FCC Test Report

FOR:

Reliant Heart.

Model Number: CTL002

Product Description: Controller for Heart Assist5 Left Ventricular Assist Device

FCC ID: 2AB4ZCTL002

47 CFR Part 2, 22, 24, 27

TEST REPORT #: EMC_RELIA-003-15001_FCC 22_24_27_WWAN_v1.4
DATE: 2015-11-11

FCC Recognized
A2LA Accredited
IC recognized # 3462E-1

***CETECOM* Inc.**
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

Table of Contents

1 Assessment

The following device was tested against the applicable criteria specified in FCC rules parts 2, 22 and 24 and 27 of Title 47 of the Code of Federal Regulations.

No deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Reliant Heart	Controller for Heart Assist5 Left Ventricular Assist Device	CTL002

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2015-11-11	Compliance	Milton Ponce de Leon (Test Lab Manager)	Milton Ponce de Leon Digitally signed by Milton Ponce de Leon DN: cn=Milton Ponce de Leon, c=US, o=Cetecom Inc., ou=OTA, email=milton.deleon@cetecom.com Date: 2015.11.11 12:13:08 -08'00'

Responsible for the Report:

Date	Section	Name	Signature
2015-11-11	Compliance	Anthony Planinac (EMC Engineer)	Anthony Planinac Digitally signed by Anthony Planinac DN: cn=Anthony Planinac, c=US, o=CETECOM, ou=EMC SD, email=anthony.planinac@cetecom.com Reason: release Date: 2015.11.11 13:07:14 -08'00'

The test results of this test report relate exclusively to the test item specified in Section3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	6370 Nancy Ridge Drive, Suite 101 San Diego, CA 92121 U.S.A.
Telephone:	+1 (858) 362 2400
Fax:	+1 (858) 587 4809
Test Lab Manager:	Milton Ponce de Leon
Responsible Project Leader	Cathy Palacios

2.2 Identification of the Client

Applicant's Name:	Reliant Heart
Street Address:	8965 Interchange Drive
City/Zip Code	Houston, TX 77054
Country	USA
Contact Person:	Bryan Lynch
Phone No.	713-457-1474
Fax:	
e-mail:	blynch@reliantheart.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as client.
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Model Number:	CTL002
Marketing Name[1]:	HeartAssist5 LVAD Controller
FCC-ID/ IC-ID :	FCC ID: 2AB4ZCTL002
Product Description:	Controller for Heart Assist5 Left Ventricular Assist Device
Technology / Type(s) of Modulation:	see the following spec of incorporated cellular module:
Integrated Module Info:	Telit HE910-D FCC ID: R17HE910 • GSM/GRPS/EDGE 850/900/1800/1900 Mhz ; • UMTS FDD: Band I/II/IV/V/VIII ; UL 5.76 Mbps/DL 21.0Mbps data rates
Operating Frequency Ranges (MHz) / Channels:	GSM 850: 824.2-848.8; 125 channels GSM 1900: 1850.2-1909.8; 300 channels FDD II: 826.4 - 846.6; 278 channels FDD IV: 1712.4 -1752.5; 203 channels FDD V: 1852.4 -1907.6; 103 channels
Antenna info:	830MHz=-1.2, 1730MHz=+2.4dBi, 1880MHz=+1.7dBi (source Reliant Heart)
Rated Operating Voltage Range:	100 – 250 VAC (unit can operate with Batteries only @ Vmin=11VDC, Vnom=12VDC, Vmax=13.5V DC or connected using the AC adapter).
Rated Operating Temperature Range:	Tmin:10°C/ Tmax: +40°C
Other Radios included in the device:	None

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	Model	SAMPLE	HW Version	SW Version
1	SN 00070	CTL002	RADIATED	M10022 Rev H	2.4.433
2	SN 00021	CTL002	CONDUCTED	M10022 Rev H	2.4.433

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Part Number
1	AC Adapter	Jerome Industries	WILF13.5MC-P1	10358

3.4 Environmental conditions during Test:

The following environmental conditions were maintained during the course of testing:
Ambient Temperature: 20-25^{o}C
Relative humidity: 40-60%

3.5 Dates of Testing:

02/18/2015 – 02/24/2015

3.6 Miscellaneous EUT information:

Only model CTL002 was tested for EMC evaluation.

4 Subject of Investigation

The objective of the measurements applied by CETECOM Inc. Was to establish compliance of the EUT as described under Ch. 3 of this Test Report, with the applicable criteria specified in

- 47 CFR Part 2: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission Frequency allocations and radio treaty matters; general rules and regulations.
- 47 CFR Part 22: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 22- Public mobile services
- 47 CFR Part 24: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 24- Personal communication services
- 47 CFR Part 27: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 27- Miscellaneous wireless communication services

This test report is to support a request for new equipment authorization under the
FCC ID: **2AB4ZCTL002**
All testing was performed on the product referred to in Section 3 as EUT.

This product integrates the precertified WWAN module : Telit HE910-D.

Per guidelines from KDB 996369, conducted signal test results from module certification is re-used for this certification.

- The Module Tune-up detaisl is reported by Telit on the techical note: 30378NT11098A

The module test data can be obtained under the FCC Filing ID: **RI7HE910**
Module test data details can be found on the follow reports available on FCC website:

- Report #: 1112FR12-02 (FCC part 22 and 24)
- By: A Test Lab Techno Corp.
- Dated: Feb. 03, 2012
- Report#: 1201FR11-02 (FCC part 27)
- By: A Test Lab Techno Corp.
- Dated: Feb. 03, 2012

5 Summary of Measurement Results

GSM/GRPS/EDGE and UMTS 850 MHz Band:

Specifications	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §22.913 (b)	RF Output Power	Nominal	GSM/GPRS/EDGE 850MHz	■	☐	☐	☐	Complies
			UMTS Band V	■	☐	☐	☐	Complies
§2.1055 §22.355	Frequency Stability	Nominal	GSM/GPRS/EDGE 850MHz	☐	☐	☐	■	Complies
			UMTS Band V	☐	☐	☐	■	Complies
§2.1049 §22.917(b)	Occupied Bandwidth	Nominal	GSM/GPRS/EDGE 850MHz	☐	☐	☐	■	Complies
			UMTS Band V	☐	☐	☐	■	Complies
§2.1051 §22.917	Band Edge Compliance	Nominal	GSM/GPRS/EDGE 850MHz	☐	☐	☐	■	Complies
			UMTS Band V	☐	☐	☐	■	Complies
§2.1051 §22.917	Conducted Spurious Emissions	Nominal	GSM/GPRS/EDGE 850MHz	☐	☐	☐	■	Complies
			UMTS Band V	☐	☐	☐	■	Complies
§2.1053 §22.917	Radiated Spurious Emissions	Nominal	GSM/GPRS/EDGE 850MHz	■	☐	☐	☐	Complies
			UMTS Band V	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.
Note 1: Leveraged from module certification.

GSM/GPRS/EDGE and UMTS 1900 MHz Band:

Specifications	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §24.232 (c)(d)	RF Output Power	Nominal	GSM/GPRS/EDGE 1900MHz	■	☐	☐	☐	Complies
			UMTS BandII	■	☐	☐	☐	Complies
§24.232 (d)	Frequency Stability	Nominal	GSM/GPRS/EDGE 1900MHz	☐	☐	☐	■	Complies
			UMTS Band II	☐	☐	☐	■	Complies
§2.1049 §22.917(b)	Occupied Bandwidth	Nominal	GSM/GPRS/EDGE 1900MHz	☐	☐	☐	■	Complies
			UMTS Band II	☐	☐	☐	■	Complies
§2.1051 §24.238	Band Edge Compliance	Nominal	GSM/GPRS/EDGE 1900MHz	☐	☐	☐	■	Complies
			UMTS Band II	☐	☐	☐	■	Complies
§2.1051 §24.238	Conducted Spurious Emissions	Nominal	GSM/GPRS/EDGE 1900MHz	☐	☐	☐	■	Complies
			UMTS Band II	☐	☐	☐	■	Complies
§2.1053 §24.238	Radiated Spurious Emissions	Nominal	GSM/GPRS/EDGE 1900MHz	■	☐	☐	☐	Complies
			UMTS Band II	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.
Note 1: Leveraged from module certification.

UMTS 1700 MHz Band:

Specifications	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §27.50(d)(4)	RF Output Power	Nominal	UMTS Band IV	■	☐	☐	☐	Complies
§27.50(d)(5)	Peak-to-average Ratio	Nominal	UMTS Band IV	☐	☐	☐	■	Complies
§2.1055 §27.54	Frequency Stability	Extreme	UMTS Band IV	☐	☐	☐	■	Complies
§2.1049 §27.53(h)	Occupied Bandwidth	Nominal	UMTS Band IV	☐	☐	☐	■	Complies
§2.1051 §27.53(h)	Band Edge Compliance	Nominal	UMTS Band IV	☐	☐	☐	■	Complies
§2.1053 §27.53(h)	Unwanted Emissions	Nominal	UMTS Band IV	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.
Note 1: Leveraged from module certification.

6 Measurements

6.1 RF Power Output

6.1.1 References

FCC: CFR Part 2.1046, CFR Part 22.913, CFR Part 24.232, CFR Part 27.50

6.1.2 Measurement requirements:

6.1.2.1 FCC 2.1046: RF power output.

Power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on circuit elements as specified. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated. RSS-Gen 4.8: RF power output.

6.1.3 Limits:

ERP/EIRP (850 MHz Band)

FCC Part 22.913 (a) & RSS-132 Section 5.4

FCC: Peak ERP < 38.45 dBm (7W)
The effective radiated power (ERP) of mobile transmitters must not exceed 7 Watts.

EIRP (1900 MHz Band)

FCC Part 24.232 I I & RSS-133 Section 6.4/SRSP-510 Section 5.1.2

FCC: Peak EIRP < 33 dBm (2W)
(b) Mobile/portable stations are limited to 2 Watts effective isotropic radiated power (EIRP).
I Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms equivalent voltage. The measurement results shall be properly adjusted for any limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement over the full bandwidth of the channel.

EIRP (1700 MHz Band)

FCC Part 27.50 (d) (4) (6) & RSS-139 Section 6.4

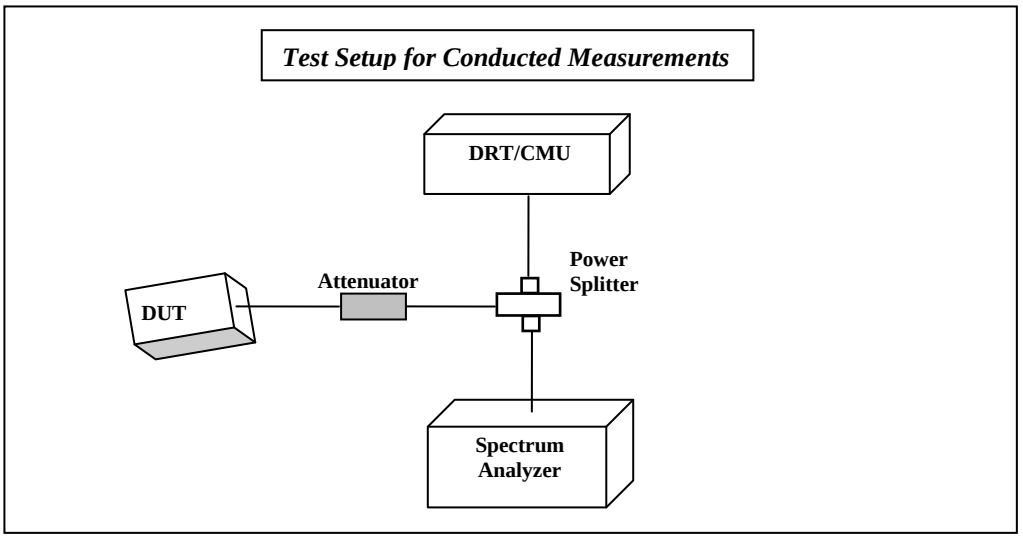
FCC: Peak EIRP < 30 dBm (1W)
Fixed, mobile and portable (handheld stations) operating in the 1710-1755 MHz band are limited to 1 watt EIRP
Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited

resolution bandwidth capability when compared to the emission bandwidth, sensitivity, *etc.*, so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel

6.1.4 Conducted Output Power Measurement

6.1.4.1 Measurement Procedure:

Measurement according to KDB 971168 D01v02r02 (Measurement guidance for certification of Licensed Digital Transmitters)
Section 5.1.1 for peak power
Section 5.2.2 for average power



1. Connect the equipment as shown in the above diagram. A Digital Radio Communication Tester (DRT: R&S CMU200 here) is used to enable the EUT to transmit and to measure the output power.
2. Adjust the settings of the CMU200 to set the EUT to its maximum power at the required channel.
3. Record the Peak and Average Output power level measured by the CMU200.
4. Correct the measured level for all losses in the RF path.
5. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band and for all types of modulation schemes.
6. GMSK mode measurements are performed in GSM 1 uplink slot configuration
7. UMTS mode measurements are performed in RMC 12.2K configuration

6.1.4.2 Measurement Uncertainty

+/- 0.5 dB

6.1.4.3 Test Conditions:

Tnom: 20°C; Vnom: 24 V

6.1.5 Measurement Results (Conducted Power Verification):

ERP/EIRP 850 MHz band

GSM/GPRS 850: GMSK Mode Antenna Gain = -1.2 dBi FCC: Peak ERP < 38.45 dBm (7W)					
Frequency (MHz)	**PEAK Conducted Output Power (dBm)**	**Average Conducted Output Power (dBm)**	**Calculated Peak EIRP** EIRP = Conducted + gain **(dBm)**	**Calculated Peak ERP** (ERP = EIRP – 2.15 dB) **(dBm)**	**Calculated Average EIRP** Avg EIRP = Conducted + gain **(dBm)**
824.2(128)	32.2	32.1	31.00	28.85	30.90
836.6(190)	32.1	31.9	30.90	28.75	30.70
848.8(251)	32.1	32.0	30.90	28.75	30.80

EDGE 850: 8PSK Mode Antenna Gain = -1.2 dBi FCC: Peak ERP < 38.45 dBm (7W)					
Frequency (MHz)	**PEAK Conducted Output Power (dBm)**	**Average Conducted Output Power (dBm)**	**Calculated Peak EIRP** EIRP = Conducted + gain **(dBm)**	**Calculated Peak ERP** (ERP = EIRP – 2.15 dB) **(dBm)**	**Calculated Average EIRP** Avg EIRP = Conducted + gain **(dBm)**
824.2(128)	29.9	27.4	28.7	26.55	26.2
836.6(190)	29.8	27.2	28.6	26.45	26.1
848.8(251)	29.8	27.2	28.6	26.45	26.1

FDD V UMTS 850: QPSK Mode Antenna Gain = -1.2 dBi FCC: Peak ERP < 38.45 dBm (7W)					
Frequency	**PEAK Conducted Output Power**	**Average Conducted Output Power**	**Calculated Peak EIRP**	**Calculated Peak ERP** (ERP = EIRP – 2.15 dB)	**Calculated Average EIRP**
(MHz)	**(dBm)**	**(dBm)**	**(dBm)**	**(dBm)**	**(dBm)**
826.4	25.17	22.02	23.97	21.82	20.82
836.6	25.35	22.10	24.15	22.00	20.90
846.6	25.3	22.12	24.1	21.95	20.92

EIRP 1900 MHz band

GPRS 1900: GMSK Mode Antenna Gain = 1.7 dBi FCC: Peak EIRP < 38.45 dBm (7W)				
Frequency (MHz)	**PEAK Conducted Output Power (dBm)**	**Average Conducted Output Power (dBm)**	**Calculated Peak EIRP (dBm)**	**Calculated Average EIRP (dBm)**
1850.2 (512)	27.7	27.6	29.40	29.30
1880 (660)	27.9	27.7	29.6	29.40
1909.8 (810)	27.9	27.8	29.6	29.5

EDGE 1900: 8PSK Mode Antenna Gain = 1.7 dBi FCC: Peak EIRP < 38.45 dBm (7W)				
Frequency (MHz)	**PEAK Conducted Output Power (dBm)**	**Average Conducted Output Power (dBm)**	**Calculated Peak EIRP (dBm)**	**Calculated Average EIRP (dBm)**
1850.2 (512)	28.6	25.8	30.3	27.5
1880 (660)	28.4	25.6	30.1	27.3
1909.8 (810)	28.3	25.4	30.0	27.2

FDD II UMTS 1900: QPSK Mode Antenna Gain = 1.7 dBi FCC: Peak EIRP < 38.45 dBm (7W)				
Frequency (MHz)	**PEAK Conducted Output Power (dBm)**	**Average Conducted Output Power (dBm)**	**Calculated Peak EIRP (dBm)**	**Calculated Average EIRP (dBm)**
1852.4	24.82	21.94	26.52	23.64
1880	24.31	21.51	26.01	23.21
1907.6	24.68	21.72	26.38	23.42

EIRP 1700 MHz band

FDD IV UMTS 1700: QPSK Mode Antenna Gain = 2.4 dBi FCC: Peak EIRP < 30 dBm (1W)				
Frequency (MHz)	**PEAK Conducted Output Power (dBm)**	**Average Conducted Output Power (dBm)**	**Calculated Peak EIRP (dBm)**	**Calculated Average EIRP (dBm)**
1712.4	24.75	21.59	27.15	23.99
1732.6	24.19	21.31	26.59	23.71
1752.6	24.68	21.41	27.08	23.81

6.1.5.1 Verification Result

All measured results remain within the manufacturing tolerance and measurement uncertainty.

6.1.5.1.1 Test Verdict

Pass.

6.2 Spurious Emissions Radiated

6.2.1 References

FCC: CFR Part 2.1053, CFR Part 22.917, CFR Part 24.238, CFR Part 27.53

6.2.2 Measurement requirements:

FCC 2.1053: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

6.2.3 Limits:

(2015) *Out of band emissions*. 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.

For all power levels +30dBm to 0dBm, this becomes a constant specification of -13dBm.

FCC 22.917 Emission limitations for cellular equipment.

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

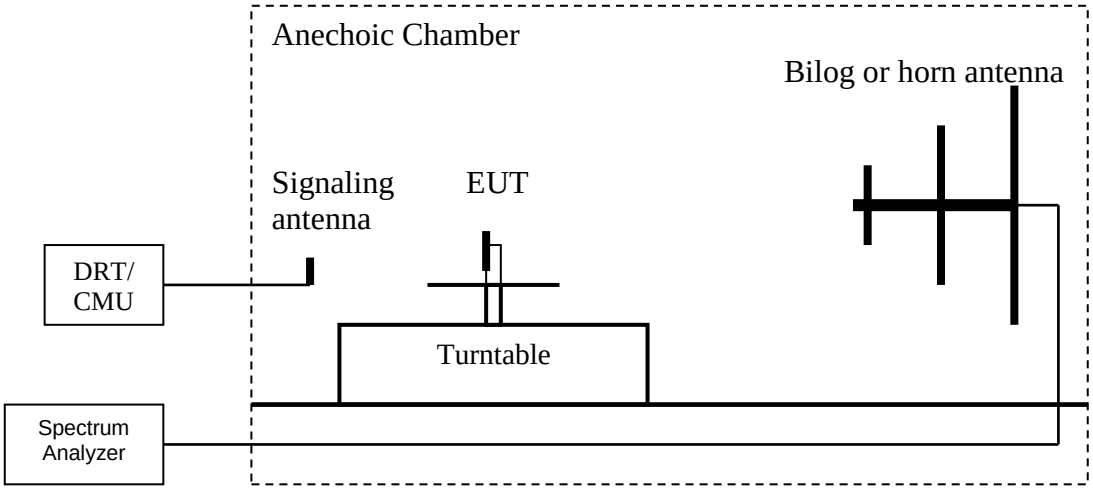
6.2.3.1 FCC 24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(b) Measurement procedure. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Radiated out of band measurement procedure:

Ref: TIA-603C 2004- 2.2.12 Unwanted emissions: Radiated Spurious



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a horizontal orientation.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to measure peak hold with the required settings.
4. Place the measurement antenna in a horizontal orientation. Rotate the EUT 360°. Raise the measurement antenna up to 4 meters in 0.5 meters increments and rotate the EUT 360° at each height to maximize all emissions. Measure and record all spurious emissions (**LVL**) up to the tenth harmonic of the carrier frequency.
5. Replace the EUT with a horizontally polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS)**. **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the level of spurious emissions using the following equation:
   Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):
8. Repeat steps 4, 5 and 6 with all antennas vertically polarized.
9. Determine the level of spurious emissions using the following equation:
   Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):
10. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.
    (N**ote:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4 and 7 above are performed with test software.)

6.2.4 Sample Calculations for Radiated Measurements

6.2.4.1 Power Measurements using Substitution Procedure:

The measurement on the Spectrum Analyzer is used as a basis for the Substitution procedure.
The EUT is replaced with a Signal Generator and an antenna. The setting on the Signal Generator is varied until the Spectrum Analyzer displays the original reading. EIRP is calculated as-

EIRP (dBm)= Signal Generator setting (dBm)- Cable Loss (dB)+ Antenna Gain (dBi)

Example:

Frequency (MHz)	Measured SA (dBµV)	Signal Generator setting (dBm)	Antenna Gain (dBi)	Dipole Gain (dBd)	Cable Loss (dB)	EIRP (dBm)
1000	95.5	24.5	6.5	0	3.5	27.5

6.2.5 Measurement Survey:

The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3m site. The spectrum is scanned from 30MHz to the 10th harmonic of the highest frequency generated by the EUT.
Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the 850 MHz, 1700 MHz and 1900 MHz bands of operation.
It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the GSM-850 MHz and the PCS-1900 MHz band into any of the other blocks respectively. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

Radiated emission measurements were made in GMSK (1 uplink slot) and UMTS RMC 12.2k modes.
Additional spot checks in mid channel of operation for all modes were performed with the slimmer battery option of the device.

