



Report number: **182253TRFWL**

Apparatus: **TRL7S8SC8A9S19AWAS**

Applicant: **TEKO Telecom S.p.A.  
Via Meucci, 24/a  
I-40024 Castel S. Pietro Terme (BO) (Italy)**

FCC ID: **XM2-LOWPOWER6**

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**

Reviewed by: **P. Barbieri**, Wireless/EMC Specialist

*Barbieri Paul*

Date: July 28, 2011

Tested by: **G. Curioni**, Wireless/EMC Specialist

*Curioni G*

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Section 1: Report summary

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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 Italy 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:	<b>Nemko Italy S.p.A.</b> Via Carroccio, 4 I-20853 Biassono (Italy)
Registration number:	481407 (10 m Semi anechoic chamber)

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90. Conducted measurements were performed in accordance with ANSI TIA-603-B-2002. Radiated tests were conducted in accordance with ANSI C63.4-2003.

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. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 2: Equipment under test

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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:	Optical System
Product marketing name:	TRL7S8SC8A9S19AWAS
Model number:	---
Serial number:	110422002
Nemko sample number:	---
FCC ID:	XM2-LOWPOWER6
Date of receipt:	July 25, 2011

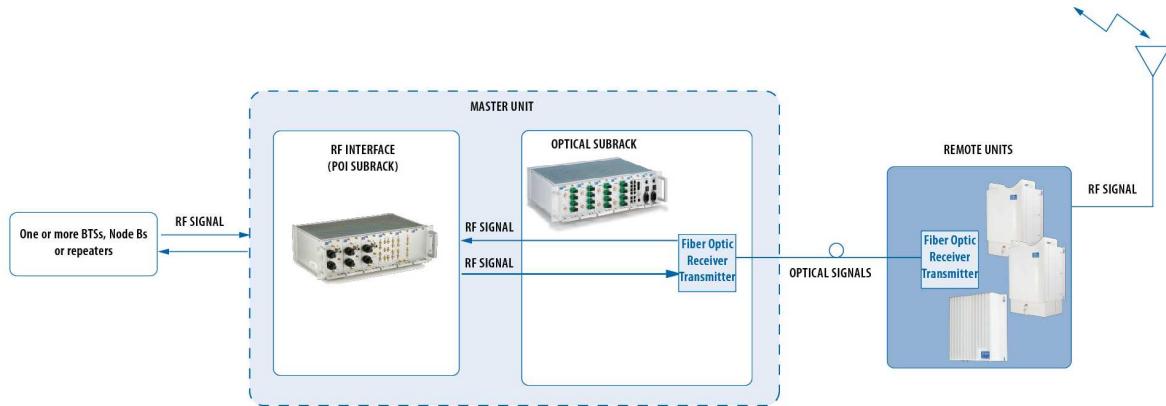
### 2.2 Accessories and support equipment

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

Item # 1	
Type of equipment:	-----
Brand name:	-----
Model name or number:	-----
Serial number:	-----
Nemko sample number:	-----
Connection port:	-----
Cable length and type:	-----
Item # 2	
Type of equipment:	-----
Brand name:	-----
Model name or number:	-----
Serial number:	-----
Nemko sample number:	-----
Connection port:	-----
Cable length and type:	-----

## Section 2: Equipment under test, continued

## 2.3 EUT description



## 2.4 Technical specifications of the EUT

Operating band:	Down Link: 862-869 MHz, Up Link: 817-824 MHz
Operating frequency:	865.5/820.5 MHz
Modulation type:	iDEN (25 QAM)
Occupied bandwidth:	25 kHz
Emission designator:	D7W
RF Output	Down Link: 29dBm (0,8W) Up Link: 4dBm typical (0,0025W typical)
Gain	Down Link: 34dB Up Link: 47dB
Antenna data:	External Antenna is not provided equipment that has an external 50 Ω RF type N connector
Power source	120 Vac, 60 Hz (100-240 Vac, 50/60 Hz).



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Section 2: Equipment under test

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## Section 2: Equipment under test, continued

### 2.5 EUT setup diagram



### 2.6 Operation of the EUT during testing

[Normal working at max gain with max RF power output \(down-link and up-link\)](#)

### 2.7 Modifications incorporated in the EUT

None



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Section 3: Test conditions

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## 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: 860–1060 hPa  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 have been performed to provide a confidence level of 95 % and can be found in Nemko S.p.A. document WML1002.



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Section 3: Test conditions

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### 3.4 Test equipment

Description	Manufacturer model	s/n	Cal. Due
Vector Signal Generator	Agilent H.P. E4438C ESG	MY45094485	July 2012
Vector Signal Generator	Agilent H.P. N5182A MXG	MY48180714	April 2012
Spectrum Analyzer	Agilent H.P. M9020A	MY48011812	July 2012
Network Analyzer	Agilent H.P. E5062A	MY44101829	November 2012

Client's property

Equipment	Manufacturer	Model	Serial N°	Call. due
Trilog Broad Band Antenna 25 MHz÷2 GHz	Schwarzbeck	VULB 9168	VULB 9168-242	08/2012
Trilog Broadband Antenna 25 ÷ 4000 MHz	Schwarzbeck	VULB 9163	VULB 9163-286	08/2012
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	08/2012
Turning-table	R&S	HCT	835 803/03	NST
Antenna mast	R&S	HCM	836 529/05	NST
Controller	R&S	HCC	836 620/7	NST
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	08/2012
Shielded room	Siemens	10m control room	1947	NST
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Section 3: Test conditions

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<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial N°</b>	<b>Cal. due</b>
Bilog antenna	Schwarzbeck	STLP 9148-123	123	09/2011
Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	07/2013
Spectrum Analyzer 9kHz-40GHz	R&S	FSEK	848255/005	08/2011
Controller	EMCO	2090	9511-1099	NST
Antenna Tower	EMCO	2071-2	9601-1940	NST
Turning table Controller	EMCO	1061-1.521	9012-1508	NST
Semi-anechoic chamber	Nemko	3m semi-anechoic chamber	70	04/2012
Shielded room	Siemens	3m control room	3	NST

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Section 4: Result summary

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## 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
§90.207	§2.1047	Modulation Characteristics	N	a)
§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	b)
§90.214	–	Transient Behavior	N	
§90.219	–	Use of boosters	N	

Notes:

- a) NO Modulation circuitry.
- b) NO frequency conversion circuitry.



