15 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	verdict	date	Remark
RF-Testing	FCC: CFR Part 2 & Part 27 ISED: RSS-Gen, Issue 5 RSS-130, Issue 2 (LTE Bands 12, 13) RSS-139, Issue 3 (LTE Band 4)	See table!	2022-04-14	-/-

15.1 Part 27/RSS-139: LTE band 4

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Extreme	Extreme	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Notes:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed

15.2 Part 27/RSS-130: LTE band 12

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Extreme	Extreme	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Notes:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed

15.3 Part 27/RSS-130: LTE band 13

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Extreme	Extreme	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Notes:

C	Compliant	NC	Not compliant	NA	Not applicable	NP	Not performed

16   RF measurements

16.1 Description of test setup

For the spurious measurements we use the substitution method according TIA/EIA 603.

16.2 Results LTE band 4

The EUT was set to transmit the maximum power.

16.2.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.
To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Sample
AQT:	See plot
Resolution bandwidth:	1 MHz
Used equipment:	See chapter 7.4 setup A
Measurement uncertainty:	See chapter 9
Measurement procedure	FCC: § 2.1046 ISED: RSS-Gen, 6.12

Limits:

FCC	ISED
§ 27.50(d)(4) & (5)	RSS-139, 6.5
(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. (5) 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.	The equivalent isotropically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed one watt. 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.
Power: **33 dBm EIRP** PAPR: **13 dB**	

Results:

Sub-Carrier Spacing [kHz]	Modulation	Number of Tones	Average Output Power [dBm] Channel No / Frequency [MHz]			Peak to Average Ratio [dB] Channel No / Frequency [MHz]		
			19951 / 1710.1	20175 / 1732.5	20399 / 1754.9	19951 / 1710.1	20175 / 1732.5	20399 / 1754.9
3.75	BPSK	1T0	19.37	19.43	19.14	2.03	2.00	2.06
		1T47	19.34	19.31	19.10	1.97	2.00	2.00
	QPSK	1T0	19.41	19.36	19.20	0.29	0.26	0.32
		1T47	19.43	19.39	19.09	1.65	1.68	1.68
15	BPSK	1T0	19.37	19.29	19.08	1.74	1.71	1.71
		1T11	19.08	19.10	18.88	1.62	1.77	1.77
	QPSK	1T0	19.35	19.48	19.06	1.68	1.62	1.71
		1T11	19.21	19.33	18.96	0.46	1.74	1.62
		12T0	17.53	17.53	17.35	6.00	6.06	6.15

The radiated output power is measured in the mode with the highest conducted output power.

Output Power (EIRP)			
Sub-Carrier Spacing [kHz]	Frequency (MHz)	Average Output Power (dBm) BPSK	Average Output Power (dBm) QPSK
3.75	1710.1	21.77	21.83
	1732.5	23.23	23.19
	1754.9	22.04	22.10
15	1710.1	21.77	21.75
	1732.5	23.09	23.38
	1754.9	21.98	21.96

16.2.2 Frequency stability

Description:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station in a "call mode". This is accomplished with the use of a R&S CMW500 DIGITAL RADIOCOMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with V_{nom}, connected to the CMW500 and in a simulated call on channel 1412 (center channel), measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with V_{nom}. Vary supply voltage from V_{min} to V_{max}, in 0.1 Volt steps re-measuring carrier frequency at each voltage. Pause at V_{nom} for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

This measurement was performed with the highest channel bandwidth supported from the EUT on the middle channel

Measurement:

Measurement parameters	
Detector:	
Sweep time:	
Video bandwidth:	Measured with CMW500
Resolution bandwidth:	
Span:	
Trace-Mode:	
Used equipment:	See chapter 7.4 setup A
Measurement uncertainty:	See chapter 9
Measurement procedure	FCC: § 2.1055 ISED: RSS-Gen, 6.11

Limits:

FCC	ISED
§ 27.54	RSS-139, 6.4
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.	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.

Results:

FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
3.2	-31	-0.0179
3.6	-31	-0.0179
4.0	-31	-0.0179

FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
-30	36	0.0208
-20	24	0.0139
-10	16	0.0092
± 0	-30	-0.0173
10	-18	-0.0104
20	-31	-0.0179
30	-62	-0.0358
40	-24	-0.0139
50	-56	-0.0232

16.2.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2014 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1750 MHz. Measurement made up to 18 GHz. The resolution bandwidth is set as outlined in Part 27.53. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE band 4.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	100 MHz Steps
Trace mode:	Max Hold
Used equipment:	See chapter 7.2 setup A
Measurement uncertainty:	See chapter 9
Measurement procedure	FCC: § 2.1053 ISED: RSS-Gen, 6.13

Limits:

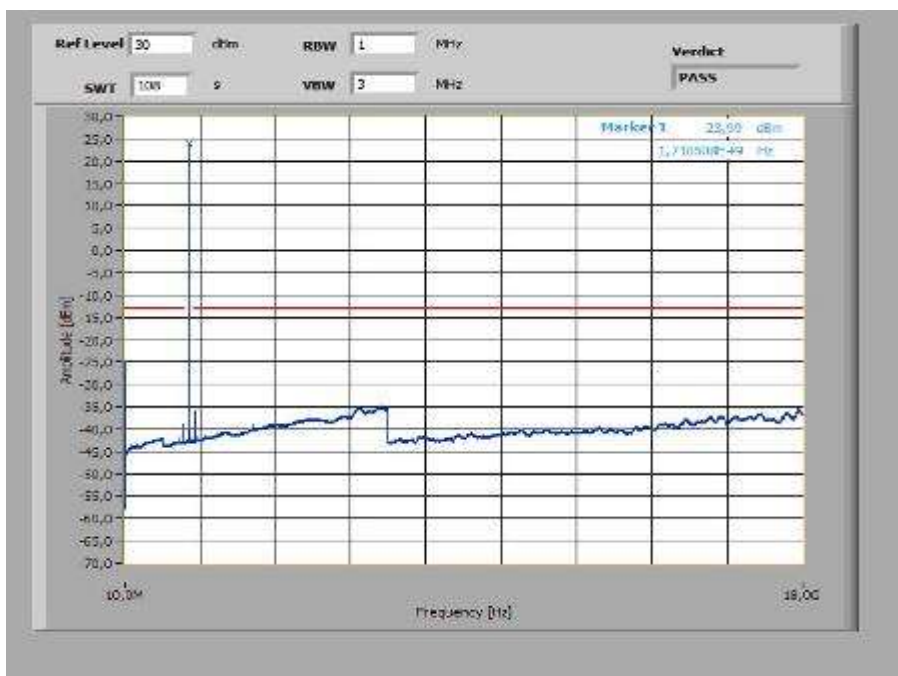| FCC	ISED
§ 27.53(h)(1) & (3)	RSS-139, 6.6
(1) Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB. (3) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.	i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 (P) (watts) dB. ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 (P) (watts) dB.
-13 dBm	

Results:

BPSK

Spurious Emission Level					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
-/-		All detected emissions are more than 20 dB below the limit.		-/-	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-

QPSK

Spurious Emission Level					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
-/-		All detected emissions are more than 20 dB below the limit.		-/-	
-/-	-/-	-/-	-/-	-/-	-/-
-/-	-/-	-/-	-/-	-/-	-/-

BPSK

Plot 1: Middle channel, up to 30 MHz
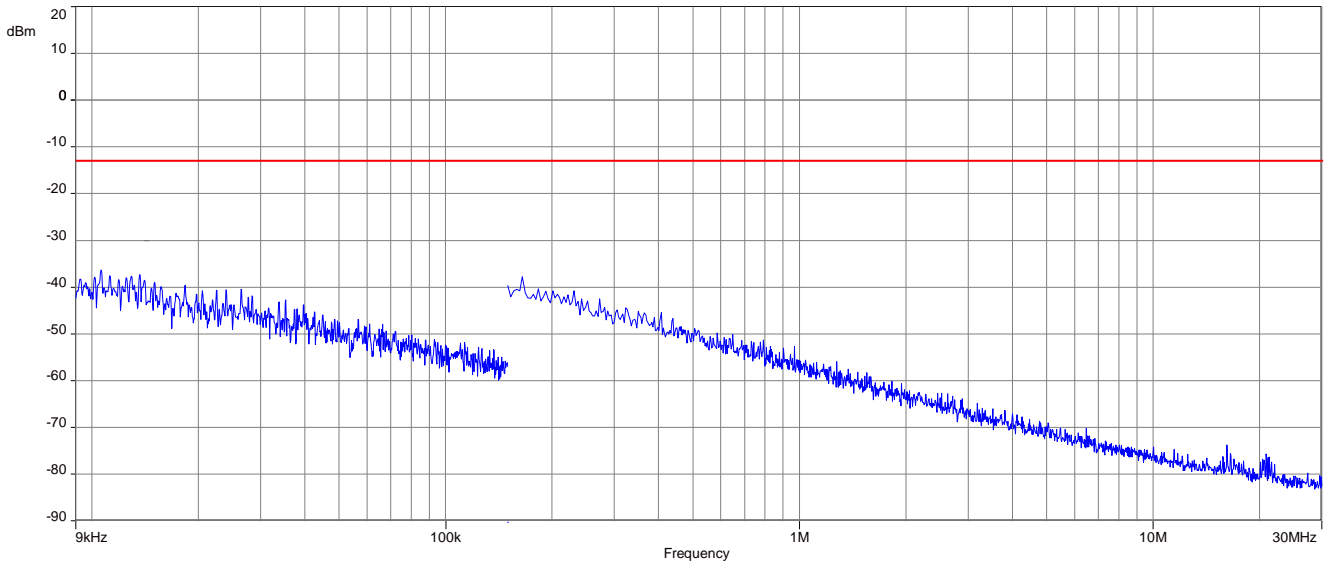
Plot 2: Middle channel, 30 MHz to 1GHz
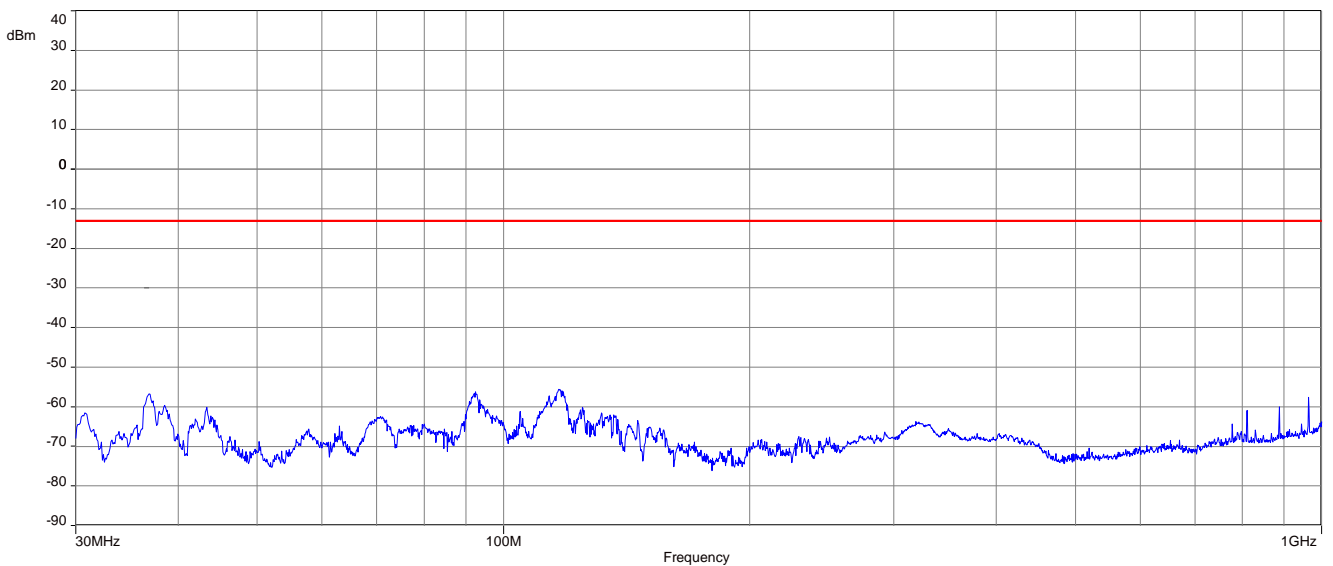
Plot 3: Middle channel, 1 GHz to 18GHz
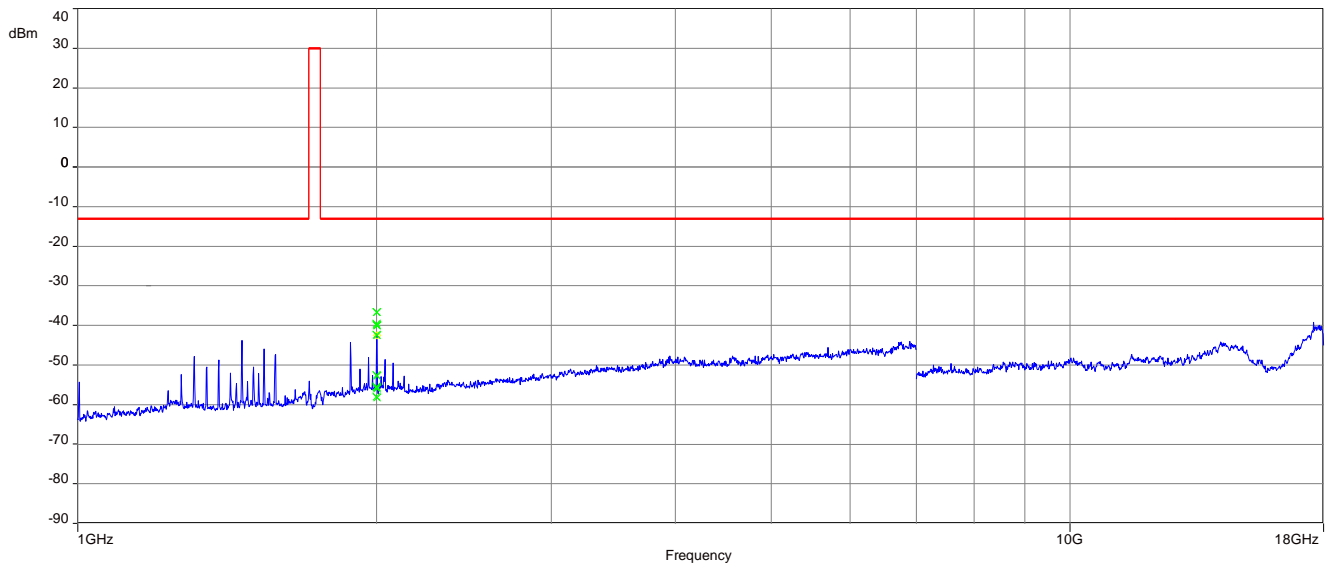
QPSK

Plot 1: Middle channel, up to 30 MHz
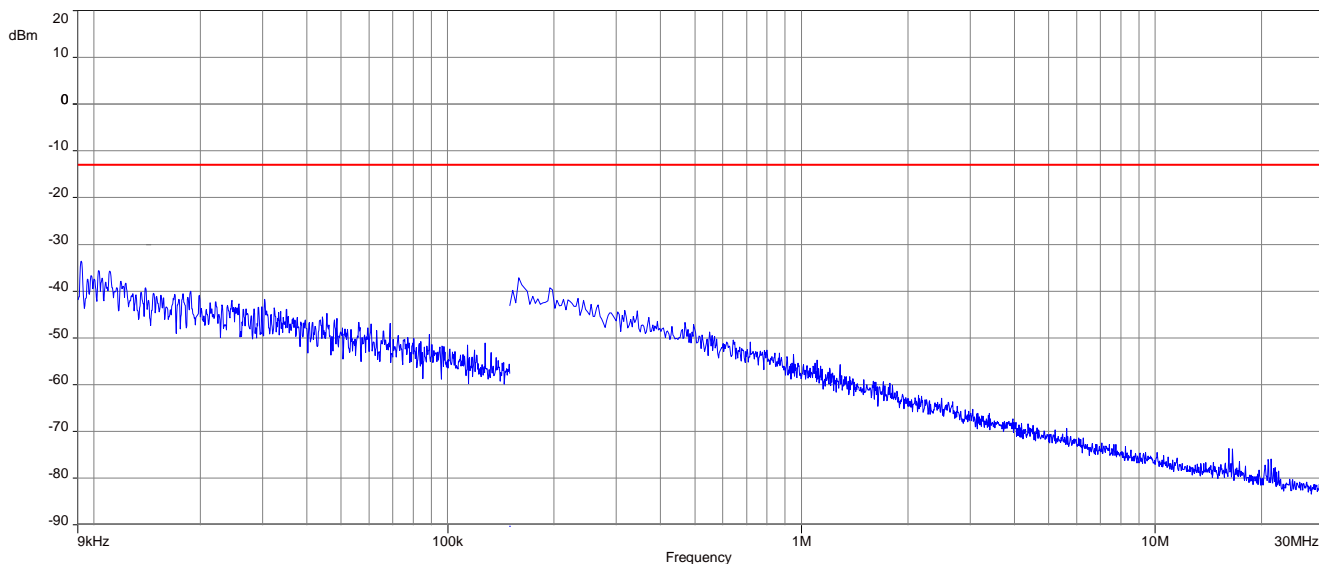
Plot 2: Middle channel, 30 MHz to 1 GHz
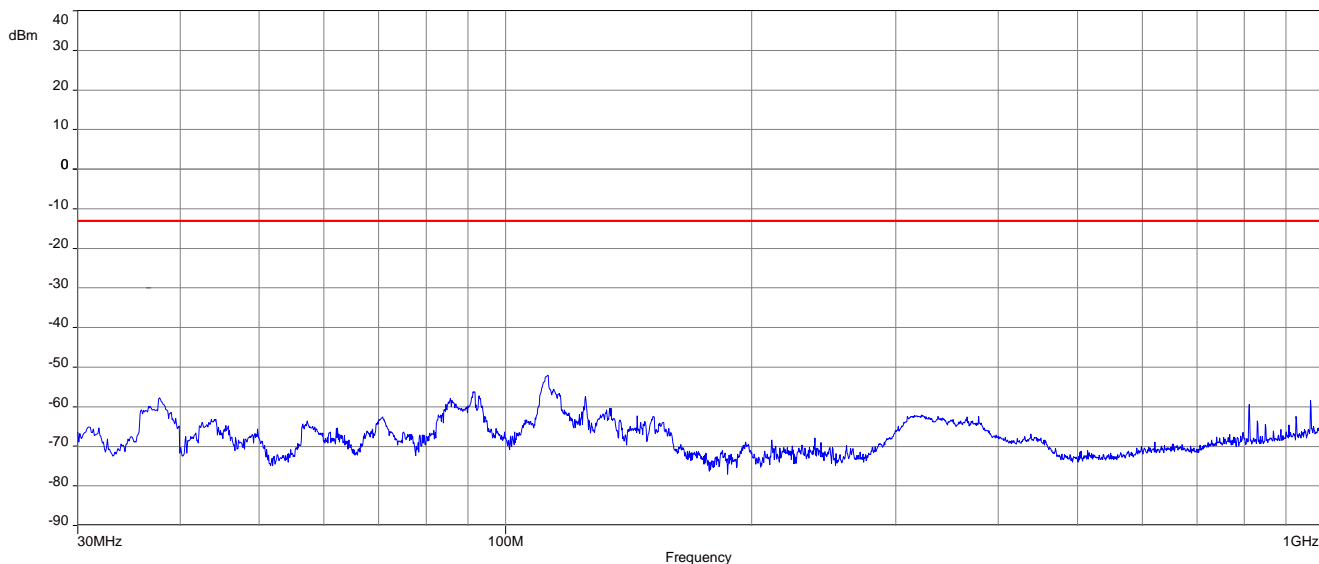
Plot 3: Middle channel, 1 GHz to 18 GHz
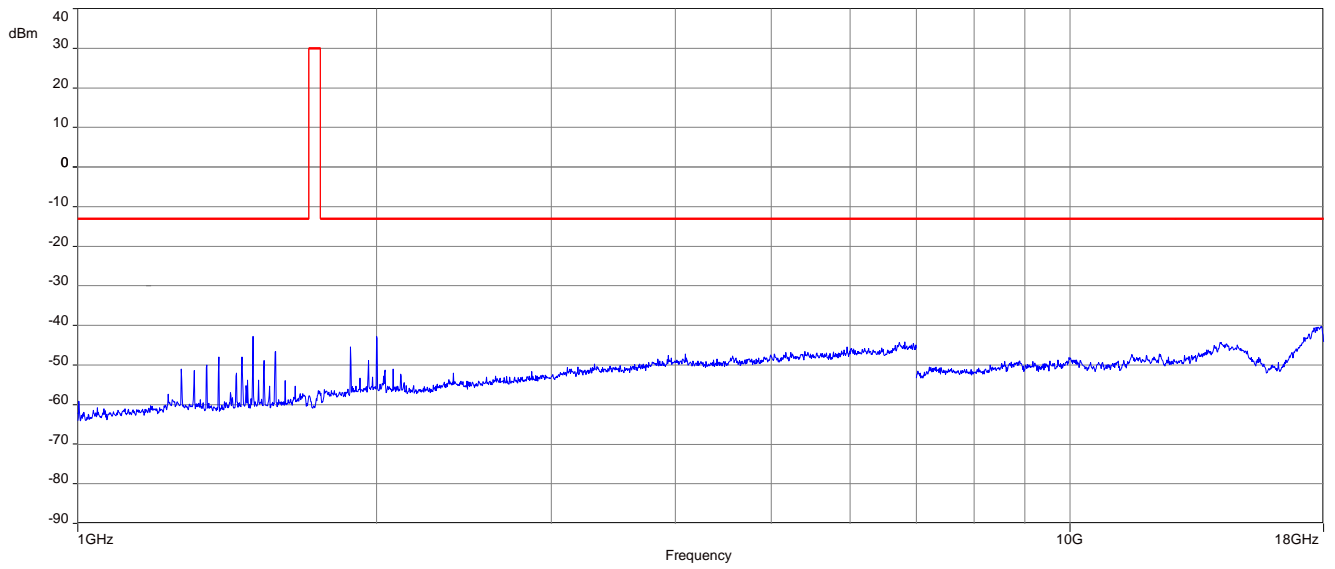
16.2.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From § 2.1057 & RSS-Gen, 6.13.2 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

For the measurement the lowest, middle and highest channel bandwidth was used. If spurious were found the other bandwidths were measured, too.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	300 kHz
Resolution bandwidth:	100 kHz
Span:	10 MHz − 18 GHz
Trace-Mode:	Max Hold
Used equipment:	See chapter 7.4 setup A
Measurement uncertainty:	See chapter 9
Measurement procedure	FCC: § 2.1051 ISED: RSS-Gen, 6.13

Limits:

FCC	ISED
§ 27.53(h)(1) & (3)	RSS-139, 6.6
(1) Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB. (3) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.	i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 (P) (watts) dB. ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 (P) (watts) dB.
-13 dBm	

Results:

BPSK

Spurious Emission Level					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3420.2	-/-	3465.0	-/-	3509.8	-/-
5130.3	-/-	5197.5	-/-	5264.7	-/-
6840.4	-/-	6930.0	-/-	7019.6	-/-
8550.5	-/-	8662.5	-/-	8774.5	-/-
10260.6	-/-	10395.0	-/-	10529.4	-/-
11970.7	-/-	12127.5	-/-	12284.3	-/-
13680.8	-/-	13860.0	-/-	14039.2	-/-
15390.9	-/-	15592.5	-/-	15794.1	-/-
17101.0	-/-	17325.0	-/-	17549.0	-/-

QPSK

Spurious Emission Level					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3420.2	-/-	3465.0	-/-	3509.8	-/-
5130.3	-/-	5197.5	-/-	5264.7	-/-
6840.4	-/-	6930.0	-/-	7019.6	-/-
8550.5	-/-	8662.5	-/-	8774.5	-/-
10260.6	-/-	10395.0	-/-	10529.4	-/-
11970.7	-/-	12127.5	-/-	12284.3	-/-
13680.8	-/-	13860.0	-/-	14039.2	-/-
15390.9	-/-	15592.5	-/-	15794.1	-/-
17101.0	-/-	17325.0	-/-	17549.0	-/-