For radiated measurements, all data in this report shows the worst case emissions data between H/V antenna polarizations and for all 3 orthogonal orientations of the EUT.

Unless mentioned otherwise, the emission signals above the limit line in the plots are from the carrier

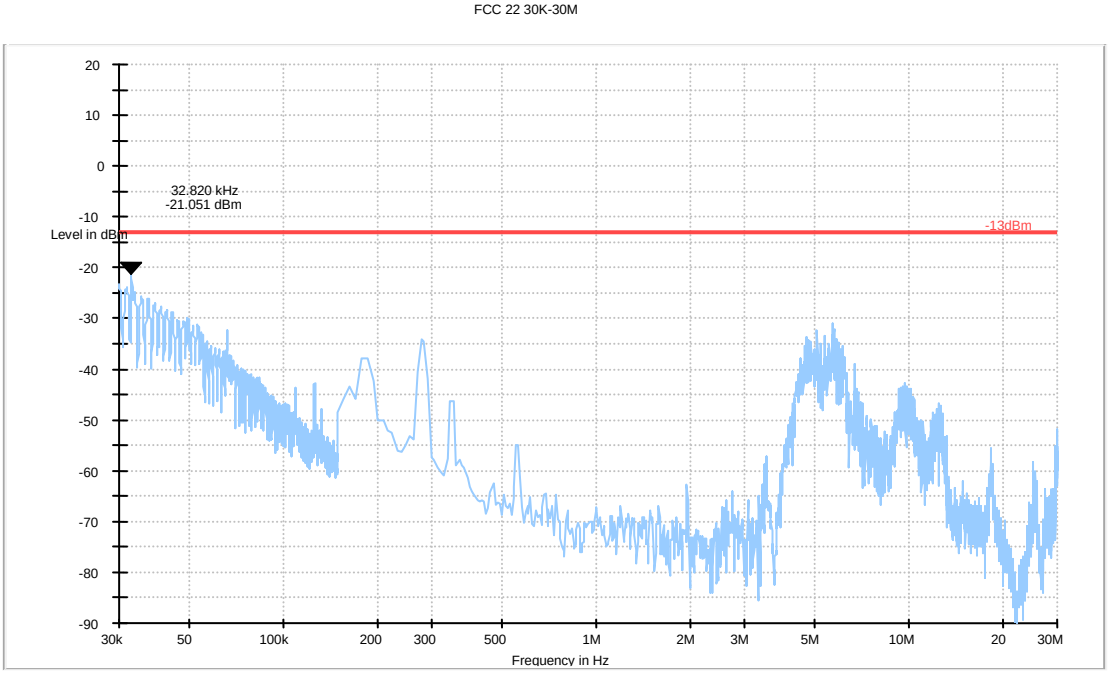
6.2.6 Test Conditions:

Tnom: 20^{o}C; Vnom: 24 V

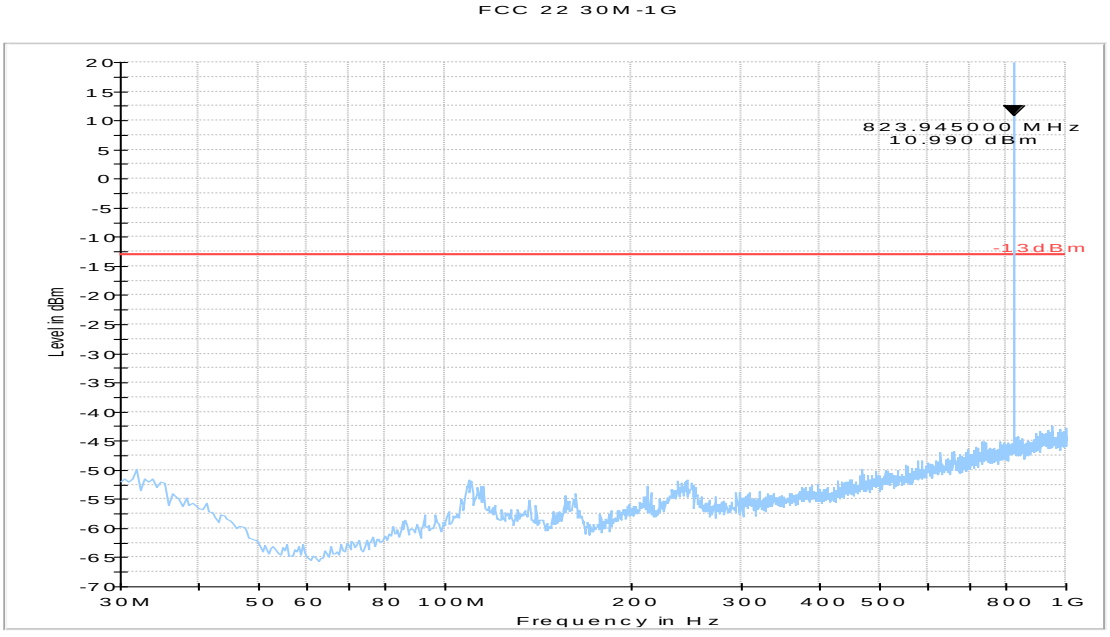
6.2.7 Test Results:

Radiated Spurious Emissions (GSM-850) Tx: Mid Channel

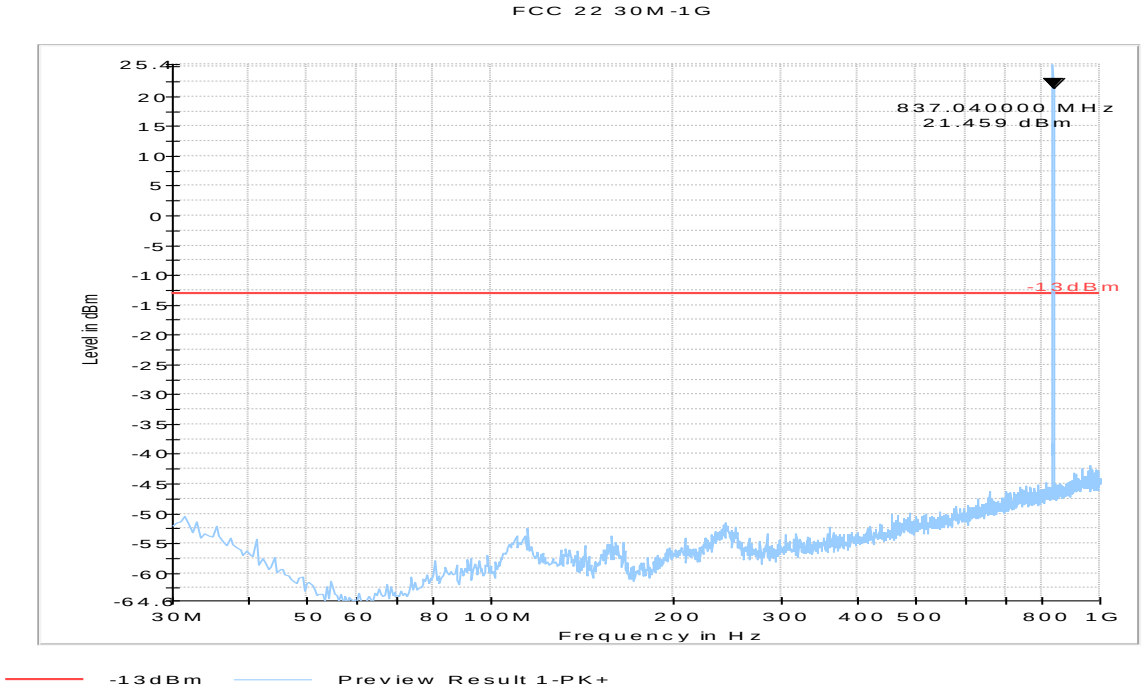
Test results: 30 kHz- 30 MHz – Mid Channel (GSM850)



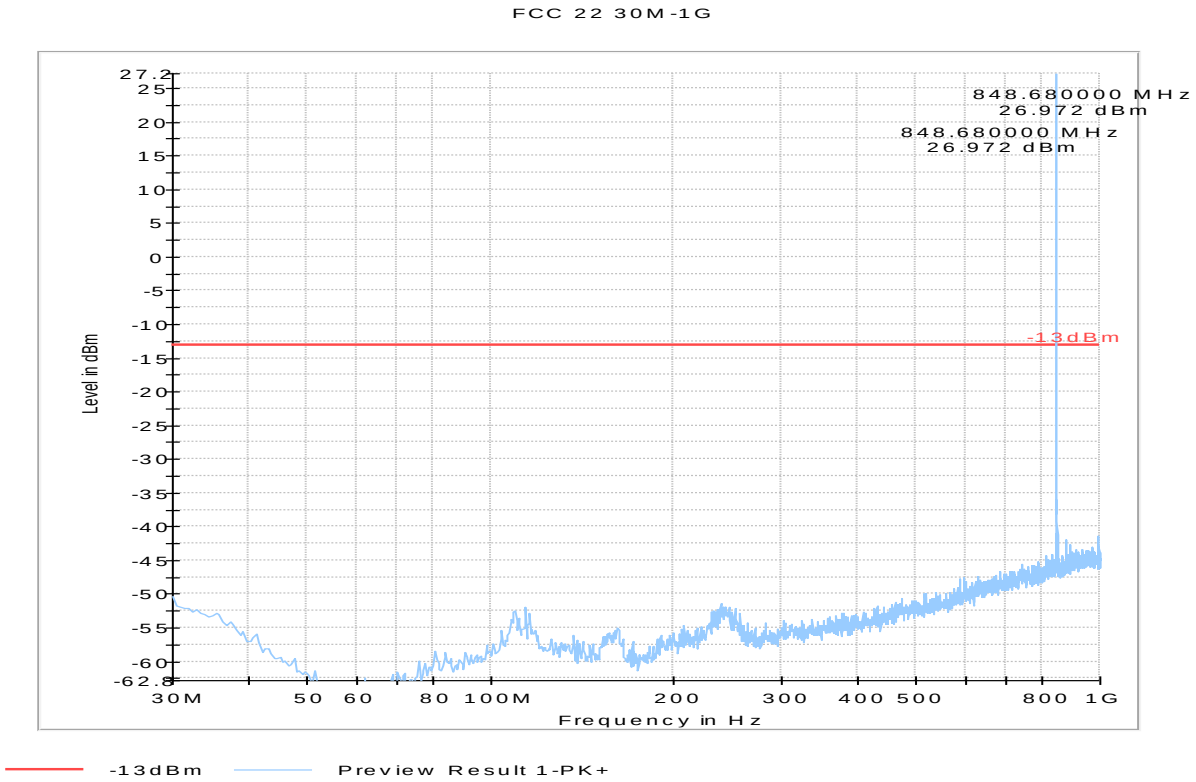
Test results – 30 MHz – 1GHz –Low Channel (GSM850). Signal above limit line is the TX signal.



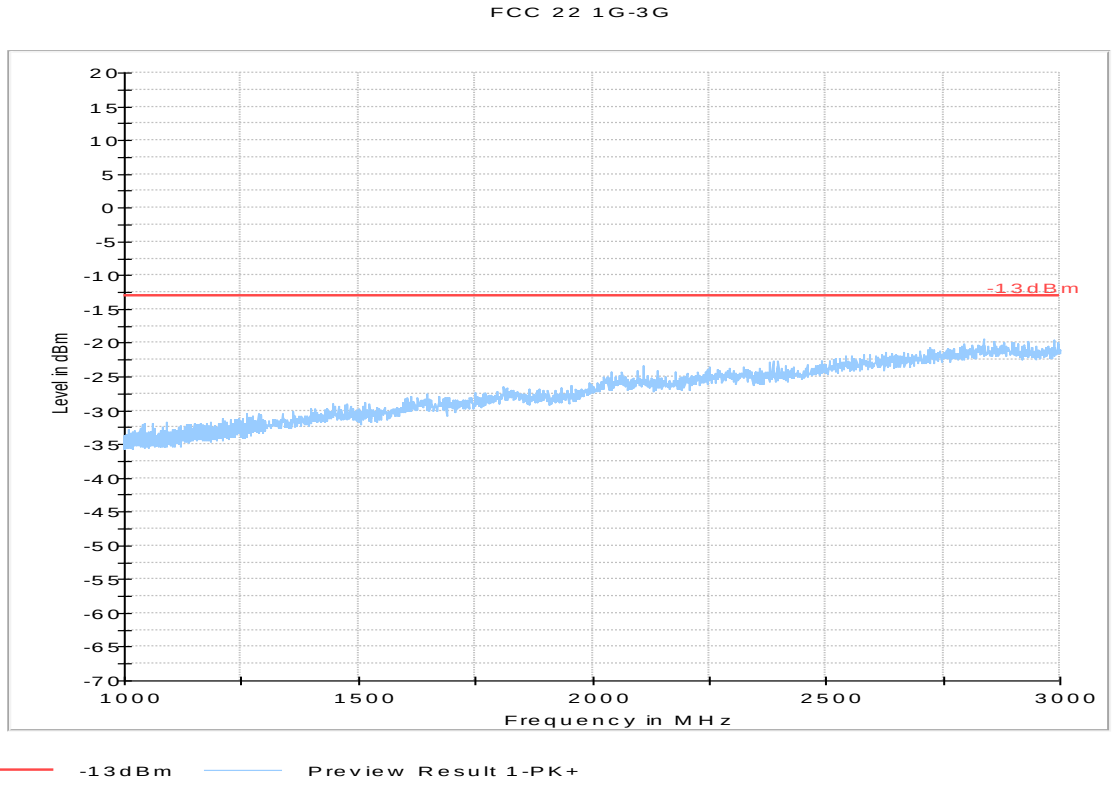
Test results – 30 MHz – 1GHz –Mid Channel (GSM850). Signal above limit line is the TX signal.



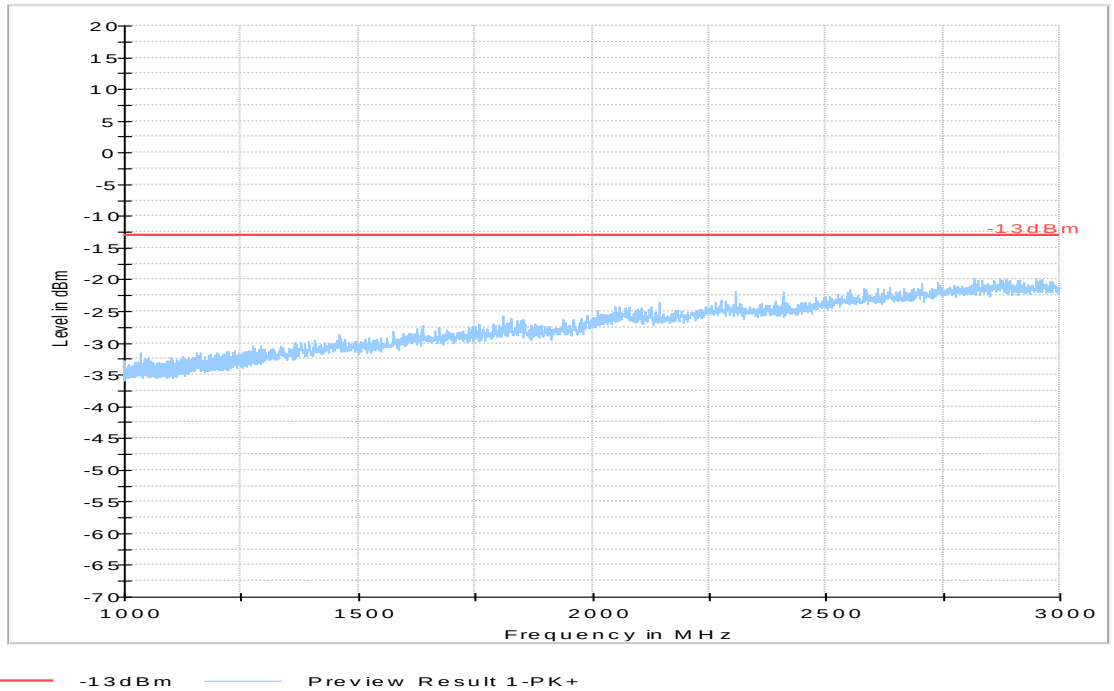
Test results – 30 MHz – 1GHz –High Channel (GSM850). Signal above limit line is the TX signal.



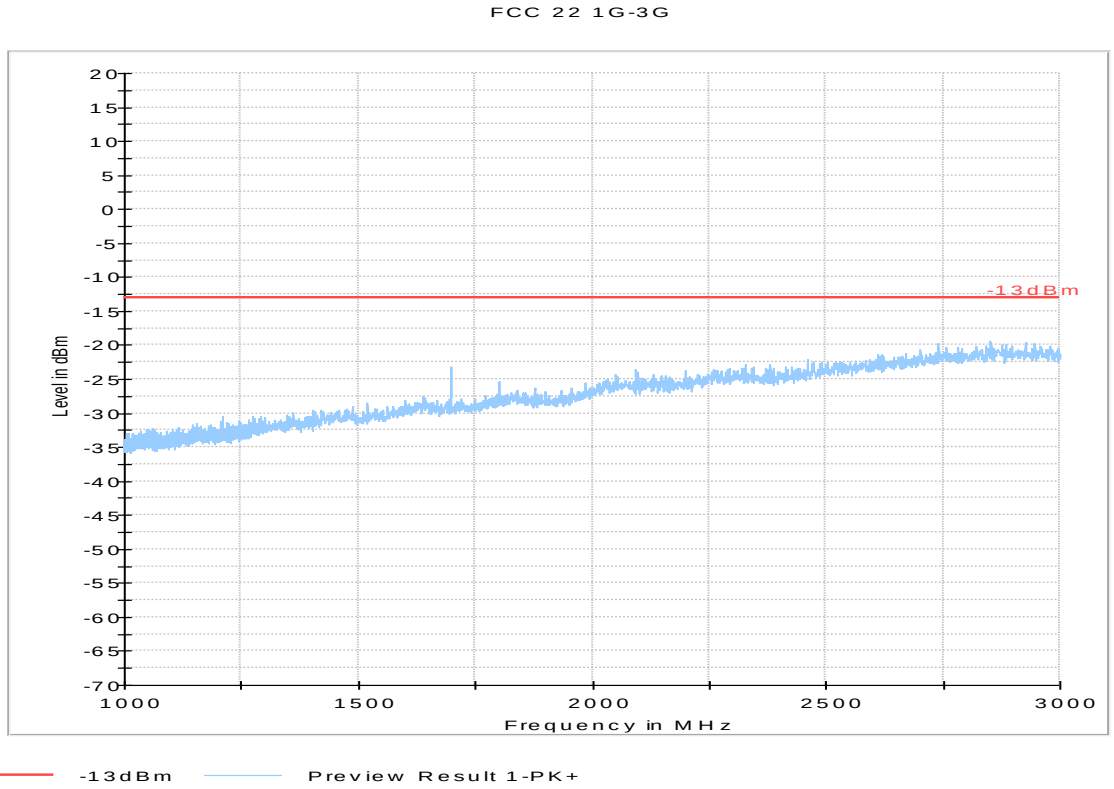
Test results – 1GHz – 3GHz –Low Channel (GSM850)



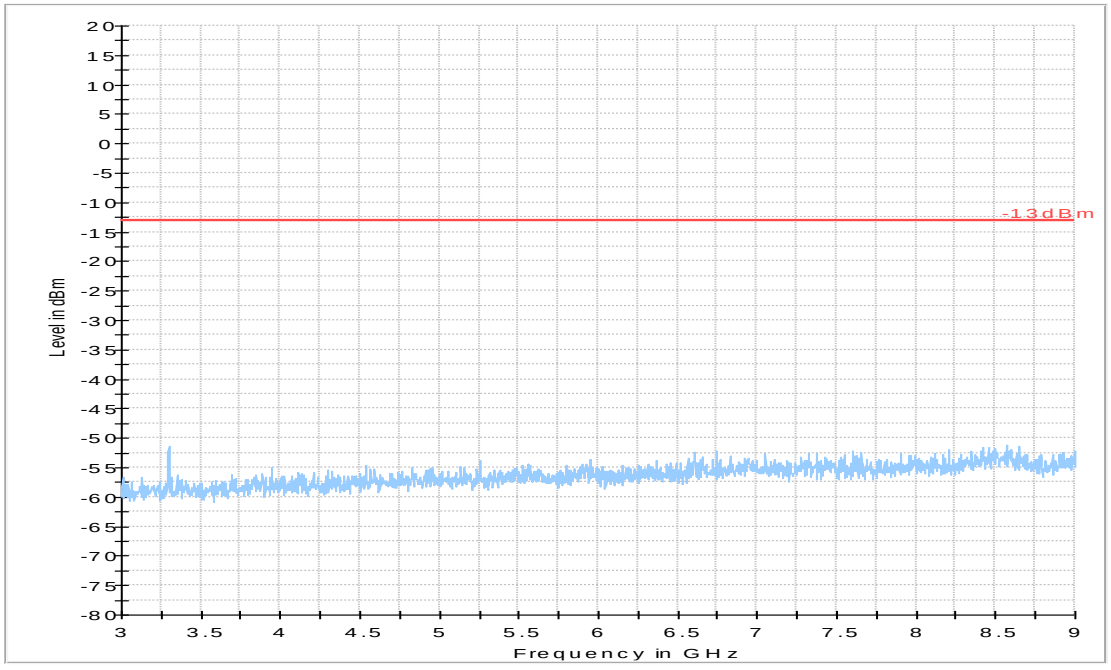
Test results – 1GHz – 3GHz –Mid Channel (GSM850)



