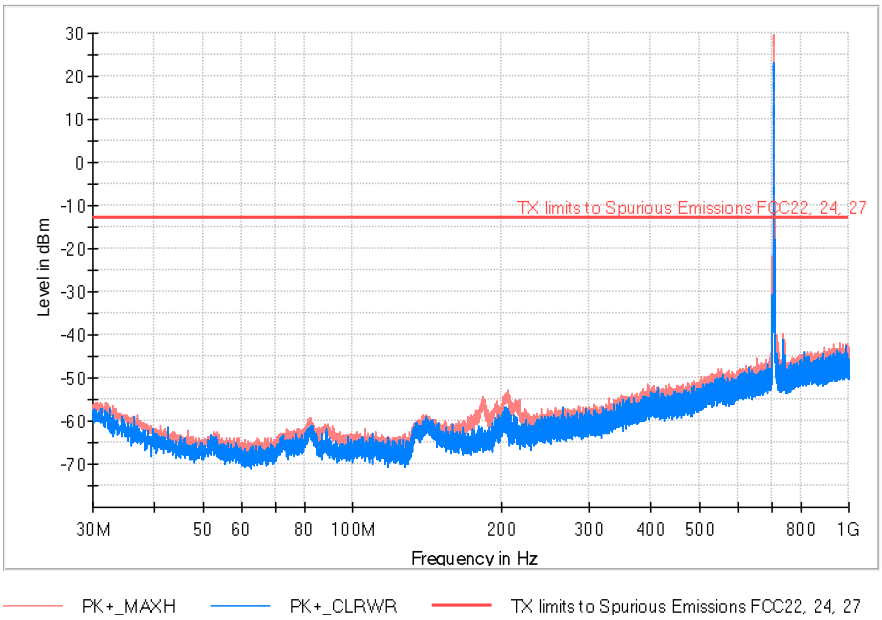
TEST RESULTS (Cont):	Middle Channel

FREQUENCY RANGE: 30-1000 MHz

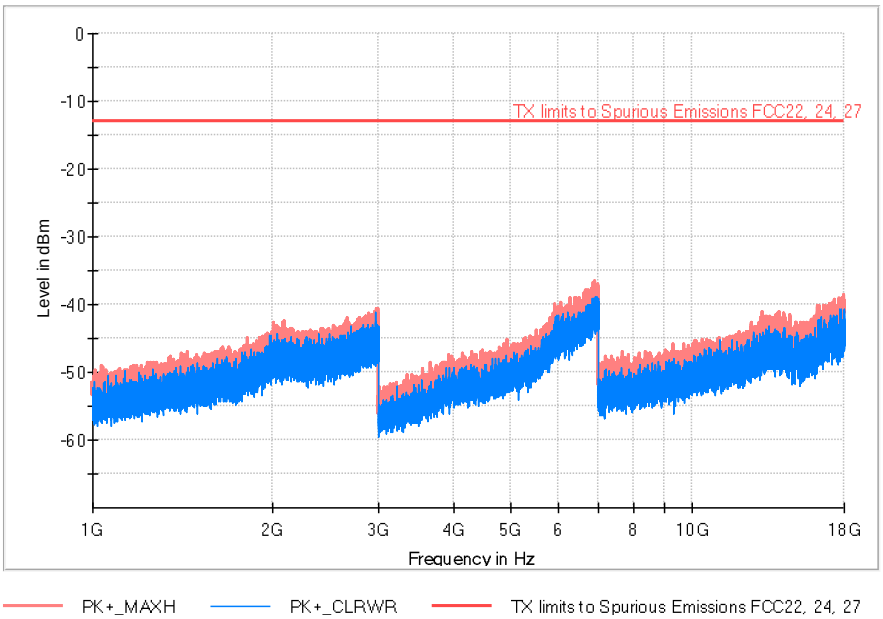
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
82.606333	-62.88	-59.40	
183.389333	-64.28	-54.25	
205.408333	-59.04	-52.85	
705.411000	22.66	29.75	Fundamental
737.356333	-44.09	-39.81	



TEST RESULTS (Cont):	Middle Channel

FREQUENCY RANGE: 1-18 GHz

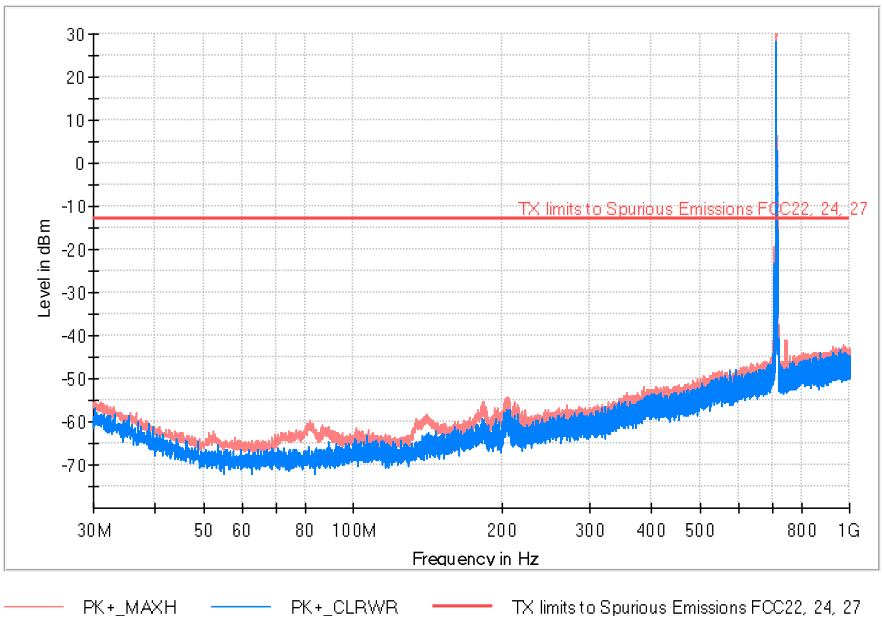
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)
1427.666667	-54.99	-47.49
2099.333333	-46.94	-42.60
3562.500000	-53.75	-49.65
6892.000000	-41.25	-36.48



TEST RESULTS(Cont.):	High Channel

FREQUENCY RANGE: 30-1000 MHz

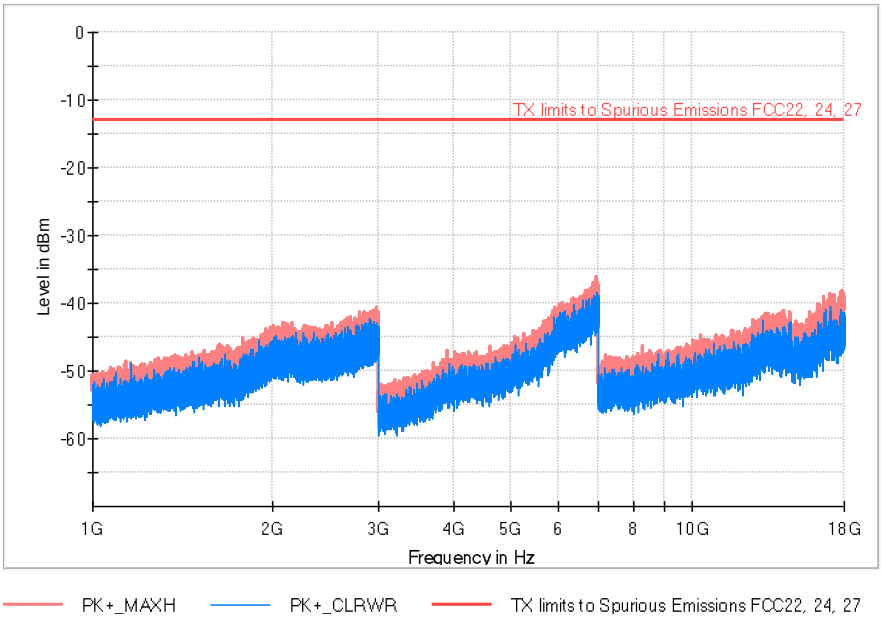
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
82.153667	-67.84	-59.70	
182.710333	-63.96	-55.45	
205.052667	-57.50	-54.32	
711.457333	27.71	30.72	Fundamental
744.049333	-51.10	-40.90	



TEST RESULTS (Cont):	High Channel

FREQUENCY RANGE: 1-18 GHz

Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)
1431.000000	-51.51	-47.82
2150.800000	-46.59	-43.00
6961.500000	-41.50	-36.17



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#04 (Band 13)
TEST RESULTS:	PASS

RESULTS

A preliminary scan determined the QPSK 5 MHz bandwidth as the worst case. The configuration of Resource Blocks which is the worst case for conducted power was used.

The following plots show the results for this configuration.

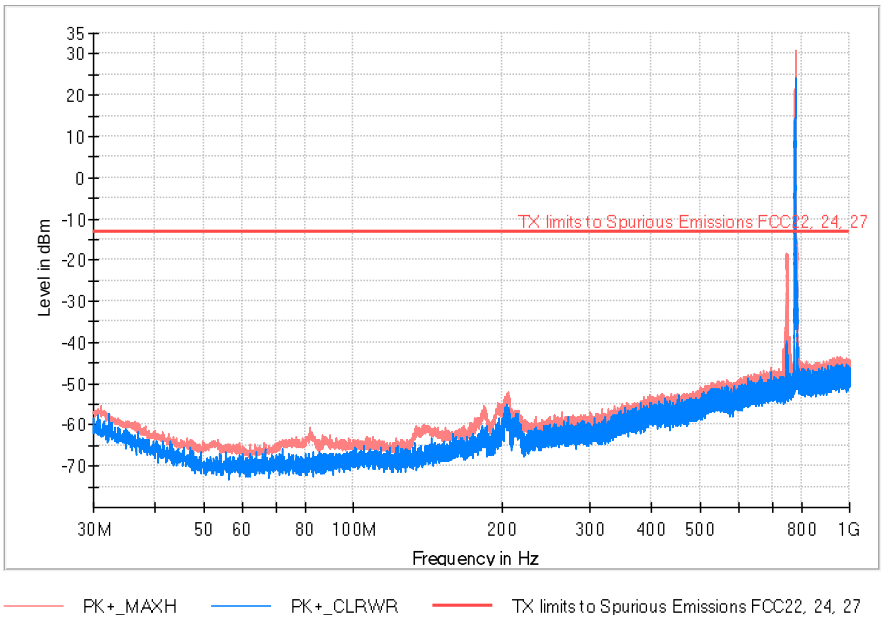
No spurious signal was found at less than 20dB respect to the limit in all the frequency ranges.

LTE QPSK MODULATION. RB = 1. Offset = 0. BW = 5 MHz

TEST RESULTS (Cont):	Low Channel

FREQUENCY RANGE: 30-1000 MHz

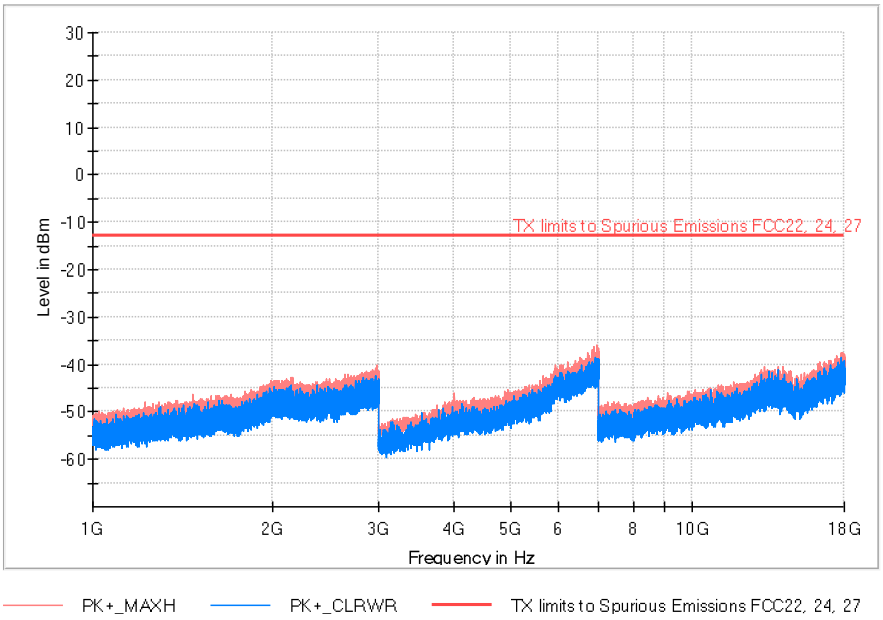
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
81.959667	-70.8	-60.7	
183.712667	-62.3	-55.4	
205.634667	-59.6	-52.2	
747.024000	-42.9	-18.2	
777.320333	23.1	30.8	Fundamental



TEST RESULTS (Cont):	Low Channel

FREQUENCY RANGE: 1-18 GHz

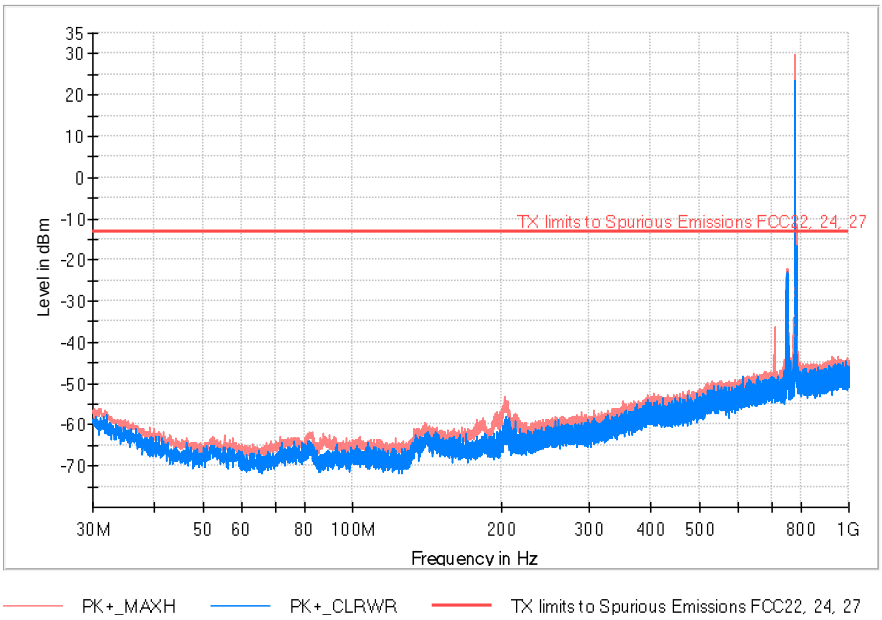
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)
2986.200000	-46.88	-40.06
4022.500000	-52.19	-46.10
6965.000000	-42.40	-35.92
13264.500000	-46.33	-40.40



TEST RESULTS (Cont):	Middle Channel

FREQUENCY RANGE: 30-1000 MHz

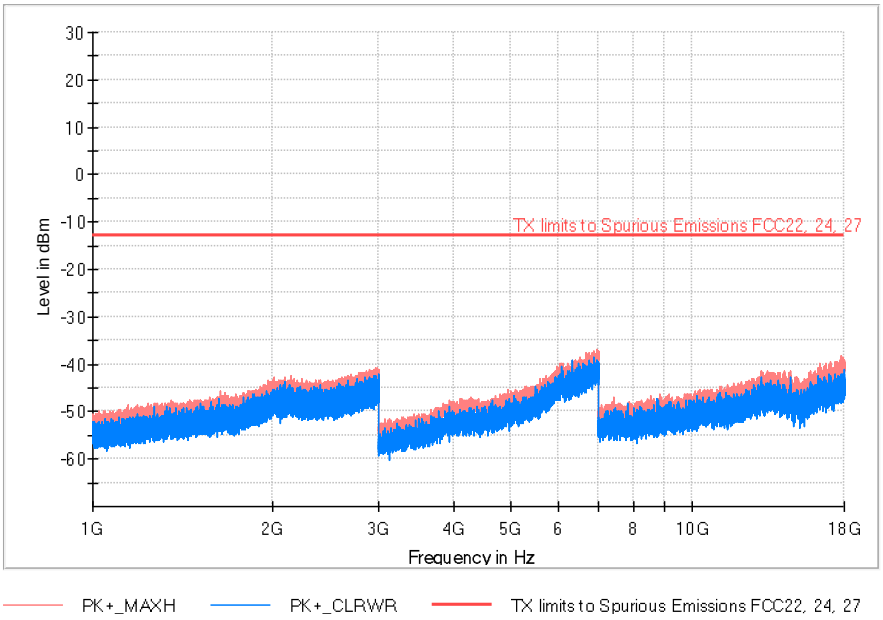
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
202.175000	-61.9	-53.0	
710.131667	-50.3	-36.3	
751.389000	-27.5	-22.0	
779.810000	23.6	29.8	Fundamental
783.463667	-32.2	-11.2	



TEST RESULTS (Cont):	Middle Channel

FREQUENCY RANGE: 1-18 GHz

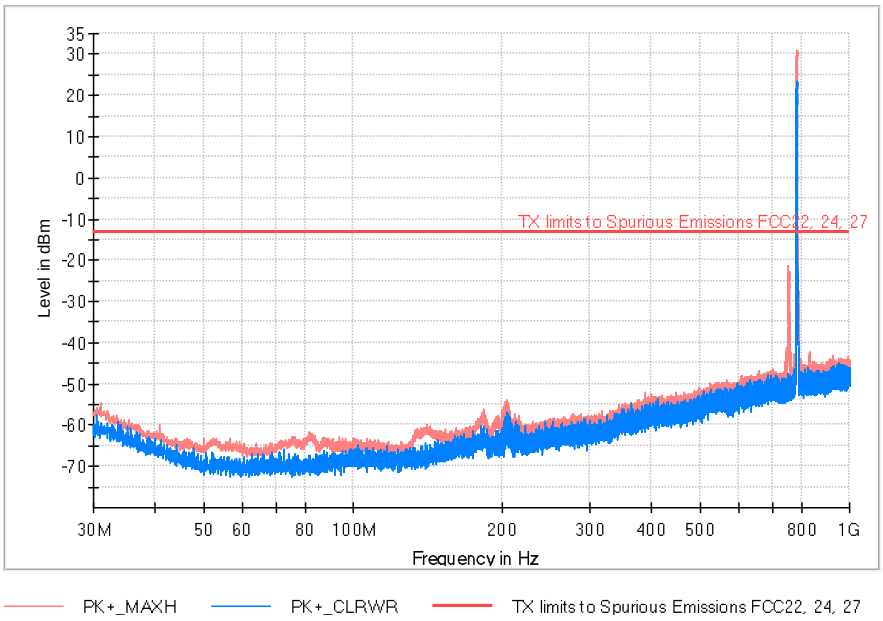
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)
2991.800000	-44.84	-40.73
6967.000000	-42.72	-36.86
17766.000000	-46.24	-38.21



TEST RESULTS(Cont.):	High Channel

FREQUENCY RANGE: 30-1000 MHz

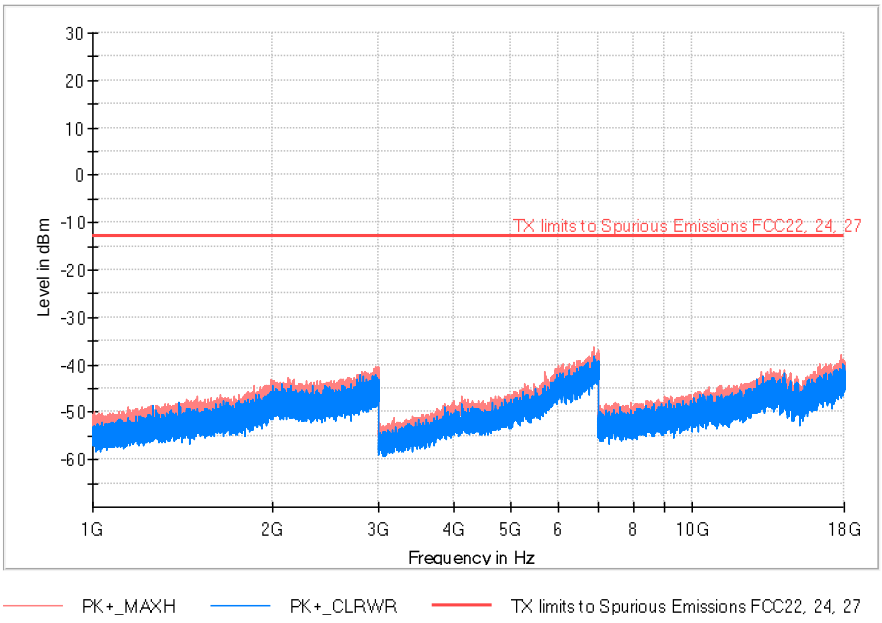
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
204.503000	-57.7	-53.9	
753.232000	-50.2	-21.4	
782.267333	21.8	31.0	Fundamental
832.772000	-48.2	-42.2	



TEST RESULTS (Cont):	High Channel

FREQUENCY RANGE: 1-18 GHz

Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)
2963.333333	-47.80	-40.36
6879.000000	-41.04	-36.33
17742.500000	-43.00	-37.74



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#05 (Band 66)
TEST RESULTS:	PASS

RESULTS

A preliminary scan determined the QPSK 15 MHz bandwidth as the worst case. The configuration of Resource Blocks which is the worst case for conducted power was used.

The following plots show the results for this configuration.

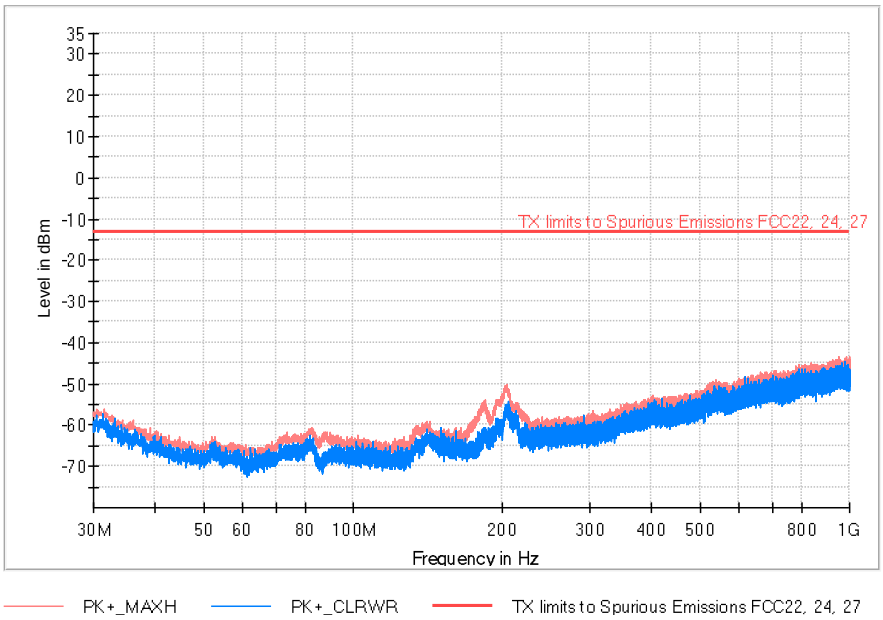
No spurious signal was found at less than 20dB respect to the limit in all the frequency ranges.

LTE QPSK MODULATION. RB = 1. Offset = 0. BW = 15 MHz

TEST RESULTS (Cont):	Low Channel

FREQUENCY RANGE: 30-1000 MHz

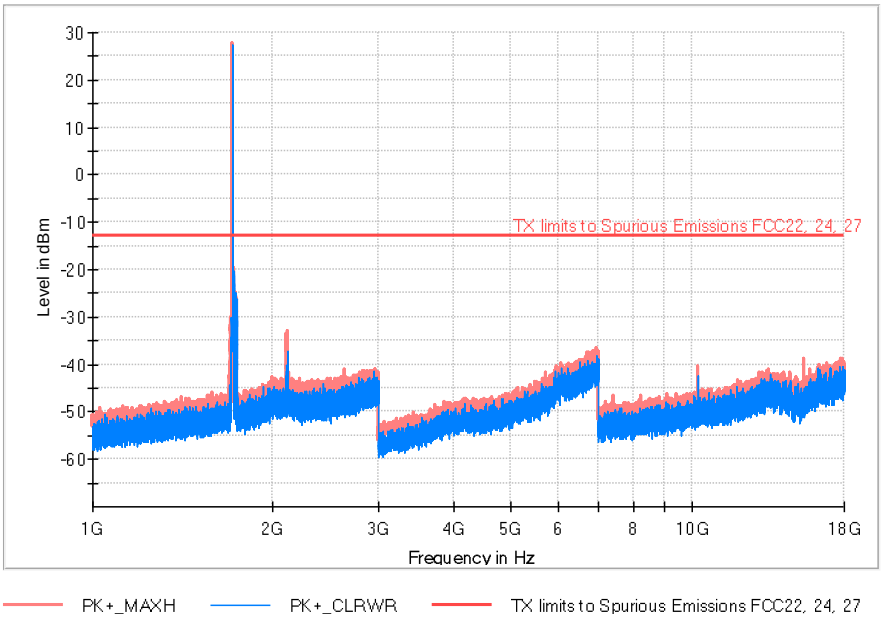
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
82.315333	-63.56	-60.70	
141.808667	-62.69	-59.87	
184.100667	-62.14	-53.99	
204.632333	-57.22	-50.30	



TEST RESULTS (Cont):	Low Channel

FREQUENCY RANGE: 1-18 GHz

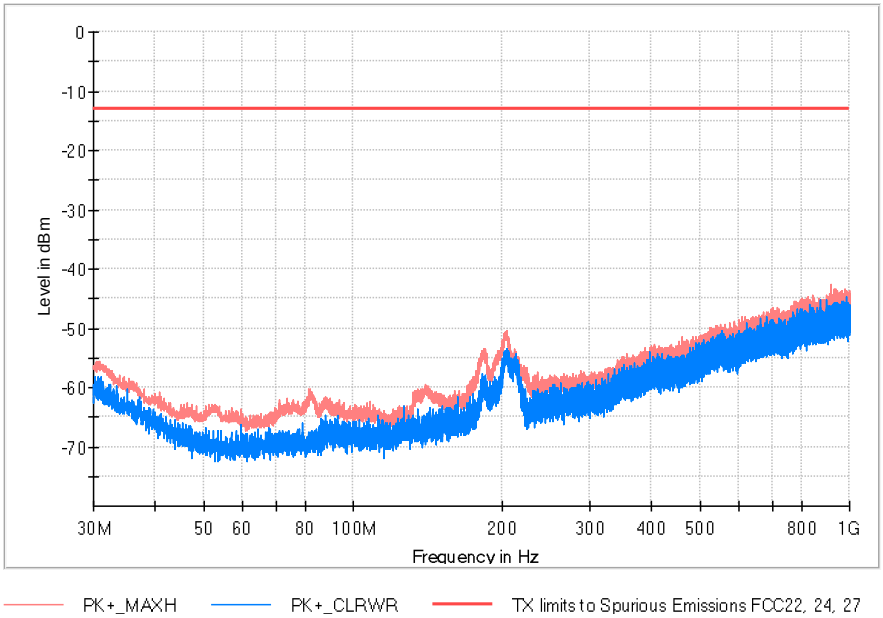
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
1710.800000	26.26	27.61	Fundamental
2112.266667	-42.59	-32.87	
10265.500000	-45.04	-40.58	
15397.500000	-45.85	-38.74	



TEST RESULTS(Cont.):	Middle Channel

FREQUENCY RANGE: 30-1000 MHz

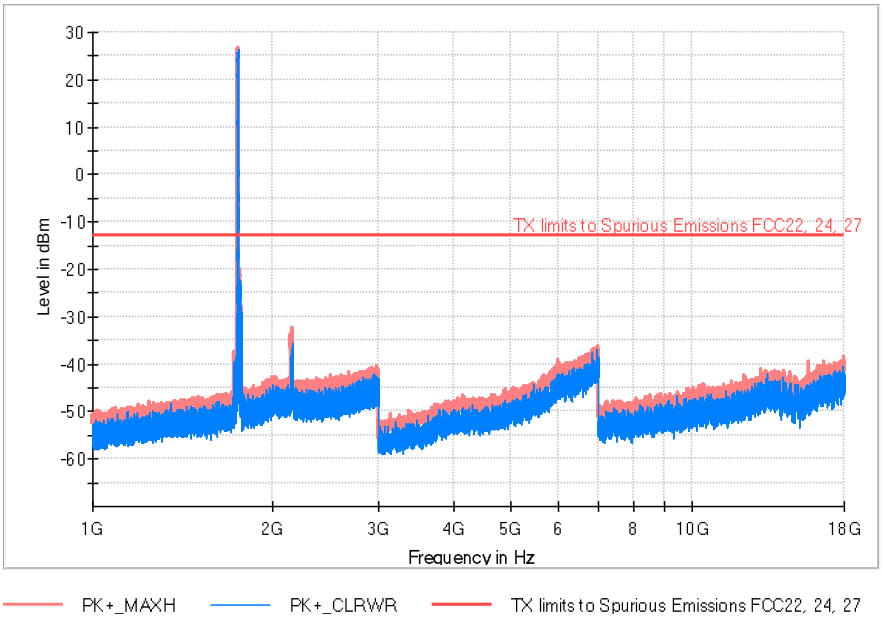
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
81.927333	-69.27	-60.57	
184.165333	-59.21	-53.39	
204.438333	-54.34	-50.45	
919.942667	-46.97	-42.54	



TEST RESULTS (Cont):	Middle Channel

FREQUENCY RANGE: 1-18 GHz

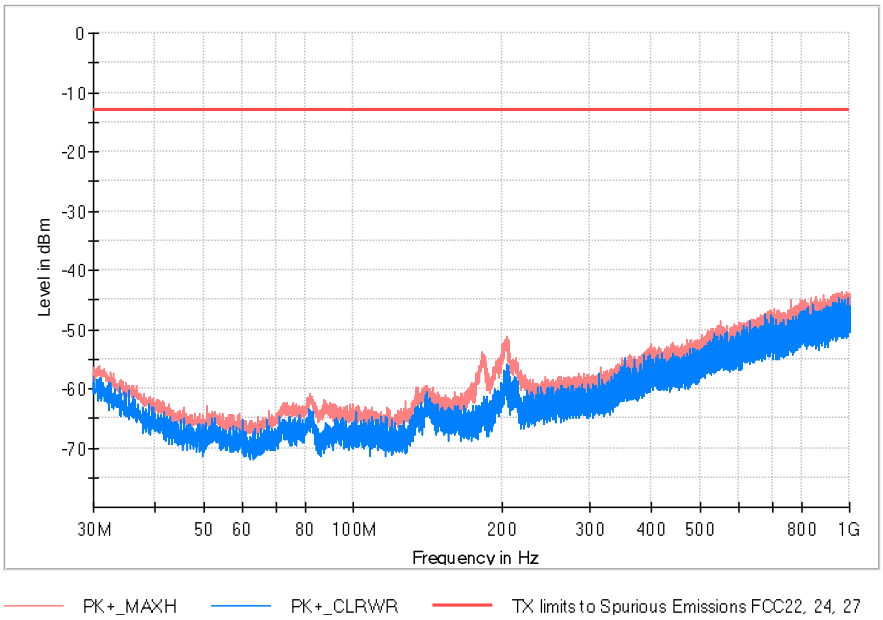
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
1748.333333	26.39	26.73	Fundamental
2156.266667	-41.39	-32.38	
15735.000000	-45.17	-39.46	



TEST RESULTS(Cont.):	High Channel

FREQUENCY RANGE: 30-1000 MHz

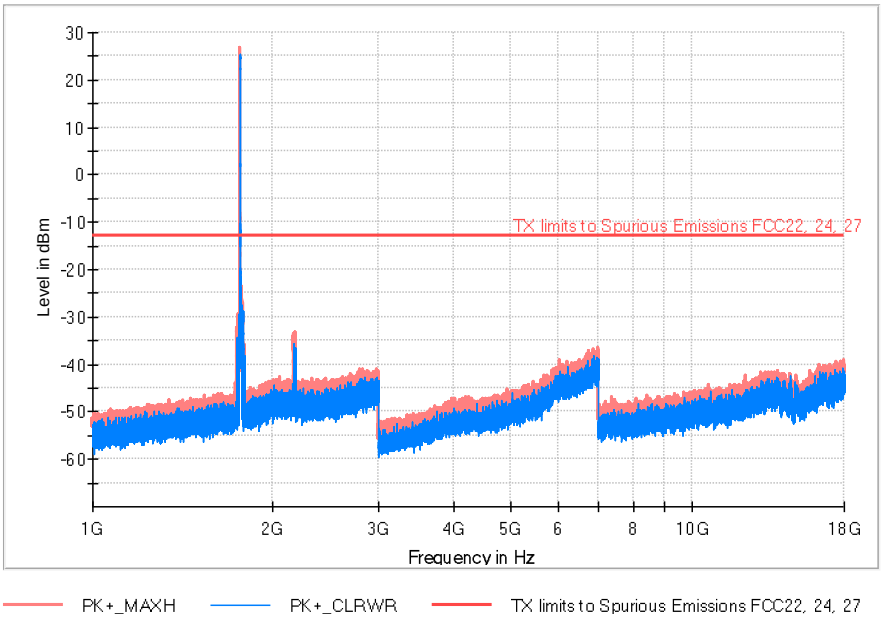
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
81.733333	-65.05	-61.00	
182.354667	-63.23	-53.85	
203.403667	-59.02	-51.27	



TEST RESULTS (Cont):	High Channel

FREQUENCY RANGE: 1-18 GHz

Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
1765.866667	25.17	26.67	Fundamental
2177.533333	-39.50	-33.30	



Appendix B: Test Results for 3G

Appendix B Content

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PRODUCT INFORMATION

The following information is provided by the client

Information	Description
Modulation	WCDMA
Maximum RF Output Power	23.5 dBm
Operation mode:	
- Operating Frequency Range	Band 4: 1710-1755 MHz
- Nominal Channel Bandwidth	Band 4: 5 MHz
Extreme operating conditions	
- Temperature range	T_{nom} = +15 to + 35 T_{min} = -30 T_{max} = +50
Antenna type	External Antenna.
Antenna gain	2 dBi
Nominal Voltage	
- Supply Voltage	12 Vdc
- Type of power source	DC voltage from power supply.

DESCRIPTION OF TEST CONDITIONS

The worst case was found when positioned as the table below. Following channel(s) was (were selected for the final test as listed below:

<table>
<tr><th>TEST CONDITIONS</th><th>DESCRIPTION</th></tr>
<tr><td>TC#01
Band 4</td><td>
<u>Power supply (V):</u>
$V_{nominal}$ = 12 Vdc

<u>Test Frequencies for Conducted tests:</u>

-Lowest Channel: 1313 (1712.6 MHZ)
-Middle Channel: 1450 (1740 MHz)
-Highest Channel: 1512 (1752.4 MHz)

<u>Test Frequencies for Radiated tests:</u>
<table>
<tr><th>Available Frequencies</th><th>Tested Frequency</th><th>Channel Bandwidth</th><th>Modulation</th></tr>
<tr><td>1710 to 1755 MHz</td><td>1712.6 MHz
1740 MHz
1752.4 MHz</td><td>5 MHz</td><td>WCDMA</td></tr>
</table>
Note: This device was tested under all channels and modulations. The worst case found in WCDMA modulation.
</td></tr>
</table>

TEST B.1: RF OUTPUT POWER

LIMITS:	Product standard:	FCC Part 27 / IC RSS-199
	Test standard:	FCC §2.1046 and §27.50 / RSS-199 Clause 4.4

LIMITS

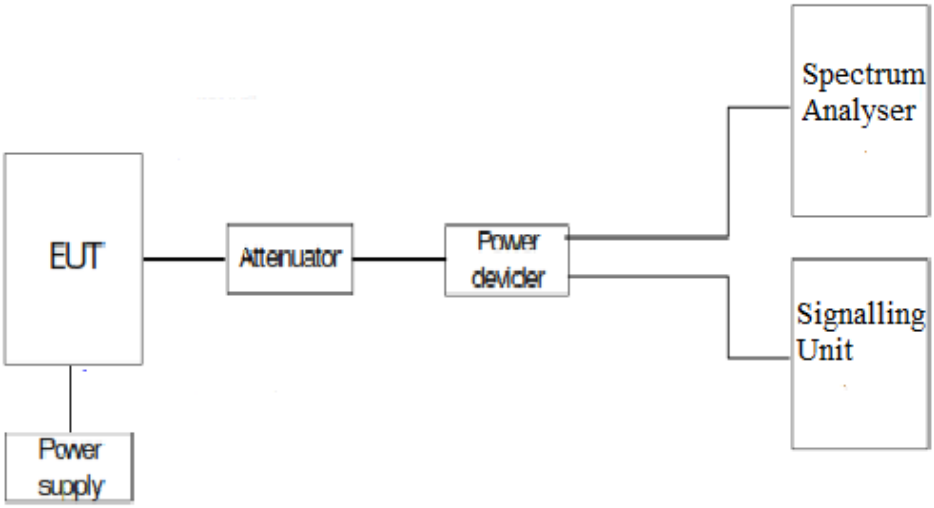
Fixed. mobile. and portable (hand-held) stations operating in the band are limited to 1-watt EIRP (30 dBm). Fixed stations operating in the band are limited to a maximum antenna height of 10 meters above ground. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.
The peak-to-average ratio (PAR) of the transmission shall not exceed 13 dB.

