PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. 410.290.6652 / Fax 410.290.6654
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MEASUREMENT REPORT
FCC Part 22

Applicant Name:
Tecore Networks
7030 Hi Tech Drive
Hanover, MD 21076
USA

Date of Testing:
5/17 - 5/18/2016
Test Site/Location:
PCTEST Lab., Columbia, MD, USA
Test Report Serial No.:
0Y1602110307.QLJ

FCC ID:	**QLJ3GRFN**
APPLICANT:	**TECORE NETWORKS**

Application Type:	Certification
Model(s):	3GRFN
EUT Type:	NodeB
FCC Classification:	Licensed Non-Broadcast Station Transmitter (TNB)
FCC Rule Part(s):	§2 §22(H)
Test Procedure(s):	ANSI/TIA-603-D-2010, KDB 971168 v02r02
Test Device Serial No.:	*identical prototype* [S/N: FCC]

Mode	Tx Frequency (MHz)	Modulation	Emission Designator	Cond. Power	
				Max. Power (dBm)	Max. Power (W)
UMTS850	871.4 - 891.6	QPSK	4M19F9W	42.650	18.41
UMTS850	871.4 - 891.6	16-QAM	4M20F9W	42.950	19.72
UMTS850	871.4 - 891.6	64-QAM	4M20F9W	42.990	19.91

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

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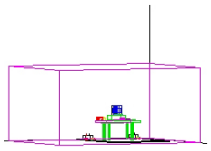
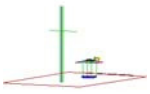


MEASUREMENT REPORT
FCC Part 22



§2.1033 General Information

APPLICANT:	Tecore Networks
APPLICANT ADDRESS:	7030 Hi Tech Drive Hanover, MD 21076, USA
TEST SITE:	PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS:	7185 Oakland Mills Road, Columbia, MD 21046 USA
FCC RULE PART(S):	§2 §22(H)
BASE MODEL:	3GRFN
FCC ID:	QLJ3GRFN
FCC CLASSIFICATION:	Licensed Non-Broadcast Station Transmitter (TNB)
MODE:	UMTS
FREQUENCY TOLERANCE:	±0.00025 % (2.5 ppm)
Test Device Serial No.:	FCC ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	5/17 - 5/18/2016
TEST REPORT S/N:	0Y1602110307.QLJ

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2 Testing Facility

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (*See Figure 1-1*).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39º 10'23" N latitude and 76º 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2014 on January 22, 2015.

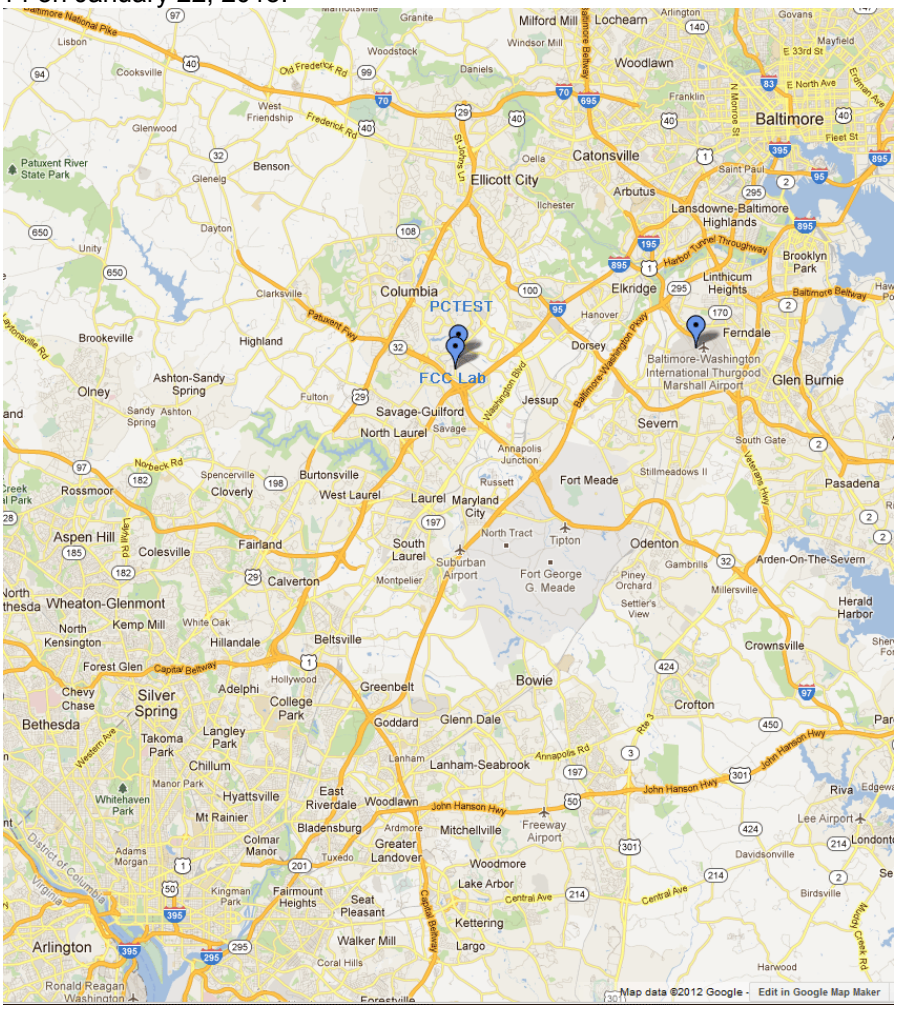


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Tecore NodeB FCC ID: QLJ3GRFN**. The NodeB generates an 850MHz band UMTS signal using QPSK, 16-QAM, and 64-QAM modulations. The signal output level is set to -30dBm and it is fed via a low loss cable to the input of a spectrum analyzer or a 50Ω load, depending on the type of testing performed. All of the settings in the NodeB are set through a connection to a laptop PC via Ethernet cable.

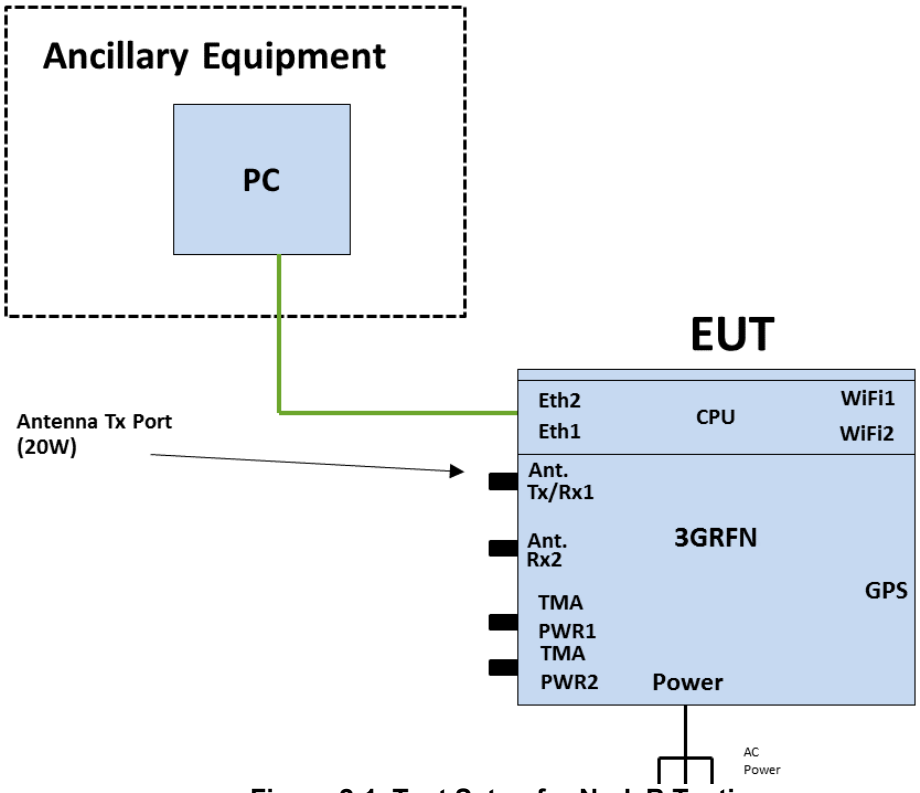


Figure 2-1. Test Setup for NodeB Testing

2.2 Device Capabilities

This device contains the following capabilities:

UMTS 850

2.3 Test Configuration

The Tecore NodeB FCC ID: QLJ3GRFN was tested per the guidance of ANSI/TIA-603-D-2010 and KDB 971168 v02r02. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

3.0 DESCRIPTION OF TESTS

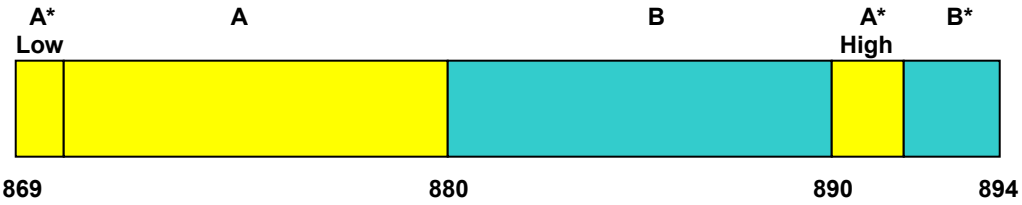
3.1 Evaluation Procedure

The measurement procedures described in the "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-D-2010) and "Measurement Guidance for Certification of Licensed Digital Transmitters" (KDB 971168 v02r02) were used in the measurement of the **Tecore NodeB FCC ID: QLJ3GRFN.**

Deviation from Measurement Procedure……..None

3.2 Cellular - Base Frequency Blocks

§22.905



BLOCK 1: 869 – 880 MHz (A* Low + A)

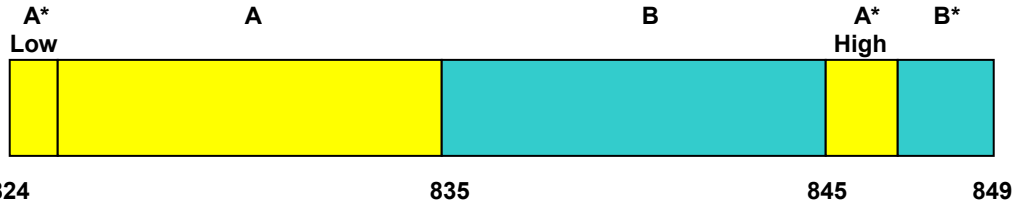
BLOCK 2: 880 – 890 MHz (B)

BLOCK 3: 890 – 891.5 MHz (A* High)

BLOCK 4: 891.5 – 894 MHz (B*)

3.3 Cellular - Mobile Frequency Blocks

§22.905



BLOCK 1: 824 – 835 MHz (A* Low + A)

BLOCK 2: 835 – 845 MHz (B)

BLOCK 3: 845 – 846.5 MHz (A* High)

BLOCK 4: 846.5 – 849 MHz (B*)

3.4 Radiated Measurements

§2.1053 §22.913(a.2) §22.917(a)

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Clause 5, Figure 5.7 of ANSI C63.4-2014. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. An ETS Lindgren Model 2188 raised turntable is used for radiated measurement. It is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. A 78cm high PVC support structure is placed on top of the turntable. A 3" (~1.9cm) sheet of high density polyethylene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm.

