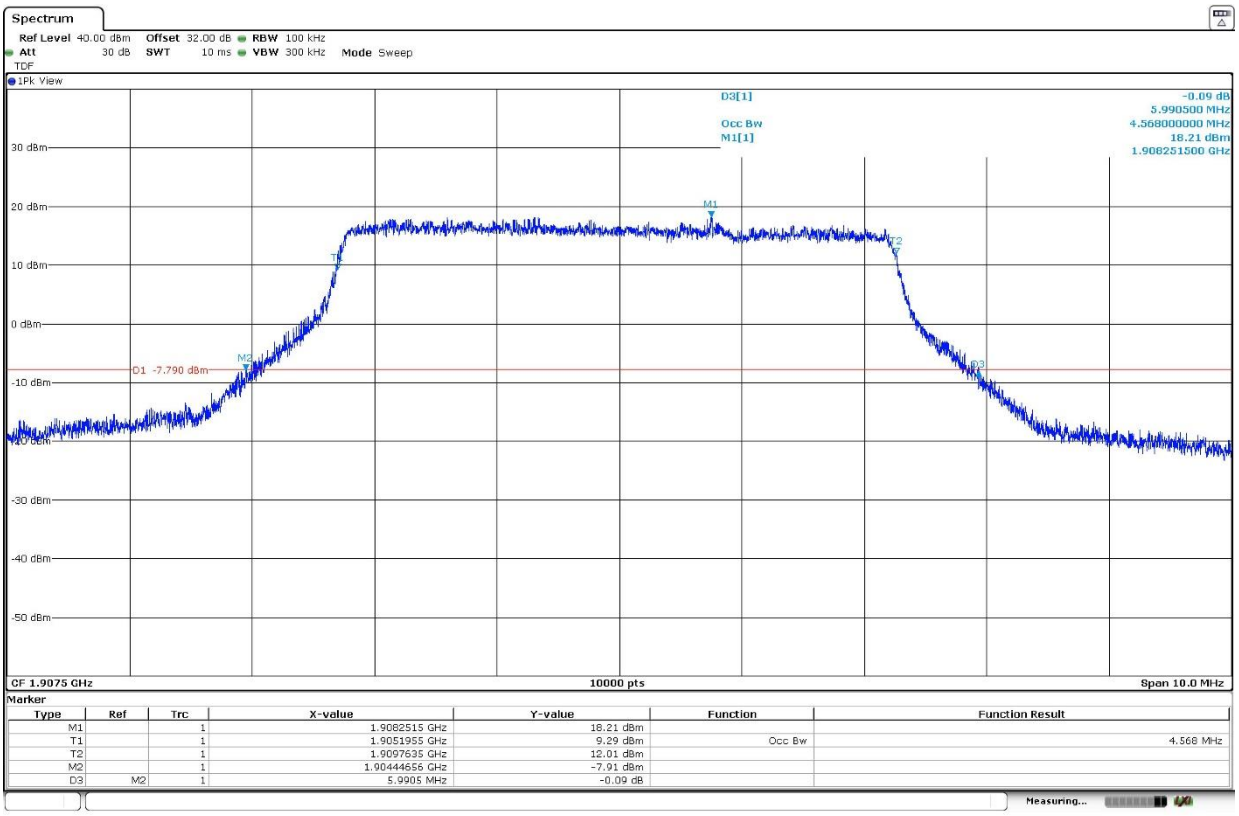
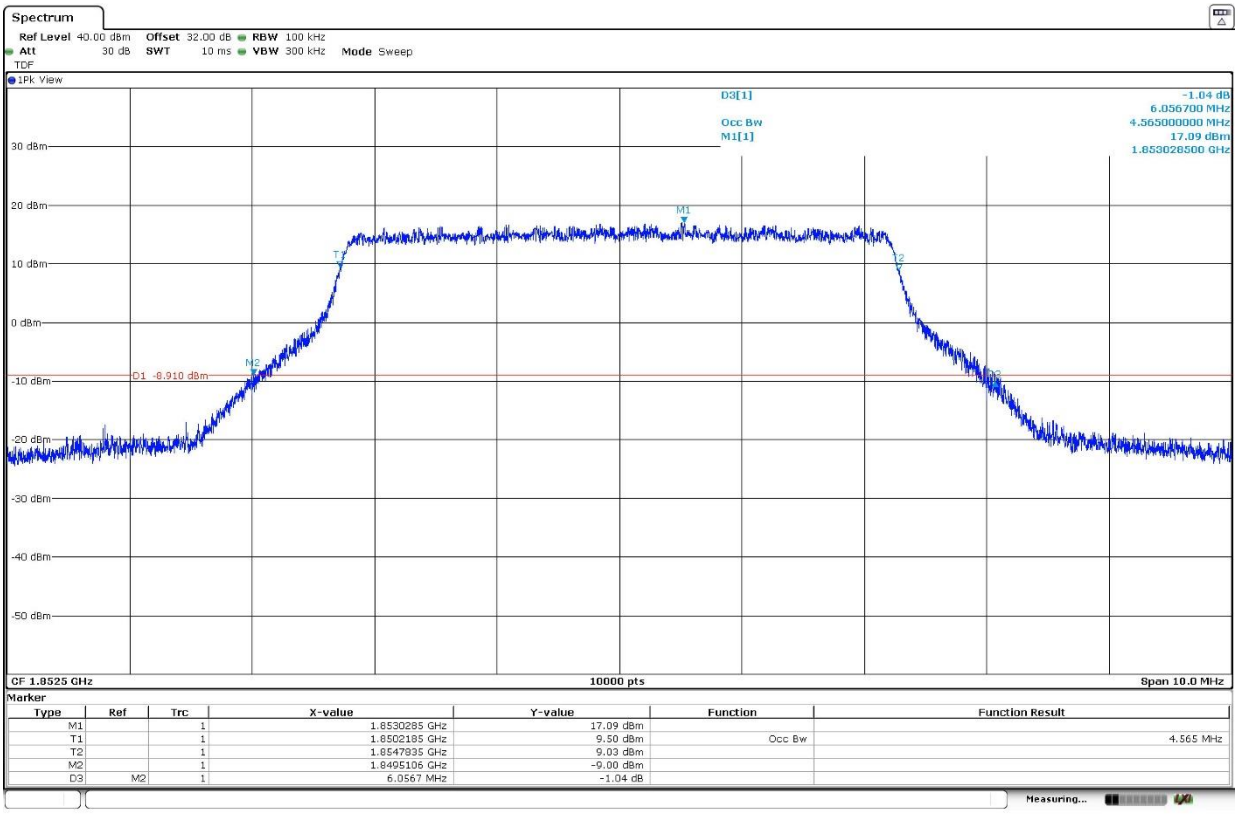
High Channel:

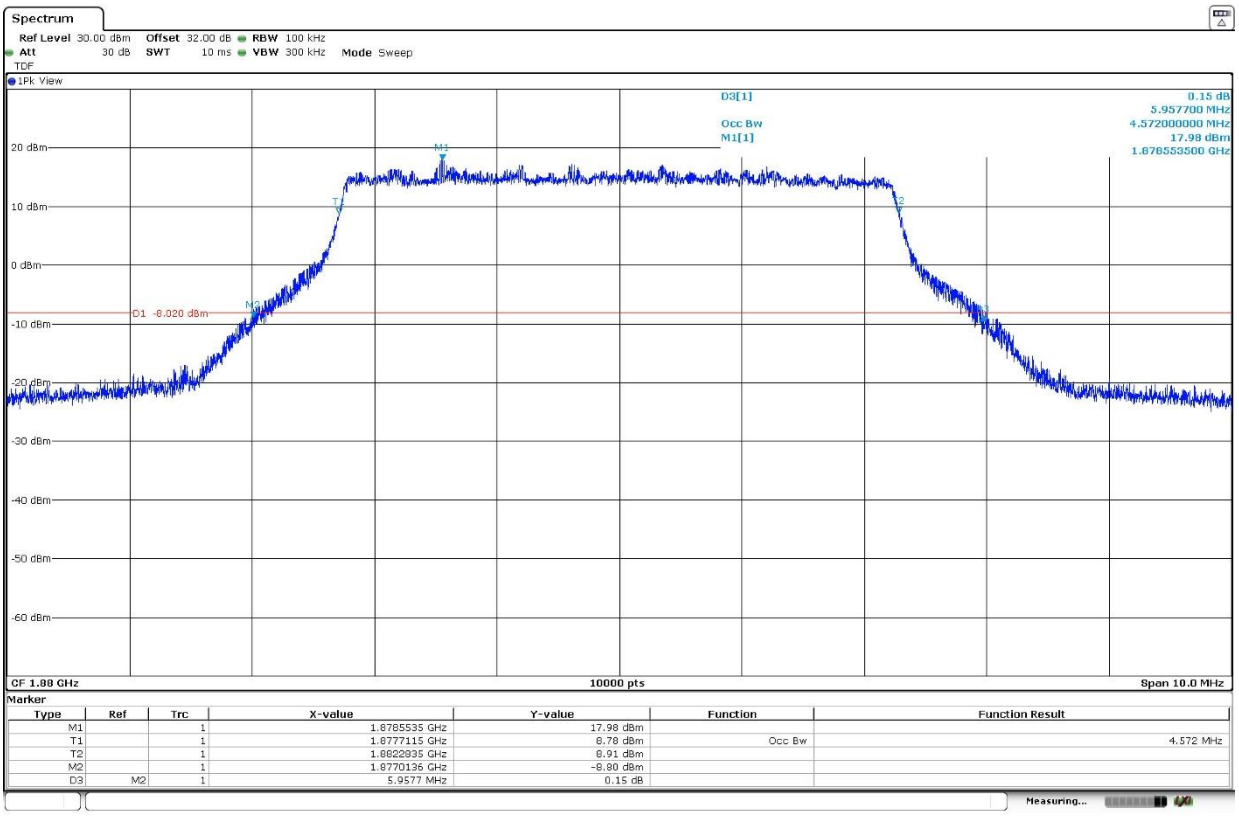


LTE Cat-4 Band 2. BW=5 MHz. 16QAM. RB Size=All.

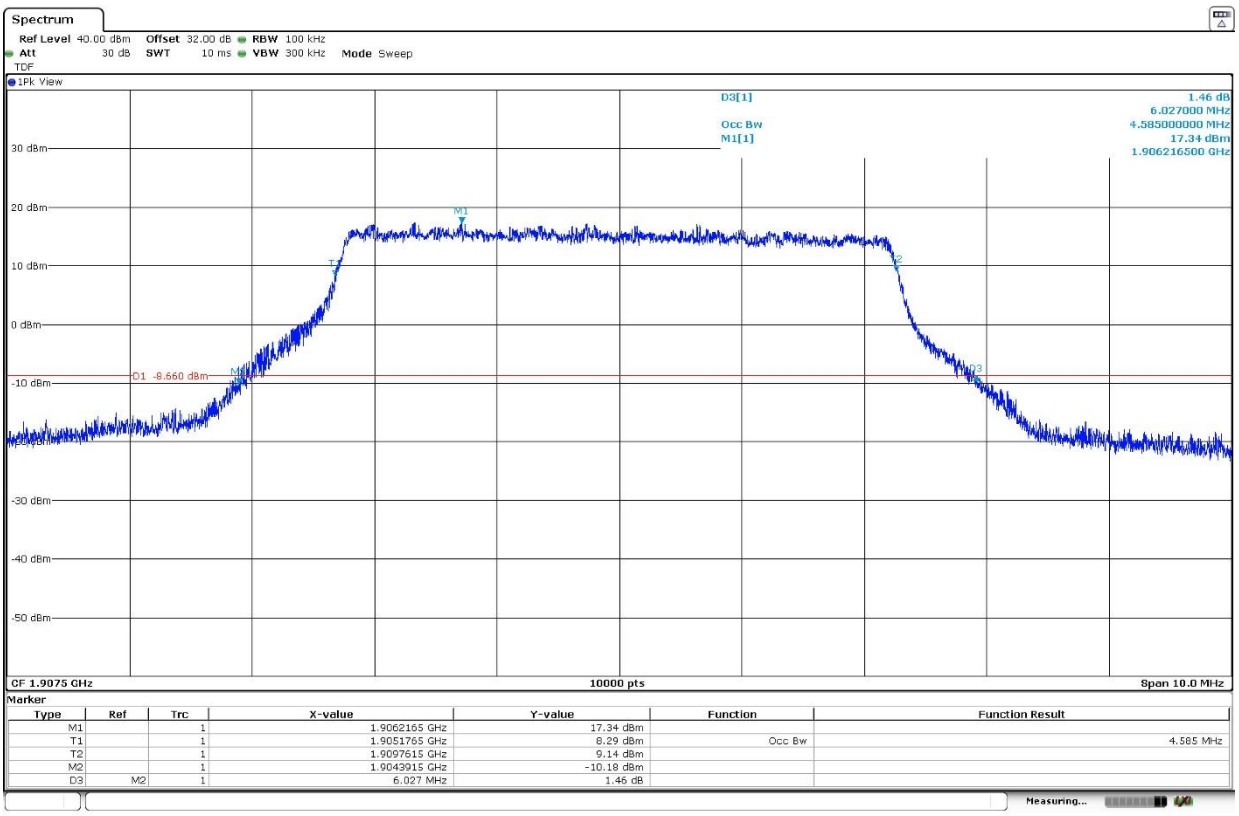
Low Channel:



Middle Channel:



High Channel:



LTE Cat-4 Band 2. BW=10 MHz. QPSK. RB Size=All. RB Offset=0.

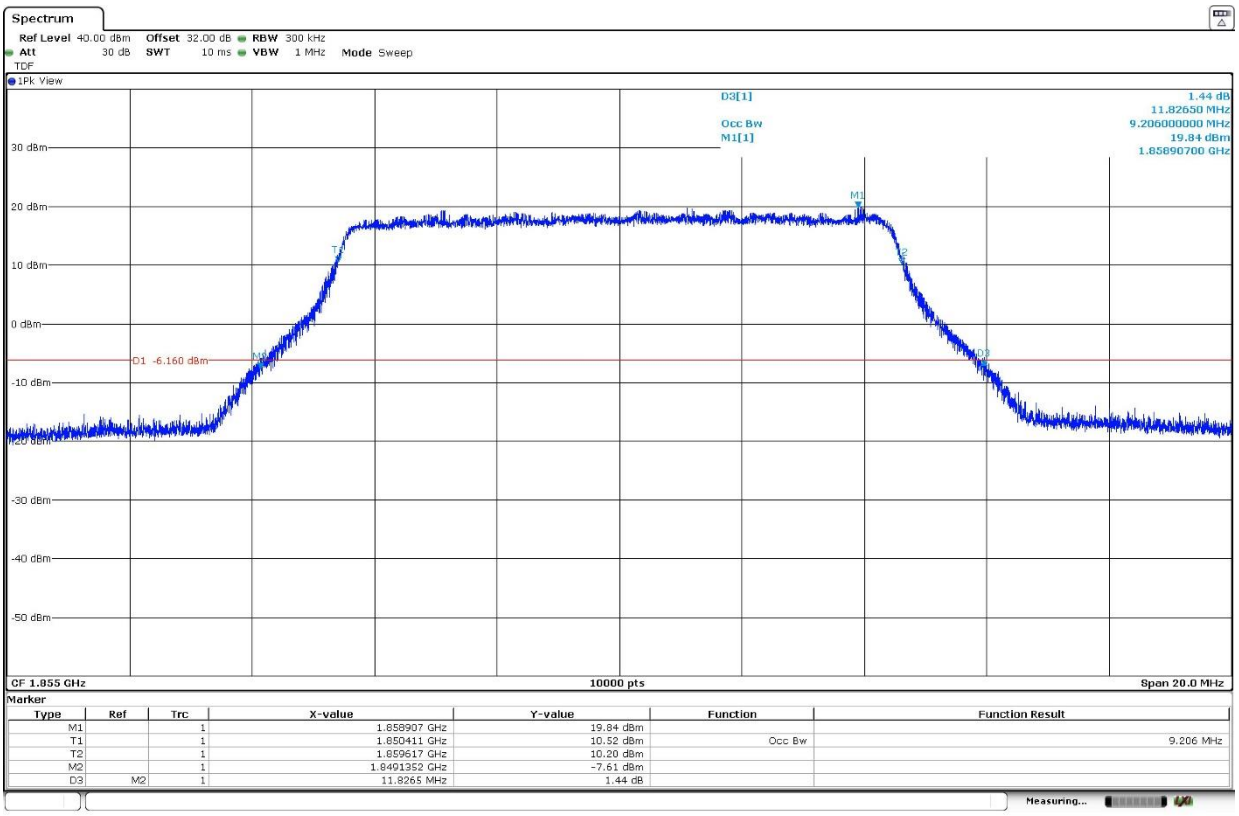
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	9.206	9.206	9.156
-26 dBc Bandwidth (MHz)	11.827	12.006	11.632
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-4 Band 2. BW=10 MHz. 16QAM. RB Size=All. RB Offset=0.

