

Test report

291050-1TRFWL

Date of issue: August 12, 2015

Applicant:

Redline Communications, Inc.

Product:

White Space Fixed TVBD

Model:

RDL-3000-RMF

FCC ID:

QC8-RDL3000RMF

Specification:

FCC 47 CFR Part 15 Subpart H - **partial**

Television Band Devices

Test location

Company name	Nemko Canada Inc.
Address	303 River Road
City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: 176392; IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	Andrey Adelberg, Senior Wireless/EMC Specialist
Reviewed by	Kevin Rose, Wireless/EMC Specialist
Date	August 12, 2015
Signature	

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 1. Report summary

1.1 Applicant and manufacturer

Company name	Redline Communications, Inc.
Address	302 Town Center Blvd.
City	Markham
Province/State	Ontario
Postal/Zip code	L3R 0E8
Country	Canada

1.2 Test specifications

FCC 47 CFR Part 15, Subpart H	Television Band Devices
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1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.4 Exclusions

As per Quote no.: Q10282346 as part of C2PC only radiated spurious emissions were performed.

1.5 Test report revision history

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

Section 2. Summary of test results

2.1 FCC Part 15, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not tested
§15.31(e)	Variation of power source	Not tested
§15.203	Antenna requirement	Pass ¹

Notes: ¹The Antennas are professionally installed.

2.2 FCC Part 15 Subpart H, test results

Part	Test description	Verdict
§15.709(a)(1)	Maximum conducted output power for fixed TVBDs	Not tested
§15.709(a)(5)(i)	Power spectral density for fixed TVBDs	Not tested
§15.709(c)(1)(i)	Adjacent channel power for fixed TVBDs	Not tested
§15.709(c)(3)	Radiated spurious emissions from TVBDs	Pass
§15.709(c)(4)	Emissions in the band 602–620 MHz	Pass
§15.709(c)(5)	AC power line conducted limits	Not tested

Note: As per Quote no.: Q10282346 as part of C2PC only radiated spurious emissions were performed.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	July 20, 2015
Nemko sample ID number	133-000790

3.2 EUT information

Product name	White Space Fixed TVBD
Model	RDL-3000-RMF
Serial number	156PC13030002

3.3 Technical information

Operating band	470–698 MHz
Operating frequency	473–598.5 MHz and 623.5–695 MHz
Modulation type	BPSK, 256-QAM
Emission designator	W7D
Power requirements	120 V _{AC} 60 Hz
Antenna information	- Redline AFD-DB-600-2ft-01 – Panel antenna, 11 dBi, 48 degrees, 470–698 MHz, dual pole - Redline AFS-DBG-60090-01 – Sector antenna, 11 dBi, 90 degrees, 470–698 MHz, dual pole - Redline eLTE-MT-8dBi-Int-Ant – Panel antenna, 8 dBi, 68–88 degrees, 470–698 MHz, dual pole

3.4 Product description and theory of operation

The RDL-3000-RMF UHF 2x2 MIMO broadband radio provides high capacity, long range communications links. Operating in 470–698 MHz band, the RDL-3000-RMF is configured via firmware options and electronic product keys.

3.5 EUT exercise details

Web GUI to control the unit was used by tuning to IP address: 192.168.25.2

3.6 EUT setup diagram

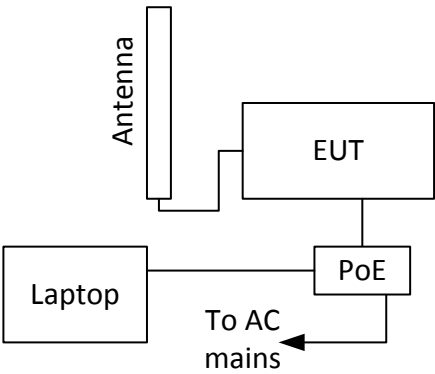


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
PoE	CINCON Electronics Co., Ltd.	TRG60A-POE-L	003641

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

C2PC with existing power settings: +16 dBm for channels 35 (598.5 MHz) and 39 (623.5 MHz) and +18 dBm for all others

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

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.

5.2 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 6. Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of $K = 2$ with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Feb. 25/16
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Power source	California Instruments	5001ix	FA002494	1 year	Jan. 22 /16
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/16
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Apr. 12/16
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Apr. 01/16
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	May 05/16

Note: NCR - no calibration required

Section 8. Testing data

8.1 FCC 15.709(c)(3) Radiated spurious emissions beyond the television channels

8.1.1 Definitions and limits

At frequencies beyond the television channels immediately adjacent to the channel in which the TVBD is operating, the radiated emissions from TVBDs shall meet the requirements of § 15.209.

Table 8.1-1: FCC §15.209 Radiated emission limits

Frequency, MHz	Field strength of emissions		Measurement distance
	µV/m	dBµV/m	m
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

8.1.2 Test summary

Test date:	July 21, 2015	Temperature:	23 °C
Test engineer:	Andrey Adelberg	Air pressure:	1006 mbar
Verdict:	Pass	Relative humidity:	32 %

8.1.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
EUT was set to transmit with 100 % duty cycle.
Radiated measurements were performed at a distance of 3 m.

Spectrum analyser settings for radiated measurements below 1 GHz:

Resolution bandwidth:	120 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak or Quasi-peak
Trace mode:	Max Hold

Spectrum analyser settings for peak radiated measurements above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for average radiated measurements above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Average
Trace mode:	Max Hold

8.1.4 Test data

Table 8.1-2: Radiated spurious emissions measurements beyond band edges

Antenna	Channel	Frequency, MHz	Peak field strength, dBμV/m	Peak* limit, dBμV/m	Margin, dB	Average field strength, dBμV/m	Average limit, dBμV/m	Margin, dB
AFS-DBG-60090-01	Low	34.62	37.14	40.00	2.86	N/A	N/A	N/A
	Low	90.35	42.65	43.50	0.85	N/A	N/A	N/A
	Low	215.57	39.96	43.50	3.54	N/A	N/A	N/A
	Low	298.79	41.02	46.00	4.98	N/A	N/A	N/A
	Low	725.04	42.16	46.00	3.84	N/A	N/A	N/A
	Low	1418.00	52.61	74.00	21.39	43.57	54.00	10.43
	High	34.64	33.75	40.00	6.25	N/A	N/A	N/A
	High	90.35	39.20	43.50	4.30	N/A	N/A	N/A
	High	151.58	37.48	43.50	6.02	N/A	N/A	N/A
	High	215.57	38.70	43.50	4.80	N/A	N/A	N/A
	High	287.45	41.09	46.00	4.91	N/A	N/A	N/A
	High	455.05	42.24	46.00	3.76	N/A	N/A	N/A
AFD-DB-600-2ft-01	High	1171.00	49.08	74.00	24.92	37.20	54.00	16.80
	High	2085.50	52.57	74.00	21.43	44.78	54.00	9.22
	Low	47.68	38.68	40.00	1.32	N/A	N/A	N/A
	Low	155.60	42.83	43.50	0.67	N/A	N/A	N/A
	Low	359.29	41.20	46.00	4.80	N/A	N/A	N/A
	Low	725.04	43.07	46.00	2.93	N/A	N/A	N/A
	Low	1418.00	53.09	74.00	20.91	40.22	54.00	13.78
	High	90.37	39.21	43.50	4.29	N/A	N/A	N/A
	High	287.45	39.87	46.00	6.13	N/A	N/A	N/A
	High	359.29	40.60	46.00	5.40	N/A	N/A	N/A
	High	455.05	41.59	46.00	4.41	N/A	N/A	N/A
	High	2085.50	53.88	74.00	20.12	37.49	54.00	16.51
eLTE-MT-8dBi-Int-Ant	Low	88.89	37.79	43.50	5.71	N/A	N/A	N/A
	Low	149.99	42.39	43.50	1.11	N/A	N/A	N/A
	Low	199.59	36.63	43.50	6.87	N/A	N/A	N/A
	Low	831.79	40.07	46.00	5.93	N/A	N/A	N/A
	High	47.79	36.66	40.00	3.34	N/A	N/A	N/A
	High	122.61	36.61	43.50	6.89	N/A	N/A	N/A
	High	151.55	41.08	43.50	2.42	N/A	N/A	N/A
	High	503.00	39.34	46.00	6.66	N/A	N/A	N/A
	High	655.04	41.50	46.00	4.50	N/A	N/A	N/A

Note: * for frequencies below 1 GHz, the limit is Quasi-Peak.

Table 8.1-3: Radiated spurious emissions measurements at the band edges

Antenna	Channel	Frequency, MHz	Field strength, dBμV/m	Limit, dBμV/m	Margin, dB
AFS-DBG-60090-01	Low	470	36.81	46.00	9.19
	High	698	36.58	46.00	9.42
AFD-DB-600-2ft-01	Low	470	40.30	46.00	5.70
	High	698	39.57	46.00	6.43
eLTE-MT-8dBi-Int-Ant	Low	470	30.53	46.00	15.47
	High	698	32.80	46.00	13.20

8.2 FCC 15.709(c)(4) Emissions in the band 602–620 MHz

8.2.1 Definitions and limits

Emissions in the band 602–620 MHz must also comply with the following field strength limits at a distance of one meter:

Table 8.2-1: 602–620 MHz band field strength limits

Frequency, MHz	Field strength, dBμV/m/120 kHz
602–607	$120 - 5 \times (F - 602)$
607–608	95
608–614	30
614–615	95
615–620	$120 - 5 \times (620 - F)$

Notes: F is frequency in MHz

8.2.2 Test summary

Test date:	August 1, 2015	Temperature:	23 °C
Test engineer:	Andrey Adelberg	Air pressure:	1006 mbar
Verdict:	Pass	Relative humidity:	32 %

8.2.3 Observations, settings and special notes

The spectrum was searched from 602 MHz to the 620 MHz.
Radiated measurements were performed at a distance of 1 m.
In order to eliminate the Spectrum analyzer overloading, notch filter tuned to the fundamental frequency and band pass filter tuned to the required frequency range (602–620 MHz) were used:

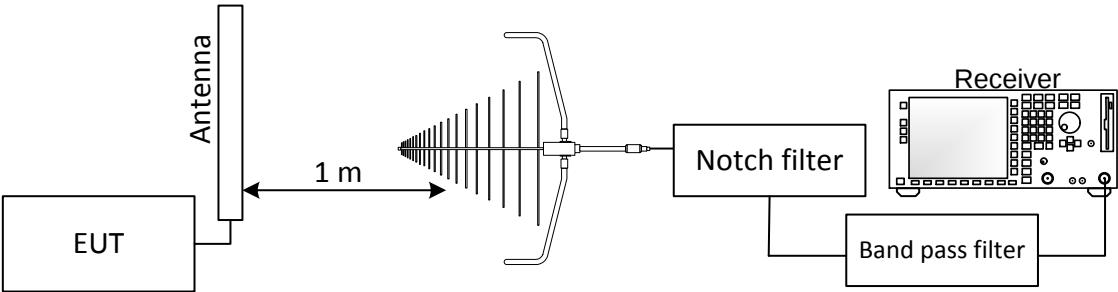
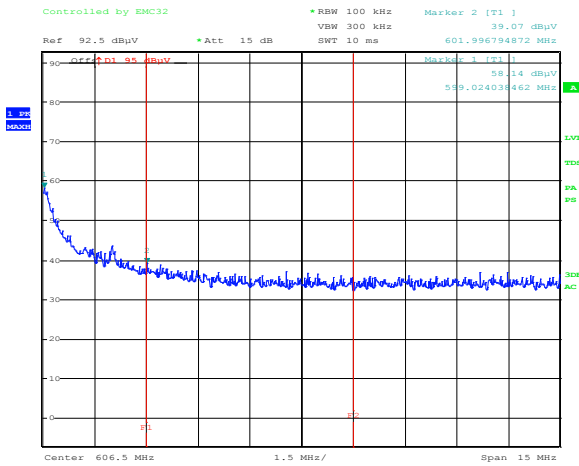


Figure 8.2-1: Setup diagram for 602–620 MHz radiated emissions measurements

Spectrum analyser settings:

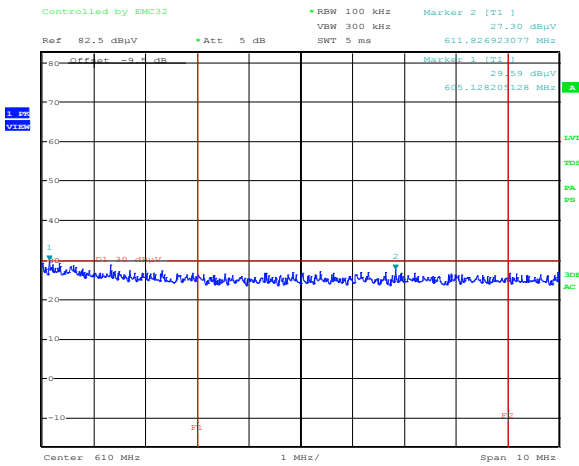
Resolution bandwidth:	120 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

8.2.4 Test data



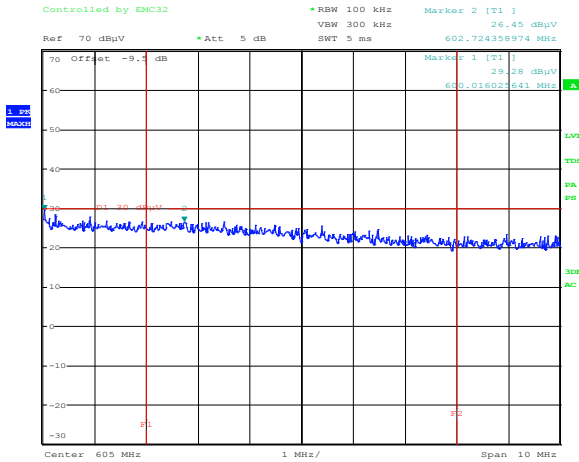
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Figure 8.2-2: Radiated spurious emissions within 602–608 MHz for low channel, AFS-DBG-60090-01 antenna



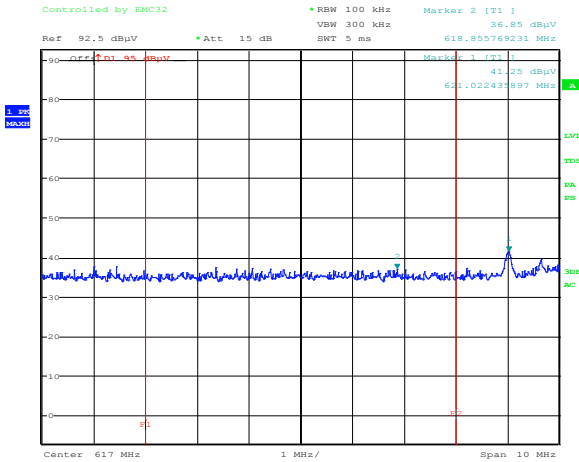
Date: 31.JUL.2015 17:00:30

Figure 8.2-3: Radiated spurious emissions within 608–614 MHz for AFS-DBG-60090-01 antenna, upper band edge



Date: 31.JUL.2015 17:07:32

Figure 8.2-4: Radiated spurious emissions within 608–614 MHz for AFS-DBG-60090-01 antenna, lower band edge

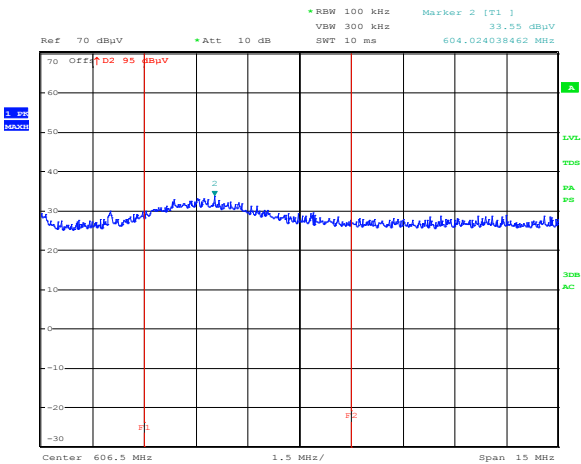


Date: 31.JUL.2015 17:05:32

Figure 8.2-5: Radiated spurious emissions within 614–620 MHz for AFS-DBG-60090-01 antenna

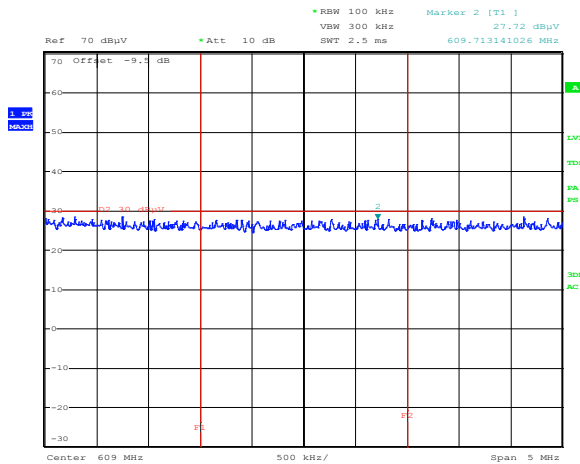
Section 8
Test name
Specification

Testing data
FCC 15.709(c)(4) Emissions in the band 602–620 MHz
FCC Part 15 Subpart H



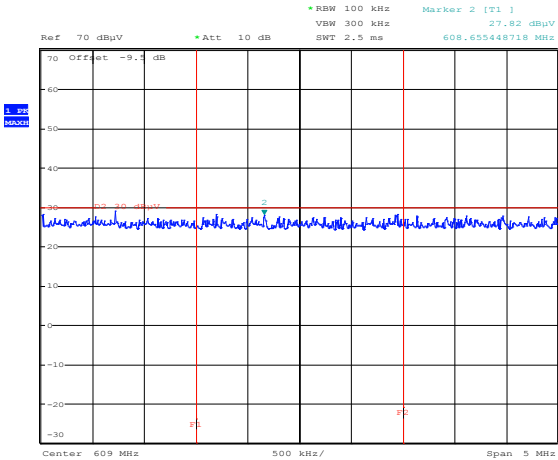
Date: 31.JUL.2015 18:15:57

Figure 8.2-6: Radiated spurious emissions within 602–608 MHz for AFD-DB-600-2ft-01 antenna



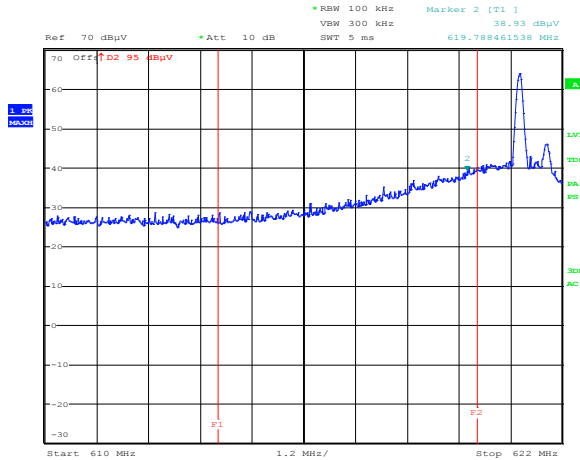
Date: 31.JUL.2015 18:17:58

Figure 8.2-7: Radiated spurious emissions within 608–614 MHz for AFD-DB-600-2ft-01 antenna, upper band edge



Date: 31.JUL.2015 18:19:33

Figure 8.2-8: Radiated spurious emissions within 608–614 MHz for AFD-DB-600-2ft-01 antenna, lower band edge

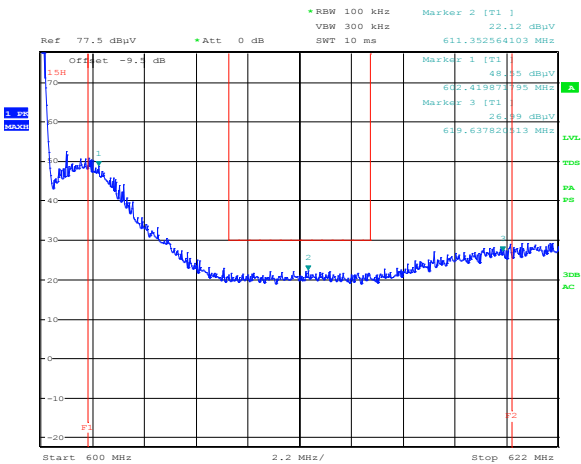


Date: 31.JUL.2015 18:20:37

Figure 8.2-9: Radiated spurious emissions within 614–620 MHz for AFD-DB-600-2ft-01 antenna

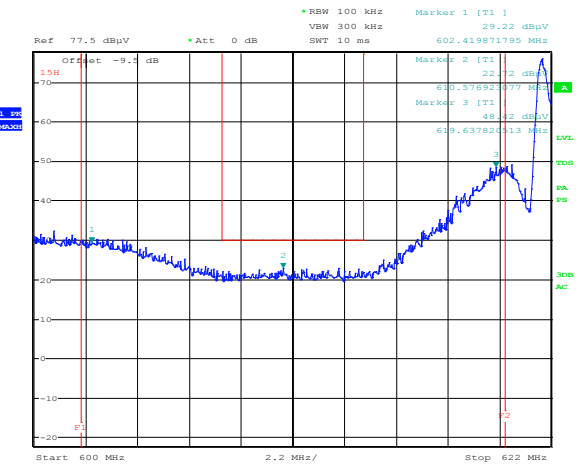
Section 8
Test name
Specification

Testing data
FCC 15.709(c)(4) Emissions in the band 602–620 MHz
FCC Part 15 Subpart H



Date: 5.AUG.2015 17:38:19

Figure 8.2-10: Radiated spurious emissions within 602–620 MHz for eLTE-MT-8dBi-Int-Ant antenna, lower band edge

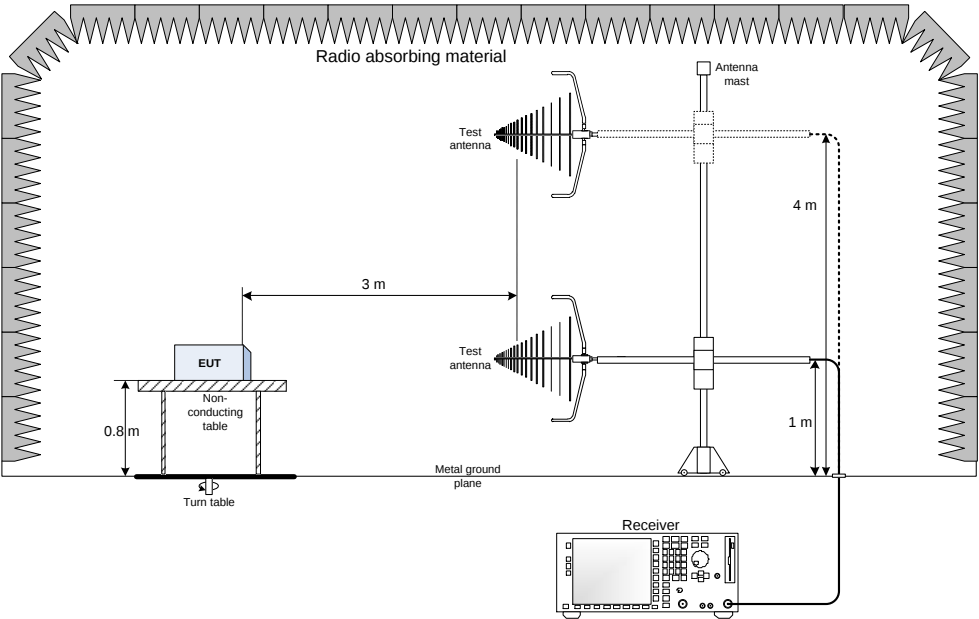


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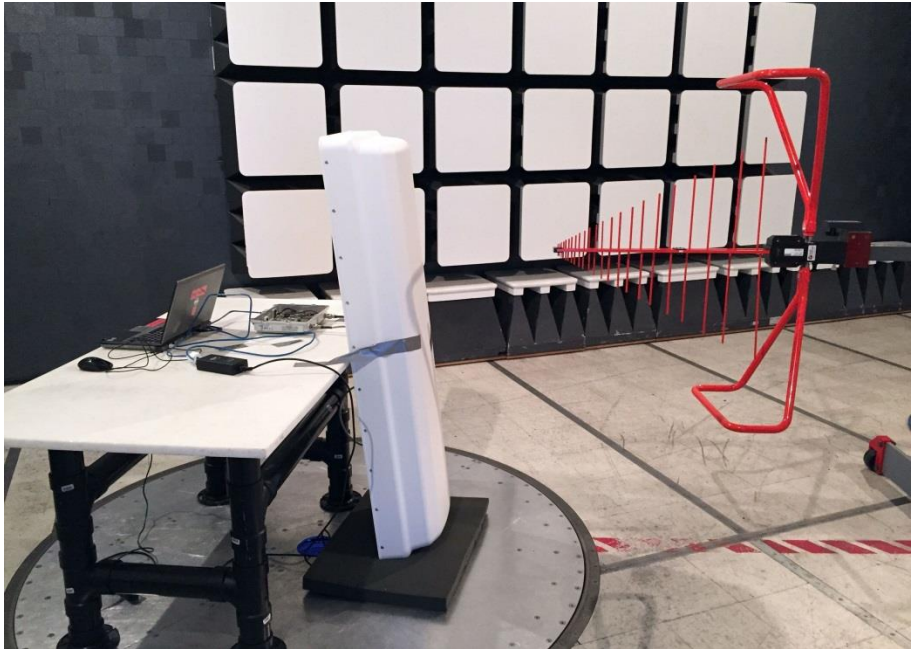
Figure 8.2-11: Radiated spurious emissions within 614–620 MHz for eLTE-MT-8dBi-Int-Ant antenna, upper band edge

Section 9. Block diagrams and photos of test set-ups

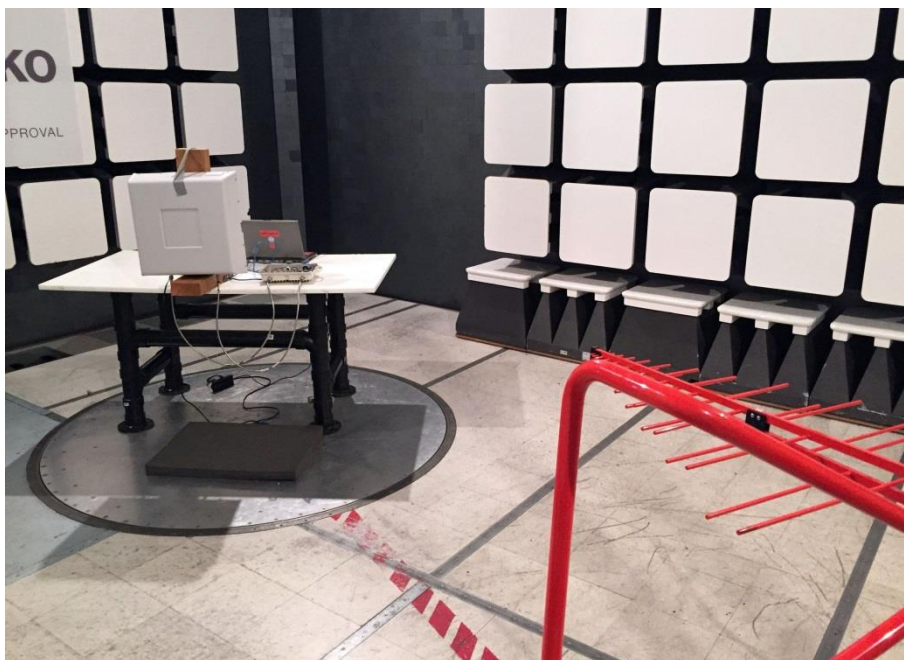
9.1 Block diagram of set-up



9.2 Photo of set-up with AFS-DBG-60090-01 antenna



9.3 Photo of set-up with AFS-DB-600-2ft-01 antenna



9.4 Photo of set-up with eLTE-MT-8dBi-Int-Ant antenna

