DEKRA Testing and Certification, S.A.U.
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c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29 507 456

ISED CABid: ES1909

Test report No:
NIE: 68561RRF.001

Partial Test Report
Reference Standard:
USA FCC Part 22, Part 24, Part 27
CANADA IC RSS-130 RSS-132, RSS-133, RSS-139, RSS-Gen

(*) Identification of item tested	3G/LTE Wireless Module
(*) Trademark	Telit
(*) Model and /or type reference	LE910-NA V2
(*) Derived model not tested	LE910-NA1, LE910B4-NA, LE910B1-NA
Other identification of the product	FCC ID: RI7LE910NAV2 IC: 5131A-LE910NAV2 HW version: 1.0 SW version: 20.00.508
(*) Features	WCDMA/HSPA/LTE
Applicant	Telit Communications S.p.A. Via Stazione di Prosecco 5/B 34010 Sgonico - Trieste, Italy
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. CANADA IC RSS-130 Issue 2, Feb 2019. CANADA IC RSS-132 Issue 3, Jan. 2013. CANADA IC RSS-133 Issue 6 Amendment 1, Jan. 2018. CANADA IC RSS-139 Issue 3, Jul. 2015. CANADA IC RSS-Gen Issue 5 (Amendment 1 (March 2019), Amendment 2 (February 2021)). ANSI C63.26-2015: American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services. KDB 971168 D01 Power Meas License Digital Systems v03r01, April. 2018
Approved by (name / position & signature)	Jose Carlos Luque RF Lab. Supervisor Firmado digitalmente por 74841983Y JOSE CARLOS LUQUE (C:A29507456) Fecha: 2021.12.23 14:29:45 +01'00'
Date of issue	2021-12-23
Report template No	FDT08_23 (*) "Data provided by the client"

Index

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 tests in this report.

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

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

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

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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Uncertainty

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

Data provided by the client

The following data has been provided by the client:
1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested"
2. The sample consists of a solder down radio module to provide connectivity to host devices through WCDMA/HSPA/LTE networks
3. Derived model not tested. These models have been declared by the supplier of the sample as being the same as the model under test.

The software version of the derived model are:

LE910-NA1	20.00.528
LE910B4-NA	20.00.538
LE910B1-NA	20.00.548

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
68561/001	Module	LE910NA-V2	358148069917487	2021/06/29

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
68561/002	Antenna LTE	--	--	2021/06/29
68561/005	Antenna LTE	--	--	2021/06/29
53445B/017	Test board	--	113990005439	2017/06/28

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

Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
68561/004	Module (20.00.507 – 02/08/2021)	LE910NA-V2	358148069917479	2021/06/29

Auxiliary elements used with the Sample S/02:

Control Nº	Description	Model	Serial Nº	Date of reception
53445B/017	Test board	--	113990005439	2017/06/28

Sample S/02 has undergone the following test(s): The Conducted tests indicated in the Appendixes A, B & C.

Test sample description

Ports…… :	Port name and description	Cable				
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)	
			☐	☐	☐	
Supplementary information to the ports…… :						
Rated power supply .....:	Voltage and Frequency		Reference poles			
			L1	L2	L3	N	PE
	☐		☐	☐	☐	☐	☐
Rated Power .....:	3.4 VDC to 4.2 VDC (Nominal: 3.8 VDC)					
Clock frequencies.....:	32kHz XTAL, 26MHz VTCXO					
Other parameters .....:	PCB Flammability V-1, 105°C, UL94, UL796					
Software version .....:	20.00.xx8					
Hardware version .....:	1.0					
Dimensions in cm (W x H x D) ....:	28.2 x 28.2 x 2.2 mm					
Mounting position .....:	☒	Other: solder down				
Modules/parts.....:	Module/parts of test item		Type		Manufacturer	
Accessories (not part of the test item) .....:	Description		Type		Manufacturer	
	Evaluation Board Kit				Telit	
	Antenna		T-AT305, L/4		ATEL-CAB	
Documents as provided by the applicant.....:	Description		File name		Issue date	

(3) Only for Medical Equipment

Identification of the client

Telit Communications S.p.A.

Via Stazione di Prosecco 5/B
34010 Sgonico - Trieste, Italy

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-08-13
Date (finish)	2021-10-28

Document history

Report number	Date	Description
68561RRF.001	2021-12-23	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative huMiddleity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative huMiddleity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative huMiddleity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Cristina Calle, José Manuel Jiménez and Javier Miguel Nadales.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N/A	N/A
2.	Wideband radio communication tester ROHDE AND SCHWARZ CMW500	2021/07	2022/07
3.	Climatic chamber BINDER MK 56	2021/03	2022/03
4.	DC Power supply 30V/5A KEYSIGHT TECHNOLOGIES U8002A	N/A	N/A
5.	Digital Multimeter FLUKE 175	2020/11	2021/11

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N/A	N/A
2.	Shielded Room ETS LINDGREN S101	N/A	N/A
3.	Wideband radio communication tester ROHDE AND SCHWARZ CMW500	2021/07	2022/07
4.	Hybrid Bilog Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2020/10	2023/10
5.	RF Pre-amplifier G>40dB 10MHz-6GHz BONN ELEKTRONIK BLNA 0160-01N	2021/03	2022/03
6.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2019/10	2021/10
7.	Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2020/08	2023/08
8.	RF Pre-amplifier, G>30 dB 1-18 GHz BONN ELEKTRONIK BLMA 0118-3A	2020/10	2021/10
9.	Signal and spectrum analyzer 10Hz-40GHz Rhode and Schwarz FSV40	2019/10	2021/10
10.	Horn antenna 18 - 40 GHz SCHWARZBECK BBHA 9170	2020/05	2023/05
11.	RF Pre-amplifier G>30dB 18-40 GHz BONN ELEKTRONIK BLMA 1840-3G	2019/11	2021/11
12.	DC Power supply 30V/5A KEYSIGHT TECHNOLOGIES U8002A	N/A	N/A
13.	Digital Multimeter FLUKE 175	2020/11	2021/11

Testing verdicts

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

Summary

FCC PART 22 / IC RSS-132 PARAGRAPH Requirement – Test case	Verdict	Remark
Clause 22.913/RSS-132 Clause 5.4: RF output power	N/M	(1)
Clause 2.1047/RSS-132 Clause 5.2: Modulation characteristics	N/M	(1)
Clause 22.355/RSS-132 Clause 5.3: Frequency stability	P	
Clause 2.1049: Occupied Bandwidth	N/M	(1)
Clause 22.917/RSS-132 Clause 5.5: Spurious emissions at antenna terminals	N/M	(1)
Clause 22.917/RSS-132 Clause 5.5: Radiated emissions	P	
Supplementary information and remarks: (1) Test not requested.		

FCC PART 24 / IC RSS-133 PARAGRAPH Requirement – Test case	Verdict	Remark
Clause 22.913/RSS-132 Clause 5.4: RF output power	N/M	(1)
Clause 2.1047/RSS-132 Clause 5.2: Modulation characteristics	N/M	(1)
Clause 22.355/RSS-132 Clause 5.3: Frequency stability	P	
Clause 2.1049: Occupied Bandwidth	N/M	(1)
Clause 22.917/RSS-132 Clause 5.5: Spurious emissions at antenna terminals	N/M	(1)
Clause 22.917/RSS-132 Clause 5.5: Radiated emissions	P	
Supplementary information and remarks: (1) Test not requested.		

FCC PART 27 / IC RSS-130, IC RSS-139 PARAGRAPH Requirement – Test case	Verdict	Remark
Clause 22.913/RSS-132 Clause 5.4: RF output power	N/M	(1)
Clause 2.1047/RSS-132 Clause 5.2: Modulation characteristics	N/M	(1)
Clause 22.355/RSS-132 Clause 5.3: Frequency stability	P	
Clause 2.1049: Occupied Bandwidth	N/M	(1)
Clause 22.917/RSS-132 Clause 5.5: Spurious emissions at antenna terminals	N/M	(1)
Clause 22.917/RSS-132 Clause 5.5: Radiated emissions	P	
Supplementary information and remarks: (1) Test not requested.		

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

INDEX

TEST CONDITIONS

Vnominal = 3.8 Vdc

Type of power supply = DC Voltage from external power supply

Type of antenna = External antenna.

Declared Gain for antenna = +2.14 dBi.

TEST FREQUENCIES:

3G - WCDMA and HSUPA modulations. (Band V)

Channel (Frequency MHz)		
Lowest	Middle	Highest
4132 (826.4)	4182 (836.4)	4233 (846.6)

LTE Band 5 (824-849 MHz). QPSK and 16QAM modulations:

	Channel (Frequency)			
	BW = 1.4 MHz	BW = 3 MHz	BW=5 MHz	**BW=10 MHz**
Low	20407 (824.70 MHz)	20415 (825.50 MHz)	20425 (826.50 MHz)	20450 (829.00 MHz)
Middle	20525 (836.50 MHz)	20525 (836.50 MHz)	20525 (836.50 MHz)	**20525 (836.50 MHz)**
High	20643 (848.30 MHz)	20635 (847.50 MHz)	20625 (846.50 MHz)	20600 (844.00 MHz)

Frequency Stability

SPECIFICATION:

FCC §2.1055 and §22.355. ±2.5 ppm for mobile stations operating in the range 821 to 896 MHz.

RSS-132. Clause 5.3. The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

METHOD:

The frequency tolerance measurements over temperature variations were made over the temperature range of –30ºC to +50ºC. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10ºC steps from –30ºC up to +50ºC.
The supply voltage was varied between 85% and 115% of nominal voltage.

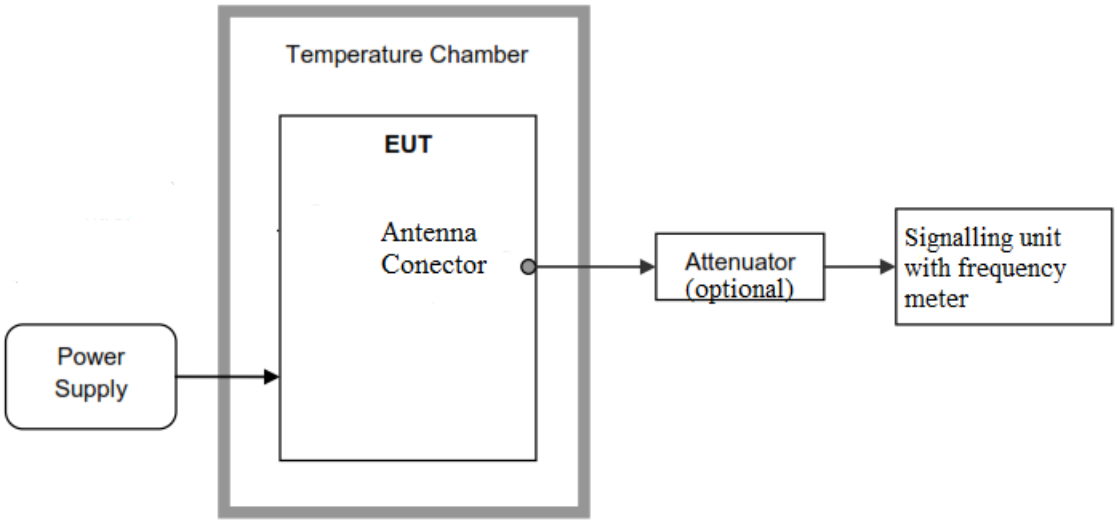
The EUT was set in “Radio Resource Control (RRC) mode” in the Middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.

In order to check that the frequency stability is sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point is established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation are identified as fL and fH respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of fL and fH to check that the resulting frequencies remain within the band.

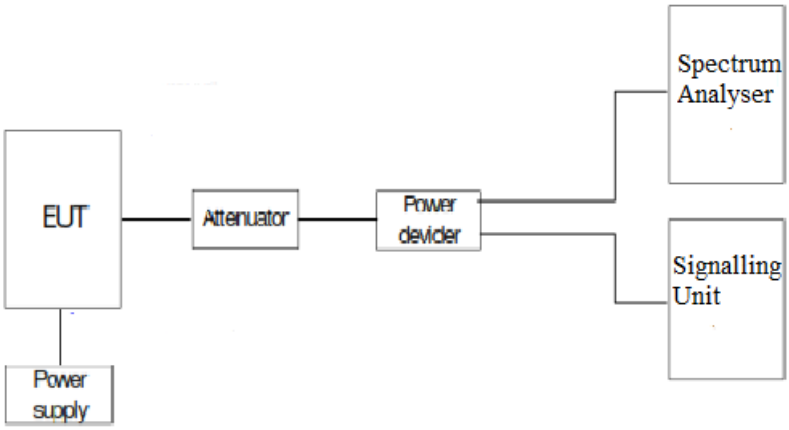
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP:

1. Frequency Tolerance:



2. Reference Frequency Points fL and fH:



RESULTS:

Frequency stability over temperature variations.

3G - 850 MHz (Band V). WCDMA and HSUPA MODULATIONS. (WCDMA)

Nominal Frequency: 836.6 MHz

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-2.08	-0.0025
+40	-2.17	-0.0026
+30	2.10	0.0025
+20	-2.01	-0.0024
+10	0.11	0.0001
0	-2.75	-0.0033
-10	1.11	0.0013
-20	1.09	0.0013
-30	-3.74	-0.0045

Frequency stability over voltage variations.

3G - 850 MHz (Band V). WCDMA and HSUPA MODULATIONS. (WCDMA)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	-3.90	-0.0047
Vmin	3.2	-2.10	-0.0025

Measurement uncertainty (Hz)	<±102

Verdict: PASS

LTE – Band 5. QPSK and 16QAM MODULATIONS. (QPSK BW=10MHz)

Nominal Frequency: 836.5 MHz

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-0.79	-0.000944411
+40	1.62	0.001936641
+30	-2.07	-0.002474597
+20	-1.82	-0.002175732
+10	-2.55	-0.003048416
0	0.66	0.000789002
-10	-2.02	-0.002414824
-20	4.36	0.005212194
-30	2.86	0.003419008

Frequency stability over voltage variations.

LTE – Band 5. QPSK and 16QAM MODULATIONS. (QPSK BW=10MHz)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	-4.48	-0.005355649
Vmin	3.2	-1.59	-0.001900777

Measurement uncertainty (Hz)	<±102

Verdict: PASS

Radiated emissions

SPECIFICATION

FCC § 22.917

RSS-132. Clause 5.5.

FCC §2.1051.

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 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum field strength (dBµV/m) is measured and recorded.

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

EIRP (dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m. D = 3 m

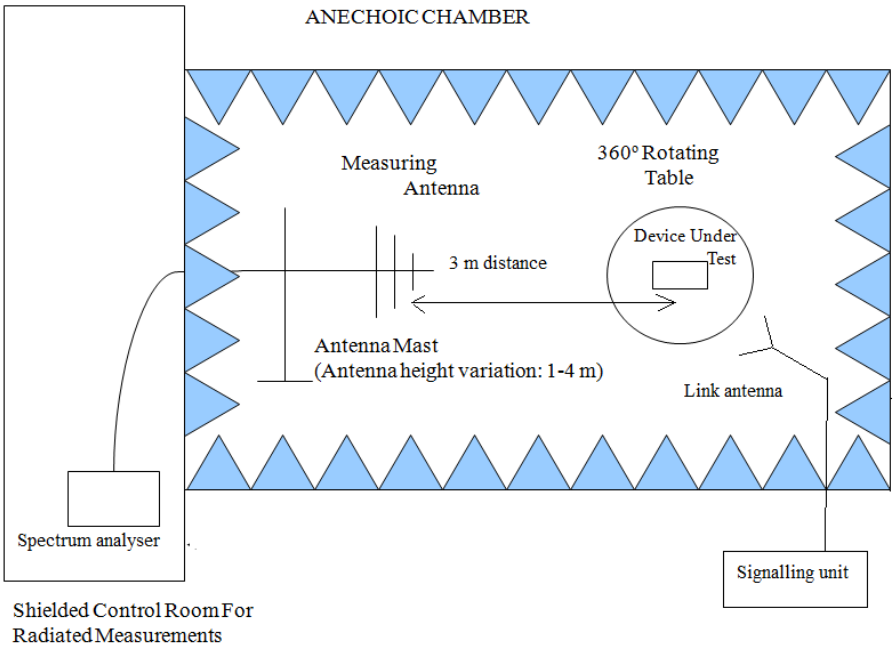
Measurement Limit:

According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. P in watts.
At Po transmitting power. the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative Po becomes:

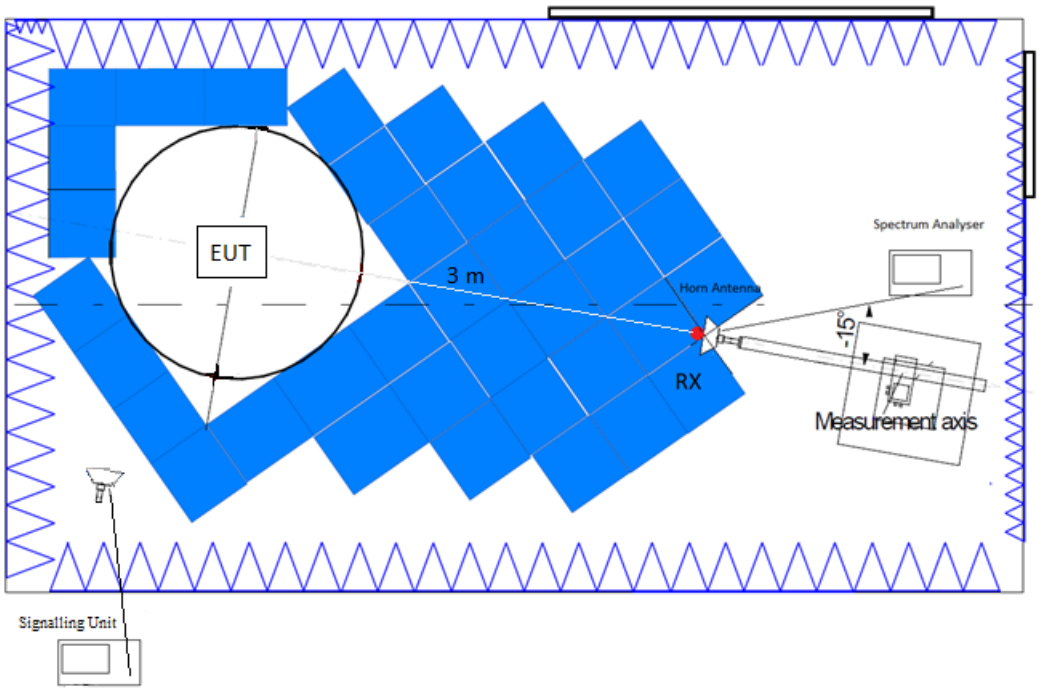
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = - 13 dBm

TEST SETUP

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



RESULTS

A preliminary study determined the 3G band as the worst case between 3G - Band V and LTE Band 5.

3G - WCDMA - 850 MHz (Band V):

WCDMA and HSUPA Modulations:
A preliminary scan determined the WCDMA modulation as the worst case. The following tables and plots show the results for the worst case modulation.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz

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

Frequency range 1 – 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 – 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 – 8.5 GHz

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

Measurement uncertainty (dB): <± 4.89 for f ≥ 30 MHz up to 1 GHz
<± 5.13 for f ≥ 1 GHz up to 8.5 GHz

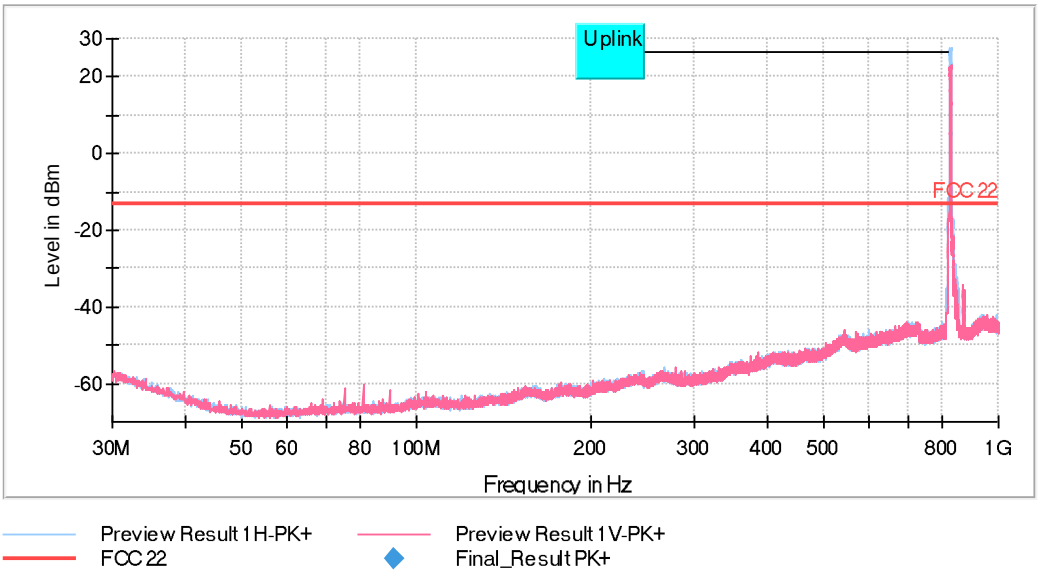
Verdict: PASS

3G - WCDMA - 850 MHz (Band V):

FREQUENCY RANGE 30 MHz - 1 GHz

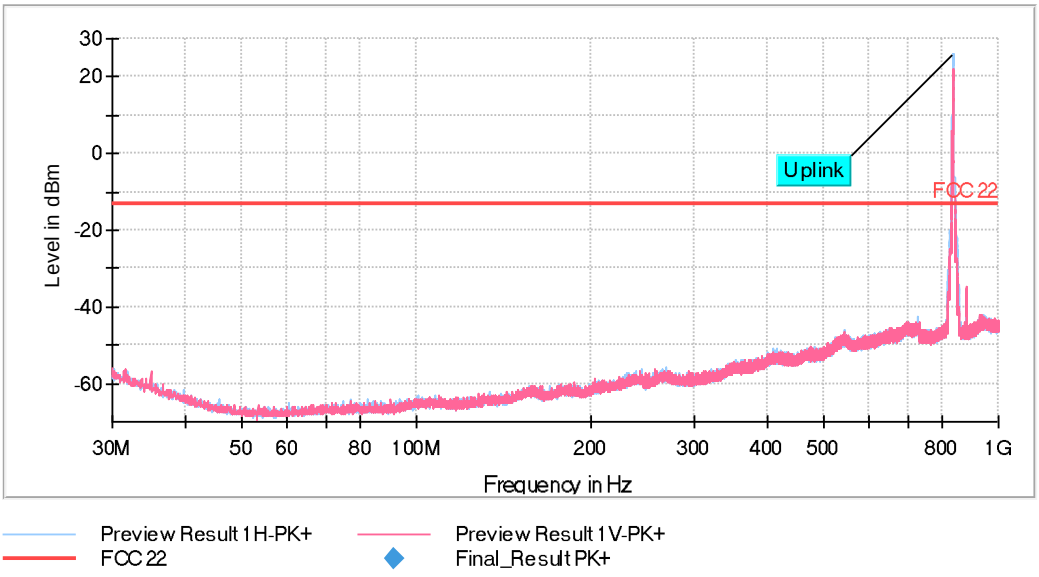
WCDMA MODULATION.

- Lowest Channel:



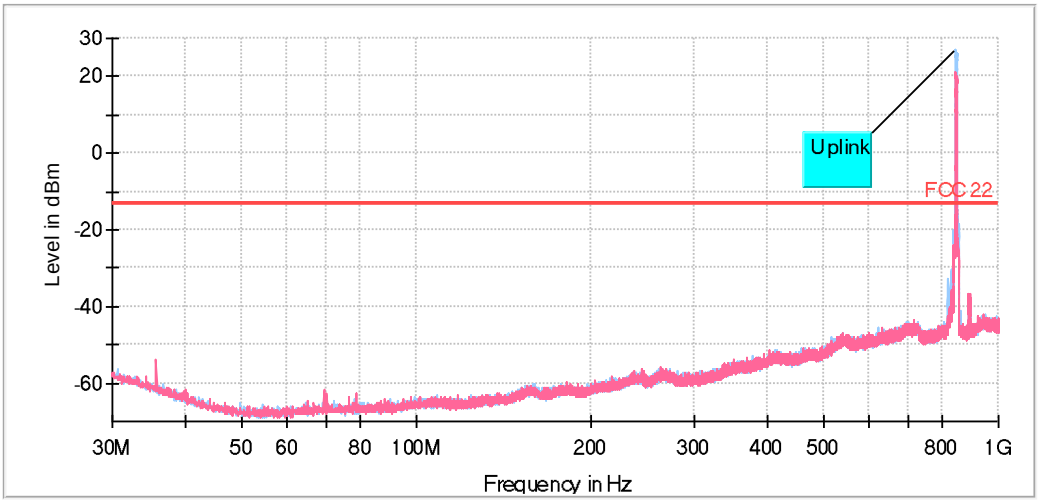
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

- Highest Channel:

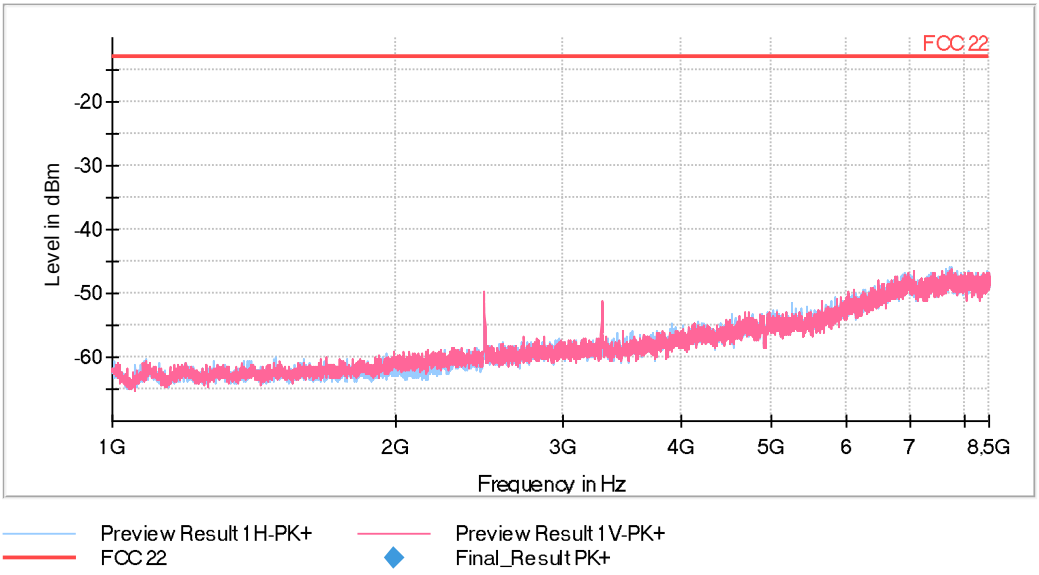


The peak above the limit is the carrier frequency.

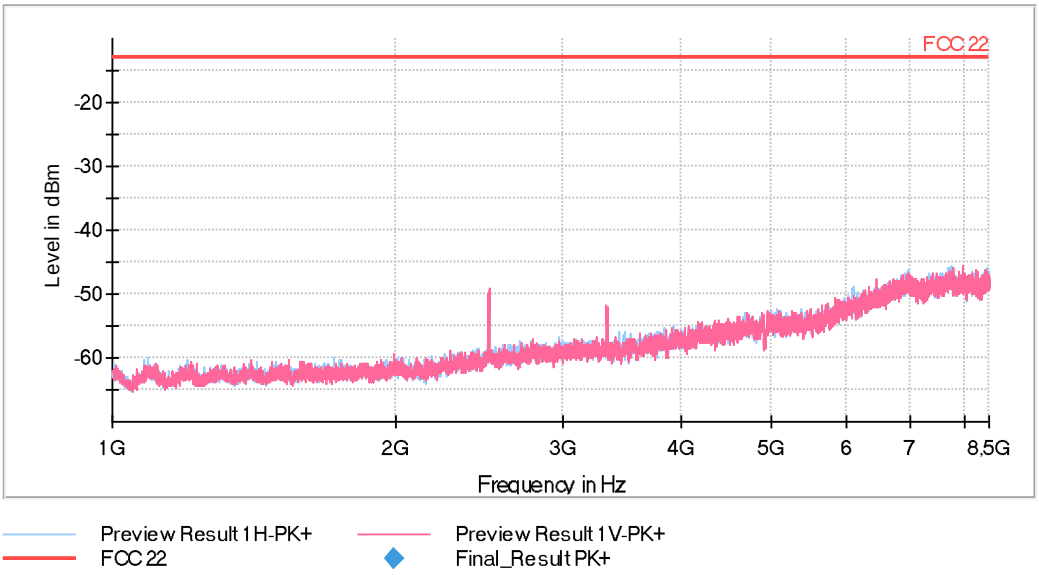
FREQUENCY RANGE 1 – 8.5 GHz

WCDMA MODULATION.

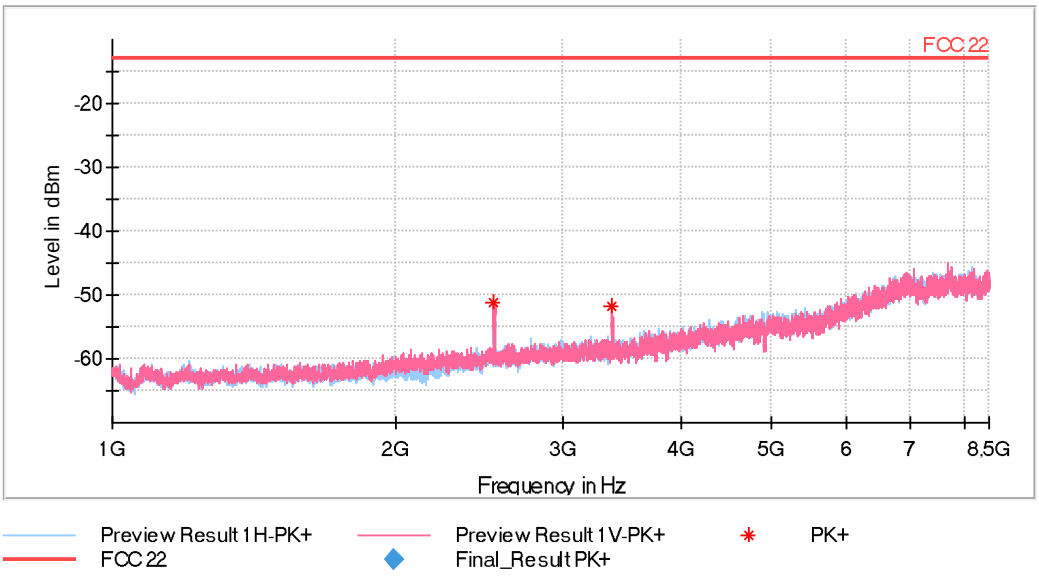
- Lowest Channel:



- Middle Channel:



- Highest Channel:



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

INDEX

TEST CONDITIONS

Vnominal = 3.8 Vdc

Type of power supply = DC Voltage from external power supply

Type of antenna = External antenna.

Declared Gain for antenna = +2.14 dBi.

TEST FREQUENCIES:

3G Band II. WCDMA and HSUPA modulations.

Channel (Frequency MHz)		
Lowest	Middle	Highest
9262 (1852.4)	9400 (1880)	9538 (1907.6)

LTE Band 2. QPSK and 16QAM modulations:

	Channel (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)

Frequency Stability

SPECIFICATION:

FCC §2.1055 and §24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-133. Clause 6.3. The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

METHOD:

The frequency tolerance measurements over temperature variations were made over the temperature range of –30ºC to +50ºC. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10ºC steps from –30ºC up to +50ºC.
The supply voltage was varied between 85% and 115% of nominal voltage.

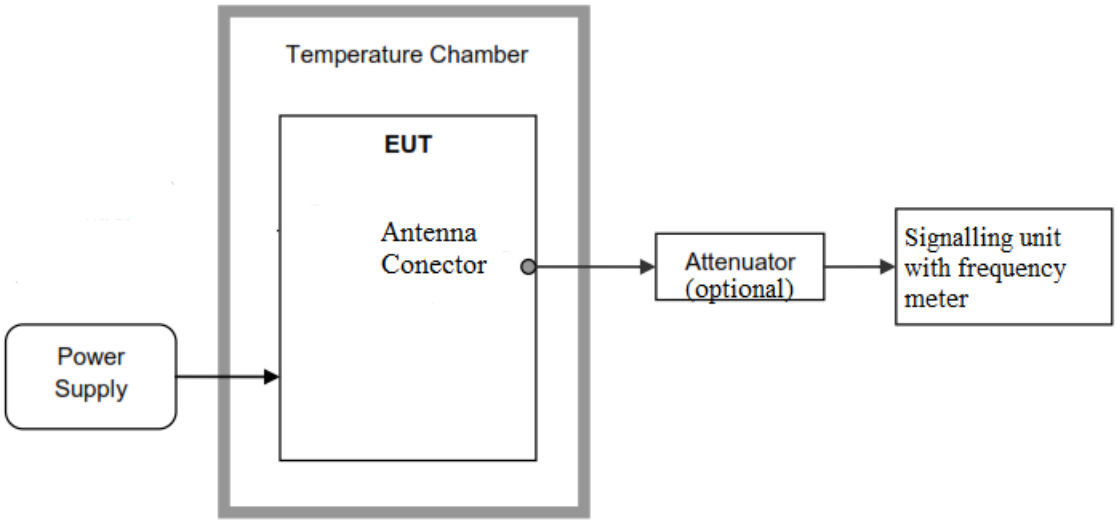
The EUT was set in “Radio Resource Control (RRC) mode” in the Middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.

In order to check that the frequency stability is sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point is established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation are identified as fL and fH respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of fL and fH to check that the resulting frequencies remain within the band.

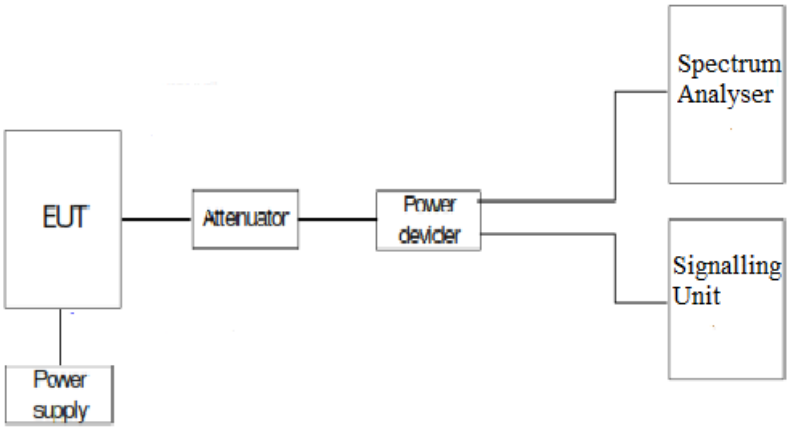
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP:

1. Frequency Tolerance:



3. Reference Frequency Points fL and fH:



RESULTS:

Frequency stability over temperature variations.

3G - 1900 MHz (Band II). WCDMA and HSUPA MODULATIONS. (WCDMA)

Nominal Frequency: 1880 MHz

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-2.90	-0.0015
+40	3.11	0.0017
+30	3.75	0.0020
+20	0.92	0.0005
+10	-1.34	-0.0007
0	-1.72	-0.0009
-10	-3.28	-0.0018
-20	-2.98	-0.0016
-30	-1.40	-0.0007

Frequency stability over voltage variations.

3G - 1900 MHz (Band II). WCDMA and HSUPA MODULATIONS. (WCDMA)

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	-4.31	-0.0023
Vmin	3.2	-0.16	-0.0001

Measurement uncertainty(Hz)	<±222

Verdict: PASS

LTE - Band 2. QPSK and 16QAM MODULATIONS. (QPSK BW=20MHz)

Nominal Frequency: 1880 MHz

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	1	0.000531915
+40	1.03	0.000547872
+30	1.19	0.000632979
+20	-4.78	-0.002542553
+10	-3.03	-0.001611702
0	1.7	0.000904255
-10	-1.85	-0.000984043
-20	3.5	0.001861702
-30	-1.17	-0.00062234

Frequency stability over voltage variations.

LTE - Band 2. QPSK and 16QAM MODULATIONS. (QPSK BW=20MHz)

Battery Supply voltage	**Voltage (V)**	**Frequency Error (Hz)**	**Frequency Error (ppm)**
Vmax	4.2	1.87	0.000994681
Vmin	3.2	-3.36	-0.001787234

Measurement uncertainty(Hz)	<±222

Verdict: PASS

Radiated emissions

SPECIFICATION

FCC § 24.238. RSS-133 Clause 6.5.

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

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 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum field strength (dBµV/m) is measured and recorded.

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

EIRP (dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m. D = 3 m

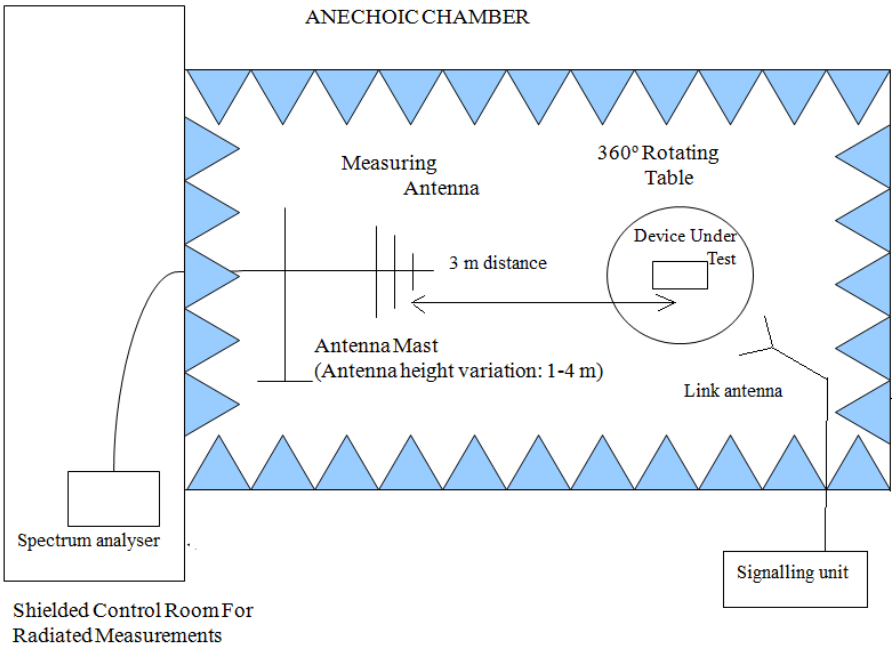
Measurement Limit:

According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. P in watts.
At Po transmitting power. the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative Po becomes:

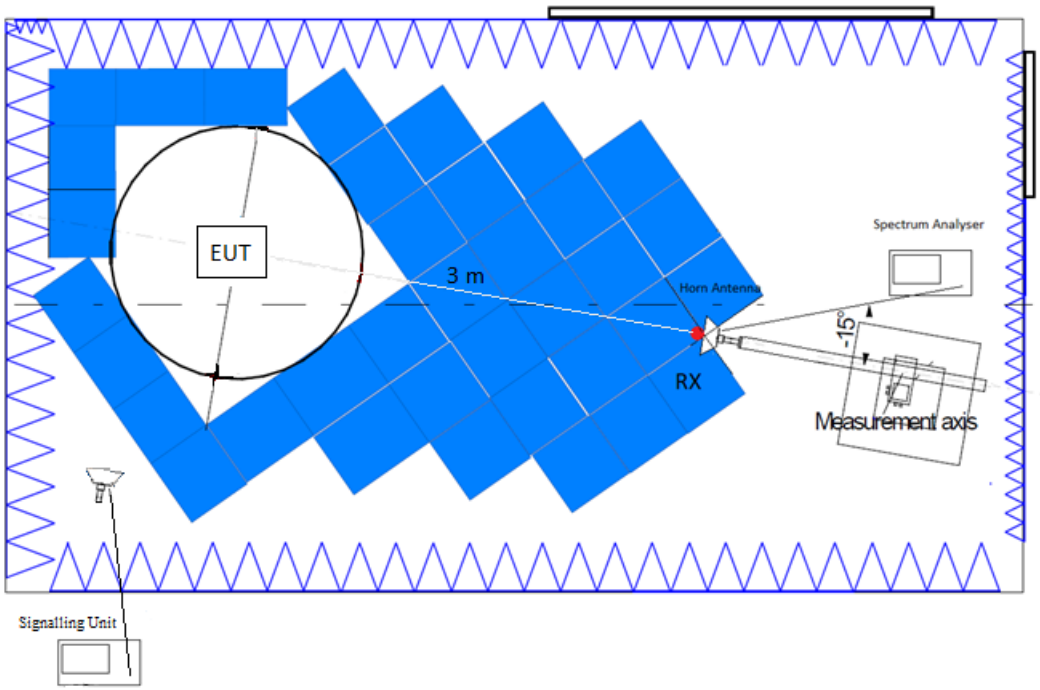
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = - 13 dBm

TEST SETUP

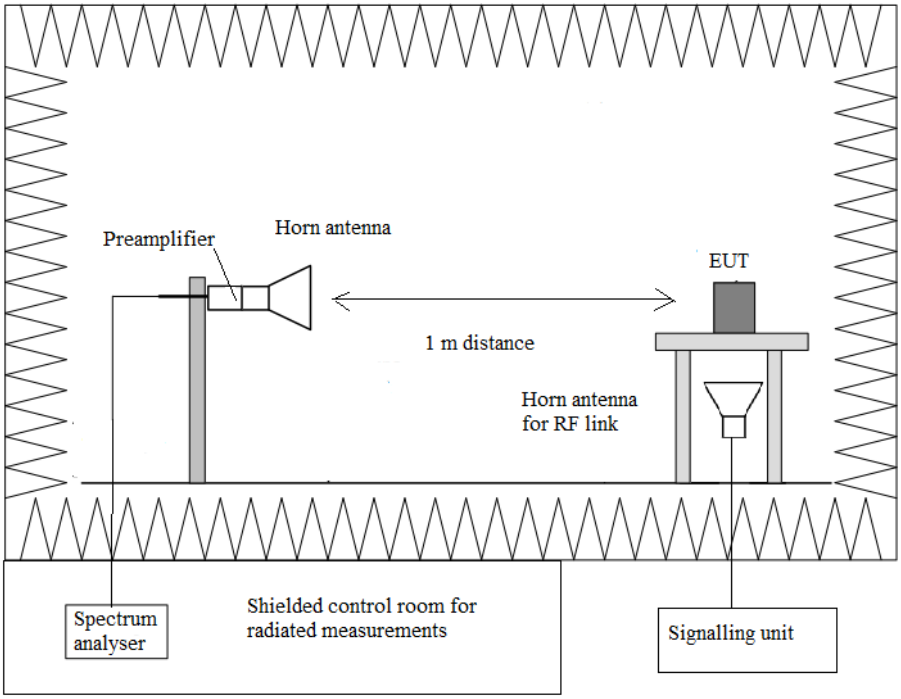
Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



Radiated measurements above 18 GHz.