Plots: BPSK

Plot 1: Lowest Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@0 tones

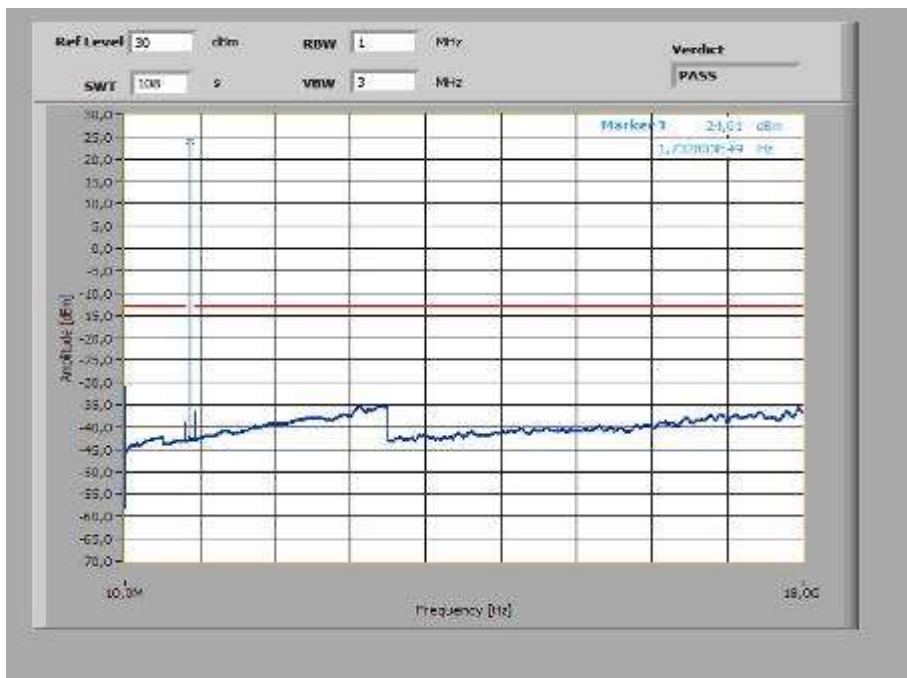**Plot 2:** Middle Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@0 tones

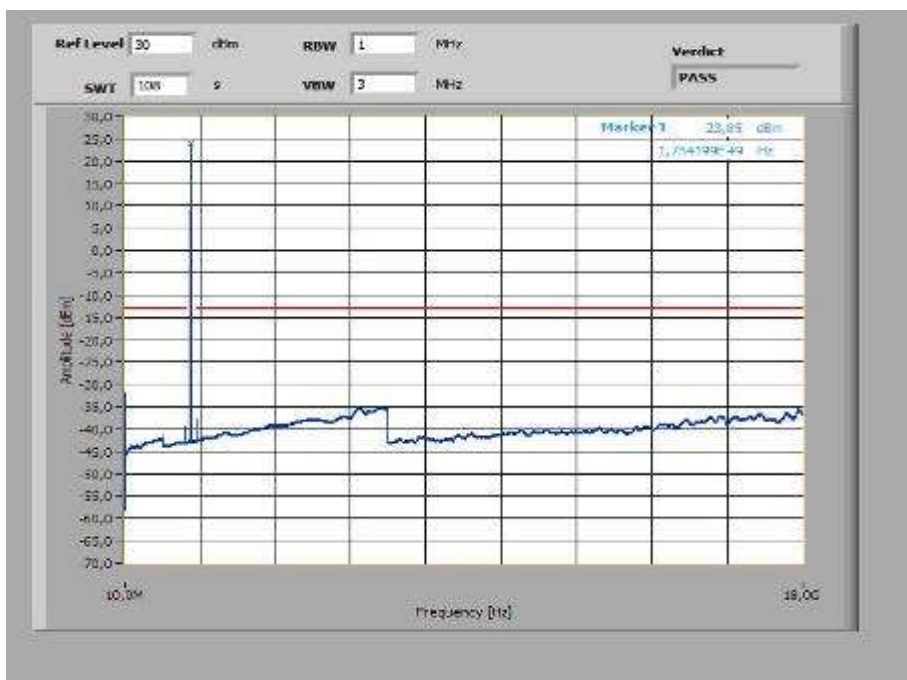**Plot 3:** Highest Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@0 tones

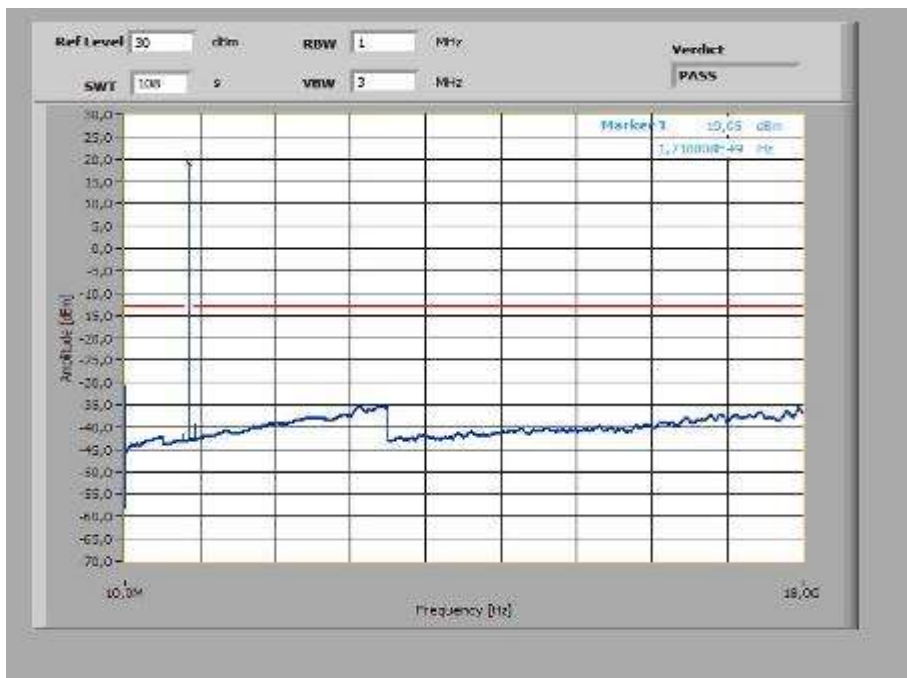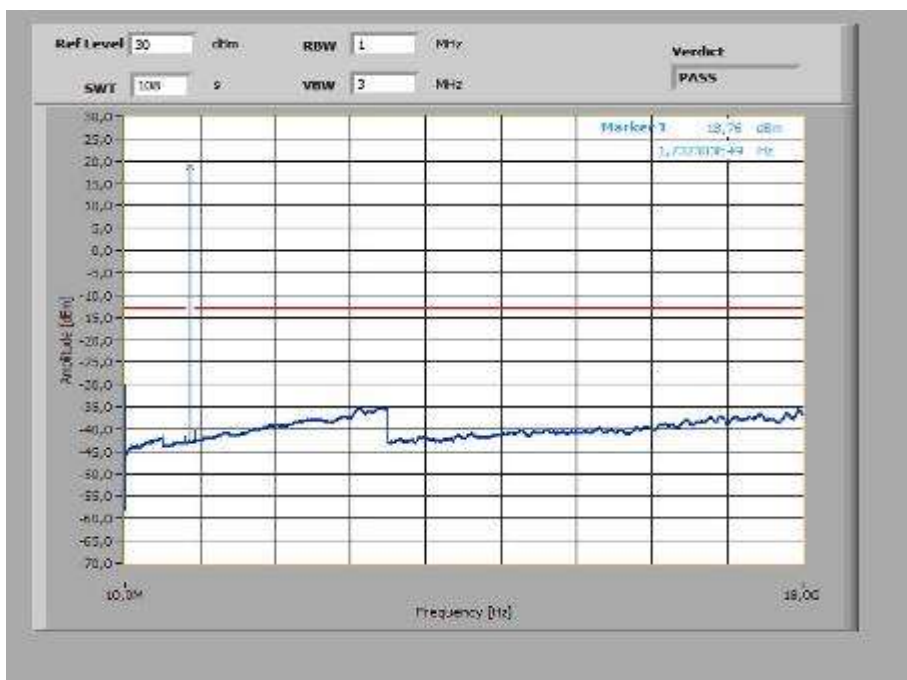**Plot 4:** Lowest Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@47 tones

Plot 5: Middle Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@47 tones

Plot 6: Highest Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@47 tones
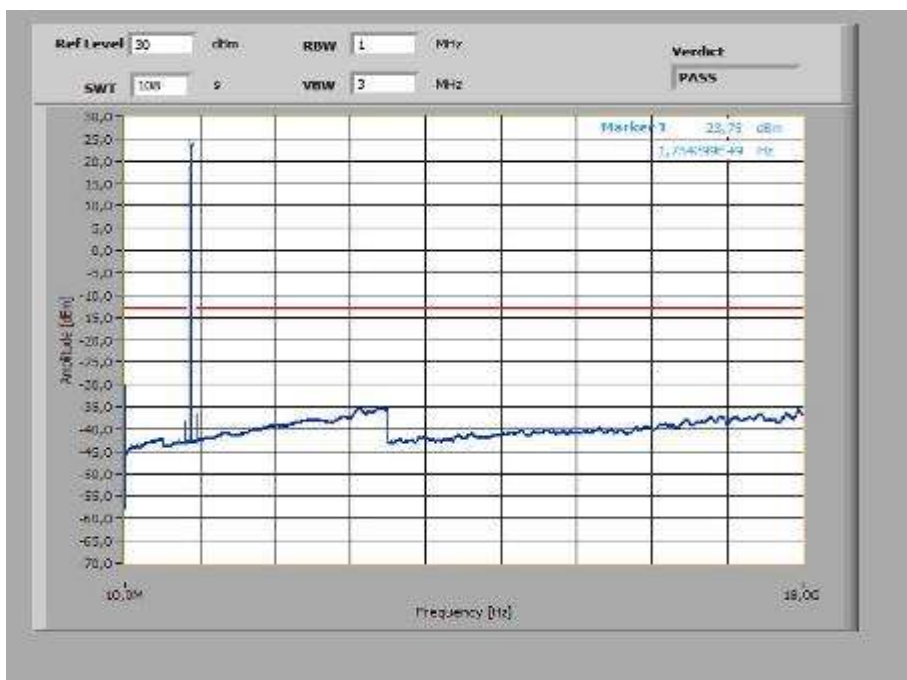
Plot 7: Lowest Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@0 tones

Plot 8: Middle Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@0 tones

Plot 9: Highest Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@0 tones

Plot 10: Lowest Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@11 tones

Plot 11: Middle Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@11 tones

Plot 12: Highest Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@11 tones

Plots: QPSK

Plot 1: Lowest Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@0 tones
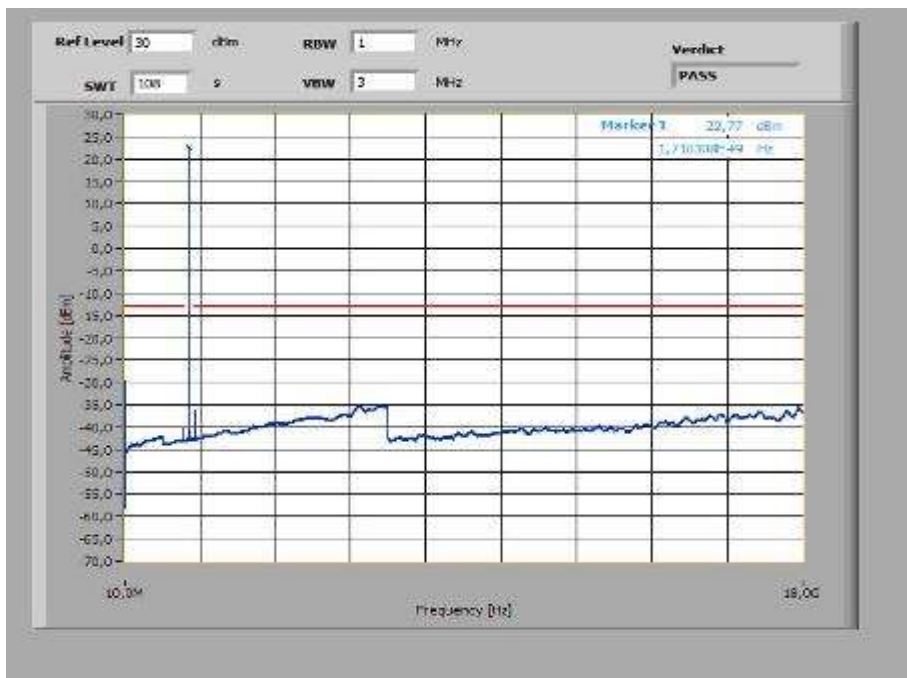
Plot 2: Middle Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@0 tones
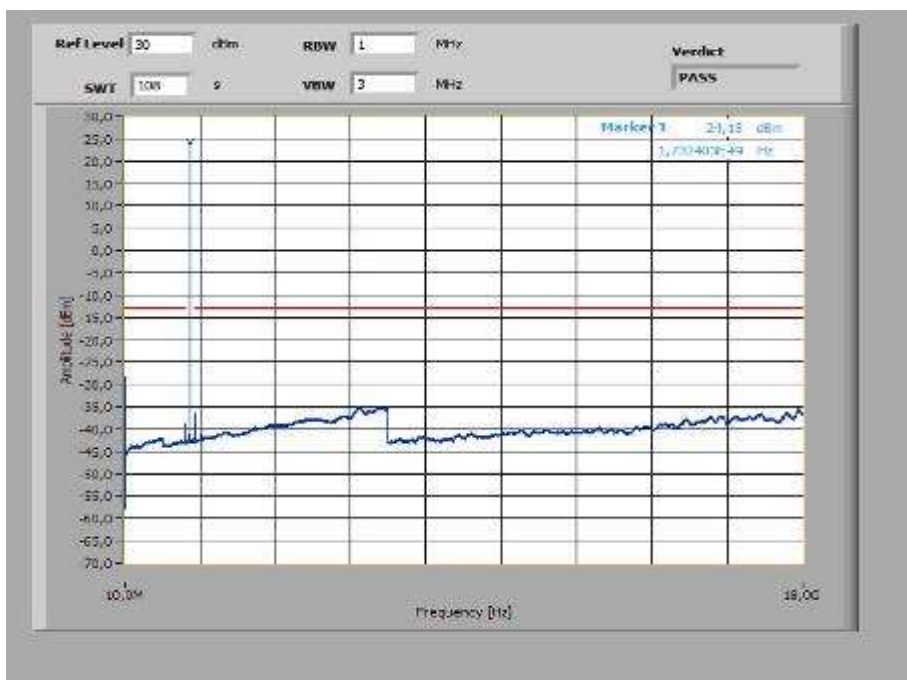
Plot 3: Highest Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@0 tones
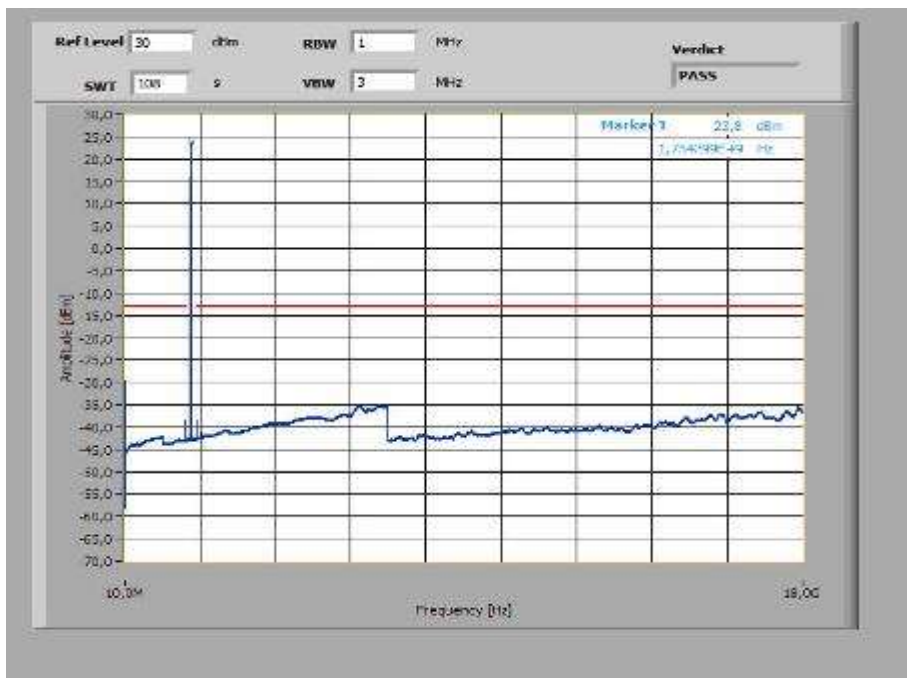
Plot 4: Lowest Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@47 tones
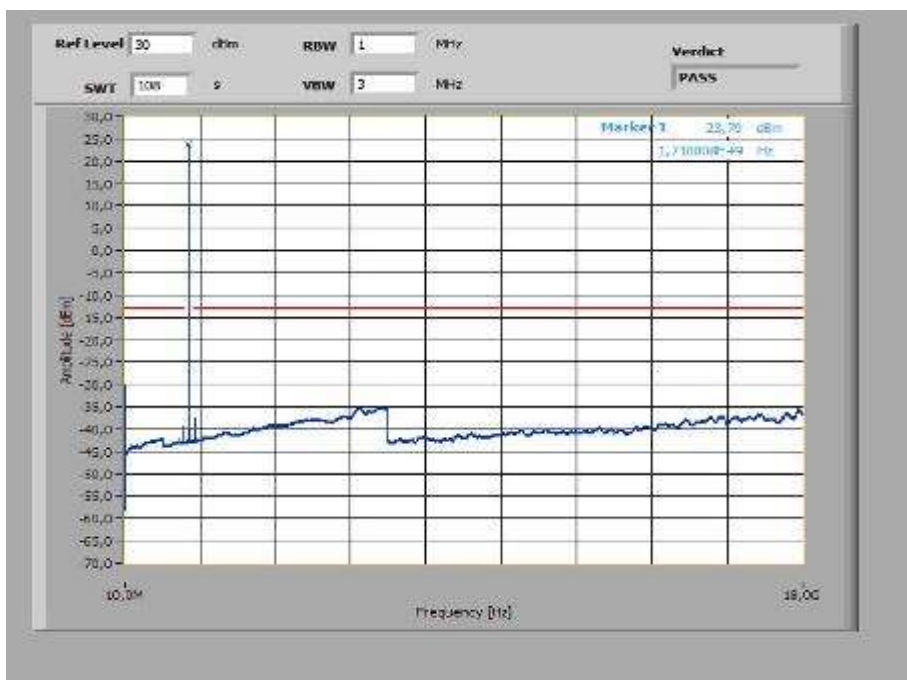
Plot 5: Middle Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@47 tones
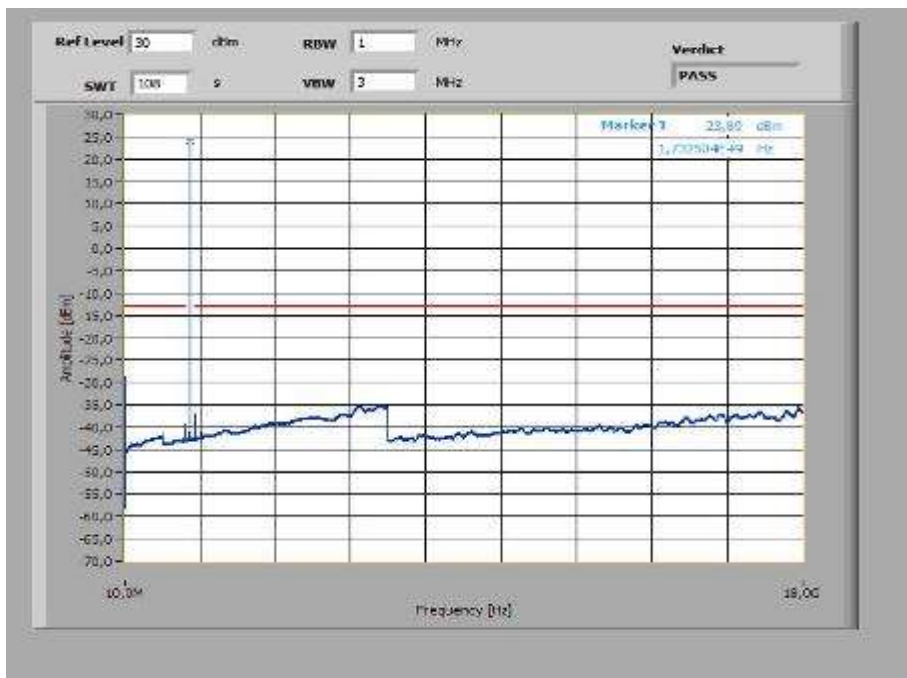
Plot 6: Highest Channel (10 MHz – 18 GHz), spacing 3.75 kHz, 1@47 tones
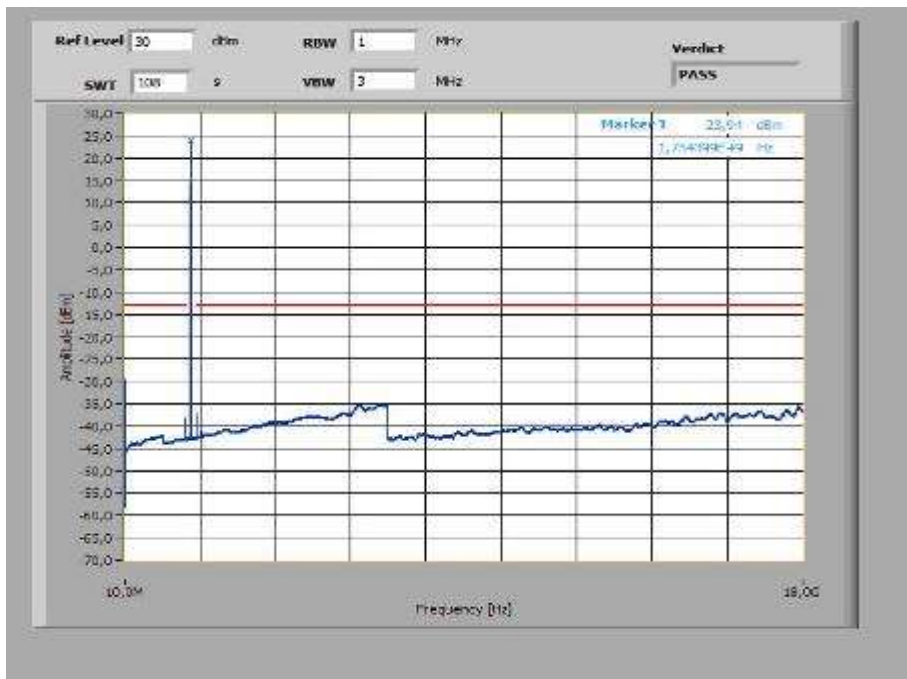
Plot 7: Lowest Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@0 tones
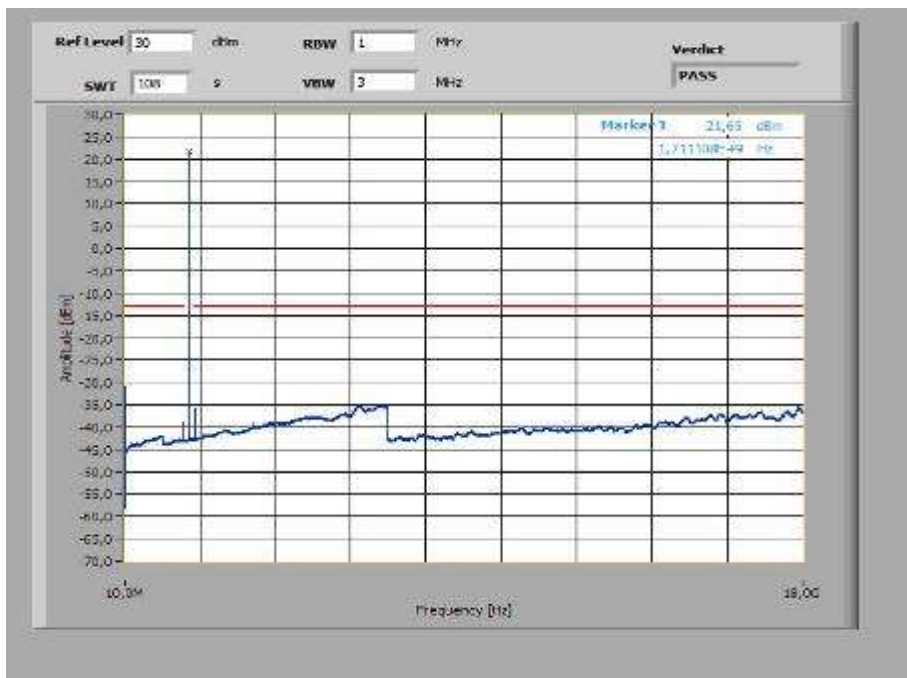
Plot 8: Middle Channel (10 MHz – 185 GHz), spacing 15 kHz, 1@0 tones
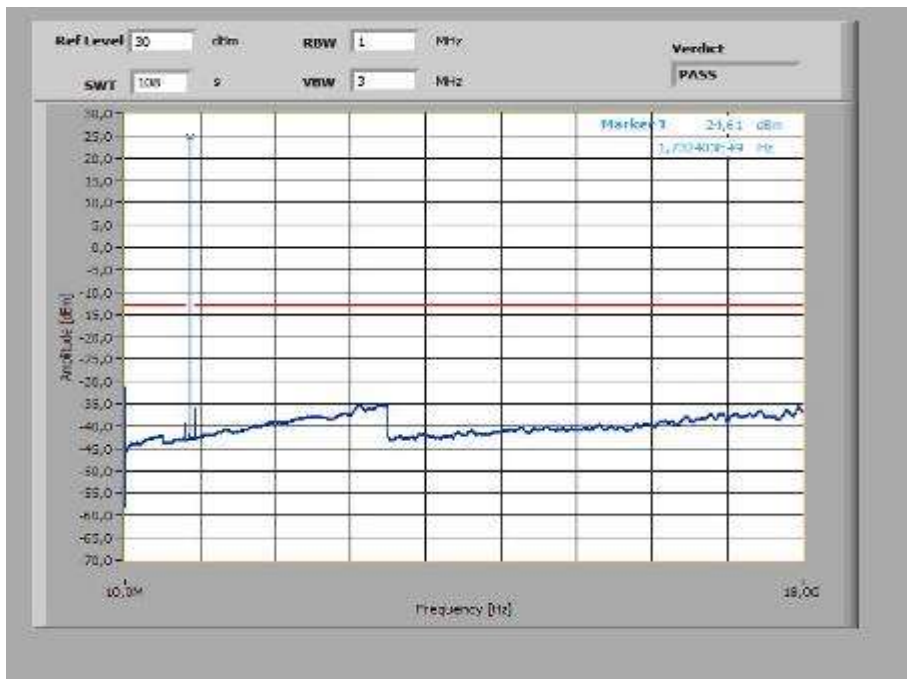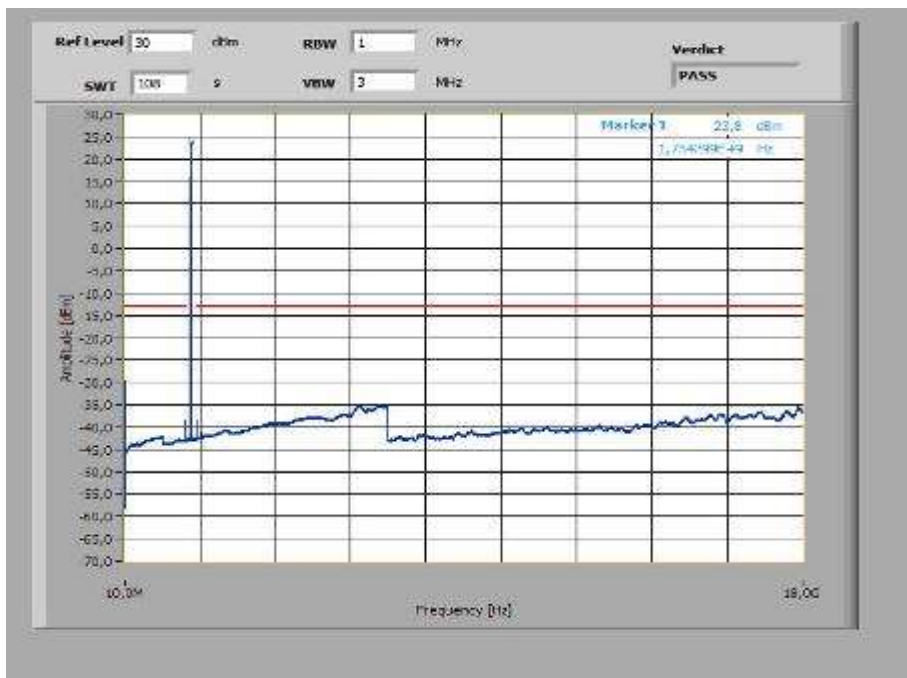
Plot 9: Highest Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@0 tones

Plot 10: Lowest Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@11 tones
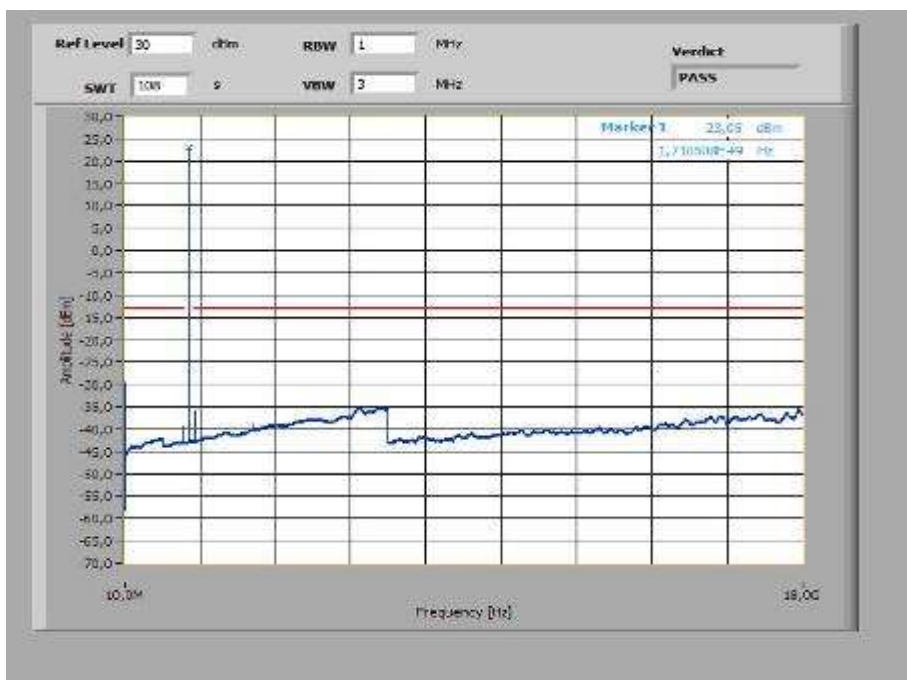
Plot 11: Middle Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@11 tones

Plot 12: Highest Channel (10 MHz – 18 GHz), spacing 15 kHz, 1@11 tones

Plot 13: Lowest Channel (10 MHz – 18 GHz), spacing 15 kHz, 12@0 tones

Plot 14: Middle Channel (10 MHz – 18 GHz), spacing 15 kHz, 12@0 tones

Plot 15: Highest Channel (10 MHz – 18 GHz), spacing 15 kHz, 12@0 tones

16.2.5 Block edge compliance

Description:

The spectrum at the band edges must comply with the spurious emissions limits.

For the measurement the lowest, middle and highest channel bandwidth was used. If spurious were found the other bandwidths were measured, too.

Measurement:

Measurement parameters	
Detector:	RMS
Sweep time:	180s
Video bandwidth:	100 kHz
Resolution bandwidth:	20 kHz
Span:	1 MHz
Trace-Mode:	Max Hold
Used equipment:	See chapter 7.2 setup A
Measurement uncertainty:	See chapter 9
Measurement procedure	FCC: § 2.1051 ISED: RSS-Gen, 6.13

Limits:

FCC	ISED
§ 27.53(h)(1) & (3)	RSS-139, 6.6
(1) Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB. (3) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.	i. In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 (P) (watts) dB. ii. After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 (P) (watts) dB.
-13 dBm Correction factor according to KDB 890810 if RBW < 1 % emission bandwidth: ☒N/A here ☐10 log (RBW1/RBW2) = X dB; whereas: RBW1 = Y, RBW2 = Z	

Results: BPSK

Plot 1: Lowest channel, spacing 3.75 kHz, 1@0 tones
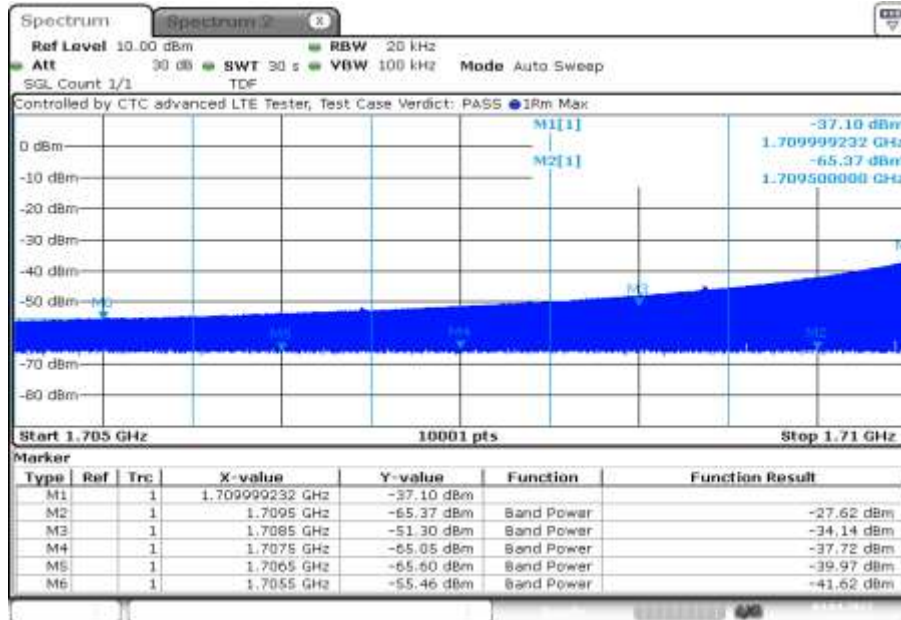

Date: 4.APR.2022 16:13:16

Plot 2: Highest channel, spacing 3.75 kHz, 1@0 tones
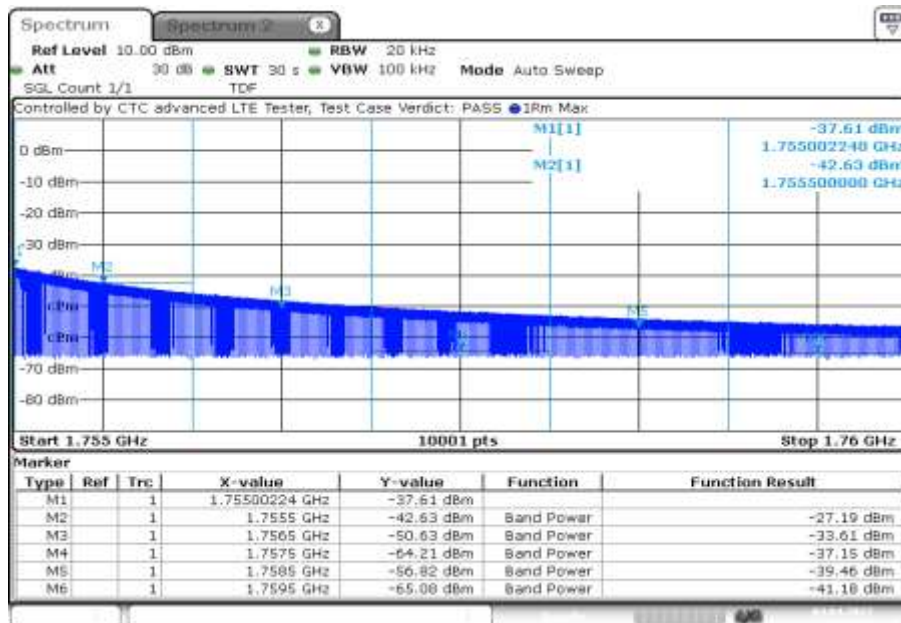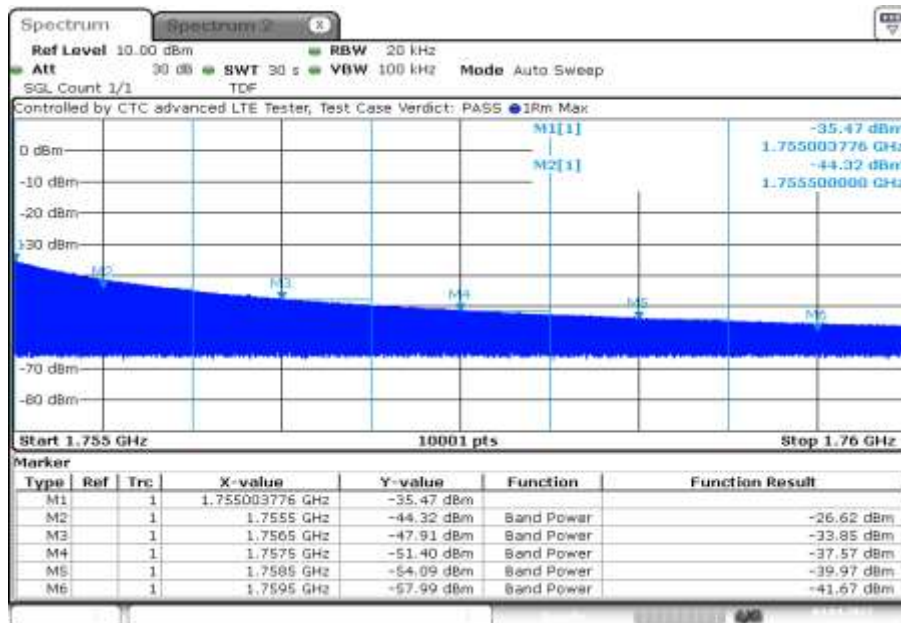

Date: 4.APR.2022 18:31:42

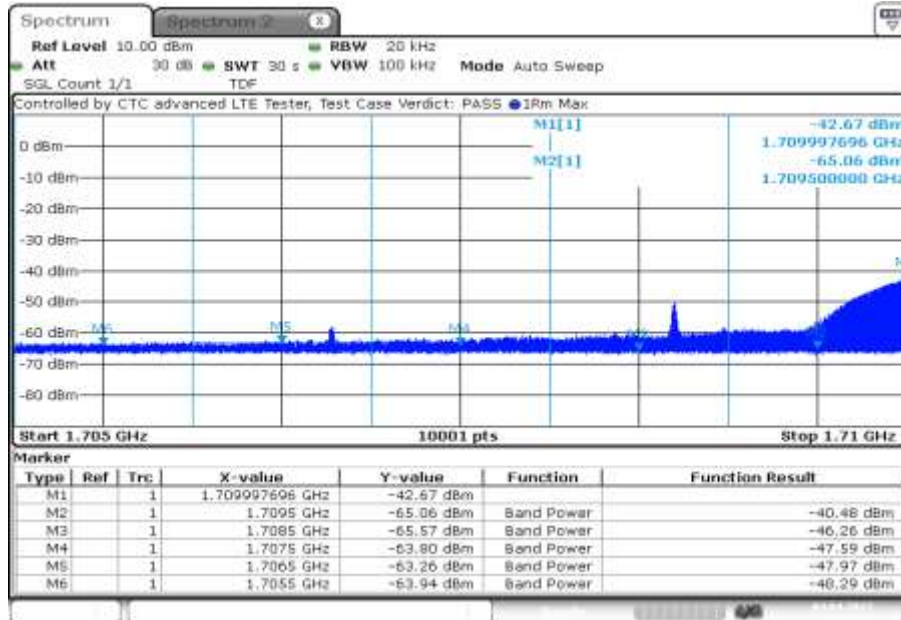**Plot 3:** Lowest channel, spacing 3.75 kHz, 1@47 tones
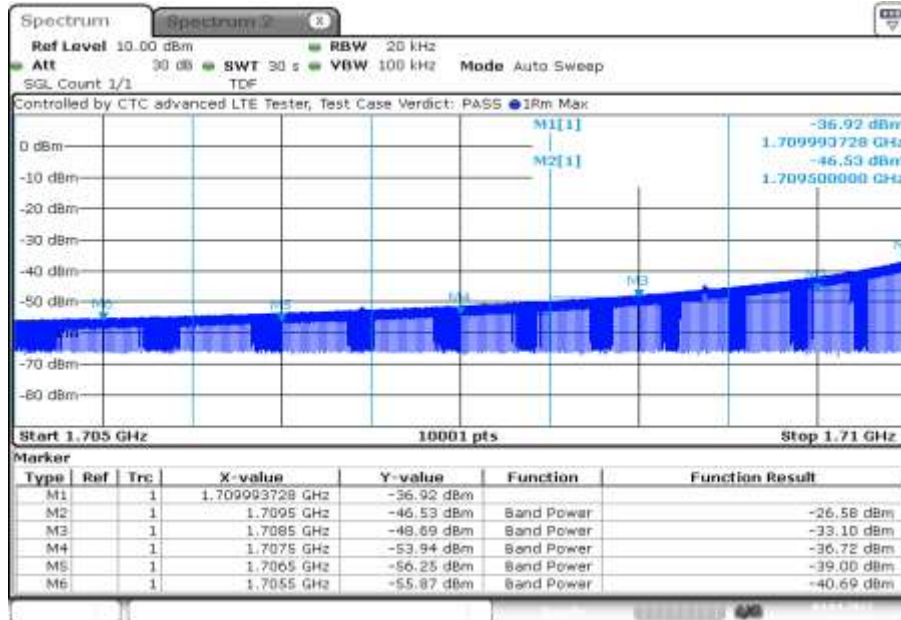
Date: 4.APR.2022 16:21:07
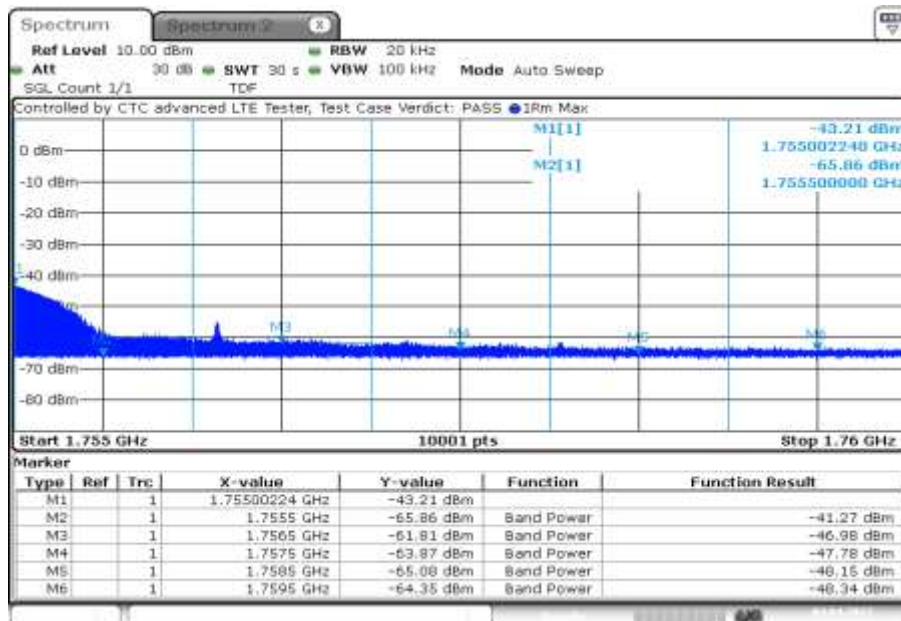
Plot 4: Highest channel, spacing 3.75 kHz, 1@47 tones
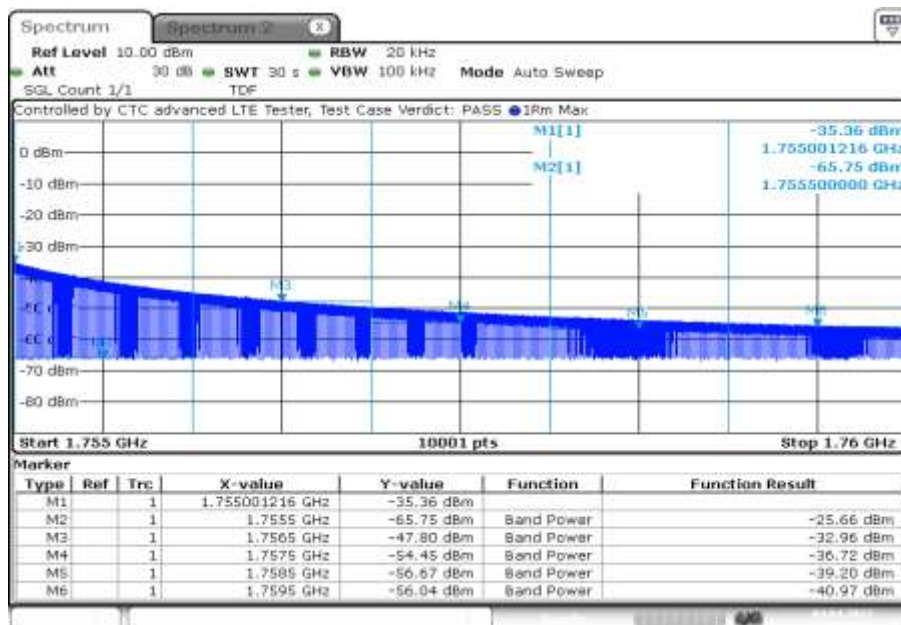
Date: 4.APR.2022 18:39:33

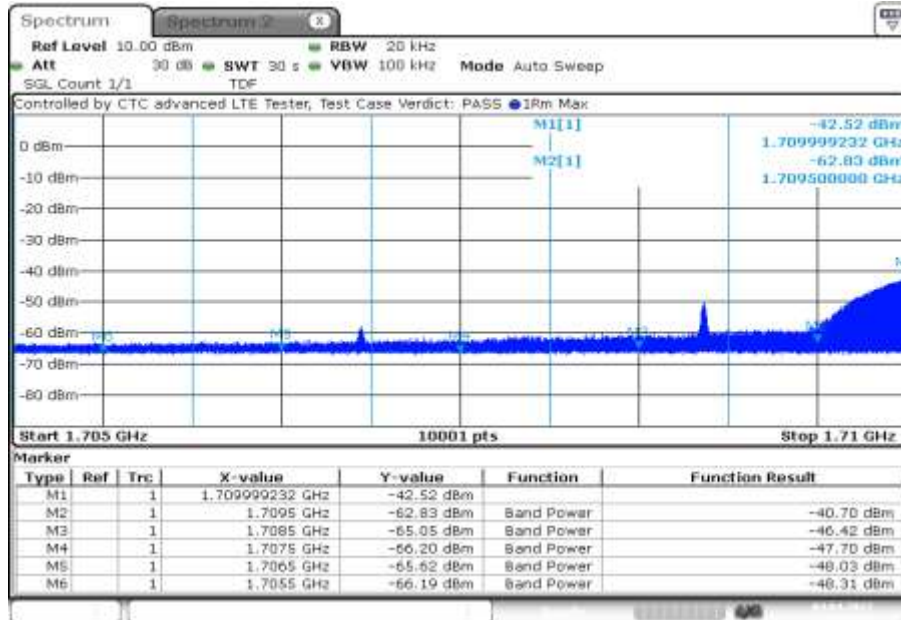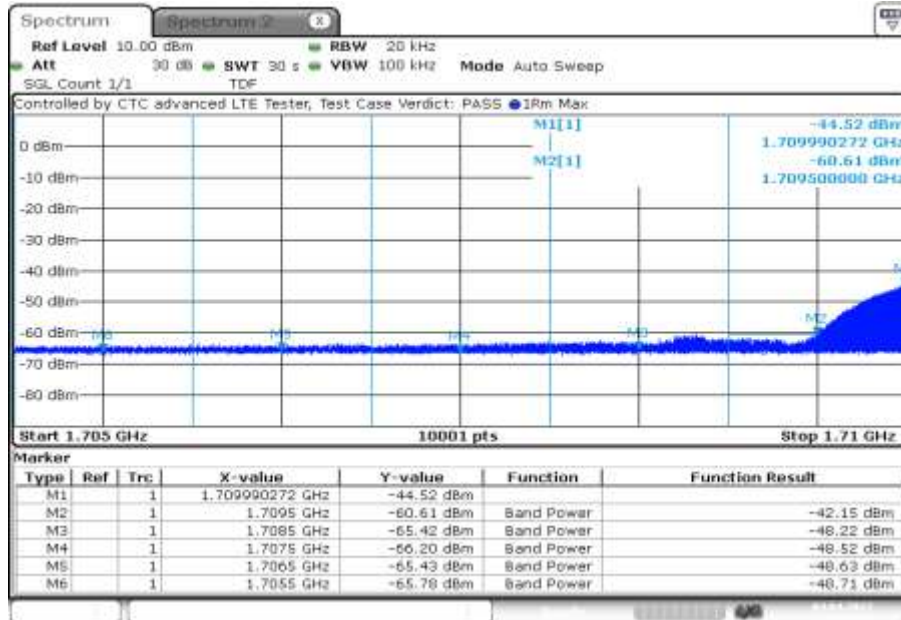**Plot 5:** Lowest channel, spacing 15 kHz, 1@0 tones
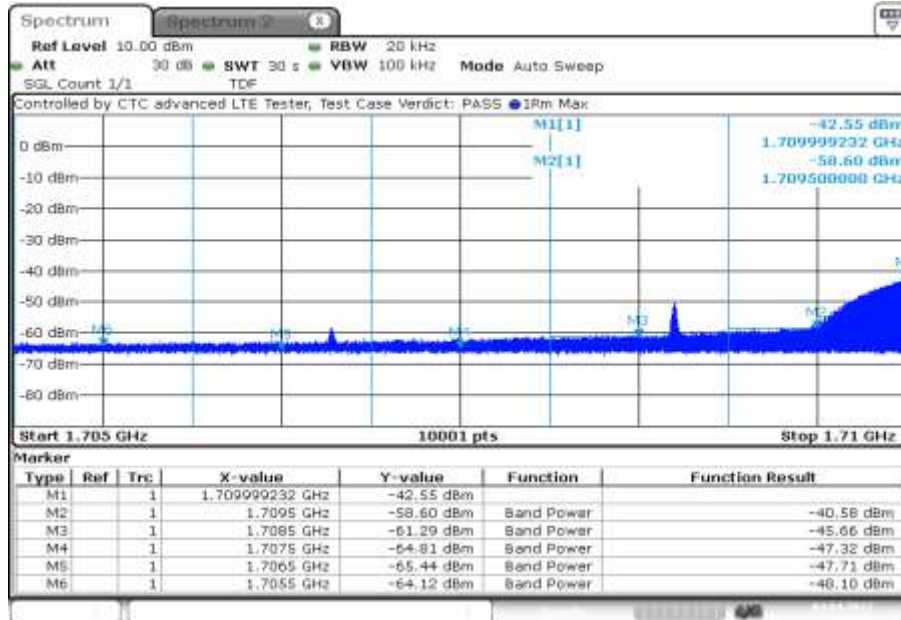
Date: 4.APR.2022 16:45:32

Plot 6: Highest channel, spacing 15 kHz, 1@0 tones
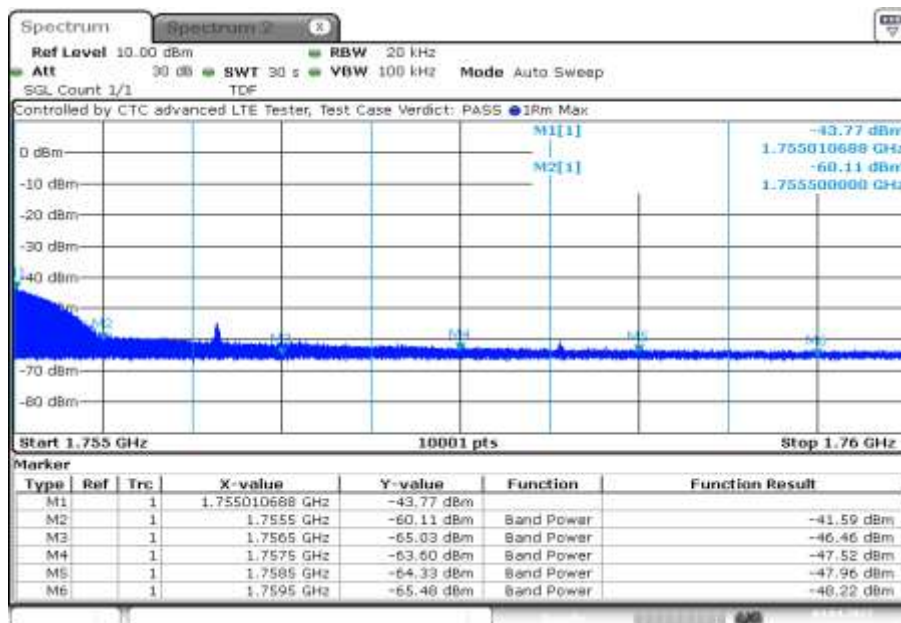
Date: 4.APR.2022 19:03:40

Plot 7: Lowest channel, spacing 15 kHz, 1@11 tones
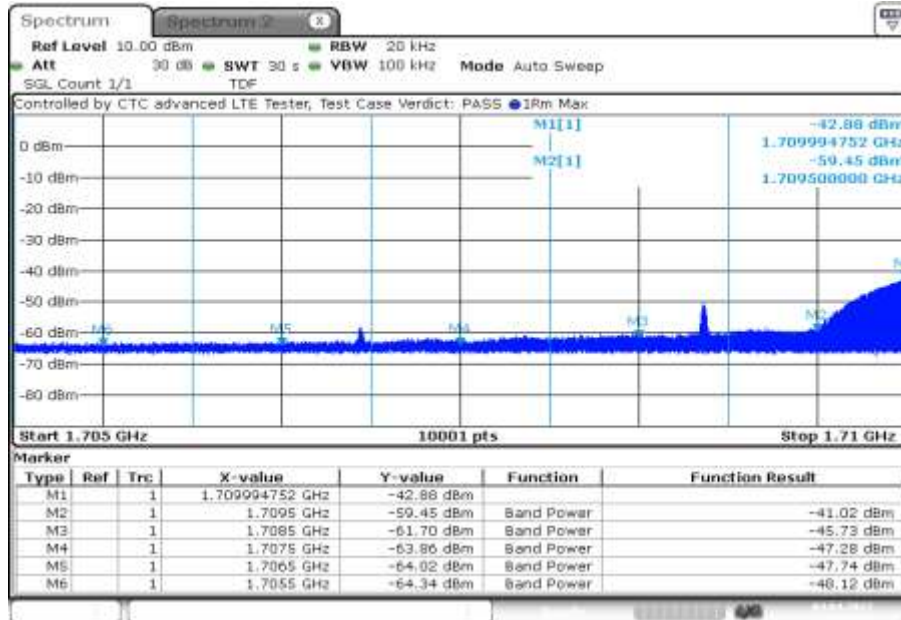
Date: 4.APR.2022 16:53:23

Plot 8: Highest channel, spacing 15 kHz, 1@11 tones
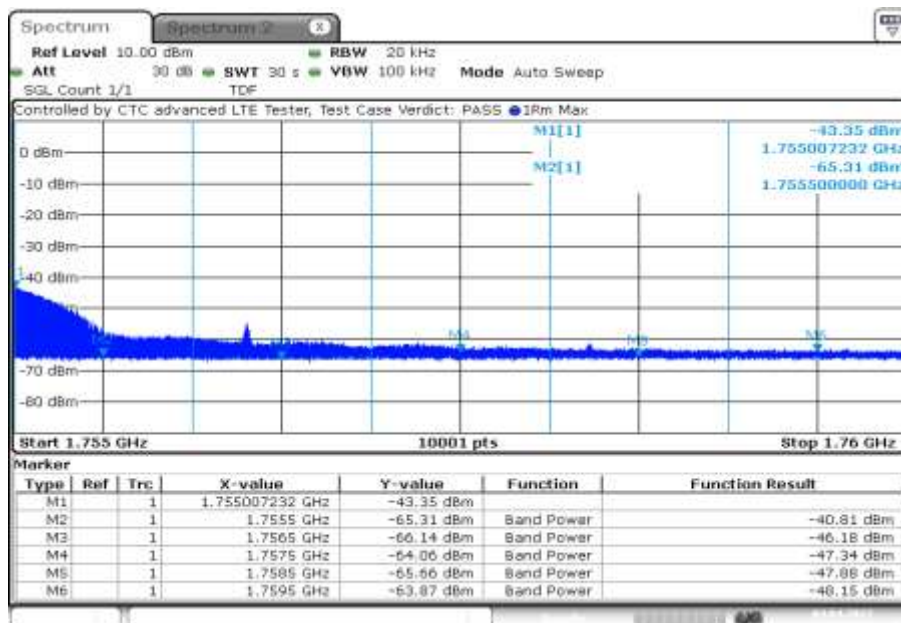
Date: 4.APR.2022 19:11:31

Results: QPSK

Plot 1: Lowest channel, spacing 3.75 kHz, 1@0 tones

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.709996288 GHz	-34.89 dBm		
M2		1	1.7095 GHz	-57.53 dBm	Band Power	-26.12 dBm
M3		1	1.7085 GHz	-47.65 dBm	Band Power	-33.53 dBm
M4		1	1.7075 GHz	-66.09 dBm	Band Power	-37.32 dBm
M5		1	1.7065 GHz	-65.74 dBm	Band Power	-39.70 dBm
M6		1	1.7055 GHz	-58.11 dBm	Band Power	-41.38 dBm
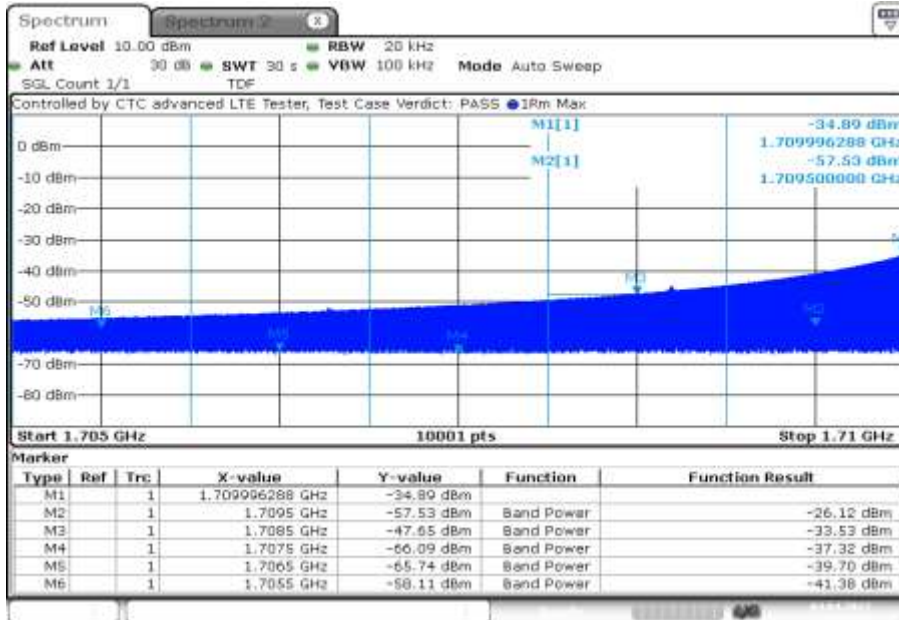
Date: 4.APR.2022 16:28:59

Plot 2: Highest channel, spacing 3.75 kHz, 1@0 tones

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.755008768 GHz	-37.42 dBm		
M2		1	1.7555 GHz	-62.85 dBm	Band Power	-27.94 dBm
M3		1	1.7565 GHz	-65.84 dBm	Band Power	-34.37 dBm
M4		1	1.7575 GHz	-64.92 dBm	Band Power	-37.87 dBm
M5		1	1.7585 GHz	-56.76 dBm	Band Power	-40.16 dBm
M6		1	1.7595 GHz	-58.56 dBm	Band Power	-41.78 dBm
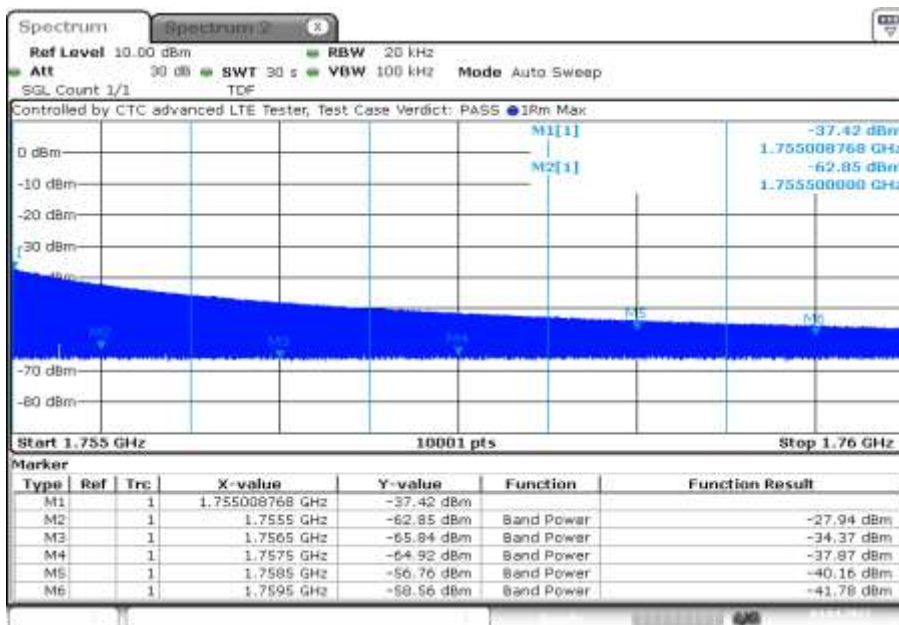
Date: 4.APR.2022 18:47:24

Plot 3: Lowest channel, spacing 3.75 kHz, 1@47 tones

Date: 4.APR.2022 16:36:50

Plot 4: Highest channel, spacing 3.75 kHz, 1@47 tones

Date: 4.APR.2022 18:55:15

Plot 5: Lowest channel, spacing 15 kHz, 1@0 tones

Date: 4.APR.2022 17:01:14

Plot 6: Highest channel, spacing 15 kHz, 1@0 tones

Date: 4.APR.2022 19:19:22

Plot 7: Lowest channel, spacing 15 kHz, 1@11 tones

Date: 4.APR.2022 17:09:06

Plot 8: Highest channel, spacing 15 kHz, 1@11 tones
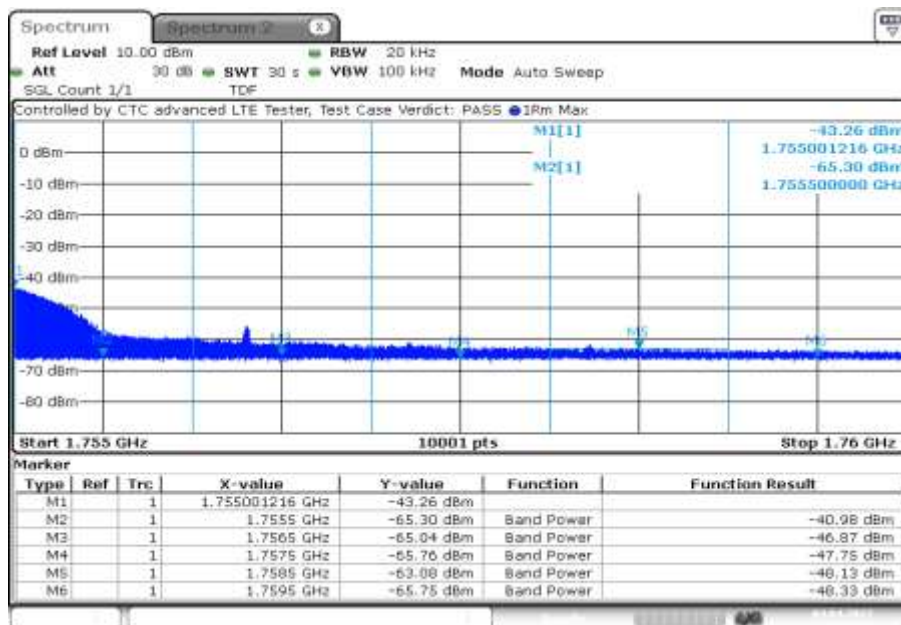
Date: 4.APR.2022 19:27:13

Plot 9: Lowest channel, spacing 15 kHz, 12@0 tones

Date: 4.APR.2022 17:16:57

Plot 10: Highest channel, spacing 15 kHz, 12@0 tones
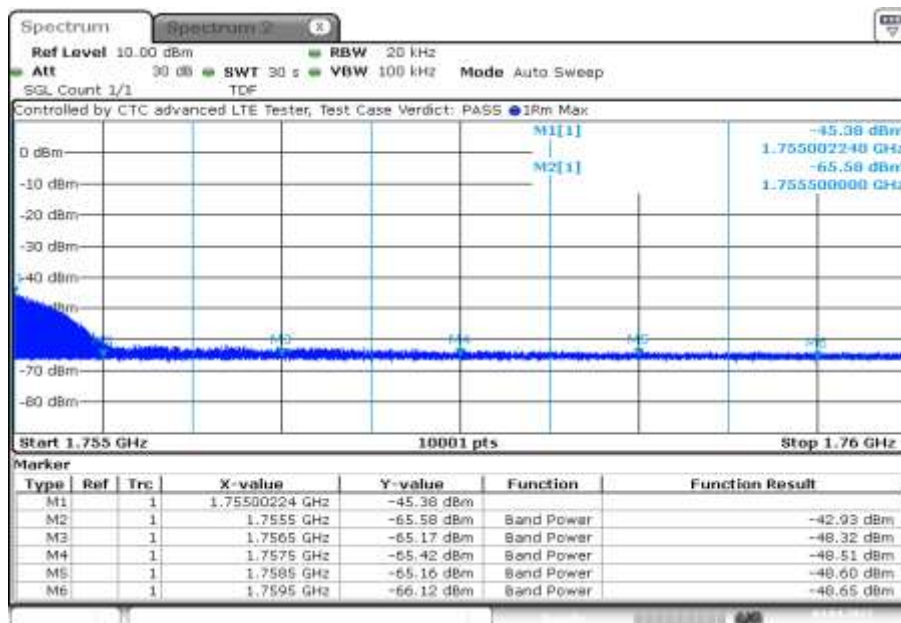
Date: 4.APR.2022 19:35:04

16.2.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the mid frequencies of the LTE band 4 frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 27.53 requires a measurement bandwidth of at least 1% of the occupied bandwidth.

Measurement parameters	
Detector:	Peak
Sweep time:	180s
Video bandwidth:	100 kHz
Resolution bandwidth:	30 kHz
Span:	2 x nominal bandwidth
Trace-Mode:	Max Hold
Used equipment:	See chapter 7.4 setup A
Measurement uncertainty:	See chapter 9
Measurement procedure	FCC: § 2.1049 ISED: RSS-Gen, 6.7

Limits:

FCC	ISED
§ 2.1049	RSS-Gen, 6.7
Reporting only	

Results:

Occupied Bandwidth – BPSK		
Mode	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
Low channel / spacing 3.75 kHz; 1@0 tones	64	40
Mid channel / spacing 3.75 kHz; 1@0 tones	63	40
High channel / spacing 3.75 kHz; 1@0 tones	63	40
Low channel / spacing 3.75 kHz; 1@47 tones	64	39
Mid channel / spacing 3.75 kHz; 1@47 tones	65	37
High channel / spacing 3.75 kHz; 1@47 tones	64	38
Low channel / spacing 15 kHz; 1@0 tones	121	100
Mid channel / spacing 15 kHz; 1@0 tones	131	103
High channel / spacing 15 kHz; 1@0 tones	116	104
Low channel / spacing 15 kHz; 1@11 tones	122	118
Mid channel / spacing 15 kHz; 1@11 tones	126	116
High channel / spacing 15 kHz; 1@11 tones	121	104

Occupied Bandwidth – QPSK		
Mode	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
Low channel / spacing 3.75 kHz; 1@0 tones	70	38
Mid channel / spacing 3.75 kHz; 1@0 tones	69	39
High channel / spacing 3.75 kHz; 1@0 tones	67	39
Low channel / spacing 3.75 kHz; 1@47 tones	67	39
Mid channel / spacing 3.75 kHz; 1@47 tones	69	39
High channel / spacing 3.75 kHz; 1@47 tones	66	39
Low channel / spacing 15 kHz; 1@0 tones	120	114
Mid channel / spacing 15 kHz; 1@0 tones	118	116
High channel / spacing 15 kHz; 1@0 tones	118	114
Low channel / spacing 15 kHz; 1@11 tones	116	130
Mid channel / spacing 15 kHz; 1@11 tones	129	113
High channel / spacing 15 kHz; 1@11 tones	116	126
Low channel / spacing 15 kHz; 12@0 tones	186	251
Mid channel / spacing 15 kHz; 12@0 tones	191	250
High channel / spacing 15 kHz; 12@0 tones	191	249

Plots: BPSK

Plot 1: low channel (99% - OBW), spacing 3.75 kHz, 1@0 tones
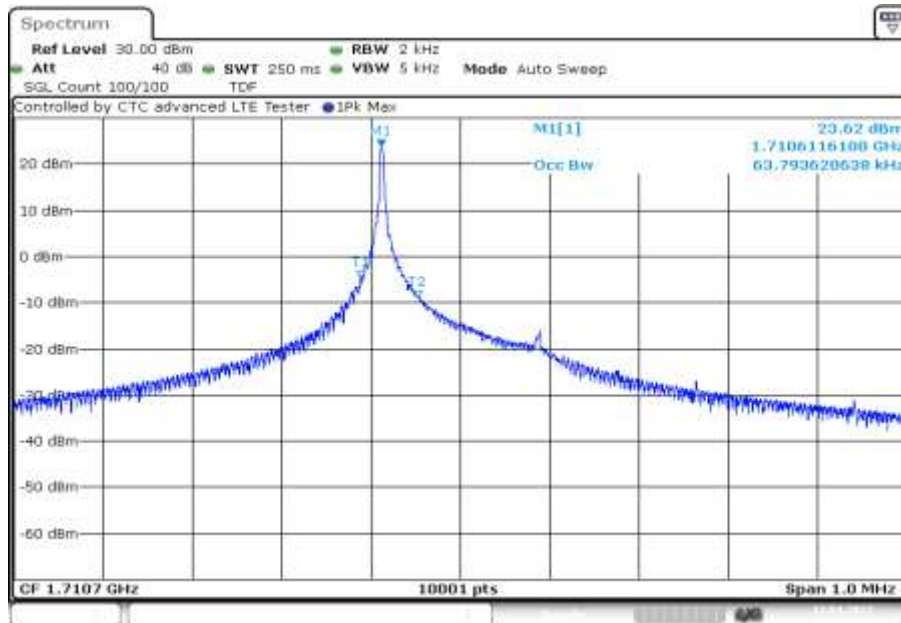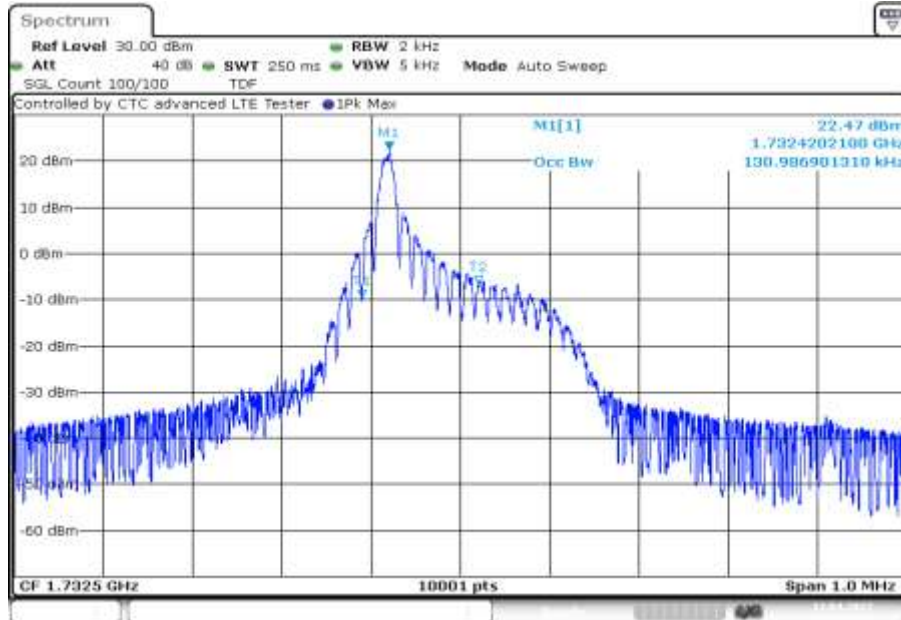

Date: 13.APR.2022 09:38:13

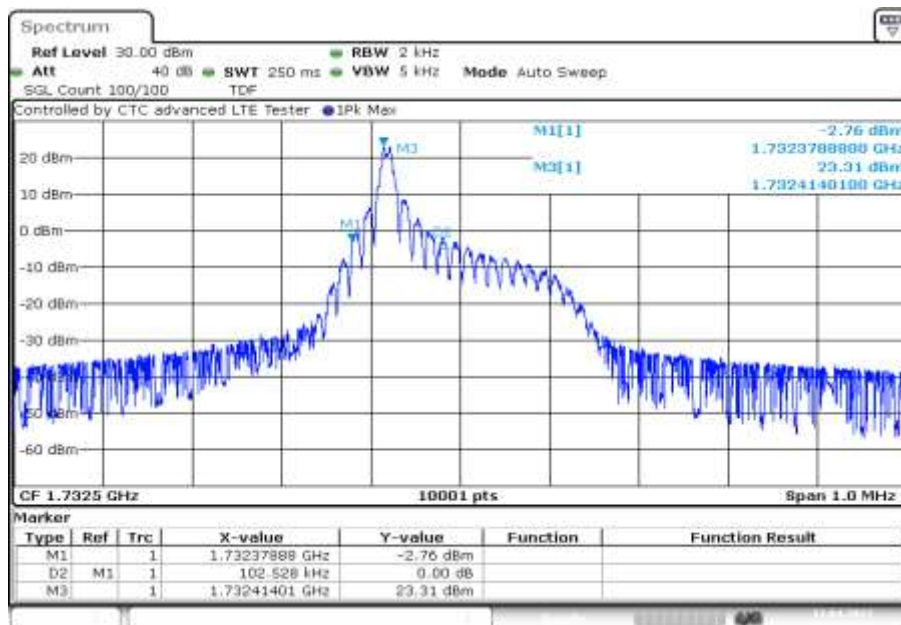**Plot 2:** low channel (-26 dBc BW), spacing 3.75 kHz, 1@0 tones
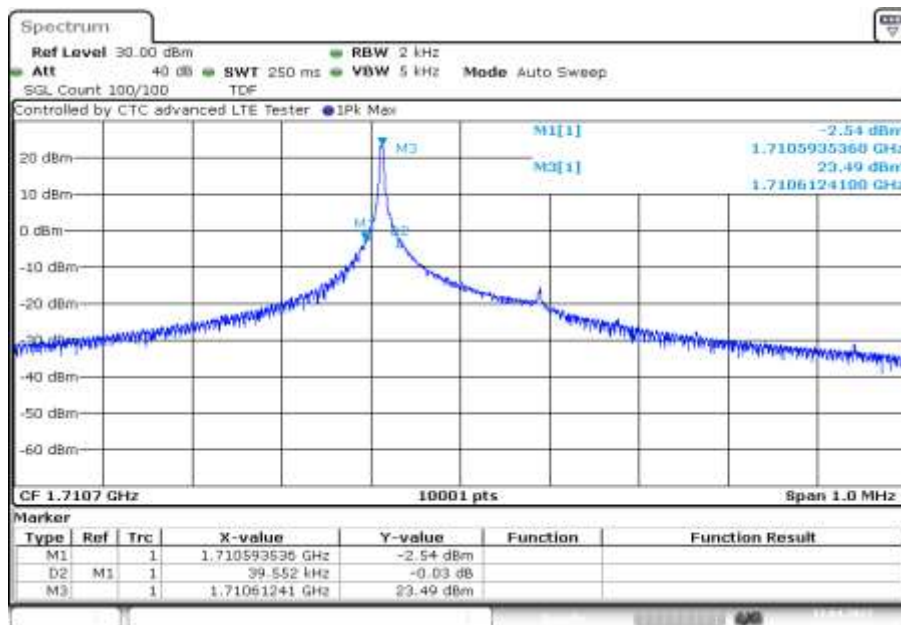
Date: 13.APR.2022 09:38:41

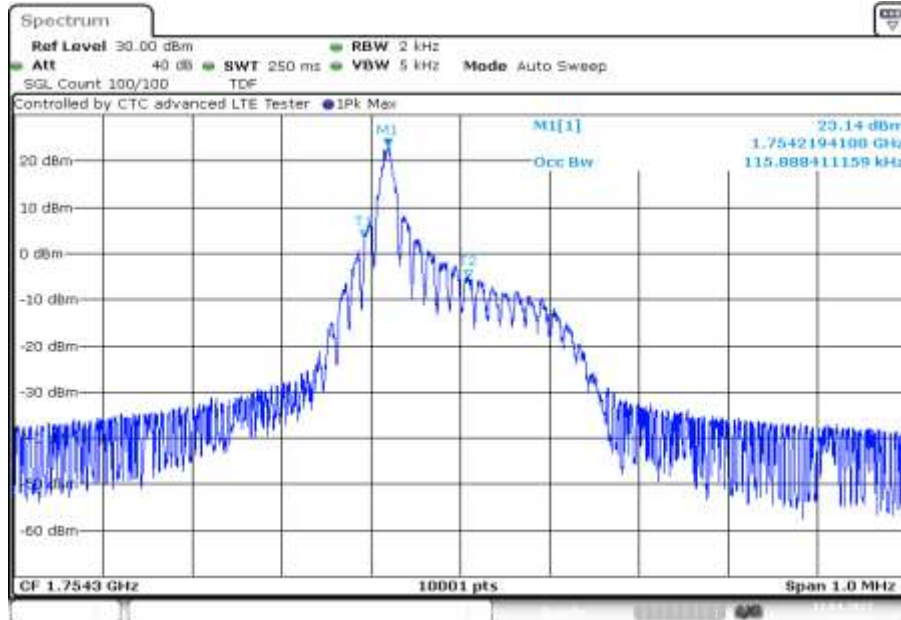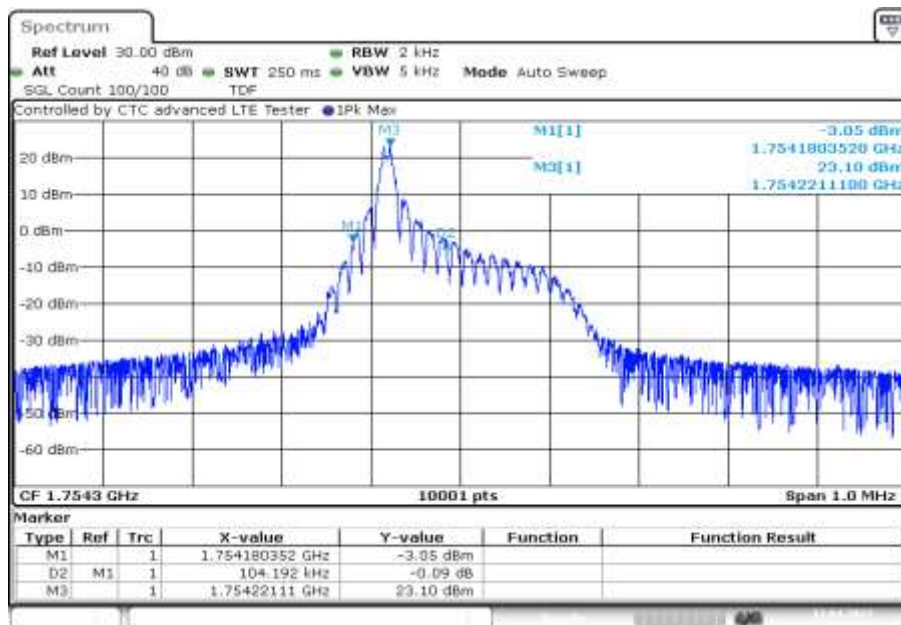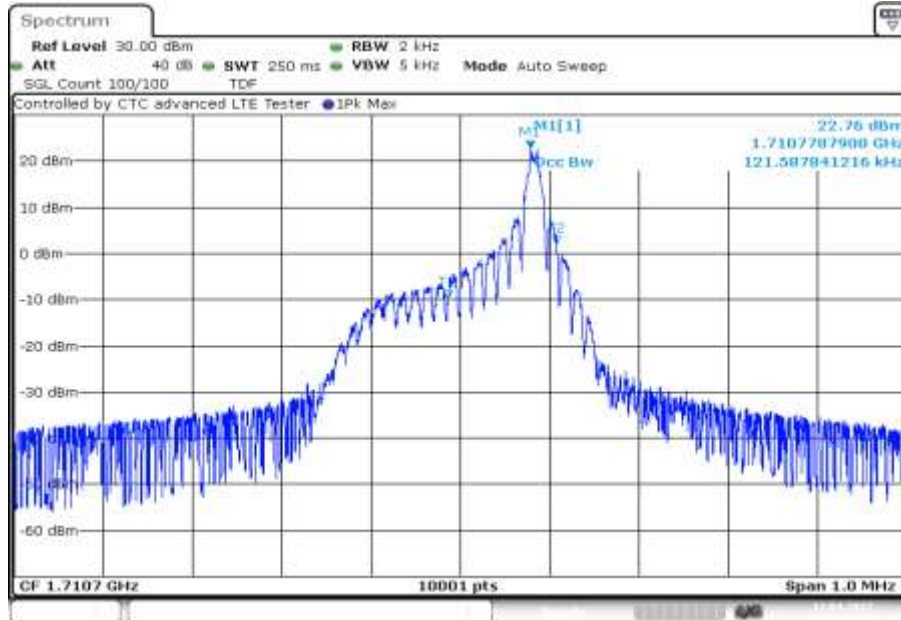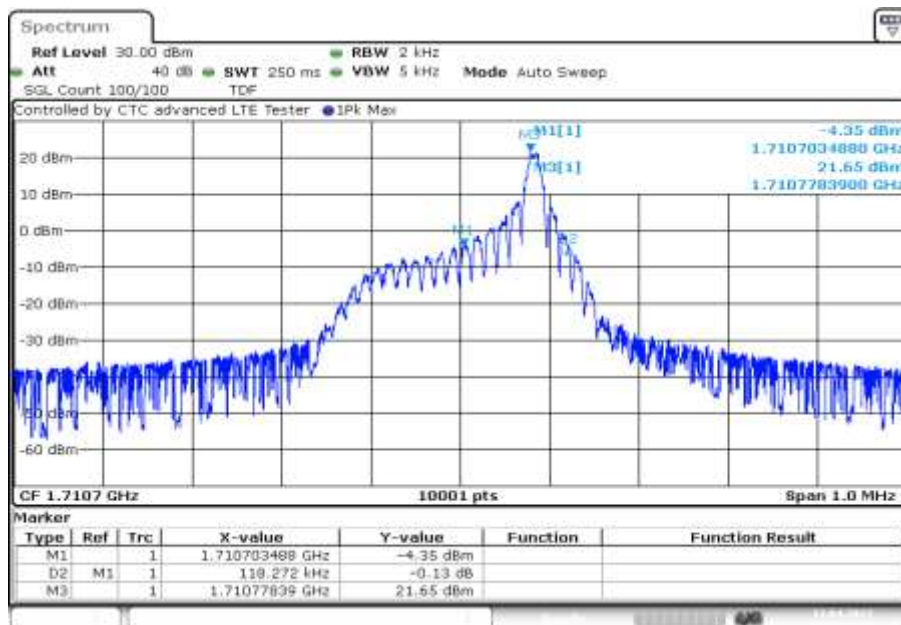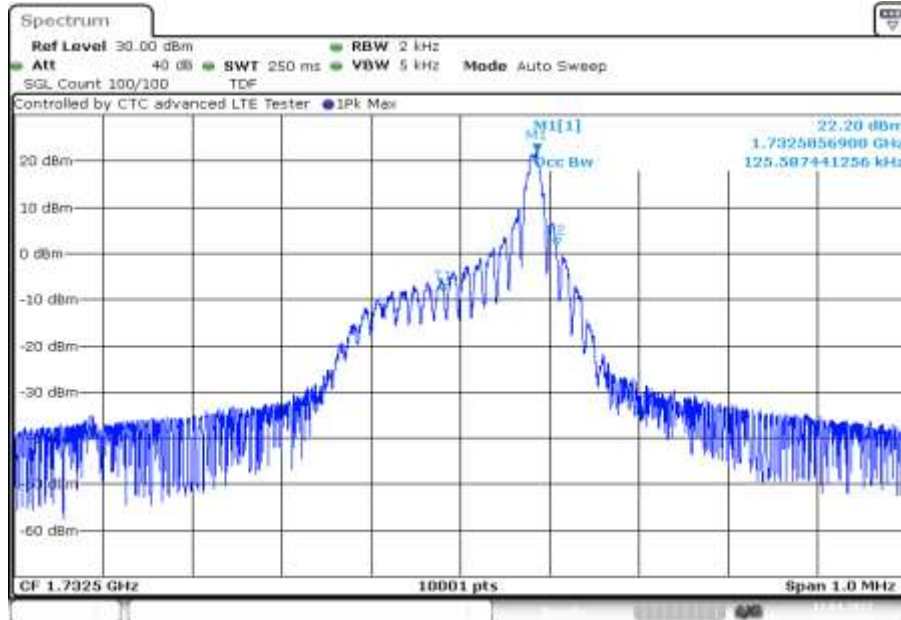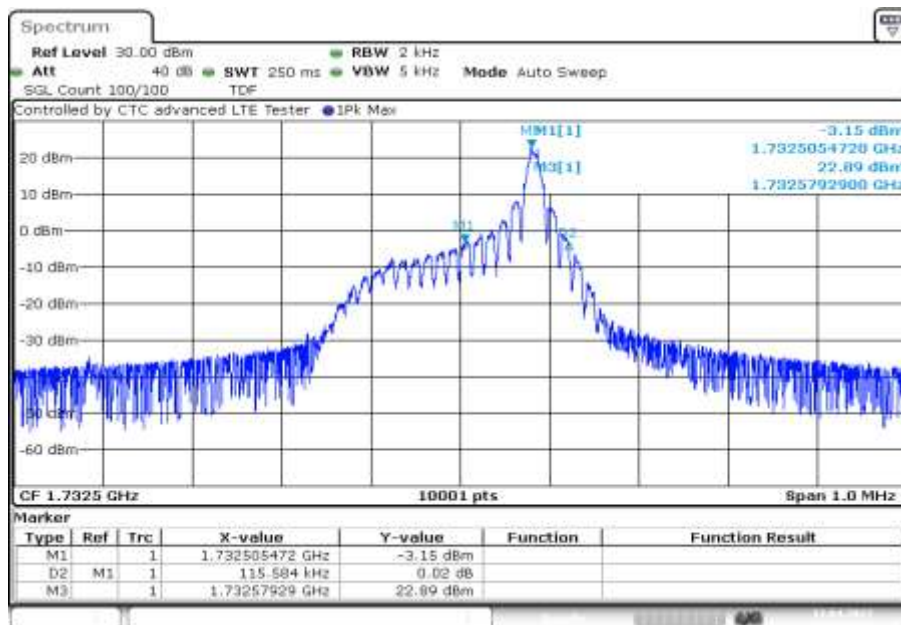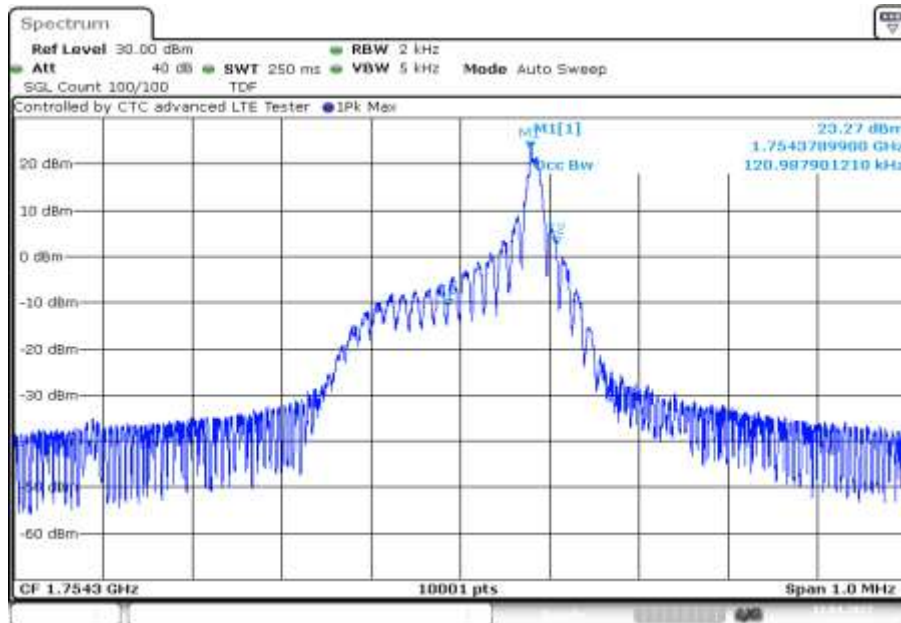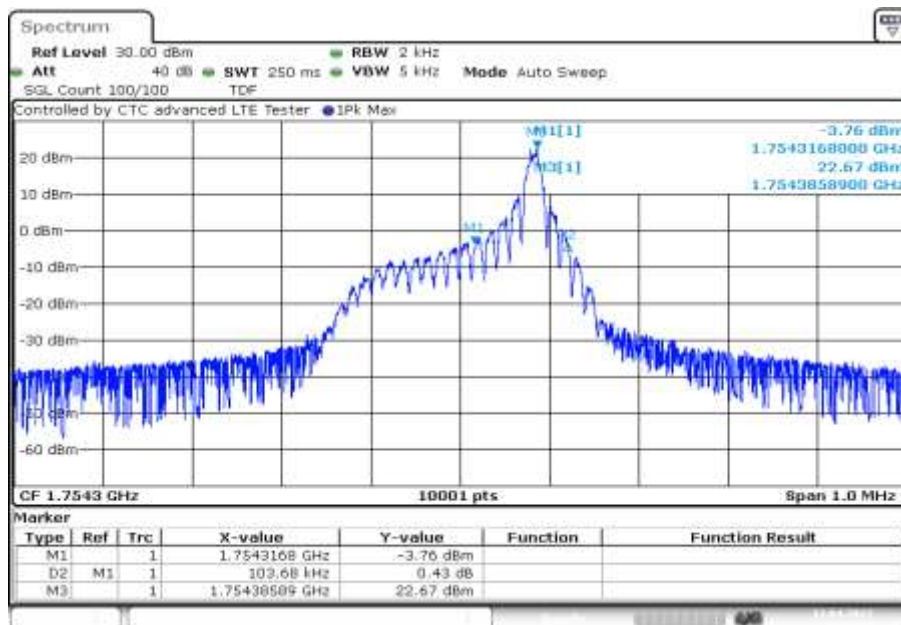**Plot 3:** mid channel (99% - OBW), spacing 3.75 kHz, 1@0 tones
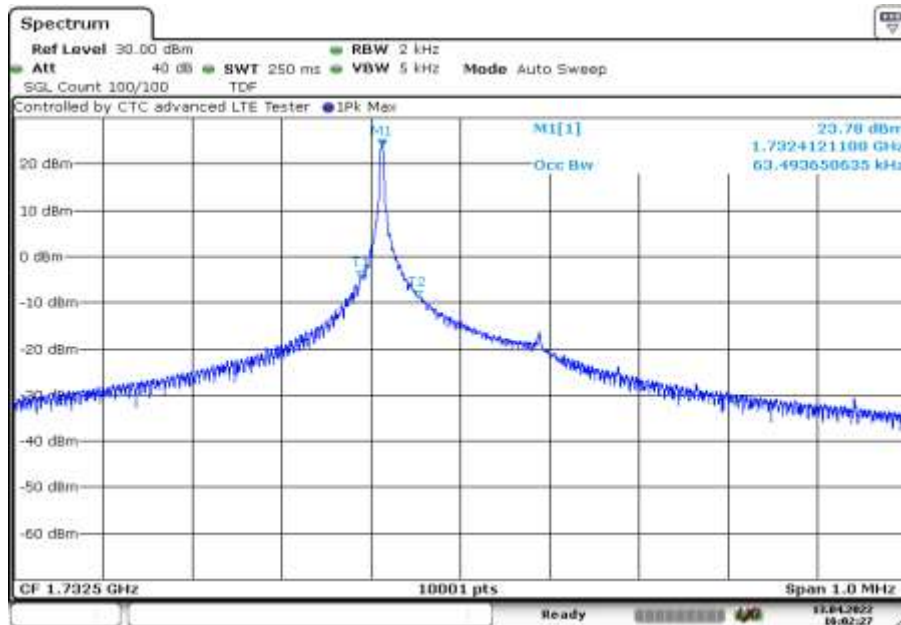
Date: 13.APR.2022 16:02:28

Plot 4: mid channel (-26 dBc BW), spacing 3.75 kHz, 1@0 tones
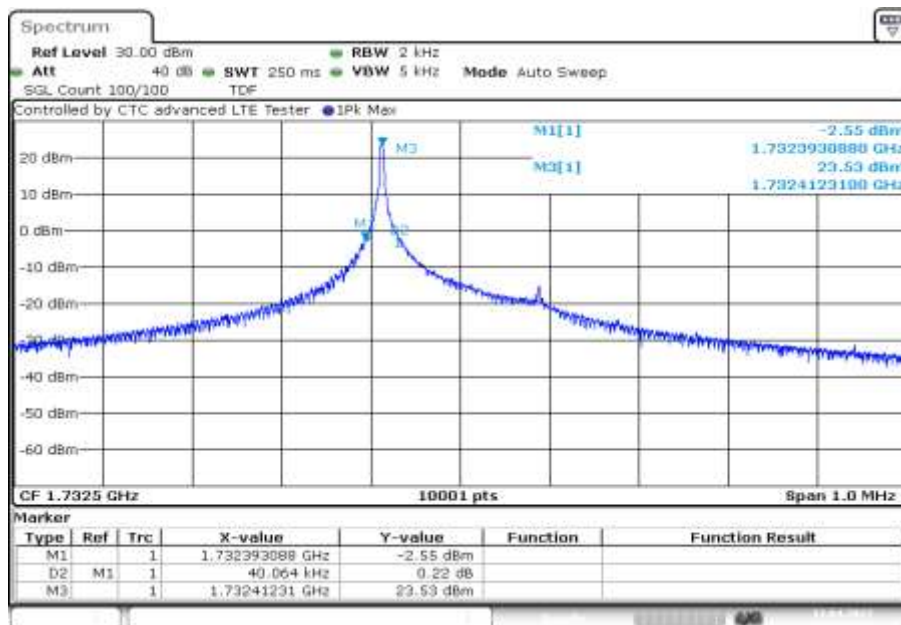
Date: 13.APR.2022 09:48:46

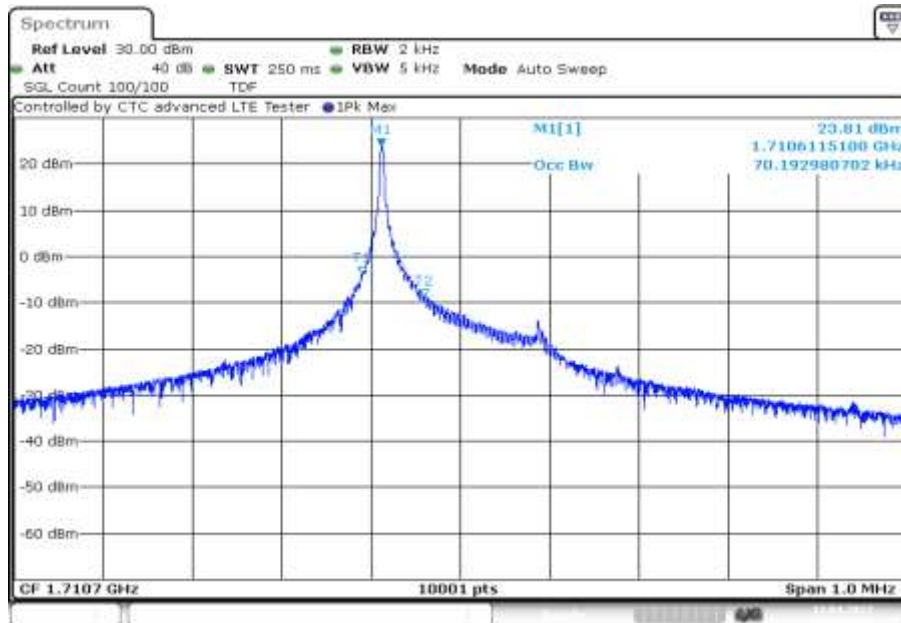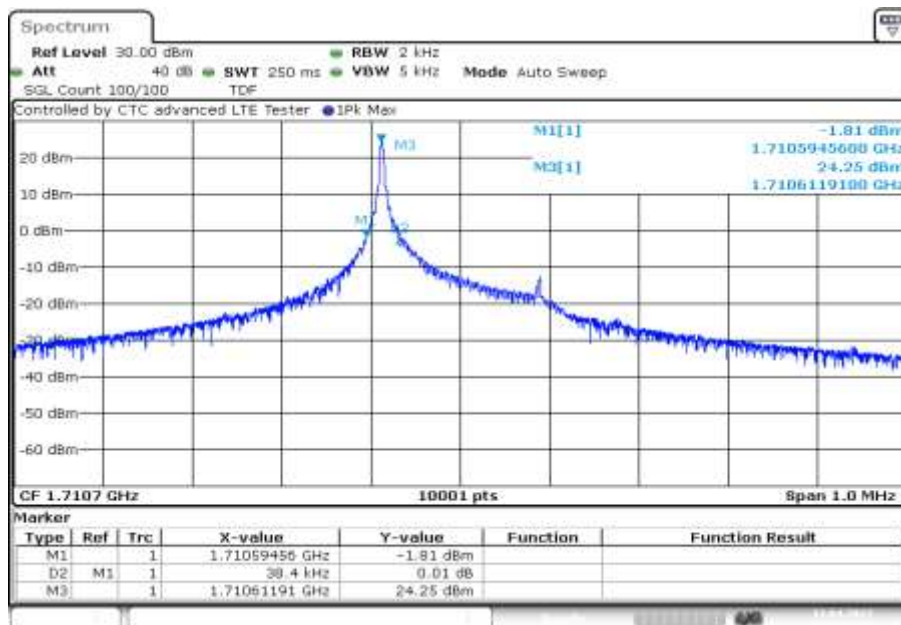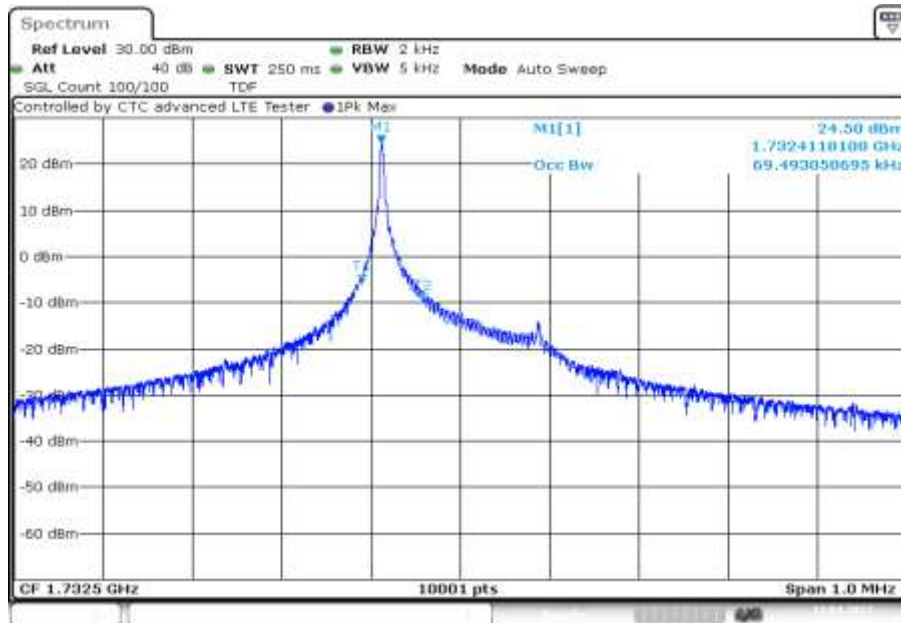**Plot 5:** high channel (99% - OBW), spacing 3.75 kHz, 1@0 tones
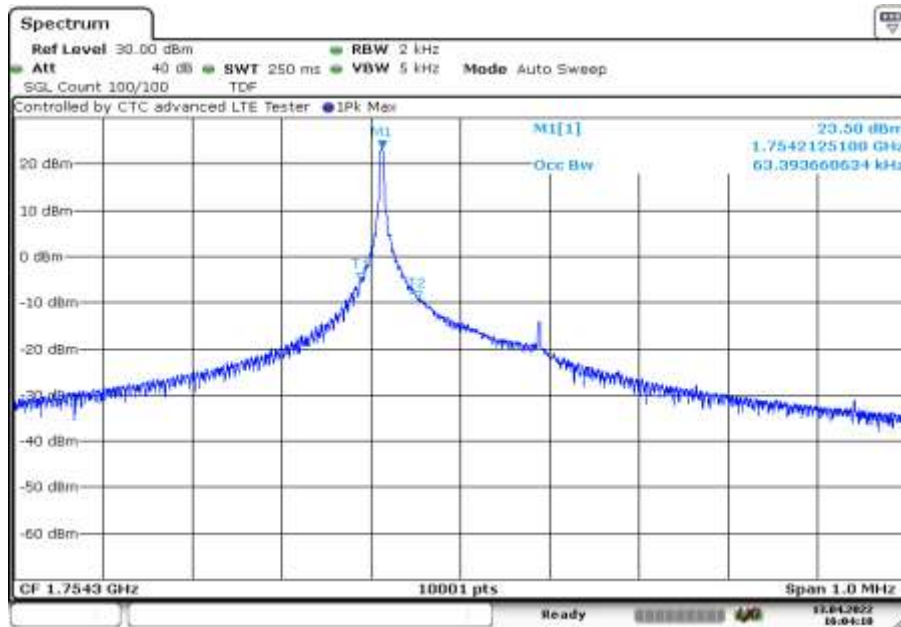
Date: 13.APR.2022 16:04:10

Plot 6: high channel (-26 dBc BW), spacing 3.75 kHz, 1@0 tones

Marker						
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.75419264 GHz	-2.80 dBm		
D2	M1	1	40.448 kHz	0.01 dB		
M3		1	1.75421141 GHz	23.29 dBm		
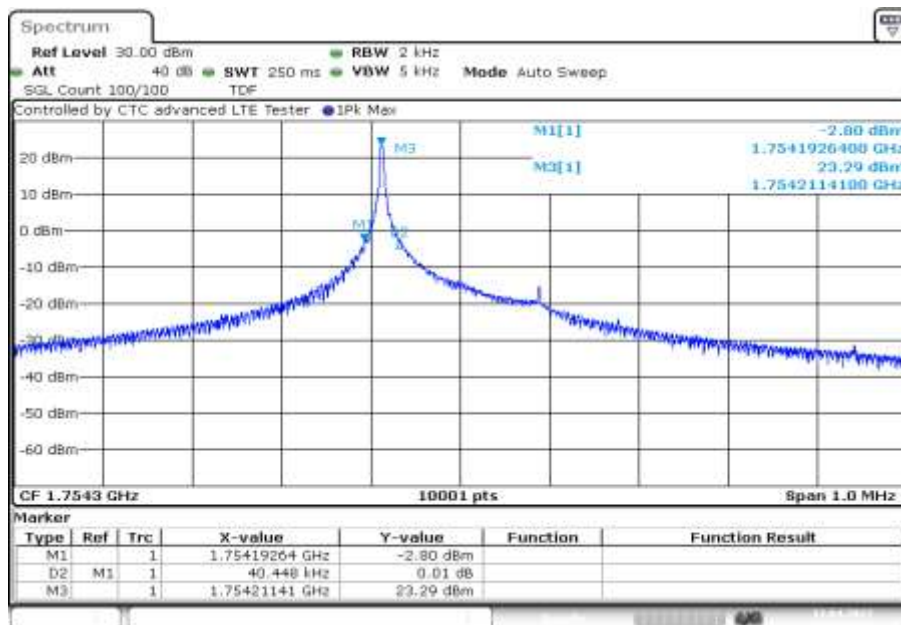
Date: 13.APR.2022 09:59:02

Plot 7: low channel (99% - OBW), spacing 3.75 kHz, 1@47 tones
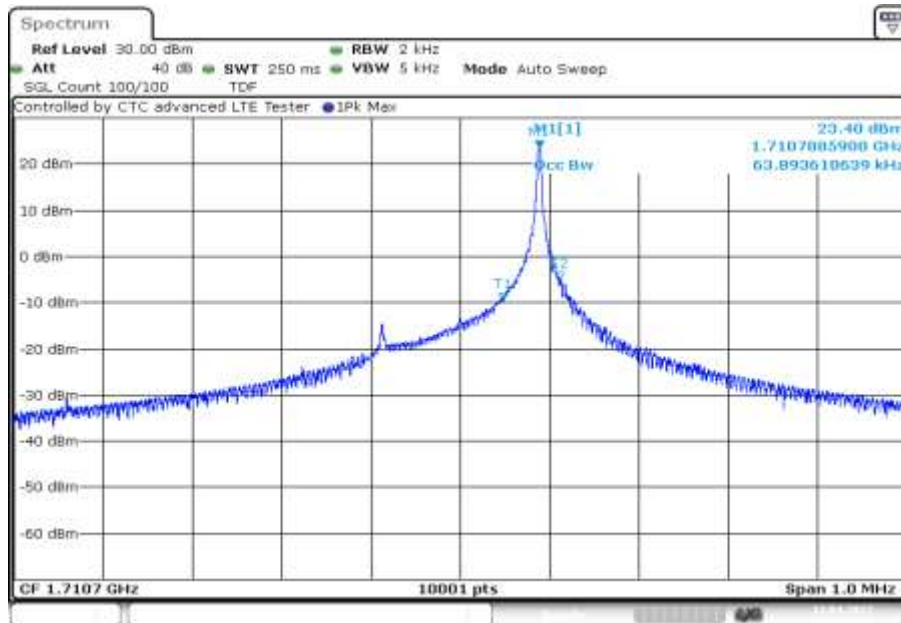
Date: 13.APR.2022 09:39:19

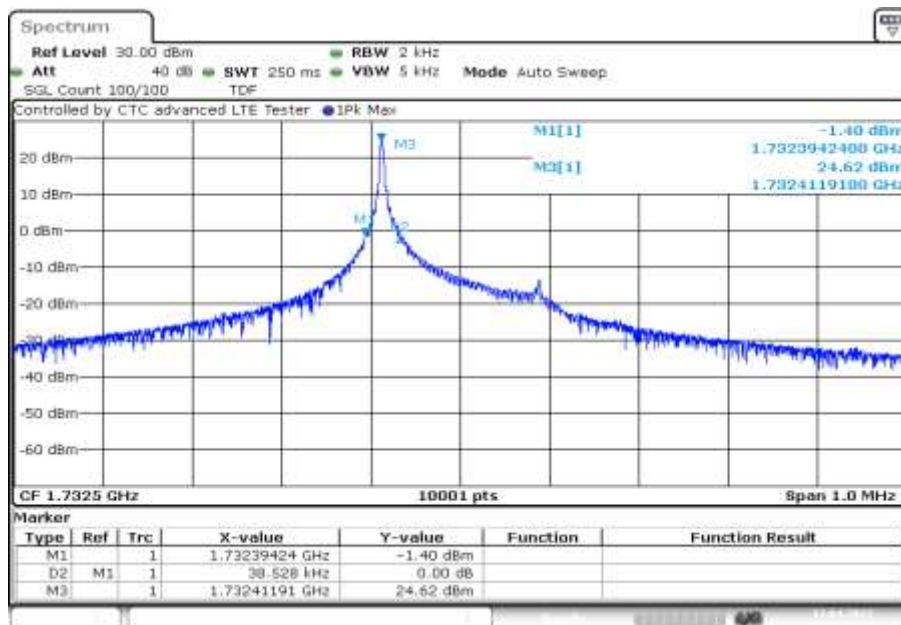**Plot 8:** low channel (-26 dBc BW), spacing 3.75 kHz, 1@47 tones
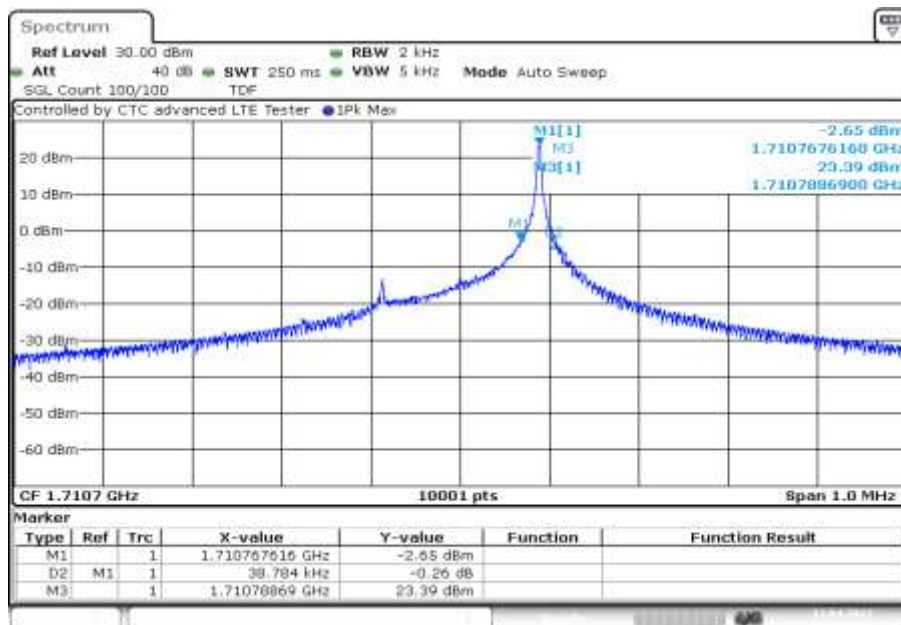
Date: 13.APR.2022 09:39:47

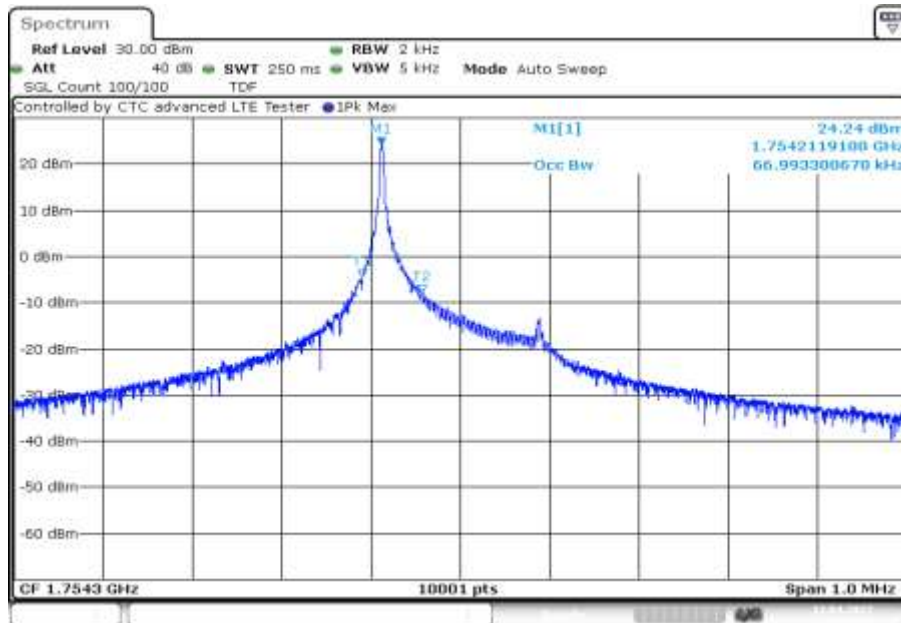**Plot 9:** mid channel (99% - OBW), spacing 3.75 kHz, 1@47 tones
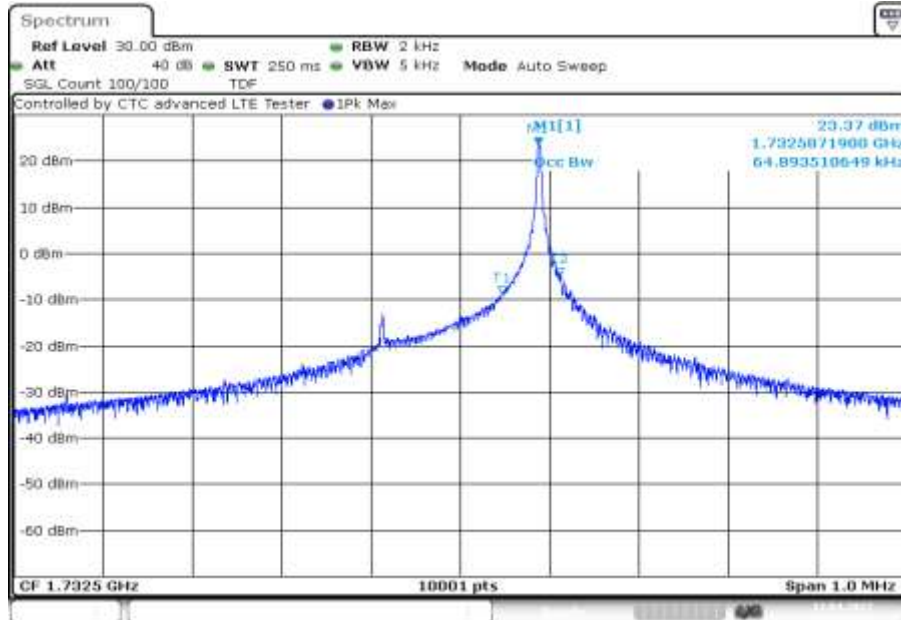
Date: 13.APR.2022 09:49:24

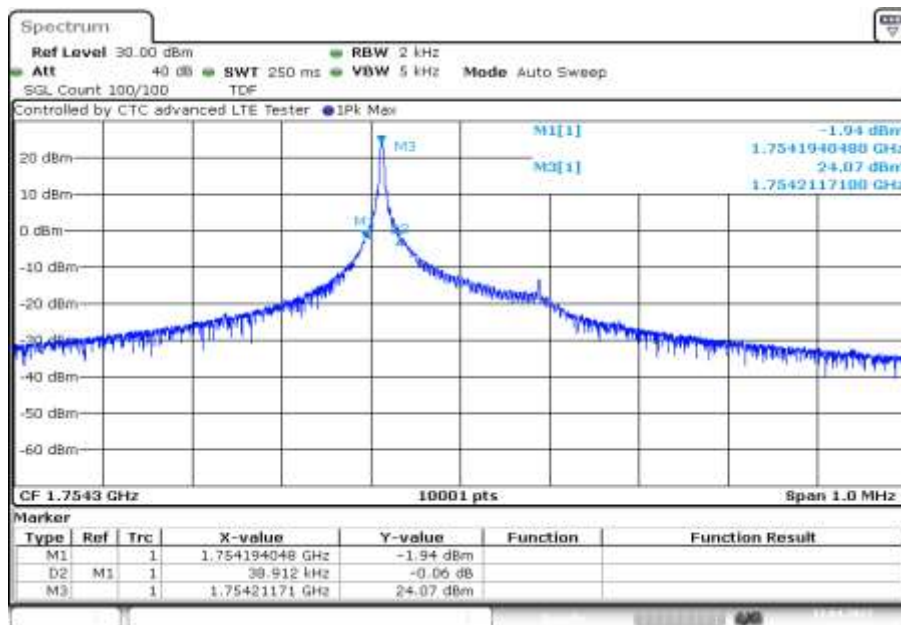**Plot 10:** mid channel (-26 dBc BW), spacing 3.75 kHz, 1@47 tones
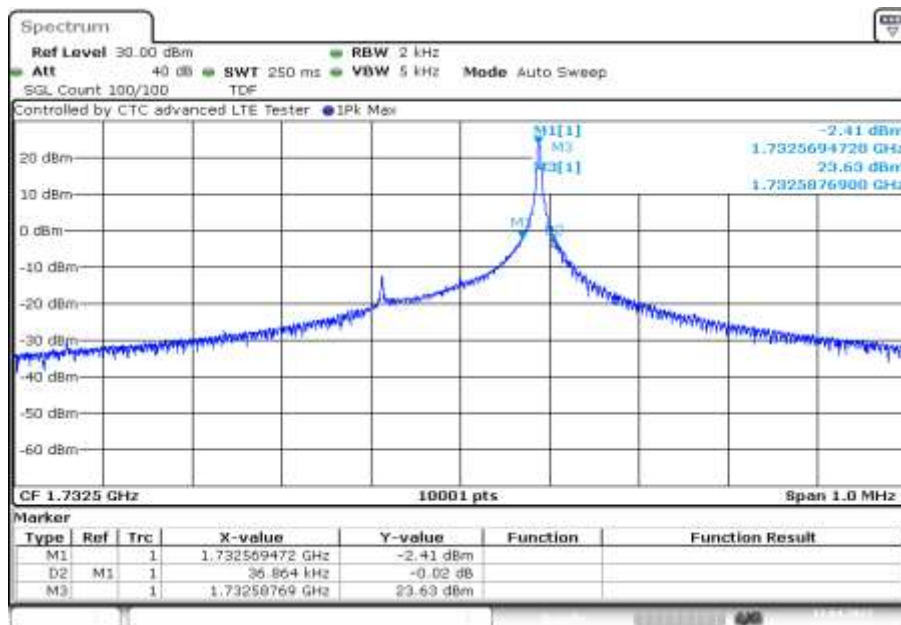
Date: 13.APR.2022 09:49:53

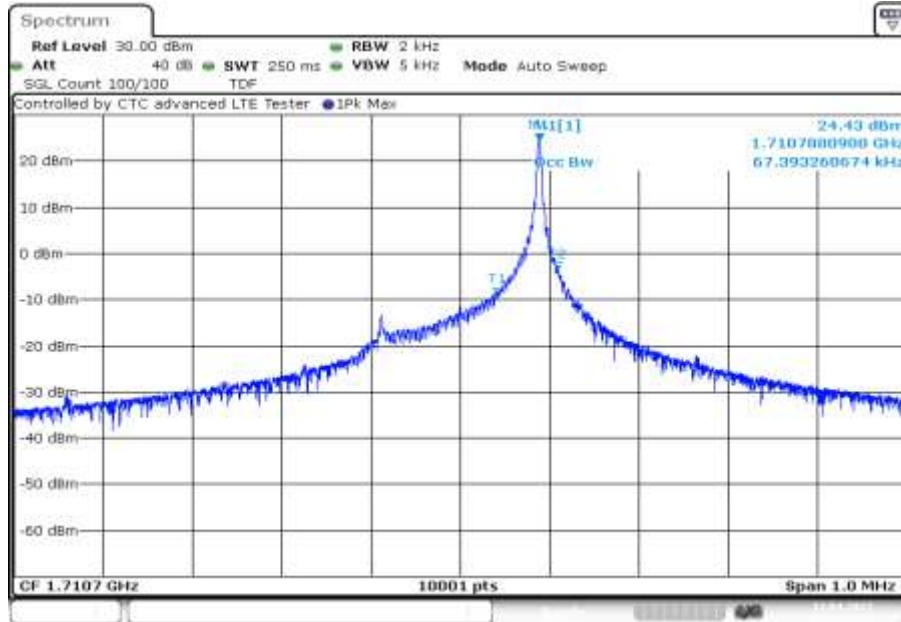**Plot 11:** high channel (99% - OBW), spacing 3.75 kHz, 1@47 tones
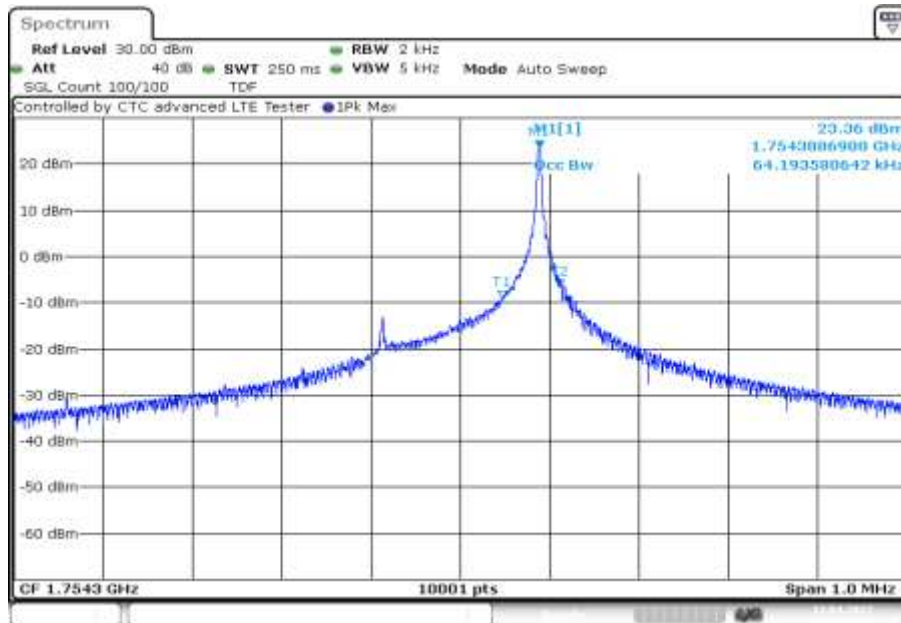
Date: 13.APR.2022 09:59:39

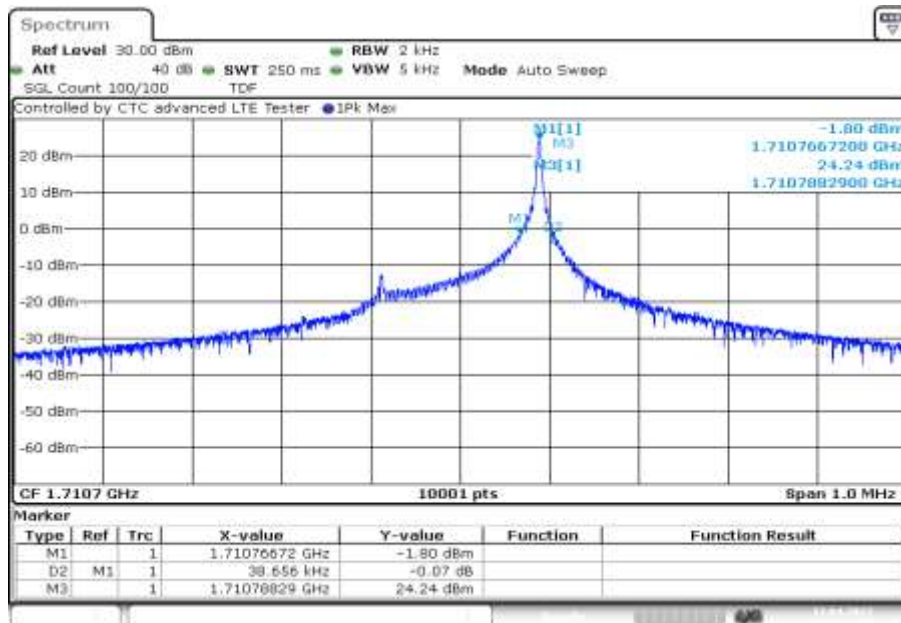**Plot 12:** high channel (-26 dBc BW), spacing 3.75 kHz, 1@47 tones
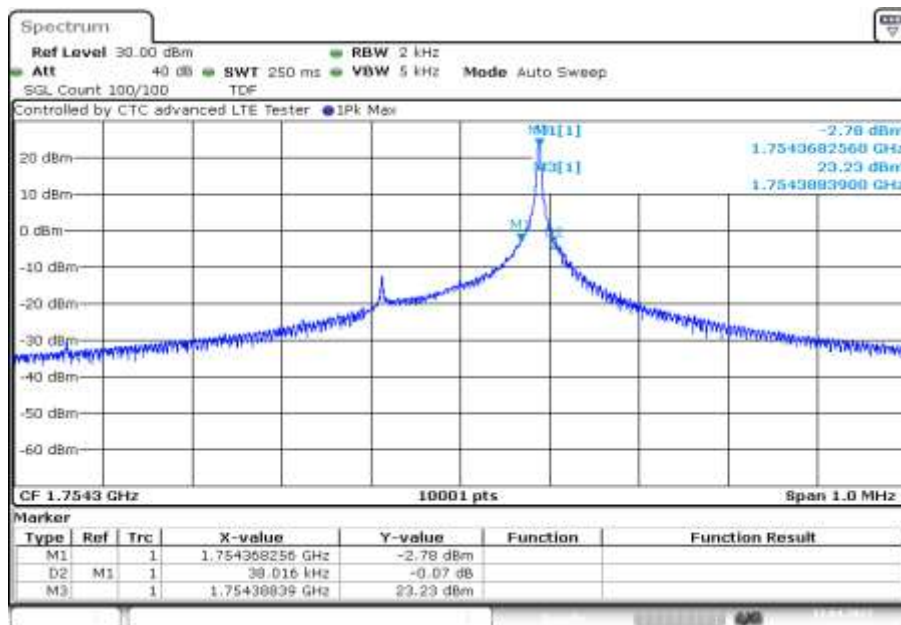
Date: 13.APR.2022 10:00:08

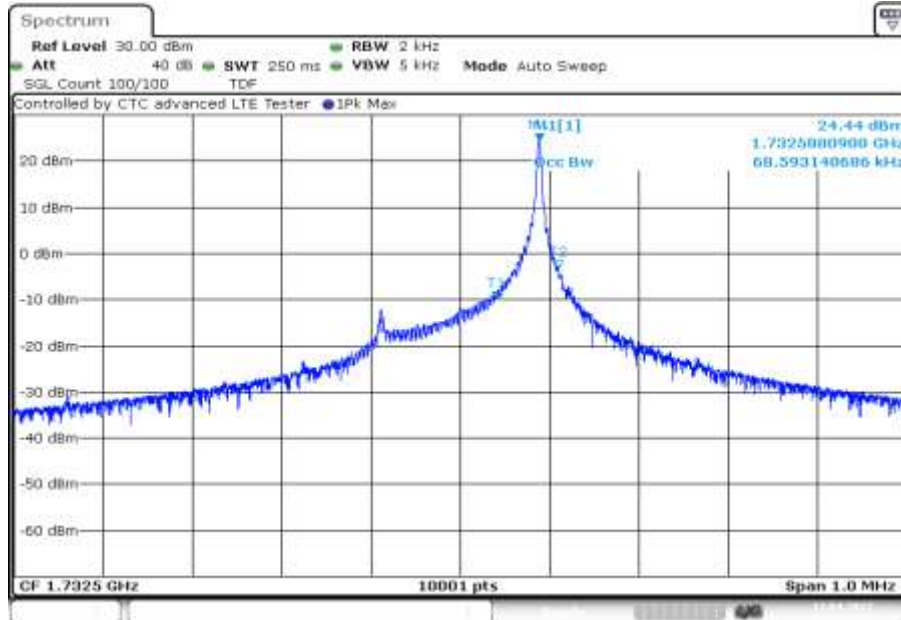**Plot 13:** low channel (99% - OBW), spacing 15 kHz, 1@0 tones
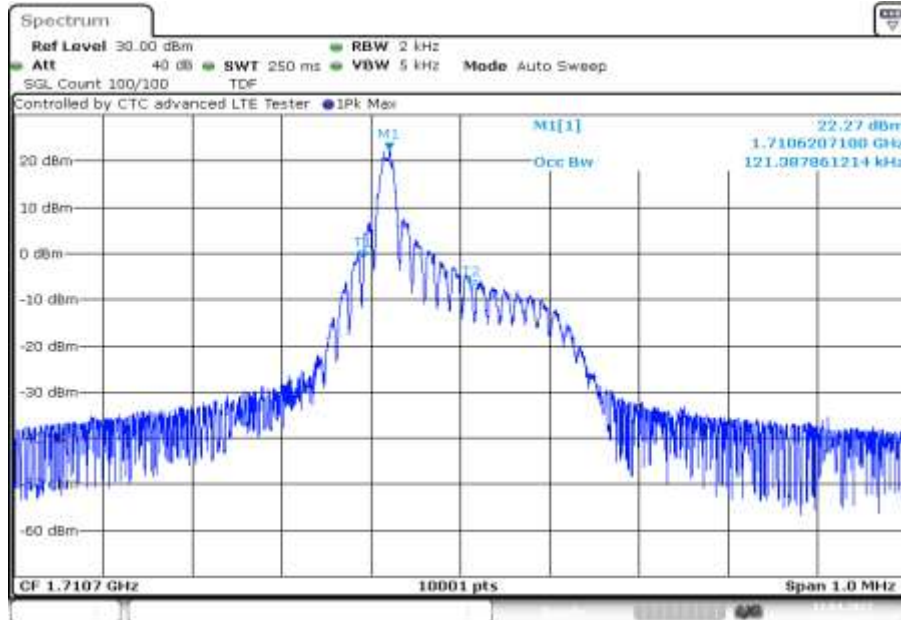
Date: 13.APR.2022 09:42:48

Plot 14: low channel (-26 dBc BW), spacing 15 kHz, 1@0 tones
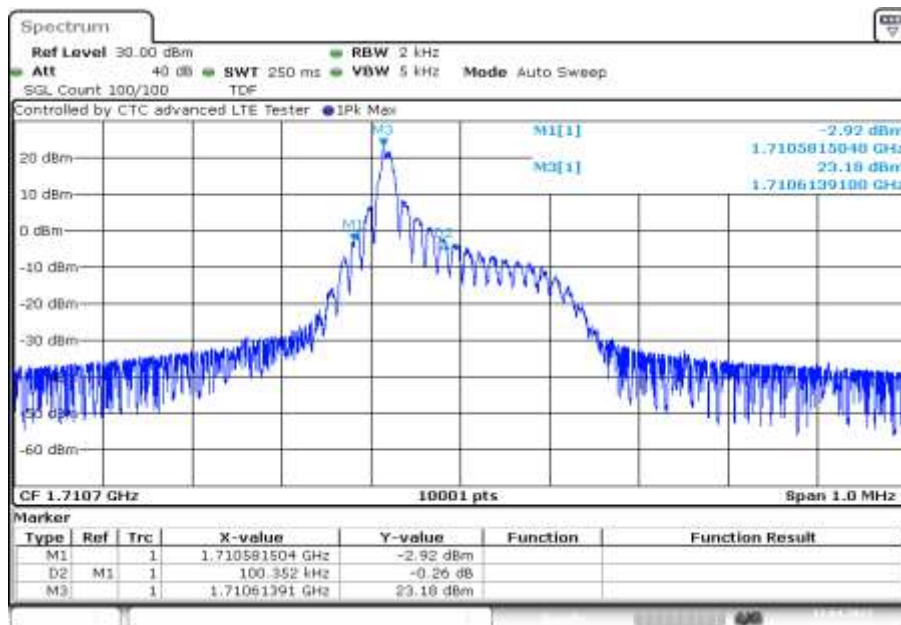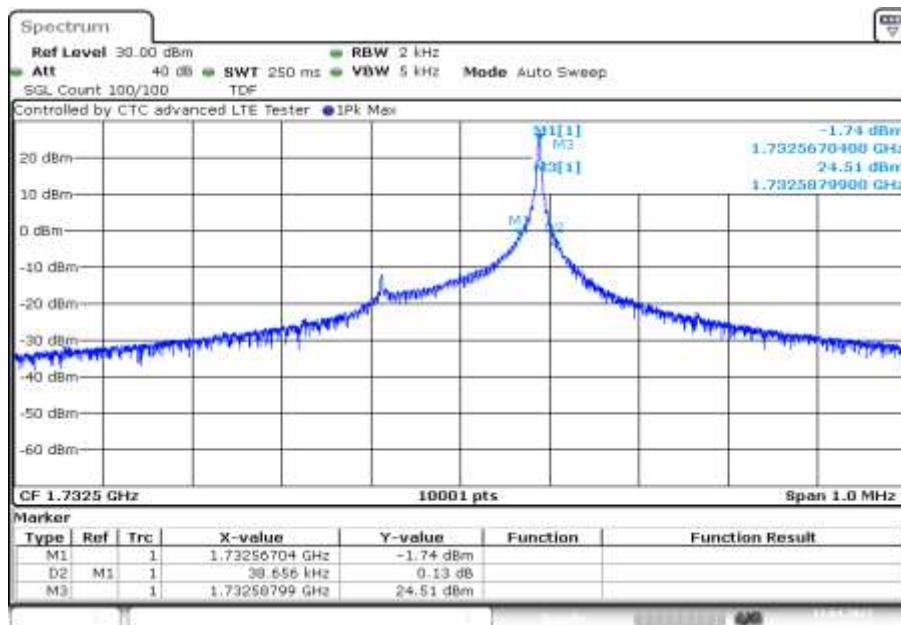

Date: 13.APR.2022 09:43:17

Plot 15: mid channel (99% - OBW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 09:52:54

Plot 16: mid channel (-26 dBc BW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 09:53:22

Plot 17: high channel (99% - OBW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 10:03:10

Plot 18: high channel (-26 dBc BW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 10:03:38

Plot 19: low channel (99% - OBW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 09:43:55

Plot 20: low channel (-26 dBc BW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 09:44:23

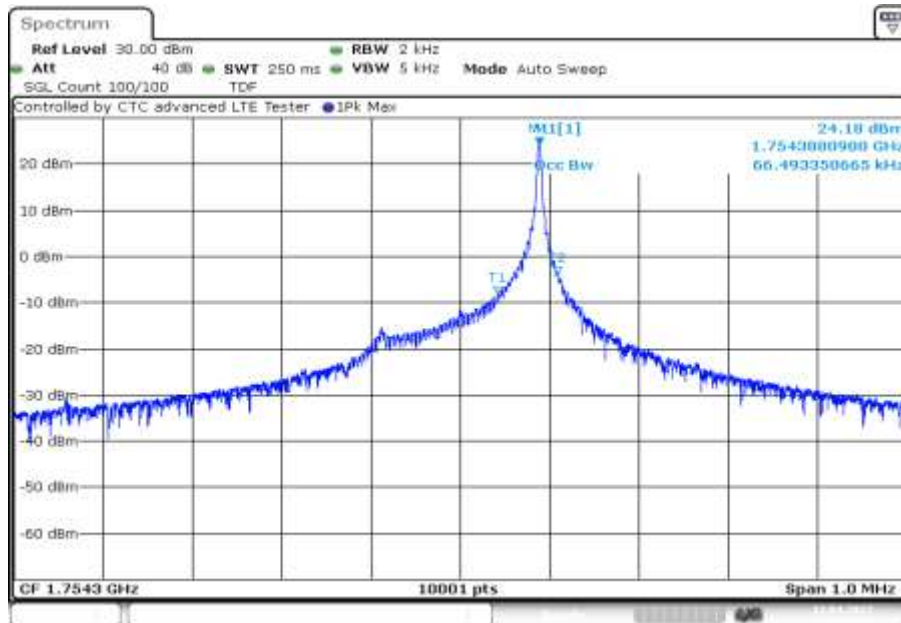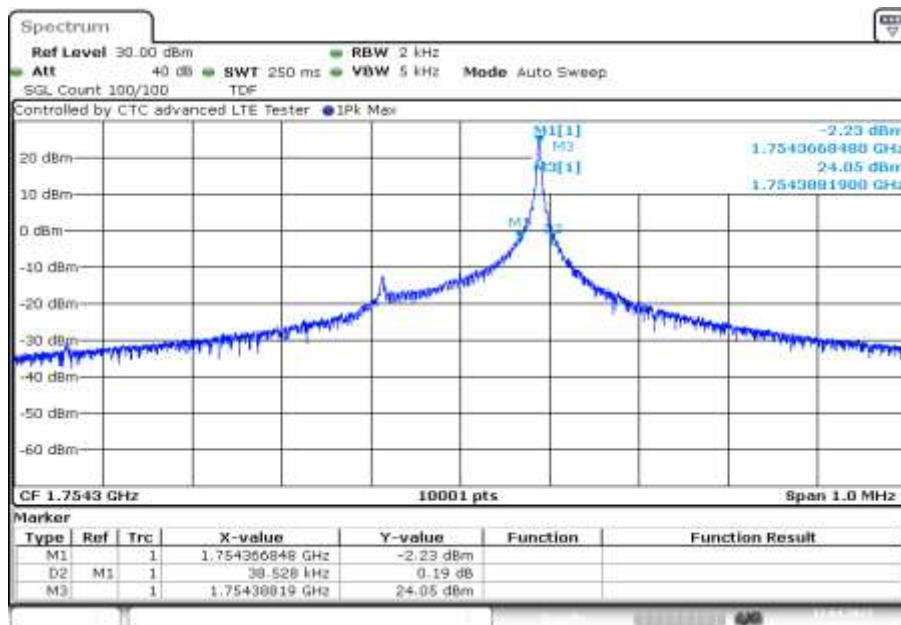**Plot 21:** mid channel (99% - OBW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 09:54:00

Plot 22: mid channel (-26 dBc BW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 09:54:28

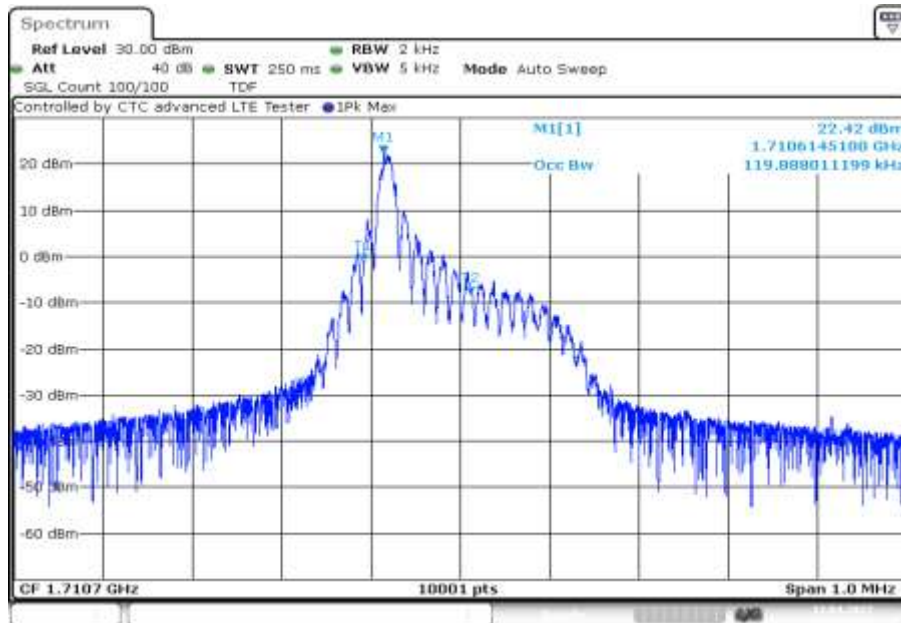**Plot 23:** high channel (99% - OBW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 10:04:16

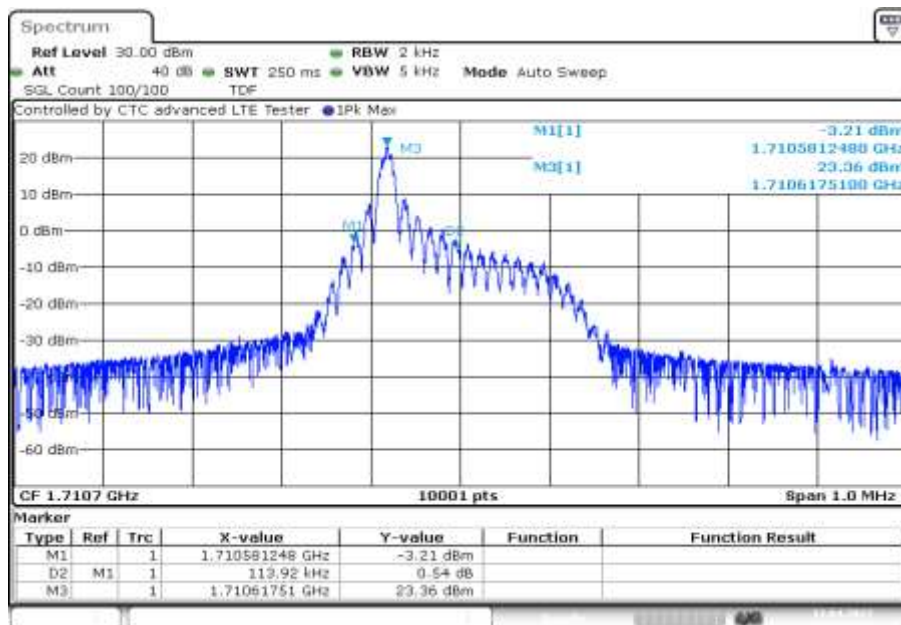**Plot 24:** high channel (-26 dBc BW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 10:04:44

Plots: QPSK

Plot 1: low channel (99% - OBW), spacing 3.75 kHz, 1@0 tones

Date: 13.APR.2022 09:40:25

Plot 2: low channel (-26 dBc BW), spacing 3.75 kHz, 1@0 tones

Date: 13.APR.2022 09:40:54

Plot 3: mid channel (99% - OBW), spacing 3.75 kHz, 1@0 tones
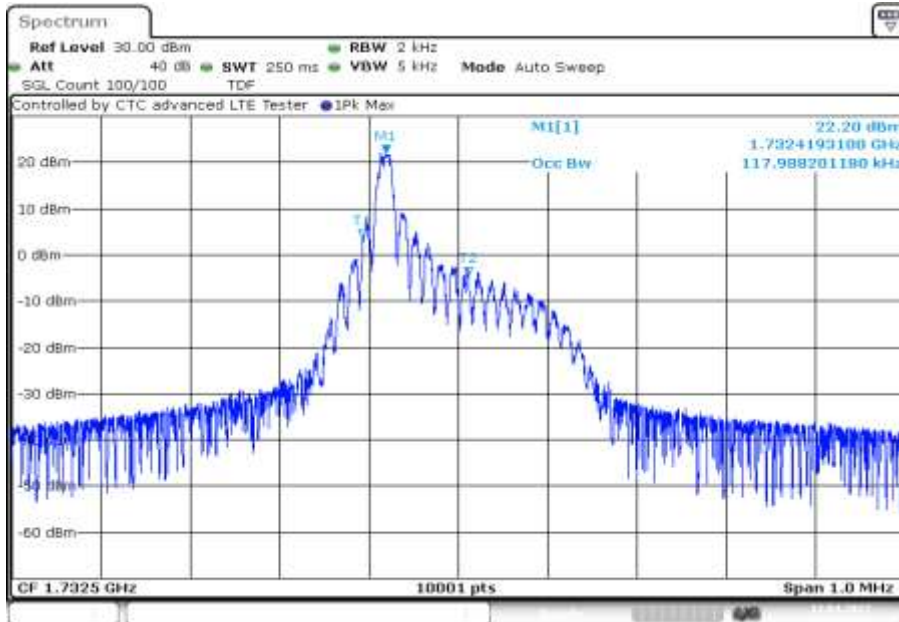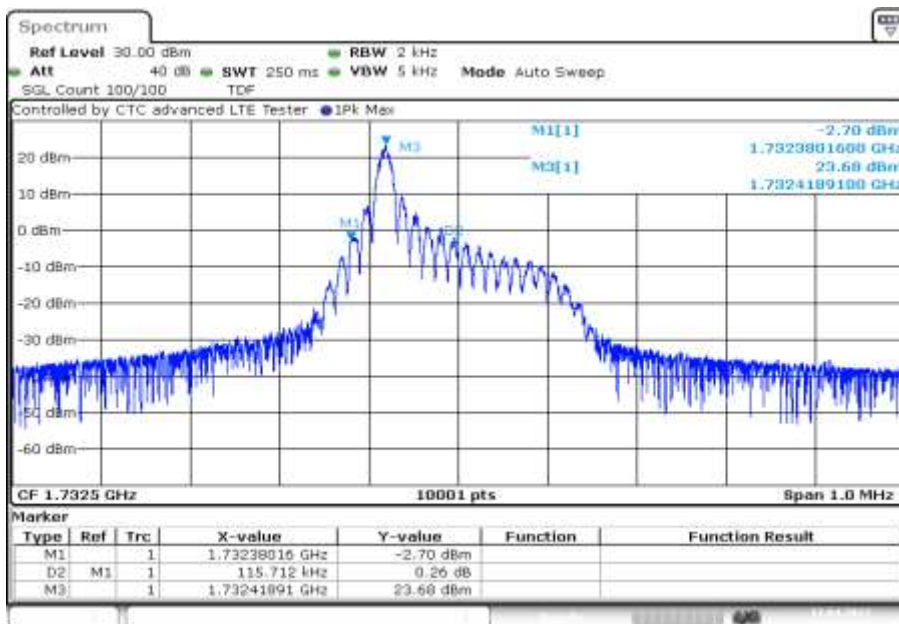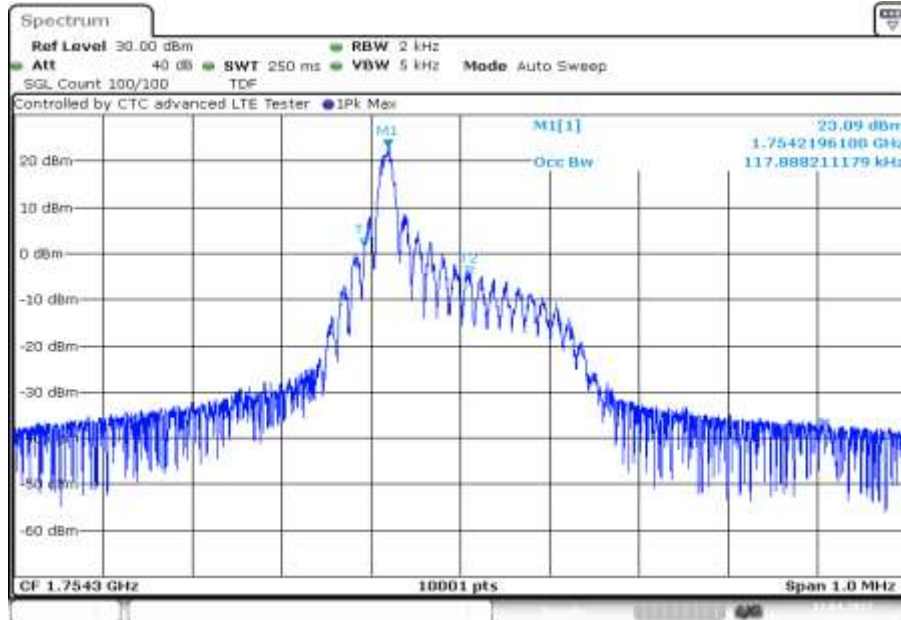

Date: 13.APR.2022 09:50:31

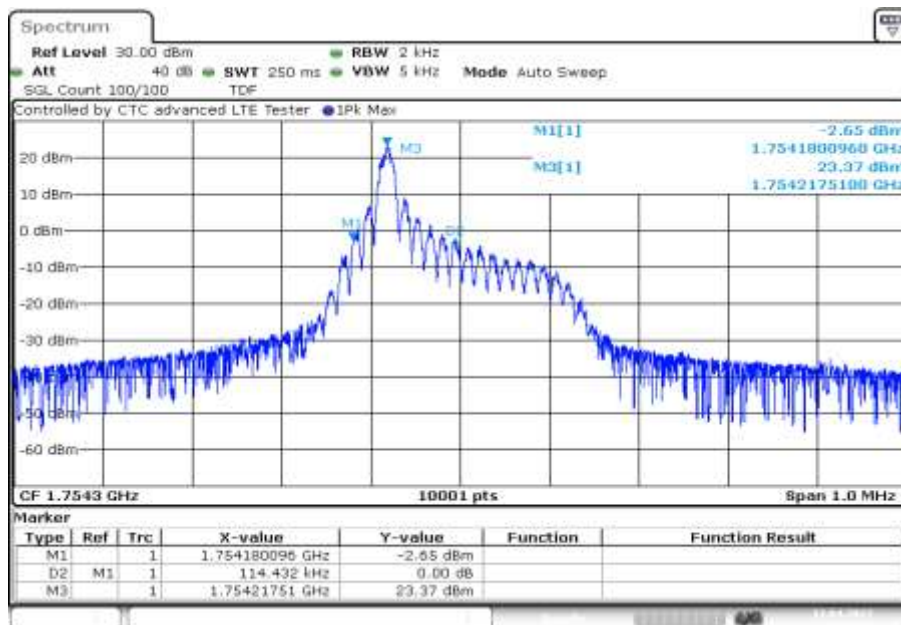**Plot 4:** mid channel (-26 dBc BW), spacing 3.75 kHz, 1@0 tones