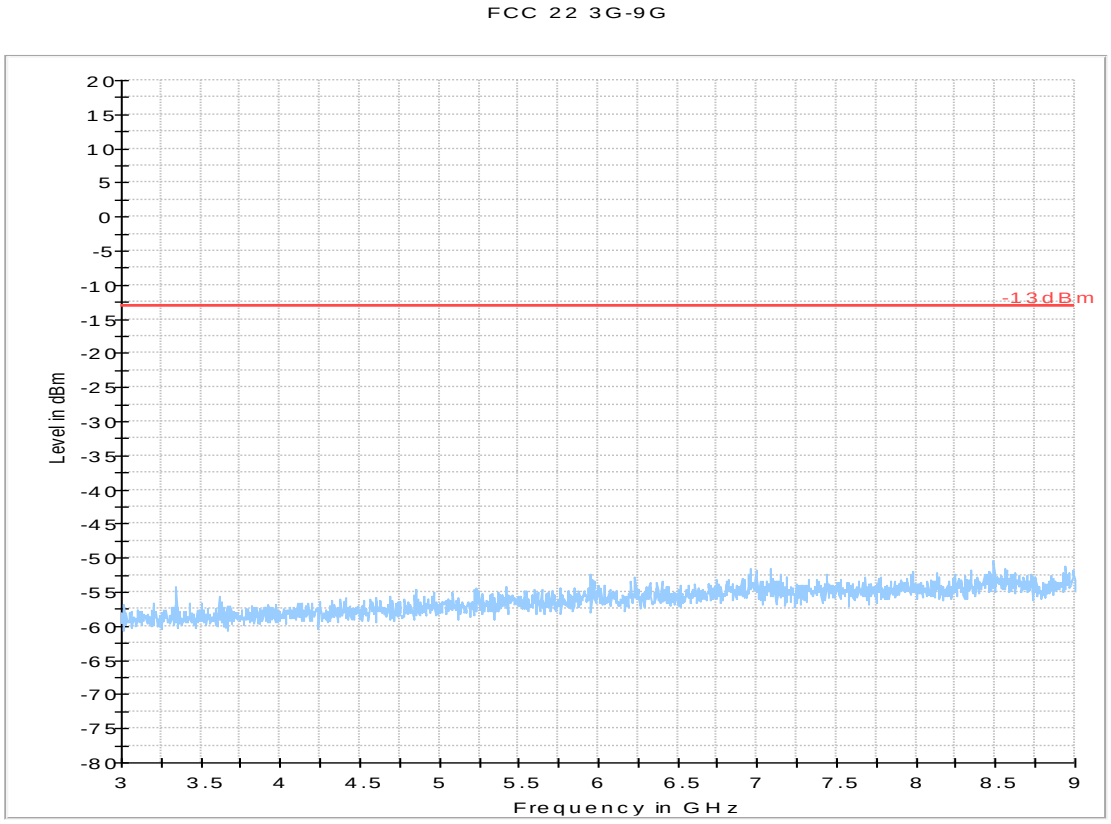
Test results – 1GHz – 3GHz –High Channel (GSM850)



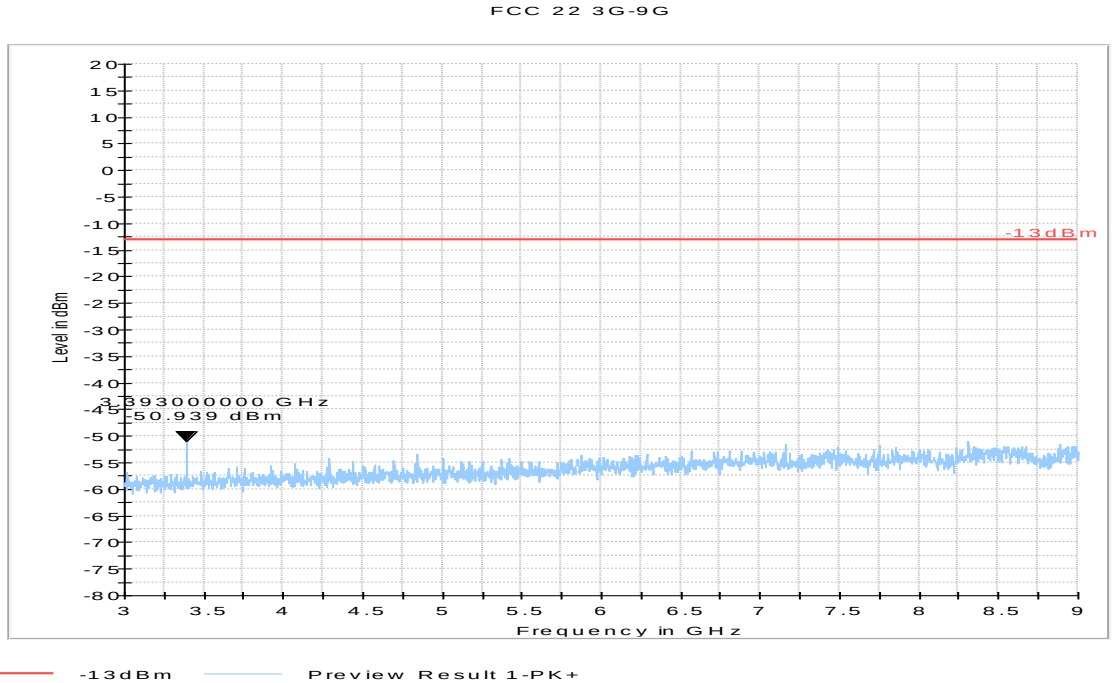
Test results – 3GHz – 9GHz –Low Channel (GSM850)



Test results – 3GHz – 9GHz –Mid Channel (GSM850)

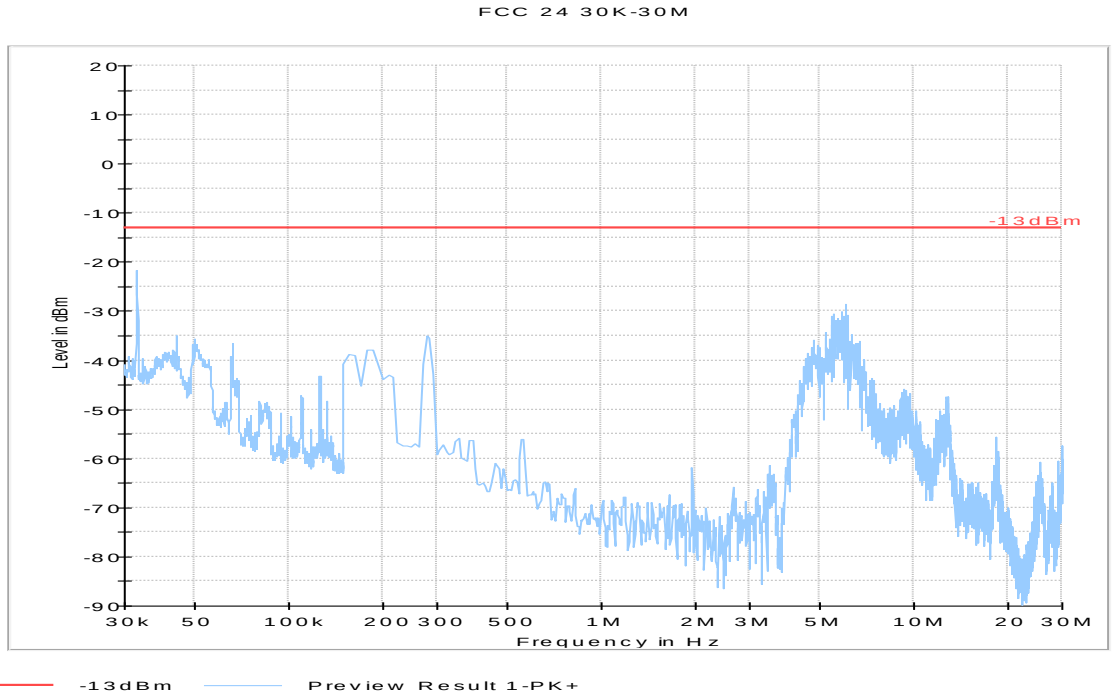


Test results – 3GHz – 9GHz –High Channel (GSM850)

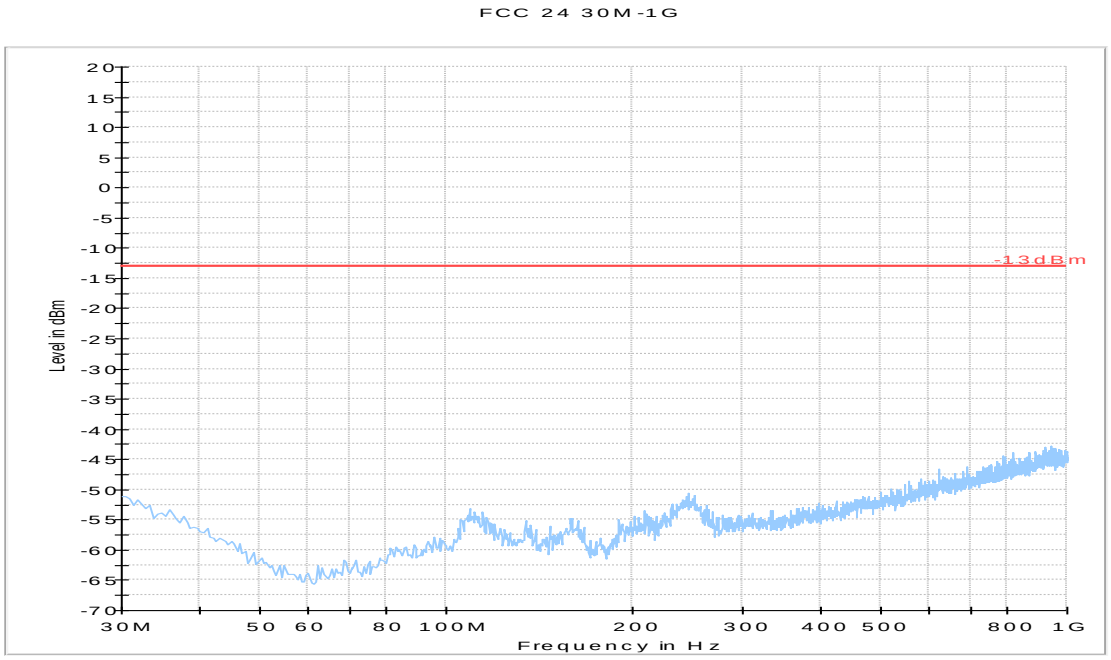


Radiated Spurious Emissions (GSM-1900) Tx:

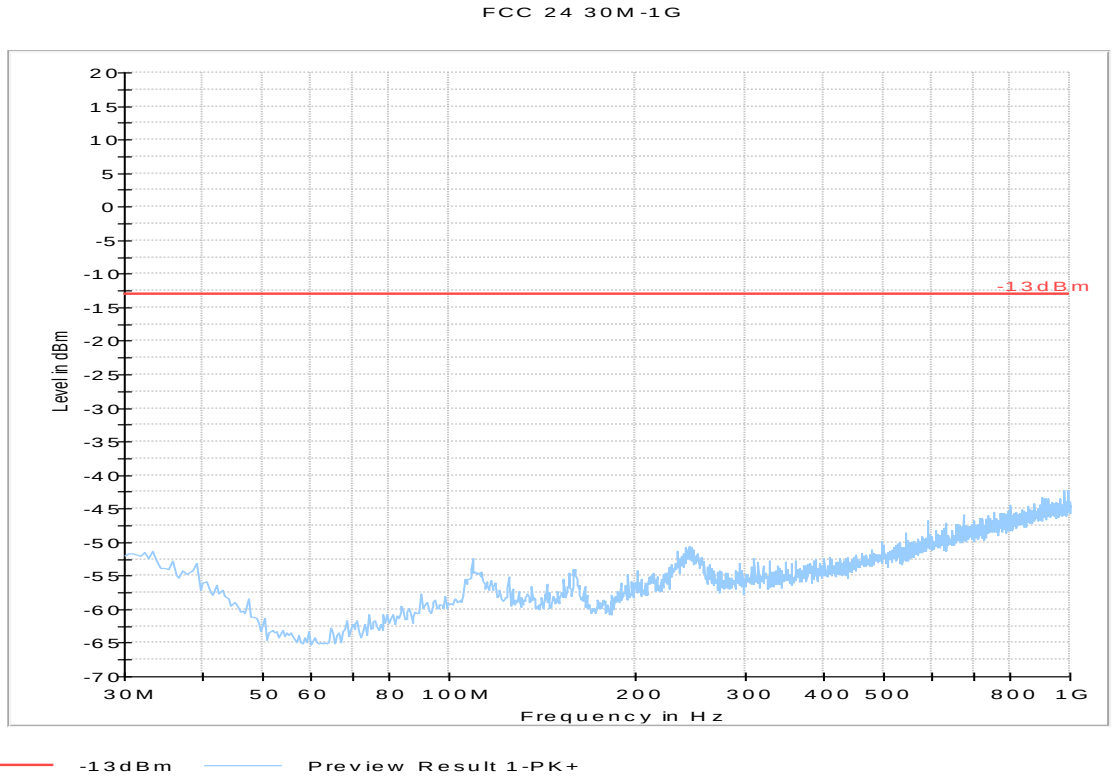
Test results 30 kHz- 30 MHz – Mid Channel (GSM-1900)



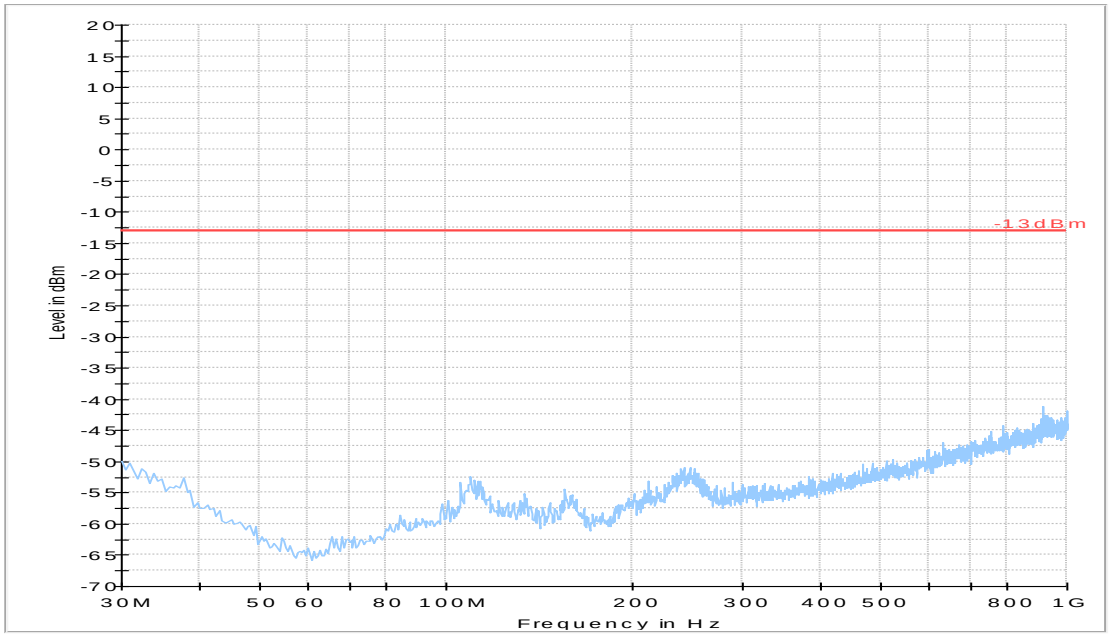
Test results – 30 MHz – 1GHz –Low Channel (GSM 1900)



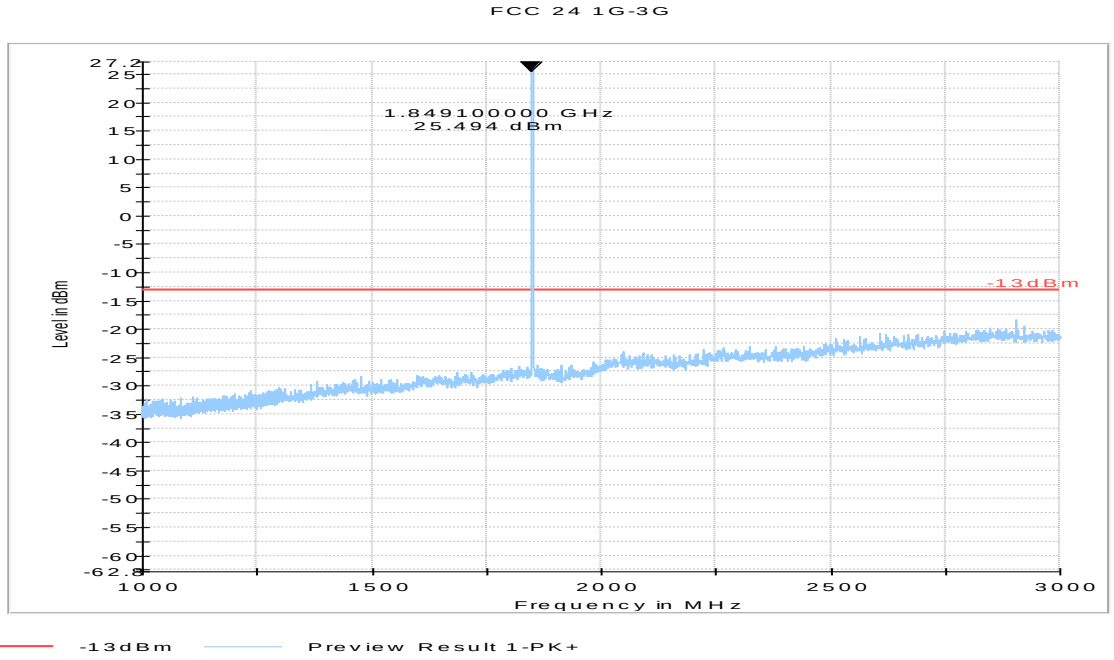
Test results – 30 MHz – 1GHz –Mid Channel (GSM 1900)



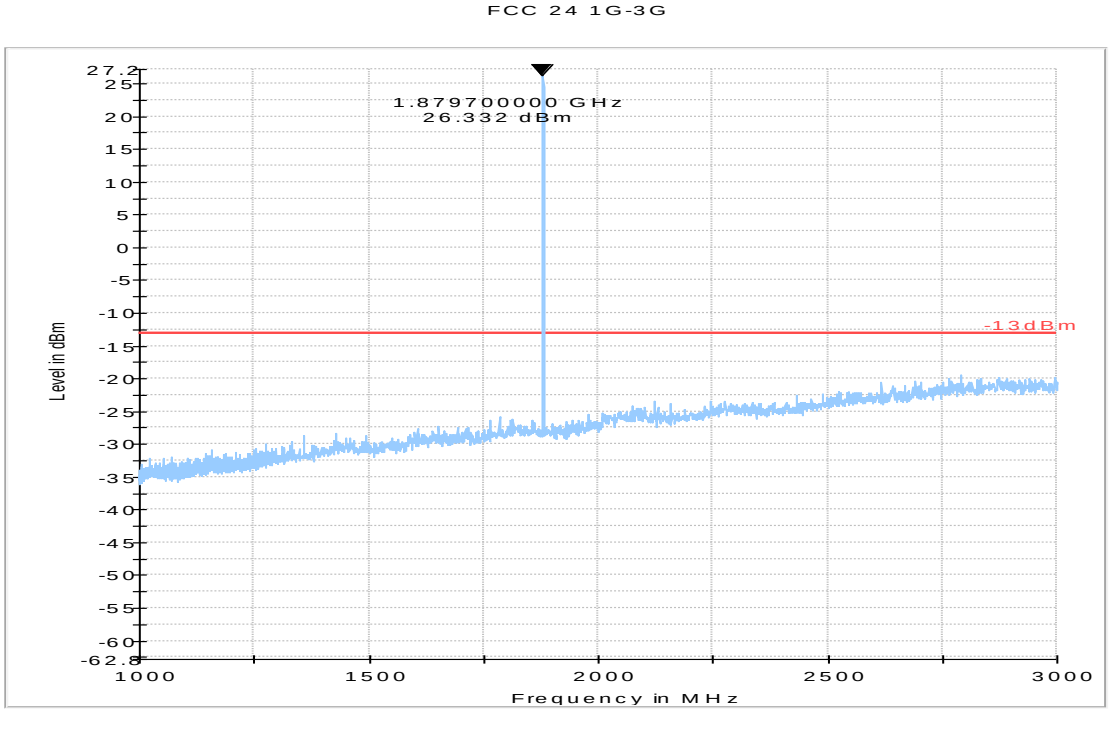
Test results – 30 MHz – 1GHz –High Channel (GSM 1900)



