FCC / IC Test Report

FOR:

Moog Inc.

Model Name:

ILC3000

Product Description:

Asset Tracker

FCC ID: 2AGRZ-ILC3000
IC ID: 20942-ILC3000

Per:

47 CFR Part 22, 24
RSS-132 Issue 3
RSS-133 Issue 6

TEST REPORT #: EMC_MOOGI-005-15001_FCC_22_24
DATE: February 3, 2016

ACCREDITED
TESTING LABORATORY
Certificate #2135.01

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

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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 22, 24 and Industry Canada Radio Standard Specifications RSS-132 Issue 3 and RSS-133 Issue 6. No deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Moog Inc.	asset tracker	ILC3000

Report reviewed by:

Date	Section	Name	Signature
February 3, 2016	Compliance	Franz Engert (Compliance Manager)	Digitally signed by Franz Engert DN: cn=Franz Engert, c=US, o=CETECOM, ou=Complience, email=franz.engert@cetecom.com

Responsible for the Report:

Date	Section	Name	Signature
February 3, 2016	Compliance	Yu-Chien Ho (EMC Engineer)	Yu-Chien Ho

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
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Compliance Manager:	Franz Engert
Responsible Project Leader	Yu-Chien Ho

2.2 Identification of the Client

Client Firm/Name:	Moog Inc.
Street Address:	1421 McCarthy Blvd.
City/Zip Code	Milpitas, CA 95035
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Applicant
Manufacturers Address:	-------
City/Zip Code	-------
Country	-------

2.4 Dates of Testing:

November 17, 2015 – December 21, 2015

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Model #:	ILC3000
HW Version :	001
SW Version :	3.0.0.1
FCC-ID :	2AGRZ-ILC3000
IC-ID:	20942-ILC3000
HVIN:	ILC3000
PMN:	ILC3000
FVIN:	N/A
Product Description:	asset tracker
Module Information:	Module UBlox Lisa U201; FCC-ID: XPYLISAU201; IC: 8595A-LISAU201;
Technology / Type(s) of Modulation:	GSM/GPRS/EGPRS 900/1800MHz, multislot class 12; UMTS/HSPA FDD BAND II, V
Operating Frequency Ranges (MHz) / Channels:	GSM 850: 824 MHz – 849 MHz GSM 1900: 1850 MHz - 1910 MHz UMTS FDD BAND V: 824 MHz – 849 MHz UMTS FDD BAND II: 1850 MHz – 1910 MHz
Max. Measured Radiated Output Power	31.5dBm EIRP GSM 850
Antenna info:	internal, PIFA, peak gain: 1.5dBi@850, 2.4dBi@1850
Rated Operating Voltage Range:	• Li-ion Rechargeable Battery: Vmin: 3.3V dDC/ Vnom: 3.7V DC / Vmax: 4.2V DC • AC/DC Battery Charger: 110V – 230V AC, 120mA.
Rated Operating Temperature Range:	Tlow: -20° C/ Tnom: 22° C/ Tmax: 60° C
Other Radios included in the Device:	WLAN BTLE 4.1 GPS
Sample Revision:	■Prototype; ☐Production; ☐Pre-Production

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	Sample	HW / SW Version
1	320008	Radiated	001 / 3.0.0.1

3.3 Identification of Accessory equipment

AE #	Type	Model	Manufacturer	Serial Number
1	N/A			

4 Summary of Measurement Results

GSM 850, 850 MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §22.913 (a) RSS-132 5.4	RF Output Power	Nominal	$GMSK_2$	■	☐	☐	☐	Complies
§2.1055 §22.355 RSS-132 5.3	Frequency Stability	Nominal	$GMSK_2$	☐	☐	☐	■	Note 1
§2.1049 §22.917(b) RSS-132 5.2	Occupied Bandwidth	Nominal	$GMSK_2$	☐	☐	☐	■	Note 1
§2.1051 §22.917 RSS-132 5.5	Band Edge Compliance	Nominal	$GMSK_2$	☐	☐	☐	■	Note 1
§2.1051 §22.917 RSS-132 5.5	Conducted Spurious Emissions	Nominal	$GMSK_2$	☐	☐	☐	■	Note 1
§2.1053 §22.917 RSS-132 5.5	Radiated Spurious Emissions	Nominal	$GMSK_2$	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.
Note 1: Leveraged from module certification. See Section 5.4
Note 2: It has been confirmed that GMSK modulation delivers highest channel power as well as highest power density. Thus GMSK has been chosen to represent worst case for all measurements in this report.

UMTS FDD V, 850MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §22.913 (a) RSS-132 5.4	RF Output Power	Nominal	UMTS FDD	■	☐	☐	☐	Complies
§2.1055 §22.355 RSS-132 5.3	Frequency Stability	Nominal	UMTS FDD	☐	☐	☐	■	Note 1
§2.1049 §22.917(b) RSS-132 5.2	Occupied Bandwidth	Nominal	UMTS FDD	☐	☐	☐	■	Note 1
§2.1051 §22.917 RSS-132 5.5	Band Edge Compliance	Nominal	UMTS FDD	☐	☐	☐	■	Note 1
§2.1051 §22.917 RSS-132 5.5	Conducted Spurious Emissions	Nominal	UMTS FDD	☐	☐	☐	■	Note 1
§2.1053 §22.917 RSS-132 5.5	Radiated Spurious Emissions	Nominal	UMTS FDD	■	☐	☐	☐	Complies

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

GSM 1900, 1900 MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §24.232 (a) RSS-133 6.4	RF Output Power	Nominal	$GMSK_2$	■	☐	☐	☐	Complies
§2.1055 §24.235 RSS-133 6.3	Frequency Stability	Nominal	$GMSK_2$	☐	☐	☐	■	Note 1
§2.1049 §24.238(b) RSS-133 6.2	Occupied Bandwidth	Nominal	$GMSK_2$	☐	☐	☐	■	Note 1
§2.1051 §24.238 RSS-133 6.5	Band Edge Compliance	Nominal	$GMSK_2$	☐	☐	☐	■	Note 1
§2.1051 §24.238 RSS-133 6.5	Conducted Spurious Emissions	Nominal	$GMSK_2$	☐	☐	☐	■	Note 1
§2.1053 §24.238 RSS-133 6.5	Radiated Spurious Emissions	Nominal	$GMSK_2$	■	☐	☐	☐	Complies

Note: NA= Not Applicable; NP= Not Performed.
Note 1: Leveraged from module certification.
Note 2: It has been confirmed that GMSK modulation delivers highest channel power as well as highest power density. Thus GMSK has been chosen to represent worst case for all measurements in this report.

UMTS FDD Band II, 1900 MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §24.232 (a) RSS-133 6.4	RF Output Power	Nominal	UMTS FDD	■	☐	☐	☐	Complies
§2.1055 §24.235 RSS-133 6.3	Frequency Stability	Nominal	UMTS FDD	☐	☐	☐	■	Note 1
§2.1049 §24.238(b) RSS-133 6.2	Occupied Bandwidth	Nominal	UMTS FDD	☐	☐	☐	■	Note 1
§2.1051 §24.238 RSS-133 6.5	Band Edge Compliance	Nominal	UMTS FDD	☐	☐	☐	■	Note 1
§2.1051 §24.238 RSS-133 6.5	Conducted Spurious Emissions	Nominal	UMTS FDD	☐	☐	☐	■	Note 1
§2.1053 §24.238 RSS-133 6.5	Radiated Spurious Emissions	Nominal	UMTS FDD	■	☐	☐	☐	Complies

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

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 Conditions

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

5.3 Nominal Environmental Test Conditions

- Test Temperature: 20°C (nominal);
- Test Voltage: 3.7 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 the certified module UBlox Lisa U201 (details see EUT spec in section 3.1)

Taking into account guidance from FCC KDB 996369 (modular approval) and where relevant test procedures did not change conducted test results are leveraged.

This test report contains full radiated testing as per FCC 22H/24E and RSS-132 issue 3 / RSS-133 issue 6

5.5 Nominal Cellular Test Conditions

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 Additional Test Information.

Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v02r02, *Measurement Guidance for Certification of Licensed Digital Transmitters* and according to relevant parts of TIA-603C 2004 as detailed below.

6 RF Power Output radiated

6.1 References

FCC: CFR Part 2.1046, CFR Part 22.913, CFR Part 24.232
IC: RSS-Gen issue 4, section 6.12; RSS-132 issue 3, section 5.4; RSS-133 issue 6, section 6.4

6.2 Limits:

ERP/EIRP (850 MHz Band)
FCC Part 22.913 (a) & RSS-132 Section 5.4

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

IC: EIRP < 40.60 dBm (11.5W)
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.

EIRP (1900 MHz Band)
FCC Part 24.232 (c) (e) & RSS-133 Section 6.4/SRSP-510 Section 5.1.2

FCC: EIRP < 33 dBm (2W)
(b) Mobile/portable stations are limited to 2 Watts effective isotropic radiated power (EIRP).
(c) 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.

IC: EIRP < 33 dBm (2W)
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 2 watts.

6.3 Test modulation

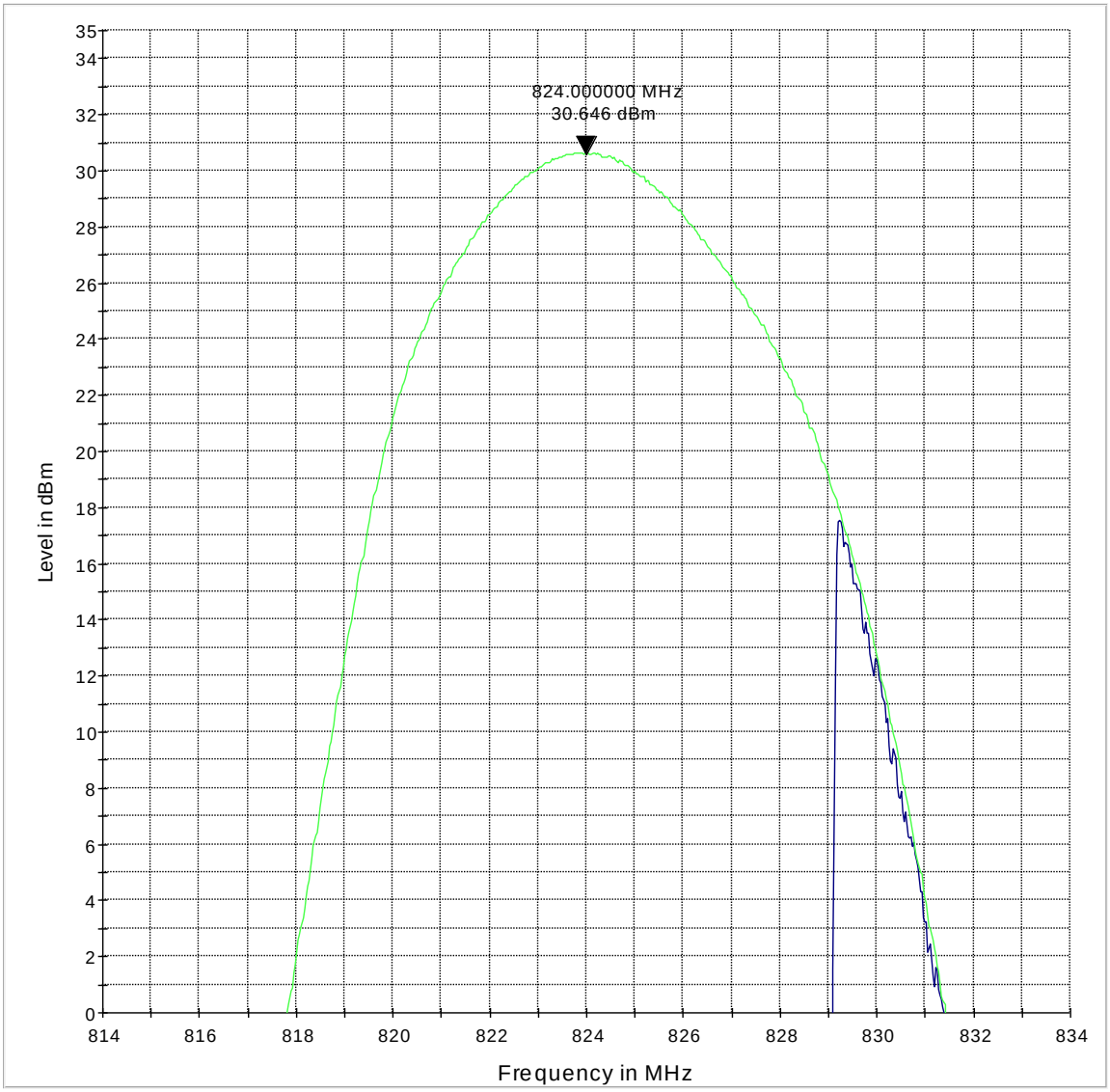
It has been confirmed that the total output powers and power densities in 1MHz are highest on GSM operating with GMSK modulation on one time slot.

6.4 Measurement Result:

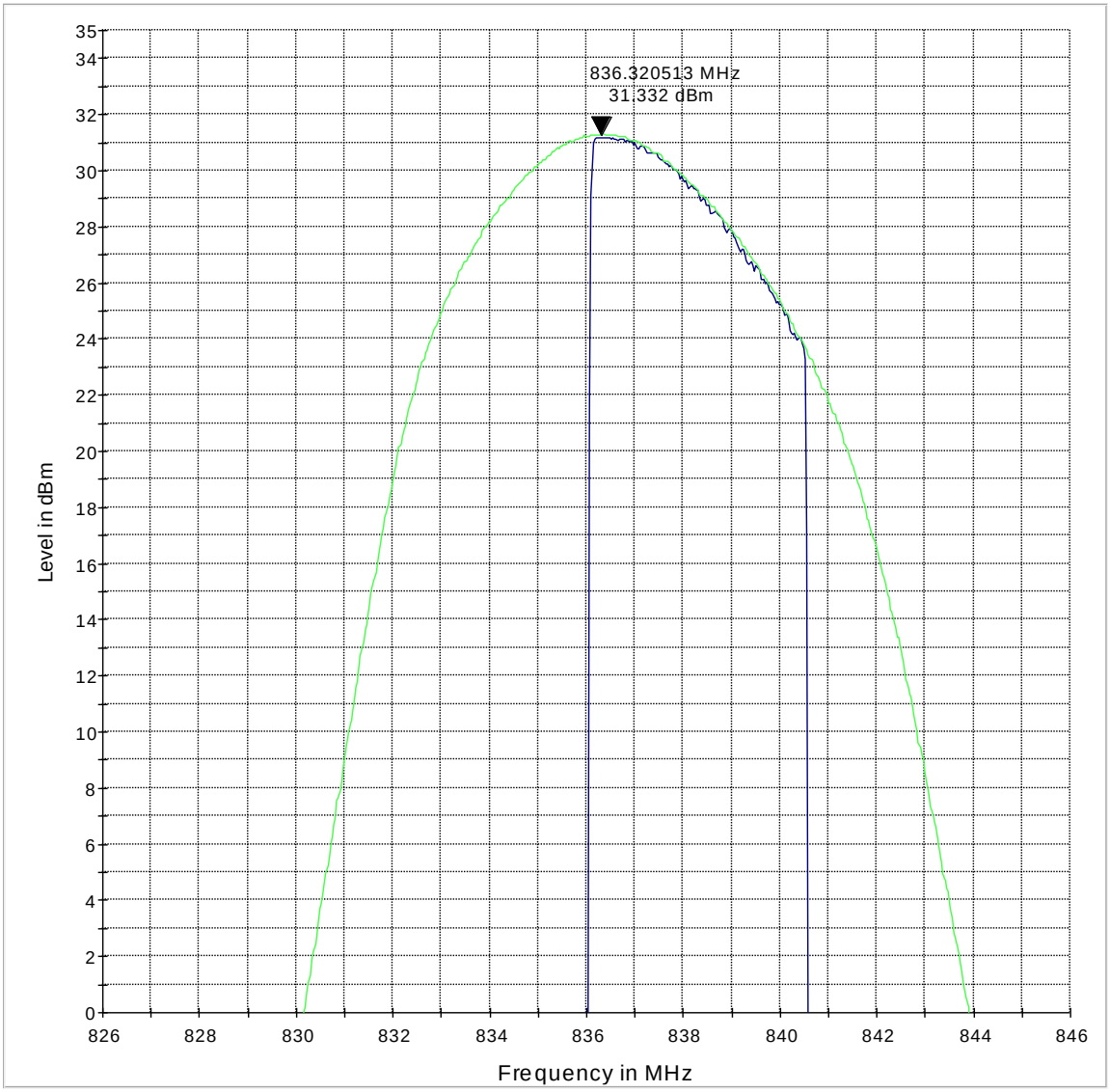
Band/Modulation	Channel	Measured Peak Power [dBm]	Limit [dBm]	Verdict
GSM 850 / GMSK	Low	30.6dBm ERP	38.45 dBm ERP	PASS
GSM 850 / GMSK	Mid	31.3dBm ERP	38.45 dBm ERP	PASS
GSM 850 / GMSK	High	**31.5dBm ERP**	38.45 dBm ERP	PASS
UMTS V	Low	23.8dBm ERP	38.45 dBm ERP	PASS
UMTS V	Mid	24.4dBm ERP	38.45 dBm ERP	PASS
UMTS V	High	24.2dBm ERP	38.45 dBm ERP	PASS
GSM 1900 / GMSK	Low	30.2dBm EIRP	33 dBm EIRP	PASS
GSM 1900 / GMSK	Mid	30.1dBm EIRP	33 dBm EIRP	PASS
GSM 1900 / GMSK	High	31.2dBm EIRP	33 dBm EIRP	PASS
UMTS II	Low	25.7dBm EIRP	33 dBm EIRP	PASS
UMTS II	Mid	25.1dBm EIRP	33 dBm EIRP	PASS
UMTS II	High	24.4dBm EIRP	33 dBm EIRP	PASS

6.5 Measurement Plots:

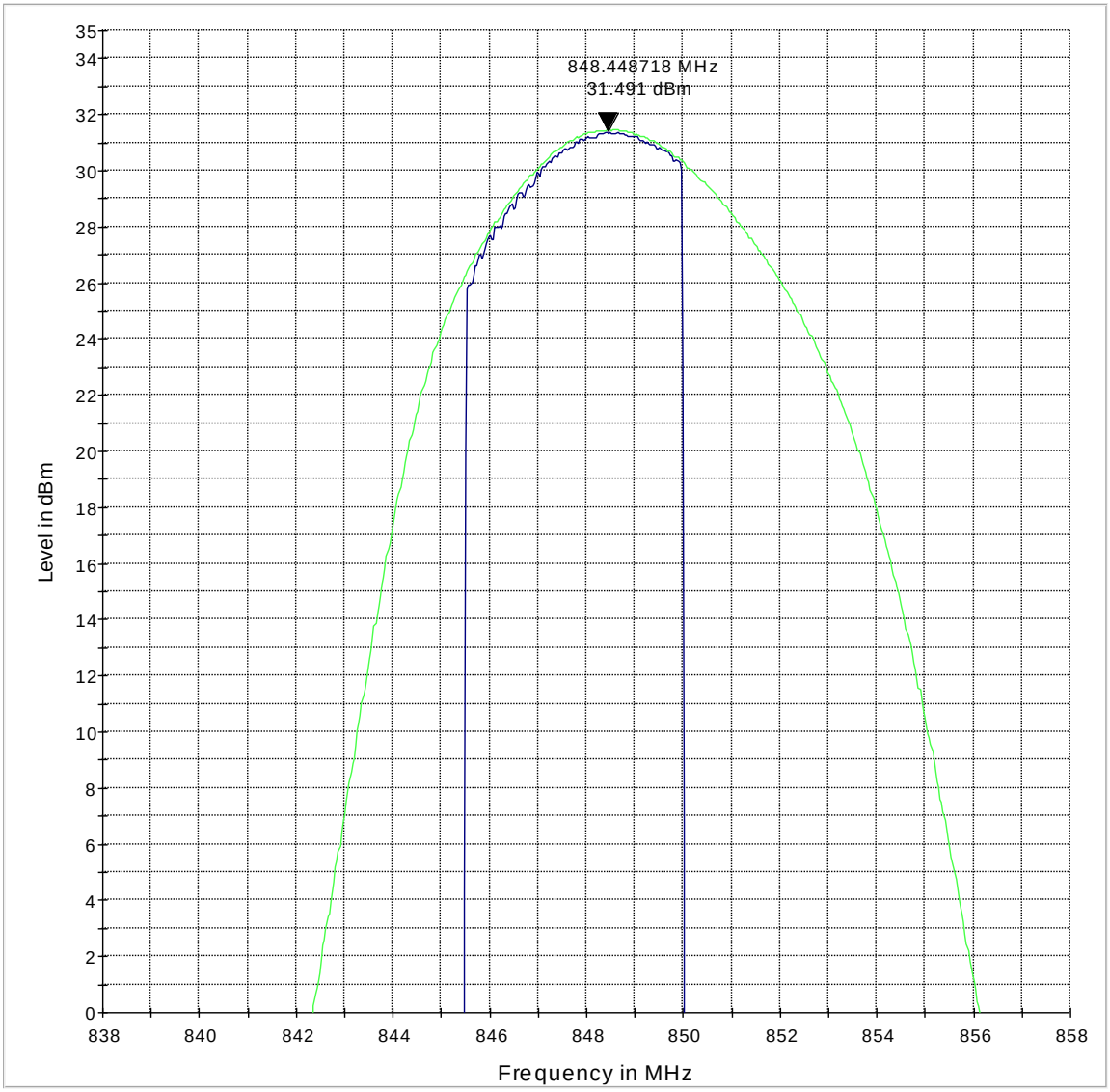
6.5.1 EIRP, GSM 850, Tx: Ch. Low



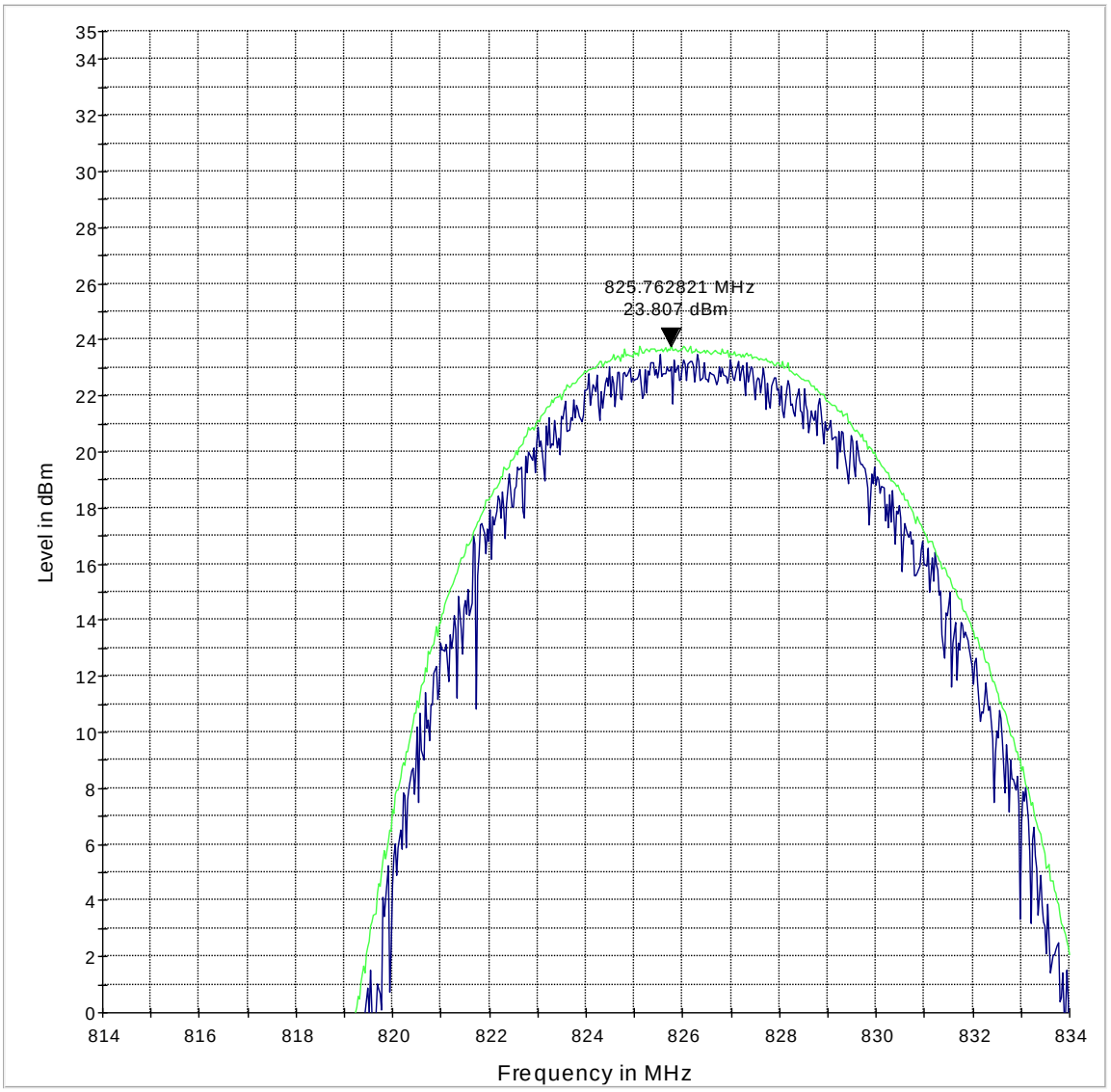
6.5.2 EIRP, GSM 850, Tx: Ch. Mid



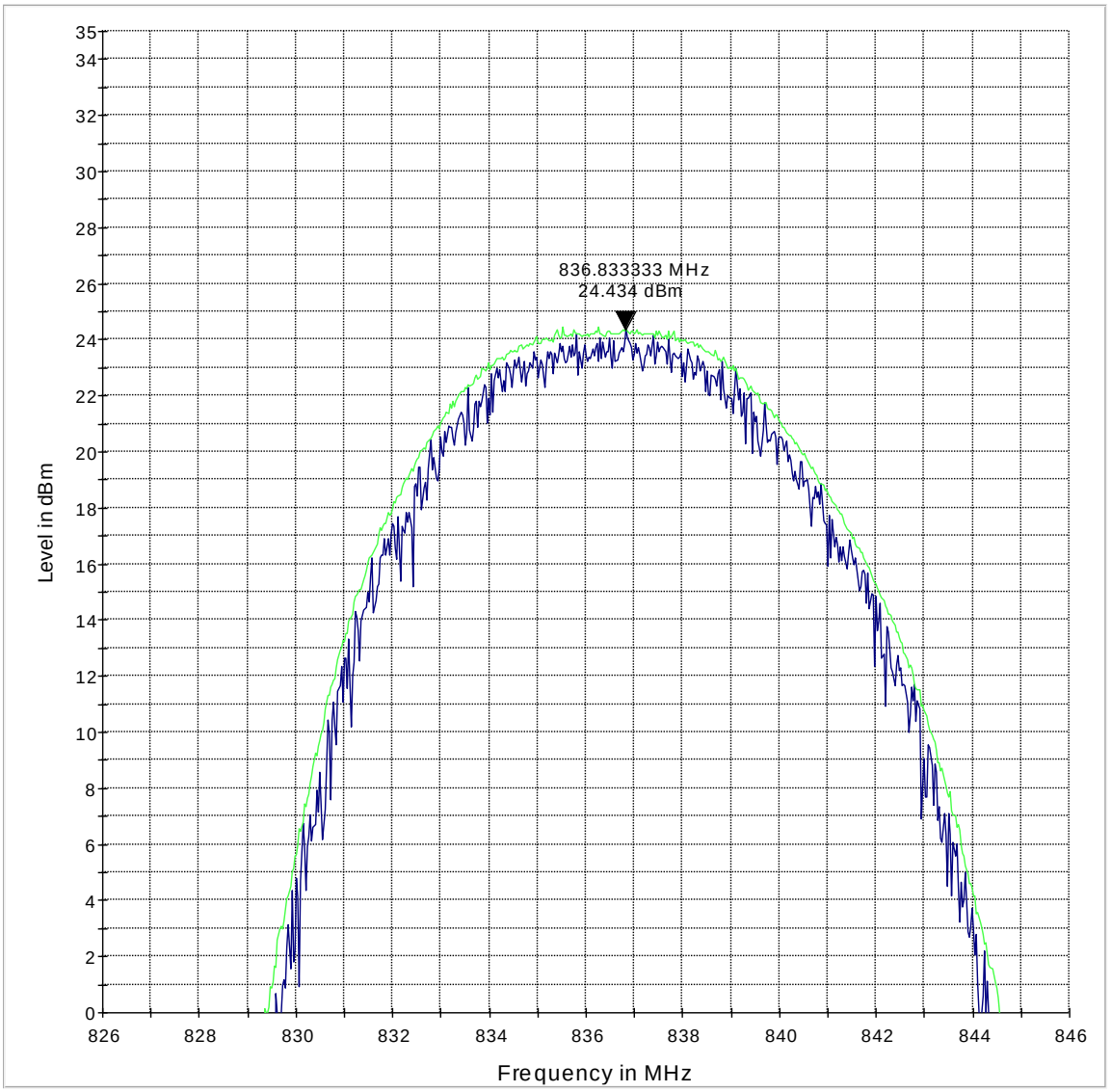
6.5.3 EIRP, GSM 850, Tx: Ch. High



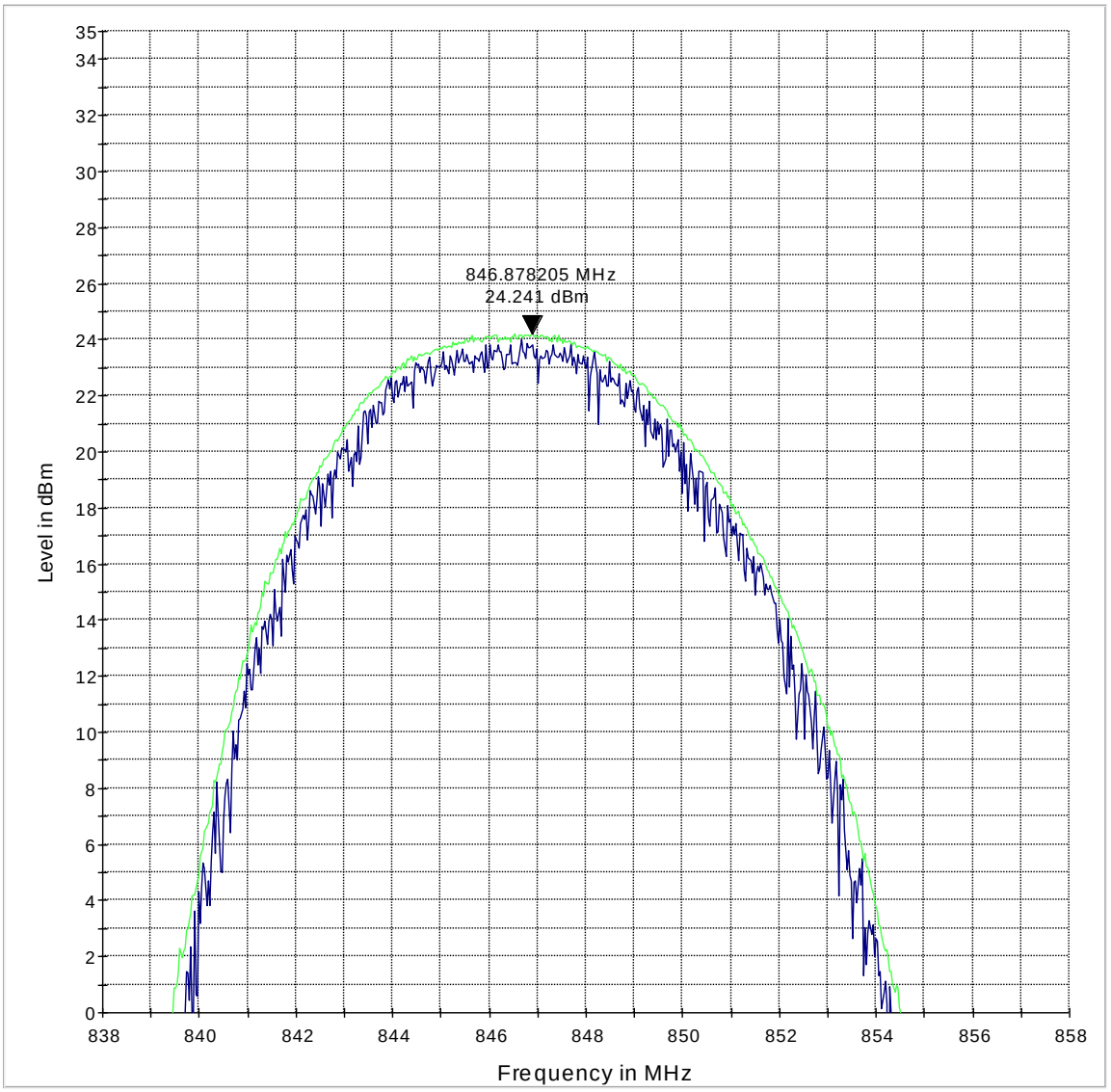
6.5.4 EIRP, UMTS FDD V, Tx: Ch. Low



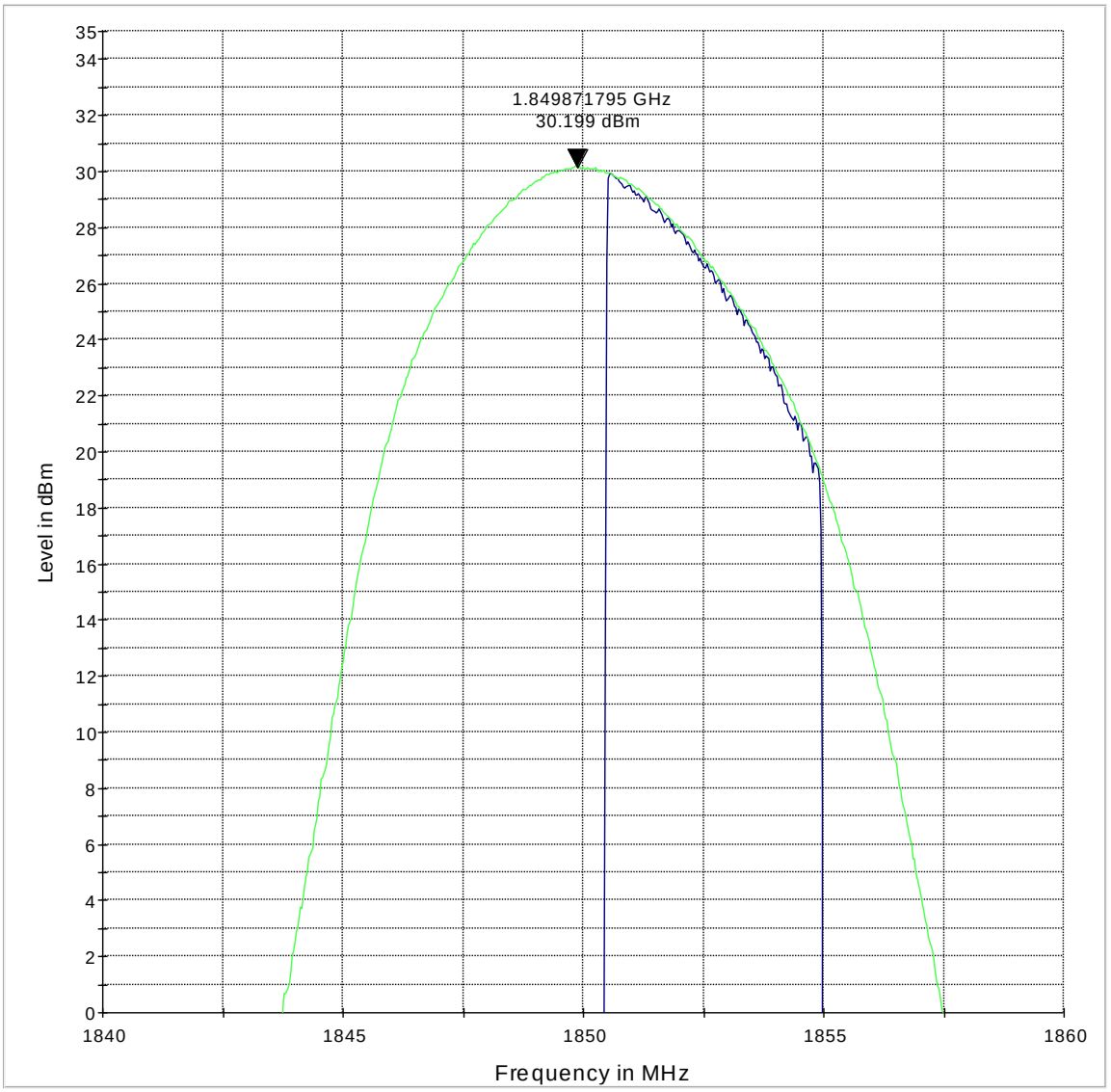
6.5.5 EIRP, UMTS FDD V, Tx: Ch. Mid



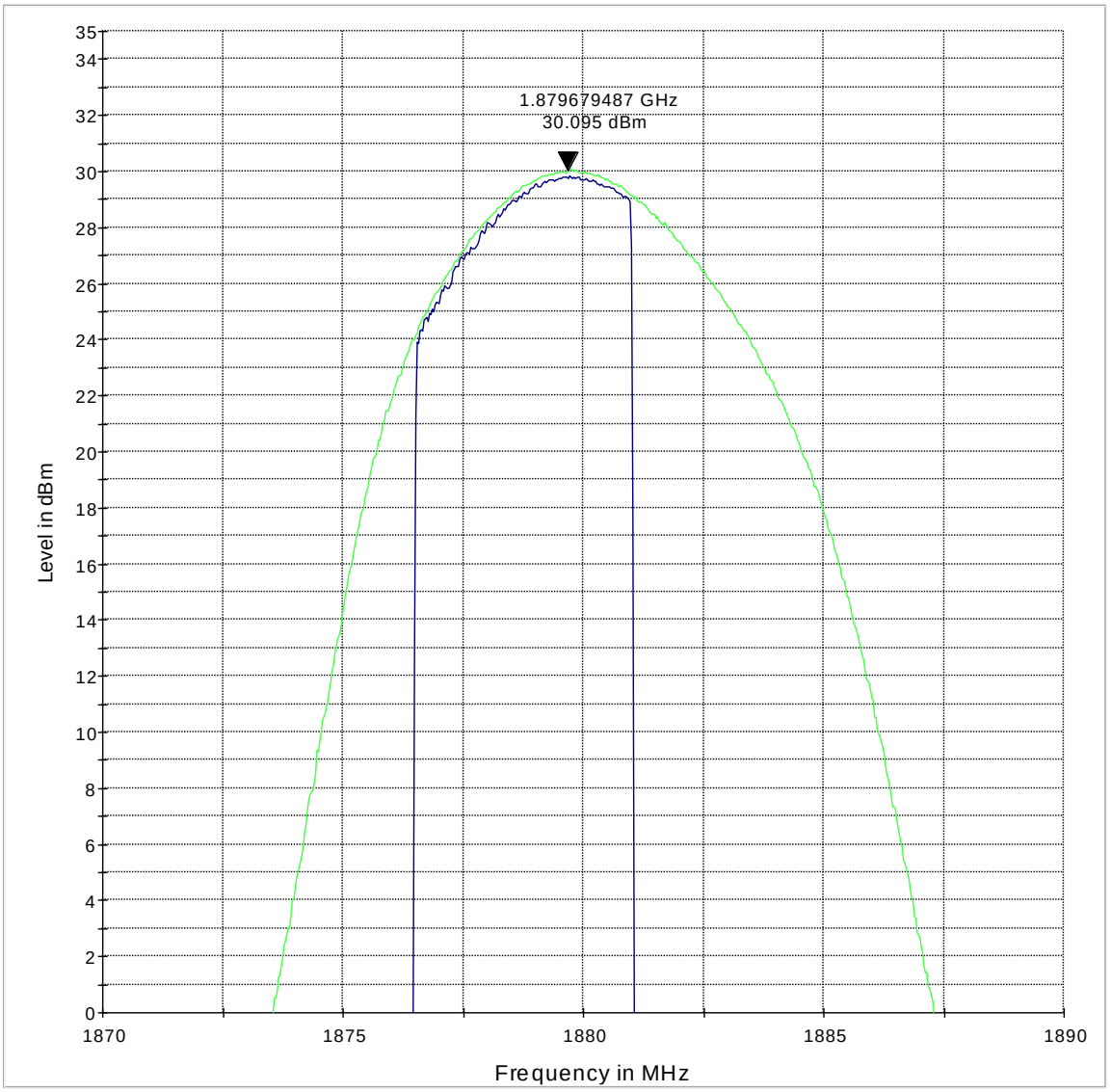
6.5.6 EIRP, UMTS FDD V, Tx: Ch. High



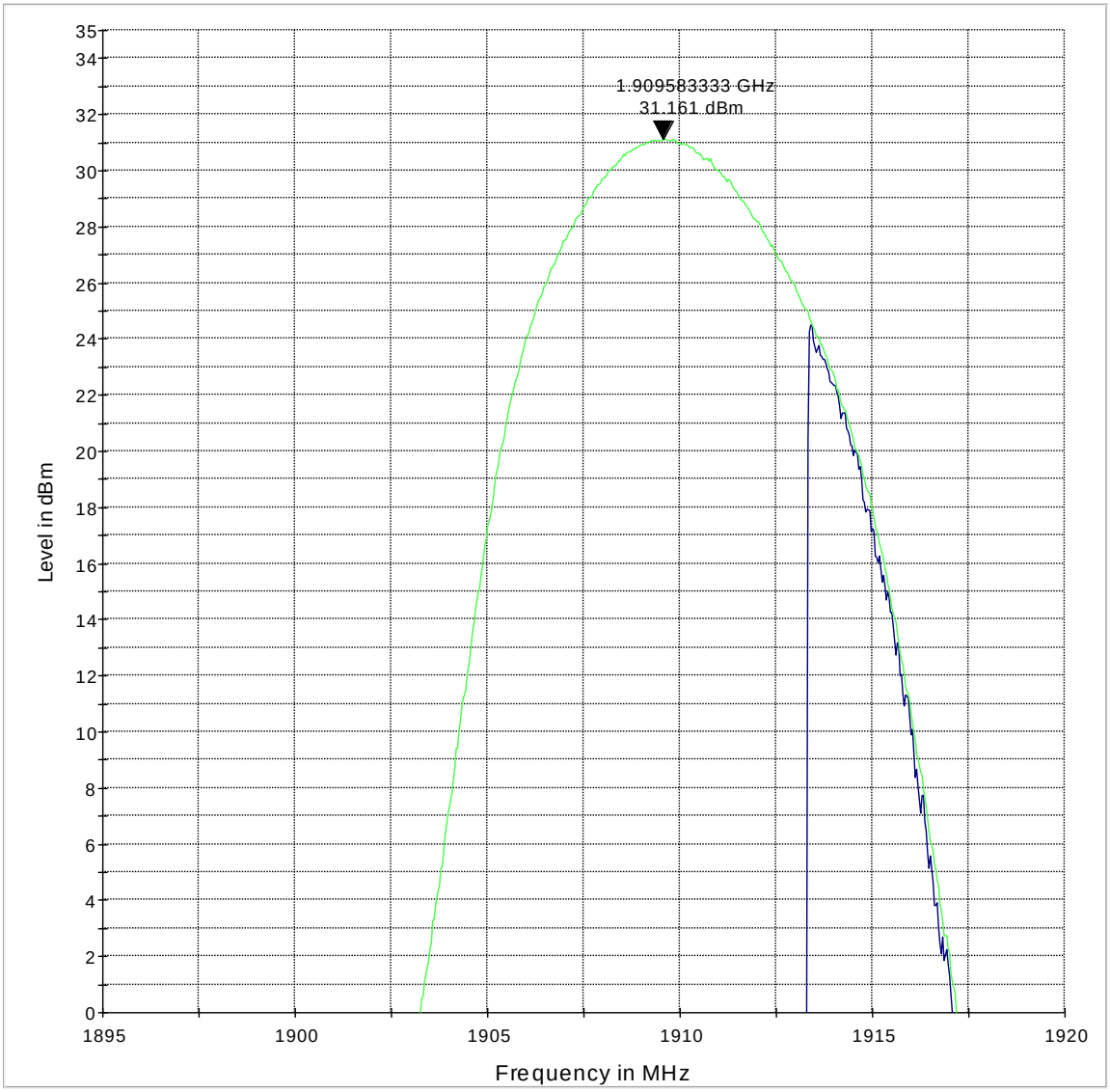
6.5.7 EIRP, GSM 1900, Tx: Ch. Low



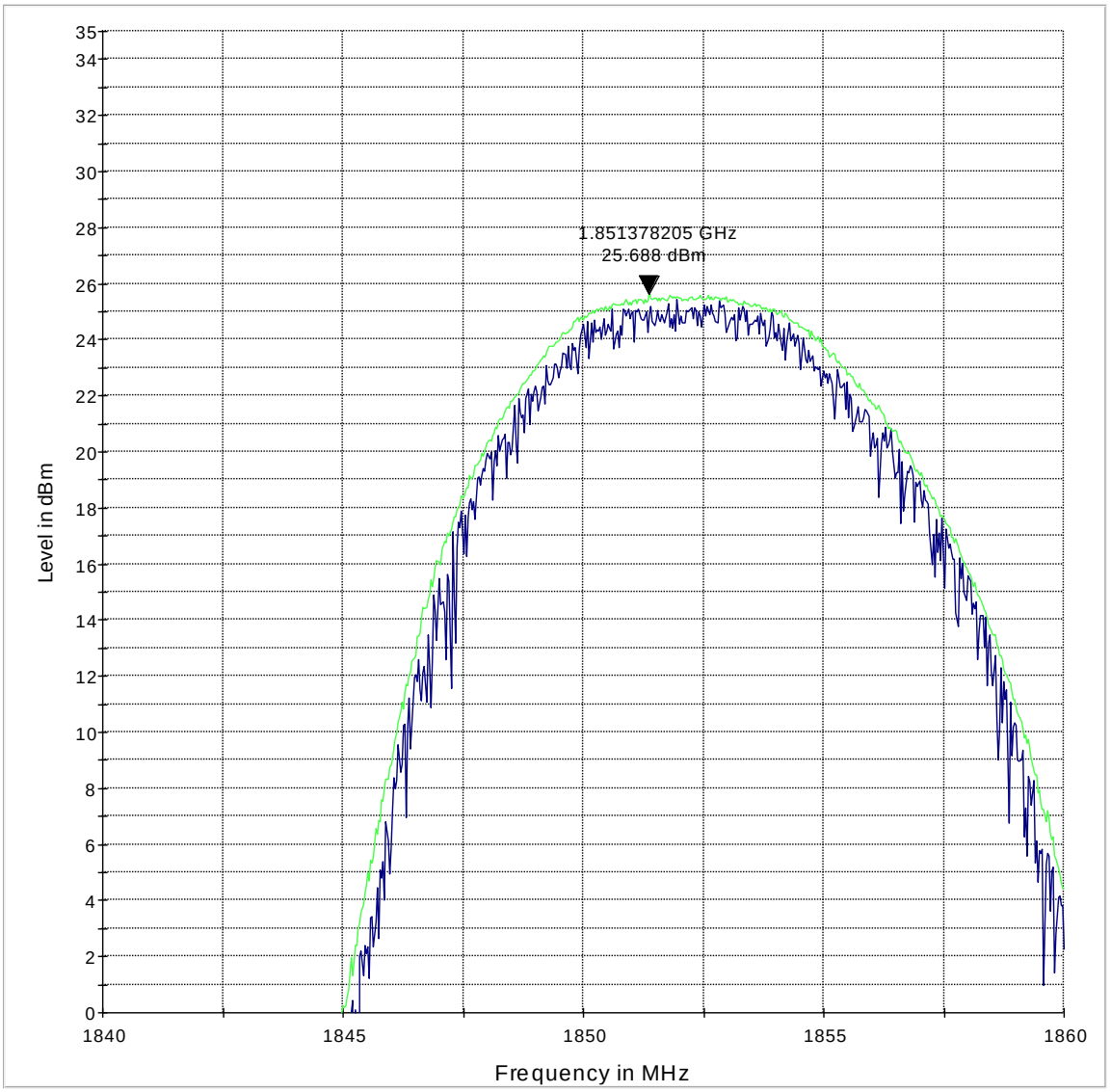
6.5.8 EIRP, GSM 1900, Tx: Ch. Mid



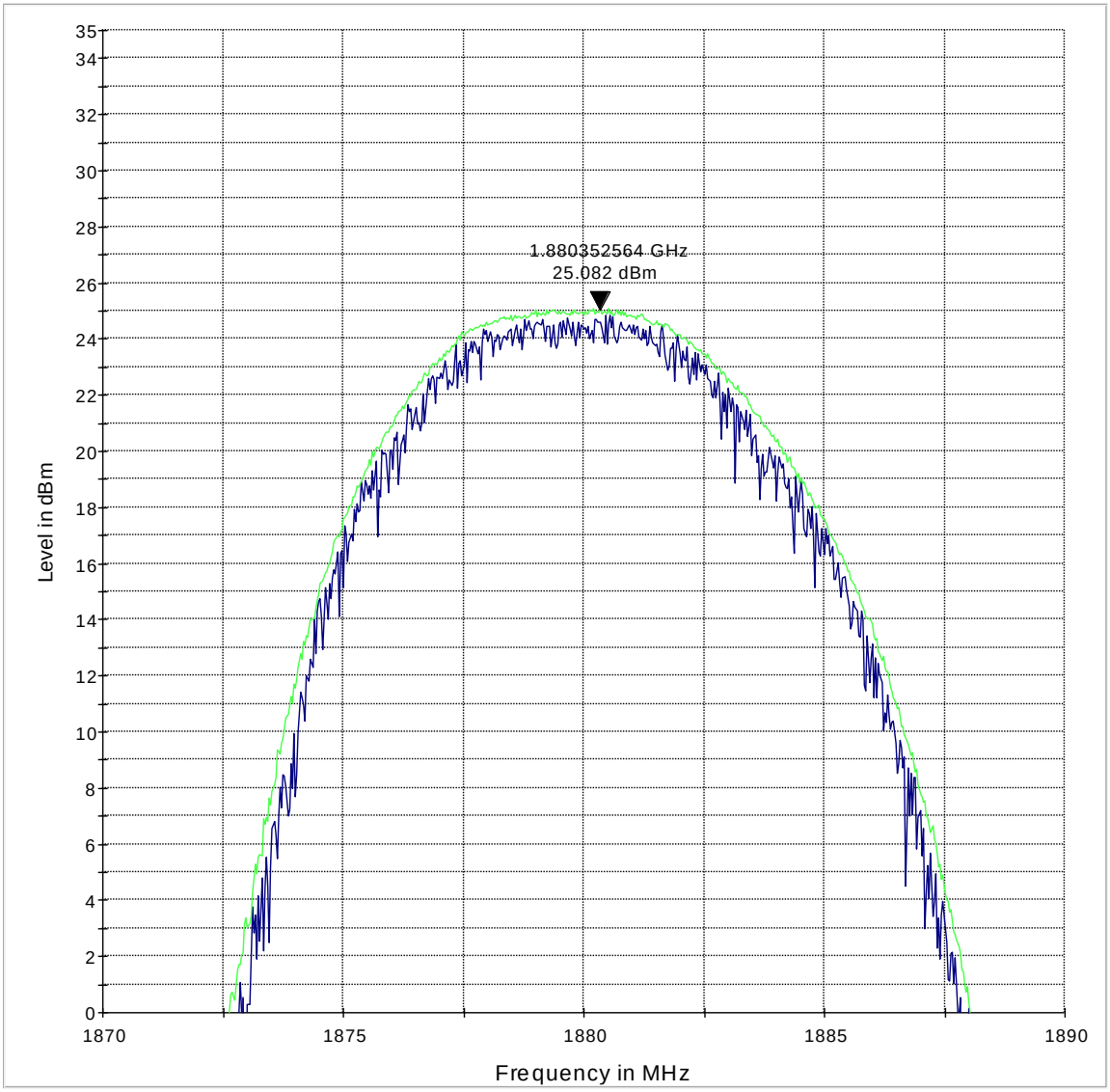
6.5.9 EIRP, GSM 1900, Tx: Ch. High



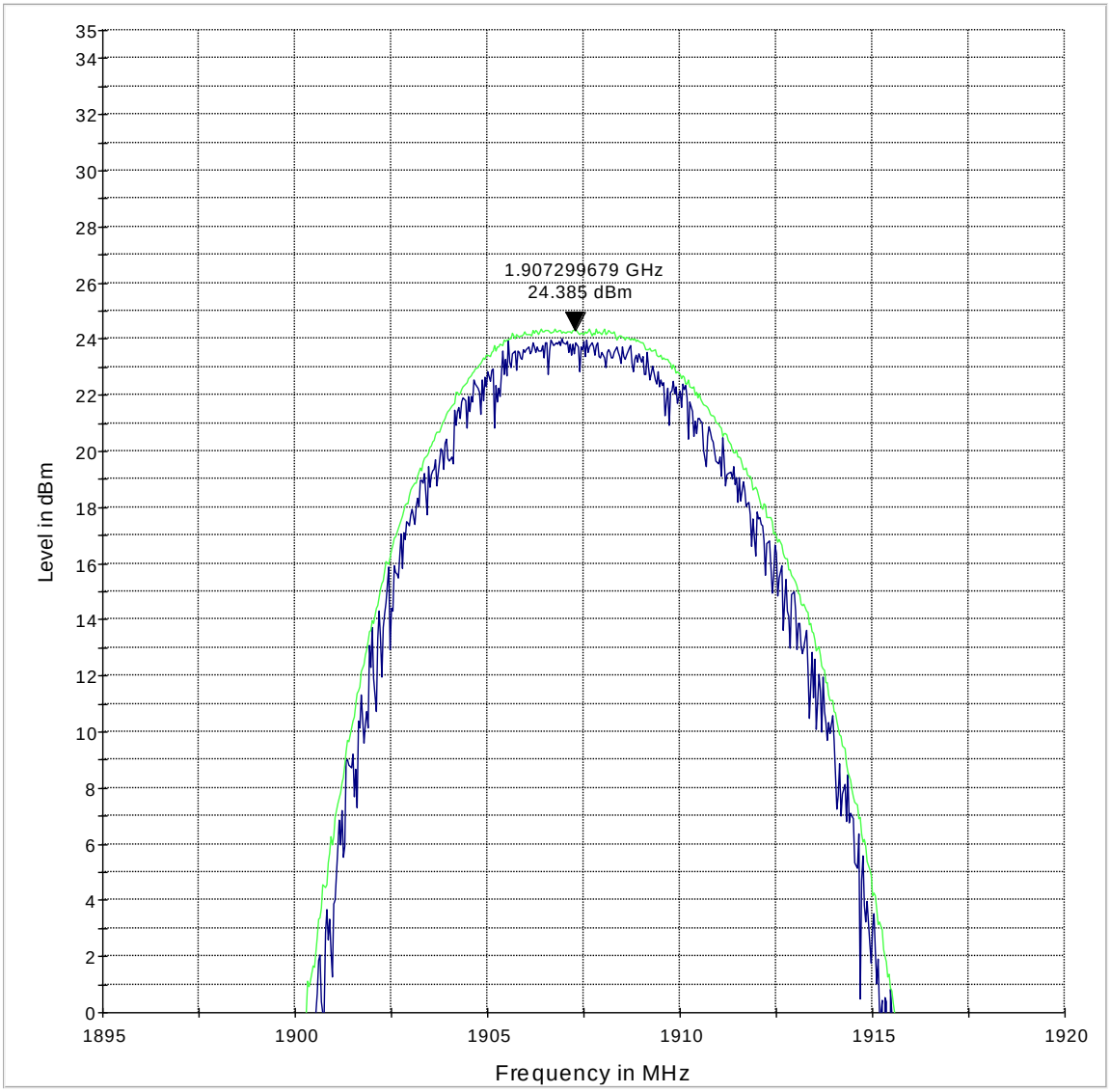
6.5.10 EIRP, UMTS FDD II, Tx: Ch. Low



6.5.11 EIRP, UMTS FDD II, Tx: Ch. Mid



6.5.12 EIRP, UMTS FDD II, Tx: Ch. High



7 Spurious Emissions Radiated

7.1 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

7.2 Limits:
(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.

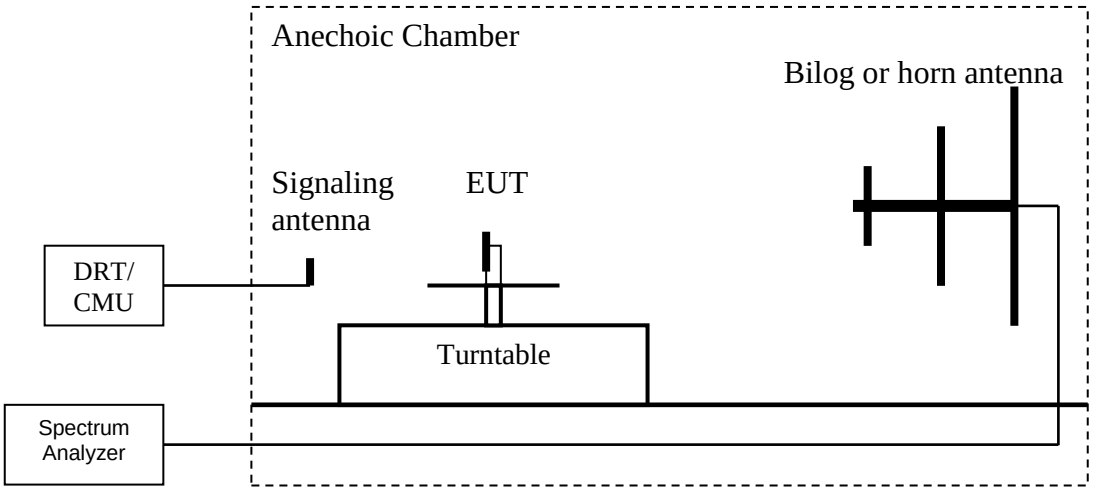
7.2.1 **FCC 22.917 Emission limitations for cellular equipment.**
The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.
(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing 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.

7.2.2 **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.
(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.

7.2.3 **RSS-132 Section 5.5.1.1 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 log10(P), dB, in any MHz of bandwidth.

7.3 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.)

7.3.1 Sample Calculations for Radiated Measurements:
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 below.

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

7.3.2 Spectrum Analyzer Settings

Settings for FCC 22

	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

7.4 Test Results

7.4.1 GSM 850

Harmonic	Tx ch-128 Freq. (MHz)	Level (dBm)	Tx ch-190 Freq. (MHz)	Level (dBm)	Tx ch-251 Freq. (MHz)	Level (dBm)	Limit FCC and IC (dBm)
2	1648.4	-41.23	1673.2	NF	1697.6	NF	-13
3	2472.6	NF	2509.8	-41.3	2546.4	-45.3	
4	3296.8	NF	3346.4	NF	3395.2	NF	
5	4121	NF	4183	NF	4244	NF	
6	4945.2	NF	5019.6	NF	5092.8	NF	
7	5769.4	NF	5856.2	NF	5941.6	NF	
8	6593.6	NF	6692.8	NF	6790.4	NF	
9	7417.8	NF	7529.4	NF	7639.2	NF	
10	8242	NF	8366	NF	8488	NF	
NF = Noise Floor Measurement Uncertainty: ±3dB							

7.4.2 UMTS FDD BAND V

Harmonic	Tx ch-128 Freq. (MHz)	Level (dBm)	Tx ch-190 Freq. (MHz)	Level (dBm)	Tx ch-251 Freq. (MHz)	Level (dBm)	Limit FCC and IC (dBm)
2	1648.4	NF	1673.2	NF	1697.6	NF	-13
3	2472.6	NF	2509.8	NF	2546.4	NF	
4	3296.8	NF	3346.4	NF	3395.2	NF	
5	4121	NF	4183	NF	4244	NF	
6	4945.2	NF	5019.6	NF	5092.8	NF	
7	5769.4	NF	5856.2	NF	5941.6	NF	
8	6593.6	NF	6692.8	NF	6790.4	NF	
9	7417.8	NF	7529.4	NF	7639.2	NF	
10	8242	NF	8366	NF	8488	NF	
NF = Noise Floor Measurement Uncertainty: ±3dB							

7.4.3 GSM 1900

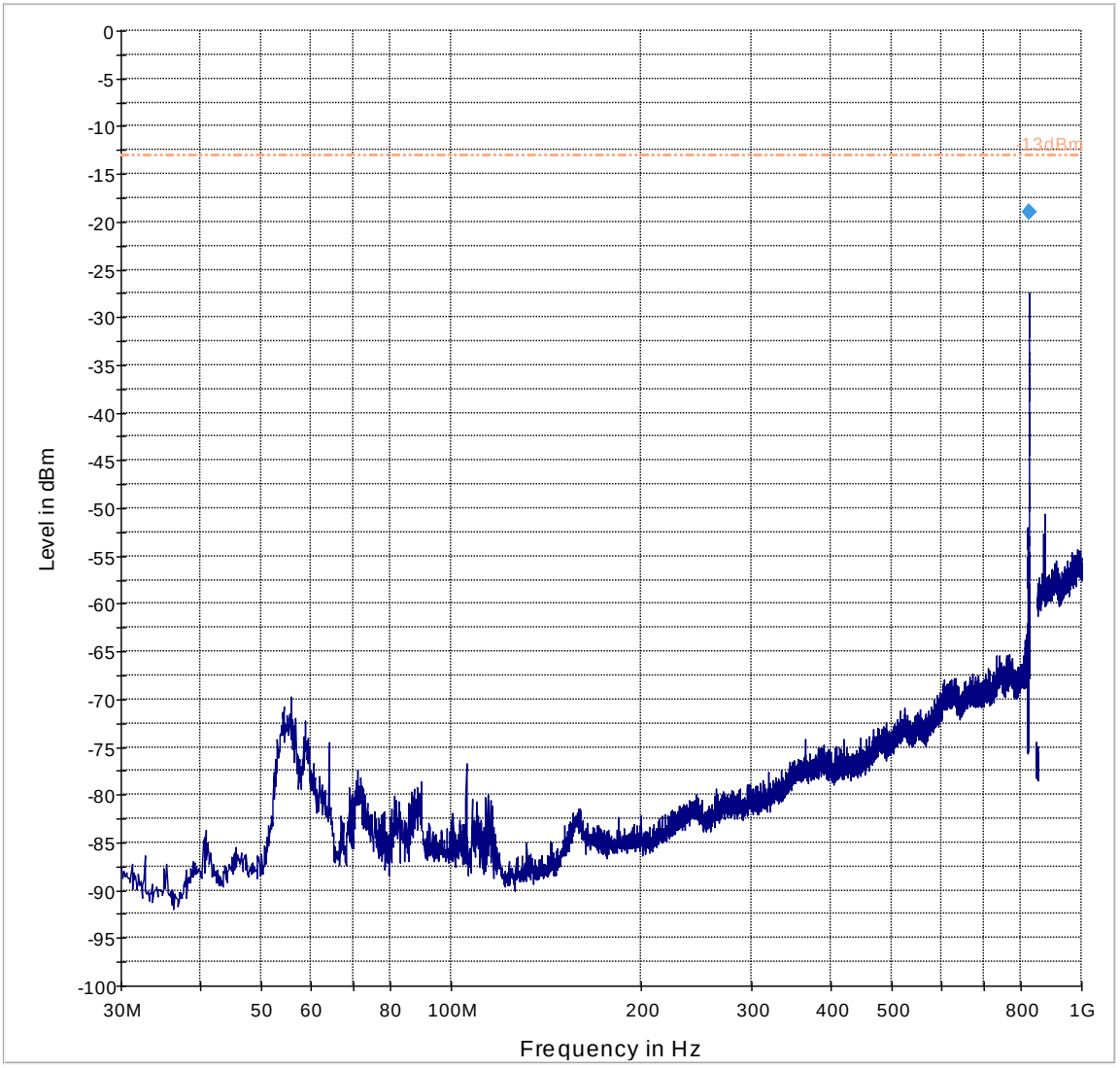
Harmonic	Tx ch-512 Freq. (MHz)	Level (dBm)	Tx ch-661 Freq. (MHz)	Level (dBm)	Tx ch-810 Freq. (MHz)	Level (dBm)	Limit FCC and IC (dBm)
2	3700.4	NF	3760	NF	3819.6	NF	-13
3	5550.6	NF	5640	NF	5729.4	NF	
4	7400.8	NF	7520	NF	7639.2	NF	
5	9251	NF	9400	NF	9549	NF	
6	11101.2	NF	11280	NF	11458.8	NF	
7	12951.4	NF	13160	NF	13368.6	NF	
8	14801.6	NF	15040	NF	15278.4	NF	
9	16651.8	NF	16920	NF	17188.2	NF	
10	18502	NF	18800	NF	19098	NF	
NF = Noise Floor Measurement Uncertainty: ±3dB							

7.4.4 UMTS FDD BAND II

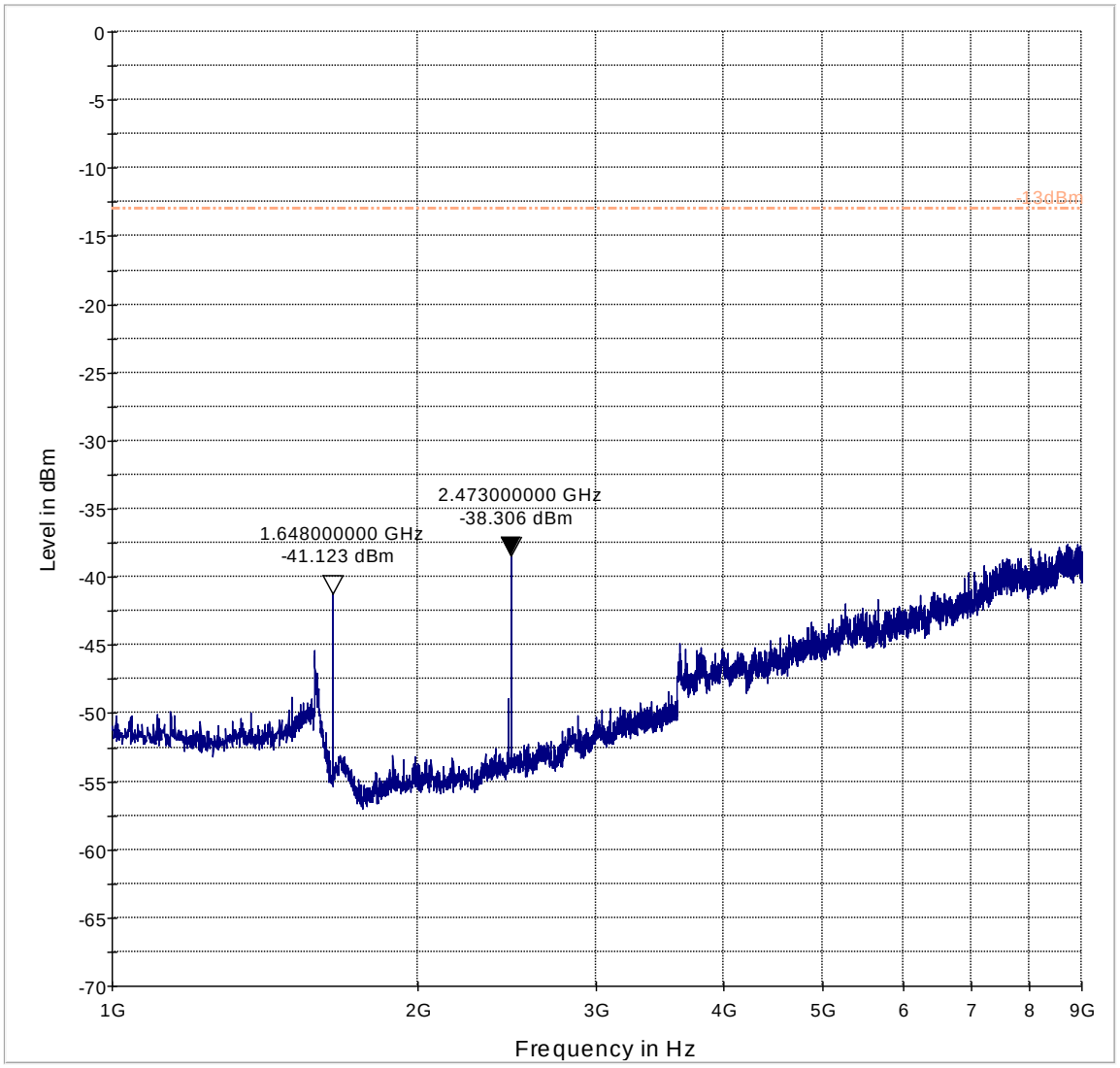
Harmonic	Tx ch-512 Freq. (MHz)	Level (dBm)	Tx ch-661 Freq. (MHz)	Level (dBm)	Tx ch-810 Freq. (MHz)	Level (dBm)	Limit FCC and IC (dBm)
2	3700.4	NF	3760	NF	3819.6	NF	-13
3	5550.6	NF	5640	NF	5729.4	NF	
4	7400.8	NF	7520	NF	7639.2	NF	
5	9251	NF	9400	NF	9549	NF	
6	11101.2	NF	11280	NF	11458.8	NF	
7	12951.4	NF	13160	NF	13368.6	NF	
8	14801.6	NF	15040	NF	15278.4	NF	
9	16651.8	NF	16920	NF	17188.2	NF	
10	18502	NF	18800	NF	19098	NF	
NF = Noise Floor Measurement Uncertainty: ±3dB							

Measurement Plots:

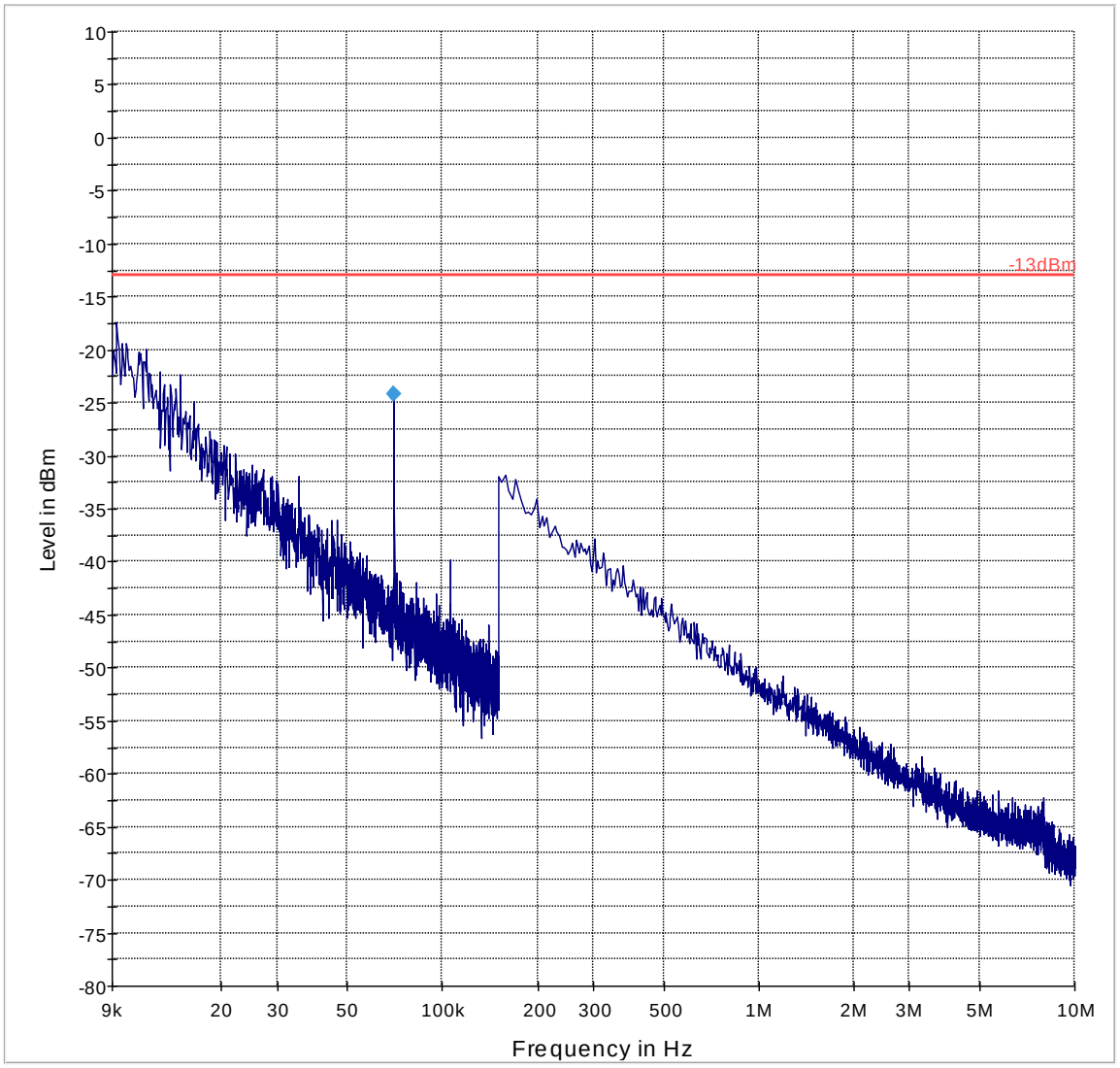
7.4.5 GSM 850, Tx: Ch. Low, 30 MHz – 1 GHz



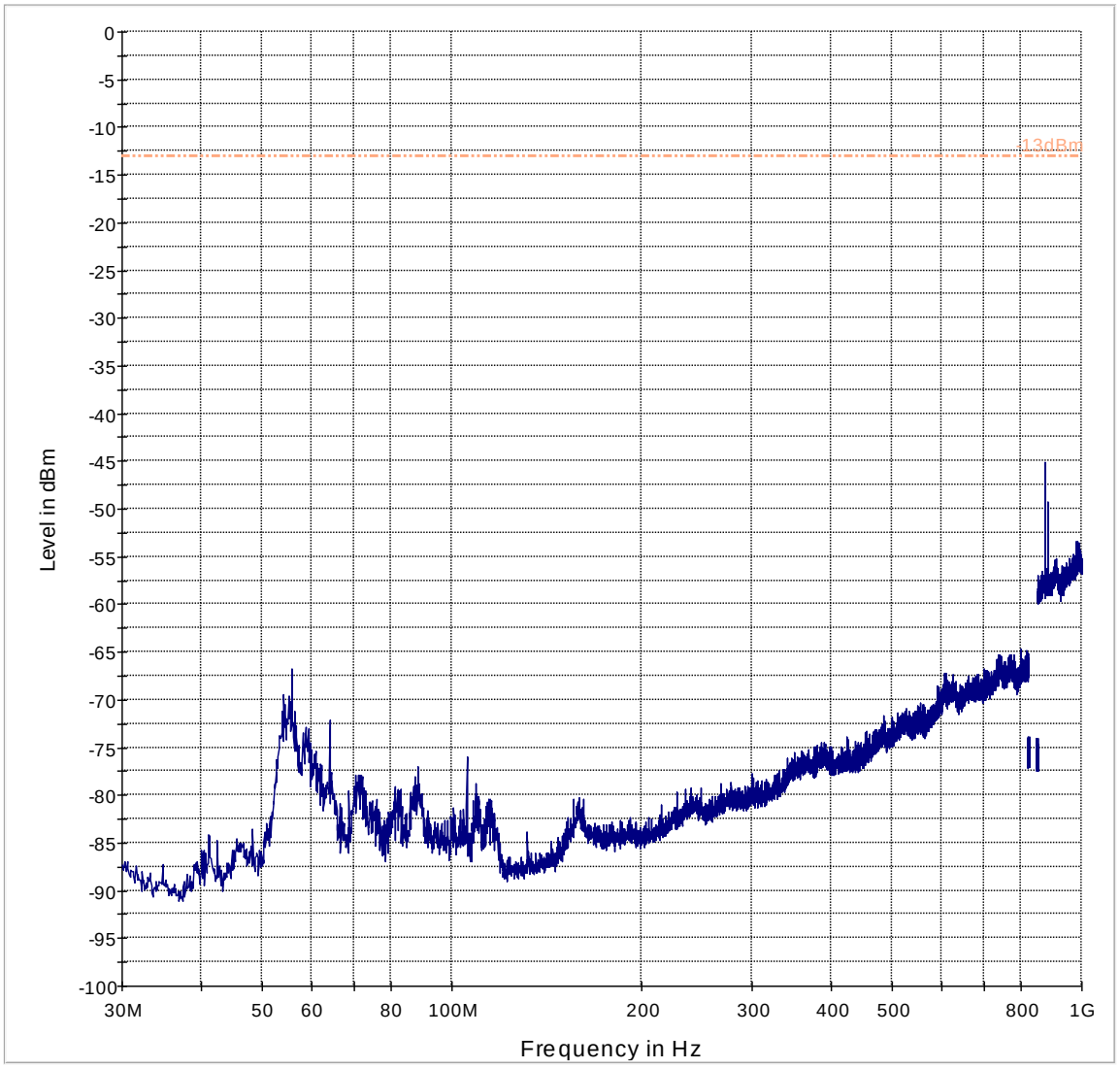
7.4.6 GSM 850, Tx: Ch. Low, 1 GHz – 9 GHz



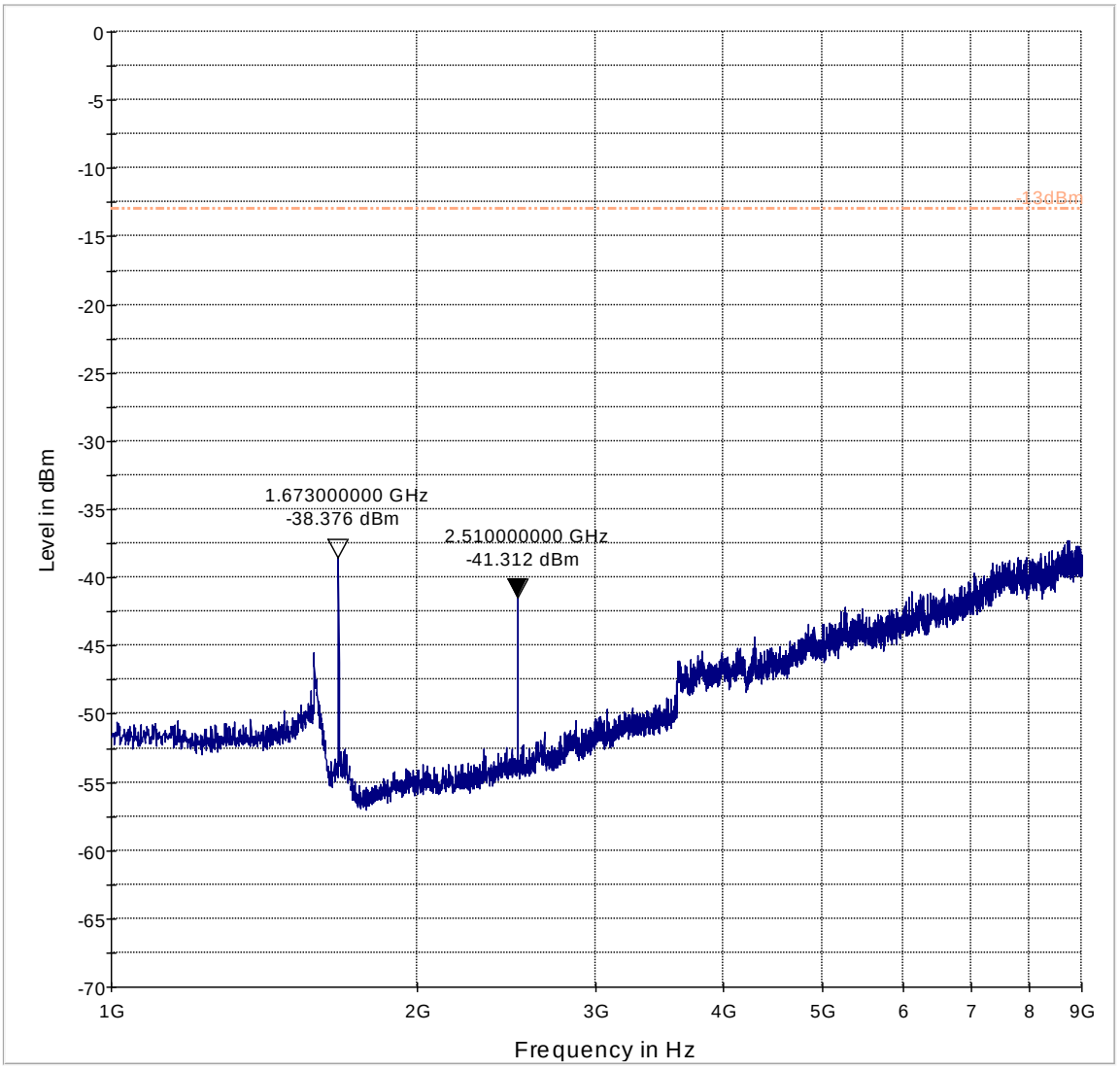
7.4.7 GSM 850, Tx: Ch. Mid, 9 KHz – 30 MHz



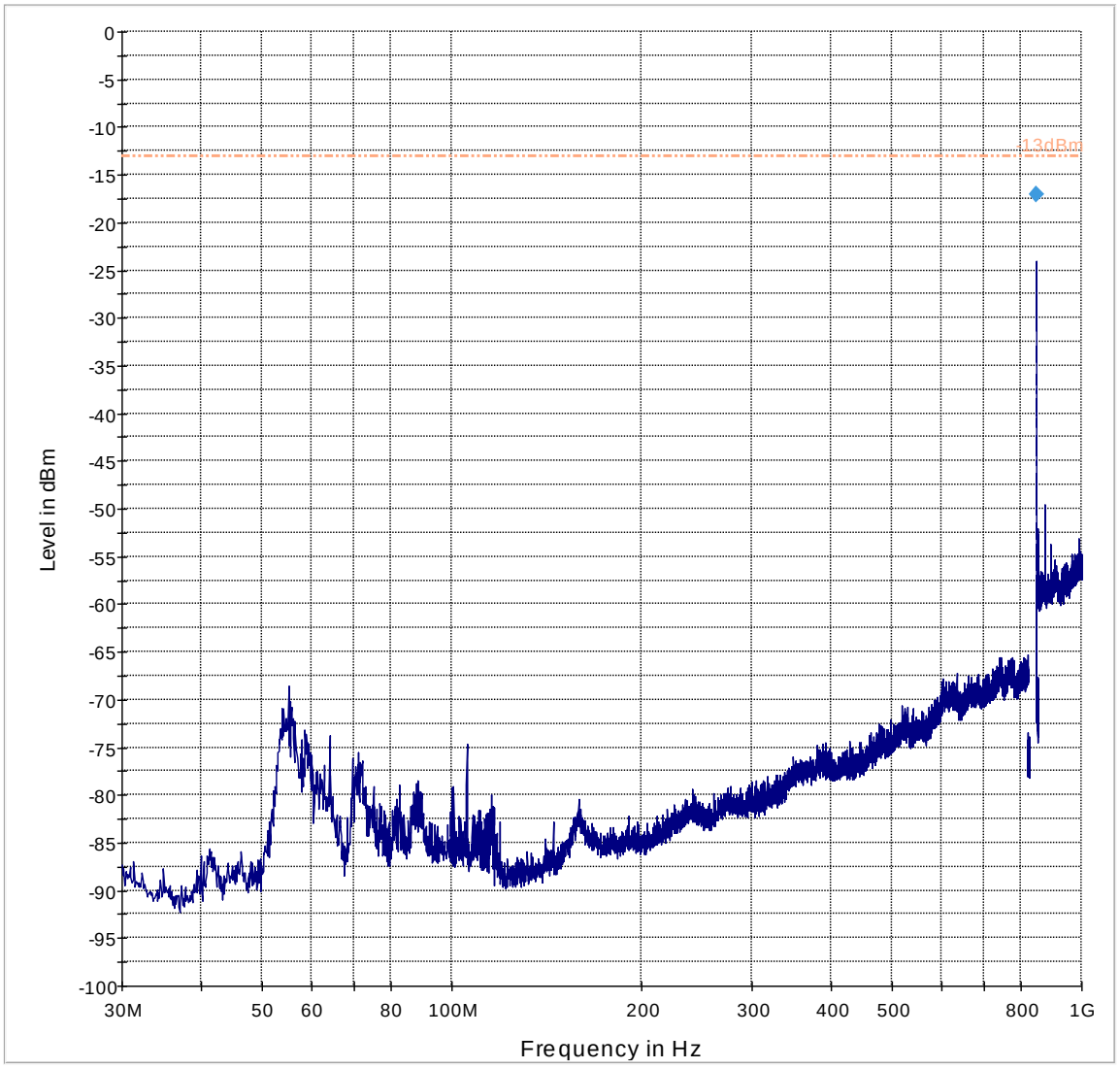
7.4.8 GSM 850, Tx: Ch. Mid, 30 MHz – 1 GHz



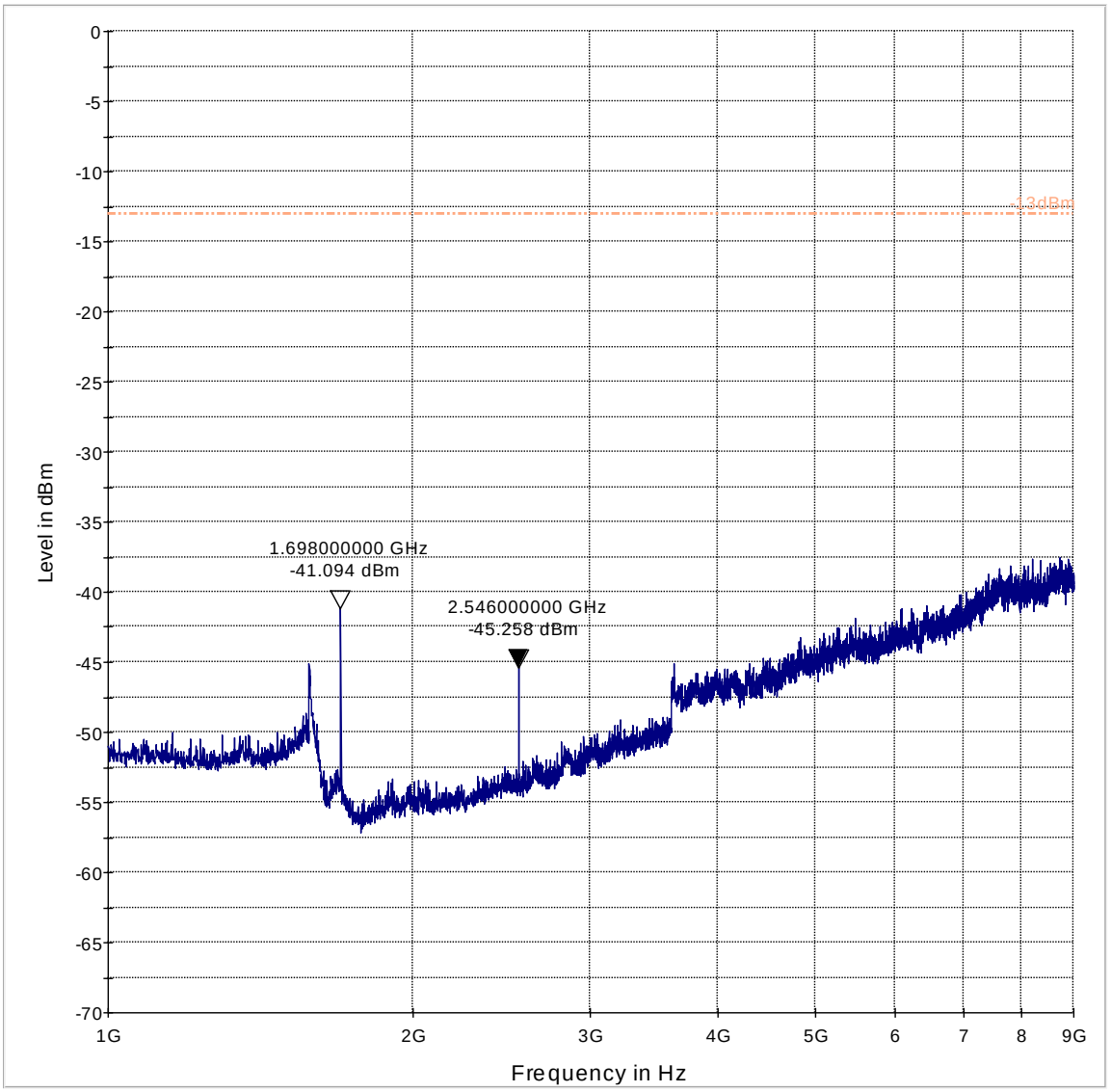
7.4.9 GSM 850, Tx: Ch. Mid, 1 GHz – 9 GHz



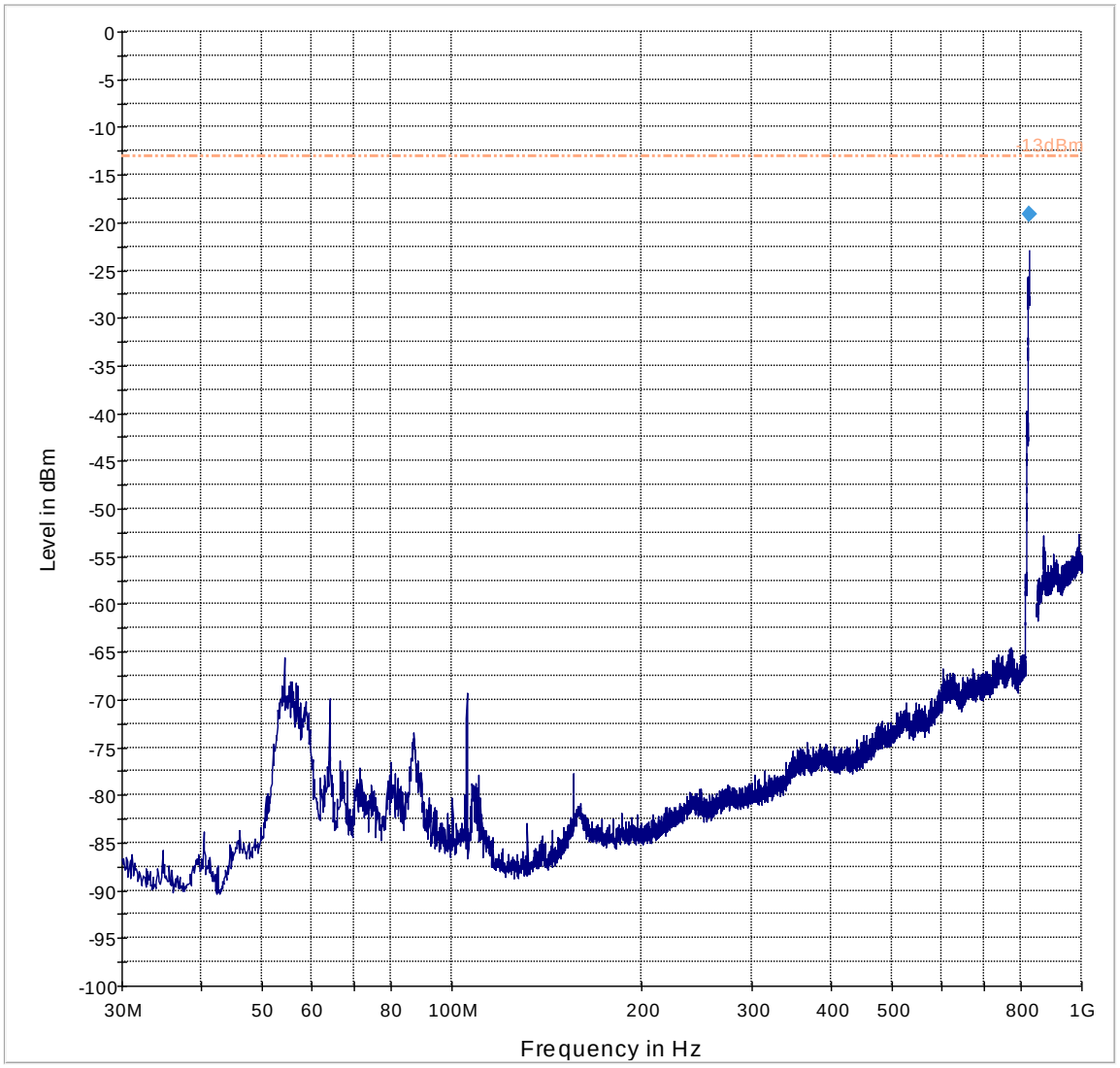
7.4.10 GSM 850, Tx: Ch. High, 30 MHz – 1 GHz



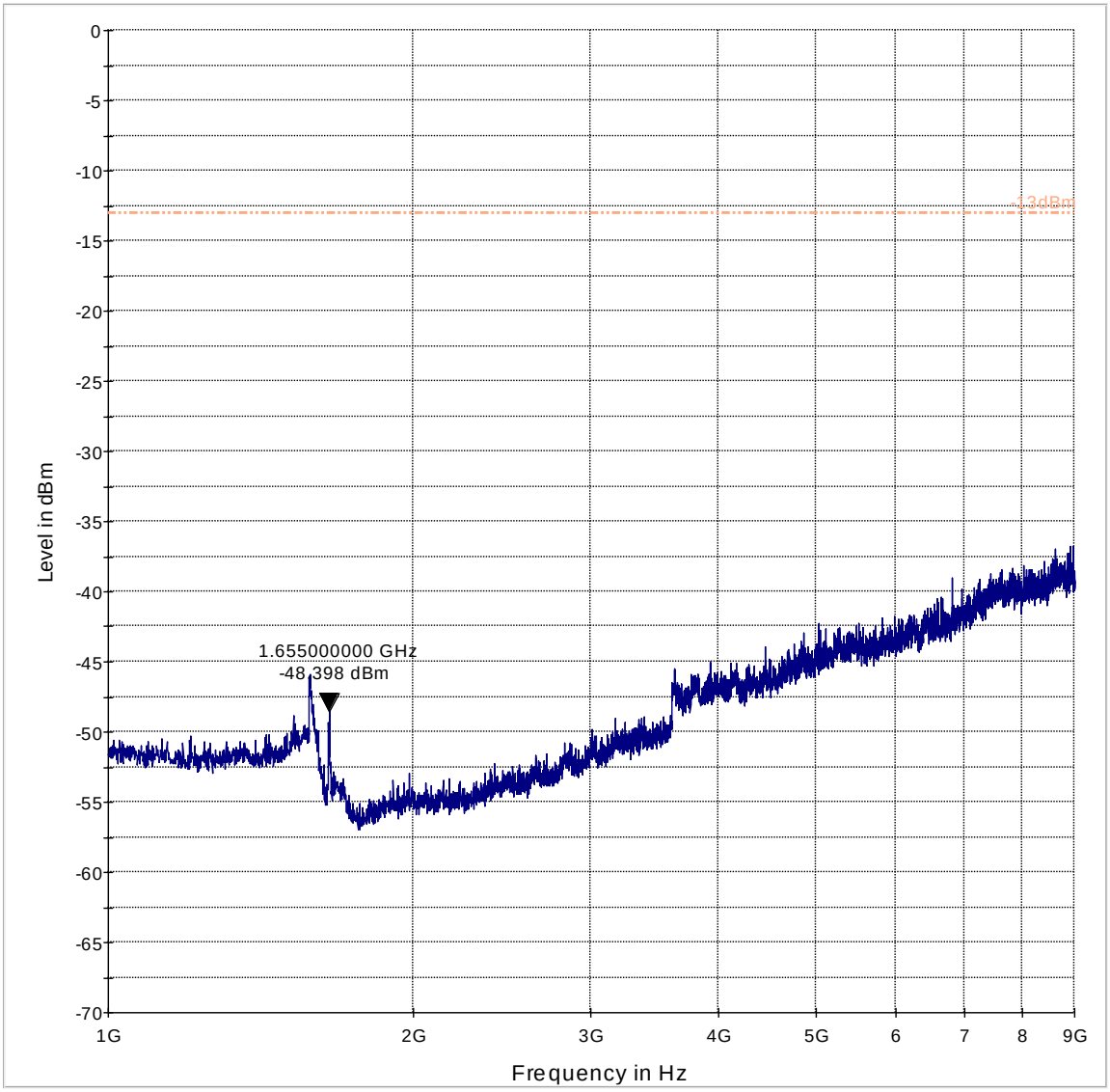
7.4.11 GSM 850, Tx: Ch. High, 1 GHz – 9 GHz



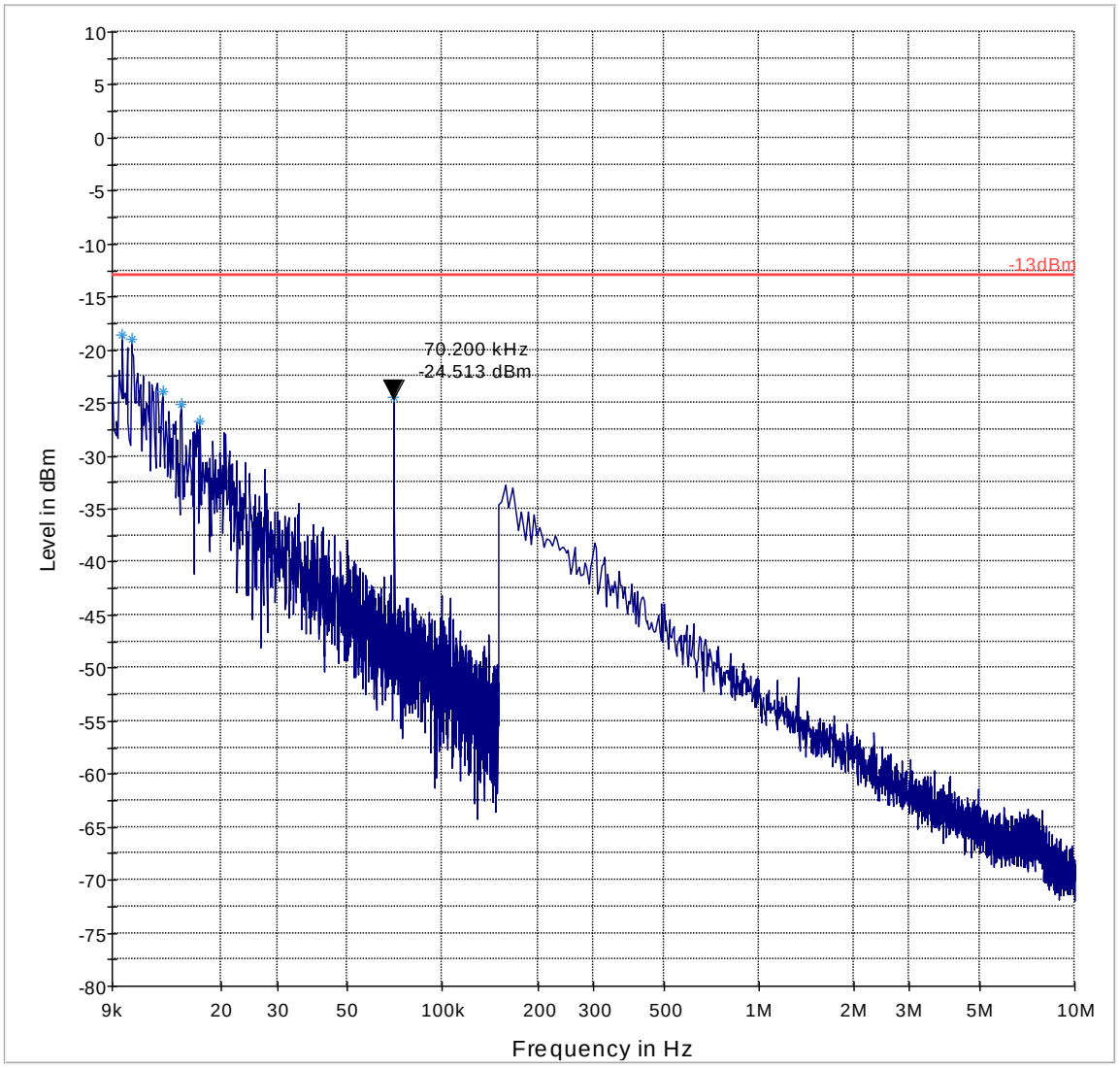
7.4.12 UMTS FDD Band V, Tx: Ch. Low, 30 MHz – 1 GHz



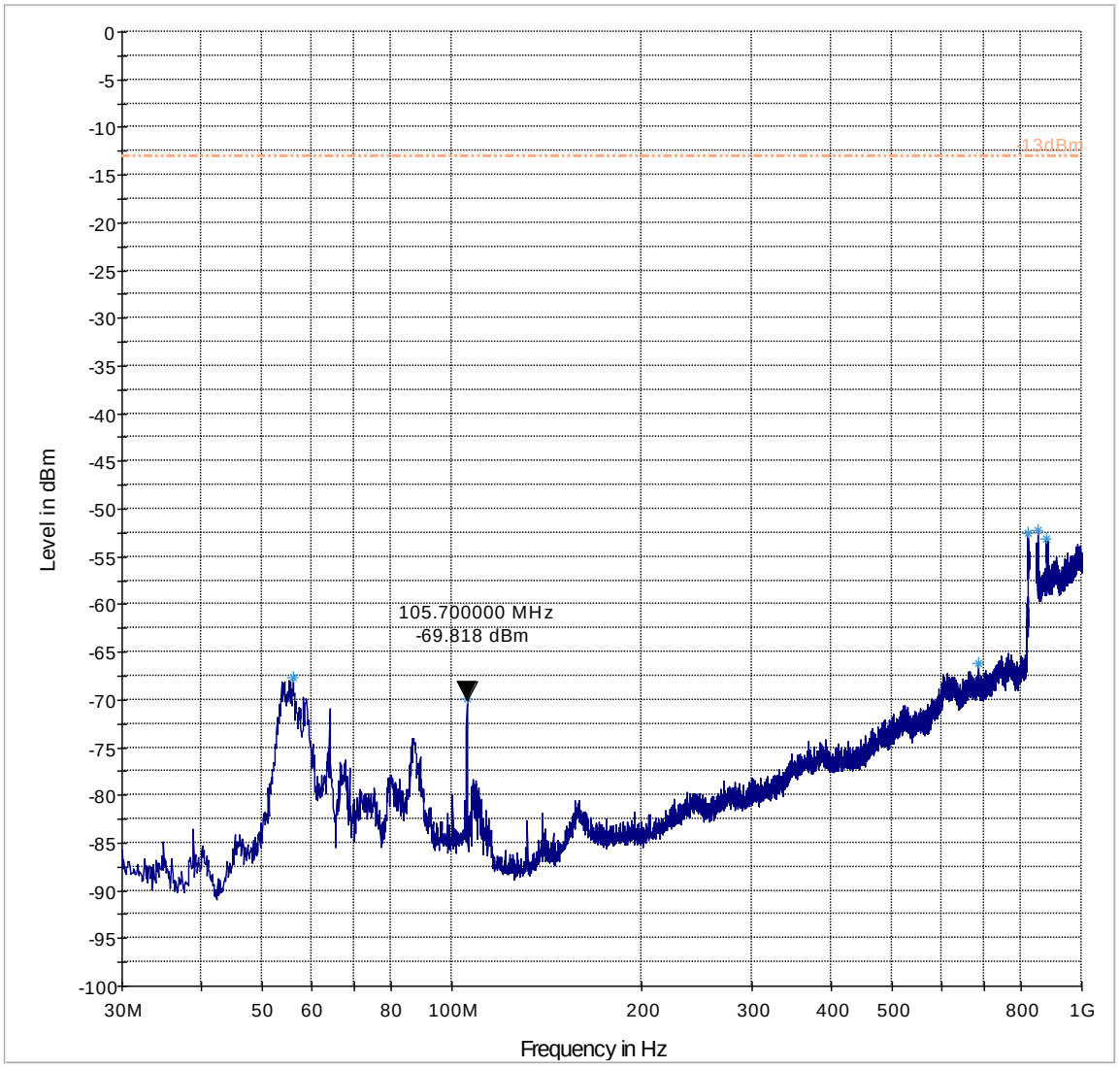
7.4.13 UMTS FDD Band V, Tx: Ch. Low, 1 GHz – 9 GHz



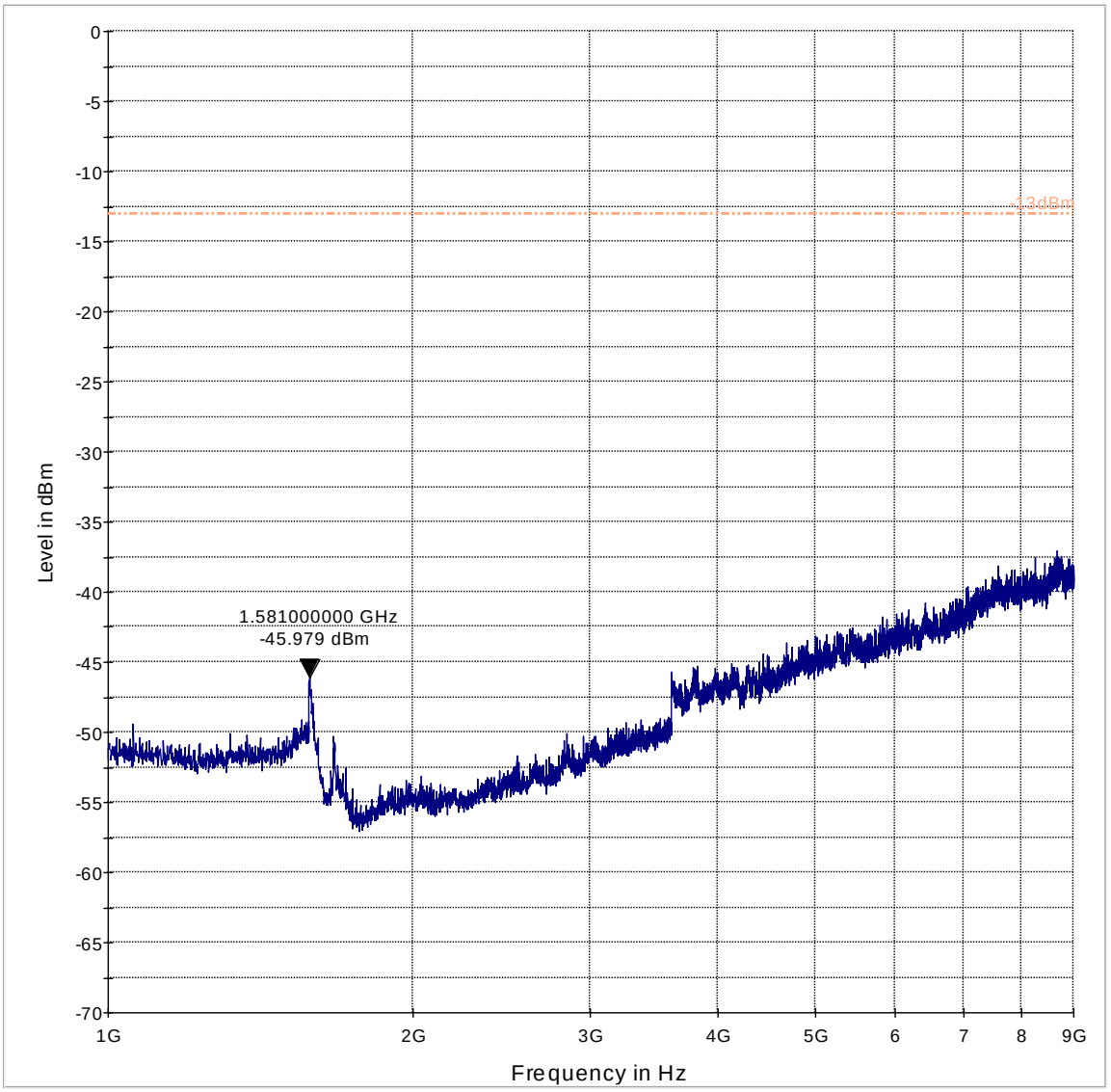
7.4.14 UMTS FDD Band V, Tx: Ch. Mid, 9 KHz – 30 MHz



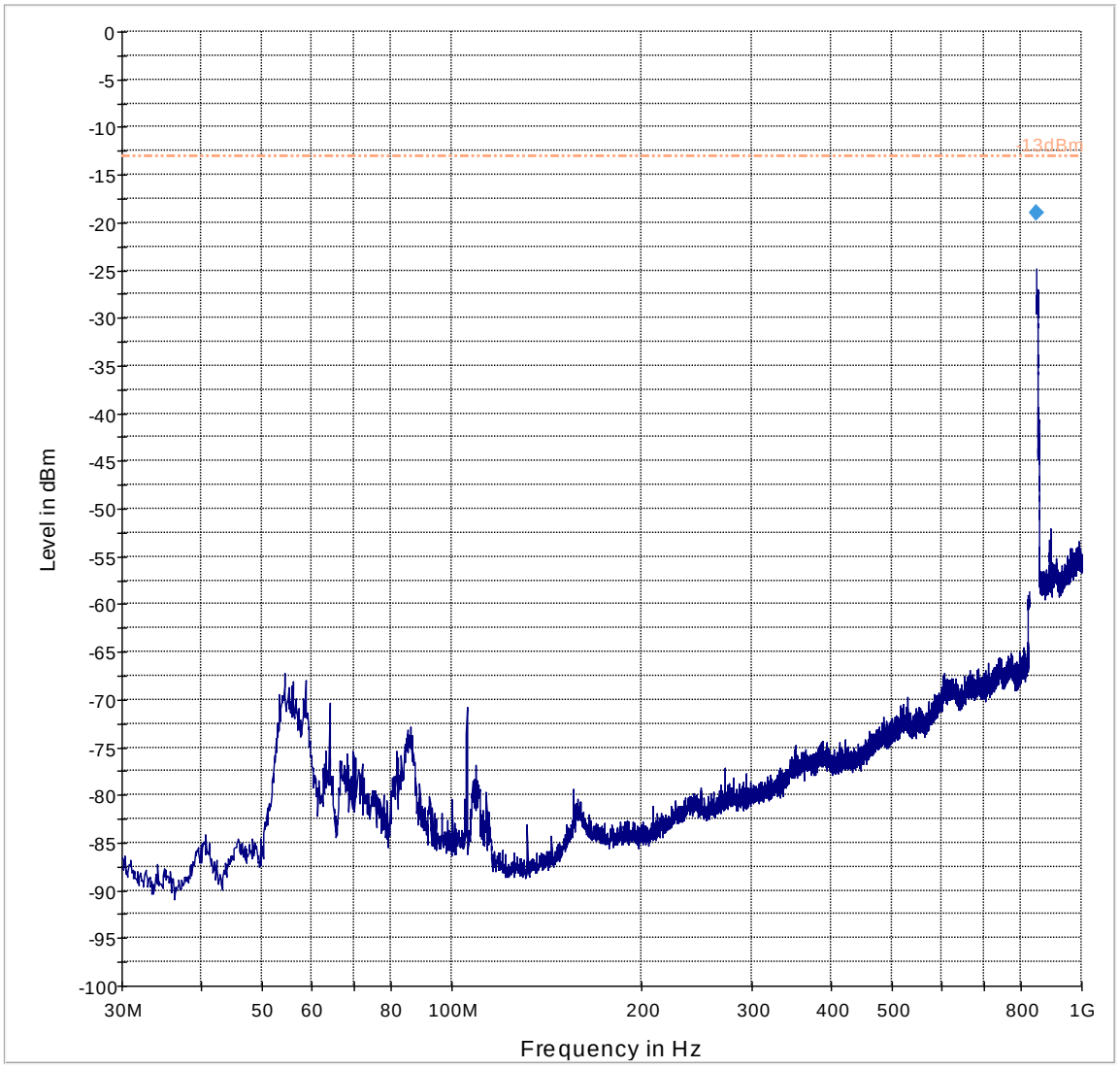
7.4.15 UMTS FDD Band V, Tx: Ch. Mid, 30 MHz – 1 GHz



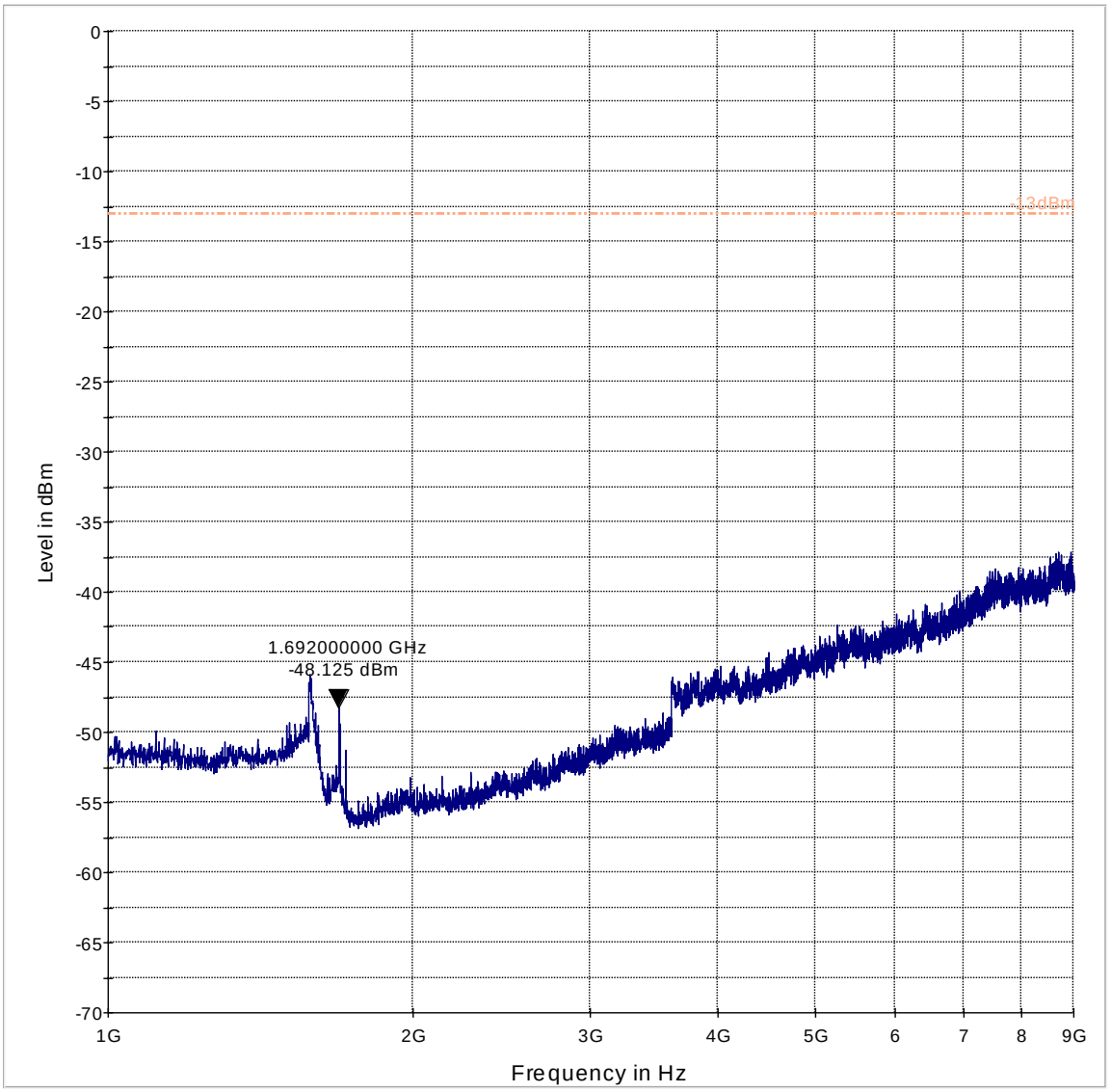
7.4.16 UMTS FDD Band V, Tx: Ch. Mid, 1 GHz – 9 GHz



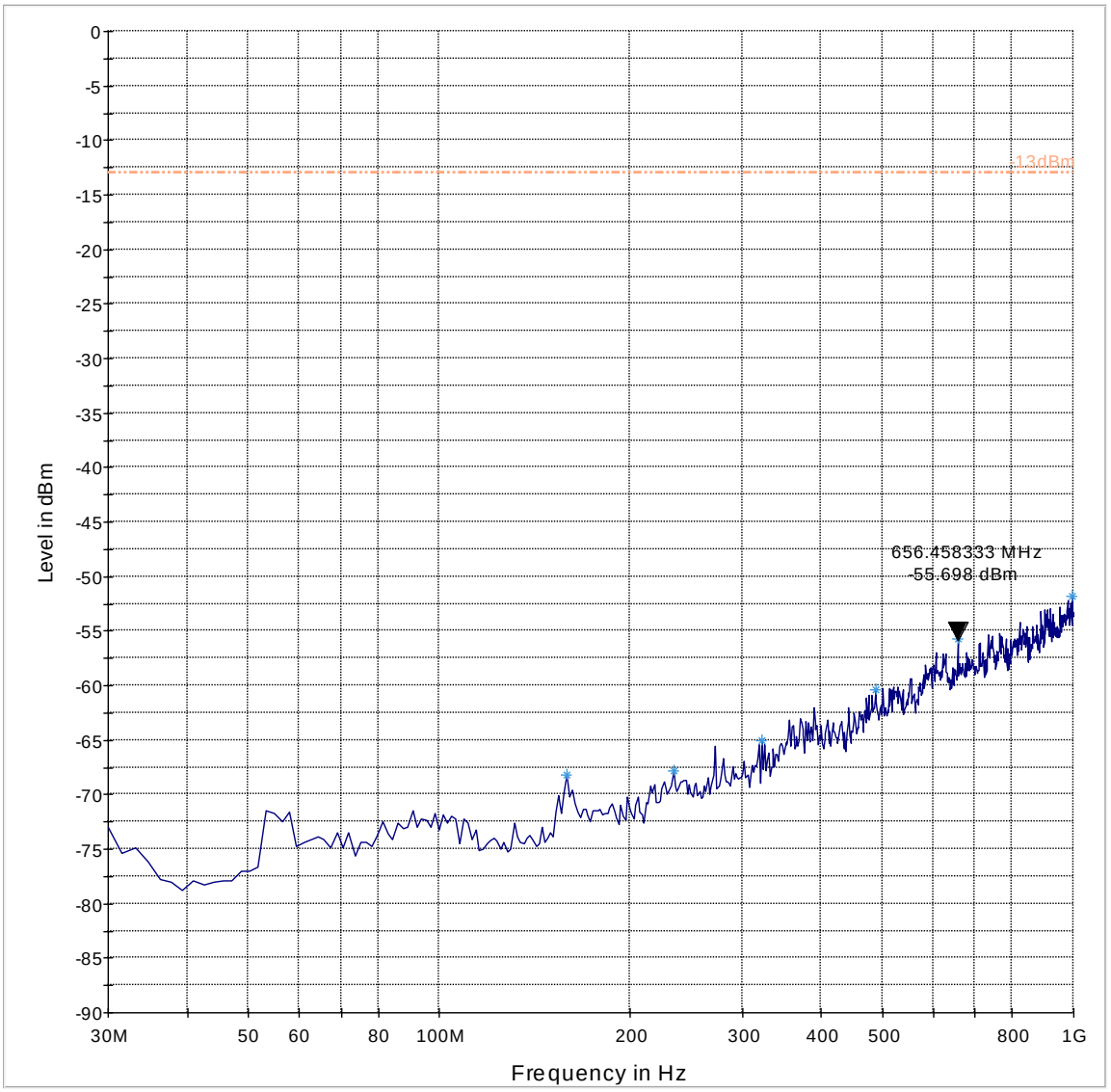
7.4.17 UMTS FDD Band V, Tx: Ch. High, 30 MHz – 1 GHz



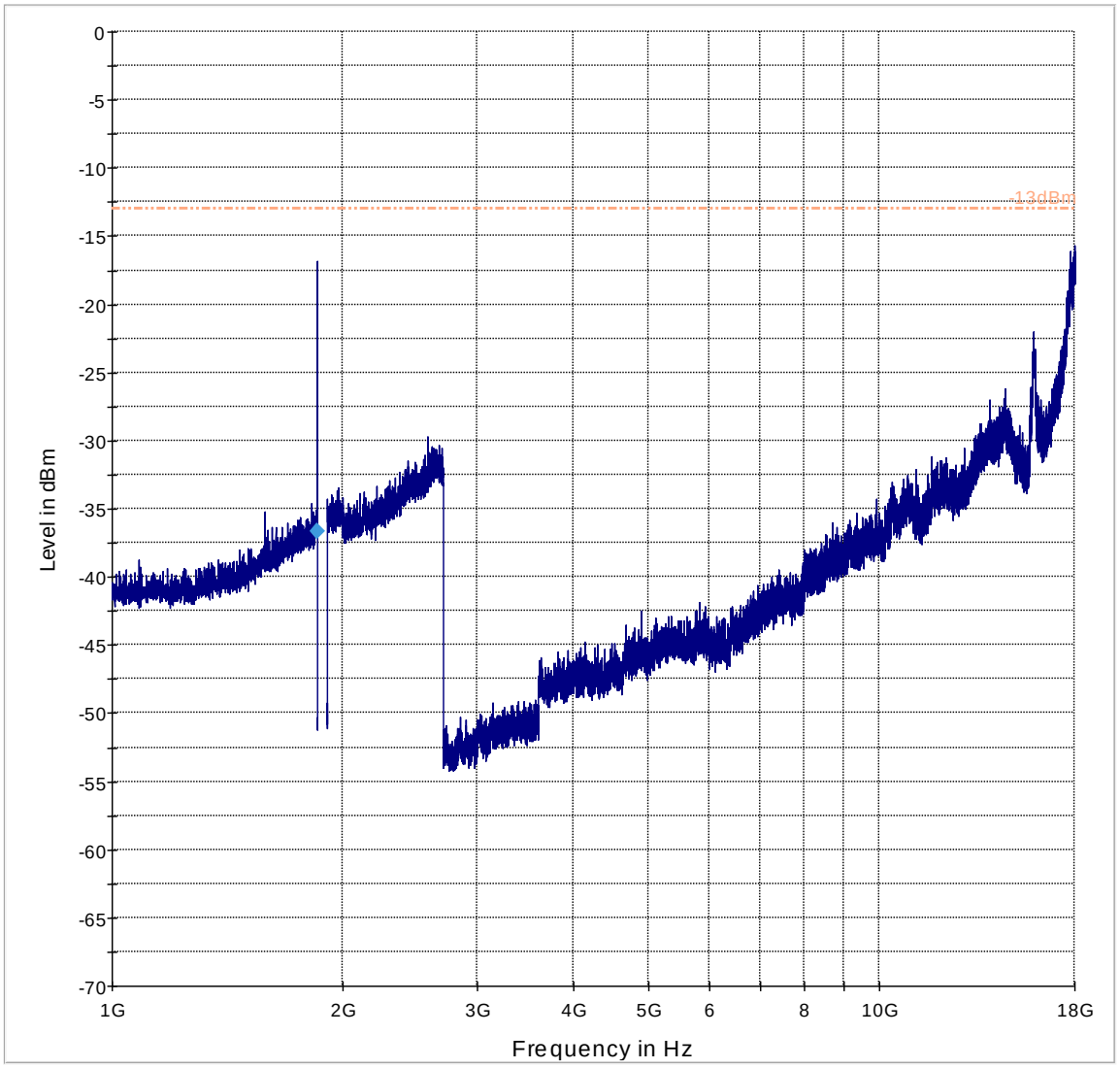
7.4.18 UMTS FDD Band V, Tx: Ch. High, 1 GHz – 9 GHz



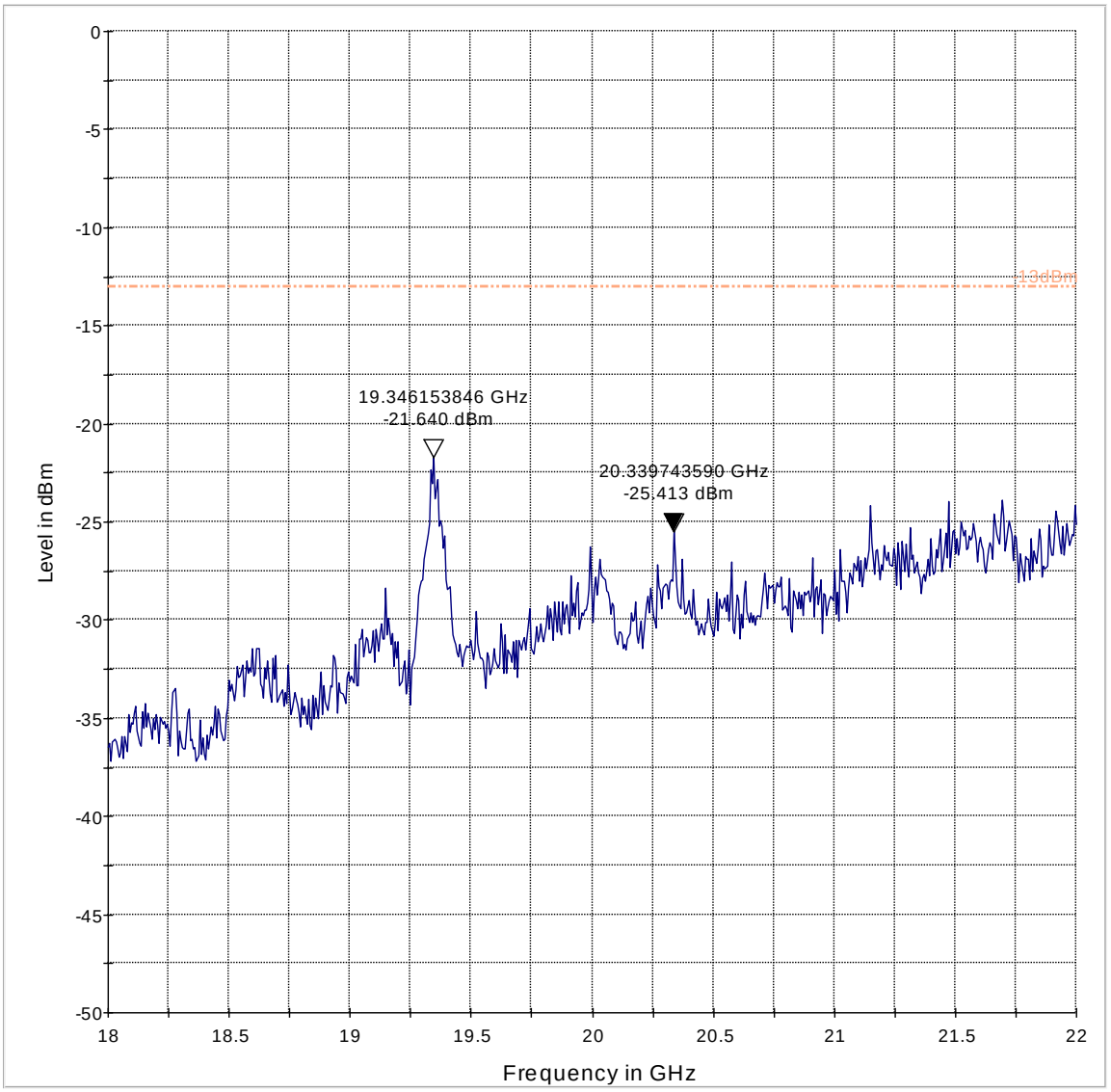
7.4.19 GSM 1900, Tx: Ch. Low, 30 MHz – 1 GHz



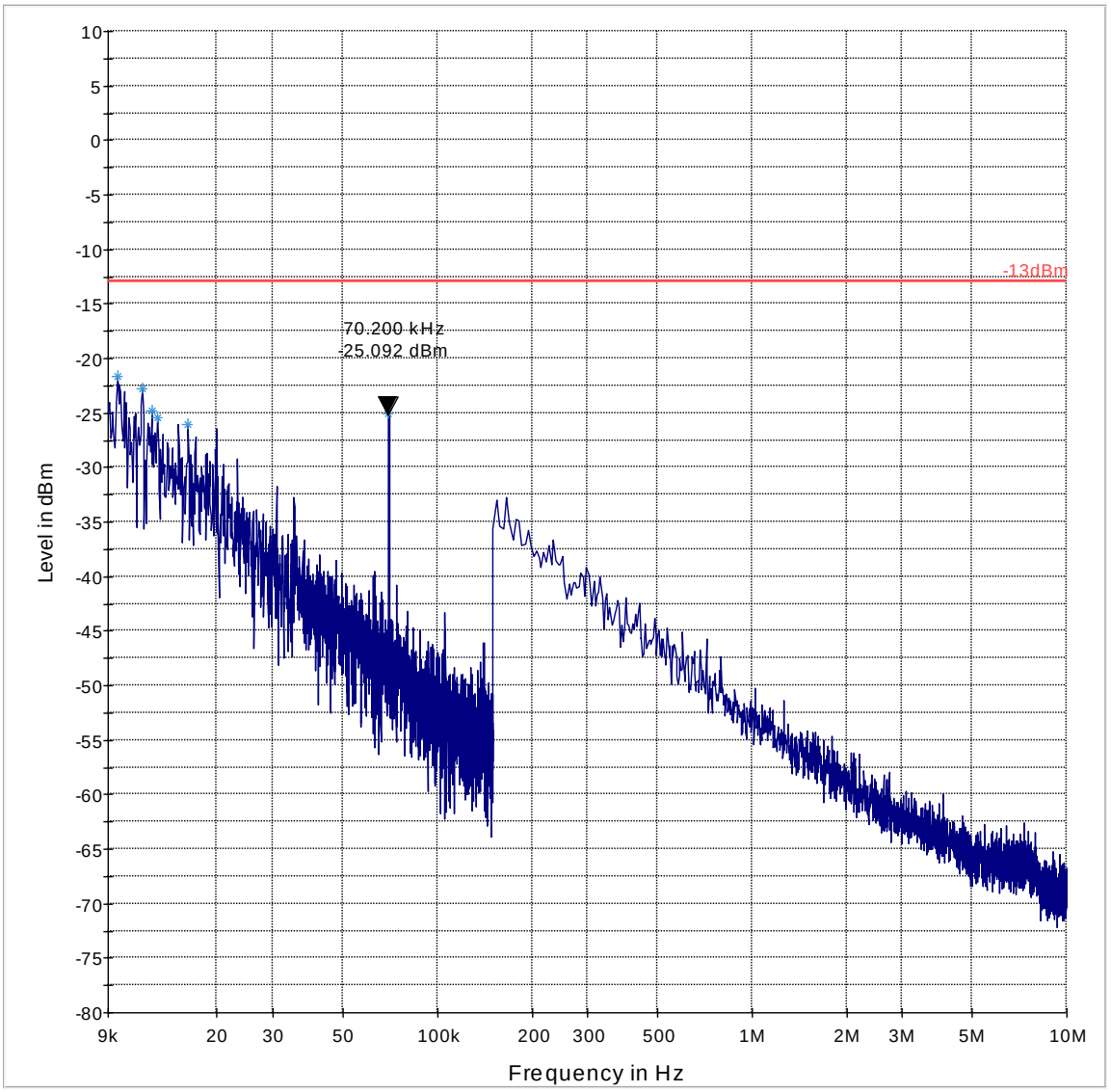
7.4.20 GSM 1900, Tx: Ch. Low, 1 GHz – 18 GHz



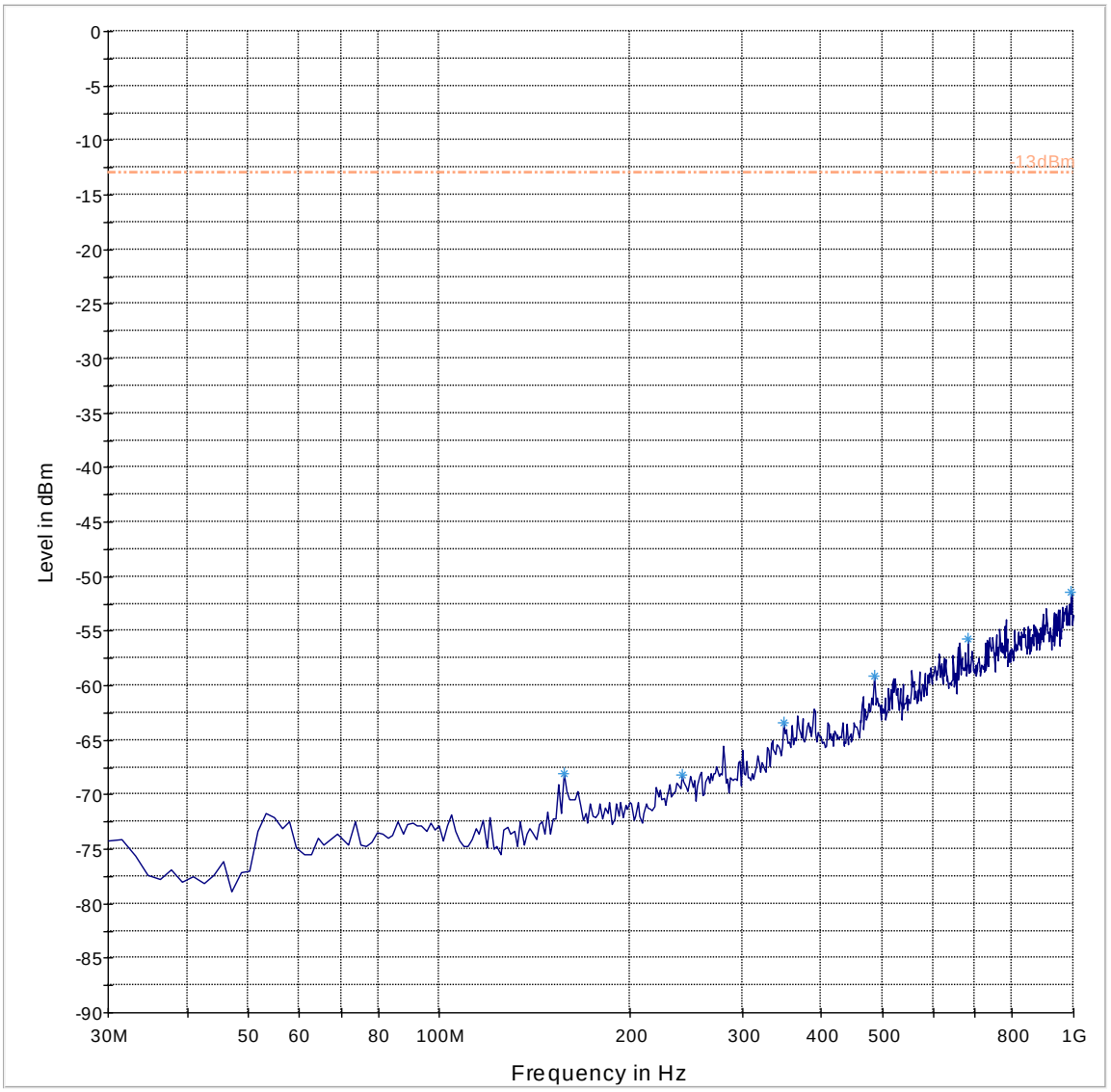
7.4.21 GSM 1900, Tx: Ch. Low, 18 GHz – 22 GHz



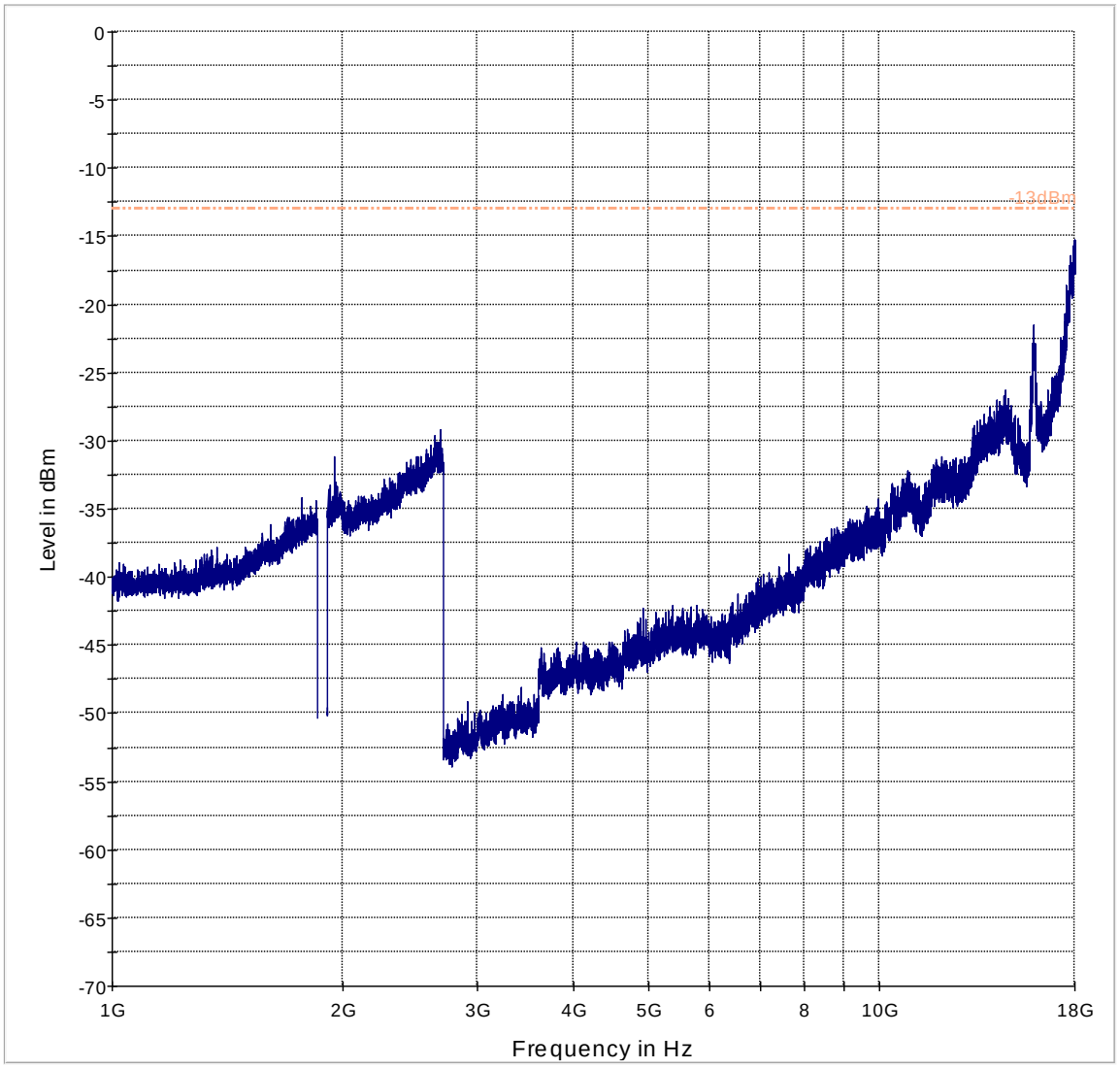
7.4.22 GSM 1900, Tx: Ch. Mid, 9 KHz – 30 MHz



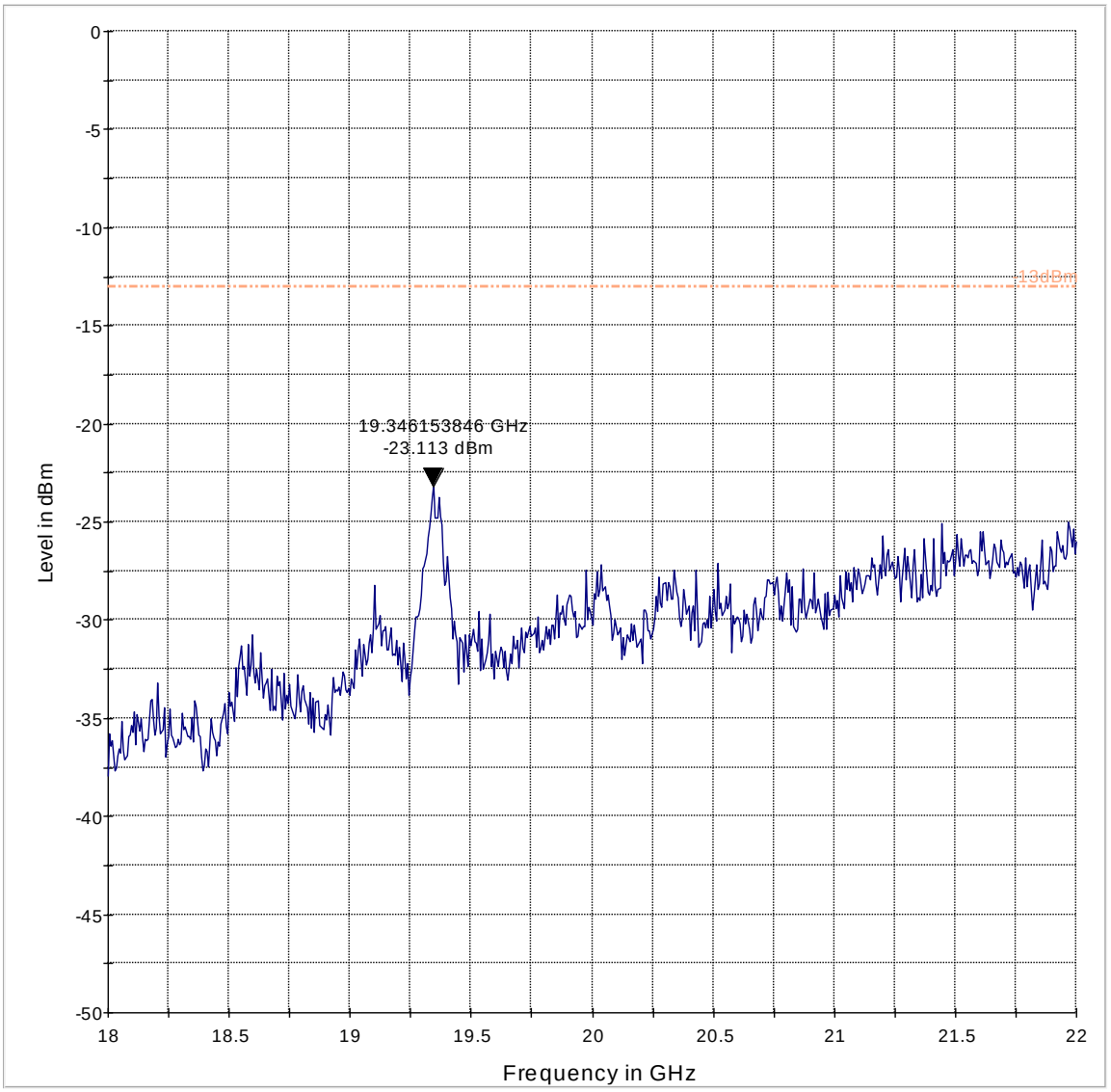
7.4.23 GSM 1900, Tx: Ch. Mid, 30 MHz – 1 GHz



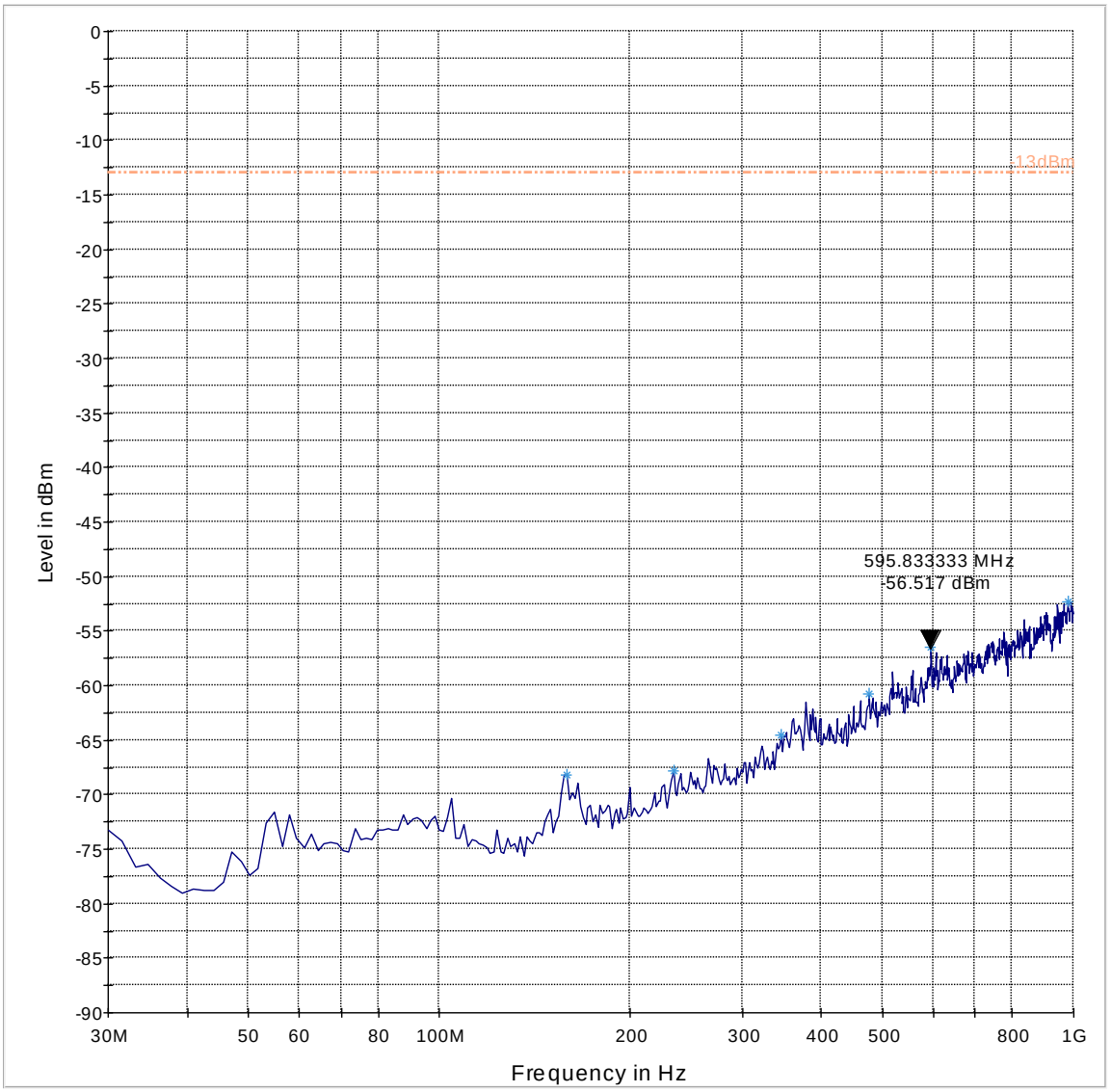
7.4.24 GSM 1900, Tx: Ch. Mid, 1 GHz – 18 GHz



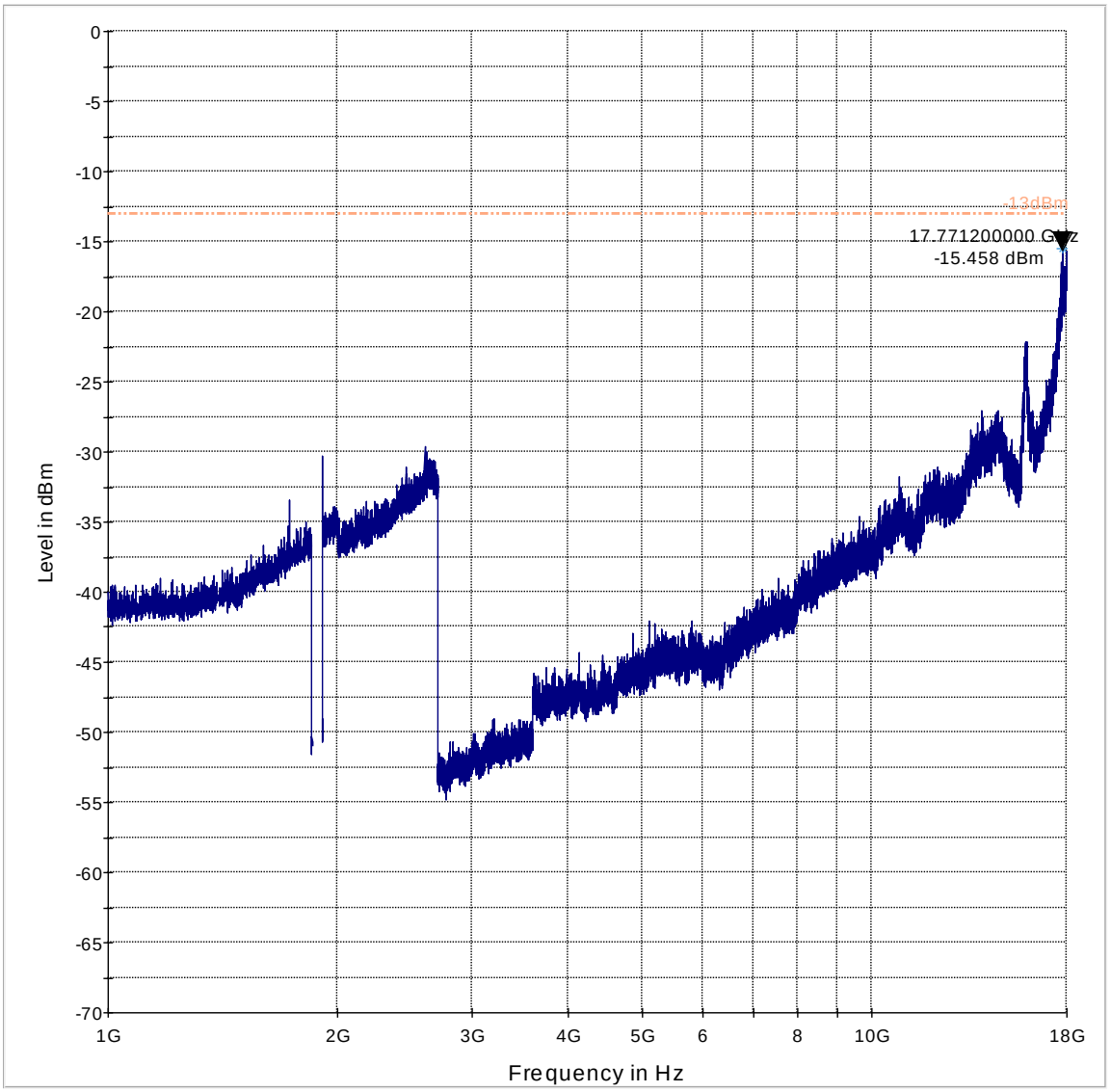
7.4.25 GSM 1900, Tx: Ch. Mid, 18 GHz – 22 GHz



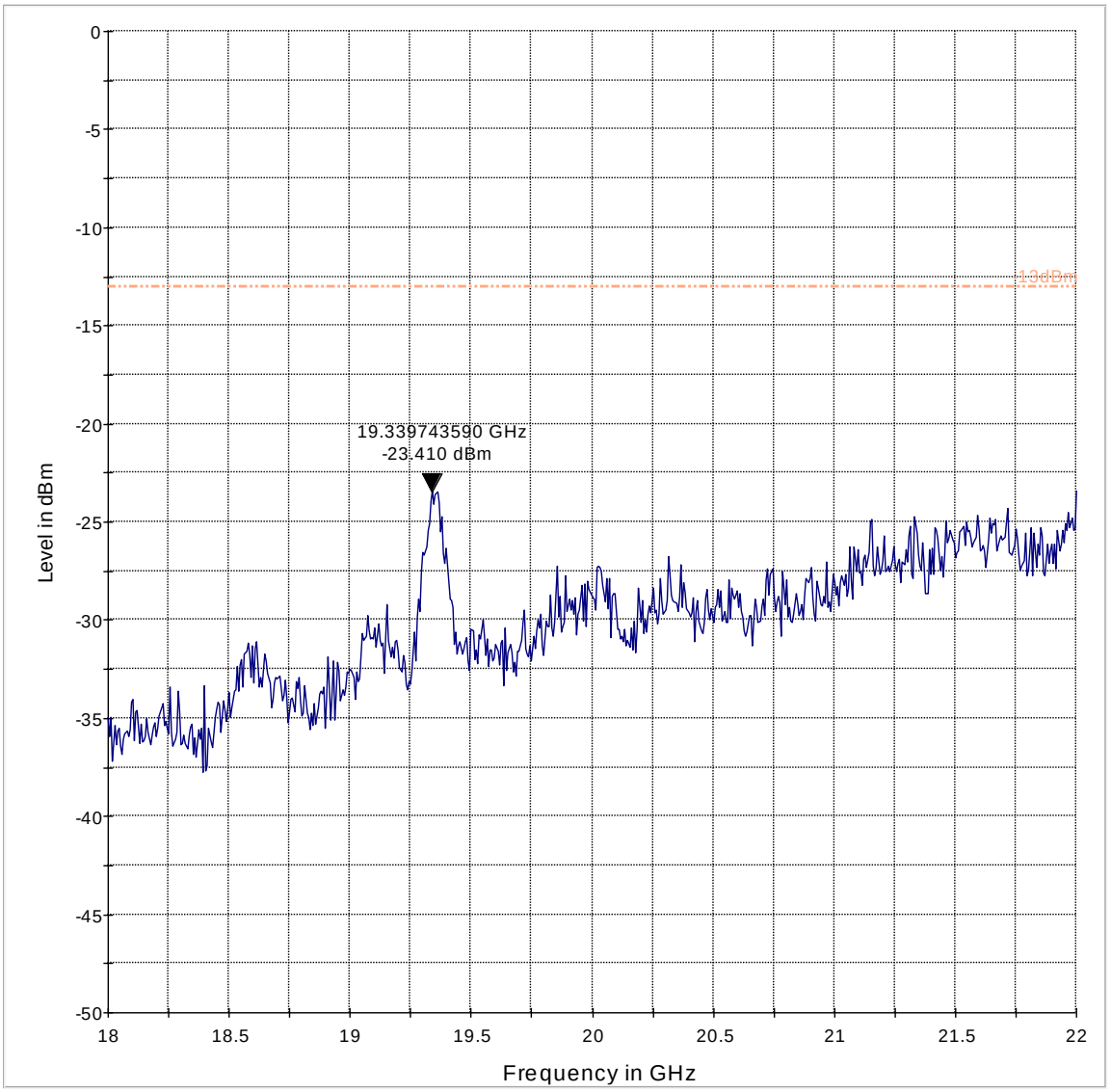
7.4.26 GSM 1900, Tx: Ch. High, 30 MHz – 1 GHz



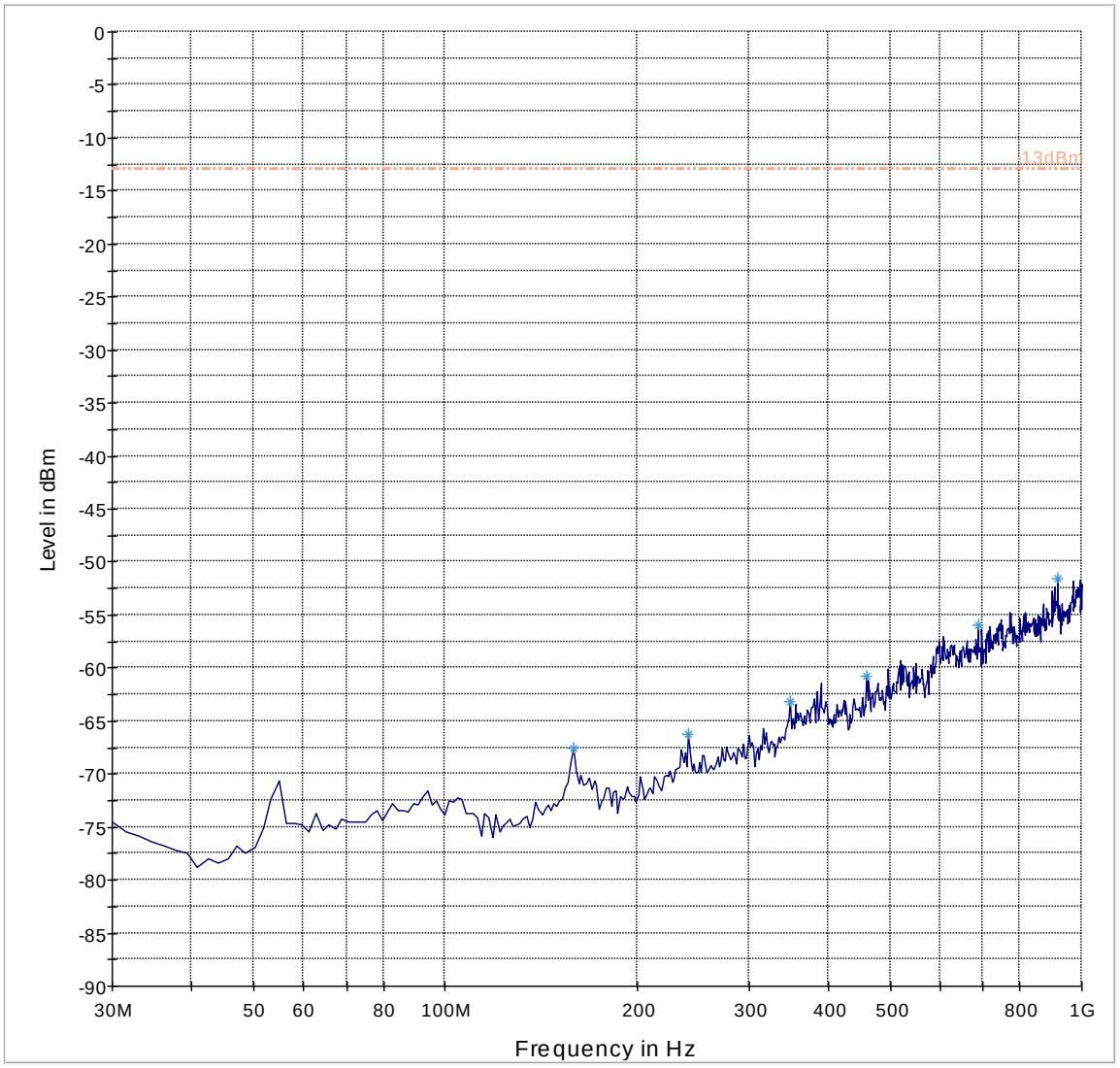
7.4.27 GSM 1900, Tx: Ch. High, 1 GHz – 18 GHz



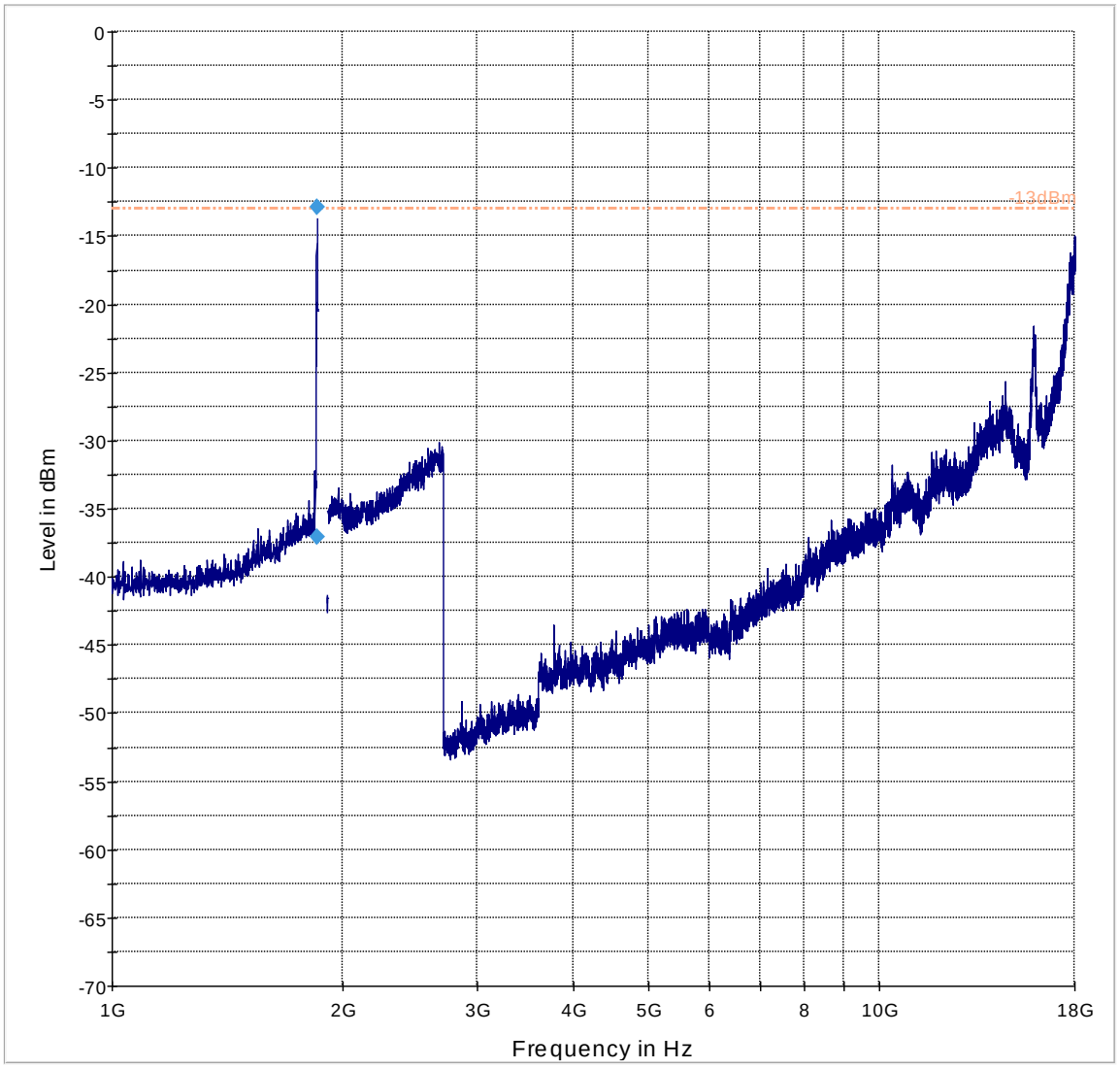
7.4.28 GSM 1900, Tx: Ch. High, 18 GHz – 22 GHz



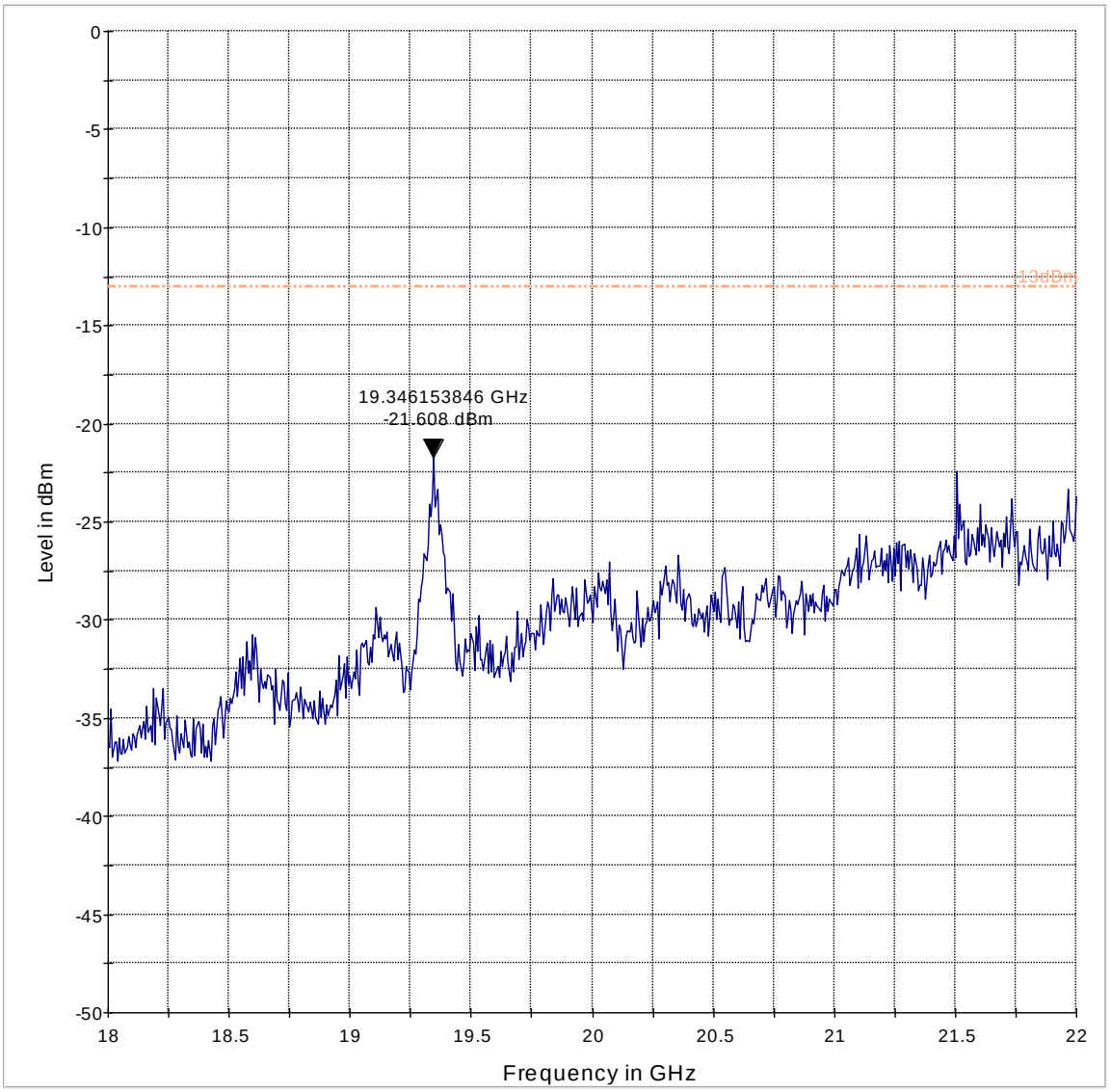
7.4.29 UMTS FDD Band II, Tx: Ch. Low, 30 MHz – 1 GHz



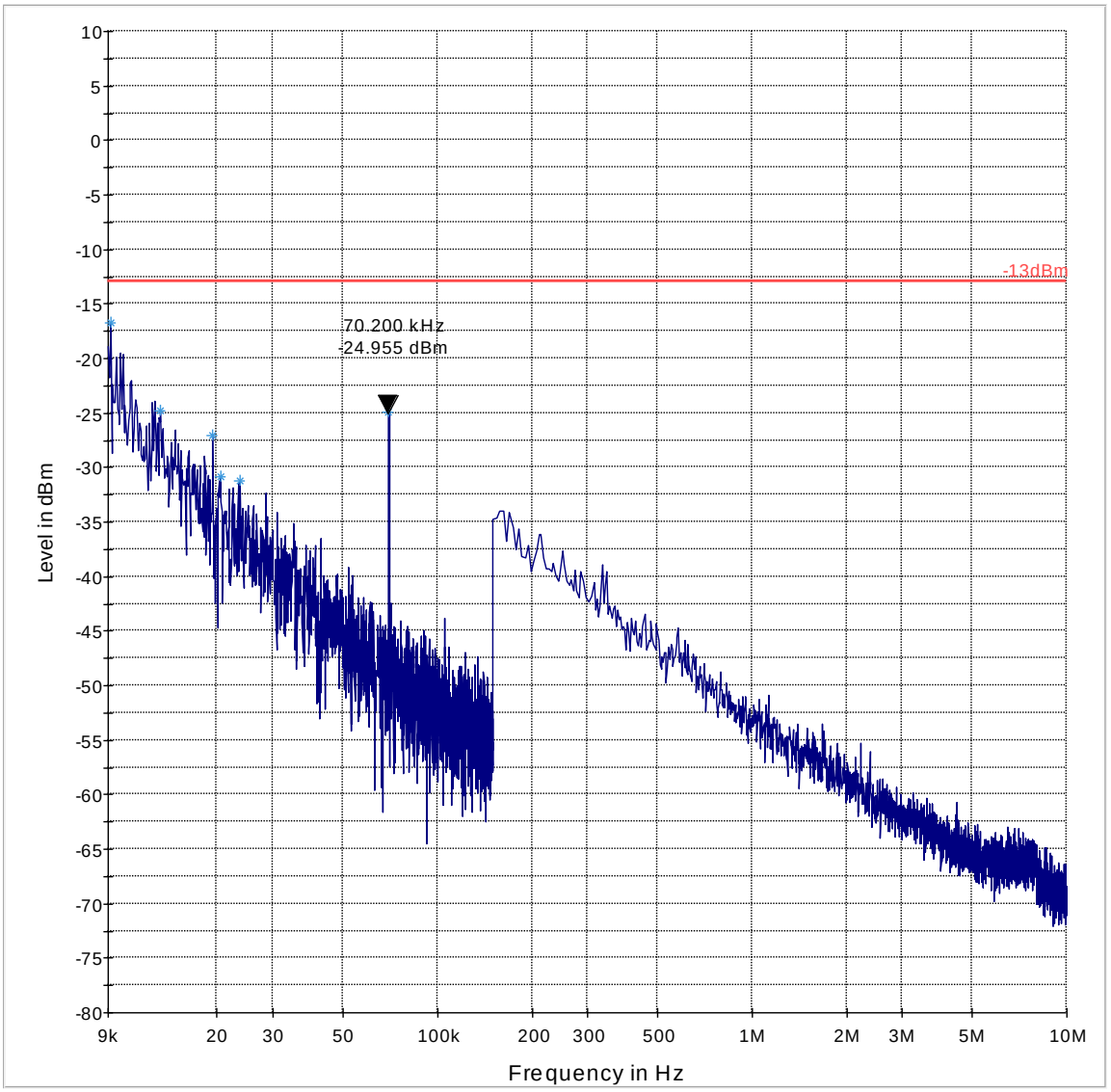
7.4.30 UMTS FDD Band II, Tx: Ch. Low, 1 GHz – 18 GHz



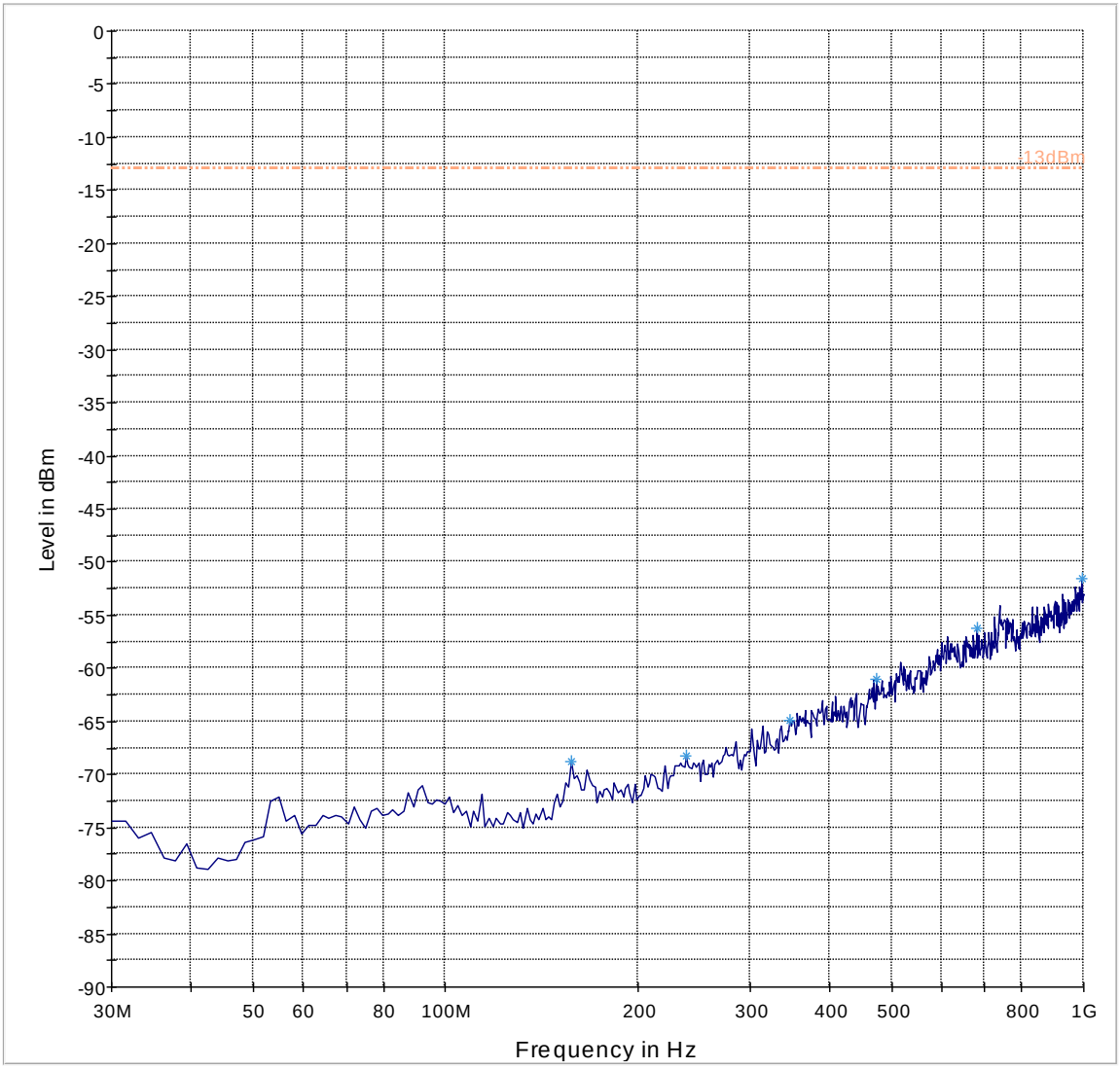
7.4.31 UMTS FDD Band II, Tx: Ch. Low, 18 GHz – 22 GHz



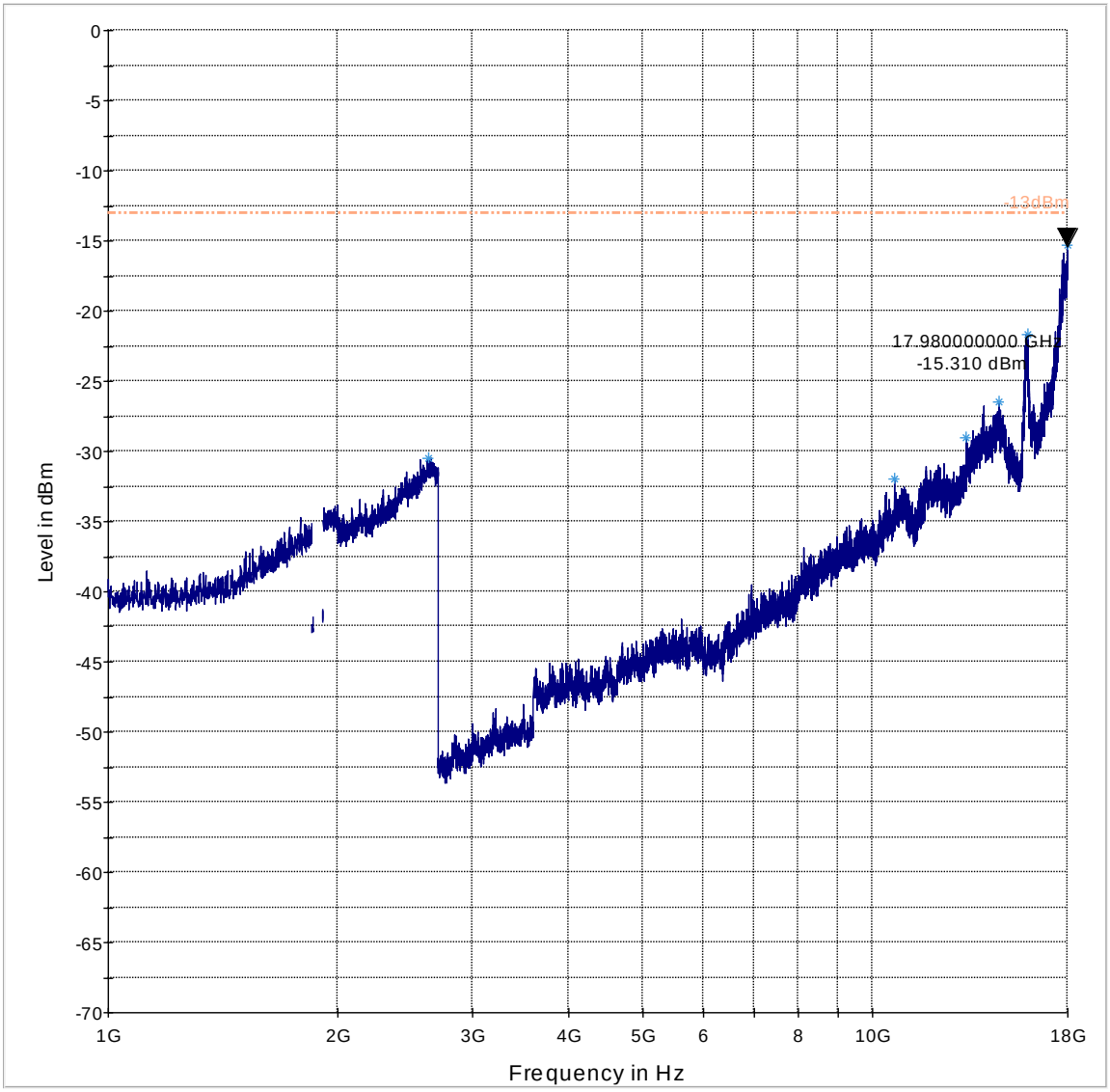
7.4.32 UMTS FDD Band II, Tx: Ch. Mid, 9 KHz – 30 MHz



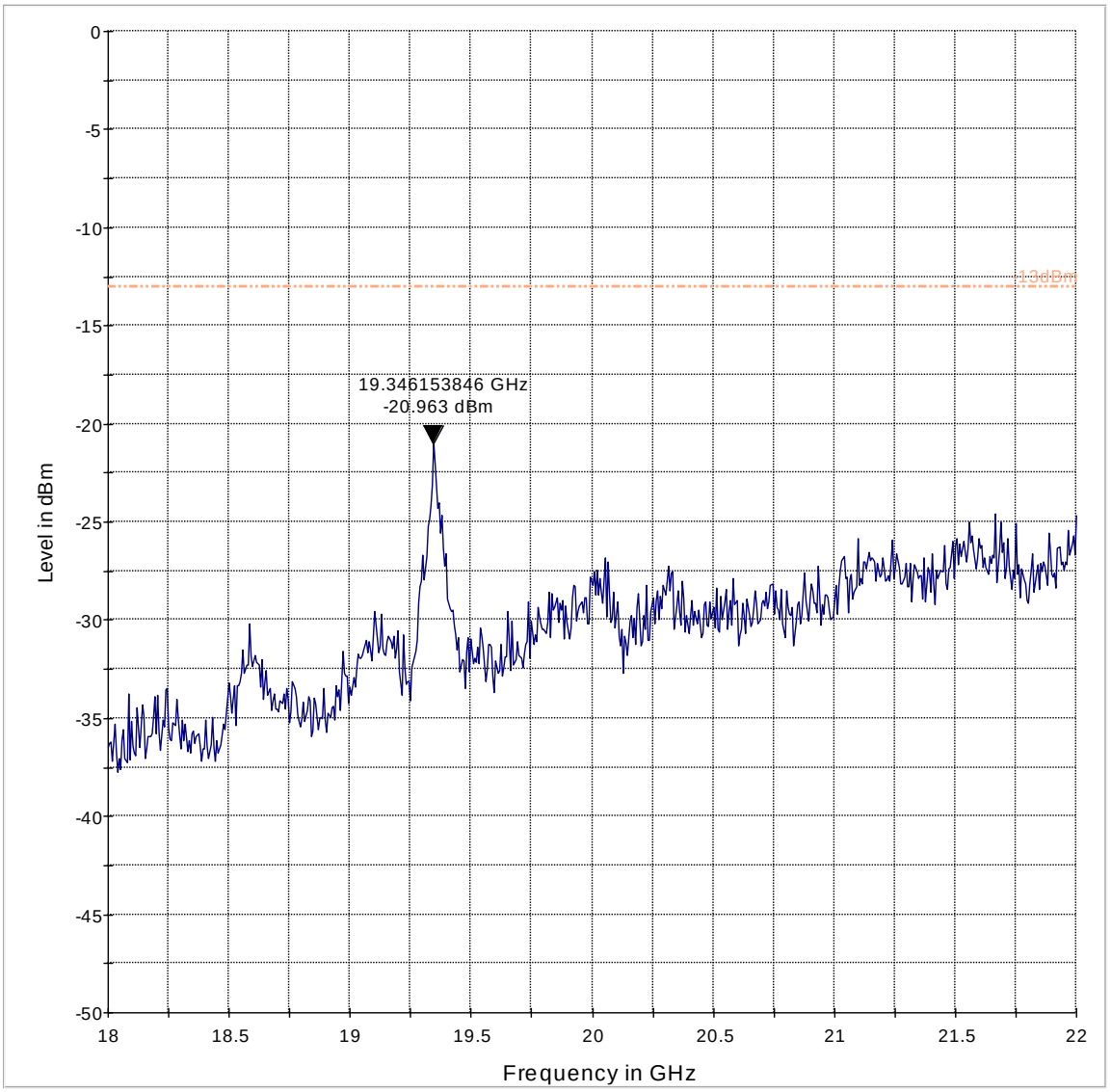
7.4.33 UMTS FDD Band II, Tx: Ch. Mid, 30 MHz – 1 GHz



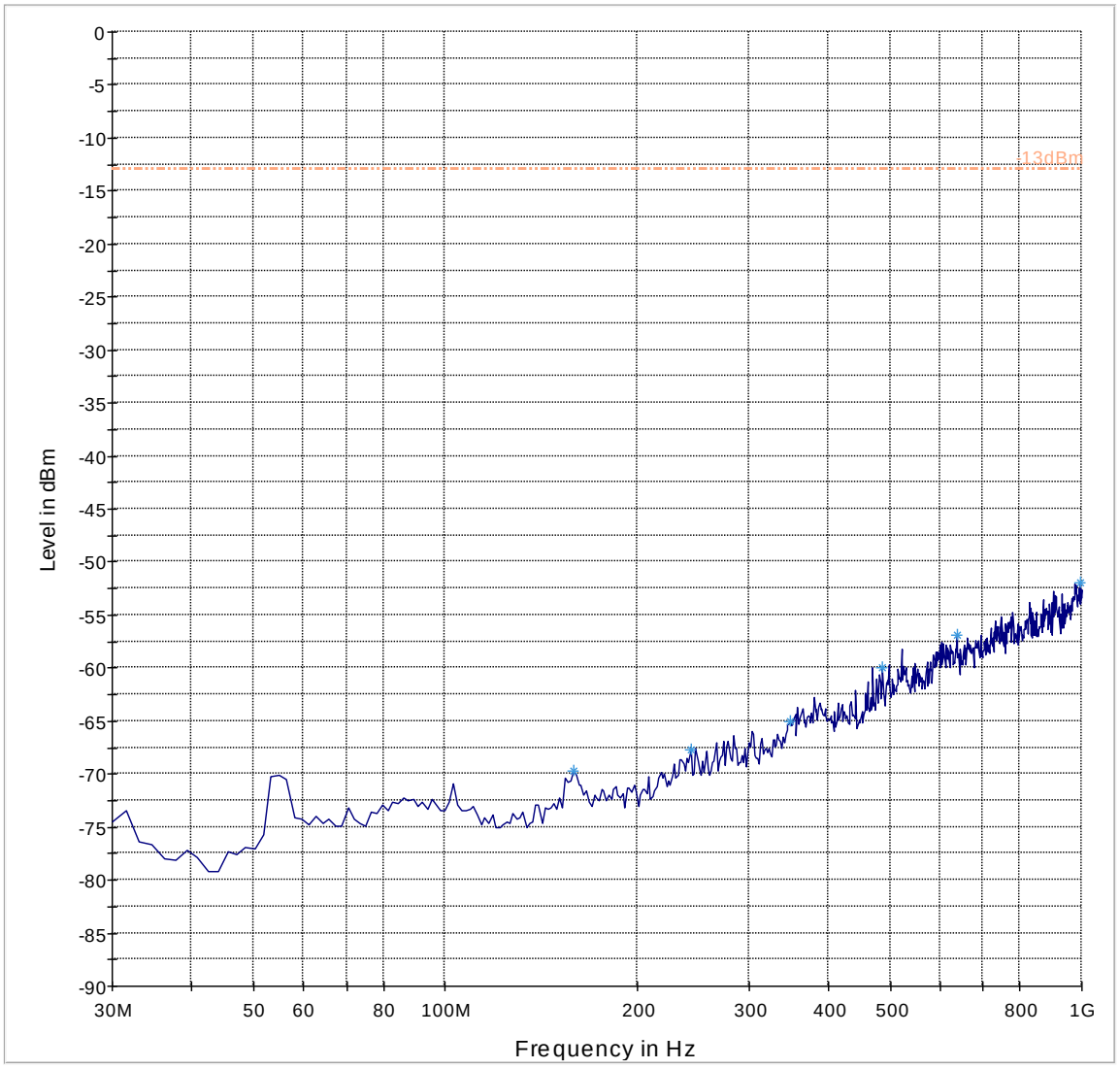
7.4.34 UMTS FDD Band II, Tx: Ch. Mid, 1 GHz – 18 GHz



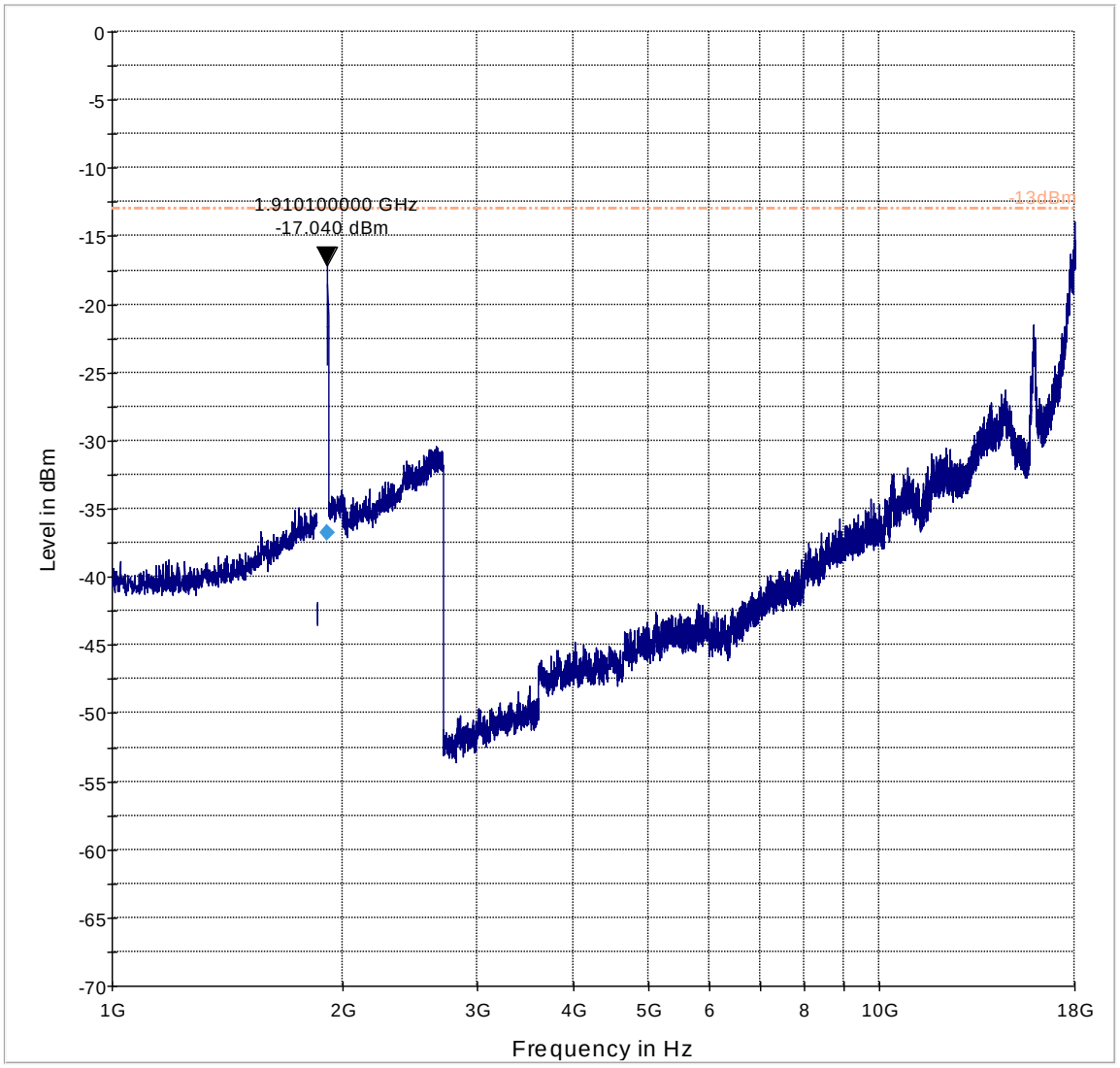
7.4.35 UMTS FDD Band II, Tx: Ch. Mid, 18 GHz – 22 GHz



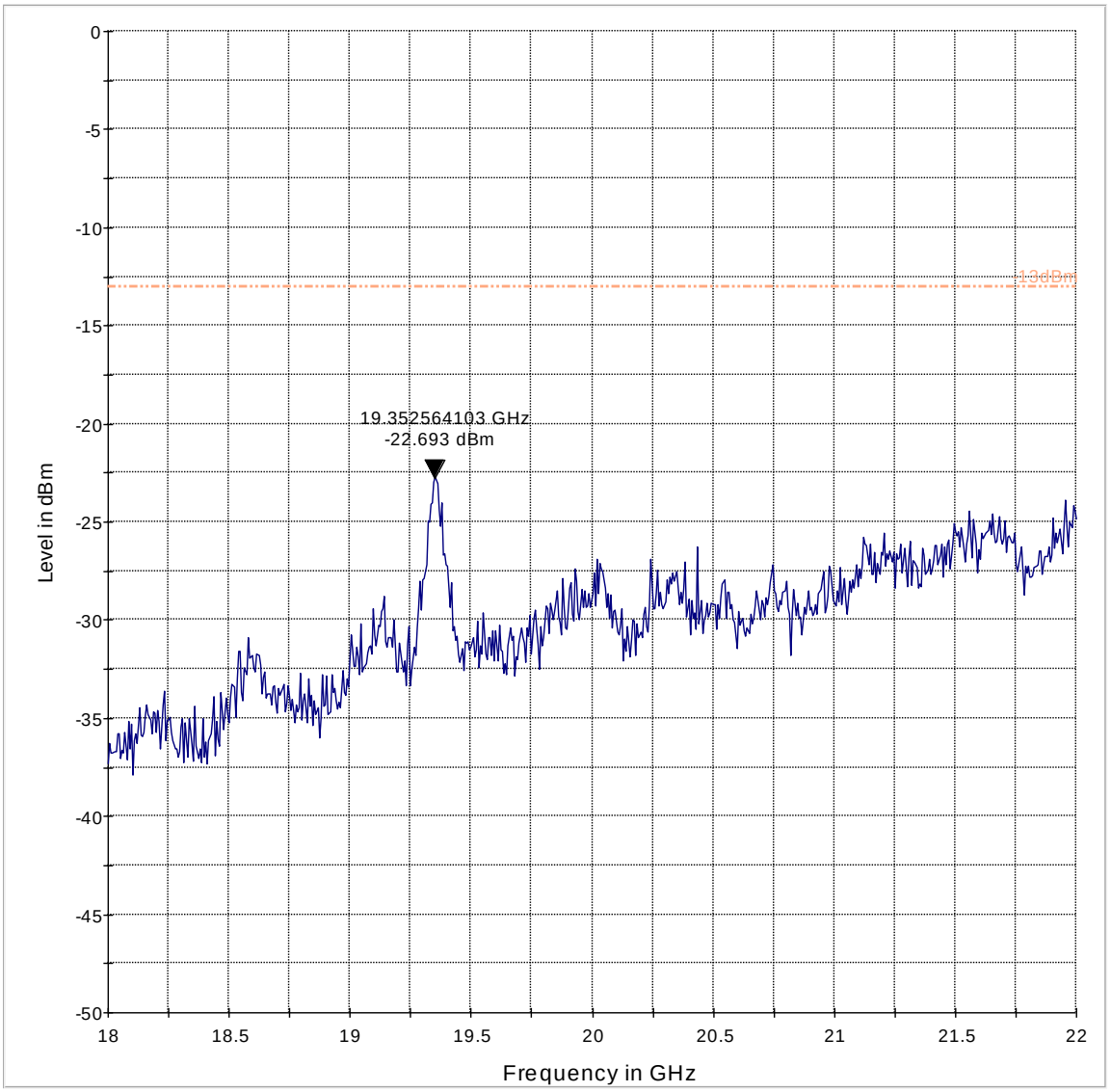
7.4.36 UMTS FDD Band II, Tx: Ch. High, 30 MHz – 1 GHz



7.4.37 UMTS FDD Band II, Tx: Ch. High, 1 GHz – 18 GHz



7.4.38 UMTS FDD Band II, Tx: Ch. High, 18 GHz – 22 GHz

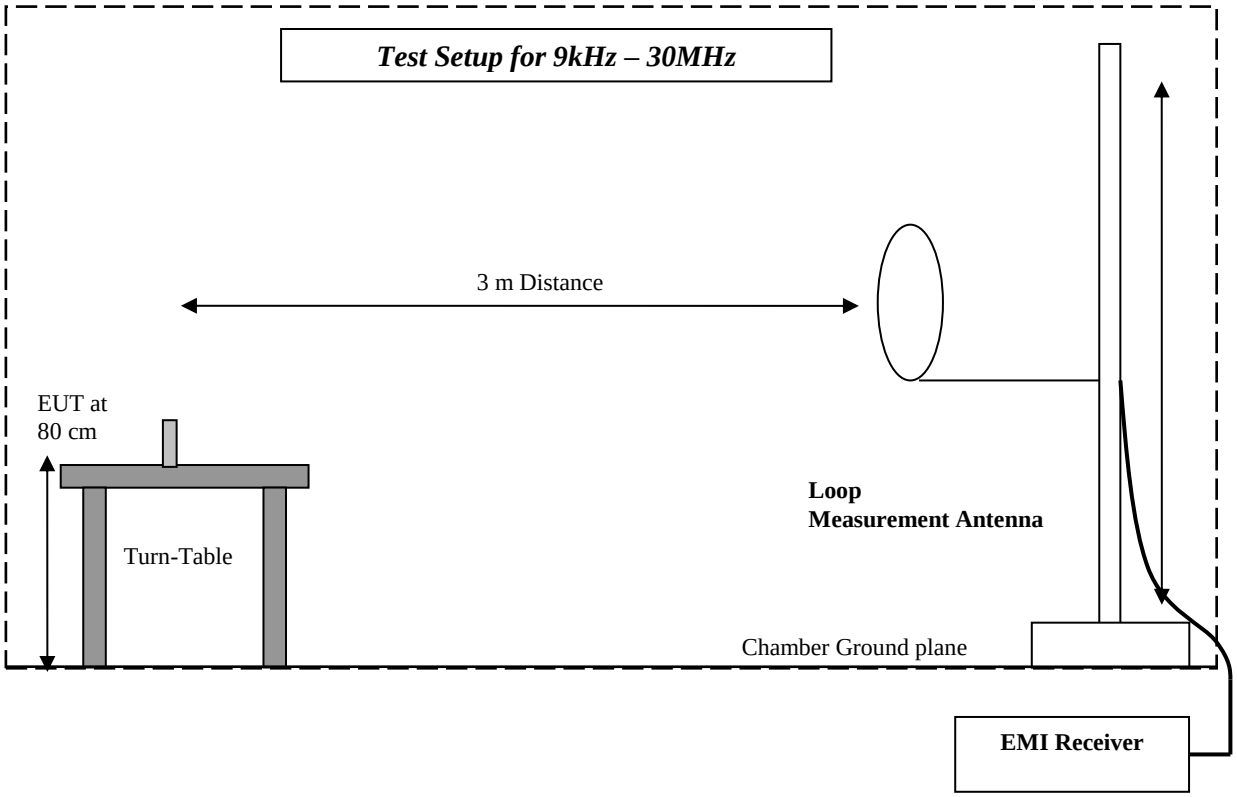


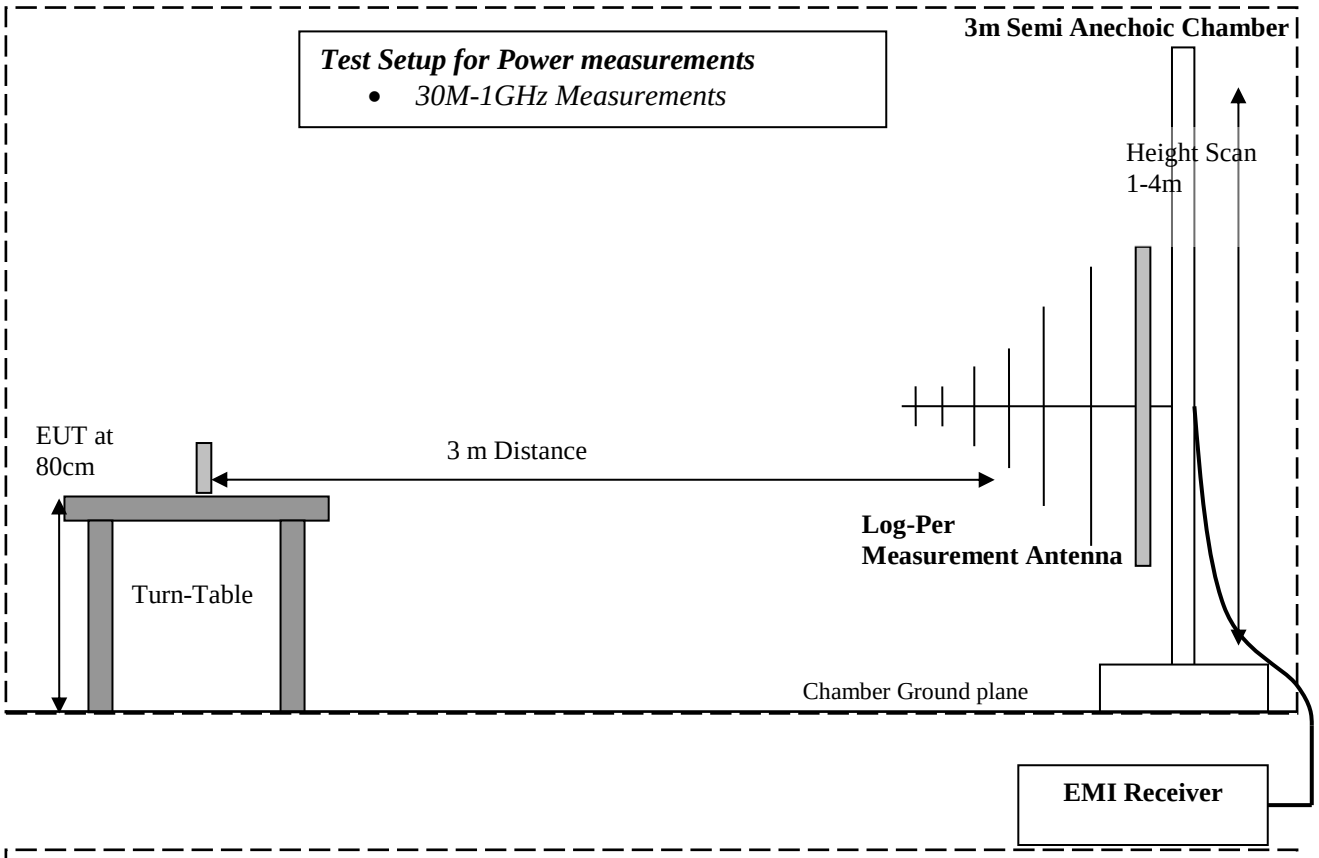
8 Test Equipment and Ancillaries used for tests.

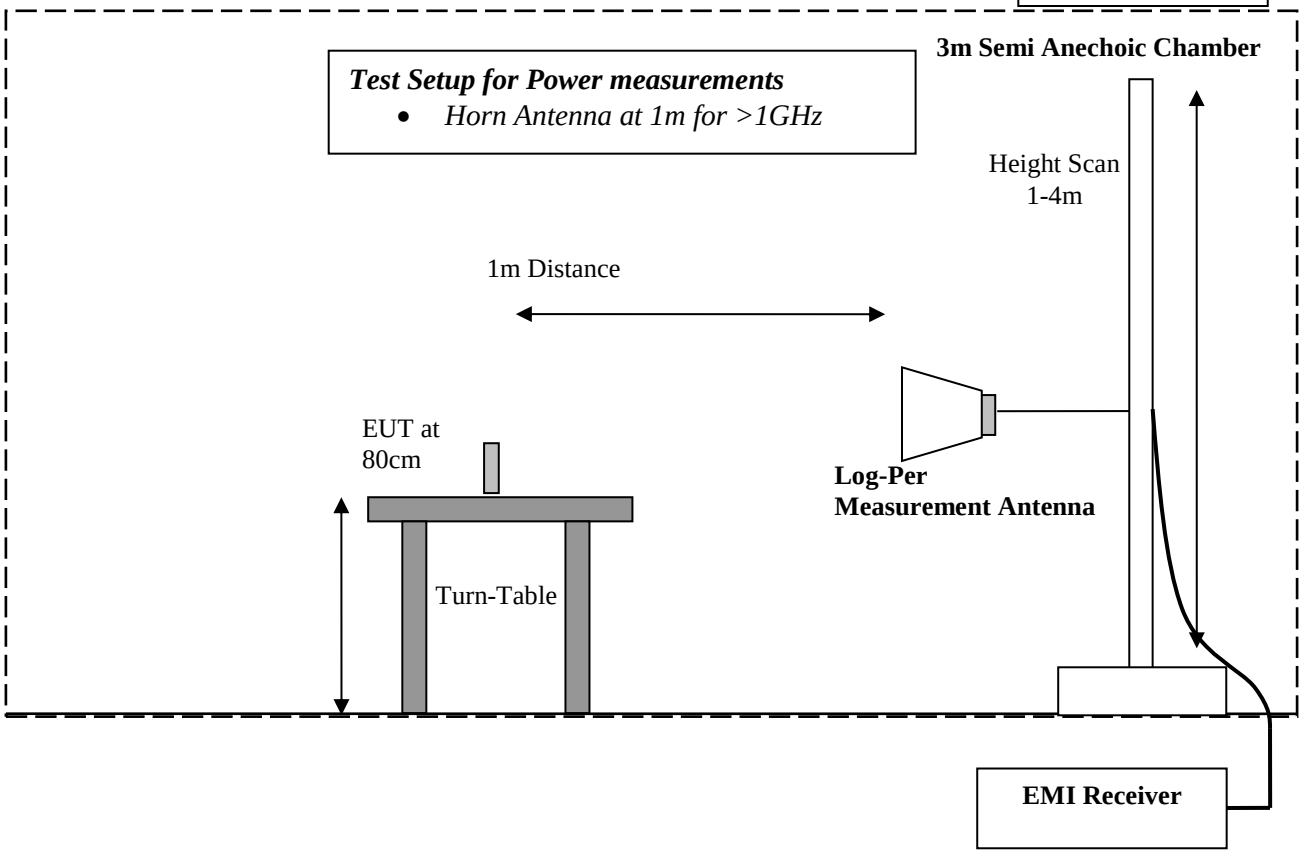
Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibrati Date
Antenna Biconilog 3142E	Biconlog Antenna	EMCO	3142E	166067	3 years	6/14/2014
Antenna Horn 3115 SN 35111	Horn Antenna	EMCO	3115	35111	3 years	7/24/2015
Antenna Horn 3116	Horn Antenna	ETS Lindgren	3116	70497	3 years	7/22/2015
Antenna Loop 6512	Loop Antenna	ETS Lindgren	6512	49838	3 years	3/13/2014
Digital Barometer	Compact Digital Barometer	Control Company	35519-055	91119547	2 Years	4/7/2015
Receiver ESU40	EMI Receiver	R&S	ESU40	100251	3 years	6/29/2015
Spectrum Analyzer FSU26 #2	Spectrum Analyzer	R&S	FSU26	200065	3 years	7/4/2015

Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
Calibration due dates, unless defined specifically, falls on the last day of the month.
Items indicated “N/A” for cal status either do not specifically require calibration or is internally characterized before use.

9 Block Diagrams




3m Semi Anechoic Chamber
Test Setup for Power measurements
30M-1GHz Measurements
Height Scan
1-4m
EUT at
80cm
3 m Distance
Log-Per
Measurement Antenna
Turn-Table
Chamber Ground plane
EMI Receiver


3m Semi Anechoic Chamber
Test Setup for Power measurements
Horn Antenna at 1m for >1GHz
Height Scan
1-4m
1m Distance
EUT at
80cm
Log-Per
Measurement Antenna
Turn-Table
EMI Receiver

10 Revision History

Date	Report Name	Changes to Report	Report prepared by
February 3, 2016	EMC_MOOGI-005-15001_FCC_22_24	Initial Version	Yu-Chien Ho