Date: 13.APR.2022 09:50:59

Plot 5: high channel (99% - OBW), spacing 3.75 kHz, 1@0 tones

Date: 13.APR.2022 10:00:45

Plot 6: high channel (-26 dBc BW), spacing 3.75 kHz, 1@0 tones

Date: 13.APR.2022 10:01:13

Plot 7: low channel (99% - OBW), spacing 3.75 kHz, 1@47 tones

Date: 13.APR.2022 09:41:32

Plot 8: low channel (-26 dBc BW), spacing 3.75 kHz, 1@47 tones

Date: 13.APR.2022 09:42:00

Plot 9: mid channel (99% - OBW), spacing 3.75 kHz, 1@47 tones

Date: 13.APR.2022 09:51:37

Plot 10: mid channel (-26 dBc BW), spacing 3.75 kHz, 1@47 tones

Date: 13.APR.2022 09:52:06

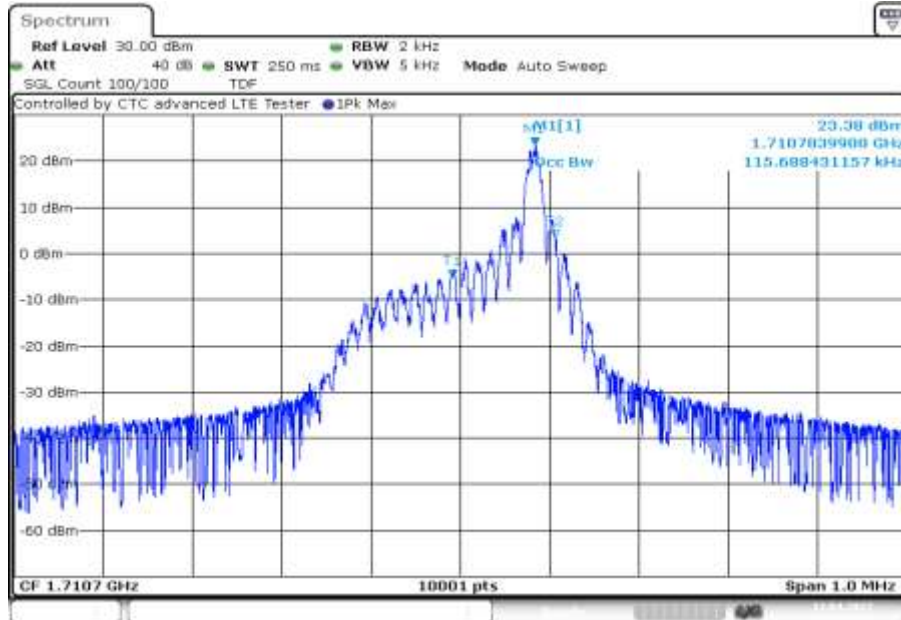**Plot 11:** high channel (99% - OBW), spacing 3.75 kHz, 1@47 tones

Date: 13.APR.2022 10:01:51

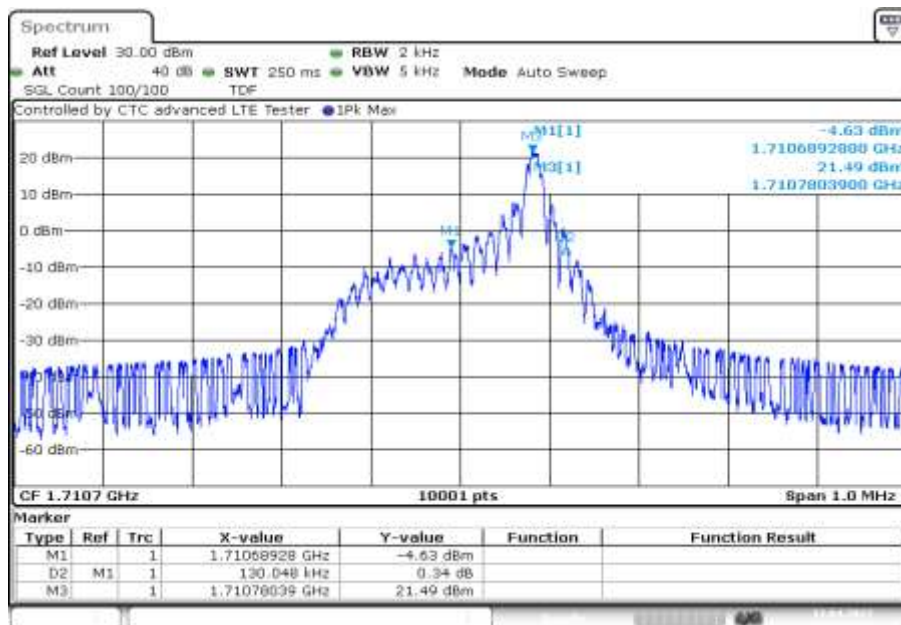**Plot 12:** high channel (-26 dBc BW), spacing 3.75 kHz, 1@47 tones

Date: 13.APR.2022 10:02:20

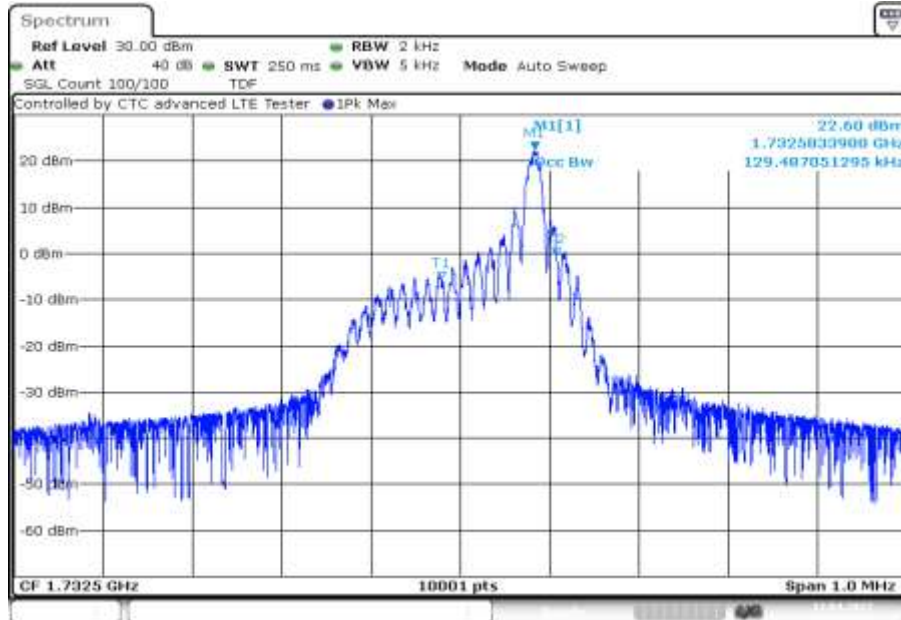**Plot 13:** low channel (99% - OBW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 09:45:01

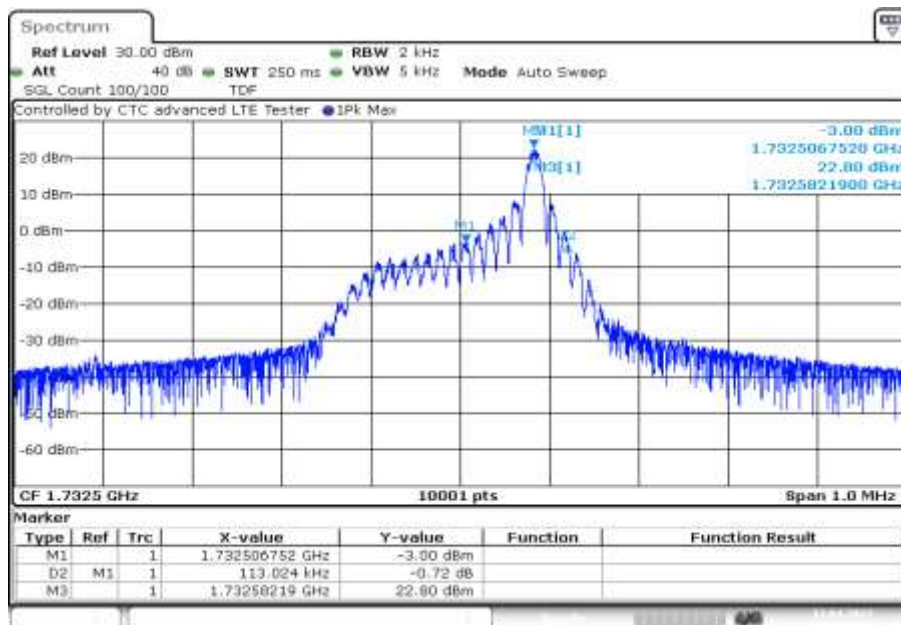**Plot 14:** low channel (-26 dBc BW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 09:45:29

Plot 15: mid channel (99% - OBW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 09:55:06

Plot 16: mid channel (-26 dBc BW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 09:55:35

Plot 17: high channel (99% - OBW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 10:05:22

Plot 18: high channel (-26 dBc BW), spacing 15 kHz, 1@0 tones

Date: 13.APR.2022 10:05:50

Plot 19: low channel (99% - OBW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 09:46:07

Plot 20: low channel (-26 dBc BW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 09:46:36

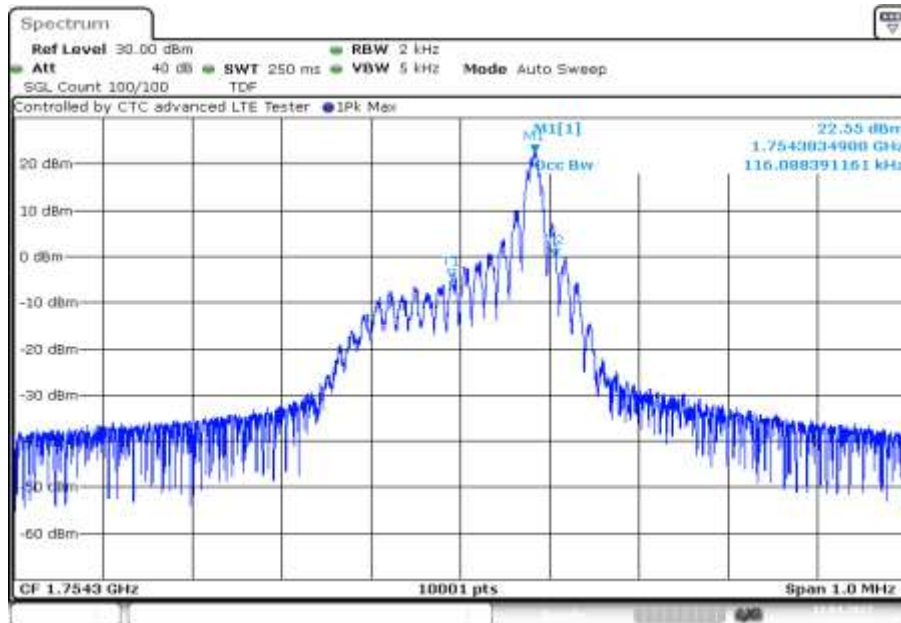**Plot 21:** mid channel (99% - OBW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 09:56:13

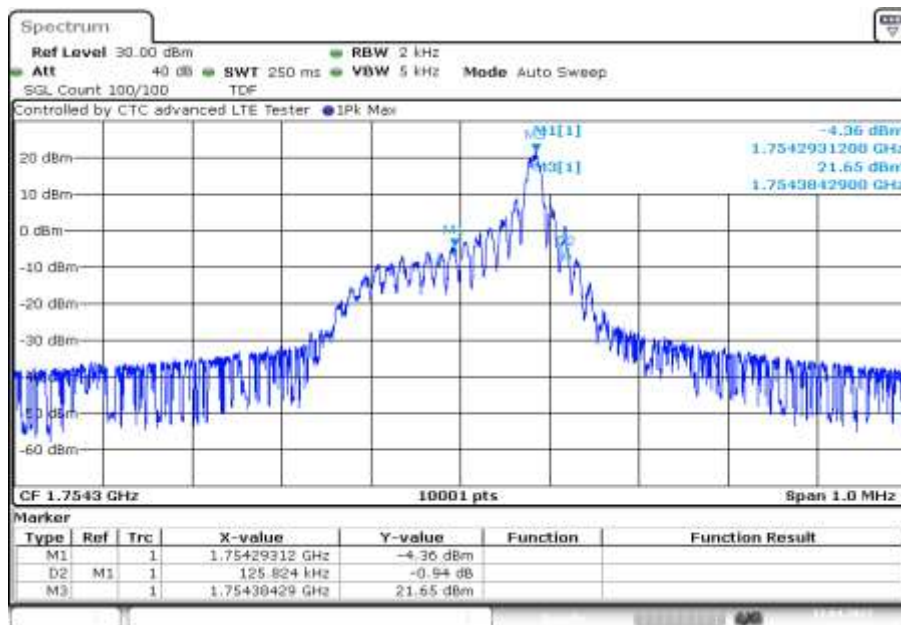**Plot 22:** mid channel (-26 dBc BW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 09:56:41

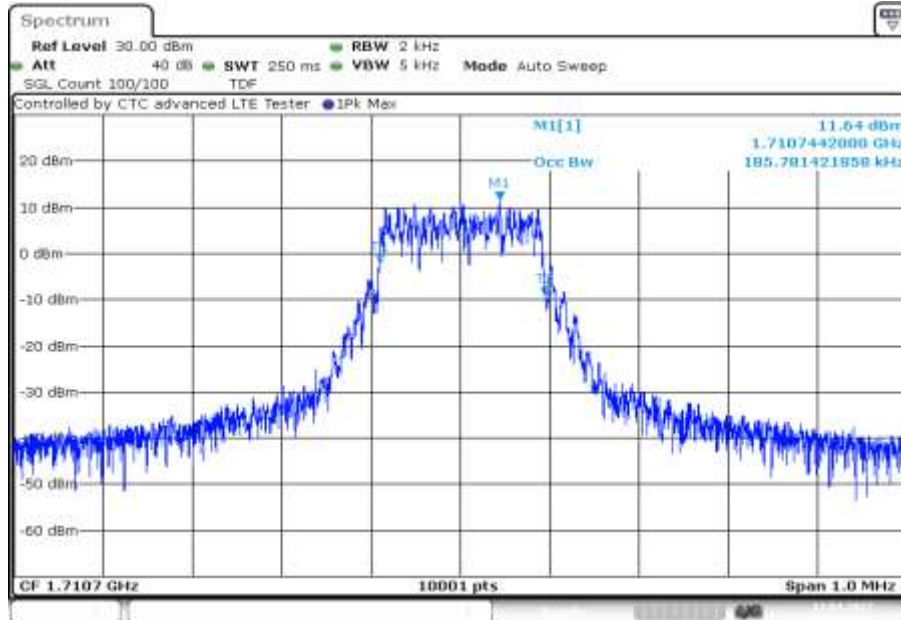**Plot 23:** high channel (99% - OBW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 10:06:28

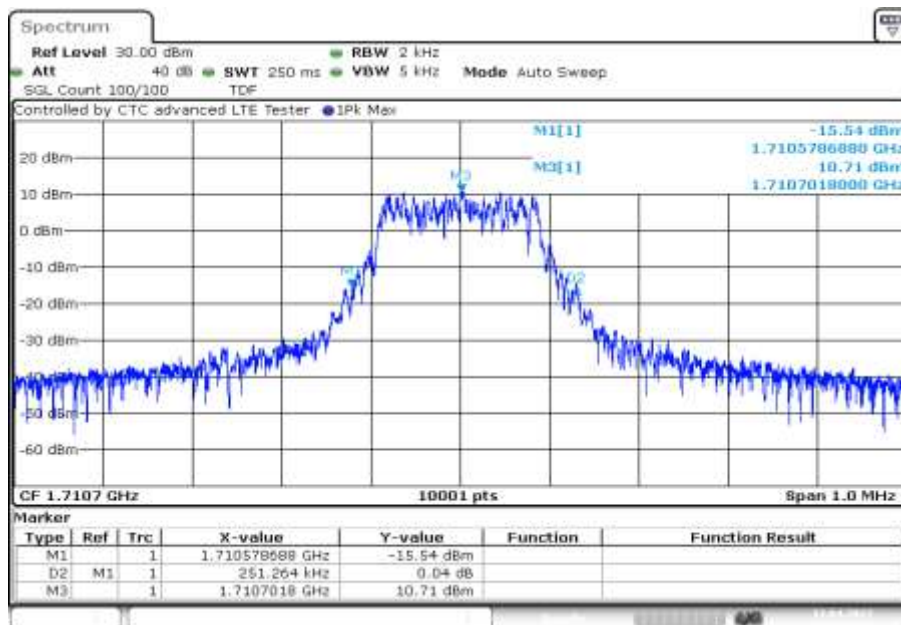**Plot 24:** high channel (-26 dBc BW), spacing 15 kHz, 1@11 tones

Date: 13.APR.2022 10:06:56

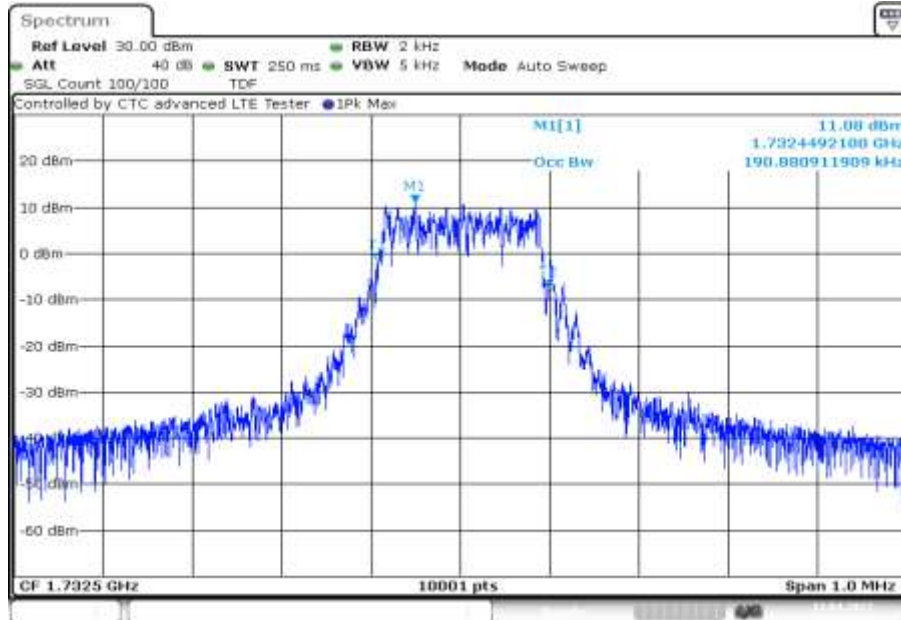**Plot 25:** low channel (99% - OBW), spacing 15 kHz, 12@0 tones

Date: 13.APR.2022 09:47:14

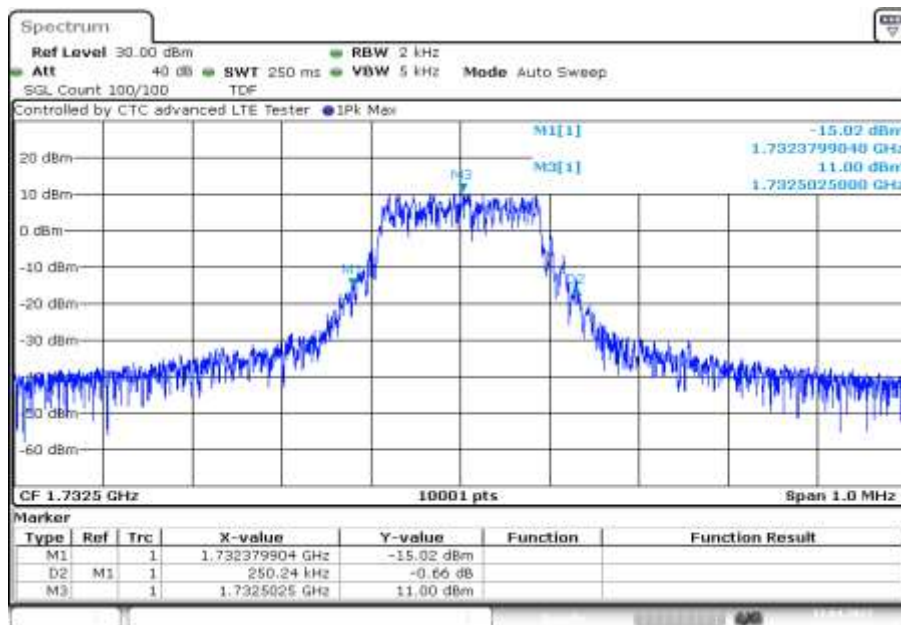**Plot 26:** low channel (-26 dBc BW), spacing 15 kHz, 12@0 tones

Date: 13.APR.2022 09:47:42

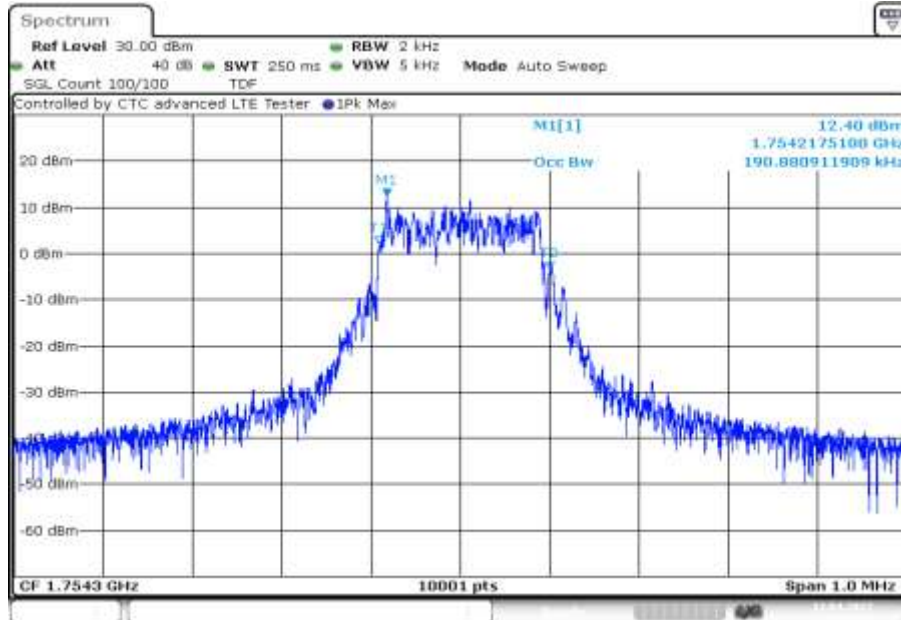**Plot 27:** mid channel (99% - OBW), spacing 15 kHz, 12@0 tones

Date: 13.APR.2022 09:57:19

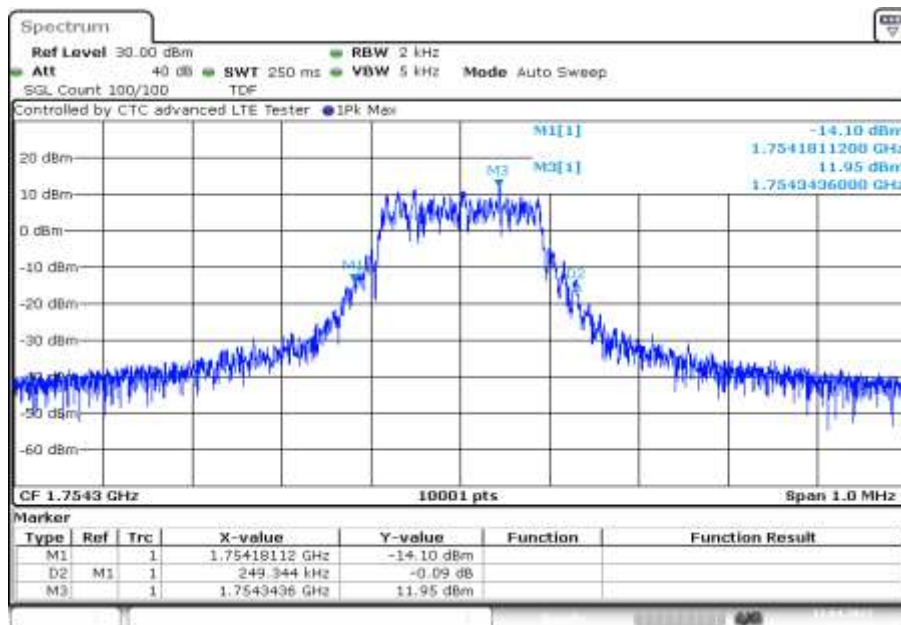**Plot 28:** mid channel (-26 dBc BW), spacing 15 kHz, 12@0 tones

Date: 13.APR.2022 09:57:47

Plot 29: high channel (99% - OBW), spacing 15 kHz, 12@0 tones

Date: 13.APR.2022 10:07:34

Plot 30: high channel (-26 dBc BW), spacing 15 kHz, 12@0 tones

Date: 13.APR.2022 10:08:02