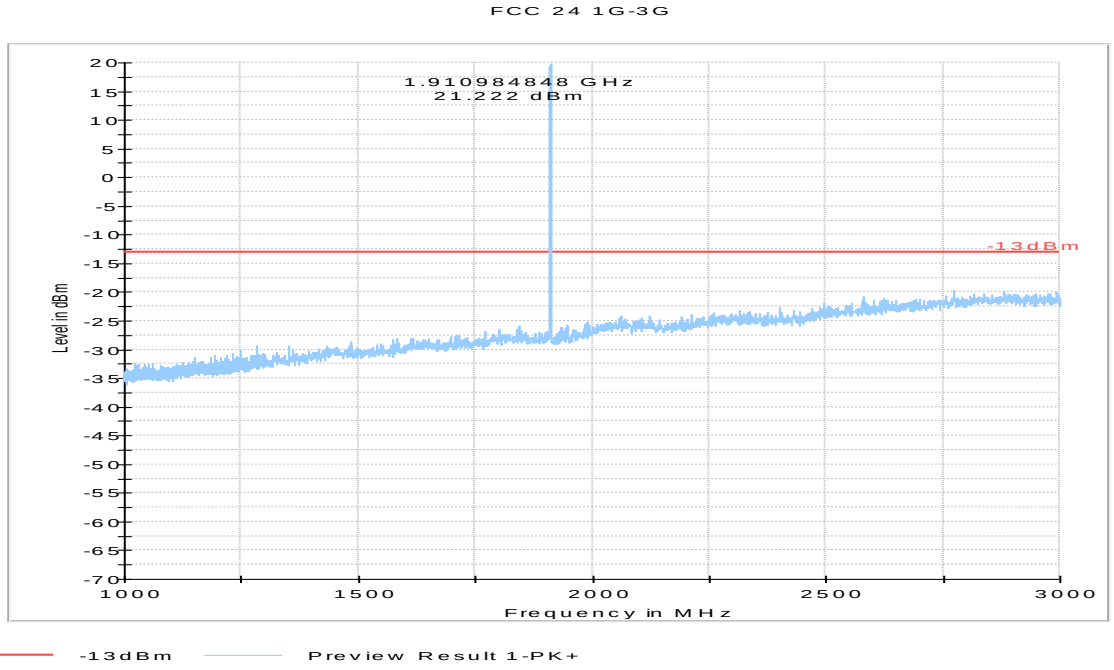
Test results – 1GHz – 3GHz –Low Channel (GSM 1900)



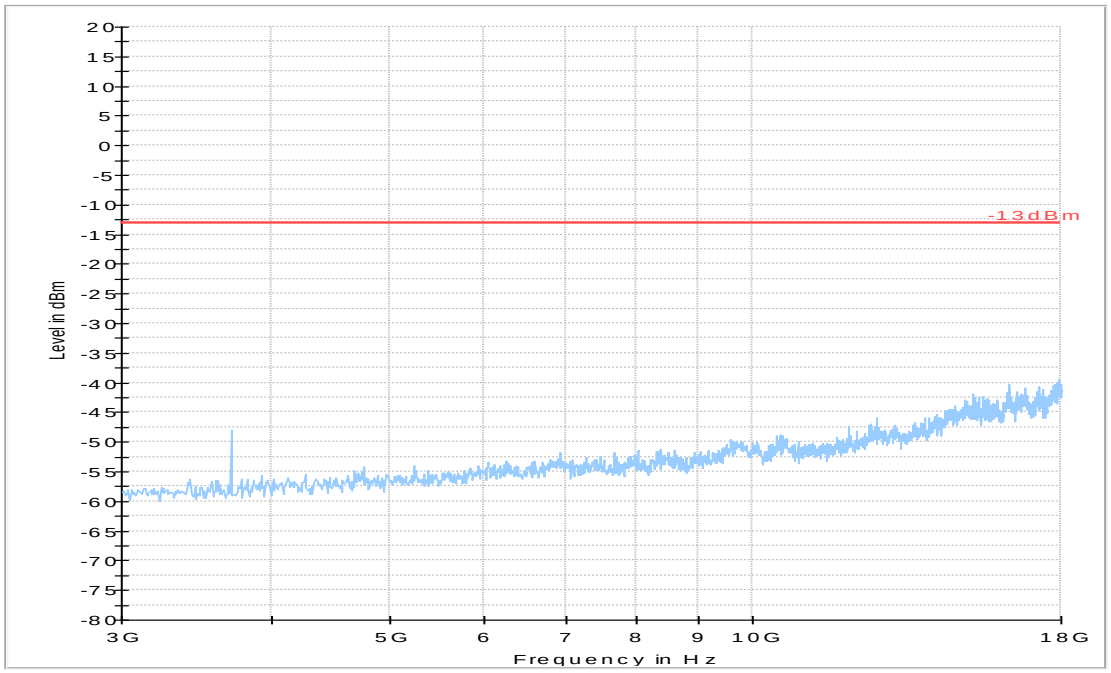
Test results – 1GHz – 3GHz –Mid Channel (GSM 1900)



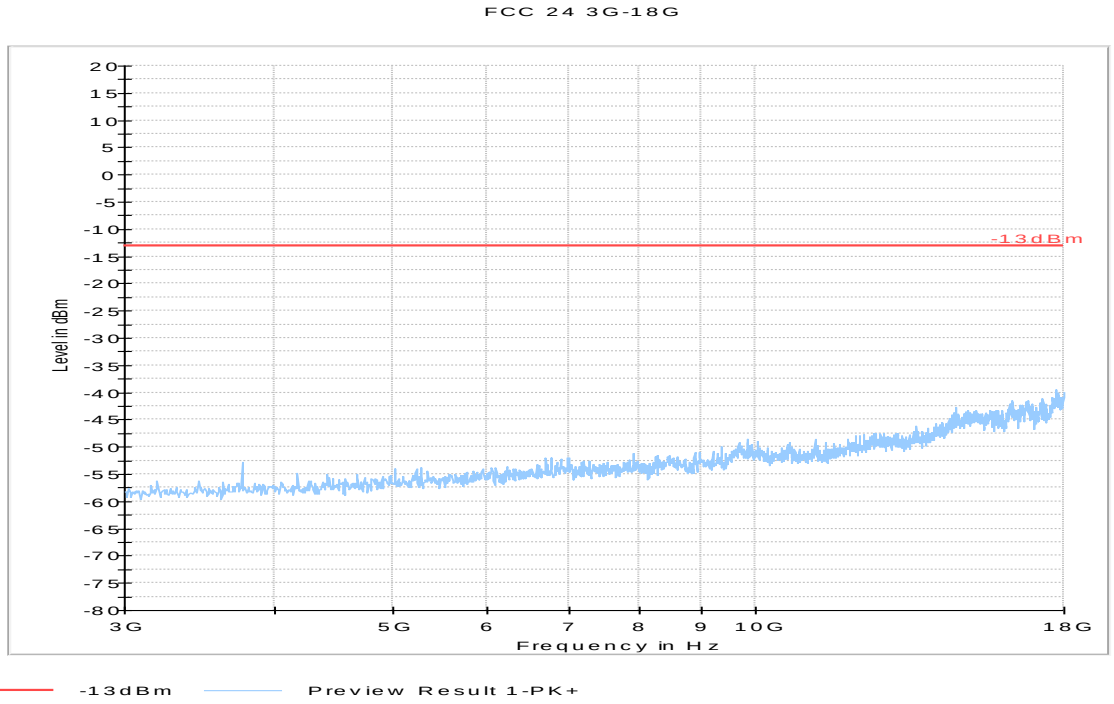
Test results – 1GHz – 3GHz –High Channel (GSM 1900)



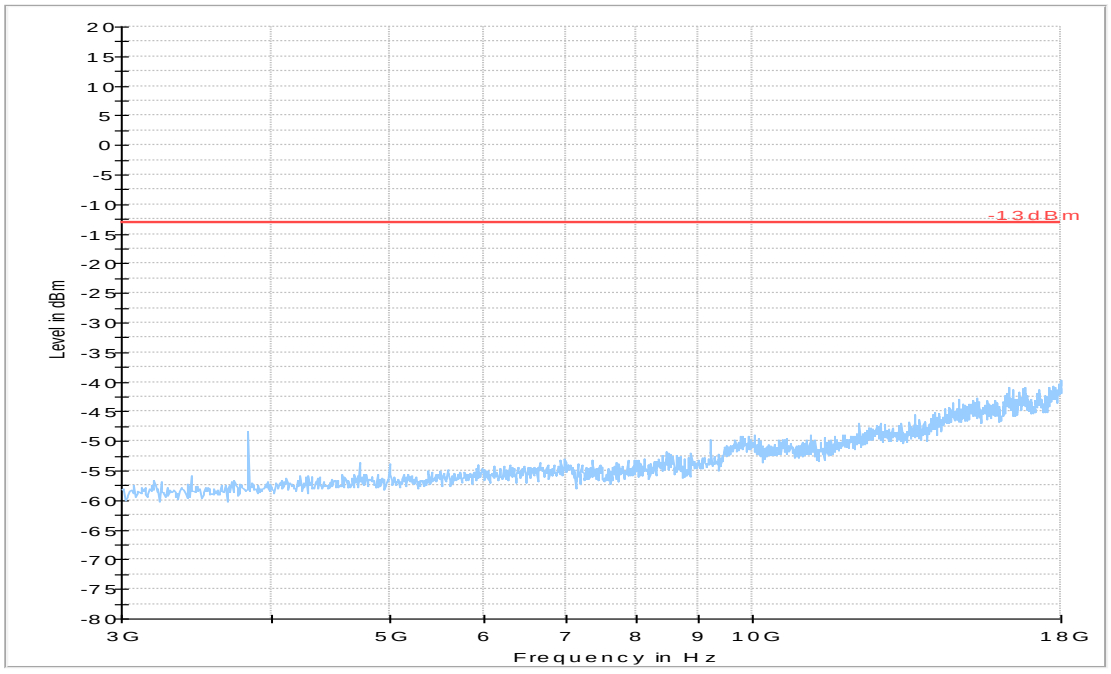
Test results – 3GHz – 18GHz –Low Channel (GSM 1900)



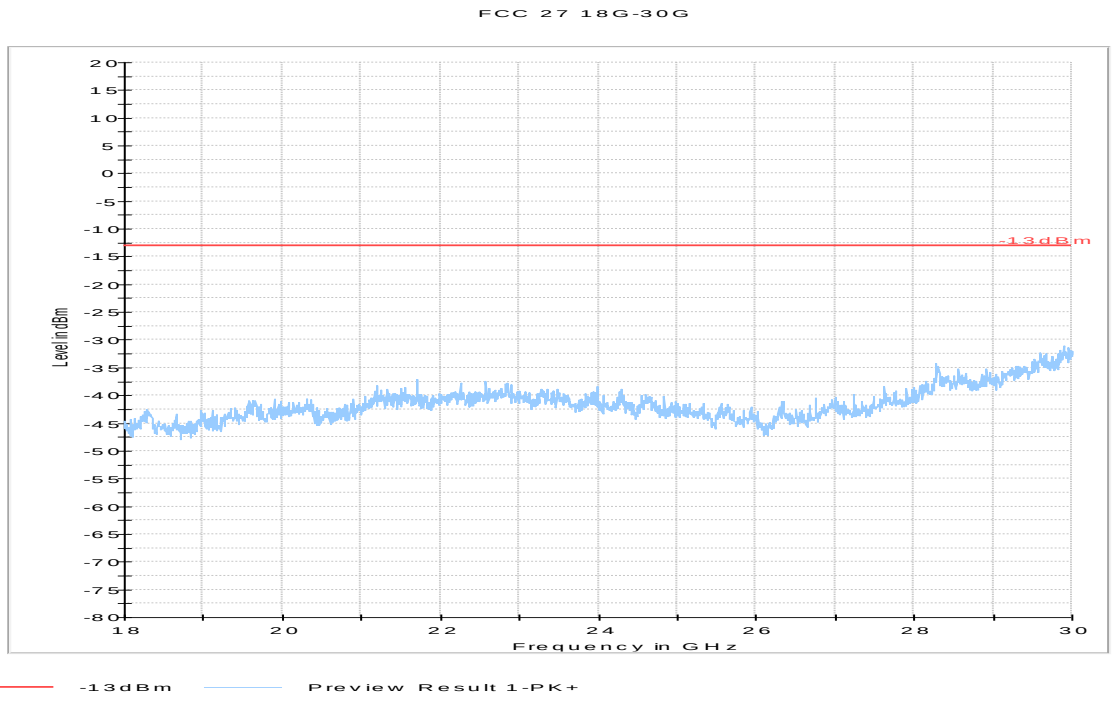
Test results – 3GHz – 18GHz –Mid Channel (GSM 1900)



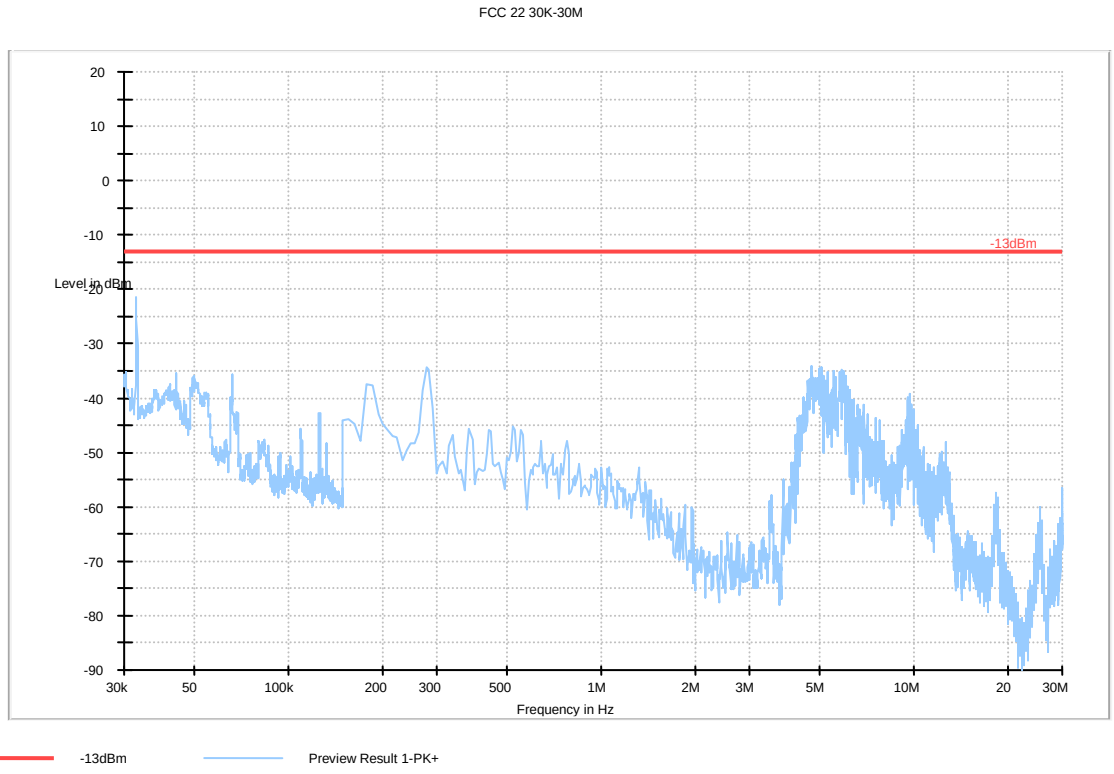
Test results – 3GHz – 18GHz –High Channel (GSM 1900)



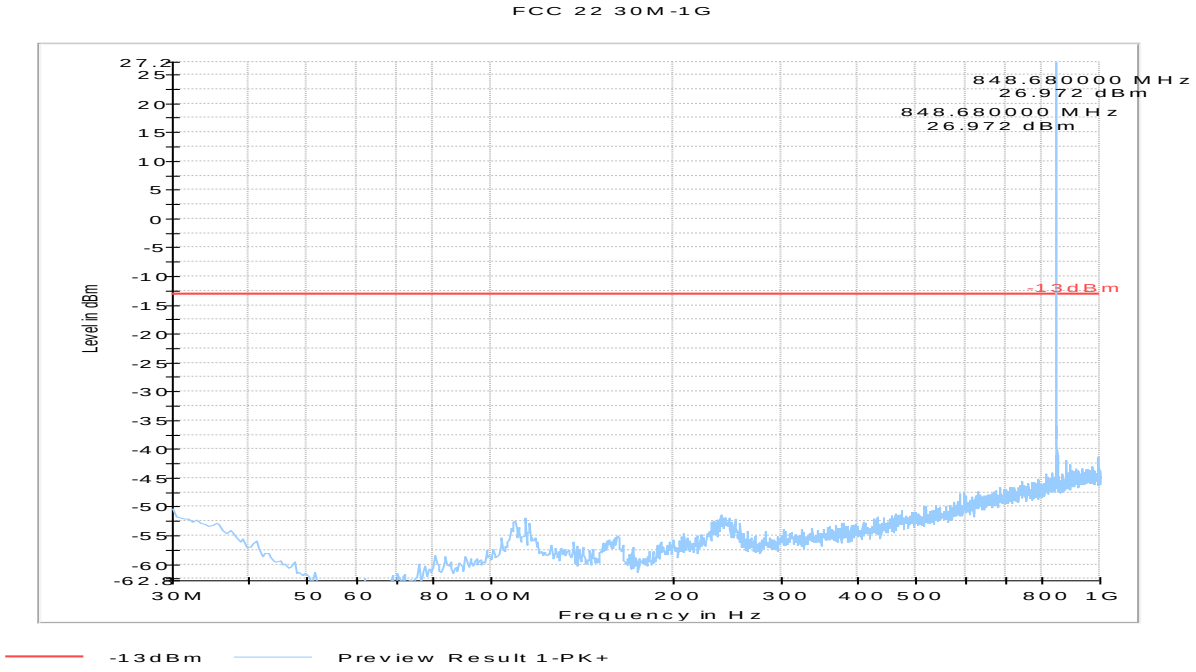
Test results – 18GHz – 30GHz –Mid Channel (GSM 1900)



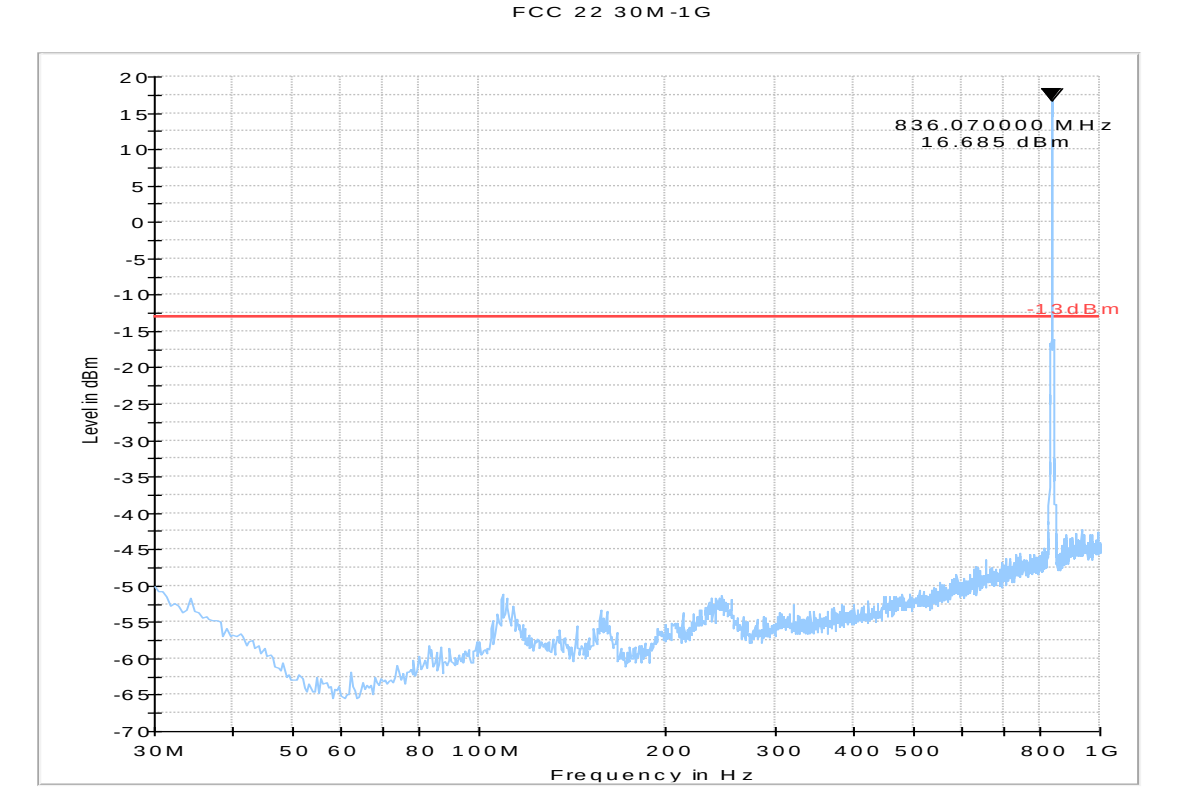
Test results 30 kHz- 30 MHz – Mid Channel (UMTS-850)



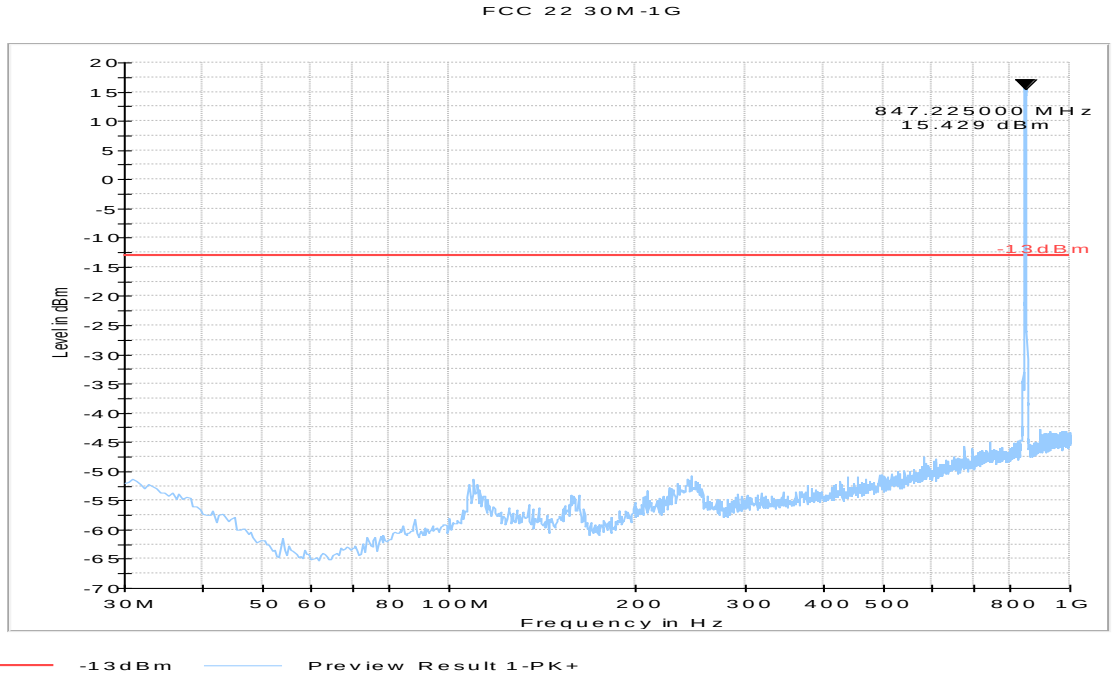
Test results – 30 MHz – 1GHz –Low Channel (UMTS 850)



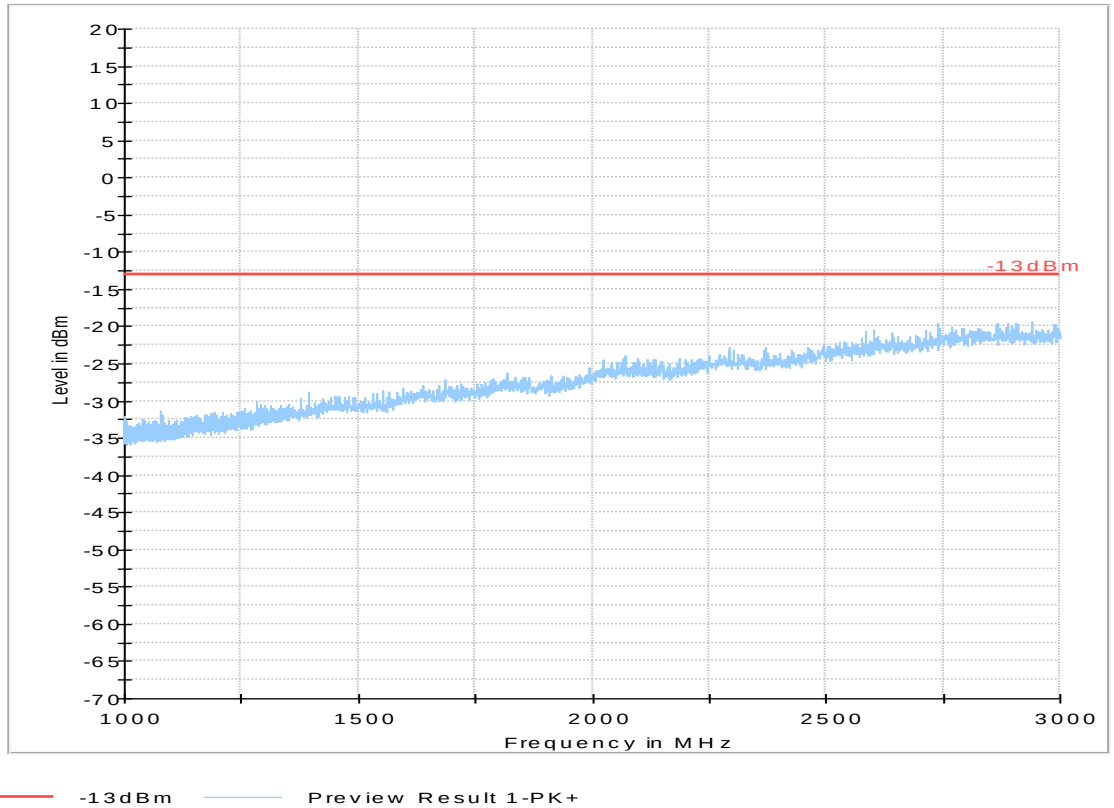
Test results – 30 MHz – 1GHz –Mid Channel (UMTS 850)



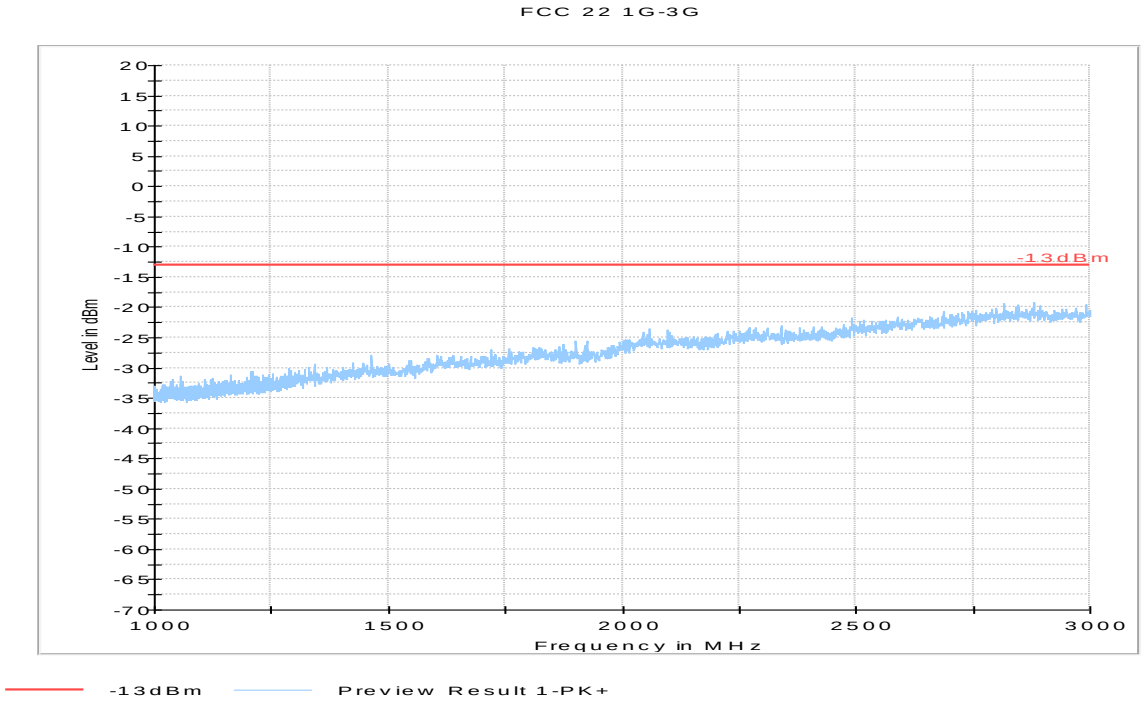
Test results – 30 MHz – 1GHz –High Channel (UMTS 850)



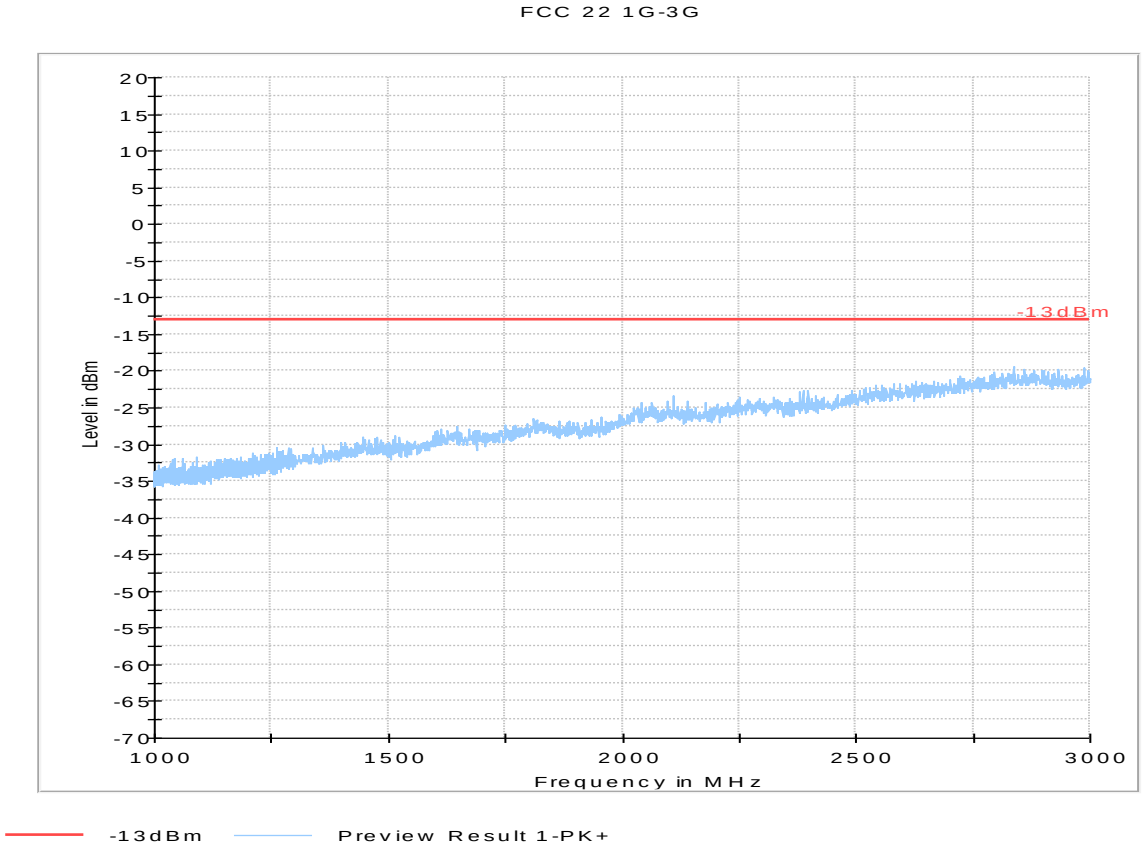
Test results – 1GHz – 3GHz –Low Channel (UMTS 850)



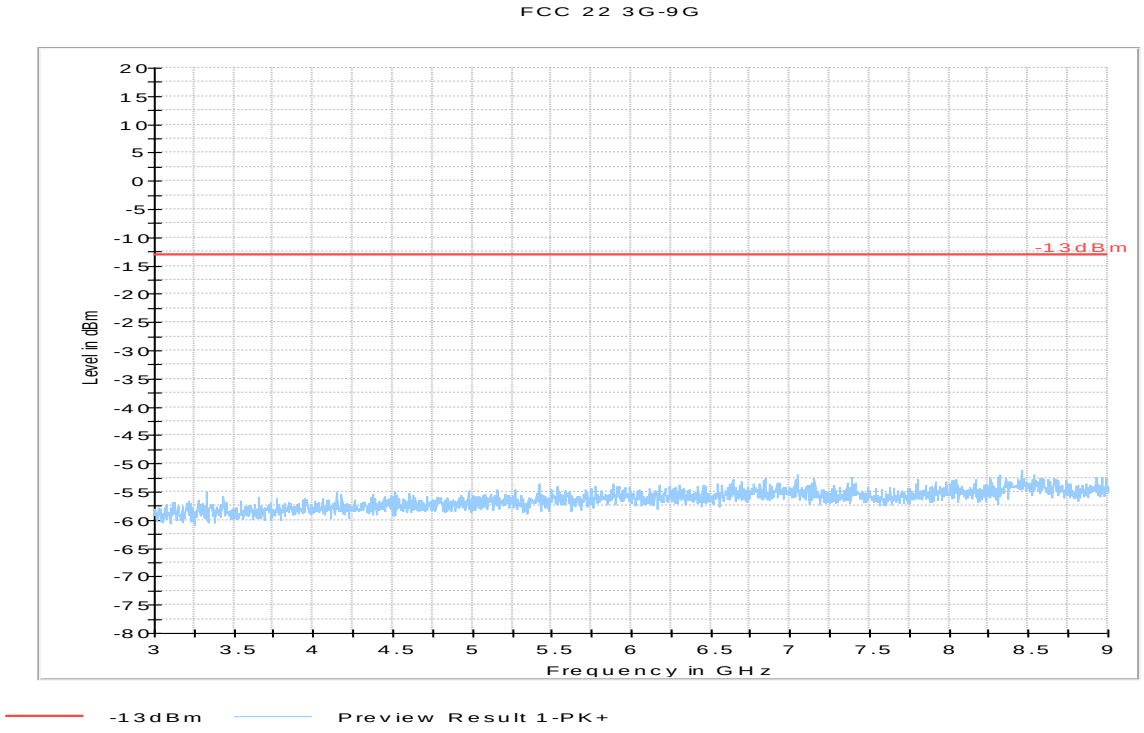
Test results – 1GHz – 3GHz –Mid Channel (UMTS 850)



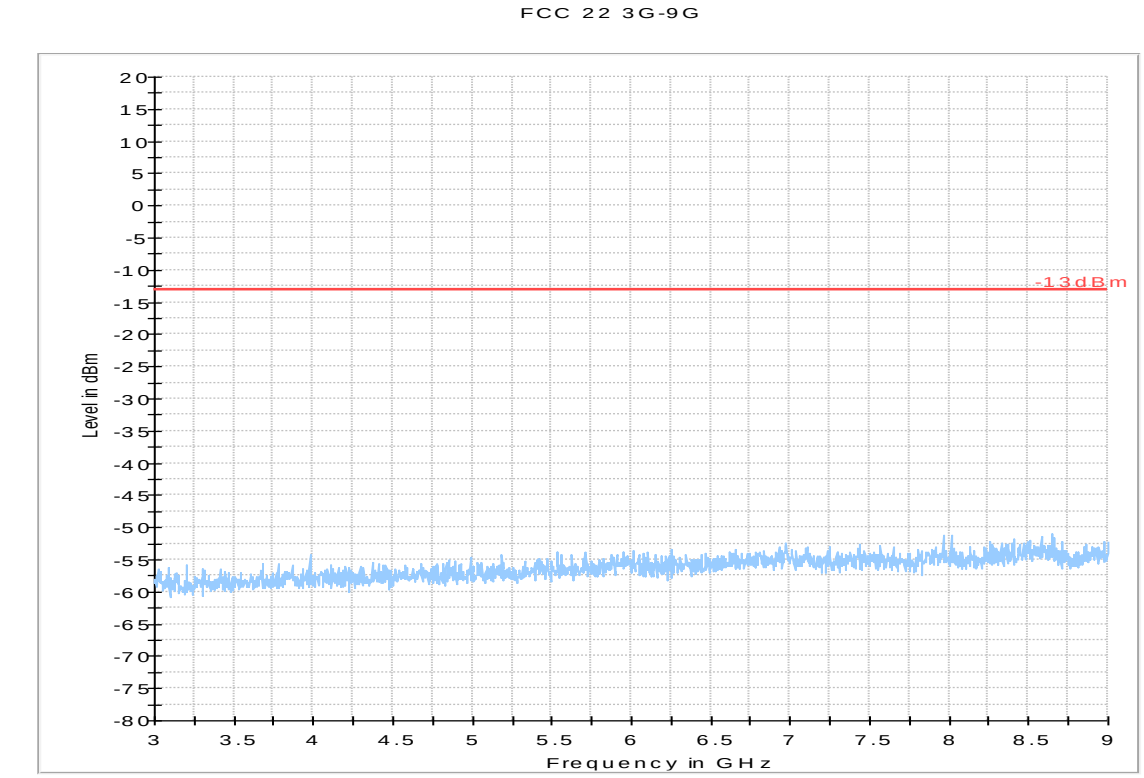
Test results – 1GHz – 3GHz –High Channel (UMTS 850)



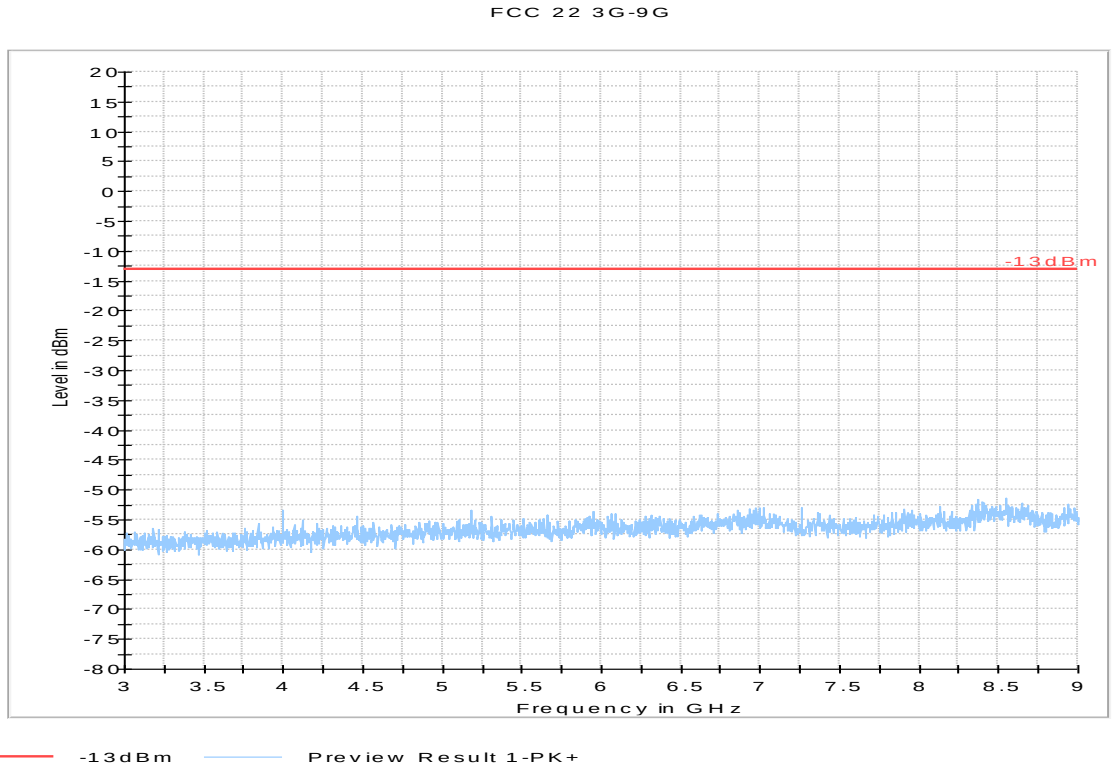
Test results – 3GHz – 9GHz –Low Channel (UMTS 850)



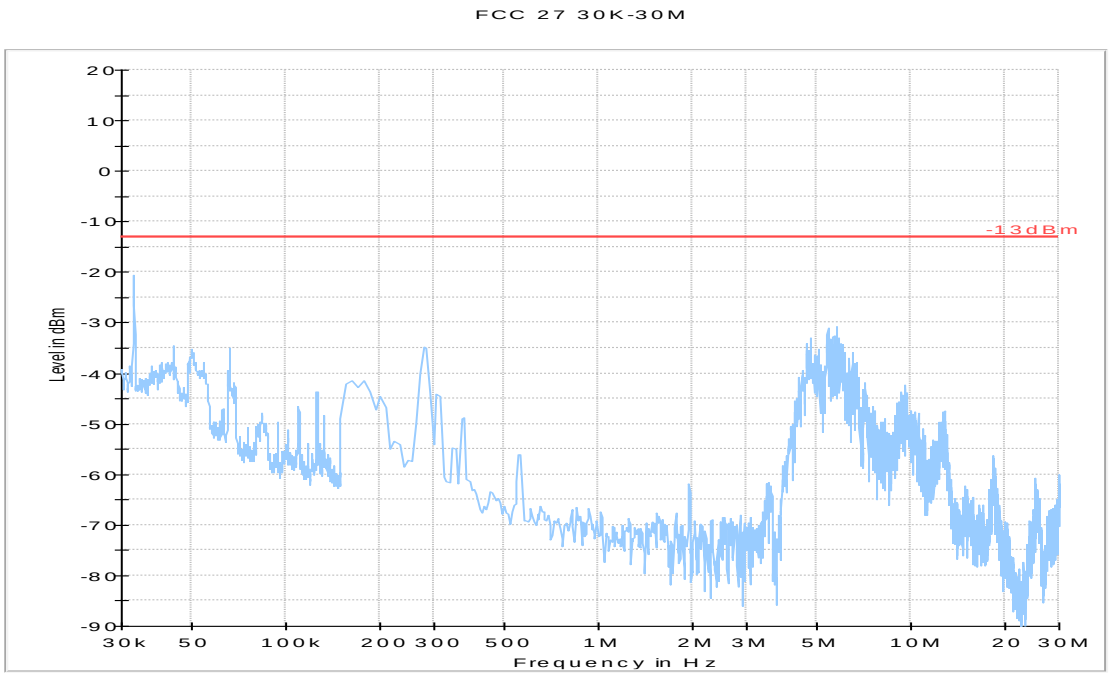
Test results – 3GHz – 9GHz –Mid Channel (UMTS 850)



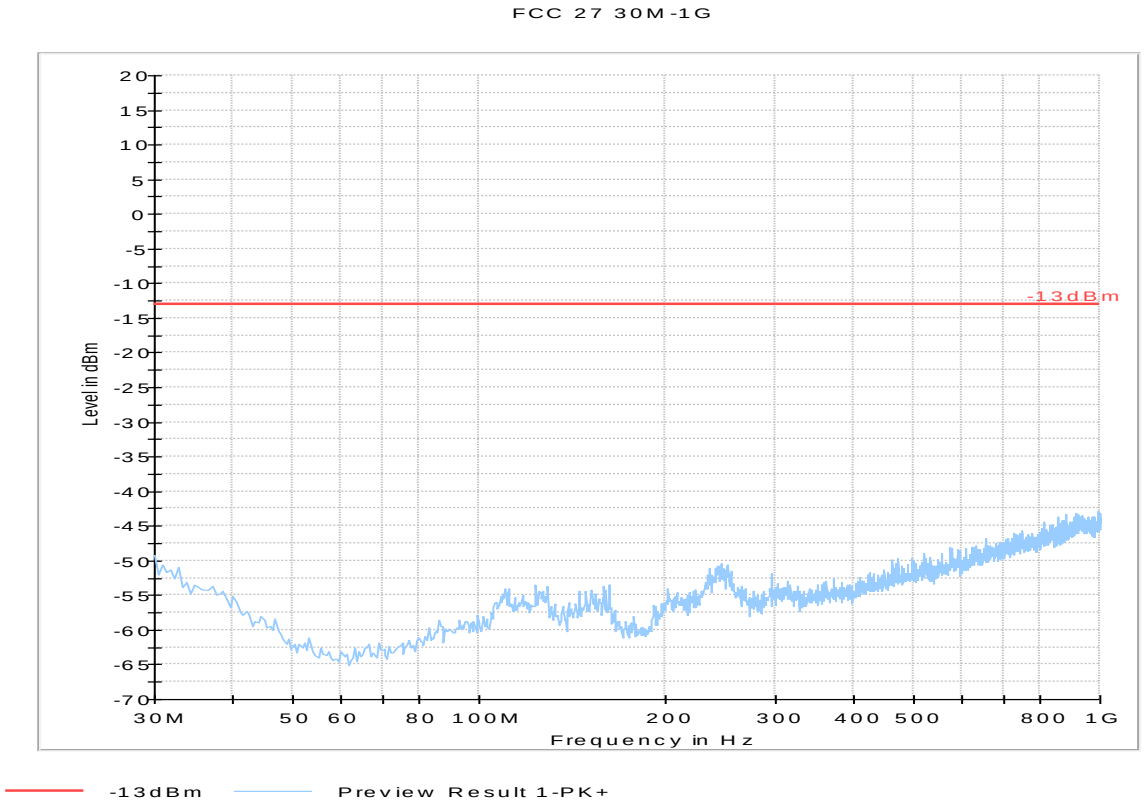
Test results – 3GHz – 9GHz –High Channel (UMTS 850)



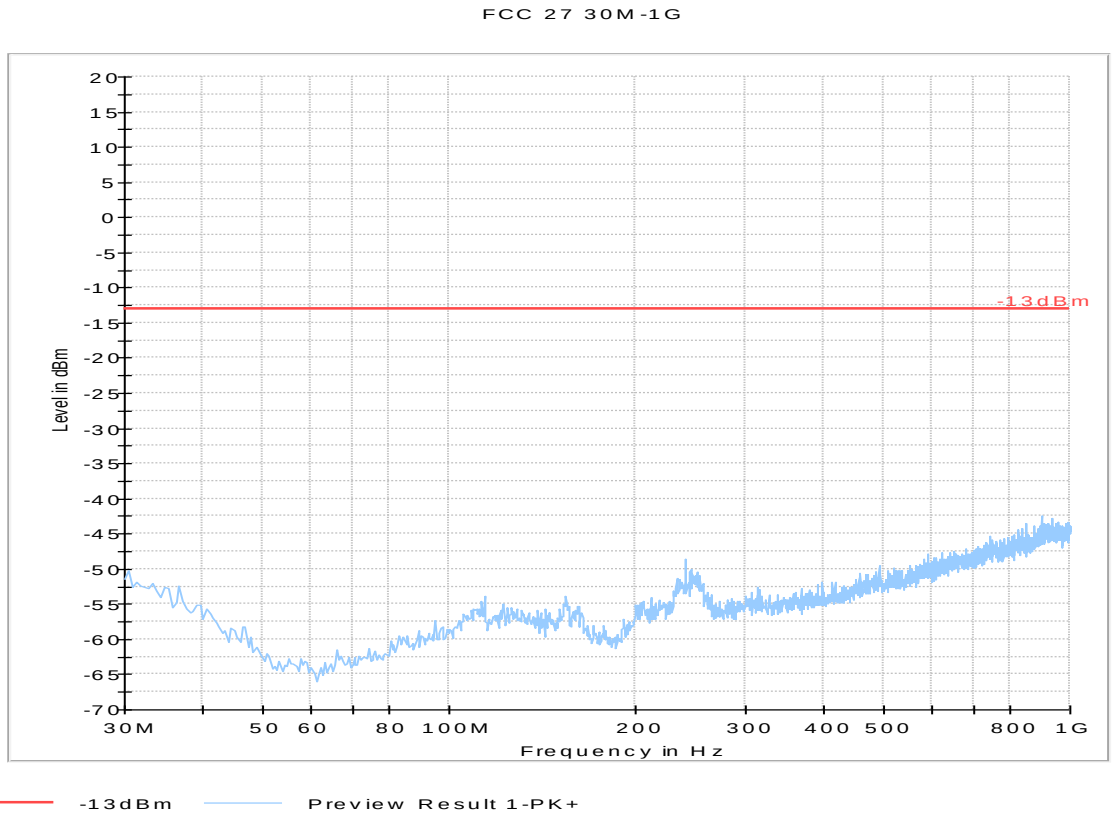
Test results 30 kHz- 30 MHz – Mid Channel (UMTS-1700)



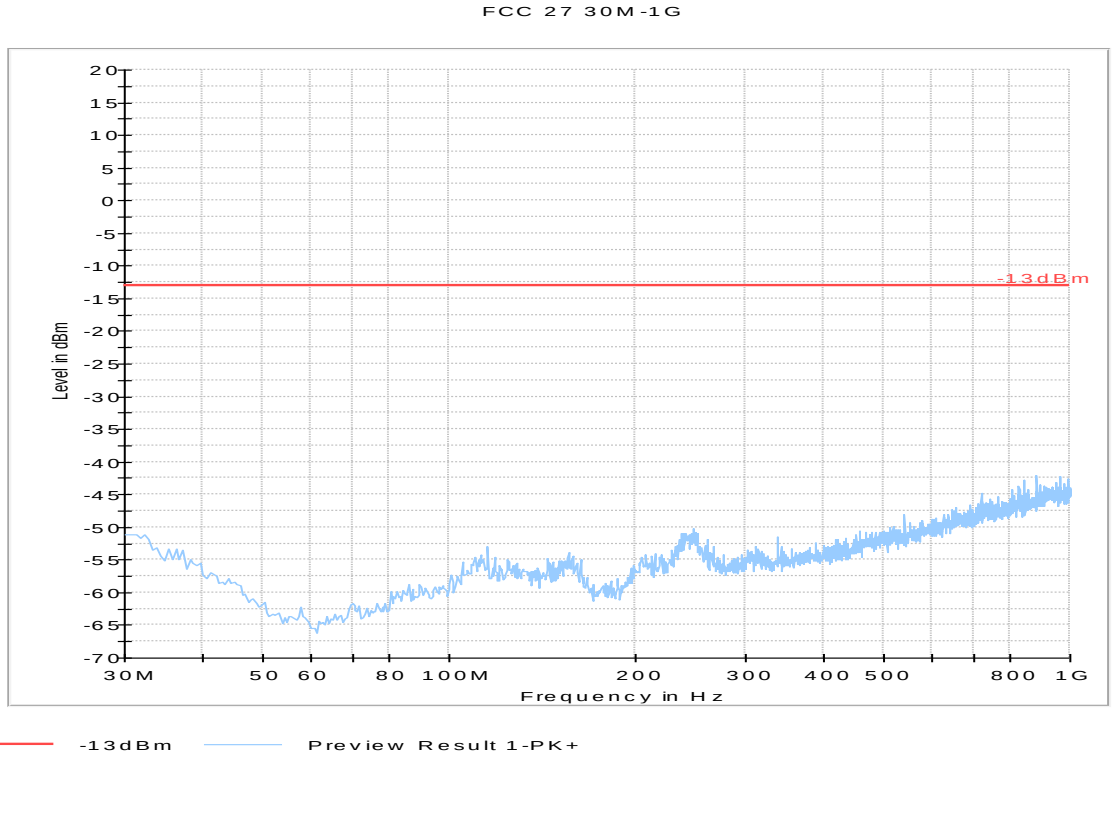
Test results – 30 MHz – 1GHz –Low Channel (UMTS-1700)



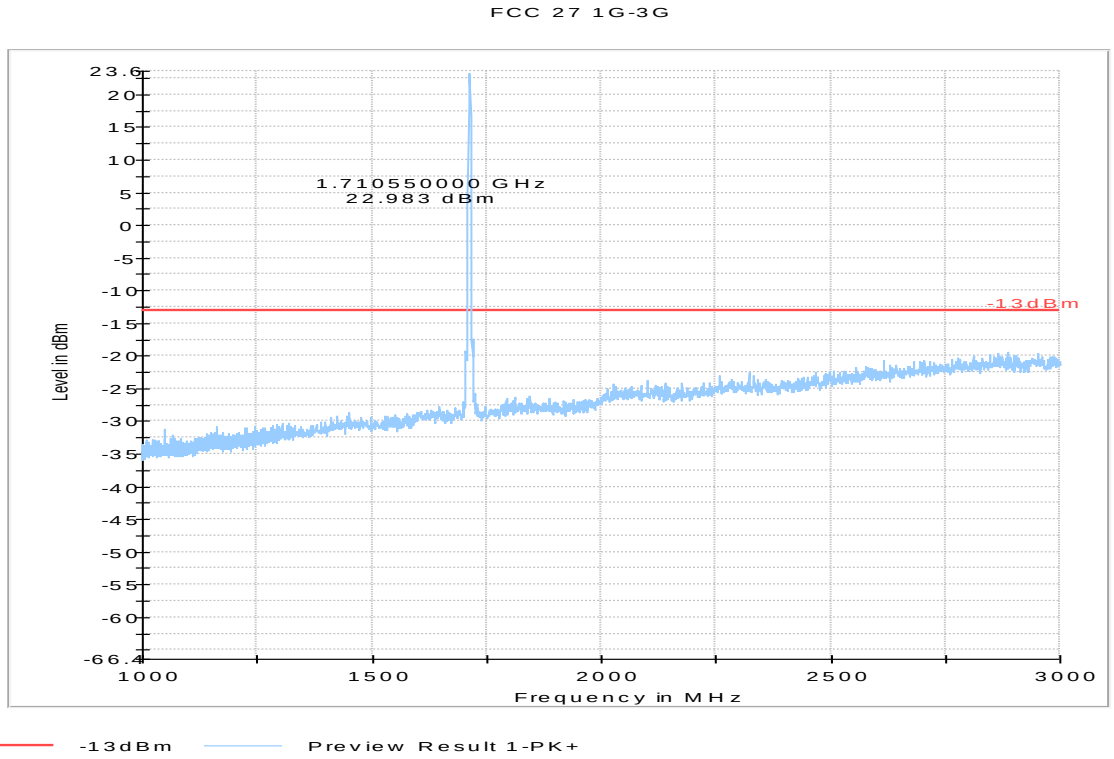
Test results – 30 MHz – 1GHz –Mid Channel (UMTS-1700)



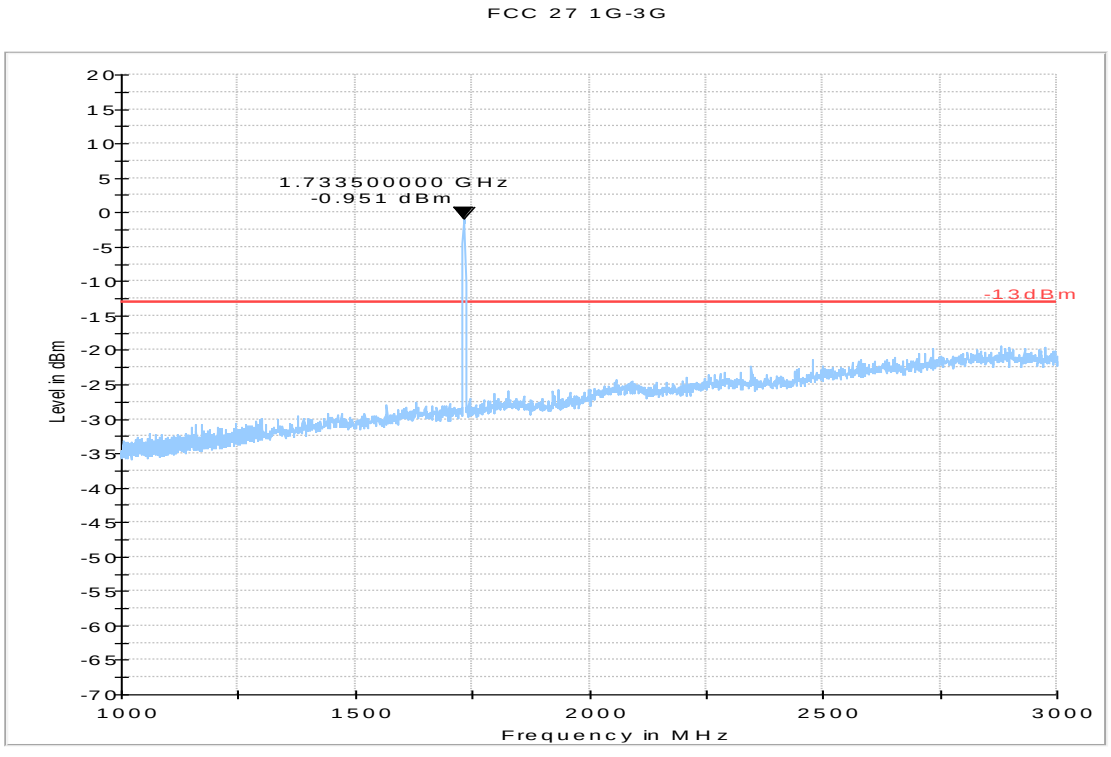
Test results – 30 MHz – 1GHz –High Channel (UMTS-1700)



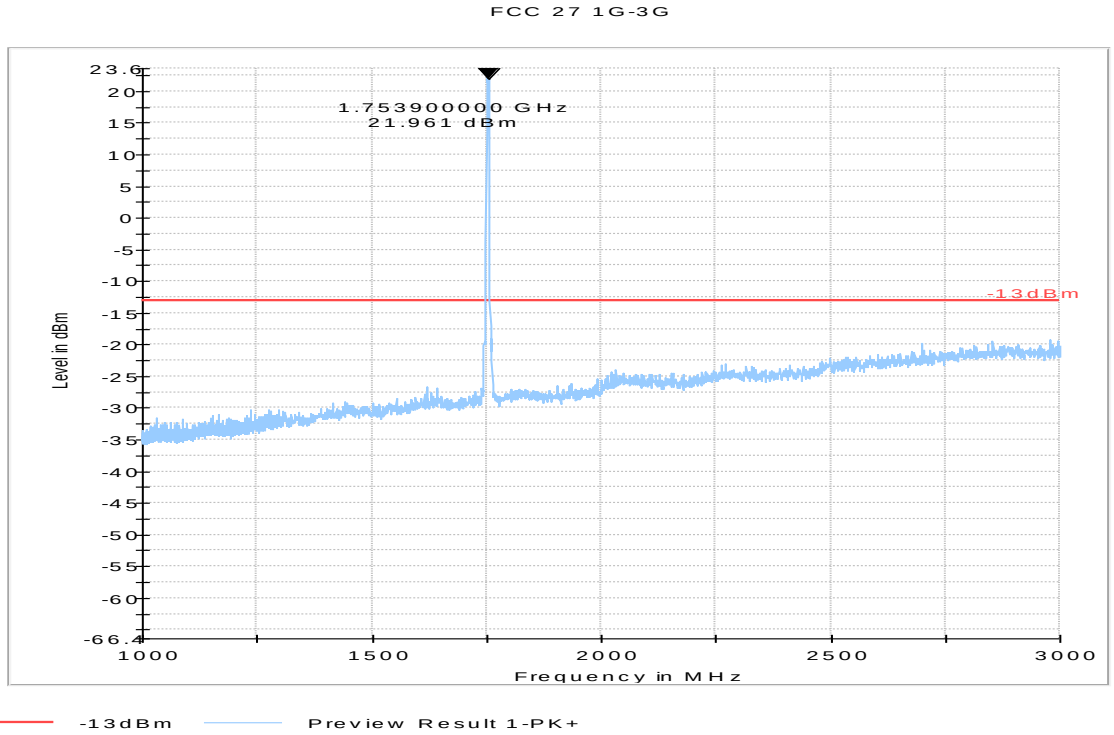
Test results – 1GHz – 3GHz –Low Channel (UMTS-1700)



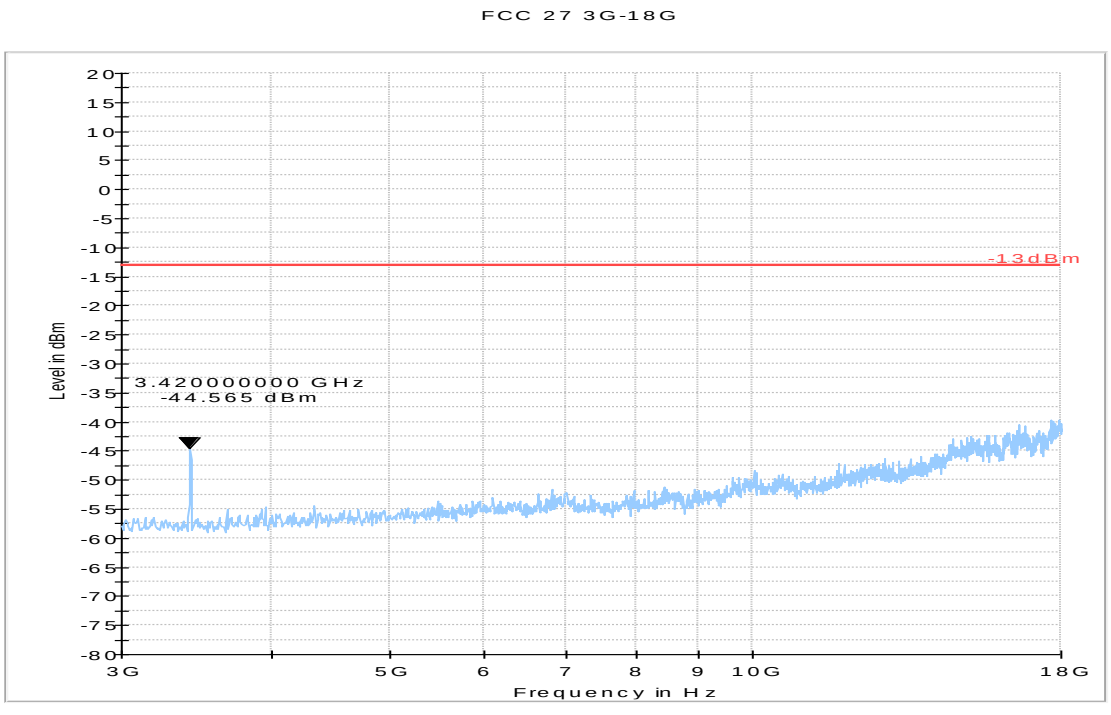
Test results – 1GHz – 3GHz –Mid Channel (UMTS-1700)



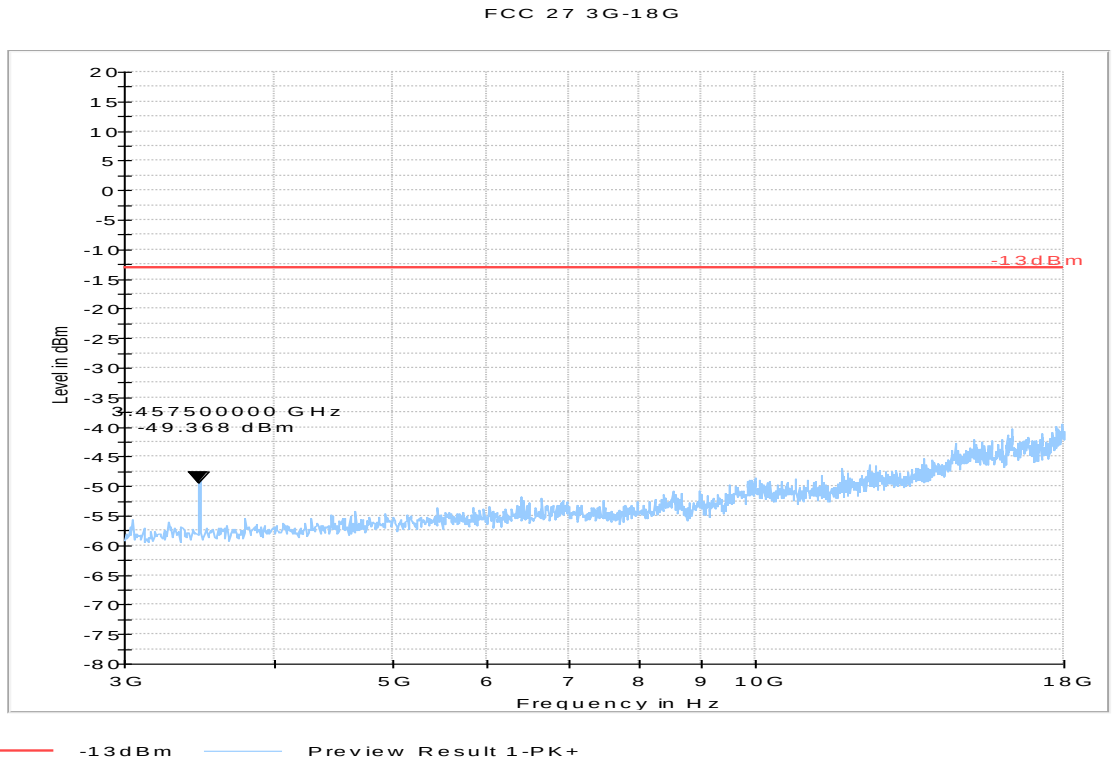
Test results – 1GHz – 3GHz –High Channel (UMTS-1700)



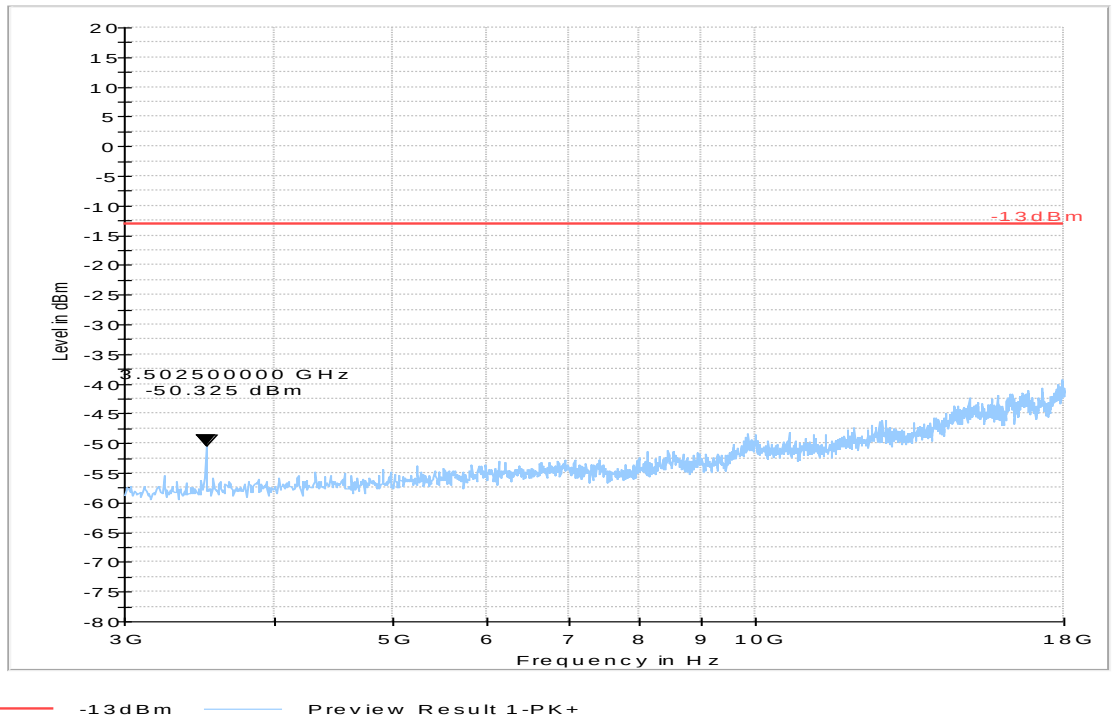
Test results – 3GHz – 18GHz –Low Channel (UMTS-1700)



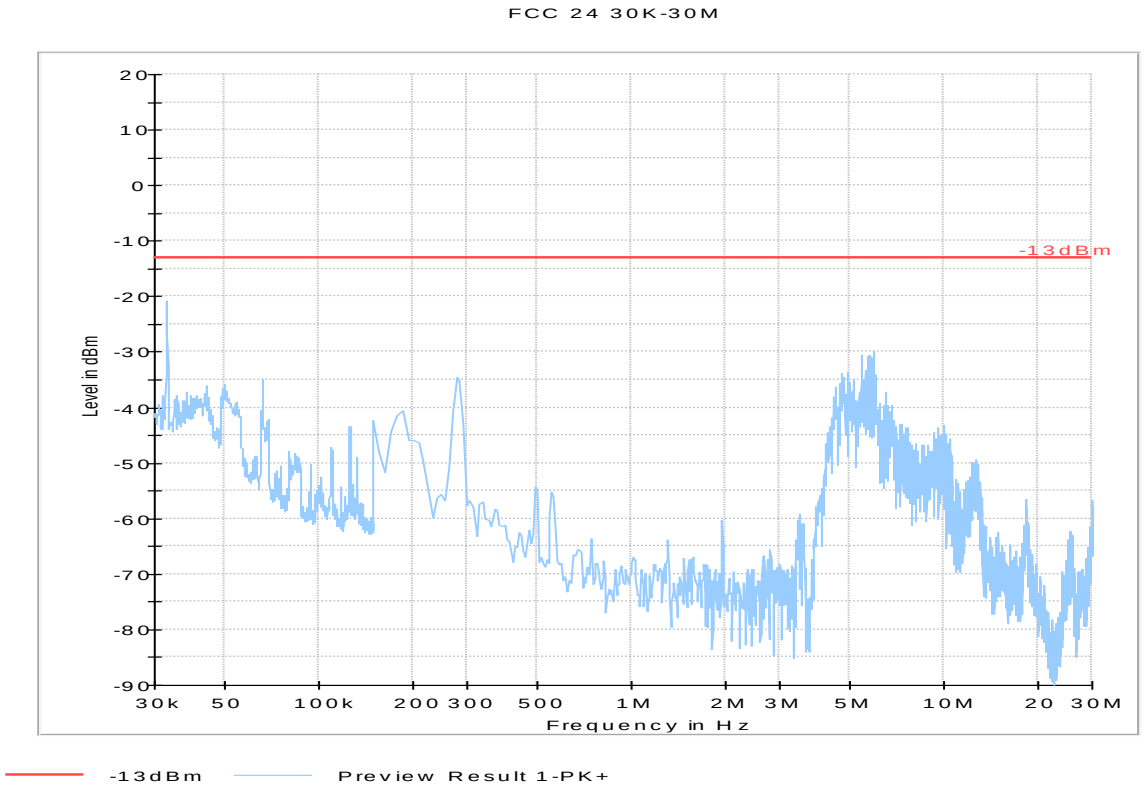
Test results – 3GHz – 18GHz –Mid Channel (UMTS-1700)



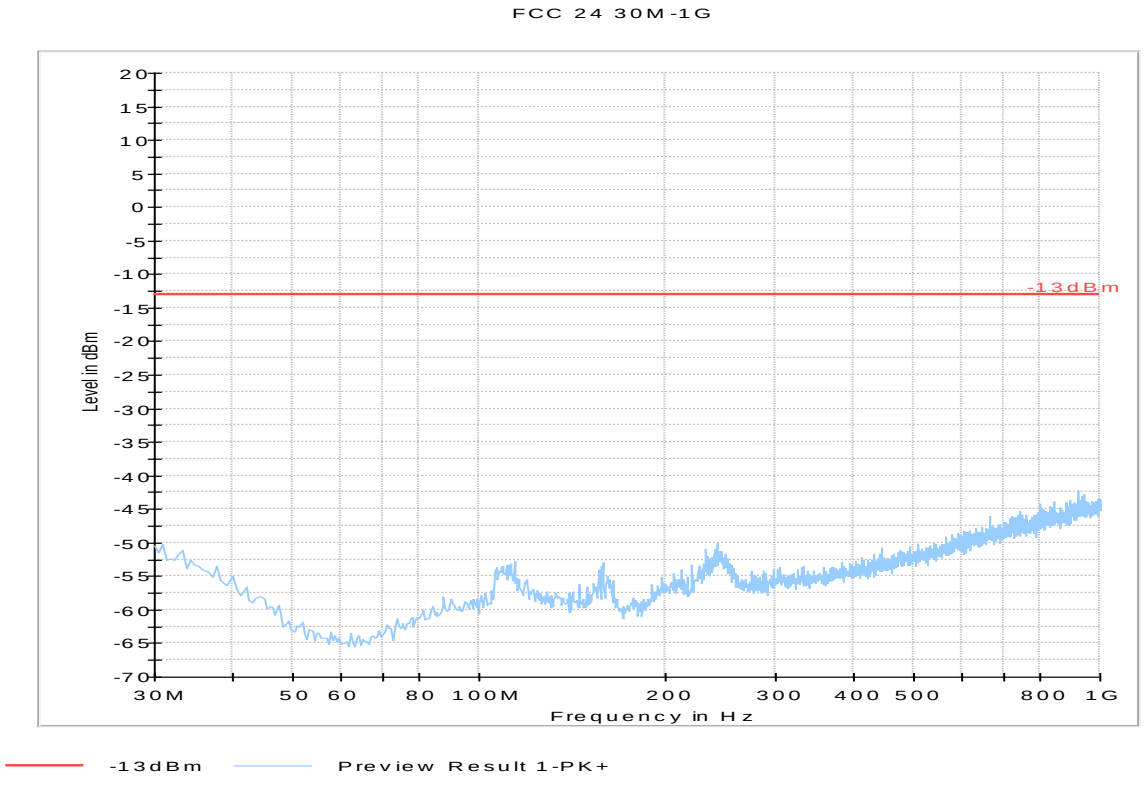
Test results – 3GHz – 18GHz –High Channel (UMTS-1700)



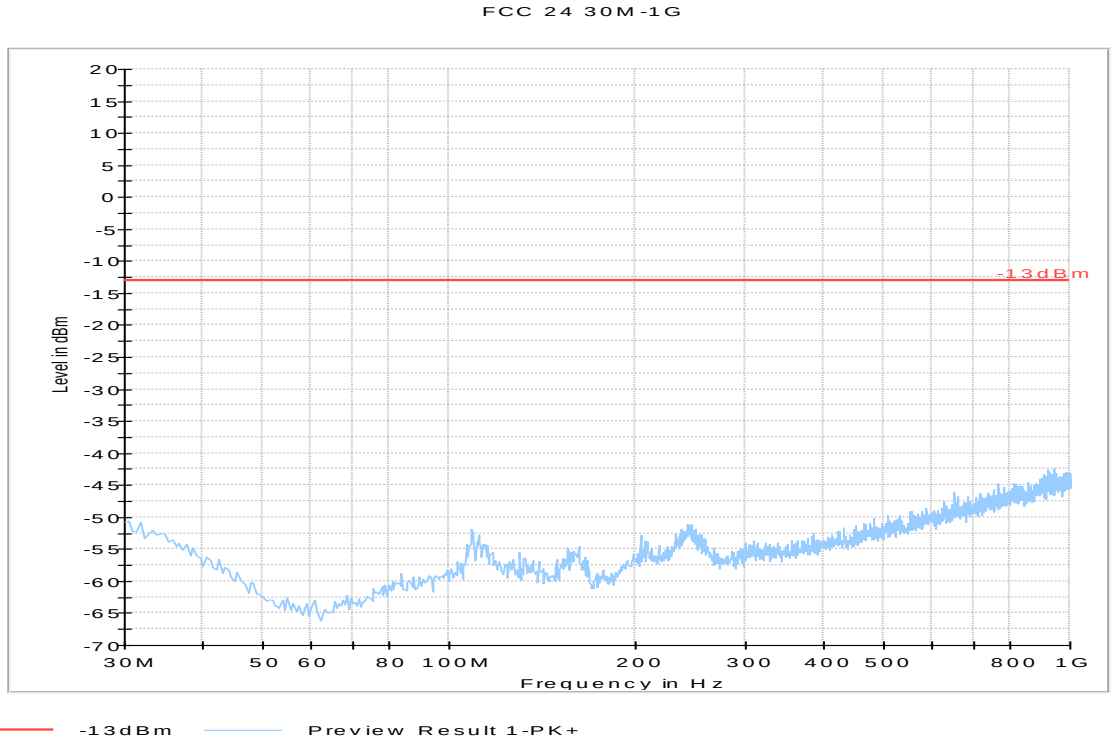
Test results 30 kHz- 30 MHz – Mid Channel (UMTS-1900)



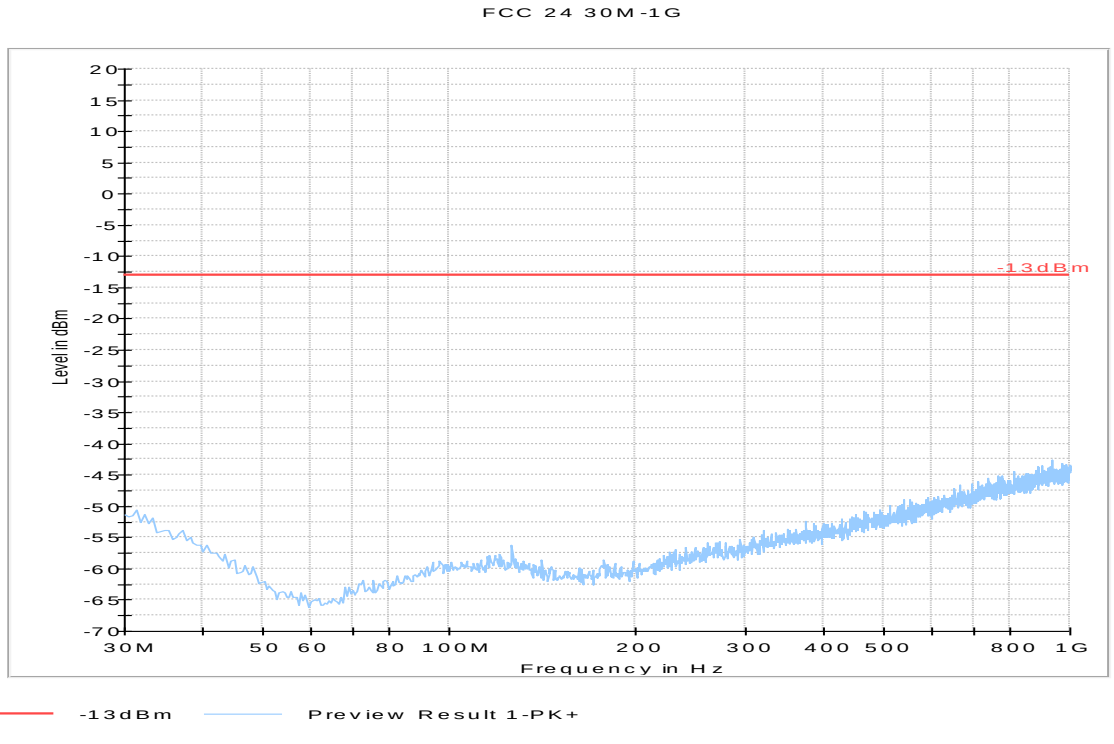
Test results – 30 MHz – 1GHz –Low Channel (UMTS 1900)



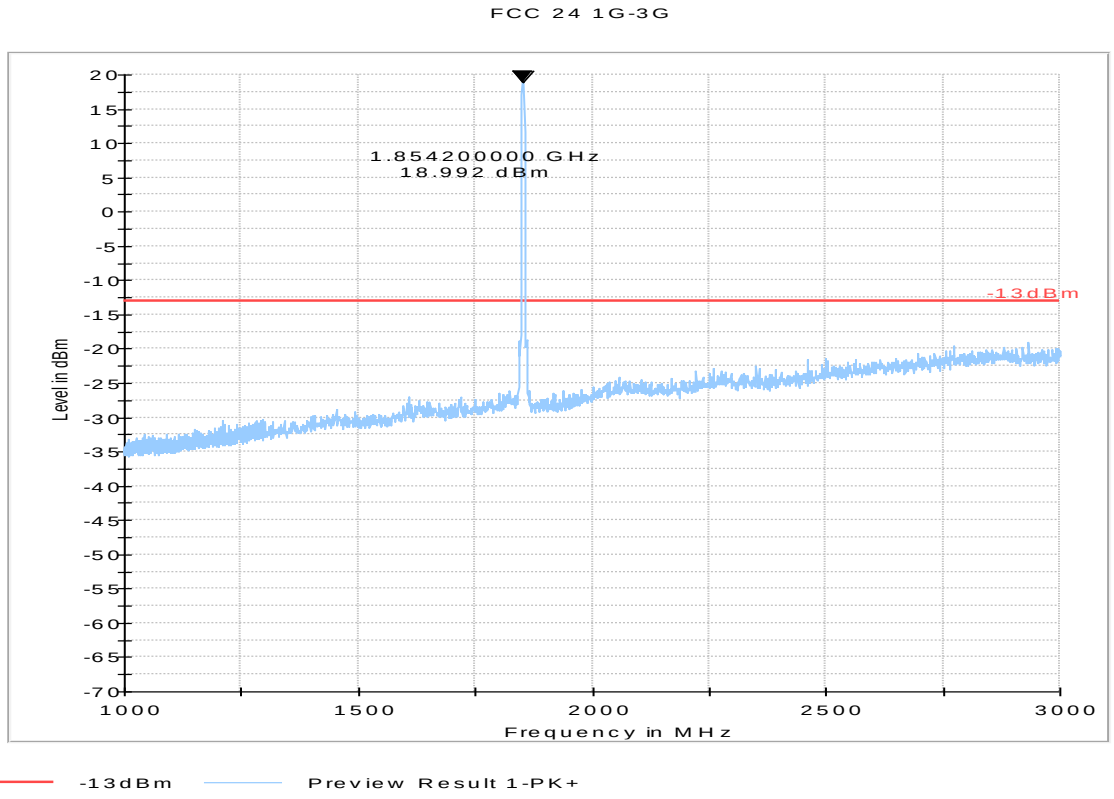
Test results – 30 MHz – 1GHz –Mid Channel (UMTS 1900)



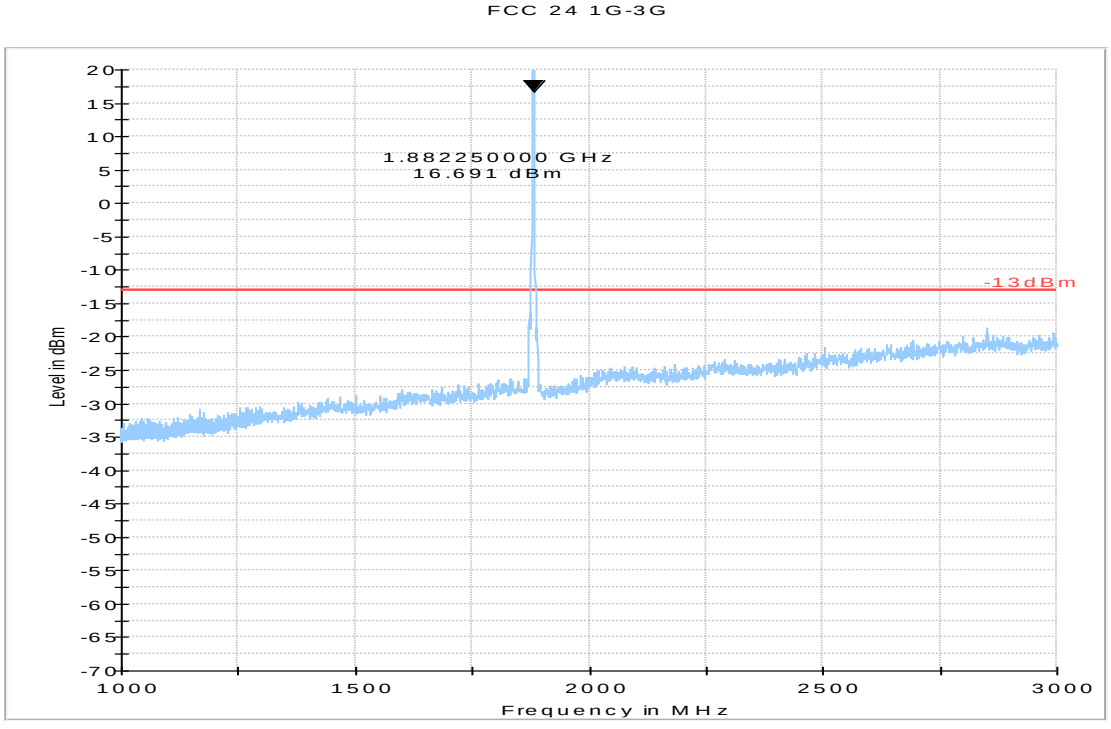
Test results – 30 MHz – 1GHz –High Channel (UMTS 1900)



