



FCC/IC Test Report

FOR

Garmin International Inc.

Model Name: A2AVGC00

Marketing Name: nüvi 2598FL

Description: Connected Personal Navigation Device

FCC ID: IPH-A2AVGC00

IC ID: 1792A-A2AVGC00

47 CFR Part 2, 22, 24, 27

RSS-132 Issue 2

RSS-133 Issue 5

RSS-139 Issue 2

TEST REPORT #: EMC_GARMI_041_12001_WWAN

DATE: 2012-07-02



**FCC listed:
A2LA Accredited**

**IC recognized #
3462B-1**

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

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1 Assessment

The following equipment (and as identified in Ch.3 of this test report) was evaluated against the applicable criteria specified in FCC CFR47 Parts 2, 22, 24 and 27 & Industry Canada Radio Standard Specifications RSS 132 Issue 2, RSS 133 Issue 5 and RSS 139 Issue 2 and no deviations were ascertained during the course of the tests performed.

Company	Description	Model Name
Garmin International Inc.	Connected Personal Navigation Device	A2AVGC00

Responsible for Testing Laboratory:

2012-07-02	Compliance	Sajay Jose (Test Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

2012-07-02	Compliance	Tunji Yusuf (EMC Engineer)	
Date	Section	Name	Signature

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:	411 Dixon Landing Road Milpitas, CA 95035 U.S.A.
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Test Lab Manager:	Sajay Jose
Test Engineer:	Tunji Yusuf

2.2 Identification of the Client

Client:	Garmin International Inc.
Street Address:	1200 E. 151 st Street
City/Zip Code	Olathe KS 66062
Country	USA
Contact Person:	Van Ruggles
Phone No.	913.397.8448
Fax:	913.397.8282
e-mail:	van.ruggles@garmin.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Garmin International Inc.
Manufacturers Address:	No. 68 Jangshu 2 nd Road
City/Zip Code	Shijr, Taipei County
Country	Taiwan

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	nüvi 2598FL
Model Name:	A2AVGC00
Product Description:	Connected Personal Navigation Device
Hardware Revision :	1
Software Revision :	1.04
FCC-ID:	IPH-A2AVGC00
IC-ID:	1792A-A2AVGC00
Frequency bands of test:	GSM 850: 824.2-848.8MHz; PCS 1900: 1850.2-1909.8MHz FDD V: 826.4-846.6MHz; FDD II: 1852.4-1907.6MHz FDD IV: 1712.4-1752.5MHz
Type(s) of Modulation:	GMSK; 8-PSK; QPSK
Number of channels:	GSM850: 125 and PCS 1900: 300 FDD II: 278/ FDD V: 103/FDD IV:203
Antenna Type and Gain:	Monopole Antenna <i>Max Gain (as declared by manufacturer):</i> 850 band: 1 dBi 1900 band: 2.5 dBi 1700 band: -1.2 dBi
Other Radios included in the device:	Bluetooth: 2400-2483.5MHz GPS Receiver: 1.57542 GHz/ L1 Band
Power Supply (VDC):	Dedicated Lithium battery pack Rated operating voltage: 4.75 (Low)/5.0 (Nom)/ 5.25 (High)
Rated Operating Temperature Range:	-20°C to 55°C
Prototype / Production unit	Production

3.2 Identification of the Equipment Under Test (EUT)

EUT #	S/N	HW Version	SW Version	Model	Notes
1	2KM00250	1	1.04	nüvi 2598FL	Radiated Sample
2	2KM00231	1	1.04	nüvi 2598FL	Conducted Sample

3.3 Identification of Accessory equipment

AE #	Type	Manufacturer	Model	Serial Number
1	Vehicle Charger	Garmin	CLA100-050	N/A
2	Car Holder	Garmin	N/A	N/A
3	USB Cable	Garmin	N/A	N/A
4	Laptop Computer	Dell	D620	N/A

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
- RSS 132- Issue 2: Spectrum management and telecommunication policy- Radio Standards Specifications Cellular telephones employing new technologies operating in the bands 824-849MHz and 869-894MHz
- RSS 133- Issue 5: Spectrum management and telecommunication policy- Radio Standards Specifications- 2GHz personal communication services
- RSS 139- Issue 2: Spectrum management and telecommunication policy- Radio Standards Specifications- Advance wireless services equipment operating in the bands 1710-1755MHz and 2110-2155MHz

This test report is to support a request for new equipment authorization under the FCC ID: **IPH-A2AVGC00** and IC ID: **1792A-A2AVGC00**.

Model A2AVGC00 integrates the precertified WWAN module : Telit HE910-D.

Per guidelines from KDB 996369, conducted signal test data from module certification has been re-used for this certification as the output power has been verified to be identical (within production tolerances and measurement uncertainties).

The module test data can be obtained under the FCC Filing ID: RI7HE910, Test Report #1112FR12-02 and #1201FR11-02 issued by A Test Lab Techno Corp. on Feb 3, 2012.

This test report contains full radiated testing as per FCC 22H/24E/27 and RSS-132/133/139 and conducted power verification required per KDB 996369.

5 Summary of Measurement Results

850 MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §22.913 (a) RSS132 4.4	RF Output Power	Nominal	GSM 850	■	□	□	□	Complies
			UMTS Band V	■	□	□	□	Complies
§2.1055 §22.355 RSS132 4.3	Frequency Stability	Nominal	GSM 850	□	□	□	■	-
			UMTS Band V	□	□	□	■	-
§2.1049 §22.917(b) RSS132 4.2	Occupied Bandwidth	Nominal	GSM 850	□	□	□	■	-
			UMTS Band V	□	□	□	■	-
§2.1051 §22.917 RSS132 4.5	Band Edge Compliance	Nominal	GSM 850	□	□	□	■	-
			UMTS Band V	□	□	□	■	-
§2.1051 §22.917 RSS132 4.5	Conducted Spurious Emissions	Nominal	GSM 850	□	□	□	■	-
			UMTS Band V	□	□	□	■	-
§2.1053 §22.917 RSS132 4.5	Radiated Spurious Emissions	Nominal	GSM 850	■	□	□	□	Complies
			UMTS Band V	■	□	□	□	Complies

Note: NA= Not Applicable;
 NP= Not Performed. Re-used from module certification data.

1900 MHz 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	GSM 1900	■	□	□	□	Complies
			UMTS Band II	■	□	□	□	Complies
§2.1055 §24.235 RSS133 6.3	Frequency Stability	Nominal	GSM 1900	□	□	□	■	-
			UMTS Band II	□	□	□	■	-
§2.1049 §24.238(b) RSS133 6.2	Occupied Bandwidth	Nominal	GSM 1900	□	□	□	■	-
			UMTS Band II	□	□	□	■	-
§2.1051 §24.238 RSS133 6.5	Band Edge Compliance	Nominal	GSM 1900	□	□	□	■	-
			UMTS Band II	□	□	□	■	-
§2.1051 §24.238 RSS133 6.5	Conducted Spurious Emissions	Nominal	GSM 1900	□	□	□	■	-
			UMTS Band II	□	□	□	■	-
§2.1053 §24.238 RSS133 6.5	Radiated Spurious Emissions	Nominal	GSM 1900	■	□	□	□	Complies
			UMTS Band II	■	□	□	□	Complies

Note: NA= Not Applicable;
 NP= Not Performed. Re-used from module certification data.

1700 MHz Band:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §27.50(d)(4) RSS139(6.4)	RF Output Power	Nominal	UMTS Band IV	■	□	□	□	Complies
§2.1055 §27.54 RSS139(6.3)	Frequency Stability	Nominal	UMTS Band IV	□	□	□	■	-
§2.1049 §27.53(h) RSS-Gen(4.6.1)	Occupied Bandwidth	Nominal	UMTS Band IV	□	□	□	■	-
§2.1051 §27.53(h) RSS139 6.5	Band Edge Compliance	Nominal	UMTS Band IV	□	□	□	■	-
§2.1051 §27.53(h) RSS139 6.5	Conducted Spurious Emissions	Nominal	UMTS Band IV	□	□	□	■	-
§2.1053 §27.53(h) RSS139 6.5	Radiated Spurious Emissions	Nominal	UMTS Band IV	■	□	□	□	Complies

Note: NA= Not Applicable;

NP= Not Performed. Re-used from module certification data.

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

IC: RSS-Gen Section 4.8; RSS 132 Section 4.4; RSS 133 Section 6.4; RSS 139 Section 6.4

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.

6.1.2.2 RSS-Gen 4.8: RF power output.

Transmitter output power measurements shall be carried out before the unwanted emissions test. The transmitter output power value, obtained from this test, serves as the reference level used to determine the unwanted emissions.

6.1.3 Limits:

6.1.3.1 FCC 22.913 (a) Effective radiated power limits.

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

6.1.3.2 FCC 24.232 (b) Power limits.

(b) Mobile/portable stations are limited to 2 Watts effective isotropic radiated power (EIRP).

6.1.3.3 FCC 27.50(d)(4) Power limits.

Fixed, mobile and portable (handheld stations) operating in the 1710-1755 MHz band are limited to 1 watt EIRP

6.1.3.4 RSS-132 Section 4.4

The transmitter output power shall not exceed the limits given in SRSP-503.

SRSP-503: The maximum EIRP shall be 11.5W for mobile stations.

6.1.3.5 RSS-133 Section 6.4

The average equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510.

SRSP-510: Mobile stations and hand-held portables are limited to 2 watts maximum e.i.r.p.

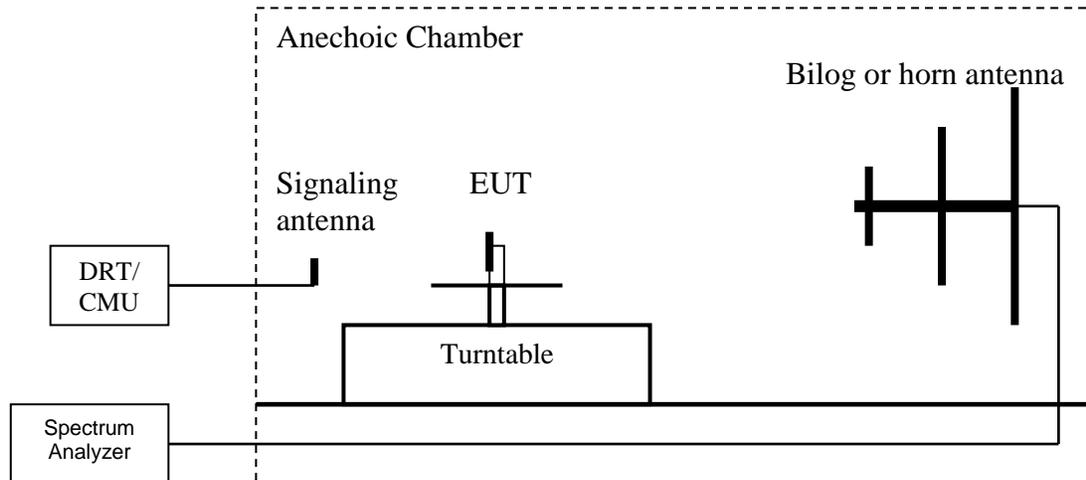
In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

6.1.3.6 RSS-139 Section 6.4

The average equivalent isotropically radiated power (e.i.r.p.) for fixed, mobile and portable transmitters in the 1710-1755 MHz shall not exceed 1 watt.

6.1.4 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. Set the analyzer to measure peak hold with the required settings.
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) + 2.14 (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.)

Measurement Uncertainty (Radiated): ±3.0 dB

6.1.5 RF Power Output 850MHz band

Limit: FCC: Nominal Peak Output Power < 38.45 dBm (7W)
IC: Nominal Peak Output Power < 40.60 dBm (11.5W)

GSM Cellular 850 (GMSK Mode)	
Frequency (MHz)	Radiated Power
	ERP (dBm)
824.2	32.2
836.6	32.3
848.8	32.8

GSM Cellular 850 (8PSK Mode)	
Frequency (MHz)	Radiated Power
	ERP (dBm)
824.2	29.3
836.6	29.3
848.8	30.1

FDD V 850 (UMTS Mode)	
Frequency (MHz)	Radiated Power
	ERP (dBm)
826.2	27.2
836.6	27.1
846.6	27.6

6.1.5.1 Measurement Result

Pass.

6.1.6 RF Power Output 1900MHz band

Limit: Nominal Peak Output Power < 33 dBm (2W)

GSM PCS 1900 (GMSK Mode)	
Frequency (MHz)	Radiated Power
	EIRP (dBm)
1850.2	28.8
1880	29.3
1909.8	29.7

GSM PCS 1900 (8PSK Mode)	
Frequency (MHz)	Radiated Power
	EIRP (dBm)
1850.2	27.7
1880	27.8
1909.8	27.9

FDD II 1900 (UMTS Mode)	
Frequency (MHz)	Radiated Power
	EIRP (dBm)
1852.4	25.0
1880	24.7
1907.6	24.8

6.1.6.1 Measurement Result

Pass.

6.1.7 RF Power Output 1700MHz band

Limit: Nominal Peak Output Power < 30 dBm (1W)

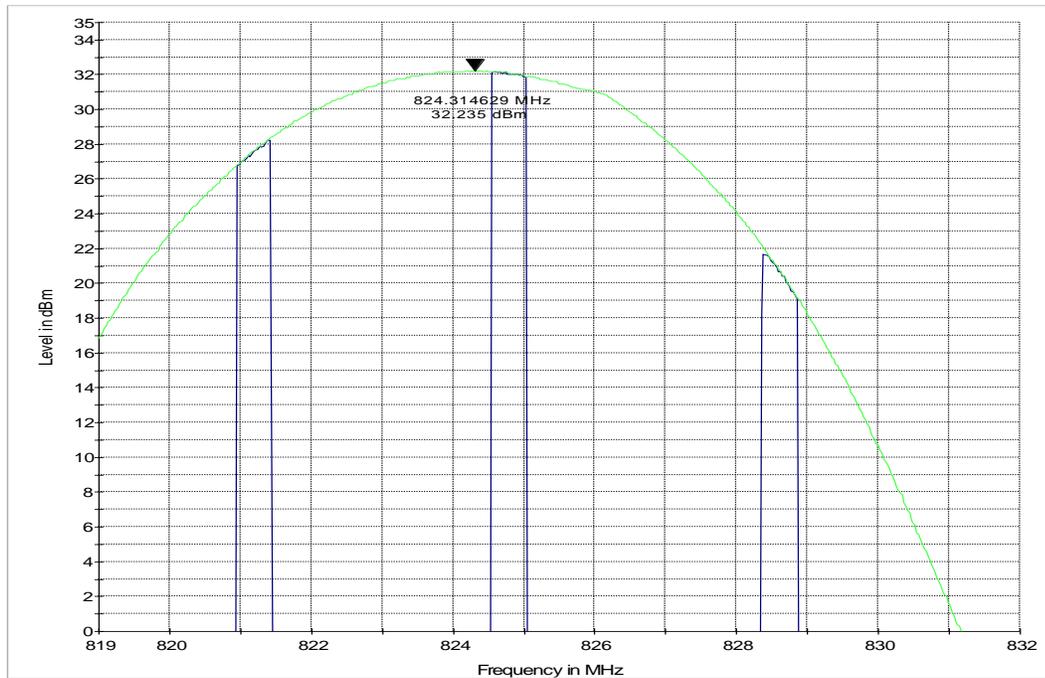
FDD IV 1700 (UMTS Mode)	
Frequency (MHz)	Radiated Power
	EIRP (dBm)
1712.4	26.8
1732.6	26.5
1752.6	25.3

6.1.7.1 Measurement Result

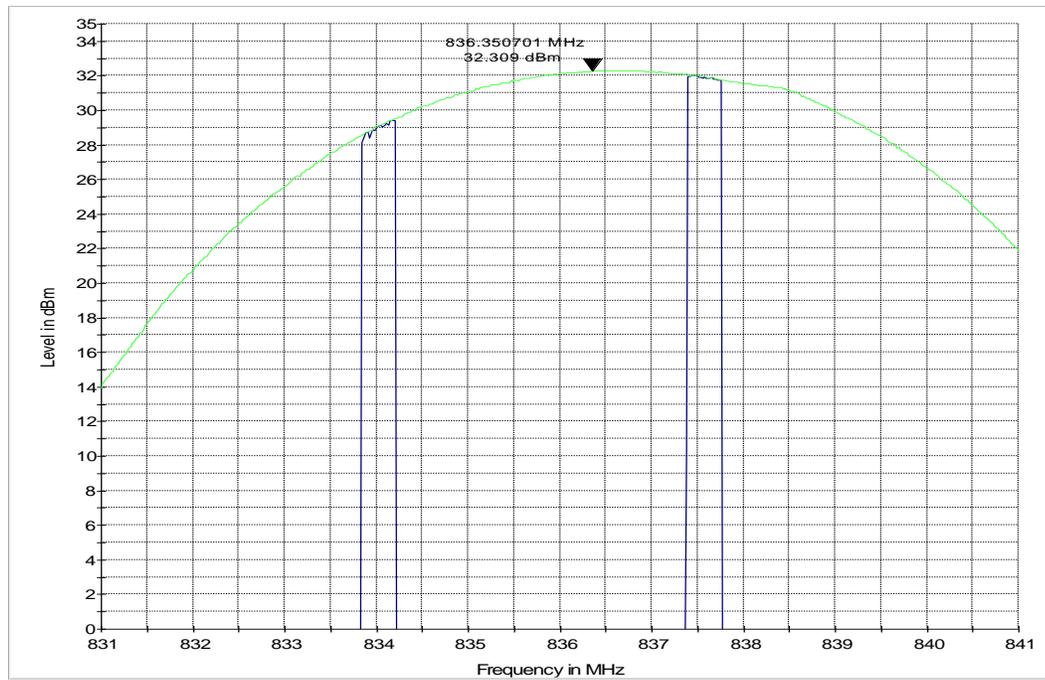
Pass.

6.1.8 Results

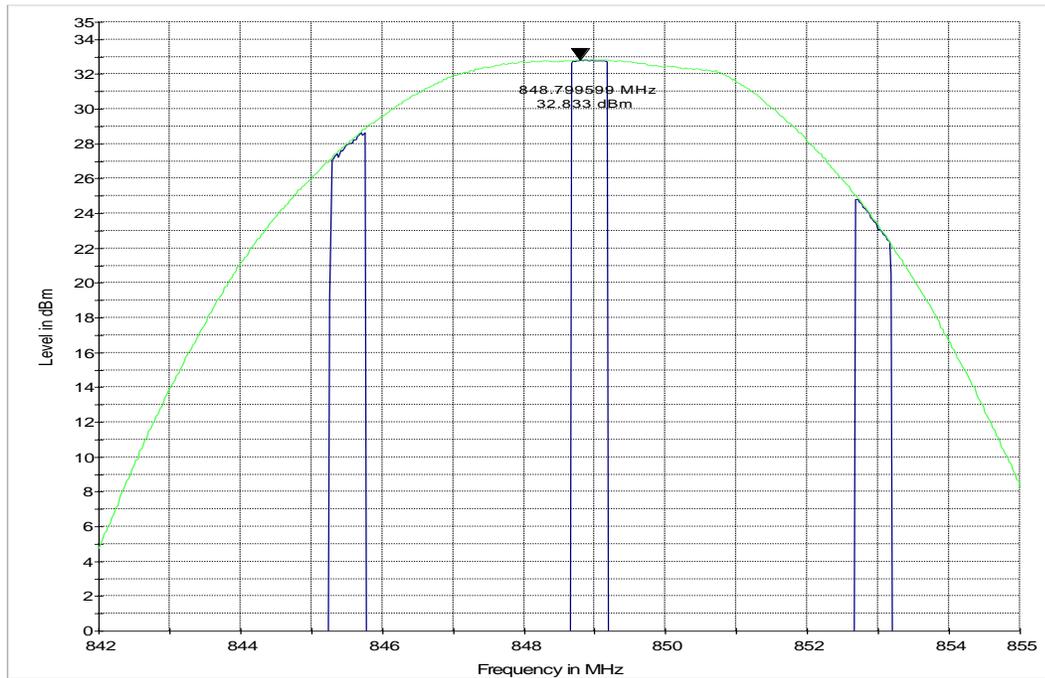
ERP (GSM 850) CHANNEL 128



ERP (GSM 850) CHANNEL 190

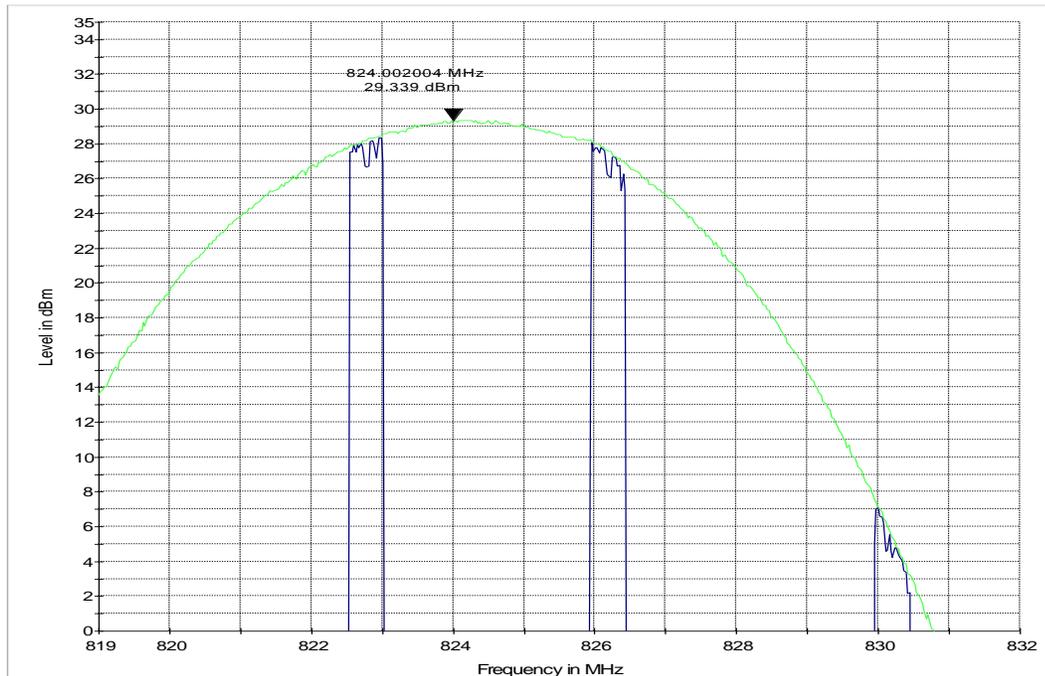


ERP (GSM 850) CHANNEL 251



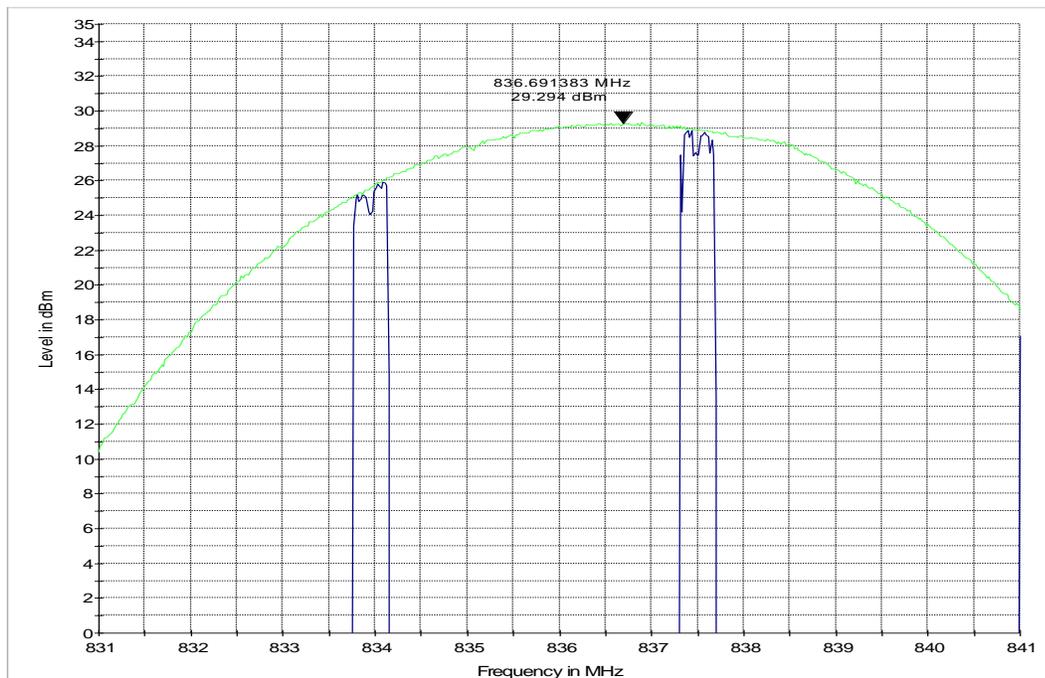
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ERP (EGPRS 850) CHANNEL 128



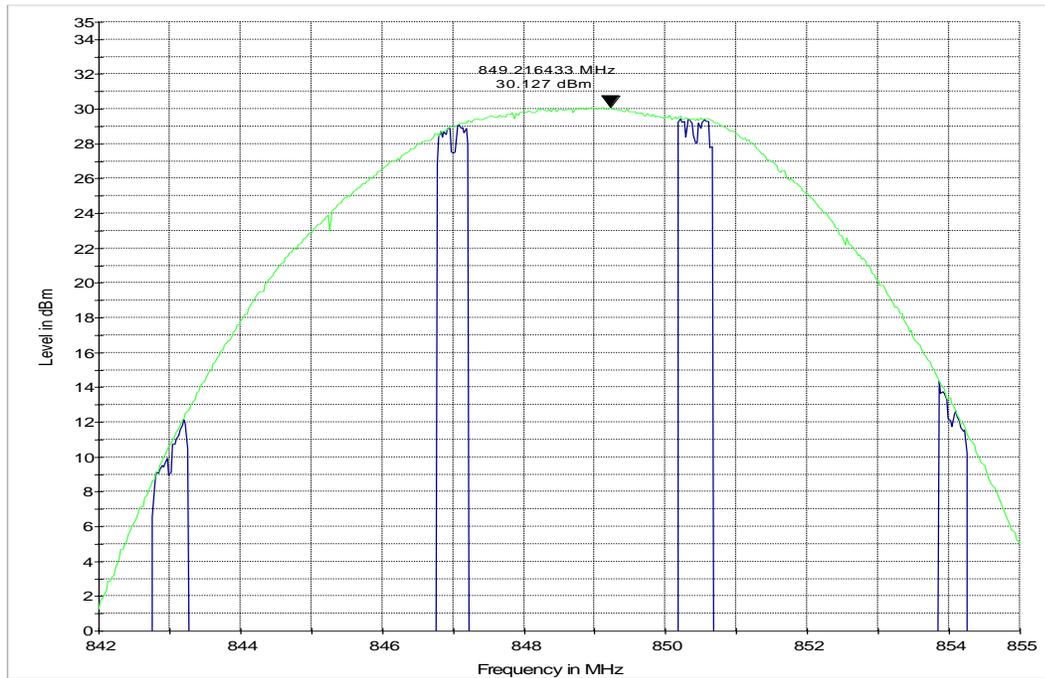
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ERP (EGPRS 850) CHANNEL 190



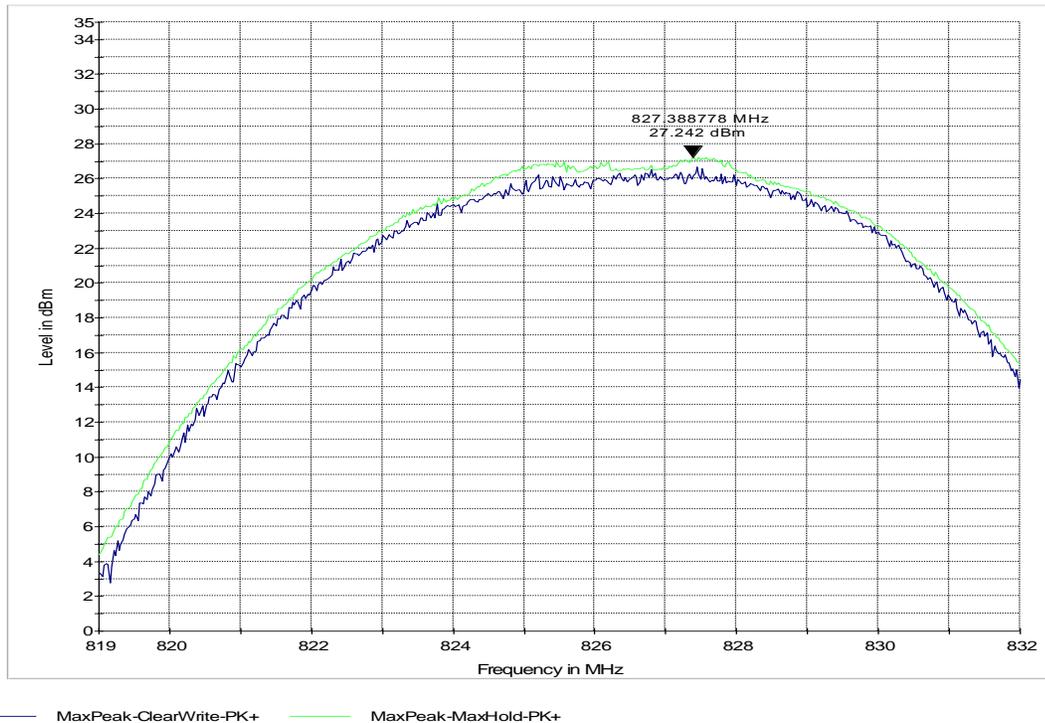
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ERP (EGPRS 850) CHANNEL 251

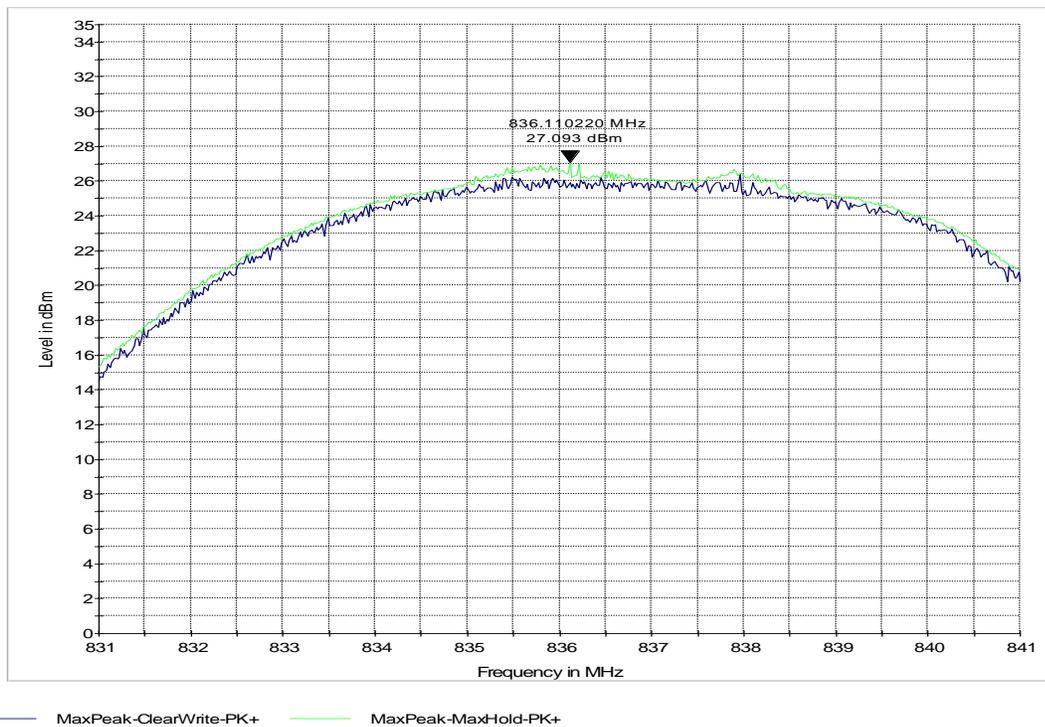


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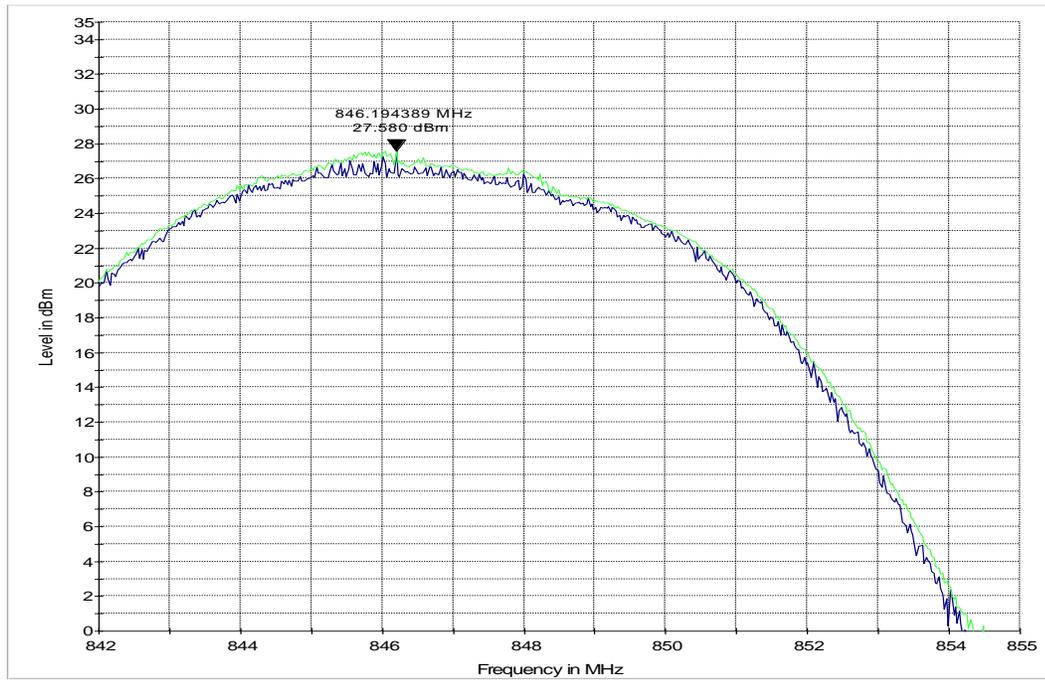
ERP (UMTS FDD5) CHANNEL 4132



ERP (UMTS FDD5) CHANNEL 4183

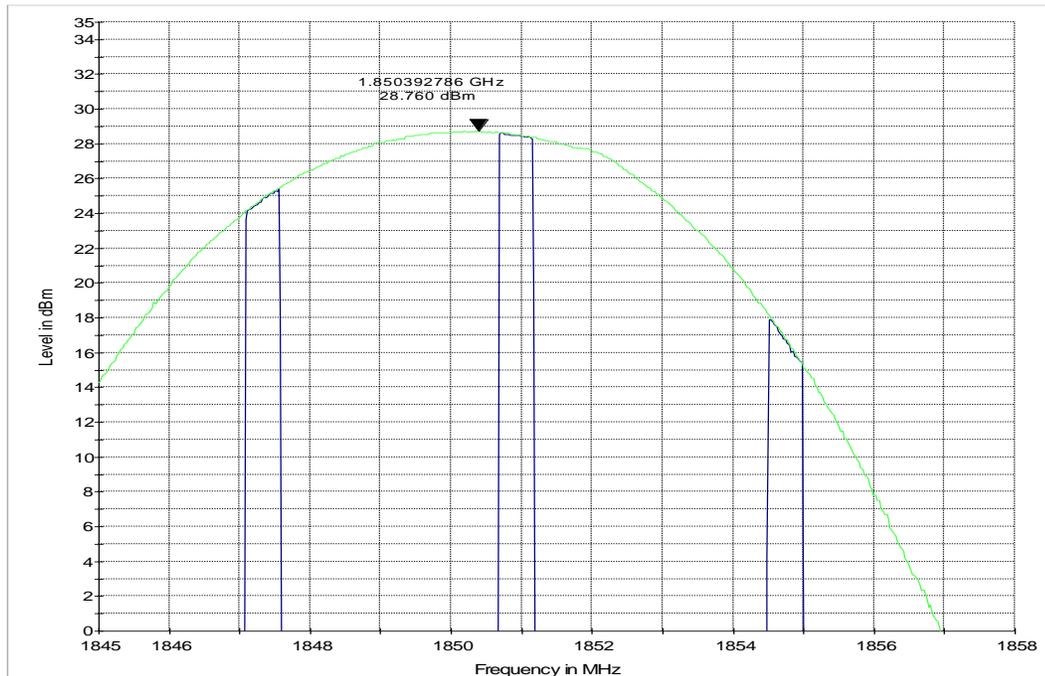


ERP (UMTS FDD5) CHANNEL 4233



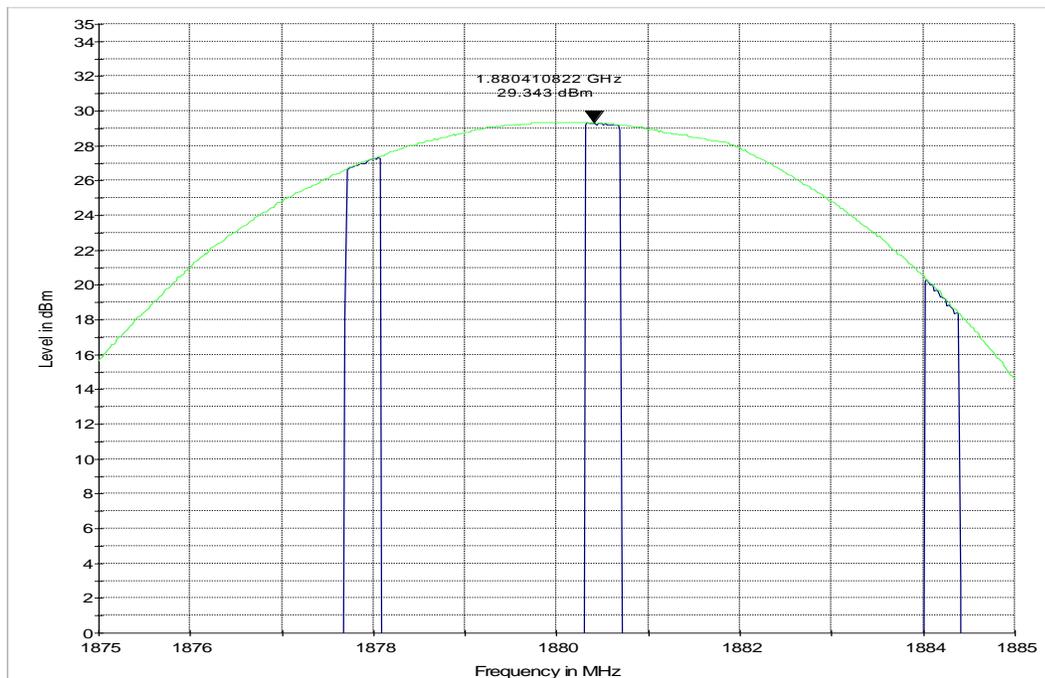
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EIRP (PCS-1900) CHANNEL 512



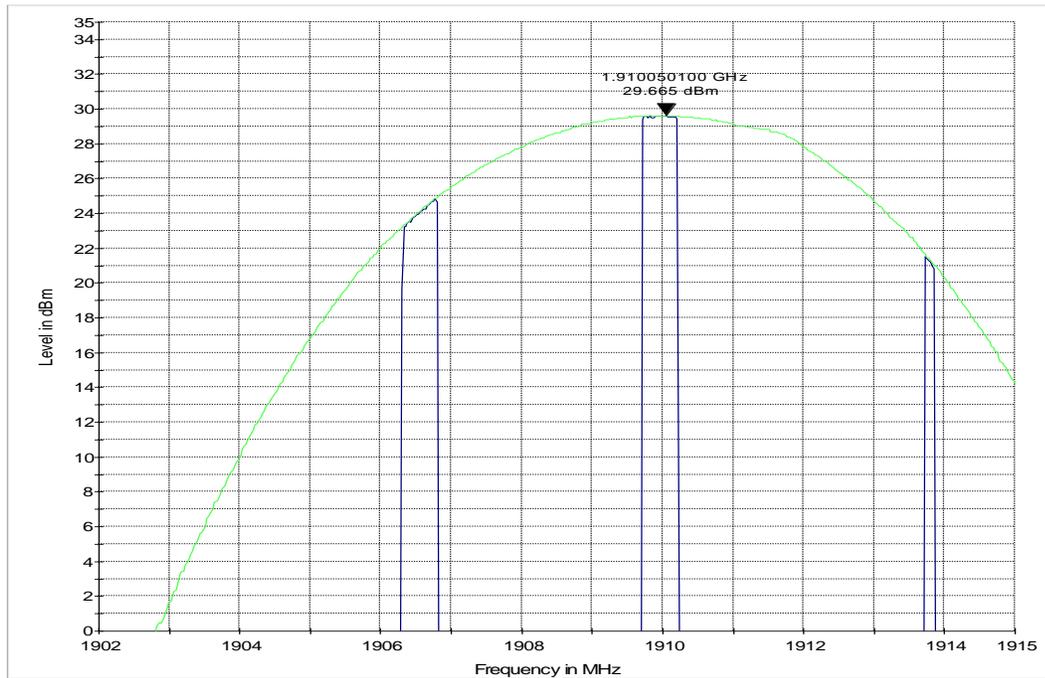
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EIRP (PCS-1900) CHANNEL 661



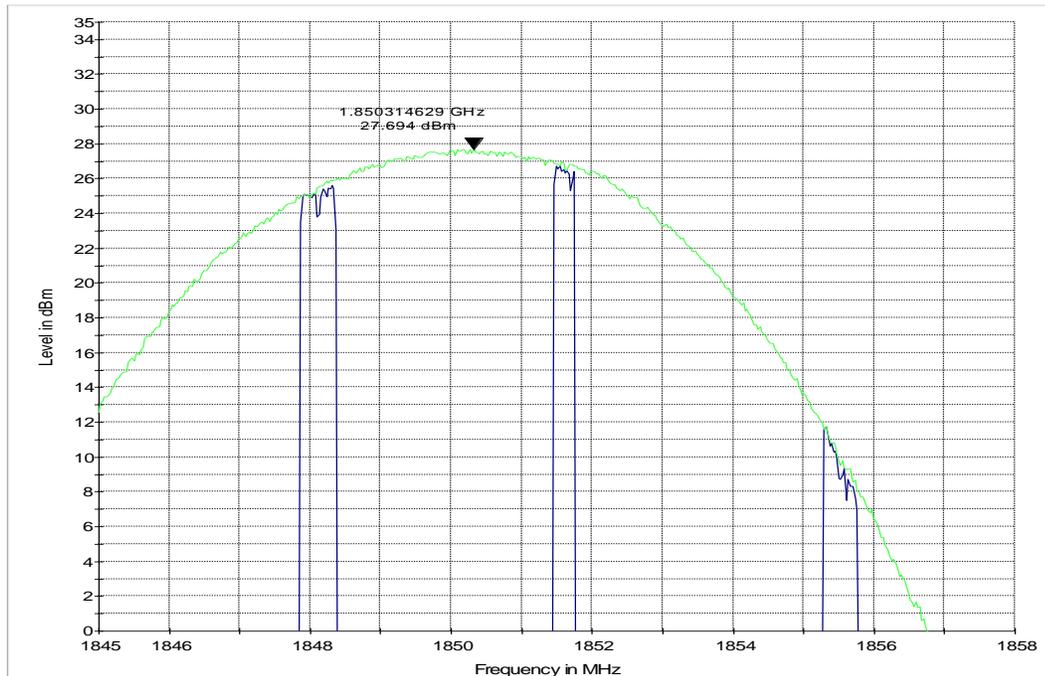
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EIRP (PCS-1900) CHANNEL 810



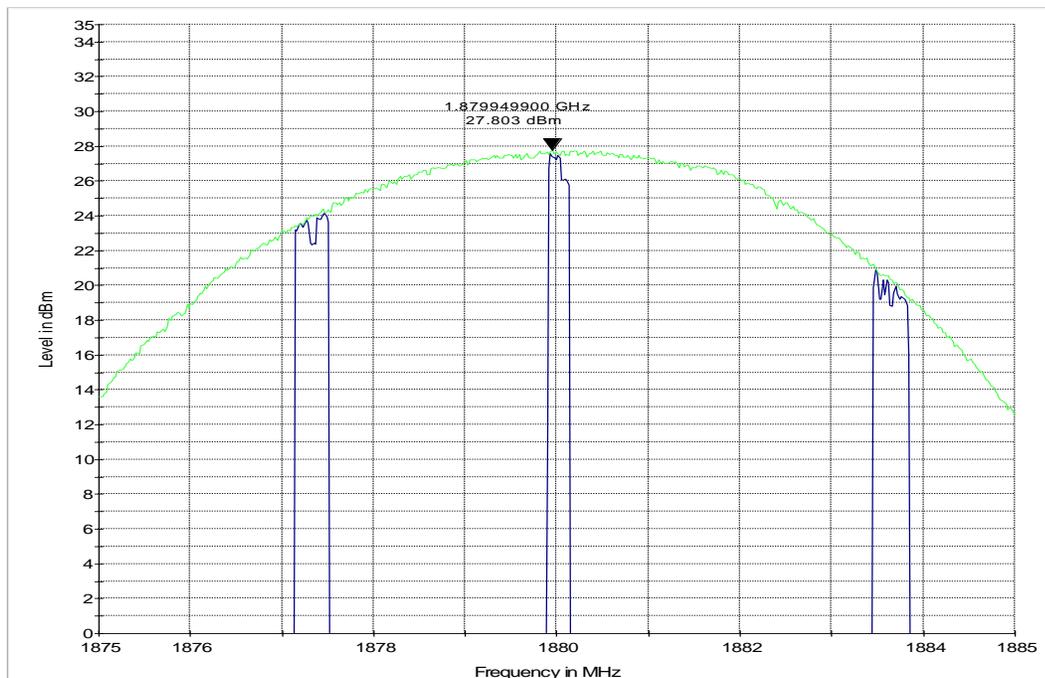
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EIRP (EGPRS 1900) CHANNEL 512



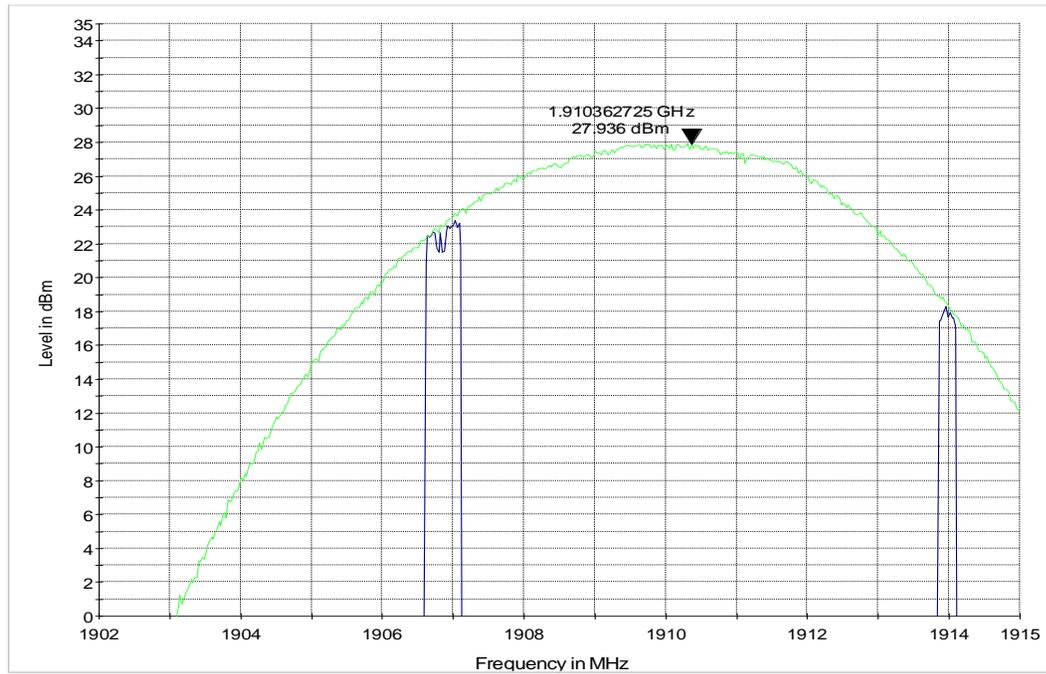
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EIRP (EGPRS 1900) CHANNEL 661



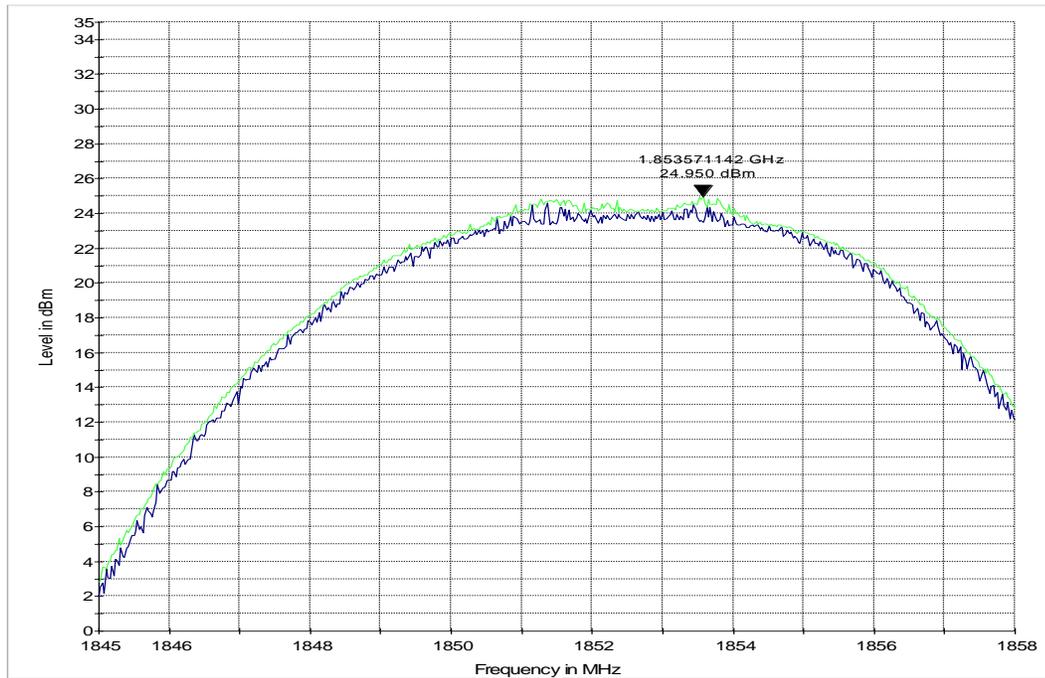
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EIRP (EGPRS 1900) CHANNEL 810



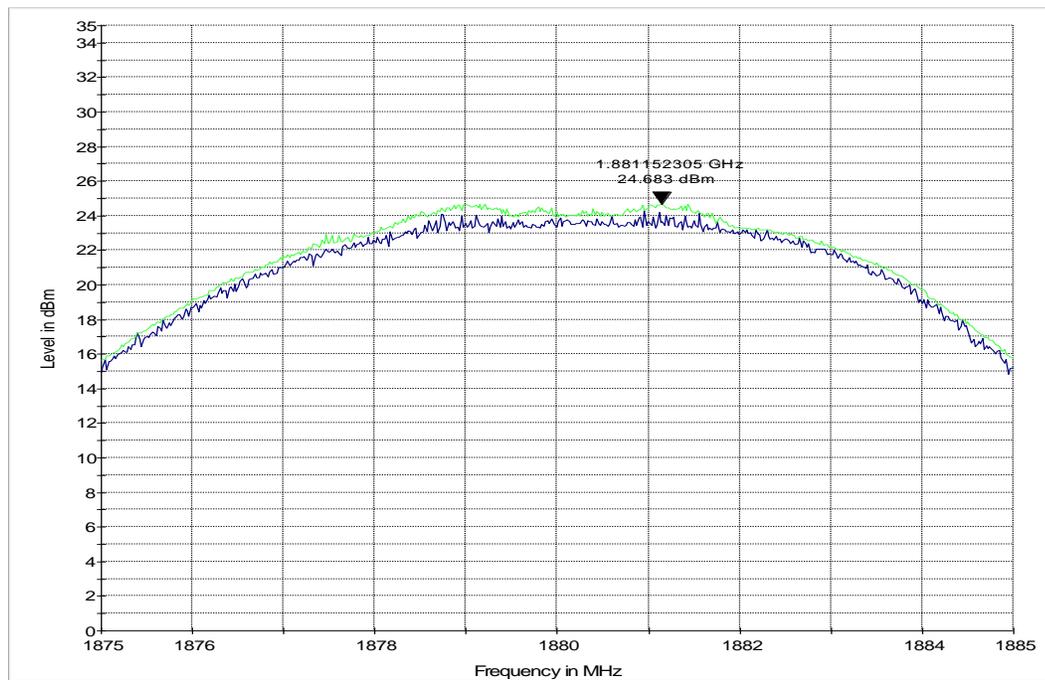
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EIRP (UMTS FDD2) CHANNEL 9262



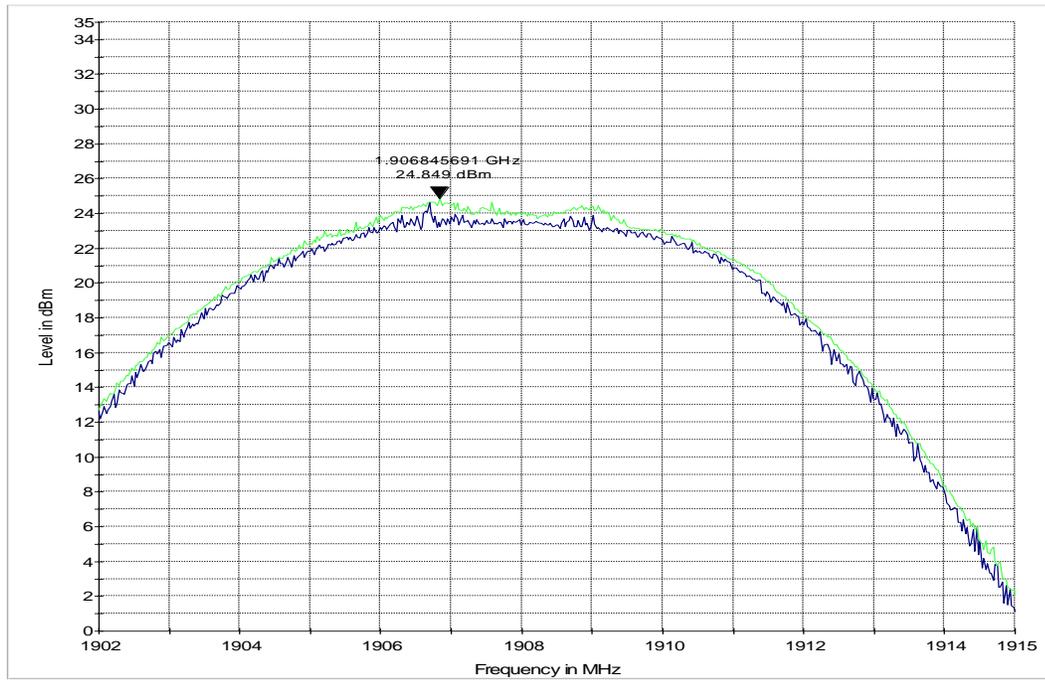
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EIRP (UMTS FDD2) CHANNEL 9400



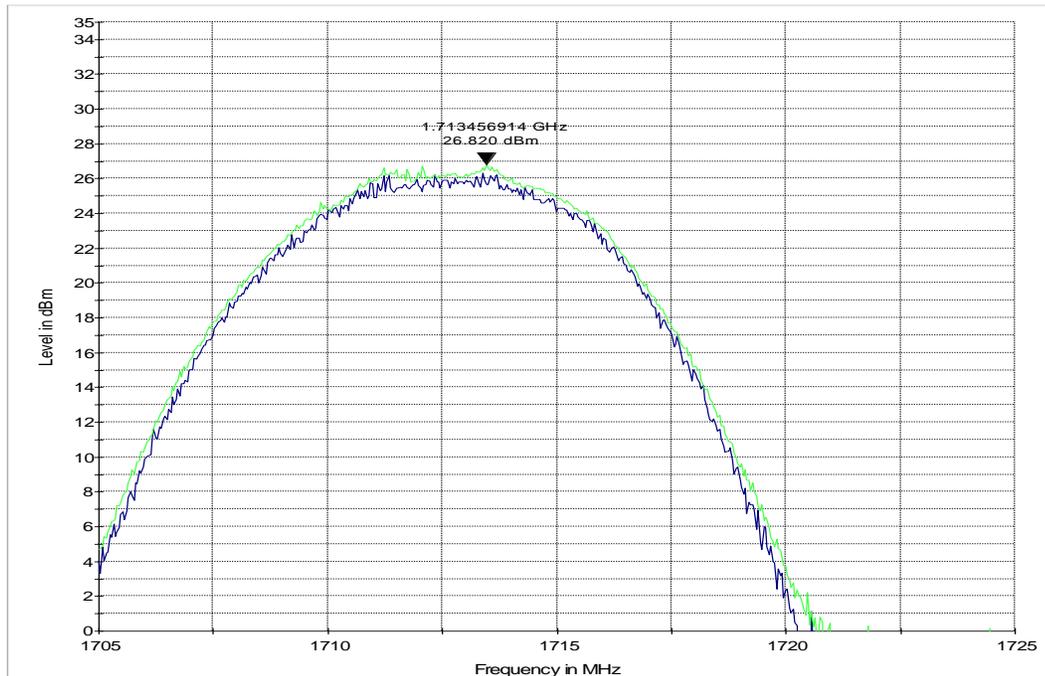
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EIRP (UMTS FDD2) CHANNEL 9538



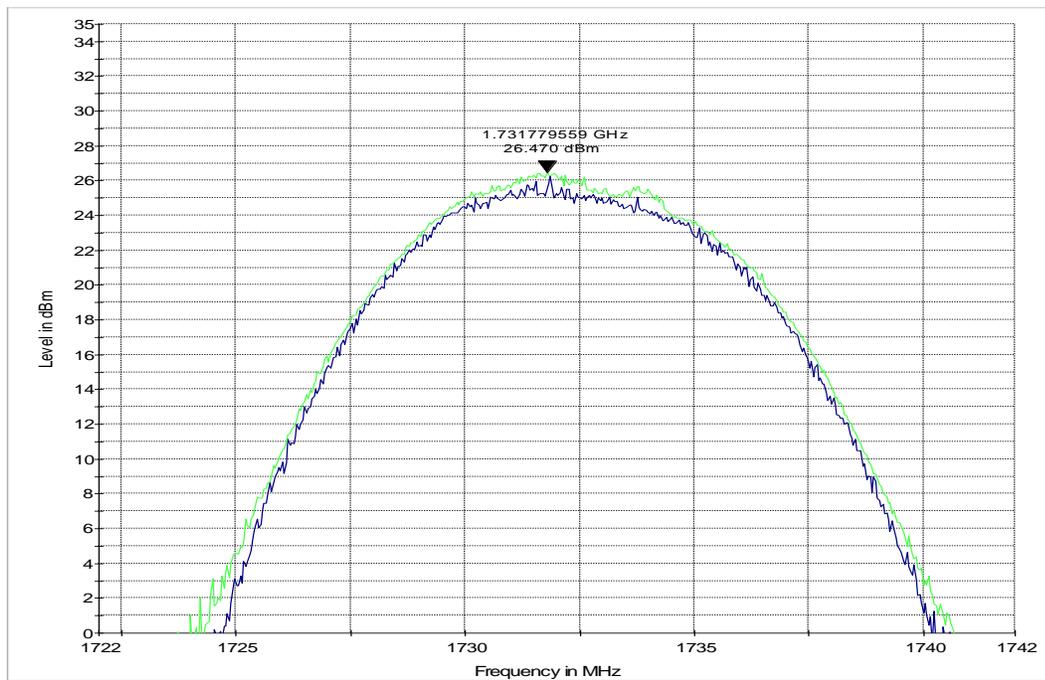
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EIRP (UMTS FDD4) CHANNEL 1312



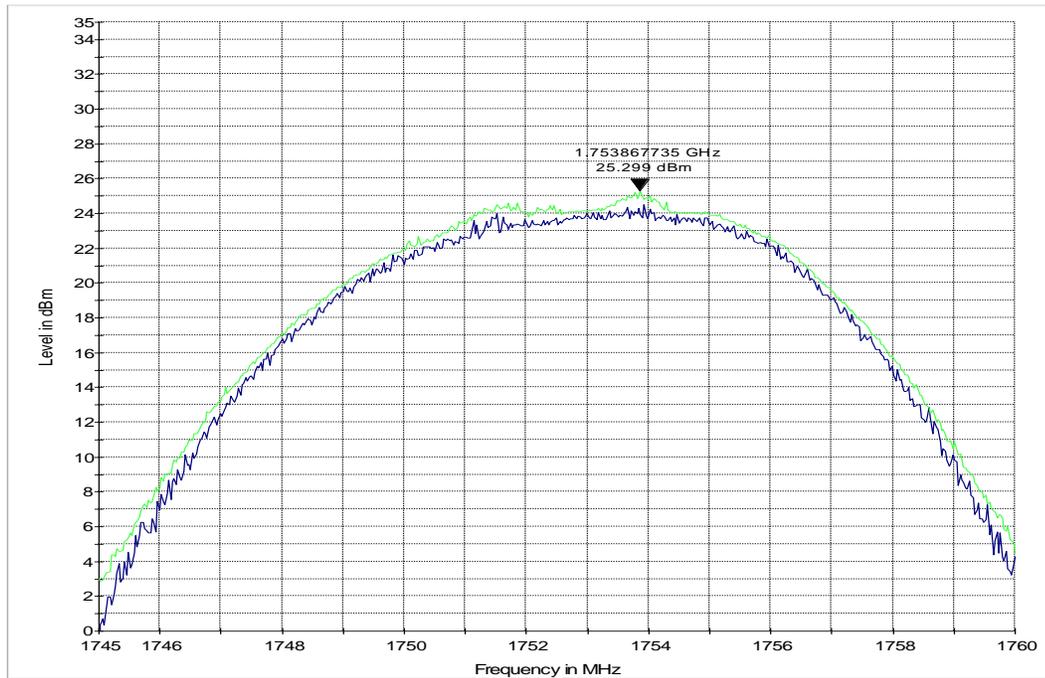
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EIRP (UMTS FDD4) CHANNEL 1413



— MaxPeak-ClearWrite-PK+ — MaxPeak-MaxHold-PK+

EIRP (UMTS FDD4) CHANNEL 1513

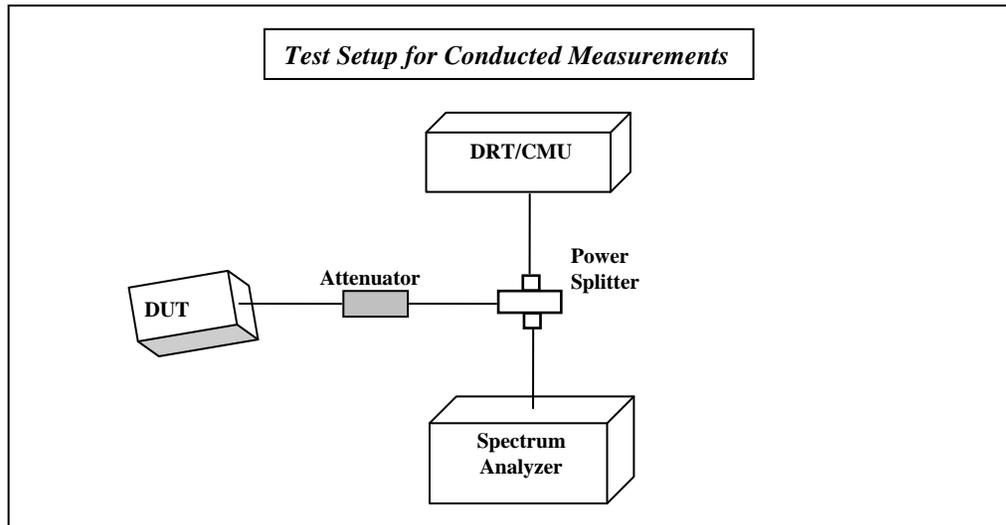


— MaxPeak-ClearWrite-PK+ — MaxPeak-MaxHold-PK+

6.1.9 Conducted Output Power Verification:

6.1.9.1 Measurement Procedure:

Ref: TIA-603C 2004 2.2.1



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 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. GPRS and EGPRS modes were tested in 4Down1Up configuration since these configurations represent the mode with the highest conducted power.

Measurement Uncertainty= +/- 0.5 dB

6.1.9.2 Measurement Results:

GSM Cellular 850 (GMSK Mode)		
Frequency (MHz)	Conducted Output Power from module certification	Conducted Output Power from the EUT
	(dBm)	(dBm)
824.2	33.0	32.4
836.6	32.9	32.5
848.8	32.9	32.5

GSM Cellular 850 (8PSK Mode)		
Frequency (MHz)	Conducted Output Power from module certification	Conducted Output Power from the EUT
	(dBm)	(dBm)
824.2	29.9	29.5
836.6	29.8	29.7
848.8	29.8	29.8

FDD V 850 (UMTS Mode)		
Frequency (MHz)	Conducted Output Power from module certification	Conducted Output Power from the EUT
	(dBm)	(dBm)
826.2	26.6	26.0
836.6	26.4	26.0
846.6	26.5	25.8

GSM PCS 1900 (GMSK Mode)		
Frequency (MHz)	Conducted Output Power from module certification	Conducted Output Power from the EUT
	(dBm)	(dBm)
1850.2	29.9	29.2
1880	29.8	29.1
1909.8	29.5	29.2

GSM PCS 1900 (8PSK Mode)		
Frequency (MHz)	Conducted Output Power from module certification	Conducted Output Power from the EUT
	(dBm)	(dBm)
1850.2	28.6	28.3
1880	28.4	28.3
1909.8	28.3	28.3

FDD II 1900 (UMTS Mode)		
Frequency (MHz)	Conducted Output Power from module certification	Conducted Output Power from the EUT
	(dBm)	(dBm)
1852.4	26.4	24.3
1880	25.9	24.3
1907.6	25.6	24.5

FDD IV 1700 (UMTS Mode)		
Frequency (MHz)	Conducted Output Power from module certification	Conducted Output Power from the EUT
	(dBm)	(dBm)
1712.4	26.4	26.3
1732.6	26.3	26.3
1752.6	26.3	25.9

6.1.9.3 Verification Result

Peak output power from module certification test report has been compared to the measured peak conducted power from the EUT.

All results within manufacturer tolerance and measurement uncertainty.

6.2 Emissions Radiated

6.2.1 References

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

IC: RSS-Gen Section 4.9; RSS 132 Section 4.5; RSS 133 Section 6.5; RSS 139 Section 6.5

6.2.2 Measurement requirements:

6.2.2.1 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.

6.2.2.2 RSS-Gen 4.9: Transmitter unwanted spurious emissions

The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements.

The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

6.2.3 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.

6.2.3.1 Emission limitations

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.

6.2.3.2 RSS-132 Section 4.5.1.1 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 $43 + 10 \log_{10}(P)$, dB, in any MHz of bandwidth.

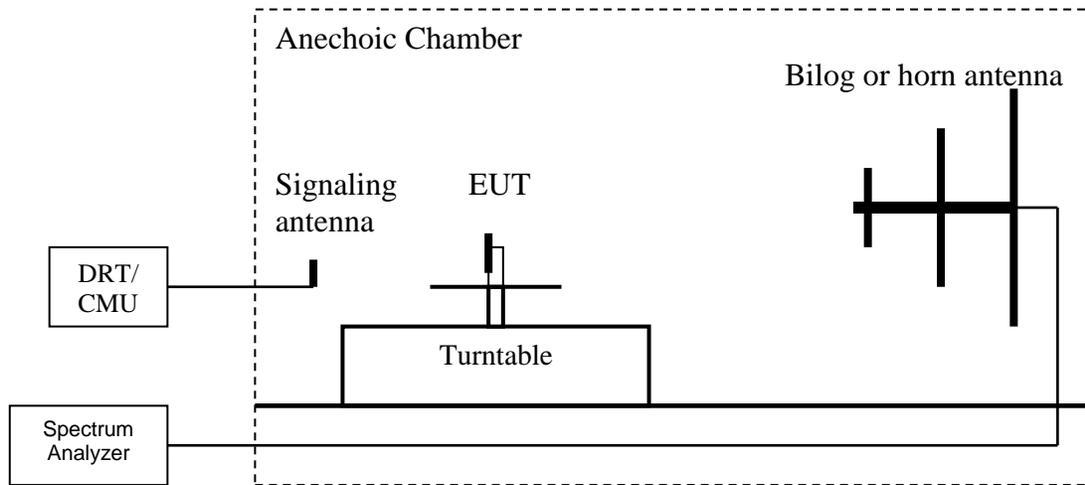
6.2.3.3 RSS-139 Section 6.5

In the first 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power 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 outside the equipment's operating frequency block, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in watts) by at least $43 + 10 \log_{10}(P)$, dB.

6.2.4 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 RadioCommunication 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.
(**Note:** 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.)

Spectrum analyzer settings: RBW=VBW=1MHz

6.2.5 Sample Calculations for Radiated Measurements

6.2.5.1 Power Measurements using Substitution Procedure:

1. The measurement from the Spectrum Analyzer is used as a basis for the Substitution procedure.
2. 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 reading as in Step 1.

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

Eg:

Frequency (MHz)	Signal Generator setting (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	EIRP (dBm)
1000	24.5	6.5	3.5	27.5

6.2.6 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 GSM-850, PCS-1900, UMTS FDD II, UMTS FDD V bands and AWS-1700.

GSM mode radiated emissions measurements are only done in circuit switched GMSK modulation since the output power in this mode is higher than in 8PSK mode, and hence considered worst case.

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.

Measurement Uncertainty= +/- 3.0 dB.

6.2.7 Radiated out of band emissions results on EUT- Transmit Mode:

6.2.7.1 Test Results

Transmitter Spurious Emission GSM850:

Harmonic	Tx ch-128 Freq. (MHz)	Level (dBm)	Tx ch-190 Freq. (MHz)	Level (dBm)	Tx ch-251 Freq. (MHz)	Level (dBm)
1	824.2	19.14	836.6	-17.05	848.8	15.16
2	1648.4	NF	1673.2	NF	1697.6	NF
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						

6.2.7.2 Measurement Result

Pass.

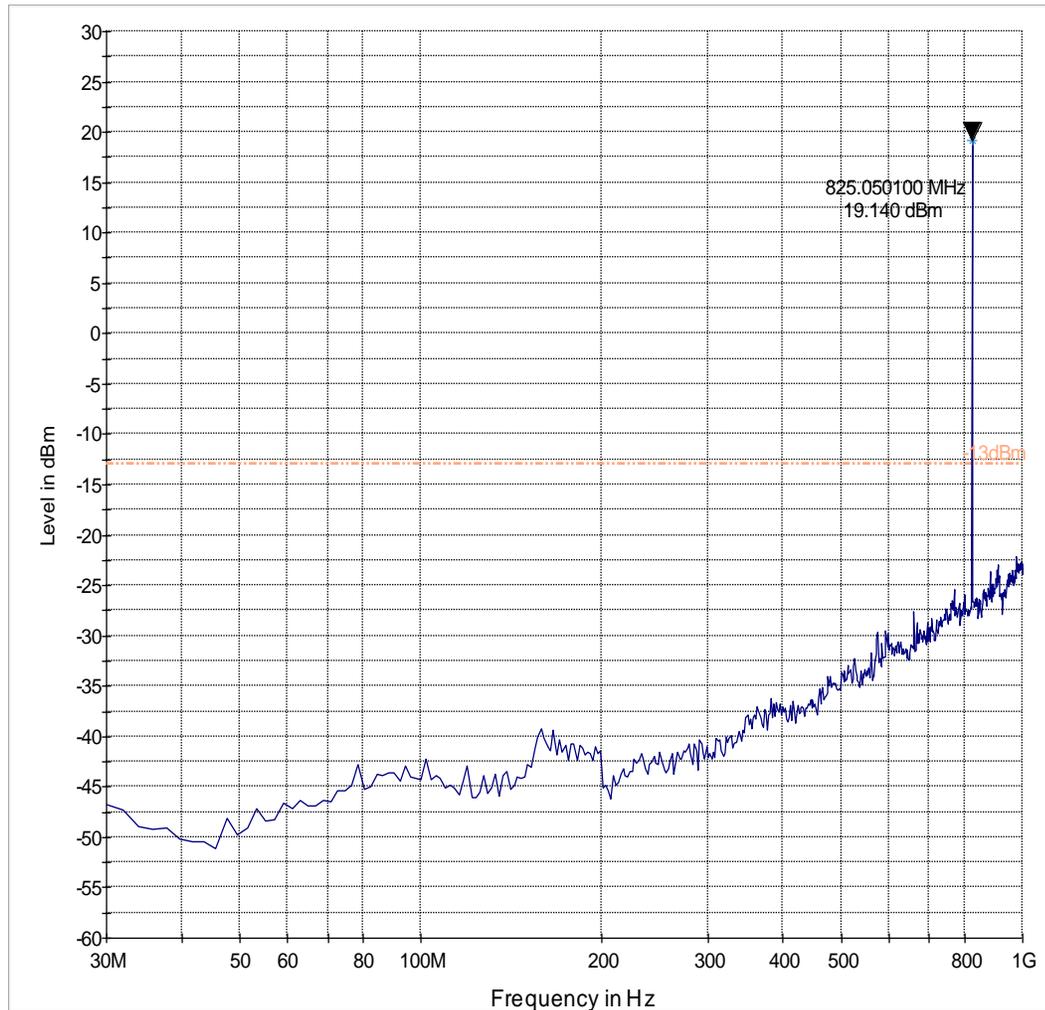
Legend for the plots:

- 13dBm.LimitLine
- Preview Result
- Data Reduction Result
- Final Measurement Result

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

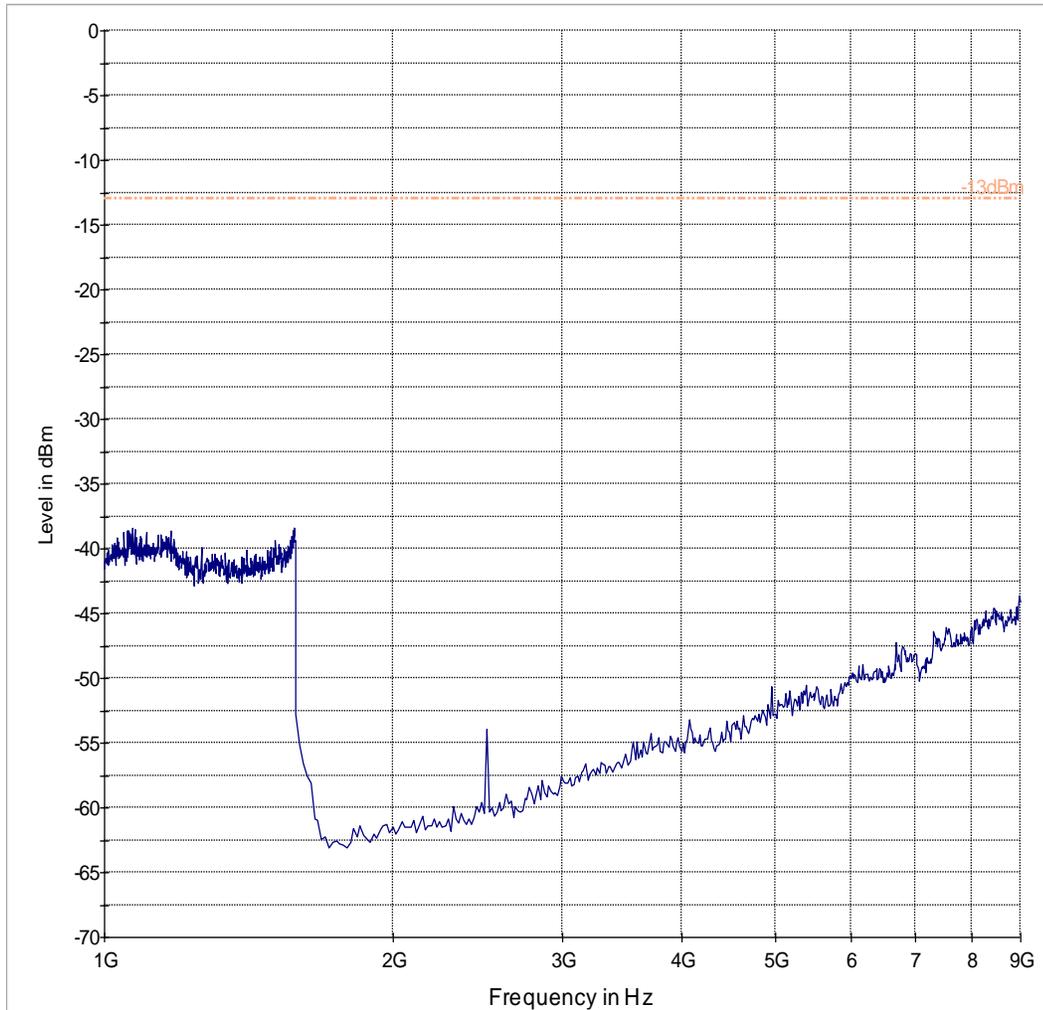
Test results 30M-1GHz:

Emission signal above the limit line in the plots is from the Carrier.



----- -13dBm ——— Preview Result 1-PK+ * Data Reduction Result 1 [1]-PK+

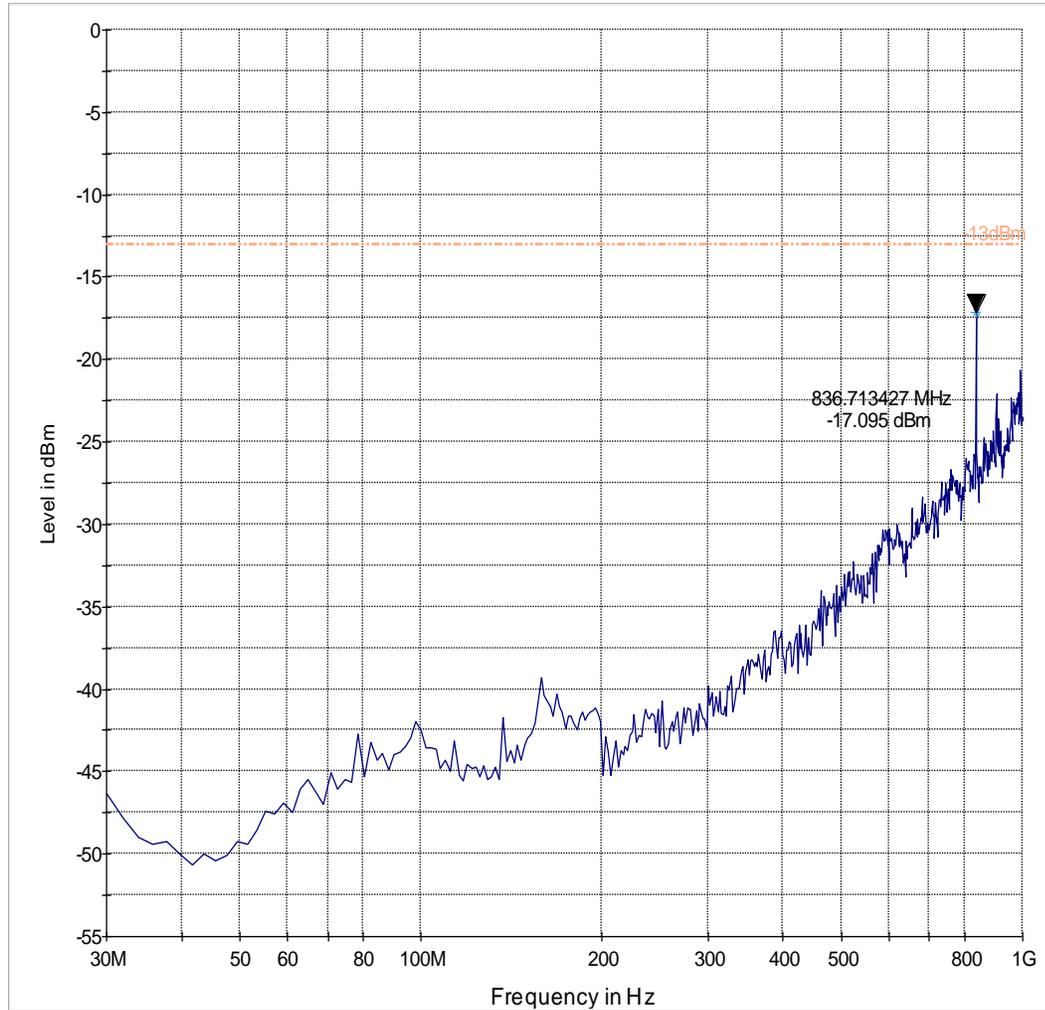
Test results 1GHz-9GHz



----- -13dBm ——— Preview Result 1-PK+

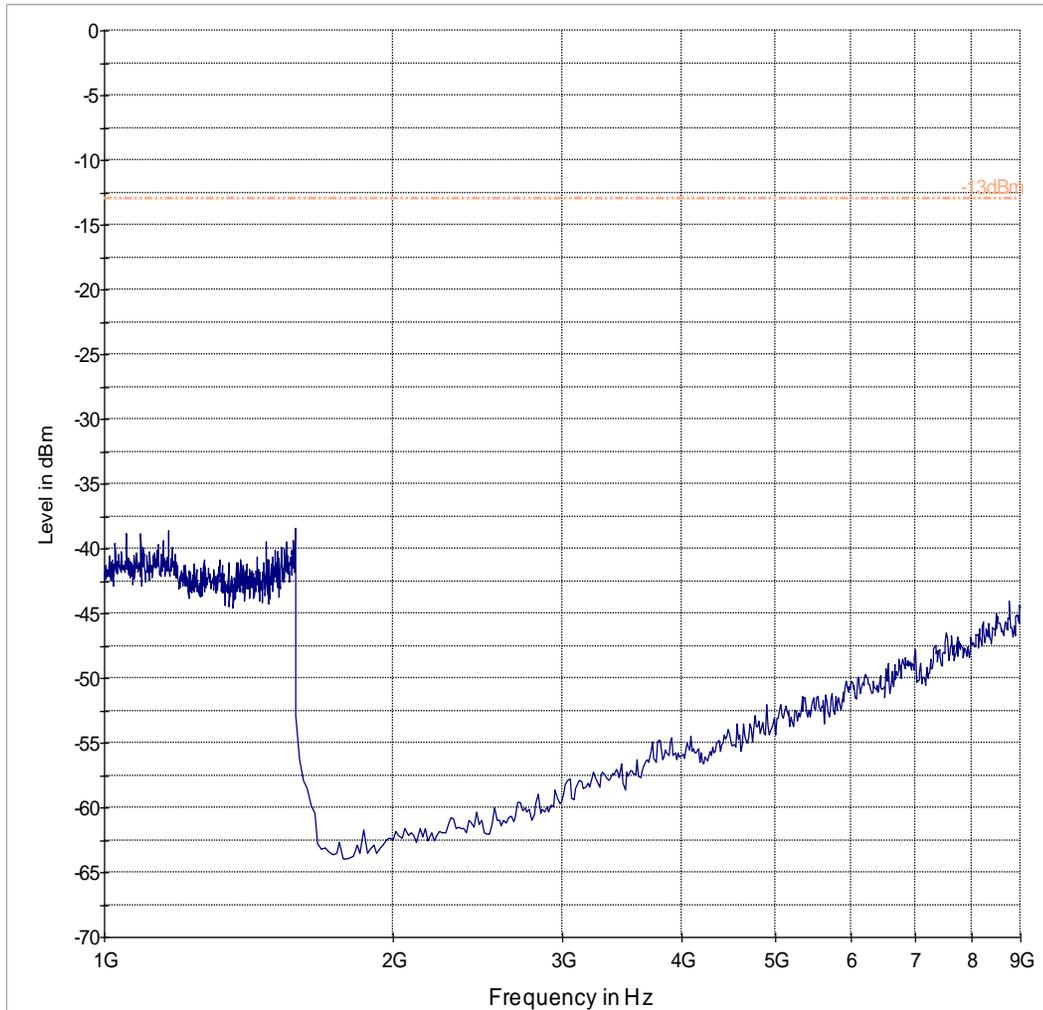
Radiated Spurious Emissions (GSM-850) Tx: Mid Channel

Test results 30M-1GHz:



----- -13dBm ——— Preview Result 1-PK+ * Data Reduction Result 1 [1]-PK+

Test results 1GHz-9GHz

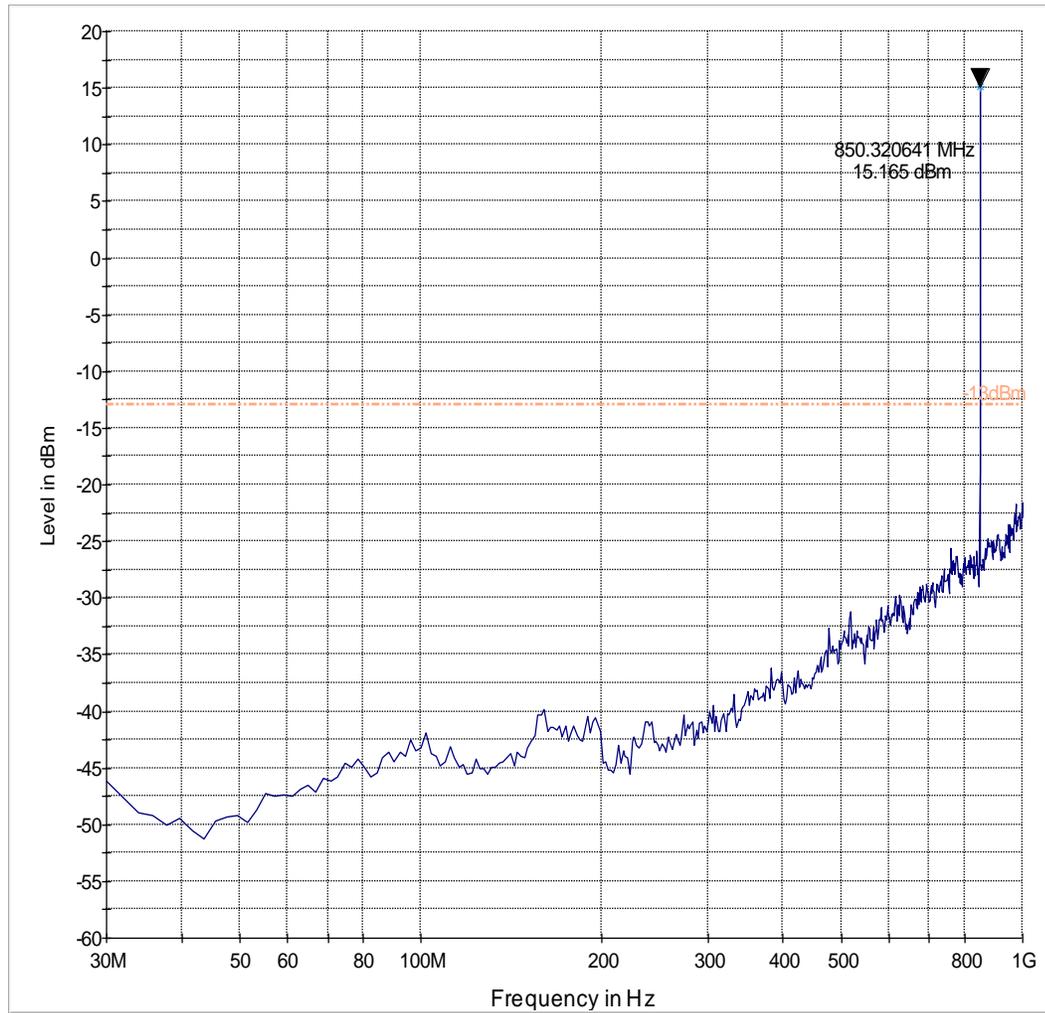


----- -13dBm ——— Preview Result 1-PK+

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

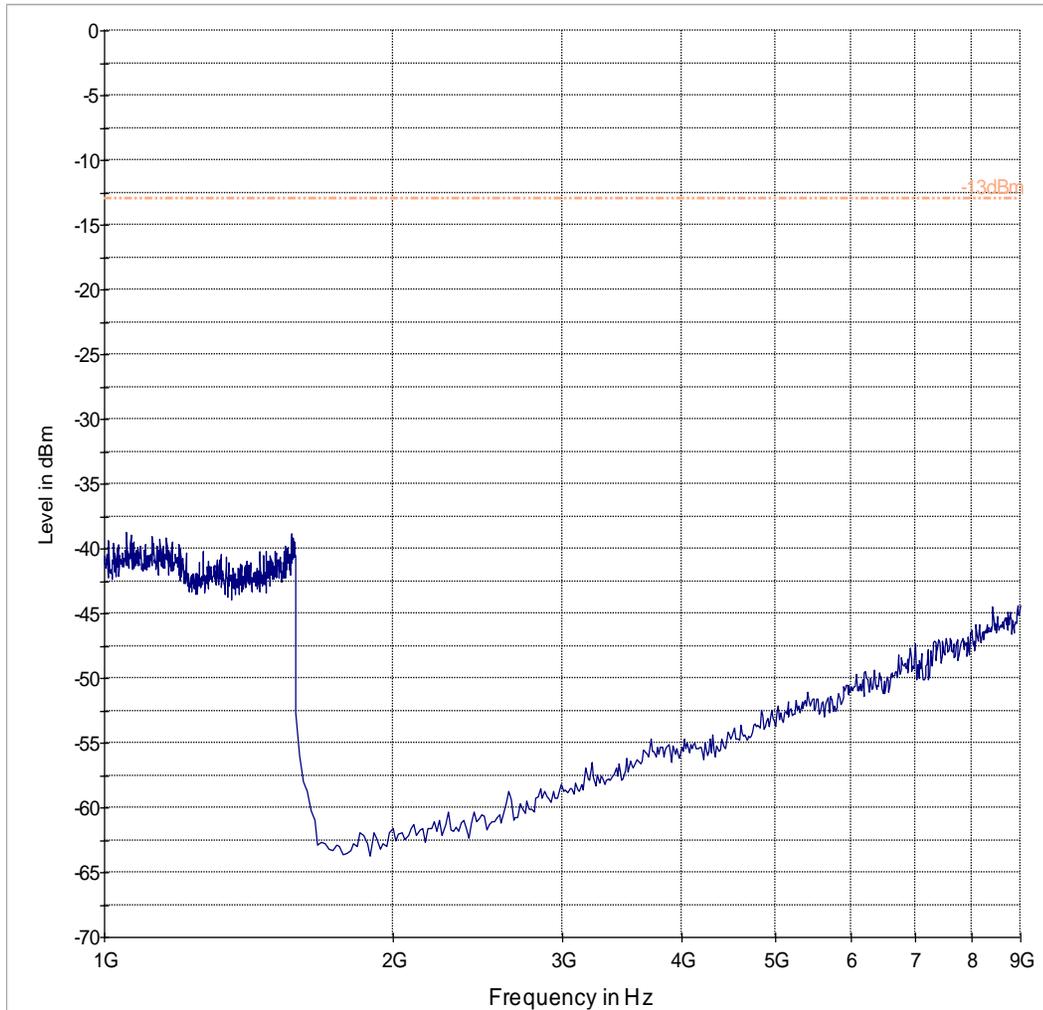
Test results 30M-1GHz

Emission signal above the limit line in the plots is from the Carrier.



----- -13dBm ——— Preview Result 1-PK+ * Data Reduction Result 1 [1]-PK+

Test results 1GHz-9GHz



----- -13dBm ——— Preview Result 1-PK+

6.2.7.3 Test Results

Transmitter Spurious Emission UMTS FDDV

Harmonic	Tx ch-4132 Freq. (MHz)	Level (dBm)	Tx ch-4183 Freq. (MHz)	Level (dBm)	Tx ch-4233 Freq. (MHz)	Level (dBm)
1	826.4	15.80	836.6	14.38	846.6	15.25
2	1652.8	NF	1673.2	NF	1693.2	NF
3	2479.2	NF	2509.8	NF	2539.8	NF
4	3305.6	NF	3346.4	NF	3386.4	NF
5	4132	NF	4183	NF	4233	NF
6	4958.4	NF	5019.6	NF	5079.6	NF
7	5784.8	NF	5856.2	NF	5926.2	NF
8	6611.2	NF	6692.8	NF	6772.8	NF
9	7437.6	NF	7529.4	NF	7619.4	NF
10	8264	NF	8366	NF	8466	NF
NF= Noise Floor Measurement Uncertainty: ±3dB						

6.2.7.4 Measurement Result

Pass.

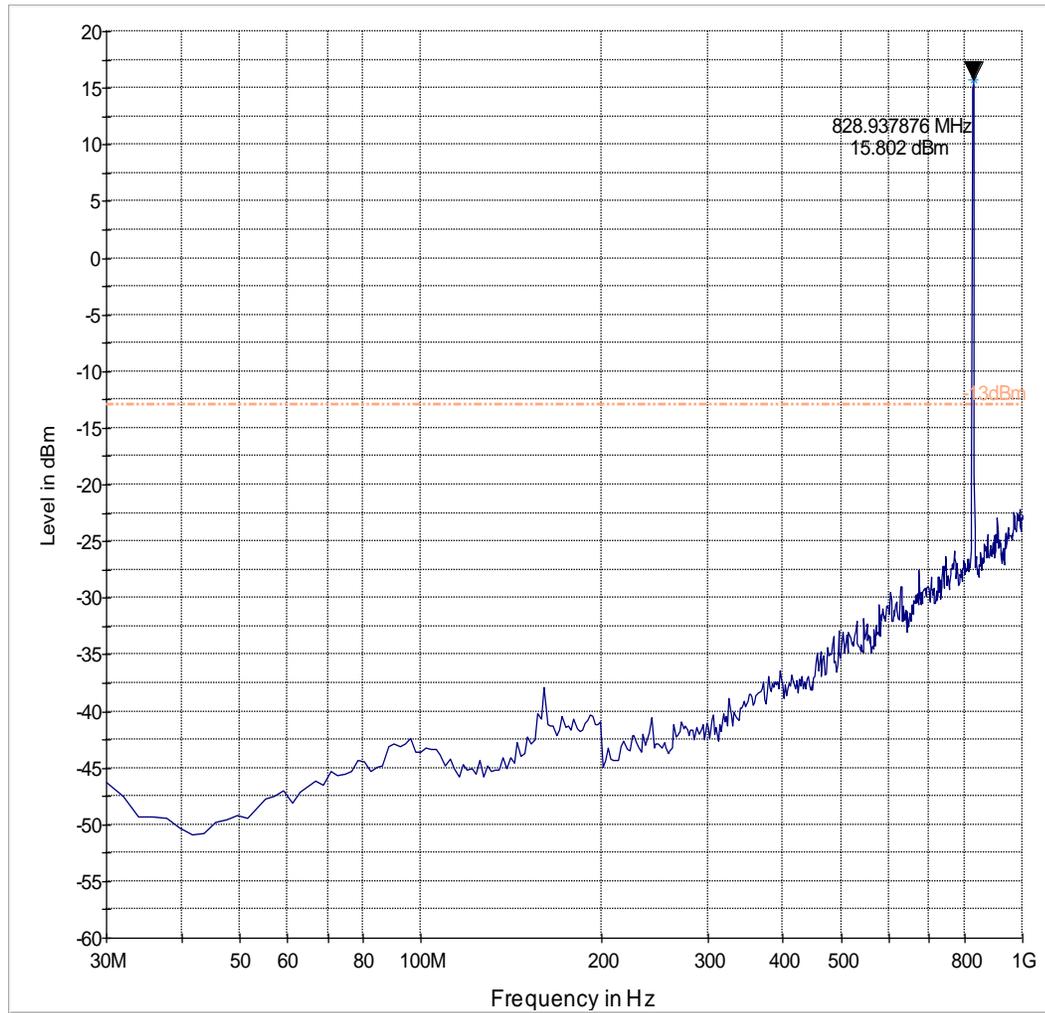
Legend for the plots:

-  -13dBm.LimitLine
-  Preview Result
-  Data Reduction Result
-  Final Measurement Result

Radiated Spurious Emissions (UMTS Band 5) Tx: Low Channel

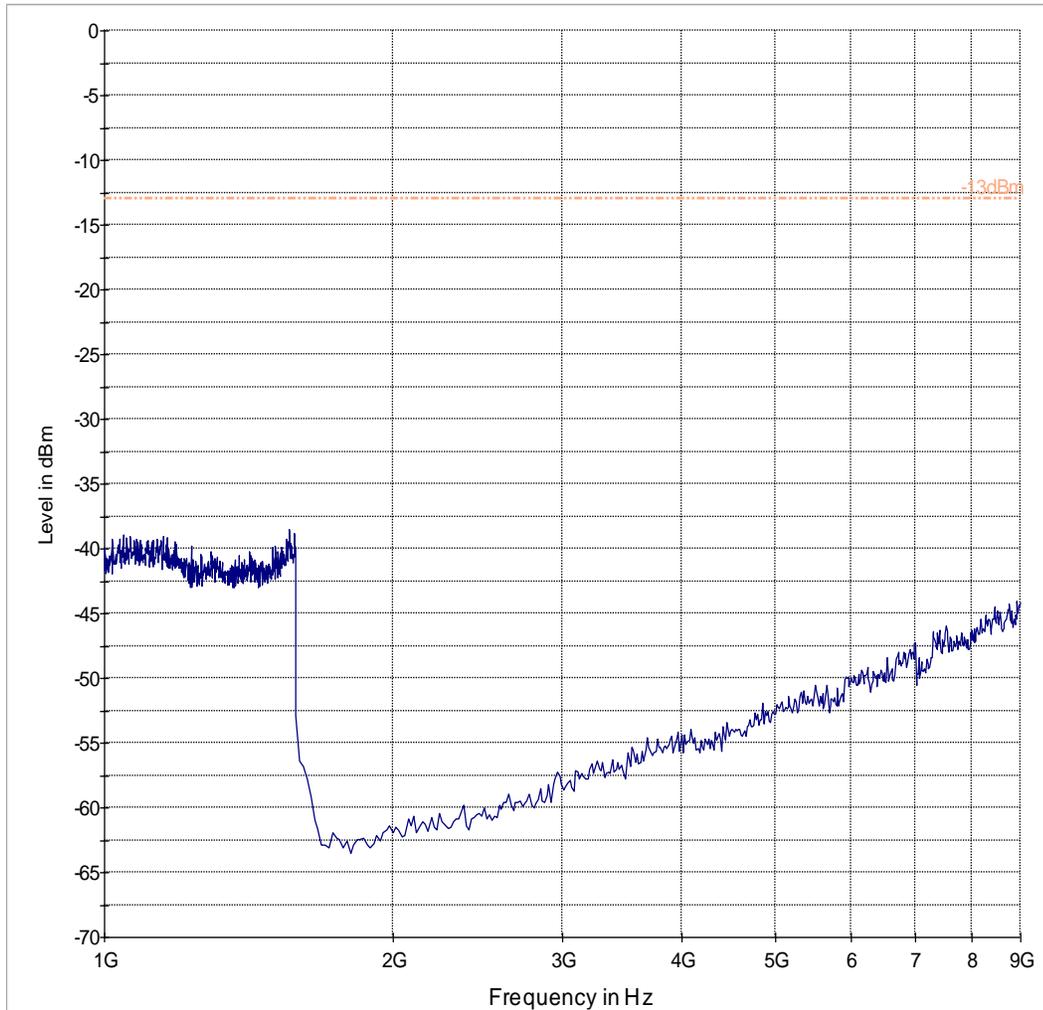
Test results 30M-1GHz

Emission signal above the limit line in the plots is from the Carrier.



----- -13dBm ——— Preview Result 1-PK+ * Data Reduction Result 1 [1]-PK+

Test results 1GHz-9GHz

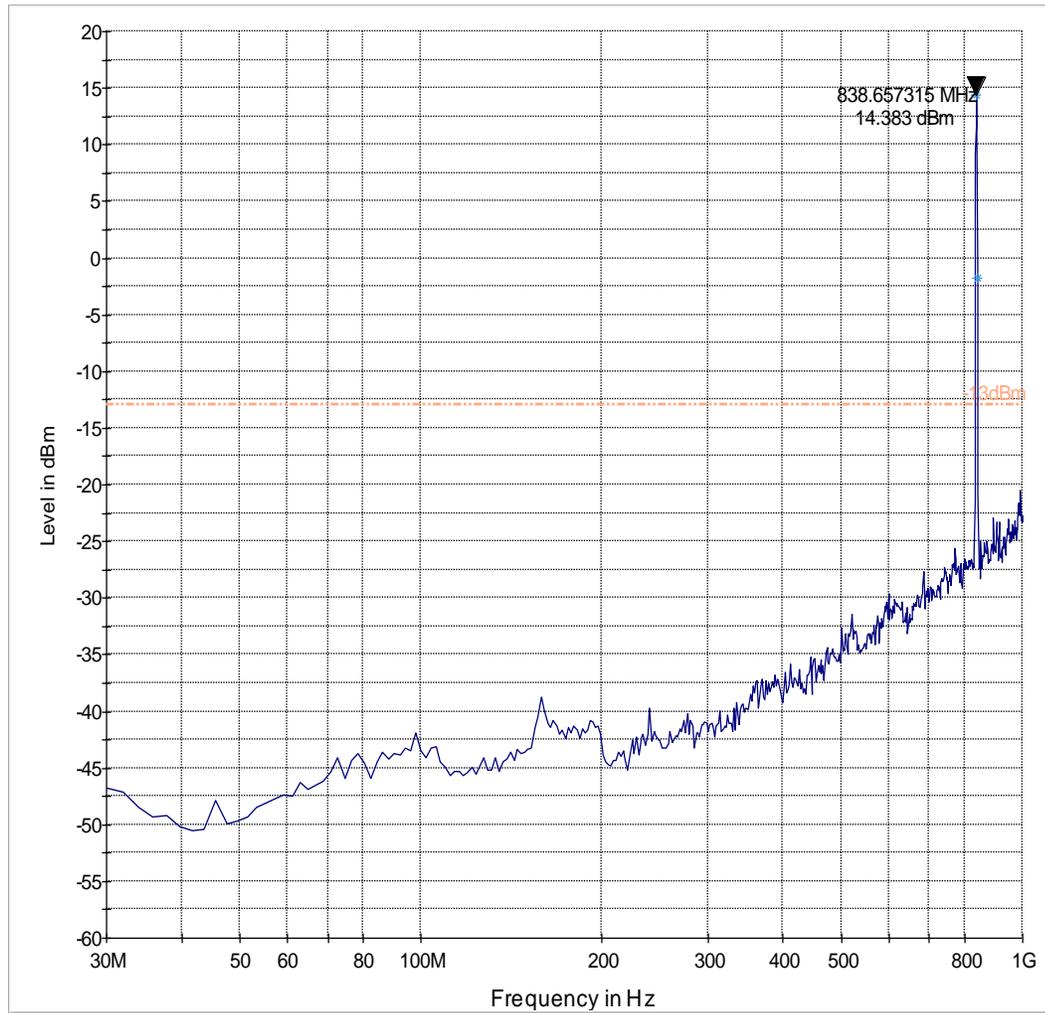


----- -13dBm ——— Preview Result 1-PK+

Radiated Spurious Emissions (UMTS Band 5) Tx: Mid Channel

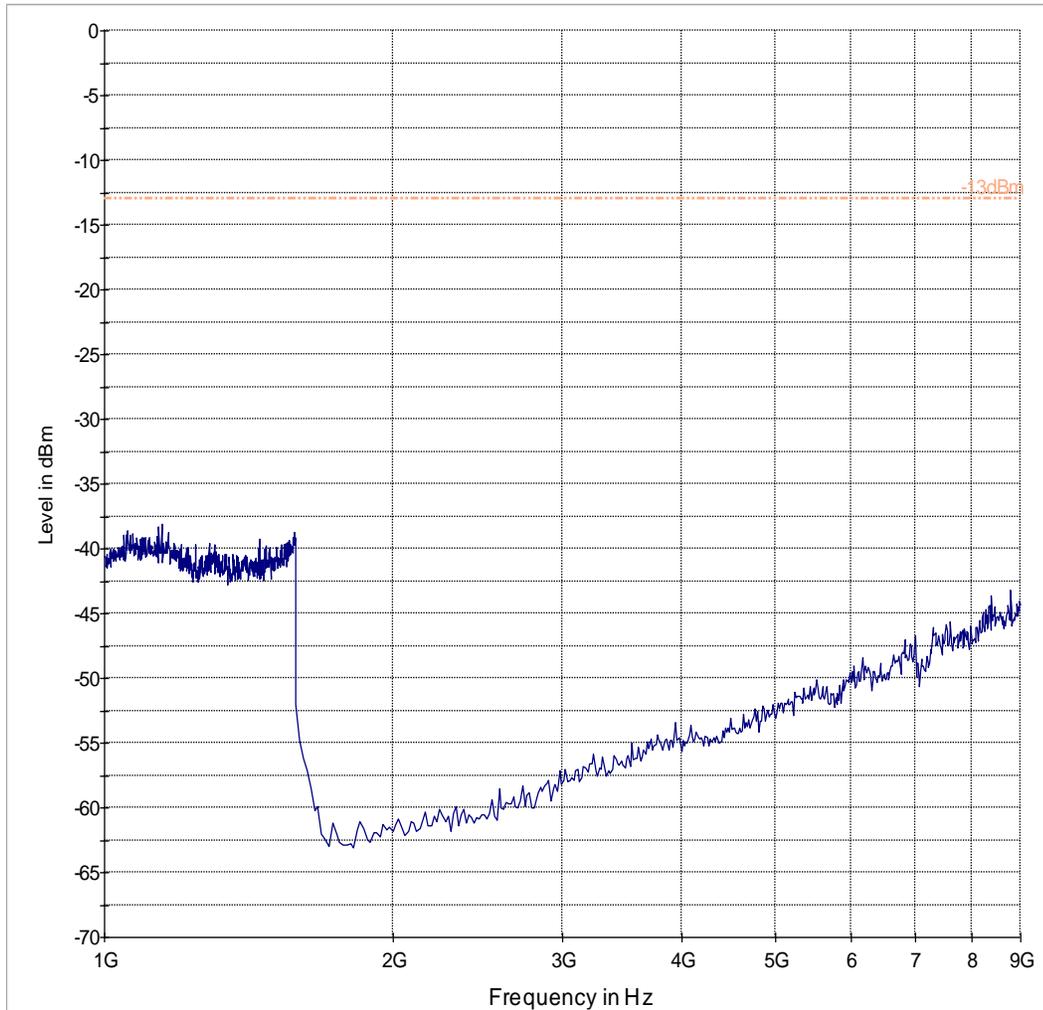
Test results 30M-1GHz

Emission signal above the limit line in the plots is from the Carrier.



----- -13dBm ——— Preview Result 1-PK+ * Data Reduction Result 1 [1]-PK+

Test results 1GHz-9GHz

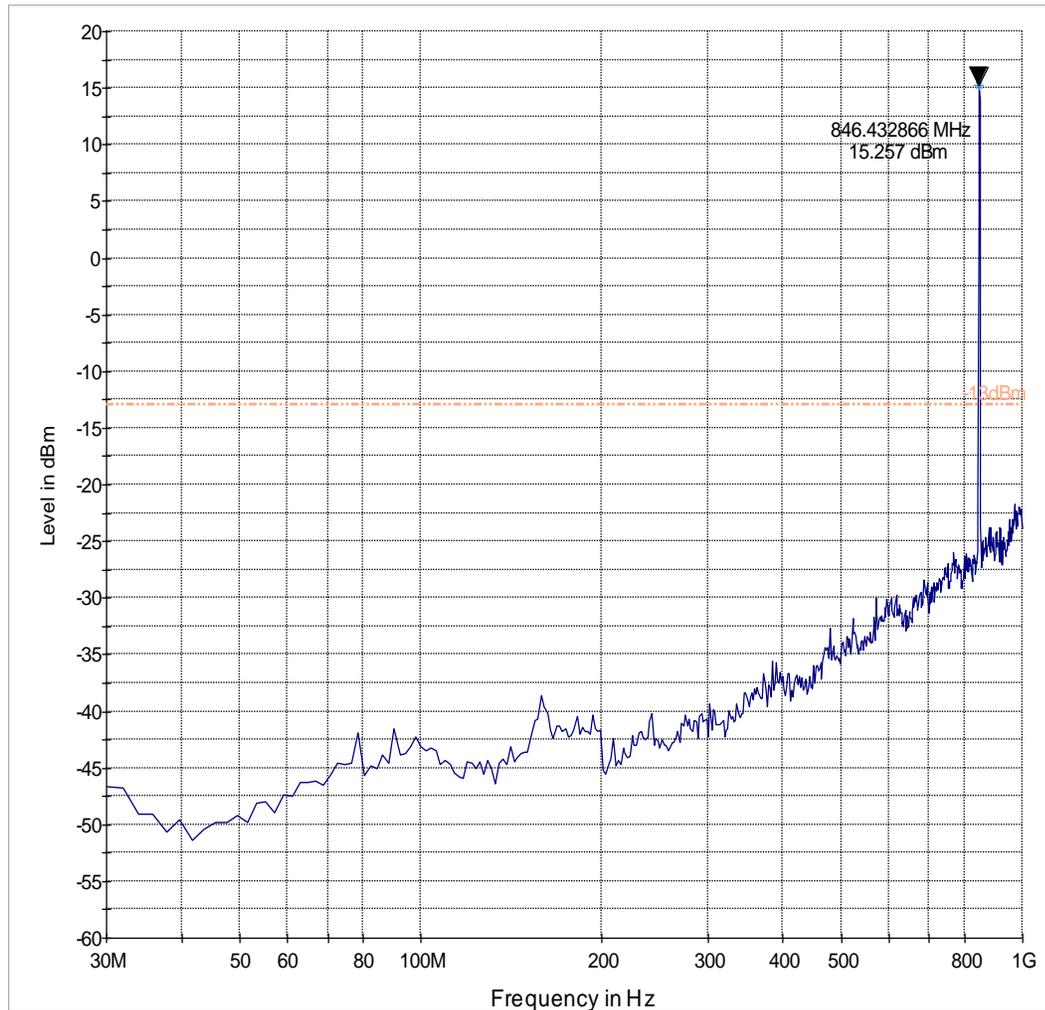


----- -13dBm ——— Preview Result 1-PK+

Radiated Spurious Emissions (UMTS Band 5) Tx: High Channel

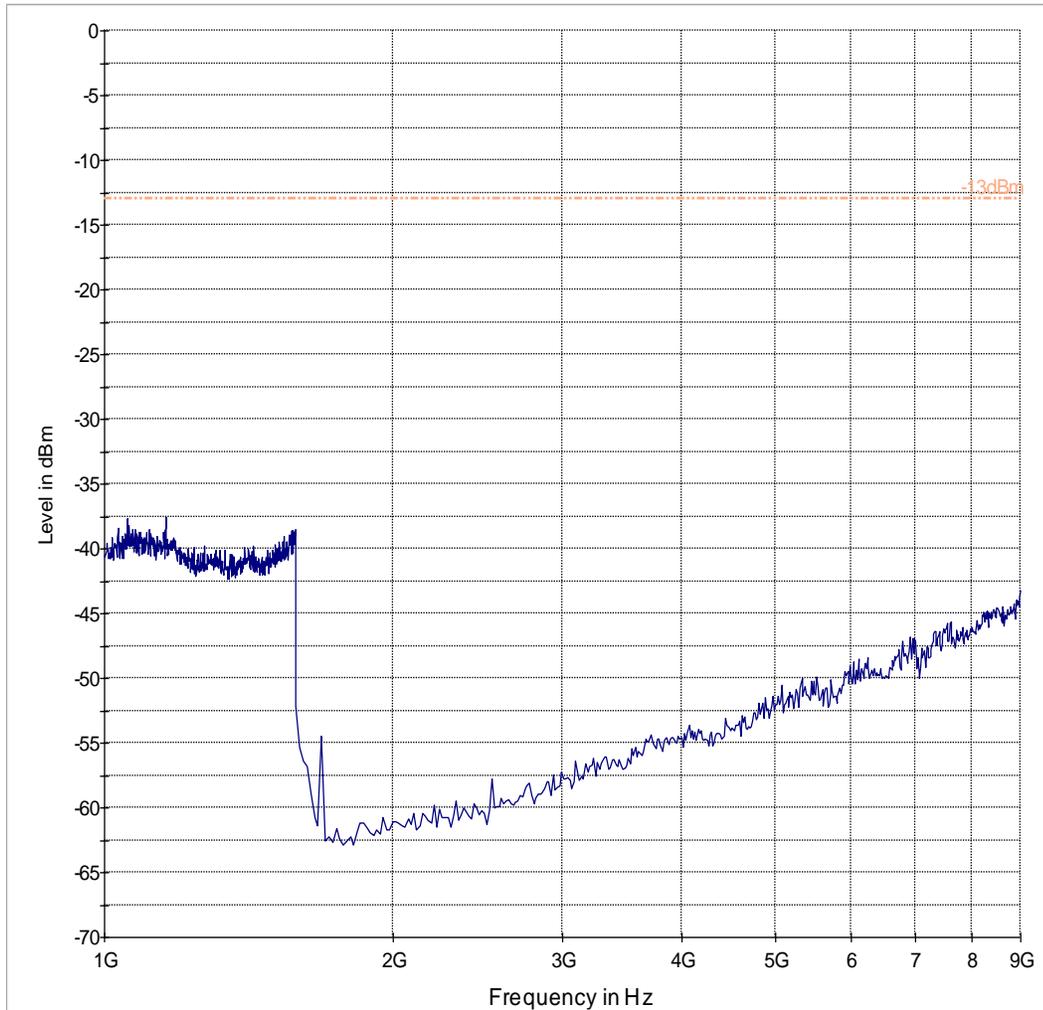
Test results 30M-1GHz

Emission signal above the limit line in the plots is from the Carrier.



----- -13dBm ——— Preview Result 1-PK+ * Data Reduction Result 1 [1]-PK+

Test results 1GHz-9GHz



----- -13dBm ——— Preview Result 1-PK+

6.2.7.5 Test Results

Transmitter Spurious Emission PCS-1900:

Harmonic	Tx ch-512 Freq.(MHz)	Level (dBm)	Tx ch-661 Freq. (MHz)	Level (dBm)	Tx ch-810 Freq. (MHz)	Level (dBm)
1	1850.2	26.06	1880.0	-17.19	1909.8	22.97
2	3700.4	NF	3760	NF	3819.6	NF
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: $\pm 3\text{dB}$						

6.2.7.6 Measurement Result

Pass.

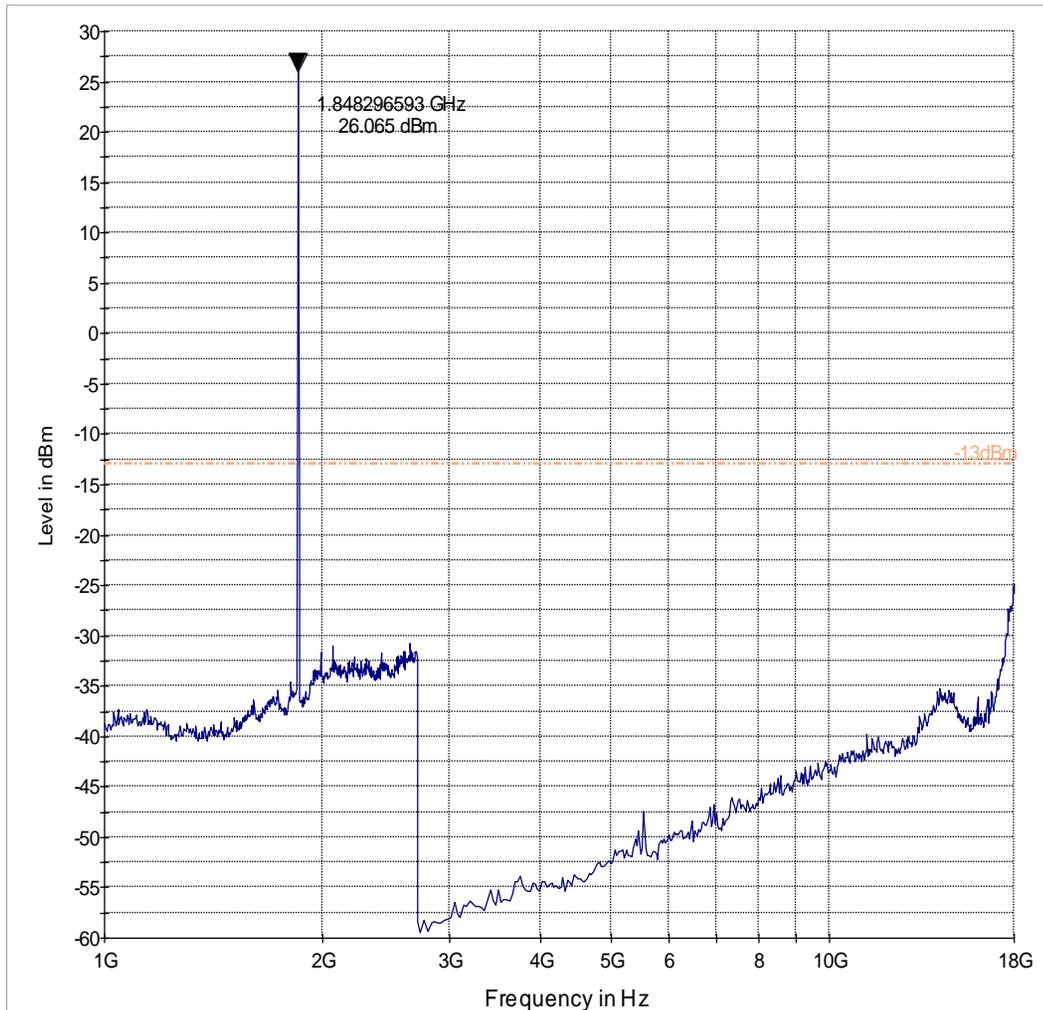
Legend for the plots:

-  -13dBm.LimitLine
-  Preview Result
-  Data Reduction Result
-  Final Measurement Result

Radiated Spurious Emissions (GSM-1900) Tx: Low Channel

Test results 1GHz-18GHz

Emission signal above the limit line in the plots is from the Carrier.

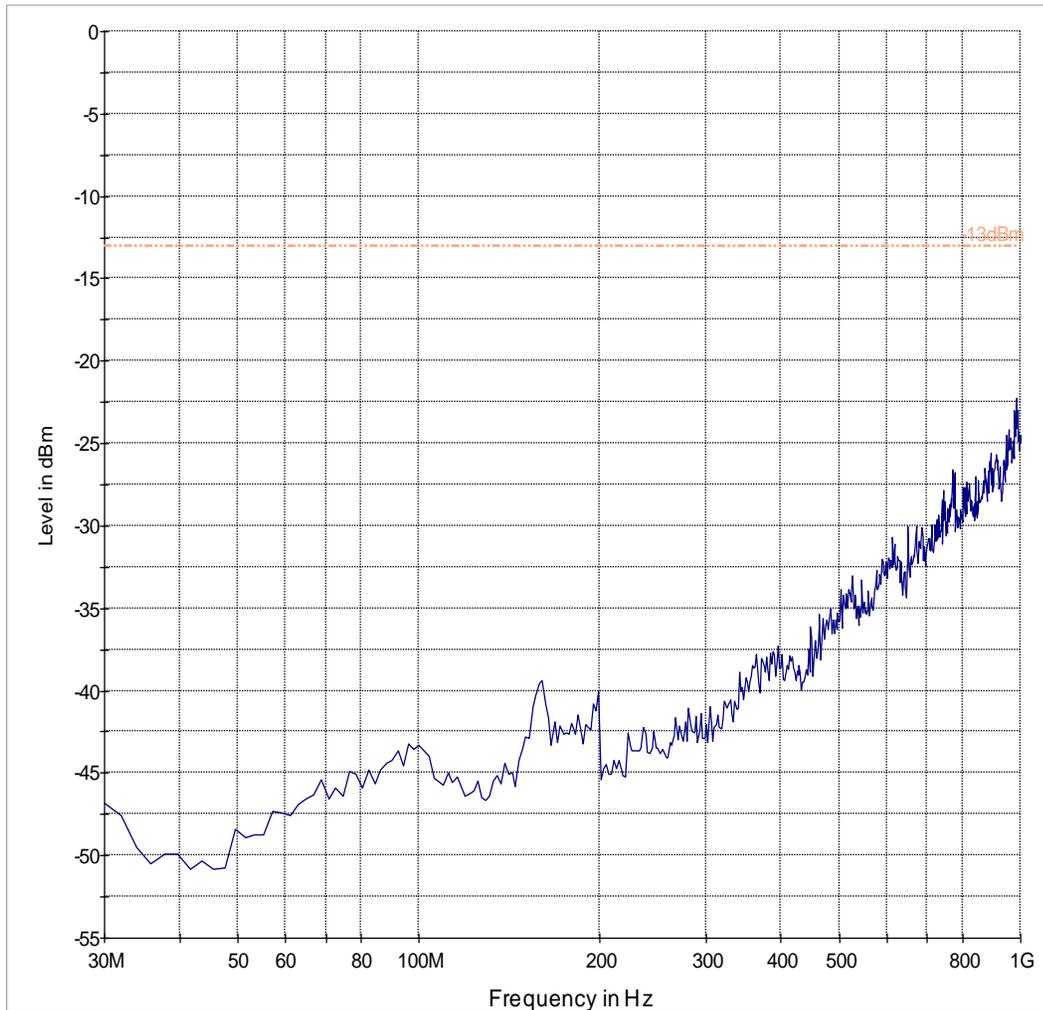


----- -13dBm ——— Preview Result 1-PK+

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

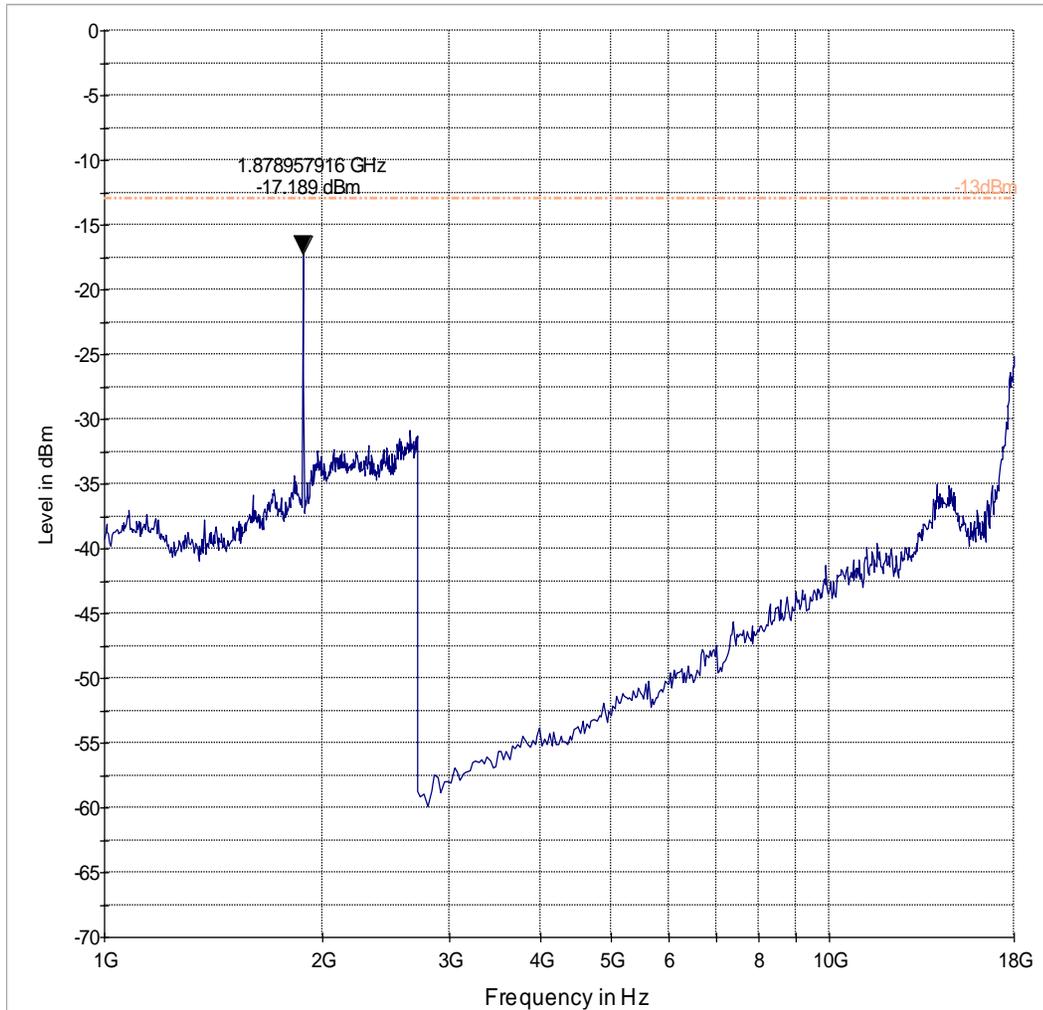
Test results 30M-1GHz

Worst case representation for all channels in this band.



----- -13dBm — Preview Result 1-PK+

Test results 1GHz-18GHz

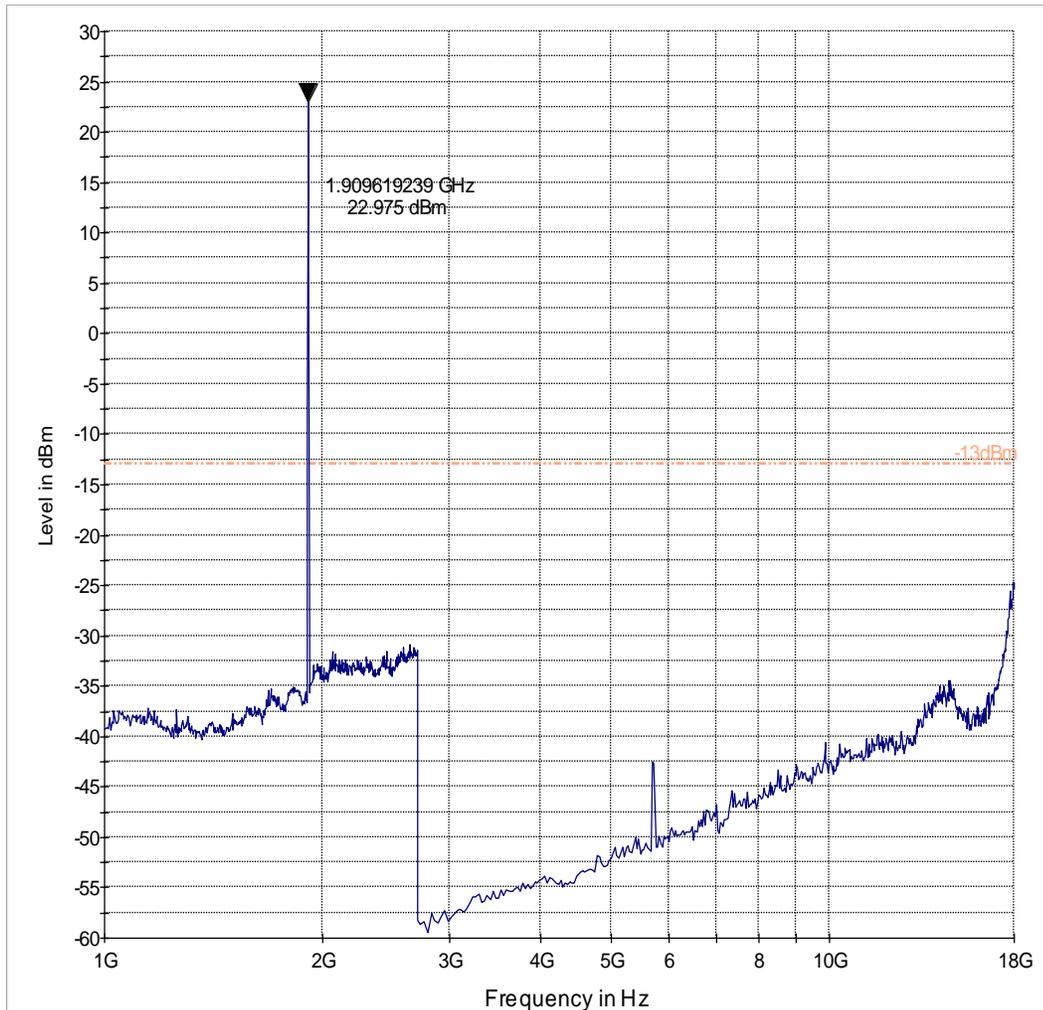


- - - - -13dBm ——— Preview Result 1-PK+

Radiated Spurious Emissions (GSM-1900) Tx: High Channel

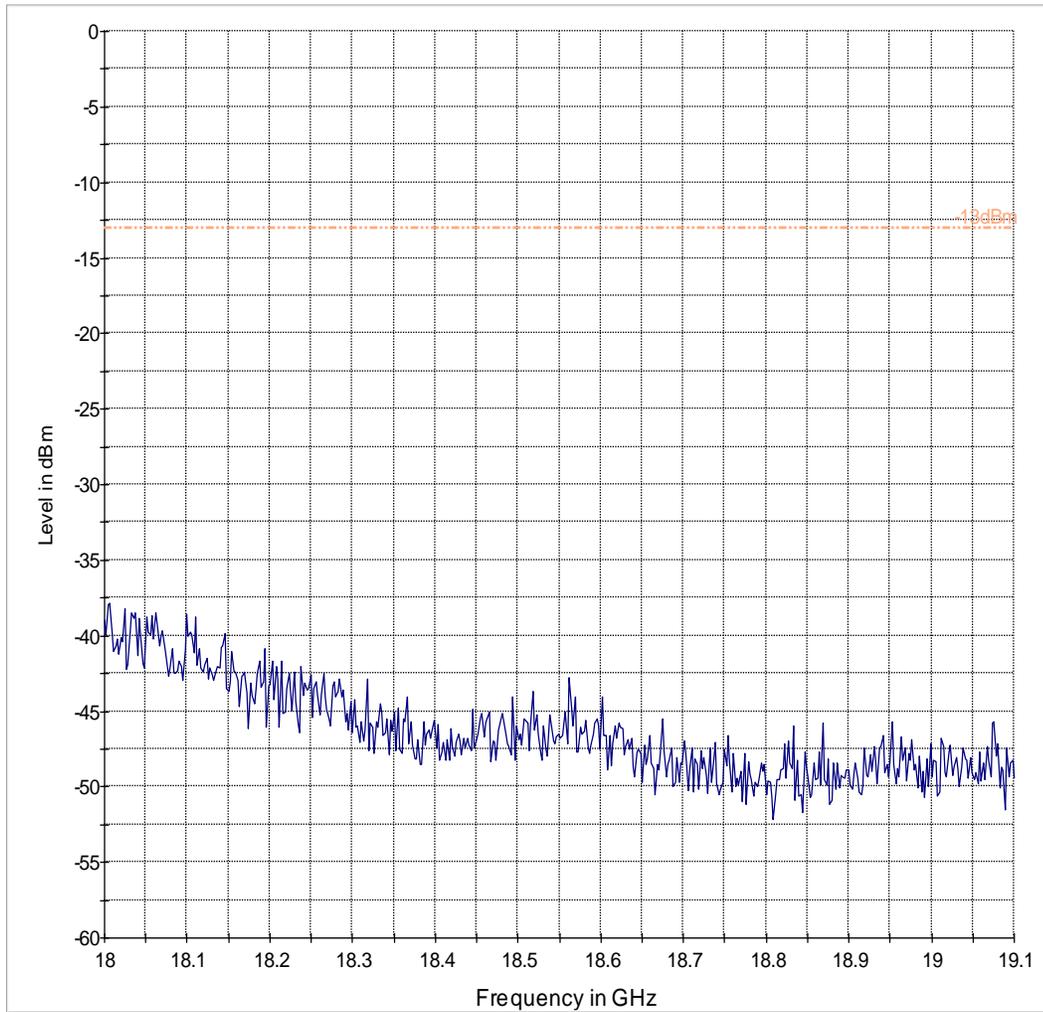
Test results 1GHz-18GHz

Emission signal above the limit line in the plots is from the Carrier.



----- -13dBm ——— Preview Result 1-PK+

Test results 18GHz-19.1GHz Tx: Mid Channel
Worst case representation for all channels in this band.



- - - - -13dBm — Preview Result 1-PK+

6.2.7.7 Test Results

Transmitter Spurious Emission UMTS FDD2:

Harmonic	Tx ch-9262 Freq. (MHz)	Level (dBm)	Tx ch-9400 Freq. (MHz)	Level (dBm)	Tx ch-9538 Freq. (MHz)	Level (dBm)
1	1852.4	19.45	1880.0	19.19	1907.6	18.59
2	3704.8	NF	3760	NF	3815.2	NF
3	5557.2	NF	5640	NF	5722.8	NF
4	7409.6	NF	7520	NF	7630.4	NF
5	9262	NF	9400	NF	9538	NF
6	11114.4	NF	11280	NF	11445.6	NF
7	12966.8	NF	13160	NF	13353.2	NF
8	14819.2	NF	15040	NF	15260.8	NF
9	16671.6	NF	16920	NF	17168.4	NF
10	18524	NF	18800	NF	19076	NF
NF= Noise Floor Measurement Uncertainty: ±3dB						

6.2.7.8 Measurement Result

Pass.

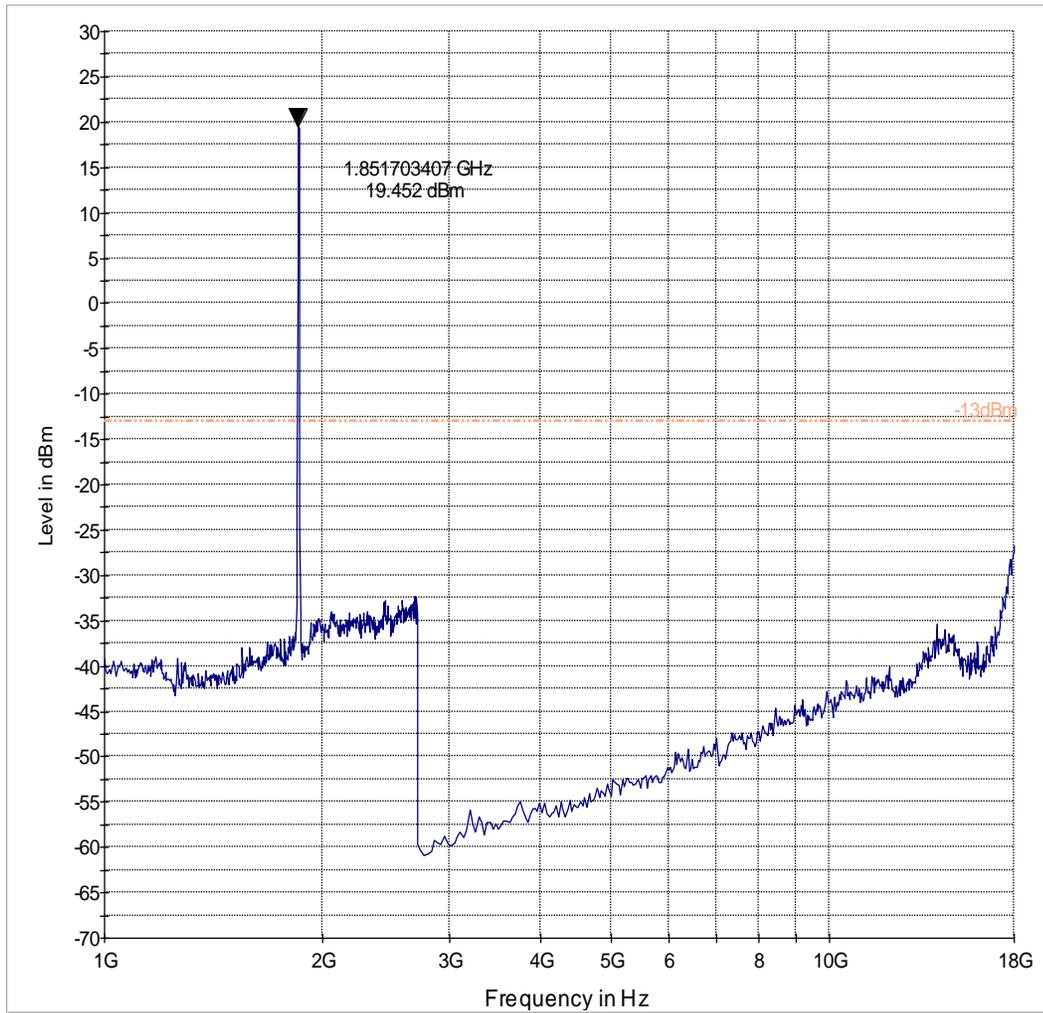
Legend for the plots:

-  -13dBm.LimitLine
-  Preview Result
-  Data Reduction Result
-  Final Measurement Result

Radiated Spurious Emissions (UMTS Band 2) Tx: Low Channel

Test results 1GHz-18GHz

Emission signal above the limit line in the plots is from the Carrier.

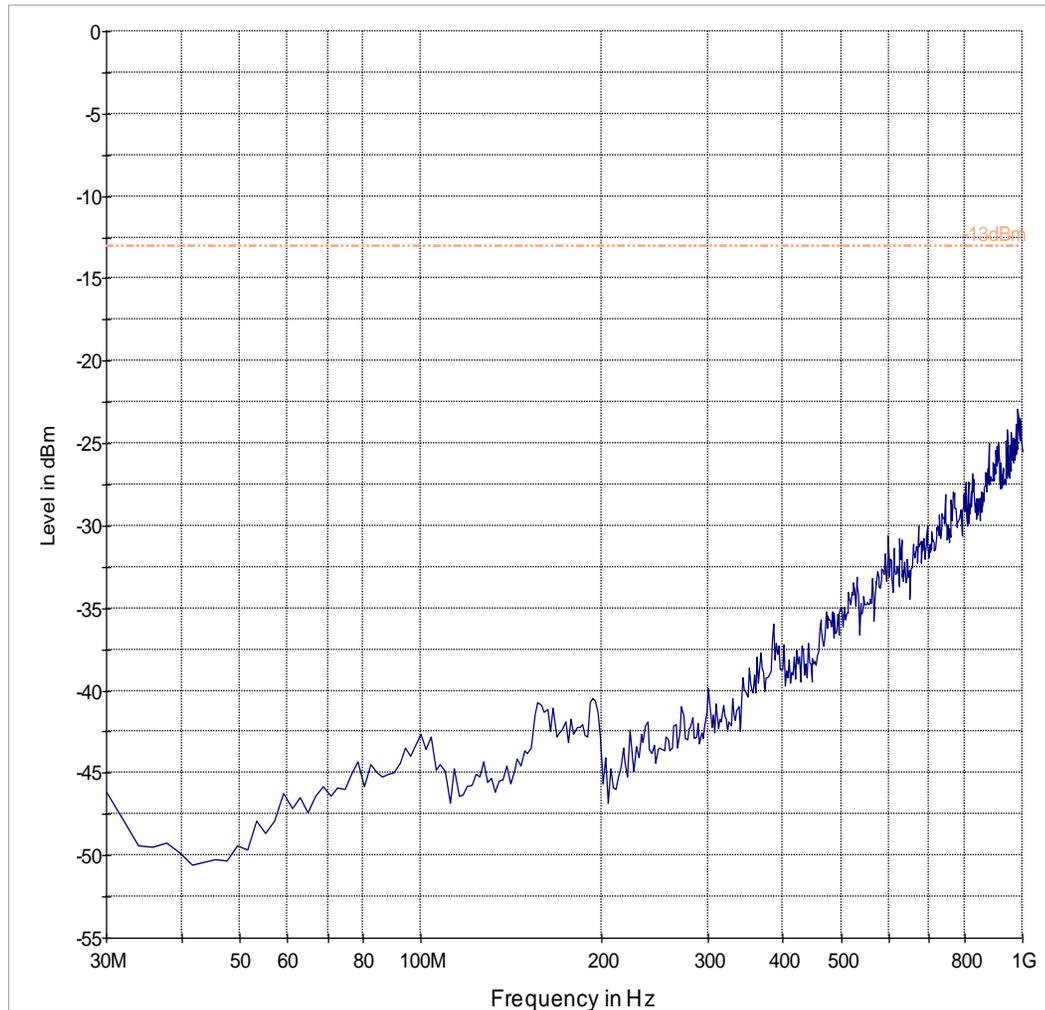


----- -13dBm ——— Preview Result 1-PK+

Radiated Spurious Emissions (UMTS Band 2) Tx: Mid Channel

Test results 30M-1GHz

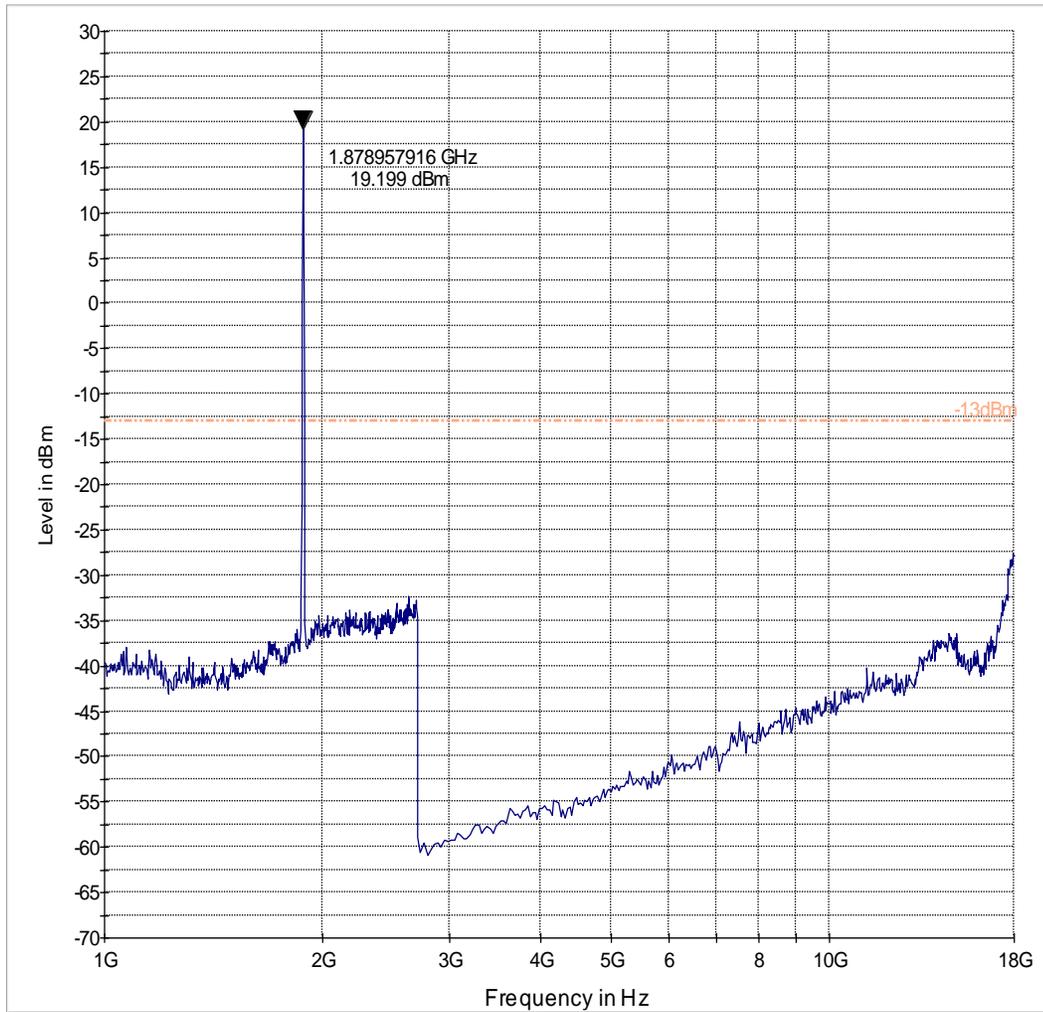
Worst case representation for all channels in this band.



----- -13dBm — Preview Result 1-PK+

Test results 1GHz-18GHz

Emission signal above the limit line in the plots is from the Carrier.

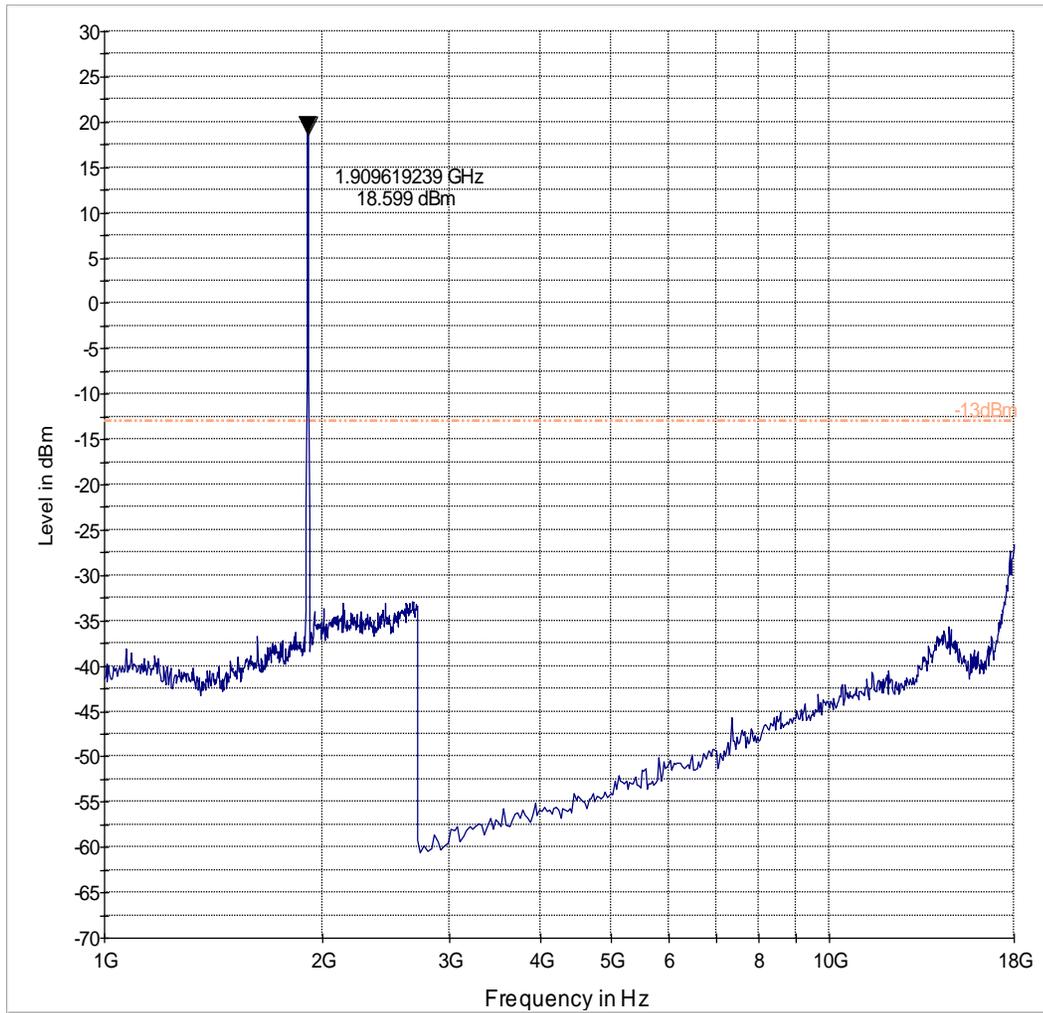


----- -13dBm — Preview Result 1-PK+

Radiated Spurious Emissions (UMTS Band 2) Tx: High Channel

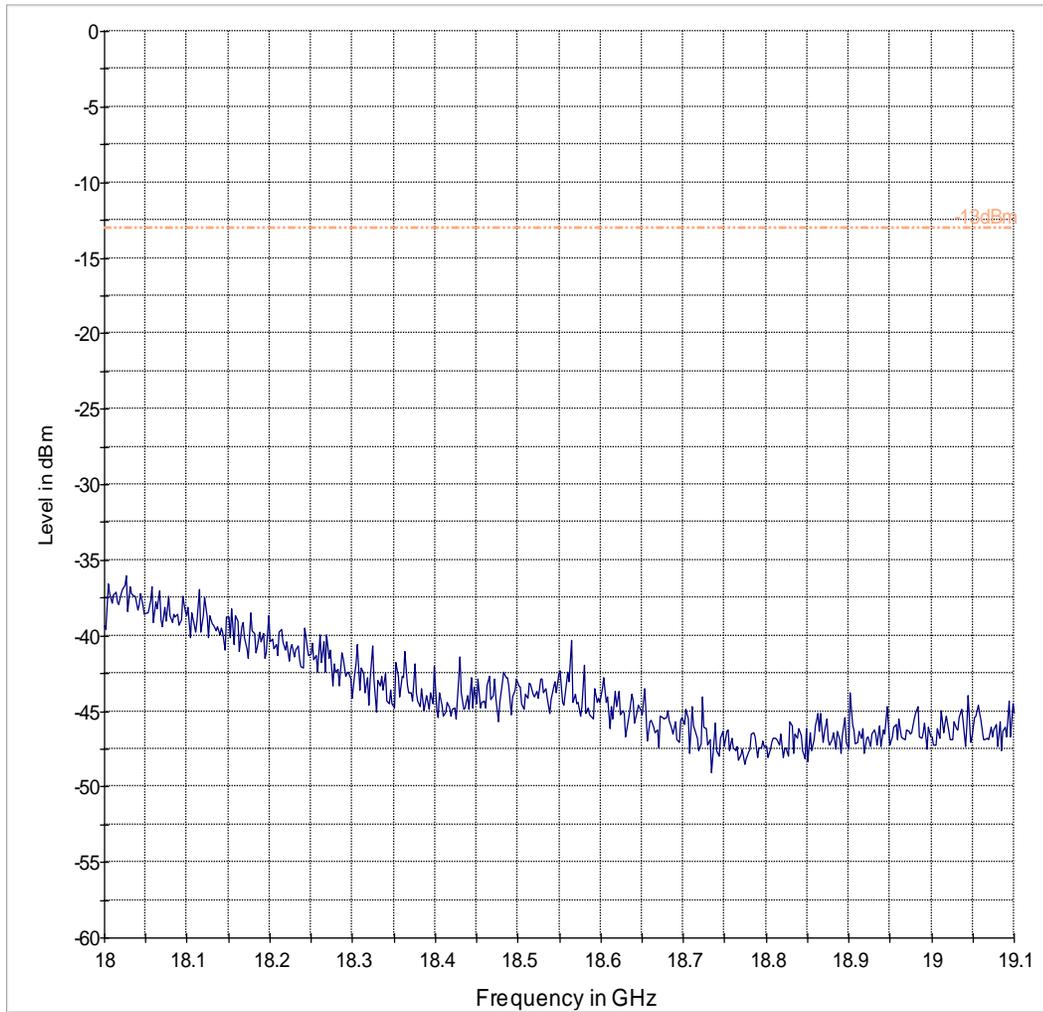
Test results 1GHz-18GHz

Emission signal above the limit line in the plots is from the Carrier.



----- -13dBm ——— Preview Result 1-PK+

Test results 18GHz-19.1GHz Tx: Mid Channel
Worst case representation for all channels in this band.



- - - - -13dBm — Preview Result 1-PK+

6.2.7.9 Test Results

Transmitter Spurious Emission UMTS FDD4:

Harmonic	Tx ch-1312 Freq. (MHz)	Level (dBm)	Tx ch-1413 Freq. (MHz)	Level (dBm)	Tx ch-1513 Freq. (MHz)	Level (dBm)
1	1712.4	17.76	1732.6	15.61	1752.6	16.38
2	3424.8	NF	3465.2	NF	3505.2	NF
3	5137.2	NF	5197.8	NF	5257.8	NF
4	6849.6	NF	6930.4	NF	7010.4	NF
5	8562	NF	8663	NF	8763	NF
6	10274.4	NF	10395.6	NF	10515.6	NF
7	11986.8	NF	12128.2	NF	12268.2	NF
8	13699.2	NF	13860.8	NF	14020.8	NF
9	15411.6	NF	15593.4	NF	15773.4	NF
10	17124	NF	17326	NF	17526	NF
NF= Noise Floor Measurement Uncertainty: ±3dB						

6.2.7.10 Measurement Result

Pass.

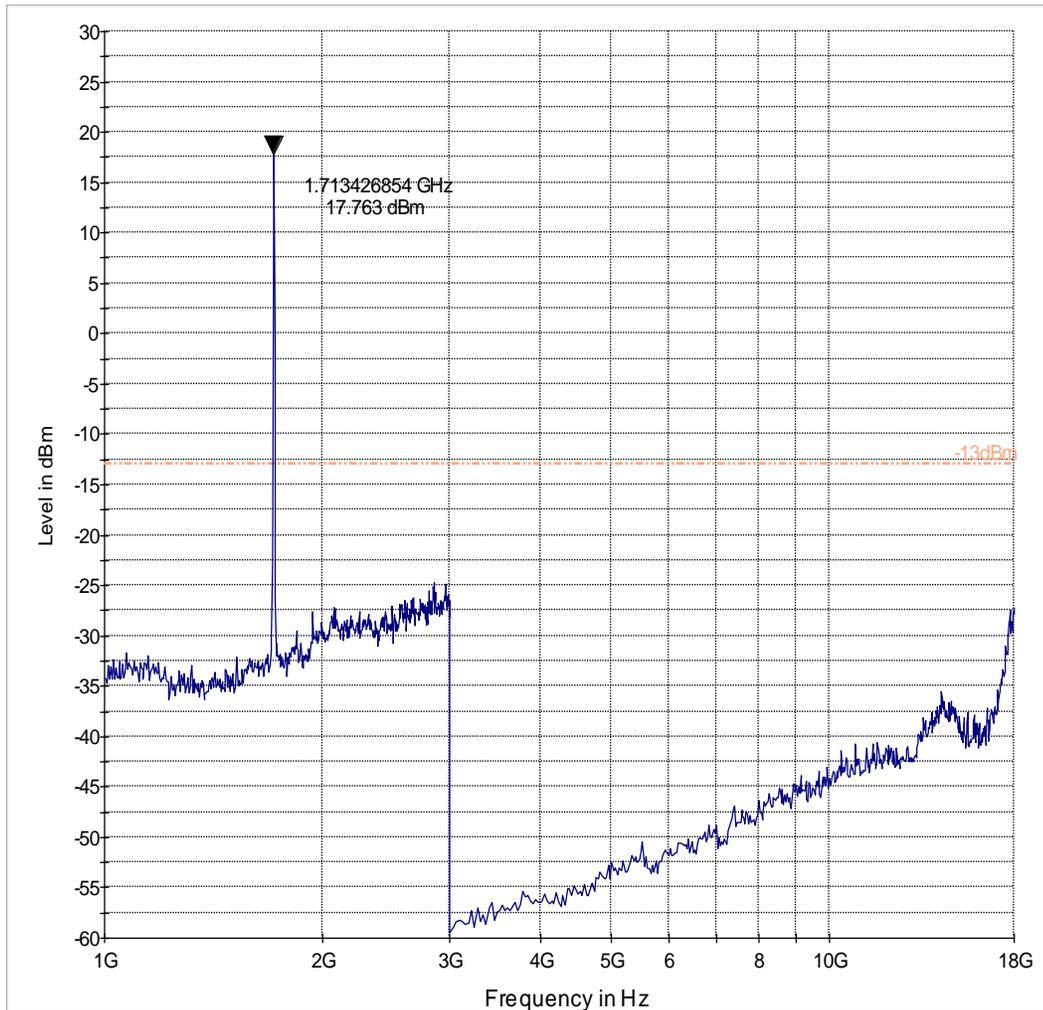
Legend for the plots:

-  -13dBm.LimitLine
-  Preview Result
-  Data Reduction Result
-  Final Measurement Result

Radiated Spurious Emissions (UMTS Band 4) Tx: Low Channel

Test results 1GHz-18GHz

Emission signal above the limit line in the plots is from the Carrier.

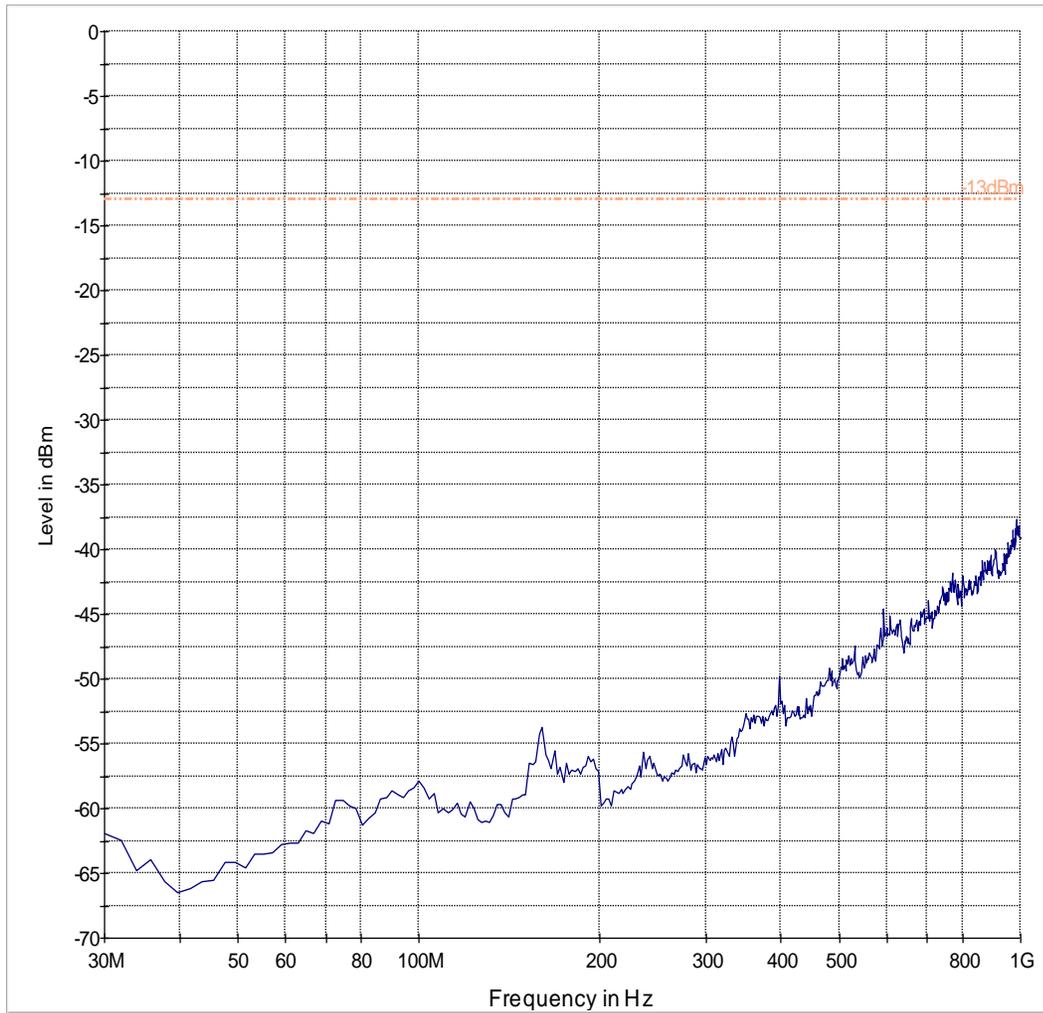


----- -13dBm ——— Preview Result 1-PK+

Radiated Spurious Emissions (UMTS Band 4) Tx: Mid Channel

Test results 30M-1GHz

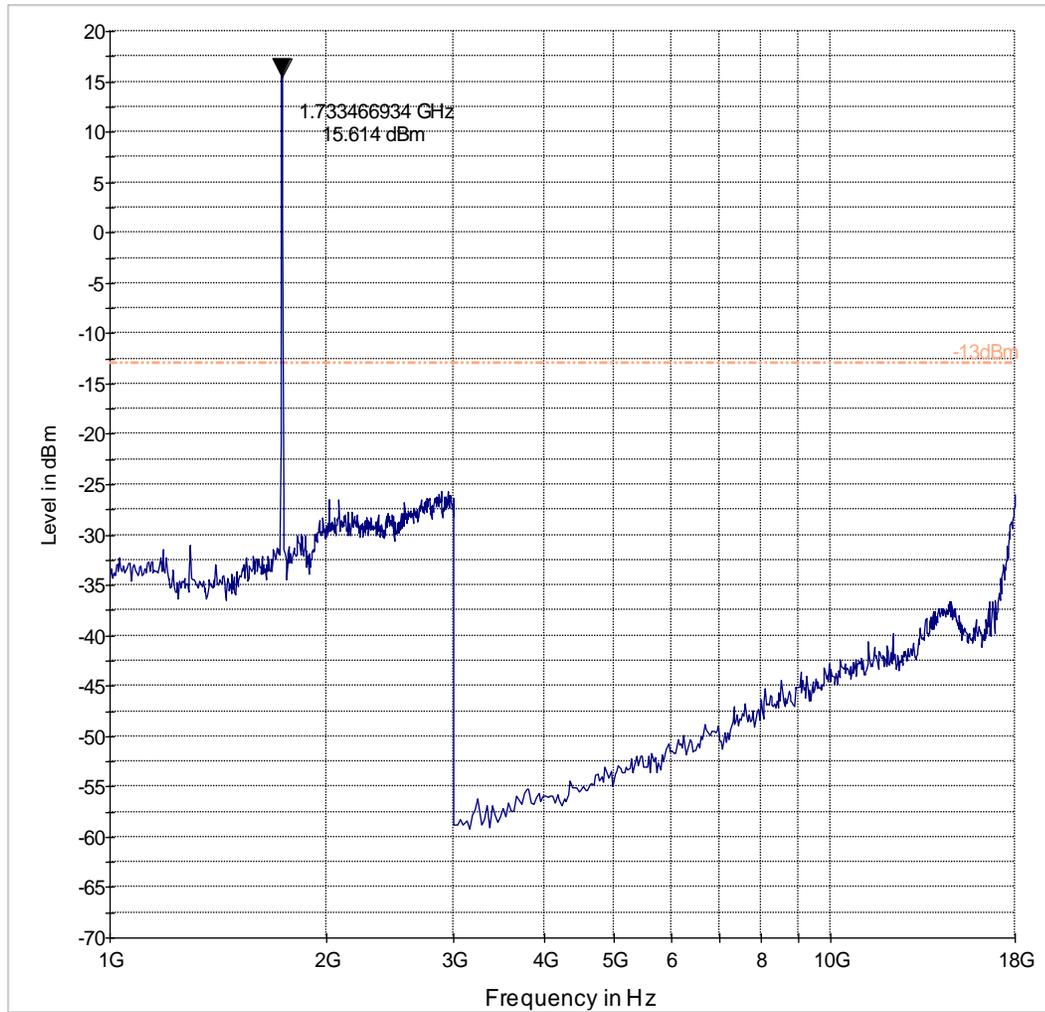
Worst case representation for all channels in this band.



----- -13dBm — Preview Result 1-PK+

Test results 1GHz-18GHz

Emission signal above the limit line in the plots is from the Carrier.

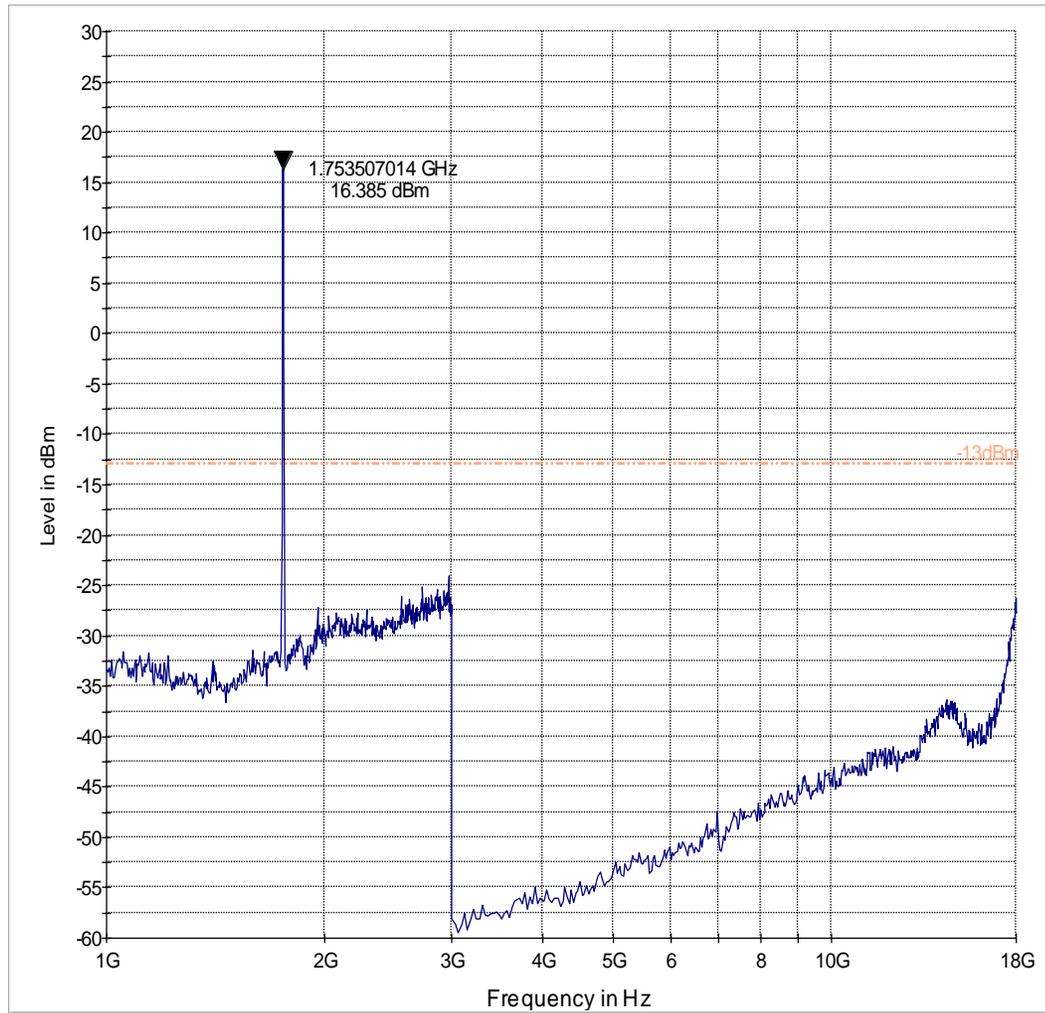


-13dBm Preview Result 1-PK+

Radiated Spurious Emissions (UMTS Band 2) Tx: High Channel

Test results 1GHz-18GHz

Emission signal above the limit line in the plots is from the Carrier.

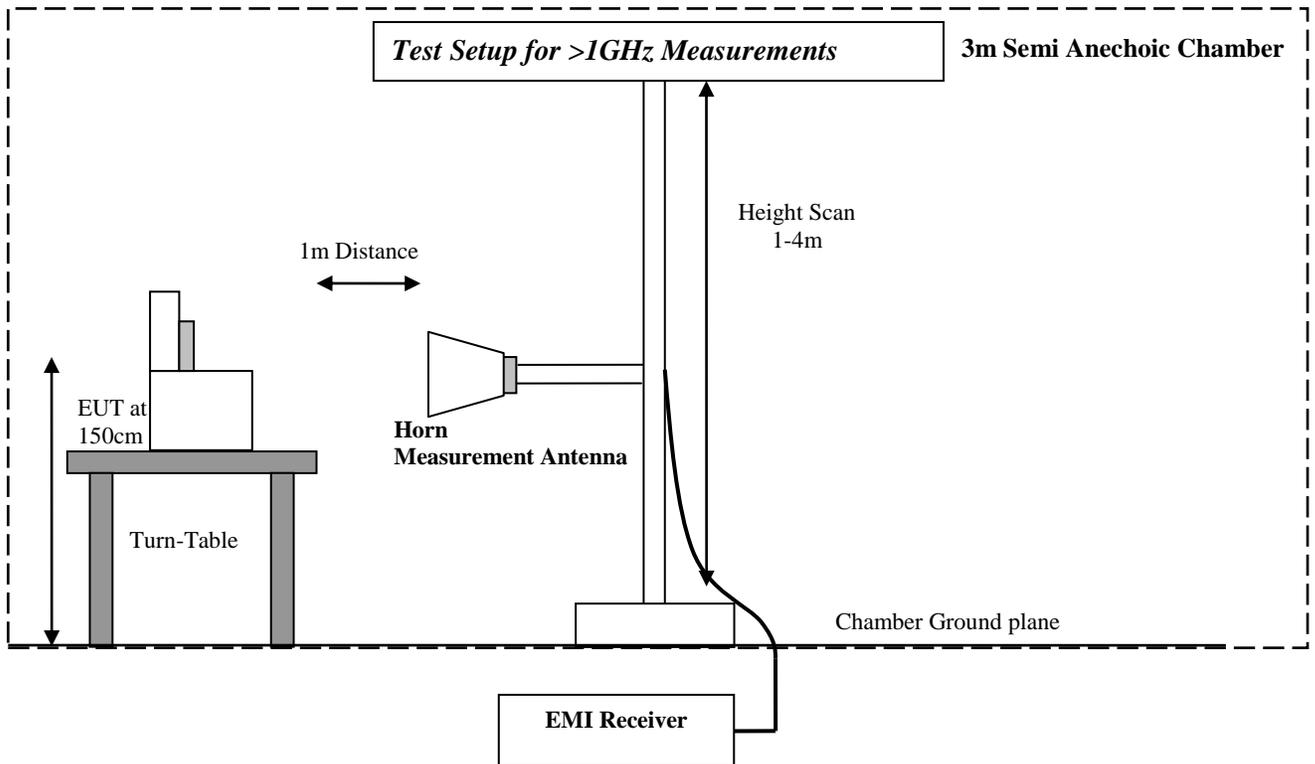
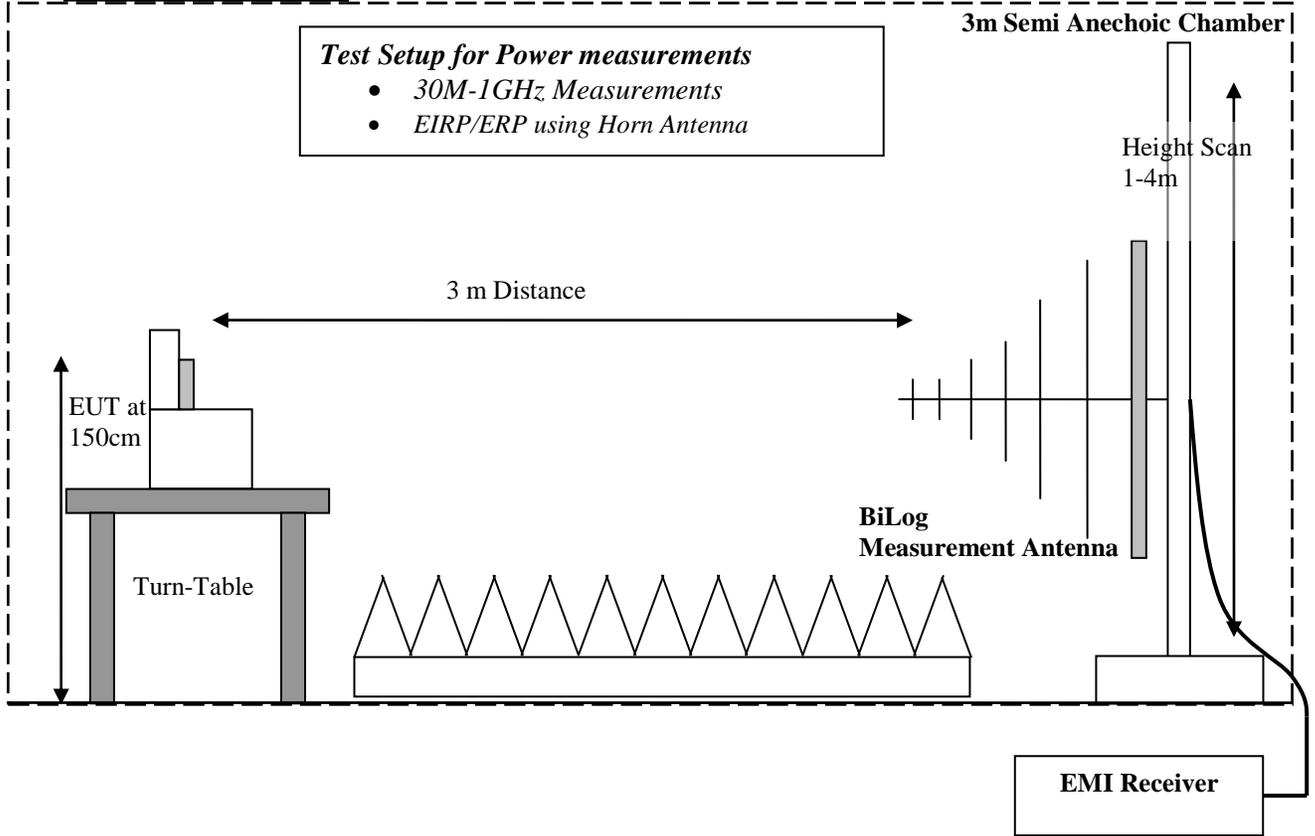


----- -13dBm ——— Preview Result 1-PK+

7 Test Equipment and Ancillaries used for tests

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
Radio Communication Tester	CMU 200	Rohde & Schwarz	101821	May 2011	2 Years
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2011	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	May 2011	2 Years
Loop Antenna	6512	EMCO	00049838	Aug 2011	3 years
Biconilog Antenna	3141	EMCO	0005-1186	Apr 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Apr 2012	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Sep 2011	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
6GHz High Pass Filter	HPM50106	Microtronics	001	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
LISN	50-25-2-08	FCC	08014	June 2011	2 Years
Power Smart Sensor	R&S	NRP-Z81	100161	May 2011	2 Years
Multimeter	MM200	Klein	N/A	Apr 2011	2 Years
Temp Hum Logger	TM320	Dickson	03280063	Mar 2012	1 Year
Temp Hum Logger	TM325	Dickson	5285354	Mar 2012	1 Year

8 Test Setup Diagrams



9 Revision History

Date	Report Name	Changes to report	Report prepared by
2012-07-02	EMC_GARMI_041_12001_WWAN	First Version	Tunji Yusuf