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Appendix A: Test results

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## 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 in FCC Part 90.205 (a) through (r).

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: [July 26-28, 2011](#)

Test results: [Pass](#)

Test data



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Appendix A: Test results

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## RF Output Power D.L. mod. 25 QAM



## RF Output Power U.L. mod. 25 QAM





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Appendix A: Test results

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Specification: FCC 90

## Clause 90.207 Modulation characteristics

Unless specified elsewhere in this part, stations will be authorized emissions as provided for in paragraphs (b) through (n) of this section.

### § 2.1047 Measurements required: Modulation characteristics.

- (a) Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.
- (b) Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.
- (c) Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power. A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.
- (d) Other types of equipment. A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

Test date: NA

Test results:

Test data

NOT APPLICABLE: Modulation characteristics testing was not performed since the E.U.T. does not contain modulation circuitry



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Appendix A: Test results

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## Clause 90.209 Occupied bandwidth

Unless specified elsewhere, channel spacing 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: [July 26-28, 2011](#)

Test results: [Pass](#)

Test data



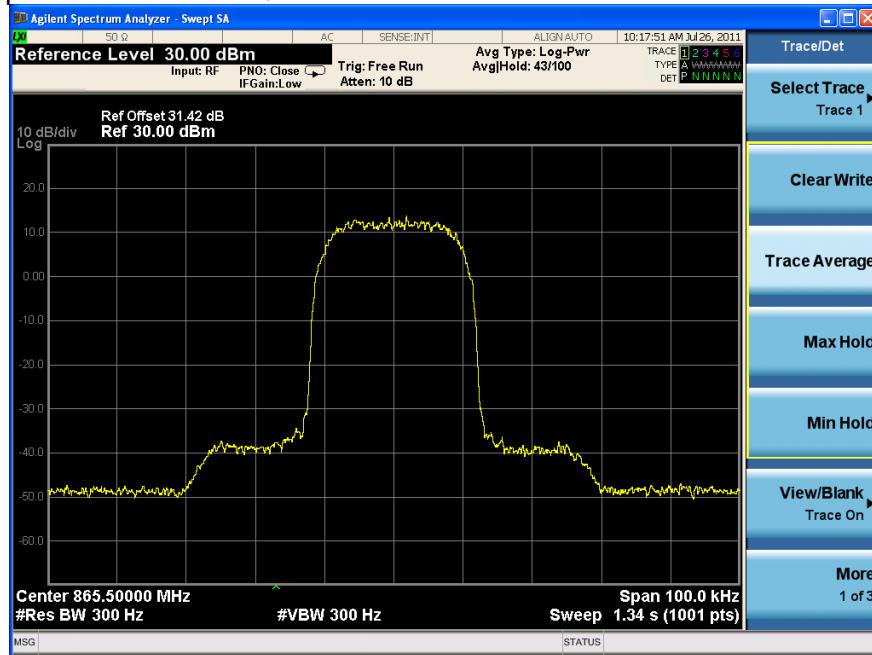
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Appendix A: Test results

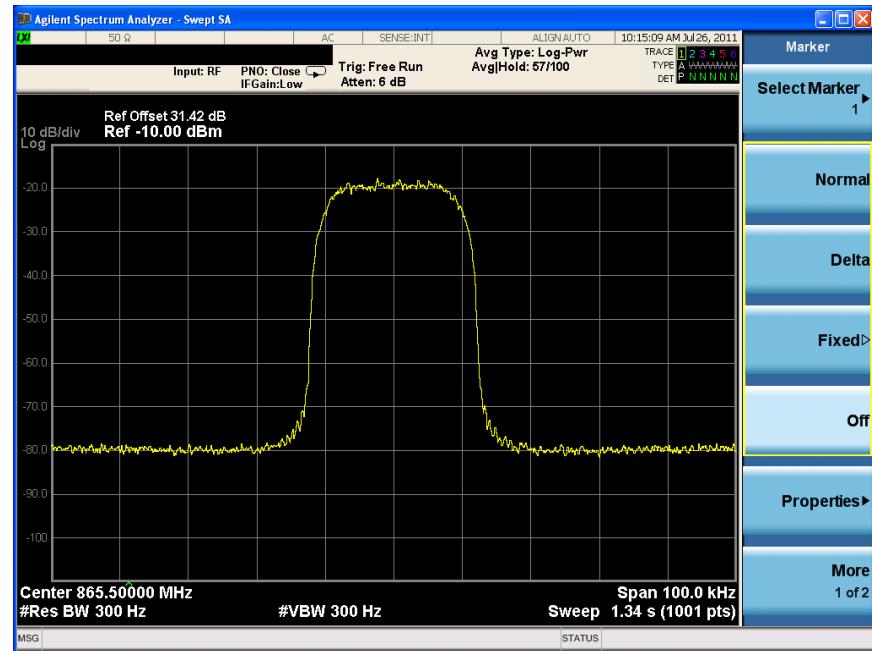
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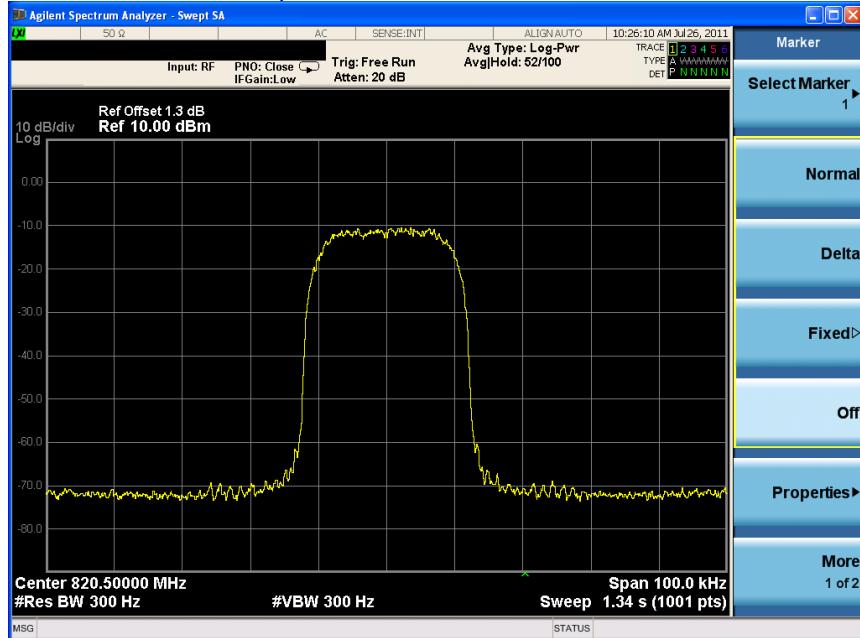
### Test Data – Occupied Bandwidth 25 QAM Downlink OUTPUT