RESULTS

A preliminary study determined the 3G band as the worst case between 3G - Band II and LTE Band 2.

3G - WCDMA - 1900 MHz (Band II):

WCDMA and HSUPA Modulations:
A preliminary scan determined the WCDMA modulation as the worst case. The following tables and plots show the results for the worst case modulation.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz

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

Frequency range 1 – 18 GHz

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

Frequency range 18 – 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 – 18 GHz

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

Frequency range 18 – 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 – 18 GHz

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

Frequency range 18 – 20 GHz

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

Measurement uncertainty (dB): <± 5.17 for f ≥ 30 MHz up to 1 GHz
<± 4.11 for f ≥ 1 GHz up to 3 GHz
<± 5.13 for f ≥ 3 GHz up to 18 GHz
<± 4.81 for f ≥ 18 GHz up to 20 GHz

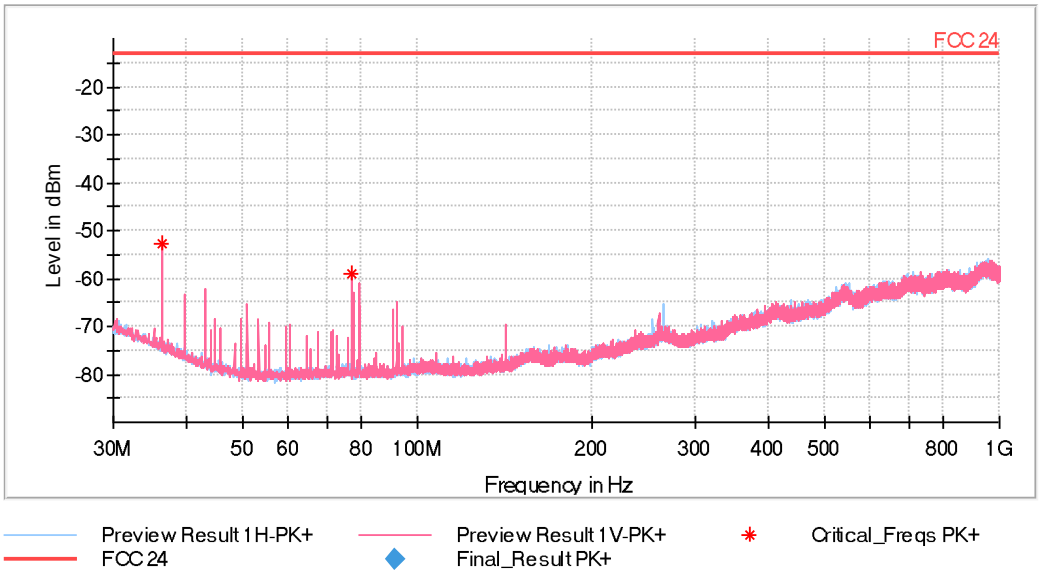
Verdict: PASS

3G - WCDMA - 1900 MHz (Band II):

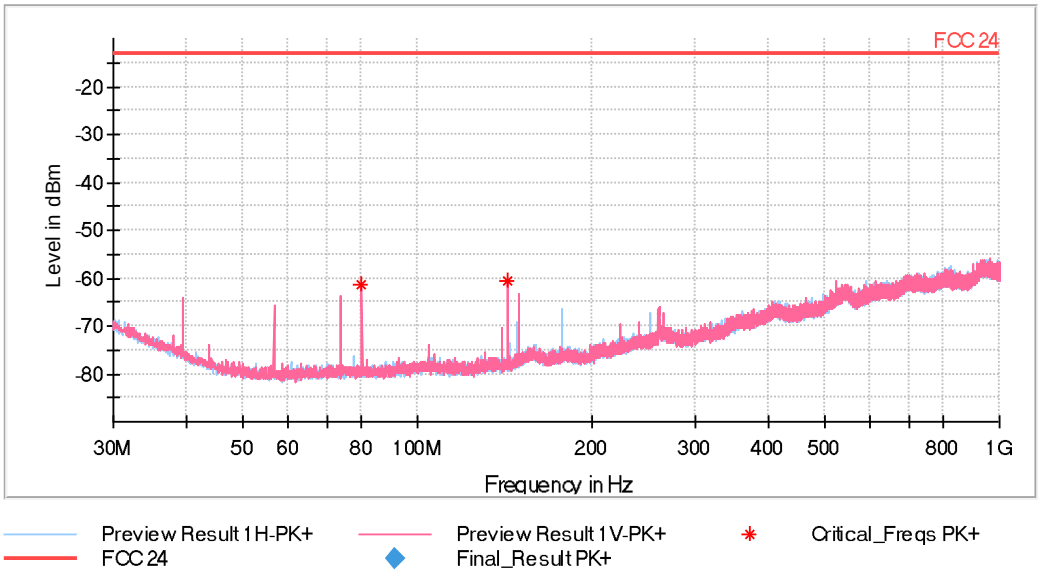
FREQUENCY RANGE 30 MHz - 1 GHz

WCDMA MODULATION.

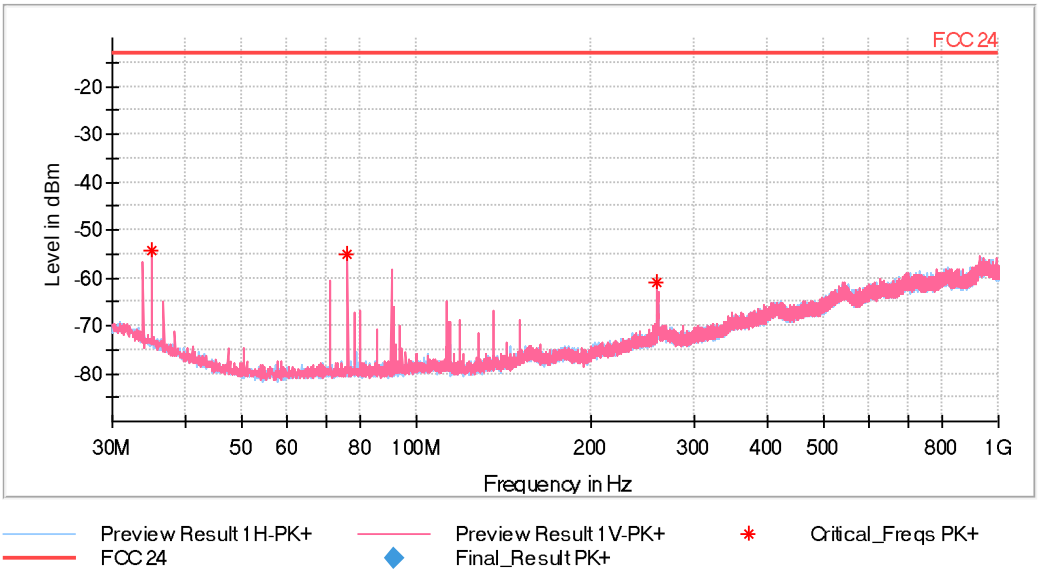
- Lowest Channel:



- Middle Channel:



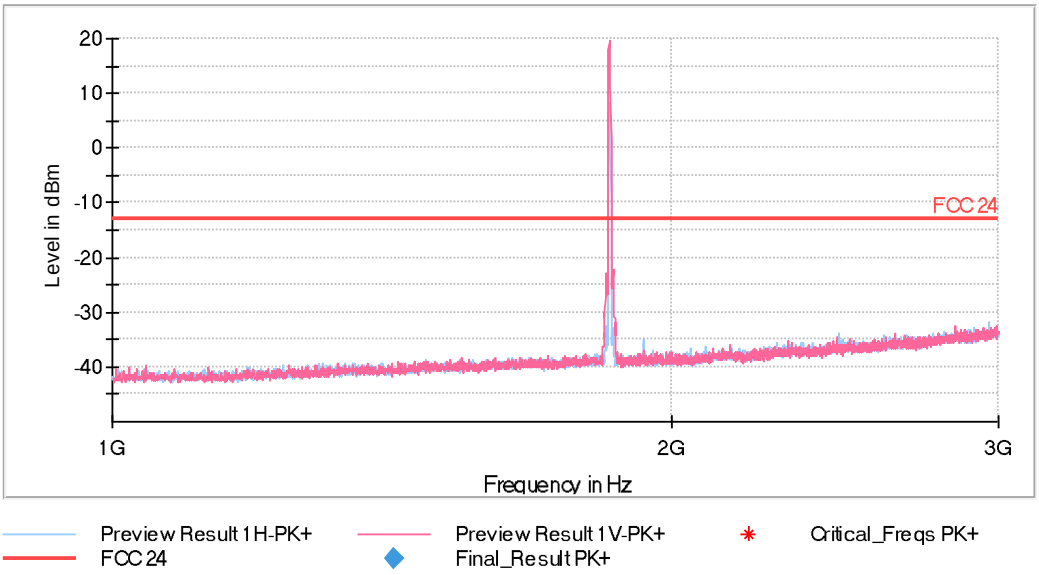
- Highest Channel:



FREQUENCY RANGE 1 – 3 GHz

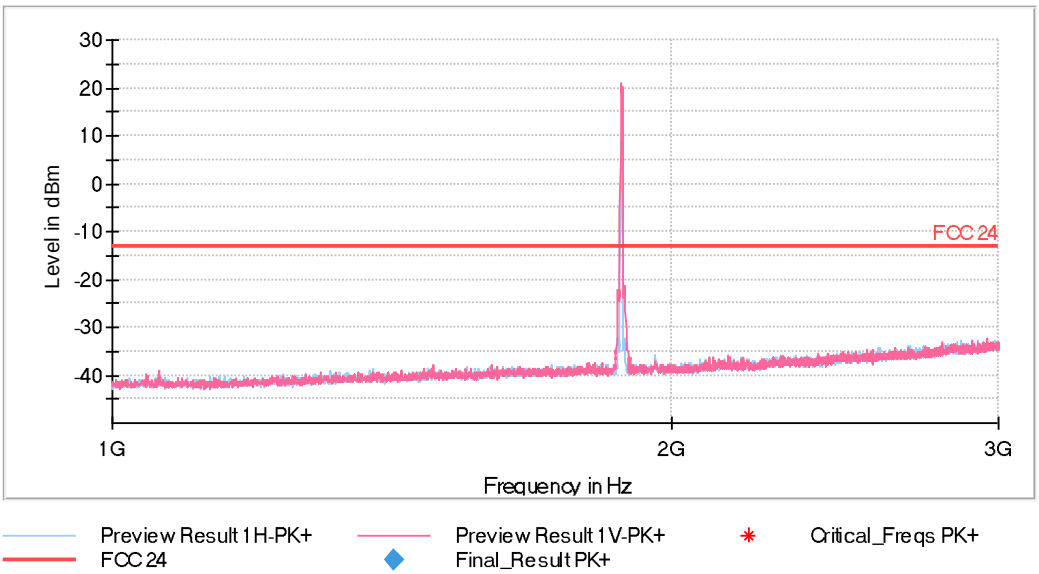
WCDMA MODULATION.

- Lowest Channel:

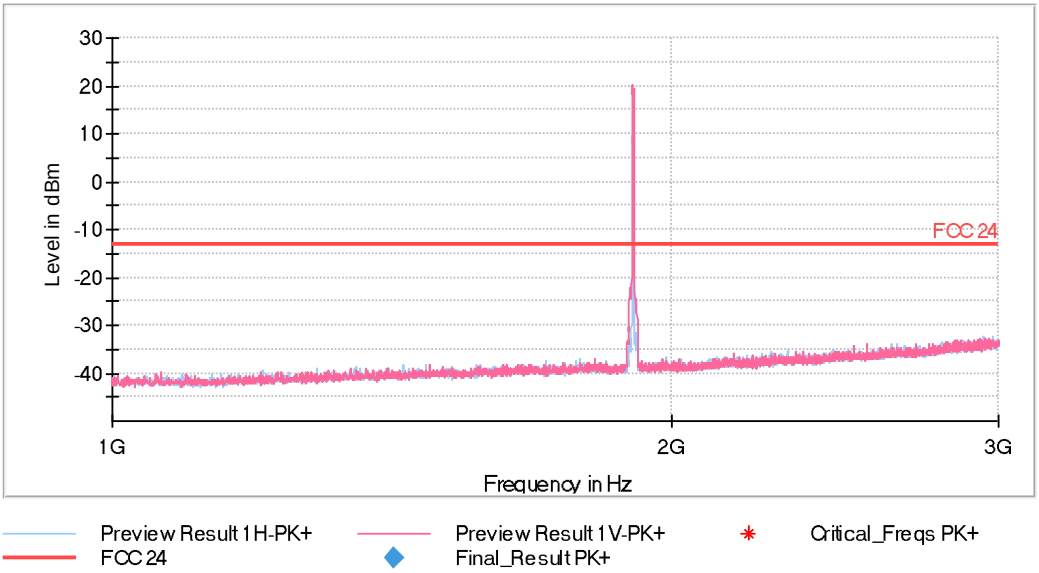


The peak above the limit is the carrier frequency.

- Middle Channel:



- Highest Channel:

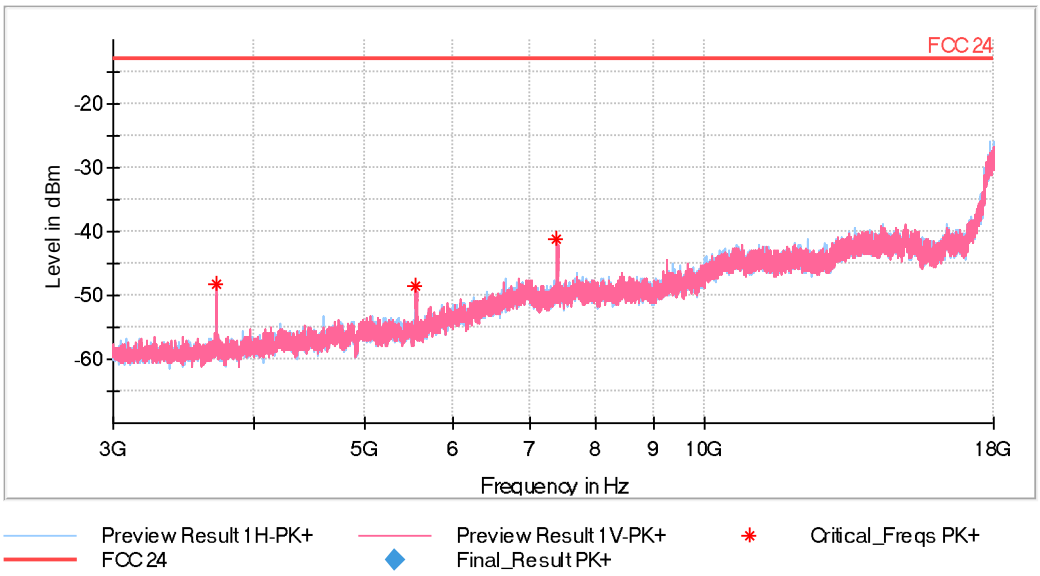


The peak above the limit is the carrier frequency.

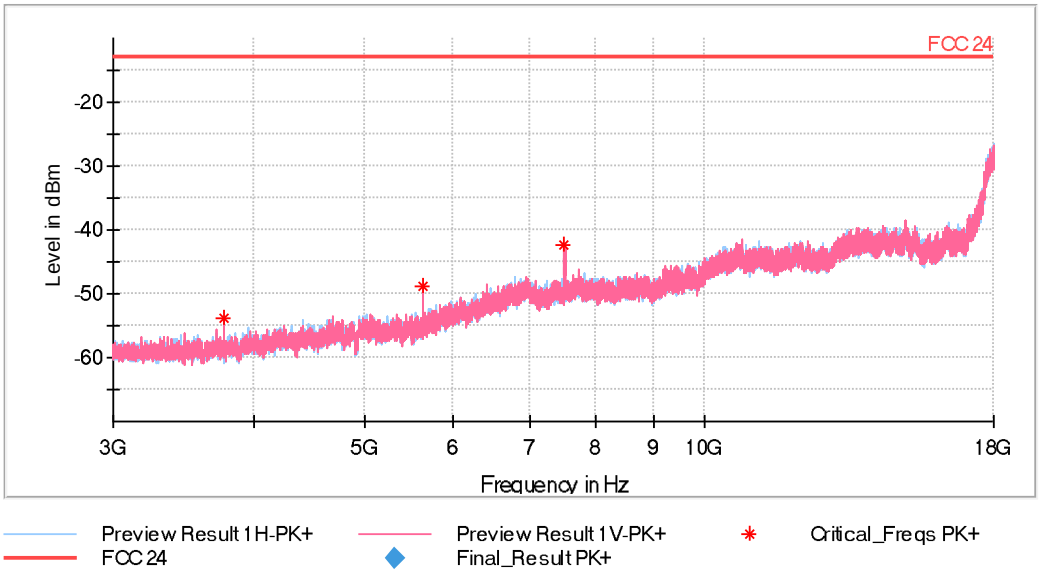
FREQUENCY RANGE 3 – 18 GHz

WCDMA MODULATION.

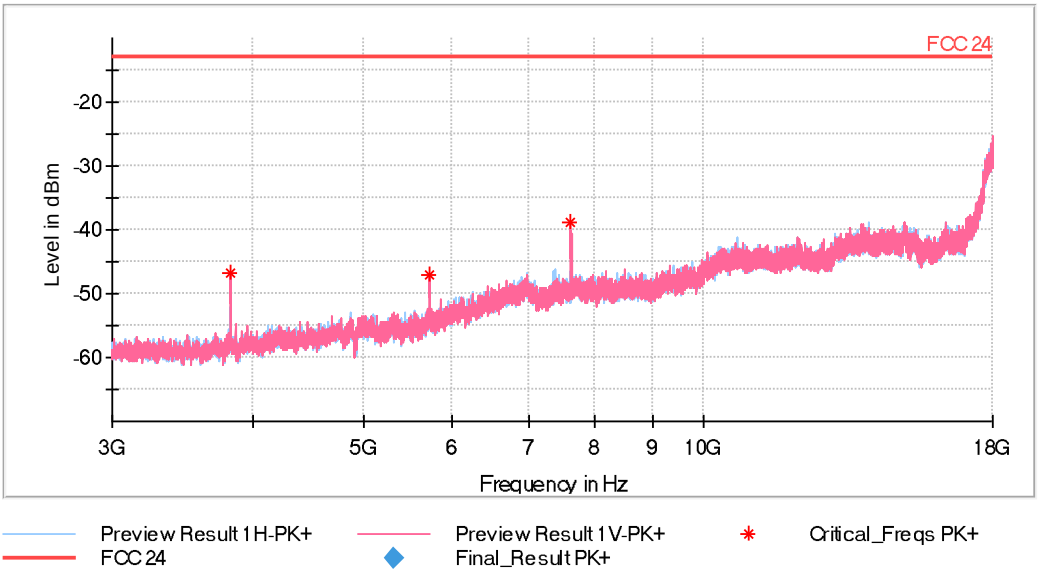
- Lowest Channel:



- Middle Channel:



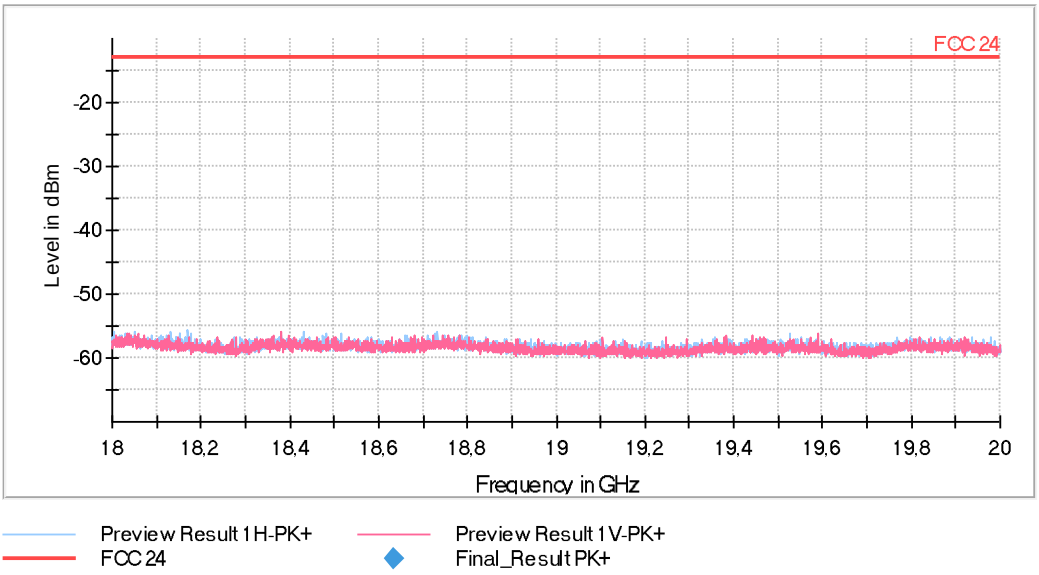
- Highest Channel:



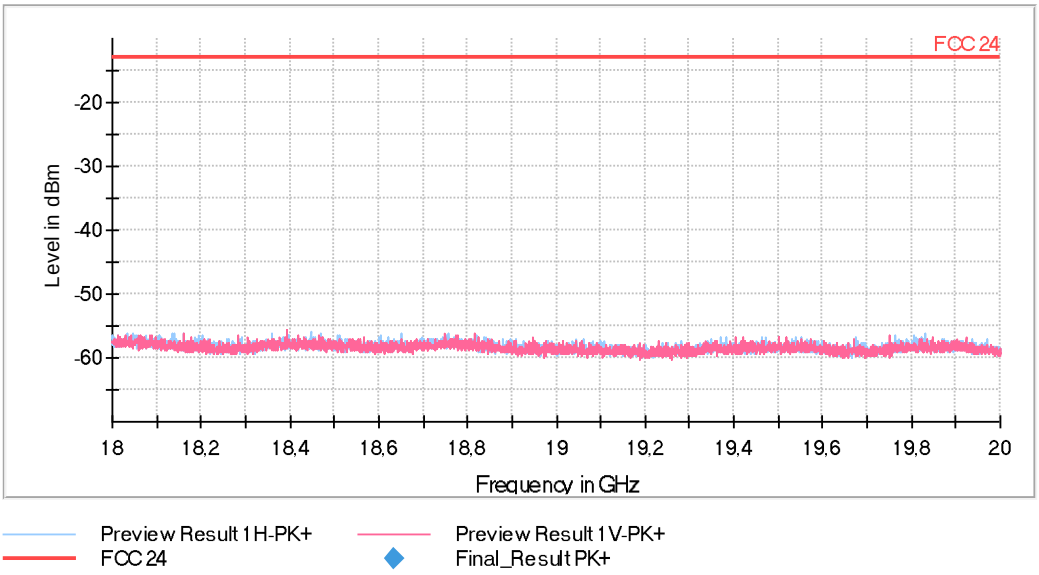
FREQUENCY RANGE 18 – 20 GHz

WCDMA MODULATION.

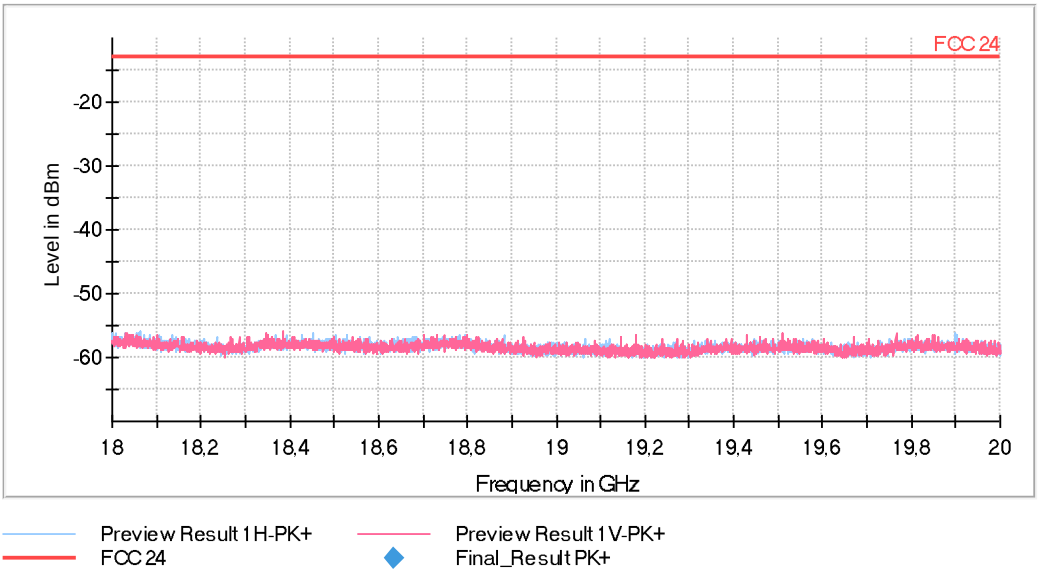
- Lowest Channel:



- Middle Channel:



- Highest Channel:



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

INDEX

TEST CONDITIONS

Vnominal = 3.8 Vdc

Type of power supply = DC Voltage from external power supply

Type of antenna = External antenna.

Declared Gain for antenna = +2.14 dBi.

TEST FREQUENCIES:

LTE Band 4. QPSK AND 16QAM MODULATION:

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

Note: RB=1 - Offset =0 - BW= 1.4 MHz

LTE Band 12. QPSK AND 16QAM MODULATION:

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

Note: RB=1 - Offset =0 - BW=1.4 MHz

LTE Band 13. QPSK AND 16QAM MODULATION:

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

NOTE: RB=1 - Offset =0 - BW=5 MHz

Frequency Stability

SPECIFICATION:

FCC §2.1055 and §27.54.

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-130. Clause 4.5.

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

RSS-139 Clause 6.4.

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

METHOD:

The frequency tolerance measurements over temperature variations were made over the temperature range of –30ºC to +50ºC. The EUT was placed inside a climatic chamber and the temperature was raised hourly in 10ºC steps from –30ºC up to +50ºC.
The supply voltage was varied between 85% and 115% of nominal voltage.

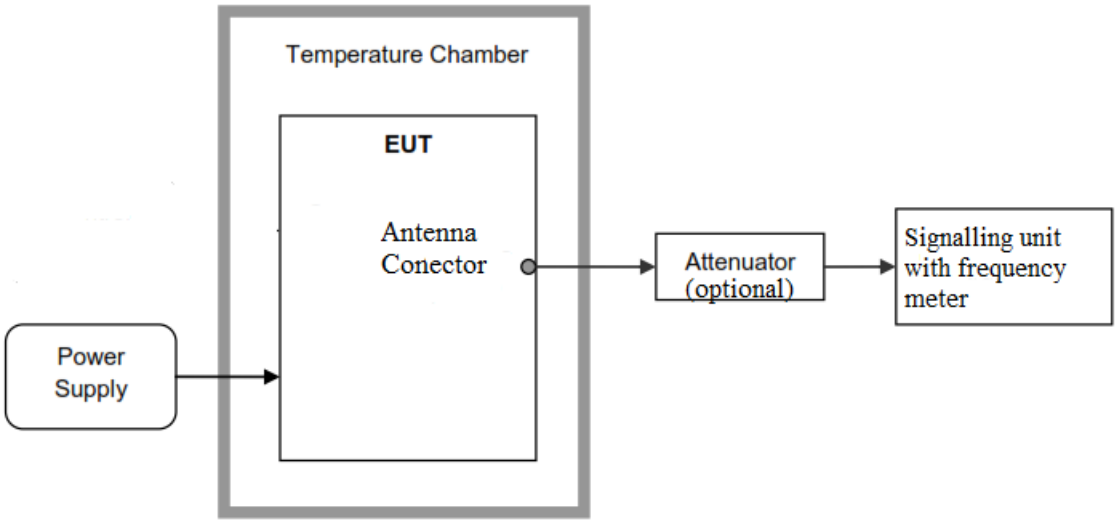
The EUT was set in “Radio Resource Control (RRC) mode” in the Middle channel using the Universal Radio Communication tester R&S CMW500 and the maximum frequency error was measured using the built-in calibrated frequency meter.

In order to check that the frequency stability is sufficient such that the fundamental emissions stay within the authorized bands of operation, a reference point is established at the applicable unwanted emissions limit using a RBW equal to the RBW required by the unwanted emissions specification of the applicable regulatory standard. These reference points measured using the lowest and highest channel of operation are identified as fL and fH respectively. The worst-case frequency offset determined in the above methods is added or subtracted from the values of fL and fH to check that the resulting frequencies remain within the band.

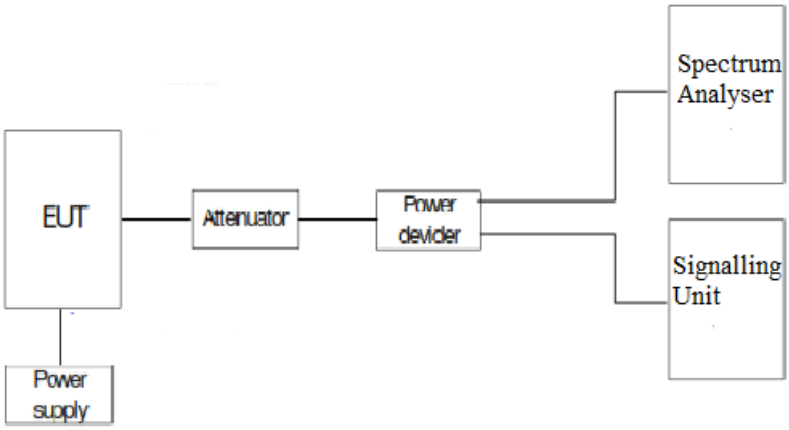
The reference point measurements were made at the RF output terminals of the EUT using an attenuator, power splitter and spectrum analyser. The EUT was controlled via the Universal Radio Communication tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation.

TEST SETUP:

1. Frequency Tolerance:



4. Reference Frequency Points fL and fH:



RESULTS:
Frequency stability over temperature variations.

LTE – Band 4. QPSK and 16QAM MODULATIONS. (QPSK) - BW= 20 MHz

Nominal Frequency: 1732.5 MHz

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	2.73	0.0016
+40	-2.06	-0.0012
+30	-6.97	-0.0040
+20	-3.23	-0.0019
+10	0.90	0.0006
0	-0.30	-0.0002
-10	2.53	0.0015
-20	-3.25	-0.0019
-30	-5.32	-0.0031

Measurement uncertainty (Hz)	<±206

LTE- Band 12. QPSK and 16QAM MODULATIONS. (QPSK) - BW=10 MHz

Nominal Frequency: 707.5 MHz

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-1.42	-0.0008
+40	3.69	0.0021
+30	-0.82	-0.0005
+20	-2.02	-0.0012
+10	0.94	0.0005
0	-1.80	-0.0010
-10	-3.89	-0.0022
-20	1.16	0.0007
-30	2.37	0.0014

Measurement uncertainty (Hz)	<±87

LTE – Band 13. QPSK and 16QAM MODULATIONS. (QPSK) - BW=10 MHz

Nominal Frequency: 782.0 MHz

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)
+50	-0.69	-0.0004
+40	-2.49	-0.0014
+30	-3.09	-0.0018
+20	-1.59	-0.0009
+10	-1.83	-0.0011
0	0.26	0.0002
-10	2.69	0.0016
-20	-0.24	-0.0001
-30	1.43	0.0008

Measurement uncertainty (Hz)	<±96

Frequency stability over voltage variations.

LTE – Band 4. QPSK and 16QAM MODULATIONS. (QPSK) - BW= 20 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	-5.74	-0.0033
Vmin	3.2	-1.52	-0.0009

Measurement uncertainty (Hz)	<±206

LTE – Band 12. QPSK and 16QAM MODULATIONS. (QPSK) - BW=10 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	1.30	0.0008
Vmin	3.2	-4.13	-0.0024

Measurement uncertainty (Hz)	<±87

LTE – Band 13. QPSK and 16QAM MODULATIONS. (QPSK) - BW=10 MHz

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)
Vmax	4.2	-0.90	-0.0005
Vmin	3.2	-0.47	-0.0003

Measurement uncertainty (Hz)	<±96

Verdict: PASS

Radiated emissions

SPECIFICATION

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. However. in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block. a resolution bandwidth of at least 30 kHz may be employed

FCC §27.53 (c) & (f).
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.

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.

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 (-40 dBm)/MHz equivalent isotropically radiated power (EIRP) for wideband signals. and −80 dBW (-50 dBm) EIRP for discrete emissions of less than 700 Hz bandwidth.

RSS-130 Clause 4.7.
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 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

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 log10 p(watts). dB. for mobile and portable equipment.

The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW (-40 dBm) /MHz for wideband signal and -80 dBW (-50 dBm) for discrete emission with bandwidth less than 700 Hz.

FCC §27.53 (h). RSS-139 Clause 6.6.
According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. P in watts.

At Po transmitting power. the specified minimum attenuation becomes 43+10 log (Po). and the level in dBm relative Po becomes:
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = -13 dBm.

METHOD

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

The EUT was placed on a 1 meter high non-conductive stand at a 3 meter distance from the measuring antenna.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum field strength (dBµV/m) is measured and recorded.

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

EIRP (dBm) = E (dBµV/m) + 20log(D) - 104.8; where D is the measurement distance (in the far field region) in m. D = 3 m

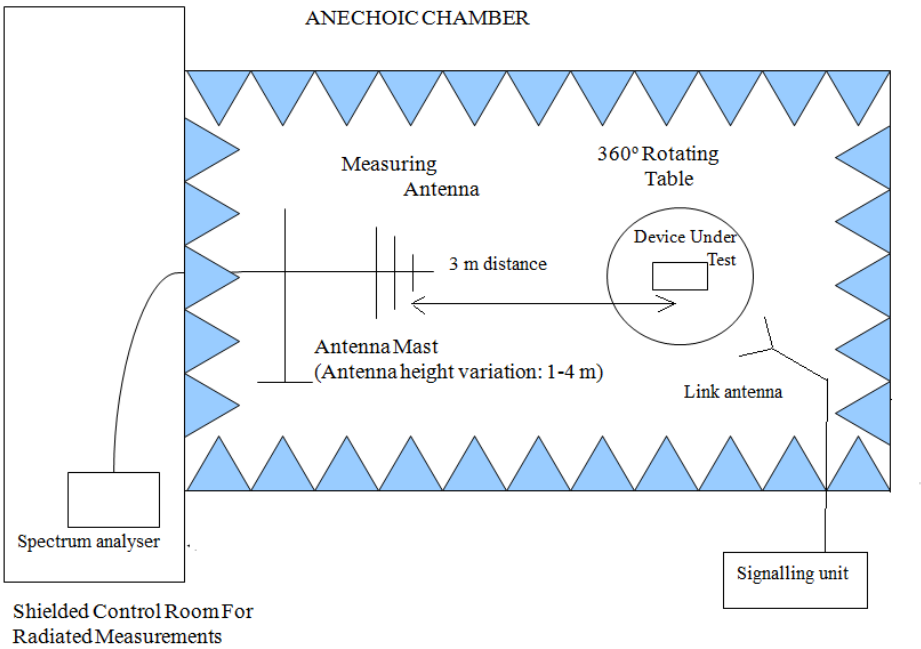
Measurement Limit:

According to specification. the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. P in watts.
At Po transmitting power. the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative Po becomes:

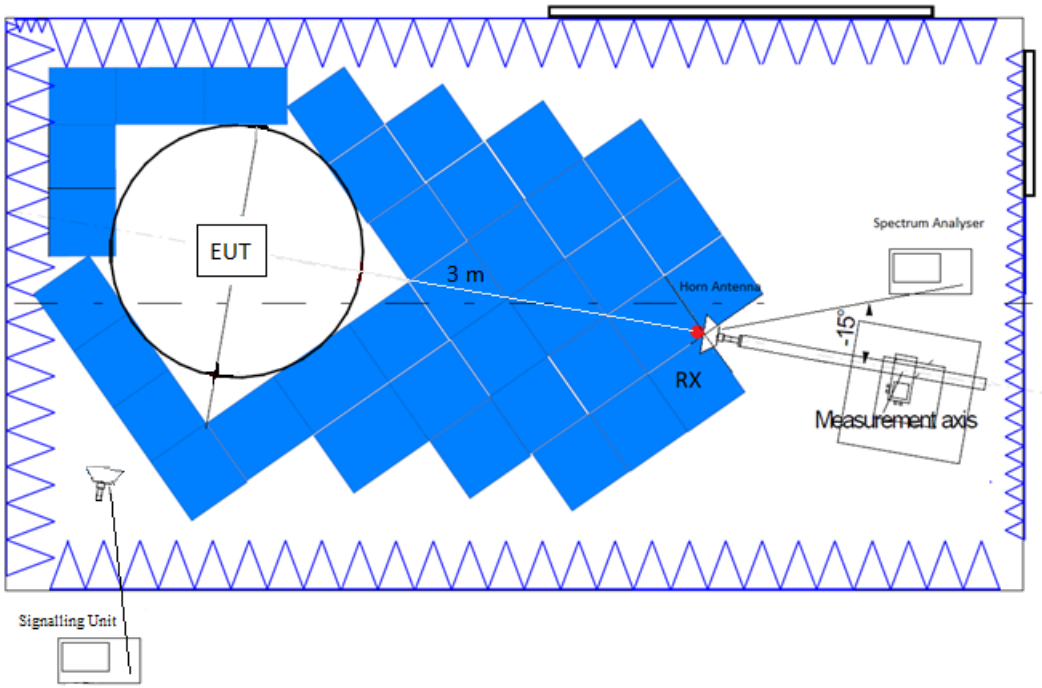
Po (dBm) – [43 + 10 log (Po in mwatts) - 30] = - 13 dBm

TEST SETUP

Radiated measurements below 1 GHz.



Radiated measurements above 1 GHz.



RESULTS

LTE Band 4:

QPSK and 16-QAM Modulations:

A preliminary scan determined the QPSK modulation, BW = 1.4 MHz, RB Size = 1, RB Offset = 0, Narrowband = 0 as the worst case. The following tables and plots show the results for this worst-case configuration.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz

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

Frequency range 1 – 3 GHz

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

Frequency range 3 – 18 GHz

Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Detector	E.I.R.P. (dBm)	Polarization
6.8411	Peak	-28.71	V

- MIDDLE CHANNEL:

Frequency range 30 MHz - 1 GHz

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

Frequency range 1 – 3 GHz

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

Frequency range 3 – 18 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 – 3 GHz

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

Frequency range 3 – 18 GHz

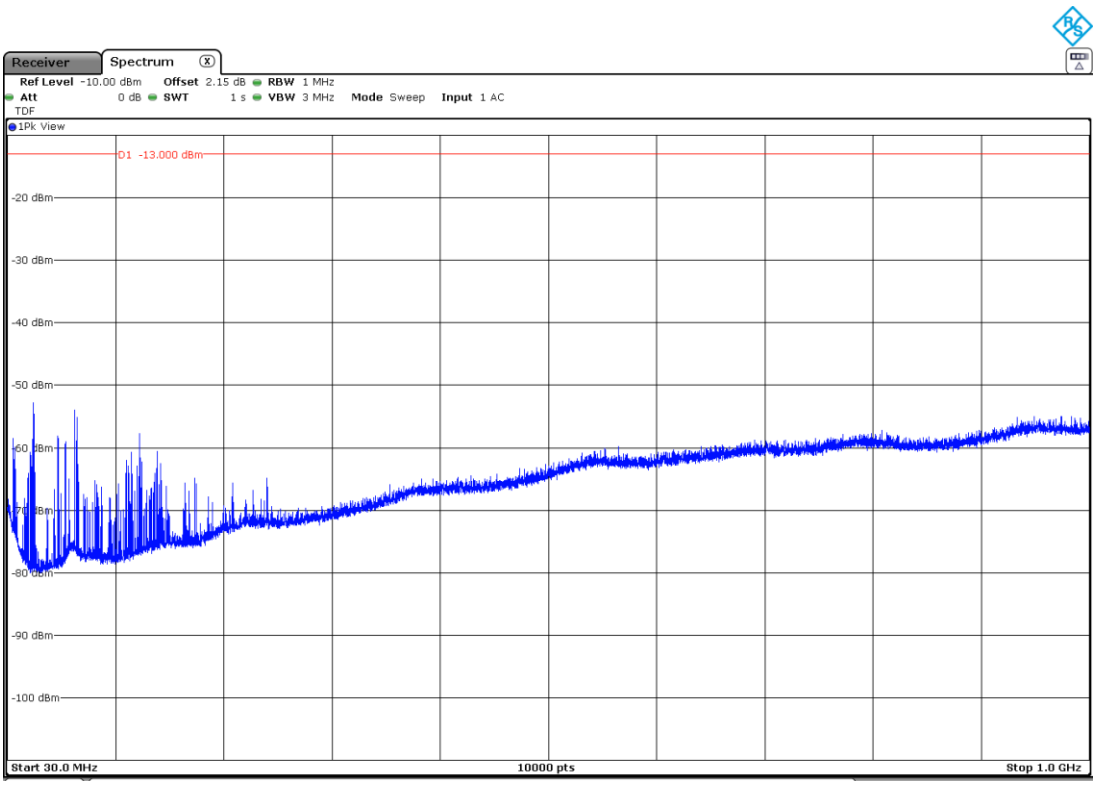
No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB) <±5.08 for f < 1GHz
<±4.11 for f ≥ 1 GHz up to 3 GHz
<±5.13 for f ≥ 3 GHz up to 18 GHz

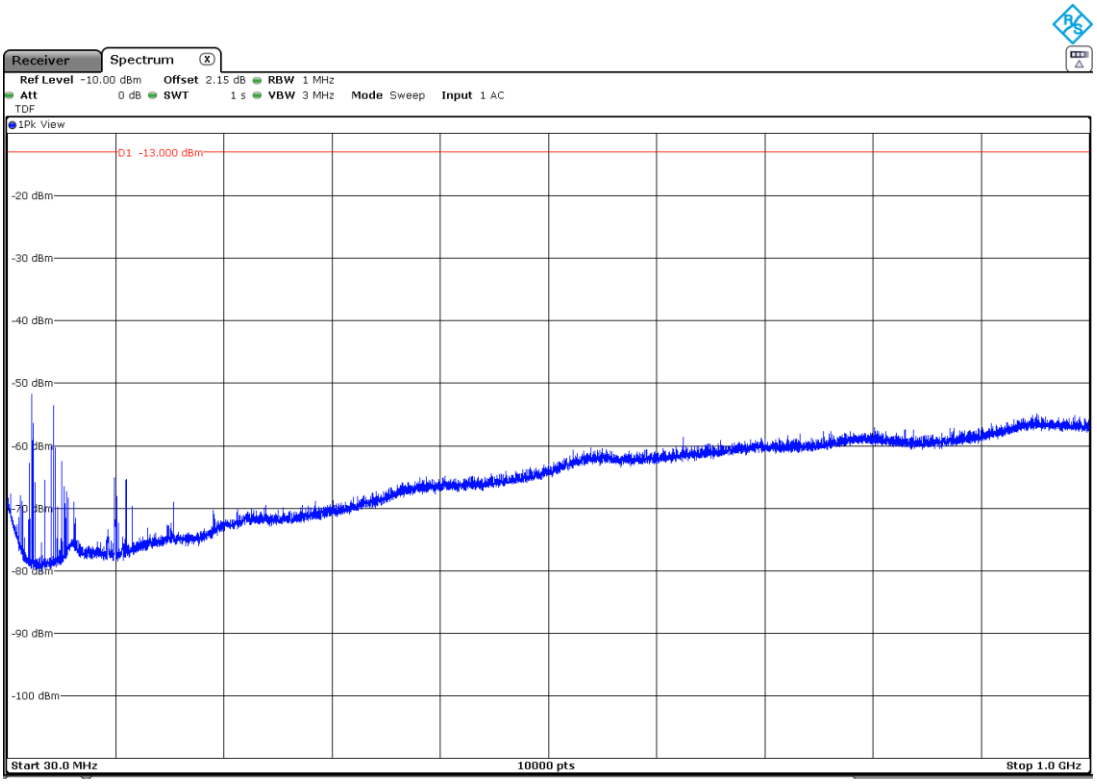
Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz (worst case):

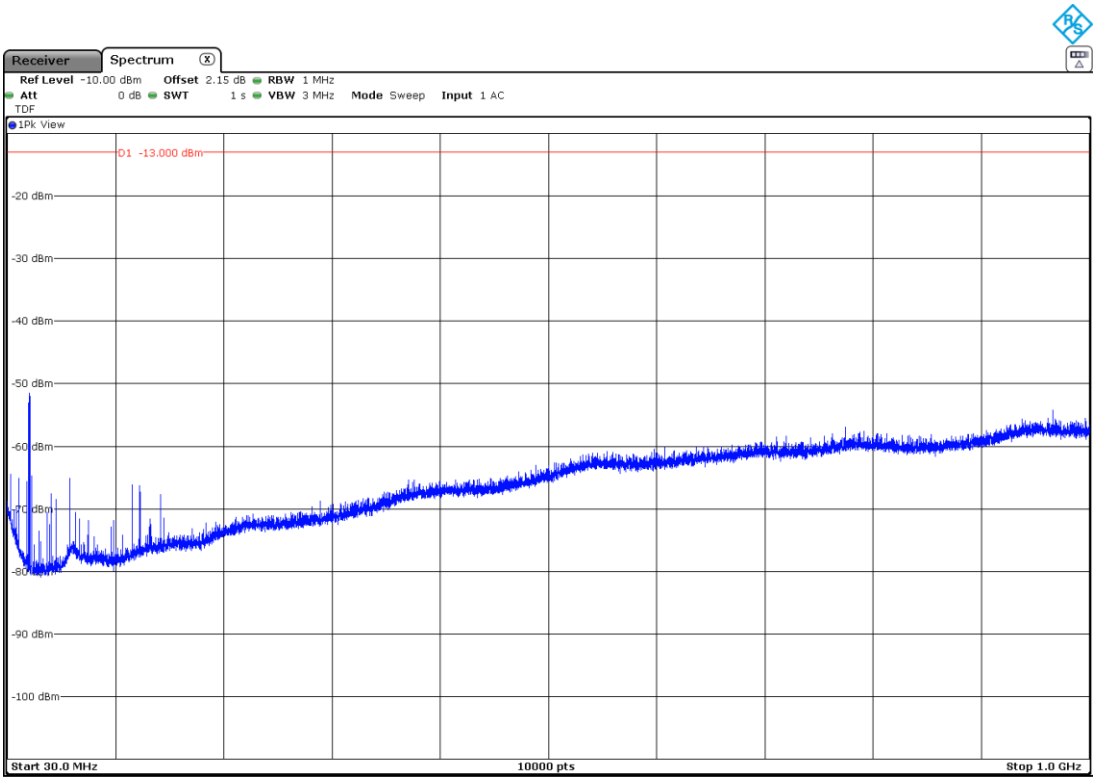
- Low Channel:



- Middle Channel:

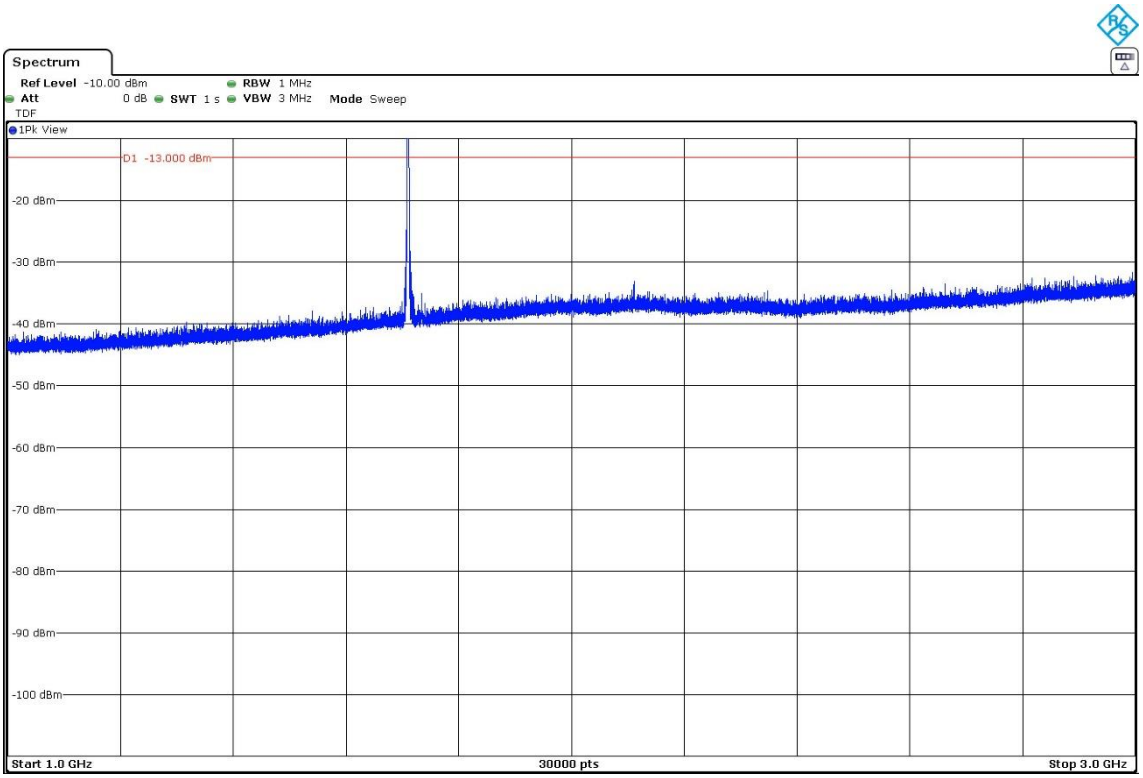


- High Channel:



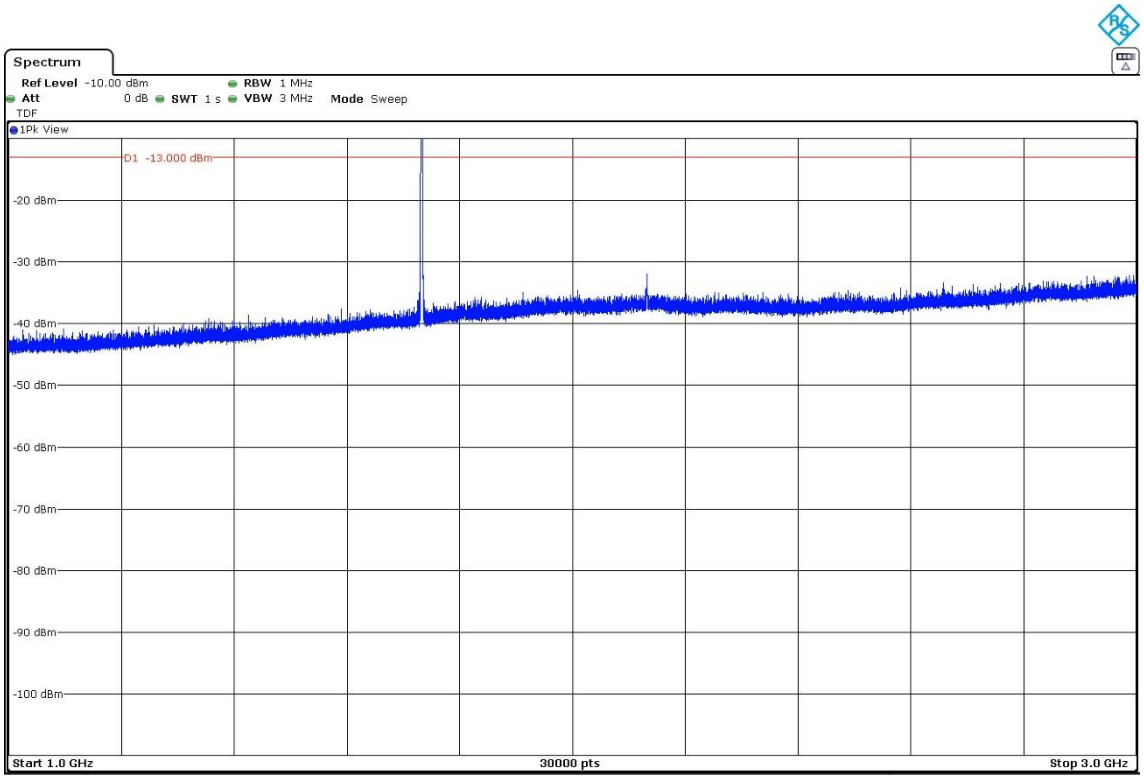
FREQUENCY RANGE 1 GHz - 3 GHz (worst case):

- Low Channel:



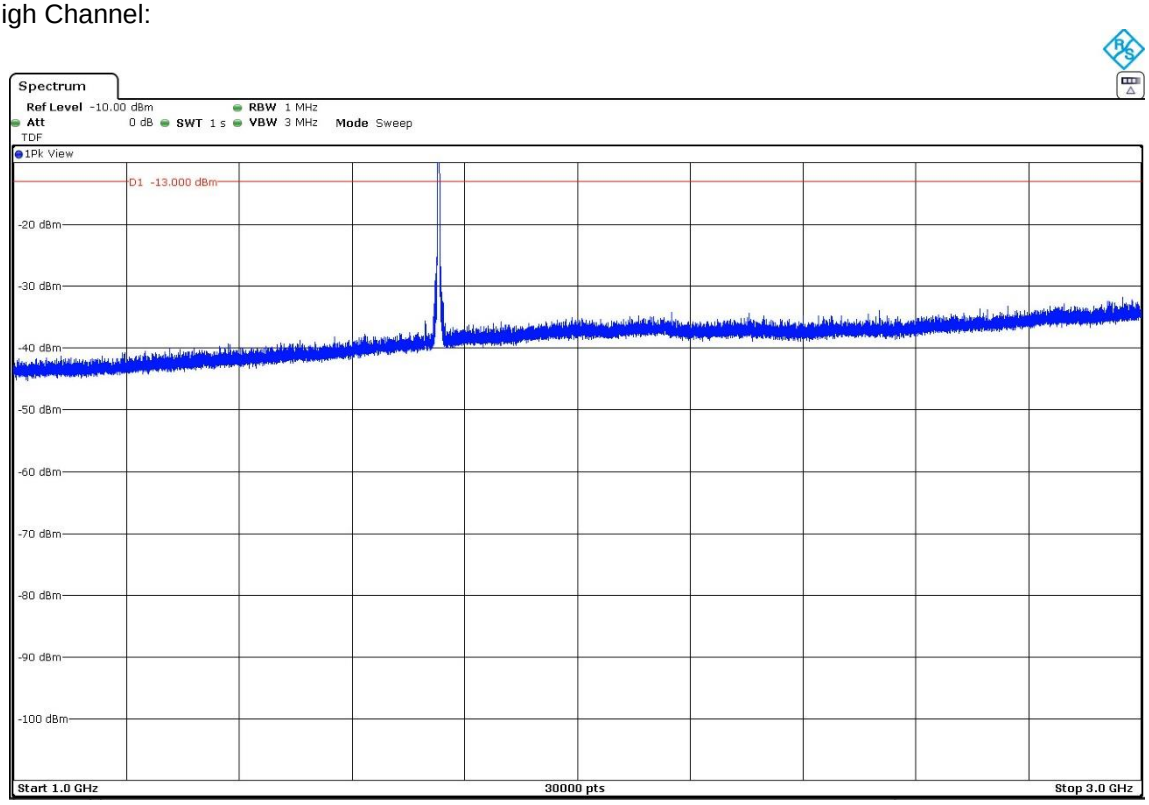
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

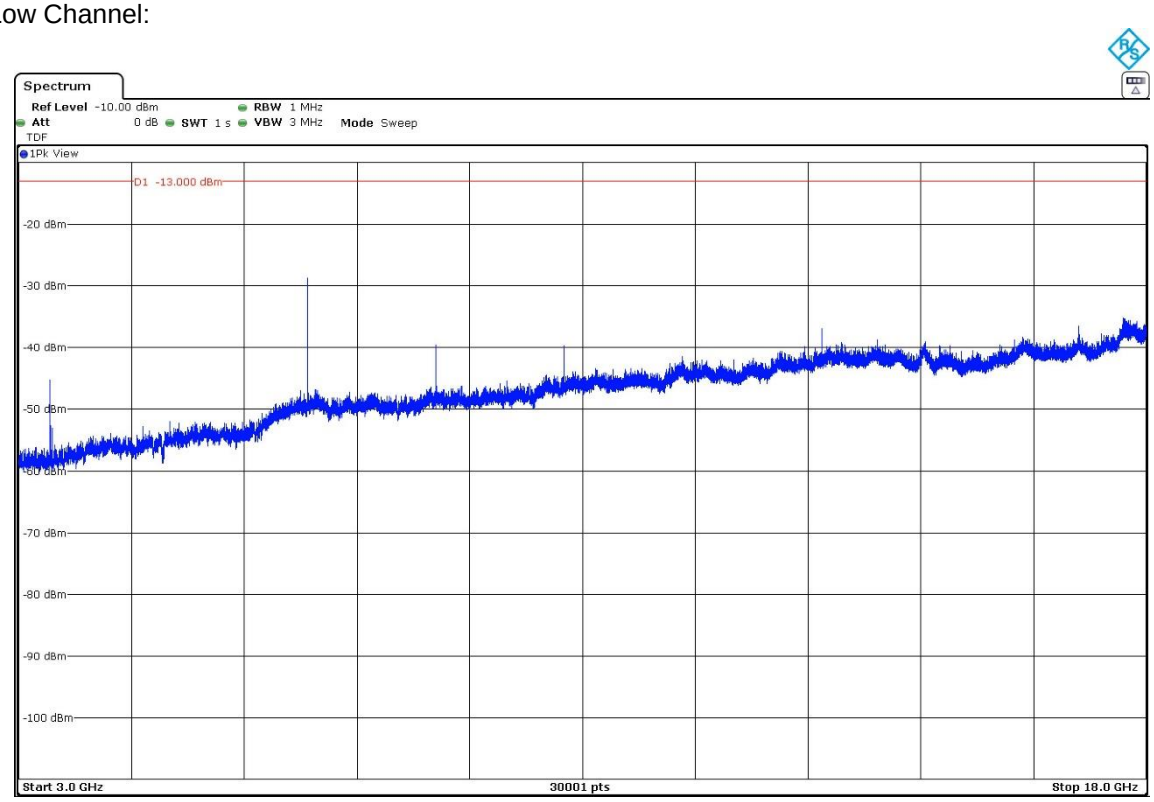
- High Channel:



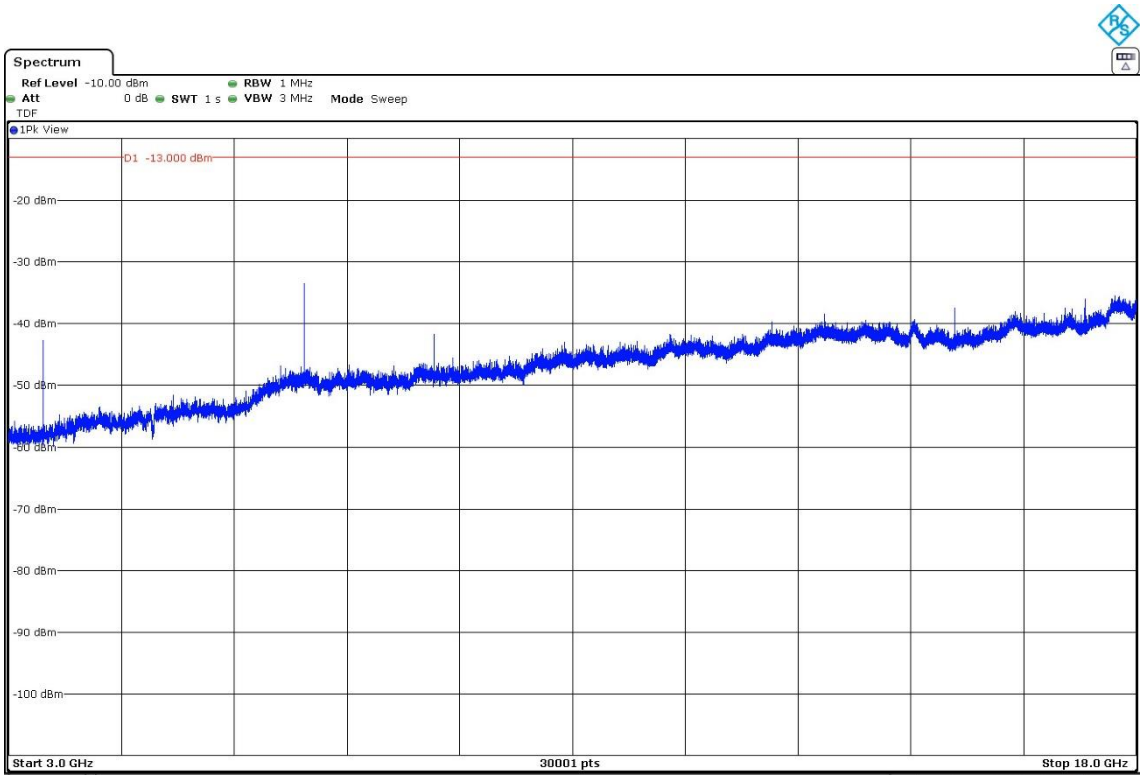
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz - 18 GHz (worst case):

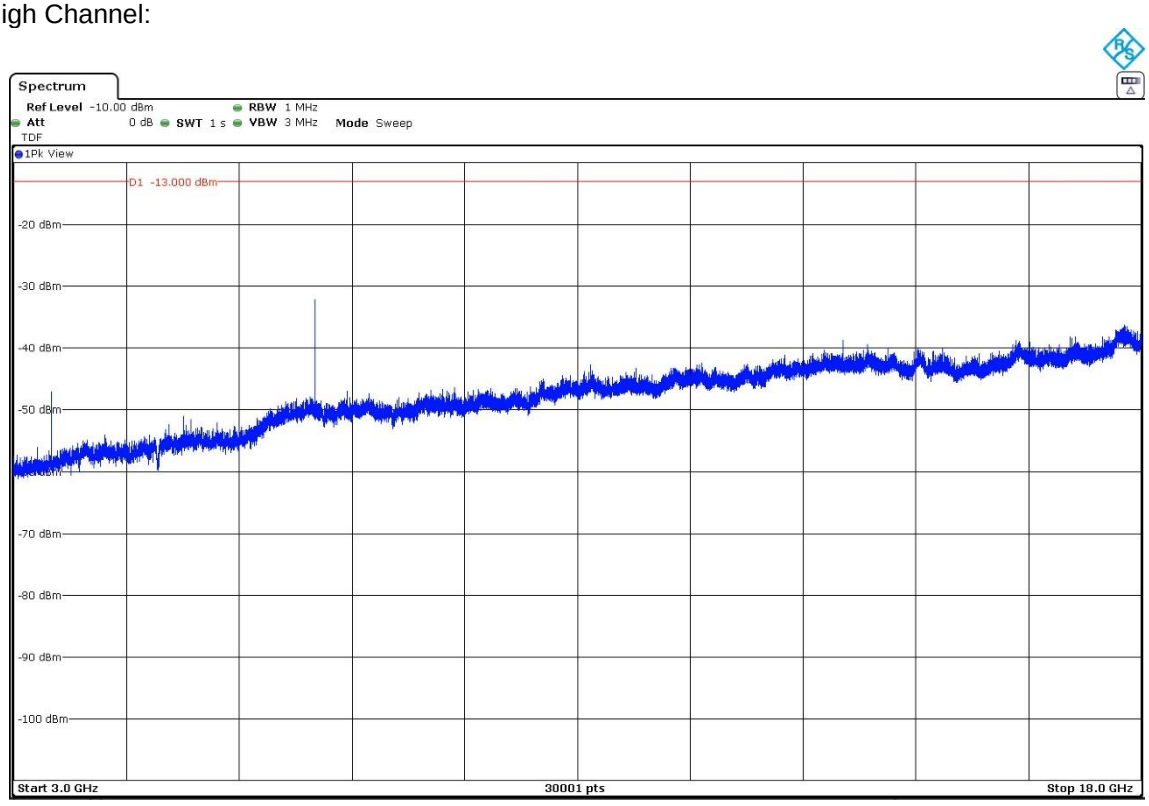
- Low Channel:



- Middle Channel:



- High Channel:



LTE Band 12:

QPSK and 16-QAM Modulations:

A preliminary scan determined the QPSK modulation, BW = 3 MHz, RB Size = 1, RB Offset = 0, Narrowband = 0 as the worst case. The following tables and plots show the results for this worst-case configuration.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz

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

Frequency range 1 – 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 – 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 – 8 GHz

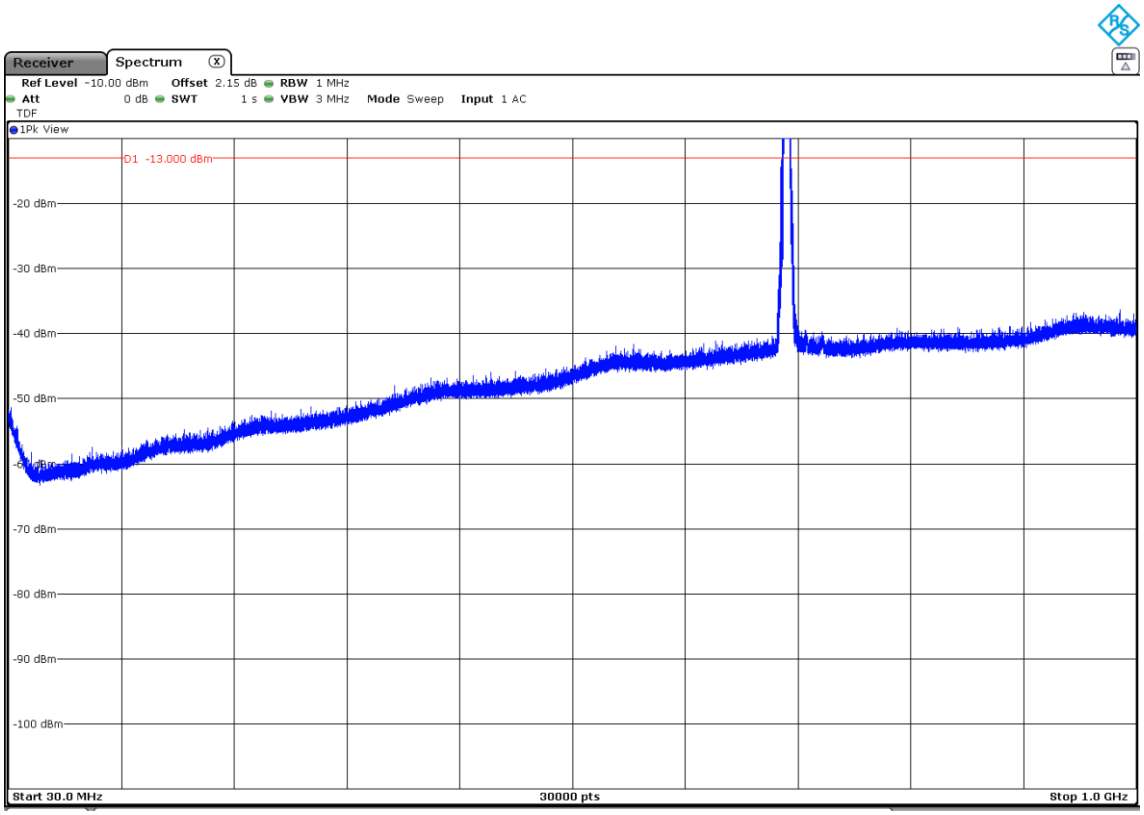
No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB) <±4.86 for f < 1GHz
<±5.13 for f ≥ 1 GHz up to 8 GHz

Verdict: PASS

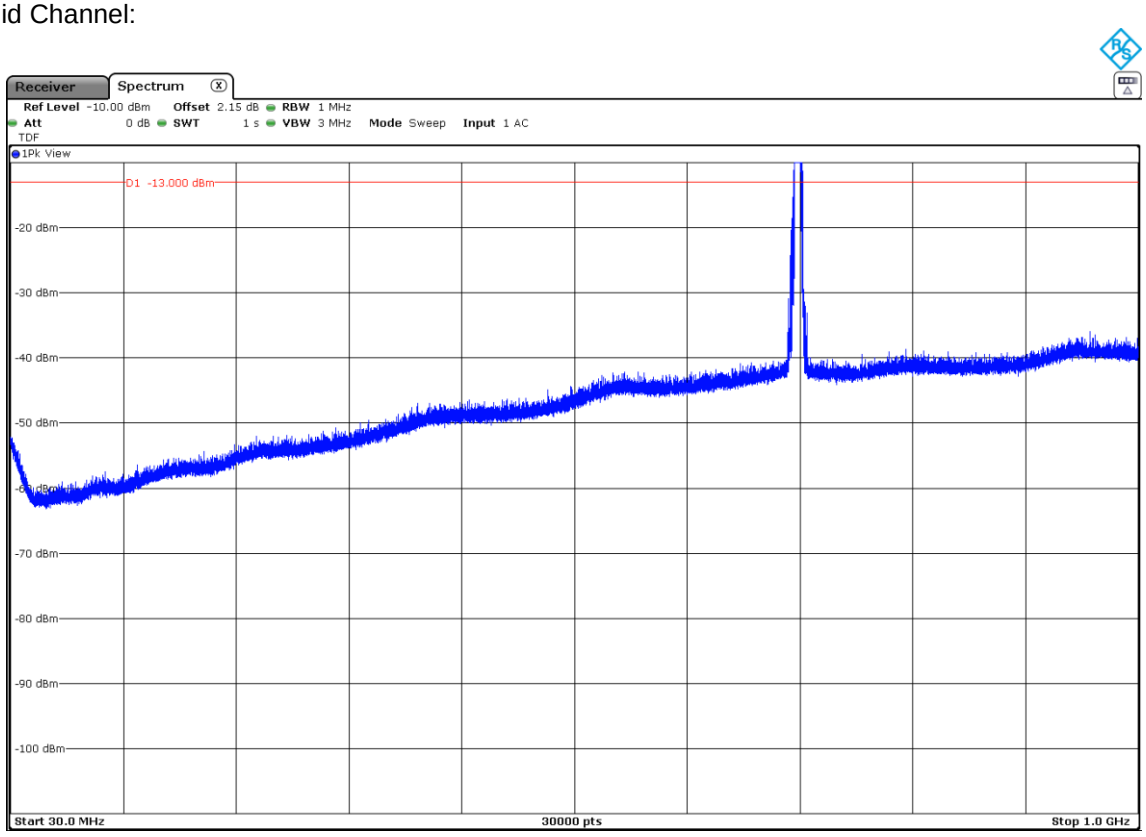
FREQUENCY RANGE 30 MHz - 1 GHz (worst case):

- Low Channel:



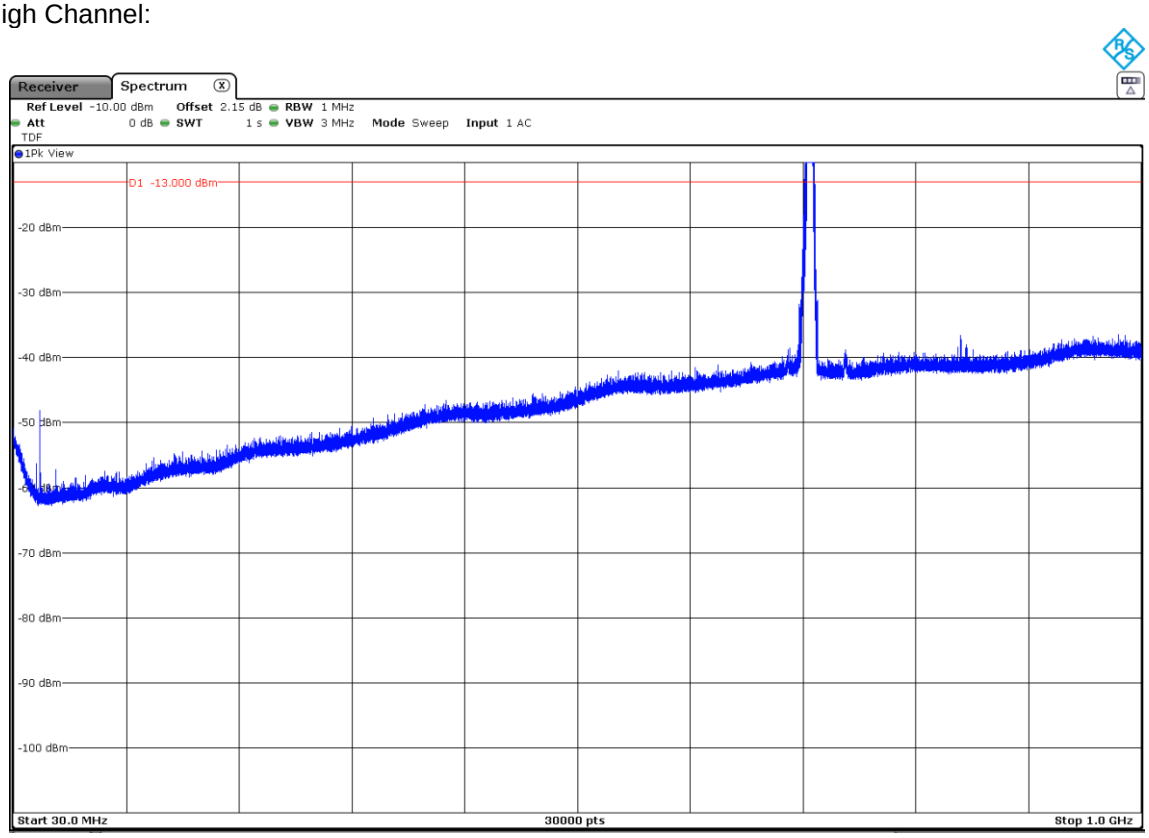
The peak above the limit is the carrier frequency.

- Mid Channel:



The peak above the limit is the carrier frequency.

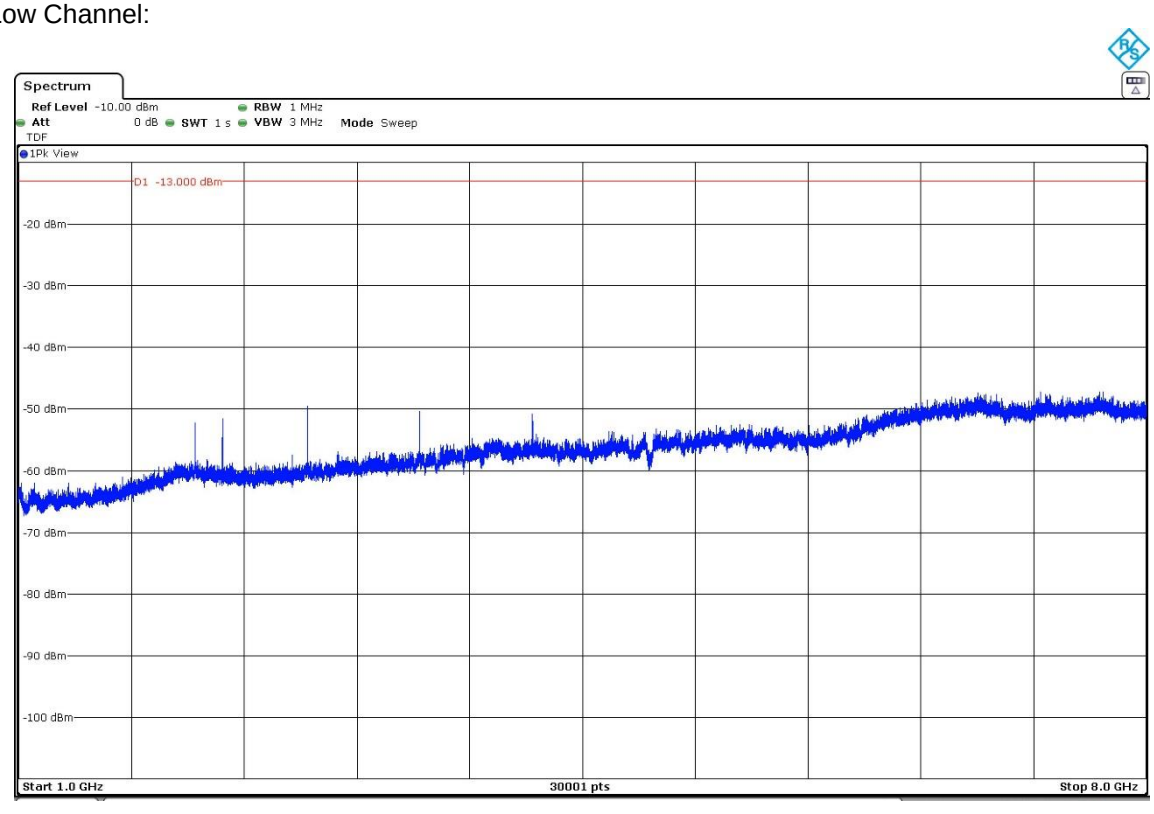
- High Channel:



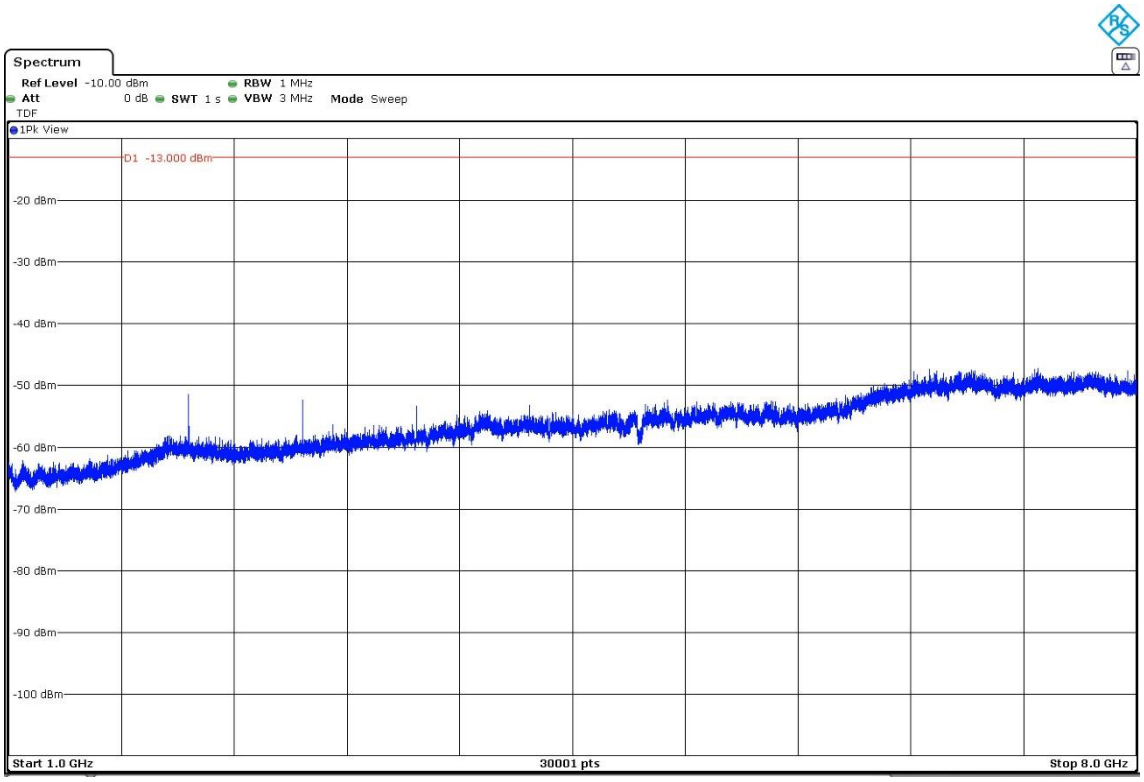
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 1 GHz - 8 GHz (worst case):

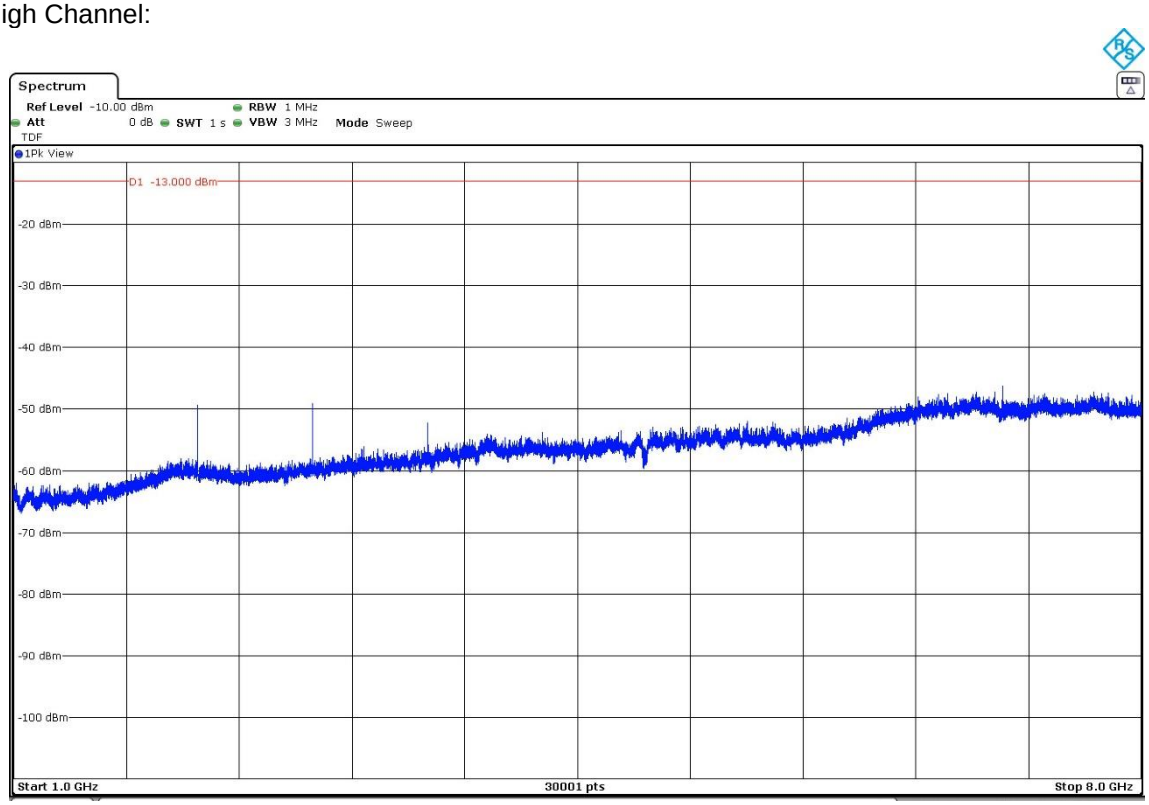
- Low Channel:



- Middle Channel:



- High Channel:



LTE Band 13:

QPSK and 16-QAM Modulations:

A preliminary scan determined the QPSK modulation, BW = 5 MHz, RB Size = 1, RB Offset = 0, Narrowband = 0 as the worst case. The following tables and plots show the results for this worst-case configuration.

- LOW CHANNEL:

Frequency range 30 MHz - 1 GHz

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

Frequency range 763 MHz – 775 MHz:

Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Detector	E.I.R.P. (dBm)	Polarization
771.4402	Peak	-57.35	V
773.0782	Peak	-46.02	V

Frequency range 793 MHz – 806 MHz:

Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Detector	E.I.R.P. (dBm)	Polarization
795.2232	Peak	-56.71	V

Frequency range 1 – 8 GHz

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

Frequency range 1559 MHz – 1610 MHz:

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 763 MHz – 775 MHz:

Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Detector	E.I.R.P. (dBm)	Polarization
773.9050	Peak	-46.32	V

Frequency range 793 MHz – 806 MHz:

Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Detector	E.I.R.P. (dBm)	Polarization
797.7357	Peak	-56.84	H

Frequency range 1 – 8 GHz

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

Frequency range 1559 MHz – 1610 MHz:

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 763 MHz – 775 MHz:

Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Detector	E.I.R.P. (dBm)	Polarization
773.6465	Peak	-53.80	H

Frequency range 793 MHz – 806 MHz:

Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Detector	E.I.R.P. (dBm)	Polarization
793.1073	Peak	-55.02	V
800.1875	Peak	-60.11	V

Frequency range 1 – 8 GHz

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

Frequency range 1559 MHz – 1610 MHz:

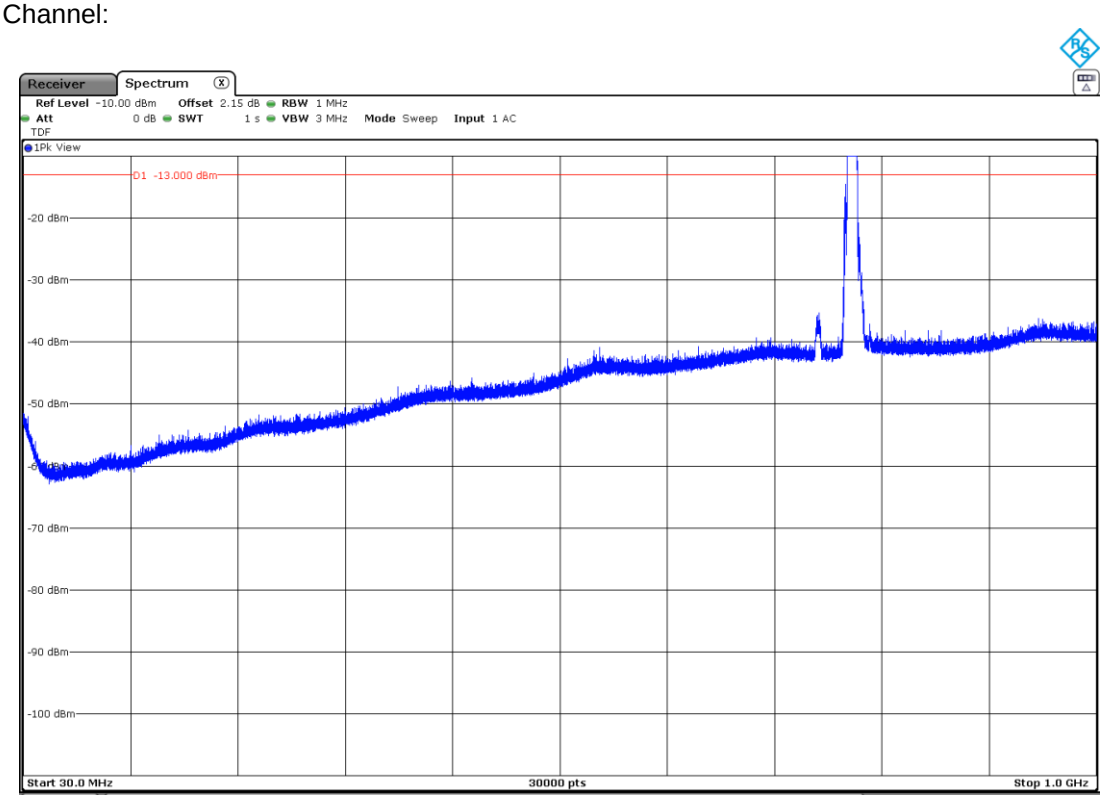
No spurious frequencies at less than 20 dB below the limit.

Measurement uncertainty (dB) <±5.08 for f < 1GHz
<±5.13 for f ≥ 1 GHz up to 8 GHz

Verdict: PASS

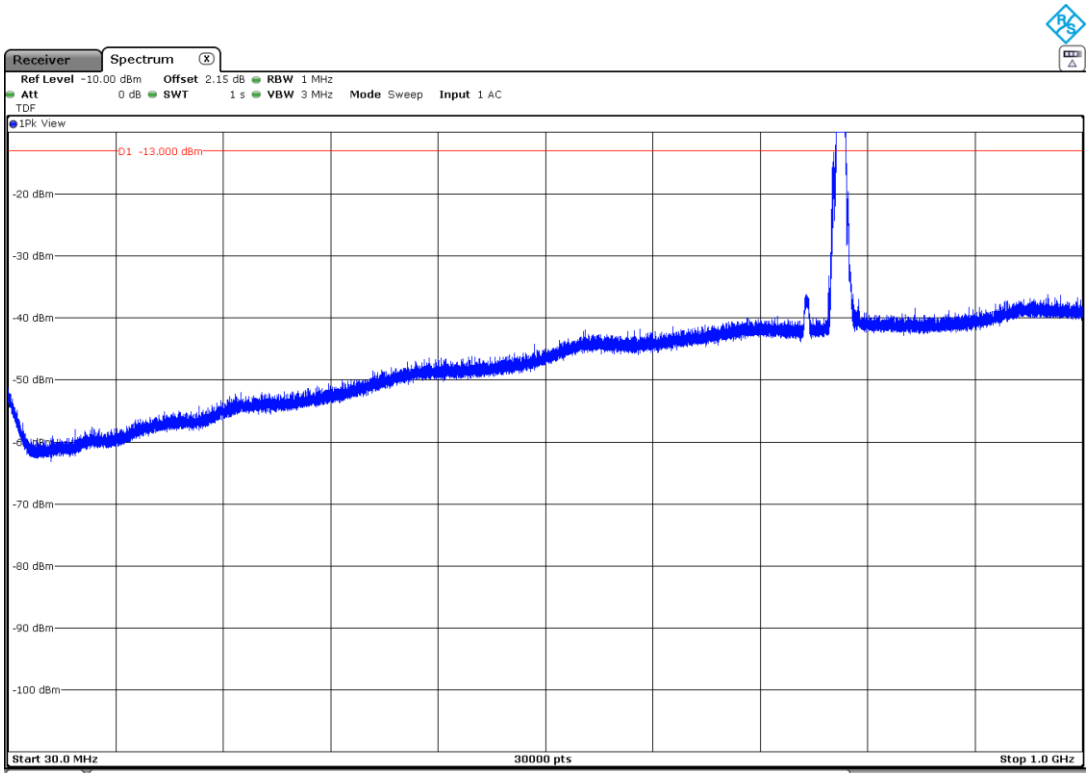
FREQUENCY RANGE 30 MHz - 1 GHz (worst case):

- Low Channel:



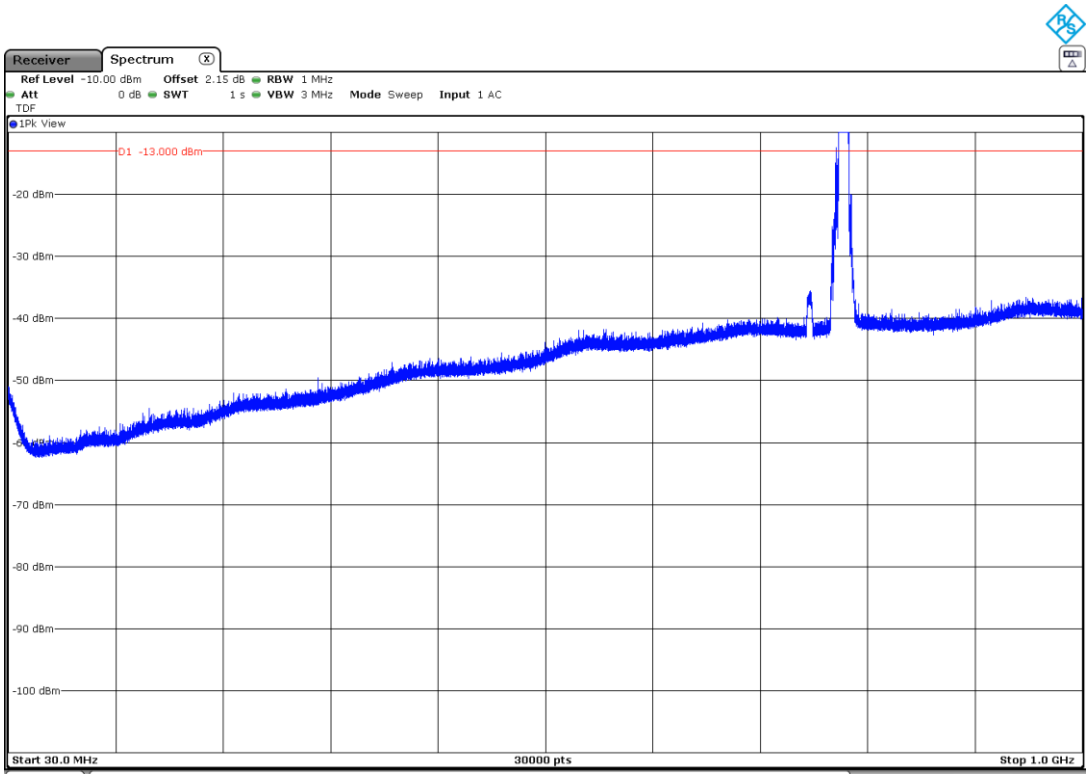
The peak above the limit is the carrier frequency. The other peak is the downlink signal.

- Middle Channel:



The peak above the limit is the carrier frequency. The other peak is the downlink signal.

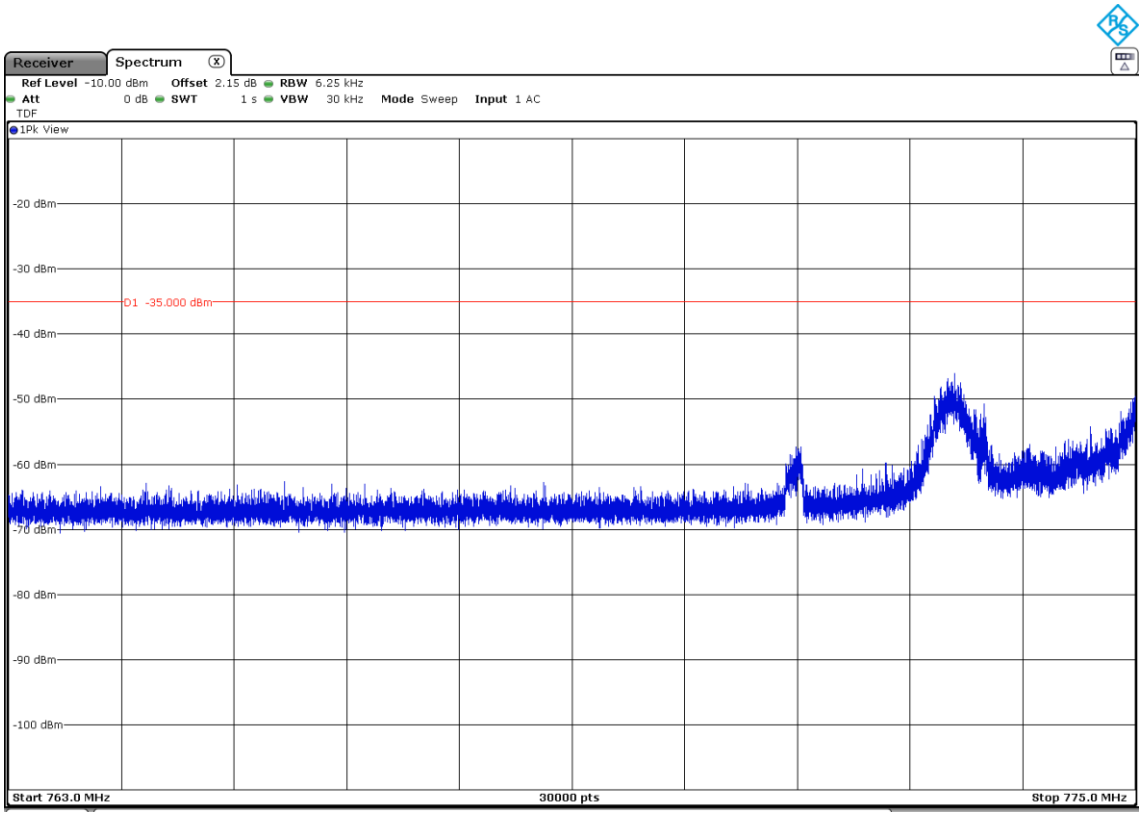
- High Channel:



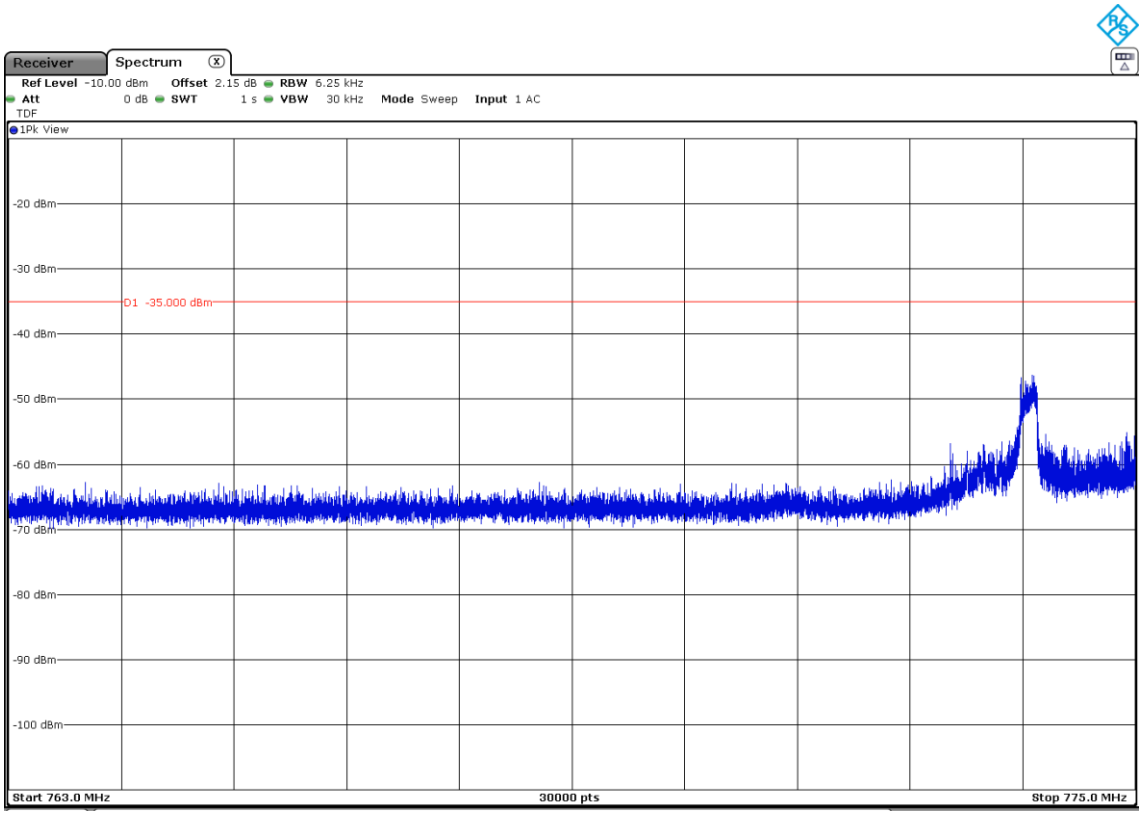
The peak above the limit is the carrier frequency. The other peak is the downlink signal.

FREQUENCY RANGE 763 MHz - 775 MHz (worst case):

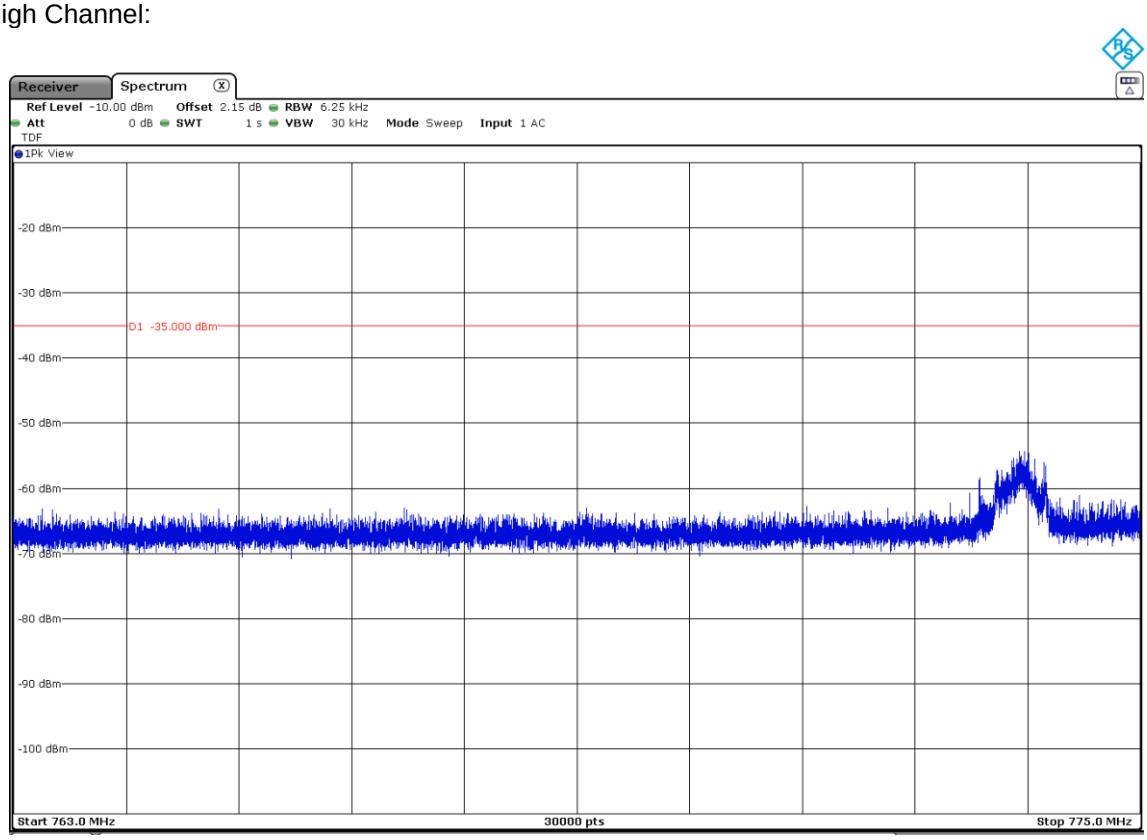
- Low Channel:



- Middle Channel:

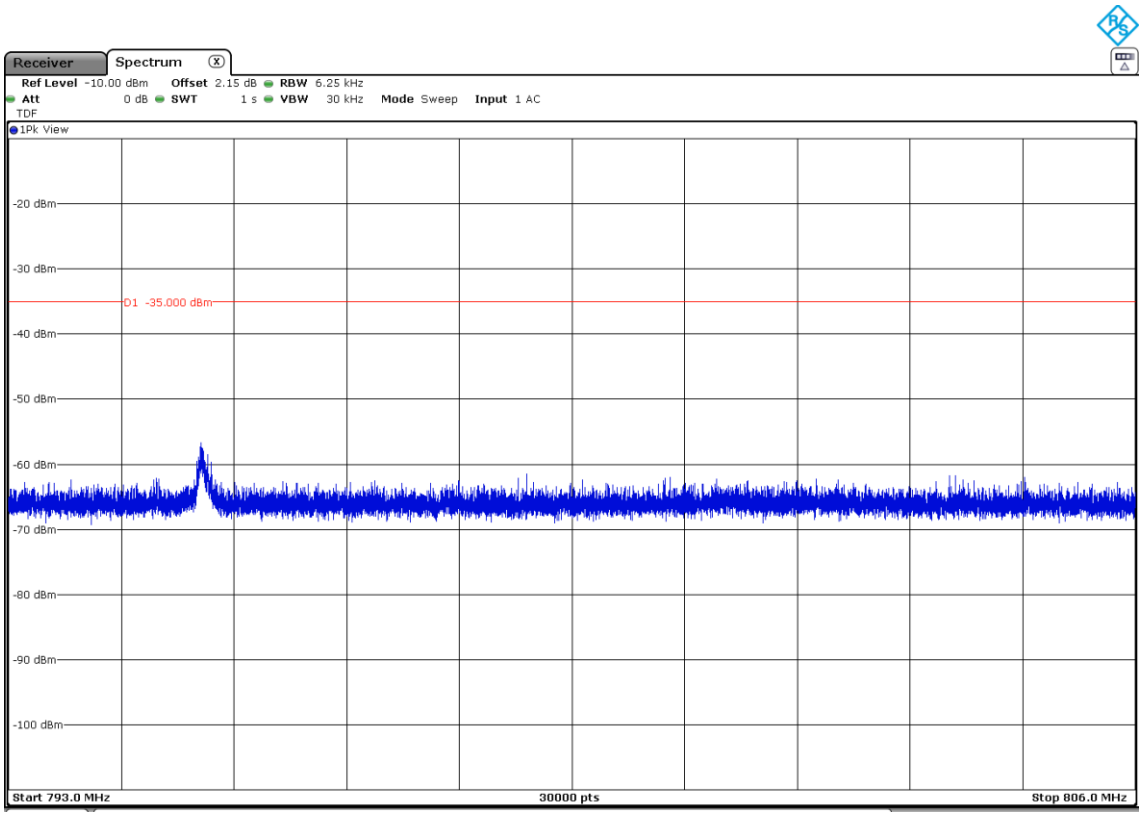


- High Channel:

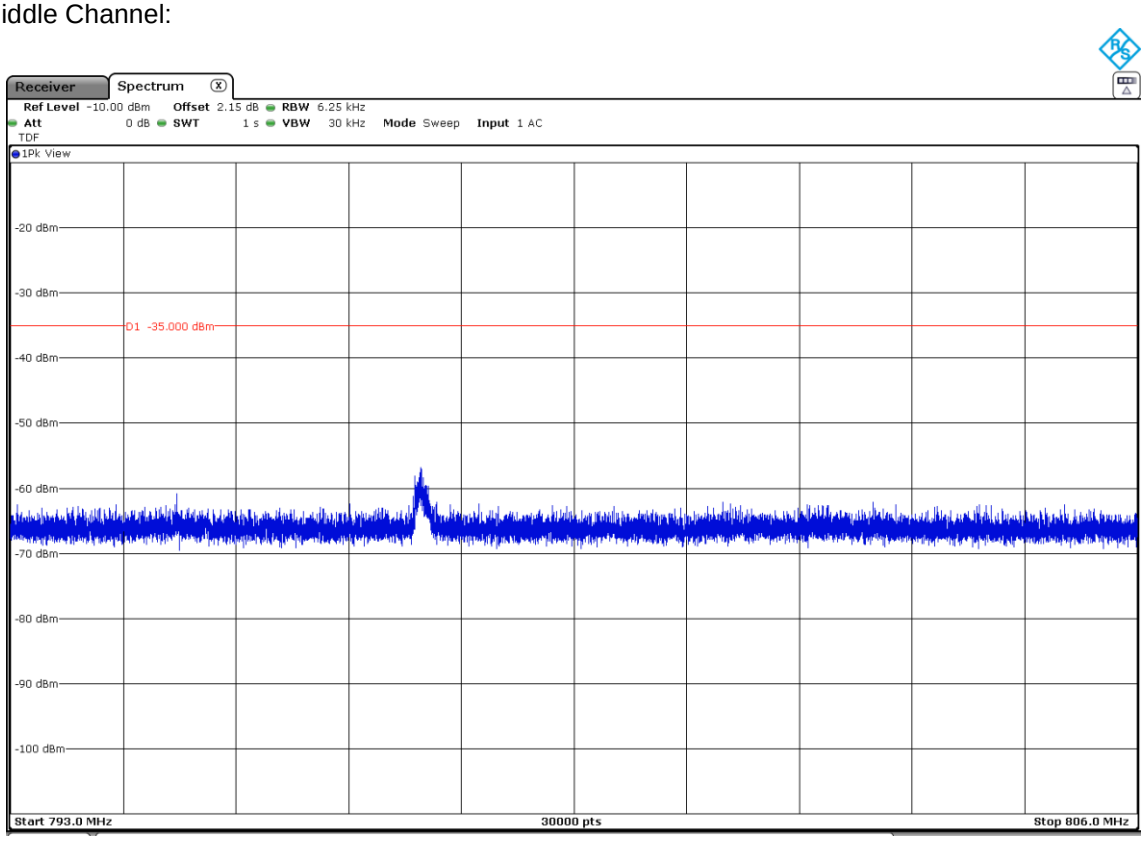


FREQUENCY RANGE 793 MHz - 806 MHz (worst case):

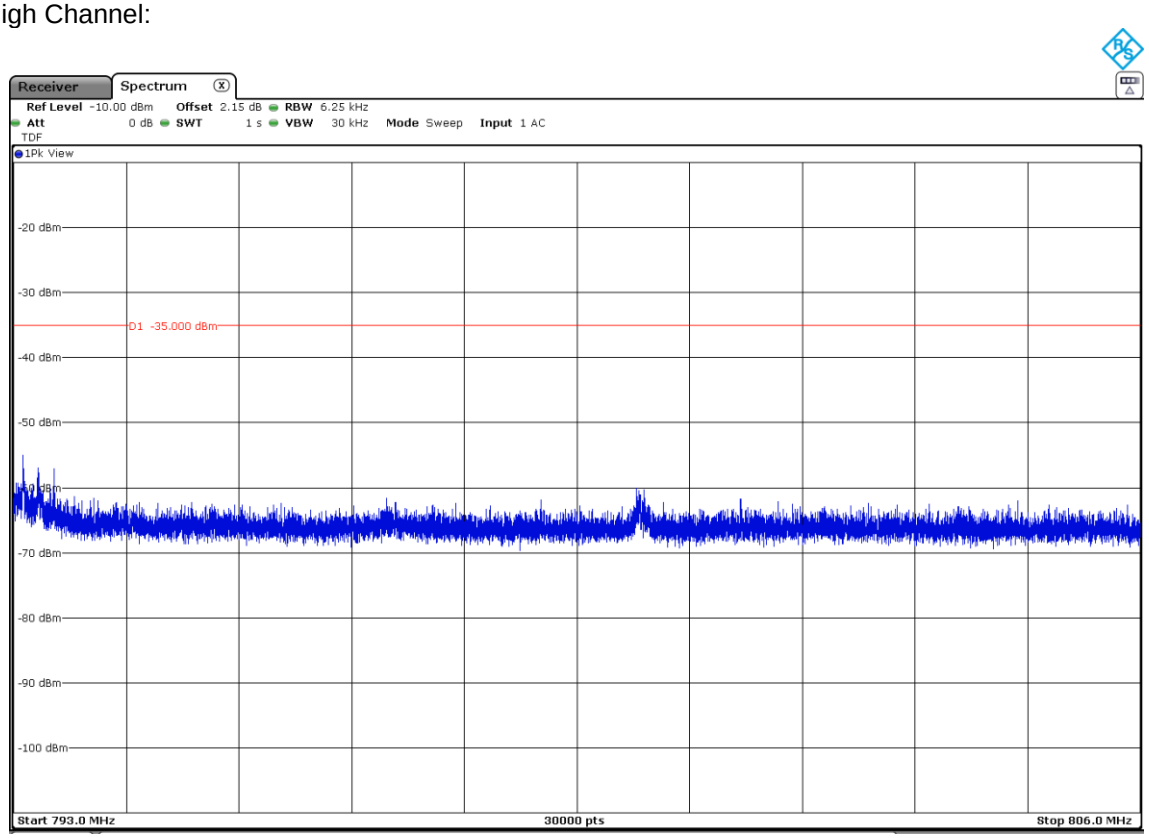
- Low Channel:



- Middle Channel:

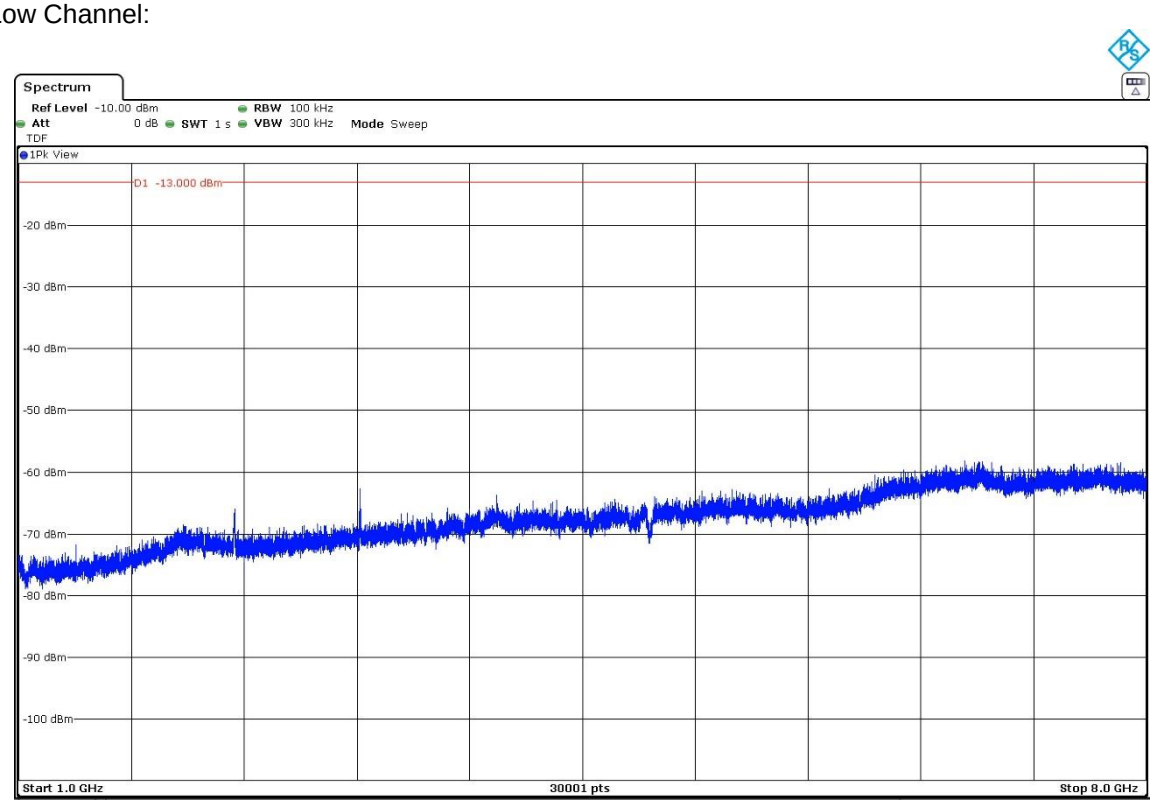


- High Channel:

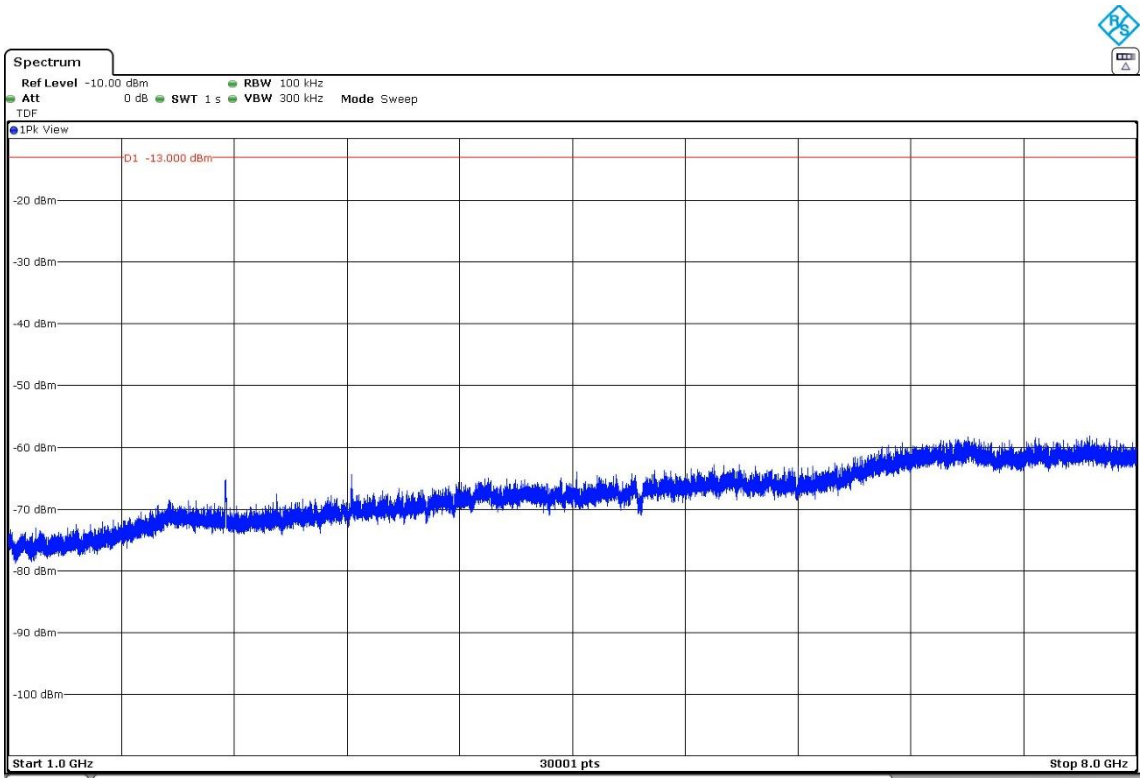


FREQUENCY RANGE 1 GHz - 8 GHz (worst case):

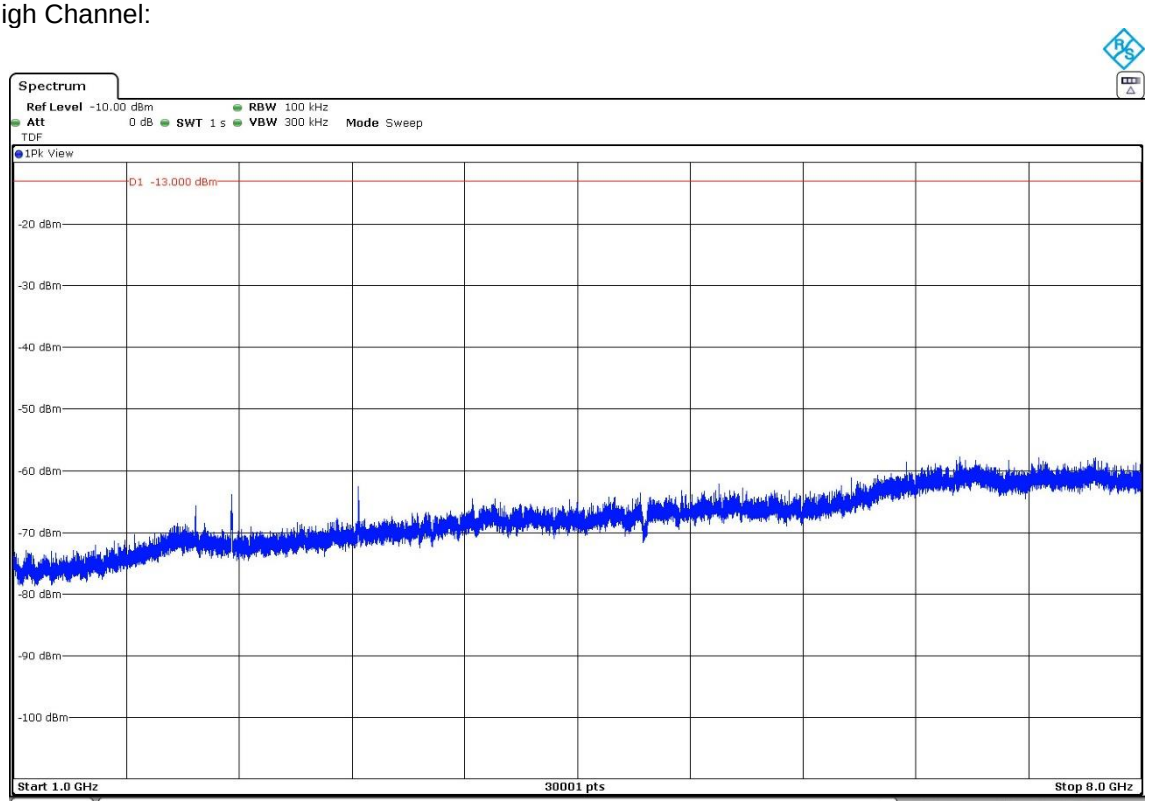
- Low Channel:



- Middle Channel:

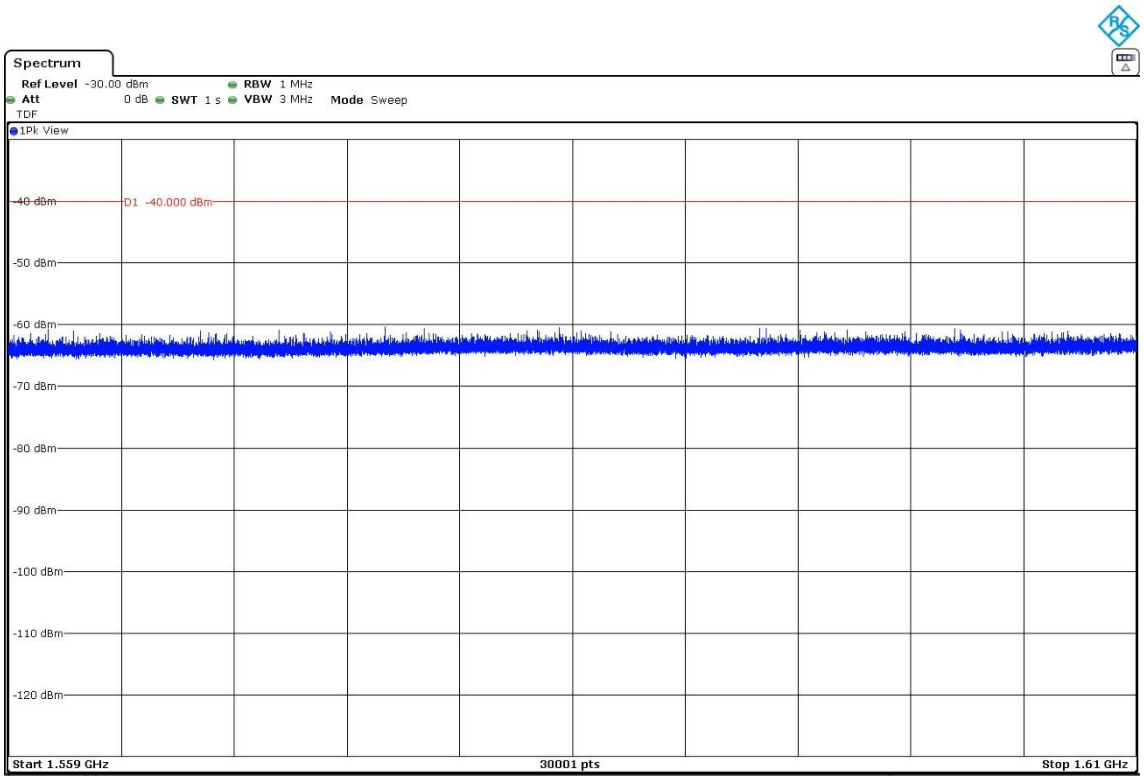


- High Channel:

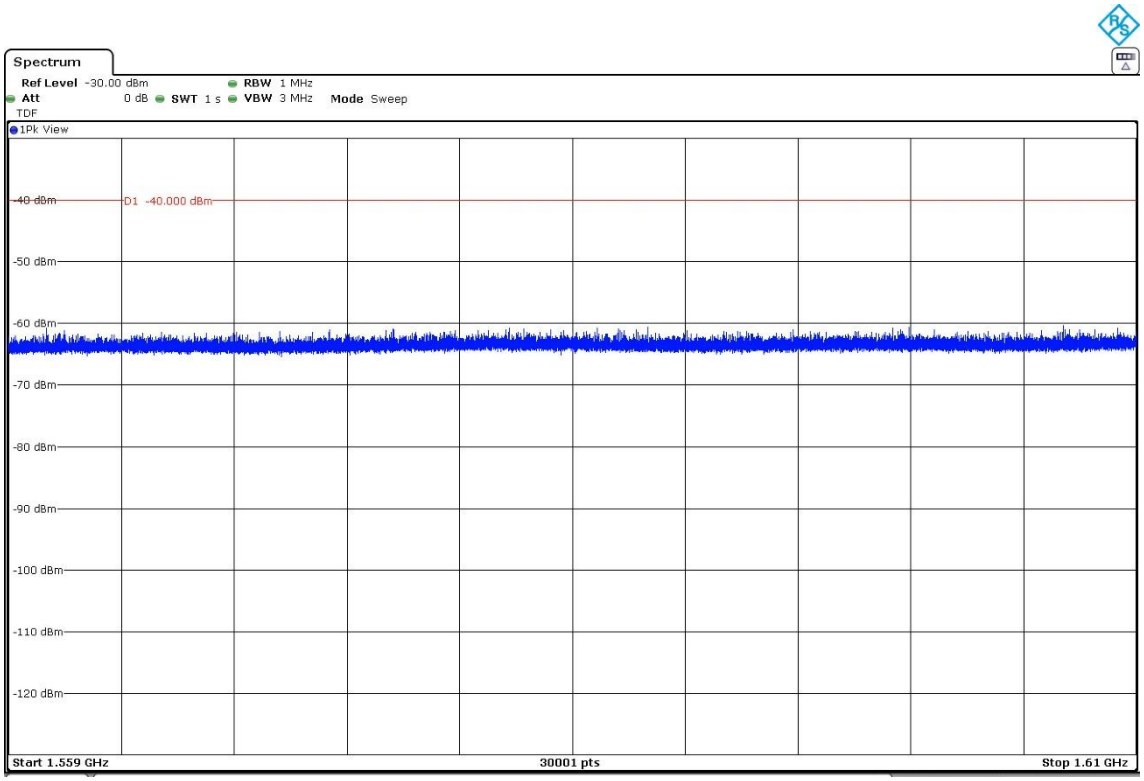


FREQUENCY RANGE 1559 MHz - 1610 MHz (worst case):

- Low Channel:



- Middle Channel:



- High Channel: