




Test report No:
 NIE: 59830RRF.009

Test report
REFERENCE STANDARD:
USA FCC Part 24
CANADA RSS-133

(*) Identification of item tested	TCAM: Telematics and Connectivity Antenna Module
(*) Trademark	Continental
(*) Model and /or type reference	TCAM1NA0
Other identification of the product	HW version: E4.2 SW version: PI007.1 FCC ID: KR5TCAM1NA0 IC: 7812D-TCAM1NA0
(*) Features	2G, 3G, LTE, GNSS, WLAN, BLE, ISM Receiver
Applicant	Continental Automotive GmbH Siemensstrasse 12, 93055 Regensburg, Germany
Test method requested, standard	USA FCC Part 24 (10-1-19 Edition). CANADA RSS-133 Issue 6, Jan. 2018. ANSI C63.26-2015. ANSI/TIA-603-E: 2016. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager  RAFAEL LÓPEZ MARTÍN 2020.07.16 08:50:51 +02'00'
Date of issue	2020-07-15
Report template No	FDT08_22 (*) "Data provided by the client"

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Competences and guarantees

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

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General conditions

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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 the Telematics and Connectivity Antenna Module (TCAM) model Continental TCAM1NA0 is a vehicle antenna module for telematic and connectivity purposes.

It consists of a fin antenna with integrated telematics transceivers for different wireless services as well as several interfaces to the vehicle.

The TCAM1NA0 main parts are:

- Antennas for cellular, WLAN, BLE, ISM receiver (RKE), SDARS with LNA
- GNSS with LNA for Navigation: Beidou, Galileo, GPS, Glonass
- Antenna selection via RF switches
- TCAM internal antennas (all are TCAM internal, no extern antenna connections):
- Tel1 ant: 2G, 3G, 4G/LTE1 (vehicle outside)
- Tel2 ant: LTE2 (Rx only) (vehicle outside)
- MIMO with LTE1- and LTE2-antenna. LTE2 is Rx only
- Backup telephone antenna: 2G, 3G, 4G/LTE (vehicle inside)
- Wi-Fi internal antenna (vehicle inside)
- Wi-Fi external antenna (vehicle outside)
- BLE antenna (vehicle outside)
- Stacked patch antenna featuring GNSS
- ISM receiver antenna
- SDARS antenna

CAT4 NAD with 2G/3G/4G/LTE and GNSS, FCC certified

VoLTE

ISM receiver module (434MHz) for: RKE (Remote Keyless Entry), PASE (Passive Start and Entry, TPMS (Tire Pressure Monitoring System), FCC tested

Wi-Fi chip

BLE chip

1st internal embedded Sim-IC

Service calls

External interfaces:

Main power supply

External backup battery

External SIM card slot (2nd private customer SIM, optional)

External microphone in the OHC (Overhead Compartment)

A2B

External backup speaker

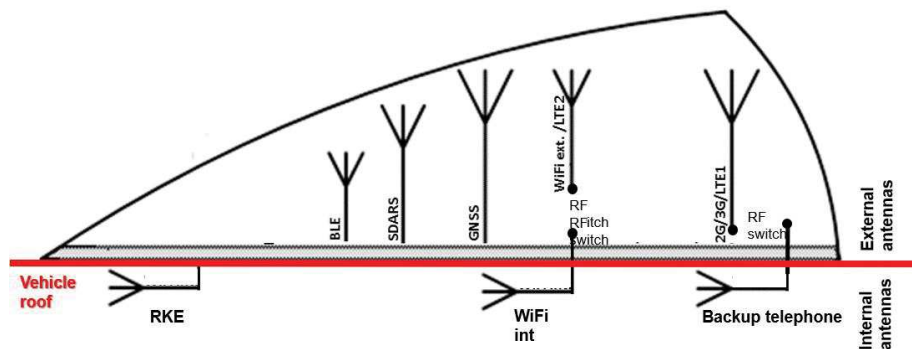
BroadR-Reach

CEM connection (K-Line)

Infotainment CAN

Airbag input

Debug interfaces (USB, UART)



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 N°	Description	Model	Serial N°	Date of reception
59830B/010	Telematics and Connectivity Antenna Module	Continental TCAM1NA0	SNRD004291	2019-10-22
59830B/031	CAN-Box	CAN-STIN3	00255	2019-11-11
59830B/036	Harness	--	--	2019-11-11

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

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

Control N°	Description	Model	Serial N°	Date of reception
59830B/011	Telematics and Connectivity Antenna Module	Continental TCAM1NA0	SNRD004290	2019-10-22
59830B/031	CAN-Box	CAN-STIN3	00255	2019-11-11
59830B/036	Harness	--	--	2019-11-11

Sample S/02 has undergone the following test(s): The radiated tests with the Tel1 Antenna indicated in Appendix A.

- Sample S/03 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
59830B/004	Telematics and Connectivity Antenna Module	Continental TCAM1NA0	SNRD004295	2019-10-22
59830B/028	CAN-BOX TCAM	CAN-STIN3	00047	2019-10-30
59830B/036	Harness	--	--	2019-11-11

Sample S/03 has undergone the following test(s): All conducted tests indicated in Appendix A.

Test sample description

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
	<i>USB diagnostic</i>	~3m	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<i>UART diagnostic</i>	~3m	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	<i>BRR diagnostic</i>	~3m	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Supplementary information to the ports..... :	--						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	DC: 12V					
Rated Power	4.2 W dc (cellular, Wi-Fi, BLE, GNSS active)						
Clock frequencies..... :	32.768kHz, 16MHz, 19.2MHz, 24MHz, 25MHz, 27.6MHz, 48MHz						
Other parameters	Operating temperature Range: -40°C to 85°C Supply Voltage Range: 8 V to 16 V DC						
Software version	PI007.1						
Hardware version	E4.2						
Dimensions in cm (W x H x D)	10.5cm x 15.5cm x 9cm						
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 checked="" type="checkbox"/>	Other: Vehicular environment equipment					
Modules/parts..... :	Module/parts of test item		Type		Manufacturer		
	Network Access Device (NAD), (cellular, GNSS)		Model: BL28NA-001		Continental Automotive Systems		

	ISM/RKE 434 MHz RF receiver module	Model: A2C38291300	Continental Automotive GmbH
Accessories (not part of the test item)	Description	Type	Manufacturer
	bracket		
	1x harness w/o USB		
	3x harness w USB		
	Inlay disc		
	Design cap		
Documents as provided by the applicant.....	Description	File name	Issue date
	TCAM_Testhouse_Manual_29Oct2019_V1		

(3) Only for Medical Equipment

Identification of the client

Continental Automotive GmbH
 Siemensstrasse 12, 93055 Regensburg, Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2020-06-10
Date (finish)	2020-07-07

Document history

Report number	Date	Description
59830RRF.009	2020-07-15	First release

Environmental conditions

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

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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

Temperature	Min. = 15 °C Max. = 35 °C
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 °C Max. = 35 °C
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: Verónica García, Javier Miguel Nadales, Cristina Calle and José Manuel Jiménez.

Used instrumentation:

Conducted Measurements

	Last Calibration	Due Calibration
1. Shielded Room ETS LINDGREN S101	N.A.	N.A.
2. Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2020/03	2022/03
3. Signal Analyzer 20 Hz to 8 GHz ROHDE AND SCHWARZ FSQ8	2018/08	2020/08
4. Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2020/07	2021/07
5. Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2020/07	2021/07
6. Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2020/04	2021/04
7. DC Power Supply, 30V, 5A KEYSIGHT TECHNOLOGIES U8002A	N.A.	N.A.
8. Digital multimeter FLUKE 179	2019/09	2020/09
9. Climatic chamber BINDER MK 56	2020/03	2021/03

Radiated Measurements

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2. Shielded Room ETS LINDGREN S101	N.A.	N.A.
3. Biconical/Log Antenna 30MHz - 6GHz ETS LINDGREN 3142E	2017/09	2020/09
4. EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10
5. RF Pre-amplifier 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	2020/02	2021/02
6. Broadband Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2018/01	2021/01
7. Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2019/10	2021/10
8. RF Pre-amplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/11	2020/11
9. Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2020/05	2023/05
10. RF Pre-amplifier 30 dB, 18 GHz-40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
11. Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2019/09	2020/09
12. Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2020/07	2021/07
13. DC Power Supply Keysight Technologies U8002A	N.A.	N.A.
14. Digital multimeter FLUKE 175	2019/10	2020/10

Testing verdicts

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

Summary

FCC PART 24 / RSS-133 PARAGRAPH		
Requirement – Test case	Verdict	Remark
Clause 24.232/RSS-133 Clause 6.4: RF output power	P	(1) (2)
Clause 2.1047/RSS-133 Clause 6.2: Modulation characteristics	P	(1) (2)
Clause 24.235/RSS-133 Clause 6.3: Frequency stability	P	(1) (2)
Clause 2.1049: Occupied Bandwidth	P	(1) (2)
Clause 24.238/RSS-133 Clause 6.5: Spurious emissions at antenna terminals	P	(1) (2)
Clause 24.238/RSS-133 Clause 6.5: Radiated emissions	P	(1) (2)
<u>Supplementary information and remarks:</u>		
<p>1. GSM mode has not been tested to prove USA FCC Part 24 compliance because the modulation scheme and the power maximum levels are the same as for GPRS mode.</p> <p>Taking into account the above comments, testing in GSM mode is redundant for FCC Part 24 as it is the same as GPRS mode. GPRS mode has been tested as indicated on the present test report.</p> <p>2. HSDPA modulation mode has not been tested to prove USA FCC Part 24 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.</p> <p>Taking into account the above comments, testing in HSDPA modulation mode is redundant for FCC Part 24 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.</p>		

Appendix A: Test results for FCC PART 24 / RSS-133

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TEST CONDITIONS

POWER SUPPLY (V):

Vn: 12 Vdc
 Vmin: 10.2 Vdc
 Vmax: 13.8 Vdc

Type of Power Supply: External power supply (Car Battery).

The subscripts 'n', 'min' and 'max' indicate voltage test conditions (normal, minimum and maximum respectively).

ANTENNA:

MIDDLE Bands	GAIN	ANTENNA TYPE
2G Band 1900 MHz	+4 dBi (Tel1 antenna) +3 dBi (backup antenna)	Internal (3D)
3G Band II	+5 dBi (Tel1 antenna) +5.9 dBi (backup antenna)	Internal (3D)
LTE Band 2	+5.9 dBi (Tel1 antenna) +5.9 dBi (backup antenna)	Internal (3D)

TEST FREQUENCIES:

2G Band 1900 MHz. GPRS and EDGE MODULATIONS:

Lowest channel (512): 1850.2 MHz
 Middle channel (662): 1880.2 MHz
 Highest channel (810): 1909.8 MHz

3G Band II. WCDMA and HSUPA MODULATIONS:

Lowest channel (9262): 1852.4 MHz
 Middle channel (9400): 1880.0 MHz
 Highest channel (9538): 1907.6 MHz

LTE Band 2. QPSK AND 16QAM MODULATIONS:

	Channel (Frequency, MHz)					
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Lowest	18607 (1850.7)	18615 (1851.5)	18625 (1852.5)	18650 (1855)	18675 (1857.5)	18700 (1860)
Middle	18900 (1880)	18900 (1880)	18900 (1880)	18900 (1880)	18900 (1880)	18900 (1880)
Highest	19193 (1909.3)	19185 (1908.5)	19175 (1907.5)	19150 (1905)	19125 (1902.5)	19100 (1900)

RF Output Power

SPECIFICATION:

FCC §2.1046 and §24.232

Mobile/portable stations are limited to 2 Watts (33 dBm) Effective Isotropic Radiated Power (E.I.R.P.).
The peak-to-average ratio (PAR) of the transmission shall not exceed 13 dB.

RSS-133. Clause 6.4.

The 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.

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 CMW500, selecting maximum transmission power of the EUT and different modes of modulation.

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

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

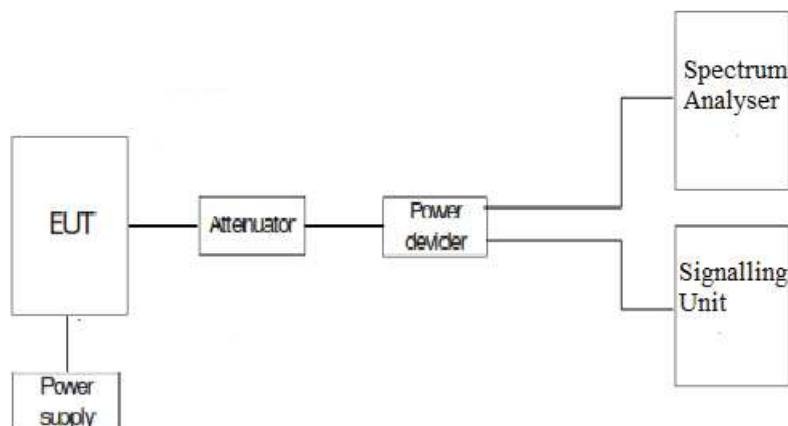
The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP:

1. CONDUCTED AVERAGE POWER:



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



RESULTS:

1. CONDUCTED AVERAGE POWER

2G Band 1900 MHz:

GPRS MODULATION:

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	4.00	4.00	4.00
Measured maximum average power (dBm) at antenna port	27.20	26.80	26.32
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	31.20	30.80	30.32
Peak-to-average ratio (PAR) (dB)	0.23	0.24	0.26
Measurement uncertainty (dB)	<±1.58		

EDGE MODULATION:

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	4.00	4.00	4.00
Measured maximum average power (dBm) at antenna port	24.19	23.89	23.48
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	28.19	27.89	27.48
Peak-to-average ratio (PAR) (dB)	3.41	3.68	3.55
Measurement uncertainty (dB)	<±1.58		

3G Band II:

WCDMA MODULATION:

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	21.81	21.72	21.44
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	27.71	27.62	27.34
Peak-to-average ratio (PAR) (dB)	3.19	3.22	2.99
Measurement uncertainty (dB)	<±1.58		

HSUPA MODULATION:

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	18.97	18.7	18.64
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	24.87	24.6	24.54
Peak-to-average ratio (PAR) (dB)	7.05	7.58	6.83
Measurement uncertainty (dB)	<±1.58		

LTE BAND 2:

LTE BAND 2. QPSK MODULATION. Bandwidth = 1.4 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	22.31	21.96	21.52
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.21	27.86	27.42
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.
 (*): Preliminary measurements determined that the modulation 16QAM, RB Size: 6, RB Offset: 0 as the worst case.
 The results in the next tables shows the results for this configuration.

LTE BAND 2. 16QAM MODULATION. Bandwidth = 1.4 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	21.21	20.93	20.72
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.11	26.83	26.62
PAPR (dB)	6.06	6.04	5.75
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.
 Worst case PAPR: Modulation 16QAM. RB Size: 6. RB Offset: 0.

LTE BAND 2. QPSK MODULATION. Bandwidth = 3 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	22.36	22.46	21.65
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.26	28.36	27.55
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 14.
 (*): Preliminary measurements determined that the modulation 16QAM, RB Size: 15, RB Offset: 0 as the worst case.
 The results in the next tables shows the results for this configuration.

LTE BAND 2. 16QAM MODULATION. Bandwidth = 3 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	21.39	21.21	20.75
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.29	27.11	26.65
PAPR (dB)	6.15	6.14	5.93
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 14.
 Worst case PAPR: Modulation 16QAM. RB Size: 15. RB Offset: 0.

LTE BAND 2. QPSK MODULATION. Bandwidth = 5 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	22.06	21.93	21.82
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.96	27.83	27.72
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 24.
 (*): Preliminary measurements determined that the modulation 16QAM, RB Size: 25, RB Offset: 0 as the worst case.
 The results in the next tables shows the results for this configuration.

LTE BAND 2. 16QAM MODULATION. Bandwidth = 5 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	20.93	20.67	20.58
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	26.83	26.57	26.48
PAPR (dB)	6.11	6.06	5.95
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 24.
 Worst case PAPR: Modulation 16QAM. RB Size: 25. RB Offset: 0.

LTE BAND 2. QPSK MODULATION. Bandwidth = 10 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	21.93	22.30	22.02
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.83	28.20	27.92
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 49.
 (*): Preliminary measurements determined that the modulation 16QAM, RB Size: 50, RB Offset: 0 as the worst case. The results in the next tables shows the results for this configuration.

LTE BAND 2. 16QAM MODULATION. Bandwidth = 10 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	20.96	21.08	20.66
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	26.86	26.98	26.56
PAPR (dB)	6.12	6.03	5.99
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 49.
 Worst case PAPR: Modulation 16QAM. RB Size: 50. RB Offset: 0.

LTE BAND 2. QPSK MODULATION. Bandwidth = 15 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	21.93	22.34	21.61
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.83	28.24	27.51
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.
 (*): Preliminary measurements determined that the modulation 16QAM, RB Size: 75, RB Offset: 0 as the worst case.
 The results in the next tables shows the results for this configuration.

LTE BAND 2. 16QAM MODULATION. Bandwidth = 15 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	21.16	21.16	20.8
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.06	27.06	26.7
PAPR (dB)	6.11	6.09	6.03
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 74.
 Worst case PAPR: Modulation 16QAM. RB Size: 75. RB Offset: 0.

LTE BAND 2. QPSK MODULATION. Bandwidth = 20 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	22.32	22.12	21.95
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.22	28.02	27.85
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.
 (*): Preliminary measurements determined that the modulation 16QAM, RB Size: 100, RB Offset: 0 as the worst case. The results in the next tables shows the results for this configuration.

LTE BAND 2. 16QAM MODULATION. Bandwidth = 20 MHz.

Channel	Lowest	Middle	Highest
Maximum declared antenna gain (dBi)	5.90	5.90	5.90
Measured maximum average power (dBm) at antenna port	21.05	21.08	20.8
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	26.95	26.98	26.7
PAPR (dB)	6.03	6.03	6.09
Measurement uncertainty (dB)	<±1.58		

Worst case AVERAGE POWER:
 Worst case PAPR:

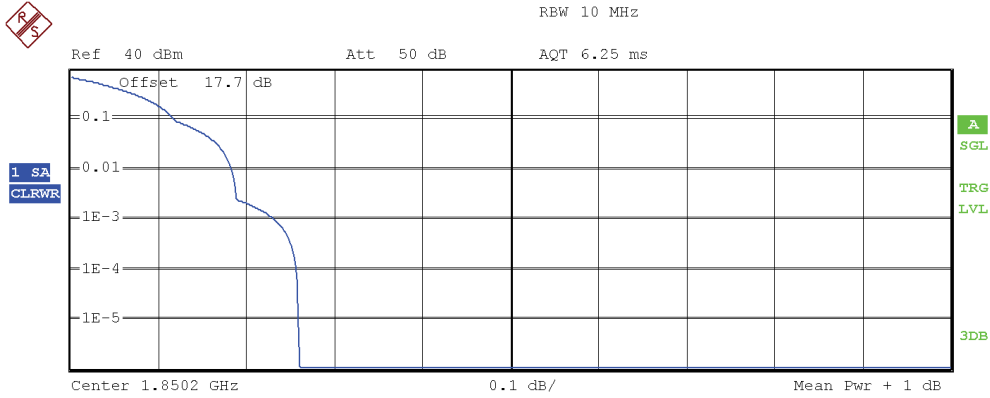
Modulation 16QAM. RB Size: 1. RB Offset: 0.
 Modulation 16QAM. RB Size: 100. RB Offset: 0.

Verdict: PASS

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

2G Band 1900 MHz. GPRS MODULATION.

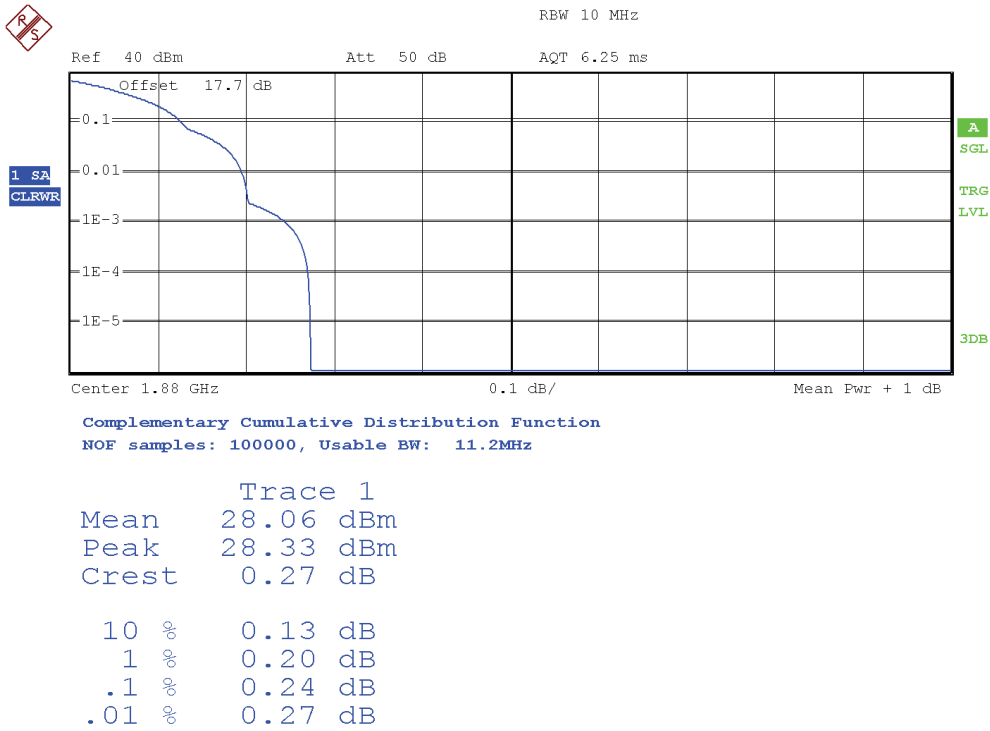
Lowest Channel :



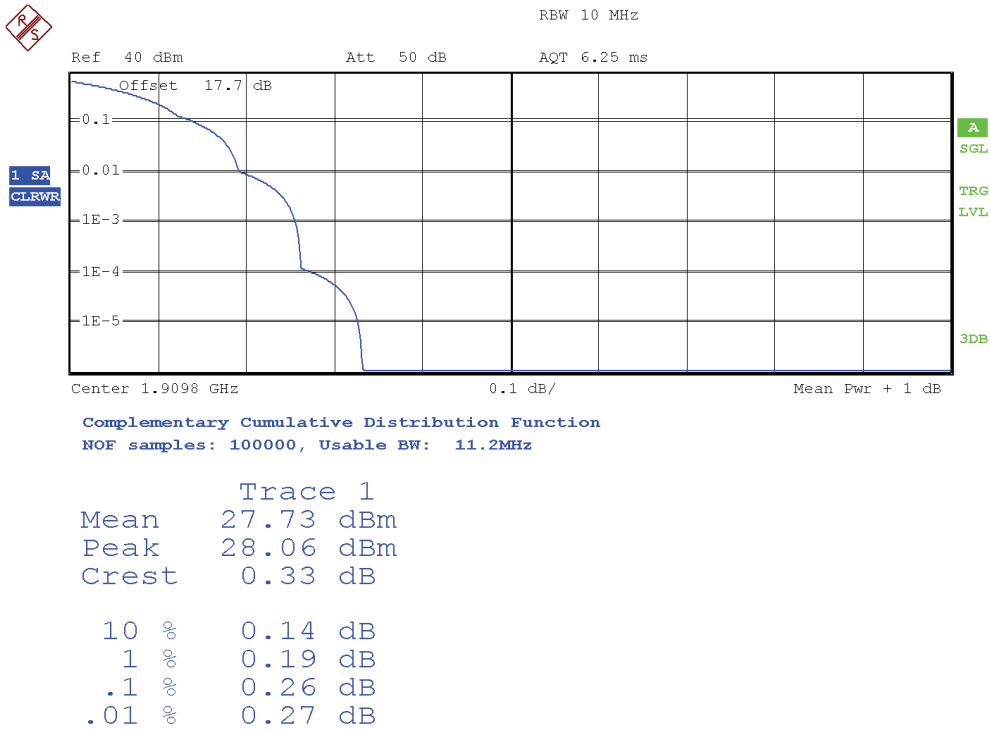
Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 11.2MHz

Trace 1	
Mean	28.47 dBm
Peak	28.73 dBm
Crest	0.26 dB
10 %	0.12 dB
1 %	0.18 dB
.1 %	0.23 dB
.01 %	0.26 dB

Middle Channel:

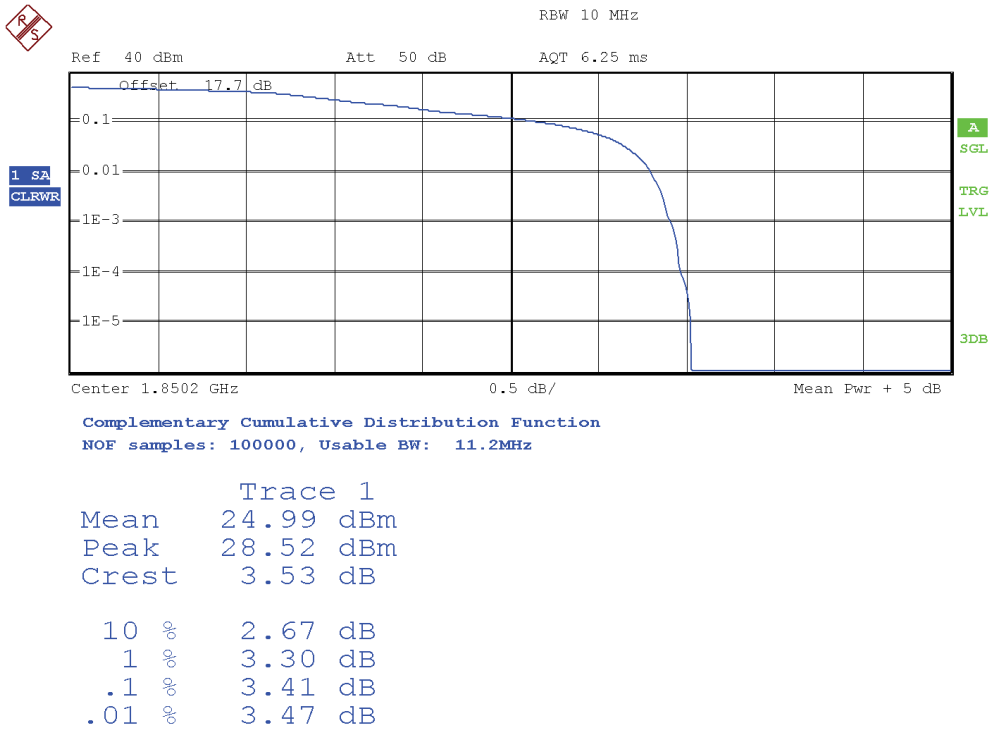


Highest Channel:

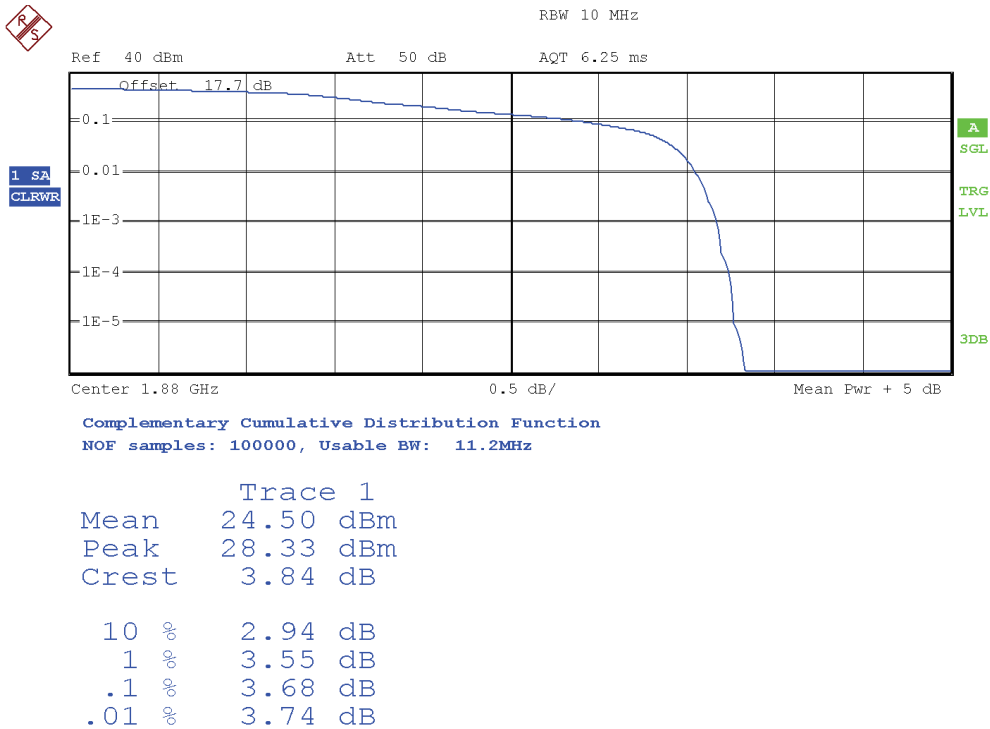


2G Band 1900 MHz. EDGE MODULATION.

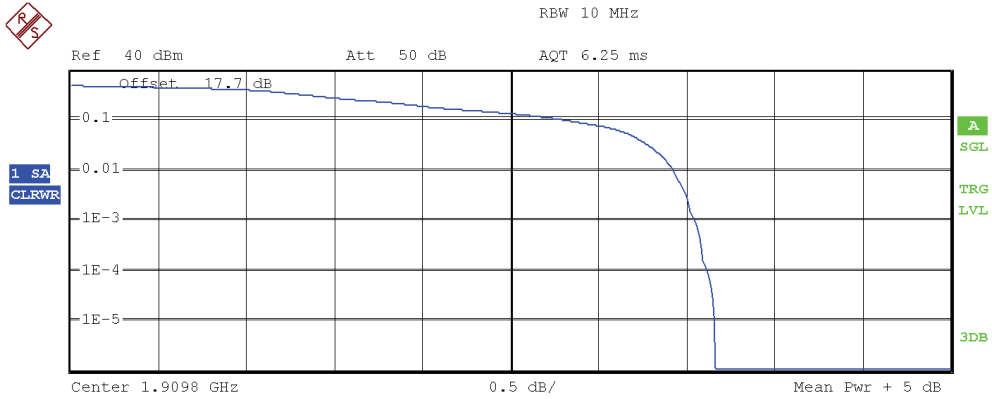
Lowest Channel:



Middle Channel:



Highest Channel:

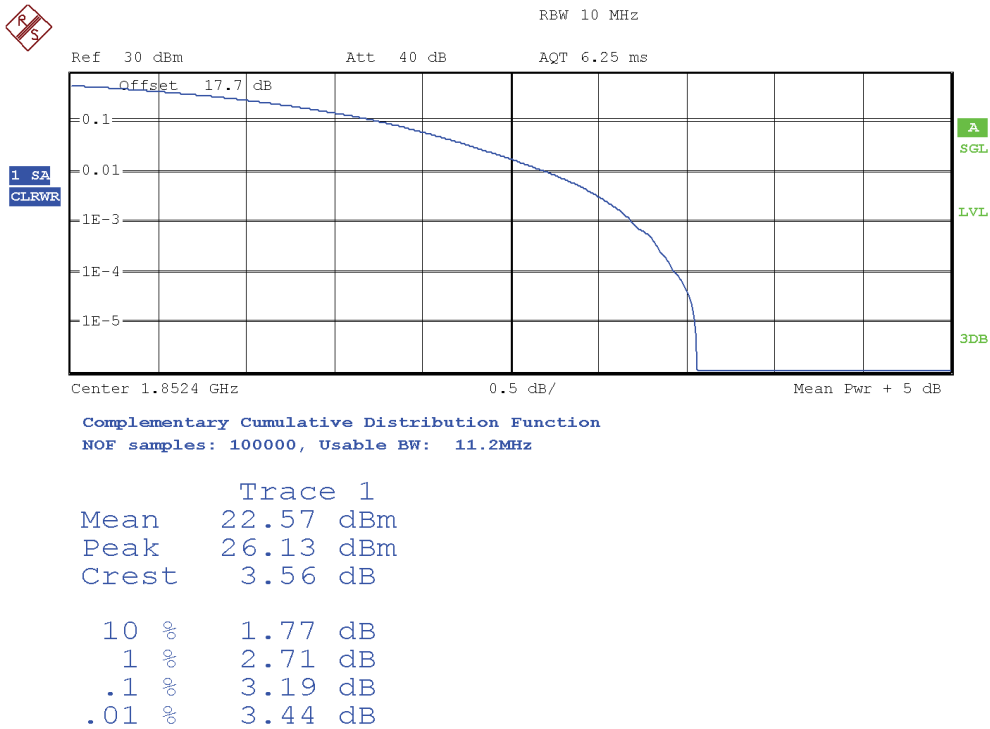


Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 11.2MHz

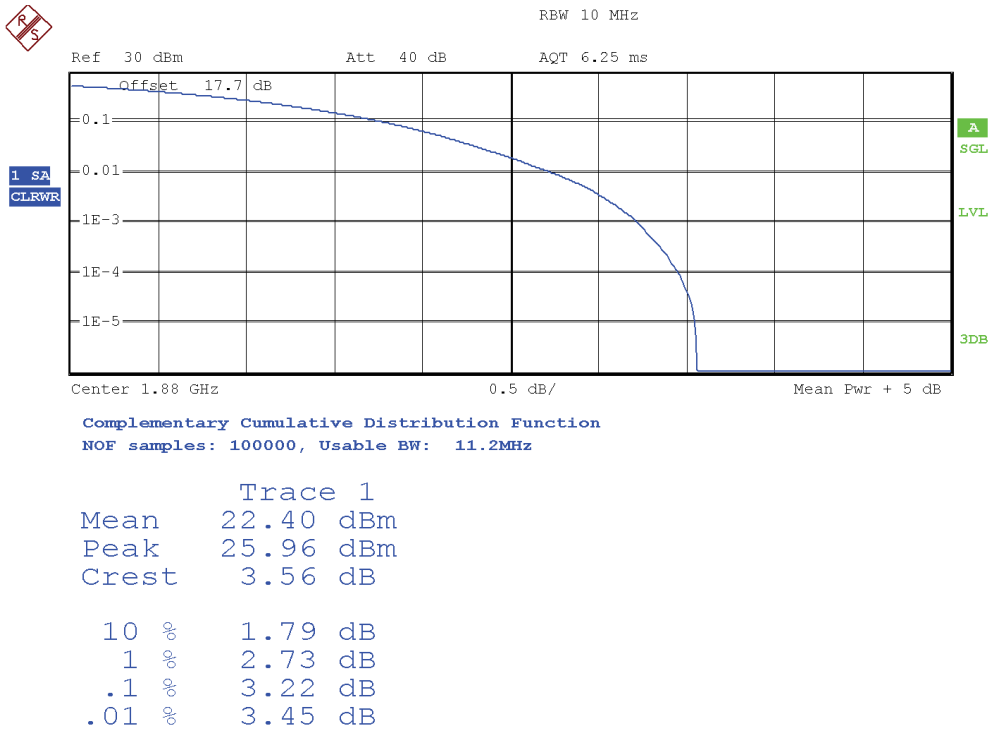
Trace 1	
Mean	24.33 dBm
Peak	27.99 dBm
Crest	3.66 dB
10 %	2.82 dB
1 %	3.43 dB
.1 %	3.55 dB
.01 %	3.62 dB

3G Band II. WCDMA MODULATION.

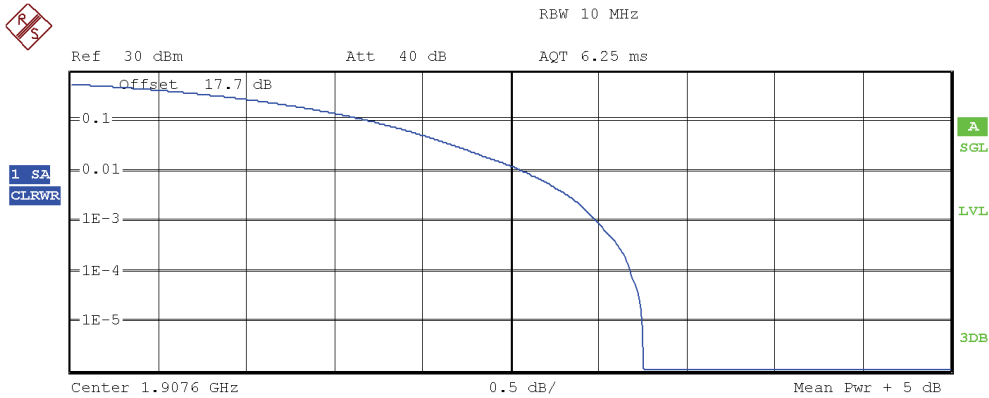
Lowest Channel:



Middle Channel:



Highest Channel:

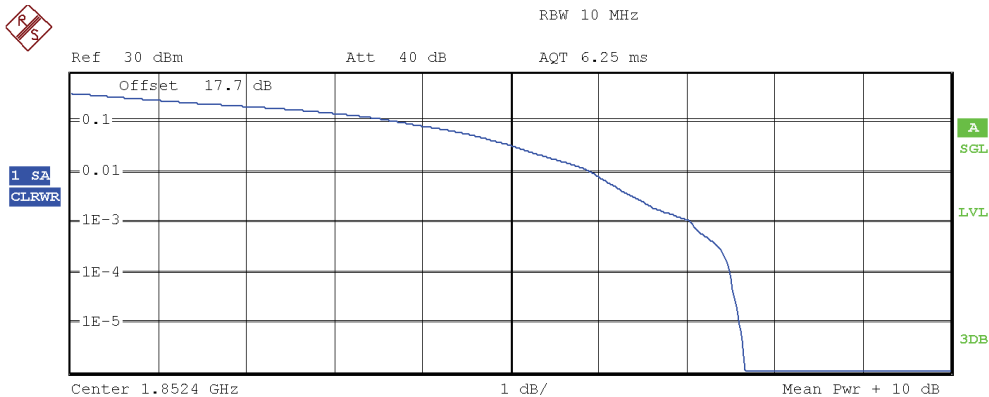


Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	22.46 dBm
Peak	25.71 dBm
Crest	3.26 dB
10 %	1.71 dB
1 %	2.57 dB
.1 %	2.99 dB
.01 %	3.18 dB

3G Band II. HSUPA MODULATION.

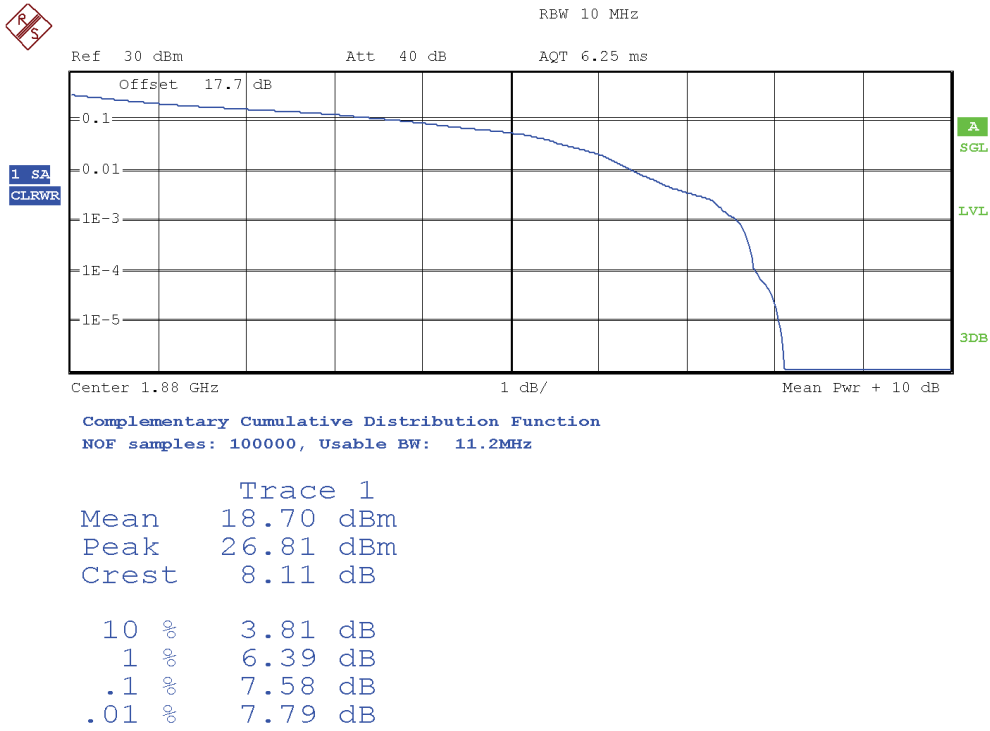
Lowest Channel:



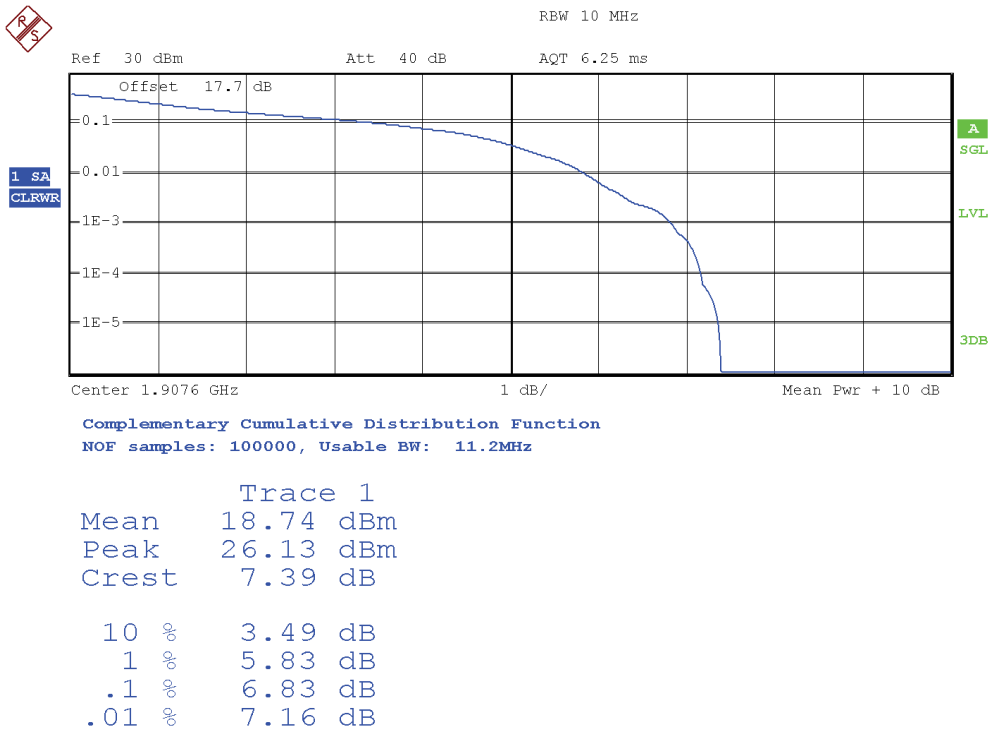
Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	18.89 dBm
Peak	26.55 dBm
Crest	7.66 dB
10 %	3.75 dB
1 %	5.91 dB
.1 %	7.05 dB
.01 %	7.50 dB

Middle Channel:

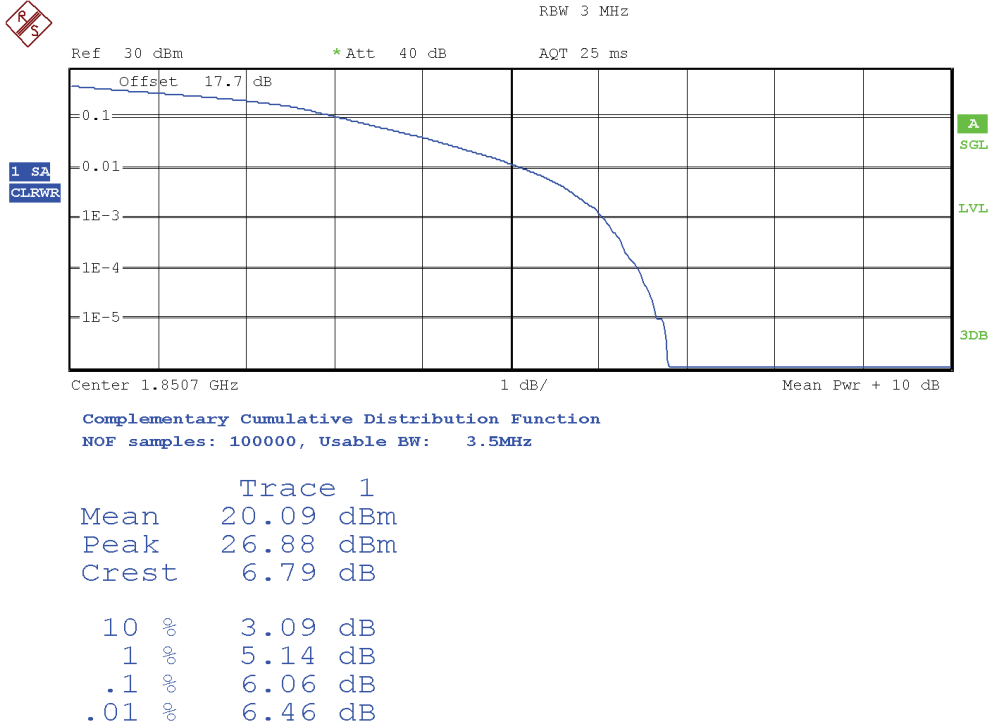


Highest Channel:

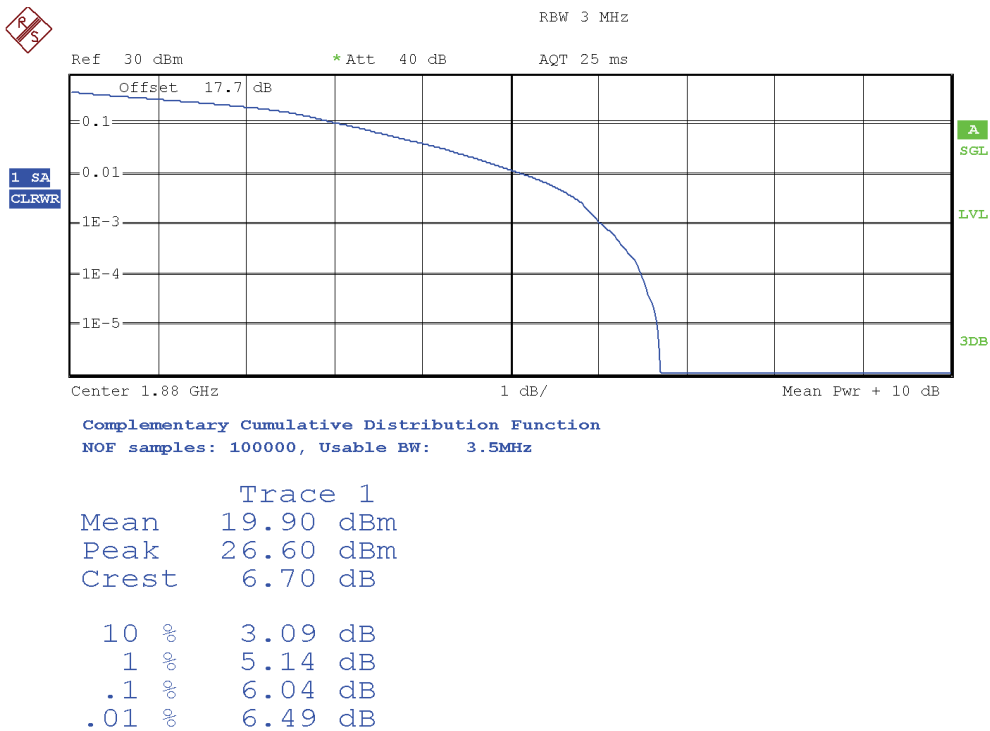


LTE Band 2. Bandwidth = 1.4 MHz. Modulation 16 QAM. RB Size: 6. RB Offset: 0.

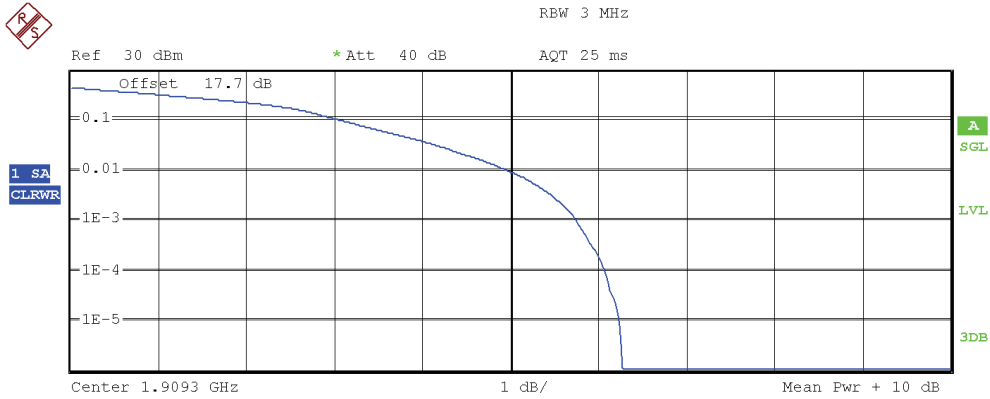
Lowest Channel:



Middle Channel:



Highest Channel:

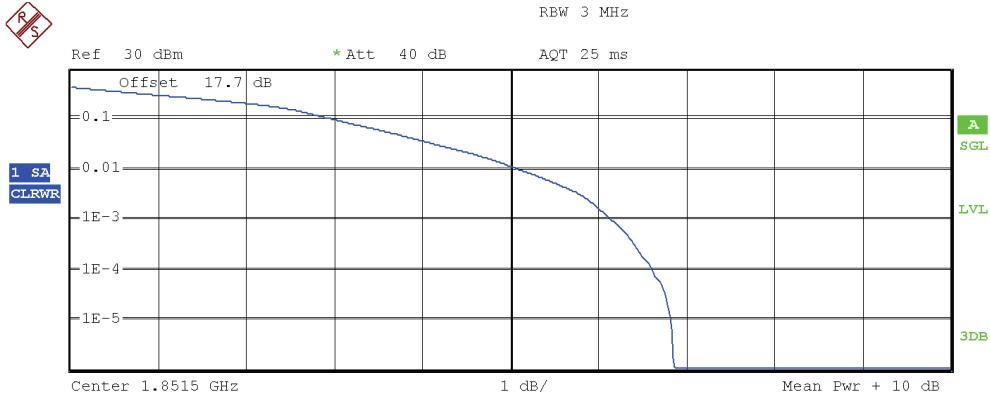


Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 3.5MHz

Trace 1	
Mean	19.70 dBm
Peak	25.97 dBm
Crest	6.27 dB
10 %	3.06 dB
1 %	4.95 dB
.1 %	5.75 dB
.01 %	6.07 dB

LTE Band 2. Bandwidth = 3 MHz. Modulation 16 QAM. RB Size: 15. RB Offset: 0.

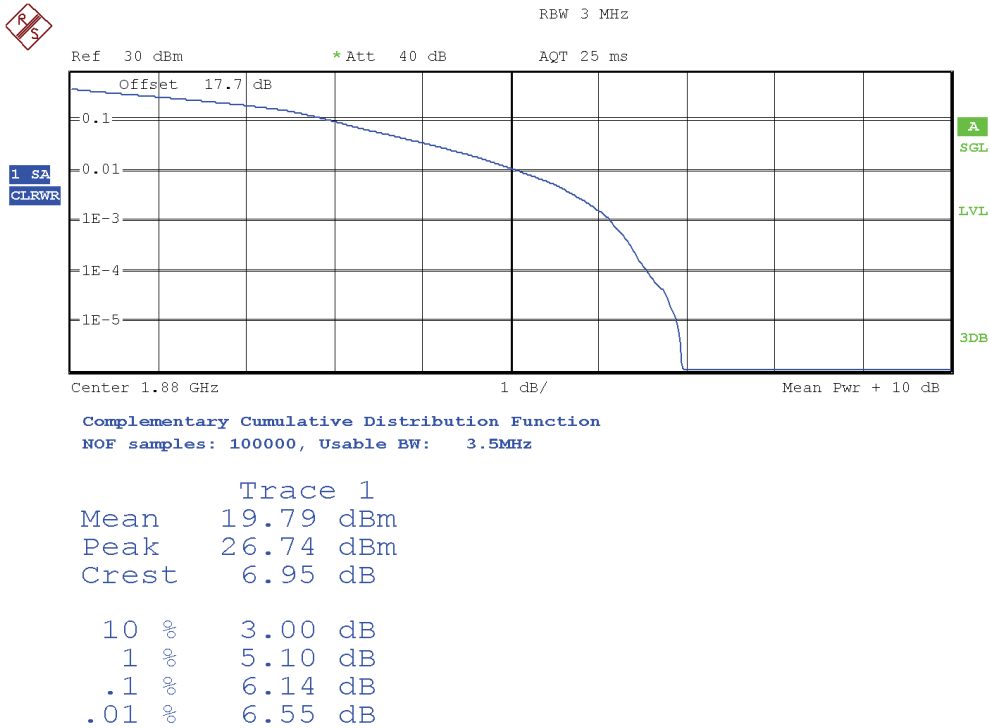
Lowest Channel:



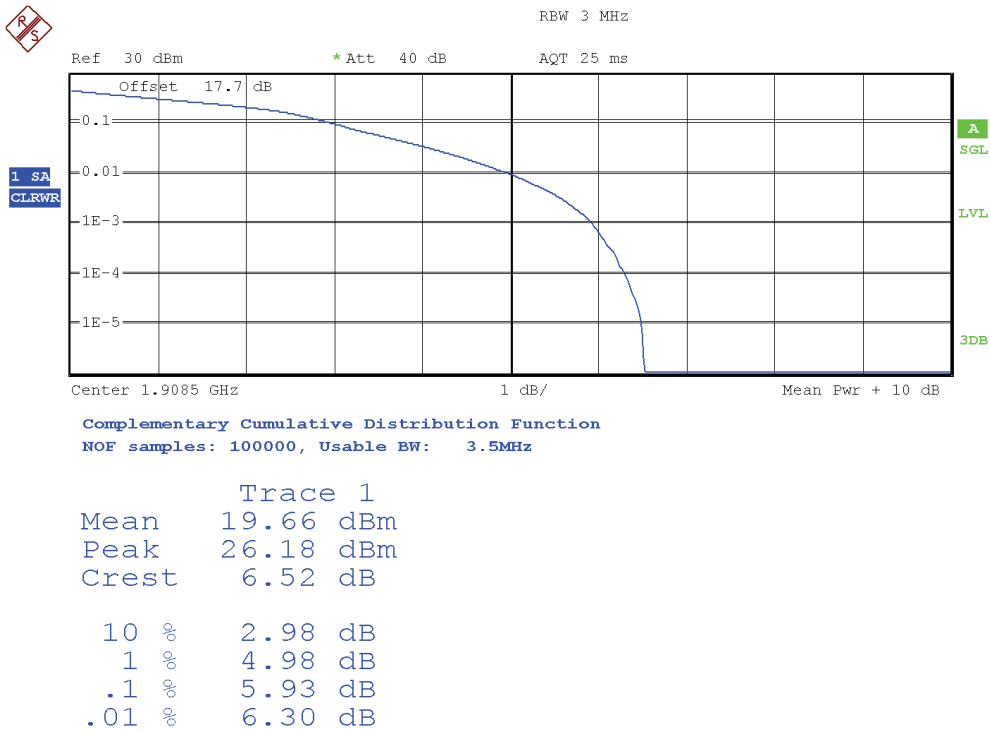
Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 3.5MHz

Trace 1	
Mean	19.82 dBm
Peak	26.67 dBm
Crest	6.85 dB
10 %	2.98 dB
1 %	5.10 dB
.1 %	6.15 dB
.01 %	6.62 dB

Middle Channel:

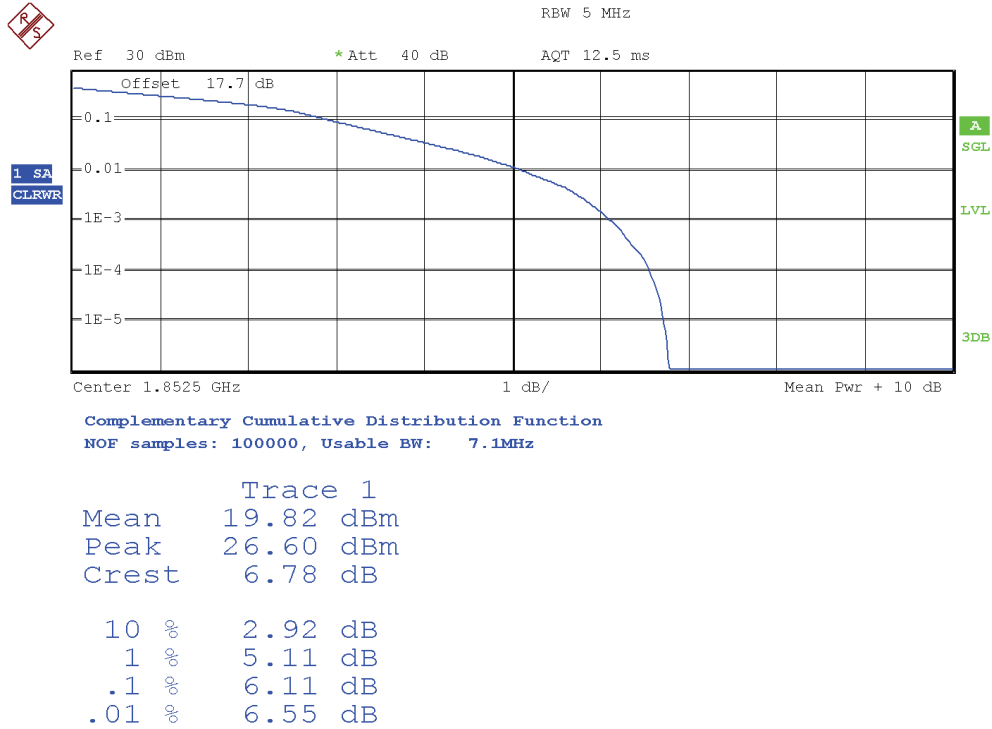


Highest Channel:

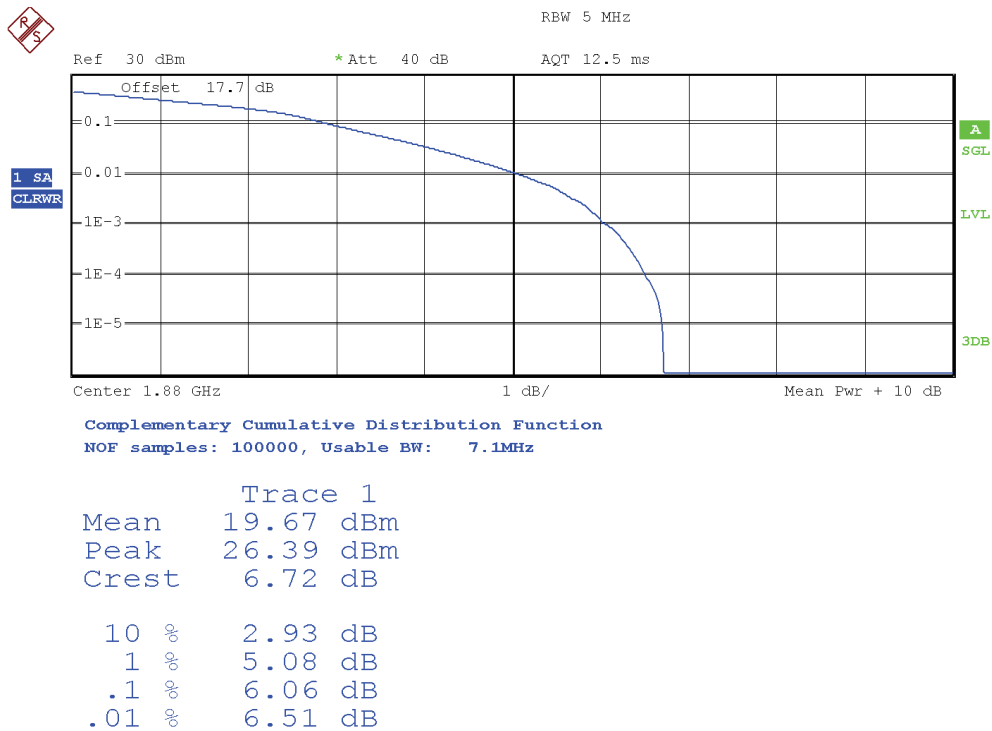


LTE Band 2. Bandwidth = 5 MHz. Modulation 16 QAM. RB Size: 25. RB Offset: 0.

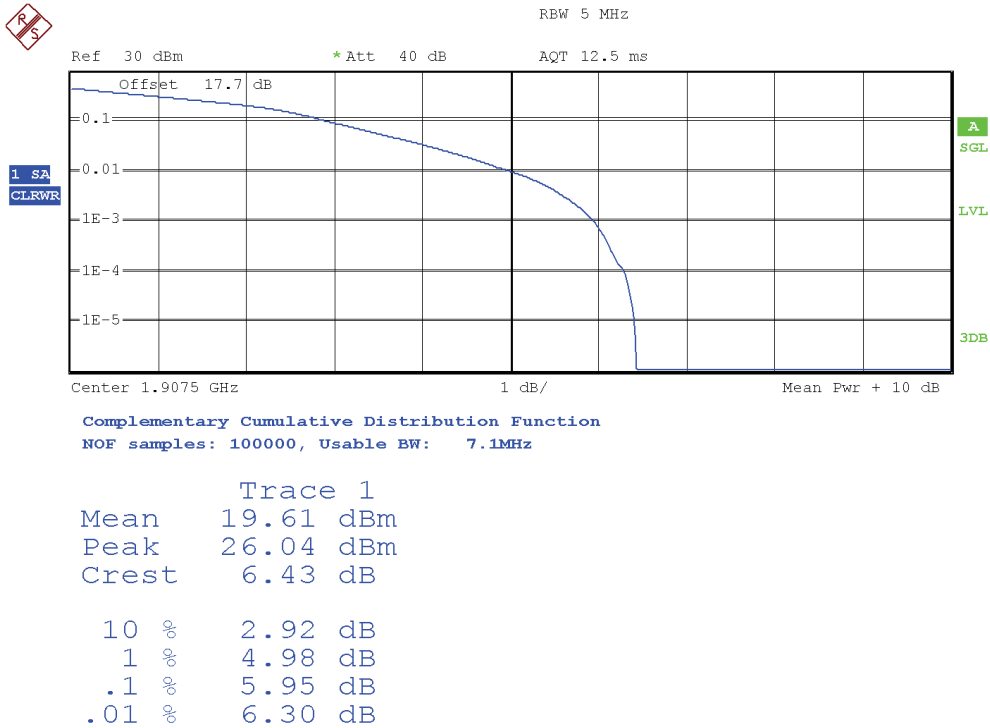
Lowest Channel:



Middle Channel:

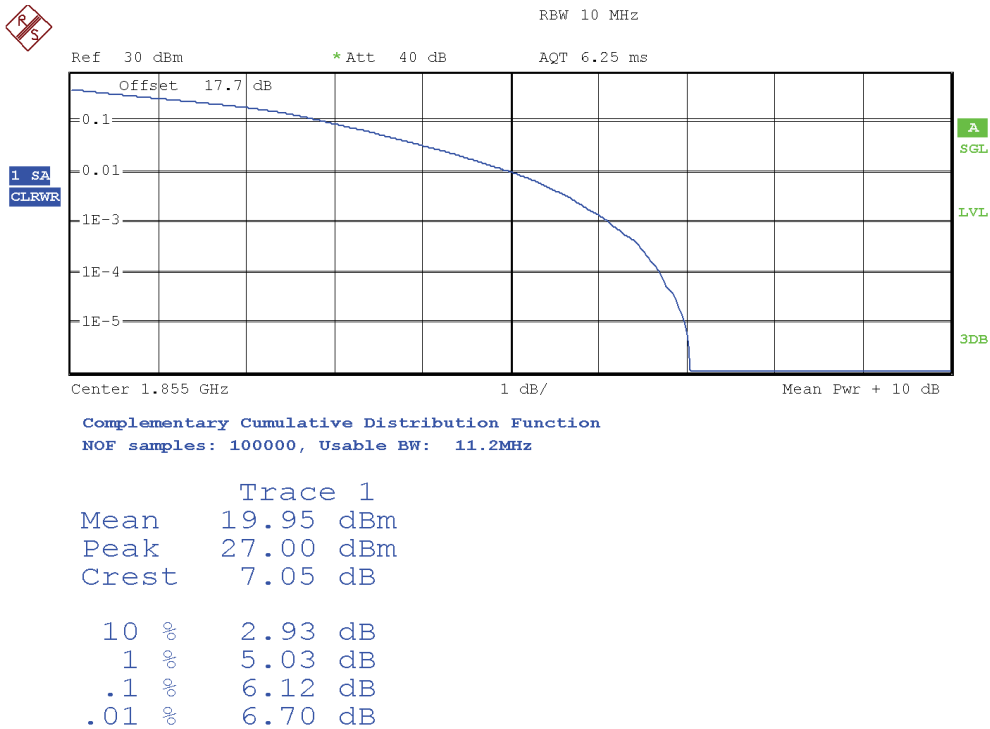


Highest Channel:

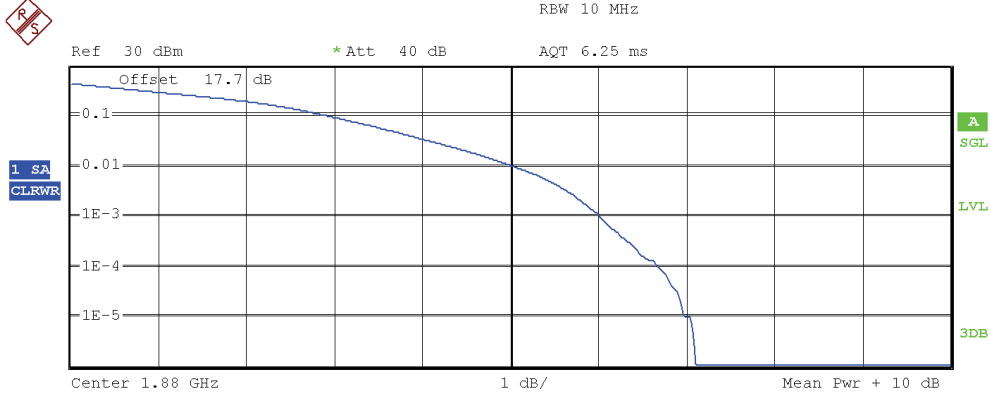


LTE Band 2. Bandwidth = 10 MHz. Modulation 16 QAM. RB Size: 50. RB Offset: 0.

Lowest Channel:



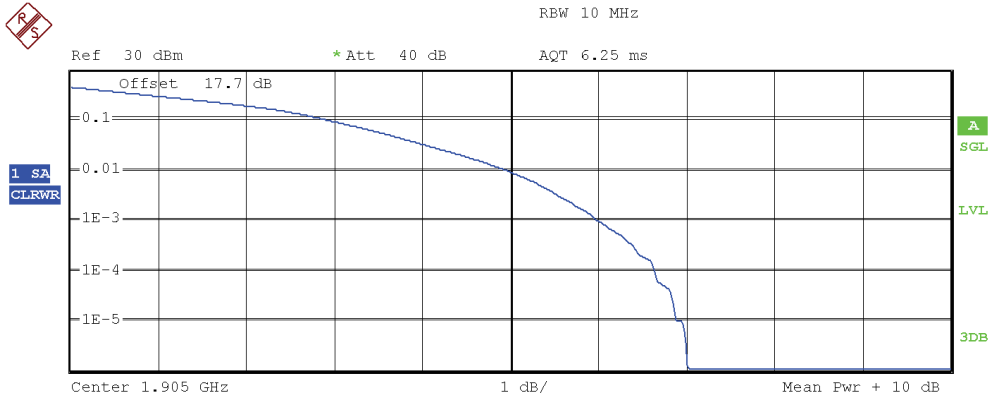
Middle Channel:



Center 1.88 GHz 1 dB/ Mean Pwr + 10 dB
 Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 11.2MHz

Trace 1	
Mean	19.93 dBm
Peak	27.03 dBm
Crest	7.11 dB
10 %	2.93 dB
1 %	5.03 dB
.1 %	6.03 dB
.01 %	6.68 dB

Highest Channel:

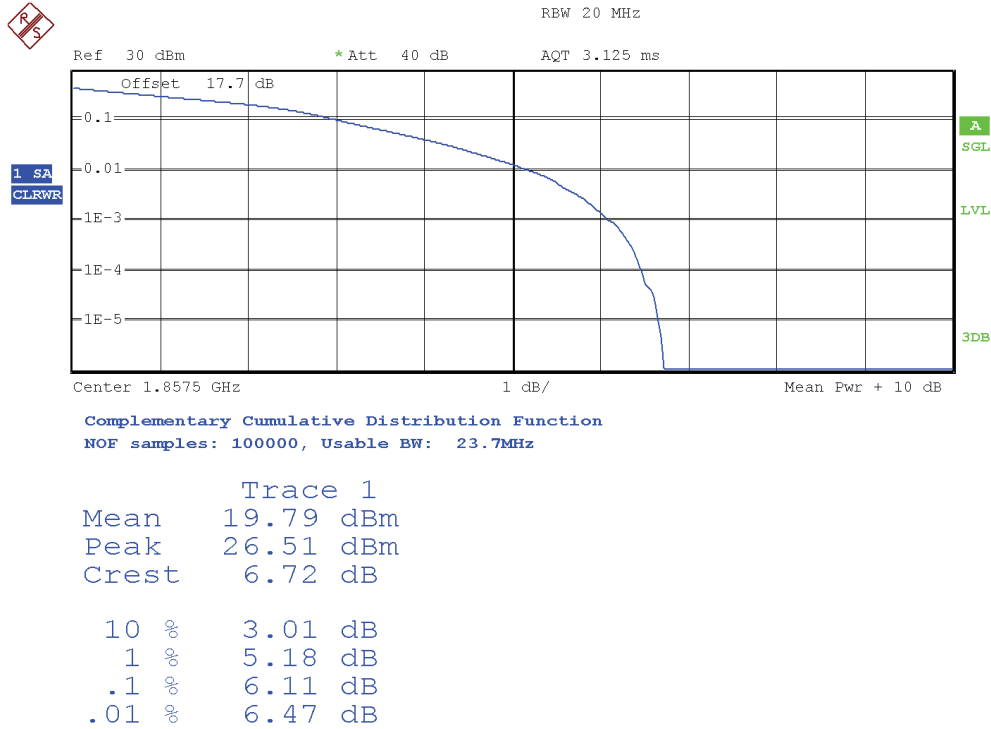


Center 1.905 GHz 1 dB/ Mean Pwr + 10 dB
 Complementary Cumulative Distribution Function
 NOF samples: 100000, Usable BW: 11.2MHz

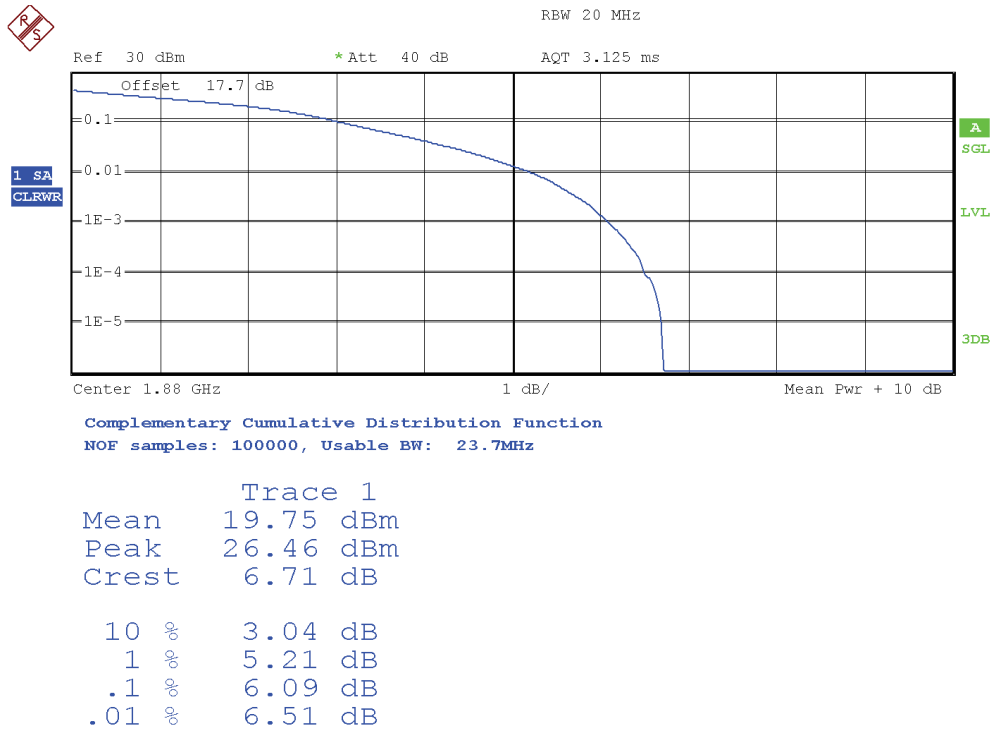
Trace 1	
Mean	19.68 dBm
Peak	26.70 dBm
Crest	7.02 dB
10 %	2.93 dB
1 %	4.95 dB
.1 %	5.99 dB
.01 %	6.65 dB

LTE Band 2. Bandwidth = 15 MHz. Modulation 16 QAM. RB Size: 75. RB Offset: 0.

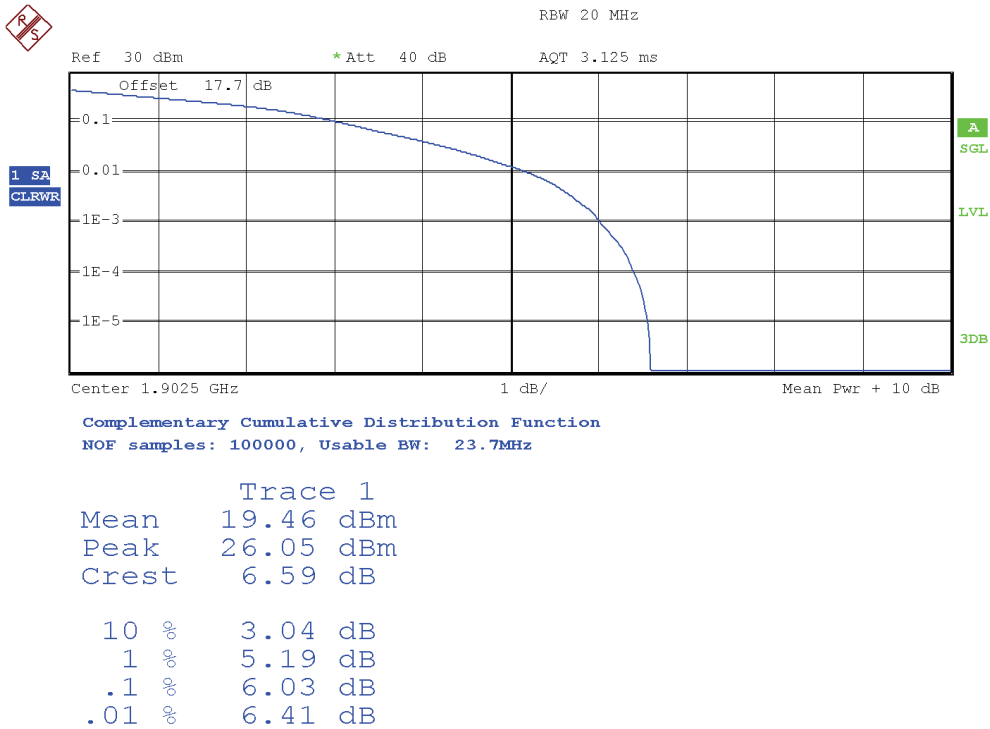
Lowest Channel:



Middle Channel:

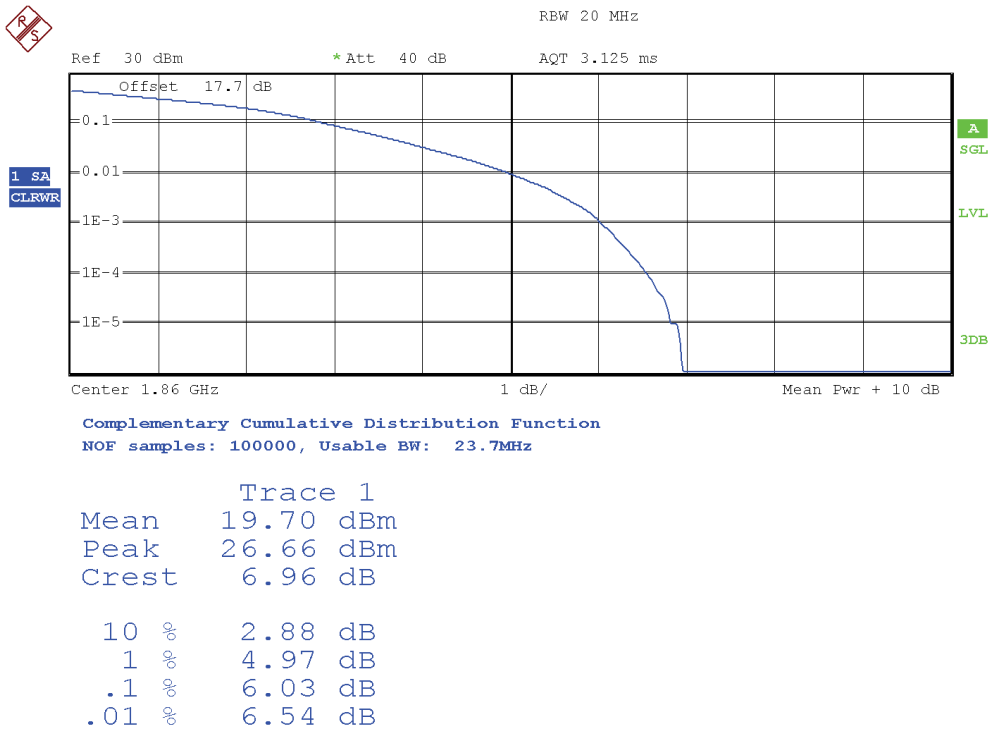


Highest Channel:

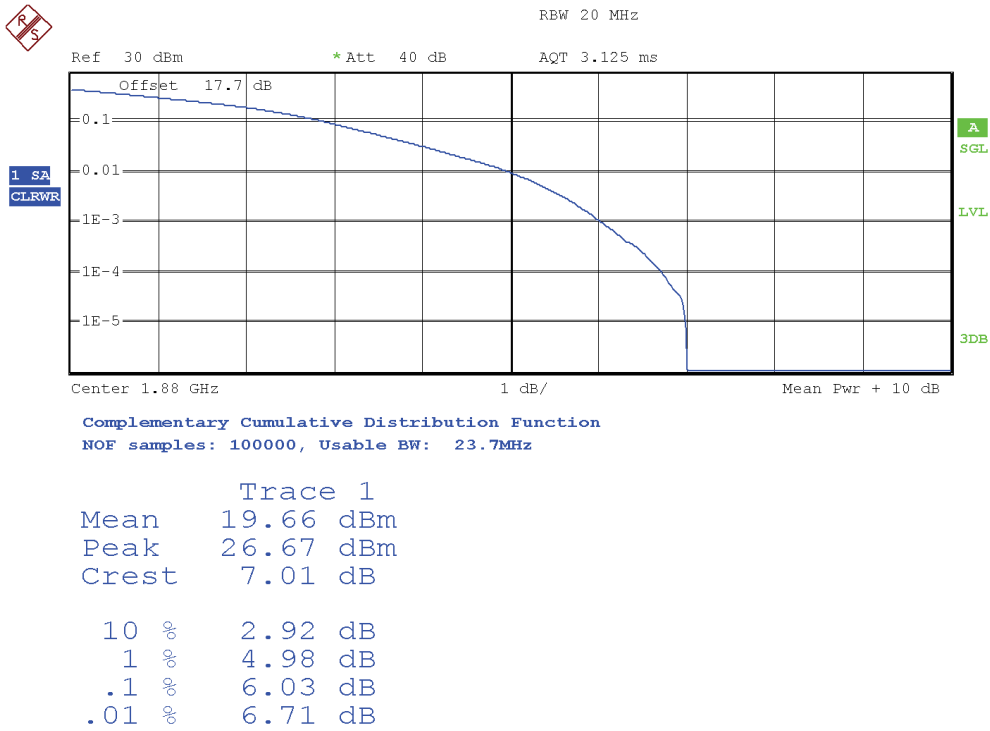


LTE Band 2. Bandwidth = 20 MHz. Modulation 16 QAM. RB Size: 100. RB Offset: 0.

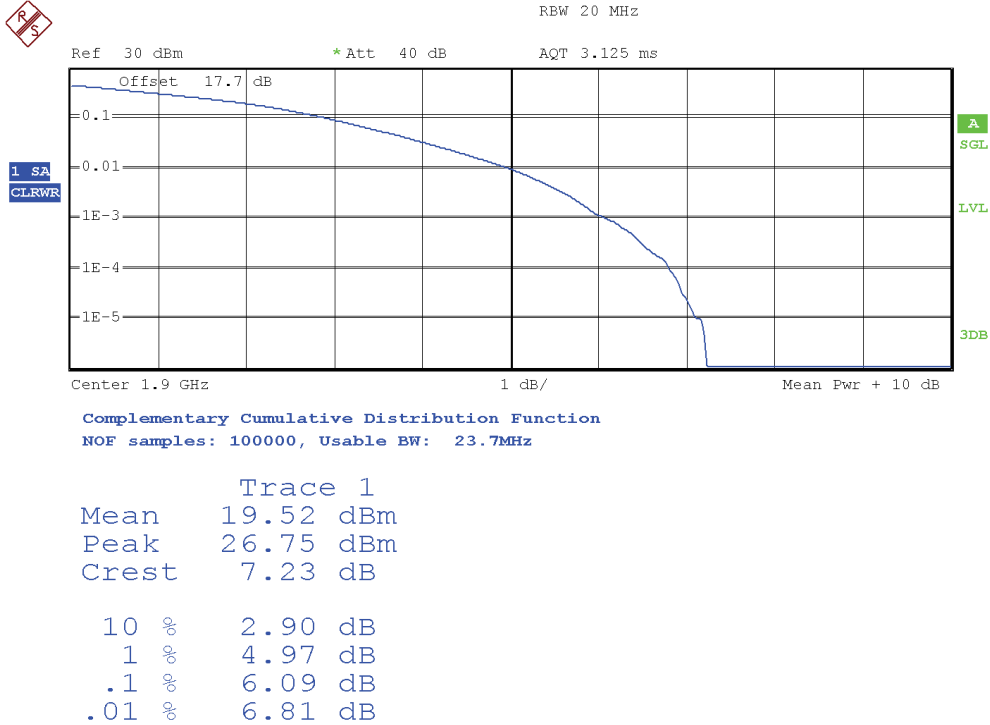
Lowest Channel:



Middle Channel:



Highest Channel:



Frequency Stability

SPECIFICATION:

FCC §2.1055 and §24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-133. Clause 6.3. 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 -30°C to $+50^{\circ}\text{C}$. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10°C steps from -30°C up to $+50^{\circ}\text{C}$.

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.

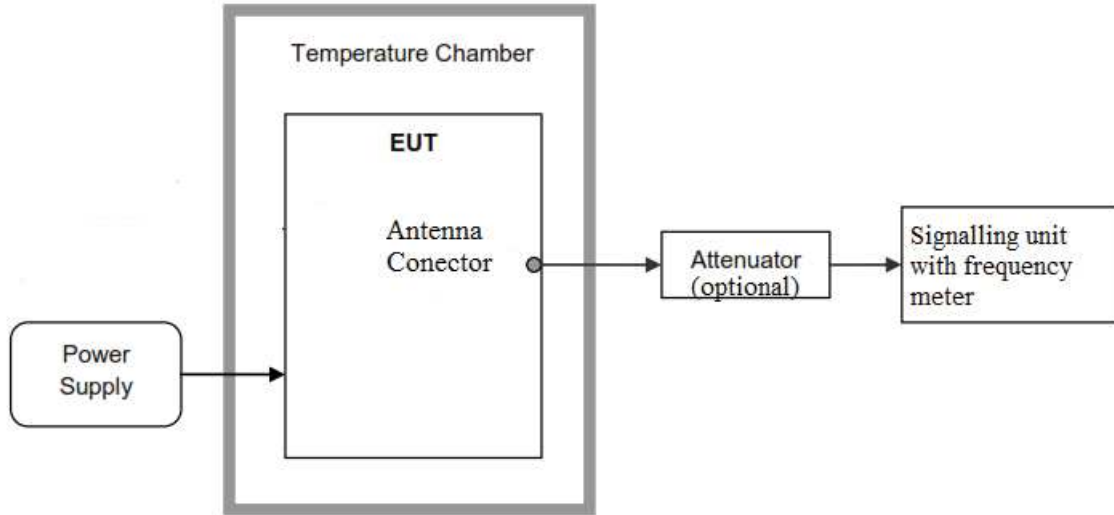
The worst case LTE mode for conducted power was used for the test.

In order to check that the frequency stability is sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point is established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation are identified as fL and fH respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of fL and fH to check that the resulting frequencies remain within the band.

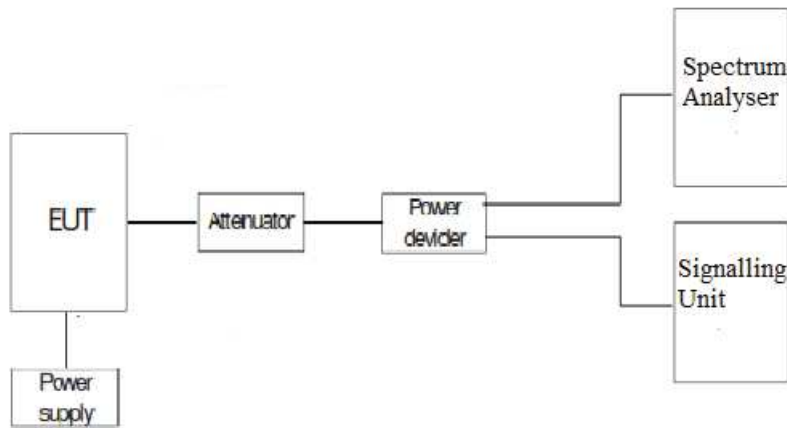
The reference point measurements were made at the RF output terminals of the EUT using an attenuator. Power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP:

1. Frequency Tolerance:



2. Reference Frequency Points f_L and f_H :



RESULTS:

1. Frequency Tolerance:

• **Frequency Stability over Temperature Variations:**

2G Band 1900 MHz. GPRS AND EDGE MODULATIONS.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	1.97	0.001047872
+40	-2.78	-0.001478723
+30	4.75	0.002526596
+20	-3.52	-0.001872340
+10	1.94	0.001031915
0	0.87	0.000462766
-10	2.4	0.001286596
-20	-7.97	-0.004239362
-30	-3.78	-0.002010638

3G Band II. WCDMA AND HSUPA MODULATIONS.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-1.19	-0.000632979
+40	-0.79	-0.000420213
+30	1.29	0.000686170
+20	-1.37	-0.000728723
+10	-1.02	-0.000542553
0	-1.28	-0.000680851
-10	-0.28	-0.000148936
-20	0.36	0.000191489
-30	0.13	6.91489E-05

LTE Band 2. QPSK MODULATION. BW = 3 MHz.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-4.78	-0.002542553
+40	-3.38	-0.001797872
+30	-3.03	-0.001611702
+20	-4.18	-0.002223404
+10	-4.72	-0.002510638
0	-3.09	-0.001643617
-10	0.59	0.000313830
-20	0.9	0.000478723
-30	-0.01	-5.31915E-06