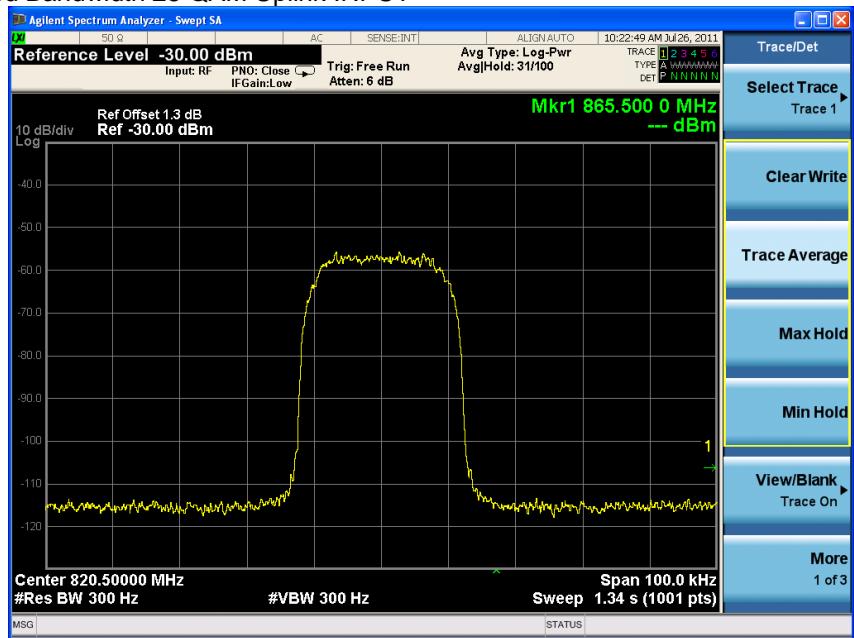
### Test Data – Occupied Bandwidth 25 QAM Downlink INPUT



## Test Data – Occupied Bandwidth 25 QAM Uplink OUTPUT



## Test Data – Occupied Bandwidth 25 QAM Uplink INPUT





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Appendix A: Test results

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## 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.

### Applicable Emission Masks:

Frequency band (MHz)	Mask for equipment with Audio low pass filter	Mask for equipment without audio low pass filter
Below 25	A or B	A or C
25–50	B	C
72–76	B	C
150–174	B, D, or E	C, D, or E
150 Paging-only	B	C
220–222	F	F
421–512	B, D, or E	C, D, or E
450 Paging-only	B	G
806–809/851–854	B	H
809–824/854–869	B	G
896–901/935–940	I	J
902–928	K	K
929–930	B	G
4940–4990	L or M	L or M.
5850–5925	–	–
All other bands	B	C

### § 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: [July 26-28, 2011](#)

Test results: [Pass](#)

Special notes



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Appendix A: Test results

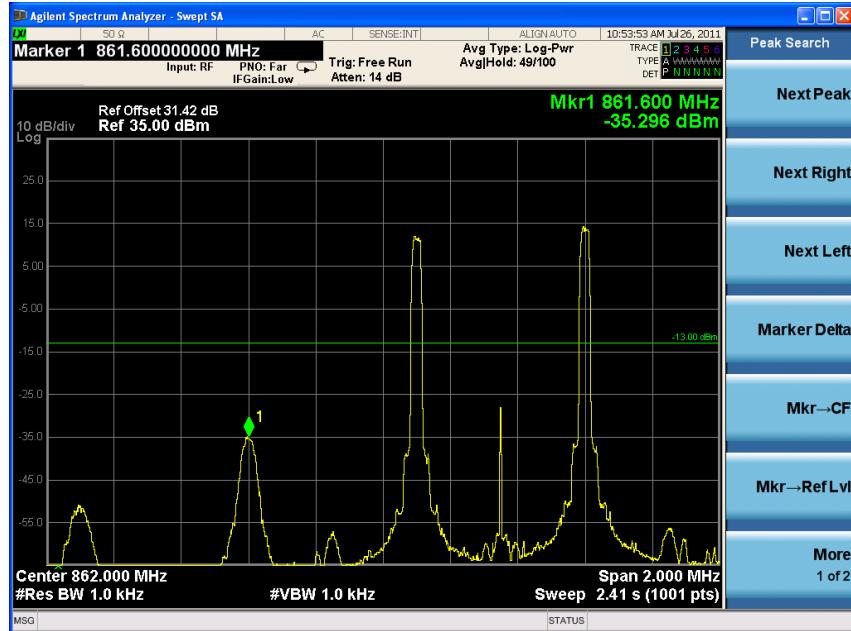
Report Number: 182253TRFWL

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## Spurious Emissions at Antenna Terminals

Downlink – 25 QAM

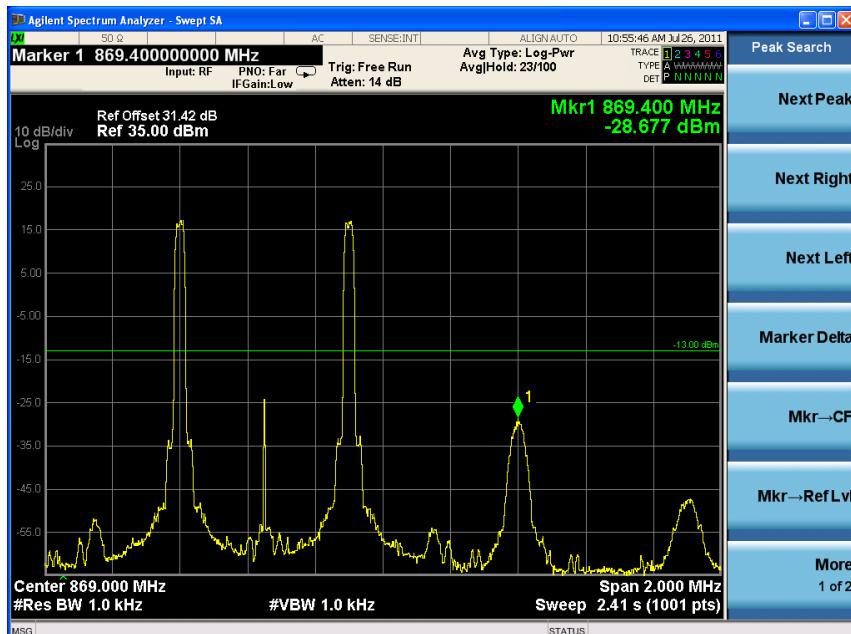
LOW BAND EDGE



## Spurious Emissions at Antenna Terminals

Downlink – 25 QAM

HIGH BAND EDGE





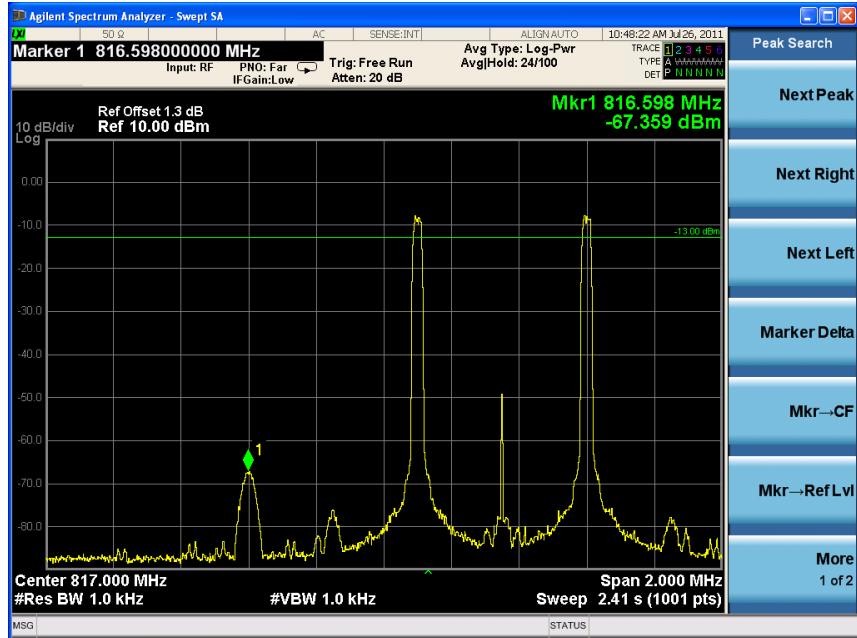
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Appendix A: Test results

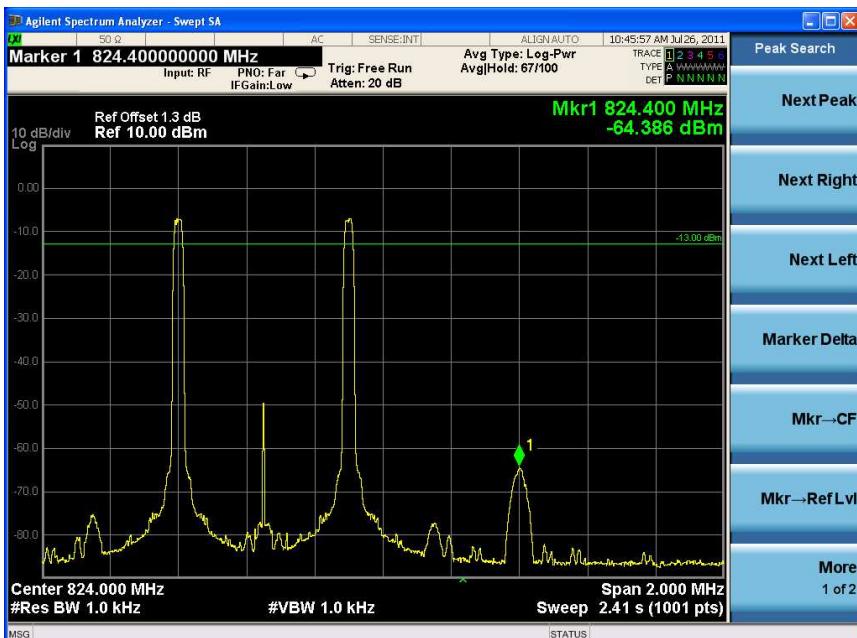
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Spurious Emissions at Antenna Terminals  
Uplink – 25 QAM  
LOW BAND EDGE



Spurious Emissions at Antenna Terminals  
Uplink – 25 QAM  
HIGH BAND EDGE





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Spurious Emissions at Antenna Terminals  
Downlink – 25 QAM  
9 – 150kHz



Spurious Emissions at Antenna Terminals  
Uplink – 25 QAM  
9 – 150kHz





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Appendix A: Test results

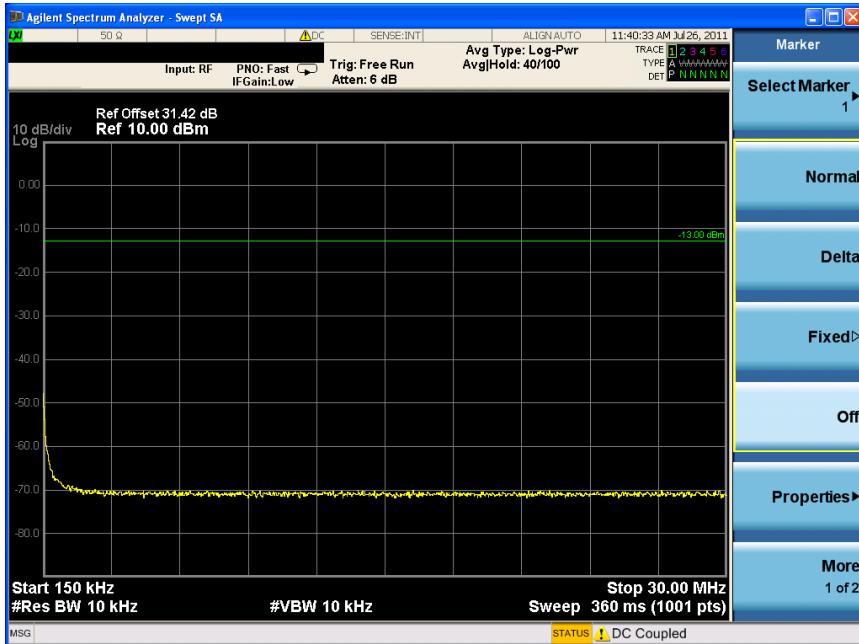
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Spurious Emissions at Antenna Terminals  
Downlink – 25 QAM  
150kHz – 30MHz



Spurious Emissions at Antenna Terminals  
Uplink – 25 QAM  
150kHz – 30MHz





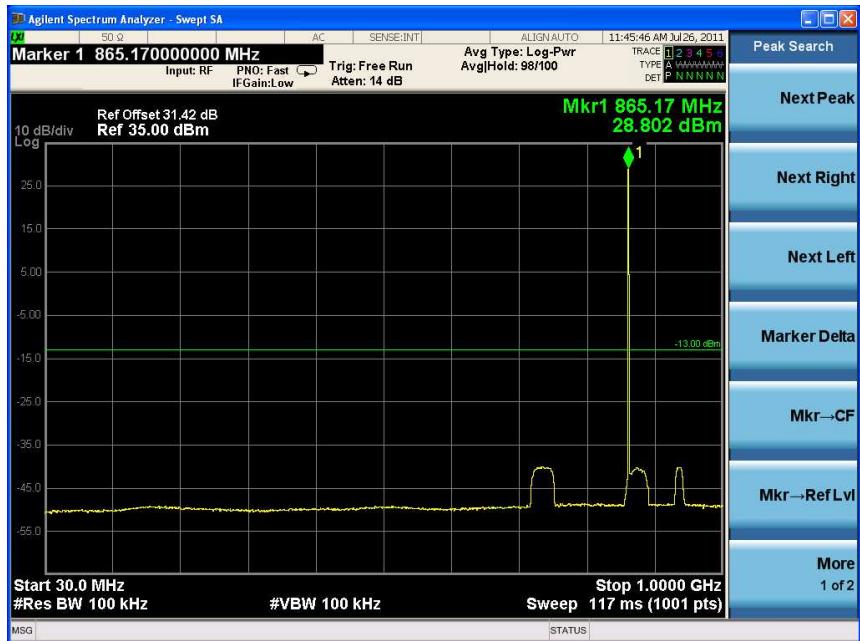
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Spurious Emissions at Antenna Terminals  
Downlink – 25 QAM  
30MHz – 1GHz



Spurious Emissions at Antenna Terminals  
Uplink – 25 QAM  
30MHz – 1GHz





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Spurious Emissions at Antenna Terminals  
Downlink – 25 QAM  
1GHz – 10GHz



Spurious Emissions at Antenna Terminals  
Uplink – 25 QAM  
1GHz – 10GHz





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Appendix A: Test results

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## Clause 90.210 Field strength of spurious radiation

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.

### § 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: [July 26-28, 2011](#)

Test results: [Pass](#)

### Special notes

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



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Appendix A: Test results

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Clause 90.210 Field Strength of spurious radiation, continued

Test data, 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.

The Unwanted Emissions Radiated Spurious were tested according to TIA-603-C Standard.

The only detected spurious..

Frequency MHz	Level measured Pol H/V dBm erp	Correction factor dB	Spurious radiation dBm erp	Limit dBm erp	Detector
865.5 Carrier	-60.0 Pol V	-38.5	-21.5	-13	PK
2130	-70.0 pol V	-17.0	-53.0	-13	PK



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## Clause 90.213 Frequency stability

Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 W output power	2 W or less output power
Below 25	100	100	200
25–50	20	20	50
72–76	5	—	50
150–174	50	5	50
216–220	1.0	—	1.0
220–222	0.1	1.5	1.5
421–512	2.5	5	5
806–809	1.0	1.5	1.5
809–824	1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	0.1	1.5	1.5
902–928	2.5	2.5	2.5
929–930	1.5	—	—
935–940	0.1	1.5	1.5
1427–1435	300	300	300
Above 2450	—	—	—

The units are in ppm

Test date: NA

Test results: -----

Special notes

NOT APPLICABLE; Frequency Stability testing was not performed since the E.U.T. does not contain modulation circuitry



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### Clause 90.213 Frequency stability, continued

#### Test data, continued

Conditions	Frequency (Hz)	Offset (ppm)
+50 °C, Nominal power		
+40 °C, Nominal power		
+30 °C, Nominal power		
+20 °C, +15 % power		
+20 °C, Nominal power		Reference
+20 °C, -15 % power		
+10 °C, Nominal power		
0 °C, Nominal power		
-10 °C, Nominal power		
-20 °C, Nominal power		
-30 °C, Nominal power		

Offset calculation: 
$$\frac{F_{Measured} - F_{reference}}{F_{reference}} \times 1 \cdot 10^6$$

#### Special notes

NOT APPLICABLE:



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Appendix A: Test results

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Specification: FCC 90

## Clause 90.214 Transient frequency behavior

Transmitters designed to operate in the 150–174 MHz and 421–512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time Intervals	Maximum frequency difference	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t1	±25.0 kHz	5.0 ms	10.0 ms
t2	±12.5 kHz	20.0 ms	25.0 ms
t3	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t1	±12.5 kHz	5.0 ms	10.0 ms
t2	±6.25 kHz	20.0 ms	25.0 ms
t3	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t1	±6.25 kHz	5.0 ms	10.0 ms
t2	±3.125 kHz	20.0 ms	25.0 ms
t3	±6.25 kHz	5.0 ms	10.0 ms

Test date: **NA**

Test results: **-----**

Special notes

**NOT APPLICABLE.**



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Appendix A: Test results

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## Clause 90.219 Use of boosters

Licensees authorized to operate radio systems in the frequency bands above 150 MHz may employ signal boosters at fixed locations in accordance with the following criteria:

- (a) The amplified signal is retransmitted only on the exact frequency(ies) of the originating base, fixed, mobile, or portable station(s). The booster will fill in only weak signal areas and cannot extend the system's normal signal coverage area.
- (b) Class A narrowband signal boosters must be equipped with automatic gain control circuitry which will limit the total effective radiated power (ERP) of the unit to a maximum of 5 W under all conditions. Class B broadband signal boosters are limited to 5 W ERP for each authorized frequency that the booster is designed to amplify.
- (c) Class A narrowband boosters must meet the out-of-band emission limits of §90.210 for each narrowband channel that the booster is designed to amplify. Class B broadband signal boosters must meet the emission limits of §90.210 for frequencies outside of the booster's designed passband.
- (d) Class B broadband signal boosters are permitted to be used only in confined or indoor areas such as buildings, tunnels, underground areas, etc., or in remote areas, i.e., areas where there is little or no risk of interference to other users.
- (e) The licensee is given authority to operate signal boosters without separate authorization from the Commission. Certificated equipment must be employed and the licensee must ensure that all applicable rule requirements are met.
- (f) Licensees employing either Class A narrowband or Class B broadband signal boosters as defined in §90.7 are responsible for correcting any harmful interference that the equipment may cause to other systems. Normal co-channel transmissions will not be considered as harmful interference. Licensees will be required to resolve interference problems pursuant to §90.173(b).

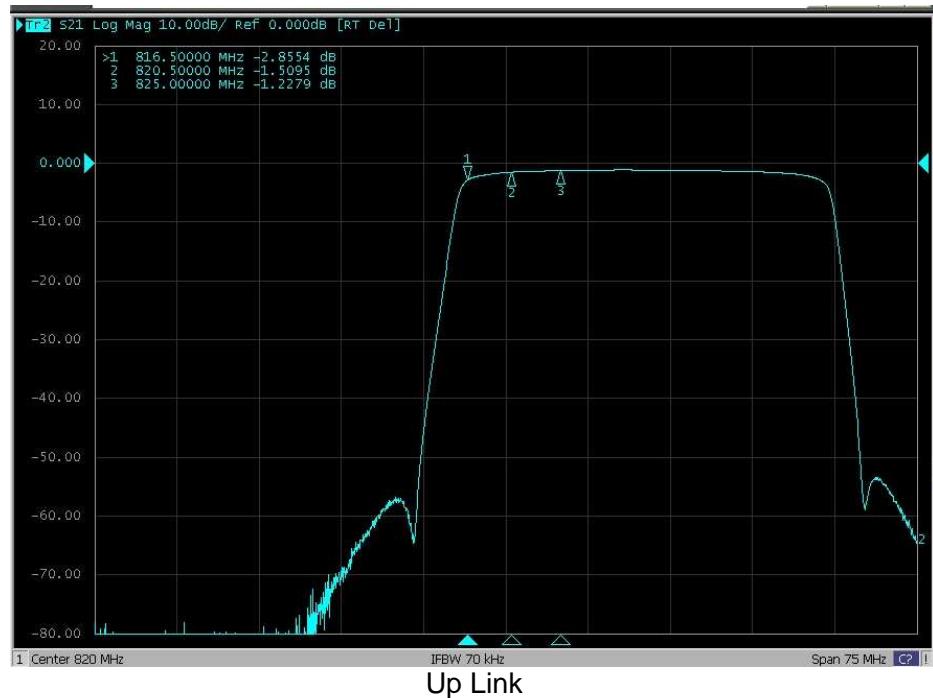
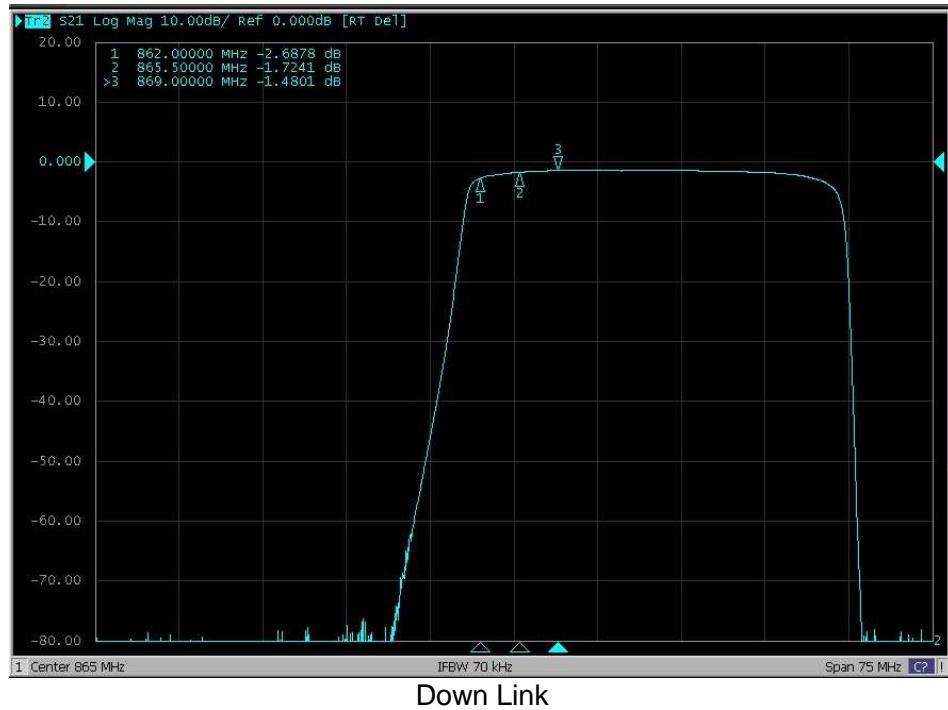
Test date: **NA**

Test results: **-----**

### Special notes

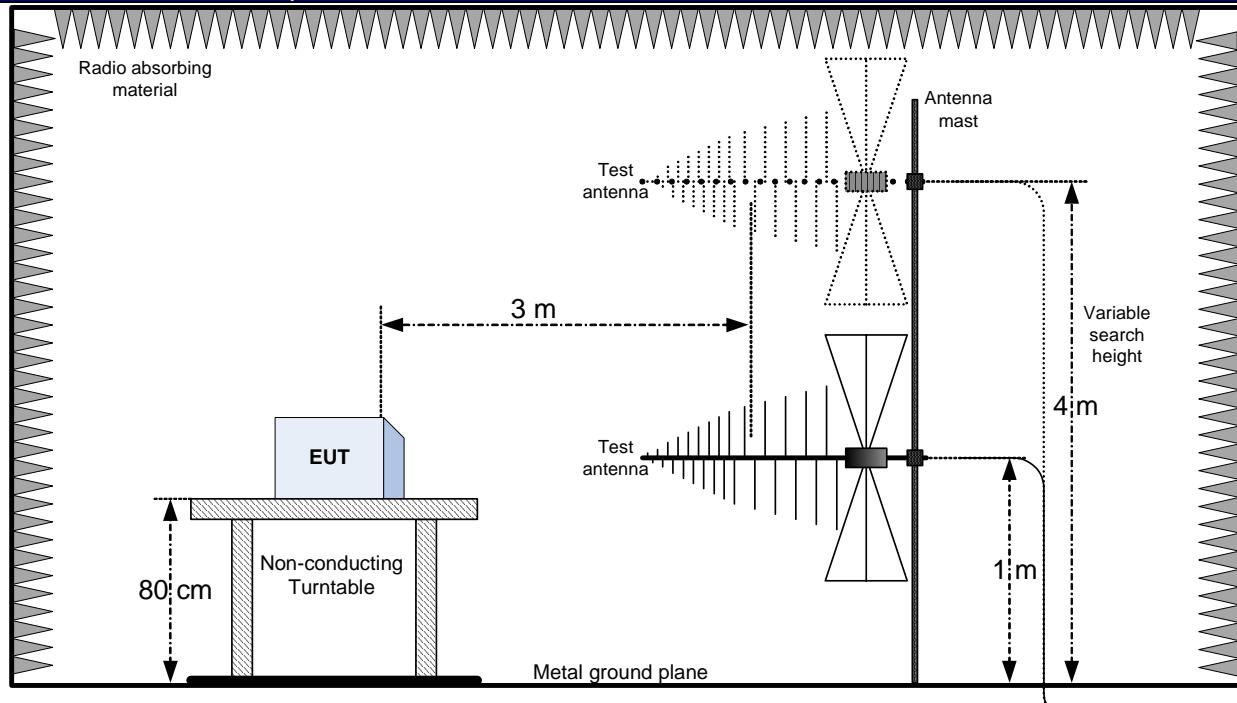
**NOT APPLICABLE.**

## Frequency Filter Response



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

### Radiated emissions set-up





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Appendix A: Test Result

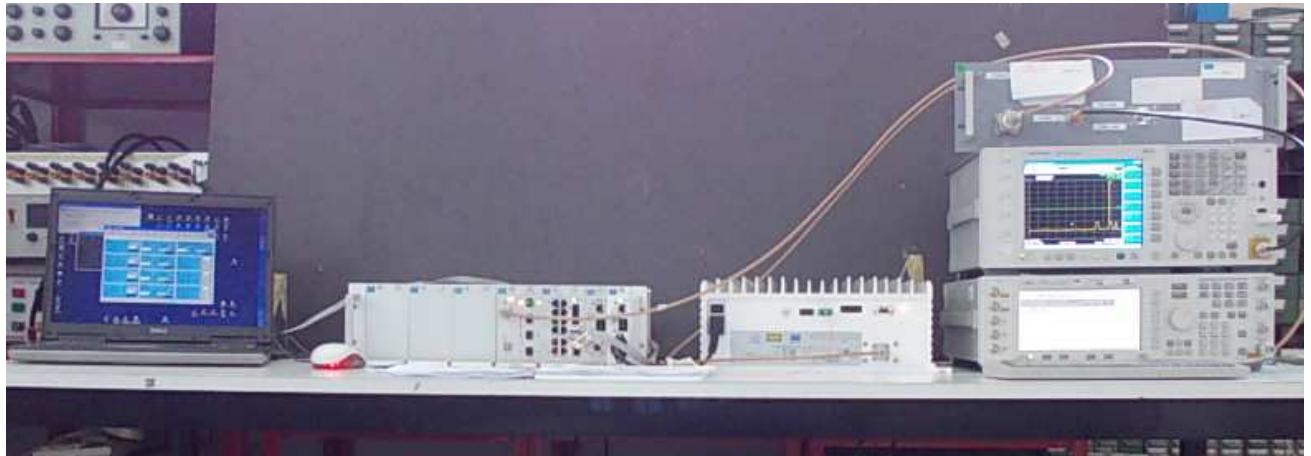
Report Number: 182253TRFWL

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## Appendix C: EUT photos

### EUT

#### SETUP





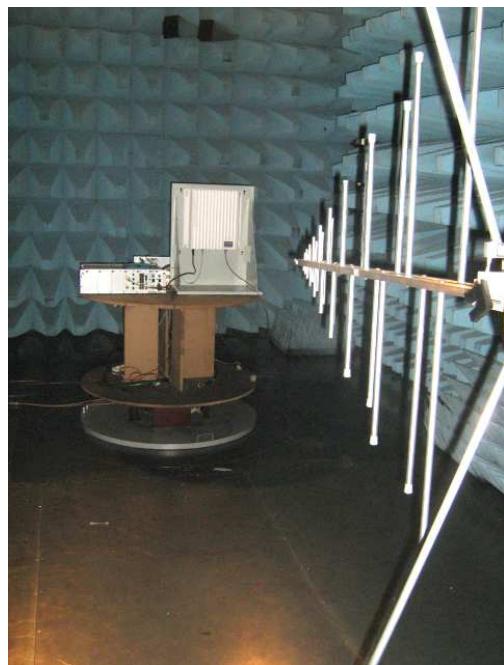
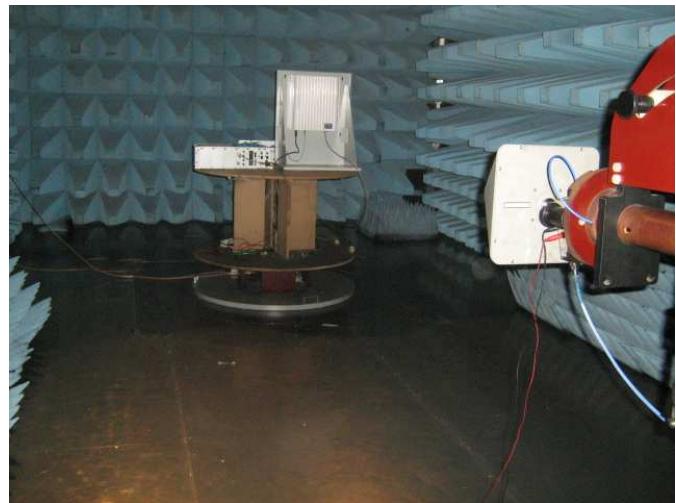
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Appendix A: Test Result

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EUT



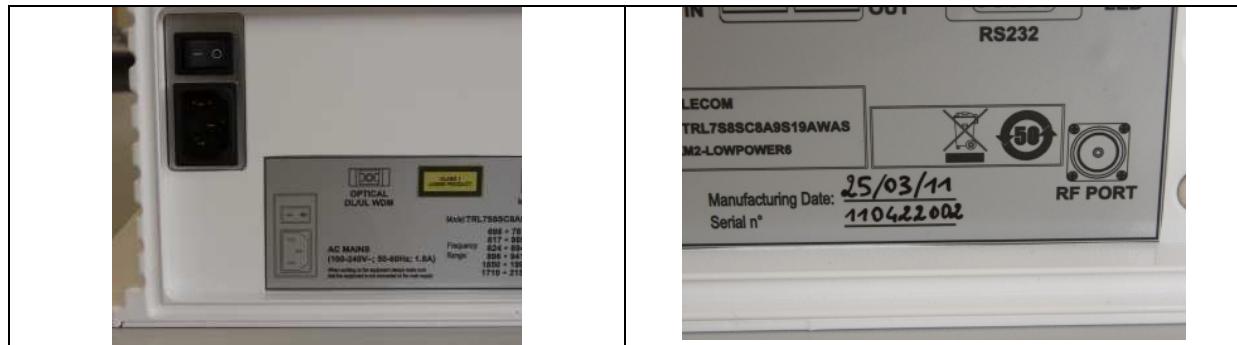


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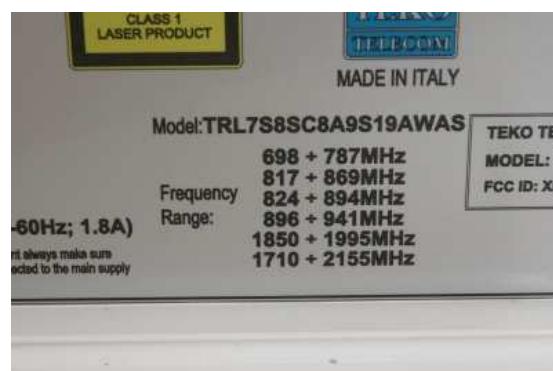
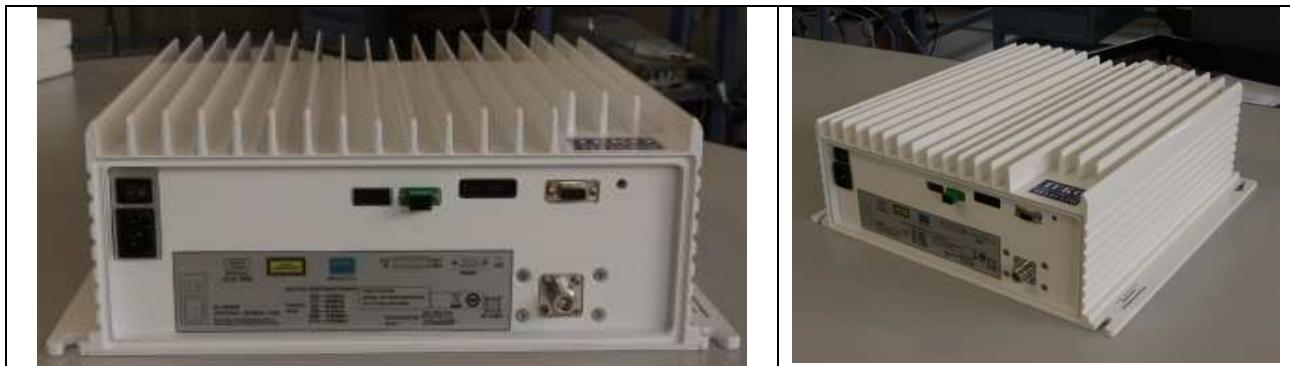
Appendix A: Test Result

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Specification: FCC 90



### REMOTE





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Appendix A: Test Result

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Specification: FCC 90

### MASTER





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Appendix A: Test Result

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Specification: FCC 90