RSS-199 Clause 6.5

The equivalent isotopically radiated power (e.i.r.p.) for mobile and portable transmitters shall not exceed two watts.

The peak-to-average power ratio (PAPR) of the transmission shall not exceed 13 dB.

TEST SETUP



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

WCDMA Modulation:

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)	PAPR (dB)
Lowest	22.71	2.0	24.71	3.33
Middle	22.61	2.0	24.61	3.30
Highest	22.56	2.0	24.56	3.36
Measurement uncertainty (dB)			<±0.95	

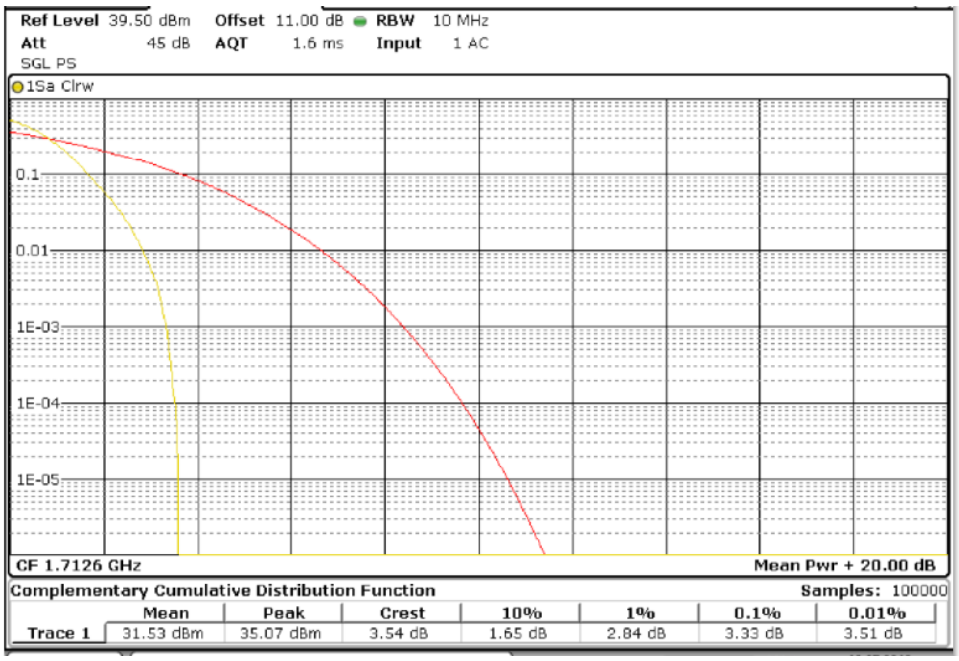
HSPA Modulation:

Channel	Average power at antenna port (dBm)	Maximum declared antenna gain (dBi)	Maximum E.I.R.P. average power (dBm)
Lowest	21.25	2.0	23.25
Middle	20.81	2.0	22.81
Highest	20.48	2.0	22.48
Measurement uncertainty (dB)			<±0.95

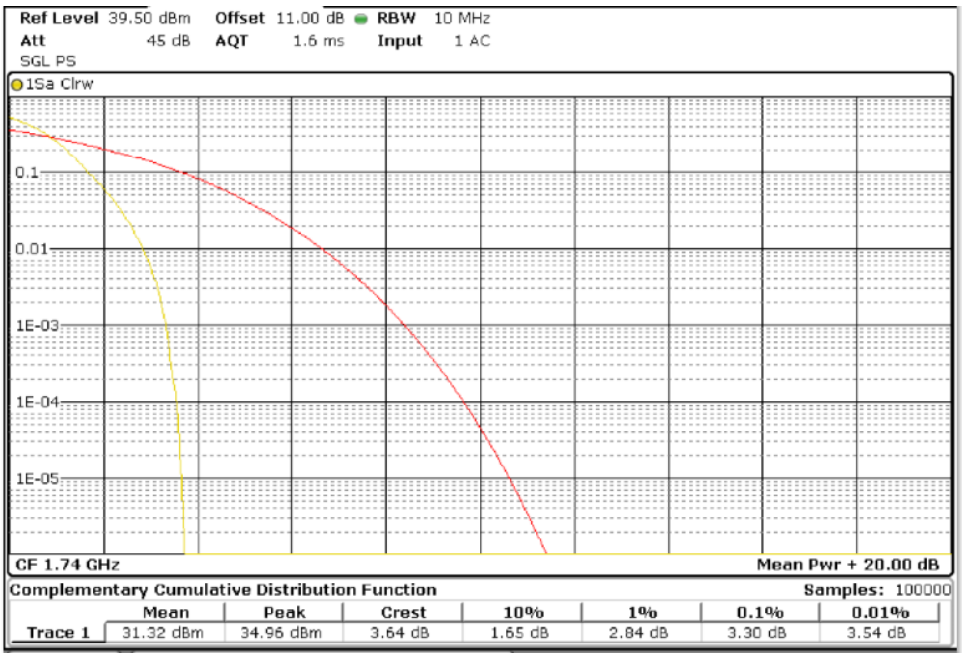
TEST RESULTS (Cont):	

WCDMA:

Lowest channel

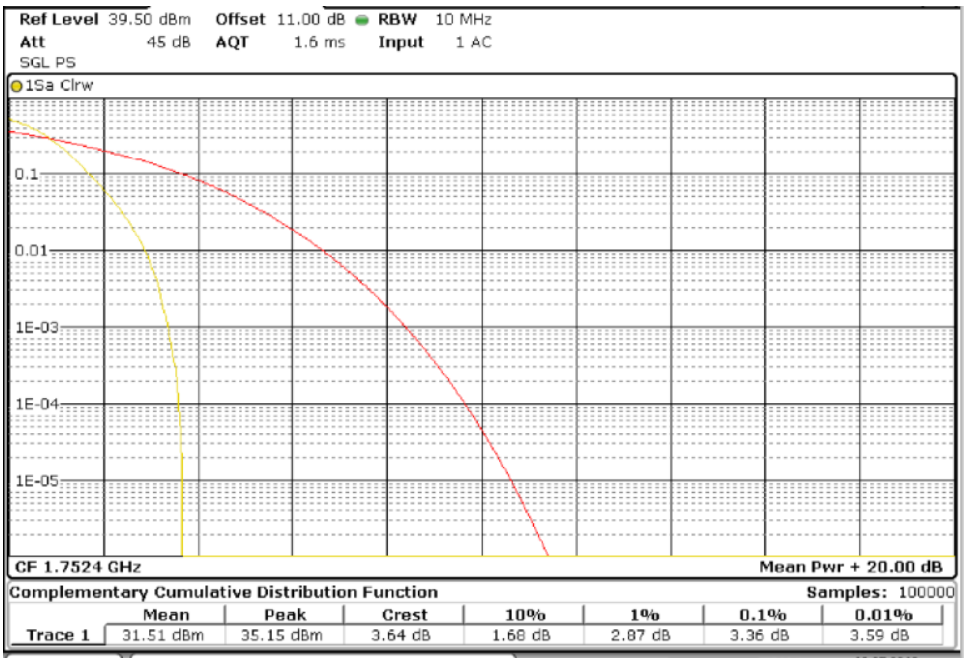


Middle channel



TEST RESULTS (Cont):	

Highest channel



TEST B.2: MODULATION CHARACTERISTICS

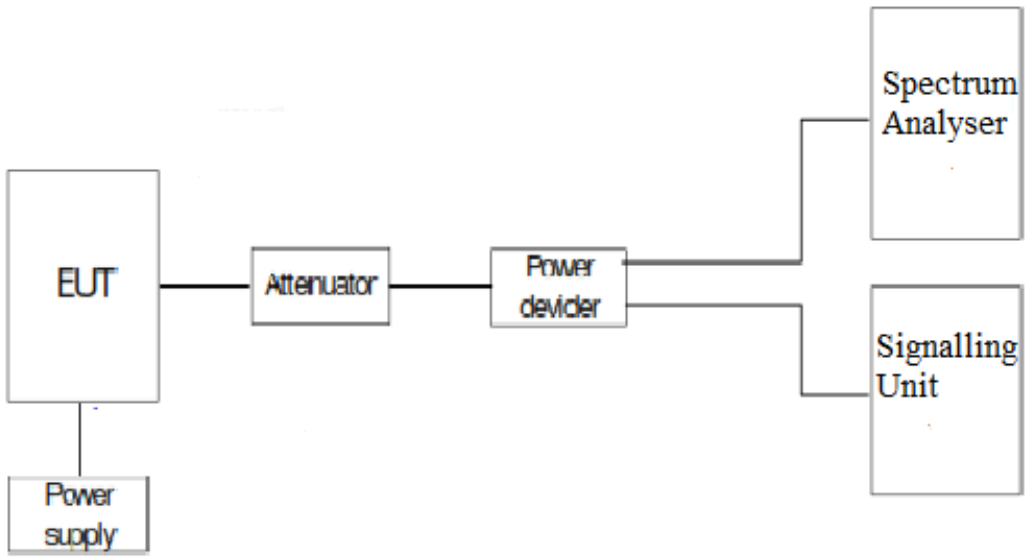
LIMITS:	Product standard:	FCC Part 27 / IC RSS-199
	Test standard:	FCC §2.1047 and §27.50 / RSS-199 Clause 4.1

LIMITS

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

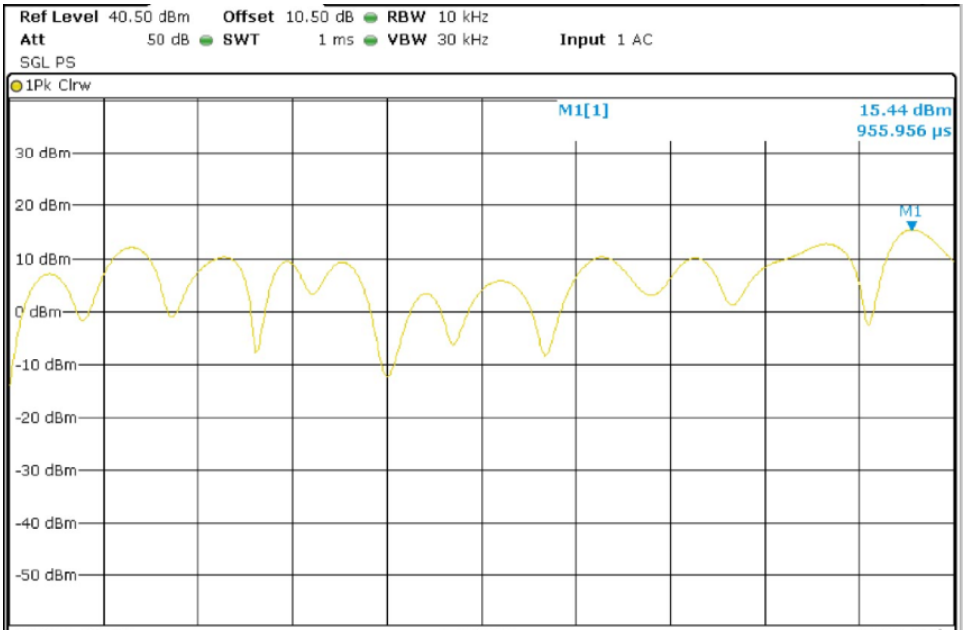
The devices shall employ digital modulation techniques.

TEST SETUP

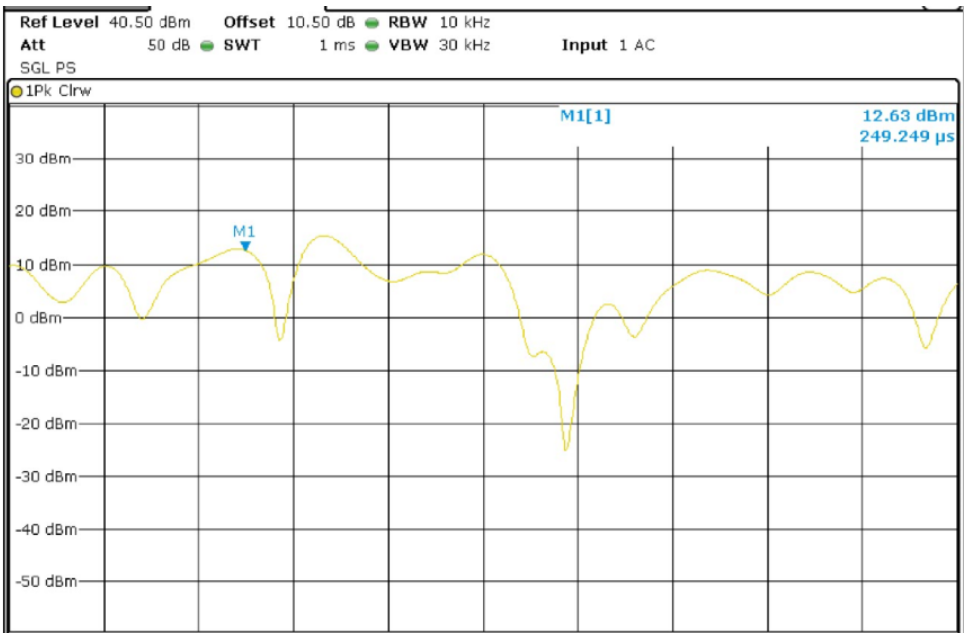


TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

WCDMA Modulation



HSPA Modulation



TEST B.3: FREQUENCY STABILITY

LIMITS:	Product standard:	FCC Part 27 / IC RSS-199
	Test standard:	FCC §2.1055 and § 27.54 / RSS-199 Clause 4.3

LIMITS

The frequency stability shall be enough to ensure that the fundamental emissions stay within the authorized bands of operation.

TEST SETUP	

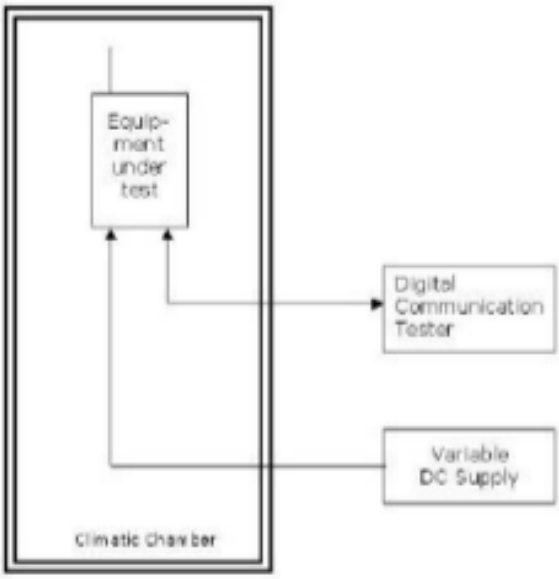
The frequency tolerance measurements over temperature variations were made over the temperature range of

–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 “call 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.

For LTE mode the QPSK modulation was used for the test as it is the worst case for conducted power.



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

GPRS MODULATION.

Frequency stability over temperature variations

Temperature (ºC)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
50	-2.32	-0.0013	-0.00000013
40	-0.83	-0.0005	-0.00000005
30	-2.56	-0.0015	-0.00000015
20	-2.78	-0.0016	-0.00000016
10	-4.04	-0.0023	-0.00000023
0	2.17	0.0012	0.00000012
-10	3.14	0.0018	0.00000018
-20	0.98	0.0006	0.00000006
-30	4.1	0.0024	0.00000024

Frequency stability over voltage variations

Battery Supply voltage	Voltage (V)	Frequency Error (Hz)	Frequency Error (ppm)	Frequency Error (%)
Vmax	13.8	-3.09	-0.0018	-0.00000018
Vmin	10.2	-1.88	-0.0011	-0.00000011

TEST B.4: OCCUPIED BANDWIDTH

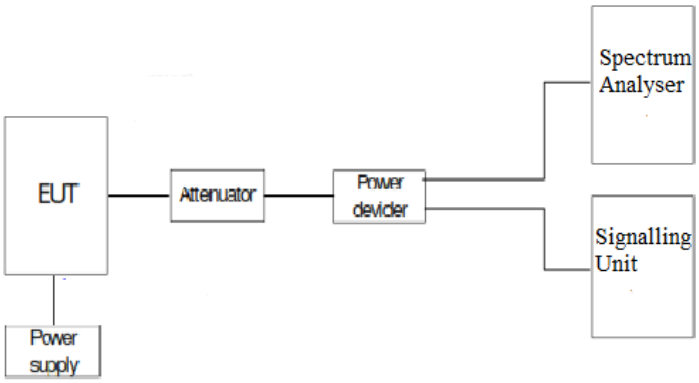
LIMITS:	Product standard:	FCC Part 27 / IC RSS-199
	Test standard:	FCC § 2.1049 / RSS-199 Clause 4.2

LIMITS

Reference only.

TEST SETUP	

The occupied bandwidth measurement was performed at the output terminals of the EUT using an attenuator, power splitter and spectrum analyzer. The EUT was controlled via the Universal Radio Communication Tester R&S CMW500 selecting maximum transmission power of the EUT and different modes of modulation. The 99% occupied bandwidth and the -26 dBc bandwidth were measured directly using the built-in bandwidth measuring option of spectrum analyzer.



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

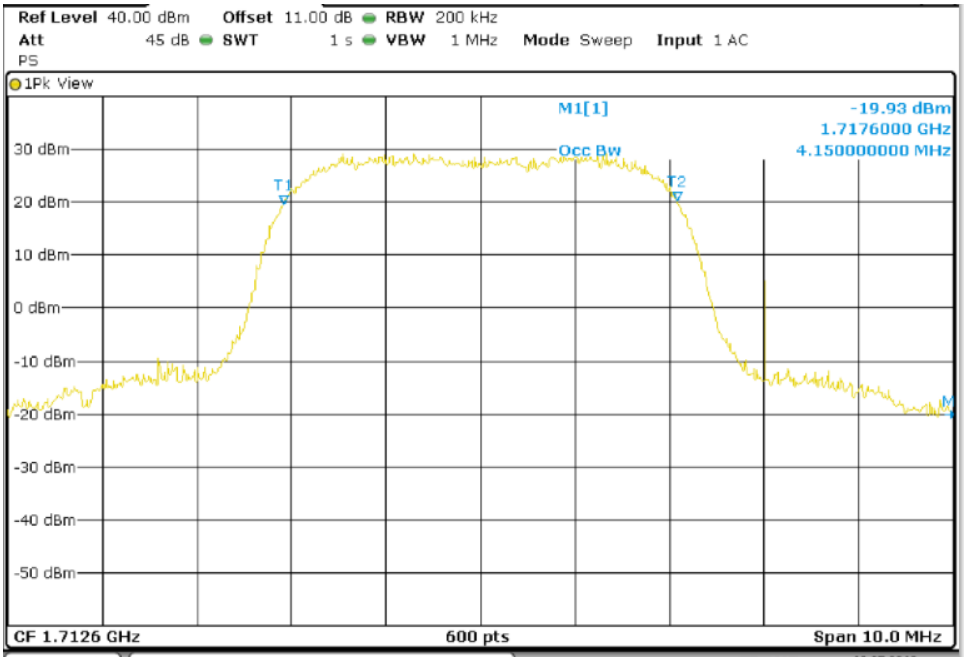
WCDMA MODULATION.

Channel	Lowest	Middle	Highest
99% Occupied bandwidth (kHz)	4.15	4.15	4.15
-26 dBc bandwidth (kHz)	4.69	4.70	4.69

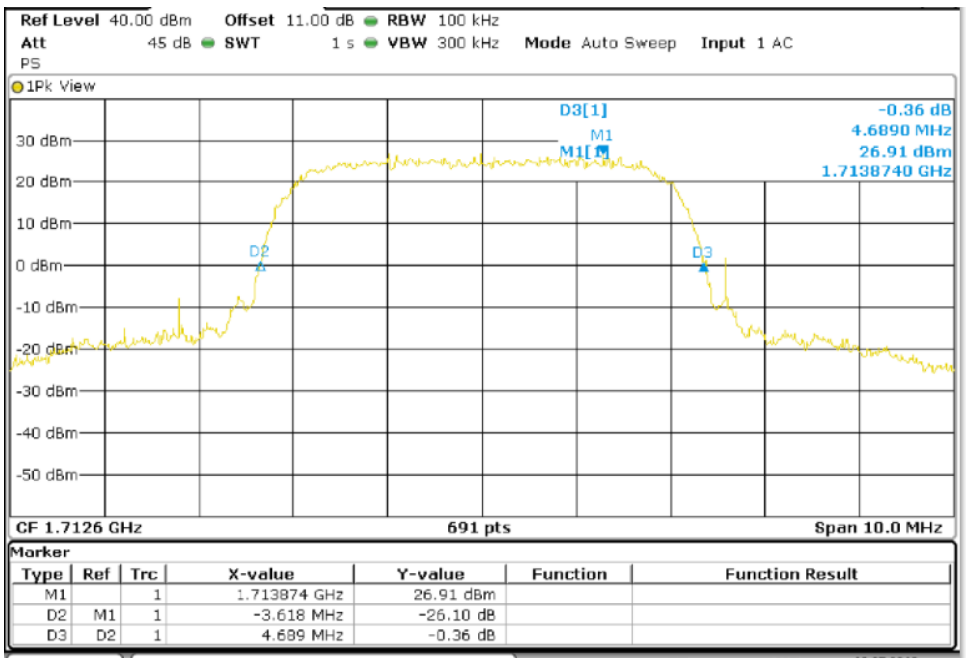
TEST RESULTS (Cont):	

WCDMA MODULATION.

Lowest Channel 99% Occupied Bandwidth

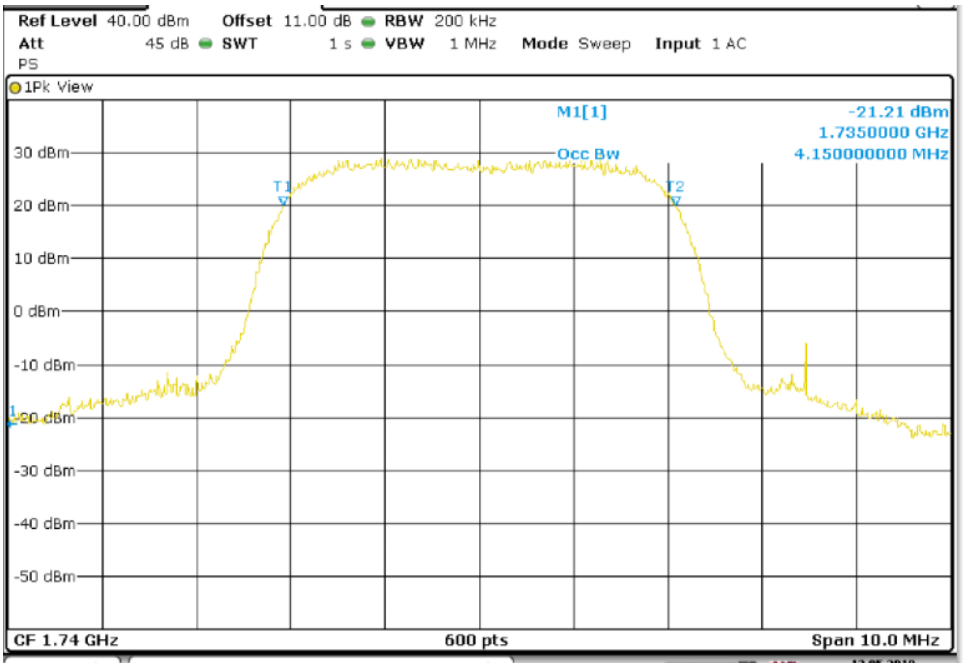


Lowest Channel -26dBc Bandwidth kHz

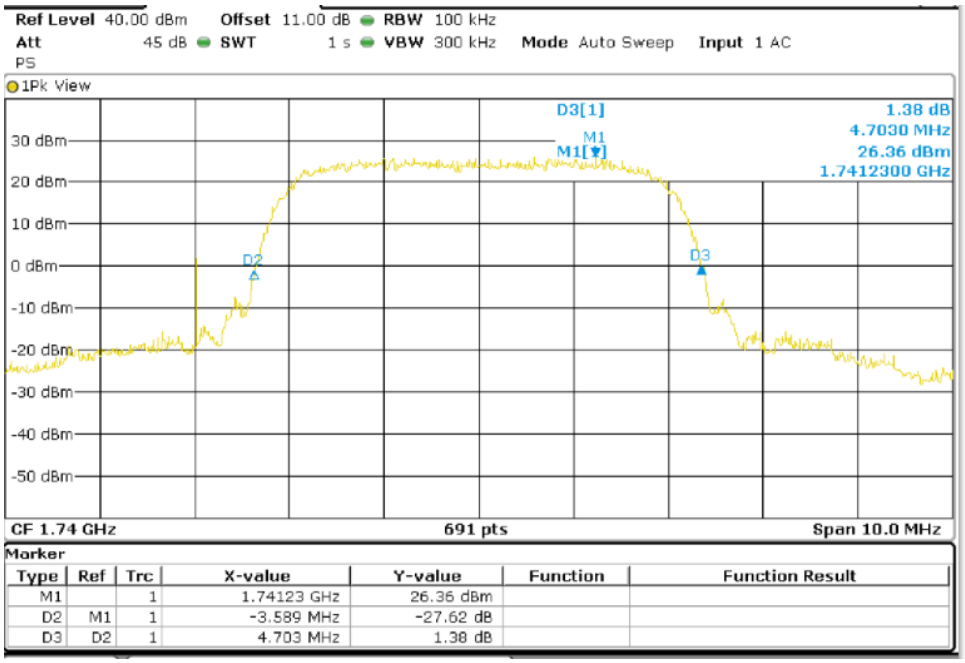


TEST RESULTS (Cont):	

Middle Channel 99% Occupied Bandwidth

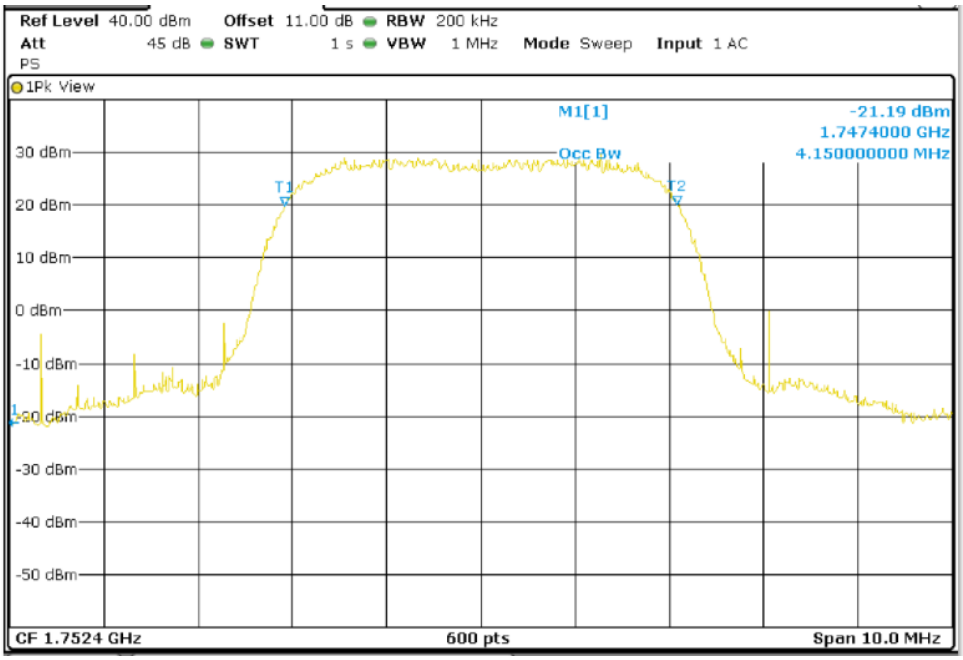


Middle Channel 26dBc Bandwidth kHz

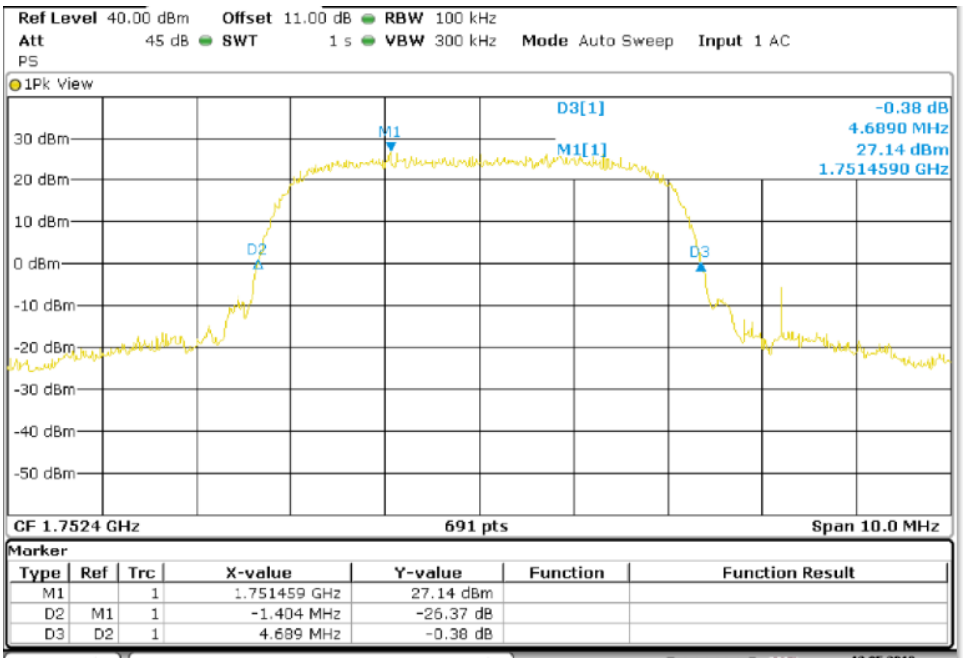


TEST RESULTS (Cont):	

Highest Channel 99% Occupied Bandwidth



Highest Channel 26dBc Bandwidth kHz



TEST B.5: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

LIMITS:	Product standard:	FCC Part 27 / IC RSS-199
	Test standard:	FCC §2.1051 and § 27.53 / RSS-199 Clause 4.5

LIMITS

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.

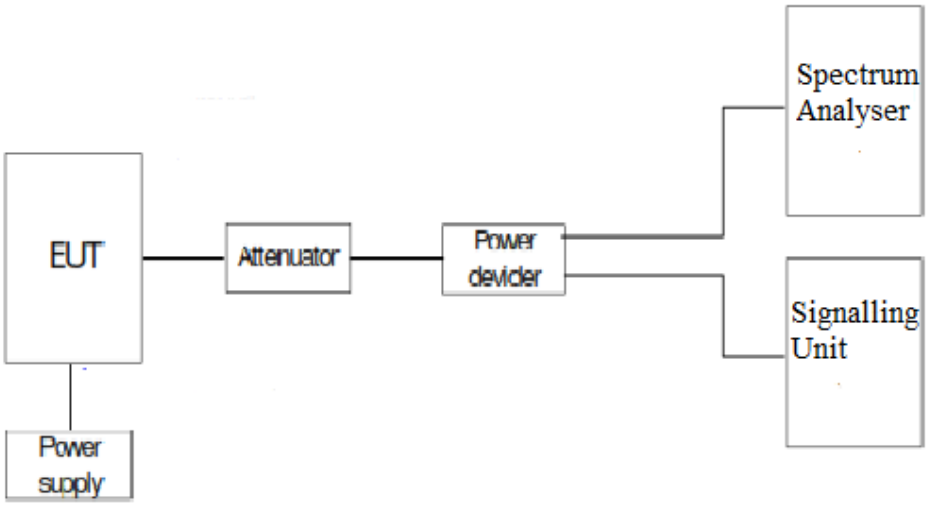
At Po transmitting power of 2 watts (33 dBm), the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative to Po becomes:

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

TEST SETUP

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

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



TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

Frequency range 9 KHz – 26 GHz

WCDMA MODULATION.

Lowest Channel

Spurious frequency (MHz)	Level (dBm)	Measurement uncertainty (dB)
2112.81	-23.48	< ± 1.20

Middle Channel

Spurious frequency (MHz)	Level (dBm)	Measurement uncertainty (dB)
2139.69	-23.28	< ± 1.20

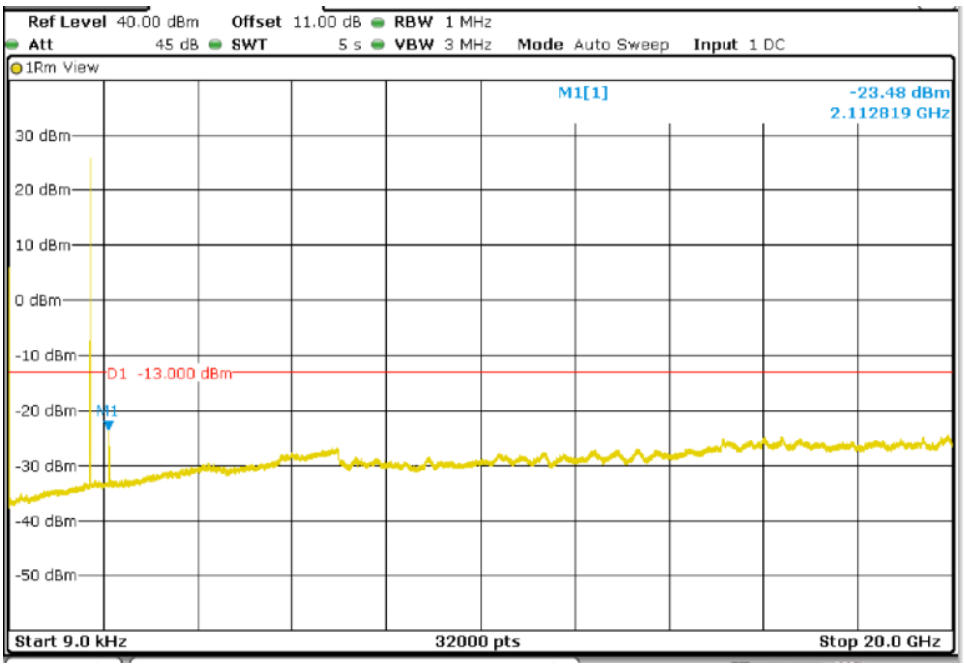
Highest Channel

Spurious frequency (MHz)	Level (dBm)	Measurement uncertainty (dB)
2151.56	-23.56	< ± 1.20

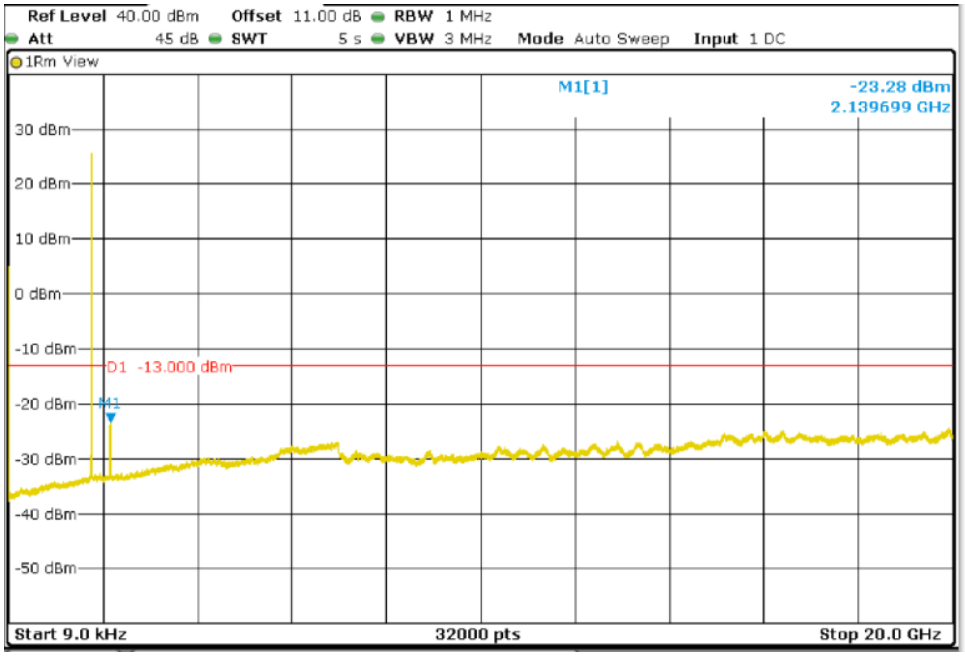
TEST RESULTS (Cont.):	

WCDMA MODULATION.

Lowest Channel

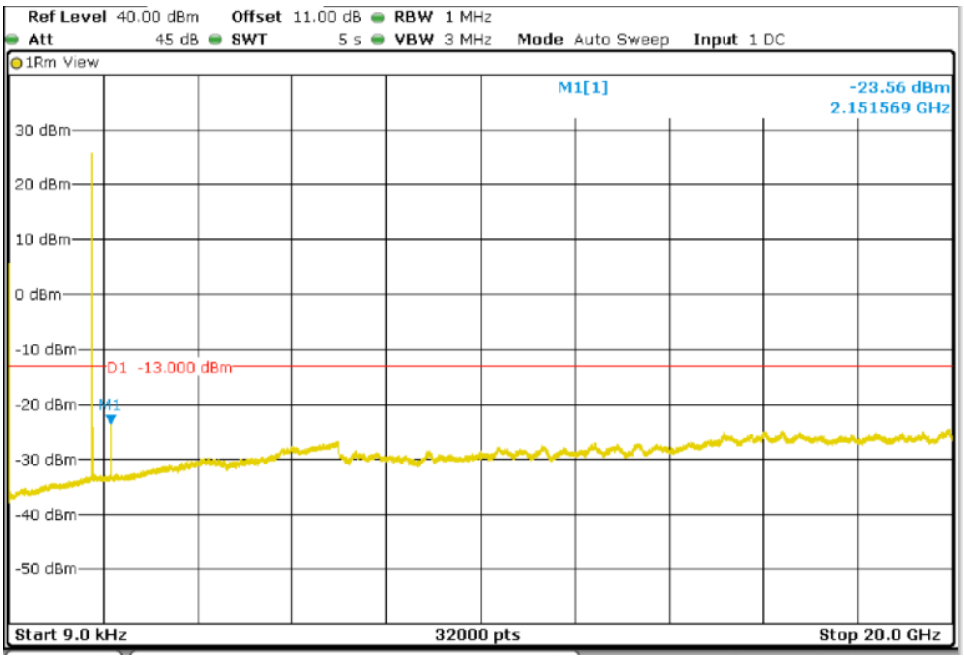


Middle Channel



TEST RESULTS (Cont):	

Highest Channel



TEST B.6: SPURIOUS EMISSIONS AT ANTENNA TERMINALS AT BLOCK EDGES

LIMITS:	Product standard:	FCC Part 27 / IC RSS-199
	Test standard:	FCC § 27.53 / RSS- Clause 4.5

LIMITS

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 of 2 watts (33 dBm), the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative to Po becomes:

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

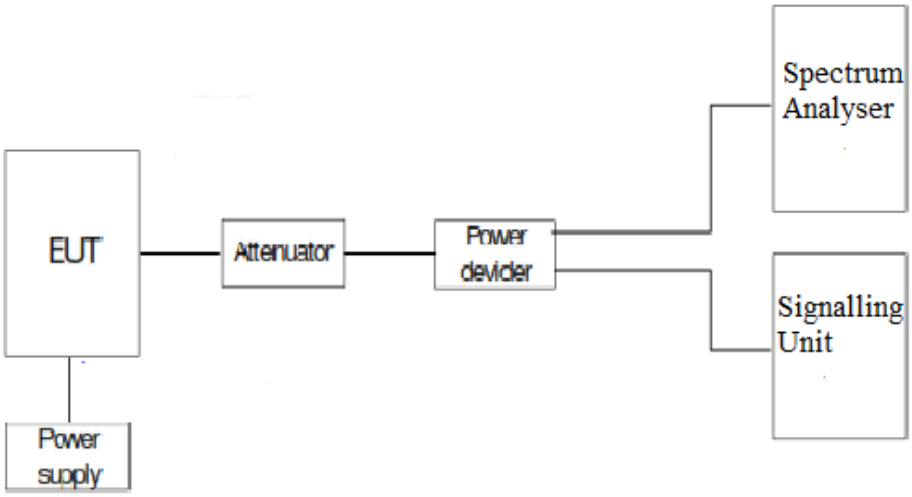
TEST SETUP

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

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

For LTE mode the configuration of modulation which is the worst case for conducted power was used.

As indicated in FCC part 27, in the 1 MHz bands immediately outside and adjacent to the licensee's frequency block or band, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.



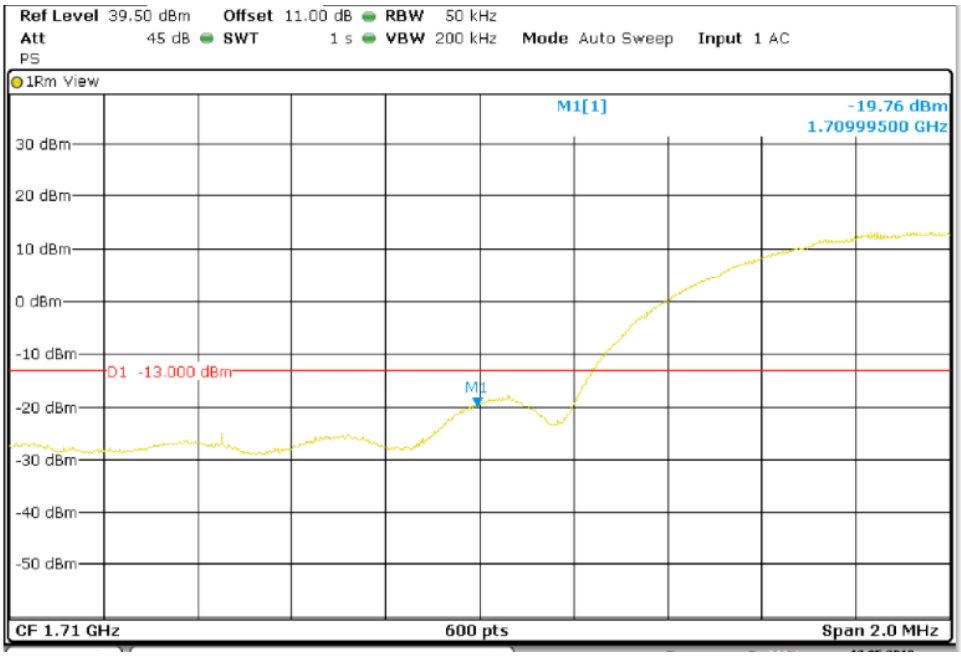
TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

WCDMA MODULATION	Low Channel	High Channel
Maximum measured level at lowest and Highest Block Edge at antenna port (dBm)	-19.76	-23.32

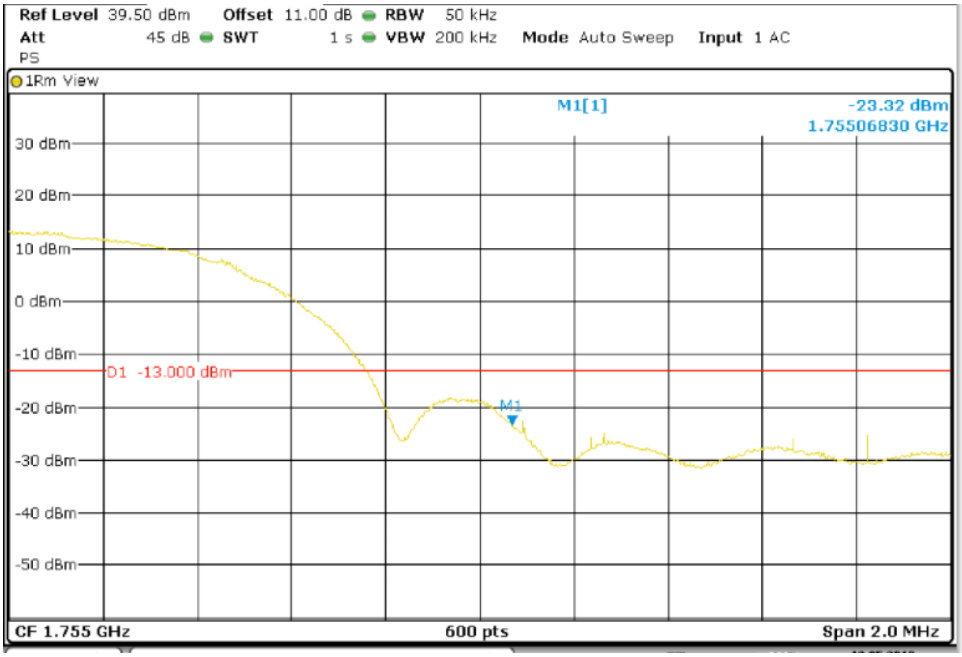
TEST RESULTS (Cont):	

WCDMA MODULATION.

Lowest Channel



Highest Channel



TEST B.7: RADIATED EMISSIONS

LIMITS:	Product standard:	FCC Part 27 / IC RSS-199
	Test standard:	FCC §2.1053 and §27.53 / RSS-199 Clause 4.5

LIMITS

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 of 2 watts (33 dBm), the specified minimum attenuation becomes 43+10log (Po). and the level in dBm relative to Po becomes:

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

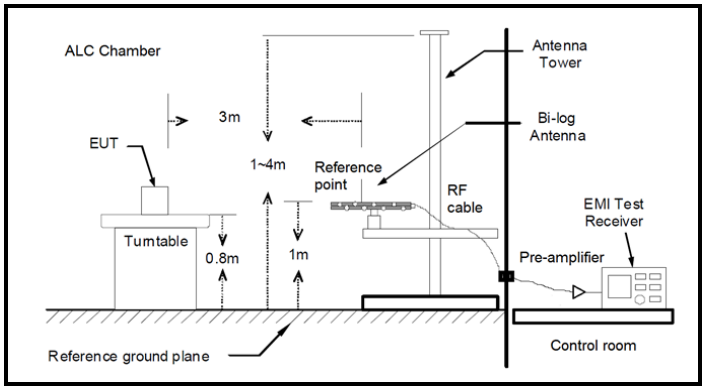
TEST SETUP

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.

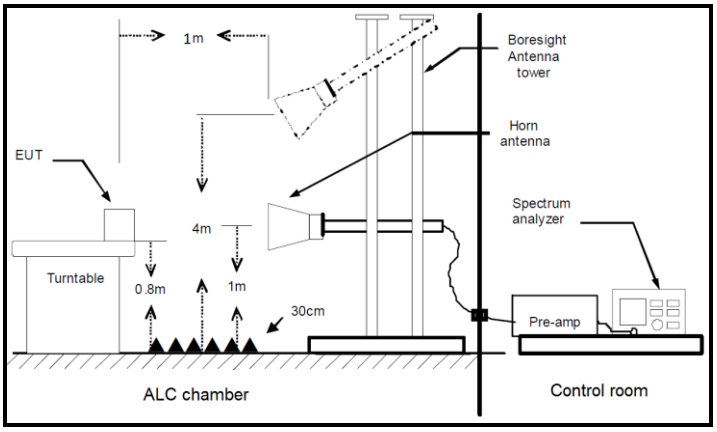
The EUT was placed on a non-conductive stand at a 3-meter distance from the measuring antenna for measurements below 1 GHz and at 1-meter distance for measurements above 1 GHz.

