DEKRA Testing and Certification, S.A.U.
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C.I.F. A29 507 456

DEKRA

ENAC ENSAYOS Nº 51/LE147

Test report No:
NIE: 59830RRF.010

Test report

REFERENCE STANDARD:
USA FCC Part 27
CANADA RSS-130, RSS-139, RSS-199

(*) 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 27 (10-1-18 Edition). CANADA RSS-130 Issue 2, Feb. 2019. CANADA RSS-139 Issue 3, Jul. 2015. CANADA RSS-199 Issue 3, Dec. 2016. 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 08:51:37 +02'00'
Date of issue	2020-07-15
Report template No	FDT08_22 (*) "Data provided by the client"

Index

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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:

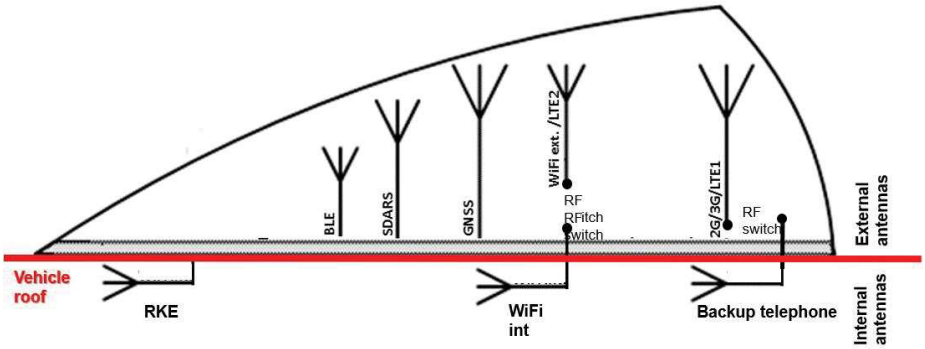
1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

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

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 Nº	Description	Model	Serial Nº	Date of reception
59830B/011	Telematics and Connectivity Antenna Module	Continental TCAM1NA0	SNRD004290	22/10/2019
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 Tel1 Antenna indicated in Appendix A.

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

Control Nº	Description	Model	Serial Nº	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/02 has undergone the following test(s): The radiated tests with the Backup Antenna indicated in Appendix A.

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

Control Nº	Description	Model	Serial Nº	Date of reception
59830B/004	Telematics and Connectivity Antenna Module	Continental TCAM1NA0	SNRD004295	22/10/2019
59830B/028	CAN-Box	CAN-STIN3	00047	2019-10-30
59830B/034	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)		
	USB diagnostic	~3m	☐	☐	☐		
	UART diagnostic	~3m	☐	☐	☐		
	BRR diagnostic	~3m	☐	☐	☐		
			☐	☐	☐		
			☐	☐	☐		
			☐	☐	☐		
Supplementary information to the ports…… :							
Rated power supply .....:	Voltage and Frequency			Reference poles			
				L1	L2	L3	N	PE
	☐	AC:		☐	☐	☐	☐	☐
	☐	AC:		☐	☐	☐	☐	☐
	☒	DC: 12V						
	☐	DC:						
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 .....:	☐	Table top equipment						
	☐	Wall/Ceiling mounted equipment						
	☐	Floor standing equipment						
	☐	Hand-held equipment						

	☒	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)	2020-06-12
Date (finish)	2020-07-04

Document history

Report number	Date	Description
59830RRF.010	2020-07-15	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 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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 Veronica García, José Manuel Jiménez, Miguel Manuel López.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
2.	Signal and Spectrum Analyzer 10 Hz - 40 GHz 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.	DC Power Supply 30V/5A 150W Keysight Technologies, U8002A	N.A.	N.A.
5.	Digital multimeter FLUKE 179	2020/06	2021/06
6.	Climatic chamber BINDER MK 56	2020/03	2021/03
7.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2020/07	2021/07
8.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2020/07	2021/07
9.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2020/04	2021/04

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.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10
4.	RF Pre-amplifier 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	2020/02	2021/02
5.	Biconical/Log Antenna 30MHz - 6GHz ETS LINDGREN 3142E	2017/09	2020/09
6.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2019/10	2021/10
7.	RF Pre-amplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/11	2020/11
8.	Broadband Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2018/01	2021/01
9.	RF Pre-amplifier G>30dB, 18-40 GHz BONN ELEKTRONIK BBHA 9170	2019/02	2021/02
10	Horn antenna 18-40 GHz SCHWARZBECK BBHA 9120 D	2020/05	2023/05
11.	Wideband Radio Communication Tester ROHDE AND SCHWARZ CMW500	2019/09	2020/09
12.	DC Power Supply Keysight Technologies U8002A	N.A.	N.A.
13.	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 27 / IC RSS-130 / RSS-139 / RSS-199 PARAGRAPH		
Requirement – Test case	**Verdict**	**Remark**
Clause 27.50 / RSS-130 Clause 4.6 / RSS-139 Clause 6.5 / RSS-199 Clause 4.4: RF output power	P	
Clause 2.1047 / RSS-130 Clause 4.2 / RSS-139 Clause 6.2 / RSS-199 Clause 4.1: Modulation characteristics	P	
Clause 27.54 / RSS-130 Clause 4.5 / RSS-139 Clause 6.4 / RSS-199 Clause 4.3: Frequency stability	P	
Clause 2.1049: Occupied Bandwidth	P	
Clause 27.53 / RSS-130 Clause 4.7 / RSS-139 Clause 6.6 / RSS-199 Clause 4.5: Spurious emissions at antenna terminals	P	
Clause 27.53 / RSS-130 Clause 4.7 / RSS-139 Clause 6.6 / RSS-199 Clause 4.5: Radiated emissions	P	

Supplementary information and remarks:

1. HSDPA modulation mode has not been tested to prove USA FCC Part 27 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 27 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 27 / RSS-130, RSS-139, RSS-199

INDEX

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 (nominal, minimum and maximum respectively).

ANTENNA:

LOW Bands	GAIN	ANTENNA TYPE
LTE Band 12	+5.9 dBi (Tel1 antenna) +5.9 dBi (Backup phone antenna)	Internal (3D)
LTE Band 13	+5.9 dBi (Tel1 antenna) +5.9 dBi (Backup phone antenna)	Internal (3D)

MIDDLE Bands	GAIN	ANTENNA TYPE
3G WCDMA Band IV	+5 dBi (Tel1 antenna) +5.9 dBi (Backup phone antenna)	Internal (3D)

HIGH Bands	GAIN	ANTENNA TYPE
LTE Band 4	+5.9 dBi (Tel1 antenna) +5.9 dBi (Backup phone antenna)	Internal (3D)
LTE Band 7	+5.9 dBi (Tel1 antenna) +5.9 dBi (Backup phone antenna)	Internal (3D)

TEST FREQUENCIES:

WCDMA and HSUPA MODULATION:

Lowest Channel (1312): 1712.4 MHz
Middle Channel (1762): 1732.5 MHz
Highest Channel (1513): 1752.6 MHz

LTE Band 4. QPSK AND 16QAM MODULATION:

	Channel (Frequency. MHz)					
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Lowest	19957 (1710.7)	19965 (1711.5)	19975 (1712.5)	20000 (1715.0)	20025 (1717.5)	20050 (1720.0)
Middle	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)	20175 (1732.5)
Highest	20393 (1754.3)	20385 (1753.5)	20375 (1752.5)	20350 (1750.0)	20325 (1747.5)	20300 (1745.0)

LTE Band 7. QPSK AND 16QAM MODULATION:

	Channel (Frequency. MHz)			
	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Lowest	20775 (2502.5)	20800 (2505.0)	20825 (2507.5)	20850 (2510.0)
Middle	21100 (2535.0)	21100 (2535.0)	21100 (2535.0)	21100 (2535.0)
Highest	21425 (2567.5)	21400 (2565.0)	21375 (2562.5)	21350 (2560.0)

LTE Band 12. QPSK AND 16QAM MODULATION:

	Channel (Frequency. MHz)			
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz
Lowest	23017 (699.7)	23025 (700.5)	23035 (701.5)	23060 (704.0)
Middle	23095 (707.5)	23095 (707.5)	23095 (707.5)	23095 (707.5)
Highest	23173 (715.3)	23165 (714.5)	23155 (713.5)	23130 (711.0)

LTE Band 13. QPSK AND 16QAM MODULATION:

	Channel (Frequency, MHz)	
	BW = 5 MHz	BW = 10 MHz
Lowest	23205 (779.5)	N/A
Middle	23230 (782.0)	23230 (782.0)
Highest	23255 (784.5)	N/A

RF Output Power

SPECIFICATION:

FCC §27.50 (b) (10):

(10) Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

FCC §27.50 (c) (10):

(10) Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

FCC §27.50 (d) (4) & (5):

(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP. Fixed stations operating in the 1710-1755 MHz band 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.

(5) Equipment employed must be authorized in accordance with the provisions of §24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB

FCC §27.50 (h) (2):

(2) Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power

RSS-130 Clause 4.6:

4.6.1 General
The transmitter output power shall be measured in terms of average power. 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 and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

4.6.2 Frequency bands 617-652 MHz and 663-698 MHz
The e.r.p. shall not exceed 3 watts for mobile equipment, fixed subscriber equipment and portable equipment.

For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the equivalent isotropically radiated power (e.i.r.p.) limits.

4.6.3 Frequency bands 698-756 MHz and 777-787 MHz
The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the e.i.r.p. limits.

RSS-139 Clause 6.5:

The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. The e.i.r.p. for fixed and base stations in the band 1710-1780 MHz shall not exceed one watt.

Consult SRSP-513 for e.i.r.p. limits on fixed and base stations operating in the band 2110-2180 MHz.

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

RSS-199 Clause 4.4:

The transmitter output power shall be measured in terms of average value.

For base station equipment, refer to SRSP-517 for the maximum permissible e.i.r.p.

For mobile subscriber equipment, the e.i.r.p. shall not exceed 2 W. For fixed subscriber equipment, the transmitter output power shall not exceed 2 W and the e.i.r.p. shall be limited to 40 W.

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 and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

For equipment with multiple antennas, the transmitter output power and e.i.r.p shall be measured according to ANSI C63.26-2015.

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 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).

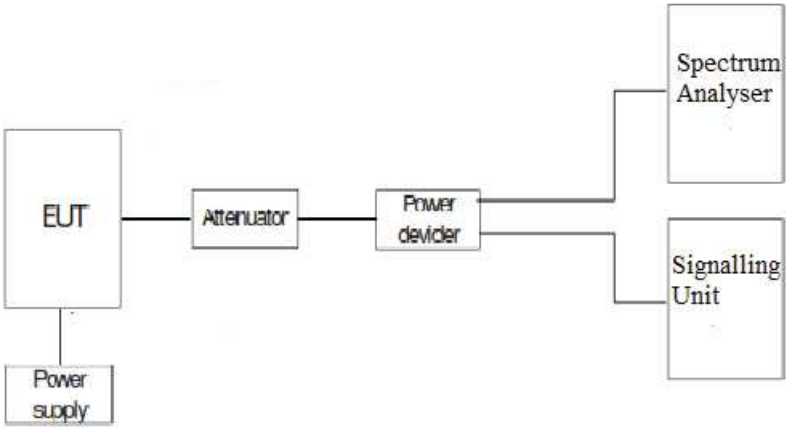
The maximum effective radiated power e.r.p. is calculated from the maximum equivalent isotropically radiated power (e.i.r.p.) by subtracting 2.15 dB:

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. AVERAGE POWER:

3G Band IV:

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	22.36	22.38	22.38
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	28.26	28.28	28.28
PAPR (dB)	2.88	2.76	2.71
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	19.50	19.56	19.59
Maximum effective isotropically radiated average power E.I.R.P. (dBm)	25.40	25.46	25.49
PAPR (dB)	6.89	6.20	6.54
Measurement uncertainty (dB)	<±1.58		

LTE Band 4:

LTE BAND 4. 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	23.00	22.71	23.11
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.90	28.61	29.01
Maximum effective radiated power E.R.P. (dBm)	26.76	26.46	26.86
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 5.
(*): Preliminary measurements determined that the modulation 16QAM, RB Size: 6, RB Offset: 0 as the worst case for PAPR.

LTE BAND 4. 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	21.70	21.70	21.96
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.60	27.60	27.86
Maximum effective radiated power E.R.P. (dBm)	25.45	25.45	25.71
PAPR (dB)	6.12	5.90	5.67
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 5.
Worst case PAPR: Modulation 16QAM. RB Size: 6. RB Offset: 0.

LTE BAND 4. 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	22.44	22.94	23.06
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.34	28.84	28.96
Maximum effective radiated power E.R.P. (dBm)	26.19	26.69	26.81
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

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 for PAPR.

LTE BAND 4. 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	21.58	21.68	21.95
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.48	27.58	27.85
Maximum effective radiated power E.R.P. (dBm)	25.33	25.43	25.70
PAPR (dB)	6.14	5.98	5.87
Measurement uncertainty (dB)	<±0.66		

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 4. 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	22.15	22.68	22.45
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.05	28.58	28.35
Maximum effective radiated power E.R.P. (dBm)	25.90	26.43	26.20
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

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 for PAPR.

LTE BAND 4. 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	21.20	21.58	21.44
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.10	27.48	27.34
Maximum effective radiated power E.R.P. (dBm)	24.95	25.33	25.19
PAPR (dB)	6.09	5.95	5.79
Measurement uncertainty (dB)	<±0.66		

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 4. 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	22.54	23.02	23.33
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.44	28.92	29.33
Maximum effective radiated power E.R.P. (dBm)	26.29	26.77	27.08
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

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 for PAPR.

LTE BAND 4. 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	21.61	21.43	21.98
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.51	27.33	27.88
Maximum effective radiated power E.R.P. (dBm)	25.36	25.18	25.73
PAPR (dB)	6.03	5.93	5.95
Measurement uncertainty (dB)	<±0.66		

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 4. 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	22.68	22.71	23.08
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.58	28.61	28.98
Maximum effective radiated power E.R.P. (dBm)	26.43	26.46	26.83
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 74.
(*): Preliminary measurements determined that the modulation 16QAM, RB Size: 75, RB Offset: 0 as the worst case for PAPR.

LTE BAND 4. 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	21.46	21.66	21.55
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.36	27.56	27.45
Maximum effective radiated power E.R.P. (dBm)	25.21	24.41	25.30
PAPR (dB)	6.04	5.96	5.93
Measurement uncertainty (dB)	<±0.66		

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 4. 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	22.78	22.47	22.70
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.68	28.37	28.60
Maximum effective radiated power E.R.P. (dBm)	26.53	26.22	26.45
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 99.
(*): Preliminary measurements determined that the modulation 16QAM, RB Size: 100, RB Offset: 0 as the worst case for PAPR.

LTE BAND 4. 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	21.40	21.51	21.41
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.30	27.41	27.31
Maximum effective radiated power E.R.P. (dBm)	25.15	25.26	25.16
PAPR (dB)	5.98	5.93	5.83
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 99.
Worst case PAPR: Modulation 16QAM. RB Size: 100. RB Offset: 0.

- Worst case of AVERAGE POWER for the LTE Band 4 is for QPSK MODULATION, BW=10 MHz, RB Size: 1, Offset 49:

Channel	Lowest	Middle	Highest
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.44	28.92	29.33
Maximum effective radiated power E.R.P. (dBm)	26.29	26.77	27.08
Measurement uncertainty (dB)	<±0.66		

- Worst case of PAPR for the LTE Band 4 is for 16QAM, BW=3 MHz RB Size: 15, RB Offset: 0

Channel	Lowest	Middle	Highest
PAPR (dB)	6.14	5.98	5.87
Measurement uncertainty (dB)	<±0.66		

LTE Band 7:

LTE BAND 7. 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	21.25	20.64	20.53
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.15	26.54	26.43
Maximum effective radiated power E.R.P. (dBm)	25.00	24.39	24.28
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

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 for PAPR.

LTE BAND 7. 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	20.11	19.26	19.36
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	26.01	25.16	25.26
Maximum effective radiated power E.R.P. (dBm)	23.86	23.01	23.11
PAPR (dB)	6.09	6.22	6.51
Measurement uncertainty (dB)	<±0.66		

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 7. 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	20.77	20.70	21.28
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	26.67	26.60	27.18
Maximum effective radiated power E.R.P. (dBm)	24.52	24.45	25.03
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.
(*): Preliminary measurements determined that the modulation 16QAM, RB Size: 50, RB Offset: 0 as the worst case for PAPR.

LTE BAND 7. 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	20.05	19.66	19.81
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.95	25.56	25.71
Maximum effective radiated power E.R.P. (dBm)	23.80	23.41	23.56
PAPR (dB)	6.20	6.14	6.55
Measurement uncertainty (dB)	<±0.66		

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

LTE BAND 7. 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	21.20	20.45	20.79
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.10	26.35	26.69
Maximum effective radiated power E.R.P. (dBm)	24.95	24.20	24.54
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

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 for PAPR.

LTE BAND 7. 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	20.09	19.74	20.05
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	25.99	25.64	25.95
Maximum effective radiated power E.R.P. (dBm)	23.84	23.49	23.80
PAPR (dB)	6.47	6.27	6.75
Measurement uncertainty (dB)	<±0.66		

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

LTE BAND 7. 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	21.45	21.53	20.92
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.35	27.43	26.82
Maximum effective radiated power E.R.P. (dBm)	25.2	25.28	24.67
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

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 for PAPR.

LTE BAND 7. 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	20.10	19.89	19.59
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	26.00	25.79	25.49
Maximum effective radiated power E.R.P. (dBm)	23.85	23.64	23.34
PAPR (dB)	6.41	6.17	6.44
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 0.
Worst case PAPR: Modulation 16QAM. RB Size: 100. RB Offset: 0.

- Worst case of AVERAGE POWER for the LTE Band 7 is for QPSK MODULATION, BW=20 MHz, RB Size: 1, Offset 0:

Channel	Lowest	Middle	Highest
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.35	27.43	26.82
Maximum effective radiated power E.R.P. (dBm)	25.2	25.28	24.67
Measurement uncertainty (dB)	<±0.66		

- Worst case of PAPR for the LTE Band 7 is for 16QAM, BW=15 MHz RB Size: 75, RB Offset: 0

Channel	Lowest	Middle	Highest
PAPR (dB)	6.47	6.27	6.75
Measurement uncertainty (dB)	<±0.66		

LTE Band 12:

LTE BAND 12. 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	22.79	23.18	22.91
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.69	29.08	28.81
Maximum effective radiated power E.R.P. (dBm)	26.54	26.93	26.54
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 5.
(*): Preliminary measurements determined that the modulation 16QAM, RB Size: 6, RB Offset: 0 as the worst case for PAPR.

LTE BAND 12. 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	22.12	22.15	22.01
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.02	28.05	27.91
Maximum effective radiated power E.R.P. (dBm)	25.87	25.9	25.76
PAPR (dB)	5.95	5.77	5.74
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 5.
Worst case PAPR: Modulation 16QAM. RB Size: 6. RB Offset: 0.

LTE BAND 12. 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	23.07	22.94	22.83
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.97	28.84	28.73
Maximum effective radiated power E.R.P. (dBm)	26.82	26.69	26.58
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.
(*): Preliminary measurements determined that the modulation 16QAM, RB Size: 15, RB Offset: 0 as the worst case for PAPR.

LTE BAND 12. 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	22.33	22.15	22.30
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.23	28.05	28.20
Maximum effective radiated power E.R.P. (dBm)	26.08	25.90	26.05
PAPR (dB)	5.99	5.90	5.88
Measurement uncertainty (dB)	<±0.66		

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

LTE BAND 12. 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	22.83	22.75	23.01
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.73	28.65	28.91
Maximum effective radiated power E.R.P. (dBm)	26.58	26.50	26.76
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

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 for PAPR.

LTE BAND 12. 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	21.78	21.65	22.13
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.68	27.55	28.03
Maximum effective radiated power E.R.P. (dBm)	25.53	25.40	25.88
PAPR (dB)	6.04	5.85	5.93
Measurement uncertainty (dB)	<±0.66		

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 12. 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	22.48	22.71	22.71
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.38	28.61	28.61
Maximum effective radiated power E.R.P. (dBm)	26.23	26.46	26.46
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation QPSK. RB Size: 1. RB Offset: 0.
(*): Preliminary measurements determined that the modulation 16QAM, RB Size: 25, RB Offset: 0 as the worst case for PAPR.

LTE BAND 12. 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	21.78	21.80	22.16
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.68	27.70	28.06
Maximum effective radiated power E.R.P. (dBm)	25.53	25.55	25.91
PAPR (dB)	5.75	5.83	5.61
Measurement uncertainty (dB)	<±0.66		

Worst case AVERAGE POWER: Modulation 16QAM. RB Size: 1. RB Offset: 49.
Worst case PAPR: Modulation 16QAM. RB Size: 25. RB Offset: 0.

- Worst case of AVERAGE POWER for the LTE Band 12 is for QPSK MODULATION, BW=1.4 MHz, RB Size: 1, Offset 5:

Channel	Lowest	Middle	Highest
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.69	29.08	28.81
Maximum effective radiated power E.R.P. (dBm)	26.54	26.93	26.54
Measurement uncertainty (dB)	<±0.66		

- Worst case of PAPR for the LTE Band 12 is for 16QAM, BW=5 MHz RB Size: 25, RB Offset: 0:

Channel	Lowest	Middle	Highest
PAPR (dB)	6.04	5.85	5.93
Measurement uncertainty (dB)	<±0.66		

LTE Band 13:

LTE BAND 13. 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	22.70	22.44	22.71
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	28.60	28.34	28.61
Maximum effective radiated power E.R.P. (dBm)	26.45	26.19	26.46
PAPR (dB)	(*)	(*)	(*)
Measurement uncertainty (dB)	<±0.66		

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 for PAPR.

LTE BAND 13. 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	21.64	20.60	21.75
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	27.54	26.50	27.65
Maximum effective radiated power E.R.P. (dBm)	25.39	24.35	25.50
PAPR (dB)	6.19	6.19	6.19
Measurement uncertainty (dB)	<±0.66		

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 13. 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	NA	22.77	NA
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	NA	28.67	NA
Maximum effective radiated power E.R.P. (dBm)	NA	26.52	NA
PAPR (dB)	NA	(*)	NA
Measurement uncertainty (dB)	<±0.66		

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 for PAPR.

LTE BAND 13. 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	NA	20.68	NA
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	NA	26.58	NA
Maximum effective radiated power E.R.P. (dBm)	NA	24.43	NA
PAPR (dB)	NA	6.19	NA
Measurement uncertainty (dB)	<±0.66		

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

- Worst case of AVERAGE POWER for the LTE Band 13 is for QPSK MODULATION, BW=10 MHz, RB Size: 1, Offset 49:

Channel	Lowest	Middle	Highest
Maximum equivalent isotropically radiated power (E.I.R.P.) (dBm)	NA	28.67	NA
Maximum effective radiated power E.R.P. (dBm)	NA	26.52	NA
Measurement uncertainty (dB)	<±0.66		

- Worst case of PAPR for the LTE Band 13 is for 16QAM, BW=10 MHz RB Size: 50, RB Offset: 0:

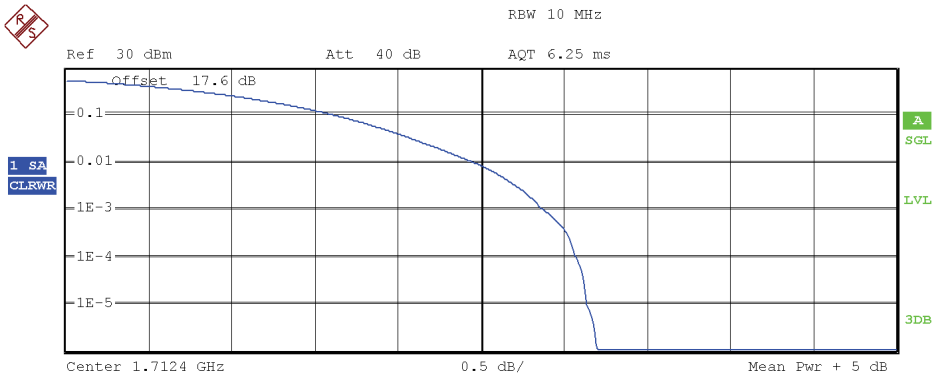
Channel	Lowest	Middle	Highest
PAPR (dB)	NA	6.19	NA
Measurement uncertainty (dB)	<±0.66		

Verdict: PASS

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

3G Band IV. WCDMA MODULATION.

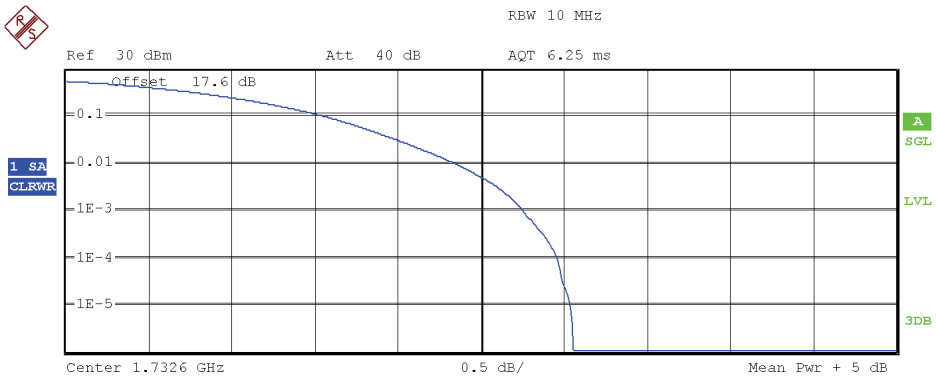
Lowest Channel:



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

	Trace 1
Mean	22.80 dBm
Peak	26.00 dBm
Crest	3.20 dB
10 %	1.63 dB
1 %	2.46 dB
.1 %	2.88 dB
.01 %	3.08 dB

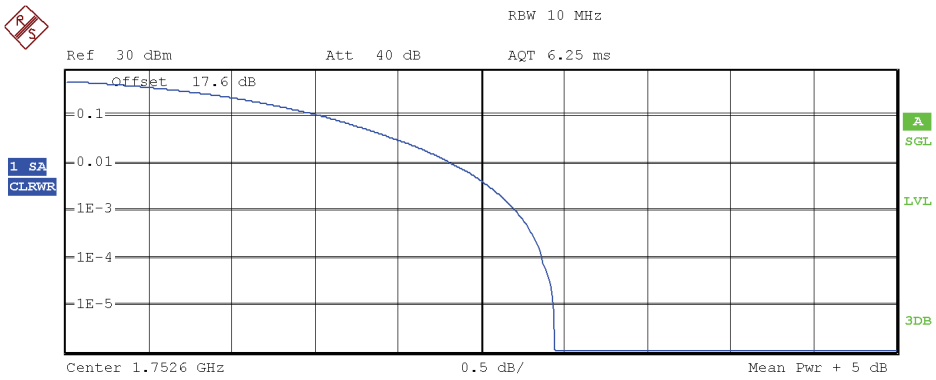
Middle Channel:



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

	Trace 1
Mean	22.62 dBm
Peak	25.68 dBm
Crest	3.06 dB
10 %	1.55 dB
1 %	2.34 dB
.1 %	2.76 dB
.01 %	2.96 dB

Highest Channel:

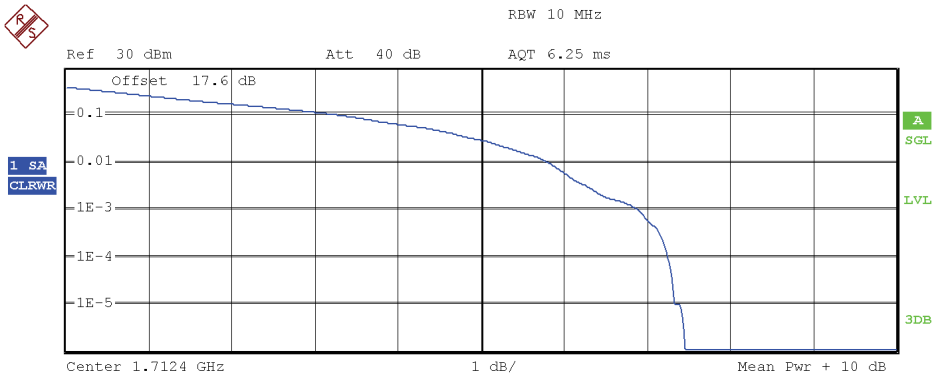


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	22.84 dBm
Peak	25.78 dBm
Crest	2.94 dB
10 %	1.55 dB
1 %	2.32 dB
.1 %	2.71 dB
.01 %	2.87 dB

3G Band IV. HSUPA MODULATION.

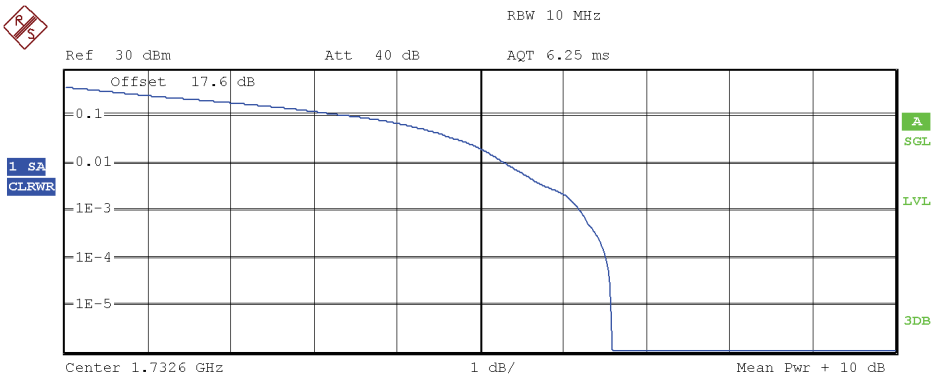
Lowest Channel:



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

	Trace 1
Mean	19.03 dBm
Peak	26.49 dBm
Crest	7.46 dB
10 %	3.33 dB
1 %	5.80 dB
.1 %	6.89 dB
.01 %	7.26 dB

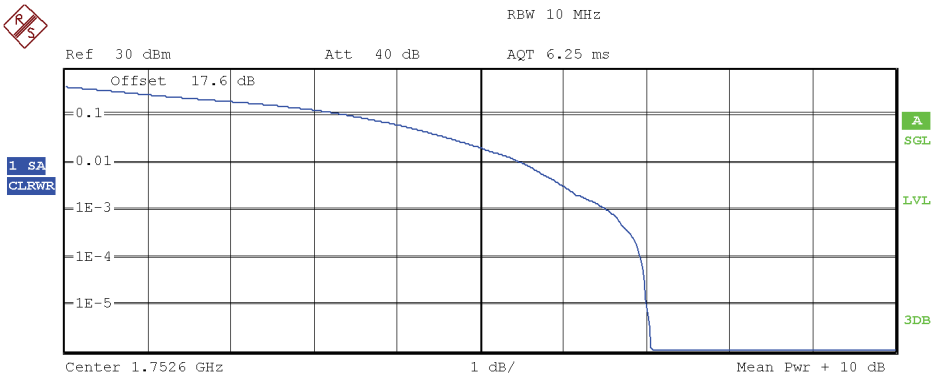
Middle Channel:



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

	Trace 1
Mean	19.45 dBm
Peak	26.04 dBm
Crest	6.58 dB
10 %	3.48 dB
1 %	5.30 dB
.1 %	6.20 dB
.01 %	6.52 dB

Highest Channel:

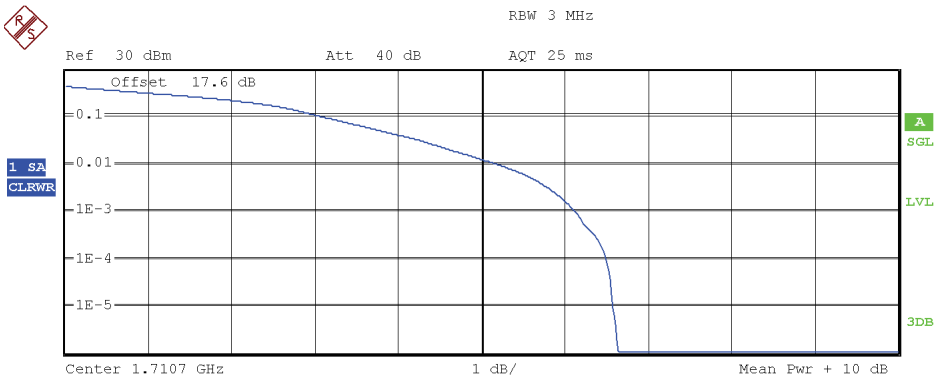


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	19.28 dBm
Peak	26.35 dBm
Crest	7.06 dB
10 %	3.43 dB
1 %	5.50 dB
.1 %	6.54 dB
.01 %	6.94 dB

LTE Band 4. BW=1.4 MHz. 16QAM. RB Size: 6. RB Offset: 0.

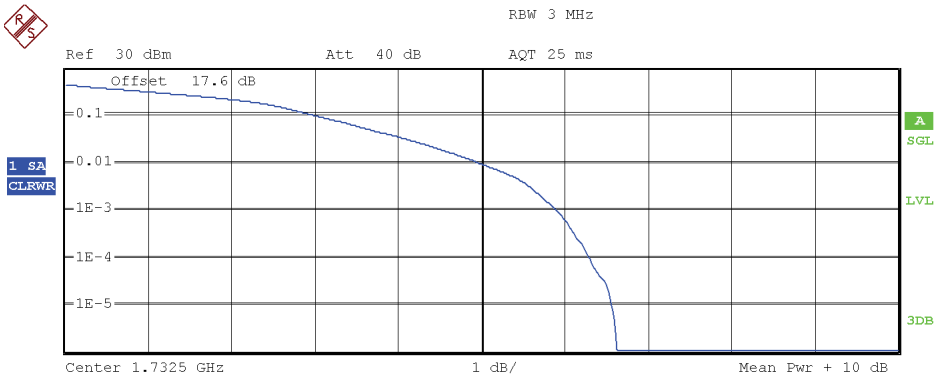
Lowest Channel:



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

	Trace 1
Mean	19.82 dBm
Peak	26.46 dBm
Crest	6.64 dB
10 %	3.09 dB
1 %	5.18 dB
.1 %	6.12 dB
.01 %	6.51 dB

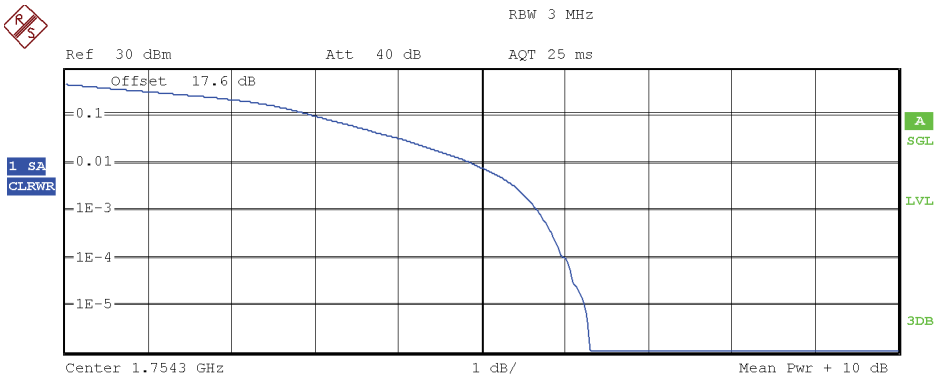
Middle Channel:



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

	Trace 1
Mean	19.55 dBm
Peak	26.17 dBm
Crest	6.63 dB
10 %	3.01 dB
1 %	4.97 dB
.1 %	5.90 dB
.01 %	6.30 dB

Highest Channel:

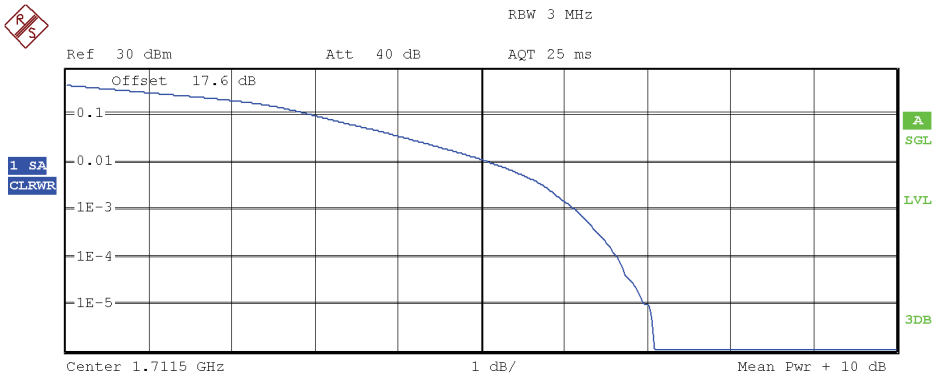


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	19.94 dBm
Peak	26.24 dBm
Crest	6.30 dB
10 %	3.00 dB
1 %	4.87 dB
.1 %	5.67 dB
.01 %	5.99 dB

LTE Band 4. BW=3 MHz. 16QAM. RB Size: 15. RB Offset: 0. (worst case)

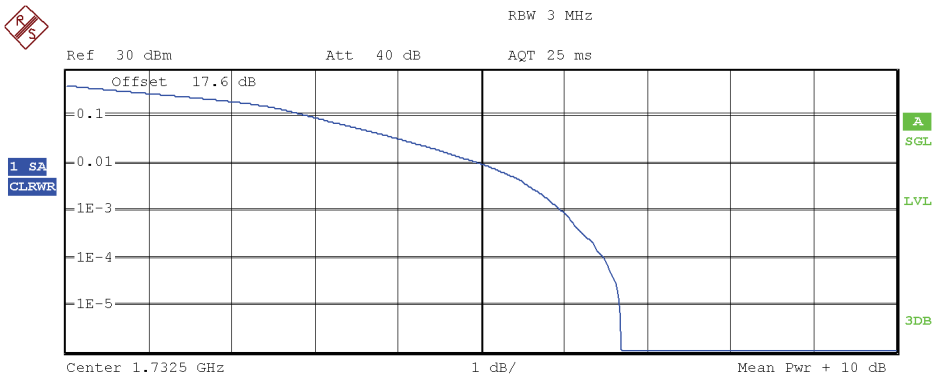
Lowest Channel:



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

	Trace 1
Mean	19.72 dBm
Peak	26.81 dBm
Crest	7.09 dB
10 %	2.98 dB
1 %	5.11 dB
.1 %	6.14 dB
.01 %	6.63 dB

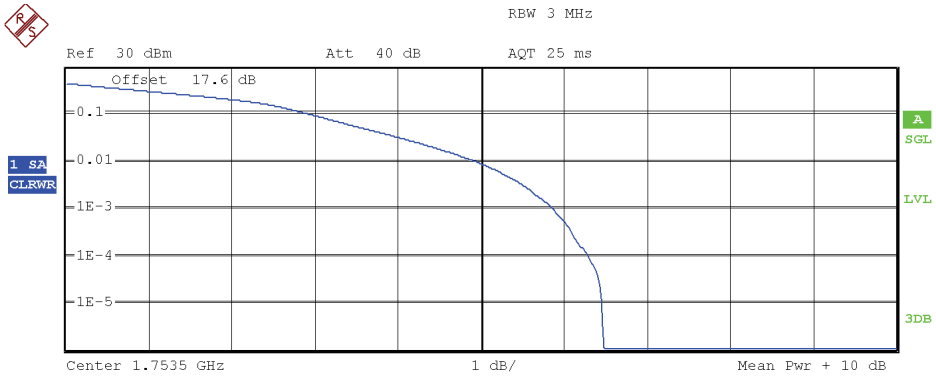
Middle Channel:



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

	Trace 1
Mean	19.63 dBm
Peak	26.32 dBm
Crest	6.69 dB
10 %	2.93 dB
1 %	5.00 dB
.1 %	5.98 dB
.01 %	6.49 dB

Highest Channel:

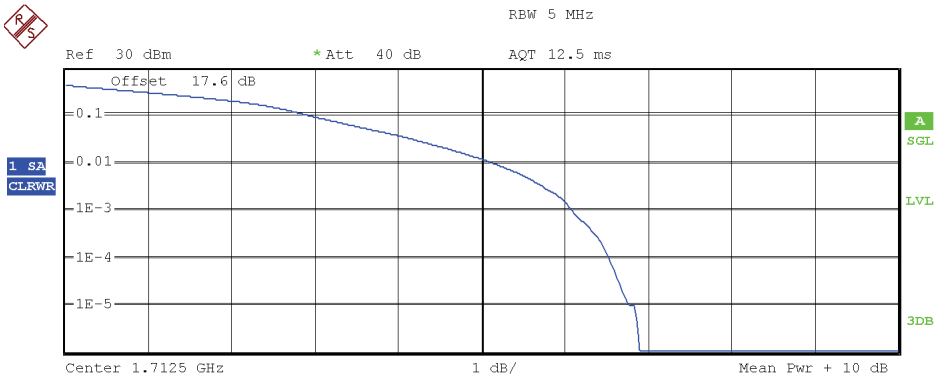


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	19.92 dBm
Peak	26.39 dBm
Crest	6.47 dB
10 %	2.95 dB
1 %	4.94 dB
.1 %	5.87 dB
.01 %	6.30 dB

LTE Band 4. BW=5 MHz. 16QAM. RB Size: 25. RB Offset: 0.

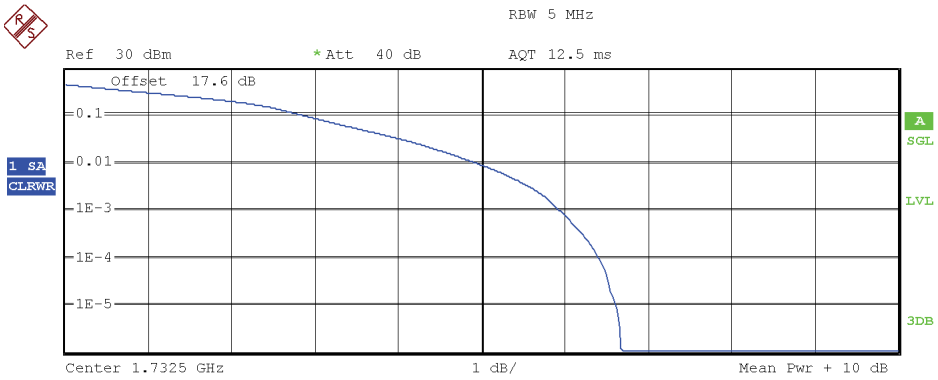
Lowest Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.20 dBm
Peak	27.10 dBm
Crest	6.90 dB
10 %	2.93 dB
1 %	5.13 dB
.1 %	6.09 dB
.01 %	6.54 dB

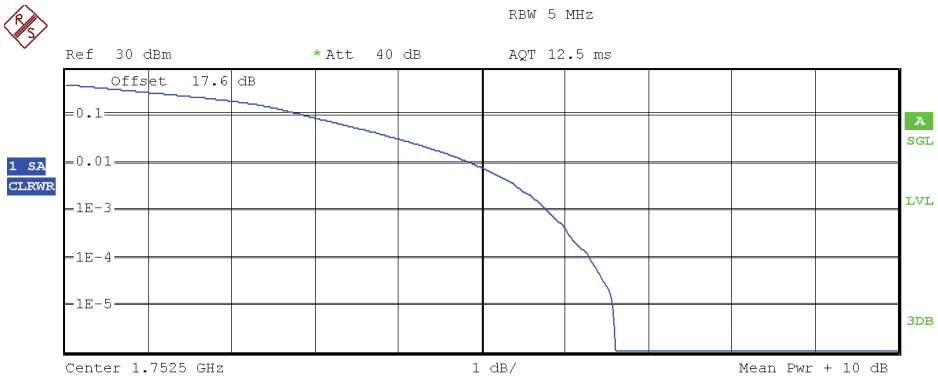
Middle Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.13 dBm
Peak	26.81 dBm
Crest	6.68 dB
10 %	2.87 dB
1 %	4.95 dB
.1 %	5.95 dB
.01 %	6.41 dB

Highest Channel:

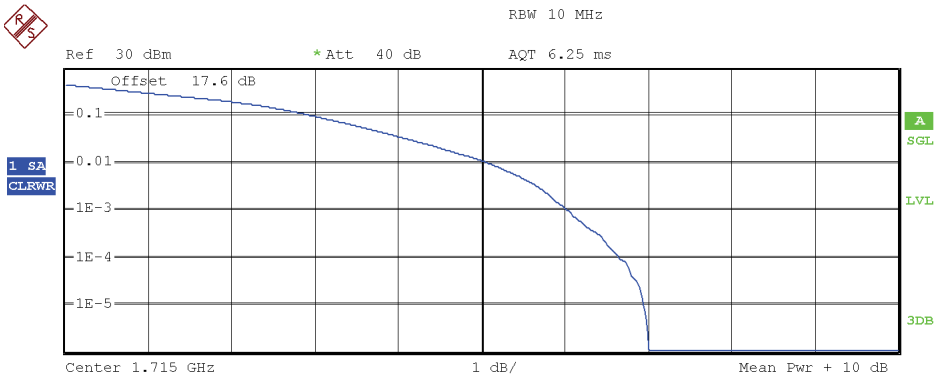


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.28 dBm
Peak	26.88 dBm
Crest	6.60 dB
10 %	2.90 dB
1 %	4.87 dB
.1 %	5.79 dB
.01 %	6.30 dB

LTE Band 4. BW=10 MHz. 16QAM. RB Size: 50. RB Offset: 0.

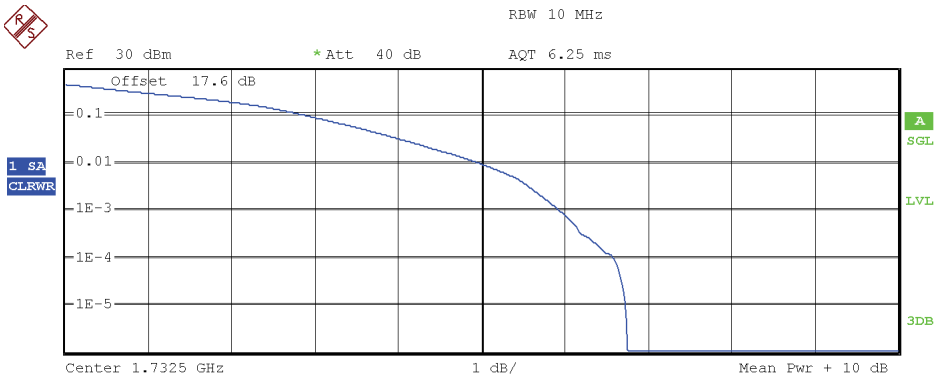
Lowest Channel:



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

	Trace 1
Mean	19.95 dBm
Peak	26.96 dBm
Crest	7.01 dB
10 %	2.96 dB
1 %	5.08 dB
.1 %	6.03 dB
.01 %	6.65 dB

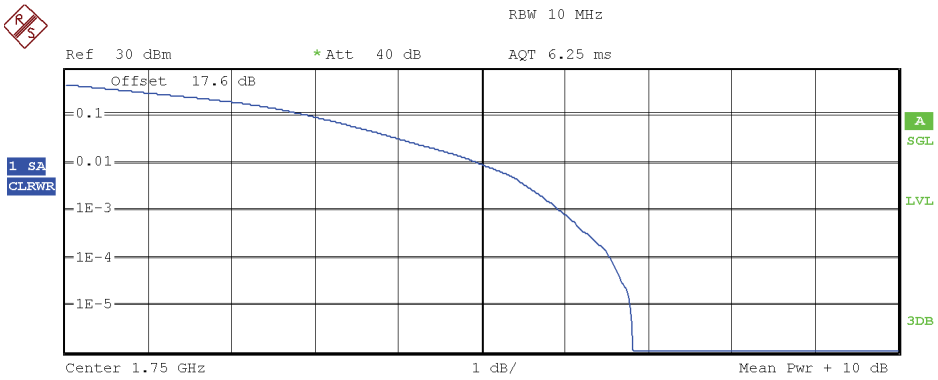
Middle Channel:



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

	Trace 1
Mean	20.04 dBm
Peak	26.79 dBm
Crest	6.75 dB
10 %	2.90 dB
1 %	4.97 dB
.1 %	5.93 dB
.01 %	6.59 dB

Highest Channel:

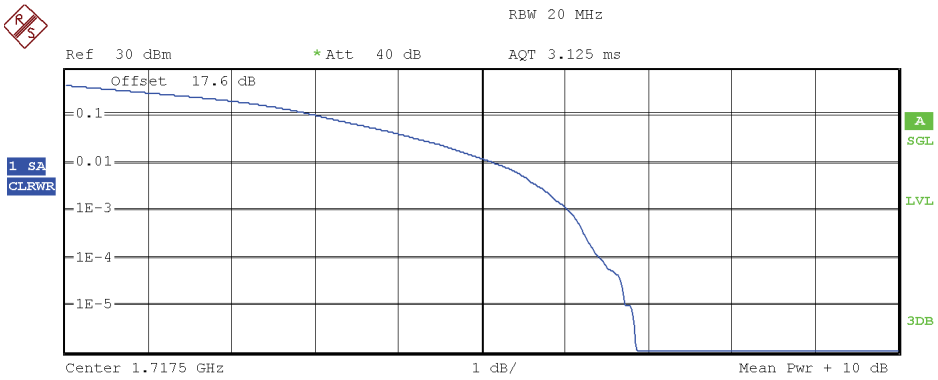


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	20.14 dBm
Peak	26.96 dBm
Crest	6.82 dB
10 %	2.93 dB
1 %	4.97 dB
.1 %	5.95 dB
.01 %	6.54 dB

LTE Band 4. BW=15 MHz. 16QAM. RB Size: 75. RB Offset: 0.

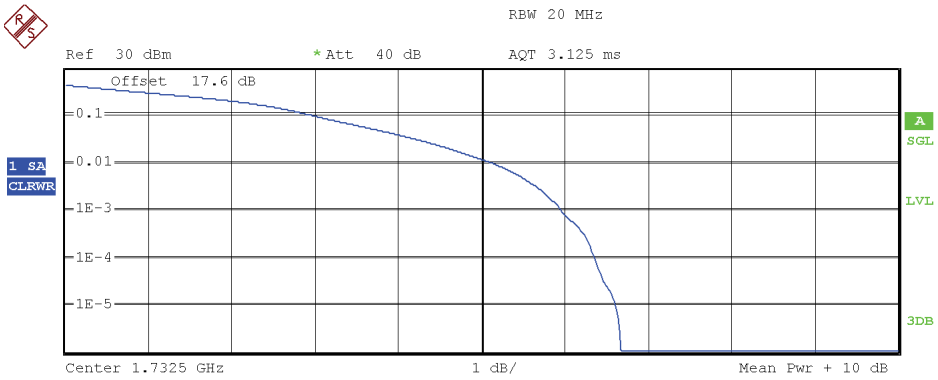
Lowest Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	19.74 dBm
Peak	26.60 dBm
Crest	6.86 dB
10 %	3.03 dB
1 %	5.16 dB
.1 %	6.04 dB
.01 %	6.43 dB

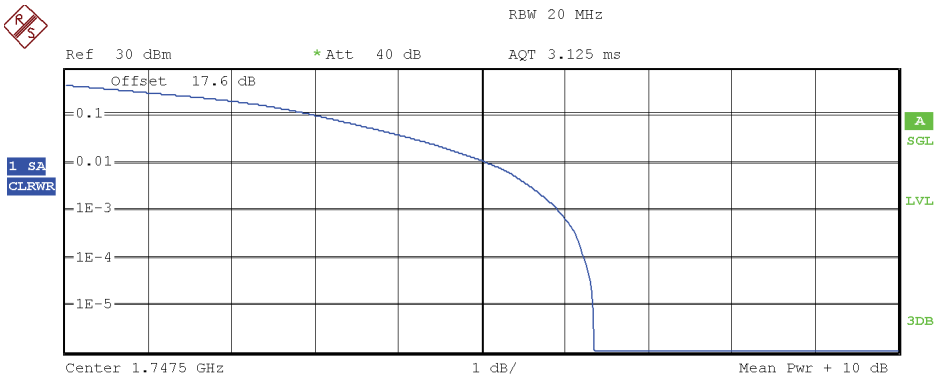
Middle Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	19.90 dBm
Peak	26.58 dBm
Crest	6.68 dB
10 %	2.98 dB
1 %	5.13 dB
.1 %	5.96 dB
.01 %	6.36 dB

Highest Channel:

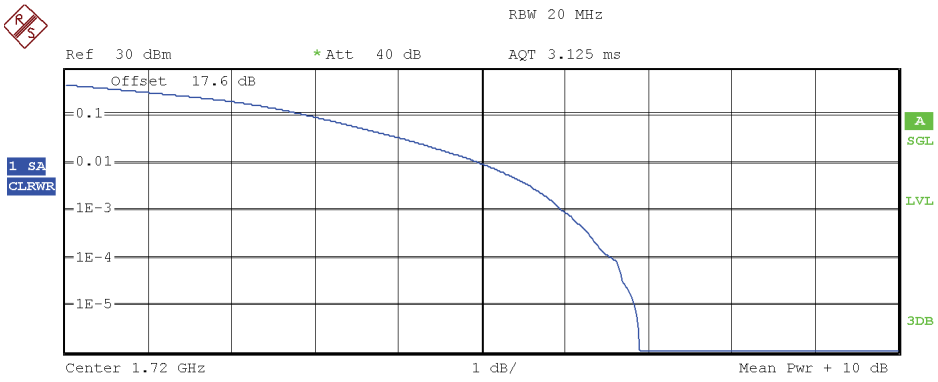


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	20.04 dBm
Peak	26.38 dBm
Crest	6.35 dB
10 %	3.03 dB
1 %	5.08 dB
.1 %	5.93 dB
.01 %	6.23 dB

LTE Band 4. BW=20 MHz. 16QAM. RB Size: 100. RB Offset: 0.

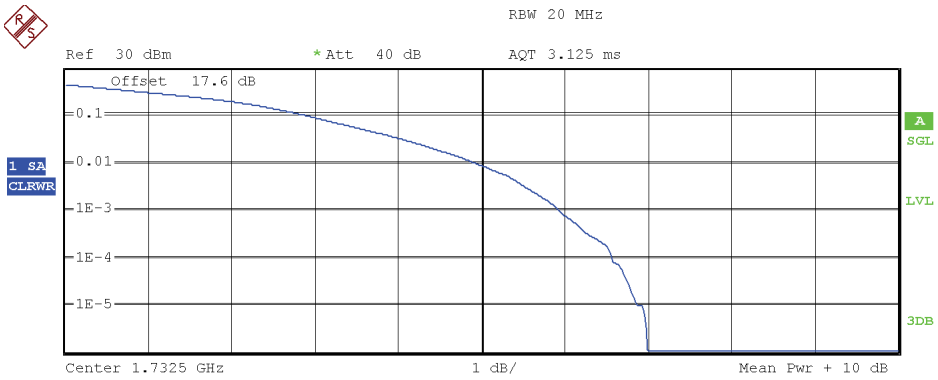
Lowest Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	19.83 dBm
Peak	26.73 dBm
Crest	6.90 dB
10 %	2.93 dB
1 %	4.98 dB
.1 %	5.98 dB
.01 %	6.55 dB

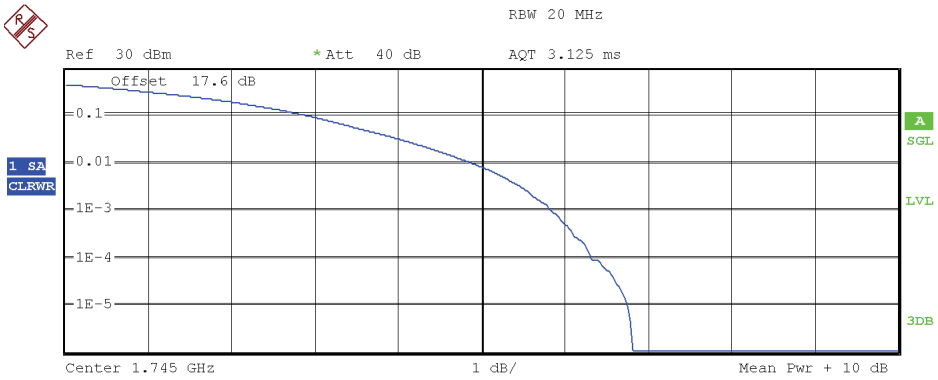
Middle Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	19.93 dBm
Peak	26.93 dBm
Crest	7.00 dB
10 %	2.90 dB
1 %	4.92 dB
.1 %	5.93 dB
.01 %	6.57 dB

Highest Channel:

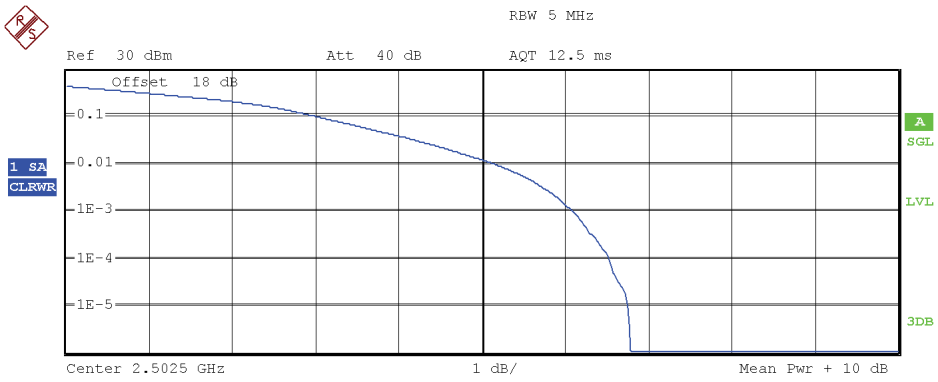


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	20.06 dBm
Peak	26.87 dBm
Crest	6.82 dB
10 %	2.92 dB
1 %	4.89 dB
.1 %	5.83 dB
.01 %	6.33 dB

LTE Band 7. BW=5 MHz. 16QAM. RB Size: 25. RB Offset: 0.

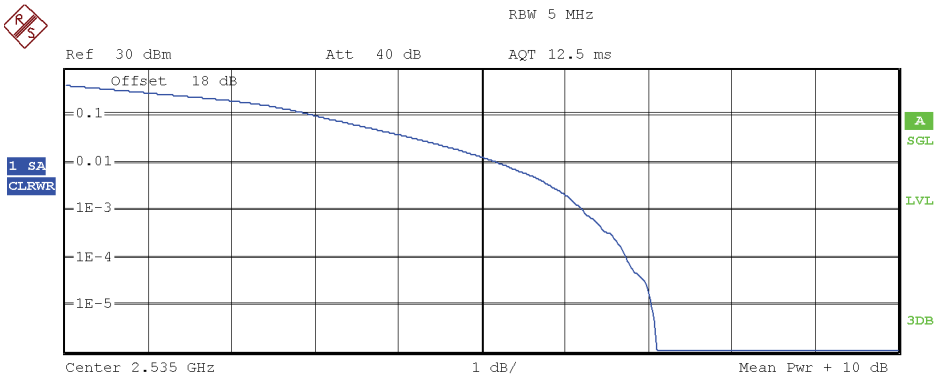
Lowest Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	19.32 dBm
Peak	26.10 dBm
Crest	6.78 dB
10 %	3.01 dB
1 %	5.14 dB
.1 %	6.09 dB
.01 %	6.52 dB

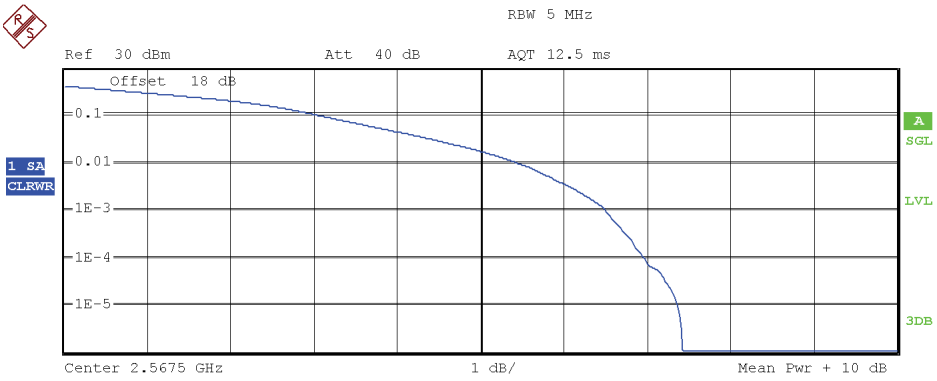
Middle Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	18.51 dBm
Peak	25.61 dBm
Crest	7.10 dB
10 %	3.01 dB
1 %	5.21 dB
.1 %	6.22 dB
.01 %	6.75 dB

Highest Channel:

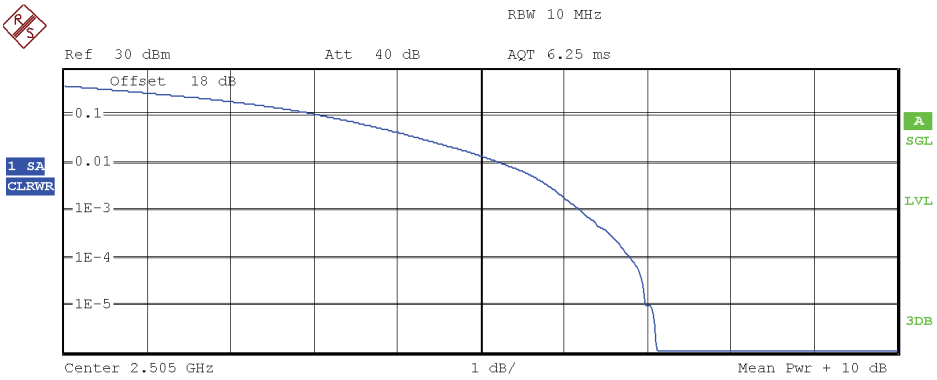


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	18.67 dBm
Peak	26.10 dBm
Crest	7.43 dB
10 %	3.08 dB
1 %	5.45 dB
.1 %	6.51 dB
.01 %	6.97 dB

LTE Band 7. BW=10 MHz. 16QAM. RB Size: 50. RB Offset: 0.

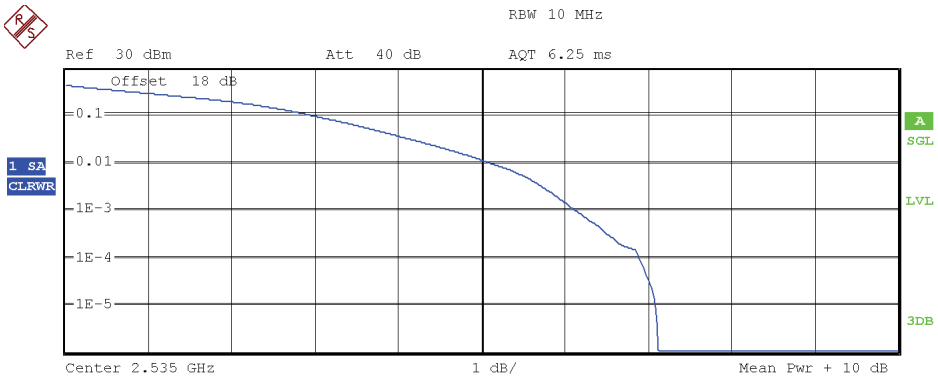
Lowest Channel:



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

	Trace 1
Mean	19.56 dBm
Peak	26.67 dBm
Crest	7.12 dB
10 %	3.11 dB
1 %	5.26 dB
.1 %	6.20 dB
.01 %	6.79 dB

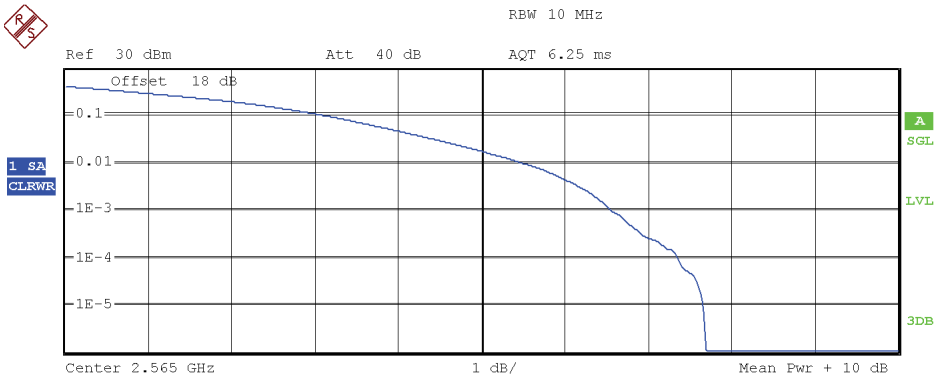
Middle Channel:



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

	Trace 1
Mean	18.85 dBm
Peak	25.97 dBm
Crest	7.12 dB
10 %	2.98 dB
1 %	5.11 dB
.1 %	6.14 dB
.01 %	6.89 dB

Highest Channel:

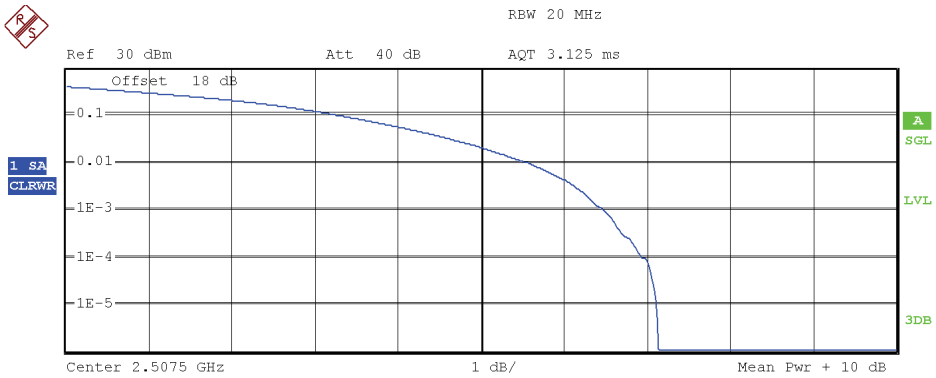


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	18.77 dBm
Peak	26.46 dBm
Crest	7.69 dB
10 %	3.14 dB
1 %	5.50 dB
.1 %	6.55 dB
.01 %	7.36 dB

LTE Band 7. BW=15 MHz. 16QAM. RB Size: 75. RB Offset: 0. (worst case)

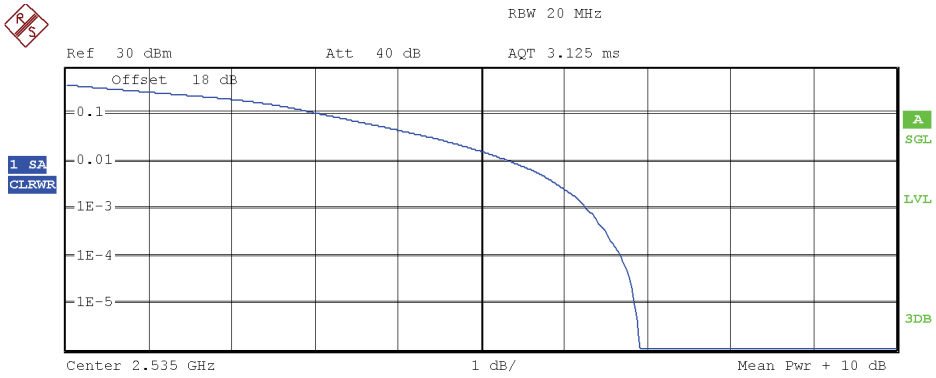
Lowest Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	19.37 dBm
Peak	26.50 dBm
Crest	7.13 dB
10 %	3.29 dB
1 %	5.56 dB
.1 %	6.47 dB
.01 %	6.94 dB

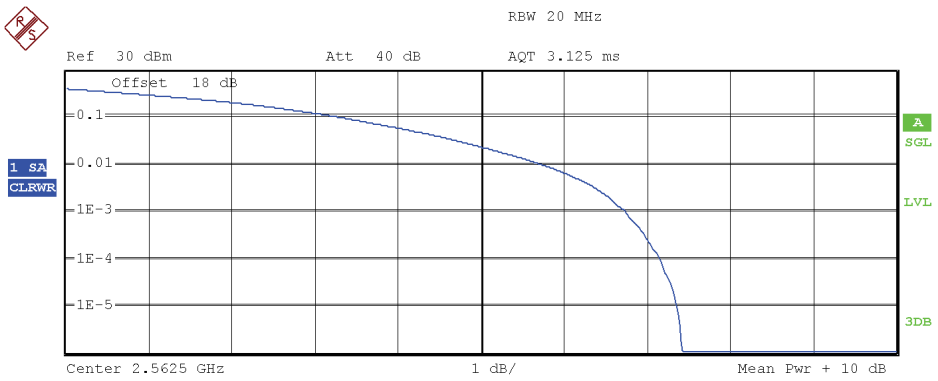
Middle Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	18.74 dBm
Peak	25.65 dBm
Crest	6.91 dB
10 %	3.09 dB
1 %	5.35 dB
.1 %	6.27 dB
.01 %	6.68 dB

Highest Channel:

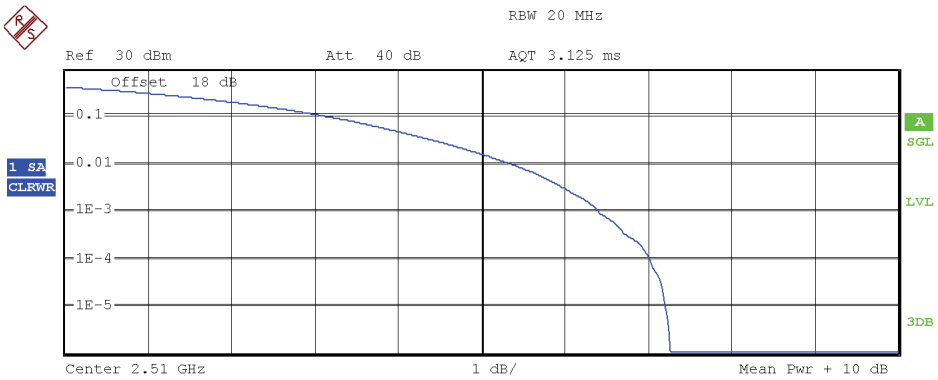


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	18.94 dBm
Peak	26.36 dBm
Crest	7.42 dB
10 %	3.30 dB
1 %	5.74 dB
.1 %	6.75 dB
.01 %	7.16 dB

LTE Band 7. BW=20 MHz. 16QAM. RB Size: 100. RB Offset: 0.

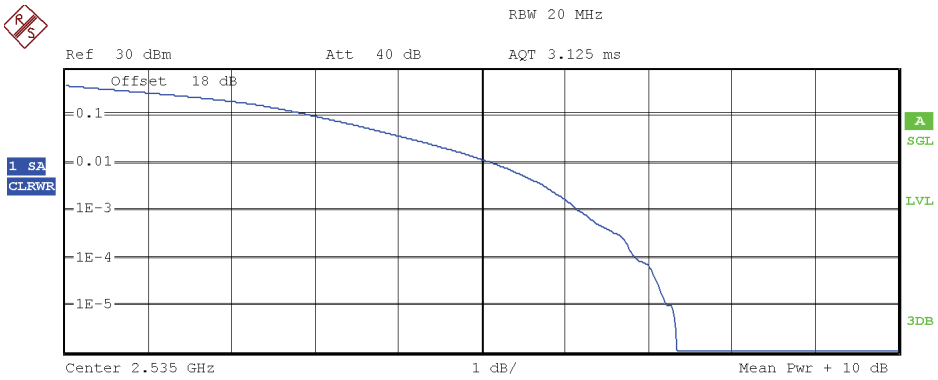
Lowest Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	19.24 dBm
Peak	26.51 dBm
Crest	7.27 dB
10 %	3.16 dB
1 %	5.35 dB
.1 %	6.41 dB
.01 %	7.02 dB

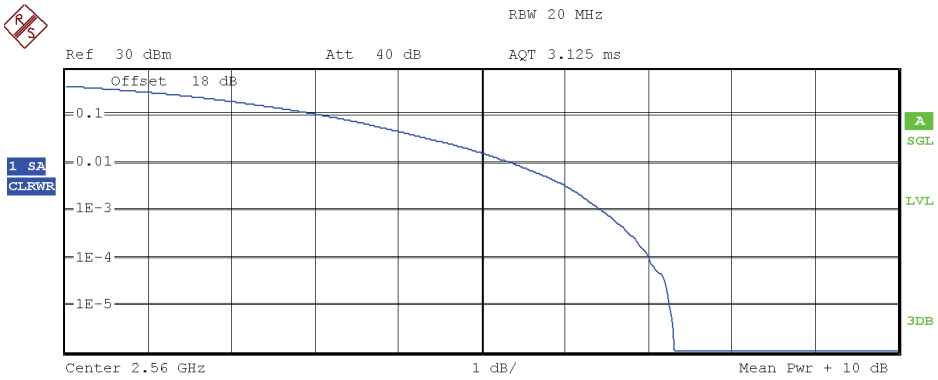
Middle Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	18.65 dBm
Peak	26.00 dBm
Crest	7.35 dB
10 %	2.98 dB
1 %	5.14 dB
.1 %	6.17 dB
.01 %	6.86 dB

Highest Channel:

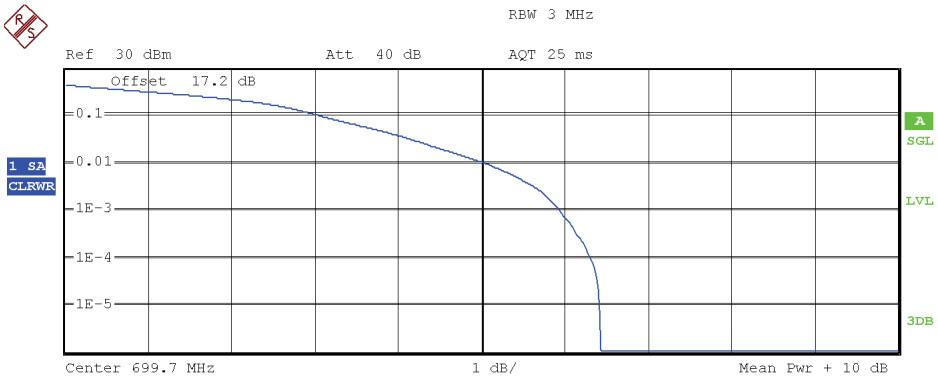


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 23.7MHz

	Trace 1
Mean	19.03 dBm
Peak	26.35 dBm
Crest	7.32 dB
10 %	3.13 dB
1 %	5.37 dB
.1 %	6.44 dB
.01 %	7.02 dB

LTE Band 12. BW=1.4 MHz. 16QAM. RB Size: 6. RB Offset: 0.

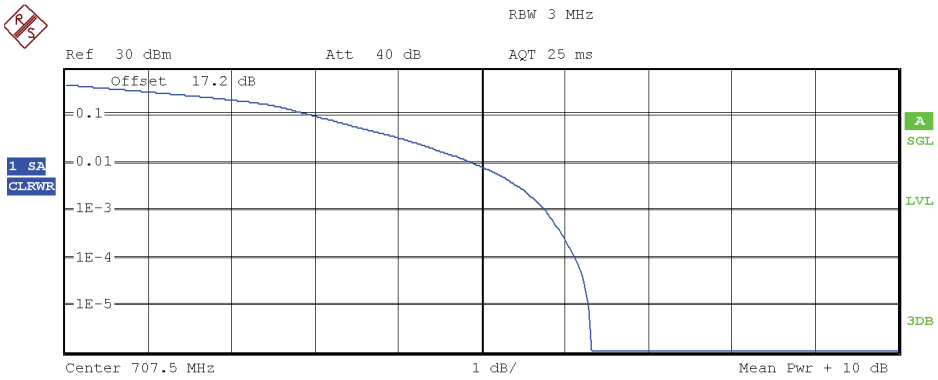
Lowest Channel:



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

	Trace 1
Mean	21.09 dBm
Peak	27.52 dBm
Crest	6.43 dB
10 %	3.06 dB
1 %	5.05 dB
.1 %	5.95 dB
.01 %	6.31 dB

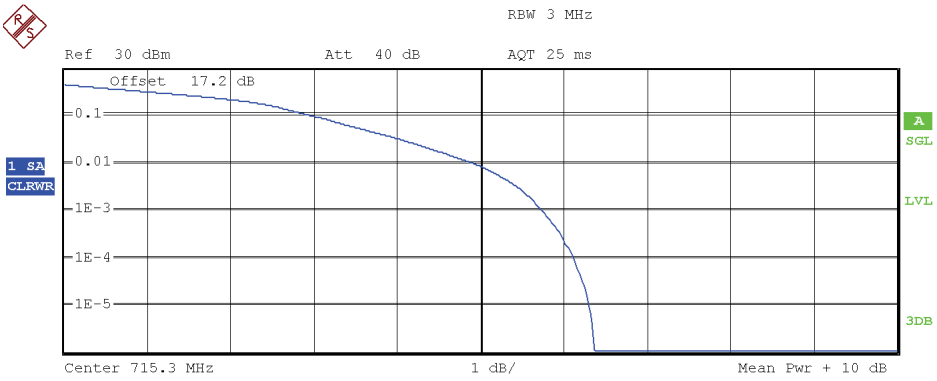
Middle Channel:



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

	Trace 1
Mean	21.06 dBm
Peak	27.38 dBm
Crest	6.32 dB
10 %	2.98 dB
1 %	4.90 dB
.1 %	5.77 dB
.01 %	6.12 dB

Highest Channel:

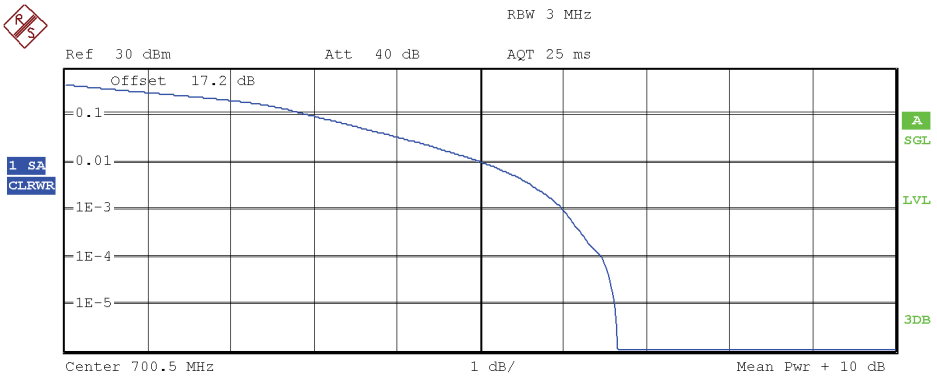


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	21.07 dBm
Peak	27.44 dBm
Crest	6.37 dB
10 %	2.98 dB
1 %	4.90 dB
.1 %	5.74 dB
.01 %	6.12 dB

LTE Band 12. BW=3 MHz. 16QAM. RB Size: 15. RB Offset: 0.

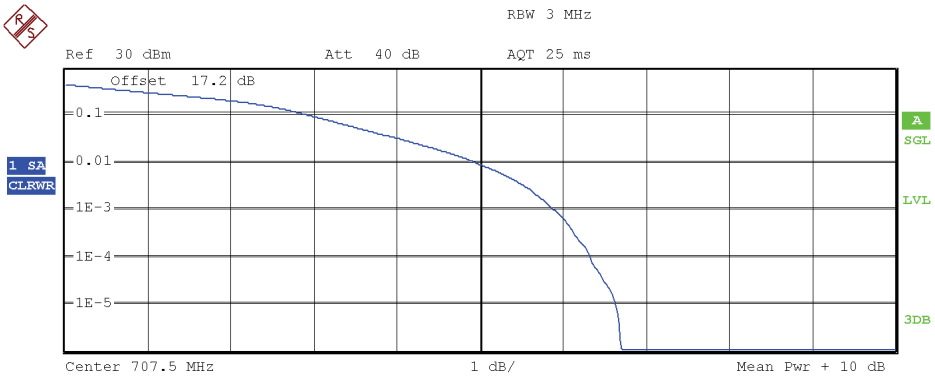
Lowest Channel:



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

	Trace 1
Mean	21.00 dBm
Peak	27.66 dBm
Crest	6.65 dB
10 %	2.96 dB
1 %	5.03 dB
.1 %	5.99 dB
.01 %	6.46 dB

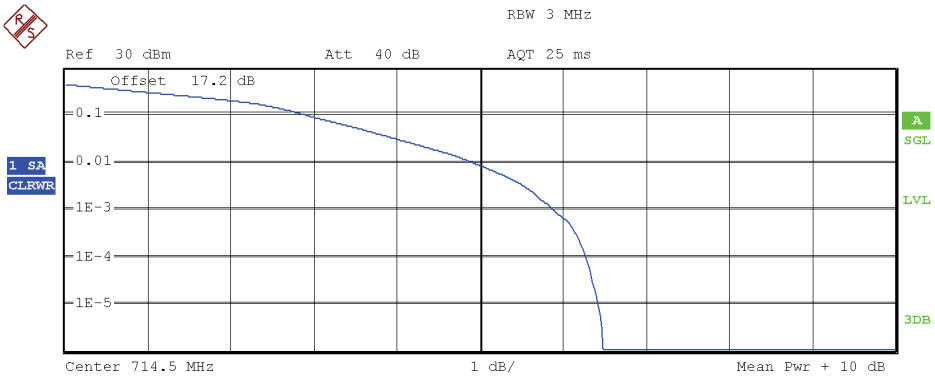
Middle Channel:



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

	Trace 1
Mean	20.89 dBm
Peak	27.59 dBm
Crest	6.70 dB
10 %	2.95 dB
1 %	4.95 dB
.1 %	5.90 dB
.01 %	6.33 dB

Highest Channel:

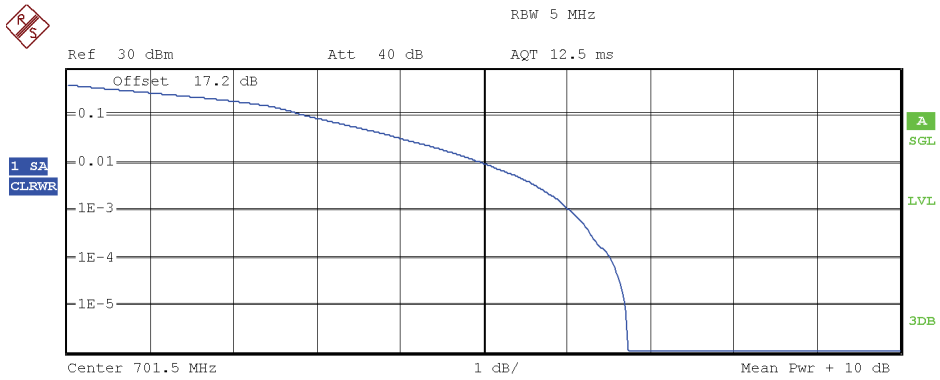


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 3.5MHz

	Trace 1
Mean	21.02 dBm
Peak	27.51 dBm
Crest	6.49 dB
10 %	2.92 dB
1 %	4.90 dB
.1 %	5.88 dB
.01 %	6.28 dB

LTE Band 12. BW=5 MHz. 16QAM. RB Size: 6. RB Offset: 0. (worst case)

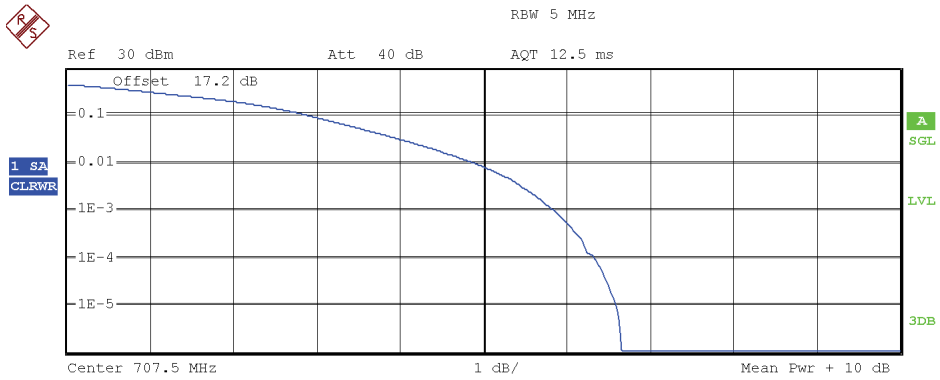
Lowest Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.93 dBm
Peak	27.66 dBm
Crest	6.73 dB
10 %	2.87 dB
1 %	5.00 dB
.1 %	6.04 dB
.01 %	6.52 dB

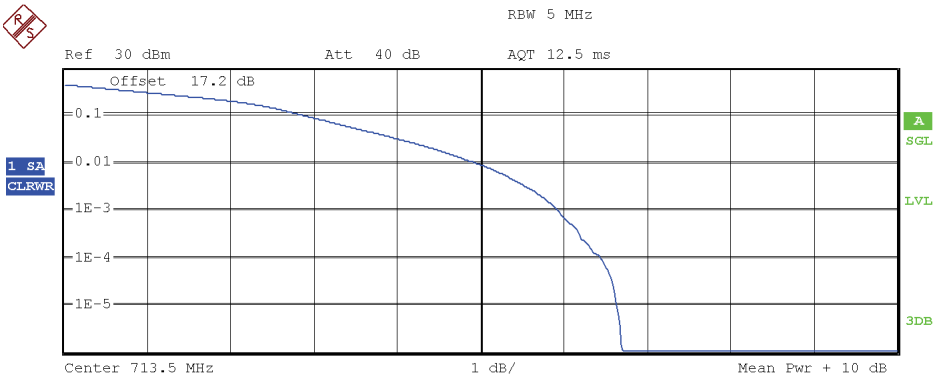
Middle Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.93 dBm
Peak	27.59 dBm
Crest	6.66 dB
10 %	2.92 dB
1 %	4.89 dB
.1 %	5.85 dB
.01 %	6.33 dB

Highest Channel:

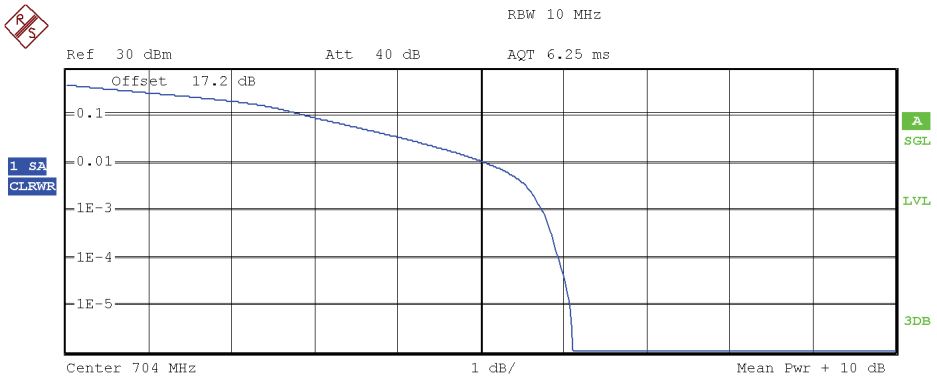


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.88 dBm
Peak	27.58 dBm
Crest	6.70 dB
10 %	2.90 dB
1 %	4.95 dB
.1 %	5.93 dB
.01 %	6.44 dB

LTE Band 12. BW=10 MHz. 16QAM. RB Size: 6. RB Offset: 0. (worst case)

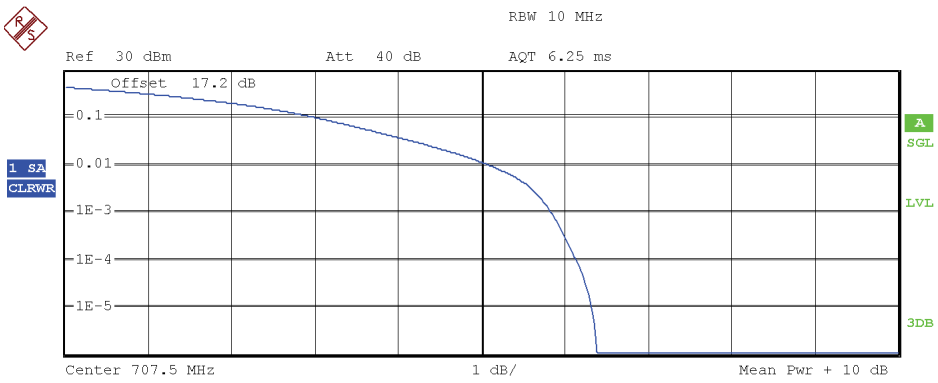
Lowest Channel:



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

	Trace 1
Mean	21.21 dBm
Peak	27.32 dBm
Crest	6.11 dB
10 %	2.92 dB
1 %	5.06 dB
.1 %	5.75 dB
.01 %	5.95 dB

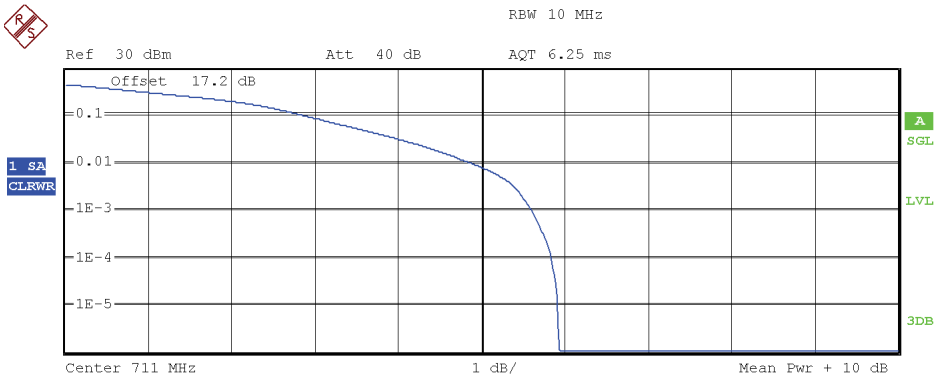
Middle Channel:



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

	Trace 1
Mean	21.22 dBm
Peak	27.60 dBm
Crest	6.39 dB
10 %	3.03 dB
1 %	5.10 dB
.1 %	5.83 dB
.01 %	6.14 dB

Highest Channel:

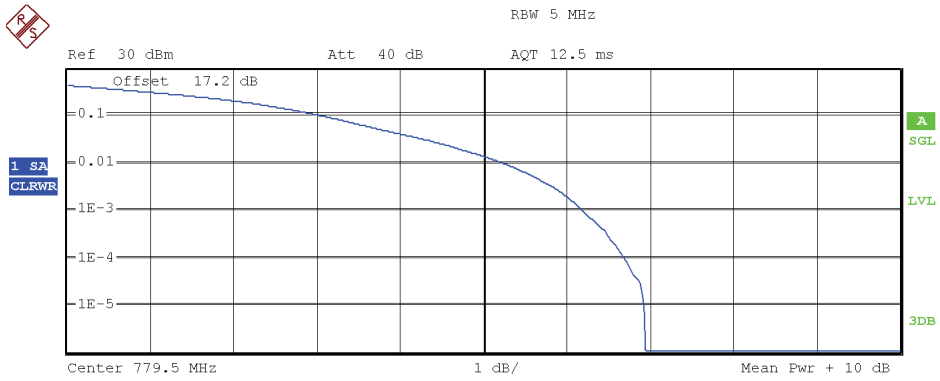


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 11.2MHz

	Trace 1
Mean	21.32 dBm
Peak	27.25 dBm
Crest	5.92 dB
10 %	2.88 dB
1 %	4.87 dB
.1 %	5.61 dB
.01 %	5.85 dB

LTE Band 13. BW=5 MHz. 16QAM. RB Size: 1. RB Offset: 24.

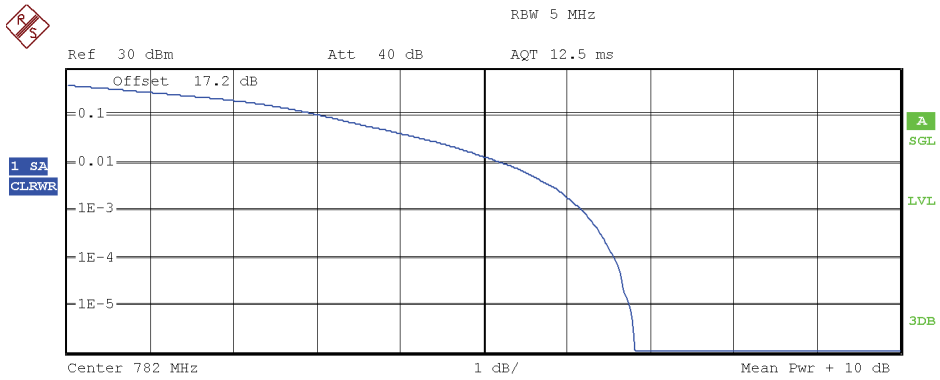
Lowest Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.50 dBm
Peak	27.44 dBm
Crest	6.95 dB
10 %	3.06 dB
1 %	5.22 dB
.1 %	6.19 dB
.01 %	6.70 dB

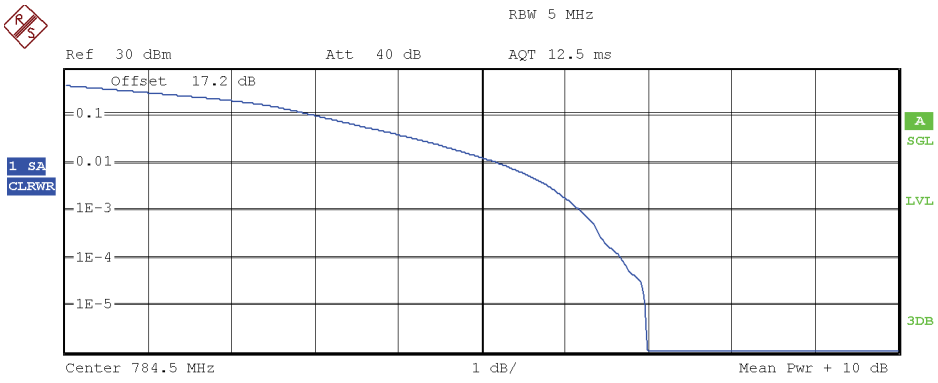
Middle Channel:



Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.62 dBm
Peak	27.44 dBm
Crest	6.82 dB
10 %	3.08 dB
1 %	5.22 dB
.1 %	6.19 dB
.01 %	6.57 dB

Highest Channel:

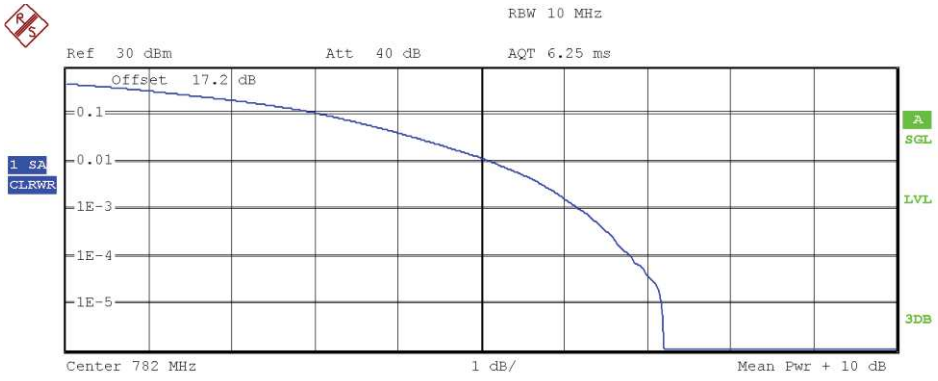


Complementary Cumulative Distribution Function
NOF samples: 100000, Usable BW: 7.1MHz

	Trace 1
Mean	20.46 dBm
Peak	27.44 dBm
Crest	6.98 dB
10 %	3.01 dB
1 %	5.21 dB
.1 %	6.19 dB
.01 %	6.68 dB

LTE Band 13. BW=10 MHz. 16QAM. RB Size: 50. RB Offset: 0. (worst case)

Middle Channel:



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

	Trace 1
Mean	20.16 dBm
Peak	27.36 dBm
Crest	7.20 dB
10 %	3.09 dB
1 %	5.13 dB
.1 %	6.19 dB
.01 %	6.81 dB

Modulation Characteristics

SPECIFICATION:

FCC §2.1047: Measurements required: Modulation characteristics.

RSS-130 Clause 4.2: Equipment certified under this standard shall employ digital modulation.

RSS-139 Clause 6.2:

The devices may employ any type of modulation techniques. The type of modulation used must be reported.

RSS-199 Clause 4.1:

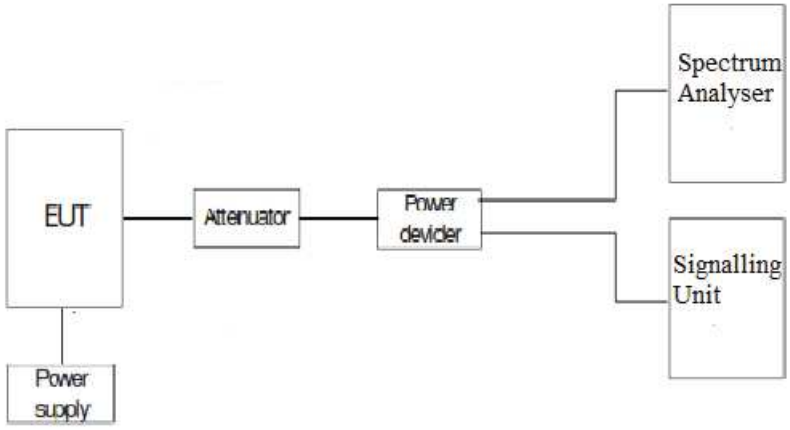
Equipment certified under this standard shall employ digital modulation.

METHOD:

For 3G, the EUT operates with WCDMA (QPSK) and HSUPA (QPSK) modes, in which the information is digitized and coded into a bit stream.

For LTE the EUT operates with QPSK and 16QAM modulation modes in which the information is digitised and coded into a bit stream. The RF transmission is multiplexed using *Orthogonal Frequency Division Multiplexing (OFDM)* using different possible arrangement of subcarriers (Resource Blocks RB).

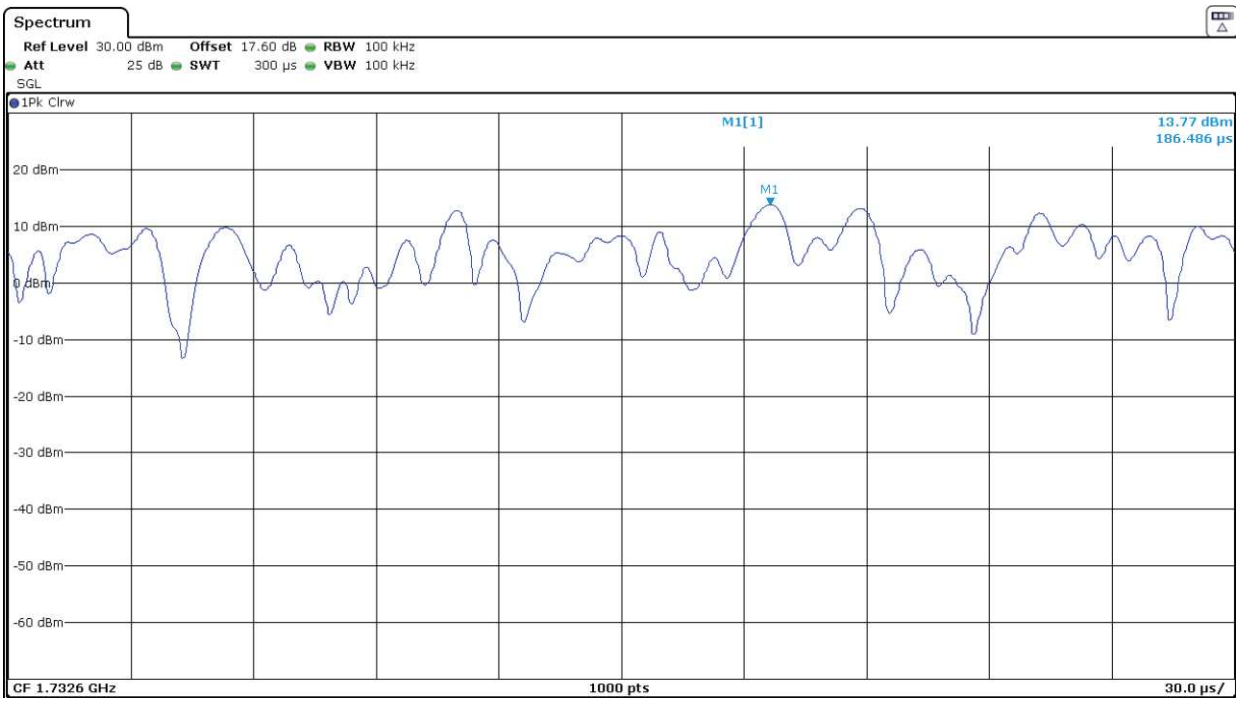
TEST SETUP:



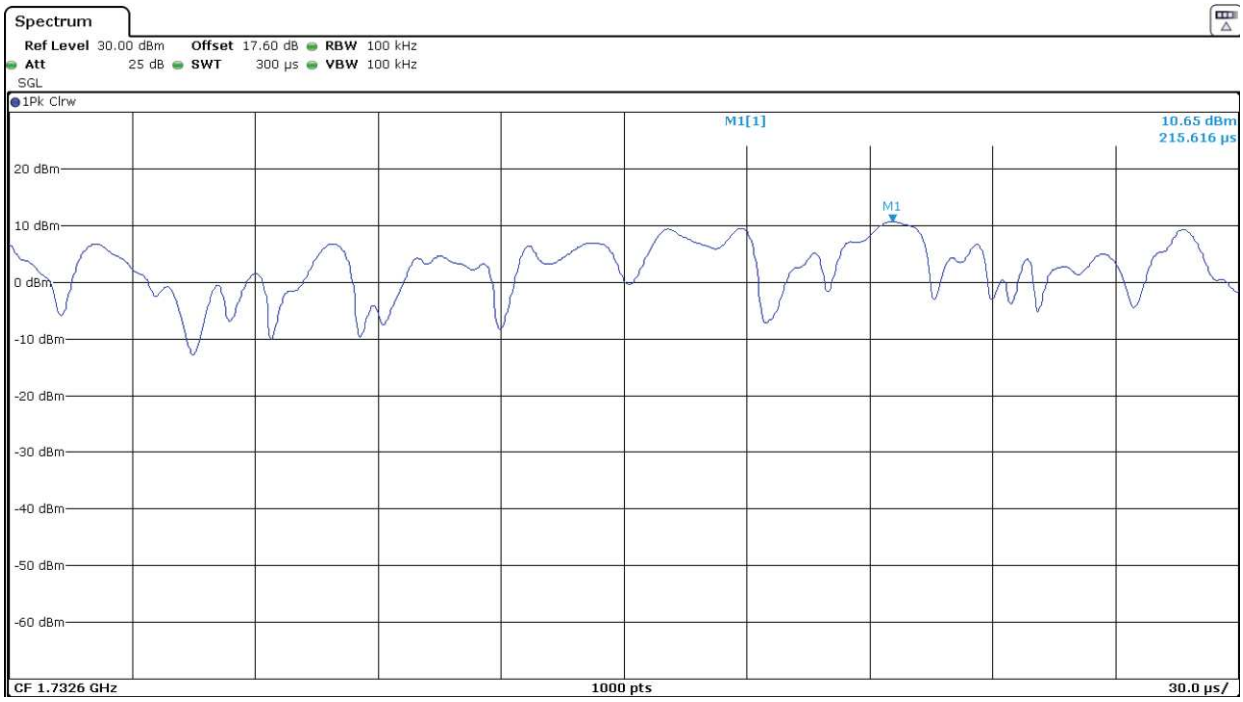
RESULTS:

The following plots show the modulation schemes in the EUT.

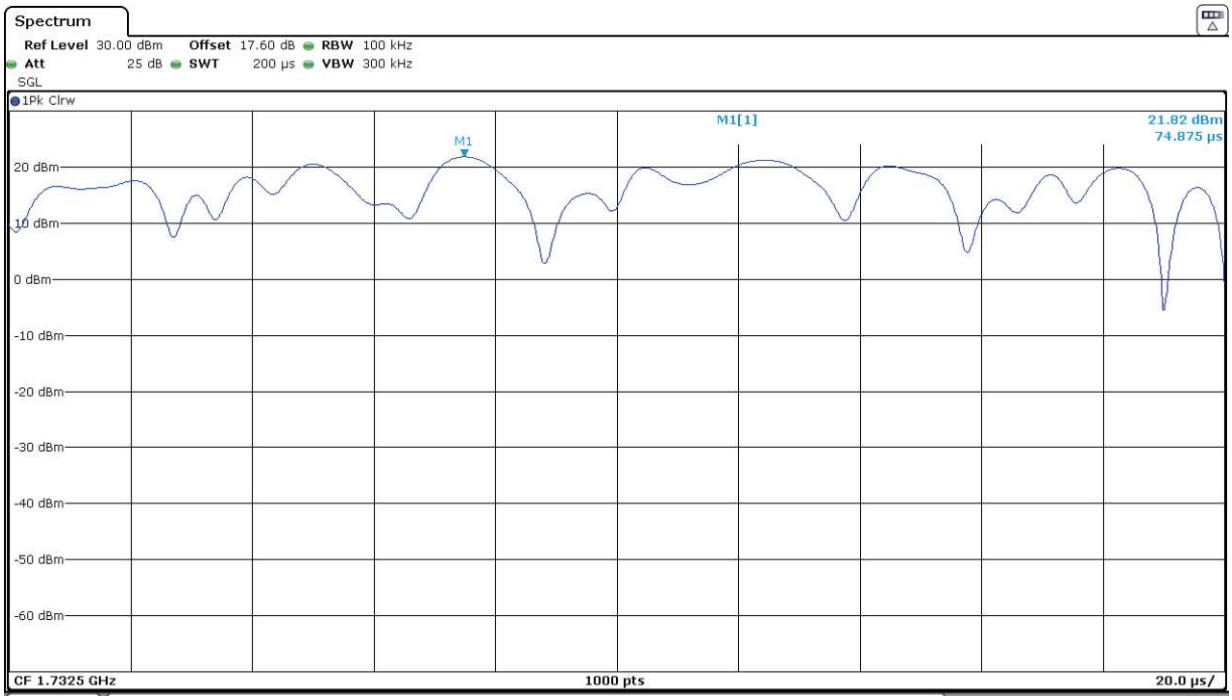
3G Band IV. WCDMA MODULATION.



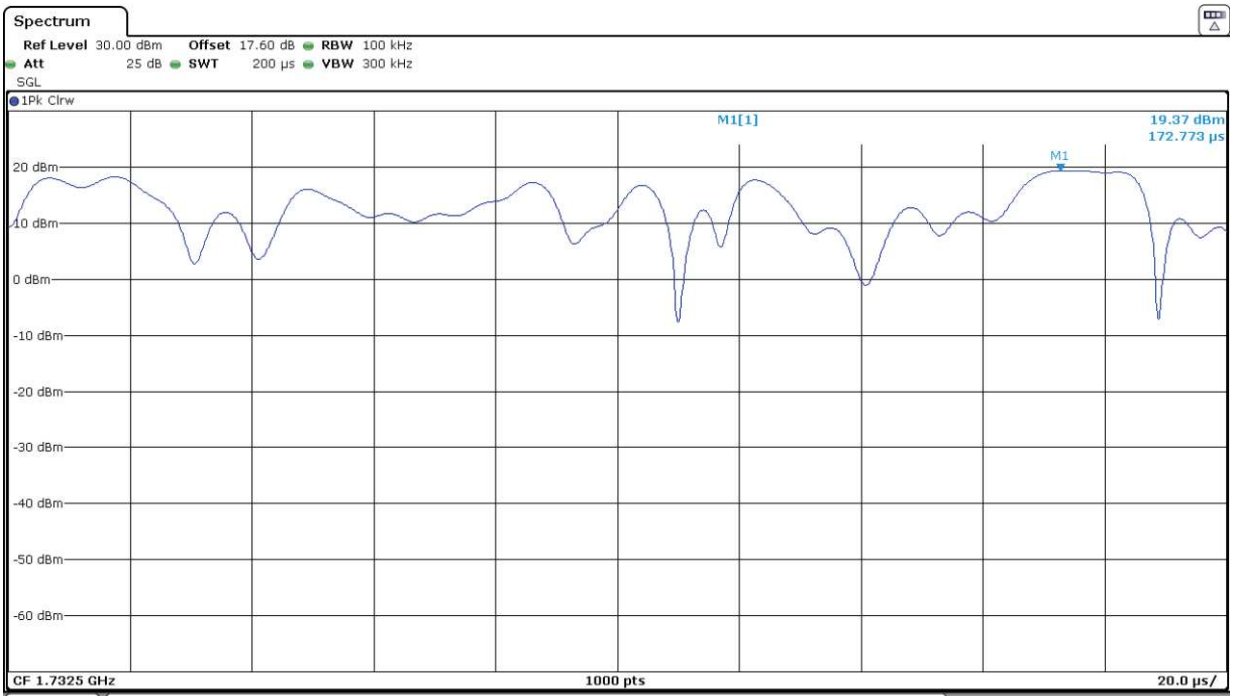
3G Band IV. HSUPA MODULATION.



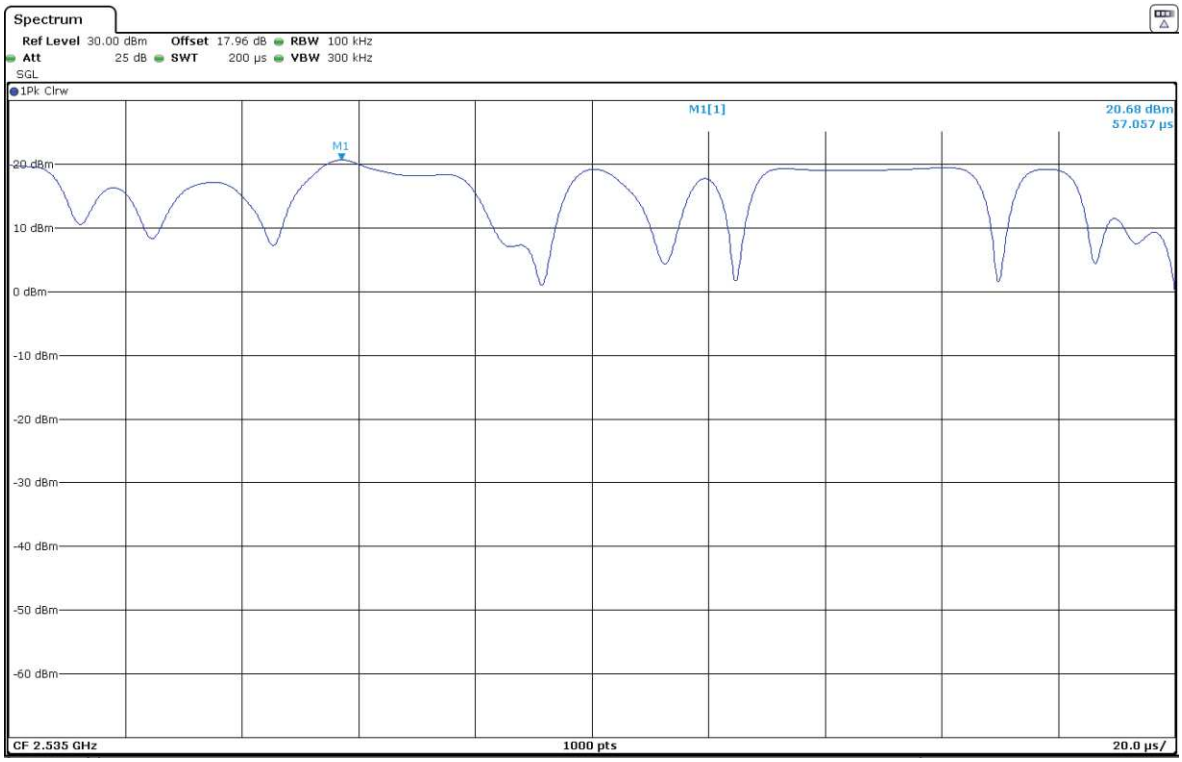
LTE Band 4. QPSK MODULATION. BW = 10 MHz.



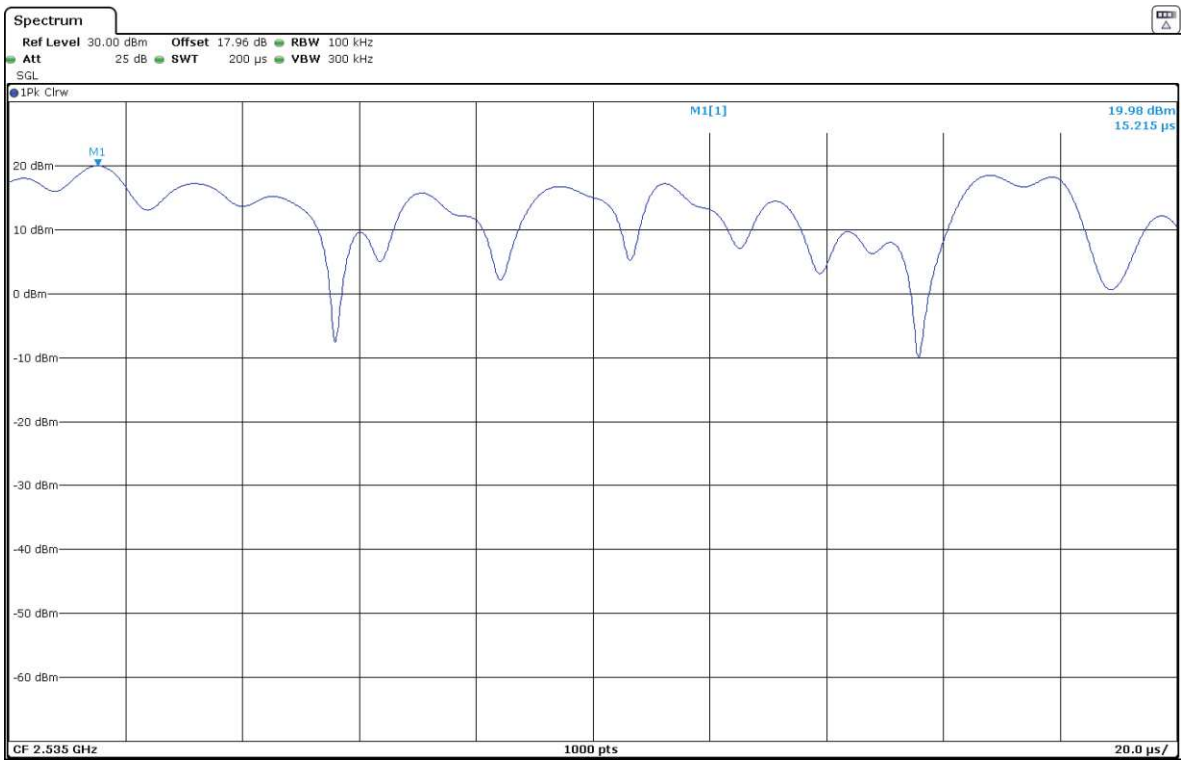
LTE Band 4. 16QAM MODULATION. BW = 10 MHz.



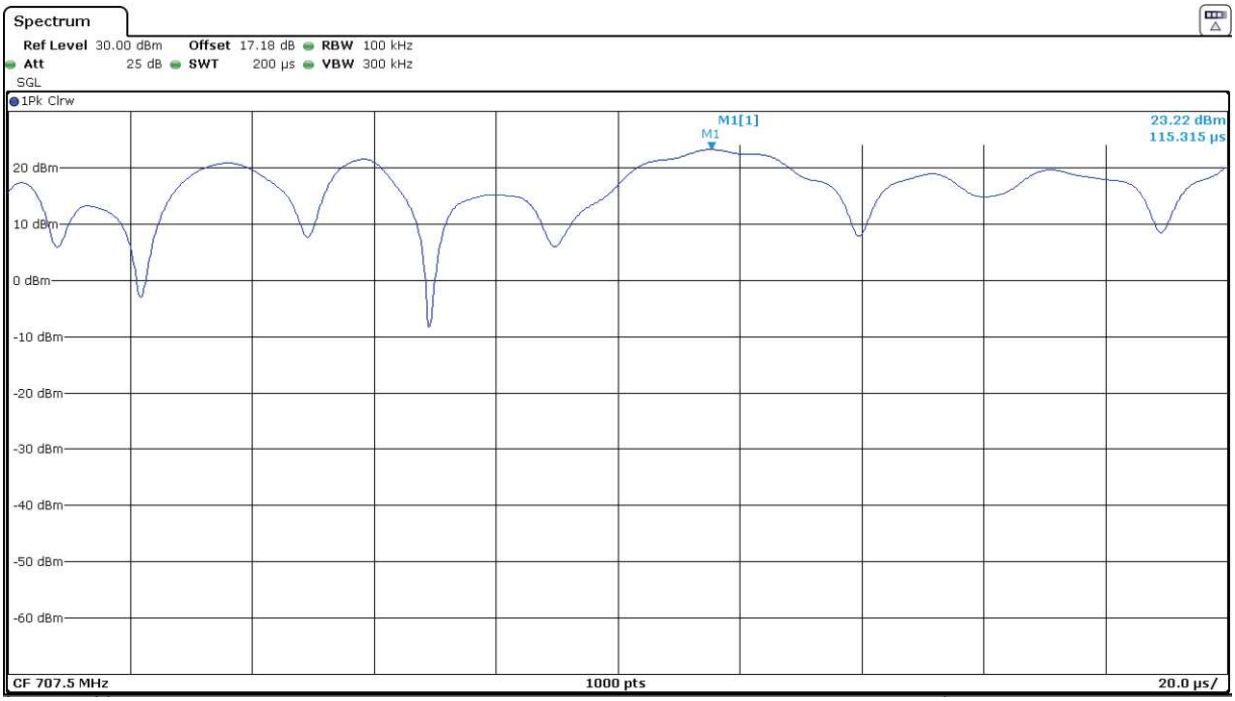
LTE Band 7. QPSK MODULATION. BW = 10 MHz.



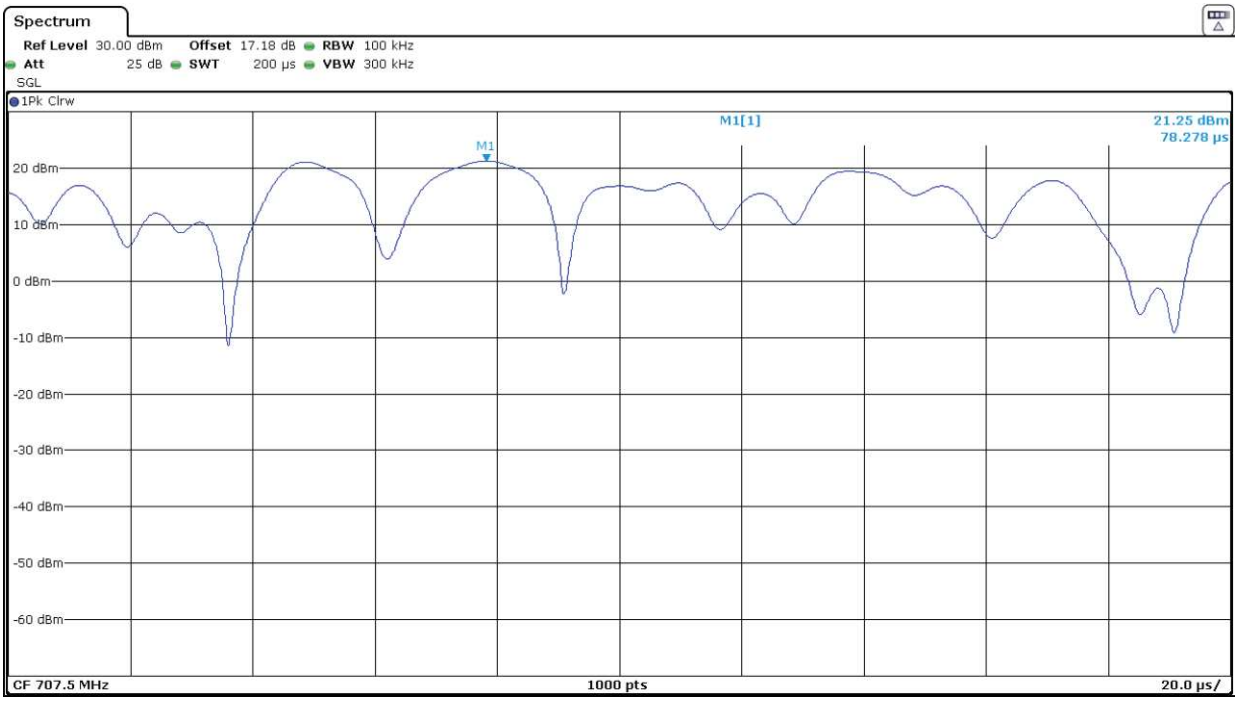
LTE Band 7. 16QAM MODULATION. BW = 10 MHz.



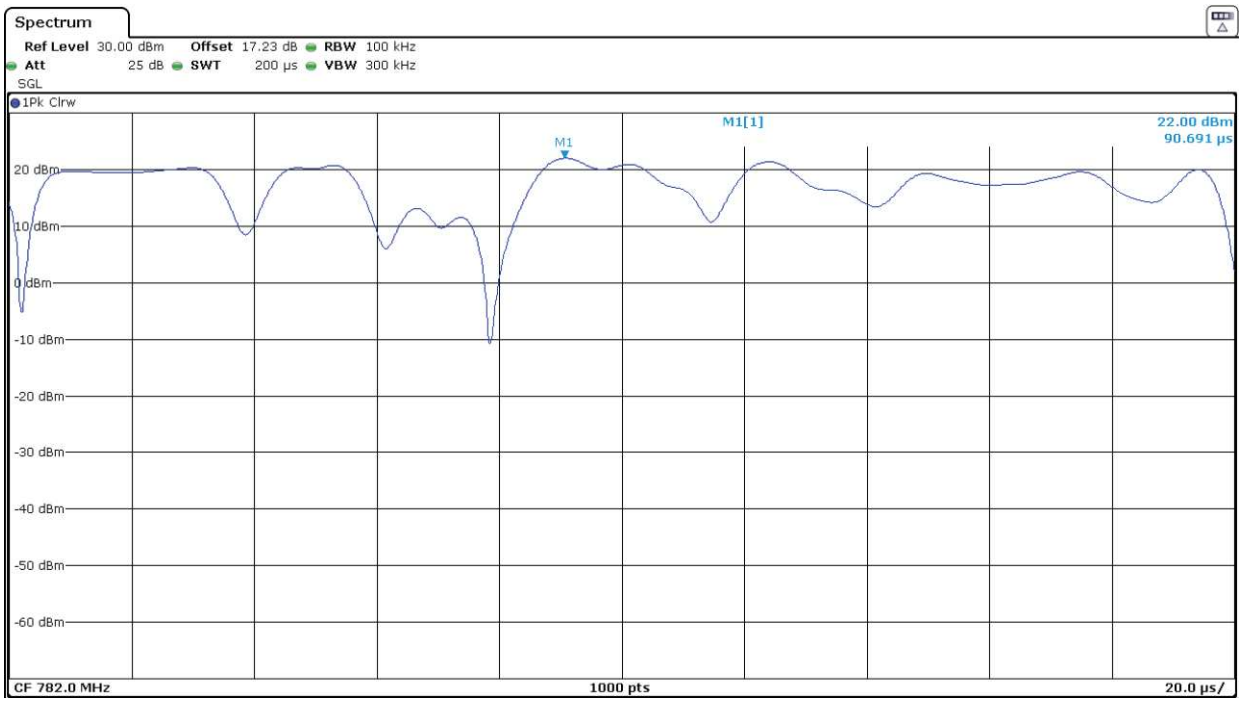
LTE Band 12. QPSK MODULATION. BW = 10 MHz.



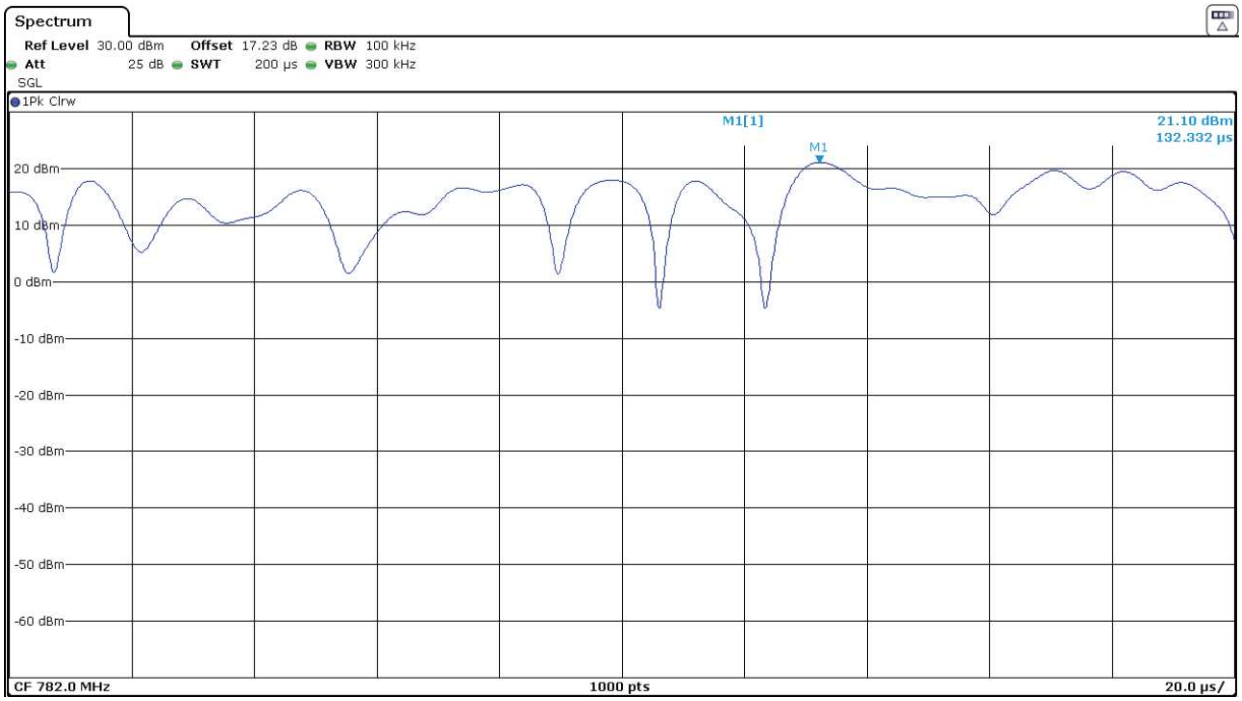
LTE Band 12. 16QAM MODULATION. BW = 10 MHz.



LTE Band 13. QPSK MODULATION. BW = 10 MHz.



LTE Band 13. 16QAM MODULATION. BW = 10 MHz.



Frequency Stability

SPECIFICATION:

FCC §27.54 & §2.1055:

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

RSS-130 Clause 4.5:

For equipment that is capable of transmitting numerous channels simultaneously for different applications (e.g. LTE and narrowband – Internet of Things (IoT)), the occupied bandwidth shall be the bandwidth representing the sum of the occupied bandwidths of these channels.

The frequency stability shall be sufficient to ensure that the occupied bandwidth remains within each frequency block range when tested at the temperature and supply voltage variations specified in RSS-Gen.

RSS-139 Clause 6.4:

The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

RSS-199 Clause 4.3:

The transmitter frequency stability limit shall be determined as follows:

a. the frequency offset shall be measured according to the procedure described in RSS-Gen and recorded.

b. using a resolution bandwidth equal to that permitted within the 1 MHz band immediately outside the channel edge, as found in section 4.5, reference points will be selected at the unwanted emission limits, which comply with the attenuation specified in section 4.5 for the type of device under test, on the emission mask of the lowest and highest channels. The frequency at these points shall be recorded as fL and fH respectively.

The applicant shall ensure compliance with frequency stability requirements by showing that fL minus the frequency offset and fH plus the frequency offset is within the frequency range in which the equipment is designed to operate.

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.

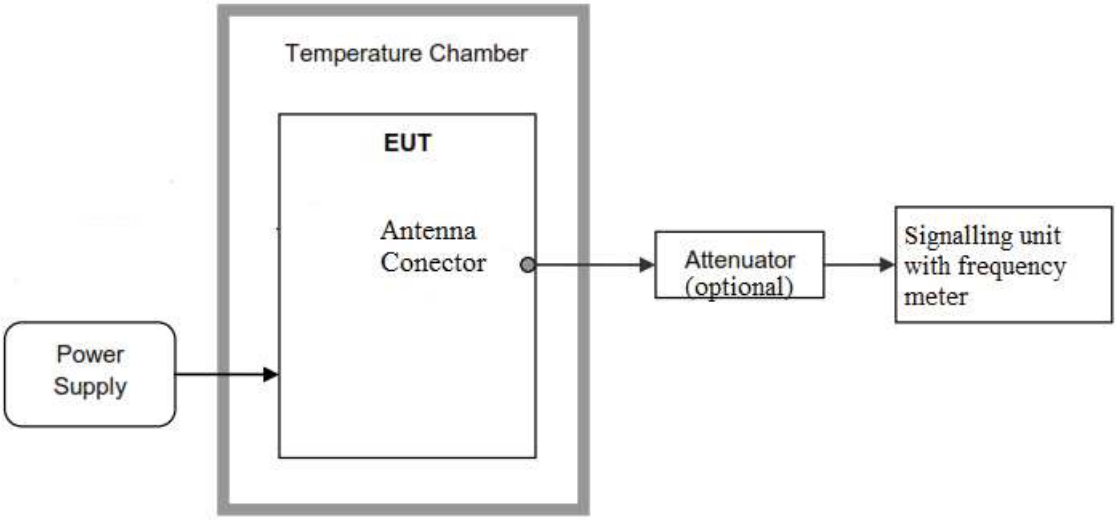
The EUT was set in “Radio Resource Control (RRC) mode” in the middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.

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.

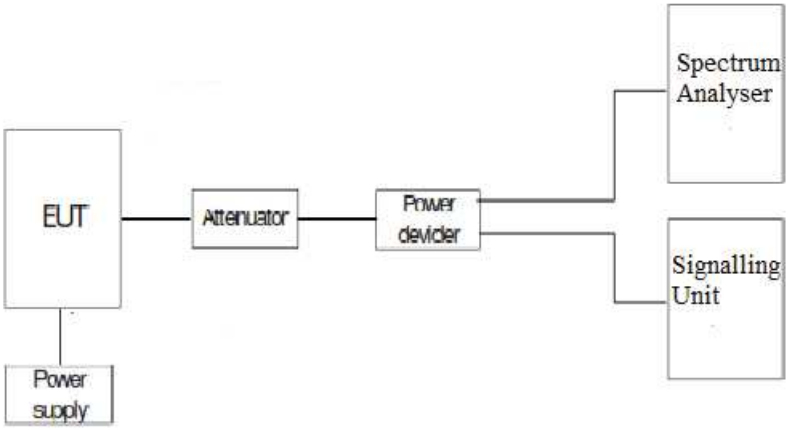
The reference point measurements were made at the RF output terminals of the EUT using an attenuator. power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP:

1. Frequency Tolerance:



2. Reference Frequency Points fL and fH:



RESULTS:

1. Frequency Tolerance:

- **Frequency Stability over Temperature Variations:**

3G Band IV. WCDMA AND HSUPA.

Nominal Frequency: 1732.5 MHz Temperature: 20 ºC

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	2.40	0.00138528
+40	2.96	0.00170851
+30	2.30	0.00132756
+20	0.92	0.00053102
+10	-1.05	-0.00060606
0	1.00	0.00057720
-10	0.89	0.00051371
-20	-0.26	-0.00015007
-30	-0.20	-0.00011544

LTE Band 4. BW = 3 MHz. QPSK

Nominal Frequency: 1732.5 MHz Temperature: 20 ºC

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	1.50	0.00086580
+40	1.30	0.00075036
+30	2.92	0.00168542
+20	1.72	0.00099278
+10	-1.19	-0.00068686
0	1.27	0.00073304
-10	1.96	0.00113131
-20	0.09	0.00005195
-30	0.41	0.00023665

LTE Band 7. BW = 5 MHz. QPSK

Nominal Frequency: 2535 MHz Temperature: 20 ºC

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	1.20	0.00047337
+40	-3.72	-0.00146745
+30	-4.98	-0.00196449
+20	-5.12	-0.00201972
+10	-3.29	-0.00129783
0	-0.62	-0.00024457
-10	-3.45	-0.00136094
-20	1.86	0.00073372
-30	1.00	0.00039447

LTE Band 12. BW = 3 MHz. QPSK

Nominal Frequency: 707.5 MHz Temperature: 20 ºC

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-0.90	-0.00127208
+40	-1.20	-0.00169611
+30	-0.74	-0.00104594
+20	-0.64	-0.00090459
+10	-0.96	-0.00135689
0	0.16	0.00022615
-10	-0.23	-0.00032509
-20	0.59	0.00083392
-30	-0.03	-0.00004240

LTE Band 13. BW = 5 MHz. QPSK

Nominal Frequency: 782 MHz Temperature: 20 ºC

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	0.70	0.00089514
+40	0.54	0.00069054
+30	-1.89	-0.00241688
+20	-1.67	-0.00213555
+10	-0.29	-0.00037084
0	-0.31	-0.00039642
-10	1.00	0.00127877
-20	-0.70	-0.00089514
-30	0.51	0.00065217

- **Frequency Stability over Voltage Variations.**

3G Band IV. WCDMA AND HSUPA MODULATION.

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	13.8	2.05	0.00118326
Vmin	10.2	3.08	0.00177777

LTE Band 4. BW = 3 MHz. QPSK

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	13.8	-1.57	-0.000906205
Vmin	10.2	-3.78	-0.002181818

LTE Band 7. BW = 5 MHz. QPSK

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	13.8	1.29	0.00050888
Vmin	10.2	1.42	0.00056016

LTE Band 12. BW = 3 MHz. QPSK

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	13.8	-1.13	-0.00159717
Vmin	10.2	-1.90	-0.00268551

LTE Band 13. BW = 5 MHz. QPSK

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	13.8	-1.12	-0.00143223
Vmin	10.2	-2.57	-0.00328645

2. Reference Frequency Points fL and fH:

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

3G Band IV:

	WCDMA
fL (MHz)	1710.13319895
fH (MHz)	1754.87160308

LTE Band 4:

	LTE QPSK . BW = 3 MHz
fL (MHz)	1710.03669622
fH (MHz)	1754.97400292

LTE Band 7:

	LTE QPSK . BW = 5 MHz
fL (MHz)	2530.99299488
fH (MHz)	2539.00800186

LTE Band 12:

	LTE QPSK . BW = 3 MHz
fL (MHz)	699.0427981
fH (MHz)	715.95230059

LTE Band 13:

	LTE QPSK . BW = 5 MHz
fL (MHz)	777.05270257
fH (MHz)	786.95789900

The reference frequency points fL and fH stay within the authorized blocks for all the bands above.

Verdict: PASS

Occupied Bandwidth

SPECIFICATION:

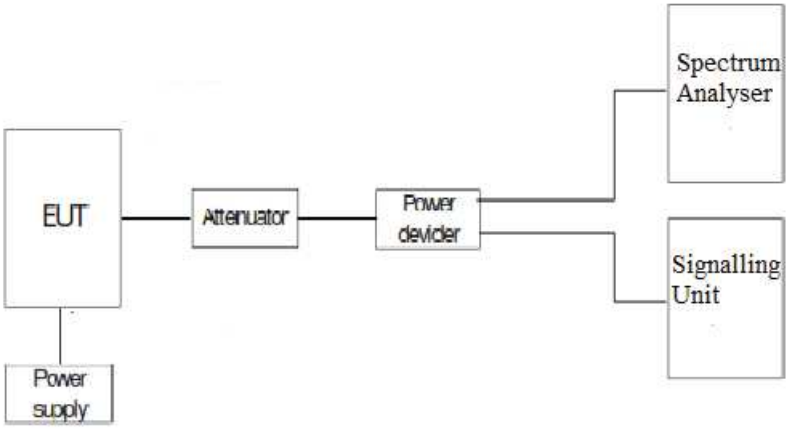
FCC §2.1049: Measurements required: Occupied bandwidth.

RSS-Gen Clause 6.7: Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth.

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 was measured directly using the built-in bandwidth measuring option of spectrum analyser. The -26 dBc bandwidth was measured with a limit line 26 dB below the maximum of the envelope of the carrier.

TEST SETUP:



RESULTS:

3G Band IV:

3G Band IV. WCDMA MODULATION.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.130	4.140	4.130
-26 dBc bandwidth (MHz)	4.710	4.727	4.744
Measurement uncertainty (kHz)	<±11.55		

3G Band IV. HSUPA MODULATION.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.130	4.130	4.130
-26 dBc bandwidth (MHz)	4.690	4.687	4.694
Measurement uncertainty (kHz)	<±11.55		

LTE Bands: The worst case of Occupied Bandwidth corresponds to all Resource Blocks (RB) with Offset 0, regardless the nominal bandwidth selected.

LTE Band 4:

LTE Band 4. BW = 1.4 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	1.098	1.101	1.107
-26 dBc bandwidth (MHz)	1.297	1.297	1.360
Measurement uncertainty (kHz)	<±4.67		

LTE Band 4. BW = 1.4 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	1.101	1.101	1.101
-26 dBc bandwidth (MHz)	1.336	1.312	1.357
Measurement uncertainty (kHz)	<±4.67		

LTE Band 4. BW = 3 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	2.742	2.730	2.736
-26 dBc bandwidth (MHz)	3.084	3.083	3.057
Measurement uncertainty (kHz)	<±10		

LTE Band 4. BW = 3 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	2.742	2.754	2.742
-26 dBc bandwidth (MHz)	3.060	3.065	3.075
Measurement uncertainty (kHz)	<±10		

LTE Band 4. BW = 5 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.510	4.500	4.520
-26 dBc bandwidth (MHz)	5.030	5.024	5.050
Measurement uncertainty (kHz)	<±16.67		

LTE Band 4. BW = 5 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.510	4.500	4.520
-26 dBc bandwidth (MHz)	5.000	4.994	5.040
Measurement uncertainty (kHz)	<±16.67		

LTE Band 4. BW = 10 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	9.040	9.060	9.040
-26 dBc bandwidth (MHz)	10.137	10.206	10.072
Measurement uncertainty (kHz)	<±33.33		

LTE Band 4. BW = 10 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	9.040	9.060	9.040
-26 dBc bandwidth (MHz)	10.077	10.146	10.172
Measurement uncertainty (kHz)	<±33.33		

LTE Band 4. BW = 15 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	13.470	13.470	13.440
-26 dBc bandwidth (MHz)	14.835	14.858	14.708
Measurement uncertainty (kHz)	<±50		

LTE Band 4. BW = 15 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	13.470	13.500	13.440
-26 dBc bandwidth (MHz)	14.775	14.858	14.678
Measurement uncertainty (kHz)	<±50		

LTE Band 4. BW = 20 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	17.880	17.880	17.840
-26 dBc bandwidth (MHz)	19.452	19.494	19.394
Measurement uncertainty (kHz)	<±66.67		

LTE Band 4. BW = 20 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	17.920	17.920	17.800
-26 dBc bandwidth (MHz)	19.372	19.494	19.314
Measurement uncertainty (kHz)	<±66.67		

LTE Band 7:

LTE Band 7. BW = 5 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.520	4.520	4.520
-26 dBc bandwidth (MHz)	5.030	5.038	4.997
Measurement uncertainty (kHz)	<±16.67		

LTE Band 7. BW = 5 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.510	4.510	4.540
-26 dBc bandwidth (MHz)	5.000	5.008	5.047
Measurement uncertainty (kHz)	<±16.67		

LTE Band 7. BW = 10 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	9.040	9.080	9.080
-26 dBc bandwidth (MHz)	10.120	10.150	10.133
Measurement uncertainty (kHz)	<±33.33		

LTE Band 7. BW = 10 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	9.04	9.06	9.08
-26 dBc bandwidth (MHz)	10.08	10.13	10.113
Measurement uncertainty (kHz)	<±33.33		

LTE Band 7. BW = 15 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	13.440	13.500	13.470
-26 dBc bandwidth (MHz)	14.767	14.870	14.813
Measurement uncertainty (kHz)	<±50		

LTE Band 7. BW = 15 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	13.470	13.470	13.440
-26 dBc bandwidth (MHz)	14.887	14.84	14.783
Measurement uncertainty (kHz)	<±50		

LTE Band 7. BW = 20 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	17.800	17.900	17.800
-26 dBc bandwidth (MHz)	19.338	19.497	19.398
Measurement uncertainty (kHz)	<±66.67		

LTE Band 7. BW = 20 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	17.800	17.950	17.850
-26 dBc bandwidth (MHz)	19.288	19.497	19.367
Measurement uncertainty (kHz)	<±66.67		

LTE Band 12:

LTE Band 12. BW = 1.4 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	1.095	1.104	1.098
-26 dBc bandwidth (MHz)	1.312	1.321	1.310
Measurement uncertainty (kHz)	<±4.67		

LTE Band 12. BW = 1.4 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	1.101	1.101	1.104
-26 dBc bandwidth (MHz)	1.303	1.331	1.325
Measurement uncertainty (kHz)	<±4.67		

LTE Band 12. BW = 3 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	2.748	2.736	2.748
-26 dBc bandwidth (MHz)	3.061	3.070	3.085
Measurement uncertainty (kHz)	<±10		

LTE Band 12. BW = 3 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	2.742	2.736	2.748
-26 dBc bandwidth (MHz)	3.067	3.052	3.073
Measurement uncertainty (kHz)	<±10		

LTE Band 12. BW = 5 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.520	4.500	4.520
-26 dBc bandwidth (MHz)	5.018	5.012	5.031
Measurement uncertainty (kHz)	<±16.67		

LTE Band 12. BW = 5 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.520	4.500	4.520
-26 dBc bandwidth (MHz)	5.038	5.012	5.051
Measurement uncertainty (kHz)	<±16.67		

LTE Band 12. BW = 10 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	9.080	8.980	9.040
-26 dBc bandwidth (MHz)	10.100	10.061	10.131
Measurement uncertainty (kHz)	<±33.33		

LTE Band 12. BW = 10 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	9.100	8.980	9.020
-26 dBc bandwidth (MHz)	10.100	10.041	10.035
Measurement uncertainty (kHz)	<±33.33		

LTE Band 13:

LTE Band 13. BW = 5 MHz. QPSK.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.510	4.500	4.520
-26 dBc bandwidth (MHz)	4.991	5.006	5.023
Measurement uncertainty (kHz)	<±16.67		

LTE Band 13. BW = 5 MHz. 16QAM.

	Lowest Channel	Middle Channel	Highest Channel
99% Occupied bandwidth (MHz)	4.520	4.510	4.520
-26 dBc bandwidth (MHz)	5.001	5.006	5.033
Measurement uncertainty (kHz)	<±16.67		

LTE Band 13. BW = 10 MHz. QPSK.

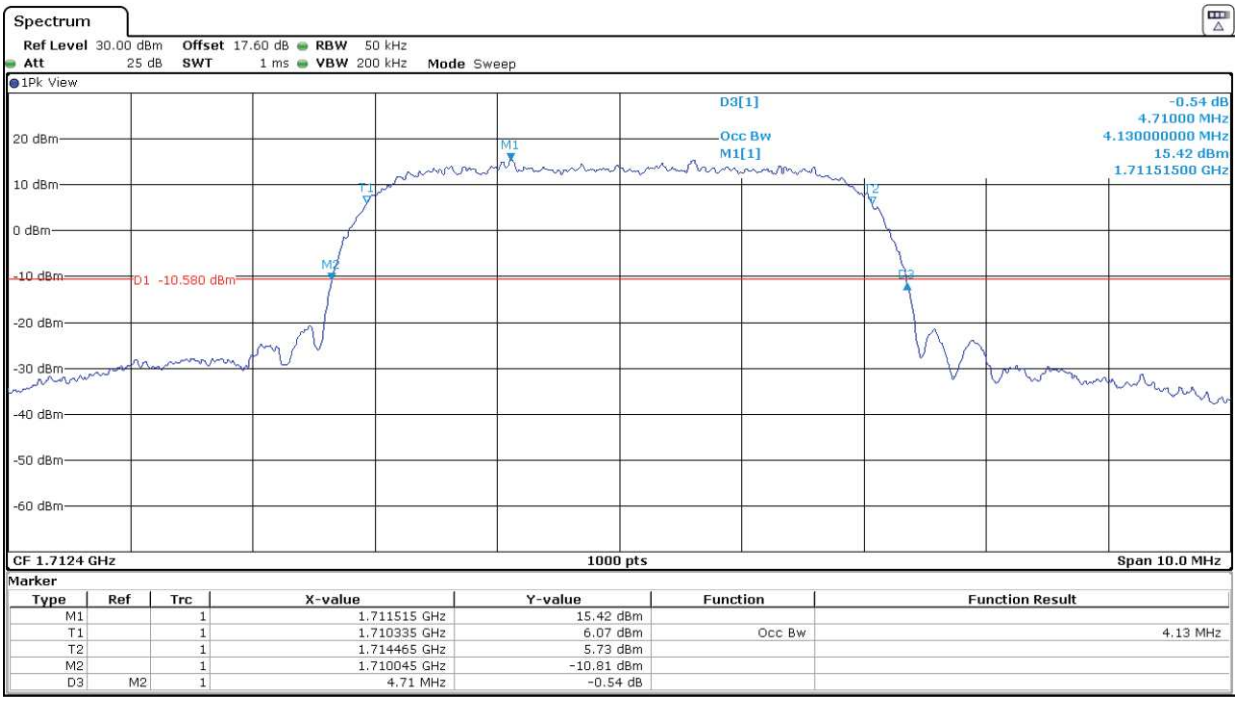
	Middle Channel
99% Occupied bandwidth (MHz)	9.000
-26 dBc bandwidth (MHz)	9.993
Measurement uncertainty (kHz)	<±33.33

LTE Band 13. BW = 10 MHz. 16QAM.

	Middle Channel
99% Occupied bandwidth (MHz)	9
-26 dBc bandwidth (MHz)	10.013
Measurement uncertainty (kHz)	<±33.33

3G Band IV. WCDMA.

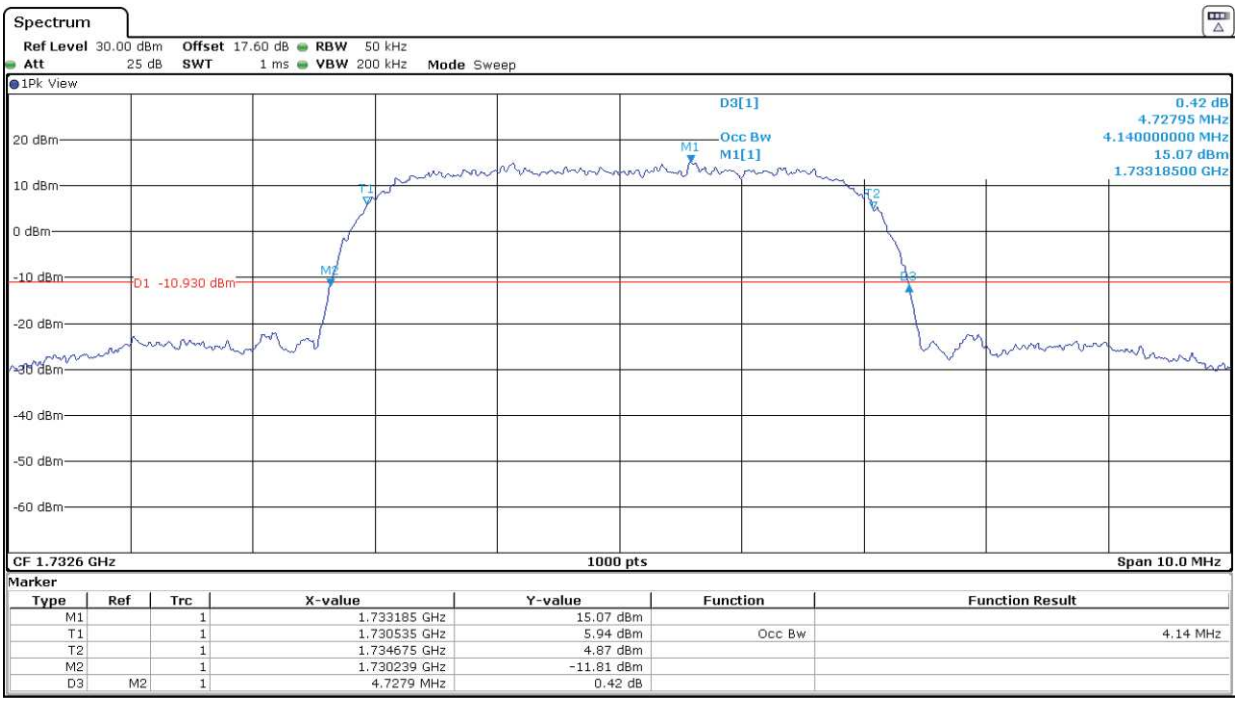
Lowest Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.711515 GHz	15.42 dBm		
T1		1	1.710335 GHz	6.07 dBm	Occ Bw	4.13 MHz
T2		1	1.714465 GHz	5.73 dBm		
M2		1	1.710045 GHz	-10.81 dBm		
D3	M2	1	4.71 MHz	-0.54 dB		

Middle Channel:



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Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.733185 GHz	15.07 dBm		
T1		1	1.730535 GHz	5.94 dBm	Occ Bw	4.14 MHz
T2		1	1.734675 GHz	4.87 dBm		
M2		1	1.730239 GHz	-11.81 dBm		
D3	M2	1	4.7279 MHz	0.42 dB		