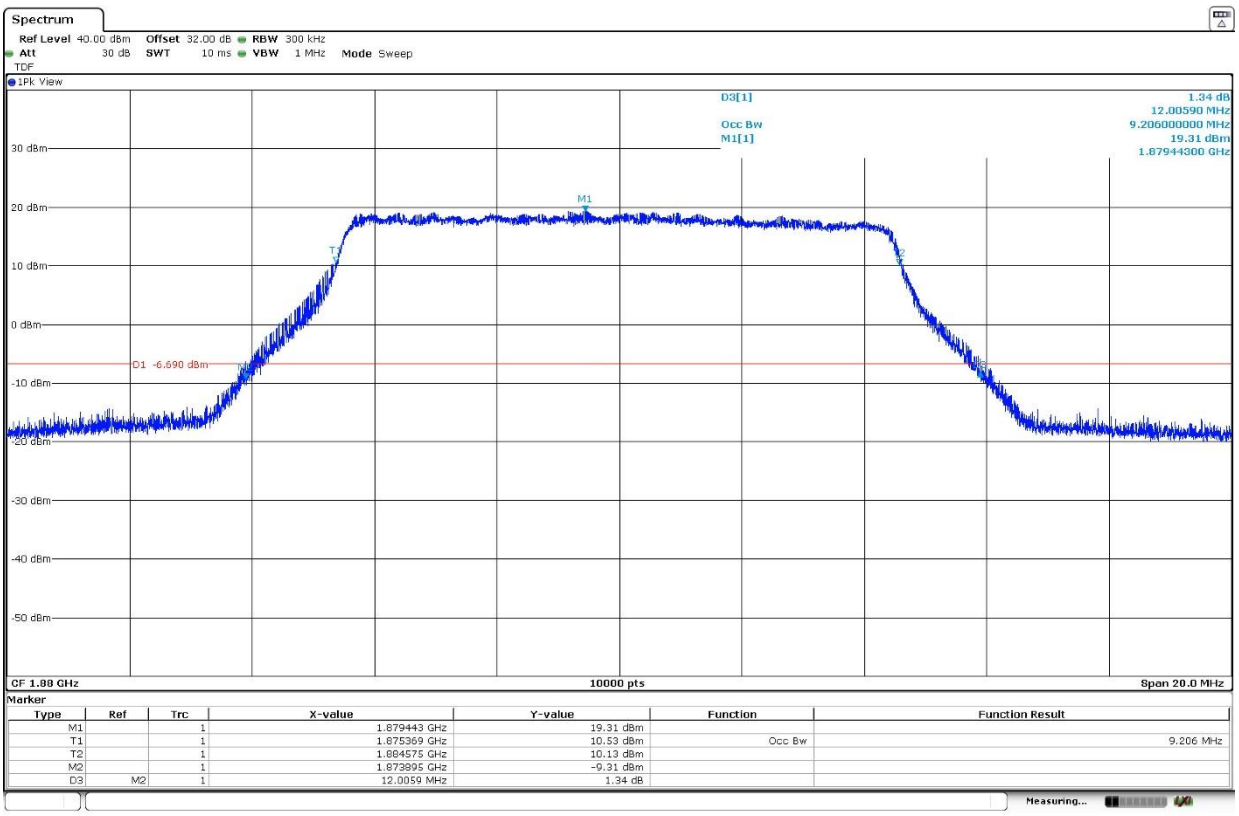
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	9.166	9.156	9.120
-26 dBc Bandwidth (MHz)	11.718	11.747	11.507
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-4 Band 2. BW=10 MHz. QPSK. RB Size=All.

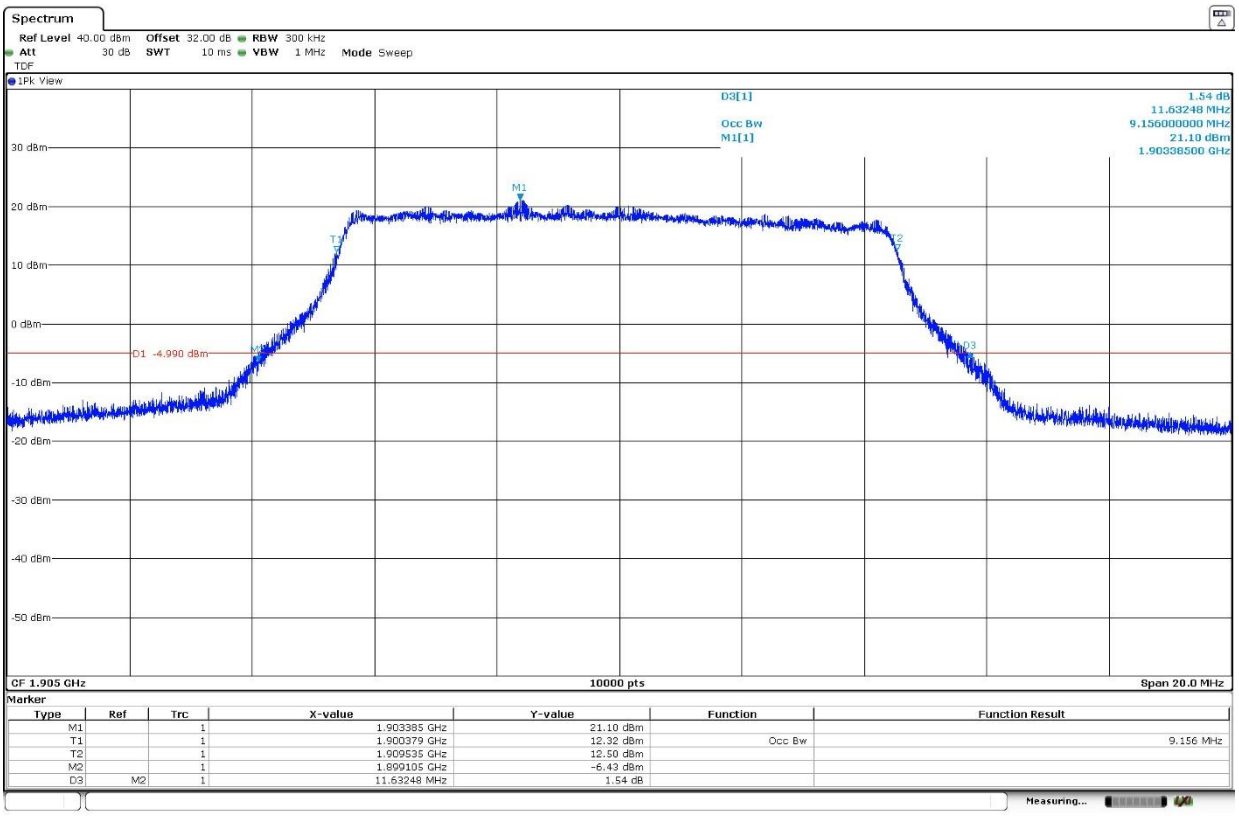
Low Channel:



Middle Channel:

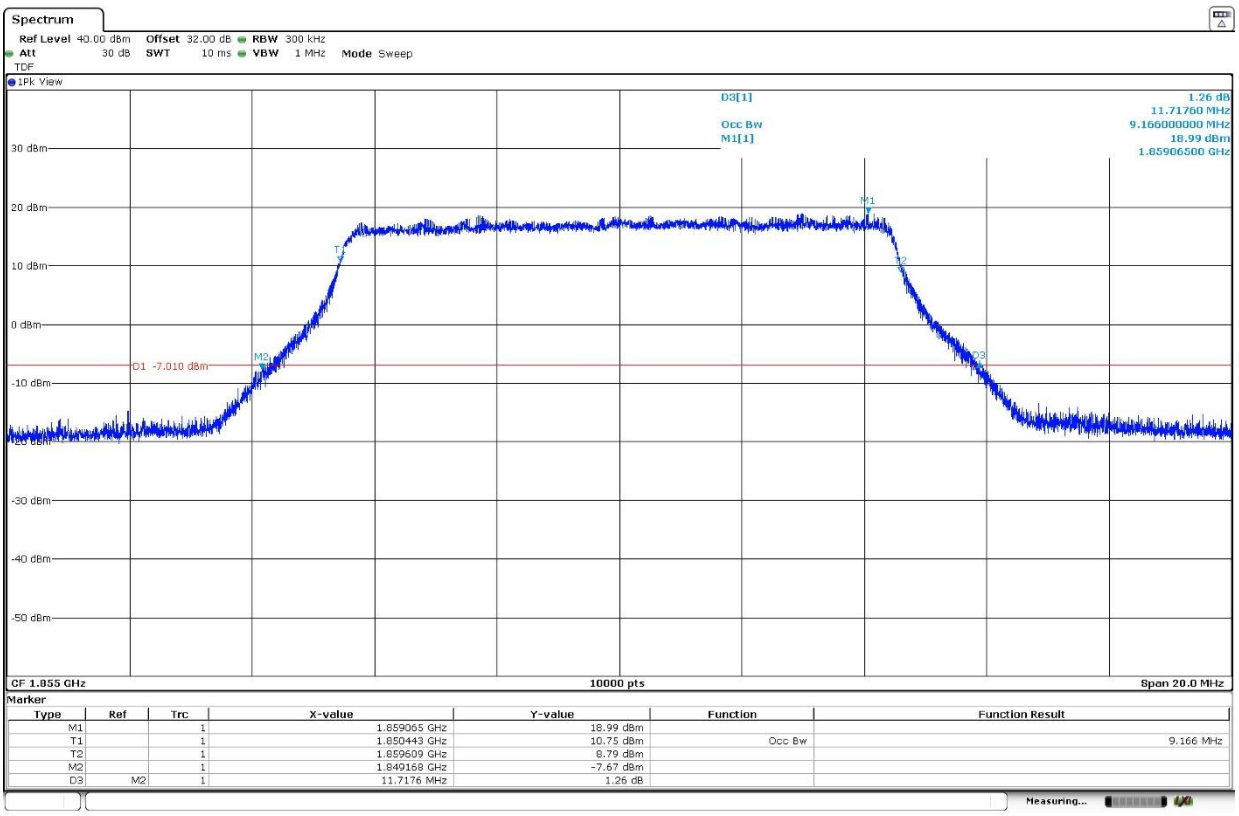


High Channel:

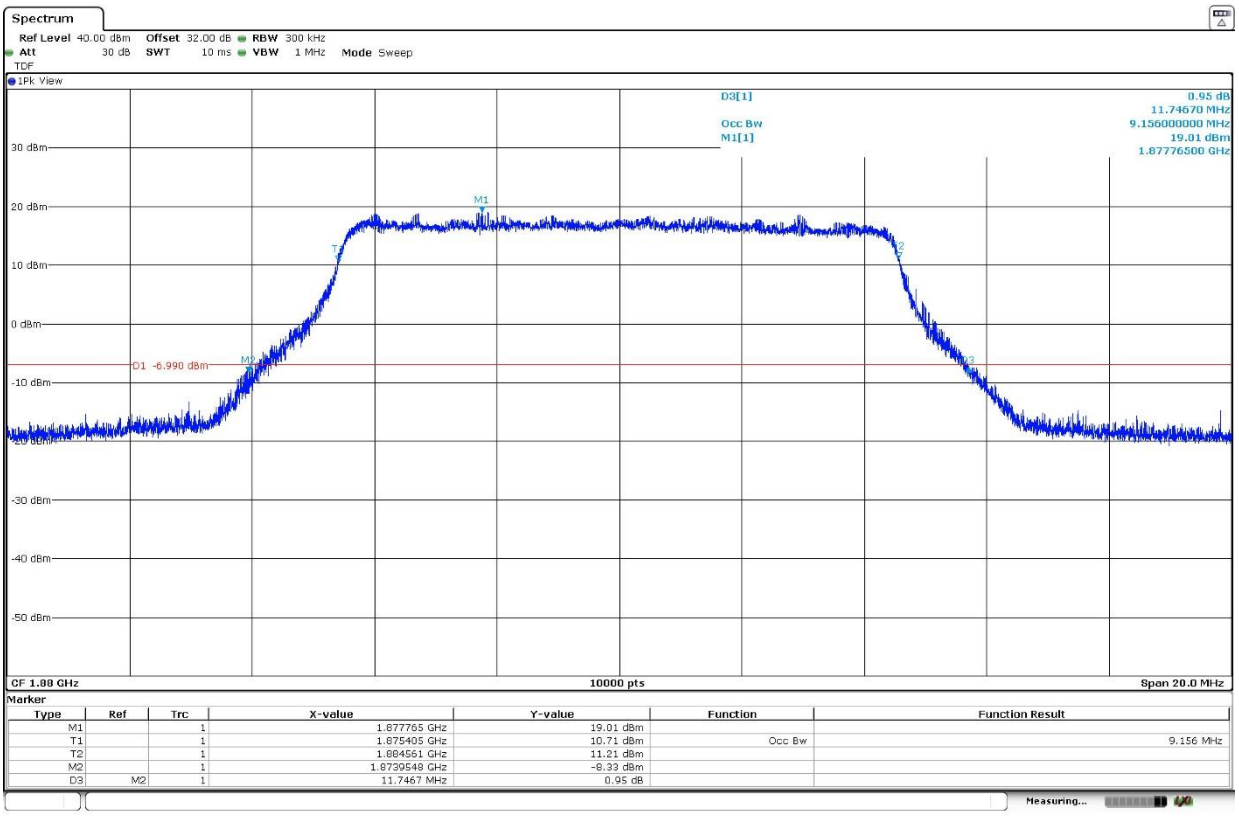


LTE Cat-4 Band 2. BW=10 MHz. 16QAM. RB Size=All.

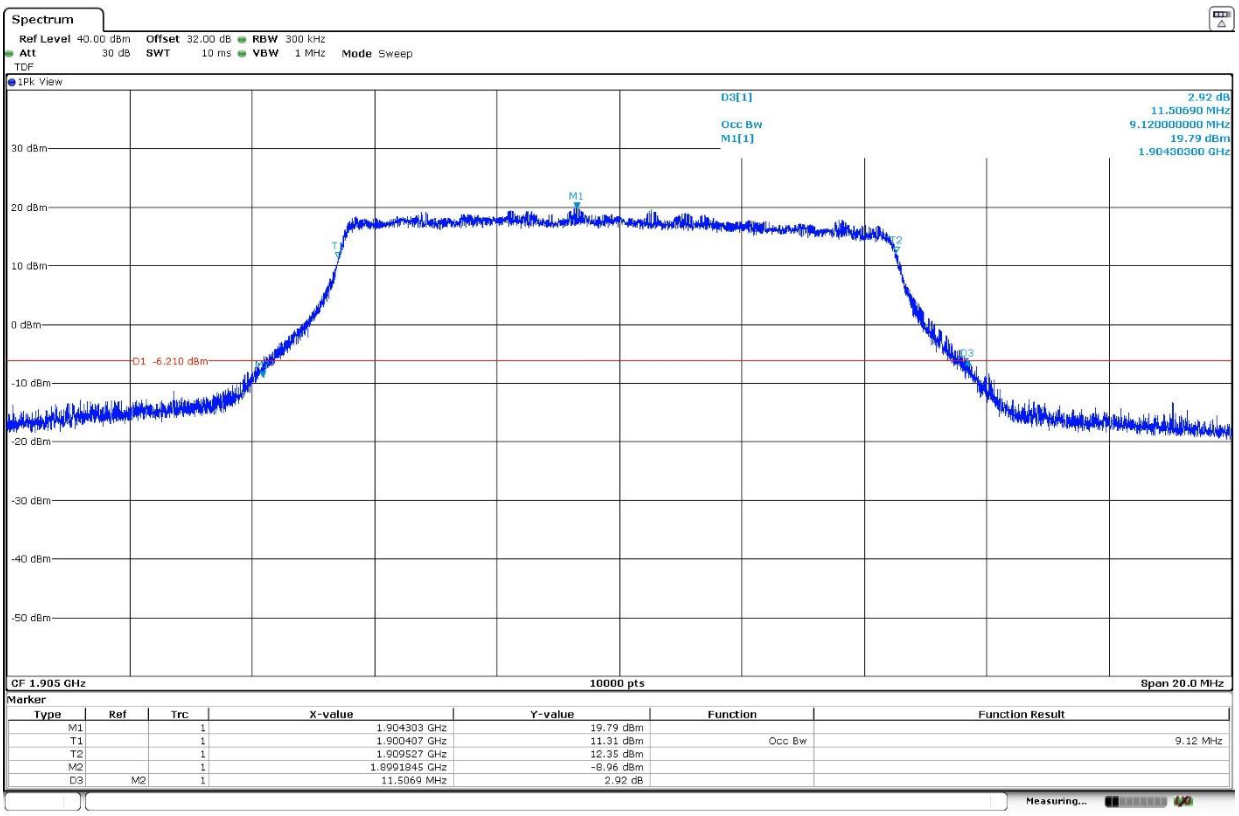
Low Channel:



Middle Channel:



High Channel:



LTE Cat-4 Band 2. BW=15 MHz. QPSK. RB Size=All. RB Offset=0.

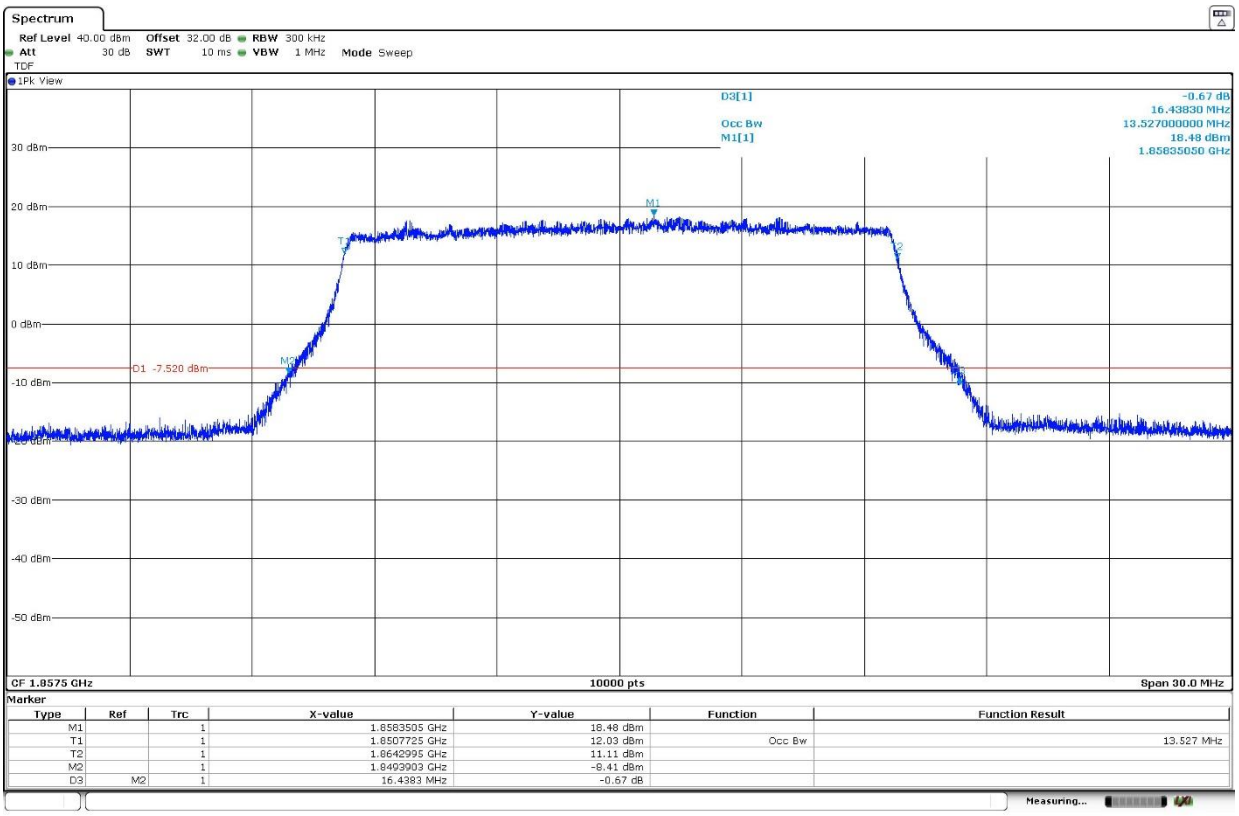
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	13.527	13.542	13.455
-26 dBc Bandwidth (MHz)	16.438	16.425	16.330
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-4 Band 2. BW=15 MHz. 16QAM. RB Size=All. RB Offset=0.

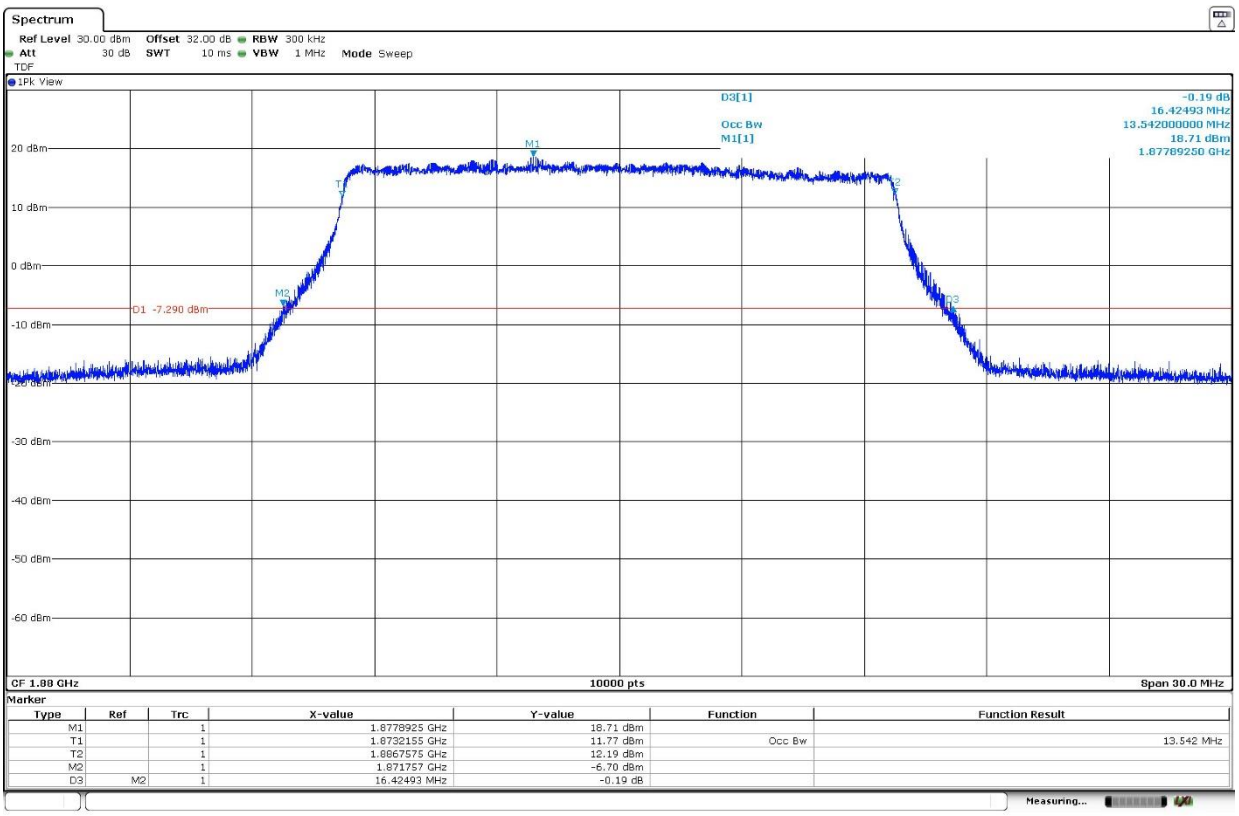
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	13.551	13.533	13.476
-26 dBc Bandwidth (MHz)	16.373	16.088	16.133
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-4 Band 2. BW=15 MHz. QPSK. RB Size=All.

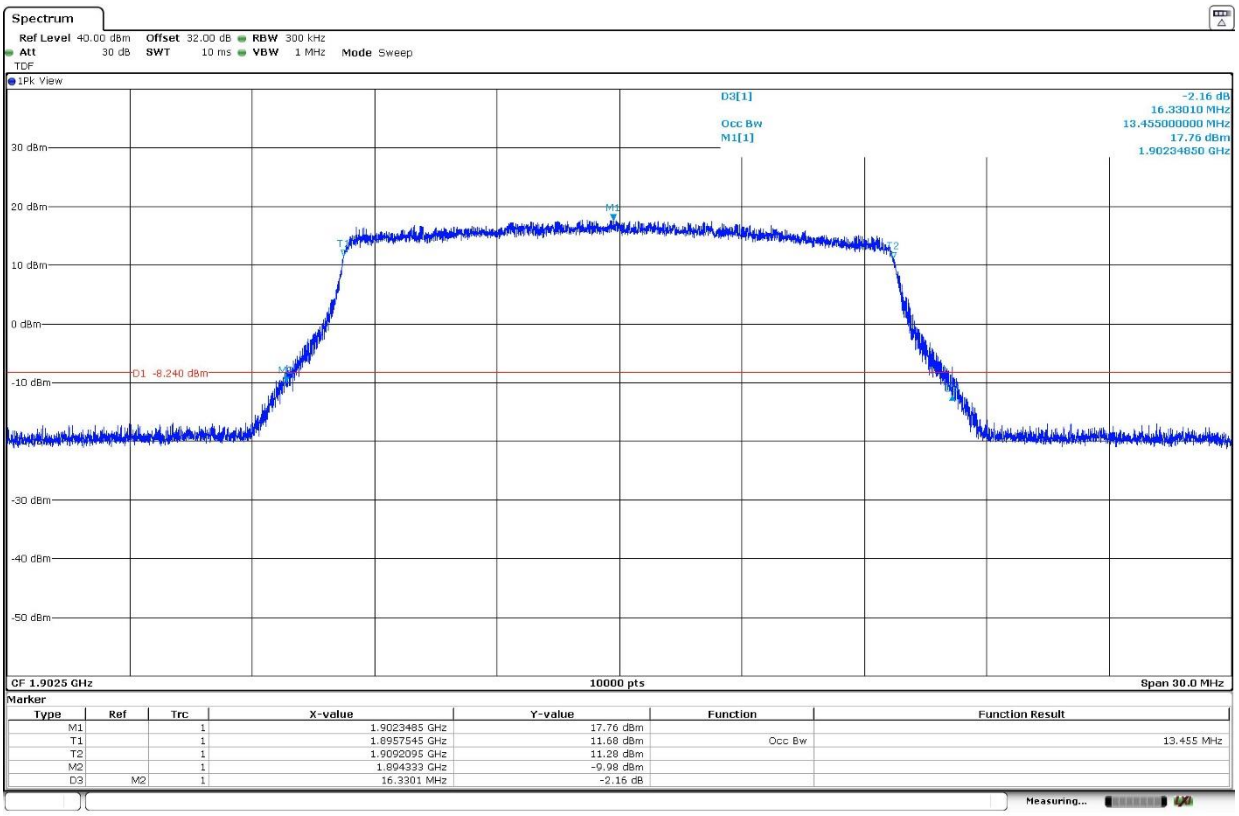
Low Channel:



Middle Channel:

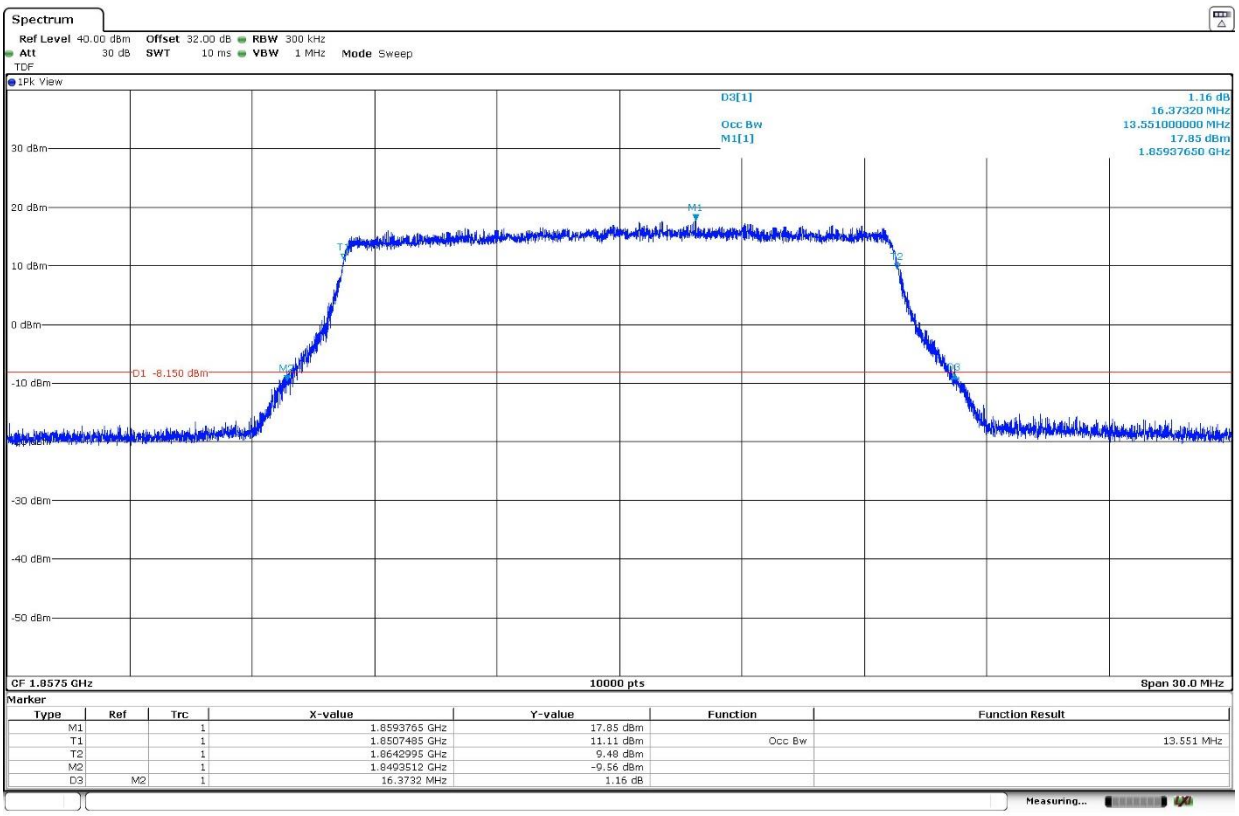


High Channel:

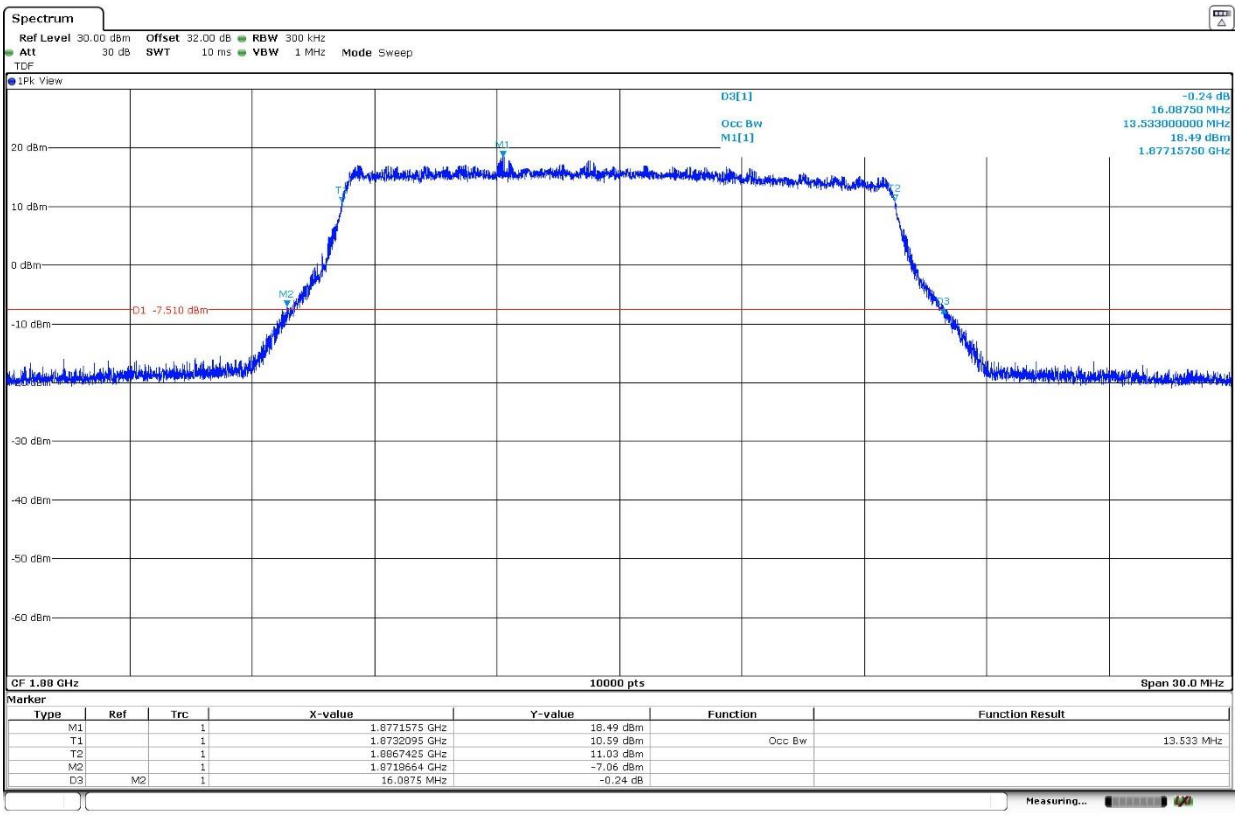


LTE Cat-4 Band 2. BW=15 MHz. 16QAM. RB Size=All.

