DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29 507 456

ENSAYOS Nº 51/LE147

Test report No:
NIE: 57478RRF.012

Test report

REFERENCE STANDARD:
USA FCC Part 22
CANADA RSS-132

(*) Identification of item tested	Secure Smartphone
(*) Trademark	Bittium
(*) Model and /or type reference	Tough Mobile 2
Other identification of the product	HW Version: 0302 SW Version: 40.1 FCC ID: V27SD-61 IC: 3282B-SD61
(*) Features	LTE • 3GPP Rel12 • FDD/TDD Cat13/5, • DL 400Mbit/s, • UL 75 Mbit/s UMTS/HSPA • 3GPP rel8, HSPA+, • DL 42 Mbit/s, • UL 5.76 Mbit/s GSM/GPRS/EDGE Complementary Radios • Wi-Fi 802.11 a/b/g/n/ac (2.4 and 5 GHz), 2 x 2 MIMO • BT 5.0 • NFC
Applicant	BITTIUM WIRELESS OY Ritaharjuntie 1, 90590 Oulu, Finland
Test method requested, standard	USA FCC Part 22 (10-1-18 Edition). CANADA RSS-132 Issue 3, Jan. 2013. ANSI C63.26-2015. ANSI/TIA-603-E: 2016
Summary	IN COMPLIANCE

Approved by (name / position & signature)	José Carlos Luque RF Lab. Supervisor 74841983Y JOSE CARLOS LUQUE (C:A29507456) Firmado digitalmente por 74841983Y JOSE CARLOS LUQUE (C:A29507456) Fecha: 2019.08.27 13:54:13 +02'00'
Date of issue	2019-08-27
Report template No	FDT08_22 (*) “Data provided by the client”

Index

Competences and guarantees 4
General conditions 4
Uncertainty 4
Data provided by the client 4
Usage of samples 5
Test sample description 6
Identification of the client 7
Testing period and place 7
Document history 7
Environmental conditions 7
Remarks and comments 8
Testing verdicts 9
Summary 9
Appendix A: Test results for FCC PART 22 / RSS-132 10

Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

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

DEKRA Testing and Certification S.A.U. 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 Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. 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 particular item under test established in this document. **IMPORTANT:** No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification S.A.U.

General conditions

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 Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

2. The sample of Tough Mobile 2 consists of a Secure Smartphone targeted for professional use where High Security is required.

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

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
57478C/032	Secure Smartphone	Tough Mobile 2	---	2018-11-26
57478C/033	USB cable	---	---	2018-11-26
57478C/034	AC/DC power adapter	---	---	2018-11-26
57478C/039	Headphones	---	---	2018-11-26

Sample S/01 has undergone the following test(s): All radiated tests indicated in Appendix A.

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
57478C/016	Secure Smartphone	Tough Mobile 2	---	2018-10-25

Sample S/02 has undergone the following test(s): All conducted tests indicated in Appendix A.

Test sample description

Ports…… :	Port name and description	Cable				
		Specified length [m]	Attached during test	Shielded		
	Not provided.		☐	☐		
	-		☐	☐		
	-		☐	☐		
	-		☐	☐		
Supplementary information to the ports…… :	N/A					
Rated power supply .....:	Voltage and Frequency	Reference poles				
		L1	L2	L3	N	PE
	☐ AC:	☐	☐	☐	☐	☐
	☒ DC: 3.6 – 4.35 Vdc.					
	☐ DC:					
Rated Power .....:	Not provided					
Clock frequencies.....:	Not provided					
Other parameters .....:	FCC ID: V27SD-61 IC: 3282B-SD61					
Software version .....:	40.1					
Hardware version .....:	0302					
Dimensions in cm (L x W x D).....:	Not provided					
Mounting position .....:	☐ Table top equipment					
	☐ Wall/Ceiling mounted equipment					
	☐ Floor standing equipment					
	☒ Hand-held equipment					
	☐ Other:					
Modules/parts.....:	Module/parts of test item	Type	Manufacturer			
	-					
Accessories (not part of the test item) .....:	Description	Type	Manufacturer			
	-					
	-					
	-					
Documents as provided by the applicant.....:	Description	File name	Issue date			
	-					

Identification of the client

BITTIUM WIRELESS OY
Ritaharjuntie 1, 90590 Oulu, Finland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2018-11-29
Date (finish)	2019-04-30

Document history

Report number	Date	Description
57478RRF.012	2019-08-27	First release

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % 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 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 35 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Jaime Barranquero, Ignacio Cabra, José Alberto Aranda, Carolina Postigo, Nicolás Salguero, José Gabriel Pendón, José Manuel Jiménez, Francisco José Alcaide.

Used instrumentation:

Conducted Measurements

		Last Calibration	Due Calibration
1.	Chamber HERAEUS VMT 04/35	2018/06	2020/06
2.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2018/05	2019/05
3.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2019/02	2020/02
4.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2018/04	2019/04
5.	Spectrum Analyzer PSA 3Hz-26.5 GHz AGILENT TECHNOLOGIES E4440A	2017/10	2019/10
6.	Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2018/02	2020/02
7.	Signal Analyzer 20 Hz to 8 GHz ROHDE AND SCHWARZ FSQ8	2018/08	2020/08
8.	DC Power Supply 40V/40A Rohde & Schwarz NGPE40	2018/02	2021/02

Radiated Measurements

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	Biconical/Log Antenna 30MHz - 6GHz ETS LINDGREN 3142E	2018/10	2021/10
3.	EMI Test Receiver R&S ESR7	2018/08	2020/08
4.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
5.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
6.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2019/05	2020/05
7.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2019/04	2020/04

Testing verdicts

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

Summary

FCC PART 22 / RSS-132 PARAGRAPH		
Requirement – Test case	**Verdict**	**Remark**
Clause 22.913/RSS-132 Clause 5.4: RF output power	P	(1) (2)
Clause 2.1047/RSS-132 Clause 5.2: Modulation characteristics	P	(1) (2)
Clause 22.355/RSS-132 Clause 5.3: Frequency stability	P	(1) (2)
Clause 2.1049: Occupied Bandwidth	P	(1) (2)
Clause 22.917/RSS-132 Clause 5.5: Spurious emissions at antenna terminals	P	(1) (2)
Clause 22.917/RSS-132 Clause 5.5: Radiated emissions	P	(1) (2)

Supplementary information and remarks:

1. GSM mode has not been tested to prove USA FCC Part 22 compliance because the modulation scheme and the power maximum levels are the same as for GPRS mode.

Taking into account the above comments, testing in GSM mode is redundant for FCC Part 22 as it is the same as GPRS mode. GPRS mode has been tested as indicated on the present test report.

2. HSDPA modulation mode has not been tested to prove USA FCC Part 22 compliance because it is an improved mode of operation only for Downlink (UE reception), but using the normal WCDMA mode for UL (Up Link, UE transmission). Therefore HSDPA has no associated a Power class or modulation scheme different than WCDMA mode for the UL transmission.

Taking into account the above comments, testing in HSDPA modulation mode is redundant for FCC Part 22 as it is the same as WCDMA mode as long as UE transmission is concerned. WCDMA modulation mode has been tested as indicated on the present test report.

Appendix A: Test results for FCC PART 22 / RSS-132

INDEX

TEST CONDITIONS 12
RF Output Power 13
Frequency Stability 23
Modulation Characteristics 26
Occupied Bandwidth 29
Spurious emissions at antenna terminals 37
Spurious emissions at antenna terminals at Block Edges 46
Radiated emissions 52

TEST CONDITIONS

POWER SUPPLY (V):

Vn: 3.8 Vdc
Vmin: 3.6 Vdc (*)
Vmax: 4.2 Vdc (*)

Type of Power Supply: Rechargeable battery.

The subscripts 'n', 'min' and 'max' indicate voltage test conditions (nominal, minimum and maximum respectively), as declared by the applicant.

ANTENNA:

LOW Bands	GAIN	ANTENNA TYPE
2G Band 850 MHz	+0.9 dBi	Internal (Monopole)
3G Band V	+0.9 dBi	Internal (Monopole)

TEST FREQUENCIES:

2G Band 850 MHz:

GPRS and EDGE MODULATIONS:

Lowest Channel (128): 824.2 MHz
Middle Channel (190): 836.6 MHz
Highest Channel (251): 848.8 MHz

3G Band V:

WCDMA and HSUPA MODULATIONS:

Lowest Channel (4132): 826.4 MHz
Middle Channel (4182): 836.4 MHz
Highest Channel (4233): 846.6 MHz

RF Output Power

SPECIFICATION:

FCC §2.1046 and FCC §22.913. The Effective Radiated Power (E.R.P.) of mobile transmitter and auxiliary test transmitter must not exceed 7 Watts (38.45 dBm E.R.P.).

RSS-132. Clause 5.4. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts (38.45 dBm E.R.P.).

In addition, the peak-to-average power ratio (PAPR) of the transmitter 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.

METHOD:

The conducted RF output power measurements were made at the RF output terminals of the EUT using the power meter of the Universal Radio Communication tester R&S CMU200 and CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

The peak-to-average power ratio (PAPR) is measured using an attenuator, power splitter and spectrum analyser with a Complementary Cumulative Distribution Function implemented.

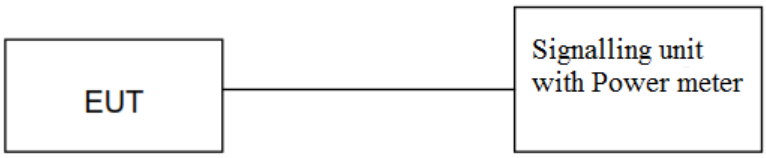
The maximum equivalent isotropically radiated power (e.i.r.p.) is calculated by adding the declared maximum antenna gain (dBi).

The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

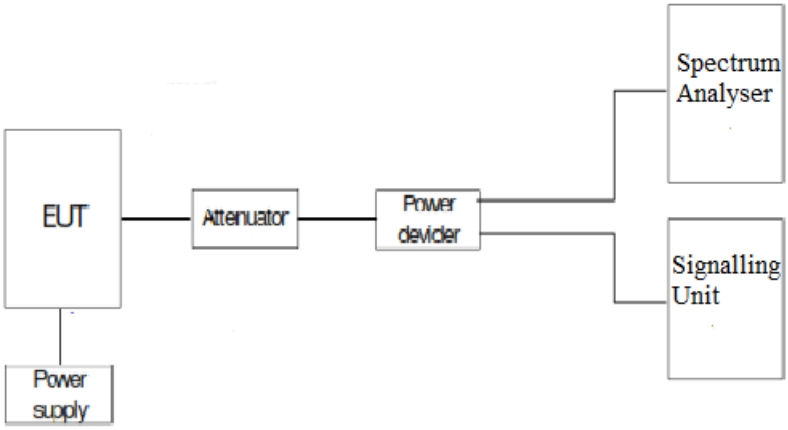
$$E.R.P. = E.I.R.P. - 2.15\ dB$$

TEST SETUP:

1. CONDUCTED AVERAGE POWER:



2. PEAK-TO-AVERAGE POWER RATIO (PAPR):



RESULTS:

1. MAXIMUM OUTPUT POWER (CONDUCTED).

2G Band 850 MHz:

2G Band 850 MHz. GPRS MODULATION.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	32.61	32.95	32.93
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	33.51	33.85	33.83
Maximum effective radiated power E.R.P. (dBm)	31.36	31.70	31.68
PAPR (dB)	0.17	0.18	0.18
Measurement uncertainty (dB)	<±0.66		

2G Band 850 MHz. EDGE MODULATION.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	26.76	26.72	27
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.66	27.62	27.90
Maximum effective radiated power E.R.P. (dBm)	25.51	25.47	25.75
PAPR (dB)	3.25	3.25	3.22
Measurement uncertainty (dB)	<±0.66		

3G Band V:

3G Band V. WCDMA MODULATION.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	24.24	24.36	23.98
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.14	25.26	24.88
Maximum effective radiated power E.R.P. (dBm)	22.99	23.11	22.73
PAPR (dB)	3.08	3.08	3.06
Measurement uncertainty (dB)	<±0.66		

3G Band V. HSUPA MODULATION.

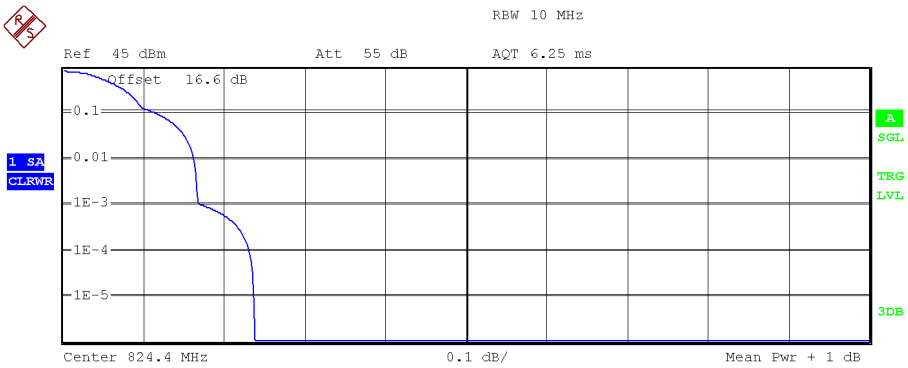
Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	0.9	0.9	0.9
Measured maximum average power (dBm) at antenna port	21.96	22.08	21.56
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	22.86	22.98	22.46
Maximum effective radiated power E.R.P. (dBm)	20.71	20.83	20.31
PAPR (dB)	4.39	4.78	4.41
Measurement uncertainty (dB)	<±0.66		

Verdict: PASS

2. PEAK-TO-AVERAGE POWER RATIO (PAPR):

2G Band 850 MHz. GPRS MODULATION.

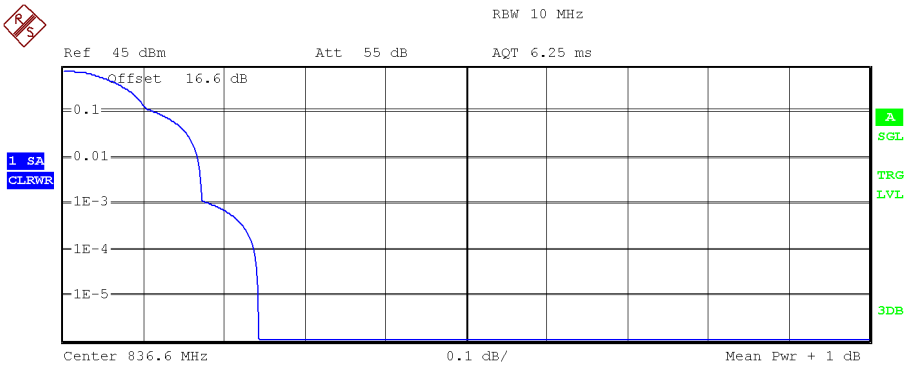
Lowest Channel:



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

	Trace 1
Mean	32.58 dBm
Peak	32.82 dBm
Crest	0.24 dB
10 %	0.11 dB
1 %	0.16 dB
.1 %	0.17 dB
.01 %	0.23 dB

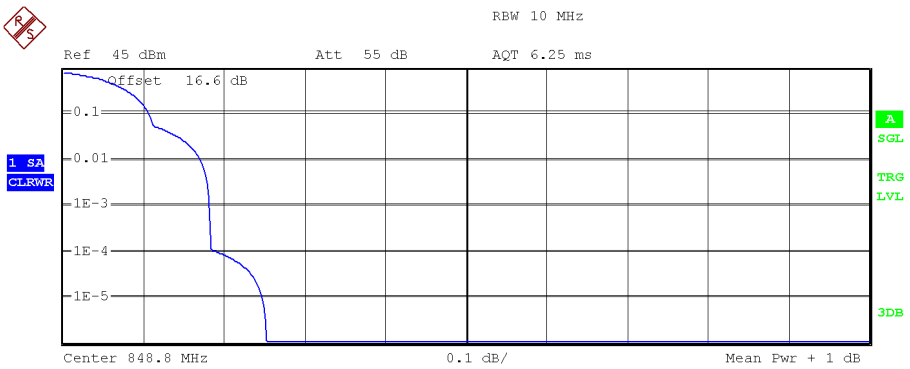
Middle Channel:



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

	Trace 1
Mean	32.46 dBm
Peak	32.71 dBm
Crest	0.24 dB
10 %	0.11 dB
1 %	0.17 dB
.1 %	0.18 dB
.01 %	0.24 dB

Highest Channel:

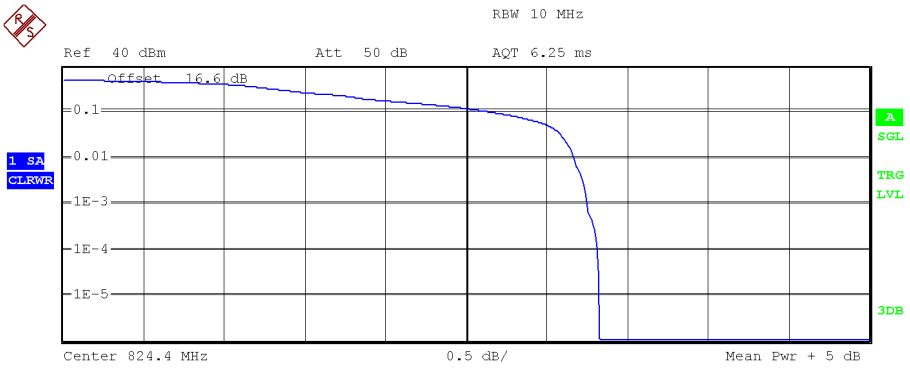


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	32.76 dBm
Peak	33.01 dBm
Crest	0.25 dB
10 %	0.11 dB
1 %	0.17 dB
.1 %	0.18 dB
.01 %	0.19 dB

2G Band 850 MHz. EDGE MODULATION.

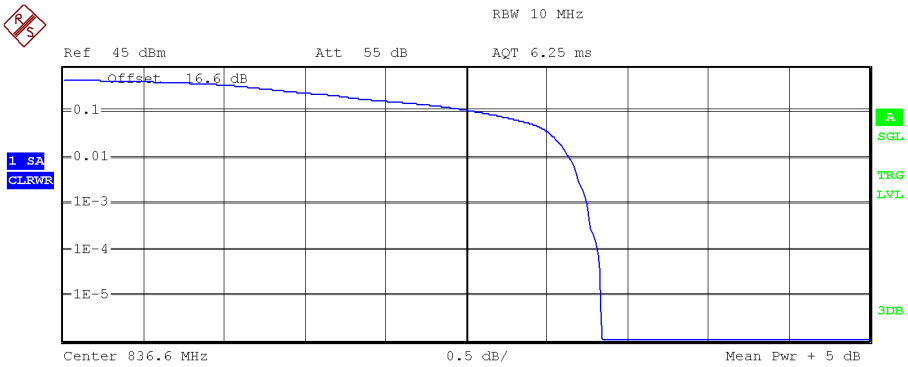
Lowest Channel:



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

	Trace 1
Mean	26.25 dBm
Peak	29.57 dBm
Crest	3.32 dB
10 %	2.66 dB
1 %	3.17 dB
.1 %	3.25 dB
.01 %	3.32 dB

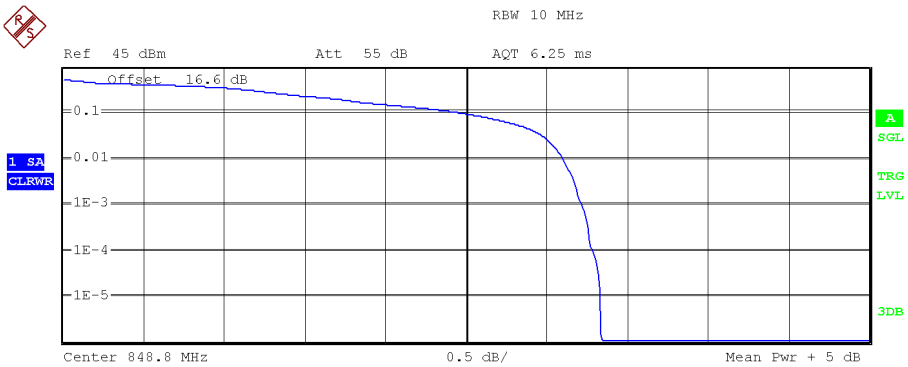
Middle Channel:



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

	Trace 1
Mean	26.55 dBm
Peak	29.88 dBm
Crest	3.34 dB
10 %	2.58 dB
1 %	3.14 dB
.1 %	3.25 dB
.01 %	3.32 dB

Highest Channel:

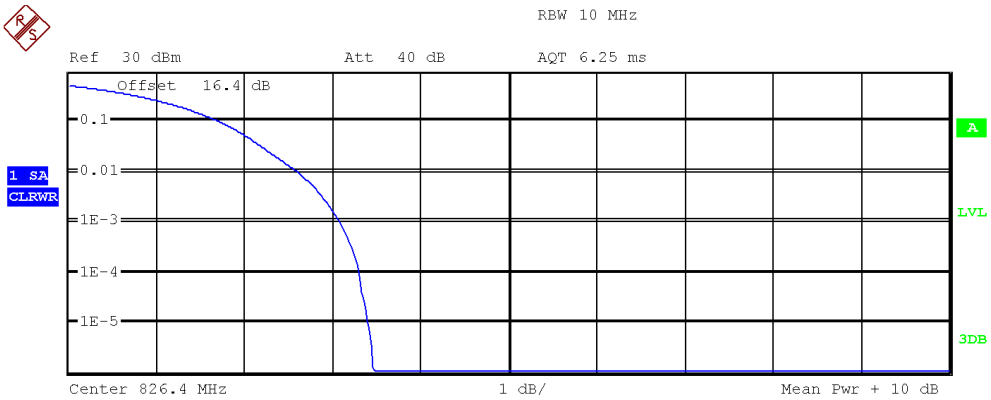


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	26.78 dBm
Peak	30.12 dBm
Crest	3.34 dB
10 %	2.48 dB
1 %	3.10 dB
.1 %	3.22 dB
.01 %	3.29 dB

3G Band V. WCDMA MODULATION.

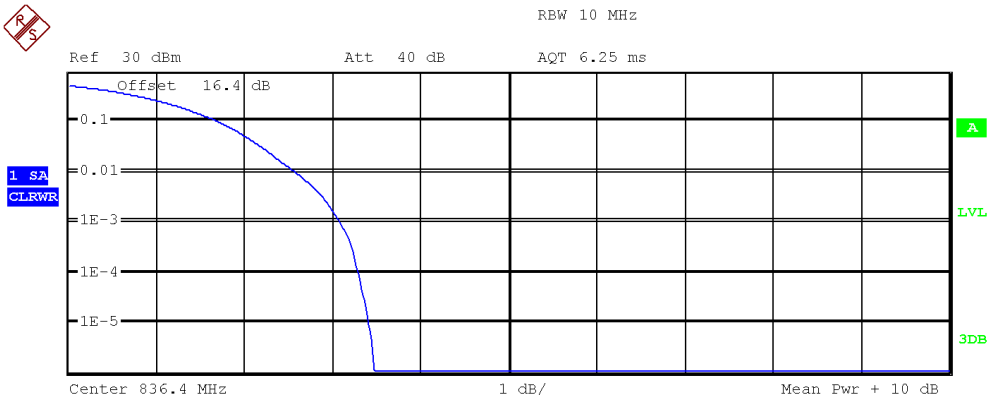
Lowest Channel:



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

	Trace 1
Mean	24.33 dBm
Peak	27.79 dBm
Crest	3.46 dB
10 %	1.71 dB
1 %	2.60 dB
.1 %	3.08 dB
.01 %	3.30 dB

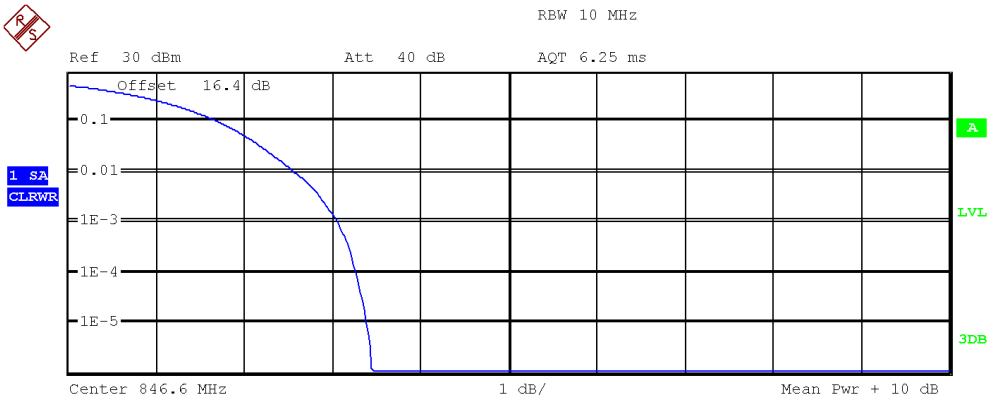
Middle Channel:



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

	Trace 1
Mean	24.03 dBm
Peak	27.50 dBm
Crest	3.47 dB
10 %	1.71 dB
1 %	2.58 dB
.1 %	3.08 dB
.01 %	3.30 dB

Highest Channel:

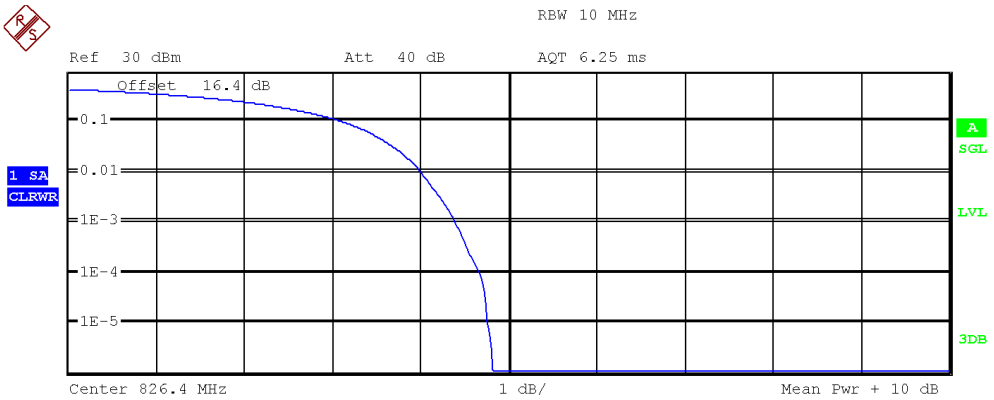


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	23.53 dBm
Peak	26.98 dBm
Crest	3.45 dB
10 %	1.70 dB
1 %	2.56 dB
.1 %	3.06 dB
.01 %	3.27 dB

3G Band V. HSUPA MODULATION.

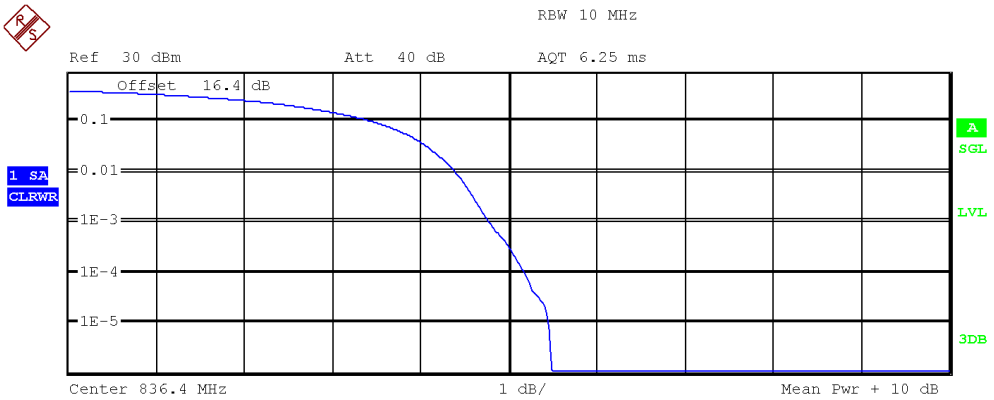
Lowest Channel:



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

	Trace 1
Mean	21.63 dBm
Peak	26.45 dBm
Crest	4.82 dB
10 %	3.13 dB
1 %	4.01 dB
.1 %	4.39 dB
.01 %	4.66 dB

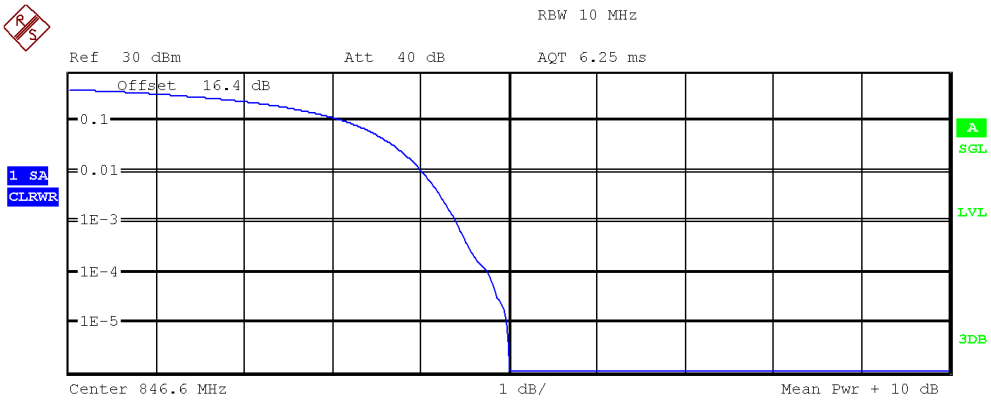
Middle Channel:



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

	Trace 1
Mean	21.03 dBm
Peak	26.51 dBm
Crest	5.48 dB
10 %	3.48 dB
1 %	4.39 dB
.1 %	4.78 dB
.01 %	5.18 dB

Highest Channel:



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

	Trace 1
Mean	20.99 dBm
Peak	25.99 dBm
Crest	5.01 dB
10 %	3.17 dB
1 %	4.02 dB
.1 %	4.41 dB
.01 %	4.76 dB

Frequency Stability

SPECIFICATION:

FCC §2.1055 and §22.355. ±2.5 ppm for mobile stations operating in the range 821 to 896 MHz.

RSS-132. Clause 5.3. The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

METHOD:

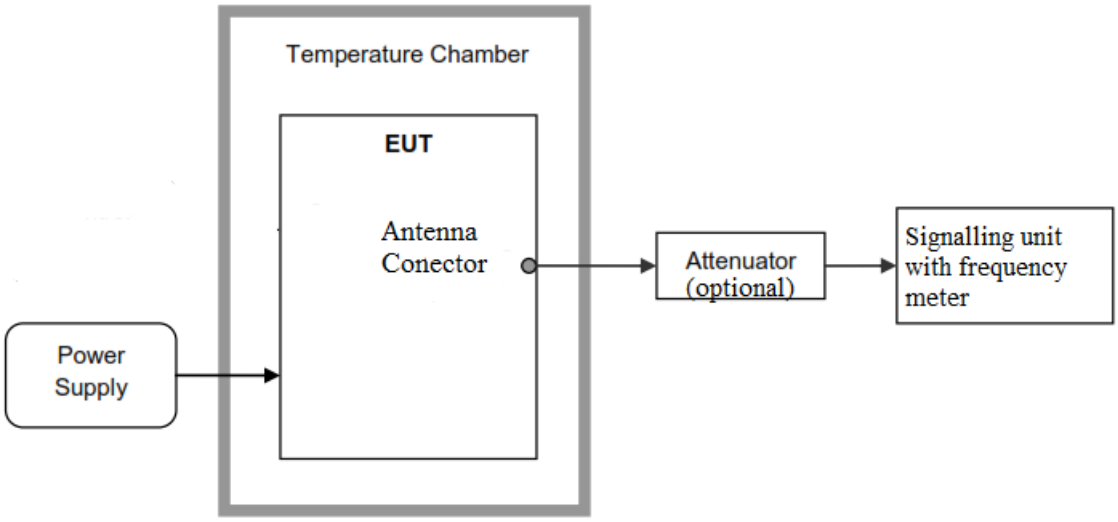
The frequency tolerance measurements over temperature variations were made over the temperature range of –30ºC to +50ºC. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10ºC steps from –30ºC up to +50ºC.
The supply voltage was varied between 85% and 115% of nominal voltage.

The EUT was set in "Radio Resource Control (RRC) 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.

The reference point measurements were made at the RF output terminals of the EUT using an attenuator. power splitter and spectrum analyser. 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.

TEST SETUP:

1. Frequency Tolerance:



RESULTS:

1. Frequency Tolerance:

- **Frequency Stability over Temperature Variations:**

2G Band 850 MHz. GPRS AND EDGE MODULATIONS.

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-9.53	-0.011
+40	-4.46	-0.005
+30	5.13	0.006
+20	1.03	0.001
+10	-7.49	-0.009
0	-2.74	-0.003
-10	-6.97	-0.008
-20	-13.85	-0.017
-30	-19.69	-0.024

3G Band V. WCDMA AND HSUPA MODULATIONS.

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-0.84	-0.010
+40	-0.67	-0.008
+30	-0.44	-0.005
+20	-0.7	-0.008
+10	-0.45	-0.005
0	-0.82	-0.010
-10	-0.63	-0.008
-20	-0.37	-0.004
-30	-0.75	-0.009

- **Frequency Stability over Voltage Variations.**

2G Band 850 MHz. GPRS AND EDGE MODULATIONS.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	0.74	0.001
Vmin	3.6	2.45	0.003

3G Band V. WCDMA AND HSUPA MODULATIONS.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	-0.69	-0.001
Vmin	3.6	-0.61	-0.001

2. Reference Frequency Points fL and fH:

The worst-case frequency offsets added or subtracted per band and bandwidth:

2G Band 850 MHz:

	GPRS MODULATION
*f*L (MHz)	824.03498
fH (MHz)	848.95900

3G Band V:

	WCDMA MODULATION
*f*L (MHz)	824.018000
fH (MHz)	848.975600

Verdict: PASS

Modulation Characteristics

SPECIFICATION:

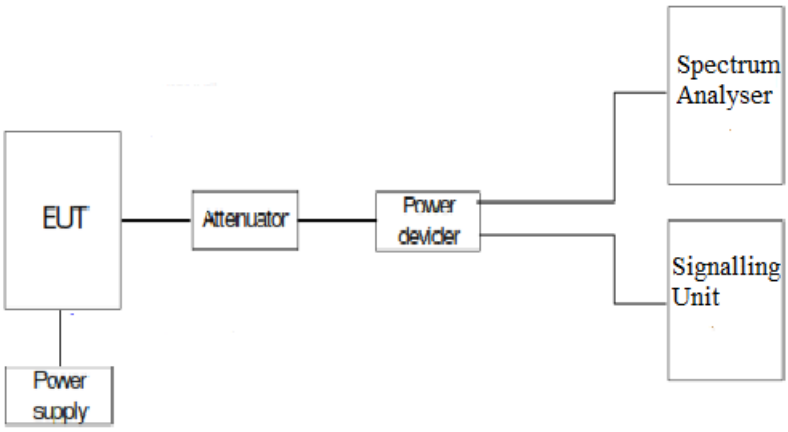
FCC §2.1047.

RSS-132. Clause 5.2: Equipment certified under this standard shall use digital modulation.

METHOD:

For 2G/3G, the EUT operates with GPRS (GMSK), EDGE (8PSK), WCDMA (QPSK) and HSUPA (QPSK) modes, in which the information is digitized and coded into a bit stream.

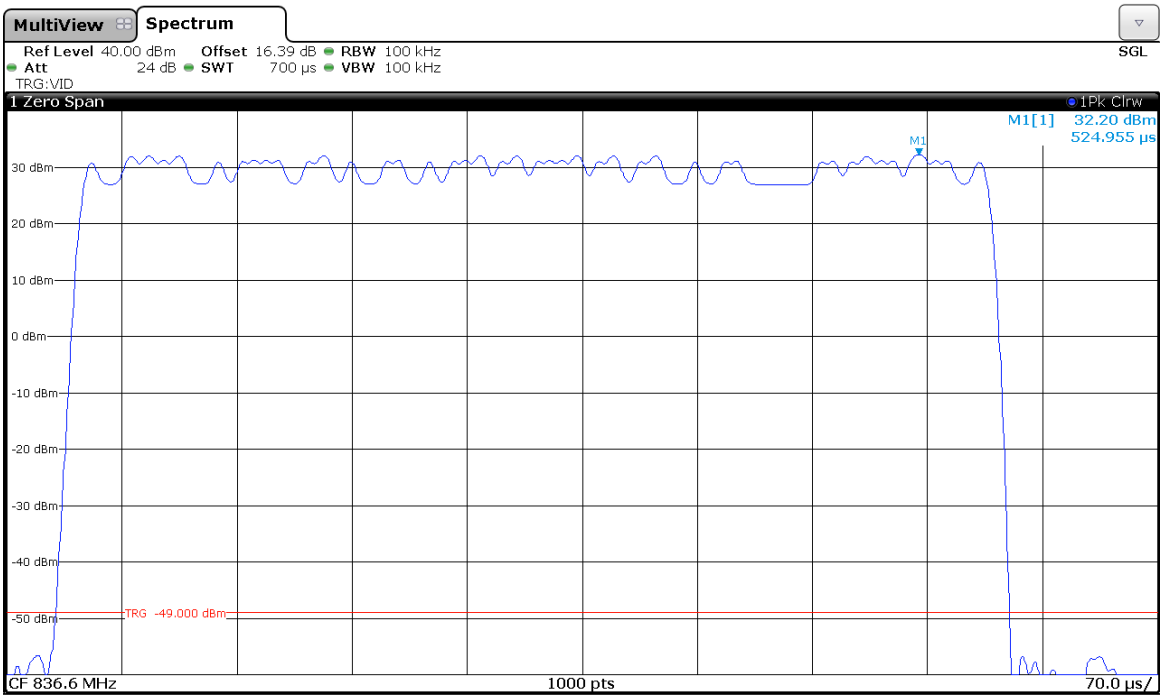
TEST SETUP:



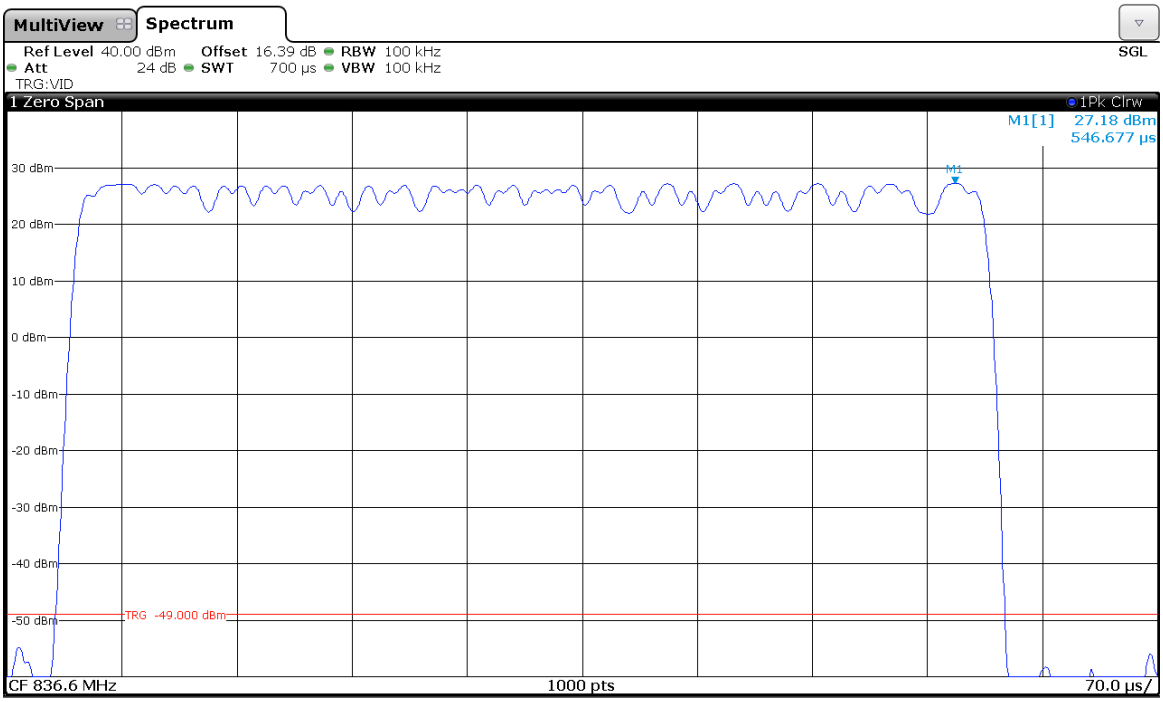
RESULTS:

The following plots show the modulation schemes in the EUT.

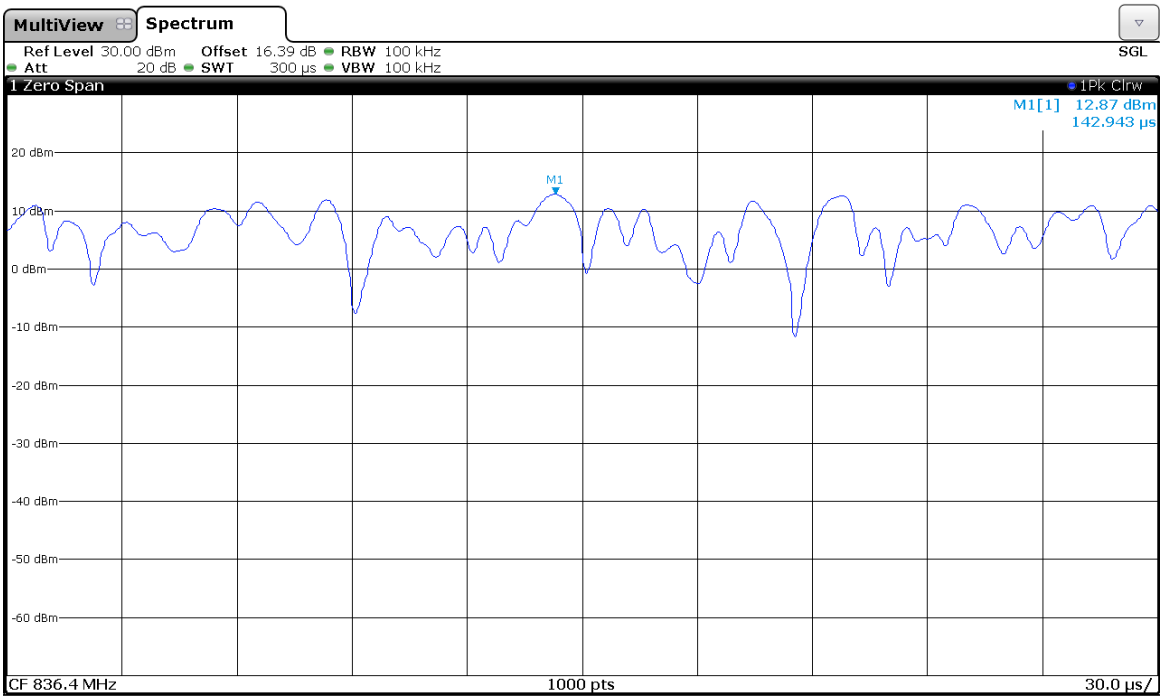
2G Band 850 MHz. GPRS MODULATION.



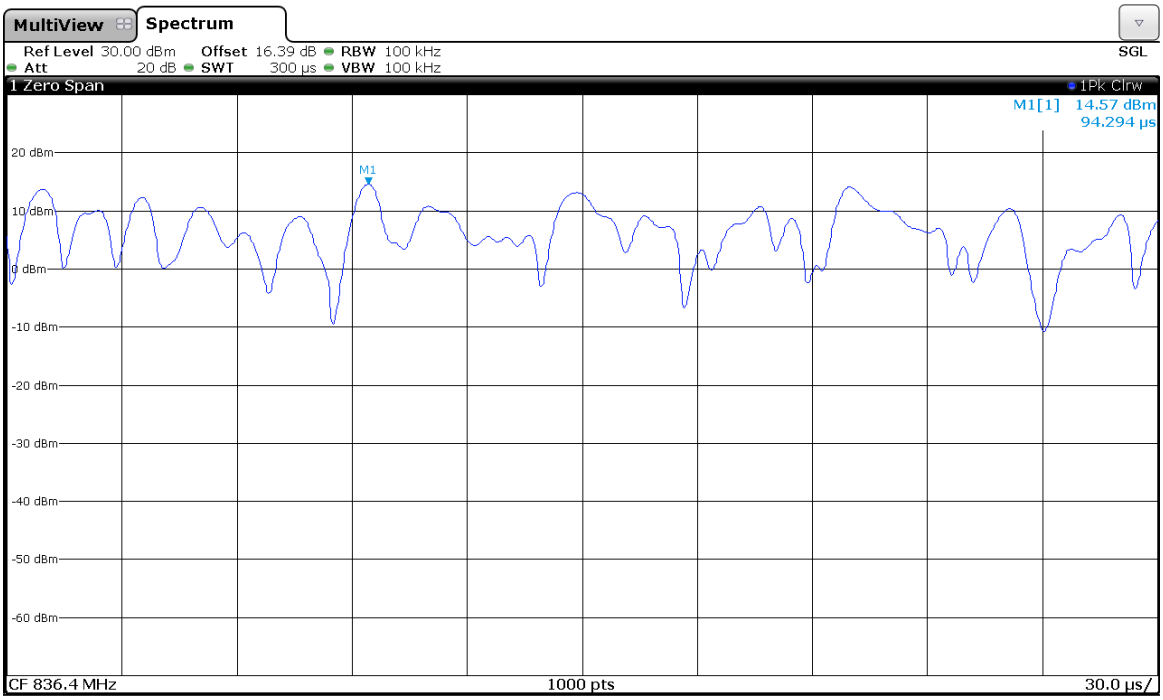
2G Band 850 MHz. EDGE MODULATION.



3G Band V. WCDMA MODULATION.



3G Band V. HSUPA MODULATION.



Occupied Bandwidth

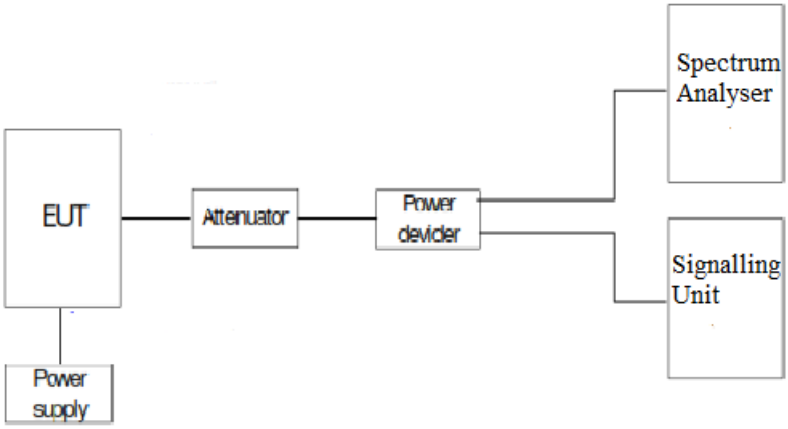
SPECIFICATION:

FCC §2.1049.

METHOD:

The occupied bandwidth measurement was performed at the output terminals of the EUT using an attenuator. power splitter and spectrum analyser. 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 analyser.

TEST SETUP:



RESULTS:

2G Band 850 MHz:

2G Band 850 MHz. GPRS MODULATION.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (kHz)	242.02	242.67	244.37
-26 dBc bandwidth (kHz)	305.40	301.76	301.70
Measurement uncertainty (kHz)	<±3.15		

2G Band 850 MHz. EDGE MODULATION.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (kHz)	240.87	241.95	241.98
-26 dBc bandwidth (kHz)	297.90	298.25	299.95
Measurement uncertainty (kHz)	<±3.15		

3G Band V:

3G Band V. WCDMA MODULATION.

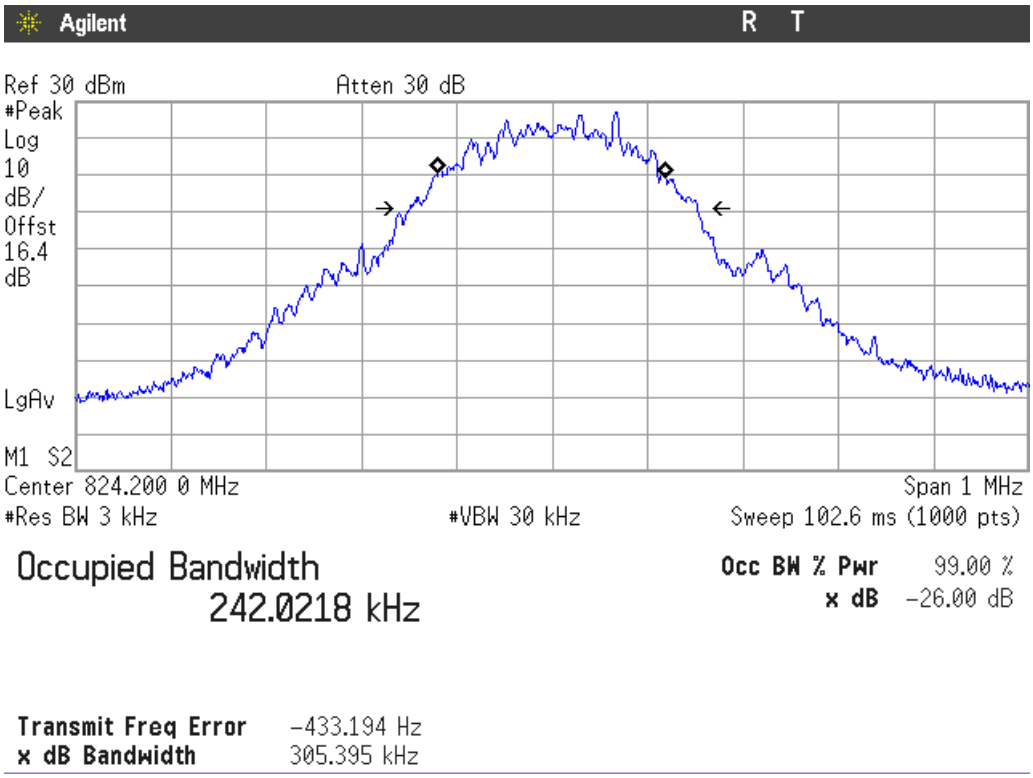
	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (kHz)	4136.9	4143.1	4130.6
-26 dBc bandwidth (kHz)	4697	4722	4710
Measurement uncertainty (kHz)	<±16.67		

3G Band V. HSUPA MODULATION.

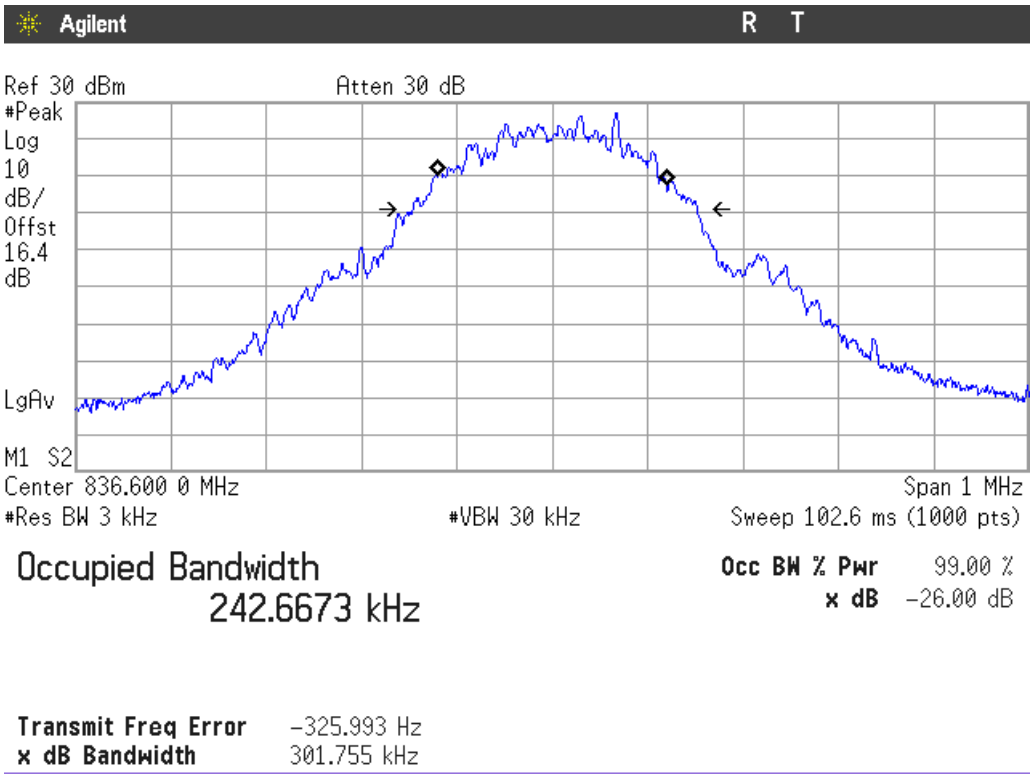
	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (kHz)	4145.2	4138.8	4144.8
-26 dBc bandwidth (kHz)	4712	4683	4696
Measurement uncertainty (kHz)	<±16.67		

2G Band 850 MHz. GPRS MODULATION.

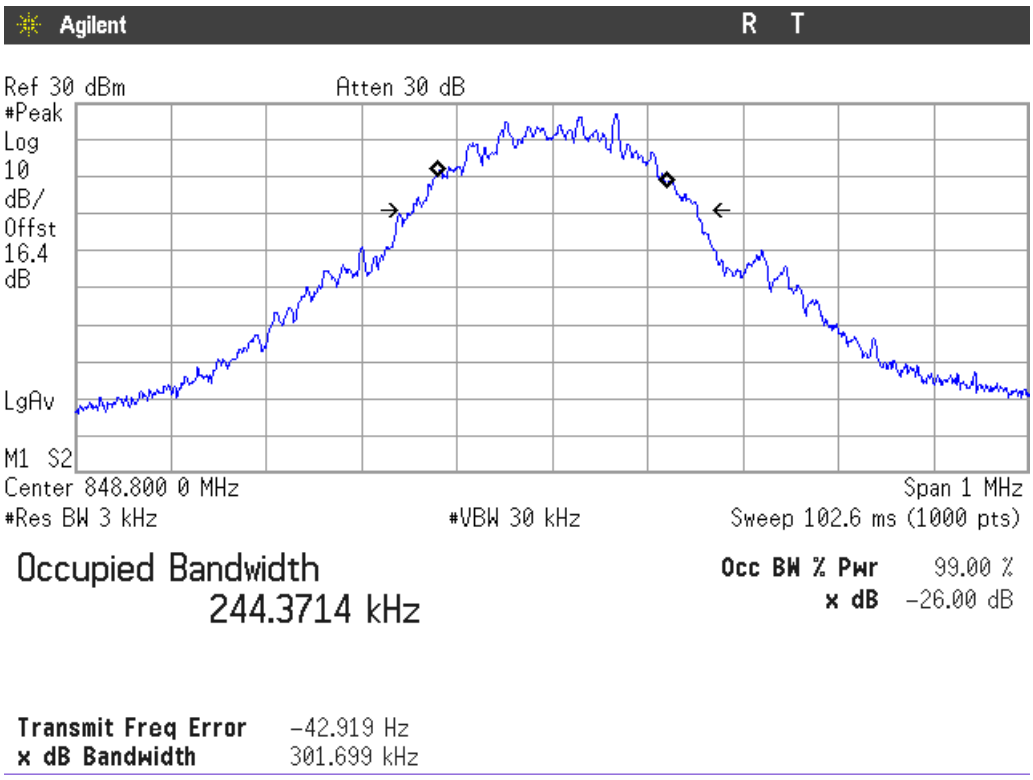
Lowest Channel:



Middle Channel:

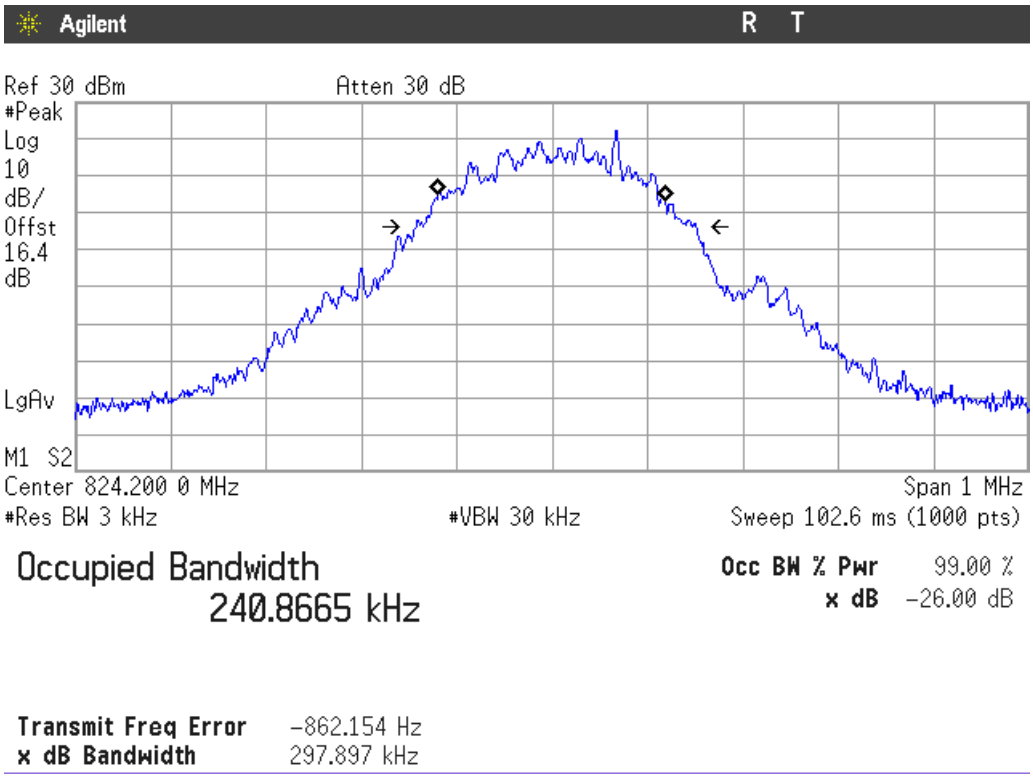


Highest Channel:

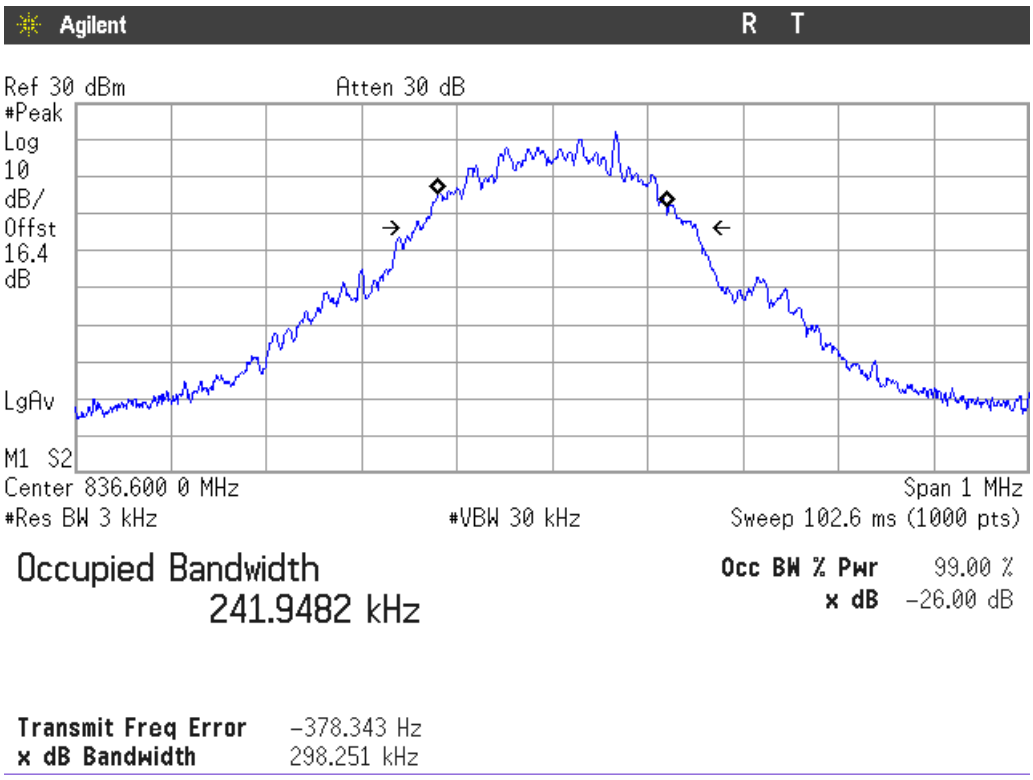


<u>2G Band 850 MHz</u>. EDGE MODULATION.

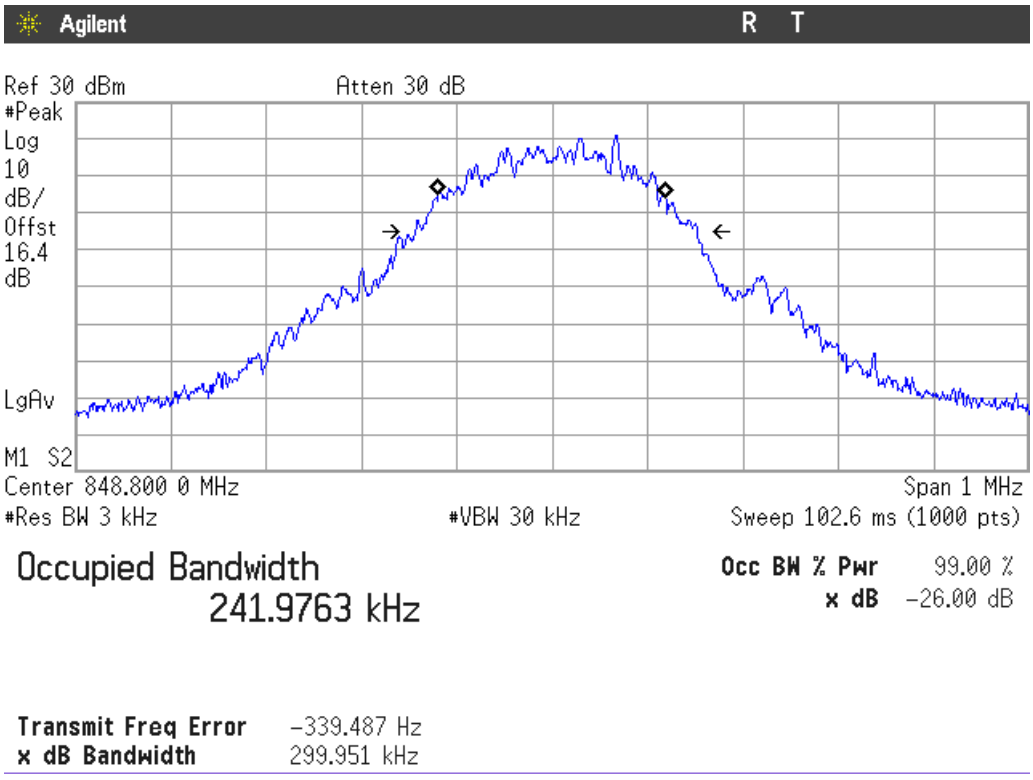
Lowest Channel:



Middle Channel:

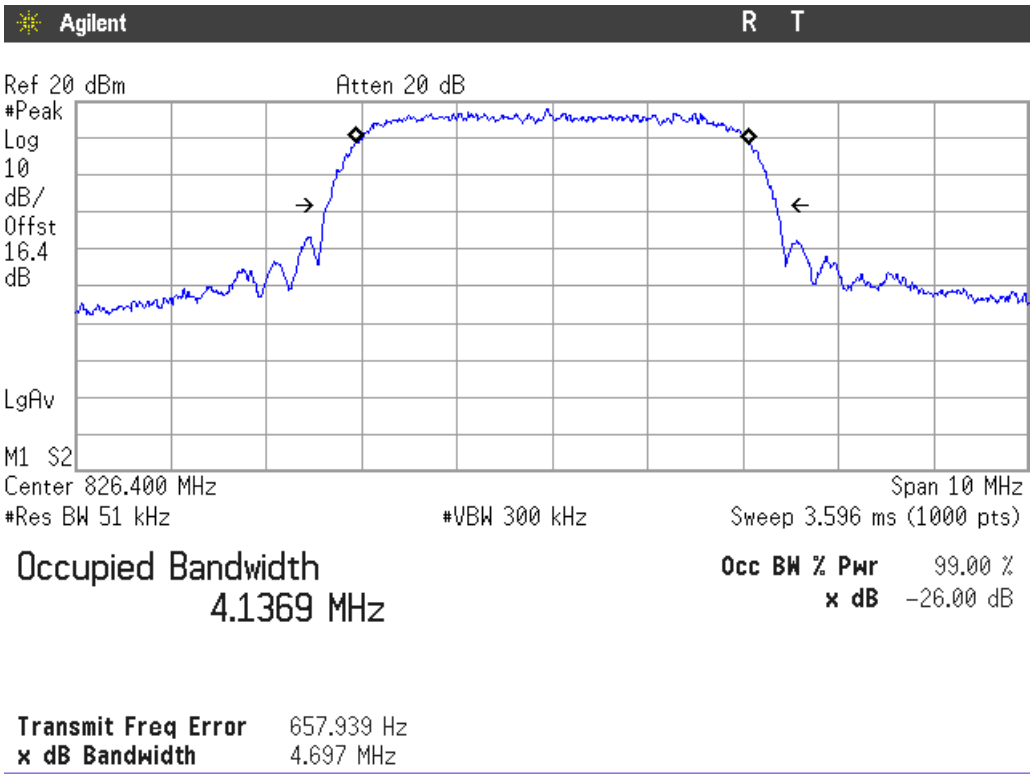


Highest Channel

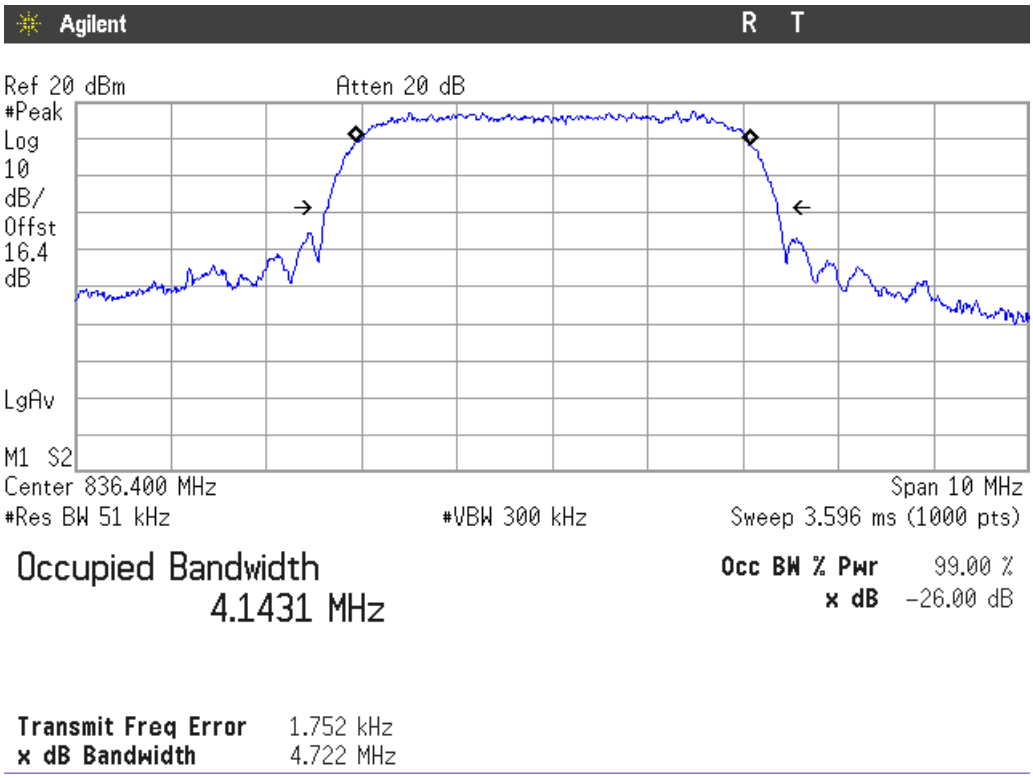


3G Band V. WCDMA MODULATION.

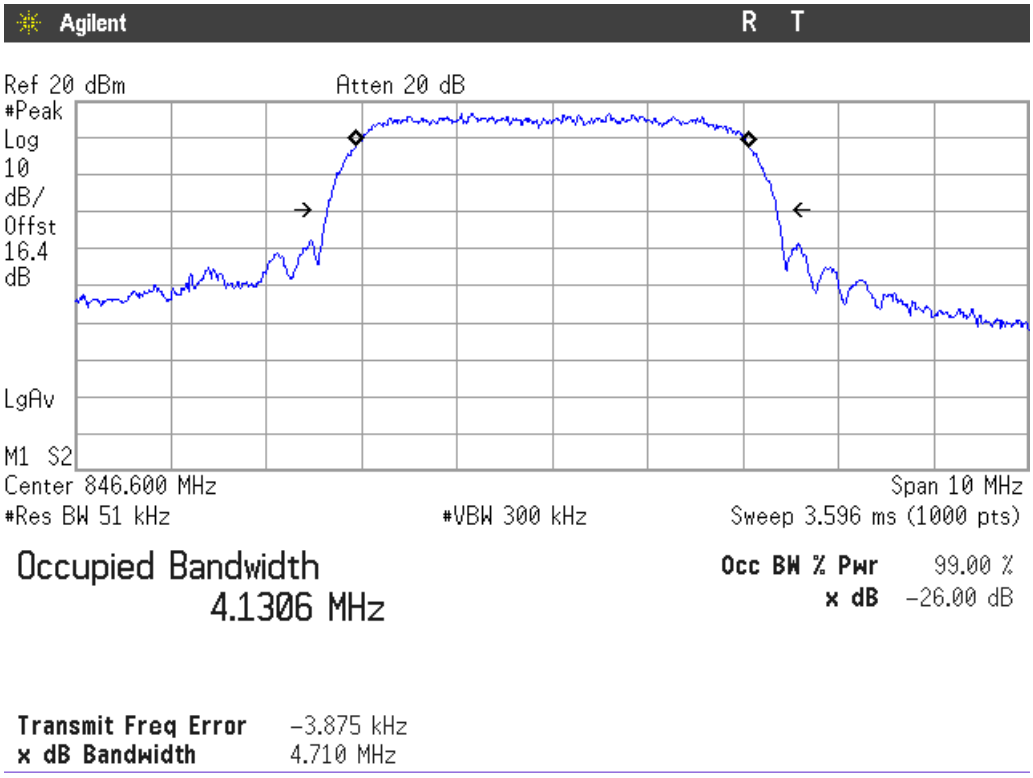
Lowest Channel:



Middle Channel:

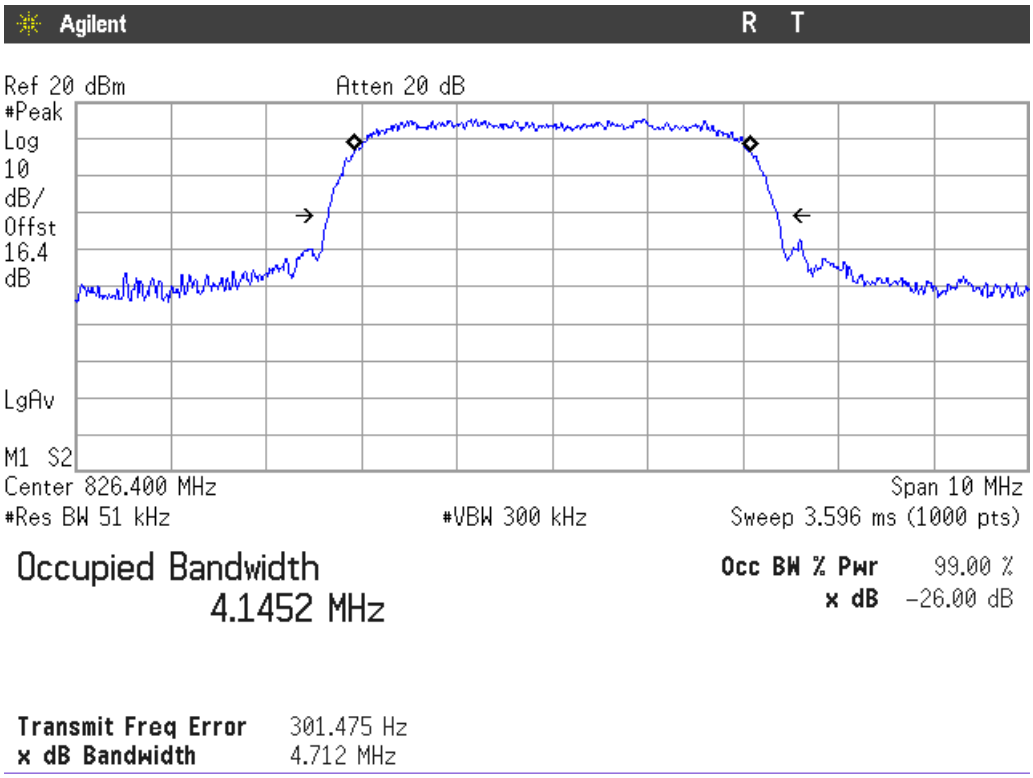


Highest Channel:

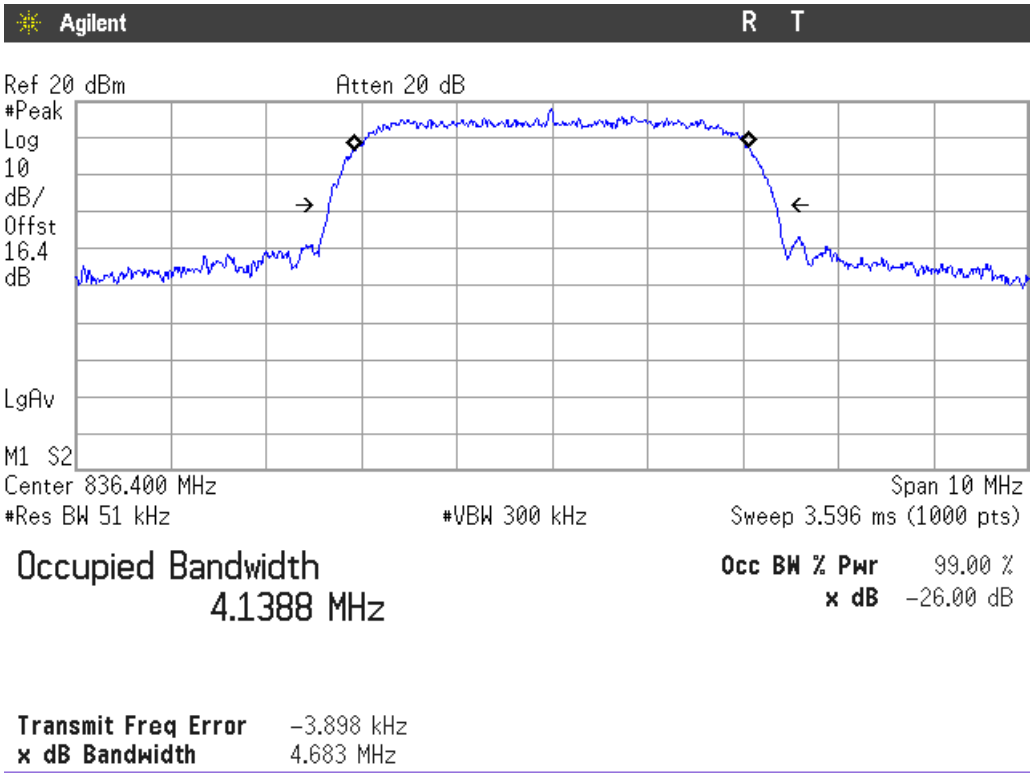


<u>3G Band V</u>. HSUPA MODULATION.

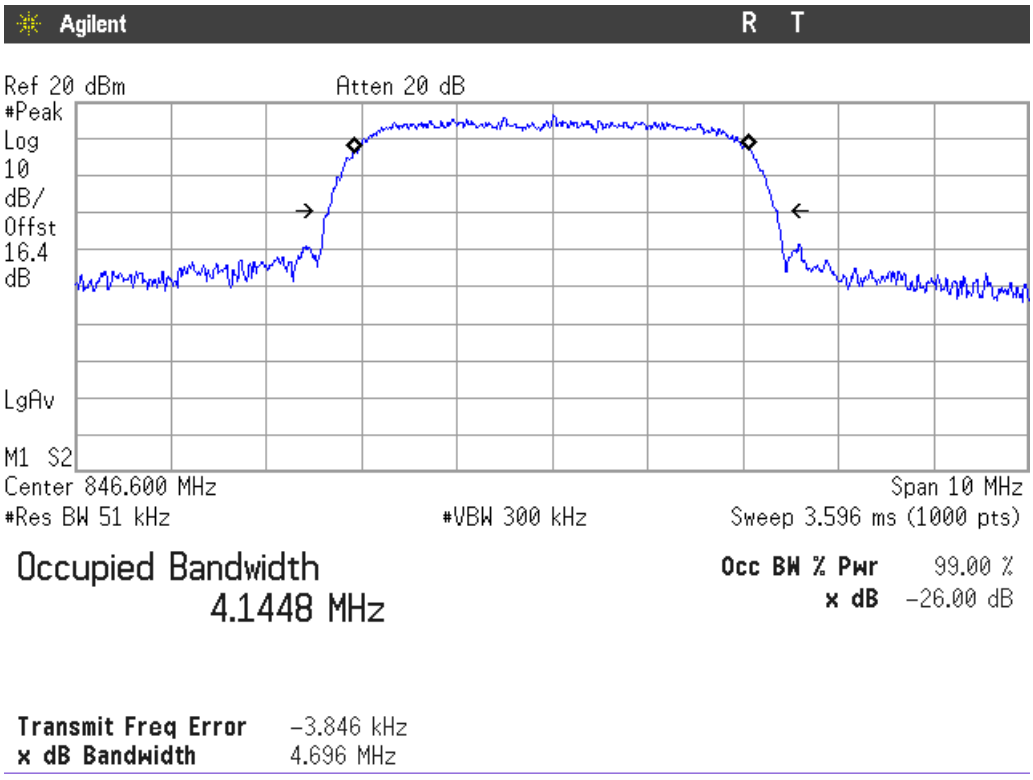
Lowest Channel:



Middle Channel:



Highest Channel:



Spurious emissions at antenna terminals

SPECIFICATION:

FCC §2.1051 and §22.917

RSS-132. Clause 5.5.

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.

METHOD:

The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMU200 and CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50 ohm attenuator and a power splitter.

The spectrum was investigated from 9 kHz to 10 GHz.

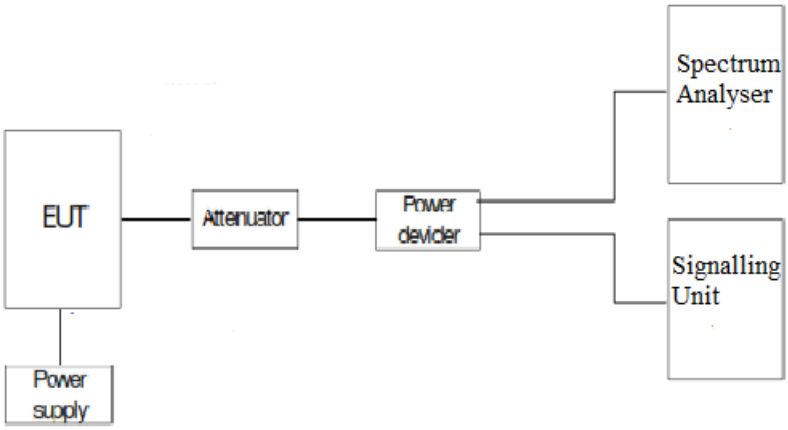
The reading of the spectrum analyser is corrected with the attenuation loss of connection between output terminal of EUT and input of the spectrum analyser.

Measurement Limit**:**

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 Po transmitting power. the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative Po becomes:

Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = - 13 dBm

TEST SETUP:



RESULTS:

2G Band 850 MHz. GPRS MODULATION.

- Lowest Channel:
Spurious frequencies detected at less than 20 dB below the limit:

Frequency (MHz)	Level (dBm)	Measurement uncertainty (dB)
127.5	-30.2	< ± 2.03

- Middle Channel:
Spurious frequencies detected at less than 20 dB below the limit:

Frequency (MHz)	Level (dBm)	Measurement uncertainty (dB)
130.8	-30.73	< ± 2.03

- Highest Channel:
Spurious frequencies detected at less than 20 dB below the limit:

Frequency (MHz)	Level (dBm)	Measurement uncertainty (dB)
116.5	-30.57	< ± 2.03

2G Band 850 MHz. EDGE MODULATION.

- Lowest Channel:
Spurious frequencies detected at less than 20 dB below the limit:

Frequency (MHz)	Level (dBm)	Measurement uncertainty (dB)
115.4	-30.99	< ± 2.03

- Middle Channel:
Spurious frequencies detected at less than 20 dB below the limit:

Frequency (MHz)	Level (dBm)	Measurement uncertainty (dB)
134.1	-30.46	< ± 2.03

- Highest Channel:
Spurious frequencies detected at less than 20 dB below the limit:

Frequency (MHz)	Level (dBm)	Measurement uncertainty (dB)
116.5	-30.88	< ± 2.03

3G Band V. WCDMA MODULATION.

- Lowest Channel:
No spurious frequencies detected at less than 20 dB below the limit.

- Middle Channel:
No spurious frequencies detected at less than 20 dB below the limit.

- Highest Channel:
No spurious frequencies detected at less than 20 dB below the limit.

3G Band V. HSUPA MODULATION.

- Lowest Channel:
No spurious frequencies detected at less than 20 dB below the limit.

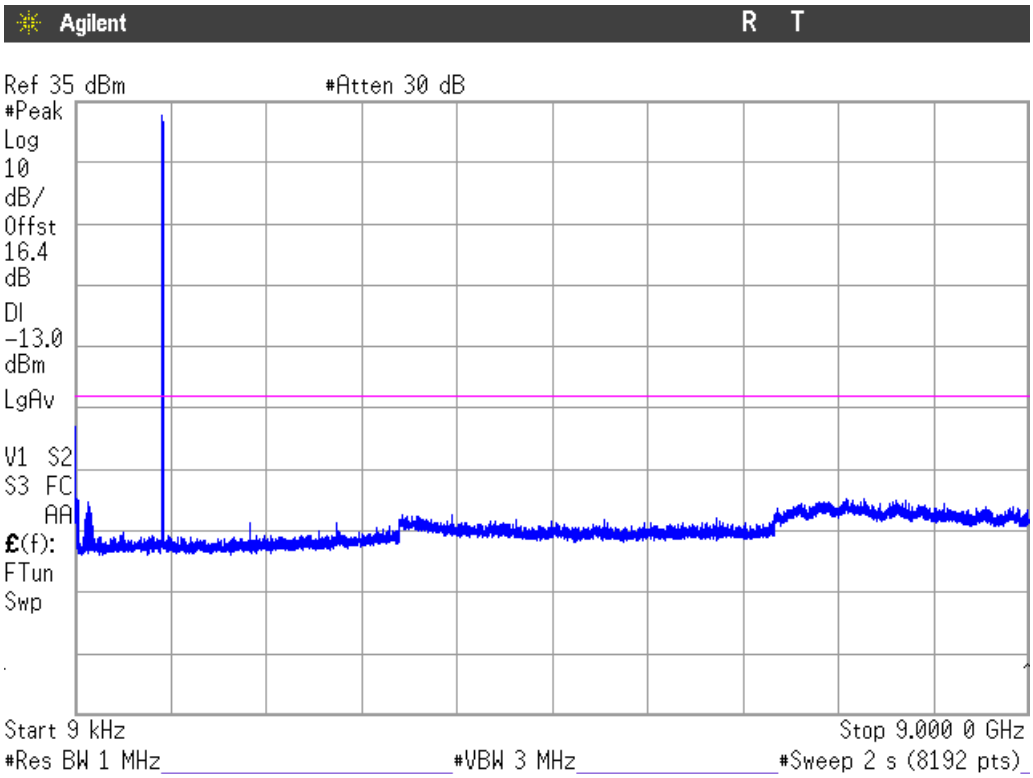
- Middle Channel:
No spurious frequencies detected at less than 20 dB below the limit.

- Highest Channel:
No spurious frequencies detected at less than 20 dB below the limit.

Verdict: PASS

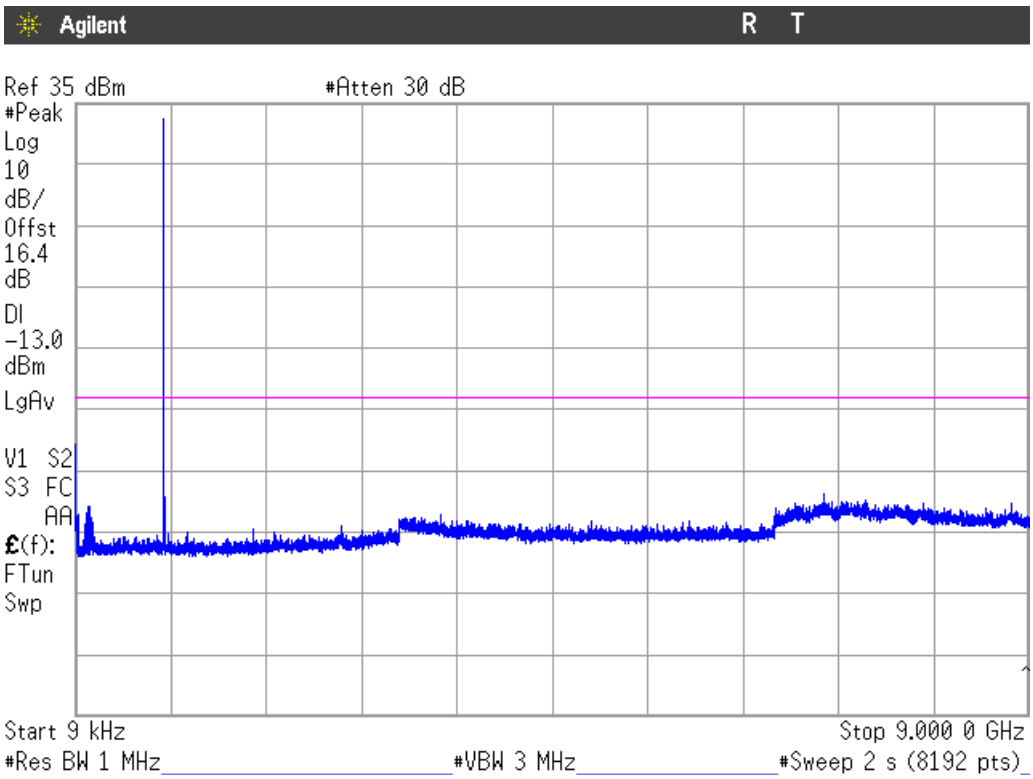
2G Band 850 MHz. GPRS MODULATION.

Lowest Channel:



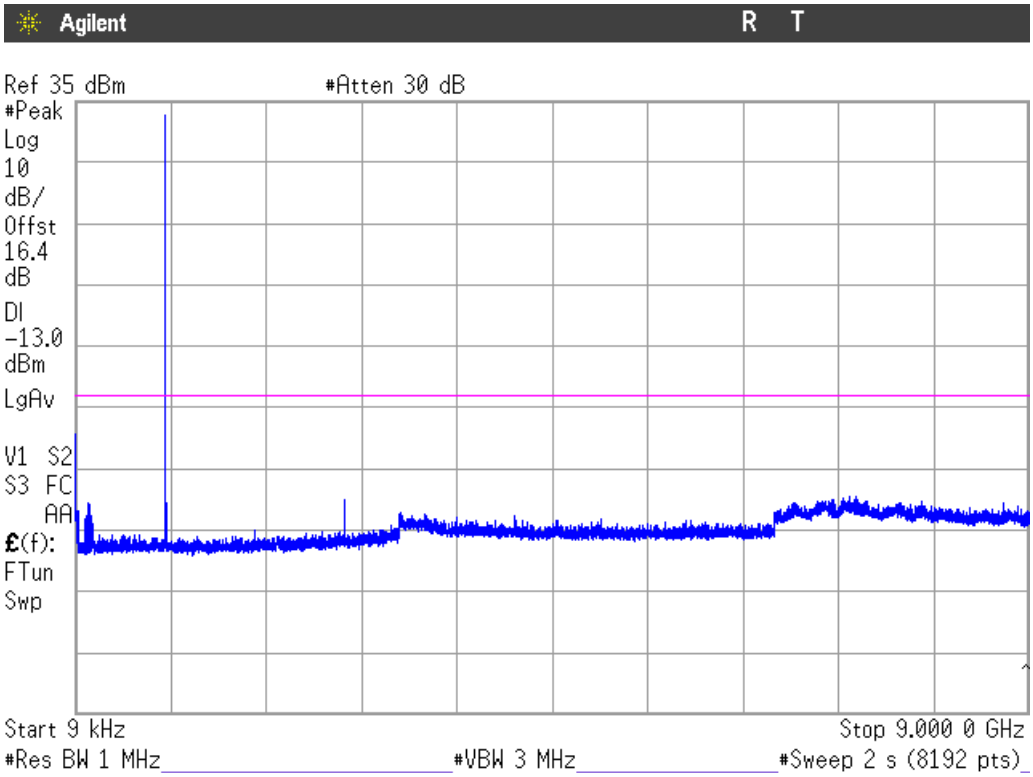
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

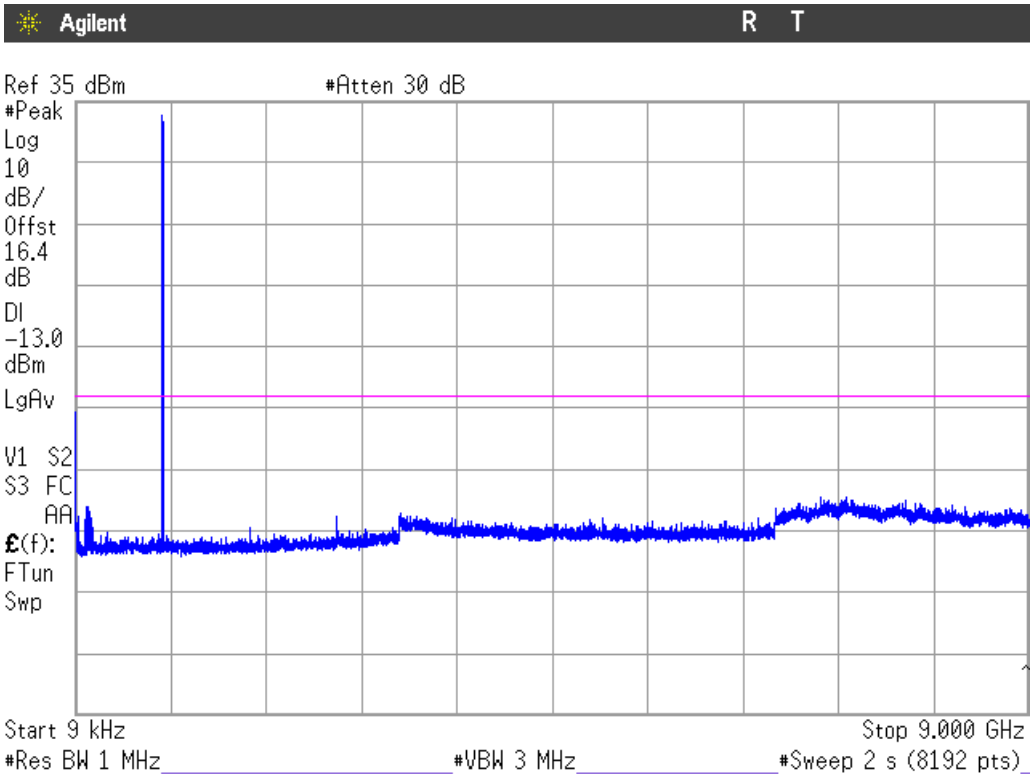
Highest Channel:



The peak above the limit is the carrier frequency.

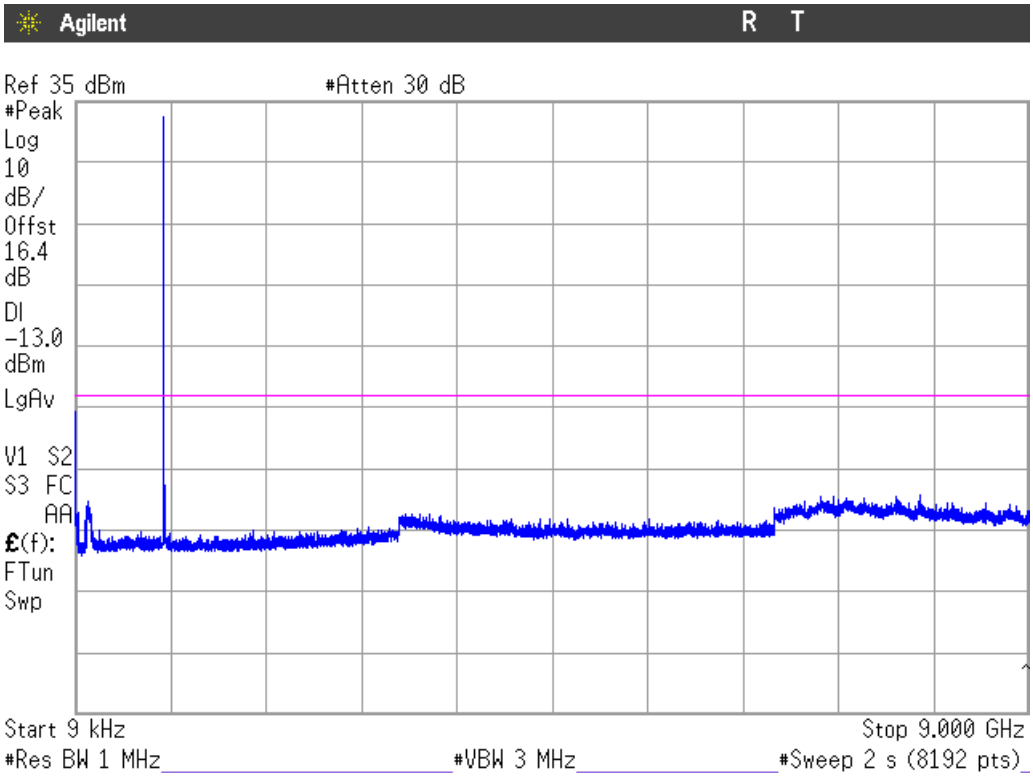
<u>2G Band 850 MHz</u>. EDGE MODULATION.

Lowest Channel:



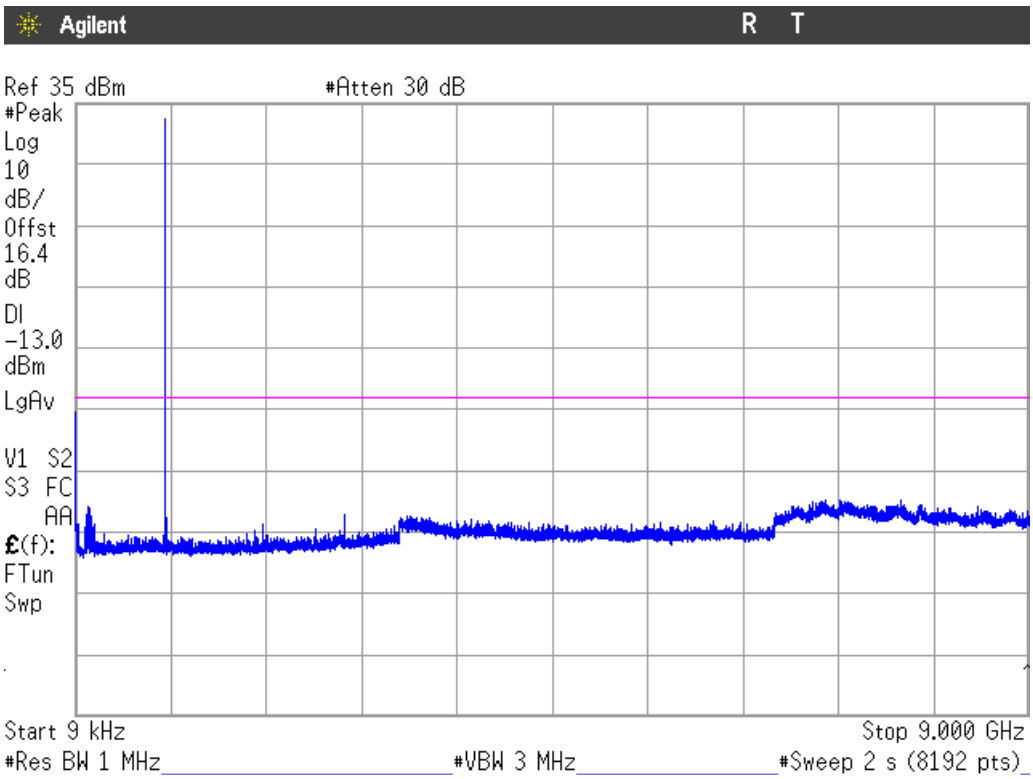
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

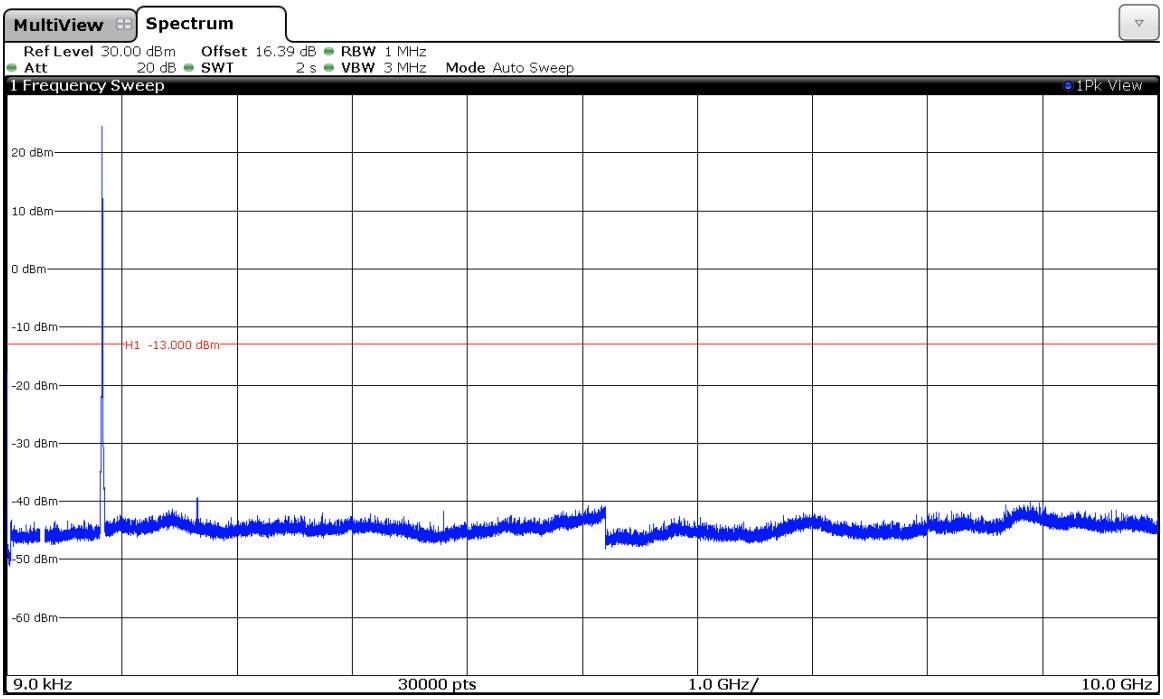
Highest Channel:



The peak above the limit is the carrier frequency.

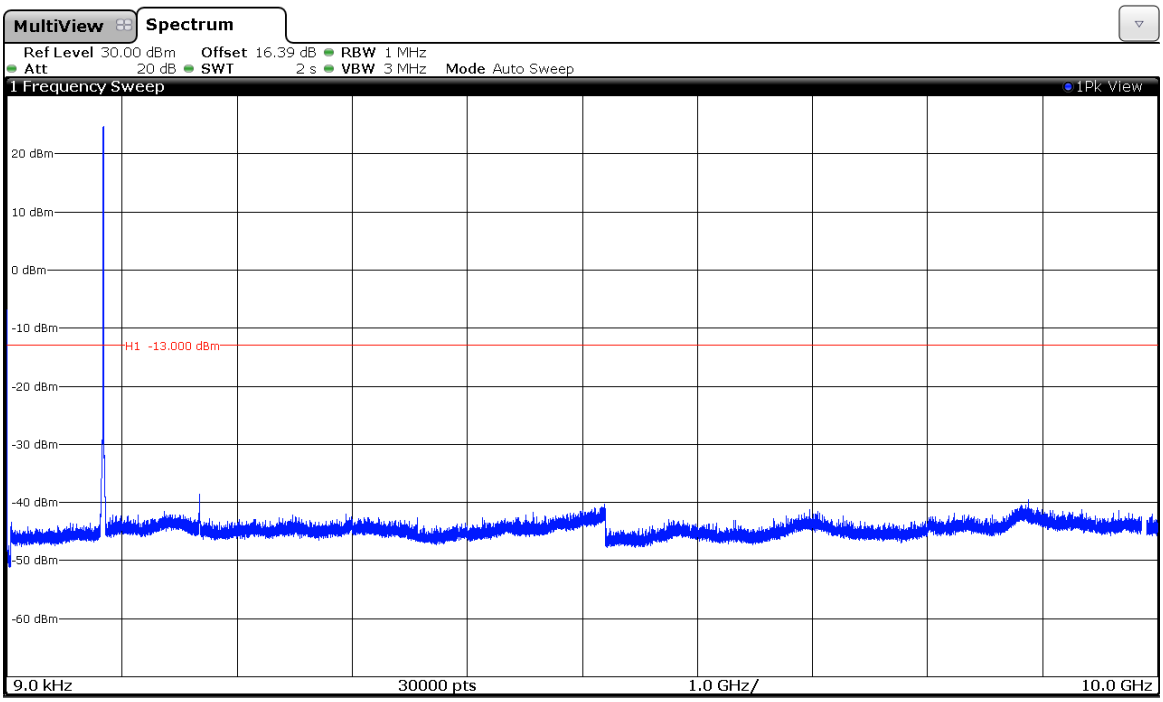
3G Band V. WCDMA MODULATION.

Lowest Channel:



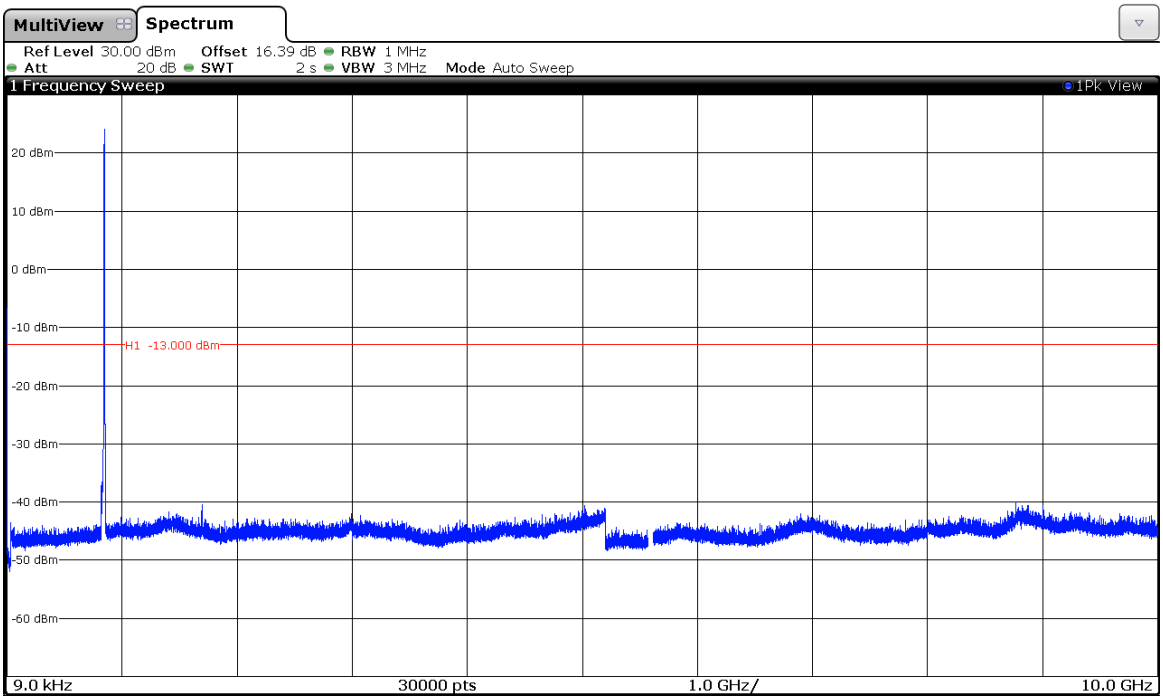
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

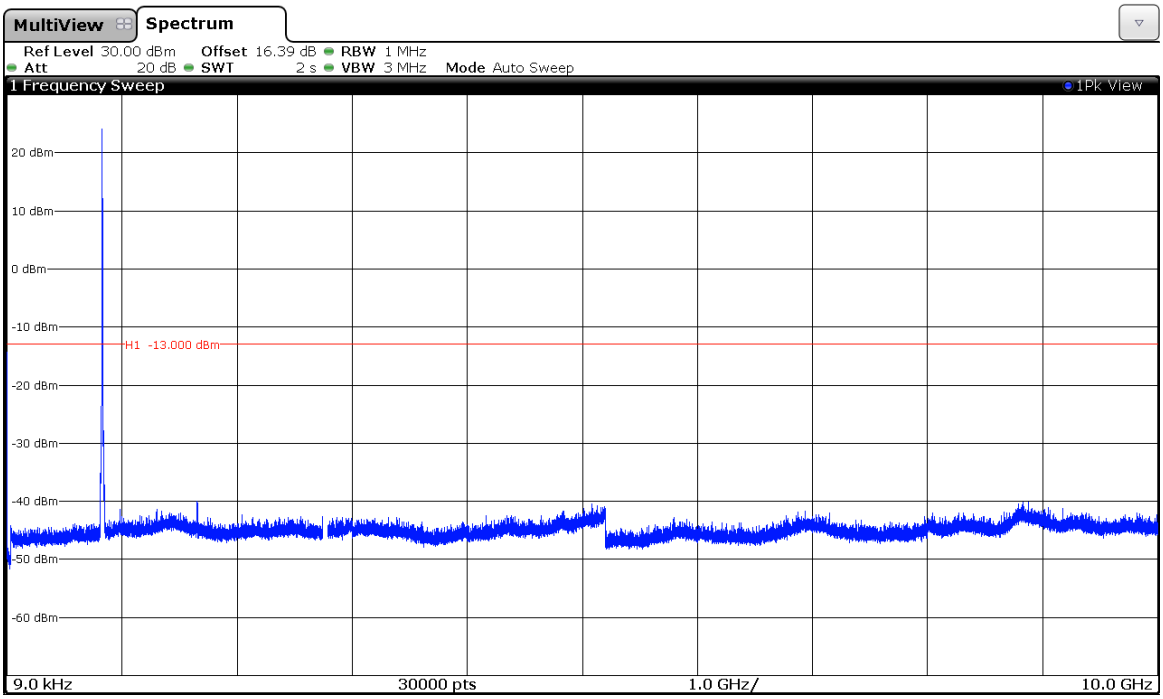
Highest Channel:



The peak above the limit is the carrier frequency.

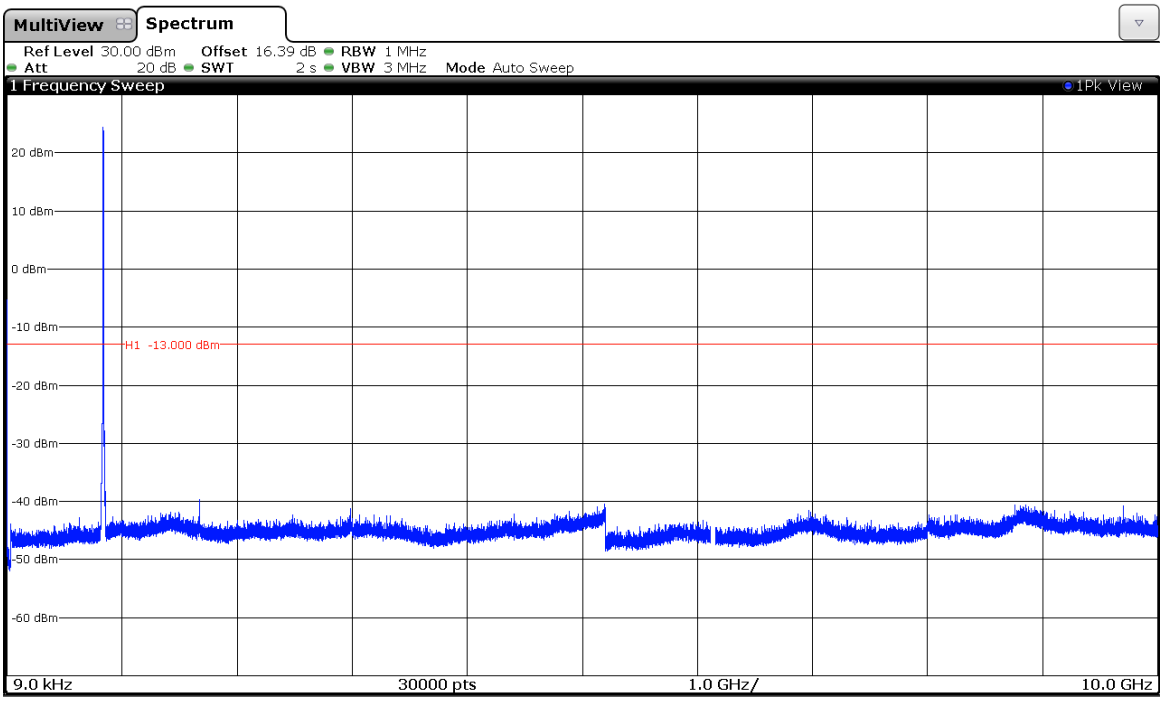
<u>3G Band V</u>. HSUPA MODULATION.

Lowest Channel:



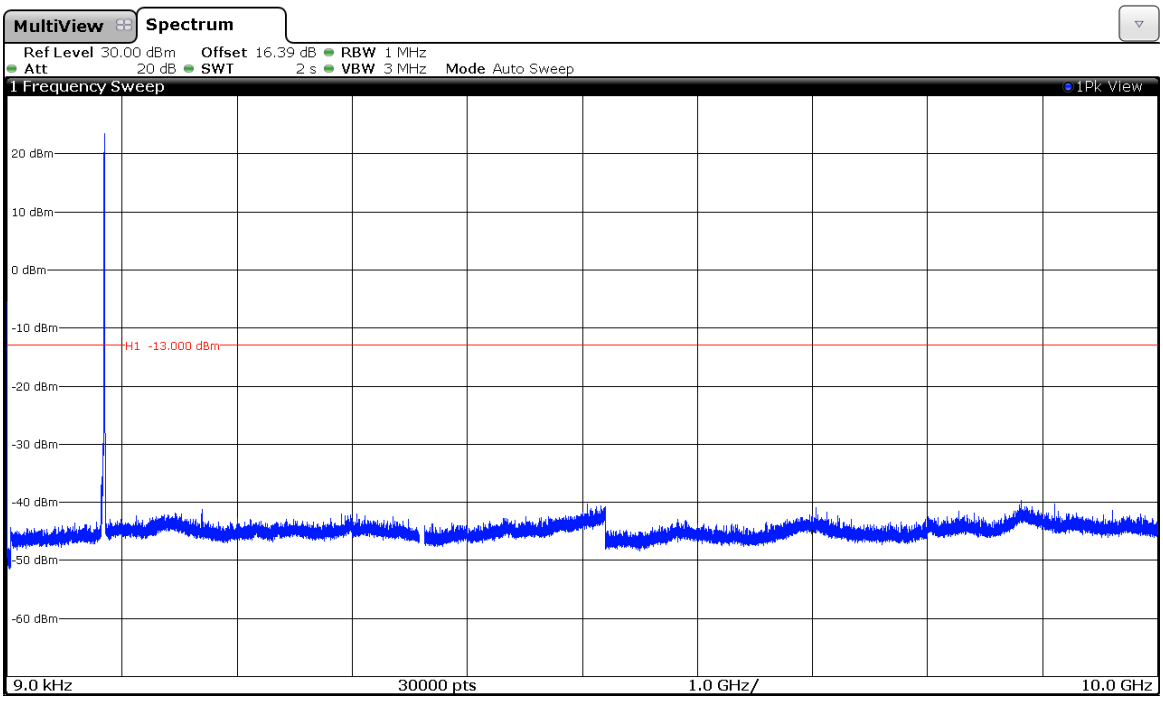
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

Highest Channel:



The peak above the limit is the carrier frequency.

Spurious emissions at antenna terminals at Block Edges

SPECIFICATION:

FCC §2.1051 and §22.917
RSS-132. Clause 5.5.

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.

METHOD:

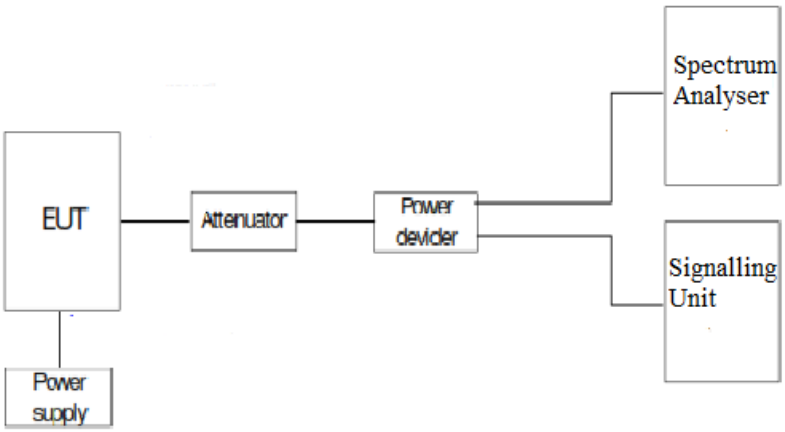
The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50 ohm attenuator and a power splitter.

As indicated in FCC part 22, in the 1 MHz bands immediately outside and adjacent to the 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.

Measurement Limit**:**
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 Po transmitting power. the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative Po becomes:

Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = - 13 dBm

TEST SETUP:



RESULTS:

2G Band 850 MHz.

MODULATION:	GPRS	EDGE
Maximum measured level at Lowest Block Edge at antenna port (dBm)	-18.83	-25.85

MODULATION:	GPRS	EDGE
Maximum measured level at Highest Block Edge at antenna port (dBm)	-19.81	-19.53

3G Band V.

MODULATION:	WCDMA	HSUPA
Maximum measured level at Lowest Block Edge at antenna port (dBm)	-17.14	-18.59

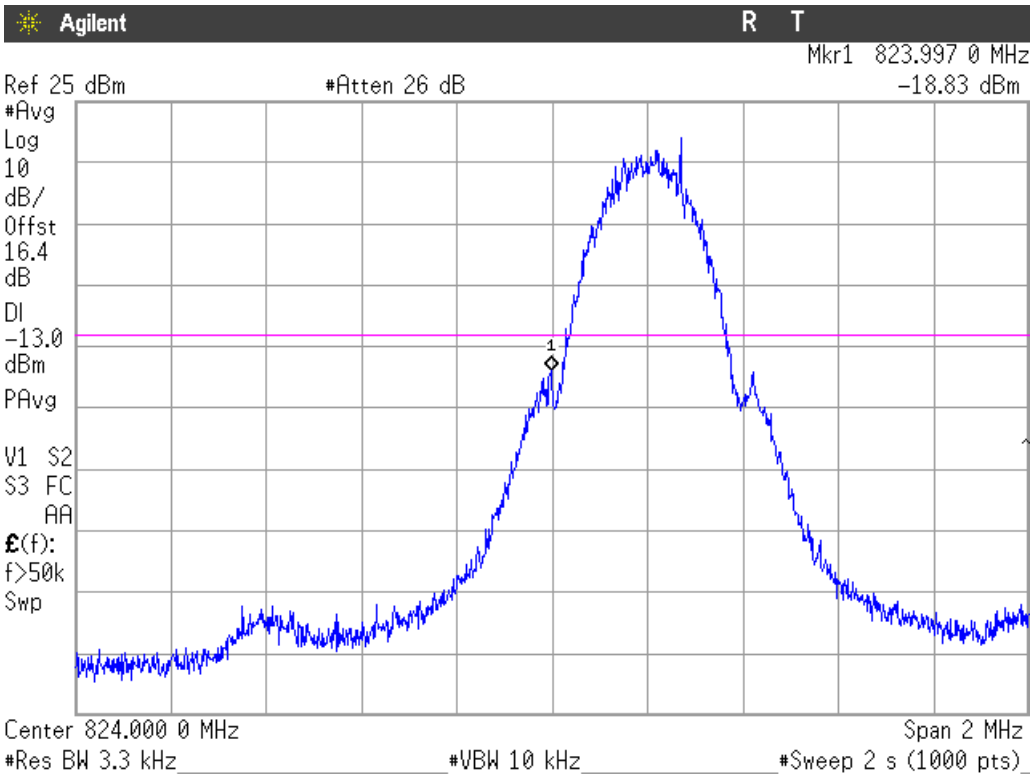
MODULATION:	WCDMA	HSUPA
Maximum measured level at Highest Block Edge at antenna port (dBm)	-17.88	-18.75

Measurement uncertainty = ±1.57 dB.

Verdict: PASS

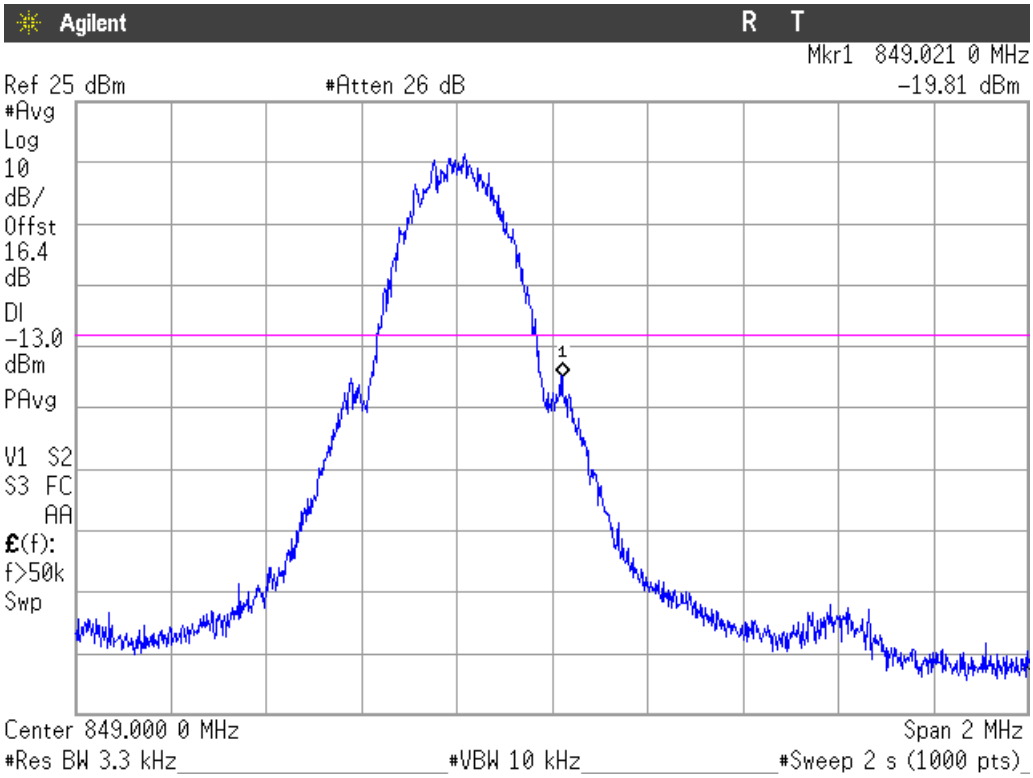
2G Band 850 MHz. GPRS MODULATION.

Lowest Channel:



The equipment transmits at the maximum output power

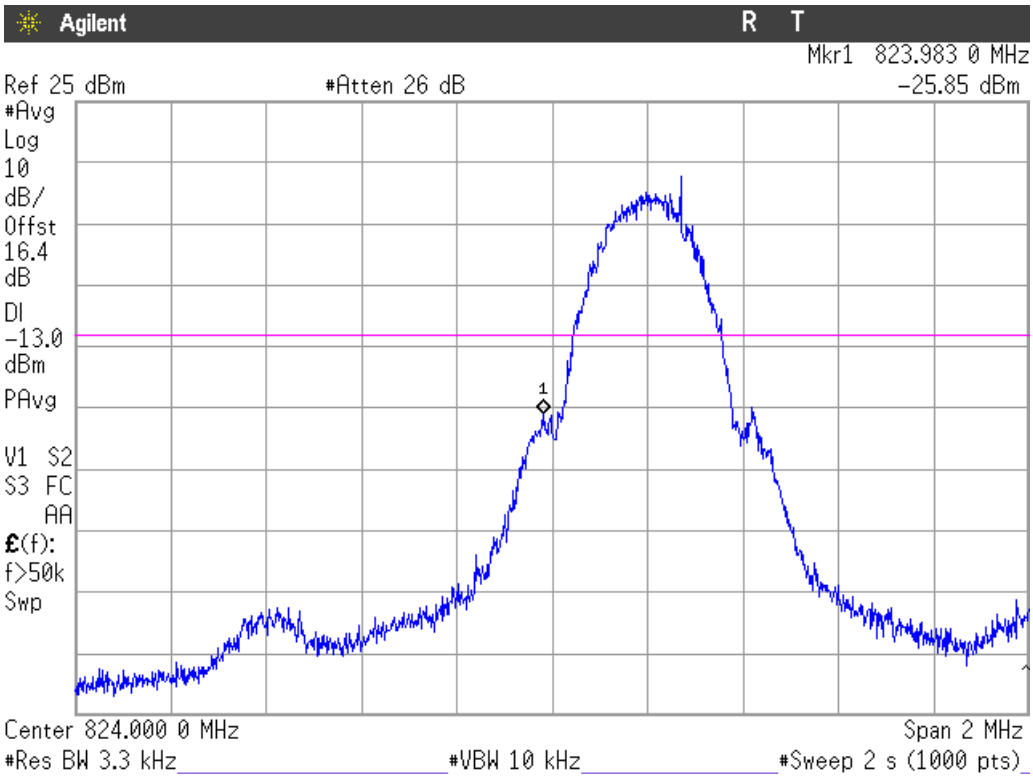
Highest Channel:



The equipment transmits at the maximum output power

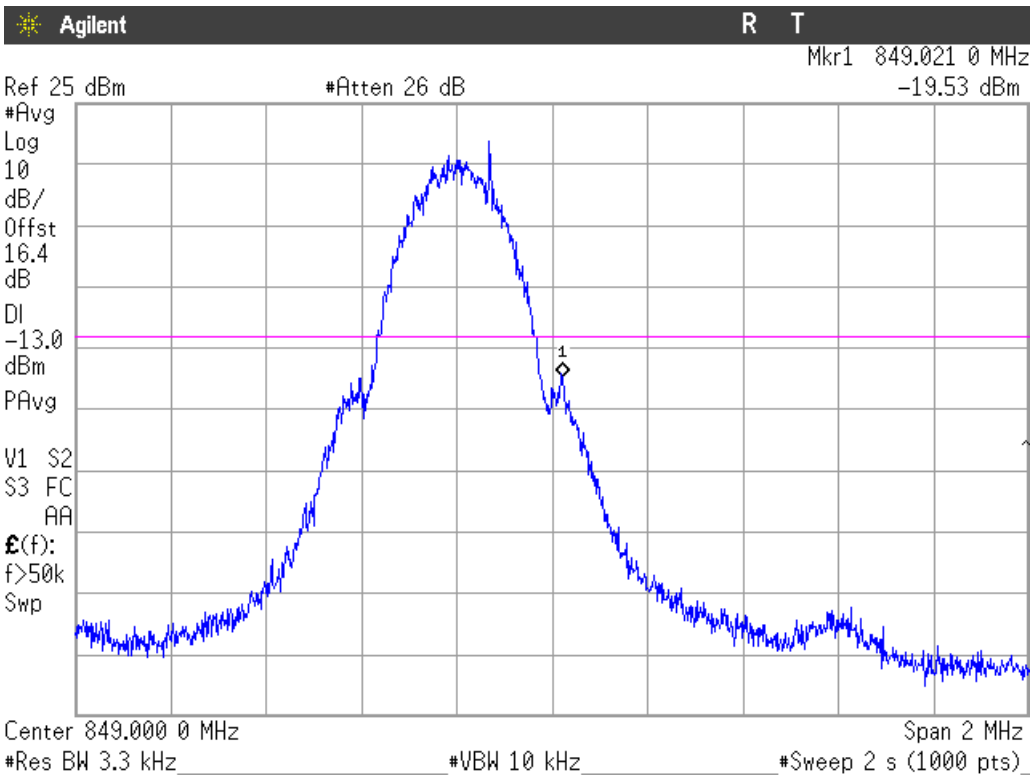
2G Band 850 MHz. EDGE MODULATION.

Lowest Channel:



The equipment transmits at the maximum output power

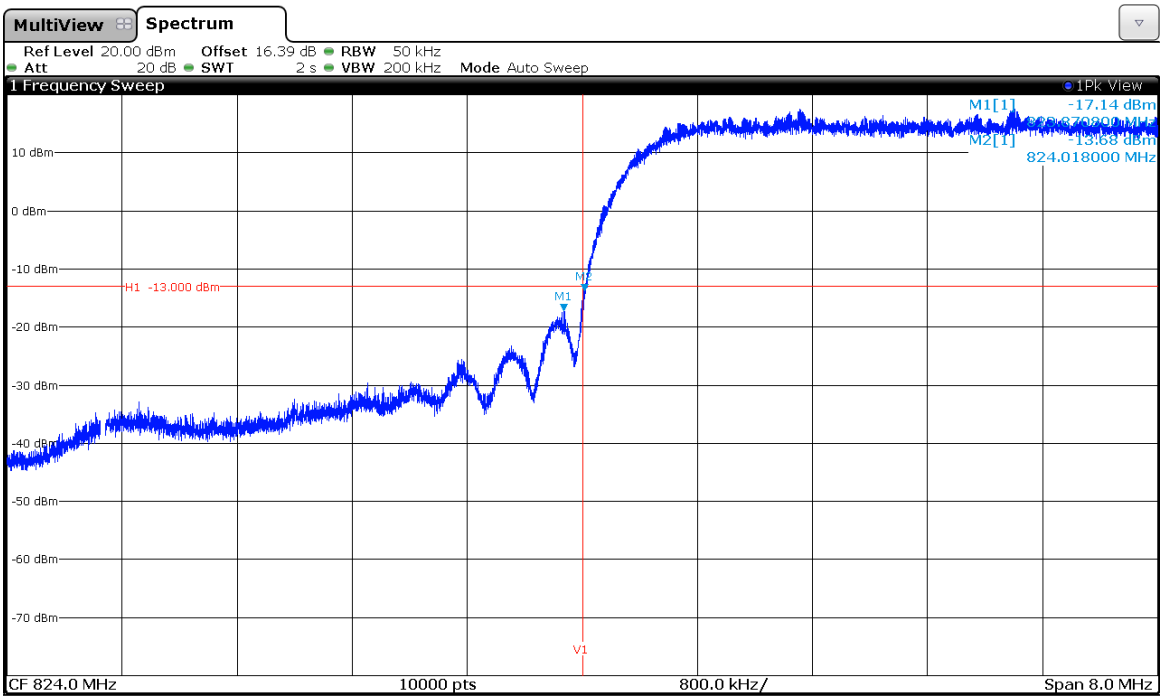
Highest Channel:



The equipment transmits at the maximum output power

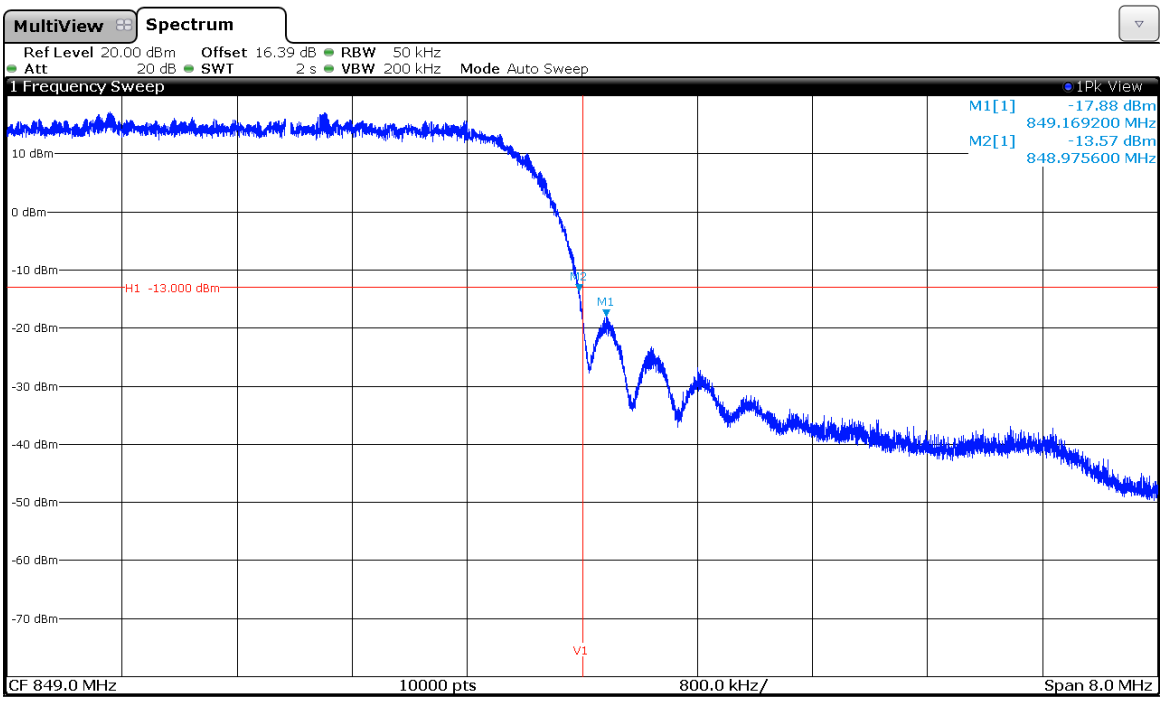
3G Band V. WCDMA MODULATION.

Lowest Channel:



The equipment transmits at the maximum output power

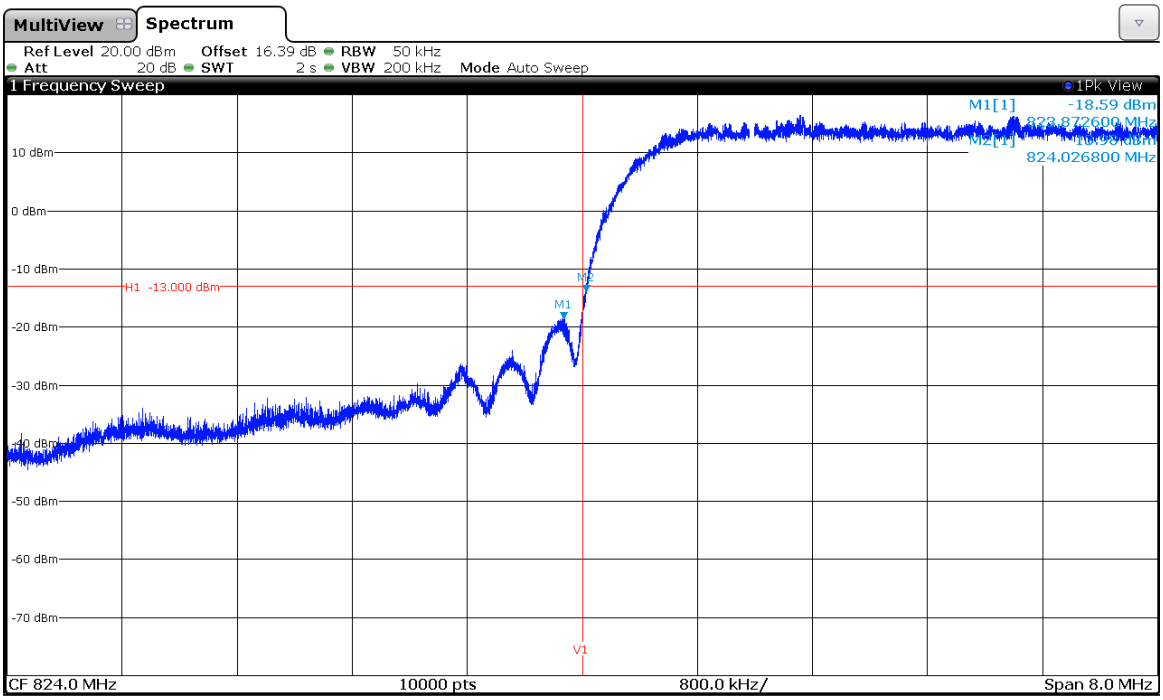
Highest Channel:



The equipment transmits at the maximum output power

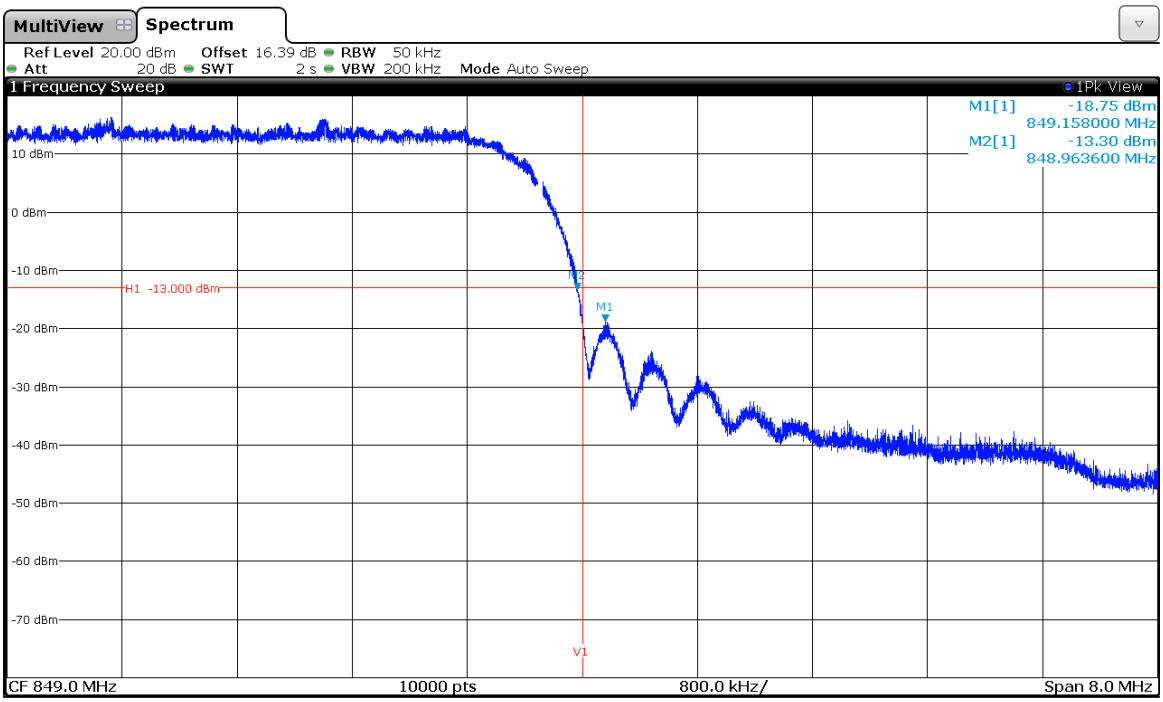
3G Band V. HSUPA MODULATION.

Lowest Channel:



The equipment transmits at the maximum output power

Highest Channel:



The equipment transmits at the maximum output power

Radiated emissions

SPECIFICATION:

FCC §22.917:

RSS-132. Clause 5.5:

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.

METHOD:

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 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna for measurements below 1 GHz and at 1 m 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 meter reading was recorded. The radiated emissions were measured with peak detector and 1 MHz bandwidth.
Each detected emission is substituted by the Substitution method, in accordance with the ANSI/TIA/EIA-603-E.

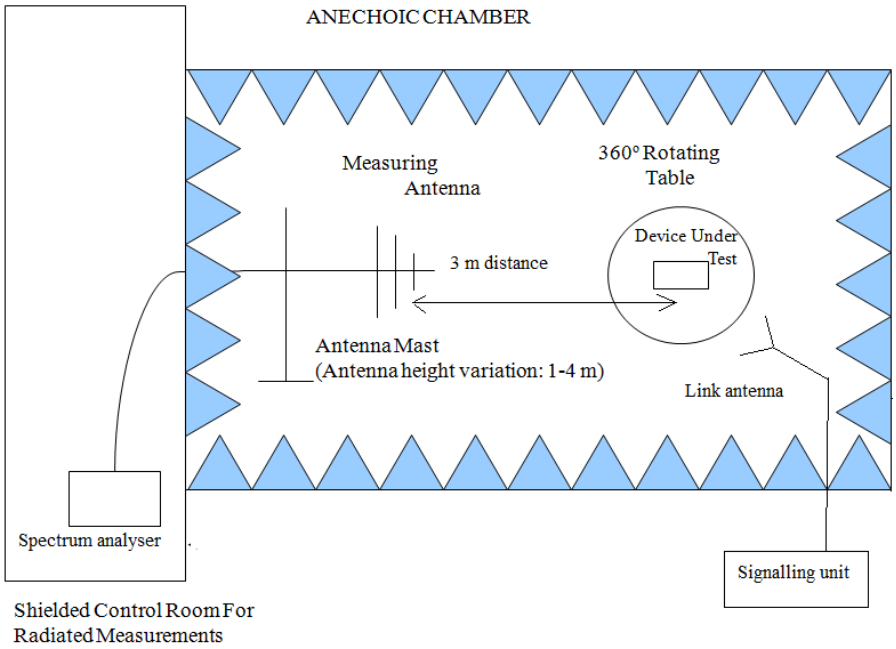
Measurement Limit**:**

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 Po transmitting power. the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative Po becomes:

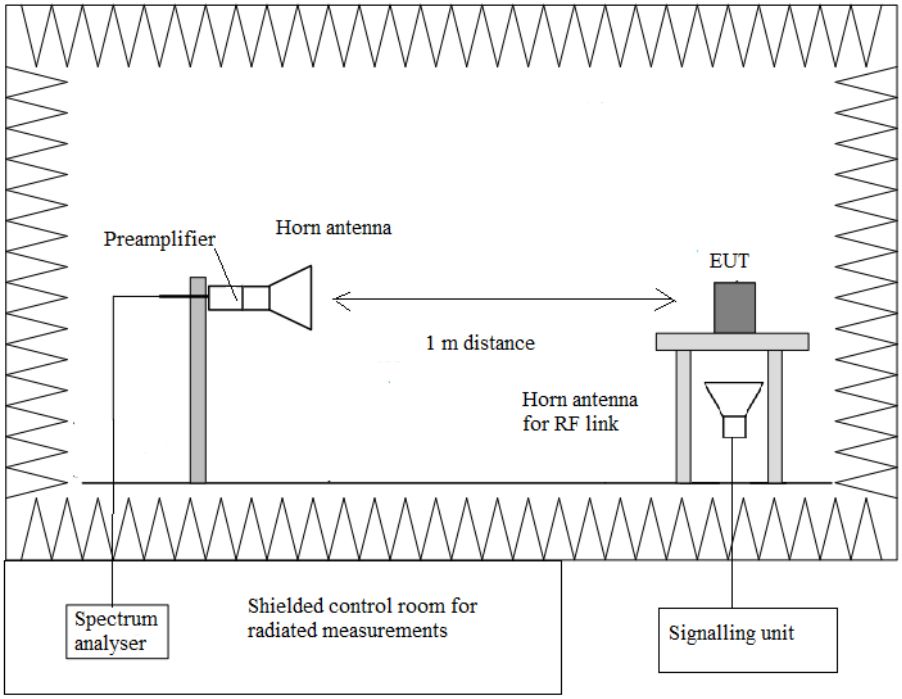
$$Po\ (dBm) – [43 + 10 \log (Po \text{ in mwatts}) - 30] = - 13\ dBm$$

TEST SETUP:

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



RESULTS:

2G Band 850 MHz:

GPRS and EDGE Modulations:
A preliminary scan determined the GPRS modulation as the worst case. The following tables and plots show the results for GPRS modulation.

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies detected at less than 20 dB below the limit.

Frequency range 1 - 10 GHz

No spurious frequencies detected at less than 20 dB below the limit.

- Middle Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies detected at less than 20 dB below the limit.

Frequency range 1 - 10 GHz

No spurious frequencies detected at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies detected at less than 20 dB below the limit.

Frequency range 1 - 10 GHz

No spurious frequencies detected at less than 20 dB below the limit.

3G Band V:

WCDMA and HSUPA Modulations:
A preliminary scan determined the HSUPA modulation as the worst case. The following tables and plots show the results for HSUPA modulation.

- Lowest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies detected at less than 20 dB below the limit.

Frequency range 1 - 10 GHz

No spurious frequencies detected at less than 20 dB below the limit.

- Middle Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies detected at less than 20 dB below the limit.

Frequency range 1 - 10 GHz

No spurious frequencies detected at less than 20 dB below the limit.

- Highest Channel:

Frequency range 30 MHz - 1 GHz

No spurious frequencies detected at less than 20 dB below the limit.

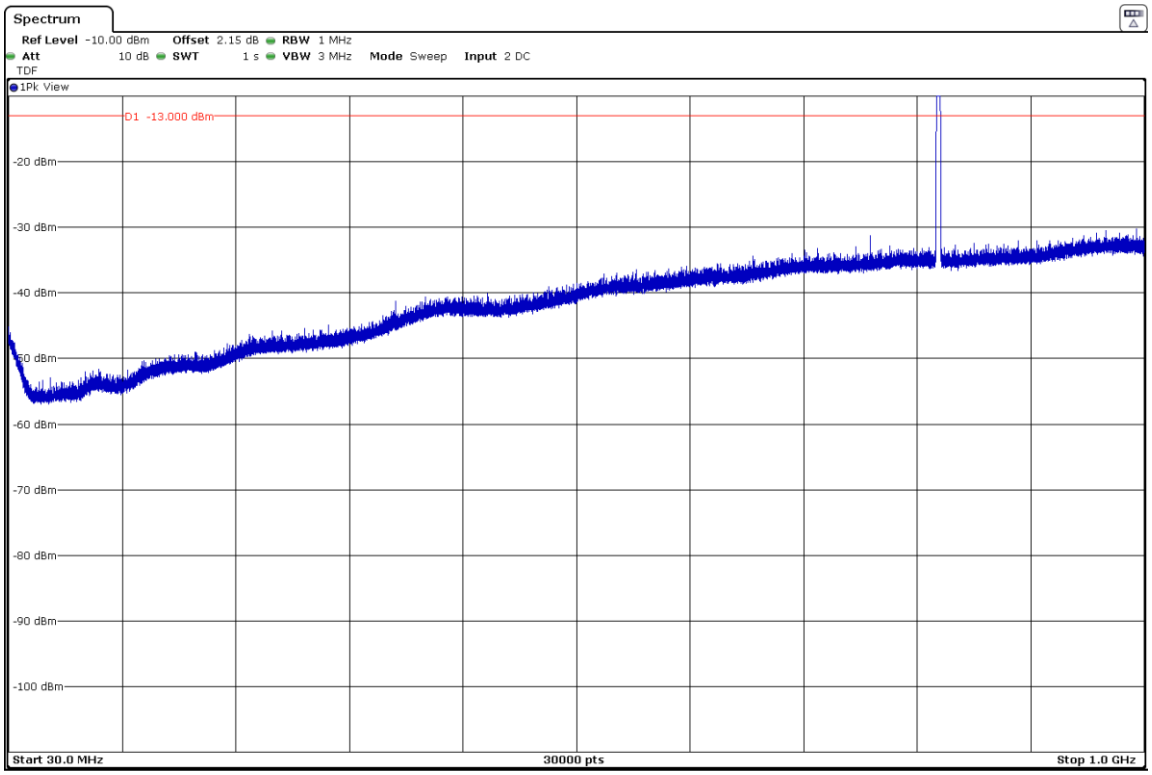
Frequency range 1 - 10 GHz

No spurious frequencies detected at less than 20 dB below the limit.

FREQUENCY RANGE 30 MHz - 1 GHz

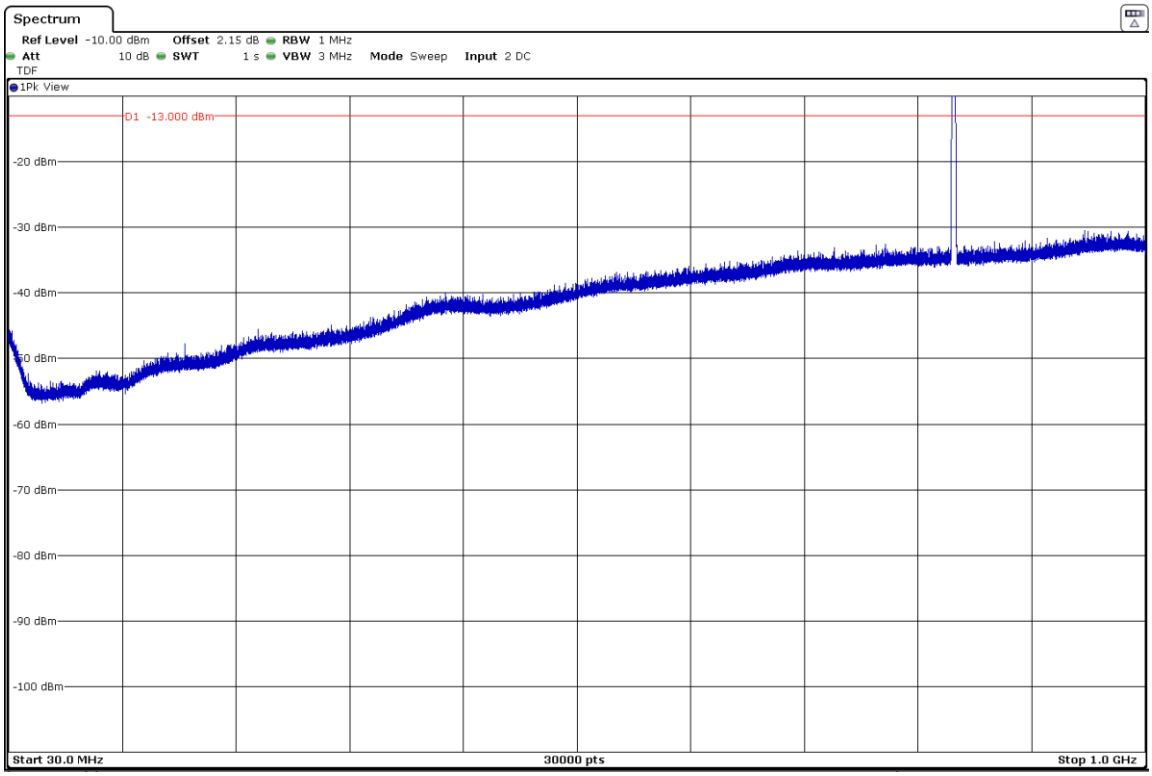
GPRS MODULATION

- Lowest Channel:



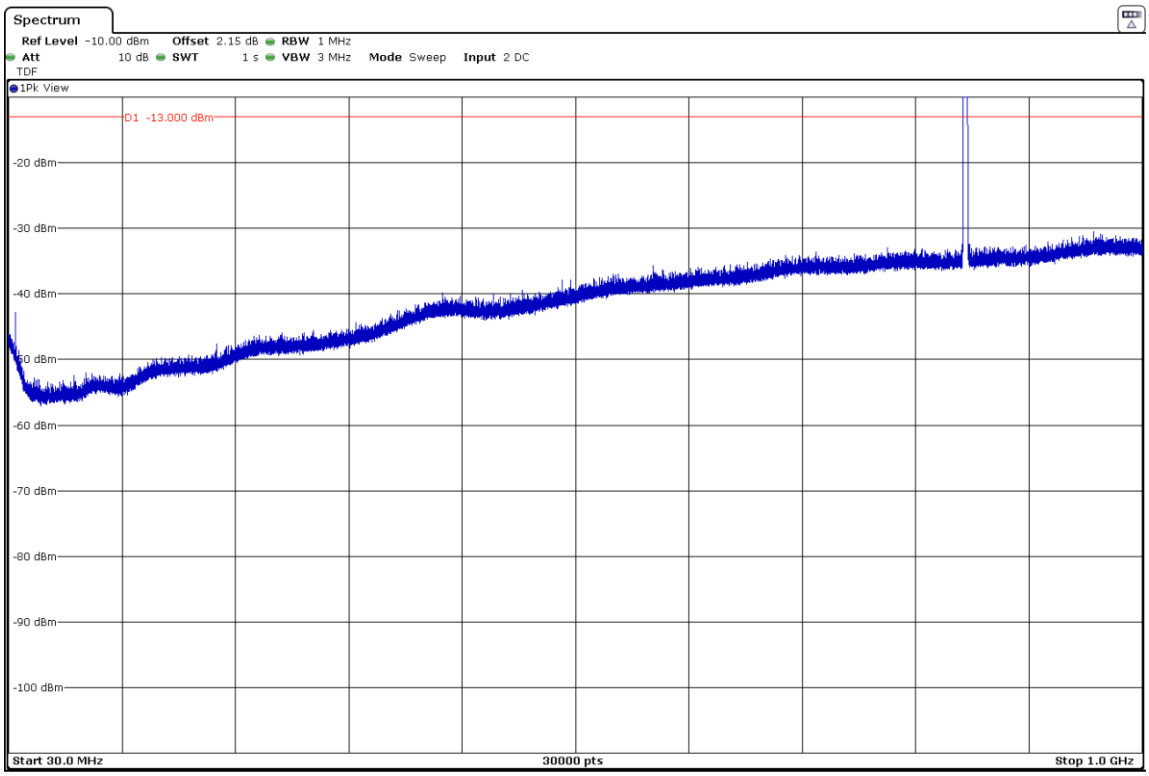
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

- Highest Channel:

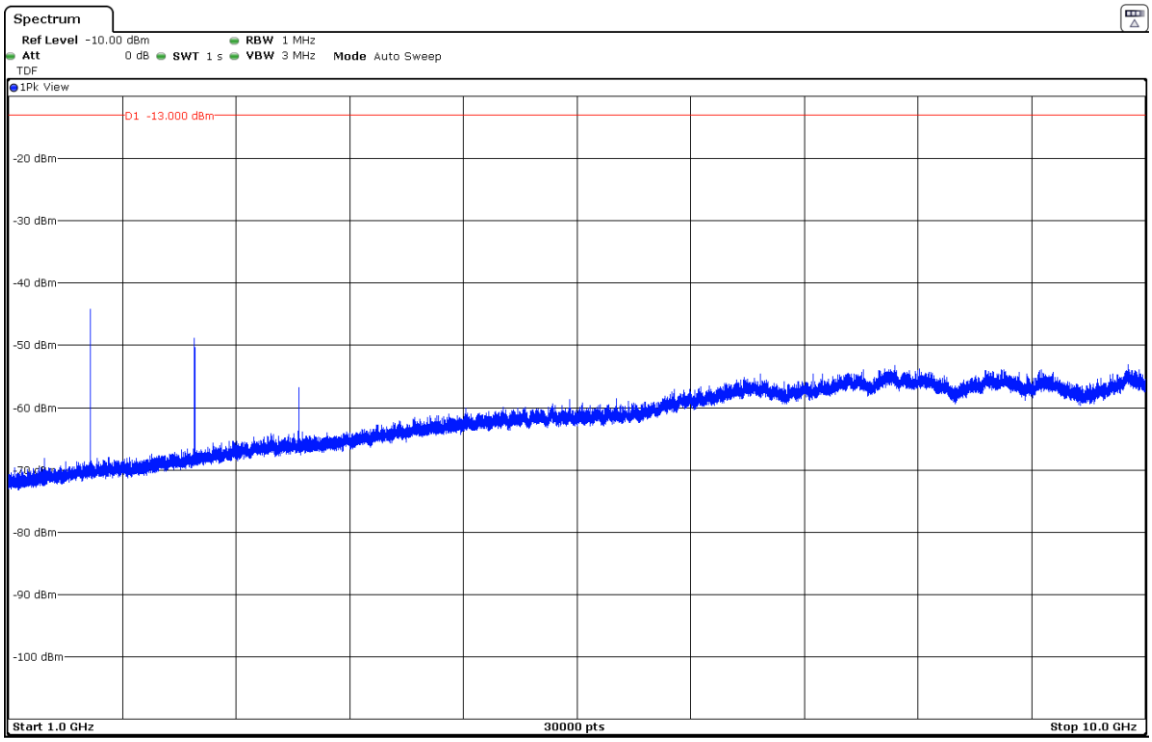


The peak above the limit is the carrier frequency.

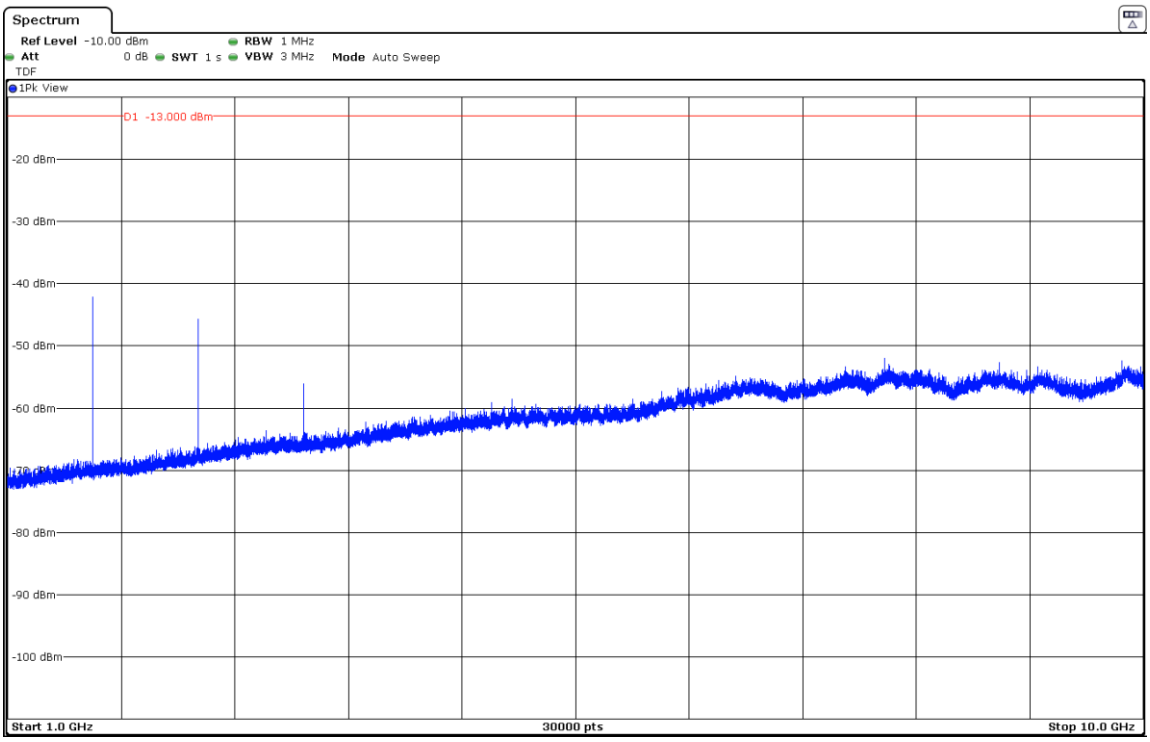
FREQUENCY RANGE 1 - 10 GHz

GPRS MODULATION

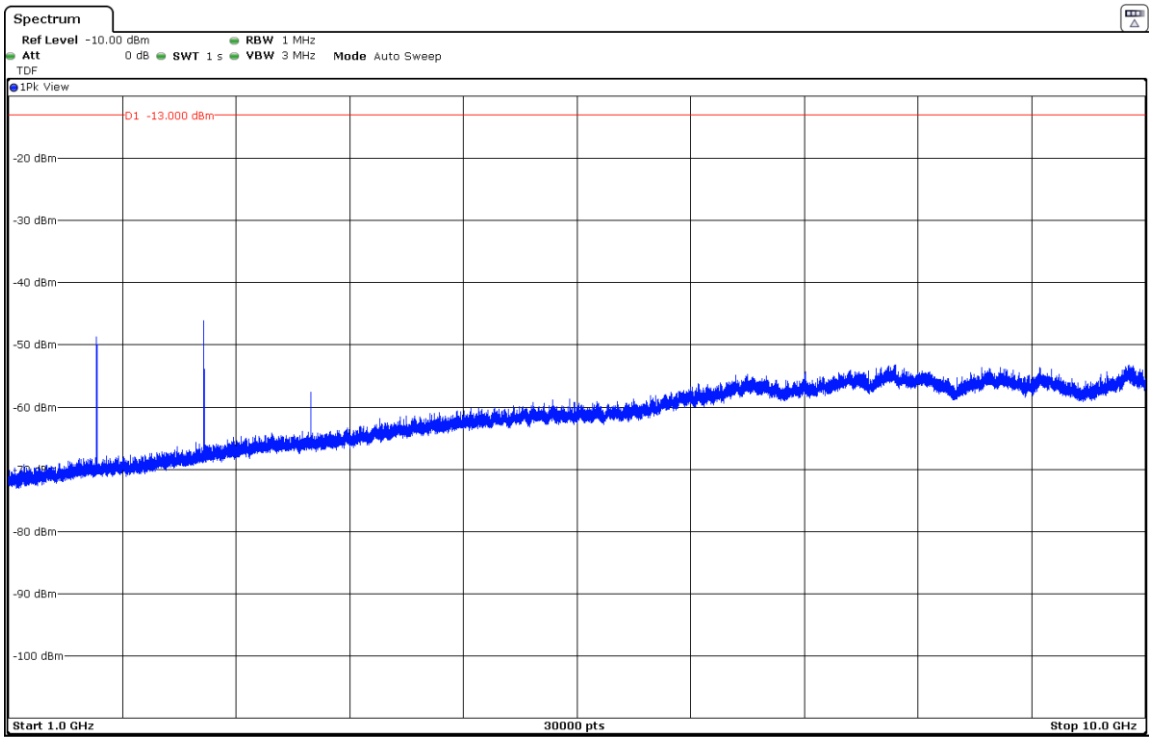
- Lowest Channel:



- Middle Channel:



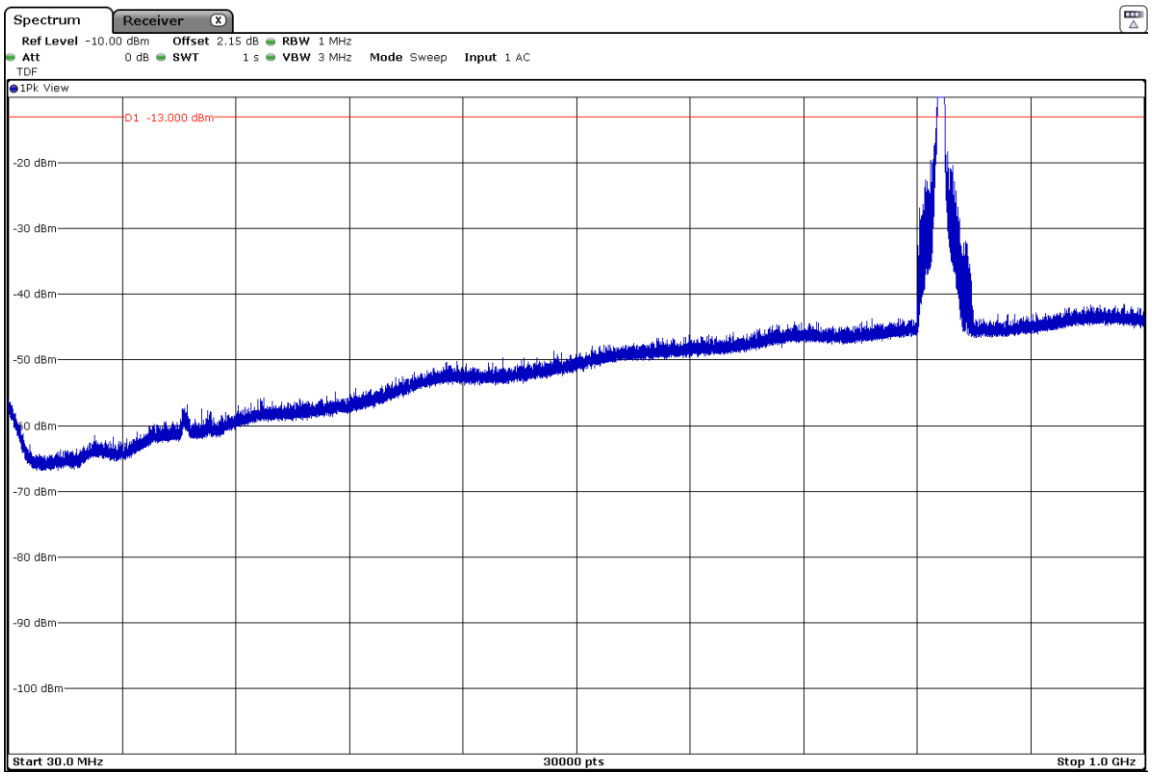
- Highest Channel:



FREQUENCY RANGE 30 MHz - 1 GHz

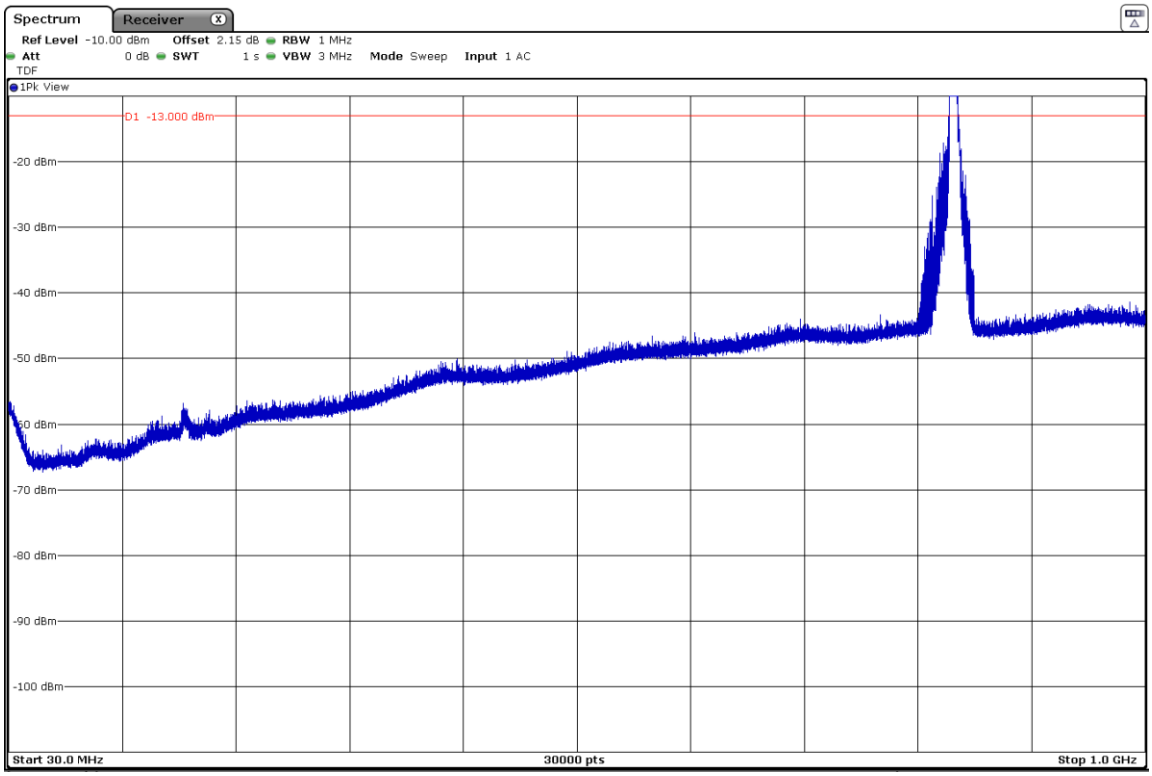
HSUPA MODULATION

- Lowest Channel:



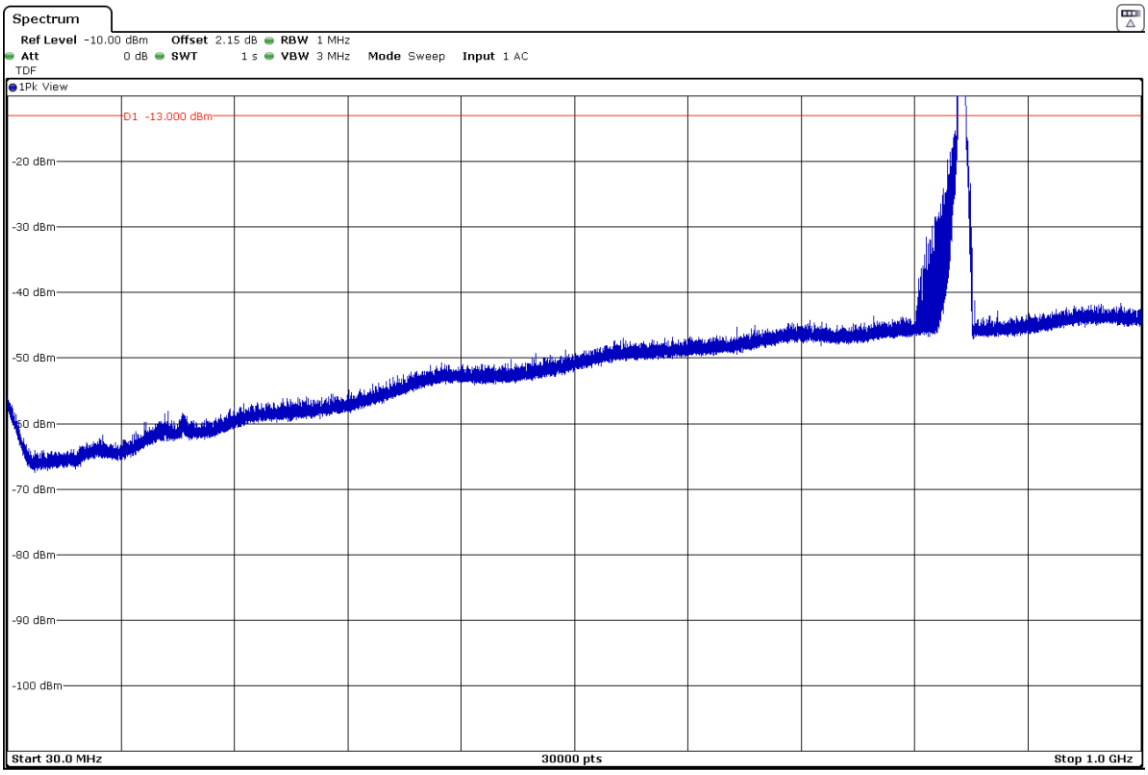
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

- Highest Channel:

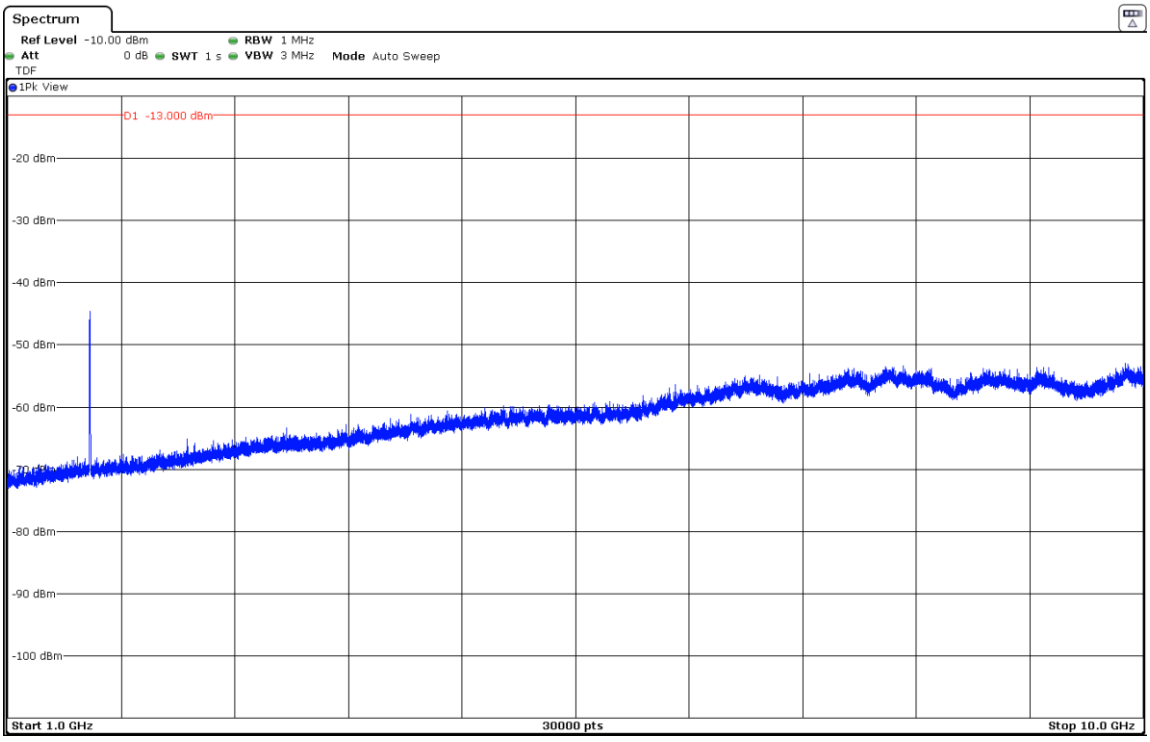


The peak above the limit is the carrier frequency.

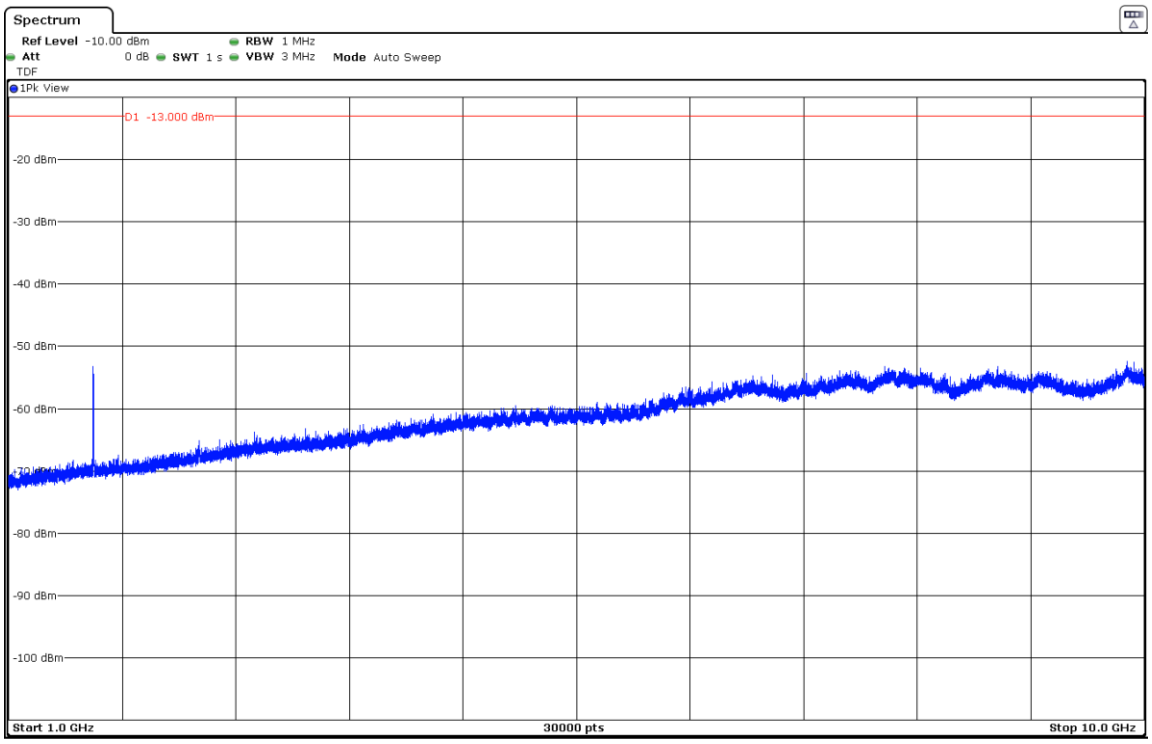
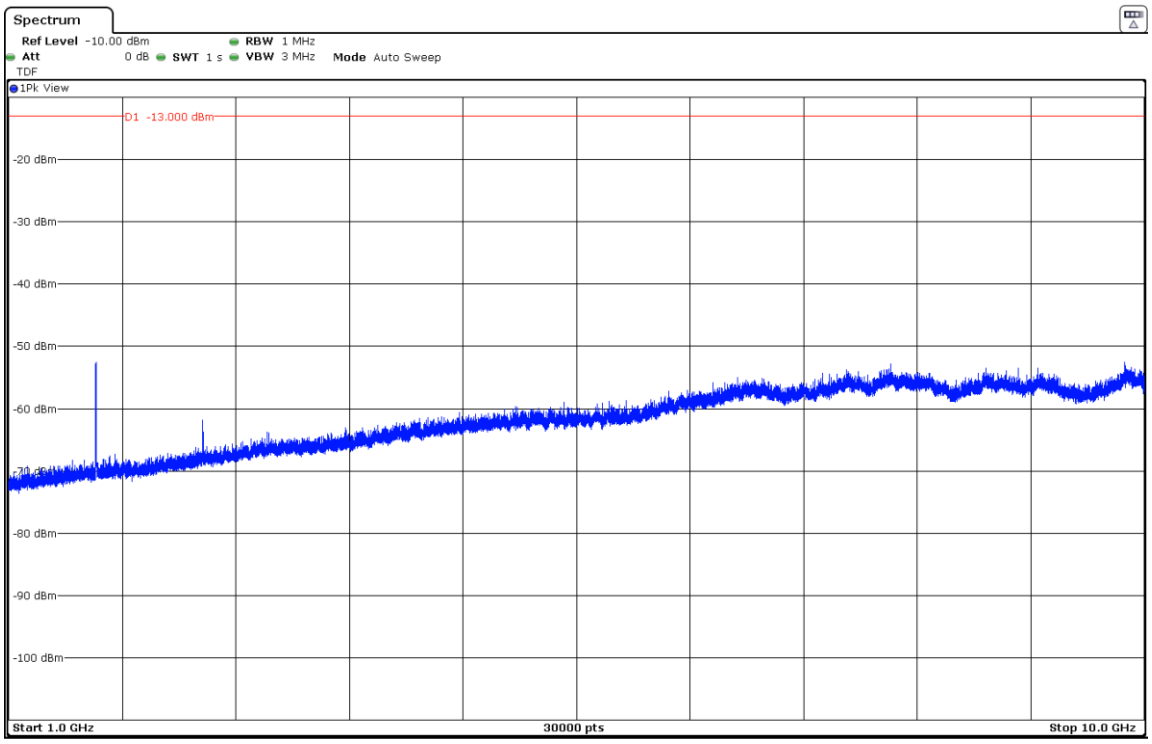
FREQUENCY RANGE 1 - 10 GHz

HSUPA MODULATION

- Lowest Channel:



- Middle Channel:



- Highest Channel: