

ISED CABid: ES1909
Lab. Company Number: 4621A

Test Report No:
85372RRF.002

Test Report

USA FCC Part 24

CANADA RSS-133

(*) Identification of item tested	LTE Cat1-bis module
(*) Trademark	Sequans Communications
(*) Model and /or type reference	GC02S1-WW
Other identification of the product	FCC ID: 2AAGMGC02SW IC: 12732A-GC02SW
(*) Features	LTE Category CAT1_BIS HW version: Rev1 SW version: LR9.0.5.1-63892
Applicant	Sequans Communications 55 Boulevard Charles de Gaulle, 92700 Colombes. FRANCE
Test method requested, standard	USA FCC Part 24 (10-1-23 Edition). CANADA RSS-133 Issue 7, Jul. 2024. ANSI C63.26-2015. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager 
Date of issue	2026-03-19
Report template No	FDT08_27 (*) "Data provided by the client"

Firmado
digitalmente
por 53680346W
JOSE MANUEL
GOMEZ
(C:A29507456)



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Competences and guarantees

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DEKRA Testing and Certification is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

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

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

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

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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 consists of: The Calliope 2 GC02S1 modules are based on Sequans's second-generation Calliope 2 silicon and delivers optimized 4G LTE Cat 1 connectivity for IoT, M2M and consumer devices such as wearables and hearables that require speeds higher than LTE-M.

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. The laboratory is not responsible for such information and it is not covered by accreditation.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial N°	Date of Reception	Application
S/01	85370/002	LTE Cat1-bis module	GC02S1-WW	-	2025-12-11	Element Under Test
S/01	85370/011	LTE Cat1-bis module	GC02S1-WW	-	2026-01-09	Element Under Test
S/02	85370/002	LTE Cat1-bis module	GC02S1-WW	-	2025-12-11	Element Under Test
S/02	85370/005	SMA Cable	-	-	2025-12-11	Auxiliary Element
S/02	85370/010	LTE Cat1-bis module	GC02S1-WW	-	2026-01-09	Element Under Test
S/02	85370/012	SMA Cable	-	-	2026-01-09	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Radiated tests
S/02	Conducted tests

Test sample description

Ports..... :	Port name and description	Cable				
		Specified max length [m]	Attached during test	Shielded		
	USB	-	X	-		
	UART	-	X	-		
Supplementary information to the ports..... :	-					
Rated power supply :	Voltage and Frequency		Reference poles			
			L1	L2	L3	N
	AC:					
	DC: 3.3 to 4.5 V					
Rated Power..... :	-					
Clock frequencies..... :	-					
Other parameters :	-					
Software version..... :						
Hardware version :						
Dimensions in cm (W x H x D) ... :	21 x 19.5 x 1.8 mm					
Mounting position :	X	Table top equipment				
		Wall/Ceiling mounted equipment				
		Floor standing equipment				
		Hand-held equipment				
		Other:				
Modules/parts..... :	Module/parts of test item		Type		Manufacturer	
	-		-		-	
Accessories (not part of the test item) :	Description		Type		Manufacturer	
	USB Cables		USB		-	
	Antennas		Antenna		-	
Documents as provided by the applicant :	Description		File name		Issue date	
	-		-		-	

Identification of the client

Sequans Communications
55 Boulevard Charles de Gaulle, 92700 Colombes. FRANCE

Testing period and place

Test Location	DEKRA TESTING AND CERTIFICATION S.A.U. C/ Severo Ochoa, 6 - Parque Tecnológico de Andalucía; 29590, Málaga, Spain
Date (start)	2025-12-16
Date (finish)	2026-01-29

Document history

Report number	Date	Description
85372RRF.002	2024-03-13	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 %

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

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

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. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Carmen Vázquez.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
06791	SEMIANECHOIC ABSORBER LINED CHAMBER IV	FACT 3 200 STP	ETS LINDGREN	N/A
06792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
06609	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2026-04-21
06615	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2026-04-24
06158	SIGNAL AND SPECTRUM ANALYZER 10 Hz - 40 GHz	FSV40	ROHDE AND SCHWARZ	2026-02-05
08849	WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE AND SCHWARZ	2026-03-31
06043	POWER DIVIDER, DC-26 GHz	5333	TEKTRONIX	N/A
06165	EMI TEST RECEIVER 9 kHz-7 GHz	ESR	ROHDE AND SCHWARZ	2025-12-27
04578	HYBRID BILOG ANTENNA 30 MHz - 6 GHz	3142E	ETS LINDGREN	2026-06-01
07692	ATTENUATOR 3 dB, 2 W, DC, 18 GHz	TWTS2G	TECHNIWAVE	2026-02-03
08835	SIGNAL AND SPECTRUM ANALYZER 2 Hz - 50 GHz	FSW50	ROHDE AND SCHWARZ	2027-04-15
05705	PRE-AMPLIFIER G>40dB, 1-18 GHz	BLMA 0118-1M	BONN ELEKTRONIK	2026-07-23
04611	HORN ANTENNA 1-18 GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2026-01-16
04716	SIGNAL AND SPECTRUM ANALYZER 2 Hz - 50 GHz	FSW50	ROHDE AND SCHWARZ	2026-08-02
10573	PRE-AMPLIFIER G>46dB 18-40 GHz	BLMA 1840-5G	BONN ELEKTRONIK	2026-03-07
04657	HORN ANTENNA 18-40 GHz	BBHA 9170	SCHWARZBECK MESS-ELEKTRONIK	2026-06-12
04848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A

Testing verdicts

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

Summary

LTE Cat 1bis Bands 2, 25.

FCC 24 / RSS-133 PARAGRAPH			
Requirement – Test case	Verdict	Remark	Location
FCC 24.232 / RSS-133 6.4: RF Output Power	P	-	DEKRA TESTING AND CERTIFICATION S.A.U. C/ Severo Ochoa, 6 - Parque Tecnológico de Andalucía; 29590, Málaga, Spain
FCC 2.1047 / RSS-133 6.2: Modulation characteristics	P	-	
FCC 24.235 / RSS-133 6.3: Frequency stability	P	-	
FCC 2.1049: Occupied Bandwidth	P	-	
FCC 24.238 / RSS-133 6.5: Spurious emissions at antenna terminals	P	-	
FCC 24.238 / RSS-133 6.5: Spurious emissions at antenna terminals at Block Edges	P	-	
FCC 24.238 / RSS-133 6.5: Radiated Emissions	P	-	
<u>Supplementary information and remarks:</u>			
None.			

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

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TEST CONDITIONS

POWER SUPPLY (*):

Vnominal: 3.8 Vdc
Vminimum: 3.3 Vdc
Vmaximum: 4.5 Vdc
Type of Power Supply: USB.

ANTENNA (*):

BAND	GAIN (dBi)	ANTENNA TYPE
LTE 2, 25	+2.4	TRIO mXTEND™ (NN03-310)

TEST FREQUENCIES:

LTE Cat 1bis Band 2. QPSK and 16QAM:

Channel per BW=(Frequency, MHz)				
	BW=5 MHz	BW=10 MHz	BW=15 MHz	BW=20 MHz
Low	18625 (1852.5)	18650 (1855)	18675 (1857.5)	18700 (1860)
Middle	18900 (1880)	18900 (1880)	18900 (1880)	18900 (1880)
High	19175 (1907.5)	19150 (1905)	19125 (1902.5)	19100 (1900)

NOTE: LTE Cat 1bis Band 2 is completely included in LTE Cat1-bis Band 25, so the channels of the LTE Cat1-bis Band 25 were tested to give conformity to the assigned block.

LTE Cat1-bis Band 25. QPSK and 16QAM:

Channel per BW=(Frequency, MHz)						
	BW=1.4 MHz	BW=3 MHz	BW=5 MHz	BW=10 MHz	BW=15 MHz	BW=20 MHz
Low	26047 (1850.7)	26055 (1851.5)	26065 (1852.5)	26090 (1855)	26115 (1857.5)	26140 (1860)
Middle	26365 (1880)	26365 (1880)	26365 (1882.5)	26365 (1882.5)	26365 (1882.5)	26365 (1882.5)
High	26683 (1909.3)	26675 (1908.5)	26665 (1912.5)	26640 (1910)	26615 (1907.5)	26590 (1905)

RF Output Power

Limits

* 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:

Mobile stations and hand-held portables are limited to 2 watts maximum e.i.r.p. 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 High 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 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:

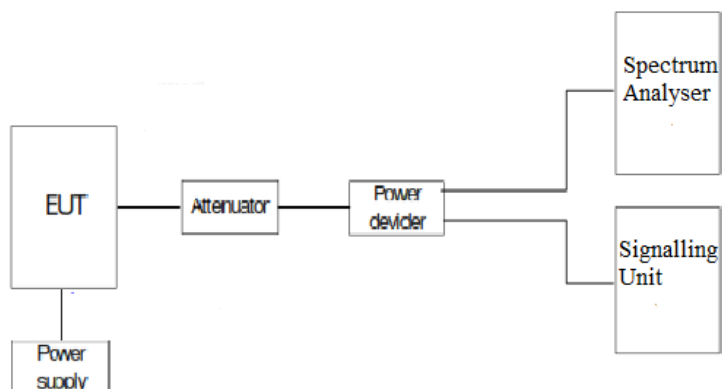
$$\text{E.R.P.} = \text{E.I.R.P.} - 2.15 \text{ dB}$$

Test Setup

1. CONDUCTED AVERAGE POWER:



2. PEAK-TO-AVERAGE POWER RATIO (PAPR) and Conducted Average power:



Results

1. CONDUCTED AVERAGE POWER:

LTE Cat1-bis Band 25:

Worst-case of RF Power is BW=15 MHz, High Channel, QPSK, RB Size=1, RB Offset=37.

BANDWIDTH (MHz)	CHANNEL	FREQUENCY (MHz)	MODULATION	RB SIZE	RB OFFSET	AVERAGE POWER (dBm)	PAPR (dB)
15	Low 26115	1857.5	QPSK	1	0	22.49	3.83
				1	37	22.74	5.04
				1	74	22.63	2.93
				36	0	21.69	5.97
				36	18	21.77	5.83
				36	37	21.88	5.59
				75	0	21.78	5.8
			16-QAM	1	0	21.86	4.35
				1	37	21.92	5.94
				1	74	21.84	3.54
				25	0	20.71	6.81
				25	25	20.86	6.81
				25	50	20.93	6.32
				75	0		
	Middle 26365	1882.5	QPSK	1	0	22.82	4.09
				1	37	22.85	4.9
				1	74	22.92	3.94
				25	0	21.94	5.62
				25	25	21.86	5.86
				25	50	21.92	5.8
				75	0	21.93	5.86
			16-QAM	1	0	21.83	3.28
				1	37	22.2	6
				1	74	21.88	3.86
				25	0	20.94	6.58
				25	25	20.97	6.61
				25	50	21	6.64
				75	0		
	High 26615	1907.5	QPSK	1	0	23.03	4
				1	37	23.13	4.61
				1	74	22.72	3.42
				25	0	21.99	5.57
				25	25	22.08	5.42
				25	50	22.05	5.33
				75	0	22.09	5.51
			16-QAM	1	0	21.85	3.48
				1	37	22.22	5.65
				1	74	21.52	3.04
				25	0	20.96	6.29
				25	25	21.11	6.23
				25	50	21.03	6.17
				75	0		

BW=15 MHz. QPSK:

MAX POWER	QPSK COND. POWER AVG (dBm)	ANTENNA GAIN (dBi)	RAD. POWER AVG EIRP (dBm)	RAD. POWER AVG ERP (dBm)
LOW	22.74	2	24.74	22.59
MIDDLE	22.92	2	24.92	22.77
HIGH	23.13	2	25.13	22.98
MAX:	23.13		25.13	22.98

BW=15 MHz. 16QAM:

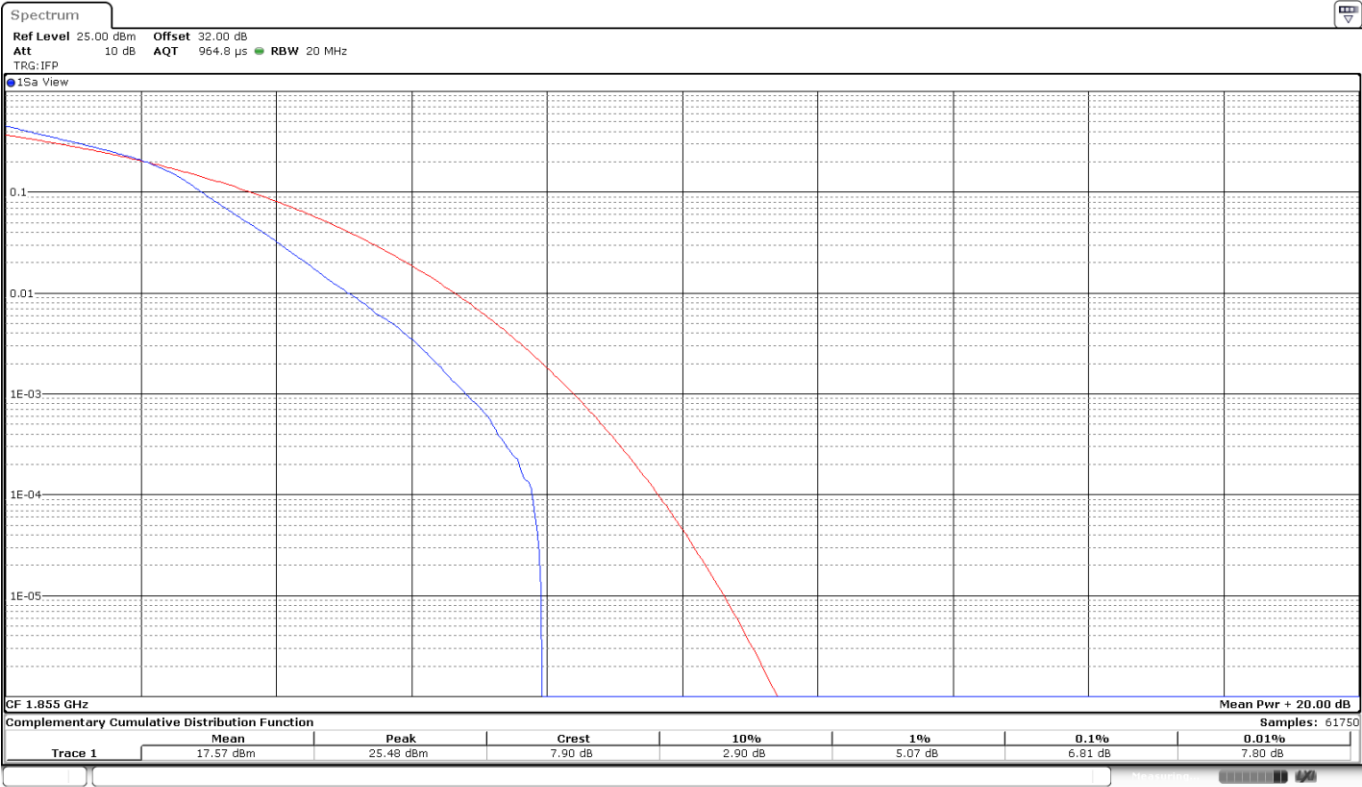
MAX POWER	16QAM COND. POWER AVG (dBm)	ANTENNA GAIN (dBi)	RAD. POWER AVG EIRP (dBm)	RAD. POWER AVG ERP (dBm)
LOW	21.92	2	23.92	21.77
MIDDLE	22.2	2	24.2	22.05
HIGH	22.22	2	24.22	22.07
MAX:	22.22		24.22	22.07

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

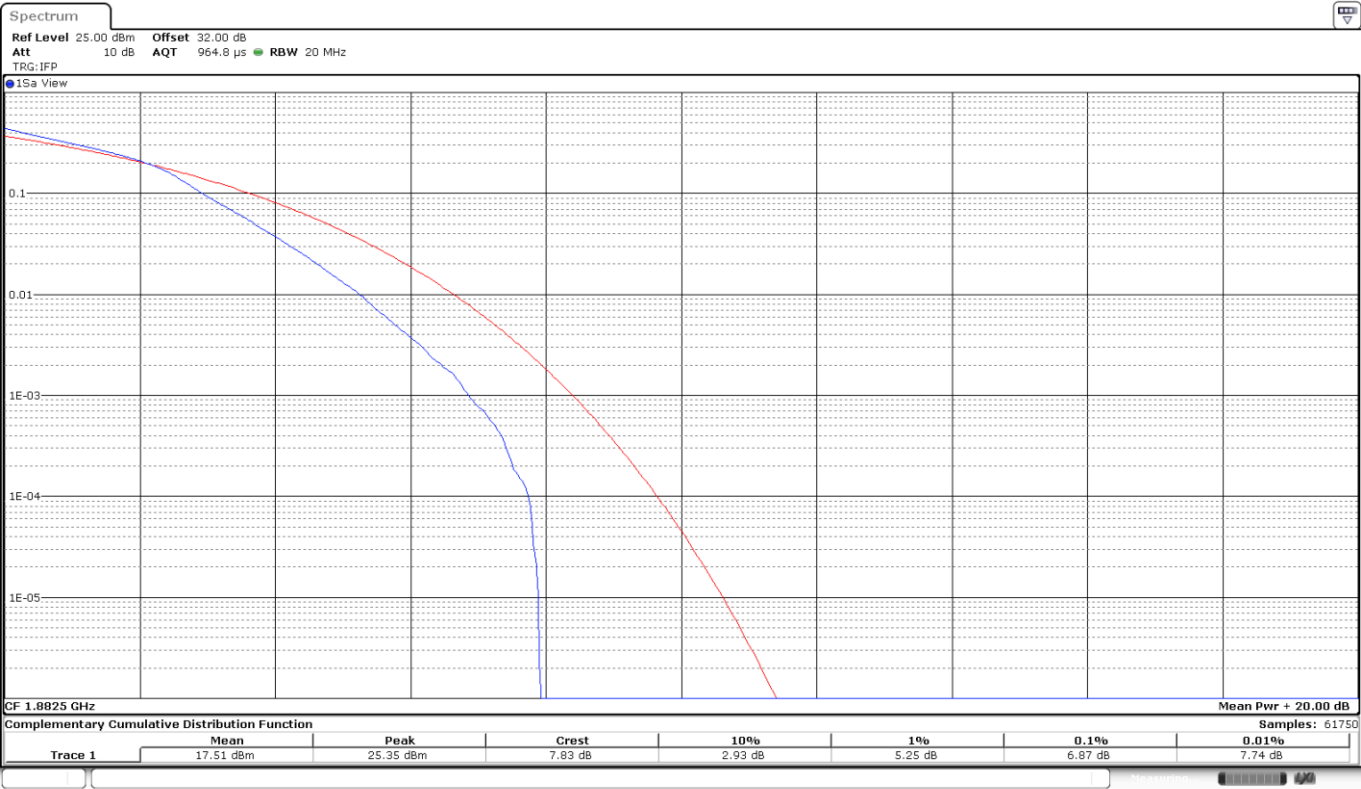
LTE Cat1-bis Band 25:

Worst-case of PAPR is BW=10 MHz, Middle Channel, 16QAM, RB Size=25, RB Offset=24.

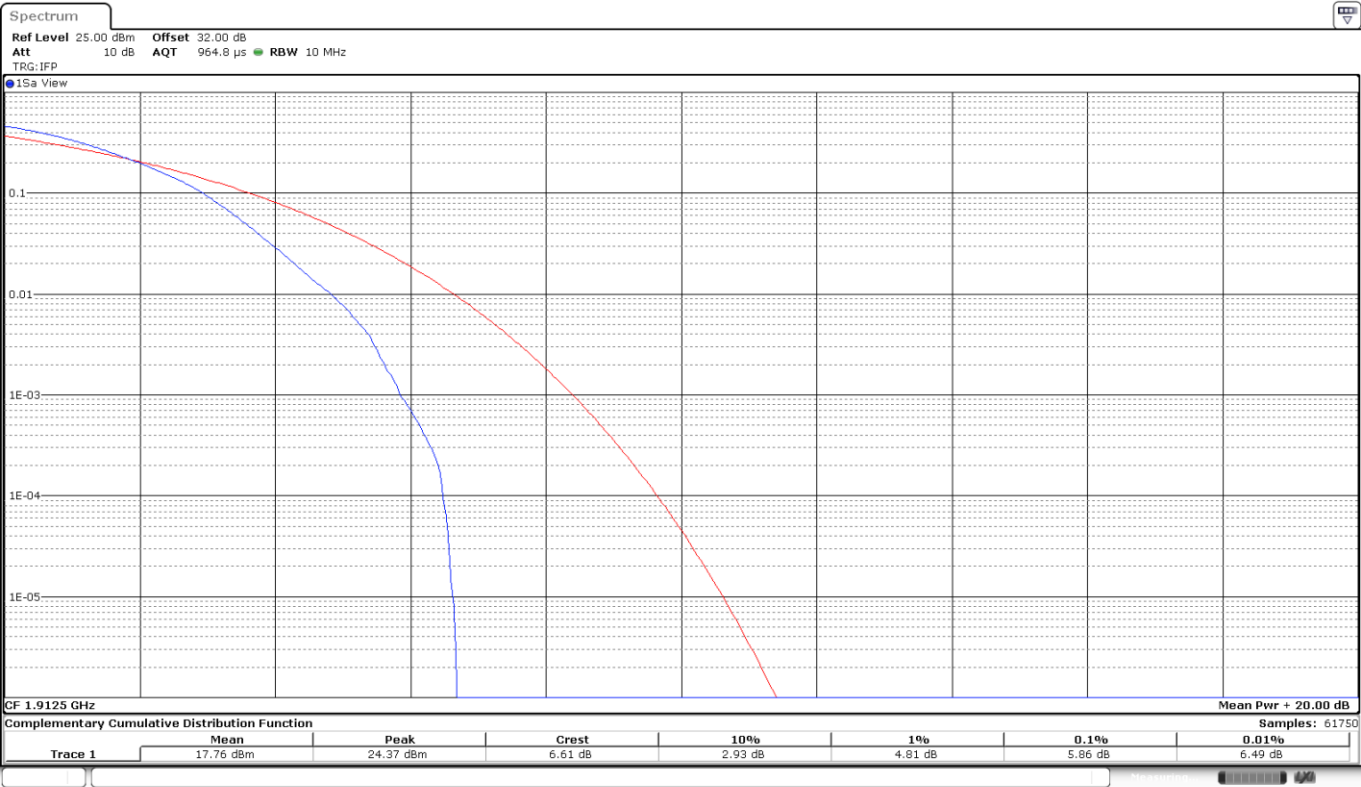
Low Channel:



Middle Channel:



High Channel:



16QAM	Low	Middle	High
PAPR (dB)	6.81	6.87	6.52

Verdict

Pass

Frequency Stability

Limits

* 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.

Temperature and voltage range of testing has been extended to the maximum and minimum values declared by customer.

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

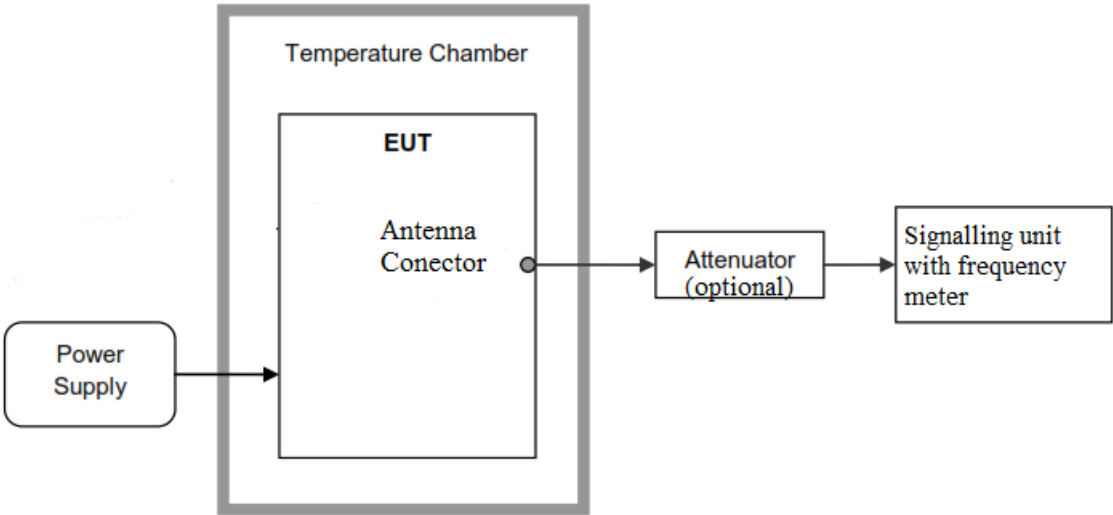
The worst case LTE mode for conducted power was used for the test.

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 channels 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.

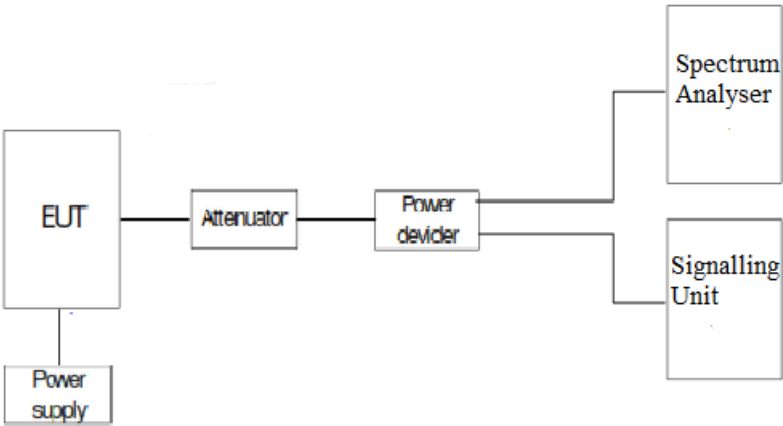
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

Test Setup

Frequency tolerance:



Reference points f_L and f_H :



Results

LTE Cat1-bis Band 25:

The worst case modulation in terms of Frequency Stability is BW=5 MHz, QPSK, RB Size=1, RB Offset=0.

1. FREQUENCY TOLERANCE:

- Frequency stability over temperature variations.

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
+85 [#]	8.25	0.004382470
+80 [#]	3.42	0.001816733
+70 [#]	-5.87	-0.003118194
+60 [#]	7.19	0.003819389
+50	-2.45	-0.001301461
+40	4.76	0.002528552
+30	-6.23	-0.003309429
+20	3.58	0.001901726
+10	-3.91	-0.002077025
0	2.58	0.001370518
-10	-8.14	-0.004324037
-20	6.32	0.003357238
-30	-4.67	-0.002480744
-40 [#]	9.18	0.004876494

Tests conditions marked with “#” are out of the scope of ENAC accreditation.

- Frequency stability over voltage variations.

Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.5	4.73	0.002512616
Vmin	3.3	-3.26	-0.00173174

2. REFERENCE FREQUENCY POINTS fL AND fH:

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

fL (MHz)	1850.1529
fH (MHz)	1914.8412

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

Measurement uncertainty (Hz): <±223.94

Verdict

PASS

Modulation Characteristics

Limits

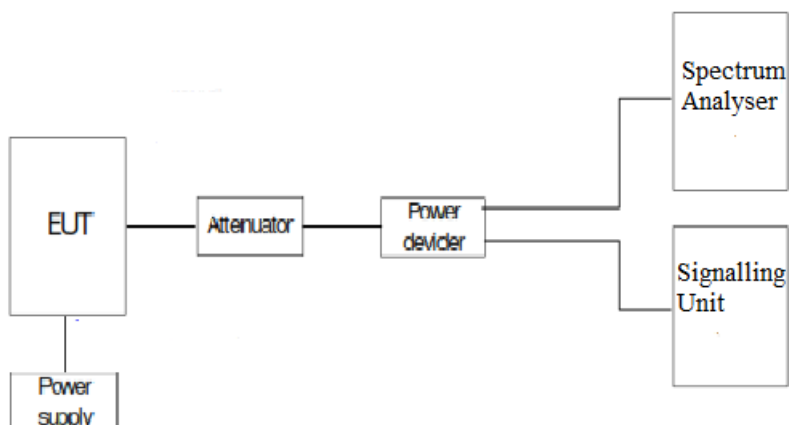
* FCC §2.1047.

* RSS-133. Clause 6.2. Equipment certified under this standard shall use digital modulation.

Method

For LTE the EUT operates with QPSK and 16QAM 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).

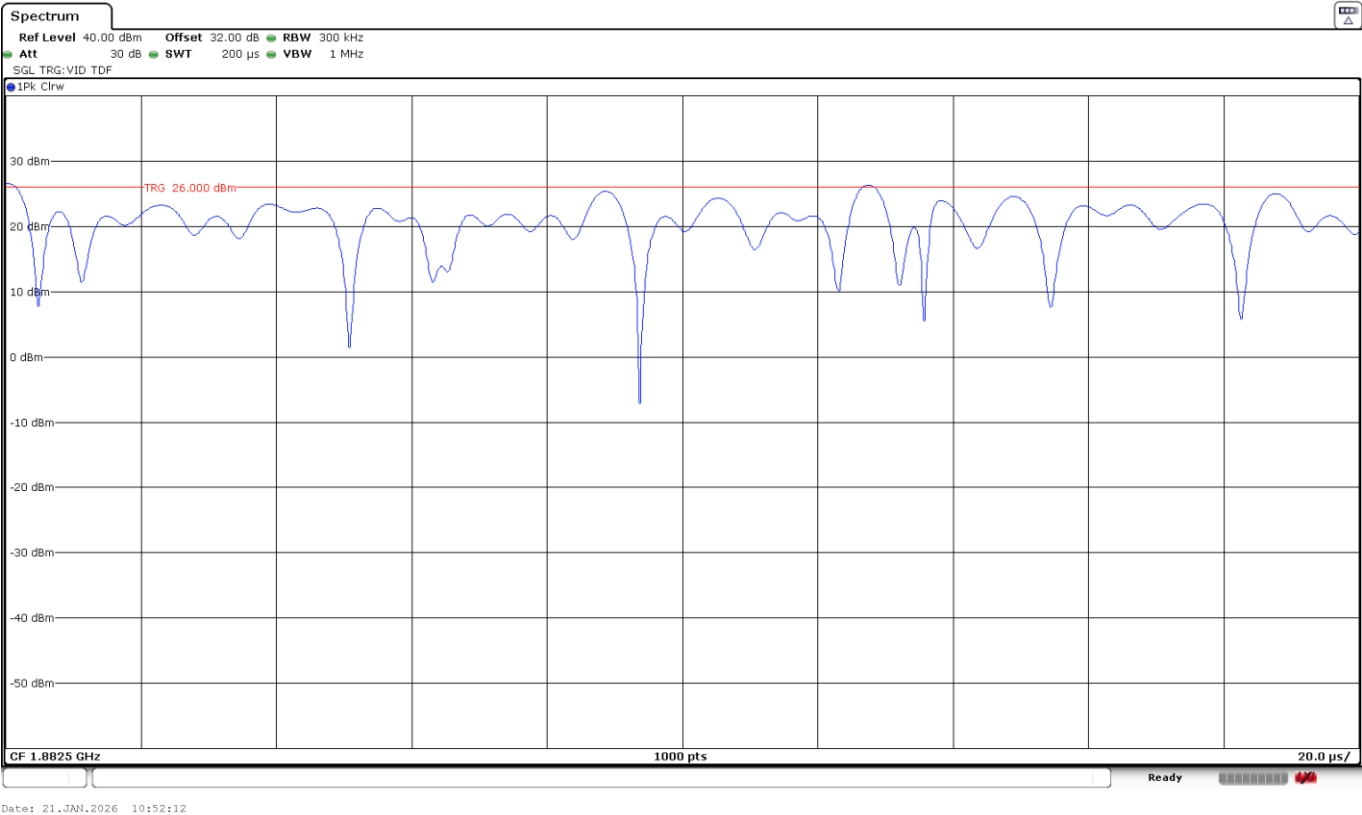
Test Setup



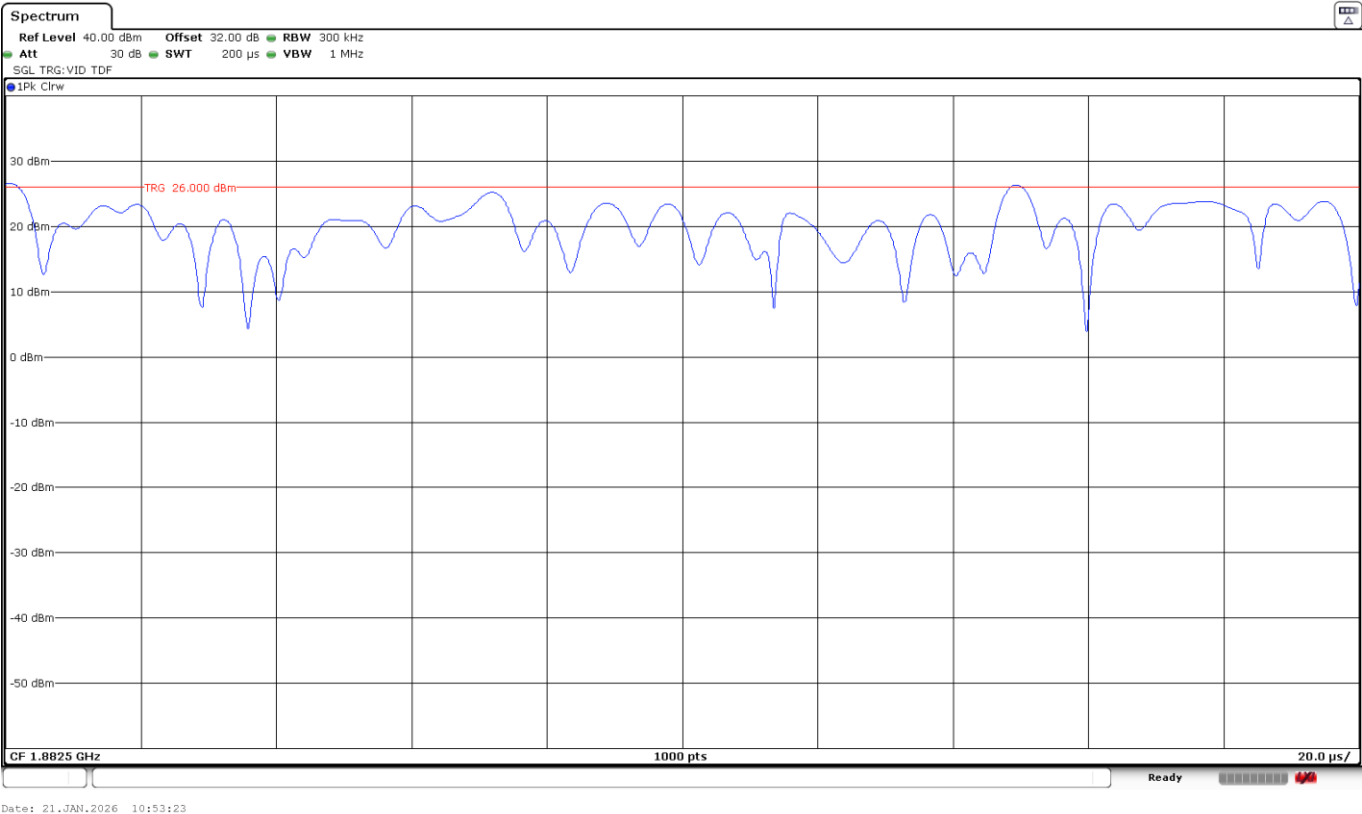
Results

The following plots show the modulation schemes in the EUT.

LTE Cat 1bis Band 2: BW=5 MHz. QPSK. RB Size=1. RB Offset=12. Middle Channel.



LTE Cat 1bis Band 2: BW=5 MHz. 16QAM. RB Size=1. RB Offset=12. Middle Channel.



Occupied Bandwidth

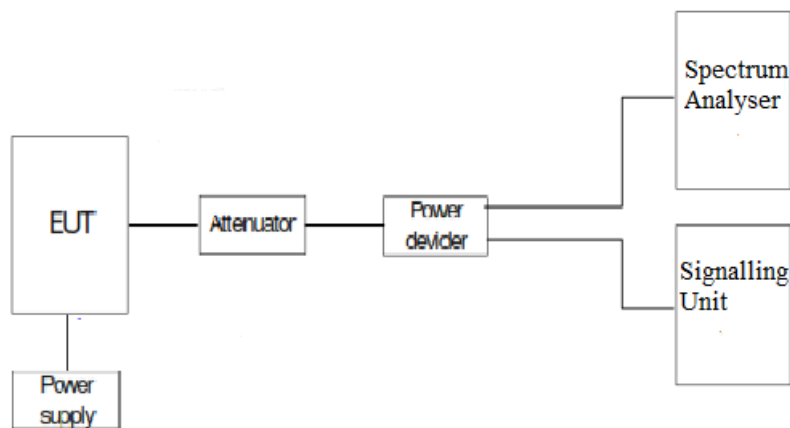
Limits

- * FCC §2.1049: Measurements required: Occupied bandwidth.
- * RSS-Gen, 6.7: Occupied bandwidth (or 99% emission 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 and the -26 dBc bandwidth were measured directly using the built-in bandwidth measuring option of spectrum analyser.

Test Setup



Results

The worst case per modulation is:

LTE Cat1-bis Band 25:

LTE Cat1-bis Band 25. BW=5 MHz. QPSK. RB Size=All.

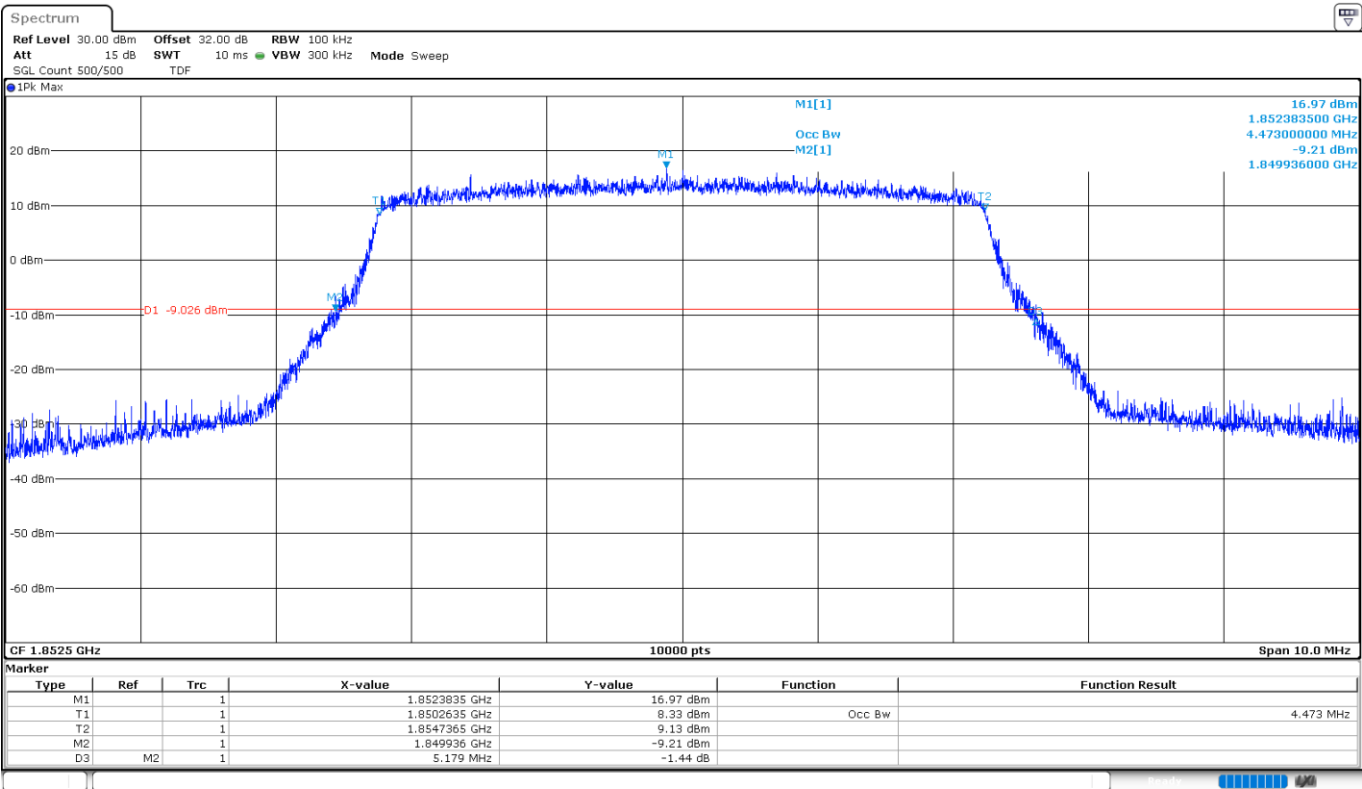
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	4.473	4.485	4.471
-26 dBc Bandwidth (MHz)	5.179	5.217	5.147
Measurement uncertainty (kHz)	<±3.75		

LTE Cat1-bis Band 25. BW=5 MHz. 16QAM. RB Size=All.

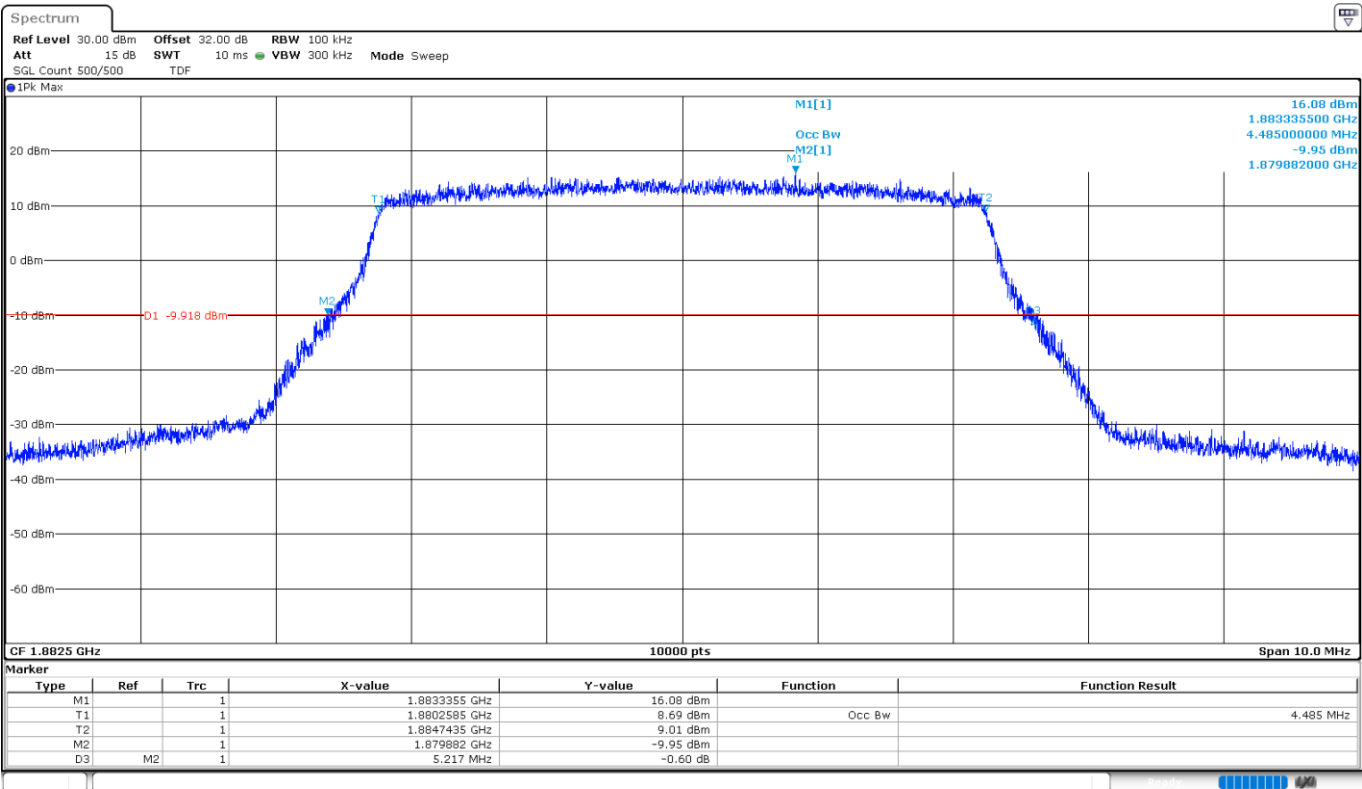
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	4.468	4.470	4.467
-26 dBc Bandwidth (MHz)	5.241	5.234	5.202
Measurement uncertainty (kHz)	<±3.75		

LTE Cat1-bis Band 25. BW=5 MHz. QPSK. RB Size=All.

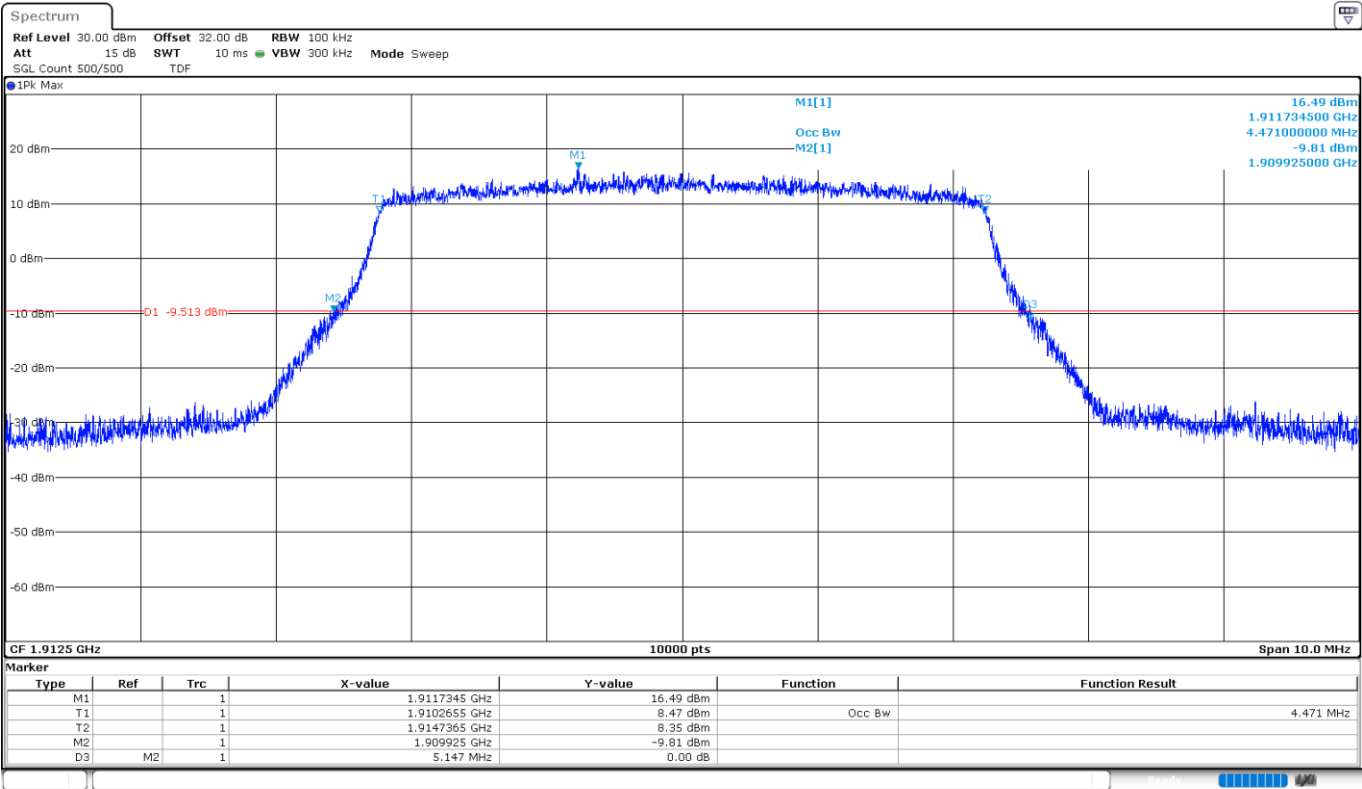
Low Channel:



Middle Channel:

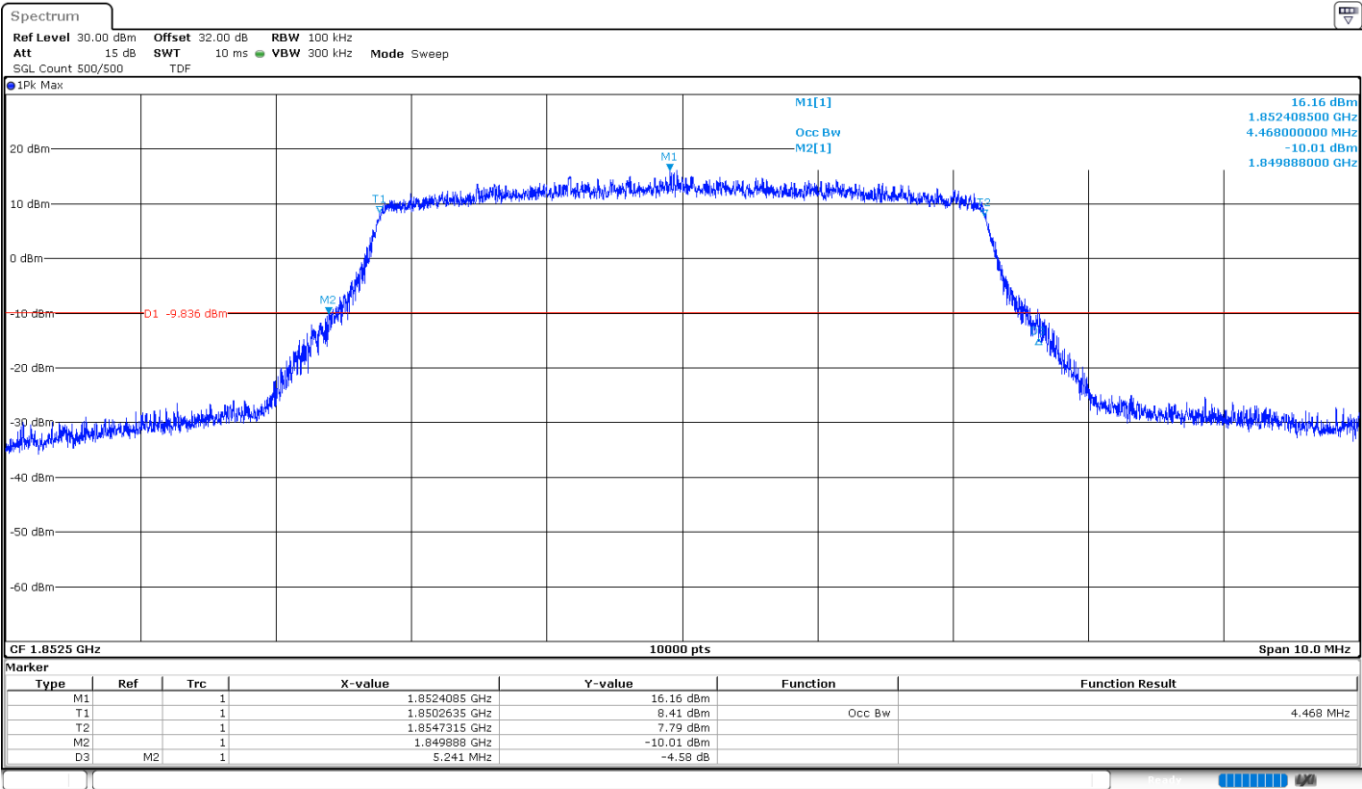


High Channel:

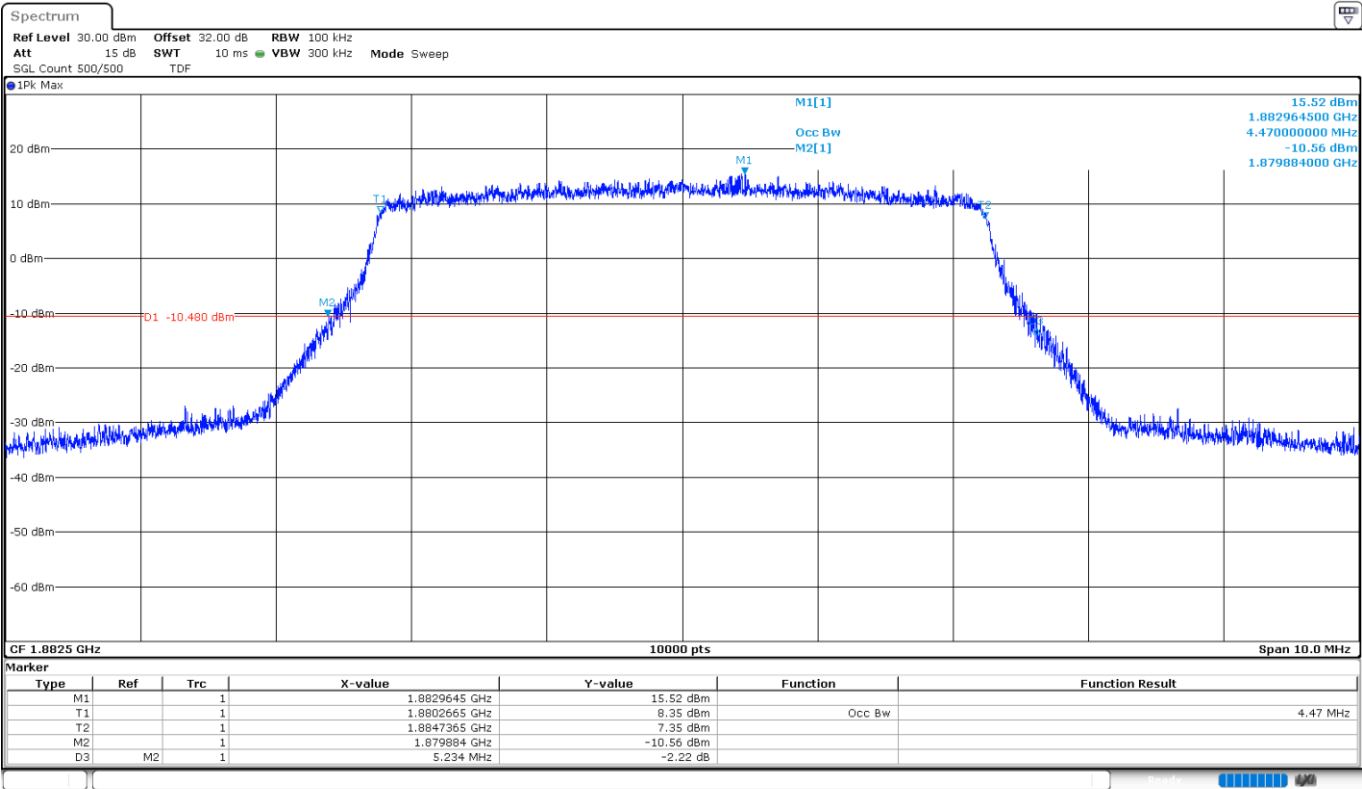


LTE Cat1-bis Band 25. BW=5 MHz. 16QAM. RB Size=All.

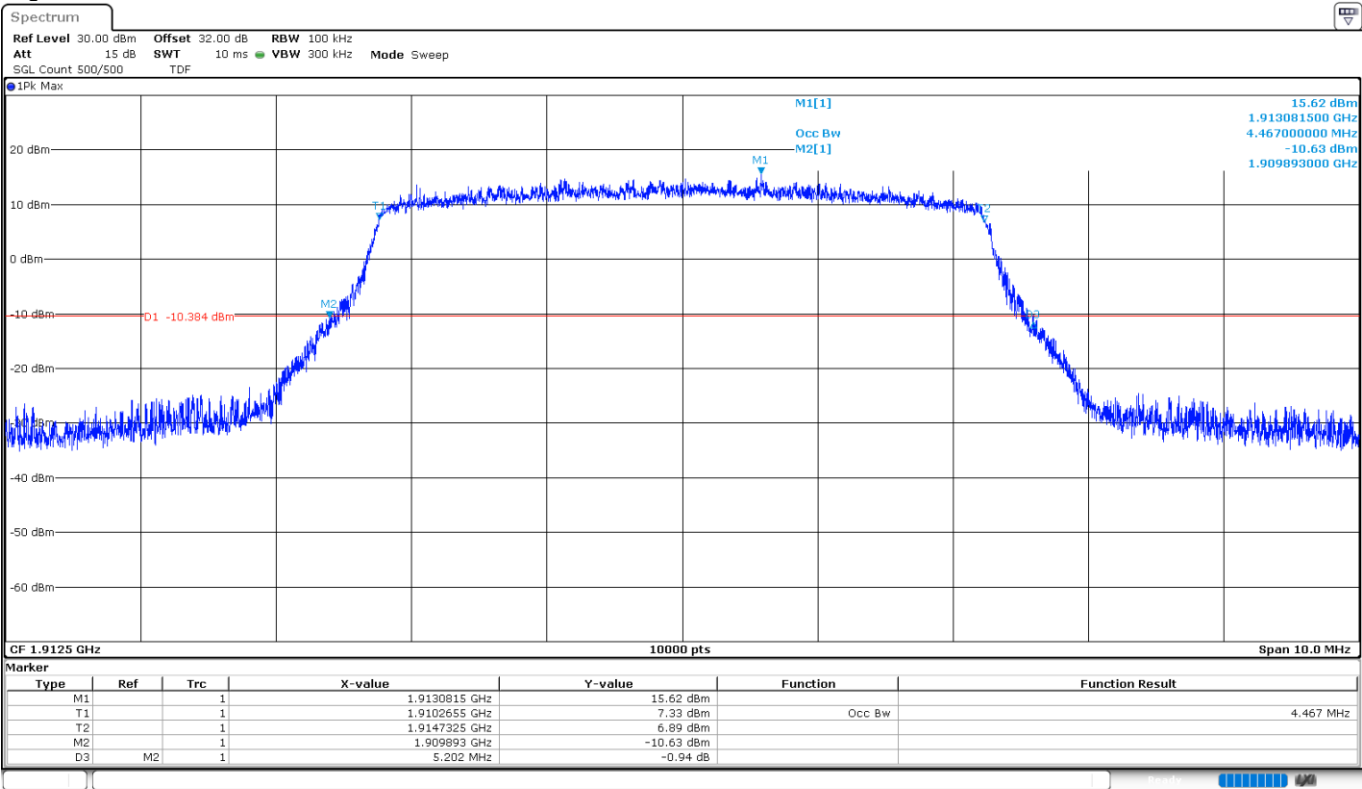
Low Channel:



Middle Channel:



High Channel:



LTE Cat1-bis Band 25. BW=10 MHz. QPSK. RB Size=All.

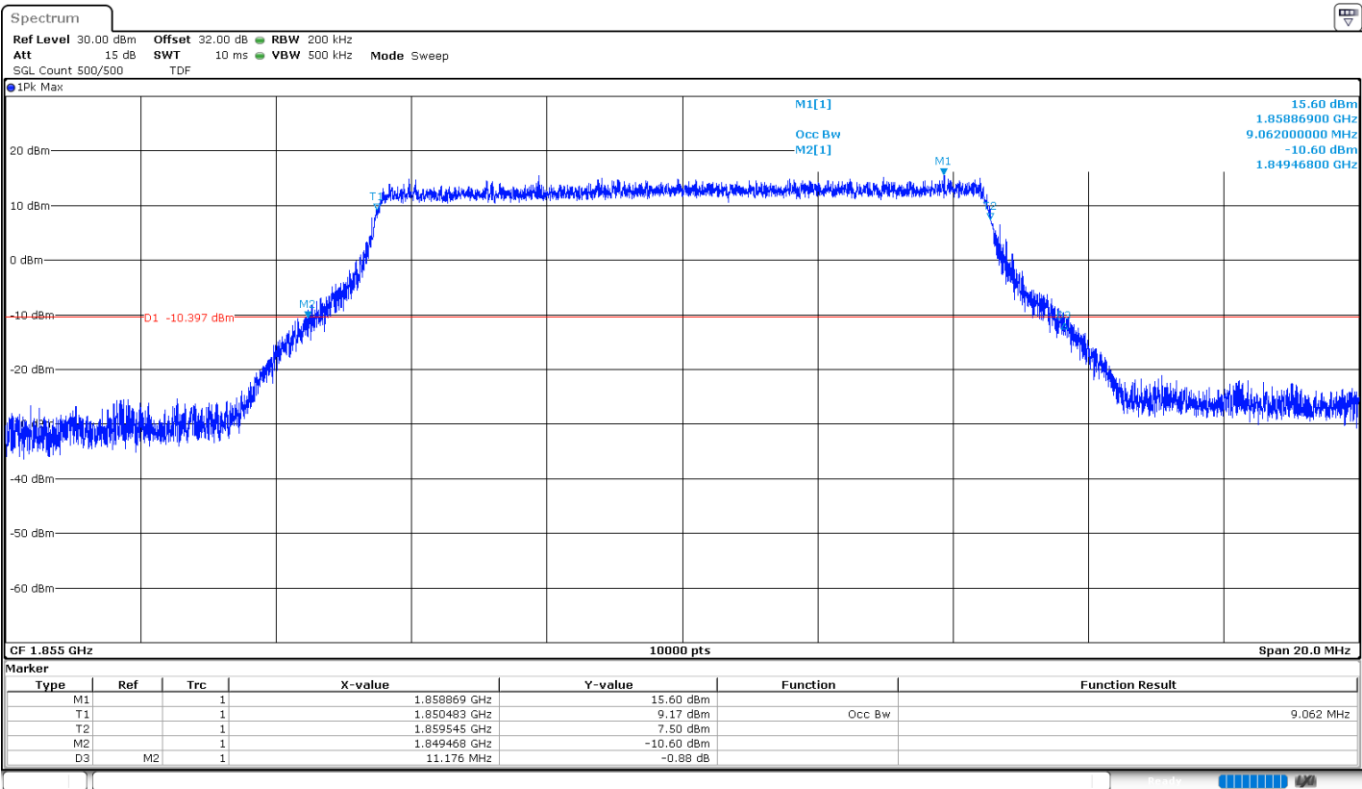
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	9.062	9.030	9.034
-26 dBc Bandwidth (MHz)	11.176	11.240	11.234
Measurement uncertainty (kHz)	<±3.75		

LTE Cat1-bis Band 25. BW=10 MHz. 16QAM. RB Size=All.

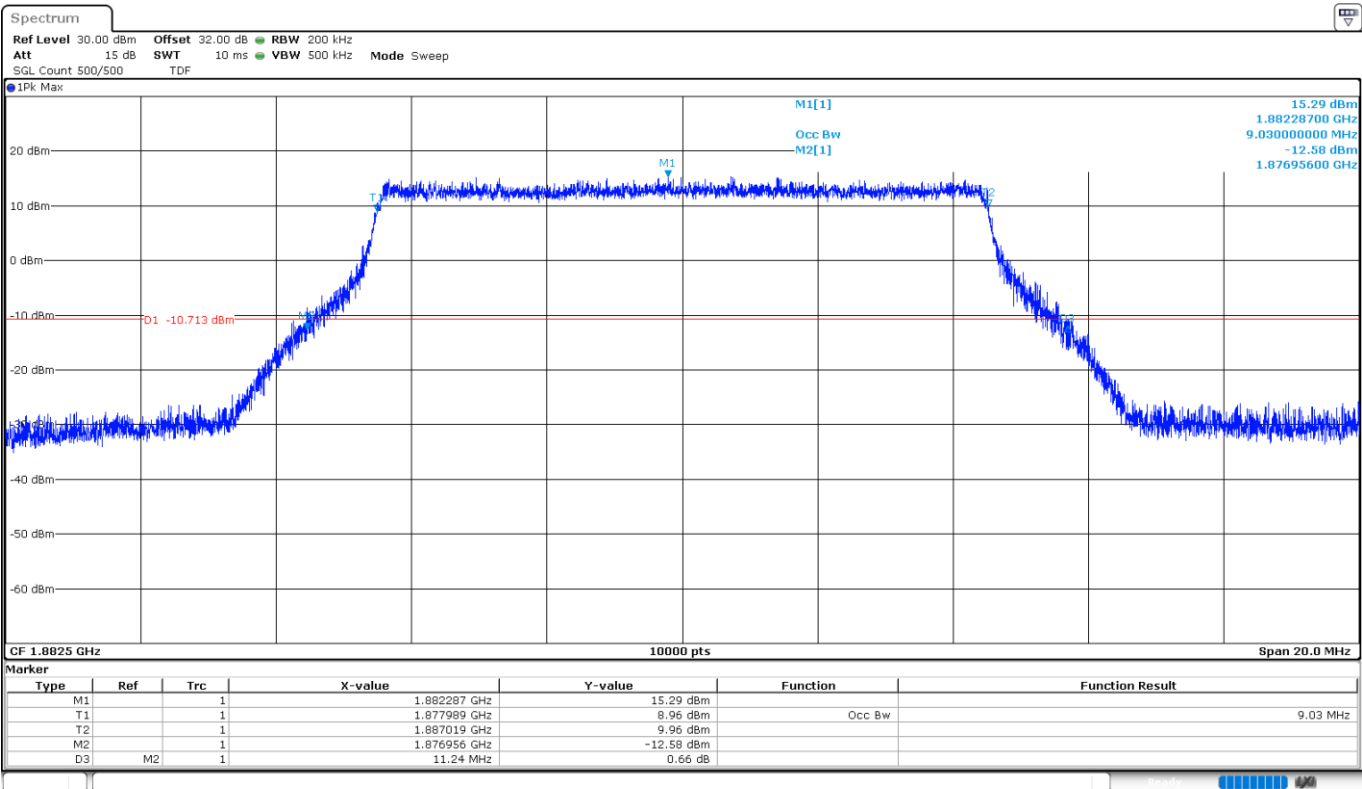
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	4.616	4.636	4.638
-26 dBc Bandwidth (MHz)	6.408	6.314	6.716
Measurement uncertainty (kHz)	<±3.75		

LTE Cat1-bis Band 25. BW=10 MHz. QPSK. RB Size=All.

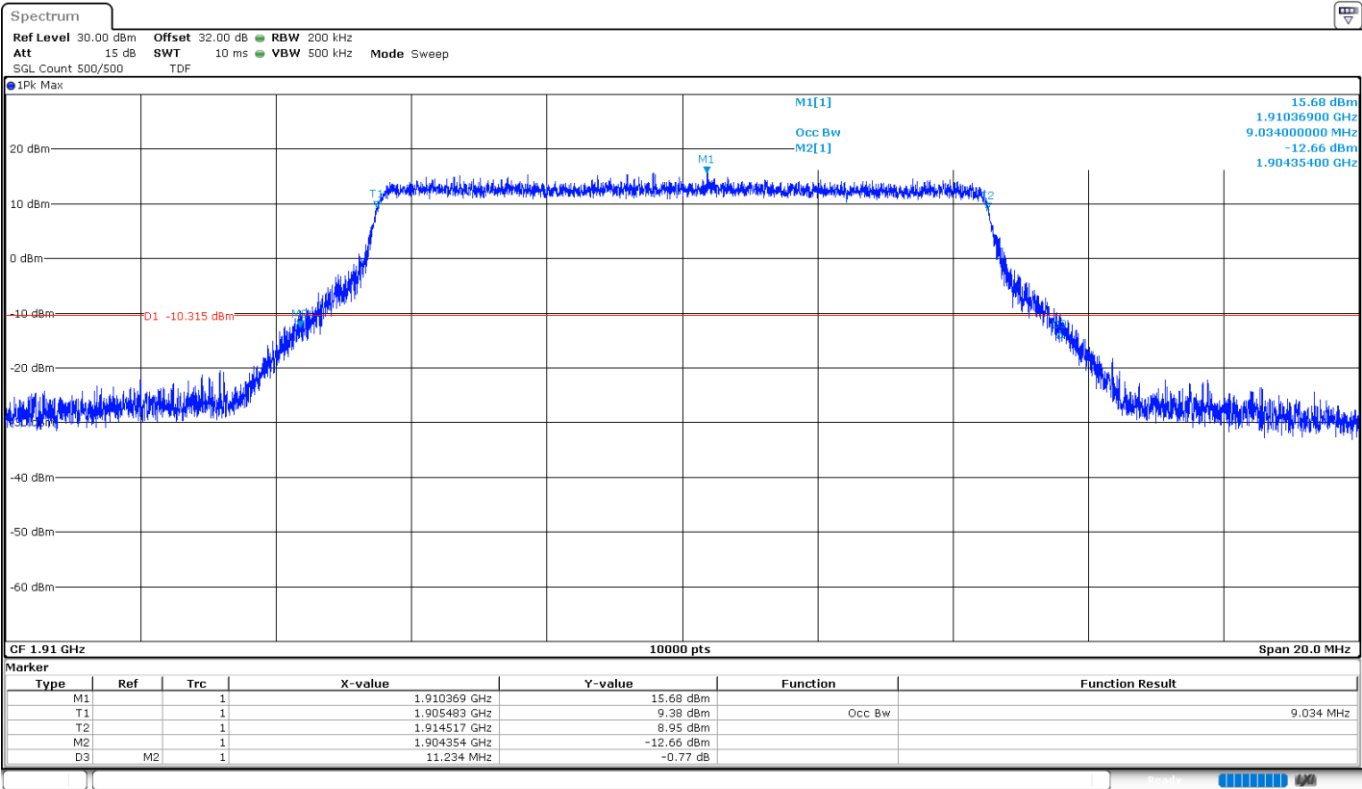
Low Channel:



Middle Channel:

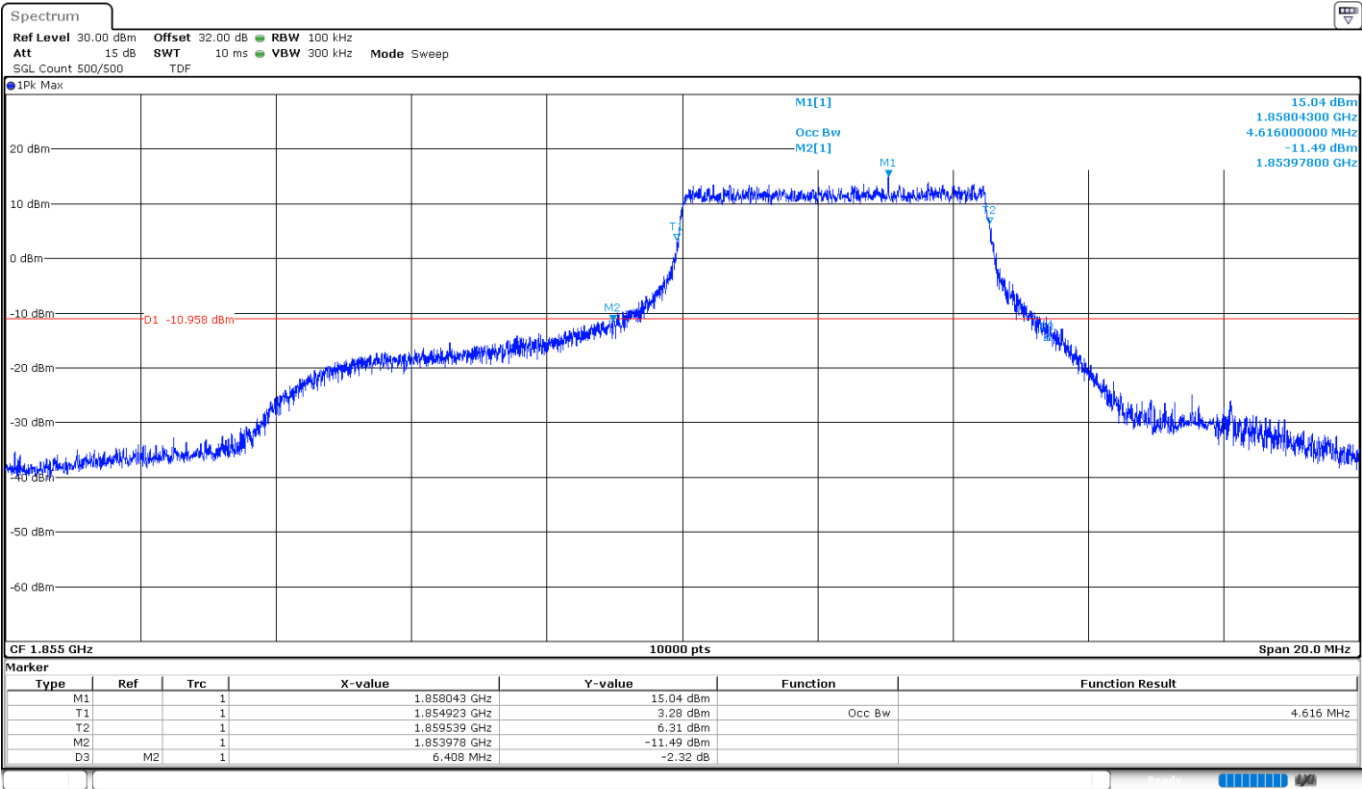


High Channel:

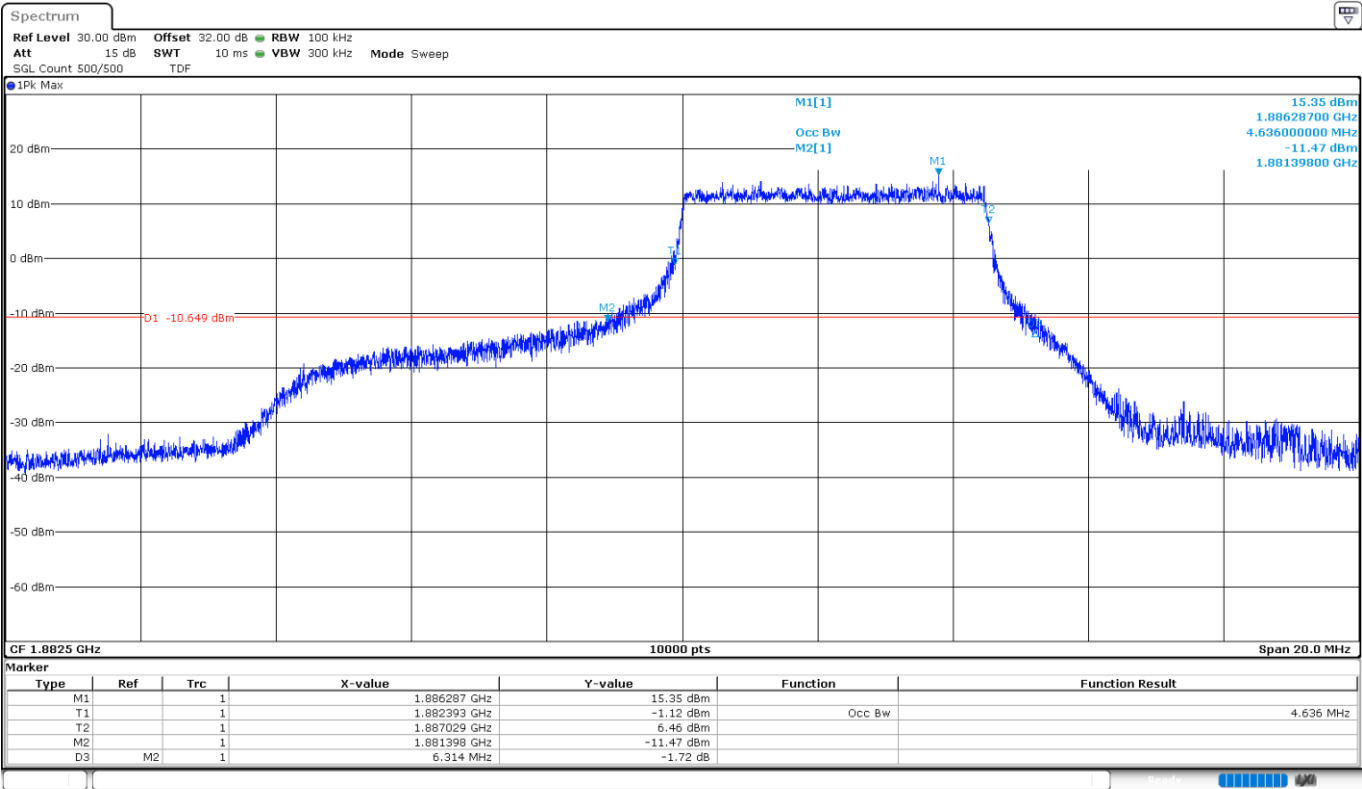


LTE Cat1-bis Band 25. BW=10 MHz. 16QAM. RB Size=All.

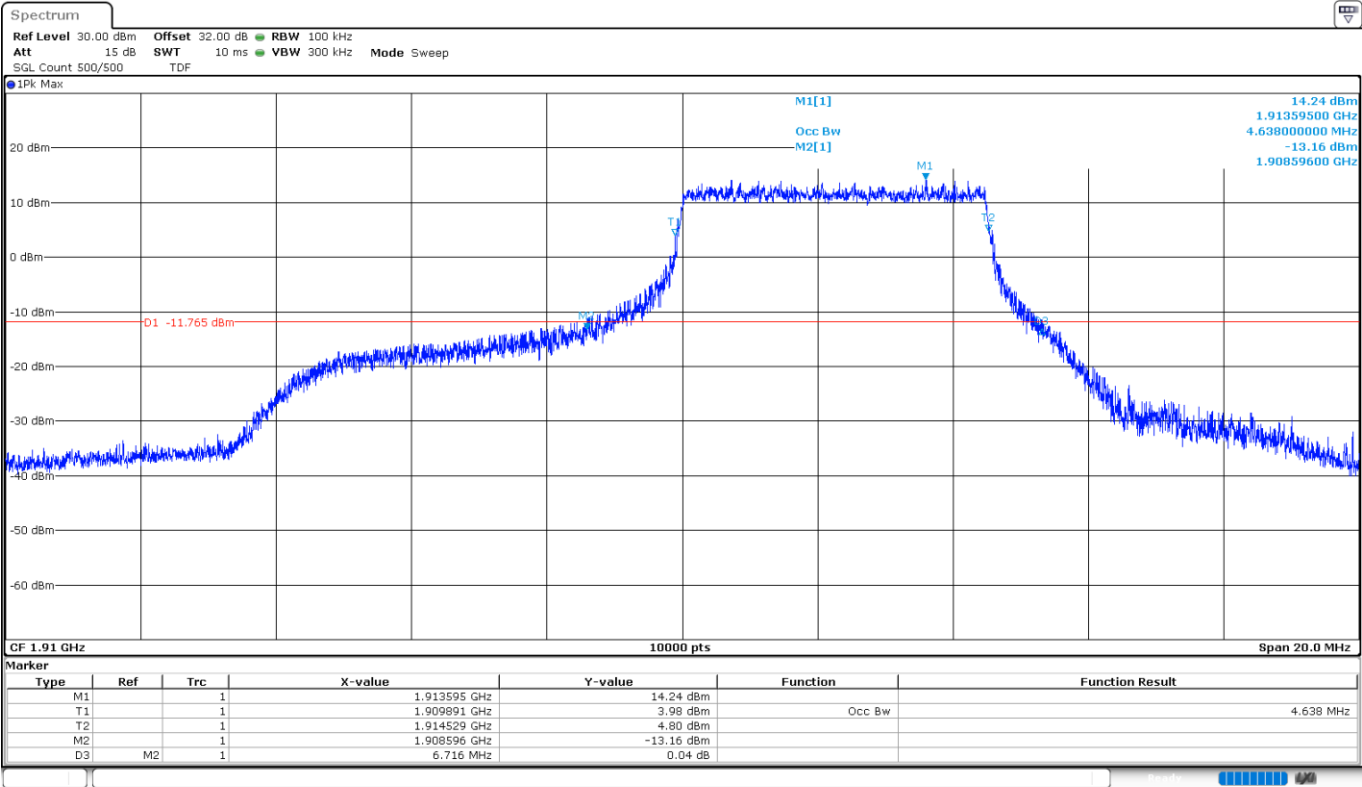
Low Channel:



Middle Channel:



High Channel:



LTE Cat1-bis Band 25. BW=15 MHz. QPSK. RB Size=All.

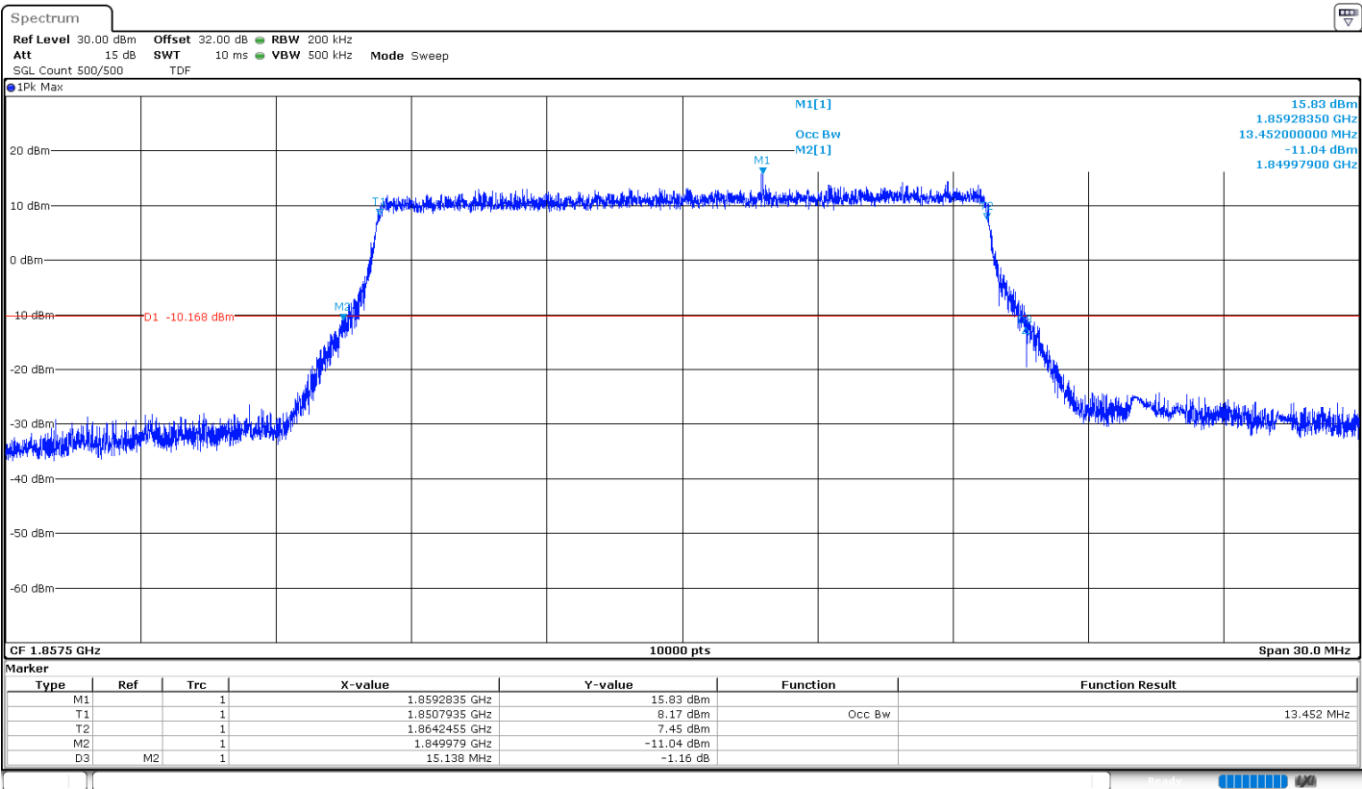
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	13.452	13.470	13.461
-26 dBc Bandwidth (MHz)	15.138	15.525	15.567
Measurement uncertainty (kHz)	<±3.75		

LTE Cat1-bis Band 25. BW=15 MHz. 16QAM. RB Size=All.

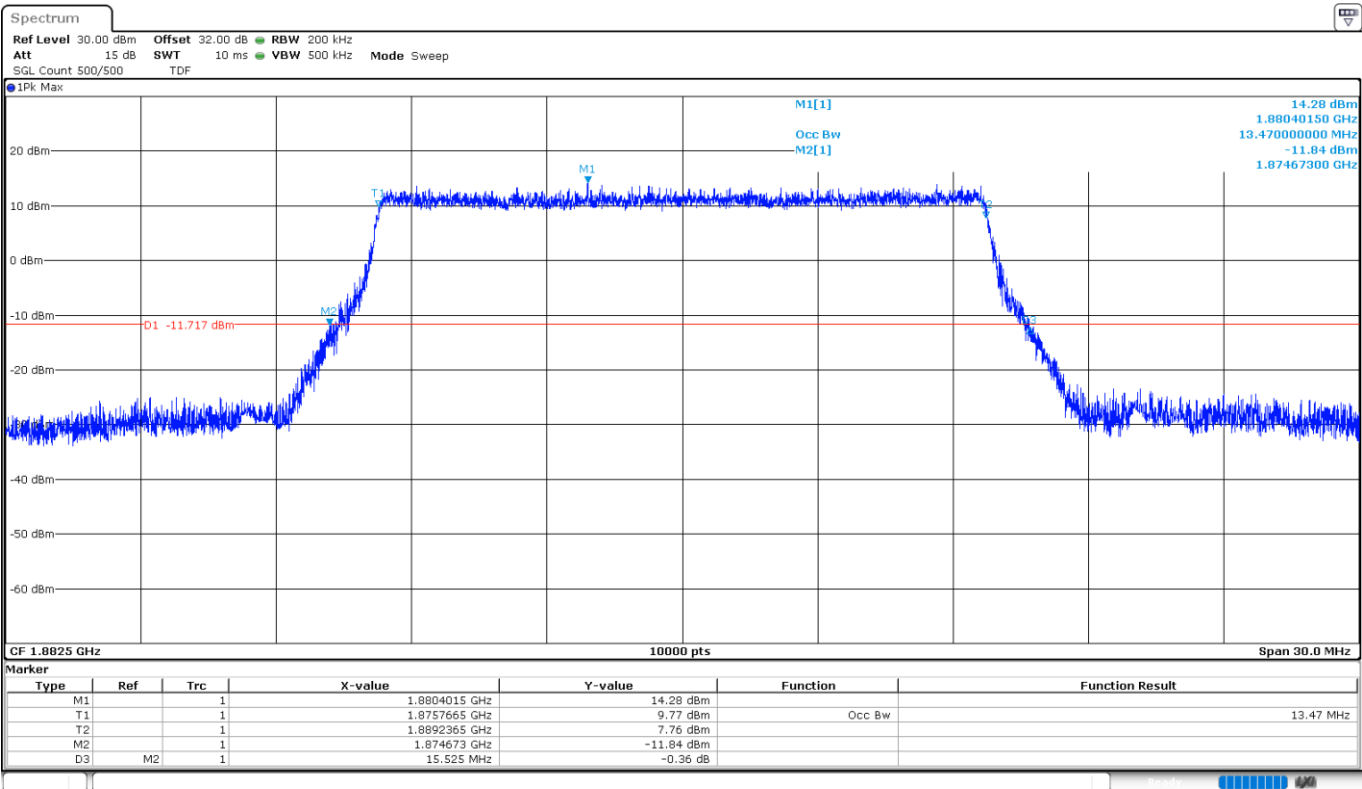
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	4.617	4.635	4.599
-26 dBc Bandwidth (MHz)	6.315	6.501	6.552
Measurement uncertainty (kHz)	<±3.75		

LTE Cat1-bis Band 25. BW=15 MHz. QPSK. RB Size=All.

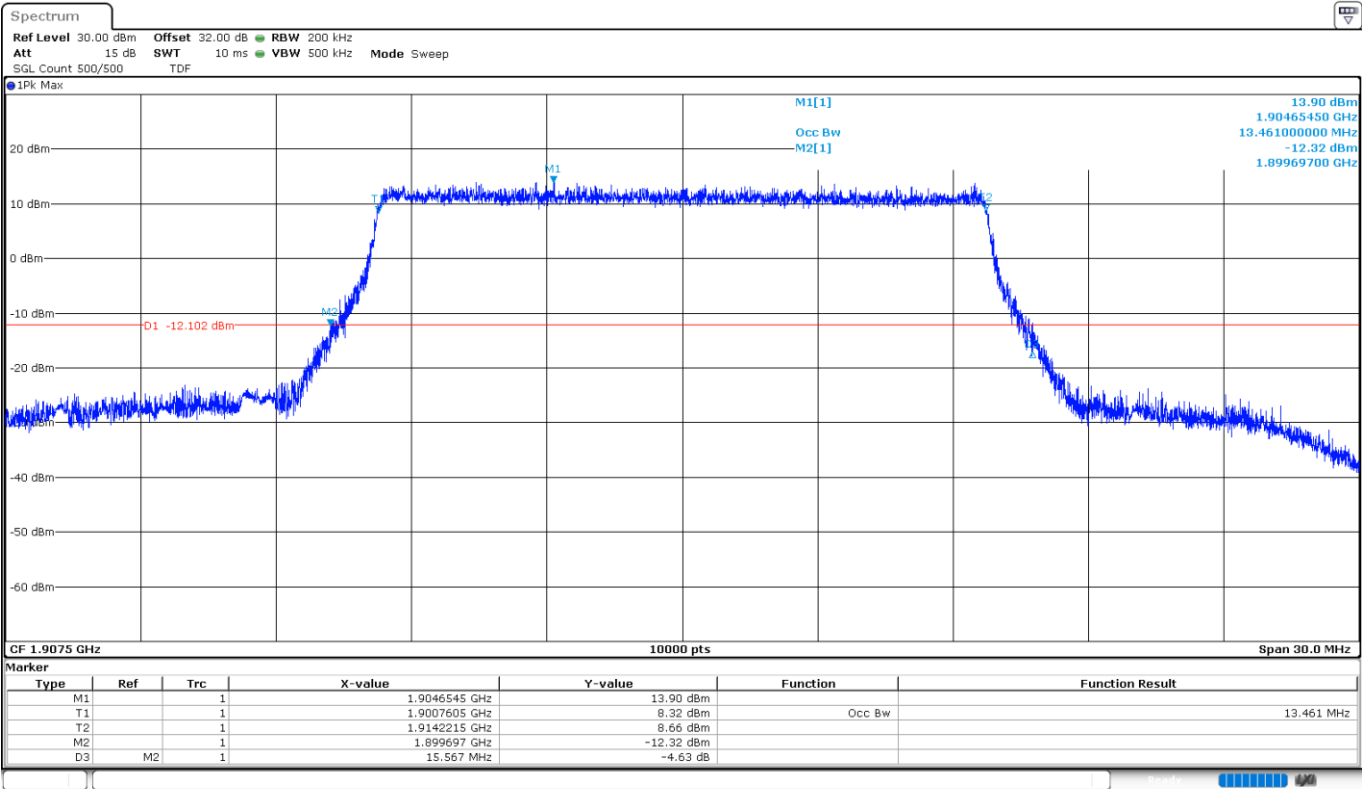
Low Channel:



Middle Channel:

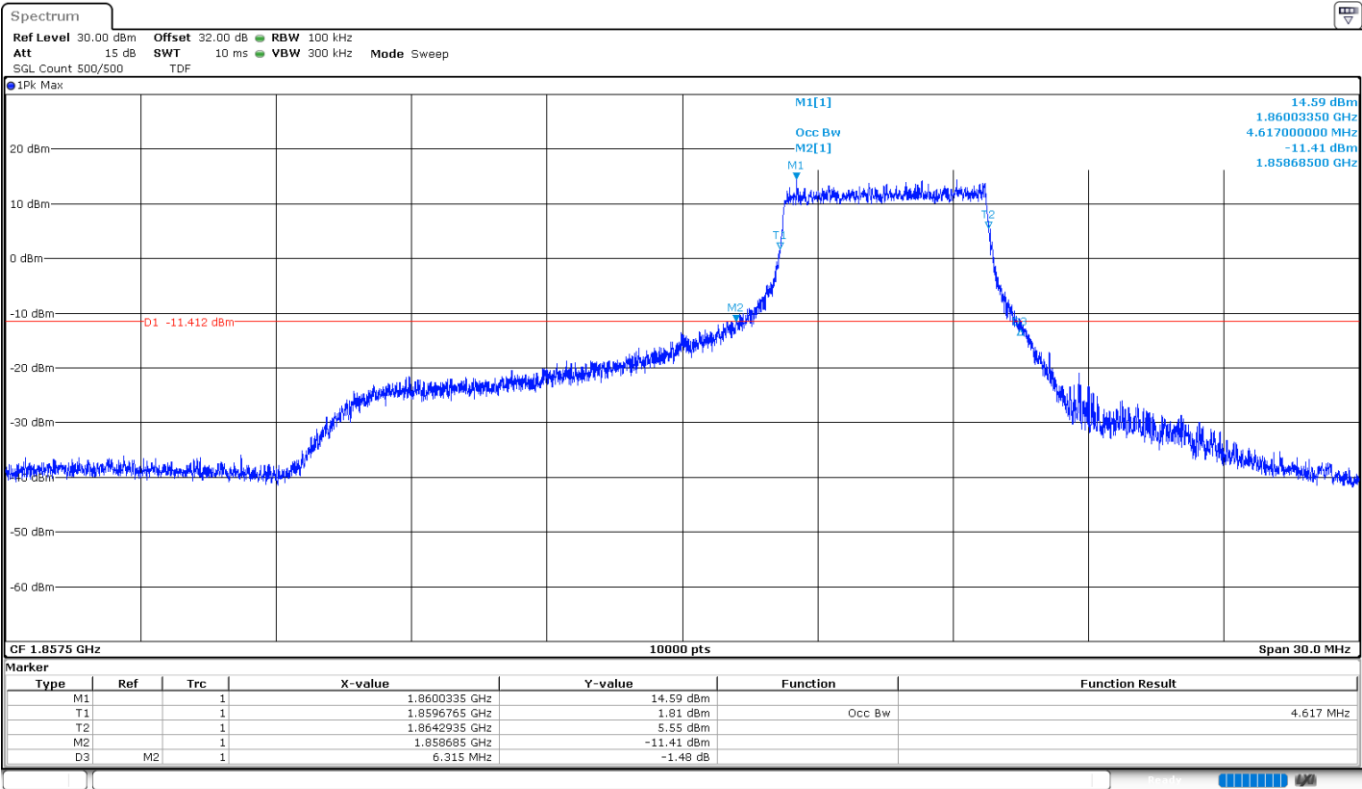


High Channel:

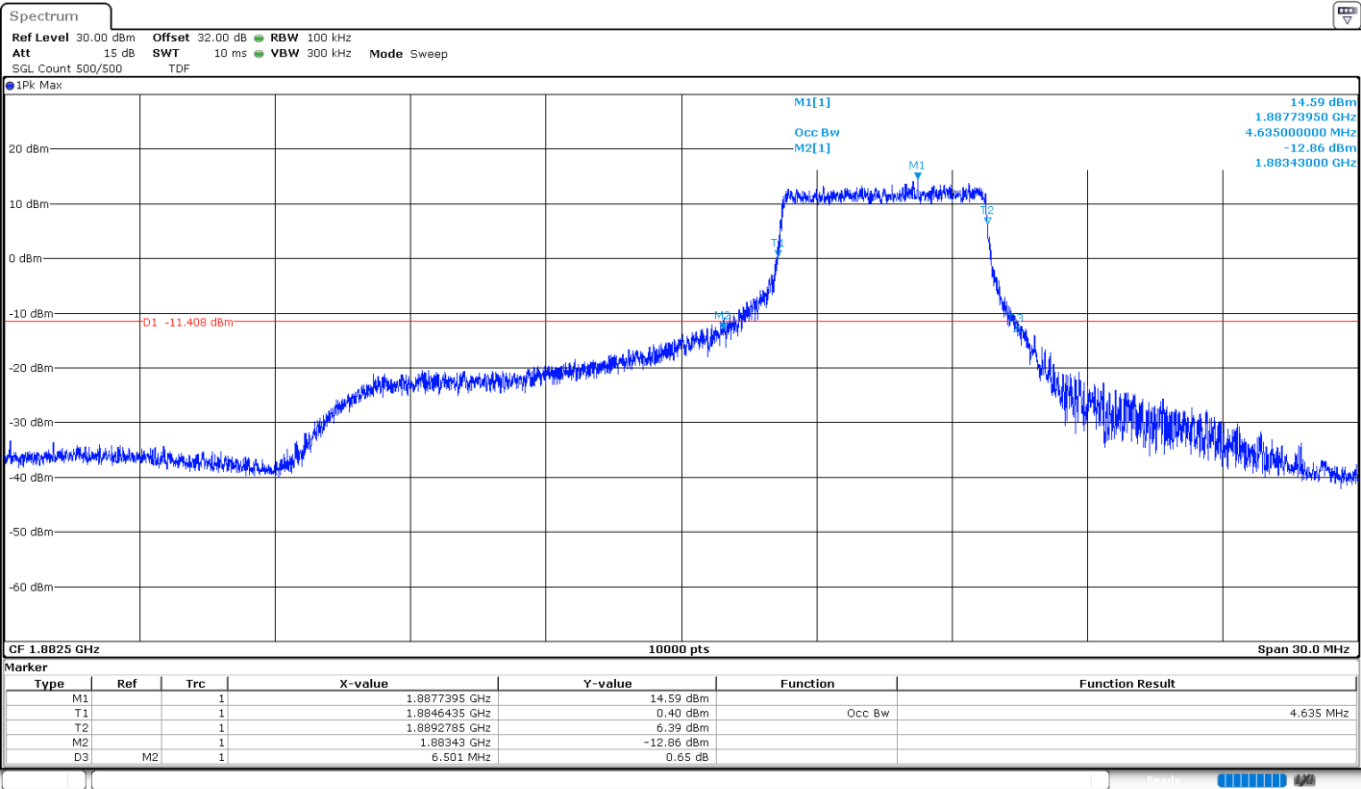


LTE Cat1-bis Band 25. BW=15 MHz. 16QAM. RB Size=All.

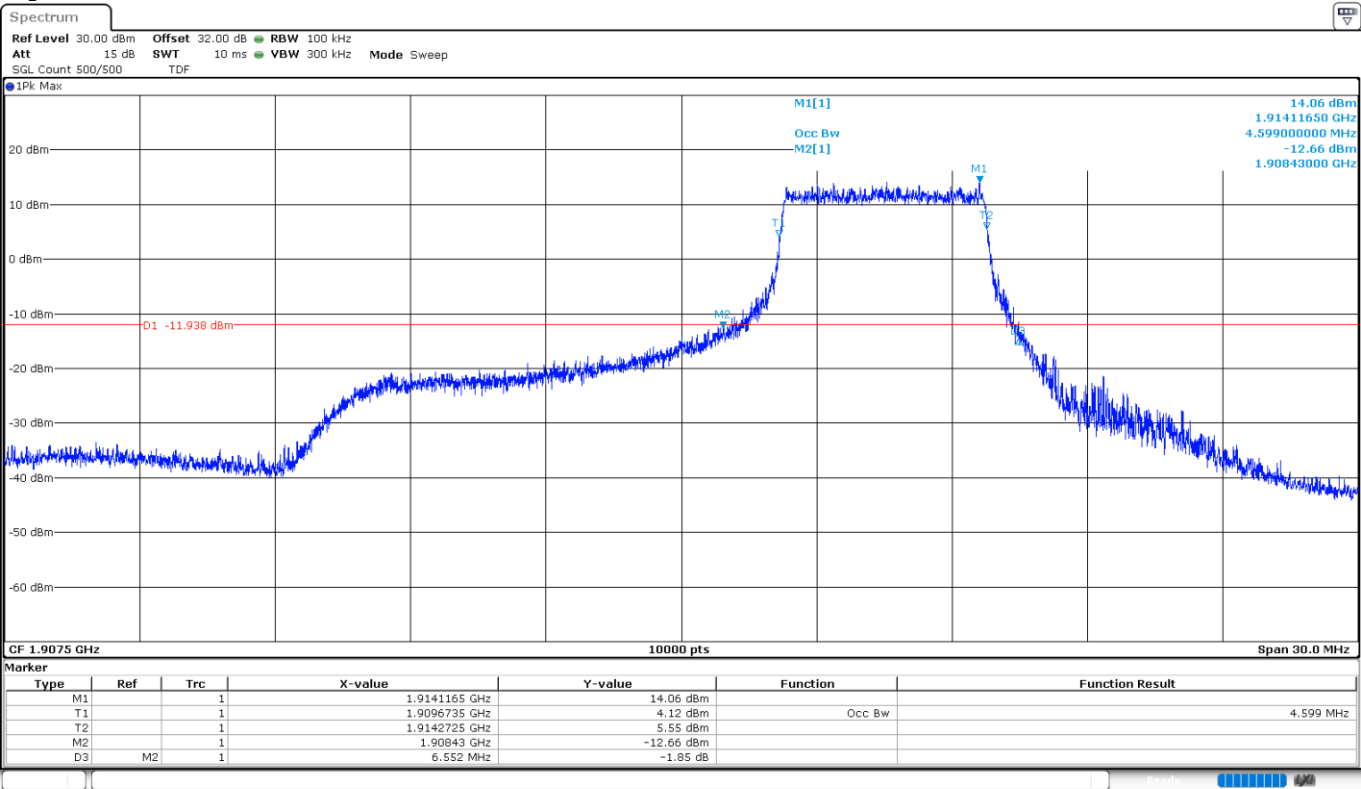
Low Channel:



Middle Channel:



High Channel:



LTE Cat1-bis Band 25. BW=20 MHz. QPSK. RB Size=All.

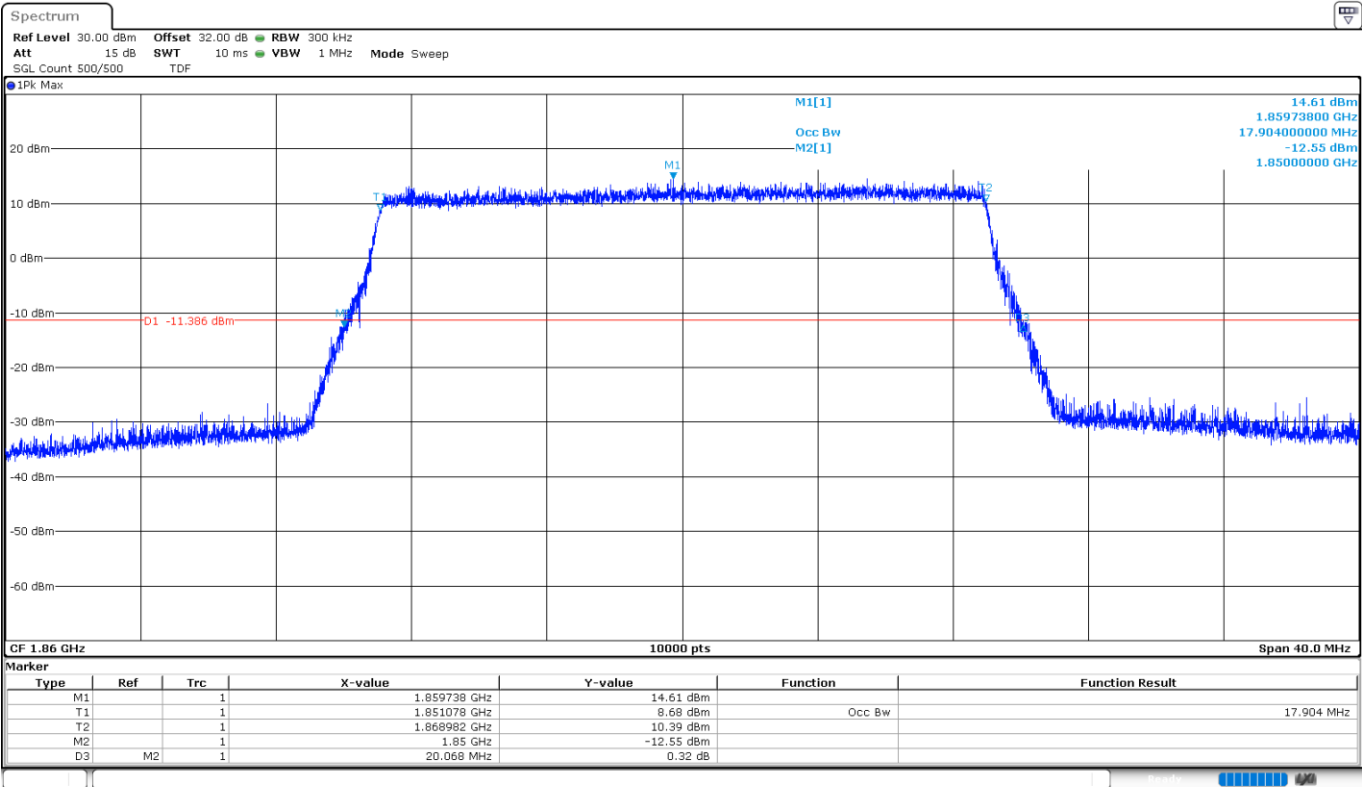
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	17.904	17.956	17.928
-26 dBc Bandwidth (MHz)	20.068	20.268	20.228
Measurement uncertainty (kHz)	<±3.75		

LTE Cat1-bis Band 25. BW=20 MHz. 16QAM. RB Size=All.

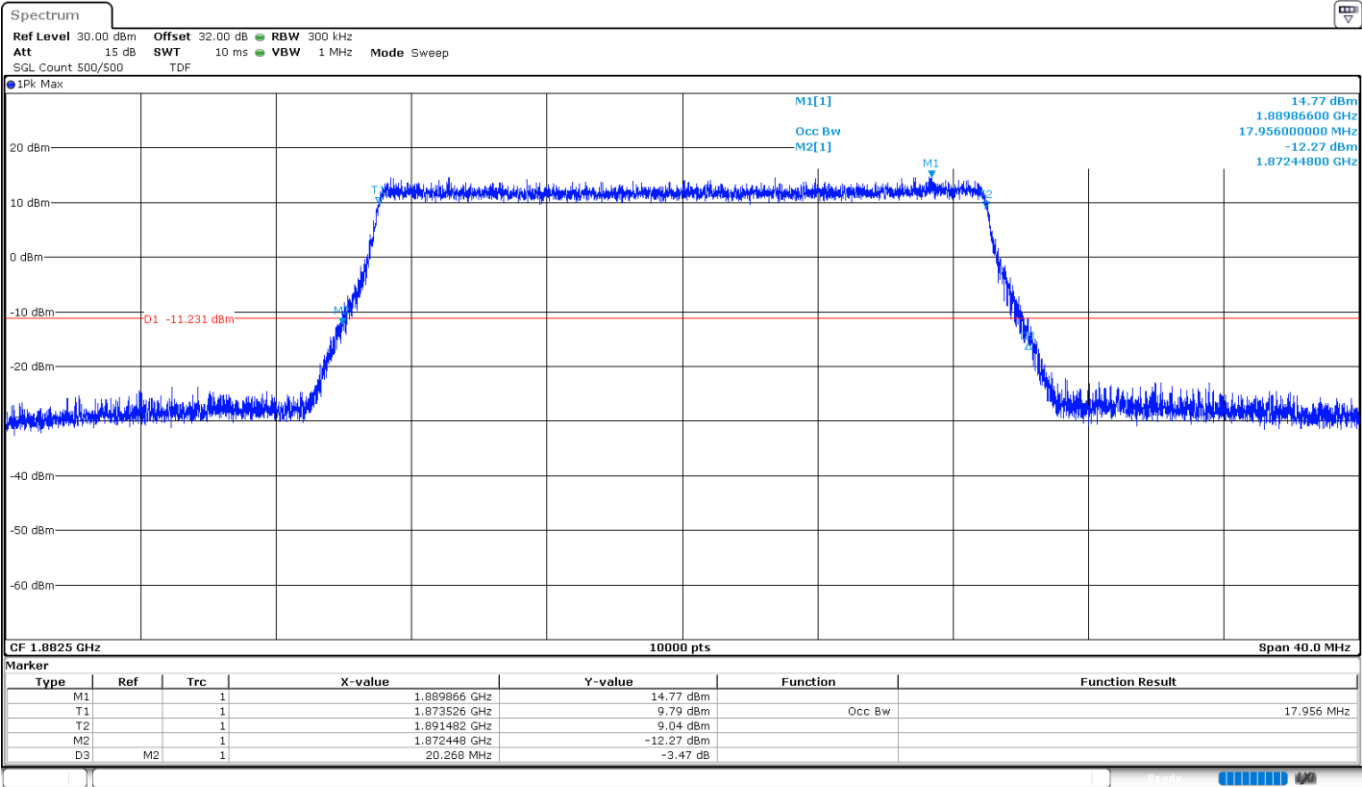
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	4.652	4.624	4.656
-26 dBc Bandwidth (MHz)	6.544	6.576	6.596
Measurement uncertainty (kHz)	<±3.75		

LTE Cat1-bis Band 25. BW=20 MHz. QPSK. RB Size=All.

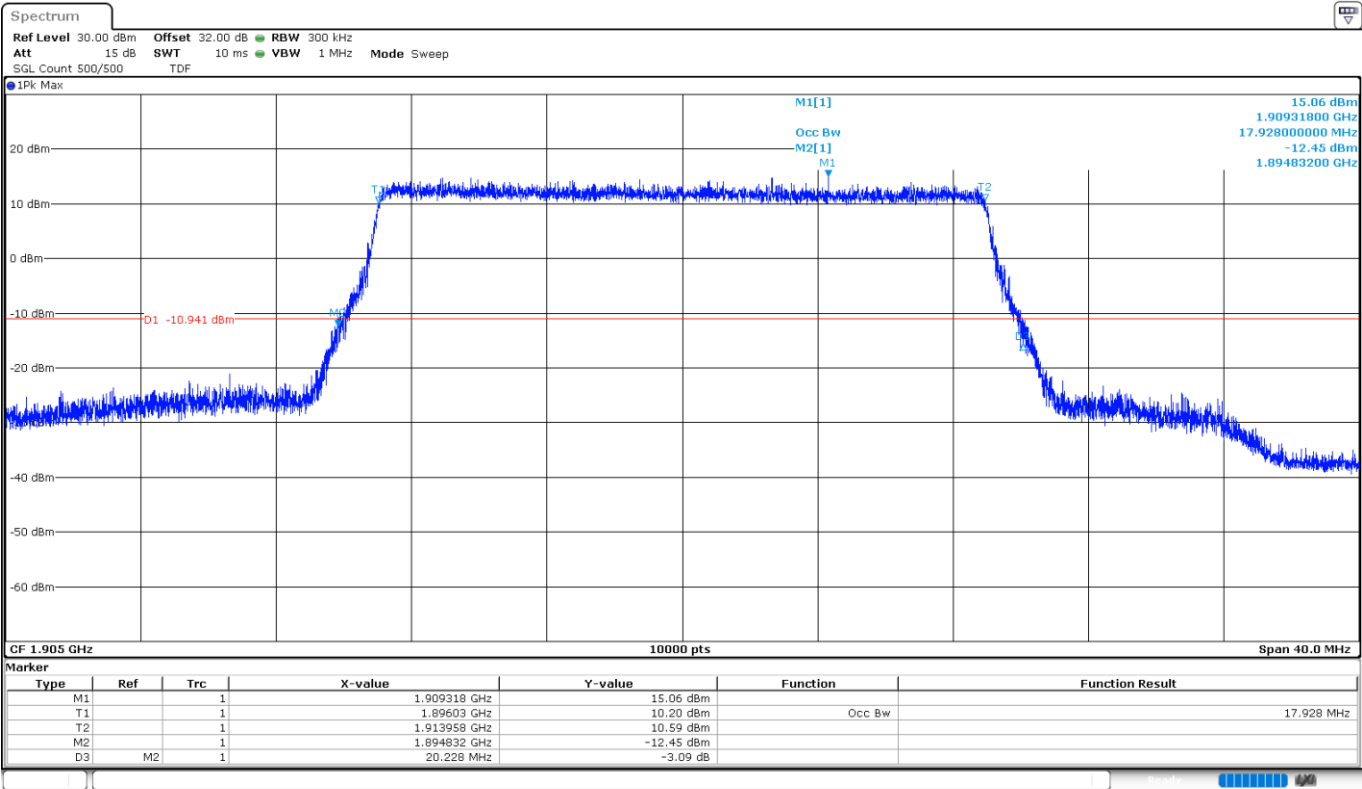
Low Channel:



Middle Channel:

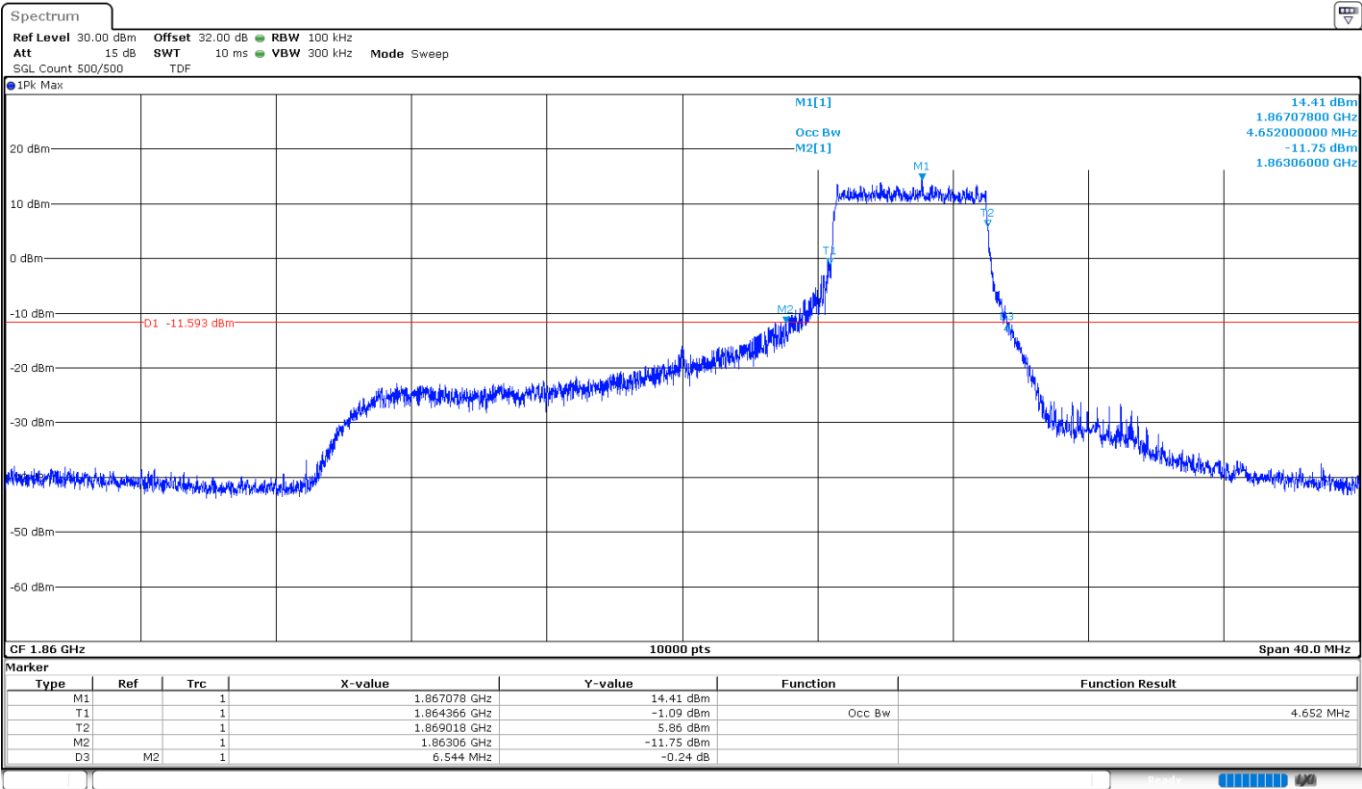


High Channel:

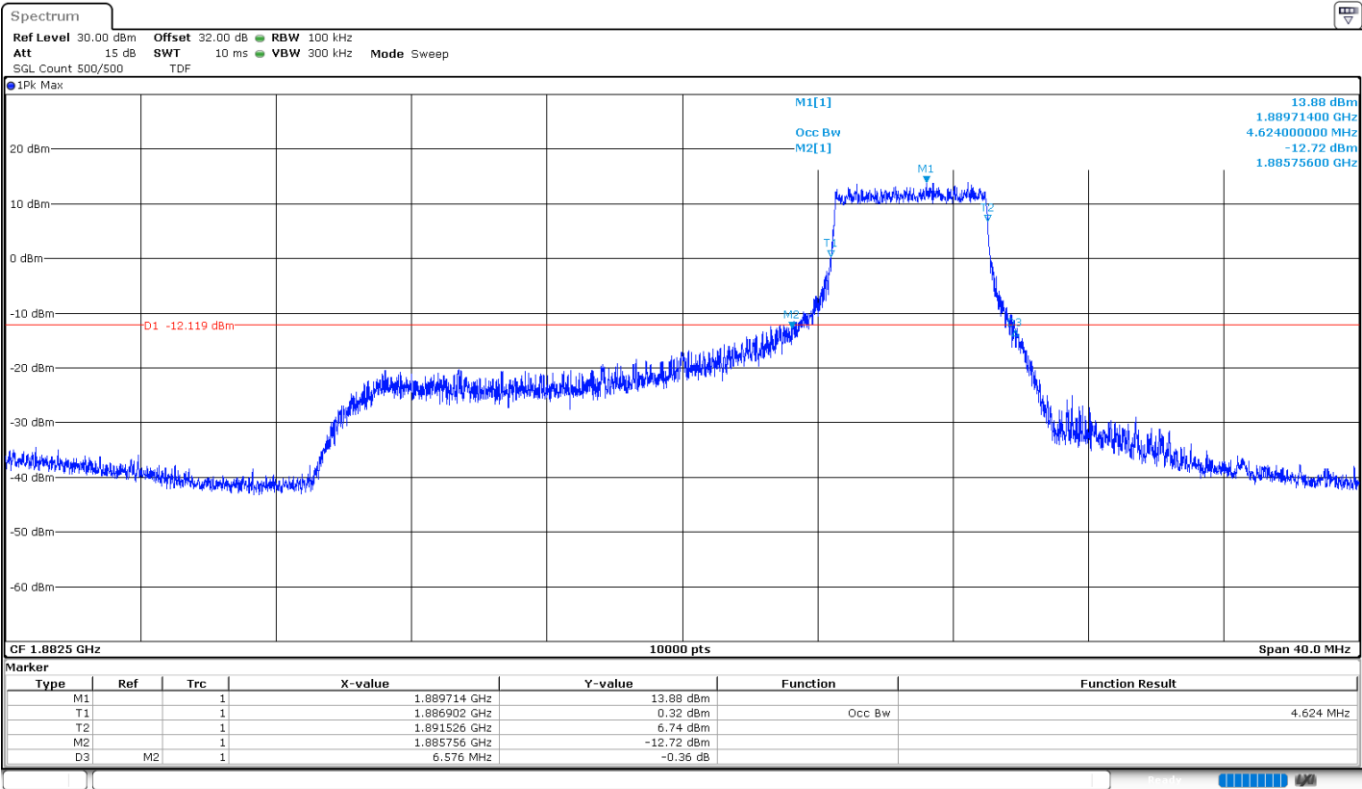


LTE Cat1-bis Band 25. BW=20 MHz. 16QAM. RB Size=All.

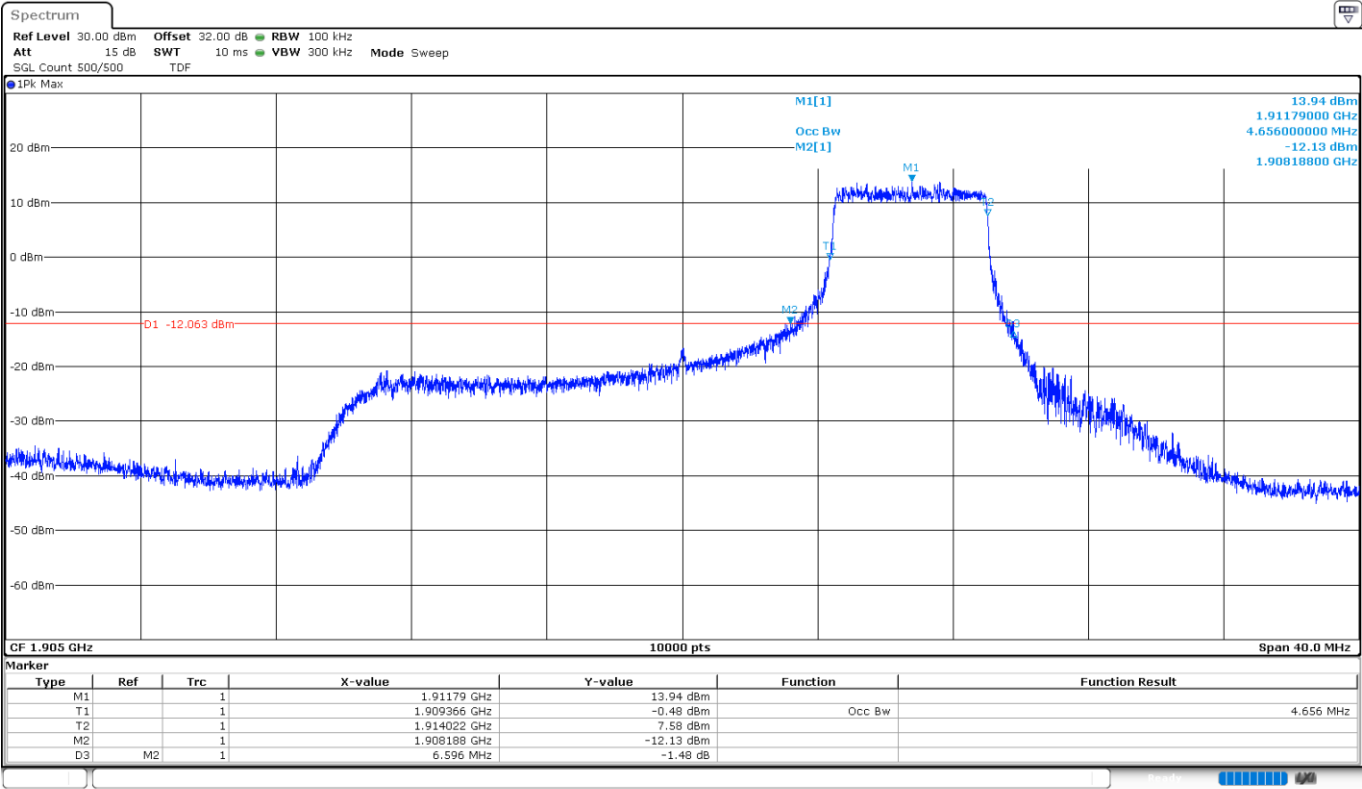
Low Channel:



Middle Channel:



High Channel:



Spurious emissions at antenna terminals

Limits

* FCC §2.1051 and §24.238. RSS-133, 6.5.

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

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater.

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

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mW}) - 30] = -13 \text{ dBm}$$

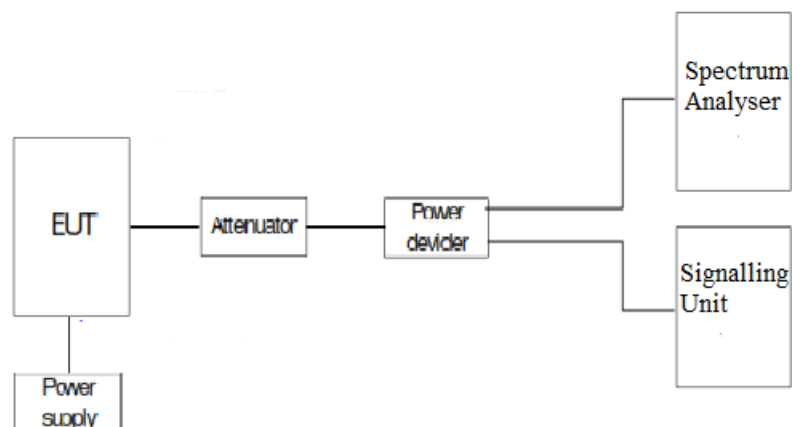
Method

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

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

The configuration of Resource Blocks and modulation which is the worst case for conducted power was used.

Test Setup



Results

LTE Cat1-bis Band 25:

A preliminary scan determined the worst-case:

BW=5 MHz. QPSK. RB Size=1. RB Offset=0.

The next results are for this worst-case configuration.

Frequency range 9 KHz - 20 GHz:

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

Measurement uncertainty (dB): $<\pm 2.76$

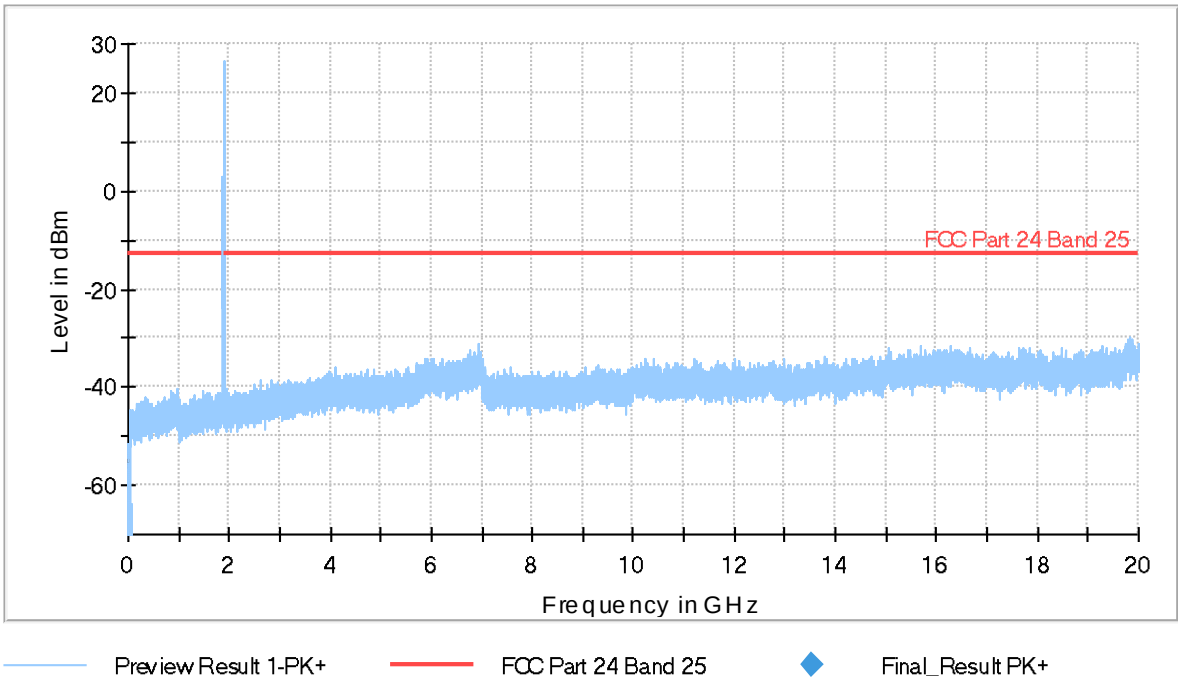
Verdict: PASS

LTE Cat1-bis Band 25: BW=5 MHz. QPSK. RB Size=1. RB Offset=12.

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [FSV 40]					
9 kHz - 150 kHz	14,1 Hz	PK+	300 Hz	Coupled	0 dB
150 kHz - 30 MHz	932,812 Hz	PK+	10 kHz	Coupled	0 dB
30 MHz - 1 GHz	303,125 kHz	PK+	1 MHz	Coupled	0 dB
1 GHz - 10 GHz	281,25 kHz	PK+	1 MHz	Coupled	0 dB
10 GHz - 20 GHz	312,5 kHz	PK+	1 MHz	Coupled	0 dB

Low Channel:

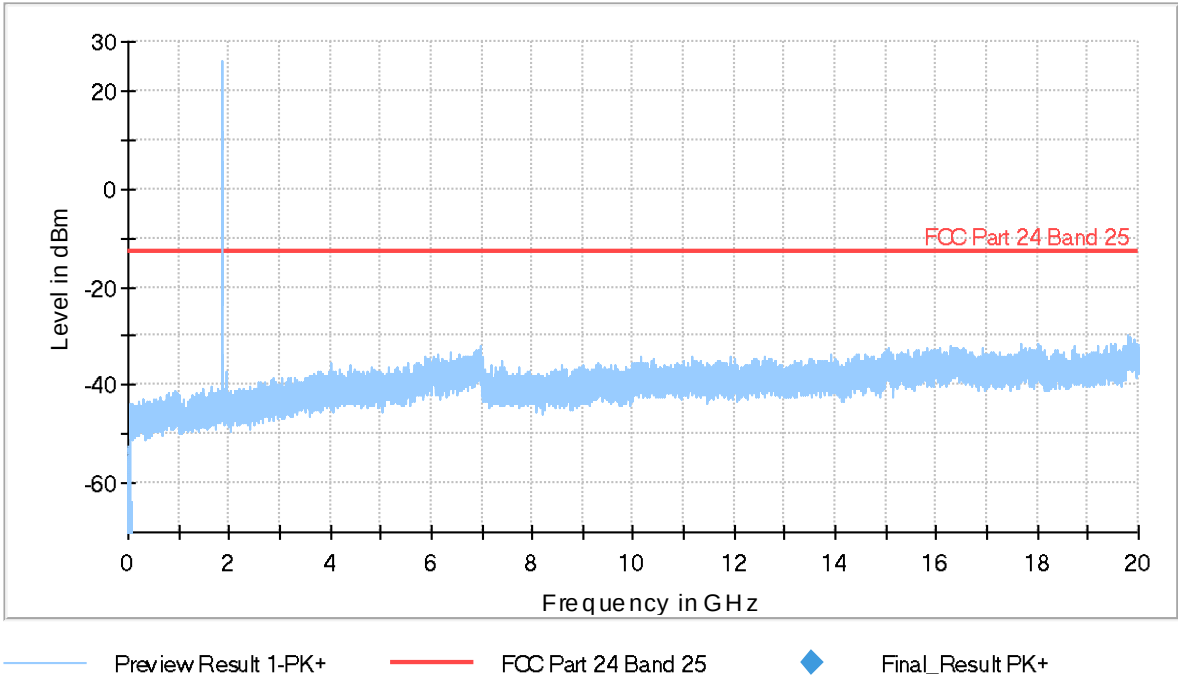
Full Spectrum



The peak above the limit is the carrier frequency.

Middle Channel:

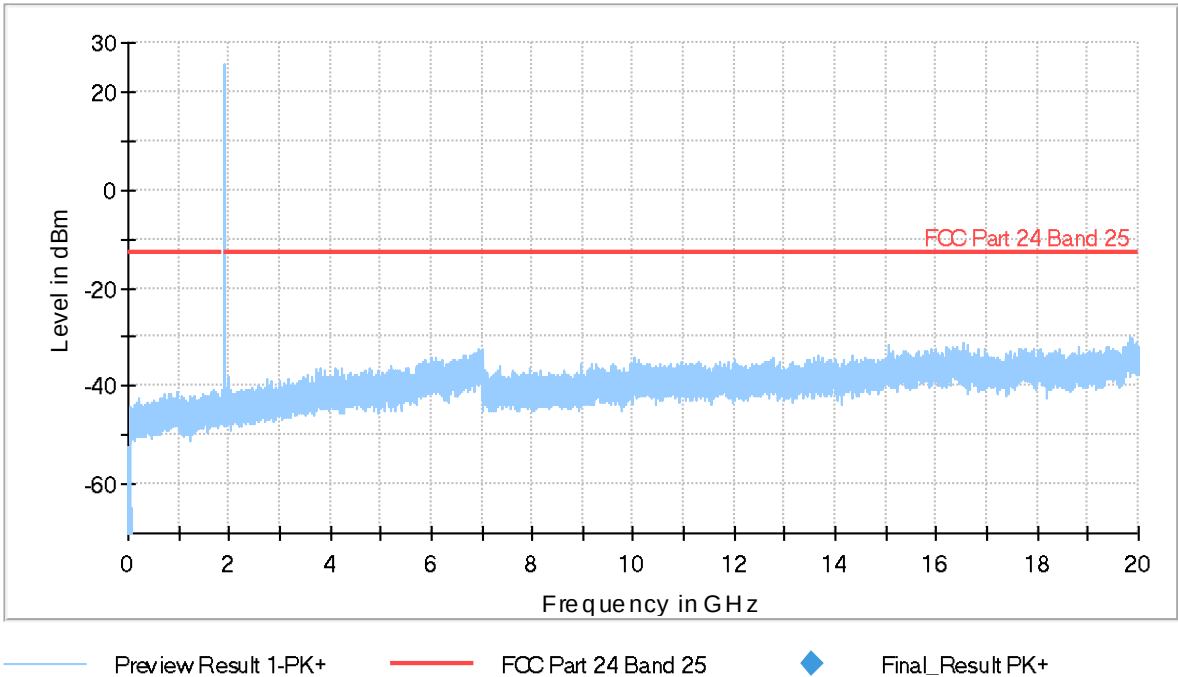
Full Spectrum



The peak above the limit is the carrier frequency.

High Channel:

Full Spectrum



The peak above the limit is the carrier frequency.

Spurious emissions at antenna terminals at Block Edges

Limits

* FCC §2.1051 and §24.238. RSS-133, 6.5.

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

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater.

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

$$P_o \text{ (dBm)} - [43 + 10 \log (P_o \text{ in mW}) - 30] = -13 \text{ dBm}$$

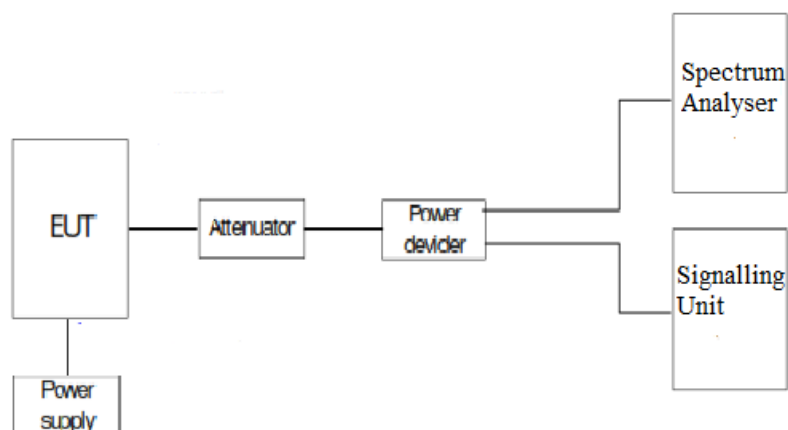
Method

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

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

As stated in FCC part 24.238 / RSS-133 Clause 6.5, in the 1 MHz bands immediately outside and adjacent to the frequency block or band a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

Test Setup



Results

LTE Cat 1bis Band 2:

Note: Low Block Edge for LTE Cat 1bis Band 2 is the same as for Band 25.

Preliminary measurements determined QPSK, BW=5 MHz as the worst-case.

LTE Cat 1bis Band 2. QPSK.	RB=1. Offset=Max. BW=1.4 MHz	RB=1. Offset=Max. BW=3 MHz	RB=1. Offset=Max. BW=5 MHz	RB=1. Offset=Max. BW=10 MHz	RB=1. Offset=Max. BW=15 MHz	RB=1. Offset=Max. BW=20 MHz
Maximum measured level at <u>High Block Edge</u> at antenna port (dBm)			-22.53	-26.12	-30.82	-35.1

LTE Cat 1bis Band 2. QPSK.	RB=All. Offset=0. BW=1.4 MHz	RB=All. Offset=0. BW=3 MHz	RB=All. Offset=0. BW=5 MHz	RB=All. Offset=0. BW=10 MHz	RB=All. Offset=0. BW=15 MHz	RB=All. Offset=0. BW=20 MHz
Maximum measured level at <u>High Block Edge</u> at antenna port (dBm)			-25.95	-26.2	-31.2	-34.03

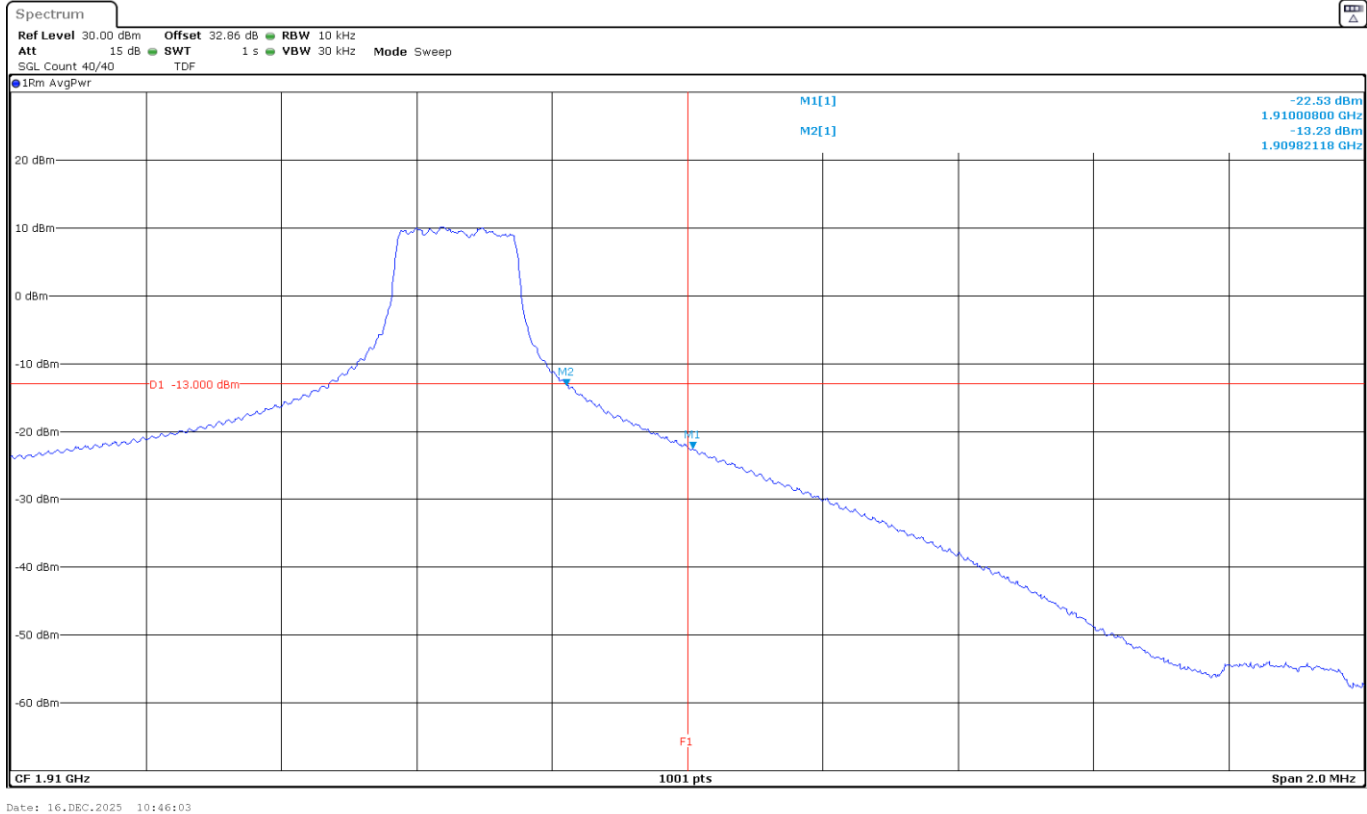
Measurement uncertainty (dB) <± 2.76

Verdict

PASS

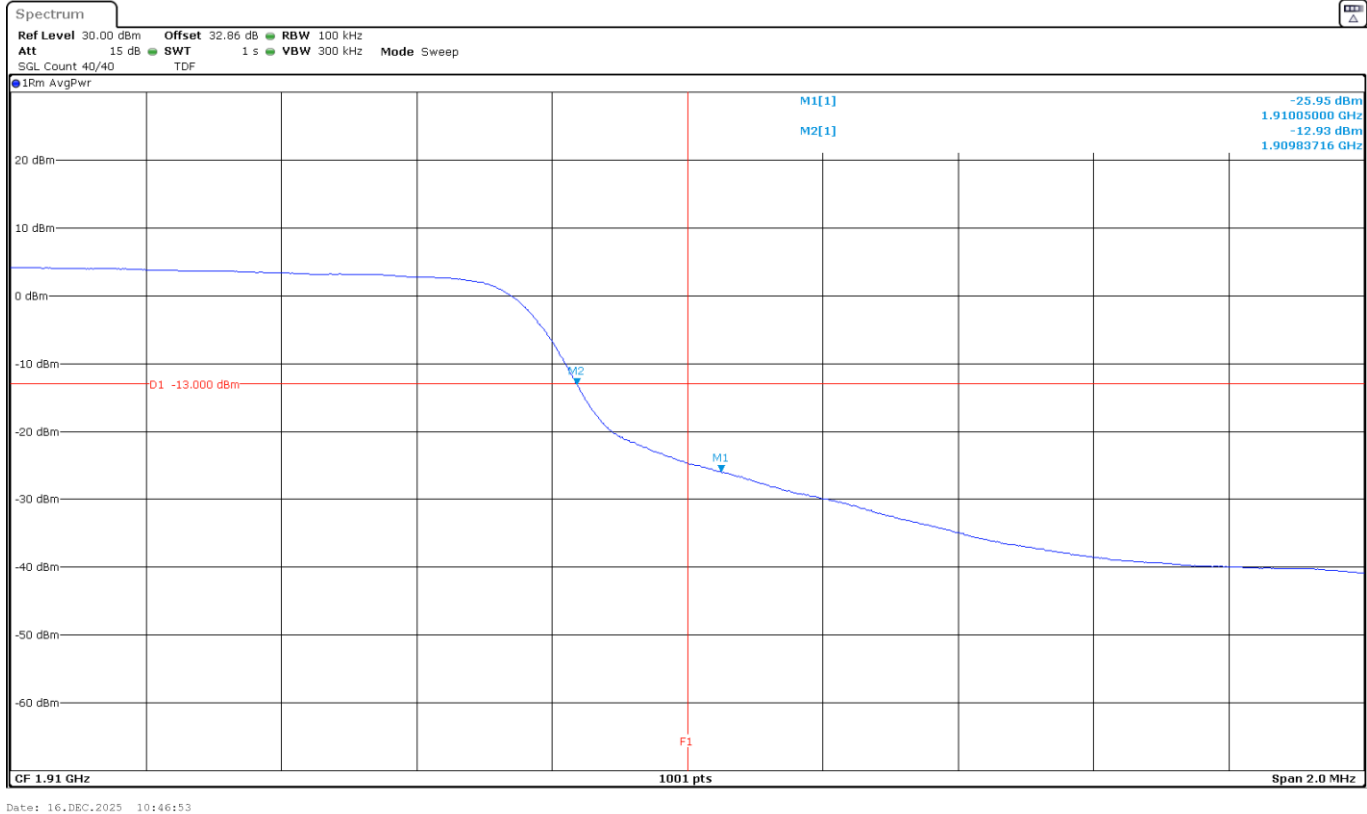
The plots below are for the worst case configuration specified before.

LTE Cat 1bis Band 2. BW=5 MHz. QPSK. RB Size=1. RB Offset=Max. High Block Edge:



The equipment transmits at the maximum output power.

LTE Cat 1bis Band 2. BW=5 MHz. QPSK. RB Size=All. RB Offset=0. High Block Edge:



The equipment transmits at the maximum output power.

LTE Cat1-bis Band 25:

Preliminary measurements determined QPSK, BW=5 MHz as the worst-case.

LTE Cat1-bis Band 25. QPSK.	RB=1. Offset =0. BW=1.4 MHz	RB=1. Offset =0. BW=3 MHz	RB=1. Offset =0. BW=5 MHz	RB=1. Offset =0. BW=10 MHz	RB=1. Offset =0. BW=15 MHz	RB=1. Offset =0. BW=20 MHz
Maximum measured level at <u>Low Block Edge</u> at antenna port (dBm)			-21.76	-24.85	-29.86	-29.94

LTE Cat1-bis Band 25. QPSK.	RB=All. Offset=0. BW=1.4 MHz	RB=All. Offset=0. BW=3 MHz	RB=All. Offset=0. BW=5 MHz	RB=All. Offset=0. BW=10 MHz	RB=All. Offset=0. BW=15 MHz	RB=All. Offset=0. BW=20 MHz
Maximum measured level at <u>Low Block Edge</u> at antenna port (dBm)			-24.42	-24.94	-31.3	-33.12

LTE Cat1-bis Band 25. QPSK.	RB=1. Offset =Max. BW=1.4 MHz	RB=1. Offset =Max. BW=3 MHz	RB=1. Offset =Max. BW=5 MHz	RB=1. Offset =Max. BW=10 MHz	RB=1. Offset =Max. BW=15 MHz	RB=1. Offset =Max. BW=20 MHz
Maximum measured level at <u>High Block Edge</u> at antenna port (dBm)			-21.77	-25.43	-29.99	-34.29

LTE Cat1-bis Band 25. QPSK.	RB=All. Offset=0. BW=1.4 MHz	RB=All. Offset=0. BW=3 MHz	RB=All. Offset=0. BW=5 MHz	RB=All. Offset=0. BW=10 MHz	RB=All. Offset=0. BW=15 MHz	RB=All. Offset=0. BW=20 MHz
Maximum measured level at <u>High Block Edge</u> at antenna port (dBm)			-25.22	-25.08	-30.06	-33

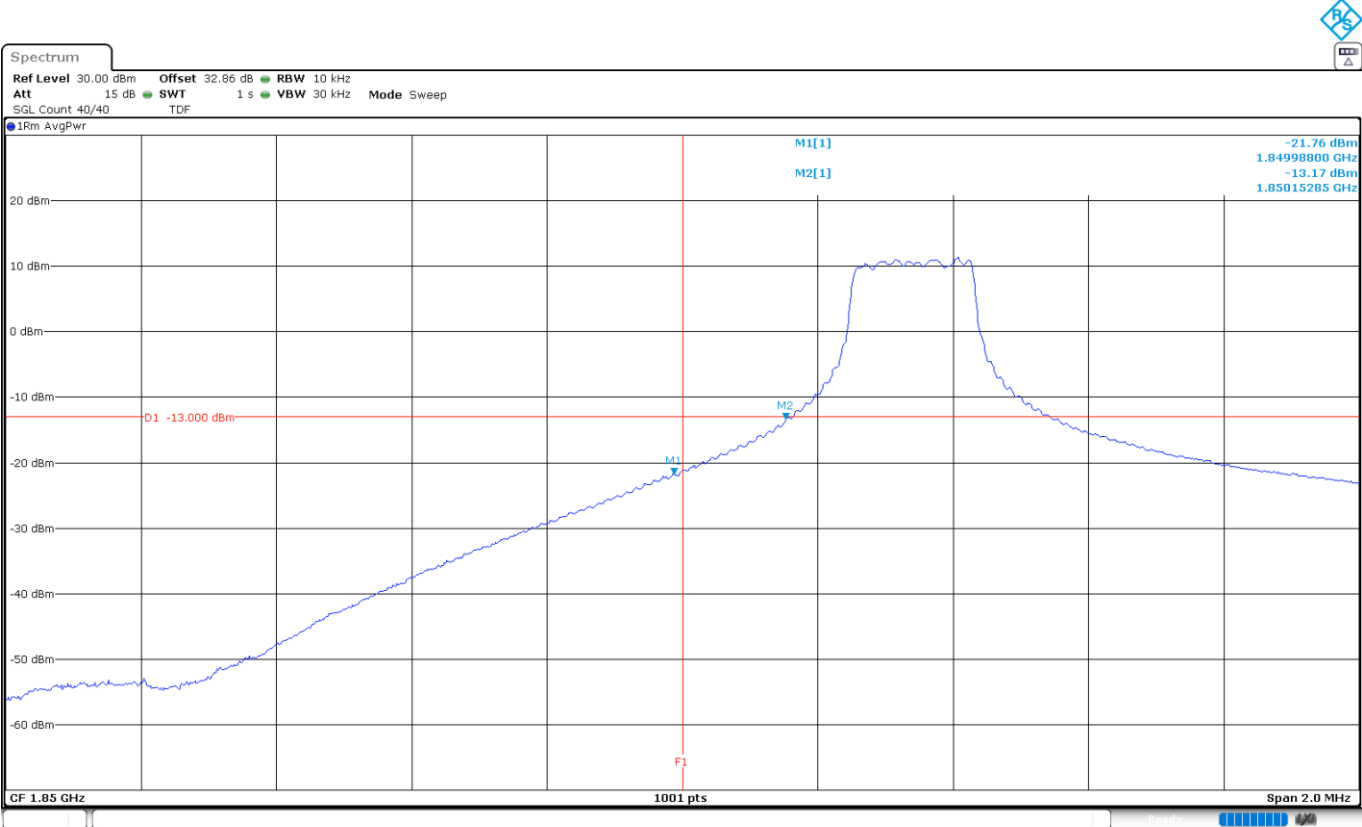
Measurement uncertainty (dB) $< \pm 2.76$

Verdict

PASS

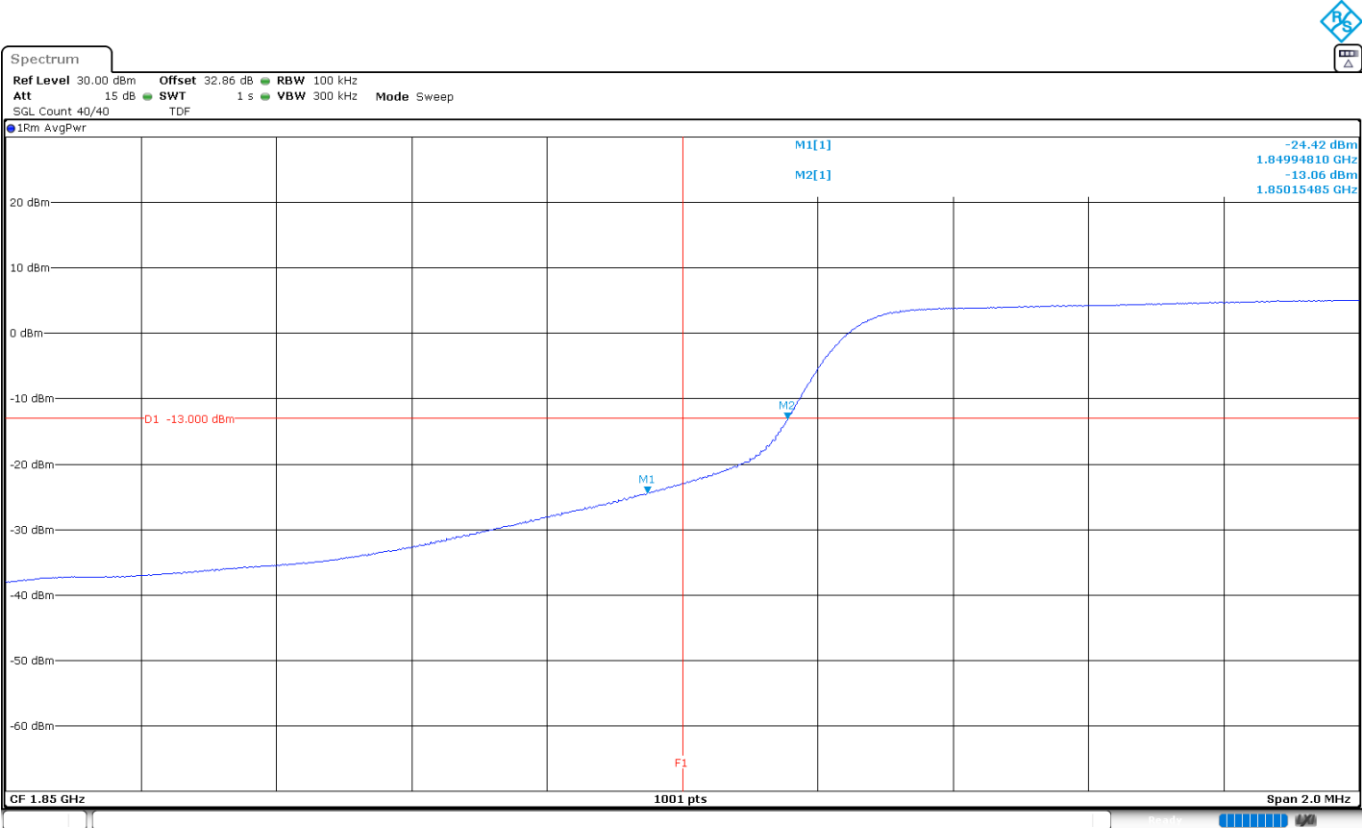
The plots below are for the worst case configuration specified before.

LTE Cat1-bis Band 25. BW=5 MHz. QPSK. RB Size=1. RB Offset=0. Low Block Edge:



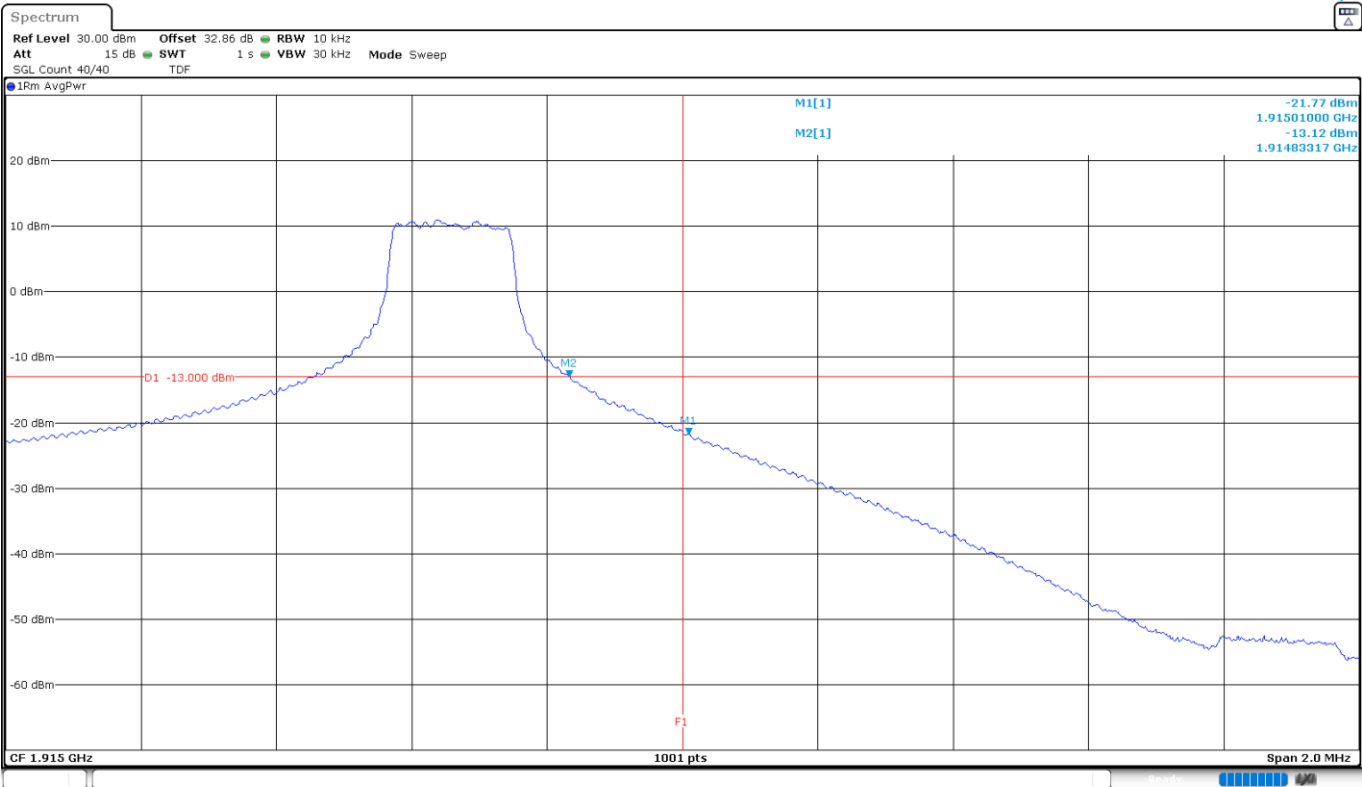
The equipment transmits at the maximum output power.

LTE Cat1-bis Band 25. BW=5 MHz. QPSK. RB Size=All. RB Offset=0. Low Block Edge:



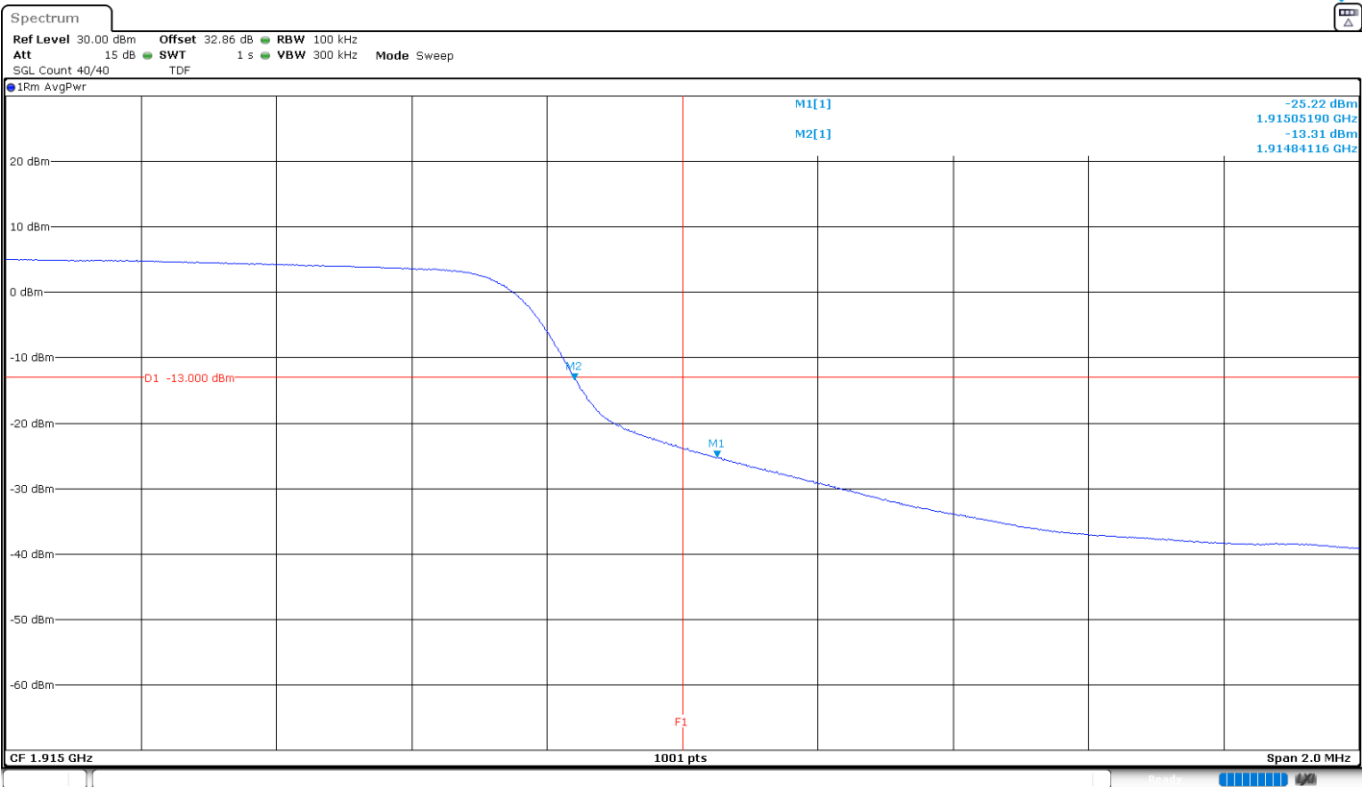
The equipment transmits at the maximum output power.

LTE Cat1-bis Band 25. BW=5 MHz. QPSK. RB Size=1. RB Offset=Max. High Block Edge:



The equipment transmits at the maximum output power.

LTE Cat1-bis Band 25. BW=5 MHz. QPSK. RB Size=All. RB Offset=0. High Block Edge:



The equipment transmits at the maximum output power.

Radiated emissions

Limits

* FCC §2.1051 and §24.238. RSS-133, Clause 6.5.

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

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater.

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

$$P_o \text{ (dBm)} - [43 + 10 \log(P_o \text{ in mW}) - 30] = -13 \text{ dBm}$$

Method

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

The EUT was placed on a non-conductive stand at 3-meter distance from the measuring antenna for measurements up to 17 GHz. Measurements above 17 GHz require the distance to be reduced to 1.5 meters.

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

Measurement Limit:

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

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

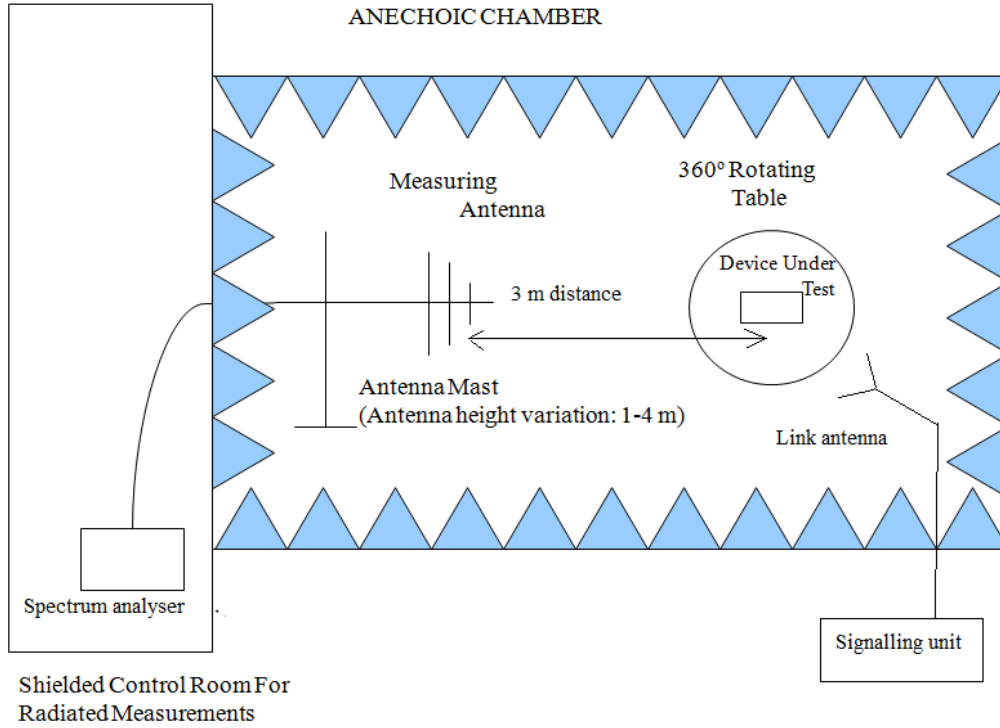
The maximum field strength (dBμV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

$$\text{EIRP (dBm)} = E \text{ (dBμV/m)} + 20 \log(D) - 104.8;$$

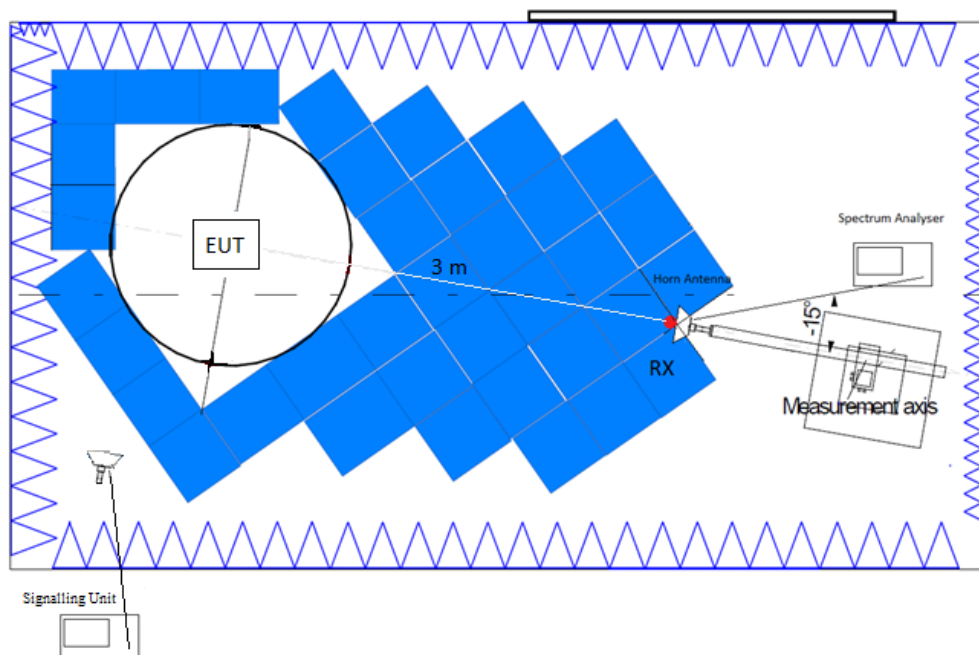
where D is the measurement distance (in the far field region) in m.

Test Setup

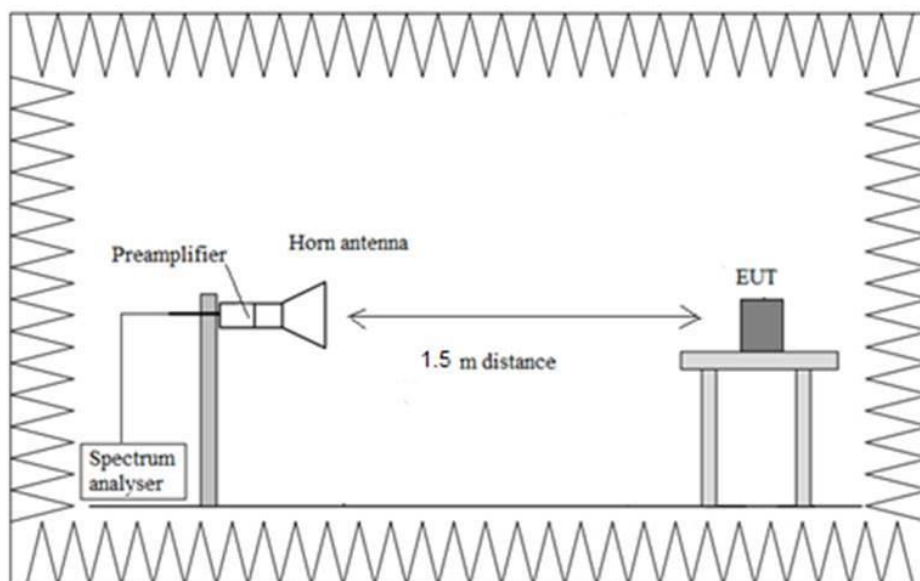
Radiated measurements below 1 GHz:



Radiated measurements above 1 GHz up to 17 GHz:



Radiated measurements above 17 GHz:



Results

LTE Cat1-bis Band 25:

INTERNAL ANTENNA:

A preliminary scan determined the BW=5 MHz. QPSK. RB Size=1. RB Offset=0 as the worst case. The following results are for this worst-case configuration.

Frequency range 30 MHz - 1 GHz:

- Low Channel:

No spurious signals were found at less than 20 dB below the limit.

- Middle Channel:

No spurious signals were found at less than 20 dB below the limit.

- High Channel:

No spurious signals were found at less than 20 dB below the limit.

Frequency range 1 - 20 GHz:

- Low Channel:

No spurious signals were found at less than 20 dB below the limit.

- Middle Channel:

No spurious signals were found at less than 20 dB below the limit.

- High Channel:

No spurious signals were found at less than 20 dB below the limit.

Measurement uncertainty (dB) $< \pm 5.03$ for $f < 1$ GHz
 $< \pm 4.32$ for $f \geq 1$ GHz up to 17 GHz
 $< \pm 4.58$ for $f \geq 17$ GHz up to 20 GHz

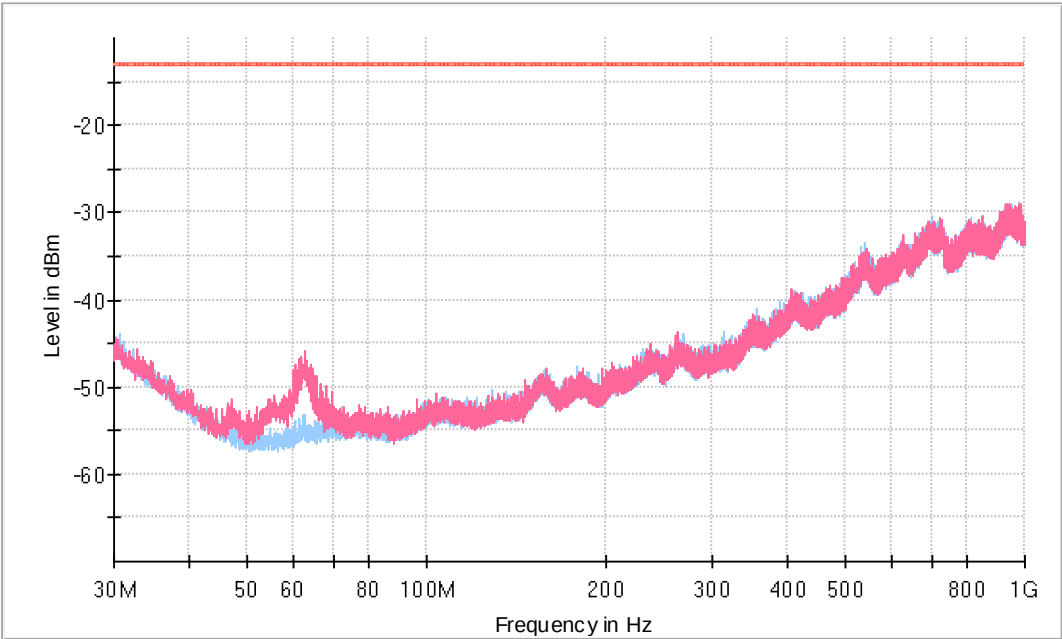
Verdict Pass

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESW 44]					
30 MHz - 1 GHz	30,312 kHz	PK+	1 MHz	Coupled	0 dB
1 GHz - 3 GHz	62,5 kHz	PK+	1 MHz	1 s	0 dB
3 GHz - 17 GHz	437,5 kHz	PK+	1 MHz	1 s	0 dB

FREQUENCY RANGE 30 MHz - 1 GHz:

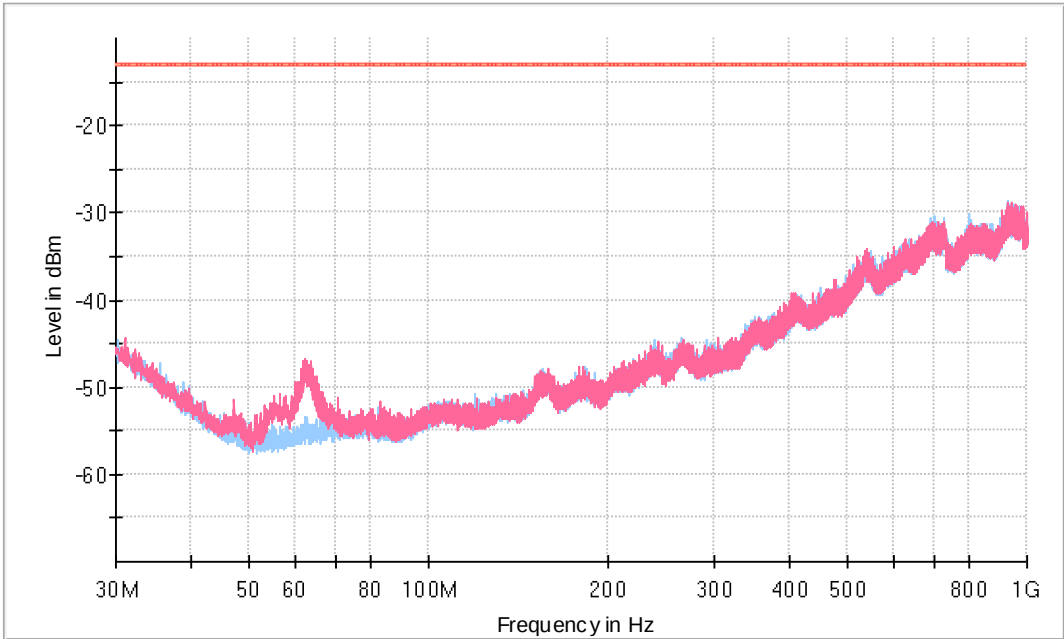
- Low Channel:

Full Spectrum



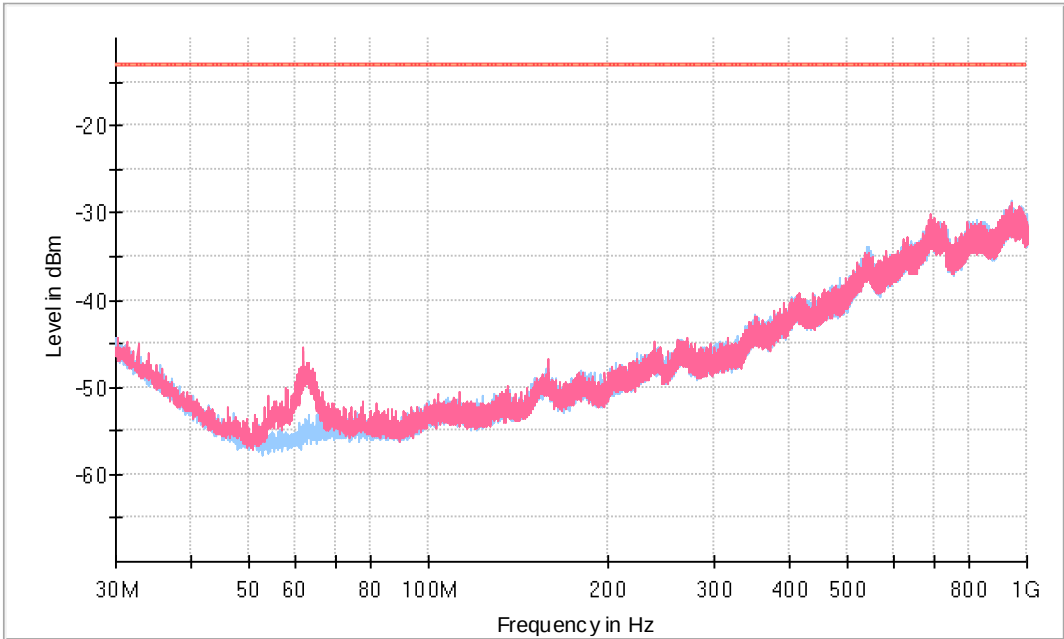
- Middle Channel:

Full Spectrum



- High Channel:

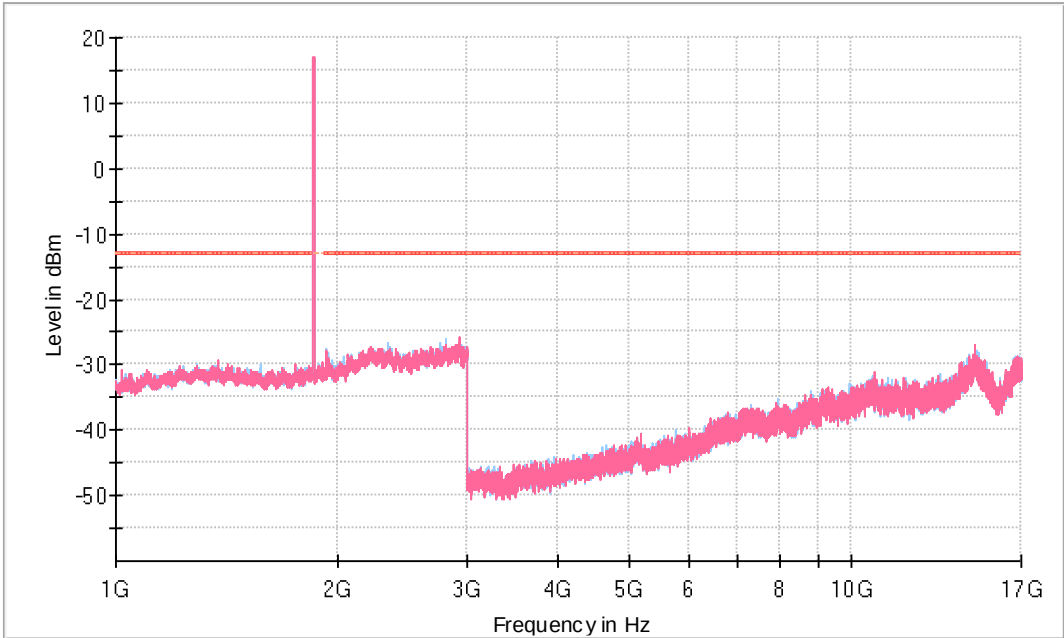
Full Spectrum



FREQUENCY RANGE 1 - 20 GHz:

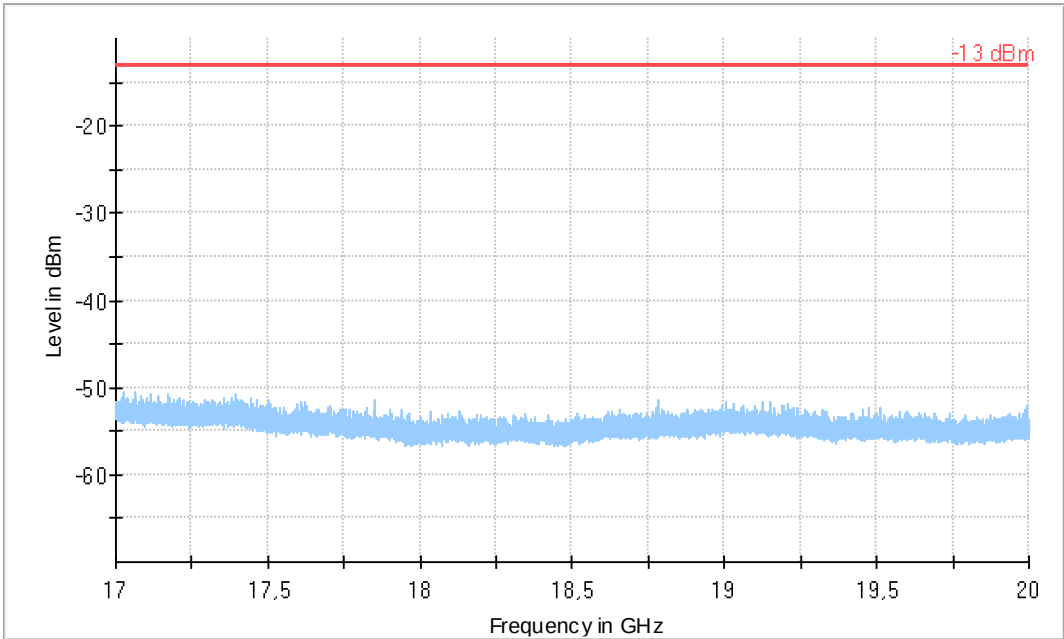
- Low Channel:

Full Spectrum



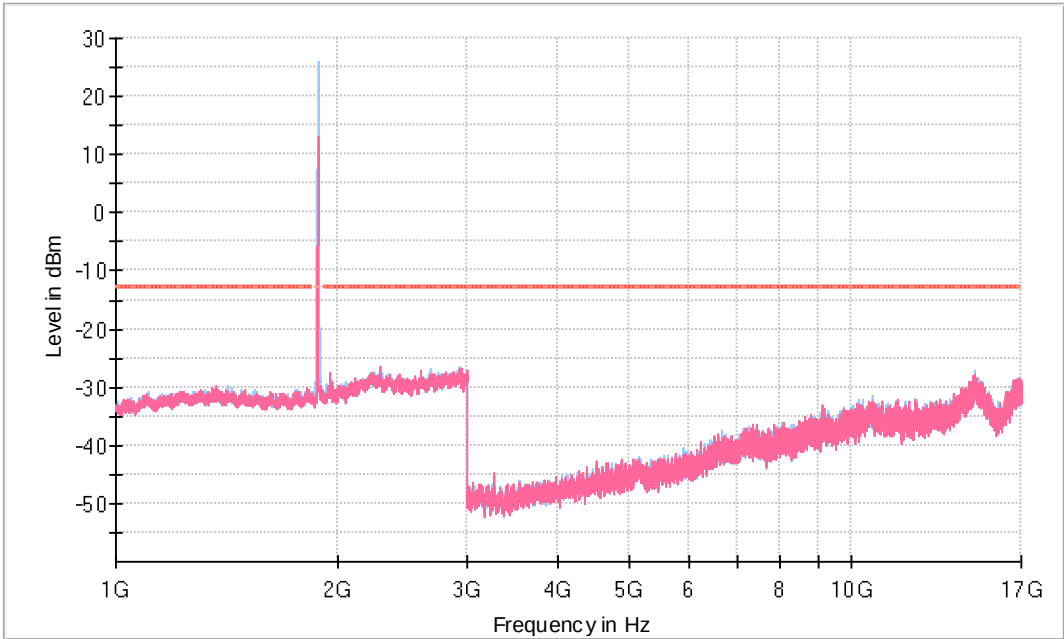
The peak above the limit is the carrier frequency.

Full Spectrum



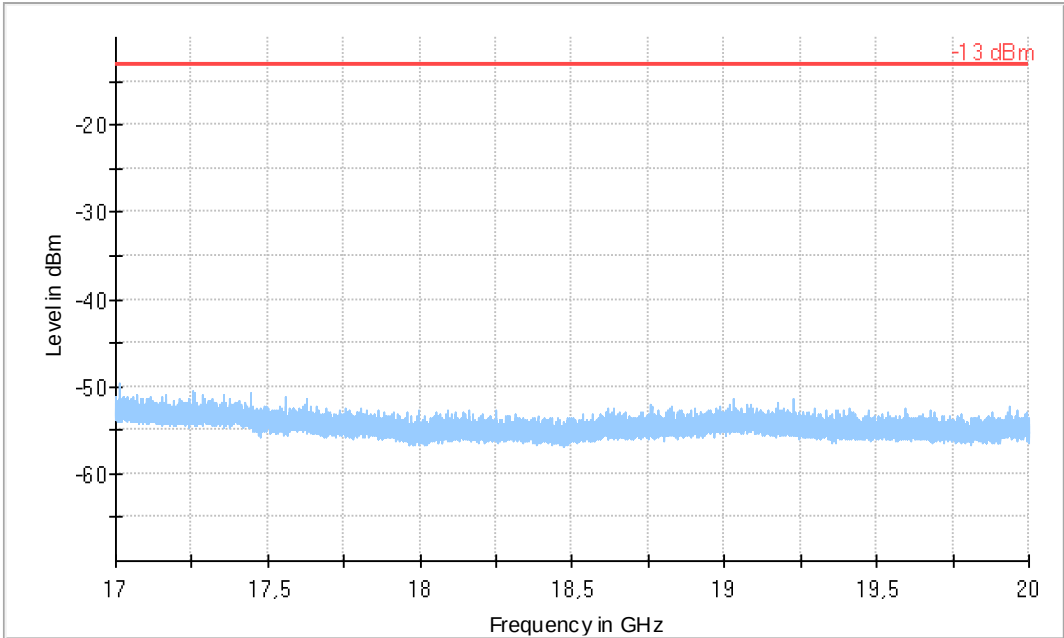
- Middle Channel:

Full Spectrum



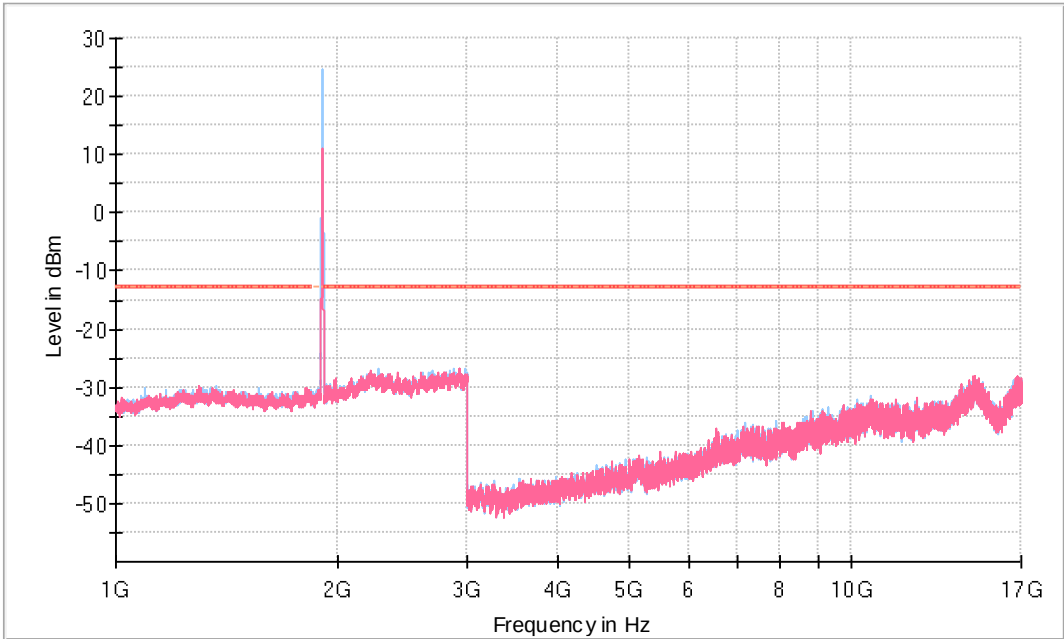
The peak above the limit is the carrier frequency.

Full Spectrum



- High Channel:

Full Spectrum



The peak above the limit is the carrier frequency.

Full Spectrum

