



TEST REPORT

Test Report No. : UL-RPT-RP10687744JD01B

Manufacturer : General Dynamics Broadband UK Ltd
Model No. : BBT
FCC ID : PKTNODEBBBK
Technology : LTE Band 14, 5 MHz & 10 MHz Channel Bandwidth
Test Standard(s) : FCC Part 90.539(d)

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2. The results in this report apply only to the sample tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0

Date of Issue: 19 May 2015

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This laboratory is accredited by UKAS.
The tests reported herein have been
performed in accordance with its' terms
of accreditation.

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Table of Contents

1. Customer Information.....	4
2. Summary of Testing.....	5
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	5
2.4. Deviations from the Test Specification	5
3. Equipment Under Test (EUT)	6
3.1. Identification of Equipment Under Test (EUT)	6
3.2. Description of EUT	6
3.3. Modifications Incorporated in the EUT	6
3.4. Additional Information Related to Testing	6
3.5. Support Equipment	7
4. Operation and Monitoring of the EUT during Testing	8
4.1. Operating Modes	8
4.2. Configuration and Peripherals	8
5. Measurements, Examinations and Derived Results.....	9
5.1. General Comments	9
5.2. Test Results	10
5.2.1. Transmitter Frequency Stability (Temperature Variation)	10
5.2.2. Transmitter Frequency Stability (Voltage Variation)	13
6. Measurement Uncertainty	15
7. Report Revision History	16

1. Customer Information

Company Name:	General Dynamics Broadband UK Ltd
Address:	Unit 7 Greenways Business Park Bellinger Close Chippenham Wilts SN15 1BN United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR90
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 90 Private Land Mobile Radio Services. Subpart R Regulations Governing the licensing And Use of Frequencies in the 763-775 and 793-805 MHz Bands
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	07 May 2015 to 12 May 2015

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
90.539(d) / 2.1055	Transmitter Frequency Stability	
Key to Results  = Complied  = Did not comply		

2.3. Methods and Procedures

Reference:	KDB 971168 D01 v02r02 October 17, 2014
Title:	Measurement Guidance for Certification of Licensed Digital Transmitters

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	General Dynamics Broadband
Model Name or Number:	BBT
Test Sample Serial Number:	BBTBE46000811
Hardware Version Number:	1.0
Software Version Number:	9.2.4
FCC ID Number:	PKTNODEBBBK

3.2. Description of EUT

The equipment under test was a RN2420 Band 14 LTE Base Station.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	LTE		
Type of Equipment	eNodeB		
Channel Bandwidth:	5 MHz & 10 MHz		
Modulation Type:	QPSK, 16QAM & 64QAM		
Duty Cycle:	100 %		
Power Supply Requirement:	Nominal	120 VAC	
	Minimum	102 VAC	
	Maximum	132 VAC	
Transmit Frequency Range:	758 MHz to 768 MHz		
Channel Bandwidth:	5 MHz		
Transmit Channels Tested:	Channel	N _{ul}	Channel Frequency (MHz)
	Bottom	5305	760.5
	Top	5355	765.5
Channel Bandwidth:	10 MHz		
Transmit Channels Tested:	Channel	N _{ul}	Channel Frequency (MHz)
	Single	5330	763.0

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Laptop
Brand Name:	Toshiba
Model Name or Number:	Satellite Pro A100
Serial Number:	67071048Q

Description:	Ethernet to serial cable (2m)
Brand Name:	Not stated
Model Name or Number:	Not stated
Serial Number:	Not stated

Description:	Serial to USB cable (0.4m)
Brand Name:	Not stated
Model Name or Number:	UC-232A
Serial Number:	Z866011AK30483

Description:	SFP to Ethernet cable (10m)
Brand Name:	None stated
Model Name or Number:	None stated
Serial Number:	None stated

Description:	SFP to Optical (terminated) (10m)
Brand Name:	None stated
Model Name or Number:	NA20354-001
Serial Number:	33544510100012

Description:	GPS Antenna
Brand Name:	None stated
Model Name or Number:	None stated
Serial Number:	None stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Transmit Mode – the EUT was set to transmit an un-modulated CW test tone.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The EUT was supplied with a three pin mains plug and was powered by 120 VAC 60 Hz mains.
- The EUT was controlled via a laptop PC, using bespoke software supplied by the customer. The customer supplied test instructions, which were followed to place the unit into the correct test mode.
- The EUT was connected to the test laptop using the Ethernet service port.
- The EUT has two transceiver RF ports marked RF1 and RF2. Testing was performed on Port RF1 and port RF2 was terminated with a suitable 50 Ohm load.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter Frequency Stability (Temperature Variation)

Test Summary:

Test Engineer:	Nick Steele	Test Date:	07 May 2015
Test Sample Serial Number:	BBTBE46000811		

FCC Reference:	Parts 90.539(d) and 2.1055
Test Method Used:	As detailed in KDB 971168 D01 Section 9.0 referencing FCC CFR Part 2.1055

Environmental Conditions:

Ambient Temperature (°C):	23
Ambient Relative Humidity (%):	37

Note(s):

1. Temperature was monitored throughout the test with a calibrated digital thermometer.
2. An external GPS antenna was connected to the GPS antenna port of the EUT. Using the communications software Teraterm, it was seen that the EUT was frequency locked to 4 satellites.
3. The EUT was configured to transmit an un-modulated CW test tone in order to measure the frequency stability.
4. Measurements were made using the frequency count function of the test receiver.

Transmitter Frequency Stability (Temperature Variation) (continued)**Results:**

Temperature (°C)	Time after Start-up					
	0 minutes (MHz)	1 minute (MHz)	2 minutes (MHz)	3 minutes (MHz)	4 minutes (MHz)	5 minutes (MHz)
-30	763.000461	763.000461	763.000462	763.000461	763.000463	763.000462
-20	763.000025	763.000025	763.000026	763.000025	763.000026	763.000026
-10	763.000015	763.000015	763.000014	763.000015	762.999999	763.000000
0	763.000014	763.000014	763.000015	763.000015	763.000014	763.000015
10	763.000015	763.000015	763.000016	763.000015	763.000016	763.000015
20	763.000012	763.000014	763.000015	763.000016	763.000014	763.000016
30	763.000024	763.000023	763.000023	763.000023	763.000024	763.000024
40	763.000035	763.000035	763.000036	763.000036	763.000035	763.000036
50	763.000039	763.000040	763.000040	763.000040	763.000040	763.000039

Temperature (°C)	Time after Start-up				
	6 minutes (MHz)	7 minutes (MHz)	8 minutes (MHz)	9 minutes (MHz)	10 minutes (MHz)
-30	763.000462	763.000464	763.000464	763.000463	763.000464
-20	763.000025	763.000026	763.000025	763.000025	763.000025
-10	763.000000	762.999999	762.999999	763.000000	762.999999
0	763.000015	763.000014	763.000014	763.000015	763.000016
10	763.000015	763.000014	763.000015	763.000016	763.000015
20	763.000016	763.000014	763.000015	763.000016	763.000016
30	763.000024	763.000023	763.000024	763.000024	763.000023
40	763.000036	763.000036	763.000036	763.000035	763.000035
50	763.000040	763.000040	763.000040	763.000039	763.000040

Frequency with Worst Case Deviation (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
763.000464	464	0.6081	1.0	0.3919	Complied

Transmitter Frequency Stability (Temperature Variation) (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
E0518	Environmental Chamber	TAS	LTCL 1200	24000107	Calibrated before use	-
M1249	Thermometer	Fluke	52II	88800049	15 May 2015	12
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
S0539	Variable AC Power Supply	Kikusui	PCR 1000L	13010170	06 Mar 2016	12
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24

5.2.2. Transmitter Frequency Stability (Voltage Variation)**Test Summary:**

Test Engineer:	Nick Steele	Test Date:	12 May 2015
Test Sample Serial Number:	BBTBE46000811		

FCC Reference:	90.539(d) and 2.1055
Test Method Used:	As detailed in KDB 971168 D01 Section 9.0 referencing FCC CFR Part 2.1055

Environmental Conditions:

Ambient Temperature (°C):	26
Ambient Relative Humidity (%):	32

Note(s):

1. Voltage was monitored throughout the test with a calibrated digital voltmeter.
2. An external GPS antenna was connected to the GPS antenna port of the EUT. Using the communications software Teraterm, it was seen that the EUT was frequency locked to 5 satellites.
3. The EUT was configured to transmit an un-modulated CW test tone in order to measure the frequency stability.
4. Measurements were made using the frequency count function of the test receiver.

Results:

Supply Voltage (VAC)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
102	763.000014	14	0.0183	1.0	0.9817	Complied
132	763.000015	15	0.0197	1.0	0.9803	Complied

Transmitter Frequency Stability (Voltage Variation) (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
S0539	Variable AC Power Supply	Kikusui	PCR 1000L	13010170	06 Mar 2016	12
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Frequency Stability	758 MHz to 768 MHz	95%	±0.92 ppm

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version

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