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Report number: **209925-4TRFWL**

Apparatus: TDFE-8S

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

FCC ID: XM2-DFE

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:  2012/06/20
Signature Date
P. Barbieri, Wireless/EMC Specialist

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Signature Date
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	Section 1: Report summary
	Report Number: 209925-4
	Specification: FCC 90

Section 1: Report summary

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

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 Italy S.p.A. Via Carroccio, 4 I-20046 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

2.1 Identification of equipment under test (EUT)

The following information identifies the EUT under test:

Type of equipment:	Digital Donor Front End
Product marketing name:	Teko Telecom S.p.A.
Model number:	TDFE-8S
Serial number:	111054002
Nemko sample number:	-----
FCC ID:	XM2-DFE
Date of receipt:	2012-06-11

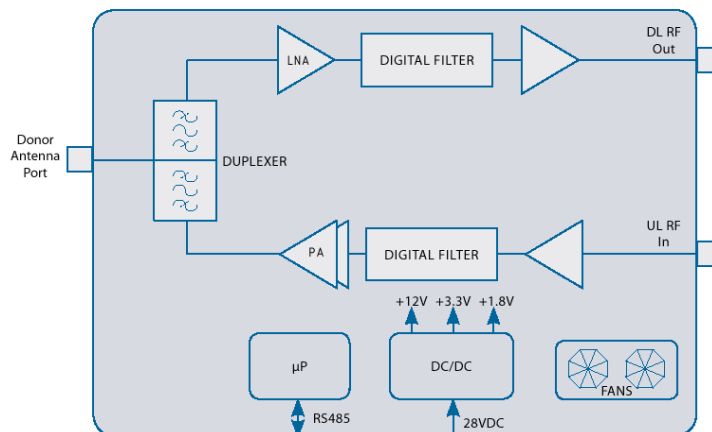
2.2 Accessories and support equipment

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



Digital Donor Front End Module block diagram

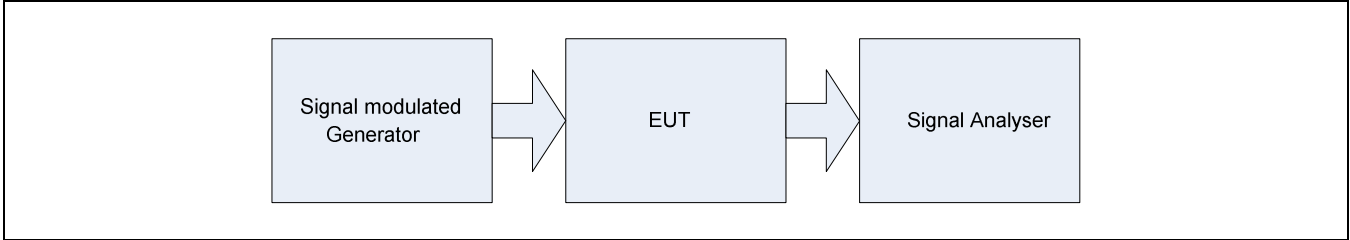
2.4 Technical specifications of the EUT

Operating band:	Down Link: 851–869 MHz, Up Link: 806-824 MHz
Operating frequency:	Wideband
Modulation type:	iDEN (QAM)
Occupied bandwidth:	25 kHz
Emission designator:	D7W
RF Output	Down Link: 10dBm (0,010W) Up Link: 26dBm (0,400W)
Gain	Down Link: 63dB Up Link: 64dB
Antenna data:	External Antenna is not provided equipment that has an external 50 Ω RF connector
Power source	28-30 Vdc stand alone 100-240 Vac in subrack with external Ac/Dc power supply

	Section 2: Equipment under test
	Report Number: 209925-4
	Specification: FCC 90

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

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 ± 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.

3.4 Test equipment

<i>Identification number</i>	<i>Description</i>	<i>Manufacturer model</i>	<i>s/n</i>	<i>Cal. Due</i>
1a	Vector Signal Generator	Agilent N5182A MXG	MY48180714	May 2013
1b	Vector Signal Generator	Agilent E4438C ESG	MY45094485	Ago 2013
2	Spectrum Analyzer	Agilent E4440A	US40420470	Jul 2012
3	Network Analyzer	Agilent E5071B	MY42301133	Jan 2013
4	Climatic chamber	Angelantoni Hygros 600	7237	Nov 2014

Client's property

<i>Identification number</i>	<i>Equipment</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Serial N°</i>	<i>Cal. due</i>
1	Trilog Broadband Antenna	Schwarzbeck	VULB 9163	VULB 9163-286	04/2013
2	Bilog antenna	Schwarzbeck	STLP 9148-123	123	09/2012
3	Double ridge waveguide horn	Spin	DRH40	061106A40	09/2013
4	Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	05/2013
5	Broadband preamplifier	Miteq	JS44	1648665	05/2013
6	Spectrum Analyzer 9kHz-40GHz	R&S	FSEK	848255/005	09/2012
7	Controller	EMCO	2090	9511-1099	NSC
8	Antenna Tower	EMCO	2071-2	9601-1940	NSC
9	Turning table Controller	EMCO	1061-1.521	9012-1508	NSC
10	Semi-anechoic chamber	Nemko	3m semi-anechoic chamber	70	04/2013
11	Control room	Siemens	3m control room	3	NSC

Property of Nemko Italy

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	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	Y	Pass
§90.214	–	Transient Behavior	N	
§90.219	–	Use of boosters	N	
§2-11-04/EAB/RF	--	Filter Frequency Response	Y	Pass

