FCC/IC Test Report

FOR:

Xirgo Technologies, Inc.

Model:
XT-4850C

Product Description:
Solar-powered Cellular, GPS, and ZiGBee Tracker

FCC ID: GKM-XT4850C
IC Certification Number: 10281A-XT4850C

47 CFR Part 2, 22, 24
RSS-GEN issue 4
RSS-132 Issue 3
RSS-133 Issue 6

TEST REPORT #: EMC_XIRGO-093-15001_FCC_22_24
DATE: 2015-05-13

ACCREDITED
TESTING LABORATORY
Certificate #2135.01

CTIA Authorized Test Lab
LAB CODE 20020328-00

FCC:
Accredited

IC recognized #
3462B-1

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

Table of Contents

1 Assessment

The following equipment as further described in section 3 of this test report was evaluated against the applicable criteria specified in FCC CFR47 Parts 2, 22 and 24 & Industry Canada Radio Standard Specifications RSS-GEN Issue 4, RSS-132 Issue 3 and RSS-133 Issue 6.
No deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Xirgo Technologies, Inc.	Solar-powered Cellular, GPS, and ZiGBee Tracker	XT-4850C

Report reviewed by:

Date	Section	Name	Signature
2015-05-13	Compliance	Heiko Strehlow (Chief Operating Officer)	Signing on Behalf of Franz Engert (Compliance Manager)

Digitally signed by Heiko Strehlow
DN: cn=Heiko Strehlow, o, ou, email, c=US
Date: 2015.05.13 16:09:21 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2015-05-13	Compliance	Douglas Antioco (EMC Engineer)	Douglas Antioco 2015.05.13 14:26:38 -07'00'

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:	CETECOM Inc. 411 Dixon Landing Rd Milpitas, CA 95035
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Compliance Manager:	Franz Engert
Responsible Project Leader	Douglas Antioco

2.2 Identification of the Client

Applicant's Name:	Xirgo Technologies, Inc.
Street Address:	188 Camino Ruiz
City/Zip Code	Camarillo CA 93012
Country	United States
Contact Person:	Nader Barakat
Phone No.	805-233-0583
e-mail:	nbarakat@xirgotech.com

2.3 Identification of the Manufacturer

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

2.4 Dates of Testing:

2015/04/01-2015/04/06

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Model Number:	XT-4850C
FCC-ID :	GKM-XT4850C
IC Certification Number:	10281A-XT4850C
Product Description:	Solar-powered Cellular, GPS, and ZiGBee Tracker
Technology / Type(s) of Modulation:	see Integrated Module Info
Integrated Module Info:	U-blox LISA-C200-24S (FCC ID: R5Q-LISAC200A / IC ID: 8595B-LISAC200A) • 800/1900 Mhz CDMA 1xRTT modulation: QPSK and HPSK
Operating Frequency Ranges (MHz)	CDMA2000/800: 824.70-848.31 CDMA2000/1900: 1851.25- 1908.75
Antenna info:	PIFA Patch Antenna documented max.antenna gain: 850 MHz Band: -2dBi dBi; 1900 MHz Band: 0 dBi
Rated Operating Voltage Range:	Vmin: 9VDC/ Vnom: 12VDC/ Vmax: 24VDC
Rated Operating Temperature Range:	Tmin: -30°C/ Tmax: 70°C
Test Sample Status:	Production
Other radios included in the device:	1. Zigbee • TI CC2530F256RHAR • 2.4 GHz band of operation 2. GPS 1575.42 MHz (Receiver only)

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	MEID	Sample	HW/SW Version
1	1	A1000036910882	Radiated	XT-4850-001/ XT-4850-01

3.3 Identification of ancillary equipment (used for testing purposes only)

AE #	Type	Manufacturer	Model	Serial Number	Comments
1	DC Power Supply	Protek	3003B	H 001416	Power Source

4 Summary of Measurement Results

CDMA 850MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §22.913 (a) RSS132 5.4	RF Output Power	Nominal	CDMA 850	■	☐	☐	☐	Complies
§2.1055 §22.355 RSS132 5.3	Frequency Stability	Nominal	CDMA 850	☐	☐	☐	■	Note 1
§2.1049 §22.917(b) RSS132 5.2	Occupied Bandwidth	Nominal	CDMA 850	☐	☐	☐	■	Note 1
§2.1051 §22.917 RSS132 5.5	Band Edge Compliance	Nominal	CDMA 850	☐	☐	☐	■	Note 1
§2.1051 §22.917 RSS132 5.5	Conducted Spurious Emissions	Nominal	CDMA 850	☐	☐	☐	■	Note 1
§2.1053 §22.917 RSS132 5.5	Radiated Spurious Emissions	Nominal	CDMA 850	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.
Note 1: Leveraged from module certification. See Section 5.4

CDMA 1900MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §24.232 (a) RSS133 6.4	RF Output Power	Nominal	CDMA 1900	■	☐	☐	☐	Complies
§2.1055 §24.235 RSS133 6.3	Frequency Stability	Nominal	CDMA 1900	☐	☐	☐	■	Note 1
§2.1049 §24.238(b) RSS133 6.2	Occupied Bandwidth	Nominal	CDMA 1900	☐	☐	☐	■	Note 1
§2.1051 §24.238 RSS133 6.5	Band Edge Compliance	Nominal	CDMA 1900	☐	☐	☐	■	Note 1
§2.1051 §24.238 RSS133 6.5	Conducted Spurious Emissions	Nominal	CDMA 1900	☐	☐	☐	■	Note 1
§2.1053 §24.238 RSS133 6.5	Radiated Spurious Emissions	Nominal	CDMA 1900	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.
Note 1: Leveraged from module certification. See Section 5.4

5 Measurements

5.1 Measurement Uncertainty

	Uncertainty in dB radiated <30MHz	Uncertainty in in dB radiated 30MHz - 1GHz	Uncertainty in dB radiated > 1GHz	Uncertainty in dB Conducted measurement
standard deviation k=1	2.48	1.94	2.16	0.64
95% confidence interval in dB	4.86	3.79	4.24	1.25
95% confidence interval in dB in delta to Result	+-2.5 dB	+-2.0 dB	+- 2.3dB	+-0.7dB

5.2 Nominal Environmental Test Conditions

- Ambient Temperature: 20-25 °C
- Relative humidity: 40-60%

5.3 Default Test Temperature and Voltage

- Test Temperature: 20°C (nominal);
- Test Voltage: 12 VDC(nominal);

Deviating test conditions are indicated at individual test description where applicable.

5.4 Inheriting Test Results from Incorporated Module Certification:

The EUT integrates a pre-certified module U-blox LISA-C200.
with FCC ID: R5Q-LISAC200A; IC Certification Number: 8595B-LISAC200A

Taking into account guidance from FCC KDB 996369 (modular approval) and where relevant test procedures did not change conducted test results are leveraged from the conducted test report for the LISA-C200 modem given by Nemko USA, Inc. dated December 7, 2012 with Report Number: 2012 12225324 FCC; FCC ID: R5Q-LISAC200A; IC Certification Number: 8595B-LISAC200A

This test report contains full radiated testing as per FCC 22H/24E and RSS-132/133 and conducted power verification required per KDB 996369.

5.5 Other Testing Notes:

1. The different cellular operation modes of the EUT as required for testing are controlled through the link with the Digital Radio Communication Tester (R&S CMU200).
2. The EUT is tested on the low, mid and high channel of each of the supported cellular operation modes.

5.6 Measurement Method:

Testing is performed according to the guidelines provided in *FCC publication (KDB) 971168 D01 Power Meas License Digital Systems v02r01: Measurement Guidance for Certification of Licensed Digital Transmitters7, June 2013* and according to relevant parts of TIA-603C 2004 as detailed below.

6 RF Output Power

6.1.1 References

FCC: CFR Part 2.1046, CFR Part 22.913, CFR Part 24.232
IC: RSS-Gen Section 6.12; RSS-132 Section 5.4; RSS-133 Section 6.4

6.1.2 Limits:

6.1.2.1 FCC 22.913 (a) Effective radiated power limits.

The effective radiated power (ERP) of mobile transmitters must not exceed 7 Watts.

6.1.2.2 FCC 24.232 (c) Power limits.

Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

6.1.2.3 RSS-132, Issue 3,

Clause 5.4
The transmitter output power shall be measured in terms of average power. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts.
In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

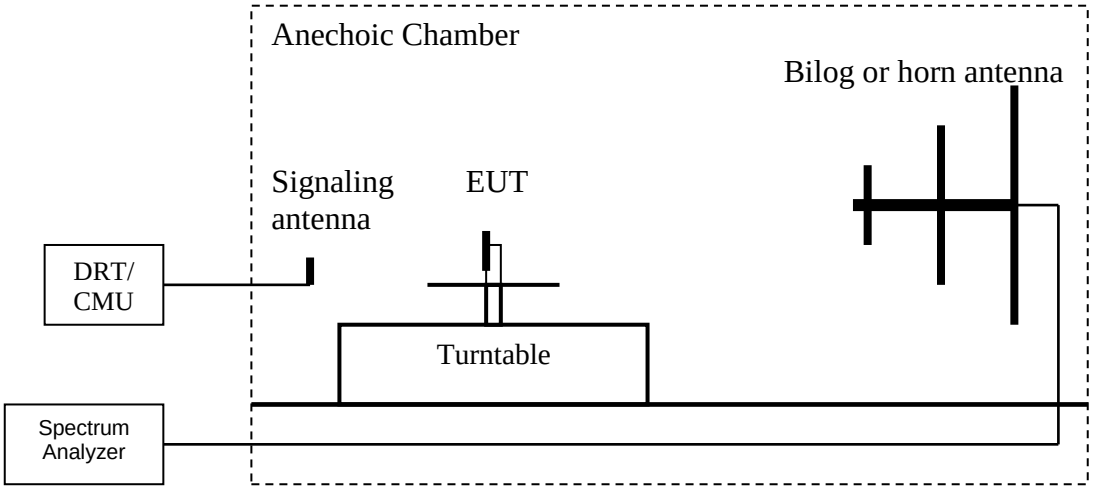
6.1.2.4 RSS-133, Issue 6

Clause 4.1
The transmitter power shall be measured in terms of average power.

Clause 6.4
The equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed 2 watts maximum e.i.r.p. In addition, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

6.1.3 **Radiated Output Power Measurement Procedure**

Ref: TIA-603C 2004 -2.2.17.2 Effective Radiated Power (ERP) or Effective Isotropic Radiated Power (EIRP)



1. Connect the equipment as shown in the above diagram with the EUT's antenna in center of the turn table.
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 the channel frequency and to required settings: peak detector, max hold trace, RBW>OBW, VBW>3xRBW, sweeptime auto couple, span > 2x RBW.
4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5. Replace the EUT with a vertically 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 ERP using the following equation: **ERP** (dBm) = **LVL** (dBm) + **LOSS** (dB)
8. Determine the EIRP using the following equation: **EIRP** (dBm) = **ERP** (dBm) + 2.15 (dB)
9. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

Note: Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4, 7 and 8 above are performed with test software.

6.1.4 Spectrum Analyzer Settings:

	ERP	EIRP
Resolution Bandwidth	5 MHz	5 MHz
Video Bandwidth	5 MHz	5 MHz
Detector	Peak	Peak
Trace Mode	Max Hold	Max Hold
Sweep Time	Auto	Auto

6.1.5 Measurement Results

Channel	Frequency (MHz)	Peak ERP / EIRP Measured (dBm)
CDMA 850		
1013	824.70	21.97 / 24.12
384	836.52	25.92 / 28.07
777	848.31	25.91 / 28.06

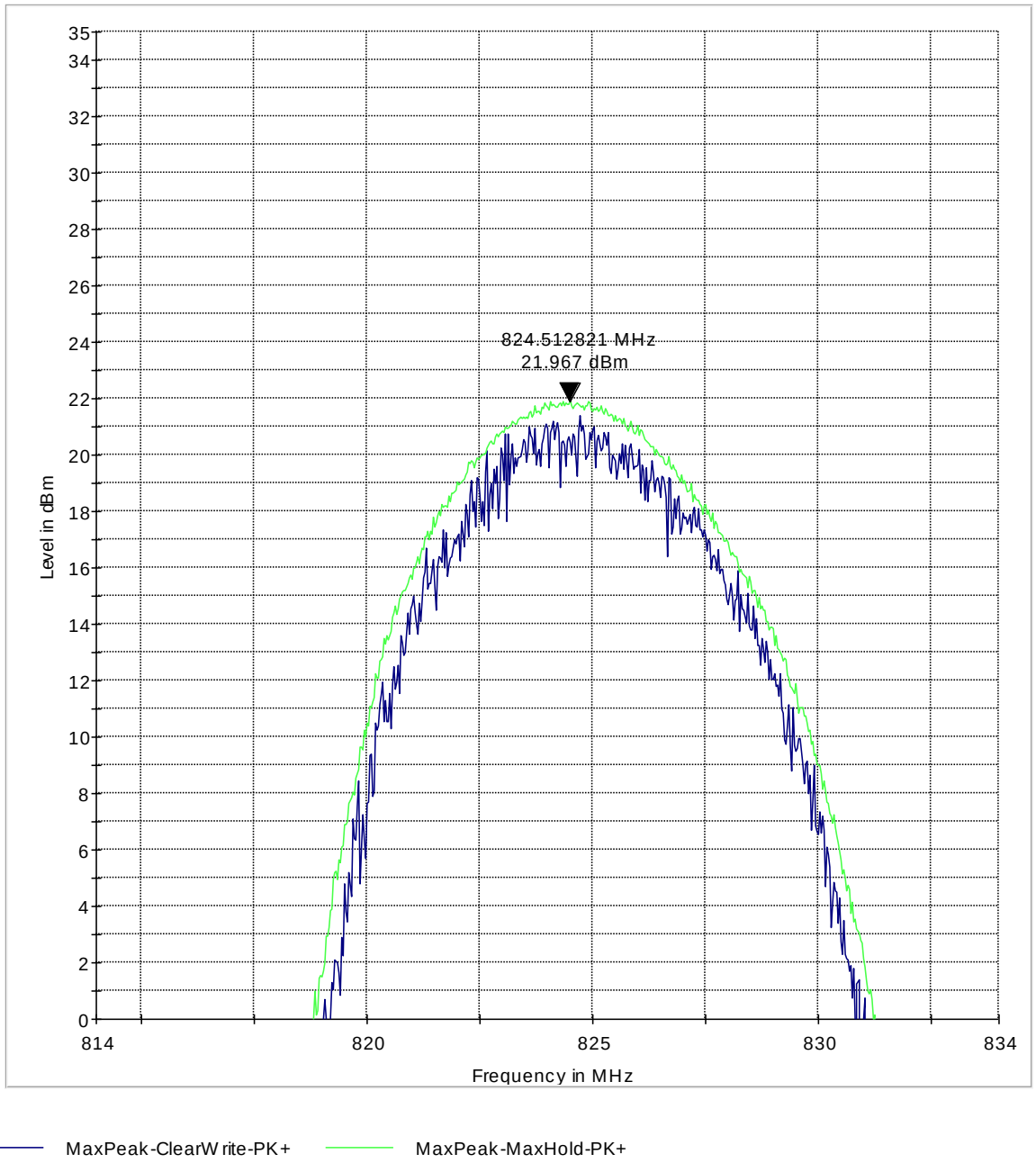
Channel	Frequency (MHz)	Peak EIRP Measured (dBm)
CDMA 1900		
25	1851.25	30.45
600	1880	29.29
1175	1909.75	29.35

6.1.6 Result

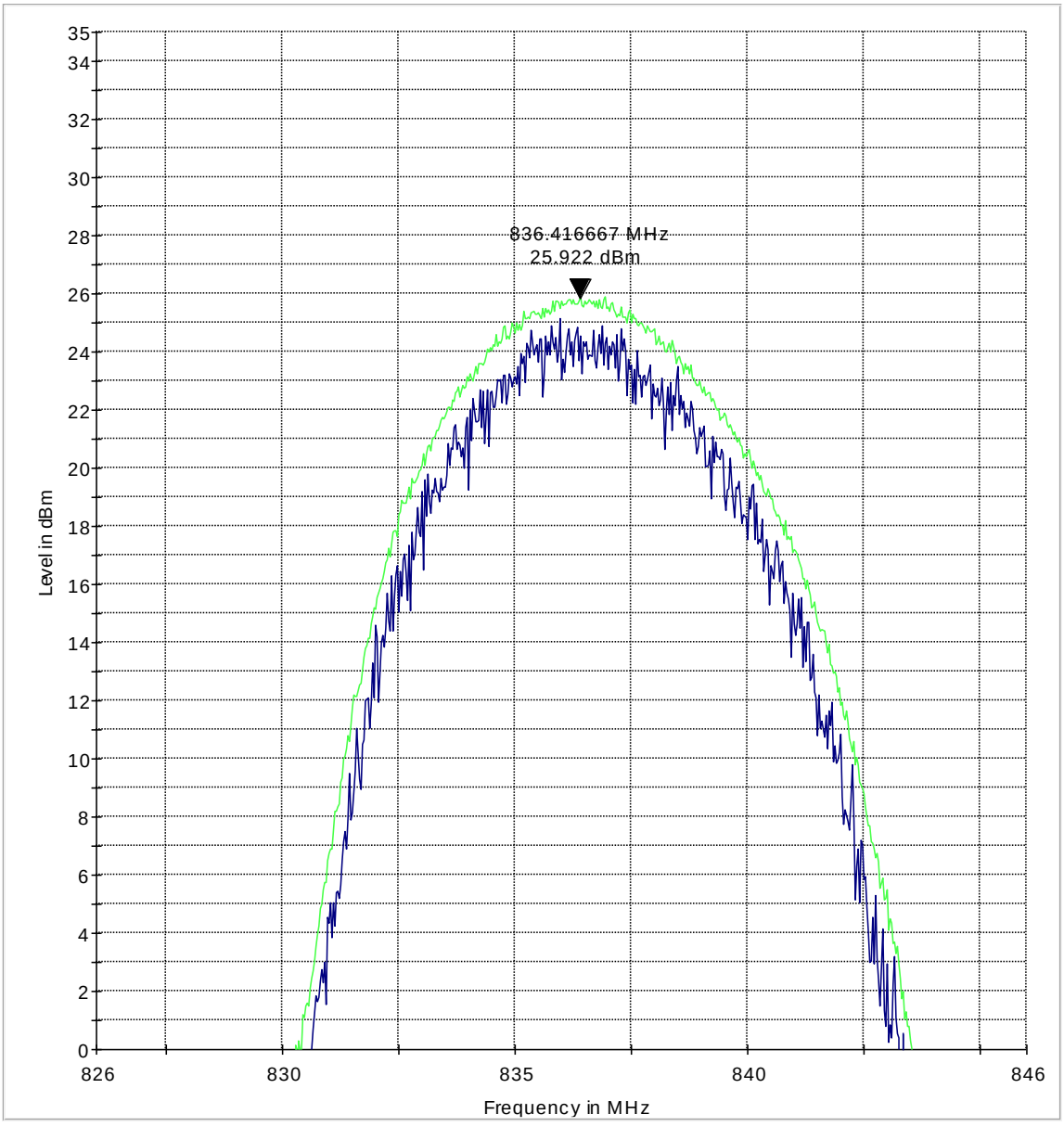
Pass, EUT ERP/EIRP measurements are below the limits in section 6.1.2.

6.1.6.1 Plots:

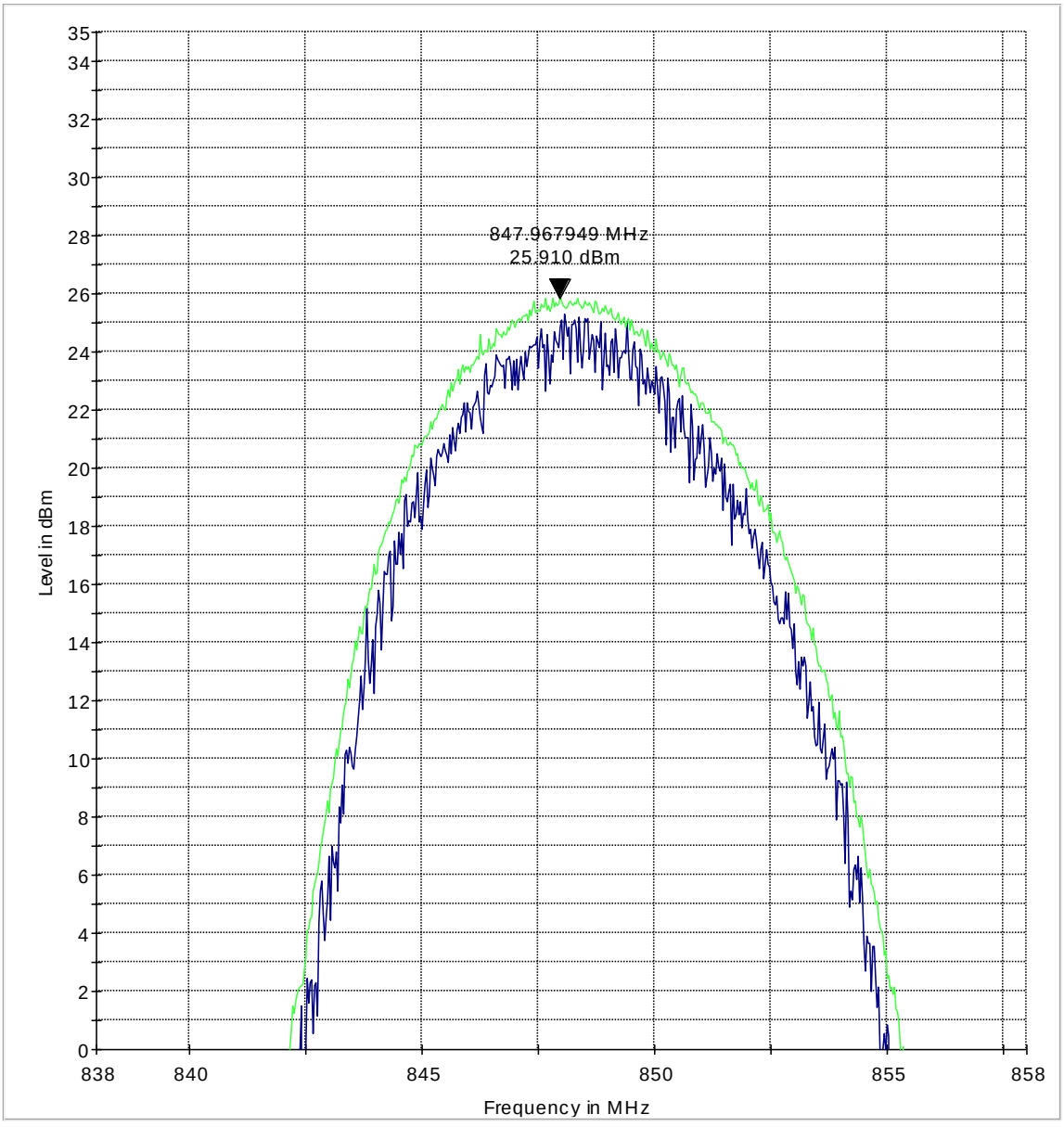
ERP (CDMA 1x-RTT 850) CHANNEL 1013 (Low)



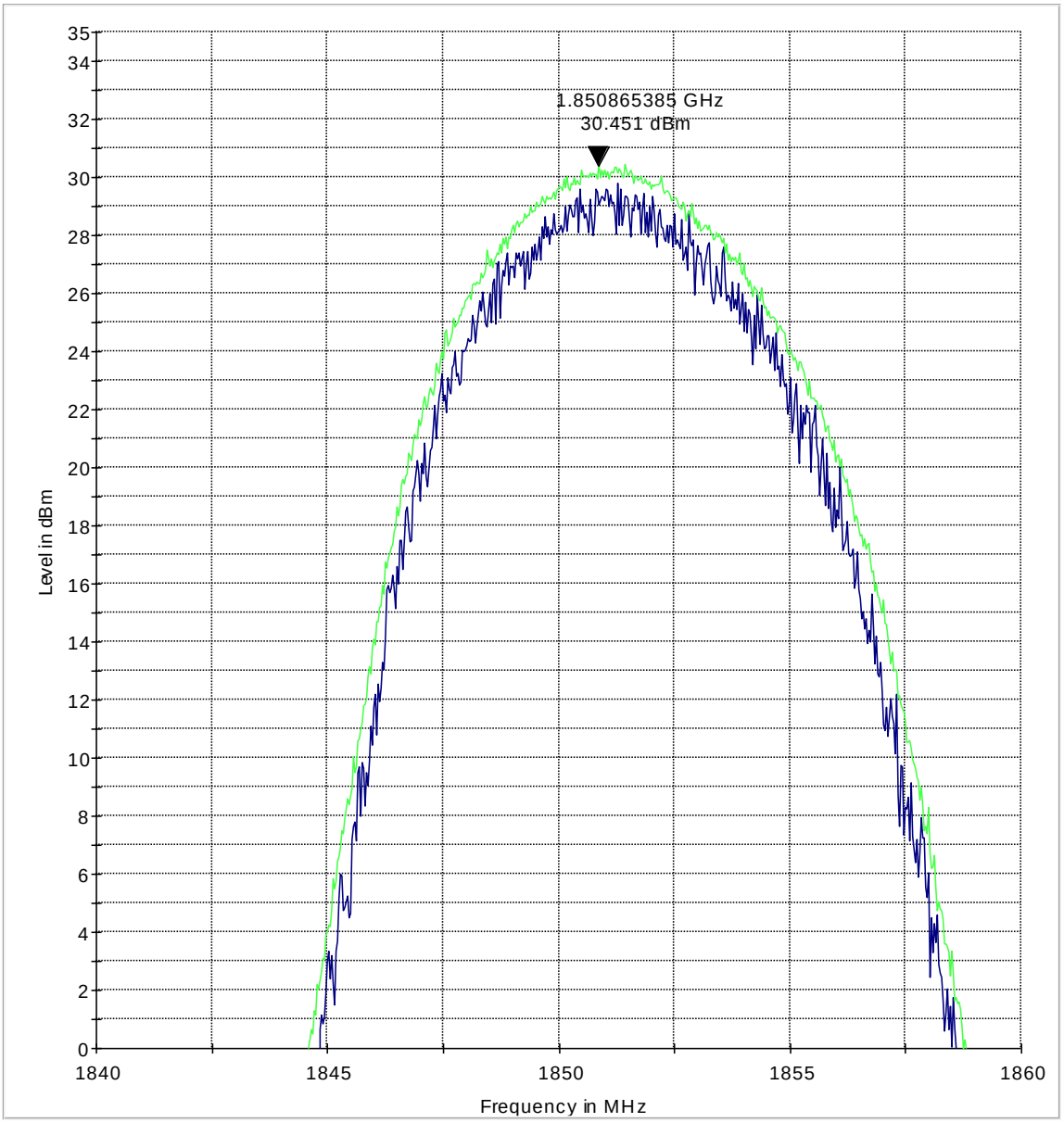
ERP (CDMA 1x-RTT 850) CHANNEL 384 (Mid)



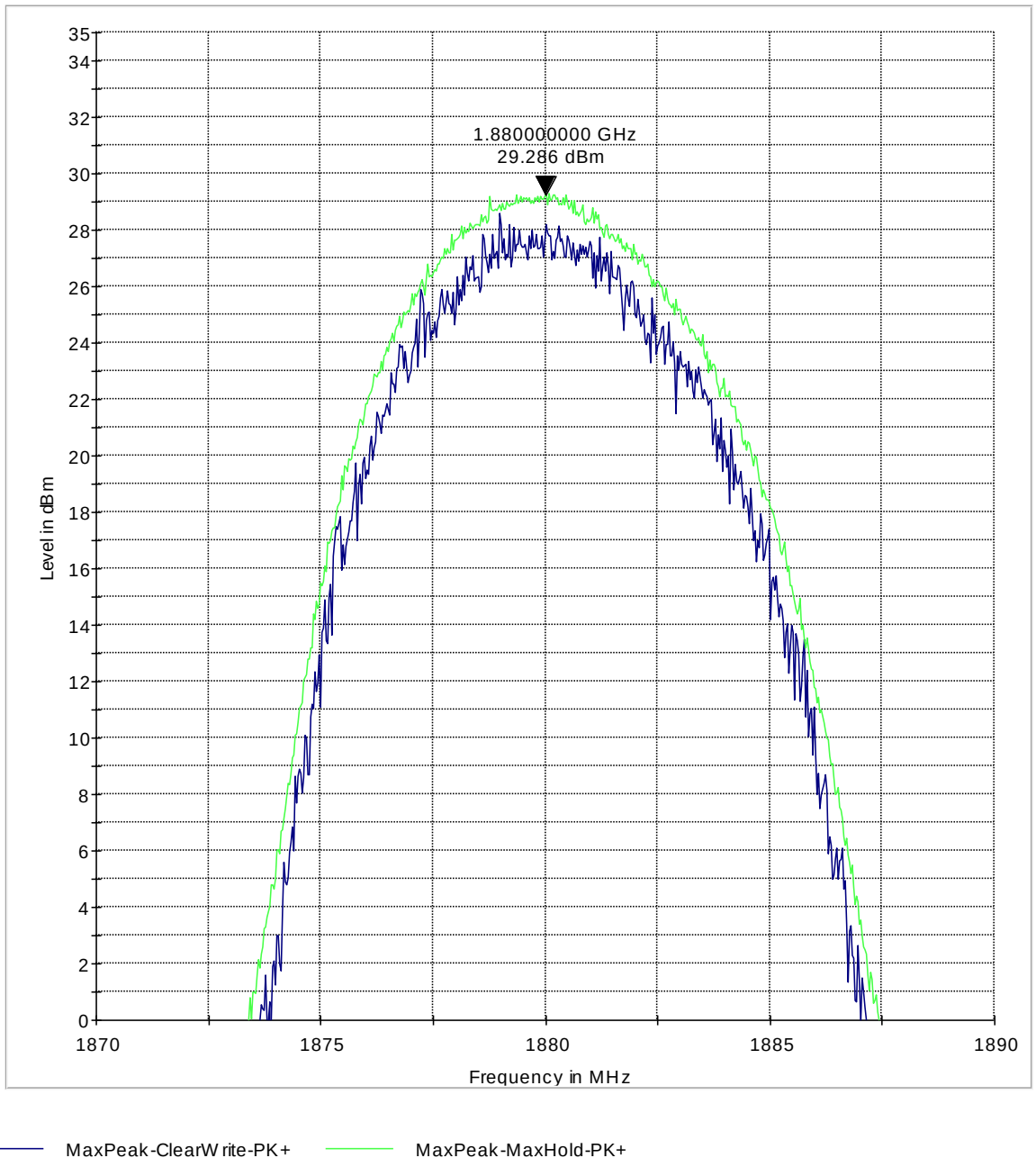
ERP (CDMA 1x-RTT 850) CHANNEL 777 (High)



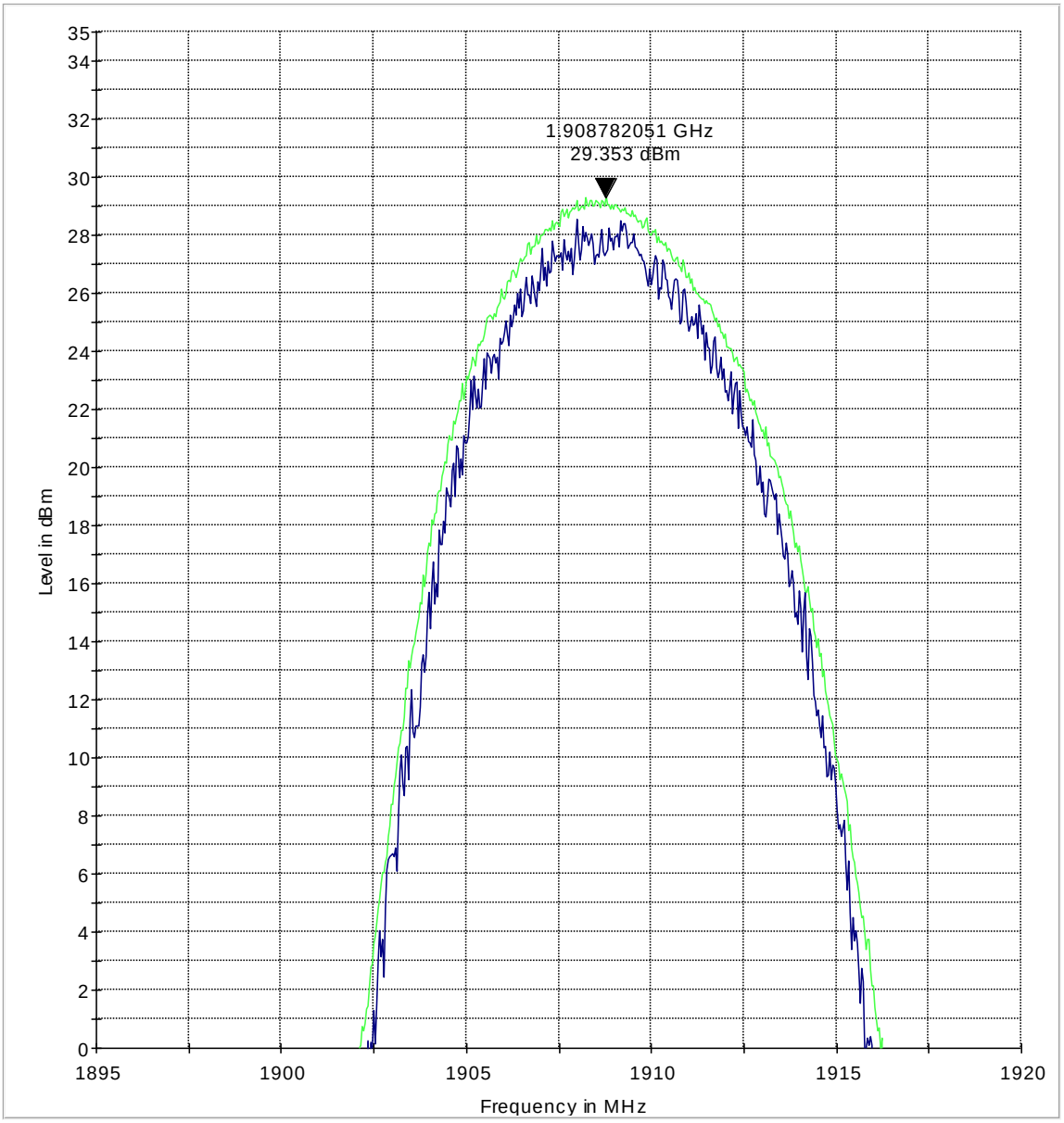
EIRP (CDMA 1x-RTT 1900) CHANNEL 25 (Low)



EIRP (CDMA 1x-RTT 1900) CHANNEL 600 (Mid)



EIRP (CDMA 1x-RTT 1900) CHANNEL 1175 (High)



7 Spurious Emissions Radiated

7.1.1 References

FCC: CFR Part 2.1053, CFR Part 22.917, CFR Part 24.238
IC: RSS-Gen Issue 4 Section 6.13; RSS 132 Issue 3 Section 5.5; RSS 133 Issue 6 Section 6.5

7.1.2 Limits:

7.1.2.1 FCC 22.917 Emission limitations for cellular equipment.

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

(a) *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.
(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.

7.1.2.2 FCC 24.238 Emission limitations for Broadband PCS equipment.

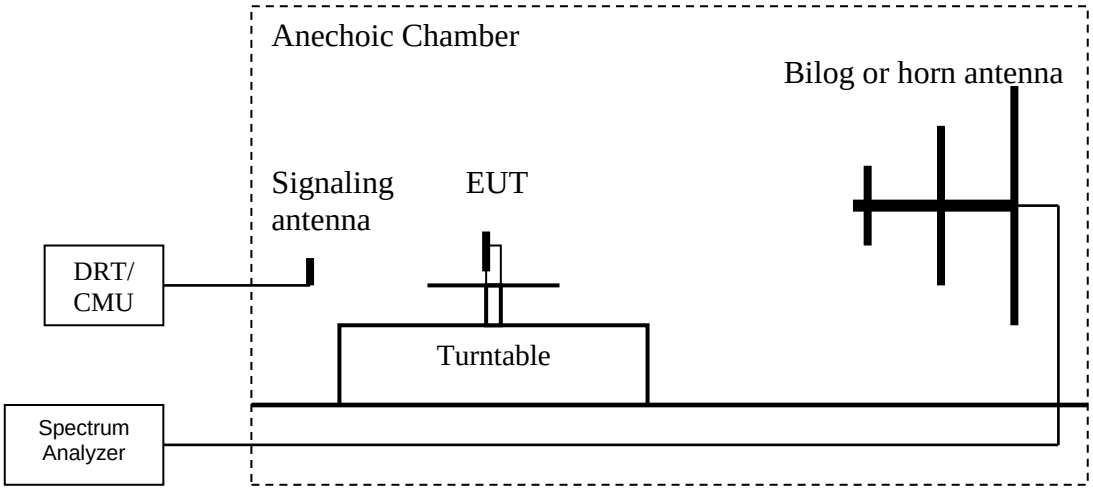
The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.
(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
(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.

7.1.2.3 RSS-132 Section 5.5 and RSS-133 Section 6.5.1

In the first 1.0 MHz band immediately outside and adjacent to the licensee's frequency block, the power of emissions per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in watts) by at least $43 + 10 \log_{10}(P)$, dB. After the first 1.0 MHz, the power of emissions shall be attenuated below the transmitter output power by at least $43 + 10 \log_{10}(P)$, dB, in any 100 kHz bandwidth.
After the first 1.5 MHz, the power of emissions shall be attenuated below the transmitter output power by at least $43 + 10 \log_{10}(P)$, dB, in any MHz of bandwidth.

7.1.3 **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.)

7.1.4 Sample Calculations for Radiated Measurements

7.1.4.1 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

7.1.5 Spectrum Analyzer Settings

Settings for FCC 22

	9 kHz – 30 MHz		
	9 – 150 kHz	**150 – 490 kHz**	**490 kHz – 30 MHz**
Resolution Bandwidth	200 Hz	9 kHz	9 kHz
Video Bandwidth	2 kHz	100 kHz	100 kHz
Detector	Peak	Peak	Peak
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep Time	Auto	Auto	Auto

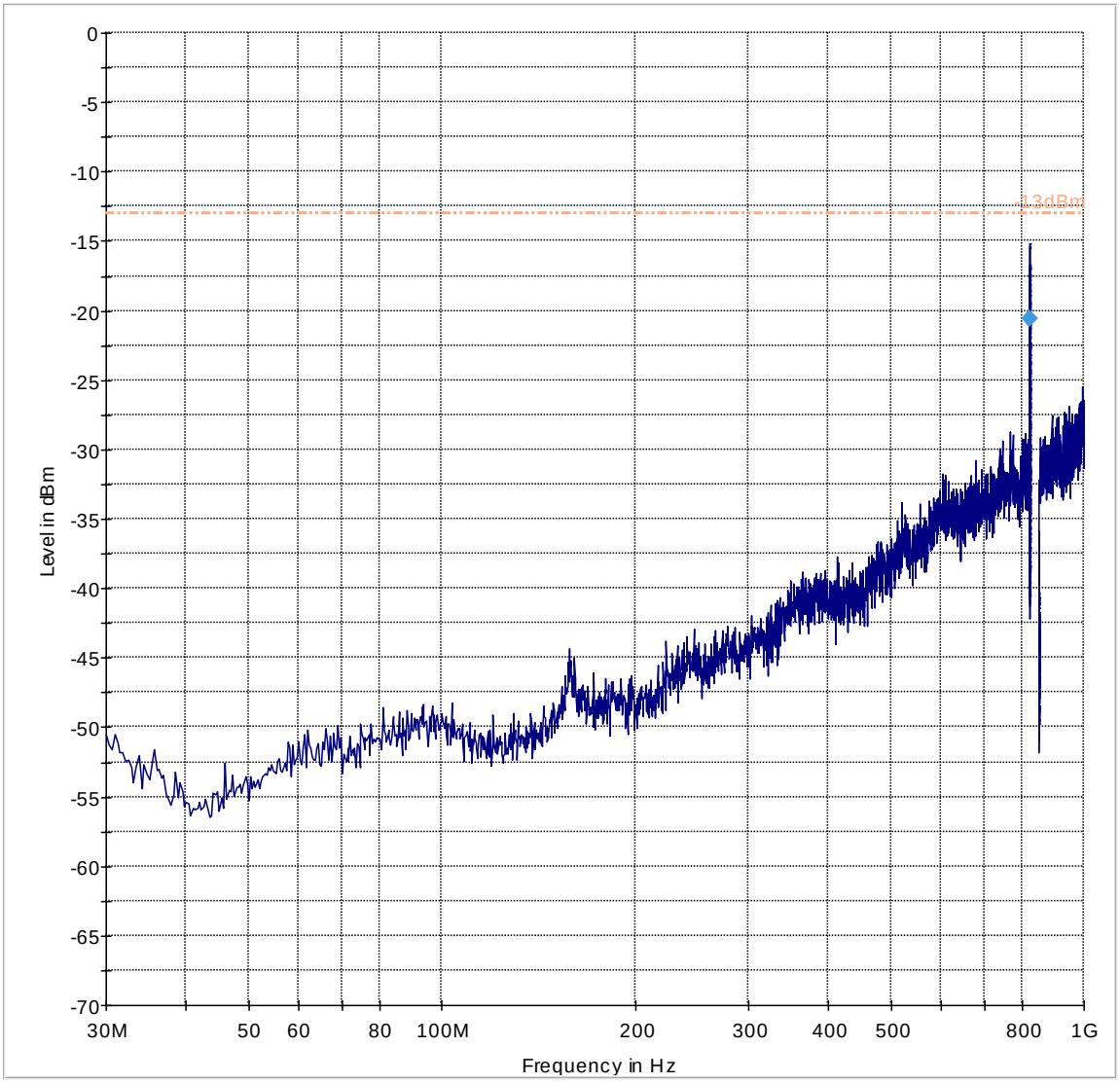
	30MHz – 1 GHz	1 – 1.58 GHz	1.58 – 9 GHz
Resolution Bandwidth	100 kHz	1 MHz	1 MHz
Video Bandwidth	100 kHz	1 MHz	1 MHz
Detector	Peak	Peak	Peak
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep Time	Auto	Auto	Auto

Settings for FCC 24

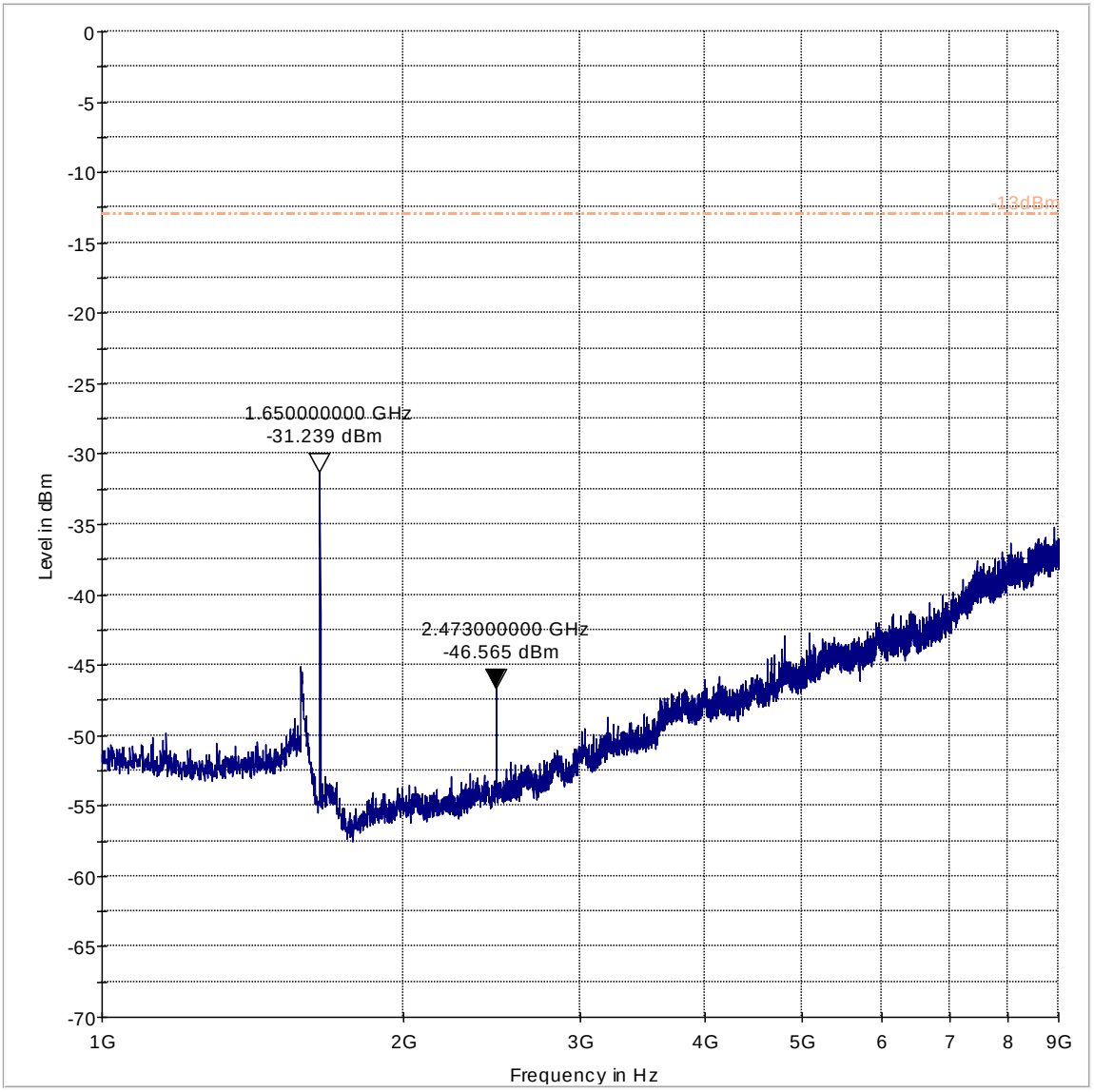
	30MHz – 1 GHz	1 – 2.7 GHz	2.7 – 18 GHz	18 – 19.1 GHz
Resolution Bandwidth	100 kHz	1 MHz	1 MHz	1 MHz
Video Bandwidth	100 kHz	1 MHz	1 MHz	1 MHz
Detector	Peak	Peak	Peak	Peak
Trace Mode	Max Hold	Max Hold	Max Hold	Max Hold
Sweep Time	Auto	Auto	Auto	Auto

7.1.6 **Test Results:**

Radiated Spurious Emissions (CDMA-850) Tx: Low Channel
Test results 30MHz-1GHz

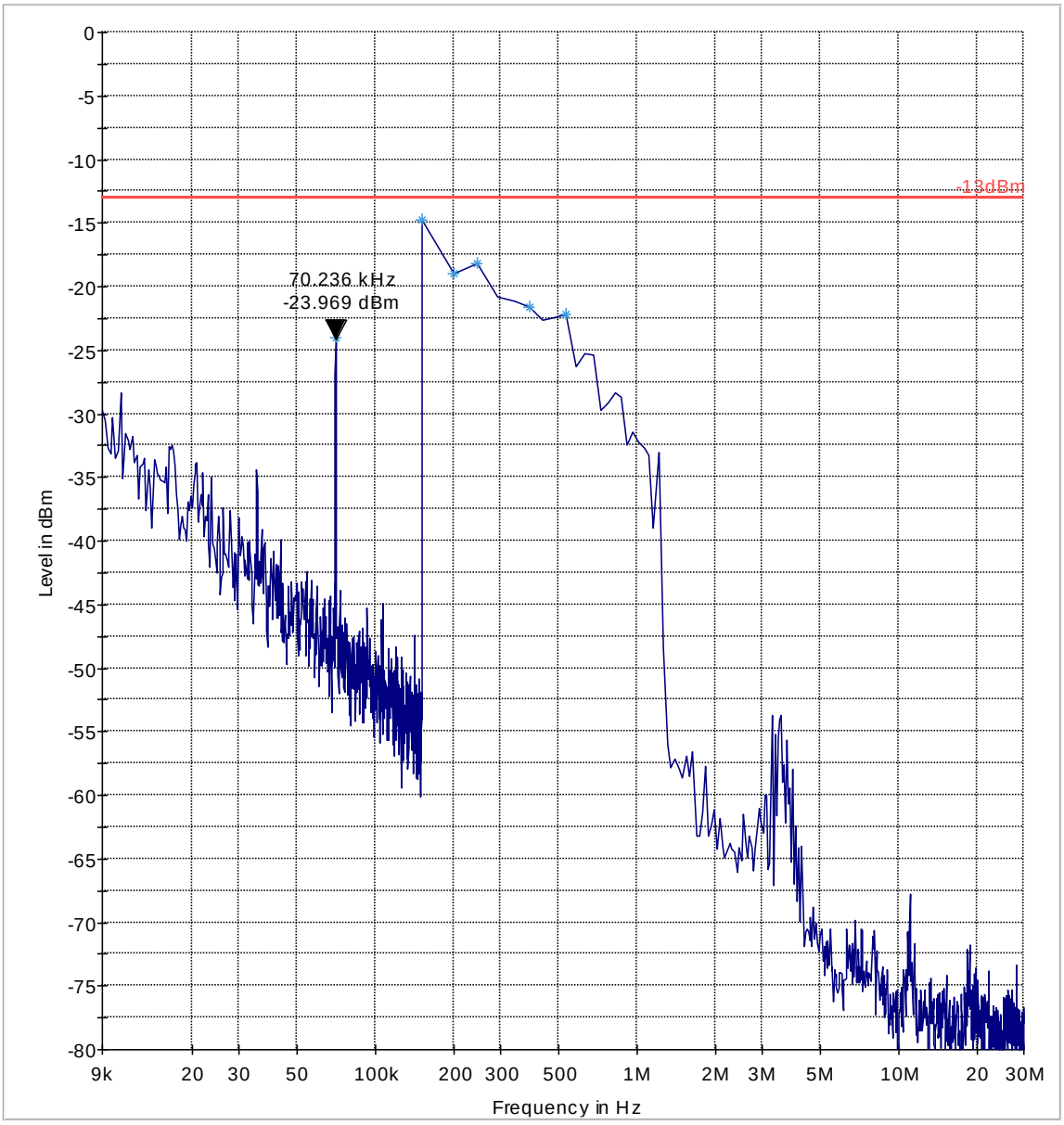


Test results 1GHz-9GHz

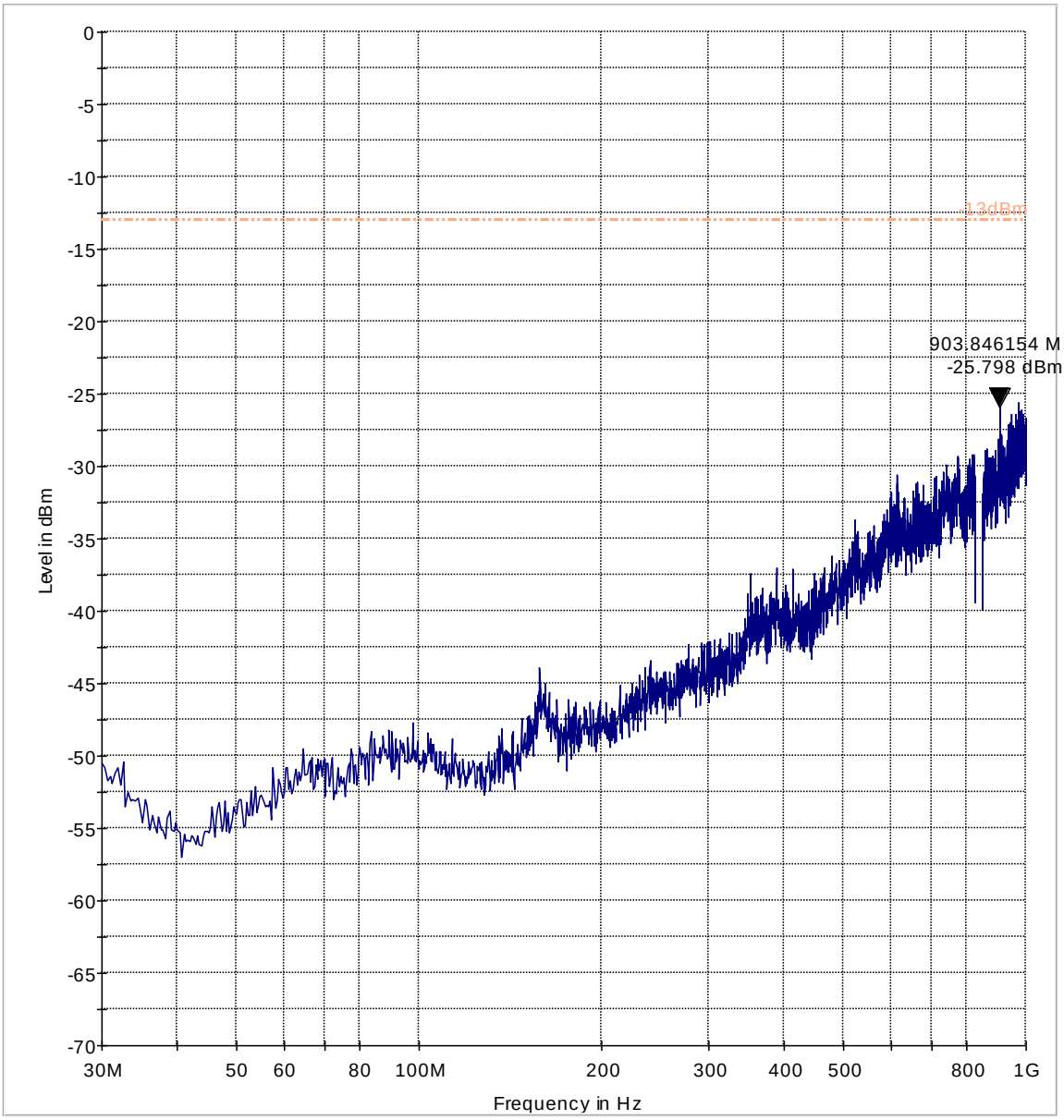


Radiated Spurious Emissions (CDMA-850) Tx: Mid Channel

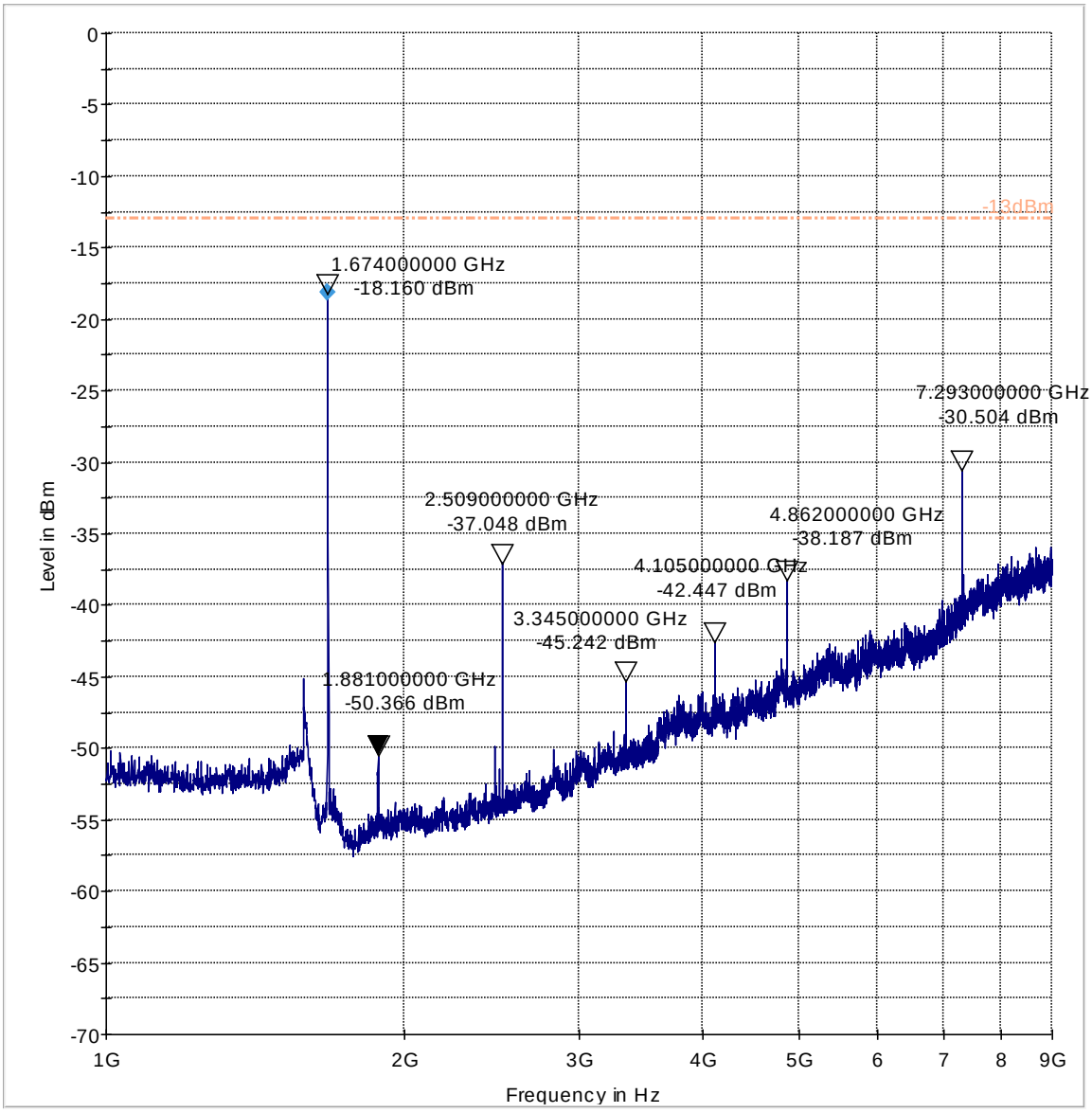
Test results 9KHz-30MHz



Test results 30MHz-1GHz

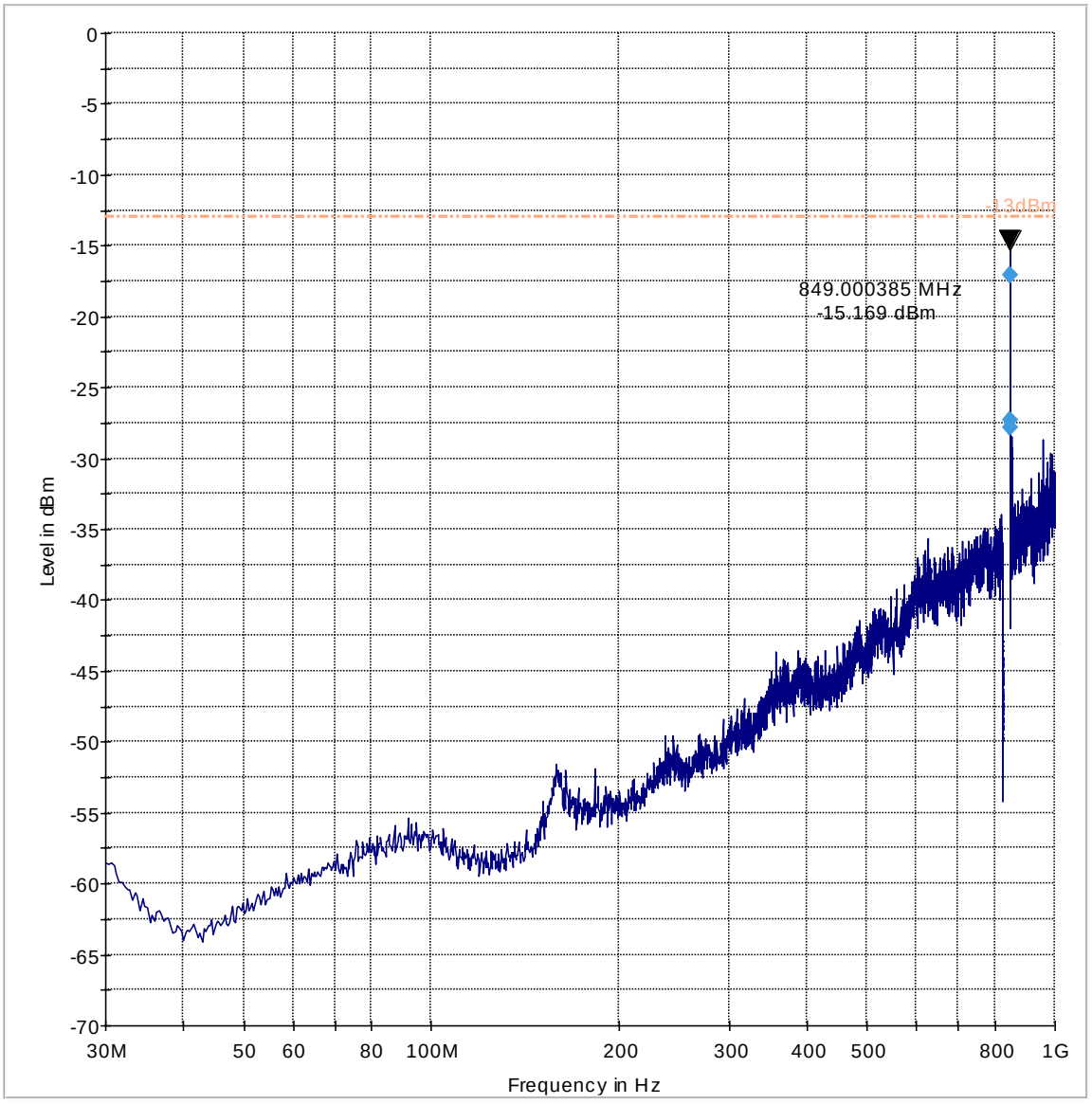


Test results 1GHz-9GHz

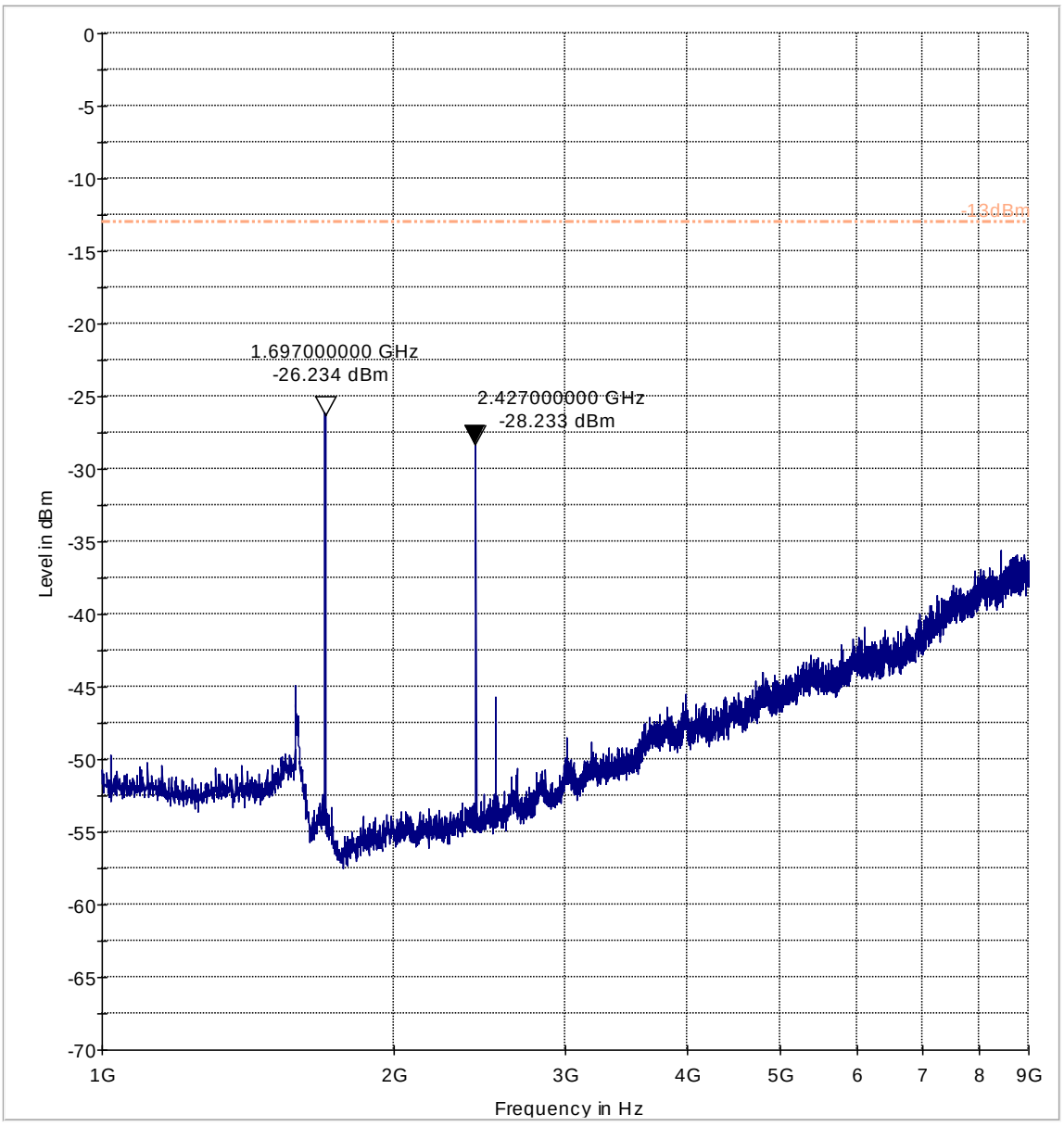


Radiated Spurious Emissions (CDMA-850) Tx: High Channel

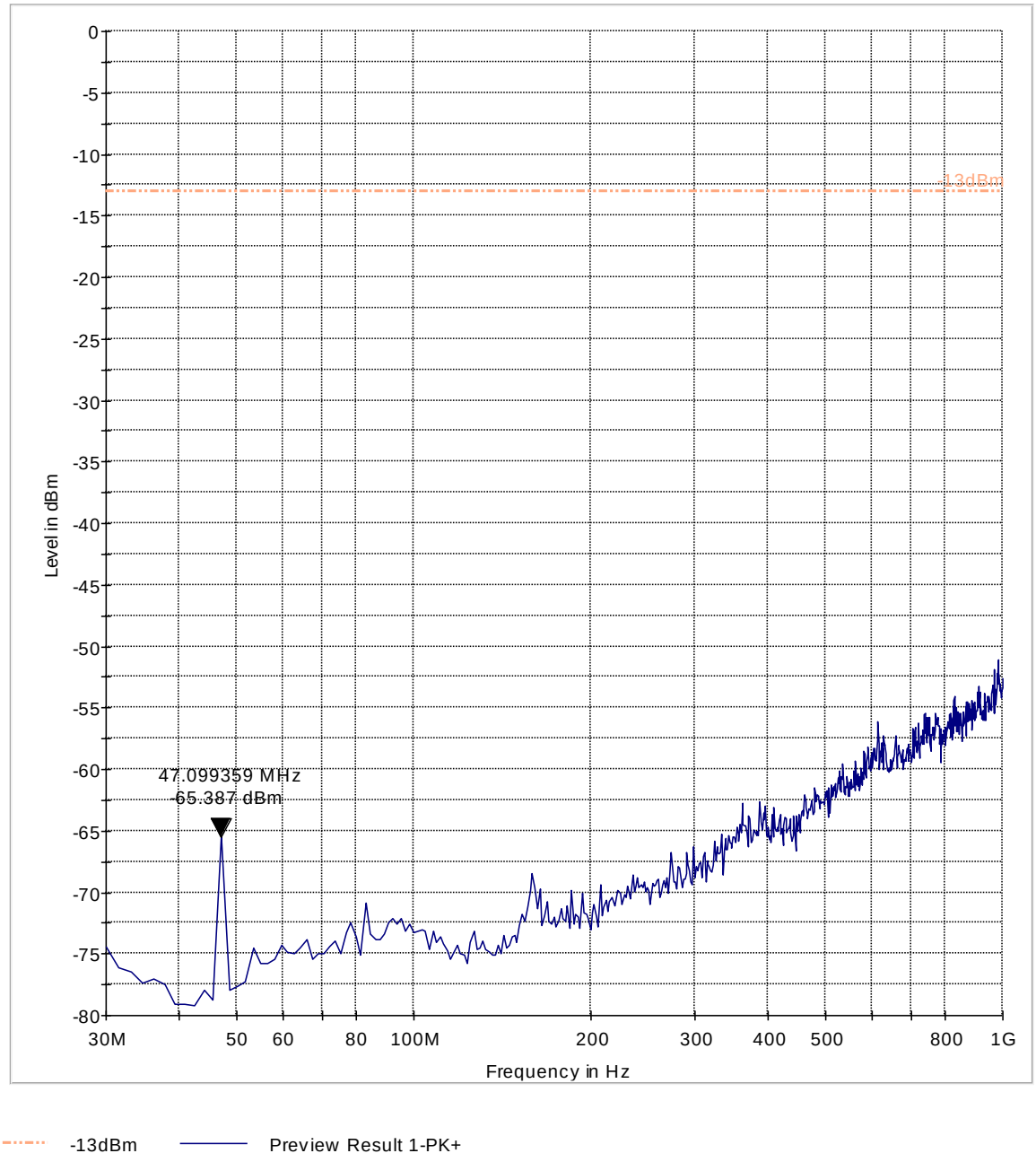
Test results 30MHz-1GHz



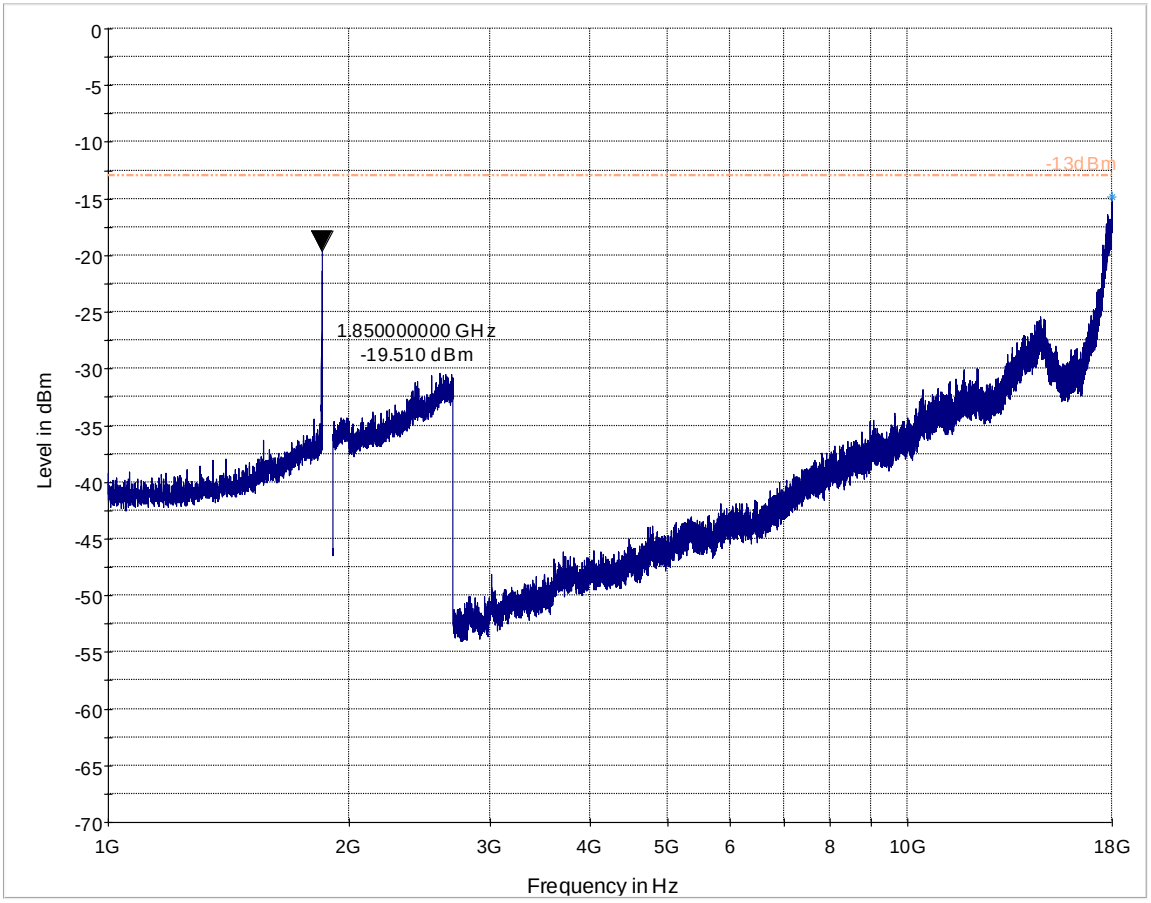
Test results 1GHz-9GHz



Radiated Spurious Emissions (CDMA-1900) Tx: Low Channel
Test results 30MHz-1GHz

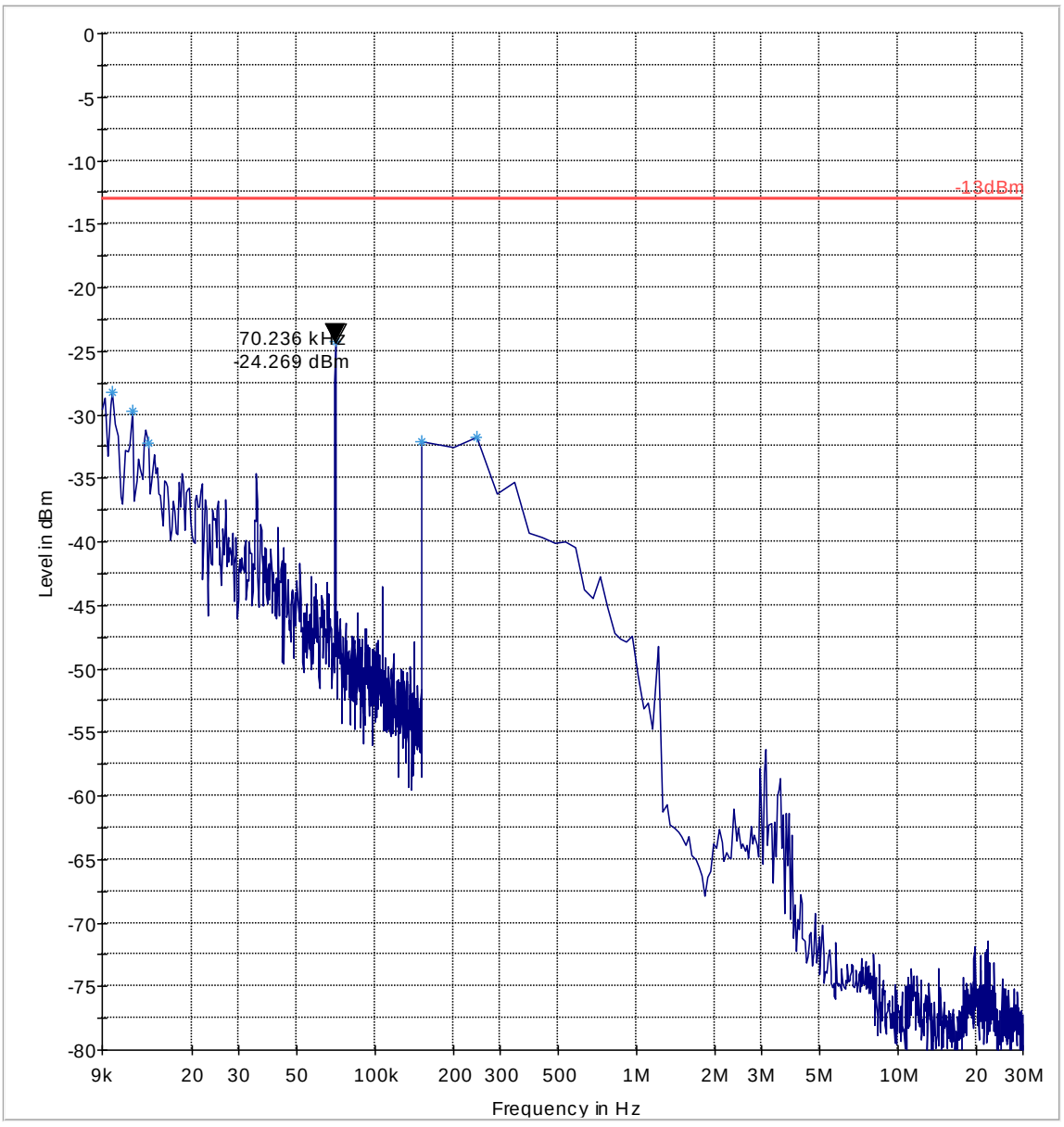


Test results 1GHz-18GHz

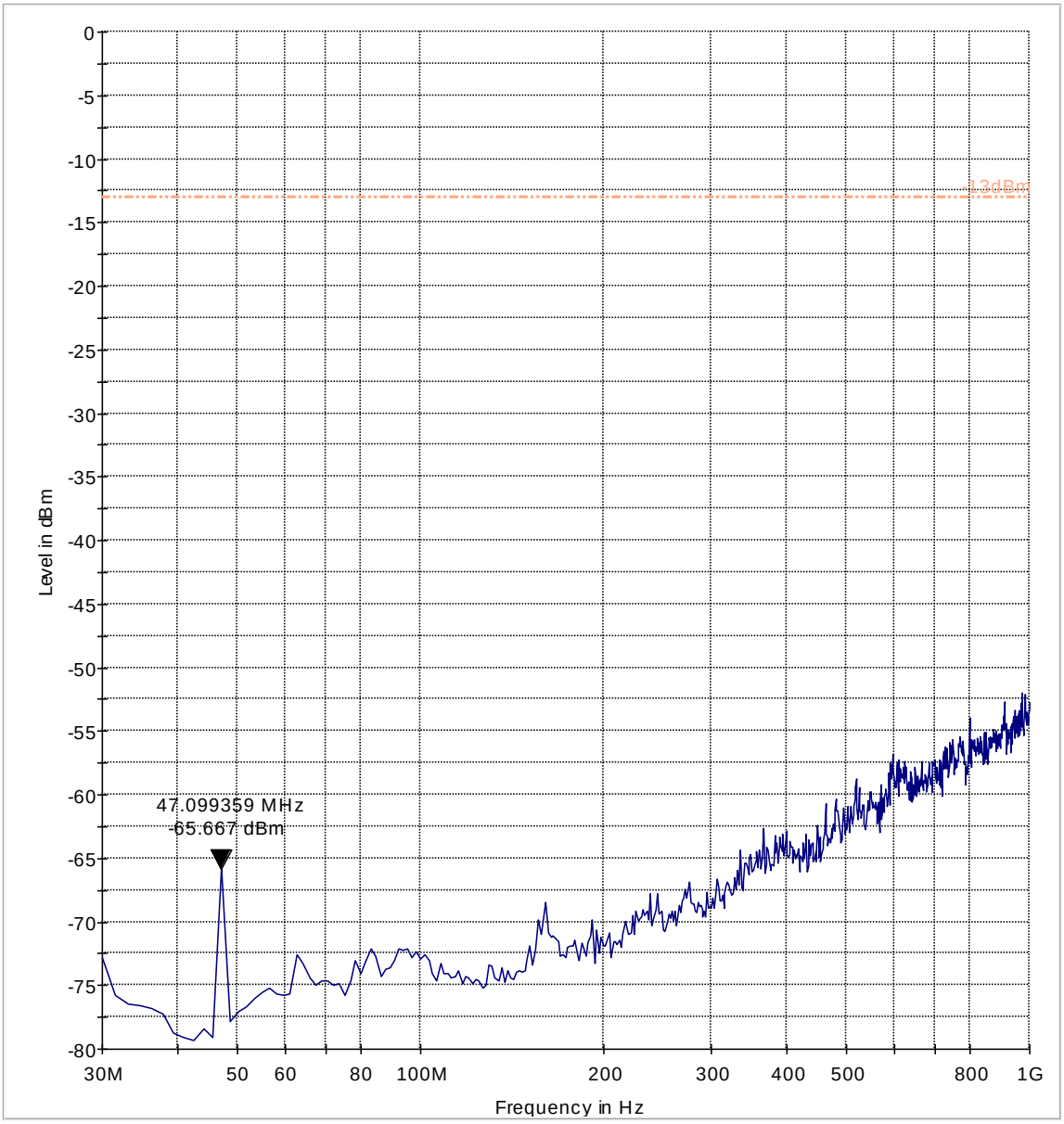


Radiated Spurious Emissions (CDMA-1900) Tx: Mid Channel

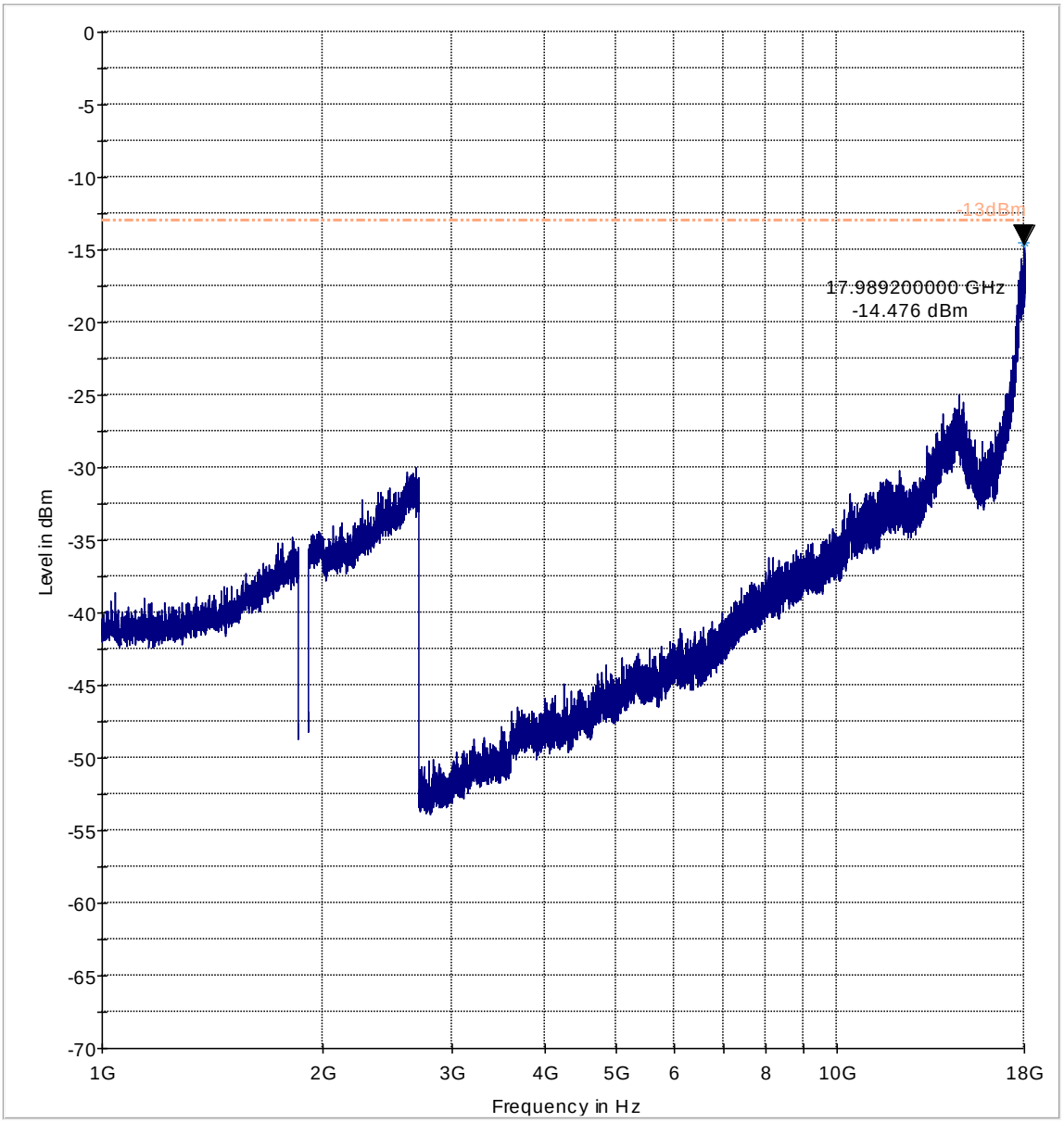
Test results 9KHz-30MHz



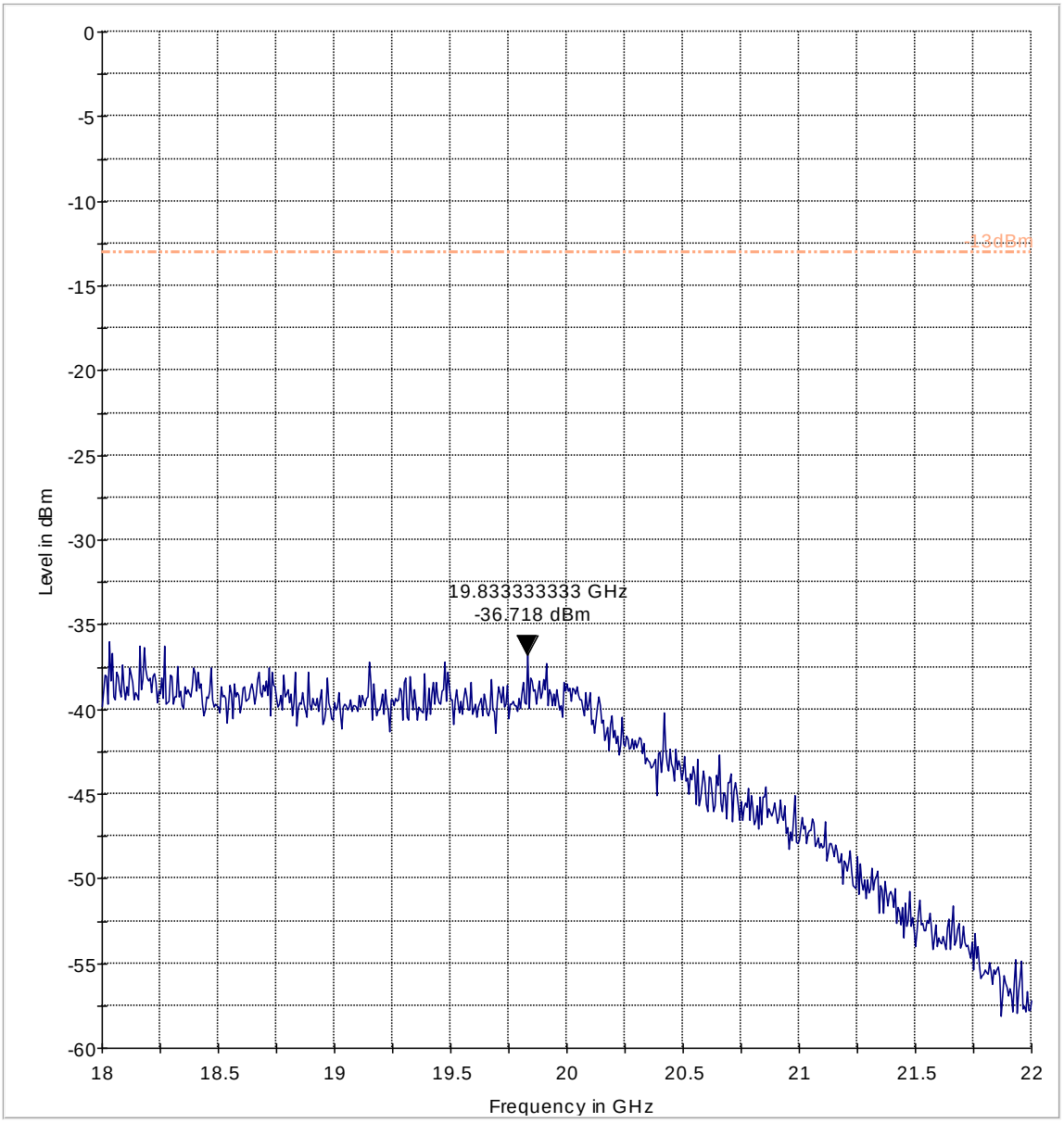
Test results 30MHz-1GHz



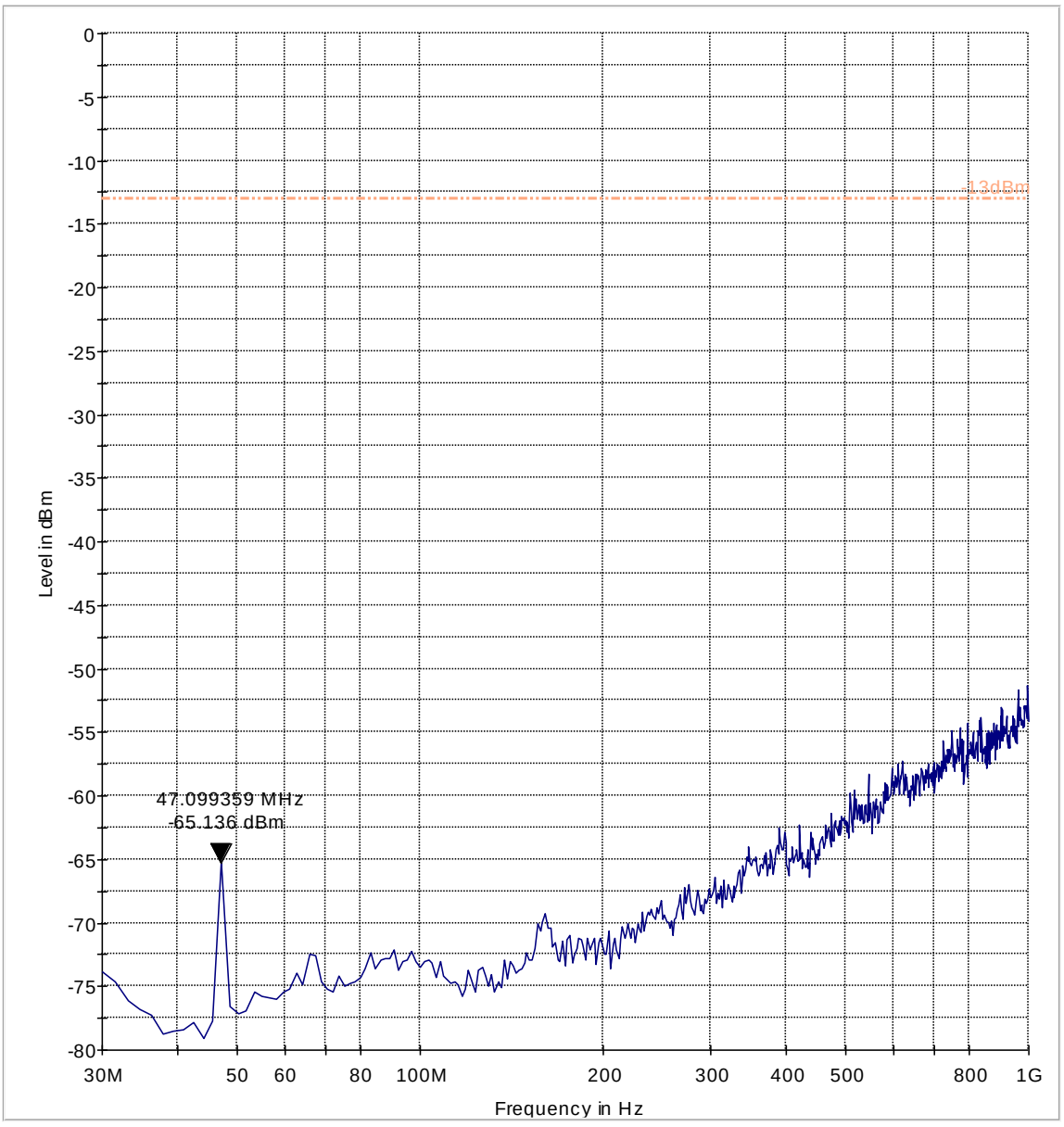
Test results 1GHz-18GHz



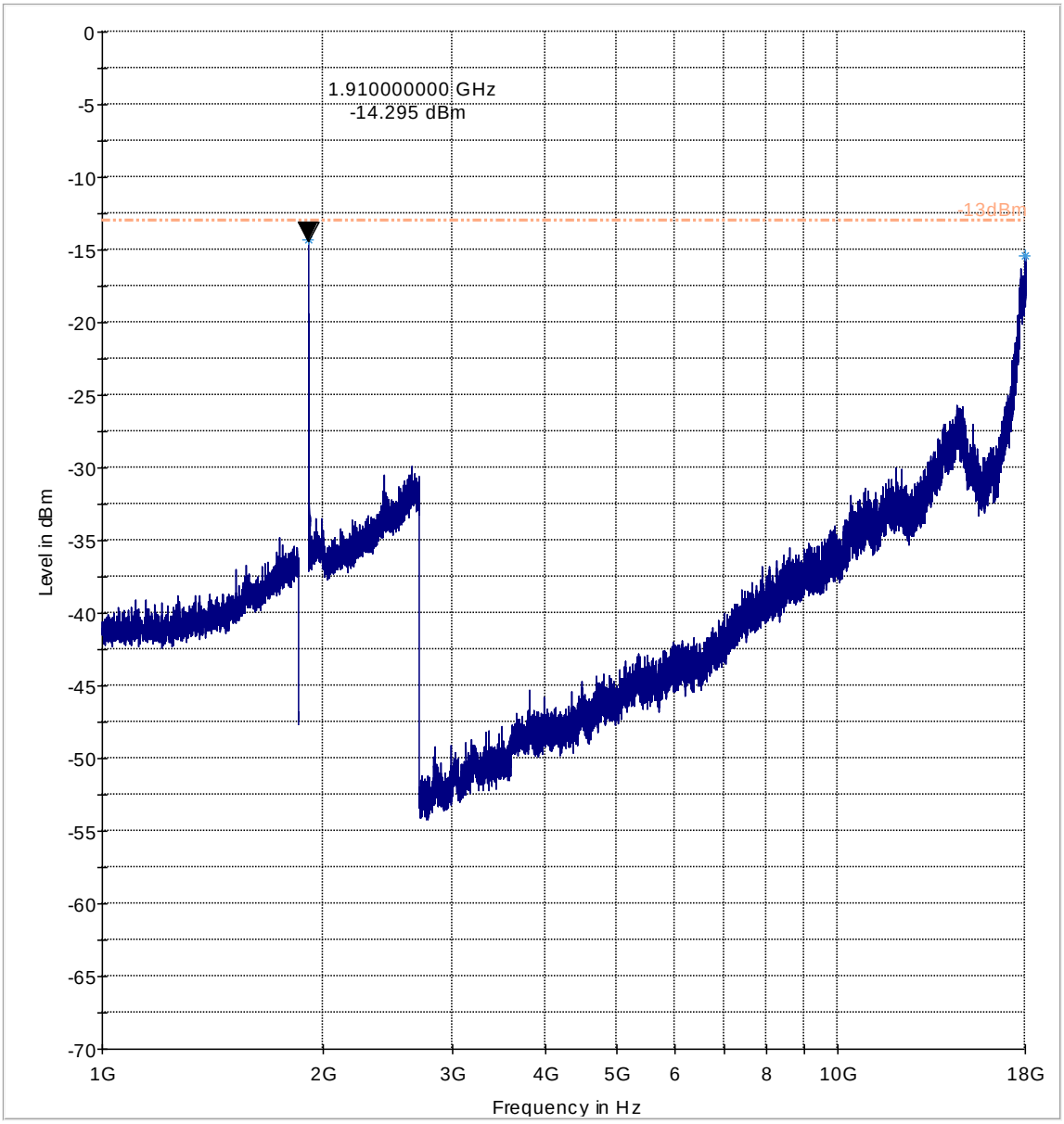
Test results 18GHz-22GHz



Radiated Spurious Emissions (CDMA-1900) Tx: High Channel
Test results 30MHz-1GHz



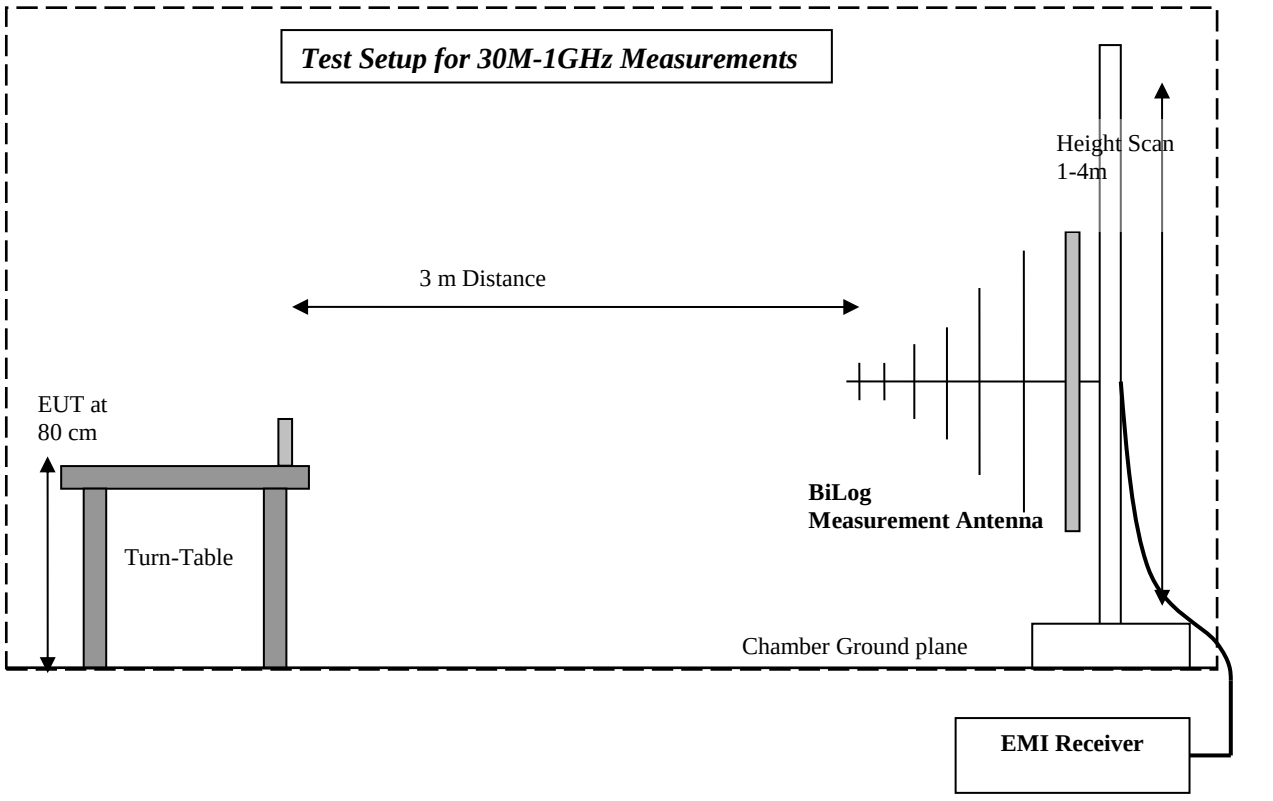
Test results 1GHz-18GHz

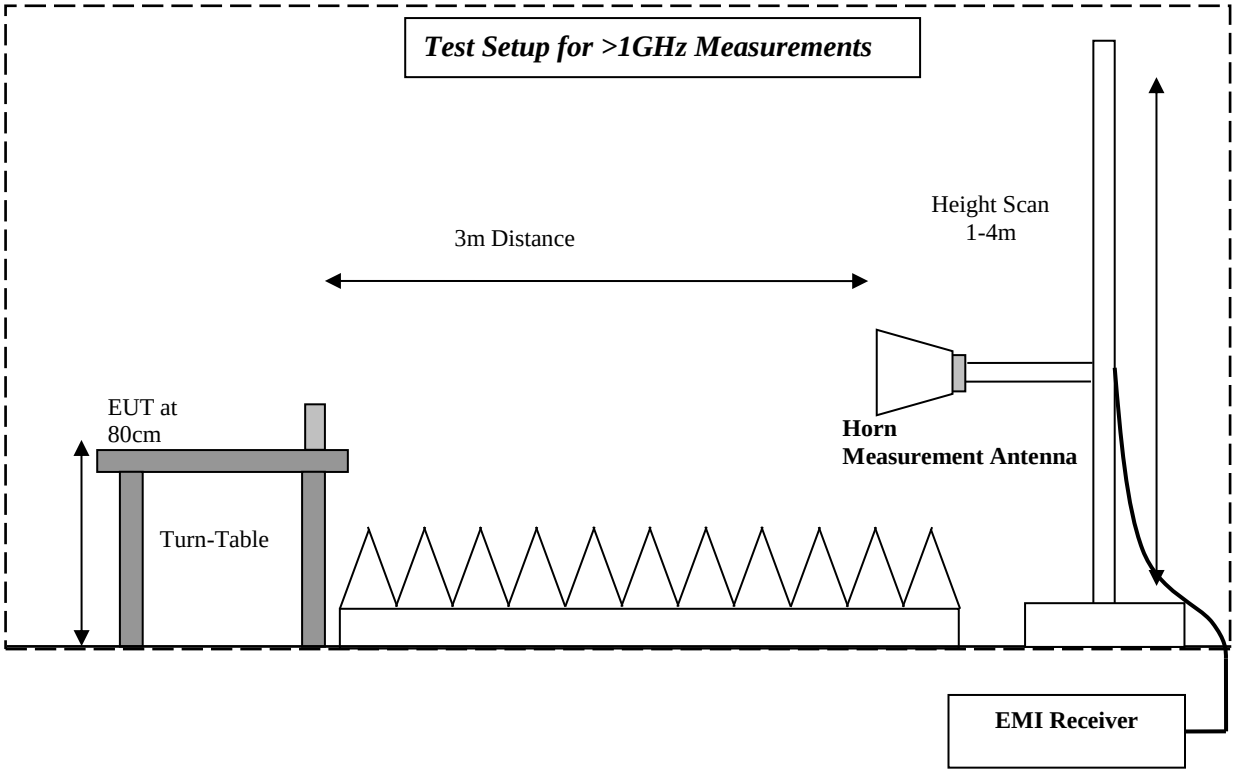


8 Test Equipment and Ancillaries used for tests

No.	Equipment Name	Manufacturer	Type/model	Serial No.	Cal Date	Cal Interval
3m Semi- Anechoic Chamber:						
	Digital Radio Comm. Tester	Rohde&Schwarz	CMU 200	101821	Jun 2013	2 Years
	EMC32 Measurement Software	Rohde&Schwarz	8.52.0	N/A	N/A	N/A
	Turn table	EMCO	2075	N/A	N/A	N/A
	MAPS Position Controller	ETS Lindgren	2092	0004-1510	N/A	N/A
	Antenna Mast	EMCO	2075	N/A	N/A	N/A
	Relay Switch Unit	Rohde&Schwarz	RSU	338964/001	N/A	N/A
	EMI Receiver/Analyzer	Rohde&Schwarz	ESU 40	100251	Sep 2013	2 Years
	1500MHz HP Filter	Filtek	HP12/1700	14c48	N/A	N/A
	2800 MHz HP Filter	Filtek	HP12/2800	14C47	N/A	N/A
	Pre-Amplifier	Miteq	JS40010260	340125	N/A	N/A
	Binconilog Antenna	EMCO	3141	0005-1186	Apr 2012	3 Years
	Horn Antenna	EMCO	3115	35114	Mar 2012	4 Years
	Horn Antenna	ETS Lindgren	3116	70497	Mar 2012	4 Years
	Spectrum Analyzer	Rohde&Schwarz	FSU	100189	Jun 2013	2 Years
	Loop Antenna 6512	ETS Lindgren	6512	49838	Mar 2014	3 Years
Ancillary equipment						
	Humidity Temperature Logger	Dickson	TM320	0928016	Jul 2014	1 Year
	Communication Antenna	IBP5-900/1940	Kathrein	N/A	N/A	N/A

9 Block Diagrams





10 Revision History

Date	Report Name	Changes to report	Report prepared by
2015-05-13	EMC_XIRGO-093-15001_FCC_22_24	First Version	Douglas Antioco