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

Radiated measurements < 1GHz



Radiated measurements > 1GHz



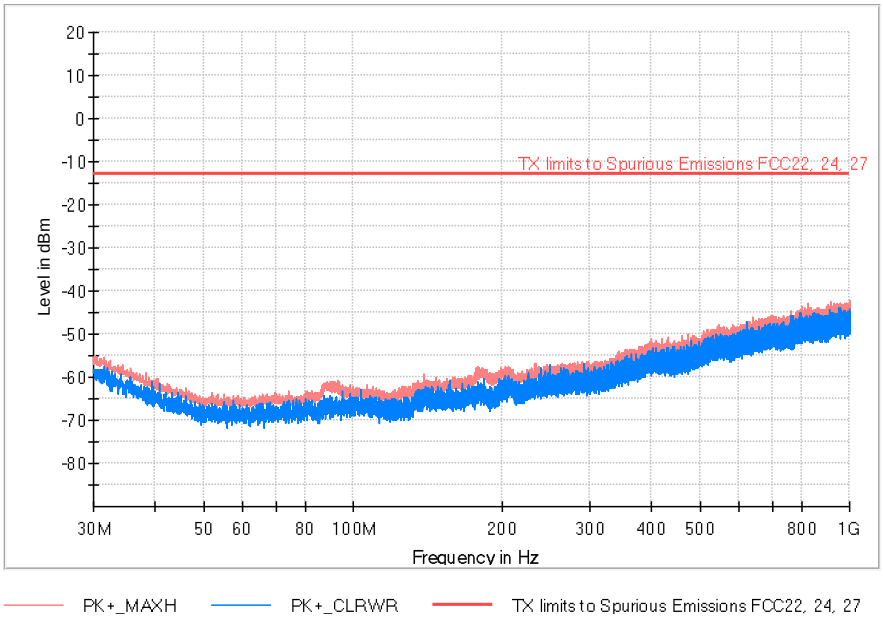
TESTED SAMPLES:	S/01
TESTED CONDITIONS MODES:	TC#01
TEST RESULTS:	PASS

A preliminary scan determined the WCDMA Modulation as the worst case. The following plots show the results for this configuration.

TEST RESULTS (Cont):	Low Channel

FREQUENCY RANGE: 30-1000 MHz

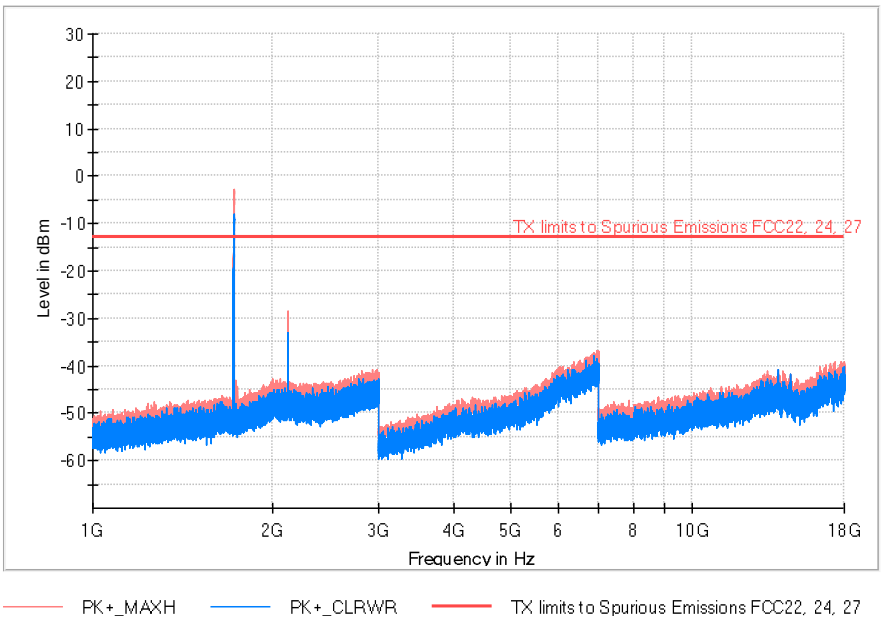
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
90.172333	-66.35	-61.58	
181.869667	-64.77	-57.83	
352.007667	-59.15	-53.69	
822.748667	-48.32	-42.79	



TEST RESULTS (Cont):	Low Channel

FREQUENCY RANGE: 1-18 GHz

Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
1721.266667	-9.32	-2.78	Fundamental
2121.133333	-36.82	-28.39	
6970.000000	-39.33	-36.77	
13994.000000	-40.88	-40.88	
17771.500000	-43.81	-39.04	

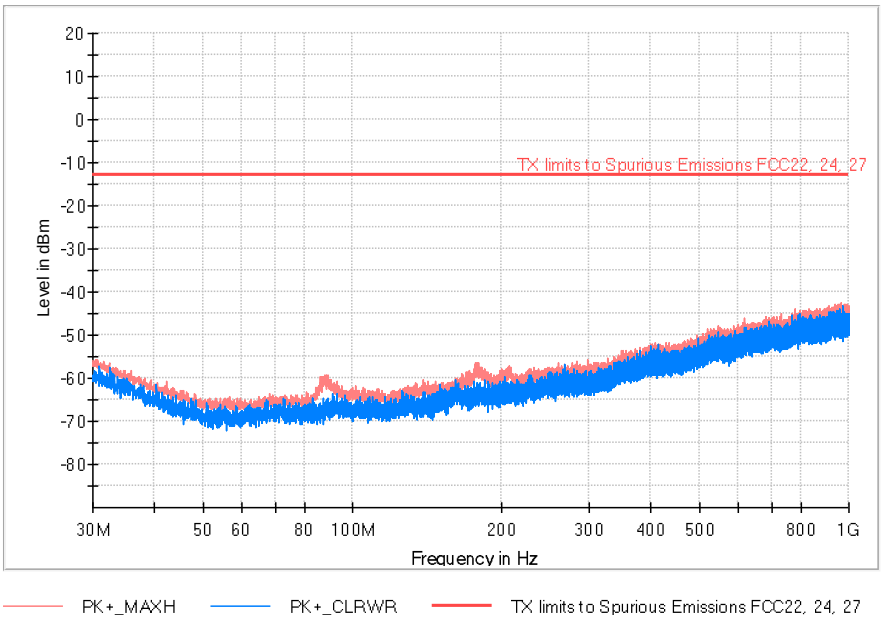


TEST RESULTS (Cont):	Mid Channel

FREQUENCY RANGE: 30MHz -1 GHz

Maximizations

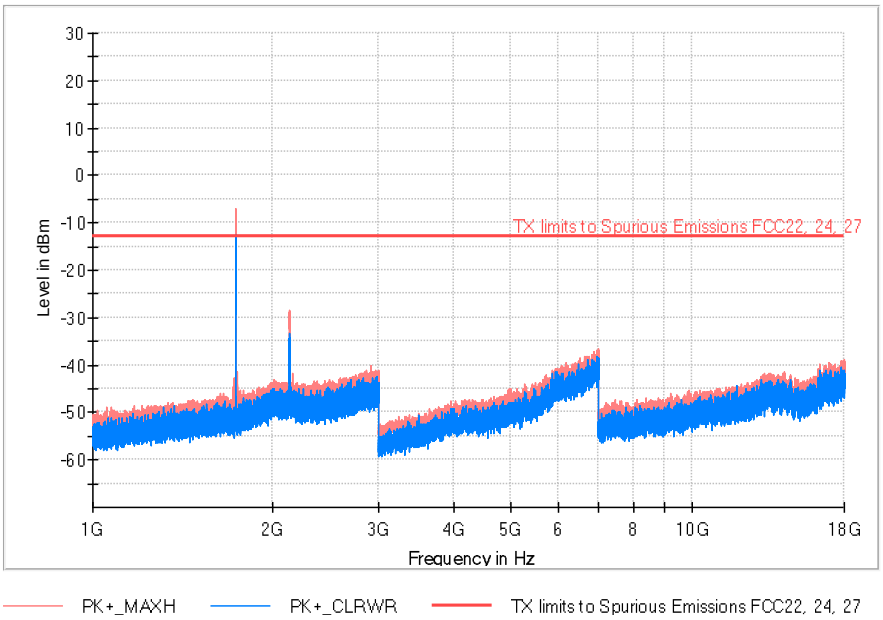
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
30.485000	-59.44	-55.68	
87.812000	-69.72	-59.28	
177.278333	-63.58	-56.39	
348.418667	-58.68	-53.48	



TEST RESULTS (Cont):	Mid Channel

FREQUENCY RANGE: 1-18 GHz

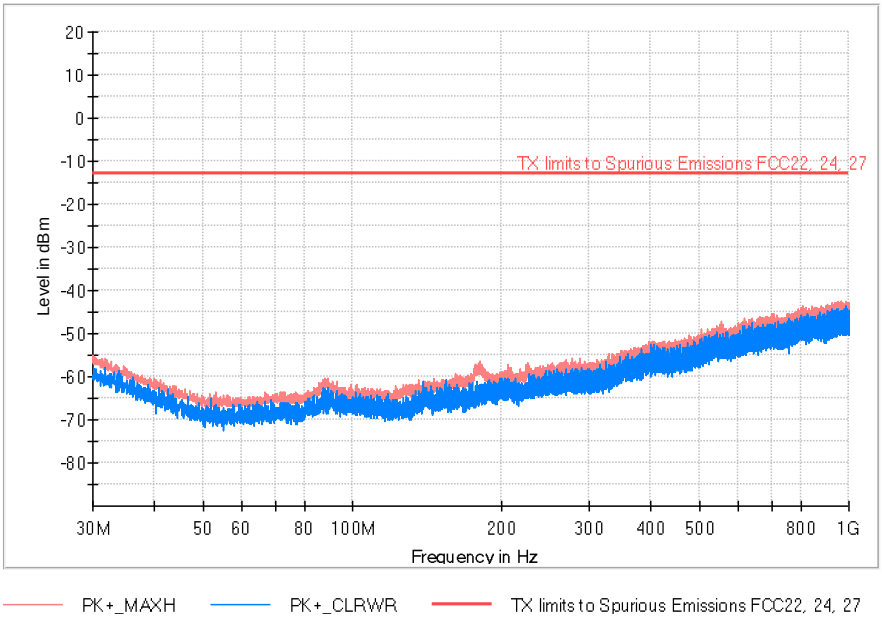
Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
1731.600000	-12.50	-6.94	Fundamental
2133.600000	-33.30	-28.59	
6998.500000	-41.82	-36.50	
17993.000000	-42.30	-38.89	



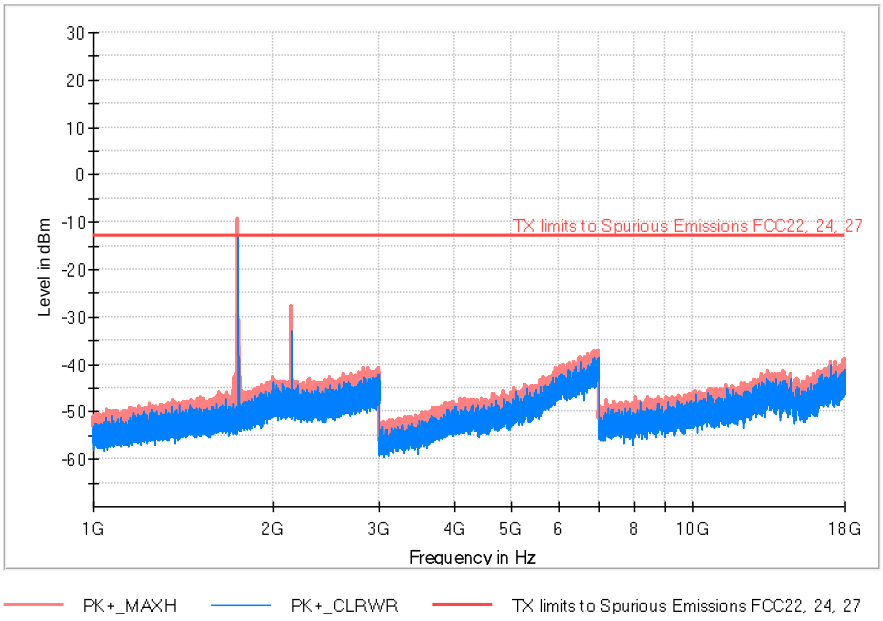
TEST RESULTS (Cont):	High Channel

FREQUENCY RANGE: 30MHz-1 GHz

Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
30.064667	-59.85	-55.10	
88.038333	-64.68	-60.35	
180.932000	-65.63	-56.56	



TEST RESULTS(Cont.):	High Channel

FREQUENCY RANGE: 1-18 GHz

Frequency (MHz)	PK+_CLRWR (dBm)	PK+_MAXH (dBm)	Comment
1743.733333	-13.82	-9.36	Fundamental
2146.066667	-34.91	-27.75	
17964.000000	-41.94	-38.77