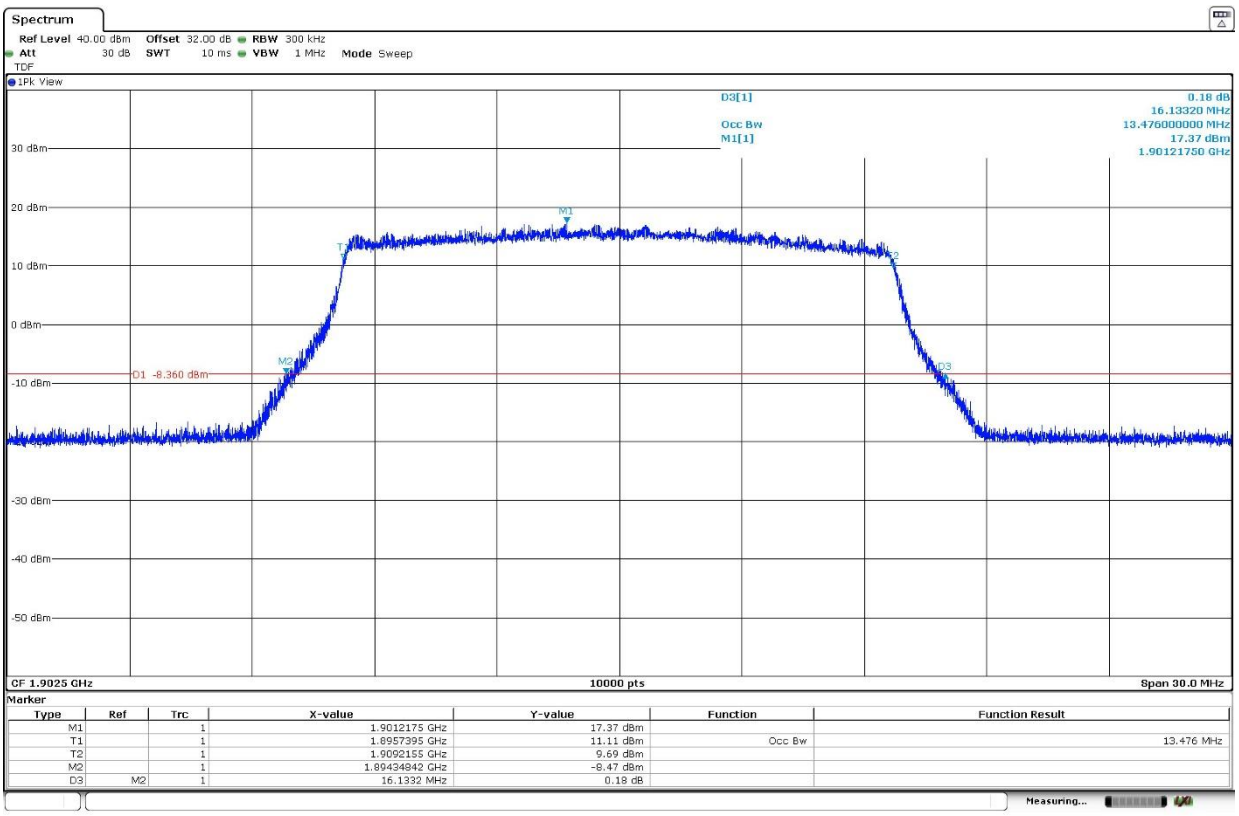
Low Channel:



Middle Channel:



High Channel:



LTE Cat-4 Band 2. BW=20 MHz. QPSK. RB Size=All. RB Offset=0.

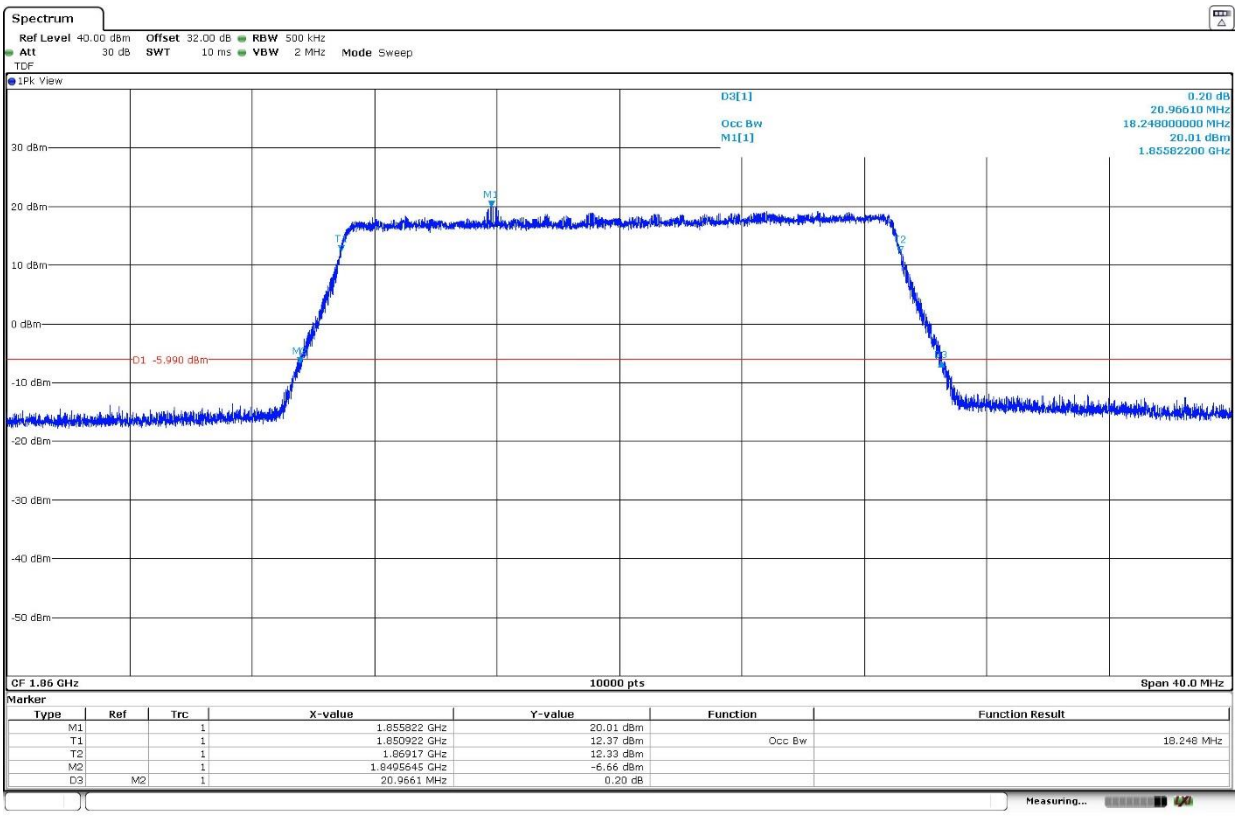
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	18.248	17.988	18.084
-26 dBc Bandwidth (MHz)	20.966	20.598	20.841
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-4 Band 2. BW=20 MHz. 16QAM. RB Size=All. RB Offset=0.

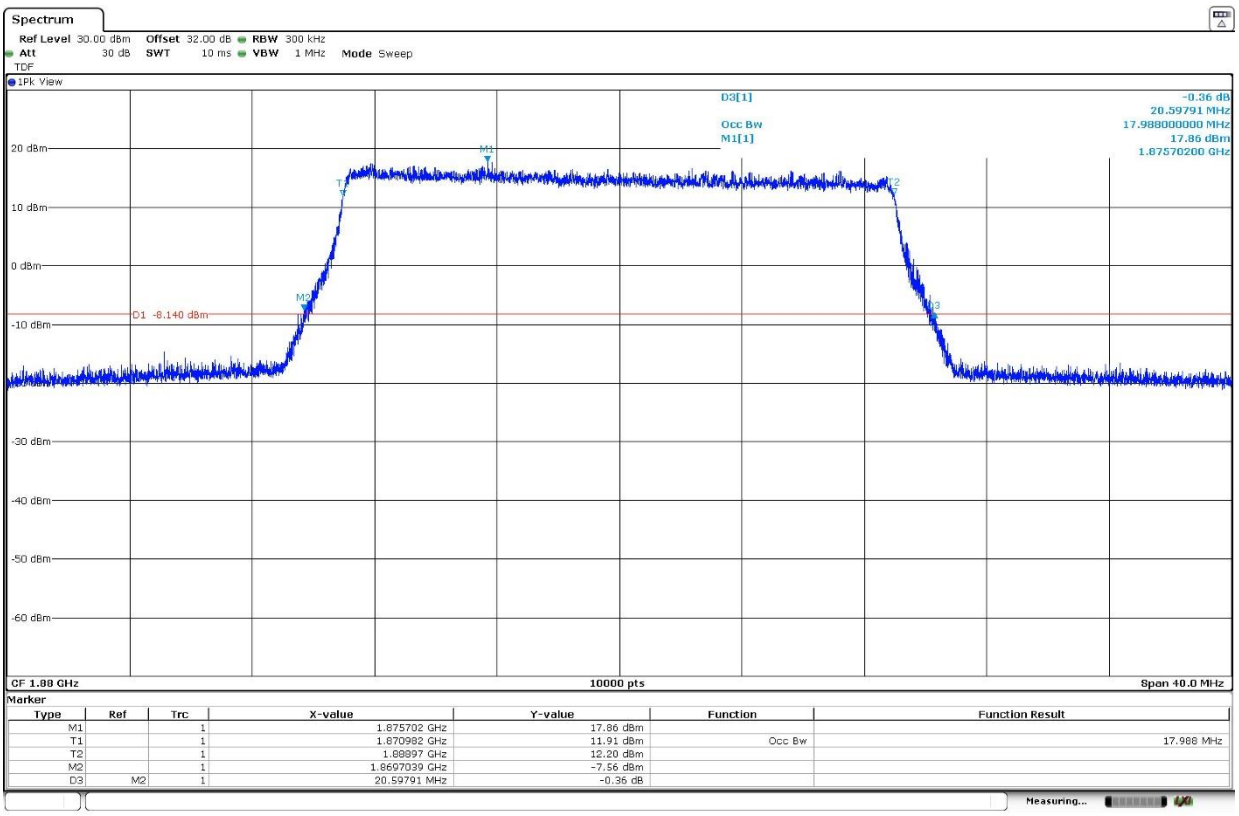
Channel	Low	Middle	High
99% Occupied Bandwidth (MHz)	18.248	18.024	18.112
-26 dBc Bandwidth (MHz)	21.104	20.672	20.859
Measurement uncertainty (kHz)	<±3.75		

LTE Cat-4 Band 2. BW=20 MHz. QPSK. RB Size=All.

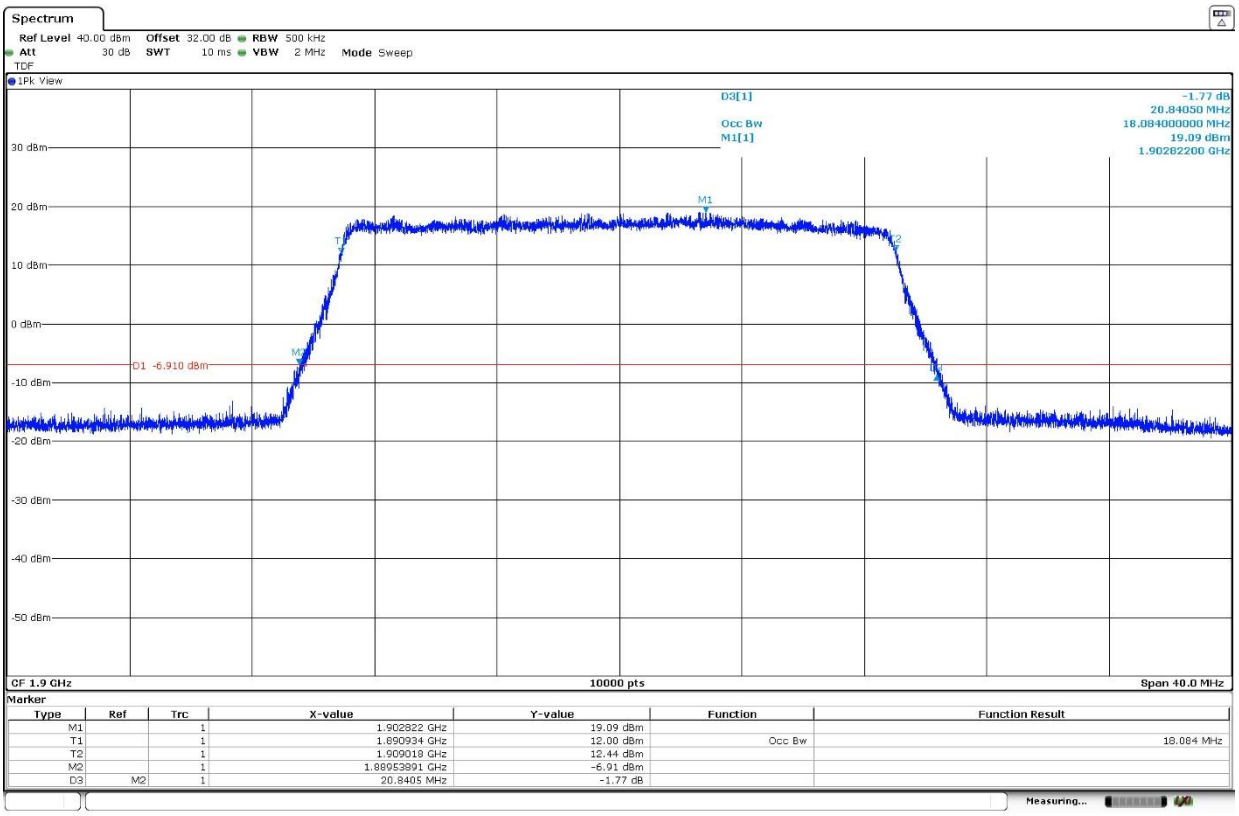
Low Channel:



Middle Channel:

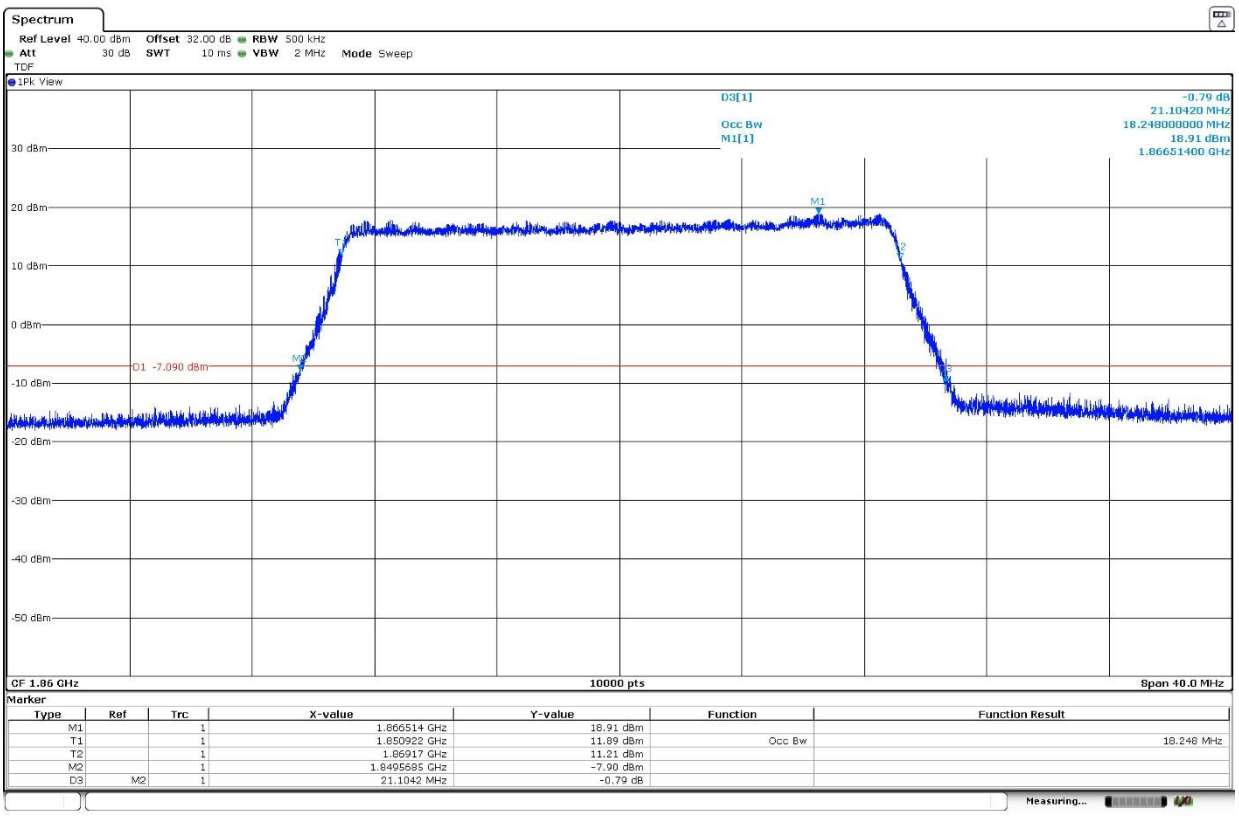


High Channel:

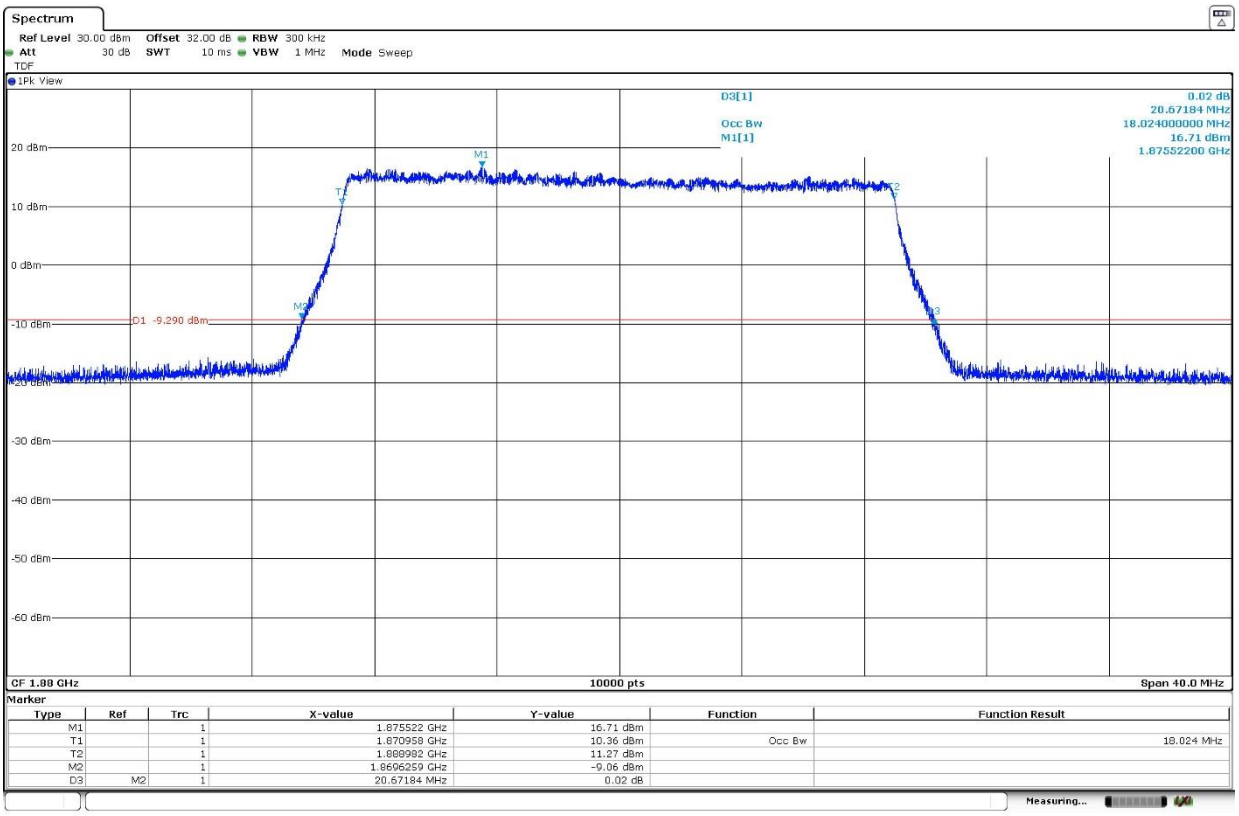


LTE Cat-4 Band 2. BW=20 MHz. 16QAM. RB Size=All.

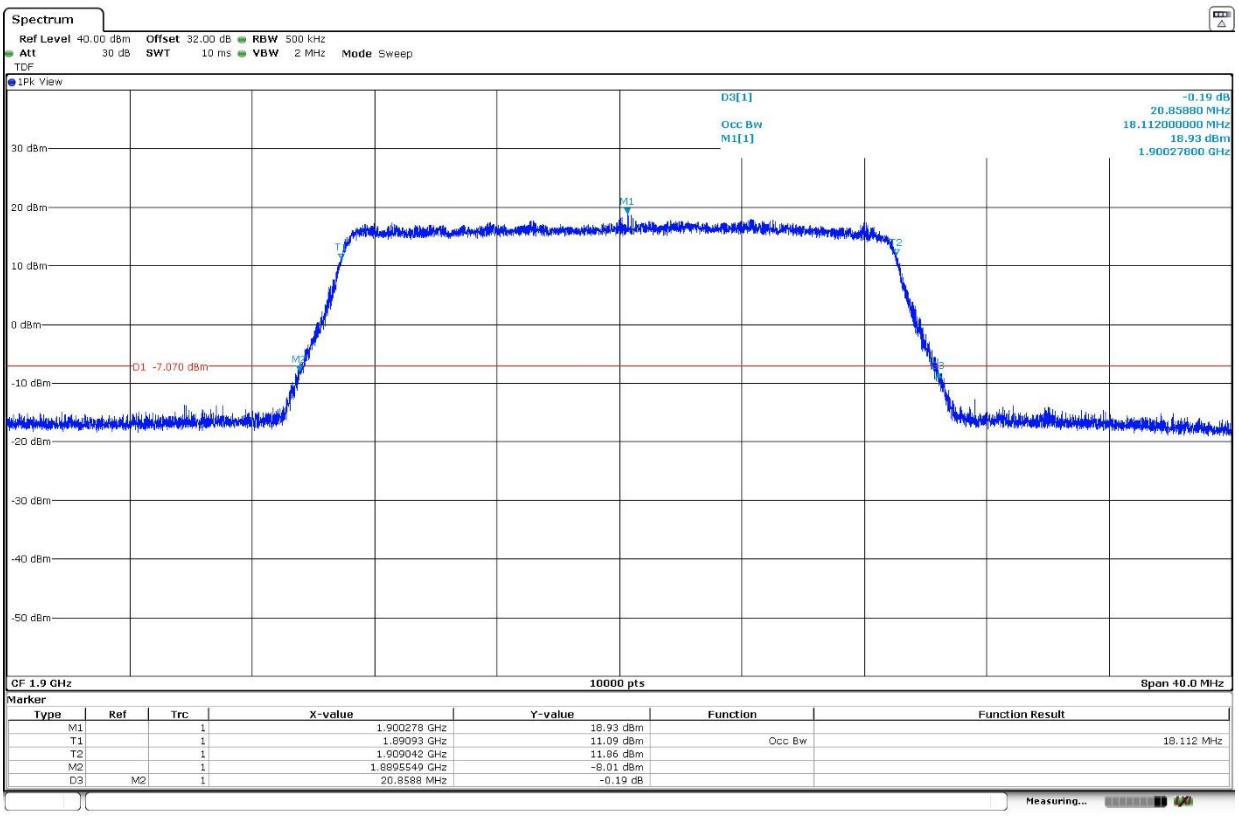
Low Channel:



Middle Channel:



High Channel:



Spurious emissions at antenna terminals

Limits

FCC §2.1051 and §24.238. RSS-133, 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 Po transmitting power, the specified minimum attenuation becomes 43+10 log (Po), and the level in dBm relative to Po becomes:

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

Method

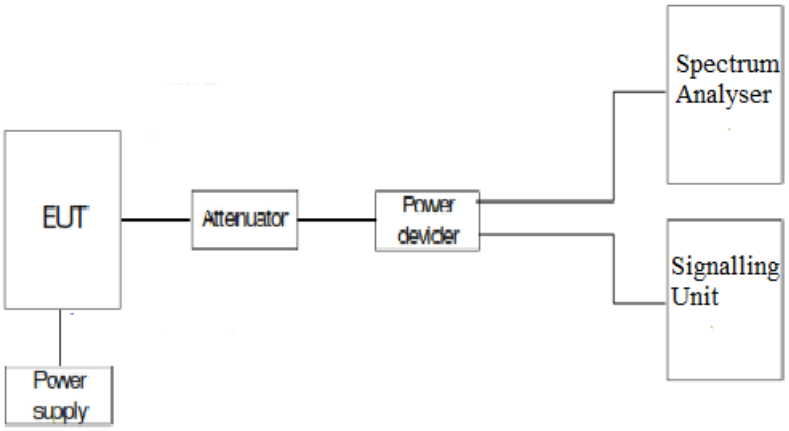
The EUT RF output connector was connected to a spectrum analyser and to the Universal Radio Communication tester R&S CMW500 (selecting maximum transmission power of the EUT and different modes of modulation) using a 50-Ohm attenuator and a power divider.

The spectrum was investigated from 9 kHz to 20 GHz.

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

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

Test Setup



Results

LTE Cat-4 Band 2:

A preliminary scan determined the worst-case:

BW=10 MHz. QPSK. RB Size=1. RB Offset=24.

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.

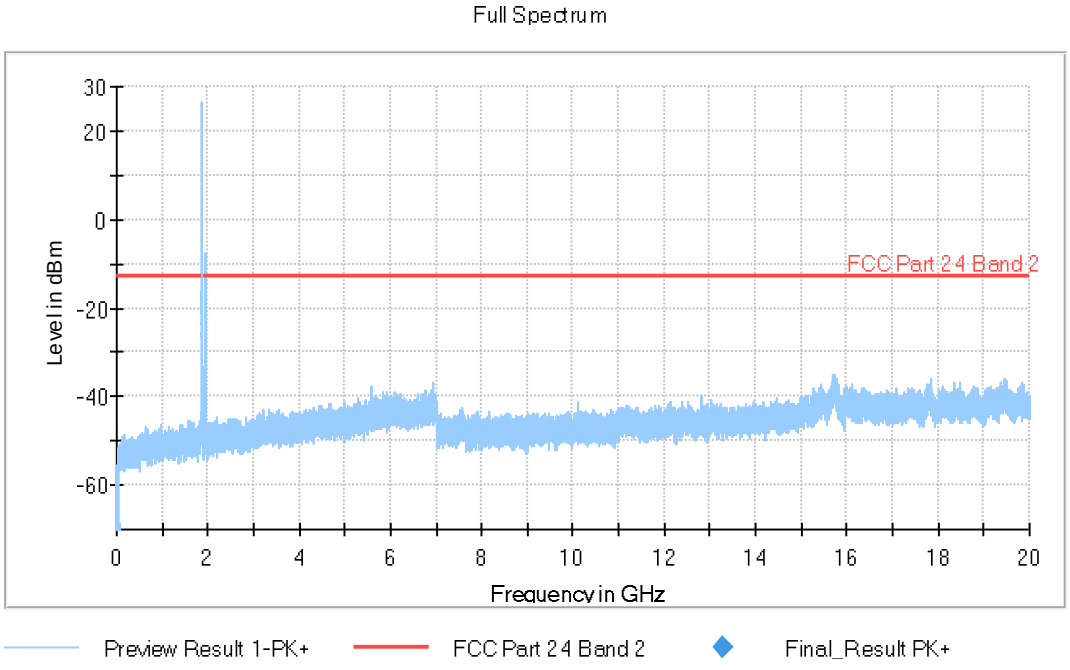
Measurement uncertainty (dB): <±2.76

Verdict: PASS

LTE Cat-4 Band 2: BW=10 MHz. QPSK. RB Size=1. RB Offset=24.

