

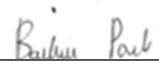


Report Reference ID:	278614-3TRFWL
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Test specification:	Title 47 – Telecommunication Chapter I – Federal Communications Commission Subchapter D – Safety and special radio services Part 90 – Private land mobile services Subpart I – General technical standards
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Applicant:	TEKO Telecom Srl. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO) (Italy)
Apparatus:	Remote Unit
Model:	TRL7S8SC8A19AW23AS
FCC ID:	XM2-EP23

Testing laboratory:	<b>Nemko Italy Spa</b> Via del Carroccio, 4 20853 Biassono (MB) – Italy Telephone: +39 039 2201201 Facsimile: +39 039 2201221
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	Name and title	Date
Tested by:	 G. Curioni, Wireless/EMC Specialist	2015-03-11
Reviewed by:	 P. Barbieri, Wireless/EMC Specialist	2015-03-11

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## Section 1: Report summary

This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Spa.

### Test specification:

FCC Part 90 Private land mobile services

Subpart I – General technical standards

Compliance status:	Complies
Exclusions:	None
Non-compliances:	None
Report release history:	Original release
Test location:	Nemko Spa Via Del Carroccio, 4 – 20853 Biassono (MB) - Italy
Registration number:	481407 (10 m Semi anechoic chamber)

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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## Section 2: Equipment under test

### 2.1 Identification of equipment under test (EUT)

The following information identifies the EUT under test:

Type of equipment:	Remote Unit
Product marketing name:	Teko Telecom Srl
Model number:	TRL7S8SC8A19AW23AS
Serial number:	140829001
Nemko sample number:	-----
FCC ID:	XM2-EP23
Date of receipt:	2015-03-09



## 2.2 Accessories and support equipment

The following information identifies accessories used to exercise the EUT during testing:

No other FCC-ID equipment are used to exercise the EUT during testing

### Item # 1

Type of equipment:	Master Unit - Subrack
Brand name:	Teko Telecom srl
Model name or number:	SUB-TRX-PSU
Serial number:	101083001
Nemko sample number:	-----
Connection port:	-----
Cable length and type:	-----

### Item # 2

Type of equipment:	Master Unit – Management Module
Brand name:	Teko Telecom srl
Model name or number:	TSPV-R
Serial number:	081900043
Nemko sample number:	-----
Connection port:	LAN port
Cable length and type:	-----

### Item # 3

Type of equipment:	Master Unit – Optical Module
Brand name:	Teko Telecom srl
Model name or number:	TTRU4W-S-M
Serial number:	110679007
Nemko sample number:	-----
Connection port:	DL/UL RF connector (to connect to the base station) Optical port (to connect to remote unit)
Cable length and type:	-----

### Item # 4

Type of equipment:	Master Unit – Power Supply
Brand name:	Teko Telecom srl
Model name or number:	TPSU/AC
Serial number:	100012286
Nemko sample number:	-----
Connection port:	-----
Cable length and type:	-----



Section 2: Equipment under test, continued

## 2.3 EUT description

See confidential block diagram and operational description

## 2.4 Technical specifications of the EUT

Operating band:	Down Link: 862–869 MHz, Up Link: 817-824 MHz
Operating frequencies:	Wideband
Modulation type:	iDEN, GSM, EDGE, CDMA, WCDMA, LTE (QAM and QPSK)
Occupied bandwidth:	Standard
Channel spacing:	Standard
Emission designator:	iDEN: D7W GSM and EDGE: GXW; CDMA, WCDMA: F9W, LTE: D7W
RF Output	Down Link: 31dBm (1,25W) Up Link: N.A. (The EUT does not transmit over the air in the up-link direction)
Gain	Down Link: 36dB Up Link: N.A. (The EUT does not transmit over the air in the up-link direction)
Antenna data:	No antenna provided
Antenna type:	No antenna provided External Antenna (Equipment that has an external 50 Ω RF connector)
Power source	100-240 Vac

## Section 2: Equipment under test, continued

### 2.5 EUT setup diagram

In this system, Remote Unit is the EUT. Master Unit includes only management module and optical module (to convert RF signal in optical signal in down link direction and viceversa optical signal in RF signal in up link direction). As described in "Operational description", master unit is connected directly to base station, so the system doesn't use another equipment (under another FCC ID) to exercise the EUT. Signal generator is linked directly to the RF connector of optical module in the Master Unit.

#### Test setup for output power, occupied bandwidth, spurious emissions:



#### Procedure

Connect the signal modulated generator to the input of the EUT, so that the EUT works at the max gain. Raise the input level to the EUT until reach the maximum output power. Connect the spectrum analyzer to the RF output connector of the EUT.

### 2.6 Operation of the EUT during testing

In down-link direction, normal working at max gain with max RF power output

### 2.7 Modifications incorporated in the EUT

None

There were no modifications performed to the EUT during this assessment

## Section 3: Test conditions

### 3.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

### 3.2 Test conditions, power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa  When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.
Power supply range:	The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$ , for which the equipment was designed.

## Section 3: Test conditions, continued

## 3.3 Measurement uncertainty

Nemko S.p.A. measurement uncertainty has been calculated using the standard CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modeling – Uncertainty in EMC measurements". All calculations can be found in Nemko S.p.A. document WML1002.

## 3.4 Test equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
Vector Signal Generator	Agilent	N5172B EXG	MY53050534	Feb 2017
Vector Signal Generator	Agilent	E4438C ESG	MY45094485	Ago 2016
Spectrum Analyzer	Agilent	N9030A PXA	MY53120882	Apr 2015
Network Analyzer	Agilent	E5071B ENA	MY46418709	Jan 2016
EMI Receiver	R & S	ESCI	100888	08/2015
V-network	R & S	ESH2-Z5	872 460/041	09/2015
Trilog Broad Band Antenna 25-2000 MHz	Schwarzbeck	VULB 9168	VULB 9168-242	02/2015
Trilog Broad Band Antenna 25-8000 MHz	Schwarzbeck	VULB 9162	VULB 9162-25	05/2015
Antenna 1-18 GHz	Schwarzbeck	STLP 9148	STPL 9148-123	02/2015
Double ridge waveguide horn	RFspin	DRH40	061106A40	08/2016
Preamplifier 18-40 GHz	Miteq	JS44	1648665	11/2015
Broadband preamplifier 1-18 GHz	Schwarzbeck	BBV 9718	9718-137	10/2015
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	02/2015
EMI receiver 20 Hz ÷ 3 GHz	R&S	ESCI	100888	08/2015
Hydraulic revolving platform	Nemko	RTPL 01	4.233	NCR
Turning-table	R&S	HCT	835 803/03	NCR
Antenna mast	R&S	HCM	836 529/05	NCR
Controller	R&S	HCC	836 620/7	NCR
Spectrum Analyzer 9kHz ÷ 40GHz	R&S	FSEK	848255/005	08/2015
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	09/2016
Shielded room	Siemens	10m control room	1947	NCR
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	70	NCR
Shielded Room	Siemens	3m semi-anechoic chamber	3	NCR
Motor controller	Emco	1051-25	9012-1559	NCR
Motor controller	Emco	1061-1.521	9012-1508	NCR
Antenna Tower	Emco	2071-2	9601-1940	NCR
Controller pole/table	Emco	2090	9511-1099	NCR
V-Network	R & S	ESH2-Z5	872 460/041	09/2015

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use

(\*) Equipment supplied by manufacturer's

## Section 4: Result summary

### 4.1 FCC Part 90: test results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N	No : not applicable / not relevant.
Y	Yes : Mandatory i.e. the apparatus shall conform to these tests.
N/T	Not Tested, mandatory but not assessed. (See report summary)

Part	Test method	Test description	Required	Result
§90.205	§2.1046	Output power	Y	Pass
§90.209	§2.1049	Occupied bandwidth	Y	Pass
§90.210	§2.1051	Spurious Emissions at the antenna terminal	Y	Pass
§90.210	§2.1053	Field strength of spurious radiation	Y	Pass
§90.213	§2.1055	Frequency stability	N	N/A a)
§ 935210 D02v02r01 (D.3)(l)	–	Out of band rejection	Y	Pass

#### Notes:

- NOT APPLICABLE: Modulation/frequency conversion circuitry not in use. No frequency change in EUT (input and output have same frequency)

## Appendix A: Test results

### Clause 90.205 Output power

Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation. Except where otherwise specifically provided for, the maximum power that will be authorized to applicants whose license applications for new stations are filed after August 18, 1995 is as follows:

(k) 806-824 MHz, 851-869 MHz, 896-901 MHz and 935-940 MHz. Power and height limitations are specified in §90.635

#### **§90.635 Limitations on power and antenna height.**

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

For measurements conducted pursuant to paragraphs (a) and (b) of § 2.1046, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

Test date: [2015-03-09](#)

Test results: [Pass](#)

#### Special notes

Conducted measurement were performed:

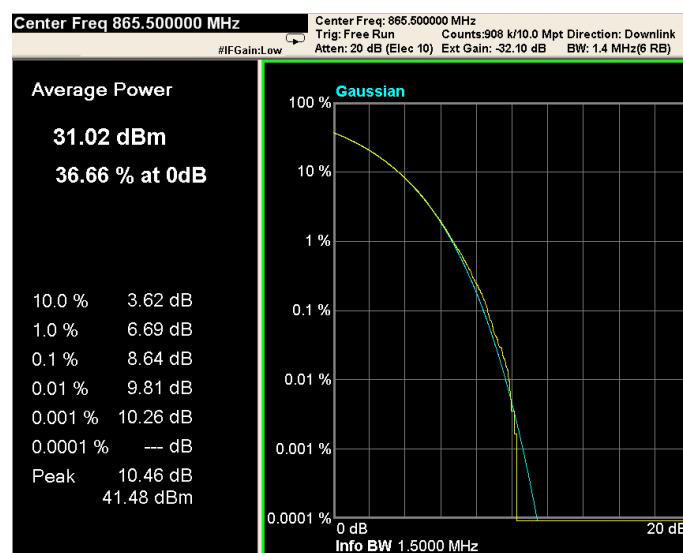
- The power was measured using spectrum analyzer with RMS detector / average power meter.

In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13dB

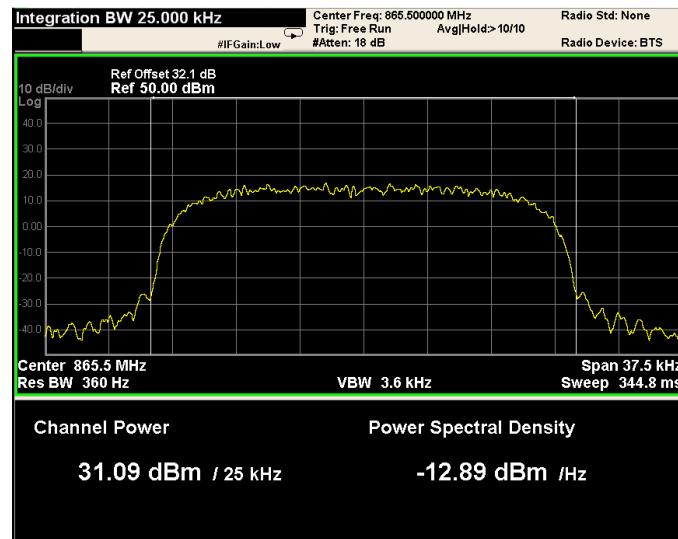
Only conducted measurement at antenna connector was possible, no antenna provided by manufacturer

Test data					
Direction	Modulation	Frequency (MHz)	RF output channel Power (dBm)	RF output channel Power (W)	PAR (dB)
Down-link	iDEN (25 kHz)	865.5	31.09	1.29	3.15
Down-link	GSM (200 kHz)	865.5	31.04	1.27	0,07
Down-link	EDGE (200 kHz)	865.5	31.09	1.29	3.27
Down-link	CDMA (1,25MHz)	865.5	31.15	1.30	9.38
Down-link	WCDMA (5MHz)	865.5	31.10	1.29	11.29
Down-link	LTE (QAM, 1,4MHz)	865.5	31.02	1.26	10,46
Down-link	LTE (QPSK, 1,4MHz)	865.5	31.09	1.29	9.87

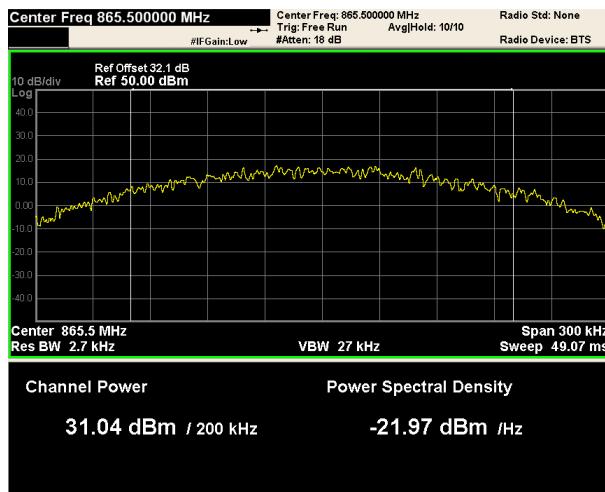
PAR measure is performed by the “CCDF” function installed on Spectrum analyzer that provides average power (the same measured with “Channel power” function), peak power and PAR. Below an example:



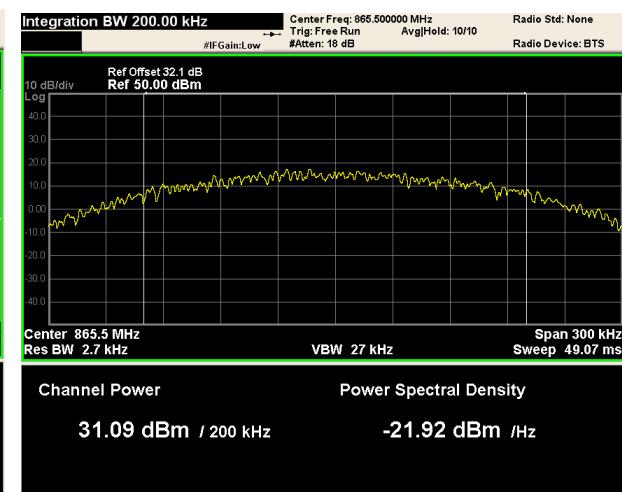
### Mod. iDEN



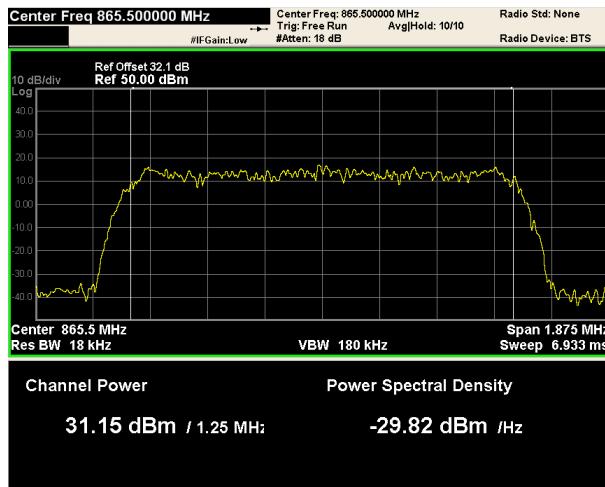
### Mod. GSM



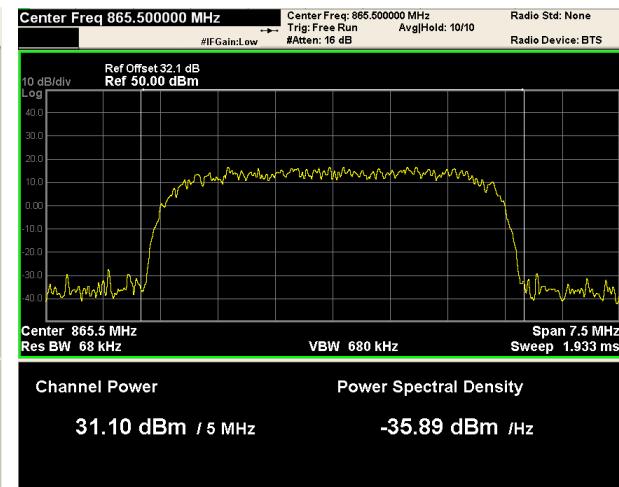
### Mod. EDGE



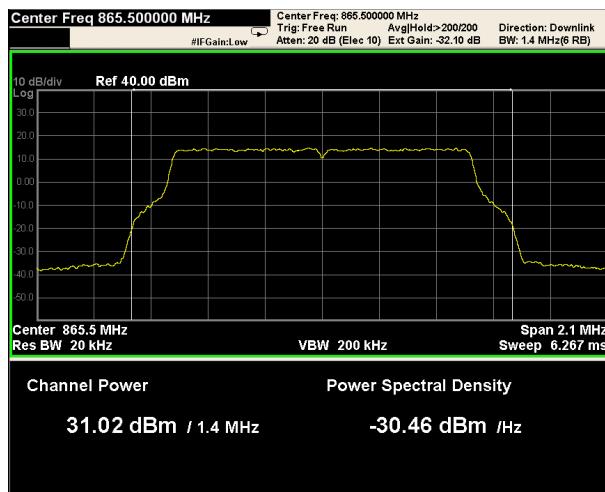
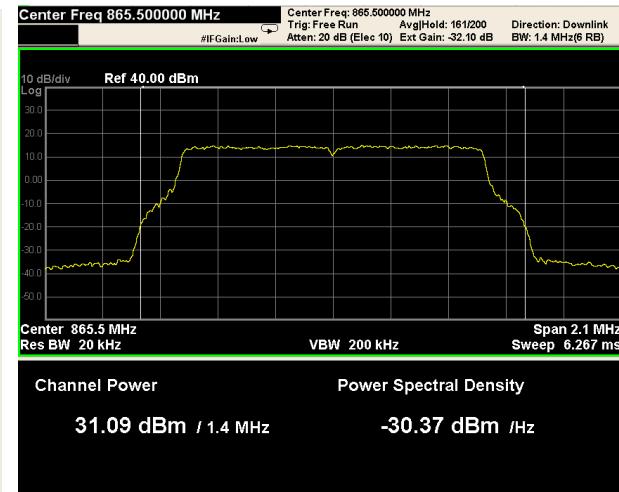
## Mod. CDMA



## Mod. WCDMA



## Mod. LTE 1,4MHz (Down-link)


**QAM**

**QPSK**

## Clause 90.209 Occupied bandwidth

Unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following table:

### Standard Channel Spacing/Bandwidth

Frequency Band (MHz)	Channel Spacing (kHz)	Authorized Bandwidth (kHz)
Below 25	—	—
25–50	20	20
72–76	20	20
150–174	7.5	20/11.25/6
216–220	6.25	20/11.25/6
220–222	5	4
406–512	6.25	20/11.25/6
806–809/851–854	12.5	20
809–824/854–869	25	20
896–901/935–940	12.5	13.6
902–928	—	—
929–930	25	20
1427–1432	12.5	12.5
2450–2483.5	—	—
Above 2500	—	—

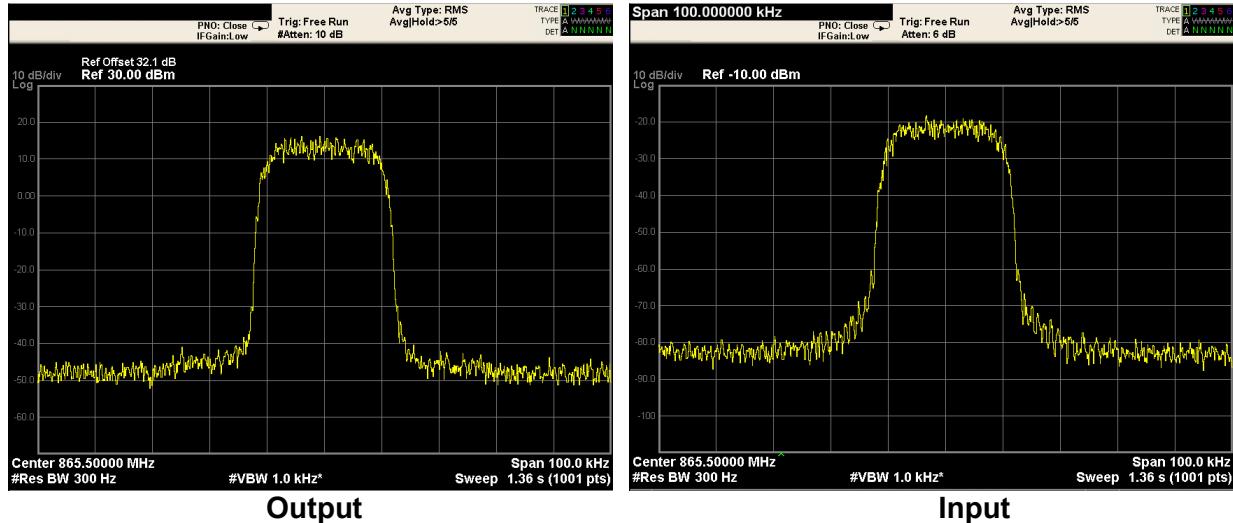
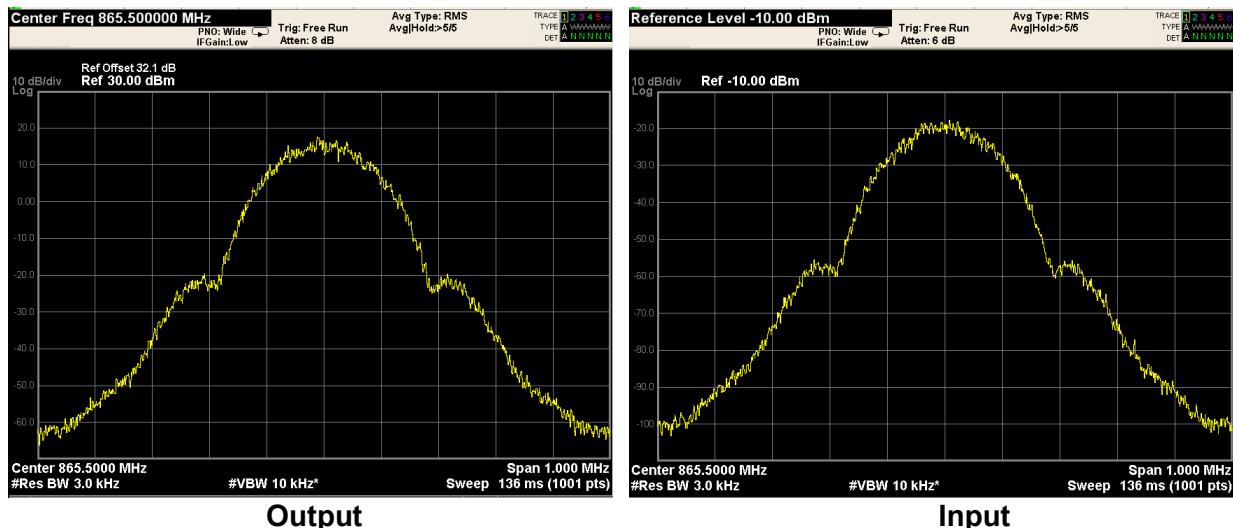
The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

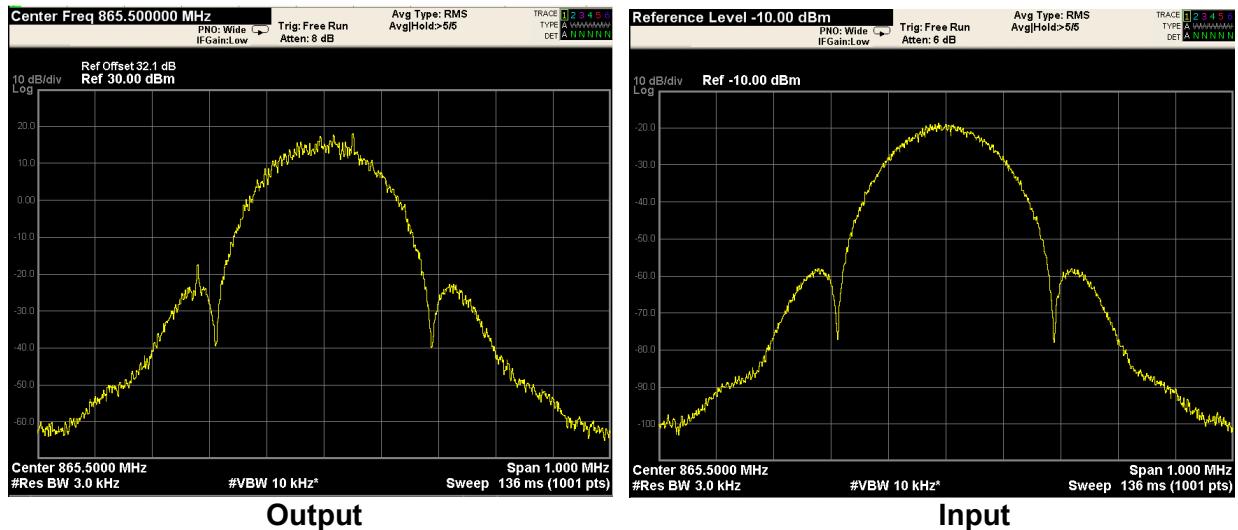
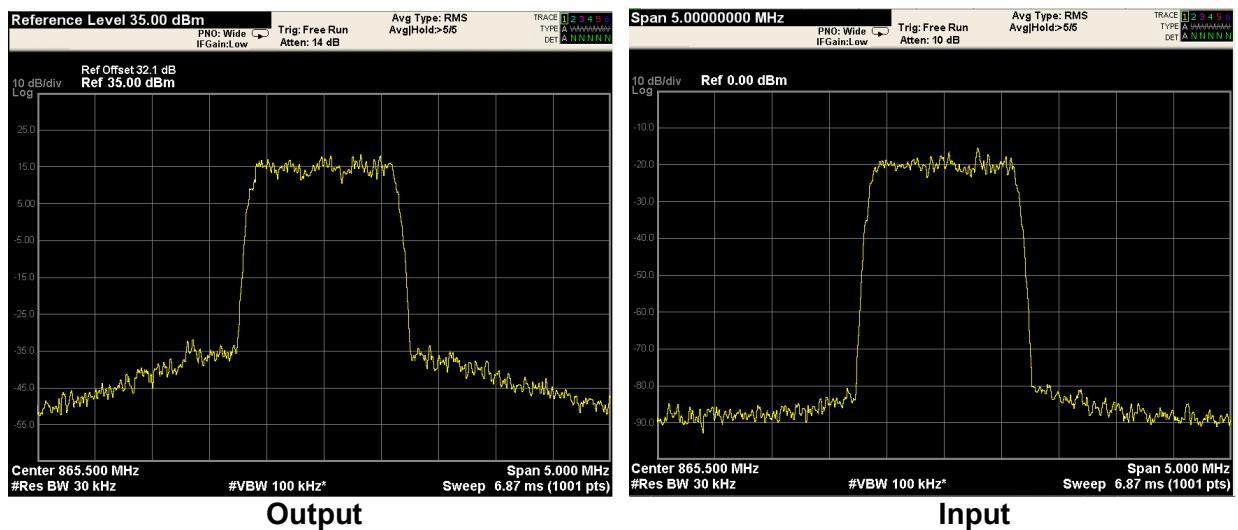
Test date: 2015-03-09

Test results: Pass

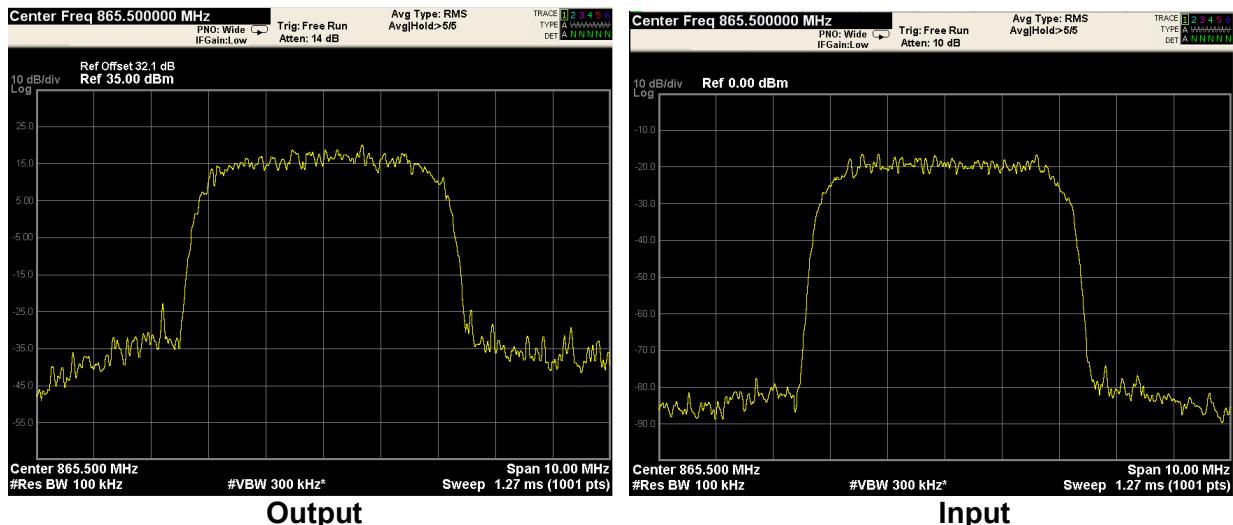
Test data

Resolution bandwidth was set wider or equal than occupied bandwidth.

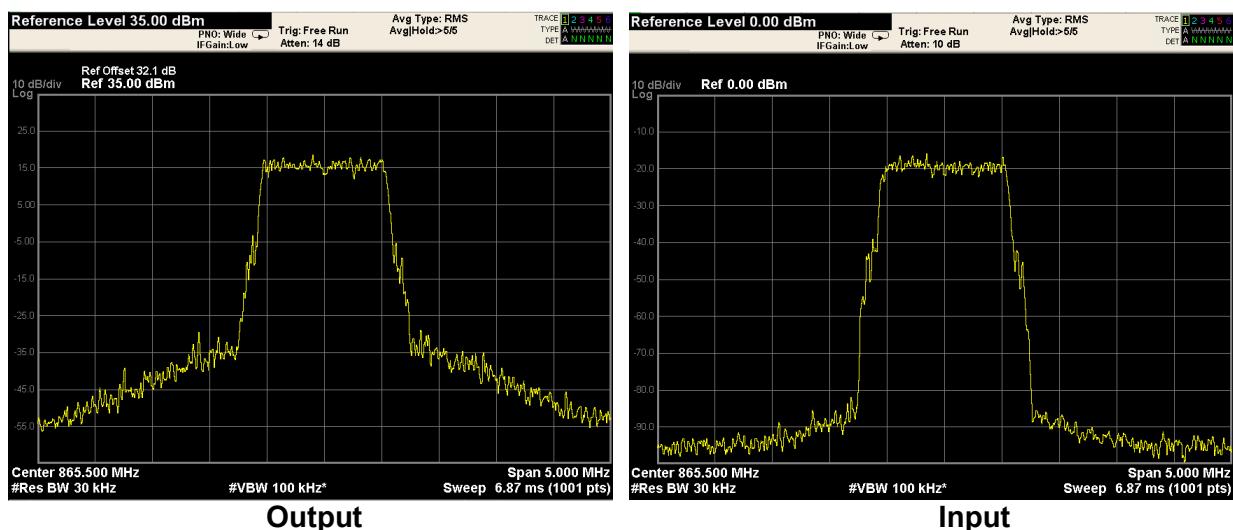
**Mod. iDEN (QAM)**

**Mod. GSM (Down-link)**


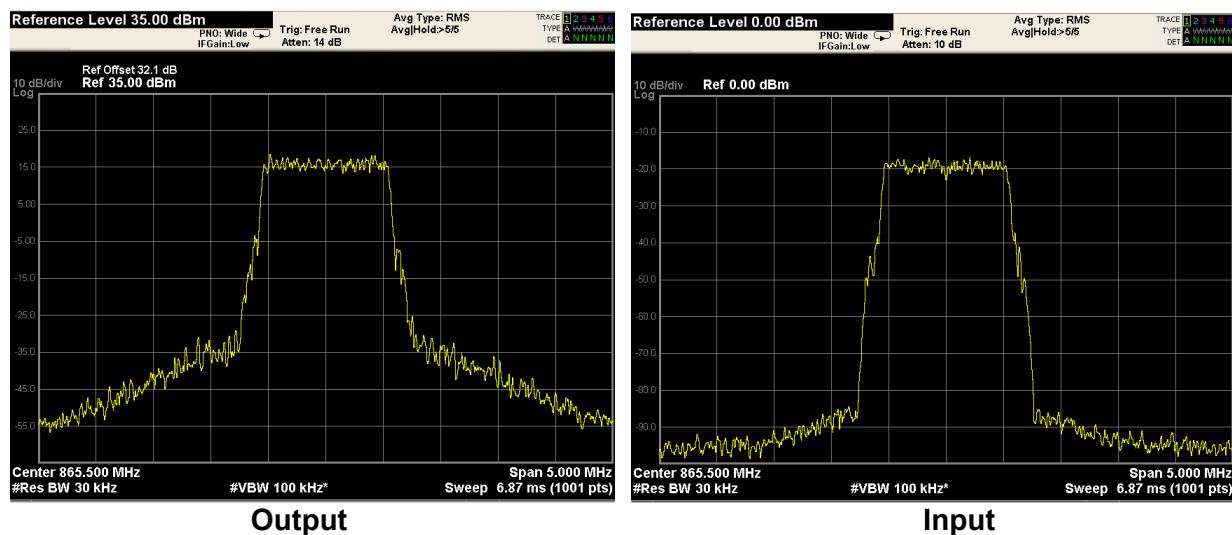
**Mod. EDGE (Down-link)**

**Mod. CDMA (Down-link)**


### Mod. WCDMA (Down-link)



### Mod. LTE 1.4MHz (QAM) (Down-link)



**Mod. LTE 1.4MHz (QPSK) (Down-link)**


## Clause 90.210 Spurious emissions at the antenna terminal

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

(g) Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.

### § 2.1051 Measurements required: Spurious emissions at antenna terminals.

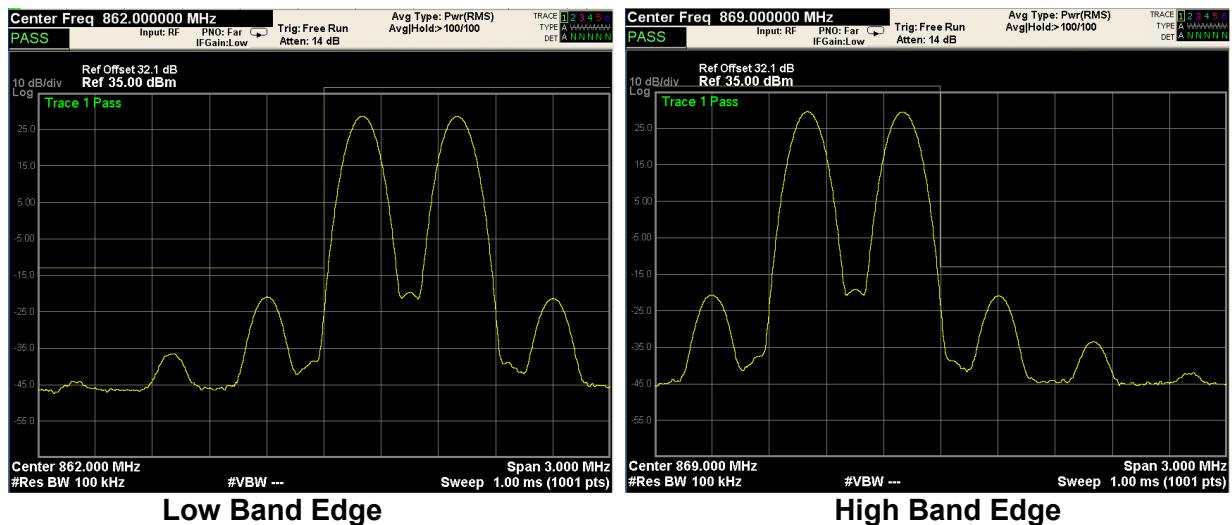
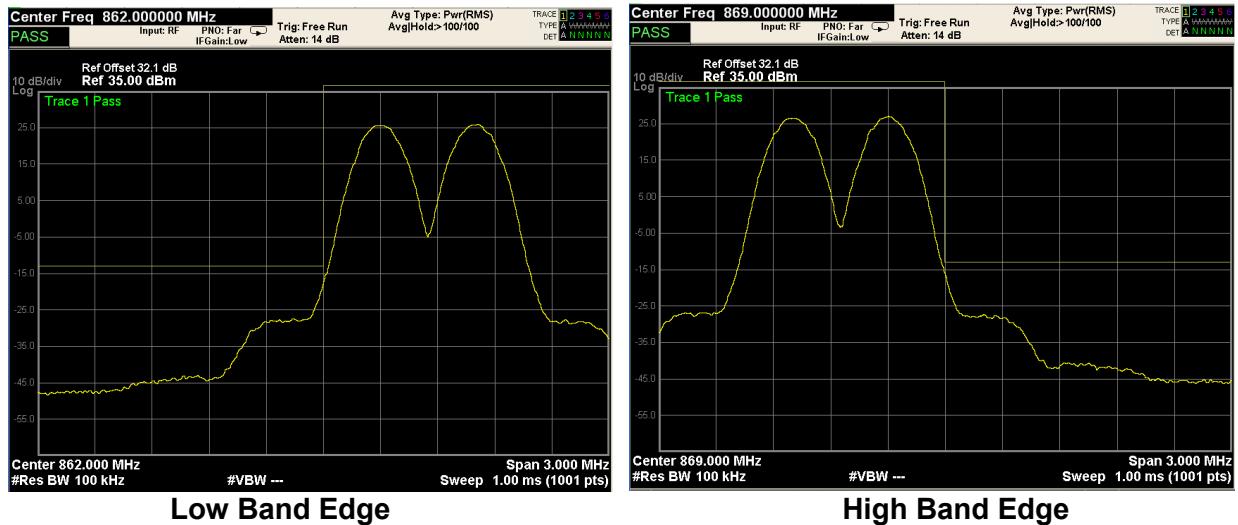
The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

Test date: 2015-03-09

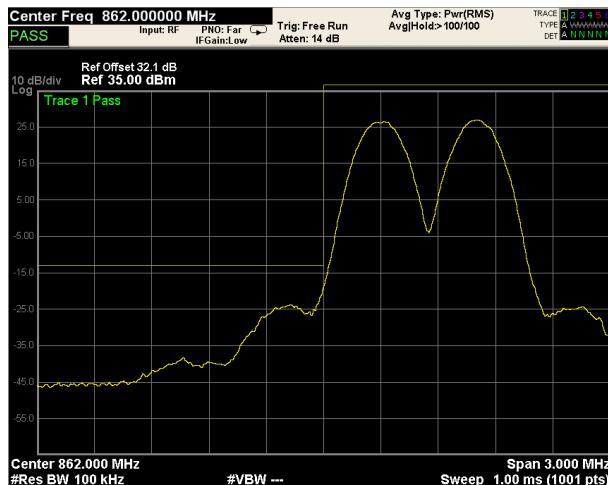
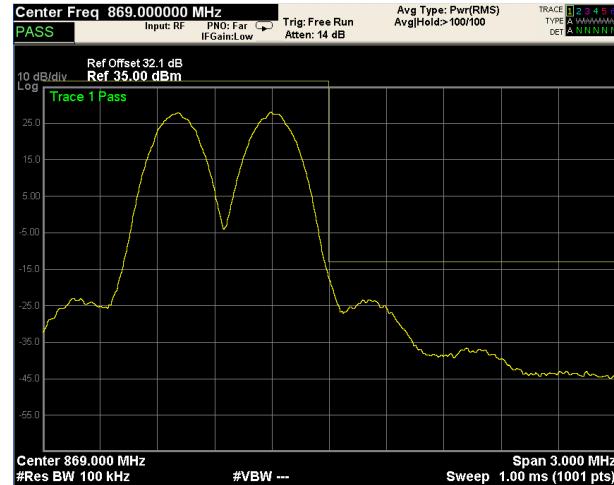
Test results: Pass

#### Special notes

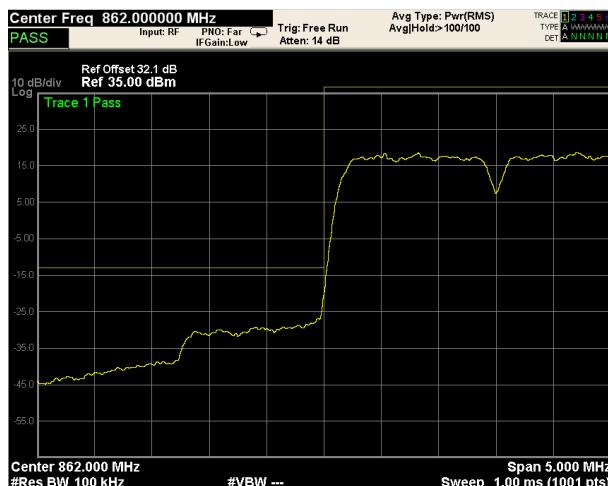
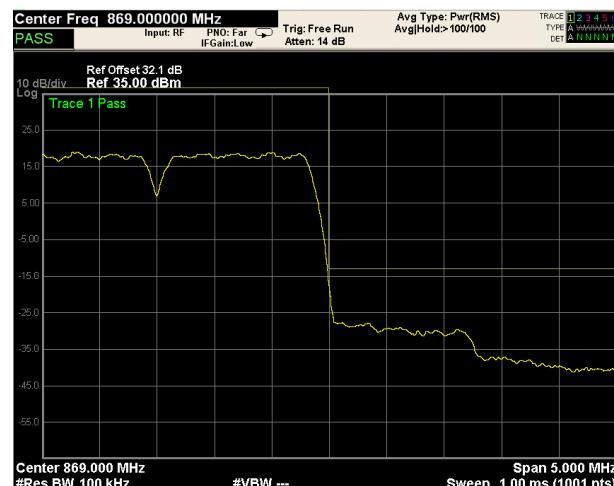
Mask G is applied.

**Band edges Inter modulation:**
**Mod. iDEN (QAM) (Down-link)**

**Mod. GSM (Down-link)**


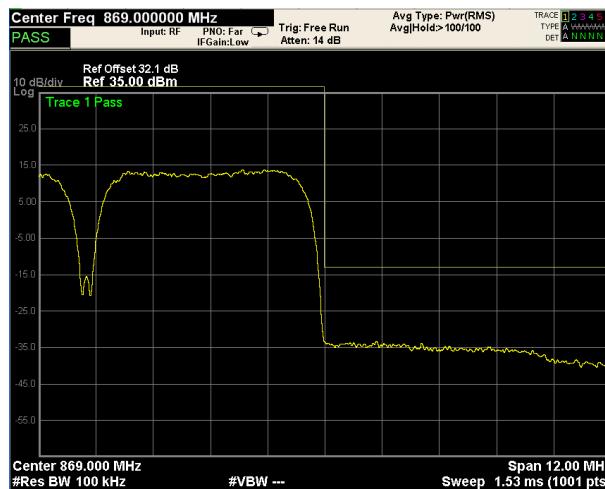
### Mod. EDGE (Down-link)


**Low Band Edge**

**High Band Edge**

### Mod. CDMA (Down-link)

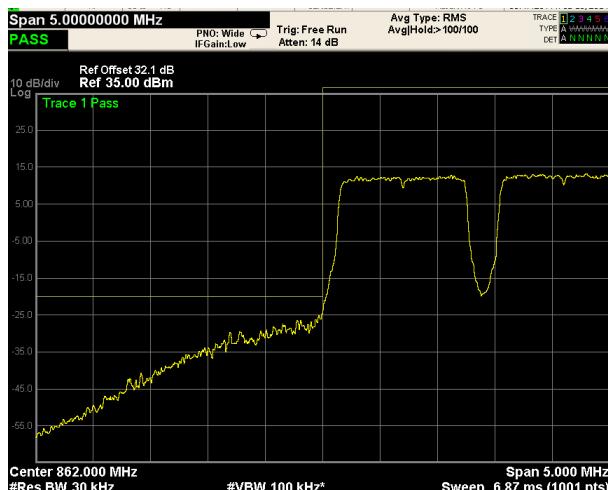
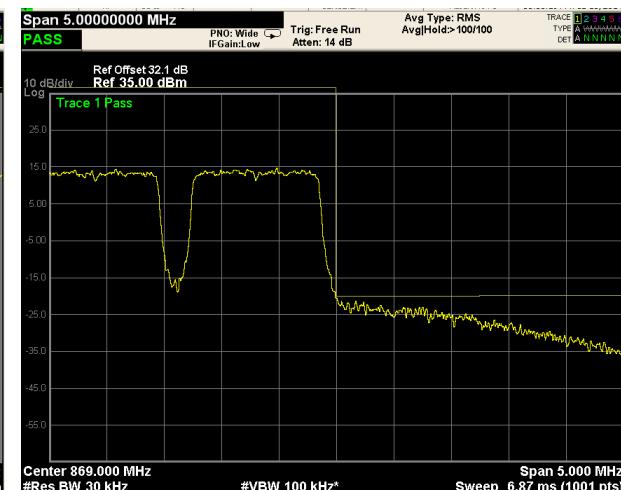

**Low Band Edge**

**High Band Edge**

### Mod. WCDMA (Down-link)

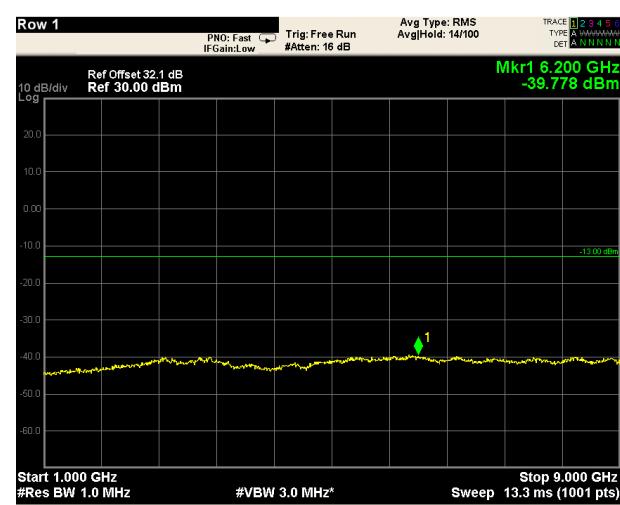
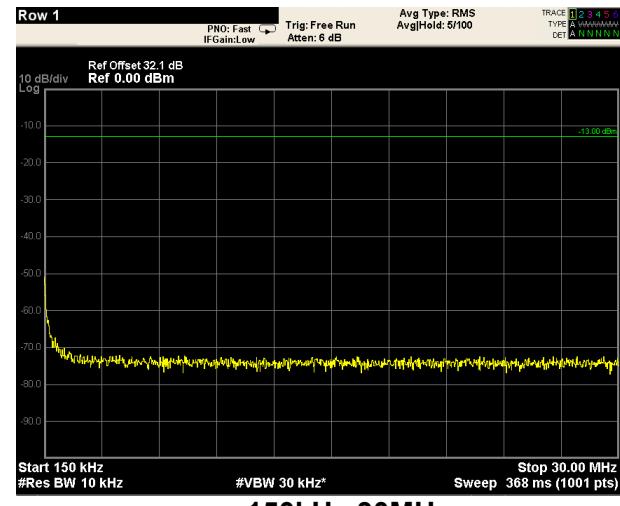
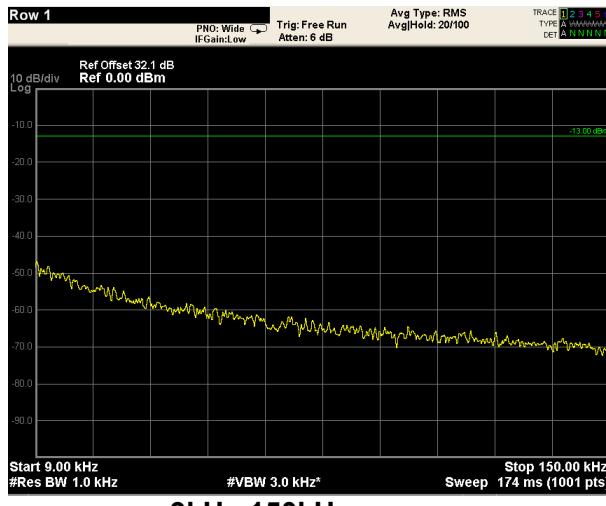

**Low Band Edge**

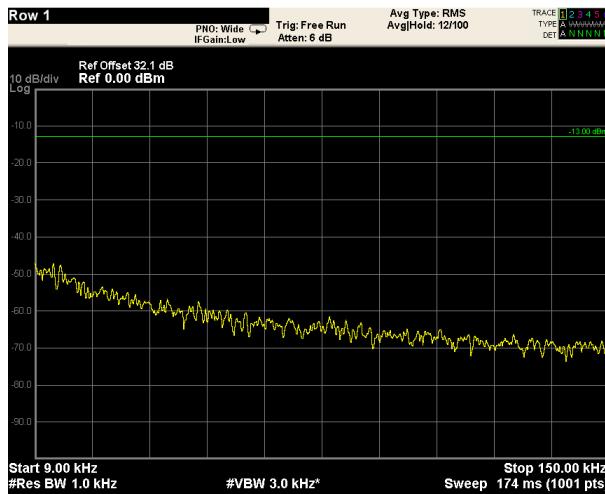
**High Band Edge**

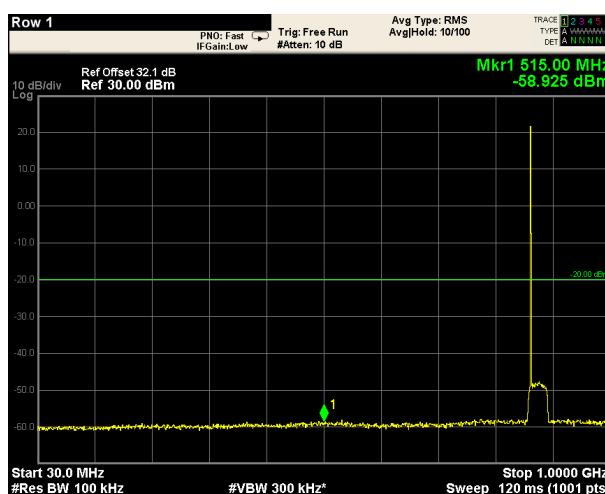
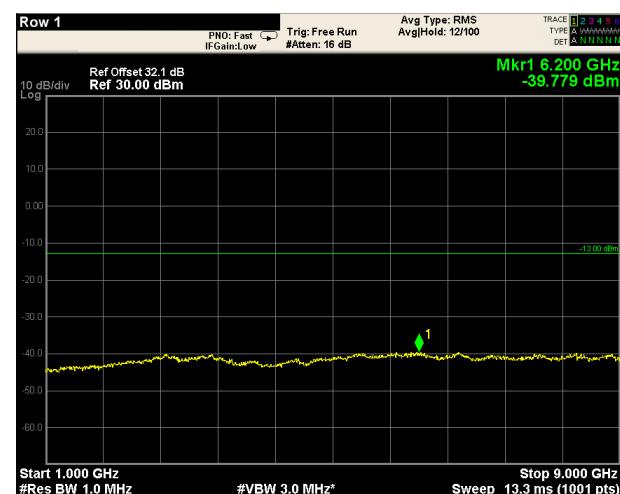
### Mod. LTE 1.4MHz (QAM) (Down-link)

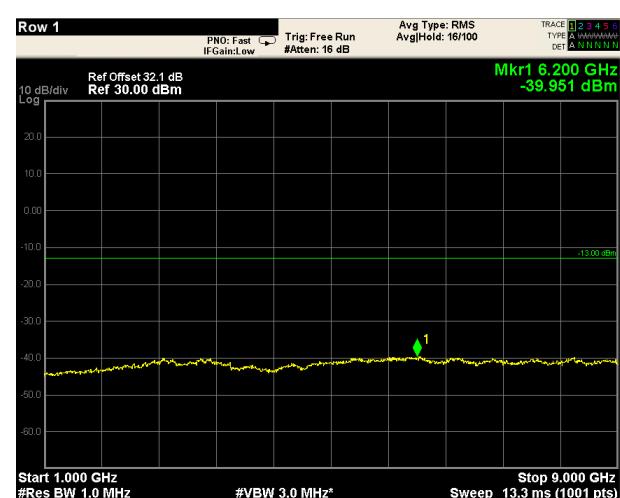
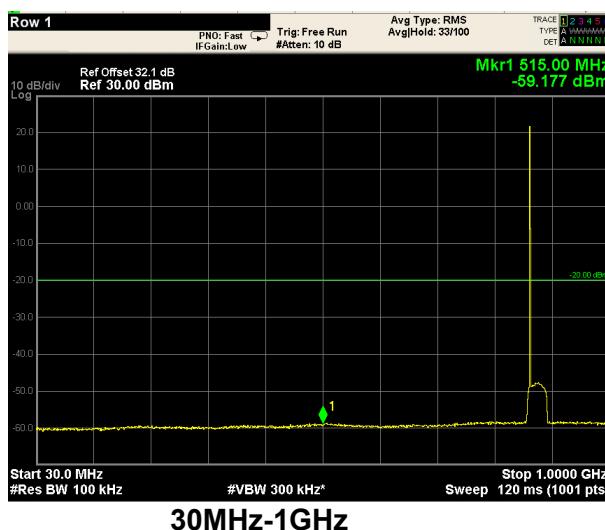
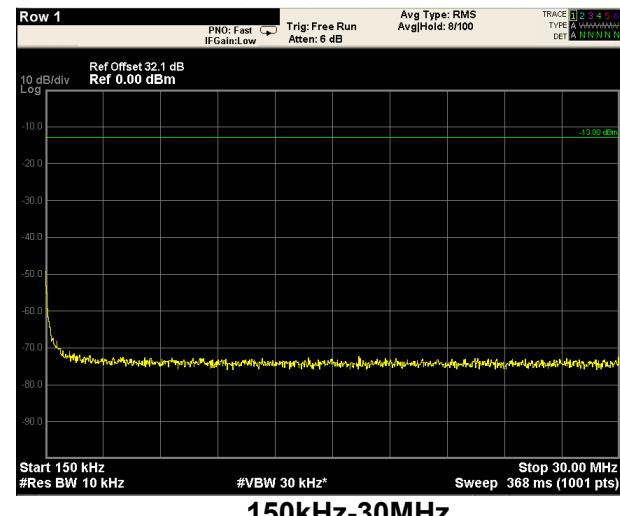
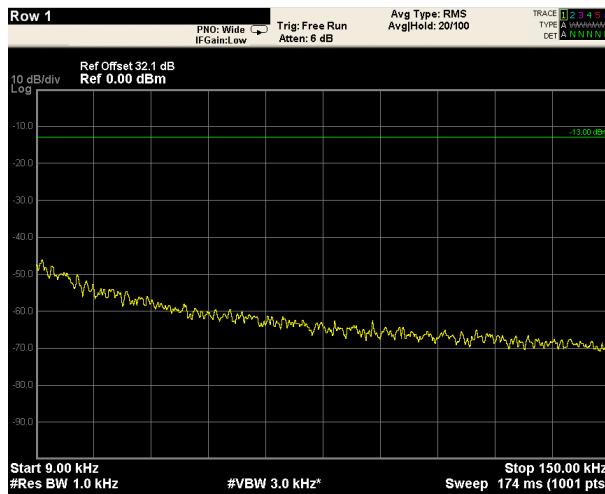

**Low Band Edge**

**High Band Edge**

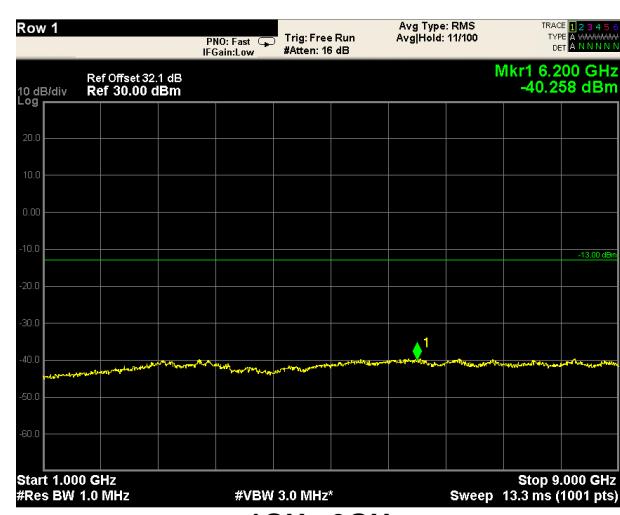
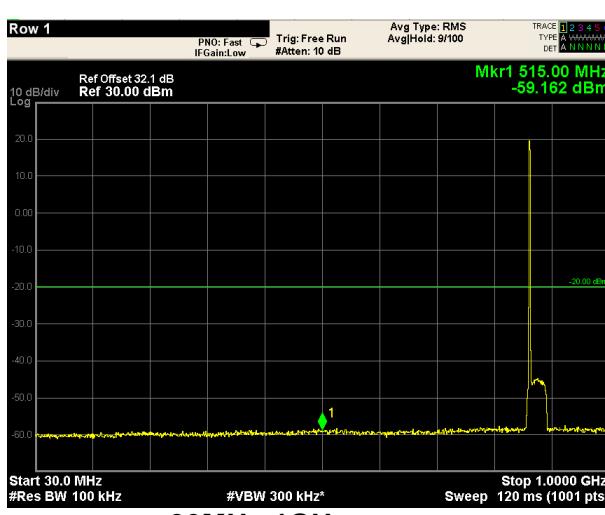
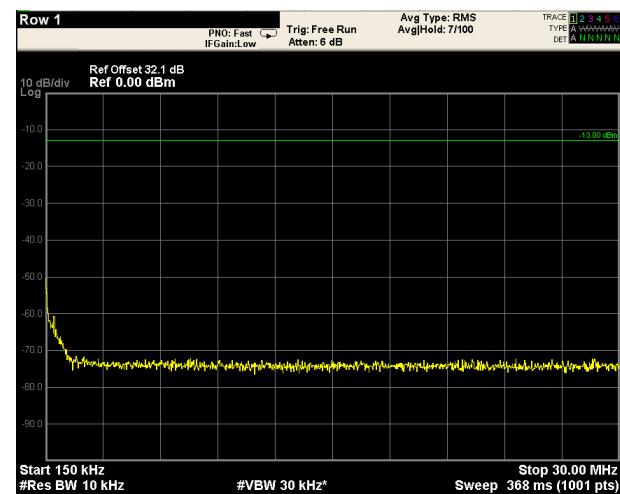
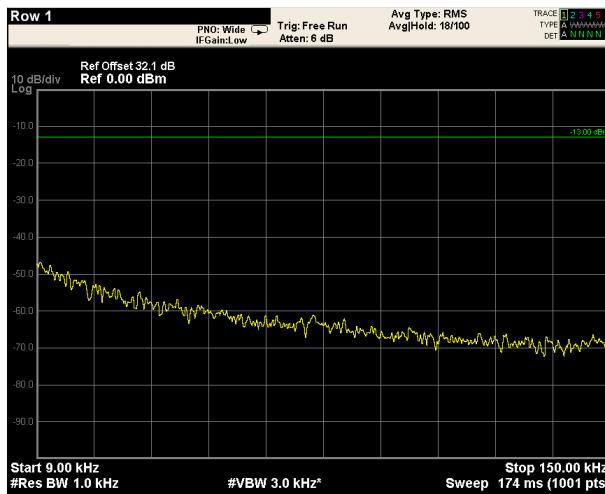
**Mod. LTE 1.4MHz (QPSK) (Down-link)**

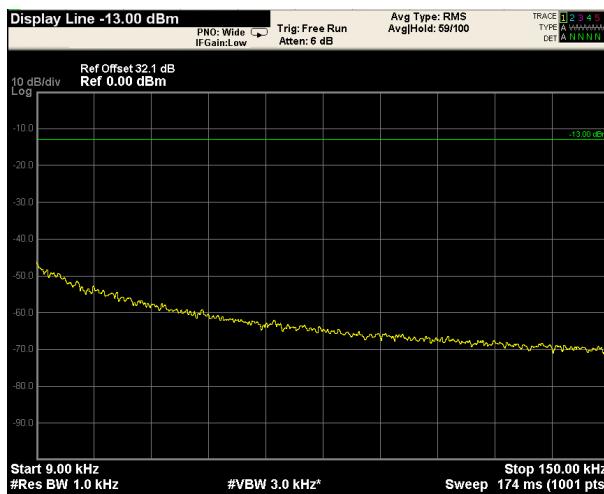
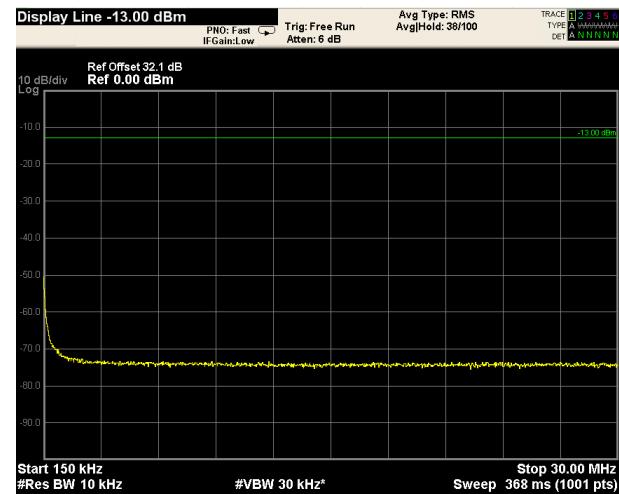

**Spurious emissions at antenna terminal:**
**Mod. iDEN (QAM) (Down-link)**


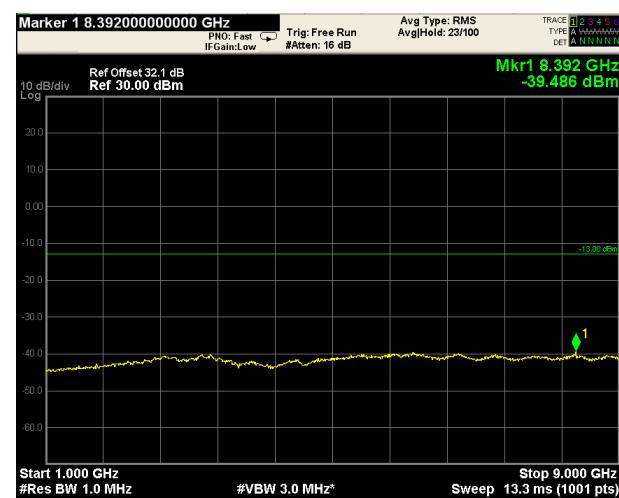
**Mod. GSM (Down-link)**

**9kHz-150kHz**

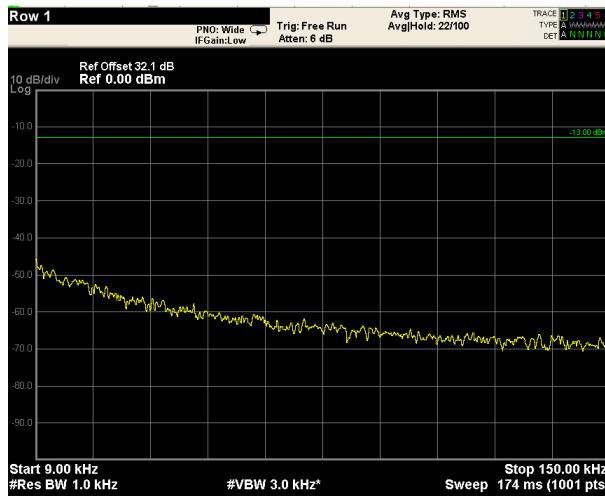
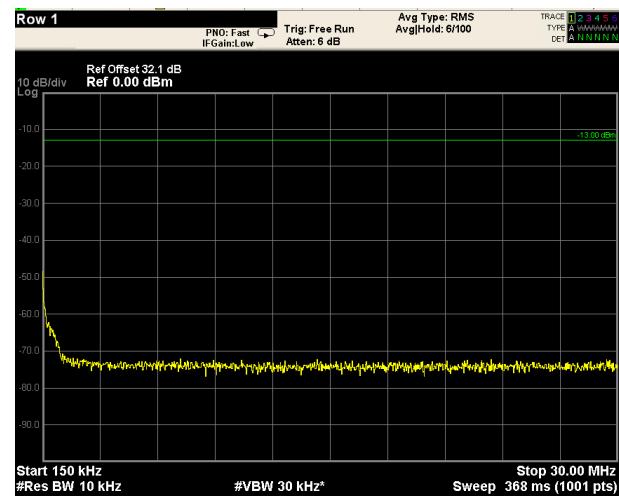
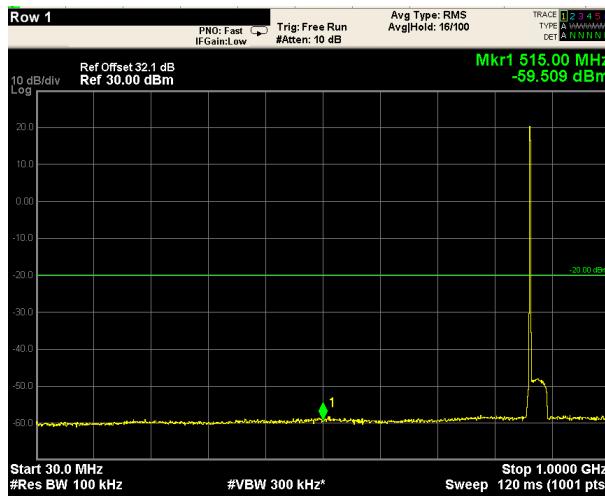
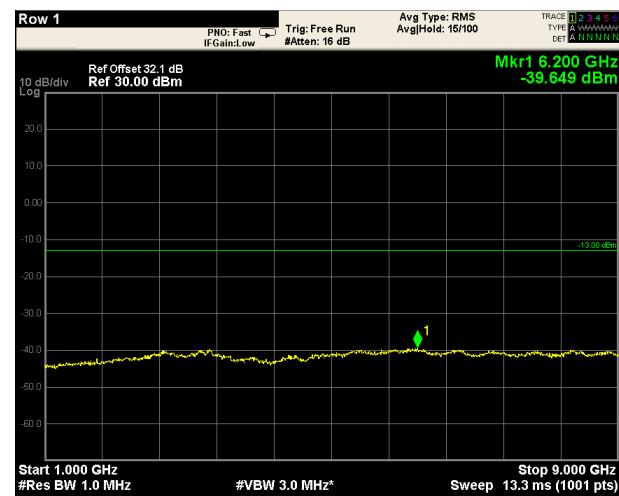
**150kHz-30MHz**

**30MHz-1GHz**

**1GHz-9GHz**

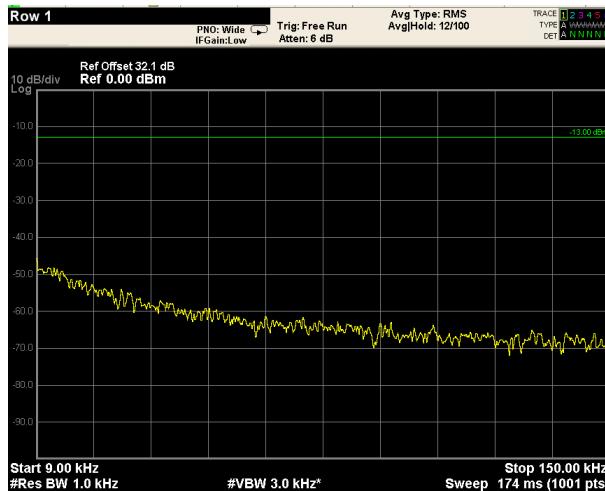
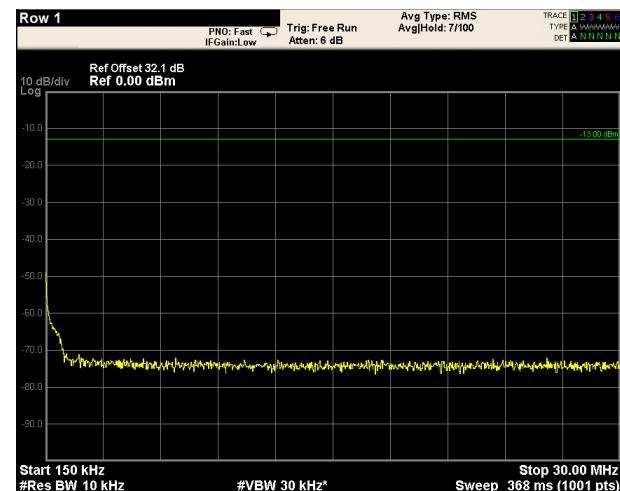
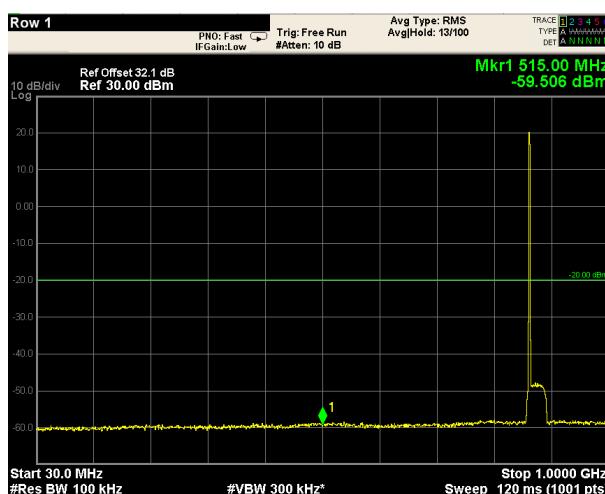
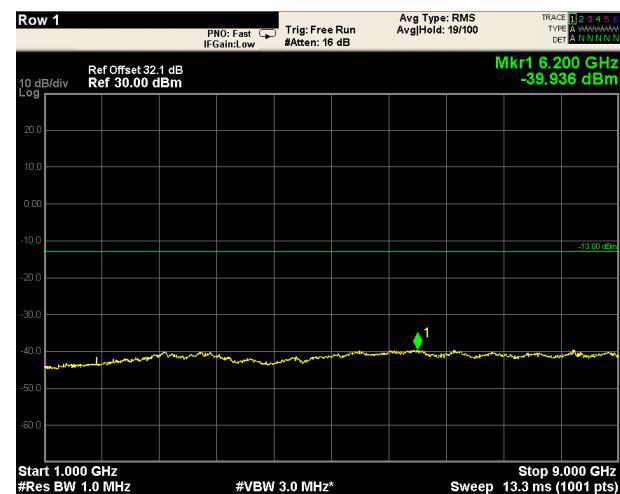
**Mod. EDGE (Down-link)**


**Mod. CDMA (Down-link)**


**Mod. WCDMA (Down-link)**

**9kHz-150kHz**

**150kHz-30MHz**

**30MHz-1GHz**

**1GHz-9GHz**

**Mod. LTE 1.4MHz (QAM) (Down-link)**

**9kHz-150kHz**

**150kHz-30MHz**

**30MHz-1GHz**

**1GHz-9GHz**

**Mod. LTE 1.4MHz (QPSK) (Down-link)**

**9kHz-150kHz**

**150kHz-30MHz**

**30MHz-1GHz**

**1GHz-9GHz**

## Clause 90.210 Field strength of spurious radiation

(g) Emission Mask G. For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least  $43 + 10 \log (P)$  dB.

### § 2.1053 Measurements required: Field strength of spurious radiation.

(a) 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. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

Test date: 15-03-10

Test results: Pass

### Special notes

- The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic.
- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- Only the worst data presented in the test report.

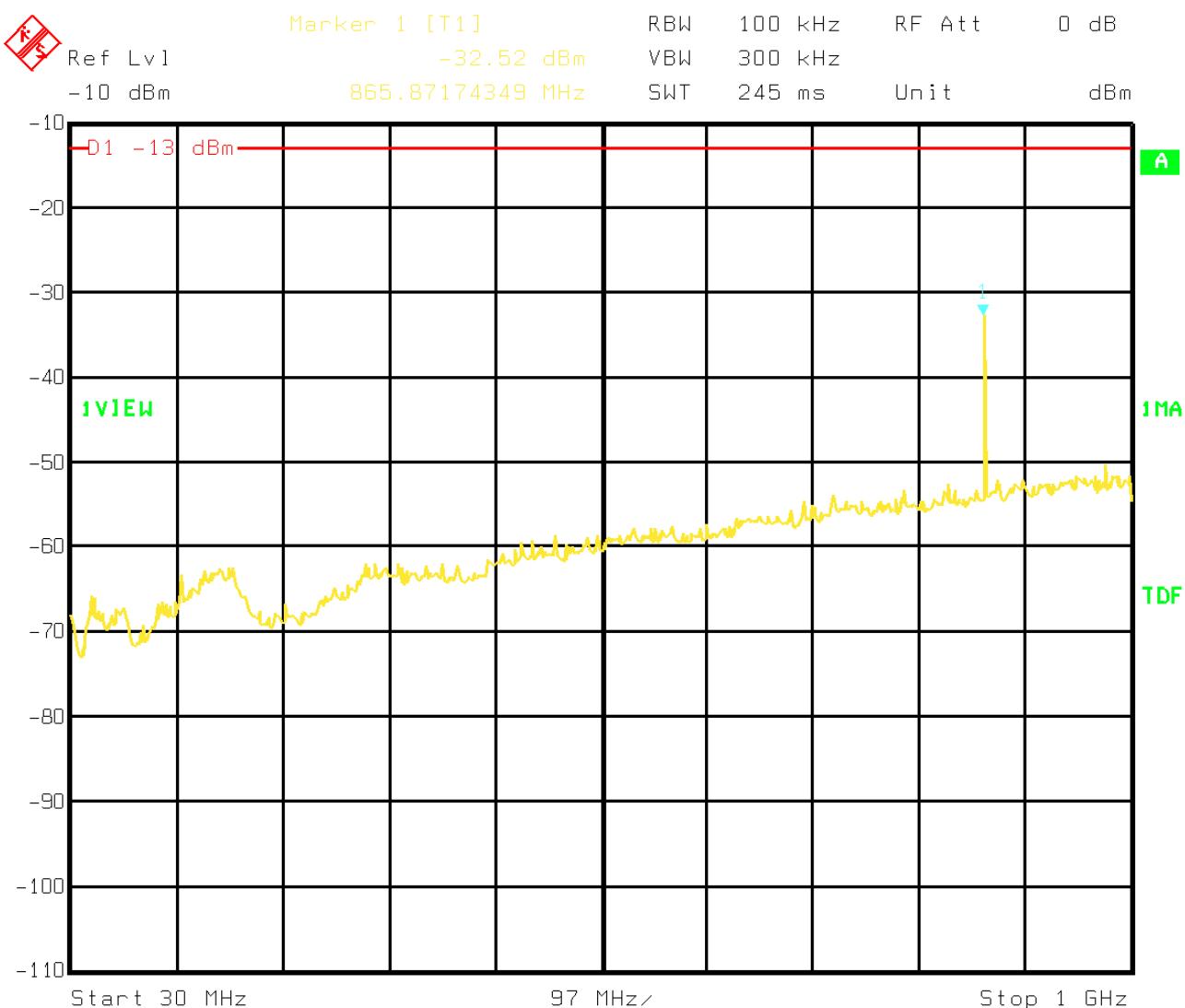
**Clause 90.210 Field Strength of spurious radiation, continued****Test data**

The D.U.T. was positioned according to the radiated emissions set-up

The D.U.T. antenna connector was terminated by a  $50 \Omega$  shielded dummy load.

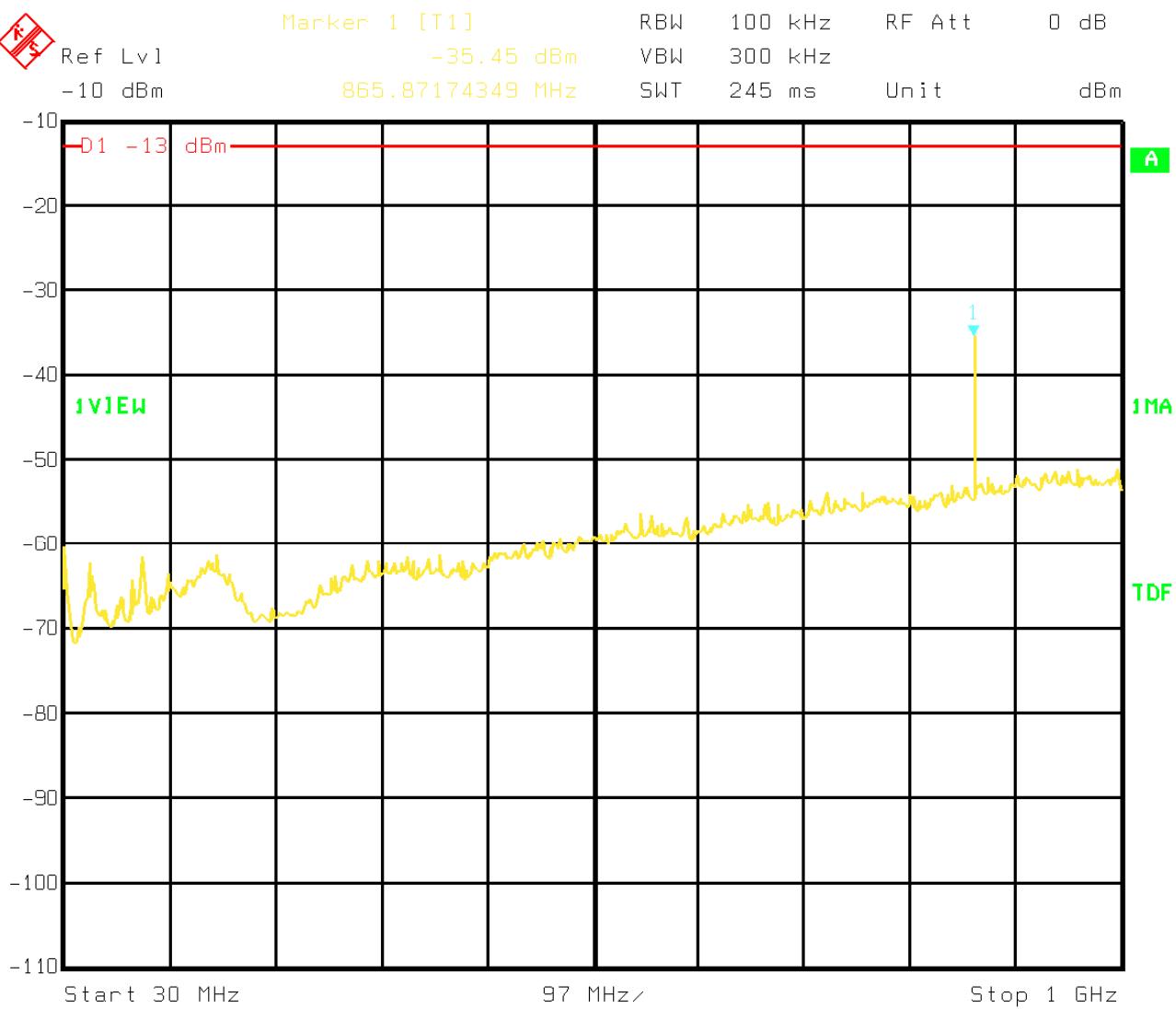
The spectrum was searched from 30 MHz to 1 GHz (RBW 100 kHz) & 1 GHz (RBW 1 MHz) to the tenth harmonic of the carrier.

There were no emissions detected above the noise floor which was at least 20 dB below the specification limit.



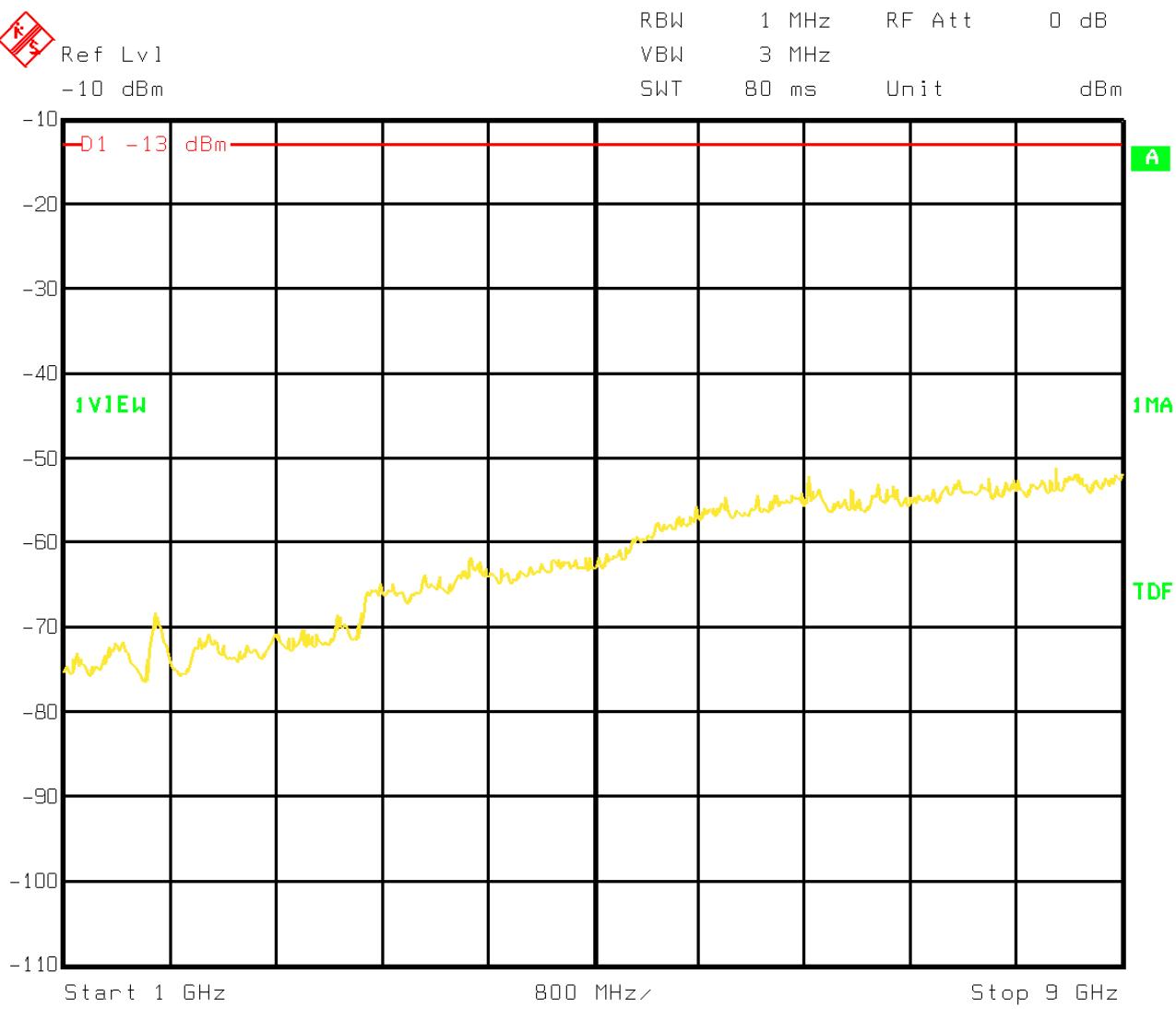
Date: 10.MAR.2015 07:42:42

**30MHz-1GHz – H Pol**



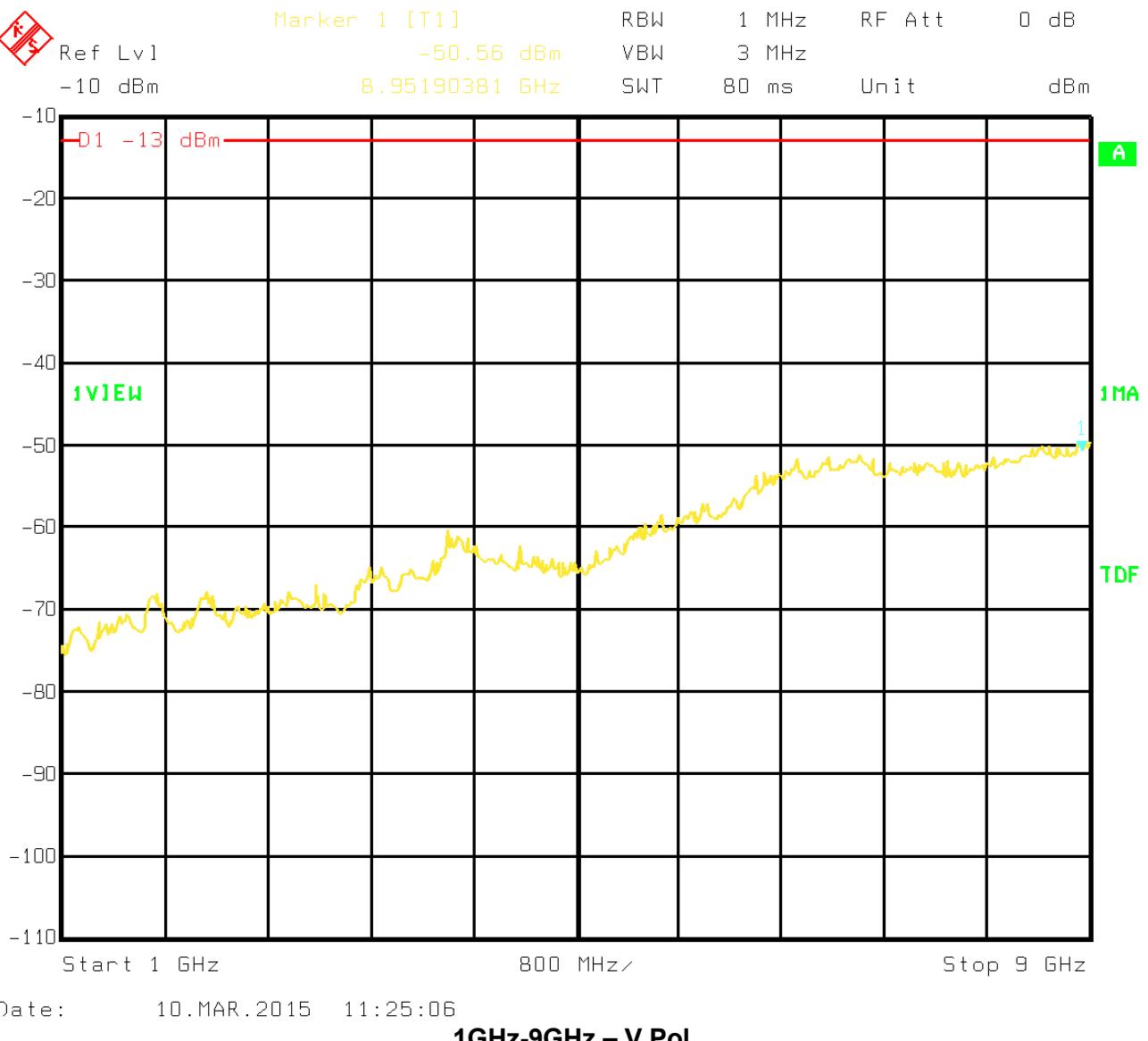
Date: 10.MAR.2015 07:39:50

**30MHz-1GHz – V Pol**



Date: 10.MAR.2015 11:28:10

**1GHz-9GHz – H Pol**

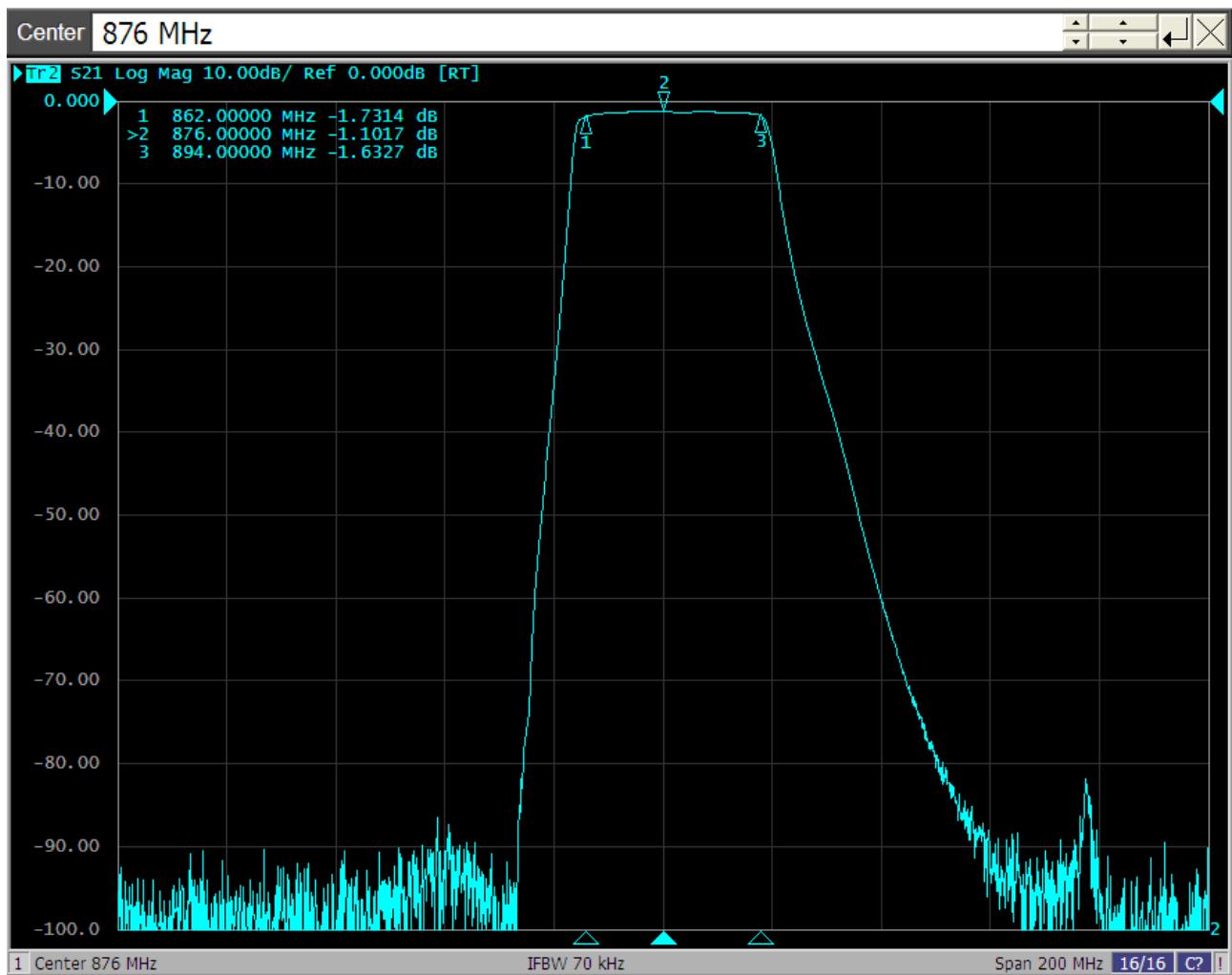


### Clause 935210 D02v02r01 (D.3)(l) Out of band rejection

Out of Band Rejection – Test for rejection of out of band signals.  
Filter frequency response plots are acceptable.

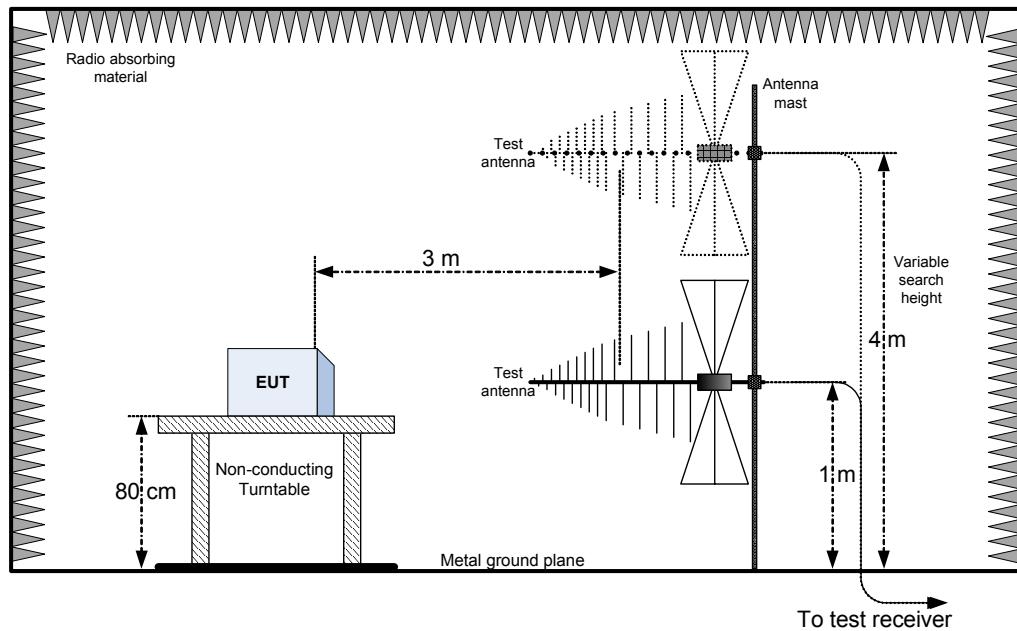
Test date: 2015-03-09

Test results: Pass

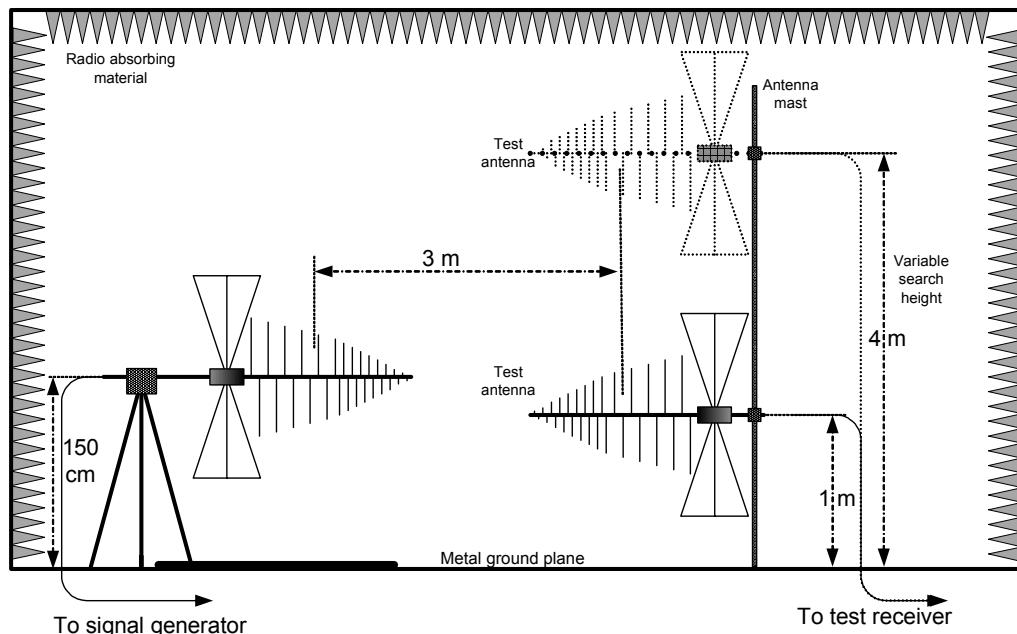


## Appendix B: Block diagrams of test set-ups

### Radiated emissions set-up



### Substitution method set-up

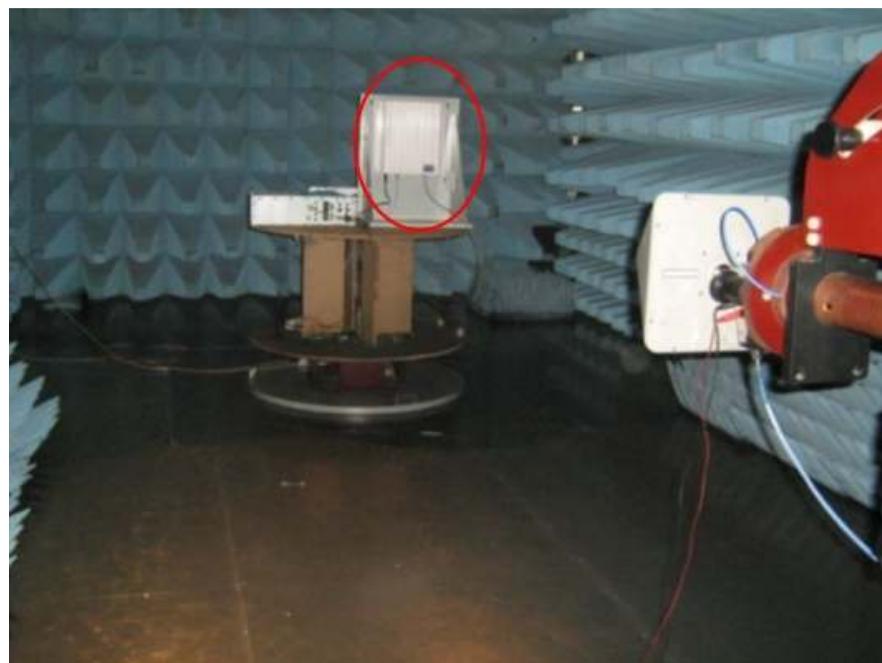


## Appendix C: EUT Photos

## Photo Set up







## Photo EUT



