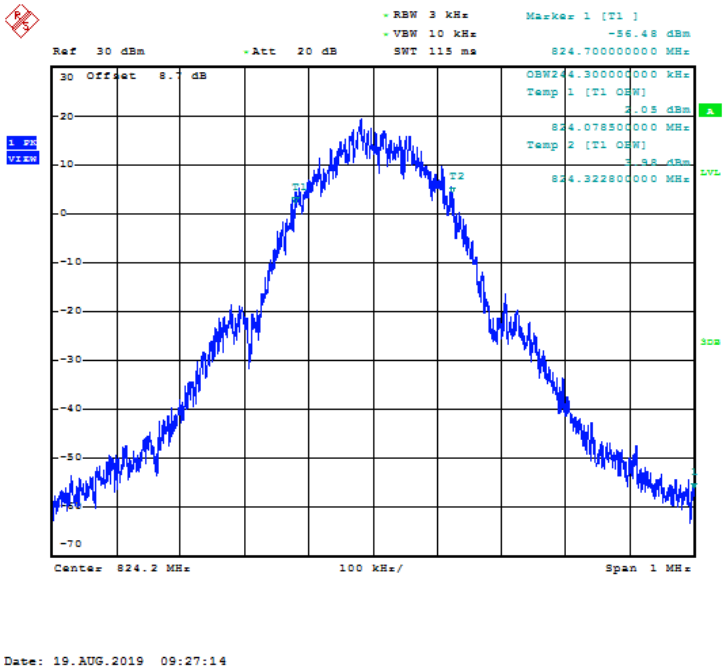


Fig.7 Channel 189-Occupied Bandwidth (99%)

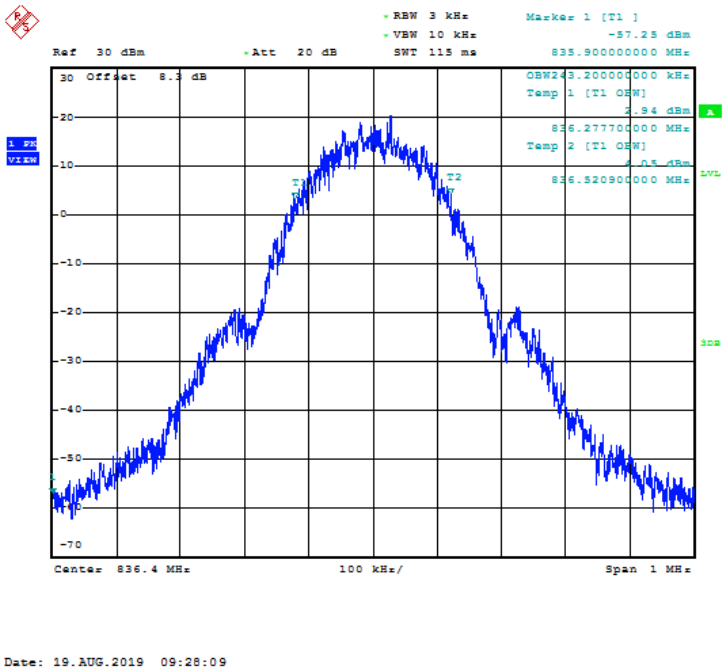


Fig.8 Channel 128-Occupied Bandwidth (99%)

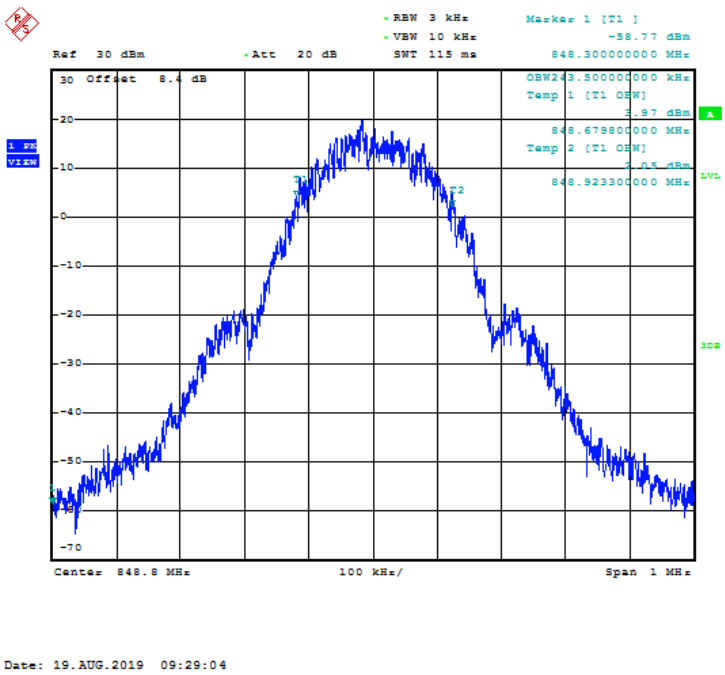


Fig.9 Channel 251-Occupied Bandwidth (99%)

GSM1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 661	1880	244.60
Low 512	1850.2	247.20
High 810	1909.8	244.70
GPRS1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 661	1880	244.20
Low 512	1850.2	242.30
High 810	1909.8	244.00
EDGE1900		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(kHz)
Mid 661	1880	246.60
Low 512	1850.2	245.70
High 810	1909.8	243.30

Conclusion: PASS

GSM 1900

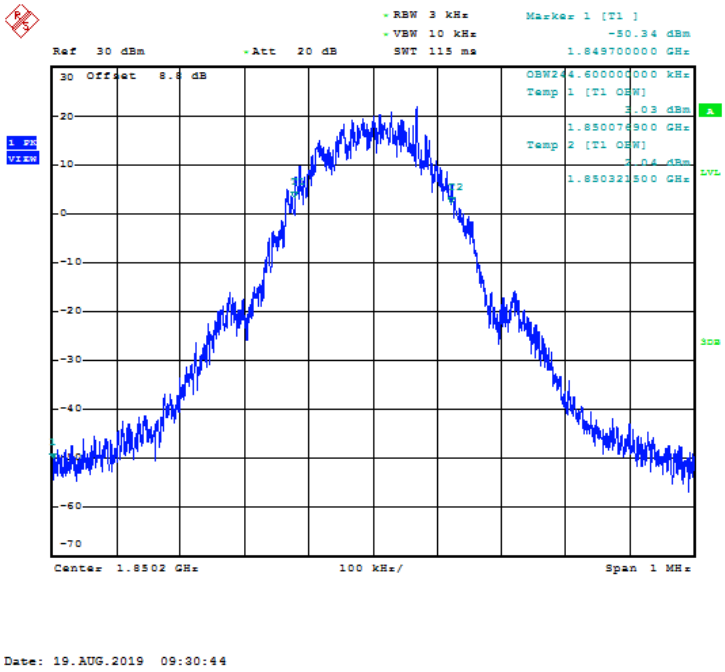


Fig.10 Channel 661-Occupied Bandwidth (99%)

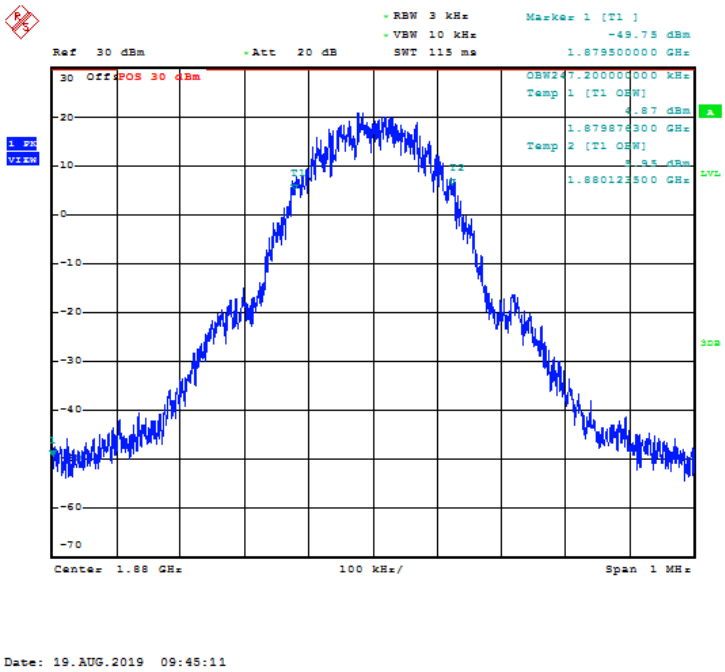


Fig.11 Channel 512-Occupied Bandwidth (99%)

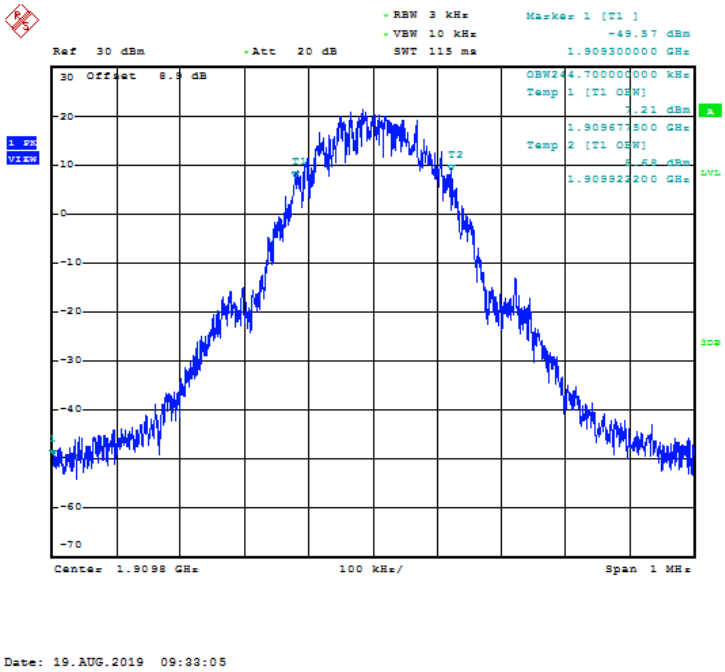


Fig.12 Channel 810-Occupied Bandwidth (99%)

GPRS 1900

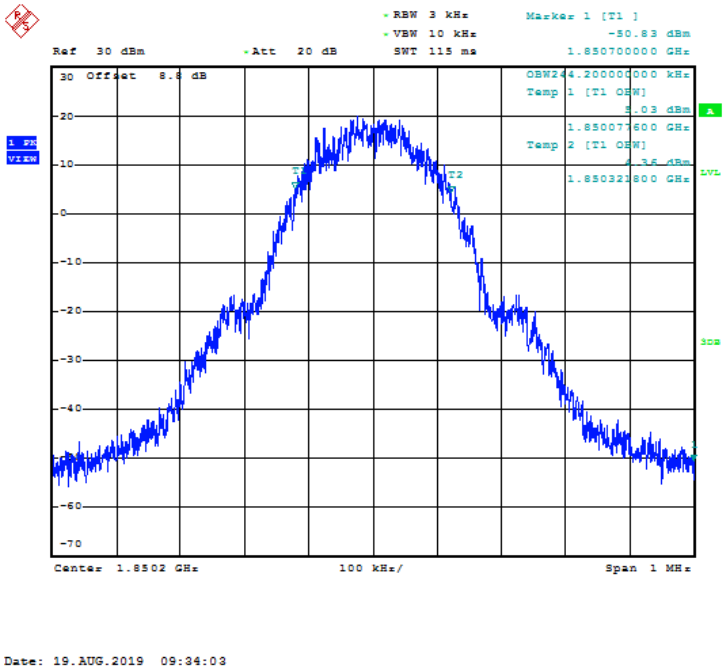


Fig.13 Channel 661-Occupied Bandwidth (99%)

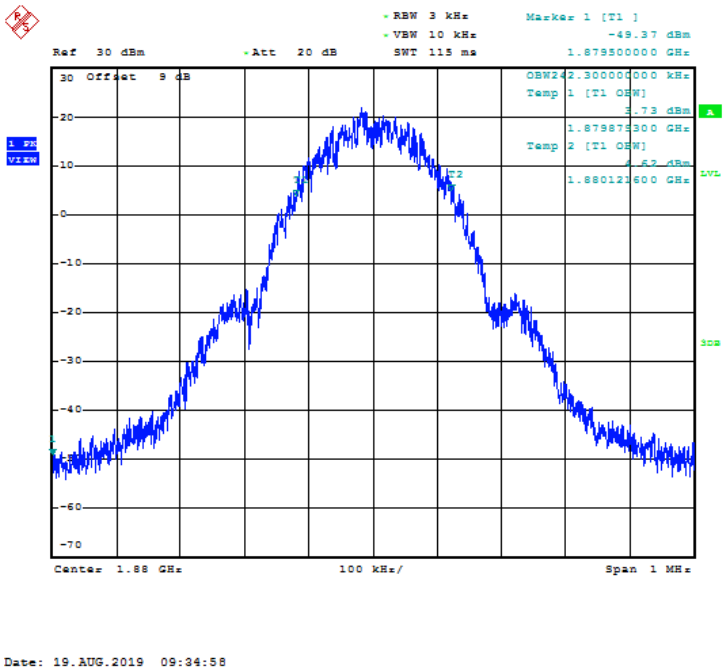


Fig.14 Channel 512-Occupied Bandwidth (99%)

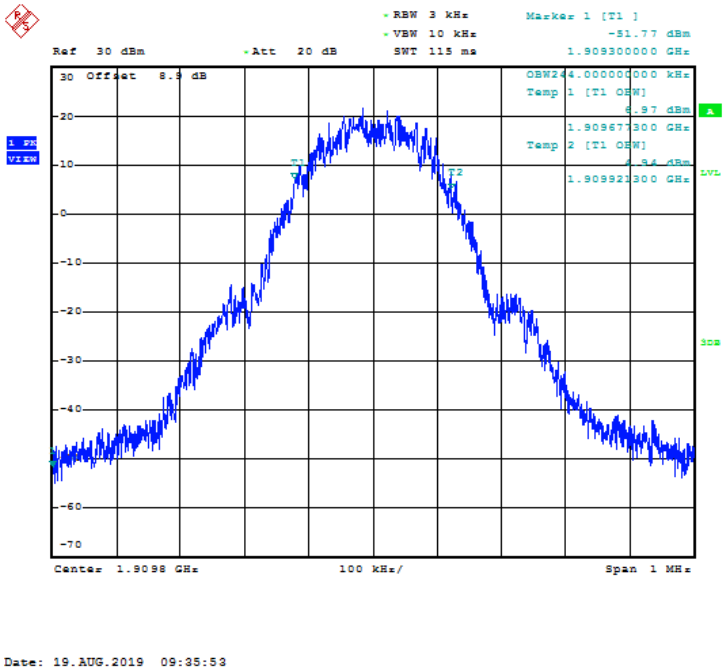


Fig.15 Channel 810-Occupied Bandwidth (99%)

WCDMA BAND II		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(MHz)
Mid 9400	1880	4.136
Low 9262	1852.4	4.135
High 9538	1907.6	4.134

Conclusion: PASS

WCDMA BAND II

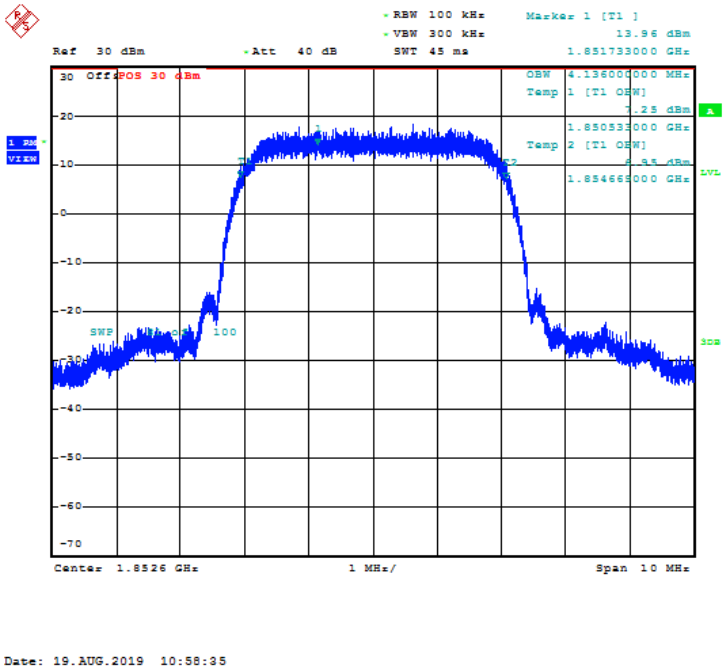


Fig.16 Channel 9400-Occupied Bandwidth (99%)

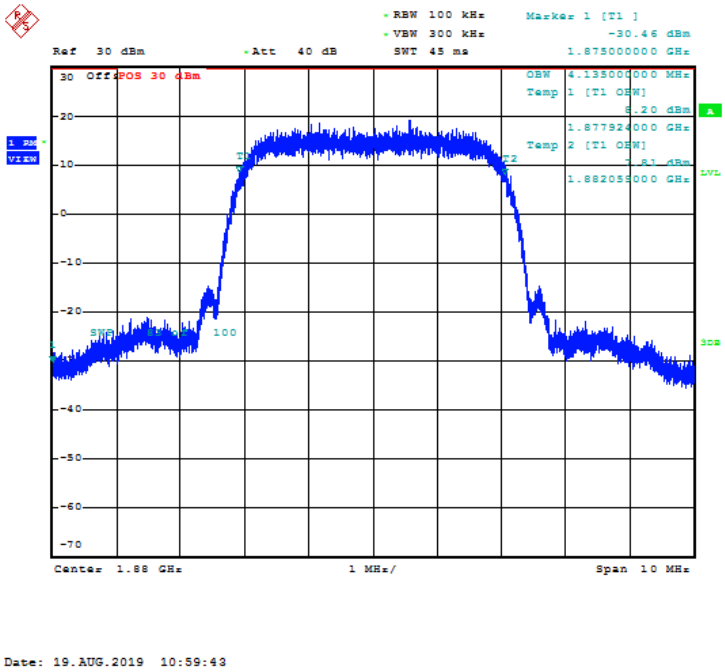


Fig.17 Channel 9262-Occupied Bandwidth (99%)

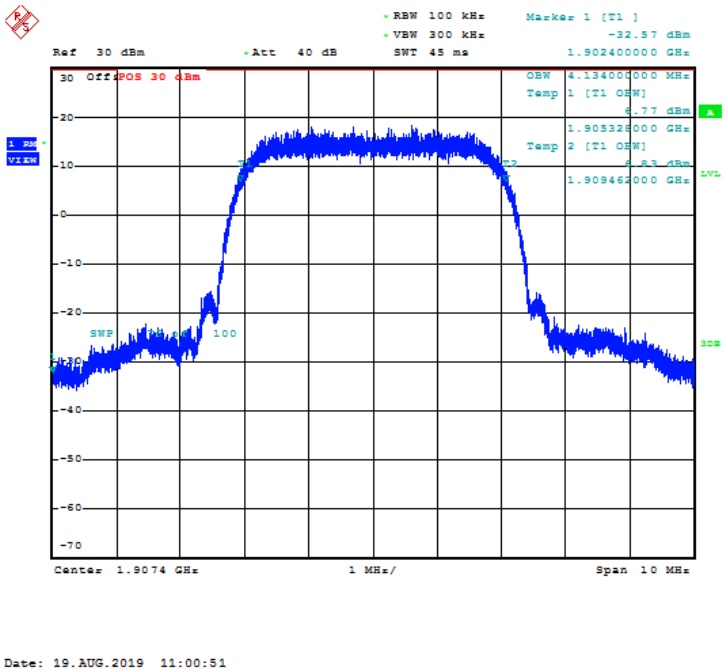


Fig.18 Channel 9538-Occupied Bandwidth (99%)

WCDMA BAND IV		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(MHz)
Mid 1413	1732.6	4.138
Low 1312	1712.4	4.145
High 1513	1752.6	4.141

Conclusion: PASS

WCDMA BAND IV

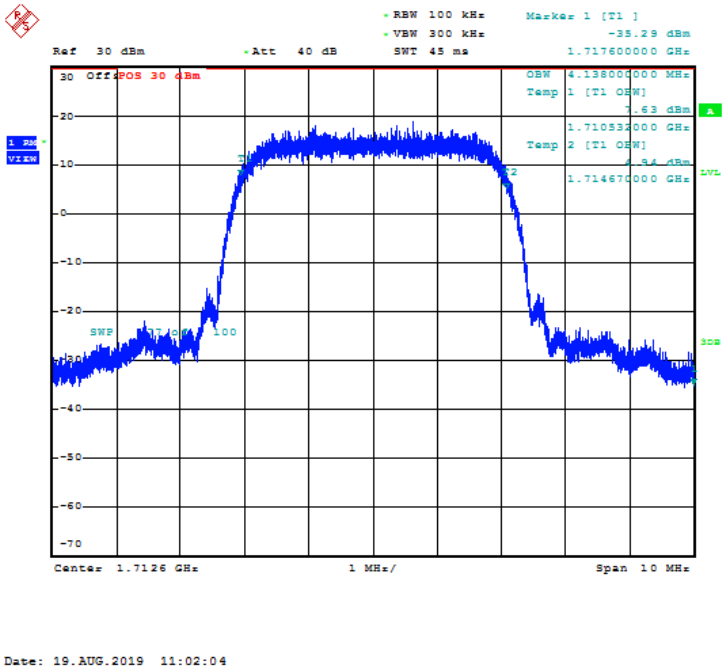


Fig.19 Channel 1413-Occupied Bandwidth (99%)

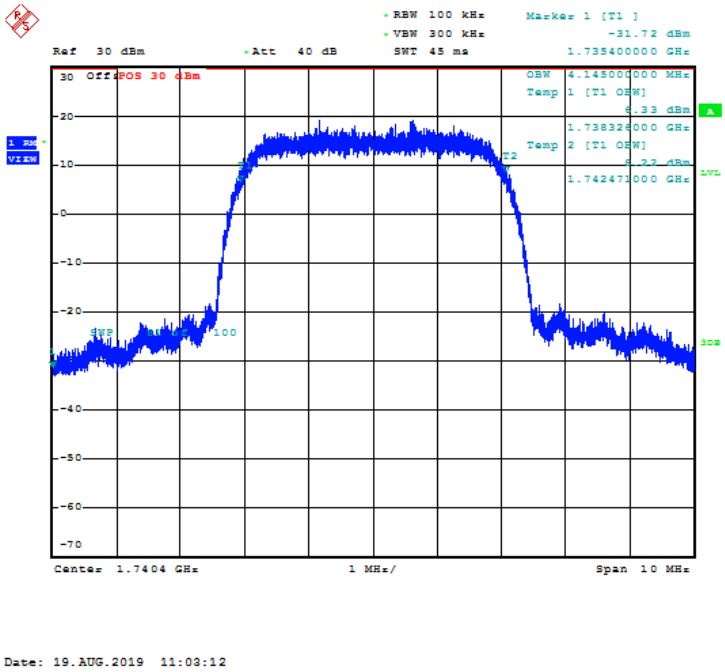


Fig.20 Channel 1312-Occupied Bandwidth (99%)

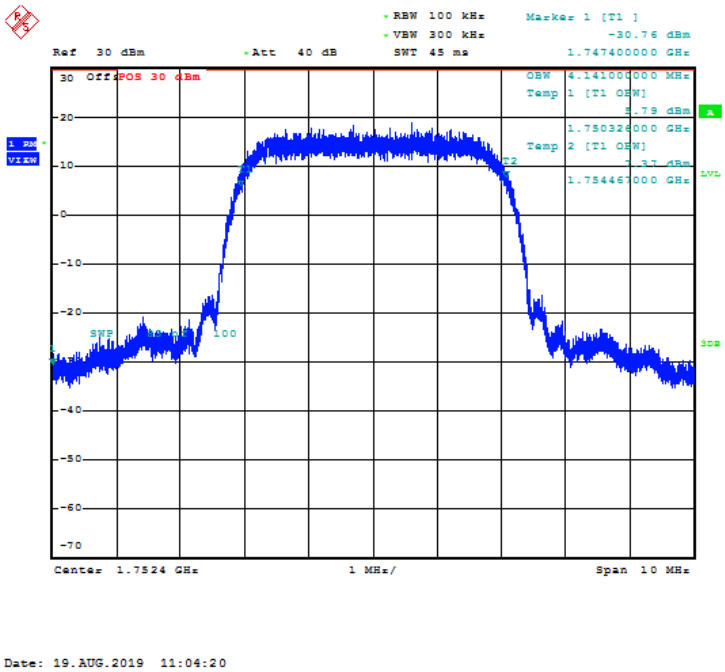


Fig.21 Channel 1513-Occupied Bandwidth (99%)

WCDMA BAND V		
Test channel	Frequency (MHz)	99% Occupied Bandwidth(MHz)
Mid 4183	836.6	4.136
Low 4132	826.4	4.140
High 4233	846.6	4.149

Conclusion: PASS

WCDMA BAND V

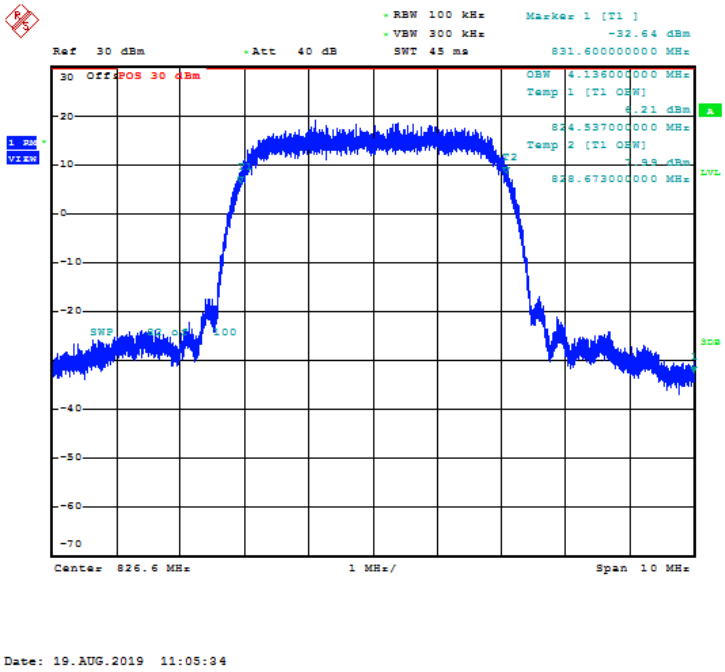


Fig.22 Channel 4183-Occupied Bandwidth (99%)

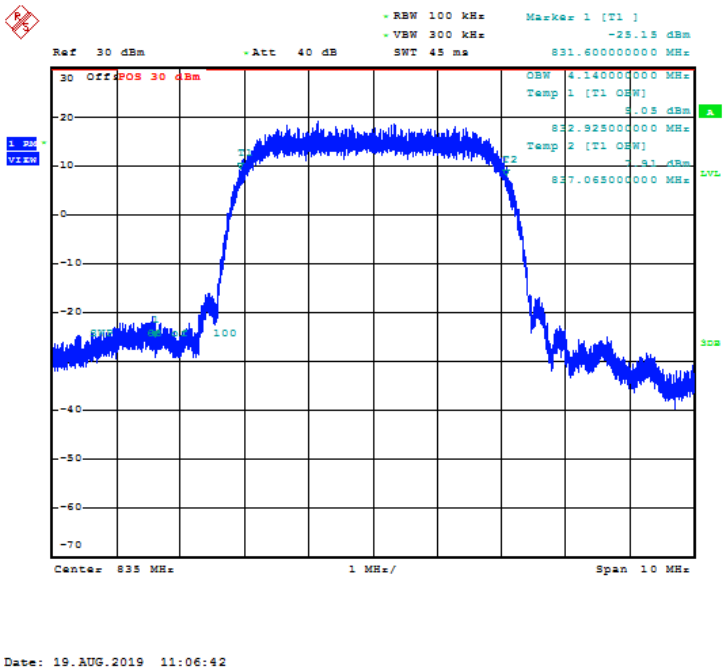


Fig.23 Channel 4132-Occupied Bandwidth (99%)

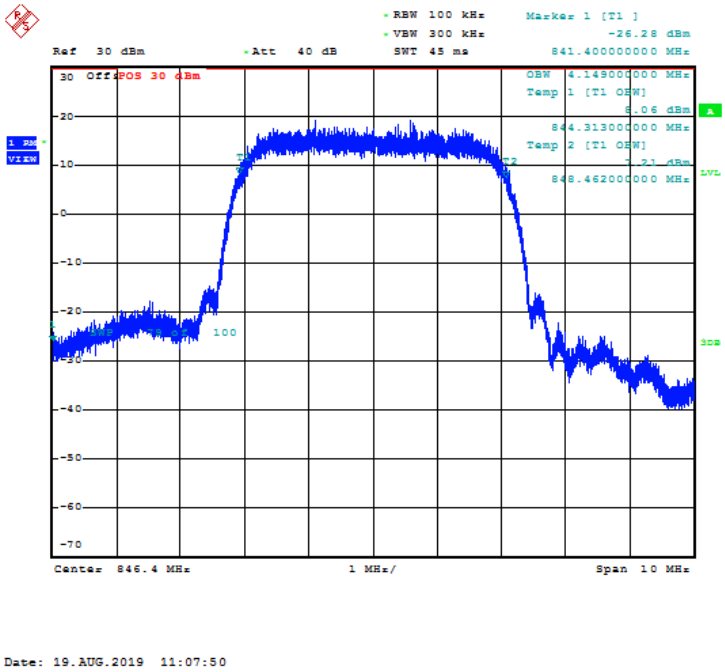


Fig.24 Channel 4233-Occupied Bandwidth (99%)

ANNEX A.4. -26dB Emission Bandwidth

Method of test please refer to KDB971168 D01 v03 clause 4.0.

A.4.1. -26dB Emission Bandwidth

Similar to conducted emissions; 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 frequencies of GSM850, PCS1900, WCDMA BANDII, WCDMA BANDIV and WCDMA BANDV.

A.4.2 Test Procedure:

1. The EUT output RF connector was connected with a short cable to the signal analyzer.
2. RBW was set to about 1% of emission BW, VBW >= 3 times RBW,.
3. 26dB bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

A.4.3 Measurement methods:

For GSM: signal analyzer setting as: RBW=3KHz;VBW=10KHz;Span=1MHz.

For WCDMA: signal analyzer setting as: RBW=50KHz;VBW=200KHz;Span=10MHz.

A.4.4 Test results:

GSM 850		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 189	836.4	309.00
Low 128	824.2	309.00
High 251	848.8	311.00
GPRS 850		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 189	836.4	314.00
Low 128	824.2	314.00
High 251	848.8	315.00
EDGE 850		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 189	836.4	310.00
Low 128	824.2	315.00
High 251	848.8	316.00

Conclusion: PASS

GSM 850

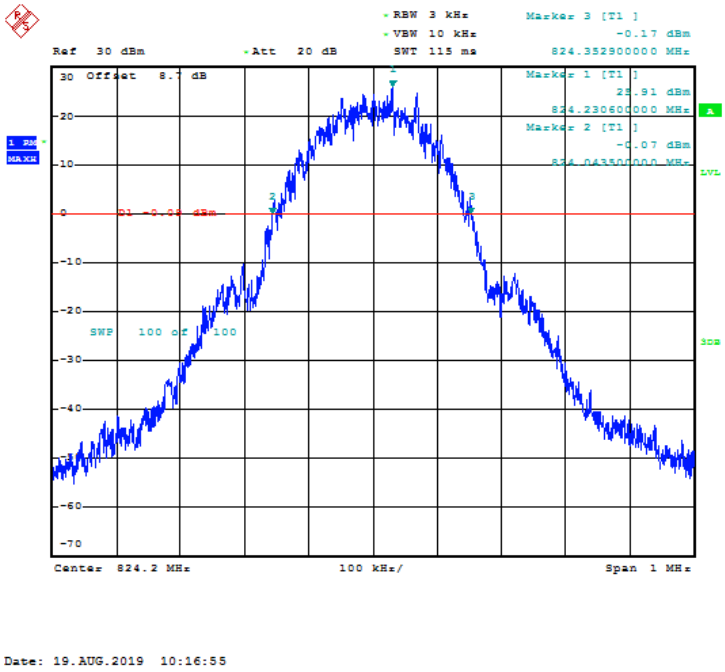


Fig.25 Channel 189- Emission Bandwidth (-26dBc BW)

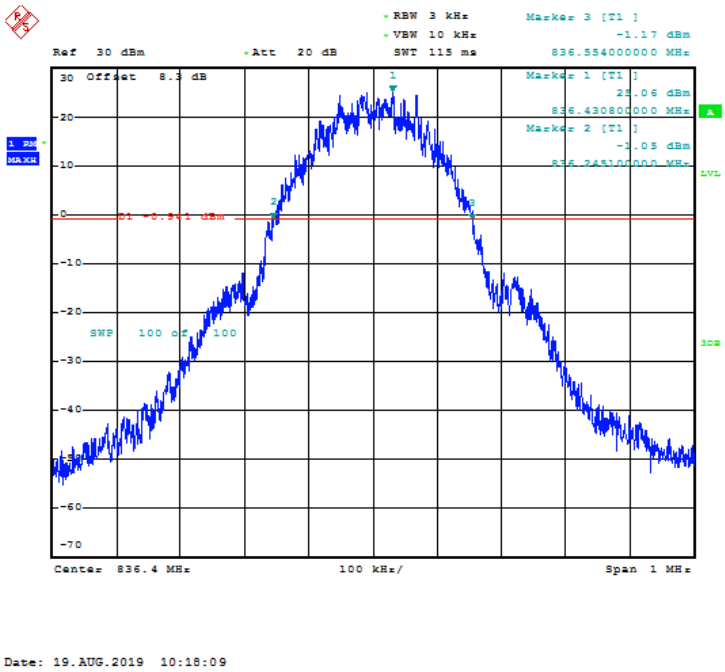


Fig.26 Channel 128- Emission Bandwidth (-26dBc BW)

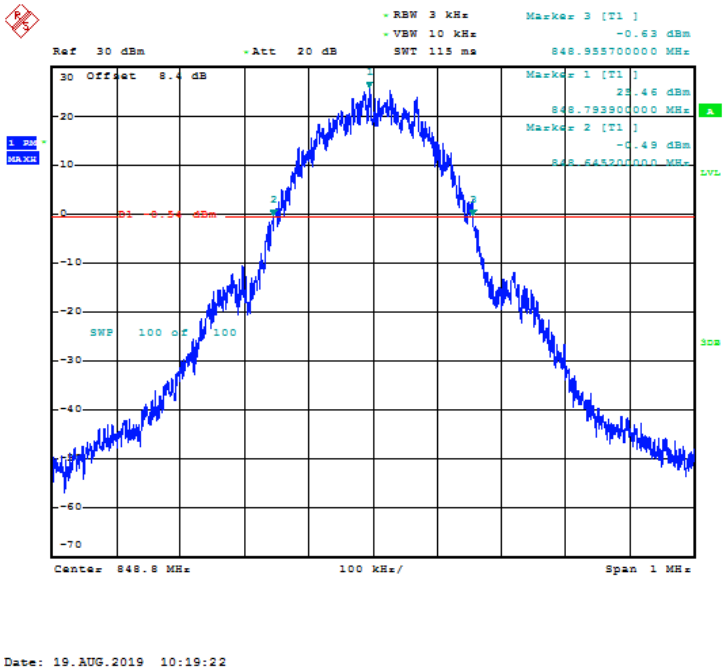


Fig.27 Channel 251- Emission Bandwidth (-26dBc BW)

GPRS 850

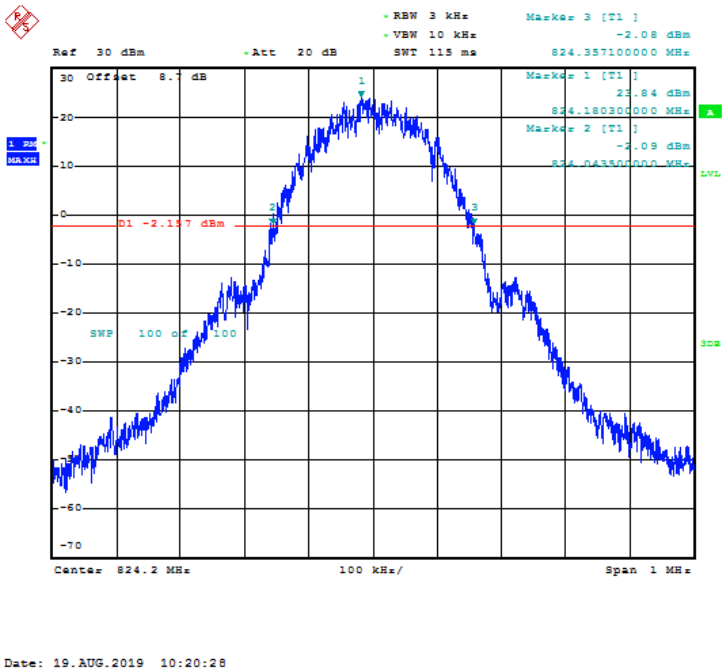


Fig.28 Channel 189- Emission Bandwidth (-26dBc BW)

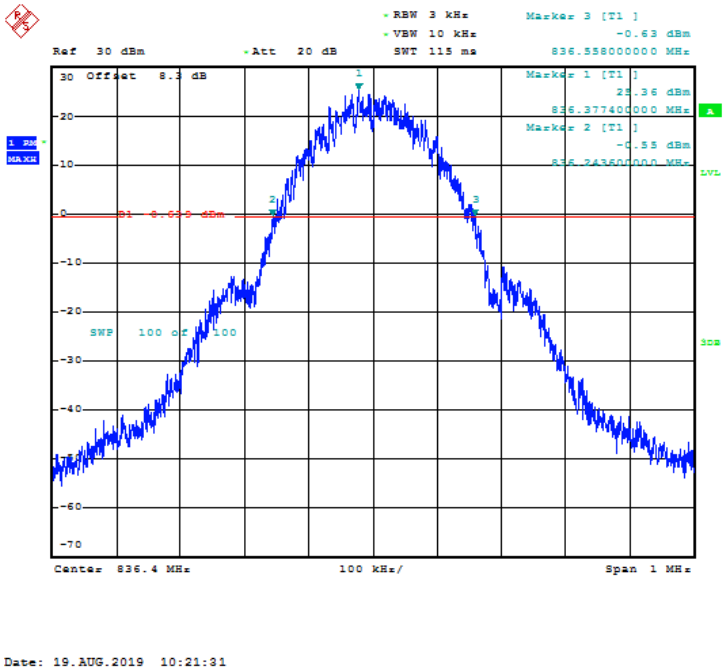


Fig.29 Channel 128- Emission Bandwidth (-26dBc BW)

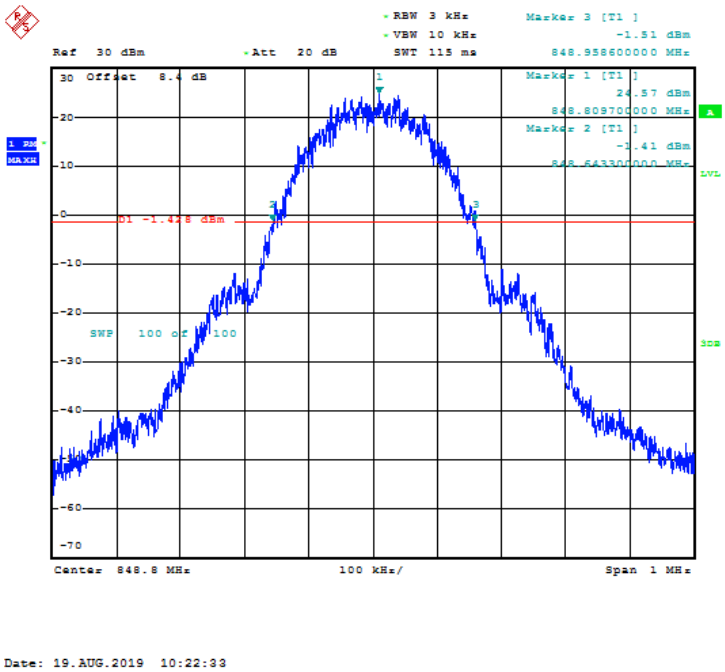


Fig.30 Channel 251- Emission Bandwidth (-26dBc BW)

EDGE 850

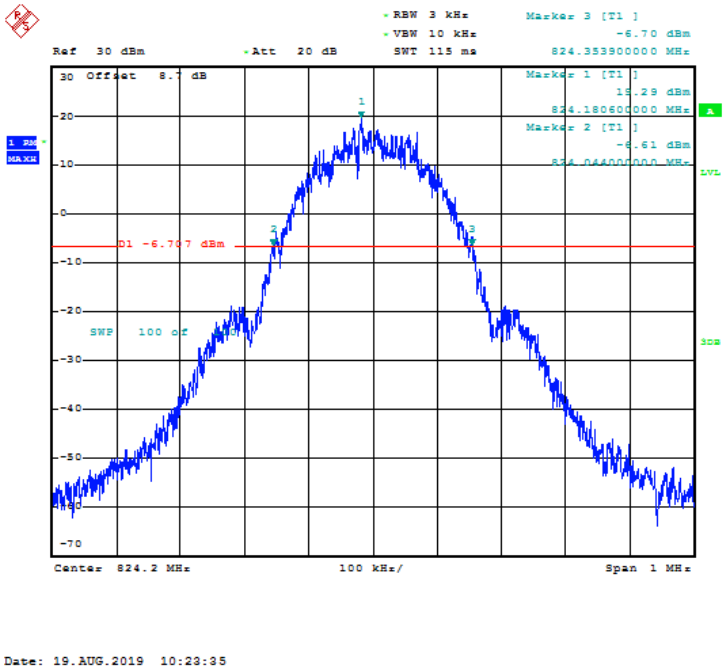


Fig.31 Channel 189- Emission Bandwidth (-26dBc BW)

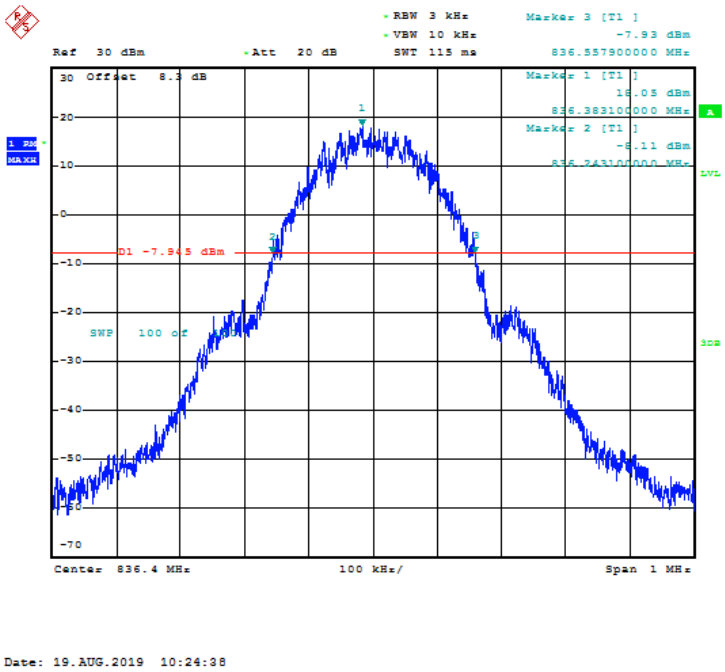


Fig.32 Channel 128- Emission Bandwidth (-26dBc BW)

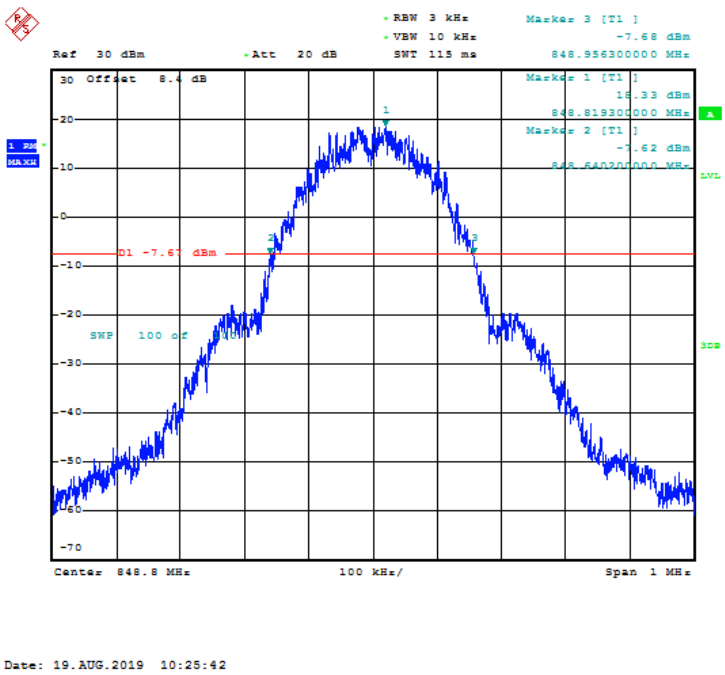


Fig.33 Channel 251- Emission Bandwidth (-26dBc BW)

GSM1900		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 661	1880	318.00
Low 512	1850.2	306.00
High 810	1909.8	305.00
GPRS1900		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 661	1880	319.00
Low 512	1850.2	308.00
High 810	1909.8	311.00
EDGE1900		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(kHz)
Mid 661	1880	309.00

Low 512	1850.2	311.00
High 810	1909.8	316.00

Conclusion: PASS

GSM 1900

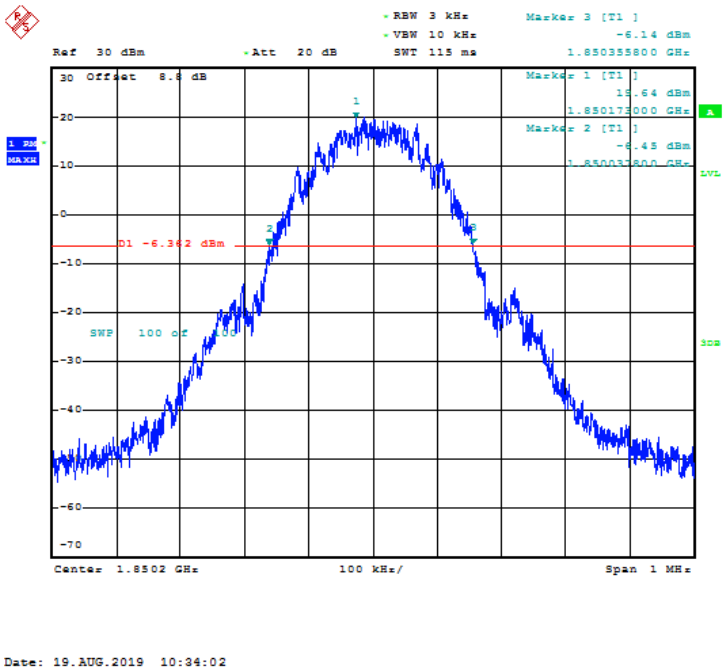


Fig.34 Channel 661- Emission Bandwidth (-26dBc BW)

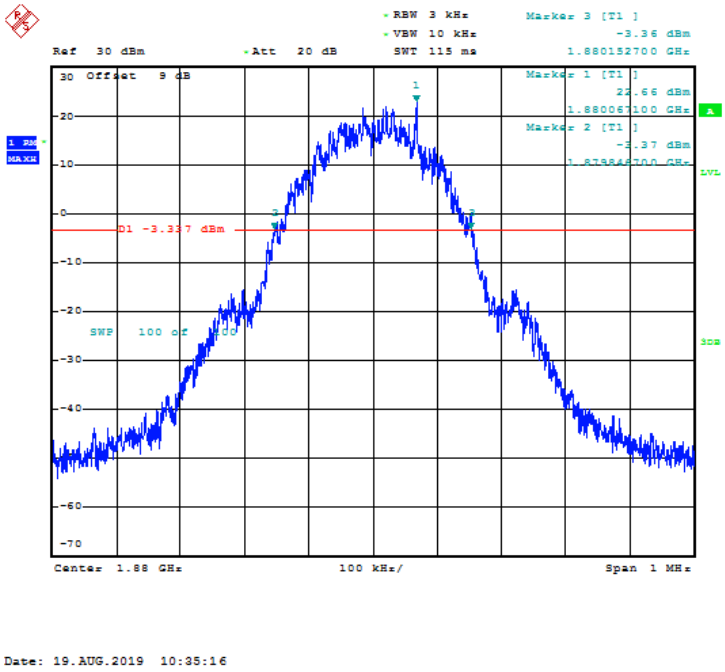


Fig.35 Channel 512- Emission Bandwidth (-26dBc BW)

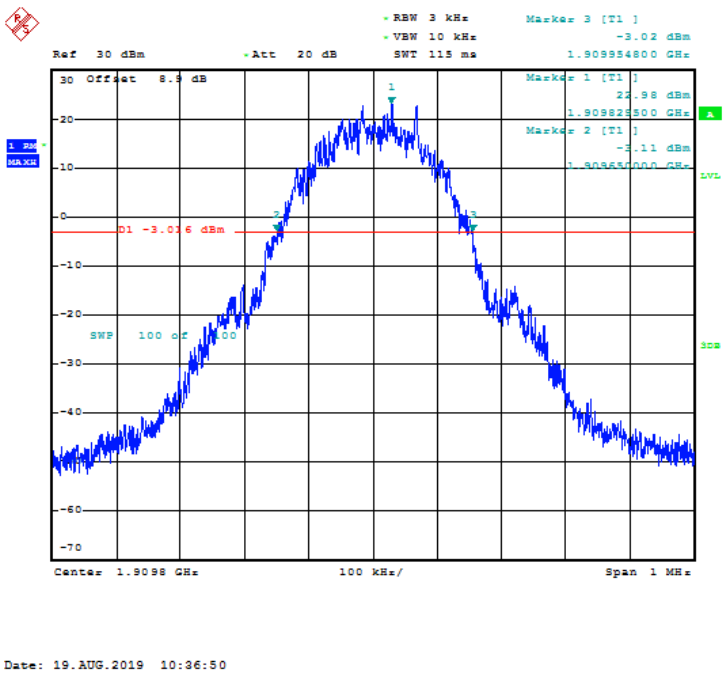


Fig.36 Channel 810- Emission Bandwidth (-26dBc BW)

GPRS 1900

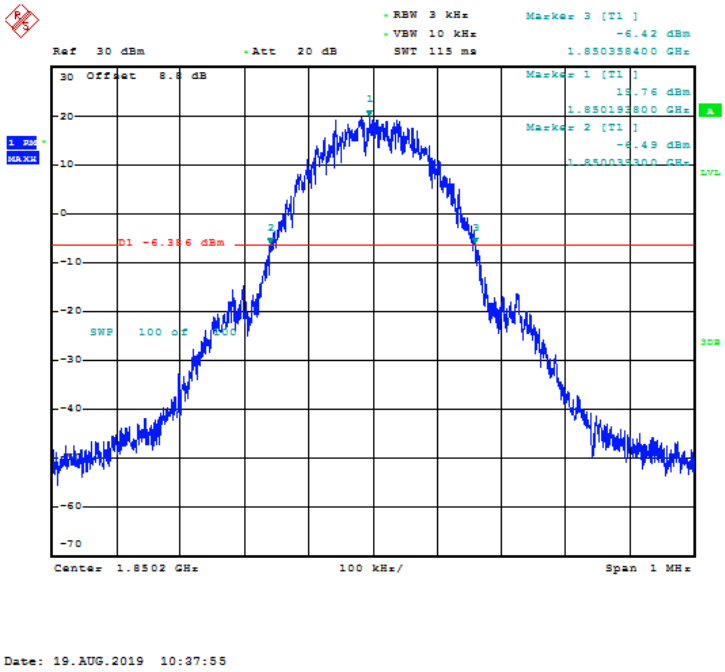


Fig.37 Channel 661- Emission Bandwidth (-26dBc BW)

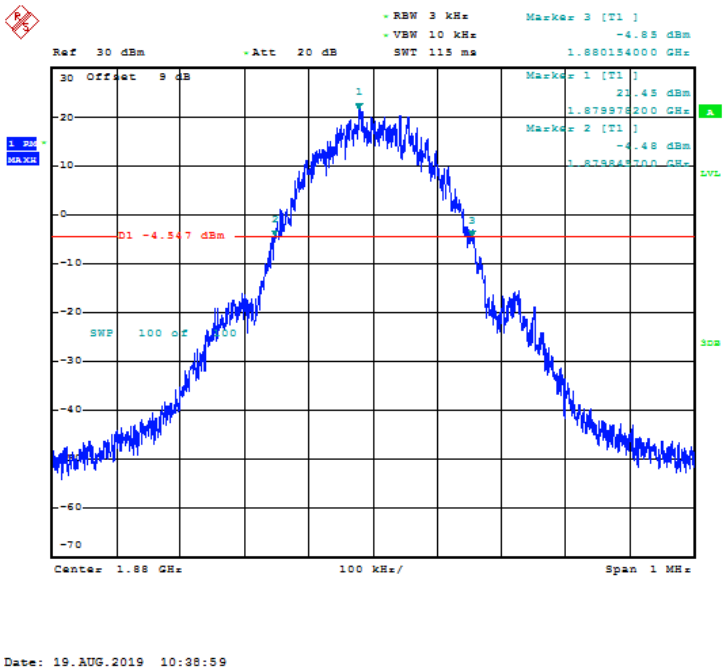


Fig.38 Channel 512- Emission Bandwidth (-26dBc BW)

EDGE 1900

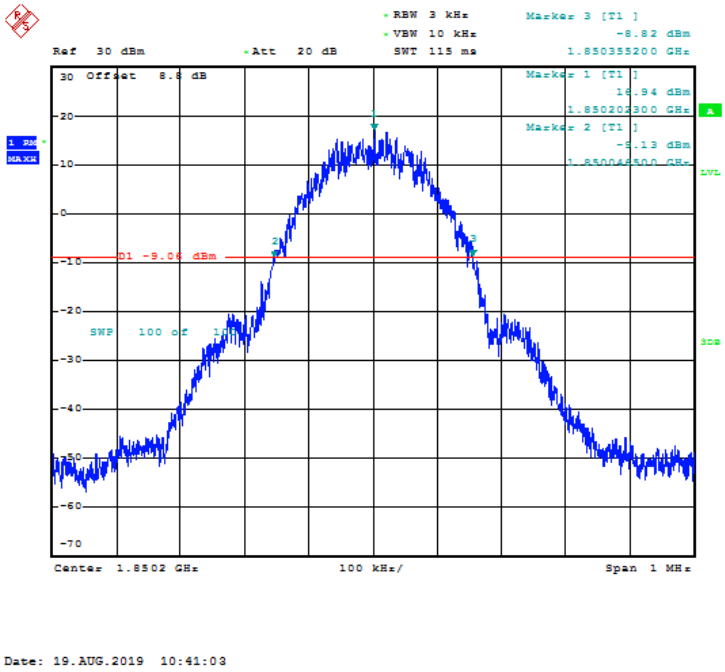


Fig.39 Channel 661- Emission Bandwidth (-26dBc BW)

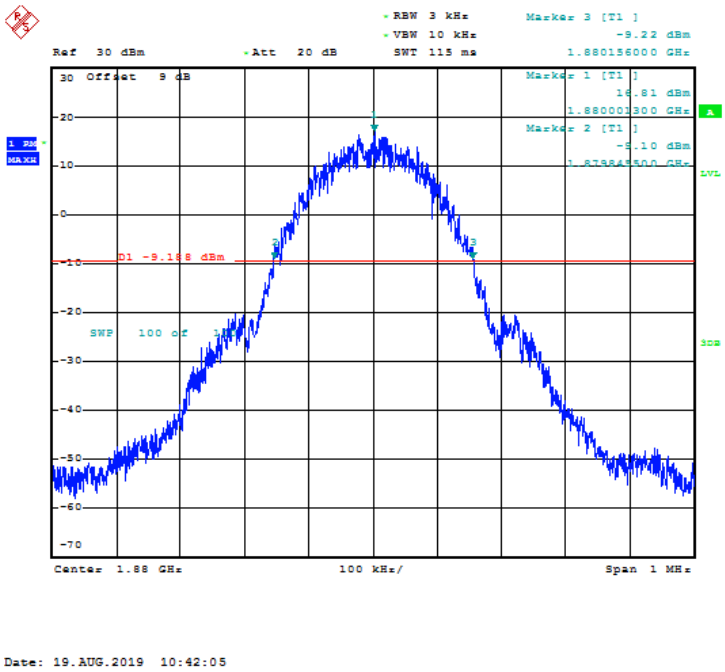


Fig.40 Channel 512- Emission Bandwidth (-26dBc BW)

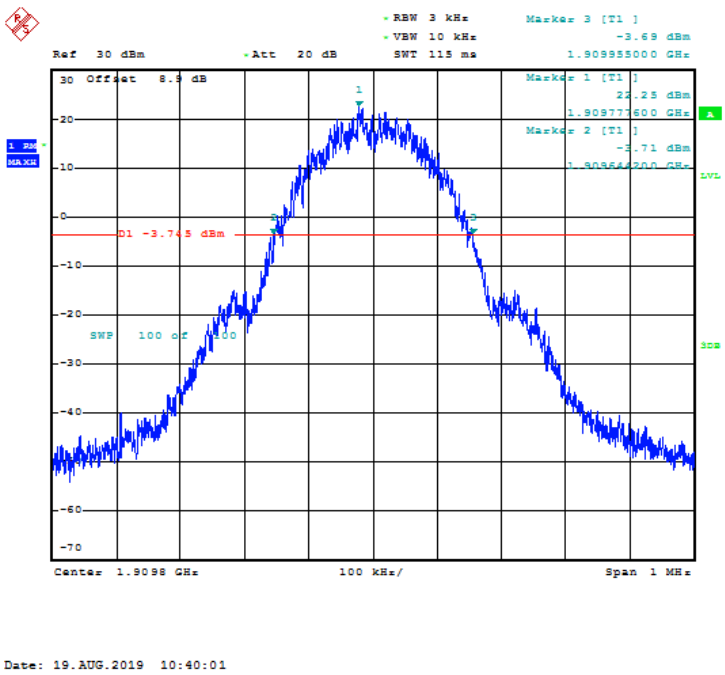


Fig.41 Channel 810- Emission Bandwidth (-26dBc BW)

WCDMA BAND II		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(MHz)
Mid 9400	1880	4.691
Low 9262	1852.4	4.674
High 9538	1907.6	4.679

Conclusion: PASS

WCDMA BAND II

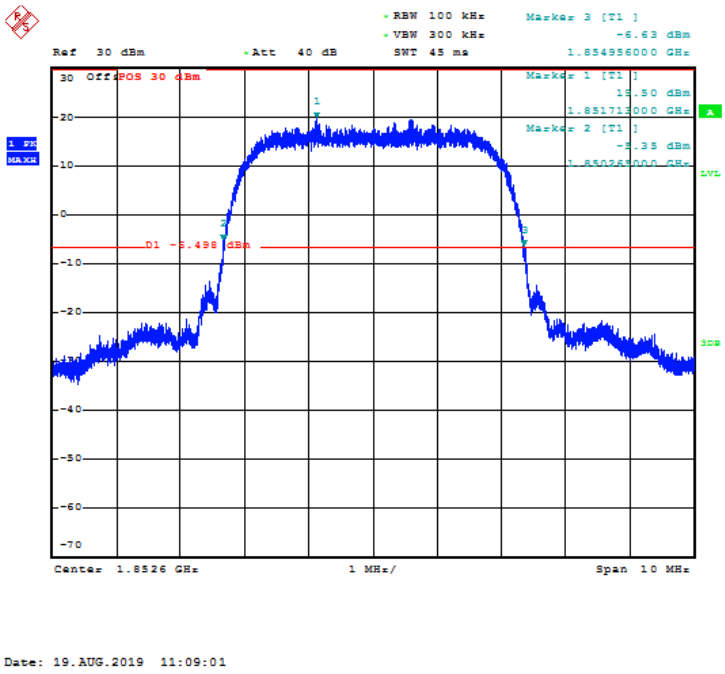


Fig.42 Channel 9400- Emission Bandwidth (-26dBc BW)

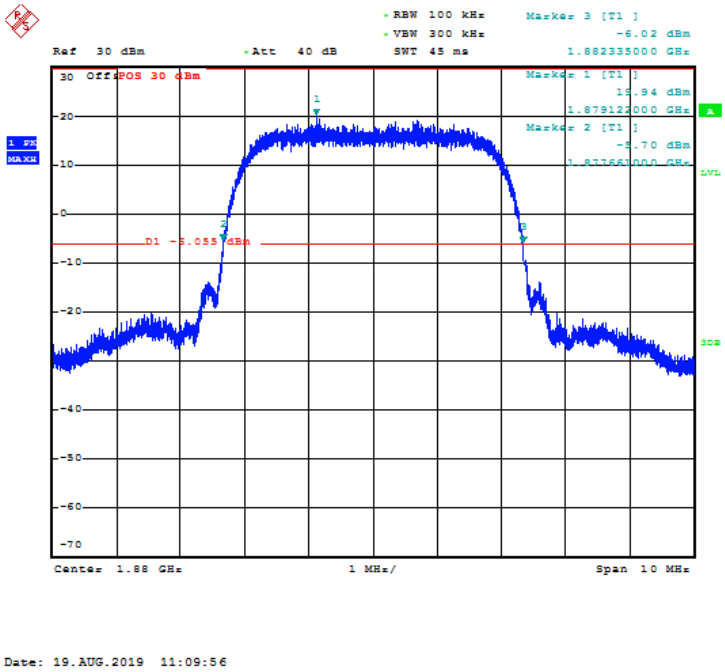


Fig.43 Channel 9262- Emission Bandwidth (-26dBc BW)

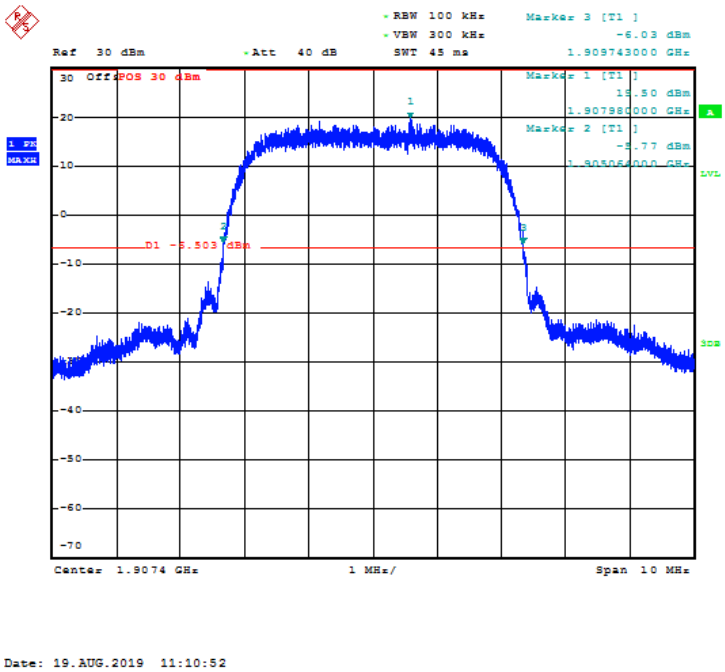


Fig.44 Channel 9538- Emission Bandwidth (-26dBc BW)

WCDMA BAND IV		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(MHz)
Mid 1413	1732.6	4.704
Low 1312	1712.4	4.710
High 1513	1752.6	4.693

Conclusion: PASS

WCDMA BAND IV

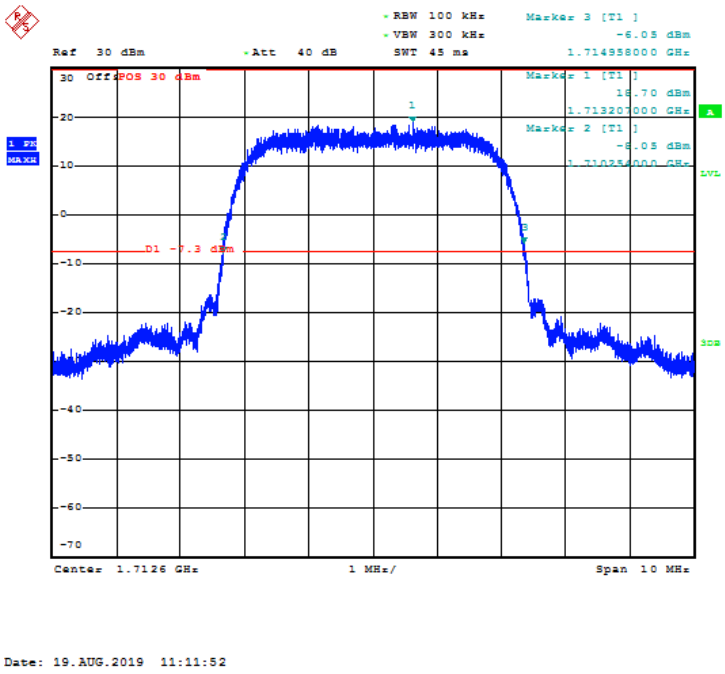


Fig.45 Channel 1413- Emission Bandwidth (-26dBc BW)

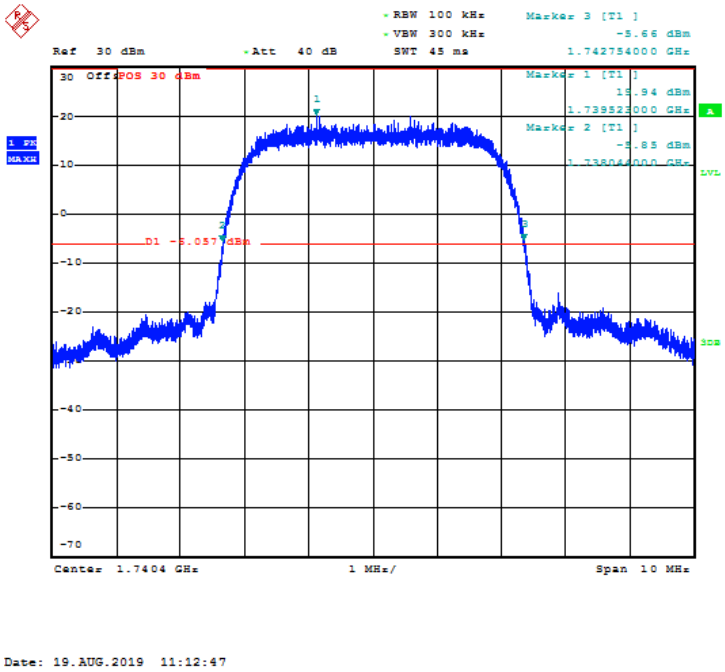


Fig.46 Channel 1312- Emission Bandwidth (-26dBc BW)

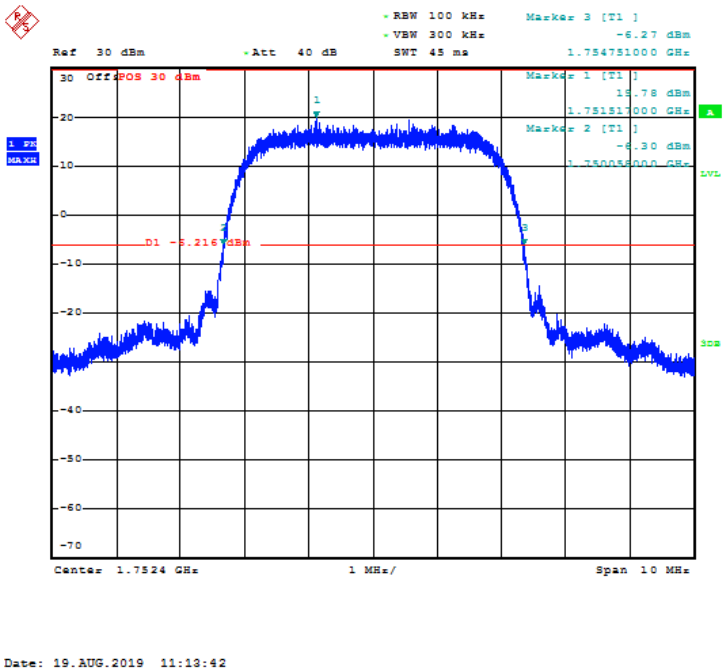


Fig.47 Channel 1513- Emission Bandwidth (-26dBc BW)

WCDMA BAND V		
Test channel	Frequency (MHz)	–26dBc Emission Bandwidth(MHz)
Mid 4183	836.6	4.687
Low 4132	826.4	4.678
High 4233	846.6	4.679

Conclusion: PASS

WCDMA BAND V

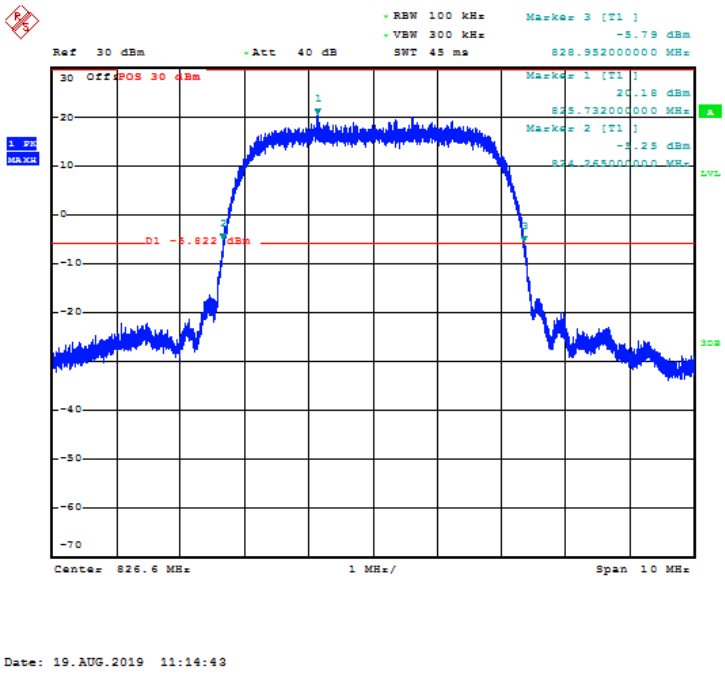


Fig.48 Channel 4183- Emission Bandwidth (-26dBc BW)

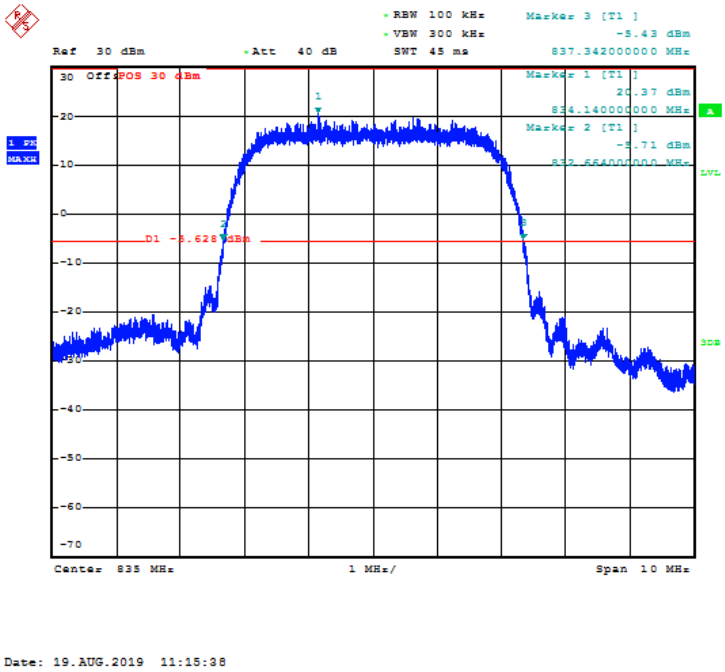


Fig.49 Channel 4132- Emission Bandwidth (-26dBc BW)

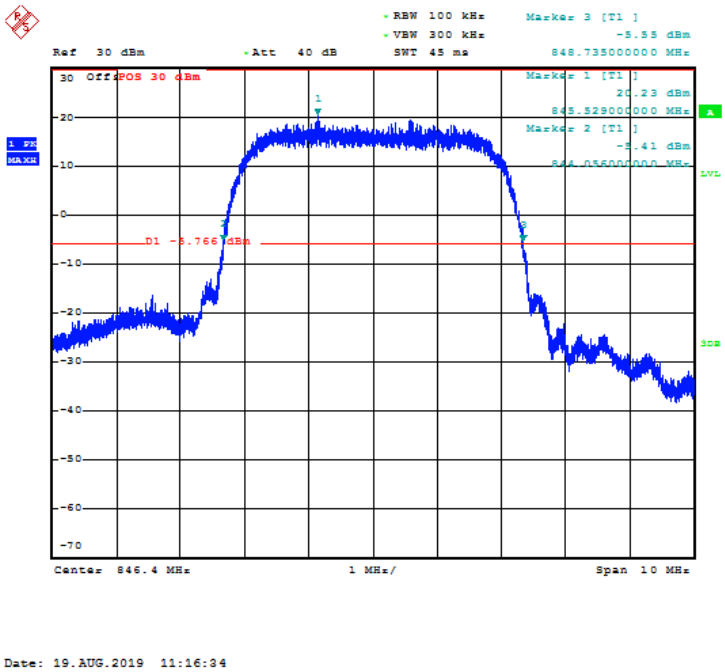


Fig.50 Channel 4233- Emission Bandwidth (-26dBc BW)

ANNEX A.5. Band Edge at antenna terminals

Method of test measurements please refer to KDB971168 D01 v03 clause 6

A.5.1 Limit:

The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under the conditions specification in the instruction manual and/or alignment procedure, shall not be less than 43+10log (Mean power in watts) dBc below the mean power output outside a license's frequency block(-13dBm).

A.5.2 Test procedure:

1. The RF output of the transceiver was connected to a signal analyzer through appropriate attenuation.
2. In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.
3. The RF fundamental frequency should be excluded against the limit line in the operating frequency band
4. The limit line is derived from 43+10log(P) Db below the transmitter power P(Watts)
   =P(W)-[43+10log(P)](Db)
   =[30+10log(P)](dBm)-[43+10log(P)](Db)
   =-13dBm

A.5.3 Test Result:

GSM 850

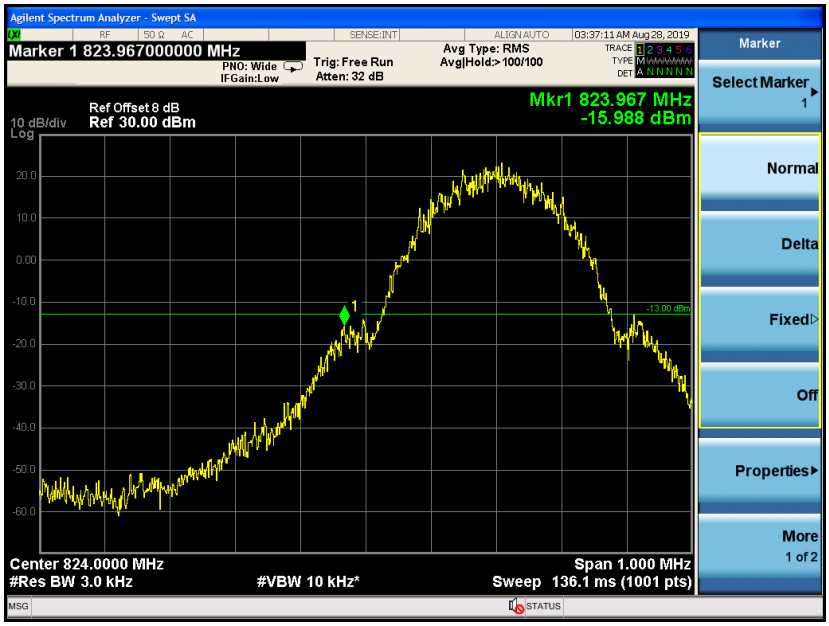


Fig.51 Channel 128- LOW BAND EDGE BLOCK

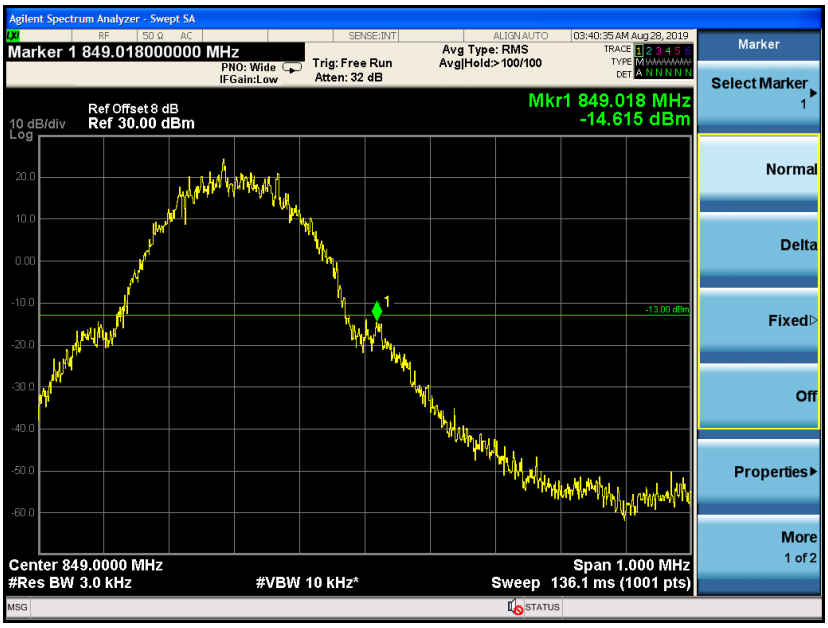


Fig.52 Channel 251- LOW BAND EDGE BLOCK

GPRS 850

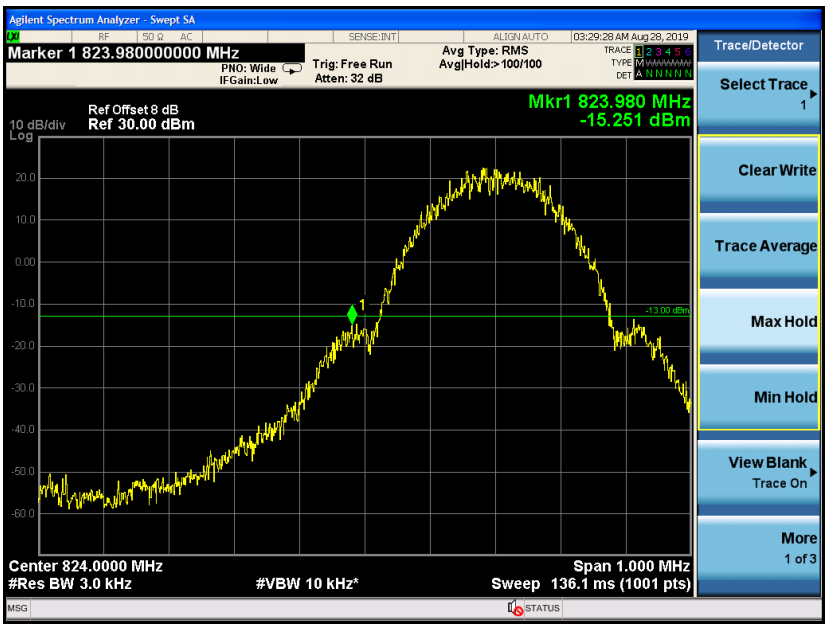


Fig.53 Channel 128- LOW BAND EDGE BLOCK

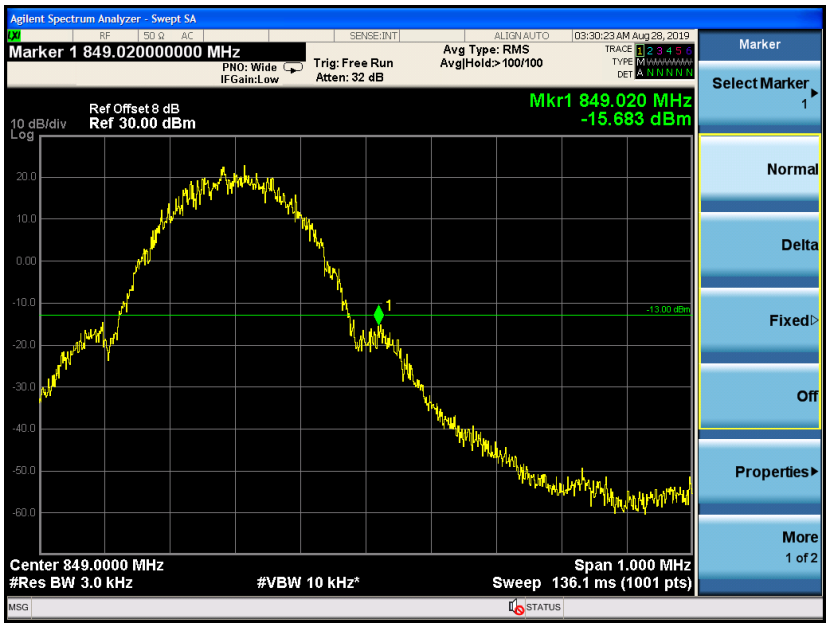


Fig.54 Channel 251- LOW BAND EDGE BLOCK

EDGE 850

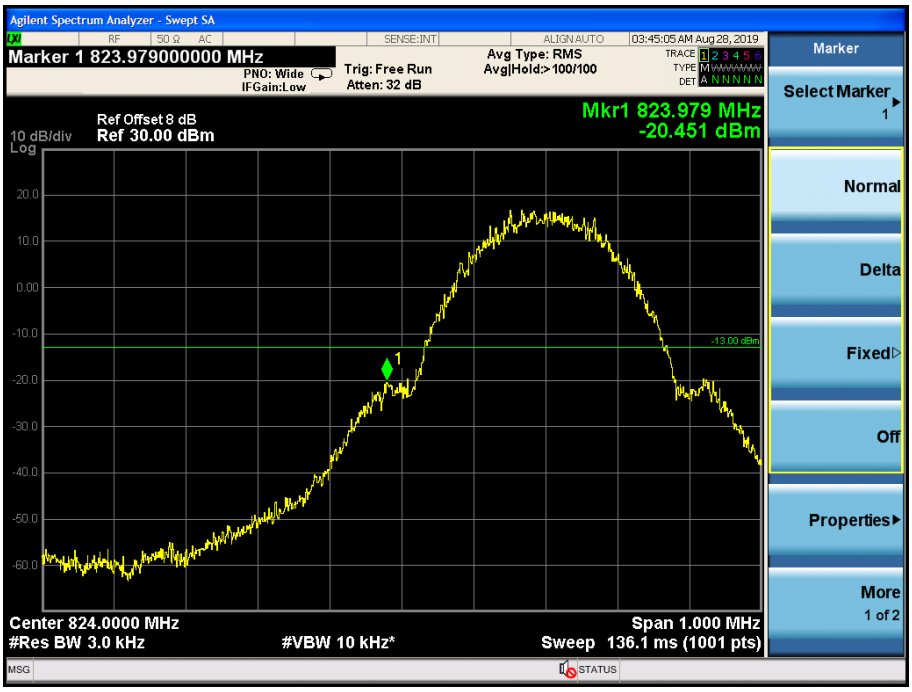


Fig.55 Channel 128- LOW BAND EDGE BLOCK

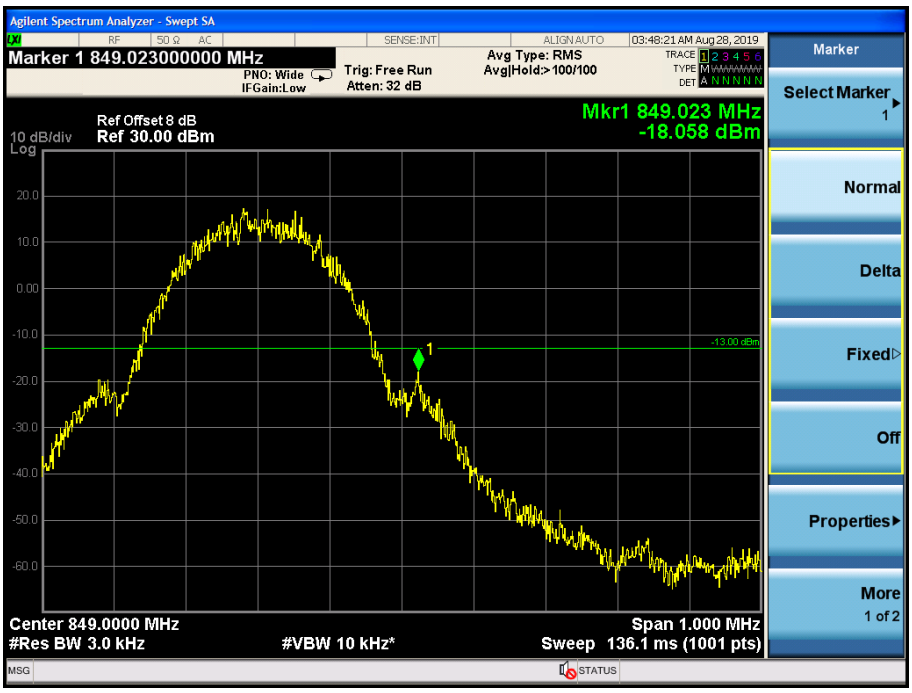


Fig.56 Channel 251- LOW BAND EDGE BLOCK

GSM 1900

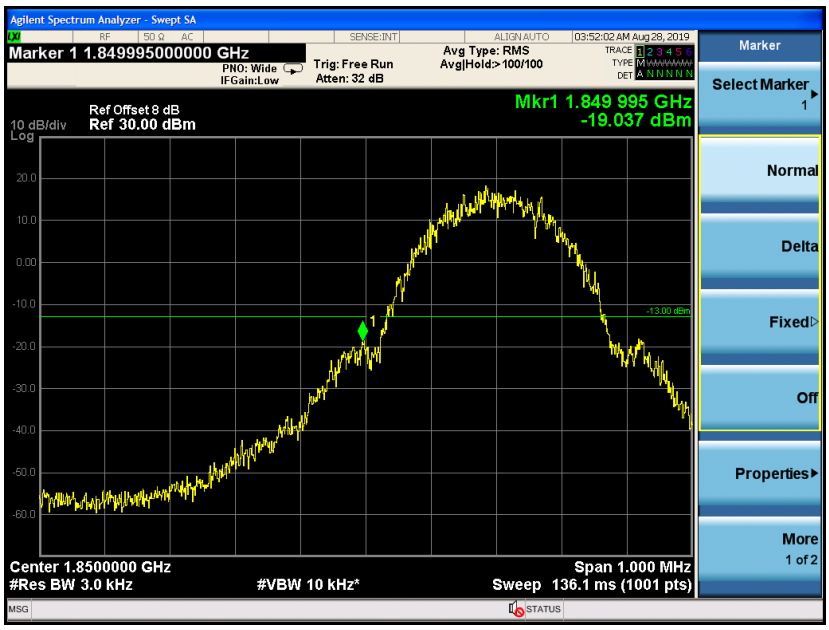


Fig.57 Channel 512- LOW BAND EDGE BLOCK

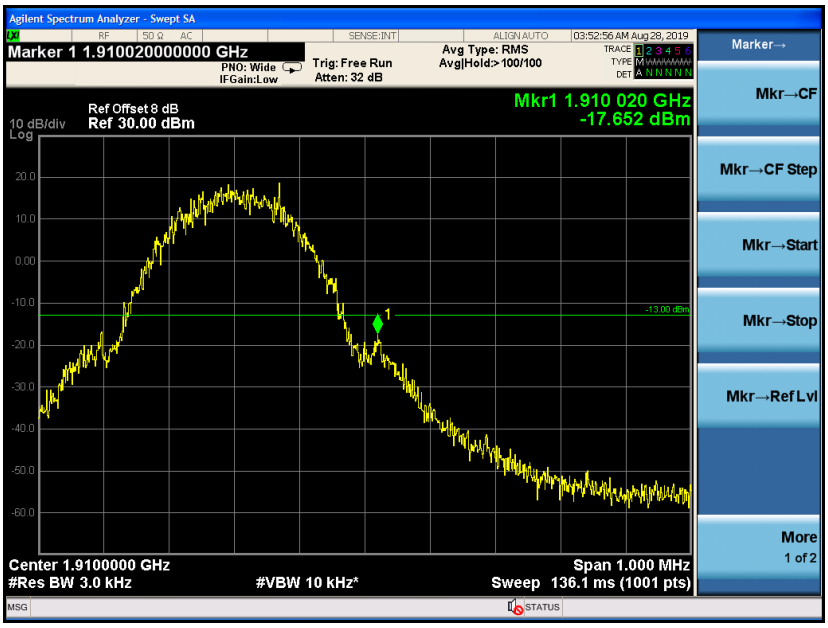


Fig.58 Channel 810- LOW BAND EDGE BLOCK

GPRS 1900

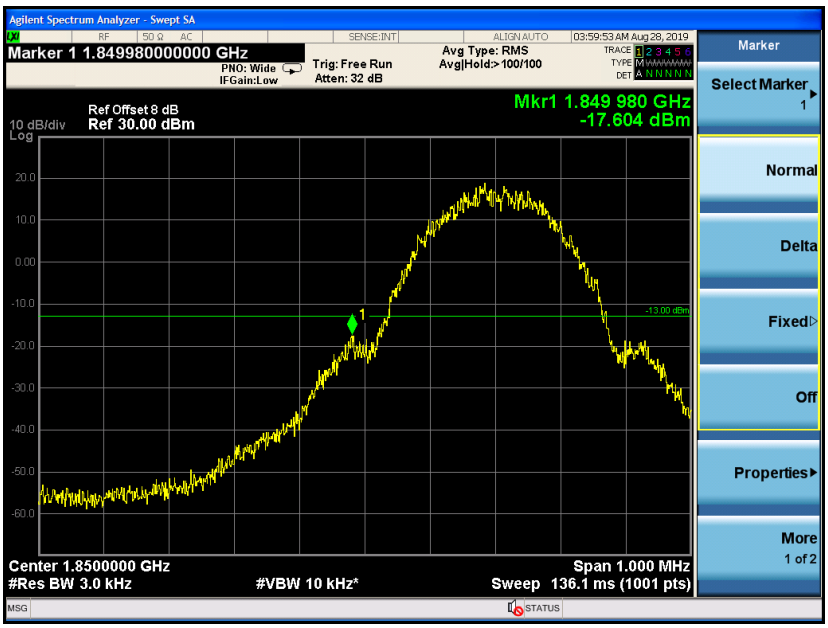


Fig.59 Channel 512- LOW BAND EDGE BLOCK

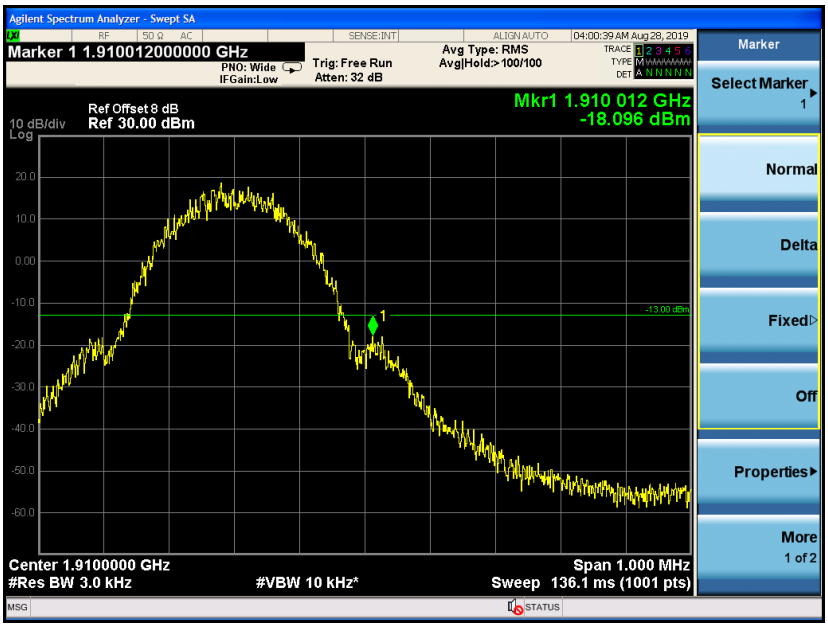


Fig.60 Channel 810- LOW BAND EDGE BLOCK

EDGE 1900

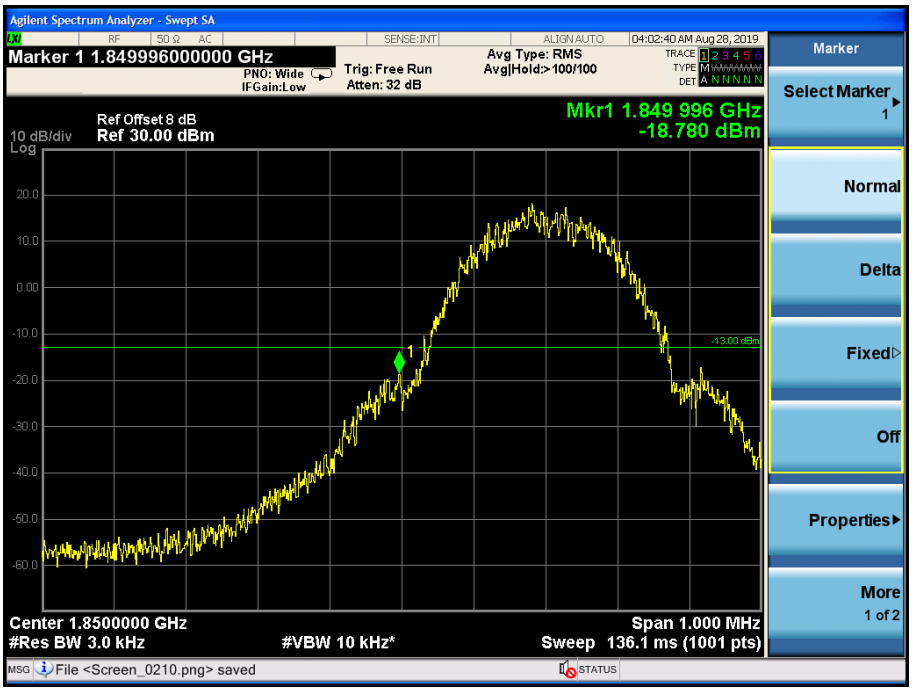


Fig.61 Channel 512- LOW BAND EDGE BLOCK

Fig.62 Channel 810- LOW BAND EDGE BLOCK

WCDMA BAND II

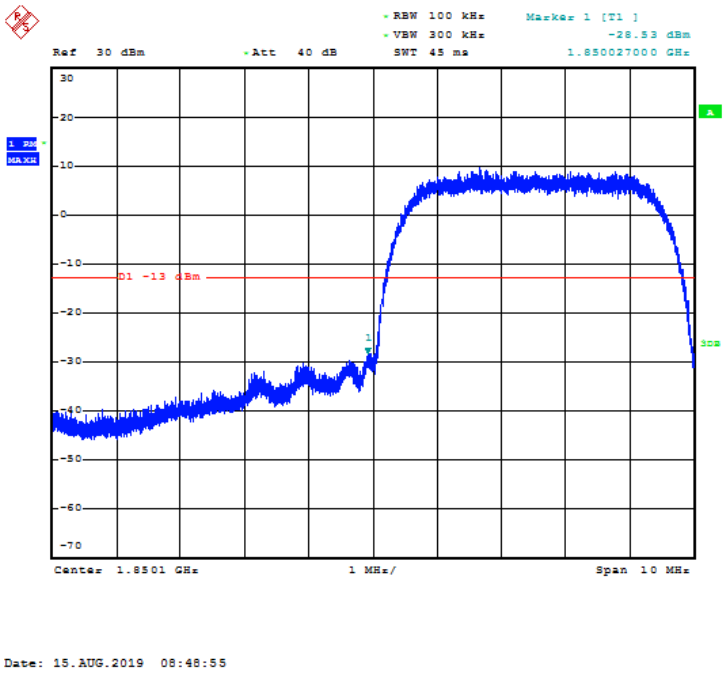


Fig.63 Channel 9262- LOW BAND EDGE BLOCK

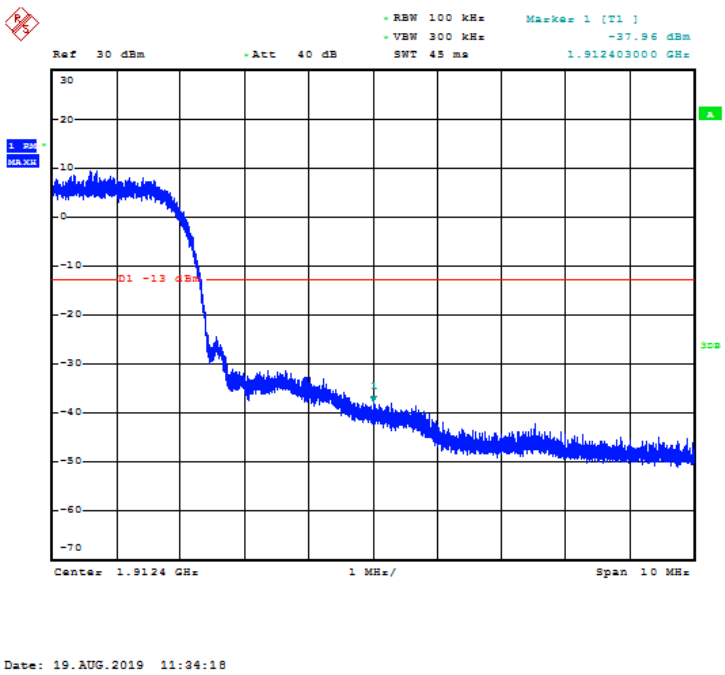


Fig.64 Channel 9538- HIGH BAND EDGE BLOCK

WCDMA BAND IV

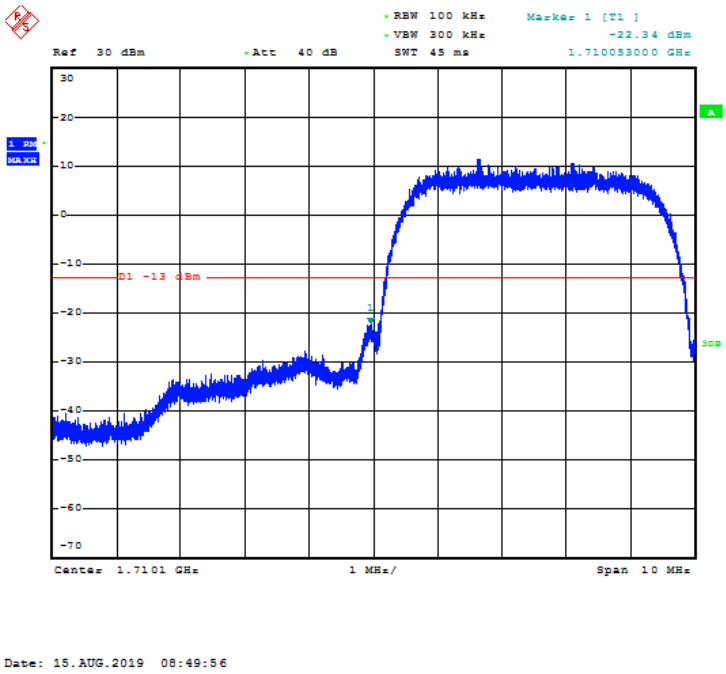


Fig.65 Channel 1312- LOW BAND EDGE BLOCK

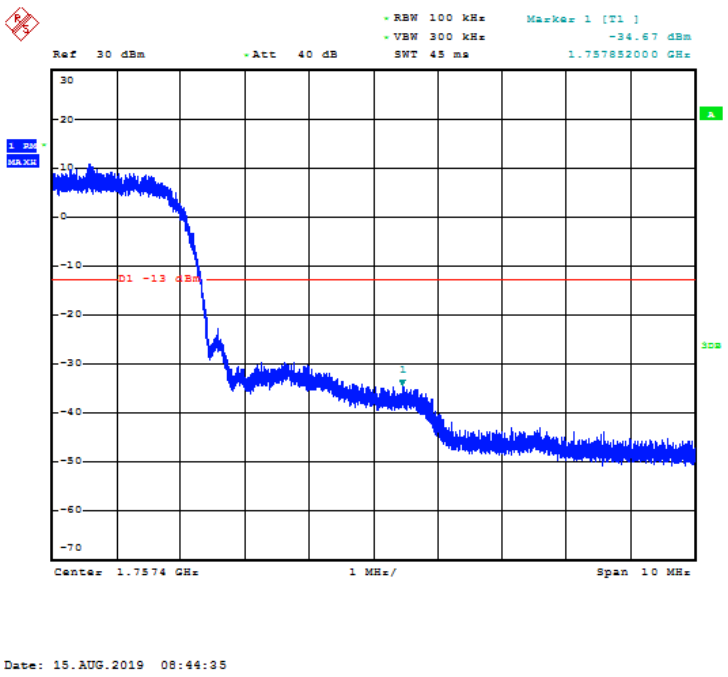


Fig.66 Channel 1513- HIGH BAND EDGE BLOCK

WCDMA BAND V

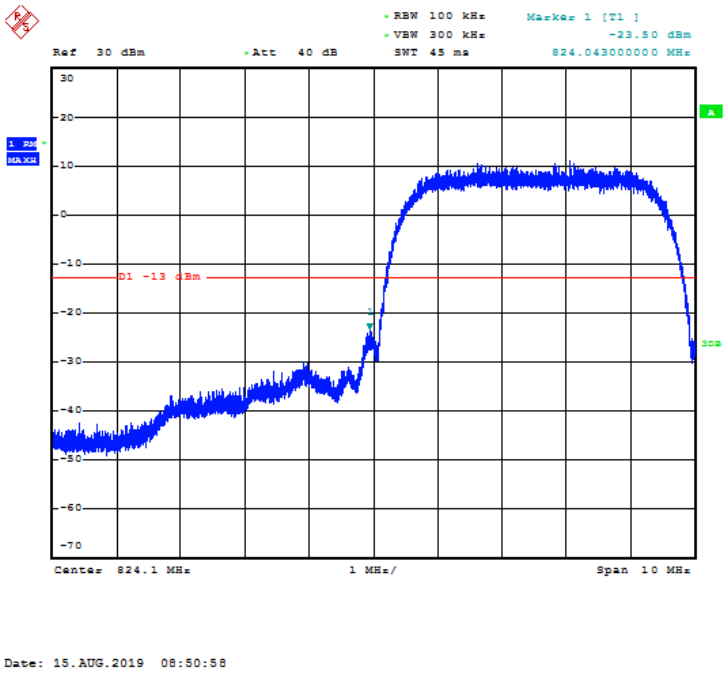


Fig.67 Channel 4132- LOW BAND EDGE BLOCK

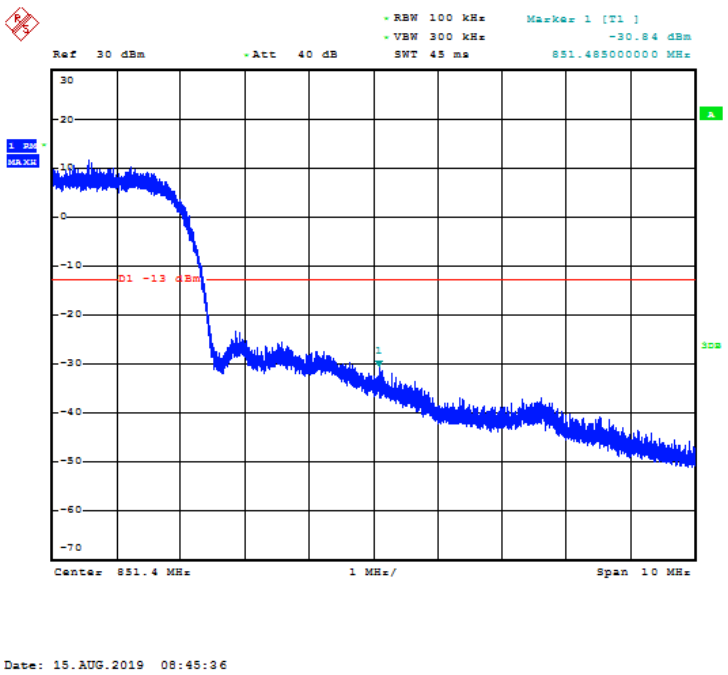


Fig.68 Channel 4233- HIGH BAND EDGE BLOCK

Conclusion: PASS

ANNEX A.6. FREQUENCY STABILITY

Method of test measurements please refer to KDB971168 D01 v03 clause 9

A.6.1.Method of Measurement and test procedures

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 R&S CMU200 DIGITAL RADIO COMMUNICATION TESTER.

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 GSM850, PCS1900, WCDMA BANDII, WCDMA BANDIV and WCDMA BANDV, 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 1/2 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 1/2 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 C 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.

A.6.2. Measurement Limit

A.6.2.1. For Hand carried battery powered equipment

According to the JTC standard the GSM frequency stability of the carrier shall be accurate to within 0.1ppm of the received frequency from the base station. And the WCDMA is 2.5ppm. This accuracy is sufficient to meet Sec.24.235, Frequency Stability. 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 between 3.6VDC and 4.35VDC, with a nominal voltage of 3.8VDC. 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. These voltages was varied from 85% to 115%.

A.6.2.2. For equipment powered by primary supply voltage

According to the JTC standard the GSM frequency stability of the carrier shall be accurate to within 0.1ppm of the received frequency from the base station. And the WCDMA is 2.5ppm. This accuracy is sufficient to meet Sec.24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

A.6.3 Test results

GSM850Mid Channel/fc(MHz) 189/836.4

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.8	-30	4.20	84
3.8	-20	5.71	84
3.8	-10	3.10	84
3.8	0	-0.48	84
3.8	10	2.58	84
3.8	20	5.49	84
3.8	30	4.42	84
3.8	40	3.65	84
3.8	50	2.68	84

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.00	25	14.98	84
3.80	25	12.62	84
4.35	25	-0.26	84

PCS1900 Mid Channel/fc(MHz) 661/1880

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.8	-30	-17.56	196
3.8	-20	-6.17	196
3.8	-10	-7.23	196
3.8	0	-0.32	196
3.8	10	-4.10	196
3.8	20	-6.04	196
3.8	30	-6.88	196
3.8	40	-10.30	196
3.8	50	-3.97	196

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.00	25	13.66	196
3.80	25	7.78	196
4.35	25	-9.59	196

WCDMA BAND II Mid Channel/fc(MHz) 9400 /1880

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.8	-30	-0.043	4700
3.8	-20	0.393	4700
3.8	-10	-0.122	4700
3.8	0	-1.531	4700
3.8	10	-0.007	4700
3.8	20	0.272	4700
3.8	30	-2.618	4700
3.8	40	0.544	4700
3.8	50	0.429	4700

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.00	25	0.1	4700
3.80	25	-0.837	4700
4.35	25	1.559	4700

WCDMA BAND IV Mid Channel/fc(MHz) 1413/1732.6

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.8	-30	-4.542	4331.5
3.8	-20	-5.98	4331.5
3.8	-10	-4.427	4331.5
3.8	0	-2.489	4331.5
3.8	10	-3.068	4331.5
3.8	20	-2.26	4331.5
3.8	30	-1.609	4331.5
3.8	40	-1.194	4331.5
3.8	50	-1.38	4331.5

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.00	25	-1.624	4331.5
3.80	25	-1.23	4331.5
4.35	25	-3.026	4331.5

WCDMA BAND V Mid Channel/fc(MHz) 4183/836.6

Frequency Error VS Temperature

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.8	-30	0.622	2091.5
3.8	-20	-2.596	2091.5
3.8	-10	-0.858	2091.5
3.8	0	0.172	2091.5
3.8	10	0.172	2091.5
3.8	20	-0.393	2091.5

3.8	30	-0.522	2091.5
3.8	40	-0.15	2091.5
3.8	50	-0.451	2091.5

Frequency Error VS Voltage

Power Supply (VDc)	Environment Temperature(℃)	Frequency error(Hz)	Limit (Hz)
3.00	25	-2.081	2091.5
3.80	25	0.129	2091.5
4.35	25	-0.536	2091.5

Conclusion: PASS

ANNEX A.7. CONDUCTED SPURIOUS EMISSION

A.7.1. GSM Measurement Method and test procedures

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

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For GSM850, data taken from 30 MHz to 10 GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; If the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give a optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:
The trace mode is set to MaxHold to get the highest signal at each frequency;
Wait 25 seconds;Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

GSM 850 Transmitter

Channel	Frequency(MHz)
128	824.2
189	836.4
251	848.8

PCS 1900 Transmitter

Channel	Frequency(MHz)
512	1850.2
661	1880.0
810	1909.8

A.7.1.1. 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.7.1.2. Measurement result

Spurious emission limit -13dBm.

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

A.7.1.2.1. GSM850

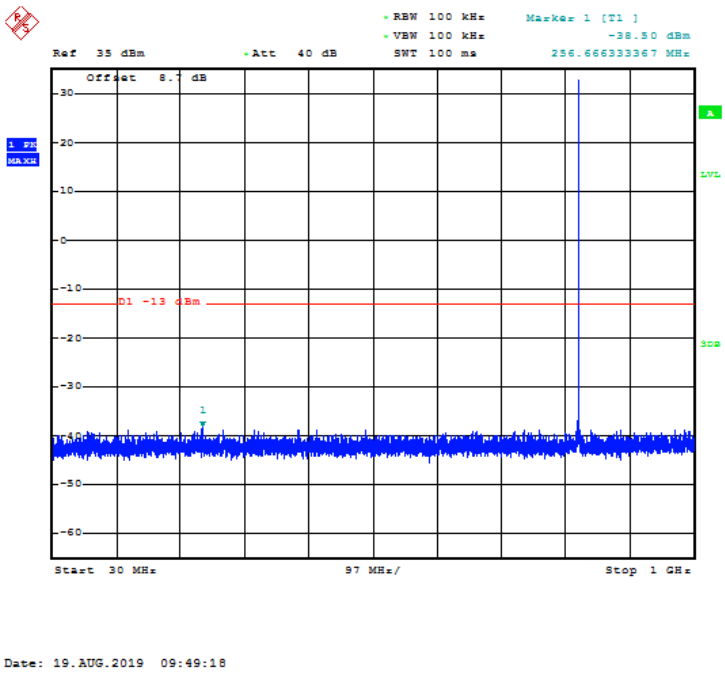


Fig.69 Channel 128: 30MHz~1GHz

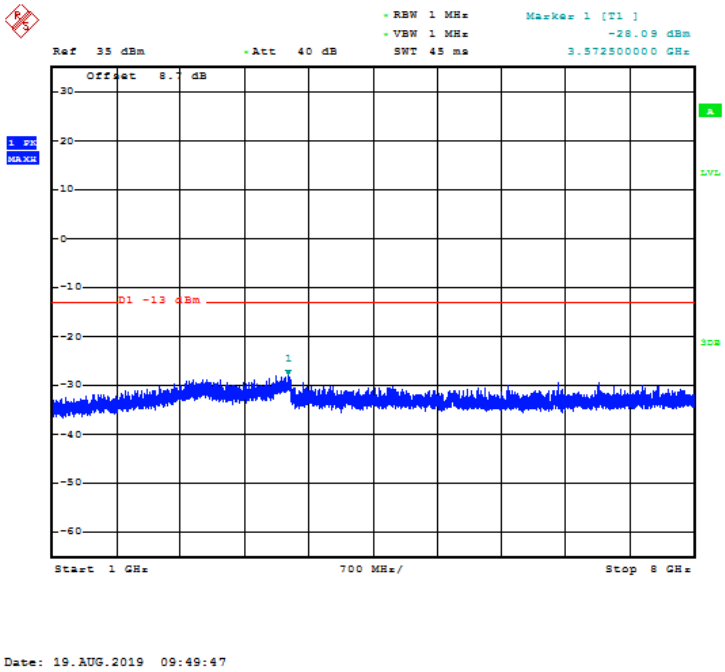


Fig.70 Channel 128: 1GHz~8GHz

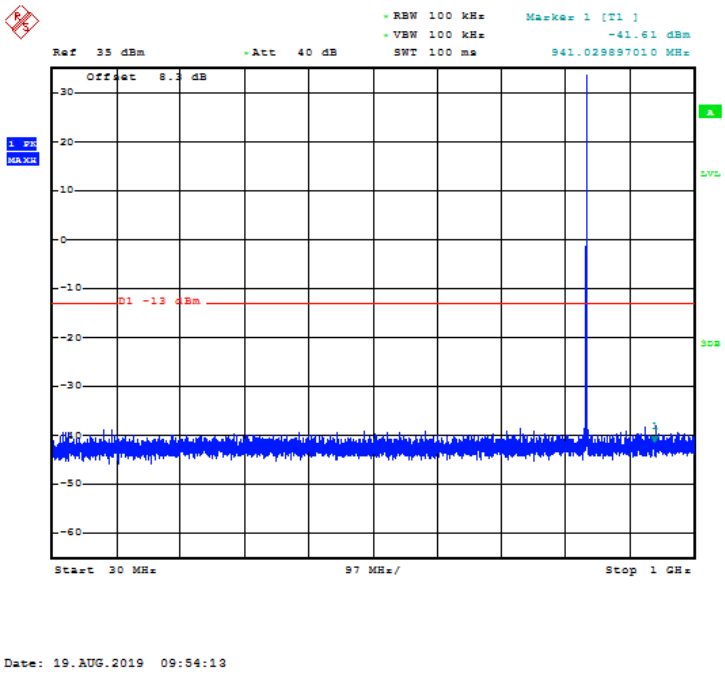


Fig.71 Channel 189: 30MHz~1GHz

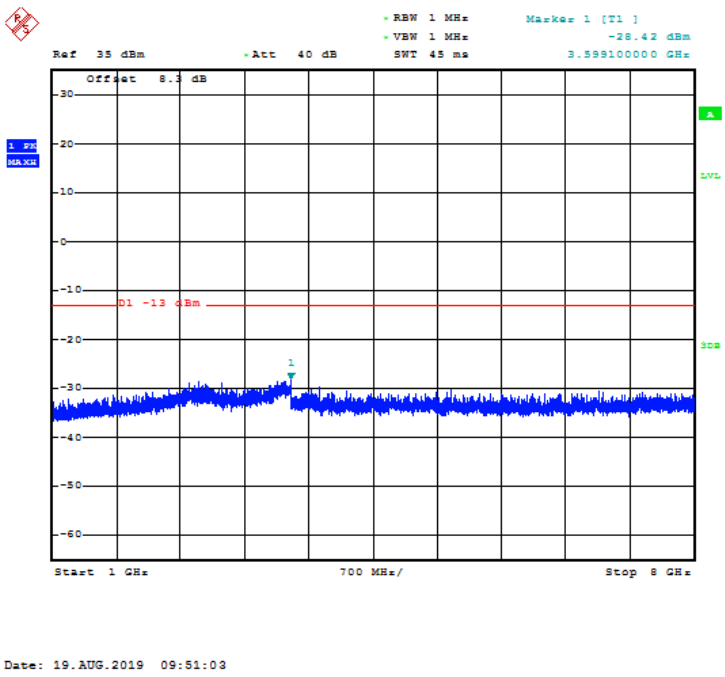


Fig.72 Channel 189: 1GHz~8GHz

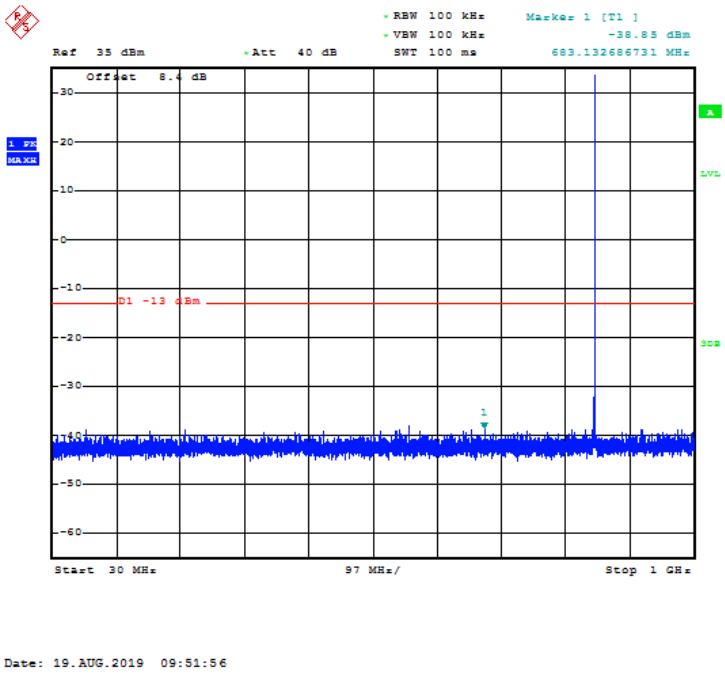


Fig.73 Channel 251: 30MHz~1GHz

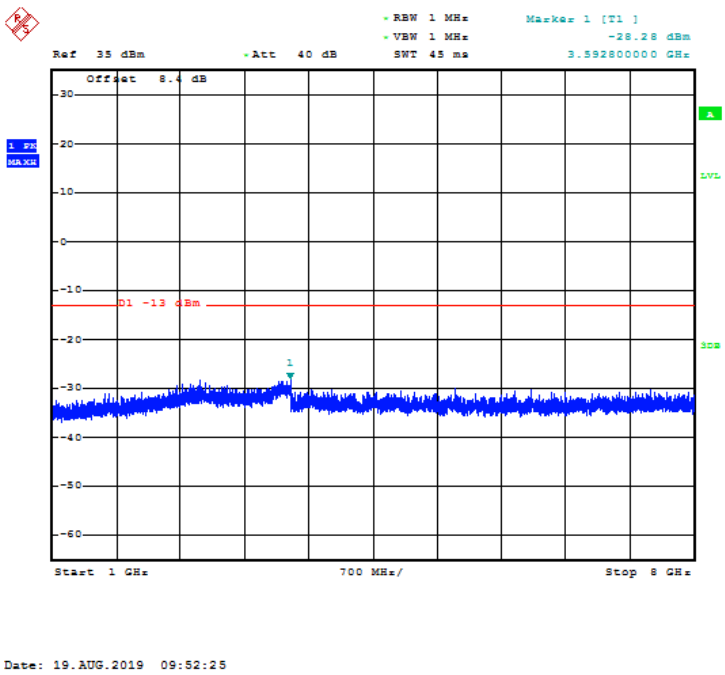


Fig.74 Channel 251: 1GHz~8GHz

A.7.1.2.2. GSM1900

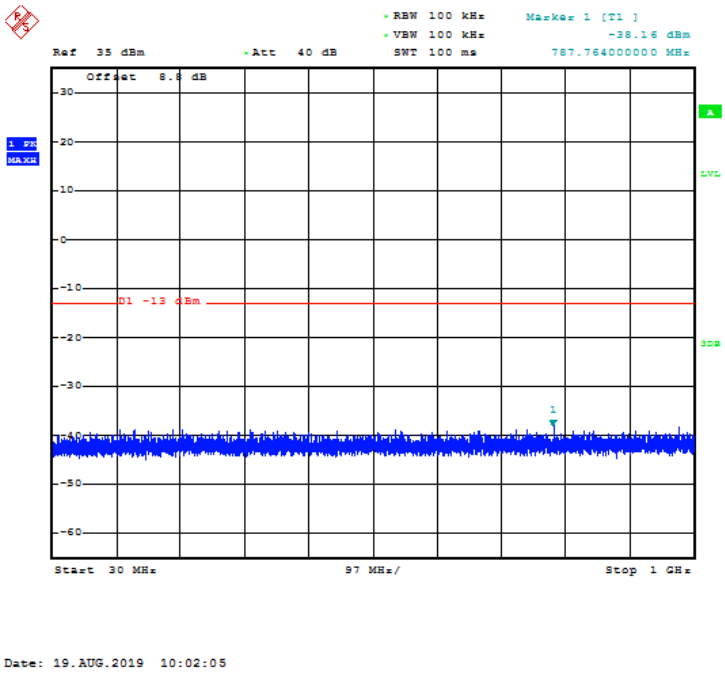


Fig.75 Channel 512: 30MHz~1GHz

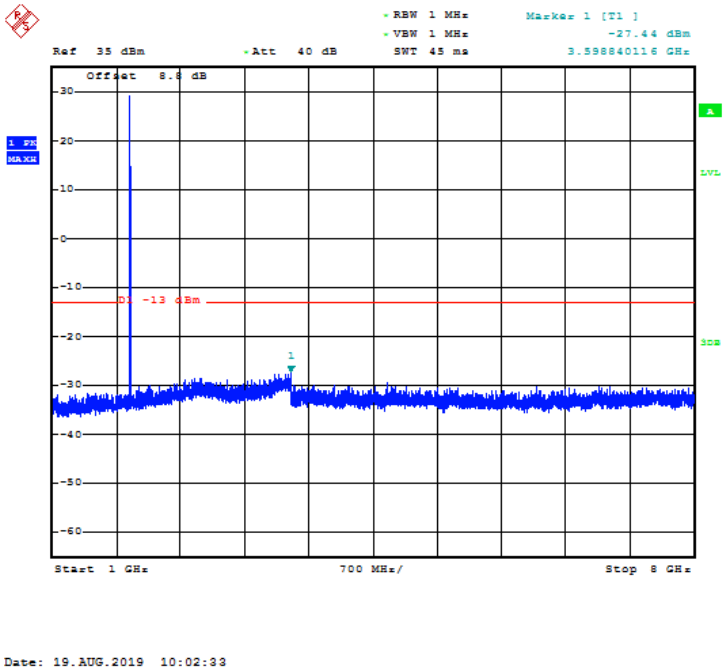


Fig.76 Channel 512: 1GHz~8GHz

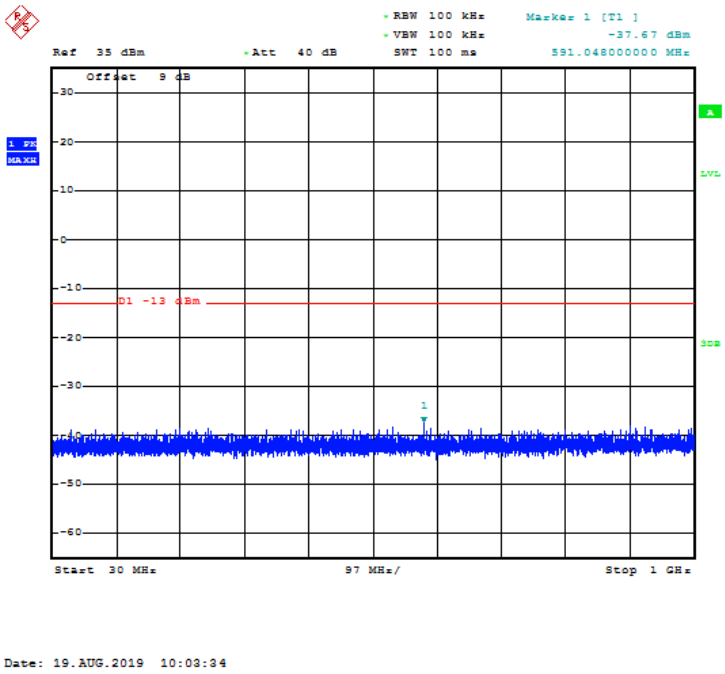


Fig.77 Channel 661: 30MHz~1GHz

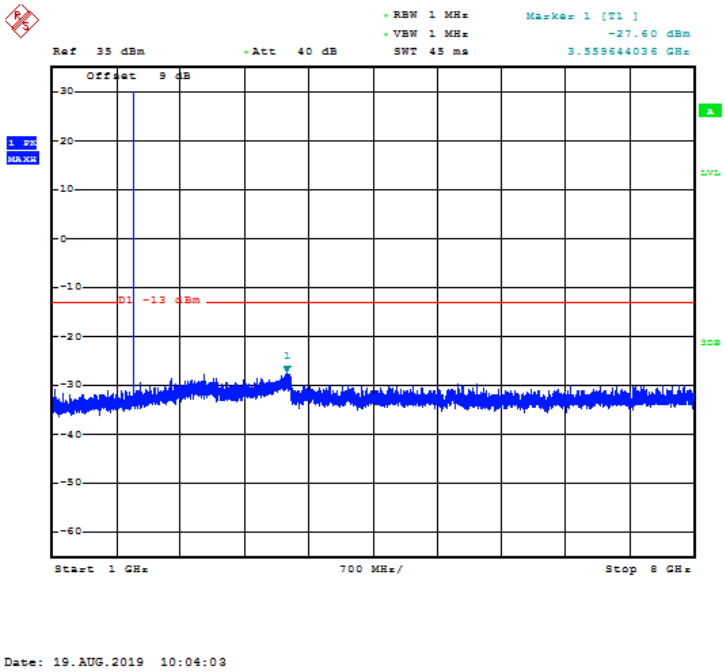


Fig.78 Channel 661: 1GHz~8GHz

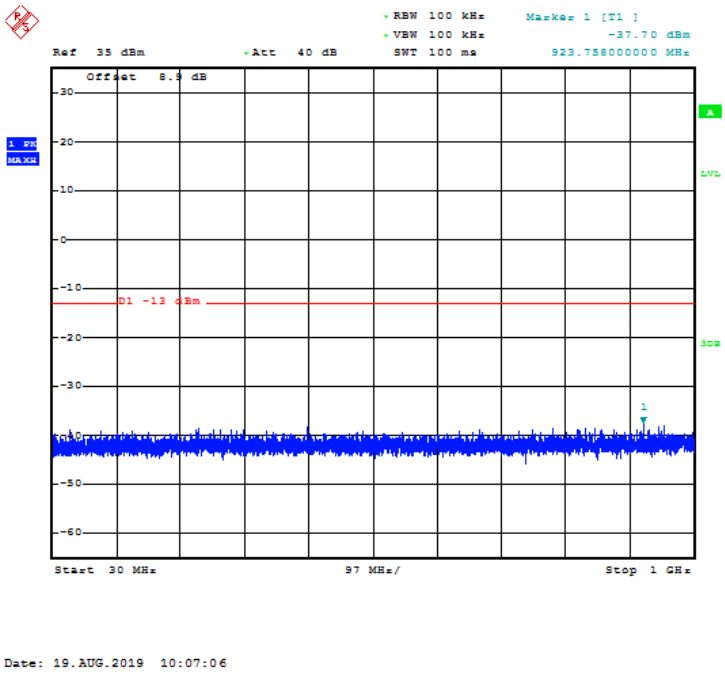


Fig.79 Channel 810: 30MHz~1GHz

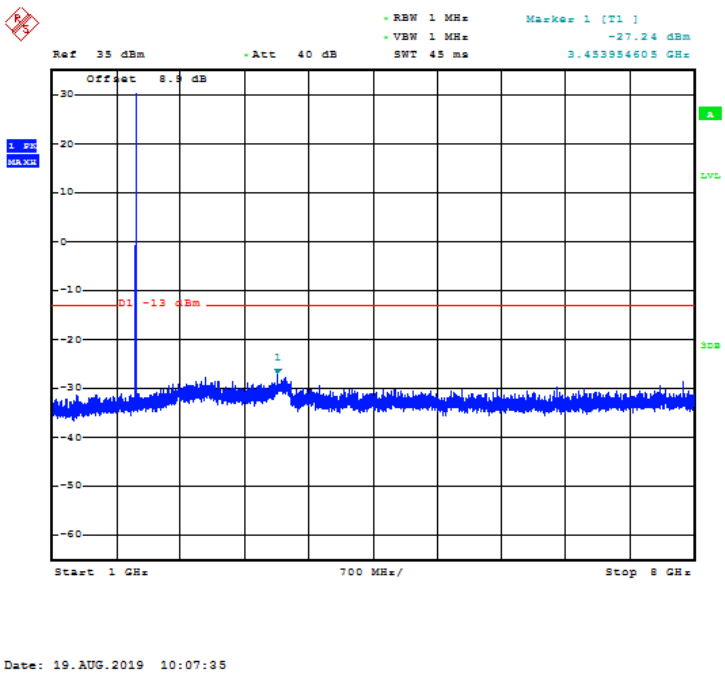


Fig.80 Channel 810: 1GHz~8GHz

Conclusion: PASS

A.7.2. WCDMA Measurement Method and test procedures

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

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of WCDMA Band II and WCDMA BANDIV, these equate to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For WCDMA Band V, data taken from 30 MHz to 10GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; If the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give a optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:
The trace mode is set to MaxHold to get the highest signal at each frequency;
Wait 25 seconds;
Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

WCDMA Band II Transmitter

Channel	Frequency (MHz)
9262	1852.40
9400	1880.00
9538	1907.60

WCDMA Band IV Transmitter

Channel	Frequency (MHz)
1312	1712.40
1413	1732.60
1513	1752.60

WCDMA Band V Transmitter

Channel	Frequency (MHz)
4132	826.40
4183	836.60
4233	846.60

A.7.2.1. 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.7.2.2. Measurement result

Spurious emission limit -13dBm.

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

A.7.2.2.1. WCDMA Band II

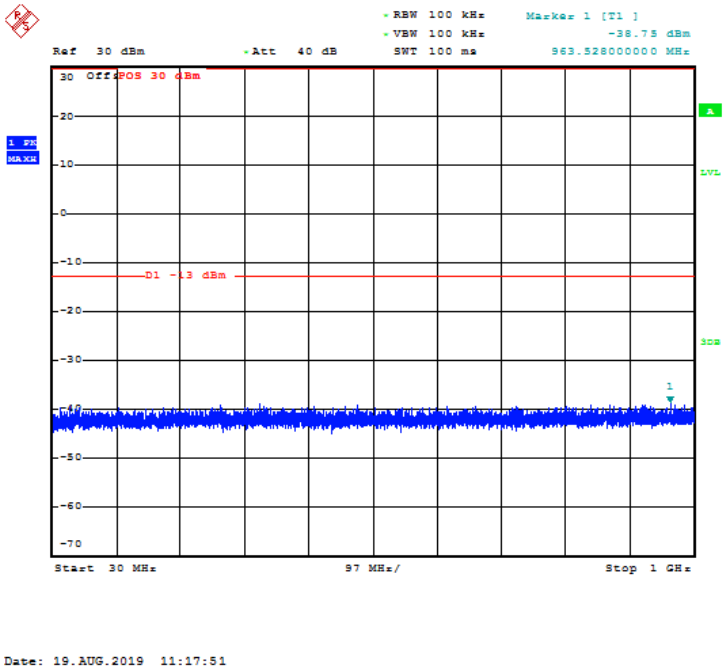


Fig.81 Channel 9262: 30MHz~1GHz

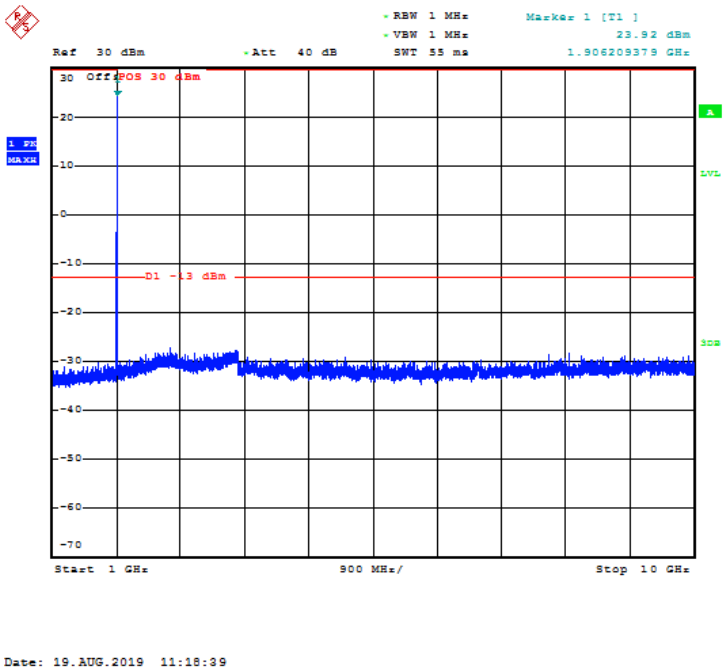


Fig.82 Channel 9262: 1GHz~10GHz

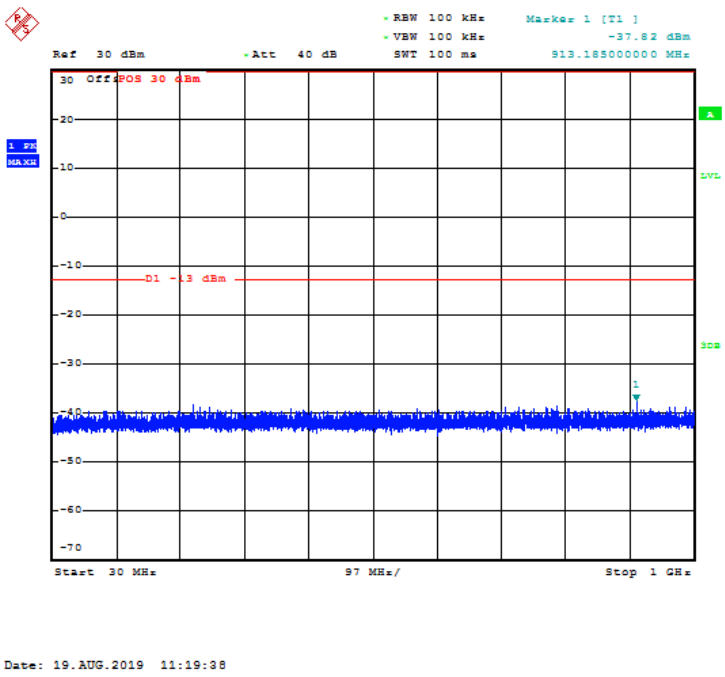


Fig.83 Channel 9400: 30MHz~1GHz

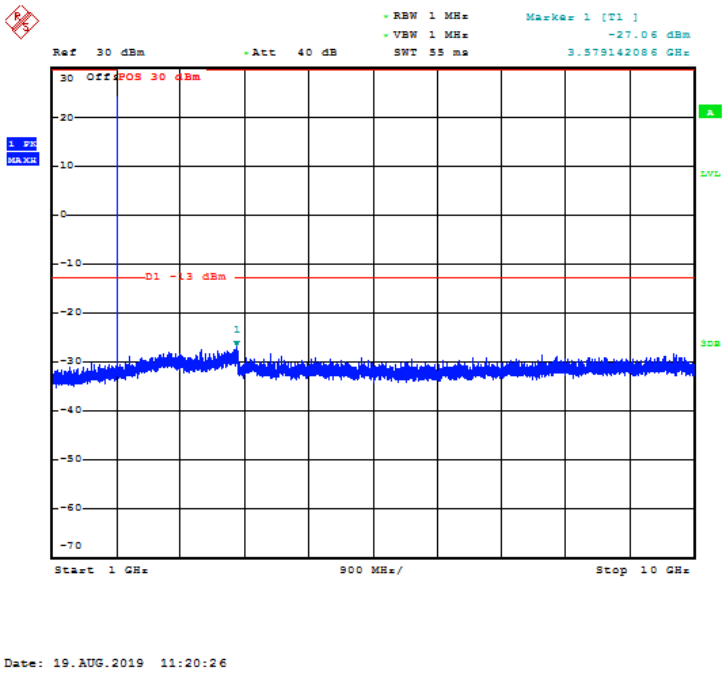


Fig.84 Channel 9400: 1GHz~10GHz

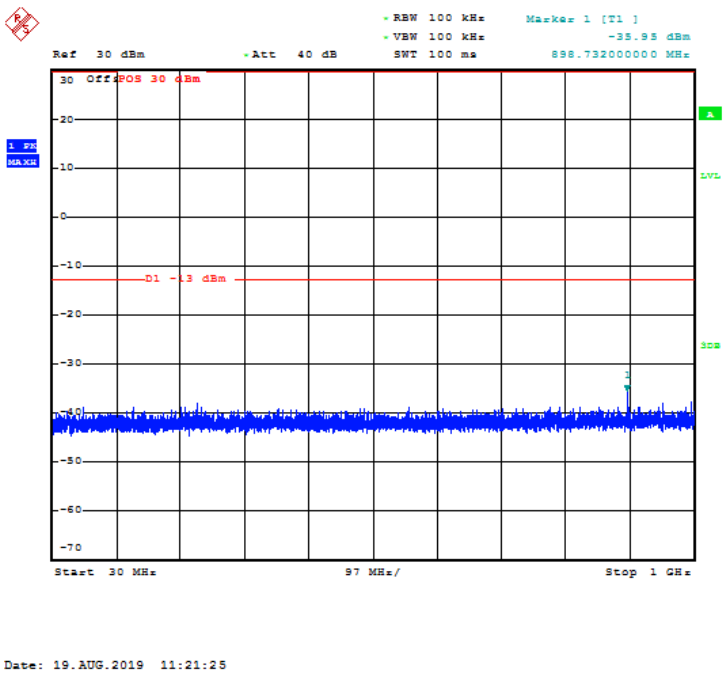


Fig.85 Channel 9538: 30MHz~1GHz

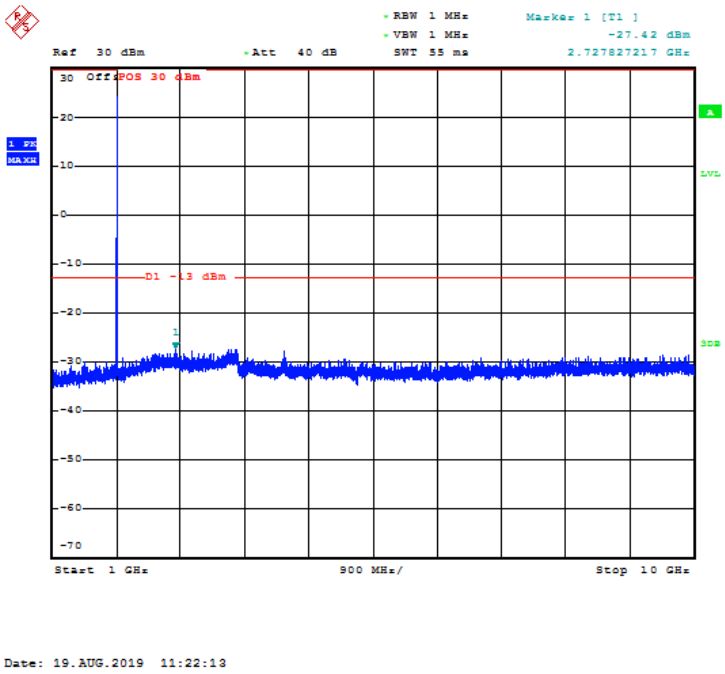


Fig.86 Channel 9538: 1GHz~10GHz

Conclusion: PASS

A.7.2.2.2. WCDMA Band IV

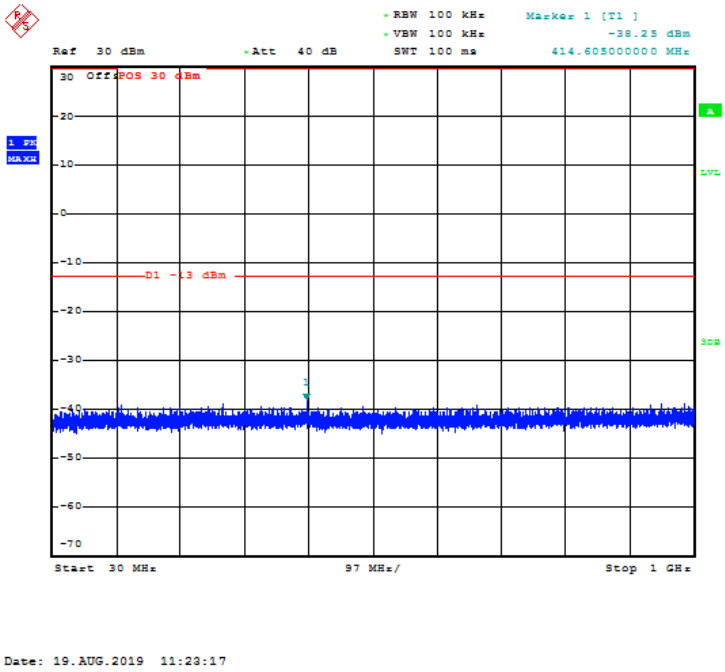


Fig.87 Channel 1312: 30MHz~1GHz

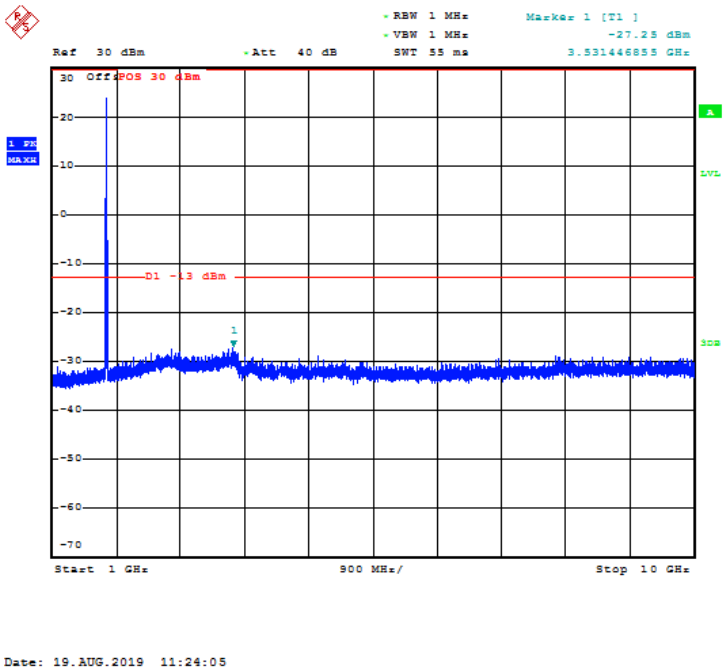


Fig.88 Channel 1312: 1GHz~10GHz

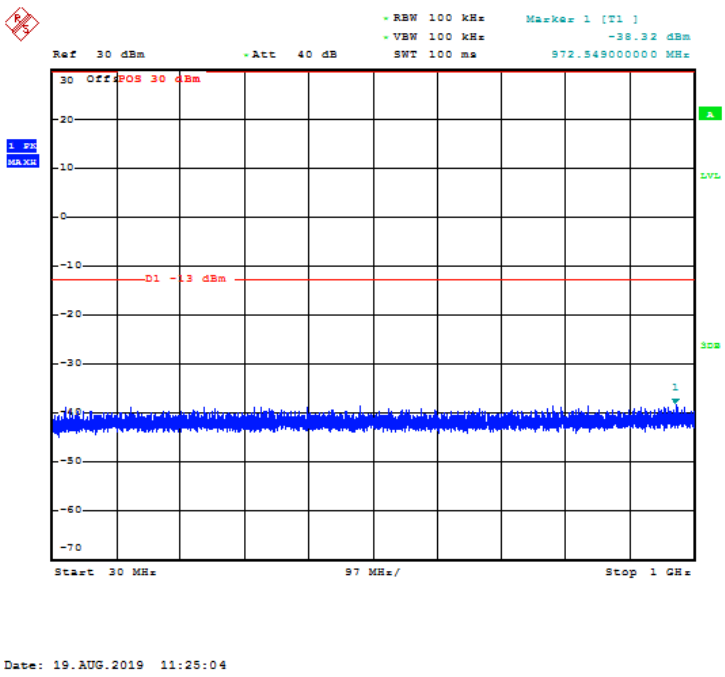


Fig.89 Channel 1413: 30MHz~1GHz

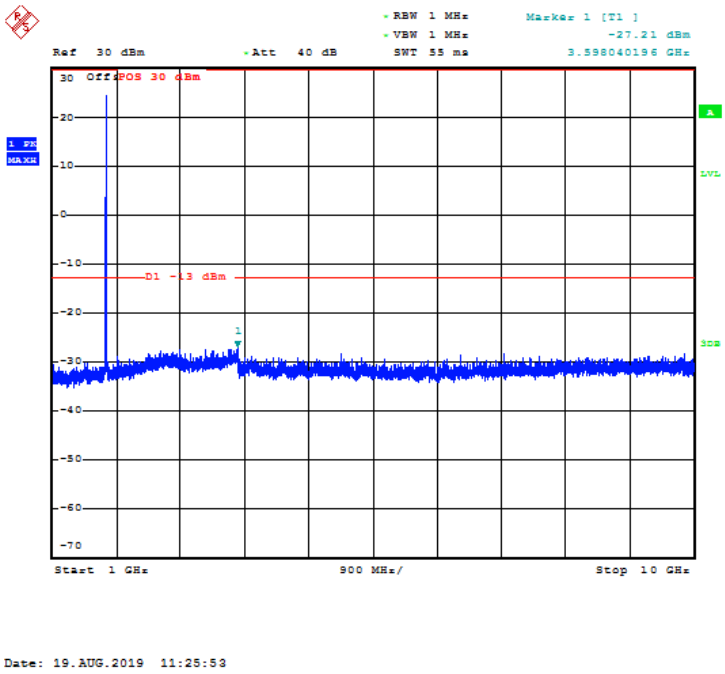


Fig.90 Channel 1413: 1GHz~10GHz

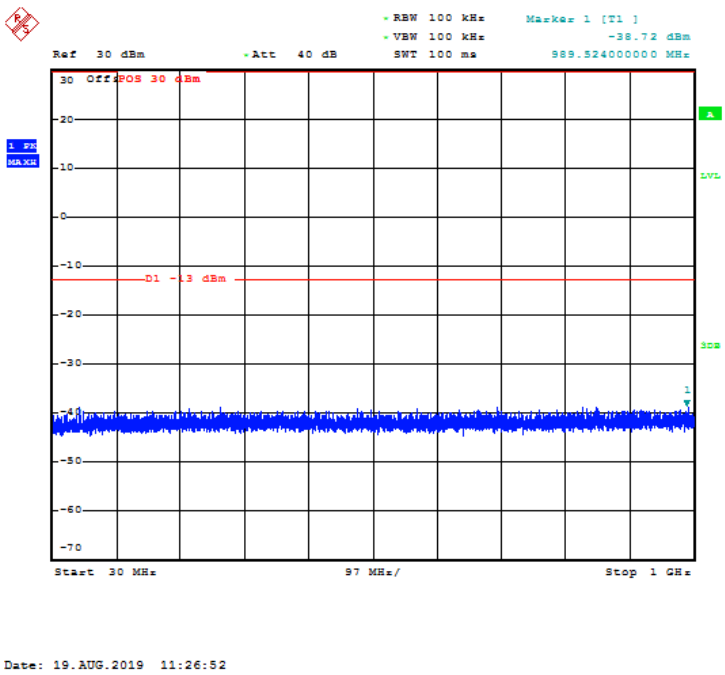


Fig.91 Channel 1513: 30MHz~1GHz

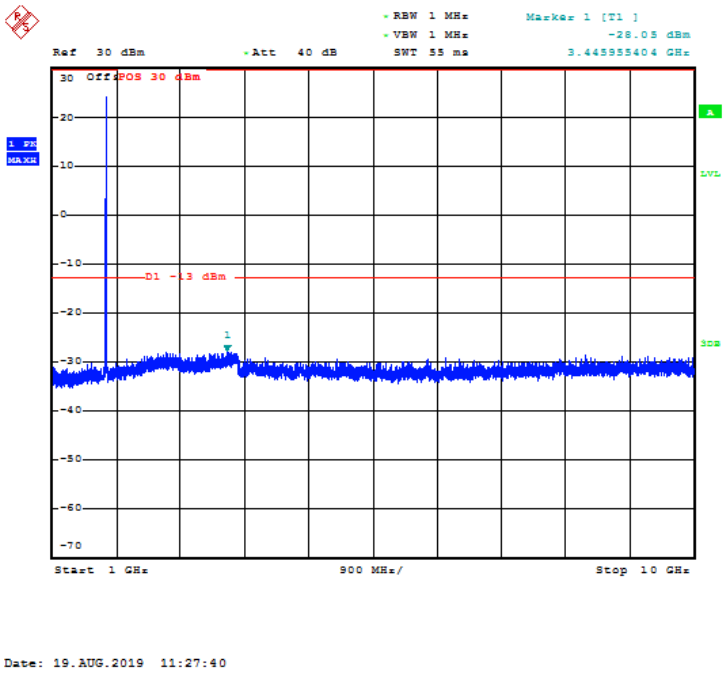


Fig.92 Channel 1513: 1GHz~10GHz

Conclusion: PASS

A.7.2.2.3. WCDMA Band V

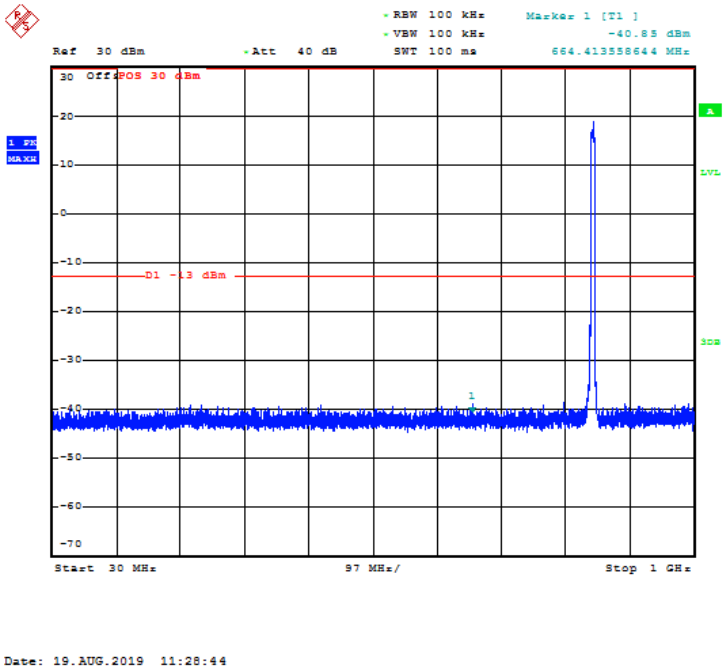


Fig.93 Channel 4132: 30MHz~1GHz

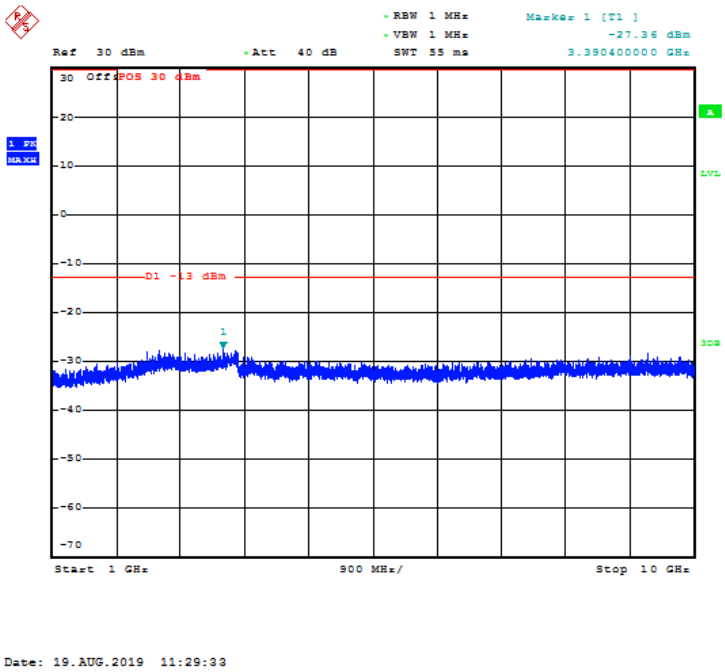


Fig.94 Channel 4132: 1GHz~10GHz

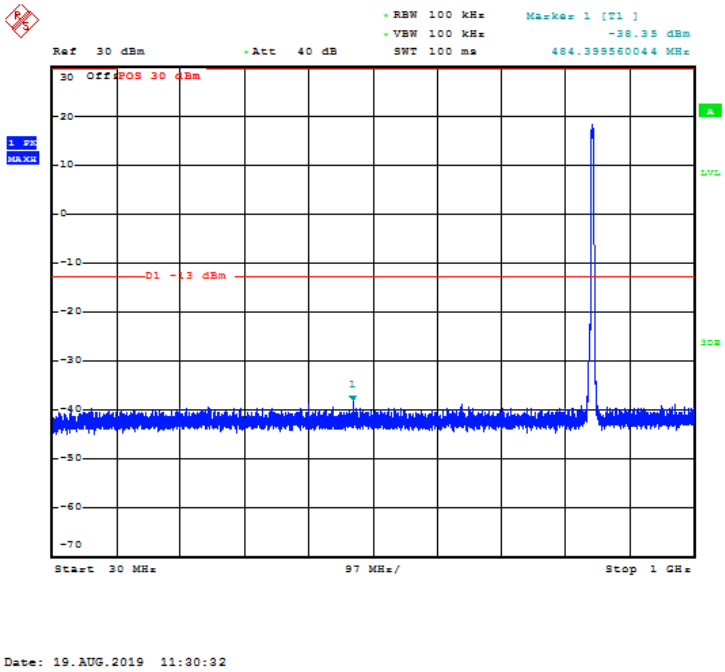


Fig.95 Channel 4183: 30MHz~1GHz

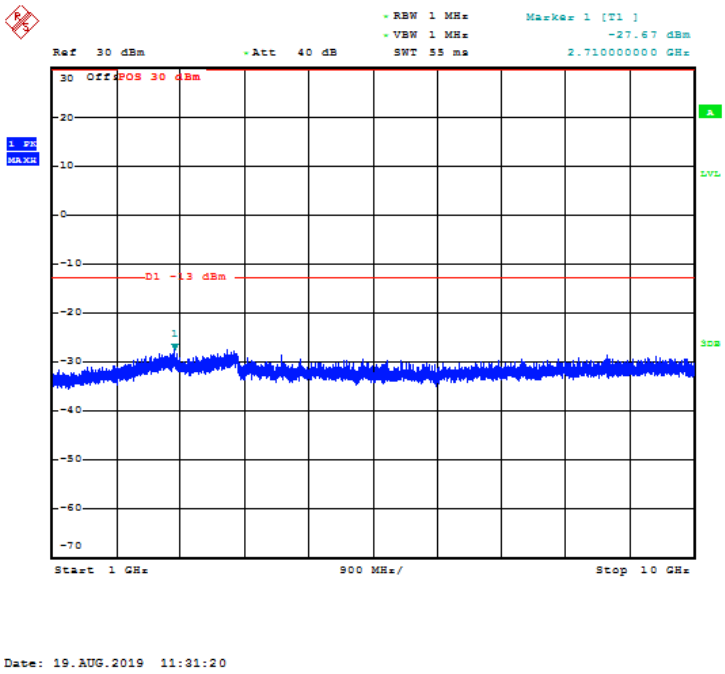


Fig.96 Channel 4183: 1GHz~10GHz

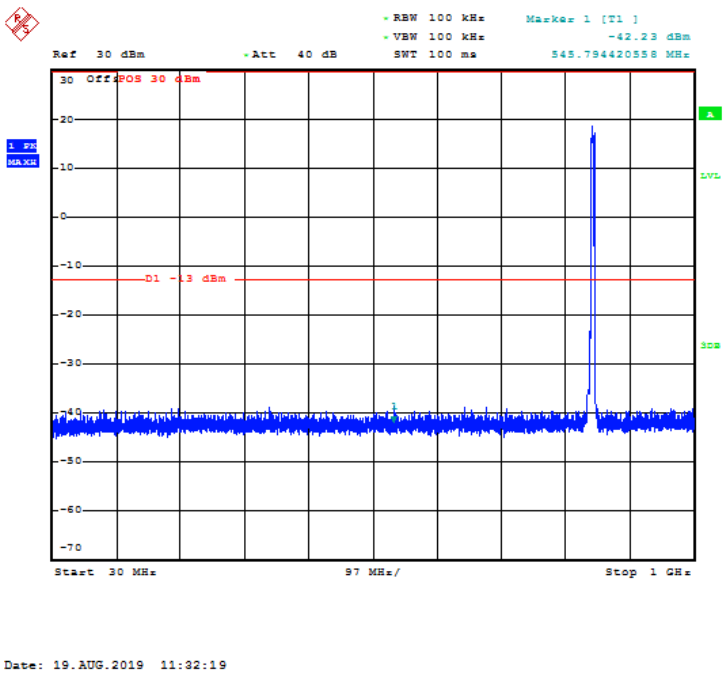


Fig.97 Channel 4233: 30MHz~1GHz

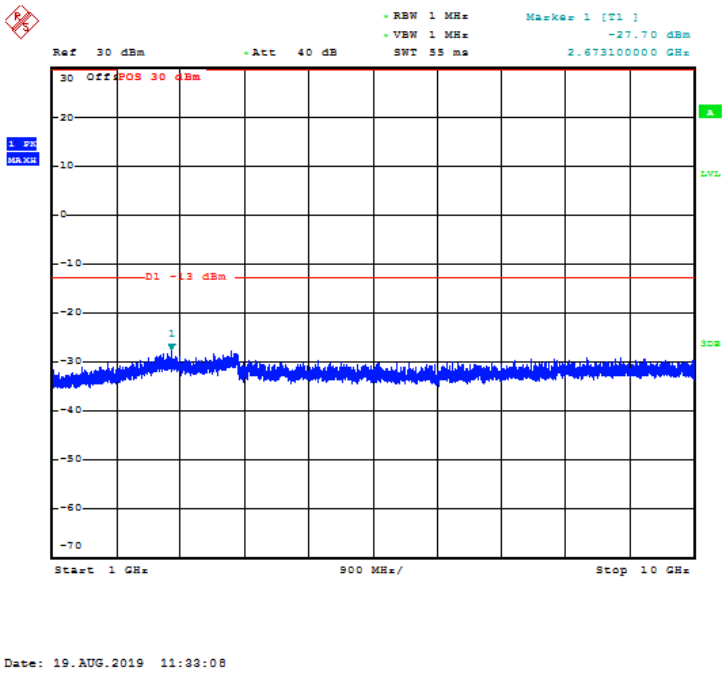


Fig.98 Channel 4233: 1GHz~10GHz

Conclusion: PASS

ANNEX A.8. RADIATED

A.8.1. EIRP

A.8.1.1. GSM EIRP

A.8.1.1.1. Description

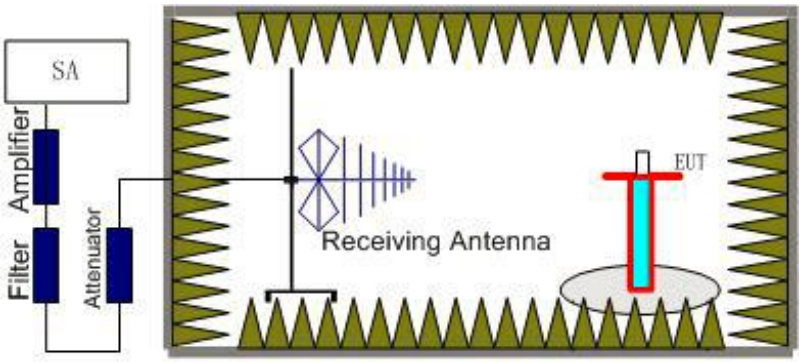
This is the test for the maximum radiated power from the EUT.

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.8.1.1.2. Method of Measurement

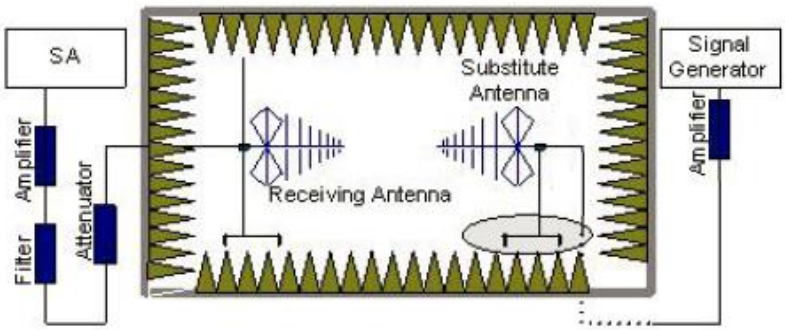
The measurements procedures in TIA-603E-2016 are used.

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



2. The EUT is then put into continuously transmitting mode at its maximum power level during the 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 the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of

the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

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

The cable loss (P_{cl}) ,the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.

The measurement results are obtained as described below:

Power(EIRP)=P_{Mea}+ P_{Ag}- P_{cl}+ G_a

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (0dBi) and known input power.

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

A.8.1.1.3 GSM 850-ERP 22.913(a)

A.8.1.1.3.1 Limits

	Power Step	**Burst Peak ERP (dBm)**
GSM	5	≤38.45dBm (7W)
GPRS	3	≤38.45dBm (7W)
EDGE	6	≤38.45dBm (7W)

A.8.1.1.3.2 Measurement result

GSM(GMSK)

Frequency(MHz)	Peak ERP (dBm)	Polarization
824.2	28.84	H
836.6	27.15	H
848.8	26.23	H

GPRS (GMSK)

Frequency(MHz)	Peak ERP (dBm)	Polarization
824.2	28.93	H
836.6	27.15	H
848.8	26.23	H

EDGE(8PSK)

Frequency(MHz)	Peak ERP (dBm)	Polarization
824.2	23.48	H
836.6	22.53	H
848.8	21.74	H

A.8.1.1.4 PCS 1900-EIRP 24.232(c)

A.8.1.1.4.1 Limits

	Power Step	**Burst Peak EIRP (dBm)**
GSM	5	≤33dBm (2W)
GPRS	3	≤33dBm (2W)
EDGE	6	≤33dBm (2W)

A.8.1.1.4.2 Measurement result

GSM(GMSK)

Frequency(MHz)	Peak EIRP (dBm)	Polarization
1850.2	30.9	V
1880.0	31.22	H
1909.8	31.45	V

GPRS(GMSK)

Frequency(MHz)	Peak EIRP (dBm)	Polarization
1850.2	30.91	V
1880.0	31.23	H
1909.8	31.12	V

EDGE(8PSK)

Frequency(MHz)	Peak EIRP (dBm)	Polarization
1850.2	26.83	V
1880.0	27.48	H
1909.8	26.90	V

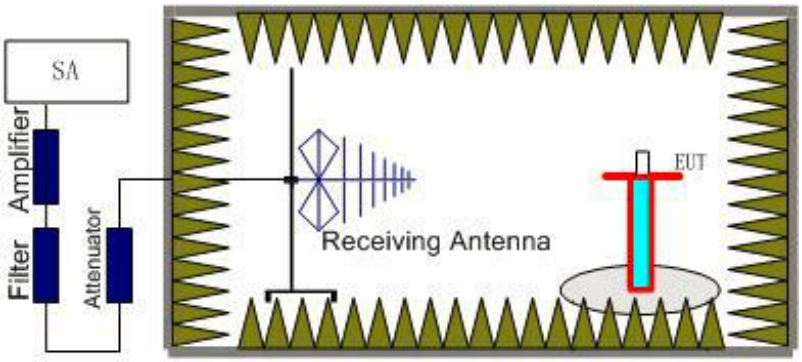
A.8.1.2. WCDMA EIRP

A.8.1.2.1. Description

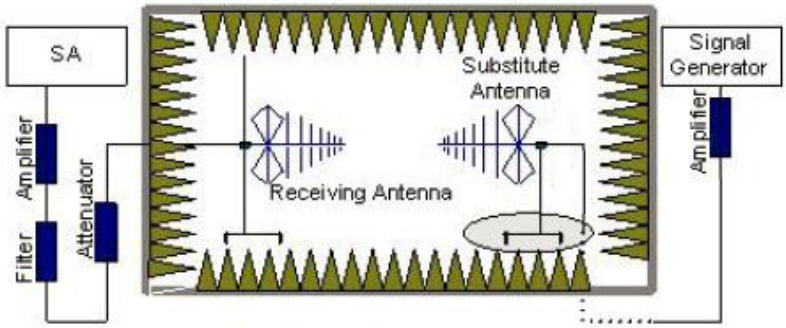
This is the test for the maximum radiated power from the EUT.
Rule Part 24.232(c) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated 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.8.1.2.2. Method of Measurement

The measurements procedures in TIA-603E-2016 are used.
1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the 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 the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

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

The cable loss (P_{cl}) ,the Substitution Antenna Gain (G_a) and the Amplifier Gain (P_{Ag}) should be recorded after test.

The measurement results are obtained as described below:

Power(EIRP)=P_{Mea}+ P_{Ag} -P_{cl}+ G_a

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

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

A.8.1.2.3 WCDMA Band II-EIRP Limits

	Burst Peak EIRP (dBm)
WCDMA Band II	≤33dBm (2W)

A.8.1.2.3.1 Measurement result

Frequency(MHz)	Peak EIRP (dBm)	Polarization
1852.4	25.73	V
1880.0	26.28	H
1907.6	26.4	V

A.8.1.2.4 WCDMA Band IV-EIRP Limits

	Burst Peak EIRP (dBm)
WCDMA Band IV	≤33dBm (2W)

A.8.1.2.4.1 Measurement result

Frequency(MHz)	Peak EIRP(dBm)	Polarization
1712.4	23.25	H
1732.6	22.99	H
1752.6	23.84	H

A.8.1.2.4 WCDMA Band V-ERP Limits

	Burst Peak ERP (dBm)
WCDMA Band V	≤38.45dBm (7W)

A.8.1.2.4.1 Measurement result

Frequency(MHz)	Peak ERP (dBm)	Polarization
826.4	18.51	H
836.6	18.06	H
846.6	17.28	H

Note: the EUT was displayed in several different direction, the worst cases were shown.

A.8.2 EMISSION LIMIT (§2.1051/§22.917§24.238)

A.8.2.1 GSM Measurement Method

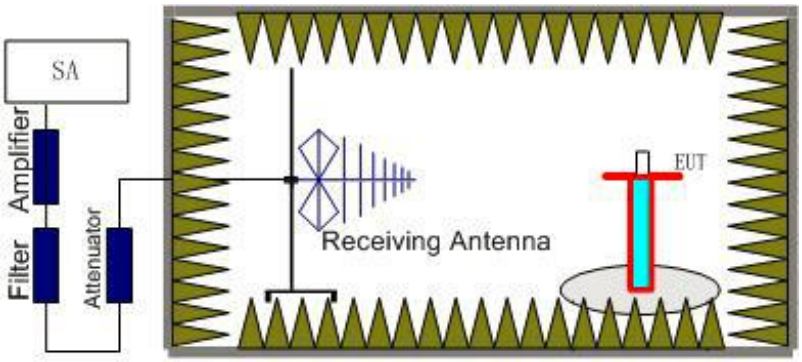
The measurement procedures in TIA-603E-2016are used.

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 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.

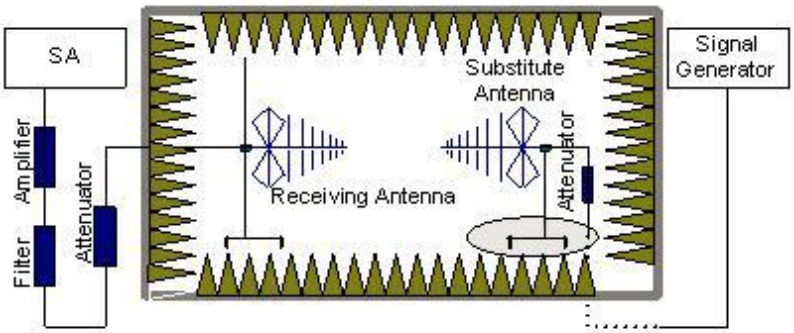
A.8.2.2 The procedure of radiated spurious emissions is as follows:

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission

measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10thharmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the 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 the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (P_{Mea}) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (P_r). The power of signal source (P_{Mea}) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
4. The Path loss (P_{pl}) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain (G_a) should be recorded after test.
A amplifier should be connected in for the test.
The Path loss (P_{pl}) is the summation of the cable loss .
The measurement results are obtained as described below:
Power(EIRP)=P_{Mea}- P_{pl}+ G_a
5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi

A.8.2.3 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.8.2.4 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.

A.8.2.5 Measurement Results

Measurements results:

Frequency	Channel	Frequency Range	Result
GSM850	Low	30MHz~10GHz	P
	Middle	30MHz~10GHz	P
	High	30MHz~10GHz	P
GSM1900	Low	30MHz~20GHz	P
	Middle	30MHz~20GHz	P
	High	30MHz~20GHz	P

GSM850

GSM Mode Channel 128

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1647.9	-40.31	4.3	2.9	-41.71	-13	V
2613.2	-35.96	5.5	3.7	-37.76	-13	V
3633.5	-50.3	6.6	7.7	-49.2	-13	H
4520.8	-47.98	7.3	7.3	-47.98	-13	H
5248.8	-49.2	8.0	8.7	-48.5	-13	V
6078.5	-49.43	8.7	10.4	-47.73	-13	V

Note:

GSM 850, CH128

Power(ERP)= Pmea-Pcl+Ga=-35.61-5.3+3.7=-37.12dbm

This method Applicable to the following table.

GSM Mode Channel 189

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1871.8	-37.49	4.6	2.9	-39.19	-13	H
2655.0	-36.13	5.5	4.1	-37.53	-13	H
3580.4	-46.74	6.5	4.7	-48.54	-13	H
4494.2	-47.4	7.3	7.3	-47.4	-13	H
5450.8	-50.11	8.1	9.5	-48.71	-13	H
6366.2	-48.99	8.8	10.8	-46.99	-13	V

GSM Mode Channel 251

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1850.4	-38.18	4.6	2.9	-39.88	-13	H
2643.2	-36.39	5.5	4.1	-37.79	-13	H
3576.9	-46.63	6.5	4.7	-48.43	-13	H
4533.5	-48.03	7.4	7.3	-48.13	-13	V
5458.8	-51.36	8.1	9.5	-49.96	-13	H
6381.5	-49.47	8.9	11.5	-46.87	-13	V

GPRS Mode Channel 128

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1647.9	-41.53	4.3	2.9	-42.93	-13	H
2607.9	-35.51	5.5	3.7	-37.31	-13	V
3586.2	-45.94	6.5	4.7	-47.74	-13	V
4474.6	-48.01	7.3	7.3	-48.01	-13	H
5326.2	-49.18	8.1	8.7	-48.58	-13	V
6101.5	-48.6	8.7	10.4	-46.9	-13	H

GPRS Mode Channel 189

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1865.4	-37.33	4.6	2.9	-39.03	-13	H
2657.1	-35.78	5.5	4.1	-37.18	-13	H
3578.1	-45.89	6.5	4.7	-47.69	-13	H
4506.9	-46.92	7.3	7.3	-46.92	-13	H
5434.6	-49.74	8.1	9.5	-48.34	-13	V
6420.0	-49.08	8.9	11.5	-46.48	-13	H

GPRS Mode Channel 251

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1855.7	-37.77	4.6	2.9	-39.47	-13	H
2611.1	-35.27	5.5	3.7	-37.07	-13	V
3583.8	-46.52	6.5	4.7	-48.32	-13	H
4555.4	-47.77	7.4	7.3	-47.87	-13	V
5400.0	-50.1	8.1	9.5	-48.7	-13	H
6352.3	-49.12	8.8	10.8	-47.12	-13	H

EGPRS Mode Channel 128

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1648.9	-41.35	4.3	2.9	-42.75	-13	V
2461.1	-37.04	5.3	3.7	-38.64	-13	H
3252.7	-48.71	6.1	4.7	-50.11	-13	H
4068.5	-50.43	6.9	7.7	-49.63	-13	V
4936.2	-52.46	7.7	9.0	-51.16	-13	V
5801.5	-50.71	8.4	10.5	-48.61	-13	V

EGPRS Mode Channel 189

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1672.5	-41.72	4.3	2.9	-43.12	-13	V
2507.1	-37.28	5.4	3.7	-38.98	-13	H
3317.3	-47.52	6.2	4.7	-49.02	-13	H
4114.6	-50.6	7.0	7.7	-49.9	-13	H
4989.2	-53.3	7.8	9.0	-52.1	-13	V
5783.1	-50.17	8.4	10.5	-48.07	-13	V

EGPRS Mode Channel 251

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1701.4	-44.38	4.4	2.9	-45.88	-13	V
2547.9	-37.23	5.4	3.7	-38.93	-13	V
3390.0	-48.8	6.3	4.7	-50.4	-13	V
4253.1	-50.54	7.1	7.7	-49.94	-13	V
5141.5	-50.94	7.9	8.7	-50.14	-13	V
5973.5	-49.82	8.5	10.4	-47.92	-13	H

GSM1900

GSM Mode Channel 512

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
4581.0	-50.52	7.4	7.3	-50.62	-13	V
6078.0	-52.13	8.7	10.4	-50.43	-13	H
8042.4	-54.64	9.9	16.6	-47.94	-13	V
10165.2	-51.58	11.3	17.4	-45.48	-13	H
12871.2	-46.34	13.0	19.2	-40.14	-13	H
16077.6	-41.71	15.0	20.4	-36.31	-13	H

GSM Mode Channel 661

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3952.8	-52.99	6.8	7.7	-52.09	-13	H
5395.8	-51.87	8.1	9.5	-50.47	-13	V
7467.6	-53.34	9.7	14.6	-48.44	-13	H
9690.0	-52.93	10.9	18.3	-45.53	-13	H
12804.0	-46.26	12.5	19.2	-39.56	-13	V
16024.8	-41.25	15.0	20.4	-35.85	-13	H

GSM Mode Channel 810

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3573.0	-50.3	6.4	4.7	-52	-13	V
4541.4	-50.64	7.4	7.3	-50.74	-13	H
5946.6	-52.67	8.5	10.4	-50.77	-13	V
8257.2	-55.2	10.1	17.3	-48	-13	V
10802.4	-49.14	11.7	17.3	-43.54	-13	H
12849.6	-46.21	12.5	19.2	-39.51	-13	H

Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

GPRS Mode Channel 512

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3808.2	-53.97	6.7	7.7	-52.97	-13	H
5702.4	-54.13	8.5	10.5	-52.13	-13	H
7692.0	-54.93	9.8	15.3	-49.43	-13	H
9519.6	-54.51	10.7	18.6	-46.61	-13	V
11385.6	-50.46	12.1	18.1	-44.46	-13	H
13326.0	-48.24	13.6	21.8	-40.04	-13	V

GPRS Mode Channel 661

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3795.0	-54.13	6.7	7.7	-53.13	-13	H
5703.0	-54.66	8.5	10.5	-52.66	-13	V
7605.6	-54.36	9.7	14.6	-49.46	-13	H
9486.0	-53.88	10.7	18.6	-45.98	-13	V
11383.2	-49.92	12.1	18.1	-43.92	-13	H
13303.2	-48.14	13.6	21.8	-39.94	-13	H

GPRS Mode Channel 810

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3972.6	-53.82	6.8	7.7	-52.92	-13	H
5974.2	-53.64	8.5	10.4	-51.74	-13	H
7950.0	-55.61	9.8	16.6	-48.81	-13	V
9954.0	-53.06	11.2	17.6	-46.66	-13	H
11958.0	-47.7	12.6	17.1	-43.2	-13	H
13936.8	-51.28	13.5	24.6	-40.18	-13	V

Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

EGPRS Mode Channel 512

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3966.0	-52.81	6.8	7.7	-51.91	-13	H
5262.6	-52.24	8.0	8.7	-51.54	-13	V
7050.0	-53.05	9.4	12.9	-49.55	-13	V
9250.8	-54.34	10.6	18.5	-46.44	-13	H
12825.6	-46.27	12.5	19.2	-39.57	-13	H
16280.4	-41.7	14.7	20.9	-35.5	-13	H

EGPRS Mode Channel 661

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3562.8	-49.54	6.4	4.7	-51.24	-13	H
5795.4	-53.33	8.4	10.5	-51.23	-13	V
7606.8	-54.05	9.7	14.6	-49.15	-13	H
9208.8	-53.44	10.5	18.5	-45.44	-13	H
11281.2	-49.33	12.1	18.5	-42.93	-13	V
13335.6	-47.74	13.6	21.8	-39.54	-13	H

EGPRS Mode Channel 810

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3575.4	-50.59	6.5	4.7	-52.39	-13	V
4552.8	-51.08	7.4	7.3	-51.18	-13	H
6410.4	-52.45	8.9	11.5	-49.85	-13	V
8407.2	-55.7	10.2	18.1	-47.8	-13	H
10806.0	-48.62	11.7	17.3	-43.02	-13	H
13928.4	-49.76	13.5	24.6	-38.66	-13	H

Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

A.8.3 WCDMA Measurement Method

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

The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment. The resolution bandwidth is set as outlined in Part 24.238 and Part 24.917.

The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of WCDMA Band V.

The procedure of radiated spurious emissions is the same like GSM.

A.8.3.1 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.8.3.2 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the WCDMA Band V (826.4MHz, 836.6MHz and 846.6MHz) . 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 WCDMA Band V 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.

A.8.3.3 Measurement Results Table

Frequency	Channel	Frequency Range	Result
WCDMA Band II	Low	30MHz~20GHz	P
	Middle	30MHz~20GHz	P
	High	30MHz~20GHz	P
WCDMA Band IV	Low	30MHz~20GHz	P
	Middle	30MHz~20GHz	P
	High	30MHz~20GHz	P
WCDMA Band V	Low	30MHz~20GHz	P
	Middle	30MHz~20GHz	P
	High	30MHz~20GHz	P

WCDMA BAND II Mode Channel 9262

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3703.6	-58.64	6.6	7.7	-57.54	-13	H
5554.0	-44.71	8.2	9.5	-43.41	-13	H
7412.8	-54.17	9.7	14.6	-49.27	-13	V
9266.4	-60.23	10.6	18.5	-52.33	-13	V
11052.2	-57.04	12.1	18.1	-51.04	-13	H
13367.4	-56.35	13.7	21.8	-48.25	-13	H

WCDMA BAND II Mode Channel 9400

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3762.0	-55.03	6.6	7.7	-53.93	-13	H
5643.6	-46.11	8.3	10.5	-43.91	-13	H
7515.2	-53.16	9.7	14.6	-48.26	-13	V
9394.0	-60.84	10.7	18.6	-52.94	-13	V
11275.1	-56.91	12.1	18.5	-50.51	-13	V
14304.0	-57.34	13.6	23.5	-47.44	-13	H

WCDMA BAND II Mode Channel 9538

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
3816.8	-54.84	6.7	7.7	-53.84	-13	H
5726.4	-43.3	8.5	10.5	-41.3	-13	H
7625.6	-51.92	9.7	15.3	-46.32	-13	V
9542.8	-59.01	10.7	18.6	-51.11	-13	V
11617.0	-56.07	12.2	18.1	-50.17	-13	V
14298.8	-56.95	13.6	23.5	-47.05	-13	H

WCDMA BAND IV Mode Channel 1312

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
5138.8	-55.78	7.9	8.7	-54.98	-13	H
6852.8	-49.03	9.2	12.3	-45.93	-13	V
9242.0	-61.63	10.6	18.5	-53.73	-13	H
10807.6	-56.23	11.7	17.3	-50.63	-13	V
12907.5	-55.33	13.0	20.2	-48.13	-13	V
15416.0	-56.25	14.4	24.2	-46.45	-13	H

WCDMA BAND IV Mode Channel 1413

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
5200.4	-50.18	8.0	8.7	-49.48	-13	H
6928.0	-46.78	9.3	12.9	-43.18	-13	V
8660.0	-62.54	10.3	18.5	-54.34	-13	H
10780.4	-56.41	11.7	17.3	-50.81	-13	H
13852.5	-56.9	13.5	24.8	-45.6	-13	V
16038.6	-49.61	15.0	20.4	-44.21	-13	H

WCDMA BAND IV Mode Channel 1513

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
5260.0	-52.05	8.0	8.7	-51.35	-13	H
7014.4	-52.29	9.3	12.9	-48.69	-13	V
9540.0	-61.36	10.7	18.6	-53.46	-13	H
11899.2	-55.57	12.5	17.1	-50.97	-13	H
14025.8	-57.53	13.7	24.6	-46.63	-13	V
16004.0	-49.94	15.0	20.4	-44.54	-13	V

WCDMA BAND V Mode Channel 4132

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1863.2	-51.8	4.6	2.9	-53.5	-13	H
2556.9	-50.74	5.4	3.7	-52.44	-13	V
3300.8	-61.19	6.2	4.7	-62.69	-13	H
4647.6	-59.17	7.5	7.9	-58.77	-13	V
6417.6	-59.53	8.9	11.5	-56.93	-13	V
8254.6	-62.86	10.1	17.3	-55.66	-13	V

WCDMA BAND V Mode Channel 4183

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1858.2	-51.6	4.6	2.9	-53.3	-13	H
2441.2	-51.12	5.3	3.7	-52.72	-13	H
3703.6	-61.2	6.6	7.7	-60.1	-13	H
4597.6	-59.31	7.4	7.3	-59.41	-13	H
5784.4	-60.39	8.4	10.5	-58.29	-13	V
7628.8	-61.94	9.7	15.3	-56.34	-13	V

WCDMA BAND V Mode Channel 4233

Final result:

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit （dBm）	Polarization
1870.4	-51.9	4.6	2.9	-53.6	-13	H
2671.5	-50.06	5.5	4.1	-51.46	-13	H
3600.0	-58.69	6.5	4.7	-60.49	-13	H
4572.0	-57.91	7.4	7.3	-58.01	-13	H
6101.6	-59.5	8.7	10.4	-57.8	-13	H
7922.8	-62.35	9.9	16.6	-55.65	-13	H

Conclusion: PASS

Note: the EUT was displayed in several different direction, the worst cases were shown.

ANNEX B. Accreditation Certificate

Accredited Laboratory

A2LA has accredited

EAST CHINA INSTITUTE OF TELECOMMUNICATIONS

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 6th day of May 2019.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2021

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

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