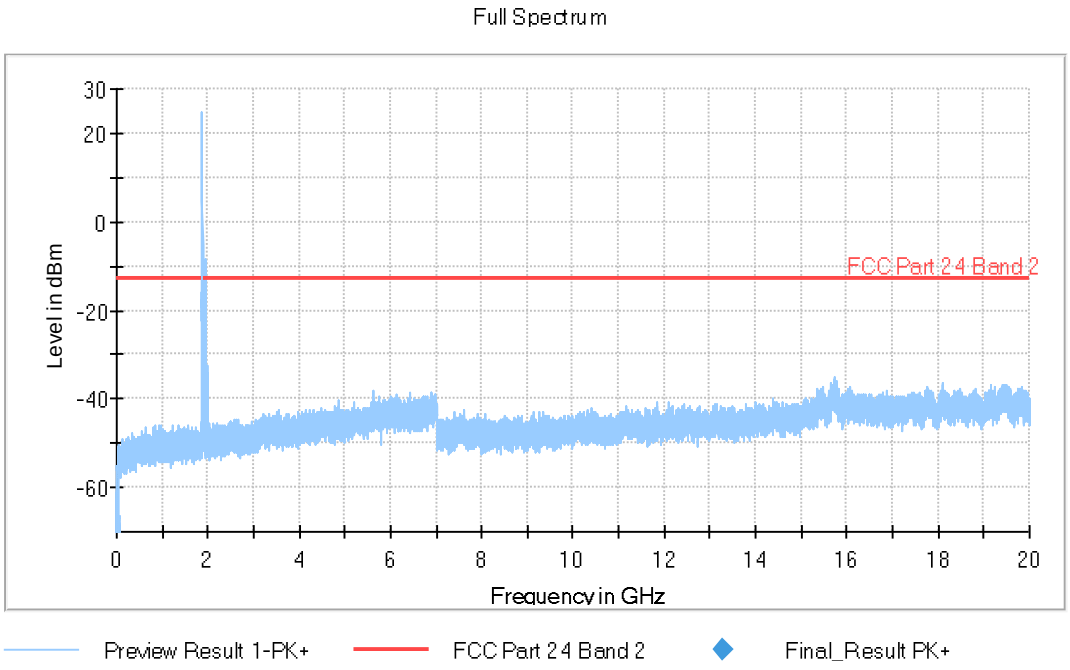
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [FSV 40]					
9 kHz - 150 kHz	14.1 Hz	PK+	300 Hz	Coupled	0 dB
150 kHz - 30 MHz	932.812 Hz	PK+	10 kHz	Coupled	0 dB
30 MHz - 1 GHz	30.312 kHz	PK+	100 kHz	Coupled	0 dB
1 GHz - 10 GHz	281.25 kHz	PK+	1 MHz	Coupled	0 dB

Low Channel:



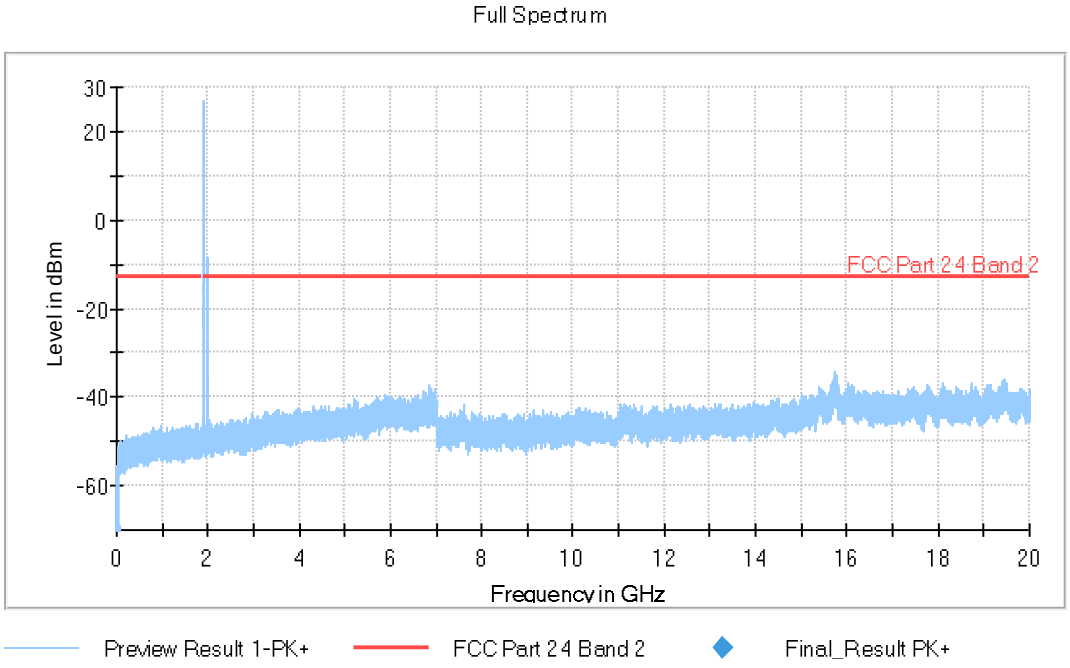
The peak above the limit is the carrier frequency.

Middle Channel:



The peak above the limit is the carrier frequency.

High Channel:



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 Clause 6.5.

> The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

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

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

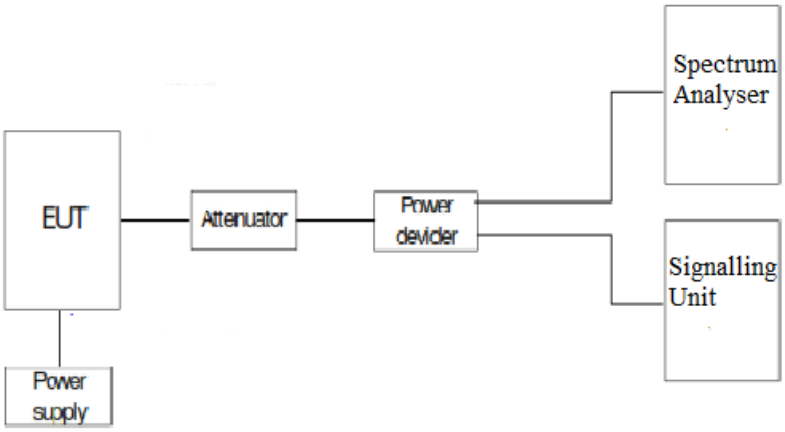
Method

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-4 Band 2:

Preliminary measurements determined QPSK, BW=3 MHz as the worst case.

LTE Cat-4 Band 2. 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 Low Block Edge at antenna port (dBm)	-22.52	-18.68	-20.4	-28.04	-30.48	-31.78

LTE Cat-4 Band 2. QPSK.	RB=5. Offset=0. BW=1.4 MHz	RB=5. Offset=0. BW=3 MHz	RB=5. Offset=0. BW=5 MHz	RB=5. Offset=0. BW=10 MHz	RB=5. Offset=0. BW=15 MHz	RB=5. Offset=0. BW=20 MHz
Maximum measured level at Low Block Edge at antenna port (dBm)	-24.57	-22.21	-19.92	-24.56	-26.57	-27.51

LTE Cat-4 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 High Block Edge at antenna port (dBm)	-18.89	-16.79	-19.36	-26.31	-29.96	-30.5

LTE Cat-4 Band 2. QPSK.	RB=5. Offset=1. BW=1.4 MHz	RB=5. Offset=1. BW=3 MHz	RB=5. Offset=1. BW=5 MHz	RB=5. Offset=1. BW=10 MHz	RB=5. Offset=1. BW=15 MHz	RB=5. Offset=1. BW=20 MHz
Maximum measured level at High Block Edge at antenna port (dBm)	-23.99	-22.9	-19.72	-22.91	-27.44	-27.5

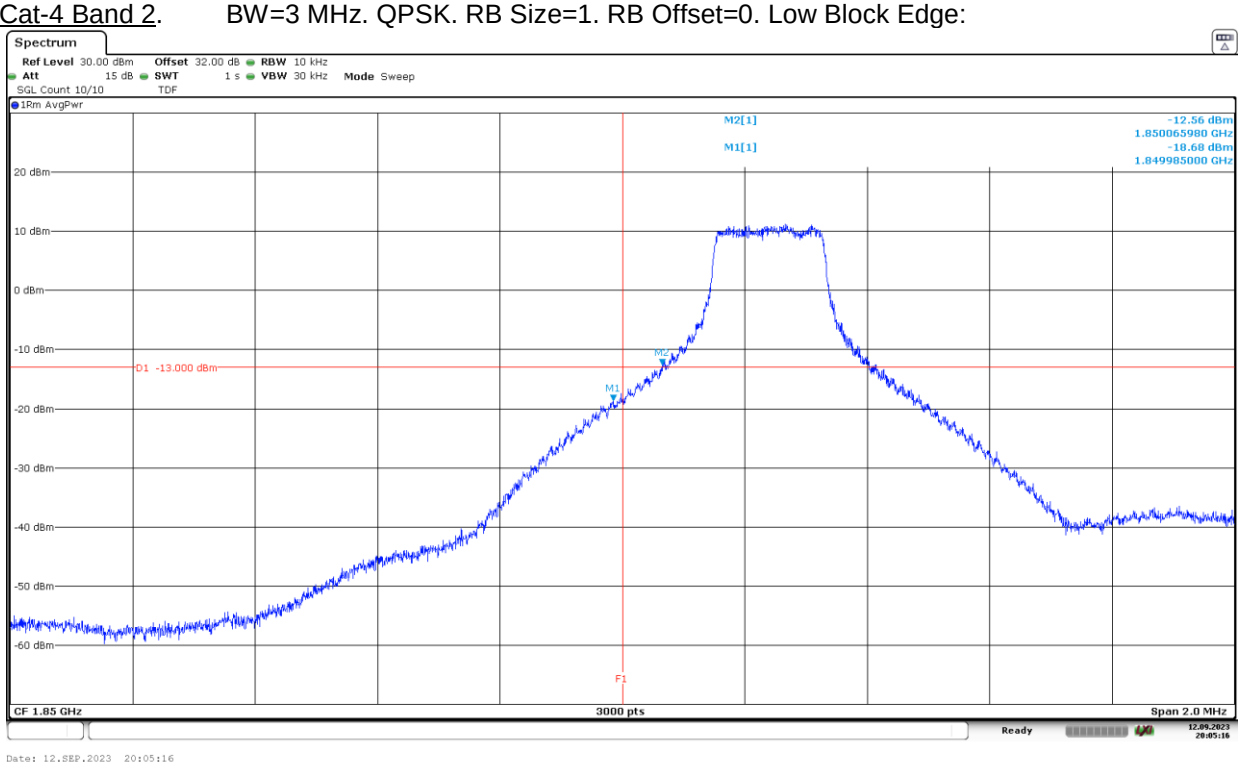
Measurement uncertainty (dB) <± 2.76

Verdict

PASS

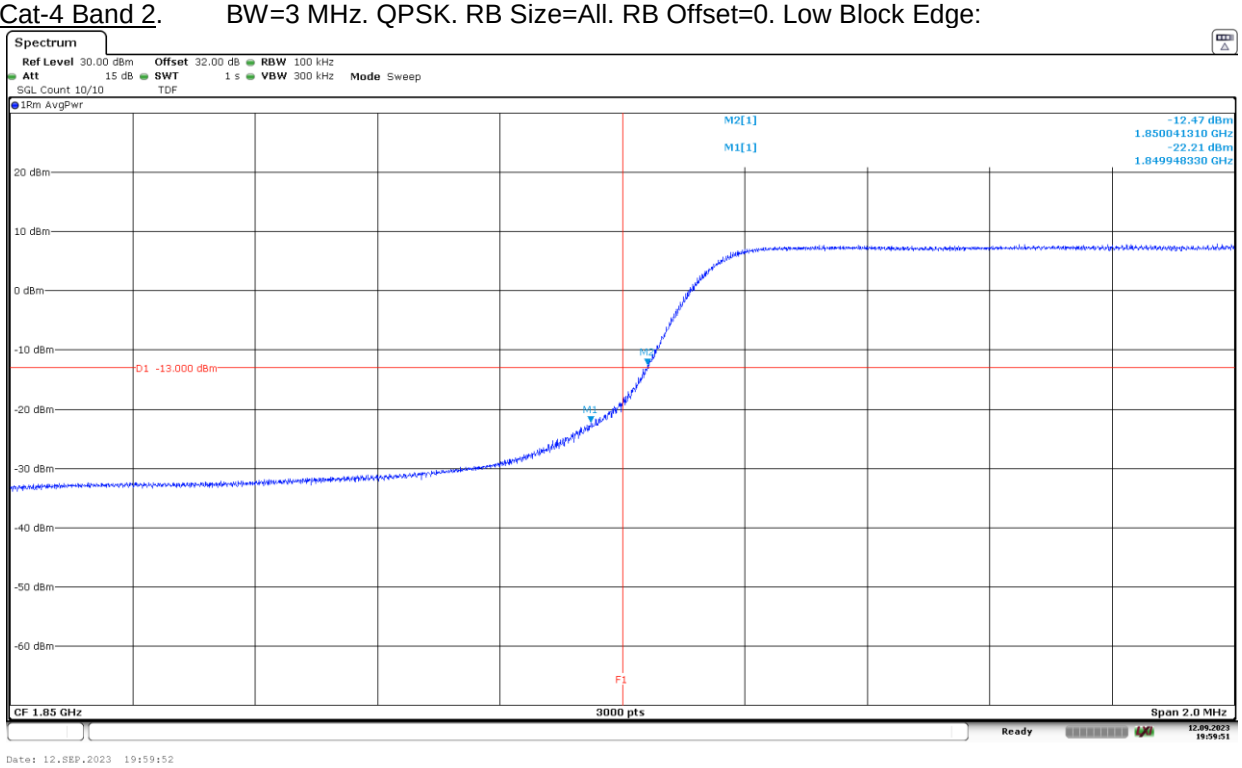
The plots below are for the worst case configuration specified before.

LTE Cat-4 Band 2. BW=3 MHz. QPSK. RB Size=1. RB Offset=0. Low Block Edge:



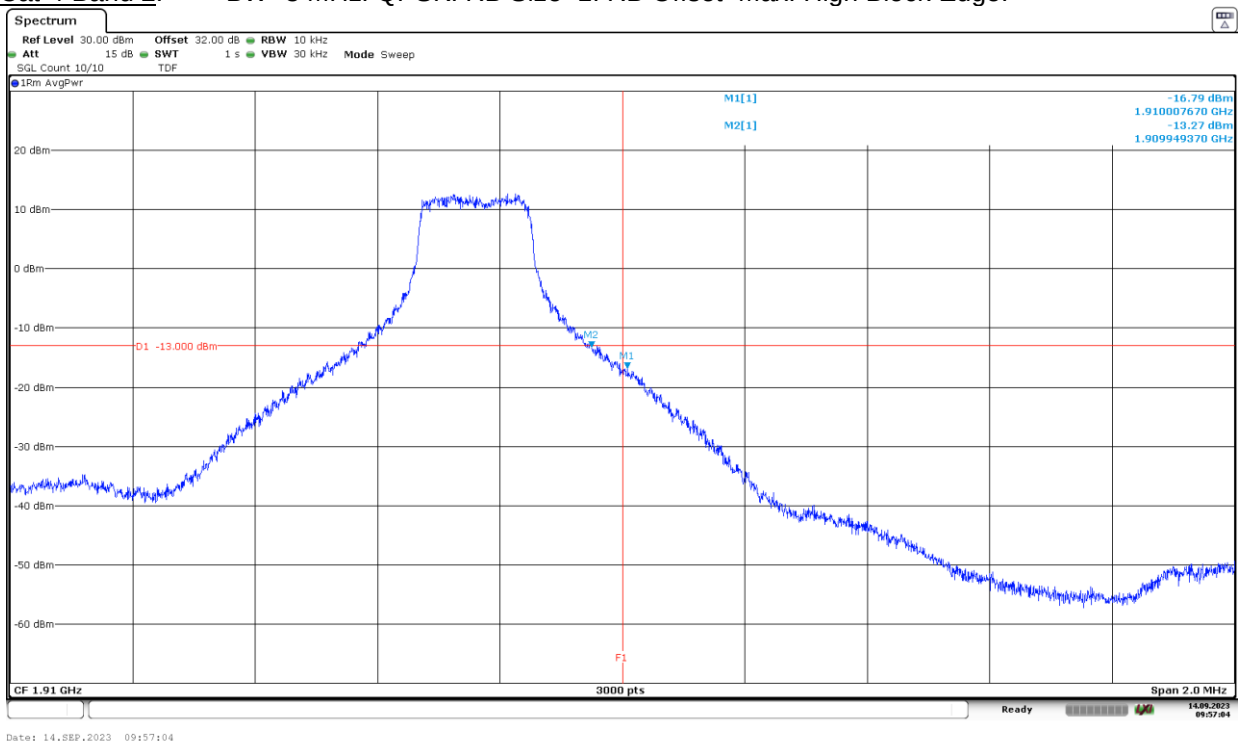
The equipment transmits at the maximum output power.

LTE Cat-4 Band 2. BW=3 MHz. QPSK. RB Size=All. RB Offset=0. Low Block Edge:



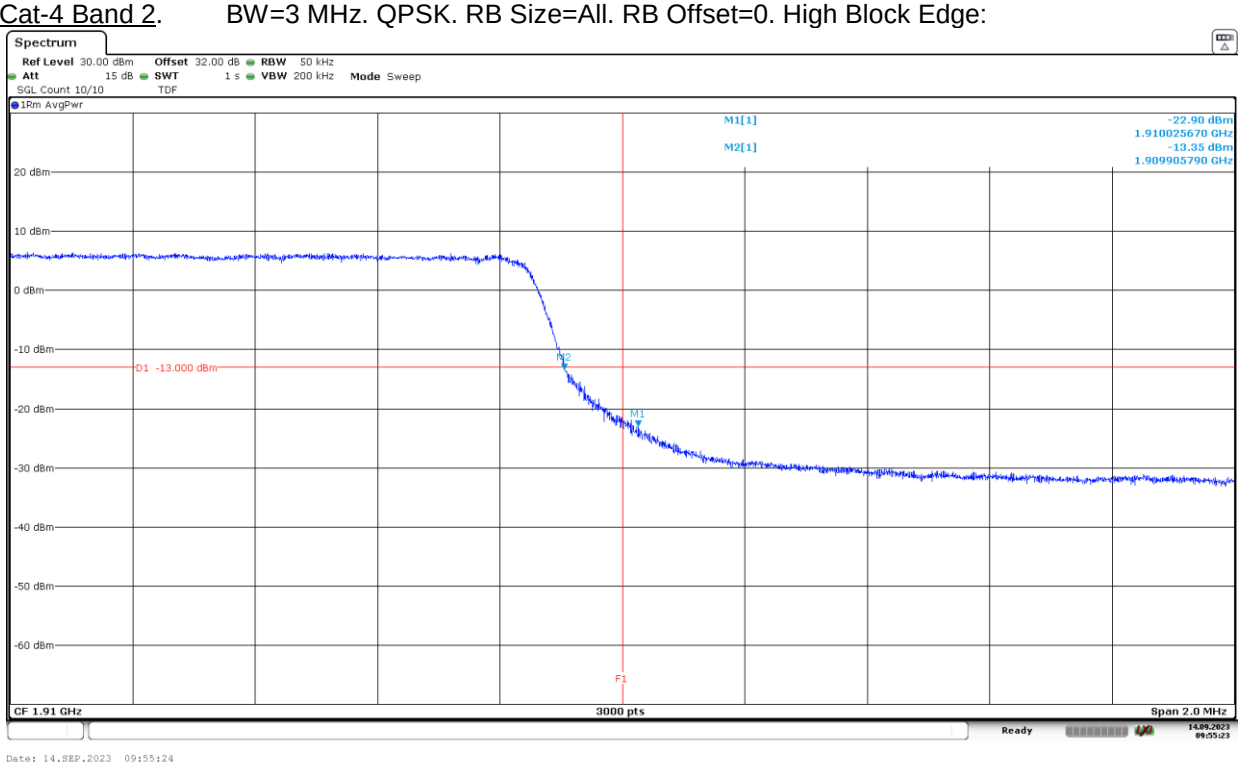
The equipment transmits at the maximum output power.

LTE Cat-4 Band 2. BW=3 MHz. QPSK. RB Size=1. RB Offset=Max. High Block Edge:



The equipment transmits at the maximum output power.

LTE Cat-4 Band 2. BW=3 MHz. QPSK. RB Size=All. RB Offset=0. High Block Edge:



The equipment transmits at the maximum output power.

Radiated emissions

Limits

* FCC § 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.

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 18 GHz. Measurements above 18 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 Po transmitting power. the specified minimum attenuation becomes 43+10log (Po) and the level in dBm relative Po becomes:

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

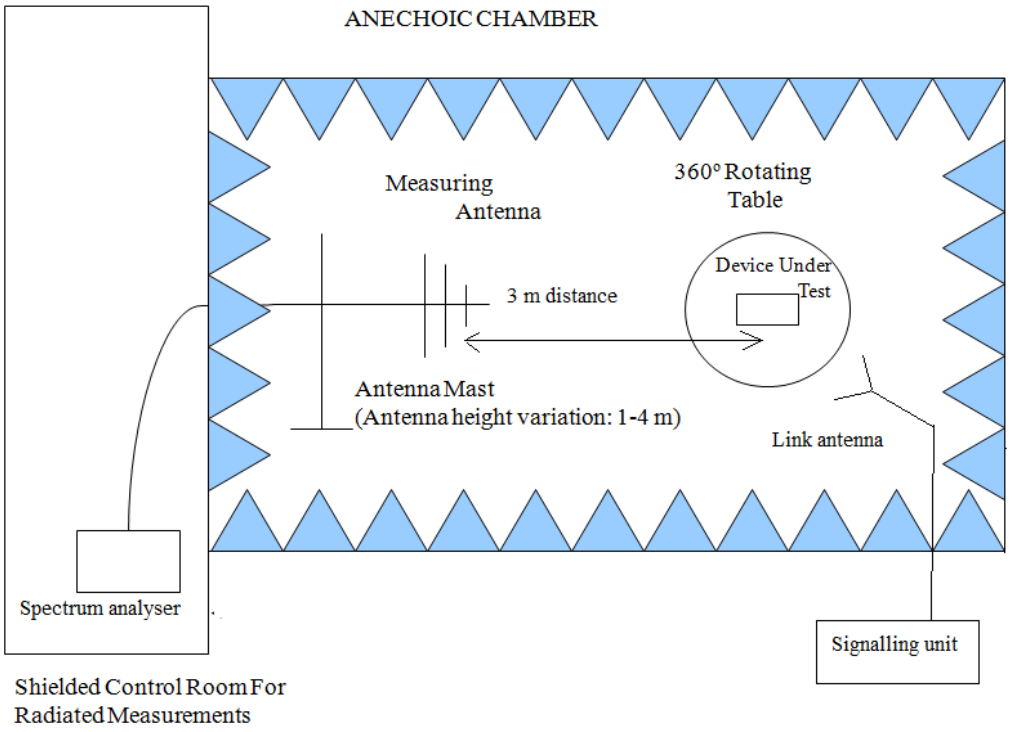
The maximum field strength (dBµV/m) of each detected emission at less than 20 dB respect to the limit is converted to an equivalent EIRP level (dBm) according to ANSI C63.26 with the formula:

$$EIRP\ (dBm) = E\ (dB\mu V/m) + 20 \log(D) - 104.8;$$

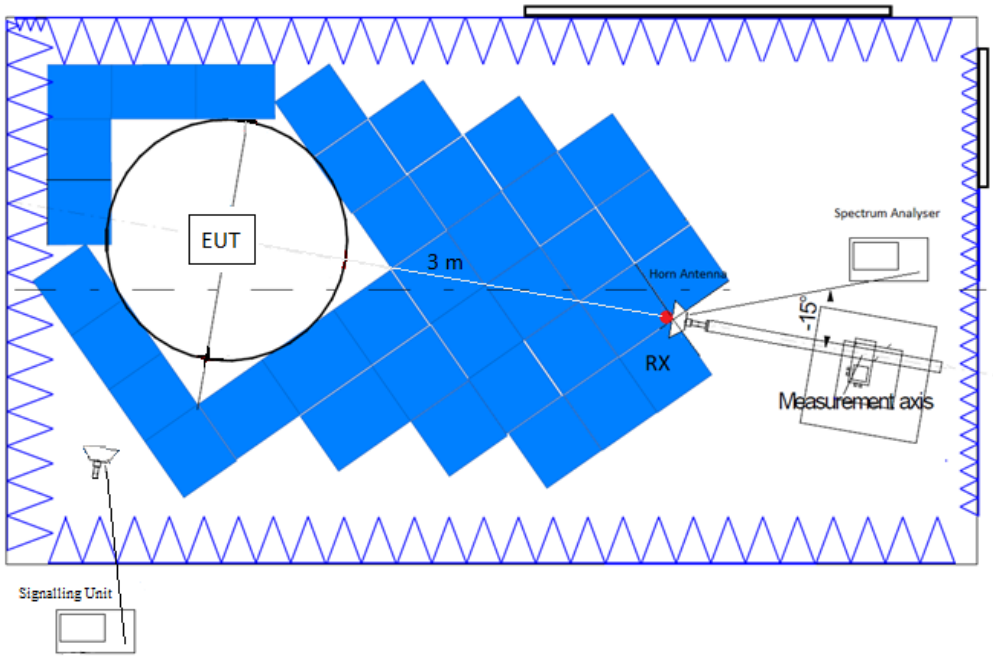
where D is the measurement distance (in the far field region) in m.

Test Setup

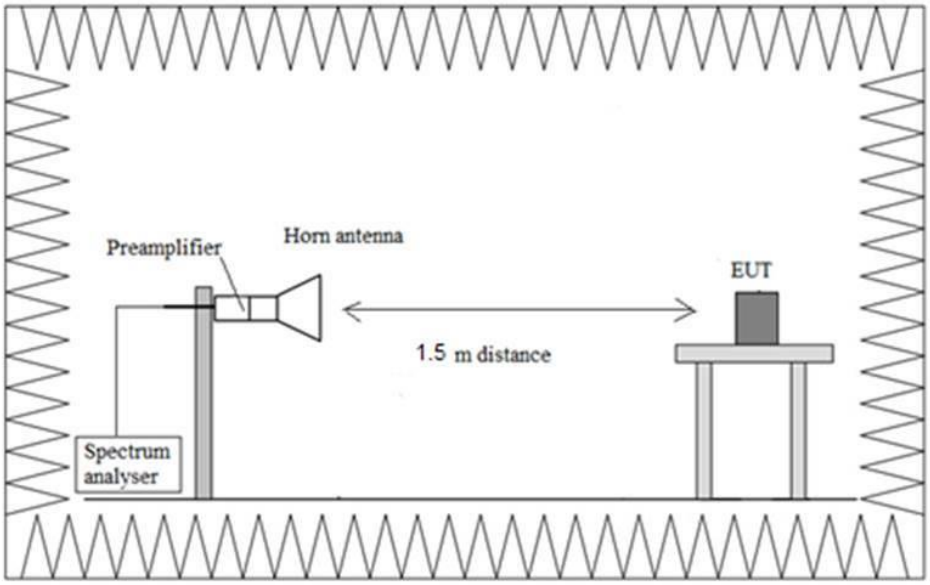
Radiated measurements below 1 GHz:



Radiated measurements above 1 GHz up to 18 GHz:



Radiated measurements above 18 GHz:



Results

LTE Cat-4 Band 2:

A preliminary scan determined the BW=10 MHz, QPSK, RB Size=1, RB Offset=24 as the worst case. The following results are for this worst-case configuration.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 18 GHz:

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

Frequency range 18 - 20 GHz:

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

- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 18 GHz:

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

Frequency range 18 - 20 GHz:

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

- HIGH CHANNEL:

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 18 GHz:

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

Frequency range 18 - 20 GHz:

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

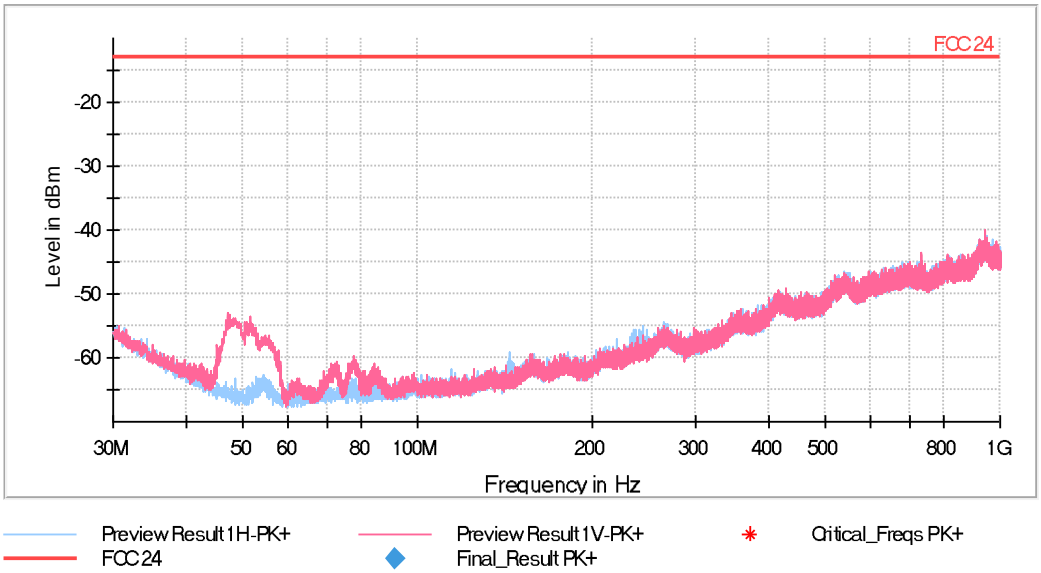
Measurement uncertainty (dB)	<± 5.03 for f < 1 GHz <± 4.32 for f ≥ 1 GHz up to 17 GHz <± 4.58 for f ≥ 17 GHz up to 20 GHz

Verdict *Pass*

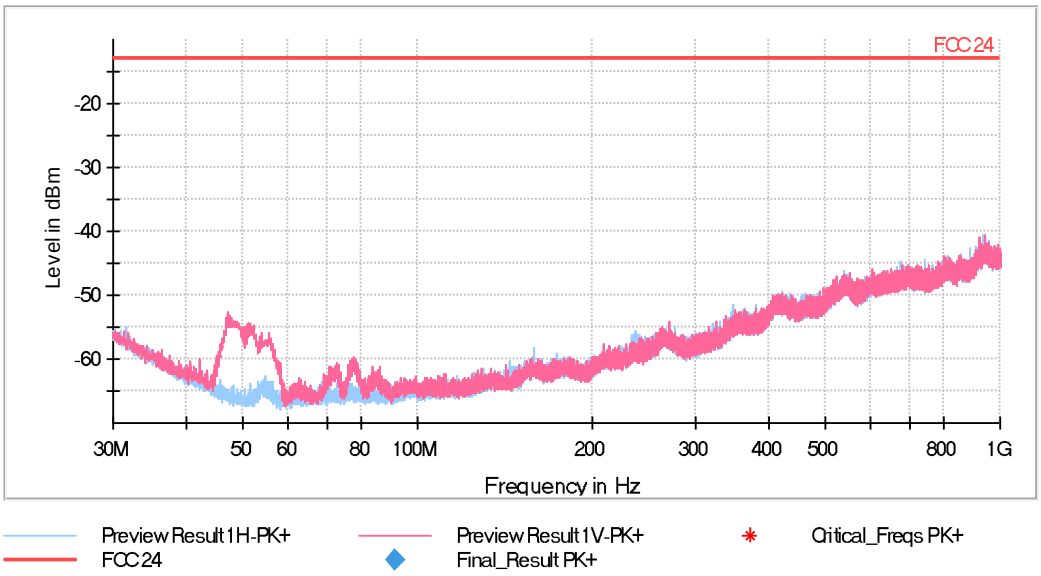
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	1 MHz	1 s	0 dB
1 GHz - 3 GHz	62.5 kHz	PK+	1 MHz	1 s	0 dB
3 GHz - 18 GHz	468.75 kHz	PK+	1 MHz	1 s	0 dB
18 GHz - 20 GHz	62.5 kHz	PK+	1 MHz	1 s	0 dB

FREQUENCY RANGE 30 MHz - 1 GHz:

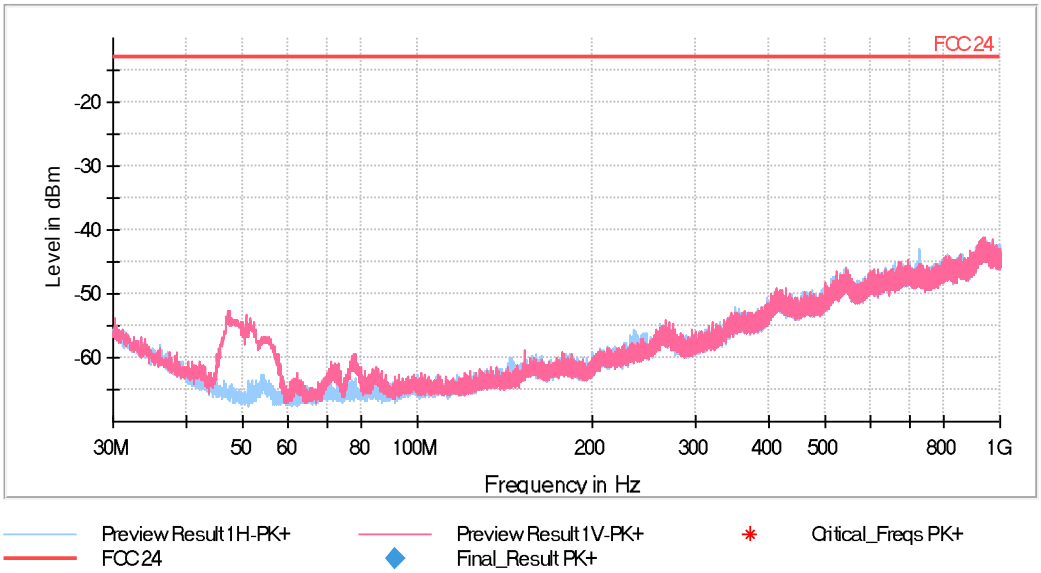
- Low Channel:



- Middle Channel:

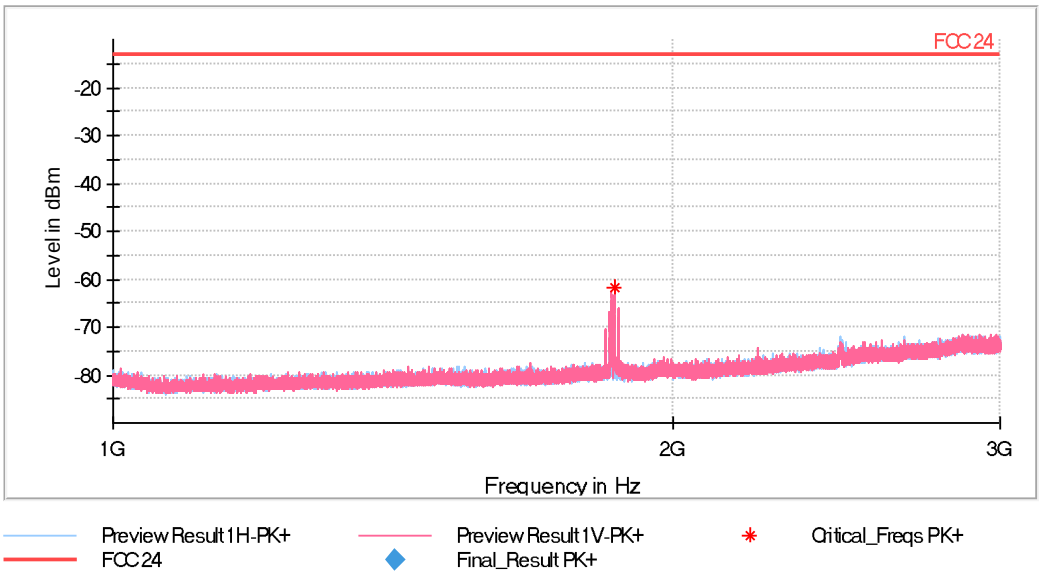


- High Channel:



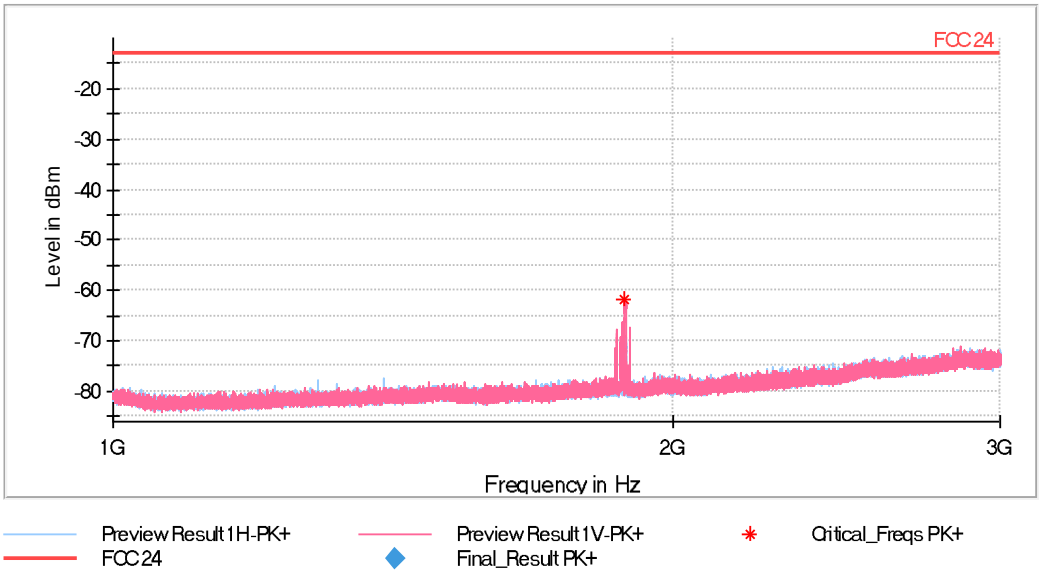
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



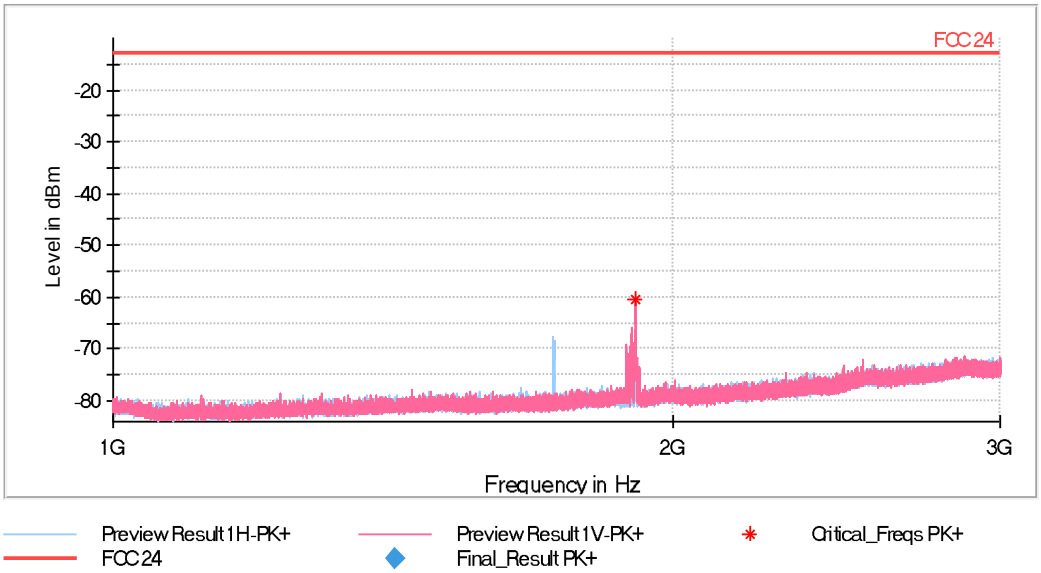
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

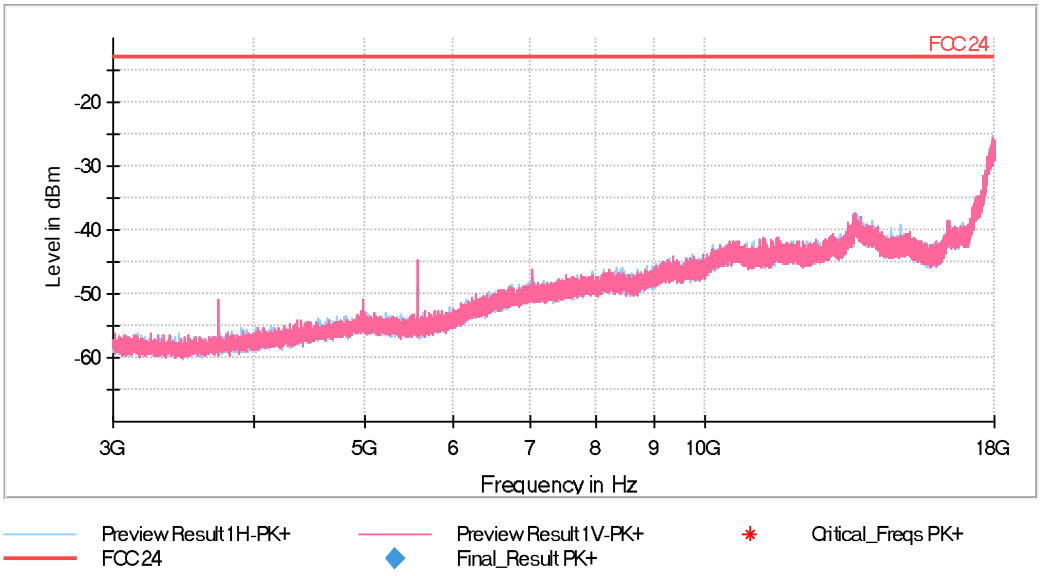
- High Channel:



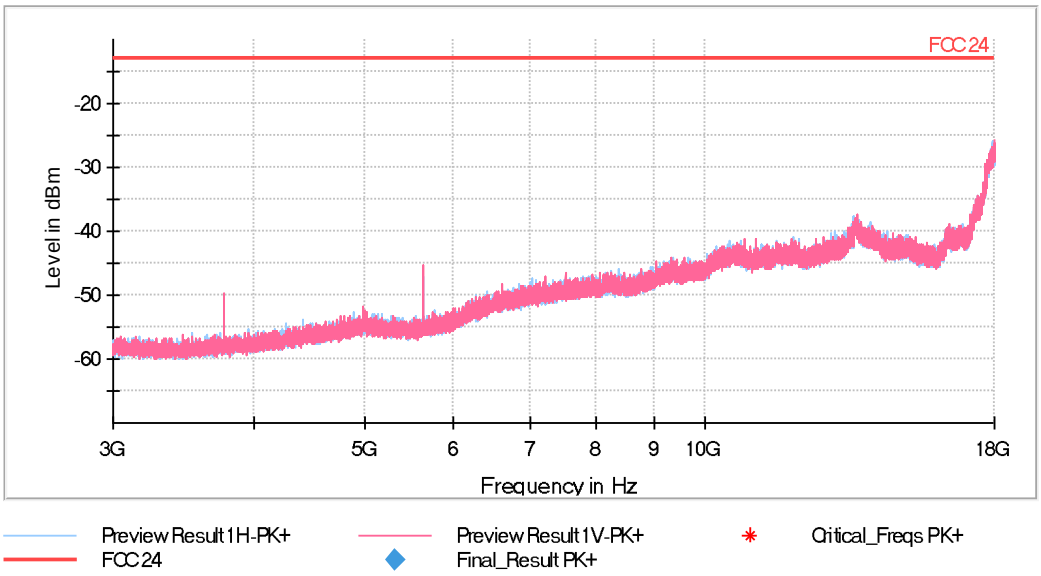
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 18 GHz:

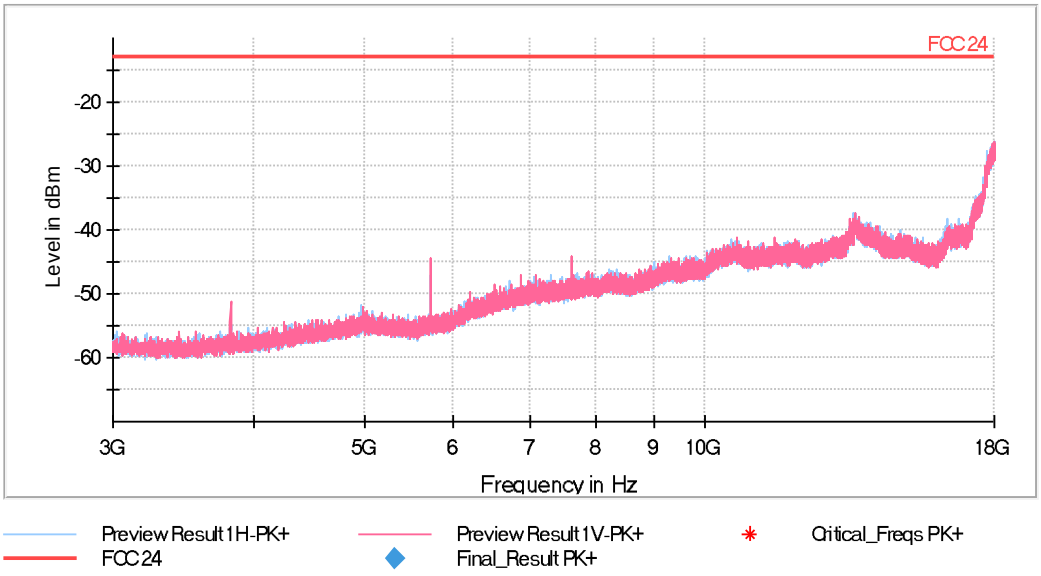
- Low Channel:



- Middle Channel:

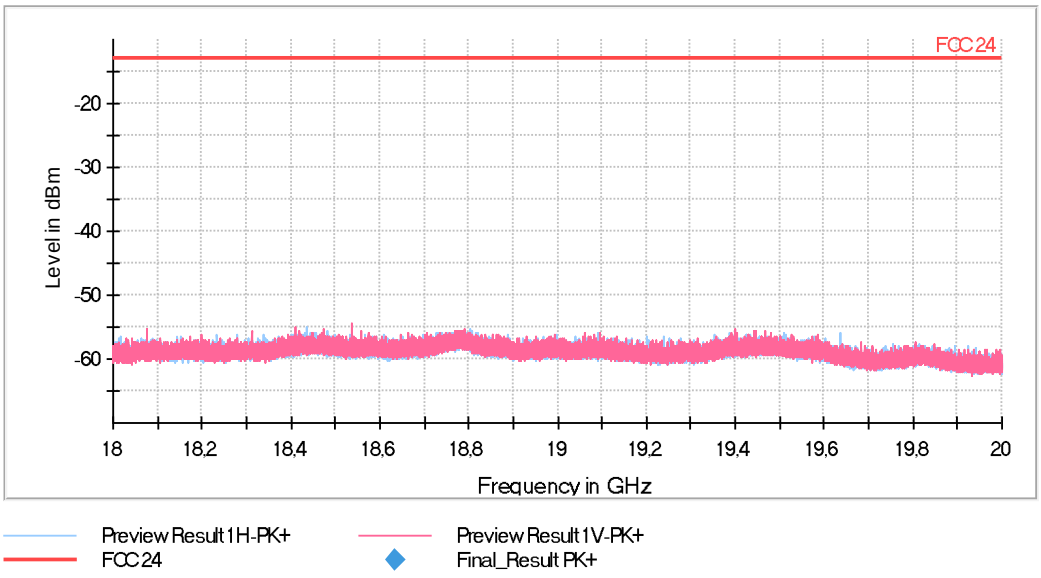


- High Channel:

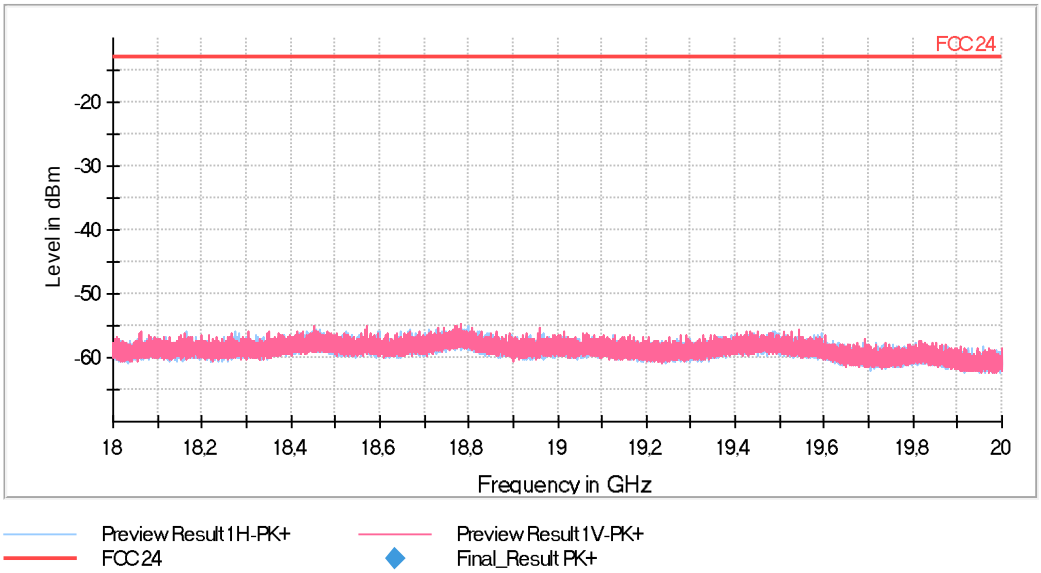


FREQUENCY RANGE 18 - 20 GHz:

- Low Channel:



- Middle Channel:



- High Channel: