



FCC LISTED, REGISTRATION  
NUMBER: 2764.01

ISED LISTED REGISTRATION  
NUMBER: 23595-1

Test report No:  
**2456ERM.012**

## Test report

REFERENCE STANDARD:  
USA FCC Part 24  
CANADA ISED RSS-133

Identification of item tested	Wireless Module
Trademark	Cinterion ALAS5-AM
Model and /or type reference	ALAS5-AM
Other identification of the product	FCC ID: QIPALAS5-AM IC: 7830A-ALAS5AM
Features	Wireless Module supporting 2G, 3G and 4G Cellular Technologies
Manufacturer	Gemalto M2M GmbH Werinherstr. 81, 81541 Munich, Germany.
Test method requested, standard	USA FCC Part 24 10-1-18 Edition CANADA IC RSS-133 Issue 6, Jan. 2013 (Amendment January 2018); Measurement Guidance 971168 D01 v02r02 for certification of Licensed Digital Transmitters. ANSI C63.26 – 2015.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager
Date of issue	05-21-2019
Report template No	FDT08_21

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## Competences and guarantees

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DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01.

DEKRA Certification Inc. is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Certification Inc. has a calibration and maintenance program for its measurement equipment.

DEKRA Certification Inc. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Certification at the time of performance of the test.

DEKRA Certification Inc. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the item under test established in this document.

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## General conditions

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1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

## Uncertainty

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Uncertainty (factor  $k=2$ ) was calculated according to the DEKRA Certification internal document PODT000.

Frequency (MHz)	U(k=2)	Units
30-180	3.82	dB
180-1000	2.61	dB
1000-18000	2.92	dB
18000-40000	2.15	dB

## Data provided by the client

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Wireless Module supporting 2G,3G and 4G Cellular Technologies.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

## Usage of samples

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Samples undergoing test have been selected by: The client.

Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
2456.08	Cinterion® ALAS5	ALAS5-AM	004401083051280	3/25/2019
2456.10	Cinterion® ALAS5	ALAS5-AM	004401083051652	3/25/2019
2456.05	Antenna	Panorama_LPBEM-7-27	-	2/7/2019
2456.06	Antenna	Panorama_LPBEM-7-27	-	2/7/2019

1. Sample S/01 was used for the following test(s):

All conducted and radiated tests indicated in appendix A.

## Test sample description

Ports..... :	Port name and description		Cable			
			Specified length [m]	Attached during test	Shielded	
	No Data Provided			<input type="checkbox"/>	<input type="checkbox"/>	
				<input type="checkbox"/>	<input type="checkbox"/>	
				<input type="checkbox"/>	<input type="checkbox"/>	
				<input type="checkbox"/>	<input type="checkbox"/>	
Supplementary information to the ports..... :	No Data Provided					
Rated power supply .....	Voltage and Frequency		Reference poles			
			L1	L2	L3	N
	<input type="checkbox"/>	AC: 230Vac / 50Hz.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	DC:3.3 to 4.2V				
<input checked="" type="checkbox"/>	DC: 3.8V					
Rated Power .....	No Data Provided					
Clock frequencies .....	No Data Provided					
Other parameters..... :	No Data Provided					
Software version .....	Rev. 1.1.4b					
Hardware version..... :	Rev 00.052					
Dimensions in cm (L x W x D) .....	No Data Provided					
Mounting position..... :	<input type="checkbox"/>	Table top equipment				
	<input type="checkbox"/>	Wall/Ceiling mounted equipment				
	<input type="checkbox"/>	Floor standing equipment				
	<input type="checkbox"/>	Hand-held equipment				
	<input type="checkbox"/>	Other:				
Modules/parts .....	Module/parts of test item		Type		Manufacturer	
	No Data provided					

Accessories (not part of the test item) .....	Description	Type	Manufacturer
Documents as provided by the applicant.....	Description	File name	Issue date
	Equipment declaration data	FDT30_15_Declaration_Equipment_Data_Gemalto_ALAS5-AM_signed	2019-05-16

**Copy of marking plate:**



## Identification of the client

Gemalto M2M GmbH  
 Werinherstr. 81, 81541 Munich, Germany

## Testing period and place

<b>Test Location</b>	DEKRA Certification, Inc.
<b>Date (start)</b>	04-04-2019
<b>Date (finish)</b>	05-06-2019

## Document history

Report number	Date	Description
2456ERM.012	05-09-2019	First release

## Environmental conditions

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In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the semi anechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

## Remarks and comments

The tests have been performed by the technical personnel: Sravani Gollamudi and Koji Nishimoto.

## Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

## Summary

FCC PART 24 /IC RSS-133 PARAGRAPH					
Report Section	FCC 24 Spec Clause	RSS Spec Clause	Test Description	Verdict	Remark
A.1	§2.1046 and §24.232	RSS-133 Clause 6.4	RF Output power	P	N/A
A.2	§2.1047	RSS-133 Clause 6.2	Modulation characteristics	P	N/A
A.3	§2.1055 and §24.235	RSS-133 Clause 6.3	Frequency stability	P	N/A
A.4	§ 2.1049	RSS-133 Clause 2.3	Occupied Bandwidth	P	N/A
A.5	§2.1051 and §24.238	RSS-133 Clause 6.5	Spurious emissions at antenna terminals	P	N/A
A.6	§24.238	RSS-133 Clause 6.5	Spurious emissions at antenna terminals at Block edges	P	N/A
A.7	§2.1053 and §24.238	RSS-133 Clause 6.5	Radiated emissions	P	N/A
<u>Supplementary information and remarks:</u>					
N/A					



## List of equipment used during the test

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### Conducted Measurements

CONTROL NUMBER	DESCRIPTION	LAST CALIBRATION	NEXT CALIBRATION
1039	Signal analyzer Rohde & Schwarz FSV40	2018/03	2020/03
1149	Wideband Radio Communication Tester Rohde & Schwarz CMW 500	2018/07	2020/07
1041	EMI Test Receiver Rohde & Schwarz ESR 7	2017/04	2019/03
101	Climatic chamber Espec	2019/10	2020/10

### Radiated Measurements

CONTROL NUMBER	DESCRIPTION	LAST CALIBRATION	NEXT CALIBRATION
1179	Semi anechoic Absorber Lined Chamber Frankonia SAC 3 plus "L"	N/A	N/A
1064	BiconicalLog antenna ETS LINDGREN 3142E	2017/03	2020/03
1057	Double-ridge Waveguide Horn antenna 1-18 GHz	2017/03	2020/03
1012	Spectrum analyzer Rohde & Schwarz ESR26	2018/09	2020/09
1014	Spectrum analyzer Rohde & Schwarz FSV40	2017/03	2019/03
1015,1017, 1019, 1020	Rohde & Schwarz EMC32 software	N/A	N/A

## Appendix A: Test Results for 2G

## Appendix A Content

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## PRODUCT INFORMATION

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The following information is provided by the client

Information	Description
Modulation	GPRS, EDGE
Maximum RF Output Power	30 dBm
Operation mode:	
- Operating Frequency Range	Band 1900: 1850-1910 MHz
- Nominal Channel Bandwidth	Band 1900: 200-300 KHz
Extreme operating conditions	
- Temperature range	T <sub>nom</sub> = +15 to + 35 T <sub>min</sub> = -30 T <sub>max</sub> = +50
Antenna type	External attachable Antenna.
Antenna gain	4 dBi
Nominal Voltage	
- Supply Voltage	3.8 Vdc
- Type of power source	DC voltage from power supply.

## DESCRIPTION OF TEST CONDITIONS

The worst case was found when positioned as the table below. Following channel(s) was (were) selected for the final test as listed below:

TEST CONDITIONS	DESCRIPTION										
TC#01 Band 1900	<p>Power supply (V):  <math>V_{\text{nominal}} = 3.8 \text{ Vdc}</math></p> <p>Test Frequencies for Conducted tests:</p> <ul style="list-style-type: none"> <li>-Lowest Channel: 512 (1850.2 MHz)</li> <li>-Middle Channel: 662 (1880.2 MHz)</li> <li>-Highest Channel: 810 (1909.8 MHz)</li> </ul> <p>Test Frequencies for Radiated tests:</p> <table border="1" data-bbox="413 1057 1224 1341"> <thead> <tr> <th data-bbox="413 1057 727 1158">Available Frequencies</th> <th data-bbox="727 1057 908 1158">Tested Frequency</th> <th data-bbox="908 1057 1066 1158">Channel Bandwidth</th> <th data-bbox="1066 1057 1224 1158">Modulation</th> </tr> </thead> <tbody> <tr> <td data-bbox="413 1158 727 1341" rowspan="3" style="text-align: center;">1850 to 1910 MHz</td> <td data-bbox="727 1158 908 1189" style="text-align: center;">1850.2 MHz</td> <td data-bbox="908 1158 1066 1341" rowspan="3" style="text-align: center;">300 KHz</td> <td data-bbox="1066 1158 1224 1341" rowspan="3" style="text-align: center;">GPRS</td> </tr> <tr> <td data-bbox="727 1189 908 1220" style="text-align: center;">1880.2 MHz</td> </tr> <tr> <td data-bbox="727 1220 908 1341" style="text-align: center;">1909.8 MHz</td> </tr> </tbody> </table> <p>Note: This device was tested under all channels and modulations. The worst case found in GPRS modulation.</p>	Available Frequencies	Tested Frequency	Channel Bandwidth	Modulation	1850 to 1910 MHz	1850.2 MHz	300 KHz	GPRS	1880.2 MHz	1909.8 MHz
Available Frequencies	Tested Frequency	Channel Bandwidth	Modulation								
1850 to 1910 MHz	1850.2 MHz	300 KHz	GPRS								
	1880.2 MHz										
	1909.8 MHz										

## TEST A.1: RF OUTPUT POWER

<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC §2.1046 and §24.232 / RSS-133 Clause 6.4

### LIMITS

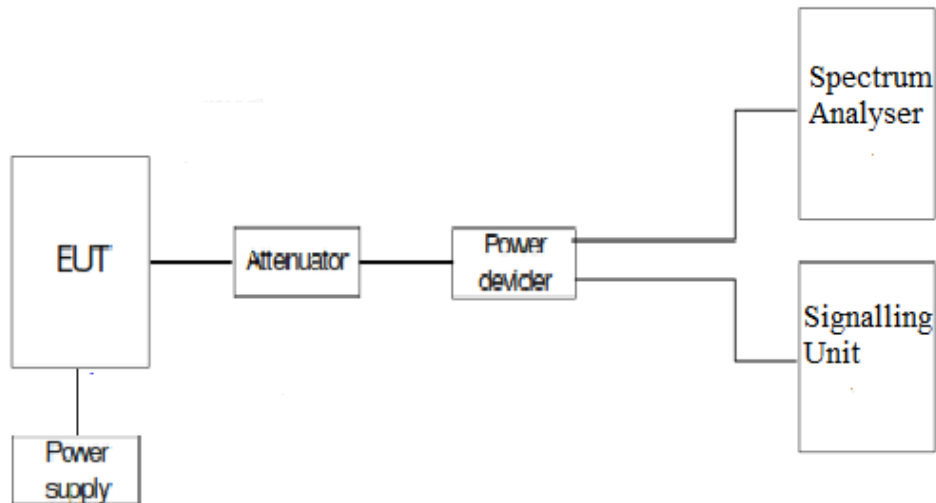
Fixed, mobile, and portable (hand-held) stations are limited to 2-watt EIRP (30 dBm). Fixed stations are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications. The peak-to-average ratio (PAR) of the transmission shall not exceed 13 dB.

### RSS-133 Clause 6.4

The equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. Moreover, base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts.

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

### TEST SETUP



<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

GPRS Modulation:

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)	PAPR (dB)
Lowest	29.64	4.0	33.64	6.03
Middle	29.60	4.0	33.60	8.52
Highest	29.58	4.0	33.58	10.00
Measurement uncertainty (dB)			<±0.95	

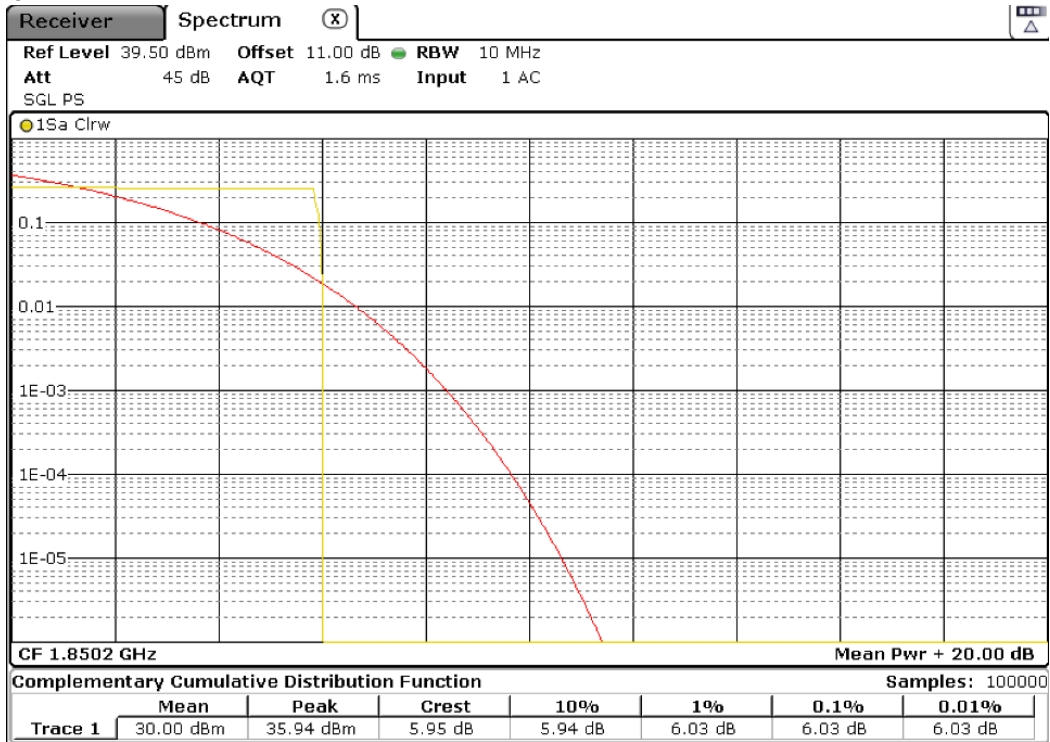
Edge Modulation:

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)	PAPR (dB)
Lowest	25.74	4.0	29.74	8.06
Middle	25.79	4.0	29.79	6.61
Highest	25.61	4.0	29.61	8.46
Measurement uncertainty (dB)			<±0.95	

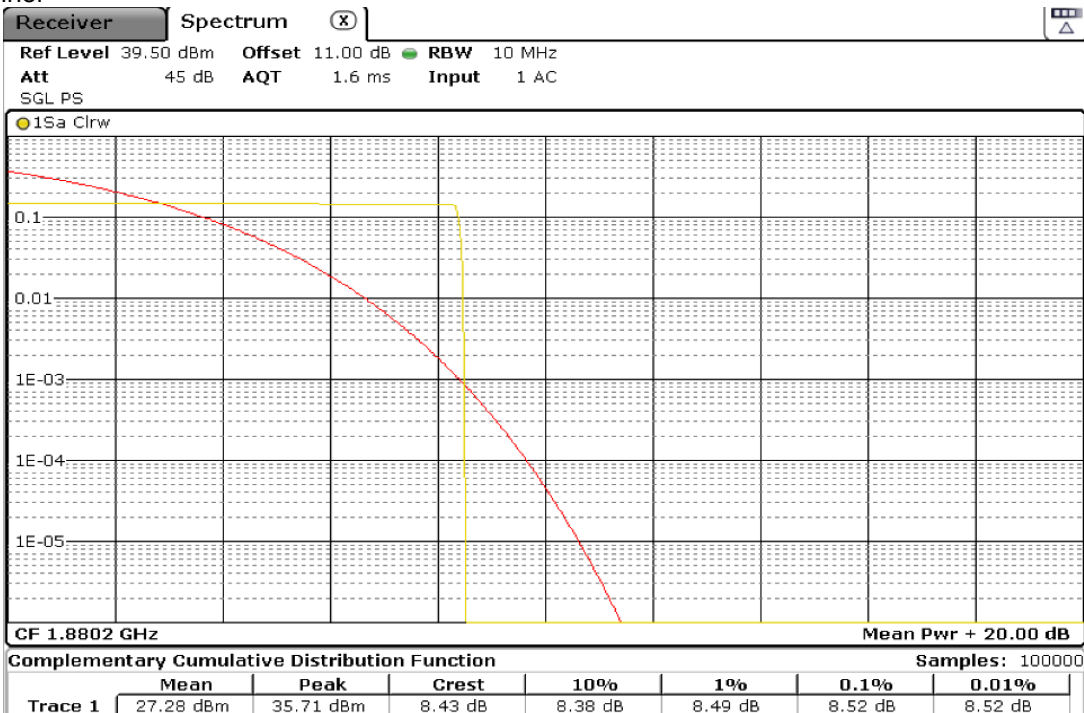
**TEST RESULTS (Cont):**

**GPRS:**

**Lowest channel**



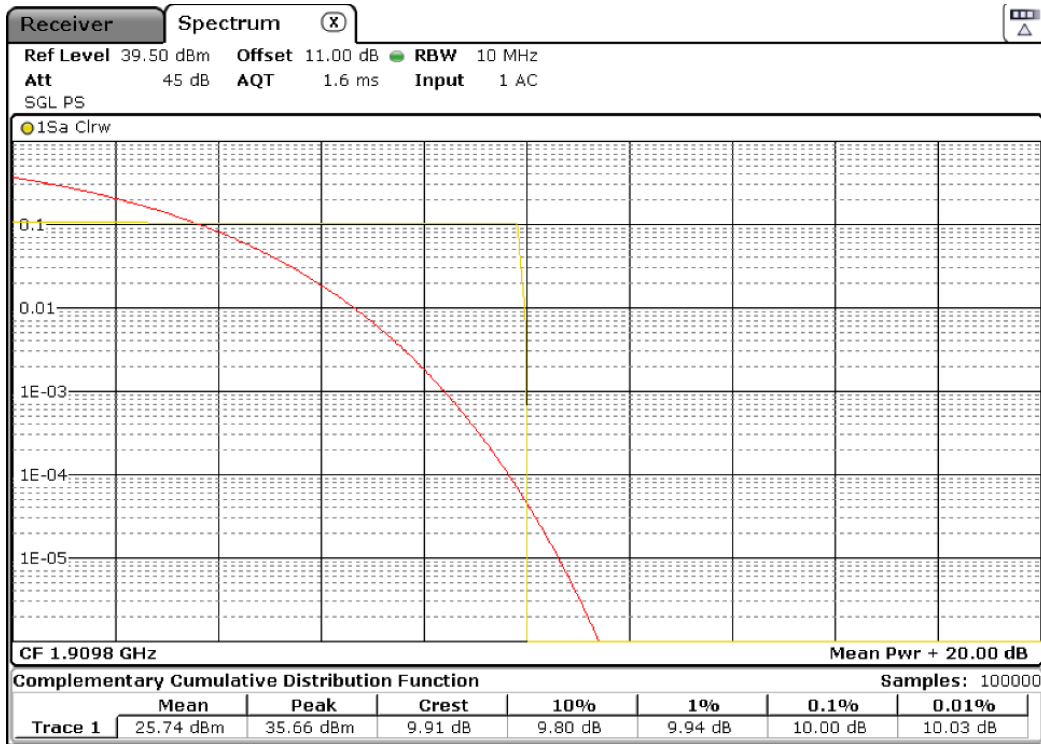
**Middle channel**





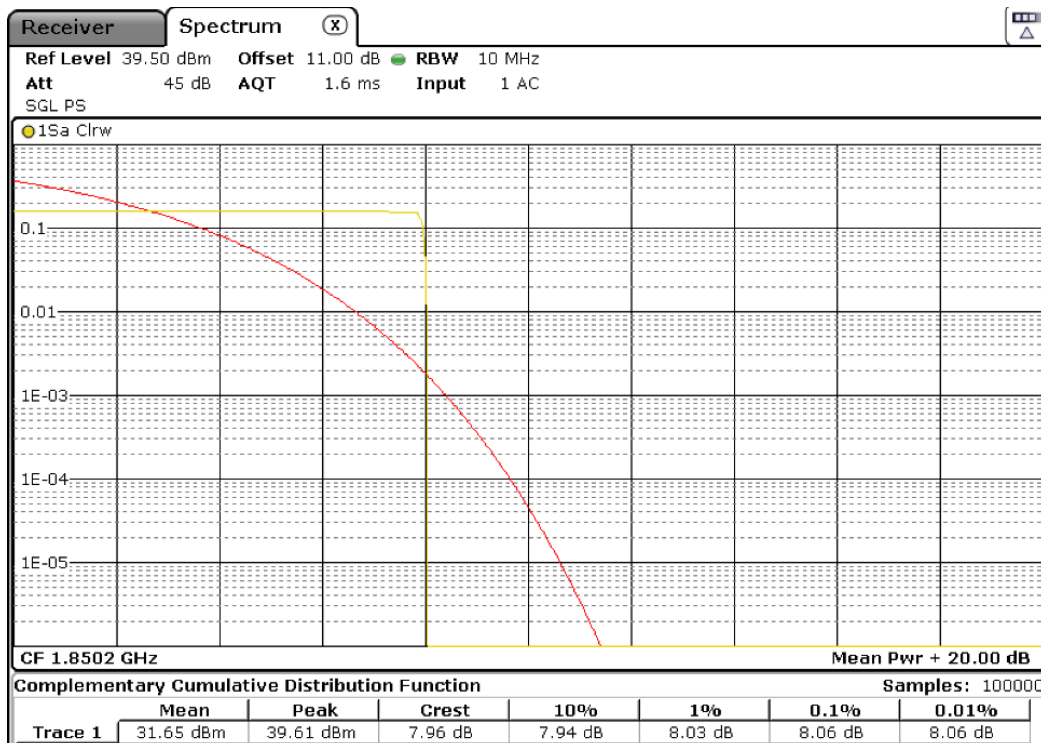
**TEST RESULTS (Cont):**

Highest channel



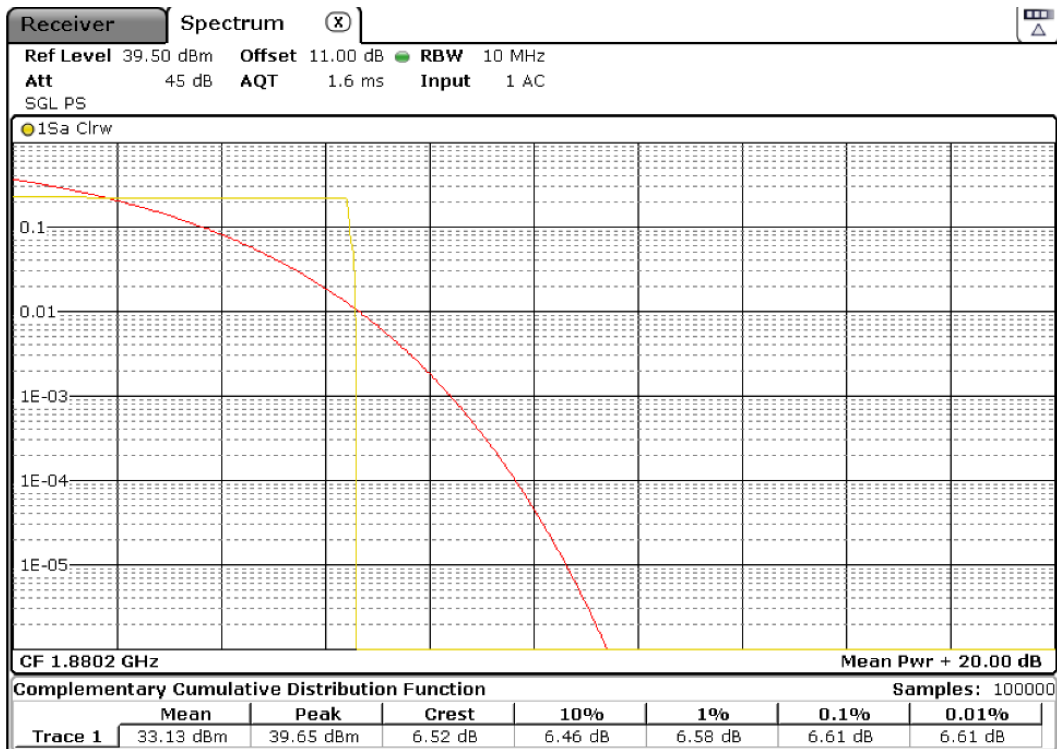
EDGE:

Lowest channel

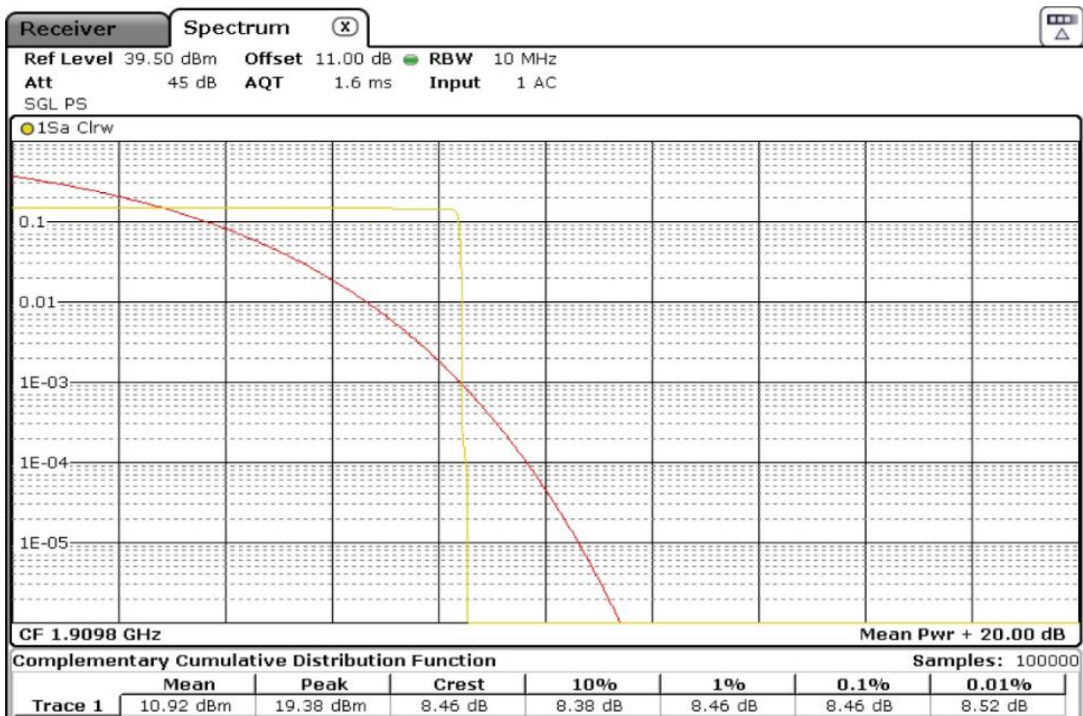


**TEST RESULTS (Cont):**

Middle channel



Highest channel



## TEST A.2: MODULATION CHARACTERISTICS

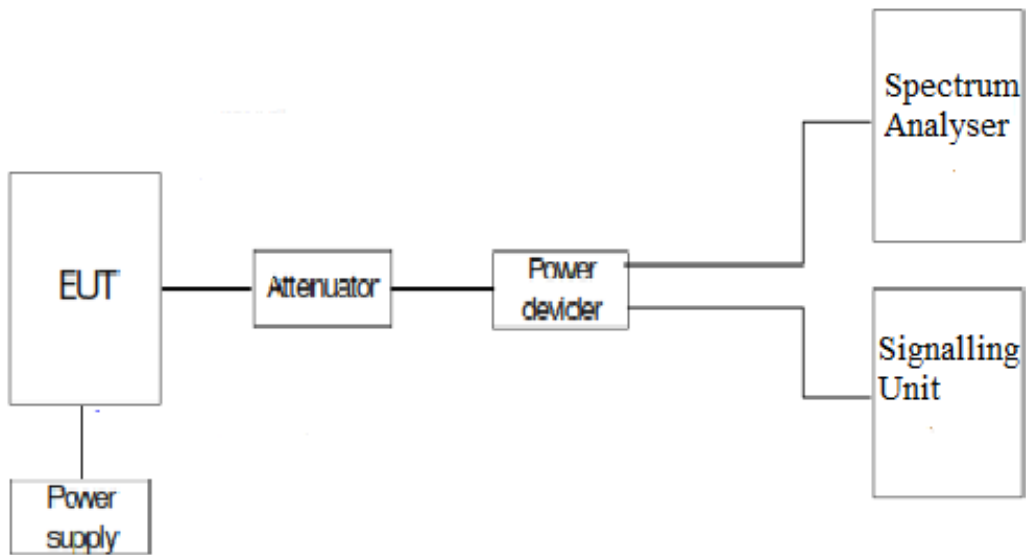
<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC §2.1047 / RSS-133 Clause 6.3

### LIMITS

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

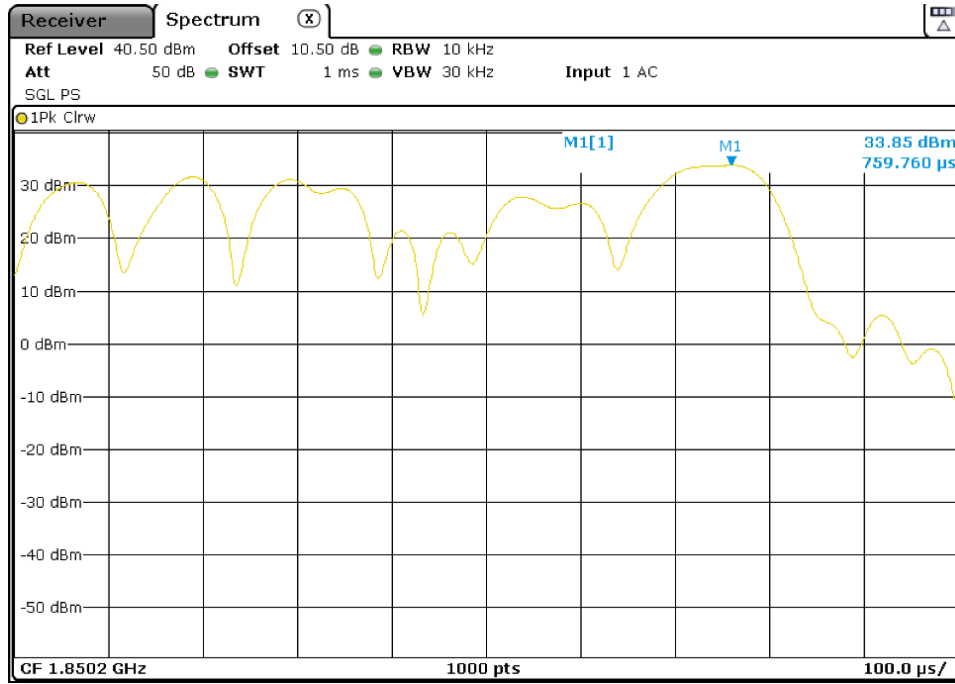
The devices shall employ digital modulation techniques.

### TEST SETUP

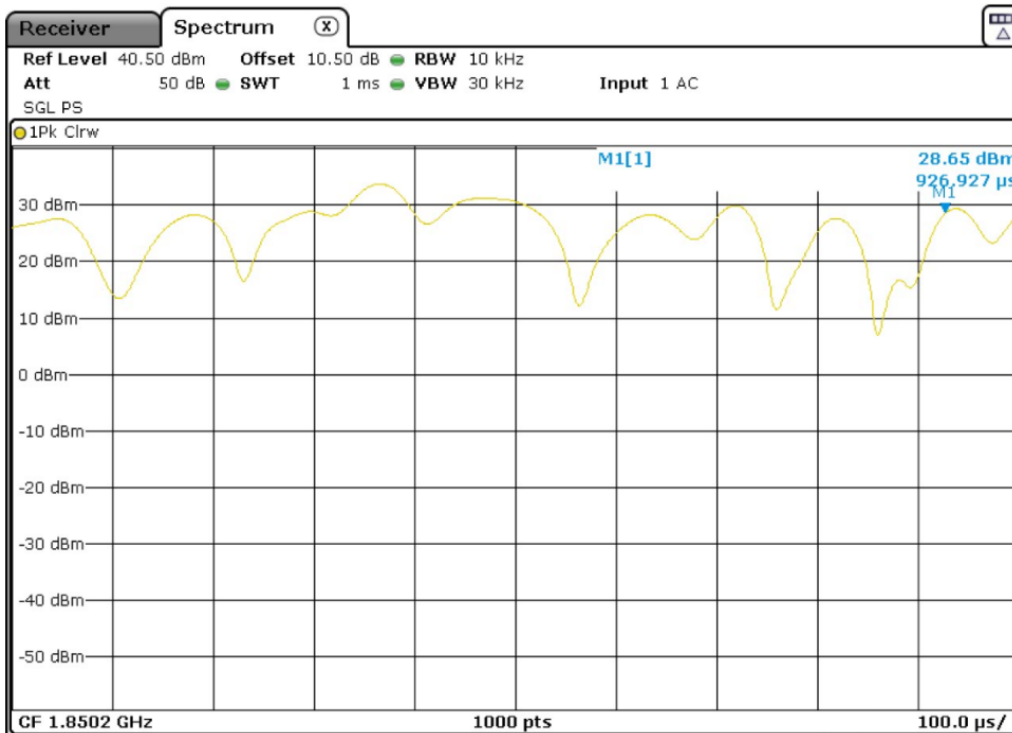


<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

GPRS Modulation



Edge Modulation



### TEST A.3: FREQUENCY STABILITY

<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC §2.1055 and § 24.235 / RSS-133 Clause 6.3

LIMITS

The frequency stability shall be enough to ensure that the fundamental emissions stay within the authorized bands of operation.

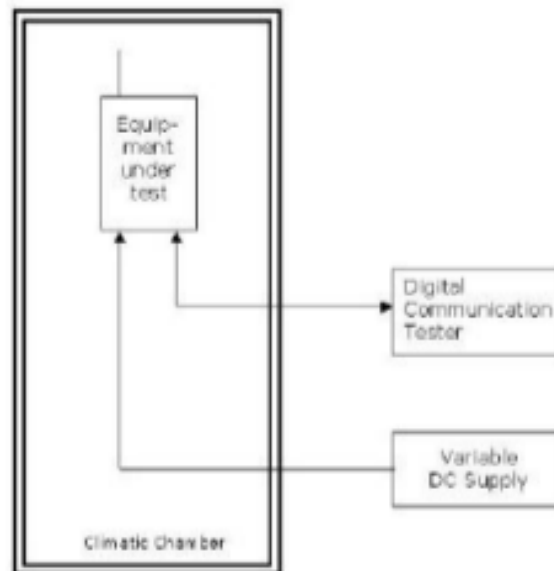
### TEST SETUP

The frequency tolerance measurements over temperature variations were made over the temperature range of  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . The EUT was placed inside a climatic chamber and the temperature was raised hourly in  $10^{\circ}\text{C}$  steps from  $-30^{\circ}\text{C}$  up to  $+50^{\circ}\text{C}$ .

The supply voltage was varied between 85% and 115% of nominal voltage.

The EUT was set in “call mode” in the middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.

For LTE mode the QPSK modulation was used for the test as it is the worst case for conducted power.



<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

GPRS MODULATION.

Frequency stability over temperature variations

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
50	24.1	0.0128	0.00000128
40	22.78	0.0121	0.00000121
30	22.32	0.0119	0.00000119
20	12.56	0.0067	0.00000067
10	21.23	0.0113	0.00000113
0	23.28	0.0124	0.00000124
-10	22.93	0.0122	0.00000122
-20	17.54	0.0093	0.00000093
-30	22.25	0.0118	0.00000118

Frequency stability over voltage variations

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	21.34	0.0113	0.00000113
Vmin	3.23	19.24	0.0102	0.00000102

## TEST A.4: OCCUPIED BANDWIDTH

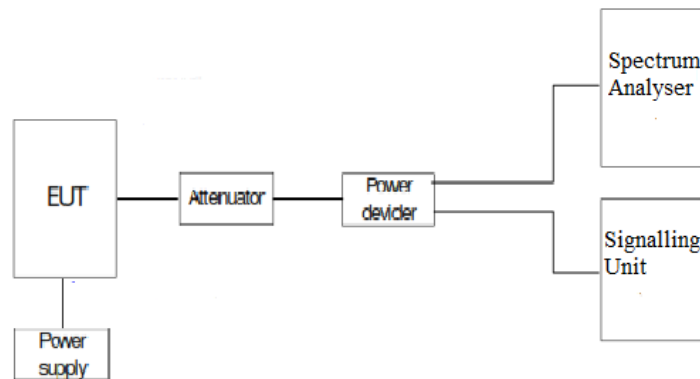
<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC § 2.1049 / RSS-133 Clause 2.3

### LIMITS

Reference only.

### TEST SETUP

The occupied bandwidth measurement was performed at the output terminals of the EUT using an attenuator, power splitter and spectrum analyzer. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation. The 99% occupied bandwidth and the -26 dBc bandwidth were measured directly using the built-in bandwidth measuring option of spectrum analyzer.



<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

### GPRS MODULATION.

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	243.33	245.00	243.33
-26 dBc bandwidth (kHz)	316.90	322.70	314.00

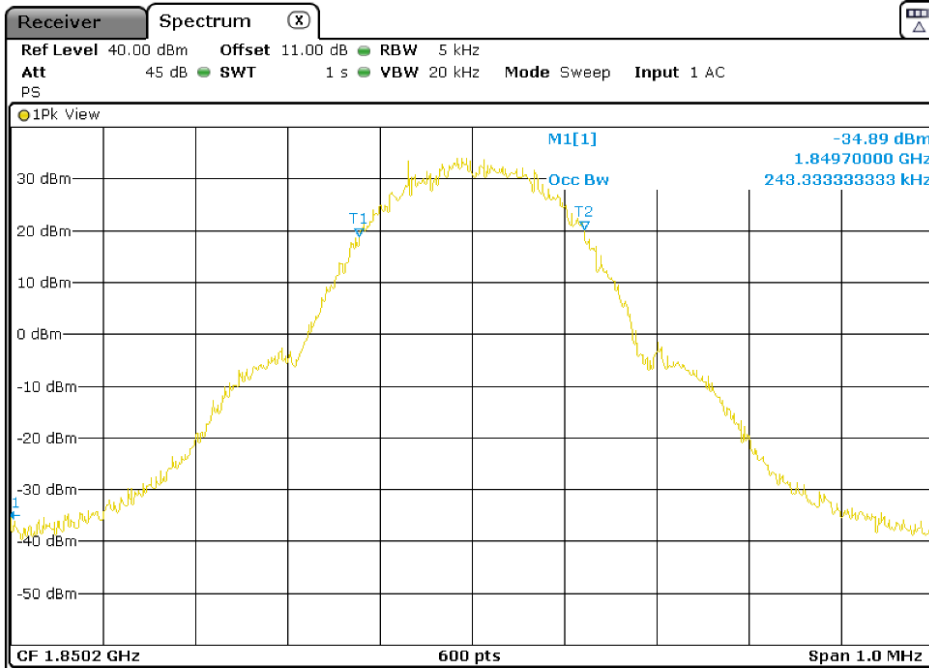
### EDGE MODULATION.

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	245.00	245.00	245.00
-26 dBc bandwidth (kHz)	315.50	316.90	315.50

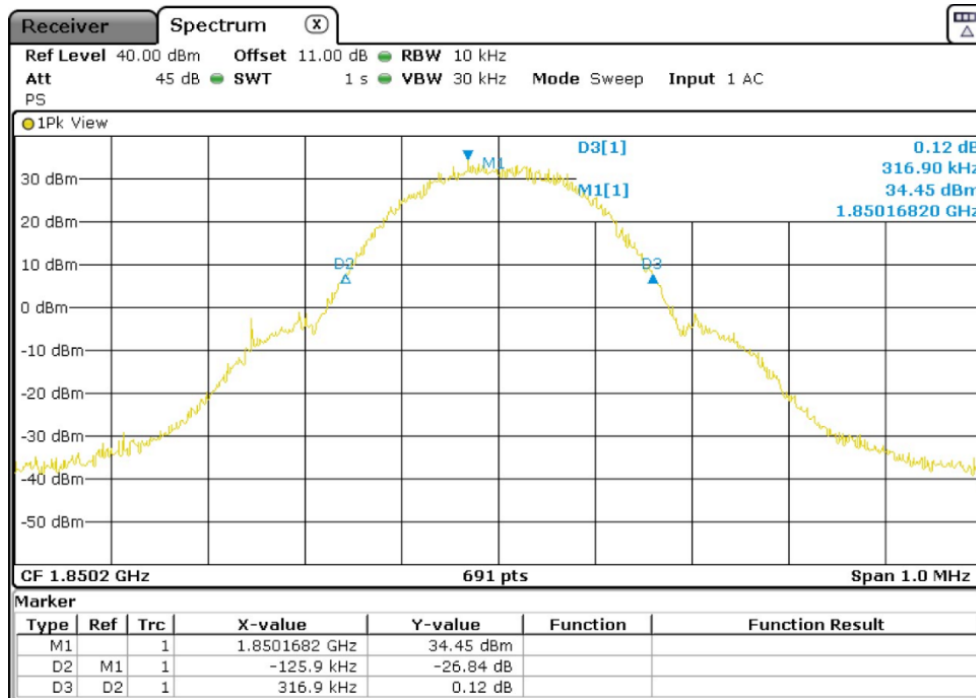
**TEST RESULTS (Cont):**

**GPRS MODULATION.**

**Lowest Channel 99% Occupied Bandwidth**



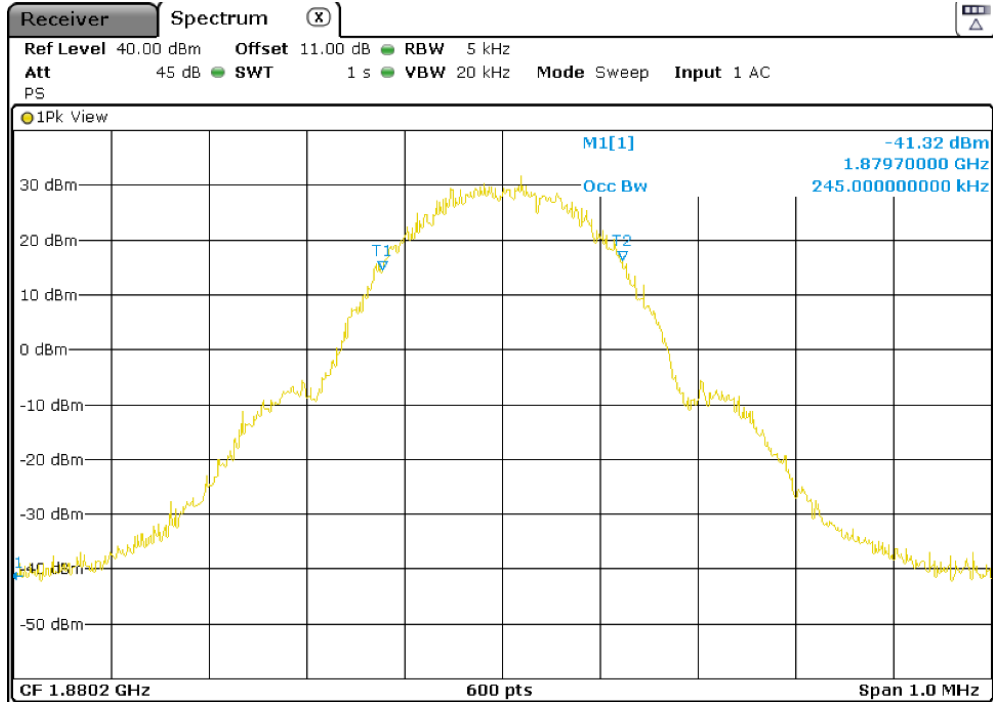
**Lowest Channel -26dBc Bandwidth kHz**



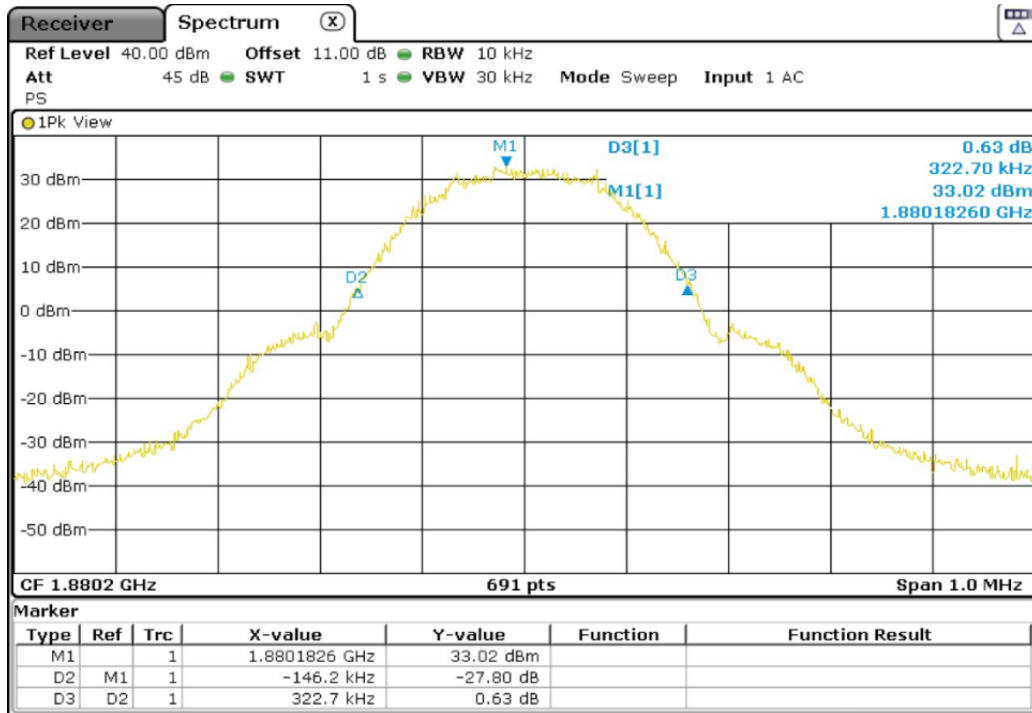


**TEST RESULTS (Cont):**

Middle Channel 99% Occupied Bandwidth

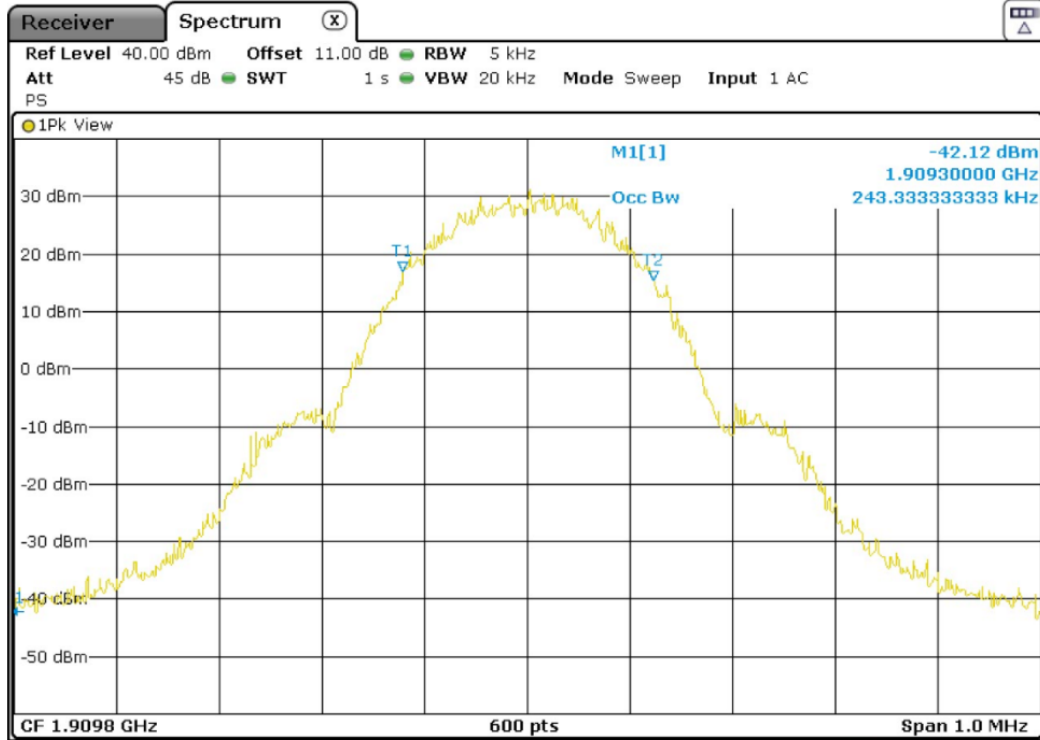


Middle Channel 26dBc Bandwidth kHz

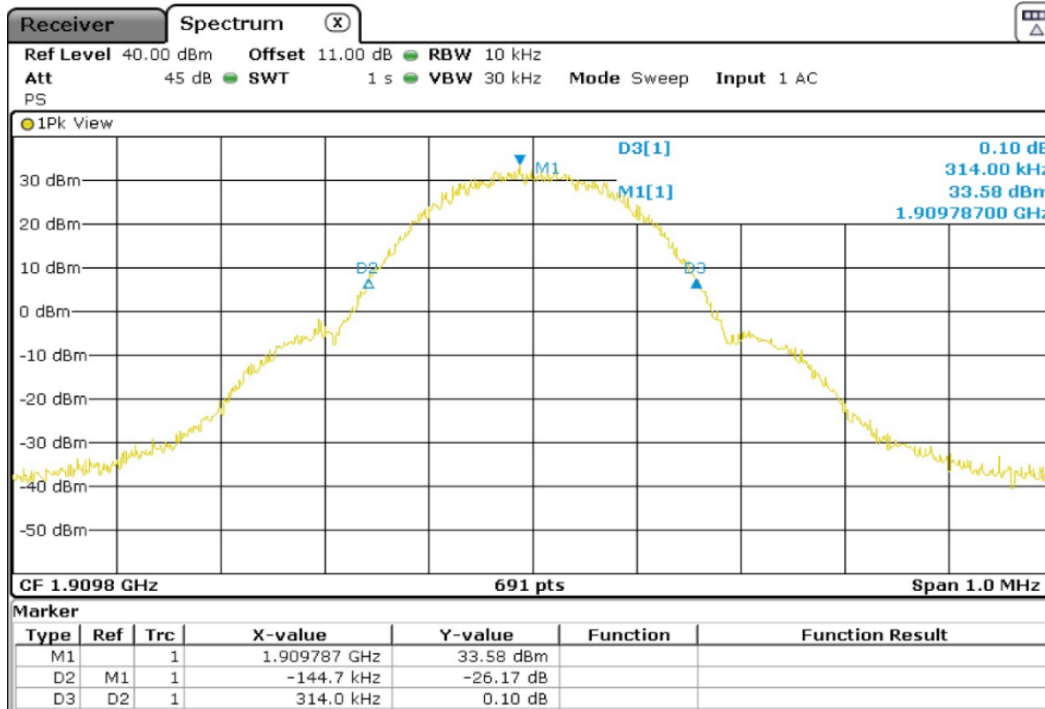


**TEST RESULTS (Cont):**

Highest Channel 99% Occupied Bandwidth



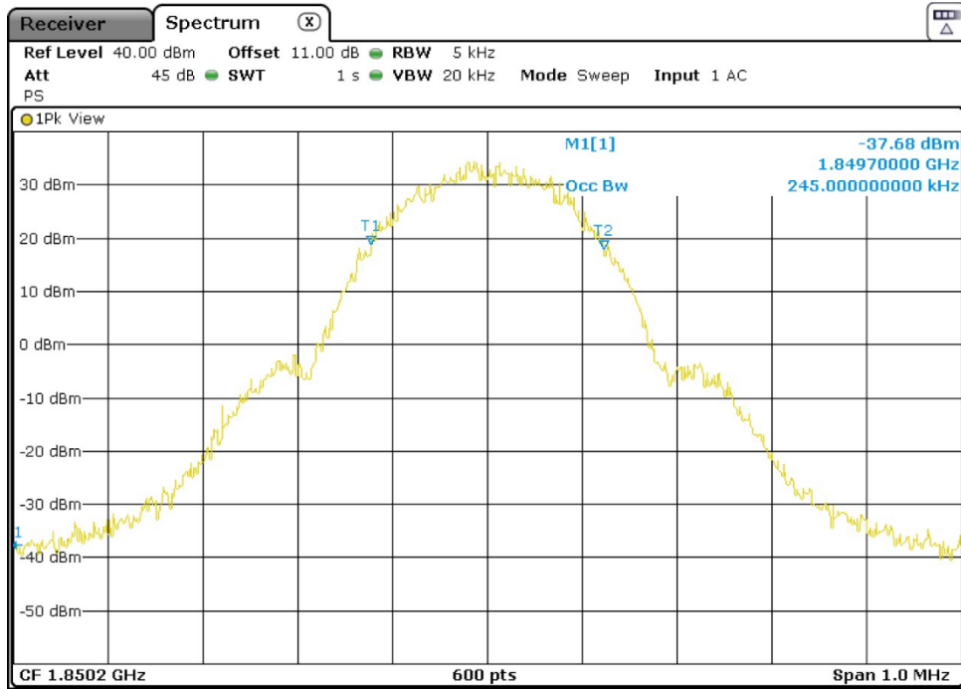
Highest Channel 26dBc Bandwidth kHz



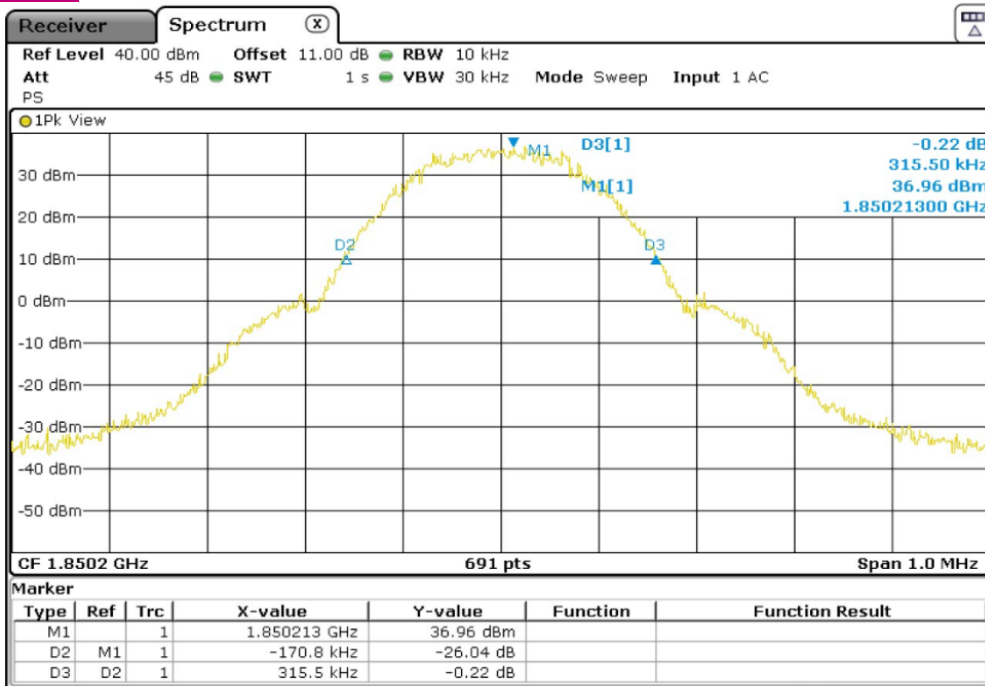
**TEST RESULTS (Cont):**

EDGE MODULATION.

Lowest Channel 99% Occupied Bandwidth

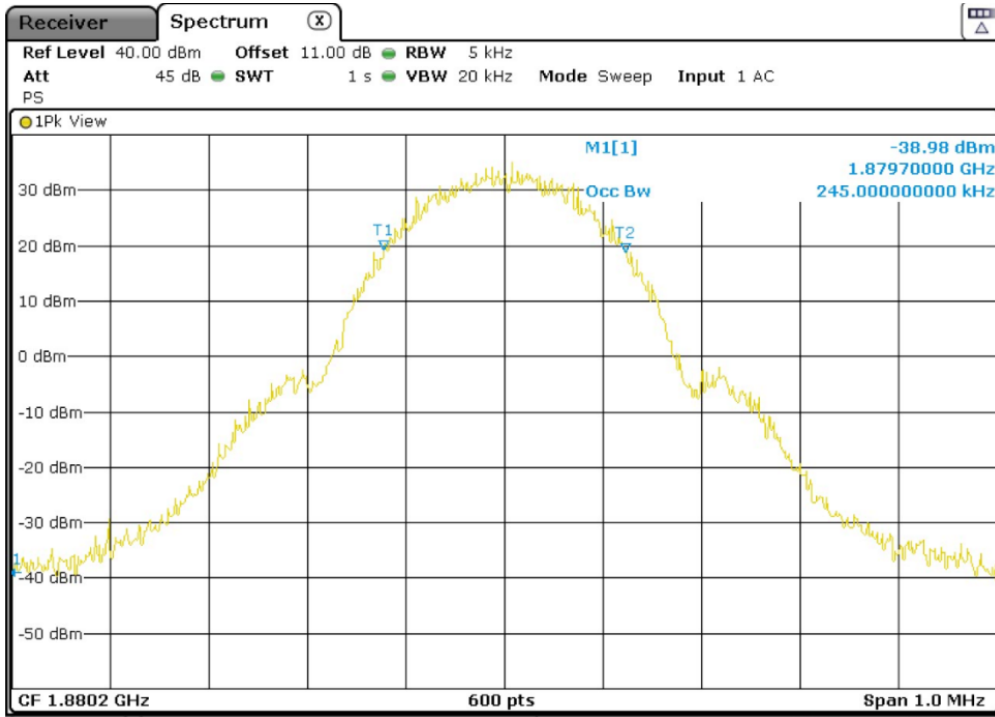


Lowest Channel -26dBc Bandwidth kHz

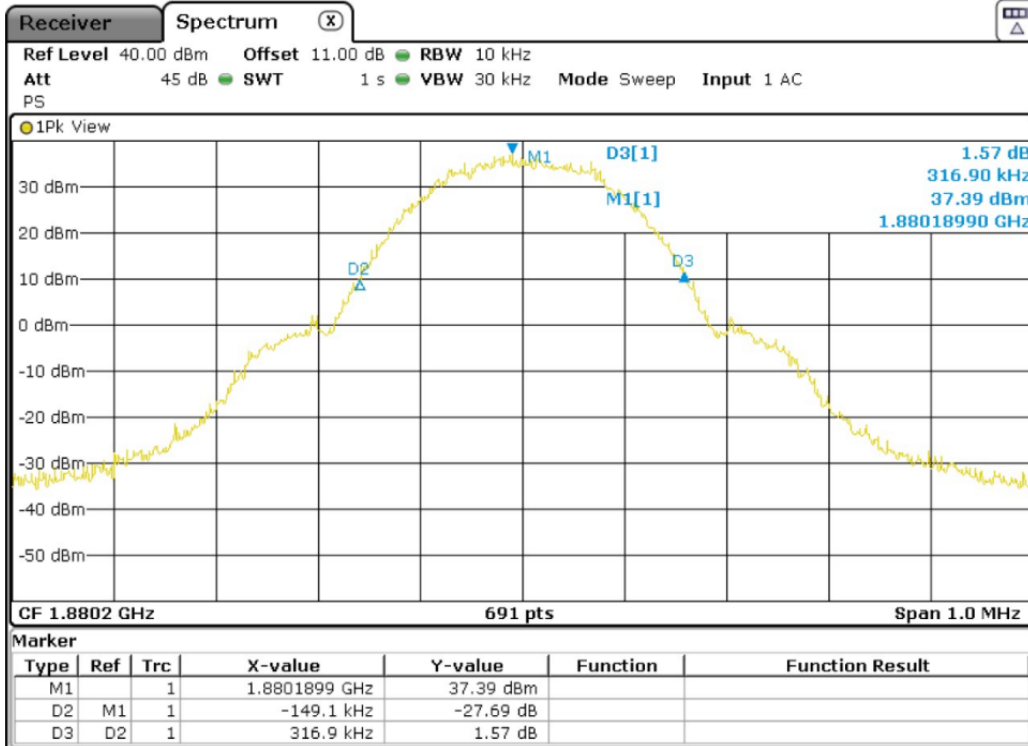


**TEST RESULTS (Cont):**

Middle Channel 99% Occupied Bandwidth

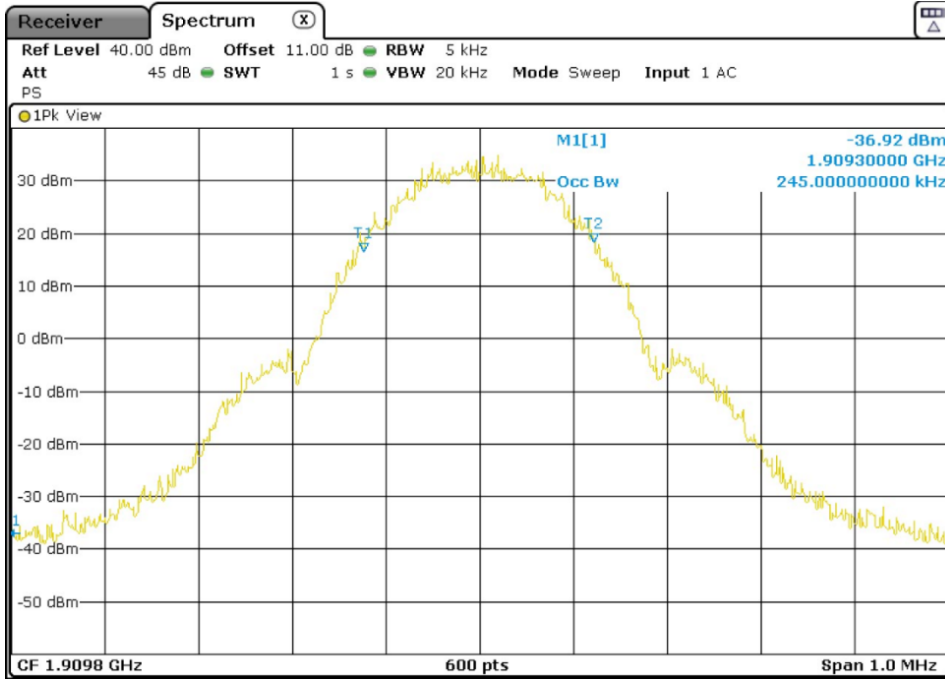


Middle Channel 26dBc Bandwidth kHz

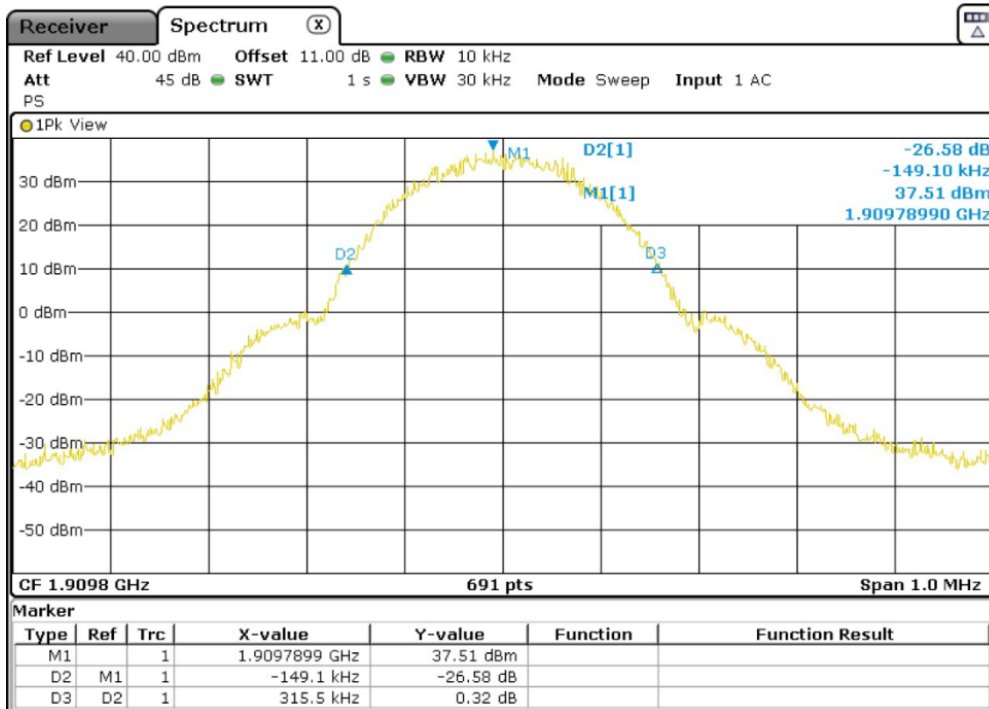


**TEST RESULTS (Cont):**

Highest Channel 99% Occupied Bandwidth



Highest Channel 26dBc Bandwidth kHz



## TEST A.5: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC §2.1051 and § 24.238 / RSS-133 Clause 6.5

### LIMITS

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in watts.

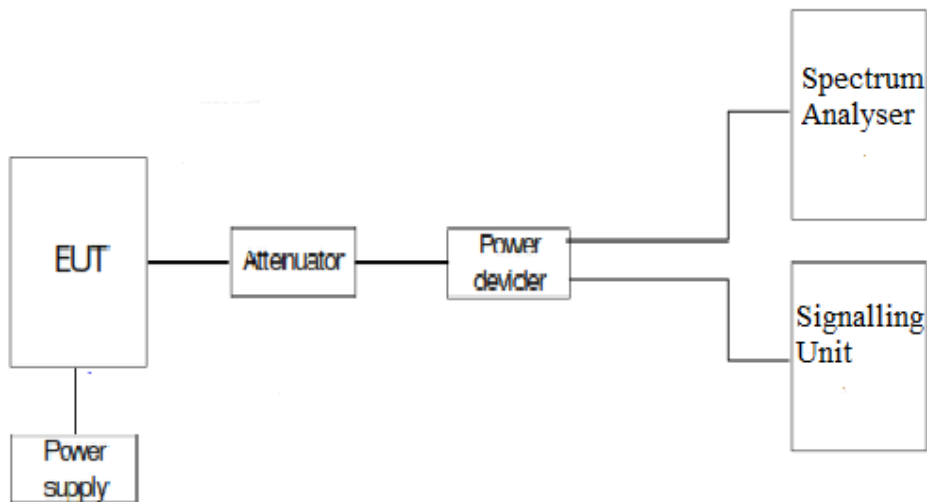
At  $P_o$  transmitting power of 2 watts (33 dBm), the specified minimum attenuation becomes  $43+10\log (P_o)$ . and the level in dBm relative to  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in watts})] = -13 \text{ dBm}$$

### TEST SETUP

The EUT RF output connector was connected to a spectrum analyzer and to the Universal Radio Communication Tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50-ohm attenuator and a power splitter.

The reading of the spectrum analyzer is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyzer.



<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

Frequency range 9 KHz – 18 GHz

**GPRS MODULATION.**

Lowest Channel  
No spurious signal was found at less than 10 dB respect to the limit in the frequency range.

Middle Channel  
No spurious signal was found at less than 10 dB respect to the limit in the frequency range.

Highest Channel  
No spurious signal was found at less than 10 dB respect to the limit in the frequency range.

**EDGE MODULATION.**

Lowest Channel  
No spurious signal was found at less than 10 dB respect to the limit in the frequency range.

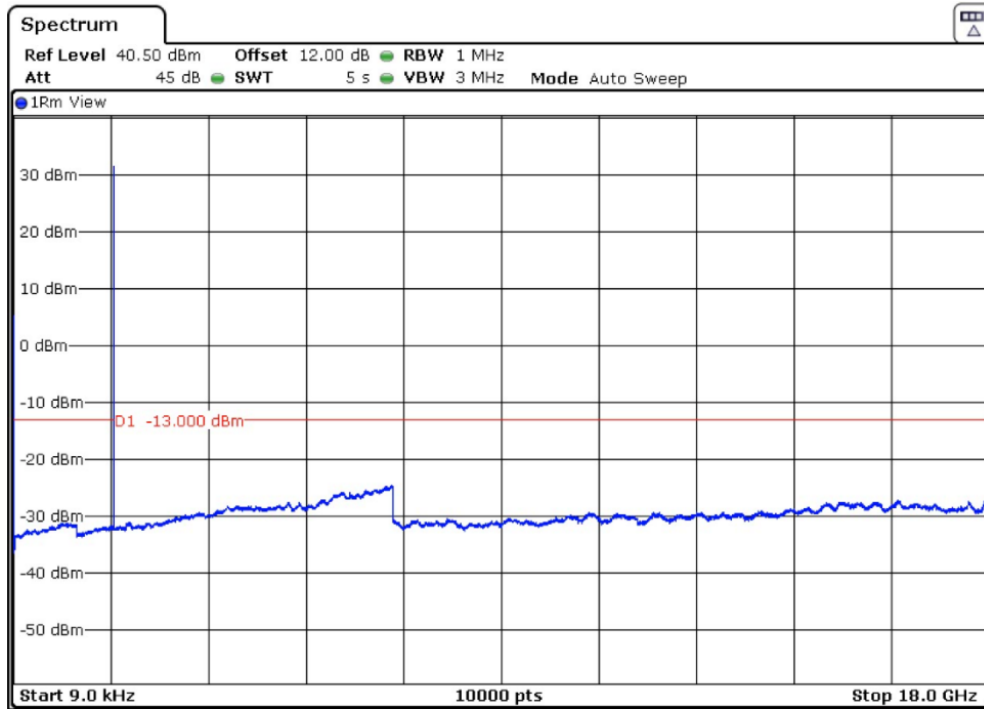
Middle Channel  
No spurious signal was found at less than 10 dB respect to the limit in the frequency range.

Highest Channel  
No spurious signal was found at less than 10 dB respect to the limit in the frequency range.

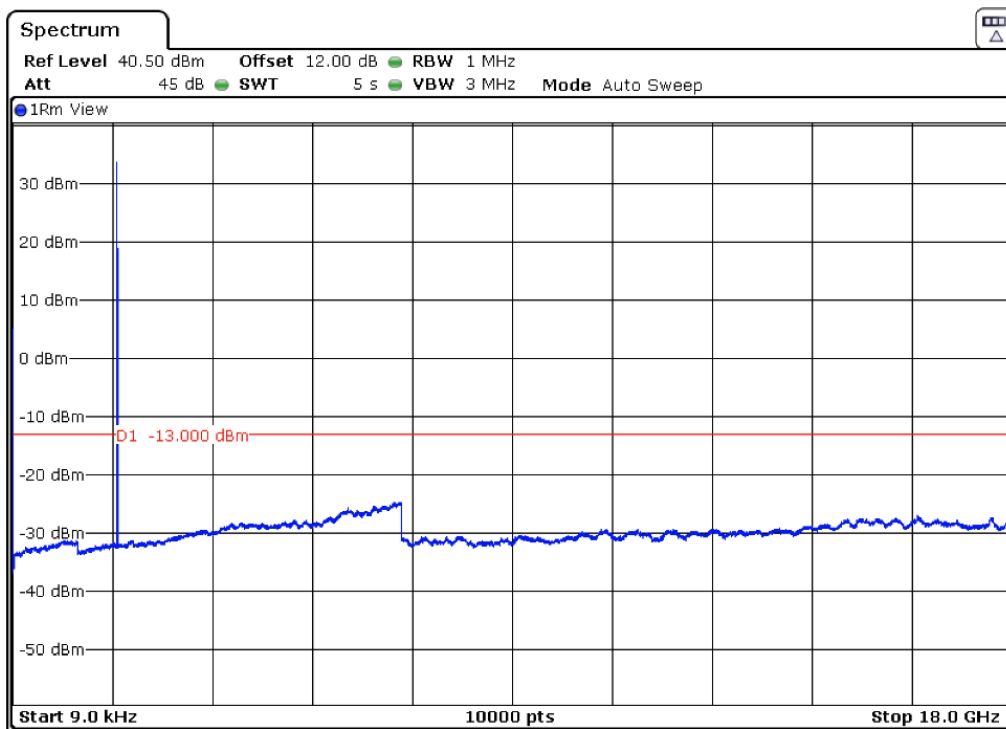
**TEST RESULTS (Cont.):**

**GPRS MODULATION.**

**Lowest Channel**



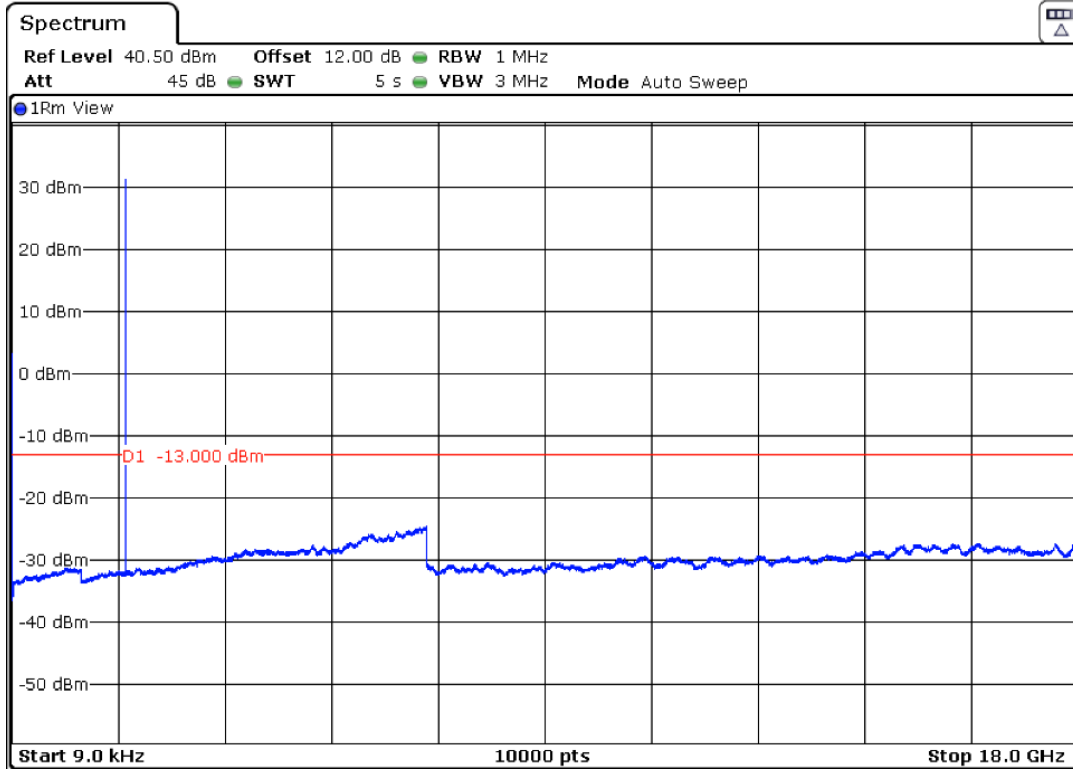
**Middle Channel**





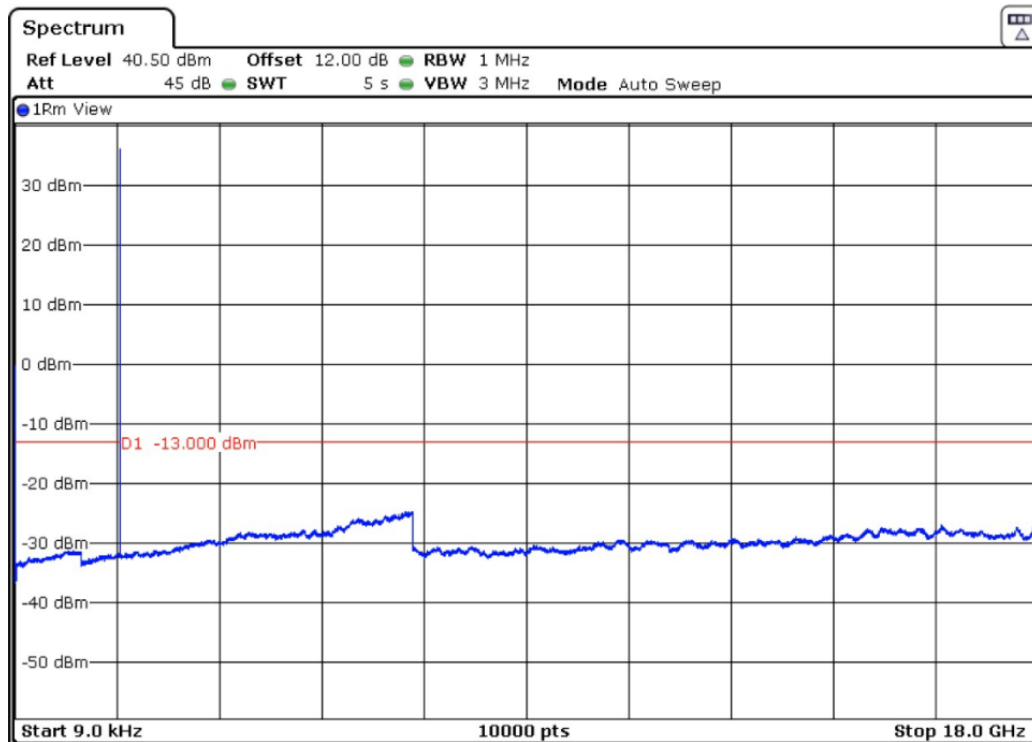
**TEST RESULTS (Cont):**

Highest Channel



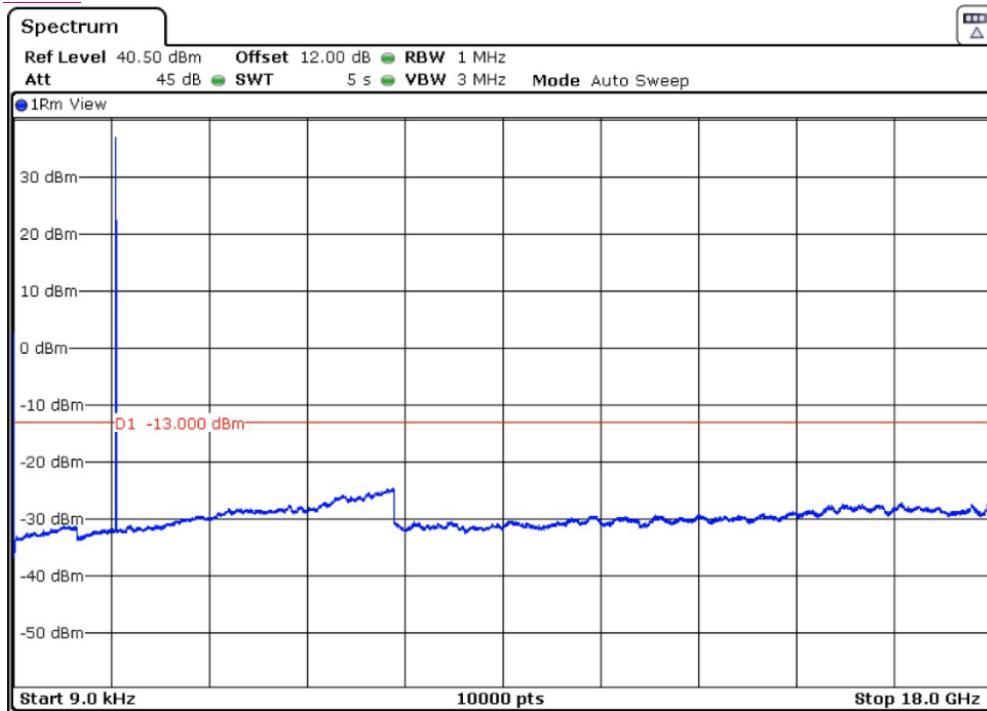
EDGE MODULATION.

Lowest Channel

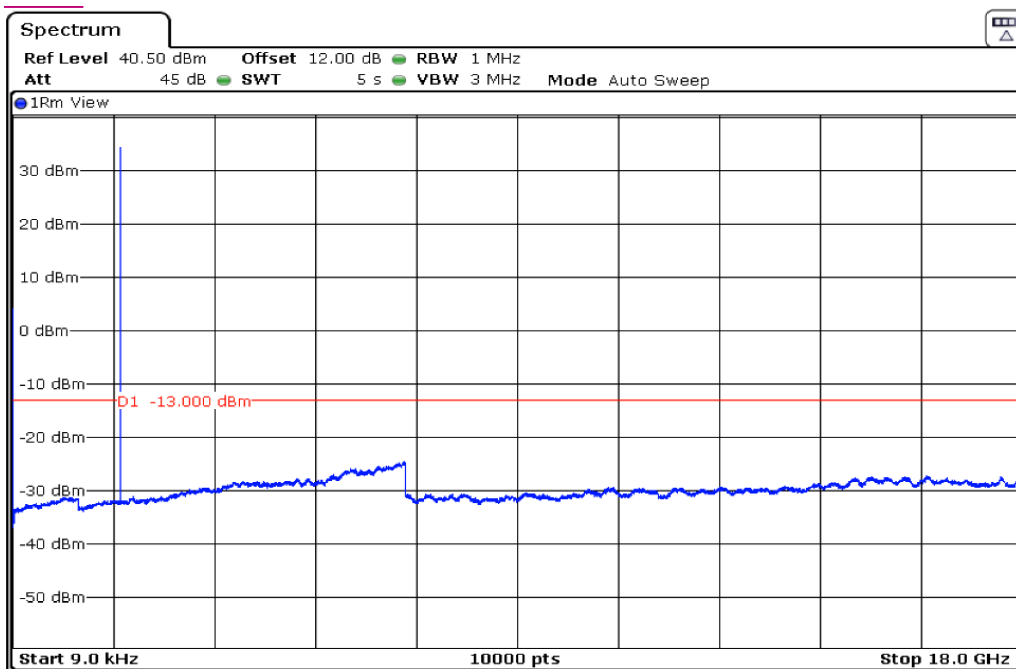


**TEST RESULTS (Cont):**

Middle Channel



Highest Channel



## TEST A.6: SPURIOUS EMISSIONS AT ANTENNA TERMINALS AT BLOCK EDGES

<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC § 24.238 / RSS 133- Clause 6.5

### LIMITS

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in watts.

At  $P_o$  transmitting power of 2 watts (33 dBm), the specified minimum attenuation becomes  $43+10\log (P_o)$ . and the level in dBm relative to  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in watts})] = -13 \text{ dBm}$$

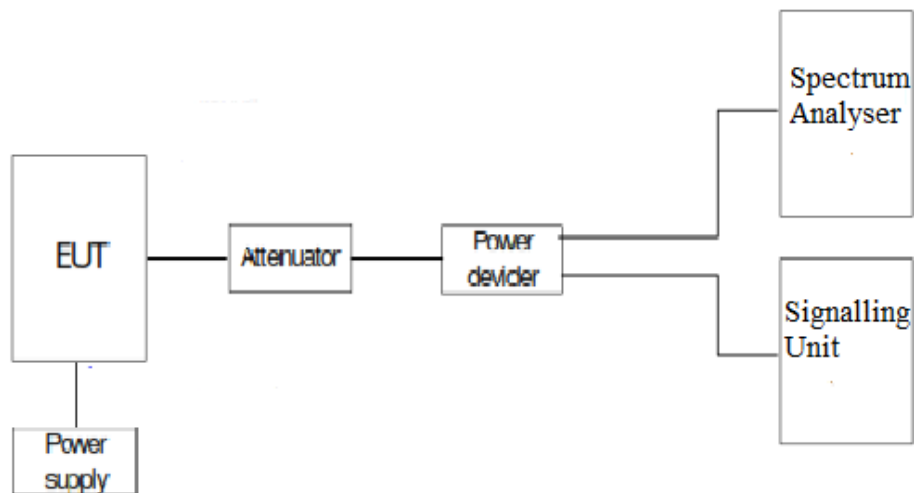
### TEST SETUP

The EUT RF output connector was connected to a spectrum analyzer and to the Universal Radio Communication Tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50 ohm attenuator and a power splitter.

The reading of the spectrum analyzer is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyzer.

For LTE mode the configuration of modulation which is the worst case for conducted power was used.

As indicated in FCC part 24, in the 1 MHz bands immediately outside and adjacent to the licensee's frequency block or band, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.



<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

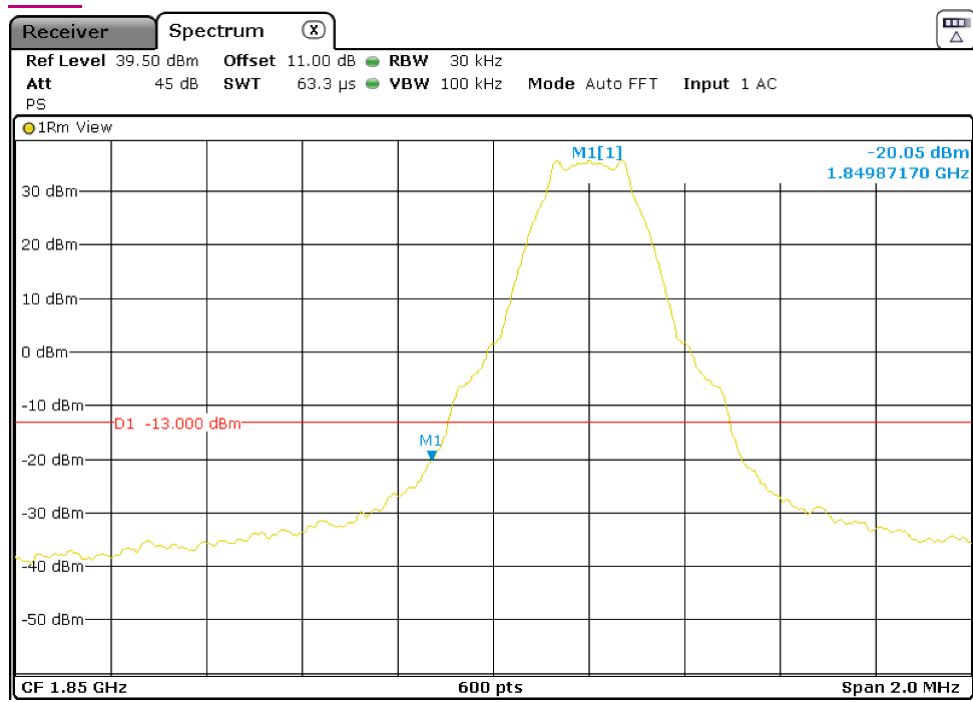
GPRS MODULATION	RB=1 Offset =0 BW = 5 MHz	RB=1 Offset =0 BW = 10 MHz
Maximum measured level at lowest and Highest Block Edge at antenna port (dBm)	-20.05	-19.08

EDGE MODULATION	RB=25 Offset =0 BW = 5 MHz	RB=50 Offset =0 BW = 10 MHz
Maximum measured level at lowest and Highest Block Edge at antenna port (dBm)	-16.92	-20.88

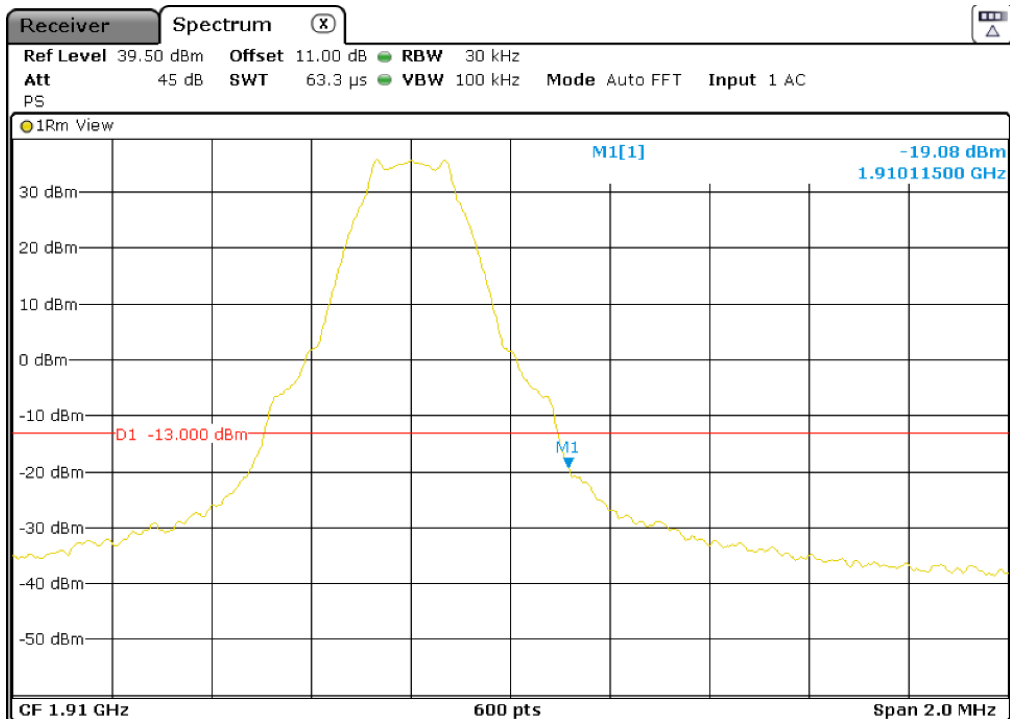
### TEST RESULTS (Cont):

GPRS MODULATION.

Lowest Channel



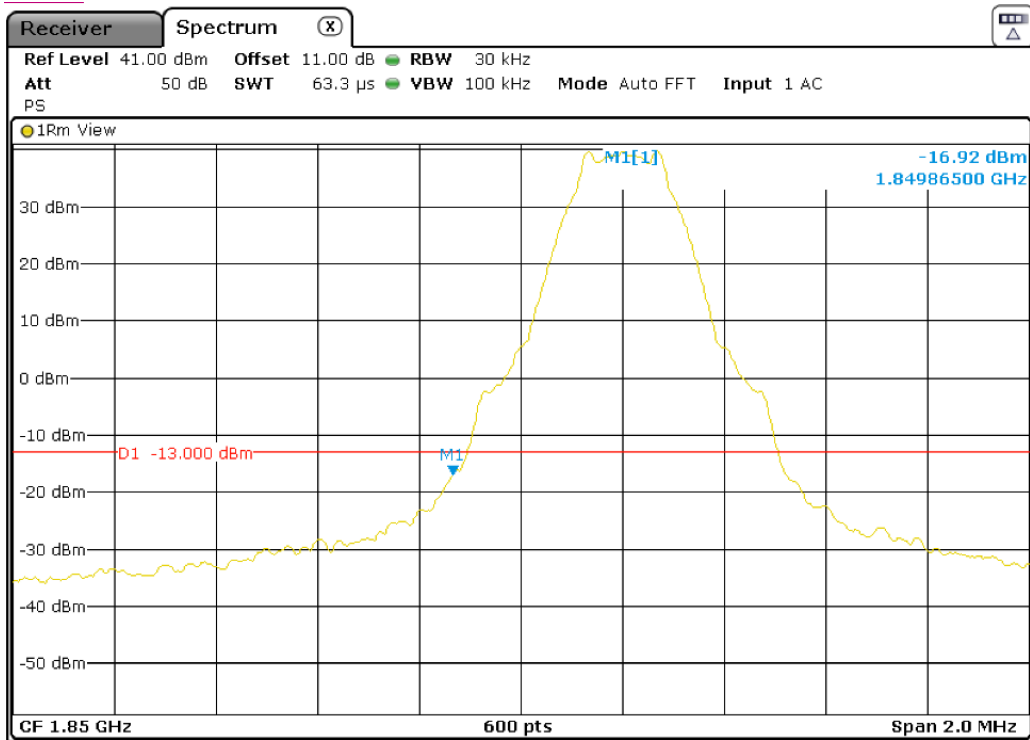
Highest Channel



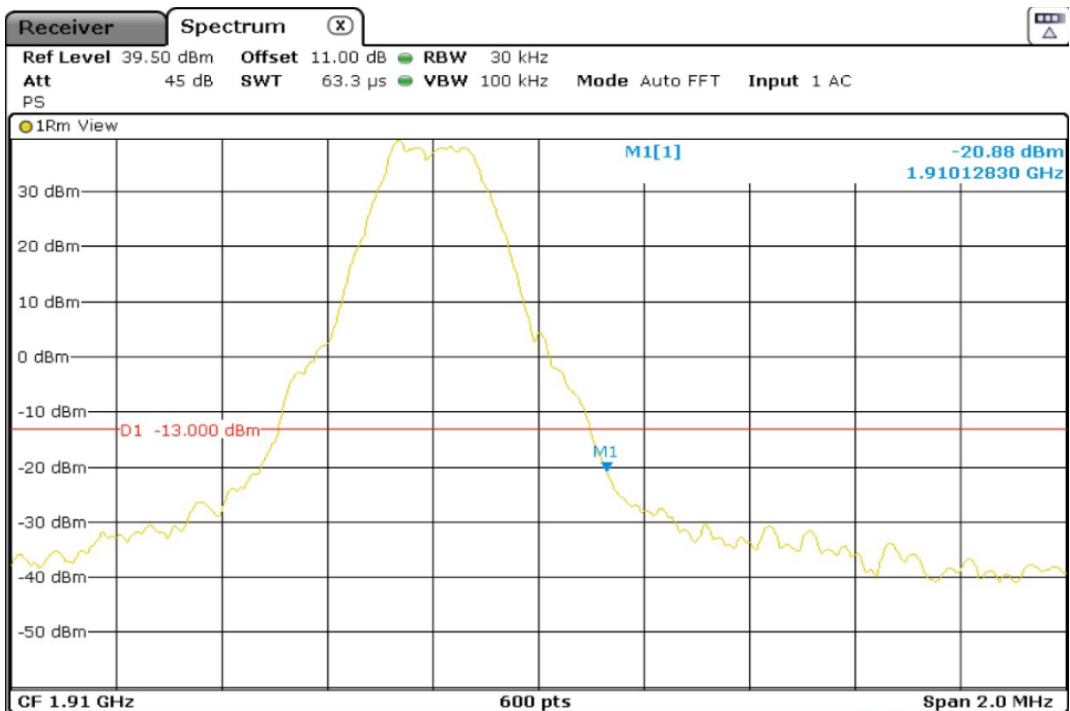
**TEST RESULTS (Cont):**

**EDGE MODULATION.**

**Lowest Channel**



**Highest Channel**



## TEST A.7: RADIATED EMISSIONS

<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC §2.1053 and §24.238 /RSS-133 Clause 6.5

### LIMITS

According to specification, the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least  $43 + 10 \log (P)$  dB. P in watts.

At  $P_o$  transmitting power of 2 watts (33 dBm), the specified minimum attenuation becomes  $43+10\log (P_o)$ . and the level in dBm relative to  $P_o$  becomes:

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in watts})] = -13 \text{ dBm}$$

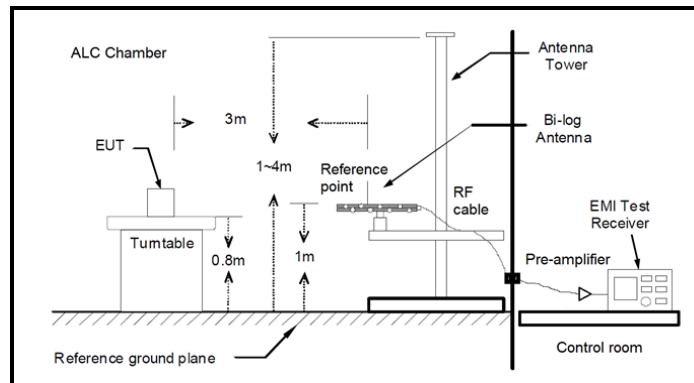
### TEST SETUP

The measurement was performed with the EUT inside an anechoic chamber. The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency generated within the equipment.

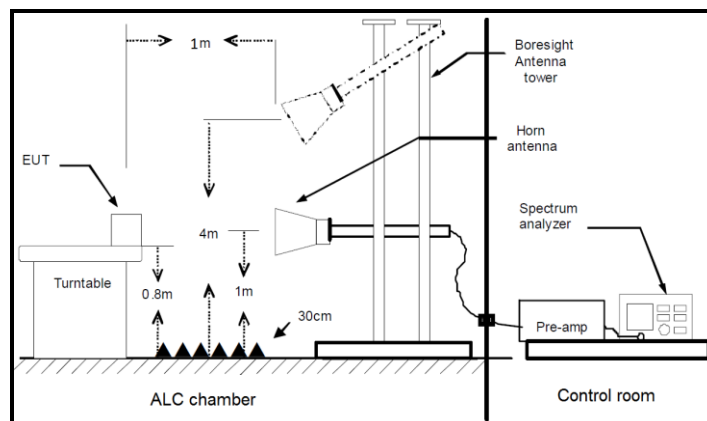
The EUT was placed on a non-conductive stand at a 3-meter distance from the measuring antenna for measurements below 1 GHz and at 1-meter distance for measurements above 1 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum reading was recorded.

Radiated measurements < 1GHz



Radiated measurements > 1GHz



<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

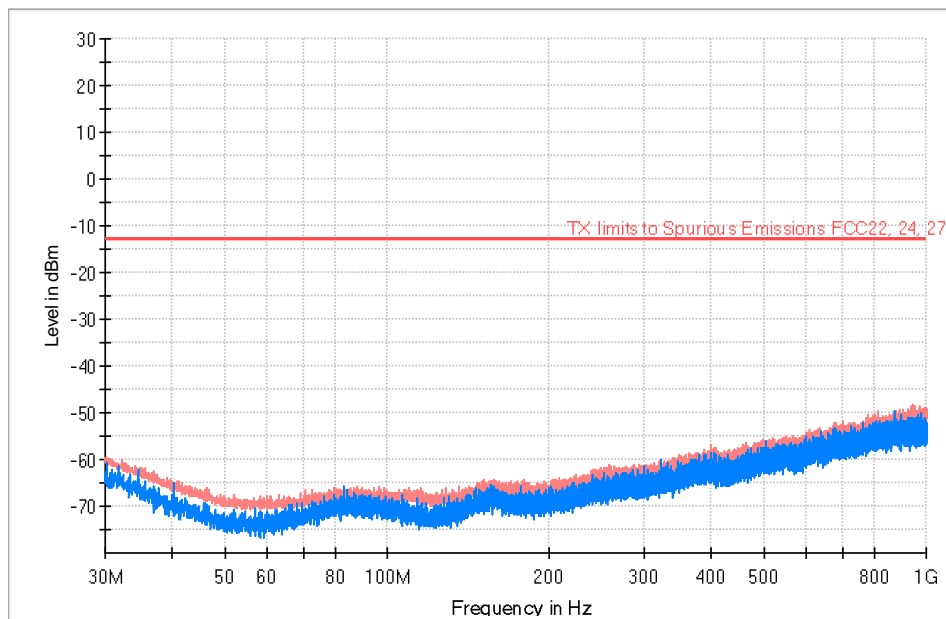
A preliminary scan determined the GPRS Modulation as the worst case. The configuration of Resource Blocks which is the worst case for conducted power was used.

The following plots show the results for this configuration.

No spurious signal was found at less than 20dB respect to the limit in all the frequency ranges.

<b>TEST RESULTS (Cont):</b>	Low Channel
-----------------------------	-------------

FREQUENCY RANGE: 30-1000 MHz



— PK+\_MAXH    — PK+\_CLRWR    — TX limits to Spurious Emissions FCC22, 24, 27

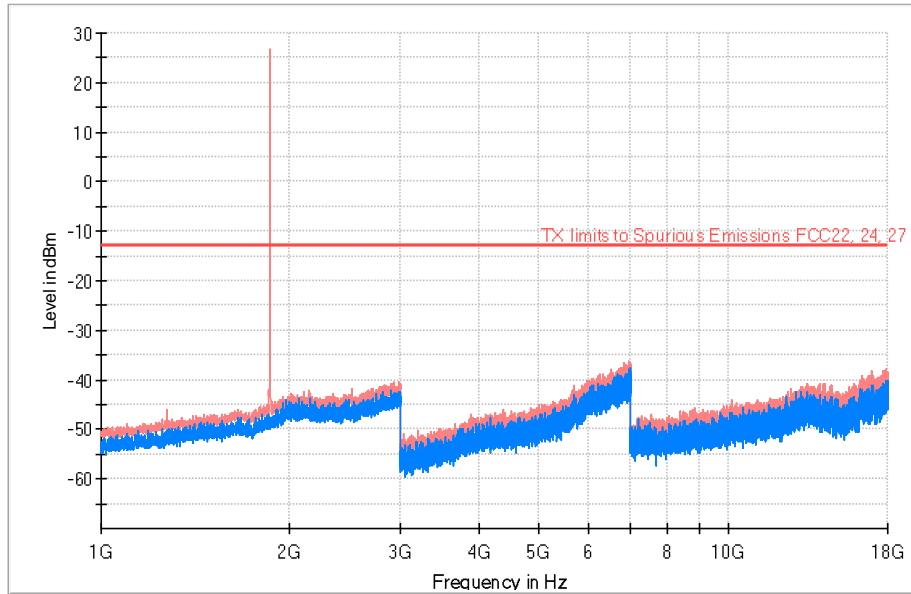


**TEST RESULTS (Cont):**

Low Channel

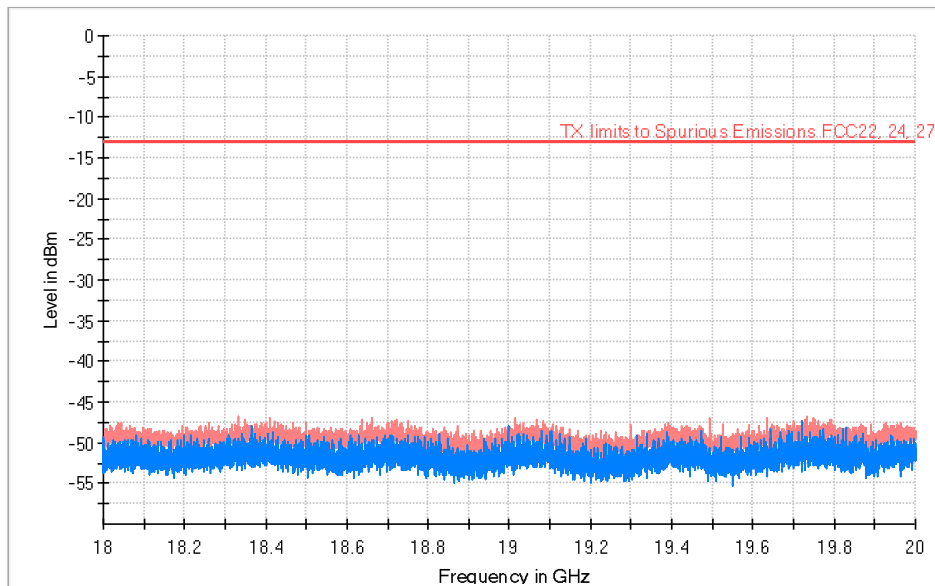
**FREQUENCY RANGE: 1-18 GHz**

Frequency (MHz)	PK+ _CLRWR (dBm)	PK+ _MAXH (dBm)	Comment
1860.000000	-48.59	26.75	Fundamental



PK+ \_MAXH PK+ \_CLRWR TX limits to Spurious Emissions FCC22, 24, 27

**FREQUENCY RANGE: 18-20 GHz**

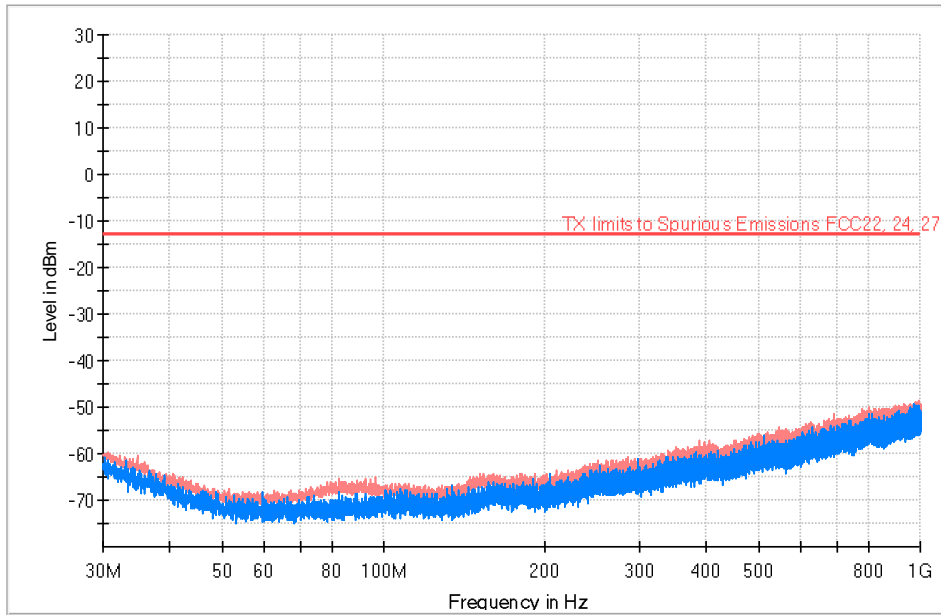


PK+ \_MAXH PK+ \_CLRWR TX limits to Spurious Emissions FCC22, 24, 27

TEST RESULTS (Cont):

Mid Channel

FREQUENCY RANGE: 30MHz -1 GHz



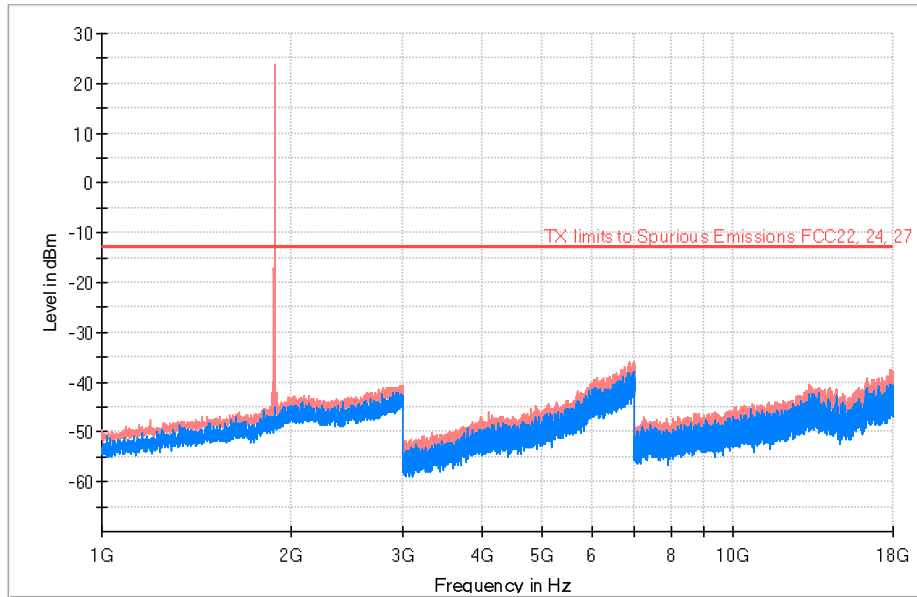
PK+\_MAXH PK+\_CLRWR TX limits to Spurious Emissions FCC22, 24, 27

**TEST RESULTS (Cont):**

Mid Channel

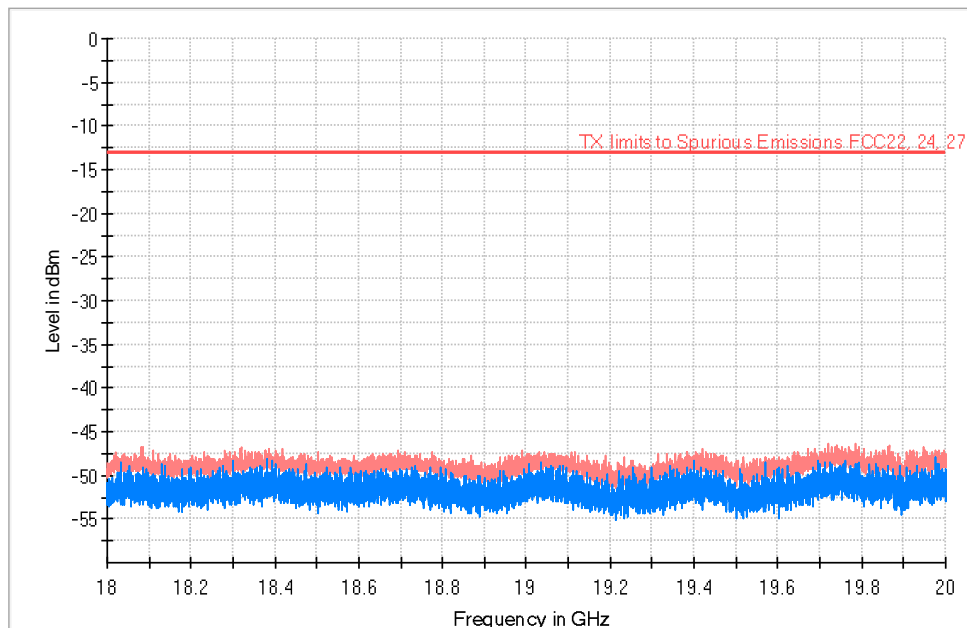
**FREQUENCY RANGE: 1-18 GHz**

Frequency (MHz)	PK+ CLRWR (dBm)	PK+ MAXH (dBm)	Comment
1880.000000	-48.95	23.77	Fundamental



PK+ MAXH PK+ CLRWR TX limits to Spurious Emissions FCC22, 24, 27

**FREQUENCY RANGE: 18-20 GHz**

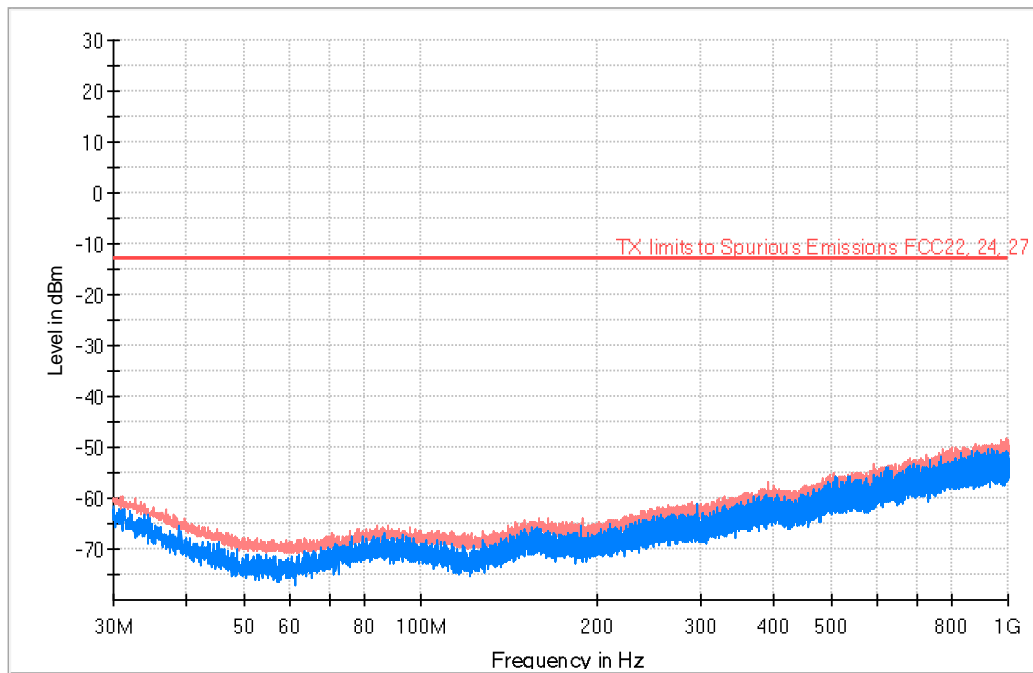


PK+ MAXH PK+ CLRWR TX limits to Spurious Emissions FCC22, 24, 27

TEST RESULTS (Cont):

High Channel

FREQUENCY RANGE: 30MHz-1 GHz



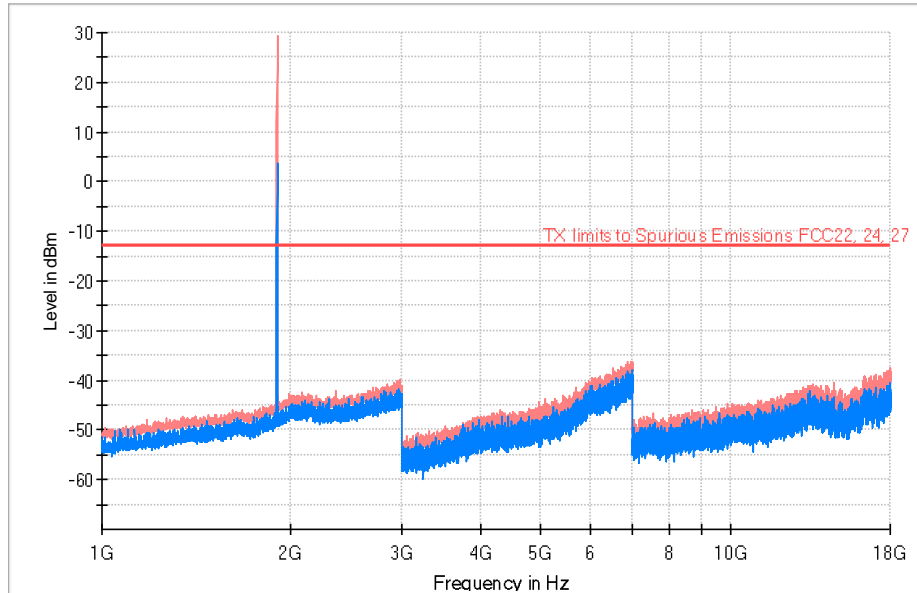
PK+\_MAXH PK+\_CLPWR TX limits to Spurious Emissions FCC22, 24, 27

**TEST RESULTS(Cont.):**

High Channel

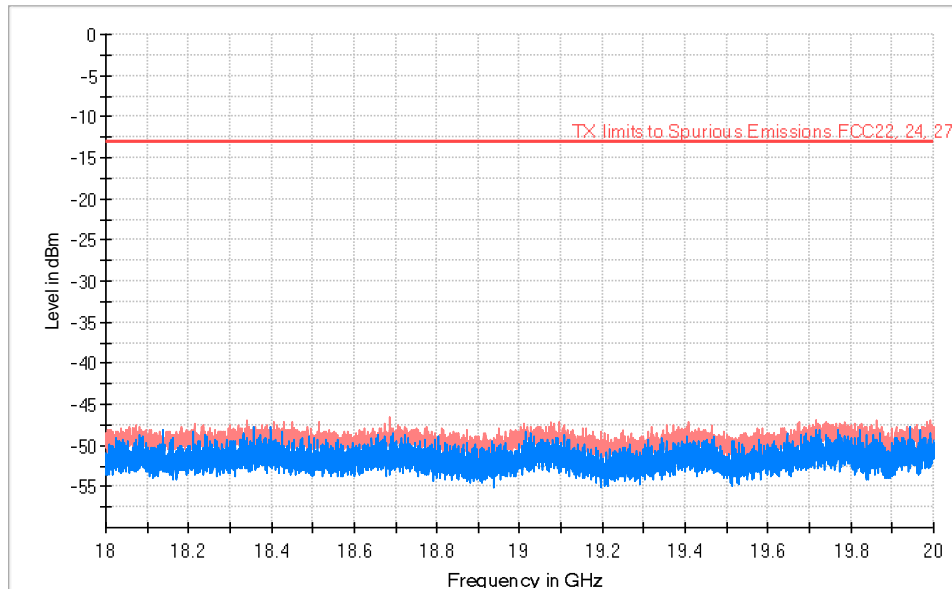
FREQUENCY RANGE: 1-18 GHz

Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
1900.00000	3.72	29.22	Fundamental



PK+\_MAXH PK+\_CLRWR TX limits to Spurious Emissions FCC22, 24, 27

FREQUENCY RANGE: 18-20 GHz



PK+\_MAXH PK+\_CLRWR TX limits to Spurious Emissions FCC22, 24, 27

## Appendix B: Test Results for 3G

## Appendix B Content

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## PRODUCT INFORMATION

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The following information is provided by the client

Information	Description
Modulation	WCDMA, HSPA
Maximum RF Output Power	24 dBm
Operation mode:	
- Operating Frequency Range	Band 2: 1850-1910 MHz
- Nominal Channel Bandwidth	Band 2: 5 MHz
Extreme operating conditions	
- Temperature range	T <sub>nom</sub> = +15 to + 35 T <sub>min</sub> = -30 T <sub>max</sub> = +50
Antenna type	External attachable Antenna.
Antenna gain	4 dBi
Nominal Voltage	
- Supply Voltage	3.8 Vdc
- Type of power source	DC voltage from power supply.



## DESCRIPTION OF TEST CONDITIONS

The worst case was found when positioned as the table below. Following channel(s) was (were) selected for the final test as listed below:

TEST CONDITIONS	DESCRIPTION			
TC#01 Band 2	<u>Power supply (V):</u> $V_{\text{nominal}} = 3.8 \text{ Vdc}$			
	<u>Test Frequencies for Conducted tests:</u> -Lowest Channel: 9263 (1852.6 MHz) -Middle Channel: 9400 (1880 MHz) -Highest Channel: 9537 (1907.4 MHz)			
	<u>Test Frequencies for Radiated tests:</u>			
	Available Frequencies	Tested Frequency	Channel Bandwidth	Modulation
	1850 to 1910 MHz	1852.6 MHz 1880 MHz 1907.4 MHz	5 MHz	WCDMA
	Note: This device was tested under all channels and modulations. The worst case found in WCDMA modulation.			

## TEST B.1: RF OUTPUT POWER

<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC §2.1046 and §24.232 / RSS-133 Clause 6.4

### LIMITS

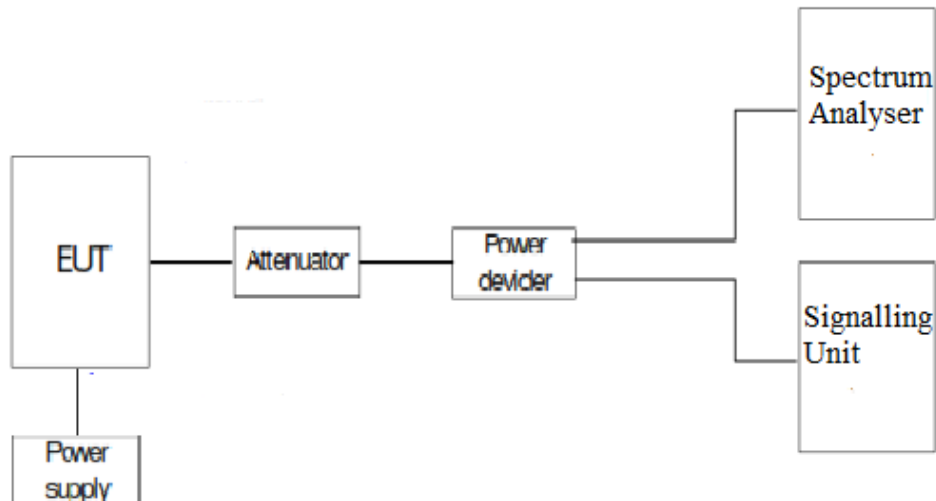
Fixed, mobile, and portable (hand-held) stations are limited to 2-watt EIRP (30 dBm). Fixed stations are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications. The peak-to-average ratio (PAR) of the transmission shall not exceed 13 dB.

### RSS-133 Clause 6.4

The equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. Moreover, base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts.

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

### TEST SETUP



<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

WCDMA Modulation:

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)	PAPR (dB)
Lowest	24.45	4.0	28.45	2.7
Middle	24.4	4.0	28.4	3.04
Highest	24.39	4.0	28.39	2.9
Measurement uncertainty (dB)			<±0.95	

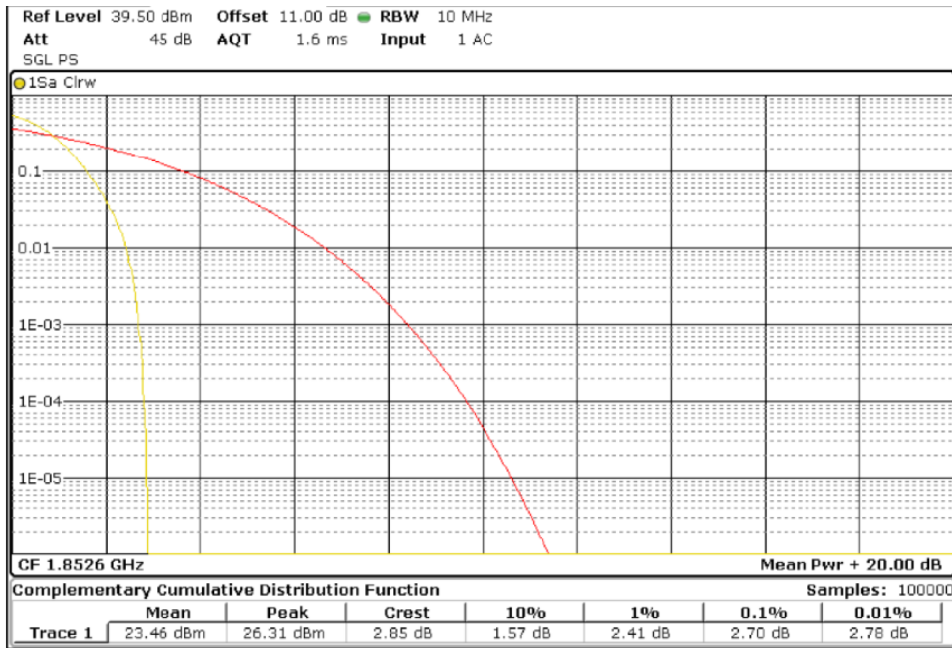
HSPA Modulation:

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)
Lowest	22.6	4.0	26.6
Middle	23.5	4.0	27.5
Highest	23.29	4.0	27.29
Measurement uncertainty (dB)			<±0.95

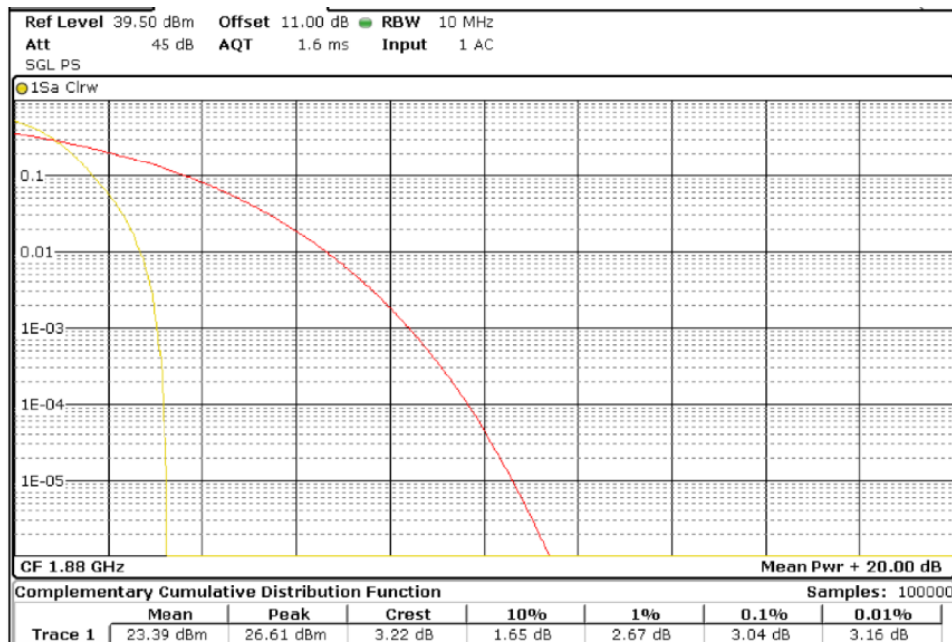
**TEST RESULTS (Cont):**

WCDMA:

Lowest channel

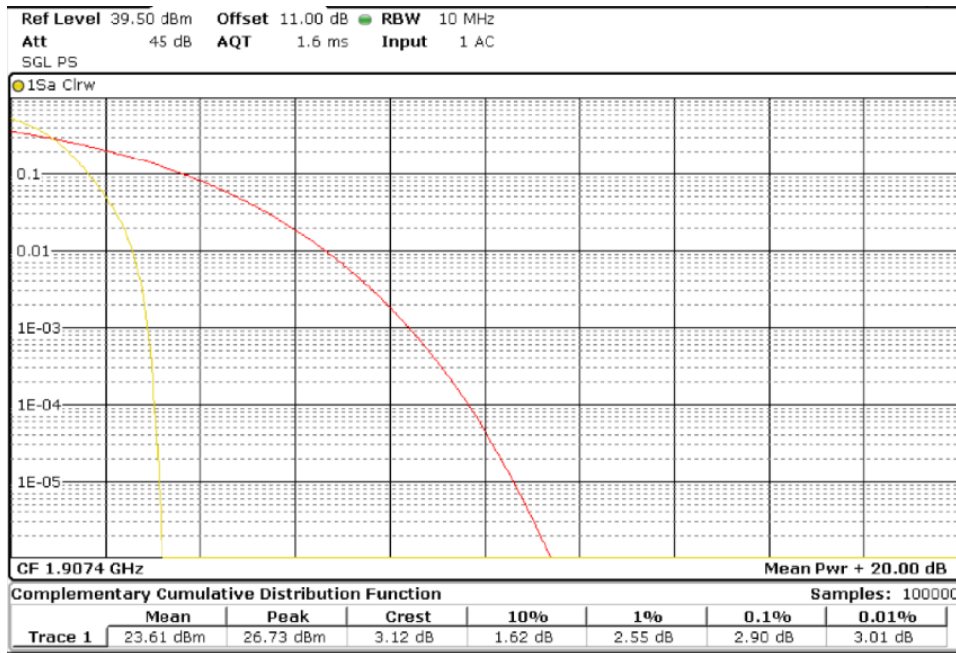


Middle channel



**TEST RESULTS (Cont):**

Highest channel



## TEST B.2: MODULATION CHARACTERISTICS

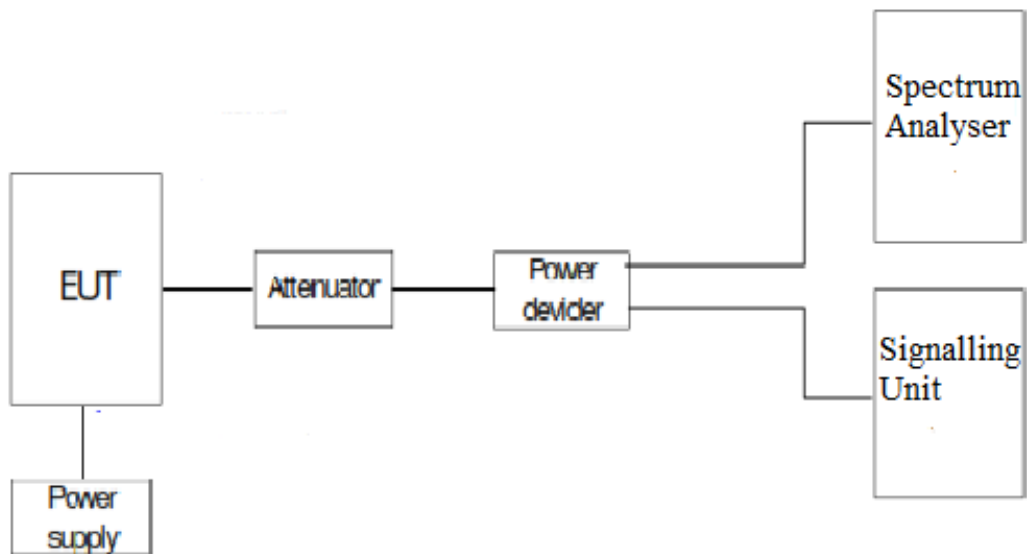
<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC §2.1047 / RSS-133 Clause 6.3

### LIMITS

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

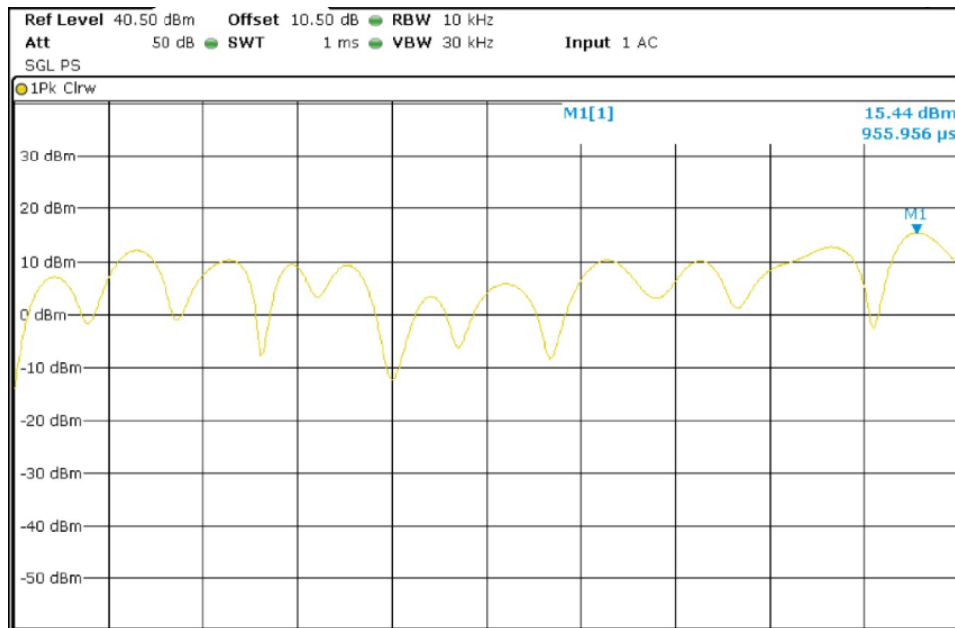
The devices shall employ digital modulation techniques.

### TEST SETUP

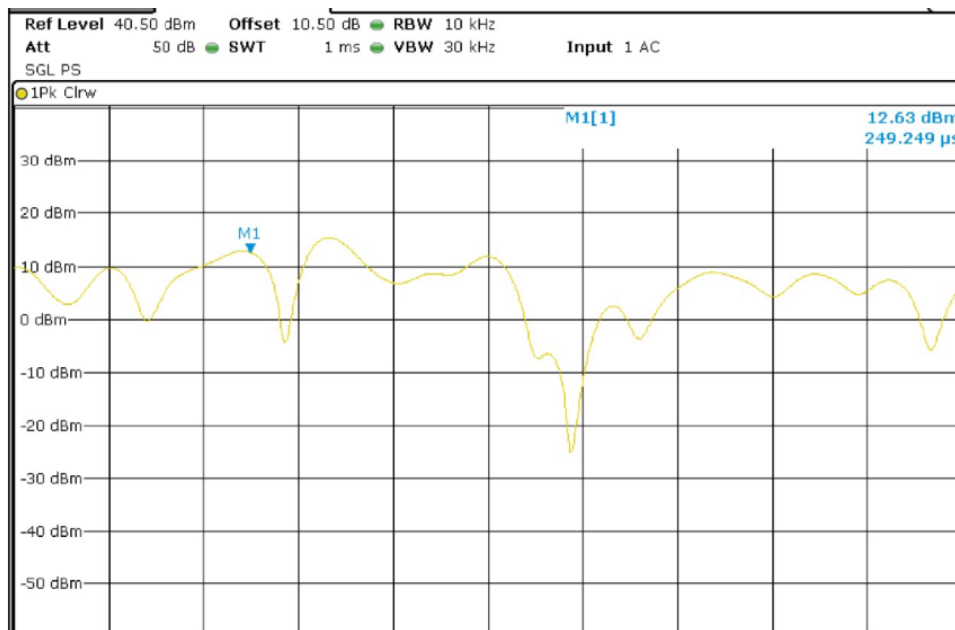


<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

WCDMA Modulation



HSPA Modulation



## TEST B.3: FREQUENCY STABILITY

<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC §2.1055 and § 24.235 / RSS-133 Clause 6.3

### LIMITS

The frequency stability shall be enough to ensure that the fundamental emissions stay within the authorized bands of operation.

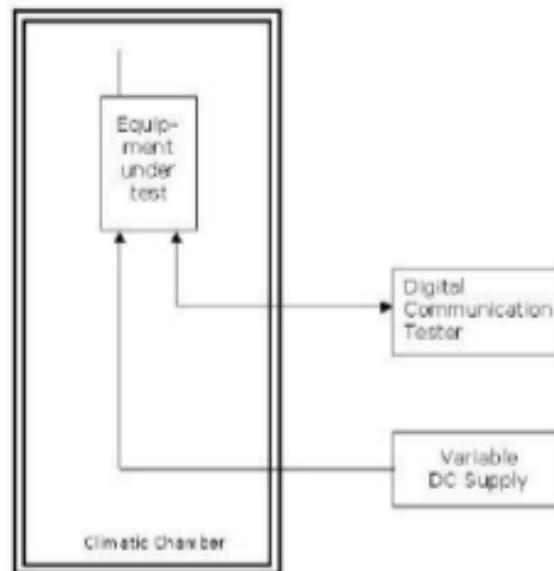
### **TEST SETUP**

The frequency tolerance measurements over temperature variations were made over the temperature range of  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . The EUT was placed inside a climatic chamber and the temperature was raised hourly in  $10^{\circ}\text{C}$  steps from  $-30^{\circ}\text{C}$  up to  $+50^{\circ}\text{C}$ .

The supply voltage was varied between 85% and 115% of nominal voltage.

The EUT was set in "call mode" in the middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.

For LTE mode the QPSK modulation was used for the test as it is the worst case for conducted power.





<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

GPRS MODULATION.

Frequency stability over temperature variations

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
50	-0.56	0.0145	0.00000145
40	-1.27	0.0133	0.00000133
30	-1.16	0.0106	0.00000106
20	2.65	0.0108	0.00000108
10	0.09	0.0129	0.00000128
0	0.24	-0.0143	-0.00000143
-10	1.56	-0.0062	-0.00000062
-20	-0.94	0.0236	0.00000236
-30	0.46	0.0159	0.00000159

Frequency stability over voltage variations

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	4.37	0.49	-0.0087	-0.00000087
Vmin	3.23	1.1	0.0147	0.00000147

## TEST B.4: OCCUPIED BANDWIDTH

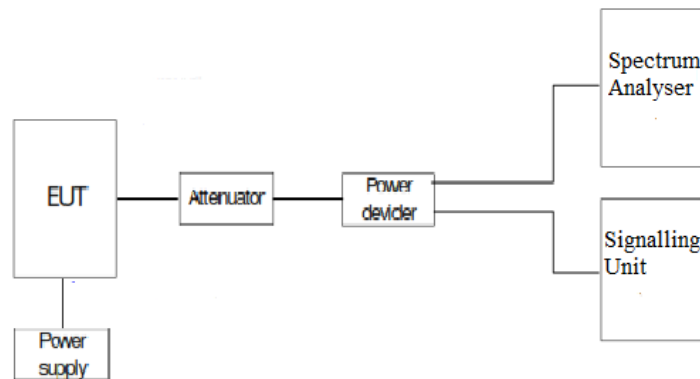
<b>LIMITS:</b>	Product standard:	FCC Part 24 / IC RSS-133
	Test standard:	FCC § 2.1049 / RSS-133 Clause 2.3

### LIMITS

Reference only.

### TEST SETUP

The occupied bandwidth measurement was performed at the output terminals of the EUT using an attenuator, power splitter and spectrum analyzer. The EUT was controlled via the Universal Radio Communication Tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation. The 99% occupied bandwidth and the -26 dBc bandwidth were measured directly using the built-in bandwidth measuring option of spectrum analyzer.



<b>TESTED SAMPLES:</b>	S/01
<b>TESTED CONDITIONS MODES:</b>	TC#01
<b>TEST RESULTS:</b>	PASS

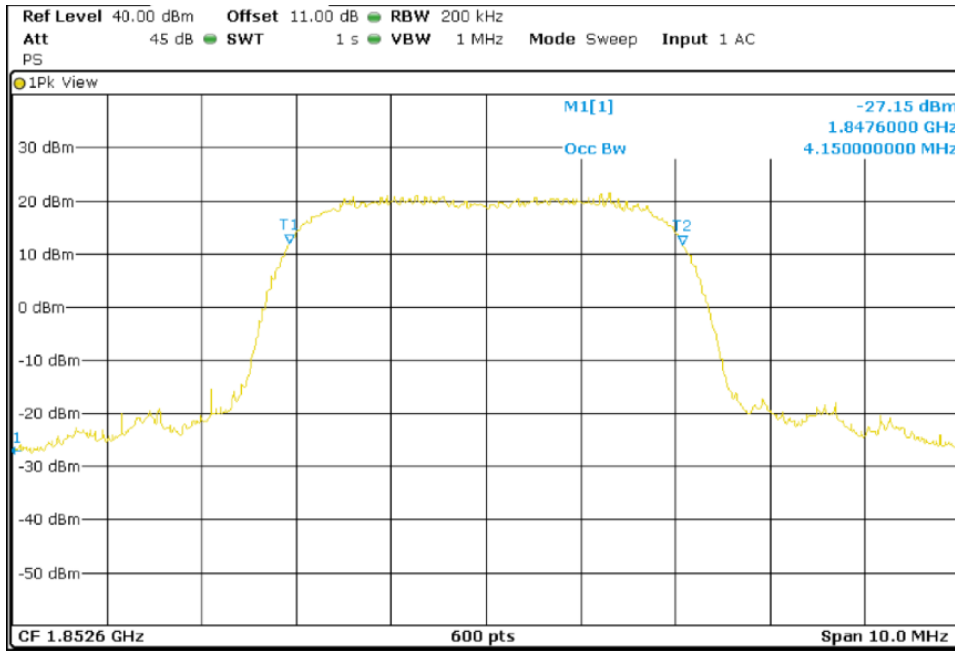
### WCDMA MODULATION.

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4.15	4.15	4.13
-26 dBc bandwidth (kHz)	4.72	4.70	4.72

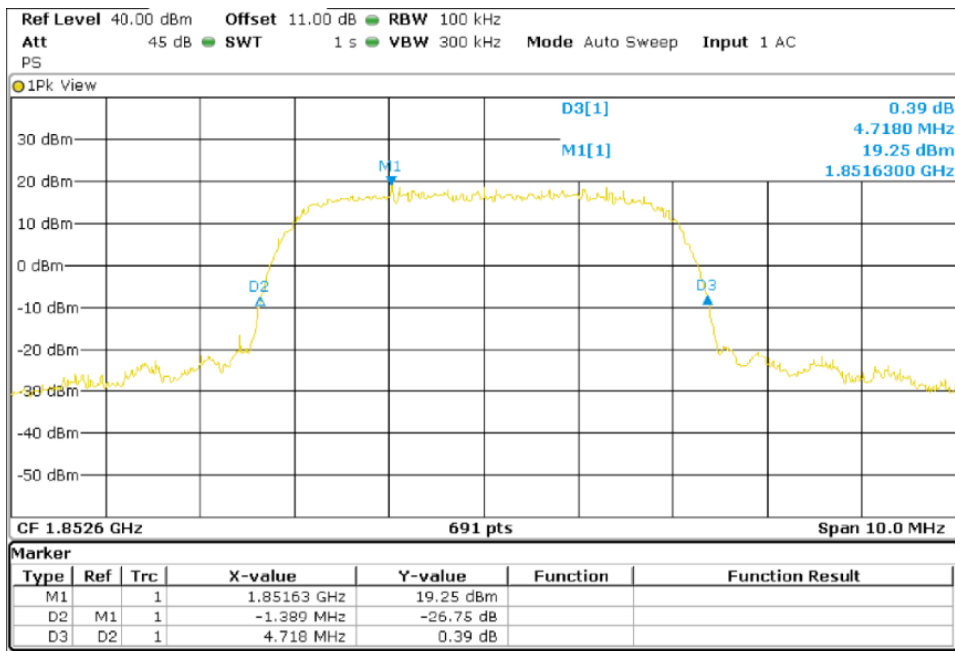
**TEST RESULTS (Cont):**

WCDMA MODULATION.

Lowest Channel 99% Occupied Bandwidth

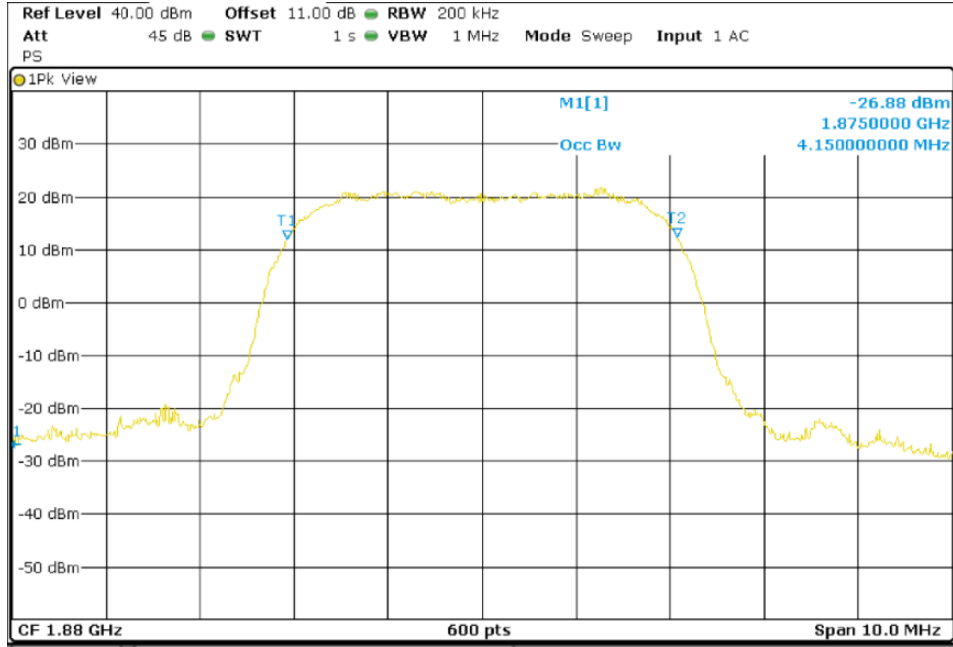


Lowest Channel -26dBc Bandwidth kHz



**TEST RESULTS (Cont):**

Middle Channel 99% Occupied Bandwidth



Middle Channel 26dBc Bandwidth kHz

