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Report Reference ID:	148253-4TRFWL

Test specification:	Title 47 – Telecommunication Chapter I – Federal Communications Commission Subchapter B – Common carrier services **Part 24 – Personal communications services** **Subpart D – Narrowband PCS**

Applicant:	TEKO Telecom S.p.A. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO) (Italy)
Apparatus:	Optical system
FCC ID:	XM2LOWPOWERL
Model:	TRU8S9S19WL/AC-WS

Testing laboratory:	**Nemko Italy S.p.A.** Via Carroccio, 4 I-20046 Biassono (Italy)

	Name and title	**Date**
Tested by:	G. Curioni, Wireless/EMC Specialist	May 24, 2010
Reviewed by:	P. Barbieri, Wireless/EMC Specialist	May 24, 2010

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Section 1: Report summary

1.1 Test specification

Specifications	**Part 24 – Personal communications services** **Subpart D – Narrowband PCS**

1.2 Statement of compliance

Compliance	In the configuration tested the EUT was found compliant Yes ☒ No ☐ This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Canada Inc. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 24, subpart D. Radiated tests were conducted in accordance with ANSI C63.4-2003.

1.3 Exclusions

Exclusions	None

1.4 Registration number

Test site FCC ID number	481407 (10 m Semi anechoic chamber)

1.5 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued
R1TRF	---

1.6 Limits of responsibility

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 contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 2: Summary of test results

2.1 FCC Part 24 Subpart D, test results

Part	Test description	Verdict
§24.131	Authorized bandwidth	N a)
§24.132	Output power	Pass
§24.133	Emissions limits	Pass
§24.135	Frequency stability	N a)
§2.1049	Occupied bandwidth	Pass

Notes:

a) Modulation & frequency conversion circuitry not in use

Section 3: Equipment under test (EUT) and application details

3.1 Applicant details		
Applicant complete business name	Name:	Teko Telecom S.p.A.
	Federal Registration Number (FRN):	0018963462
	Grantee code	XM2
Mailing address	Address: City: Province/State: Post code: Country:	Via Meucci, 24/a Castel S. Pietro Terme Bologna 40024 Italy

3.2 Modular equipment	
a) Single modular approval	Single modular approval Yes ☐ No ☒
b) Limited single modular approval	Limited single modular approval Yes ☐ No ☒

3.3 Product details		
FCC ID	Grantee code:	XM2
	Product code:	LOWPOWERL
Equipment class	PCB	
Description of product as it is marketed	Optical System	
	Model name/number:	TRU8S9S19WL/AC-WS
	Serial number:	100236001

3.4 Application purpose	
Type of application	☒ Original certification ☐ Change in identification of presently authorized equipment Original FCC ID: Grant date: ☐ Class II permissive change or modification of presently authorized equipment

3.5 Composite/related equipment	
a) Composite equipment	The EUT is a composite device subject to an additional equipment authorization Yes ☒ No ☐
b) Related equipment	The EUT is part of a system that operates with, or is marketed with, another device that requires an equipment authorization Yes ☒ No ☐
c) Related FCC ID	If either of the above is “yes”: ☒ has been granted under the FCC ID(s) listed below: ☒ is in the process of being filled under the FCC ID(s) listed below: ☐ is pending with the FCC ID(s) listed below: ☐ has a mix of pending and granted statues under the FCC ID(s) listed below: i FCC ID: XM2-LOWPOWER ii FCC ID: XM2LOWPOWERL

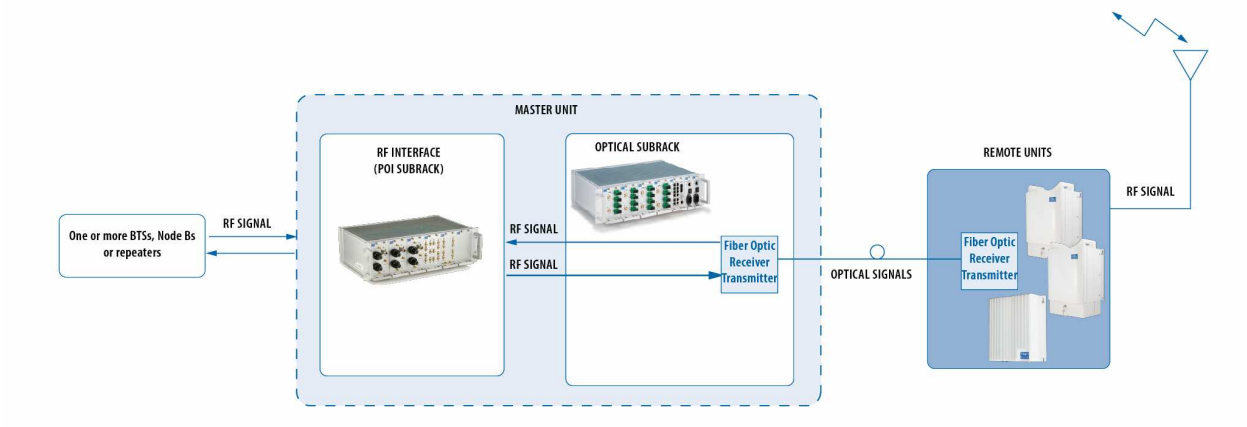
3.6 Sample information

Receipt date:	May 5,2010
Nemko sample ID number:	-----

3.7 EUT technical specifications

Operating band:	Down Link: 940–941 MHz, Up Link: 901-902 MHz
Operating frequency:	Wideband
Modulation type:	iDEN (QAM)
Occupied bandwidth:	25 kHz, 45 kHz
Channel spacing:	standard
Emission designator:	25K0D7W, 45K0D7W
RF Output	Down Link: 29dBm (0,8W) Up Link: 4dBm typical (0,0025W typical)
Gain	Down Link: 34dB Up Link: 47dB
Antenna type:	External Antenna is not provided, equipment that has an external 50 Ω RF connector
Power source:	100-240 Vac external

3.8 EUT setup diagram



Section 4: Engineering considerations

4.1 Modifications incorporated in the EUT

Modifications	Modifications performed to the EUT during this assessment None ☒ Yes ☐, performed by Client ☐ or Nemko ☐ Details:

4.2 Deviations from laboratory tests procedures

Deviations	Deviations from laboratory test procedures None ☒ Yes ☐ - details are listed below:

4.3 Technical judgment

Judgment	None

Section 5: Test conditions

5.1 Power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 ℃ 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 ±5 %, for which the equipment was designed.

Section 6: 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.

Section 7: Test equipment

Identification number	***Description***	***Manufacturer model***	***s/n***	***Cal. Due***
1a	Vector Signal Generator	Agilent H.P. E4438C ESG	MY45094485	July 2010
1b	Vector Signal Generator	Agilent H.P. N5182A MXG	MY48180714	April 2011
2	Spectrum Analyzer	Agilent H.P. E4445A	MY46181806	July 2010
3	Network Analyzer	Agilent H.P E5062A	MY44101829	November 2012
4	2xcables+directional coupler+dummyload			

Client's property

Identification number	***Equipment***	***Manufacturer***	***Model***	***Serial N°***	***Cal. due***
5	Trilog Broadband Antenna	Schwarzbeck	VULB 9163	VULB 9163-286	04/2011
6	Bilog antenna	Schwarzbeck	STLP 9148-123	123	09/2011
7	Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	05/2011
8	Spectrum Analyzer 9kHz-40GHz	R&S	FSEK	848255/005	09/2010
9	Controller	EMCO	2090	9511-1099	NSC
10	Antenna Tower	EMCO	2071-2	9601-1940	NSC
11	Turning table Controller	EMCO	1061-1.521	9012-1508	NSC
12	Semi-anechoic chamber	Nemko	3m semi-anechoic chamber	70	04/2011
13	Trilog Broadband Antenna	Siemens	3m control room	3	NSC

Property of Nemko Italy

Section 8: Testing data

8.1 Clause 24.131 Authorized bandwidth

The authorized bandwidth of narrowband PCS channels will be 10 kHz for 12.5 kHz channels and 45 kHz for 50 kHz channels. For aggregated adjacent channels, a maximum authorized bandwidth of 5 kHz less than the total aggregated channel width is permitted.

Special notes

The measurements were performed using RBW of 1 % of emission bandwidth.

Test data

Frequency (MHz)	Channel bandwidth (kHz)	Limit (kHz)	Margin (Hz)
		12.5/50	
		12.5/50	
		12.5/50	

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

8.2 Clause 24.132 Output power

(a) Stations transmitting in the 901–902 MHz band are limited to 7 W (38.45 dBm) e.r.p.

(b) Mobile stations transmitting in the 930–931 MHz and 940–941 MHz bands are limited to 7 W (38.45 dBm) e.r.p.

(c) Base stations transmitting in the 930–931 MHz and 940–941 MHz bands are limited to 3500 W (65.44 dBm) e.r.p. per authorized channel and are unlimited in antenna height except as provided in paragraph (d) of this section.

Special notes

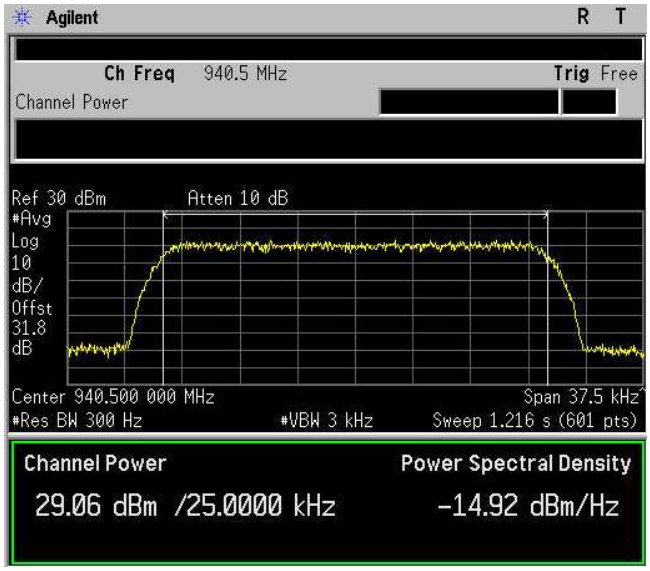
The measurements were performed with spectrum analyzer with RMS detector.

Nemko	**Section 8:** Testing data	**Product:** TRU8S9S19WL/AC-WS	
	Test name: Clause 24.132 Output power		
	Test date: 11-14 May 2010	**Test engineer:** G. Curioni	
	Verdict: Pass	**Supply input:** 100-240 Vac	
	Temperature: 25 ℃	**Air pressure:** 860-1060 hPa	**Relative humidity:** 50 %
	Specification: FCC Part 24		

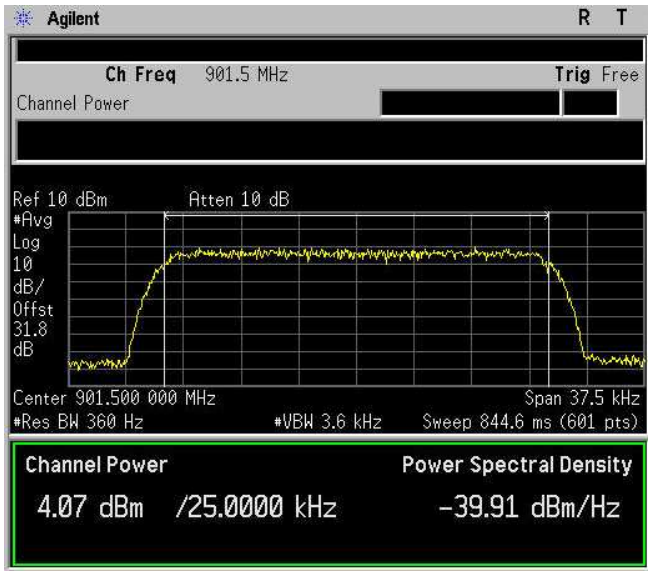
Test data

Direction	Modulation	Frequency (MHz)	RF output power (dBm)
Down-link	iDEN (QAM, 25kHz)	940,5	29.06
Down-link	iDEN (QAM, 45kHz))	940,5	29.07
Up-link	iDEN (QAM, 25kHz)	901,5	4.07
Up-link	iDEN (QAM, 45kHz))	901,5	4.13

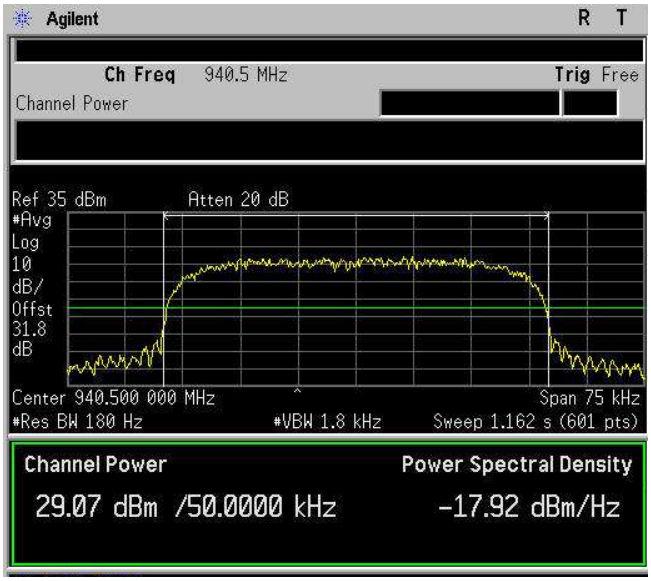
RF Power Output D.L. mod. 25 QAM



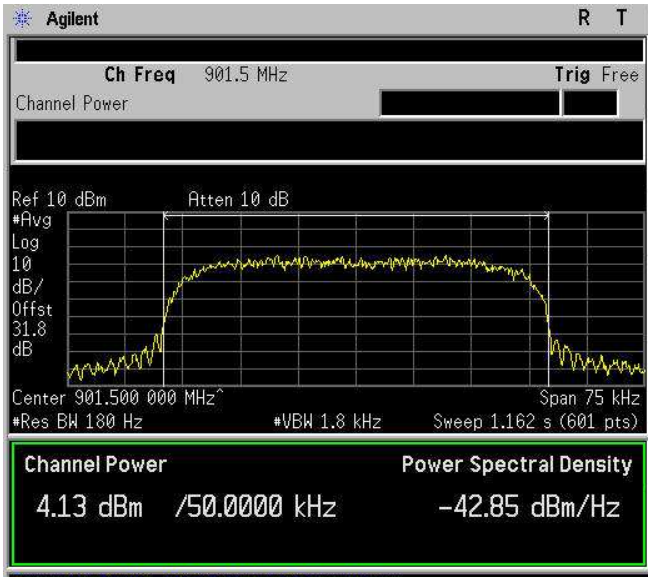
RF Power Output U.L. mod. 25 QAM



RF Power Output D.L. mod. 45 QAM



RF Power Output U.L. mod. 45 QAM



8.3 Clause 24.133 Emissions limits

(a) The power of any emission shall be attenuated below the transmitter power (P), as measured in accordance with §24.132(f), in accordance with the following schedule:

(1) For transmitters authorized a bandwidth greater than 10 kHz:

(i) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (f_d in kHz) of up to and including 40 kHz:
at least 116 Log10((f_d +10)/6.1) decibels or 50 plus 10 Log10(P) decibels or 70 decibels, whichever is the lesser attenuation;

(ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 40 kHz: at least 43+10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation.

(2) For transmitters authorized a bandwidth of 10 kHz:

(i) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (f_d in kHz) of up to and including 20 kHz: at least
116 × Log10((f_d +5)/3.05) decibels or 50+10×Log10(P) decibels or 70 decibels, whichever is the lesser attenuation;

(ii) On any frequency outside the authorized bandwidth and removed from the edge of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 20 kHz: at least 43+10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation.

(b) The measurements of emission power can be expressed in peak or average values provided they are expressed in the same parameters as the transmitter power.

(c) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

(d) The following minimum spectrum analyzer resolution bandwidth settings will be used: 300 Hz when showing compliance with paragraphs (a)(1)(i) and (a)(2)(i) of this section; and 30 kHz when showing compliance with paragraphs (a)(1)(ii) and (a)(2)(ii) of this section.

§24.132(f): All power levels specified in this section are expressed in terms of the maximum power, averaged over a 100 millisecond interval, when measured with instrumentation calibrated in terms of an rms-equivalent voltage with a resolution bandwidth equal to or greater than the authorized bandwidth.

Special notes

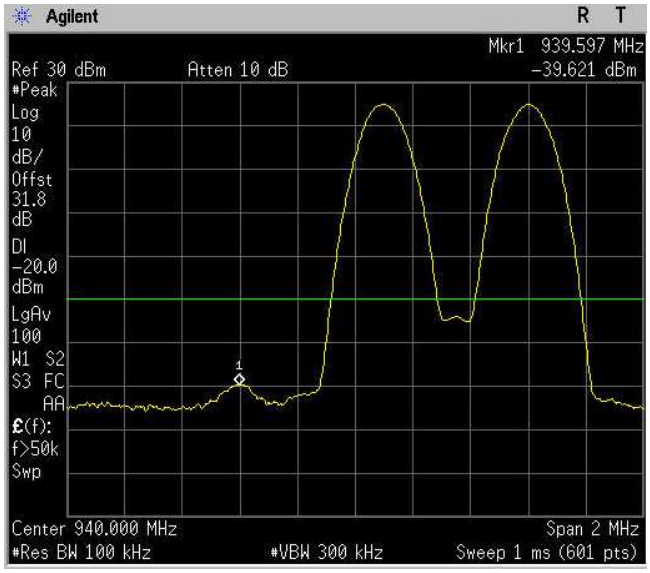
- The spectrum was searched from 30 MHz to the 10th harmonic.
- All measurements were performed using a RMS detector.
- RBW within 30–1000 MHz was 100 kHz and 1 MHz above 1 GHz. VBW was wider than RBW.

Nemko	**Section 8:** Testing data	**Product:** TRU8S9S19WL/AC-WS	
	Test name: Clause 24.133 Emissions limits		
	Test date: 11-14 May 2010	**Test engineer:** G. Curioni	
	Verdict: Pass	**Supply input:** 100-240 Vac	
	Temperature: 25 ℃	**Air pressure:** 860-1060 hPa	**Relative humidity:** 50 %
	Specification: FCC Part 24		

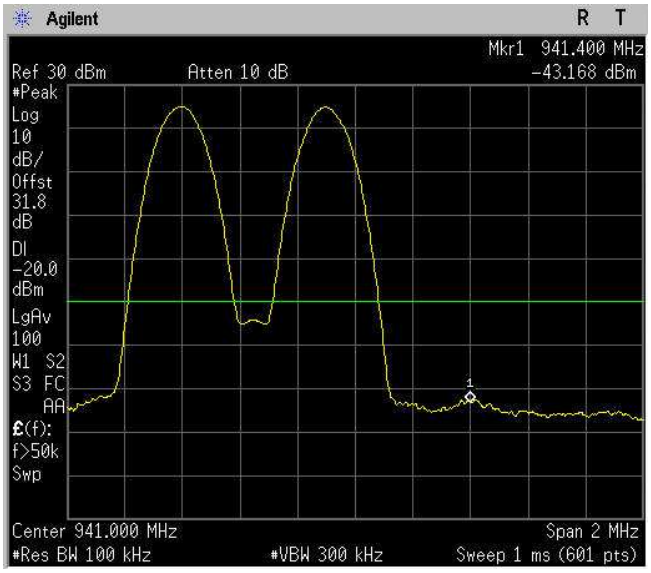
Test data			
Insert plots here			
Spurious emissions measurement results:			
Frequency (MHz)	Spurious emission (dBm)	Limit (dBm)	Margin (dB)
Low channel			
First channel Down-link	Negligible	-13	
First channel Up-link	Negligible	-13	
Mid channel			
940.5 MHz Down-link	Negligible	-13	
901.5 MHz Down-link	Negligible	-13	
High channel			
Last channel Down-link	Negligible	-13	
Last channel Up-link	Negligible	-13	

See Plots below

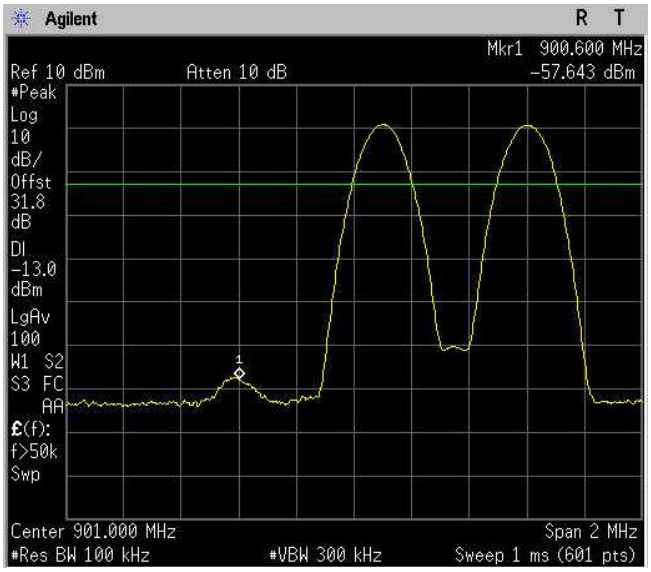
Spurious Emissions at Antenna Terminals
Downlink – 25 QAM
LOW BAND EDGE



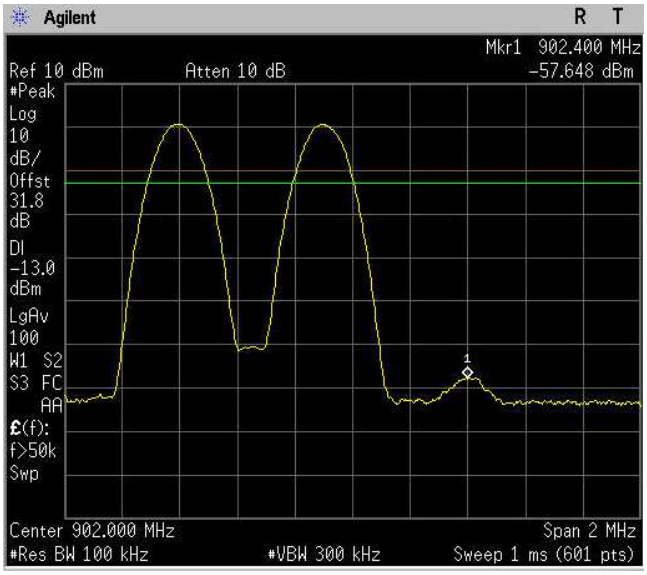
Spurious Emissions at Antenna Terminals
Downlink – 25 QAM
HIGH BAND EDGE



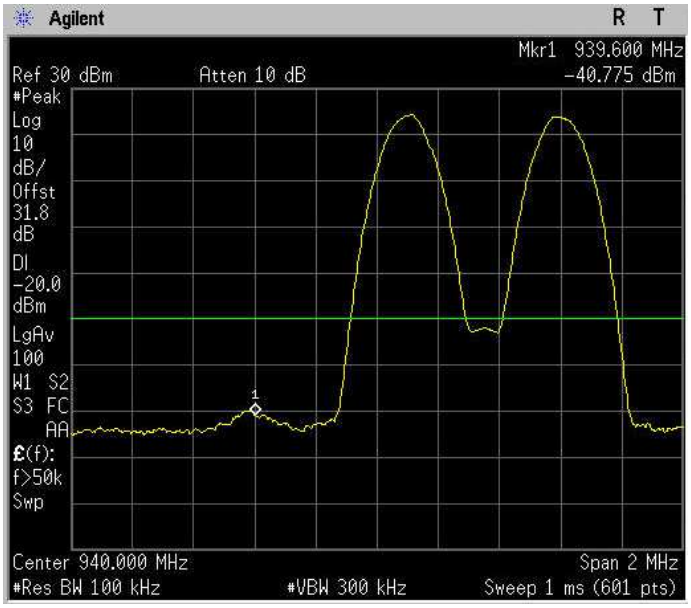
Spurious Emissions at Antenna Terminals
Uplink – 25 QAM
LOW BAND EDGE



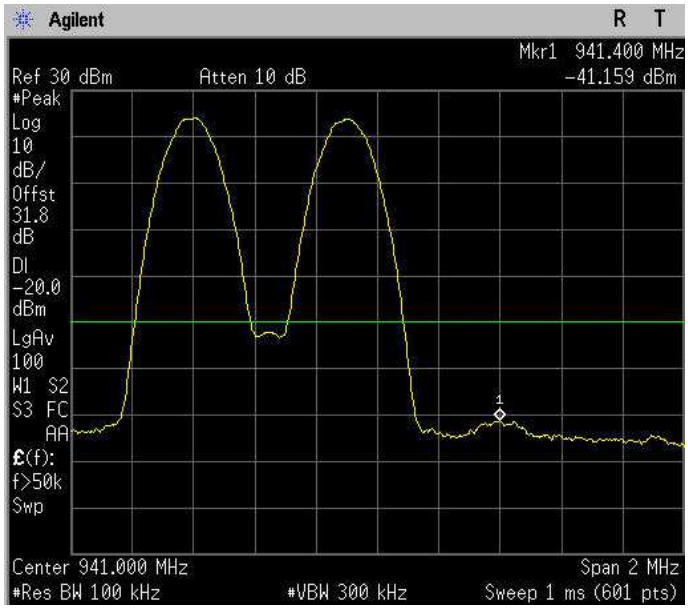
Spurious Emissions at Antenna Terminals
Uplink – 25 QAM
HIGH BAND EDGE



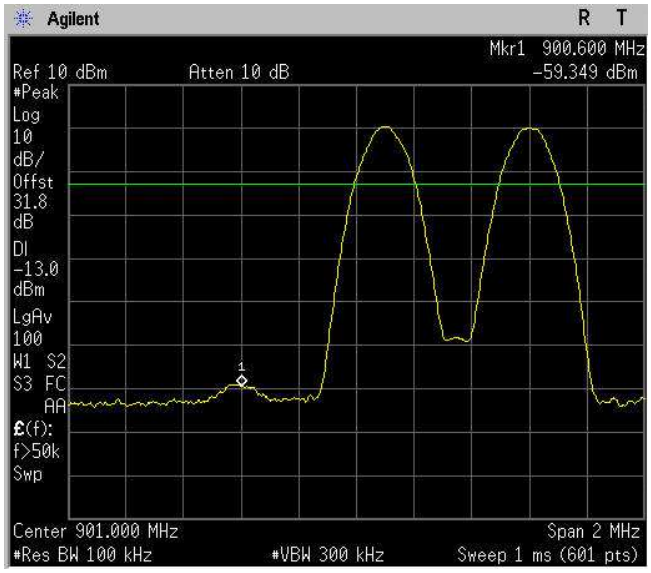
Spurious Emissions at Antenna Terminals
Downlink – 45 QAM
LOW BAND EDGE



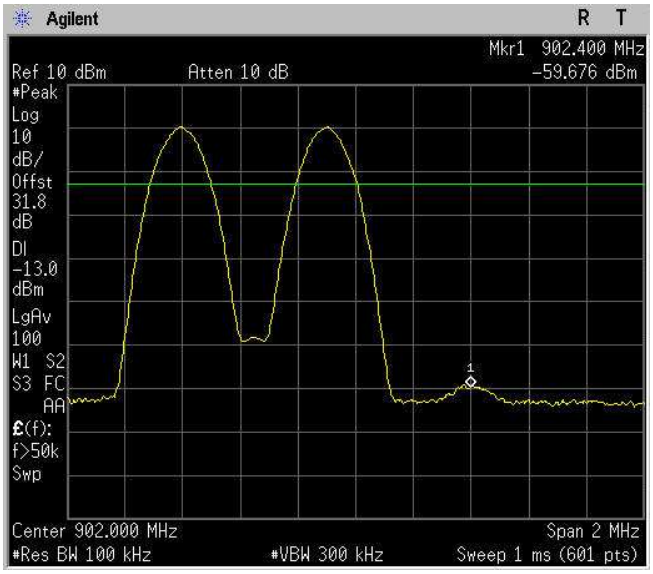
Spurious Emissions at Antenna Terminals
Downlink – 45 QAM
HIGH BAND EDGE



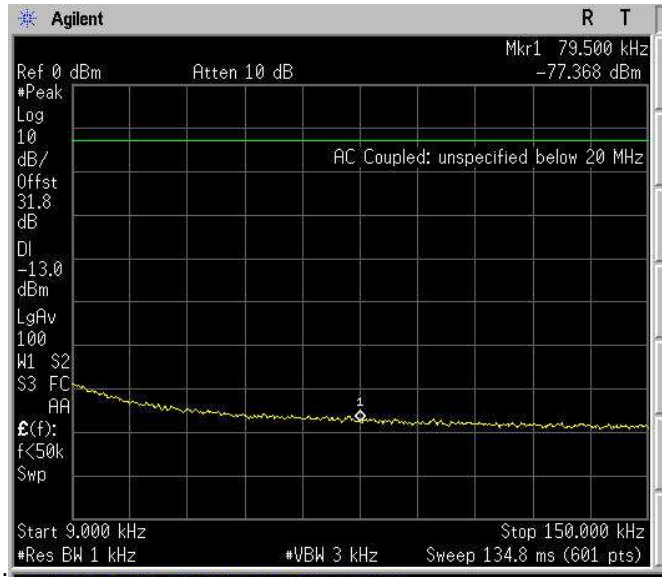
Spurious Emissions at Antenna Terminals
Uplink – 45 QAM
LOW BAND EDGE



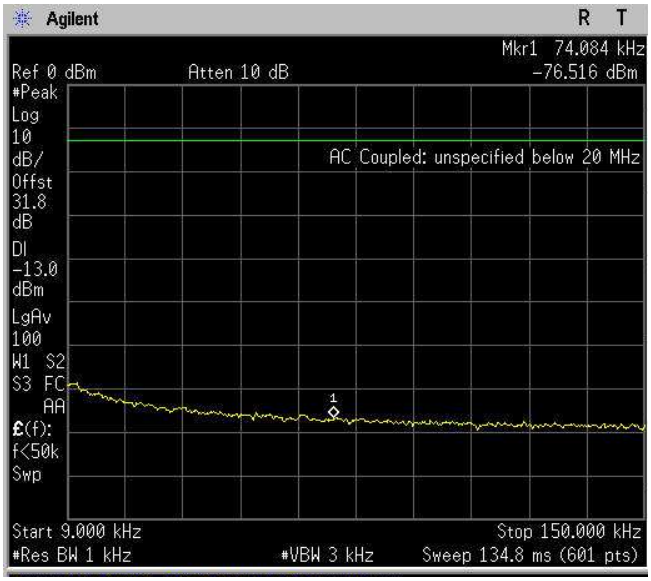
Spurious Emissions at Antenna Terminals
Uplink – 45 QAM
HIGH BAND EDGE



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

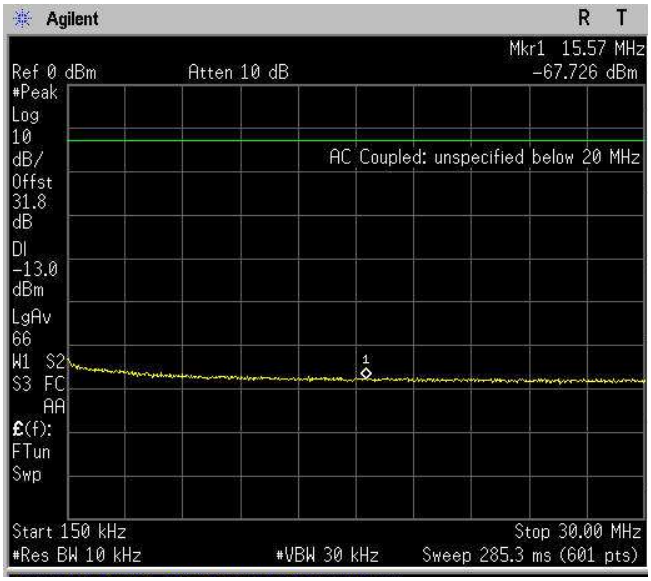


Spurious Emissions at Antenna Terminals
Uplink – 25 QAM
9 kHz – 150 kHz

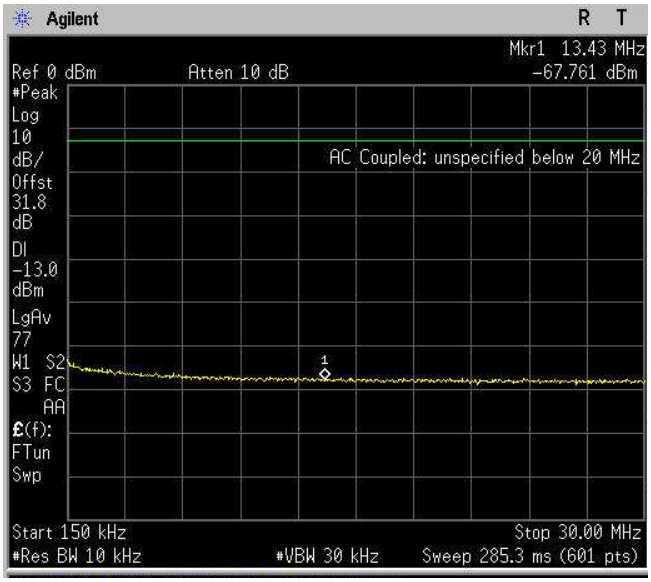


Only 25 QAM 9kHz-150kHz spurious emission plots are included here, other modulations spurious emission plots are negligible and the same.

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

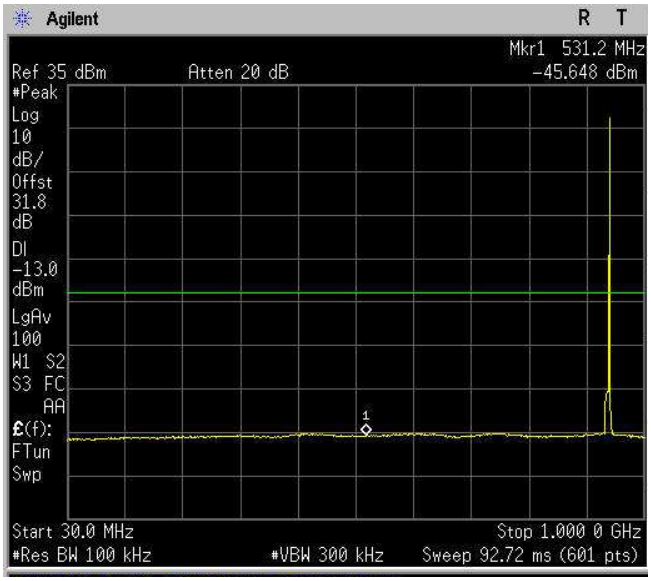


Spurious Emissions at Antenna Terminals
Uplink – 25 QAM
150 kHz – 30MHz

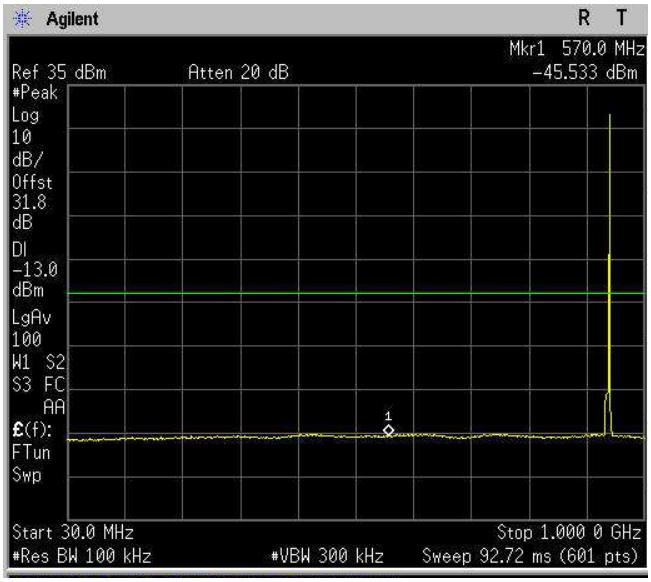


Only 25 QAM 150kHz-30MHz spurious emission plots are included here, other modulations spurious emission plots are negligible and the same.

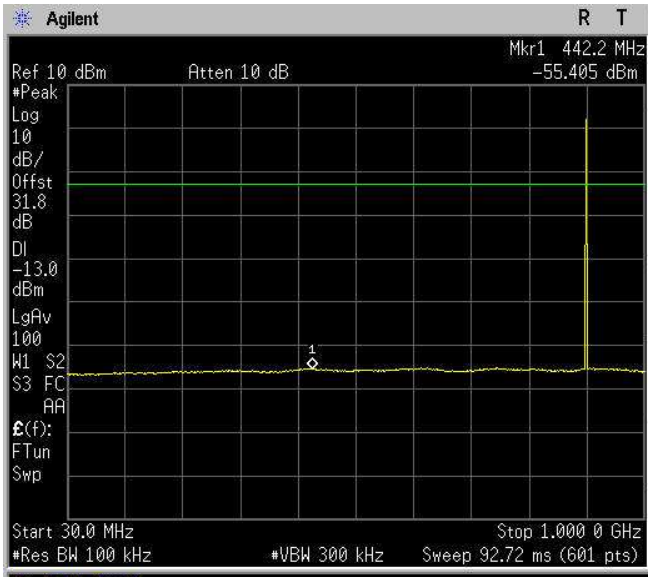
Spurious Emissions at Antenna Terminals
Downlink – 25 QAM
30MHz – 1 GHz



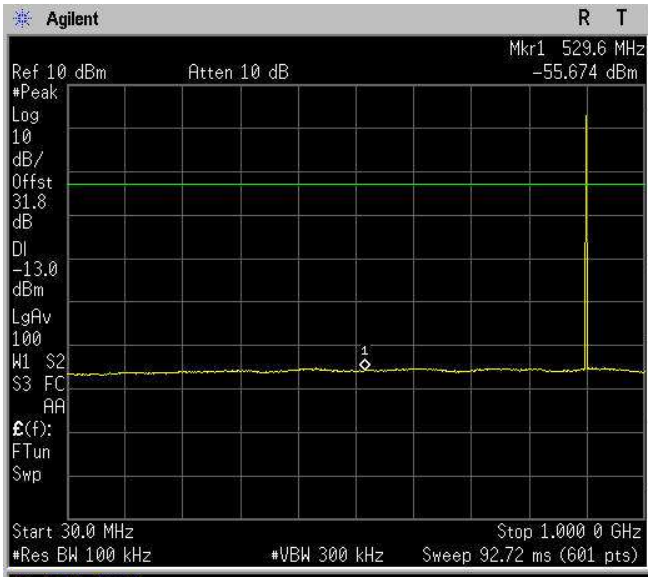
Spurious Emissions at Antenna Terminals
Downlink – 45 QAM
30MHz – 1 GHz



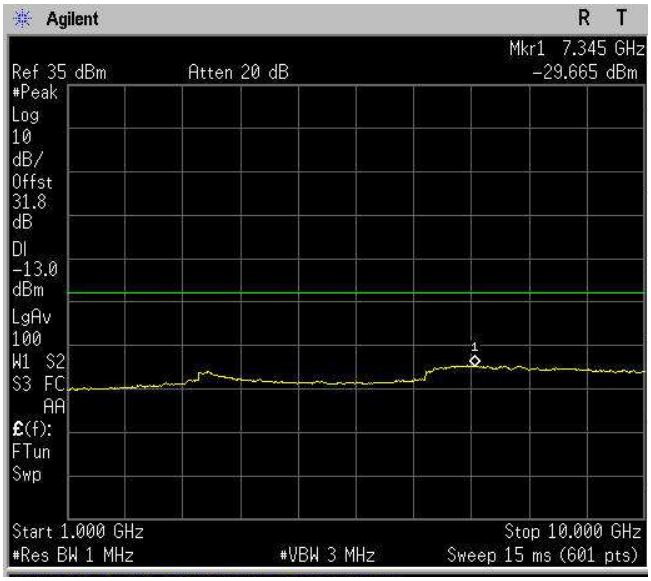
Spurious Emissions at Antenna Terminals
Uplink – 25 QAM
30MHz – 1 GHz



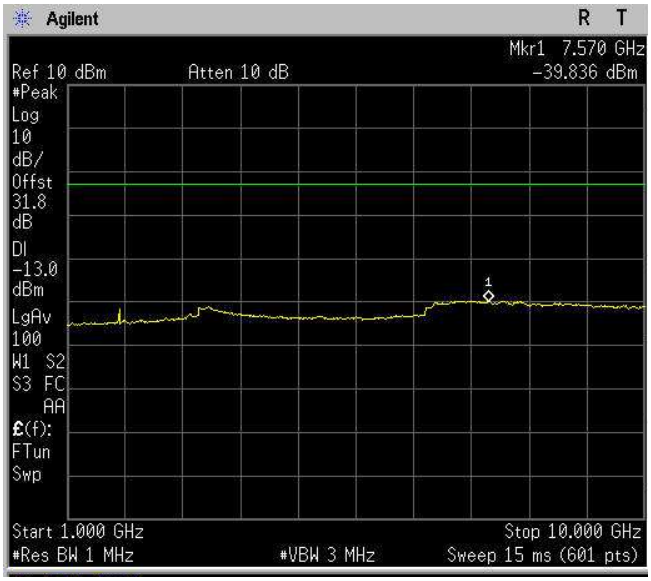
Spurious Emissions at Antenna Terminals
Uplink – 45 QAM
30MHz – 1 GHz



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



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



Only 25 QAM 1GHz-10GHz spurious emission plots are included here, other modulations spurious emission plots are negligible and the same.

Field Strength of Spurious Radiation

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

The D.U.T. antenna connector was terminated by a 50 Ω 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 anechoic chamber is pre-calibrated as regards 0 dBm. (antenna factor not necessary).

8.4 Clause 24.135 Frequency stability

(a) The frequency stability of the transmitter shall be maintained within ±0.0001 percent (±1 ppm) of the center frequency over a temperature variation of −30 ℃ to +50 ℃ at normal supply voltage, and over a variat ion in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20 ℃.

(b) For battery-operated equipment, the equipment tests shall be performed using a new battery without any further requirement to vary supply voltage.

(c) It is acceptable for a transmitter to meet this frequency stability requirement over a narrower temperature range provided the transmitter ceases to function before it exceeds these frequency stability limits.

Special notes

– RBW was set to 300 Hz.

Nemko	**Section 8:** Testing data	**Product:** TRU8S9S19WL/AC-WS	
	Test name: Clause 24.135 Frequency stability		
	Test date: 11-14 May 2010	**Test engineer:** G. Curioni	
	Verdict: Pass	**Supply input:** 100-240 Vac	
	Temperature: 25 ℃	**Air pressure:** 860-1060 hPa	**Relative humidity:** 50 %
	Specification: FCC Part 24		

Test data

Test conditions	Frequency (Hz)	Offset* (ppm)	Limit (ppm)	Margin (ppm)
+50 ℃, Nominal			1.0	
+40 ℃, Nominal			1.0	
+30 ℃, Nominal			1.0	
+20 ℃, +15 %			1.0	
+20 ℃, Nominal		Reference		
+20 ℃, -15 %			1.0	
+10 ℃, Nominal			1.0	
0 ℃, Nominal			1.0	
-10 ℃, Nominal			1.0	
-20 ℃, Nominal			1.0	
-30 ℃, Nominal			1.0	

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

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

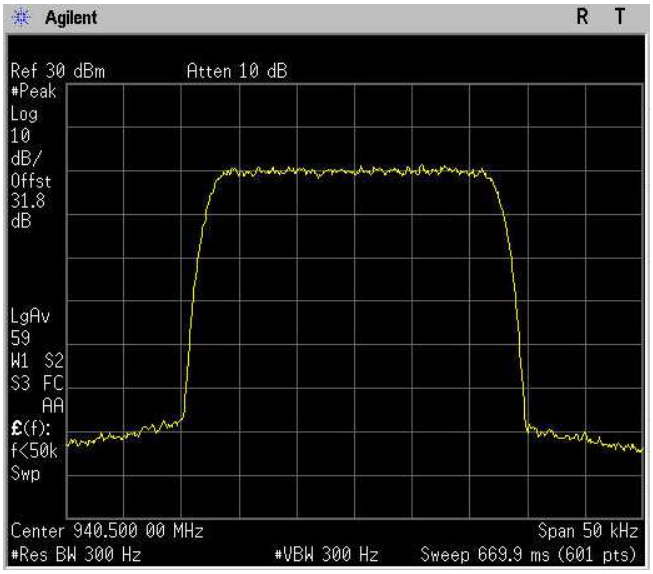
8.5 Clause 2.1049 Occupied bandwidth

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.

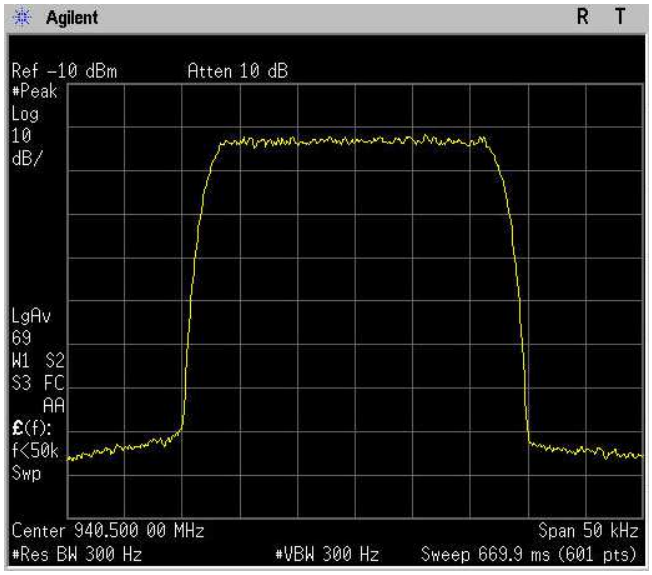
Special notes

- 26 dBc points provided in terms of attenuation below unmodulated carrier.
- RBW was set to 1 % of emissions bandwidth.

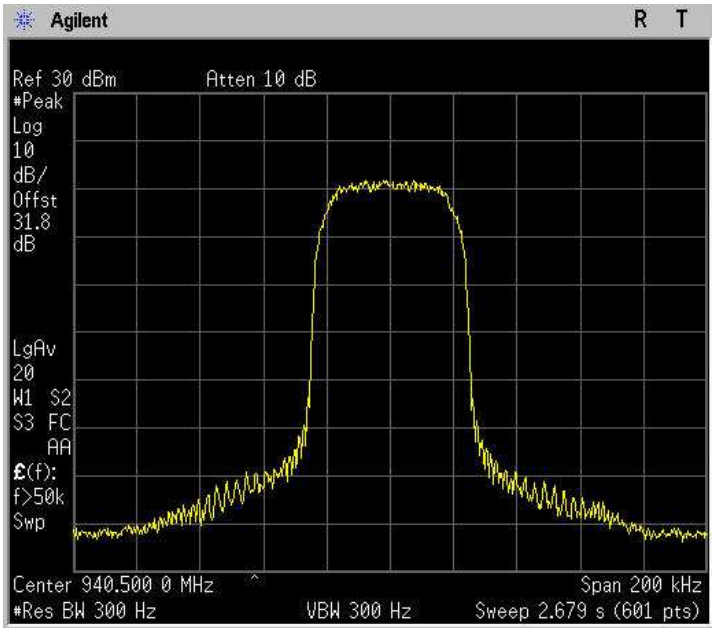
Occupied Bandwidth
Downlink – 25 QAM
OUTPUT



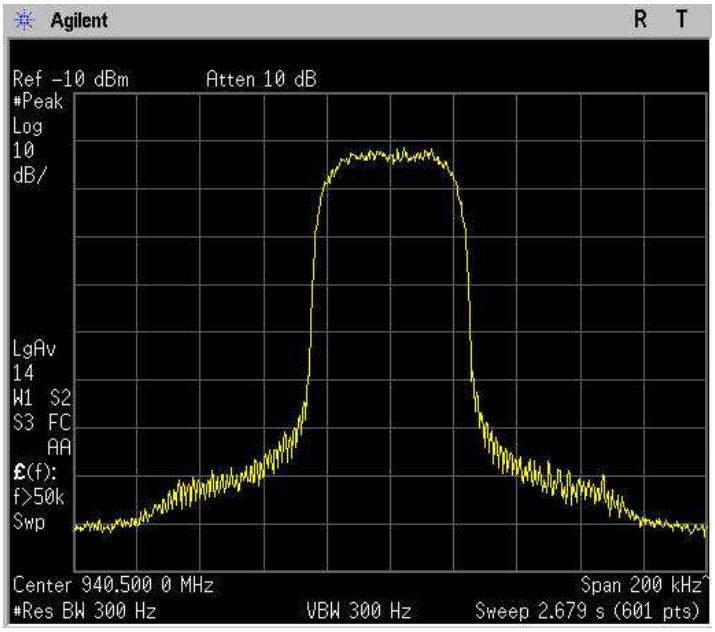
Occupied Bandwidth
Downlink – 25 QAM
INPUT



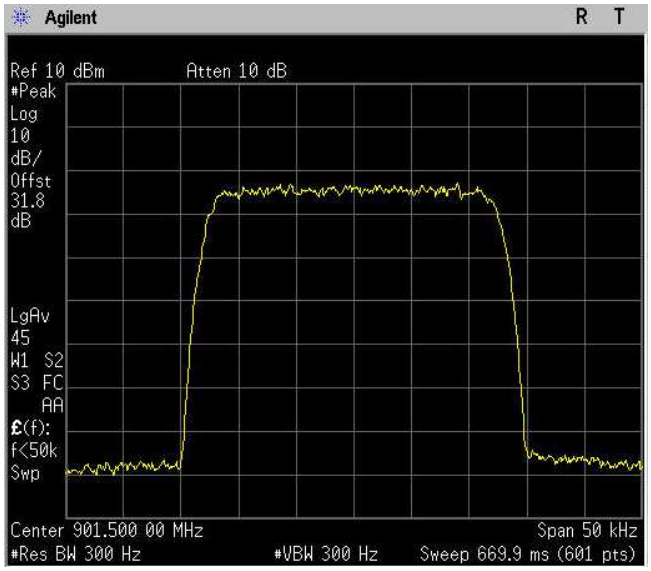
Occupied Bandwidth
Downlink – 45 QAM
OUTPUT



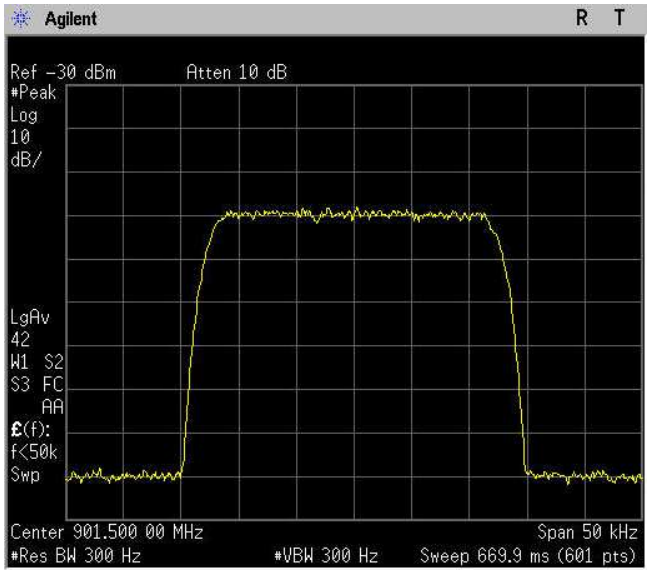
Occupied Bandwidth
Downlink – 45 QAM
INPUT



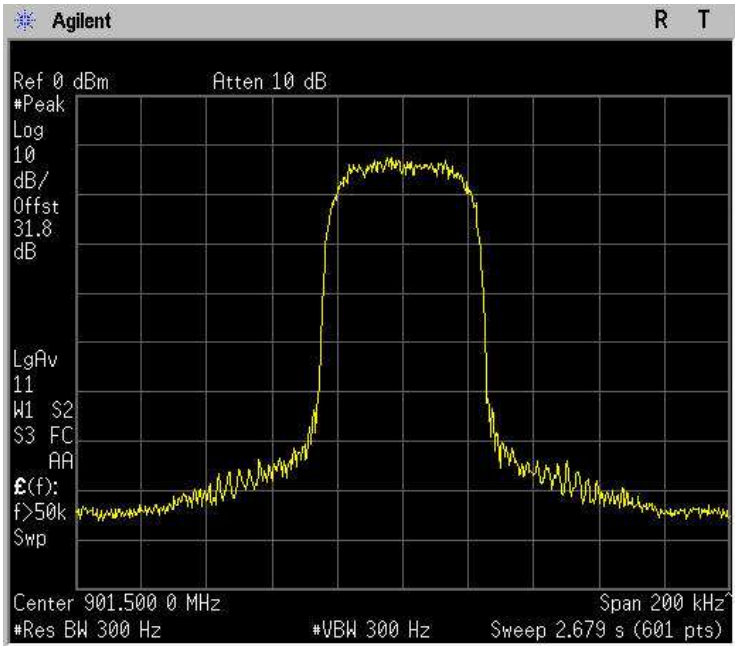
Occupied Bandwidth
Uplink – 25 QAM
OUTPUT



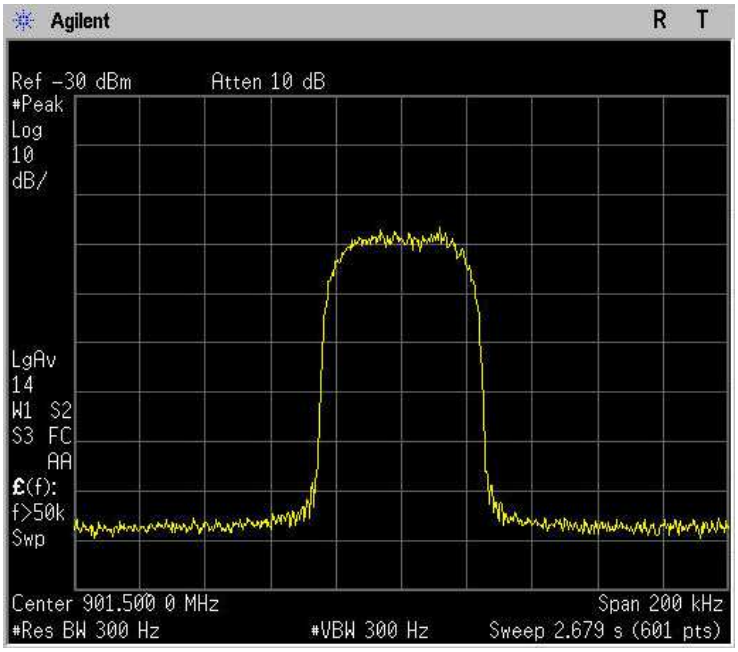
Occupied Bandwidth
Uplink – 25 QAM
INPUT



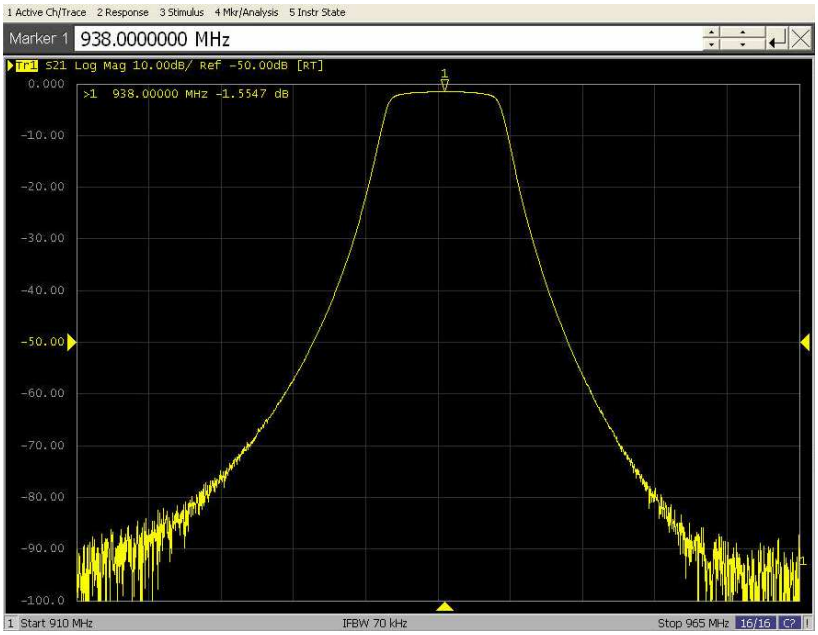
Occupied Bandwidth
Uplink – 45 QAM
OUTPUT



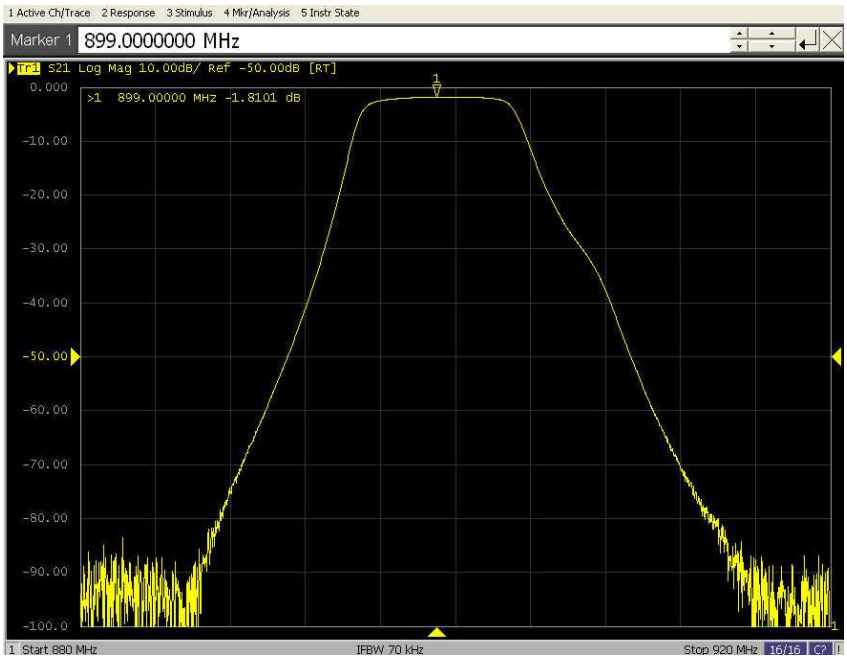
Occupied Bandwidth
Uplink – 45 QAM
INPUT



Section 9: Filter Frequency Response



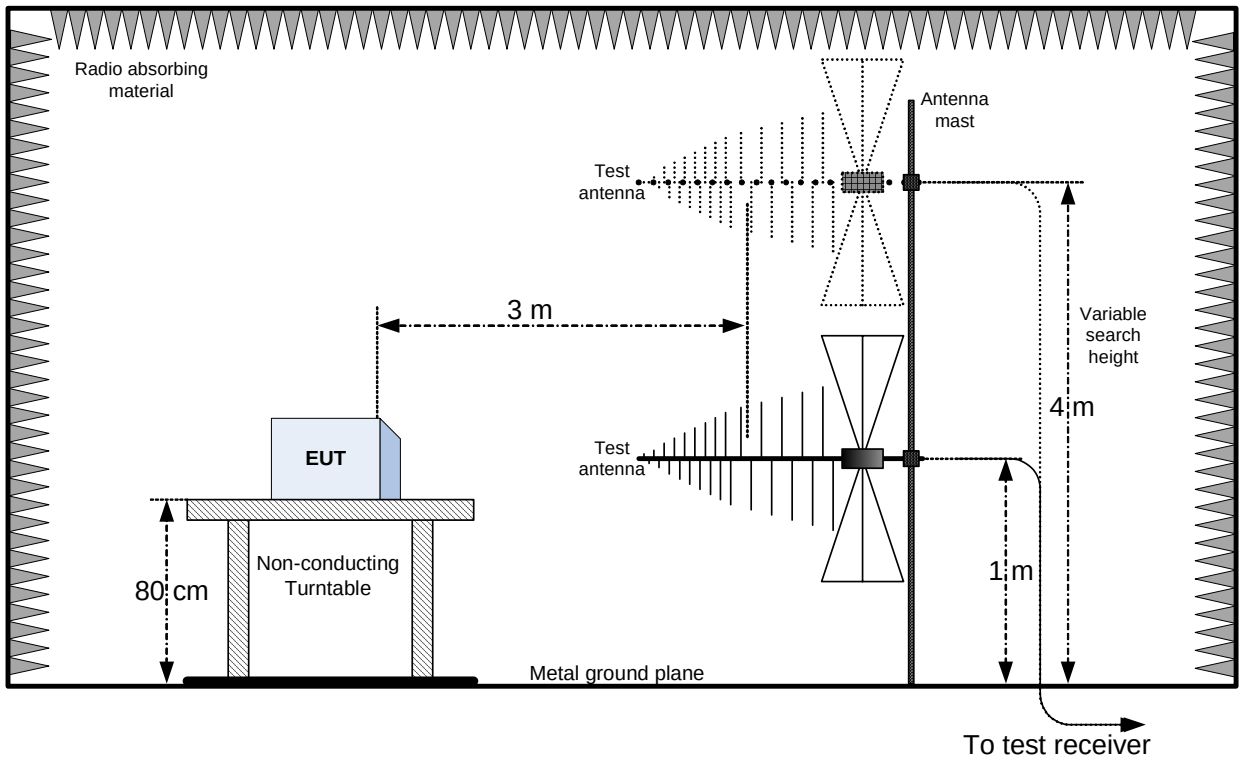
Down-link



Up-link

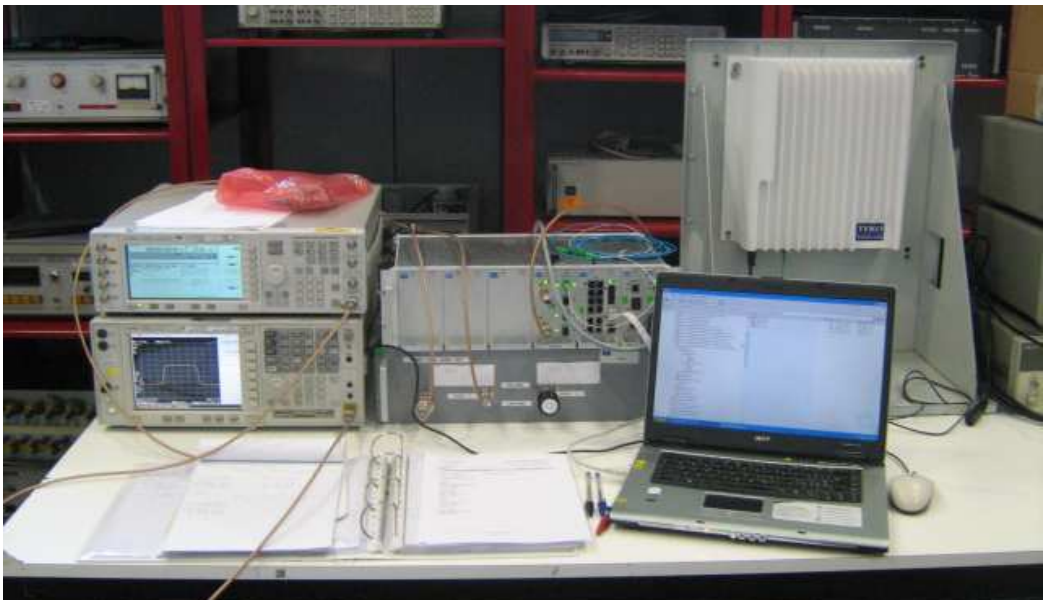
Section 10: Block diagrams of test set-ups

Radiated emissions set-up

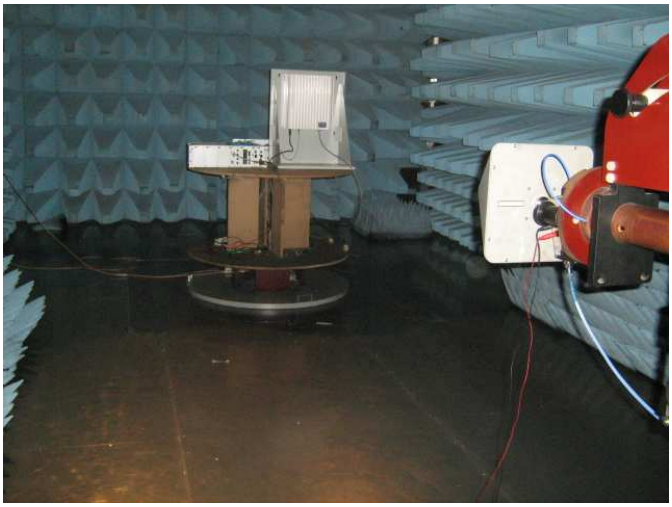


Section 11: EUT photos

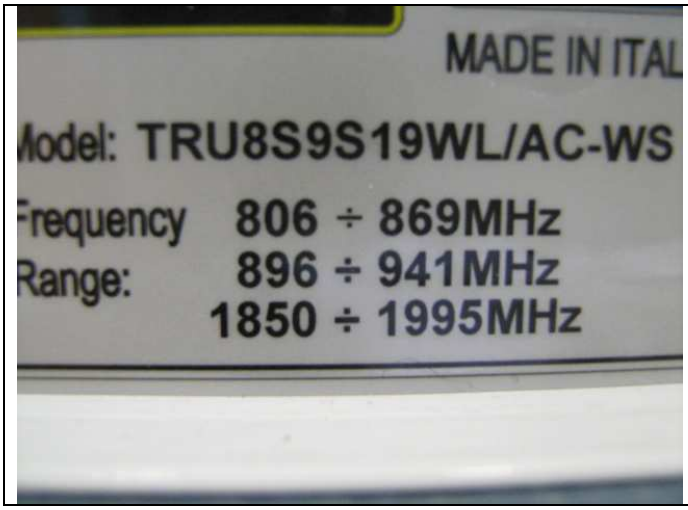
EUT



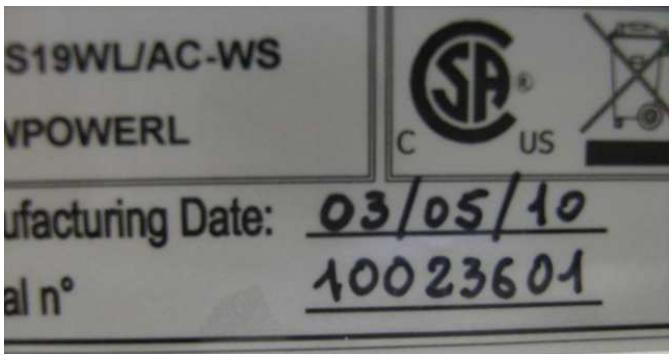
EUT



REMOTE


MADE IN ITAL
Model: TRU8S9S19WL/AC-WS
Frequency 806 ÷ 869MHz
Range: 896 ÷ 941MHz
1850 ÷ 1995MHz


CLASS 1
LASER PRODUCT
AC MAINS
(100-240V~; 50-60Hz; 1.5A)


S19WL/AC-WS
POWERL
C US
ufacturing Date: 03/05/10
al n° 10023601

MASTER