Notes:

	Appendix A: Test results
	Report Number: 209925-4
	Specification: FCC 90

Appendix A: Test results

Clause 90.205 Output power

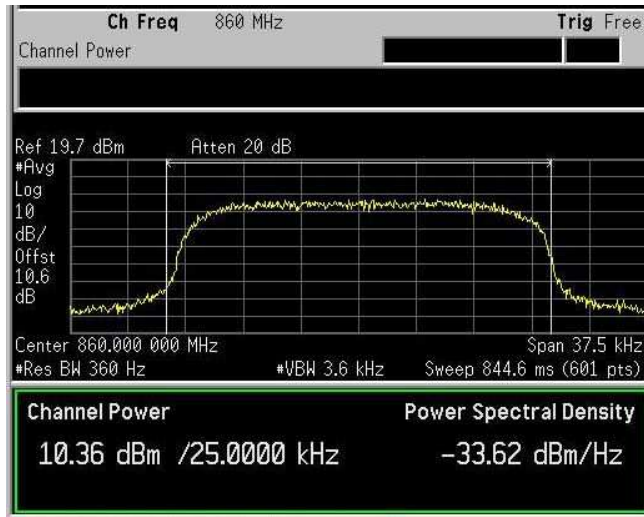
Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation. Except where otherwise specifically provided for, the maximum power that will be authorized to applicants whose license applications for new stations are filed after August 18, 1995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

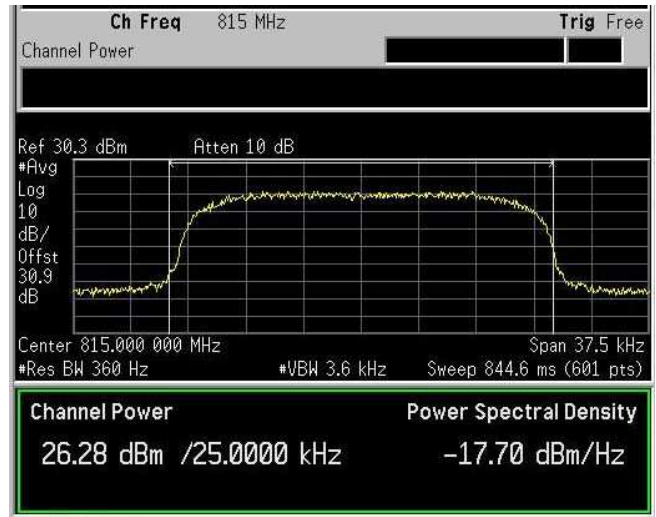
Test date: 2012-06-11
Test results: Pass

Test data

Mod. iDEN (QAM)



Down-link



Up-link

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.

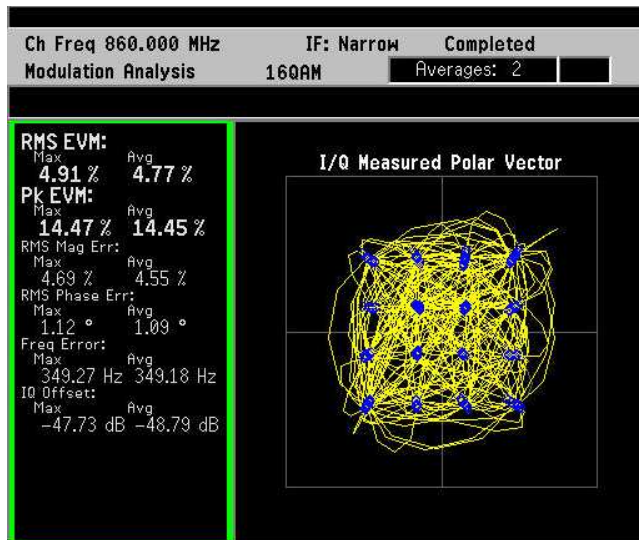
(d) Other types of equipment. A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

Test date: 2012-06-11

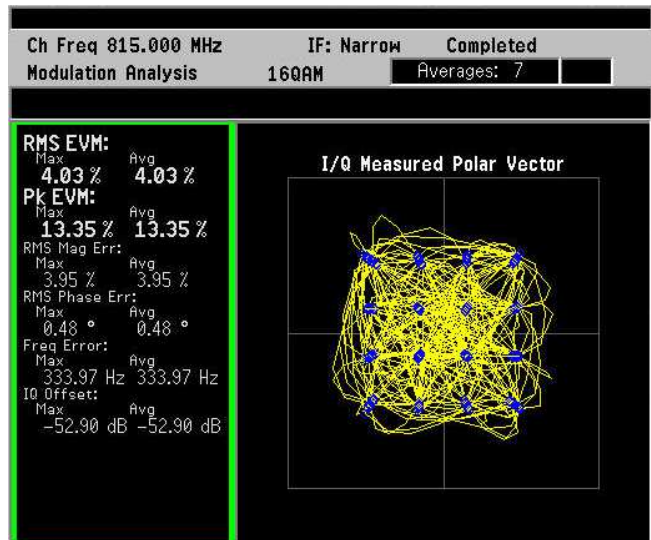
Test results: Pass

Test data

Mod. iDEN (QAM)



Down-link



Up-link

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	–	–

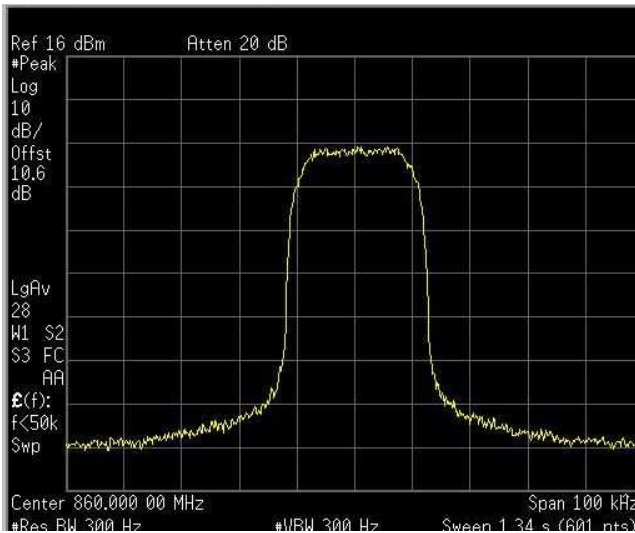
The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Test date: [2012-06-11](#)

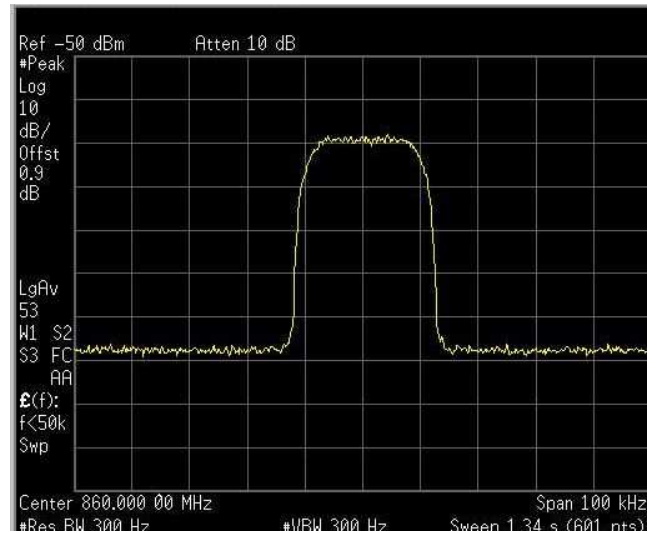
Test results: [Pass](#)

Test data

Mod. iDEN (QAM) (Down-link)

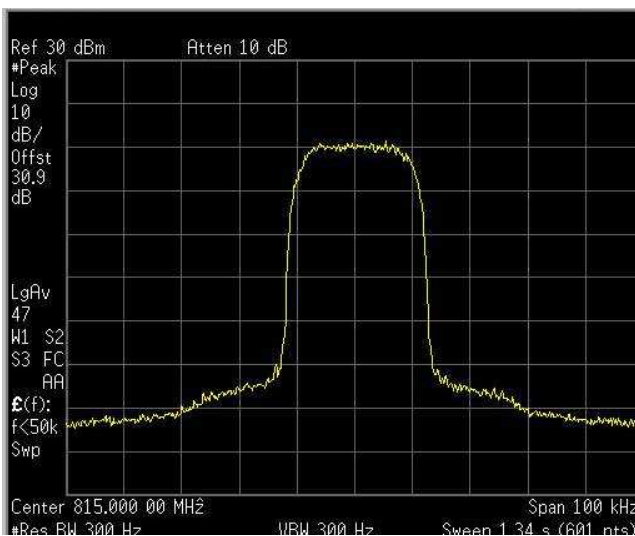


Output

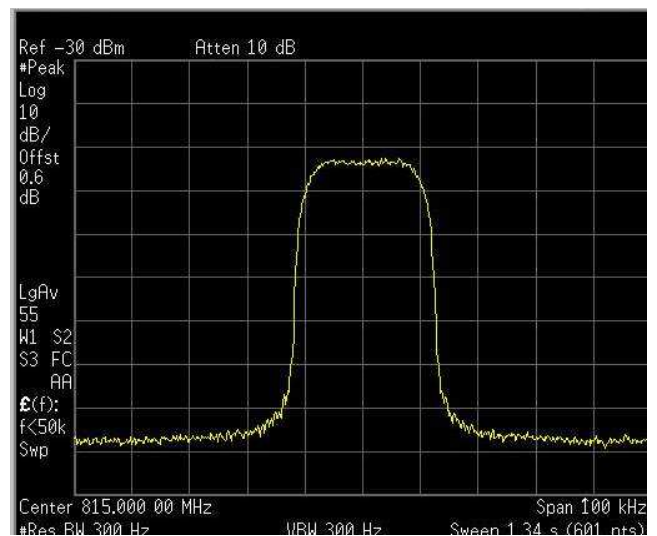


Input

Mod. iDEN (QAM) (Up-link)



Output



Input

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.

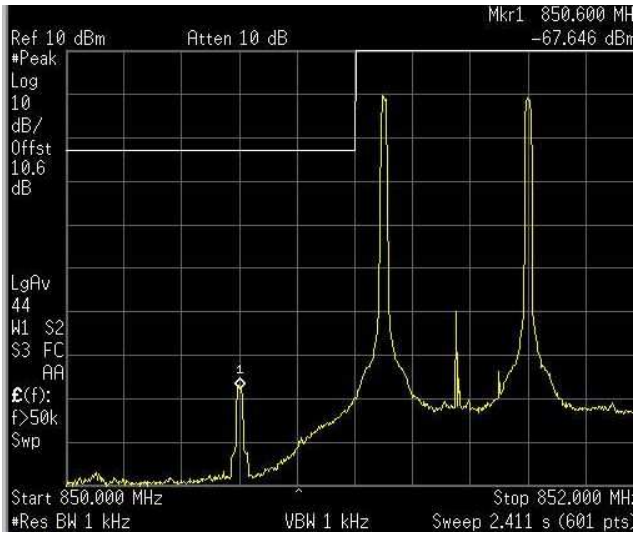
Test date: 2012-06-11

Test results: **Pass**

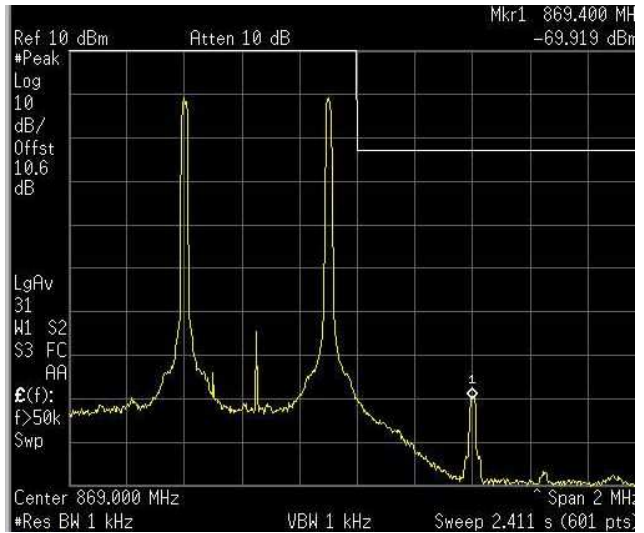
Special notes

Mask H-G is applied.

Mod. iDEN (QAM) (Down-link)

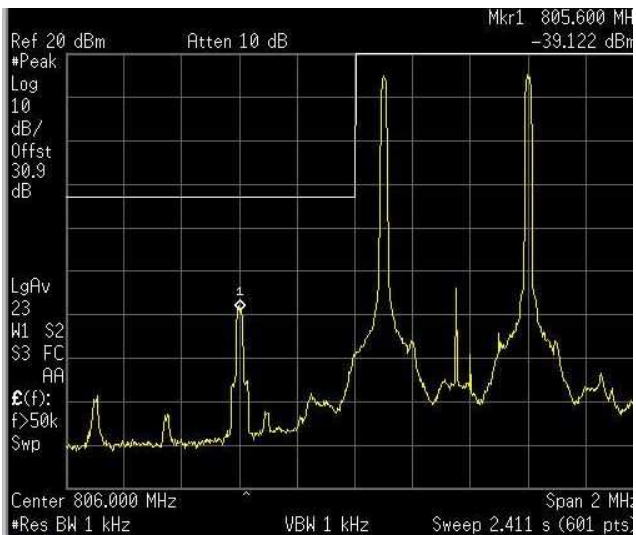


Low Band Edge

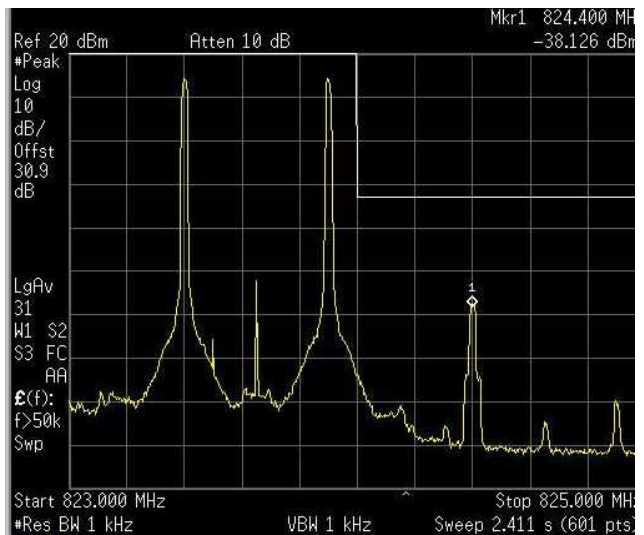


High Band Edge

Mod. iDEN (QAM) (Up-link)



Low Band Edge

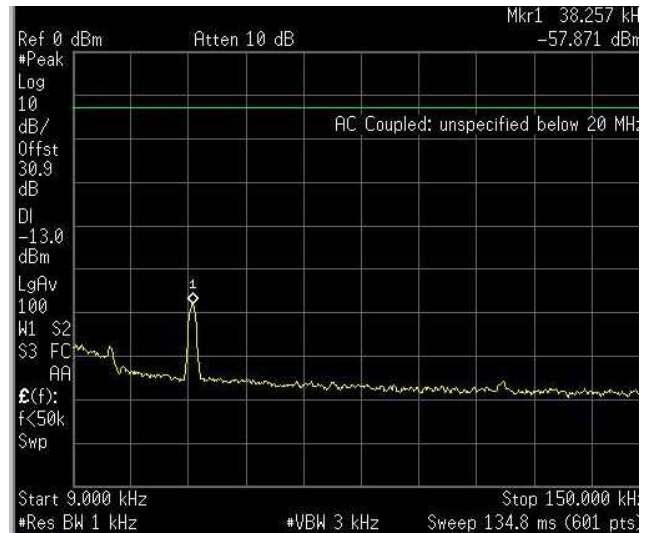


High Band Edge

Mod. iDEN (QAM) (9kHz-150kHz)

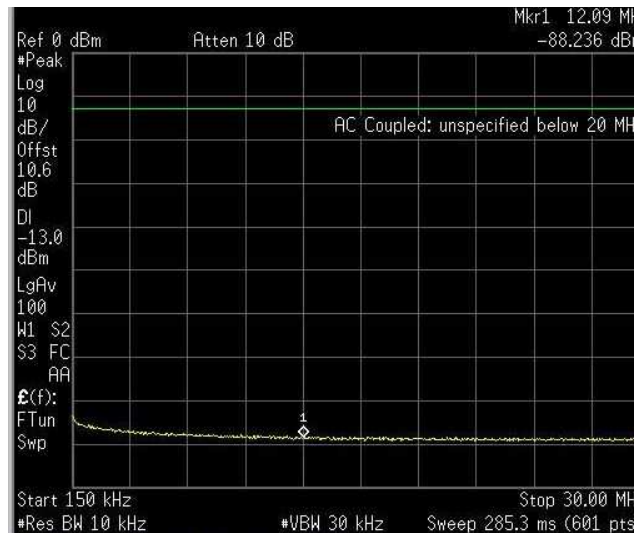


Downlink

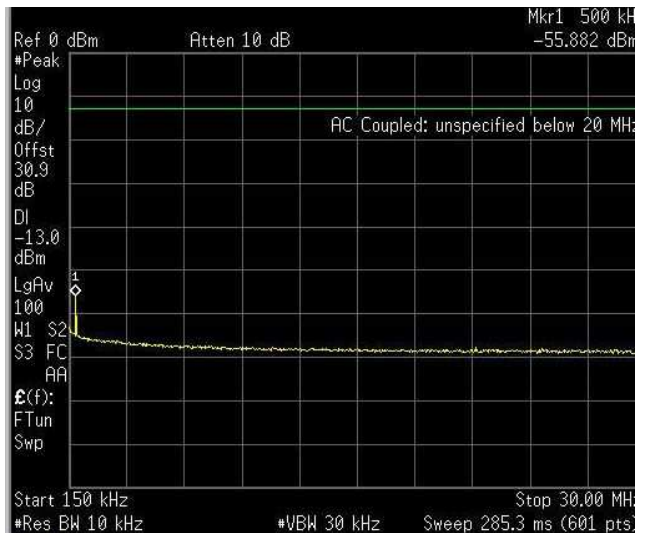


Uplink

Mod. iDEN (QAM) (150kHz-30MHz)

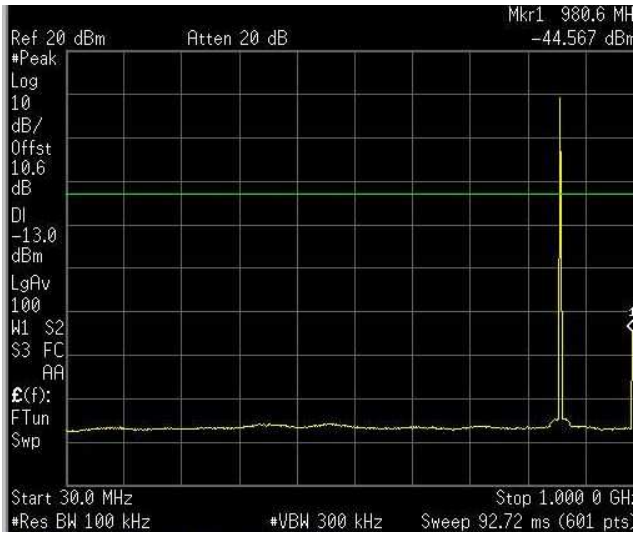


Downlink

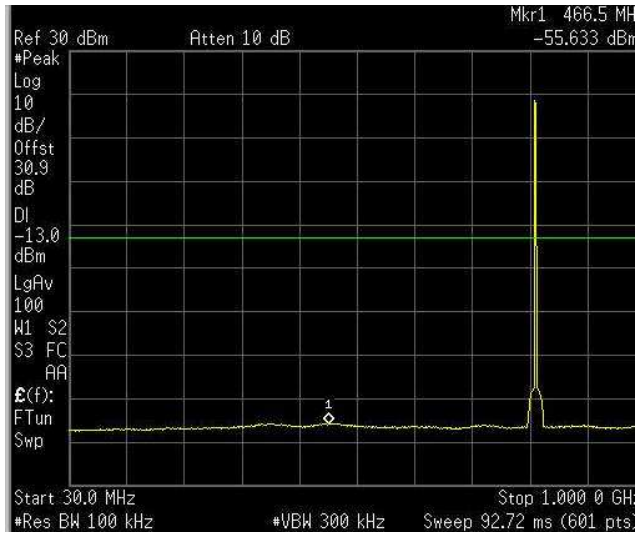


Uplink

Mod. iDEN (QAM) (30MHz-1GHz)

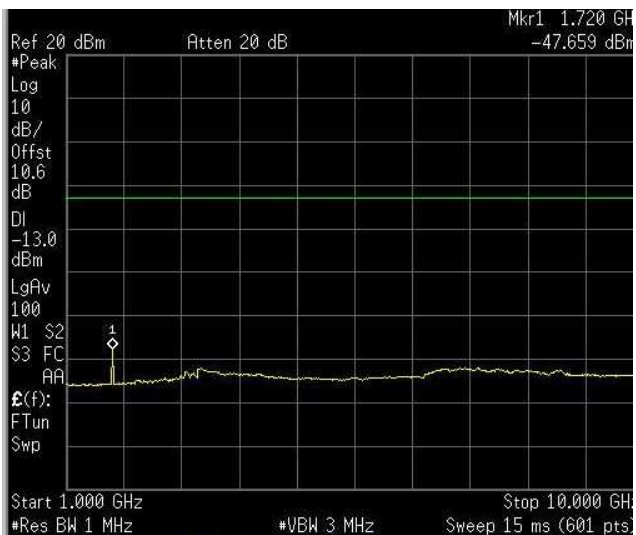


Downlink

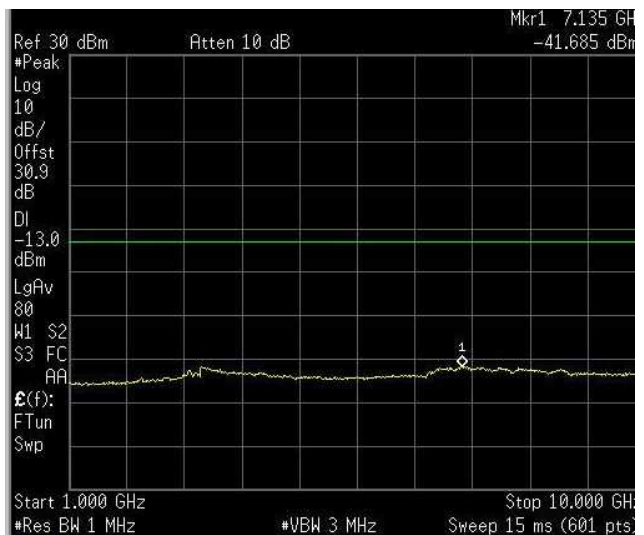


Uplink

Mod. iDEN (QAM) (1GHz -10GHz)



Downlink



Uplink

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: [2012-06-11](#)

Test results: [Pass](#)

Special notes

- The spectrum was searched from 30 MHz to the 10th 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.

	Appendix A: Test results
	Report Number: 209925-4
	Specification: FCC 90

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 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.

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

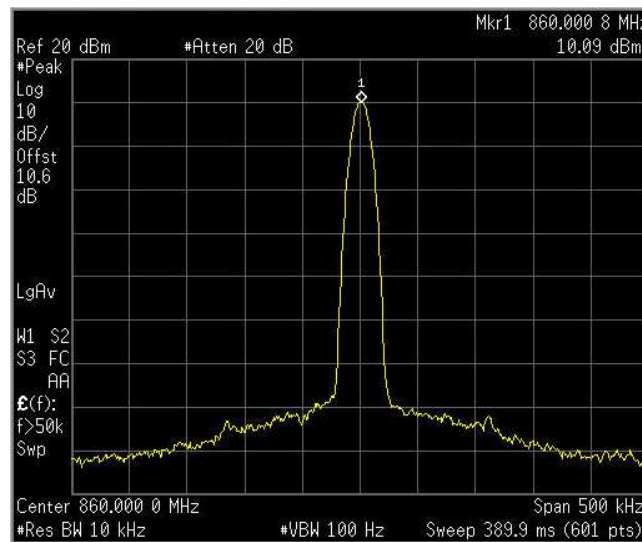
Test date: 2012-06-11

Test results: Pass

Special notes

Clause 90.213 Frequency stability, continued

Test data, continued



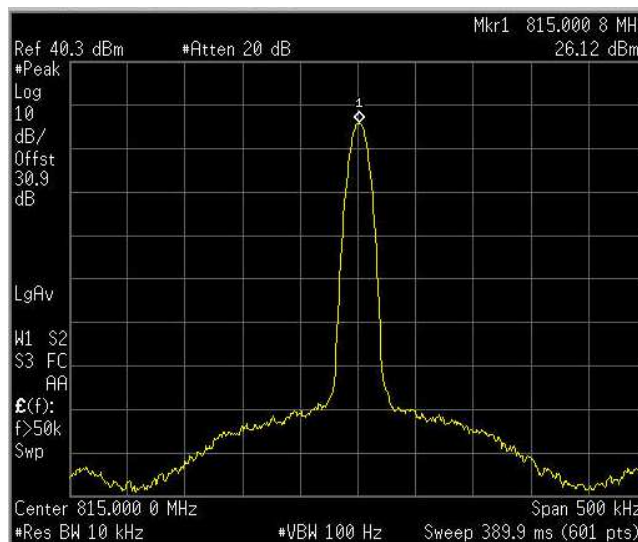
Down-link

Conditions	Frequency (Hz)	Offset (ppm)
+50 °C, Nominal power	860 000 800	0
+40 °C, Nominal power	860 000 800	0
+30 °C, Nominal power	860 000 800	0
+20 °C, +15 % power	860 000 800	0
+20 °C, Nominal power	860 000 800	Reference
+20 °C, -15 % power	860 000 800	0
+10 °C, Nominal power	860 000 800	0
0 °C, Nominal power	860 000 800	0
-10 °C, Nominal power	860 000 800	0
-20 °C, Nominal power	EUT doesn't work	
-30 °C, Nominal power	EUT doesn't work	

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

Maximum frequency drift is 0 kHz

Test data, continued



Down-link

Conditions	Frequency (Hz)	Offset (ppm)
+50 °C, Nominal power	815 000 800	0
+40 °C, Nominal power	815 000 800	0
+30 °C, Nominal power	815 000 800	0
+20 °C, +15 % power	815 000 800	0
+20 °C, Nominal power	815 000 800	Reference
+20 °C, -15 % power	815 000 800	0
+10 °C, Nominal power	815 000 800	0
0 °C, Nominal power	815 000 800	0
–10 °C, Nominal power	815 000 800	0
–20 °C, Nominal power	EUT doesn't work	
–30 °C, Nominal power	EUT doesn't work	

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

Maximum frequency drift is 0 kHz

Clause 90.214 Transient frequency behaviour

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: different operating band](#)

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).

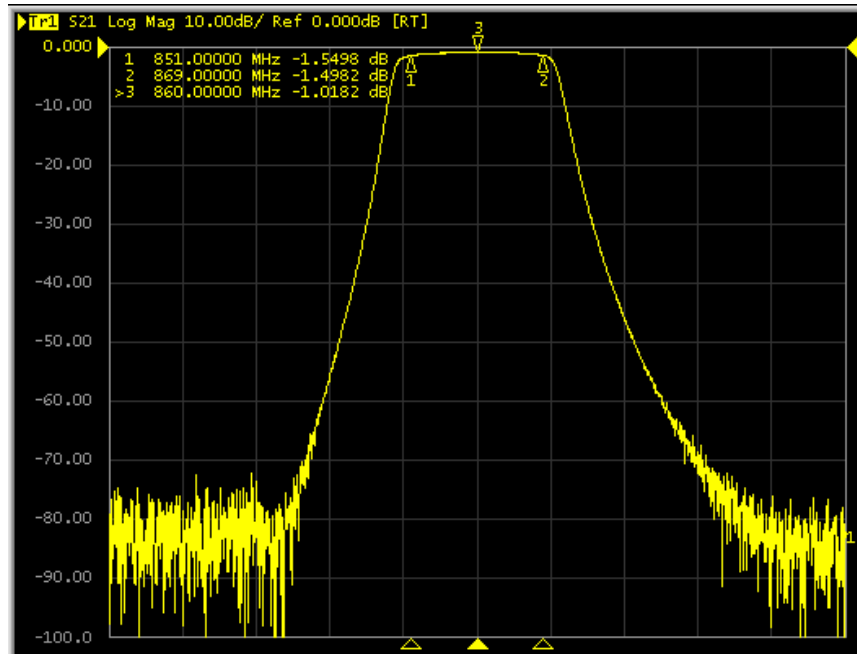
Test date: [NA](#)

Test results: [-----](#)

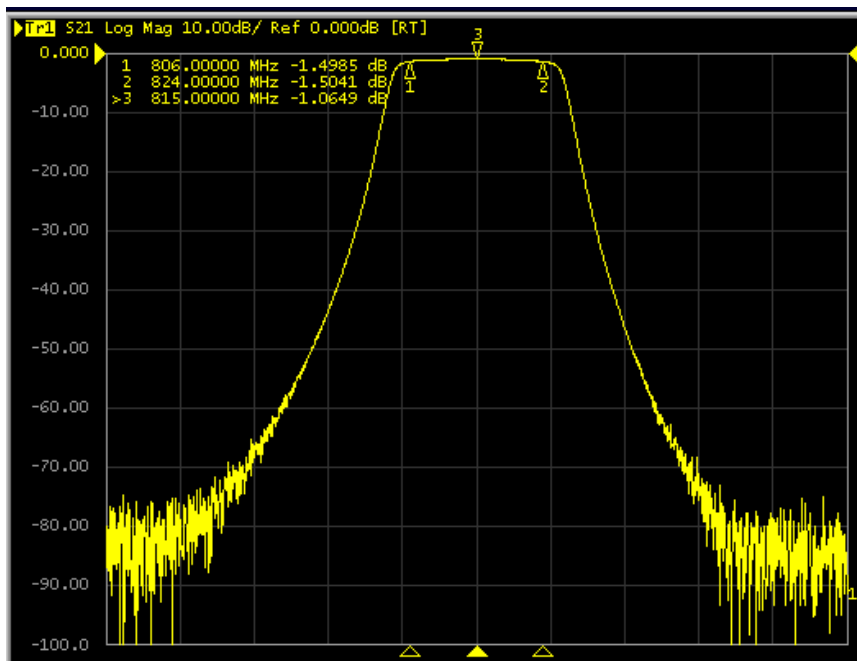
Special notes

[None](#)

Frequency Filter Response



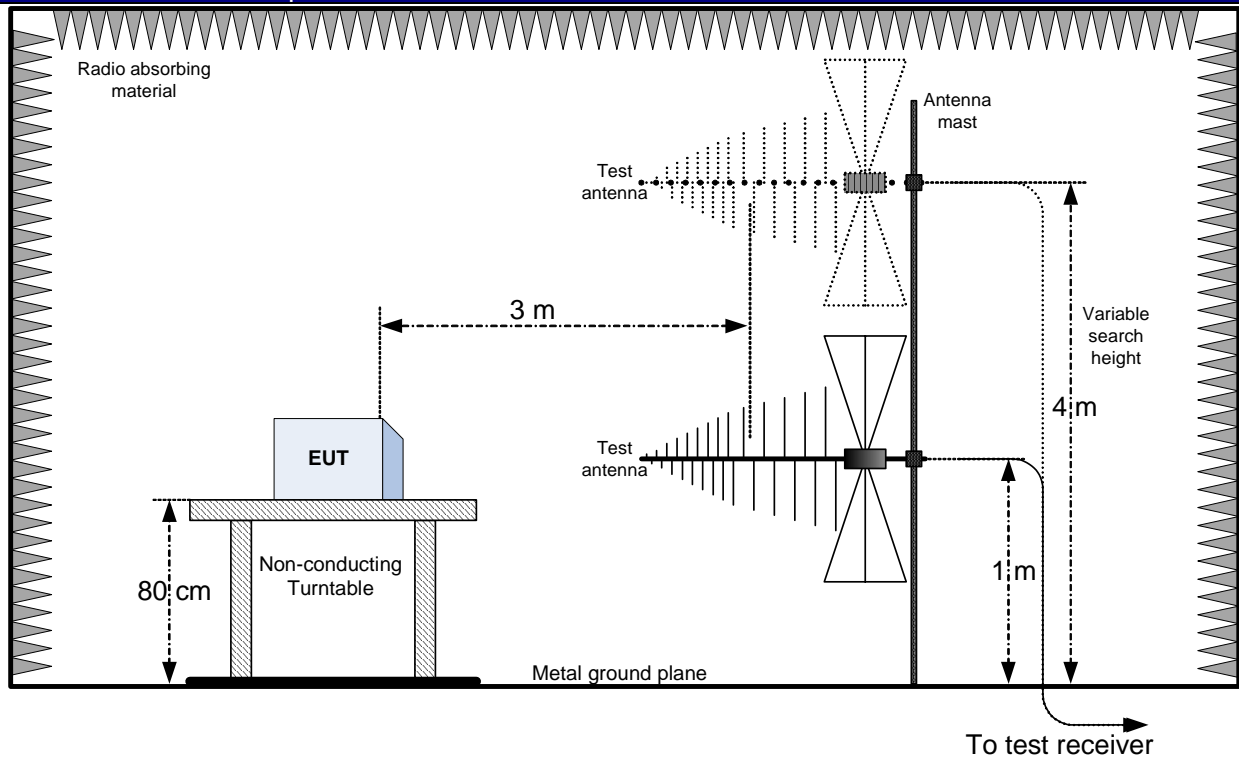
Down Link



Up Link

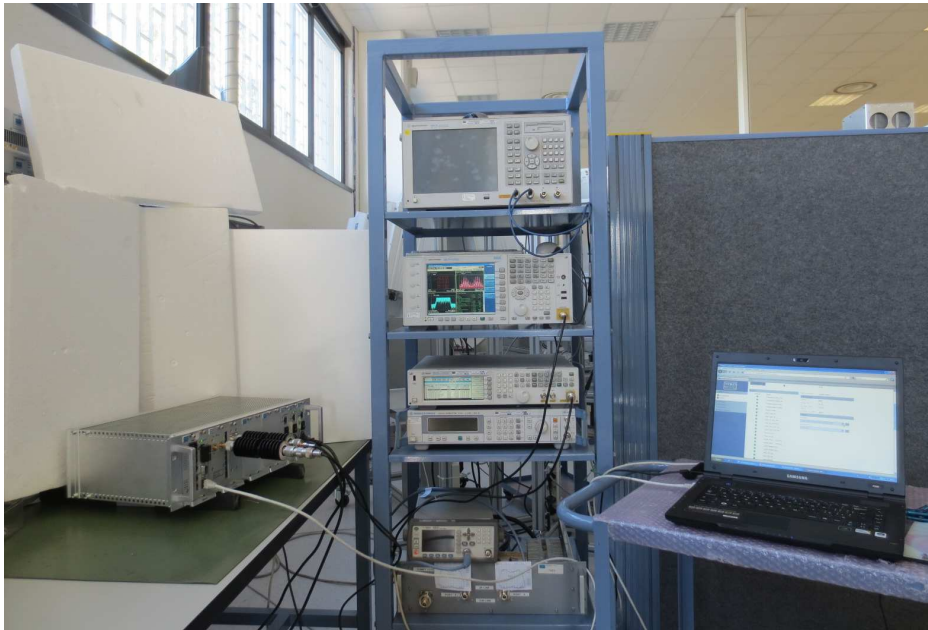
Appendix B: Block diagrams of test set-ups

Radiated emissions set-up



Appendix C: EUT photos

Photo Set up



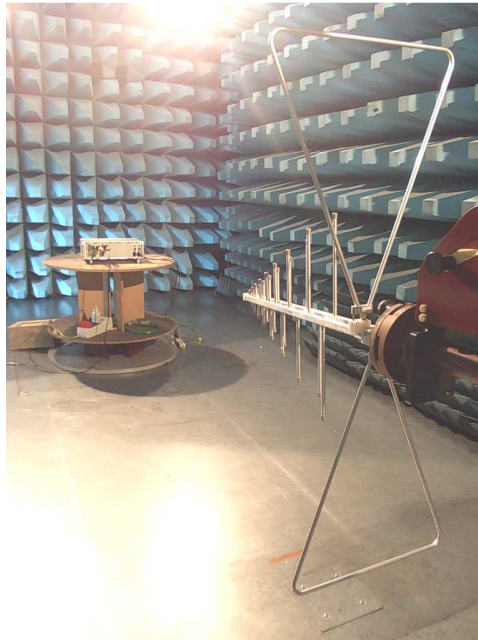


Photo EUT



<div data-bbox="132 197 421 268">  Nemko </div>	Appendix A: Test Result
	Report Number: 209925-4
	Specification: FCC 90