The equipment under test was transmitting while connected to a 50Ω load and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees to achieve the highest reading on the receive spectrum analyzer.

Per the guidance of ANSI/TIA-603-D-2010, a half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_{d\ [dBm]} = P_{g\ [dBm]} - \text{cable loss}_{\ [dB]} + \text{antenna gain}_{\ [dBd/dBi]}$$

Where, P_d is the dipole equivalent power, P_g is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_{g\ [dBm]}$ – cable loss $_{[dB]}$.

Spurious emissions levels are investigated with the receive antenna horizontally and vertically polarized per ANSI/TIA-603-D-2010.

4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	LTx3	LIcensed Transmitter Cable Set	6/12/2015	Annual	6/12/2016	LTx3
-	RE3	Radiated Emissions Cable Set	11/18/2015	Annual	11/18/2016	RE3
Agilent	N9020A	MXA Signal Analyzer	11/5/2015	Annual	11/5/2016	US46470561
Emco	3115	Horn Antenna (1-18GHz)	3/10/2016	Biennial	3/10/2018	9704-5182
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	10/22/2014	Biennial	10/22/2016	128338
K & L	13SH10-1000/U1000	N Type High Pass Filter	7/18/2015	Annual	7/18/2016	13SH10-1000/U1000-1
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	3/4/2016	Annual	3/4/2017	11401010036
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A		N/A	11208010032
Mini-Circuits	TVA-11-422	RF Power Amp	N/A		N/A	QA1303002
Rohde & Schwarz	TS-PR18	1-18 GHz Pre-Amplifier	3/7/2016	Annual	3/7/2017	100071
Rhode & Schwarz	ESU40	EMI Test Receiver (40GHz)	7/17/2015	Annual	7/17/2016	100348

Table 5-1. Test Equipment

Notes:

1. Equipment with a calibration date of “N/A” shown in this list was not used to make direct calibrated measurements.

6.0 SAMPLE CALCULATIONS

UMTS Emission Designator

Emission Designator = 4M16F9W

UMTS BW = 4.16 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data)

Spurious Radiated Emission

Example: Spurious emission at 3700.40 MHz

The receive spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3700.40 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.50 dBm so this harmonic was 25.50 dBm – (-24.80) = 50.3 dBc.

7.0 TEST RESULTS

7.1 Summary

Company Name: Tecore

FCC ID: QLJ3GRFN

FCC Classification: Licensed Non-Broadcast Station Transmitter (TNB)

Mode(s): UMTS

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (TX)					
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1051 22.917(a)	Conducted Band Edge / Spurious Emissions	> 43 + $\log_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions		PASS	Sections 7.4, 7.5
2.1046	Transmitter Conducted Output Power	N/A		PASS	Section 7.5
2.1055 22.355	Frequency Stability	< 1.5 ppm Emission must remain in band		PASS	Section 7.7
2.1053 22.917(a)	Radiated Spurious Emissions	> 43 + $\log_{10}$ (P[Watts]) for all out-of-band emissions		PASS	Section 7.6

Table 7-1. Summary of Test Results

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.

7.2 Conducted Power Output Data

§2.1046

Test Overview

The NodeB was set to transmit in all three available modulations of UMTS mode at -30dBm through a laptop PC. A NodeB output power level of -30dBm was used to ensure that the amplifier would operate in its linear region. The output of the NodeB was connected through a calibrated cable and 30dB of external attenuation to a signal analyzer. The signal analyzers' "Channel Power" function was used to measure the conducted output powers in accordance to the guidance of KDB 971168 V02R02.

Test Procedures Used

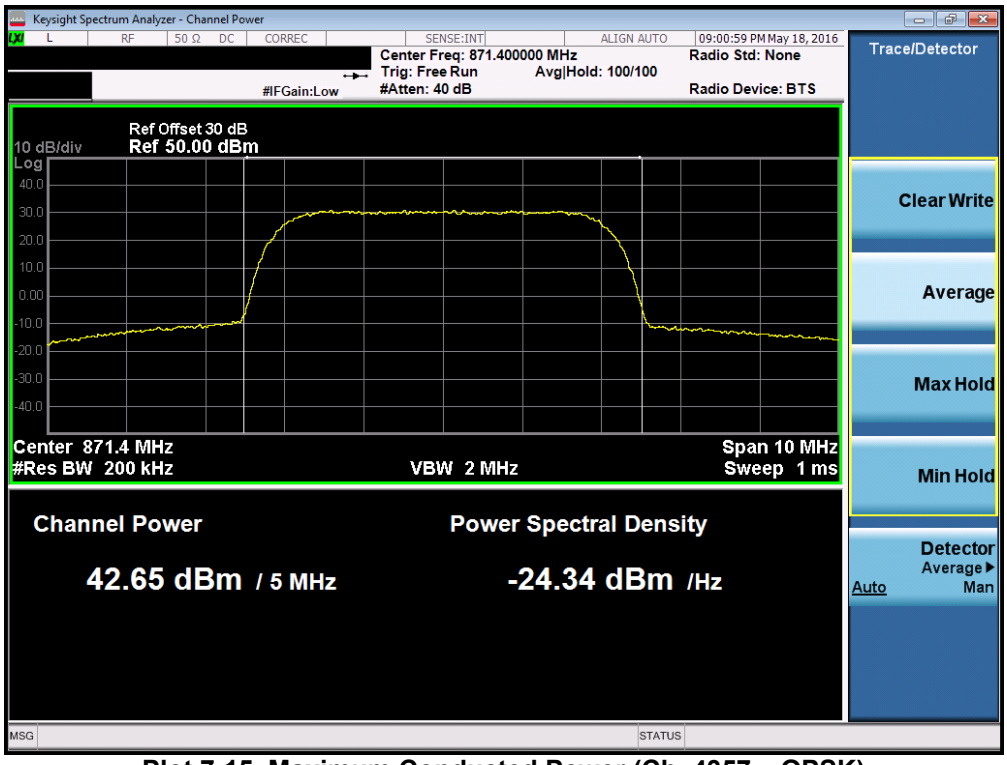
KDB 971168 v02r02 – Section 5.2.1

Test Settings

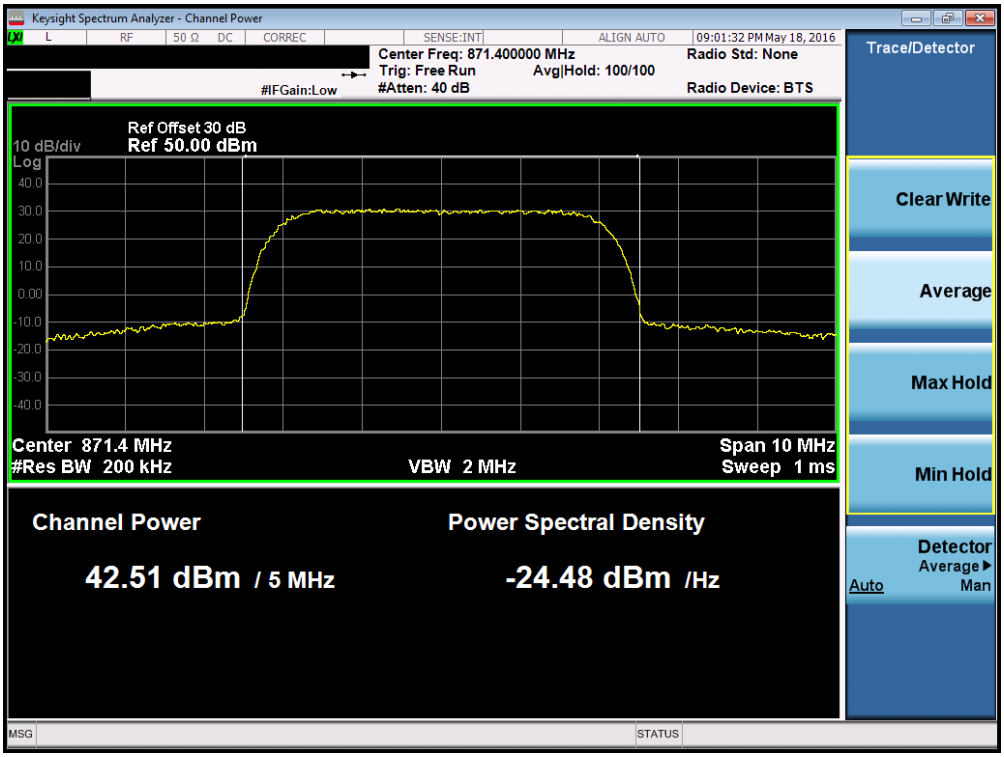
1. Power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Frequency [MHz]	Mode	Modulation	Conducted Power [dBm]	Conducted Power [Watts]
871.4	UMTS850	QPSK	42.65	18.408
		16QAM	42.51	17.824
		64QAM	42.62	18.281
881.4		QPSK	42.93	19.634
		16QAM	42.85	19.275
		64QAM	42.95	19.724
891.6		QPSK	42.99	19.907
		16QAM	42.97	19.815
		64QAM	42.73	18.750

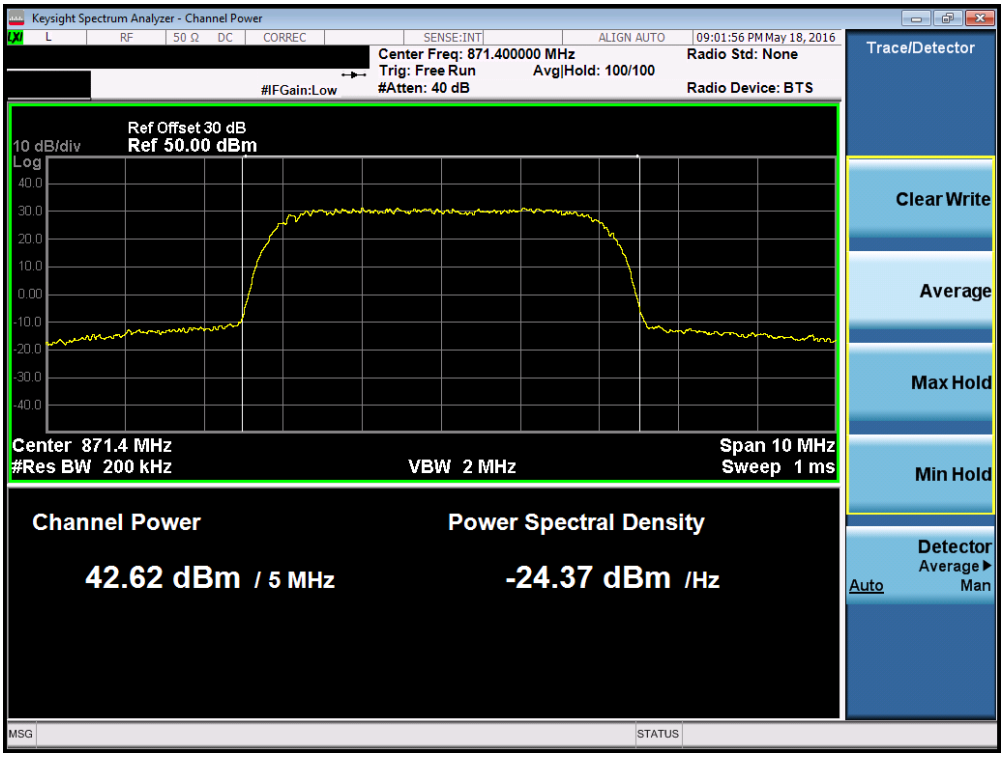
Table 7-2. Maximum Average Conducted Power



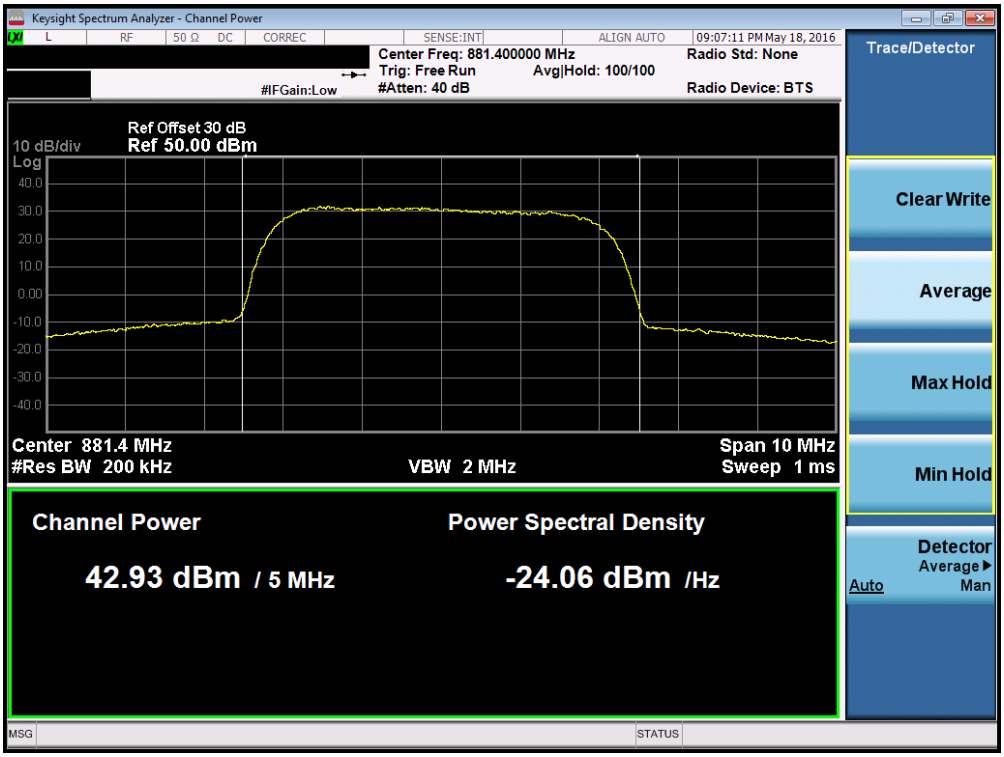
Plot 7-15. Maximum Conducted Power (Ch. 4357 – QPSK)



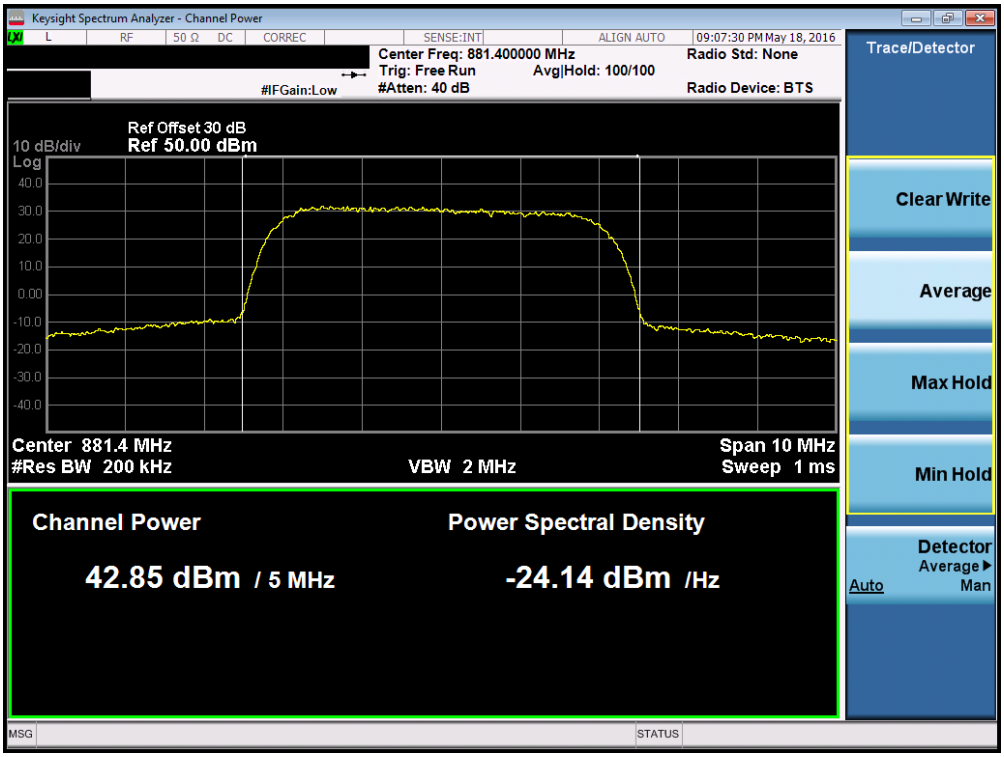
Plot 7-16. Maximum Conducted Power (Ch. 4357 – 16-QAM)



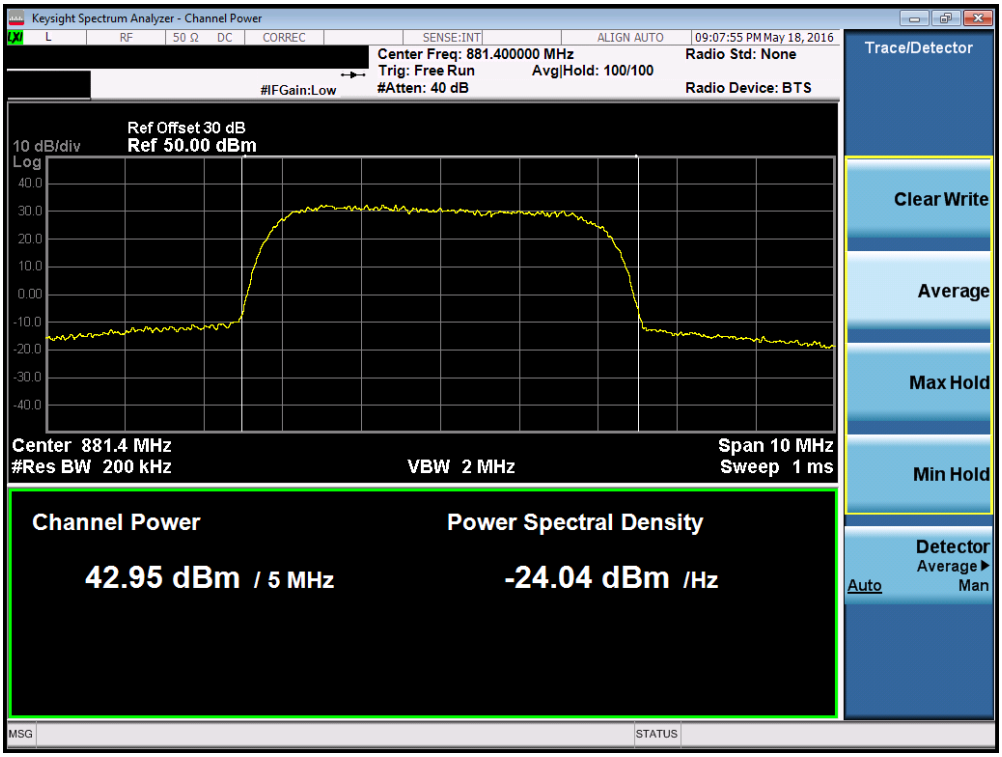
Plot 7-17. Maximum Conducted Power (Ch. 4357 – 64-QAM)



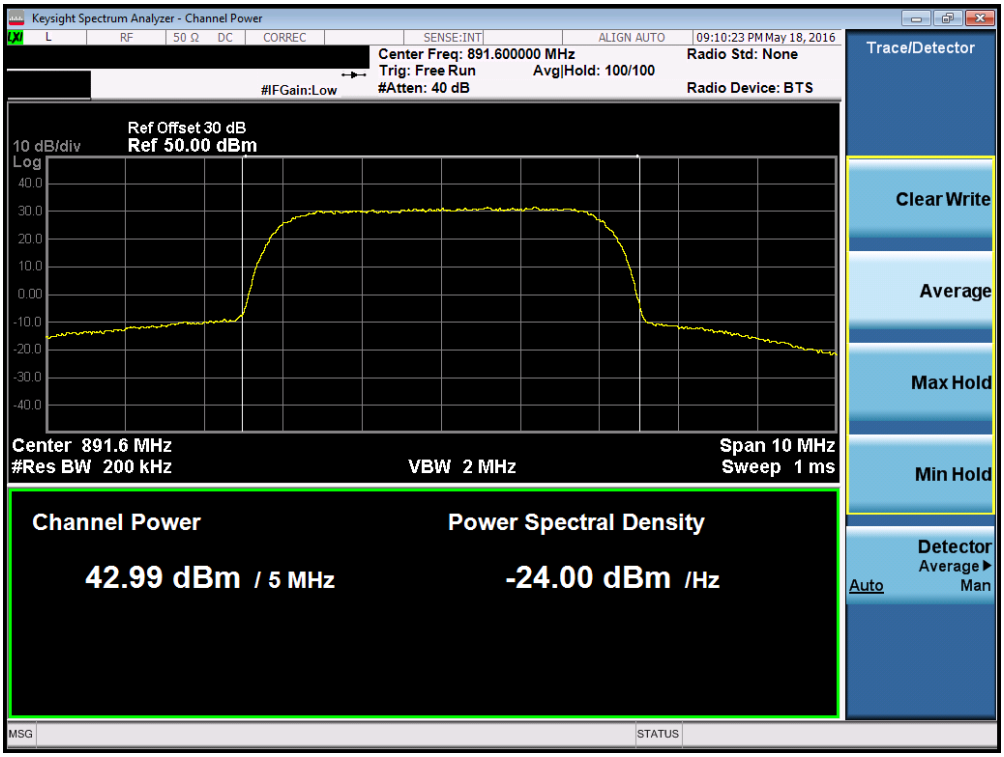
Plot 7-18. Maximum Conducted Power (Ch. 4407 – QPSK)



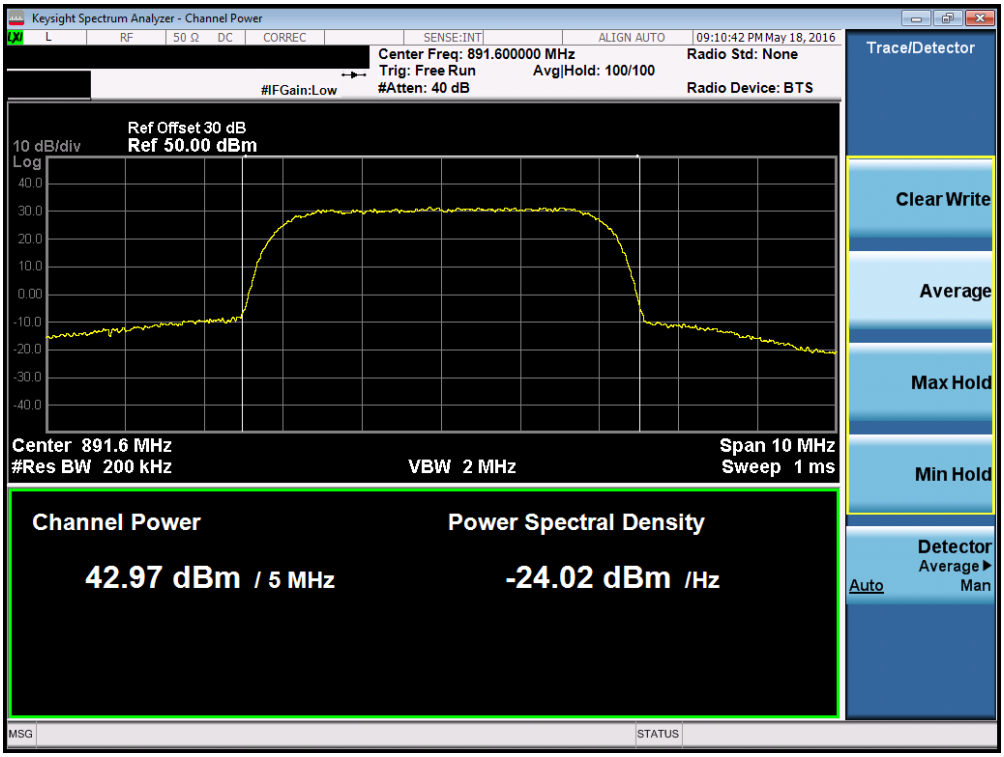
Plot 7-19. Maximum Conducted Power (Ch. 4407 – 16-QAM)



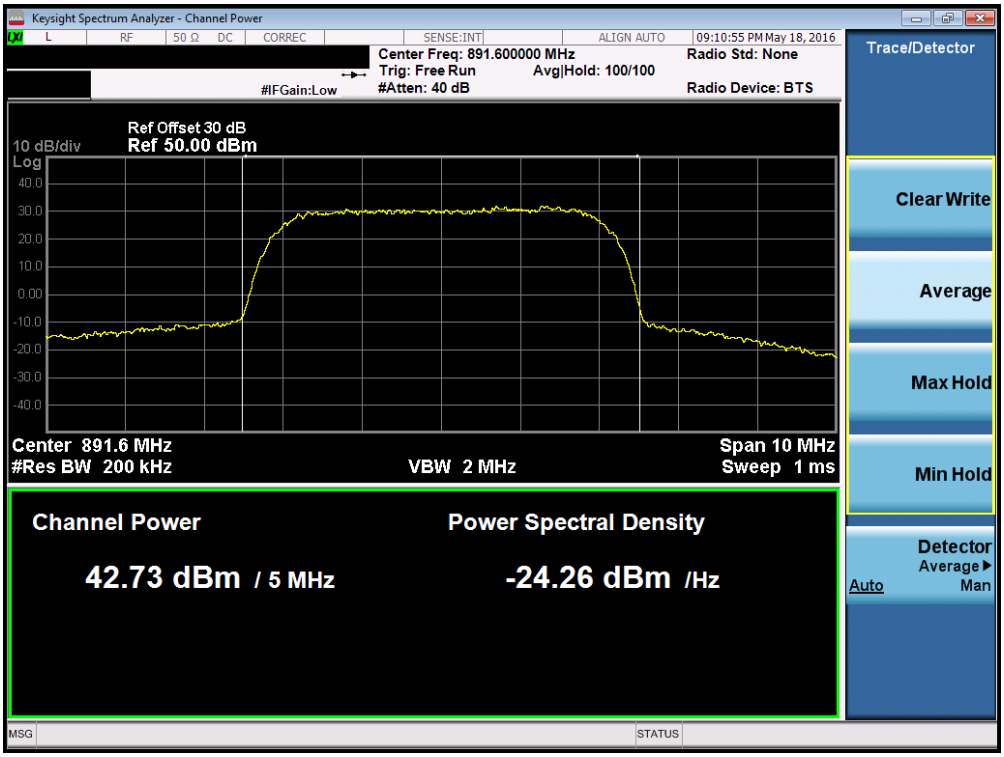
Plot 7-20. Maximum Conducted Power (Ch. 4407 – 64-QAM)



Plot 7-21. Maximum Conducted Power (Ch. 4458 – QPSK)



Plot 7-22. Maximum Conducted Power (Ch. 4458 – 16-QAM)



Plot 7-23. Maximum Conducted Power (Ch. 4458 – 64-QAM)

7.3 Occupied Bandwidth

§2.1049

Test Overview

The occupied bandwidth, that 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 shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 v02r02 – Section 4.2

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

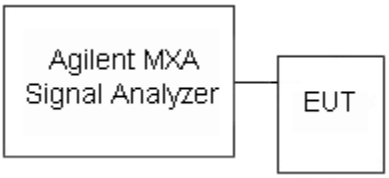
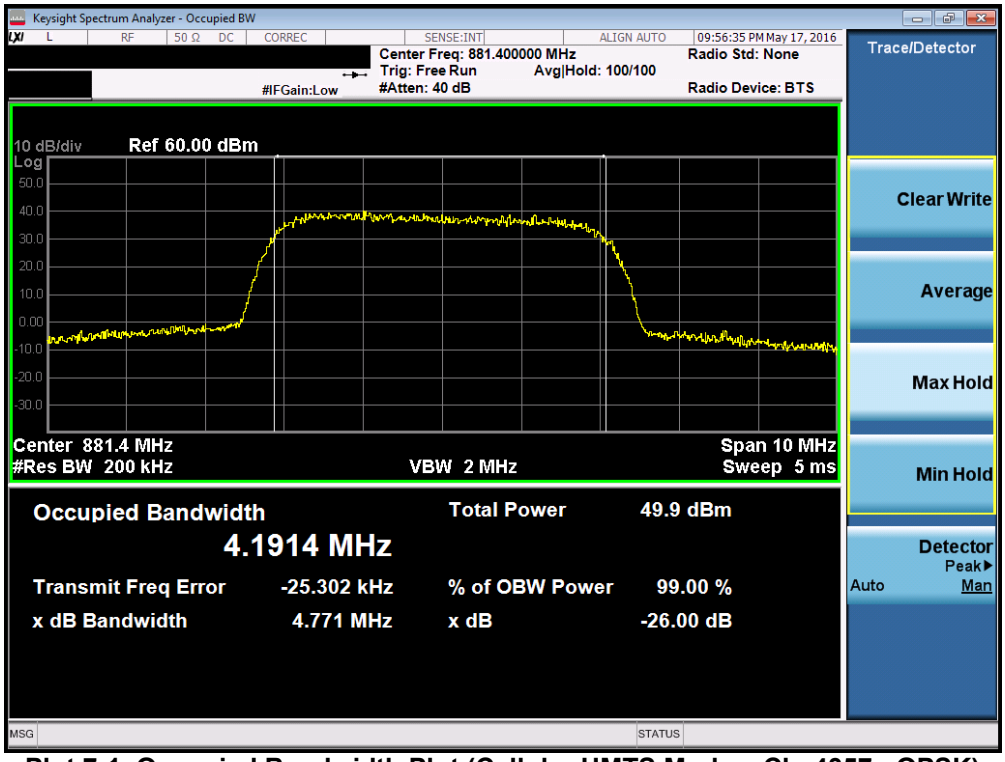


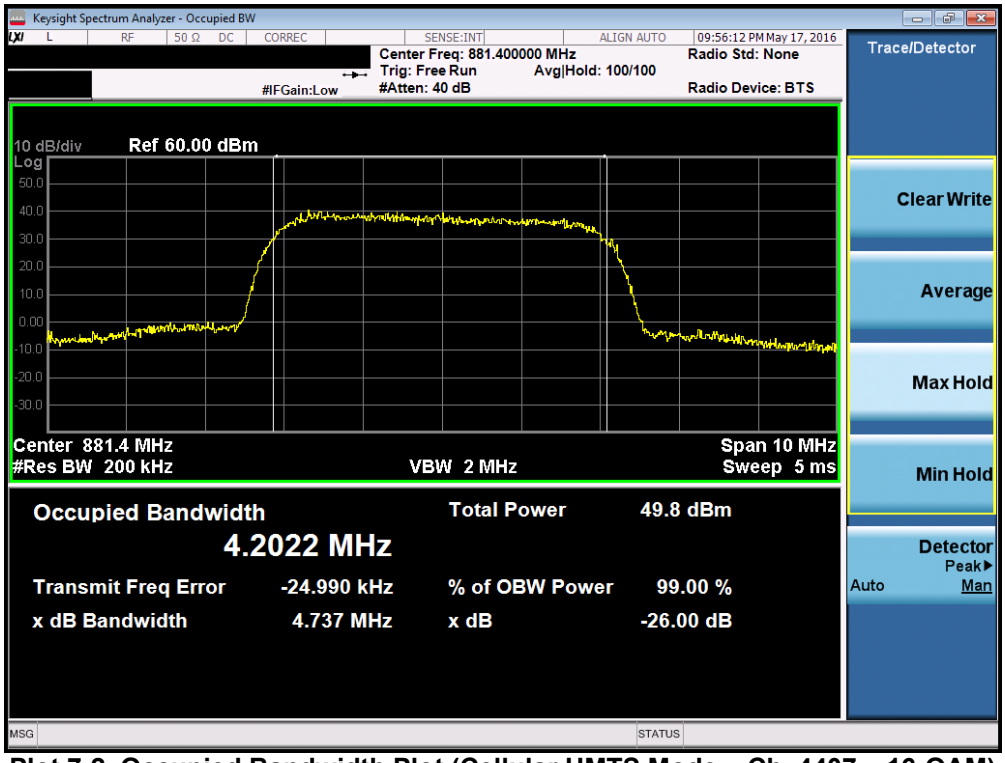
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

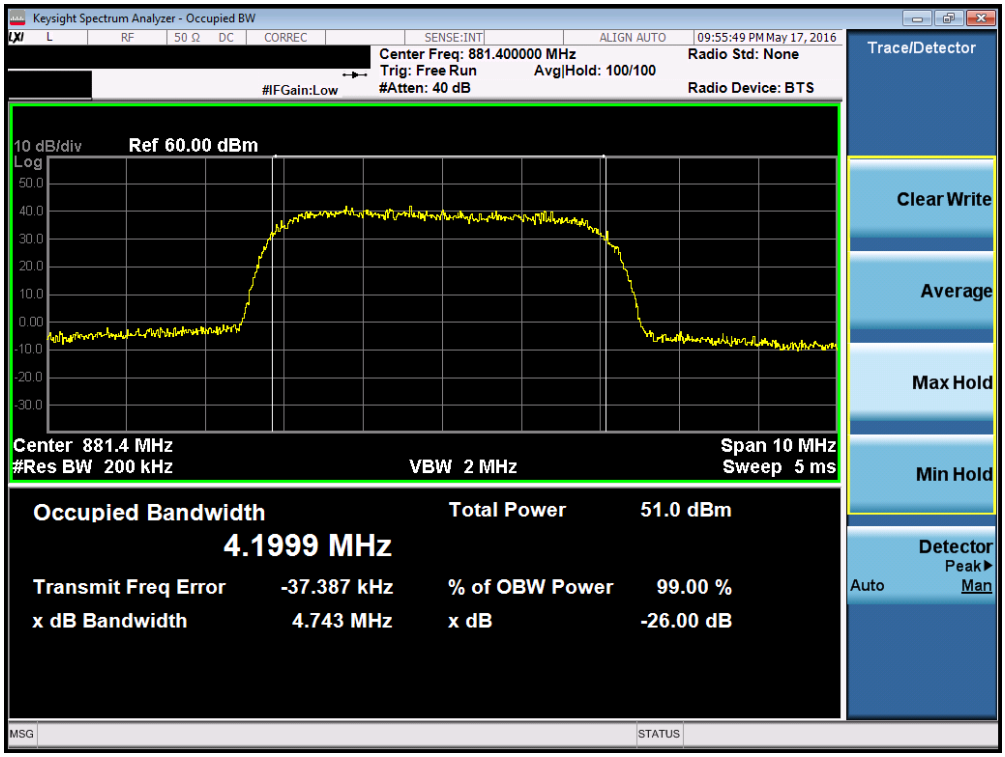
None.



Plot 7-1. Occupied Bandwidth Plot (Cellular UMTS Mode – Ch. 4357 - QPSK)



Plot 7-2. Occupied Bandwidth Plot (Cellular UMTS Mode – Ch. 4407 – 16-QAM)



Plot 7-3. Occupied Bandwidth Plot (Cellular UMTS Mode – Ch. 4458 – 64-QAM)

7.4 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §22.917(a)

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 v02r02 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. Detector = Peak
3. Trace mode = Max Hold
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

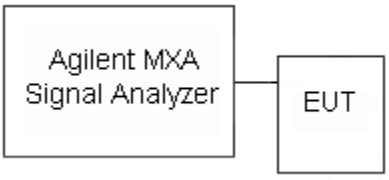
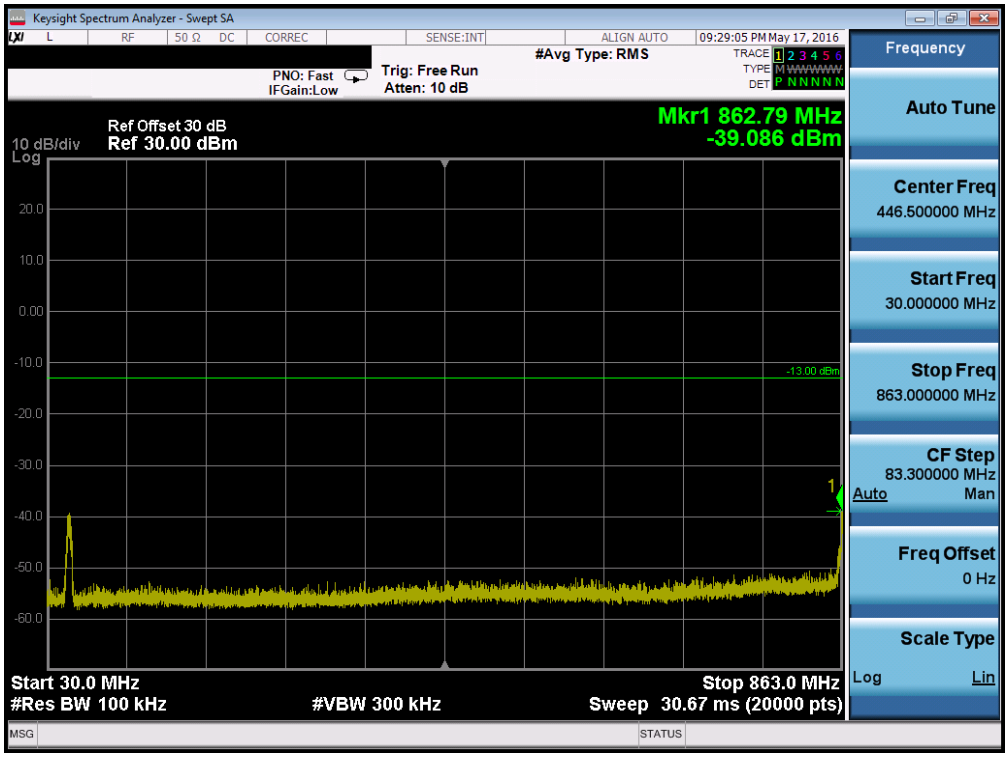


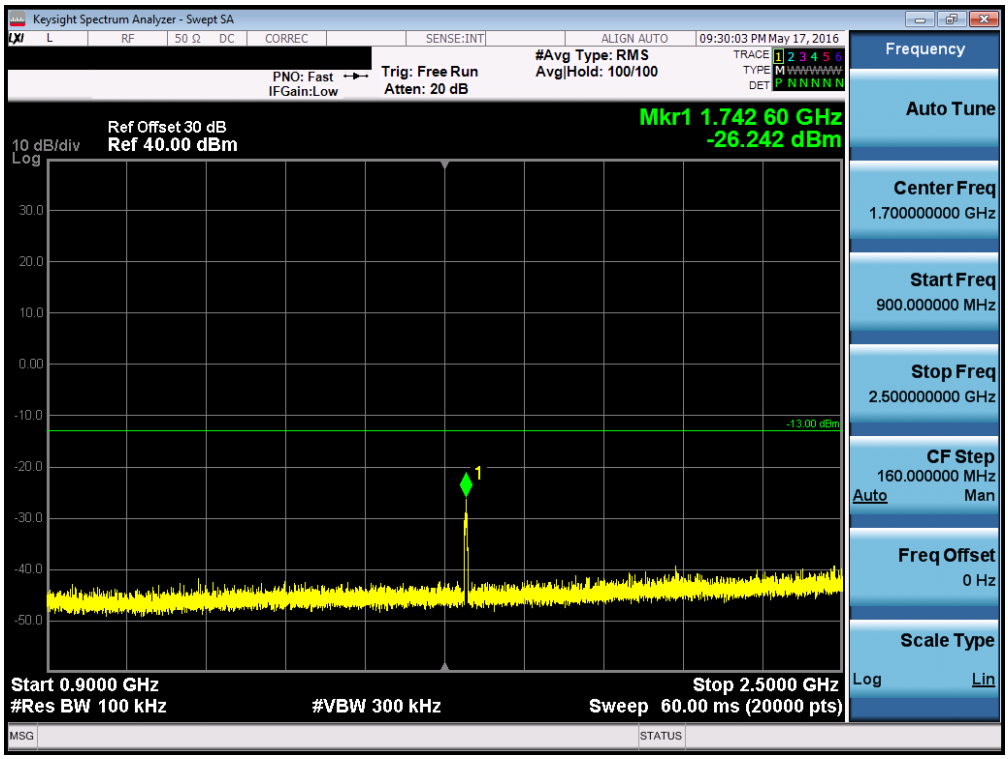
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

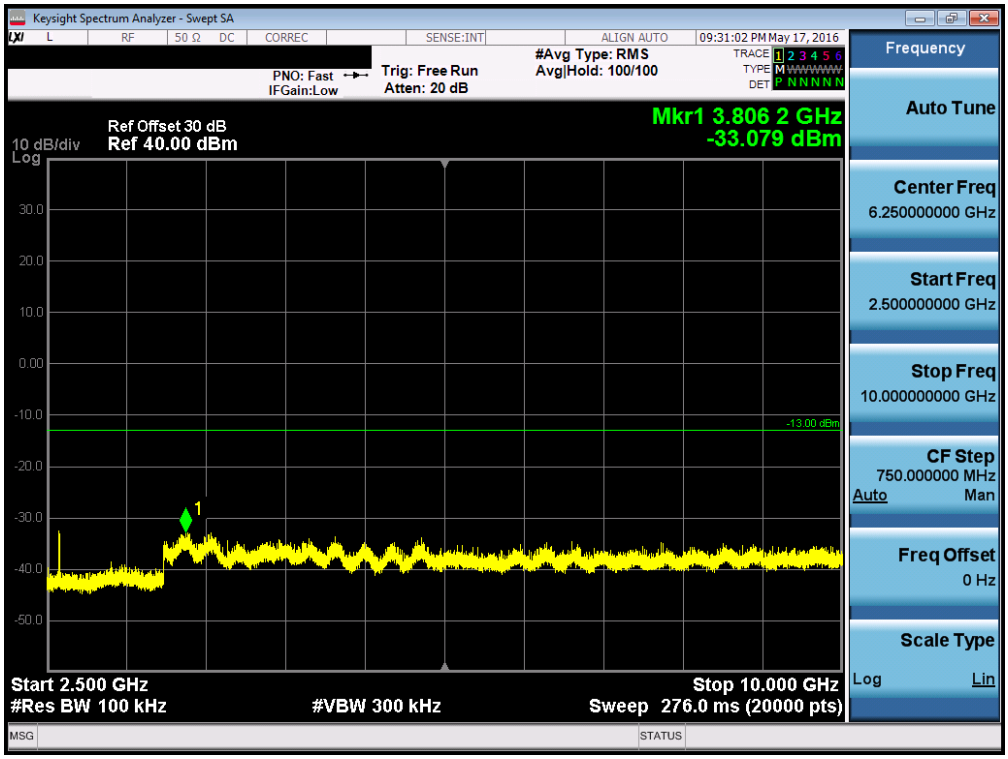
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for Part 22. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.



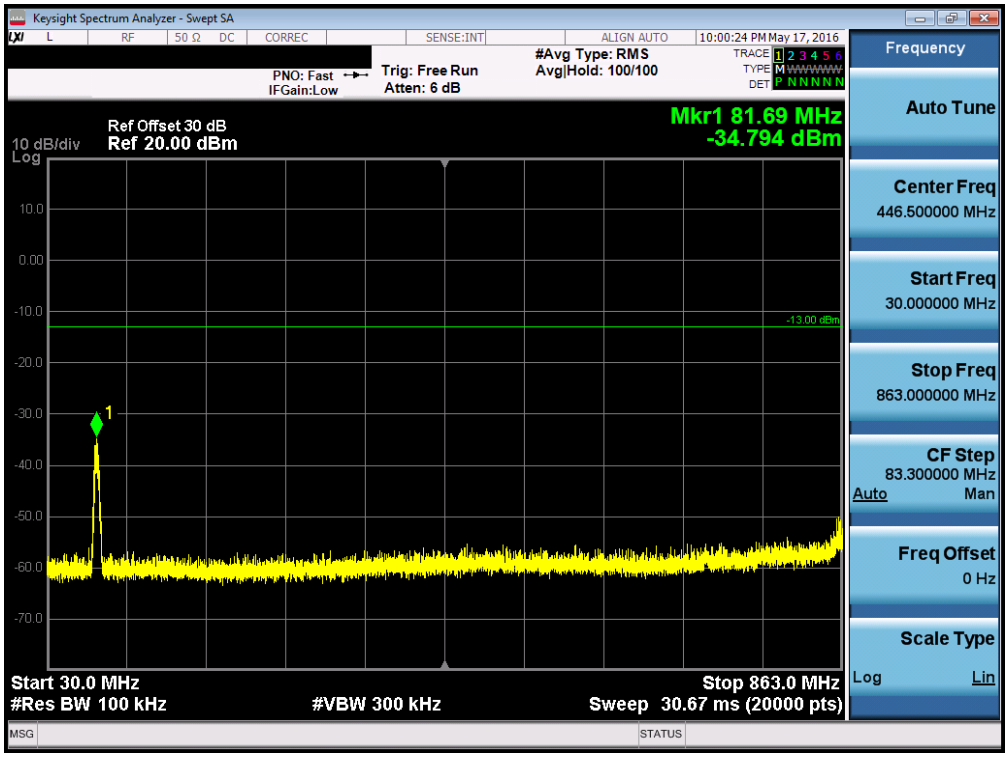
Plot 7-4. Conducted Spurious Plot (Cellular UMTS Mode – Ch. 4357)



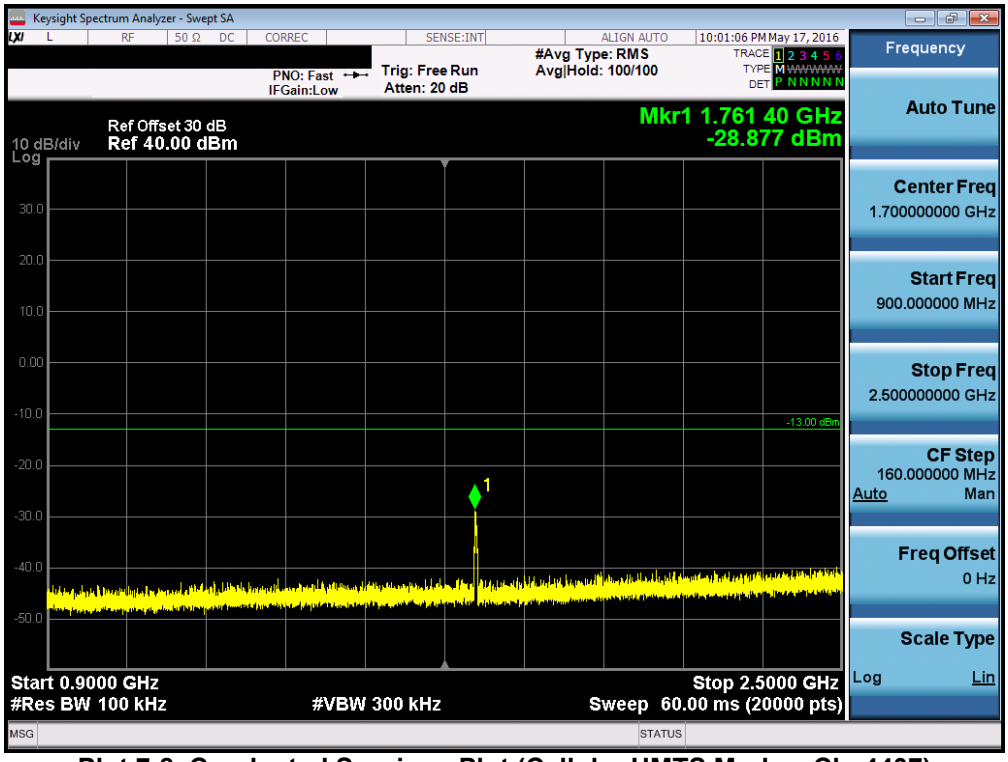
Plot 7-5. Conducted Spurious Plot (Cellular UMTS Mode – Ch. 4357)



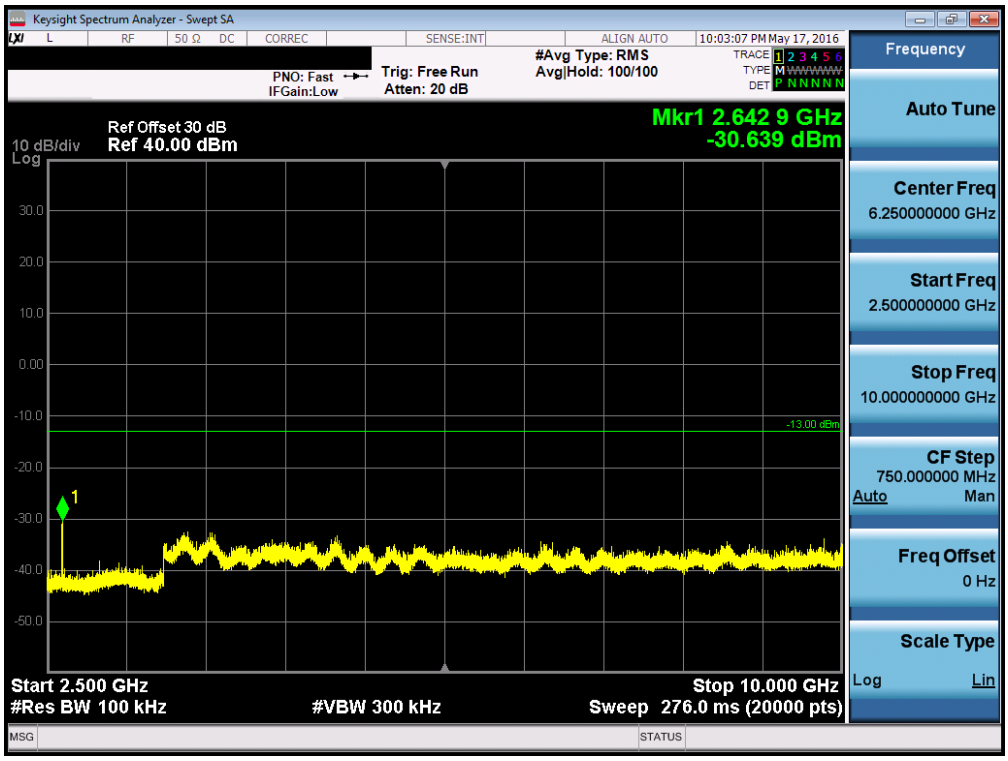
Plot 7-6. Conducted Spurious Plot (Cellular UMTS Mode – Ch. 4357)



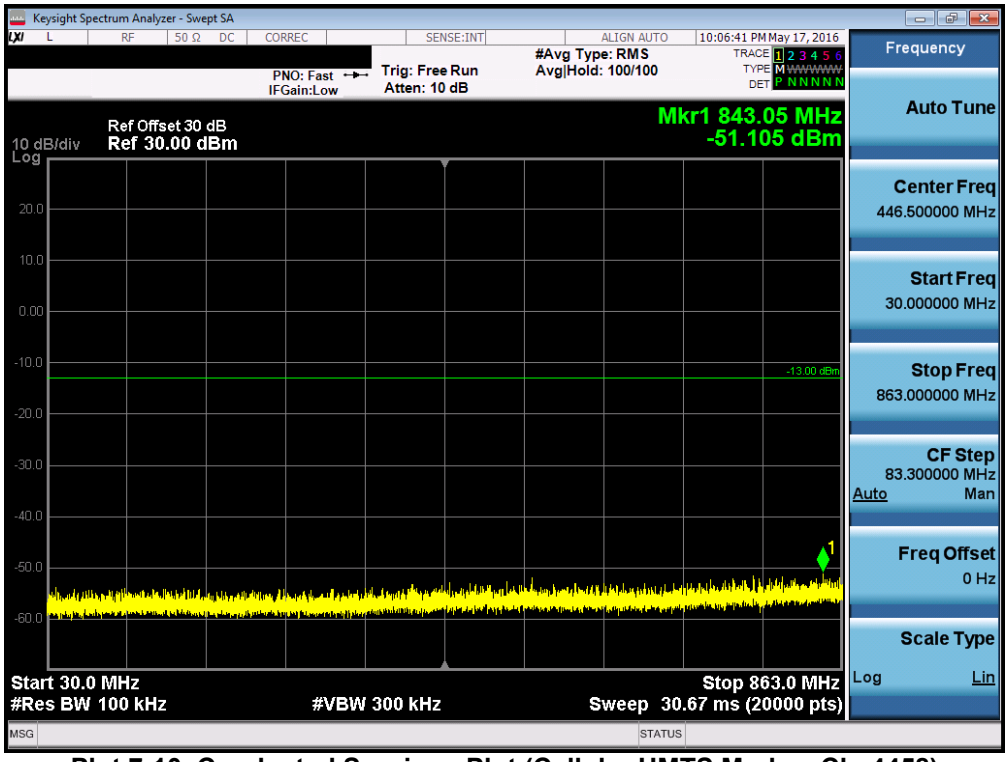
Plot 7-7. Conducted Spurious Plot (Cellular UMTS Mode – Ch. 4407)



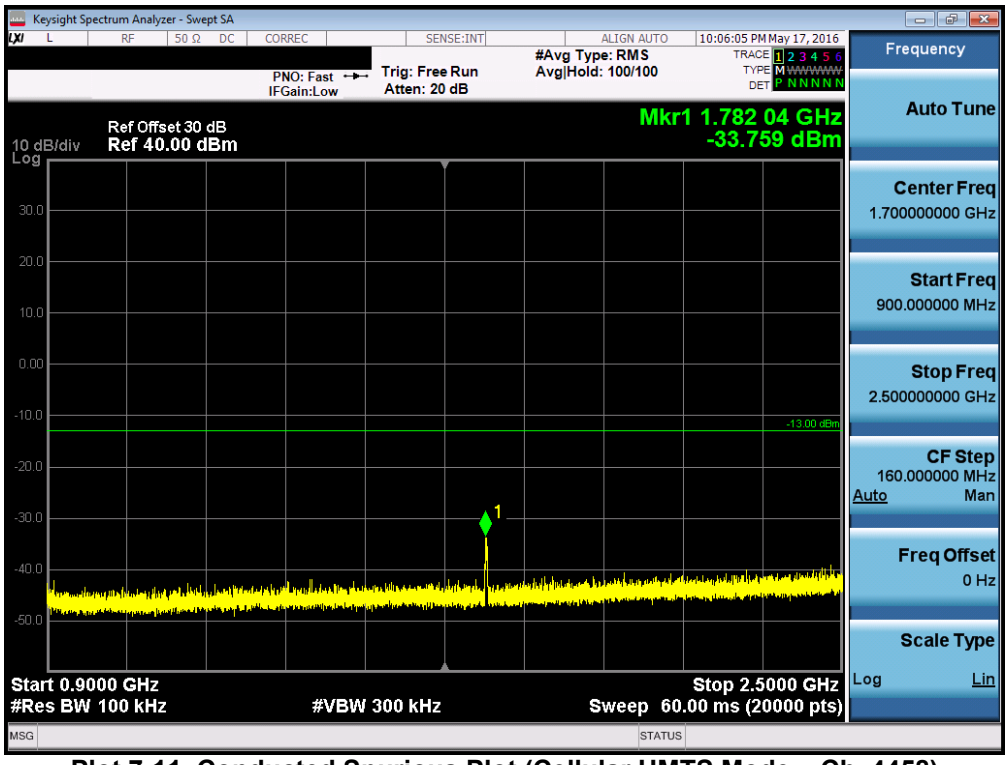
Plot 7-8. Conducted Spurious Plot (Cellular UMTS Mode – Ch. 4407)



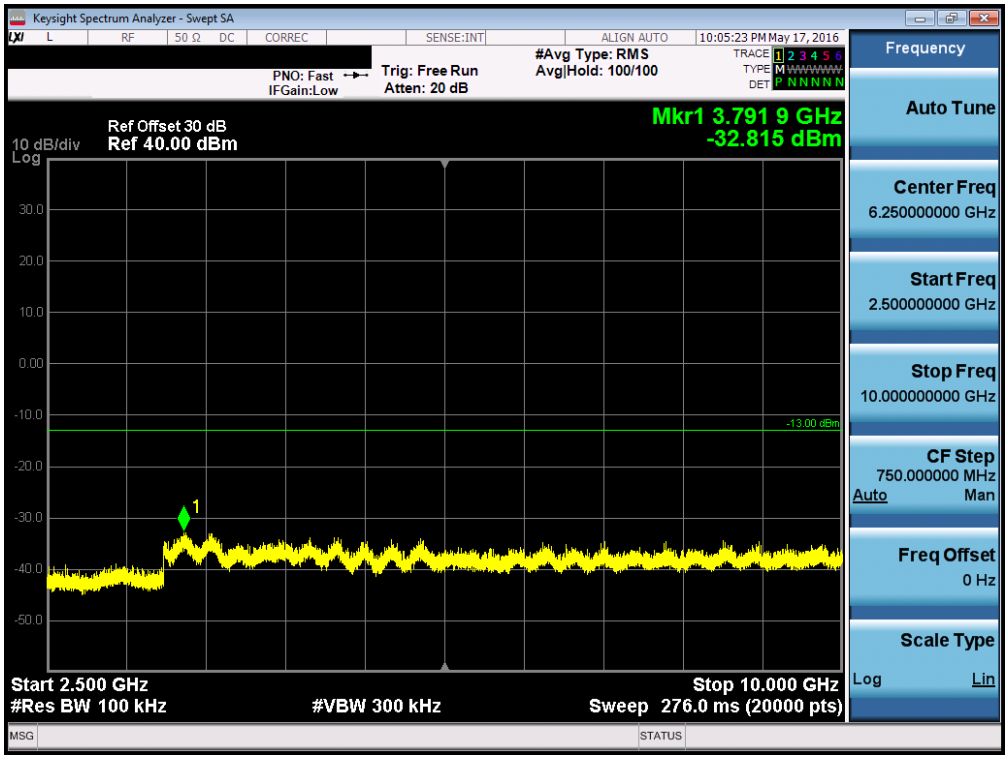
Plot 7-9. Conducted Spurious Plot (Cellular UMTS Mode – Ch. 4407)



Plot 7-10. Conducted Spurious Plot (Cellular UMTS Mode – Ch. 4458)



Plot 7-11. Conducted Spurious Plot (Cellular UMTS Mode – Ch. 4458)



Plot 7-12. Conducted Spurious Plot (Cellular UMTS Mode – Ch. 4458)

7.5 Band Edge Emissions at Antenna Terminal

§2.1051 §22.917(a)

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 v02r02 – Section 6.0

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

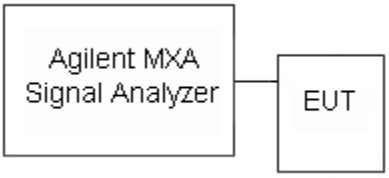


Figure 7-3. Test Instrument & Measurement Setup

Test Notes

Per 22.917(b), in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. 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 emission are attenuated at least 26 dB below the transmitter power.

Plot 7-13. Band Edge Plot (Cellular UMTS Mode – Ch. 4357)

Plot 7-14. 4MHz Span Plot (Cellular UMTS Mode – Ch. 4357)

Plot 7-15. Band Edge Plot (Cellular UMTS Mode – Ch. 4458)

Plot 7-16. 4MHz Span Plot (Cellular UMTS Mode – Ch. 4458)

7.6 Radiated Spurious Emissions Measurements

§2.1053 §22.917(a)

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-D-2010 with the EUT transmitting into a 50Ω load. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 v02r02 – Section 5.8

ANSI/TIA-603-D-2010 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

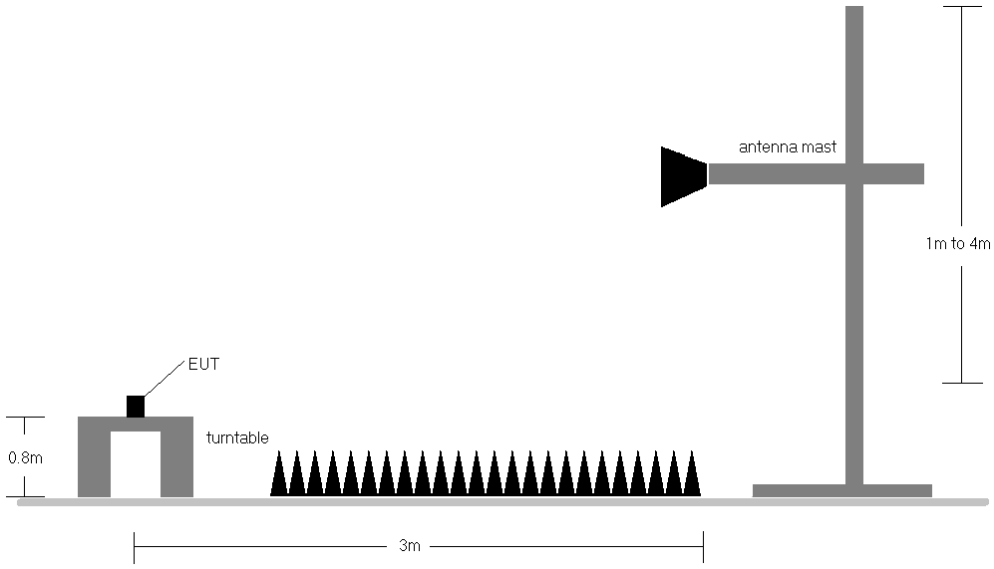


Figure 7-4. Test Instrument & Measurement Setup

Test Notes

1) This unit was tested while powered by an AC power source.

2) The output of the amplifier was terminated in 50Ω for radiated spurious emissions testing.

3) The EUT was placed flat on the test table top while its output port was terminated with a 50Ω load. The data reported in the table above was measured in this test setup.

4) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

5) The "-" in the tables below denote a noise floor measurement.

OPERATING FREQUENCY:	871.40	MHz
CHANNEL:	4357	
MODULATION SIGNAL:	UMTS	
DISTANCE:	3	meters
LIMIT:	-13.00	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1742.80	H	260	34	-41.80	6.49	-35.31	-22.3
2614.20	H	150	76	-49.94	7.42	-42.52	-29.5
3485.60	H	103	265	-54.02	7.57	-46.45	-33.5
4357.00	H	100	325	-39.11	8.64	-30.47	-17.5
5228.40	H	-	-	-54.02	8.46	-45.55	-32.6

Table 7-2. Radiated Spurious Data (Cellular UMTS Mode – Ch. 4357)

OPERATING FREQUENCY:	881.40	MHz
CHANNEL:	4407	
MODULATION SIGNAL:	UMTS	
DISTANCE:	3	meters
LIMIT:	-13.00	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1762.80	H	302	42	-44.65	6.55	-38.10	-25.1
2644.20	H	189	120	-53.99	7.34	-46.65	-33.6
3525.60	H	100	284	-57.71	7.44	-50.27	-37.3
4407.00	H	176	309	-45.39	8.20	-37.19	-24.2
5288.40	H	-	-	-55.30	8.74	-46.56	-33.6

Table 7-3. Radiated Spurious Data (Cellular UMTS Mode – Ch. 4407)

OPERATING FREQUENCY:	891.60	MHz
CHANNEL:	4458	
MODULATION SIGNAL:	UMTS	
DISTANCE:	3	meters
LIMIT:	-13.00	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1783.20	H	103	285	-45.68	6.55	-39.13	-26.1
2674.80	H	189	135	-54.92	7.36	-47.56	-34.6
3566.40	H	-	-	-58.51	7.50	-51.01	-38.0
4458.00	H	100	189	-55.75	8.36	-47.39	-34.4
5349.60	H	-	-	-55.56	8.63	-46.94	-33.9

Table 7-4. Radiated Spurious Data (Cellular UMTS Mode – Ch. 4458)

7.7 Frequency Stability / Temperature Variation

§2.1055 §22.355

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-D-2010. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

For Part 22, the frequency stability of the transmitter shall be maintained within ±0.00015% (±1.5 ppm) of the center frequency.

Test Procedure Used

ANSI/TIA-603-D-2010

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

Test Notes

None

Frequency Stability / Temperature Variation

§2.1055 §22.355

OPERATING FREQUENCY:	881,400,000	Hz
CHANNEL:	4407	
REFERENCE VOLTAGE:	120.00	VAC
DEVIATION LIMIT:	1.5 ppm	

VOLTAGE (%)	POWER (VAC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	120.00	+ 20 (Ref)	881,400,179	179	0.0000203
100 %		- 30	881,399,873	-127	-0.0000144
100 %		- 20	881,399,652	-348	-0.0000395
100 %		- 10	881,400,306	306	0.0000347
100 %		0	881,400,061	61	0.0000069
100 %		+ 10	881,400,158	158	0.0000179
100 %		+ 20	881,400,133	133	0.0000151
100 %		+ 30	881,400,085	85	0.0000096
100 %		+ 40	881,399,957	-43	-0.0000049
100 %		+ 50	881,400,145	145	0.0000165
85 %	102.00	+ 20	881,399,739	-261	-0.0000296
115 %	138.00	+ 20	881,400,037	37	0.0000042

Table 7-5. Frequency Stability Data (Cellular UMTS Mode – Ch. 4407)

Frequency Stability / Temperature Variation

§2.1055 §22.355

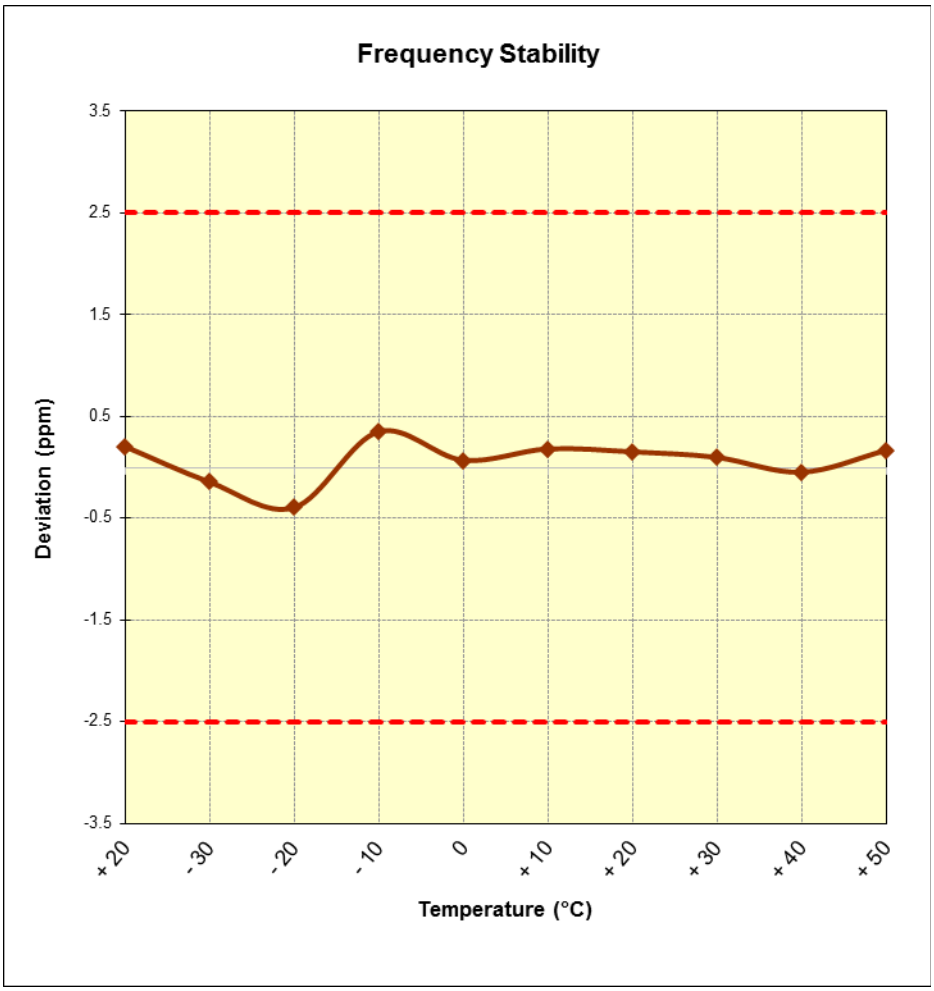


Figure 7-5. Frequency Stability Graph (Cellular UMTS Mode – Ch. 4407)

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Tecore NodeB FCC ID: QLJ3GRFN** complies with all the requirements of Part 22 of the FCC rules.