Element Materials Technology
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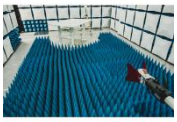

PART 27 C2PC MEASUREMENT REPORT

Applicant Name:
iRhythm Tecnologies Inc.
699 8th St. Ste 600
San Francisco, CA 94103
United States

Date of Testing:
10/09/2024 – 10/15/2024
Test Report Issue Date:
1/23/2025
Test Site/Location:
Element Materials Technology Morgan Hill, CA, USA
Test Report Serial No.:
1C2408130047-02-R2.2AFBP

FCC ID:	**2AFBP-AT18G**
APPLICANT:	**iRhythm Technologies, Inc**

Application Type:	Certification
Model:	Zio AT Gateway (ASB0004)
Variant Model:	Zio MCT Gateway (SB10051)
EUT Type:	Portable Transmitter
FCC Classification:	Licensed Non-Broadcast Station Transmitter (TNB)
FCC Rule Part:	27
Test Procedure(s):	ANSI C63.26-2015, TIA-603-E-2016, KDB 971168 D01 v03r01
Class II Permissive Change:	Please see FCC change document
Original Grant Date:	06/06/2018

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.

This revised Test Report (S/N: 1C2408130047-02-R2.2AFBP) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose accordingly.

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.

RJ Ortanez
Executive Vice President

Prepared by: WKR0000007111

Reviewed by: WKR0000005849

ACCREDITED
CERT #2041.02

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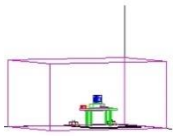
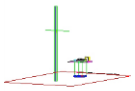


PART 27 MEASUREMENT REPORT



Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	OBW [MHz]	PAR at 0.1% [dB]	EIRP		Emission Designator
						Max. Power [W]	Max. Power [dBm]	
LTE Band 4	1.4 MHz	QPSK	1710.7 - 1754.3	1.1198	10.30	0.146	21.64	1M12G7W
		16QAM	1710.7 - 1754.3	0.9432	10.76	0.090	19.54	943KD7W

Overview Table

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) 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 Innovation, Science and Economic Development Canada.

1.2 Element Materials Technology Test Location

These measurement tests were conducted at the Element Materials Technology facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

1.3 Test Facility / Accreditations

Measurements were performed at Element Materials Technology

- Element Materials Technology is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- Element Materials Technology TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- Element Materials Technology facility is a registered (22831) test laboratory with the site description on file with ISED.

- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Agreements (MRAs).

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Portable Transmitter FCC ID: 2AFBP-AT18G**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 27.

Test Device Serial No.: 354444119420620, 354444119286278

2.2 Device Capabilities

This device contains the following capabilities:

LTE and Bluetooth (LE-1M)

2.3 Antenna Description

The following antenna gain provided by the manufacturer was used for testing.

Band	Antenna Gain [dBi]
LTE Band 4	-1.5

Table 2-1. Highest Antenna Gain

2.4 Test Support Equipment

1	Power Supply	Model:	Keysight U8001A	S/N:	MY54330033
2	Banana clippers	Model:	N/A	S/N:	N/A
3	Simcard	Model:	R&S CMW-201	S/N:	895253031660000C528F
4	Breakout Board	Model:	MB10015	S/N:	58

Table 2-2. Test Support Equipment

2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015, TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

The following variant models were not tested as part of this evaluation but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Element Material Technology does not make any claims of compliance for samples or variants which were not tested.

Zio MCT Gateway
Model Number: SB10051

Per manufacturer's declaration, both Zio AT Gateway (ASB0004) and Zio MCT Gateway (SB10051) models were evaluated with spot-check measurements in-house and determined that model Zio AT Gateway represents the worst case data for the purpose of compliance. This report represents measurement data for Zio AT Gateway model accordingly.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. The emissions below 1GHz were tested with the highest transmitting power and the worst case channel.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

2.6 Software and Firmware

The test was conducted with Zio MCT Gateway u-blox Cellular Modem Firmware (SFW0194.A) installed on the EUT.

2.7 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the documents titled “American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services” (ANSI C63.26-2015 and TIA-603-E-2016) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

Deviation from Measurement Procedure……..……..None

3.2 Radiated Spurious Emissions

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 Figure 5.7 of Clause 5 in ANSI C63.4-2014. 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 above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table 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. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna 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, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

For radiated spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. Field Strength (EIRP) is calculated using the following formulas:

$$E_{[dB\mu V/m]} = \text{Measured amplitude level}_{[dBm]} + 107 + \text{Cable Loss}_{[dB]} + \text{Antenna Factor}_{[dB/m]}$$

And

$$EIRP_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8;\ \text{where D is the measurement distance in meters.}$$

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014.

Per KDB 414788 D01 v01r01, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

Radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015 and TIA-603-E-2016.

4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below 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	2.07
Radiated Disturbance (<30MHz)	4.12
Radiated Disturbance (30MHz-1GHz)	4.85
Radiated Disturbance (1-18GHz)	5.08
Radiated Disturbance (>18GHz)	5.22

5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna	3/14/2024	Annual	3/14/2025	T058701-01
ESPEC	SU-241	Tabletop Temperature Chamber	11/17/2023	Annual	11/17/2024	92009574
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	4/9/2024	Annual	4/9/2025	00218555
Fairview Microwave	FMCA1975-36	30MHz-40GHz Conducted Cable *	6/10/2024	Annual	6/10/2025	-
Fairview Microwave	M2CP1122-10	30MHz-40GHz Conducted Coupler *	6/10/2024	Annual	6/10/2025	1946
Keysight Technologies	N9030A	PXA Signal Analyzer	10/18/2023	Annual	10/18/2024	618
Rohde & Schwarz	ESW26	EMI Test Receiver	8/12/2024	Annual	8/12/2025	101299
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	9/4/2024	Annual	9/4/2025	102143
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	11/30/2023	Annual	11/30/2024	161616
Rohde & Schwarz	HFH2-Z2	Loop Antenna	6/21/2024	Annual	6/21/2025	100519
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	7/3/2024	Annual	7/3/2025	102356
Schwarzbeck	VULB 9162	Bilog Antenna (30MHz - 6GHz)	4/29/2024	Annual	4/29/2025	00304

Table 5-1. Test Equipment

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
2. * denotes passive equipment that have been internally verified/calibrated.

6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7W
BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/Digital Info
W = Combination of Any

QAM Modulation

Emission Designator = 8M45D7W
LTE BW = 8.45 MHz
D = Amplitude/Angle Modulated
7 = Quantized/Digital Info
W = Combination of Any

Spurious Radiated Emission

Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)

The average 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 analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80).

7.0 TEST RESULTS

7.1 Summary

Company Name: iRhythm Technologies, Inc

FCC ID: 2AFBP-AT18G

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

Mode(s): LTE

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Occupied Bandwidth	2.1049	N/A	N/A	Section 7.2
	Conducted Band Edge / Spurious Emissions	2.1051, 27.53	-13 dBm at Band Edge and for all out-of-band emissions	PASS	Sections 7.3, 7.4
	Peak-Average Ratio	27.50(d)(5)	< 13 dB	PASS	Section 7.5
	Transmitter Conducted Output Power	2.1046	N/A	N/A	See RF Exposure Report
	Frequency Stability	2.1055, 27.54	Fundamental emissions stay within authorized frequency block over the temperature and voltage range as tested	PASS	Section 7.8
	Equivalent Isotropic Radiated Power	27.50(d)(4)	< 1 Watts max. EIRP	PASS	Section 7.6
RADIATED	Radiated Spurious Emissions	2.1053, 27.53	-13 dBm for all out-of-band emissions	PASS	Section 7.7

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. 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.

4. All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized is Element EMC Software Tool v1.1.

7.2 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 D01 v03r01 – 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.

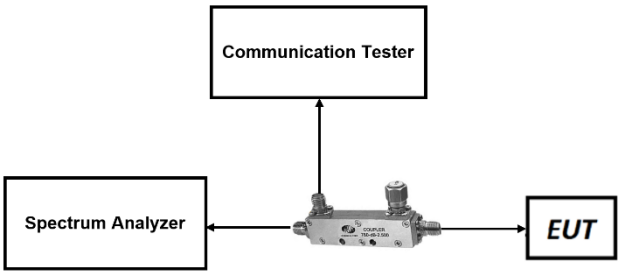
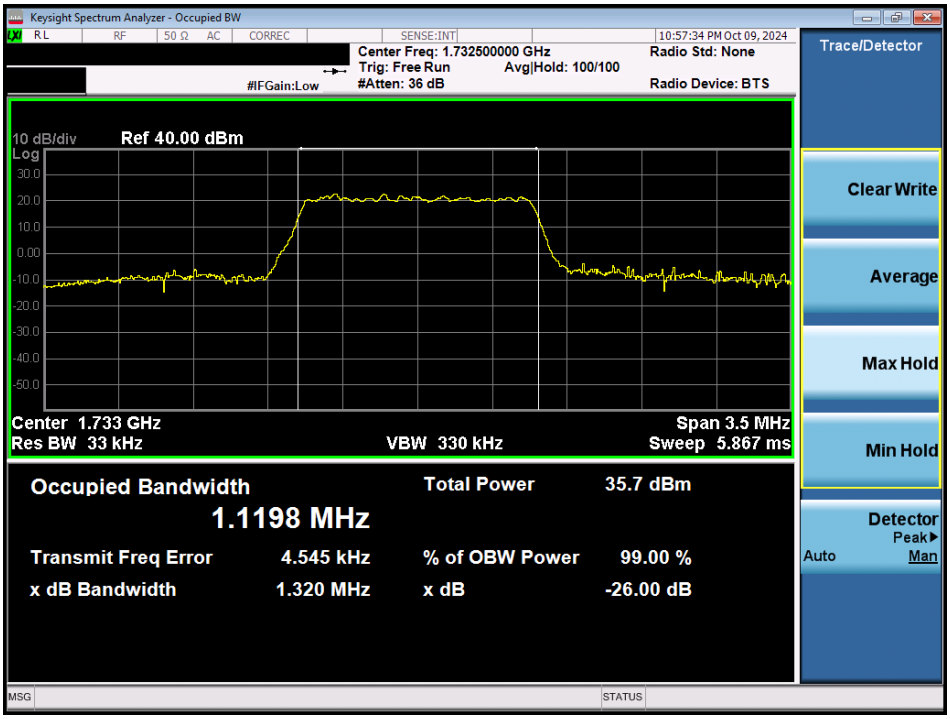


Figure 7-1. Test Instrument & Measurement Setup

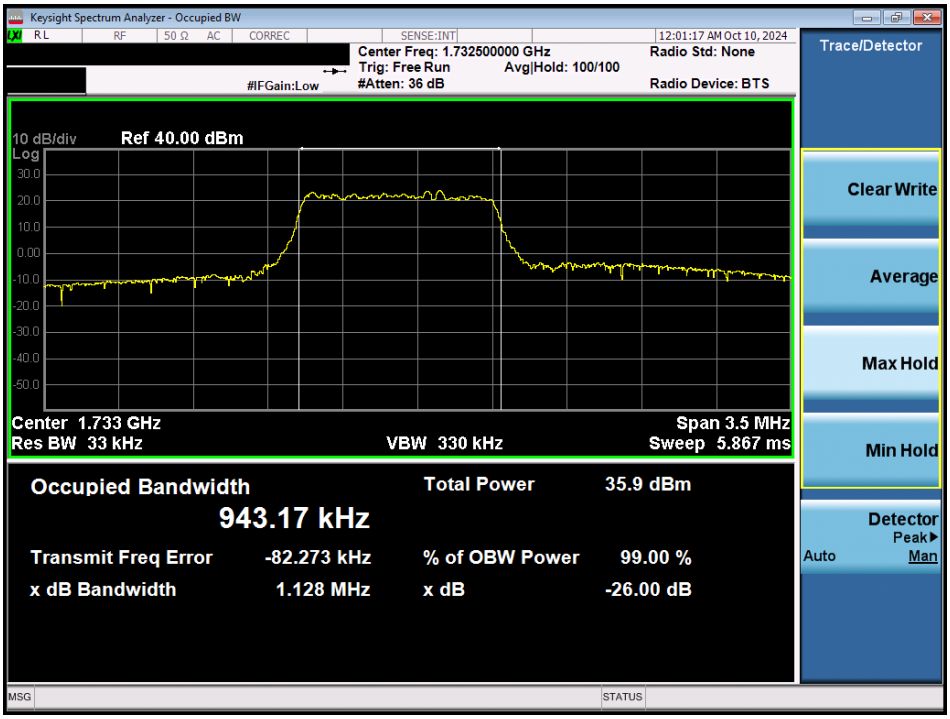
Test Notes

None.

LTE Band 4



Plot 7-1. Occupied Bandwidth Plot (LTE Band 4 - 1.4MHz QPSK - Full RB)



Plot 7-2. Occupied Bandwidth Plot (LTE Band 4 - 1.4MHz 16-QAM - Full RB)

7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051, §27.53

Test Overview and Limit

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 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 18GHz (separated into at least two plots per channel)
2. RBW ≥ 100kHz
3. VBW ≥ 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

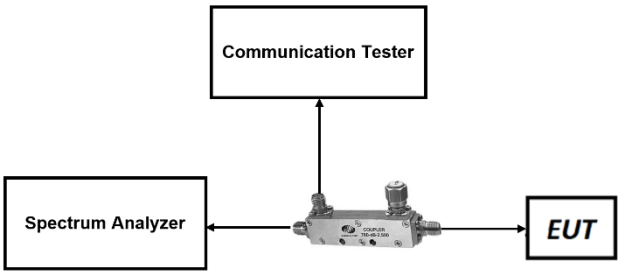
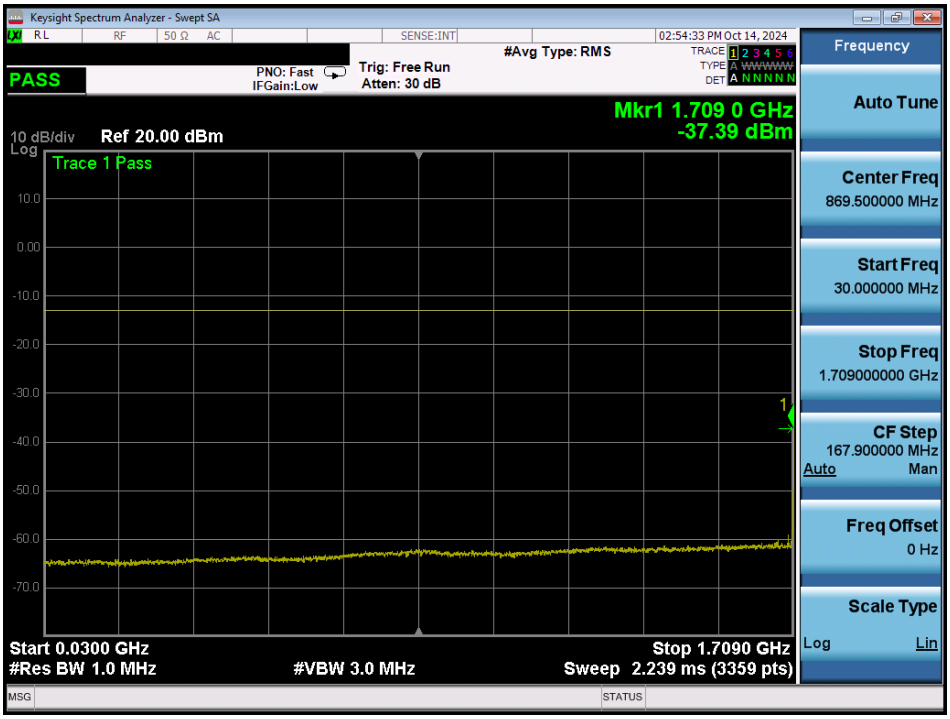


Figure 7-2. Test Instrument & Measurement Setup

Test Notes

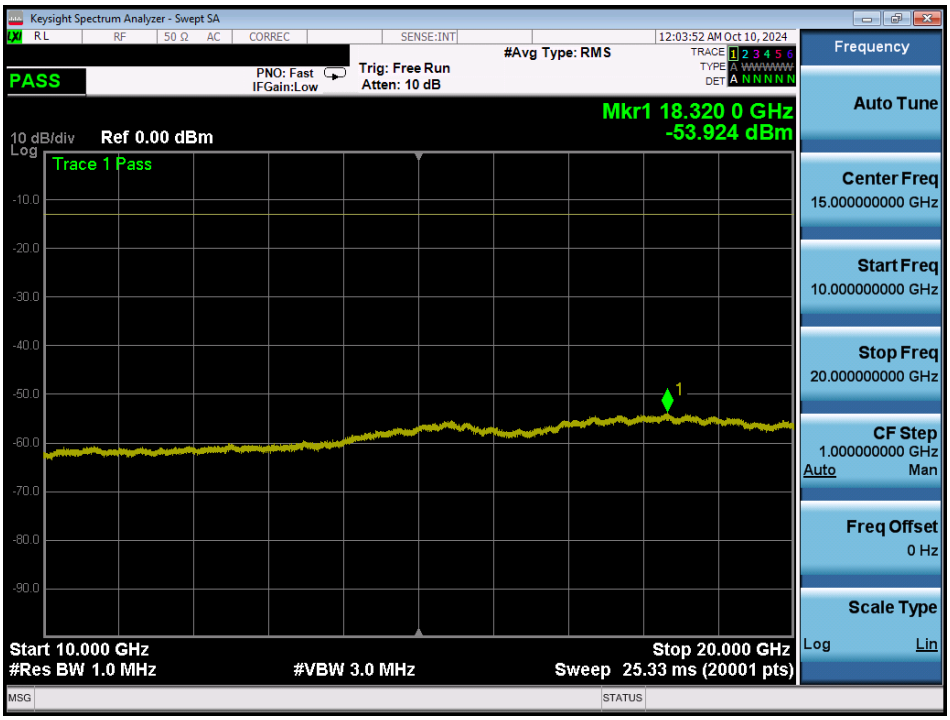
1. Per Part 27, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 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 emission are attenuated at least 26 dB below the transmitter power.

LTE Band 4



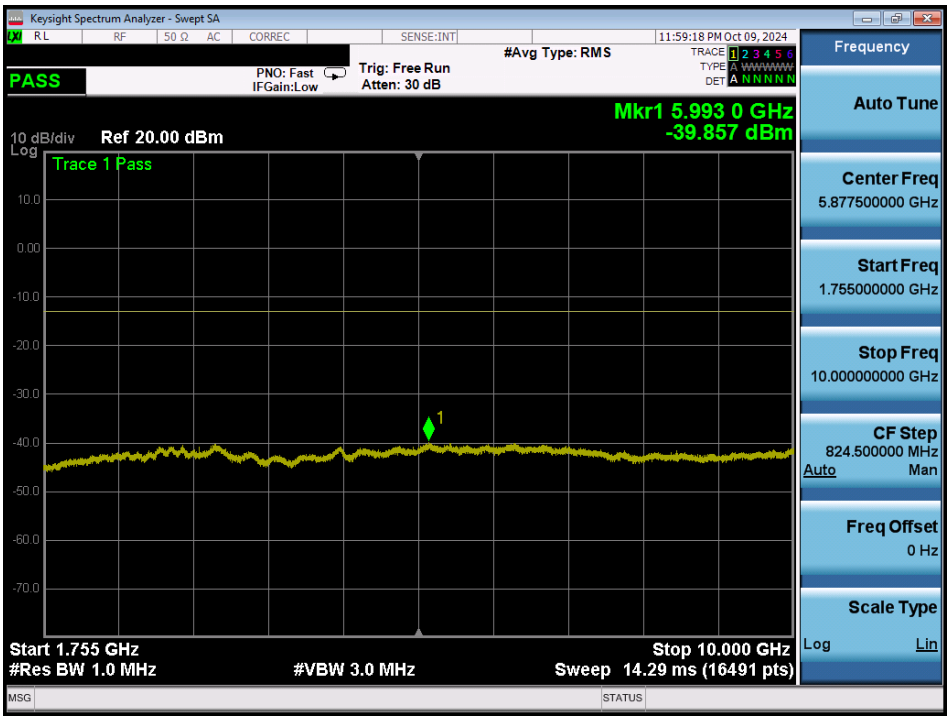
Plot 7-3. Conducted Spurious Plot (LTE Band 4 - 1.4MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

Plot 7-4. Conducted Spurious Plot (LTE Band 4 - 1.4MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

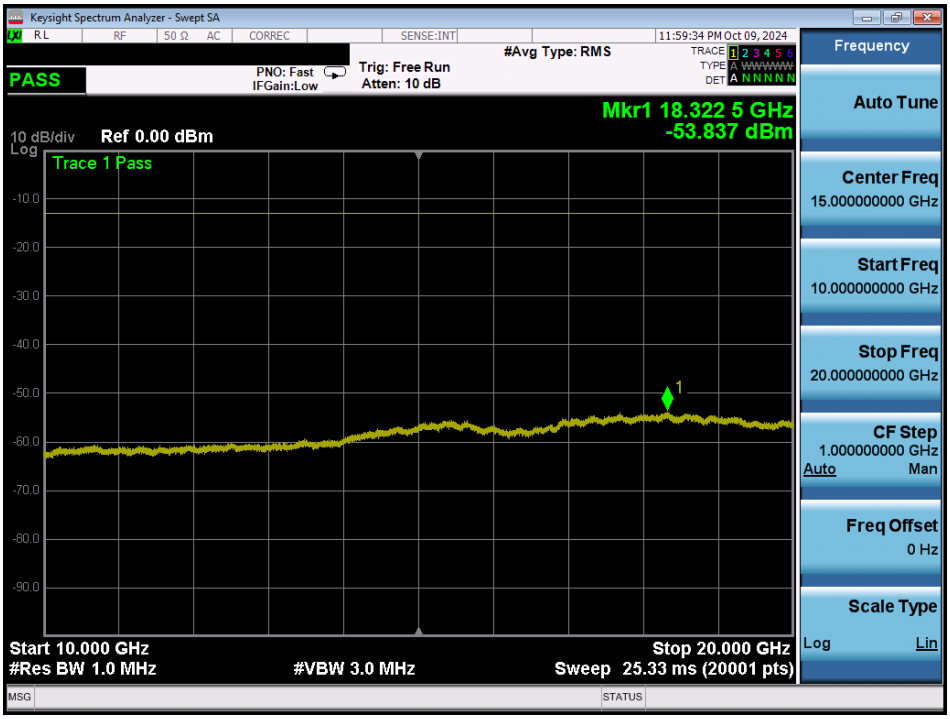


Plot 7-5. Conducted Spurious Plot (LTE Band 4 - 1.4MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

Plot 7-6. Conducted Spurious Plot (LTE Band 4 - 1.4MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

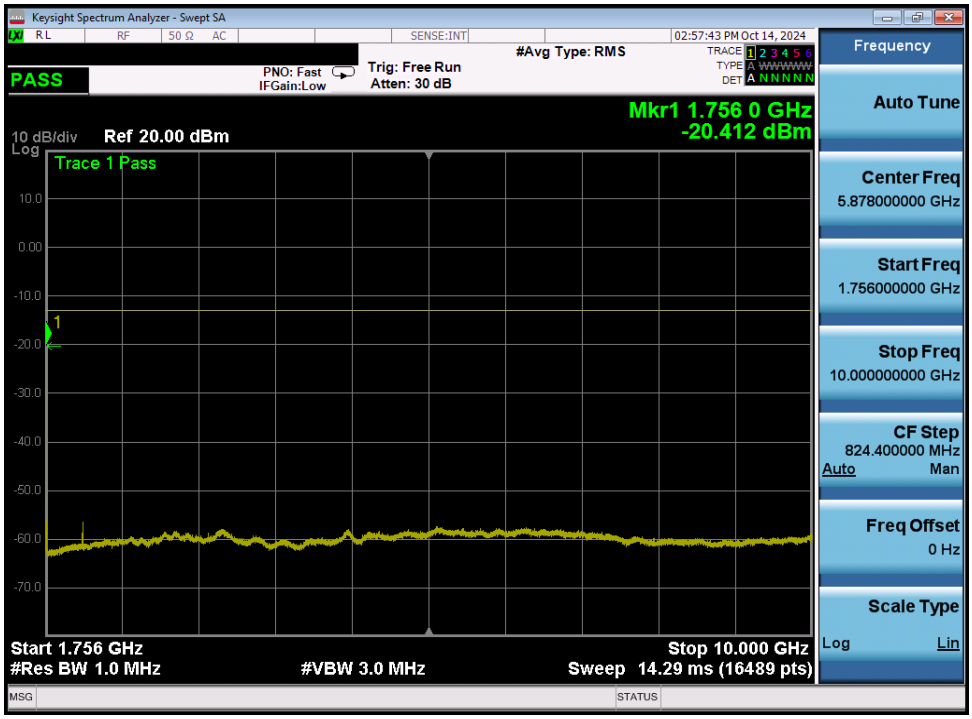


Plot 7-7. Conducted Spurious Plot (LTE Band 4 - 1.4MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

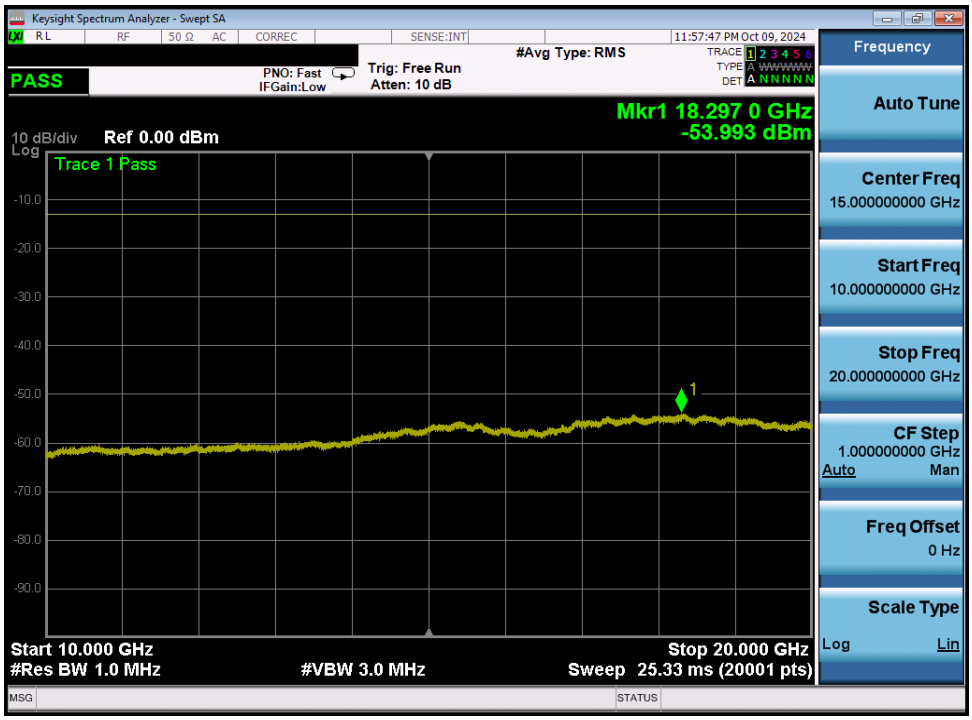


Plot 7-8. Conducted Spurious Plot (LTE Band 4 - 1.4MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

Plot 7-9. Conducted Spurious Plot (LTE Band 4 - 1.4MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-10. Conducted Spurious Plot (LTE Band 4 - 1.4MHz QPSK - RB Size 1, RB Offset 0 - High Channel)



Plot 7-11. Conducted Spurious Plot (LTE Band 4 - 1.4MHz QPSK - RB Size 1, RB Offset 0 - High Channel)

7.4 Band Edge Emissions at Antenna Terminal

§2.1051, §27.53

Test Overview and Limit

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 its maximum duty cycle, 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 + 10 $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – 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 for continuous emissions, max hold for pulse emissions
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.

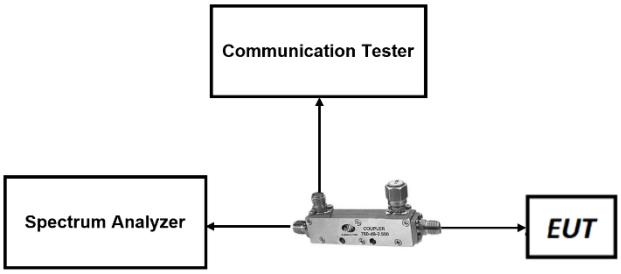
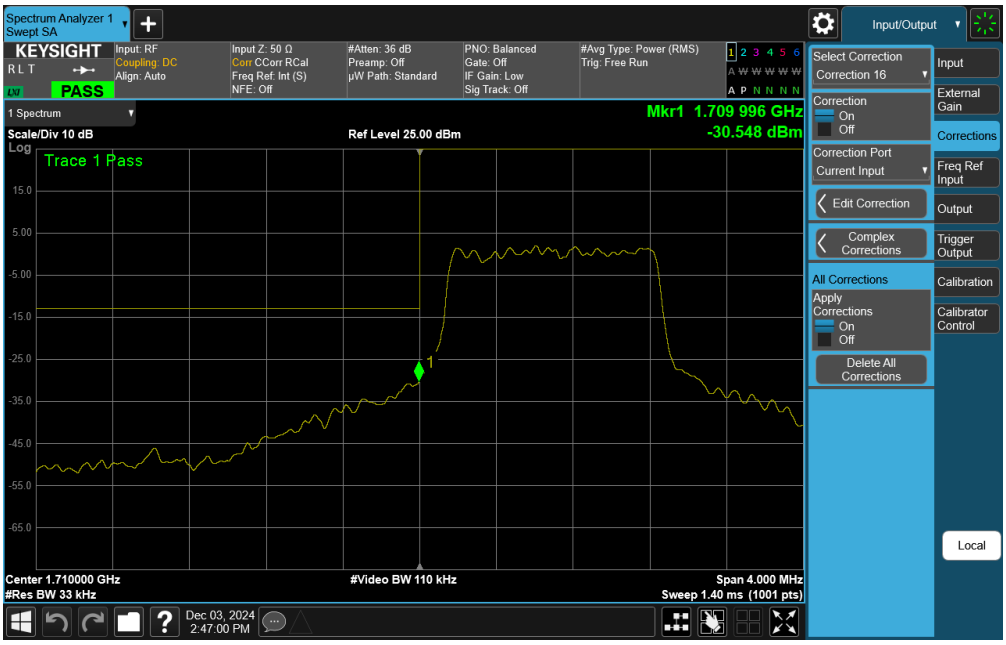


Figure 7-3. Test Instrument & Measurement Setup

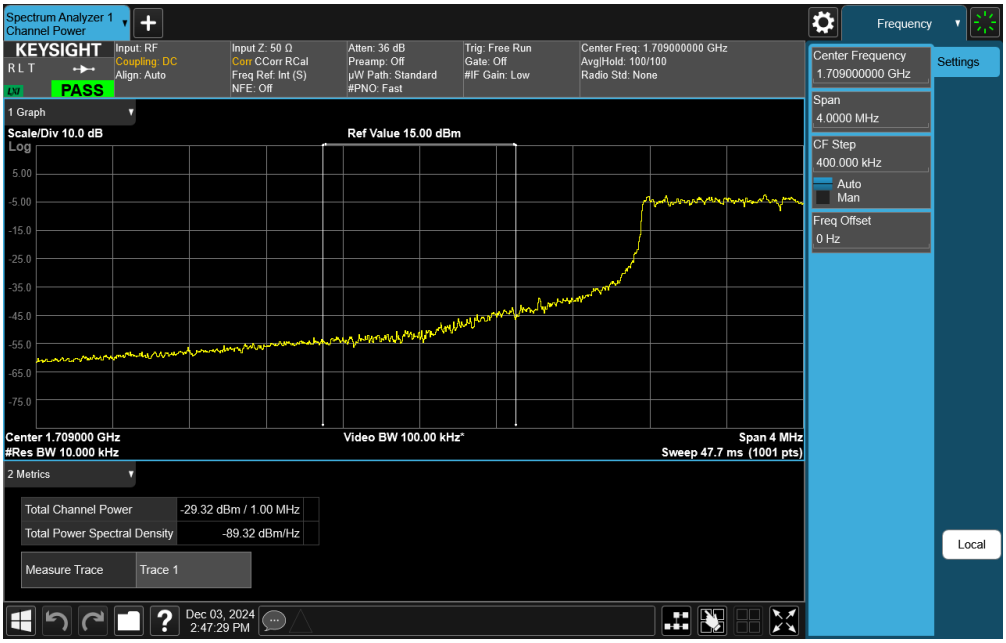
Test Notes

1. Per 27.53(h) 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.

LTE Band 4

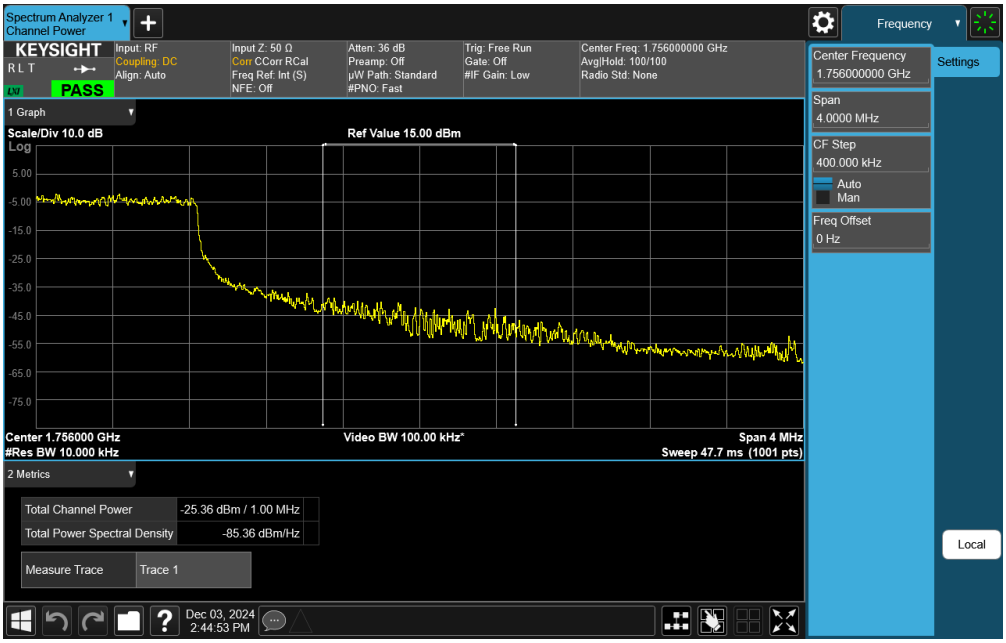


Plot 7-12. Lower Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)



Plot 7-13. Lower Extended Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)

Plot 7-14. Upper Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)



Plot 7-15. Upper Extended Band Edge Plot (LTE Band 4 – 1.4MHz QPSK – Full RB)

7.5 Peak-Average Ratio

§27.50(d)(5)

Test Overview and Limit

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. The peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time.

The peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1% of the time.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 5.7.1

Test Settings

1.
2. The signal analyzer's CCDF measurement profile is enabled
3. Frequency = carrier center frequency
4. Measurement BW ≥ OBW or specified reference bandwidth
5. The signal analyzer was set to collect one million samples to generate the CCDF curve
6. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

Test Setup

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

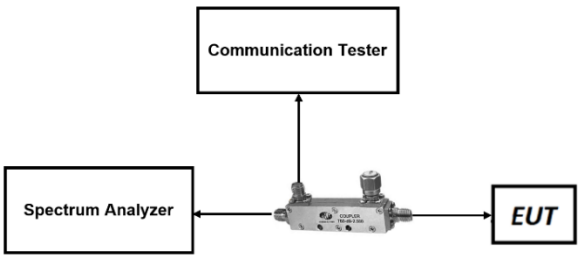
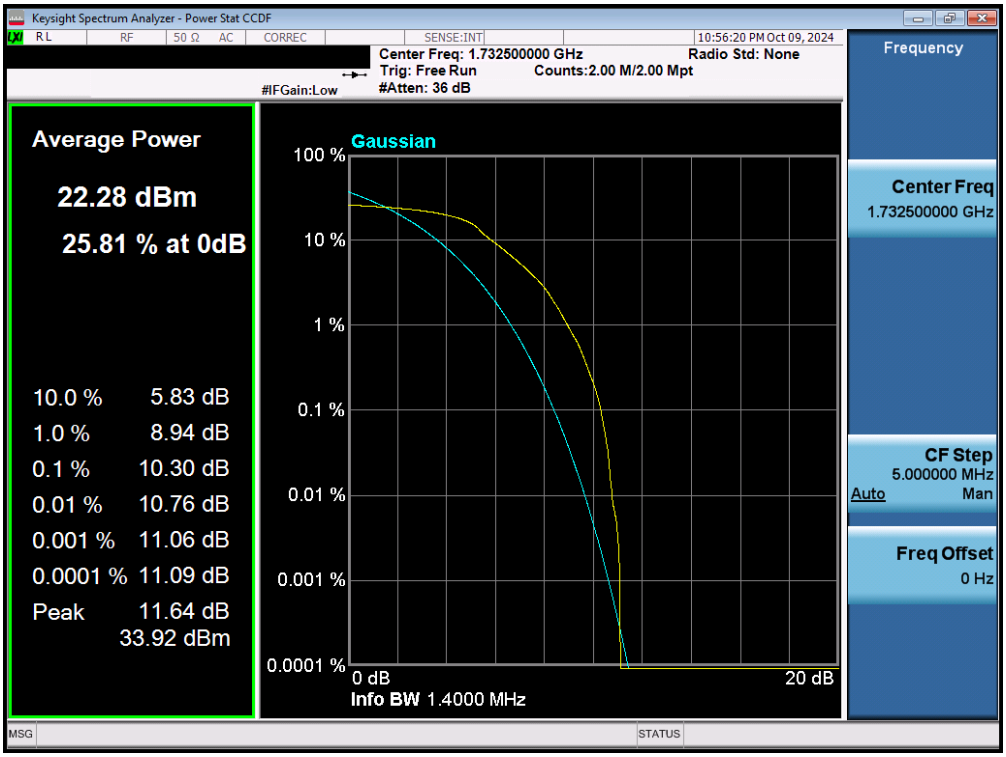


Figure 7-4. Test Instrument & Measurement Setup

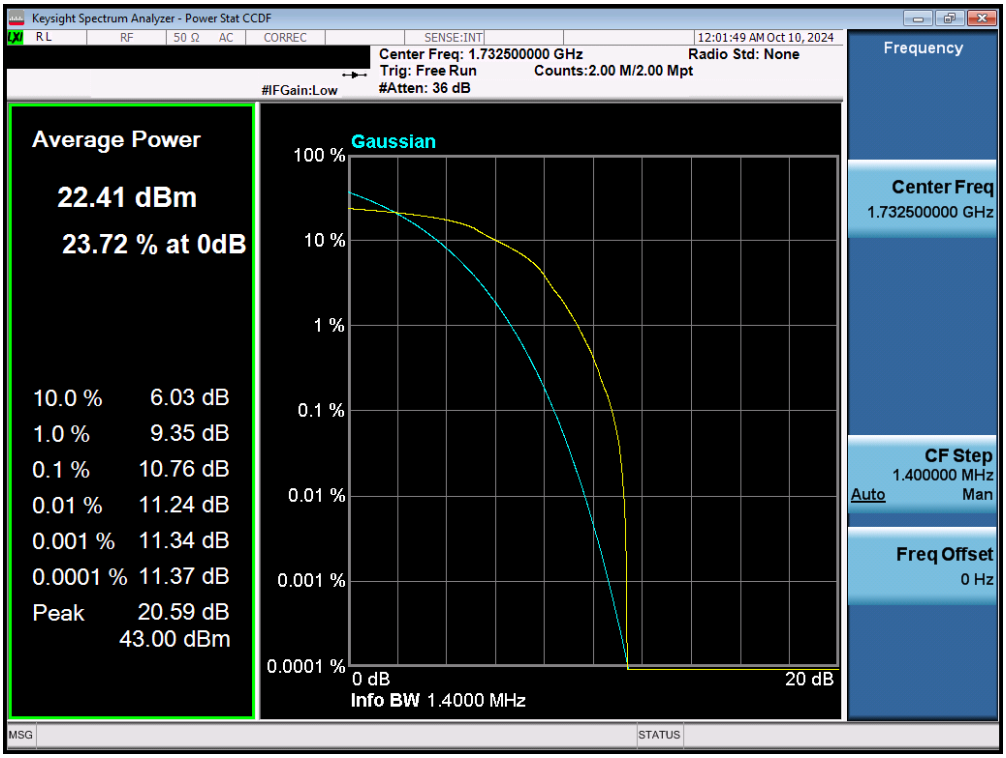
Test Notes

None.

LTE Band 4



Plot 7-16. PAR Plot (LTE Band 4 - 1.4MHz QPSK - Full RB)



Plot 7-17. PAR Plot (LTE Band 4 - 1.4MHz 16-QAM - Full RB)

7.6 Radiated Power (EIRP)

§27.50(d)(4)

Test Overview

Equivalent Isotropic Radiated Power (EIRP) measurements are calculated by adding highest antenna gain to maximum measured conducted output power. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1
ANSI C63.26-2015 – Section 5.2.5.5

Test Settings

The relevant equation for determining the EIRP from the conducted RF output power measured is:

EIRP = PMeas – LC + GT

Where:

EIRP = Effective or Equivalent Isotropic Radiated Power, respectively (expressed in the same units as PMeas, typically dBW or dBm)

PMeas = measured transmitter output power or PSD, in dBW or dBm

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

GT = gain of the transmitting antenna, in dBi (EIRP)

Test Setup

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

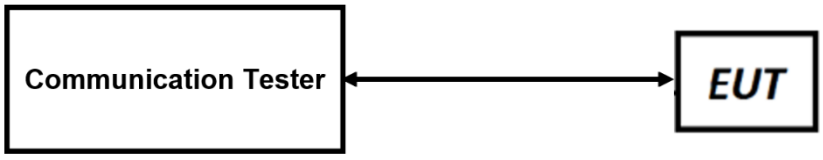


Figure 7-5. EIRP Measurement Setup

Test Notes

1. The EUT was tested in all possible test configurations. The worst case emissions are reported with the EUT modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2. This unit was tested with its standard battery.

3. The Level (dBm) readings in the table were taken with a correction table loaded into the base station simulator. The correction table was used to account for the signal attenuation in the connecting cable between the transmitter and antenna.

4. The Ant. Gains (GT) are listed in dBi.

7.6.1 EIRP

LTE Band 4

Bandwidth	Mod.	Frequency [MHz]	Ant. Gain [dBi]	RB Size/Offset	Conducted Power [dBm]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
1.4 MHz	QPSK	1710.7	-1.50	1 / 3	23.03	21.53	0.142	30.00	-8.47
		1732.5	-1.50	1 / 3	22.98	21.48	0.141	30.00	-8.52
		1754.3	-1.50	1 / 3	23.14	**21.64**	0.146	30.00	-8.36
	16-QAM	1732.5	-1.50	1 / 0	21.04	19.54	0.090	30.00	-10.46

Table 7-2. EIRP Data (LTE Band 4)

7.7 Radiated Spurious Emissions

§2.1053, §27.53

Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized broadband hybrid antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed while the EUT is operating at maximum power and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

ANSI C63.26-2015, TIA-603-E-2016 – 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 = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

Test Setup

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

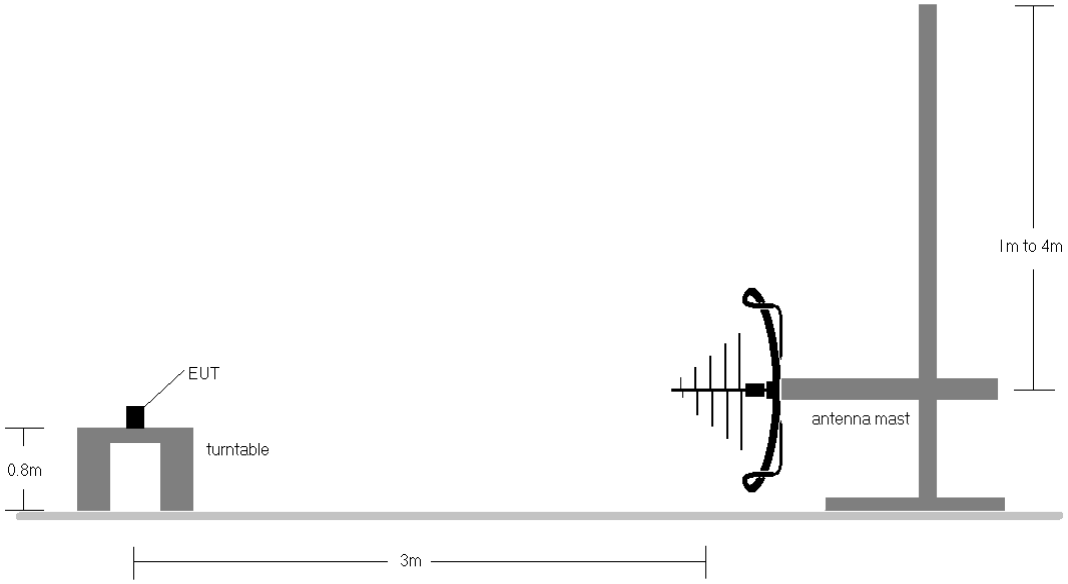


Figure 7-6. Test Instrument & Measurement Setup < 1GHz

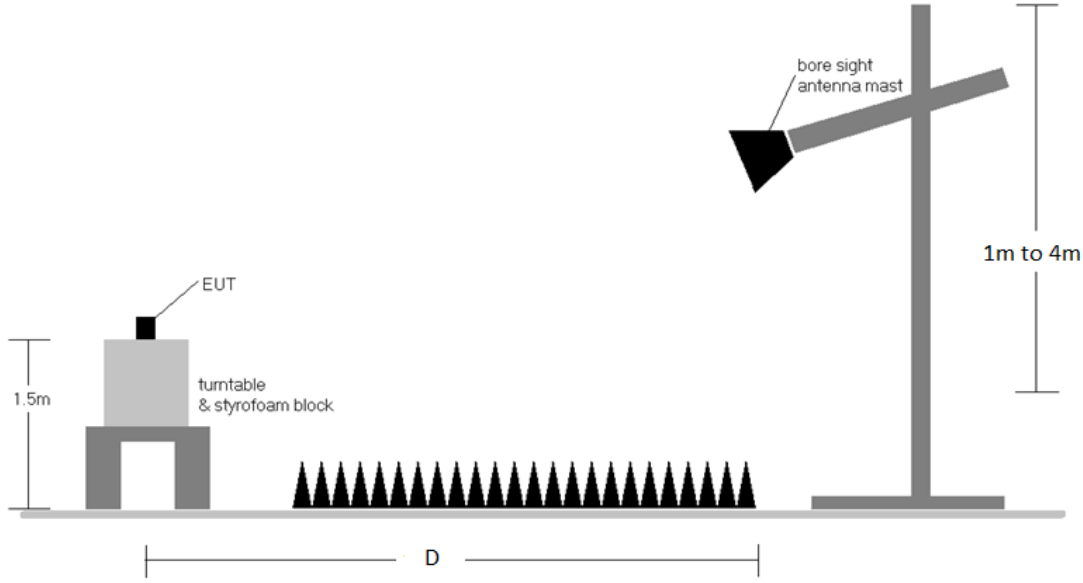


Figure 7-7. Test Instrument & Measurement Setup > 1GHz

Test Notes

1. Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
    a. E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
    b. EIRP (dBm) = E(dBµV/m) + 20logD – 104.8; where D is the measurement distance in meters.

2. The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

3. This unit was tested with its standard battery.

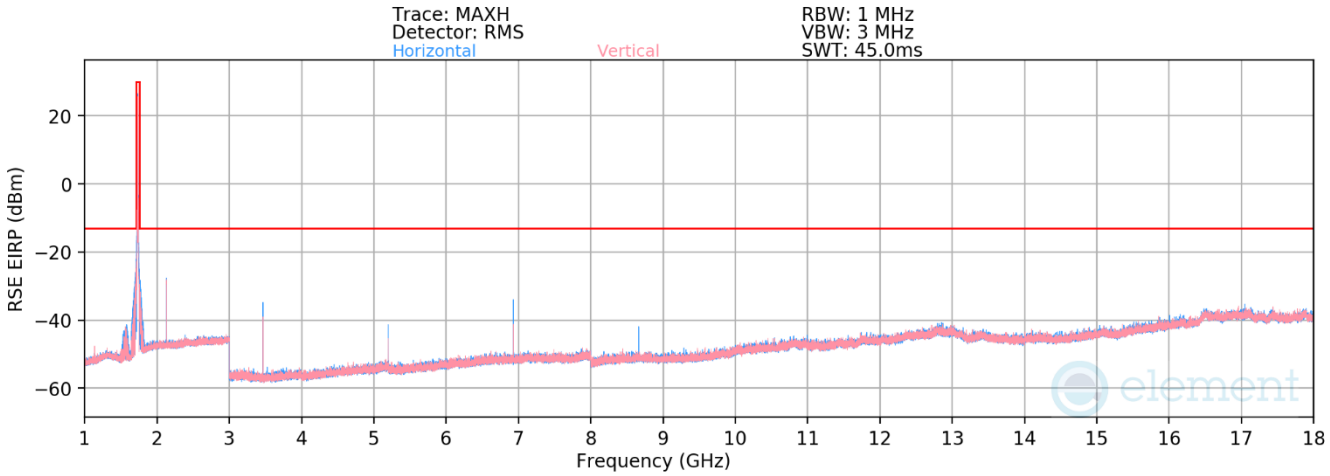
4. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

5. D is the measurement test distance and emissions 1-18GHz were measured at a 3 meters test distance.

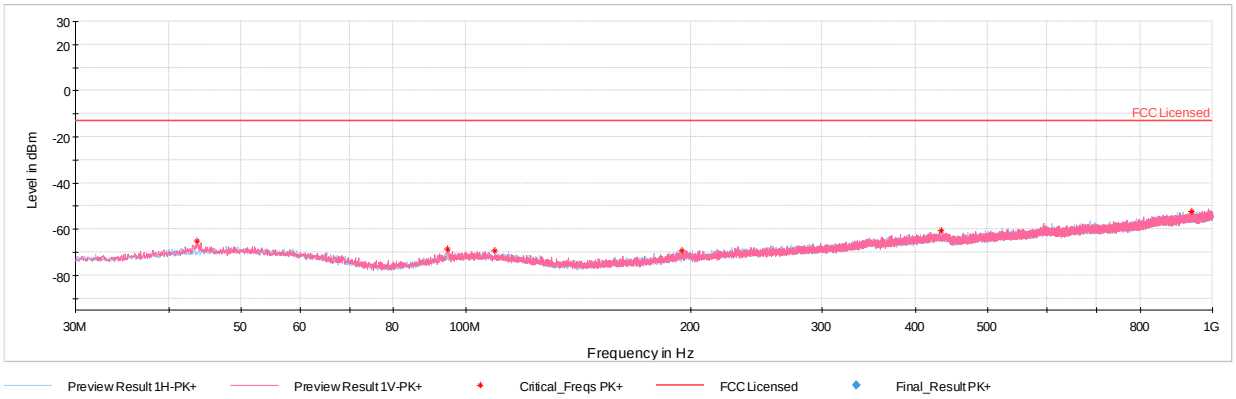
6. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

7.7.1 Radiated Spurious Emission Measurement

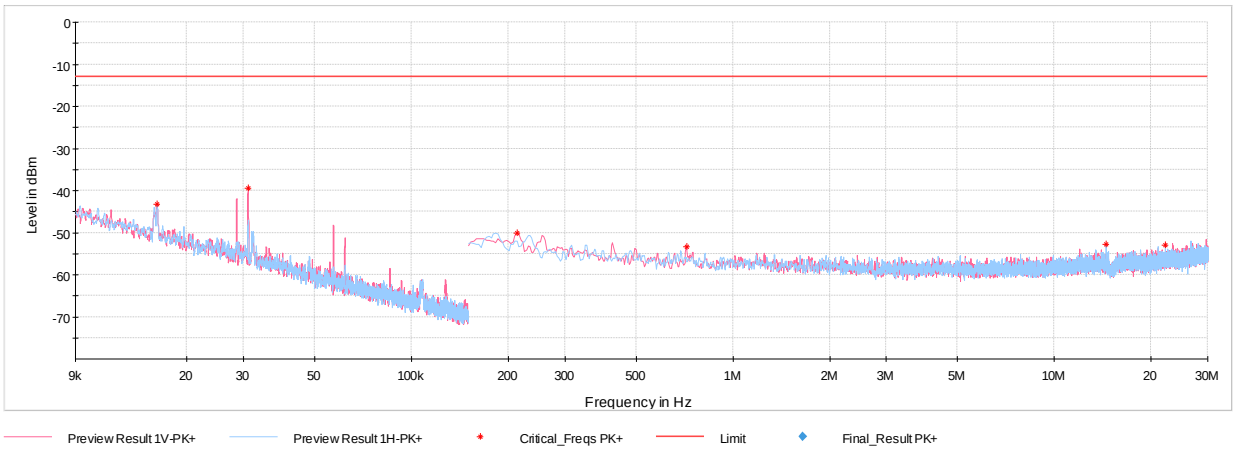
LTE Band 4



Plot 7-18. Radiated Spurious Emission above 1GHz (LTE Band 4)



Plot 7-19. Radiated Spurious Emission 30MHz-1GHz (LTE Band 4)



Plot 7-20. Radiated Spurious Emission 9kHz-30MHz (LTE Band 4)

Bandwidth (MHz):	1.4
Frequency (MHz):	1710.7
RB / Offset:	1 / 3

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3421.4	H	290	216	-59.65	5.11	52.46	-42.80	-13.00	-29.80
5132.1	H	251	353	-75.06	9.10	41.04	-54.21	-13.00	-41.21
6842.8	H	176	185	-69.68	11.94	49.26	-46.00	-13.00	-33.00
8553.5	H	244	143	-78.82	12.67	40.85	-54.40	-13.00	-41.40
10264.2	H	249	249	-82.79	15.60	39.81	-55.45	-13.00	-42.45
11974.9	H	-	-	-85.34	18.98	40.64	-54.62	-13.00	-41.62
13685.6	H	-	-	-86.07	20.42	41.35	-53.90	-13.00	-40.90
15396.3	H	-	-	-85.68	23.22	44.54	-50.71	-13.00	-37.71

Table 7-3. Radiated Spurious Data (LTE Band 4 – Low Channel)

Bandwidth (MHz):	1.4
Frequency (MHz):	1732.5
RB / Offset:	1 / 3

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3465.0	H	213	216	-58.76	5.21	53.45	-41.80	-13.00	-28.80
5197.5	H	291	259	-73.81	9.25	42.44	-52.82	-13.00	-39.82
6930.0	H	169	182	-69.69	12.28	49.59	-45.67	-13.00	-32.67
8662.5	H	246	150	-68.23	13.10	51.87	-43.39	-13.00	-30.39
10395.0	H	164	240	-82.93	15.95	40.02	-55.24	-13.00	-42.24
12127.5	H	-	-	-85.53	19.32	40.79	-54.46	-13.00	-41.46
13860.0	H	-	-	-86.12	20.72	41.60	-53.66	-13.00	-40.66
15592.5	H	-	-	-85.79	23.02	44.23	-51.02	-13.00	-38.02

Table 7-4. Radiated Spurious Data (LTE Band 4 – Mid Channel)

Bandwidth (MHz):	1.4
Frequency (MHz):	1754.3
RB / Offset:	1/3

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
3508.6	H	208	218	-58.94	5.13	53.19	-42.06	-13.00	-29.06
5262.9	H	373	283	-73.48	9.97	43.49	-51.77	-13.00	-38.77
7017.2	H	143	184	-67.98	12.38	51.40	-43.86	-13.00	-30.86
8771.5	H	153	250	-77.39	12.96	42.57	-52.69	-13.00	-39.69
10525.8	H	228	256	-83.50	16.64	40.14	-55.12	-13.00	-42.12
12280.1	H	-	-	-85.34	19.52	41.18	-54.08	-13.00	-41.08
14034.4	H	-	-	-86.14	21.34	42.20	-53.06	-13.00	-40.06
15788.7	H	-	-	-85.76	23.53	44.77	-50.49	-13.00	-37.49

Table 7-5. Radiated Spurious Data (LTE Band 4 – High Channel)

7.8 Frequency Stability / Temperature Variation

§2.1055, §27.54

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015 and TIA-603-E-2016. 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 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI C63.26-2015

TIA-603-E-2016

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

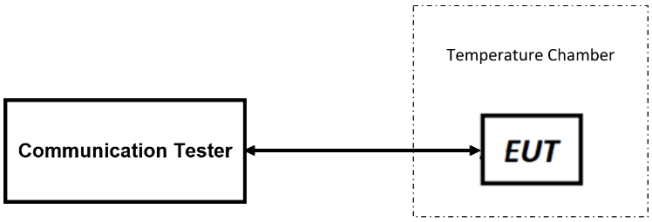


Figure 7-8. Test Instrument & Measurement Setup

Test Notes

None

Frequency Stability / Temperature Variation

LTE Band 4				
	Operating Band Lower Boundary (GHz)		1.710	
	Ref. Voltage (VDC):		4.00	
Voltage (%)	**Power (VDC)**	**Temp (°C)**	**Measured Freq. (GHz)**	**Freq. Delta from Operating Range (GHz)**
100 %	4.00	- 30	1.71070000	-0.00070000
		- 20	1.71070001	-0.00070001
		- 10	1.71070001	-0.00070001
		0	1.71070000	-0.00070000
		+ 10	1.71070001	-0.00070001
		+ 20 (Ref)	1.71070000	-0.00070000
		+ 30	1.71070000	-0.00070000
		+ 40	1.71070001	-0.00070001
		+ 50	1.71070000	-0.00070000
Battery Endpoint	2.25	+ 20	1.71070001	-0.00070001

Table 7-6. LTE Band 4 Lower Boundary Frequency Stability Data

LTE Band 4				
	Operating Band Upper Boundary (GHz)		1.780	
	Ref. Voltage (VDC):		4.00	
Voltage (%)	**Power (VDC)**	**Temp (°C)**	**Measured Freq. (GHz)**	**Freq. Delta from Operating Range (GHz)**
100 %	4.00	- 30	1.75430001	-0.02569999
		- 20	1.75430001	-0.02569999
		- 10	1.75430000	-0.02570000
		0	1.75430000	-0.02570000
		+ 10	1.75430001	-0.02569999
		+ 20 (Ref)	1.75430001	-0.02569999
		+ 30	1.75430001	-0.02569999
		+ 40	1.75430000	-0.02570000
		+ 50	1.75430000	-0.02570000
Battery Endpoint	2.25	+ 20	1.75430000	-0.02570000

Table 7-7. LTE Band 4 Upper Boundary Frequency Stability Data

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Portable Transmitter FCC ID: 2AFBP-AT18G** complies with all the requirements of Part 27 of the FCC rules.