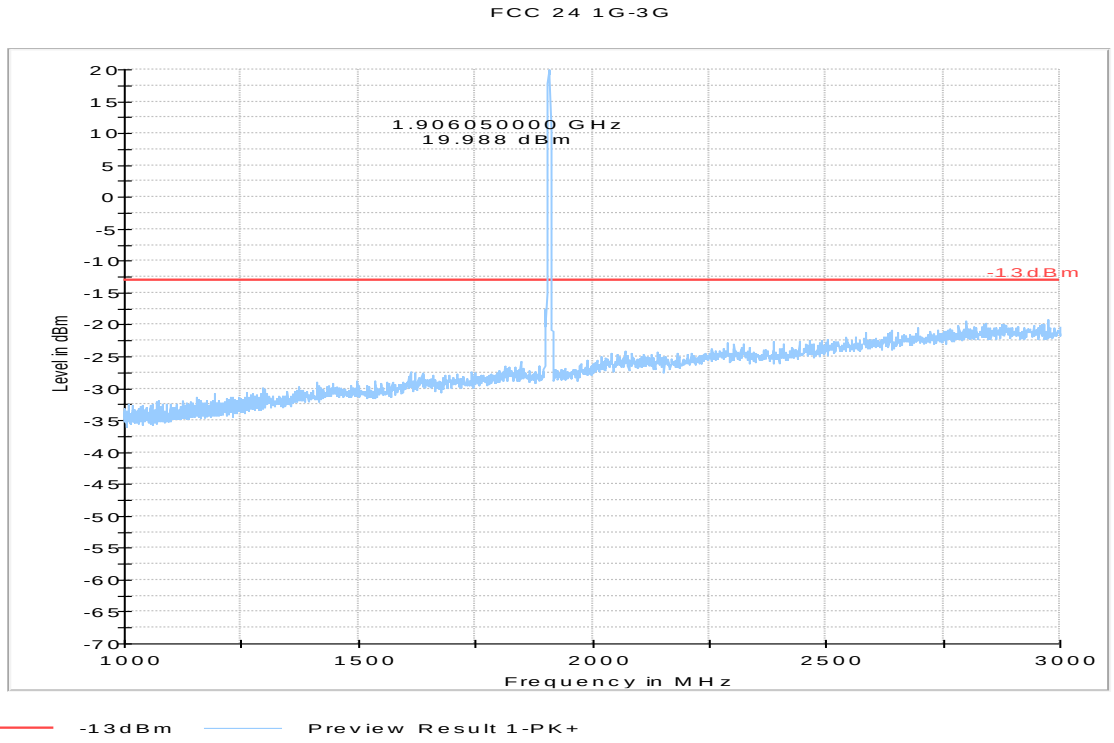
Test results – 1GHz – 3GHz –Low Channel (UMTS 1900)



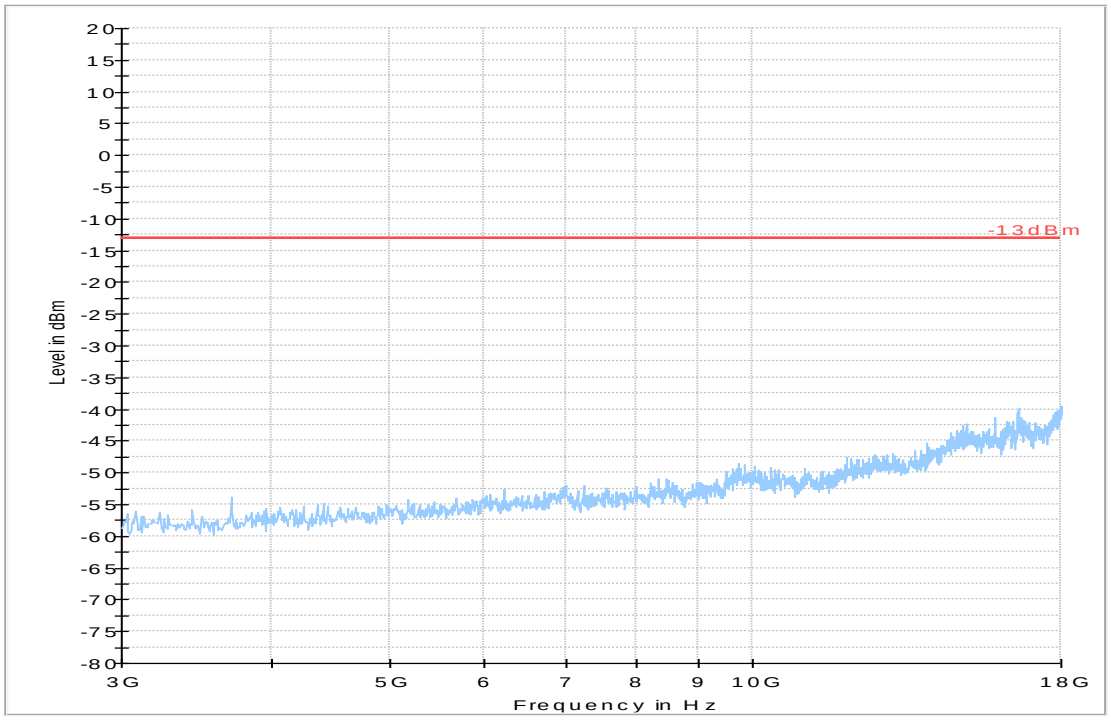
Test results – 1GHz – 3GHz –Mid Channel (UMTS 1900)



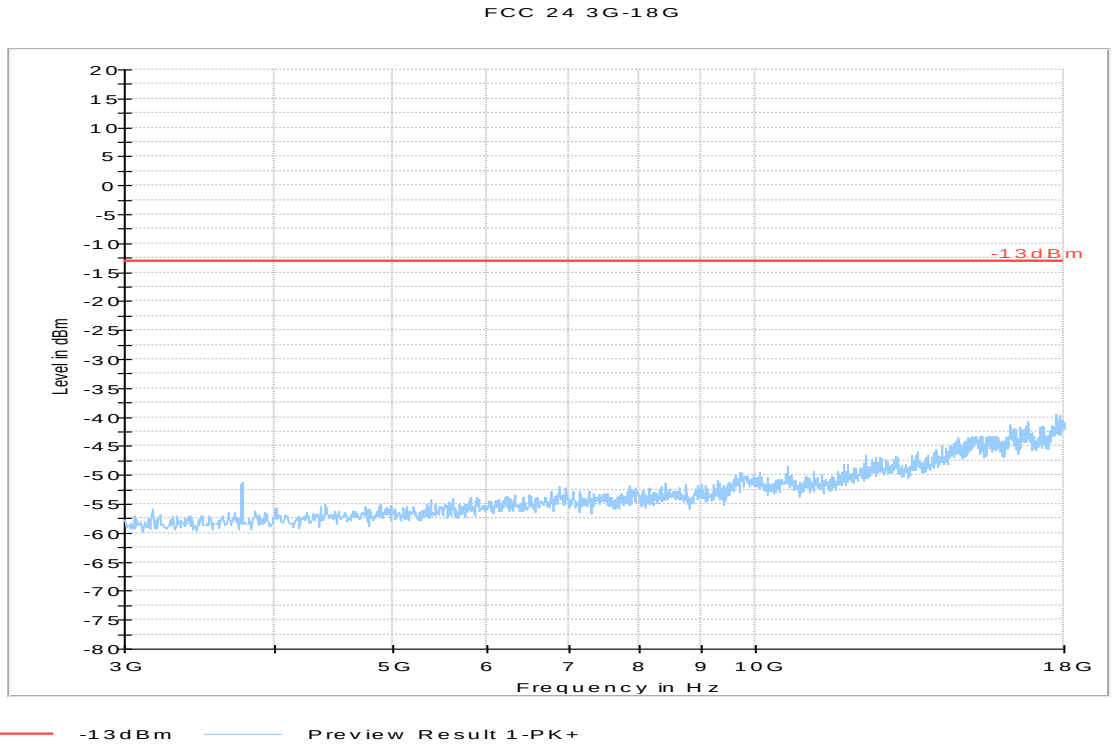
Test results – 1GHz – 3GHz –High Channel (UMTS 1900)



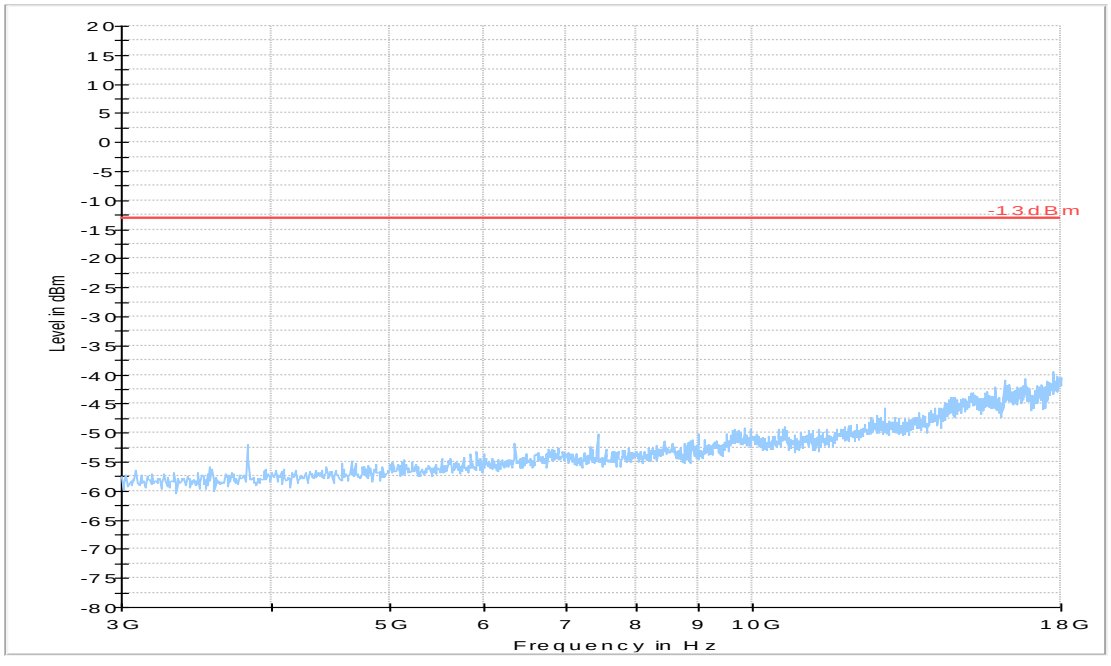
Test results – 3GHz – 18GHz –Low Channel (UMTS 1900)



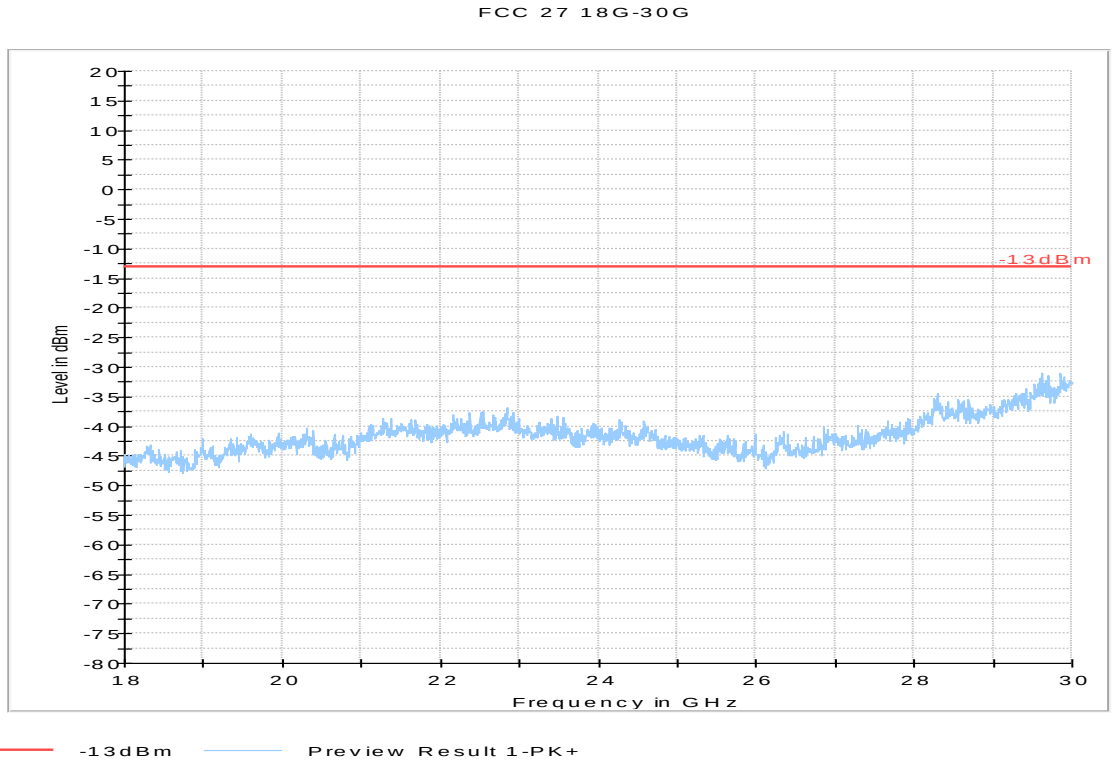
Test results – 3GHz – 18GHz –Mid Channel (UMTS 1900)



Test results – 3GHz – 18GHz –High Channel (UMTS 1900)



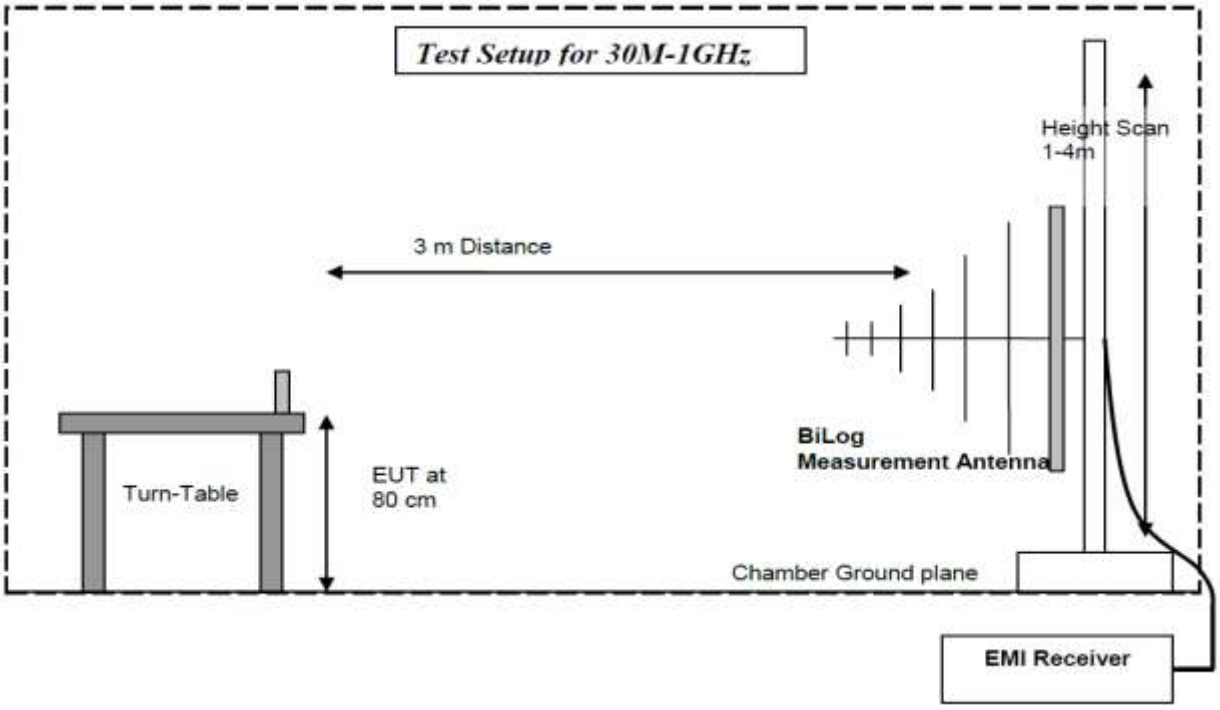
Test results – 18GHz – 30GHz –Mid Channel (UMTS 1900))

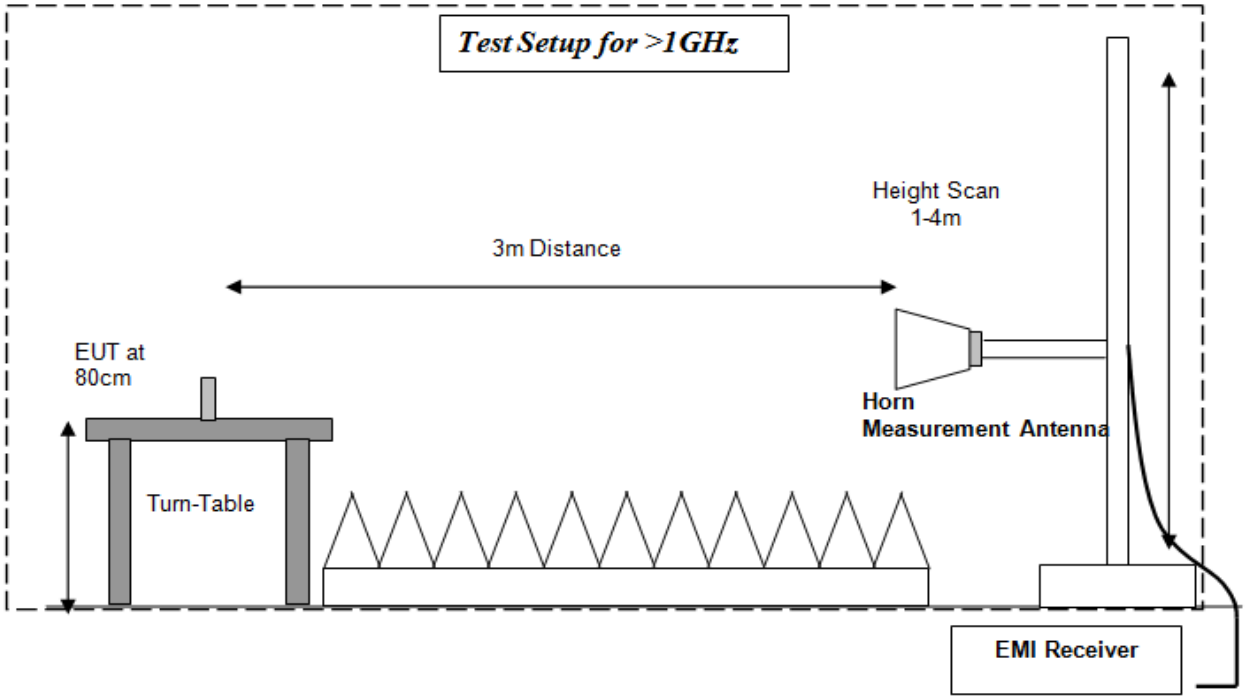


7 Test Equipment and Ancillaries used for tests

Equipment Name	Manufacturer	Type/Model	Serial No.	Cal Date	Cal Interval	Next cal date
3m Semi- Anechoic Chamber and Ground Plane:						
Spectrum Analyzer	Rohde und Schwarz	FSV 40	101022	7/2014	3 years	7/2016
Receiver	Rohde und Schwarz	ESR3	101663	7/2015	3 years	7/2018
LISN	Rohde und Schwarz	ESV 216	101129	7/2015	3 years	7/2018
Radio Communications Tester	Rohde and Schwarz	CMU 200	121672	7/2015	3 years	7/2017
Log Periodic Antenna	Rohde and Schwarz	HL 050	100515	4/2013	3 year	4/2016
Ultralog Antenna	Rohde and Schwarz	HL 562	100495	5/2015	3 year	5/2018
Double-ridge Horn Antenna (1G-18G)	ETS-Lindgren	3117-PA	00167061	7/2014	3 year	7/2017
Double-ridge Horn Antenna (18G-40G)	ETS-Lindgren	3116C-PA	00166821	7/2014	3 year	7/2017
Loop Antenna	ETS-Lindgren	6512	00164698	7/2014	3 year	7/2017
Open Switch Control Unit	Rohde and Schwarz	OPS 130	10085	n/a		
Extention Unit Open Switch Control Unit	Rohde and Schwarz	OSP 150	10086	n/a		
Turn Table TT	Maturo	1.5 SI	TT 1.5SI/204/6070 910	n/a		
Compact antenna Mast	Maturo	CAM 4.0-P	CAM4.0-P/067/6000910	n/a		
Multiple Control Unit	Maturo	MCU	2140910	n/a		
Pre-Amplifier	Rohde and Schwarz	TS-PR 18	100072	Part of the system calibration		
High Pass Filter	Mini-Circuits	SHP-1200+	RUU11201224			
High Pass Filter	Wainwright Instr.	WHKX 3.0/18	109			

8 Test Setup Diagrams





9 Revision History

Date	Report Name	Changes to report	Report prepared by
2015-11-04	EMC_RELIA-003-15001_WWAN	First Revision	Ahmed A. Libab
2015-11-04	EMC_RELIA-003-15001_WWAN	V1.1 update product description	Ahmed A. Libab
2015-11-10	EMC_RELIA-003-15001_WWAN	V1.2 updated antenna gain	Ahmed A. Libab
2015-11-11	EMC_RELIA-003-15001_WWAN	V1.3 add EDGE results	MPDL
2015-11-11	EMC_RELIA-003-15001_WWAN_v1.4	Update power values and report name	MPDL