

Report Reference ID:	333994-1TRFWL	
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	
Applicant:	TEKO Telecom Srl. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO) (Italy)	
Apparatus:	Enhanced Power Remote Unit	
Model:	TRU7FL8P9PPWE/AC-WT	
FCC ID:	XM2-EP7FL8P9PP	

Testing laboratory:	Nemko Italy Spa Via del Carroccio, 4 20853 Biassono (MB) – Italy Telephone: +39 039 2201201 Facsimile: +39 039 2201221
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	Name and title	Date	
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Section 1: Report summary

1.1 Test sp	ecification	
Specifications Part 90 – Private land mobile services		

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 90. Radiated tests were conducted in accordance with ANSI C63.4-2003.		

1.3 Exclusion	ons
Exclusions	None

1.4 Registration number

Test site FCC	176392 (3 m Semi anechoic chamber)
ID number	

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.

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Section 2: Summary of test results

Part	Methods	Test description	Verdict
	§ 935210 D05v01r01 (4.2)	AGC threshold	Pass
	§ 935210 D05v01r01 (4.3)	Out of band rejection	Pass
§90.209 §90.219(e)(4)	§ 935210 D05v01r01 (4.4)	Occupied bandwidth	Pass
§90.205 §90.542(a)(3) §90.219(e)(1)	§ 935210 D05v01r01 (4.5)	Output power at RF antenna connector	Pass
§90.219(e)(2)	§ 935210 D05v01r01 (4.6)	Noise Figure	Pass
§90.543(e) §90.219(e)(3)	§ 935210 D05v01r01 (4.7)	Spurious emissions at RF antenna connector	Pass
§90.543(e) §90.219(e)(3)	§ 935210 D05v01r01 (4.9)	Radiated spurious emissions	Pass
§90.543(f) §90.219(e)(3)	§ 935210 D05v01r01 (4.9)	Radiated spurious emissions within 1559-1610 MHz band	Pass
§90.213	§ 935210 D05v01r01 (4.8)	Frequency stability	N/A a)

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



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

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

3.2 Modular ed	quipment
a) Single modular	Single modular approval
approval	Yes 🗌 No 🛛
b) Limited single	Limited single modular approval
modular approval	Yes 🗌 No 🖂

3.3 Product de	tails	
FCC ID	Grantee code:	XM2
	Product code:	-EP7FL8P9PP
Equipment class	B9B	
Description of	Booster	
product as it is marketed	Model name/number:	TRU7FL8P9PPWE/AC-WT
	Serial number:	1007068001

3.4 Application	n purpo	se
Type of	\boxtimes	Original certification
application		Change in identification of presently authorized equipment
		Original FCC ID: Grant date:
		Class II permissive change or modification of presently authorized
		equipment



Section 3: Equipment under test

3.5 Composite	/related equipment				
a) Composite	The EUT is a composite device subject to an additional equipment				
equipment	authorization				
	Yes 🗌 No 🖂				
b) Related	The EUT is part of a system that operates with, or is marketed with,				
equipment	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:				
	ii FCC ID:				

3.6 Sample inf	ormation
Receipt date:	06/26/2017
Nemko sample ID number:	

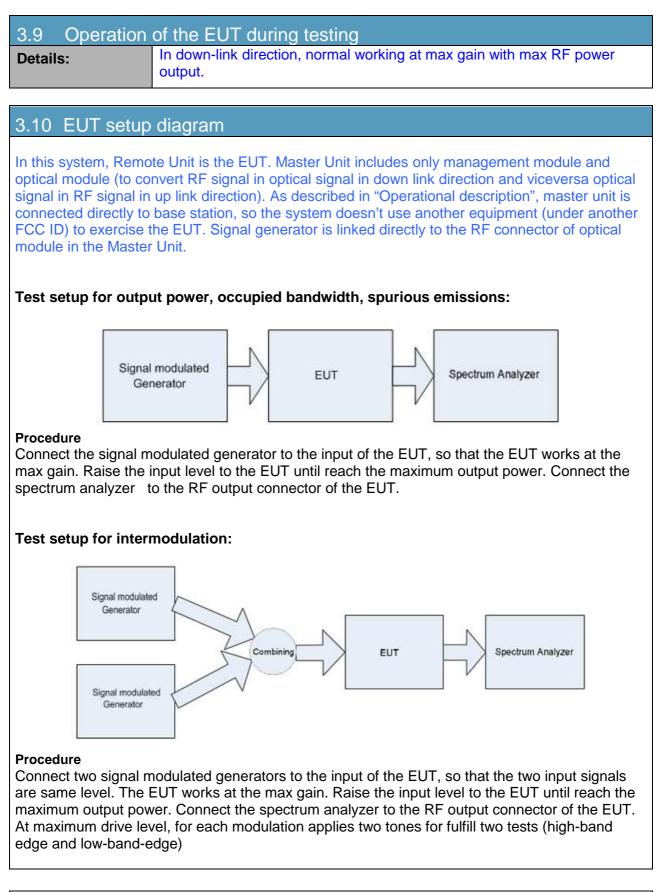
3.7 EUT techn	ical specifications					
Operating band:	Down Link: 758–768 MHz, Up Link: 788-798 MHz					
Operating frequency:	Wideband					
Modulation type:	LTE (QAM and QPSK)					
Occupied bandwidth:	LTE: 5 MHz, 10 MHz					
Channel spacing:	standard					
Emission designator:	LTE: D7W					
RF Output	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 type:	External Antenna is not provided, equipment that has an external 50 Ω RF connector					
Power source:	100-240 Vac					



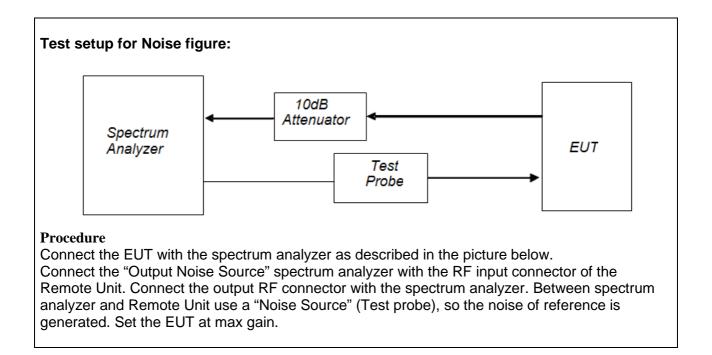
Section 3: Equipment under test

3.8 Accessories and	d support equipment
The following information id	lentifies accessories used to exercise the EUT during testing:
No other FCC-ID equipmen	t 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:	110942253
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:	081063004
Nemko sample number:	
Connection port:	
Cable length and type:	











Section 4: Engineering considerations

4.1 Modificatio	ns 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 \square Yes \square - details are listed below:

4.3 Technical	judgment
Judgment	None



Section 5: Test conditions

5.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

5.2 Test condit	tions, 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 ± 5 %, for which the equipment was designed.



Section 5: Test conditions, continued

5.3 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.

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
ector Signal enerator	Agilent	N5172B EXG	MY53051238	Jan 2018
ector Signal	Agilent	E4438C ESG	MY45094485	Ago 2019
Spectrum Analyzer	Agilent	N9030A PXA	MY53120882	Nov 2017
letwork Analyzer	Agilent	E5071C ENA	MY46106183	Ago 2017
-network	R&S	ESH2-Z5	872 460/041	10/2017
ilog Broad Band ntenna 25-2000 MHz	Schwarzbeck	VULB 9168	VULB 9168-242	06/2018
rilog Broad Band ntenna 25-8000 MHz	Schwarzbeck	VULB 9162	VULB 9162-25	07/2018
Antenna 1-18 GHz	Schwarzbeck	STLP 9148	STPL 9148-123	06/2018
Antenna horn	A.H.System Inc.	SAS-574	061106A40	10/2017
reamplifier 18-40 GHz	Miteq	JS44	1648665	12/2017
roadband preamplifier -18 GHz	Schwarzbeck	BBV 9718	9718-137	12/2017
MI receiver 20 Hz ÷ 8 Hz	R&S	ESU8	100202	04/2018
EMI receiver 20 Hz ÷ 3 GHz	R&S	ESCI	100888	08/2017
lydraulic revolving latform	Nemko	RTPL 01	4.233	NCR
Furning-table	R&S	HCT	835 803/03	NCR
ntenna mast	R&S	НСМ	836 529/05	NCR
ontroller	R&S	HCC	836 620/7	NCR
pectrum Analyzer kHz ÷ 40GHz	R&S	FSEK	848255/005	01/2018
Semi-anechoic hamber	Nemko	10m semi-anechoic chamber	530	10/2018
Shielded room	Siemens	10m control room	1947	NCR
emi-anechoic hamber	Nemko	10m semi-anechoic chamber	70	NCR
Shielded Room	Siemens	3m semi-anechoic chamber	3	NCR
Notor controller	Emco	1051-25	9012-1559	NCR
lotor controller	Emco	1061-1.521	9012-1508	NCR
ntenna Tower	Emco	2071-2	9601-1940	NCR
Controller pole/table	Emco	2090	9511-1099	NCR

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use (*) Equipment supplied by manufacturer's



Appendix A: Test results

Clause 935210 D05v01 (4.2) AGC threshold

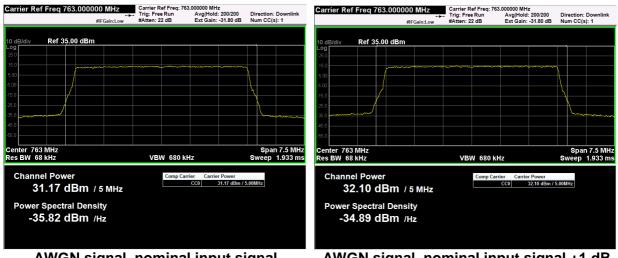
Measure of EUT AGC Threshold

Test date: 06/27/2017 Test results: Pass

Special notes

- AWGN test signal used (5 MHz LTE channel)

Test data



AWGN signal, nominal input signal

AWGN signal, nominal input signal +1 dB



Clause 935210 D05v01 (4.3) Out of band rejection

Out of Band Rejection – Test for rejection of out of band signals.

Test date: 06/27/2017 Test results: Pass

Special notes

Test data

Marker 1 763.0000	00000 MHz NFE PNO: Fast IFGain:Lov		Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE WM WWWW DET P P NNNN
Ref Offset 3 10 dB/div Ref 35.00			Mkr	1 763.00 MHz 31.327 dBm
25.0				
15.0	2/		3	
5.00				
-5.00				
-15.0				
-25.0				
-35.0		nh and the Mean of the		
		NUMANA MANAMATA		MARWAN
Center 766.50 MHz #Res BW 100 kHz	#\	/BW 300 kHz		Span 80.00 MHz)0 ms (1001 pts)
MKR MODE TRC SCL	× 763.00 MHz	Y F 31.332 dBm	UNCTION FUNCTION WIDTH	FUNCTION VALUE
2 N 2 f 3 N 2 f 4 5	750.18 MHz 781.30 MHz	11.099 dBm 11.395 dBm		
		III		•



Clause 90.209, 90.219(e)(4) Occupied bandwidth

§ 90.219(e)(4)

A signal booster must be designed such that all signals that it retransmits meet the following requirements: (i) The signals are retransmitted on the same channels as received. Minor departures from the

exact provider or reference frequencies of the input signals are allowed, *provided that* the retransmitted signals meet the requirements of § 90.213.

(ii) There is no change in the occupied bandwidth of the retransmitted signals.

(iii) The retransmitted signals continue to meet the unwanted emissions limits of § 90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

Test date: 06/27/2017

Test results: Pass

Special notes

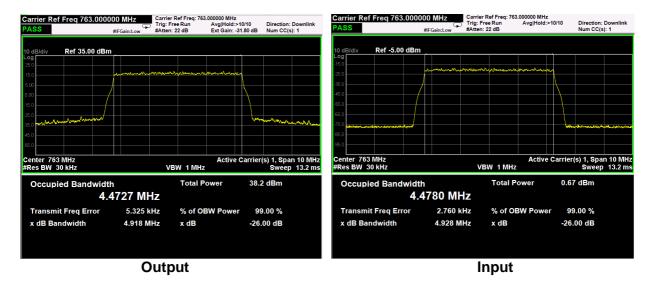
- AWGN test signal used (5 MHz LTE channel)



Occupied bandwidth, continued

Test data

AWGN signal, nominal input signal



AWGN signal, nominal input signal + 3dB



Output





Clause 90.205, 90.542(a)(3), 90.219(e)(1) Output power at RF antenna connector

§ 90.205

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).

§ 90.542(a)(3)

(a) The following power limits apply to the 758-768/788-798 MHz band:

(3) Fixed and base stations transmitting a signal in the 758-768 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP accordance with Table 3 of this section.

§ 90.219(e)(1)

The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

Test date: 06/27/2017

Test results: Pass

Special notes

- AWGN test signal used (5 MHz LTE channel)



Output power at RF antenna connector

AWGN signal, nominal input signal

Test data								
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	RF output Power (W/MHz)	PAR (dB)		
Down-link	AWGN (LTE, 5MHz)	763,0	31,16	1,31	0,26	11,40		



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.

Test result	
Gmax antenna gain (dBi) = 39 - 31.16 = 7.84 dBi	
EIRP = 31.16 + 7.84 = 39 dBm	
ERP = 39 - 2.14 = 36.86dBm = 4.85W < 5 W ERP	



AWGN signal, nominal input signal + 3dB

Test data						
Direction	Modulation	Frequency (MHz)	RF output Power (dBm)	RF output channel Power (W)	RF output Power (W/MHz)	PAR (dB)
Down-link	AWGN (LTE, 5MHz)	763,0	32,10	1,62	0,324	10,82



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.



Clause 935210 D05v01 (4.6) Noise figure

§ 90.219(e)(2)

The noise figure of a signal booster must not exceed 9 dB in either direction.

Test date: 06/27/2017

Test results: Pass

Special notes

In the Remote Unit, only up-link measurement can be performed (test probe is connect to antenna port)

	7.8989899 MI		DUT: Amplifie		CONTEXT FREQ=RF CALSTATE CAL
PR	REAMP		Atten: 0 dB		ENR STATE ENR
Noise Figur				Mkr3 79	7.89899 MHz
0.3 dB/div	Ref 4.8 dB			 	3.6288 dB
6.0					
5.7 5.4					
5.1 4.8					
4.5			<u> </u>		
4.2 3.9		~ -			<u> </u>
3.6				 <u>+</u>	~~~ `
			^		
Gain					
0.2 dB/div	Ref 45.9 d	В		~	
46.7 46.5					
46.3					
46.1					
45.9					
45.9					
45.9 45.7 45.5					
45.9 45.7 45.5 45.3 45.1					
45.9 45.7 45.5 45.3 45.1	788.00000 M	Hz	*	Stop Freq 79	8.00000 MHz
45.9 45.7 45.5 45.3 45.1 Start Freq 7		Hz 296.50 K	(Default)	Stop Freq 79 Irce: Norm	
45.9 45.7 45.5 45.3 45.1	lz T cold		(Default)		
45.9 45.7 45.5 45.3 45.1 Start Freq 7 BW 4.0 MH	lz T cold	296.50 K	88.0000000 MHz	rce: Norm	8.00000 MHz Points 100
45.9 45.7 45.5 45.3 45.1 Start Freq 7 BW 4.0 MH	lz T cold	296.50 K		rce: Norm	Points 100



Clause 90.543(e), 90.219(e)(3) Spurious emissions at the antenna terminal

§ 90.543(e)

For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

§ 90.219(e)(3)

Spurious emissions from a signal booster must not exceed –13dBm within any 100 kHz measurement bandwidth.

Test date: 2016-03-15 Test results: Pass

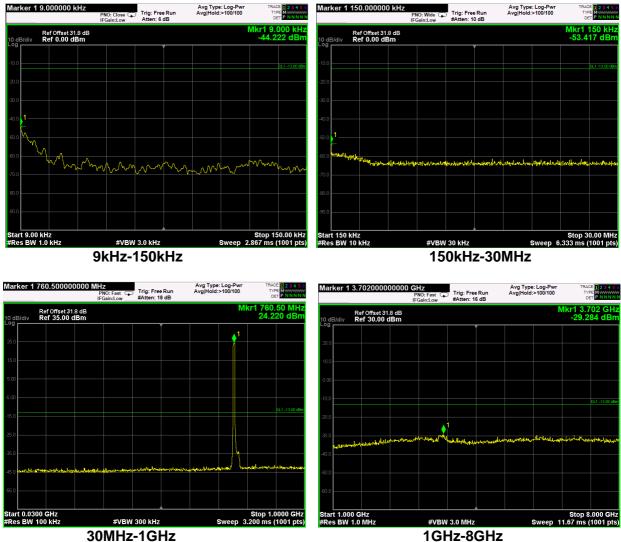
Special notes

- AWGN test signal used (5 MHz LTE channel)



Test data: Spurious emissions at RF antenna connector

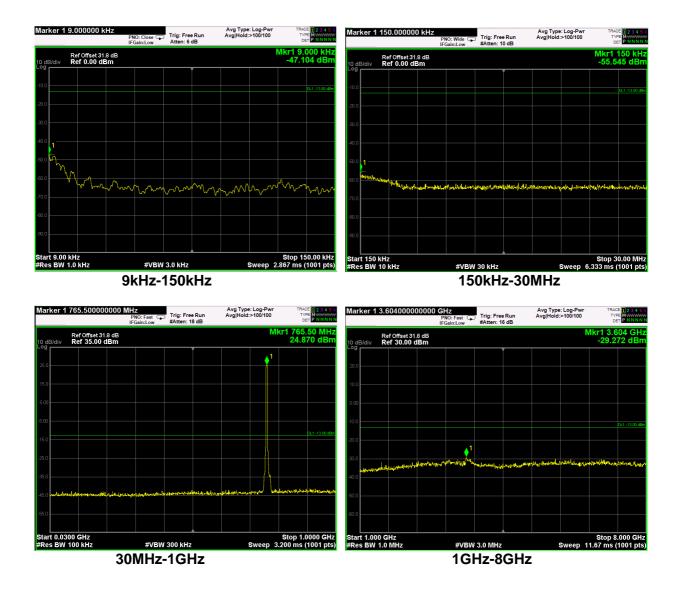
AWGN signal - First Channel (760,5MHz)



30MHz-1GHz







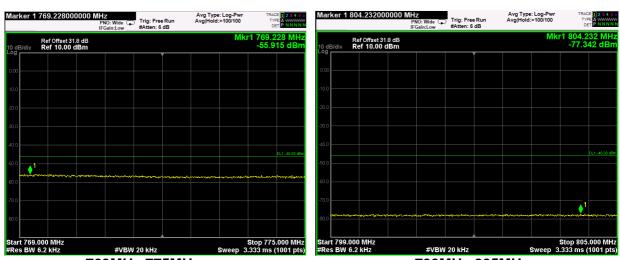
Test data: Spurious emissions at RF antenna connector: 90.543(e)(1)

Special notes

On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations

76 + 10 log P (W) = 76 + 10 log 1,25W = 77 P (W) = 1,25W = 31 dBm →limit: 31 - 77 = -46 dBm/6,25kHz

AWGN signal - First Channel (760,5MHz)



769MHz-775MHz

799MHz-805MHz

AWGN signal - Last Channel (765,5MHz)



Report reference 333994-1TRFWL

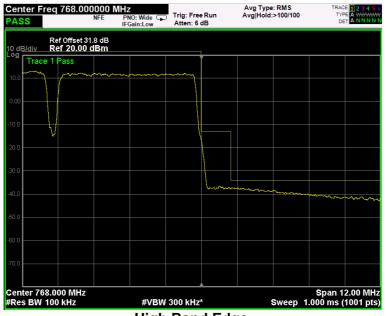


Test data: Spurious emissions at RF antenna connector: band edges intermodulation

AWGN signal, nominal input signal



Low Band Edge



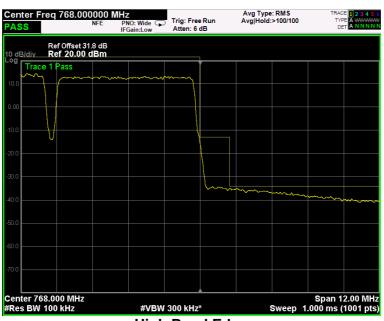
High Band Edge





AWGN signal, nominal input signal + 3dB

Low Band Edge



High Band Edge



Clause 90.543(e), 90.219(e)(3) Spurious emissions radiated

(§ 90.543(e)

For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations.

(2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.

(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least $43 + 10 \log (P) dB$.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.

§ 90.219(e)(3)

Spurious emissions from a signal booster must not exceed –13dBm within any 100 kHz measurement bandwidth.

Test date: 06/28/2017 Test results: Pass

Special notes



Radiated spurious emissions, 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.

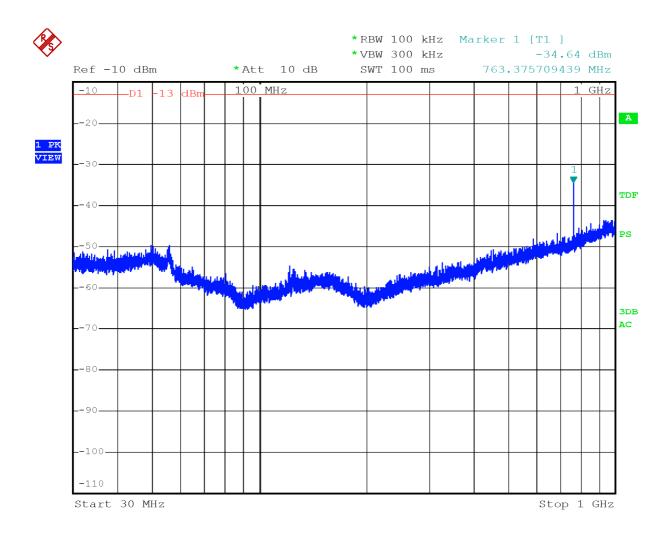
The spectrum was searched from 30 MHz to 1 GHz (RBW 100 kHz) & 1 GHz (RBW 1 MHz) to the tenth harmonic of the carrier.

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

Spurious emissions measurement results:

Frequency (MHz)	Polarization. V/H	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low channel				
Mid channel				
Link shannal				
High channel				
Note: Field strengt where applicable.	th includes correction	n factor of antenna,	cable loss, amplifier	, and attenuators

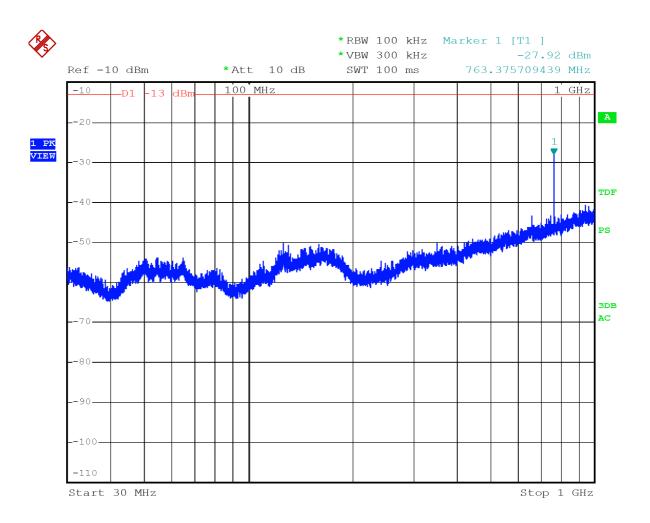




Date: 28.JUN.2017 11:58:18

30MHz-1GHz – H Pol

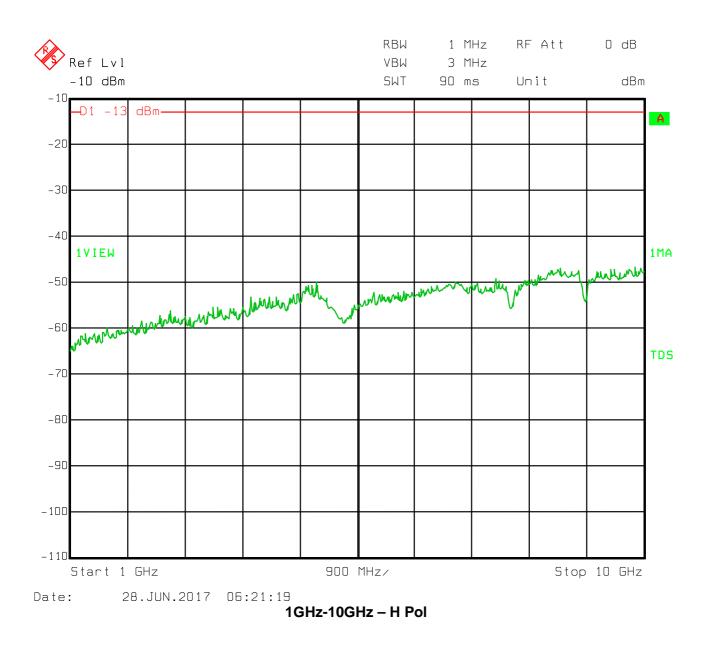




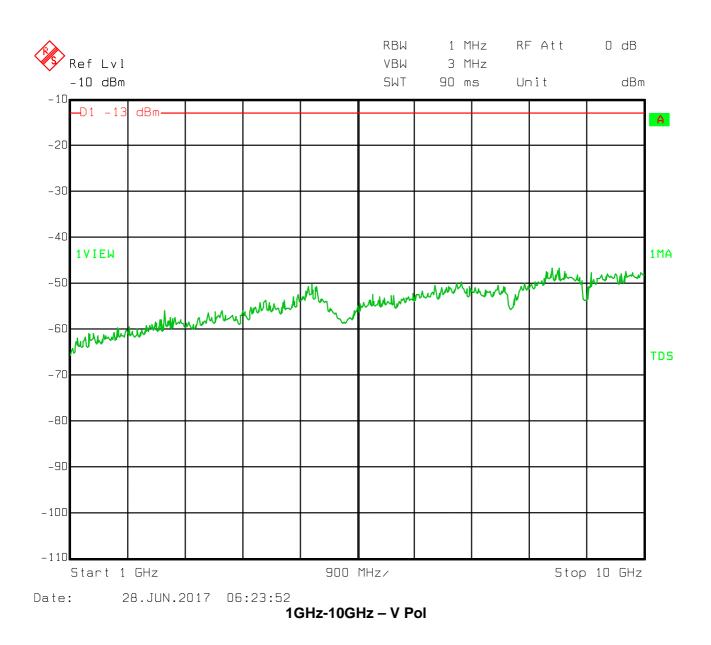
Date: 28.JUN.2017 11:59:42

30MHz-1GHz - V Pol











Clause 90.543(f) Radiated spurious emissions within 1559–1610 MHz band

§ 90.543(f)

For operations in the 758-775 MHz and, 788-805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation

Note:

Method of measurement according to TIA-603-C (EIRP in GNSS band: 1.556 to 1.610 GHz). Δ Band = 51 MHz, Correction Factor calculated at central band 1604.5 MHz. in Fraunhofer Region.

Test date: 06/28/2016 Test results: Pass

Special notes

- The spectrum was searched from 1559–1610 MHz.
- All measurements were performed using a peak detector.
- The measurements were performed at the distance of 3 m.
- RBW was set to 1 MHz and VBW was wider than RBW



Result of D.L. 31 dBm, 763.0 MHz,

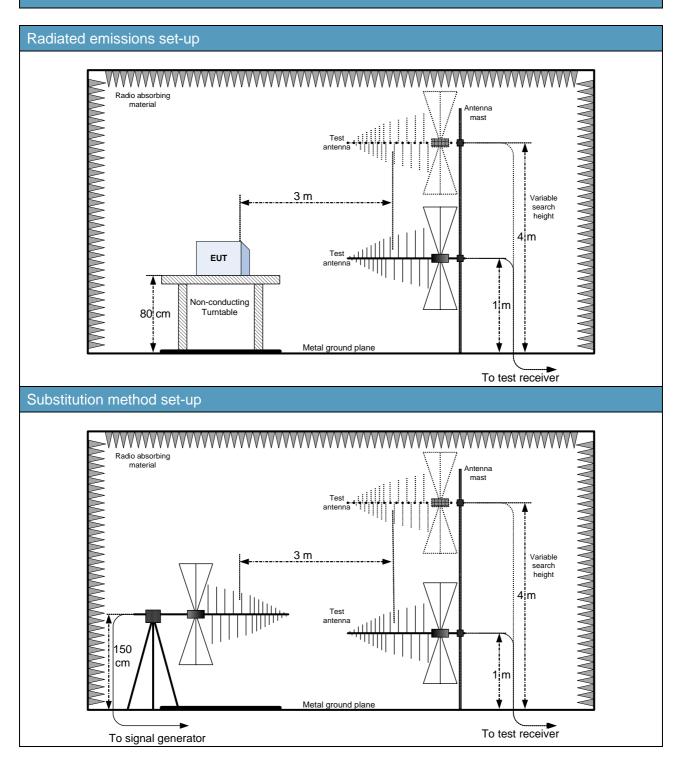
st data								
	Marker 1 [T		RBW			F Att	0 dB	
Ref Lvl		59.83 dBm 76353 GHz	VBW SWT		MHz ms U			
–10 dBm 0	1.089		1 40	D	ms u		dBm	
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Spurious emissions	s measurement results	6:		
Frequency (MHz)	Polarization. V/H	Result Eirp (dBm)	Limit eirp (dBm)	Margin (dB)
1589.76	V(max. eirp)	-59.83	-50	-9.83
1303.70	V(max. enp)	-00.00	-30	-9.00

Limit used for discrete emissions: -80 dBw = -50 dBm



Appendix B: Block diagrams of test set-ups





Appendix C: EUT Photos

Photo Set up









Photo EUT











Label EUT



WARNING. This is NOT a CONSUMER device. This is a 90.219 Class B signal booster. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.