

ISED CABid: ES1909

Test report No:
 NIE: 70437RRF.001A2

Partial Test Report

Reference Standard:
 USA FCC Part 22, Part 24, Part 27, Part 90
 CANADA RSS-130, RSS-132, RSS-133, RSS-139

(*) Identification of item tested	AirCurve 11
(*) Trademark	ResMed
(*) Model and /or type reference	39428
(*) Derived test models not tested	For USA: 39491, 39492, 39493, 39494, 51400. For Canada: 39495, 39496, 39497, 39498, 51400.
Other identification of the product	HW version: 1.0 SW version: SW04600 FCC ID: 2ACHL-AIR11M1B IC: 9103A-AIR11M1B
(*) Features	LTE Cat-M1, BLE
Applicant	ResMed Pty Ltd. 1 Elizabeth Macarthur Drive Bella Vista, NSW 2153 Australia
Test method requested, standard	USA FCC Part 22 (10-1-20 Edition). Public Mobile Services. USA FCC Part 24 (10-1-20 Edition): Personal Communications Services. USA FCC Part 27 (10-1-20 Edition). Miscellaneous Wireless Communications Services. USA FCC Part 90 (10-1-20 Edition). Private Land Mobile Radio Services. CANADA RSS-130 Issue 2, Feb 2019. CANADA RSS-132 Issue 3, Jan. 2013. CANADA RSS-133 Issue 6 Amendment 1, Jan. 2018. CANADA RSS-139 Issue 3, Jul. 2015. ANSI C63.26-2015. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018.
Approved by (name / position & signature)	Rafael López EMC Consumer & RF Lab. Manager
Date of issue	2022-05-31
Report template No	FDT08_24 (*) "Data provided by the client"

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Competences and guarantees

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

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General conditions

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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of the model 39428 is a bilevel device with integrated cellular and Bluetooth connectivity.
3. Derived models of 39428 are not tested: 39491, 39492, 39493, 39494, 39495, 39496, 39497, 39498 and 51400.



Date: 01 Dec 2021

DECLARATION OF EQUIVALENCE

This document declares that the following designated products are equivalent to the unit under test **39428**.

For USA:

Model Name / Product Code	Marketing Name
39491	AIRCURVE 11 ASV USA
39492	AIRCURVE 11 S USA
39493	AIRCURVE 11 ST USA
39494	AIRCURVE 11 VAUTO USA

For Canada:

Model Name / Product Code	Marketing Name
39495	AIRCURVE 11 VAUTO CAN
39496	AIRCURVE 11 S CAN
39497	AIRCURVE 11 ST CAN
39498	AIRCURVE 11 ASV CAN

For USA & Canada:

Model Name / Product Code	Marketing Name
51400	AIRCURVE 11 ST NORTH AMERICA

All the above stated products have the same hardware, cellular firmware and Bluetooth firmware.

Applicant:

Company Name: ResMed Pty Ltd
Address: 1 Elizabeth Macarthur Drive,
Bella Vista NSW 2153
Australia

By,



Christopher Jenkins
Title: Associate Manager – Systems Engineering
Company: ResMed Pty Ltd
Telephone: +61 2 8884 1517
e-mail: Christopher.jenkins@resmed.com.au

Usage of samples

Samples undergoing test have been selected by: the client.

Sample S/01 is composed of the following elements:

Control No.	Description	Model	Serial No.	Date of reception
70437B/003	AirCurve 11	39428	22211762279	2021/11/19
70437B/006	AC/DC adapter	390001	210002829XB	2021/11/19
63467B/015	ClimateLine	AIR11	22201142041	2020/10/14

Sample S/01 has undergone the following test(s): The tests indicated in the Appendixes A, B, C, D.

Test sample description

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
	Power		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Supplementary information to the ports..... :	---						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input checked="" type="checkbox"/>	AC: 100-240V~50-60 Hz 1.0-1.5A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	AC: 115V~400Hz 1.5A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Rated Power	24 VDC, 3.75A						
Clock frequencies..... :	N/A						
Other parameters	390001 (PSU Model Number)						
Software version	SW04600 (DUT)						
Hardware version	1.0 (DUT)						
Dimensions in cm (W x H x D)	13.85 cm x 25.94 cm x 9.45 cm						
Mounting position	<input checked="" type="checkbox"/>	Table top equipment					
Modules/parts..... :	Module/parts of test item		Type	Manufacturer			
	Wireless Module		EXS62-W	Thales			
	Bluetooth LE		EFR32BG1	SiLabs			
Accessories (not part of the test item)	Description		Type	Manufacturer			
	Power Supply Unit 390001		N/A	ResMed			
Documents as provided by the applicant	Description		File name	Issue date			

⁽³⁾ Only for Medical Equipment

Identification of the client

ResMed Pty Ltd.
1 Elizabeth Macarthur Drive
Bella Vista, NSW 2153
Australia

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-12-02
Date (finish)	2021-12-09

Document history

Report number	Date	Description
70437RRF.001	2022-03-16	First release.
70437RRF.001A1	2022-05-06	First modification: added clarification for supported power supply. This modification test report cancels and replaces the test report 70437RRF.001.
70437RRF.001A2	2022-05-31	Second modification: correction on antenna value typo for Band 4 and Band 66. This modification test report cancels and replaces the test report 70437RRF.001A1.

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 sem-ianechoic chamber, 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: Javier Miguel Nadales and Nicolás Salguero.

Used instrumentation:

Radiated Measurements:

Equipment	Model	Manufacturer	Last Calibration	Due Calibration
SEMIANECHOIC ABSORBER LINED CHAMBER II	FACT 3 200 STP	ETS LINDGREN	N.A.	N.A.
SHIELDED ROOM	S101	ETS LINDGREN	N.A.	N.A.
PRE-AMPLIFIER G>40dB 10MHz-6GHz	BLNA 0160-01N	BONN ELEKTRONIK	2021-03	2022-03
HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2020-04	2023-04
PRE-AMPLIFIER G>40dB 1-18 GHz	BLMA 0118-1M	BONN ELEKTRONIK	2021-06	2022-06
HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS- ELEKTRONIK	2019-11	2022-11
PRE-AMPLIFIER G>30dB 17-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2021-09	2022-09
HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2020-05	2023-05
EMI TEST RECEIVER 9kHz-7GHz	ESR7	ROHDE AND SCHWARZ	2020-12	2022-12
SIGNAL AND SPECTRUM ANALYZER 2Hz-50GHz	FSW50	ROHDE AND SCHWARZ	2020-07	2022-07
AC POWER SUPPLY 135/270V 5/10/20/40A	CS-AC35(351SL)	ELGAR	2019-09	2022-09

Testing verdicts

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

Summary

LTE Cat M1 Band FDD 5, LTE Cat M1 Band FDD 26 (824 – 849 MHz)

FCC PART 22 / RSS-132 PARAGRAPH		
Requirement – Test case	Verdict	Remark
FCC 22.913 / RSS-132 5.4: RF output power	N/M	
FCC 2.1047 / RSS-132 5.2: Modulation characteristics	N/M	
FCC 22.355 / RSS-132 5.3: Frequency stability	N/M	
FCC 2.1049: Occupied Bandwidth	N/M	
FCC 22.917 / RSS-132 5.5: Spurious emissions at antenna terminals	N/M	
FCC 22.917 / RSS-132 5.5: Radiated emissions	P	(1)
<u>Supplementary information and remarks:</u>		
(1) Only test requested.		

LTE Cat M1 Band FDD 2, LTE Cat M1 Band FDD 25

FCC PART 24 / RSS-133 PARAGRAPH		
Requirement – Test case	Verdict	Remark
FCC 24.232 / RSS-133 6.4: RF output power	N/M	
FCC 2.1047 / RSS-133 6.2: Modulation characteristics	N/M	
FCC 24.235 / RSS-133 6.3: Frequency stability	N/M	
FCC 2.1049: Occupied Bandwidth	N/M	
FCC 24.238 / RSS-133 6.5: Spurious emissions at antenna terminals	N/M	
FCC 24.238 / RSS-133 6.5: Radiated emissions	P	(1)
<u>Supplementary information and remarks:</u>		
(1) Only test requested.		

LTE Cat M1 Band FDD 4, LTE Cat M1 Band FDD 12, LTE Cat M1 Band FDD 13, LTE Cat M1 Band FDD 66

FCC PART 27 / RSS-130 / RSS-139 PARAGRAPH		
Requirement – Test case	Verdict	Remark
FCC 27.50 / RSS-130 4.6, RSS-139 6.5: RF output power	N/M	
FCC 2.1047 / RSS-130 4.2, RSS-139 6.2: Modulation characteristics	N/M	
FCC 27.54 / RSS-130 4.5, RSS-139 6.4: Frequency stability	N/M	
FCC 2.1049: Occupied Bandwidth	N/M	
FCC 27.53 / RSS-130 4.7.1, RSS-139 6.6: Spurious emissions at antenna terminals	N/M	
FCC 27.53 / RSS-130 4.7.1, RSS-139 6.6: Radiated emissions	P	(1)
<u>Supplementary information and remarks:</u> (1) Only test requested.		

LTE Cat M1 Band FDD 26 (814 – 824 MHz)

FCC PART 90 PARAGRAPH		
Requirement – Test case	Verdict	Remark
FCC 90.635 (b): RF output power	N/M	
FCC 2.1047: Modulation characteristics	N/M	
FCC 90.213: Frequency stability	N/M	
FCC 2.1049: Occupied Bandwidth	N/M	
FCC 90.691: Spurious emissions at antenna terminals (Emission mask requirements for EA-based systems)	N/M	
FCC 90.691: Radiated emissions	P	(1)
<u>Supplementary information and remarks:</u> (1) Only test requested.		

Appendix A: Test results for FCC Part 22 / RSS-132

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TEST CONDITIONS

POWER SUPPLY (V):

Vn: 115 Vac / 60Hz (*)

Type of Power Supply: AC Voltage mains.

The subscript 'n' indicates nominal voltage test conditions.

(*): Preliminary RSE scan determined 115Vac / 60Hz as worst case of power supply.

ANTENNA:

Band	Gain (dBi)	Antenna type
LTE Cat M1 Band 5	+2.2	Internal
LTE Cat M1 Band 26	+2.2	

TEST FREQUENCIES:

LTE Cat M1 Band 5: QPSK and 16-QAM modulations.

	Channel per Nominal Bandwidth (Frequency)			
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz
Low	20407 (824.7 MHz)	20415 (825.5 MHz)	20425 (826.5 MHz)	20450 (829 MHz)
Middle	20525 (836.5 MHz)	20525 (836.5 MHz)	20525 (836.5 MHz)	20525 (836.5 MHz)
High	20643 (848.3 MHz)	20635 (847.5 MHz)	20625 (846.5 MHz)	20600 (844 MHz)

LTE Cat M1 Band 26 (824 – 849 MHz): QPSK and 16-QAM modulations.

	Channel per Nominal Bandwidth (Frequency)				
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz
Low	26797 (824.7 MHz)	26805 (825.5 MHz)	26815 (826.5 MHz)	26840 (829 MHz)	26865 (831.5 MHz)
Middle	26915 (836.5 MHz)	26915 (836.5 MHz)	26915 (836.5 MHz)	26915 (836.5 MHz)	26915 (836.5 MHz)
High	27033 (848.3 MHz)	27025 (847.5 MHz)	27015 (846.5 MHz)	26990 (844 MHz)	26965 (841.5 MHz)

NOTE: Sub-block 824 – 849 MHz of Band 26 is completely included in band 5, so the channels of band 5 were tested to give conformity to the assigned block.

Radiated emissions

SPECIFICATION:

FCC §22.917. RSS-132 Clause 5.5.

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.

In the spectrum below 1 GHz, instrumentation should employ a reference bandwidth of 100 kHz or greater. In the spectrum above 1 GHz, instrumentation should employ a reference bandwidth of 1 MHz.

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 highest frequency generated within the equipment.

The EUT was placed on a non-conductive stand at a 3-meter distance from the measuring antenna for measurements from 30 MHz up to 8.5 GHz.

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.

The maximum field strength (dB μ V/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:

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

Where D is the measurement distance (in the far field region) in m. $D = 3$ m.

Measurement Limit:

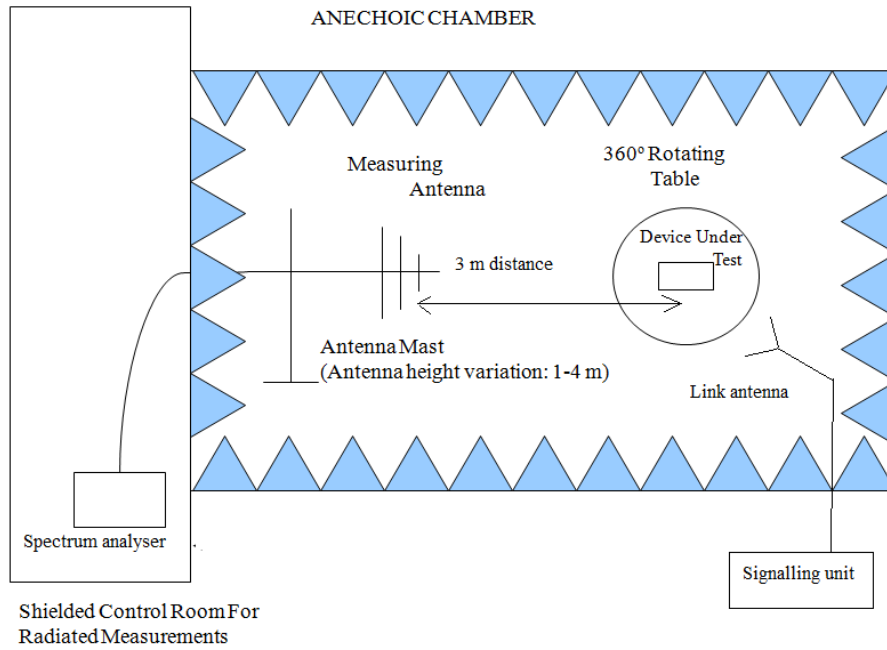
At P_o transmitting power, the specified minimum attenuation becomes $43+10 \log(P_o)$, and the level in dBm relative to P_o becomes:

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

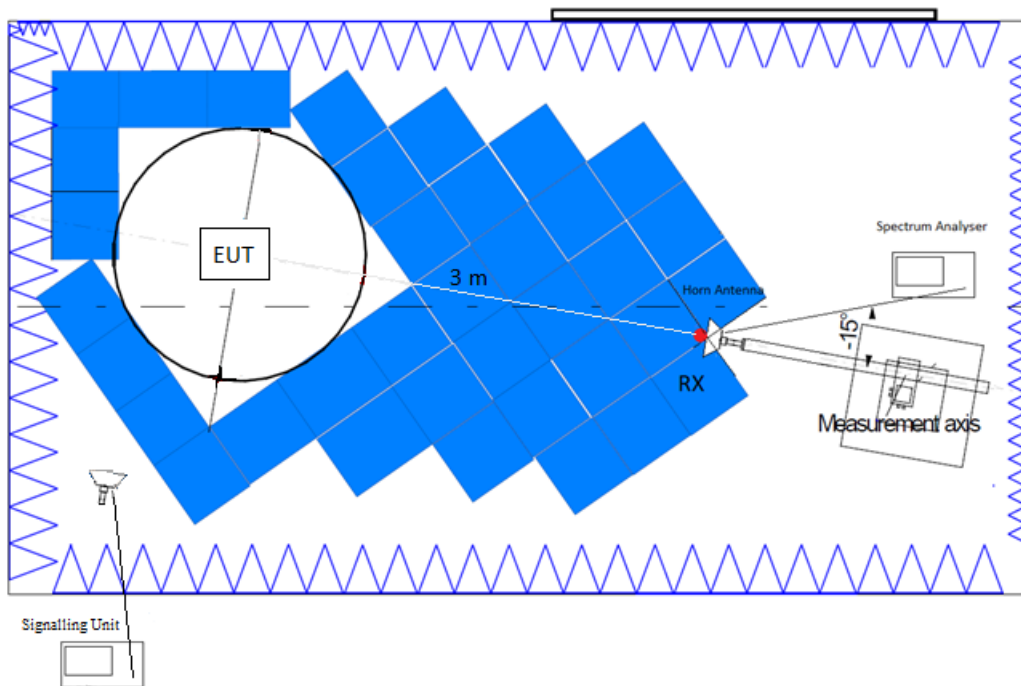
A resolution bandwidth / video bandwidth of 1 MHz / 3 MHz was used.

TEST SETUP:

Radiated measurements setup below 1 GHz.



Radiated measurements setup above 1 GHz up to 8.5 GHz.



RESULTS:

LTE Cat M1 Band 5:

QPSK and 16-QAM modulations:

A preliminary scan determined the 16-QAM modulation, BW = 10 MHz, RB Size 5, Offset 0, Narrow band = 0 as the worst case.

The next results are for this worst-case configuration (plots in next pages).

- **Low Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 8.5 GHz

No spurious frequencies at less than 20 dB below the limit.

- **Middle Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 8.5 GHz

No spurious frequencies at less than 20 dB below the limit.

- **High Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 8.5 GHz

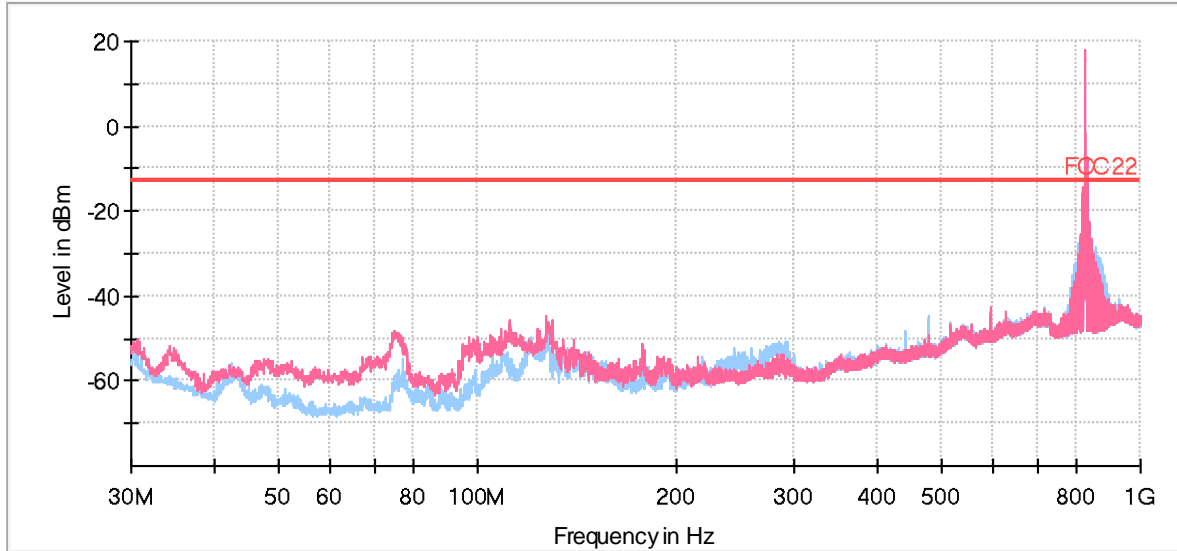
No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB): $<\pm 4.68$ for $f < 1$ GHz
 $<\pm 4.22$ for $f \geq 1$ GHz up to 8.5 GHz

Verdict: PASS

FREQUENCY RANGE 30 MHz – 1 GHz:

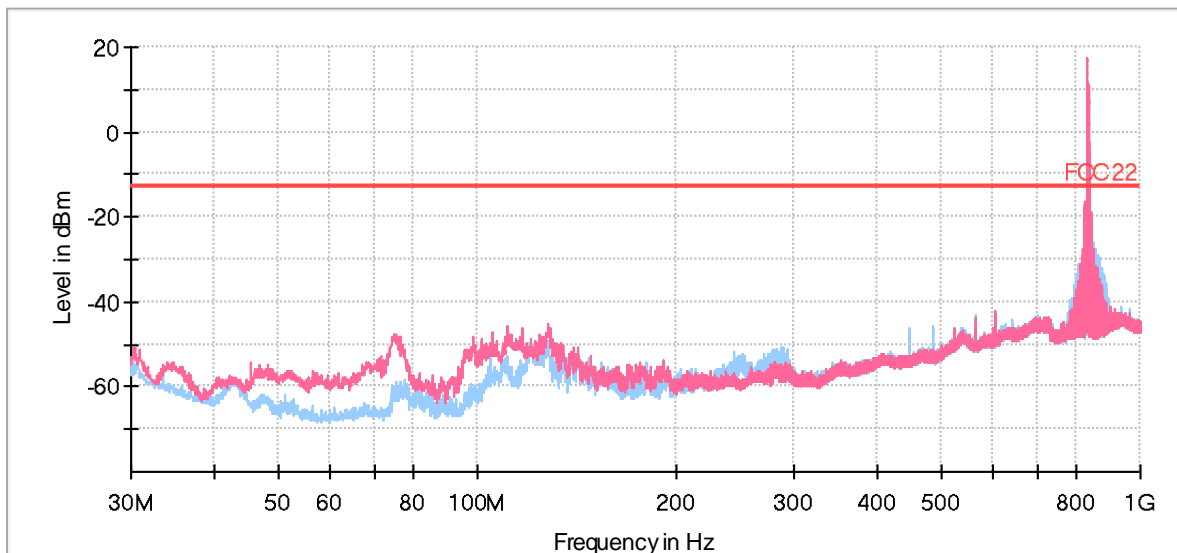
- Low Channel:



— Preview Result 1H-PK+ — Preview Result 1V-PK+
— FCC22 ◆ Final_Result PK+

The peak above the limit is the carrier frequency.

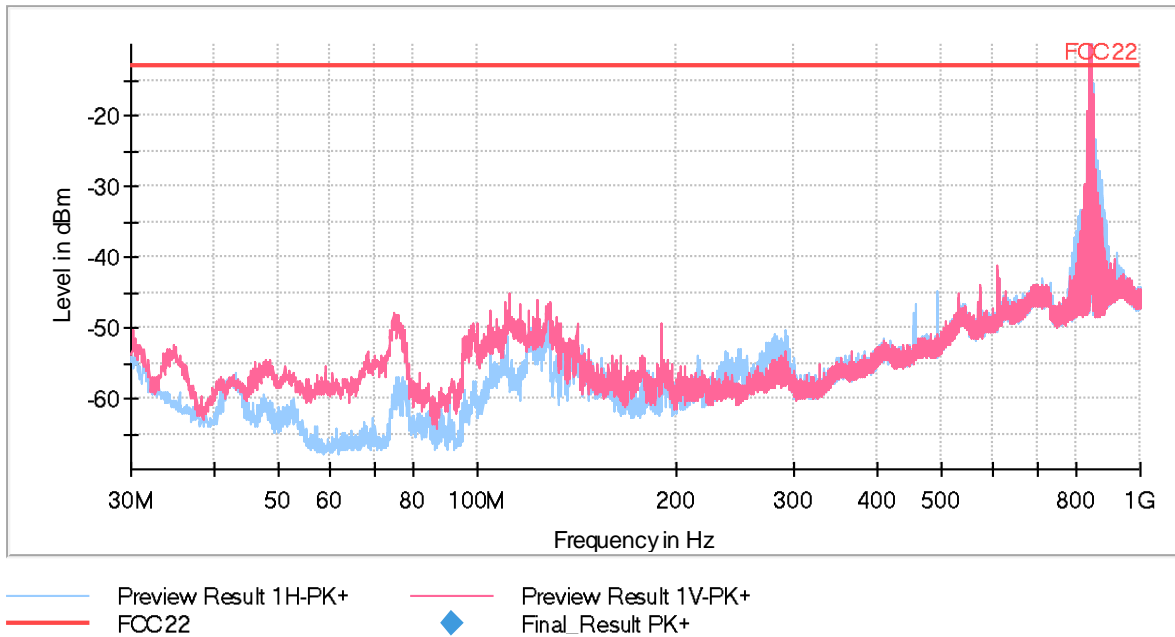
- Middle Channel:



— Preview Result 1H-PK+ — Preview Result 1V-PK+
— FCC22 ◆ Final_Result PK+

The peak above the limit is the carrier frequency.

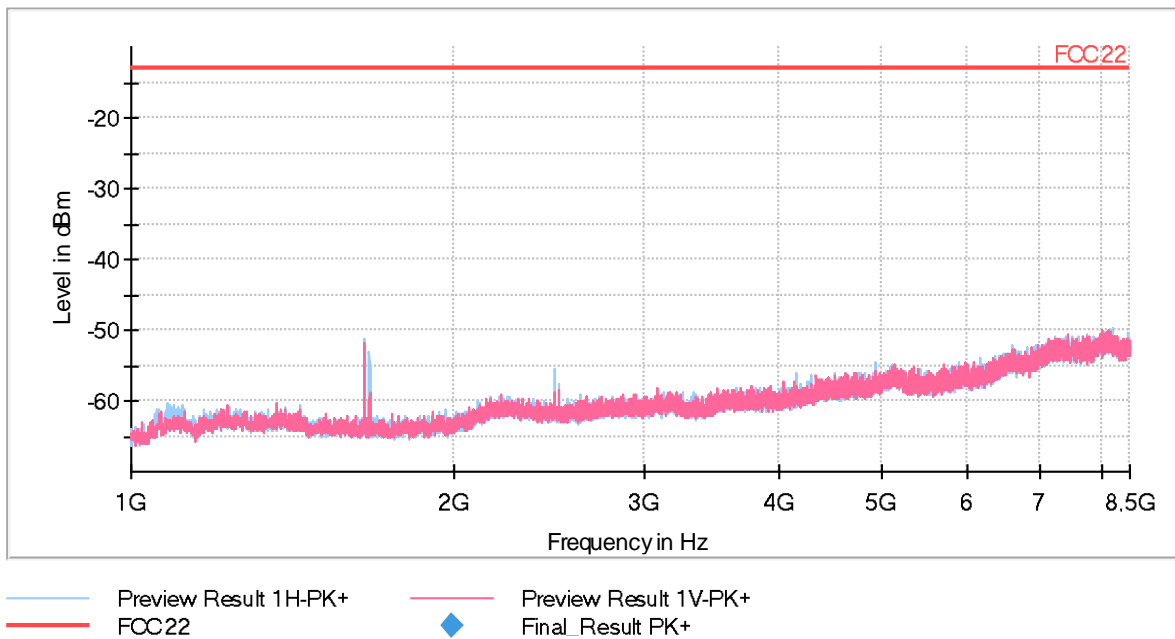
- High Channel:



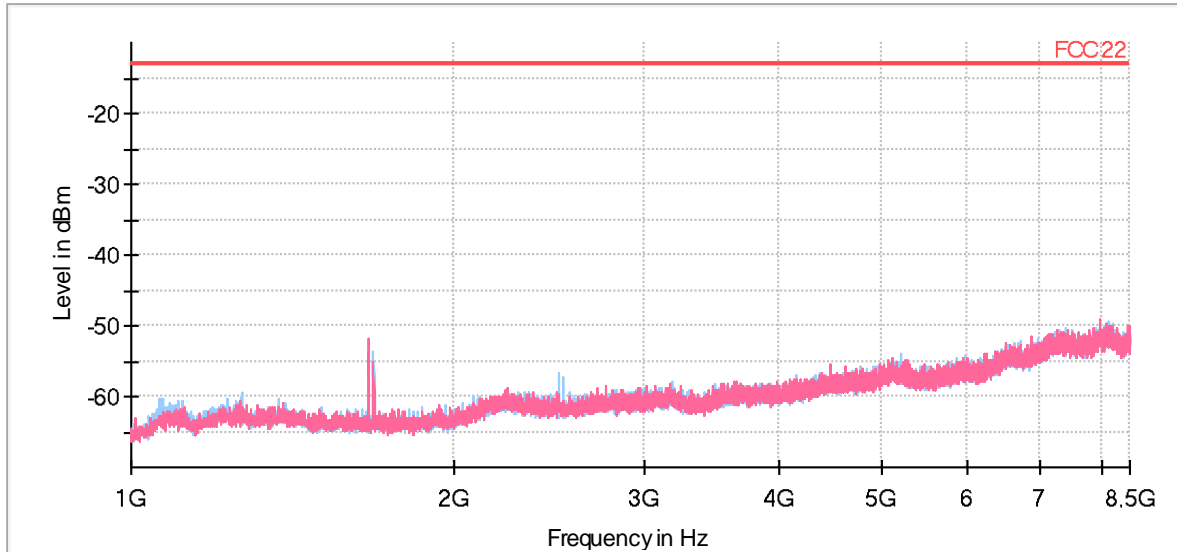
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 GHz – 8.5 GHz:

- Low Channel:

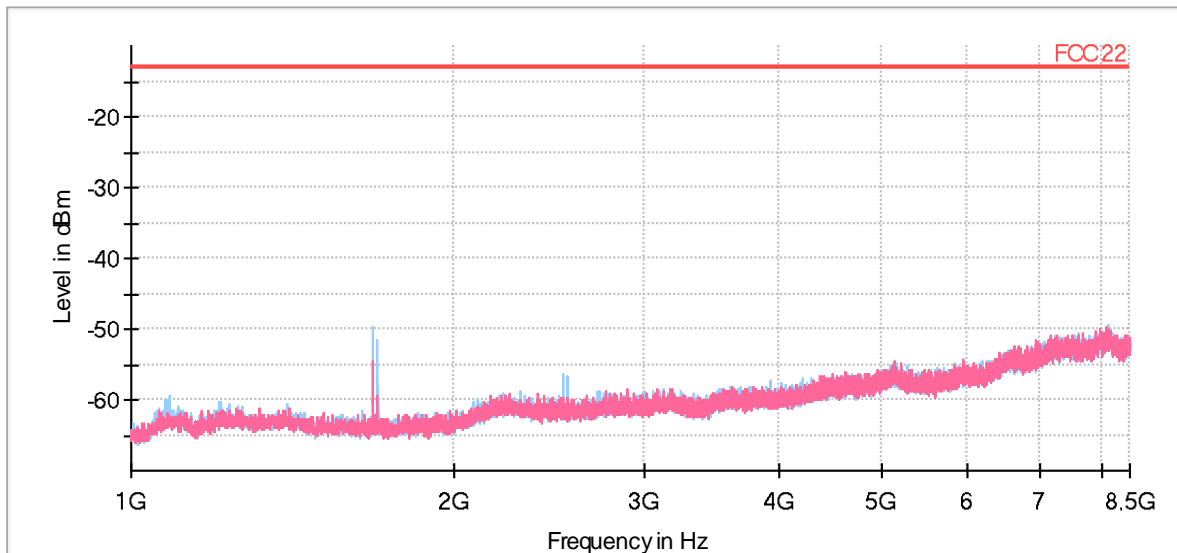


- Middle Channel:



Preview Result 1H-PK+ Preview Result 1V-PK+
FCC22 Final_Result PK+

- High Channel:



Preview Result 1H-PK+ Preview Result 1V-PK+
FCC22 Final_Result PK+

Appendix B: Test results for FCC Part 24 / RSS-133

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TEST CONDITIONS

POWER SUPPLY (V):

Vn: 115 Vac / 60Hz (*)

Type of Power Supply: AC Voltage mains.

The subscript 'n' indicates nominal voltage test conditions.

(*): Preliminary RSE scan determined 115Vac / 60Hz as worst case of power supply.

ANTENNA:

Band	Gain (dBi)	Antenna type
LTE Cat M1 Band 2	+2.5	Internal
LTE Cat M1 Band 25	+2.5	

TEST FREQUENCIES:

LTE Cat M1 Band 2: QPSK and 16-QAM modulations.

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

NOTE: Band 2 is completely included in band 25, so the channels of band 25 were tested to give conformity to the assigned block.

LTE Cat M1 Band 25: QPSK and 16-QAM modulations.

	Channel per Nominal Bandwidth (Frequency)					
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Low	26047 (1850.7 MHz)	26055 (1851.5 MHz)	26065 (1852.5 MHz)	26090 (1855 MHz)	26115 (1857.5 MHz)	26140 (1860 MHz)
Middle	26365 (1882.5 MHz)	26365 (1882.5 MHz)	26365 (1882.5 MHz)	26365 (1882.5 MHz)	26365 (1882.5 MHz)	26365 (1882.5 MHz)
High	26683 (1914.3 MHz)	26675 (1913.5 MHz)	26665 (1912.5 MHz)	26640 (1910 MHz)	26615 (1907.5 MHz)	26590 (1905 MHz)

Radiated emissions

SPECIFICATION:

FCC §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.

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 highest frequency generated within the equipment.

The EUT was placed on a non-conductive stand at a 3-meter distance from the measuring antenna for measurements from 30 MHz up to 18 GHz and at 1 m distance for measurements above 18 GHz.

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.

The maximum field strength (dB μ V/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:

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

Where D is the measurement distance (in the far field region) in m. $D = 3$ m.

Measurement Limit:

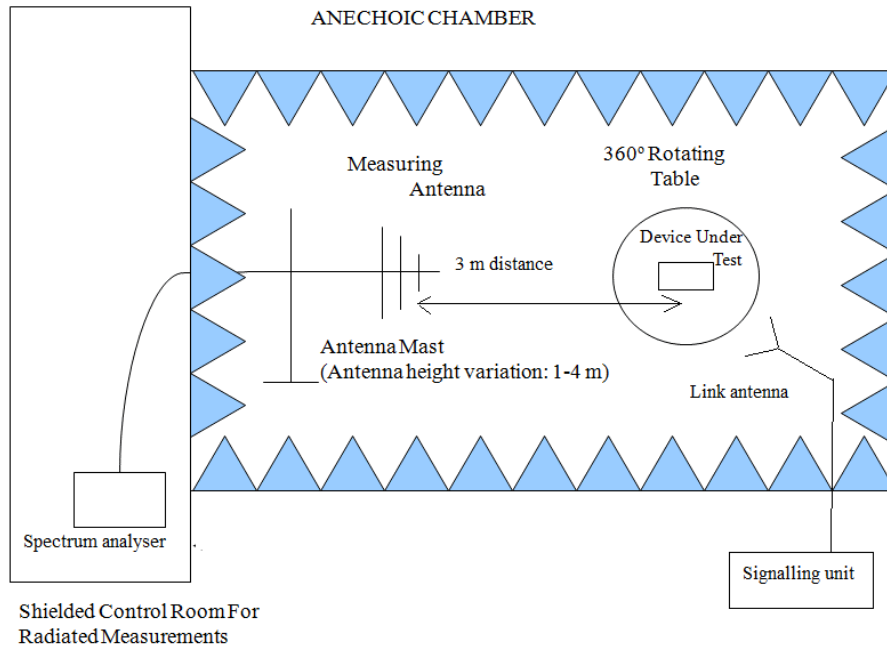
At P_o transmitting power, the specified minimum attenuation becomes $43+10 \log (P_o)$, and the level in dBm relative to P_o becomes:

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

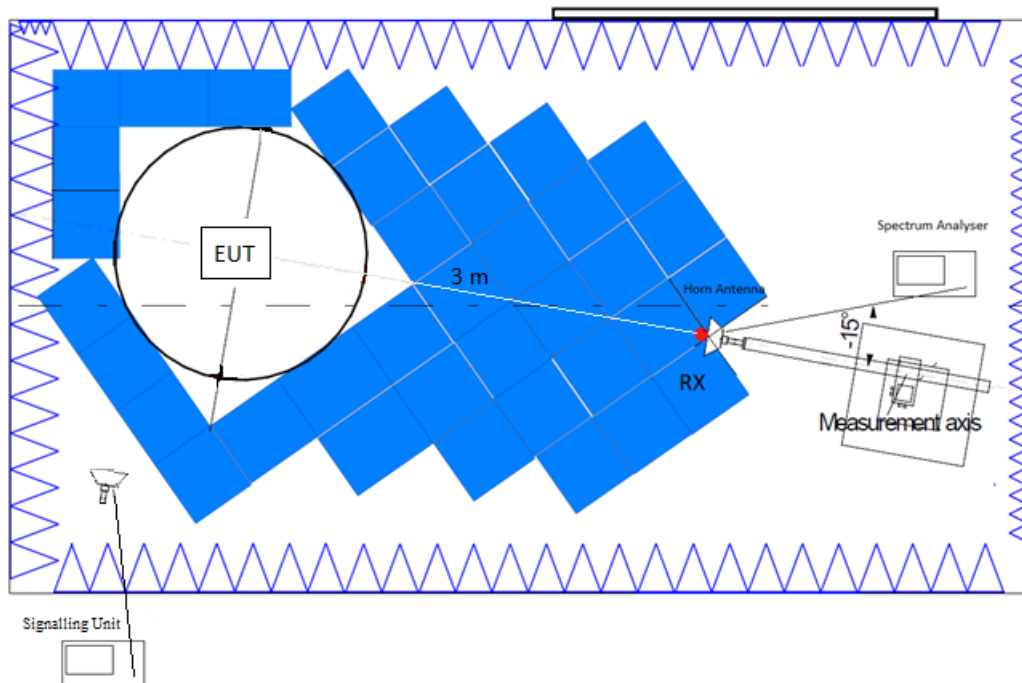
A resolution bandwidth / video bandwidth of 1 MHz / 3 MHz was used.

TEST SETUP:

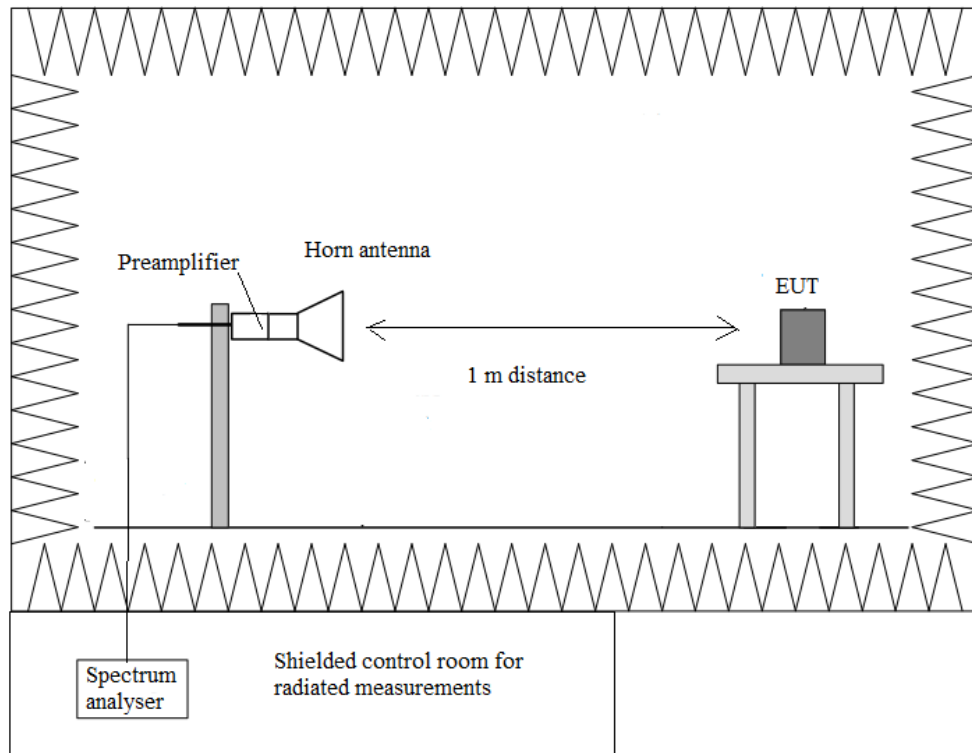
Radiated measurements setup below 1 GHz:



Radiated measurements setup from 1GHz to 18 GHz:



Radiated measurements setup above 18 GHz:



RESULTS:

LTE Cat M1 Band 25:

QPSK and 16-QAM modulations:

A preliminary scan determined the QPSK modulation, BW = 20 MHz, RB Size 1, Offset 0, Narrow band = 0 as the worst case.

The next results are for this worst-case configuration (plots in next pages).

- **Low Channel:**

- Frequency range 30 MHz – 1 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- Frequency range 1 GHz – 18 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- Frequency range 18 GHz – 20 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- **Middle Channel:**

- Frequency range 30 MHz - 1 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- Frequency range 1 GHz – 18 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- Frequency range 18 GHz – 20 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- **High Channel:**

- Frequency range 30 MHz – 1 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- Frequency range 1 GHz – 18 GHz**

- Spurious frequencies at less than 20 dB below the limit:

Frequency range 18 GHz – 20 GHz

No spurious frequencies at less than 20 dB below the limit.

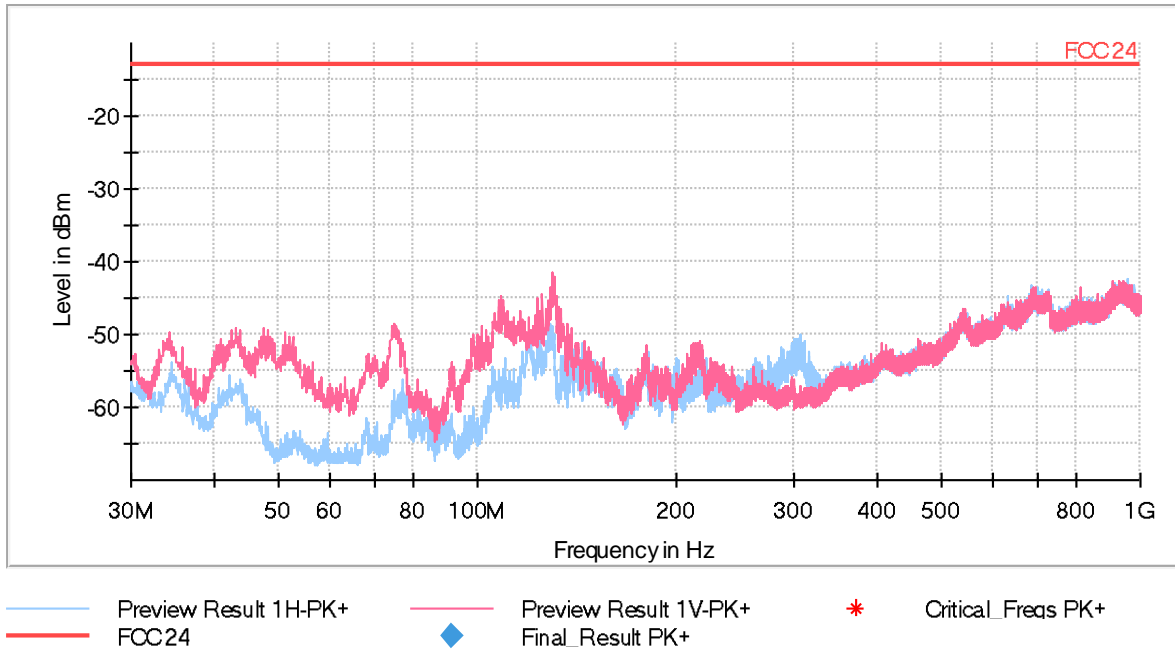
Measurement uncertainty (dB):

- <± 5.01 for $f < 1$ GHz
- <± 4.00 for $f \geq 1$ GHz up to 3 GHz
- <± 4.22 for $f \geq 3$ GHz up to 18 GHz
- <± 4.71 for $f \geq 18$ GHz up to 20 GHz

Verdict: PASS

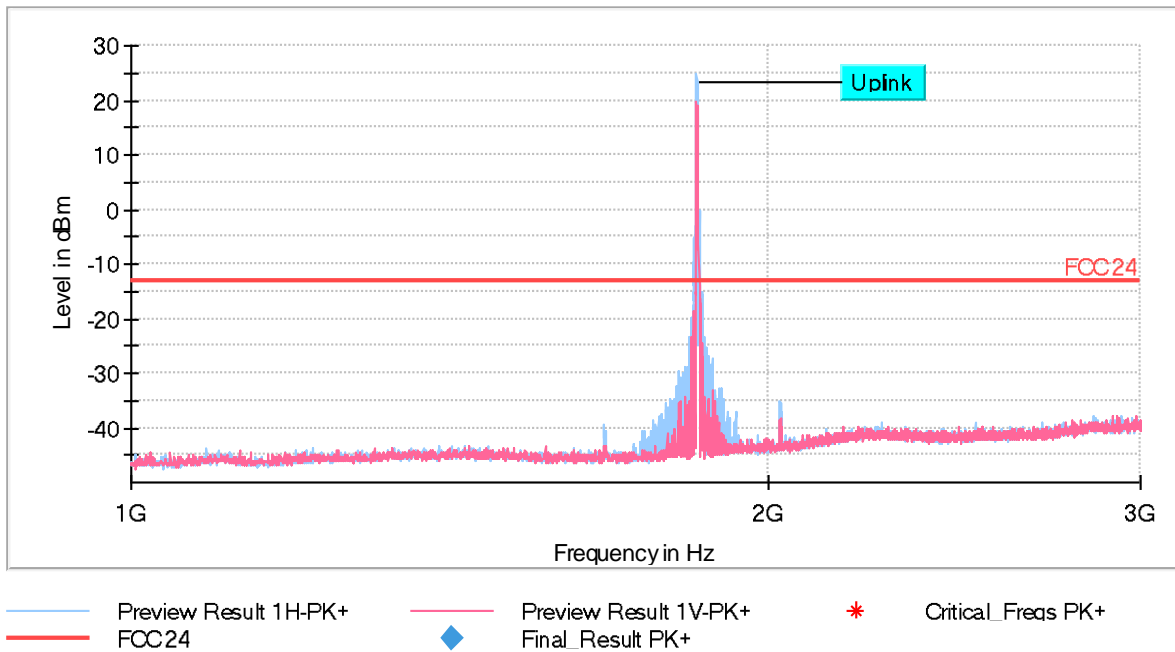
FREQUENCY RANGE 30 MHz –1 GHz:

This plot is valid for the Low, Middle and High Channels:



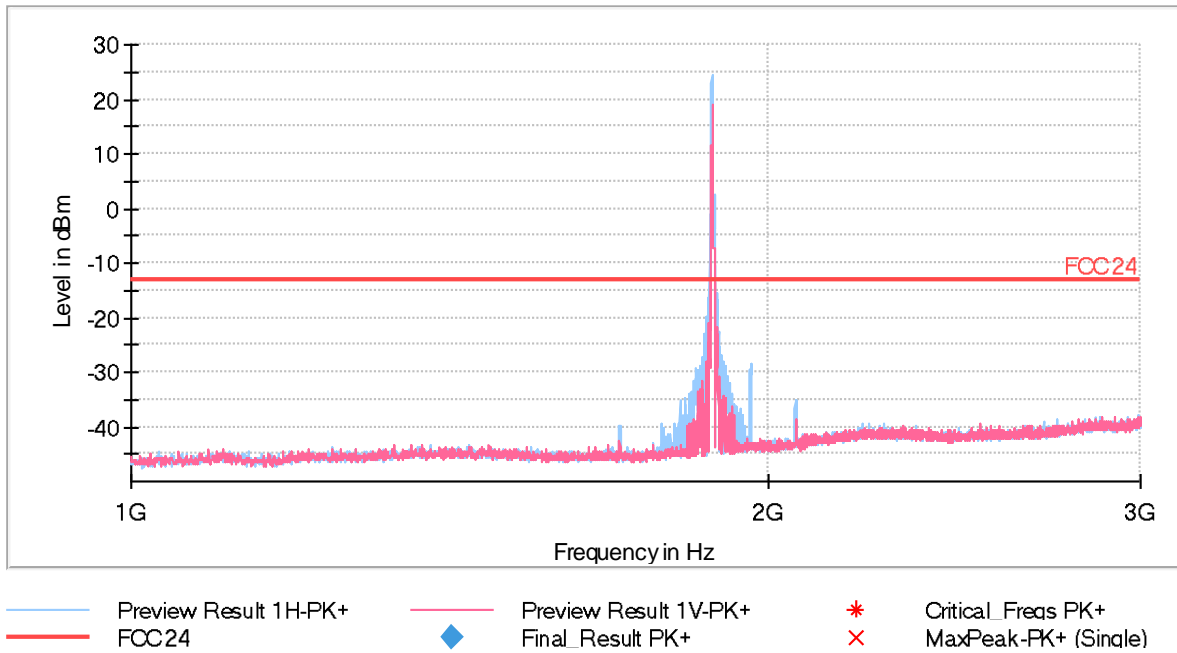
FREQUENCY RANGE 1 GHz – 3 GHz:

- Low Channel:



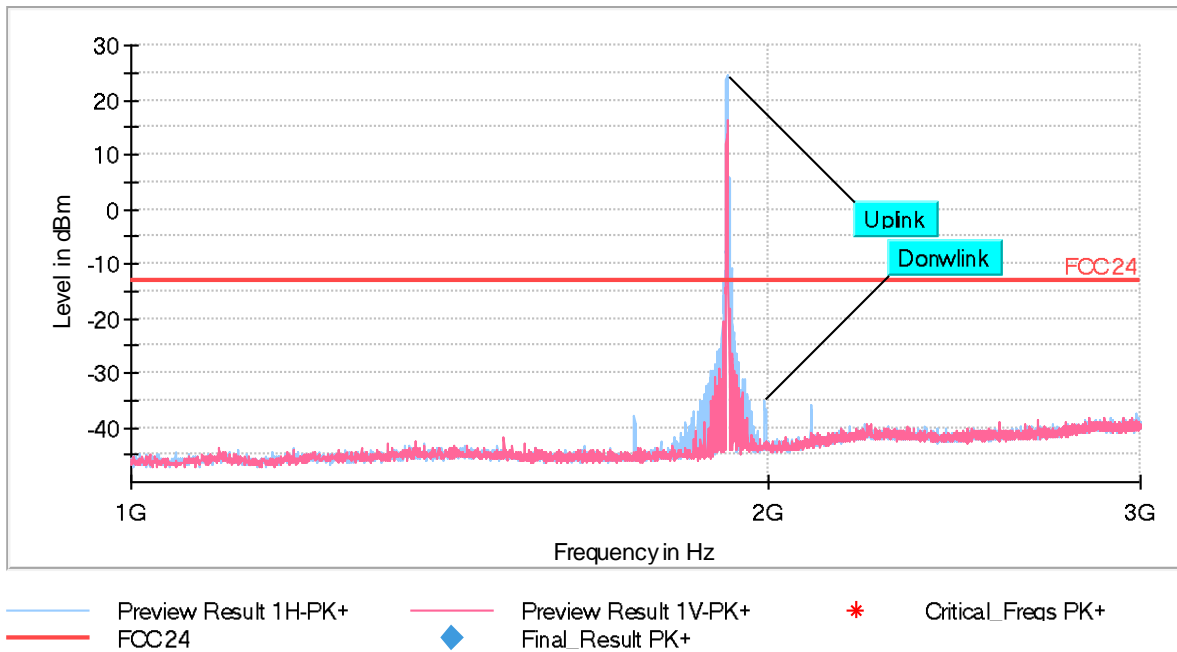
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

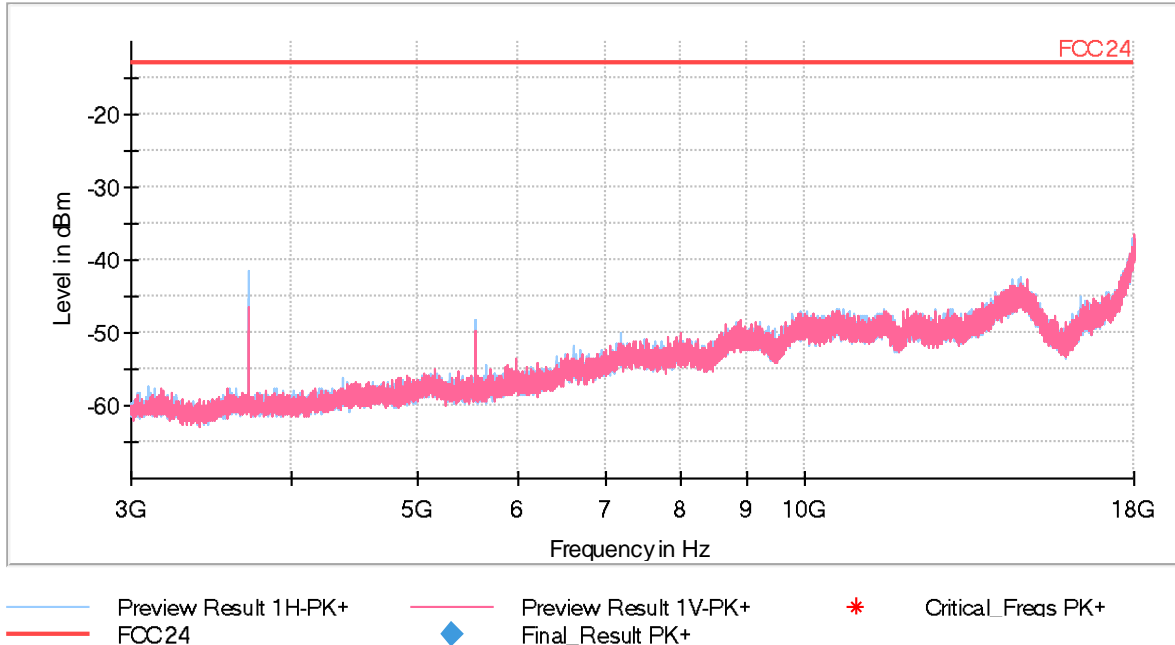
- High Channel:



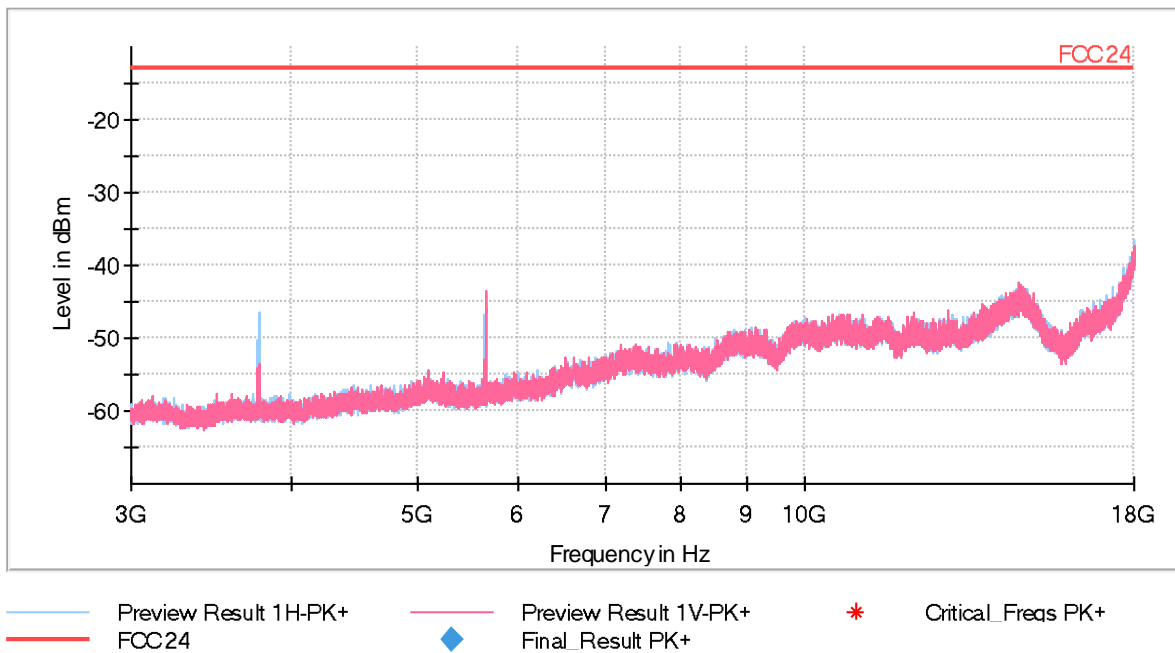
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz – 18 GHz:

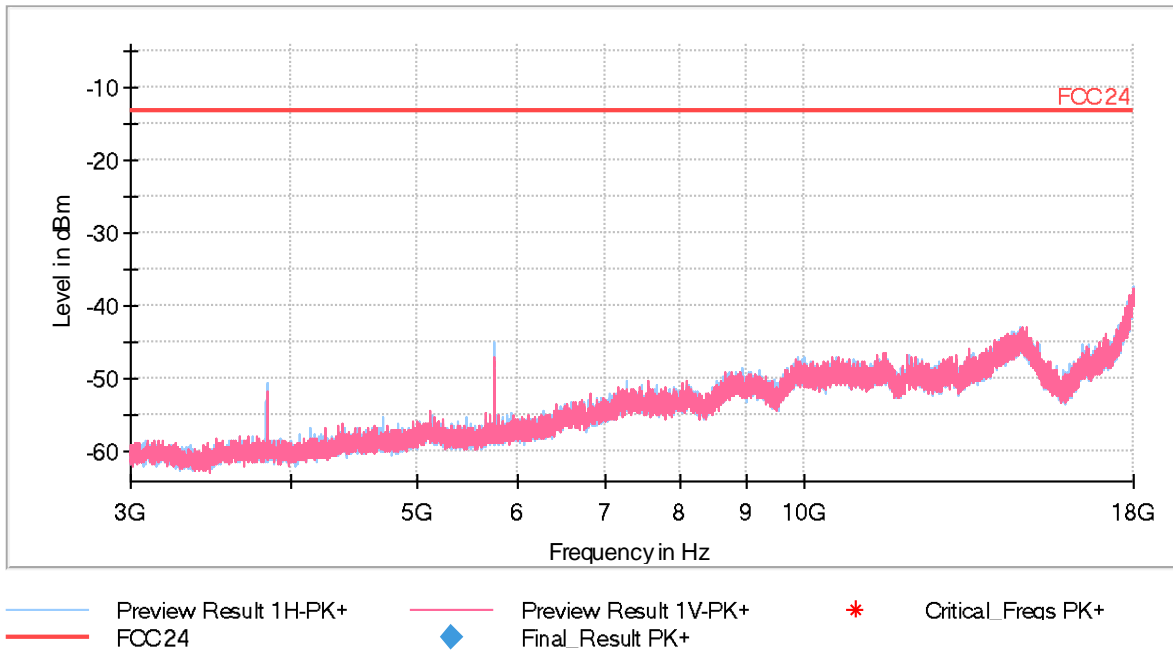
- Low Channel:



- Middle Channel:

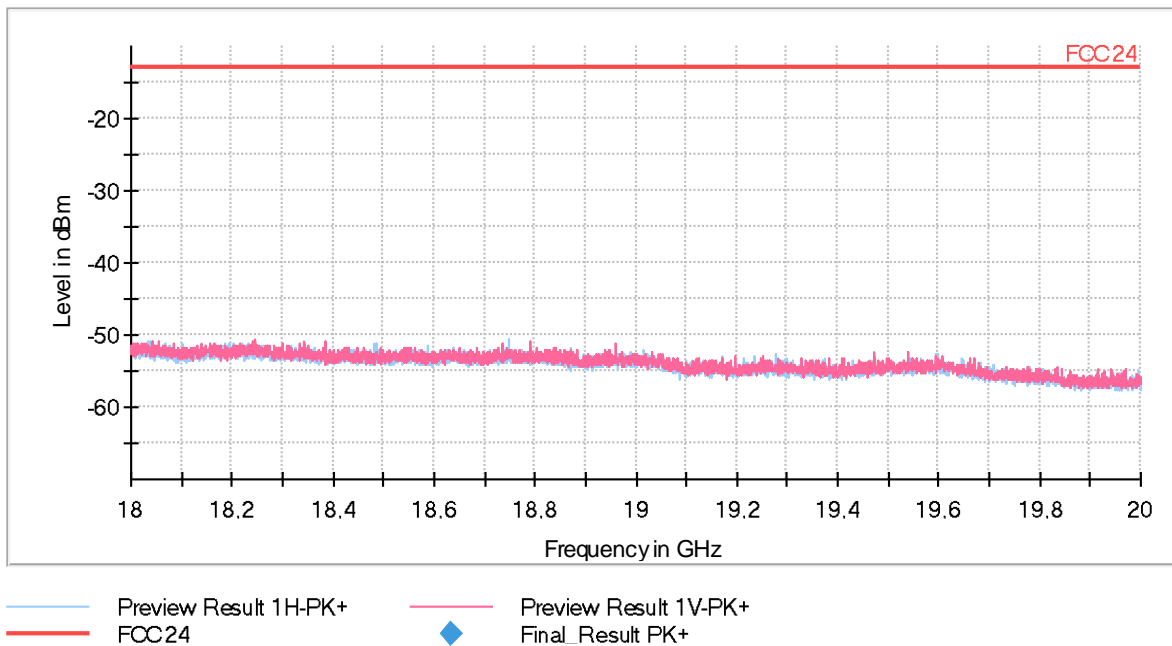


- High Channel:



FREQUENCY RANGE 18 GHz – 20 GHz:

This plot is valid for the Low, Middle and High Channels:



Appendix C: Test results for FCC Part 27 / RSS-130, RSS-139

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TEST CONDITIONS

POWER SUPPLY (V):

Vn: 115 Vac / 60Hz (*)

Type of Power Supply: AC Voltage mains.

The subscript 'n' indicates nominal voltage test conditions.

(*): Preliminary RSE scan determined 115Vac / 60Hz as worst case of power supply.

ANTENNA:

Band	Gain (dBi)	Antenna type
LTE Cat M1 Band 4	+4.5	Internal
LTE Cat M1 Band 12	+2.0	
LTE Cat M1 Band 13	+2.0	
LTE Cat M1 Band 66	+4.5	

TEST FREQUENCIES:

LTE Cat M1 Band 4: QPSK and 16-QAM modulations.

	Channel per Nominal Bandwidth (Frequency)					
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Low	19957 (1710.7 MHz)	19965 (1711.5 MHz)	19975 (1712.5 MHz)	20000 (1715 MHz)	20025 (1717.5 MHz)	20050 (1720 MHz)
Middle	20175 (1732.5 MHz)	20175 (1732.5 MHz)	20175 (1732.5 MHz)	20175 (1732.5 MHz)	20175 (1732.5 MHz)	20175 (1732.5 MHz)
High	20393 (1754.3 MHz)	20385 (1753.5 MHz)	20375 (1752.5 MHz)	20350 (1750 MHz)	20325 (1747.5 MHz)	20300 (1745 MHz)

NOTE: Band 4 is completely included in band 66, so the channels of band 66 were tested to give conformity to the assigned block 1710-1780 MHz.

LTE Cat M1 Band 12: QPSK and 16-QAM modulations.

	Channel per Nominal Bandwidth (Frequency)			
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz
Low	23017 (699.7 MHz)	23025 (700.5 MHz)	23035 (701.5 MHz)	23060 (704 MHz)
Middle	23095 (707.5 MHz)	23095 (707.5 MHz)	23095 (707.5 MHz)	23095 (707.5 MHz)
High	23173 (715.3 MHz)	23165 (714.5 MHz)	23155 (713.5 MHz)	23130 (711 MHz)

LTE Cat M1 Band 13: QPSK and 16-QAM modulations.

	Channel per Nominal Bandwidth (Frequency)	
	BW = 5 MHz	BW = 10 MHz
Low	23205 (779.5 MHz)	N/A
Middle	23230 (782 MHz)	23230 (782 MHz)
High	23255 (784.5 MHz)	N/A

LTE Cat M1 Band 66. QPSK and 16-QAM modulations.

	Channel per Nominal Bandwidth (Frequency)					
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz	BW = 20 MHz
Low	131979 (1710.7 MHz)	131987 (1711.5 MHz)	131997 (1712.5 MHz)	132022 (1715 MHz)	132047 (1717.5 MHz)	132072 (1720 MHz)
Middle	132322 (1745 MHz)	132322 (1745 MHz)	132322 (1745 MHz)	132322 (1745 MHz)	132322 (1745 MHz)	132322 (1745 MHz)
High	132665 (1779.3 MHz)	132657 (1778.5 MHz)	132647 (1777.5 MHz)	132622 (1775 MHz)	132597 (1772.5 MHz)	132572 (1770 MHz)

Radiated emissions

SPECIFICATION:

LTE Cat M1 Band 12, LTE Cat M1 Band 13

FCC §27.53 (c):

On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB. Compliance is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater.

On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations. Compliance is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

FCC §27.53 (f):

For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC §27.53 (g):

For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater.

RSS-130 Clause 4.7.1:

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB.

RSS-130 Clause 4.7.2:

The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least $65 + 10 \log_{10} p$ (watts), dB, for mobile and portable equipment.

The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and -80 dBW for discrete emission with bandwidth less than 700 Hz.

LTE Cat M1 Band 4, LTE Cat M1 Band 66

FCC §27.53 (h), RSS-139 Clause 6.6:

According to specification, 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 $43 + 10 \log_{10} (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz 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 highest frequency generated within the equipment.

The EUT was placed on a non-conductive stand at a 3-meter distance from the measuring antenna for measurements from 30 MHz up to 18 GHz.

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.

The maximum field strength (dB μ V/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:

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

Where D is the measurement distance (in the far field region) in m. D = 3 m.

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:

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

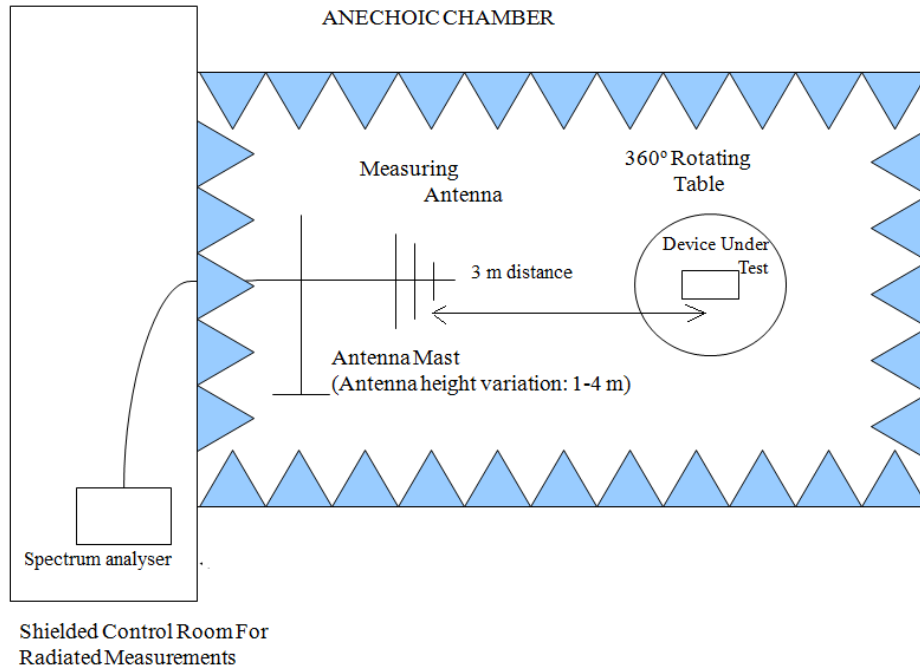
At P_o transmitting power, the specified minimum attenuation becomes $65+10 \log (P_o)$, and the level in dBm relative to P_o becomes:

$$P_o \text{ (dBm)} - [65 + 10 \log (P_o \text{ in mW}) - 30] = -35 \text{ dBm}$$

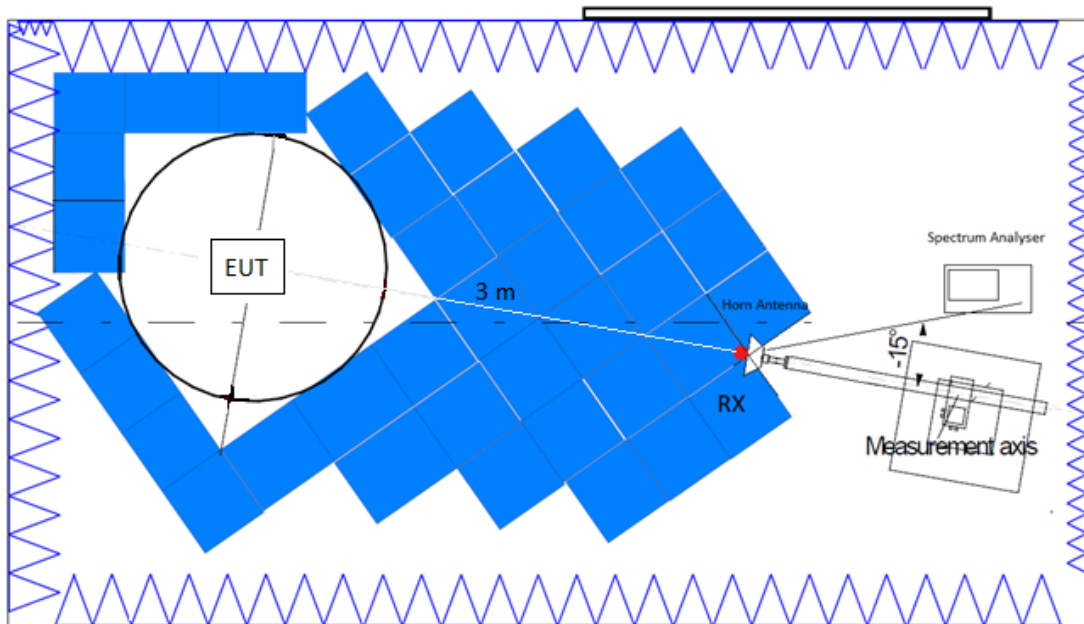
A resolution bandwidth / video bandwidth of 1 MHz / 3 MHz was used except in ranges 763–775 and 793–806 MHz.

TEST SETUP:

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 18 GHz:



RESULTS:

LTE Cat M1 Band 12:

Preliminary measurements determined QPSK modulation, Nominal Bandwidth of 5 MHz, RB Size 1, RB Offset 0, Narrow band = 0 as the worst case.

The next results are for this worst-case configuration (plots in next pages).

- **Low Channel:**

- Frequency range 30 MHz – 1 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- Frequency range 1 GHz – 8 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- **Middle Channel:**

- Frequency range 30 MHz – 1 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- Frequency range 1 GHz – 8 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- **High Channel:**

- Frequency range 30 MHz – 1 GHz**

- No spurious frequencies at less than 20 dB below the limit.

- Frequency range 1 GHz – 8 GHz**

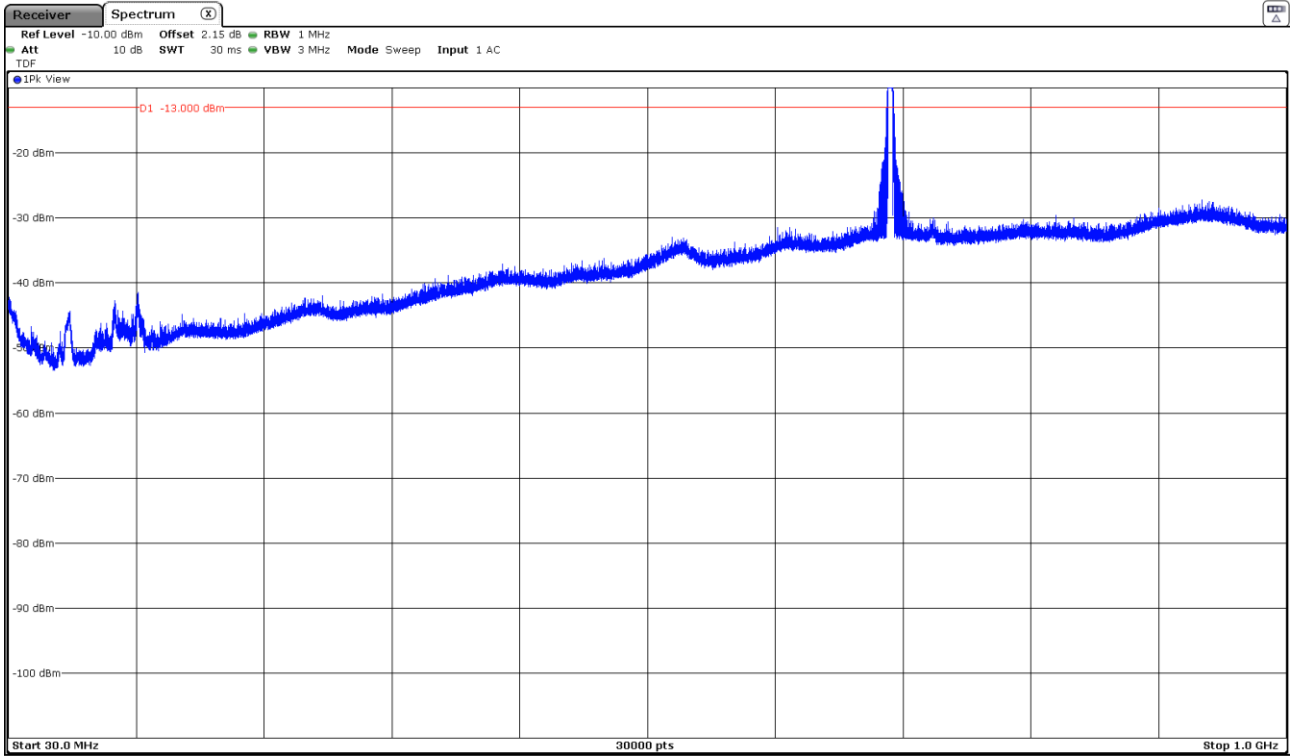
- No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB): $<\pm 4.68$ for $f < 1$ GHz
 $<\pm 4.22$ for $f \geq 1$ GHz up to 8 GHz

Verdict: PASS

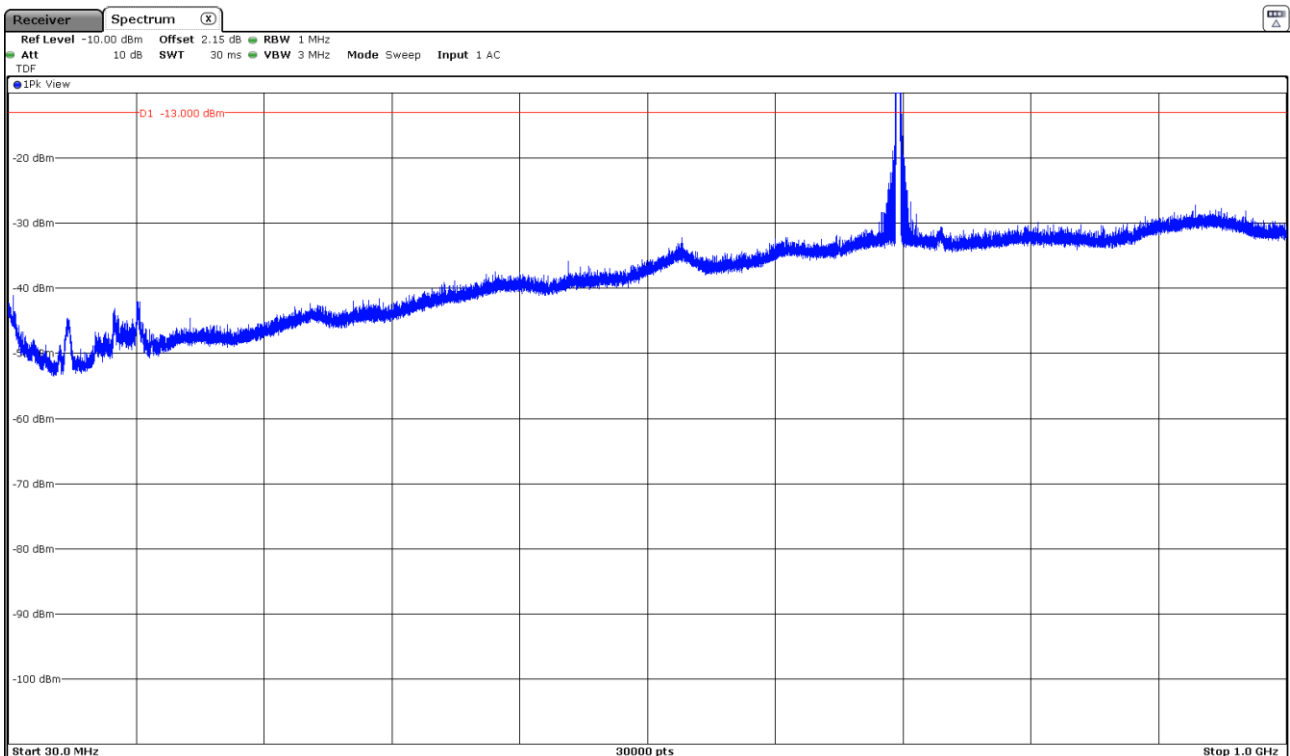
FREQUENCY RANGE 30 MHz – 1 GHz:

- Low Channel:



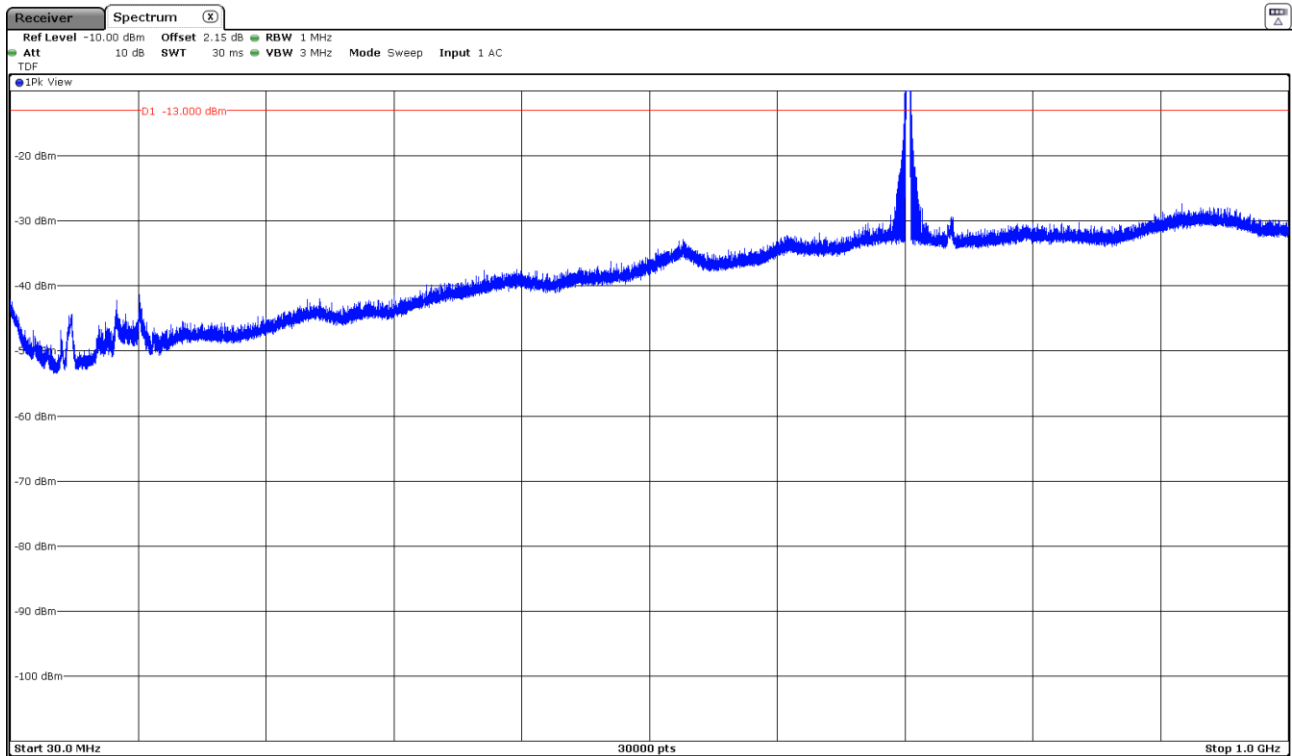
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

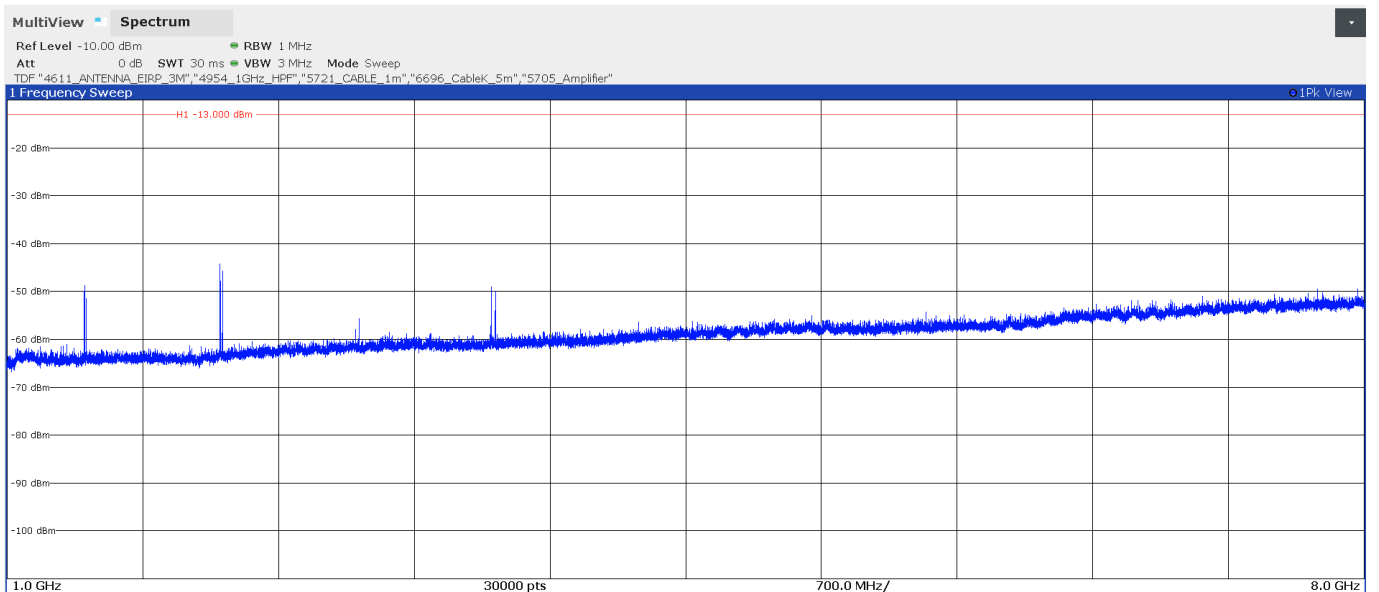
- High Channel:



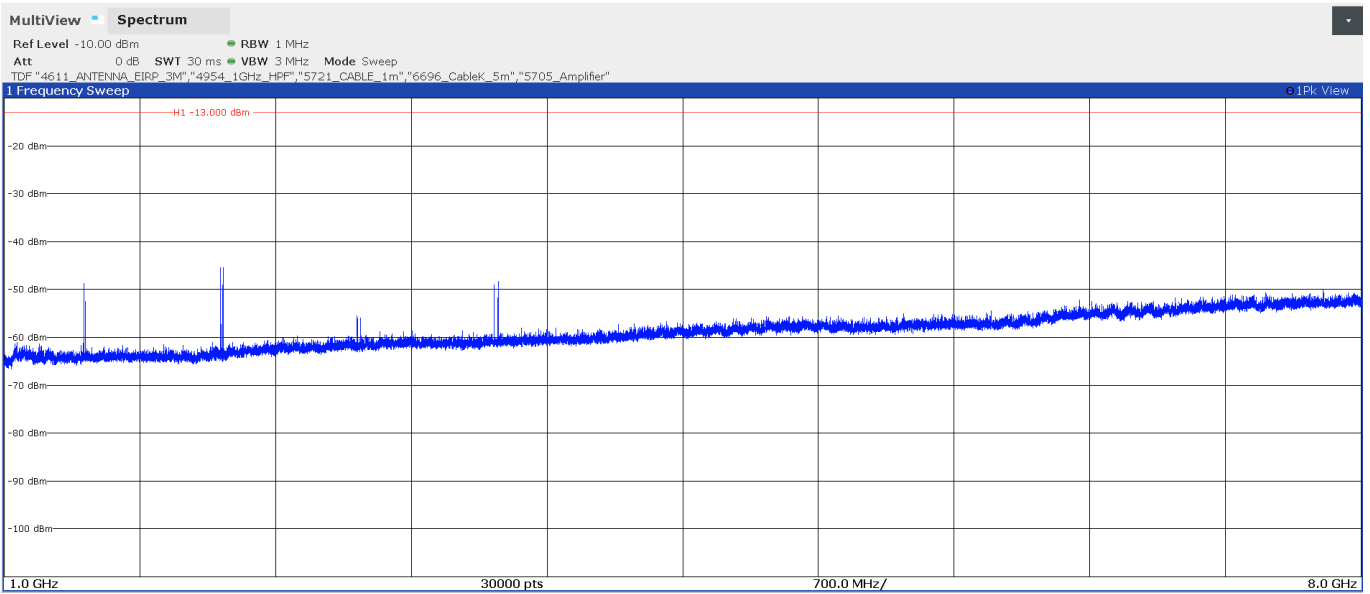
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 GHz – 8 GHz:

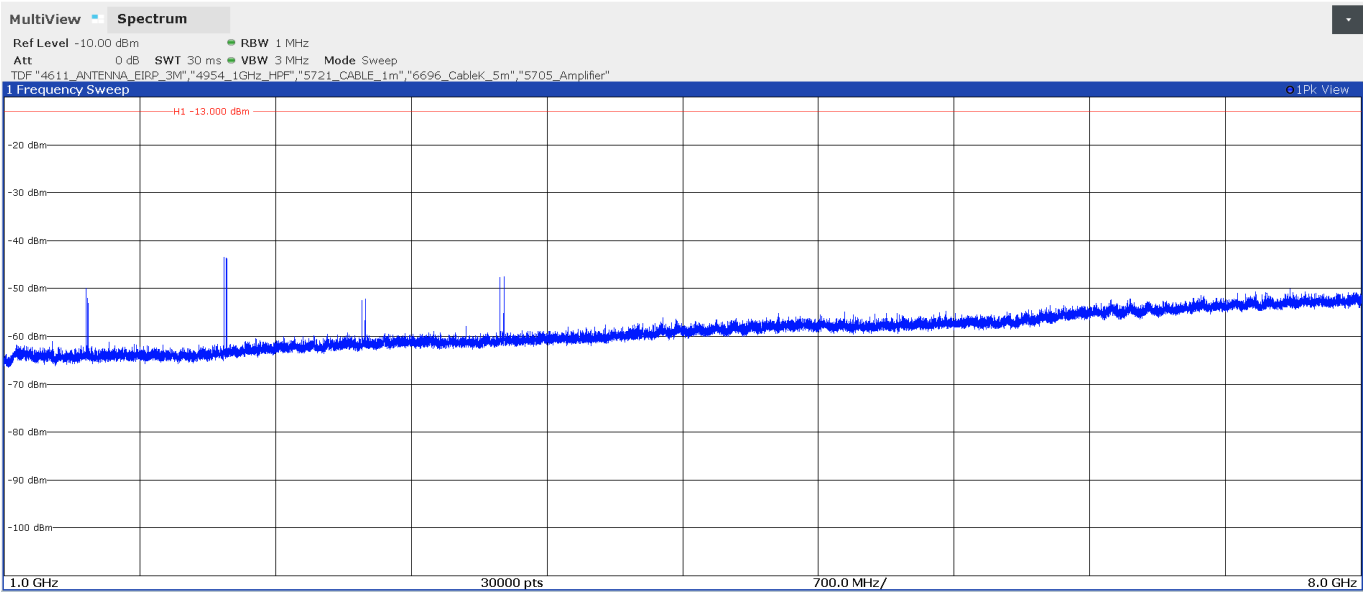
- Low Channel:



- Middle Channel:



- High Channel:



LTE Cat M1 Band 13:

Preliminary measurements determined 16-QAM modulation, Nominal Bandwidth of 5 MHz, RB Size 1, RB Offset 0, Narrow band = 0 as the worst case.

The next results are for this worst-case configuration (plots in next pages).

- **Low Channel:**

Frequency range 30 MHz – 1 GHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
774.934600	-51.92	H	Peak	-35

Frequency range 1 GHz – 8 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1559 MHz – 1610 MHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
1.563319	-52.99	H	Peak	-40

Only wideband signals were detected, no discrete signals.

- **Middle Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 8 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1559 MHz – 1610 MHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
1.559761	-46.93	H	Peak	-40
1.568274	-53.28	H	Peak	-40

Only wideband signals were detected, no discrete signals.

- **High Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 8 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1559 MHz – 1610 MHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector	Limit (dBm)
1.564511	-53.23	H	Peak	-40
1.573174	-50.38	H	Peak	-40

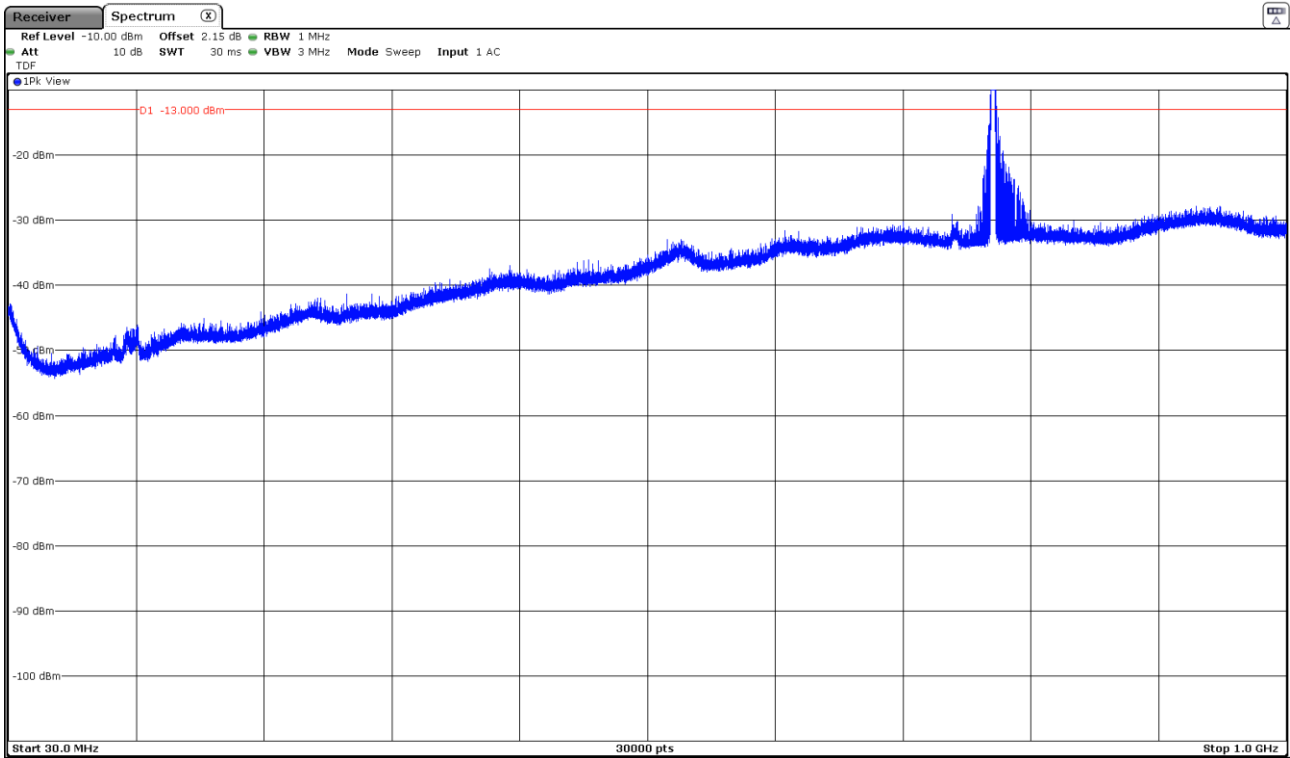
Only wideband signals were detected, no discrete signals.

Measurement uncertainty (dB): $<\pm 4.68$ for $f < 1$ GHz
 $<\pm 4.22$ for $f \geq 1$ GHz up to 8 GHz

Verdict: PASS

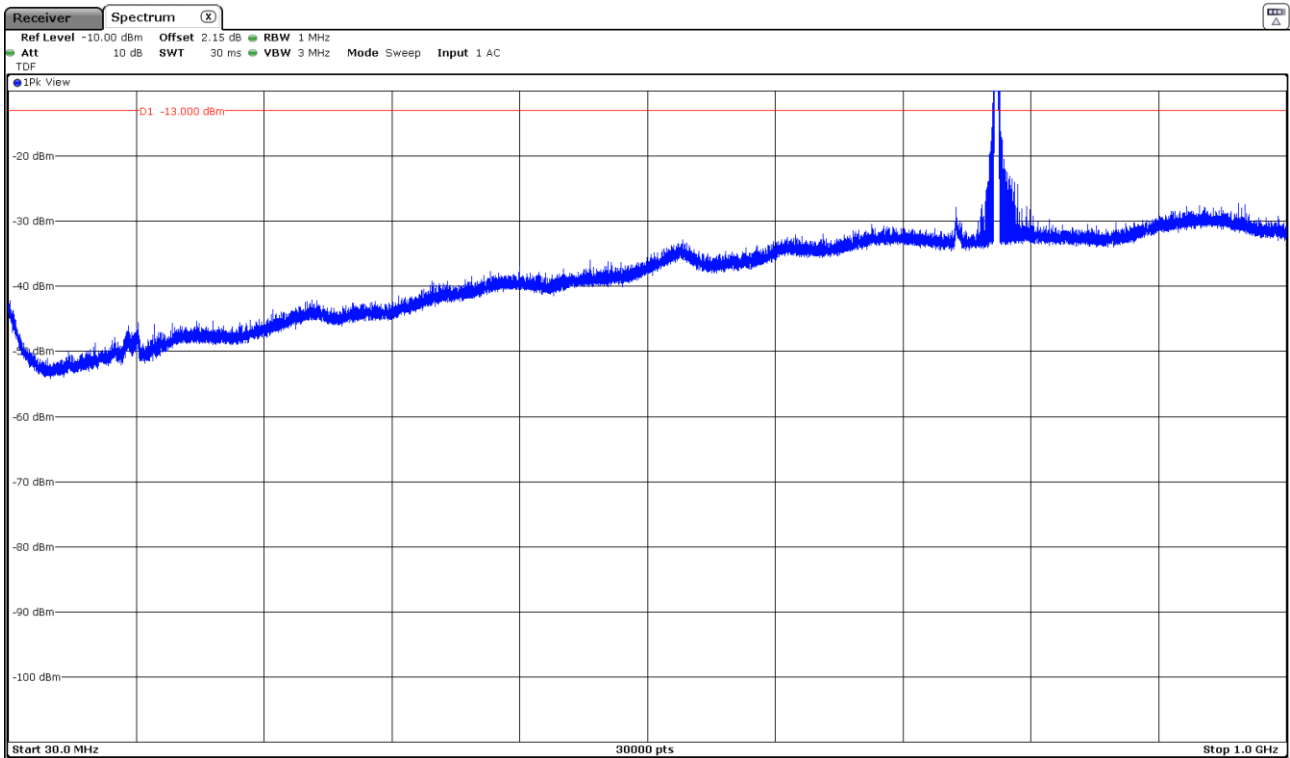
FREQUENCY RANGE 30 MHz – 1 GHz:

- Low Channel:



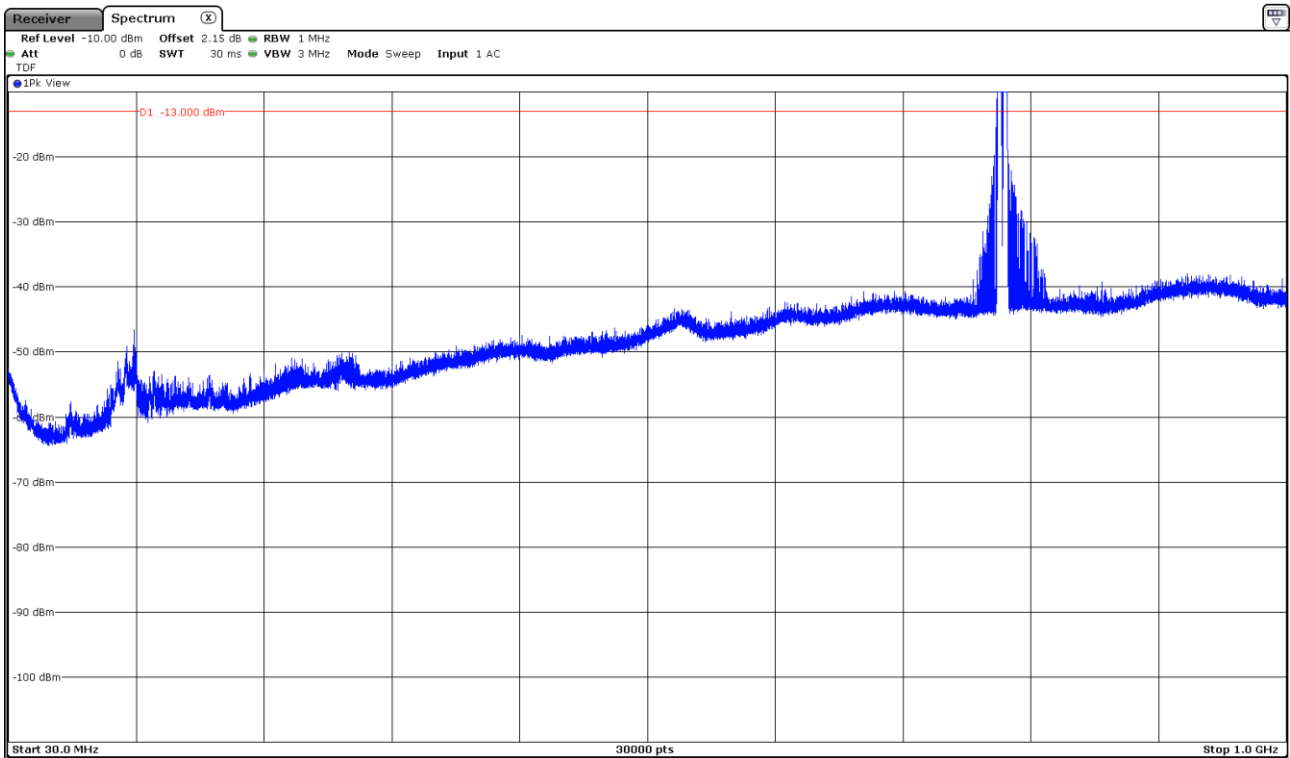
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

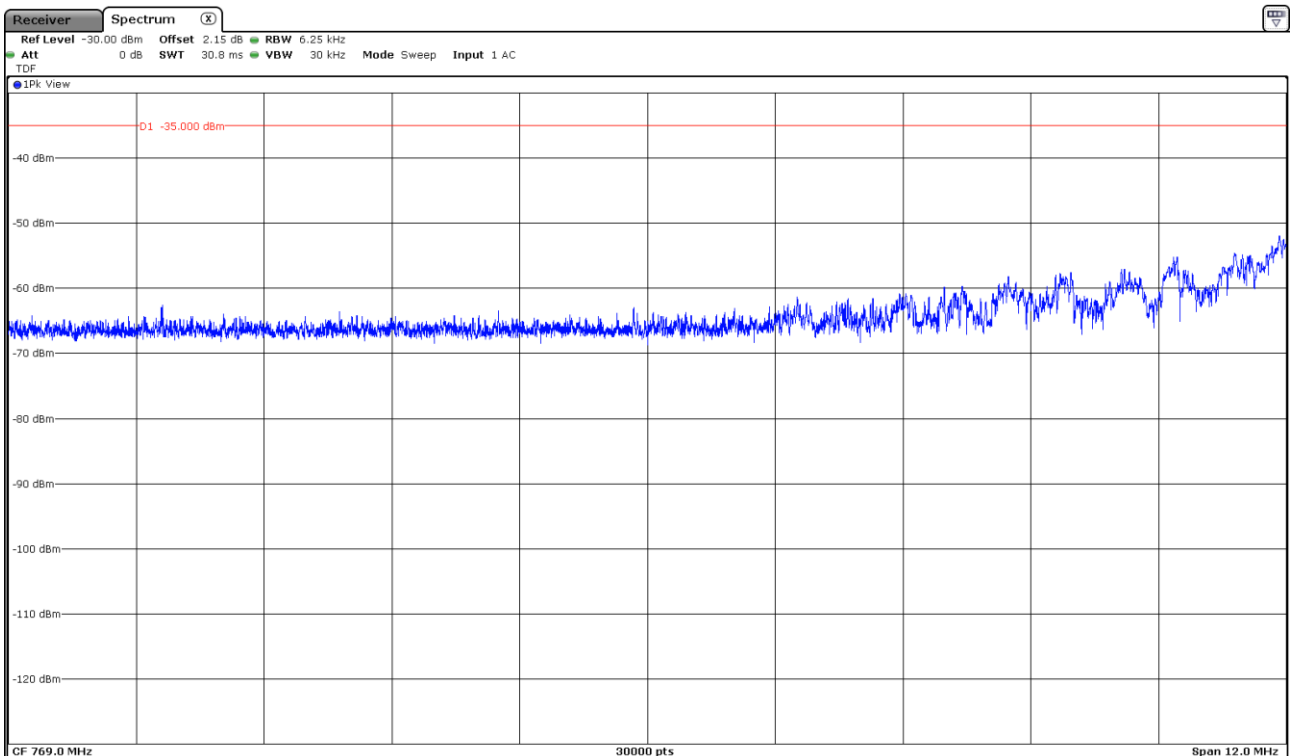
- High Channel:



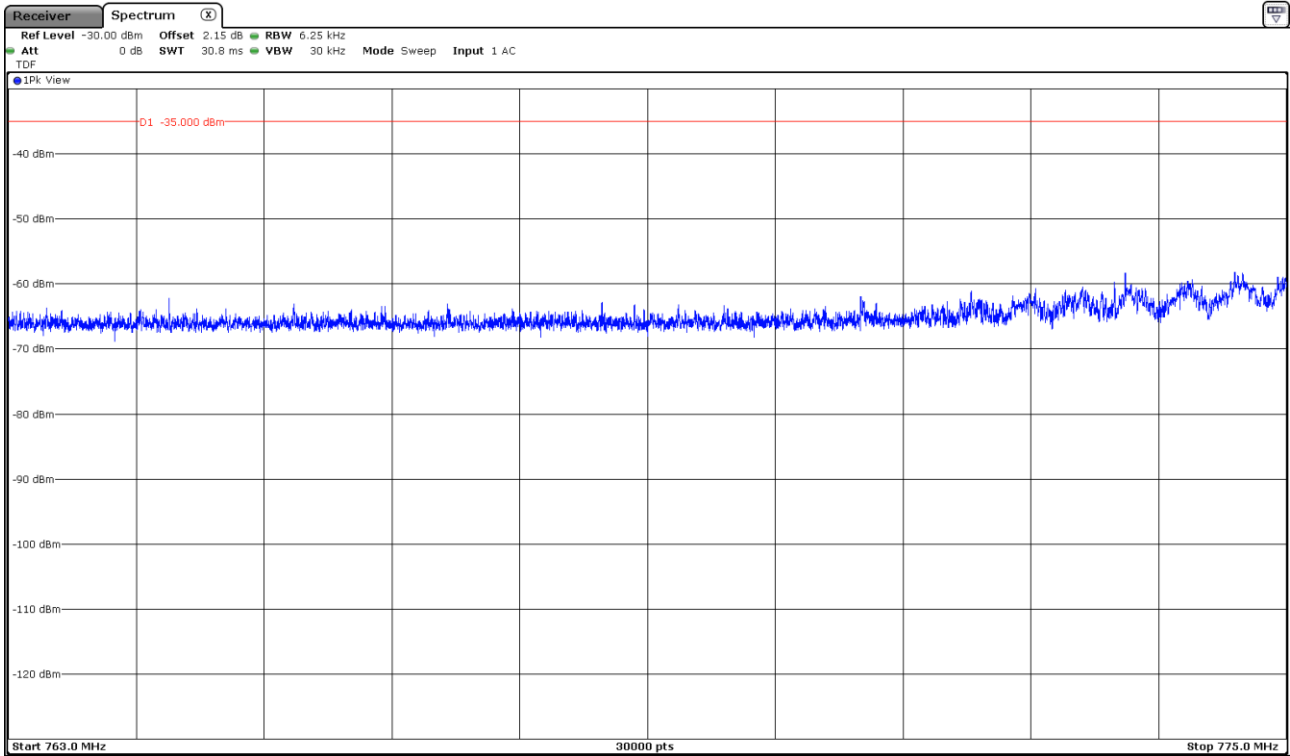
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 763 MHz – 775 MHz:

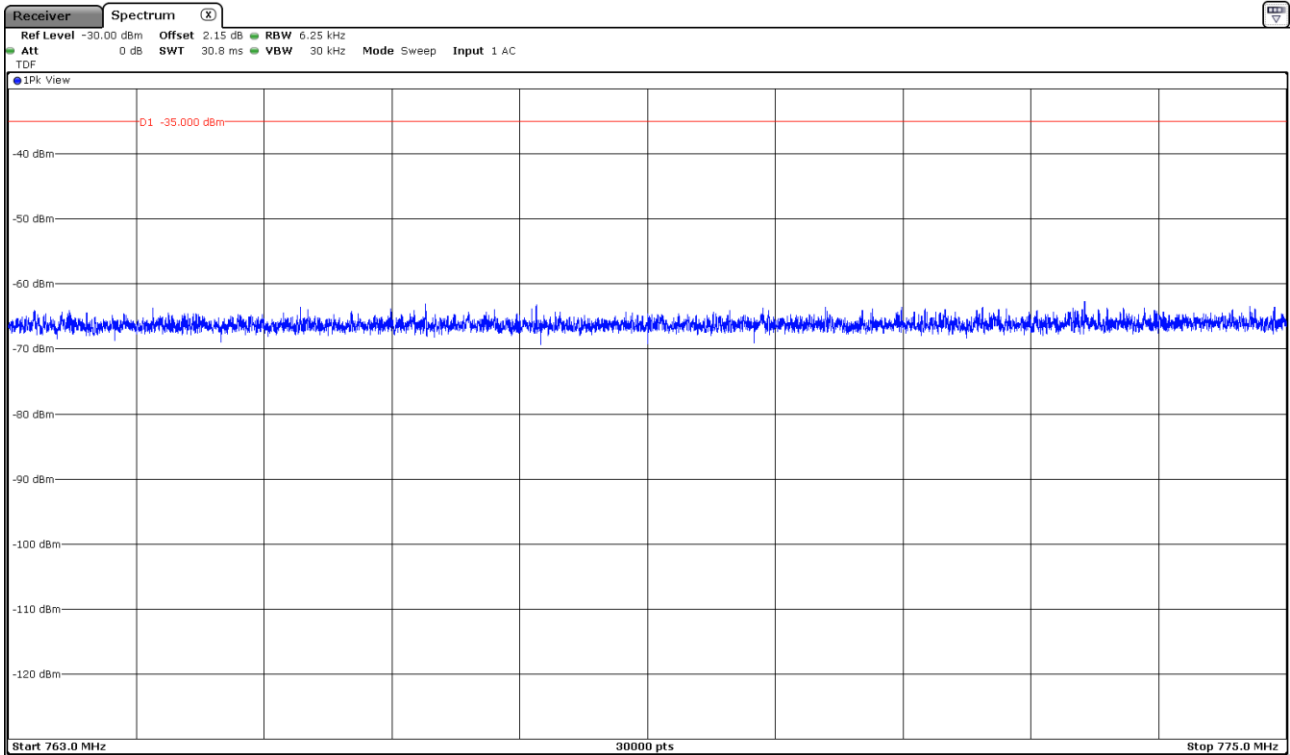
- Low Channel:



- Middle Channel:

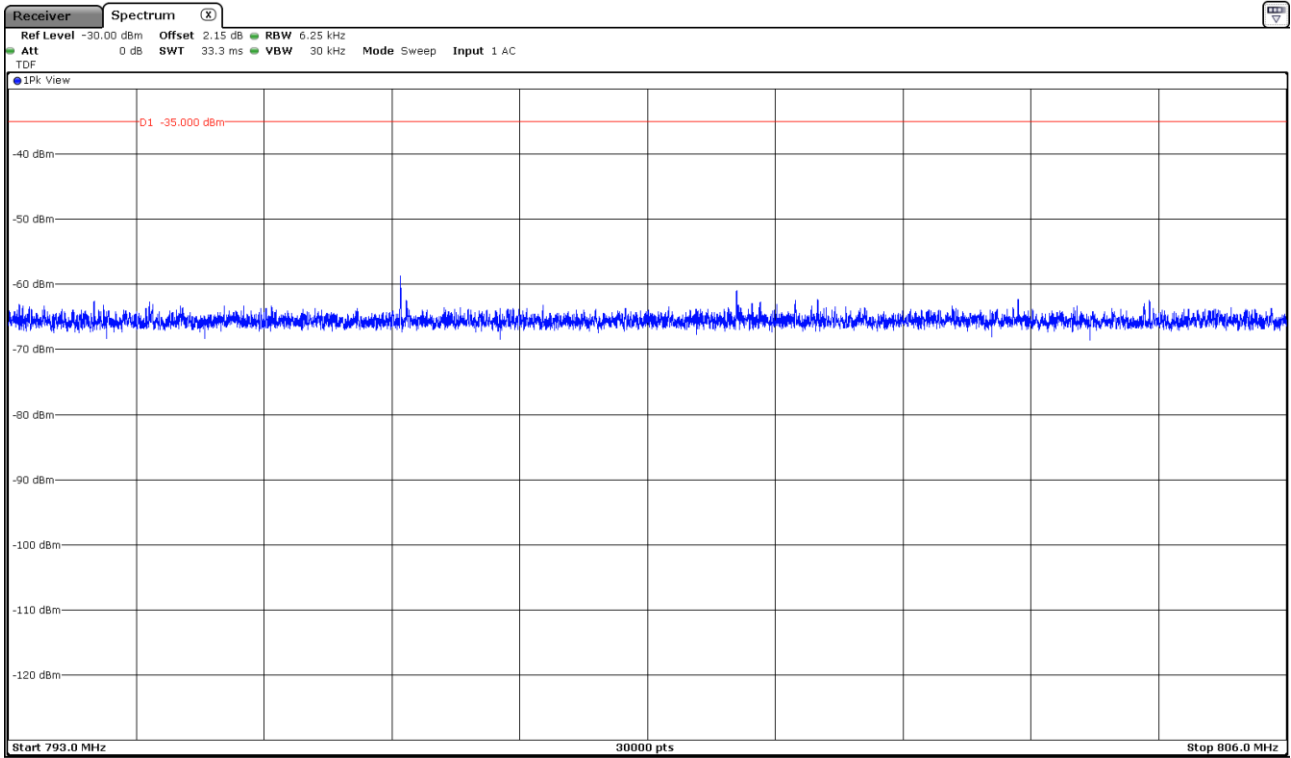


- High Channel:

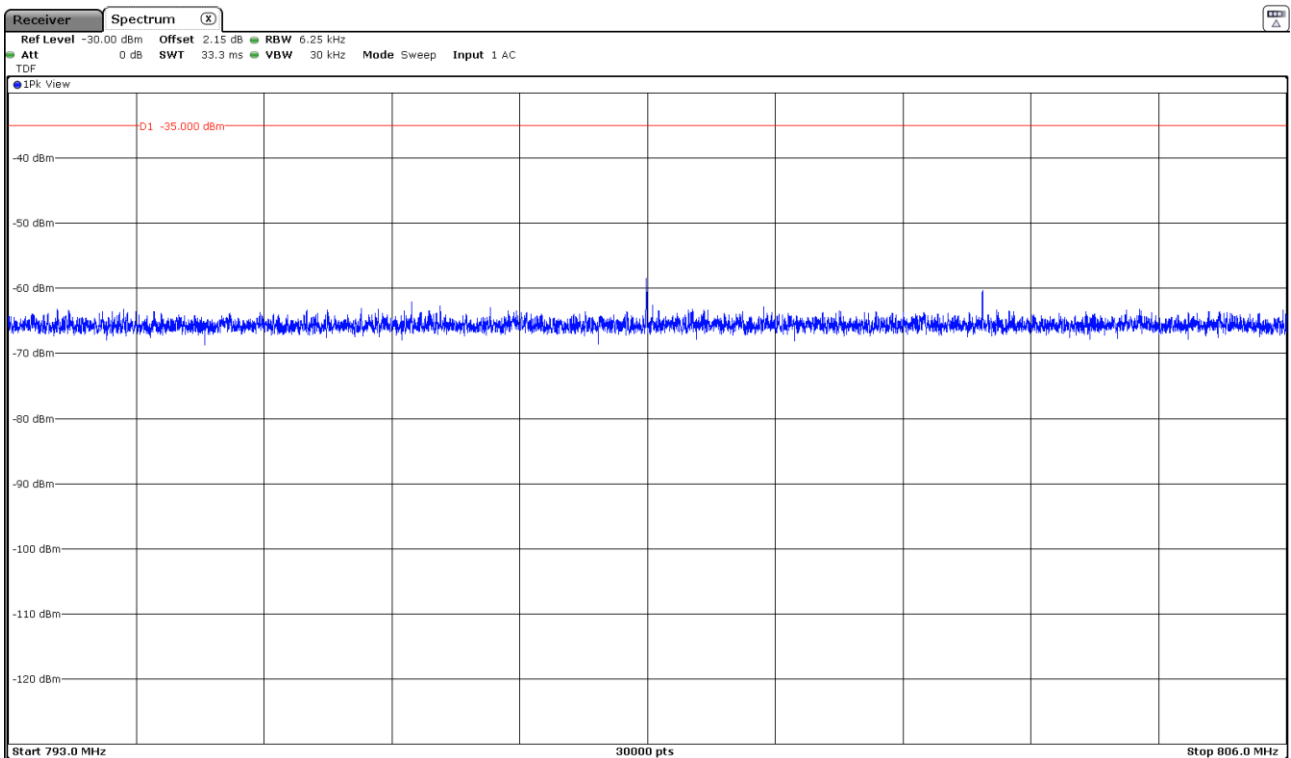


FREQUENCY RANGE 793 MHz – 806 MHz:

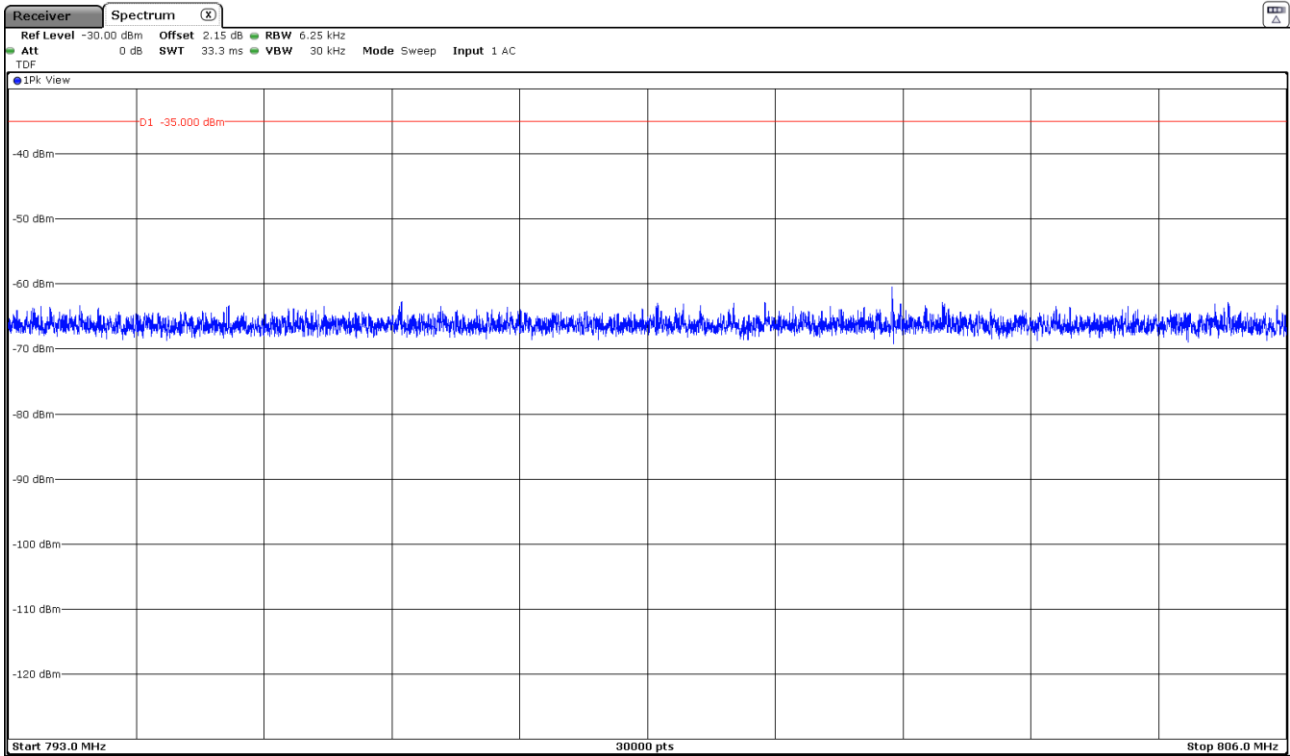
- Low Channel:



- Middle Channel:

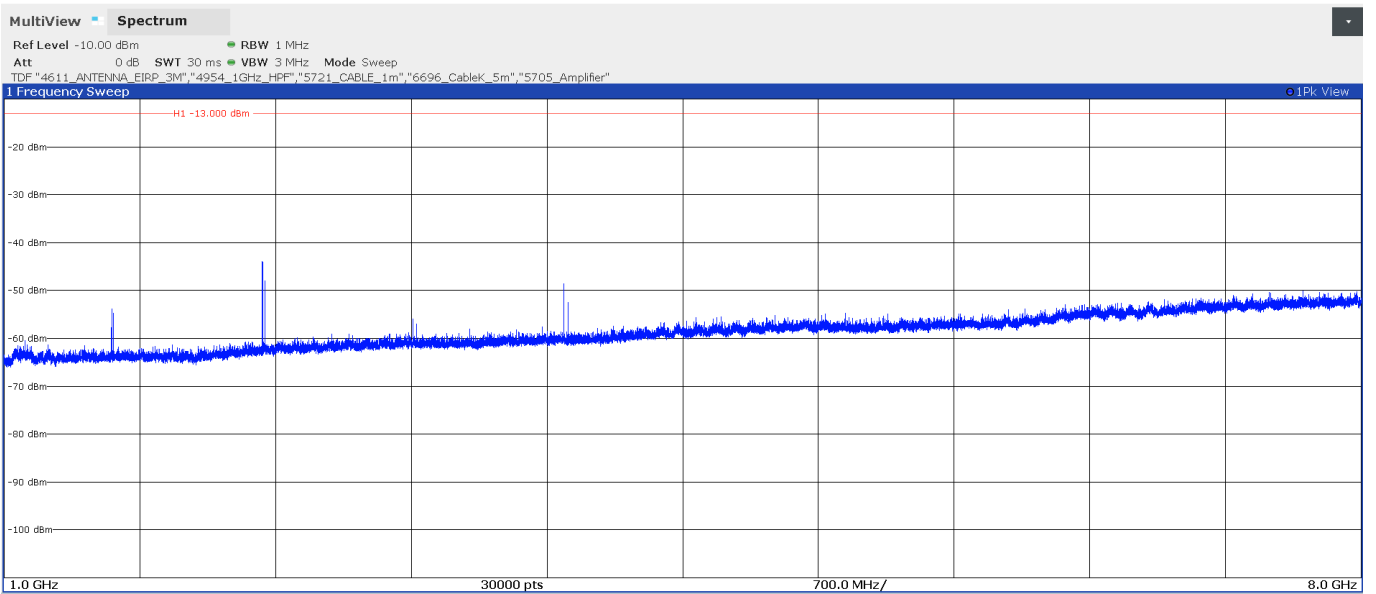


- High Channel:

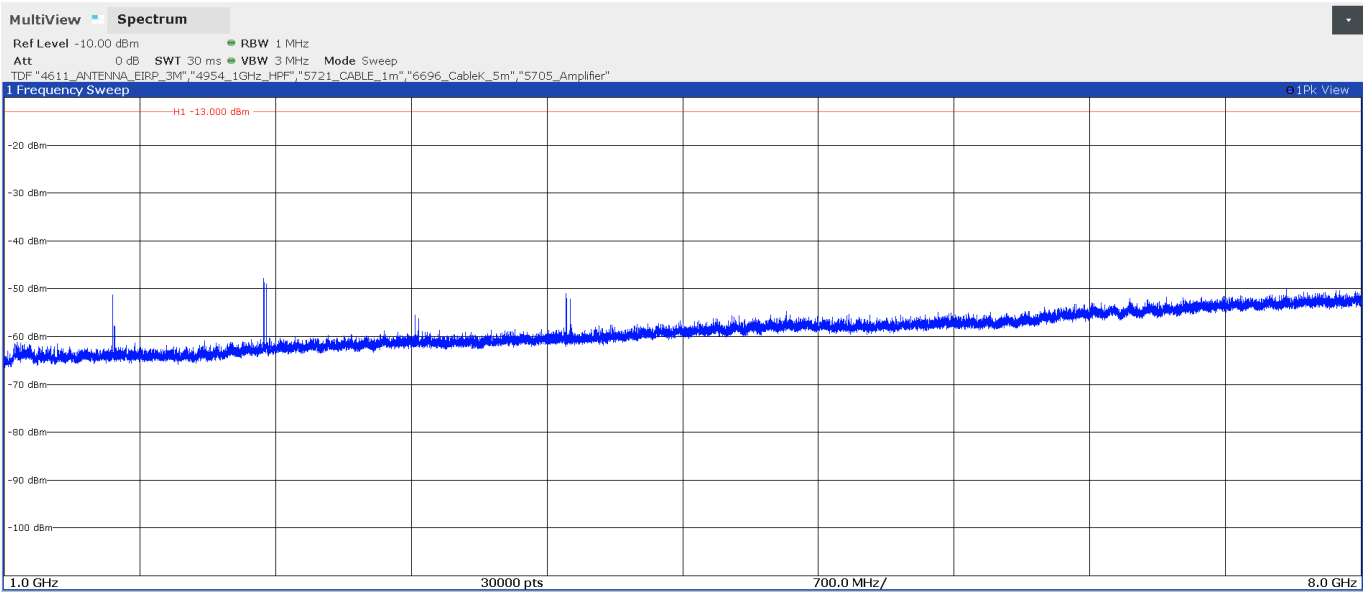


FREQUENCY RANGE 1 GHz – 8 GHz:

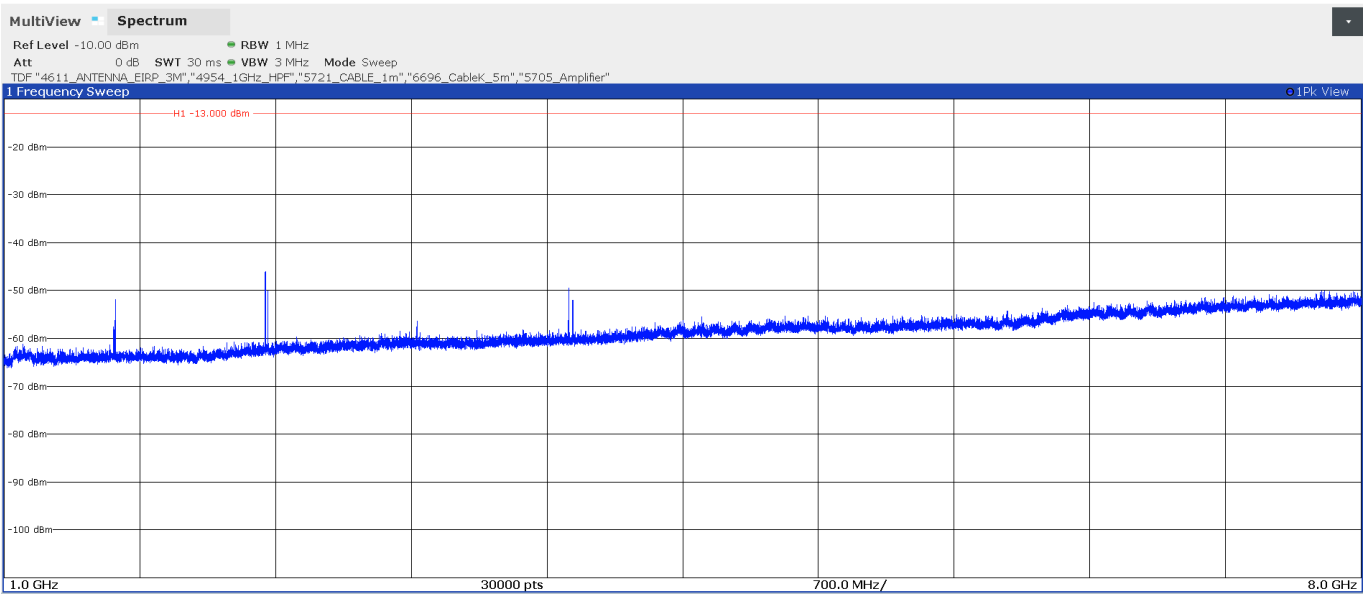
- Low Channel:



- Middle Channel:

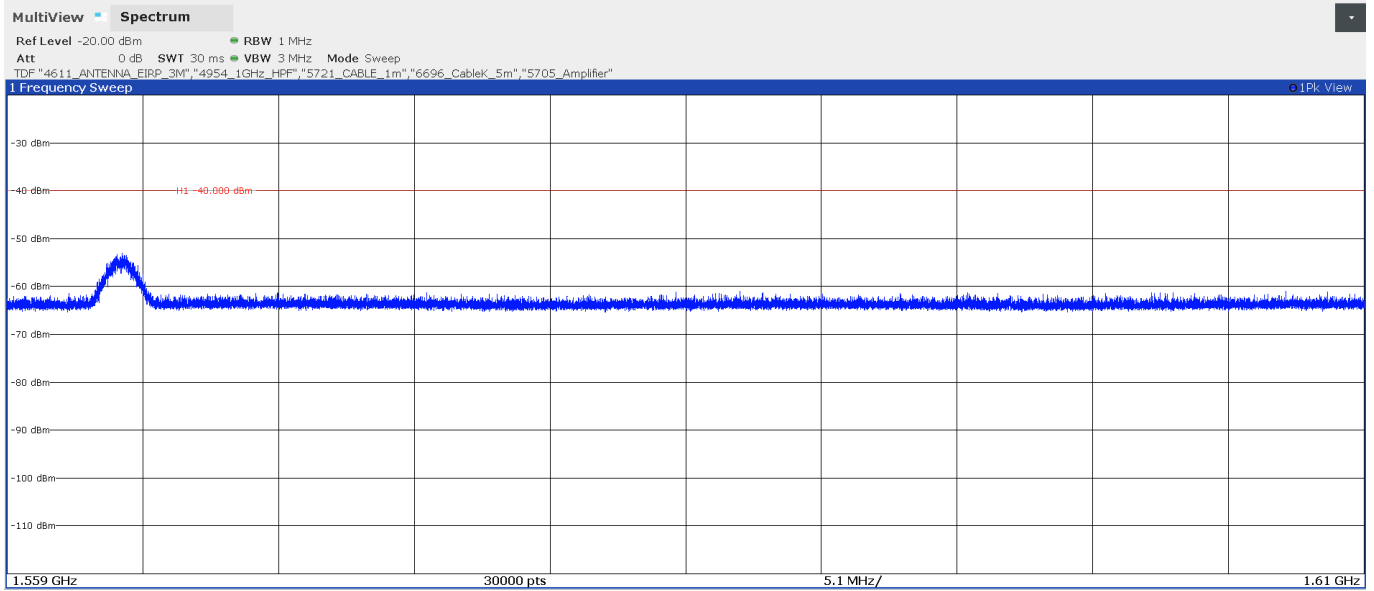


- High Channel:

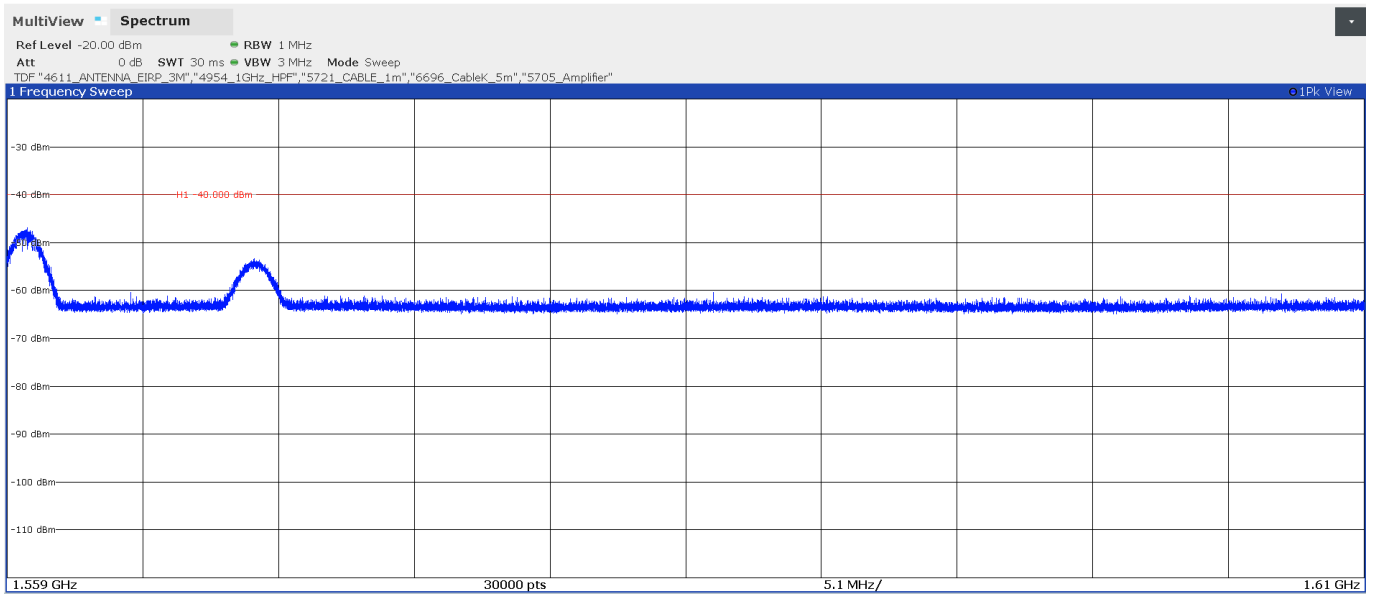


FREQUENCY RANGE 1559 MHz – 1610 MHz:

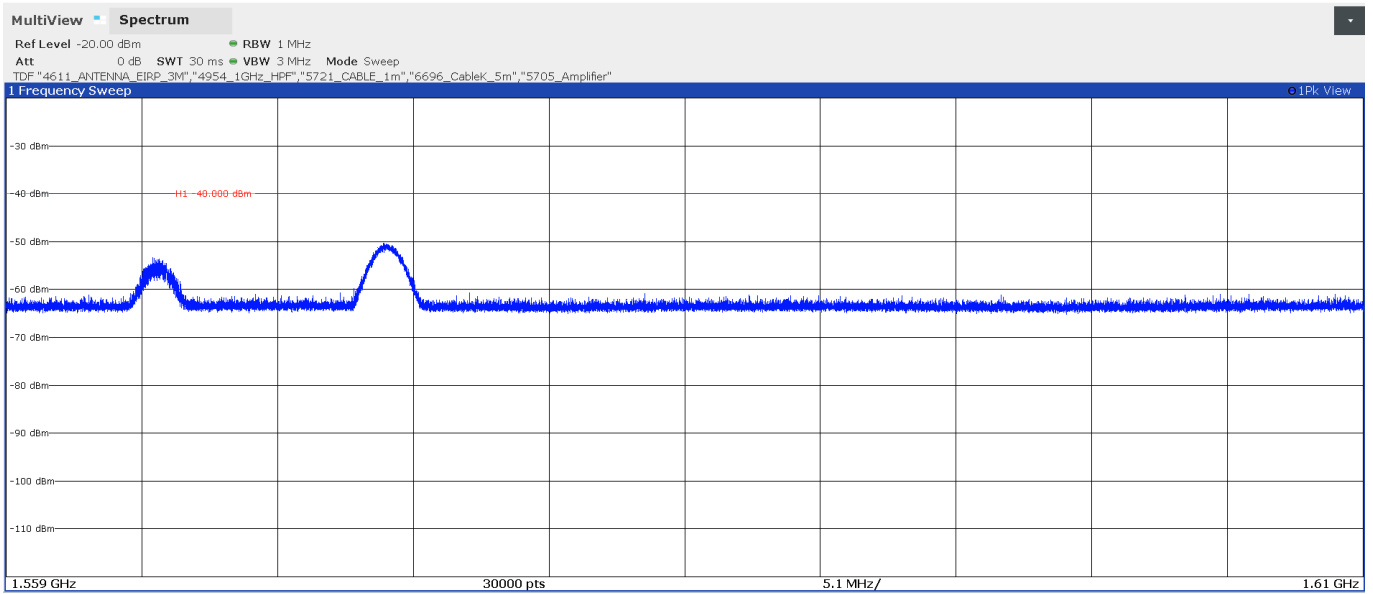
- Low Channel:



- Middle Channel:



- High Channel:



LTE Cat M1 Band 66:

Preliminary measurements determined 16-QAM modulation, Nominal Bandwidth of 20 MHz, RB Size 1, RB Offset 0, Narrow band = 0 as the worst case.

The next results are for this worst-case configuration (plots in next pages).

- **Low Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 18 GHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
1.860043	-32.96	H	Peak

- **Middle Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 18 GHz

Spurious frequencies at less than 20 dB below the limit:

Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
1.887546	-32.73	H	Peak
3.472750	-30.73	H	Peak

- **High Channel:**

Frequency range 30 MHz –1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 18 GHz

Spurious frequencies at less than 20 dB below the limit:

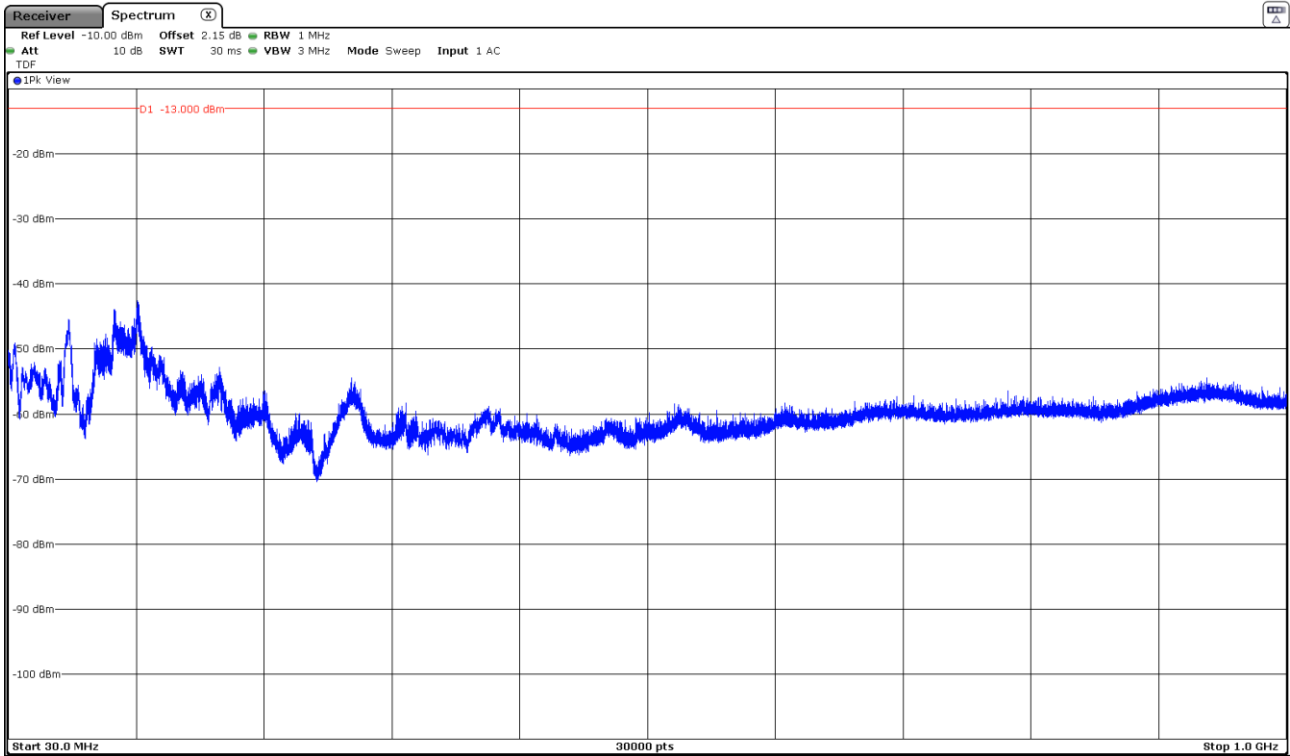
Spurious Frequency (GHz)	E.I.R.P (dBm)	Polarization	Detector
3.523250	-31.99	H	Peak

Measurement uncertainty (dB): $<\pm 5.01$ for $f < 1$ GHz
 $<\pm 4.00$ for $f \geq 1$ GHz up to 3 GHz
 $<\pm 4.22$ for $f \geq 3$ GHz up to 18 GHz

Verdict: PASS

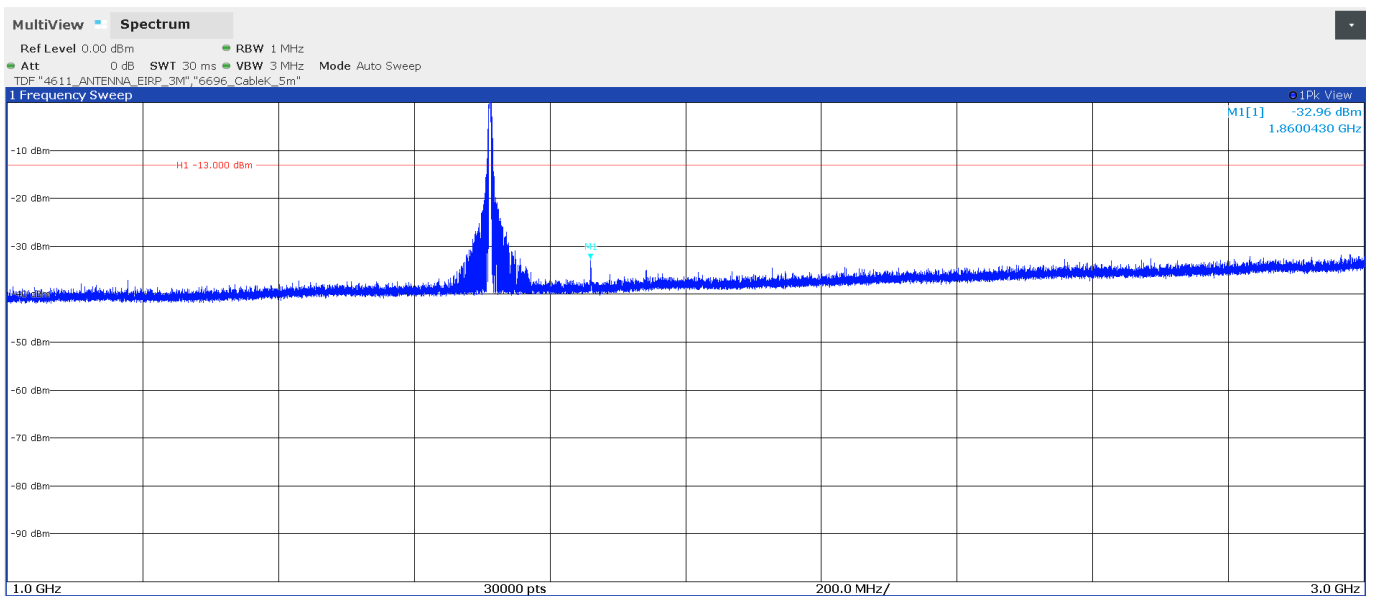
FREQUENCY RANGE 30 MHz – 1 GHz:

This plot is valid for the Low, Middle and High Channels:



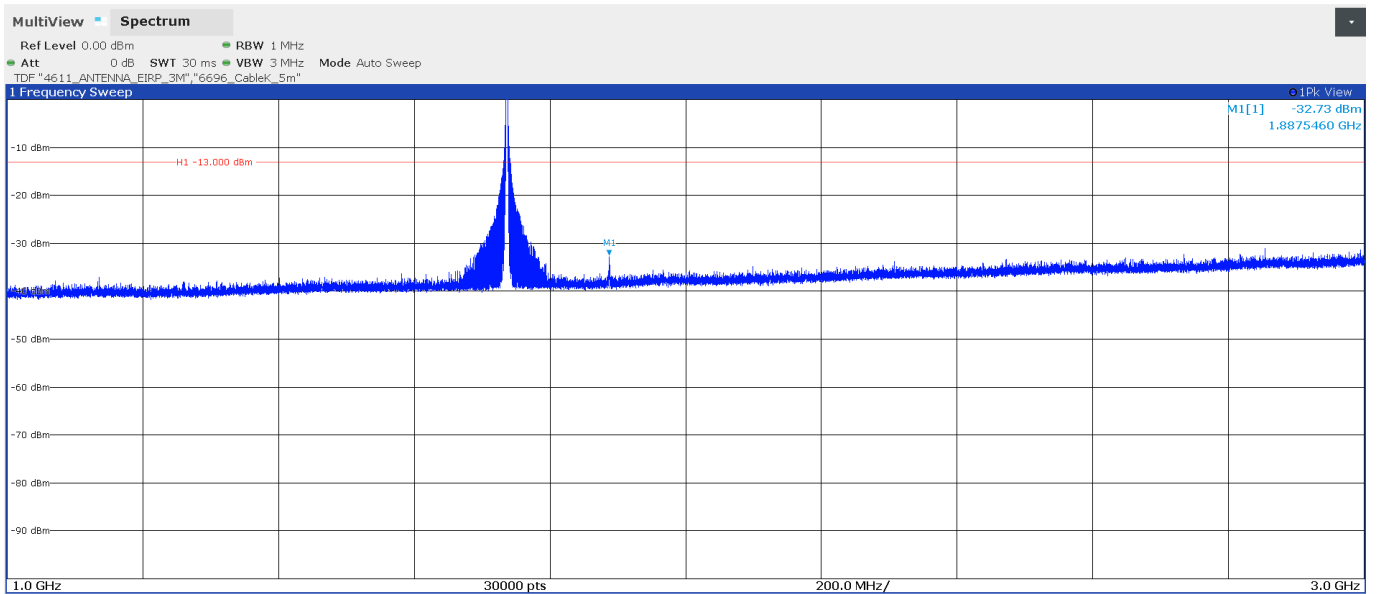
FREQUENCY RANGE 1 GHz – 3 GHz:

- Low Channel:



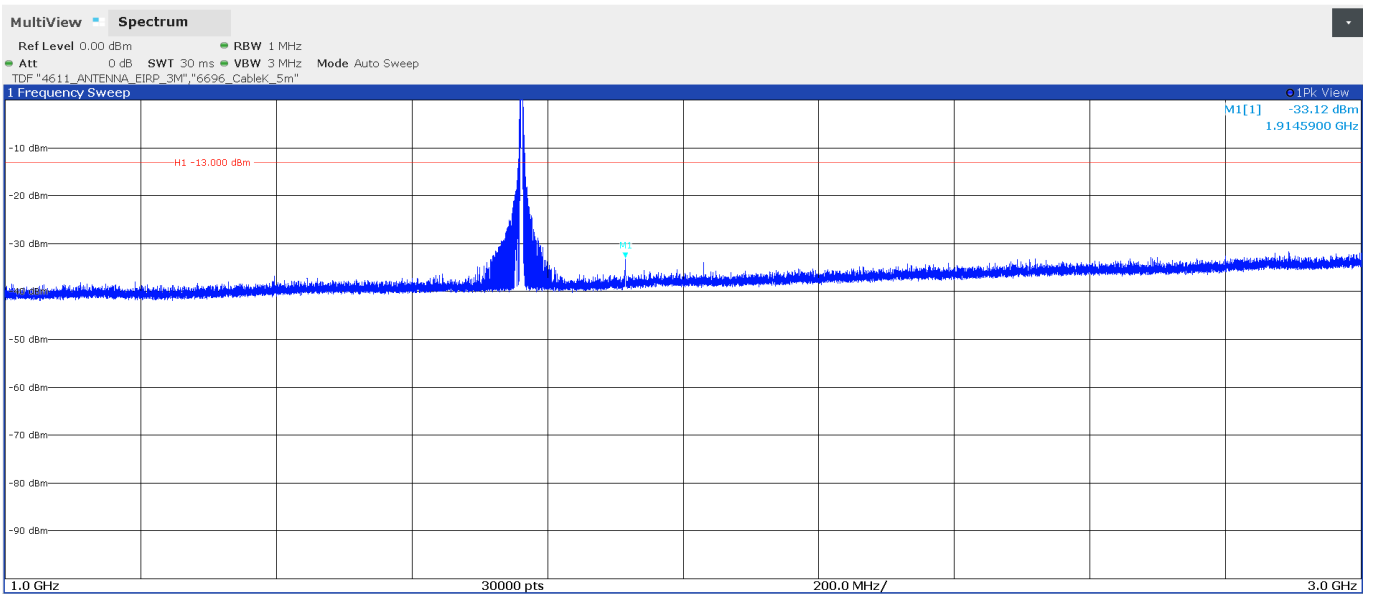
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

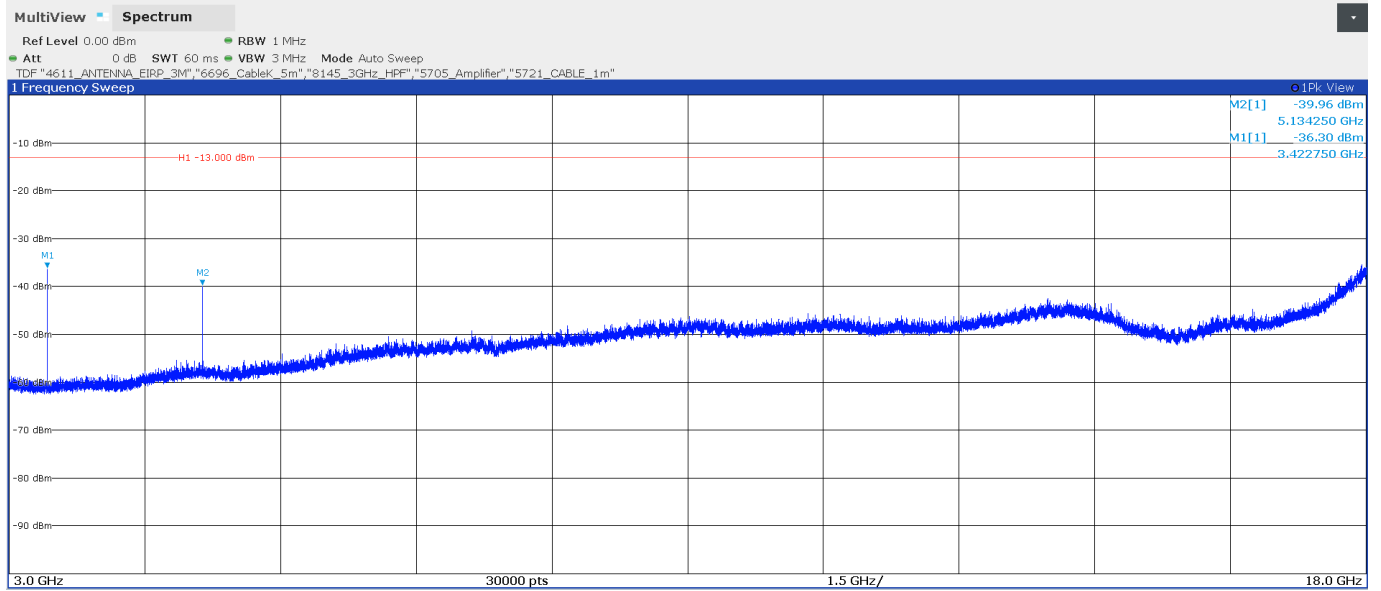
- High Channel:



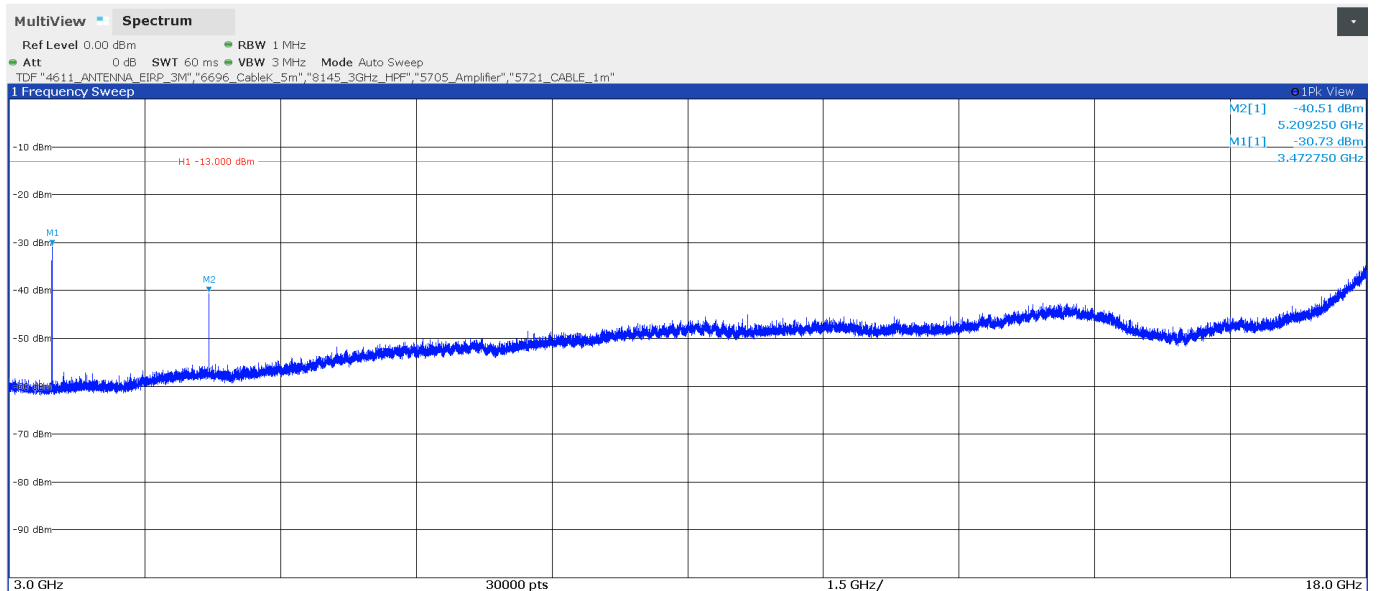
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz –18 GHz:

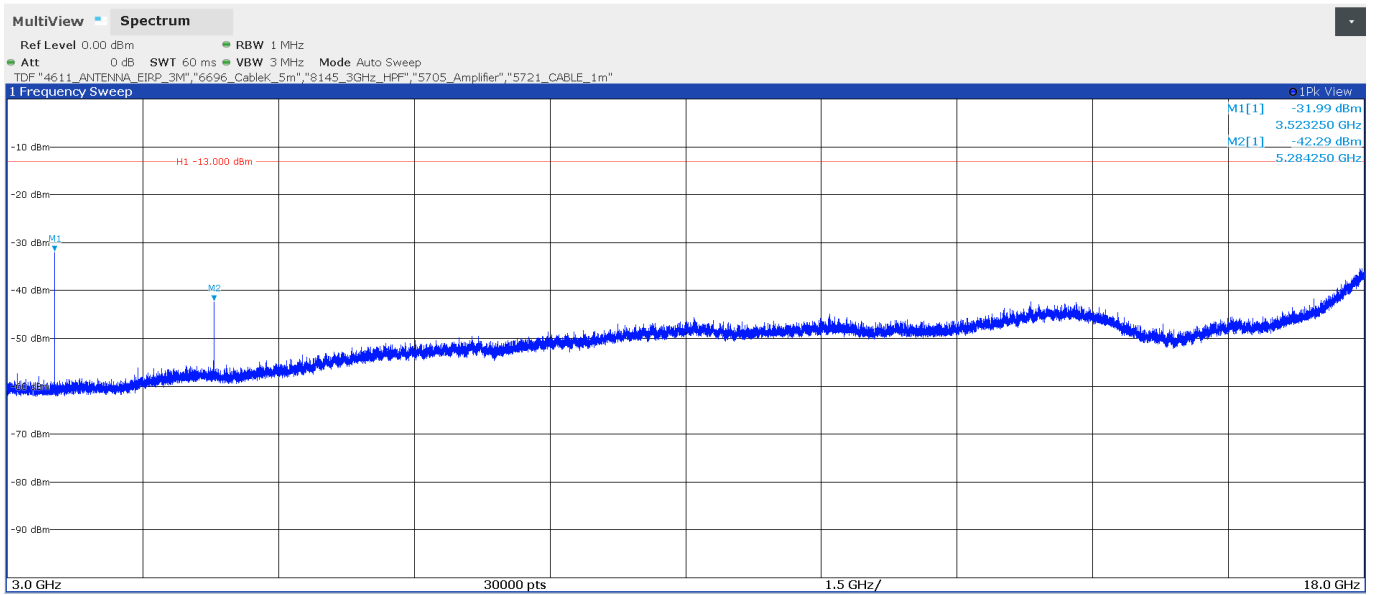
- Low Channel:



- Middle Channel:



- High Channel:



Appendix D: Test results for FCC Part 90

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TEST CONDITIONS

POWER SUPPLY (V):

Vn: 115 Vac / 60Hz (*)

Type of Power Supply: AC Voltage mains.

The subscript 'n' indicates nominal voltage test conditions.

(*): Preliminary RSE scan determined 115Vac / 60Hz as worst case of power supply.

ANTENNA:

Band	Gain (dBi)	Antenna type
LTE Cat M1 Band 26	+2.2	Internal

TEST FREQUENCIES:

LTE Cat M1 Band 26 (814 – 824 MHz): QPSK and 16-QAM modulations.

	Channel per Nominal Bandwidth (Frequency)				
	BW = 1.4 MHz	BW = 3 MHz	BW = 5 MHz	BW = 10 MHz	BW = 15 MHz
Low	26697 (814.7 MHz)	26705 (815.5 MHz)	26715 (816.5 MHz)	26740 (819 MHz)	N/A
Middle	26740 (819 MHz)	26740 (819 MHz)	26740 (819 MHz)		N/A
High	26783 (823.3 MHz)	26775 (822.5 MHz)	26765 (821.5 MHz)		N/A

Radiated emissions

SPECIFICATION:

FCC §90.691:

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

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 highest frequency generated within the equipment.

The EUT was placed on a non-conductive stand at a 3-meter distance from the measuring antenna for measurements from 30 MHz up to 8.5 GHz.

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.

The maximum field strength (dB μ V/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:

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

Where D is the measurement distance (in the far field region) in m. D = 3 m.

Measurement Limit:

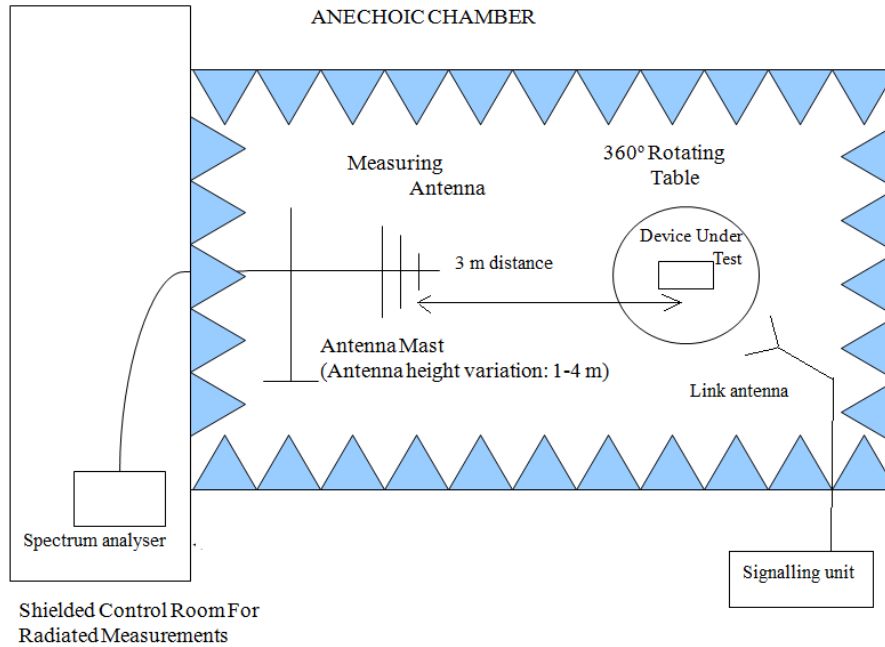
At P_o transmitting power, the specified minimum attenuation becomes $43+10 \log(P_o)$, and the level in dBm relative to P_o becomes:

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

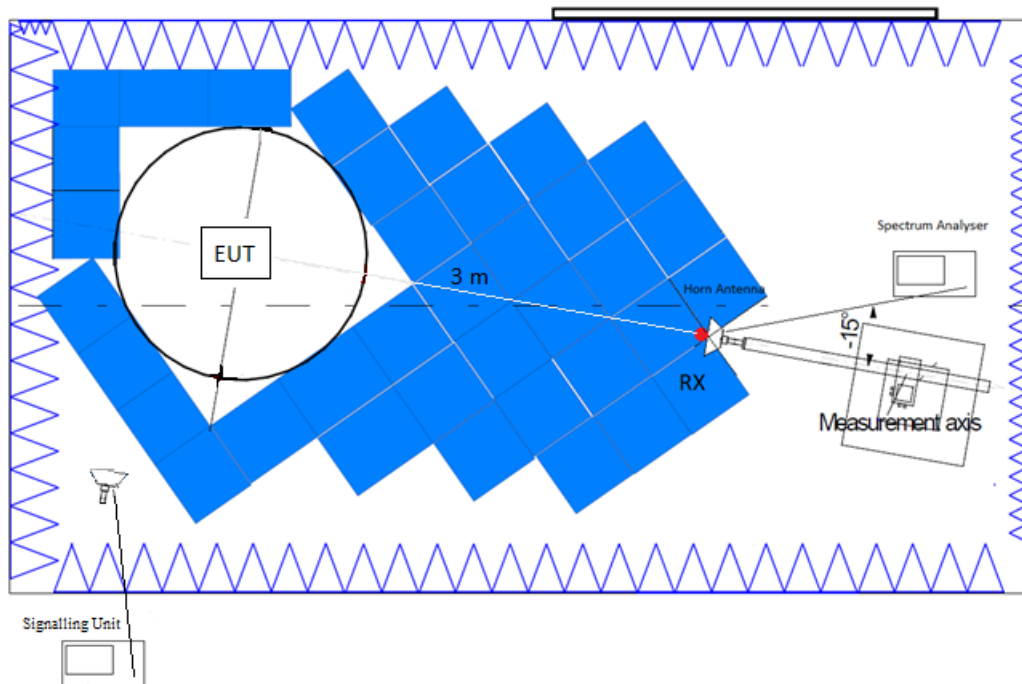
A resolution bandwidth / video bandwidth of 1 MHz / 3 MHz was used.

TEST SETUP:

Radiated measurements setup below 1 GHz.



Radiated measurements setup above 1 GHz up to 8.5 GHz.



RESULTS:

LTE Cat M1 Band 26:

QPSK and 16-QAM modulations:

A preliminary scan determined the 16-QAM modulation, BW = 3 MHz, RB Size 6, Offset 0, Narrow band = 0 as the worst case.

The next results are for this worst-case configuration (plots in next pages).

- **Low Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 8.5 GHz

No spurious frequencies at less than 20 dB below the limit.

- **Middle Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 8.5 GHz

No spurious frequencies at less than 20 dB below the limit.

- **High Channel:**

Frequency range 30 MHz – 1 GHz

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 GHz – 8.5 GHz

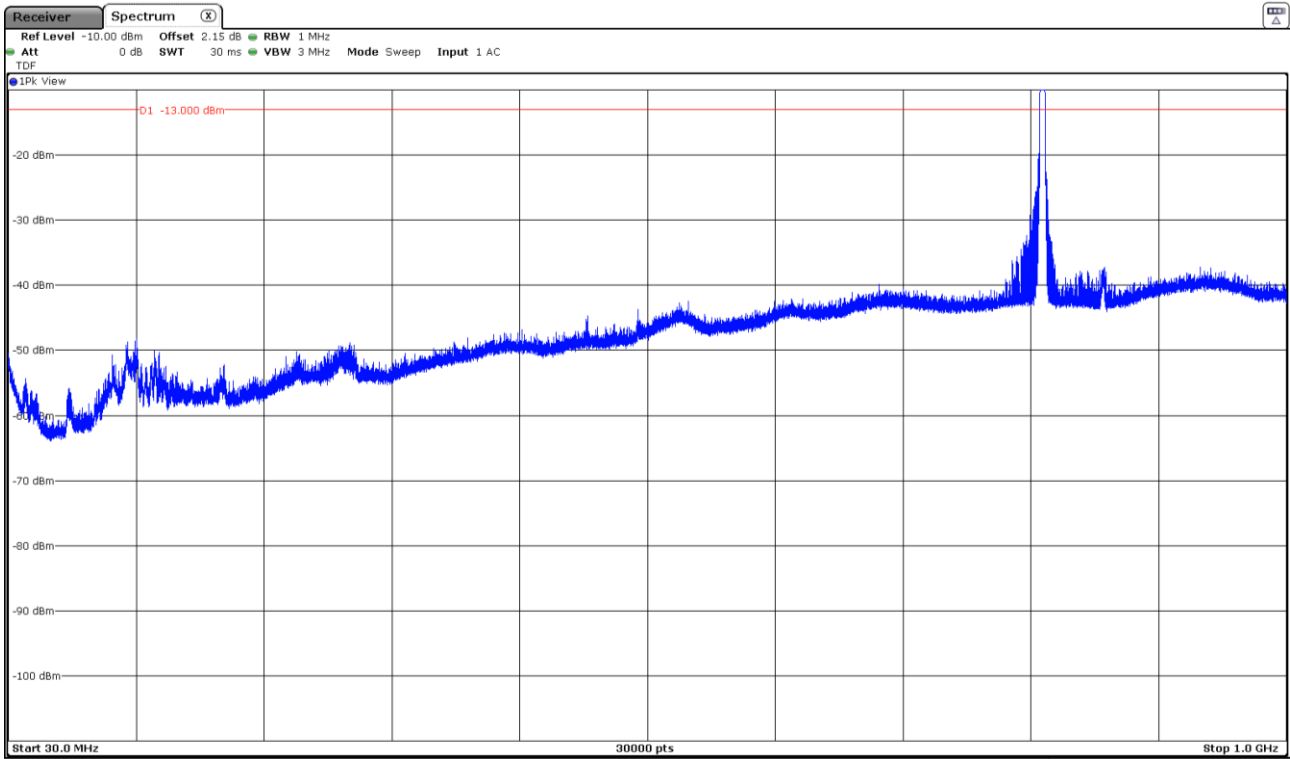
No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB): $< \pm 4.68$ for $f < 1$ GHz
 $< \pm 4.22$ for $f \geq 1$ GHz up to 8.5 GHz

Verdict: PASS

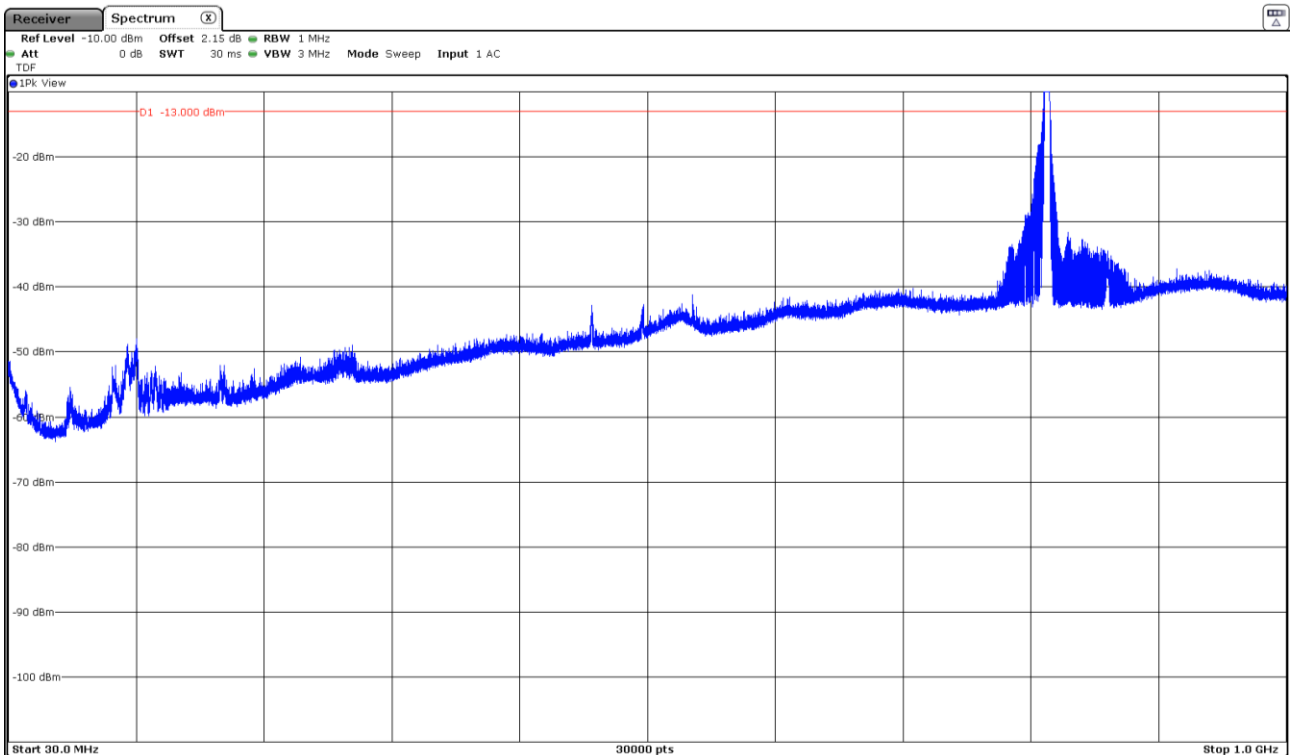
FREQUENCY RANGE 30 MHz – 1 GHz:

- Low Channel:



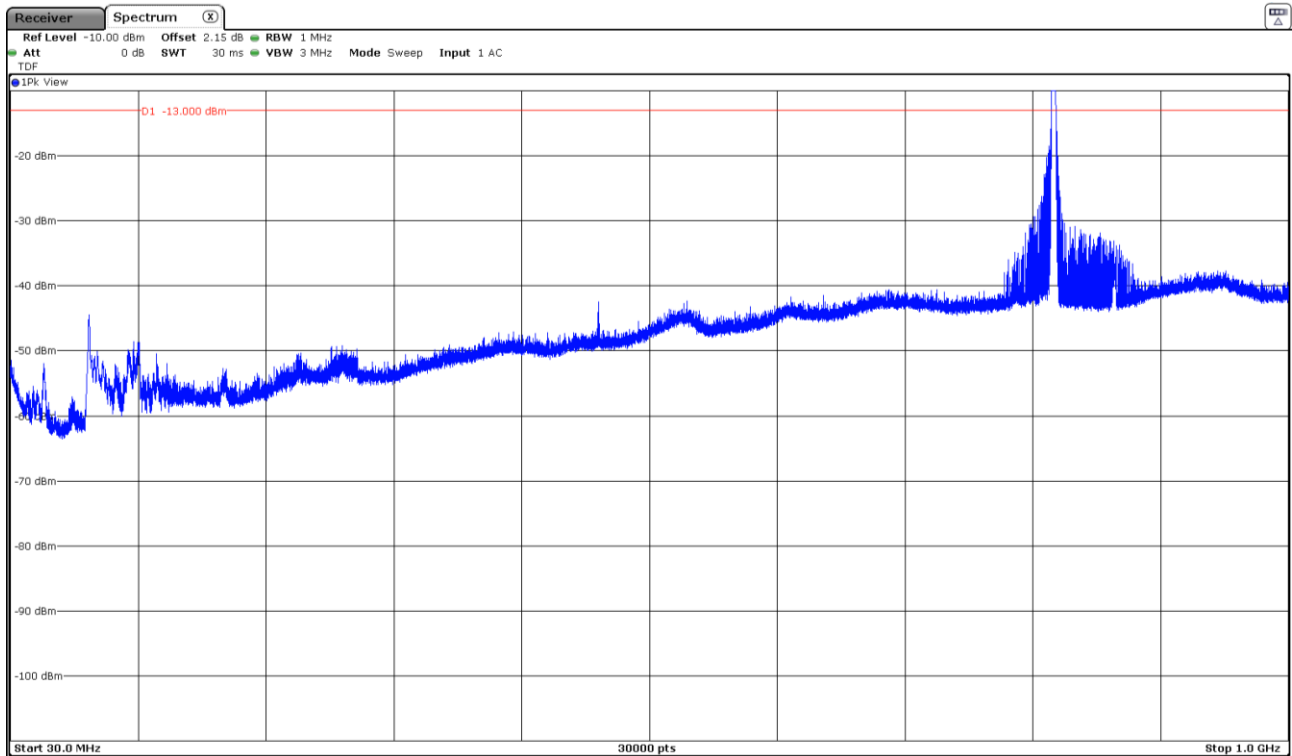
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

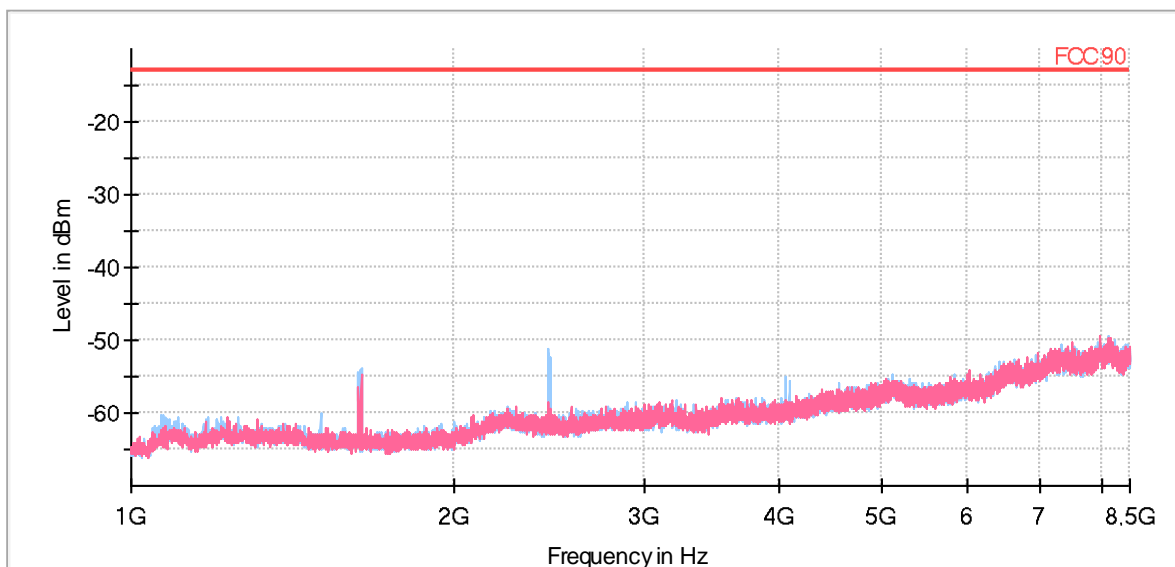
- High Channel:



The peak above the limit is the carrier frequency.

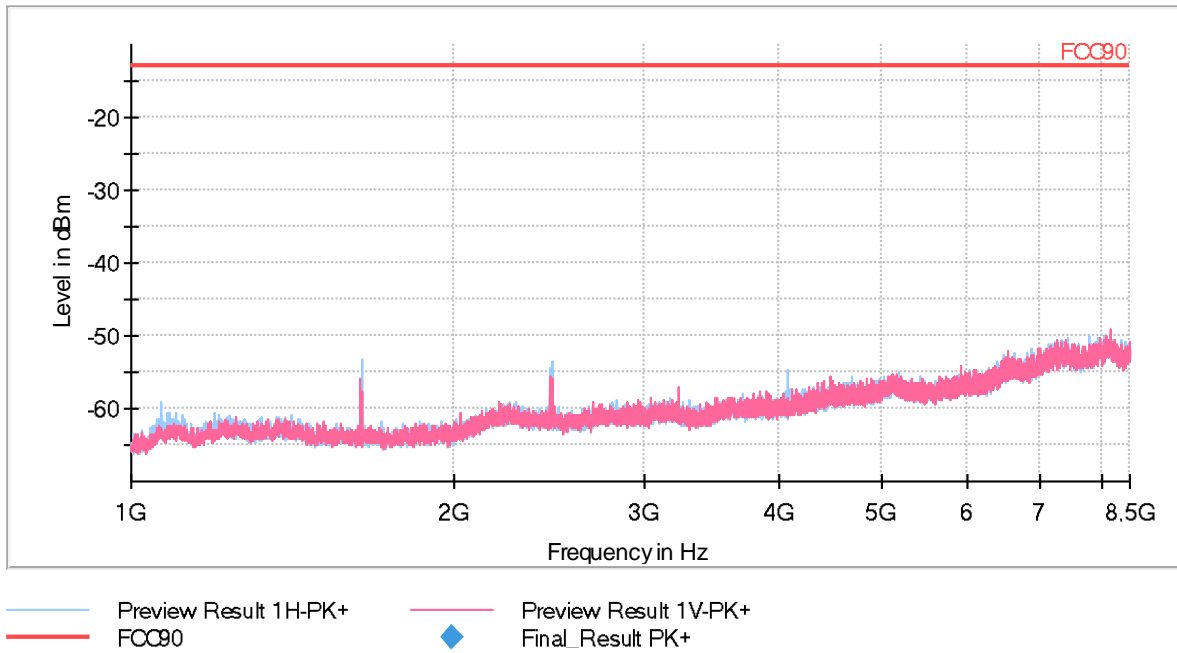
FREQUENCY RANGE 1 GHz – 8.5 GHz:

- Low Channel:



— Preview Result 1H-PK+ — Preview Result 1V-PK+
— FCC90 ◆ Final Result PK+

- Middle Channel:



- High Channel:

